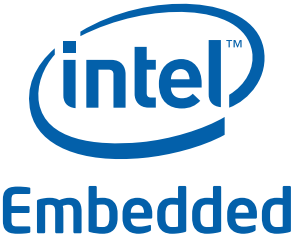

# Intel® Embedded Graphics Drivers, EFI Video Driver, and Video BIOS v10.4

## User's Guide

*April 2011*

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# Revision History

This document may have been updated since the release shown below. See http://edc.intel.com/Software/Downloads/ for the most recent version.

| Date | Revision | Description |
|---|---|---|
| April 2011 | 032 | Added Section 6.4, "Microsoft Windows CE 7.0* (WEC7) Installation" on page 148. Change bars indicate areas of change. |
| February 2011 | 031 | Updated for use with version 10.4 and 10.4.1 of the product. This is a fully validated release and includes the following new graphics driver features:<br>• Added Multi GPU Multi-Monitor (formerly Hybrid Graphics) support for platforms based on the Intel® Atom™ Z5xx Processor + Intel® US15 System Controller Hub and External x1 PCI-Express Graphics Card.<br>• New Linux XV_AUTOPAINT_COLORKEY option integrated for VA which prevents erasure of other contents displayed in the desktop area. IEGD 10.4 continues to automatically draw the colorkey before displaying the first video frame.<br>• Enabled driver support for all LVDS panels with a Data Enable (DE) signal and Data Enable mode supported by IEGD.<br>• Approximately tripled the boot/BLDK splash screen size with EPOG driver by implementing support of 8 bits per pixel .BMP format (originally was 24 bpp .BMP)<br>• Full-screen display of 1280x720 (720p), 1600x900, 1920x1080 (1080i & 1080p) resolutions in all officially supported Windows and Linux IEGD operating systems now achieved via internal VGA and/or internal LVDS display controllers. This occurs so long as chipset hardware supports necessary pixel rate for desired resolution. Some IEGD chipsets do not have integrated VGA and/or LVDS. Check IEGD Feature Matrix for internal display controller(s) available.<br>• Included VA API in IEGD to allow a vaPutSurface equivalent targeting video surface output as a Pixmap pointer as opposed to a drawable window.<br>• Increased DisplayID functionality; X&Y resolution settings now function equivalently via DisplayID (DID) or via EDID files.<br>• Enhanced CED application to allow display ID settings to have priority over INF file settings. When DisplayID is available on the LVDS port, all attributes in DisplayID override any similar settings in the INF file.<br>• Hardware accelerated video-to-video memory GDI-Alphablending support added.<br><br>The following operating systems have been removed from IEGD 10.4 support:<br>Fedora* 7 (kernel 2.6.21 – 1.3194 and X.org 7.2), Red Hat Linux* (kernel 2.6.23, X.org 7.2, X server 1.3), Ubuntu* MID 8.04, Wind River Linux* (kernel 2.6.21, X.org 7.2, X server 1.3), and Windows CE 5.0. These operating systems are no longer officially validated as of IEGD 10.4. Customers interested in using any of these operating systems are urged to download and use IEGD 10.3.1 from Intel's Embedded Design Center (edc.intel.com/Software/Downloads/IEGD/#download). IEGD 10.3.1 build #1550 was the final fully validated version of IEGD that was validated against these older/mature operating systems.<br><br>See the Release Notes for additional details of all defects resolved in this release. |

| Date | Revision | Description |
|---|---|---|
| June 2010 | 030 | Updated for use with the version 10.3.3 of the product. This is a maintenance release only and does not include any new graphics features. Version 10.3.3 includes fixes related to 3d/OGL, S3/Resume, flickering on 50 Hz and 60 Hz panels running on Intel® System Controller Hub US15W, screen rotation and flipping, color corruption, and VBIOS timing issues. See the Release Notes for complete details of all defects resolved in this release. |
| March 2010 | 029 | Updated for use with the version 10.3.1 of the product including support for the Intel® Atom™ Processor 400 and 500 Series. Only IEGD version 10.3.1 provides graphics driver support for the Intel® Atom™ Processor 400 and 500 Series. |
| February 2010 | 028 | Updated for use with version 10.3 of the product, including support for the 2D Frame Buffer Alpha Blending mode on US15W, VC-1 VLD video decoding for Windows on US15W, RealPlayer for Netbooks (RP4NB) v1.1 media player for Linux, the newest Windows Media Player (WMP) versions, and the newest official Moblin-IVI 2.1 image (dated November 5, 2009). |
| December 2009 | 027 | Updated for use with the Preliminary version 10.3 of the product. |
| December 2009 | 026 | Updated for use with version 10.2.4 of the product, including enhanced instructions. |
| December 2009 | 025 | Updated for use with version 10.2.4 of the product. |
| October 2009 | 024 | Updated for use with version 10.2.2 of the product. |
| October 2009 | 023 | Updated for use with version 10.2 of the product, including support for IEGD embedded pre-OS graphics feature driver in the Boot Loader Development Kit (BLDK) runtime environment, support for DDSCAPS_OWNDC capabilities for Windows CE 5.0 and CE 6.0, support for Moblin 2.1 release (moblin-ivi-gnome-20090819-001.img) dated August 19, 2009, and support for Windows Embedded CE 6.0 Monthly Update (June 2009). |
| September 2009 | 022 | Updated for use with PRELIMINARY version 10.2 of the product, including support for IEGD embedded pre-OS graphics feature driver in the Boot Loader Development Kit (BLDK) runtime environment, support for DDSCAPS_OWNDC capabilities for Windows CE 5.0 and CE 6.0, support for Moblin 2.1 release (moblin-ivi-gnome-20090819-001.img) dated August 19, 2009, and support for Windows Embedded CE 6.0 Monthly Update (June 2009). |
| July 2009 | 021 | Updated for use with version 10.1 of the product, including support for Fedora 10, XP/XPe SP3, transparent overlay for Linux and Windows CE 6.0 for Intel® System Controller Hub US15W/WP/WPT chipsets. |
| June 2009 | 020 | Updated for use with PRELIMINARY version 10.1 of the product, including support for Fedora 10, XP/XPe SP3, transparent overlay for Linux and Windows CE 6.0 for Intel® System Controller Hub US15W/WP/WPT chipsets. |
| March 2009 | 019 | Updated for use with Version 10.0 of the product, including support for Intel® G41, G45, GL40 and GS45 Express chipsets, Intel® System Controller Hub US15WP/WPT, and Ubuntu on 8.0.4 on 945GME/GSE. |
| February 2009 | 018 | Updated for use with PRELIMINARY Version 10.0 of the product, including support for Intel® G41, G45, GL40 and GS45 Express chipsets, Intel® System Controller Hub US15WP/WPT, and Ubuntu on 8.0.4 on 945GME/GSE. |
| December 2008 | 017 | Updated for use with Version 9.1.1 of the product, including support for the Ubuntu operating system. |
| November 2008 | 016 | Updated for use with PRELIMINARY Version 9.1.x of the product, including support for the Ubuntu operating system. |
| October 2008 | 015 | Updated for use with Version 9.1 of the product, including support for the Intel® Q45 Express chipset. |

| Date | Revision | Description |
|---|---|---|
| June 2008 | 014 | Updated for use with Version 9.0 of the product, including support for the Intel® System Controller Hub US15W, Mobile Intel® GM45 Express chipset (2D only), and Mobile Intel® GLE960 Express chipset. |
| October 2007 | 013 | Updated for use with Version 8.0 of the product, including support for the Intel® Q35. |
| June 2007 | 012 | Updated for use with Version 7.0 of the product, including support for the Intel® Mobile Intel® GME965 and Mobile Intel® 910GMLE chipsets. |
| December 2006 | 011 | Updated for use with Version 6.1 of the product. |
| September 2006 | 010 | Updated for use with Version 6.0 of the product, including support for the Intel® Q965 and Damn Small Linux*. |
| June 2006 | 009 | Updated for use with Version 5.1 of the product, including support for the Texas Instruments TFP410* DVO encoder, Microsoft Windows Embedded for Point of Service (WEPOS)* operating system, and SuSE 10. |
| February 2006 | 008 | Updated for use with Version 5.0 of the product, including support for the Intel® 852GM, Intel® 945G, and Intel® 945GM chipsets, the Silicon Image SiI 1362* and SiI 1364* sDVO transmitters, and External PCI as a Primary graphics adaptor. |
| October 2005 | 007 | Updated for use with Version 4.1 of the product. |
| June 2005 | 006 | Updated for use with Version 4.0 of the product, including support for the Intel® 915GV and Intel® 915GM chipsets, the Chrontel CH7307* and Chrontel CH7308* sDVO transmitters, and Advanced EDID Configuration. |
| May 2005 | 005 | Updated for use with Version 3.4 of the product, including use of the enhanced Video BIOS, Windows* installer/uninstaller, runtime configuration GUIs, and display discovery feature. |
| July 2004 | 004 | Updated for use with Version 3.2 of the product, including use of the dynamic port driver feature. |
| May 2004 | 003 | Updated for usage with version 3.1 of the product, including details on PCF format and usage, Universal INF format, and updates to the User Build System. |
| February 2004 | 002 | Updated chipset support to reflect current Embedded IA32 roadmap. |
| February 2004 | 001 | Initial Release |

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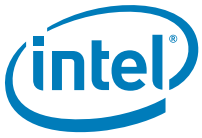


# 1.0 Introduction

The Intel® Embedded Graphics Drivers (IEGD) comprise a suite of multi-platform graphics drivers designed to meet the requirements of embedded applications. Featuring Intel® Dynamic Display Configuration Technology (DDCT), the drivers run on the following Embedded Intel® Architecture (eIA) chipsets:

- Intel® Atom™ Processor 400 and 500 Series (CPU+GPU combination)
- Intel® System Controller Hub US15W/US15WP/WPT chipset
- Mobile Intel® 945GSE Express chipset
- Mobile Intel® 945GME Express chipset
- *Intel® 945G Express chipset*
- *Intel® Q45/G41/G45 Express chipset*
- *Intel® GM45/GL40/GS45 Express chipset*
- *Intel® Q35 Express chipset*
- *Mobile Intel® GLE960/GME965 Express chipset*
- *Intel® Q965 Express chipset*
- *Intel® 915GV Express chipset*
- *Mobile Intel® 915GME Express chipset*
- *Mobile Intel® 910GMLE Express chipset*

*Notes:* (a) The IEGD v10.4 release is validated on only these platforms:

- — Intel® Atom™ Processor 270 + Mobile Intel® 945GSE Express chipset
- — Intel® Atom™ Processor 400 and 500 Series (combination CPU+GPU)
- — Intel® Atom™ Z5xx Processor + Intel®US15 System Controller Hub
- — Intel® Atom™ Z5xx Processor + Intel®US15WP/WPT System Controller Hub

(b) All other legacy Gen3/Gen4/GenX chipsets (in italics above) will continue to be supported by the fully validated March 2010 IEGD 10.3.1 and as necessary in 2011 and beyond IEGD10.3.x Hot Fixes or Engineering Candidates.

Customers requiring driver support for these Gen3/Gen 4/Gen X chipsets/platforms must download and use the final fully validated driver for these chipsets - IEGD10.3.1 build #1550 released in March 2010.

Critical bug fixes for these platforms will still be enabled with future IEGD 10.3.x-based Hot Fixes.

(c) If you need support for a chipset that is not listed above but is in the same family as those listed, please contact your Intel representative.

IEGD supports five types of display devices:

- Analog CRT/VGA
- LVDS flat panels
- TMDS DVI displays
- HDMI displays
- HDTV/Standard Definition analog TVs

IEGD is designed to work with fixed-function systems, such as Point-of-Sale (POS) devices, ATMs, gaming devices, In-vehicle Information/Entertainment systems, etc. It can be configured to work with various hardware and software systems and supports both Microsoft Windows* and Linux* operating systems, including embedded versions of these operating systems.

The Intel Embedded Graphics Suite consists of both IEGD and a Video BIOS (VBIOS) component. These two components are configurable and work together to provide a wide range of features. This document provides information on configuring and using both IEGD and the VBIOS.

IEGD provides the following features:

- Enhanced VBIOS and EFI support
- Dynamic Port Drivers
- Support for Dual Independent Head (DIH) displays
- Support of a Universal INF file
- EDID and EDID-less display support
- Display discovery and initialization
- Direct 3D* support
- Installer/Uninstaller GUI for Microsoft Windows* OS
- Runtime configuration GUI for Microsoft Windows OS and Linux OS
- OpenGL and OpenGL ES supported in specific chipsets and OS (refer to Appendix D for details)

## 1.1 Purpose

This manual provides information on both firmware and software, providing hardware design considerations, installation requirements, and static configuration options.

## 1.2 Intended Audience

This document is targeted at all platform and system developers who need to interface with the graphics subsystem. This includes, but is not limited to: platform designers, system BIOS developers, system integrators, original equipment manufacturers, system control application developers, and end users.

## 1.3 Related Documents

The following documents provide additional information on the hardware supported by IEGD. Additional resources are available at http://edc.intel.com/Software/Downloads/IEGD/.

- *Intel® Atom™ Processor 400 and 500 Series Datasheets* – Volume One (Document Number 322847) and Volume Two (Document Number 322848)
- *Intel® Embedded Graphics Drivers Version 10.4 for Embedded Intel® Architecture Product Brief*
  (Document Number: 315587)
- *Intel® Embedded Graphics Drivers Version 10.4 Feature Matrix*
  (Document Number: 317416)
- *Intel® Atom™ Processor Z5xx Series Datasheet*
  (Document Number: 319535)
- *Intel® System Controller Hub (Intel® SCH) Datasheet*
  (Document Number:319537)
- *Intel® Embedded Graphics Drivers Version 10.4 Release Training Presentation*
  (Document Number: TBD)
- *Intel® Embedded Graphics Drivers Version 10.4 Specification Update*
  (Document Number: 309380)
- *Intel® 35 Express Chipset Family Datasheet*
  (Document Number: 31696602)
- *Intel® I/O Controller Hub 9 (ICH9) Family Datasheet*
  (Document Number:31696602)
- *Mobile Intel® GME965 Express Family Chipset for Embedded Datasheet*
  (Document Number: 31627303)
- *Mobile Intel® 965 Express Chipset Family Datasheet*
  (Document Number: 316273)
- *Intel® 965 Express Chipset Family Datasheet*
  (Document Number: 313053)
- *Mobile Intel® 915PM/GM/GMS and 910GML Express Chipset Datasheet*
  (Document Number: 305264)
- *Intel® 915G/915GV/915P Express Chipset Datasheet*
  (Document Number: 304467)
- *Intel® I/O Controller Hub 6 (ICH6) Family Datasheet*
  (Document Number: 301473)
- *IEGD Linux Kernel Module Porting and Patching Methods* White Paper
  (Document Number: 435867)
- *Integrated Dual Independent Display on Intel® Digital Security Surveillance Multifunction Platforms* Application Brief
  (Document Number:30130301)
- *Display Panel Debugging with the Intel Graphics Memory Controller Hub*
  (Document Number: 305964)
- *Implementing Multiple Displays with IEGD Multi-GPU -Multi-Monitor Mode on Intel® Atom™ Processor with Intel® System Controller Hub US15W Chipset* White Paper
  (Document Number: 324821)

- *Hybrid Multi-monitor Support; Enabling new usage models for Intel® Embedded Platforms* White Paper
  (Document Number: 323214)
- *VESA BIOS Extensions/Display Data Channel Standard*
  This document provides information on the 4F VBE functions, which are supported by the Intel embedded Video BIOS.
- *VESA BIOS Extension (VBE) Core Functions Standard Version 3.0*
  Contains information on the VESA BIOS Extension (VBE) specification for standard software access to graphics display controllers that support resolutions, color depths, and framebuffer organizations beyond the VGA hardware standard.

*Note:* The above two documents are available from http://www.vesa.org. Membership may be required to access these documents. Reproductions may also be available from elsewhere on the Internet.

- *Cloning Linux Drives Using MondoArchive* Application Note
  (Document Number: 449300)
- *Installing Fedora 10 for Platforms Based on Intel® Atom™ Z510/Z520/Z530 Processor + Intel® US15W System Controller Hub* Application Note
  (Document Number: 449700)

  Contains information on the VESA BIOS Extension (VBE) specification for standard software access to graphics display controllers that support resolutions, color depths, and framebuffer organizations beyond the VGA hardware standard.

## 1.4 Conventions

The following conventions are used throughout this document.

| | |
|---|---|
| **Boldface** | Represents text that you type and text that appears on a screen. |
| *Italics* | Introduces new terms and titles of documents. |
| `Courier New` | Identifies the names of files, executable program names, and text that appears in a file. |
| Angle Brackets (< >) | Encloses variable values in syntax or value ranges that you must replace with actual values. |
| Vertical Bar ( \| ) | Used to separate choices (for example, TRUE \| FALSE) |

## 1.5 New Features for Version 10.4

The table below presents new IEGD features and capabilities.

**Table 1. IEGD v10.4 New Features (Sheet 1 of 3)**

| New Features |
|---|
| **IEGD now provides VA API to allow a vaPutSurface equivalent targeting video surface output as a Pixmap pointer as opposed to a drawable window.**<br>Support of create_ogl_texture_from_pixmap extension and the ability to handle NV12 textures in this same OpenGL extension now enabled. Created vaDerivePixmapEXT() function that returns a NV12 pixmap.<br>This allows for a colorspace conversion to happen when the pixmap is bound to a texture. IEGD implementation of vaPutSurface changed to use the pixmap instead of the surface. This feature thus delivers better performance only when using video decoded surfaces as textures for a subsequent OpenGL operation. Compatibility retained with the original VA-API 0.29. |
| **Increase BLDK splash screen size with EPOG driver by implementing support of 8-bit per pixel.BMP format.**<br>Previous splash screen size in IEGD EPOG limited to 50kB .BMP format at 24 bits per pixel. This feature allows for a tripling of the splash image size to approximately 300x300 pixels by allowing for support of splash screen .BMP format files at 8 bits per pixel. Memory limit remains at 50kB maximum. |
| **IEGD allows display resolution to be set with both DisplayID and EDID with LVDS displays. In cases where the Windows OS requests information about the LVDS display and that display is programmed via DisplayID (DID), the IEGD driver will convert the DisplayID data into a Windows driver compatible, supported data structure-format.**<br><br>For Windows XP-XP Embedded which are Display ID-unaware operating systems, IEGD 10.4 will translate Display ID data into EDID data structure when Windows XP makes requests for display-firmware information. This conversion is required as Windows makes use of the requested display firmware information to determine the preferred resolution.<br><br>This new FCB means that systems based on IEGD 10.4 and that store the DisplayID file in EPROM will behave precisely the same way as when EDID is being utilized in terms of the default resolution and behavior. In other words, Windows will utilize DisplayID configuration settings on bootup and no longer default to the default VGA resolution.<br><br>***Note:*** With IEGD 10.3.1 and earlier versions of IEGD, there was a problem with Display ID panel in Windows XP if no prior display resolution was configured after installation. If a customer used LVDS display with EDID, Windows XP would start in native resolution. If customer used LVDS display with Display ID, then Windows starts in VGA resolution only unless the resolution is reconfigured with Display property. |
| **Multi-GPU - Multi-Monitor Mode (formerly known as Hybrid Multi-monitor) now supported with internal US15W and external PCI-Express graphics card and IEGD 10.4.**<br><br>Multi-GPU - Multi-Monitor Mode (formerly known as Hybrid Multi-monitor) is now officially supported and validated for platforms based on IEGD 10.4 and the Intel® Atom™ Z5xx processor and Intel® System Controller Hub US15W graphics chipset. This feature lets customers increase the total number of simultaneously displayed outputs from their IEGD 10.4 US15W-based platforms from a maximum of two, to three or more. With Multi-GPU - Multi-Monitor Mode enabled, the first two outputs come from the US15W's internal LVDS and SDVO ports while 1 - 4 additional outputs (and whether they are DVI, VGA, TV out, or DisplayPort) come from an external graphics card. Two usage models were comprehensively tested internally by Intel: Usage Model #1 transmits 4 display outputs simultaneously. The US15W generates displays from its internal LVDS and internal SDVO and two additional independent Display Outputs come via the External PCIe x1 graphics card. With Usage Model #1, internal SDVO can be VGA/DVI/HDMI/LVDS or TVOut and outputs from the x1 PCI-E graphics card can be VGA/DVI/HDMI/DisplayPort or TVOut. Intel also validated Usage Model #2 which transmits six display outputs simultaneously. In Usage Model #2, IEGD 10.4 and US15W generate displays from its internal LVDS and internal SDVO and four additional independent outputs are transmitted via the Matrox* M9120 Plus LP PCIe x1 Video Card + Matrox '60 pin LFH (M) - HD-15 (F)' display cable combination which drive out four additional independent VGA analog displays.<br><br>To date, this feature has been validated only with the Windows* XP Service Pack 3 (SP3) operating system. Linux* Xinerama was not tested by Intel for Multi-GPU Multi Monitor mode functionality but is expected to operate properly with correct configuration of Linux. OEMs/ODMs are welcome to attempt enabling of Multi-GPU - Multi-Monitor Mode on their US15W-based Linux platform. Refer to the December 2010 white paper # 324821-001US titled *Implementing Multiple Displays with IEGD Multi-GPU - Multi-Monitor Mode on Intel® Atom™ Processor with Intel® System Controller Hub US15W Chipset* for further implementation details. |

## Table 1. IEGD v10.4 New Features (Sheet 2 of 3)

| New Features |
|---|
| **New Linux XV_AUTOPAINT_COLORKEY option integrated for VA which prevents erasure of other contents displayed in the desktop area. Driver continues to automatically draw the colorkey before displaying the first video frame.**<br><br>Assists with Linux video playback. |
| **Data Enable (DE) type LVDS Panels from x, y, z (Vendor model/make #s filled in later) supported by IEGD.**<br><br>LVDS panels typically do not have a DE (data enable) signal as part of their interface. IEGD enhanced to support these new type of panels. |
| **Full-screen display of 1280x720 (720p), 1600x900, 1920x1080(1080i & 1080p) via internal VGA and LVDS display controllers.**<br><br>Multiple Embedded segments require full 720p and 1080p resolution outputs.<br><br>So long as the particular ECG chipset's integrated LVDS, DVI, HDMI, VGA, or SDVO display controller supports the necessary pixel rates required for generation of full-screen 1280x720 (720p), 1600x900, 1920x1080-interlaced (1080i), 1920x1080 progressive(1080p) active resolutions then the system using IEGD can render full 720p, 1080p and 1600x900 active resolutions.<br><br>Sample exception: US15W's maximum pixel clock = 112 MHz which equates to 1376x768 @ 85 Hz. as maximum resolution. Thus, hardware limitations prevent support of 1080p & 1080i and 1600x900 for US15W LVDS. |
| **While outputting LVDS, when DisplayID is used or detected by the IEGD 10.4-based system, the driver will give priority to DisplayID parameters and attributes over CED/.INF file attributes.**<br><br>CED and the .INF file no longer override and take precedence over DID settings. When DID is present the only way to control the settings is by manually editing or replacing the DID file or deleting it from the EEPROM. |
| **For Atom+US15W-based Windows CE 6.0 R2 only platforms, hardware accelerated alphablending for applications performing video to video (memory) operations.**<br><br>Applications using system-to video-operations and GDI-alphablending will not be hardware accelerated. The internal US15W hardware acceleration will be used to increase the frames-per-second metric and decrease CPU utilization for video to video (memory) operations. |
| **IEGD allows display resolution to be set with both DisplayID and EDID with LVDS displays. In cases where the Windows OS requests information about the LVDS display and that display is programmed via DisplayID (DID), the IEGD driver will convert the DisplayID data into a Windows driver compatible, supported data structure-format.**<br><br>For Windows XP-XP Embedded which are Display ID-unaware operating systems, IEGD 10.4 will translate Display ID data into EDID data structure when Windows XP makes requests for display-firmware information. This conversion is required as Windows makes use of the requested display firmware information to determine the preferred resolution.<br><br>This new FCB means that systems based on IEGD 10.4 and that store the DisplayID file in EPROM will behave precisely the same way as when EDID is being utilized in terms of the default resolution and behavior. In other words, Windows will utilize DisplayID configuration settings on bootup and no longer default to the default VGA resolution.<br><br>With IEGD 10.3.1 and earlier versions of IEGD, there was a problem with Display ID panel in Windows XP if no prior display resolution was configured after installation. If a customer used LVDS display with EDID, Windows XP would start in native resolution. If customer used LVDS display with Display ID, then Windows starts in VGA resolution only unless the resolution is reconfigured with Display property. |

**Table 1. IEGD v10.4 New Features (Sheet 3 of 3)**

| New Features |
|---|
| **Removed support for these older operating systems: Fedora 7, Red Hat Linux* (kernel 2.6.23, X.org 7.2, X server 1.3), Ubuntu 8.04 MID, Wind River Linux* (kernel 2.6.21, X.org 7.2, X server 1.3), and Windows CE 5.0.**<br>These operating systems are no longer validated by engineering as of IEGD version 10.4. Customers can still use these operating systems with IEGD for their embedded systems but Intel recommends utilizing IEGD 10.3.1 (version #1550 released in March 2010) since it was the final IEGD Driver to be fully validated with Fedora 7, Red Hat Linux* (kernel 2.6.23), Ubuntu 8.04 MID, Wind River Linux* (kernel 2.6.21), and Windows CE 5.0.<br><br>Go to the Embedded Design Center (http://edc.intel.com/Software/Downloads/IEGD/#download) to download IEGD 10.3.1 or contact your local Intel representative. |

This release also contains resolutions for errata. For details on errata, including status site (premier.intel.com) and the Intel® Embedded Design Center (http://edc.intel.com).

## 1.6 Acronyms and Terminology

The table below lists the acronyms and terminology used throughout this document.

**Table 2. Acronyms and Terminology (Sheet 1 of 4)**

| Term | Description |
|---|---|
| ADD Card | APG Digital Display. An adapter card that can be inserted into the PCIe x16 port of Intel chipset family-based systems. ADD cards allow configurations for TV-out, LVDS, and TMDS output (i.e., televisions, digital displays, and flat panel displays). |
| AIM | Add In Module. |
| API | Application Programming Interface. |
| BDA | BIOS Data Area. A storage area that contains information about the current state of a display, including mode number, number of columns, cursor position, etc. |
| BIOS | Basic Input/Output System. IEGD interacts with two BIOS systems: system BIOS and Video BIOS (VBIOS). VBIOS is a component of the system BIOS. |
| BLDK | Boot Loader Development Kit. This driver is a module within the BLDK. The EPOG feature enables quick display of the user's chosen splash screen (8-bit or 24-bit per pixel .bmp format with size less than 50 KB). |
| CED | Configuration EDitor. Graphical pre-installation utility allows easy creation of consolidated driver installation packages for Windows*, Windows CE*, and Linux *operating systems, and VBIOS across numerous platforms and display combinations. |
| Clone Display Configuration | A type of display configuration that drives two display devices, each displaying the same content, but can have different resolutions and (independent) timings. Compare Twin Display Configuration and DIH Display Configuration. |
| Contrast | Contrast is the measure of the difference between light and dark on a display. If the contrast is increased, the difference between light and dark is increased. So something white will be very bright and something black will be very dark. |
| COPP | Certified Output Protection Protocol*. A Microsoft-defined API to provide applications with information about what output protection options are available on a system. |
| D3D | Microsoft Direct3D*. A 3D graphics API as a component of DirectX* technology. |

## Table 2. Acronyms and Terminology (Sheet 2 of 4)

| Term | Description |
|---|---|
| DC | Display Configuration. |
| DDCT | Intel® Dynamic Display Configuration Technology. |
| DirectDraw* | A component of the DirectX* Graphics API in Microsoft Windows OS. |
| DIH Display Configuration | Dual Independent Head. A type of display configuration that supports two displays with different content on each display device. IEGD supports Extended mode for Microsoft Windows systems and Xinerama for Linux systems. |
| DTD | Detailed Timing Descriptor. A set of timing values used for EDID-less devices. |
| DVI | Digital Video Interface. |
| DVO | Digital Video Output. |
| EBDA | Extended BIOS Data Area. An interface that allows the system BIOS and Option ROMs to request access to additional memory. |
| EDID | Extended Display Identification Data. A VESA standard that allows the display device to send identification and capabilities information to IEGD. IEGD reads all EDID data, including resolution and timing data, from the display, thus negating the need for configuring DTD data for the device. |
| EDID-less | A display that does not have the capability to send identification and timing information to the driver and requires DTD information to be defined in the driver. |
| EFI | Extensible Firmware Interface. |
| eIA | Embedded Intel® Architecture. |
| EMI | Electromagnetic Interference. |
| EPOG | Embedded Pre-OS Graphics feature. |
| Extended Clone Mode | A feature that allows you to have different sized displays in Clone mode. |
| Framebuffer | A region of physical memory used to store and render graphics to a display. |
| GEN3 | Napa Graphics Core in 910/915 family chipset. |
| GEN3.5 | Napa+ Graphics Core in 945 family chipset. |
| GEN4 | Graphics Core in 965 family chipset. |
| GEN5 | Graphics Core in the GL40/GM45 family chipset. |
| GDI | Graphics Device Interface. A low-level API used with Microsoft Windows operating systems. |
| GMA | Intel Graphics Media Accelerator. Refers to both the graphic hardware in Intel chipsets as well as the desktop/mobile driver. The GMA driver is not intended for use in embedded applications. |
| GMCH | Graphics and Memory Controller Hub. |
| GMS | Graphics Mode Select (stolen memory). |
| HAL | Hardware Abstraction Layer. An API that allows access to the Intel® chipsets. |
| HDCP | High-bandwidth Digital-Content Protection. A specification that uses the DVI interface. HDCP encrypts the transmission of digital content between the video source (transmitter) and the digital display (receiver). |
| HDMI | High-Definition Multimedia Interface, an uncompressed, all-digital audio/video interface. |
| IAL | Interface Abstraction Layer. An API that allows access to graphics interfaces including the GDI, and DirectDraw*. |
| iDCT | Inverse Discrete Cosine Transformation (hardware feature). |
| IEGD | Intel® Embedded Graphics Drivers |

## Table 2. Acronyms and Terminology (Sheet 3 of 4)

| Term | Description |
|---|---|
| IEGS | Intel® Embedded Graphics Suite. Runtime graphics driver plus a VBIOS component. |
| IKM | IEGD Kernel Module |
| INF file | A standard Microsoft Windows text file, referred to as an information file, used by Microsoft Windows OS to provide information to the driver. The default .inf file for IEGD is `iegd.inf`. You can create customized parameters using the CED utility. |
| LPCM | Linear Pulse Code Modulation. A method of encoding audio information digitally. The term also refers collectively to formats using this method of encoding. |
| LVDS | Low Voltage Differential Signaling. Used with flat panel displays, such as a laptop computer display. |
| NTSC | National Television Standards Committee. An analog TV standard used primarily in North and Central America, Japan, the Philippines, South Korea, and Taiwan. |
| OAL | Operating system Abstraction Layer. An API that provides access to operating systems, including Microsoft Windows and Linux. |
| Option ROM (OROM) | Code which is integrated with the system BIOS and resides on a flash chip on the motherboard. The Intel Embedded Video BIOS is an example of an option ROM. |
| OS | Operating System. |
| PAL | Phase Alternating Lines. An analog TV standard used in Europe, South America, Africa, and Australia. |
| PCF | Parameters Configuration File. |
| PCI | Peripheral Component Interface. |
| Port Driver | A driver used with the sDVO interfaces of the Graphics and Memory Controller Hub (GMCH). |
| POST | Power On Self Test. |
| PWM | Pulse Width Modulation. |
| Reserved Memory | A region of physical memory in a Windows CE* system set aside for BIOS, VBIOS, and Graphics Driver operations. Reserved memory can be configured to be used by the operating system and other applications when not in use by the BIOS. |
| Saturation | Monitors and scanners are based on the “additive” color system using RGB, starting with black and then adding Red, Green, and Blue to achieve color. Full saturation of RGB gives the perception of white, and images are created that radiate varying amounts of RGB, or varying saturation of RGB. |
| SCART | French Acronym - Syndicat des Constructeurs d'Appareils Radiorecepterus et Televiseurs. A video interface possessing up to four analog signals (Red/Green/Blue/Composite PAL). S-Video (Luma/ Chroma) is possible over the SCART interface as well. |
| sDVO | Serial Digital Video Output. |
| Single Display Configuration | A type of display configuration that supports one and only one display device. |
| SSC | Spread Spectrum Clock. |
| Stolen Memory | A region of physical memory (RAM) set aside by the system BIOS for input and output operations. The amount of stolen memory is configurable. Stolen memory is not accessible to the operating system or applications. |
| System BIOS | The standard BIOS used for basic input and output operations on PCs. |
| TMDS | Transitioned Minimized Differential Signaling. Used with DVI displays, such as plasma TVs. |

**Table 2. Acronyms and Terminology (Sheet 4 of 4)**

| Term | Description |
|---|---|
| TOM | Top Of Memory. |
| TSR | Terminate and Stay Resident. A program that is loaded and executes in RAM, but when it terminates, the program stays resident in memory and can be executed again immediately without being reloaded into memory. |
| Twin Display Configuration | A type of display configuration that supports two display devices each of which has the same content, resolution, and timings. Compare Clone Display Configuration. Note: Twin configuration is not supported on US15W series chipsets. |
| UBS | User Build System. A process for building a VBIOS. |
| VBIOS | Video Basic Input Output System. A component of system BIOS that drives graphics input and output. |
| VESA | Video Electronics Standards Organization. |
| VGA | Video Graphics Array. A graphics display standard developed by IBM* that uses analog signals rather than digital signals. |
| VLD | Variable Length Decoding. |
| VMR | Video Mixing Render. |
| WHQL | Windows* Hardware Quality Labs. WHQL is a testing organization responsible for certifying the quality of Windows drivers and hardware that runs on Windows operating systems. |
| XDDM | Defined by Microsoft as XP Display Driver Model. For IEGD to function properly, it must be run in XDDM mode under Microsoft Vista* OS. |
| YUV | Informal, but imprecise reference to the video image format, Y'CbCr. The Y' component is luma, a nonlinear video quality derived from RGB data denoted without color. The chroma components, Cb and Cr that correspond nonlinearly with U and V as differences between the blue and luma, and the red and luma respectively. |

## 1.7 Downloading IEGD and Video BIOS

IEGD and the Video BIOS (VBIOS) are available on Intel Premier Support (QuAD) (premier.intel.com) and the Intel Embedded Design Center (http://edc.intel.com/Software/Downloads/IEGD/#download) only. The download package includes:

- IEGD drivers and VBIOS for Linux* operating systems and all Windows* operating systems
- Intel Embedded Graphics Driver Configuration Editor (CED) release which includes an online help system

*Note:* CED currently runs only on Windows operating systems.

*Note:* The Embedded Video BIOS version 10.4 is recommended for use with each of the graphics drivers in most cases. Click the following link to see the FAQ page for details on the differences of these versions.

http://edc.intel.com/Software/Downloads/IEGD/#faqs

After you have downloaded, installed, and run CED, you can configure and customize the drivers and VBIOS following the procedures in this document. Once they have been configured, you can integrate the VBIOS with the system BIOS ROM and install IEGD on your operating system.

# 2.0 Architectural Overview

## 2.1 Introduction

The Intel Embedded Graphics Suite (IEGS) is composed of a runtime graphics driver and a Video BIOS (VBIOS) firmware component. (See the illustrations below.) Both the driver and VBIOS control the GMCH to perform display and render operations. The VBIOS is predominantly leveraged by System BIOS during system boot but is also used at runtime by the driver to handle full-screen text mode on Microsoft Windows* operating systems.

**Figure 1. Intel Embedded Graphics Suite**

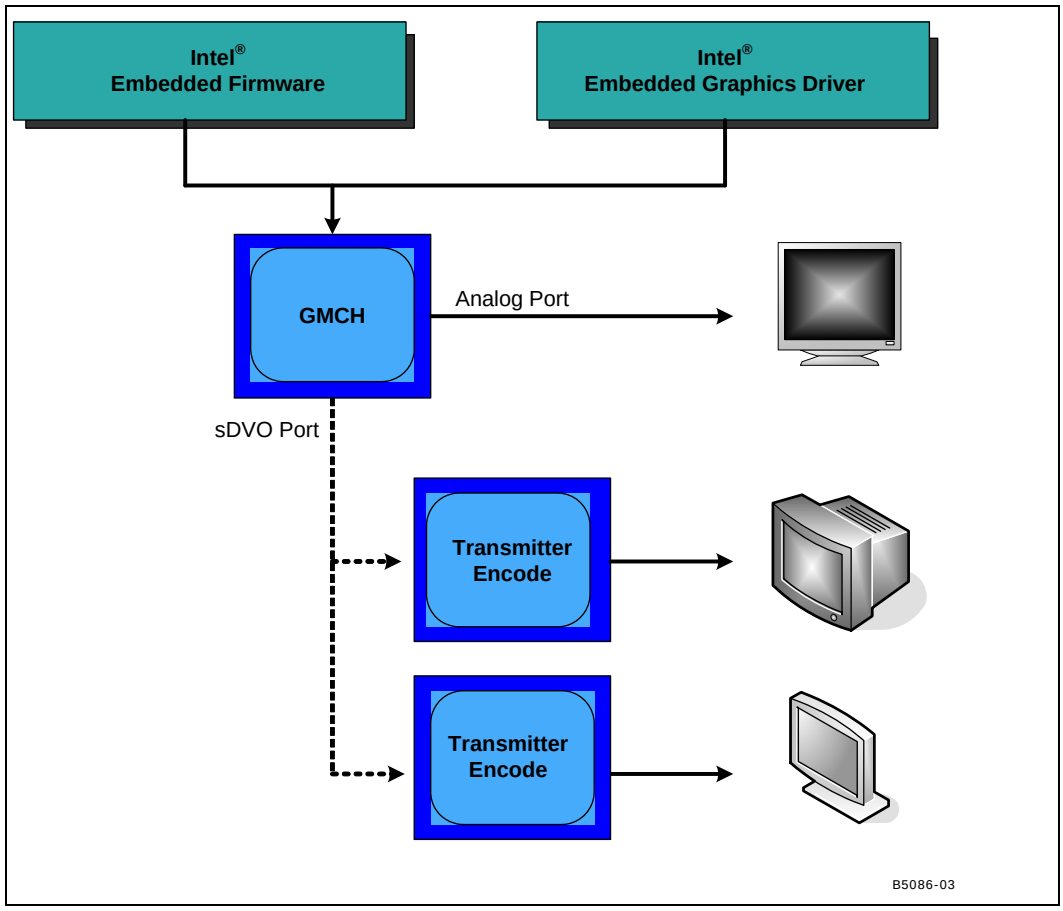


**Figure 2. Graphics Driver Architecture**

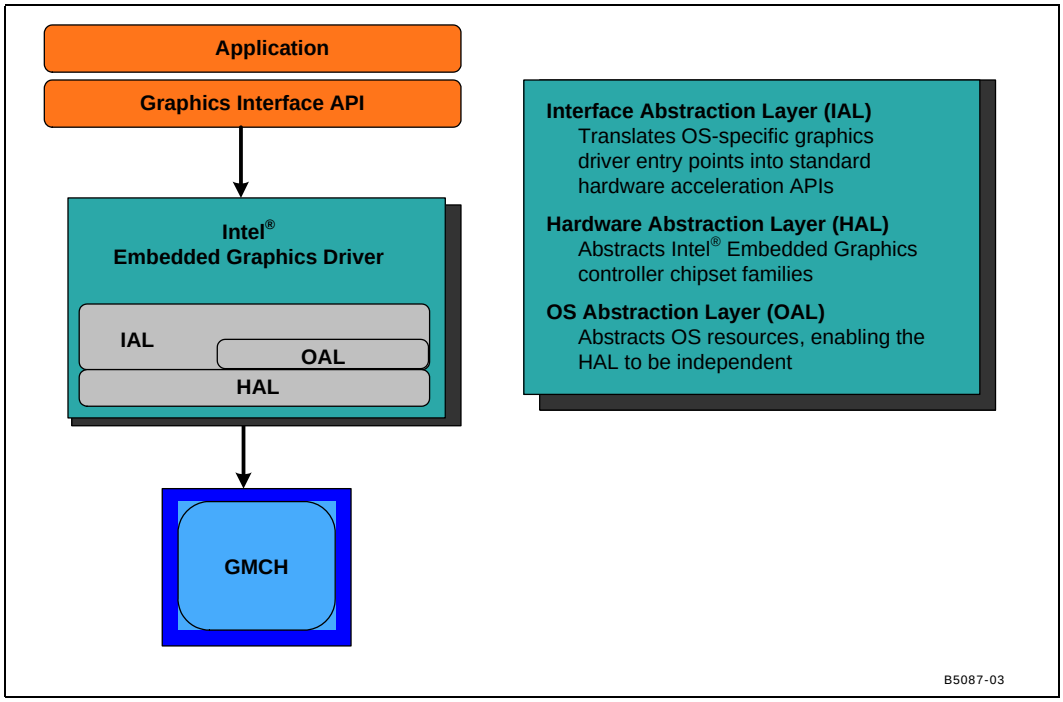
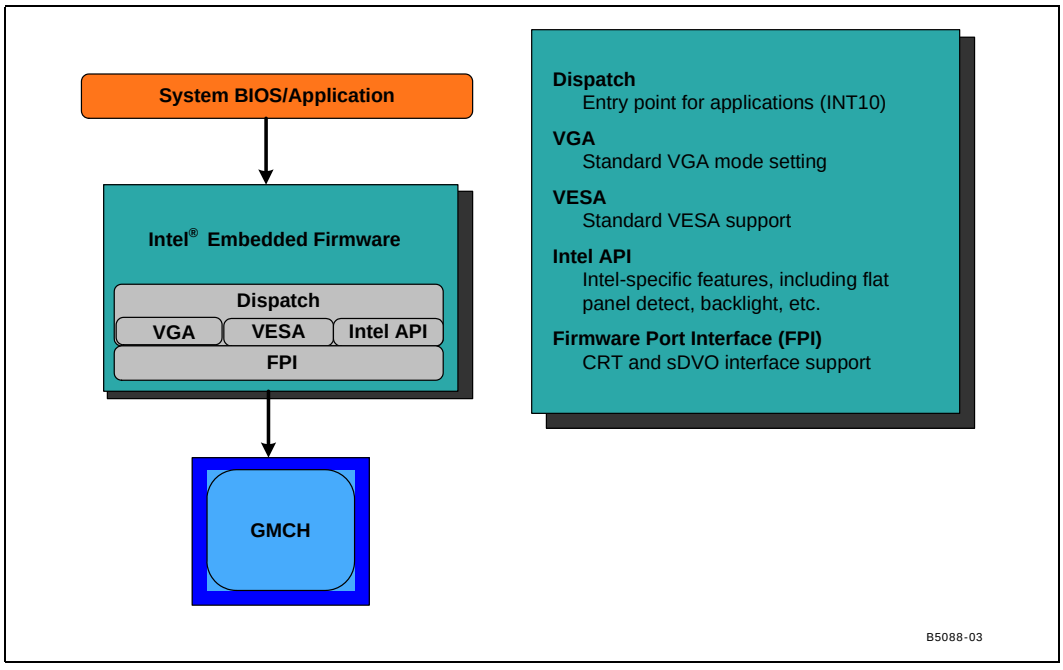



**Figure 3. Firmware Architecture**



## 2.1.1 Display Options

The following section describes the types of displays and configurations supported by the Intel Embedded Graphics Driver.

### 2.1.1.1 Types of Displays

The table below lists the types of displays supported by IEGD.

**Table 3. Types of Displays**

| Display | Description |
|---|---|
| CRT | Analog CRT, natively supported with RGB signaling or via an external encoder sDVO port. |
| Flat Panel | TMDS (DVI, HDMI) and LVDS compliant flat panels are supported with the use of an external transmitter via an sDVO port. Integrated LVDS flat panels are also natively supported on the Mobile Intel® 910GMLE, Mobile Intel® 915GME Express, Mobile Intel® 945GME, Mobile Intel® 945GSE Express, Mobile Intel® GLE960/GME965 chipsets, the Intel® System Controller Hub US15W/US15WP/WPT chipset, and Intel® Atom™ Processor 400 and 500 Series.<br><br>***Note:*** IEGD 10.4 Enabled driver support for all LVDS panels with a physical Data Enable (DE) signal as part of the interface. LVDS panels with a Data Enable mode are now supported with IEGD 10.4. |
| TV | HDTV and standard-definition TV-out is typically supported via an external encoder connected to the SDVO port and port driver.<br><br>***Note:*** TV-Out can also be enabled internally if the chipset has D-A converters and its datasheet lists TV out as a supported display option. |

### 2.1.1.2 Display Configuration

IEGD supports driving two displays simultaneously. Several configurations are supported, dependent on operating system and chipset. The various display configurations are described in the table below.

**Table 4. Display Configuration Definitions**

| Display Configuration Mode | Description |
|---|---|
| Single | Normal desktop configuration, single monitor. |
| Twin | Two displays, same content, single resolution, same timings (not supported with US15W series). |
| Clone | Two displays, same content, different resolutions, independent timings. |
| Extended | Two displays, continuous content (available in Windows only). |
| DIH | Dual Independent Head. Two displays, different content, independent resolutions. |

The table below summarizes which display configurations are supported by Intel chipsets.

**Table 5. Supported Display Configurations**

| Chipset | Operating System | | |
|---|---|---|---|
| | Windows XP* / Vista* | Windows CE* | Linux |
| Intel® US15W/US15WP/WPT, Intel®Atom™ 400/500 | Single, Clone, Extended | Single, Clone, Vertical Extended | Single, Clone, Xinerama, DIH |
| Intel® Q45/G41/G45<br>Intel® GM45/GL40/GS45,<br>Intel® Q35,<br>Intel® GLE960,<br>Intel® GME965,<br>Intel® Q965,<br>Intel® 945GM,<br>Intel® 945GSE,<br>Intel® 945G,<br>Intel® 915GME,<br>Intel® 910GMLE | Single, Twin, Clone, Extended | Single, Twin, Clone | Single, Twin, Clone, Xinerama, DIH |
| Intel® 915GV | Single, Twin, Clone | Single, Twin, Clone | Single, Twin, Clone |

IEGD supports Twin and Clone modes through custom APIs. In contrast, Microsoft Windows and Linux operating systems (X.org*) both natively support Extended and DIH.

## 2.2 Features

The following sections describe major features IEGD supports.

### 2.2.1 Chipsets Supported

The table below lists IEGD-supported chipsets.

**Table 6. Chipsets Supported by the Intel Embedded Graphics Suite**

| Chipset | IEGD VBIOS Support | IEGD Support |
|---|---|---|
| Intel®Atom™ 400/500 | Yes | Yes |
| Intel® US15W/US15WP/WPT | Yes | Yes |
| Intel® Q45/G41/G45 | Yes | Yes |
| Intel® GM45/GL40/GS45 | Yes | Yes |
| Intel® Q35 | Yes | Yes |
| Intel® GLE960/GME965,<br>Intel® Q965 | Yes | Yes |
| Intel® 945G<br>Intel 945GME<br>Intel 945GSE | Yes<br>Yes<br>Yes | Yes<br>Yes<br>Yes |
| Intel® 915GV<br>Intel® 915GME | Yes<br>Yes | Yes<br>Yes |
| Intel® 910GMLE | Yes | Yes |

All supported chipsets provide for a single analog output for CRTs. In addition, digital monitors, flat panels and TVs are supported through the GMCH sDVO interface.

### 2.2.2 OS and API Support

IEGD and Video BIOS support the following operating systems and APIs. For OpenGL APIs, see Appendix D, “2D/3D API Support”.

- Linux X.org
- Fedora* 10 (kernel 2.6.27, X.org 1.5)
- Moblin 2.1 IVI and Moblin 2.1 Linux* (kernel 2.6.31, X server 1.6.1) (Intel® System Controller Hub US15W/US15WP/WPT only)
- Windows Embedded Standard 2009, Windows XP* ver. SP3, Windows XP Professional* ver. SP3, Windows XP Embedded* ver. SP3, WEPOS* ver. SP3:
  - DirectX* 8.1 and 9.0 (DirectDraw* and Direct3D*)
- Microsoft Windows CE* 7.0/Windows Embedded CE 7.0 (WEC7) for Intel® Atom™ Processor 400 and 500 Series only and Windows CE and 6.0 R2 for all other IEGD chipsets

*Note:* The following features are NOT supported in IEGD v10.4:

- Microsoft Vista* 2D + 3D
- Vista DirectX 9.0L, DirectX 10.0 (Combine with MS Vista 2D + 3D)
- Windows Aero* is not supported by IEGD under Windows Vista[1]

### 2.2.3 DisplayID Support

The Intel Embedded Graphics Driver supports the newly developed DisplayID specification. DisplayID is a new VESA specification (www.vesa.org) that describes the data format for the display configuration parameters and provides the capability to unify the display data structure thereby decreasing the need to rely on proprietary extensions. For more information on DisplayID, its uses and parameters please reference the VESA specification (www.vesa.org).

### 2.2.4 EDID-Less Configuration

EDID-less support is the ability to run a display panel that does not have display timing information within the panel. Therefore, the user has to provide the display timing information to the graphics drivers. For IEGD, this must be done through:

- CED
- Configuration file for the graphics drivers.

This document describes only the necessary edits to the configuration files that are required to implement the graphics driver and VBIOS, and not specific settings for EDID-less panel configuration. Please refer to the manufacturer’s specifications for the DTD settings to use for your EDID-less panels.

1. Windows Aero is a graphics function that adds glass or translucent effects to menus, balloons, and dialog boxes in Windows Vista along with 3D scrolling. Its purpose is to add more intuition to toolbars and navigation. “Aero” is Microsoft's code name for the Microsoft Vista theme or shell.

#### 2.2.4.1 EDID-Less Panel Type Detection

The Intel Embedded Graphics Suite supports EDID-less displays that do not export timing modes. This is accomplished by allowing configuration of a Detailed Timing Descriptor (DTD), and associating that DTD with a specific display port. IEGD provides further flexibility in allowing numerous DTDs to be defined and having the selection of the DTD be configurable though selection of Configuration IDs. The selection of the Configuration ID can be done from the System BIOS, as long as it supports the Intel 5F40h function and passes the appropriate Configuration ID to the VBIOS. The VBIOS in turn notifies the Graphics Driver of which Configuration ID is active. This is not required however, but the VBIOS and/or Graphics Driver require the Configuration ID to be set prior to installation.

### 2.2.5 sDVO Devices

IEGD supports many third-party digital transmitters connected to the sDVO ports of the GMCH. The driver code that supports each of these devices is abstracted and is a separate driver called a port driver. Port drivers can be dynamically loaded at the time IEGD is initialized, and IEGD can be configured to allow any number of these port drivers to be loaded. By default, all the port drivers for the devices listed in the following table as “Included in Release Package” will load by default if the corresponding transmitter is detected. If a port driver is not specified in the configuration before installation, that device will not be detected, and the port driver will not load. The configuration can be modified before installation to prevent certain port drivers from loading or to include additional port drivers to load.

**Table 7. SDVO Devices Supported**

| Device | VBIOS/EPOG/EFI Video Driver Support | Graphics Driver Support |
|---|---|---|
| Internal LVDS | Yes | Yes |
| Internal TV Out | No | Yes |
| Chrontel CH7022* RGB VGA/SDTV/HDTV out | Yes | Yes |
| Chrontel CH7307* Single-port DVI out | Yes | Yes |
| Chrontel CH7308* LVDS out | Yes | Yes |
| Chrontel CH7317* RGB VGA out | Yes | Yes |
| Chrontel CH7315* HDMI out | Yes | Yes |
| Chrontel CH7319* Dual-port DVI out with HDCP | Yes | Yes |
| Chrontel CH7320* Dual-port DVI out | Yes | Yes |
| Silicon Image SiI 1362*Single-port DVI out | Yes | Yes |
| Silicon Image SiI 1364* Single-port DVI out | Yes | Yes |

### 2.2.6 Rotation

Rotation is the ability to rotate the display for the Intel Embedded Graphics Driver. Rotation support includes 0°, 90°, 180°, 270°. Rotation is supported only on the following chipsets using Windows XP*, and Linux operating systems:

- Intel® Atom™ Processor 400 and 500 Series
- Intel® Q45/G41/G45 Express chipset
- Intel® GM45/GL40/GS45 Express chipset
- Intel® System Controller Hub US15W/US15WP/WPT chipset
- Intel® Q35 Express chipset
- Mobile Intel® GLE960/GME965 Express chipset
- Intel® Q965 Express chipset
- Mobile Intel® 945GSE Express chipset
- Mobile Intel® 945GME Express chipset
- Mobile Intel® 945GM Express chipset
- Intel® 945G Express chipset
- Intel® 915GV Express chipset
- Mobile Intel® 915GME Express chipset
- Mobile Intel® 910GMLE Express chipset

*Note:* Rotation is not supported with the VBIOS. Rotation is supported with Windows CE* but only in static mode.



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# 3.0 Platform Configuration Using CED

The Intel® IEGD Configuration Editor (CED) is a Windows-based Graphical User Interface (GUI) that allows you to create configurations, package the configurations, and create installations that can be loaded directly on a specific OS or Video BIOS platform. Configurations are associated with a specific chipset and can be created for any one of the following supported chipsets:

- Intel® Atom™ Processor 400 and 500 Series
- Intel® Q45/G41/G45 Express chipset
- Intel® GM45/GL40/GS45 Express chipset
- Intel® System Controller Hub US15W/US15WP/WPT chipset
- Intel® Q35 Express chipset
- Mobile Intel® GLE960/GME965 Express chipset
- Intel® Q965 Express chipset
- Mobile Intel® 945GSE Express chipset
- Mobile Intel® 945GME Express chipset
- Intel® 945G Express chipset
- Intel® 915GV Express chipset
- Mobile Intel® 915GME Express chipset
- Mobile Intel® 910GMLE Express chipset

IEGD configurations can be created for the following supported operating systems and Video BIOS:

- Linux X.org
- Fedora 10
- Moblin 2.1 IVI for Intel® System Controller Hub US15W/US15WP/WPT only
- Microsoft Windows Embedded Standard 2009*, Microsoft Windows XP* SP3, Microsoft Windows XP Professional* SP3, Microsoft Windows XP Embedded* SP3, and Microsoft WEPOS* SP3:
  - — DirectX* 8.1 and 9.0 (DirectDraw* and Direct3D*)
- Microsoft Windows Vista
  - — Choose “Windows XP/XPE” when configuring a package in CED for Windows Vista.
  - — IEGD will automatically run in XDDM mode once installed on a system using Microsoft Vista* and one of the aforementioned Intel embedded chipsets.
- Microsoft Windows CE 6.0 R2
- Microsoft Windows CE 7.0/WEC7 for Intel® Atom™ Processor 400 and 500 Series only

*Note:* The following features are NOT supported in IEGD v10.4:

- Microsoft Vista* 2D + 3D (WDDM)
- Vista DirectX 9.0L, DirectX 10.0 (Combine with MS Vista 2D + 3D)

The CED GUI is designed for ease of use and configuration of IEGD. Each configuration page has online help available and each data field is validated. If you enter an incorrect value, the CED displays an error message at the top of the page and displays the valid range of values for the field. You cannot finish a configuration until all fields contain valid values.

The following sections show how to create a configuration for any of the supported chipsets, operating systems, and IEGD Video BIOS.


- "Starting the CED" on page 33
- "Creating a New Customized DTD" on page 34
- "Creating a New Configuration" on page 38
- "Creating a New Package" on page 58
- "Generating an Installation" on page 66


## 3.1 Before You Begin

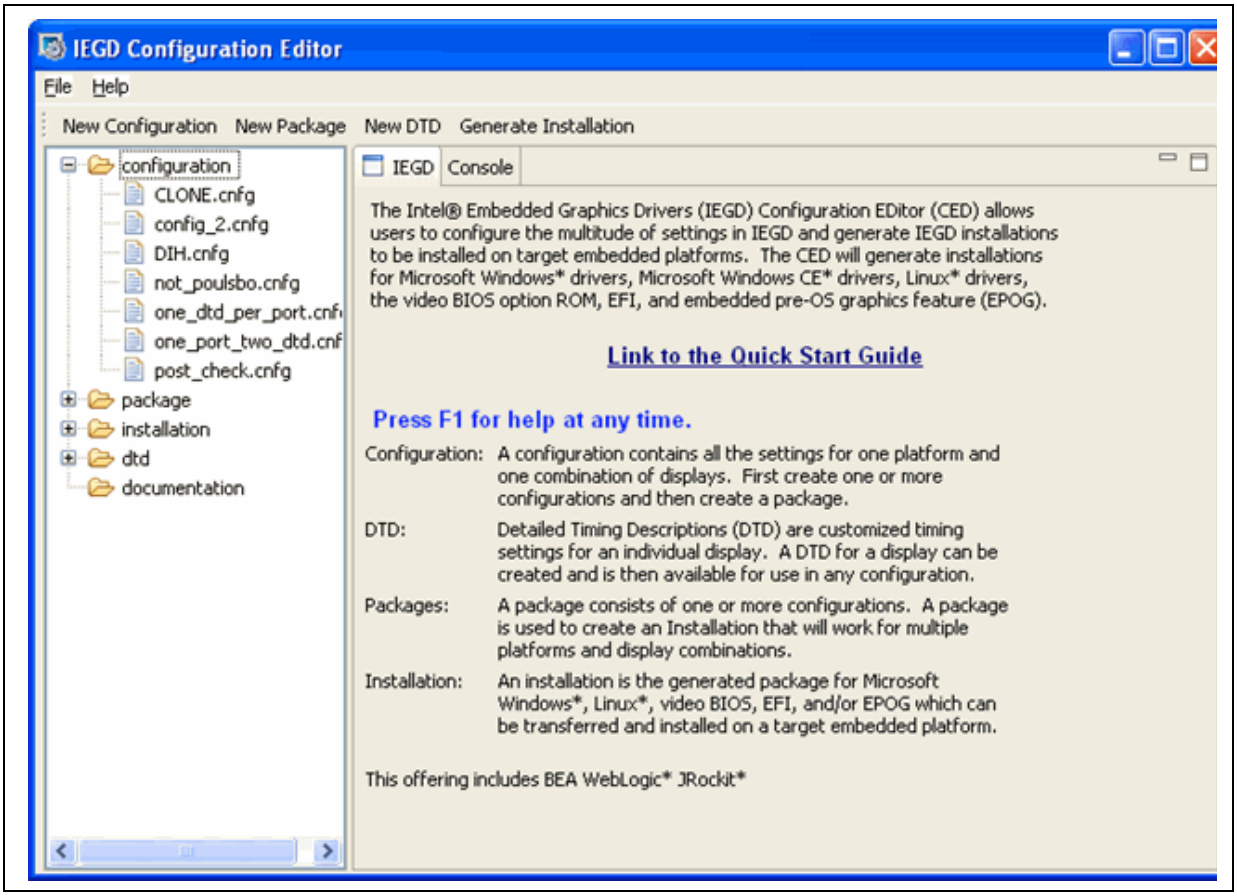
To configure IEGD software using CED, you will need some information on the panel you are using. This information is usually found in the product specifications. In some cases the terminology used in the CED may not match the labels used in your panel's product specification. Refer to Table 9, "Timing Specification Example Values" on page 37 for hints on which specs correspond to CED Detailed Timings Descriptor (DTD) fields. After you obtain the correct specification values, you may need to derive other values for the DTD fields.

## 3.2 Creating a Configuration in CED – Summary Steps

The following steps present a sample CED configuration.

1. (Optional) If you have custom panels and timings you may want to create your own DTD; otherwise you can use the standard DTDs provided by CED. If needed, select **New DTD**.
   - Choose the DTD Type that most closely aligns with your display parameters, enter parameters, and then click **Finish**. Or, to create a DTD, see "Creating a New Customized DTD" on page 34.
2. Select **New Configuration**.
   - Enter a name for the configuration, select the mode, chipset, ports, port drivers, DTDs, etc., for the configuration and then click **Finish**. For details, see "Creating a New Configuration" on page 38.
3. Select **New Package**.
   - Enter a name for the package, select the configurations for your package, the platforms for the installation, and then click **Finish**. For details, see "Creating a New Package" on page 58.
4. Select the created package and then select **Generate Installation**.
   The generated files are placed in the installation folder. The zip files (for Linux, Windows CE, and Windows operating systems) contain the generated `iegd.reg`, or INF file. For details, see "Generating an Installation" on page 66.

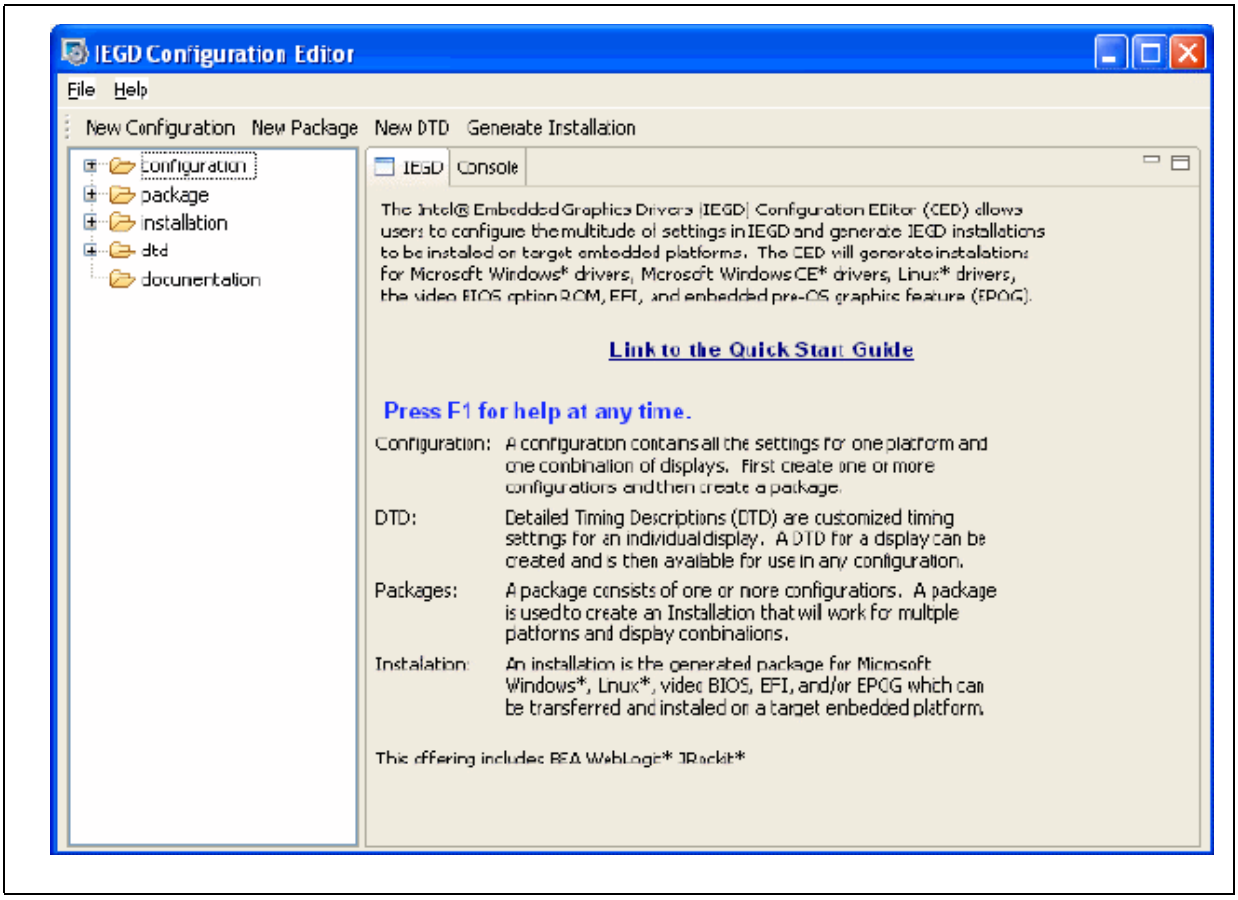
**Figure 4. Sample CED Configuration Start Page**




## 3.3 Starting the CED

To start IEGD CED, open the folder where you installed the CED and click the `iegd-ced.exe` icon. The IEGD CED splash window appears for a few moments followed by the IEGD Configuration Editor main window.

**Figure 5. IEGD Configuration Editor Main Window**




From this window, you can create configurations, package the configurations, and create installations from the packages that can be installed directly on a platform. The main window also provides a Console tab that displays information when you build a package or an installation.

The following sections show how to create a configuration for any of the supported chipsets, operating systems, and the IEGD Video BIOS.

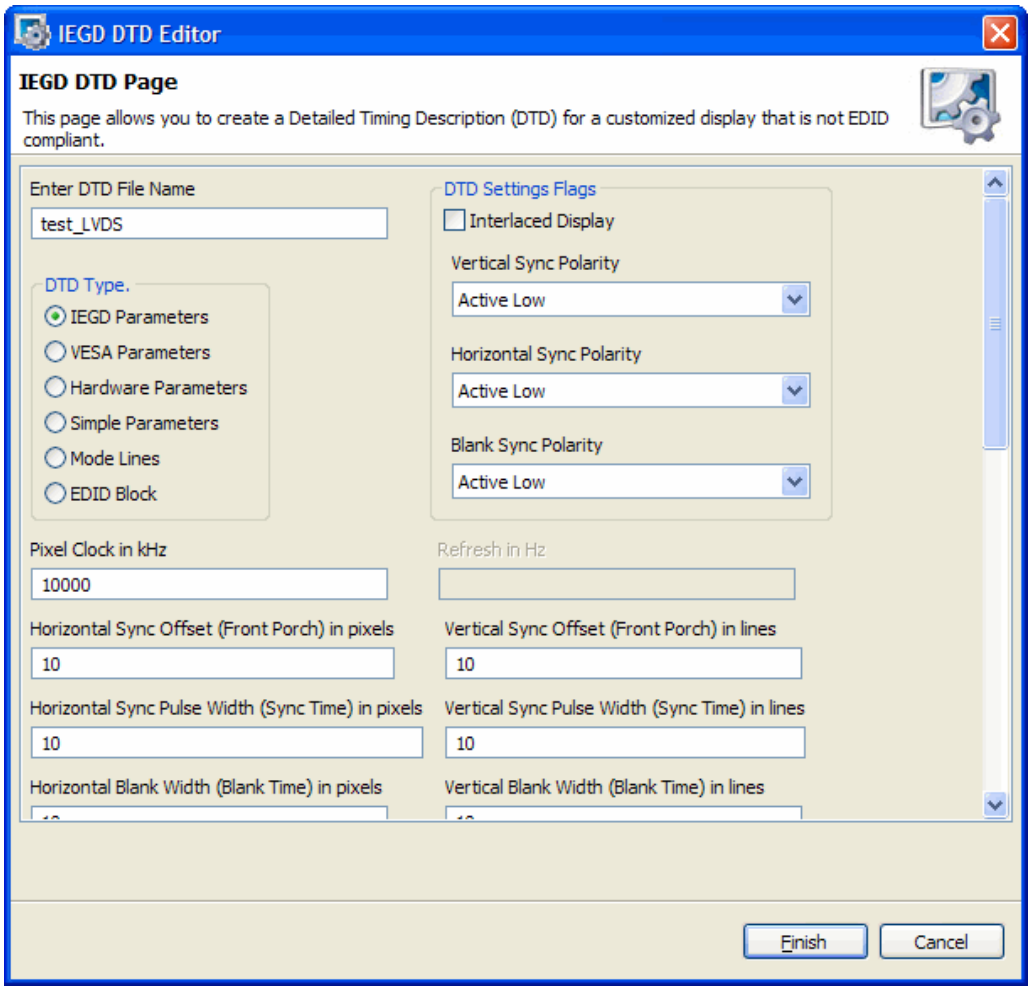
## 3.4 Creating a New Customized DTD

CED allows you to create Dynamic Timings Definitions (DTD) for EDID-less displays or displays for which you do not want to use the display's EDID settings. In either of those cases, you can create your own DTD using the steps below. Otherwise you can use one of the standard DTDs included in CED.

You can create a new DTD by clicking the **New DTD** link at the top of the main CED window, or you can create DTDs for each configured port when you create a new configuration. Any DTDs you create will be available for all configurations.

When you select **New DTD** from the main CED window, the following IEGD DTD Page appears.

### Figure 6. IEGD DTD Page




To create a custom DTD setting:

1. From the CED main screen, select **New DTD**.
2. Enter a name for the DTD in the text box provided, for example, *test_LVDS*.
3. Using the data sheet from the panel being used, enter the DTD timings in the appropriate fields. Refer to Table 8, "IEGD DTD Setting Options" for field descriptions.
   The screen will be similar to the example shown in Figure 6.
4. Click **Finish**.
   The custom DTD is complete.

## Table 8. IEGD DTD Setting Options (Sheet 1 of 2)

| DTD Parameter | Description |
|---|---|
| Enter DTD File Name | Enter a name for this customized DTD. This is a required field and the name must be between 1 and 50 characters and may contain spaces and underscores. |
| DTD Type | Select the DTD Type that most closely aligns with your display parameters. Options are:<br>• **IEGD Parameters**:<br>The IEGD Parameters are the same as the current PCF/CED DTD parameters.<br>• **VESA Parameters**:<br>The VESA Parameters allow the user to create a DTD from a VESA monitor timing standard.<br>• **Hardware Parameters**:<br>The Hardware Parameters are the parameters that are used by IEGD.<br>• **Simple Parameters**:<br>The Simple Parameters (CVT Standard) is a process for computing standard timing specifications. The method for developing Reduced Blanking timings is not included.<br>• **Mode Lines**:<br>The Mode Lines are a video timing spec used by X.org. The X.org timing setting for Mode Lines is “name” I A B C D E F G H. For example: “640x480@8bpp” 25.175 640 672 728 816 480 489 501 526.<br>• **EDID Block**:<br>The EDID Block is the detailed timing section (18 bytes) of the basic 128-byte EDID data structure. The detailed timing section starts at 36h of the 128-byte EDID data structure. Enter the EDID block 1 byte at a time. Example:<br>a0 0f 20 00 31 58 1c 20 d2 1a 14 00 f6 b8 00 00 00 18 |
| Pixel Clock | Pixel clock value in KHz. Range 0-0x7fffffff. |
| DTD Settings Flags | This section allows you to set flags for Interlace, Vertical Sync Polarity, Horizontal Sync Polarity, and Blank Sync Polarity. Each field in this section is described below.<br>**Interlaced Display**:<br>• Check for Interlaced<br>• Cleared for Non-interlaced<br>**Vertical Sync Polarity**:<br>• Active Low (Default)<br>• Active High<br>**Horizontal Sync Polarity**:<br>• Active Low (Default)<br>• Active High<br>**Blank Sync Polarity**:<br>• Active Low (Default)<br>• Active High<br><br>***Note:*** These flags are IEGD-specific and do not correspond to VESA 3.0 flags. |
| Horizontal Sync Offset (Front Porch) in pixels | Specifies the amount of time after a line of the active video ends and the horizontal sync pulse starts (Horizontal Front Porch). Range 0-1023 [10 bits]. |
| Horizontal Sync Pulse Width (Sync Time) in pixels | Width of the Horizontal Sync Pulse (Sync Time) which synchronizes the display and returns the beam to the left side of the display. Range 0-1023 [10 bits]. |
| Horizontal Blank Width (Blank Time) in pixels | This parameter indicates the amount of time it takes to move the beam from the right side of the display to the left side of the display (Blank Time). During this time, the beam is shut off, or blanked. Range 0-4095 [12 bits]. |
| Horizontal Active (Width) in pixels | Number of pixels displayed on a horizontal line (Width). Range 1-32767 [15 bits]. |

**Table 8. IEGD DTD Setting Options (Sheet 2 of 2)**

| DTD Parameter | Description |
|---|---|
| Horizontal Sync Start in pixels | This parameter specifies the start of the horizontal active time. Range 0-40957. |
| Horizontal Sync End in pixels | This parameter specifies the end of the horizontal active time. Range 0-49148. |
| Horizontal Blank Start in pixels | This parameter specifies the start of one line of the video and margin period. Range 0-32766. |
| Horizontal Blank End in pixels | This parameter specifies the end of one line of the video and margin period. Range 0-65533. |
| Refresh in Hz | Also known as the Vertical Refresh, the rate the full display updates. Standard refresh rates are 50Hz, 60Hz, 75Hz, and 85Hz. |
| Vertical Sync Offset (Front Porch) in lines | Specifies the amount of time after last active line of video ends and vertical sync pulse starts (Vertical Front Porch). Range 0-4095 [12 bits]. |
| Vertical Sync Pulse Width (Sync Time) in lines | Specifies the Width of the Vertical Sync Pulse which synchronizes the display on the vertical axis and returns the beam to the top, left side of the display. Range 0-63 [6 bits]. |
| Vertical Blank Width (Blank Time) in lines | The amount of time for the complete vertical blanking operation to complete. It indicates the time it takes to move the beam from the bottom right to the top, left side of the display (Blank Time). During this time, the beam is shut off, or blanked. Range 0-4095 [12 bits]. |
| Vertical Active (Height) in lines | The number of active lines displayed (Height). Range 1-4095 [12 bits]. |
| Vertical Sync Start in lines | This parameter specifies the start of the vertical sync. Range 0-4157. |
| Vertical Sync End in lines | This parameter specifies the end of the vertical sync. Range 0-4220. |
| Vertical Blank Start in lines | This parameter specifies the start of display vertical blanking including margin period. Range 0-4094. |
| Vertical Blank End in lines | This parameter specifies the end of vertical blanking. Range 0-8189. |

## 3.4.1 DTD Example Specifications

The following table shows example product specifications that can be used in the timing fields.

**Table 9. Timing Specification Example Values (Sheet 1 of 2)**

| Item | | Symbol | Standard value | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Clock | Frequency | 1/ts | 29.91 | 33.231 | 36.55 | MHz |
| | Period | ts | 27.36 | 30.06 | 33.43 | ns |
| | Hi-time | tsh | 7 | – | – | ns |
| | Low-time | tsl | 7 | – | – | ns |
| | DUTY ratio | th/tl | 35 | 50 | 65 | ns |
| Data | Setup time | tds | 7 | – | – | ns |
| | Hold time | tdh | 4 | – | – | ns |
| H sync. | Period | tlpl, tlpd | 24.51 | 31.75 | 32.05 | us |
| | | | 880 | 1056 | 1088 | clk |
| | Pulse width | tlw | 3 | 128 | 200 | clk |
| H display | Term | thd | 800 | 800 | 800 | clk |
| Enable | Setup time | tdrs | 7 | – | – | ns |
| | Hold time | tdrh | 4 | – | – | ns |

**Table 9. Timing Specification Example Values (Sheet 2 of 2)**

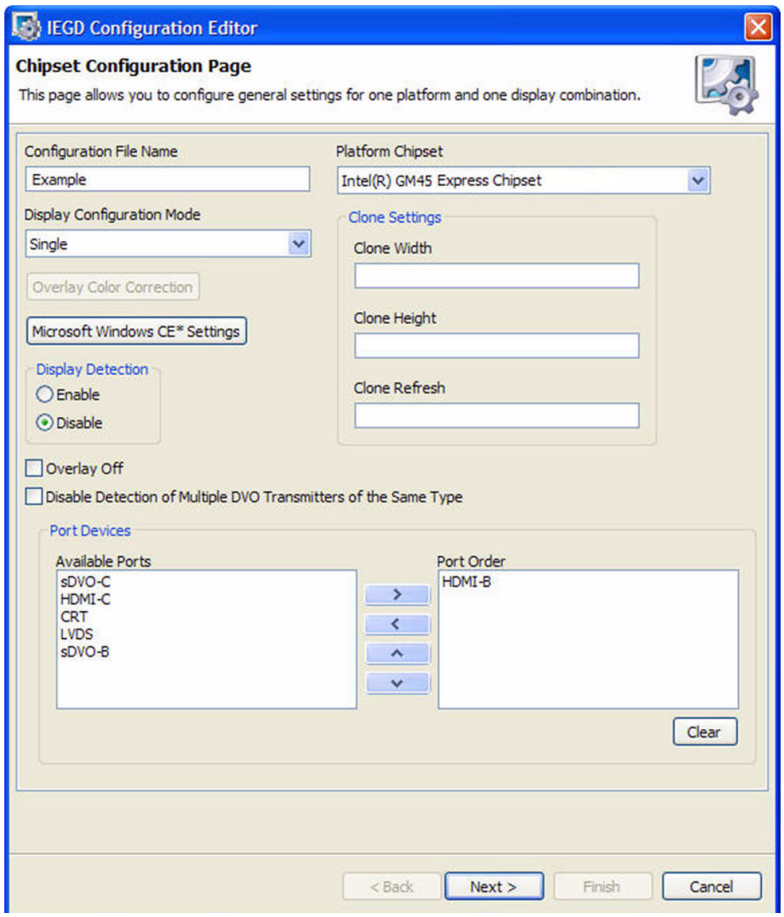
| Item | | Symbol | Standard value | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| V sync. | Period | tfpf, tfpd | 520 | 525 | 680 | Line |
| | Pulse width | tfw | 1 | 2 | 3 | Line |
| V display | Term | tvd | 480 | 480 | 480 | Line |
| | Start | tfd | 10 | 33 | 40 | Line |
| Phase difference | H sync. ~ enable | tdrds | 50 | 216 | 260 | clk |
| | H sync. ~ clock | tls | 7 | – | – | ns |
| | H sync. ~V sync. | tn | 7 | – | – | ns |

For information about creating DTDs for Windows CE, see Chapter 6.0, "Configuring and Building IEGD for Microsoft Windows CE* Systems."

## 3.5 Creating a New Configuration

To create a new configuration, click the **New Configuration** selection located on the top of the IEGD CED main window. The Chipset Configuration Page appears.

**Figure 7. Chipset Configuration Page**



The Chipset Configuration Page allows you to specify settings that apply to all OS, VBIOS, EFI, and EPOG platforms (Note: The EPOG feature is available only in single display mode on Intel® System Controller Hub US15W.)

The table below describes each setting on the Chipset Configuration page.

**Table 10. Chipset Configuration Page Settings (Sheet 1 of 2)**

| Setting | Description |
|---|---|
| Configuration File Name | Provide a name for the configuration you are creating. This name is required and is used when you create packages. The name can consist of any alphanumeric characters and any special characters and must be between 1 and 50 characters. You must enter a configuration before you can enter any other information on this page. |
| Platform Chipset | Select the target chipset for this configuration from the drop-down list. |
| Display Configuration Mode | Select the type of display configuration from the drop-down list. You can select any one of the following display configurations:<br>• Single — Single display configuration.<br>• Twin — Two displays where both displays have the same resolution, refresh rate, and content.<br>• Clone — Two displays where both displays have the same content but can have different resolutions and timings.<br>• DIH — Dual Independent Head. This is a configuration where both displays can have different resolutions, different refresh rates, and different content.<br>***Note:*** On Microsoft Windows* DIH configurations, the display DOES NOT automatically come up in extended display mode. You must go into the Display properties on the Control Panel and manually set the display to DIH mode. |
| Overlay Color Correction | Overlay Color Correction allows the Overlay plane to have color-correction settings that are different from the main frame buffer color-correction settings. See "Overlay Color Correction" on page 40.<br>***Note:*** Overlay color correction is not supported on the Intel® GM45 chipset. |
| Microsoft Windows CE* Settings | If you are creating a package for a Microsoft Windows* CE platform, click the **Microsoft Windows CE* Settings** button for additional settings that may be required for your configuration. Please see "Changing Windows CE OS Options" on page 43 for descriptions of these settings. |
| Display Detection | Display Detection allows you to specify if the driver should detect displays on the system. The default is Disabled. For more information on Display Detection, refer to "Display Detection and Initialization" on page 78. |

**Table 10. Chipset Configuration Page Settings (Sheet 2 of 2)**

| Setting | Description |
|---|---|
| Port Devices (Available Ports, Port Order) | The Port Devices section lists the ports available based on the chipset selected.<br>The Available Ports box lists the ports available to the chipset. You can move these port devices to the Port Order box to determine the search order for detecting attached displays. To move a port device to the Port Order box, either double-click the port device or click the port device to highlight it, and then click the right arrow button to move it from the Available Ports to the Port Order box.<br>The Port Order section allows you to determine the search order for detecting attached displays for the Display Detection feature. When Display Detection is enabled, the Port Order determines which display is primary and which display is secondary.<br>You can choose default ordering by not moving any of the Available Ports to the Port Order box and leaving the Port Order box empty. Default ordering is chipset-specific. See Table 56, "Default Search Order" on page 218 for more information on default port ordering based on chipset.<br>When you move one or more ports to the Port Order box, you can configure each port by clicking **Next**. For each port listed in the Port Order box, you can click **Next** to configure each port. See "Configuring Ports" on page 45 for information on configuring ports.<br>***Note:*** When specifying the port order, if sDVOC is before sDVOB, you should specify the I2C parameter i2Cdab=0x72 for sDVOC. This allows the driver to detect the SDVO encoder connected to sDVOC properly. See other details in "i2cdab" on page 75. |
| Clone Settings<br>Clone Width<br>Clone Height<br>Clone Refresh | If you are creating a clone display configuration, you can specify the width, height, and refresh rate for the clone display in this section. For more information about clone display configurations, refer to "Enhanced Clone Mode Support" on page 84. |
| Overlay Off | This field allows you disable Overlay support, which is enabled by default.<br>***Note:*** This field is only for Microsoft Windows* and Microsoft Windows CE operating systems. The Linux* OS configuration for the xorg.conf provides a standard option that performs the same function. |

## 3.5.1 Setting Color Correction

Color Correction is available for both overlays and framebuffers, and is accessed under the **New Configuration** link at the top of the main CED window. For both overlay and framebuffer color correction, user-assigned values must be between 0.6 to 6. By default, gamma is 1.0 (no correction).

*Note:* Overlay color correction is not supported on the Intel® GM45/GL40/GS45 chipset.

### 3.5.1.1 Overlay Color Correction

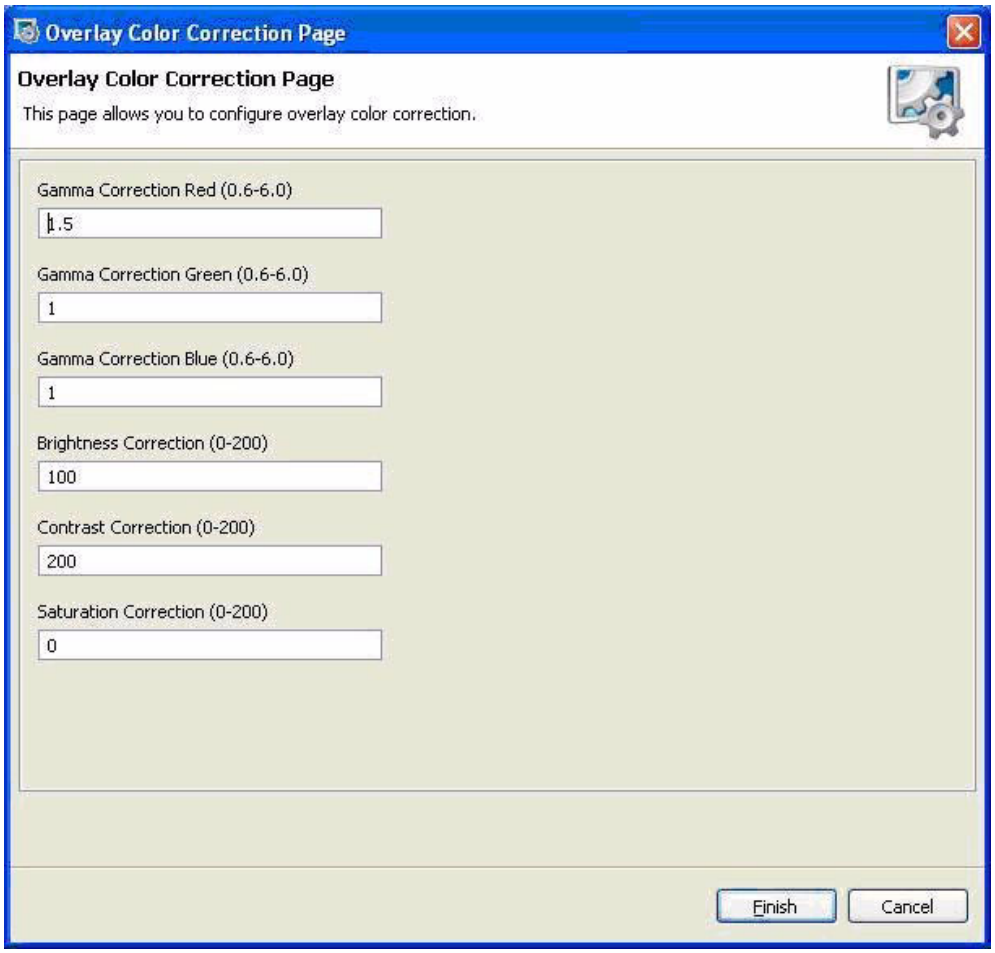
Overlay Color Correction allows the Overlay plane to have color-correction settings different from the main framebuffer color-correction settings. This feature lets you color-correct for red, green, and blue, plus it enables you to adjust brightness, contrast, and saturation.

**Table 11. Overlay Color Correction Values (applies to ALL color)**

| | |
|---|---|
| Gamma: | 0.6 to 6.0 (default value is 1) |
| Brightness: | 0 to 200 (default value is 100) |
| Contrast: | 0 to 200 (default value is 100) |
| Saturation: | 0 to 200 (default value is 100) |

To assign overlay color correction, click the **Overlay Color Correction** button on the Chipset Configuration Page. The Overlay Color Correction Page appears, as shown in the figure below.

**Figure 8. Overlay Color Correction Page**




Add your desired values to the correction fields and then click **Finish**.

### 3.5.1.2 Framebuffer Color Correction Attributes

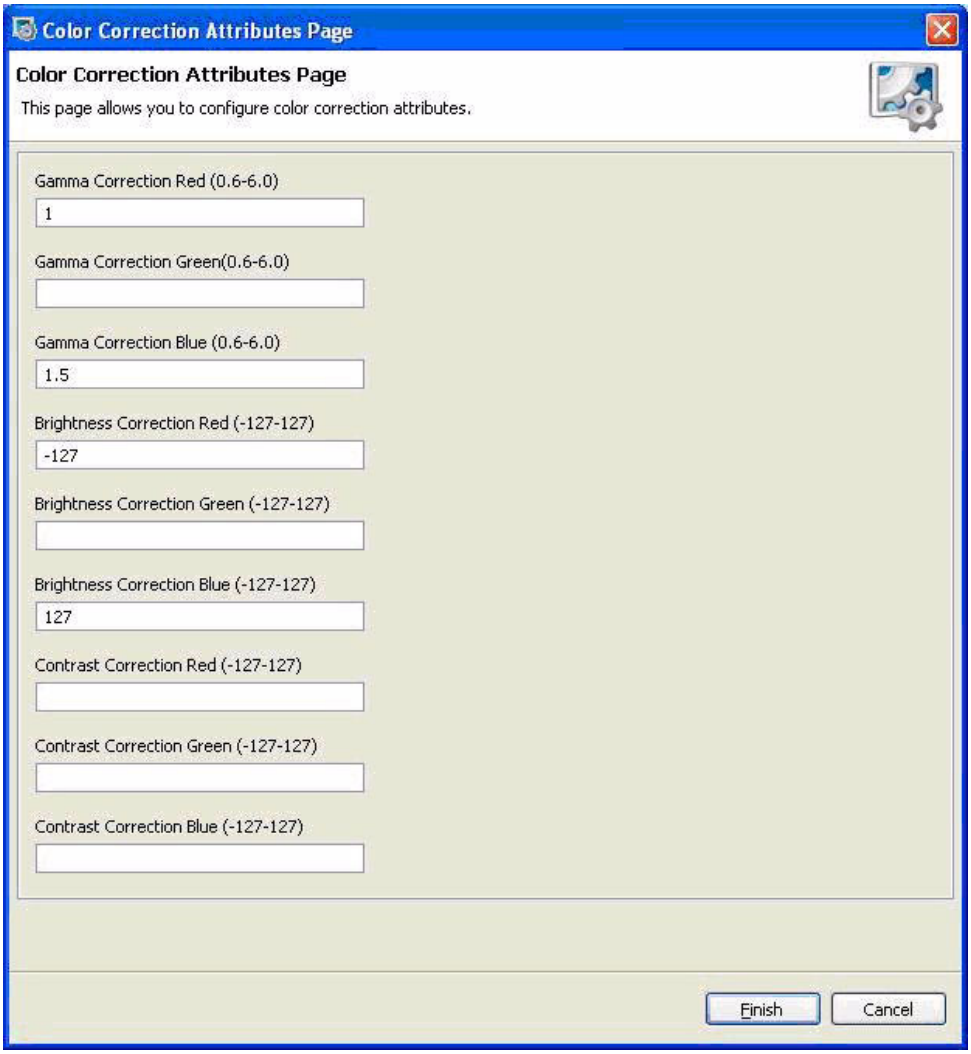
Framebuffer Color Correction Attributes allow you to adjust the main color attributes. This feature lets you color-correct for red, green, and blue, and enables you to adjust brightness and contrast.

**Table 12. Framebuffer Color Correction Values (applies to R, G, B color)**

| | |
|---|---|
| Gamma: | 0.6 to 6.0 (default value is 1) |
| Brightness: | -127 to 127 (default value is 0) |
| Contrast: | -127 to 127 (default value is 0) |

To assign framebuffer color correction, click the **Framebuffer Color Correction Attributes** button on the port configuration page (CRT, LVDS, sDVO, or HDMI). The Framebuffer Color Correction Page appears, as shown in Figure 9.

**Figure 9. Framebuffer Color Correction Page**

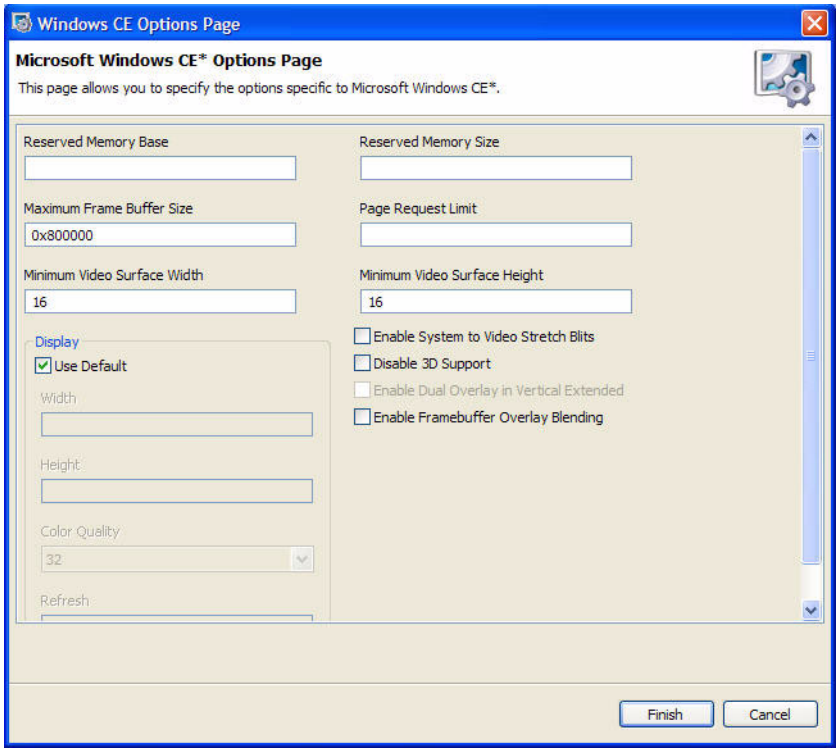



Add your desired values to the correction fields and then click **Finish**.

### 3.5.2 Changing Windows CE OS Options

The Windows CE Options Page allows you to enter Windows CE OS-specific options into the configuration. When you click the **Microsoft Windows CE* Settings** button from the IEGD Package Page (see "Creating a New Package" on page 58), the following page appears.

**Figure 10. Chipset Configuration Page**



The table below describes each field on this page.

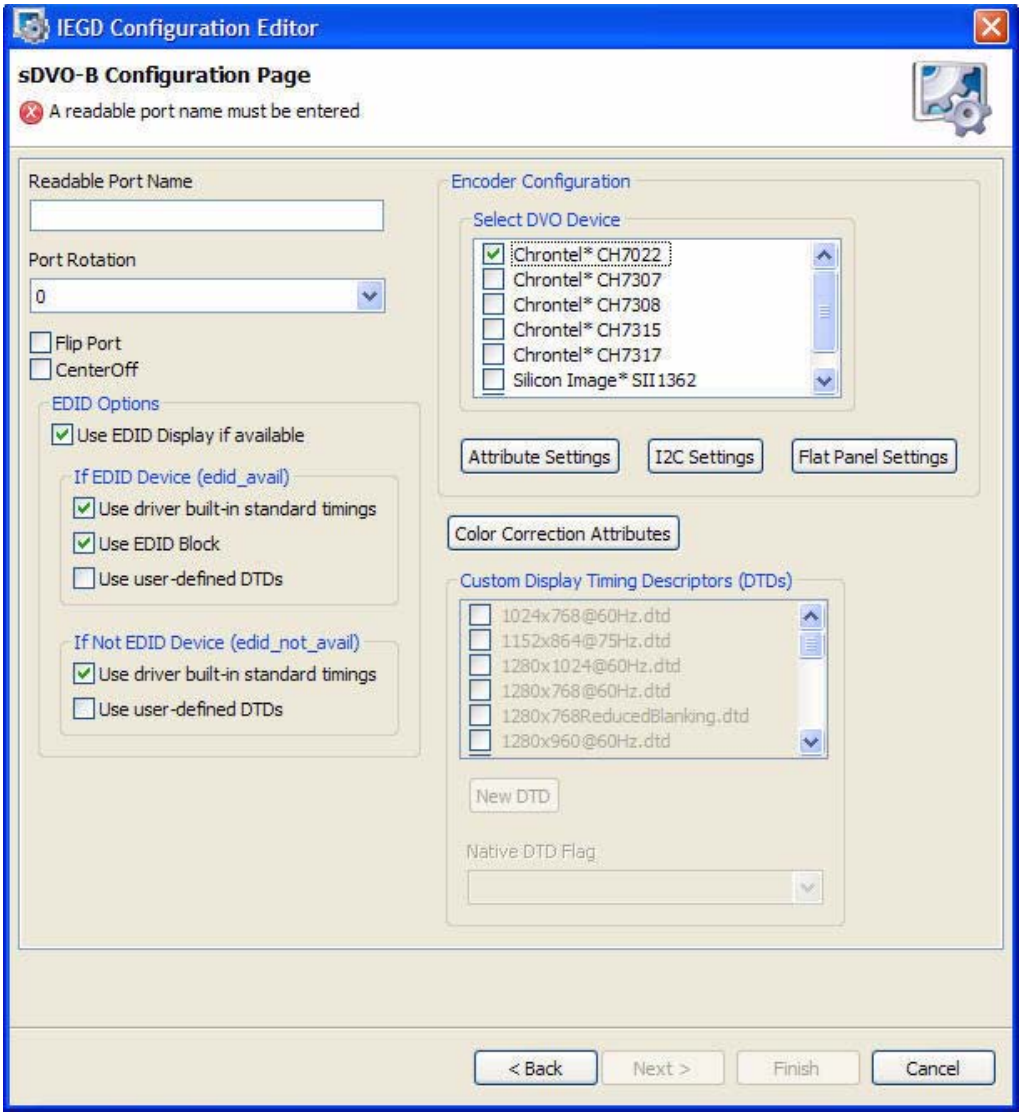
**Table 13. Windows CE OS Settings**

| Windows CE OS Option | Description |
|---|---|
| Reserved Memory Base<br>Reserved Memory Size | These two fields let you specify the amount and the starting point of statically reserved video memory. Video memory can be statically reserved or dynamically allocated on demand. If both Reserved Memory Base and Reserved Memory Size are non-zero, video memory allocation uses the static model. Base plus Size must extend to TOM (Top Of Memory) and not conflict with other reserved memory arenas in the `config.bib` file.<br>The default for both Reserved Memory Base and Reserved Memory Size is zero, indicating a dynamic allocation model.<br>Default behavior disables static memory model. |
| Maximum Frame Buffer Size | The maximum size of the expected frame buffer. By providing this hint, the display driver can more efficiently organize GART memory, leading to a smaller video memory consumption. This value must be greater than or equal to the expected size of the frame buffer. Units represent the number of bytes and are specified in hexadecimal. Specifying zero causes the default frame buffer reservation sizing.<br>The default is 0x300000 |
| Page Request Limit | The Page Request Limit controls the maximum allocations of offscreen video surfaces, buffers, etc. This value represents the number of pages (4K) allocated and is independent of dynamic or static memory configuration.<br>The maximum is 128MB (0x8000) |
| Minimum Video Surface Width<br>Minimum Video Surface Height | In pixels, the minimum width and height of surfaces acceptable for allocation in video memory. Due to hardware restrictions that optimize memory access, it is advisable to reserve video memory for larger surfaces and allow GDI and DirectDraw* to allocate small surfaces from system memory.<br>Default value for both width and height is 16. |
| Enable System to Video Stretch Blits | When checked, this enables system-to-video memory stretch blit operations to take advantage of hardware-accelerated filtering. Normally, it is more efficient to allow GDI to conduct system-to-video stretch blits, but the default filtering used by GDI is Nearest.<br>The default is disabled. |
| Disable D3D | Specify whether to disable or enable D3D graphics.<br>***Note:*** For Windows CE 7.0 OS, this box should be checked as IEGD currently does not support D3D on Windows CE 7.0/WEC7 systems. |
| Enable Dual Overlay in Vertical Extended | This option is available only if DIH (vertical extended) mode has been selected as the display configuration on the Chipset Configuration page. See Table 10, “Chipset Configuration Page Settings” on page 39 for details. |
| Enable Frame Buffer Overlay Blending | When checked, this option enables overlay blending with the framebuffer on both display outputs (if in VEXT mode) on US15W and when display mode resolution is 32-bit XRGB. |
| Enable No Tearing Option | If enabled, all blit operations to the frame buffer are synchronized with video sync to eliminate any visible tearing on the display screen. Disabling this feature achieves a performance gain. |
| Display<br>Use Default<br>Width<br>Height<br>Color Quality<br>Refresh | The Display section allows you select the default resolution, color depth, and refresh rate for the configuration. If you do not select a default display mode, the configuration uses the default display mode for the operating system it is installed on. |

### 3.5.3 Configuring Ports

You can configure each port listed in the Port Order box of the Chipset Configuration Page by clicking **Next**. When you do, a port Configuration Page appears similar to the one shown here.

**Figure 11. Port Configuration Page**




The Port Configuration Page allows you to specify whether to use EDID timings or customized DTD timings for the display connected to this specific port. From this page, you can also specify Attribute Settings, I2C Settings, and Flat Panel Settings and create a new DTD that can be used with any configuration.

Table 14 describes each field on this page.

## Table 14. Port Configuration Settings (Sheet 1 of 2)

| Port Configuration Field | Description |
|---|---|
| Readable Port Name | Enter a name for the port. This is a required field and the name must be between 1 and 50 characters and may contain spaces. |
| Port Rotation | This list allows you select a rotation for the display connected to this port. You can choose between 0, 90, 180, and 270 degrees. The default is 0.<br>***Note:*** For Windows CE Static rotation, setting the width and height to the rotated values is no longer required with the improvements beginning in v10.1. |
| Flip Port | Check this box if you want the display connected to this port to be inverted horizontally. The default is not to invert horizontally. |
| CenterOff | When this option is enabled it DISABLES centering. Also, depending on the combination of “edid” + “user-dtd” + connected hardware, IEGD will add missing compatibility modes (6x4, 8x6, 10x7& 12x10) via centering. Use this option to disable this feature. |
| EDID Options | This section allows you to set EDID options for the display. IEGD supports three different types of EDID display modes:<br>• Built-in display modes: These modes are hard-coded in IEGD. These modes can be filtered based on the EDID block.<br>• EDID Block: These are Detailed Timing Descriptors read from an EDID display. An EDID display can contain DTD as well as other information about the display.<br>• User-specified DTDs.<br>If you want to use the display's EDID information if it is available, click the **Use EDID Display if Available** check box.<br>If the display attached to this port contains EDID information, you can choose one or more of the following options from the If EDID Device section to determine which set of timings to use for the display connected to the port:<br>• Use driver built in standard timings — If this box is checked, the standard timings built into IEGD are used.<br>• Use EDID block — If this box is checked, the EDID block is used.<br>• Use user-defined DTDs — If this box is checked, a user-defined DTD is used. You can select which DTD to use by checking the appropriate box in the Custom Display Timings Descriptors (DTDs) section. If no DTDs are defined, you can click **New DTD** and create a custom DTD. For information on creating custom DTD, refer to Table 21 on page 63.<br>If you select both **Use driver built-in standard timings** and **Use EDID block**, IEGD uses its built-in display timings and the timings provided by the display.<br>If the display attached to this port does not contain EDID information, you can choose one or both of the following options from the If Not EDID Device section:<br>• Use driver built-in standard timings — If this box is checked, the standard timings are used.<br>• Use user-defined DTDs — If this box is checked, a user defined DTD is used. You can select which DTD to use by checking the appropriate box in the Custom Display Timings Descriptors (DTDs) section. If no DTDs are defined, you can click **New DTD** and create a custom DTD. For information on creating custom DTD, refer to Table 21 on page 63.<br>See “Sample Advanced EDID Configurations” on page 81 for example configurations. |

**Table 14. Port Configuration Settings (Sheet 2 of 2)**

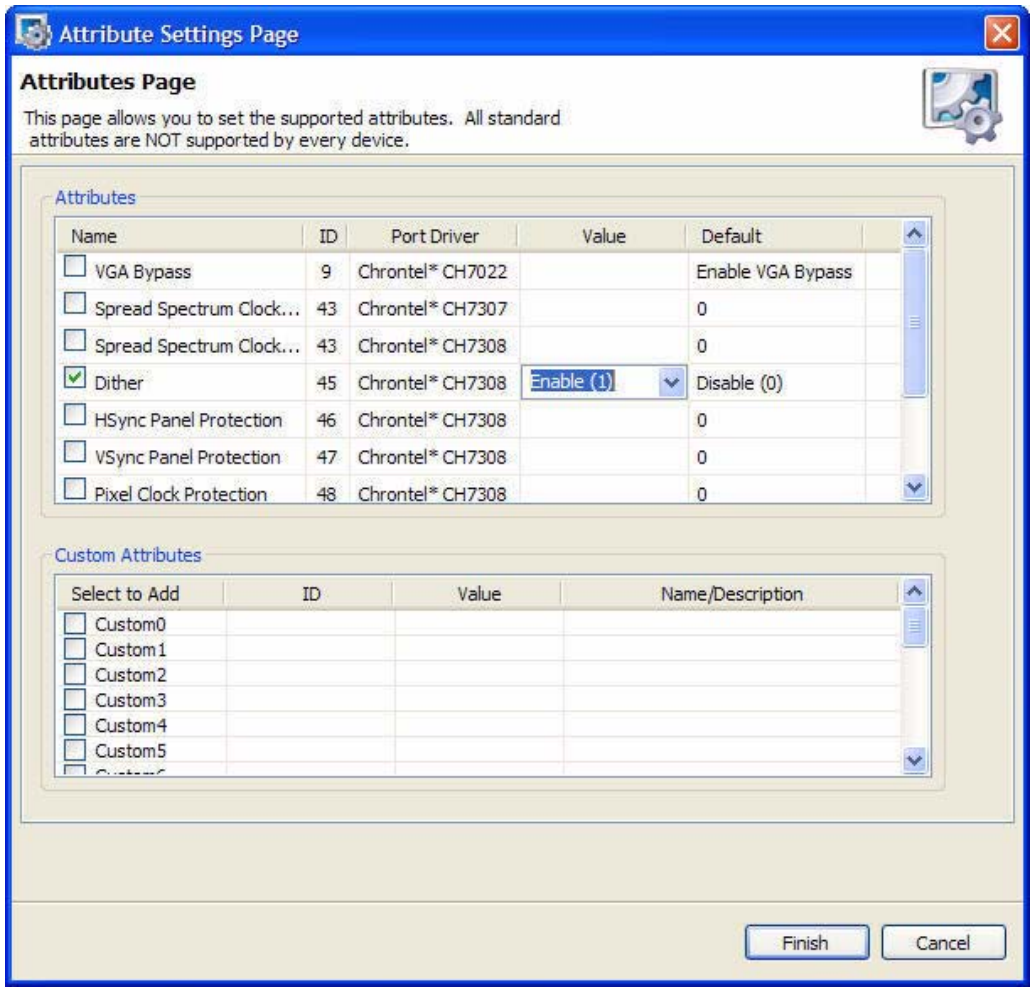
| Port Configuration Field | Description |
|---|---|
| Encoder Configuration | This section lets you to specify the type of encoder connected to an sDVO port and encoder Attributes, I2C settings, and Flat Panel settings for the port.<br>The **Select sDVO Device** drop-down list contains the list of all supported sDVO devices. Select the device that will be connected to this port.<br>To change the device's attributes, click the **Attribute Settings** button. Refer to "Changing Port Attribute Settings" for information on device attributes.<br>To change the device's I2C settings, click the **I2C Settings** button. See "Changing I2C Settings" on page 49 for information on I2C settings.<br>To change the device's flat panel settings, click the **Flat Panel Settings** button. See "Changing Flat Panel Settings" on page 50 for information for changing flat panel settings. |
| Color Correction Attributes | Color Correction Attributes allow you to adjust the main Frame Buffer color attributes. See "Framebuffer Color Correction Attributes" on page 41. |
| Native DTD Flag | The Native DTD list lets you choose whether to use a display's built-in timings. |

### 3.5.3.1 Changing Port Attribute Settings

When you click the **Attributes Settings** button from the Encoder Configuration section of the Port Configuration Page, the CED displays a page of attributes for the selected encoder device. The actual page that appears depends upon the encoder device selected and only the attributes that apply to the selected encoder appear. For a full description of all attributes for all supported encoders, refer to "Port Driver Attributes" on page 209.

Figure 12 shows a sample Attributes Settings Page for the Chrontel CH7022, CH7307, and CH7308 encoders.

**Figure 12. Attribute Settings Page for the Chrontel CH7022/CH7307/CH7308 Encoders**



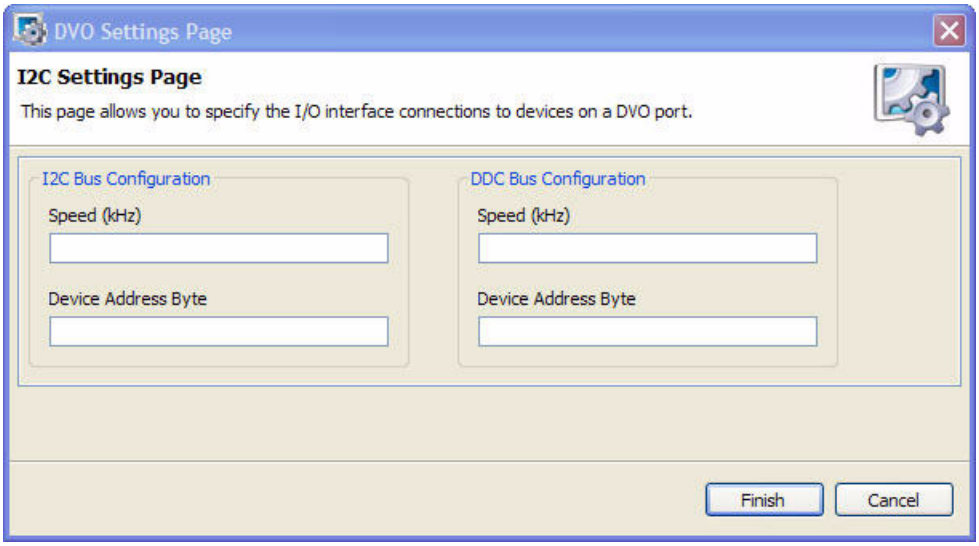

When the Attributes Settings Page first appears, it shows the **Use Default** box checked for all attributes.

To change a default value, clear the **Use Default** check box and enter a new value. For a description of all attributes for all supported encoders, see "Port Driver Attributes" on page 209.

### 3.5.3.2 Changing I2C Settings

The I2C Settings Page allows you to specify the I/O interface connections to devices on an sDVO port. When you click **I2C Settings** from the Port Configuration Page, the following screen appears.

**Figure 13. sDVO Settings Page**




To change the default settings for the **I2C Bus Configuration** or the **DDC Bus Configuration**, clear the **Use Default** box and enter new values. The following table describes each field on this page.

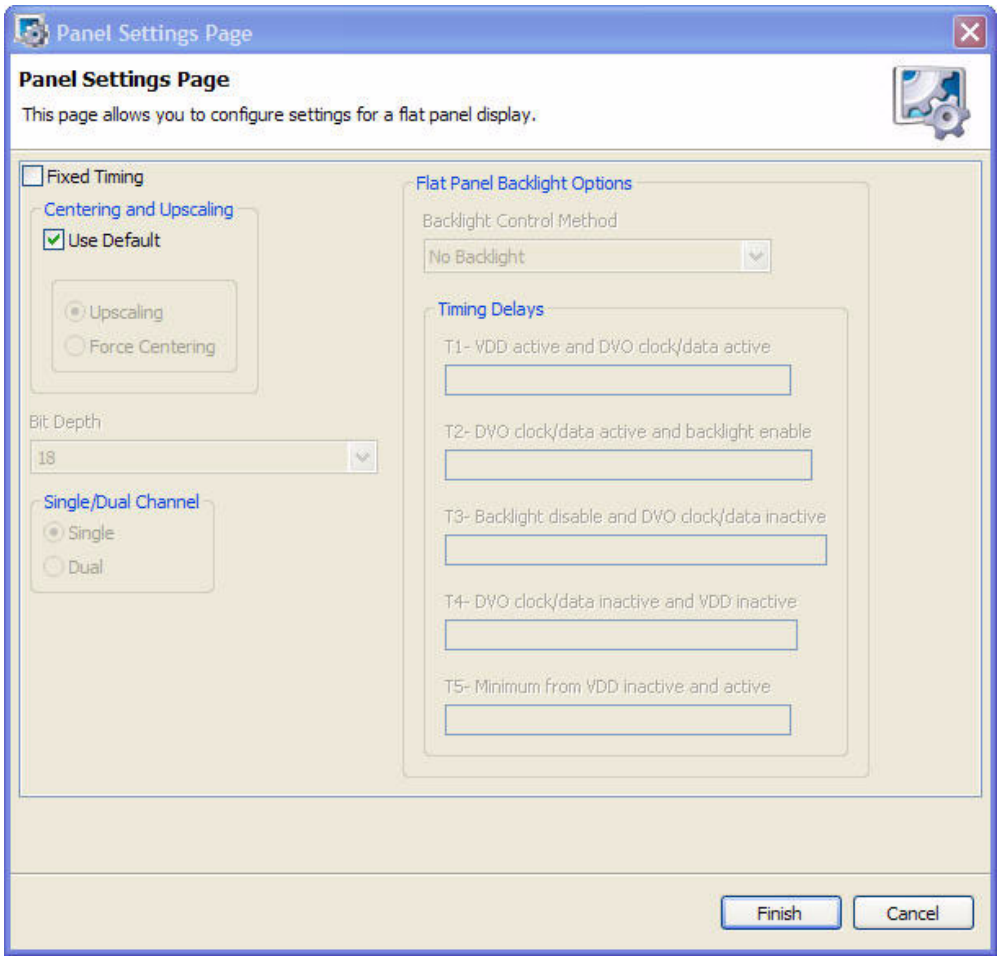
**Table 15. I2C Settings**

| I2C/DDC Bus Setting | Description |
|---|---|
| Device Address Byte | You can enter a device address byte for the device that this port is connected to in these boxes.<br>The I2C device address is for reading and writing device registers. The device address byte must be in 8-bit format with the 7-bit slave address assigned to its bits 7:1 and bit 0 set to 0.<br>The DDC Device Address Byte is the I2C device address for reading EDID data from the display through the DDC bus. |
| Speed (KHz) | Speed of I2C bus for the device and for the EDID device. The range for these two fields is 10-400 KHz. |

### 3.5.3.3 Changing Flat Panel Settings

The Panel Settings Page allows you to specify settings for a flat panel display connected to this sDVO port. When you click **Flat Panel Settings** from the Port Configuration Page, the following screen appears.

**Figure 14. Panel Settings Page**



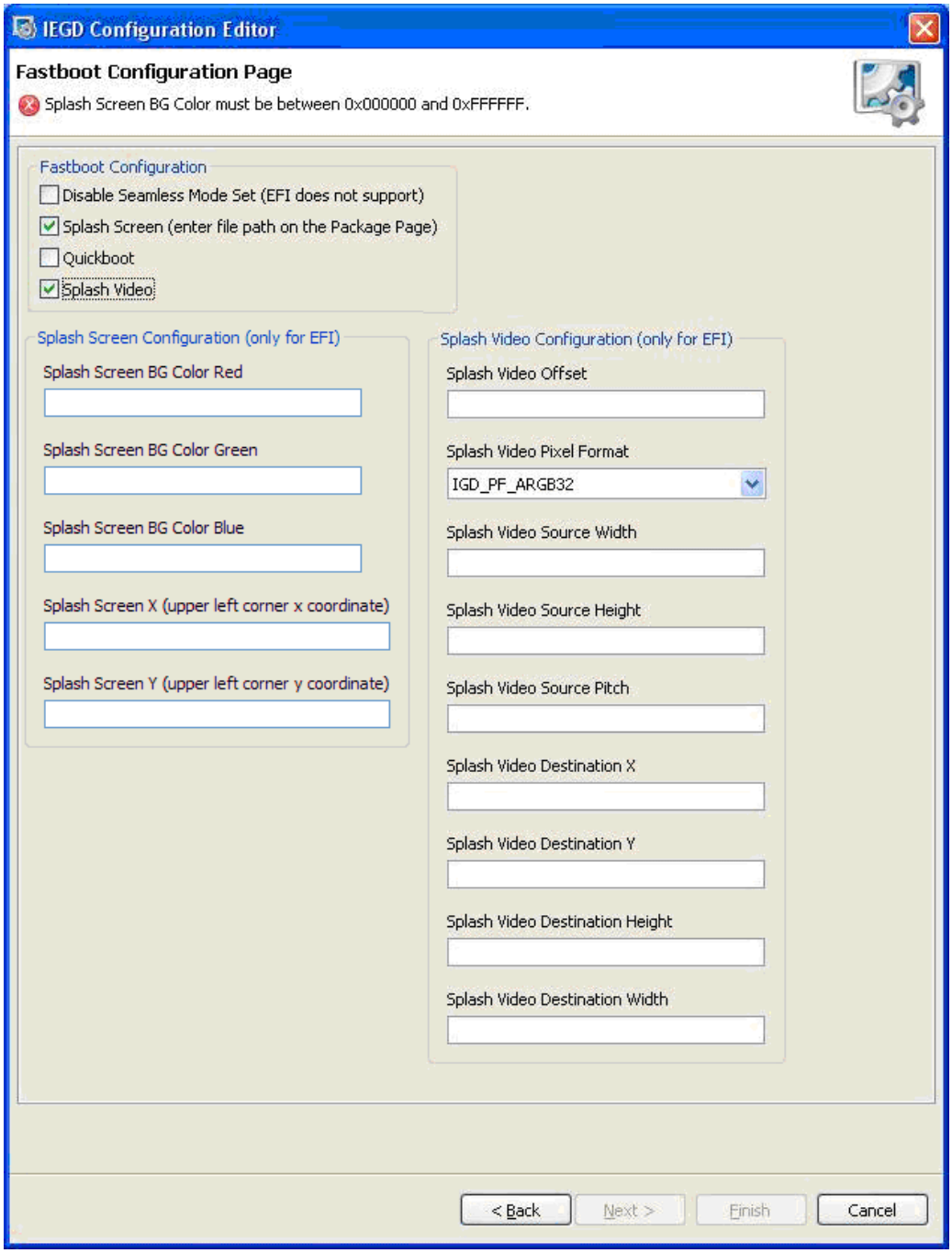
The table below describes each section of this page.

**Table 16. Panel Settings Options**

| Flat Panel Settings | Description |
|---|---|
| Fixed Timing | This section indicates whether the attached display is a fixed timing display. |
| Centering and Upscaling | The **Use Default** check box lets you choose the default setting or either Upscaling or Force Centering. |
| GPIO Pin Connections | If you select **Port Driver, GMCH**, or **ICH** from the Flat Panel Backlight Options list, you can specify the following GPIO pin connections.<br>• Panel Power Signal — GPIO connection for panel power.<br>• VDD backlight sequence signal — GPIO connection for backlight power on/off sequencing signal.<br>• Backlight signal — GPIO connection to enable backlight signal. |
| Bit Depth | This list lets you select a color depth for the panel. You can choose either 18 or 24 bit color depth. The default is 18. |
| Single/Dual Channel | This option determines the chip channel mode. Single mode is recommended for TV displays. For flat panels, refer to the panel's specification. |
| Flat Panel Backlight Options | This section provides options for controlling the backlight of the flat panel display and specifying timing delays.<br>• The Backlight Control Methods list lets you choose among **No Backlight**, **Port Driver**, **GMCH**, or **ICH** to control the backlight. If choose Port Driver, GMCH, or ICH, you can specify the timing delays in the Timing Delays section and the GPIO pin connections in the GPIO Pin Connections section. The default is No Backlight. |
| Timing Delays | This section lets you specify timing delays for the backlight signals as follows:<br>• T1-VDD active and sDVO clock/data active: 1-512, increment by 1.<br>• T2-DVO active and backlight enable: 2-256, increment by 2.<br>• T3-Backlight disable and DVO clock/data inactive: 2-256, increment by 2.<br>• T4-DVO clock/data active and inactive: 1-512, increment by 1.<br>• T5-Minimum from VDD inactive and active: 1-1600, increment by 50.<br>***Note:*** Timers are very specific to the panel you are using. If they are set incorrectly the display can be damaged or ruined. Please refer to the datasheet for your display to determine the correct settings. |

### 3.5.4 Configuring Fastboot

**Figure 15. Fastboot Configuration Page**




The table below describes each section of this page.

*Note:* Enter the file path for the splash video on the Package Page. See Figure 18 on page 58.

## Table 17. Fastboot Options (Sheet 1 of 2)

| Fastboot Settings | Description |
|---|---|
| Disable Seamless Mode Set | The Seamless mode set feature ensures that on a properly configured embedded device there is only 1 mode set between power on and a fully functional system. Under normal circumstances a PC will set the mode several times during initialization which causes screen flicker and latency that is undesirable for an embedded device. With seamless mode set, the firmware sets the mode and the driver adopts the existing mode without altering the hardware state. This feature can be combined with splash screen or splash video for optimal effect. EFI and the EPOG feature do not support this feature. |
| Splash Screen | The Splash screen feature provides a user-configurable splash screen image that is loaded to the framebuffer at the earliest possible time by the EPOG feature and EFI graphics driver and remains in place until overwritten by the OS or driver. Additionally IEGD can be configured to suppress OS drawing to the on-screen framebuffer until notified by an application. Instead, drawing is redirected to an off-screen framebuffer. When notified by the application, IEGD will flip the already prepared off-screen framebuffer to be on-screen and cease redirection of drawing. In this manner the configured splash screen will be displayed early during boot and remain in place until a time when the OS is fully loaded and the application interface has been prepared.<br><br>Only `.bmp` format is supported for the splash screen. |
| Quickboot | The quickboot feature optimizes the speed that IEGD loads at the expense of compatibility and ease of use. Quickboot disables non-critical features that affect the initialization time of the driver that are not needed for targeted embedded applications. For example, there is no port detection; it supports only an LVDS interface. |
| Splash Video | The Splash Video feature provides a mechanism to use a portion of the off-screen pre-allocated video memory (“Stolen Memory”) as a video image that is displayed on an overlay to the framebuffer. The intention is that a video capture device external to IEGD will be configured to transfer a video stream to the configured location in video memory using DMA. The splash video remains in place until IEGD is notified by an external application to disable the overlay. |
| Splash Screen BG Color Red (EFI only) | Splash Screen BG Color Red must be between 0x0 and 0xFF. |
| Splash Screen BG Color Green (EFI only) | Splash Screen BG Color Green must be between 0x0 and 0xFF. |
| Splash Screen BG Color Blue (EFI only) | Splash Screen BG Color Blue must be between 0x0 and 0xFF. |
| Splash Screen X (upper left corner x coordinate) (EFI and EPOG feature only) | The X location, in pixels, where the Firmware Splash Screen will be placed. This number is a signed number in 2's complement. Positive numbers are offset from the left of the screen. Negative numbers are offset from the right of the screen. |
| Splash Screen Y (upper left corner y coordinate) (EFI and EPOG feature only) | The Y location, in pixels, where the Firmware Splash Screen will be placed. This number is a signed number in 2's complement. Positive numbers are offset from the top of the screen. Negative numbers are offset from the bottom of the screen. |
| Splash Video Offset (EFI and EPOG feature only) | The offset, in bytes, from the base of video memory where the Splash Video will be placed. Care must be taken to ensure that this location is past the end of the on-screen framebuffer and that the full Splash Video image within the pre-allocated video memory. |
| Splash Video Pixel Format (EFI and EPOG feature only) | The pixel format of the Splash Video image in memory. The available pixel formats are encoded values used within IEGD. |
| Splash Video Source Width (EFI and EPOG feature only) | The width, in pixels, of the Splash Video image in memory. |
| Splash Video Source Height (EFI and EPOG feature only) | The height, in pixels, of the Splash Video image in memory. |
| Splash Video Source Pitch (EFI and EPOG feature only) | The pitch, in bytes, of the Splash Video image in memory.<br>Pitch must be >= bytes per pixel * source width. |

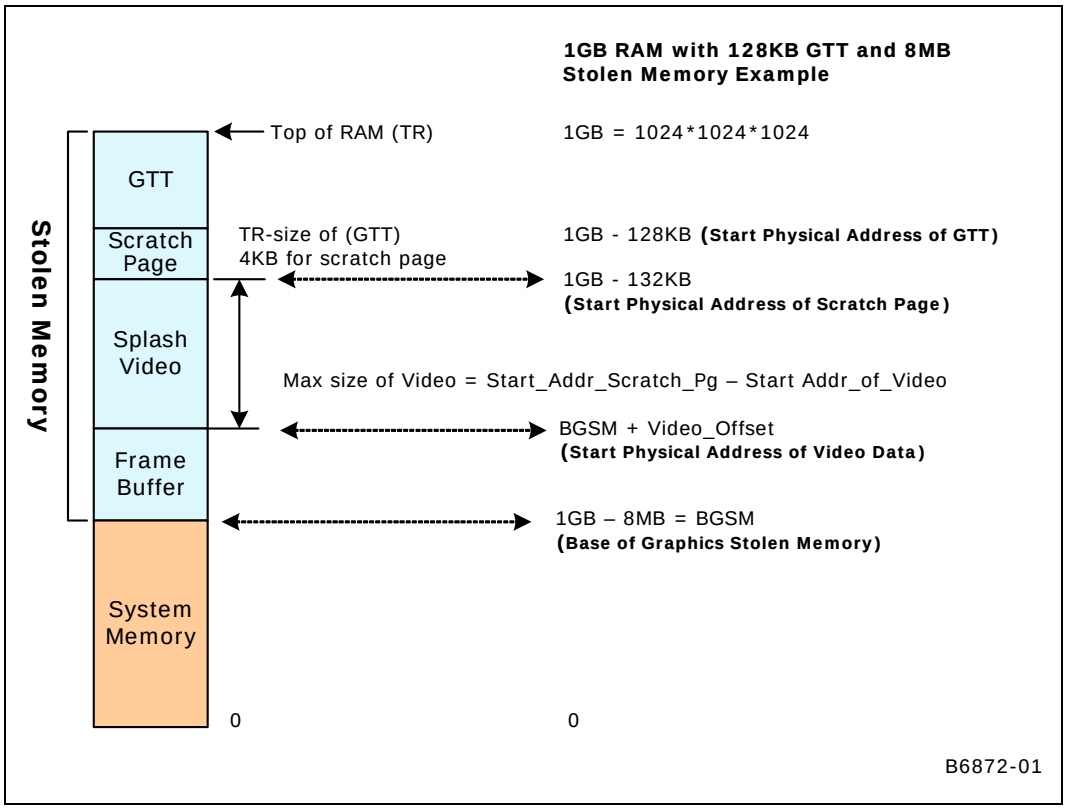
**Table 17. Fastboot Options (Sheet 2 of 2)**

| Fastboot Settings | Description |
|---|---|
| Splash Video Destination X (EFI only) | The X location, in pixels, where the Splash Video will be placed. This number is a signed number in 2's complement. Positive numbers are offset from the left of the screen. Negative numbers are offset from the right of the screen. |
| Splash Video Destination Y (EFI only) | The Y location, in pixels, where the Splash Video will be placed. This number is a signed number in 2's complement. Positive numbers are offset from the top of the screen. Negative numbers are offset from the bottom of the screen. |
| Splash Video Destination Height (EFI only) | The height, in pixels, of the Splash Video window on the screen. This number must currently be the same as SrcHeight. |
| Splash Video Destination Width (EFI only) | The width of the screen. This number must currently be the same as SrcWidth. |

### 3.5.4.1 Configuring Splash Video

The splash video feature can be used to display a video while the system is booting to the operating system. This section describes how to configure the options needed.

**Figure 16. Splash Video with 8 MBytes of Stolen Memory Example**




The Video DMA area is where the video will be streamed. It is part of the stolen memory of our graphics device.

The external PCI device that is connected to the camera needs to know the exact DDR RAM physical address to stream, or dump the video data at that memory location.

To calculate the Start DDR RAM physical address:

**Start_Phy_Ram_Addr = BGSM + Video_Offset**

where **BGSM** = Base of Graphics Stolen Memory,

and **Video_Offset** = Offset where the video data is present. This is what you enter into the CED tool.

There are two ways to calculate BGSM:

- The recommended method is to use the `setpci` command in Linux to find the BGSM from the PCI Config space.

  At the Linux command prompt, type the following:

  ```
  $ setpci -s 0:2.0 0x5C.L
  ```

OR

- Find the amount of physical RAM populated in the system, for example, 1 Gbyte, and the stolen memory selected by the user in the system BIOS, for example, 8 Mbyte.

  **BGSM = 1 Gbyte - 8 Mbytes = 0x4000 0000 - 0x80 0000 = 0x3F80 0000**

### 3.5.4.2 How to Select the Video_Offset

Determine the size of the maximum resolution of the framebuffer.

**Size = framebuffer_height * framebuffer_pitch**

where **framebuffer_pitch** = framebuffer_width * Bytes_per_Pixel (page aligned)

For example, 1024x768 at 32-bit BPP:

**Size = 768 * (1024 * 4) = 3145728 = 0x30 0000**

For some usage models, the framebuffer pitch is set to 8192 bytes. In that case:

**Size = 768 * (8192) = 6291456 = 0x60 0000**

The Video_Offset can start from **0x30 0000** or **0x60 0000** (if the pitch is 8192). See the notes below on the recommended values for the Video Offset.

Max Size of Splash Video = Size of Stolen Memory - Max Frame buffer size – Size of GTT – Size of Scratch Page (4 KB)

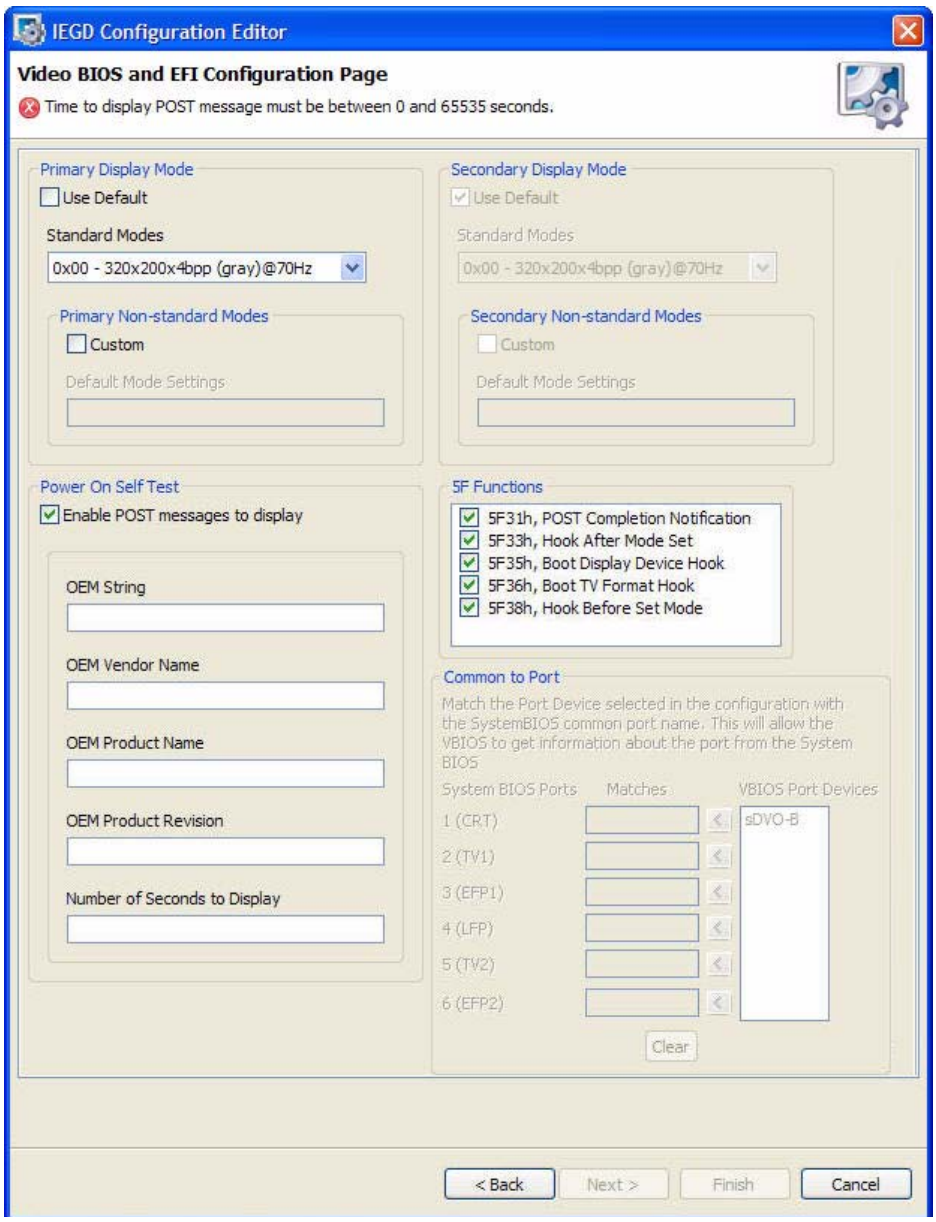
*Notes:*

1. For the Splash Video option the stolen memory MUST be a minimum of **8 Mbytes**. This is selected in the BIOS menu.
2. The recommended Video Offsets for the splash video are **0x600000** and **0x700000**.
3. If the Size of the Video frame is more than **1 Mbyte**, please choose **0x600000**.

### 3.5.5 Configuring the Video BIOS and EFI

The final page of IEGD Configuration allows you to configure your video BIOS (if you are creating a configuration that includes the Video BIOS) and EFI. You can configure the Video BIOS by clicking **Next** after you configure each port. When you do, the following Video BIOS and EFI Configuration Page appears.

**Figure 17. Video BIOS Configuration Page**




From this page, you can customize POST (Power On Self Test) messages and default display modes as well as matching port devices to System BIOS ports.

The table below describes each field on this page.

**Table 18. Video BIOS Settings Options (Sheet 1 of 2)**

| Video BIOS Settings | Description |
|---|---|
| Primary Display Mode | This section allows you to specify a standard or a customized display mode for the primary display. You can select a standard mode from any of the standard modes listed in the drop-down list. If you want to use a customized mode for the primary display, check the **Custom** check box and enter the mode number in the box. For a complete list of customized VGA and VESA modes, refer to Table 27, "Supported VGA Video Display Modes" on page 99 and Table 28, "VESA Modes Supported by Video BIOS" on page 100. |
| Secondary Display Mode | This section allows you to specify a standard or a customized display mode for the secondary display. You can select a standard mode from any of the standard modes listed in the drop-down list. If you want to use a customized mode for the secondary display, check the **Custom** check box and enter the mode number in the box. For a complete list of customized VGA and VESA modes, refer to Table 27, "Supported VGA Video Display Modes" on page 99 and Table 28, "VESA Modes Supported by Video BIOS" on page 100. |
| 5F Functions | These settings allow you to enable or disable the five System BIOS 15h interrupt hooks. (Please see "Intel® 5F Extended Interface Functions" on page 221 for more information on 5F functions.)<br>All five functions are enabled by default. |
| Common to Port | The Common to Port section lets you match port devices with common System BIOS ports. This allows the Video BIOS to retrieve information about the port from the System BIOS. It allows you to associate standard display names used in most system BIOSs to specific ports that are recognized by IEGD (for example, LVDS, sDVO). The VBIOS makes this association when the VBIOS calls the System BIOS Intel® 5F interrupt functions.<br><br>This setting consists of six numbers, where each number is associated with one of the System BIOS displays:<br><br>1 : CRT - Standard analog CRT<br>2 : TV1 - TV Output 1<br>3 : EFP1 - DVI Flat Panel 1<br>4 : LFP - Local Flat Panel (Internal LVDS display)<br>5 : TV2 - TV Output 2<br>6 : EFP2 - DVI Flat Panel 2<br><br>The values above are an example of the typical displays and corresponding order used by a system BIOS. However, this may vary depending on how your system BIOS has implemented the displays and the Intel 5F interrupt functions.<br><br>The value in each position in the setting should be the associated port device. Using the typical settings above, if you want to associate CRT in the system BIOS with the internal CRT (port 1) and LFP in the system BIOS with internal LVDS (port 4) in the VBIOS, select **CRT** from the VBIOS Port Devices list and click the left arrow button next to the CRT row in the Matches column, and then select LFP from the VBIOS Port Devices list and click the left arrow button next to the LFP row in the Matches column.<br><br>***Notes:*** This feature must be compatible with the System BIOS. If the System BIOS does not properly implement the Intel 5F functions, then using the Common to Port feature could cause unpredictable results with the displays. If you are unsure, leave the Matches column blank for all ports to disable this feature.<br><br>The Display Detect field on the Chipset Configuration page must be set to **Enable** in order for the Common to Port values to be used. |
| Enable POST messages to display | To enable Power On Self Test (POST) messages to display during the power on sequence, check this box. If left unchecked (i.e., cleared), the POST messages do not display. |
| OEM String | Enter a string of up to 100 characters. This string appears on the display when the Video BIOS starts up. The default is a blank string. |

**Table 18. Video BIOS Settings Options (Sheet 2 of 2)**

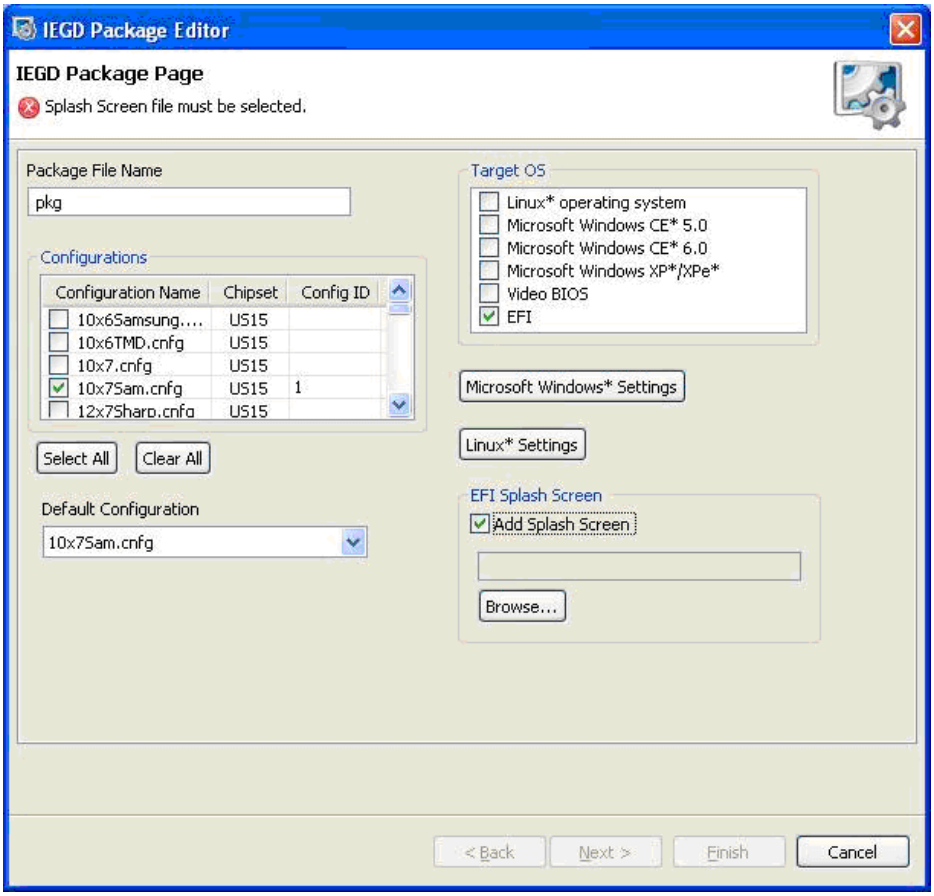
| Video BIOS Settings | Description |
|---|---|
| OEM Vendor Name | Enter a string of up to 80 characters that identifies the OEM Vendor. This string appears on the display when the Video BIOS starts up. The default is a blank string. |
| OEM Product Name | Enter a string of up to 80 characters that identifies the OEM Product Revision. This string appears on the display when the Video BIOS starts up. The default is a blank string. |
| OEM Product Revision | Enter a string of up to 80 characters that identifies the OEM Product Revision. This string appears on the display when the Video BIOS starts up. The default is a blank string. |
| Number of Seconds to Display | Enter the number of seconds to display the above information. The default is 1. |

## 3.6 Creating a New Package

A package consists of one or more configurations and is used to create an installation that works for multiple operating systems and chipset platforms and displays.

To create a new package, click the **New Package** link at the top of the main CED window. The IEGD Package Page appears.

**Figure 18. IEGD Package Editor Page**



The table below describes each field on this page.

**Table 19. IEGD Package Editor Setting Options**

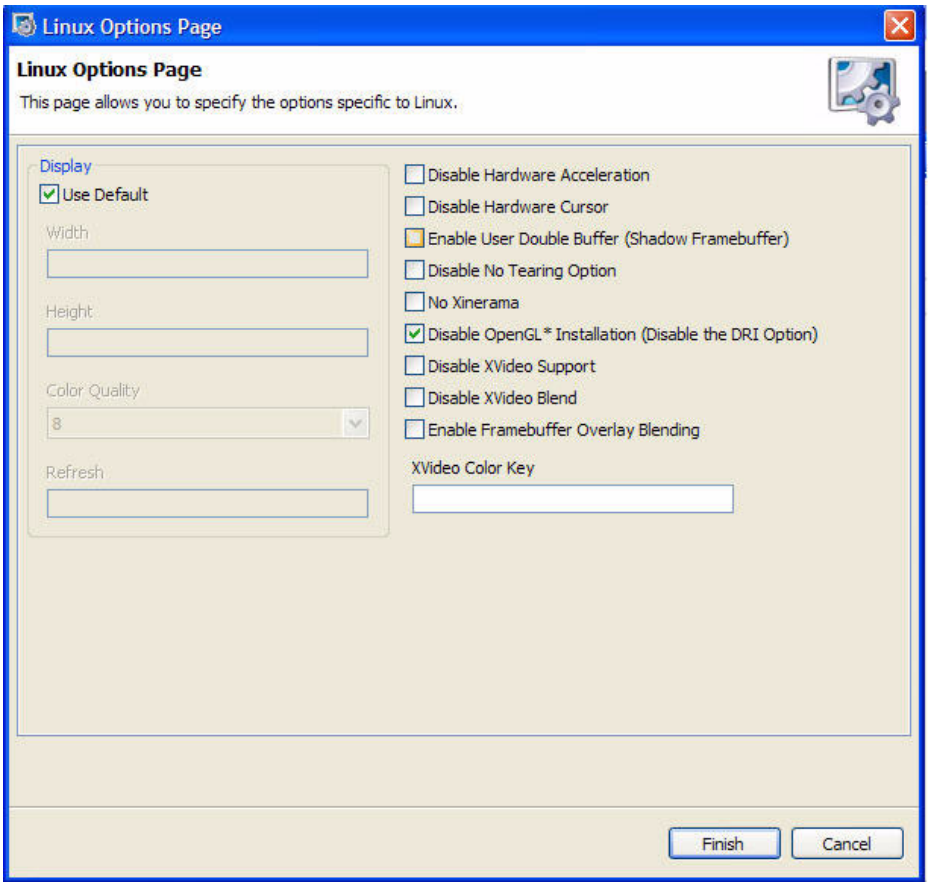
| Package Option | Description |
|---|---|
| Package File Name | Enter a name for the package. This is a required field and the name must be between 1 and 50 characters and may contain spaces. |
| Configurations | This blocks shows the configurations that are available to be packaged. Each package consists of one or more configurations, each of which is associated with a specific chipset.<br><br>To select a configuration, click the check box next to the configuration name. You can select all available configurations by clicking the `Select All` button located below the Configurations block and clear all configurations by clicking the **Clear All** button.<br><br>The Configuration Name column shows the name of each configuration and the Chipset column shows the chipset associated with each configuration.<br><br>In the Config ID column, you must enter a configuration ID for each configuration. The configuration ID must be a number between 1 and 15. By default, the Package Editor automatically assigns the next available configuration ID when you select a configuration. You can change the default configuration ID by clicking in the edit box and entering a different value. |
| Default Configuration | The Default Configuration list box allows you to select a default configuration from the configurations you selected in the Configurations block.<br>For single configurations the default is the one selected in the previous option. For multiple configurations, the default is the first one selected in the Configurations list. To have no default configuration, select **None**. See also Section 5.1.1, "Universal INF Configuration" on page 103. |
| Target OS | This block allows you to select one or more operating systems and Video BIOS for the package. For each target you select, the CED produces a configuration file for the selected OS or Video BIOS platform. Please see the following section for settings on the Target OS:<br>• "Entering Linux OS Options" on page 60<br>• "Entering Windows OS Options" on page 62<br>• "Generating a VBIOS Package" on page 63<br>• "Entering EFI Options" on page 64<br>• "Entering EPOG Feature Options" on page 65 |
| Microsoft Windows Settings | If you are creating a package for a Microsoft Windows* platform, click the **Microsoft Windows Settings** button for additional settings that may be required for your configuration. Please see "Entering Windows OS Options" on page 62 for descriptions of these settings. |
| Linux Settings | If you are creating a package for a Linux OS platform, click the **Linux Settings** button for additional settings that may be required for your configuration. Please see "Entering Linux OS Options" on page 60 for descriptions of these settings. |
| EFI and EPOG Splash Screen | The **Add Splash Screen** check box enables the use of a splash screen, which you define using the Browse... button to locate the file. Only `.bmp` format is supported for the splash screen. |

If you are not creating a VBIOS package, click **Finish**. When you click **Finish**, the CED creates a package that can be used for generating an installation.

### 3.6.1 Entering Linux OS Options

The Linux Options Page allows you to enter Linux OS-specific options into the configuration. When you click **Linux Settings** from the IEGD Package Page, the following page appears.

**Figure 19. Linux Options Page**



The table below describes each of these settings.

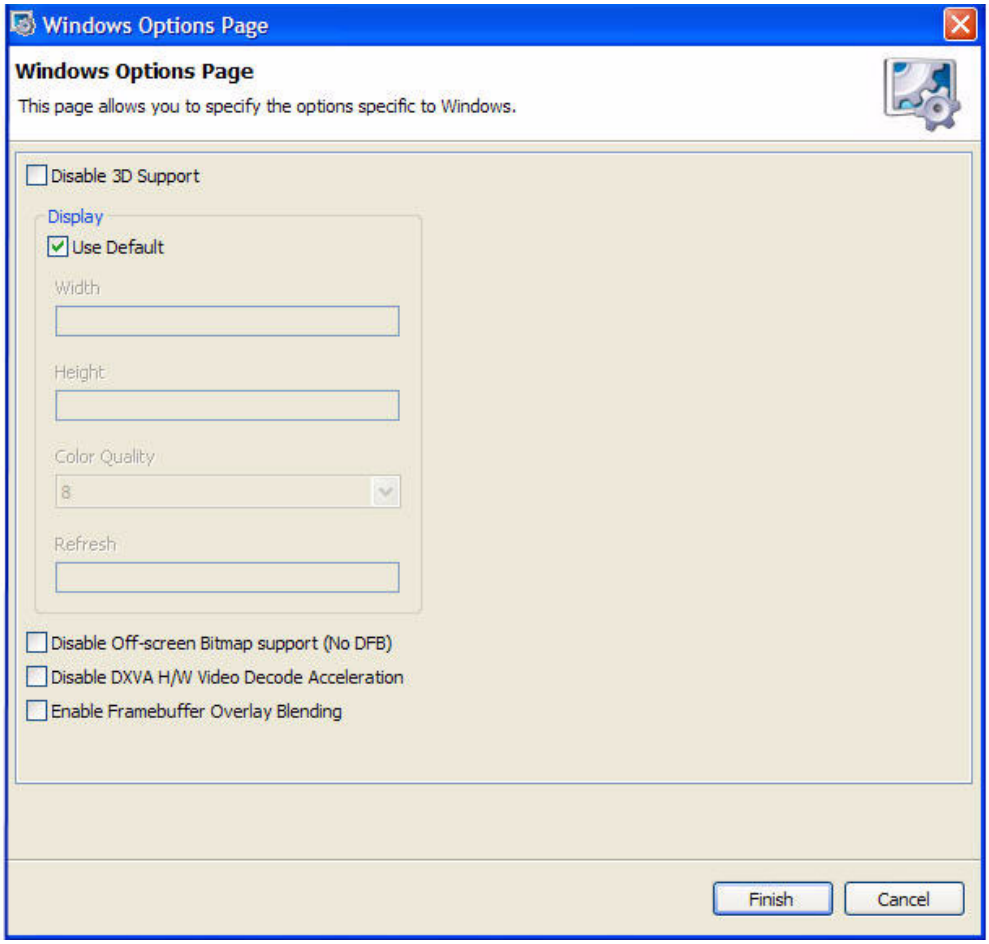
## Table 20. Linux OS Settings Options

| Linux OS Option | Description |
|---|---|
| Default Display Modes | The Default Display Modes section allows you select the default resolution, color depth, and refresh rate for the configuration. If you do not select a default display mode, the package uses the default display mode for the operating system it is installed on. |
| Disable Hardware Acceleration | Disable or enable hardware 2D acceleration. The default is to enable hardware acceleration, so to disable acceleration, click the check box. |
| Disable Hardware Cursor | Disable or enable the use of the hardware cursor. By default, the hardware cursor is enabled. |
| Enable Use Double Buffer (Shadow Framebuffer) | Enable double buffering on the framebuffer. By default, double buffering is disabled. To enable it, click the check box. |
| Disable No Tearing Option | Disable No Tearing. By default, the No Tearing is enabled. Disabling this option results in a performance penalty as the driver is forced to synchronize page flips to the vertical blanking signal. |
| No Xinerama | Xinerama support. Xinerama is an extension to the X Window System which allows applications and window managers to use the two (or more) physical displays as one large virtual display. By default, Xinerama is enabled. To disable it, click the check box. |
| Disable OpenGL* Installation (Disable the DRI Option) | OpenGL* (Disable the Direct Rendering Infrastructure (DRI) Option). DRI allows the client to directly write to DMA buffers that are used by the graphics hardware.<br>To **disable** OpenGL, check the box. The option “DRI” “0” will be set for every available display. This will turn off direct rendering and disable hardware accelerated OpenGL.<br>By default, OpenGL is enabled. No “DRI” line(s) are placed in the configuration file. The driver will intelligently determine if DRI can be supported and will enable it if possible.<br>***Note:*** If you manually edit the configuration file and set option “DRI” “1” on more than one display, deadlock will occur and OpenGL will fail. If you are unsure of which setting to use, just leave the box unchecked (i.e., cleared) and do not edit the DRI option in the configuration file and the driver will handle it automatically. This feature can be used if you want to test your applications with and without hardware accelerated OpenGL.<br>For a list of related application programming interfaces, see “2D/3D API Support” on page 231. |
| Disable XVideo Support | Disable XVideo support. In a dual independent head configuration, either the first display or the second display supports XVideo. Both displays can not support XVideo simultaneously. The default is XVideo support is enabled. |
| Disable XVideo Blend | Disable XVideo support using the 3D blend manager. This provides XVideo support in configurations that cannot be supported with overlay. For example, this is supported on both displays in a dual independent head setup. It is also supported when the display is rotated or flipped. Color key is only supported if ShadowFB is enabled and the VideoKey is defined. The default is XVideoBlend support is enabled. |
| Enable Frame Buffer Overlay Blending | When checked, this enables overlay blending with the framebuffer on both display outputs (if in VEXT mode on Windows CE) on US15W and when display mode resolution is 32-bit XRGB. |
| XVideo Color Key | This sets the color key for XVideo and XVideoBlend. This value is either a 24-bit value or a 16-bit value, depending on the pixel depth of the screen. The color key is always enabled for XVideo, even when it is not defined. The color key is always disabled for XVideoBlend unless both this option is defined and the ShadowFB option is enabled. The default color key for XVideo is 0x0000ff00. For XVideo Blend, the color key is disabled by default. |

### 3.6.2 Entering Windows OS Options

The Windows Options Page allows you to enter Windows OS-specific options into the configuration. When you click **Microsoft Windows Settings** from the IEGD Package Page, the following page appears.

**Figure 20. Windows Options Page**



The table below describes each field on this page.

**Table 21. Windows OS Setting Options**

| Windows OS Option | Description |
|---|---|
| Display | The Display section allows you to use the default settings by checking the **Use Default** check box or to select the default width, height, color quality, and refresh rate for the configuration. |
| Disable 3D Support | Specifies whether to enable D3D. The default is to enable 3D support (not checked). |
| Disable Off-screen Bitmap support (No DFB) | This option turns OFF the driver capabilities to create and use offscreen bitmaps that are used to improve GDI and DirectDraw* performance in the driver. When this option is ON, you may see some GDI and DirectDraw performance degradation. The drv functions below will be affected when this option is turned on.<br>• DrvCreateDeviceBitmap<br>• DrvDeleteDeviceBitmap<br>• DrvDeriveSurface |
| Disable DXVA H/W Video Decode Acceleration | This option is enabled by default in IEGD, however, by selecting this option, you can disable DXVA hardware video decode acceleration. |
| Enable Frame Buffer Overlay Blending | When checked, this option enables overlay blending with the framebuffer on both display outputs (if in VEXT mode) on US15W and when display mode resolution is 32-bit XRGB. |
| Enable Frame Buffer Overlay Blending 2D Alpha Override | This option applies only to Windows XP and US15W. When checked, it enables an override to the frame buffer overlay blending 2D alpha.<br><br>***Notes:*** Checking the Frame Buffer Overlay Blending option and running a 3D alpha blending application on overlay [non full screen mode] causes the black icons on the desktop to appear. This is expected behavior as the operating system sets the 2D alpha values. To overcome this behavior, choose **Enable Frame Buffer Overlay Blending 2D Alpha Override** option and then enter the alpha value. This alpha override will cause performance impact when a lot of 2D blitting operations take place.<br><br>This option applies only to Windows XP and US15W. When checked, it enables an override to the frame buffer overlay blending 2D alpha. |
| Frame Buffer Overlay Blending Alpha Value | The valid range is from 0x00 to 0xFF. |

## 3.6.3 Generating a VBIOS Package

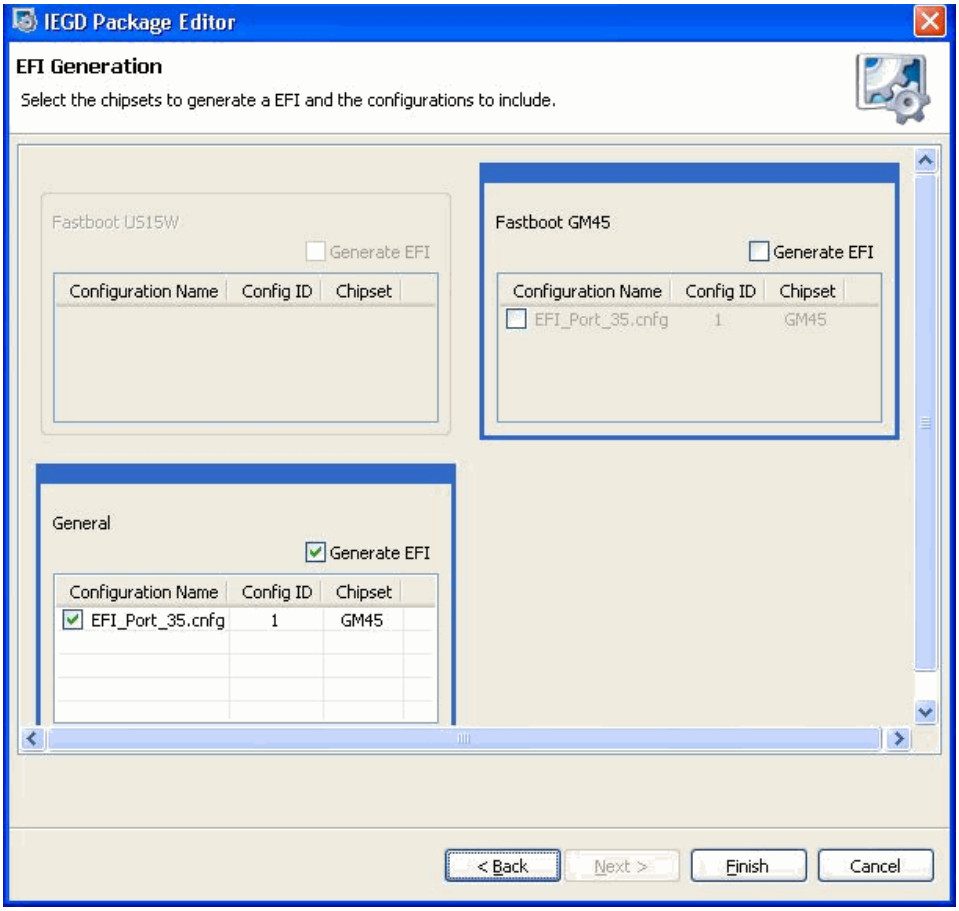
If you are creating a package for a VBIOS installation, click **Next**. The CED displays the VBIOS Generation page.

To generate a VBIOS, click the **Generate VBIOS** check box and select the configurations to include. After selecting the chipset and the configurations, click **Finish**. The CED generates a package that includes both the OROM and the TSR for the chipsets and the configurations you selected.

### 3.6.4 Entering EFI Options

If you are creating a package for an EFI installation, click **Next**. The CED displays the EFI Generation page.

**Figure 21. EFI Generation Page**




To generate an EFI configuration:

1. In the Fastboot and/or General modes sections, click the **Generate EFI** checkbox.
2. Select the chipset and configuration(s) to include.
3. Click **Finish**.
   The CED generates a package that includes the EFI driver for the modes, chipsets and the configurations you selected.

### 3.6.5 Using the Generated EFI Configuration

Use IEGD CED to configure and build an EFI video driver for your platform, as described in Section 3.6.4 and then follow the instructions below to install the driver.

1. After building the EFI driver, copy the appropriate module to your working directory where you keep your Aptio MMTOOL and EFI BIOS that needs to be updated.
   The file is typically called `IEGD.DXE` and is found in the IEGD ZIP file in the installations folder under EFI.
2. Make a working copy of your EFI BIOS image.
   For example, copy `CBCHAxxx.ROM` to `CBCHA`*`xxx`*`_IEGD_EFI.ROM`
   where *xxx* = the release version of Standard BIOS

   OR

   Copy `CBFBAxxx.ROM` to `CBFBAxxx_IEGD_EFI.ROM`
   where *xxx* = the release version of Fast Boot BIOS)
3. Start the MMTOOL in GUI mode.
4. Load the EFI BIOS image using the **Load Image** button.
   After it loads you will be presented with a list of existing modules.
5. Select `CBCHAxxx_IEGD_EFI.ROM` or `CBFBAxxx_IEGD_EFI.ROM` (from step 2)
6. If it exists, delete any legacy VBIOS by highlighting the old video solution, select the DELETE tab at the top, and then press the **DELETE** button.

*Note:* The EFI Fast Boot images typically do NOT contain a video module.

For example, for `CBCHAxxx.ROM` you will see a CSMVIDEO module. This is the Compatibility Software Module for a legacy VBIOS.

7. If it exists, delete any old versions of the IEGD EFI Fast Boot Video Driver. Look for an unnamed module with a GUID that starts with "2B13E5F0-" or with a module name that includes "IEGD". If it exists, select the DELETE tab, highlight the module and then click the **DELETE** button.
8. Insert the new video module by clicking on the INSERT tab, specifying the module file name, and then clicking the **INSERT** button. You may browse to locate the file, for example, `iegd.dxe`.)
9. Save image by clicking the **Save Image** button and then close the dialog box.
10. Flash the image into your flash chip and install it on the board. You can either use the hardware flash programmer or the Aptio AFUDOS tool for this purpose.

### 3.6.6 Entering EPOG Feature Options

If you are creating a package for an EPOG feature installation, follow the steps below.

1. From the Target OS section, select **EPOG**.
2. If you want to use a splash screen, select the Add Splash Screen check box and then browse to the `.bmp` file you want to use.
3. Click **Finish**.
   The CED generates a package that includes the embedded pre-OS graphics feature for the modes, chipsets, and configurations you selected.

### 3.6.7 Using the Generated Embedded Pre-OS Graphics Feature Configuration

Use IEGD CED to configure and build a driver with the embedded pre-OS graphics feature, as described in "Entering EPOG Feature Options" and then follow the instructions below to install the driver.

1. After generating the driver with the embedded pre-OS graphics feature, untar the tar file generated by the CED.
2. Copy the file `libepog.a` and paste it in the `lib/elf` directory in BLDK.
3. Follow the BLDK build procedure with graphics enabled. (BLDK can be obtained at the Intel Validation Internet portal https://platformsw.intel.com/index.aspx)

## 3.7 Generating an Installation

After you have created a package, you can generate an installation for the package by following this procedure.

1. Select a package from the Package folder located on the left pane of the CED main window.
2. Click **Generate Installation**. While the installation is building, the CED displays a progress bar. When the installation is complete, the CED places the output in the Installation folder on the left pane of the CED window.

For each OS and VBIOS platform specified in the package, the CED generates a folder in the `...\workspace\installation` folder under the current folder. For example, if you select a package that contains configurations for all supported operating systems and the VBIOS, the CED generates the following folders:

...\workspace\installation\<package name_installation>\IEGD_10_4_Linux

...\workspace\installation\<package name_installation>\IEGD_10_4_WINDOWS

...\workspace\installation\<package name_installation>\IEGD_10_4_WINCE60

...\workspace\installation\<package name_installation>\IEGD_10_4_VBIOS

...\workspace\installation\<package name_installation>\IEGD_10_4_EFI

These folders contain all the subfolders required for the installation onto the target systems. To complete the installations on the target systems, refer to the following sections:

- "Installing and Configuring Linux* OS Drivers" on page 159
- "Configuring and Installing Microsoft Windows Drivers" on page 103
- "Configuring and Building IEGD for Microsoft Windows CE* Systems" on page 119
- "Entering Linux OS Options" on page 60

## 3.8 Configuring the System BIOS for Use with IEGD

Some aspects of configuring the Intel® Embedded Graphics Drivers are common across the Video BIOS (VBIOS), EFI, and the drivers for the supported operating systems. The following  provide an overview for configuring both the VBIOS and the Intel Embedded Graphics Drivers and describe in detail the common components and tools.  also describe how to configure the system BIOS for the supported systems.

## 3.9 System BIOS Settings

Before installing the Intel Embedded Graphics Drivers, you must first configure the system BIOS. The following sections describe the required settings. These descriptions are based on AMIBIOS8* from American Megatrends, Inc., which is the recommended system BIOS to use with the Intel Embedded Graphics Drivers. Settings may vary if a different system BIOS is used.

### 3.9.1 GMCH PCI Device Enabling

The PCI Device Enabling feature on the Graphics and Memory Controller Hub (GMCH) should be set as specified in the table below.

**Table 22. GMCH Device 2, Function 1 BIOS Setting**

| OS | Chipset |
|---|---|
| | Intel®Atom™ 400/500, Intel® Q35, Intel® GLE960/GME965, Intel® Q965, Intel® 945GM, Intel® 945G, Intel® 915GME, Intel® 915GV, Intel® 910GMLE |
| Microsoft Windows XP* and Microsoft Windows XPe* | Disabled |
| Microsoft Windows CE* | Disabled |
| Linux | Disabled |

### 3.9.2 Graphics Mode Select (GMS)

The System BIOS typically allows a portion of physical memory to be dedicated to firmware and graphics driver use. This dedicated memory is known as stolen memory since it is not available to the operating system. The size of this memory is selectable and chipset-specific. Stolen memory is typically used by the firmware and graphics driver to locate the framebuffer, but can also be used as scratch and surface memory. Because it is programmatically set aside during boot by the System BIOS, access to it is direct and does not require OS memory allocation services. Firmware is fully responsible for stolen memory management.

Graphics Mode Select (GMS), or stolen memory, can be set to any of the sizes listed in the table below. Smaller sizes limit the framebuffer size during firmware boot. Larger sizes marginally increase surface allocation performance for the graphics driver.

**Table 23. GMS Settings**

| Chipset | GMS Settings |
|---|---|
| Intel®Atom™ 400/500 | 0, 1 Mbyte, 4 Mbytes, 8 Mbytes, 16 Mbytes, 32 Mbytes, 48 Mbytes, 64 Mbytes |
| Intel®US15W/US15WP/WPT, GM45/GL40/GS45, Q45 | 64 Mbytes, 128 Mbytes, 256 Mbytes |
| Intel® Q35, Q965/GLE960/GME965 | 0, 1 Mbyte, 4 Mbytes, 8 Mbytes, 16 Mbytes, 32 Mbytes, 48 Mbytes, 64 Mbytes |
| Intel® 945G/945GME/945GSE | 0, 1 Mbyte, 8 Mbytes |
| Intel® 915GV/915GME/910GMLE | 0, 1 Mbyte, 8 Mbytes |

### 3.9.3 AGP (Accelerated Graphics Port) Aperture Size

The AGP Aperture size controls the total amount of graphics memory that can be mapped in the AGP Aperture. This value can be set from 64 Mbytes up to 256 Mbytes, depending on the chipset. Refer to specific chipset details for information on the valid range.

## 3.10 VBIOS and Driver Configuration

The Intel Embedded Graphics Suite allows user configuration of both the VBIOS and graphics driver as well as programming of Detailed Timing Descriptors (DTDs) for EDID-less panels for both the VBIOS and graphics driver. This is accomplished using CED, which offers several ways to input DTDs, each associated with a potential target panel and display mode for the system. CED generates DTD and configuration settings used by the IEGD VBIOS, Linux, and/or Windows drivers.

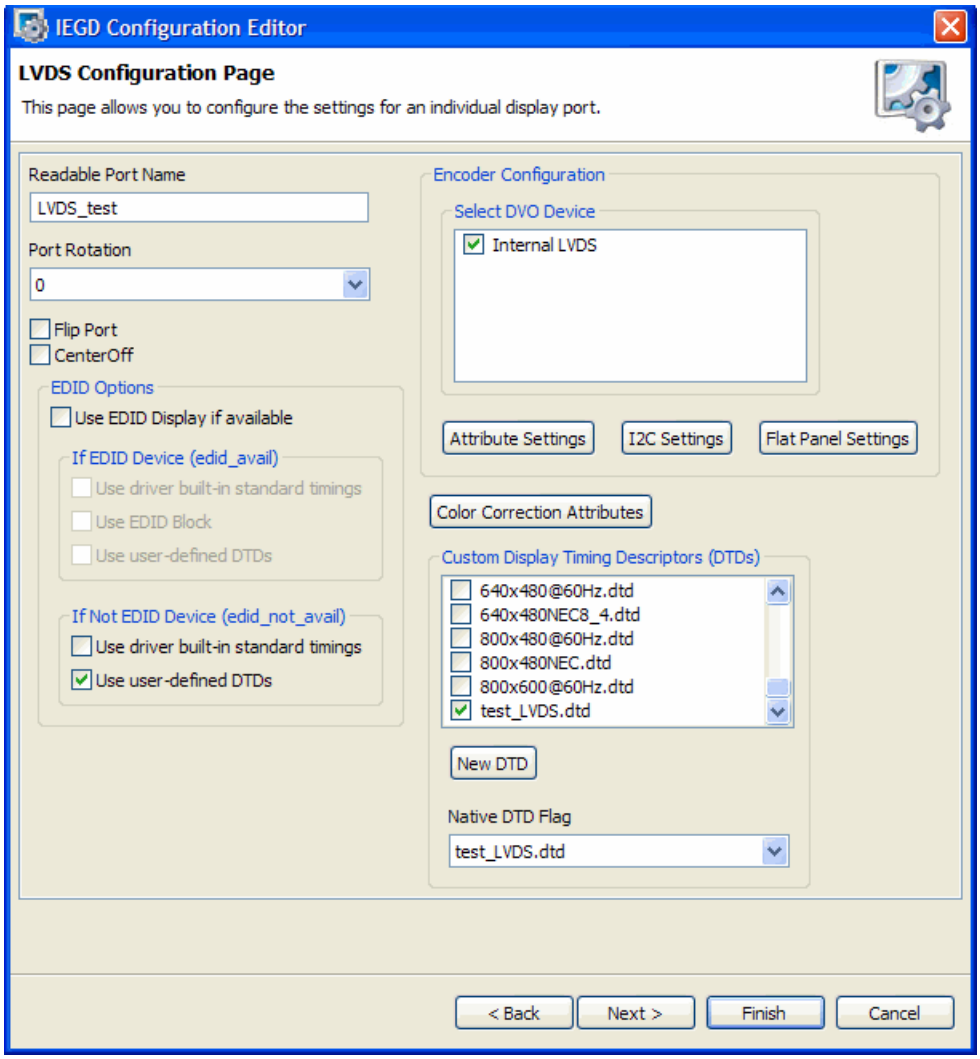
The following example is for a 945GME system setup with just an internal LVDS and sample timing parameters for illustration purposes only. You can use this example to set up DTD timings that are specific to your non-standard panels and then activate the panels using a custom mode.

To create a configuration and configure the LVDS options:

1. Create a custom DTD as described in Section 3.4, “Creating a New Customized DTD” on page 34.
1. From the CED main screen, select **New Configuration**.
2. Enter a name for the configuration in the text box provided, for example, *LVDS_test*.
3. Select the platform chipset. This example uses the 945GME chipset.
4. In the list of available ports, select **LVDS** and then click **Next**.
5. On the LVDS Configuration Page, clear the checkboxes for **Use EDID Display if available** and **Use driver built-in standard timings**.
6. Select the checkbox for **Use user-defined DTDs**.
7. In the Encoder Configuration section, select **Internal LVDS**.
8. In the Custom Display Timing Descriptors (DTDs) list, select the DTD you created in Section 3.4, “Creating a New Customized DTD” on page 34 for example, *test_LVDS*.

The screen will be similar to the example below.

**Figure 22. LVDS Configuration Page**

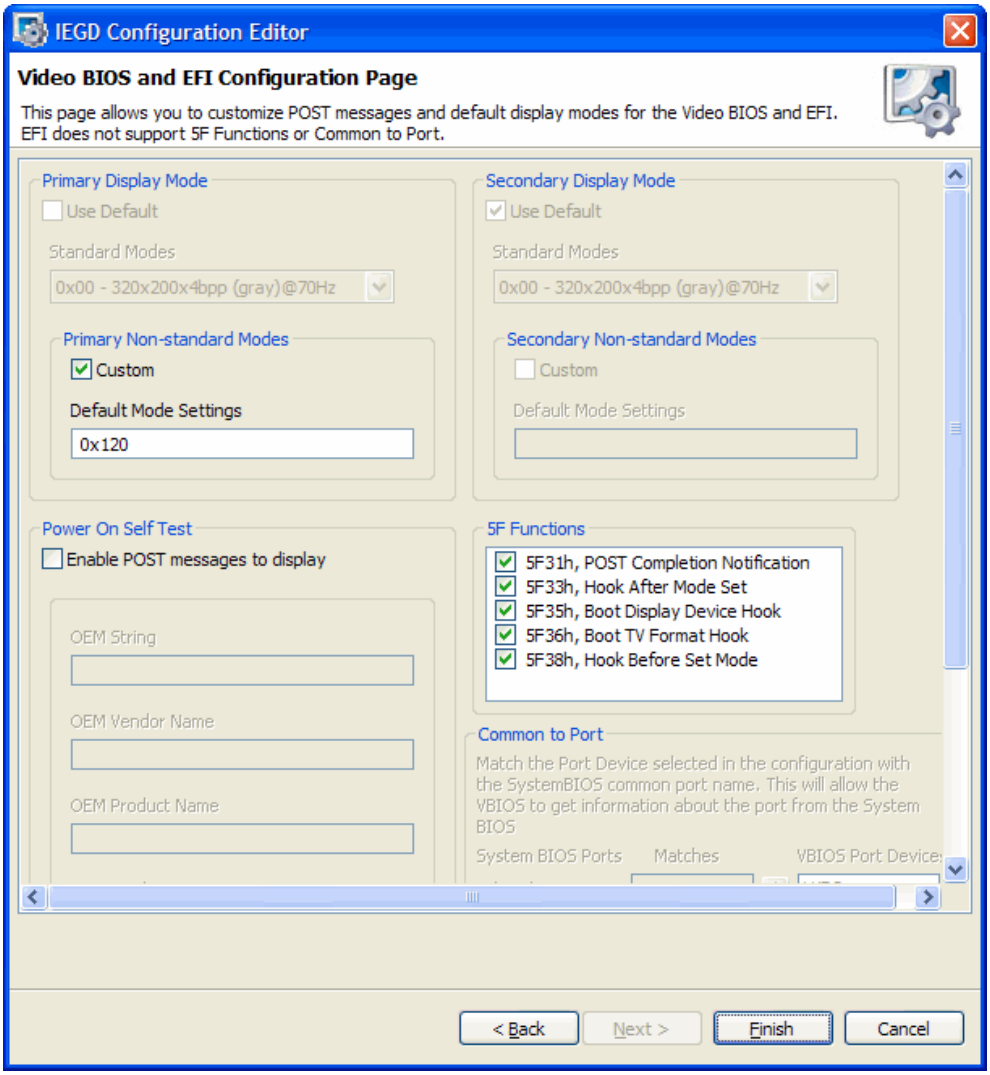



9. Click **Next**.
10. (Optional) Configure Fastboot options as described in "Configuring Fastboot" on page 52.
11. Click **Next**.

To set the custom mode:

1. From the IEGD Configuration Editor screen, in the Primary Display Mode section, clear the **Use Default** checkbox.
2. In the Primary Non-standard Modes section, select the checkbox for **Custom**.
3. In the Primary Non-standard Modes section, enter 0x120 in the Default Mode Settings text box. (See a description of the custom modes.)
   The screen will be similar to the example below.

**Figure 23. IEGD Configuration Editor Page**




### Custom Modes

The custom modes begin with 0x120 (0x121 and 0x122 are the same modes in different pixel formats). If there was a second custom mode entered it would begin with 0x123 to 0x125.

From the above DTD 200x200 example, this is what the custom modes represent:

0x120 200x200@8bpp

0x121 200x200@16bpp

0x122 200x200@32bpp

And if the second custom mode was a 400x400 panel, its custom modes would be:

0x123 400x400@8bpp

0x124 400x400@16bpp

0x125 400x400@32bpp

## 3.11 Configuration Options

The table below describes available IEGD settings. The gray rows are block headings and the non-gray rows that follow each heading are settings within the block. Some of these block headings are contained within prior block headings.

**Table 24. Parameter Configuration Format (Sheet 1 of 7)**

| Name | Range / Value | Description |
|---|---|---|
| ConfigID | Integer (1-15) | Optional keyword used to specify which configuration is used. The config ID specified here must match one of the configuration IDs defined with CED. If this keyword is omitted, all configurations specified in the config file are used.<br>Note that this keyword is not required for Linux OS and VBIOS configurations. |
| Config | Integer (1-15) | More than one configuration is valid. |
| Comment | | A quoted string used to identify the origin of the .bin or .inf file. |
| Name | | A quoted string used to identify the configuration name.<br>Name is a required field for VBIOS configuration. |
| General | | Settings that are generic to the configuration. |
| DisplayConfig | 1 – Single<br>2 – Clone<br>4 – Twin<br>8 – Extended<br><br>Default: 1 | Used to configure initial state of attached displays.<br>1 – Single. A single display.<br>2 – Clone. Primary and secondary displays enabled and configured with separate timing pipes. This allows different timings to be applied to each display. Resolutions can be different on both displays.<br>4 – Twin. Primary and secondary displays are enabled, but with only a single pipe. Both displays share the same resolutions and timings.<br>8 – Extended. Configures separate pipes to allow primary and secondary displays to have different resolutions and display different content. Upon first boot after the driver installation, this option will enable only the primary display, as the extended modes must be enabled in the operating system (i.e., **Extended Desktop** in the **Display Properties** sheet within Microsoft Windows). |
| DisplayDetect | 0 - Disable<br>1 - Enable | Enable or disable Display Detection. Note that this parameter must be Enabled in order to use COMMON_TO_PORT values.<br>Default is 0. Please see Section 3.12, "Display Detection and Initialization" on page 78 for detailed information on this parameter. |

## Table 24. Parameter Configuration Format (Sheet 2 of 7)

| Name | Range / Value | Description |
|---|---|---|
| PortOrder | PortOrder must be specified as a quoted string containing five digits. The valid values are:<br>1 - Integrated TV Encoder (mobile chipsets only)<br>2 - sDVO B port<br>3 - sDVO C port<br>4 - Integrated LVDS port (mobile chipsets only)<br>5 - Analog CRT port<br>6 - Internal HDMI<br>Default: 0 for all keys | Search order for detecting attached displays for the Display Detection feature. When Display Detection is enabled, the PortOrder determines which display is primary and which display is secondary.<br>The port search order can be specified to ensure the port device (sDVO device) is found, based on the system integrator's routing choices. Default ordering is chosen by specifying zeros in the PortOrder keys.<br>Default ordering is chipset specific; see Table 56, "Default Search Order" on page 218.<br>Please see Section 3.12, "Display Detection and Initialization" on page 78 for more information on using `PortOrder` in combination with the Display Detect feature. |
| CloneWidth<br>CloneHeight | Typical sizes:<br>clonewidth – 800, cloneheight - 600<br>clonewidth – 1024, cloneheight - 768<br>clonewidth – 1280, cloneheight - 768<br>clonewidth – 1400, cloneheight – 1050 | Width and height for a cloned display. |
| CloneRefresh = 60 | Typical refresh rates (expressed in Hz):<br>60 Hz, 75 Hz, 85 Hz | Refresh rate for a cloned display. |
| OverlayOff | 0 - Overlay on (default)<br>1 - Overlay off | This parameter allows you disable Overlay support, which is enabled by default.<br>**Note:** This parameter is only for Microsoft Windows* and Microsoft Windows CE. The Linux* OS configuration for the xorg.conf provides a standard option that performs the same function. |
| FbBlendOvl | 0 - Off (Default)<br>1 - On | When checked, this enables overlay blending with the framebuffer on both display outputs (if in VEXT mode on Windows CE) on US15W and when display mode resolution is 32-bit XRGB. |
| No_DFB | 0 - Off (Default)<br>1 - On | This parameter enables IEGD to pass the DIB call back to the OS. This is required in certain circumstances to improve performance. |
| vbios | | This block contains settings for the Video BIOS. Note that you only need to specify the parameters you are actually using. You do not need to specify all the parameters in this block. If you omit any parameters, the vbios uses the default values. |
| COMMON_TO_PORT | 6 digit value | Maps the ports from the system BIOS to a port number used by the graphics hardware. Please see Section 4.3.2, "Configuring the Video BIOS" on page 94 for more information on this parameter. Note that the `displaydetect` parameter must be set to Enabled in order for the COMMON_TO_PORT values to be used.<br>The default is all zeroes: 000000 |

## Table 24. Parameter Configuration Format (Sheet 3 of 7)

| Name | Range / Value | Description |
|---|---|---|
| post_display_msg | 0 - disable<br>greater than 0 - enable and display POST message for the specified number of seconds | Enables or disables the POST (Power On Self Test) message. When you specify a value greater than 0, the message is displayed for the specified number of seconds. For example:<br><br>post_display_msg = 5<br><br>This enables the POST message and displays it for approximately 5 seconds. The maximum value that can be entered here is 65535.<br><br>The default is 1, enable and display the POST message for approximately 1 second. |
| oem_string | double-quoted string | This string appears on the display when the post_display_msg is enabled and the VBIOS starts up. The maximum string length is 100 characters.<br>The default is " " (two double quotes with a single space in between). |
| oem_vendor | double-quoted string | This string appears on the display when the post_display_msg is enabled and the VBIOS starts up. The maximum string length is 80 characters.<br>The default is " " (two double quotes with a single space in between). |
| oem_product_name | double-quoted string | This string appears on the display when the post_display_msg is enabled and the VBIOS starts up. The maximum string length is 80 characters.<br>The default is " " (two double quotes with a single space in between). |
| oem_product_rev | double-quoted string | This string appears on the display when the post_display_msg is enabled and the VBIOS starts up. The maximum string length is 80 characters.<br>The default is " " (two double quotes with a single space in between). |

## Table 24. Parameter Configuration Format (Sheet 4 of 7)

| Name | Range / Value | Description |
|---|---|---|
| int15 | 5 digits | This parameter allows you to enable or disable the five System BIOS 15h interrupt hooks. The value must be 5 digits in length. Each digit is associated with one of the five System BIOS interrupt 15h hooks as shown below (left to right)<br>1 - 5F31h, POST Completion Notification Hook<br>2 - 5F33h, Hook After Mode Set<br>3 - 5F35h, Boot Display Device Hook<br>4 - 5F36h, Boot TV Format Hook<br>5 - 5F38h, Hook Before Set Mode<br><br>(Please see Appendix C for more information on 5F functions.)<br><br>The value of each digit must be a 0 or a 1 as follows:<br>0 - disable a System BIOS 15h hook<br>1 - enable a System BIOS 15h hook<br><br>For example,<br>`int15 = 11001`<br><br>Enables 5F31h, 5F33h, and 5F38h hooks only. The 5F35h and 5F36h hooks are disabled.<br><br>The default is 11111, enable all five hooks. |
| port | 1 - Integrated TV Encoder (mobile chipsets only)<br>2 -sDVO B port<br>3 - sDVO C port<br>4 - Integrated LVDS port (mobile chipsets only)<br>5 - Analog CRT port | Used to define port specific settings. |
| rotation | Windows* OS Range:<br>0x0 or 0 – 0 degrees<br>0x5A or 90 – 90 degrees<br>0xB4 or 180 – 180 degrees<br>0x10E or 270 – 270 degrees<br><br>Linux OS Range:<br>0 – 0 degrees<br>90 – 90 degrees<br>180 – 180 degrees<br>270 – 270 degrees<br><br>Default: 0 | Rotation of the display.<br><br>***Note:*** For Windows CE Static rotation, setting the width and height to the rotated values is no longer required with the improvements beginning in v10.1. |
| flip | Windows OS:<br>0x0 or 0 – turn off horizontal flip<br>0x1 or 1 – turn on horizontal flip<br>Default: 0<br><br>Linux OS Boolean:<br>on - horizontal flip<br>off - no horizontal flip<br>Default: off | Flip of the display. |

## Table 24. Parameter Configuration Format (Sheet 5 of 7)

| Name | Range / Value | Description |
|---|---|---|
| centeroff | Default: 0 – disabled, allow centering and add compatibility modes<br>1 – enabled, no centering, no added compatibility modes | When this option is enabled it DISABLES centering. Also, depending on the combination of “edid” + “user-dtd” + connected hardware, IEGD will add missing compatibility modes (6x4, 8x6, 10x7& 12x10) via centering. Use this option to disable this feature. |
| edid | 0 – Do not read EDID from panel/CRT<br>1 – Attempt to extract EDID timing data from panel/CRT | If VBIOS/driver reads EDID from panel/CRT. |
| edid_avail<br>edid_not_avail | Range [16 bits]<br>Valid values (specified in hex):<br>bit 0<br>----------<br>0 - Do not use driver built-in standard timings<br>1 - Use driver built-in standard timings<br>bit 1 (not applicable to edid_not_avail)<br>----------<br>0 - Do not use EDID block<br>1 - Use EDID block and filter modes<br>bit 2<br>----------<br>0 - Do not use user-defined DTDs<br>1 - Use user-defined DTDs<br>bit3 - bit15<br>----------<br>Reserved for future use. | These two parameters are used to control the available timings for any display. edid_avail is used when EDID values are read from the display. If an attempt to read EDID from the display fails or the edid parameter is set to 0, then the driver uses the edid_not_avail flags.<br>The value for both parameters must be specified as a hex value.<br><br>Defaults:<br>edid_avail: 3 (hex). Bit 0 = 1, Bit 1 = 1, Bit 2 =0 (Use driver built-in standard timings and EDID block and filter modes.)<br>edid_not_avail: 1 (hex). Bit 0 = 1, Bit 1 = 0, Bit 2 = 0. (Use driver-built-in standard timings.)<br><br>Please see Section 3.13, “Advanced EDID Configuration” on page 80 for detailed information. |
| multidvo | 0 – Do not attempt to detect a second decoder of same type<br>1 – After detect of a decoder, continue to attempt detection of same type of decoder until fail | If VBIOS/driver detects a second decoder of same type.<br>This value is hard-coded to “1” for Windows configuration and will ignore this setting. |
| dvo | | sDVO device information. |
| i2cpin | <0-6> | The GPIO pin pair used on the $I^2C$ bus to read and write to sDVO device registers. |
| ddcpin | <0-6> | The GPIO pin pair used as DDC bus to read panel EDID data. |
| i2cdab | <0x00-0xff> | $I^2C$ device address for reading and writing device registers.<br>The device address should be in 8-bit format with the 7-bit slave address assigned to its bits 7:1 and bit 0 set to 0. |
| ddcdab | <0x00-0xff> | $I^2C$ device address for reading EDID data from display through the DDC bus. |
| i2cspeed | [10-400]. Units in KHz | Speed of $I^2C$ bus for sDVO device. |
| ddcspeed | [10-400]. Units in KHz | Speed of $I^2C$ bus for EDID device. |
| fpinfo | | Panel-specific information. |

## Table 24. Parameter Configuration Format (Sheet 6 of 7)

| Name | Range / Value | Description |
|---|---|---|
| bkltmethod | Range [0-3]<br>0 – no backlight<br>1 – Port Driver<br>2 – GMCH<br>3 – ICH<br><br>***Note:*** The only supported parameter for internal LVDS is 1 – Port Driver | Instructs which backlight method is required for the panel attached to the given port.<br>If zero is supplied, or the key is not present, then no backlight control is provided. |
| bkltt1 | Range [0 -0xfff].<br>Units of 1ms => the limit specified in your hardware specifications. For example, the maximum for the CH7307 is 409 ms. | (T1) Time delay between VDD active, and sDVO clock/data active. Zero indicates no delay required. |
| bkltt2 | | (T2) Time delay between sDVO clock/data active and backlight enable. |
| bkltt3 | | (T3) Time delay between backlight disable and sDVO clock/data inactive. |
| bkltt4 | | (T4) Time delay between sDVO clock/data inactive and VDD inactive. |
| bkltt5 | | (T5) Minimum delay between VDD inactive, and active. |
| gpiopinvee | Valid ICH GPIO pin, 0 indexed<br><br>For example:<br>gpiopinvdd = 3<br>gpiopinvee = 5<br>gpiopinenable = 1 | GPIO connection for panel power. |
| gpiopinvdd | | GPIO connection for backlight power on/off sequencing signal. |
| gpiopinbklt | | GPIO to enable backlight signal. |
| UseGMCHClockPin | 1 - Flat panel is connected to the clock pin<br>0 - Flat panel is not connected to the clock pin | This entry is needed when GMCH is selected as backlight control method. |
| UseGMCHDataPin | 1 - Flat panel is connected to the data pin<br>0 - Flat panel is not connected to the data pin | This entry is needed when GMCH is selected as backlight control method. |
| dtd | | Denotes a Detailed Timing Descriptor (DTD) block. Settings in this section, except for the `flags` parameter, correspond to the Detailed Timing Block described in the VESA standard “Extended Display Identification Data Standard”, Version 3, November 13, 1997. |
| p_clock | Range [0-0x7fffffff] | Pixel clock value in KHz. |
| h_active | Range 0-4096 [12 bits] | Horizontal Active. |
| v_active | Range 0-4096 [12 bits] | Vertical Active. |
| h_sync | Range 0-1024 [10 bits] | Horizontal Sync Offset. |
| v_sync | Range 0-64 [6 bits] | Vertical Sync Offset. |
| h_syncp | Range 0-1024 [10 bits] | Horizontal Sync Pulse Offset. |
| v_syncp | Range 0-64 [6 bits] | Vertical Sync Pulse Width. |
| h_blank | Range 0-4096 [12 bits] | Horizontal Blanking. |
| v_blank | Range 0-4096 [12 bits] | Vertical Blanking. |
| h_border | Range 0-256 [8 bits] | Horizontal Border. Currently not supported. |
| v_border | Range 0-256 [8 bits] | Vertical Border. Currently not supported. |
| h_size | Range 0-4096 [12 bits] | Horizontal Size. Currently not supported. |

## Table 24. Parameter Configuration Format (Sheet 7 of 7)

| Name | Range/Value | Description |
|---|---|---|
| v_size | Range0-4096 [12 bits] | Vertical size. Currently not supported. |
| flags | Range [32 bits]<br>Valid values:<br>bit 31<br>----------<br>0 - Non-interlaced<br>1 - Interlaced<br><br>bit 27<br>----------<br>0 - vertical sync polarity active low<br>1 - vertical sync polarity active high<br><br>bit 26<br>----------<br>0 - horizontal sync polarity active low<br>1 - horizontal sync polarity active high<br><br>bit 25<br>----------<br>0 - blank sync polarity active high<br>1 - blank sync polarity active low<br><br>bit 17<br>----------<br>0 - Normal DTD<br>1 - Panel/display Native DTD<br><br>All other bits<br>----------<br>Do not use any other bits; all other bits must be set to 0. | Interlace, Horizontal polarity, Vertical polarity, Sync Configuration, etc. Note that these flags are IEGD specific and do not correspond to VESA 3.0 flags. For example, to set Interlaced with Horizontal Sync Polarity high (bits 31 and 26), then the flags value = 0x84000000. (Binary = 10000100 00000000 00000000 00000000) |
| attr | 0-0xFFFF | Attribute values that are specific to the sDVO device for the port. See Appendix B, “Port Driver Attributes” for specific attribute IDs and associated values. |
| id <Attribute ID> | 0 - $2^{32}$ | id = <value>.<br><br>Both the Attribute ID and its value should be specified in decimal. For example, to set brightness to 50, you specify<br><br>id 0 = 50<br>See Appendix B, “Port Driver Attributes”. |

## 3.12 Display Detection and Initialization

The Display Detection and Initialization feature, when enabled, automatically detects displays and allocates ports without the need to change any configuration files. This feature is off by default and can be enabled either through CED or by directly editing the `iegd.inf` file for Microsoft Windows or the `xorg.conf` file for the Linux OS.

To enable the feature via CED, select the `DisplayDetect` option on the CED Chipset Configuration page. Please see Section 3.5, “Creating a New Configuration” on page 38.

Alternatively, you can enable the feature in Microsoft Windows by entering the following line in the **`[iegd_SoftwareDeviceSettings]`** section of the `iegd.inf` file:

**HKR, All\<ConfigID>\General, DisplayDetect, %REG_DWORD%, 1**

where <ConfigID> is the configuration ID (without the angle brackets).

To enable the feature in the Linux OS, enter the following line Option setting in the `xorg.conf` file:

**Option “Config/<ConfigID>/General/DisplayDetect” “1”**

When the display detection feature is enabled, ports are allocated only when the display satisfies the following conditions:

1. The port is not in use (that is, it is not already allocated).
2. The port driver detects the display.

The first port that passes these conditions is allocated. If condition 2 fails for all ports, then the first port in the `PortOrder` setting that passes condition 1 is allocated. If the port is not detectable (specifically the internal LVDS or external LVDS using CH7308), the driver assumes the display is connected. Condition number 2 always passes for these displays.

When this feature is disabled, display allocation is done based on `PortOrder` and no display detection is performed.

### 3.12.1 Display Detect Operation

This section describes the logic of the Display Detection feature and provides several examples.

1. If Display Detect is disabled, the driver uses the first two ports identified in the PortOrder.
2. If Display Detect is enabled and you are using the 10.4 version of the VBIOS, the VBIOS performs the display detection. The driver then checks whether the VBIOS returns the display allocations and if it does, the driver does not re-execute the display detection steps.

   If you are not using the v10.4 Legacy VBIOS, then the driver performs display discovery as described in the following steps.
3. The number of displays to be detected is based on the `DisplayConfig` settings in the configuration. If this is set to **Single**, then only one display is detected. If it is set to any other value, a maximum of two displays will be detected.

4. IEGD goes through each port in the `PortOrder` settings and attempts to detect a display using the following algorithm:

   a. PortOrder sequence determines display detection. Port allocation shows after the display has been detected. For example:

      PortOrder = “53240” (CRT, sDVO, LVDS)

      Displays Connected = CRT

      **Primary display allocation**: Searches for a display connected by the PortOrder sequence. The first detected display is a CRT, so the Primary display is “CRT.”

      **Secondary display allocation**: Searches for a display connected according to the PortOrder sequence. The first non-allocated display detected is sDVO, so the Secondary display is “sDVO.”

   b. With no display detected on any port, turn off the DisplayDetect option and allocate ports in the order defined by PortOrder. For example:

      PortOrder = “32000”

      Displays Connected = None

      **Primary display allocation**: Searches for a connected display by the PortOrder. Because IEGD detects no displays, the Primary display is set to “sDVO-C.”

   c. The driver cannot detect the presence of a display connected to the Internal LVDS and external LVDS displays connected to some sDVO devices, for example, an LVDS connected to the CH7308. Consequently, the driver assumes that an LVDS display is connected if it is in the PortOrder. If you only want to use the internal LVDS when no CRT and devices are connected, then put LVDS in the PortOrder after them. For example:

      PortOrder = “53240” (CRT, LVDS)

      Display Connected = None

      **Primary display allocation**: Searches for a display connected according to PortOrder sequence. Since no display is connected and since LVDS is specified in the PortOrder, the driver assumes that an LVDS display is connected. Consequently, set the Primary display to LVDS.

   d. Because the driver cannot detect the presence of a display connected to the Internal LVDS and certain external LVDS displays, it therefore always assumes that they are connected if they are listed in the PortOrder. Be careful not to set the PortOrder that prevents the driver from detecting a connected display. For example:

      PortOrder = “54320” (CRT, LVDS sDVO)

      Displays Connected = CRT

      **Primary display allocation**: Searches for a connected display by the PortOrder. In this case, set the Primary display to “CRT.”

      **Secondary display allocation**: Searches for a connected display by the PortOrder. Even though sDVO is connected, the driver assumes that the internal LVDS is also connected. Consequently, the driver never detects the display connected to the sDVO port. To change this, move sDVO-C before LVDS in the PortOrder (“53420” rather than “54320”).

   e. When the port drivers do not load for any ports specified in the PortOrder, the driver enables port 5 (CRT) only. For example:

      PortOrder = “32000” (sDVO)

      PortDrivers = “” (None)

      **Primary display allocation:** Searches for displays connected by the PortOrder. Since no port drivers are available for the specified ports, CRT port 5 is enabled. Consequently, set the Primary display to “CRT.”

### 3.12.2 Detectable Displays

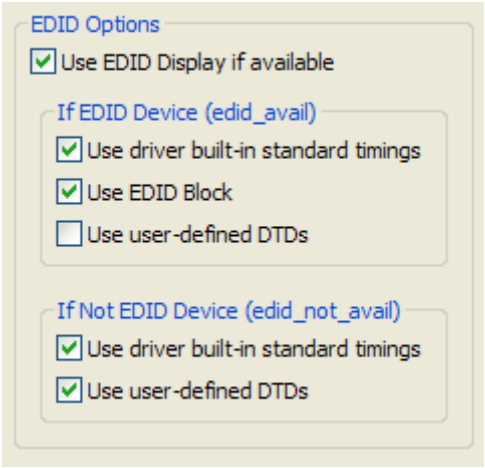
The table below provides a list of displays that are detectable by IEGD.

**Table 25. Detectable Displays**

| Transmitter | Display Type | Detectable by IEGD? |
|---|---|---|
| GMCH Analog CRT | VGA | Yes |
| GMCH Integrated LVDS | LVDS | No (assumed attached) |
| GMCH Integrated TV Out | TV Out | N/A |
| CH7022 | VGA Bypass | Yes |
| CH7307 | DVI | Yes |
| CH7308 | LVDS | No (assumed attached) |
| CH7315 | HDMI/DVI | Yes |
| CH7317 | VGA Bypass | Yes |
| CH7319 | DVI | Yes |
| CH7320 | DVI | Yes |
| SiI 1362 | DVI | Yes |
| SiI 1364 | DVI | Yes |

## 3.13 Advanced EDID Configuration

Shown in the following EDID Options example, the If EDID Device (`edid_avail`) and If Not EDID Device (`edid_not_avail`) options in CED are found on the CRT, sDVO, LVDS, and TV Out configuration pages.




These options control the available timings for any display. Use the `edid_avail` parameter when EDID information is read from the display. If the driver cannot read EDID information from the display or if the `edid` parameter is set to “`0`” (disable), use the settings of the `edid_not_avail` parameter.

The default behavior of `edid_avail` is to use the driver’s built-in standard timings and EDID block and filter modes. The default for `edid_not_avail` is to use the driver’s built-in standard timings. Please see Table 24 in Section 3.11 for more information on these parameters.

IEGD supports three different types of EDID display modes:

1. **Built-in display modes**. These modes are hard-coded in IEGD. These modes can be filtered based on the EDID block.
2. **EDID-DTDs**: These are Detailed Timing Descriptors read from the EDID block. EDID can have these DTDs along with other information about the display.
3. **User-specified DTDs** defined in CED. See Section 3.13.2.

The Advanced EDID Configuration supports different possible combinations of display modes when an EDID display exists with user-specified DTDs.

### 3.13.1 Sample Advanced EDID Configurations

The table below presents various EDID configurations and the EDID settings in CED used for those configurations.

**Table 26. Sample Advanced EDID Configurations**

| Configurations | CED Settings | Description |
|---|---|---|
| 1. Use only filtered built-in and any EDID-DTDs when the display has EDID information<br>2. Use all built-in modes when the display does not contain EDID information | edid = 1<br>edid_avail = 3<br>edid_not_avail = 1 | Default values. |
| 1. Use only filtered built-in modes and EDID-DTDs when the display has EDID.<br>2. Use only user-DTDs otherwise. | edid = 1<br>edid_avail = 3<br>edid_not_avail = 4 | This configuration allows IEGD to use its built-in display modes and the modes provided by the display.<br>If IEGD cannot read EDID information from the display, then IEGD uses the user-DTDs defined in CED. |
| 1. Use only user-DTDs regardless of connected display. (Typically used for a custom panel that only supports user-defined DTDs.)<br>2. Use limited set of timings when a panel EDID is present, but IEGD cannot read the EDID information. | edid = 0<br>edid_avail = (any value)<br>edid_not_avail = 4 | Only user-DTDs defined in CED are used. |
| 1. Use EDID-DTDs for an EDID display.<br>2. Use user-DTDs for a non-EDID display. | edid = 1<br>edid_avail = 2<br>edid_not_avail = 4 | This configuration uses the EDID-DTDs when detecting an EDID display and EDID information comes from the display.<br>If the driver detects a non-EDID display, then IEGD uses user-DTDs defined in CED. |
| 1. Use only EDID-DTDs and user-DTDs for an EDID display.<br>2. Use user-DTDs only for a non-EDID display. | edid = 1<br>edid_avail = 6<br>edid_not_avail = 4 | This configuration uses both EDID-DTDs and user-DTDs when IEGD detects an EDID display.<br>If the driver detects a non-EDID display, then IEGD uses user-DTDs defined in CED. |

### 3.13.2 User-Specified DTDs

CED provides the ability to input DTD data directly. There are numerous sources of DTD data: VESA, panel manufacturers, etc. See Creating a New Customized DTD for more information.

## 3.14 Using an External PCI Graphics Adapter as the Primary Device

IEGD can be configured to work with an external PCI graphics adapter card as the primary graphics adapter device with the Intel internal graphics device (GMCH) as the secondary graphics device. You can configure your system to boot with a PCI graphics adapter in the System BIOS. When designating an external PCI graphics adapter as the primary graphics adapter, the Intel GMCH becomes the secondary graphics device.

*Note:* The term *secondary* adapter refers to the adapter that is not the *boot-up*, or VGA-Compatible, adapter. The secondary adapter is not necessarily the secondary display as assigned by the OS.

You can configure an external PCI card to work with IEGD as follows:

- The external PCI card as the primary graphics adapter and the GMCH internal graphics device as the secondary.
- The external PCI card as the secondary graphics adapter and the GMCH internal graphics device as the primary.

*Note:* This feature is not supported on Microsoft Windows CE systems.

IEGD lets you specify which display is primary, secondary, and tertiary. It allows Twin and Clone configurations on the internal graphics device when the external PCI display is the primary graphics adapter. It also allows Twin and Clone configurations on the internal graphics device when the external PCI device is the secondary graphics adapter.

An external PCI graphics driver runs independently without sharing resources with IEGD.

The following figures show several configurations when an external PCI adapter is the primary graphics device and when it is the secondary graphics device.

Figure 24 shows an External PCI card as the primary graphics adapter card and IEGD as the secondary. The drivers do not share hardware resources. The OS decides the framebuffer content and handles that by drawing to the respective driver independently.

**Figure 24. External PCI Graphics Card as Primary Driver and IEGD as Secondary Driver**

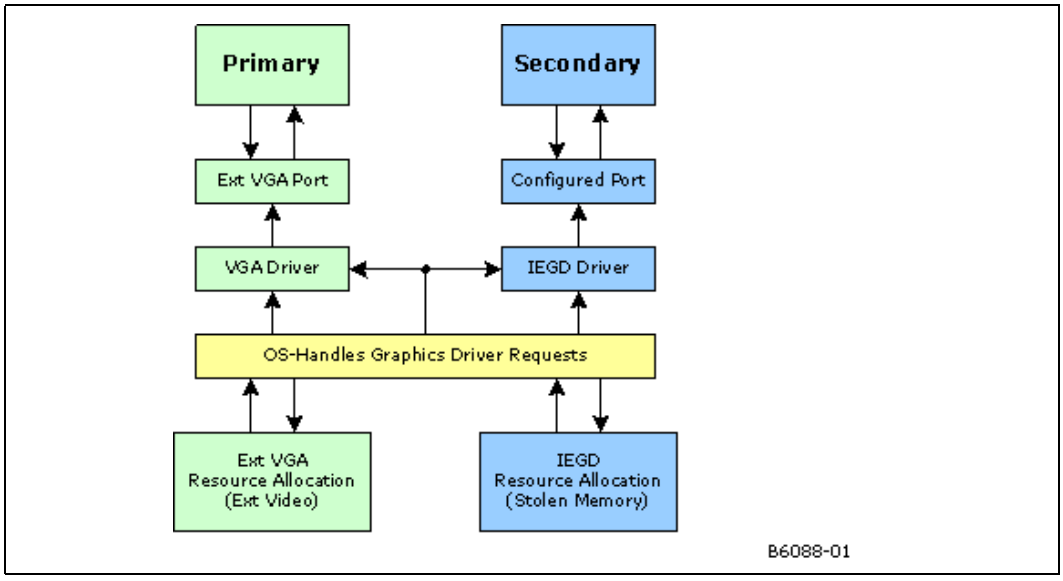


Figure 25 shows the interaction between IEGD and the External VGA driver when IEGD is booted as the primary driver. Again, the drivers do not share hardware resources. The OS decides the framebuffer content and handles it by drawing to the respective driver independently.

**Figure 25. IEGD as Primary Driver and External PCI Graphics Card as Secondary Driver**

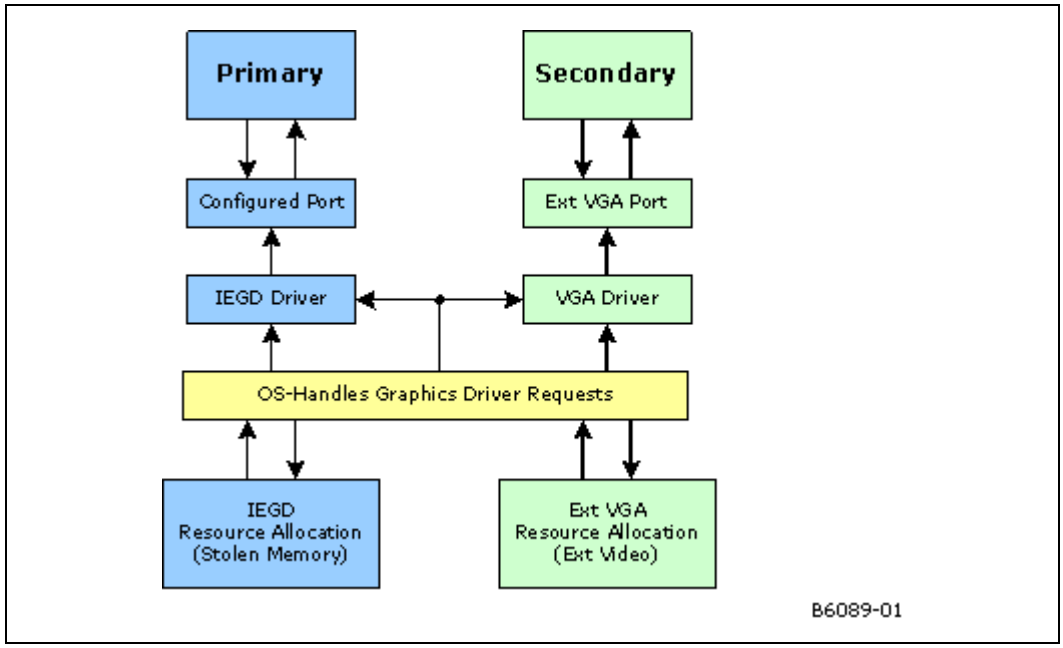
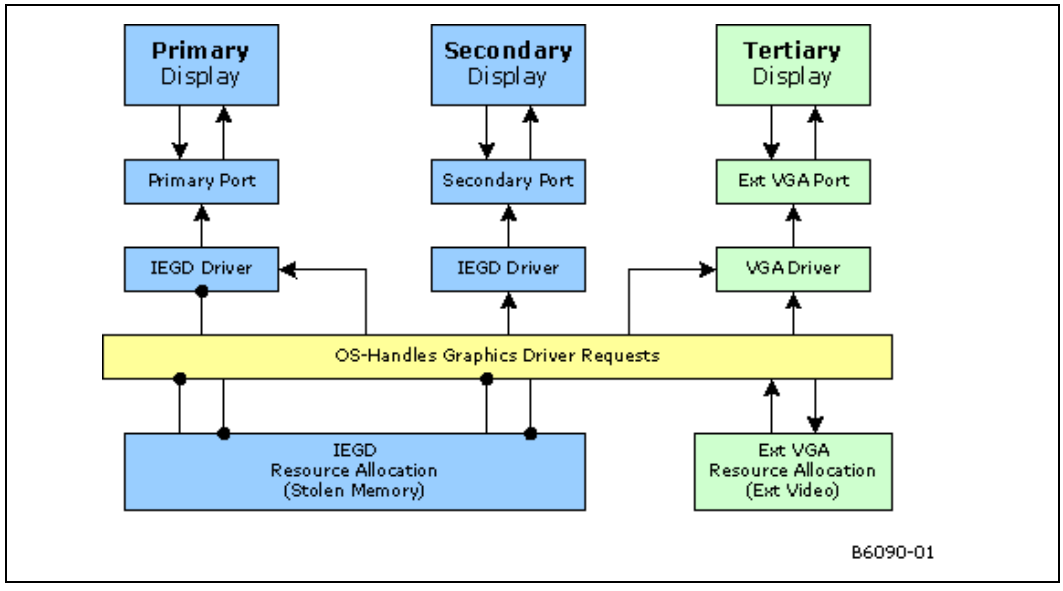



Figure 26 shows a sample configuration where the internal graphics device is primary and configured to use two ports to drive two displays while an external PCI graphics adapter is used to drive a tertiary display. Note that regardless of the number of ports being assigned to a driver, the external PCI graphics run independently without sharing resources with IEGD.

**Figure 26. IEGD as Primary Driver with Two Displays and External PCI Driving a Tertiary Display**



## 3.15 Multi-GPU Multi-monitor

IEGD supports Multi-GPU Multi-monitor (formerly known as Hybrid Multi-Monitor mode), defined as a PCI- or PCI Express*-based external graphics card operating concurrently with Intel chipsets' integrated graphics.

This feature enables concurrent operation of Intel's integrated GPU along with a discrete GPU solution, allowing for operability of greater than two independently driven displays.

Intel platforms that support this feature those based on the Intel® Atom™ Processor with Intel® System Controller Hub US15W Chipset combination, the Intel® Q45/G41/G45 Express chipsets, and the Intel® GM45/GL40/GS45 Express Mobile chipsets. **Please verify with your Intel field representative to determine whether your particular Intel chipset has been validated as supporting this capability before attempting to use this feature.**

The external PCI-Express graphics card will need to have "well behaved" VBIOS and drivers for this feature to operate successfully. Failure to operate usually indicates a system BIOS issue, external card VBIOS issue, or external card driver issue.

IEGD is validated as supporting this capability using known good external cards. Inquire with your Intel field representative if your chosen graphics card has been validated as supporting Multi-GPU Multi-monitor before attempting this function. For platforms based on the Intel® Atom™ Processor with Intel® System Controller Hub US15W Chipset combination, PCI-E x1 graphics cards from ATI, NVIDIA, and Matrox have all been validated with IEGD 10.4.

For more details, refer to the white paper *Implementing Multiple Displays with IEGD Multi-GPU -Multi-Monitor Mode on Intel® Atom™ Processor with Intel® System Controller Hub US15W Chipset* (document number 324821). It is available on the Embedded Design Center (http://download.intel.com/embedded/software/IEGD/324821.pdf) or can be requested from your local Intel sales representative.

For Windows operating systems (such as XP, XP Embedded, Embedded Standard 2009, etc.), Windows Display Properties Settings should be used to manage the heterogeneous display adapters, resolutions, color quality levels, and refresh rates. IEGD and the Display Properties configure the multiple displays appropriately which includes user assignment of Intel's internal chipset graphics as the primary, secondary, tertiary, or quad ports which dictate where the desktop content will appear. The external graphics card and drivers activate the alternate port(s) not driven by the Intel chipset.

IEGD also enables Multi-GPU Multi-monitor support under most Linux Operating systems.

For more details on this feature and a step-by-step Enablement Process for Multi-GPU Multi-monitor, refer to Intel's white paper titled *Hybrid Multi-monitor Support; Enabling new usage models for Intel® Embedded Platforms*. This is found on Embedded Design Center at http://edc.intel.com/Software/Downloads/IEGD/#download; search for document number 323214.

## 3.16 Enhanced Clone Mode Support

The Enhanced Clone Mode feature lets you specify a clone display size that is different from the primary display. It also allows you to change the clone display size at runtime using the IEGD Runtime GUI (see Section 5.5, "Viewing and Changing the Driver Configuration from Microsoft Windows" on page 113 or for Linux systems).

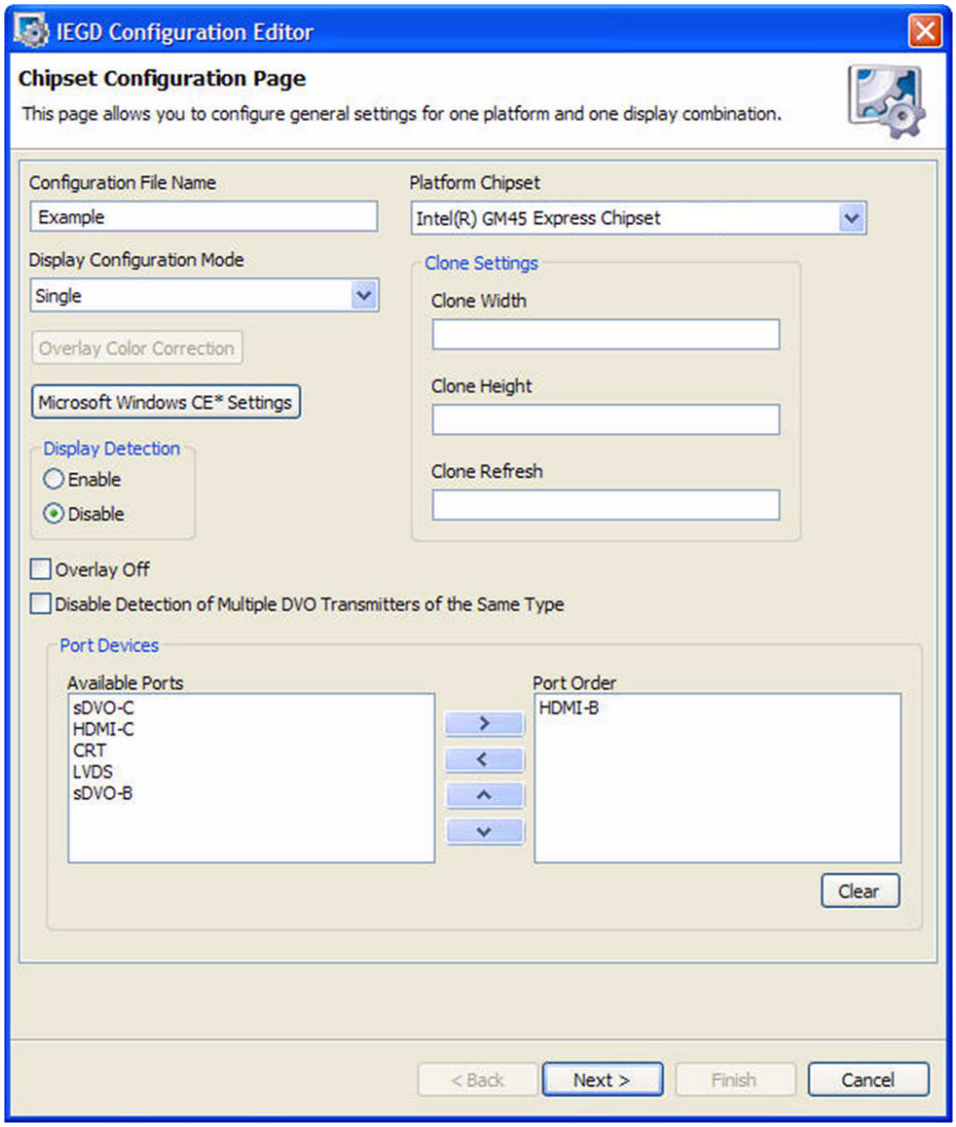
In Clone mode, the framebuffer is always allocated to match the primary display size. On the clone display (secondary display) the image is centered if the display is bigger than the framebuffer. Centering happens only if the requested resolution and refresh rate is not available for the clone display.

Extended Clone mode uses four CED parameters:

- Clone Width — specifies a width for the clone display
- Clone Height — specifies a height for the clone display
- Clone Refresh — specifies a refresh rate for the clone display
- Enable interlace mode — uses interlace mode for the clone display

### 3.16.1 Extended Clone Mode CED Configuration

The following CED screenshot shows a sample Extended Clone mode setting configuration.



See also “Sample Clone Mode Configurations”.

## 3.16.2 Sample Clone Mode Configurations

The following examples illustrate Clone Mode configurations for the following combinations:

- CRT + integrated LVDS (Example 1 on page 86)
- CRT + Fixed size DVI display (Example 2 on page 86)

### Example 1. Mobile Intel® GM45 Express Chipset, Internal LVDS, CRT, and LVDS

This example shows how to set up a clone mode configuration consisting of an internal LVDS, CRT, and external LVDS device.

1. Choose a CRT that supports resolutions larger than 1024x768 and configure the following settings on the Chipset Configuration Page:
   - — Platform Chipset = Mobile Intel® GM45 Express Chipset
   - — Display Configuration Mode = Clone
   - — Clone Width = 1024
   - — Clone Height = 768
   - — Clone Refresh = 60
   - — Port Order = CRT, LVDS
2. Click **Next** on the Chipset Configuration Page and provide port names for the CRT, LVDS, and sDVO-B port devices.
3. On the LVDS Port Configuration Page, click the **Flat Panel Settings** button and set the Width and Height to **1024** and **768** respectively.
4. Package and generate an installation for the configuration and move the resulting `iegd.inf` file to the target machine. (Please see “Creating a New Package” on page 58 for specific instructions.)

After you have moved the `iegd.inf` file to the target machine, do the following:

1. Set 800x600 on CRT and ensure that an 800x600 image appears at the top, left corner of the LVDS display or that the image has been scaled to match the panel size based on panel used.
2. Set 1280x1024 on CRT and check that the LVDS display is panning. Ensure that the clone mouse pointer is in sync with the primary display.

### Example 2. Intel® 915GV, Chrontel 7307, CRT, and DVI

This sample shows how to set up a clone mode configuration consisting of a CRT and DVI display on a Chrontel* 7307 serial sDVO transmitter.

1. Choose a CRT that supports resolutions larger than 1024x768 and configure the following settings on the Chipset Configuration Page:
   - — Platform Chipset = Intel® 915GV
   - — Display Configuration Mode = Clone
   - — Clone Width = 1024
   - — Clone Height = 768
   - — Clone Refresh = 60
   - — Port Order = CRT, sDVO-B

2. Click **Next** on the Chipset Configuration Page and provide port names for the CRT and sDVO-B port devices.
3. On the sDVO-B Port Configuration Page, click the **Flat Panel Settings** button and set the Width and Height to **1024** and **768** respectively. Select **CH7307** from the Select sDVO Device list.
4. Package and generate an installation for the configuration and move the resulting `iegd.inf` file to the target machine. (Please see "Creating a New Package" on page 58 for specific instructions.)

After you have moved the `iegd.inf` file to the target machine, do the following:

1. Set 800x600 on CRT and ensure that an 800x600 image appears at the top, left corner of the DVI display or that the image has been scaled to match the panel size based on panel used.
2. Set 1280x1024 on CRT and check that the DVI display is in panning mode. Ensure that the clone mouse pointer is in sync with the primary display.

## 3.17 Scaling and Centering Configurations

This release supports the following scaling and centering configurations:

- Upscaling for the Chrontel CH7308 LVDS Transmitters
- Internal LVDS Scaling With EDID Panels
- Alignment in Clone mode
- sDVO as Primary
- Render Scaling modes to native panels connected to non-scaling port encoders

See the following topics for configuration details:

- "Upscaling for the Chrontel CH7308 LVDS Transmitters"
- "Internal LVDS Scaling with EDID Panels"
- "Centering Primary Display with Scaling Encoders"
- "Enabling Render Scaling on Port Encoders without Hardware Scaling"
- "Alignment in Clone Mode"

### 3.17.1 Upscaling for the Chrontel CH7308 LVDS Transmitters

IEGD can upscale lower-resolution modes (those smaller than the size of the respective panel) to the native size of the panel connected to a Chrontel CH7308* LVDS transmitter.

IEGD uses a user-supplied DTD with the native flag set (also known as native DTD) as native timing for the panel connected to either a CH7308 transmitter.

If the user does not supply a native DTD, IEGD takes the first available matching FP `info width` and `height` timings as native timing for the panel if standard timings were selected as part of `edid_avail` or `edid_not_avail` flags.

To support upscaling, the LVDS transmitters require setting the pipe to native timing of the panel despite the user-selected resolution. It also requires finding the native timing (also known as native DTD) of the panel based on user-supplied configuration information.

The CH7308 (sDVO) port drivers limit the list of supported modes to the size of panel. The port drivers also mark one of the timings as native DTD as follows (it goes to the next step only if native DTD is not found in the current step).

1. It finds the timing with the user-defined DTD with the native DTD flag set. This becomes the native DTD for the panel.
2. If the panel is an EDID panel and user selected to use EDID DTDs, then the port driver marks the EDID DTD as native DTD.
3. If the user supplies a DTD without the native DTD flag set, then the port driver marks this one as the native DTD.
4. If none of the above steps works, the port driver finds the first matching timing for FP width, height and marks it as native DTD.

If none of the above steps works, then there is no native DTD and no upscaling is performed.

### 3.17.2 Internal LVDS Scaling with EDID Panels

The Internal LVDS connected to an EDID Panel supports scaling of modes other than native mode. To support this, the port driver exports information to the EDID parser that it can scale. The EDID parser does not remove other modes (that is, non-native modes) from the mode table. It only marks the native mode. When IEGD queries the port driver on which modes are supported, the port driver then removes any modes that cannot be scaled (up or down depending on the port's hardware capability). When mode-setting occurs, the second display in Clone mode can indeed support non-native modes even though the panel had EDID. This occurs only if a native mode can be found the port driver can scale. Otherwise, the port driver ignores the scaling information and IEGD proceeds normally.

The driver also supports Internal LVDS Scaling on EDID-less panels. The steps that enable this are the same as those described for the scaling of Chrontel LVDS transmitters in Section 3.17.1.

### 3.17.3 Centering Primary Display with Scaling Encoders

In Clone mode, IEGD expects the primary display to have a framebuffer size (OS Aware mode) that matches the display's native size of panel timings. When the user designates a display as primary in a Clone mode configuration and wants to center it (as explained in Section 3.17.5), they may want this setup to align a primary display on a scaling encoder with a secondary one that can only center. This will not work by default for certain port encoders such as the internal LVDS, which default to hardware scaling. But IEGD has a mechanism to override hardware scaling, thus forcing centering.

When possible, IEGD allows centering of 640x480, 800x600, and 1024x768 resolutions on the primary display. In some cases (depending on panels), the image may appear on the top-left. It may also produce unusable output on some displays (such as a TV). Therefore, this type of configuration is more appropriate for LVDS panels.

To disable hardware scaling and force centering for a primary display on the above modes, users only need to set the "Panel_Fit" attribute ("0x12") to "0" (zero).

### 3.17.4 Enabling Render Scaling on Port Encoders without Hardware Scaling

IEGD Render Scaling feature allows the driver to support any one of the standard modes (640x480, 800x600, 1024x768 or 1280x1024) as a drawable framebuffer size output to a native panel and connected via a port encoder that does not hardware scale. To achieve this, the GPU engine repeats all rendering operations twice from the original OS-targeted back buffer to a separate front buffer, which is rendered via the 3D engine for scaling. This feature is enabled by turning on the “Panel-Fit” attribute (“0x12”) on a port driver that does not support that attribute. But this only happens if there is a native mode timing (see Section 3.17.1 for information about how native mode timing is determined).

Users should be aware that this feature can impact performance and produce scaled output which is inferior in quality to hardware encoder scaling.

### 3.17.5 Alignment in Clone Mode

In Clone mode, both can be configured with separate timings and different resolutions. Both displays show the same content. In the case where resolutions are different on the cloned displays, the display identified as primary drives the display mode and framebuffer size. In this situation, three options exist for the cloned displays:

- *Panning*: If the clone display is smaller than the primary display, the displayed image can be off the screen with the display showing only a window into the overall image. Panning moves the window following the cursor.
- *Centering*: If the clone display is larger than the primary display mode, the display image can be centered in the clone display. Black borders are displayed around the image on the display.
- *Scaling:* There are two types of scaling in Clone mode, as described below.
  - *Hardware Encoder Scaling*: This feature adjusts the resolution of the image from the primary display to fit the resolution of the clone display. This permits scaling up to a larger display (upscaling), or scaling down to a smaller display (downscaling). It also allows the full image to be displayed within the full resolution of the clone display, known as picture-boxing.

    Some systems may have cloned displays that cannot scale but have a primary display that can scale, such as an internal LVDS. In non-panning modes, i.e., centering/hardware scaling, this display combination results in the primary display (LVDS) scaling up but the clone display centering. Section 3.17.3 explains how to force the primary display to center — thus allowing both displays to center. Or, use *Render Scaling* to make both displays scale up to full size.
  - *Render Scaling:* For clone display, a situation is possible where the primary display uses a hardware scaling port encoder and the secondary display uses a non-scaling port encoder. Assuming both displays are output via native panels, the resulting output should see the primary scaling of any smaller mode to full panel size. But the secondary display will center the smaller modes. *Hardware Encoder Scaling* explains how to align both displays to be centered. Using the Render Scaling feature, the opposite can be achieved. Ensure the non-scaling encoder is primary and enable Render Scaling on that port (see Section 3.17.4). This will make the GPU render-scale the smaller mode and achieve the full panel size. The clone display, now the scaling encoder, will take the render-scaled image as its input (and output) to the clone display panel. This feature will be upgraded in the future so that the clone display can independently take in the original framebuffer image as its input.

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# 4.0 VBIOS

## 4.1 Overview

The Intel Embedded Video BIOS incorporates many of the features and capabilities of the Intel® Embedded Graphics Drivers. The 10.4 version of the VBIOS includes support for the following chipsets:

- Intel® Atom™ Processor 400 and 500 Series
- Intel® Q45/G41/G45 Express chipset
- Intel® System Controller Hub US15W/US15WP/WPT chipset
- Intel® GM45/GL40/GS45 Express chipset
- Intel® Q35 Express chipset
- Mobile Intel® GLE960/GME965 Express chipset
- Intel® Q965 Express chipset
- Mobile Intel® 945GSE Express chipset
- Mobile Intel® 945GME Express chipset
- Intel® 945G Express chipset
- Intel® 915GV Express chipset
- Mobile Intel® 915GME Express chipset
- Mobile Intel® 910GMLE Express chipset

*Note:* When using the IEGD VBIOS on US15W and installing Linux distributions, only text mode is supported with some Linux distributions, not graphical.

Enabling the SMSW instruction used when IEGD VBIOS sets up its caching functions increases the boot speed during POST and system boot. Linux* distributions fall back to text mode as a side effect of the Linux Virtual X86 Engine, which does not work well with SMSW. Caching is vital for the IEGD VBIOS and it uses SMSW by design. Changes to the IEGD VBIOS cannot happen without affecting its performance. If you need to install Linux distributions using a GUI interface, use the GMA VBIOS. The IEGD VBIOS can install Linux distributions only in text mode.

## 4.2 System Requirements

The new Video BIOS can be built on a host system running Microsoft Windows* and moved to the target system. The host system must have a 32-bit Microsoft Windows operating system installed with the capability to execute DOS commands from a command line window.

The target system must contain one of the following Intel chipsets:

- Intel® Atom™ Processor 400 and 500 Series
- Intel® Q45/G41/G45 Express chipset
- Intel® GM45/GL40/GS45 Express chipset
- Intel® System Controller Hub US15W/US15WP/WPT chipset
- Intel® Q35 Express chipset
- Mobile Intel® GLE960/GME965 Express chipset
- Intel® Q965 Express chipset
- Mobile Intel® 945GSE Express chipset
- Mobile Intel® 945GME Express chipset
- Intel® 945G Express chipset
- Intel® 915GV Express chipset
- Mobile Intel® 915GME Express chipset
- Mobile Intel® 910GMLE Express chipset

The target system must contain a minimum of 64 Mbytes of RAM.

## 4.3 Configuring and Building the VBIOS with CED

The Intel® Embedded VBIOS is built with the Intel Configuration Editor (CED). The VBIOS will use the configuration that you specify in CED. The VBIOS is selected to be built when you specify it as a Target OS in your package configuration. After specifying VBIOS, follow all CED prompts, and be sure to select “Generate VBIOS” when available. The VBIOS will then be built when you select “Generate Installation” in CED.

Before building your VBIOS, you must set up your DOS environment with the steps below.

1. Download the Open Watcom* C/C++ compiler from http://www.openwatcom.com.
   The User Build System for the VBIOS relies on the Open Watcom C/C++ compiler to be able to build a 16-bit DOS binary required for the BIOS. The VBIOS has been tested with version 1.7a of the Open Watcom compiler.

*Note:* Using any other compiler other than 1.7a may result in VBIOS issues that are not supported and may not be fixed.

2. Install the Open Watcom* C/C++ compiler using the full or complete option. **Do not use the default installation option as it may cause errors when creating the BIOS in CED**.
3. Set up directory paths.
   You must set up the PATH environment variable in DOS to be able to execute the Watcom compiler. If Watcom was installed with its default path, CED will by default be able to use it.

When you generate a VBIOS, the CED produces the following folders and files:

- Compiled_VBIOS folder
  - — `iegdtsr.exe` (Terminate and Stay Resident executable)
  - — VGA.BIN (Option ROM)
- `IEGD_10_4_VBIOS.zip` (this file is generated by the build system)

The `iegdtsr.exe` can be copied to any folder on the target machine. To run the TSR, boot the target machine with DOS, and then run the `iegdtsr.exe` from the DOS command line.

The VGA.bin file is the binary option ROM that can be merged with your system BIOS per the instructions provided by your system BIOS vendor.

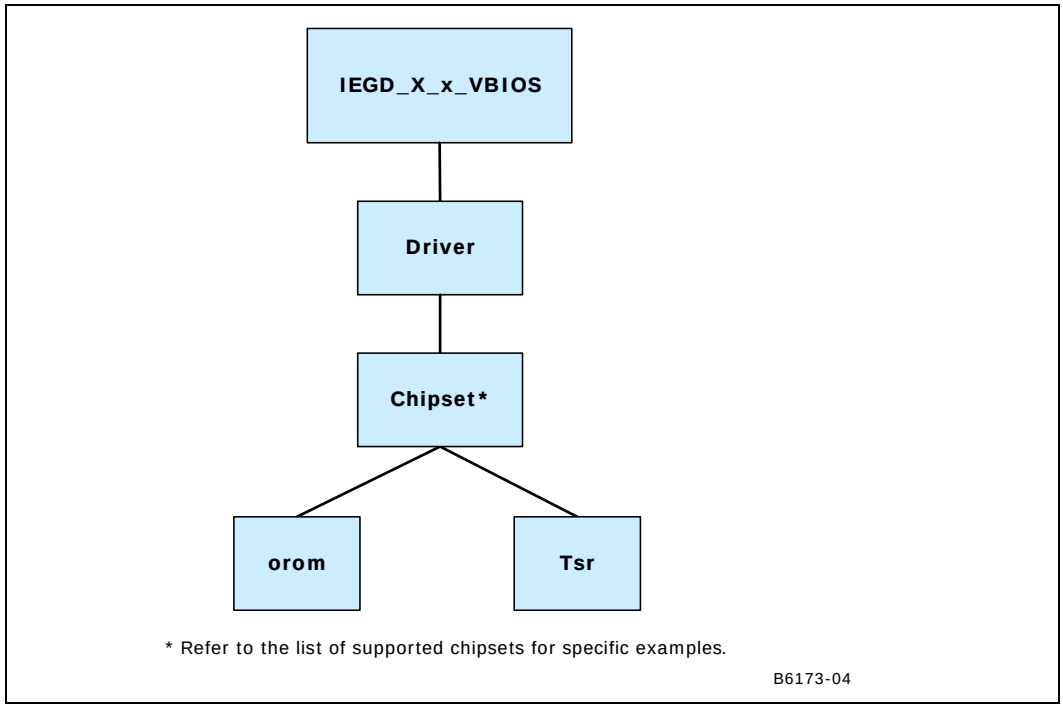
The `IEGD_10_4_VBIOS.zip` file contains default builds of the TSR executable and Option ROM for the various chipsets. The filenames are `iegdtsr-def.exe` and `vga-def.bin` and are located in the tsr or orom folder of the specific chipset folder (see Figure 27).

### 4.3.1 Selecting the Build Folder

The 10_4 version of the VBIOS contains specific folders used for creating a VBIOS that is either an option ROM (OROM) that can be merged with the system BIOS, or an executable Terminate and Stay Resident (TSR) program for debugging purposes. There are also separate directories for the different chipsets that are supported. CED will build both the TSR and OROM.

Figure 27 shows the directory structure for the Video BIOS libraries contained within CED.

**Figure 27. Video BIOS Directory Structure**



### 4.3.2 Configuring the Video BIOS

Use CED to configure the VBIOS. Display settings will be used the same way as for the driver.

#### 4.3.2.1 COMMON_TO_PORT

This setting allows you to associate standard display names used in most system BIOSs to specific ports that are recognized by IEGD (e.g., LVDS, sDVO-B, sDVO-C). The VBIOS makes this association when the VBIOS calls the System BIOS Intel® 5F interrupt functions.

This setting is a six digit number, where each digit is associated with one of the system BIOS displays (from left to right):

1 : CRT - Standard analog CRT

2 : TV1 - TV Output 1

3 : EFP1 - DVI Flat Panel 1

4 : LFP - Local Flat Panel (Internal LVDS display)

5 : TV2 - TV Output 2

6 : EFP2 - DVI Flat Panel 2

The example values above show the typical displays and corresponding order used by a system BIOS. However, this may vary depending on how your system BIOS has implemented the displays and the Intel 5F interrupt functions.

The value in each setting associates with the port number. Using the typical settings above, set COMMON_TO_PORT to be 500400 if you want to associate CRT in the system BIOS with the internal CRT (port 5) and LFP in the system BIOS with internal LVDS (port 4) in the VBIOS.

***Warning:*** This feature must be compatible with the system BIOS. If the system BIOS does not properly implement the Intel 5F functions, then using the COMMON_TO_PORT feature could cause unpredictable results with the displays. If you are unsure, set COMMON_TO_PORT to all zeros (000000) to disable this feature.

*Note:* The `displaydetect` parameter must be set to `Enabled` in order for the COMMON_TO_PORT values to be used.

#### 4.3.2.2 post_display_msg

This setting is a binary setting that enables (1) or disables (0) POST messages to the display.

#### 4.3.2.3 OEM Vendor Strings

The following settings are string values that allow you to set the values that are returned from the Intel 4F interrupt functions.

`oem_string`

`oem_vendor_name`

`oem_product_name`

`oem_product_rev`

#### 4.3.2.4 Default Mode Settings

These settings establish the default VGA or VESA mode to use for the primary (0) and secondary (1) displays. The values should be set to a valid standard VGA or VESA mode (in hexadecimal format, for example, 0x117). Note that a VGA mode can only be set on one display and a second display is disabled unless the `DisplayConfig` parameter is set to `twin` or `clone` mode.

`default_mode_0`

`default_mode_1`

#### 4.3.2.5 Default Refresh Settings

These settings allow you to specify which refresh rate to use for certain VESA modes on the primary and secondary displays. For example, mode 0x117 specifies refresh rates of 60 Hz, 75 Hz, and 85 Hz. This setting allows use to specify which of those three rates to use (specified in decimal, e.g., default_refresh_0=60).

`default_refresh_0`

`default_refresh_1`

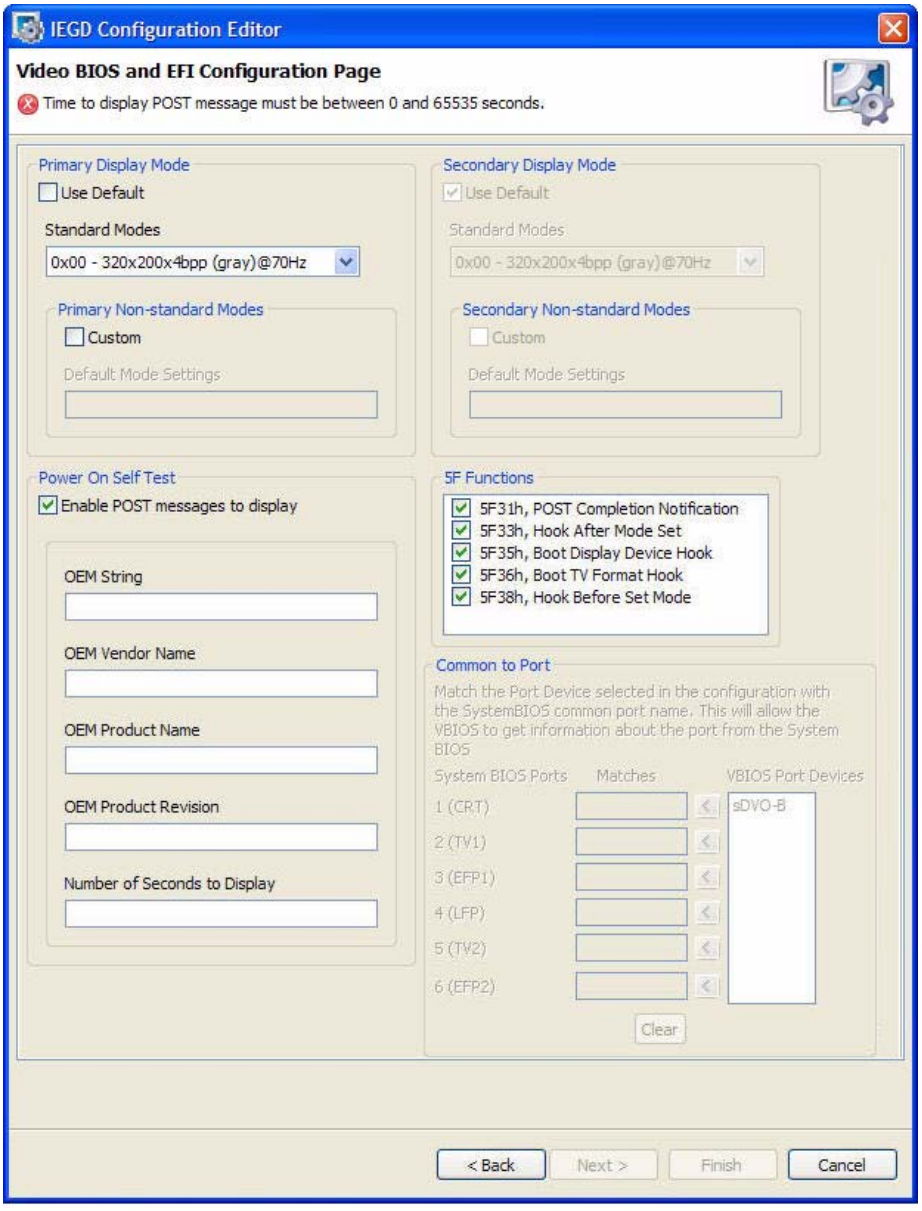
#### 4.3.2.6 default_vga_height

This setting allows you to specify which resolution to use for certain VGA modes. Because only one VGA mode can be supported on both displays, this setting applies to the primary display mode (default_mode_0). For example, mode 3 specifies three possible resolutions: 640x200, 640x350, and 720x400. In this example, setting default_vga_height=350 indicates the resolution 640x350.

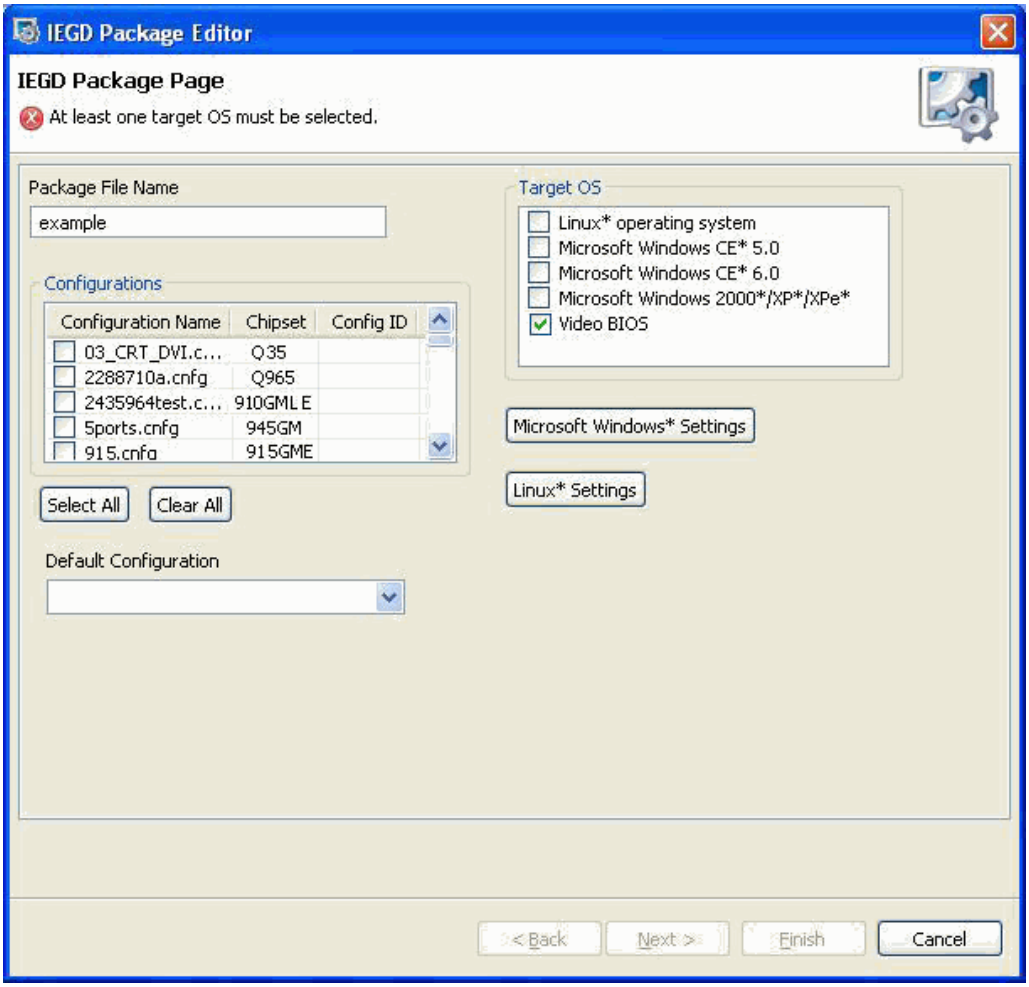
### 4.3.3 Building the VBIOS

CED is used to build the VBIOS. The following steps and screenshots outline a typical CED VBIOS build procedure.

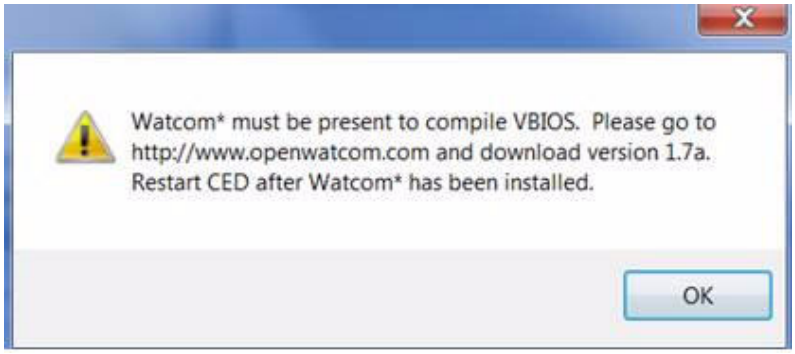
1. Define your configuration via CED, being sure to complete the Video BIOS Configuration Page.

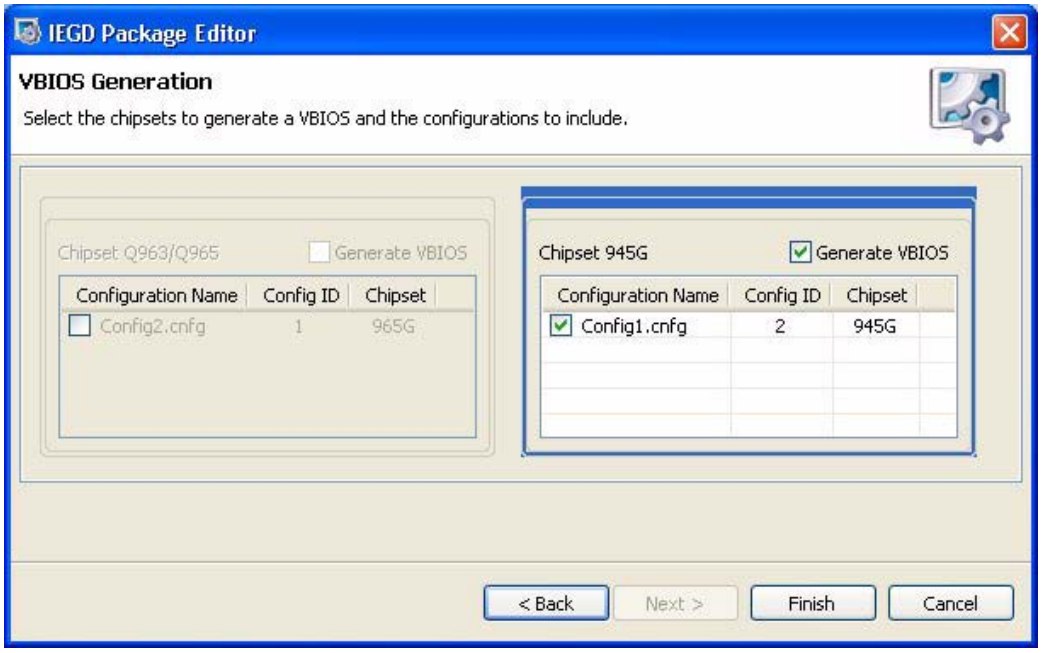

IEGD Configuration Editor
Video BIOS and EFI Configuration Page
Time to display POST message must be between 0 and 65535 seconds.
Primary Display Mode
Use Default
Standard Modes
0x00 - 320x200x4bpp (gray)@70Hz
Primary Non-standard Modes
Custom
Default Mode Settings
Secondary Display Mode
Use Default
Standard Modes
0x00 - 320x200x4bpp (gray)@70Hz
Secondary Non-standard Modes
Custom
Default Mode Settings
Power On Self Test
Enable POST messages to display
OEM String
OEM Vendor Name
OEM Product Name
OEM Product Revision
Number of Seconds to Display
5F Functions
5F31h, POST Completion Notification
5F33h, Hook After Mode Set
5F35h, Boot Display Device Hook
5F36h, Boot TV Format Hook
5F38h, Hook Before Set Mode
Common to Port
Match the Port Device selected in the configuration with the SystemBIOS common port name. This will allow the VBIOS to get information about the port from the System BIOS
System BIOS Ports
Matches
VBIOS Port Devices
1 (CRT)
2 (TV1)
3 (EFP1)
4 (LFP)
5 (TV2)
6 (EFP2)
sDVO-B
Clear
< Back
Next >
Finish
Cancel

2. When defining the package to build, be sure to select “Video BIOS” as “Target OS”.

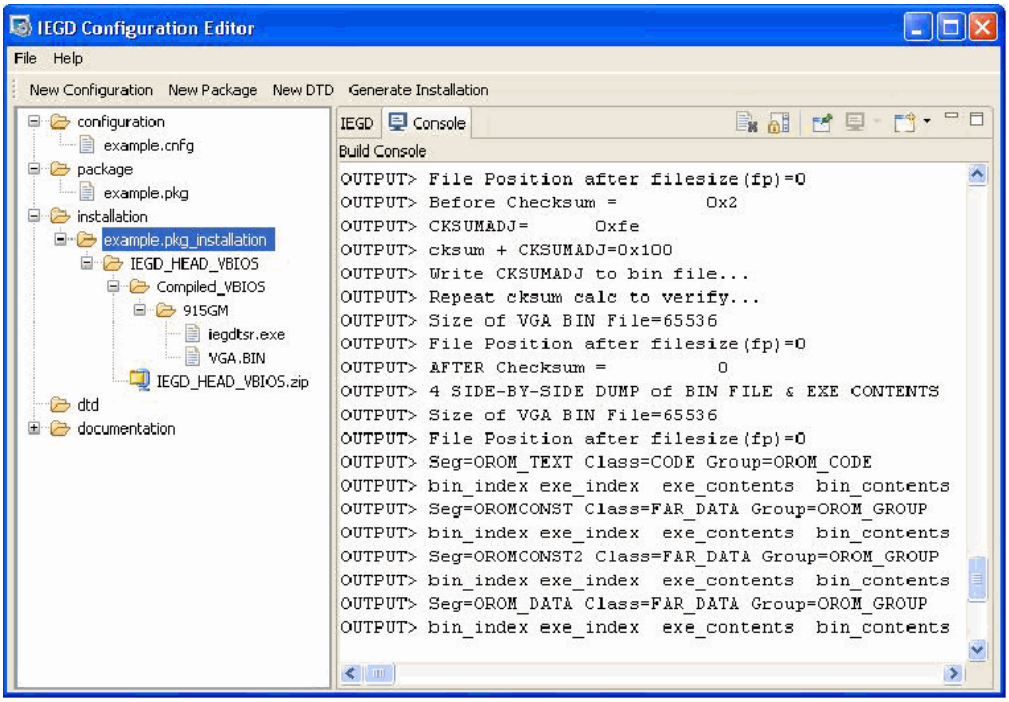



3. Generate the installation. The following may display:






4. Generated files should now be in your CED Installation folder.



## 4.4 VBIOS, Driver Compatibility, and Data Dependencies

The Intel Embedded Graphics Drivers do not depend on any data from the VBIOS, and will either use driver settings or select default values for the attached displays. This allows the driver to properly operate with incompatible BIOS or BIOS replacements.

The Intel Embedded Graphics Drivers will retrieve settings, such as panel ID and other display settings from the Embedded VBIOS. The Embedded VBIOS can configure display timings that can also be used for the Intel Embedded Graphics Drivers.

The VBIOS supports many VESA and standard VGA modes. See Table 27 and Table 28 for the VGA and VESA modes and vertical refresh rates that are supported by the VBIOS.

*Note:* Although IBM labeled certain EGA modes with a (*) suffix and the VGA modes with a (+) suffix (such as mode 3, 3* and 3+), the VGA modes are so common that this document does not use the (+) suffix to refer to them.

The actual availability of any particular mode depends on the capabilities of the display device, the amount of memory installed, and other system parameters.

**Table 27. Supported VGA Video Display Modes (Sheet 1 of 2) (Sheet 1 of 2)**

| Video Mode | Pixel Resolution | Color Depth (bpp) | Mode Type | Display Adapter | Font Size | Character Resolution | Dot Clock (MHz) | Horiz. Freq. (KHz) | Vert Freq (Hz) | Video Memory (KBytes) |
|---|---|---|---|---|---|---|---|---|---|---|
| 00h | 320 x 200 | 16 (gray) (4 bpp) | Text | CGA | 8 x 8 | 40 x 25 | 25 | 31.5 | 70 | 256 |
| | 320 x 350 | 16 (gray) (4 bpp) | | EGA | 8 x 14 | 40 x 25 | 25 | 31.5 | 70 | 256 |
| | 360 x 400 | 16 (4 bpp) | | VGA | 9 x 16 | 40 x 25 | 28 | 31.5 | 70 | 256 |
| 01h | 320 x 200 | 16 (4 bpp) | Text | CGA | 8 x 8 | 40 x 25 | 25 | 31.5 | 70 | 256 |
| | 320 x 350 | 16 (4 bpp) | | EGA | 8 x 14 | 40 x 25 | 25 | 31.5 | 70 | 256 |
| | 360 x 400 | 16 (4 bpp) | | VGA | 9 x 16 | 40 x 25 | 28 | 31.5 | 70 | 256 |
| 02h | 640 x 200 | 16 (gray) (4 bpp) | Text | CGA | 8 x 8 | 80 x 25 | 25 | 31.5 | 70 | 256 |
| | 640 x 350 | 16 (gray) (4 bpp) | | EGA | 8 x 14 | 80 x 25 | 25 | 31.5 | 70 | 256 |
| | 720 x 400 | 16 (4 bpp) | | VGA | 9 x 16 | 80 x 25 | 28 | 31.5 | 70 | 256 |
| 03h | 640 x 200 | 16 (4 bpp) | Text | CGA | 8 x 8 | 80 x 25 | 25 | 31.5 | 70 | 256 |
| | 640 x 350 | 16 (4 bpp) | | EGA | 8 x 14 | 80 x 25 | 25 | 31.5 | 70 | 256 |
| | 720 x 400 | 16 (4 bpp) | | VGA | 9 x 16 | 80 x 25 | 28 | 31.5 | 70 | 256 |
| 04h | 320 x 200 | 4 | Graph | All | 8 x 8 | 40 x 25 | 25 | 31.5 | 70 | 256 |
| 05h | 320 x 200 | 4 (gray) | Graph | CGA | 8 x 8 | 40 x 25 | 25 | 31.5 | 70 | 256 |
| | 320 x 200 | 4 (gray) | | EGA | 8 x 8 | 40 x 25 | 25 | 31.5 | 70 | 256 |
| | 320 x 200 | 4 | | VGA | 8 x 8 | 40 x 25 | 25 | 31.5 | 70 | 256 |
| 06h | 640 x 200 | 2 | Graph | All | 8 x 8 | 80 x 25 | 25 | 31.5 | 70 | 256 |

### Table 27. Supported VGA Video Display Modes (Sheet 2 of 2) (Sheet 2 of 2)

| Video Mode | Pixel Resolution | Color Depth (bpp) | Mode Type | Display Adapter | Font Size | Character Resolution | Dot Clock (MHz) | Horiz. Freq. (KHz) | Vert Freq (Hz) | Video Memory (KBytes) |
|---|---|---|---|---|---|---|---|---|---|---|
| 07h | 720 x 350 | Mono | Text | MDA | 9 x 14 | 80 x 25 | 28 | 31.5 | 70 | 256 |
| | 720 x 350 | Mono | | EGA | 9 x 14 | 80 x 25 | 28 | 31.5 | 70 | 256 |
| | 720 x 400 | Mono | | VGA | 9 x 16 | 80 x 25 | 28 | 31.5 | 70 | 256 |
| 08h-0Ch | Reserved | | | - | | - | | | | |
| 0Dh | 320 x 200 | 16 (4 bpp) | Graph | E/VGA | 8 x 8 | 40 x 25 | 25 | 31.5 | 70 | 256 |
| 0Eh | 640 x 200 | 16 (4 bpp) | Graph | E/VGA | 8 x 8 | 80 x 25 | 25 | 31.5 | 70 | 256 |
| 0Fh | 640 x 350 | Mono | Graph | E/VGA | 8 x 14 | 80 x 25 | 25 | 31.5 | 70 | 256 |
| 10h | 640 x 350 | 16 (4 bpp) | Graph | E/VGA | 8 x 14 | 80 x 25 | 25 | 31.5 | 70 | 256 |
| 11h | 640 x 480 | 2 (4 bpp) | Graph | VGA | 8 x 16 | 80 x 30 | 25 | 31.5 | 60 | 256 |
| 12h | 640 x 480 | 16 (4 bpp) | Graph | VGA | 8 x 16 | 80 x 30 | 25 | 31.5 | 60 | 256 |
| 13h | 320 x 200 | 256 (8 bpp) | Graph | VGA | 8 x 8 | 40 x 25 | 25 | 31.5 | 70 | 256 |

The following table lists the supported VGA display modes. The actual availability of any particular mode depends on the capabilities of the display device, the amount of memory installed, and other system parameters.

### Table 28. VESA Modes Supported by Video BIOS (Sheet 1 of 3)

| Video Mode | Pixel Resolution | Colors (bpp) | Mode Type | Display Adapter | Vertical Frequency (Hz) | Video Memory (Mbytes) |
|---|---|---|---|---|---|---|
| 101h | 640 x 480 | 256 (8 bpp) | Graph | VGA | 60 | 0.5 |
| | 640 x 480 | 256 (8 bpp) | Graph | VGA | 75 | 0.5 |
| | 640 x 480 | 256 (8 bpp) | Graph | VGA | 85 | 0.5 |
| 103h | 800 x 600 | 256 (8 bpp) | Graph | SVGA | 60 | 1 |
| | 800 x 600 | 256 (8 bpp) | Graph | SVGA | 75 | 1 |
| | 800 x 600 | 256 (8 bpp) | Graph | SVGA | 85 | 1 |
| 105h | 1024 x 768 | 256 (8 bpp) | Graph | XVGA | 60 | 1 |
| | 1024 x 768 | 256 (8 bpp) | Graph | XVGA | 75 | 1 |
| | 1024 x 768 | 256 (8 bpp) | Graph | XVGA | 85 | 1 |

## Table 28. VESA Modes Supported by Video BIOS (Sheet 2 of 3)

| Video Mode | Pixel Resolution | Colors (bpp) | Mode Type | Display Adapter | Vertical Frequency (Hz) | Video Memory (Mbytes) |
|---|---|---|---|---|---|---|
| 107h | 1280 x 1024 | 256 (8 bpp) | Graph | SXGA | 60 | 2 |
| | 1280 x 1024 | 256 (8 bpp) | Graph | SXGA | 75 | 2 |
| | 1280 x 1024 | 256 (8 bpp) | Graph | SXGA | 85 | 2 |
| 111h | 640 x 480 | 64K (16 bpp) | Graph | VGA | 60 | 1 |
| | 640 x 480 | 64K (16 bpp) | Graph | VGA | 75 | 1 |
| | 640 x 480 | 64K (16 bpp) | Graph | VGA | 85 | 1 |
| 114h | 800 x 600 | 64K (16 bpp) | Graph | SVGA | 60 | 2 |
| | 800 x 600 | 64K (16 bpp) | Graph | SVGA | 75 | 2 |
| | 800 x 600 | 64K (16 bpp) | Graph | SVGA | 85 | 2 |
| 117h | 1024 x 768 | 64K (16 bpp) | Graph | XVGA | 60 | 2 |
| | 1024 x 768 | 64K (16 bpp) | Graph | XVGA | 75 | 2 |
| | 1024 x 768 | 64K (16 bpp) | Graph | XVGA | 85 | 2 |
| 11Ah | 1280 x 1024 | 64K (16 bpp) | Graph | SXGA | 60 | 4 |
| | 1280 x 1024 | 64K (16 bpp) | Graph | SXGA | 75 | 4 |
| | 1280 x 1024 | 64K (16 bpp) | Graph | SXGA | 85 | 4 |
| 112 | 640 x 480 | 16M (32 bpp) | Graph | VGA | 60 | 2 |
| | 640 x 480 | 16M (32 bpp) | Graph | VGA | 75 | 2 |
| | 640 x 480 | 16M (32 bpp) | Graph | VGA | 85 | 2 |
| 115 | 800 x 600 | 16M (32 bpp) | Graph | SVGA | 60 | 4 |
| | 800 x 600 | 16M (32 bpp) | Graph | SVGA | 75 | 4 |
| | 800 x 600 | 16M (32 bpp) | Graph | SVGA | 85 | 4 |

**Table 28. VESA Modes Supported by Video BIOS (Sheet 3 of 3)**

| Video Mode | Pixel Resolution | Colors (bpp) | Mode Type | Display Adapter | Vertical Frequency (Hz) | Video Memory (Mbytes) |
|---|---|---|---|---|---|---|
| 118 | 1024 x 768 | 16M (32 bpp) | Graph | XVGA | 60 | 4 |
| | 1024 x 768 | 16M (32 bpp) | Graph | XVGA | 75 | 4 |
| | 1024 x 768 | 16M (32 bpp) | Graph | XVGA | 85 | 4 |
| 11B | 1280 x 1024 | 16M (32 bpp) | Graph | SXGA | 60 | 8 |
| | 1280 x 1024 | 16M (32 bpp) | Graph | SXGA | 75 | 8 |
| | 1280 x 1024 | 16M (32 bpp) | Graph | SXGA | 85 | 8 |

# 5.0 Configuring and Installing Microsoft Windows Drivers

## 5.1 Editing the Microsoft Windows INF File

This section describes the driver-level information (`iegd.inf`) for the Microsoft Windows* operating system, which includes the following[1]:

- Microsoft Windows Embedded Standard 2009*
- Microsoft Windows XP* SP3
- Microsoft Windows XP Professional* SP3
- Microsoft Windows XP Embedded* SP3
- Microsoft WEPOS* SP3
- Microsoft Windows Vista*

*Note:* For IEGD to function properly under the Microsoft Vista* OS, it will automatically run in XDDM mode once installed.

*Note:* Configuration and Installation information for the Microsoft Windows CE operating system is described in Chapter 6.0, “Configuring and Building IEGD for Microsoft Windows CE* Systems”.

### 5.1.1 Universal INF Configuration

One INF file can specify multiple display configurations. A ConfigId parameter uniquely identifies each configuration.

The driver reads the PanelId from the System BIOS during initialization and uses the configuration whose ConfigId matches the PanelId. If the System BIOS does not set a valid PanelId (for example, panelId = 0), the driver reads a configuration using ConfigId = 1. (A ConfigId value of 0 is invalid.)

*Note:* When setting up a multiple display configuration to be used with the PanelID, do not set a default configuration. To have no default configuration, select **None** from the Default Configuration drop-down menu on the IEGD Package Page. See Section 3.6, “Creating a New Package” on page 58 for details.

You can override the default behavior by specifying a ConfigId parameter as follows:

```
HKR,, ConfigId, %REG_DWORD%, %DEFAULT_CONFIG_ID%
```

In this case, the driver ignores the PanelId returned by the System BIOS. Instead, IEGD uses the configuration information using the specified ConfigId.

1. These versions of the drivers are not WHQL (Windows Hardware Quality Labs) certified.

### 5.1.2 INF File Backward Compatibility

The current version of IEGD uses the new INF file format. You cannot use the new INF file with pre-5.0 versions of IEGD. However, you can still use pre-5.0 INF file formats with the current version of IEGD.

#### 5.1.2.1 INF File Backward Compatibility with IEGD Version 4.0

IEGD version 4.0 provides backward compatibility with pre-4.0 versions of the INF file. This support is implemented through the PcfVersion key in the INF file, shown below:

```
HKR,, PcfVersion,     %REG_DWORD%, 0x0400
```

IEGD uses this key to determine which version of the .inf file it is interpreting. When this key is present in the .inf file and its value is 0x0400, the driver reads it as a 4.0 .inf file. If this key is omitted from the .inf file or if its value is less than 0x0400, the driver reads the .inf file as a pre-4.0 file.

Note the following rules:

- If you use a pre-4.0 version of the .inf file with version 4.0 of IEGD, the driver translates pre-4.0 configuration parameters to 4.0 parameters.
- You cannot use 4.0 parameters in a pre-4.0 .inf file. If you try, the driver ignores them.
- You cannot use pre-4.0 parameters in a 4.0 .inf file. If you try, the driver ignores them.

For example, the usestdtimings parameter is a pre-4.0 parameter. If it is specified in a 4.0 INF file, the driver ignores it. Similarly, if you attempt to add the edid_avail and edid_non_avail parameters to a pre-4.0 .inf file (that is, an .inf file where the PcfVersion key is not present), they are ignored by the driver.

The PcfVersion key is generated automatically by the CED utility and is placed in the [iegd_SoftwareDeviceSettings] section of the .inf file. The default iegd.inf file already contains the PcfVersion key. Please see Appendix A, “Example INF File” to view a sample .inf file.

### 5.1.3 Dual Panel Configuration

Below are the settings required to set the INF file to enable extended display configurations. Typically, these settings are output from the CED utility. However, the INF file may also be edited directly. See Table 29 for a description of these settings.

```
HKR, Config\%DEFAULT_CONFIG_ID%\General, DisplayConfig, %REG_DWORD%, 8
HKR, Config\%DEFAULT_CONFIG_ID%\General, PortOrder, %REG_SZ%, "52000"
```

### 5.1.4 Chipset Dual Display Example

The table below presents the dual display example for an Intel chipset.

**Table 29. Example of Chipset Dual Display Parameter Setting**

| Dual Display Combination | Port Order |
|---|---|
| CRT + Internal LVDS | “54000” |
| CRT + sDVOB | “52000” |
| CRT + sDVOC | “53000” |
| Internal LVDS + CRT | “45000” |
| Internal LVDS + sDVOB | “42000” |
| Internal LVDS + sDVOC | “43000” |
| sDVOB + CRT | “25000” |
| sDVOB + Internal LVDS | “24000” |
| sDVOB + sDVOC | “23000” |
| sDVOC + CRT | “35000” |
| sDVOC + Internal LVDS | “34000” |
| sDVOC + sDVOB | “32000” |

### 5.1.5 Creating Registry Settings for Graphics Driver INF File

Use CED to configure the driver settings. It generates the following output, which is then inserted into the graphics driver INF file before driver installation. CED simply translates the configuration options to the INF file. See Table 24, “Parameter Configuration Format” on page 71 for details on the specific settings and values, which also apply to the settings and values of the INF file. The values of the INF file may also be directly modified. See the example below for syntax and usage. Also, see Appendix A, “Example INF File” for a complete sample INF file.

```
HKR,, PcfVersion,    %REG_DWORD%, 0x0700

HKR,, No_D3D, %REG_DWORD%, 0
HKR,, PortDrivers, %REG_SZ%, “lvds”

;-------------------------------------------------------------------------------
[iegd_SoftwareDeviceSettings_nap]
HKR,, InstalledDisplayDrivers, %REG_MULTI_SZ%, iegddis
HKR,, MultiFunctionSupported, %REG_MULTI_SZ%, 1
HKR,, VgaCompatible, %REG_DWORD%, 0
HKR,, PcfVersion,    %REG_DWORD%, 0x0700

HKR,, No_D3D, %REG_DWORD%, 0

HKR,, PortDrivers, %REG_SZ%, “analog sdvo lvds tv”

;-------------------------------------------------------------------------------
[iegd_SoftwareDeviceSettings_gn4]
HKR,, InstalledDisplayDrivers, %REG_MULTI_SZ%, iegddis
HKR,, MultiFunctionSupported, %REG_MULTI_SZ%, 1
HKR,, VgaCompatible, %REG_DWORD%, 0
HKR,, PcfVersion,    %REG_DWORD%, 0x0700

HKR,, No_D3D, %REG_DWORD%, 0

HKR,, PortDrivers, %REG_SZ%, “analog sdvo lvds hdmi”
;-------------------------------------------------------------------------------
```

```
[iegd_SoftwareDeviceSettings_plb]
HKR,, InstalledDisplayDrivers, %REG_MULTI_SZ%, iegddis
HKR,, MultiFunctionSupported, %REG_MULTI_SZ%, 1
HKR,, VgaCompatible, %REG_DWORD%, 0
HKR,, PcfVersion,    %REG_DWORD%, 0x0700

HKR,, No_D3D, %REG_DWORD%, 0

HKR,, PortDrivers, %REG_SZ%, "sdvo lvds"

HKR, All\1\General, DxvaOptions, %REG_DWORD%, 1
;=============================================================================
[Strings]

;-----------------------------------------------------------------------
; Localizable Strings
;-----------------------------------------------------------------------
Intel=”Intel Corporation”
DiskDesc=”Embedded Installation”

i915GD0=”915G/915GV/910GL Embedded Graphics Controller Function 0”
i915GD1=”915G/915GV/910GL Embedded Graphics Controller Function 1”
i915AL0=”915GM/915GMS/910GML Embedded Graphics Controller Function 0”
i915AL1=”915GM/915GMS/910GML Embedded Graphics Controller Function 1”
i945LP0=”945G Embedded Graphics Controller Function 0”
i945LP1=”945G Embedded Graphics Controller Function 1”
i945CT0=”945GM Embedded Graphics Controller Function 0”
i945CT1=”945GM Embedded Graphics Controller Function 1”

i965BW0=”965G Embedded Graphics Controller Function 0”
i965BW1=”965G Embedded Graphics Controller Function 1”
iG9650=”G965 Embedded Graphics Controller Function 0”
iG9651=”G965 Embedded Graphics Controller Function 1”
iQ9650=”Q963/Q965 Embedded Graphics Controller Function 0”
iQ9651=”Q963/Q965 Embedded Graphics Controller Function 1”
i946GZ0=”946GZ Embedded Graphics Controller Function 0”
i946GZ1=”946GZ Embedded Graphics Controller Function 1”
i965GM0=”GM965 Embedded Graphics Controller Function 0”
i965GM1=”GM965 Embedded Graphics Controller Function 1”
i965GME0="GLE960/GME965 Embedded Graphics Chipset Function 0"
i965GME1="GLE960/GME965 Embedded Graphics Chipset Function 1"
iGM450="GM45/GS45/GL40 Embedded Graphics Chipset Function 0"
iGM451="GM45/GS45/GL40 Embedded Graphics Chipset Function 1"
iG450="G45 Embedded Graphics Chipset Function 0"
iG451="G45 Embedded Graphics Chipset Function 1"
iG410="G41 Embedded Graphics Chipset Function 0"
iG411="G41 Embedded Graphics Chipset Function 1"
iELK0="Q45 Embedded Graphics Chipset Function 0"
iELK1="Q45 Embedded Graphics Chipset Function 1"
iQ450="Q45 Embedded Graphics Chipset Function 0"
iQ451="Q45 Embedded Graphics Chipset Function 1"
i900G0="US15 Embedded Graphics Chipset Function 0"
i945WB0="945GME/945GSE Embedded Graphics Chipset Function 0"
i35BL0="Q35 Embedded Graphics Chipset Function 0"
i35BL1="Q35 Embedded Graphics Chipset Function 1"
i35BL0A2="Q35 Embedded Graphics Chipset Function 0"
i35BL1A2="Q35 Embedded Graphics Chipset Function 1"
;-----------------------------------------------------------------------
; Non Localizable Strings
;-----------------------------------------------------------------------
SERVICE_BOOT_START     = 0x0
SERVICE_SYSTEM_START   = 0x1
SERVICE_AUTO_START     = 0x2
SERVICE_DEMAND_START   = 0x3
SERVICE_DISABLED       = 0x4
```

```
SERVICE_KERNEL_DRIVER  = 0x1

SERVICE_ERROR_IGNORE   = 0x0; Continue on driver load fail
SERVICE_ERROR_NORMAL   = 0x1; Display warn, but continue
SERVICE_ERROR_SEVERE   = 0x2; Attempt LastKnownGood
SERVICE_ERROR_CRITICAL = 0x3; Attempt LastKnownGood, BugCheck

REG_EXPAND_SZ = 0x00020000
REG_MULTI_SZ  = 0x00010000
REG_DWORD     = 0x00010001
REG_SZ        = 0x00000000
```

### 5.1.6 Dynamic Port Driver Configuration

IEGD supports many third-party digital transmitters connected to the sDVO ports of the GMCH though device drivers called port drivers. These port drivers are dynamically loaded at startup. The driver configuration can be modified to add or remove availability of specific port drivers.

This section describes the portions of the `iegd.inf` file that can be modified to either add or remove a port driver for the Microsoft Windows version of the Intel® Embedded Graphics Drivers.

#### 5.1.6.1 iegd.PortDrvs_xxx

The first step in either adding or removing a port driver is to identify the family of the chipset you are using. 915 and 945 are Napa (nap), and 965 is Gen 4 (gn4). Next locate the appropriate [iegd.PortDrvs_xxx] section for your graphics family. Below are the default settings for the blocks of associated port drivers for a particular graphics chipset family:

```
[iegd.PortDrvs_nap]
sdvo.sys
lvds.sys
tv.sys
analog.sys

[iegd.PortDrvs_gn4]
sdvo.sys
lvds.sys
analog.sys
hdmi.sys

[iegd.PortDrvs_plb]
sdvo.sys
lvds.sys
```

To remove one or more port drivers, delete the associated line from the `iegd.PortDrvs_xxx` block. To add a port driver, add the associated line into the appropriate `iegd.PortDrvs_xxx` block. For example, to add a new port driver for a device named “NewPD”, add the following line to the `iegd.PortDrvs_alm` block:

```
NewPD.sys
```

### 5.1.6.2 SourceDisksFiles

To either add or remove a port driver, identify the specific port driver file names in the SourceDisksFiles blocks. The default settings are as follows:

```
[SourceDisksFiles]
iegdmini.sys   = 1
iegddis.dll    = 1
iegd3dg3.dll   = 1
iegd3dg4.dll   = 1
lvds.sys       = 1
sdvo.sys       = 1
tv.sys         = 1
hdmi.sys       = 1
sdvo.vp        = 1
hdmi.vp        = 1
analog.vp      = 1
lvds.vp        = 1
tv.vp          = 1
iegdckey.vp    = 1
iegdmsys.vp    = 1
iegdcagt.cpa   = 1
iegdcagt.vp    = 1
iegd3dga.dll   = 1
iegdglga.dll   = 1
libGLES_CM.dll = 1
libGLESv2.dll  = 1
analog.sys     = 1
```

To remove a port driver, delete the associated line in the [SourceDisksFiles] block. To add a port driver, add the associated line to the block. For example, to add a port driver for a device whose driver is named NewPD.sys, add the following line:

```
NewPD.sys  = 1
```

### 5.1.6.3 PortDrivers Registry Key

Modify the registry key in the appropriate [iegd_SoftwareDeviceSettings_xxx] section that defines the list of available port drivers. Below are the default values of this registry key in the iegd.inf file:

For the [iegd_SoftwareDeviceSettings_nap] block:
```
HKR,, PortDrivers, %REG_SZ%, “sdvo lvds tv”
```

For the [iegd_SoftwareDeviceSettings_gn4] block:
```
HKR,, PortDrivers, %REG_SZ%, “sdvo lvds”
```

Remove or add port driver names as appropriate to the list of port drivers specified within the quoted string. For example, to add support for a new port driver named “NewPD”, the registry key would be defined as follows:

```
HKR,, PortDrivers, %REG_SZ%, "lvds NewPD"
```

### 5.1.7 Creating an .sld file for Microsoft Windows XP Embedded Systems

Microsoft Windows XP Embedded* operating systems require the use of an `.sld` (system level definitions) file. The following steps detail how to create such a file for IEGD from your custom `iegd.inf` file that you created using CED.

1. Run Component Designer.
2. In the **File** menu, select **Import**.
3. In the **Choose File for Import** dialog, select **Setup Information files (*.inf)**. in the **File of type** drop-down list.
4. Select **iegd.inf** from installation directory.
5. In the **Inf Processing Options** dialog, select **Automatic** in the **Parsing Options** dialog and click **OK**.
6. Click **Start** in the **Import File** dialog box. Close the dialog on completion. There should not be any errors.
7. If there are no errors, **Save** the `.sld` file.
8. Run Component Database Manager and import the `.sld` file created above.

*Note:* Multiple versions will be created.

9. To move the binaries, copy the IEGD/driver files into the root repository: `\Windows Embedded Data\Repository`
10. In Target Designer, all IEGD files are found under `Hardware\Devices\Display Adapters` and can be selected by dragging and dropping into your build.

### 5.1.8 Changing Default Display Mode

After installing the Intel® Embedded Graphics Drivers, Microsoft Windows selects a default display mode for the initial startup of the system. This is an 800 x 600 resolution in 8-bit, 16-bit, or even 32-bit color mode.

The display modes are set through CED; however if you want to change the settings using the registry keys, you may add the following lines to the `[iegd_SoftwareDeviceSettings]`section of the `iegd.inf` file:

```
HKR,, DefaultSettings.XResolution, %REG_DWORD%, 1024

HKR,, DefaultSettings.YResolution, %REG_DWORD%, 768

HKR,, DefaultSettings.BitsPerPel,  %REG_DWORD%, 32

HKR,, DefaultSettings.VRefresh,    %REG_DWORD%, 60
```

The example above makes the default resolution 1024 x 768, with a 32-bit color depth and a refresh rate of 60 MHz.

## 5.2 Installing IEGD on Microsoft Windows

You can install and uninstall IEGD on a Microsoft Windows system by using the `setup.exe` program located in the `Windows\Utilities` folder. The following procedure shows how to install IEGD. Section 5.3, “Uninstalling the Current Version of the Driver” on page 112 provides instructions for uninstalling the current version of IEGD.

### 5.2.1 Silent Installation

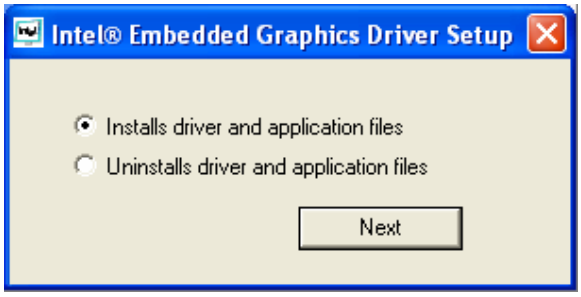
IEGD supports silent installation through an option in `setup.exe`. With command line installation, and the parameter "/s" (case insensitive), for example **setup.exe /s** at the command prompt. When this option is used, the installation does not display any messages or splash screen except the warning messages about IEGD not being WHQL compliant. After the silent installation, a message box prompts the user to reboot the system.

*Note:* To disable the Windows WHQL compliance warning messages, use the Windows **System Properties** -> **Hardware** -> **Driver Signing** -> **Ignore** option.

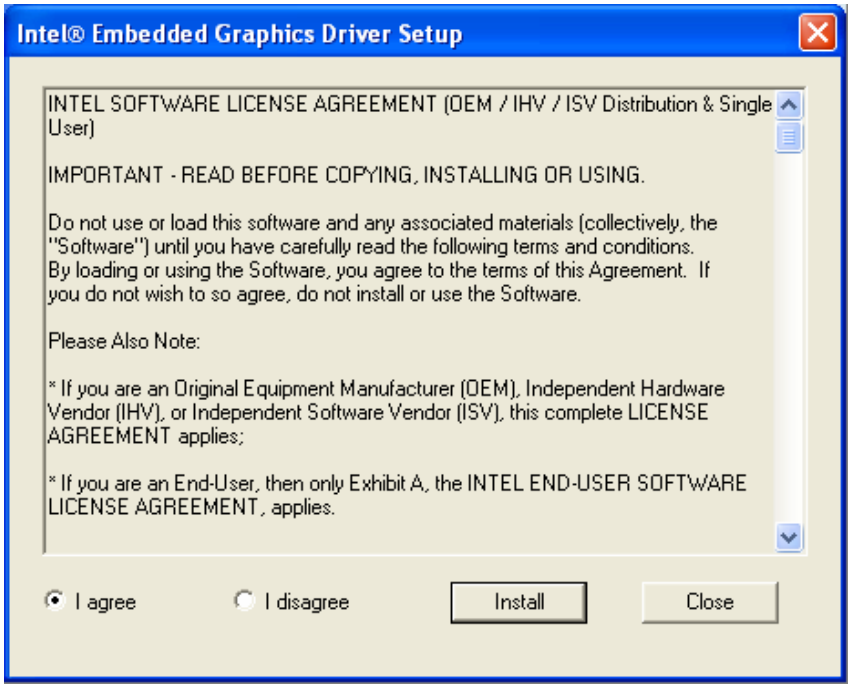
To allow automatic reboot without the reboot dialog box stopping the installation, use the option "/nr" following the `setup.exe` command, for example, **setup.exe /nr**. The end user will be responsible to do their own reboot.

***Warning:*** If you have a previous version of IEGD installed on your system, you must remove it using the uninstall driver (see Section 5.3 for instructions.). Do not use the current version of the IEGD Install program to uninstall previous versions of the driver. If you do, unpredictable results may occur. You can use this program only to uninstall the driver from the current version. Each version of the driver has its own version of the installer/uninstaller utility.

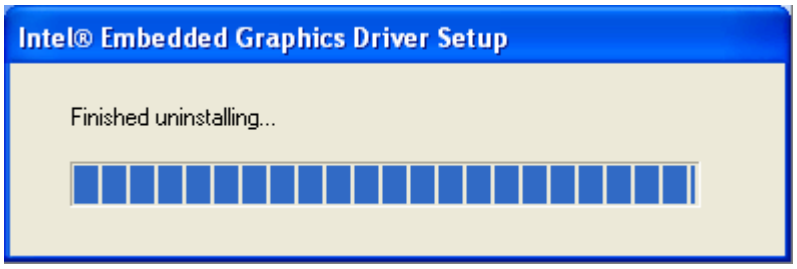
1. Double-click the `setup.exe` icon in the `Utilities` folder. The following dialog box appears.




2. To install the driver, make sure that **Installs driver and application files** is selected, and then click **Next**. The accept license screen appears.

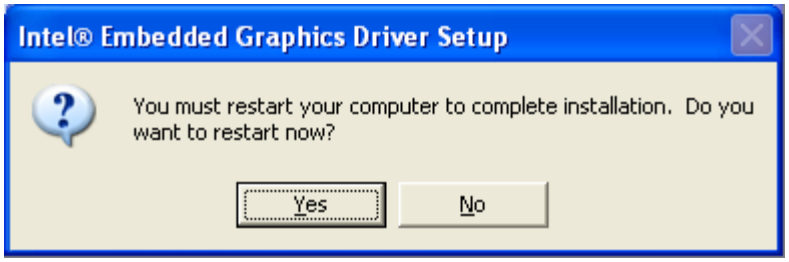



3. Click **I agree**, and then click **Install**. The installation begins and shows a progress bar as follows:




*Note:* If you get an "unsigned driver" warning, disregard and click **Continue** to allow the installation to continue.

4. After the driver and application files have been copied, the system must be restarted to complete the installation. If you want the installation program to restart your computer, click **Yes**.



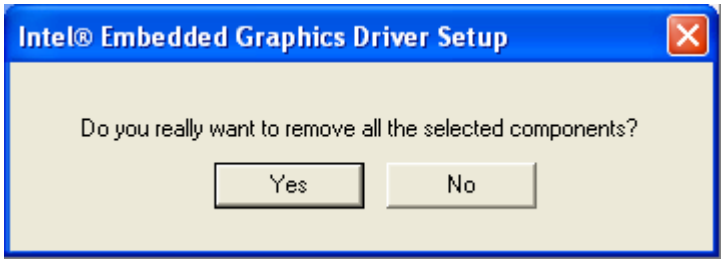
## 5.3 Uninstalling the Current Version of the Driver

You can use the `setup.exe` Microsoft Windows GUI program to remove the driver from your system. When you run the uninstaller program, it removes the following items from the system:

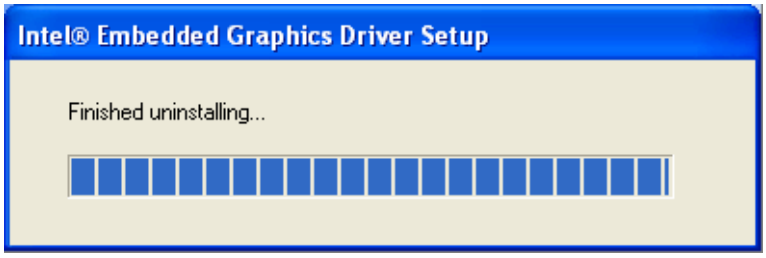
- IEGD files
- The `.inf` and `.pnf` files from the `windows\system32\inf` folder.
- The `DisplayPage.dll` and `qt-mt332.dll` from the `windows\system32` folder
- Data registry items by running `regsvr32.exe` with the uninstall option.

***Warning:*** If you have a previous version of IEGD installed on your system, you must remove it. Do not use the current version of the IEGD Install program to uninstall previous versions of the driver. If you do, unpredictable results may occur. You can use this program only to uninstall the driver from the current version. Each version of the driver has its own version of the installer/uninstaller utility.

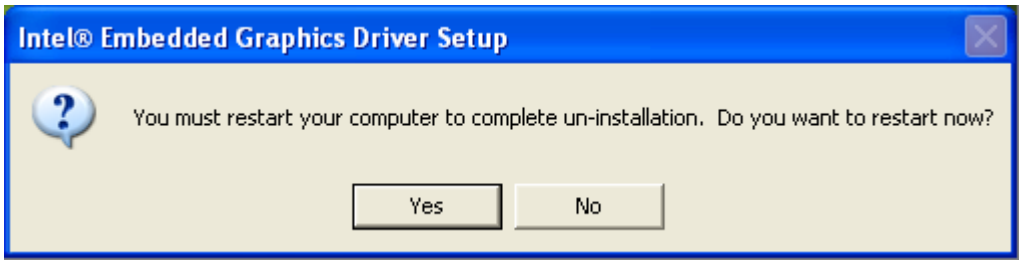
1. Click the `setup.exe` icon located in the `Utilities` subfolder of the `Windows` folder.
2. In the dialog box, select **Uninstalls driver and application files**, and then click **Next**. The following prompt appears:




3. Click **Yes** to remove the driver. A progress bar displays and when the driver has been removed, the following screen appears.




4. To complete the uninstallation, you must restart your system. If you want to restart your system now, click **Yes** in the following dialog box.



## 5.4 Run-Time Operation

Resolution, refresh rate, and color bit depth can be changed after installation and reboot via a Microsoft Windows display property sheet. On Microsoft Windows XP, extended desktop can be enabled and disabled, along with swapping primary and secondary displays. Other operations such as enabling and disabling ports (display output), rotation, port configuration, and attribute control are accessible via the standard display driver escape protocol.

## 5.5 Viewing and Changing the Driver Configuration from Microsoft Windows

*Note:* IEGDGUI requires that the MS Sans Serif(8) font is installed in the system font folder for correct display.

You can change certain configuration attributes of IEGD using the `iegdgui.exe` program located in the `\Utilities` folder. On Microsoft Windows XP systems, you can access IEGD configuration on the display properties setting tab. This program launches the IEGD Configuration GUI that consists of the following four tabs:

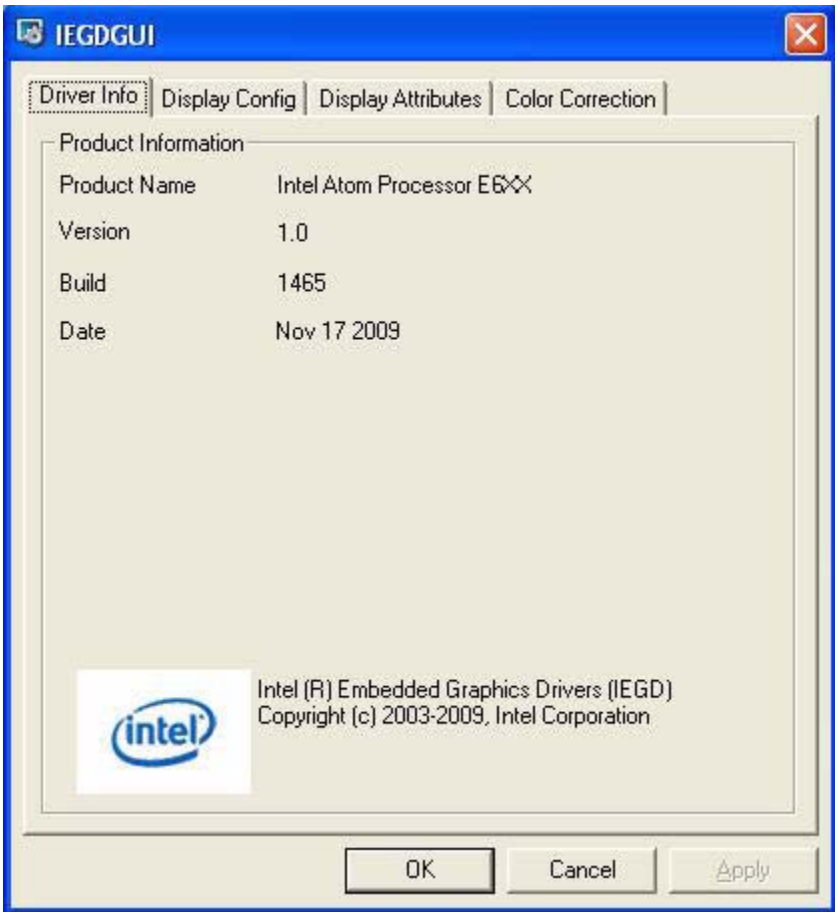
- **Driver Info** — Contains the driver information.
- **Display Config** — Contains current display information and allows configuration of display configurations, display resolutions and bit depth for primary and secondary displays, flip, rotation, and enabling/disabling for a given port.
- **Display Attributes** — Contains the supported Port Driver (PD) attributes and allows configuration of PD attributes.
- **Color Correction** — Contains color-correction information for the framebuffer and overlay. Using this tab, you can change the framebuffer and overlay color settings.

To view or change the driver settings using the GUI interface, follow this procedure.

1. Double-click the `iegdgui.exe` icon in the `Utilities` folder. On Microsoft Windows XP systems, you can select **Display** from the control panel or right-click from the desktop and select **Properties** - **Settings** - **Advanced** - **Driver info** to show information about the driver.

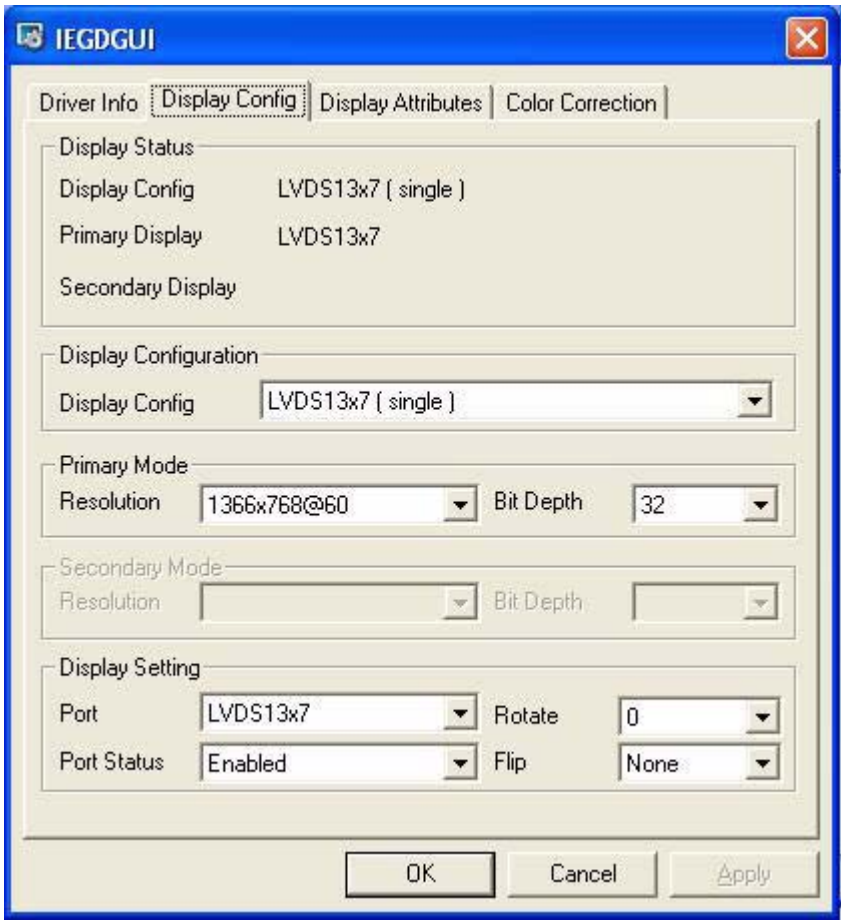
   To change display configuration, mode, and display setting, select **Display Config**.

**Figure 28. Example Runtime Configuration GUI — Driver Info Tab**



2. Click the **Display Config** tab to show the current configuration.

**Figure 29. Example Runtime Configuration GUI — Display Config Tab**



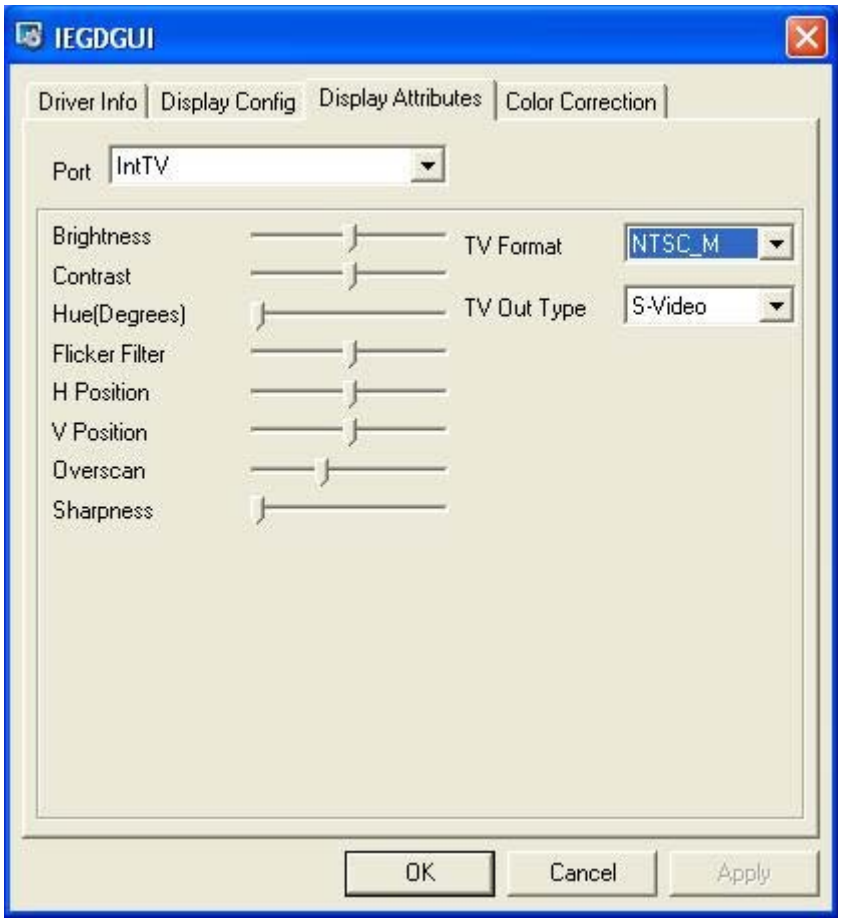

The **Display Status** section of the above dialog shows the current configuration for the **Primary** and **Secondary** displays.

3. In the **Display Configuration** section of the dialog, select the required display configuration in the **Display Config** drop-down list. This allows the user to choose between Single, Twin, Clone and Extended for all connected ports. A maximum of two ports per display configuration is currently allowed.
4. In the **Primary Mode** and **Secondary Mode** sections of the dialog, change resolution and bit depth of the primary and secondary displays via the **Resolution** and **Bit Depth** drop-down lists.
5. In the **Display Settings** section of the dialog, view and change the settings for a port, rotate and flip the display via the appropriate drop-down lists:
   - **Port**: Allows you to select the required port.
   - **Port Status**: Allows you to enable or disable the selected port.
   - **Rotate**: You can rotate the display 0, 90, 180, and 270 degrees.
   - **Flip**: Inverts the display horizontally.

*Note:* If you change any configuration settings in the **Display Config** dialog box, click **Apply** for the changes to take effect.

6. Click the **Display Attributes** tab to view and change the attributes for a port. The screen that appears depends upon the port drivers used.

**Figure 30. Example Runtime Configuration GUI — Display Attributes Tab**




The figure above shows the attributes that can be changed for the selected port in the **Port** drop-down list. You can change the Port Driver by selecting the appropriate one for your device. The attributes that appear on this tab depend upon the selected port driver. Please see Appendix B, "Port Driver Attributes," for a complete list of port driver attributes.

7. Click the **Color Correction** tab to view and change color corrections. Figure 31 shows a sample Color Correction tab screen.

   Color Correction is available for both overlays and framebuffers.

**Figure 31. Example Runtime Configuration GUI — Color Correction Tab**

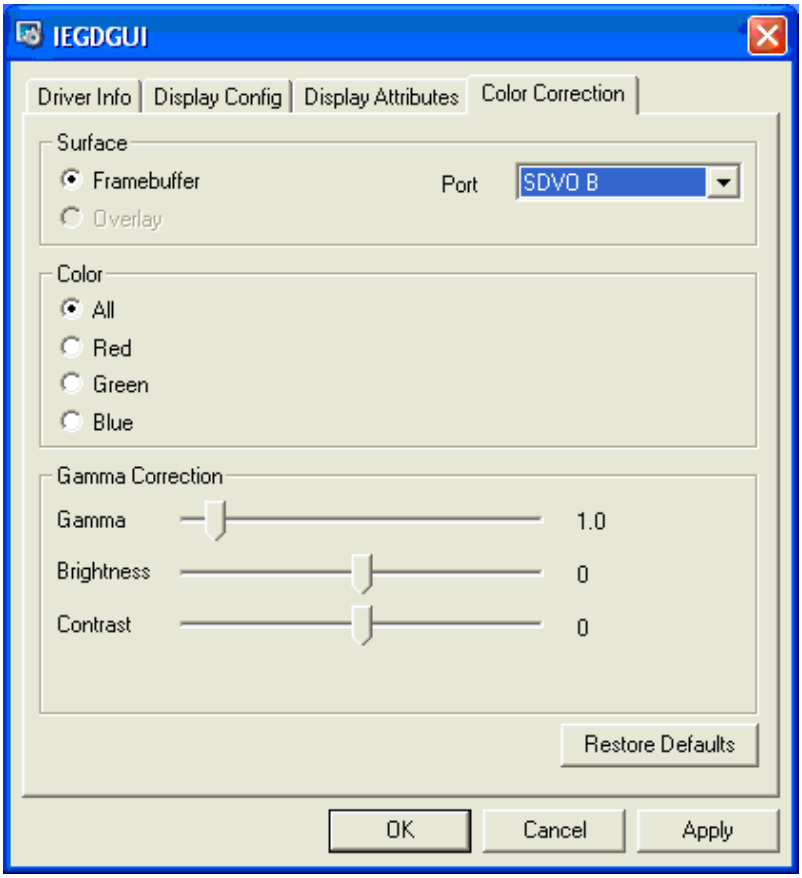



**Table 30. Framebuffer Color Correction Values (applies to R, G, B color)**

| | |
|---|---|
| Gamma: | 0.6 to 6.0 (default value is 1) |
| Brightness: | -127 to 127 (default value is 0) |
| Contrast: | -127 to 127 (default value is 0) |

**Table 31. Overlay Color Correction Values (applies to ALL color)**

| | |
|---|---|
| Gamma: | 0.6 to 6.0 (default value is 1) |
| Brightness: | 0 to 200 (default value is 100) |
| Contrast: | 0 to 200 (default value is 100) |
| Saturation: | 0 to 200 (default value is 100) |

The following sub-steps present an example color-correction procedure:

a. Select **Framebuffer** in the **Surface** section and select the appropriate port for the color correction to be applied to or select **Overlay** in the Surface section for color correction to be applied to the overlay.

b. Select the required color to be corrected in the **Color** section.

c. Select the required color attribute to be corrected in the **Gamma Correction** section.

d. Click **Restore Defaults** to restore the default values.

*Note:* If you make any changes to the color-correction settings, click **Apply** to have the changes take effect.

*Note:* The hardware does not support brightness, saturation, and contrast of the overlay and second overlay with RGB pixel format.

# 6.0 Configuring and Building IEGD for Microsoft Windows CE* Systems

## 6.1 Overview

This  describes the driver-level information for Microsoft Windows CE* operating systems.

The Microsoft Windows CE drivers are configured and built from the options provided on the General Settings Page (see "Creating a New Configuration" on page 38) and the . After you configure IEGD for a Microsoft Windows CE system, package IEGD and generate an installation. The CED produces an `iegd.reg` (see "Sample iegd.reg File" on page 137) file and a `IEGD_10_4_WINCEXX.zip` file, where XX is either `6_0` or `7_0` (see Section 2.2.2, "OS and API Support" on page 27 for limitations) that you use to build an image for a Microsoft Windows CE system using the Microsoft Windows CE Platform Builder.

To build an IEGD image for a Microsoft Windows CE system, the following are the general steps. For specific instructions for the particular version of Windows CE that you are using, either 7.0 - WEC7 or 6.0 R2, refer to the appropriate section.

1. Enter IEGD configuration settings using the CED. (Please see "Creating a Configuration in CED – Summary Steps" on page 32 and "Creating a New Package" on page 58.)
2. Package the configuration. (See "Creating a New Package" on page 58.)
3. Generate an installation using the `Generate Installation` option on the CED main window (see "Generating an Installation" on page 66). This produces an `iegd.reg` file and an `IEGD_6_0_WINCEXX.zip` file. The `iegd.reg` file contains registry entries and the `IEGD_10_4_WINCEXX.zip` file contains required driver files.
4. Integrate the `iegd.reg` file with the Microsoft Windows CE Platform Builder. Please see "Integrating IEGD with Microsoft Windows CE* Platform Builder" on page 120.

## 6.2 Microsoft Windows CE* Installation

### 6.2.1 Prerequisites

The development system should have the following software installed:

- Microsoft Windows XP* Professional, SP3
- Platform Builder for Microsoft Windows CE* 6.0 (with latest R2 service packs installed)

The target system must contain one of the following Intel chipsets:

- Intel® Atom™ Processor 400 and 500 Series
- Intel® Q45/G41/G45 Express chipset
- Intel® GM45/GL40/GS45 Express chipset
- Intel® System Controller Hub US15W/US15WP/WPT chipset
- Intel® Q35 Express chipset
- Mobile Intel® GLE960/GME965 Express chipset
- Intel® Q965 Express chipset
- Mobile Intel® 945GSE Express chipset
- Mobile Intel® 945GME Express chipset
- Intel® 945G Express chipset
- Intel® 915GV Express chipset
- Mobile Intel® 915GME Express chipset
- Mobile Intel® 910GMLE Express chipset

The target system must contain a minimum of 64 Mbytes of RAM.

### 6.2.2 Integrating IEGD with Microsoft Windows CE* Platform Builder

The integration/installation of the driver binaries depends upon the requirements of the target device; while `ddi_iegd.dll` is required, port drivers may be optionally included.

Windows CE* 6.0 does not employ the catalog file present with 5.0. Windows CE 6.0 R2 also does not require the previous Windows CE 5.0 import into the Platform Builder's catalog.

In order for the Platform Builder to use IEGD, the `iegd.reg` file included with the release has to be properly included into the BSP. Note that you must specify the correct path to the `iegd.reg` file.

Finally, to include the actual driver binaries into the OS image, you must reference them in the BSP's BIB file by appending the path to ddi_iegd.dll and the port drivers into platform.bib, as shown below.

**Figure 32. Sample FILES Block from `platform.bib` File**

```
FILES
;       Name                            Path                                Memory Type
;       ------------------------        ------------------------            -----------
;       @CESYSGEN ENDIF CE_MODULES_DEVICE
;       @CESYSGEN IF CE_MODULES_DEVICE


        ddi_iegd.dll                    <specify_path_here>\ddi_iegd.dll  NK
```

#### 6.2.2.1 Catalog Feature File

For Windows CE*, IEGD's Catalog Feature File, `iegd.cec`, is provided in the release package. To import IEGD into the workspace's catalog, complete the following steps:

1. From the File menu, select **Manage Catalog Features**.
2. Choose **Import**.
3. In the **Import Catalog Features** dialog box, select the `.cec` file, and then click **Open**.
4. From the **View** menu, select **Catalog** to display the Catalog.

### 6.2.3 Microsoft Windows CE* 6.0 Installation

#### 6.2.3.1 Prerequisites

The development system should have the following software installed:

- Windows CE* 6.0 R2
- Latest Monthly Updates from the Microsoft Web site dated only until June 2009
- Intel® Embedded Graphics Drivers (IEGD) v10.3.1 or later

*Notes:* When using a platform based on the Intel® Atom™ Processor 400 and 500 Series, for proper driver operation you must:

1. Replace the default system BIOS with the IEGD VBIOS 1550.
2. Install the IEGD 10.3.1 release driver version 1550.

Always install the most recent IEGD VBIOS with the matching, most recent IEGD 10.3.1 release driver. Pairing the most recent matching VBIOS and driver ensures systems based on the Intel® Atom™ Processor 400 and 500 Series will wake up from S3 and S4 screen or desktop corruption or visual anomalies.

Using the default GMA VBIOS with the IEGD VBIOS 1550 has caused this corruption on waking up from S3/S4. Failure happens only when an application runs concurrently using PPlane with video playback and with WinACPI on S3/S4.

For further details on this problem, refer to the latest IEGD Specification Update.

#### 6.2.3.2 CED Requirements

1. Follow instructions in sections Section 3.5, “Creating a New Configuration” on page 38.
2. Create a folder on the Platform Builder machine to hold IEGD-specific files.
3. Move your IEGD installation ZIP file the folder created in step 2 and extract the ZIP file contents.

   It is recommended that you extract the files and keep them in one source directory for purposes of this build and then follow instructions in Section 6.2.3.3.

#### 6.2.3.3 Platform Builder Requirements

You must configure your Platform Builder parameters specific to the options that the system and image require, for example, options for the operating system. A Board Support Package (BSP) is also required however, configuration steps for the BSP are beyond the scope of this procedure. An Intel® BSP can be used or the CEPC BSP that is included Platform Builder.

##### 6.2.3.3.1 Platform.reg Changes

1. From the Properties page of Platform Builder for your project, go to the Build Options page and check the box for “Runtime image can be larger than 32MB”.
2. Edit your `Platform.reg` file as shown in the example below. The **bold text** shows the content that needs to be added.

**Example `Platform.reg` snippet:**

```
; @CESYSGEN IF CE_MODULES_DISPLAY
      IF BSP_NODISPLAY !
         [HKEY_LOCAL_MACHINE\System\GDI\DisplayCandidates]
            "Candidate6"="Drivers\\Display\\Intel"
         [$(PCI_BUS_ROOT)\Template\IEGD]
            "DisplayDll"="ddi_iegd.dll"
            "Class"=dword:03
            "SubClass"=dword:00
            "ProgIF"=dword:00
            "VendorID"=multi_sz:"8086", "8086", "8086",
            "8086", "8086", "8086", "8086", "8086", "8086",
            "8086", "8086", "8086", "8086", "8086", "8086",
            "8086", "8086", "8086", "8086", "8086", "8086",
            "8086", "8086", "8086", "8086", "8086", "8086"
            "DeviceID"=multi_sz:"3582", "2572", "2562",
            "357B", "3577", "1132", "7125", "7123", "7121",
            "2582", "2782", "2592", "2792", "2772", "2776",
            "27A2", "27A6", "2982", "2983", "29A2", "29A3",
            "2992", "2993", "2972", "2973", "8108", "2A12"

      #include "C:\<folder location>\iegd.reg"
```

#### 6.2.3.3.2 Platform.bib Changes

1. Edit your Platform.bib file.
2. At the bottom of the `Platform.bib` file add the parameters needed using this format:

```
<iegd file>    c:\<folder location>\<file name>       NK SH
```

The examples below may include some that are not needed or more may need to be added.

```
ddi_iegd.dll    c:\<folder location>\ddi_iegd.dll      NK SHK
analog.dll      c:\<folder location>\analog.dll        NK SHK
iegd3dg3.dll    c:\<folder location>\iegd3dg3.dll      NK SHK
iegd3dg4.dll    c:\<folder location>\iegd3dg4.dll      NK SHK
iegd3dga.dll    c:\<folder location>\iegd3dga.dll      NK SHK
sdvo.dll        c:\<folder location>\sdvo.dll          NK SHK
lvds.dll        c:\<folder location>\lvds.dll          NK SHK
hdmi.dll        c:\<folder location>\hdmi.dll          NK SHK
tv.dll          c:\<folder location>\tv.dll            NK SHK
libGLES_GM.dll c:\<folder location>\libGLES_GM.dll    NK SHK
libGLESV2.dll  c:\<folder location>\libGLESV2.dll     NK SHK
libOpenGL.dll  c:\<folder location>\libOpenGL.dll     NK SHK
isr_iegd.dll    c:\<folder location>\isr_iegd.dll      NK SHK
```

### 6.2.4 Integrating IEGD DirectX DirectShow Codecs for Intel® System Controller Hub US15W

#### 6.2.4.1 IEGD DirectShow Codecs Overview

Microsoft's DirectX DirectShow infrastructure provides a standardized interface for middleware audio-video codec software libraries to expose features for accelerating video and audio processing. This infrastructure does not differentiate between hardware and software acceleration but the middleware codec libraries have the choice of employing either methods. For the purpose of enabling hardware accelerated video decode on Windows CE 6.0, the IEGD Windows CE DirectShow filters are provided in the form of middleware codec libraries (DLLs) that will interface with the IEGD Windows CE driver to operate.

The IEGD DirectShow package includes the following Windows CE 6.0 codecs that are DirectShow transform filters in .dll binary form:

- `mpeg2_dec_filter.dll`
- `mpeg2_spl_filter.dll`
- `mpeg4_dec_filter.dll`
- `mpeg4_spl_filter.dll`
- `h264_dec_filter.dll`
- `aac_dec_filter.dll`
- `ac3_dec_filter.dll`

The codecs with “spl” are splitter codecs. The `aac_dec_filter` and `ac3_dec_filter` are AAC and AC3 audio decoder codecs respectively. The rest are video decode codecs.

*Notes:* IEGD DirectShow codecs are supported only on the Windows CE 6.0 operating system.

IEGD splitter filters can connect with most source filters but have been verified to connect only with IEGD transform filters on its downstream pins. The same case is true with respect to IEGD transform filter connection with upstream splitter filters.

*Important:* IEGD audio and video codec filters work only with IEGD splitter filters. If these codecs are installed properly into the Windows CE OS image (via registry changes), the `CEPlayer.exe` is able to load and use IEGD codecs without any help.

#### 6.2.4.2 Installing IEGD DirectShow Codecs

Prerequisites:

- At least 1GByte RAM for the target system. The hardware video decode performance depends on what other processes are being run on the system.
- The target system must contain chipset US15W that supports the video engine.
- Include IEGD Graphics Driver in the Windows CE 6.0 OS image per the appropriate installation instructions in Section 6.2.2 and Section 6.2.3.

The latest EVALUATION ONLY versions of the IEGD DirectShow codecs are available on the Intel Premier Support site in the IEGD product area (premier.intel.com).

After you have the codec package, follow these steps to set up the IEGD DirectShow codecs:

1. Ensure that the IEGD DirectShow codecs are included in the Windows CE OS image. You do this by including it into either the `platform.bib` or `project.bib` file.
2. Ensure that the `iegd_filters.reg` file is included into the image registry. You do this by including it into either the `platform.reg` or `project.reg` file.
3. Set the backbuffers required for IEGD Codecs on the Microsoft video renderer filter for smoother performance by changing the following registry key:

   [HKEY_LOCAL_MACHINE\Software\Microsoft\DirectX\DirectShow\Video Renderer]

   “MaxBackBuffers”=dword:X

   where X is the current value that you need to change to equal to or greater than 5.
4. For smoother playback and lower CPU utilization, ensure you use interrupts with IEGD if available. See Section 6.2.3.3.2, “Platform.bib Changes” on page 123 for details.

## 6.3 Microsoft Windows CE* Configuration

The following sections describe how to configure IEGD on the Microsoft Windows CE* operating system. All the IEGD-specific registry keys are located within the path `[HKEY_LOCAL_MACHINE\DRIVERS\Display\Intel]`

All keys use one of the following syntax:

"<*keyname*>"=dword:<*value*>,

or

"<*keyname*>" = <*value*>

where <*value*> in the second case is a string in double quotes.

*Note:* Unless specified otherwise, the "value" field is in hex format.

The `iegd.reg` file contains display configuration registry entries for IEGD. A sample `iegd.reg` file is provided along with the driver package. The content of this file may be included through the "#include" directive in `platform.reg` (see Section 6.2.2), or it may be copied into the proper section in `platform.reg`.

### 6.3.1 Basic Driver Configuration

This section discusses basic driver configuration keys located in `[HKEY_LOCAL_MACHINE\Drivers\Display\Intel\ALL\1\General].`

The table below lists the keys in the "`Intel`" folder.

**Table 32. [HKLM\DRIVERS\Display\Intel] Registry Keys**

| Registry Entry | Description | Possible Ranges |
|---|---|---|
| PCFversion | Specifies the version of the current configuration file. | 400 or 700 |
| ConfigId | This selects the configuration set. | 1, 2, 3, 4, or 5 |
| PortDrivers | List of port drivers to be dynamically loaded when the system boots. The dll's must exist in the `c:\Windows` directory. sDVO transmitter port drivers to load when the system boots. | Space separated string enclosed in quotes, where each port driver name is listed in the string. The default string included with the release has all supported port drivers. |

#### 6.3.1.1 Graphics Memory Configuration

The Intel Embedded Graphics Suite (IEGS = VBIOS + Graphics driver) provides the ability to dedicate additional memory for graphics functions on the Microsoft Windows CE* platform. This is known as *reserved memory*. Firmware selects the amount of reserved memory. The reservation size is passed to the graphics driver through a scratch register available on the GMCH. Reserved memory helps minimize the amount of memory stolen from the OS for memory-limited, embedded systems. For instance, if firmware utilizes a 640 x 480, 32-bit framebuffer, a total of 1.2 Mbytes is required. Stolen memory would need to be configured as 8 Mbytes or higher, since the next smaller option is only 1 Mbyte, too small for the 640 x 480, 32-bit framebuffer. In such a case, stolen memory can be programmed to 1 Mbyte. Reserved memory can provide the additional memory required for the framebuffer, removing only a minimum amount of memory from the OS.

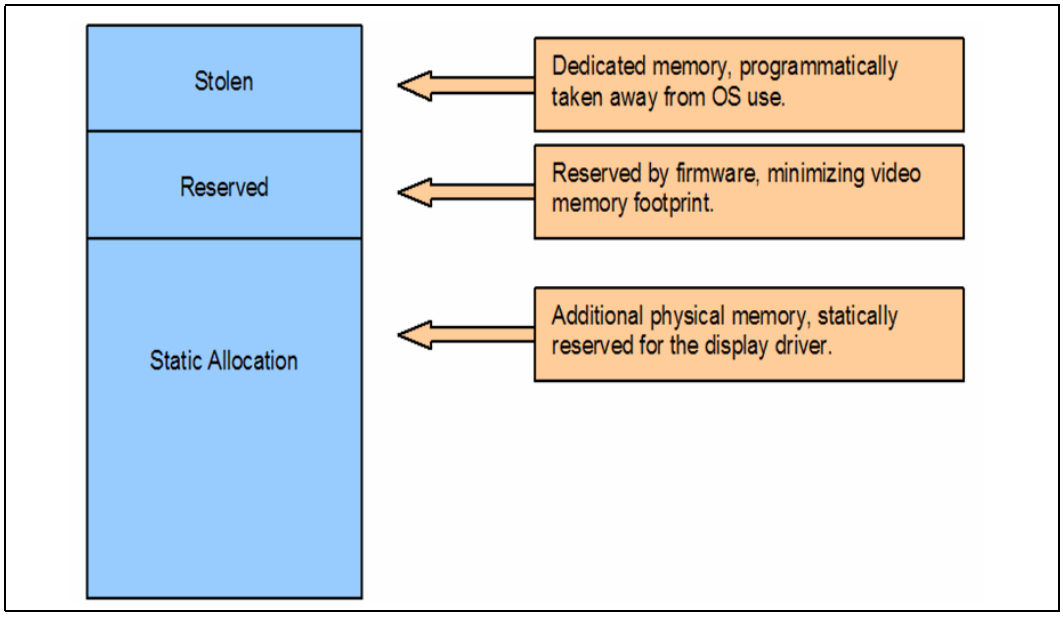
*Note:* Reserved memory is only available on the Microsoft Windows CE operating system, and must be accounted for in the `config.bib` memory layout file.

Additionally, one can configure the Microsoft Windows CE display driver for either static or dynamic allocation of video memory. The static model preallocates physical memory for the display driver and provides a more efficient surface allocation scheme. The dynamic model allocates surface memory on demand from the system and will incur a small performance hit. However, the dynamic model has the advantage of deallocation of video memory when not required, thus making it available to other applications.

The static memory model requires a base and size specification registered in the `project.reg` file. The base + size must reach to top of memory (TOM). Since this is not required to be specified in the config.bib memory map, care must be taken not to overlap any other memory arenas with the static allocation. See Section 6.3.1.2, "Defining Graphics Memory Size" on page 126 for further details on how to configure the static memory model.

Figure 33 shows a typical memory map, using a static memory model.

**Figure 33. Typical Memory Map Using Static Memory Model**




### 6.3.1.2 Defining Graphics Memory Size

The driver supports the ability to allocate graphics memory dynamically by sharing system resources with the operating system or statically by pre-allocating a block of system memory to be used exclusively by the graphics driver.

To configure the driver to operate using static video memory, two registry settings "ReservedMemoryBase" and "ReservedMemorySize" need to be enabled and defined with valid values. These two registry entries control the start address and size of the memory range pre-allocated for graphics driver use. The pre-allocated memory range should include the stolen memory (BIOS setting). For the Intel® System Controller Hub US15W chipset, this feature does not reuse the stolen video memory reserved by BIOS. Intel recommends getting BIOS to limit this to the smallest size as this memory is wasted due to some OS-HW combinational limitation.

For example, on a system with 512 MBytes of system memory and 4 MBytes of stolen memory (BIOS option), if an additional 14 MBytes of graphics memory (for a total of 18 MBytes) is desired, these settings should be used.

```
"ReservedMemoryBase"=dword:1E400000
"ReservedMemorySize"=dword:01C00000
```

These settings indicate that the managed graphics memory pool will begin at physical address 0x1E400000 (484 MBytes) and will be 18 MBytes in size. As you can see, the base address, “ReservedMemoryBase” is the physical system address value and the stolen memory from the BIOS settings is included.

Check with the platform you are using to ensure you have all the stolen memory taken into account. For example, in the case of the Cobra board that uses Intel's ACSFL firmware, 2 MBytes of stolen video memory needs to be included in this configuration. Always remember to include the amount of stolen memory in this number.

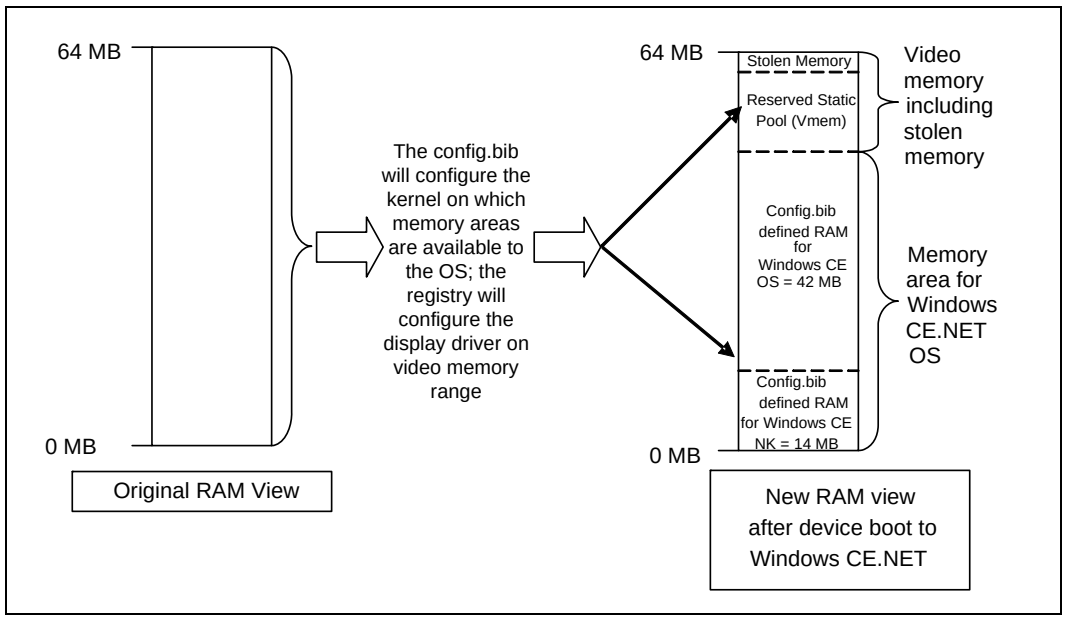
Besides the registry entry, the Platform Builder working project also needs to be updated to ensure that the kernel does not try to access this stolen memory. Two items in the `config.bib` of the project workspace need editing.

The two items are the NK image/RAM memory partitioning and the memory reservation list. Using the example of the registry configurations above, the kernel would have to be configured not to use the physical memory above the 484 MByte mark since that's where the static video memory begins. Thus, the total of the NK image and the system's available RAM must be no more than 484 MBytes, so you must change your `config.bib` accordingly:

```
NK      80220000 009BE0000  RAMIMAGE ;14 MBytes for nk.bin + misc.

RAM     80C00000 1DA00000  RAM ;42 MBytes for RAM
```

The `NK.BIN` image plus the lower conventional memory DMA buffers used by Windows CE takes 10 MBytes; 474 MBytes is for the RAM. Thus, the memory area above the 484 MByte mark is untouched by the kernel and will be used by the display driver.

Overall solution from above example settings in terms of physical system memory viewpoint:



#### 6.3.1.3 Framebuffer and Video Surface Size

Two additional optional registry settings are available to limit the framebuffer size of the display driver and the total size of offscreen video surfaces.

The MaxFbSize registry entry will control the maximum size of the framebuffer only. Actual usage will depend on the mode being used.

The PageReqLimit registry entry will control the total size in pages (4 Kbytes) of all video surfaces, buffers allocated for any use. Both of these registry configurations apply to both the static as well as dynamic video memory management explained in the previous section. The default below indicates that a maximum of 2 Mbytes are used for the framebuffer and a maximum of 16 Mbytes are permitted for all offscreen videosurface allocations.

```
"MaxFbSize"=dword:200000
"PageReqLimit"=dword:1000
```

In the case of Microsoft Windows CE*, because the OS does not allow for dynamically setting the framebuffer size, the MaxFbSize can be changed to match the mode setting being used in order to minimize on video memory waste. The following are different suggested values for MaxFbSize for different display modes. These values have not been validated. Note that 640x480 is calculated as 640x512 and 800x600 is calculated as 800x768 for stride alignment purposes.

```
640x512X16 = A0000
640x512X24 = F0000
640x512X32 = 140000
800x768X16 = 12C000
800x768X24 = 1C2000
800x768X32 = 258000
1024x768X16 = 180000
1024x768X24 = 240000
1024x768X32 = 300000
1280x1024x16 = A000000
1280x1024x32 = A000000
```

#### 6.3.1.4 Video Surface Allocation Rule

Another two optional registry entries determine a minimum width and height that allow video surface allocations to succeed.

In Windows CE GDI, video surface allocations can happen with a REQUIRE_VIDEO _MEMORY or a PREFER_VIDEO_MEMORY flag. The following options will force surface allocations with the PREFER_VIDEO_MEMORY flag to be allocated in system memory if the width and height are lower than stated.

The “MinVidSurfX” registry entry defines the minimum width of a surface allocation for it to succeed with video memory. “MinVidSurfY” defines the minimum height. The surface allocation will succeed if either the width or the height is at the required minimum.

```
"MinVidSurfX"=dword:10
“MinVidSurfY”=dword:10
```

In this example, surfaces allocated with the PREFER_VIDEO_MEMORY where the width and height are both less than 16 pixels are forced to be in system memory.

This option increases performance of the display device as smaller video images, such as icons, would be kept in system memory and only blitted onto the visible frame buffer when they are needed. This ensures optimal use of the display device for larger video surfaces where acceleration makes sense.

#### 6.3.1.5 System-to-Video Stretch Blit

System to Video Memory stretch blits are not natively supported on Intel GMCH devices. This feature allows you to enable a soft copy of system surfaces to video surfaces to conduct an accelerated stretch blit. The advantage is that the stretch blit uses the blend engine and hardware filtering can be applied. The filtering options are listed in Section 6.3.2.

A value of 1 for the “SysToVidStretch” enables system-to-video stretch blits, as described above, while a value of 0, disables this feature and forwards all system-to-video stretch blits to the emulator provided by the operating system.

```
[HKEY_LOCAL_MACHINE\Drivers\Display\Intel\ALL\1\General]
"SysToVidStretch"=dword:0
```

#### 6.3.1.6 iegd.reg File Backward Compatibility

The Intel Embedded Graphics Driver expects a configuration file in the PCFVersion 700 format. However, the driver will maintain backward support with version 4.0. This support is implemented through the `PcfVersion` key as shown below:

```
[HKEY_LOCAL_MACHINE\Drivers\Display\Intel\ALL\1\General]
"PcfVersion"=dword:400
```

IEGD uses this key to determine the format of the configuration file. When this key is present, IEGD parses the configuration file using the format specified by the key (400 or 700). If this key is not present, then IEGD assumes 4.0 format.

### 6.3.2 Configuration Sets

The Intel® Embedded Graphics Drivers allows multiple configuration sets for OEMs who want to use the same `iegd.reg` file across different platforms. There can be up to 16 instances of configurations. The registry key described in the previous section, ConfigId, ensures the display driver selects the right instance. Each instance may contain multiple groups of per-config and per-config+per-port platform customizations.

The configuration sets are defined in the registry tree as

```
[HKEY_LOCAL_MACHINE\Drivers\Display\Intel\<platform>\<config id>],
```

Where <config id> is the configuration number. The “ConfigID” key described in the previous section selects the active configuration set.

### 6.3.3 General Configuration

Registry keys described in this section can be found in [HKEY_LOCAL_MACHINE\Drivers\Display\Intel\<platform>\<config id>\], where <config id> is the configuration number, and where <*platform*> is one of the following: ALL, Intel® Atom™ 400/500, Q45/G41/G45, US15W/US15WP/WPT, GM45/GL40/GS45, Q35, GLE960/GME965, Q965, 945G, 945GM, 945GME/945GSE, 945GSE, 915GV, 915GME, and 910GMLE. The driver first attempts to find the configuration or platform on which it is booted, but if the configuration for that platform is not present, the driver uses the ALL platform setting.

**Table 33. [HKLM\Drivers\Display\Intel\<platform>\<config id>\]Registry Keys (Sheet 1 of 2)**

| Registry Entry | Description | Possible Ranges |
|---|---|---|
| Width | Width of the display | Width and Height must be expressed as hexadecimal values. For example:<br>1024 x 768: 400 x 300<br>800 x 600: 320 x 258<br>640 x 480: 280 x 1E0 |
| Height | Height of the display | See above. |
| Depth | Color depth in bpp (bits per pixel) | Depth must be expressed as a hexadecimal number and must be one of the following values:<br>8bpp: 8<br>16bpp: 10<br>24bpp: 18<br>32bpp: 20<br>(Note that the Intel 915 chipsets do not support 24 bpp.) |
| Refresh | The refresh rate of the display. | Refresh rate must be in hex:<br>60 : 3c<br>70 : 46<br>75 : 4b<br>85 : 55<br>etc...<br><br>This value can be any valid refresh rate as long as the display port supports it. A refresh of '0' takes the first refresh that matches width, height and depth. |
| NO_D3D | Specify whether to enable D3D. | 0 = Enable D3D<br>1 = Disable D3D<br>Default is 0. |
| ReservedMemoryBase<br>ReservedMemorySize | Video memory can be statically reserved or dynamically allocated on demand. If both *ReservedMemoryBase* and *ReservedMemorySize* are non-zero, then Video memory allocation uses the static model. | The ReservedMemoryBase plus the ReservedMemorySize must extend to the TOM (Top Of Memory) and not conflict with other reserved memory arenas in config.bib. Default for both base and size is zero, indicating a dynamic allocation model.<br>Default behavior disables static memory model. |
| MaxFbSize | Maximum size of the expected framebuffer. By providing this hint, the display driver can more efficiently organize GART memory, leading to a smaller video memory consumption. | Must be greater than or equal to the expected size of framebuffer. Units are in bytes. Specifying zero causes the default framebuffer reservation sizing.<br>Default:<br>All other chipsets: 16 Mbytes |

**Table 33. [HKLM\Drivers\Display\Intel\<platform>\<config id>\]Registry Keys (Sheet 2 of 2)**

| Registry Entry | Description | Possible Ranges |
|---|---|---|
| MinVidSurfX<br>MinVidSurfY | In pixels, the minimum width and height of surfaces in order to be acceptable for allocation in Video memory. Due to hardware restrictions that optimize memory access, it is advisable to reserve video memory for larger surfaces and allow GDI and DirectDraw* to allocate small surfaces from system memory. | No limitations. Suggested values for both width and height are 10. Default value for both width and height is 1.<br>Default:<br>MinVidSurfX = 1<br>MinVidSurfY = 1 |
| SysToVidStretch | Enables system-to-video memory stretch blit operations to take advantage of hardware-accelerated filtering. Normally, it is more efficient to allow GDI to conduct system-to-video stretch blits, but the default filtering used by GDI is Nearest. | 0 = Disabled<br>1 = Enabled<br>Default: 0 |
| BlendFilter | Provides selection of hardware-accelerated filtering methods for stretch blit operations. | 0 = Nearest<br>1 = Bilinear<br>2 = Anisotropic<br>Default: 2 |
| TearFB | If enabled, all blit operations to the framebuffer are synchronized with video sync to eliminate any visible tearing or flickering on the display screen. Disabling this feature achieves a performance gain. | 0 = Disabled, tearing allowed<br>1 = Enabled, no visible tearing<br>Default: 1 |
| OverlayDualVext | Provides selection for enabling two hardware overlay planes (one for each screen) to display independent video stream on each overlay plane. This selection only applicable in Vertical Extended Mode on Intel® System Controller Hub US15W. Note that the hardware overlay plane for each display locks on that screen; the overlay fails to display if it is crossed into the wrong screen. | 0 = Disabled<br>1 = Enabled<br>Default: 0 |
| DisplayConfig | The “DisplayConfig” key sets the display configuration to be in Single, Twin, Clone, or Vertical Extended modes. (Unlike Microsoft Windows* XP, Microsoft Windows CE* does not support Extended mode). It does not, however, dictate what type of display ports will be used. | 1 (single), 2 (clone), 4 (twin), 5 (vertical extended) |
| DisplayDetect | The “DisplayDetect” key allows the user to enable a display port only if a display device is connected. Displays without EDID will not be detected. | 0 = disable<br>1 = enable<br>Default: 0 |
| PortOrder | The PortOrder setting ensures the correct display port types are used based on user selection. | See Section 6.3.3.1. |

#### 6.3.3.1 PortOrder Information

PortOrder specifies the actual ports that are used for the Primary and Secondary display. As shown in the table below, the port numbers are slightly different among the supported chipsets.

**Table 34. PortOrder Information**

| Port Number | Chipsets |
|---|---|
| 1 | Integrated TV Encoder |
| 2 | sDVO B Port/RGBA Port |
| 3 | sDVO C Port |
| 4 | Internal LVDS Port |
| 5 | Analog Port |

The driver attempts to use the ports in the order specified by “PortOrder”. For example, “PortOrder” = “5420” will assign the analog port to the primary display and the LVDS port to the secondary display (if any), assuming all the ports are present and detected. Suppose port “5” is not present, in that case the driver tries to assign the next port (4, in this case) in line to the primary display, resulting LVDS port for primary and sDVO B port for secondary.

Setting PortOrder to “00000” causes the driver to use default internal settings.

```
*************
[HKEY_LOCAL_MACHINE\Drivers\Display\Intel\ALL\1\General]
;-------------------------------------
; Select Port Order
;-------------------------------------
“PortOrder”=“54320”

;  PortOrder specifies the actual of port
;  that will be taken for the Primary /
;  Secondary ports if there are duplicates
;  of the same type. For example, if both
;  Primary and Secondary are digital, then
;  port order will which sDVO ports will be
;  first and second. The section below gives
;  the port order numbers for various chipsets.
;  Specify value “0000” to use default settings.
;  On i915 chipsets:
;  ==============================
;    1 - Integrated TV Encoder
;    2 - sDVO B port/RGBA port
;    3 - sDVO C port
;    4 - Internal LVDS port
;    5 - Analog port
;
```

#### 6.3.3.2 Vertical Extended Mode

The Windows CE* IEGD driver supports Vertical Extended display mode, which is one large framebuffer that extends across two displays by doubling the height of resolution. The top half of the framebuffer is on the first pipe and the bottom half is on the second pipe. The Windows CE operating system is unaware of the two displays. This feature is supported only on the dual-pipelined chipsets, which is every supported platform stated in Section 6.2.1.

This feature is enabled through the `DisplayConfig` key in the `project.reg` file. The resolution, bit depth, and refresh rates of both displays must be the same. Vertical and horizontal panning are *not* supported. DirectDraw is supported on both pipes, but DirectDraw 3D must be disabled when Vertical Extended Display mode is enabled.

### 6.3.4 Per Port Platform Customization

The Intel Embedded Graphics Drivers provide what is considered the most useful tools to the embedded market — per port platform customizations. This includes the following:

- Defining custom DTD panel timings
  : `PixelClock, HorzActive, HorzSync` etc...
- Customized GPIO pin selection for $I^2C$ and DDC communication with sDVO encoders and panels.
  :`I2cPin, I2cDab, I2cSpeed` etc...
- Flat Panel width and height limitations and power and/or backlight control mechanisms
  :`BkltMethod, BkltT1, BkltT2, GpioPinVdd` etc...
- Port driver specific attribute settings for initialization at boot time.
  : `Brightness, Contrast, H-Position` etc...

All of the above can be set for each individual port depending on the maximum number of ports the chipset supports. Also, you can have multiple instances of these configurations to allow different settings per configuration.

The usage model for this per-config, per-port platform customizations follows after the same options available in the INF registry settings for the Intel Embedded Graphics Drivers for Microsoft Windows XP*. Please see Figure 6.3.7, “Sample iegd.reg File” on page 137 or to the provided registry sample file in the IEGD Windows CE* driver package for examples. The following sections provide information on these configurations

#### 6.3.4.1 Per Port Customization — General Port Configuration

This section describes port-specific general configuration options. These options are located under
`[HKEY_LOCAL_MACHINE\Drivers\Display\Intel\ALL\1\Port\1\General]`

- Edid
  This boolean key enables (set to 1) or disables (set to 0) the EdidAvail and EdidNotAvail keys.

- EdidAvail and EdidNotAvail

  These two 16-bit keys control the available timings for the display. If an EDID is successfully read from the display device, then IEGD uses the EdidAvail flag to determine what timings are available. Otherwise, if an EDID cannot be read, then IEGD uses the EdidNotAvail key.

| Bit # | Value (0 or 1) |
|---|---|
| 0 | Disable/Enable driver built-in timings |
| 1 | Disable/Enable EDID timings. (Only valid for the EdidAvail flag) |
| 2 | Disable/Enable DTD |
| 3-15 | Reserved |

- CenterOff

  If the selected frame buffer size is smaller than what the IEGD hardware can support, by default the frame buffer will be centered with a black border around it. To explicitly turn off this feature, the user may set the “CenterOff” key to “1”.

- Rotation and Flip

  IEGD supports desktop rotation through the “Rotation” key in Single, Twin, and Clone mode. Rotation is not supported in Vertical Extended Mode.

  The “Rotation” key can be set to one of the four follow values.

| Degrees | Key Value |
|---|---|
| 0 | 0 (default) |
| 90 | 5A |
| 180 | B4 |
| 270 | 10E |

  So, “Rotation”=dword:5A will rotate the frame buffer 90 degrees.

  The “Flip” key flips the desktop horizontally, displaying a mirror image. “Flip” is a boolean value:  1 to enable, 0 to disable.

- Scale

  IEGD can scale the desktop to the output panel using the panel’s DTD or EDID (in that order). Scaling (attribute ID “18”) is a boolean value, “18”=dword:1 to enable, 0 to disable.

### 6.3.4.2 Per Port Customization — Custom DTD Timings

For each configuration, each port can be added with up to 255 customized DTD modes.

The following is an example of adding 800x640 mode to the LVDS port when ConfigId=1 is used.

```
[HKEY_LOCAL_MACHINE\Drivers\Display\Intel\ALL\1\Port\4\DTD\1]
 “PixelClock”=dword:9c40
 “HorzActive”=dword:320
 “HorzSync”=dword:28
 “HorzSyncPulse”=dword:80
 “HorzBorder”=dword:0
 “HorzBlank”=dword:100
 “HorzSize”=dword:0
 “VertActive”=dword:280
 “VertSync”=dword:1
 “VertSyncPulse”=dword:4
 “VertBorder”=dword:0
 “VertBlank”=dword:1c
 “VertSize”=dword:0
 “Flags”=dword:1e
```

### 6.3.4.3 Per Port Customization — Custom Flat Panel Controls

Similarly, the flat panel native resolution and power and backlight sequencing controls can also be configured here.

```
;[HKEY_LOCAL_MACHINE\Drivers\Display\Intel\ALL\1\Port\1\FPInfo]
      ;  “BkltMethod”=dword:0
      ;  “BkltT1”=dword:0
      ;  “BkltT2”=dword:0
      ;  “BkltT3”=dword:0
      ;  “BkltT4”=dword:0
      ;  “BkltT5”=dword:0
      ;  “GpioPinVdd”=dword:0
      ;  “GpioPinVee”=dword:0
      ;  “GpioPinBklt”=dword:0
      ;  “BkltEnable”=dword:0
      ;  “UseGMCHClockPin”=dword:0
      ;  “UseGMCHDataPin”=dword:0
```

*Note:* For Per-Config, Per-Port configuration, the subkey path includes the correct “Config” and “Port” numbers

#### 6.3.4.4 Per Port Customization — Attribute Initialization

Attributes are also per config and per port. However, the actual keys are dependent on the port driver being used. Below are examples of registry keys associated with initializing attributes for the Chrontel Port Driver.

For complete information on port driver attributes, refer to Appendix B.

*Note:* For Per-Config, Per-Port configuration, the subkey path includes the correct “Config” and “Port” numbers.

The following example sets the port driver attributes using the attribute IDs. Please see Section B.1.4, “Internal TV Out Port Driver Attributes (Mobile chipsets only)” on page 213 for a list of attribute IDs and their meanings.

```
[HKEY_LOCAL_MACHINE\Drivers\Display\Intel\ALL\1\Port\1\Attr]
      “0”=dword:32
      “1”=dword:4
      “3”=dword:1
      “8”=dword:1
      “12”=dword:0
      “14”=dword:1
      “19”=dword:1
```

### 6.3.5 Miscellaneous Configuration Options

This section covers registry settings not in [HKEY_LOCAL_MACHINE\Drivers\Display\Intel].

#### 6.3.5.1 Text Anti-Aliasing

The Microsoft Windows CE* driver supports text anti-aliasing. To switch it on, add these registry settings:

```
[HKEY_LOCAL_MACHINE\System\GDI\Fontsmoothing]
[HKEY_LOCAL_MACHINE\System\GDI]
   "ForceGRAY16"=dword:1
```

*Note:* Always turn on Text Anti-Aliasing when using a TV display device.

### 6.3.6 Direct3D* Mobile Support

IEGD v10.4 supports Direct3D* Mobile on Windows CE* 6.0. Users need to ensure that their Windows CE target machine platform workspace has been included with D3D Mobile support. Do this by simply turning it on via the check box in Windows CE 6.0.

Also, include the new IEGD D3D mobile driver binary, “iegd3dg3.dll” (part of the IEGD driver release for Windows CE 6.0) in the workspace image. Add this binary into the “.BIB” configuration file of the target platform workspace (see Figure 32):

```
iegd3dg3.dll <specify_path_here>\iegd3dg3.dll NK
```

No other IEGD registry configuration is necessary for this feature to work.

*Note:* The IEGD Windows CE D3D Mobile feature requires more memory at runtime:

- For Windows CE 6.0, depending on the number of components built into the target platform workspace, the amount of memory could be significantly more, due in part to the new kernel memory architecture adopted by the OS, assuming all multimedia components are built-in. It is recommended that 84 Mbytes of memory be configured for the target machine workspace image. Refer to the following Microsoft URL for information on how to configure more than 64 Mbytes on Windows CE 6.0:
  http://msdn.microsoft.com/en-us/library/aa909457.aspx

See also the “Sample iegd.reg File”.

### 6.3.7 Sample iegd.reg File

```
;****************** BEGIN INTEL DISPLAY DRIVER REGISTRY ENTRY *****************
;******************************************************************************
;*-----------------------------------------------------------------------------
;* Copyright (c) Intel Corporation (2002 - 2011).
;*
;* The source code contained or described herein and all documents
;* related to the source code ("Material") are owned by Intel
;* Corporation or its suppliers or licensors. Title to the Material
;* remains with Intel Corporation or it suppliers and licensors. The
;* Material contains trade secrets and proprietary and confidential
;* information of Intel or its suppliers and licensors. The Material is
;* protected by worldwide copyright and trade secret laws and
;* treaty provisions. No part of the Material may be used, copied,
;* reproduced, modified, published, uploaded, posted, transmitted,
;* distributed, or disclosed in any way without Intels prior express
;* written permission.
;*
;* No license under any patent, copyright, trade secret or other
;* intellectual property right is granted to or conferred upon you by
;* disclosure or delivery of the Materials, either expressly, by
;* implication, inducement, estoppel or otherwise. Any license
;* under such intellectual property rights must be express
;* and approved by Intel in writing.
;*-----------------------------------------------------------------------------
```

```
[HKEY_LOCAL_MACHINE\Drivers\BuiltIn\PCI\Template\IEGD]
       "Dll"="isr_iegd.dll"
       "Class"=dword:03
       "SubClass"=dword:00
       "ProgIF"=dword:00
       "VendorID"=multi_sz:"8086"
       "DeviceID"=multi_sz:"8108"
                  ; US15 is the only chipset supporting interrupts
       "Prefix"="IGD"
       "IsrDll"="isr_iegd.dll"
       "IsrHandler"="isr_handler"
;*-------------------------------------------------------------------------
[HKEY_LOCAL_MACHINE\System\GDI\Drivers]
       "Display"="ddi_iegd.dll"
      [HKEY_LOCAL_MACHINE\System\D3DM\Drivers]
       "RemoteHook"="ddi_iegd.dll"
      [HKEY_LOCAL_MACHINE\System\GDIM\Drivers]
       "D3DMOverride"="ddi_iegd.dll"
;*************************************************************************
; The Following Sections Provide
; General Driver-Wide Registry Settings
;*************************************************************************
[HKEY_LOCAL_MACHINE\Drivers\Display\Intel]
;-------------------------------------------------------------------------
; Following registry entry for
; pcf version used
; 700 : IEGD version
;-------------------------------------------------------------------------
"PcfVersion"=dword:700
;-------------------------------------------------------------------------
; This value dictates the configuration to select for Per-Port settings from
; port specific regsitry. The settings mirror Windows XP IEGD drivers
; implementation. Refer to the User's Guide for details.
;-------------------------------------------------------------------------
"ConfigId"=dword:1
;-------------------------------------------------------------------------
; Provide a list of port drivers to attempt to load upon boot time
;-------------------------------------------------------------------------
"PortDrivers"="analog ch7009 ch7017 fs454 lvds ns2501 ns387 sii164 ti410 th164 sdvo
hdmi tv"
;*************************************************************************
; The Following Sections Provide Per-Config configuration. The Platform string in
; the path can be "ALL" for all platforms, or any of the following for
; platform-specific configurations:
; Q35, GM965, Q965, 946GZ, 945G, 945GM, 915GV, and 915GM
;*************************************************************************
[HKEY_LOCAL_MACHINE\Drivers\Display\Intel\ALL\1\General]
;-------------------------------------------------------------------------
; Following registry entries for display settings:resolution, bit depth and
; refresh rate
;
```

```
; Width & Height values must be hex, for example
; 1400x1050 : 578h x 41Ah
; 1280x1024 : 500h x 400h
; 1024x768 : 400h x 300h
; 800x600 : 320h x 258h
; 640x480 : 280h x 1E0h
; etc...
;
; In vertical extented mode, height is doubled
; 640x960 : 280h x 3c0
; 800x600 : 320h x 4b0h
; etc...;
;-------------------------------------------------------------------------------
"Width"=dword:320
"Height"=dword:258
;-------------------------------------------------------------------------------
; Bit depth must be one of:
; 8bpp : 8
; 16bpp : 10
; 24bpp : 18
; 32bpp : 20
; (all current IEGD 6.0 & above chipsets do not support 24 bpp)
;-------------------------------------------------------------------------------
"Depth"=dword:20
;-------------------------------------------------------------------------------
; Refresh rate must be in hex:
; 60 : 3c
; 70 : 46
; 75 : 4b
; 85 : 55
; etc...
; any refresh rate as long as the display port supports it refresh of '0' will
; take the first refresh that matches width, height and bpp
;-------------------------------------------------------------------------------
"Refresh"=dword:3c
;-------------------------------------------------------------------------------
; Following is registry entry for controlled configuration of video memory
; usage / location
;
; The following settings are for a 64M platform, where the video memory is 14M
; at the top the above settings are assuming there is no system bios / firmware
; that has stolen memory from top of memory. If it does exist reduce
; ReservedMemorySize avoiding overlap exception for ACSFL, memory area is
; reused
;
; NOTE: CURRENTLY THESE SETTINGS ARE REMARKED FOR DYNAMIC VIDEO MEMORY
; CONFIGURATION
;-------------------------------------------------------------------------------
; "ReservedMemoryBase"=dword:03200000
; "ReservedMemorySize"=dword:00E00000
;-------------------------------------------------------------------------------
; Below is Maximum Frame Buffer Size used to limit the maximum size in bytes
; of the main frame buffer
;-------------------------------------------------------------------------------
"MaxFbSize"=dword:800000
```

```
;-------------------------------------------------------------------------
; Page Request Limit is used to control the max allocations of offscreen video
; surfaces, buffers etc.. value is in number of pages (4K).
; this is independant of dynamic or static memory configuration.
;
; The max for 915s, 945s = 256 Mbytes = 0x10000
;-------------------------------------------------------------------------
"PageReqLimit"=dword:0
;-------------------------------------------------------------------------
; Above settings are to define a minimum width and heigh that would allow for
; video surface allocations to succeed, eg: surfaces with width < 16 are
; forced to be in system-mem, surfaces with height < 16 are forced to be in
; system-mem only affects allocations of surfaces with GPE_PREFER_VIDEO_MEMORY
; flag
;-------------------------------------------------------------------------
"MinVidSurfX"=dword:10
"MinVidSurfY"=dword:10
;-------------------------------------------------------------------------
; Following are the registry entries for acceleration configuration
;-------------------------------------------------------------------------
; Set SysToVidStrech to '1' enables driver to perform System to Video stretch
; blits
;-------------------------------------------------------------------------
"SysToVidStretch"=dword:0
;-------------------------------------------------------------------------
"BlendFilter"=dword:2
;-------------------------------------------------------------------------
; Option for enabling/disabling TEARING - Default is OFF
;-------------------------------------------------------------------------
; Set '1' to enable the NOTEARING option
"TearFB"=dword:1
;-------------------------------------------------------------------------
; Specify whether to enable d3d
; NO_D3D Value: 0(default)
; : 0 --> Enable D3D
; : 1 --> Disable D3D
;-------------------------------------------------------------------------
"NO_D3D"=dword:0
;-------------------------------------------------------------------------
; Select Display configuration, single, twin ...
; Possible Display Config combo:
; DisplayConfig 1 == SINGLE
; (Single is default if none specified)
; DisplayConfig 4 == TWIN
; --> (Twin mode: common timing across ports)
; DisplayConfig 2 == CLONE
; --> (Clone mode: distinct timing per port)
; DisplayConfig 5 == VEXT (vertical extend)
; --> (Vert Extended modes : "Height" )
; ( registry key value must be 2X the )
; ( intended port timings. Both ports )
; ( must use the same timings. For )
; ( example, for port timings of )
; ( 800x600, the DisplayConfig should )
; ( be 5 and the Height=1200 or 0x4b0 )
```

```
; ( Overlay will not work in VEXT mode. )
; (915GV does not support Vext)
;--------------------------------------------------------------------------
"DisplayConfig"=dword:1
;--------------------------------------------------------------------------
; Select Port Order
; PortOrder specifies the actual port that will be used for the primary and
; secondary ports. IF specified port is unavailable (port driver failed or
; display detection failed or port is not available on current chipset), then
; the next port in the above order will be used. PortOrder must be set,
; based on chipset specifications:
; On i915 chipsets:
; ================================
; 1 - Integrated TV Encoder
; 2 - sDVO B port/RGBA port
; 3 - sDVO C port
; 4 - Internal LVDS port
; 5 - Analog port
;
; On i865 chipsets:
; ================================
; 1 - sDVO A port
; 2 - sDVO B port/RGBA port
; 3 - sDVO C port
; 4 - Internal LVDS port
; 5 - Analog port
;
; On 835: If RGBA is used (sDVO B & C together), then use sDVO B number
; to specify any parameter for it.
;
; On i81x chipsets:
; =================
; Port numbers:
; 3 - sDVO port
; 5 - Analog port
;--------------------------------------------------------------------------
"PortOrder"="52340"
;--------------------------------------------------------------------------
; Set Clone Port resolutions
;--------------------------------------------------------------------------
; "CloneWidth"=dword:320
; "CloneHeight"=dword:258
; "CloneRefresh"=dword:3c

;--------------------------------------------------------------------------
; Set "1" to enable Display Detection
; DisplayDetect is to detect display child device before using it
; (panel/tv/etc...).BEWARE, setting this to '1' will mean display for the
; requested port will not be enabled if detection failed. Use this option wisely.
;--------------------------------------------------------------------------
```



```
"DisplayDetect"=dword:0
;-------------------------------------------------------------------------
; Set "1" to enable Dual Overlay in Vertical Extended in Windows CE 6.0
; This is set by the user to enable Dual Hardware Overlays. This is a special
; flag for a specific usage. When two apps request overlays, these two will
; use the two hardware overlays
;-------------------------------------------------------------------------
  "OverlayDualVext"=dword:0
;-------------------------------------------------------------------------
; Overlay Color Correction Settings
; Gamma: 32-bit integer in 24i.8f format, ranging from 0.6 - 6.0 decimal
; Brightness: 32-bit integer ranging from 0 to 0xFFFF. 0x8000 = no correction
; Contrast: 32-bit integer ranging from 0 to 0xFFFF. 0x8000 = no correction
; Saturation: 32-bit integer ranging from 0 to 0xFFFF. 0x8000 = no correction
;-------------------------------------------------------------------------
; "OverlayGammaCorrectR"=dword:100
; "OverlayGammaCorrectG"=dword:100
; "OverlayGammaCorrectB"=dword:100
; "OverlayBrightnessCorrect"=dword:8000
; "OverlayContrastCorrect"=dword:8000
; "OverlaySaturationCorrect"=dword:8000
;*************************************************************************
; The sections below are for the more detailed per port
; registry configurations. It follows the same usage model and
; key value meanings as the Windows INF registry configuration
; file. Refer to the User's Guide for details.
;*************************************************************************
;-------------------------------------------------------------------------
; Config 1 - sDVO-B Port (For Almador) |
;-------------------------------------------------------------------------
; Following are the registry
; entries for port's general config
;-------------------------------------------------------------------------
;
;[HKEY_LOCAL_MACHINE\Drivers\Display\Intel\915GV\1\Port\2\General]
;
; Advanced Edid Configuration
; ---------------------------
; "Edid"=dword:1
; "EdidAvail"=dword:7 ; STD TIMINGS + EDID TIMINGS + USER TIMINGS
; "EdidNotAvail"=dword:7 ; STD TIMINGS + USER TIMINGS
;
; EdidAvail and EdidNotAvail: <only 16 bits used>
; ---------- -------------
; These 2 parameters can be used to control the available timings for
; any display. 'EdidAvail' is used when EDID is read from the display
; device. If an attempt to read EDID is failed or 'Edid = 0' then
; driver uses 'EdidNotAvail' flags.
;
; See below bit definitions for both 'EdidAvail' and 'EdidNotAvail'
;
; BIT 0:
; ------
; 0 - Do not use driver built-in standard timings
; 1 - Use driver built-in standard timings
```

```
;
; BIT1: <not applicable to EdidNotAvail>
; ------
; 0 - Do not use EDID block
; 1 - Use EDID block and filter modes
;
; BIT2:
; ------
; 0 - Do not use user-DTDs
; 1 - Use user-DTDs.
;
; BIT3-BIT15
; -----------
; Future use.
;
; Default behavior:
; -----------------
; If user does not provide EdidAvail and EdidNotAvail, then
; EdidAvail = Use Std timings + Use EDID block and Filter modes
; EdidNotAvail = Use Std timings
;
; Rotation Configuration
; ----------------------
; "Rotation"=dword:0
; Rotation entries must be at a right
; angle. An invalid entry will be ignored and
; and no rotation will happen for primary.
; In clone or twin modes, the secondary
; port defaults to follow the primary (if set)
; 0 degrees = 0 (not rotated = default)
; 90 degrees = 5A
; 180 degrees = B4
; 270 degrees = 10E
;
; Flip Configuration
; ----------------------
; "Flip"=dword:0
; Flip has a valid entry of 1 to turn on
; and 0 to turn off. When turn on the display
; will be horizontally flip.
;
; Rendered Scaling Configuration
; ------------------------------
; "Scale"=dword:0
; Scale works as a boolean switch. Valid
; entries are zero or 1. When "Scale" = 1,
; IEGD will scale the requested framebuffer
; resolution to the fixed native panel size
; indicated by per-port FPInfo, User-DTD or
; EDID (in that order).
; In clone or twin modes, the secondary
; port defaults to follow the primary (if set)
;-------------------------------------------------------------------------
; Following are the registry entries
; for port's sDVO I2C settings
```

```
;-------------------------------------------------------------------------
;[HKEY_LOCAL_MACHINE\Drivers\Display\Intel\915GV\1\Port\2\sDVO]
; "I2cPin"=dword:2
; "I2cDab"=dword:70
; "I2cSpeed"=dword:0
; "DdcPin"=dword:0
; "DdcSpeed"=dword:0
;-------------------------------------------------------------------------
; Following are the registry entries
; for port's flat panel's mode-limits,
; power and backlight control
;-------------------------------------------------------------------------
;[HKEY_LOCAL_MACHINE\Drivers\Display\Intel\915GV\1\Port\2\FPInfo]
; Only need Width & Height if Panel cannot accept other timings
; "BkltMethod"=dword:3
; "BkltT1"=dword:1E
; "BkltT2"=dword:4
; "BkltT3"=dword:4
; "BkltT4"=dword:14
; "BkltT5"=dword:1F4
; "GpioPinVdd"=dword:27
; "GpioPinVee"=dword:26
; "GpioPinBklt"=dword:28
; "UseGMCHClockPin"=dword:0
; "UseGMCHDataPin"=dword:0
;-------------------------------------------------------------------------
; Following are the registry entries
; for ports first custom DTD mode to add
;-------------------------------------------------------------------------
;[HKEY_LOCAL_MACHINE\Drivers\Display\Intel\915GV\1\Port\2\DTD\1]
; "PixelClock"=dword:9c40
; "HorzActive"=dword:320
; "HorzSync"=dword:28
; "HorzSyncPulse"=dword:80
; "HorzBorder"=dword:0
; "HorzBlank"=dword:100
; "HorzSize"=dword:0
; "VertActive"=dword:280
; "VertSync"=dword:1
; "VertSyncPulse"=dword:4
; "VertBorder"=dword:0
; "VertBlank"=dword:1c
; "VertSize"=dword:0
; "Flags"=dword:1e
;-------------------------------------------------------------------------
; Following are the registry entries
; for ports second custom DTD mode to add
; (Up to 255 can be added)
;-------------------------------------------------------------------------
```

```
;[HKEY_LOCAL_MACHINE\Drivers\Display\Intel\915GV\1\Port\2\DTD\2]
; "PixelClock"=dword:9c40
; "HorzActive"=dword:320
; "HorzSync"=dword:28
; "HorzSyncPulse"=dword:80
; "HorzBorder"=dword:0
; "HorzBlank"=dword:100
; "HorzSize"=dword:0
; "VertActive"=dword:258
; "VertSync"=dword:1
; "VertSyncPulse"=dword:4
; "VertBorder"=dword:0
; "VertBlank"=dword:1c
; "VertSize"=dword:0
; "Flags"=dword:1e
;-------------------------------------------------------------------------
; Following are the registry
; entries for the port device'
; display attribute parameters
; Use when enabling Port device
; example below is for Conexant
; on Port2 (sDVO-B for almador)
; key names depend on port driver
;-------------------------------------------------------------------------
;[HKEY_LOCAL_MACHINE\Drivers\Display\Intel\915GV\1\Port\2\Attr]
; "Brightness"=dword:32
; "Contrast"=dword:4
; "Flicker Filter"=dword:1
; "Saturation"=dword:4
; "Hue"=dword:32
; "Text Filter"=dword:0
; "Overscan ratio"=dword:1
; "TV Format"=dword:1
; "TV Output"=dword:1
; "Composite and S-Video"=dword:1
;-------------------------------------------------------------------------
; Config 1 - Analog Port (For Any Chipset)
;-------------------------------------------------------------------------
;[HKEY_LOCAL_MACHINE\Drivers\Display\Intel\915GV\1\Port\5\General]
; "Edid"=dword:1
; "EdidAvail"=dword:7 ; STD TIMINGS + EDID TIMINGS + USER TIMINGS
; "EdidNotAvail"=dword:7 ; STD TIMINGS + USER TIMINGS
;[HKEY_LOCAL_MACHINE\Drivers\Display\Intel\Config\1\Port\5\attr]
; GAMMA, BRIGHTNESS, CONTRAST
; "35"=dword:a0a0a0 ; gamma: 3i.5f format for R-G-B, ranging 0.6 to 6
; "36"=dword:808080 ; brightness: 0 to FF, 0x80 is no correction
; "37"=dword:808080 ; contrast: 0 to FF, 0x80 is no correction
;[HKEY_LOCAL_MACHINE\Drivers\Display\Intel\Config\1\Port\5\DTD\1]
; "PixelClock"=dword:9c40
; "HorzActive"=dword:320
; "HorzSync"=dword:28
; "HorzSyncPulse"=dword:80
; "HorzBorder"=dword:0
; "HorzBlank"=dword:100
; "HorzSize"=dword:0
```

```
; "VertActive"=dword:280
; "VertSync"=dword:1
; "VertSyncPulse"=dword:4
; "VertBorder"=dword:0
; "VertBlank"=dword:1c
; "VertSize"=dword:0
; "Flags"=dword:1e
;[HKEY_LOCAL_MACHINE\Drivers\Display\Intel\915GV\1\Port\5\DTD\2]
; "PixelClock"=dword:9c40
; "HorzActive"=dword:320
; "HorzSync"=dword:28
; "HorzSyncPulse"=dword:80
; "HorzBorder"=dword:0
; "HorzBlank"=dword:100
; "HorzSize"=dword:0
; "VertActive"=dword:258
; "VertSync"=dword:1
; "VertSyncPulse"=dword:4
; "VertBorder"=dword:0
; "VertBlank"=dword:1c
; "VertSize"=dword:0
; "Flags"=dword:1e
;-------------------------------------------------------------------------
; Config 1 - Int-LVDS Port (For 915GM) |
;-------------------------------------------------------------------------
;[HKEY_LOCAL_MACHINE\Drivers\Display\Intel\915GV\1\Port\4\General]
; "Edid"=dword:1
; "EdidAvail"=dword:7 ; STD TIMINGS + EDID TIMINGS + USER TIMINGS
; "EdidNotAvail"=dword:7 ; STD TIMINGS + USER TIMINGS
;[HKEY_LOCAL_MACHINE\Drivers\Display\Intel\915GV\1\Port\4\FPInfo]
; Only need Width & Height if Panel cannot except other timings
; "BkltMethod"=dword:0
; "BkltT1"=dword:0
; "BkltT2"=dword:0
; "BkltT3"=dword:0
; "BkltT4"=dword:0
; "BkltT5"=dword:0
; "GpioPinVdd"=dword:0
; "GpioPinVee"=dword:0
; "GpioPinBklt"=dword:0
; "UseGMCHClockPin"=dword:0
; "UseGMCHDataPin"=dword:0
;[HKEY_LOCAL_MACHINE\Drivers\Display\Intel\915GV\1\Port\4\Attr]
; "27"=dword:1
; Attribute "27" = Dual Channel (boolean)
; "18"=dword:1
; Attribute "18" = Panel Fit Upscale (boolean)
;[HKEY_LOCAL_MACHINE\Drivers\Display\Intel\915GV\1\Port\4\DTD\1]
; "PixelClock"=dword:9c40
; "HorzActive"=dword:320
; "HorzSync"=dword:28
; "HorzSyncPulse"=dword:80
; "HorzBorder"=dword:0
; "HorzBlank"=dword:100
; "HorzSize"=dword:0
```

```
; "VertActive"=dword:280
; "VertSync"=dword:1
; "VertSyncPulse"=dword:4
; "VertBorder"=dword:0
; "VertBlank"=dword:1c
; "VertSize"=dword:0
; "Flags"=dword:1e
;[HKEY_LOCAL_MACHINE\Drivers\Display\Intel\915GV\1\Port\4\DTD\2]
; "PixelClock"=dword:9c40
; "HorzActive"=dword:320
; "HorzSync"=dword:28
; "HorzSyncPulse"=dword:80
; "HorzBorder"=dword:0
; "HorzBlank"=dword:100
; "HorzSize"=dword:0
; "VertActive"=dword:258
; "VertSync"=dword:1
; "VertSyncPulse"=dword:4
; "VertBorder"=dword:0
; "VertBlank"=dword:1c
; "VertSize"=dword:0
; "Flags"=dword:1e
;-------------------------------------------------------------------------
; Config 1 - sDVO Port-B (For Napa)
;-------------------------------------------------------------------------
;[HKEY_LOCAL_MACHINE\Drivers\Display\Intel\915GV\1]
; "name"="IEGD sDVO Configuration File"
;[HKEY_LOCAL_MACHINE\Drivers\Display\Intel\915GV\1\Port\2]
; "name"="svga"
;[HKEY_LOCAL_MACHINE\Drivers\Display\Intel\915GV\1\Port\2\FPInfo]
; For a sDVO driver, sample settings for the panel:1400x1050
; Only need Width & Height if Panel cannot except other timings
; "Width"=dword:578
; "Height"=dword:41A
;[HKEY_LOCAL_MACHINE\Drivers\Display\Intel\915GV\1\Port\2\Attr]
; "27"=dword:1
; Attribute "27" = Dual Channel (boolean)
; Optional - Only enable for font anti-aliasing
; Enabling this causes minor performance impact
; Only recommended for TV Output.
;[HKEY_LOCAL_MACHINE\System\GDI\Fontsmoothing]
;
;[HKEY_LOCAL_MACHINE\System\GDI]
; "ForceGRAY16"=dword:1
;****************** INTEL DISPLAY DRIVER REGISTRY ENTRY END ******************
```

## 6.4 Microsoft Windows CE 7.0* (WEC7) Installation

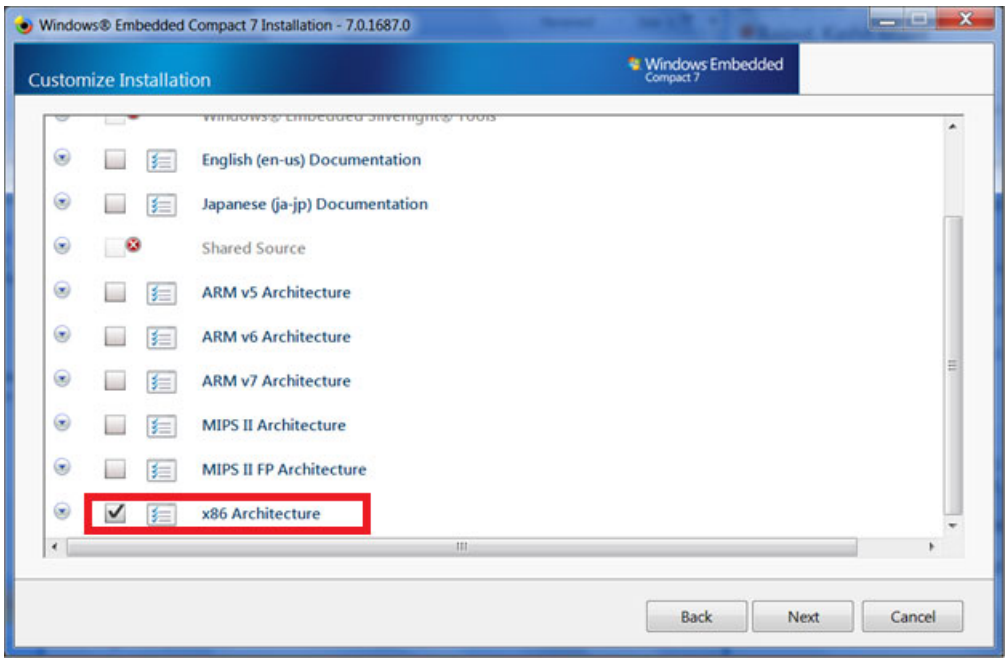
### 6.4.1 Prerequisites

- Visual Studio 2008 Professional
- Visual Studio 2008 Professional SP1
- Windows Embedded Compact 7 Platform Builder
- Board Support Package (BSP) – INTEL_WEC7_BSP_3.0.0_GOLD
- Intel Embedded Graphics Driver (IEGD) - IEGD_10_4_1_xxxx.exe

### 6.4.2 Install Steps

Please install the prerequisite software in the sequence listed below. This step is crucial in successful image compilation.

- Visual Studio 2008 Professional
- Visual Studio 2008 Professional SP1
- Windows Embedded CE 7.0 Platform Builder (please make sure to select x86 processor architecture during setup)




- Board Support Package 3.0 - BSP available for download at:
  http://www.bsquare.com/software-downloads.aspx
  http://www.adeneo-embedded.com/en/Products/Board-Support-Packages
  http://www.wipro.com/services/pes/wincebsp.htm

  Verify installation patch - `C:\WINCE700\PLATFORM\INTEL_CS`
- Intel Embedded Graphics Driver 10.4.1

  a. From the IEGD_10_4 installation path, located file IEGD 10_4_WEC7.zip at:

C:\IEGD\IEGD_10_4\plugins\com.intel.iegd.drivers_10.4.0\WEC7

b. Unzip the contents of IEGD_10_4_WEC7.zip into:
C:\WINCE700\platform\INTEL_CS\SRC\DRIVERS\IEGD

Verify creation of folder **IEGD_10_4_WEC7** after the extraction process.

Edit C:\WinCE700\platform\Intel_CS\Intel_cs.bat

Change: **BSP_Display_FLAT = 1** to: **BSP_Display_FLAT =**

Append the following code segment to the end of the file:

```
set WEC7_IEGD_DRIVER=1
```

Edit **C:\WinCE700\Platform\Intel_CS\Files\platform.reg**

Append the following code segment to the end of the file:

```
IF WEC7_IEGD_DRIVER
     [HKEY_LOCAL_MACHINE\System\GDI\DisplayCandidates]
        "Candidate6"="Drivers\\Display\\Intel"
        [$(PCI_BUS_ROOT)\Template\IEGD]
          "DisplayDll"="ddi_iegd.dll"
          "Class"=dword:03
          "SubClass"=dword:00
          "ProgIF"=dword:00
            "VendorID"=multi_sz:"8086", "8086", "8086", "8086", "8086",
     "8086", "8086", "8086", "8086", "8086", "8086", "8086", "8086",
     "8086", "8086", "8086", "8086", "8086", "8086", "8086", "8086",
     "8086", "8086", "8086", "8086", "8086", "8086"
           "DeviceID"=multi_sz:"3582", "2572", "2562", "357B", "3577",
     "1132", "7125", "7123", "7121", "2582", "2782", "2592", "2792",
     "2772", "2776", "27A2", "27A6", "2982", "2983", "29A2", "29A3",
     "2992", "2993", "2972", "2973", "2A12", "8108"

     ; include the path to the iegd.reg file in the release package
     #include
     $(PLATFORM_DRIVERS_DIR)\IEGD\IEGD_10_4_WEC7\Driver\iegd.reg
ENDIF WEC7_IEGD_DRIVER
```

Edit C:\WinCE700\Platform\Intel_CS\Files\platform.bib

a. Append the following code segment to the top of the file:

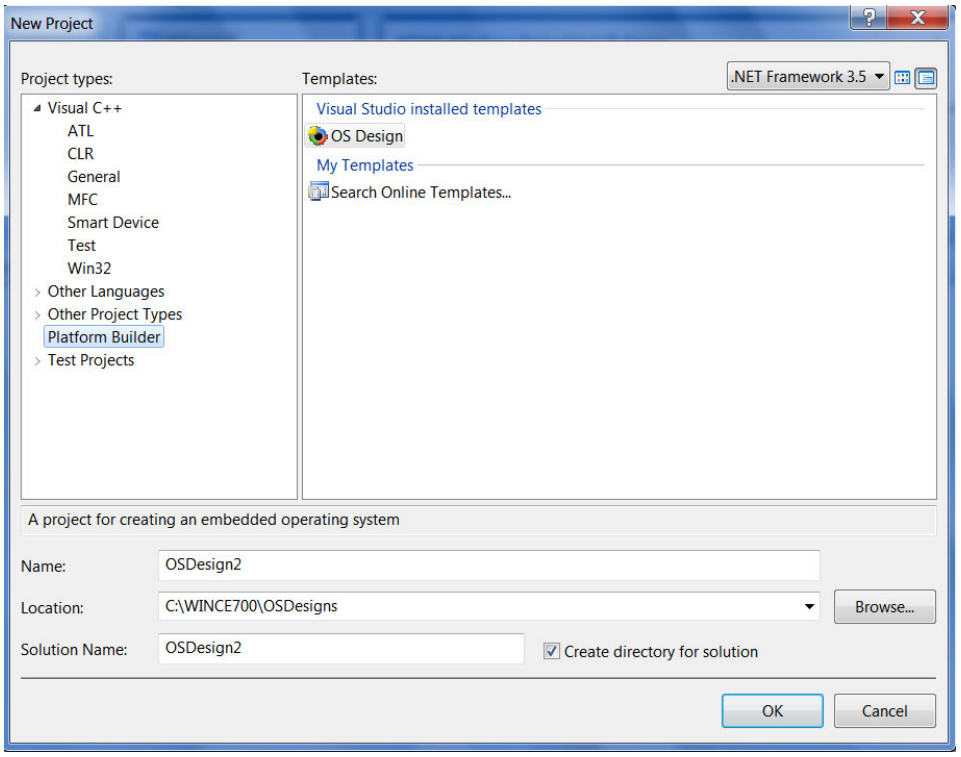
```
#define PLATFORM_DRIVERS_DIR $(_TARGETPLATROOT)\src\drivers
```

b. Append the following code segment to the bottom of the file:

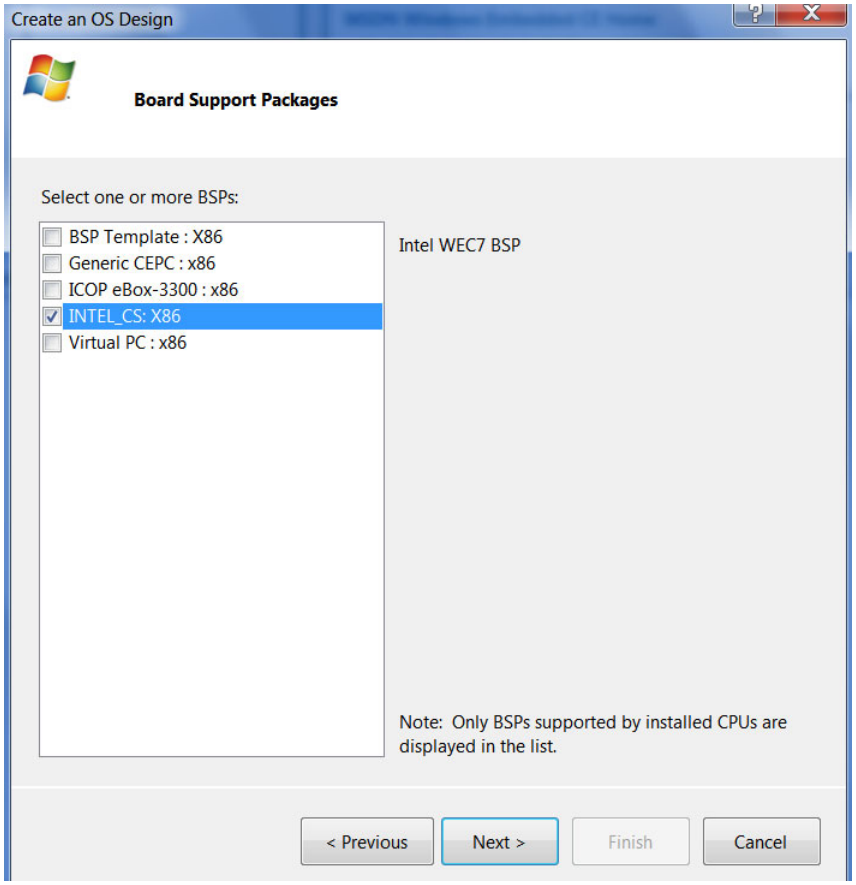
```
IF WEC7_IEGD_DRIVER

analog.dll       $(PLATFORM_DRIVERS_DIR)\IEGD\IEGD_10_4_WEC7\Driver\analog.dll   NK SHK
ddi_iegd.dll     $(PLATFORM_DRIVERS_DIR)\IEGD\IEGD_10_4_WEC7\Driver\ddi_iegd.dll NK SHK
lvds.dll         $(PLATFORM_DRIVERS_DIR)\IEGD\IEGD_10_4_WEC7\Driver\lvds.dll     NK SHK

ENDIF WEC7_IEGD_DRIVER
```

### 6.4.3 Creating an OS Design Runtime Image

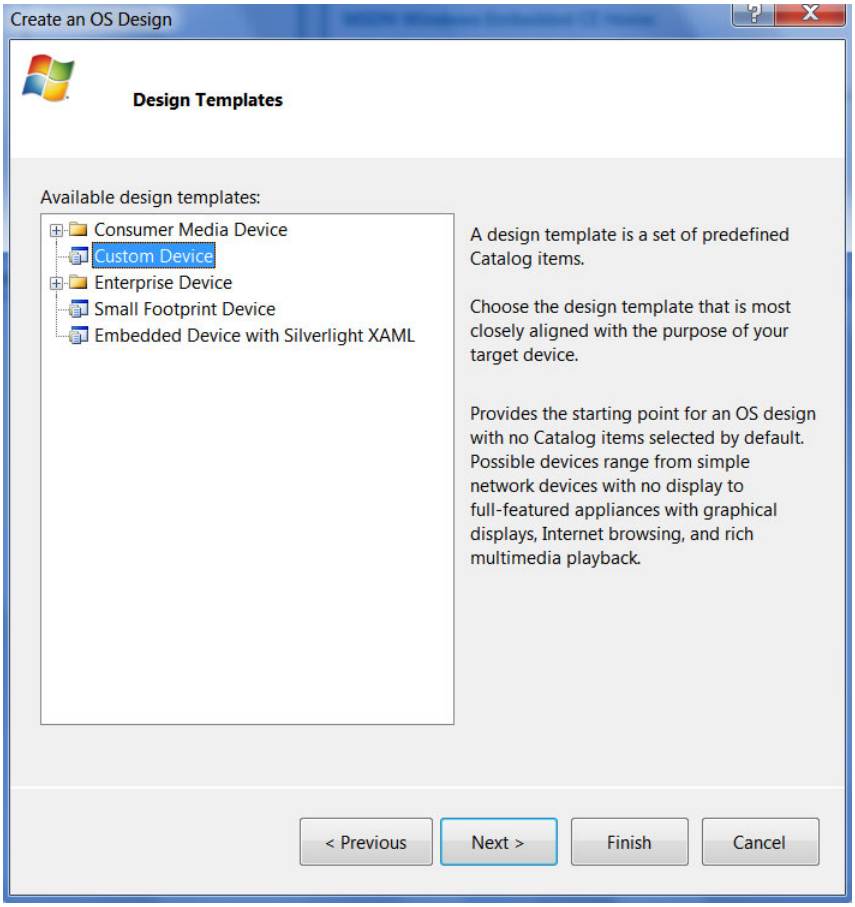
1. Start Visual Studio 2008, File -> New -> Project.
2. Select Platform Builder for CE 7.0, OS Design.



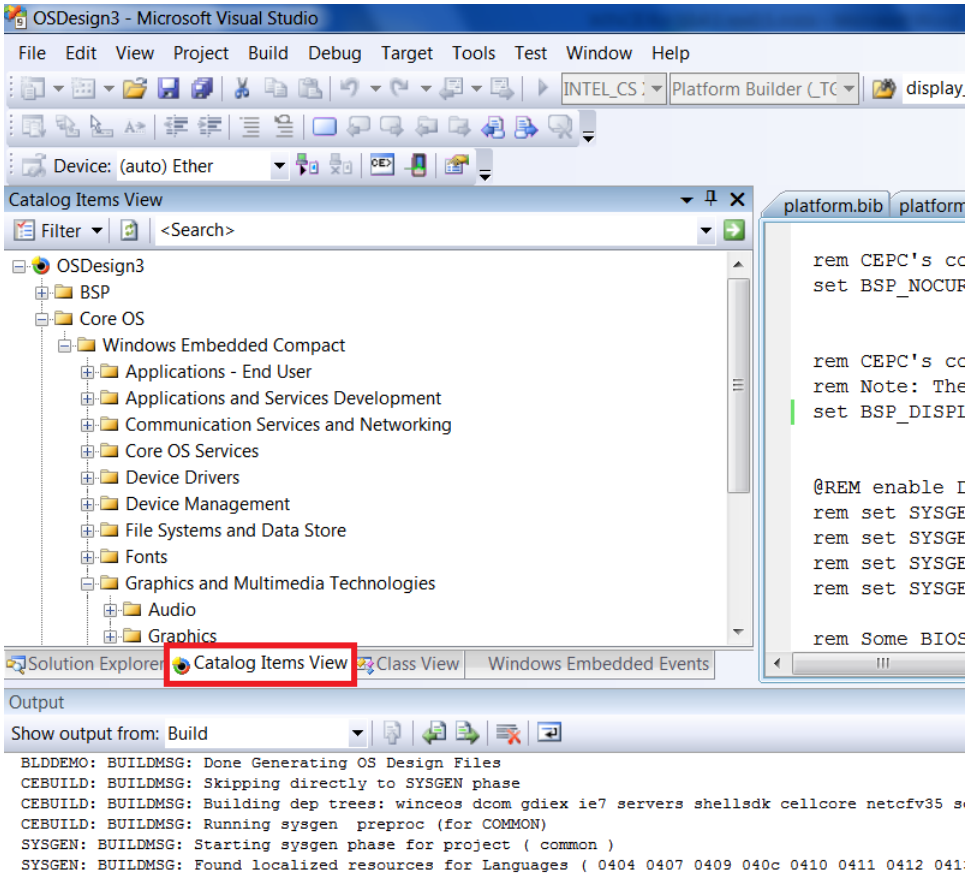

3. Select INTEL_CS: X86




4. Select your OS design template and applications according to your project needs.




Catalog items can be customized prior to image build by selecting the “Catalog Items View” tab.



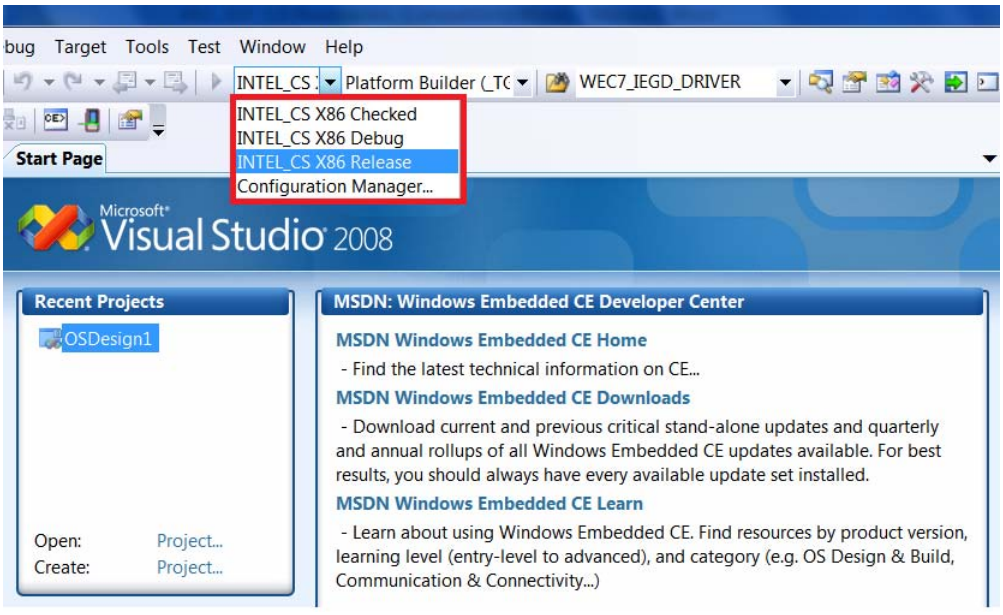

The following catalog items should be selected if you require the feature(s) to be supported:

| Features | Catalog Item Path |
|---|---|
| USB Keyboard & Mouse | Core OS\Windows Embedded Compact\Device Drivers\USB\USB Host\USB Class Drivers\USB Human Input Device (HID) Class<br>Core OS\Windows Embedded Compact\Device Drivers\USB\USB Host\USB Class Drivers\USB Human Input Device (HID) Class\USB HID Keyboard and Mouse |
| USB Mass Storage | Core OS\Windows Embedded Compact\Device Drivers\USB\USB Host\USB Class Drivers\USB Storage Class Driver |
| ATAPI (SATA & PATA) | Core OS\Windows Embedded Compact\Device Drivers\Storage Devices\ATAPI PCI Support<br>Core OS\Windows Embedded Compact\Device Drivers\Storage Devices\ATAPI PCI Support\Basic ATAPI PCI CD/DVD-ROM Support |
| Storage Manager Control Panel Applet | Core OS\Windows Embedded Compact\File Systems and Data Store\Storage Manager\Storage Manager Control Panel Applet |
| Mouse Cursor | Core OS\Windows Embedded Compact\Shell and User Interface\User Interface\Mouse |

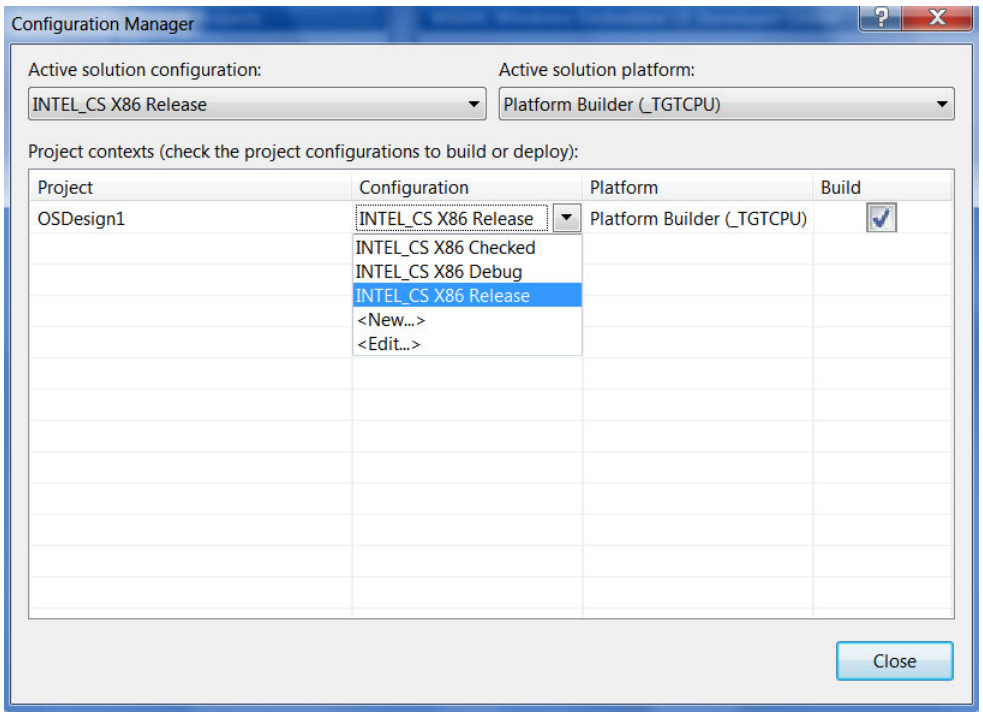
| Features | Catalog Item Path |
|---|---|
| PS/2 Keyboard & Mouse<br>***Note:*** You can only select one. | Core OS\Windows Embedded Compact\Device Drivers\Input Devices\Keyboard/Mouse\8042 PS/2 Keyboard Mouse<br>Core OS\Windows Embedded Compact\Device Drivers\Input Devices\Keyboard/Mouse\Layout Manager |
| Audio Codec | Core OS\Windows Embedded Compact\Graphics and Multimedia Technologies\Media\Audio Codecs and Renderers\MP3 Codec<br>Core OS\Windows Embedded Compact\Graphics and Multimedia Technologies\Media\Audio Codecs and Renderers\WMA Codec<br>Core OS\Windows Embedded Compact\Graphics and Multimedia Technologies\Media\Audio Codecs and Renderers\Waveform Audio Renderer<br>Core OS\Windows Embedded Compact\Graphics and Multimedia Technologies\Media\Audio Codecs and Renderers\Wave/AIFF/au/snd File Parser<br>Core OS\Windows Embedded Compact\Graphics and Multimedia Technologies\Media\Audio Codecs and Renderers\MPEG-1 Layer 1 and 2 Audio Codec<br>For more audio codec types, please refer to MSDN for more info. |
| Windows Media Player | Core OS\Windows Embedded Compact\Graphics and Multimedia Technologies\Media\WMA and MP3 Local Playback<br>Core OS\Windows Embedded Compact\Graphics and Multimedia Technologies\Media \Windows Media Player\Windows Media Player Applications\Windows Music Player<br>For more Windows Media Player option, please refer to MSDN for more info. |

### 6.4.4 Configuring OS Design

1. Select the appropriate OS design variables before initiating image compilation. Go to the solution view, right-click the OS design that you created, select properties. In the Property Page, set the "Configuration" drop-down box to **"Active(Intel_CS X86 Release)"**.

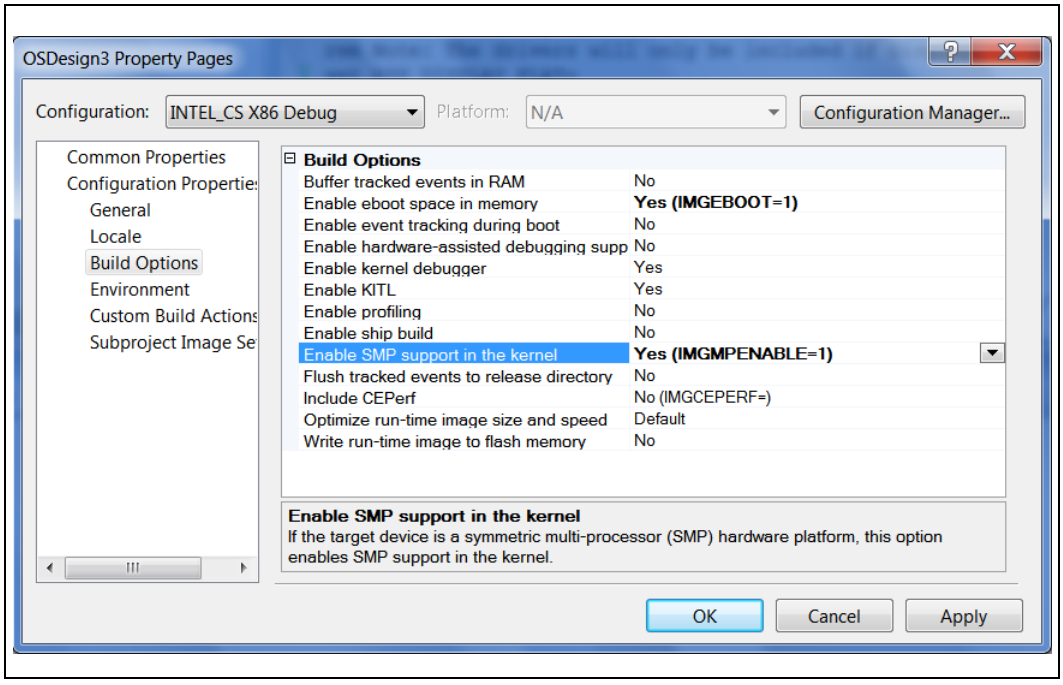


Use the Configuration Manager to designate "(Intel_CS X86 Release)" as the active configuration.



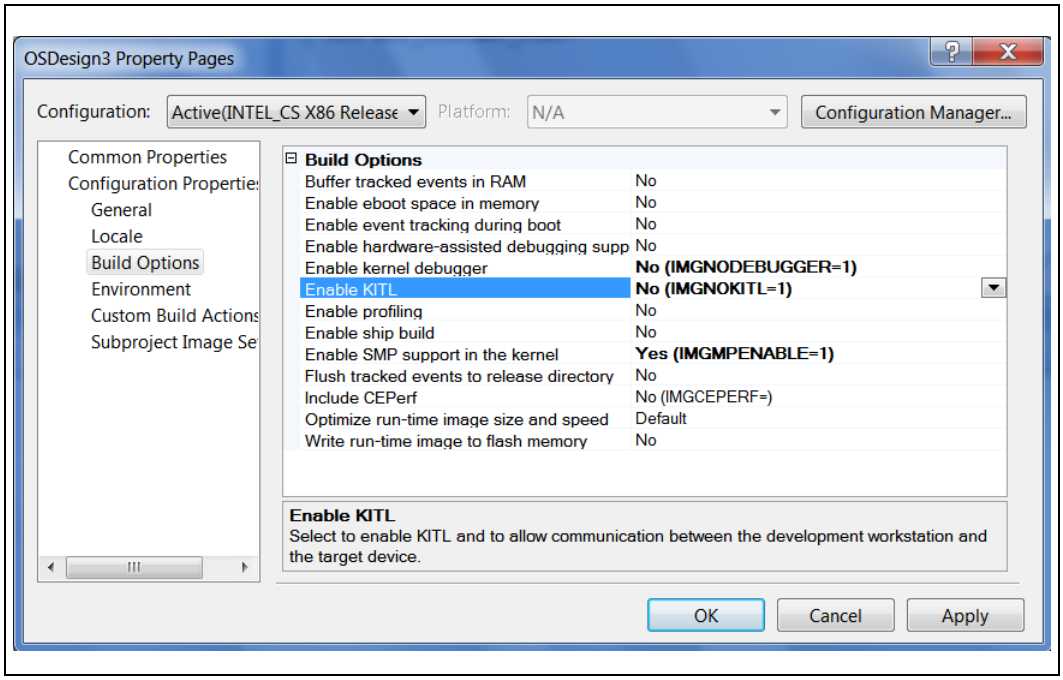

**Debug Build Options**: In the OS Design Property Page, select "Configuration Properties"->"Build Options" in the left panel. In the right panel, check the following build options for Intel_CS x86 Debug:

- Debug only: Enable eboot space in the memory (IMGEBOOT=1)
- Debug only: Enable KITL
- Debug only: Enable kernel debugger
- Enable SMP support in the kernel (IMGMPENABLE)




**Release Build Options**: In the OS Design Property Page, select "Configuration Properties"->"Build Options" in the left panel. In the right panel, check the following build options for Intel_CS x86 Release:

- Enable SMP support in the kernel (IMGMPENABLE)



### 6.4.5 Compile the OS Design

1. Go to Menu -> Build -> Build and Sysgen.
2. Go to Menu -> Build -> Make Run-Time Image

*Note:* You will see some warnings during the build process; this is normal.

The compiled run-time image, NK.bin, can be found under:

`c:\WINCE700\OSDesigns\OSDesign1\OSDesign1\RelDir\Intel_CS_x86_Release`

### 6.4.6 Loading the Runtime Image via USB

**Hardware Perquisites**

- — USB or PS/2 Keyboard
- — USB or PS/2 Mouse
- — VGA display panel
- — USB mass storage device (example: USB thumb drive)

**Boot BIOS Configuration**

- — Please verify that the Board BIOs Version is CMCKG049.
- — Configure Boot Option Priorities so that the USB device is Boot Option #1.

**Boot Device Setup**

Please follow the following instructions in the exact sequence outlined below for successful runtime image boot.

1. Ensure your USB thumb drive is a DOS-bootable formatted.

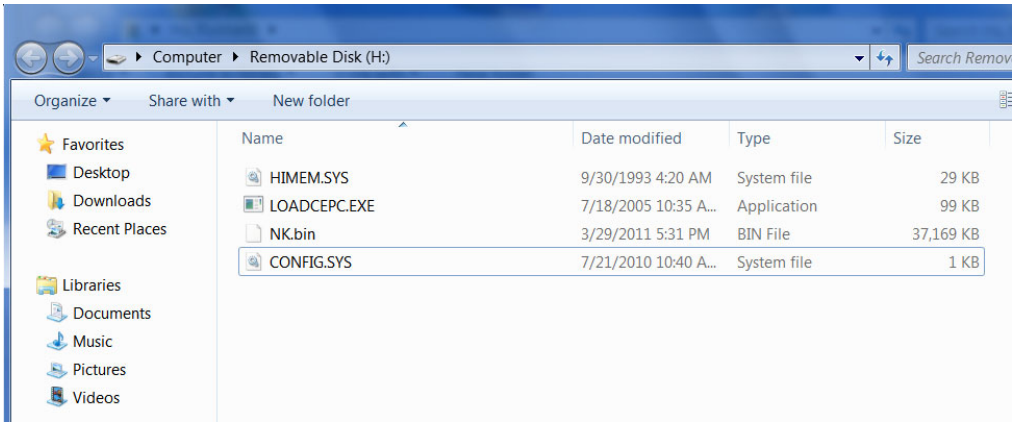
- Launch the program “HP USB Disk Storage Format Tool”
- Under “Device”, select the appropriate USB drive
- Select the following options:
  - — “File system” → FAT
  - — “Format options” → Quick format
  - — “Format options” → Create a DOS startup disk
  - — Browse to the location of the downloaded Win 98 boot files
  - — Click “Start”

2. Files required to load WEC7 runtime image (nk.bin)

- himem.sys (DOS systems file)
- config.sys (DOS systems file)
- loadcepc.exe (**C:\WINCE700\PLATFORM\CEPC\SRC|BOOTLOADER\DOS**)
- The two DOS files can be generated by MakeImageDisk.exe located under the following path. Please note you will need a floppy drive device.

  **C:\Program Files (x86)\Microsoft Platform Builder\7.00\cepb\utilities.**

3. Copy the desired WEC7 runtime image (nk.bin) to the USB device.




- Loading Runtime Image
  - Boot up your embedded platform.
  - Once DOS is loaded, issue command "**loadcepc /L:800x600x16 nk.bin**" at the prompt. This will load up the WEC7 nk.bin on your embedded device.

*Note:* For WEC7 images not using IEGD as the graphics display driver, issue command "**loadcepc /L:640x480x16 nk.bin**" at the prompt.

# 7.0 Installing and Configuring Linux* OS Drivers

This describes the configuration and installation of IEGD for Linux* systems. IEGD supports X Servers from the X.org* organization.

The Intel Linux driver is for use with the graphics core integrated into Intel chipsets that comprise the Embedded Intel Architecture roadmap. The driver supports 8-, 16- and 24-bit pixel depths, dual independent head configuration on capable hardware, flat panel, hardware 2D acceleration, hardware cursor, the XV extension, and the Xinerama extension. Stock library files, for example `libva`, can be used with IEGD.

## 7.1 Overview

Kernel patches, separate DRM modules, and kernel recompilation were all necessary in previous versions of IEGD. In version 10.4, the IEGD Kernel Module (IKM) contains a combination of the AGPGART and DRM modules which must be present for IEGD. Both modules have been modified for the IEGD architecture and are combined with the Linux kernel.

IEGD Linux distribution package contains drivers built for the following X Servers:

- X Server 1.5.3
- X Server 1.6.x

IEGD has been tested with the official version of these servers from the http://www.X.org Web site and may not operate with other versions of these servers.

During the installation, the `X -version` command returns a result indicating the server version, not the X.org version as was done in earlier versions.

## 7.2 Prerequisites

The following lists the prerequisites for installing and configuring the IEGD Linux* driver.

- Platform with supported Intel chipset.
- Platform with a minimum of 128 Mbytes.
- Resolution and timing specifications for the display devices that will be configured.
- Driver package consisting of directories and files (see the following reduced samples, which are located under the IEGD `Linux` directory).

*Note:* In the following, "Xorg-xserver 1.5.3/ is an example X Server version that should be replaced with the version to be used.

  - Documents/Relnotes
    Documents/UsersGuide.pdf
    Documents/Xorg-xserver 1.5.3/iegd.4
    Documents/Xorg-xserver 1.5.3/IntelEscape.3x
  - License/License.txt
  - Driver/<xserver name>/iegd_drv.o (or iegd_drv.so for Xorg 7.0)
    Driver/<xserver name>/libXlibXiegd_escape.a
    Driver/<xserver name>/libXiegd_escape.so.2.0.0
    Driver/<xserver name>/iegd_escape.h
    Driver/<xserver name>/lvds.so
    Driver/<xserver name>/tv.so

- Linux kernel header package for active running kernel.
  - Direct Rendering support enabled.
- Other system capabilities
  - IEGD Kernel Module for GART and DRM patches
- System administration privileges.

### 7.2.1 Supported Hardware

IEGD supports the following chipsets with integrated graphics:

- Intel® Atom™ Processor 400 and 500 Series
- Intel® Q45/G41/G45 Express chipset
- Intel® GM45/GL40/GS45 Express chipset
- Intel® System Controller Hub US15W/US15WP/WPT chipset
- Intel® Q35 Express chipset
- Mobile Intel® GLE960/GME965 Express chipset
- Intel® Q965 Express chipset
- Mobile Intel® 945GSE Express chipset
- Mobile Intel® 945GME Express chipset
- Intel® 945G Express chipset
- Intel® 915GV Express chipset
- Mobile Intel® 915GME Express chipset
- Mobile Intel® 910GMLE Express chipset

## 7.3 Installation

Refer to Section 1.7, “Downloading IEGD and Video BIOS” on page 22 for instructions on obtaining the software. You can then install IEGD by executing the instructions for your specific Linux distribution found in the following sections:

- “Linux Installer Overview”
- “Installing Fedora 10” on page 163
- “Installing Moblin 2.1 IVI (for Intel® US15W only)” on page 166

*Note:* Linux versions of IEGD do not exist separately. You must use CED on a Windows system to build a Linux driver version of IEGD and then transfer it to the Linux system for installation. If you use a Linux distribution different from this list, you may need to adapt the instruction steps.

### 7.3.1 Linux Installer Overview

The Linux installer does the following:

- Automatically copies all appropriate IEGD files for detected kernel version and X Server.
- Invokes the Intel Kernel Module (IKM) to patch the kernel.
- Runs AGP and DRM tests to make sure IKM was installed correctly.
- Invokes `modprobe` to enable IEGD module.
- Creates a shortcut to the IEGD GUI on the desktop.
- Supports uninstallation of IEGD.

The Linux Installer script is located in a compressed tarball (TGZ file) in the path, `IEGD_10_4_Linux/Utilities/install.sh`.

After extracting everything from the TGZ file, to execute the installer, change to the directory containing the installer and run the following command:

```
./install.sh
```

To uninstall the IEGD files, run the following command:

```
./install.sh -u
```

*Note:* The IEGD Linux Installer does not support all distributions. You may have to do a manual installation if your distribution is not supported. If an unsupported distribution is detected by the Linux installer, you have the option to continue the installation manually.

### Installation Steps

1. Log into a system administration account.
2. Untar the driver package to a convenient location.

   **tar -xvzf <driver package.tgz>**

   This creates a directory structure in the directory where you extracted the `.tgz` file and contains the following directories:

   — `IEGD_10_4_Linux` - Contains the Documents, Driver, License, IKM, and Utilities subdirectories.
   - The *Driver* directory contains subdirectories for the supported versions of the X.org X Servers. This directory contains `man` pages for IEGD.
   - The *Documents* directory contains the release notes.
   - The *License* directory contains the license for the IEGD release.
   - The *Utilities* directory contains IEGD utilities, including the `iegdgui` runtime configuration utility.
   - The *IKM* directory contains files for patching the Linux kernel AGPGART module.
3. Invoke the Linux installer using the command **./install.sh** from the `IEGD_10_4_Linux/Utilities` folder. If successful, skip to step 11.

*Note:* If the installer does not work, use the following manual install steps.

4. Check the version of the X Server your system is running. Type the following command:

   **X -version**

*Note:* For Fedora 7 (F7), the result from this command is 1.3.

5. Copy the IEGD binary, `iegd_drv.o` (or `iegd_drv.so`), from the `IEGD_10_4_Linux/driver/<xserver name>` directory to the X Server's `modules/drivers` directory.

   For F7 (X Server 1.3-based distribution), the default location is `/usr/lib/xorg/modules/drivers`. This location can vary by distribution so check your system for the proper path.

   **cd IEGD_10_4_Linux/driver/Xorg-xserver-1.3**

   **cp iegd_drv.so /usr/lib/xorg/modules/drivers**
6. Copy the necessary port driver files (*.so files in the `IEGD_10_4_Linux/driver/<xserver name>` directory) to the X Server `lib/modules` directory. The default installation location is `/usr/lib/xorg/modules`. This location can vary, so check your system for the proper path. After the required port drivers have been copied, you can specify them in the PortDrivers option in the Device section of the config file. For more information on specifying the PortDrivers option, refer to Table 44, “Supported Driver Options” on page 183. For example, to copy all the port drivers use the following command:

   **cp *.so /usr/lib/xorg/modules**
7. Copy the escape control library `libXiegd_escape.so.2.0.0` from the `IEGD_10_4_Linux/driver/<xserver name>` directory to the X Server library directory. The default installation location is `/usr/lib`. For example,

   **cp libXiegd_escape.so.2.0.0 /usr/lib**

8. In the X Server library directory, create symbolic links for the escape library aliases:

   **cd /usr/lib**
   **ln -sfv libXiegd_escape.so.2.0.0 libXiegd_escape.so**
   **ln -sfv libXiegd_escape.so.2.0.0 libXiegd_escape.so.2**
   **ldconfig**

9. From the X Server directory you are using, unzip the `iegd.4.gz` file and copy the driver man page, `iegd.4`, to the `man/man4` directory. The default installation location is `/usr/share/man/man4`. This location can vary by distribution so check your system for the proper path. For example, for Fedora 7,

   **cd IEGD_10_4_Linux/driver/Xorg-xserver-1.3**

   **cp iegd.4.gz /usr/share/man/man4**

   **cp iegd_escape.3x.gz /usr/share/man/man3x**

10. Execute the following commands:

    **cd IEGD_10_4_Linux/IKM**

    **./install.sh**

    (Note: if a permissions error is displayed, do a **chmod +x install.sh**)

    **modprobe iegd_mod**

11. Modify your `xorg.conf` file to include a device section for this driver and a Monitor section for your display. See Section 7.6.1, “Configuration Overview” on page 176 for details on the driver configuration and the list of supported options. The default installation location for this file is `/etc/X11`.

12. Reboot

### 7.3.2 Installing Fedora 10

To install IEGD v10.4 on Fedora 10, use the following steps:

- “Installation Steps” on page 164
- “OpenGL Installation” on page 193

*Note:* Before installing Fedora, determine whether you need to do either or all of the following:

- Disable SELinux security to allow IEGD to load. To disable it, use the Security application in X. If you do not disable SELinux security, you will need to configure SELinux to allow IEGD to operate.
- Disable AIGLX because IEGD does not support or work with it. To disable AIGLX, add the **Option “AIGLX” “FALSE”** command to the `xorg.conf` file in the ServerFlags section.

*Notes:* There are known bugs in the X.org X Server 1.5.3 version used by Fedora 10. The bugs affect OpenGL applications.

Without applying the work-around below, many OpenGL applications will not display properly and display only a blank (black) window.

A simple workaround, described below, is needed for distributions using a 1.5.x version of the X Server, however it does not apply to 1.6.0 version of the X Server.

**Workaround for AIGLX and X Server version 1.5.x**

*Note:* This workaround applies to the two previous bullets above.

In the xorg.conf file, set the “GlxVisuals” option to “all.” This goes in the ServerFlags section of the file, as shown in the following example:

```
Section "ServerFlags"
   Option "Xinerama" "False"
   Option "AllowMouseOpenFail" "1"
   Option "BlankTime" "0"
   ….
   Option "AIGLX" "False"
   Option "GlxVisuals" "all"
EndSection
```

**Installation Steps**

1. Log into a system administration account.
2. Extract the driver package from the compressed tar (TGZ) file to a convenient location. For example, you may want to collect all IEGD software into a subdirectory under one directory in `/etc/X11`:

   **cd /etc/X11**

   **mkdir iegd**

   **cd iegd**

   **tar -xvzf <driver package.tgz>**

   This creates a subdirectory structure in the directory where you extracted the .tgz file containing the following directories:

   — `IEGD_10_4_Linux` - Contains the Documents, Driver, License, IKM, and Utilities subdirectories.
   - The *Driver* directory contains subdirectories for the supported versions of the X.org X Servers. This directory contains `man` pages for IEGD.
   - The *Documents* directory contains the release notes.
   - The *License* directory contains the license for the IEGD release.
   - The *Utilities* directory contains IEGD utilities, including the `iegdgui` runtime configuration utility.
   - The *IKM* directory contains files for patching the Linux kernel AGPGART module.
3. Check the X Server version your system is running. Type the following command:

   **X -version**

*Note:* For Fedora 10, the server version this command reports is 1.5.3.

4. Before installing, if you have a working `xorg.conf` file using another driver, such as “vesa,” consider starting X (**startx**), opening a terminal, and running the glxgears program for half a minute or so. This program displays rotating gears using OpenGL and gives a frame rate average for the animation. After installing IEGD, comparing this “before picture” frame rate could be informative.
5. Copy the IEGD binary, `iegd_drv.so` from the `IEGD_10_4_Linux/driver/<xserver name>` directory to the X Server's `modules/drivers` directory.

   For F10 (X Server 1.5.3 based distribution), the default location is `/usr/lib/xorg/modules`. This location can vary by distribution so check your system for the proper path. You can discover your system's setting by running the command **X -showDefaultModulePath** and also checking your current `/etc/X11/xorg.conf` to see whether a “Files” section has changed the default ModulePath.

   **cd IEGD_10_4_Linux/driver/Xorg-xserver-1.5.3**

   **cp -p iegd_drv.so /usr/lib/xorg/modules/drivers**

*Note:* Using “cp -p” preserves the original files' permissions into the copies.

6. Copy the necessary port driver files (some, not all, of the *.so files in the IEGD_10_4_Linux/driver/<xserver name> directory) to the X Server lib/modules directory. After the required port drivers have been copied, you can specify them in the PortDrivers option in the Device section of the config file. For more information on specifying the PortDrivers option, refer to Table 44, “Supported Driver Options” on page 183. For example:

   **cp -p {analog,hdmi,lvds,sdvo,softpd,tv}.so /usr/lib/xorg/modules**

7. Copy the escape control library libXiegd_escape.so.2.0.0 from the IEGD_10_4_Linux/driver/<xserver name> directory to the X Server library directory. The default installation location is /usr/lib. You can see your system's setting by running the **X -showDefaultLibPath** command.

   **cp -p libXiegd_escape.so.2.0.0 /usr/lib**

8. Copy the driver man pages:

   **cp -p iegd.4.gz /usr/share/man/man4**

   **cp -p iegd_escape.3x.gz /usr/share/man/man3x**

   If you want to install OpenGL, add the following command:

   **cp -p iegd_dri.so /usr/lib/dri**

   — For OpenGL pick only one of the following link commands according to your chipset, then copy what the link points to into the library directory:

   **ln -s libGL_ga.so.1.2 libGL.so.1.2** (only for US15W chipset)

   **ln -s libGLgn3.so libGL.so.1.2** (only for 910/915/945/Intel Atom Processor 400 and 500 series)

   **ln -s libGLgn4.so libGL.so.1.2** (only 965/GM45 chipsets)

   **cp -p libGL.so.1.2 /usr/lib** (answer **y** to the overwrite query)

*Note:* Using “ln -s” makes a symbolic link to a file, which “ln -l” (long listing) will reveal in the future.

   — For OpenGL/ES add the following commands:

   **cp -p lib{EGL,GLES}* /usr/lib**

   **cp -p egl_*dri.so /usr/lib**

9. In the library directories, create symbolic links for the library aliases that need special handling and notify the linker of the library files' locations:

   **cd /usr/lib**

   **ln -s libXiegd_escape.so.2.0.0 libXiegd_escape.so**

   **ln -sf libGL.so.1 libGL.so**

   **cd /lib**

   **ln -s libexpat.so.1.5.2 libexpat.so.0**

   **ldconfig**

10. Install IKM and add the Xorg file. The install.sh script and another script it uses are missing execute permissions. Run the following commands:

    **cd /etc/X11/iegd/IEGD_10_4_Linux/IKM**

    **chmod +x install.sh kernelchecker_tests/ikmchecker.sh**

    **./install.sh** (Answer y to the install module query)

    **depmod -ae**

    **modprobe iegd_mod**

11. Reboot.

12. After reboot:
    a. **LIBGL_DEBUG=VERBOSE glxinfo**
       The result of this command provides information about the OpenGL environment.
    b. glxgears
       The result of this command displays spinning gears. Let it run for half a minute or so to see the frame rate. Compare this rate with the rate from before IEGD was installed.
    **c. export _GL_FSAA_MODE=4 # enable MSAA**
       **export _GL_FSAA_MODE=0 # disable MSAA**
       **export _GL_FSAA_MODE=1 # alternate disable MSAA**

       These environment variable settings enable or disable Multi-Sample Anti-Aliasing (MSAA) in OpenGL/ES on the Intel US15W. Consider putting your default setting into a system-wide startup script, such as `/etc/profile.d/opengles.sh` or in `/etc/bashrc`.

### 7.3.3 Installing Moblin 2.1 IVI (for Intel® US15W only)

There are two ways to get IEGD on Moblin:

- Install the pre-integrated Moblin image (see Section 7.3.3.1)

  OR

- Manually install IEGD on Moblin by doing the following:
  - "Preparing for the Intel Embedded Graphics Driver Installation"
  - "Installing the Intel Embedded Graphics Driver (IEGD) for Moblin 2.1"

#### 7.3.3.1 Install the Pre-integrated Moblin Image

1. Download the pre-integrated Moblin image from the moblin.org site at http://moblin.org/projects/ivi
2. Follow the installation directions at moblin.org to create a live USB flash image and install on a hard disk.

#### 7.3.3.2 Manually Installing IEGD

1. Download and install the standalone Moblin image with open source VESA driver. This image is available from Moblin.org at: http://moblin.org/projects/2.1-ivi-fc-release.
2. Follow the installation directions at moblin.org to create a live USB flash image and install on a hard disk.

#### 7.3.3.3 Preparing for the Intel Embedded Graphics Driver Installation

Proceed with the following installation steps.

1. Log in as SuperUser.
2. Edit `grub.conf` and comment out the line with splash screen:
   **vi /boot/grub/grub.conf**

   This step is recommended so that the system can be debugged instead of remaining stuck at the splash screen or blank screen.
3. Edit the `inittab` file using the following command and change the default value from 5 to 3:
   **vi /etc/inittab**

#### 7.3.3.4 Installing the Intel Embedded Graphics Driver (IEGD) for Moblin 2.1

1. Untar the driver package to a convenient location using the following command:

   **tar -xvzf <*driver package.tgz*>**

   This creates a directory structure in the directory where you extracted the .tgz file. It contains the following directories:

   — `IEGD_10_4_Linux` - Contains the Documents, Driver, License, IKM, and Utilities subdirectories.
   - The *Documents* subdirectory contains the release notes for IEGD.
   - The *Driver* directory contains subdirectories for the supported versions of the X.org X Servers.
   - The *License* directory contains the license for the IEGD release.
   - The *Utilities* directory contains IEGD utilities, including the `iegdgui` runtime configuration utility.
   - The *IKM* directory contains files for patching the Linux kernel AGPGART module.
2. Verify the version of the X Server your system is running using the following command:
   **X -version**

*Note:* For Moblin 2.1, the result from this command should be 1.6.4.901.

3. Copy the IEGD binary, `iegd_drv.o` (or `iegd_drv.so`), from the `IEGD_10_4_Linux/driver/<xserver name_version>` directory to the X server's `modules/drivers` directory using the commands below. For Moblin 2.1 (X Server 1.6-based distribution), the default location is `/usr/lib/xorg/modules/drivers`.

*Note:* The default location can vary by distribution so check your system for the proper path.

**cd IEGD_10_4_Linux/driver/Xorg-xserver-1.6.4.901**
**cp iegd_drv.so /usr/lib/xorg/modules/drivers**
**cp iegd_drv_video.so /usr/lib/xorg/modules/drivers**

**cp lvds.so /usr/lib/xorg/modules**
**cp sdvo.so /usr/lib/xorg/modules**

**cp iegd_dri.so /usr/lib/dri**
**cp libGL_ga.so.1.2 /usr/lib**

```
cp libva.so.0.29.0 /usr/lib
cp libXiegd_escape.so.2.0.0 /usr/lib

cp libEGL.so.1.0 /usr/lib
cp libGLESv1_CM.so.1.1.0 /usr/lib
cp libGLESv2.so.2.0.0 /usr/lib
cp egl_xdri.so /usr/lib
cp egl_iegd_dri.so /usr/lib/dri
```

4. In the lib directory, create symbolic links for the following aliases:

```
cd /usr/lib

ln -sfv libXiegd_escape.so.2.0.0 libXiegd_escape.so
ln -sfv libXiegd_escape.so.2.0.0 libXiegd_escape.so.2

ln -sfv libva.so.0.29.0 libva.so.0.29
ln -sfv libva.so.0.29.0 libva.so.0
ln -sfv libva.so.0.29.0 libva.so

ln -sfv libGL_ga.so.1.2 libGL.so
ln -sfv libGL_ga.so.1.2 libGL.so.1
ln -sfv libGL_ga.so.1.2 libGL.so.1.2

ln -sfv libEGL.so.1.0 libEGL.so
ln -sfv libEGL.so.1.0 libEGL.so.1

ln -sfv libGLESv1_CM.so.1.1.0 libGLESv1_CM.so.1
ln -sfv libGLESv1_CM.so.1.1.0 libGLESv1_CM.so
ln -sfv libGLESv2.so.2.0.0 libGLESv2.so.2.0
ln -sfv libGLESv2.so.2.0.0 libGLESv2.so.2
ln -sfv libGLESv2.so.2.0.0 libGLESv2.so

cd /lib

ln -sfv libexpat.so.1.5.2 libexpat.so.0
ldconfig
```

*Note:* If an error is displayed, “command not found” then use **/sbin/ldconfig** in place of the **ldconfig** command above.

5. Execute the following commands:

```
cd IEGD_10_4_Linux/IKM
./install.sh
```

(Answer **y** to the install module query)

*Note:* If a permissions error is displayed, do a **chmod +x install.sh** or try using the command **sudo bash ./install.sh**

```
modprobe iegd_mod
```

*Note:* If an error is displayed, “command not found” then use **/sbin/modprobe iegd_mod** in place of the command above.

6. Modify your `xorg.conf` file to include a device section for this driver and a monitor section for your display.

   The default installation location for this file is `/etc/X11`.

*Note:* You need to use the Configuration EDitor tool (CED) to create an IEGD compatible `xorg.conf` file that correctly uses IEGD as the driver and sets the IEGD configuration properly. See "Platform Configuration Using CED" on page 31 for details.

7. Reboot.

#### 7.3.3.5 Known Issues

If you encounter text corruption, please set your default color depth to 24-bit in the screen section in the `xorg.conf`. See "Screen Section" on page 182 for details.

## 7.4 IKM Patch Instructions

The IKM process is designed to replace the need to patch your kernel GART and DRM.

See also the following topics:

- "Finding and Installing the Kernel Source (Headers)"
- "Installing IKM with Fedora"
- "Using the IEGD Kernel Module"
- "Linux Installer IKM Validation"
- "Uninstalling the IKM"

### 7.4.1 Finding and Installing the Kernel Source (Headers)

- Building the IKM requires kernel headers and the kernel config file for the kernel the IKM will be created for.
- KERNEL_VERSION is the output of the command **uname -r**
- If you use a kernel from your distribution you will typically have a package with all the files required to build kernel modules for your kernel image.
  - On Fedora and compatibles this is the `kernel-devel` package. Or if you run `kernel-smp` or `kernel-xen`, you need `kernel-smp-devel` or `kernel-xen-devel`, respectively.
  - In some distributions (e.g., Fedora) the installation of the `kernel-devel` / `kernel-headers` package will be a newer version than the one you currently run. In such a case, you may need to upgrade the kernel package itself and reboot.
  - If you update the kernel you may also need to edit `/etc/grub.conf` (a symlink for `/boot/grub/grub.conf`, also known as `/boot/grub/menu.lst`) to put the new kernel into the boot list. After validating the new kernel, change the "default" setting to point to the new kernel entry in the boot list, or change the new kernel's listing to the first position and leave the setting, "default=0".

### 7.4.2 Installing IKM with Fedora

This section can be used if you are trying to get a non-supported LINUX distribution running with IKM. Fedora 10 is not supported for these instructions.

1. Install `kernel-$ARCH-devel`. The version of the package must be the same as the running kernel. Replace $ARCH with architecture of the kernel (e.g., smp).
2. Install `Kernel-devel` from the CD/DVD or through the `yum` utility.
3. Install the kernel source for the version you are running by choosing one of the following methods.
   - If you are using a CD or DVD, search for the RPM package for `kernel-$ARCH-devel` and install using

     **rpm -ivh kernel-$ARCH-devel**
   - For the `yum` utility, type the following command:

     **yum install kernel-devel**

     This will install `kernel-devel` and resolve dependencies. Note that, as stated earlier, `kernel-devel` that is installed through this method might not be the same version as a running kernel. In this case IKM compilation might be successful, however, when trying to insert it into the running kernel, **modprobe/insmod** will produce an error. The solution is to upgrade the kernel-package itself and reboot to make the Linux* OS run the updated kernel.
4. (Optional) Hardlink is a utility that consolidates duplicates files in one or more directories by traversing the directories and searching for duplicate files. When Hardlink finds duplicate files, it uses one of them as the master, removes all other duplicates, and places a hardlink for each one pointing to the master file.

*Note:* Hardlink is not necessary for IEGD installation. If you cannot download Hardlink from the link below, you can skip this step without affecting the installation outcome.

   Download Hardlink from the Fedora site:
   http://archive.fedoraproject.org/pub/archive/fedora/linux/core/5/i386/os/Fedora/RPMS/hardlink-1.0-1.21.2.i386.rpm

5. Install Hardlink using one of the methods described below.
   - Run the following command:

     **rpm -ivh hardlink-1.0-1.21.2.i386.rpm**
   - Run the following command through yum utility, making sure the computer is connected to the Internet:

     **yum install hardlink**

   Hardlink is now installed and will resolve any dependencies.
6. Compile the module using the following commands:

   **cd IEGD_10_4_Linux/IKM**

   **./install.sh**

   (Answer **y** to the install module query)

   **depmod -a**

   **modprobe iegd_mod**
7. Modify your xorg.conf file to include a device section for this driver and a Monitor section for your display. See Section 7.6.1, “Configuration Overview” on page 176 for details on the driver configuration and the list of supported options. The default installation location for this file is `/etc/X11`.

8. Reboot.

At this point, when X Windows starts, it should be using IEGD as the driver. To verify this, you can check your Xorg log, or run the `iegdgui` utility found in the Utilities directory.

*Note:* You may need to set the `iegdgui` file properties to be executable before it will run.

### 7.4.3 Using the IEGD Kernel Module

*Note:* Run this after adding the IEGD components and updating the symbolic links in the Linux* OS.

An installation script is provided that generates the Makefile together with the compilation environment for that particular kernel or distro. To install the IKM, run the shell script provided:

**cd IEGD_10_4_Linux/IKM**

**./install.sh**

(Answer **y** to the install module query)

(Note: if a permissions error is displayed, do a **chmod +x install.sh**)

The installation script detects the kernel version and points to the proper header files location before creating the Makefile. The script then calls the Make program to start the compiling process. After compiling is complete, the script tries to install the IKM. If the script is run as a normal user, it prompts for the superuser password before copying the generated file, and then runs a **depmod -a** command to resolve module dependencies.

To insert the module into the kernel, run

**modprobe iegd_mod**

This will load all the modules that iegd_mod depends on before loading iegd_mod itself.

IKM installation requires a matching kernel source tree and a working Linux build system. Some of the programs require additional libraries.

### 7.4.4 Linux Installer IKM Validation

The Linux Installer also validates the IKM installation using AGP and DRM tests to verify that it is installed and working correctly, as described below.

#### 7.4.4.1 AGP Test

The AGP test opens the AGPGART component and then communicates using IOCTLs to ensure that the AGP portion of the IKM works.

You may see “Error on AGPIOC_BIND. Trying new address for bind 8000.” This is OK. The validation test is looking for unused memory. If an actual error occurs, the script test will immediately exit.

#### 7.4.4.2 DRM Test

The DRM tests work similarly. It is a comprehensive set of tests to verify the functionality of all device file interfaces. The test opens the DRM and communicates using the IOCTLs to ensure that the DRM portion of the IKM works.

Compilation for AGP

**cd .../IEGD_10_4_Linux/IKM/agp**
**gcc –o agp_test agp_test.c**

Compilation for DRM

**cd .../IEGD_10_4_Linux/IKM/drm**
**gcc –o drm_test drm_test.c**

Execution

Optional parameter **–v** [verbose mode].

AGP

**./agp_test**

DRM

**./drm_test**

#### 7.4.4.3 Kernel Checker

The kernel checker ensures that the Kernel API that IKM depends on exists.

When you run `install.sh` it calls the `ikmchecker.sh`, which is found in the `kernelchecker_tests` folder. Next, you see the message, "Checking kernel dependencies ..." After executing the script a `build.log` file in the `kernelchecker_tests` folder contains the results of the compilation. If an error occurred there will be an `error.log` file appears in that folder and the error will display on the console. The APIs that the Linux installer checks for are shown in tables 35 through 43.

**Table 35. Memory Management Functions**

| S.No | APIS | Header Files |
|---|---|---|
| 1 | vfree | <linux/vmalloc.h> |
| 2 | kfree | <linux/slab.h> |
| 3 | alloc_pages | <linux/gfp.h> |
| 4 | __get_free_pages | <linux/gfp.h> |
| 5 | free_pages | <linux/gfp.h> |
| 6 | kmalloc | <linux/slab.h> |
| 7 | do _munmap | <linux/mm.h> |
| 8 | do_mmap | <linux/mm.h> |
| 9 | get_page | <linux/mm.h> |
| 10 | put_page | <linux/mm/h> |
| 11 | page_mapcount | <linux/mm.h> |
| 12 | memset | <linux/string.h> |

### Table 36. PCI Related Routines

| S.No | APIS | Header Files |
|---|---|---|
| 1 | pci_save_state | <linux/pci.h> |
| 2 | pci_restore_state | <linux/pci.h> |
| 3 | pci_find_capability | <linux/pci.h> |
| 4 | pci_get_device | <linux/pci.h> |
| 5 | pci_dev_driver | <linux/pci.h> |
| 6 | pci_register_driver | <linux/pci.h> |
| 7 | pci_unregister_driver | <linux/pci.h> |
| 8 | pci_dev_put | <linux/pci.h> |
| 9 | pci_assign_resource | <linux/pci.h> |
| 10 | pci_enable_device | <linux/pci.h> |
| 11 | pci_read_config_dword | <linux/pci.h> |
| 12 | pci_set_drvdata | <linux/pci.h> |
| 13 | pci_read_config_word | <linux/pci.h> |
| 14 | pci_write_config_dword | <linux/pci.h> |
| 15 | pci_read_config_byte | <linux/pci.h> |
| 16 | PCI_FUNC | <linux/pci.h> |
| 17 | pci_write_config_word | <linux/pci.h> |
| 18 | pci_resource_start | <linux/pci.h> |

### Table 37. I/O Functions

| S.No | APIS | Header Files |
|---|---|---|
| 1 | printk | <linux/kernel.h> |
| 2 | readl | <asm/io.h> |
| 3 | writel | <asm/io.h> |
| 4 | readb | <asm/io.h> |
| 5 | iowrite32 | |
| 6 | ioread32 | |
| 7 | iounmap | <asm/io.h> |
| 8 | ioremap | <asm/io.h> |

### Table 38. Synchronization Functions

| S.No | APIS | Header Files |
|---|---|---|
| 1 | atomic_dec | <asm/atomic.h> |
| 2 | set_bit | <asm/bitops.h> |
| 3 | spin_lock_irqsave | <linux/spinlock.h> |
| 4 | spin_lock_irqrestore | <linux/spinlock.h> |
| 5 | up_write | <linux/rwsem.h> |
| 6 | down_wite | <linux/rwsem.h> |
| 7 | mutex_lock | <linux/mutex.h> |
| 8 | mutex_unlock | <linux/mutex.h> |
| 9 | atomic_add_negative | <asm/atomic.h> |
| 10 | atomic_inc | <asm/atomic.h> |
| 11 | spin_lock | <linux/spinlock.h> |
| 12 | spin_unlock | <linux/spinlock.h> |
| 13 | lock_kernel | <linux/smp_lock.h> |
| 14 | unlock_kernel | <linux/smp_lock.h> |
| 15 | down | |
| 16 | up | |

### Table 39. Page Related Functions

| S.No | APIS | Header Files |
|---|---|---|
| 1 | virt_to_page | <asm/page.h> |
| 2 | pmd_offset | <asm/pgtable-3level.h> |
| 3 | pud_none | <asm/pgtable-3level.h> |
| 4 | pte_none | <asm/pgtable-3level.h> |
| 5 | pte_clear | <asm/pgtable-3level.h> |
| 6 | pte_unmap | <asm/pgtable.h> |
| 7 | pte_offset_map | <asm/pgtable.h> |
| 8 | pgd_offset | <asm/pgtable.h> |
| 9 | SetPageLocked | <linux/page-flags.h> |
| 10 | unlock_page | <linux/pagemap.h> |
| 11 | SetPageReserved | <linux/page-flags.h> |
| 12 | ClearPageReserved | <linux/page-flags.h> |
| 13 | io_remap_pfn_range | <asm/pgtable.h> |
| 14 | copy_page | <asm/page.h> |
| 15 | pte_page | <asm/pgtable-3level.h> |
| 16 | pmd_none | <asm/pgtable.h> |
| 17 | change_page_attr | <asm/cacheflush.h> |

**Table 40. Linked Lists**

| S.No | APIS | Header Files |
|---|---|---|
| 1 | list_add | <linux/list.h> |
| 2 | list_del | <linux/list.h> |
| 3 | list_for _each | <linux/list.h> |

**Table 41. Linux Driver Model Specific**

| S.No | APIS | Header Files |
|---|---|---|
| 1 | module_init | <linux/init.h> |
| 2 | module_exit | <linux/init.h> |

**Table 42. CPU/Cache**

| S.No | APIS | Header Files |
|---|---|---|
| 1 | rdmsr | <asm/msr.h> |
| 2 | wrmsr | <asm/msr.h> |
| 3 | on_each_cpu | <linux/smp.h> |
| 4 | boot_cpu_has | <asm/cpufeature.h> |
| 5 | flush_tlb_all | <asm/tlbflush.h |
| 6 | wbinvd | |
| 7 | wmb | |
| 8 | virt_to_phys | |
| 9 | global_cache_flush | |

**Table 43. User Access**

| S.No | APIS | Header Files |
|---|---|---|
| 1 | copy_from_user | <asm/uaccess.h> |
| 2 | copy_to_user | |

## 7.5 Uninstalling the IKM

To uninstall the IKM, run the install script described in Section 7.4.3 on page 171 with following argument:

**./install.sh uninstall**

This deletes the IKM file from kernel module location and invokes **depmod -a** to resolve dependencies for other module. A reboot might be required because IKM cannot be removed through the rmmod utility if a previous AGPGART is part of the kernel image.

## 7.6 Configuring Linux*

This section describes how to edit the Linux X Server configuration file for use with IEGD.

The Intel Linux driver is for use with the integrated graphics of Intel chipsets on the Embedded Intel Architecture roadmap. The driver supports 8-, 16- and 24-bit pixel depths, dual independent head setup on capable hardware, flat panel, hardware 2D acceleration, hardware cursor, the XV extension, and the Xinerama extension.

### 7.6.1 Configuration Overview

IEGD auto-detects all device information necessary to initialize the integrated graphics device in most configurations. However, you can customize the IEGD configuration for any supported display by editing the X Server's configuration file, `xorg.conf`. Please refer to the `Xorg(5x)` man page for general configuration details. This section only covers configuration details specific to IEGD.

To configure IEGD for the Linux* OS, you must edit the X server's configuration file. You can either edit the configuration directly or you can use CED to create configurations that must then be copied into the configuration file. Even if you use CED to create a configuration, you must still edit the Linux configuration file.

### 7.6.2 Linux* OS Configuration Using CED

You can configure the Linux* driver settings using CED as described in Section 3.0, "Platform Configuration Using CED" on page 31.

The output file (`yourbuildnamehere.x`) from CED contains the settings required to configure IEGD for Linux systems and can be pasted into the appropriate sections of the `xorg.conf` file.

### 7.6.3 Editing the Linux* OS Configuration File Directly

Instead of using the CED, you can edit the `xorg.conf` file directly. The following procedure outlines the steps to follow when editing the Linux* configuration file. Section 7.6.4, "The Linux* OS Configuration File" on page 177 provides details on each section of the configuration file.

1. Log in as root and open the configuration file for editing. The configuration file is typically located in the `/etc/X11` directory but may be located elsewhere on your system.
2. In the `Device` section of the configuration file, enter the appropriate information for your driver. The configuration file must have at least one `Device` section. The `Device` section lets you define information about IEGD. You can use a single `Device` section for single, twin, or clone configurations. For Dual Independent Head configurations, you must specify a second `Device` section.
3. In the `Screen` section, enter information for each display in your configuration. The configuration file must have at least one `Screen` section. The `Screen` section binds a `Device` with a `Monitor` and lets you define resolution modes for the display. The Screen section is referenced in the `ServerLayout` section of the configuration file.
4. In the `Monitor` section, define monitor specifications and timings that will be used for the display. You must have a `Monitor` section defined for each display in your configuration. The `Monitor` section is referenced by the `Screen` section.

5. Save your changes to the file. For systems booted to run level 3, **startx** to restart. For systems booted to run level 5, kill X (Ctrl-Alt-Backspace) to restart. Reboot if necessary.

### 7.6.4 The Linux* OS Configuration File

To configure IEGD for use with the Linux* OS, you must edit the Linux configuration file (`xorg.conf`). There are several sections within the configuration that must be edited or created, including:

- 
- 
- 
- (when configuring DIH)
- (when configuring Xinerama)

The above Sections are described following the sample file. Please see the `xorg.conf` man pages for complete details.

**Figure 34. Example xorg.conf File**

```
##
## X Config options generated from CED
## x11 conf skeleton
## DriverVer=
##

Section "Screen"
       Identifier    "Screen0"
       Device        "Intel_IEGD-0"
       Monitor       "Monitor0"
       DefaultDepth  24
       SubSection    "Display"
       Depth         24
       Modes         "1024x600"
       EndSubSection
EndSection

Section "Monitor"
       Identifier    "Monitor0"
       HorizSync     30.0 - 75.0
       VertRefresh   50.0 - 75.0
       Option        "dpms"
EndSection

Section "Monitor"
       Identifier    "Monitor1"
       HorizSync     30.0 - 75.0
       VertRefresh   50.0 - 75.0
       Option        "dpms"
EndSection


# Primary (First/only) display
```

```
Section "Device"
        Identifier "Intel_IEGD-0"
        Driver     "iegd"
        VendorName "Intel(R) DEG"
        BoardName  "Embedded Graphics"
        BusID      "0:2:0"
        Screen      0
        Option     "PcfVersion"            "1792"
        Option     "ConfigId"              "1"
        Option     "ALL/1/name"                    "dih965"
        Option     "ALL/1/General/PortOrder"       "42000"
        Option     "ALL/1/General/DisplayConfig"   "8"
        Option     "ALL/1/General/DisplayDetect"   "0"
        Option     "ALL/1/General/CloneRefresh"    "60"
        Option     "ALL/1/General/CloneWidth"      "1280"
        Option     "ALL/1/General/CloneHeight"     "1024"
        Option     "ALL/1/Port/4/General/name"                  "LVDS"
        Option     "ALL/1/Port/4/General/EdidAvail"       "0"
        Option     "ALL/1/Port/4/General/EdidNotAvail"    "5"
        Option     "ALL/1/Port/4/General/Rotation"        "0"
        Option     "ALL/1/Port/4/General/Edid"            "0"
        Option     "ALL/1/Port/4/FpInfo/BkltMethod"       "0"
        Option     "ALL/1/Port/4/Dtd/1/PixelClock"        "54720"
        Option     "ALL/1/Port/4/Dtd/1/HorzActive"        "1024"
        Option     "ALL/1/Port/4/Dtd/1/HorzSync"          "230"
        Option     "ALL/1/Port/4/Dtd/1/HorzSyncPulse"     "16"
        Option     "ALL/1/Port/4/Dtd/1/HorzBlank"         "476"
        Option     "ALL/1/Port/4/Dtd/1/VertActive"        "600"
        Option     "ALL/1/Port/4/Dtd/1/VertSync"          "4"
        Option     "ALL/1/Port/4/Dtd/1/VertSyncPulse"     "1"
        Option     "ALL/1/Port/4/Dtd/1/VertBlank"         "8"
        Option     "ALL/1/Port/4/Dtd/1/Flags"             "0x20000"
        Option     "ALL/1/Port/4/Attr/27"    "0"
        Option     "ALL/1/Port/4/Attr/26"    "18"
        Option     "ALL/1/Port/4/Attr/60"    "1"
        Option     "ALL/1/Port/2/General/name"                  "DVI"
        Option     "ALL/1/Port/2/General/EdidAvail"       "3"
        Option     "ALL/1/Port/2/General/EdidNotAvail"    "1"
        Option     "ALL/1/Port/2/General/Rotation"        "0"
        Option     "ALL/1/Port/2/General/Edid"            "1"
        Option     "PortDrivers"           "lvds sdvo"
EndSection

Section "ServerLayout"
        Identifier     "Default Layout"
        Screen 0       "Screen0" 0 0
        Screen 1       "Screen1" RightOf "Screen0"
#    InputDevice    "Mouse0" "CorePointer"
#    InputDevice    "Keyboard0" "CoreKeyboard"
#    InputDevice    "DevInputMice" "SendCoreEvents"
EndSection
```

```
Section "Screen"
        Identifier    "Screen1"
        Device        "Intel_IEGD-1"
        Monitor       "Monitor1"
        DefaultDepth  24
        SubSection    "Display"
        Depth         24
        Modes         "1280x1024" "1024x768"
        EndSubSection
        EndSection

# Secondary (for dual-head only) display
Section "Device"
        Identifier "Intel_IEGD-1"
        Driver     "iegd"
        VendorName "Intel(R) DEG"
        BoardName  "Embedded Graphics"
        BusID      "0:2:0"
        Screen     1
        Option     "PcfVersion"            "1792"
        Option     "ConfigId"              "1"
        Option     "ALL/1/name"                    "dih"
        Option     "ALL/1/General/PortOrder"       "42000"
        Option     "ALL/1/General/DisplayConfig"   "8"
        Option     "ALL/1/General/DisplayDetect"   "0"
        Option     "ALL/1/General/CloneRefresh"    "60"
        Option     "ALL/1/General/CloneWidth"      "1280"
        Option     "ALL/1/General/CloneHeight"     "1024"
        Option     "ALL/1/General/DRI"             "1"
EndSection

Section "ServerFlags"
        Option    "Xinerama"  "False"
EndSection
```

### 7.6.4.1 Device Section

The Device section provides a description of a graphics device. The Linux* configuration file (xorg.conf) must have at least one Device section for the graphics driver. If your chipset supports multiple graphics pipelines, you may have multiple Device sections, but in most situations, only one is required. If you are creating a Dual Independent Head (DIH) configuration, you must have at least two Device sections.

Device sections in xorg.conf have the following format:

```
Section “Device”
      Identifier “devname”
      Driver “iegd”
      ...
EndSection
```

The Identifier field defines the device. This name associates the device with a screen in the Screen sections.

The `Driver` field defines the driver to use and is a required field in the `Device` section. The Intel driver, `intel_drv.o`, must be installed in the `/usr/lib/xorg/modules/drivers` (or the correct path for your system).

The remainder of the `Device` section can contain IEGD-specific options. Please see Table 44 on page 183 for a list and description of IEGD supported options.

### DTD IDs for Multiple Ports

While DTD IDs must be unique, if two ports use the same DTD, CED writes to the configuration file twice, once for each port, each with the same ID. **This configuration is correct and should not be changed if you manually edit the configuration file. In most cases you should use CED to configure your system.**

For example, in the Device Section shown below, you see in the first set of option lines in blue that port 2 uses DTD 1 and in the second set of option lines in blue that port 4 also uses DTD 1. The configuration text is correct as written by CED and should not be changed. This situation applies only to Linux configurations.

```
Section "Device"
            Identifier "Intel_IEGD-0"
            Driver     "iegd"
            VendorName "Intel(R) DEG"
            BoardName  "Embedded Graphics"
            BusID      "0:2:0"
            Screen      0
            Option     "PcfVersion"            "1792"
            Option     "ConfigId"              "1"
            Option     "ALL/1/name"                    "dtd_test"
            Option     "ALL/1/General/PortOrder"       "24000"
            Option     "ALL/1/General/DisplayConfig"   "1"
            Option     "ALL/1/General/DisplayDetect"   "0"
            Option     "ALL/1/Port/2/General/name"             "sdvo-b"
            Option     "ALL/1/Port/2/General/EdidAvail"        "7"
            Option     "ALL/1/Port/2/General/EdidNotAvail"     "5"
            Option     "ALL/1/Port/2/General/Rotation"         "0"
            Option     "ALL/1/Port/2/General/Edid"             "1"
            Option     "ALL/1/Port/2/Dtd/1/PixelClock"         "108000"
            Option     "ALL/1/Port/2/Dtd/1/HorzActive"         "1280"
            Option     "ALL/1/Port/2/Dtd/1/HorzSync"           "48"
            Option     "ALL/1/Port/2/Dtd/1/HorzSyncPulse"      "112"
            Option     "ALL/1/Port/2/Dtd/1/HorzBlank"          "408"
            Option     "ALL/1/Port/2/Dtd/1/VertActive"         "1024"
            Option     "ALL/1/Port/2/Dtd/1/VertSync"           "1"
            Option     "ALL/1/Port/2/Dtd/1/VertSyncPulse"      "3"
            Option     "ALL/1/Port/2/Dtd/1/VertBlank"          "42"
            Option     "ALL/1/Port/2/Dtd/1/Flags"              "0xc020000"
            Option     "ALL/1/Port/2/Dtd/2/PixelClock"         "25175"
            Option     "ALL/1/Port/2/Dtd/2/HorzActive"         "640"
            Option     "ALL/1/Port/2/Dtd/2/HorzSync"           "8"
            Option     "ALL/1/Port/2/Dtd/2/HorzSyncPulse"      "96"
            Option     "ALL/1/Port/2/Dtd/2/HorzBlank"          "144"
            Option     "ALL/1/Port/2/Dtd/2/VertActive"         "480"
            Option     "ALL/1/Port/2/Dtd/2/VertSync"           "2"
            Option     "ALL/1/Port/2/Dtd/2/VertSyncPulse"      "2"
            Option     "ALL/1/Port/2/Dtd/2/VertBlank"          "29"
            Option     "ALL/1/Port/2/Dtd/2/Flags"              "0x0"
```

```
        Option      "ALL/1/Port/4/General/name"           "lvds"
        Option      "ALL/1/Port/4/General/EdidAvail"      "0"
        Option      "ALL/1/Port/4/General/EdidNotAvail"   "5"
        Option      "ALL/1/Port/4/General/Rotation"       "0"
        Option      "ALL/1/Port/4/General/Edid"           "0"
        Option      "ALL/1/Port/4/Dtd/3/PixelClock"       "65000"
        Option      "ALL/1/Port/4/Dtd/3/HorzActive"       "1024"
        Option      "ALL/1/Port/4/Dtd/3/HorzSync"         "24"
        Option      "ALL/1/Port/4/Dtd/3/HorzSyncPulse"    "136"
        Option      "ALL/1/Port/4/Dtd/3/HorzBlank"        "320"
        Option      "ALL/1/Port/4/Dtd/3/VertActive"       "768"
        Option      "ALL/1/Port/4/Dtd/3/VertSync"         "3"
        Option      "ALL/1/Port/4/Dtd/3/VertSyncPulse"    "6"
        Option      "ALL/1/Port/4/Dtd/3/VertBlank"        "38"
        Option      "ALL/1/Port/4/Dtd/3/Flags"            "0x20000"
        Option      "ALL/1/Port/4/Dtd/1/PixelClock"       "108000"
        Option      "ALL/1/Port/4/Dtd/1/HorzActive"       "1280"
        Option      "ALL/1/Port/4/Dtd/1/HorzSync"         "48"
        Option      "ALL/1/Port/4/Dtd/1/HorzSyncPulse"    "112"
        Option      "ALL/1/Port/4/Dtd/1/HorzBlank"        "408"
        Option      "ALL/1/Port/4/Dtd/1/VertActive"       "1024"
        Option      "ALL/1/Port/4/Dtd/1/VertSync"         "1"
        Option      "ALL/1/Port/4/Dtd/1/VertSyncPulse"    "3"
        Option      "ALL/1/Port/4/Dtd/1/VertBlank"        "42"
        Option      "ALL/1/Port/4/Dtd/1/Flags"            "0xc000000"
        Option      "ALL/1/Port/4/Dtd/4/PixelClock"       "81230"
        Option      "ALL/1/Port/4/Dtd/4/HorzActive"       "1280"
        Option      "ALL/1/Port/4/Dtd/4/HorzSync"         "48"
        Option      "ALL/1/Port/4/Dtd/4/HorzSyncPulse"    "112"
        Option      "ALL/1/Port/4/Dtd/4/HorzBlank"        "408"
        Option      "ALL/1/Port/4/Dtd/4/VertActive"       "768"
        Option      "ALL/1/Port/4/Dtd/4/VertSync"         "3"
        Option      "ALL/1/Port/4/Dtd/4/VertSyncPulse"    "6"
        Option      "ALL/1/Port/4/Dtd/4/VertBlank"        "34"
        Option      "ALL/1/Port/4/Dtd/4/Flags"            "0x4000000"
        Option      "PortDrivers"                         "sdvo lvds"

EndSection
```

### 7.6.4.2 Screen Section

The Screen section binds a Screen with a Device and a Monitor. It defines resolution modes, color depths, and various other screen characteristics. Please see the xorg man page for detailed information.

The Screen section has the following format:

```
Section “Screen”
      Identifier     “screenname”
      Device         “devname”
      Monitor        “Monitor0”
      DefaultDepth   24
      Subsection “Display”
         Depth       24
         Modes       “1280x1024” “1024x768” “800x600” “640x480”
      EndSubSection

EndSection
```

### 7.6.4.3 Monitor Section

Use the Monitor section to define monitor characteristics and timings for a display. You should have one Monitor section for each display your system supports. The Monitor section is referenced in a Screen section and has the following format.

```
Section “Monitor”
      Identifier “Monitor0”
      VendorName “NEC”
      MonitorName “MEC MultiSync LCD”
      HorizSync   30-60
      VertRefresh 50-75
      ...

EndSection
```

### 7.6.4.4 ServerLayout Section

The ServerLayout section defines the overall layout of the system configuration. Input devices are specified in the InputDevice fields and output devices usually consist of multiple components, such as a graphics board and a monitor, which are bound together in a Screen section. Typically, edit this section only when you are using a DIH configuration. Add a line to reference the second Screen section and specify its relative location to the first screen. In the following sample, the line beginning with Screen 1... is required for DIH configurations.

```
Section “ServerLayout”
      Identifier “Default Layout”
      Screen 0 “Screen0” 0 0
      Screen 1 “Screen1” RightOf “Screen0”
      InputDevice entries...

EndSection
```

#### 7.6.4.5 ServerFlags Section

If you are configuring IEGD for Xinerama support, you must set the "Xinerama" option to "True" in the ServerFlags section of the configuration file.

```
Section "ServerFlags"
      Option "Xinerama" "True"

EndSection
```

### 7.6.5 Xorg* Configuration Options

IEGD provides a format syntax for Linux* configuration options. The syntax is similar to the Microsoft Windows* INF file and is as follows:

"All/<ConfigID>/<block name>/<option name>"

IEGD parses the configuration options and looks for "new-style" 4.0 and later options. If it does not find any, then it falls back to processing old-style options.

Device configuration must contain the "pcfversion" option with value "0x700". This indicates to the driver the options format to use. Earlier pcfversions (0 and 0x400) are supported for backward compatibility.

IEGD supports multiple sets of installed configuration options that may be selected at runtime.

Configuration ID 0 is used unless otherwise specified in the configuration file or supplied by the system BIOS.

The table below shows the supported driver options.

**Table 44. Supported Driver Options (Sheet 1 of 4)**

| Option | Description |
|---|---|
| Option "PcfVersion" "integer" | This option indicates that the new IEGD format is being used for the Linux* Configuration files (xorg.conf). The new format is hierarchical (similar to the Microsoft Windows* INF file) and allows both global and per-configuration information to be stored in the X Server's configuration file (xorg.conf) rather than having per-configuration information stored separately in the EDIDx.bin file.<br><br>This option is usually set to 0700 hex (1792 decimal) and is required for the new format. |
| Option "All/<ConfigID>/General/SWCursor" "boolean" | Enable the use of the software cursor. Default is off and the hardware cursor is used. |
| Option "All/<ConfigID>/General/ShadowFB" "boolean" | Enable or disable double buffering on the framebuffer. Default disables double buffering. |

## Table 44. Supported Driver Options (Sheet 2 of 4)

| Option | Description |
|---|---|
| Option “All/<ConfigID>/General/TearFB” “boolean” | Disable or enable wait for vblank when doing blits. The default is to not wait for vblank when doing blits. This is faster but may cause visible tearing of the display.<br>Set to “1” (default) to not wait for vblank<br>Set to “0” to wait for vblank to reduce tearing<br><br>***Note:*** The following usage models are not supported with TearFB:<br>- Render extension<br>- Rotation and Flip<br>- ShadowFB<br>- XvBlend<br>- When Blend or OGL writes to the framebuffer |
| Option “All/<ConfigID>/General/XVideo” “boolean” | Disable or enable XVideo support. In a dual independent head configuration, either the first display or the second display support XVideo. Both displays cannot support XVideo simultaneously. The default is XVideo support is enabled. |
| Option “All/<ConfigID>/General/XVideoBlend” “boolean” | Disable or enable XVideo support using the 3D blend manager. This provides XVideo support in configurations that cannot be supported with overlay. For example, this is supported on both displays in a dual independent head setup. It is also supported when the display is rotated or flipped. Color key is only supported if ShadowFB is enabled and the VideoKey is defined. Default enables XVideoBlend support. |
| Option “ConfigID” “integer” | This option identifies the configuration. |
| Option “All/<ConfigID>/Name” “string” | A quoted string used to identify the configuration name. |
| Option “All/<ConfigID>/Comment” “string” | A quoted string used to identify the configuration file.<br>Comment is a required field for Linux* configurations. |
| Option “PortDrivers” “string” | This option specifies which port driver(s) must be loaded. The string is a space- or comma-separated list of port driver names corresponding to the *.so port driver files included with the Linux* OS version of the driver.<br>The port driver for the built-in analog output from the GMCH is always included and does not need to be specified in the PortDrivers option.<br>Port drivers for the built-in LVDS and TV components, on chipsets with such features, are NOT automatically included. The “lvds” and “inttv” port drivers must be specified to use those output ports. |
| Option “All/<ConfigID>/General/PortOrder” “string” | This option changes the default port allocation order. The default order can vary depending on chipset. List the port type numbers in the priority order starting from first to last. The port type numbers are as follows:<br>1 - Integrated TV Encoder (mobile chipsets only)<br>2 - sDVO B port<br>3 - sDVO C port<br>4 - Integrated LVDS port (mobile chipsets only)<br>5 - Analog CRT port<br>To set the order as Integrated TV Encoder, ANALOG, LVDS, sDVO C, sDVO B set the PortOrder string to “15432”. Zeros can be used to specify don’t care. Setting this option incorrectly can result in port allocation failures. |
| Option “All/<ConfigID>/Port/<port number>/ General/Rotation” “integer” | Rotate the display. Valid values are 0, 90, 180, 270. |

## Table 44. Supported Driver Options (Sheet 3 of 4)

| Option | Description |
|---|---|
| Option “All/<ConfigID>/Port/<port number>/ General/Flip” “boolean” | Invert the display horizontally. |
| Option “All/<ConfigID>/General/VideoKey” “integer” | This sets the color key for XVideo and XVideoBlend. This value is either a 24-bit value or a 16-bit value, depending on the pixel depth of the screen. The color key is always enabled for XVideo, even when it is not defined. The color key is always disabled for XVideoBlend unless both this option is defined and the ShadowFB option is enabled. The default color key for XVideo is 0x0000ff00. For XVideoBlend, the color key is disabled by default. |
| Option “All/<ConfigID>/General/CloneWidth” “integer” | This sets the display width for a clone port when CloneDisplay is active. Default is 640. |
| Option “All/<ConfigID>/General/CloneHeight” “integer” | This sets the display height for a clone port when CloneDisplay is active. Default is 480. |
| Option “All/<ConfigID>/General/CloneRefresh” “integer” | This sets the display vertical refresh rate for a clone port when CloneDisplay is active. Default is 60 Hz. |
| Option “All/<ConfigID>/Port/<port number>/ General/EDID” “boolean” | Enable or disable reading of EDID data from the output port device. Note that if the EDID option is specified in the config file (`xorg.conf`), all per-port EDID options in the configuration are overwritten by the EDID option specified in the config file. |
| Option “All/<ConfigID>/General/Accel” “boolean” | Enable 2D acceleration. Default is enabled. |
| Option “All/<ConfigID>/General/DRI” “boolean” | Enable DRI support for OGL. Default is enabled. |
| Option “All/<ConfigID>/General/ OverlayGammaCorrectR” “integer” | Gamma correction value for overlay (red) in 24i8f format. |
| Option “All/<ConfigID>/General/ OverlayGammaCorrectG” “integer” | Gamma correction value for overlay (blue) in 24i8f format. |
| Option “All/<ConfigID>/General/ OverlayGammaCorrectB” “integer” | Gamma correction value for overlay (green) in 24i8f format. |
| Option “All/<ConfigID>/General/ OverlayBrightnessCorrect” “integer” | Overlay brightness adjustments. |
| Option “All/<ConfigID>/General/ OverlayContrastCorrect” “integer” | Overlay contrast adjustments. |
| Option “All/<ConfigID>/General/ OverlaySaturationCorrect” “integer” | Overlay saturation adjustments. |
| Option “All/<ConfigID>/Port/<port number>/ General/Name” “string” | A quoted string used to identify the port name, for example, “sdvo”. |
| Option “All/<ConfigID>/Port/<port number>/ General/”EdidAvail “string” | Specifies how standard and user-defined modes are used when EDID is available. Default is 0. |
| Option “All/<ConfigID>/Port/<port number>/ General/”EdidNotAvail “string” | Specifies how standard and user-defined modes are used when EDID is not available. Default is 0. |
| Option “All/<ConfigID>/Port/<port number>/ General/CenterOff” “boolean” | When this option is enabled it DISABLES centering. Also, depending on the combination of “edid” + “user-dtd” + connected hardware, IEGD will add missing compatibility modes (6x4, 8x6, 10x7& 12x10) via centering. Use this option to disable this feature. |
| Option “All/<ConfigID>/Port/<port number>/Dvo/ I2cDab” “string” | I2c device address. |
| Option “All/<ConfigID>/Port/<port number>/Dvo/ I2cSpeed” “string” | I2c bus speed. |
| Option “All/<ConfigID>/Port/<port number>/Dvo/ DdcSpeed” “string” | DDC bus speed. |
| Option “All/<ConfigID>/Port/<port number>/Dvo/ DdcDab” “string” | DDC device address. |

**Table 44. Supported Driver Options (Sheet 4 of 4)**

| Option | Description |
|---|---|
| Option “All/<ConfigID>/Port/<port number>/Dtd/ PixelClock” “integer” | Pixel clock frequency in kHz. |
| Option “All/<ConfigID>/Port/<port number>/Dtd/ HorzActive” “integer” | The active horizontal area in pixels. |
| Option “All/<ConfigID>/Port/<port number>/Dtd/ HorzSync” “integer” | Starting pixel for horizontal sync pulse. |
| Option “All/<ConfigID>/Port/<port number>/Dtd/ HorzSyncPulse” “integer” | Width of the horizontal sync pulse in pixels. |
| Option “All/<ConfigID>/Port/<port number>/Dtd/ HorzBlank” “integer” | Width of the horizontal blanking period in pixels. |
| Option “All/<ConfigID>/Port/<port number>/Dtd/ VertActive” “integer” | The active vertical area in pixels. |
| Option “All/<ConfigID>/Port/<port number>/Dtd/ VertSync” “integer” | Starting pixel for vertical sync pulse. |
| Option “All/<ConfigID>/Port/<port number>/Dtd/ VertSyncPulse” “integer” | Width of the vertical sync pulse in pixels. |
| Option “All/<ConfigID>/Port/<port number>/Dtd/ VertBlank” “integer” | Width of the vertical blanking period. |
| Option “All/<ConfigID>/Port/<port number>/Dtd/ Flags” “integer” | Additional interlaced timing information. |
| Option “All/<ConfigID>/Port/<port number>/ FpInfo/BkltMethod” “integer” | Specifies the backlight method. |
| Option “All/<ConfigID>/Port/<port number>/ FpInfo/BkltT1” “integer” | Specifies backlight timing T1. |
| Option “All/<ConfigID>/Port/<port number>/ FpInfo/BkltT2” “integer” | Specifies backlight timing T2. |
| Option “All/<ConfigID>/Port/<port number>/ FpInfo/BkltT3” “integer” | Specifies backlight timing T3. |
| Option “All/<ConfigID>/Port/<port number>/ FpInfo/BkltT4” “integer” | Specifies backlight timing T4. |
| Option “All/<ConfigID>/Port/<port number>/ FpInfo/BkltT5” “integer” | Specifies backlight timing T5. |

## 7.6.6 Sample Dual Independent Head (DIH) Configuration

For DIH operation, several additional options must be set in the `Device` sections for each head. Both `Device` sections must specify the `BusID`, and the `BusID` must be the same for both devices. Each `Device` section must specify the `Screen` section that will associate the device with the `Screen` option.

```
BusID  - B:F:S (Bus, Function, Slot)
Screen  - number
```

The example below shows a sample DIH configuration. Only the `Device`, `Screen`, and `Server Layout` sections of the configuration file are shown. For a complete example of a configuration file, see Figure 34 on page 177.

**Figure 35. Sample DIH Configuration**

```
Section "Device"
      Identifier "IntelEGD-1"
      Driver     "iegd"
      BusID       "0:2:0"
      Screen      0
      VideoRam    32768

EndSection

Section "Device"
      Identifier  "IntelEGD-2"
      Driver      "iegd"
      BusID       "0:2:0"
      Screen      1
      VideoRam    32768

EndSection

Section "Screen"
      Identifier  "Screen 1"
      Device      "IntelEGD-1"
      Monitor     "Monitor1"
      DefaultDepth 24
      Subsection "Display"
         Depth       8
         Modes       "1280x1024" "1024x768" "800x600" "640x480"
         ViewPort    0 0
      EndSubsection
      Subsection "Display"
         Depth       16
         Modes       "1280x1024" "1024x768" "800x600" "640x480"
         ViewPort    0 0
      EndSubsection
      Subsection "Display"
         Depth       24
         Modes       "1280x1024" "1024x768" "800x600" "640x480"
         ViewPort    0 0
      EndSubsection EndSection

Section "Screen"
      Identifier  "Screen 2"
      Device      "IntelEGD-2"
      Monitor     "Monitor2"
      DefaultDepth 24
      Subsection "Display"
         Depth       8
         Modes       "1280x1024" "1024x768" "800x600" "640x480
         ViewPort    0 0
      EndSubsection
```

```
        Subsection "Display"
           Depth       16
           Modes       "1280x1024" "1024x768" "800x600" "640x480"
           ViewPort    0 0
        EndSubsection
        Subsection "Display"
           Depth       24
           Modes       "1280x1024" "1024x768" "800x600" "640x480"
           ViewPort    0 0
        EndSubsection

EndSection

Section "ServerLayout"
        Identifier  "Dual Head Layout"
        Screen "Screen 1"
        Screen "Screen 2" Right Of "Screen 1"
        InputDevice "Mouse1" "CorePointer"
        InputDevice "Keyboard1" "CoreKeyboard"

EndSection
```

### 7.6.7 Video Memory Management

The Intel integrated graphics controllers have a unified memory architecture that uses system memory for video RAM. The amount of available video memory is not constant and can be configured through the `xorg.conf` file. Some video memory is required for normal operation of the device. This memory, such as framebuffers, backbuffers, and scratch space, is allocated by the driver as needed. The bulk of video memory is used for off-screen allocation of pixmaps by the X Server. By default, 32 Mbytes of memory, possibly shared between two screens, is available for these purposes. This can be changed with the VideoRam option in the Device section of the configuration file (see ). It may be set to any reasonable value up to the limits of the hardware. Increasing this value reduces the amount of system memory available for other applications. This value is in units of 1024 Kbytes (32 Mbytes is represented by 32768).

### 7.6.8 Configuring Accelerated Video Decode for IEGD and Intel® System Controller Hub US15W

#### 7.6.8.1 Hardware Video Acceleration Overview

Hardware Video Acceleration is the use of a specialized video engine to decode video streams (such as MPEG2, MPEG4, H.264 and VC-1) in order to free up the processor from having to do all of the decoding. Only some chipsets (such as the US15W) integrate a video decode engine. The flow of video through the various components generally is as follows:

1. The video player, such as the IEGD-validated `Splay`, reads a video file and determines the type.
2. Based on type, the proper codec shared library object is loaded.
3. The codec loads the VA library shared library object.
4. The VA library loads the `iegd_drv_video.so` shared library object.
5. The `iegd_drv_video.so` communicates, over the X wire protocol, with the IEGD X driver to send encoded video to the hardware for decoding.

You can either use the provided binary of the `libva` library found in the appropriate `Xorg/Xserver` directory in the IEGD release or build it from the source. To build it, use the following steps:

1. Untar `libva.tgz` included in the IEGD driver package in the Extras folder.
2. Enter the following commands:
   **./autogen.sh --prefix=/usr**
   **make**
   **make install**

#### 7.6.8.2 Installing IEGD for Linux

First install IEGD for Linux* per the appropriate installation instructions in Section 7.3. IEGD should be fully configured and running X properly before installing the VA Library.

#### 7.6.8.3 Installing the VA Library (version 0.29)

Install the VA shared library object on the library path using the steps below.

1. Change to the IEGD directory for the X Server version that matches your release where the library file is located (see Section 7.1 on page 159). For example,
   **cd IEGD_10_4_Linux/driver/Xorg-xserver-1.4**
2. Copy the `libva.so.0.29.0` file to the `/usr/lib` folder using the following command:
   **cp libva.so.0.29.0 /usr/lib**
3. Create the library aliases:
   **ln -s /usr/lib/libva.so.0.29.0 /usr/lib/libva.so**
   **ln -s /usr/lib/libva.so.0.29.0 /usr/lib/libva.so.0**
4. Set the Libva environment variable to point to the correct folder:
   Set LIBVA_DRIVERS_PATH to point to the location of IEGD. The following is an example (with the BASH command shell):
   **export LIBVA_DRIVERS_PATH=/usr/lib/xorg/modules/drivers**

Your driver location may vary, so please use the path to where you installed IEGD files. To make this “sticky” you may want to add this to your `.profile`, `bashrc` or whatever your distribution uses to store these variables.

#### 7.6.8.4 Installing the IEGD Video Acceleration Driver

To install the provided Video Acceleration Driver (`iegd_drv_video.so`):

1. Change to the appropriate Xorg/Xserver directory where you unpacked the IEGD release.
2. Copy the driver to the directory where you installed the main IEGD files from Section 7.3. For example:
   **cp iegd_drv_video.so /usr/lib/xorg/modules/drivers**

*Note:* Your actual directory will vary depending on your particular Linux* distribution.

### 7.6.8.5 Installing Helix Framework

Set up the Helix Framework environment to use accelerated video playback with IEGD using the steps below.

1. Download helix-dbu-server and splay plug-ins from:
   https://helix-client.helixcommunity.org/releases

   You will need to accept the Helix DNA Technology Binary Research Use License agreement and register an account before downloading the software.

   a. Download the latest Splay Plug-ins files.
      Example: **splay-plugin-atlas-01.2.0.tg**z
   b. Download the latest Helix DBUS Server files.
      Example: **helix-dbus-server-0.6.0.tar.bz2**
2. Untar `splay-plugins.tgz` and copy the contents to the directory **/usr/lib/helix/splay**
3. Untar `helix-dbus-server-0.6.0.tar.bz2`
4. Run `make install` from the `helix-dbus-server-0.6.0` directory.

### 7.6.8.6 Installing Intel® Media Codec

The latest EVALUATION ONLY versions of the VA API enabled hardware accelerated codecs for Helix are available by contacting Intel through the Intel Premier Support (QuAD) system. After you have the codec package, follow these steps to install it:

1. Untar the codec package.
2. Copy `libipp_hx_*.so` to `/usr/lib/helix/splay`
3. Remove `/usr/lib/helix/splay/mpgfformat.so`
4. Remove `/usr/lib/helix/splay/h264dec.so`
5. Remove `/usr/lib/helix/splay/mp4vrender.so`
6. Remove `/usr/lib/helix/splay/wmvrender.so`
7. Remove `/usr/lib/helix/splay/wmv9.so`

### 7.6.8.7 Playing Video

The video player application used must support the Helix plug-in framework. A sample player (Splay) is included and known to work. The Splay application is located in the `/usr/lib/helix/splay` directory.

To play a video, enter the following command:

— **/usr/lib/helix/splay/splay -l /usr/lib/helix/splay <Video file>**
where <*Video file*> is replaced with an actual file name.

#### 7.6.8.8 Troubleshooting

1. If the `Splay` application quits silently, try removing the helix configuration files **~/.helix, ~/.hxplayerrc,** and **~/.realplayerrc.**
2. Check the codec version numbers using the `script get_lib_version.sh` included with the codecs. The output should be:

```
libipp_hx_ac3ad.so    -> ipp_hx_version:20080822:1.8.8.22
libipp_hx_h264vd.so   -> ipp_hx_version:20080822:1.8.8.22
libipp_hx_mp2sp.so    -> ipp_hx_version:20080822:1.8.8.22
libipp_hx_mp2vd.so    -> ipp_hx_version:20080822:1.8.8.22
libipp_hx_mp4vd.so    -> ipp_hx_version:20080822:1.8.8.22
libipp_hx_vc1vd.so    -> ipp_hx_version:20080401:1.8.8.22
```

3. If you receive the following message when you try to play video:

```
libva: Trying to open /usr/X11R6/lib/modules/dri/
iegd_drv_video.so
libva: va_openDriver() returns -1
```

   make sure the LIBVA_DRIVERS_PATH environment variable is set to the location where you installed the `iegd_drv_video.so` file. Typically, this would be `/usr/lib/xorg/modules/drivers`.

### 7.6.9 Graphics Port Initialization

When used with a graphic chipset that supports multiple graphics pipelines, the driver supports multiple screens and Xinerama. Enable this support by creating additional `Device` sections for each additional graphics device on the PCI bus. The driver locates the first device on the bus and associates it with the device section that matches or one that does not specify a busID. This becomes the primary display. If the chipset supports multiple display pipes, and the config file specifies two `Device` sections and two `Screen` sections, the driver attempts to operate in a DIH mode. After all the graphics devices and device sections have been matched up, the driver attempts to allocate any remaining output ports and attach them to the primary graphics device. For example:

- Two pipes and two ports allows for dual independent displays.
- One pipe and two ports allows for a cloned display (915GV special case).

### 7.6.10 OpenGL Support

IEGD supports OpenGL* for the following Intel chipsets:

- Intel® Atom™ Processor 400 and 500 Series
- Intel® Q45/G41/G45 Express chipset
- Intel® GM45/GL40/GS45 Express chipset
- Intel® System Controller Hub US15W/US15WP/WPT chipset
- Intel® Q35 Express chipset
- Mobile Intel® GLE960/GME965 Express chipset
- Intel® Q965 Express chipset
- Mobile Intel® 945GSE Express chipset
- Mobile Intel® 945GME Express chipset
- Intel® 945G Express chipset
- Mobile Intel® 915GME Express chipsets
- Intel® 915GV Express chipsets
- Mobile Intel® 910GMLE Express chipset

The OpenGL implementation for IEGD consists of three components.

- `libGL`: This is the shared library that implements the OpenGL and GLX APIs. It is linked by all OpenGL applications.
- `iegd.ko`: This is the Direct Rendering Manager (DRM). It is a kernel module that provides the OpenGL application with the permissions necessary to directly access the DMA buffers used by libGL.
- `X Server`: The existing IEGD X server driver has been enhanced to communicate with `libGL`.

Installing the IEGD OpenGL driver provides a fully hardware accelerated implementation of the OpenGL library to applications. This implementation makes use of a Direct Rendering technology, which allows the client to directly write to DMA buffers that are used by the graphics hardware.

Due to the use of direct rendering technology, system designers should take special care to ensure that only trusted clients are allowed to use the OpenGL library. A malicious application could otherwise use direct rendering to destabilized the graphics hardware or, in theory, elevate their permissions on the system.

A system designer can control the access to the direct rendering functionality by limiting the access to the DRI device file located at:

```
/dev/dri/card0
```

The permissions on this device are set by the X Server using the information provided in the “DRI” section of the configuration file.

### 7.6.10.1 OpenGL Installation

To install the IEGD libGL onto a system, copy the library binary from the package to the standard location and then link the files, compile and install the Direct Rendering Manager (DRM) kernel module from the sources provided. Lastly, enable the DRI option in the X server's configuration file. Refer to the sections below for details on specific operating systems.

**Linux***

The OGL/ES application requires the following share libraries:

- `libEGL.so`
- `libGLESv1_CM.so (ES1.1)`
- `libGLESv2.so (ES2.0)`
- `iegd_dri.so`
- `egl_xdri.so`
- `egl_iegd_dri.so`
- `libEGLdri.so`

A typical OpenGL ES program will link with `libEGL.so` and either `libGLESv1_CM.so` or `libGLESv2.so`. Then `libEGL.so` will link to `libEGLdri.so` or `egl_xdri.so` or `egl_iegd_dri.so`. Then, `libEGLdri.so/egl_xdri.so/egl_iegd_dri.so` will link to `iegd_dri.so`.

**Installation Steps**

1. **cd IEGD_10_4_Linux/driver/<directory>**
   where <directory> is whichever X Server or Xorg driver directory is being used. For example, for Fedora 10 it would be `driver/Xorg-xserver-1.5.3`.

*Note:* The locations and commands may be different for a specific Linux distribution.

2. **cp -p iegd_dri.so /usr/lib/dri**

*Note:* If you find that you are still using software rendering and hardware rendering is not being used, copy the `iegd_dri.so` to `/usr/X11R6/lib/dri`.

3. **cp -p libGLgn#.so /usr/lib/libGL.so.1.2**
   - For 910GMLE, 915GME, 915GV, 945GME, 945GSE, 945G, Atom Processor 400/500 Series
     Use `libGLgn3.so`
   - For Q965, GLE960/GME965, Q45, GM45/GL40/GS45, Q35
     Use `libGLgn4.so`
   - US15W/US15WP/WPT
     Use `libGL_ga.so.1.2`

*Note:* For Fedora 10, perform the following steps. For other operating systems, continue with step 4.

**cd /lib**
**ln -s libexpat.so.1.5.2 libexpat.so.0**

4. **cd /usr/lib**
5. **ln -s /usr/lib/libGL.so.1.2 libGL.so**
6. **ldconfig**

*Note:* Skip steps 7 and 8 if you are using the IKM method detailed in Section 7.4.

7. **cd IEGD_10_4_Linux/IKM/Drm**
8. **make**
   This will build and install the kernel module for the currently running kernel. If another kernel is installed or used, do this step again.
9. **depmod -Ae**
10. Restart the X Server or restart the system.

#### 7.6.10.2 Enabling or Disabling Multi-Sample Anti-Aliasing (MSAA)

If you would like to enable or disable MSAA on the Intel US15W, enter the following commands into the terminal:

- Enable: **export _GL_FSAA_MODE=4**
- Disable: **export _GL_FSAA_MODE=0**
  or
  **export _GL_FSAA_MODE=1**

#### 7.6.10.3 OpenGL Use Considerations

*Allocation of Mipmaps and Memory Usage*

Under normal circumstances the OpenGL driver will allocate all mip levels for a texture at allocation time. This is due to the fact that the OpenGL API allows an application to make use of the mips without first conveying an intention to do so. Therefore, all mips are available all the time.

The IEGD OpenGL driver has a special-case scenario to prevent the allocation of mips when the application can ensure that they will never be populated or used. On some hardware configurations this can save 50% on texture memory usage. To enable this feature, the application should do the following:

Using glTexParameter*(), set the GL_TEXTURE_MAX_LEVEL parameter to 0 before populating the texture, before any call to glTexImage2D(). This will prevent mips 1-N from being allocated but will not prevent them from being used. If the mips are inadvertently used, the results are undefined.

#### 7.6.10.4 OpenGL ES

Download OpenGLES headers from http://www.khronos.org/opengles/spec/.

Download EGL headers from http://www.khronos.org/registry/egl/.

See also Appendix D, “2D/3D API Support”.

### 7.6.11 Sample Advanced EDID Configurations for Linux* OS

The `edid_avail` and `edid_not_avail` parameters control the available timings for any display. Use the `edid_avail` parameter when reading EDID information from the display. If the driver is unable to read EDID information from the display or if the `edid` parameter in the config file is set to “0” (disable), use the settings of the `edid_not_avail` parameter. Please see Section 3.0, “Platform Configuration Using CED” on page 31.

An `edid` option can be placed in the `xorg.conf` to control the behavior of the overall driver. EDID settings also exist within CED that control the behavior on each port (`edid`, `edid_avail`, and `edid_not_avail`). The combination of these settings determines how the driver behaves. The table below shows various configurations and the expected behavior of the driver.

**Table 45. Sample Advanced EDID Configurations for Linux* OS**

| Case | CED: Per port "edid" option | Expected driver behavior |
|---|---|---|
| 1. | No edid flag specified | For every port, driver uses edid_avail. |
| 2. | edid=0 for some ports and edid=1 for some ports | For edid=0 ports, driver uses edid_not_avail flags.<br>For edid=1 ports driver uses edid_avail flags. |
| 3. | Setting does not matter. | For all ports driver will not read edid and interprets edid_not_avail flags.<br>Driver overrides any per-port edid flags, treats all displays as EDID-less displays, and uses edid_not_avail flags. |
| 4. | edid=0 for some ports and edid=1 for some ports | Same as case 2 |

***Notes:*** For all cases:

1. If there is not an edid_not_avail flag specified for a port, and an EDID-less display is detected, the driver defaults to using the standard built-in timings for that port.
2. If there is not an edid_avail flag specified for a port, and an EDID display is detected, the driver defaults to using the EDID data from the display, plus any user-specified DTDs.
3. If edid=1 and the display device is EDID-less, the driver uses edid_not_avail flags.

## 7.6.12 AGPGART Errors

The following are the most common AGPGART errors:

1. Symptom: No "agpgart: " in the system log
   Cause: The IEGD AGPGART patch has not been applied to the system.
2. Symptom: The Xorg.0.log has the following:
   (EE) INTEL(0): gart.c: Acquire IOCTL failed
   Cause: The IEGD AGPGART module has not been loaded.
3. Symptom: When starting the X Server, the following message is listed in the X log file.
   "Graphics hardware initialization failed.
   The most likely cause is a missing or incorrect AGPGART kernel module.
   module_init returned -1"
   Cause: The AGPGART kernel module is not loaded or does not support the chipset being used. Check the kernel messages for the message:
   "agpgart: Detected an Intel xxxx chipset"
   If this message is there, the AGPGART is not the problem.

The Intel Embedded Graphics Drivers GUI (`iegdgui`) is an application used to view and control the Intel® Embedded Graphics Drivers. It retrieves status of the display and driver and is also used to configure the supported display attributes. You can change the configuration and runtime attributes of the driver using the `iegdgui` runtime configuration tool, which resides in the `/Utilities` directory. The `iegdgui` also demonstrates multi-monitor support.

### 7.6.13 iegdgui Setup

To run `iegdgui`, you need to ensure that the X Server has been configured to use IEGD. See Section 7.6.1, “Configuration Overview” on page 176 for details on configuring and installing IEGD.

You need GTK+ and libglade, which are part of the Linux* distribution and should already be installed.

The `ldconfig` cache should have entries pointing to the X library. You can verify that with the following commands:

```
Xorg -showDefaultLibPath          # Display X library path
ldconfig -p | grep -c resultpath  # Quantity of entries in cache
```

The `Xorg` command shows the path X will use. Plug that result path into the `grep` part of the `ldconfig` command line. If there is a count, that library path is known to the linker. Otherwise, run a temporary test by setting the LD_LIBRARY_PATH environment variable to point to the X library by running the following command:

```
echo $LD_LIBRARY_PATH
```

If it is blank or it does not show X's library path, add it using the following command:

```
export LD_LIBRARY_PATH=“$LD_LIBRARY_PATH:resultpath”
```

If LD_LIBRARY_PATH setting works, create a file containing the name of the X default library directory and add it to a file in the `/etc/ld.so.conf.d` directory or append it to `/etc/ld.so.conf` if the directory does not exist on your version of Linux. If the directory exists, use this command:

```
echo "resultpath" >> /etc/ld.so.conf.d/xlibs.conf
```

If you use a version of Linux that does not have the `/etc/ld.so.conf.d` directory, you can append the X default library directory to that file using this command:

```
echo "resultpath" >> /etc/ld.so.conf
```

Ensure the `iegdgui` is executable by changing directories to `.../IEGD_10_4_Linux/Utilities` and running the following command:

```
ls -l iegdgui
```

Executable permissions should be set for all three Linux* groups (user, group, world) and should look like this:

```
rwxr-xr-x iegdgui ...
```

If the permissions do not contain an “x” for each group, change the permissions using the following command:

```
chmod a+x iegdgui
```

After you have completed this step, `iegdgui` can be launched.

### 7.6.14 Using the iegdgui Runtime Configuration Utility

The `iegdgui` application provides four tabs: **Driver Info**, **Display Config**, **Display Attributes,** and **Color Correction**.

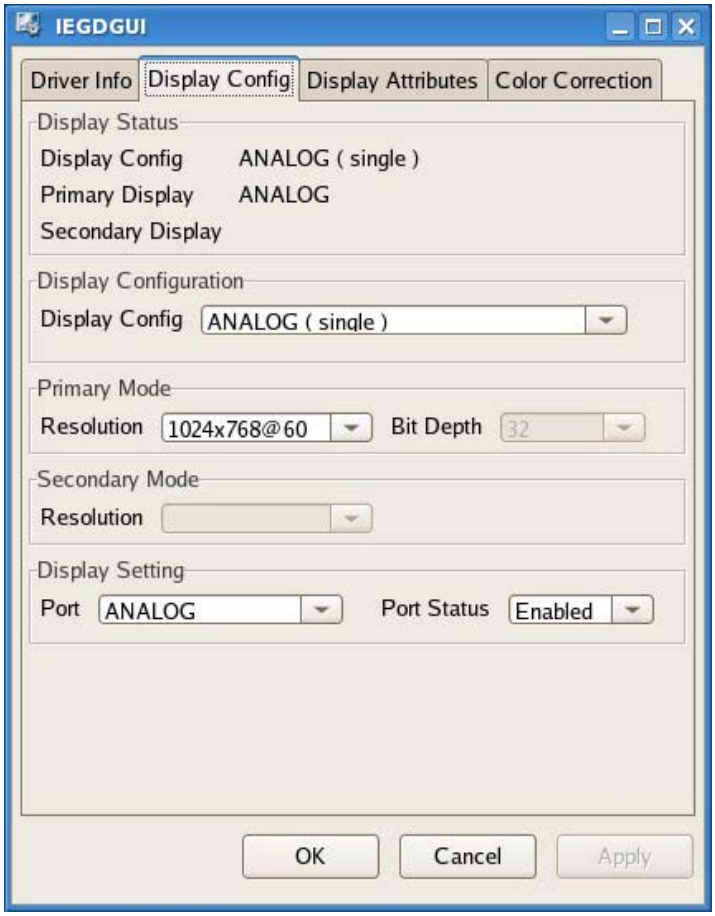
- **Driver Info**: Contains the driver name, version, build number, and date.
- **Display Config**: Contains current display information and allows changing display configurations, resolutions for primary and secondary displays and enabling/ disabling of a specified port.
- **Display Attributes**: Contains the supported Port Driver (PD) attributes and allows configuration of PD attributes.
- **Color Correction**: Contains current color-correction information for the framebuffer and overlay. Use this tab to change the framebuffer and overlay color settings.

To view current display information or to change the current settings of display configurations, resolutions of the primary and secondary displays, and enabling or disabling of a specified port, click the **Display Config** tab.

*Note:* If you make any changes to the configuration, click **Apply** for the changes to take effect.

The figure below shows a sample configuration.

**Figure 36. Example Linux* Runtime Configuration GUI — Display Config Tab**




The **Display Status** section of the above dialog shows the current configuration for the **Primary** and **Secondary** displays.

In the **Display Configuration** section of the dialog, select the required display configuration in the **Display Config** drop-down list. This allows the user to choose between Single, Twin, Clone and Extended for all connected ports. A maximum of two ports per display configuration is currently allowed.

In the **Primary Mode** and **Secondary Mode** sections of the dialog, you can change display resolutions via the **Resolution** drop-down list.

In the **Display Setting** section of the dialog you can view and change the settings for a port and then rotate and flip the display via the appropriate drop-down lists:

- **Port**: Allows you to select the required port.
- **Port Status**: Allows you to enable or disable the selected port.

*Note:* If you change any configuration settings in the **Display Config** dialog box, click **Apply** for the changes to take effect.

To view or change the attributes for a port, click the **Display Attributes** tab. The figure below shows a sample configuration. Please see Appendix B for detailed information on port driver attributes.

*Note:* If you make any changes to the port driver attributes, click **Apply** for the changes to take effect.

**Figure 37. Example Linux* Runtime Configuration GUI — Display Attributes Tab**

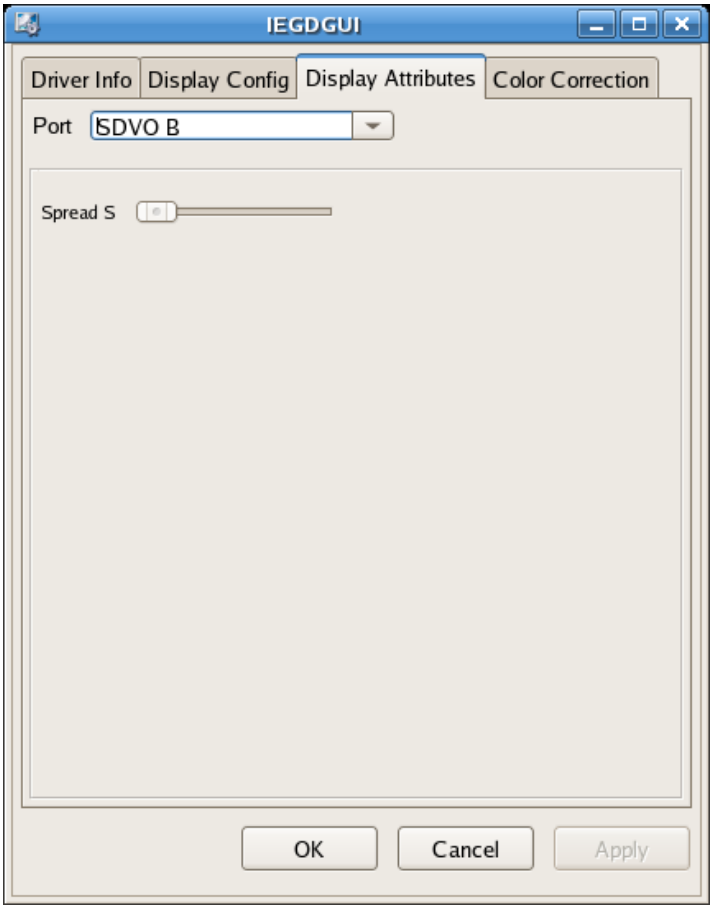
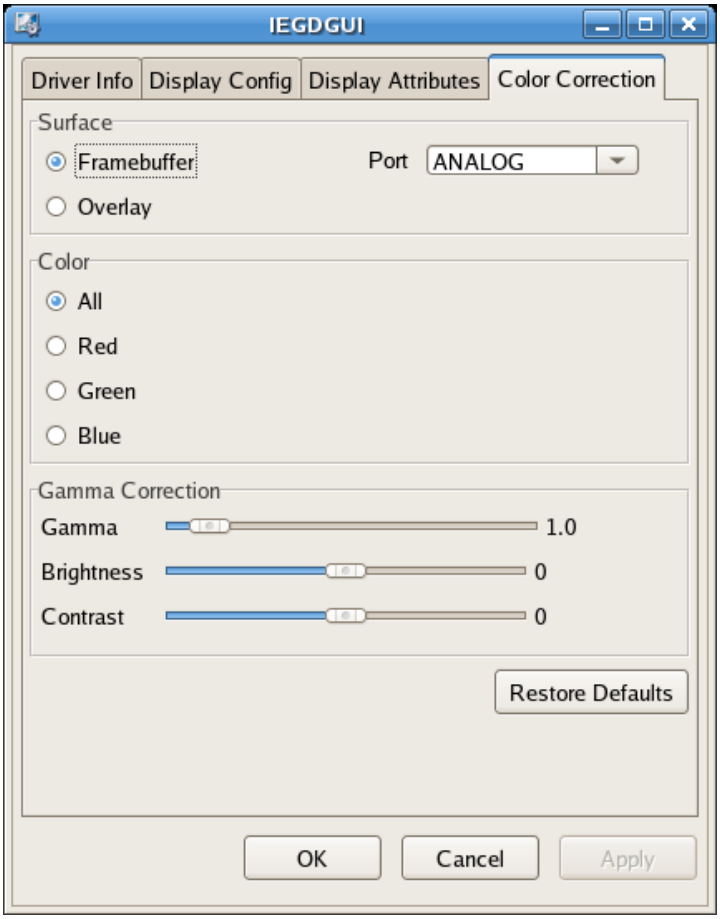


**Figure 38. Example Linux* Runtime Configuration GUI — Color Correction Tab (Framebuffer)**




To view and change color corrections, click the **Color Correction** tab. The figures above and below show sample Color Correction tab screens for **Framebuffer** and **Overlay**, color correction values for which are shown in Table 30 and Table 31.

*Note:* If you make any changes to the color-correction attributes, click **Apply** for the changes to take effect.

The following steps present an example color-correction procedure:

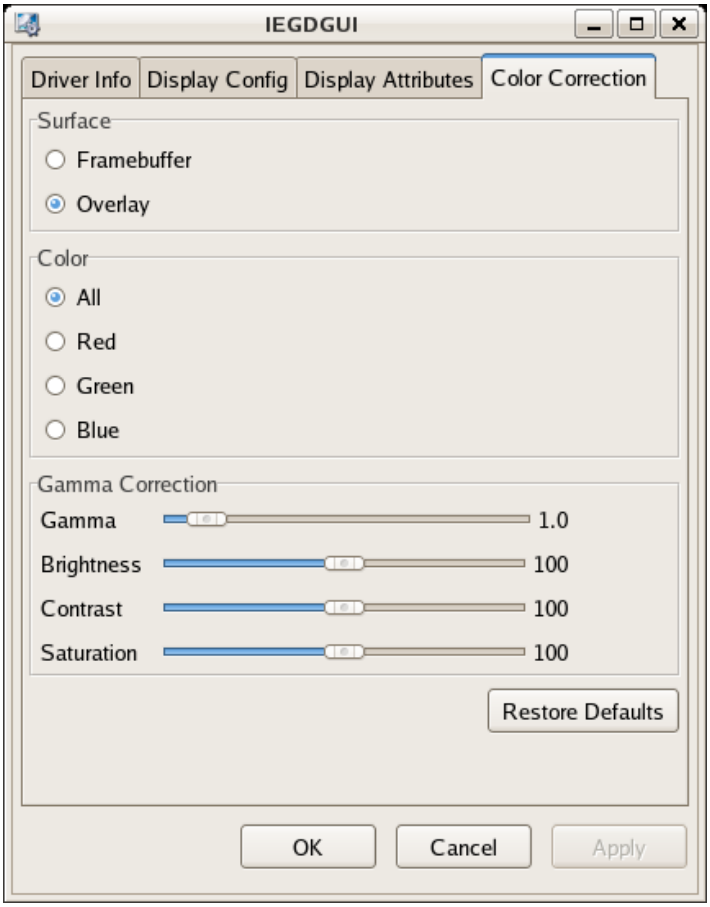
a. Select **Framebuffer** in the **Surface** section and select the appropriate port for the color correction to be applied to or select **Overlay** in the Surface section for color correction to be applied to the overlay.

b. Select the required color to be corrected in the **Color** section.

c. Select the required color attribute to be corrected in the **Gamma Correction** section.

d. Click **Restore Defaults** to restore the default values.

**Figure 39. Example Linux* Runtime Configuration GUI — Color Correction Tab (Overlay)**





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# Appendix A Example INF File

```
;*****************************************************************************
; Filename: iegd.inf
; $Revision$
; $Id$
; $Source$
;
; Copyright (c) 2011 Intel Corporation.  All rights reserved.
;
;*****************************************************************************

[Version]
Signature="$WINDOWS NT$"
Class=Display
ClassGUID={4D36E968-E325-11CE-BFC1-08002BE10318}
Provider=%Intel%
;CatalogFile=iegd.cat
DriverVer = 12/17/2009,10.3.0


;=============================================================================
[SourceDisksNames]
1=%DiskDesc%,,,""

[SourceDisksFiles]
iegdmini.sys = 1
iegdckey.vp  = 1
iegdmsys.vp  = 1
iegdcagt.cpa = 1
iegdcagt.vp  = 1
iegddis.dll  = 1
iegd3dg3.dll = 1
iegd3dg4.dll = 1
iegd3dga.dll = 1
iegdglga.dll = 1
libGLES_CM.dll = 1
libGLESv2.dll  = 1
analog.sys   = 1
lvds.sys     = 1
sdvo.sys     = 1
tv.sys       = 1
hdmi.sys     = 1
sdvo.vp      = 1
hdmi.vp      = 1
analog.vp    = 1
lvds.vp      = 1
tv.vp        = 1
;=============================================================================
[DestinationDirs]
DefaultDestDir     = 11; System directory
iegd.Display_nap  = 11
iegd.Display_gn4  = 11
iegd.Display_plb  = 11
iegd.OpenGL_plb   = 11
```

```
iegd.Miniport     = 12; Drivers directory
iegd.Copp[1]         = 12
iegd.PortDrvs_nap = 12
iegd.PortDrvs_gn4 = 12
iegd.PortDrvs_plb = 12

;===============================================================================
[Manufacturer]
%Intel%=Intel.Mfg

;===============================================================================
[Intel.Mfg]
%Intel% %i915GD0%  = iegd_nap, PCI\VEN_8086&DEV_2582
%Intel% %i915GD1%  = iegd_nap, PCI\VEN_8086&DEV_2782
%Intel% %i915AL0%  = iegd_nap, PCI\VEN_8086&DEV_2592
%Intel% %i915AL1%  = iegd_nap, PCI\VEN_8086&DEV_2792
%Intel% %i945LP0%  = iegd_nap, PCI\VEN_8086&DEV_2772
%Intel% %i945LP1%  = iegd_nap, PCI\VEN_8086&DEV_2776
%Intel% %i945CT0%  = iegd_nap, PCI\VEN_8086&DEV_27A2
%Intel% %i945CT1%  = iegd_nap, PCI\VEN_8086&DEV_27A6
%Intel% %i945WB0%  = iegd_nap, PCI\VEN_8086&DEV_27AE
%Intel% %i35BL0%   = iegd_nap, PCI\VEN_8086&DEV_29C2
%Intel% %i35BL1%   = iegd_nap, PCI\VEN_8086&DEV_29C3
%Intel% %i35BL0A2% = iegd_nap, PCI\VEN_8086&DEV_29B2
%Intel% %i35BL1A2% = iegd_nap, PCI\VEN_8086&DEV_29B3
%Intel% %i3150DT0% = iegd_nap, PCI\VEN_8086&DEV_A001
%Intel% %i3150DT1% = iegd_nap, PCI\VEN_8086&DEV_A002
%Intel% %i3150MB0% = iegd_nap, PCI\VEN_8086&DEV_A011
%Intel% %i3150MB1% = iegd_nap, PCI\VEN_8086&DEV_A012

%Intel% %i965BW0%  = iegd_gn4, PCI\VEN_8086&DEV_2982
%Intel% %i965BW1%  = iegd_gn4, PCI\VEN_8086&DEV_2983
%Intel% %iG9650%   = iegd_gn4, PCI\VEN_8086&DEV_29A2
%Intel% %iG9651%   = iegd_gn4, PCI\VEN_8086&DEV_29A3
%Intel% %iQ9650%   = iegd_gn4, PCI\VEN_8086&DEV_2992
%Intel% %iQ9651%   = iegd_gn4, PCI\VEN_8086&DEV_2993
%Intel% %i946GZ0%  = iegd_gn4, PCI\VEN_8086&DEV_2972
%Intel% %i946GZ1%  = iegd_gn4, PCI\VEN_8086&DEV_2973
%Intel% %i965GM0%  = iegd_gn4, PCI\VEN_8086&DEV_2A02
%Intel% %i965GM1%  = iegd_gn4, PCI\VEN_8086&DEV_2A03
%Intel% %i965GME0% = iegd_gn4, PCI\VEN_8086&DEV_2A12
%Intel% %i965GME1% = iegd_gn4, PCI\VEN_8086&DEV_2A13
%Intel% %iGM450%   = iegd_gn4, PCI\VEN_8086&DEV_2A42
%Intel% %iGM451%   = iegd_gn4, PCI\VEN_8086&DEV_2A43
%Intel% %iG450%    = iegd_gn4, PCI\VEN_8086&DEV_2E22
%Intel% %iG451%    = iegd_gn4, PCI\VEN_8086&DEV_2E23
%Intel% %iG410%    = iegd_gn4, PCI\VEN_8086&DEV_2E32
%Intel% %iG411%    = iegd_gn4, PCI\VEN_8086&DEV_2E33
%Intel% %iELK0%    = iegd_gn4, PCI\VEN_8086&DEV_2E02
%Intel% %iELK1%    = iegd_gn4, PCI\VEN_8086&DEV_2E03
%Intel% %iQ450%    = iegd_gn4, PCI\VEN_8086&DEV_2E12
%Intel% %iQ451%    = iegd_gn4, PCI\VEN_8086&DEV_2E13

%Intel% %i900G0%  = iegd_plb, PCI\VEN_8086&DEV_8108

;===============================================================================
[iegd_nap.GeneralConfigData]
MaximumNumberOfDevices = 2
MaximumDeviceMemoryConfiguration = 256

[iegd_gn4.GeneralConfigData]
MaximumNumberOfDevices = 2
MaximumDeviceMemoryConfiguration = 512
```

1. Certified Output Protection Protocol (COPP) is a proprietary product of Microsoft Corporation.

```
[iegd_plb.GeneralConfigData]
MaximumNumberOfDevices = 2
MaximumDeviceMemoryConfiguration = 256

;=============================================================================
[iegd_nap]
CopyFiles = iegd.Miniport, iegd.Display_nap, iegd.PortDrvs_nap, iegd.Copp

[iegd_gn4]
CopyFiles = iegd.Miniport, iegd.Display_gn4, iegd.PortDrvs_gn4, iegd.Copp

[iegd_plb]
CopyFiles = iegd.Miniport, iegd.Display_plb, iegd.OpenGL_plb, iegd.PortDrvs_plb,
iegd.Copp

;=============================================================================
[iegd.Miniport]
iegdmini.sys

[iegd.Copp]
iegdckey.vp
iegdmsys.vp
sdvo.vp
hdmi.vp
analog.vp
lvds.vp
tv.vp
iegdcagt.cpa
iegdcagt.vp

[iegd.Display_nap]
iegddis.dll
iegd3dg3.dll

[iegd.Display_gn4]
iegddis.dll
iegd3dg4.dll

[iegd.Display_plb]
iegddis.dll
iegd3dga.dll

[iegd.OpenGL_plb]
iegdglga.dll
libGLES_CM.dll
libGLESv2.dll

[iegd.PortDrvs_nap]
analog.sys
sdvo.sys
lvds.sys
tv.sys

[iegd.PortDrvs_gn4]
analog.sys
sdvo.sys
lvds.sys
hdmi.sys

[iegd.PortDrvs_plb]
sdvo.sys
lvds.sys
```

```
;=============================================================================
[iegd_nap.Services]
AddService = iegdmini, 0x00000002, iegd_Service_Inst, iegd_EventLog_Inst
AddService = analog,  ,analog_Service_Inst, iegd_EventLog_Inst
AddService = lvds,    ,lvds_Service_Inst, iegd_EventLog_Inst
AddService = sdvo,    ,sdvo_Service_Inst, iegd_EventLog_Inst
AddService = tv,      ,tv_Service_Inst, iegd_EventLog_Inst

[iegd_gn4.Services]
AddService = iegdmini, 0x00000002, iegd_Service_Inst, iegd_EventLog_Inst
AddService = analog, ,analog_Service_Inst, iegd_EventLog_Inst
AddService = lvds,    ,lvds_Service_Inst, iegd_EventLog_Inst
AddService = sdvo,    ,sdvo_Service_Inst, iegd_EventLog_Inst
AddService = hdmi,    ,hdmi_Service_Inst, iegd_EventLog_Inst

[iegd_plb.Services]
AddService = iegdmini, 0x00000002, iegd_Service_Inst, iegd_EventLog_Inst
AddService = lvds,    ,lvds_Service_Inst, iegd_EventLog_Inst
AddService = sdvo,    ,sdvo_Service_Inst, iegd_EventLog_Inst

;=============================================================================
[iegd_Service_Inst]
ServiceType    = 1
StartType      = %SERVICE_DEMAND_START%
ErrorControl   = 0
LoadOrderGroup = Video
ServiceBinary  = %12%\iegdmini.sys

[analog_Service_Inst]
DisplayName    = "analog"
ServiceType    = %SERVICE_KERNEL_DRIVER%
StartType      = %SERVICE_DEMAND_START%
ErrorControl   = %SERVICE_ERROR_IGNORE%
ServiceBinary  = %12%\analog.sys

[lvds_Service_Inst]
DisplayName    = "lvds"
ServiceType    = %SERVICE_KERNEL_DRIVER%
StartType      = %SERVICE_DEMAND_START%
ErrorControl   = %SERVICE_ERROR_IGNORE%
ServiceBinary  = %12%\lvds.sys

[sdvo_Service_Inst]
DisplayName    = "sdvo"
ServiceType    = %SERVICE_KERNEL_DRIVER%
StartType      = %SERVICE_DEMAND_START%
ErrorControl   = %SERVICE_ERROR_IGNORE%
ServiceBinary  = %12%\sdvo.sys

[tv_Service_Inst]
DisplayName    = "tv"
ServiceType    = %SERVICE_KERNEL_DRIVER%
StartType      = %SERVICE_DEMAND_START%
ErrorControl   = %SERVICE_ERROR_IGNORE%
ServiceBinary  = %12%\tv.sys

[hdmi_Service_Inst]
DisplayName    = "hdmi"
ServiceType    = %SERVICE_KERNEL_DRIVER%
StartType      = %SERVICE_DEMAND_START%
ErrorControl   = %SERVICE_ERROR_IGNORE%
ServiceBinary  = %12%\hdmi.sys
```

```
;=============================================================================
[iegd_EventLog_Inst]
AddReg = iegd_EventLog_AddReg

[iegd_EventLog_AddReg]
HKR,,EventMessageFile,0x00020000,"%SystemRoot%\System32\IoLogMsg.dll;%SystemRoot%\
System32\drivers\iegdmini.sys"
HKR,,TypesSupported,0x00010001,7

;=============================================================================
[iegd_nap.SoftwareSettings]
AddReg = iegd_SoftwareDeviceSettings_nap

[iegd_gn4.SoftwareSettings]
AddReg = iegd_SoftwareDeviceSettings_gn4

[iegd_plb.SoftwareSettings]
AddReg = iegd_SoftwareDeviceSettings_plb
AddReg = iegd_ICDSoftwareSettings

;=============================================================================
[iegd_SoftwareDeviceSettings_nap]
HKR,, InstalledDisplayDrivers, %REG_MULTI_SZ%, iegddis
HKR,, MultiFunctionSupported, %REG_MULTI_SZ%, 1
HKR,, VgaCompatible, %REG_DWORD%, 0
HKR,, PcfVersion,    %REG_DWORD%, 0x0700

HKR,, ConfigId, %REG_DWORD%, 1


HKR,, PortDrivers, %REG_SZ%, "analog"

;-----------------------------------------------------------------------------
[iegd_ICDSoftwareSettings]
HKLM, "SOFTWARE\Microsoft\Windows NT\CurrentVersion\OpenGLDrivers\iegddis", DLL,
%REG_SZ%, iegdglga
HKLM, "SOFTWARE\Microsoft\Windows NT\CurrentVersion\OpenGLDrivers\iegddis",
DriverVersion, %REG_DWORD%, 0x00000001
HKLM, "SOFTWARE\Microsoft\Windows NT\CurrentVersion\OpenGLDrivers\iegddis", Flags,
%REG_DWORD%, 0x00000001
HKLM, "SOFTWARE\Microsoft\Windows NT\CurrentVersion\OpenGLDrivers\iegddis",
Version, %REG_DWORD%, 0x00000002

;=============================================================================
[Strings]

;-----------------------------------------------------------------------
; Localizable Strings
;-----------------------------------------------------------------------
Intel="Intel Corporation"
DiskDesc="Embedded Installation"

i915GD0="915G/915GV/910GL Embedded Graphics Chipset Function 0"
i915GD1="915G/915GV/910GL Embedded Graphics Chipset Function 1"
i915AL0="915GM/915GMS/915GME/910GML/910GMLE Embedded Graphics Chipset Function 0"
i915AL1="915GM/915GMS/915GME/910GML/910GMLE Embedded Graphics Chipset Function 1"
i945LP0="945G Embedded Graphics Chipset Function 0"
i945LP1="945G Embedded Graphics Chipset Function 1"
i945CT0="945GM Embedded Graphics Chipset Function 0"
i945CT1="945GM Embedded Graphics Chipset Function 1"
i945WB0="945GME/945GSE Embedded Graphics Chipset Function 0"
i35BL0="Q35 Embedded Graphics Chipset Function 0"
i35BL1="Q35 Embedded Graphics Chipset Function 1"
i35BL0A2="Q35 Embedded Graphics Chipset Function 0"
i35BL1A2="Q35 Embedded Graphics Chipset Function 1"
i3150DT0="GMA 3150 Embedded Graphics Chipset Function 0"
i3150DT1="GMA 3150 Embedded Graphics Chipset Function 1"
```

```
i3150MB0="GMA 3150 Embedded Graphics Chipset Function 0"
i3150MB1="GMA 3150 Embedded Graphics Chipset Function 1"

i965BW0="965G Embedded Graphics Chipset Function 0"
i965BW1="965G Embedded Graphics Chipset Function 1"
iG9650="G965 Embedded Graphics Chipset Function 0"
iG9651="G965 Embedded Graphics Chipset Function 1"
iQ9650="Q963/Q965 Embedded Graphics Chipset Function 0"
iQ9651="Q963/Q965 Embedded Graphics Chipset Function 1"
i946GZ0="946GZ Embedded Graphics Chipset Function 0"
i946GZ1="946GZ Embedded Graphics Chipset Function 1"
i965GM0="GM965 Embedded Graphics Chipset Function 0"
i965GM1="GM965 Embedded Graphics Chipset Function 1"
i965GME0="GLE960/GME965 Embedded Graphics Chipset Function 0"
i965GME1="GLE960/GME965 Embedded Graphics Chipset Function 1"
iGM450="GM45/GS45/GL40 Embedded Graphics Chipset Function 0"
iGM451="GM45/GS45/GL40 Embedded Graphics Chipset Function 1"
iG450="G45 Embedded Graphics Chipset Function 0"
iG451="G45 Embedded Graphics Chipset Function 1"
iG410="G41 Embedded Graphics Chipset Function 0"
iG411="G41 Embedded Graphics Chipset Function 1"
iELK0="Q45 Embedded Graphics Chipset Function 0"
iELK1="Q45 Embedded Graphics Chipset Function 1"
iQ450="Q45 Embedded Graphics Chipset Function 0"
iQ451="Q45 Embedded Graphics Chipset Function 1"

i900G0="US15 Embedded Graphics Chipset Function 0"

;---------------------------------------------------------------------
; Non Localizable Strings
;---------------------------------------------------------------------
SERVICE_BOOT_START     = 0x0
SERVICE_SYSTEM_START   = 0x1
SERVICE_AUTO_START     = 0x2
SERVICE_DEMAND_START   = 0x3
SERVICE_DISABLED       = 0x4

SERVICE_KERNEL_DRIVER  = 0x1

SERVICE_ERROR_IGNORE   = 0x0; Continue on driver load fail
SERVICE_ERROR_NORMAL   = 0x1; Display warn, but continue
SERVICE_ERROR_SEVERE   = 0x2; Attempt LastKnownGood
SERVICE_ERROR_CRITICAL = 0x3; Attempt LastKnownGood, BugCheck

REG_EXPAND_SZ = 0x00020000
REG_MULTI_SZ  = 0x00010000
REG_DWORD     = 0x00010001
REG_SZ        = 0x00000000
```

# Appendix B Port Driver Attributes

## B.1 Standard Port Driver Attributes

Port drivers are modules within the IEGD suite that control GMCH-specific modules such as GMCH LVDS, GMCH TV or add-on modules to GMCH. The table below lists the attributes available to port drivers. Some of these standard attributes can be customized for specific port drivers and are detailed in the following

In the  tables, device-specific (non-standard) attributes are highlighted in gray.


- "Internal LVDS Port Driver Attributes (Mobile chipsets only)" on page 211
- "CRT (Analog) Port Driver Attributes" on page 212
- "HDMI Port Driver Attributes" on page 212
- "Chrontel CH7307 Port Driver Attributes" on page 214
- "Chrontel CH7308 Port Driver Attributes" on page 214
- "Chrontel CH7315/CH7319/CH7320 Port Driver Attributes" on page 215
- "Chrontel CH7317 Port Driver Attributes" on page 215
- "Chrontel CH7022 Port Driver Attributes" on page 216
- "Silicon Image SiI 1362/SiI 1364 Port Driver DVI Attributes" on page 217


*Note:* Not all standard attributes are supported by all port drivers. Please see the  for details on the specific attributes supported by each port driver. Flat panel settings are specified via the FPINFO options of the configuration; please see Table 24.

**Table 46. Standard Port Driver Attributes (Sheet 1 of 3)**

| Attribute Name | Attribute ID Number | Description |
|---|---|---|
| BRIGHTNESS | 0 | Brightness adjustment. |
| CONTRAST | 1 | Contrast adjustment. |
| HUE | 2 | Hue adjustment. |
| FLICKER | 3 | Setting to reduce flicker. |
| HPOSITION | 4 | Controls the horizontal position of the display. |
| VPOSITION | 5 | Controls the vertical position of the display. |
| HSCALE | 6 | Horizontal scaling ratio. |
| VSCALE | 7 | Vertical scaling ratio. |
| TVFORMAT | 8 | TV formats are device-specific. |
| DISPLAY TYPE | 9 | Allows selection of different displays for multi-display devices. This attribute is device-specific. |
| LUMA FILTER | 10 | TV Luma Filter adjustment. |
| CHROMA FILTER | 11 | Chroma Filter adjustment. |

## Table 46. Standard Port Driver Attributes (Sheet 2 of 3)

| Attribute Name | Attribute ID Number | Description |
|---|---|---|
| TEXT FILTER | 12 | Text Filter adjustment. |
| TV OUTPUT TYPE | 14 | TV output types. This attribute is device-specific. |
| SATURATION | 15 | Saturation adjustment. |
| PANEL FIT | 18 | Panel fitting. Yes or no. |
| SCALING RATIO | 19 | Output Scaling. Device-specific. |
| FP BACKLIGHT ENABLE | 20 | Enable flat panel backlight. |
| PANEL DEPTH | 26 | Can be either 18 or 24. 18 specifies 6-bit output per color, 24 specifies 8-bit output per color. |
| DUAL CHANNEL PANEL | 27 | Is it a dual channel panel or not? Takes 0 or 1. |
| GANG MODE | 28 | For achieving a Gang mode output using two digital ports. |
| GANG MODE EVEN ODD | 29 | Gang display even or odd. This attribute is to be set along with Gang mode (28). This mode (Gang Mode Even Odd) puts even pixels on one digital port and odd pixels on the other, and needs to be selected based on the display panel used. |
| SHARPNESS | 31 | Sharpness. |
| HWCONFIG | 32 | Hardware Configuration for sDVO encoders that support multiple configurations. |
| HORZFILTER | 33 | Horizontal Filter. |
| VERTFILTER | 34 | Vertical Filter. |
| FRAME BUFFER GAMMA | 35 | Framebuffer gamma correction. |
| FRAME BUFFER BRIGHTNESS | 36 | Framebuffer brightness. |
| FRAME BUFFER CONTRAST | 37 | Framebuffer contrast. |
| 2D FLICKER | 39 | Two-dimension flicker. |
| ADAPTIVE FLICKER | 40 | Adaptive flicker. |
| HORIZONTAL OVERSCAN | 41 | Horizontal overscan. |
| VERTICAL OVERSCAN | 42 | Vertical overscan. |
| SPREAD SPECTRUM CLOCKING | 43 | Spectrum Clocking |
| DOT_CRAWL | 44 | Dot crawl affects the edges of color and manifests itself as moving dots of color along these edges. |
| DITHER | 45 | Dither setting |
| PANEL PROTECT HSYNC | 46 | Horizontal sync panel protection |
| PANEL PROTECT VSYNC | 47 | Vertical sync panel protection |
| PANEL PROTECT PIXCLK | 48 | Pixel clock protection |
| LVDS PANEL TYPE | 49 | This is used to select SPWG vs. OpenLDI panel types. 0=SPWG; 1=OpenLDI. |
| VGA 2X IMAGE | 57 | Controls VGA image in Gang mode. |
| TEXT ENHANCEMENT | 58 | Controls text tuning. |

**Table 46. Standard Port Driver Attributes (Sheet 3 of 3)**

| Attribute Name | Attribute ID Number | Description |
|---|---|---|
| MAINTAIN ASPECT RATIO | 59 | This controls scaled image to match source image aspect ratio or full screen image. |
| FIXED TIMING | 60 | This indicates whether the attached display is a fixed timing display. |
| INTENSITY | 70 | This attribute provides a method to control the backlight intensity. It is not a method to turn on backlight but provides a way to adjust its value in percentages from 0% to 100% |

## B.1.1 Internal LVDS Port Driver Attributes (Mobile chipsets only)

**Table 47. Internal LVDS Port Driver Attributes (Sheet 1 of 2)**

| Attribute Name | Attribute ID | Description | Possible Ranges |
|---|---|---|---|
| PANELDEPTH | 26 | Specify Panel Depth based on connected panel. | Default is 18, however, on some GMCH chipsets 24-bit also is supported. For example, GM965 supports both 18 and 24-bit outputs. |
| DUALCHANNEL | 27 | Single or Dual Channel Panel | 0 = Single<br>1 = Dual<br>Default is 0. |
| Spread Spectrum Clocking | 43 | Spectrum Clocking | 3-9 for US15W<br>4-13 for GM45/GL40/GS45<br>0-15 for other chipsets<br>Default = 7<br>Step = 1<br>***Note:*** This setting changes the EMI characteristics, which can be measured with tuning equipment. The change will not necessarily be visible in the display. |
| DITHER | 45 | On and off Dithering | Dither=0 for 24-bit panels<br>Dither=1 for 18-bit panels<br>Default:<br>• dither = 1 for 18-bit panels<br>• dither = 0 for 24-bit panels. |
| LVDS Panel Type | 49 | LVDS panel connector. | 0 = SPWG formatted LVDS output (default)<br>1 = OpenLDI unbalanced color mapping output<br>Default = 0 |
| FIXED TIMING | 60 | This indicates whether attached display is a fixed timing display. | 0 = on<br>1 = off |

**Table 47. Internal LVDS Port Driver Attributes (Sheet 2 of 2)**

| Attribute Name | Attribute ID | Description | Possible Ranges |
|---|---|---|---|
| INTENSITY | 70 | This attribute provides a method to control the backlight intensity. It is not a method to turn on backlight but provides a way to adjust its value in percentages from 0% to 100% | Valid range is 0-100%.<br>Default is 0. |
| INVERTER FREQUENCY | 71 | A method of controlling the backlight. It determines the number of time base events in total for a complete cycle of modulated backlight control. | Valid range is 0-65535 Hz.<br>Default is 0.Typical value is 300 – 1000. |
| BACKLIGHT LEGACY MODE | 72 | A method for controlling whether to use legacy mode for PWM duty cycle. Legacy mode is where the PWM duty cycle will be calculated using a combination of Backlight duty cycle and Legacy backlight Control (LBPC). In non-legacy mode, it will be calculated using Backlight duty cycle only. | Valid values are 0 for non-legacy mode or 1 for legacy mode.<br>Default is 0. |

## B.1.2 CRT (Analog) Port Driver Attributes

*Note:* The analog port driver is included in the driver by default, unlike other port drivers available for selection as part of the driver configuration. It is a dynamically loadable port driver instead of being statically linked into the main driver, for example `iegdmini.sys` for Windows* or `iegd_drv.so` for Linux*.

**Table 48. CRT (Analog) Port Driver Attributes**

| Attribute Name | Attribute ID | Description | Possible Ranges |
|---|---|---|---|
| FIXED TIMING | 60 | Set this attribute if the attached display supports only one timing. | 0 = Not a fixed timing display.<br>1 = Fixed timing display.<br>Default is 0. |
| DETECT METHOD | 32769 | Controls display detection for the CRT. | 0 = Uses DDC method first, then Analog sense to detect the display<br>1 = DDC method only (Digital Sense method) by reading EDID<br>2 = Analog Sense only<br>Default is 0. |

## B.1.3 HDMI Port Driver Attributes

### B.1.3.1 Audio

The IEGD package does not include an HDMI audio driver, so you must obtain and install the driver yourself. The HDMI audio driver needs to support Intel HD Audio to be compatible with IEGD. You must also obtain Microsoft patch KB888111 to enable HDMI audio. IEGD supports only the Windows* HDMI audio driver.

### B.1.3.2 SDVO-HDMI (CH7315)

IEGD supports only one type of SDVO-HDMI encoder, which is CH7315. SDVO-B cannot coexist with HDMI-B; SDVO-C cannot coexist with HDMI-C.

SDVO takes precedence over the HDMI port driver. If no SDVO encoder is available HDMI is automatically loaded by default (only in the GM45 Express chipset).

### B.1.3.3 Internal HDMI

Internal HDMI is available only for the GM45 Express chipset. Only one HDMI port has audio at any one time. The first port in the port order has audio while the second port would have only display without audio.

Only one HDMI port has HDCP at any one time. The first port to receive a request for HDCP has HDCP enabled only in that port.

### B.1.3.4 HDCP

HDCP is supported through the Certified Output Protection Protocol* (COPP) interface in Windows.

## B.1.4 Internal TV Out Port Driver Attributes (Mobile chipsets only)

**Table 49. Internal TV Out Port Driver Attributes (Sheet 1 of 2)**

| Attribute Name | Attribute ID | Description | Possible Ranges |
|---|---|---|---|
| BRIGHTNESS | 0 | Screen brightness | 0-100. Default is 50. |
| CONTRAST | 1 | Color contrast | 0-7. Default is 3. |
| HUE | 2 | Hue adjustment | 0-100. Default is 0. |
| TV FLICK FILTER | 3 | TV Flicker Filter. The higher the value, the higher the amount of flicker filtering and text enhancement. | 0-1000. Default is 999. |
| H POSITION | 4 | Horizontal Position. Increasing the value moves the image to the right and decreasing the value moves the image to the left. | 0-511. Default is 64. |
| V POSITION | 5 | Vertical Position. The value represents the TV line number relative to the VGA vertical sync. Increasing the value moves the image down and decreasing the value moves the image up. | 0-511. Default is 0. |

**Table 49. Internal TV Out Port Driver Attributes (Sheet 2 of 2)**

| Attribute Name | Attribute ID | Description | Possible Ranges |
|---|---|---|---|
| TV FORMAT | 8 | TV formats are device-specific. | Default is NTSC-M (1). |
| TV OUTPUT | 14 | TV output types. This attribute is device-specific.<br>***Note:*** TV output types are limited to S-Video and Composite for the VBIOS. | Default is S-VIDEO (2). |
| OVERSCAN/SCALING RATIO | 19 | Output Scaling. | 0-1000. Default is 350. |

## B.1.5 Chrontel CH7307 Port Driver Attributes

The table below shows the attributes for the Chrontel CH7307* port driver.

*Note:* For flat panel backlight timing settings, please see Table 24.

**Table 50. Chrontel CH7307 Port Driver Attributes**

| Attribute Name | Attribute ID | Description | Possible Ranges |
|---|---|---|---|
| Spread Spectrum Clocking | 43 | Spectrum clocking | 0-15<br>Default = 0<br>Step = 1 |
| FIXED TIMING | 60 | This indicates whether attached display is a fixed timing display. | 0 = on<br>1 = off |

## B.1.6 Chrontel CH7308 Port Driver Attributes

The table below shows the attributes for the Chrontel CH7308* port driver.

*Note:* For FPINFO panel width, height, and backlight timing settings, please see Table 24.

**Table 51. Chrontel CH7308 Port Driver Attributes (Sheet 1 of 2)**

| Attribute Name | Attribute ID | Description | Possible Ranges |
|---|---|---|---|
| LVDS Color Depth | 26 | Panel depth | 18 = 18 bits<br>24 = 24 bits<br>Default = 18 |
| DUAL_CHANNEL | 27 | Dual-channel pane | Default - 0 |
| Spread Spectrum Clocking | 43 | Spectrum Clocking | 0-15<br>Default = 7<br>Step = 1 |
| Dither | 45 | Dither setting | Default = 0 |
| HSync Panel Protection | 46 | Horizontal sync panel protection | Default = 0 |
| VSync Panel Protection | 47 | Vertical sync panel protection | Default = 0 |

**Table 51. Chrontel CH7308 Port Driver Attributes (Sheet 2 of 2)**

| Attribute Name | Attribute ID | Description | Possible Ranges |
|---|---|---|---|
| Pixel Clock Protection | 48 | Pixel clock protection | Default = 0 |
| LVDS Panel Type | 49 | LVDS panel connector. | 0 = SPWG formatted LVDS output (default)<br>1 = OpenLDI unbalanced color mapping output<br>Default = 0 |
| Text Enhancement | 58 | Controls text tuning. | 0-4. |
| Fixed Timing | 60 | This indicates whether attached display is a fixed timing display. | 0 = on<br>1 = off |

## B.1.7 Chrontel CH7315/CH7319/CH7320 Port Driver Attributes

*Note:* For flat panel backlight timing settings, please see Table 24 in .

**Table 52. Chrontel CH7315/CH7319/CH7320 Port Driver Attributes**

| Attribute Name | Attribute ID | Description | Possible Ranges |
|---|---|---|---|
| Fixed Timing | 60 | This indicates whether attached display is a fixed timing display. | 0 = on<br>1 = off |

## B.1.8 Chrontel CH7317 Port Driver Attributes

The table below shows the attributes for the Chrontel CH7317 port driver.

**Table 53. Chrontel CH7317 Port Driver Attributes**

| Attribute Name | Attribute ID | Description | Possible Ranges |
|---|---|---|---|
| VGA Bypass | 9 | Enables VGA bypass. To enable VGA Bypass, this configuration setting line must exist in the configuration file with the value of 2. Attribute 9 is used to enable selection of several possible display types based on what was supported on an SDVO device as defined in SDVO specifications. Default value of 2 represent VGA display. | 1) Enable VGA Bypass |

### B.1.9 Chrontel CH7022 Port Driver Attributes

The table below shows the attributes for the Chrontel CH7022 port driver.

**Table 54. Chrontel CH7022 Port Driver Attributes (Sheet 1 of 2)**

| Attribute Name | Attribute ID | Description | Possible Ranges |
|---|---|---|---|
| DISPLAY TYPE | 9 | Allows selection of different displays for multi-display devices. This attribute is device-specific. ***Note:*** TV Out is not available with VBIOS. | 1) VGA Bypass (2)<br>2) Composite (4)<br>3) S-Video (8)<br>4) YPrPb (16) |
| BRIGHTNESS | 0 | Brightness adjustment. | 0-255 |
| SATURATION | 15 | Saturation adjustment. | 0-127 |
| HUE | 2 | Hue adjustment. | 0-127 |
| CONTRAST | 1 | Contrast adjustment. | 0-127 |
| HORIZONTAL OVERSCAN | 41 | Horizontal overscan. | 0-47 |
| VERTICAL OVERSCAN | 42 | Vertical overscan. | 0-47 |
| Vertical Position/VPOSITION | 5 | Controls the vertical position of the display. | 0-1023 |
| SHARPNESS | 31 | Sharpness. | 0-7 |
| TV Chroma Filter | 11 | ChromaFilter adjustment. | 0-3 |
| TV Luma Filter | 10 | TV Luma Filter adjustment. | 0-2 |
| Adaptive Flicker Filter | 40 | Adaptive flicker. | 0-7 |
| Dot Crawl | 44 | Dot crawl affects the edges of color and manifests itself as moving dots of color along these edges. | 1) Have Dot Crawl Run Freely (0)<br>2) Freeze Dot Crawl (1) |
| TV Output Format | 8 | TV formats are device-specific. | Refer to the Attributes Page for the complete list of choices. |

**Table 54. Chrontel CH7022 Port Driver Attributes (Sheet 2 of 2)**

| Attribute Name | Attribute ID | Description | Possible Ranges |
|---|---|---|---|
| Analog Source | 52 | VGA | 1) No Data (0)<br>2) Analog Source (1)<br>3) Pre-recorded Packaged (2)<br>4) Not Analog Pre-recorded (3) |
| Scan Information | 53 | TV attributes are device specific. | 1) No Data (0)<br>2) Overscanned (1)<br>3) Under scanned (2) |
| Picture Aspect Ratio | 54 | The relative horizontal and vertical sizes. | 1) No Data (0)<br>2) 4:3 (1)<br>3) 16:9 (2) |
| Active Format Ratio | 55 | Output ratio. | 1) No Data (0)<br>2) Active Format (1)<br>3) Square Pixels(8)<br>4) 4:3 Center (9)<br>5) 16:9 Center (10)<br>6) 14:9 Center (11)<br>7) 16:9 Letterbox (Top)(2)<br>8) 14:9 Letterbox (Top)(3)<br>9) 16:9 Letterbox (Center)<br>10) 4:3 (with shoot and protect 14:9 center)<br>11) 16:9 (with shoot and protect 14:9 center) (10610)<br>12) 16:9 (with shoot and protect 4:3 center) |

## B.1.10 Silicon Image SiI 1362/SiI 1364 Port Driver DVI Attributes

*Note:* For flat panel backlight timing settings, please see Table 24.

**Table 55. Silicon Image SiI 1362/SiI 1364 Port Driver Attributes**

| Attribute Name | Attribute ID | Description | Possible Ranges |
|---|---|---|---|
| FIXED TIMING | 60 | This indicates whether attached display is a fixed timing display. | 0 = on<br>1 = off |

## B.1.11 Default Search Order

*Note:* See more information pertaining to port order in the description for "Port Devices (Available Ports, Port Order)" on page 40.

### Table 56. Default Search Order

| Chipset | Default Search Order |
|---|---|
| Intel®Atom™ 400/500 | ANALOG, LVDS |
| Intel® Q45/G41/G45 | ANALOG, sDVOB, sDVOC |
| Intel® GM45/GL40/GS45 | ANALOG, sDVOB, sDVOC, LVDS |
| Intel® US15W/US15WP/WPT | LVDS, sDVOB |
| Intel® Q35 | ANALOG, sDVOB, sDVOC |
| Intel® GLE960/GME965 | ANALOG, sDVOB, sDVOC, LVDS |
| Intel® Q965 | ANALOG, sDVOB, sDVOC |
| Intel® 945GME/945GSE | ANALOG, sDVOB, sDVOC, LVDS |
| Intel® 945G | ANALOG, sDVOB, sDVOC |
| Intel® 915GV | ANALOG, sDVOB, sDVOC |
| Intel® 915GME | ANALOG, sDVOB, sDVOC, LVDS |
| Intel® 910GMLE | ANALOG, sDVOB, sDVOC, LVDS |

## B.1.12 Default GPIO Pin Pair Assignments

### Table 57. Default GPIO Pin Pair Assignments

| Chipset | Default GPIO Pin Pair for EDID | | | |
|---|---|---|---|---|
| | sDVO/A | sDVOB | sDVOC | LVDS |
| Intel®Atom™ 400/500 | N/A | 4 | 2 | 2 |
| Intel® Q45/G41/G45 | N/A | 4 | 4 | N/A |
| Intel® GM45/GL40/GS45 | N/A | 4 | 4 | 2 |
| Intel® US15W/WP/WPT | N/A | 4 | 4 | 2 |
| Intel® Q35 | N/A | 4 | 4 | N/A |
| Intel® GLE960/GME965 | N/A | 4 | 4 | 2 |
| Intel® Q965 | N/A | 4 | 4 | N/A |
| Intel® 945GME/945GSE | N/A | 4 | 4 | 2 |
| Intel® 945G | N/A | 4 | 4 | N/A |
| Intel® 915GV | N/A | 4 | 4 | N/A |
| Intel® 915GM | N/A | 4 | 4 | 2 |
| Intel® 910GMLE | N/A | 4 | 4 | 2 |

## B.1.13 Default I2C Device Address Byte Assignment

### Table 58. Default I²C Device Address Byte Assignment

| Port Driver | Default Device Address Bytes (DAB) |
|---|---|
| CH7315, CH7317, CH7319, CH7320, CH7022 | 0x70 (for first sDVO device)<br>0x72 (for second sDVO device) |
| CH7307 | 0x70 (for first sDVO device)<br>0x72 (for second sDVO device) |
| CH7308 | 0x70 (for first sDVO device)<br>0x72 (for second sDVO device) |
| SiI 1362 | 0x70 (for first sDVO device)<br>0x72 (for second sDVO device) |
| SiI 1364 | 0x70 (for first sDVO device)<br>0x72 (for second sDVO device) |



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# Appendix C Intel® 5F Extended Interface Functions

The BIOS provides a set of proprietary function calls to control operation of the extended features. These function calls all use AH = 5Fh in their designed interface for easy identification as a proprietary function.

These functions are designed to maintain maximum compatibility with the Desktop and Mobile Video BIOS. As such many of the definitions behave identically. When the behavior of the Embedded Video BIOS is not identical to the Desktop and Mobile Video BIOS it is noted.

In addition to these 5F functions, the Video BIOS also supports all 4F functions defined by the *VESA BIOS Extension (VBE) Core Functions Standard, Version 3.0* with the exception of the 0A function (Return VBE Protected Mode Interface). All other functions, from 00 through 09 and 0B are supported by the Video BIOS. The *VESA BIOS Extension (VBE) Core Functions Standard, Version 3.0* document is available from http://www.vesa.org/vesa-standards/free-standards/

The table below provides a summary of the IEGD supported Intel 5F functions.

## C.1 BIOS Extended Interface Functions

The BIOS provides a set of proprietary function calls to control operation of the extended features. These function calls all use AH = 5Fh in their designed interface for easy identification as a proprietary function

These functions are designed to maintain maximum compatibility with the Desktop and Mobile Video BIOS. As such many of the definitions behave identically. When the behavior of the Embedded Video BIOS is not identical to the Desktop and Mobile Video BIOS it is noted.

### C.1.1 5F01h – Get Video BIOS Information

This function returns the Video BIOS Build information.

*Note:* This function is an extension of the Desktop and Mobile Video BIOS. If register ECX does not contain ASCII characters “IEGD” then the VBIOS is not described by this specification.

***Calling Register:***

AX = 5F01h, Get Video Information function

***Return Registers:***

AX = Return Status (function not supported if AL != 5Fh):
= 005Fh, Function supported and successful
= 015Fh, Function supported but failed
EBX = 4 bytes Video BIOS Build Number ASCII string, e.g., ‘1000’
ECX = 4 bytes Embedded Identifier, ASCII string ‘IEGD’

### C.1.2 5F05h – Refresh Rate

This function sets a new vertical refresh rate for a given mode and returns the current vertical refresh rate and available refresh rate for a given non-VGA mode.

#### C.1.2.1 5F05h, 00h – Set Refresh Rate

This sub-function sets a new default refresh rate for the selected pipe. If the mode is currently active, the CRT controller and other registers will be automatically programmed setting the requested refresh rate.

*Note:* This function is not entirely compatible with the Desktop and Mobile versions. It is not possible to set the refresh rate for a given mode in advance. This function sets the "desired" refresh rate which will be applied to all subsequent mode sets when possible. If the mode provided in BL is the current mode, then a mode change will be automatically performed.

***Calling Register:***

AX = 5F05h, Refresh Rate function
BH = 00h, Set Refresh Rate sub-function
BL = Mode Number
ECX = Refresh rate (indicated by setting one bit):
Bits 31 - 9 = Reserved
Bit 8 = 120 Hz
Bit 7 = 100 Hz
Bit 6 = 85 Hz
Bit 5 = 75 Hz
Bit 4 = 72 Hz
Bit 3 = 70 Hz
Bit 2 = 60 Hz
Bit 1 = 56 Hz
Bit 0 = 43 Hz (Interlaced - Not supported)

***Return Registers:***

AX = Return Status (function not supported if AL != 5Fh):
= 005Fh, Function supported and successful
= 015Fh, Function supported but failed

### C.1.2.2 5F05h, 01h – Get Refresh Rate

This sub-function returns current vertical refresh rate for the selected pipe and available refresh rates information for a given Non-VGA mode.

*Note:* This sub-function returns a status of supported but failed (AX = 015Fh) if executed with a standard VGA mode.

***Calling Registers:***

AX = 5F05h, Refresh Rate function
BH = 01h, Get Refresh Rate sub-function
BL = Mode number

***Return Registers:***

AX = Return Status (function not supported if AL != 5Fh):
= 005Fh, Function supported and successful
= 015Fh, Function supported but failed
EBX = Available refresh rates (indicated by one or more bits set):
Bits 31 - 9 = Reserved
Bit 8 = 120 Hz
Bit 7 = 100 Hz
Bit 6 = 85 Hz
Bit 5 = 75 Hz
Bit 4 = 72 Hz
Bit 3 = 70 Hz
Bit 2 = 60 Hz
Bit 1 = 56 Hz
Bit 0 = 43 Hz (Interlaced - Not supported)
ECX = Current refresh rate (see EBX for bit definitions)

### C.1.3 5F10h – Get Display Memory Information

This function returns information regarding the linear memory starting address, size and memory mapped base address.

***Calling Register:***

AX = 5F10h, Get Linear Display Memory Information function

***Return Registers:***

AX = Return Status (function not supported if AL != 5Fh):
= 005Fh, Function supported and successful
= 015Fh, Function supported but failed
ESI = Display memory base address
ECX = Total physical display memory size (in bytes)
EDX = Available display memory size (in bytes)
EDI = Memory Mapped I/O Base Address
EBX = Stride (memory scan line width in bytes)

### C.1.4 5F1Ch – BIOS Pipe Access

This function will set the BIOS pipe access or return the BIOS pipe access status.

#### C.1.4.1 5F1Ch, 00h – Set BIOS Pipe Access

This sub-function will set the currently selected pipe. All 5f functions operate on the currently selected pipe.

When not in clone modes this value cannot be set.

***Calling Registers:***

AX = 5F1Ch, BIOS Pipe Access function
BH = 00h, Set BIOS Pipe Access sub-function
CH = BIOS Pipe access:
= 00h, Pipe A
= 01h, Pipe B

***Return Registers:***

AX = Return Status (function not supported if AL != 5Fh):
= 005Fh, Function supported and successful
= 015Fh, Function supported but failed

#### C.1.4.2 5F1Ch, 01h – Get BIOS Pipe Access

This sub-function will return the currently selected pipe.

***Calling Registers:***

AX = 5F1Ch, BIOS Pipe Access function
BH = 01h, Get BIOS Pipe Access sub-function

***Return Registers:***

AX = Return Status (function not supported if AL != 5Fh):
= 005Fh, Function supported and successful
= 015Fh, Function supported but failed
CH = BIOS Pipe access:
= 00h, Pipe A
= 01h, Pipe B

### C.1.5 5F29h – Get Mode Information

This function returns the requested mode's resolution, color depth, and maximum required bandwidth using its current refresh rate. This function is applied to extended-graphics modes only. If the mode number is not an extended graphics mode, the function will return failure.

***Calling Registers:***

AX = 5F29h, Get Mode Information function
BH = Mode To Use:
= 80h, Current Mode
= 00h - 7Fh, Given Mode Number

***Return Registers:***

AX = Return Status (function not supported if AL != 5Fh):
= 005Fh, Function supported and successful
= 015Fh, Function supported but failed
EBX bits 31 - 16 = Mode horizontal (X) resolution in pixels
EBX bits 15 - 0 = Mode vertical (Y) resolution in pixels
ECX bits 31 - 16 = Maximum bandwidth in megabytes per second
ECX bits 15 - 0 = Color depth in bits per pixel

### C.1.6 5F61h – Local Flat Panel Support Function

This function supports local flat panel only features.

*Note:* Only Subfunction 5h of the 5f61h interface is supported for the Embedded vBIOS.

#### C.1.6.1 5F61h, 05h – Get Configuration ID

This function is used to return the Configuration ID.

*Note:* This function is known as "Get Local Flat Panel Number" in the Desktop and Mobile Video BIOS. This function performs a similar purpose however, the configuration IDs have no pre-defined meaning. The Configuration ID is reported to the Embedded Graphics Driver and will be used as described in the *Intel® Embedded Graphics Drivers and Video BIOS User's Guide*.

***Calling Registers:***

AX = 5F61h, Local Flat Panel Support function
BH = 05h, Get Config ID Subfunction

***Return Registers:***

AX = Return Status (function not supported if AL != 5Fh):
= 005Fh, Function supported and successful
= 015Fh, Function supported but failed
BL = Config ID

### C.1.7 5F68h – System BIOS Callback

This is a generic function that allows SoftBIOS to do any system callbacks through INT 15h. The Input/Output of this function is dependent on the definition of the desired INT 15h hook except for the EAX register.

***Calling Registers:***

AX = 5F68h, System BIOS Callback Function
EAX bits 31:16 = System BIOS INT 15h Hook Function

***Return Registers:***

AX = Return Status (function not supported if AL != 5Fh):
= 005Fh, Function supported and successful
= 015Fh, Function supported but failed

## C.2 Hooks for the System BIOS

The video BIOS performs several system BIOS interrupt function calls (interrupt 15h hooks). Each function provides the system BIOS with the opportunity to gain control at specific times to perform any custom processing that may be required. After each interrupt hook, the system BIOS must return control to the video BIOS. INT 10h calls could be made within the INT 15h hook calls provided that it is not recursive and thus cause a deadlock.

### C.2.1 5F31h – POST Completion Notification Hook

This hook signals the completion of video POST (Power On Self Test). The hook executes after the sign-on message is displayed and PCI BIOS resizing.

***Calling Registers:***

AX = 5F31h, POST Completion Notification Hook

***Return Registers:***

AX = Return Status (function not supported if AL != 5Fh):
= 015Fh, Function supported but failed
= 005Fh, Function supported and successful

### C.2.2 5F33h – Hook After Mode Set

This hook allows the system BIOS to intercept the video BIOS at the end of a mode set.

***Calling Registers:***

AX = 5F33h, Hook After Mode Set
BH = Number of character columns
BL = Current mode number
CH = Active display page

***Return Registers:***

AX = Return Status (function not supported if AL != 5Fh):
= 015Fh, Function supported but failed
= 005Fh, Function supported and successful

### C.2.3 5F35h – Boot Display Device Hook

This hook allows the system BIOS to override the video display default setting. The graphics BIOS will set the returned video display during POST (power up initialization).

*Note:* This function is not entirely compatible with the Desktop and Mobile Video BIOS. The bits in CL have a configurable mapping to the Port Numbers as defined in the *Intel® Embedded Graphics Drivers and Video BIOS User's Guide*. The assigned meanings used in the Desktop specification can be duplicated with a correct configuration. The values below are the default values if no "Common To Port" mapping is provided.

***Calling Registers:***

AX = 5F35h, Boot Display Device Hook

***Return Registers:***

AX = Return Status (function not supported if AL != 5Fh);
= 005Fh, Function supported and successful
= 015Fh, Function supported but failed
CL = Display Device Combination to boot (1 = Enable display, = 00h, VBIOS Default
Bit 7 - 6 = Reserved
Bit 5 = Port 5 (or common_to_port[5])
Bit 4 = Port 4 (or common_to_port[4])
Bit 3 = Port 3 (or common_to_port[3])
Bit 2 = Port 2 (or common_to_port[2])
Bit 1 = Port 1 (or common_to_port[1])
Bit 0 = Port 0 (or common_to_port[0])

### C.2.4 5F36h – Boot TV Format Hook

This hook allows the system BIOS to boot TV in selected TV format state.

***Calling Registers:***

AX = 5F36h, Boot TV Format Hook

***Return Registers:***

AX = Return Status (function not supported if AL != 5Fh):
= 015Fh, Function supported but failed
= 005Fh, Function supported and successful
BL = TV Format requested:
= 00h, No Preference
= 01h, NTSC_M
= 11h, NTSC_M_J
= 21h, NTSC_433
= 31h, NTSC_N
= 02h, PAL_B
= 12h, PAL_G
= 22h, PAL_D
= 32h, PAL_H
= 42h, PAL_I
= 52h, PAL_M
= 62h, PAL_N
= 72h, PAL_60
= 03h, SECAM_L
= 13h, SECAM_L1
= 23h, SECAM_B
= 33h, SECAM_D
= 43h, SECAM_G
= 53h, SECAM_H
= 63h, SECAM_K
= 73h, SECAM_K1

### C.2.5 5F38h – Hook Before Set Mode

This hook allows the system BIOS to intercept the video BIOS before setting the mode.

***Calling Registers:***

AX = 5F38h, Hook Before Set Mode
CL = New video mode to be set

***Return Registers:***

AX = Return Status (function not supported if AL != 5Fh):
= 015Fh, Function supported but failed
= 005Fh, Function supported and successful

### C.2.6 5F40h – Config ID Hook

This function is known as “Boot Panel Type Hook” in the Desktop and Mobile Video BIOS. It allows the system BIOS to supply a configuration ID that will eventually be passed to the driver. This configuration ID is unused by the Video BIOS; however, it alters the behavior of the driver as described in the *Intel® Embedded Graphics Drivers and Video BIOS User’s Guide*.

***Calling Registers:***

AX = 5F40h, Config ID Hook

***Return Registers:***

AX = Return Status (function not supported if AL != 5Fh):
= 005Fh, Function supported and successful
= 015Fh, Function supported but failed
CL = Configuration ID

# Appendix D 2D/3D API Support

This appendix provides information on supported and non-supported OpenGL and OpenGL ES APIs. See Section 7.6.10, “OpenGL Support” on page 192 for additional information.

## D.1 2D Support

IEGD provides 2D capabilities on Linux through UXA and on Windows through DirectX/GDI.

## D.2 3D Support

IEGD provides 3D capabilities on Linux, Windows, and Windows CE through several industry-standard APIs, such as OpenGL, OpenGL ES, Direct3D, and D3DMobile. These APIs are described in the following sections.

### D.2.1 OpenGL APIs

The following OpenGL versions are supported:

- Version 1.3 on all Embedded Intel® Architecture (eIA) chipsets (Linux only)
- Version 1.4 on 915GV, 915GM, 945G, 945GM, Q965, GLE960/GME965 (Linux only) and Intel® Atom™ Processor 400 and 500 Series
- Version 1.5 on Q965, GLE960/GME965, Q45/G41/G45, GM45/GL40/GS45, and Q35 (Linux only)
- Version 2.0 on US15W/US15WP/WPT (Linux and Windows), Q35, Q45 and GM45 (Linux only)

For general OpenGL information, visit http://www.opengl.org/about/overview/.

**Table 59. Supported Intel® OpenGL APIs (Sheet 1 of 2)**

| Supported API Name(s) |
|---|
| GL_3DFX_texture_compression_FXT1* |
| GL_ARB_depth_texture |
| GL_ARB_fragment_program (965 or later only) |
| GL_ARB_multitexture |
| GL_ARB_occlusion_query (965 or later only) |
| GL_ARB_point_sprite |
| GL_ARB_shadow |
| GL_ARB_texture_env_dot3 |
| GL_ARB_texture_border_clamp |
| *Not supported on Intel US15W series chipsets. |

## Table 59. Supported Intel® OpenGL APIs (Sheet 2 of 2)

| Supported API Name(s) |
|---|
| GL_ARB_texture_compression |
| GL_ARB_texture_cube_map |
| GL_ARB_texture_env_add |
| GL_ARB_texture_env_combine |
| GL_ARB_texture_env_crossbar |
| GL_ARB_transpose_matrix |
| GL_ARB_vertex_buffer_object |
| GL_ARB_vertex_program (965 or later only) |
| GL_EXT_abgr |
| GL_EXT_bgra |
| GL_EXT_blend_color |
| GL_EXT_blend_func_separate |
| GL_EXT_blend_minmax |
| GL_EXT_blend_subtract |
| GL_EXT_clip_volume_hint* |
| GL_EXT_compiled_vertex_array |
| GL_EXT_cull_vertex |
| GL_EXT_fog_coord |
| GL_EXT_mulit_draw_arrays |
| GL_EXT_packed_pixels |
| GL_EXT_rescale_normal |
| GL_EXT_secondary_color |
| GL_EXT_separate_specular_color |
| GL_EXT_shadow_funcs |
| GL_EXT_stencil_two_side* |
| GL_EXT_texture_compression_s3tc |
| GL_EXT_texture_env_add |
| GL_EXT_texture_filter_anisotropic |
| GL_EXT_texture_lod_bias (965 or later only) |
| GL_IBM_texture_mirrored_repeat |
| GL_NV_blend_square |
| GLX_ARB_get_proc_address |
| *Not supported on Intel US15W series chipsets. |

**Table 60. Non-Supported Intel® OpenGL APIs**

| Non-Supported API Name(s) |
|---|
| GL_ARB_color_buffer_float |
| GL_ARB_fragment_program_shadow |
| GL_ARB_shader_objects |
| GL_ARB_shading_language_100 |
| GL_ARB_texture_non_power_of_two |
| GL_EXT_paletted_texture |
| GL_WIN_swap_hint |
| WGL_ARB_buffer_region |
| WGL_ARB_extensions_string |
| WGL_ARB_make_current_read |
| WGL_ARB_pbuffer |
| WGL_ARB_pixel_format |
| WGL_EXT_swap_control |

### D.2.2 OpenGL ES 1.1

The following chipsets support OpenGL ES 1.1:

- US15W/WP/WPT

Except where noted by individual chipsets, the following OpenGL ES 1.1 extensions are supported:

- GL_OES_byte_coordinates
- GL_OES_fixed_point
- GL_OES_single_precision
- GL_OES_matrix_get
- GL_OES_read_format
- GL_OES_compressed_paletted_texture
- GL_OES_point_size_array
- GL_OES_point_sprite
- GL_OES_draw_texture
- GL_OES_query_matrix
- GL_OES_blend_equation_separate
- GL_OES_blend_func_separate
- GL_OES_blend_subtract
- GL_OES_framebuffer_object
- GL_OES_texture_cube_map
- GL_OES_texture_env_crossbar
- GL_OES_texture_mirrored_repeat
- GL_OES_depth24
- GL_OES_depth32

- GL_OES_element_index_uint
- GL_OES_fbo_render_mipmap
- GL_OES_mapbuffer
- GL_OES_rgb8_rgba8
- GL_OES_stencil1
- GL_OES_stencil4
- GL_OES_stencil8
- GL_EXT_texture_filter_anisotropic

### D.2.3 OpenGL ES 2.0

The following chipsets support OpenGL ES 2.0:

- US15W/WP/WPT

Except where noted by individual chipsets, the following OpenGL ES 2.0 extensions are supported:

- GL_OES_single_precision
- GL_OES_compressed_paletted_texture
- GL_OES_depth24
- GL_OES_depth32
- GL_OES_element_index_uint
- GL_OES_fbo_render_mipmap
- GL_OES_mapbuffer
- GL_OES_rgb8_rgba8
- GL_OES_stencil1
- GL_OES_stencil4
- GL_OES_texture_3D
- GL_OES_texture_npot
- GL_EXT_texture_filter_anisotropic
- GL_EXT_texture_type_2_10_10_10_REV
- GL_OES_depth_texture
- GL_OES_standard_derivatives

### Table 61. Non-Supported Intel® OpenGL ES APIs on US15W/WP/WPT

| Non-Supported API Name(s) |
|---|
| GL_OES_stencil_wrap |
| GL_OES_compressed_ETC1_RGB8_texture |
| GL_OES_matrix_palette |
| GL_OES_EGL_image |
| GL_AMD_compressed_3DC_texture |
| GL_AMD_compressed_ATC_texture |
| GL_OES_texture_float |
| GL_OES_texture_half_float |
| GL_OES_texture_float_linear |
| GL_OES_texture_half_float_linear |
| GL_OES_vertex_half_float |
| GL_OES_vertex_type_10_10_10_2 |
| GL_OES_fragment_precision_high |



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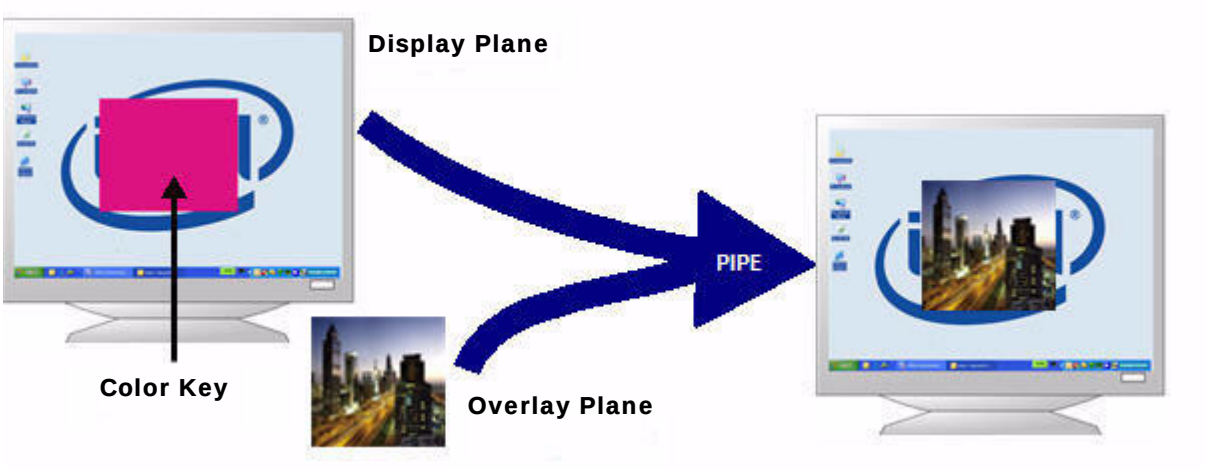
# Appendix E Framebuffer Overlay Blending

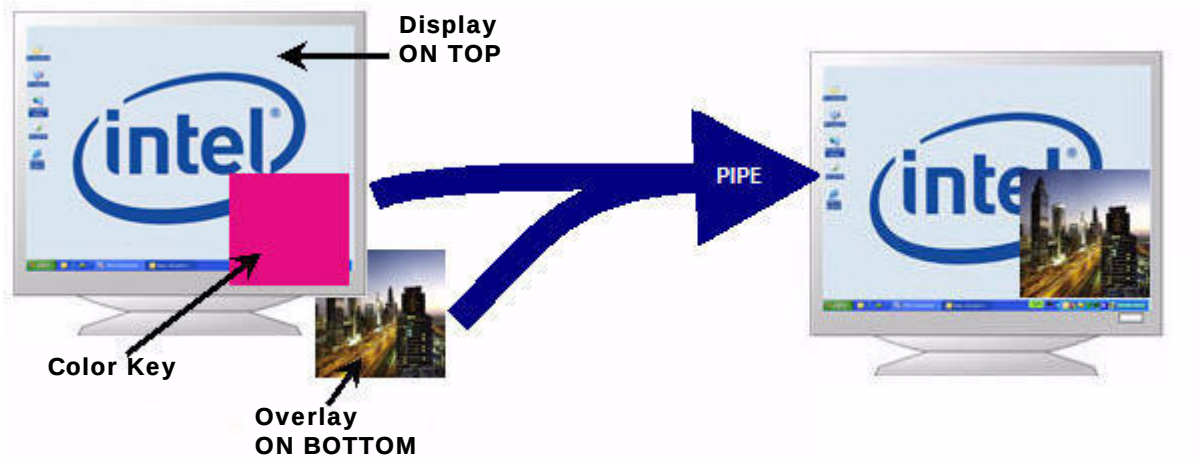
This appendix describes behavior of the IEGD Framebuffer Overlay Blending (FB_BLEND_OVL) feature.

## E.1 How Overlay Works

The overlay is visible as if “on top” of the frame buffer, appearing only where the color key matches.




The overlay plane is actually behind the display plane (last in Z-order). The framebuffer overrides all overlay pixels in the pipe except where the color key matches.

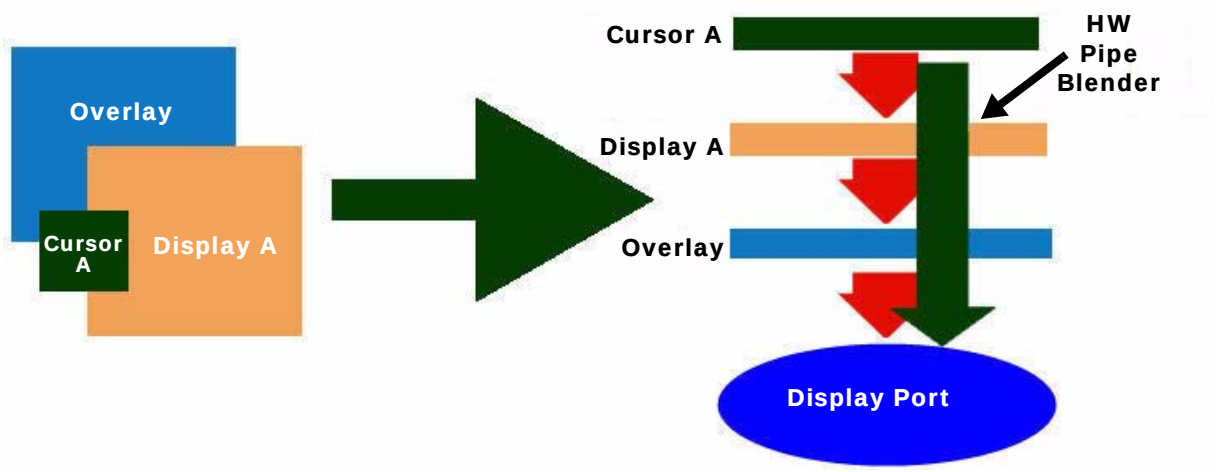


## E.2 About Framebuffer in "Blend" Mode

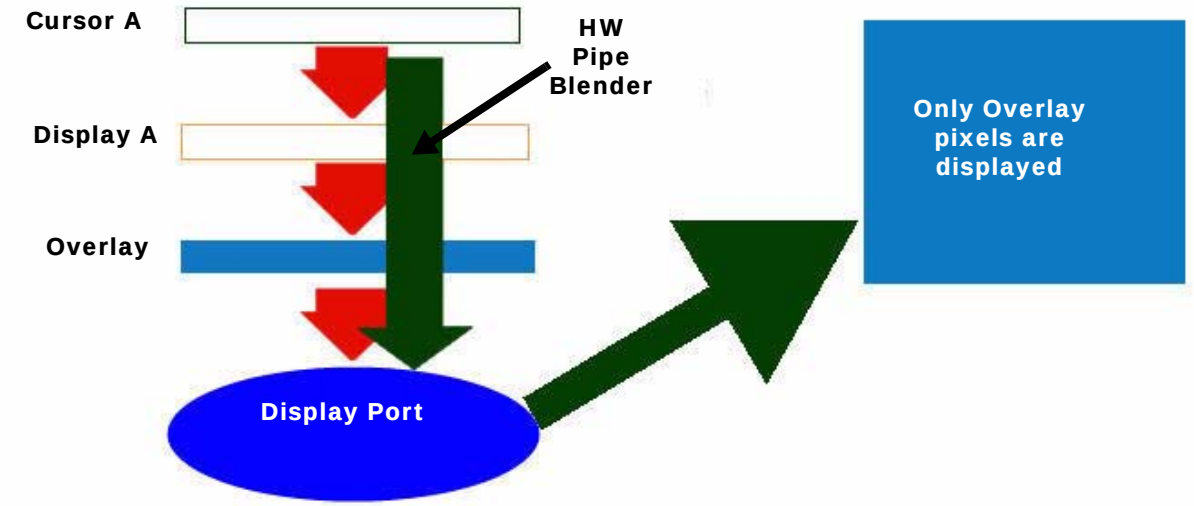
IEGD has always expressed the mode setting operation as Width X Height at 8, 16, or 32 bpp. In all bit depths, IEGD does not expose any mode with an alpha channel (i.e., 32 bpp = X8R8G8B8, not A8R8G8B8).

However, the hardware does support 32 bpp with alpha (== A8R8G8B8).

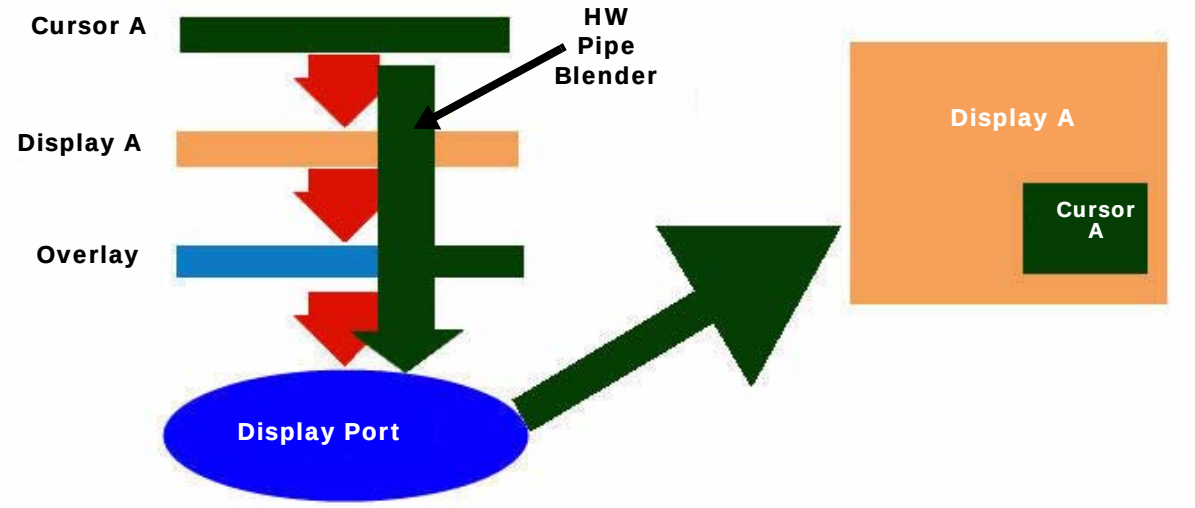
How is this used? The Display Plane in ARGB32 contains per-pixel Alpha to be blended with all other planes on the same display pipeline. This "Alpha" data is dictated by the application.



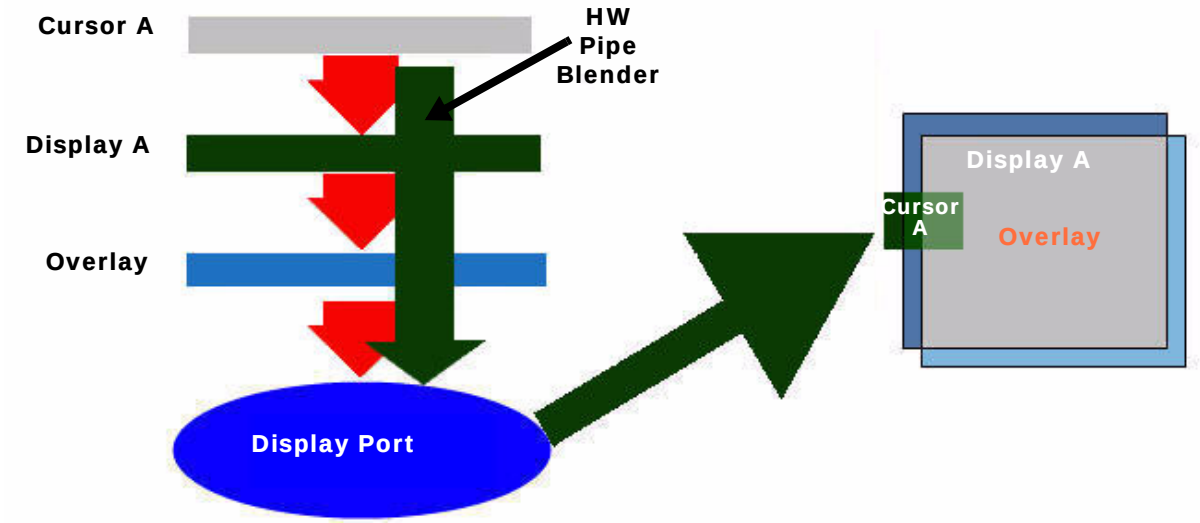

If all the Alpha channel (8 MSbits) for Display A and Cursor A were zero (0x00), this means those two planes are completely transparent.




If all the Alpha channel (8 MSbits) for Display A and Cursor A were max (0xFF) – this means it is completely opaque.




If all the Alpha channel (8 MSbits) for Display A and Cursor A were 50% (0x80) – this means it is 50% transparent.




*Note:* Destination Chroma-keying will not work with the FB-Blend-Ovl feature.

## E.3 Example to Enable the FB_BLEND_OVL Feature

*Note:* This feature applies to the Intel® System Controller Hub US15W only.

1. Enable the feature:
   a. Set the display mode to Width x Height @ 32 bpp.
   b. Edit the Windows XP `.inf` or Windows CE `.reg` or Linux `Xorg.conf` file and add the following line in the same section where you find "DisplayConfig": "FbBlendOvl" = 1
2. Boot the OS. An example is shown below.

3. Run a video with any video stream, as long as overlay is being used.

4. Run a D3D/OGL application.
   Ensure that the application has been modified so that the render target has valid alpha. Use an alpha value such as 0.5 (0x80 = 50% transparency).

The 3D output appears on the display, carries a 50% transparency, and is blended with the overlay. The overlay is behind and 3D output is on top – on the display plane.

## E.4 Summary

You must use a 3D API to get the application on the framebuffer with a valid alpha value to blend on top of the video overlay. 2D API is not supported.

If the application has an alpha value of 0.0 or 1.0, it is either semi-transparent or fully opaque – which is useless because color keying can give you the same effect.

On any operating system you can use OS APIs that already exist to directly write alpha data to the framebuffer if you want.



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