The table below lists the types of displays supported by the Intel® Embedded Media and Graphics Driver.

Table 2.Types of Displays SupportedDisplay	Description
CRT	Analog CRT. Also known as “VGA” typically using a 15 pin D-Sub connector.
Flat Panel	TMDS and LVDS compliant flat panels are supported.
HDMI	High-Definition Multimedia Interface (video only, no audio)
DP	DisplayPort
eDP	embedded DisplayPort

2.1.1.2Display Configuration

Intel® EMGD 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 3.Display Configuration DefinitionsDisplay Configuration Mode	Description
Single	Normal desktop configuration, single monitor
Clone	Two displays, same content, different resolutions, independent timings
Extended	Two displays, different content, independent resolutions

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

Table 4.Supported Display Configurations Chipset	Operating System	
	Windows* XP	Windows* Embedded Compact 7
Intel® Atom™ Processor N2000 and D2000 Series	Single, Clone, Extended	Single, Clone, Extended

Intel® EMGD supports Clone mode through custom APIs. Microsoft Windows operating systems natively support Extended mode.

2.2Features

The following sections describe major features Intel® EMGD supports.

2.2.1Chipsets Supported

The table below lists Intel® EMGD-supported chipsets.

Table 5.Chipsets Supported by Intel® EMGD v1.15Chipset	Intel® EMGD VBIOS Support	Intel® EMGD Support
Intel® Atom™ Processor N2000 and D2000 Series	No	Yes

All supported chipsets provide for SINGLE LVDS output. In addition, digital monitors, CRTs and TVs are supported through the integrated display ports such as Display Port (DP), embedded Display Port (eDP), HDMI, etc. interfaces, depending on hardware availability.

2.2.2OS and API Support

The Intel® Embedded Media and Graphics Driver and Video BIOS support the following operating systems and APIs. Intel® EMGD does not support updating your software past the versions specified here.

- Microsoft Windows* XP with Service Pack 3, Windows* XP Embedded with Embedded Standard 2009 (including POSReady* 2009)
  - —DirectX* 9.0C (DirectDraw* and Direct3D*)
- Microsoft Windows* Embedded Compact 7

Note: The following features are NOT supported in Intel® Embedded Media and Graphics Driver:

- D3D in Microsoft Windows* Embedded Compact 7

2.2.3DisplayID Support

The Intel® Embedded Media and Graphics Driver supports the DisplayID specification. DisplayID is a 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).

2.2.4EDID-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 during configuration using CED. See “Creating a New Customized DTD” on page 20.

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.

2.2.4.1EDID-Less Panel Type Detection

The Intel® Embedded Media and Graphics Driver 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.

2.2.5Rotation

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

- Intel® Atom™ Processor N2000 and D2000 Series

Note: Rotation is not supported with the VBIOS. Rotation is supported with Windows* Embedded Compact 7 but only in static mode.

§ §

3.0Platform Configuration Using CED

The Intel® EMGD 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 N2000 and D2000 Series

Refer to Section 2.2.2, “OS and API Support” on page 16 for a list of supported operating systems and APIs.

The CED GUI is designed for ease of use and configuration of the Intel® EMGD. Each configuration page has online help available and each data field is validated. If you enter an incorrect value, 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 the Intel® EMGD Video BIOS.

- “Creating a New Customized DTD” on page 20
- “Creating a New Configuration” on page 23
- “Creating a New Package” on page 41
- “Generating an Installation” on page 46

Note: There are two versions of CED, one for Windows XP and another for Windows Embedded Compact 7. Not all options covered here may be available, depending on the version of CED you are using.

3.1 Before You Begin

To configure the Intel® EMGD 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 CED may not match the labels used in your panel’s product specification. Refer to Table 7, “Timing Specification Example Values” on page 23 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 20.

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 23.

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 41.

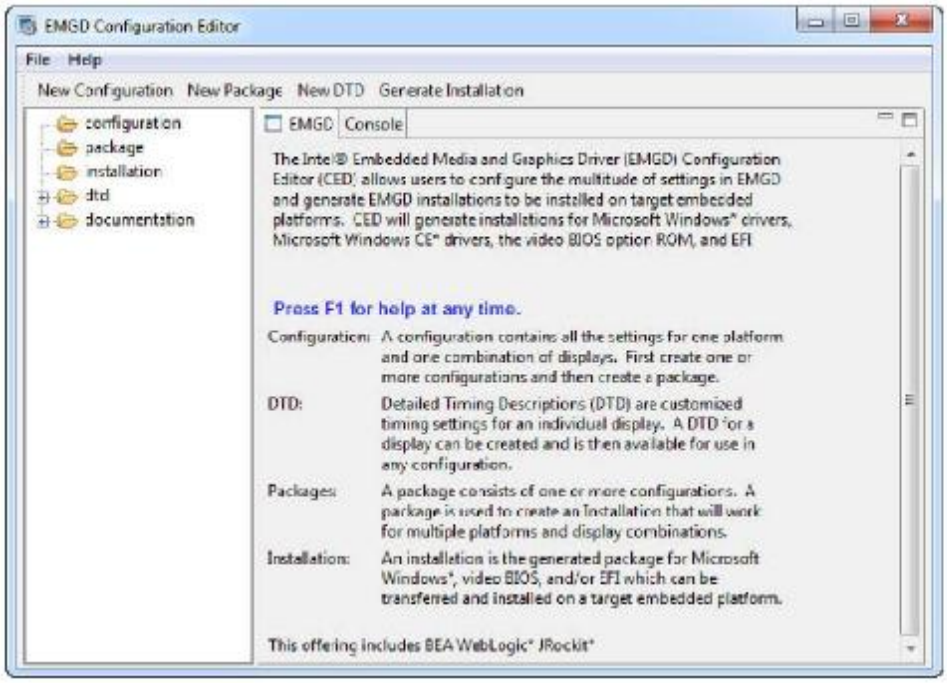
4. Select the created package and then select **Generate Installation**.

   The generated files are placed in the installation folder. The zip files for Windows, and Windows Embedded Compact 7 operating systems contain the generated configuration files. For details, see “Generating an Installation” on page 46.

3.3 Starting CED

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

Figure 4.Intel® EMGD 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 Intel® EMGD Video BIOS.

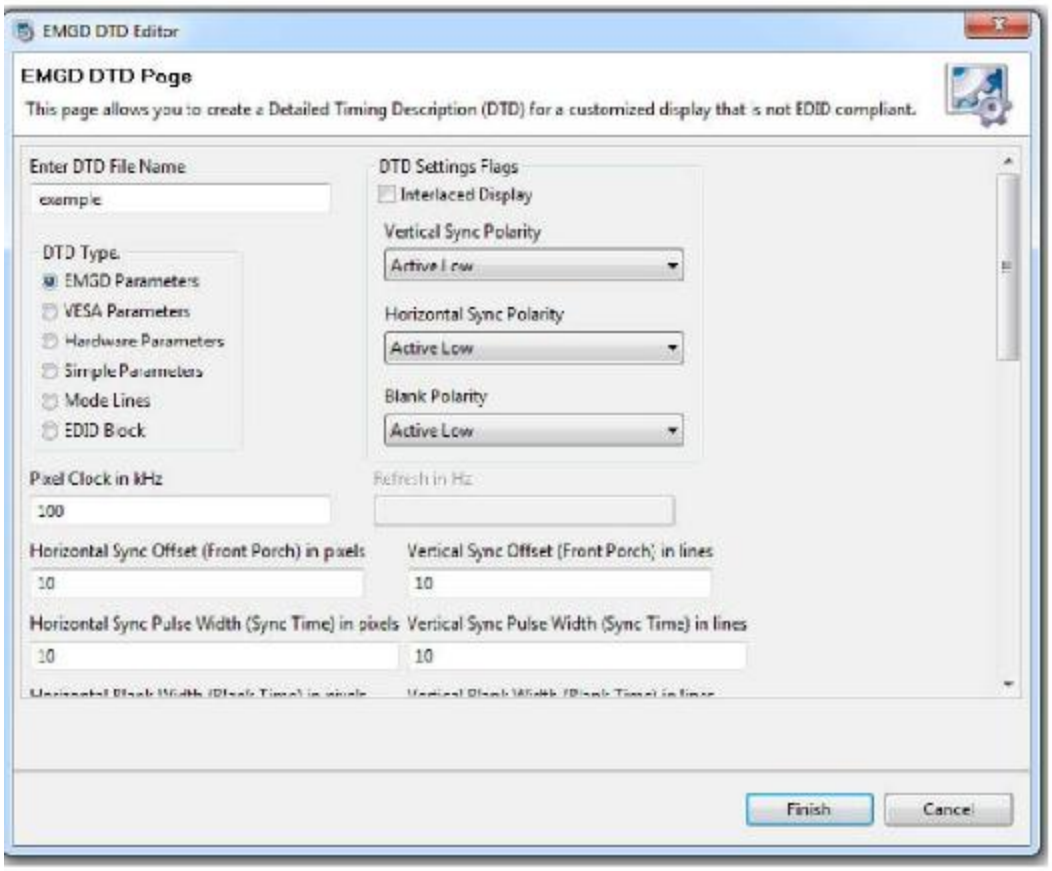
3.4Creating a New Customized DTD

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 Intel® EMGD DTD Page appears.

Figure 5.EMGD 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 6, "Intel® EMGD DTD Setting Options" for field descriptions.**
   The screen will be similar to the example shown above.
4. **Click Finish.**
   The custom DTD is complete.

Table 6.Intel® EMGD 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:** **•Intel® EMGD Parameters:** **The Intel® EMGD Parameters are the same as the current PCF/CED DTD parameters.** **VESA Parameters•:** **The VESA Parameters allow the user to create a DTD from a VESA monitor timing standard.** **Hardware Parameters•:** **The Hardware Parameters are the parameters that are used by Intel® EMGD.** **Simple Parameters•:** **The Simple Parameters (CVT Standard) is a process for computing standard timing specifications. The method for developing Reduced Blanking timings is not included.** **Mode Lines•:** **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.** **EDID Block•:** **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:** **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.** **Interlaced Display:** **•Check for Interlaced** **•Cleared for Non-interlaced** **Vertical Sync Polarity:** **•Active Low (Default)** **•Active High** **Horizontal Sync Polarity:** **•Active Low (Default)** **•Active High** **Blank Polarity:** **•Active Low (Default)** **•Active High** ***Note:*These flags are Intel® EMGD-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].**
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.

3.4.1DTD Example Specifications

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

Table 7.Timing Specification Example Values

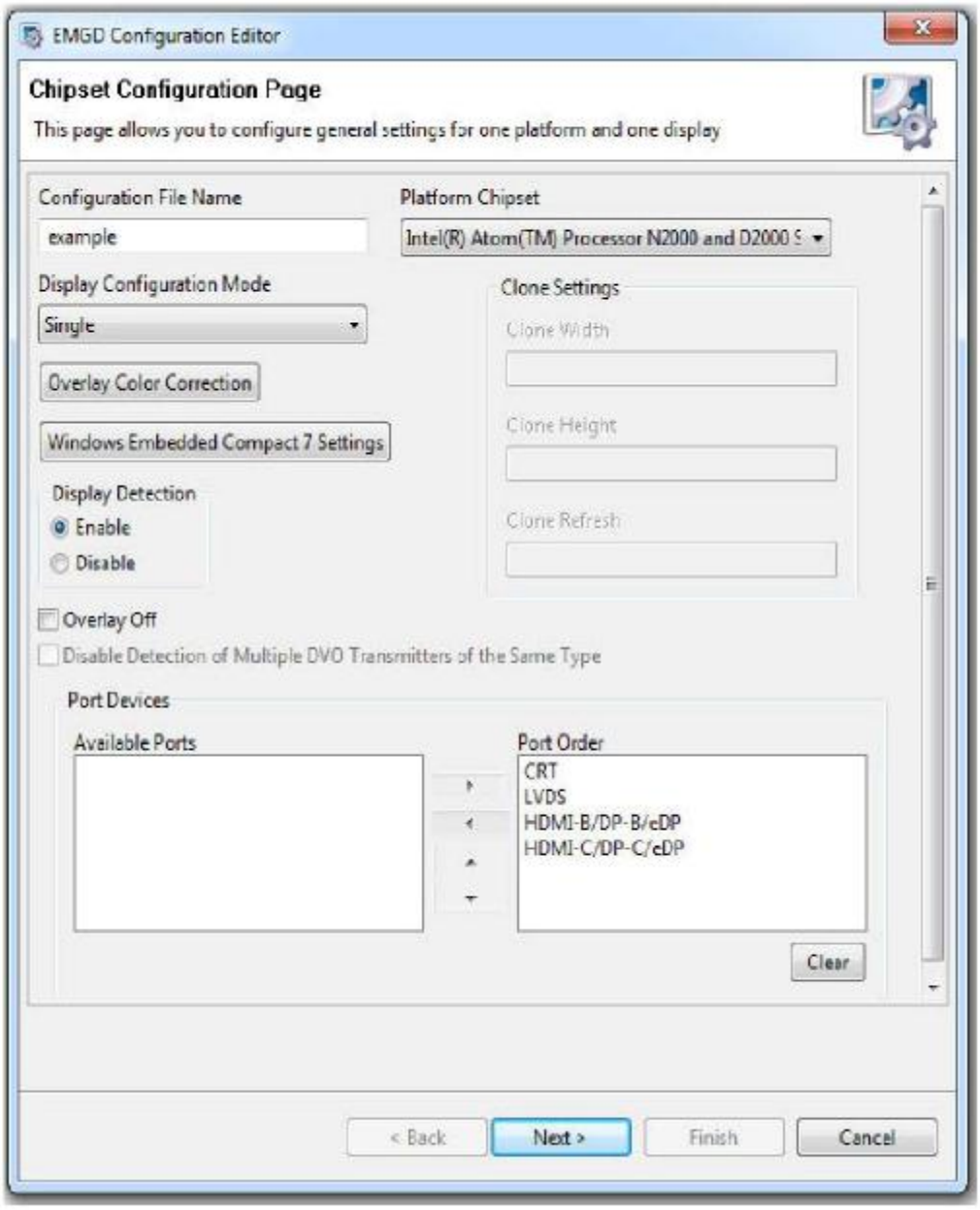
Item		Symbol	Standard value			Unit
			Min.	Typ.	Max.	
Clock	Frequency	1/ts	29.91	33.231	36.55	MHz
	Period	ts	27.36	30.06	33.43	ns
	Hi-time	tsh	7	–	–	ns
	Low-time	tsl	7	–	–	ns
	DUTY ratio	th/tl	35	50	65	ns
Data	Setup time	tds	7	–	–	ns
	Hold time	tdh	4	–	–	ns
H sync.	Period	tlpl, tlpd	24.51	31.75	32.05	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
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 Embedded Compact 7, see Chapter 6.0, “Configuring and Building Intel® EMGD for Microsoft Windows* Embedded Compact 7.”

3.5Creating a New Configuration

To create a new configuration, click the New Configuration selection located on the top of the Intel® EMGD CED main window. The Chipset Configuration Page appears, as shown in the next figure.

Figure 6.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.)

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

Table 8.Chipset Configuration Page Settings 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:** **Single — Single• display configuration.** **•Clone — Two displays where both displays have the same content but can have different resolutions and timings.** **•DIH — Dual Independent Head. This is a configuration where both displays can have different resolutions, different refresh rates, and different content.** ***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 26.**
Windows Embedded Compact 7 Settings	**If you are creating a package for a Microsoft Windows* CE platform, click the Windows Embedded Compact 7 Settings button for additional settings that may be required for your configuration. Please see "Changing Windows Embedded Compact 7 OS Options" on page 28 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 58.**
Port Devices (Available Ports, Port Order)	**The Port Devices section lists the ports available based on the chipset selected.** **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.** **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.** **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 35, "Default Search Order" on page 118 for more information on default port ordering based on chipset.** **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 30 for information on configuring ports.**
Clone Settings **Clone Width** **Clone Height** **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 61.**
Overlay Off	**This field allows you disable Overlay support, which is enabled by default.**

3.5.1Setting 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).

3.5.1.1Overlay Color Correction

Overlay Color Correction allows the Overlay plane to have color-correction settings that are 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 **0.6 to 6.0 (default value is 1)**

9.Overlay Color Correction Values (applies to ALL color)	**Gamma:**
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 next figure.

Figure 7.Overlay Color Correction Page

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

3.5.1.2Framebuffer Color Correction Attributes

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

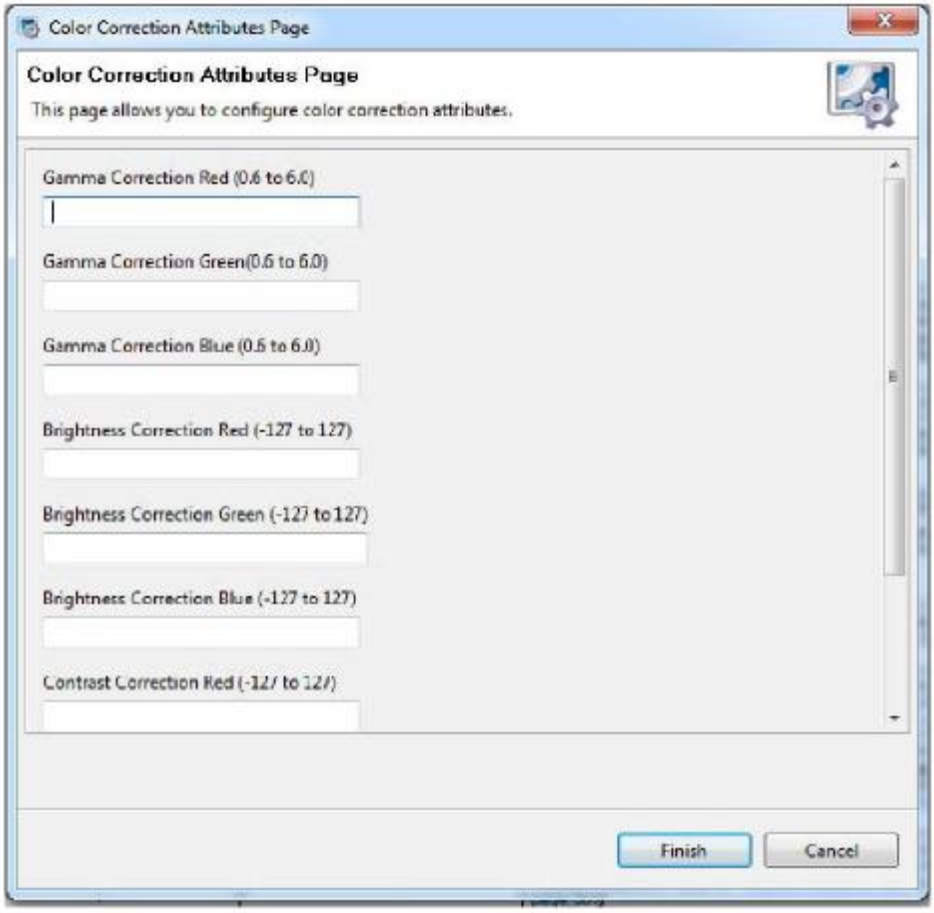
Table 10.Framebuffer Color Correction Values (applies to R, G, B color)	**Gamma:** **0.6 to 6.0 (default value is 1)**
Brightness:	**-127 to 127 (default**

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 (LVDS). The Framebuffer Color Correction Page appears, as shown in Figure 8.

Figure 8.Framebuffer Color Correction Page

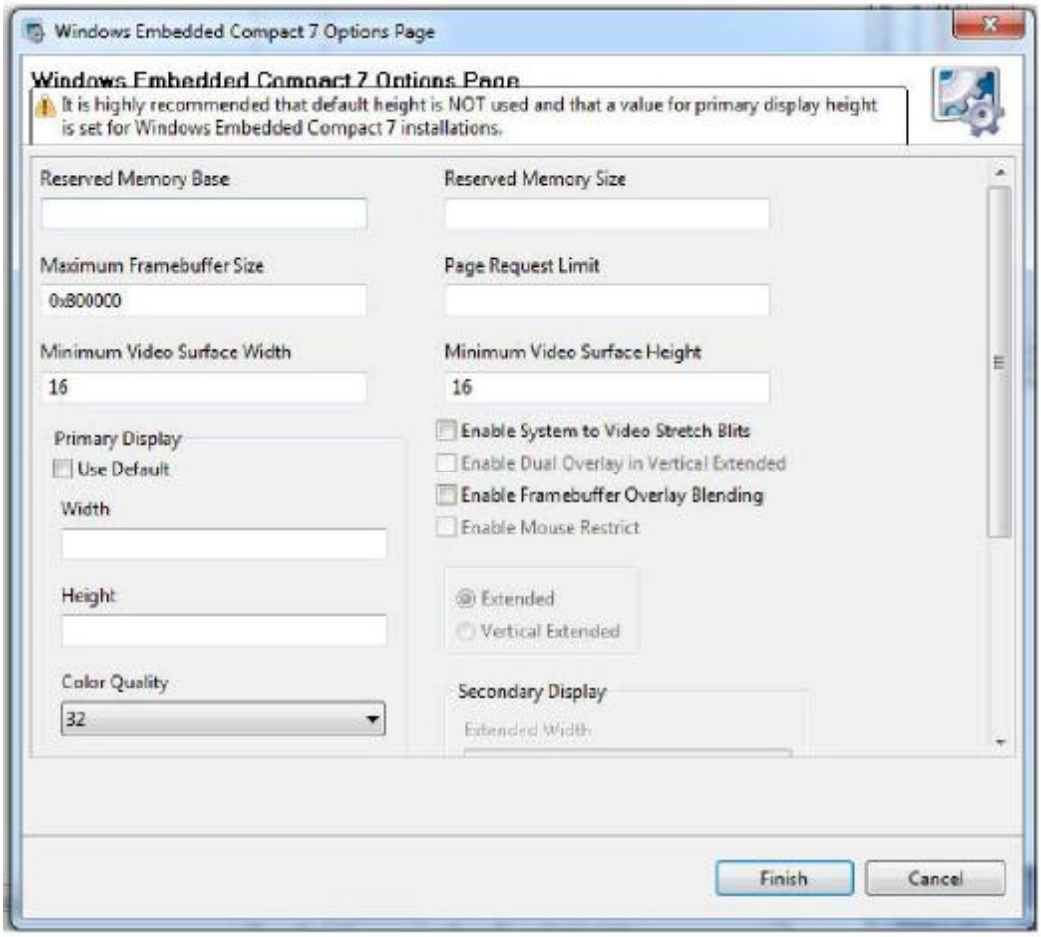


Add your desired values to the correction fields and then click **Finish**.

3.5.2Changing Windows Embedded Compact 7 OS Options

The Windows Embedded Compact 7 Options Page allows you to enter Windows CE OS-specific options into the configuration. When you click the **Windows Embedded Compact 7 Settings** button from the EMGD Package Page (see Figure 6, “Chipset Configuration Page” on page 24), the following page appears.

Figure 9.Windows Embedded Compact 7 Configuration Page



The table below describes each field on this page.

Table 11.Windows Embedded Compact 7 Settings (Sheet 1 of 2)

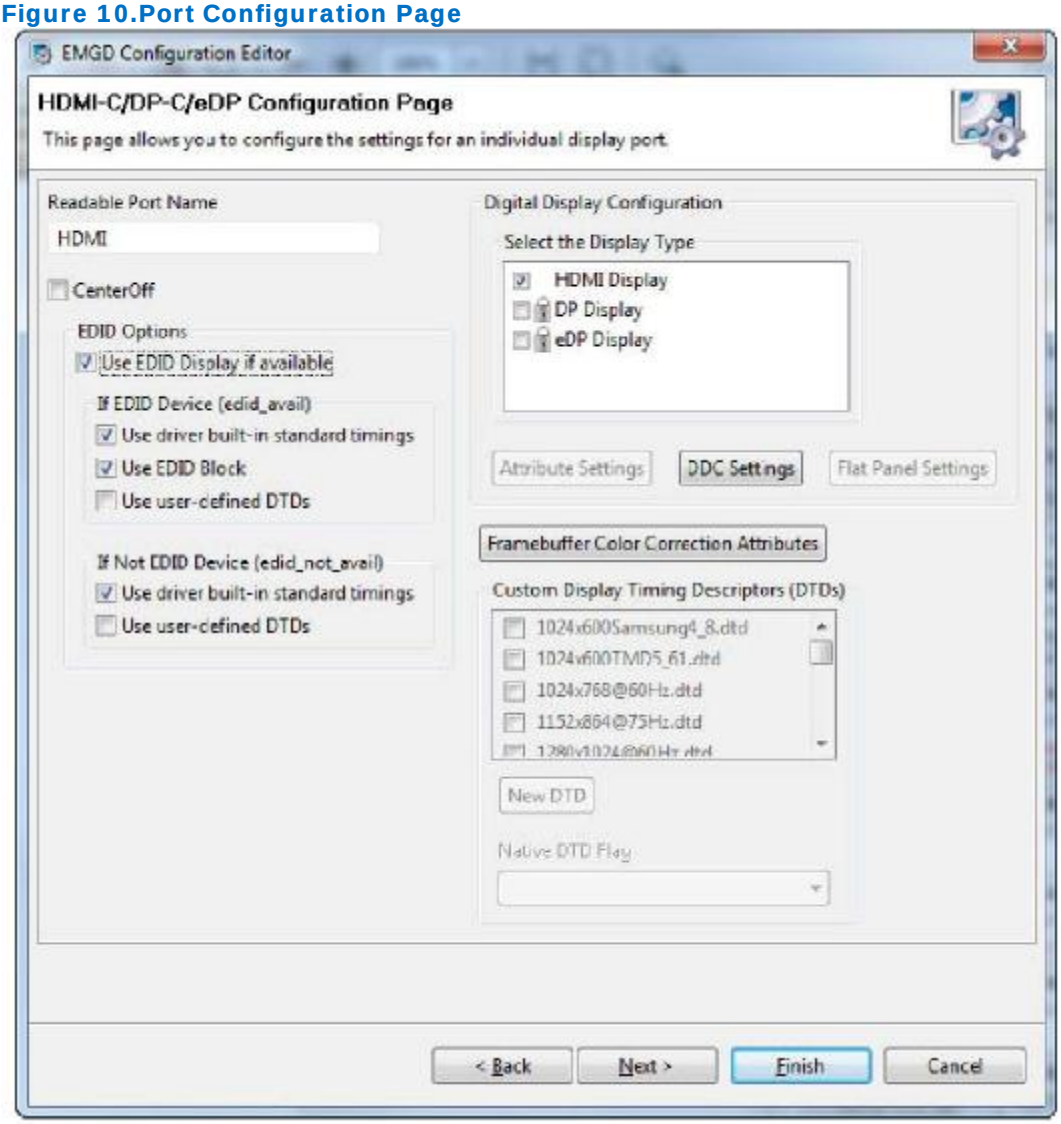
Windows Embedded Compact 7 Option	Description
Reserved Memory Base Reserved Memory Size	These two fields let you specify the amount and the starting point of statically reserved video memory. Video memory can be statically reserved or dynamically allocated on demand. If both Reserved Memory Base and 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. The default for both Reserved Memory Base and Reserved Memory Size is zero, indicating a dynamic allocation model. 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. 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. The maximum is 128MB (0x8000)

Minimum Video Surface Width **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.** **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.** **The default is disabled.**
Disable D3D Support	**Specify whether to disable or enable D3D graphics.**
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 8, "Chipset Configuration Page Settings" on page 25 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) and when display mode resolution is 32-bit XRGB.**
Enable Mouse Restrict	**This is enabled only if the Dual Independent Head display config mode is selected. This control is disabled if Single or Clone display configuration mode is selected. When checked, it is displayed in the `emgd.reg` file as** **"MouseRestrict"=dword: 1** **The purpose of this option is to prevent the mouse from entering areas of the display buffer that are not visible on screen.**
Display **Use Default** **Width** **Height** **Color Quality** **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.** **Intel recommends that you set the values here instead of leaving the resolution to be auto-detected.**

3.5.3Configuring 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 following.

Figure 10.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, DDC Settings, and Flat Panel Settings and create a new DTD that can be used with any configuration.

Table 12 describes each field on this page.

Table 12.Port Configuration Settings (Sheet 1 of 2)

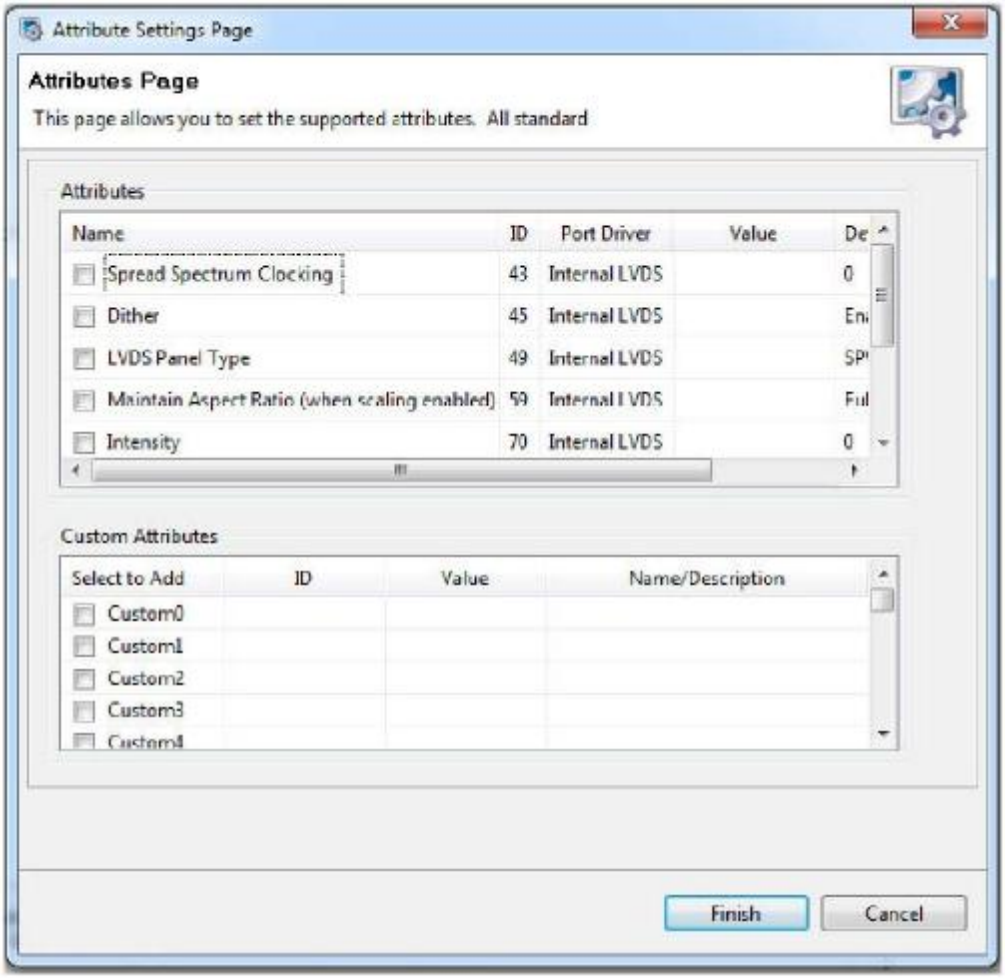
Port Configuration Field	Description
Readable Port Name	Enter a name for the port. This is a required field and the name must be between 1 and 50 characters and may contain spaces.
Port Rotation	This list allows you select a rotation for the display connected to this port. You can choose between 0, 90, 180, and 270 degrees. The default is 0.
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, Intel® EMGD 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. The Intel® EMGD supports three different types of EDID display modes:** **•Built-in display modes: These modes are hard-coded in the Intel® EMGD. These modes can be filtered based on the EDID block.** **•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.** **•User-specified DTDs.** **If you want to use the display's EDID information if it is available, click the Use EDID Display if Available check box.** **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:** **•Use driver built in standard timings — If this box is checked, the standard timings built into the Intel® EMGD are used.** **•Use EDID block — If this box is checked, the EDID block is used.** **•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 18, "Windows OS Setting Options" on page 43.** **If you select both Use driver built-in standard timings and Use EDID block, the Intel® EMGD uses its built-in display timings and the timings provided by the display.** **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:** **•Use driver built-in standard timings — If this box is checked, the standard timings are used.** **•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 18, "Windows OS Setting Options" on page 43.** **See "Sample Advanced EDID Configurations" on page 61 for example configurations.**
Digital Display Configuration	**This section lets you to specify the type of digital display connected to a port and encoder Attributes, I2C settings, and Flat Panel settings for the port.** **The Select the Display Type list contains the list of all supported digital devices. Select the device that will be connected to this port.** **To change the device's attributes, click the Attribute Settings button. Refer to "Changing Port Attribute Settings" for information on device attributes.** **To change the device's I2C settings, click the I2C Settings button. See "Changing DDC Settings" on page 33 for information on I2C settings.** **To change the device's flat panel settings, click the Flat Panel Settings button. See "Changing Flat Panel Settings" on page 33 for information for changing flat panel settings.**
Framebuffer Color Correction Attributes	**Framebuffer Color Correction Attributes allow you to adjust the main Frame Buffer color attributes. See "Framebuffer Color Correction Attributes" on page 27.**
New DTD	**To define a new Dynamic Timings Definition, click this option. See Section 3.4, "Creating a New Customized DTD" on page 20.**
Native DTD Flag	**The Native DTD list lets you choose whether to use a display's built-in timings.**

3.5.3.1Changing Port Attribute Settings

When you click the Attributes Settings button from the Encoder Configuration section of the Port Configuration Page, 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 Appendix B, "Port Driver Attributes".

Figure 11.Attribute Settings Page for Internal LVDS



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 Appendix B, "Port Driver Attributes".

3.5.3.2Changing DDC Settings

The DDC Settings Page allows you to specify the I/O interface connections to devices on the HDMI, DisplayPort, or embedded DisplayPort ports. When you click DDC Settings from the Port Configuration Page, the following screen appears.

Figure 12.DDC Settings Page

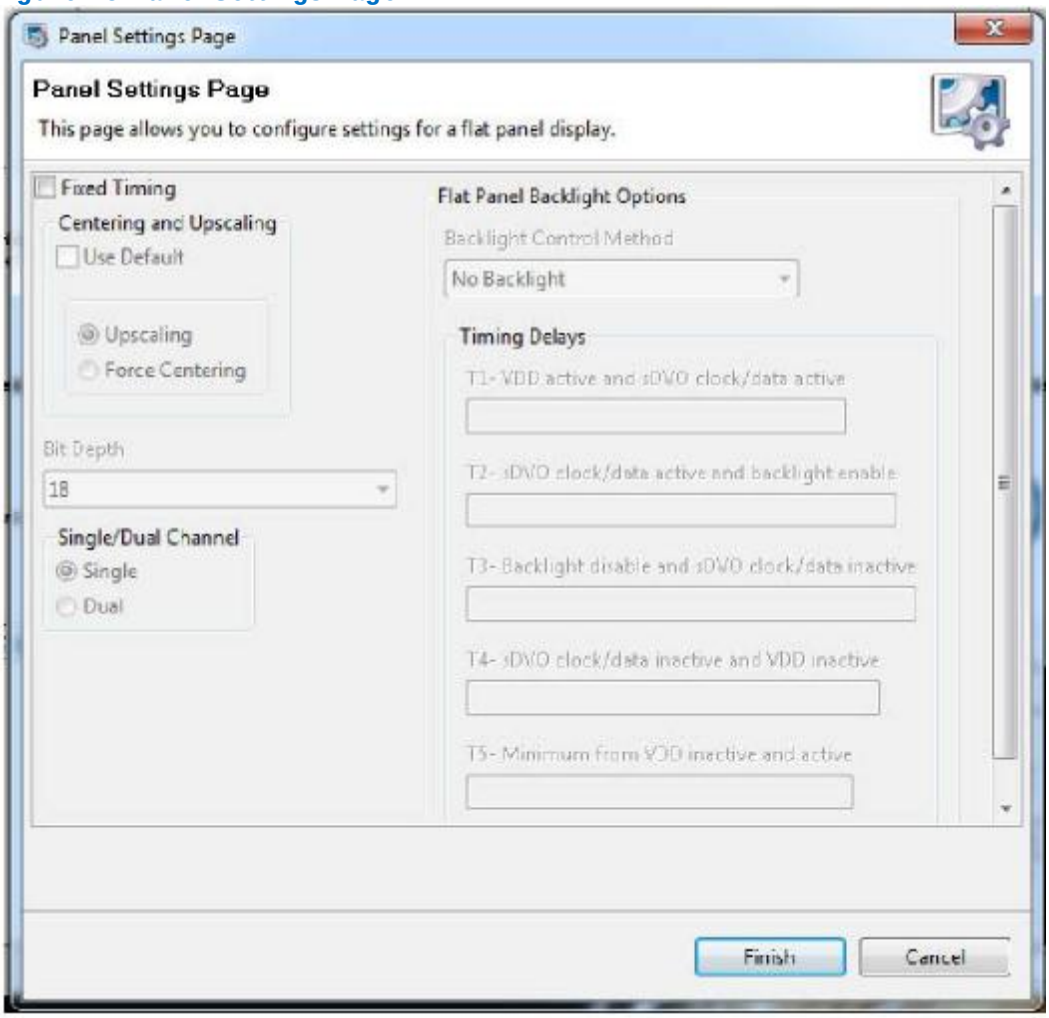
The following table describes each field on this page.

Table 13.DDC Settings	Description
DDC Bus Configuration	
Speed (KHz)	**Speed of DDC bus for the device. The range for this field is 10-400 KHz.**
Device Address Byte	**Enter a device address byte for the device that this port is connected to. The DDC Device Address Byte is the device address for reading EDID data from the display through the DDC bus.**

3.5.3.3Changing Flat Panel Settings

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

Figure 13.Panel Settings Page



The table below describes each section of this page.

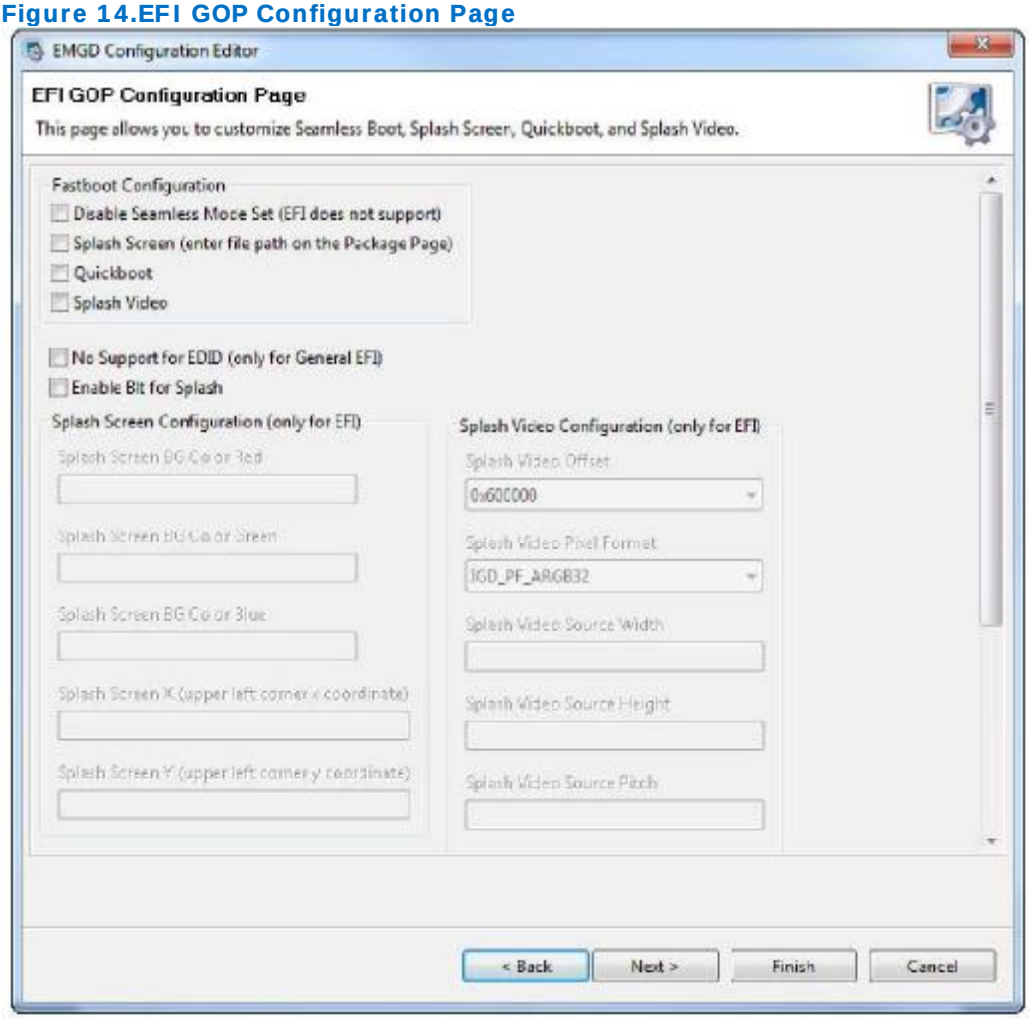
Table 14.Panel Settings Options (Sheet 1 of 2)

Flat Panel Settings	Description
Fixed Timing	To use fixed timing for the attached display, select this option.
Centering and Upscaling	The Use Default check box lets you choose the default setting or either Upscaling or Force Centering.
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.
Flat Panel Backlight Options	This section provides options for controlling the backlight of the flat panel display and specifying timing delays. •The Backlight Control Methods list lets you choose either No Backlight or Port Driver to control the backlight. If you 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:** **•T1-VDD active: 1-512, increment by 1.** **•T2-DVO active and backlight enable: 2-256, increment by 2.** **•T3-Backlight disable and DVO clock/data inactive: 2-256, increment by 2.** **•T4-DVO clock/data active and inactive: 1-512, increment by 1.** **•T5-Minimum from VDD inactive and active: 1-1600, increment by 50.** ***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.**

3.5.4Configuring EFI GOP

Figure 14.EFI GOP Configuration Page



***Note:*Enter the file path for the splash video on the Package Page. See Figure 17, "Intel® EMGD Package Editor Page" on page 41.**

Table 15.EFI GOP Options (Sheet 1 of 2)	**Description**
Fastboot Settings	

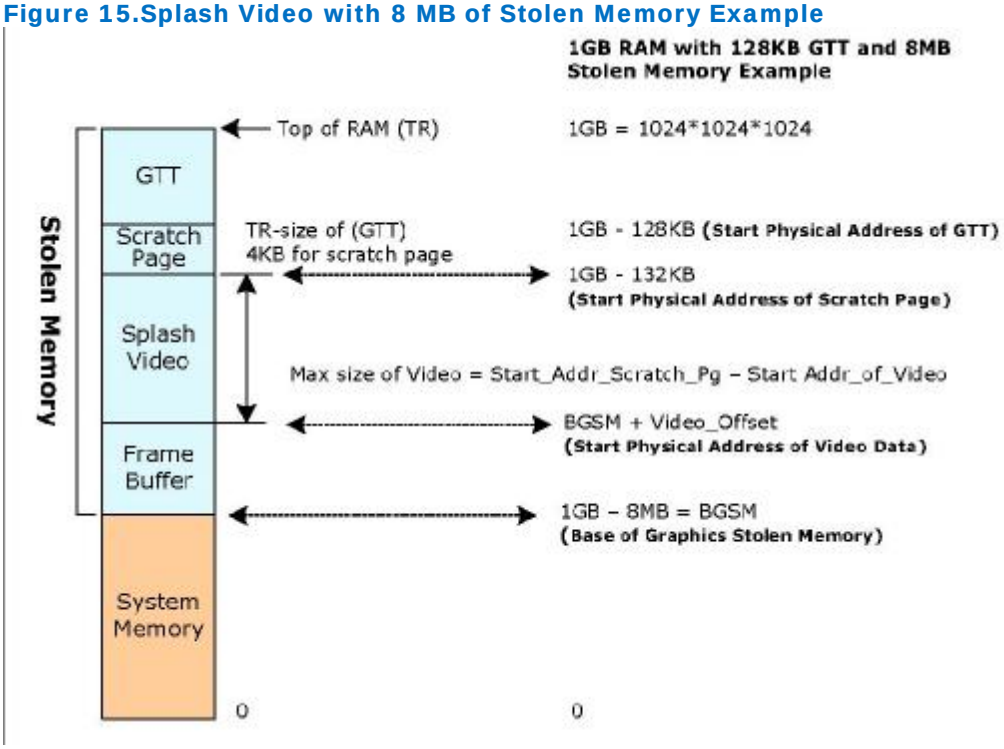
Disable Seamless Mode Set	**The Seamless mode set feature ensures that on a properly configured embedded device there is only 1 mode set between power on and a fully functional system. Under normal circumstances a PC will set the mode several times during initialization which causes screen flicker and 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 the Intel® EMGD 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, the Intel® EMGD 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.** **The splash screen is limited to 50kb in size and JPG and BMP formats. For Quickboot, only BMP format is allowed.**
Quickboot	**The quickboot feature optimizes the speed that Intel® EMGD 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 Intel® EMGD will be configured to transfer a video stream to the configured location in video memory using DMA. The splash video remains in place until the Intel® EMGD is notified by an external application to disable the overlay.**
No Support for EDID (Only for General EFI. EPOG does not support)	**This feature provides an option to skip checking the EDID for optimizing the boot time.** ***Note:*** **It is not applicable to EPOG.**
Enable BLT for Splash	**This option enables the BLT function when a splash screen is enabled. If you are experiencing problems where the splash screen does not disappear after boot, make sure this option is enabled.**
Splash Screen BG Color Red	**Splash Screen BG Color Red must be between 0x0 and 0xFF.**
Splash Screen BG Color Green	**Splash Screen BG Color Green must be between 0x0 and 0xFF.**
Splash Screen BG Color Blue	**Splash Screen BG Color Blue must be between 0x0 and 0xFF.**
Splash Screen X (upper left corner x coordinate)	**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)	**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	**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 fits within the pre-allocated video memory.**
Splash Video Pixel Format	**The pixel format of the Splash Video image in memory. The available pixel formats are encoded values used within the Intel® EMGD.**
Splash Video Source Width	**The width, in pixels, of the Splash Video image in memory.**
Splash Video Source Height	**The height, in pixels, of the Splash Video image in memory.**
Splash Video Source Pitch	**The pitch, in bytes, of the Splash Video image in memory.** **Pitch must be >= bytes per pixel * source width.**
Splash Video Destination X	**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	**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	**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	**The width of the screen. This number must currently be the same as SrcWidth.**

3.5.4.1Configuring 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 15.Splash Video with 8 MB 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 PCIe 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.

To calculate BGSM, find the amount of physical RAM populated in the system, for example, 1 GB, and the stolen memory selected by the user in the system BIOS, for example, 8 MB.

BGSM = 1 GB - 8 MB = 0x4000 0000 - 0x80 0000 = 0x3F80 0000

3.5.4.2How 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)

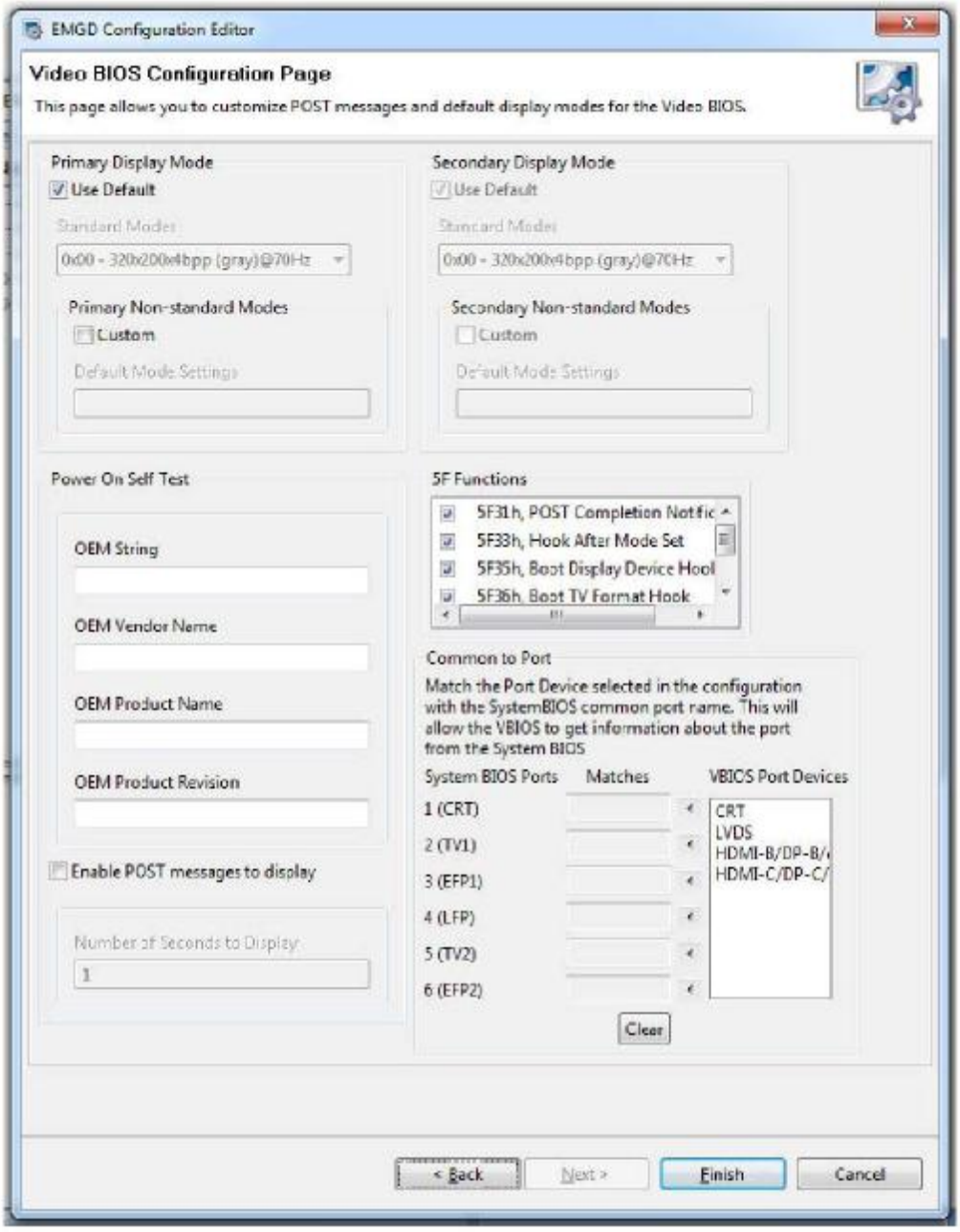
Notes:

1. **For the Splash Video option the stolen memory MUST be a minimum of 8 MB. 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 MB, please choose 0x600000.**

3.5.5Configuring the Video BIOS and EFI

The final page of the Intel® EMGD 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 16.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 16.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 25, "Supported VGA Video Display Modes" on page 72 and Table 26, "VESA Modes Supported by Video BIOS" on page 74.**

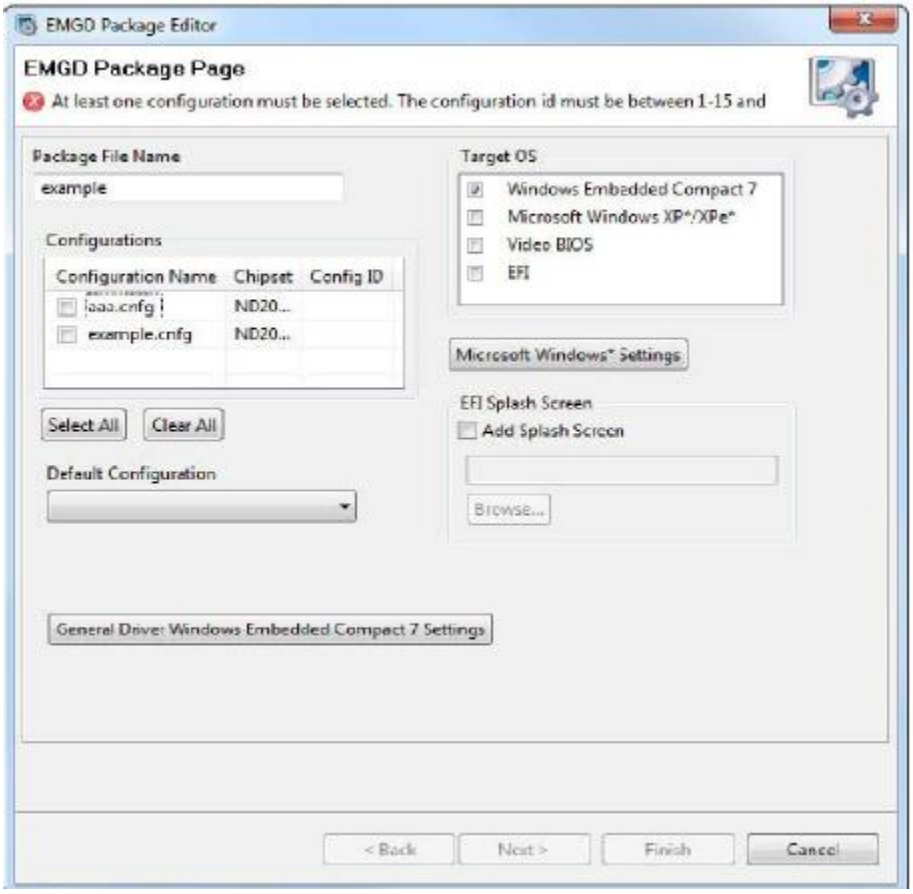
Secondary Display Mode	This section allows you to specify a standard or a customized display mode for the secondary display. You can select a standard mode from any of the standard modes listed in the drop-down list. If you want to use a customized mode for the secondary display, check the Custom check box and enter the mode number in the box. For a complete list of customized VGA and VESA modes, refer to Table 25, "Supported VGA Video Display Modes" on page 72 and Table 26, "VESA Modes Supported by Video BIOS" on page 74.
5F Functions	These settings allow you to enable or disable the five System BIOS 15h interrupt hooks. (Please see Appendix C, "Intel® 5F Extended Interface Functions" for more information on 5F functions.) 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 Intel® EMGD (for example, LVDS). The VBIOS makes this association when the VBIOS calls the System BIOS Intel® 5F interrupt functions. This setting consists of six numbers, where each number is associated with one of the System BIOS displays: 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 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. 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. *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. 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.
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 Intel® EMGD Package Page appears.

Figure 17. Intel® EMGD Package Editor Page



The table below describes each field on this page.

Table 17. Intel® EMGD 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 block 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. To select a configuration, click the check box next to the configuration name. You can select all available configurations by clicking Select All located below the Configurations block and clear all configurations by clicking Clear All. The Configuration Name column shows the name of each configuration and the Chipset column shows the chipset associated with each configuration. 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.

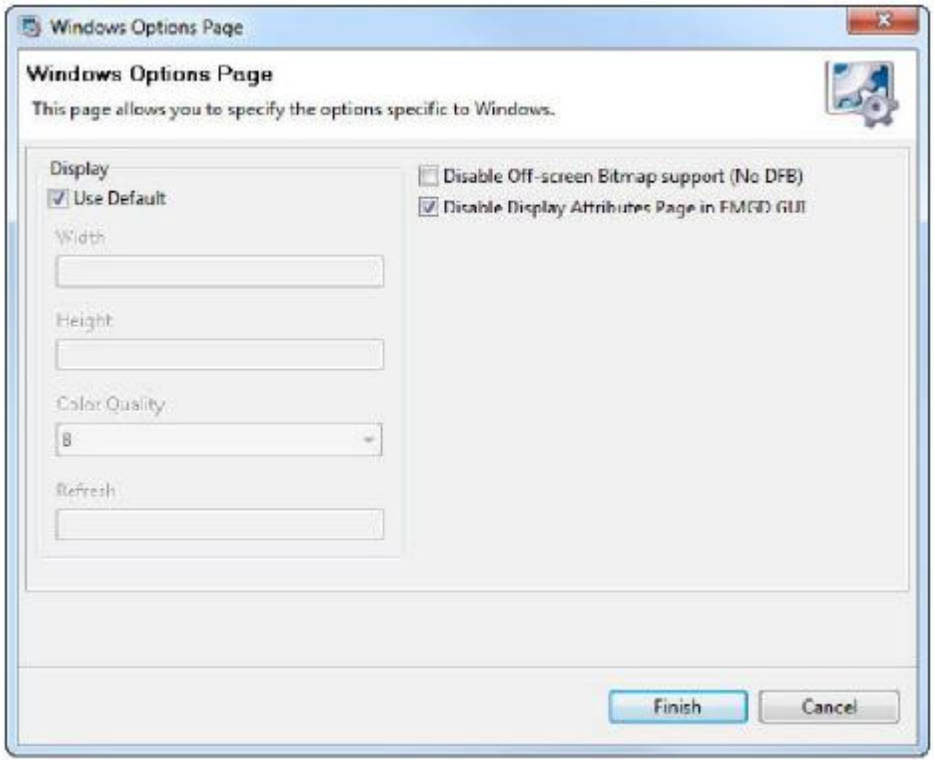
Default Configuration	**The Default Configuration list box allows you to select a default configuration from the configurations you selected in the Configurations block.** **For single configurations the default is the one selected in the previous option. For multiple configurations, the default is the first one selected in the Configurations list. To have no default configuration, select None. See also Section 5.2.1, "Universal INF Configuration" on page 76.**
Target OS	**This block allows you to select one or more operating systems and Video BIOS for the package. For each target you select, CED produces a configuration file for the selected OS or Video BIOS platform. Please see the following section for settings on the Target OS:** **•"Entering Windows OS Options" on page 42** **•"Generating a VBIOS Package" on page 44** **•"Entering EFI Options" on page 45**
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" for descriptions of these settings.**
General Driver Windows Embedded Compact 7 Settings	**To specify general setting for Windows Embedded Compact 7, click this button. See "Entering General Windows Embedded Compact 7 Options" on page 43.**

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

3.6.1Entering 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 Intel® EMGD Package Page, the following page appears.

Figure 18.Windows Options Page



The table below describes each field on this page.

Table 18.Windows OS Setting Options Windows	Description

OS Option	
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 Off-Screen Bitmap support (No DFB)	Setting No DFB causes the driver to enable using off-screen Bitmap support potentially using more memory, but speeding up bit map handling. Default is enabled.
Disable Display Attributes Page in EMGD GUI	Some OEMs may choose to limit the features in the standard EMGD GUI interface. Setting this option removes the display attributes from the GUI presented to the end user. Default is this feature disabled, thus allowing full GUI features.

3.6.2Entering General Windows Embedded Compact 7 Options

The General Driver Windows Embedded Compact 7 Settings Page allows you to enter Windows Embedded Compact 7 OS-specific options into the configuration. When you click General Driver Windows Embedded Compact 7 Settings from the Intel® EMGD Package Page, the following page appears.

Figure 19.General Driver Windows Embedded Compact 7 Settings Page

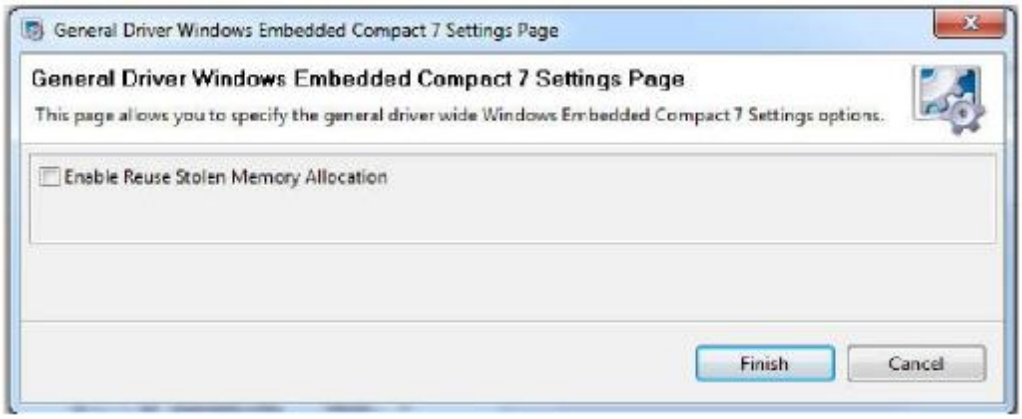
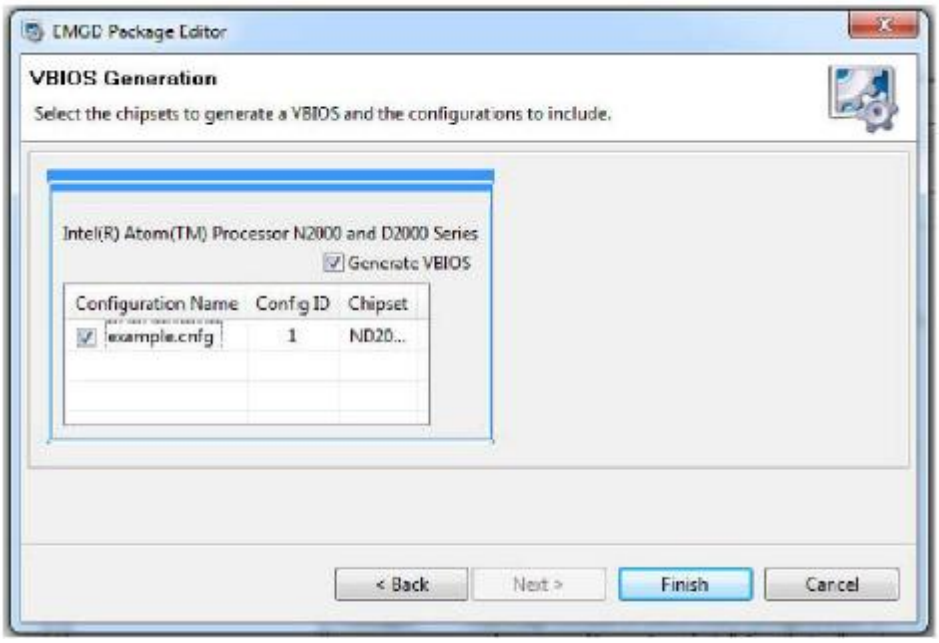


Table 19.Driver Windows Embedded Compact 7 Settings Options Windows Embedded Compact 7 OS Option	Description
Enable Reuse Stolen Memory Allocation	The dynamic memory option allows you to choose whether you want to use the memory stolen by the BIOS, or if you want to scrap that memory and re-allocate memory dynamically.

3.6.3Generating a VBIOS Package

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

Figure 20.VBIOS Generation Page

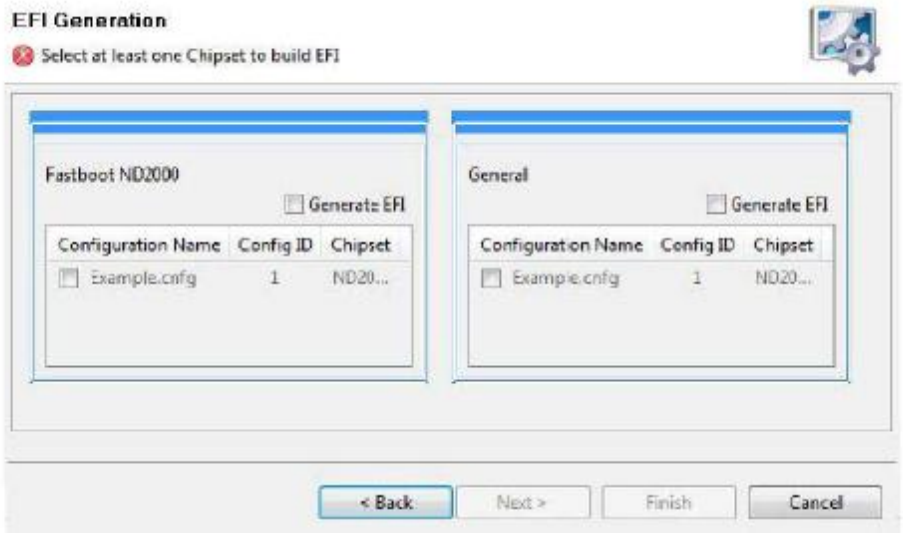


To generate a VBIOS, click the Generate VBIOS check box and select the configurations to include. After selecting the chipset and the configurations, click Finish. CED generates a package that includes both the OROM and the TSR for the chipsets and the configurations you selected.

3.6.4Entering EFI Options

If you are creating a package for a EFI installation, click Next. 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.**

   CED generates a package that includes the EFI driver for the modes, chipsets and the configurations you selected.