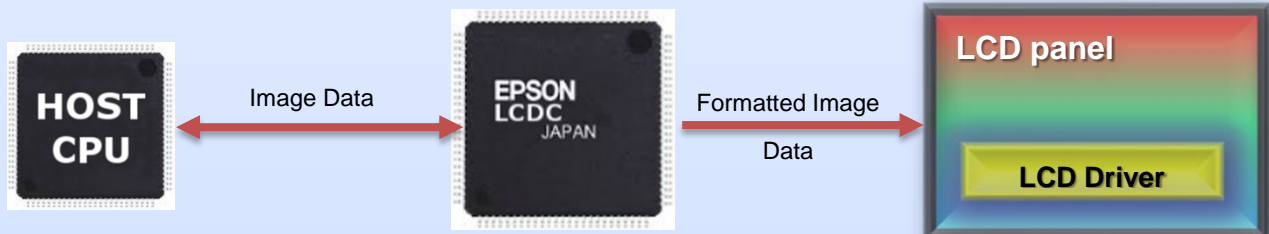


Configuring an Epson LCDC

What is an LCDC?

Often referred to as a Display Controller, an LCDC (or LCD Controller) is an IC that receives image data to be displayed on an LCD panel. The image data is managed by the LCDC and then output with the required timing and format to the LCD panel.



When Should I Use an LCDC?

With so many possible methods to drive an LCD panel, consider the following examples:

Problem

- SOC's built-in LCDC uses too much resources (i.e. bandwidth, memory)
- Update existing design to TFT
- Power consumption too high due to MCU managing LCD panel
- Specific Display Feature required for customer project (i.e. Rotation)
- Cost of High-end CPU/SOC with built-in LCDC

Solution

- **Need LCDC!**
- **Need LCDC!!**
- **Need LCDC!!!**
- **Need LCDC!!!!**
- **Need LCDC!!!!**

For many applications a separate **Epson LCDC** is the **best option**.

Configuring an LCDC

For many Epson LCDCs, there are several methods that can be used to configure an LCDC for use with a specific LCD panel. For example:

- Using the CFG Configuration Tool to generate a register initialization sequence
- Using the Panel Initialization spreadsheet to create basic panel configuration register values
- Using the Windows Application Programming Interface (API) to simplify programming the LCDC

Note: Not all methods are available for all LCDC products. To determine which resources are available for each LCDC, check the LCDC Resources Table at <https://vdc.epson.com/lcd-resources>.

CFG Configuration Tool

CFG is an interactive Windows® configuration tool for determining Epson LCDC register values based on a user defined configuration. This configuration information can be saved in a variety of text file formats for use in other applications. The configuration utility may also be used to configure Epson LCDC utilities, such as PLAY, or any program built with the Application Programming Interface (API) or Hardware Abstraction Layer (HAL) libraries.

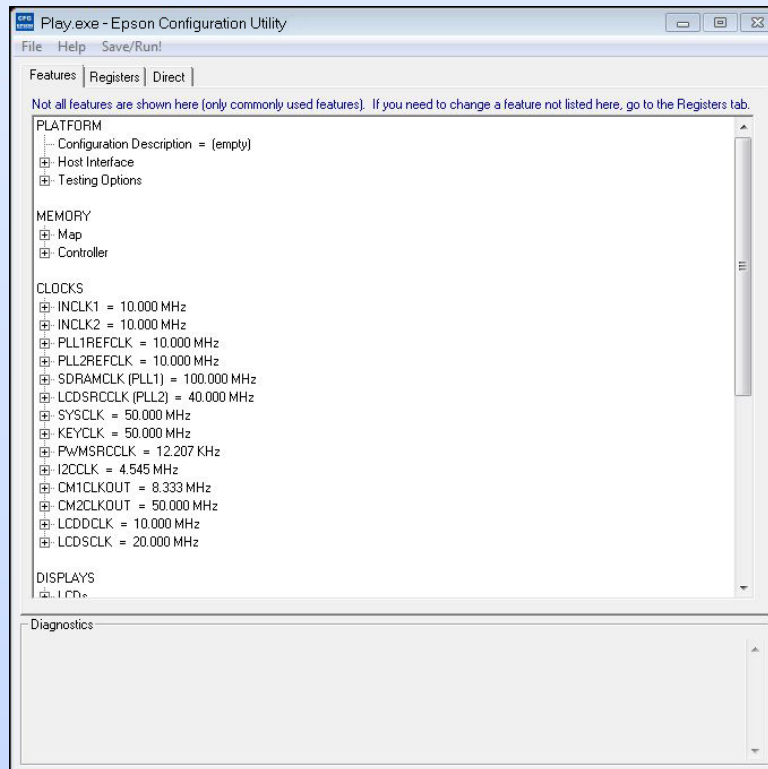
Using CFG

The basic flow for using the CFG Configuration Tool is:

1. Create a configuration using the CFG Tabs (see Features, Registers, Direct Tab descriptions)
2. If necessary, modify registers directly
3. Export the configuration information to desired format
4. Optionally, CFG can be used to directly modify any executable built with the Windows API

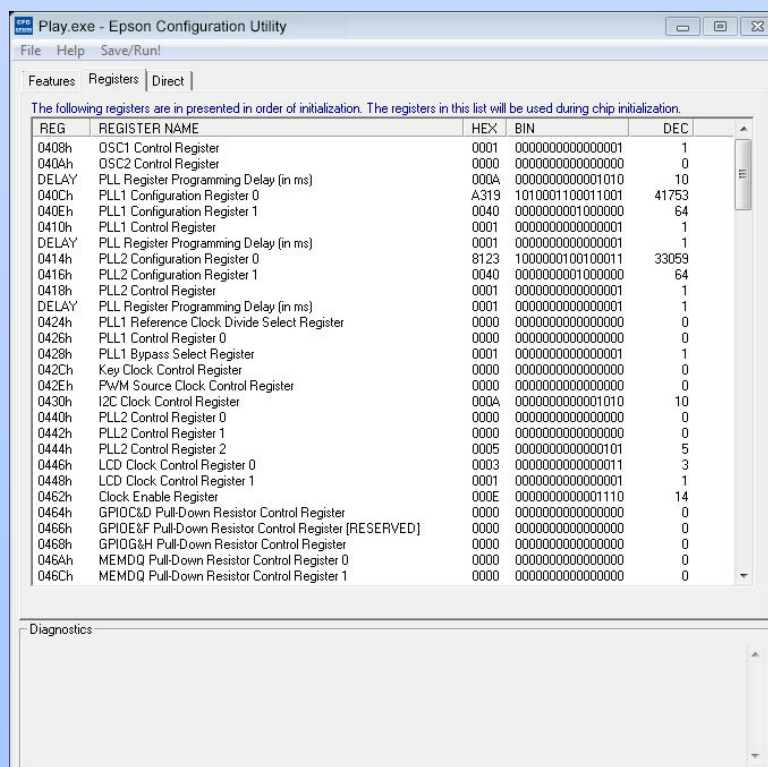
Features Tab

The Features Tab allows a specific LCDC configuration to be defined. All features are presented in a tree-control pane. The configuration is changed by selecting the desired setting for each feature. If the panels.xml file is present in the same folder as the CFG tool, a number of predefined panel configurations are available. For detailed information about each feature, hover the cursor over the feature name and a tooltip is shown with expanded information.



Registers Tab

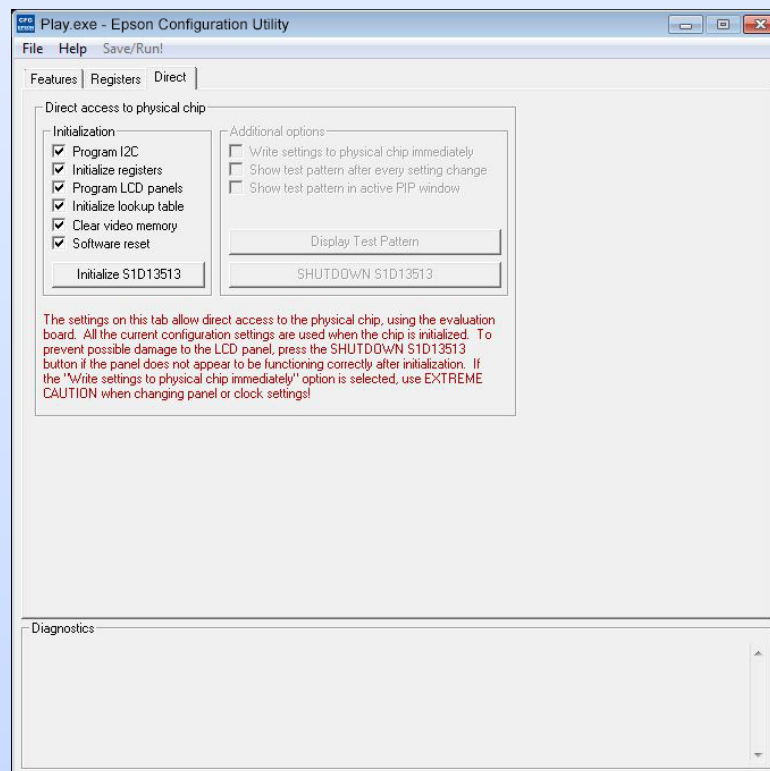
The Registers Tab allows viewing and editing of the LCDC register values that will be included in the initialization sequence. These registers are listed in the order in which they will be initialized by an application.



Direct Tab

The Direct Tab allows direct access to the LCDC through a supported Epson Evaluation Board.

The settings on this tab allow direct access to the physical chip while using the evaluation board. All the current configuration settings are used when the chip is initialized. This Tab is not available in all versions of CFG.



CFG Menus

The following describes some of the options in the File and Help menus of the CFG Configuration Tool. Not all selections, or additional selections, may be available in all versions of the CFG Configuration Tool.

- **Open**
The Open option allows the CFG tool to read the configuration information from programs based on the Epson API or HAL libraries. When CFG opens a file, it scans the file for an identification string, and if found reads the configuration information. This feature may be used to quickly arrive at a starting point for register configuration.
- **Save / Save As**
The Save option allows configuration information to be saved to programs based on the Epson API or HAL libraries. This allows such applications to initialize the LCDC to a specified configuration at startup.
- **Configure Multiple**
This option allows configuration information to be saved into multiple programs at once. All applications must be based on the Epson API or HAL libraries.
- **Export**
After determining a desirable configuration, this option allows the user to save the register information as a variety of useful ASCII text file formats such as:
 - C header file for use in writing HAL library applications with the Windows API
 - C header file which lists each register and the value it should be set to
 - C header file intended for use in developing display drivers for operating systems such as Linux
 - Comma delimited text file containing the configuration information in CSV format
 - Text file that can be used as a reference guide to the LCDC registers
 - C source file containing configuration information for LCDC API support
- **Import**
This option allows the user to import the configuration information from an initialization (.ini) file.

Panel Initialization Spreadsheet

A Panel Initialization Spreadsheet is available for several Epson LCDCs that assists with the generation of initialization values for a number of popular panels. It is designed to accept the required specifications of a given panel and, if possible, generate compatible panel initialization register values for the LCDC. Note that not all panels are compatible with all LCDCs.

1. Enter the panel resolution in the Table-1. (Yellow cells)
 2. Enter the panel output data bit width in the Table-2. (Yellow cell)
Note1. Please refer to Section 4.5 "Panel Interface Pin Mapping" of S1D13781 specification.
 3. Enter the color depth of the image data in the Table-3. (Yellow cell)
 4. Enter the specifications of the panel to be used in the Table-4. (Yellow cells)
Note2. Front porch and Back porch are sometimes described as "Blanking" in a panel specification. In this case, please set (Front porch + Back porch = Blanking period)
Note3. The Horizontal Low Width and Vertical Low Width may not be described in a panel specification. In this case, please set H Low Width = 0, V Low Width = 0
Note4. Please refer to panel specification for the PCLK, DE, HS and VS polarity.
 5. Enter the input clock in the Table-5. (Yellow cell)
 6. Enter the PLL setting of S1D13781 in the Table-6 (Yellow cells)
Note5. The frequency of Input Clock to PLL should be in the range of red colored figures in the Table-6.
Note6. Match the panel frequency (A) in the Table-4 and PLL out frequency (PCLK) in the Table-6.

Table-1		Table-2		Table-3		Table-4		Table-5		Table-6	
Horizontal	480 pixel	RGB Panel Data Bus Width	3	1: TFT 16bit		Panel Clock(MHz)	9 → A	Input Clock (CLKI)	24 MHz	Input Clock to PLL (1MHz - 2MHz) = CLKI / Mdiv4	
Vertical	272 pixel			2: TFT 18bit		H Front Porch	2 PCLK			1.5 MHz	24 18 1-33
				3: TFT 24bit		H Back Porch	2 PCLK			PLL Output (System clk)	FpLin L-Cnt
						H Period (th)	528 PCLK			63 MHz	1.5 42 17-66
						H Low Width	41 PCLK			PCLK	pll0 V
						V Front Porch	2 LINE			9 MHz	63 7 1-16
						V Back Porch	2 LINE				
						V Period	288 LINE				
						V Low Width	10 LINE				
						V Frequency	59.9 Hz				
						DE Polarity					

Windows API

A Windows Application Programming Interface (API) is available for many Epson LCDCs. The intent of the API is to provide a wrapper over the actual LCDC hardware that abstracts tasks into pre-written functions. This simplifies developing test applications using the API. It also provides royalty-free source code that can be adapted for use in custom applications and with a variety of operating systems.

The API includes:

- Royalty-free source code for the core LCDC functions
- Test and sample source code demonstrating the use of the API
- Project files to build and develop an application using MS Visual Studio
- Epson Evaluation Board support

Why Use Epson?

Epson provides a wide range of LCDC solutions that meet the diverse requirements of today's complex markets. Epson LCD Controllers are ideal for products targeting WQVGA to XGA size LCD Panels.

Epson produces the LCDC series of products in its own FAB allowing Epson to achieve a good reputation with many customers for quality control and stable supply.



For more information on Epson Display Controllers visit:

https://global.epson.com/products_and_drivers/semicon/products/display_controllers



For technical resources, such as Specifications, Software, and Videos visit:
https://global.epson.com/products_and_drivers/semicon/information/support.html