MSP Graphics Library version 3.30.00.21

USER'S GUIDE

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1 Using Template Driver files

This template driver is intended to be modified for creating new LCD drivers. It is setup so that only Template_DriverPixelDraw() and DPYCOLORTRANSLATE() and some LCD size configuration settings in the header file `Template_Driver.h` are **REQUIRED** to be written. These functions are marked with the string "TemplateDisplayFix" in the comments so that a search through `Template_Driver.c` and `Template_Driver.h` can quickly identify the necessary areas of change.

Template_DriverPixelDraw() is the base function to write to the LCD display. Functions like WriteData(), WriteCommand(), and SetAddress() are suggested to be used to help implement the Template_DriverPixelDraw() function, but are not required. SetAddress() should be used by other pixel level functions to help optimize them.

This is not an optimized driver and will significantly impact performance. It is highly recommended to first get the prototypes working with the single pixel writes, and then go back and optimize the driver. Please see application note `SLAA548` for more information on how to fully optimize LCD driver files. In short, driver optimizations should take advantage of the auto-incrementing of the LCD controller. This should be utilized so that a loop of WriteData() can be used instead of a loop of Template_DriverPixelDraw(). The pixel draw loop contains both a SetAddress() + WriteData() compared to WriteData() alone. This is a big time saver especially for the line draws and Template_DriverPixelDrawMultiple(). More optimization can be done by reducing function calls by writing macros, eliminating unnecessary instructions, and of course taking advantage of other features offered by the LCD controller. With so many pixels on an LCD screen each instruction can have a large impact on total drawing time.

2 Circle API

 The Circle API provides simple functions to draw a circle on the display. There are two different functions used to draw a circle; one which draws the outline, and the other which draws a filled-in circle. The clipping of the circle is performed within the routine; the display driver's circle fill routine is used to permore the actual circle fill.

The code for this API is contained in `<SDK_INSTALL_DIR>/source/ti/grlib/circle.c`, with `<SDK_INSTALL_DIR>/source/ti/circle.h` containing the API definitions for use by applications.

2.0.1 API Functions

The Circle API is broken into two separate functions both of which write to the display.

The function which draws a circle is handled by

Graphics_drawCircle()

The function which draws a filled-in circle is handled by

Graphics_fillCircle()

Graphics_Context g_sContext;

// // Initialize the graphics context // Graphics_initContext(g_sContext, g_sKitronix320x240x16_SSD2119, g_sKitronix320x240x16_SSD2119_funcs); Graphics_setForegroundColor(g_sContext, GRAPHICS_COLOR_BLACK); Graphics_setBackgroundColor(g_sContext, GRAPHICS_COLOR_WHITE);

Graphics_clearDisplay(g_sContext);

Graphics_drawCircle(g_sContext, 275, 100, 30); Graphics_fillCircle(g_sContext, 50, 100, 30);

3 Context API

 The Context API provides simple functions to initialize a drawing context, preparing it for use on the display. The display driver will be used for all subsequent graphics operations.

The code for this API is contained in `<SDK_INSTALL_DIR>/source/ti/grlib/context.c`, with `<SDK_INSTALL_DIR>/source/ti/grlib/context.h` containing the API definitions for use by applications.

3.0.2 API Functions

The Context API is broken into two separate functions both of which initialize the context for the display, but differ in the way they set the clipping regions of the screen. The clipping region is not allowed to exceed the extents of the screen, but may be a portion of the screen. The supplied coordinates are inclusive for the clipping region. As a consequence, the clipping region must contain at least one row and one column.

The function which initializes the context and who's clipping region is set to the extent of the entire screen is handled by

Graphics_initContext()

The function which initializes the context and also sets a clipping region is handled by

Graphics_setClipRegion()

Graphics_Context g_sContext;

// // Initialize the graphics context // Graphics_initContext(g_sContext, g_sKitronix320x240x16_SSD2119, g_sKitronix320x240x16_SSD2119_funcs); Graphics_setBackgroundColor(g_sContext, GRAPHICS_COLOR_BLACK); Graphics_setForegroundColor(g_sContext, GRAPHICS_COLOR_WHITE);

__no_operation();

4 Image API

?? The Image API provides simple functions to draw images on the screen. There are two different functions used to draw a image; one which converts the palette of a bitmap image and the other which renders the bitmap image onto the screen.

The code for this API is contained in `<SDK_INSTALL_DIR>/source/ti/grlib/image.c`, with `<SDK_INSTALL_DIR>/source/ti/grlib/image.h` containing the API definitions for use by applications.

4.0.3 API Functions

The Image API is broken into two separate functions, one to converte the palette and the other to render to the display. Calling the GrImageDraw() function also invokes GrPaletteConversion() as well so the user only needs to be concerned with the GrImageDraw() function.

The image may be either 1-, 4-, or 8-bits per pixel by using a palette supplied in the image data. The image palette is in 24-bit RGB form and by calling GrPaletteConversion(), the palette can then be sent to the LCD usign DpyColorTranslate function. The converted palette is contained in a global buffer while the original image remains the same. The palette can be uncompressed data or it can be compressed using several different compresion types. Compression options are either 4-, 7- or 8-bit run length encoding, or a custom run lenth endocing variation written for complex 8-bit per pixel images.

The function which draws a bitmap image is handled by

Graphics_drawImage()

Graphics_Context g_sContext;

// // Initialize the graphics context // Graphics_initContext(g_sContext, g_sKitronix320x240x16_SSD2119, g_sKitronix320x240x16_SSD2119_funcs); Graphics_setForegroundColor(g_sContext, GRAPHICS_COLOR_BLACK); Graphics_setBackgroundColor(g_sContext, GRAPHICS_COLOR_WHITE);

Graphics_clearDisplay(g_sContext);

Graphics_drawImage(sContext, imageName, 200, 70);

5 Line API

 The Line API provides simple functions to draw lines on the display. There are five different functions used to draw a line; two optimized functions for horizontal and vertical drawing, one generic line drawing function, two functions for clipping. The user needs only to be concerned with the generic line drawing function, GrLineDraw(), as it incorporates the use of all the other functions automatically.

The code for this API is contained in `<SDK_INSTALL_DIR>/source/ti/grlib/line.c`, with `<SDK_INSTALL_DIR>/source/ti/grlib/line.h` containing the API definitions for use by applications.

5.0.4 API Functions

The Line API is broken into two separate functions; one for drawing and the other for clipping (internal functions).

The functions that draw a line are handled by

Graphics_drawLineV()

Graphics_drawLineH()

Graphics_drawLine()

The user needs only to be concerned with the generic line drawing function, GrLineDraw(), as it incorporates the use of all the other functions automatically.

Graphics_Context g_sContext;

// // Initialize the graphics context // Graphics_initContext(g_sContext, g_sKitronix320x240x16_SSD2119, g_sKitronix320x240x16_SSD2119_funcs); Graphics_setForegroundColor(g_sContext, GRAPHICS_COLOR_BLACK); Graphics_setBackgroundColor(g_sContext, GRAPHICS_COLOR_WHITE);

Graphics_clearDisplay(g_sContext);

Graphics_drawLine(sContext, 130, 30, 275, 200); Graphics_drawLineH(sContext, 20, 180, 220); Graphics_drawLineV(sContext, 30, 50, 160);

6 Rectangle API

 The Rectangle API provides simple functions to draw a rectangle on the display. There are two different functions used to draw a rectangle; one which draws the outline, and the other which draws a filled-in rectangle. The clipping of the rectangle is performed within the routine; the display driver's rectangle fill routine is used to permore the actual rectangle fill.

The code for this API is contained in `<SDK_INSTALL_DIR>/source/ti/grlib/rectangle.c`, with `<SDK_INSTALL_DIR>/source/ti/grlib/rectangle.h` containing the API definitions for use by applications.

6.0.5 API Functions

The Rectangle API is broken into two groups; one that draws to the screen and the other which perform checks(internal functions).

The functions which draw rectangles are handled by

Graphics_drawRectangle()

Graphics_fillRectangle()

Graphics_Context g_sContext; Graphics_Rectangle myRectangle1 = { 60, 60, 120, 120}; Graphics_Rectangle myRectangle2 = { 160, 60, 220, 120};

// // Initialize the graphics context // Graphics_initContext(g_sContext, g_sKitronix320x240x16_SSD2119, g_sKitronix320x240x16_SSD2119_funcs); Graphics_setBackgroundColor(g_sContext, GRAPHICS_COLOR_BLACK); Graphics_setForegroundColor(g_sContext, GRAPHICS_COLOR_WHITE);

Graphics_clearDisplay(g_sContext);

Graphics_drawRectangle(g_sContext, myRectangle1); Graphics_fillRectangle(g_sContext, myRectangle2);

7 String API

 The String API provides simple functions to draw strings on the screen. There are several different functions used to draw a string; one which counts the number of leading zeroes, one for obtaining the display width of the string, one for drawing the string to the display, one for setting the location of the current string table, one to set the current language, and the last one for grabbing the string from the current string table. The user should not directly call NumLeadingZeroes() as it is used internally.

The code for this API is contained in `<SDK_INSTALL_DIR>/source/ti/grlib/string.c`, with `<SDK_INSTALL_DIR>/source/ti/grlib/string.h` containing the API definitions for use by applications.

7.0.6 API Functions

The String API available are classified as below.

The functions which calculate and set up parameters are handled by

Graphics_getStringWidth()

The function which draws a string to the display is handled by

Graphics_drawString()

Graphics_Context g_sContext;

// // Initialize the graphics context // Graphics_initContext(g_sContext, g_sKitronix320x240x16_SSD2119, g_sKitronix320x240x16_SSD2119_funcs); Graphics_setBackgroundColor(g_sContext, GRAPHICS_COLOR_BLACK); Graphics_setForegroundColor(g_sContext, GRAPHICS_COLOR_WHITE);

Graphics_clearDisplay(g_sContext);

Graphics_setFont(g_sContext, g_sFontCm26); Graphics_drawString(g_sContext, "Welcome to ", -1, 20, 8, 0);

Graphics_setFont(g_sContext, g_sFontCm30); Graphics_drawString(g_sContext, "Dallas TX", -1, 20, 180, 0);

8 Button API

8.0.7 API Functions

The Button API is broken into four separate functions both of which write to the display.

The function which draws a button is handled by

Graphics_drawButton()

The function which draws a selected button

Graphics_drawSelectedButton()

The function which draws a released button

Graphics_drawReleasedButton()

The function which determines if button has been pressed

Graphics_isButtonSelected()

Graphics_Button yesButton;

yesButton.xMin = 80; yesButton.xMax = 150; yesButton.yMin = 80; yesButton.yMax = 120; yesButton.borderWidth = 1; yesButton.selected = false; yesButton.fillColor = GRAPHICS_COLOR_RED; yesButton.borderColor = GRAPHICS_COLOR_RED; yesButton.selectedColor = GRAPHICS_COLOR_BLACK; yesButton.textColor = GRAPHICS_COLOR_BLACK; yesButton.selectedTextColor = GRAPHICS_COLOR_RED; yesButton.textXPos = 100; yesButton.textYPos = 90; yesButton.text = "YES"; yesButton.font = g_sFontCm18;

Graphics_drawButton(g_sContext, yesButton);

9 ImageButton API

 ?? The ImageButton API provides simple functions to draw a imageButton on the display.

9.0.8 API Functions

The ImageButton API is broken into four separate functions both of which write to the display.

The function which draws a imageButton is handled by

Graphics_drawImageButton()

The function which draws a selected imageButton

Graphics_drawSelectedImageButton()

The function which draws a released imageButton

Graphics_drawReleasedImageButton()

The function which determines if imageButton has been pressed

Graphics_isImageButtonSelected()

Graphics_ImageButton primitiveButton;

primitiveButton.xPosition=20; primitiveButton.yPosition=50; primitiveButton.borderWidth=5; primitiveButton.selected=false; primitiveButton.imageWidth=Primitives_Button4BPP_UNCOMP.xSize; primitiveButton.imageHeight=Primitives_Button4BPP_UNCOMP.ySize; primitiveButton.borderColor=GRAPHICS_COLOR_WHITE; primitiveButton.selectedColor=GRAPHICS_COLOR_RED; primitiveButton.image=Primitives_Button4BPP_UNCOMP;

Graphics_drawImageButton(g_sContext, primitiveButton);

10 RadioButton API

10.0.9 API Functions

The RadioButton API is broken into four separate functions both of which write to the display.

The function which draws a radioButton is handled by

Graphics_drawRadioButton()

The function which draws a selected radioButton

Graphics_drawSelectedRadioButton()

The function which draws a released radioButton

Graphics_drawReleasedRadioButton()

The function which determines if radioButton has been pressed

Graphics_isRadioButtonSelected()

Graphics_RadioButton radioButton1 = { 5, 15, true, 4, GRAPHICS_COLOR_BLACK, 9, GRAPHICS_COLOR_BLACK, GRAPHICS_COLOR_WHITE, g_sFontFixed6x8, "Option 1" };

Graphics_drawRadioButton(g_sContext, radioButton1);

11 CheckBox API

11.0.10 API Functions

The CheckBox API is broken into four separate functions both of which write to the display.

The function which draws a checkBox is handled by

Graphics_drawCheckBox()

The function which draws a selected checkBox

Graphics_drawSelectedCheckBox()

The function which draws a released checkBox

Graphics_drawReleasedCheckBox()

The function which determines if checkBox has been pressed

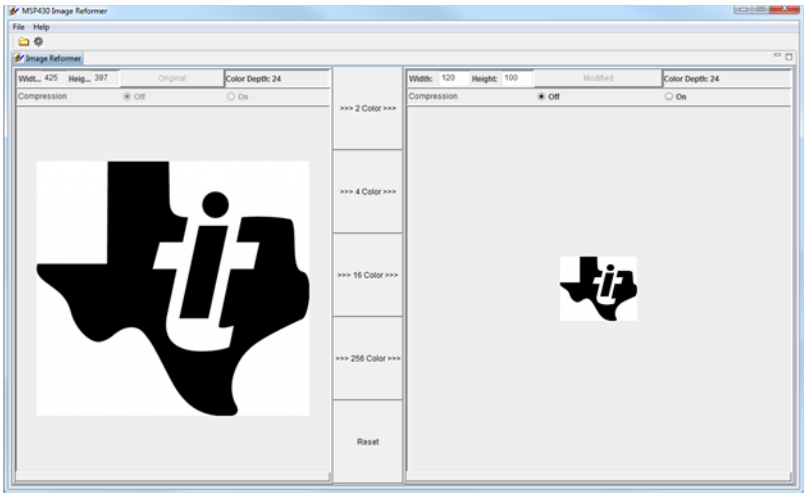
Graphics_isCheckBoxSelected()

Graphics_CheckBox checkBox1 = { 5, 15, false, 4, GRAPHICS_COLOR_BLACK, GRAPHICS_COLOR_WHITE, GRAPHICS_COLOR_BLACK, 9, g_sFontFixed6x8, "Option 1" };

Graphics_drawCheckBox(g_sContext, checkBox1);

12 Using the MSP Image Reformer Tool

Image Reformer converts images into C code that can be used with the MSP Graphics Library. Import your source image, make your bpp and size settings, generate C code, and then add the resulting file into your project.



To run the tool go to `<SDK_INSTALL_DIR>\tools\image-reformer` and run `image_Reformer.jar`

In order to keep MSP Graphics Library and Open Source Project the JRE is not shipped with the Library and it requires that the users have Java 1.5 or later installed in their machines. Currently the tool only has support for Windows OS support.

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