



Graphical and Segmented Display Solutions



PIC® MCUs Driving Displays

Digital displays improve the user interface of just about any application. Segmented LCDs have historically been a popular choice of display technology and their use continues to grow in a variety of medical and industrial applications. In recent years there has been a significant rise in the use of graphical displays—such as TFT, OLED and CSTN—in consumer, appliance and automotive applications. Users prefer intuitive menus, vivid graphics, touch panel interaction and, in some cases, the ability to interact remotely with a system. Designers migrating toward graphical displays face several challenges such as cost of components associated with driving the display, complexity of software needed for updating graphics, battery life and remote connectivity.

If you are looking to add newer and feature-rich interfaces to your products in an aesthetically pleasing manner, Microchip has a broad portfolio of solutions that include touch sensing and display technologies. Microchip delivers these latest advancements as complete hardware and software solutions to get your design to market faster at a lower total system cost.

Display Controller Solutions

Segmented LCD

- Direct drive of inexpensive displays
- Up to 512 segments
- Integrated analog for sensor applications like temperature sensing in thermostats
- Touch sensing function
- Integrated cryptographic engine with secure RAM key management for secure applications

Graphical Displays

- Up to WVGA (800 × 480) resolution
- Up to 24 bit per pixel
- Graphics Display Design GUI and free graphics library
- PIC24 “DA” family features integrated graphics acceleration and display controller
- High-performance 32-bit MCUs with integrated Ethernet and CAN for remote interfaces
- USB OTG and mTouch® sensing solutions

Direct Drive for Segmented Displays

Display Solutions for Segmented LCD

Segmented displays are used in a wide variety of applications, ranging from meters to portable medical devices to thermostats to exercise equipment. PIC microcontrollers with integrated LCD drivers can directly drive segmented displays with letters, numbers, characters and icons. The main features of Microchip’s LCD portfolio include:

- Flexible LCD segments
 - 28 pins, up to 72 segments
 - 40 pins, up to 116 segments
 - 64 pins, up to 240 segments
 - 80 pins, up to 368 segments
 - 100 pins, up to 480 segments
 - 121 pins, up to 512 segments
- Variable clock inputs
- Integrated voltage bias generation
- Direct drive for both 3V and 5V powered displays
- Software contrast control for boosting or dimming for different temperature or lighting conditions
- Drive LCD while conserving power in Sleep mode
- Integrated real time clock and calendar for displaying time and date information
- mTouch capacitive touch sensing capability

Direct Drive for Segmented Displays

The LCD PIC microcontrollers support direct LCD panel drive capability with no external components needed, lowering total system cost. They have integrated voltage bias generation which allows the MCU to generate the different voltage levels that are required to drive the LCD segment pins and provide good contrast for the display.



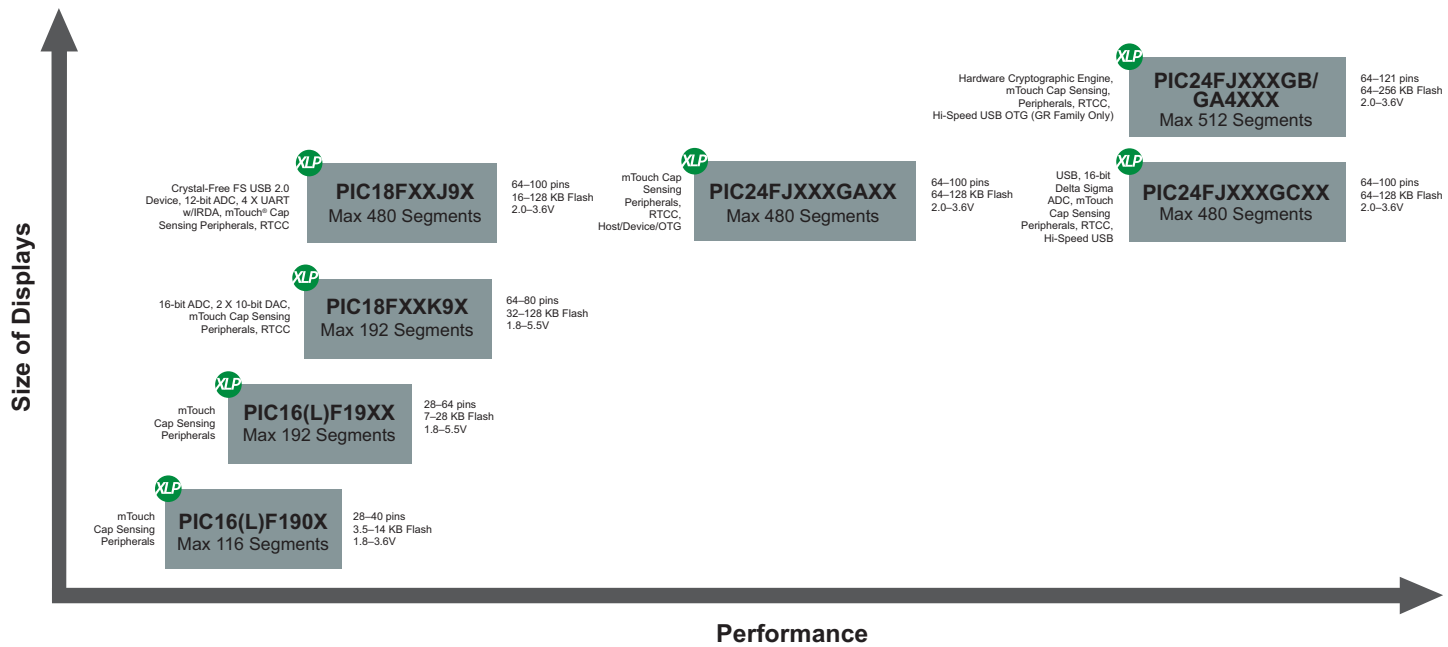
The LCD MCUs support a range of fixed and variable bias options as well as variable clock inputs that enable the flexibility to work with many different glass vendors.

Contrast Control

Software contrast control is a key feature using firmware to either boost or dim the contrast of the display. Boost the contrast up to V_{DD} or beyond if you are using one of the MCUs with an integrated charge pump. Software contrast control allows you to vary the contrast on the LCD to account for different operating conditions such as temperature, lighting and humidity. Software contrast control can also be invaluable for portable applications. As the battery level starts to drop, the firmware can apply a boost to the contrast, helping extend the battery life while still producing a crisp image on the display.

Direct Drive for Segmented Displays

Positioning Graph

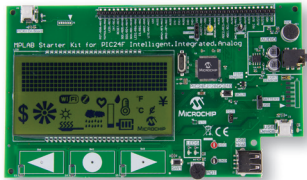


Maximum Number of Segments						
Product Family	Pins	1 Common	2 Commons	3 Commons	4 Commons	8 Commons
PIC16(L)F1902/3/6	28	19	38	57	72	–
PIC16(L)F1933/6	28	16	32	48	60	–
PIC16(L)F1904/7	40	29	58	87	116	–
PIC16(L)F1934/7/9	40	24	48	72	96	–
PIC16(L)F1946/7	64	46	92	138	184	–
PIC18F6XJ90	64	32	64	96	128	–
PIC18F6XJ93	64	33	66	99	132	–
PIC18F6XJ94	64	34	68	102	136	240
PIC18F6XK90	64	33	66	99	132	–
PIC18F8XJ90	80	48	96	144	192	–
PIC18F8XJ94	80	50	100	150	200	368
PIC18F8XJ93	80	48	96	144	192	–
PIC18F8XK90	80	48	96	144	192	–
PIC24FJXXGA306	64	34	68	112	146	240
PIC24FJXXGC006	64	34	68	112	146	240
PIC24FJXXGA308	80	50	100	150	200	368
PIC18F9XJ94	100	64	128	192	256	480
PIC24FJXXGA310	100	64	128	192	264	480
PIC24FJXXGC010	100	64	128	192	264	480
PIC24FJXXGB/GA4XX	121	64	128	192	256	512

Direct Drive for Segmented Displays

Development Tools for Segmented LCD

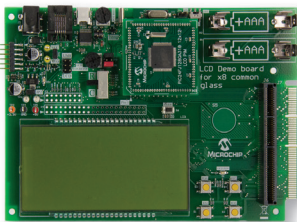
PIC24F Intelligent Analog Starter Kit (DM240015)



This development kit featuring the PIC24F “GC” family of 16-bit microcontrollers offers an analog header, allowing clean analog signals to be accessed to preserve

signal integrity. To complement the header, the board also features on-board sensors including a light sensor, potentiometer, microphone, temperature and capacitive touch. The custom LCD display features a 296 dot-matrix array for text display and 17 special icons. The board includes connections for microphone and headphones as well as on-board light and temperature sensors. The segmented display showcases custom icons and a scrolling banner. The board also includes cap touch buttons, USB connection and easy connection for RF modules.

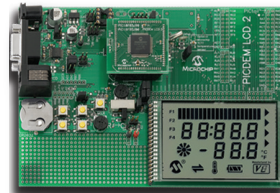
LCD Explorer Development Board (DM240314)



- Supports Microchip's 100-pin microcontrollers with $\times 8$ common segment LCD drivers
- Provides an ideal platform to evaluate a MCU with an $\times 8$ common LCD driver on a 38 segment $\times 8$ common LCD display

- PICTail™ Plus connections enable evaluation of selected MCUs in a complex system by adding PICTail Plus daughter boards
- PIC18F97J94 PIM (MA180034)

PICDEM™ LCD 2 Demo Board (DM163030)



- Illustrates and supports the main features of Microchip's 28-, 40-, 64- and 80-pin LCD PIC microcontrollers
- LCD glass with icons, numbers, alphanumeric and starburst display
- Demonstrates booster capability for contrast control and dimming
- Separate Processor Plug-in Modules (PIMs) are available to evaluate all of the LCD products
 - PIC18F87J90 PIM (MA180025)
 - PIC18F87K90 PIM (MA180027)
 - PIC16F1947 PIM (MA160016)
 - LCD PIM Pack (PIC16) (MA180019)

Application Notes for LCD Displays

- *Low Power Techniques for LCD Applications*, TB1098
- *Implementing an LCD Using the PIC16F1947 Microcontroller*, AN1354
- *Solving Sensor Offset Problem*, AN781
- *Low-Power Real-Time Clock*, AN582
- *LCD Biasing and Contrast Control Methods*, AN1428
- *LCD Fundamentals and the LCD Driver Module for 8-bit PIC Microcontrollers*, AN658

Graphical Displays

Graphical Displays

Microchip offers varying levels of solutions to drive everything from simple monochrome LCDs to full-color WVGA user interfaces. Graphics support includes the following approaches:

- PIC24F “DA” integrated graphics controller
- PIC32 controllerless graphics
- Support for PIC MCU with external graphics controllers

The silicon offering is complemented with powerful, free and easy-to-use graphics library, display designer GUI and hardware development kits with flexible interface to various glass sizes.

Supported Screen Sizes and Colors

Microchip graphics solutions support various screen sizes and colors ranging from small monochrome OLED displays up to WVGA displays with vivid color. The table below shows the bits per pixel required to represent color.

Display Representation	Color Examples	Color Depth (bits per pixel)
Mono	Black and White	1
Grayscale	4 shades	2
	16 shades	4
Color	256 colors	8
	65K colors	16
	16 million colors	24

As the color depth and display resolution increase, the frame buffer grows. Depending on the size, the frame buffer can be stored in the microcontroller RAM, in external SRAM or integrated into an external graphics controller. The table below shows examples of the frame buffer sizes required for some popular resolution and color depths.

- PIC24 “DA” family supports up to 96 KB on chip
- PIC32 MCUs support up to 512 KB on chip
- External SRAM can be used for larger frame buffers
- For advanced graphics, external graphics controllers have additional frame buffer storage

Screen Size and Colors

Display Resolution Typical Sizes		Color Depth/ Memory Requirement in (bytes)					
		1 bpp	2 bpp	4 bpp	8 bpp	16 bpp	24 bpp*
Colors		2	4	16	256	65K	16.7M
WVGA	800 × 480	48,000	96,000	192,000	384,000	768,000	1,152,000
VGA	640 × 480	38,400	76,800	153,600	307,200	614,400	921,600
WQVGA	480 × 272	16,320	32,640	65,280	130,560	261,120	391,680
QVGA	320 × 240	9,600	19,200	38,400	76,800	153,600	230,400
Common for OLED	128 × 64	1,024	2,048	4,096	8,192	16,384	24,576

Internal SRAM on PIC32MX

PIC32MZ Internal SRAM

External SRAM

*The minimum required for 24 bpp is more because of our 32-bit word length



FREE Microchip Graphics Library



The Microchip Graphics Library is highly modular and is optimized for Microchip's 16- and 32-bit microcontrollers. It is easy to use and has an open

documented interface for driver or controller support. The library supports the following features:

- Pre-made graphics objects
- Multiple fonts and languages
- User interface for mTouch sensing solutions
- Includes buttons, charts, check boxes, scroll bars, list boxes, images and basic animation
- For PIC32 MCUs the graphics library is available as a part of MPLAB® Harmony
- For 16-bit MCUs the graphics library is available through the Microchip Library for Applications (MLA)

Visual Design Tools

Microchip provides several visual design tools to help you with the development of graphics firmware. These GUI-based tools reduce the need to memorize graphics object information, improve the edits-compile-execute cycle and allow developers to work in the same space as users.

MPLAB Harmony Graphics Composer (MHGC) for 32-bit Microcontrollers

MPLAB Harmony Graphics Composer (MHGC) is Microchip's industry-leading GUI design tool for PIC32 microcontrollers. As a fully-integrated component of MPLAB Harmony Configurator (MHC), MHGC will accelerate your application's front end design without leaving the MPLAB X IDE.

- Concept to glass in minutes without writing a single line of code
- Configure project for your GUI requirements
- Drag and drop widget and objects directly into the design
- Extend your brand by importing custom images
- Design directly for MPLAB Harmony Graphics Primitive Library

MHGC is fully integrated into MHC which is available as an MPLAB X IDE plug in.



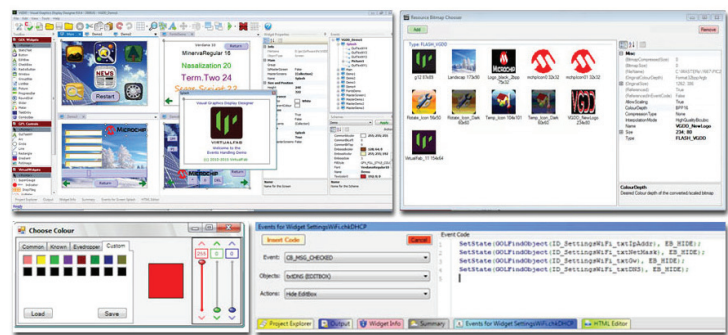
SEGGER emWin Pro Library

emWin from SEGGER Microcontroller GmbH and Co. KG is a software graphics library that provides efficient GUI building blocks for applications that operate with a graphical LCD.

- Complete ANSI C code, no need to C++
- RTOS independent
- GUIBuilder drag-and-drop design interface
- Robust graphics widget and shape drawing library
- Alternative for MPLAB Harmony Graphics Object Library and Primitive Layer
- User SEGGER development tool chain and utilities
- Integrated with MPLAB Harmony Configurator

Visual Graphics Display Design (VGDD) for 16-bit Microcontrollers

The Visual Graphics Display Designer is a standalone third-party graphics display designer tool with a companion VGDD-Link MPLAB X IDE plug in, supporting 16-bit PIC24 MCUs and dsPIC® Digital Signal Controllers. Compatible with MPLAB Code Configurator (MCC), VGDD utilizes the Microchip Graphics Library available as part of Microchip Libraries of Applications (MLA) to produce output source files that can be compiled using Microchip's XC16 Compilers to create interactive GUIs.



VGDD-Link is available as an MPLAB X plug in for GUI design, providing a seamless development experience. The VGDD-Link tool can be directly downloaded and installed from the MPLAB X IDE Plug In menu.

- Concept to glass in minutes without writing a single line of code
- Configure projects for your GUI requirements
- Drag and drop widgets and objects directly into the design (WYSIWYG design simplicity)
- Extend your brand by importing custom images
- Designed directly for Microchip Libraries of Applications

What's New?

- What You See Is What You Get (WYSIWYG) design
- Multi-platform (Windows®, Linux®, Mac®)
- Improved design tools
 - Drawing grid, auto widget alignment and other drawing shortcuts/productivity features
 - Cut, copy, paste properties
- Improved screen navigation
 - PowerPoint® style screen listing

Key Features

- Allows you to resize, align and move widgets, create color schemes and add fonts and images to your application
- Generates source code ready for PIC24F microcontrollers and digital signal controllers
- Provides the same visual representation of the embedded screen to draw objects on the PC screen
- Eliminates the need to manually calculate the (x, y) coordinates for on-screen object placements
- General guidance and information on selected screen elements (e.g. memory resource impact, color placement, etc.)
- Information box to provide context-sensitive information
- Multi-screen thumbnails enable quick switching amongst screens to develop the flow of your graphical user interface

Display Controller Solutions

Target Applications

Applications that benefit from attractive and easy-to-use graphical displays include:

Consumer: Thermostats, cordless phones, remote controls

Home Appliance: Coffee makers, washing machines, refrigerators, ovens

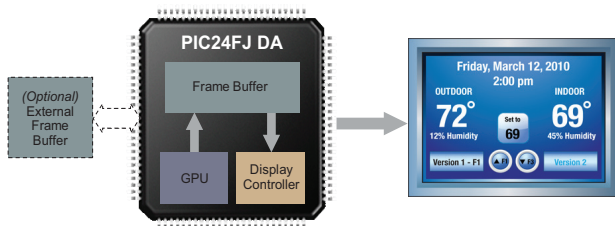
Industrial: Digital instrument gauges, storage controls, remote terminals

Portable Medical: Glucometers, blood pressure monitors, portable ECGs

Application Notes and Documentation for Graphical Displays

- *Fonts in the Microchip Graphics Library*, AN1182
- *How to Use Widgets in Microchip Graphics Library*, AN1136
- *How to Create Widgets in Microchip Graphics Library*, AN1246
- *Using a Keyboard with the Microchip Graphics Library*, AN1227
- *Developing Graphics Applications using an MCU with Integrated Controller*, AN1368
- *Using PIC32 MCUs to Develop Low-Cost Controllerless (LCC) Graphics Solutions*, AN1387

PIC24F with Integrated Graphics Controller: Low Cost, Easy to Use

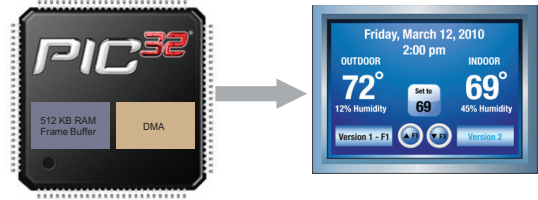


The PIC24F “DA” family makes it easy and cost-effective to add advanced graphics to your application by eliminating the need for external frame buffers or display controllers.

- Dedicated graphics clock for a continuous, clean display
- On-chip display controller provides direct interface to TFT, STN and OLED displays
- Easy-to-use Graphics Processing Units for hardware acceleration
 - Move and copy rectangles with smooth, fast memory transfers
 - Decompress images without CPU intervention
 - Render text without CPU intervention
- Color look-up table and 96 KB frame buffer to support multiple colors
 - Supports QVGA 8 bpp with internal frame buffer
 - Supports WQVGA 16 bpp with external frame buffer using PMP (Parallel Master Port)

With the hardware acceleration, this family is able to process and render graphics without using any MCU MIPS. The dedicated graphics engine is able to continuously drive a display without being shared with any other function.

PIC32 Low Cost Controllerless Graphics: 32-bit Performance, Flexibility, Integration



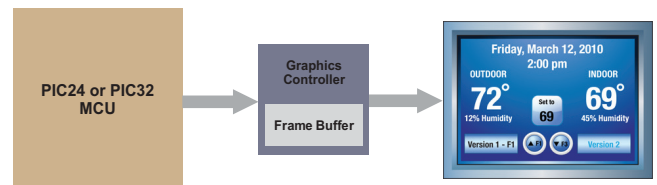
Microchip’s PIC32 line of 32-bit microcontrollers offers up to 330 DMIPS and high-performance DMA to render graphics directly to displays. This enables PIC32 devices to drive a display without an external graphics controller.

- Uses <5 MIPS and DMA to render graphics
 - Direct interface to STN, TFT displays
- Integrated up to 512 KB RAM for frame buffering
- Works with any PIC32 microcontroller

These devices offer up to 2 MB Flash and 512 KB RAM, giving you plenty of space for application code, communications stacks and data buffering. In addition to the graphics capabilities, PIC32 MCUs also have integrated peripherals for USB, CAN, Ethernet, I²C™, SPI, EBI, Crypto Engine and capacitive touch sensing.

External Graphics Controller: PIC24 or PIC32 with Parallel Master Port (PMP)

PIC24 and PIC32 MCUs can also work with an external graphics controller to support larger screen sizes or more advanced graphical features. Many external graphics controllers are supported by the graphics library; a few that we support with development tools are highlighted below.



The Solomon Systech SSD1926 Graphics Controller has hardware graphics acceleration to free up the MIPS of the PIC MCU. This controller includes an SD™ Card interface and JPEG decode engine as well as 256 KB RAM. The Graphics PICtail Plus SSD1926 Board (AC164127-5) includes serial Flash for data storage and interfaces to either Explorer 16 or PIC32 Starter Kits.

The Epson S1D13517 Graphics Controller includes alpha blending, picture-in-picture and supports up to WVGA (800 × 480) at 24 bpp. This controller has an SDRAM interface for connection to low-cost external memory. The Graphics Controller PICtail Plus Epson S1D13517 Board (AC164127-7) includes 128 MB SDRAM frame buffer and 64 MB serial Flash and interfaces to either Explorer 16 or PIC32 Starter Kits.

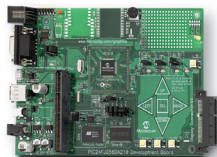
Tools for Designing Graphical Displays

	PIC24 "DA" Integrated Graphics Controller	PIC32 Controllerless Graphics	External Solomon Systech Graphics Controller SSD1926	External Epson Graphics Controller S1D13517
Display*	WQVGA 480 × 272	WVGA 800 × 480	WQVGA 480 × 272	WVGA 800 × 480
Graphics	HW Acceleration: rectangles, characters, images	Alpha-blending, speed, picture-in-picture, layering	HW Acceleration, SD™ Card, I/F, JPEG engine	SDRAM, I/F, alpha-blending, picture-in-picture
Frame Buffer	Color Lookup Table + 96 KB on MCU + Ext SRAM	512 KB on MCU + Ext SRAM	256 KB on Solomon Systech Controller	Ext SDRAM
Core MIPS	16	330	—	—
Power	Better	Good	Good	Good
Cost	\$	\$	\$\$	\$\$\$

*Max resolution at 16 bpp

Low-Cost Solution Without External Graphics Controller

PIC24FJ256DA210 Development Board (DM240312)



This board is a low-cost and efficient development board to evaluate the features and performance of the PIC24FJ256DA210 with integrated graphics, mTouch sensing and USB.

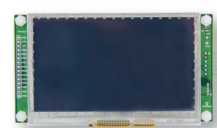
The development board requires a display board to complete the two-board setup. It has a Microchip display connector V1, and allows you to match it with any of the listed 3.2", 4.3" TFT displays, or the graphics prototype board available from Microchip.

Low-Cost Controllerless (LCC) Graphics PICtail Plus Board (AC164144)



This board enables development of graphics solutions without an external graphics controller. The board is designed to attach to a PIC32 Starter Kit or an Explorer 16 Development Board and one of Microchip's LCD modules.

PIC32 GUI Development Board with PCAP Touch (DM320015)



This board enables development of cost-effective multi-touch graphical user interfaces. It is based on the PIC32MX795F512H with 105 DMIPS performance, 512 KB Flash and

128 KB RAM. The PIC32 is coupled with a low-cost PSRAM as a high-speed graphics frame buffering and a 4.3" WQVGA touch display enabling development of graphics solutions without an external graphics controller.

Multimedia Expansion Board II (DM320005-2)

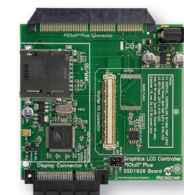


This board is a highly-integrated, compact and flexible development platform which works with PIC32MZ Starter Kits. This kit features a 4.3" WQVGA PCAP touch display daughter board and supports detachable display boards allowing for

a variety of resolutions. The kit also has an on-board 24-bit stereo audio codec, VGA camera, 802.11b/g wireless module, Bluetooth® HCI transceiver, temperature sensor, microSD™ slot and analog accelerometer.

Solutions with External Graphics Controllers

Graphics LCD Controller PICtail Plus SSD1926 Board (AC164127-5) (Includes Solomon Systech SSD1926 Controller)



The Graphics LCD Controller PICtail Plus SSD1926 Board is a demonstration board for evaluating Microchip's graphic display solution and graphics library for 16- and 32-bit microcontrollers.

It is an expansion board compatible with the Explorer 16 Development

Board (DM240001) or one of the PIC32 Starter Boards (DM320001, DM320003). The controller board has a connection for the display boards, such as the Graphics Display Truly 3.2" 240 × 320 Board (AC164127-4). The features include:

- Solomon Systech SSD1926 Graphics Display Controller supporting 4/8-bit STN, 4/8-bit CSTN, 18-bit HR-TFT and 9/12/18/24-bit TFT interface
- SD/MMC Card socket, connected to SSD1926 via 4-wire interface
- 16 Megabit (2M × 8) serial Flash memory for additional data storage
- Display connector for interfacing with different display boards
- PICtail Plus Interface for connecting to Explorer 16 Development Board
- PIC32 Starter Kit Connector

Multimedia Expansion Board (DM320005) (Includes Solomon Systech SSD1926 Controller)



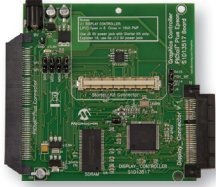
The Multimedia Expansion Board is an integrated, yet flexible, solution for development of high-impact user interfaces. The board comes with a 3.2" color TFT touch-screen display and interfaces to a PIC32 Starter Kit* allowing you to choose the device

family that works best for you. The Multimedia Expansion Board comes with an on-board FCC certified Wi-Fi® module and includes a 24-bit stereo audio codec, a three-axis accelerometer, a joystick and a MicroSD memory card slot.

*A PIC32 Starter Kit is required to use this expansion board.

Tools for Designing Graphical Displays

Graphics Controller PICtail Plus Epson S1D13517 Board (AC164127-7)



The Graphics PICtail Plus Epson S1D13517 Board is a demonstration board for evaluating Microchip's graphics-display solution and graphics library for 16- and 32-bit microcontrollers. This expansion board is compatible

with the Explorer 16 Development Board (DM240001) or one of the PIC32 Starter Boards (DM320001, DM320003). The controller board has a connection for display boards such as Graphics Display Truly 5.7" 640 × 480 Board (AC164127-8) and the Graphics Display Truly 7 800 × 480 Board (AC164127-9). Features include:

- Support for VGA, WVGA, QVGA, WQVGA displays
- Alpha blending
- Support for 24 bpp
- Touch interface
- 128-megabit (8M × 16) SDRAM for frame buffering
- 64-Megabit serial Flash memory for additional data storage

Display Boards

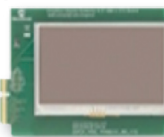
Graphics Display Truly 3.2" 240 × 320 Board (AC164127-4)



The Graphics Display Truly 3.2" 240 × 320 Board is a demonstration board for evaluating Microchip's graphic display solution and graphics library for 16- and 32-bit microcontrollers. It is an

expansion board compatible with the LCD controller boards such as the Graphics LCD Controller PICtail Plus SSD1926 Board (AC164127-5).

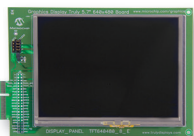
Graphics Display Powertip 4.3" 480 × 272 Board (AC164127-6)



The Graphics Display Powertip 4.3" 480 × 272 Board is a demonstration board for evaluating Microchip's graphic display solution and graphics library for 16- and 32-bit microcontrollers. It is an expansion board compatible with the

LCD controller boards such as the Graphics LCD Controller PICtail Plus SSD1926 Board (AC164127-5).

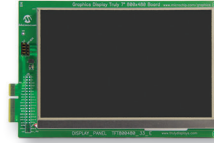
Graphics Display Truly 5.7" 640 × 480 Board (AC164127-8)



The Graphics Display Truly 5.7" 640 × 480 Board is a demonstration board for evaluating Microchip's graphics display solution and graphics library for 16 and 32-bit microcontrollers. This expansion board

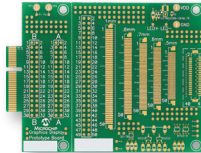
is compatible with LCD controller boards such as the Graphics Controller PICtail Plus Epson S1D13517 Board (AC164127-7).

Graphics Display Truly 7" 800 × 480 Board (AC164127-9)



The graphics Display Truly 7" 800 × 480 board is a demonstration board for evaluating Microchip's graphics display solution and graphics library for 16- and 32-bit microcontrollers. This expansion board is compatible with LCD controller boards such as the Graphics Controller PICtail Plus Epson S1D13517 Board (AC164127-7).

Graphics Display Prototype Board (AC164139)



The Graphics Display Prototype Board (set of three) provides an easy path to integrate a graphics LCD panel of your choice to one of the following platforms:

- PIC24FJ256DA210 development board (DM240312)
- Graphics LCD Controller PICtail Plus SSD1926 Board (AC164127-5)

Additional Graphics Development Boards

Remote Control Demo Board (DM240315-2)



Microchip's Remote Control Demo Board integrates Graphics, mTouch technology, USB and RF4CE into a single demo. The board demonstrates a remote populated with a PIC24FJ256DA210 MCU, 3.5" Graphical TFT LCD with resistive

touch screen, capacitive touch keys with plastic overlay, MRF24J40 2.4 GHz transceiver and ZENA™ wireless adapter. The Remote Control Demo Board offers the complete software and hardware including bill of materials, schematics and reference code.

Pervasive Displays E-Paper EPD PICtail Plus Daughter Board (Sold by Pervasive Displays #S0000AS0T3)



Microchip has partnered with Pervasive Displays to introduce an e-paper PICtail Plus Board that connects to Microchip's Explorer 16 development platform. The sample Microchip MPLAB X IDE project

provides an open source driving waveform, including global update and partial update capability with command interface to update content on the EPD panel without a graphic display controller or timing control board. The EPD PICtail Plus Daughter Board features:

- Support for driving 1.44", 2" and 2.7" EPD panels; all three sizes are included
- Direct-drive EPD by a Microchip PIC24 or PIC32 microcontroller without the need for any external graphic or timing controller
- Open documentation and driving waveform for EPD panel
- Microchip MPLAB X IDE project source code with Microchip Graphic Library

Tools for Designing Graphical Displays

Visual Design Tools

	MLA Graphics Library v3.XX (PIC24/dsPIC/PIC32MX)	MLA Graphics Library v4.00+ (PIC24/dsPIC)	MPLAB® Harmony v1.03 and older (PIC32MX/MZ)	MPLAB Harmony v1.04+ (PIC32MX/MZ)
VGDD with VGDD-Link MPLAB X IDE Plug In (VGDD-Link Plug In requires VGDD v9+ and MPLAB X IDE v3.00+)	✓	✓		
MPLAB Harmony Graphics Composer (requires MPLAB X IDE v3.00+)				✓

Microchip Graphics Solutions

These tables shows the out-of-the-box support for the following development boards and kits. With proper software and hardware configuration, compatibility of certain hardware combinations and other PIC devices can be achieved.

PIC32 Starter Kit-Based Tools

Starter Kits		Graphics LCD Controller PICTail™ Plus SSD1926 Board (AC164127-5)	Graphics Controller PICTail Plus Epson S1D13517 Board (AC164127-7)	Low-Cost Controllerless (LCC) Graphics PICTail Plus Daughter Board (AC164144)	Multimedia Expansion Board (DM320005)	Multimedia Expansion Board II (DM320005-2)
PIC32 Starter Kit (DM320001)	Graphics Display Truly 3.2" 240 × 320 Board (AC164127-4)	✓	✓	✓	–	–
PIC32 USB Starter Kit II (DM320003-2)		✓	✓	✓	–	–
PIC32 USB Starter Kit III (DM320003-3)		✓+	✓+	✓+	–	–
PIC24E USB Starter Kit (DM240012)		✓+	✓+	–	–	–
dsPIC33E USB Starter Kit (DM320012)		✓+	✓+	–	–	–
PIC32 Starter Kit (DM320001)		–	–	–	✓	–
PIC32 USB Starter Kit II (DM320003-2)		–	–	–	✓	–
PIC32 USB Starter Kit III (DM320003-3)		–	–	–	✓+	–
PIC24E USB Starter Kit (DM240012)		–	–	–	✓	–
dsPIC33E USB Starter Kit (DM320012)		–	–	–	✓	–
PIC32 Starter Kit (DM320001)	Graphics Display Powertip 4.3" 480 × 272 Board (AC164127-6)	✓	✓	✓(4)	–	–
PIC32 USB Starter Kit II (DM320003-2)		✓	✓	✓(4)	–	–
PIC32 USB Starter Kit III (DM320003-3)		✓+	✓+	✓+(4)	–	–
PIC24E USB Starter Kit (DM240012)		✓+	✓+	–	–	–
dsPIC33E USB Starter Kit (DM320012)		✓+	✓+	–	–	–
PIC32MZ EF Starter Kit (DM320007)		–	–	–	–	✓(6)
PIC32MZ EF Starter Kit with Crypto Engine (DM320007-C)		–	–	–	–	✓(6)
PIC32 Starter Kit (DM320001)	Graphics Display Truly 5.7" 640 × 480 Board (AC164127-8)	–1	✓	✓+(3)	–	–
PIC32 USB Starter Kit II (DM320003-2)		–1	✓	✓+(3)	–	–
PIC32 USB Starter Kit III (DM320003-3)		–1	✓+	✓+(3)	–	–
PIC24E USB Starter Kit (DM240012)		✓+	✓+	–	–	–
dsPIC33E USB Starter Kit (DM320012)		✓+	✓+	–	–	–
PIC32 Starter Kit (DM320001)	Graphics Display Truly 7" 800 × 480 Board (AC164127-9)	–1	✓	✓+(3)	–	–
PIC32 USB Starter Kit II (DM320003-2)		–1	✓	✓+(3)	–	–
PIC32 USB Starter Kit III (DM320003-3)		–1	✓+	✓+(3)	–	–
PIC32MZ EF Starter Kit (DM32007)		✓+	✓+	–	–	–
PIC32MZ EF Starter Kit with Crypto Engine (DM320007-C)		✓+	✓+	–	–	–
PIC24E USB Starter Kit (DM240012)	Graphics Display Prototype Board (AC164139)	✓+	✓+	–	–	–
dsPIC33E USB Starter Kit (DM320012)		✓+	✓+	–	–	–
PIC32 Starter Kit (DM320001)		✓(2)	✓(2)	✓(2)	✓(2)	–
PIC32 USB Starter Kit II (DM320003-2)		✓(2)	✓(2)	✓(2)	✓(2)	–
PIC32 USB Starter Kit III (DM320003-3)		✓(2)	✓(2)	✓(2)	✓+(2)	–
PIC32MZ EF Starter Kit (DM32007)		✓+(2)	✓+(2)	✓+(2)	–	✓(2)
PIC32MZ EF Starter Kit with Crypto Engine (DM320007-C)		✓+(2)	✓+(2)	✓+(2)	–	✓(2)
PIC24E USB Starter Kit (DM240012)		✓(2)	✓(2)	✓(3)	✓(2)	–
dsPIC33E USB Starter Kit (DM320012)		✓(2)	✓(2)	✓(3)	✓(2)	–

- ✓ = Compatible (out of the box)
✓+ = Compatible (will need firmware modification)
– = Incompatible

Notes:

- SSD1926 supports up to WQVGA (480 × 272) displays.
- Manually assemble chosen display panel to the prototyping board.
- Run at 8 bpp with external memory.
- 8 bpp or less using internal memory, 8 bpp or 16 bpp using external memory.
- 8 bpp or 16 bpp with external memory.
- Only works with PIC32MZ Starter Kits.

Tools for Designing Graphical Displays

Other Development Tools

	Explorer 16 Development Board (DM240001) + Plug-In Modules (PIMs)		Graphics Display Truly 3.2" 240 × 320 Board (AC164127-4)	Graphics Display Powertip 4.3" 480 × 272 Board (AC164127-6)	Graphics Display Truly 5.7" 640 × 480 Board (AC164127-8)	Graphics Display Truly 7" 800 × 480 Board (AC164127-9)	Graphics Display Prototype Board (AC164139)
PIC24FJ256DA210 Development Board (DM240312)			✓ ⁽⁴⁾	✓ ⁽⁵⁾	✓ ⁽³⁾	–	✓ ⁽²⁾
Graphics LCD Controller PICTail Plus SSD1926 Board (AC164127-5)	PIC24F PIMs	✓	✓	✓	–	–	✓ ⁽²⁾
	PIC32MX PIMs	✓	✓	✓	–	–	✓ ⁽²⁾
	PIC32MZ PIM	✓	✓	✓	–	–	✓ ⁽²⁾
	PIC24EP and dsPIC33P PIMs	✓	✓	✓	–	–	✓ ⁽²⁾
	PIC24H and dsPIC33F PIMs	✓	✓	✓	–	–	✓ ⁽²⁾
Graphics Controller PICTail Plus Epson S1D13517 Board (AC164127-7)	PIC24F PIMs	✓	✓	✓	✓	–	✓ ⁽²⁾
	PIC32MX PIMs	✓	✓	✓	✓	✓	✓ ⁽²⁾
	PIC32MZ PIM	✓	✓	✓	✓	✓	✓ ⁽²⁾
	PIC24EP and dsPIC33EP PIMs	✓+	✓	✓	✓	✓	✓ ⁽²⁾
	PIC24H and dsPIC33F PIMs	✓+	✓+	✓+	✓+	✓+	✓ ⁽²⁾
Low-Cost Controllerless (LCC) Graphics PICTail Plus Daughter Board (AC164144)	PIC24F PIMs	–	–	–	–	–	–
	PIC32MX PIMs	✓	✓ ⁽⁴⁾	✓	✓ ⁽³⁾	–	✓ ⁽²⁾
	PIC32MZ PIM	✓	✓	✓	✓	✓	✓ ⁽²⁾
	PIC24H and dsPIC33F PIMs	–	–	–	–	–	–

✓ = Compatible (out of the box)

✓+ = Compatible (will need firmware modification)

– = Incompatible

Notes:

1. SSD1926 supports up to WQVGA (480 × 272) displays.

2. Manually assemble chosen display panel to the prototyping board.

3. Run at 8 bpp with external memory.

4. 8 bpp or less using internal memory, 8 bpp or 16 bpp using external memory.

5. 8 bpp or 16 bpp with external memory.

6. Only works with PIC32MZ Starter Kits.

Stand-Alone Development Boards

Development Board	Description
Remote Control Demo Board with ZENA™ Wireless Adapter (DM240315-2)	Stand-alone development board with built-in display that comes with the ZENA Wireless Adapter.
MPLAB® Starter Kit for PIC24H MCUs (DM240021)	Stand-alone development board with a built-in display.
MPLAB Starter Kit for PIC24F MCUs (DM240011)	Stand-alone development board with a built-in display.
PIC24F PIMs	PIC24FJ128GA010 PIM (MA240011) PIC24FJ256GA110 PIM (MA240015) PIC24FJ256GB110 PIM (MA240014) PIC24FJ256GB210 PIM (MA240021)
PIC32MZ and PIC32MX PIMs	PIC32MX360F512L PIM (MA320001) PIC32MX460F512L PIM (MA320002) PIC32MX795F512L PIM (MA320003) PIC32MX450/470 PIM (MA320002-2) PIC32MZ EF PIM (MA320019)
PIC24EP and dsPIC33EP PIMs	dsPIC33EP512MU810 PIM (MA330025-1) PIC24EP512GU810 (MA240025-1)
PIC24H and dsPIC33F PIMs	PIC24HJ128GP504 PIM (MA240016-2) dsPIC33FJ128GP804 PIM (MA330019-2)

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DS00001699B



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