

## Embedded E-Paper Display Module

# LCD-EPDP24-XX



The LCD-EPDP24 is an Embedded LCD module featuring E-Paper Panels from Pervasive Displays, similar to those used in the Kindle and other e-Readers. Designed for low power applications, the E-Paper displays mimic the appearance of ordinary ink on paper, making them more comfortable to read and giving the surface a wider viewing angle. Furthermore, E-Paper uses only minimal power to change the image on screen, while using no power what-so-ever to maintain a static image.

Powered by Microchip's 16-bit PIC24F microcontroller, the module offers designers a host of features including a 10-bit ADC @ 500ksps, 59 Digital I/O, UART, I<sup>2</sup>C, SPI, Timers / Counters, USB 2.0 Full Speed (functional as a Host or Client), and much more. Furthermore, an additional 256K SPI SRAM and a 256K SPI EEPROM provide ample storage for display centric human interactive applications.

Using the free MPLAB X IDE and vast resources of software libraries and example software available, developers can bring their projects to life with ease and a quick time to market.

The small form factor, low power requirements, and vast feature set make it ideal for control, display, and human interaction applications which are limited in space, but require reliability and a high CPU processing ability.

The LCD-EPDP24 can be purchased Module only, or populated with the display of your choice.

### Software Support

Microchip App Libraries:  
Graphics  
USB  
File System  
Encryption  
and much more!

Example Software:  
C/C++ MCU Code showing  
E-Paper Display operation

### Development Tools

Microchip MCPLAB X IDE  
XC30 Compiler  
ICD3 Programmer / Debugger with  
Tag-Connect Interface

**CPU:**  
16-bit PIC24F

**Performance:**  
16 MIPS  
@ 32MHz

**Memory:**  
16KB Internal SRAM  
256KB Internal Flash  
256 KB SPI SRAM  
256KB SPI EEPROM

**Low Power:**  
~ 20 mA runtime  
~ 100 nA sleep mode

**10-bit ADC @ 500ksps**  
59 Digital I/O lines

**Supported Displays:**  
Pervasive Displays  
1.44", 2.00", 2.70"  
v110 (Vizplex)

**Onboard Temp Sensor**

**Operating Temp:**  
\*\*see back\*\*

**Operating Humidity:**  
5% to 95%  
non-condensing

**Storage Temp:**  
-20°C to +60°C

MADE IN USA

### Electrical @25°C:

Supply Voltage.....+2.7 to +6.0V DC  
 Typical Operating Current..... 20mA  
 Max Operating Current..... 140mA  
 Idle Current..... 9mA  
 LCD Max Inrush Current ..... 100mA  
 \*\* Low Power and sleep modes also avai.

### Memory:

CPU SRAM..... 16 KB  
 CPU Flash (Program Memory)..... 256 KB  
 ▶ 10,000 erase/write endurance (min)  
 ▶ 20 year data retention (min)  
 ▶ Selectable write protection boundary  
 ▶ Self-programmable via software  
 External SPI SRAM..... 256 Kbits  
 External SPI EEPROM..... 256 Kbits  
 ▶ 64-byte page  
 ▶ 1,000,000 erase/write endurance  
 ▶ >200 year data retention  
 ▶ Self-Timed Erase and Write Cycles

### CPU: Microchip PIC24FJ256GB110

- ▶ 16-bit Modified Harvard Architecture
- ▶ Up to 16 MIPS performance @ 32MHz
- ▶ 17-bit x 17-bit Single-Cycle Multiplier
- ▶ 32-bit x 16-bit Divider
- ▶ 16 x 16-bit working Register Array
- ▶ Two address generation units for separate read and write addressing
- ▶ Switch between clock sources in Real-Time
- ▶ Idle, Sleep and Doze modes with Fast Wake-Up and Two-Speed Start-Up
- ▶ Fail-Safe Clock Monitor: detects clock failure and switches to internal clock
- ▶ Power-on Reset (POR)
- ▶ Power-up Timer (PWRT)
- ▶ Low-Voltage Detect (LVD)
- ▶ Oscillator Start-up Timer (OST)
- ▶ Watchdog Timer (WDT)
- ▶ Brown-out Reset (BOR)

### Peripherals:

- ▶ Peripheral Pin Select (PPS)
  - ▶ Allows I/O pin remapping at runtime
- ▶ Five 16-bit Timers/Counters
- ▶ Nine 16-bit Capture Inputs
- ▶ Nine 16-bit Compare/PWM Outputs
- ▶ 59 Digital I/O
  - ▶ 5.5V Tolerant Inputs
  - ▶ Configurable Open-Drain Outputs
  - ▶ Configurable weak Pull-up resistors
  - ▶ High-Current Sink/Source (18mA)
- ▶ Hardware Real-Time Clock/Calendar (RTCC)
  - ▶ Provides clock, calendar, alarms
- ▶ Cyclic Redundancy CheckGenerator (CRC)
- ▶ Up to five External Interrupt Sources

### Analog Features:

- ▶ 10-bit, up to 16 channel ADC @ 500ksps
- ▶ ADC available in sleep mode
- ▶ Three Analog Comparators with programmable input/output config.
- ▶ Charge Time Measurement Unit (CTMU)
- ▶ On-board Temperature Sensor
  - ▶ Measurement Range: -40°C to +125°C
  - ▶ Accuracy: ± 2°C at 25°C

### Communication Protocols:

- ▶ Up to three 3-Wire/4-Wire SPI modules
  - ▶ 4 Frame Modes
  - ▶ 8-level FIFO Buffer
- ▶ Up to three I<sup>2</sup>C modules
  - ▶ Multi-Master or slave modes
  - ▶ 7-bit/10-bit addressing modes
- ▶ Up to four UART modules
  - ▶ Supports RS-485, RS232, LIN/J2602 protocols and hardware IrDA.
  - ▶ Auto-wakeup and Baud-Rate Detect
  - ▶ 4-level FIFO buffer
- ▶ USB 2.0 On-The-Go Compliant
  - ▶ Dual-Role: can be Host or Client
  - ▶ Full-Speed (12MB/s)

### Programming/Debugging:

- ▶ 2-wire ICSP interface with Tag-Connect Cable
- ▶ Unintrusive hardware based instruction trace

### Jumpers:

Power Select..... W1  
 USB Config..... W2

### LEDs:

Power (Green)..... D1

### External Connectors:

USB 2.0 Full Speed..... J1  
 Power ..... J2  
 40-pin I/O connector..... J3/J4  
 ICSP Programming Header..... J5  
 LCD ..... J6  
 4-40 mounting holes..... (2)

### Dimensions & Operating Temp:

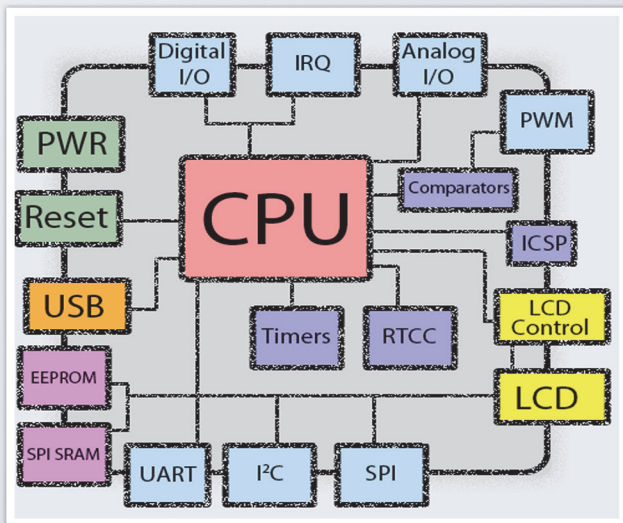
Module Only ..... 2.80" x 1.90"  
 ..... -40°C to +85°C  
 Module w/ 1.44" Display ..... 2.80" x 1.90"  
 ePD v110 (Vizplex) ..... 0°C to +50°C  
 Module w/ 2.00" Display ..... 2.80" x 1.90"  
 ePD v110 (Vizplex) ..... 0°C to +50°C  
 Module w/ 2.70" Display ..... 2.80" x 2.57"  
 ePD v110 (Vizplex) ..... 0°C to +50°C

### LCD Properties:

1.44" Active Area..... 29.312 x 21.984 mm  
 Resolution ..... 128 x 96 pixels (111dpi)  
 2.00" Active Area..... 45.80 x 21.984 mm  
 Resolution ..... 200 x 96 pixels (111dpi)  
 2.70" Active Area ..... 57.288 x 38.192 mm  
 Resolution ..... 264 x 176 pixels (117dpi)

### Additional Required Items:

Microchip ICD3 Programmer / Debugger....(1)  
 Tag-Connect TC2030-MCP-NL (Cable).....(1)  
 Tag-Connect TC2030-CLIP ( Cable Clip)..... (1)



## Ordering Information

LCD-EPDP24 ..... E-Paper Module Only  
 LCD-EPDP24-1.44 ..... E-Paper Module w/ 1.44" display  
 LCD-EPDP24-2.00 ..... E-Paper Module w/ 2.00" display  
 LCD-EPDP24-2.70 ..... E-Paper Module w/ 2.70" display



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