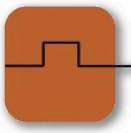
MX PIC24F Educational Module

User Manual

Revision History

Date	Description
2011-03-29	Initial release.



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1. Introduction

Thank you for purchasing the MX PIC24F Educational Module. This module, when combined with the MX Educational Target, provides a powerful, low-cost, development environment. This environment is equally useful to beginners just starting out or to professionals who require a rapid prototyping environment.

The MX PIC24F Educational Module includes an on-board circuit that is a licensed programmer/debugger based on the PICkit3 from Microchip. This eliminates the need to use an external debugger or programming device (PICkit3, ICD3, Real ICE, …).

The MX Module series is a family of compact (65x50mm), robust, pre-engineered modules. A complete rapid prototyping environment is easily obtained when considering the off-the-shelf targets available from Stratford Digital and complete functional firmware projects.

These modules are pre-engineered to be ready to insert into your end application. Unlike most rapid prototyping system, engineering details like ESD, signal and power integrity, and minimal power consumption are already designed in.

Each module in the MX Series conforms to this specification to allow for maximum inter-changing between the modules. The mating board (called a target) will be able to accept any module that conforms to this specification. This allows for the ability to scale processing power, high-speed connectivity solutions, and memory resources by simply switching out the module in the end application.

1.1. Package Contents

The MX PIC24F Educational Module will be shipped with the following items:

- MX PIC24F Educational Module (p/n MX-MOD-PIC24F-EDU)
- Warranty Certificate and Support Contact Information Sheet

1.2. Key Hardware Features

The MX PIC24F Educational module includes these key features as indicated in Figure 1 (below):

1. In-Circuit Serial Programming (ICSP) USB Connector
2. ICSP Status LED's
3. EEPROM SPI Memory (256Kbit)
4. Optional RAM SPI Memory (256Kbit)
5. 32KHz Timing Crystal
6. PIC24FJ256GB110 16-Bit Microcontroller
7. MX Interface Connectors (on bottom, not shown)

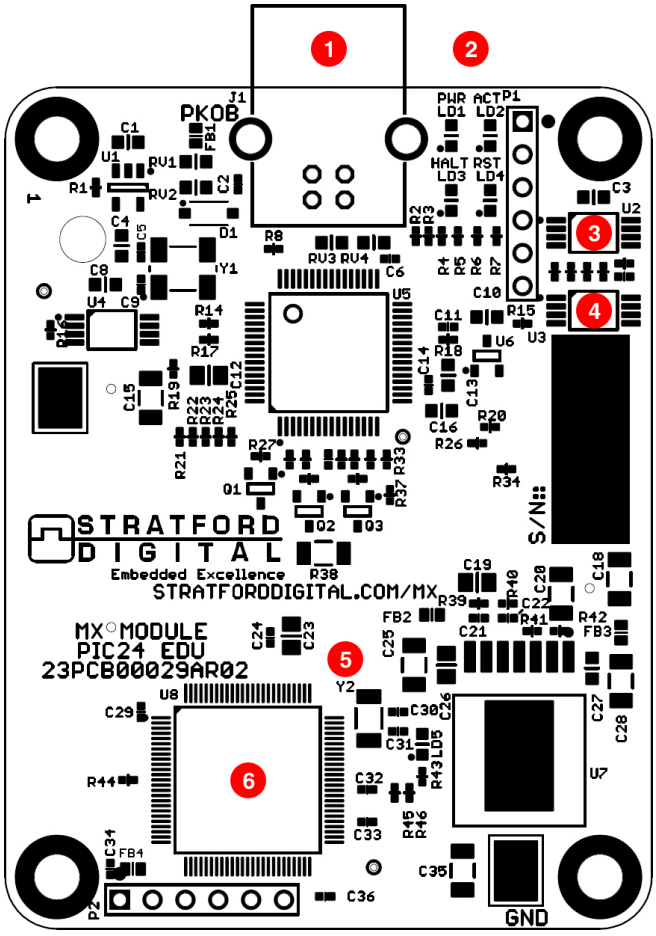

Figure 1 :: MX PIC24F Educational Module Features

2. Hardware Features

This section describes the key hardware features of this board as illustrated in Figure 1 (above).

2.1. Programmer/Debugger USB Connector

The MX PIC24F Educational Module includes an on-board circuit that is a licensed programmer/debugger based on the PICkit3 from Microchip. A host PC running Microchip's MPLAB IDE (version 8.6 or later) can program or debug the PIC24F microcontroller directly by connecting a USB cable from the PC to this USB connector. No external programmer or debugger is required.

To use this port select in the MPLAB IDE select "Licensed Debugger" from the Debugger->Select Tool menu or Programmer->Select Programmer menu.

Note: In MPLAB v8.60 this port is labeled "PICkit3 On Board" in both the Debugger and Programmer menus.

2.2. Programmer/Debugger Status LED's

Table 1 (below) describes the functionality of the Programmer/Debugger Status LED's.

LED	Signal	Color	Description
LD1	PWR	Green	Indicates that the power is supplied to the licensed debugger/programmer via the USB port.
LD2	ACT	Green	Indicates that the licensed debugger/programmer has connection to the PC USB port and the communication link is active.
LD3	HALT	Red	These LED's indicate the current state of operation.
LD4	RST	Red	**Busy**: LD4 ON, LD3 ON **Success**: LD4 OFF, LD3 ON **Error**: LD4 ON, LD3 OFF **Idle**: LD4 OFF, LD3 OFF

Table 1 :: ICSP Status LED Description

2.3. EEPROM SPI Memory

A Microchip 25LC256 256Kbit EEPROM device is connected to the PIC24F microcontroller via a SPI bus. With the Peripheral Pin Select (PPS) module this can be connected to any

internal SPI hardware module. The active-low chip select for this memory chip is connected to pin RB14.

The PIC24F does not have any on-chip EEPROM memory so this external memory can be used to store non-volatile data as required by the end application.

Other memory sizes are available. Contact Stratford Digital for custom memory configuration on orders of 50+ modules.

2.4. Optional RAM SPI Memory

A Microchip 23K256 256Kbit RAM device (or equivalent) can be connected to the PIC24F microcontroller via a SPI bus. This uses the same SPI bus microcontroller pins as the EEPROM SPI Memory in Section 2.3 (above). The active-low chip select for this memory chip is connected to pin RD7.

This memory can be used to extend the on-chip RAM memory for large data arrays. By default, this part is not populated.

Other memory sizes are available. Contact Stratford Digital for custom memory configuration on orders of 50+ modules.

2.5. 32KHz Timing Crystal

This crystal is connected to the microprocessor Secondary Oscillator pins. These pins can directly clock both the TMR1 (Timer 1) and RTC (Real Time Clock) modules for very-low power operating modes.

2.6. PIC24FJ256GB110 16-Bit Microcontroller

This microcontroller is the device that controls all of the module I/O and operation. It is ideal for low power (<100nA standby current) and connectivity applications that benefit from the availability of multiple serial ports (3xI2C, 3xSPI), 4xUARTS, and 23 independent timers. Large amounts of RAM (16kB) memory for buffering and large (up to 256kB) Enhanced Flash program memory make it ideal for embedded control and monitoring applications. PPS (peripheral pin select) aids in configuring the most efficient pin configuration of available I/O, and CTMU provides touch support for up to 64 individual buttons. Supports USB 2.0 for device, Host, and OTG with a complete and free software stack that includes a thumb drive application stack.

2.7. MX Interface Connectors

Like all MX Modules, the mechanical and electrical interface is described in the MX Interface Specification Document found at www.stratforddigital.com/mx.

Off-board I/O lines as well as input and output power pins are available on the MX Interface Connectors (J101 and J102). These connectors are on the bottom of the module and are intended to connect to a target board that conforms to the MX Interface Specification.

2.7.1. Module Specific Pinout

Table 2 (below) lists each I/O signal in the MX Interface connector and lists the specific connection to the PIC24F microcontroller.

	PIC24F Microcontroller		
MX Signal Name	**Pin Function**	**Port Name**	**QFP100 Pin**
AN_CH0	AN0	RB0	25
AN_CH1	AN1	RB1	24
AN_CH2	AN2	RB2	23
AN_CH3	AN3	RB3	22
AN_CH4	AN4	RB4	21
AN_CH5	AN8	RB8	32
AN_REF-	VREF-	RA9	28
AN_REF+	VREF+	RA10	29
CAN1_RX	I/O	RF0	87
CAN1_TX	I/O	RF1	88
CAN2_RX	I/O	RG0	90
CAN2_TX	I/O	RG1	89
DIG0	I/O	RE9	19
DIG1	I/O	RC4	9
DIG2	I/O	RC3	8
DIG3	I/O	RC2	7
DIG4	I/O	RC1	6
DIG5	I/O	RG15	1
DIG6	I/O	RG13	97
DIG7	I/O	RG12	96
I2C1_SCL	SCL1	RA14	66
I2C1_SDA	SDA1	RA15	67
I2C2_SCL	SCL2	RA2	58
I2C2_SDA	SDA2	RA3	59
PGC	--	--	--
PGD	--	--	--
PMP_A0	PMPA0	RB15	44
PMP_A1	PMPA1	RB14	43
PMP_AD0	PMPD0	RE0	93
PMP_AD1	PMPD1	RE1	94
PMP_AD2	PMPD2	RE2	98
PMP_AD3	PMPD3	RE3	99
PMP_AD4	PMPD4	RE4	100
PMP_AD5	PMPD5	RE5	3
PMP_AD6	PMPD6	RE6	4
PMP_AD7	PMPD7	RE7	5
PMP_CS1	PMP_CS1	RD11	71
PMP_CS3	I/O	RG14	95

PMP_RD	PMPRD	RD5	82
PMP_WR	PMPWR	RD4	81
PWM1	PPS I/O	RD0	72
PWM2	PPS I/O	RD1	76
PWM3	PPS I/O	RD2	77
PWM4	PPS I/O	RD3	78
QE1_INDX	I/O	RD12	79
QE1_QEA	I/O	RD8	68
QE1_QEB	I/O	RD9	69
QE1_UPD	I/O	RB11	35
QE2_INDX	I/O	RB9	33
QE2_QEA	I/O	RD13	80
QE2_QEB	I/O	RC15	64
QE2_UPD	I/O	RB10	34
SPI_MISO	PPS I/O	RG7	11
SPI_MOSI	PPS I/O	RG8	12
SPI_SCK	PPS I/O	RG6	10
nSPI_CS2	I/O	RD6	83
nSPI_SS/CS1	PPS I/O	RG9	14
TCK	TCK	RA1	38
TDI	TDI	RA4	60
TDO	TDO	RA5	61
TMS	TMS	RA0	17
U1_RX	PPS I/O	RF2	52
U1_TX	PPS I/O	RF8	53
nU1_CTS/U2_RX	PPS I/O	RD14	47
nU1_RTS/U2_TX	PPS I/O	RD15	48
U3_RX	PPS I/O	RF12	40
U3_TX	PPS I/O	RF13	39
nU3_CTS/U4_RX	PPS I/O	RB12	41
nU3_RST/U4_TX	PPS I/O	RF4	49
UNIO_SCIO	I/O	RA6	91

Table 2 :: Microcontroller MX Signal Pinout

Pin Function Legend

PPS I/O :: can be configured using the Peripheral Pin Select (PPS) module to connect directly to related hardware modules of the microcontroller

I/O :: connected to generic I/O pins for bit-banging software interfaces

Appendix A :: Schematics

Figure 2 (below) shows the schematic for the main processor circuitry.

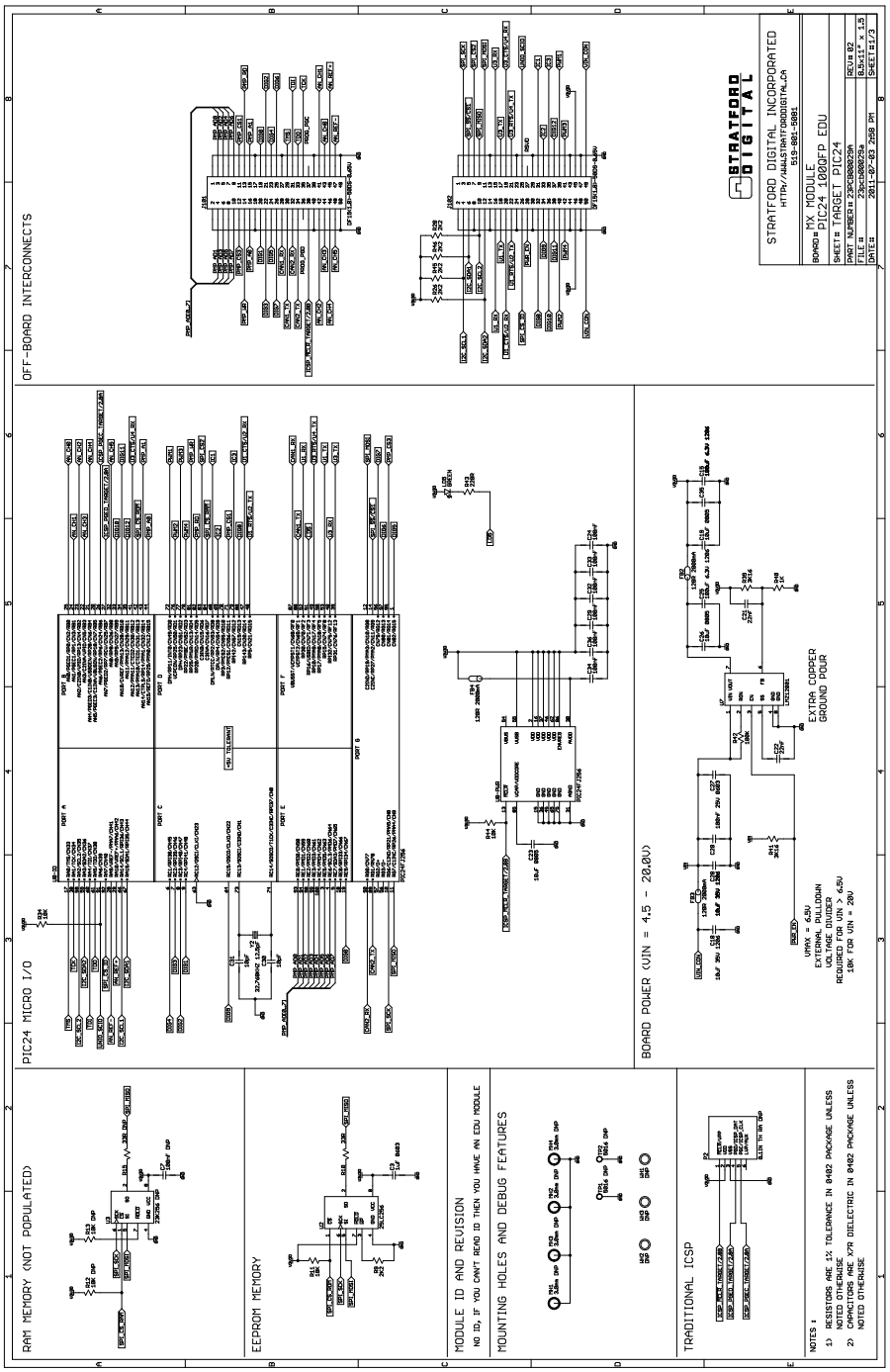

Figure 2 :: Module Schematics

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