MPLAB® Xpress PIC16F18446

MPLAB® Xpress PIC16F18446 Evaluation Board

Preface

The MPLAB® Xpress PIC16F18446 evaluation kit is a hardware platform to evaluate the PIC16F18446 microcontroller. The MPLAB® Xpress PIC16F18446 board contain two sections; the programmer section and the application section. The programmer section contains the circuitry necessary for programming, while the application section contains the circuitry that is used by the microcontroller application.

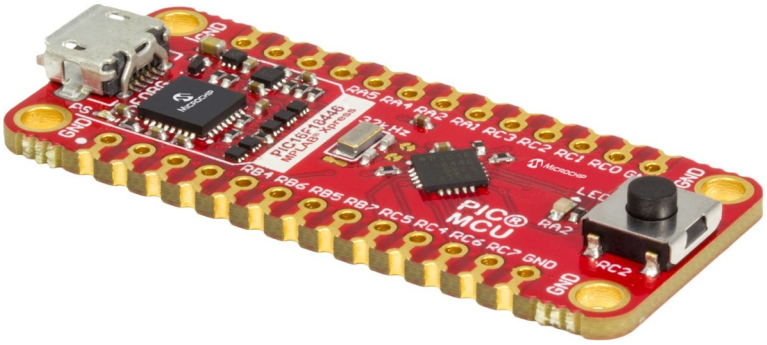


Table of Contents

1. Introduction

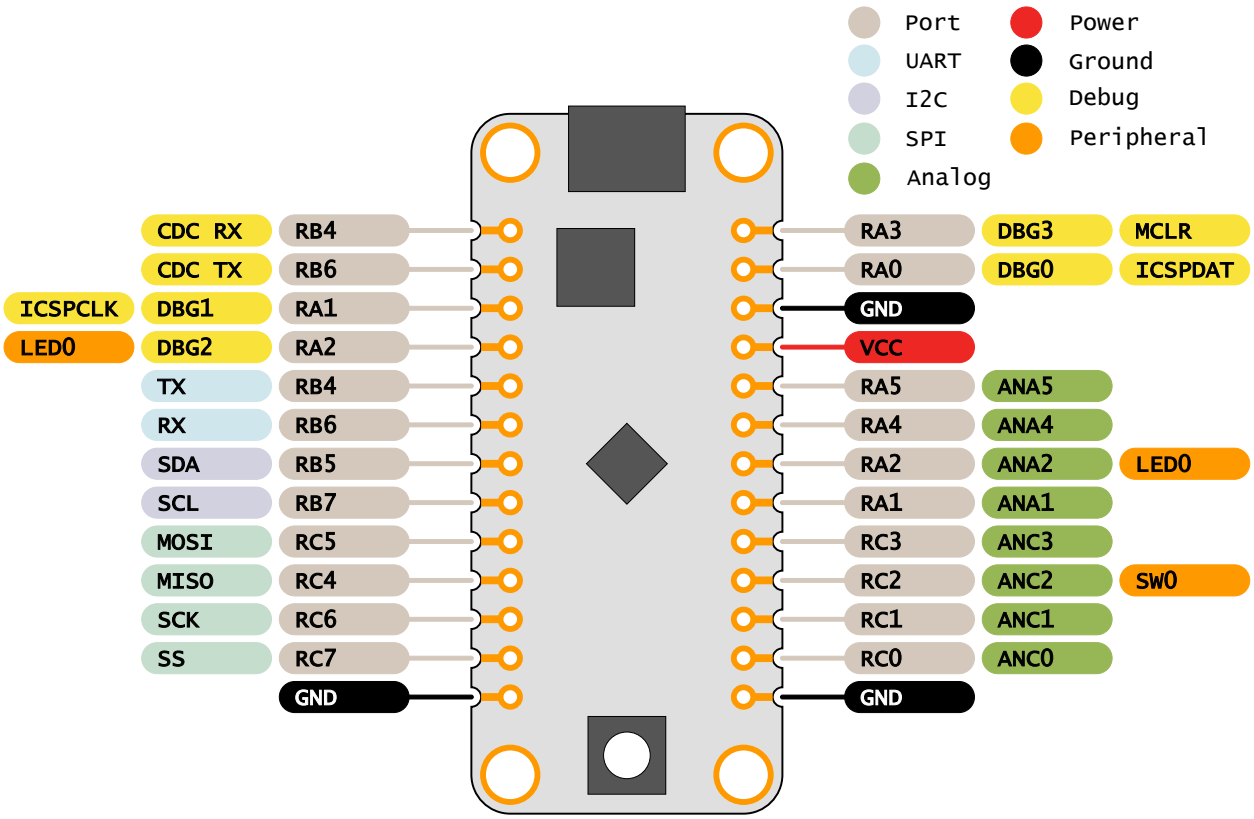
1.1 Features

- PIC16F18446 microcontroller
- One yellow user LED
- One mechanical user button
- nEDBG
  - Programming
  - Virtual COM port (CDC)
  - One green board status LED
- USB powered

1.2 Kit Overview

The Microchip MPLAB® Xpress PIC16F18446 evaluation board is a hardware platform to evaluate the Microchip PIC16F18446.

Figure 1-1. MPLAB® Xpress PIC16F18446 Evaluation Board Overview



2. Getting Started

2.1 MPLAB® Xpress Quick Start

The Xpress Evaluation Boards are designed to work with the MPLAB® Xpress IDE, but can also be used with MPLAB® X IDE. MPLAB Xpress IDE does not require any downloads and can be accessed by visiting mplabxpress.microchip.com. The Xpress Evaluation Boards allow for rapid development of custom applications without the need to download the IDE or compilers to a computer and allows the storage of a project in the cloud. This allows a user the ability to access their project from virtually anywhere (requires an Internet connection) and from any computer. Microchip also provides code examples to help get you started.

Programming the Xpress board is accomplished by connecting a Micro-USB cable to the onboard USB connector, creating the .hex file, and dragging and dropping the .hex file into the Xpress board.

To begin, connect a Micro-USB cable to the onboard USB connector. Next, open the MPLAB Xpress IDE.

The procedure to create a new project or open an existing MPLAB Xpress project is the same as within MPLAB X IDE. Navigate to the File tab, select Project Properties > Configuration > Hardware Tool > Hardware Tools and select ‘Simulator/Xpress Board’ (see Figure 2-1). This ensures that the Xpress board is chosen as the development tool. Once selected, the ‘Simulator/Xpress Board’ selection will appear under the ‘Debug Tool’ section in the Dashboard window (see Figure 2-2).

Once the project is open and ready to program into the target device, simply click on the Make and Program Device button (see Figure 2-3).

MPLAB Xpress will build and compile the project, and once completed, will open or save the .hex file that was created. Under the Save button, you can either hit Save and the .hex file will be stored in your downloads folder, or you can hit Save as and choose the location for the .hex file. It is important to remember where the file is stored since the .hex file is what will be programmed into the target PIC® device.

Figure 2-1. Selecting the Xpress Kit in MPLAB® Xpress IDE

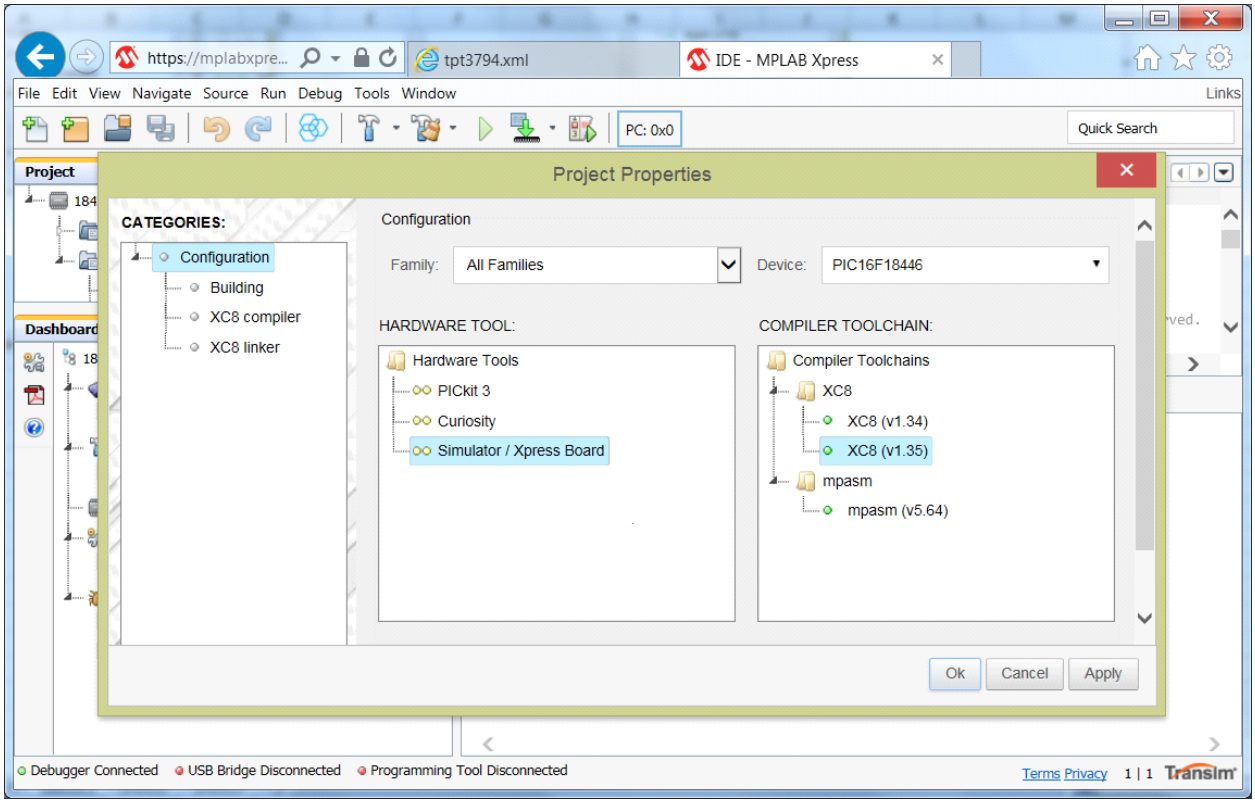


Figure 2-2. Selecting the Xpress Kit in MPLAB® Xpress IDE (Cont)

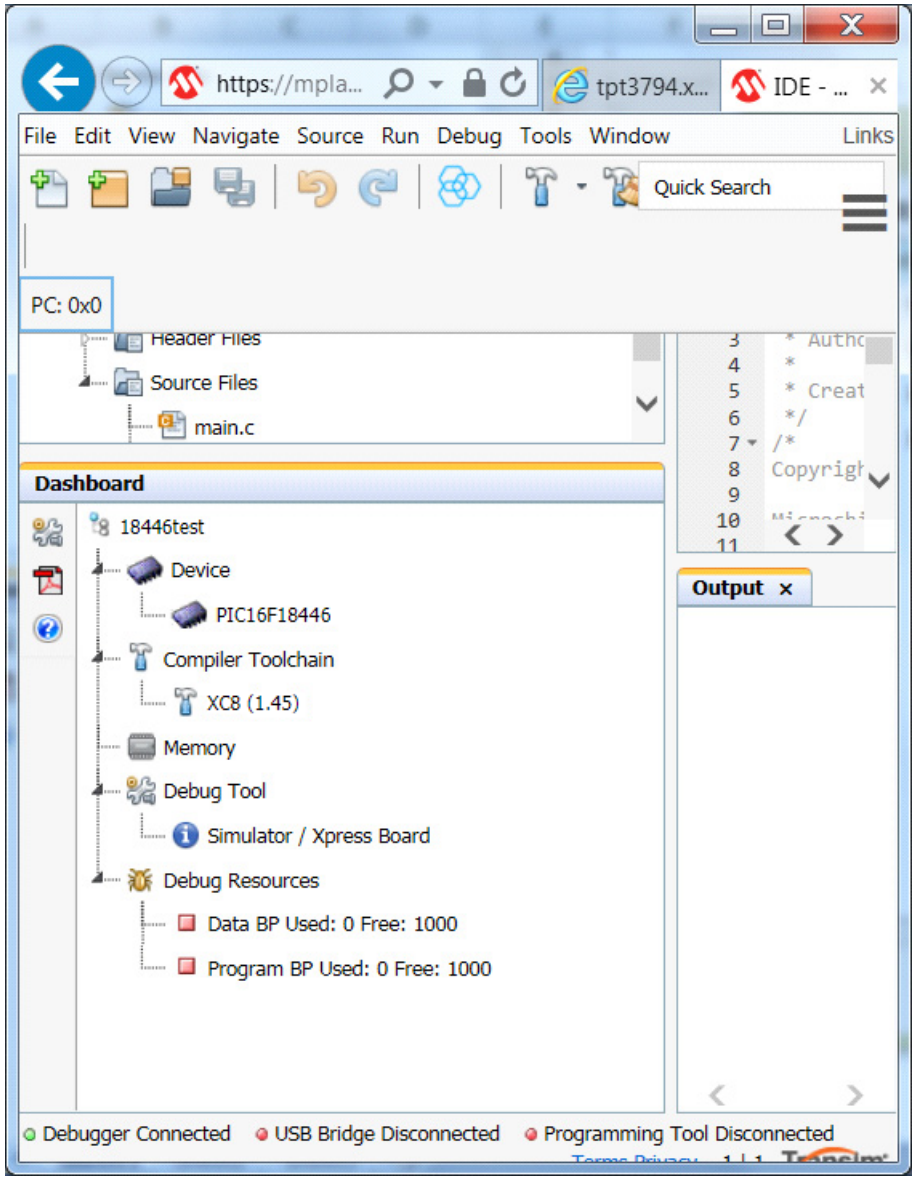
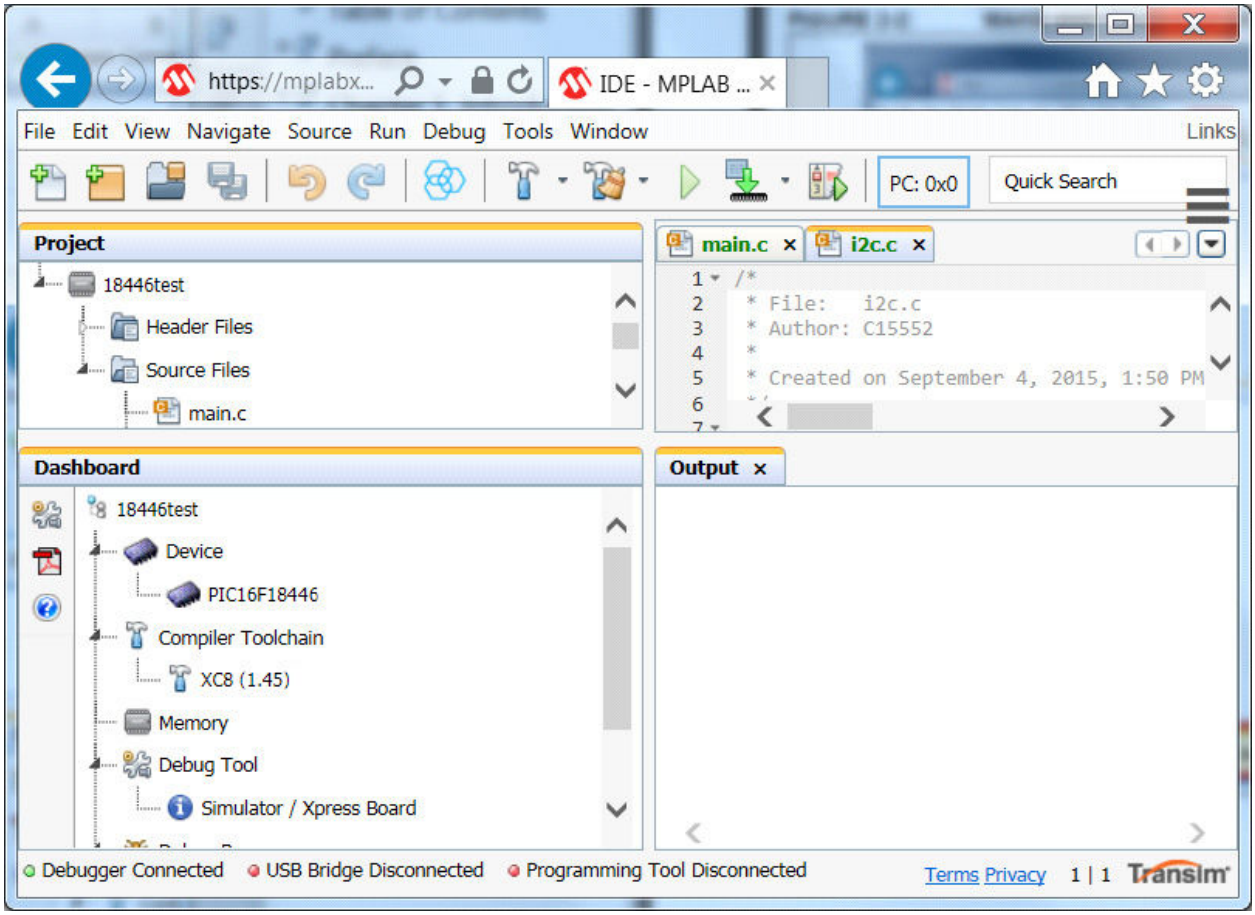


Figure 2-3. Make and Program Device



2.2 Design Documentation and Relevant Links

The following list contains links to the most relevant documents and software for the MPLAB® Xpress PIC16F18446.

- **Microchip sample store** - Microchip sample store where you can order samples of devices.
- **MPLAB Xpress PIC16F18446 website** - Kit information, latest user guide and design documentation.
- **MPLAB® X IDE** - MPLAB X IDE is a software program that runs on a PC (Windows®, Mac OS®, Linux®) to develop applications for Microchip microcontrollers and digital signal controllers. It is called an Integrated Development Environment (IDE) because it provides a single integrated "environment" to develop code for embedded microcontrollers.
- **MPLAB® Xpress Cloud-based IDE** - MPLAB® Xpress Cloud-Based IDE is an online development environment that contains the most popular features of our award-winning MPLAB X IDE. This simplified and distilled application is a faithful reproduction of our desktop-based program, which allows users to easily transition between the two environments.

3. Hardware User Guide

3.1 Power Supply

The kit is powered through the USB port as shown in the diagram below. The kit contains two regulators for generating 3.3V for the debugger and an adjustable regulator for the target. The target regulator is set to generate 3.3V on MPLAB® Xpress PIC16F18446.

If an external voltage is required, the power supply and the target must be separated. This can be done by cutting the strap on the bottom side of the kit marked *VREG* as shown in the figure below. Cutting the strap will not separate the target supply from the level shifter, allowing programming of the PIC16F18446 with an external voltage.

⚠WARNING Supplying external power to the board while the USB cable is plugged in, without cutting the VREG strap, can permanently damage the toolkit and the USB port of the PC.

Figure 3-1. Power Supply Block Diagram

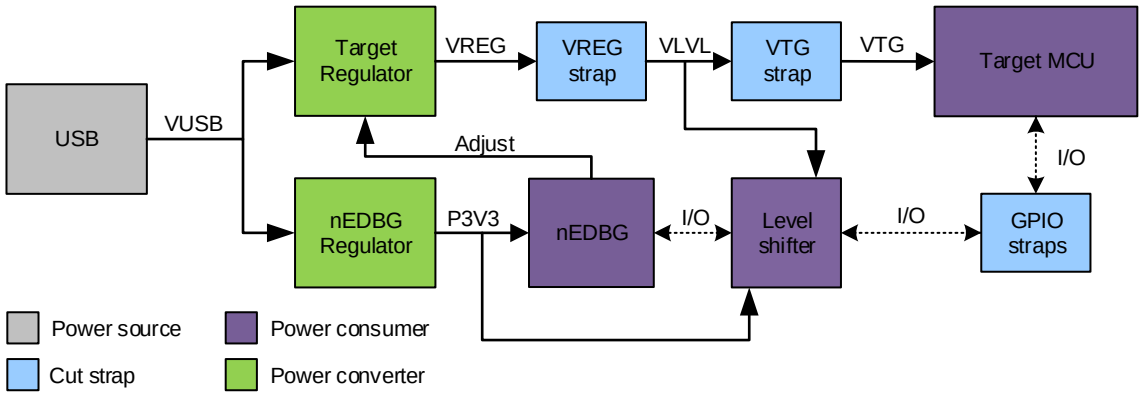
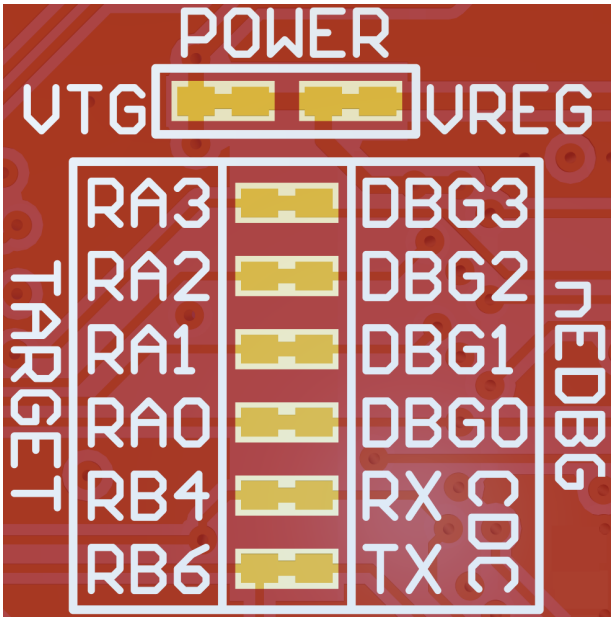


Figure 3-2. nEDBG Cut Straps



3.2 Connectors

3.2.1 MPLAB® Xpress PIC16F18446 Pinout

MPLAB® Xpress PIC16F18446 has most of it's I/O's accessible at the edge connectors. Some I/O's are connected to the nEDBG for programming and communication purposes.

Table 3-1. Edge Connector

Edge Connector	PIC16F18446 Pin	Standard Function	Description and Shared Functionality
1	RB4	CDC RX	Target UART TX
2	RB6	CDC TX	Target UART RX
3	RA1	DBG1	ICSP CLK
4	RA2	DBG2	DGI GPIO and user LED
5	RB4	UART TX	CDC RX
6	RB6	UART RX	CDC TX
7	RB5	I^2C SDA	
8	RB7	I^2C SCL	
9	RC5	SPI MOSI	
10	RC4	SPI MISO	
11	RC6	SPI SCK	
12	RC7	SPI SS	
13	GND	Ground	

Edge Connector	PIC16F18446 Pin	Standard Function	Description and Shared Functionality
14	GND	Ground	
15	RC0	ADC	
16	RC1	ADC	
17	RC2	ADC	User switch
18	RC3	ADC/PWM	
19	RA1	ADC/PWM	
20	RA2	ADC	User LED
21	RA4	ADC	32 KHz Crystal
22	RA5	ADC	32 KHz Crystal
23	VCC	Power Supply	
24	GND	Ground	
25	RA0	DBG0	ICSP DAT
26	RA3	DBG3	MCLR

3.3 Peripherals

3.3.1 LED

There is one yellow LED available on the MPLAB® Xpress PIC16F18446 board that can be turned ON and OFF. The LED can be activated by driving the connected I/O line to GND.

Table 3-2. LED Connection

PIC16F18446 Pin	Description	Shared Functionality
RA2	Yellow user LED0	Edge connector

3.3.2 Mechanical Buttons

MPLAB® Xpress PIC16F18446 contains one mechanical button. This is a generic user configurable button and when a button is pressed it will drive the I/O line to GND.

Info: There is no pull-up resistor connected to the generic user button. Remember to enable the internal pull-up in the PIC16F18446 to use the button.

Table 3-3. Mechanical Button

PIC16F18446 Pin	Description	Shared Functionality
RC2	User switch SW0	Edge connector

3.3.3 Crystal

The MPLAB® Xpress PIC16F18446 board has a 32768 Hz crystal mounted on the board.

The crystal is not connected to the PIC16F18446 by default, as the GPIO's are routed out to the edge connector. To use the crystal, some hardware modifications are required. The two I/O lines routed to the edge connector should be disconnected to both reduce the chance of contention to the crystal as well as removing excessive capacitance on the lines. This can be done by cutting the two straps on the bottom side of the board, marked RA4 and RA5 as shown in the figure below. Next, solder on a solder blob on each of the circular solder points next to the crystal on the top side of the board as shown in the figure below.

The 32.768 kHz crystal on MPLAB® Xpress PIC16F18446 is a Kyocera Corporation ST3215SB32768C0HPWBB 7 pF crystal.

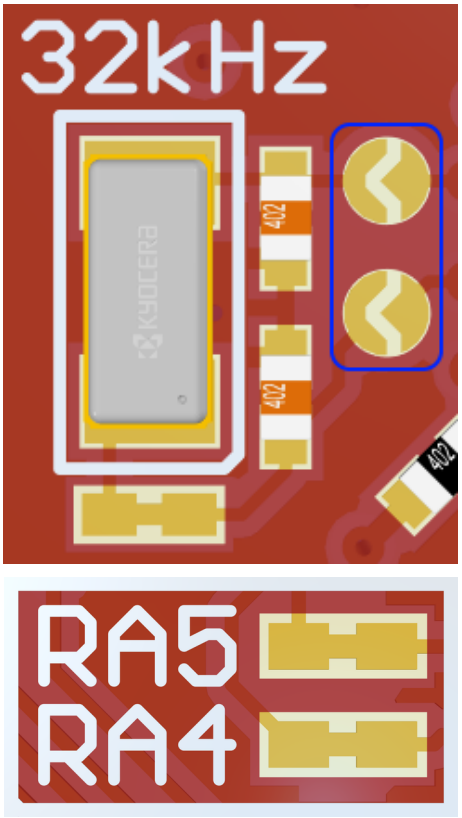
The crystal has been formally tested and matched to the PIC16F18446 by Kyocera. The test report is available in the design documentation distributed with this document for MPLAB® Xpress PIC16F18446.

Info: Kyocera Crystal Device Corporation crystals that are matched with specific products can be found on their website: http://prdct-search.kyocera.co.jp/crystal-ic/?p=en_search/

Table 3-4. Crystal Connections

PIC16F18446 Pin	Description	Shared Functionality
RA4	SOSC0	Edge connector
RA5	SOSCI	Edge connector

Figure 3-3. Crystal Connection and Cut Straps



4. Embedded Debugger Implementation

MPLAB® Xpress PIC16F18446 contains an embedded debugger (nEDBG) that can be used to program the PIC16F18446 using ICSP.

The nEDBG can program the PIC16F18446 with a USB mass storage drive and also include a Virtual COM Port interface over UART.

4.1 ICSP

The In-Circuit Serial Program (ICSP) interface use three pins to communicate with the target.

Info: There is a 10 kΩ pull-up resistor connected to RA3 and there are 47 kΩ pull-down resistors connected to RA0 and RA1.

Table 4-1. ICSP Connections

PIC16F18446 Pin	Function	Shared Functionality
RA0	ICSP DAT	DBG0 nEDBG
RA1	ICSP CLK	DBG1 nEDBG, edge connector
RA3	MCLR	DBG3 nEDBG

4.2 Virtual COM Port

The nEDBG acts as a Virtual COM Port gateway by using one of the PIC16F18446 UARTs.

The Virtual COM Port is connected to a UART on the PIC16F18446 and provides an easy way to communicate with the target application through terminal software. It offers variable baud rate, parity, and stop bit settings. The settings on the PIC16F18446 must match the settings given in the terminal software.

Info: The Virtual COM Port in the nEDBG requires the terminal software to set the Data Terminal Ready (DTR) signal to enable the UART pins. If the DTR signal is not enabled, the UART pins on the nEDBG are kept in tri-state (high-z) to render the COM Port not usable. The DTR signal is automatically set by some terminal software, but it may have to be manually enabled in your terminal.

Table 4-2. Virtual COM Port Connections

PIC16F18446 Pin	Function	Shared Functionality
RB4	UART TXD (PIC16F18446 TX line)	nEDBG CDC RX
RB6	UART RXD (PIC16F18446 RX line)	nEDBG CDC TX

5. Hardware Revision History

This user guide provides the latest available revision of the kit. This chapter contains information about known issues, a revision history of older revisions, and how older revisions differ from the latest revision.

5.1 Identifying Product ID and Revision

The revision and product identifier of MPLAB® Xpress PIC16F18446 can be found in two ways; either through Atmel Studio/Microchip MPLAB X or by scanning sticker on the bottom side of the PCB with a 2D barcode reader.

By connecting a MPLAB® Xpress PIC16F18446 to a computer with Atmel Studio/Microchip MPLAB X running, an information window will pop up. The first six digits of the serial number, which is listed under kit details, contain the product identifier and revision.

The same information can be found on the sticker on the bottom side of the PCB. Most kits will print the identifier and revision in plain text as A09-nnnn\rr, where nnnn is the identifier and rr is the revision. Boards with limited space have a sticker with only a data-matrix barcode, which contains a serial number string.

The serial number string has the following format:

"nnnnrrssssssssss"

n = product identifier

r = revision

s = serial number

The product identifier for MPLAB® Xpress PIC16F18446 is A09-3160.

5.2 Revision 1

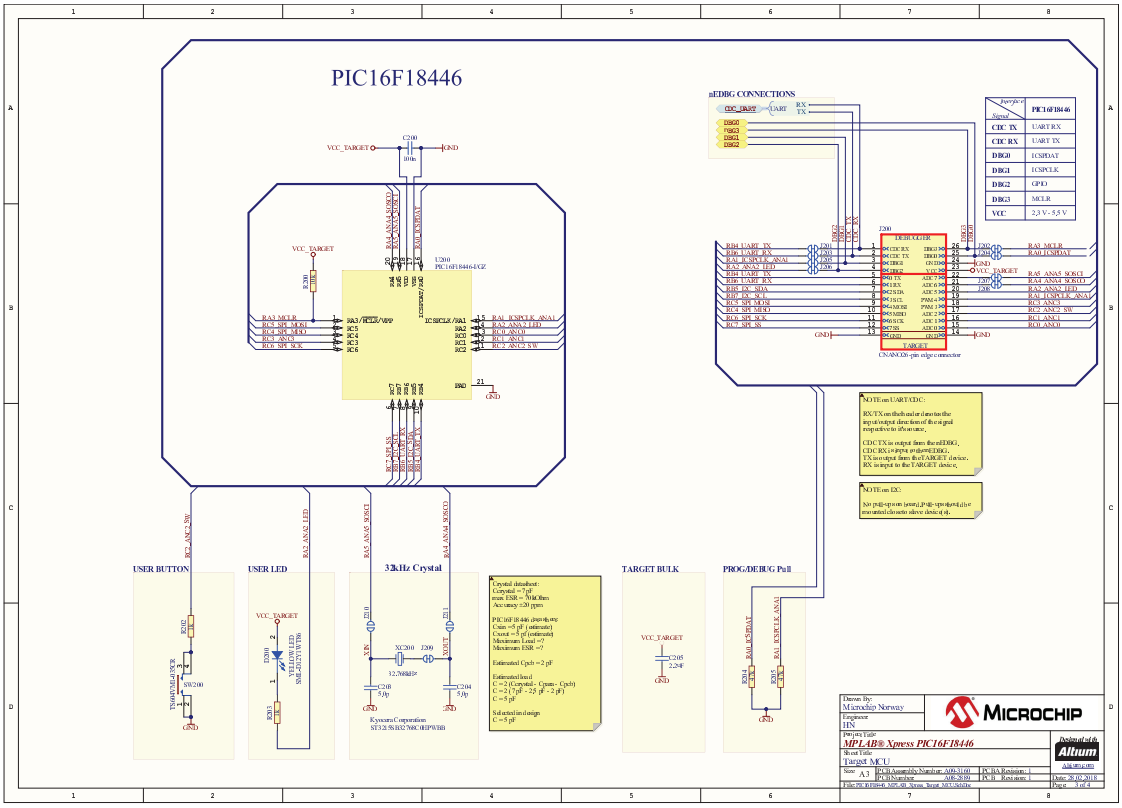
Revision 1 is the initially released revision.

6. Document Revision History

Doc. rev.	Date	Comment
A	03/2018	Initial document release.

7. Appendix

Figure 7-1. MPLAB® Xpress PIC16F18446 Schematics



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