

### ProtoPIC28 Universal 28-pin PICMicro™ Prototype Development Board

#### Features

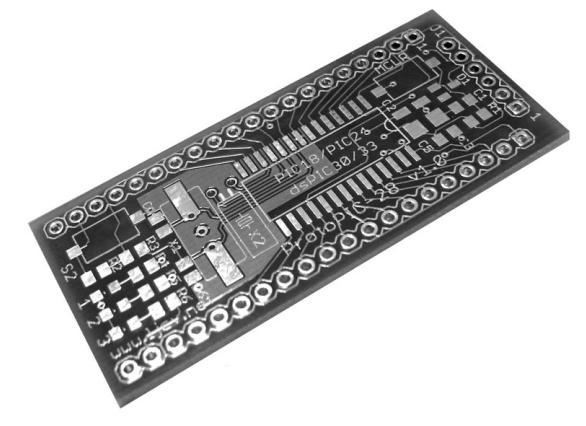
- Microchip PICMicro™ Microcontrollers and Digital Signal Processors Universal quick prototyping development board
- Supports many SOIC 28-pin compatible devices from the PIC16, PIC18, PIC24, dsPIC30 and dsPIC33 families
- Small 1.00" x 2.20" board layout compatible with solderless breadboards
- Flexible main clock source options
- Pads for secondary crystal clock source
- On board Reset (MCLR) push button
- ICSP header pads compatible with Microchip's **PICKit2**
- 3 user LEDs and one push button
- RS-232 transceiver on bottom
- Available as a bare PCB

#### Description

The **ProtoPIC28** is a small (1.00" x 2.20") printed circuit board designed to facilitate quick prototyping with Microchip Technology compatible 28-pin PICMicro™ Microcontrollers and Digital Signal Processors available in standard 7.50mm wide SOIC packages.

The **ProtoPIC28** board layout includes all necessary pads for the minimal required components to get your PICMicro™ based design up and running in few minutes.

The board can also be used as a plug-in module as part of a larger design.



#### Applications

- Remote control and monitoring
- Data capture and logging
- Industrial Automation
- Building Automation
- Robotics
- Microcontroller Research and Development
- Educational
- Electronics Hobbyists

## General Description

The **ProtoPIC28** is a small (1.00" x 2.20") printed circuit board designed for quick prototyping with compatible 28-pin PICMicro™ Microcontrollers and Digital Signal Processors available in standard 7.50mm wide SOIC packages.

The board layout includes surface mount pads for the minimal required components to get your PICMicro™ up and running with different oscillator configurations, provision for a secondary 32.768KHz crystal for Timer and RTCC modules, a RESET push button and an extra pushbutton with pull-up resistor, and three LEDs with limiting resistors.

In addition, on the bottom side, the board can accommodate a 16-pin SOIC CMOS to RS-232 transceiver such as the MAX3232 or equivalent, and its required capacitors.

All 28 pins of the PICMicro™ device are present in the two 20-pin header connectors (J2A and J2B) on the board edges which are also used for connection to the extra pushbutton, LEDs, and input/outputs of the RS-232 transceiver.

Spacing between header pins is standard 0.1", and distance between both headers enable the board to be easily mounted on a regular solderless prototype breadboard.

The pin out of the J1 header on the top edge of the board is compatible with Microchip's **PICKit2** Programmer/Debugger.

Pin	Signal
1	VPP/MCLR
2	VDD
3	VSS
4	PGD
5	PGC
6	N/C

J1 Header

Appendix A and B show a generic schematics, and top and bottom side layouts with component designation and location.

All surface mount resistors, ceramic capacitors and LEDs are standard 0805 (2112 Metric) package size, which still permits putting together the board by hand soldering.

The pushbutton switches layout is based on a 3.5 x 6mm Mountain Switch tactile switch part number TS3724TI600-EV or equivalent.

## Board Configuration

Depending on the particular PICMicro™ device that you are planning to use, there are slight differences for some particular pins between parts.

Also, some devices that run at a lower CORE voltage and that include an internal voltage regulator, require an external small capacitor on the VCAP/VDDCORE pin.

To properly provide power to other components in the board, and to route the appropriate signals to the J1 header if a **PICKit2** (Microchip P/N PG164120) or equivalent will be used, there is a group of solder jumpers on the bottom side of the board that must be properly configured for each particular device family (see Table-1).

There are four groups of solder jumpers (SJ1, SJ2/SJ3, SJ4/SJ5, and SJ6).

The board layout on Appendix B shows the location and position 1 of each of these jumpers (the board does not include a silk screen legend layer for the bottom side).

The SJ1 jumper selects from which pin of the PICMicro™ device we can obtain supply power (VDD).

For some of the supported devices VDD can be obtained from pin 20 (for PIC18F for example) or pin 28 (for PIC24F).

Since this jumper connects VDD to other components and optionally to the RS-232 transceiver, it is always required to configure it in the correct position.

SJ2 and SJ3 jumpers select which pin corresponds to the ICSP Data signal for serial programming of Flash devices using the **PICKit2** or equivalent connected to J1.

All PIC18F devices use pin 28 as PGD, PIC24 and dsPIC33 devices use pin 4 as PGD1 while dsPIC30 uses pin 17.

These two jumpers need to be configured only if you are planning to use a **PICKit2** or if you want to access the ICSP interface via J1.

SJ4 and SJ5 jumpers select which pin corresponds to ICSP Clock signal for serial programming.

All PIC18F devices use pin 27 as PGC, PIC24 and dsPIC33 devices use pin 5 as PGC1 while dsPIC30 uses pin 18.

These two jumpers need to be configured only if you are planning to use a **PICKit2** or if you want to access the ICSP interface via J1.

Finally SJ6 is used to connect a bypass capacitor (C2) for devices that require a low ESR small capacitor (4.7 $\mu$ F-10 $\mu$ F) for its internal regulator.

Notice that devices from the PIC24FJ family include a pin to enable/disable the internal regulator. To enable the internal regulator connect pin 19 of the PIC24FJ (J2B-31) to VSS.

If your device does not require this external capacitor SJ6 can be left open and C2 unpopulated.

The pads for C2 can accommodate a tantalum capacitor with standard 3216 package size.

Table-1 shows the correct jumper settings for each supported PICMicro™ family and associated notes.

Appendix C shows a list of all pin compatible devices for each family and a selection of pin out diagrams extracted from the original Microchip datasheets for each device family group.

## Oscillator Options

It's a common characteristic among many of the PICMicro™ devices to support multiple options for the configuration of the oscillator source for the primary clock.

Many devices include an internal oscillator, in this case no external components are required and the associated pins can be used as additional Input/Output ports.

In case you choose to use the RC option, an external resistor (R3) and a capacitor (C6) are required.

Consult the corresponding datasheet for your particular device for guidelines to determine the proper values for these two components.

For applications that require high clock stability a crystal based oscillator configuration is recommended, in this case you need to populate X1 with the appropriate crystal value (the pads support both surface mount and through hole standard HC49 packages) and corresponding load capacitors (C6 and C7).

Consult the corresponding datasheet for recommended crystal types.

An option for applications that don't require high clock stability is to use a Ceramic Resonator instead of a crystal.

You also have the option to have an external clock source such as a CAN oscillator connected directly to the OSC1 pin.

In this case, besides the external clock source no other components are required on the **ProtoPIC28**.

**Note: Always consult the corresponding datasheet for your particular device**

## Secondary Oscillator

Many PICMicro™ devices also support a secondary oscillator as the clock source for Timer and RTCC modules.

Normally this is accomplished by adding an external 32.768KHz cylinder type crystal (X2) and corresponding load capacitors (C8 and C9 on the bottom side).

If you are not using this option X2, C8 and C9 can be left unpopulated and the associated pins can be used for other functions.

**Note: Always consult the corresponding datasheet for your particular device.**

## RS-232 Transceiver

Even if your application does not use the UART module it becomes very handy to have a serial RS-232 interface to a Personal Computer for debugging/development purposes.

If such is the case, the **ProtoPIC28** board includes the pads for a standard 16-pin SOIC package such as the MAX3232 or equivalent, and the associated capacitors (C4, C10, C11, C12 and C13).

These RS-232 transceivers include two set of Transmit and Receive drivers, all four associated pins are present on the J2 header connectors.

To connect the PICMicro™ UART module pins to the appropriate transceiver pins, an external connection from the PICMicro™ to the appropriate pin via the J2 headers is required.

Figure-1 shows how to connect the RS-232 transceiver pins (only Rx and Tx shown) with a PIC18F and a female DB-9 connector.

## Board Extras

As mentioned before the **ProtoPIC28** board includes some extra components to facilitate prototyping such as three LEDs with limiting resistors and a pushbutton with a 10K pull up resistor to VDD.

The pushbutton and LEDs can be connected to any pin of the PICMicro™ device or any other external components via the J2 headers.

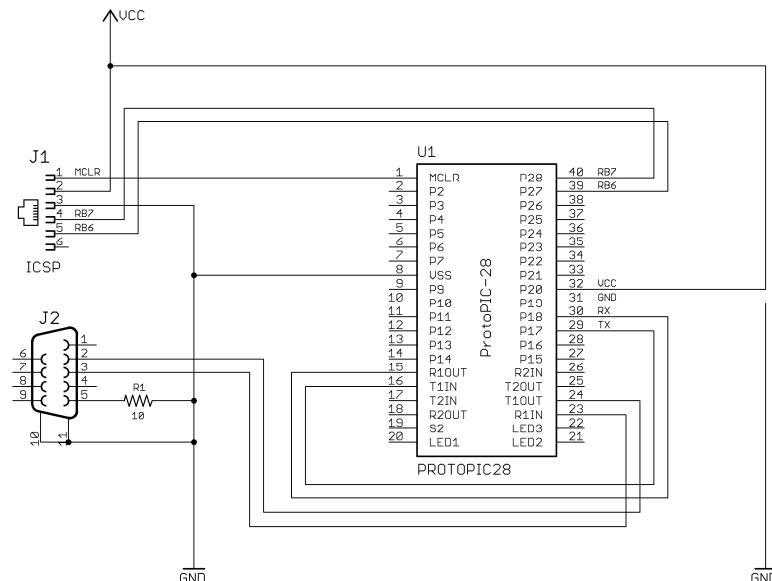


Figure-1

**Table-1 - Solder Jumpers Configuration**

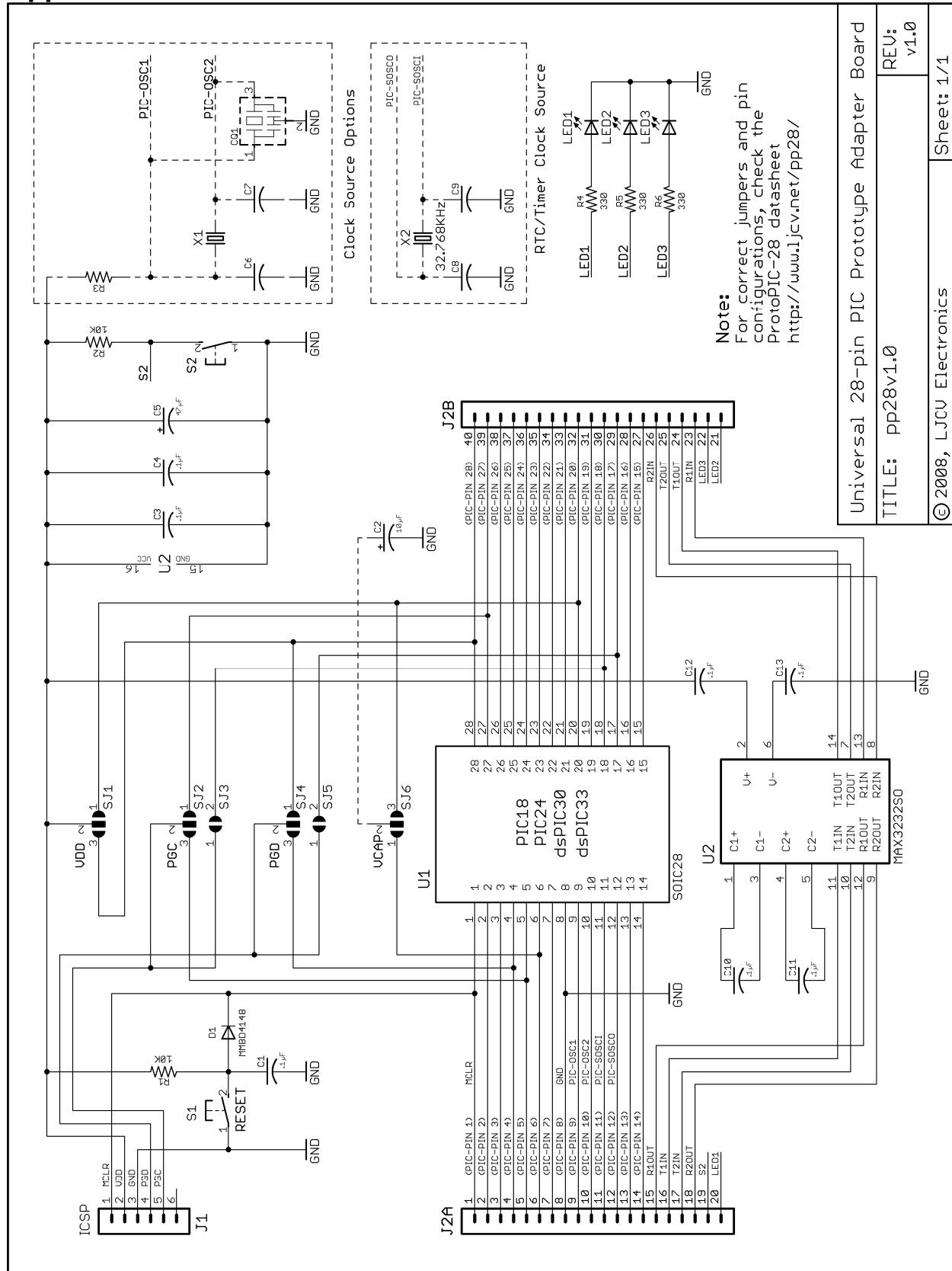
Jumper	PIC16F	PIC18F	PIC24FJ	PIC24HJ	dsPIC30	dsPIC33
SJ1 (VDD)	1-2	1-2	2-3	2-3	2-3	2-3
SJ2 (PGC)	1-2	1-2	2-3	2-3	Open	2-3
SJ3 (PGC)	Open	Open	Open	Open	Close	Open
SJ4 (PGD)	1-2	1-2	2-3	2-3	Open	2-3
SJ5 (PGD)	Open	Open	Open	Open	Close	Open
SJ6 (VCAP)	n/a	Note 1	Note 2	Note 2	n/a	Note 2

Note 1: For PIC18F2XJXX parts connect 1-2 on SJ6 and install VCAP on C2

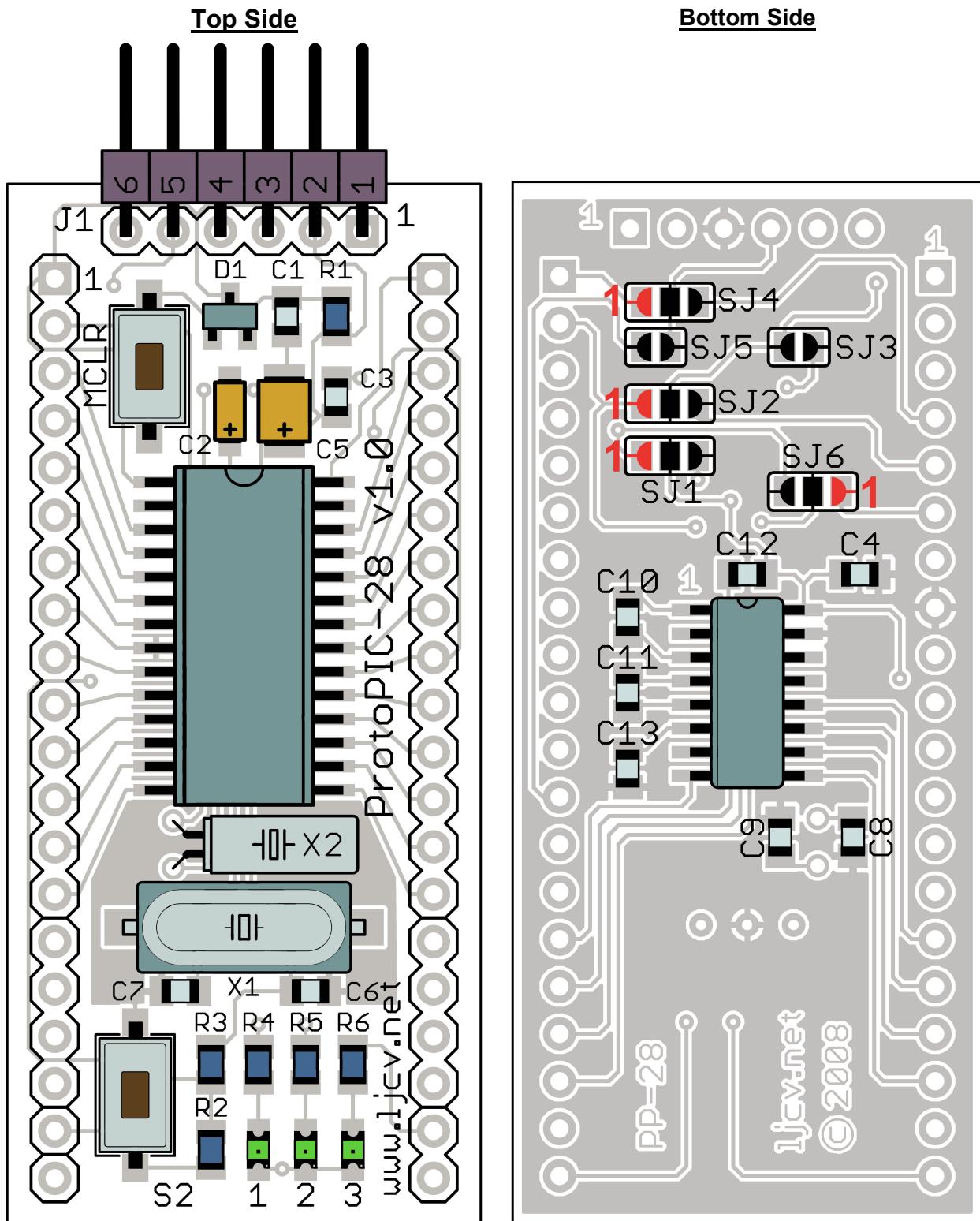
Note 2: Connect 2-3 on SJ6 and install VCAP on C2

**Note: Always consult the corresponding datasheet for your particular device.**

## Appendix A – ProtoPIC 28 Schematics



## Appendix B – ProtoPIC 28 Board Layout and Component Location



## Appendix C – Supported PICMicro™ devices and pin outs

This appendix includes a list of PICMicro™ devices available in SOIC-28 package supported by the ProtoPIC28 board, and a selection of device pin out diagrams extracted from the original Microchip datasheets.

### **PIC16 Family**

PIC16F72, PIC16F73, PIC16F737, PIC16F76, PIC16F767, PIC16F870, PIC16F872 (Obsolete use PIC16F882), PIC16F873A (Obsolete use PIC16F883), PIC16F876A (Obsolete use PIC16F886), PIC16F882, PIC16F883, PIC16F886, PIC16F913.

### **PIC18 Family**

PIC18F2220, PIC18F2221, PIC18F2320, PIC18F2321, PIC18F2331, PIC18F23K20, PIC18F2410, PIC18F2420, PIC18F2423, PIC18F2431, PIC18F2450, PIC18F2455, PIC18F2548, PIC18F2480, PIC18F24J10, PIC18F24J11, PIC18F24J50, PIC18F24K20, PIC18F2510, PIC18F2515, PIC18F2520, PIC18F2523, PIC18F2525, PIC18F2550, PIC18F2553, PIC18F2580, PIC18F2585, PIC18F25J10, PIC18F25J11, PIC18F25J50, PIC18F25K20, PIC18F2610, PIC18F2620, PIC18F2680, PIC18F2682, PIC18F2685, PIC18F26J11, PIC18F26J50, PIC18F26K20.

### **PIC24F Family**

PIC24FJ16GA002, PIC24FJ32GA002, PIC24FJ48GA002, PIC24FJ64GA002.

### **PIC24H Family**

PIC24HJ128GP202, PIC24HJ128GP502, PIC24HJ12GP202, PIC24HJ32GP202, PIC24HJ32GP302, PIC24HJ64GP202, PIC24HJ64GP502.

### **dsPIC30 Family**

dsPIC30F1010, dsPIC30F2010, dsPIC30F2012, dsPIC30F2020, dsPIC3010, dsPIC30F3013, dsPIC30F4012.

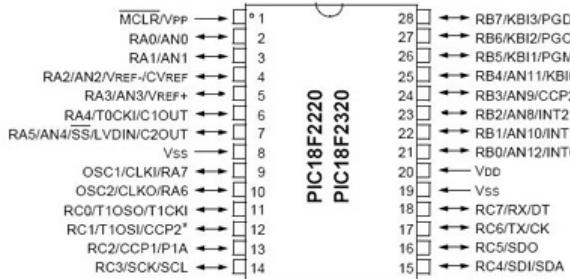
### **dsPIC33 Family**

dsPIC33FJ128GP202, dsPIC33FJ128GP802, dsPIC33FJ128MC202, dsPIC33FJ128MC802, dsPIC33FJ12GP202, dsPIC33FJ12MC202, dsPIC33FJ32GP202, dsPIC33FJ32GP202, dsPIC33FJ32GP302, dsPIC33F32MC202, dsPIC33F32FJMC302, dsPIC33FJ64GP202, dsPIC33FJ64GP802, dsPIC33F64MC202, dsPIC33FJ60MC802.

**Note: Always consult the corresponding datasheet for your particular device.**

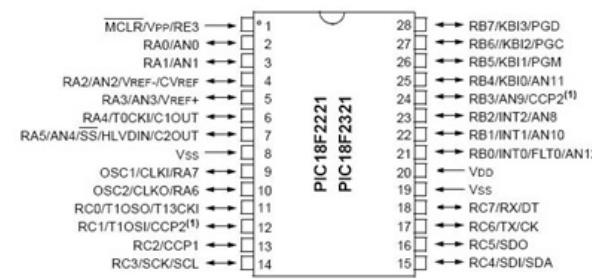
## Appendix C – Supported PICMicro™ devices and pin outs (cont'd)

### PIC18F2220 PIC18F2320



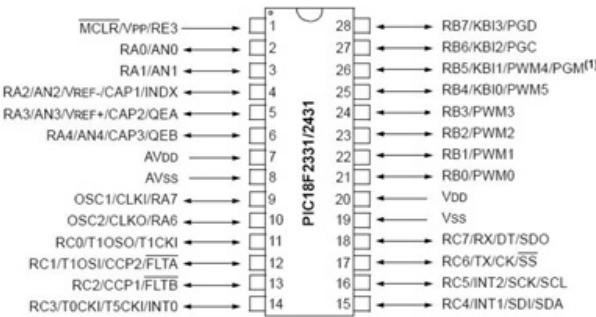
\*RB3 is the alternate pin for the CCP2 pin multiplexing.

### PIC18F2221 PIC18F2321



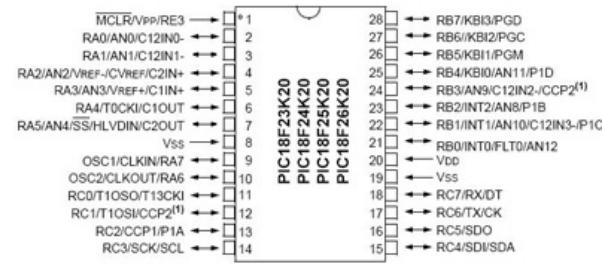
Note 1: RB3 is the alternate pin for the CCP2 pin multiplexing.

### PIC18F2331 PIC18F2431



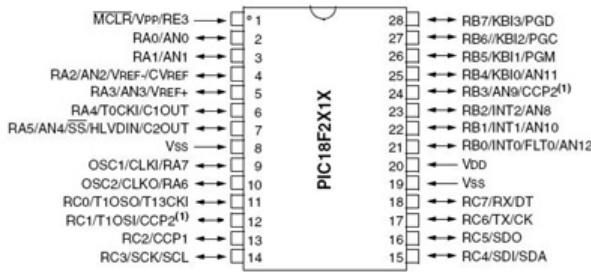
Note 1: Low-Voltage Programming must be enabled

### PIC18F23K20, PIC18F24K20 PIC18F25K20, PIC18F26K20



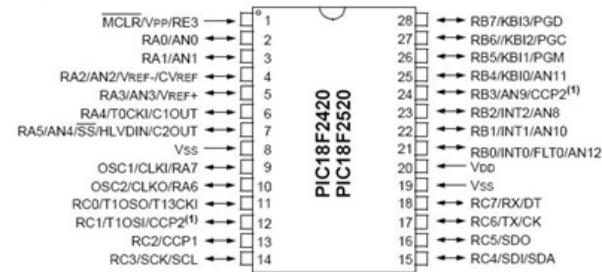
Note 1: RB3 is the alternate pin for the CCP2 pin multiplexing.

### PIC18F2410, PIC18F2510 PIC18F2515, PIC18F2610



Note 1: RB3 is the alternate pin for the CCP2 pin multiplexing.

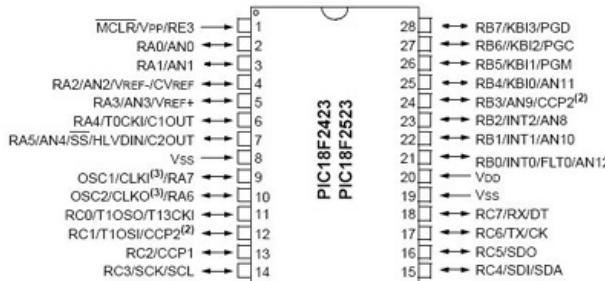
### PIC18F2420 PIC18F2520



Note 1: RB3 is the alternate pin for the CCP2 pin multiplexing.

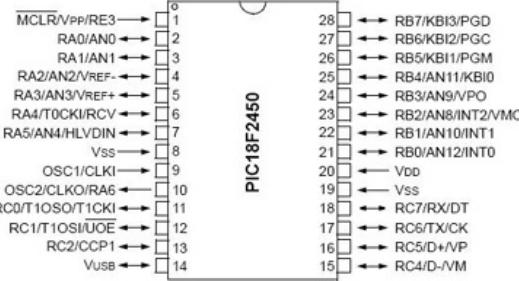
## Appendix C – Supported PICMicro™ devices and pin outs (cont'd)

**PIC18F2423  
PIC18F2523**

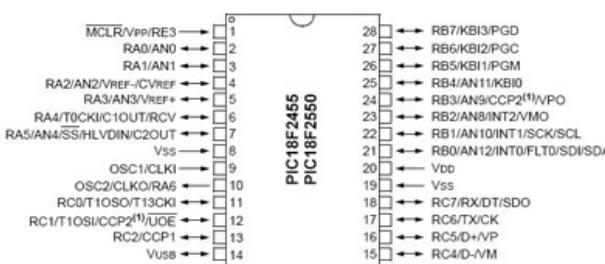


Note 2: RB3 is the alternate pin for the CCP2 pin multiplexing.  
 Note 3: OSC1/CLKI and OSC2/CLKO are only available in selected oscillator modes and when these pins are not being used as digital I/O.

**PIC18F2450**

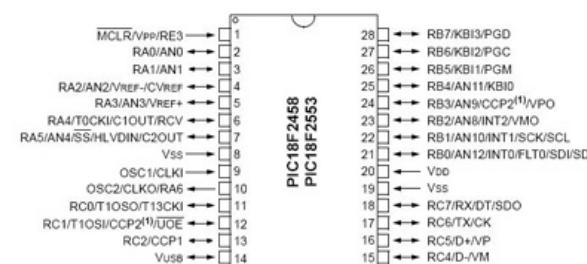


**PIC18F2455  
PIC18F2550**



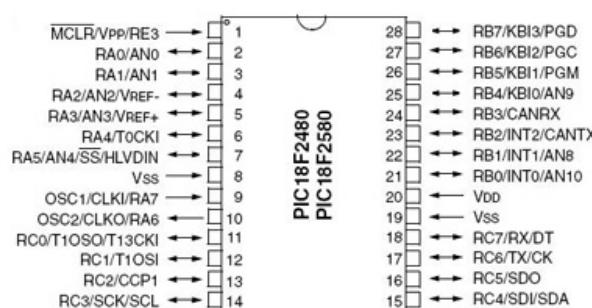
Note 1: RB3 is the alternate pin for the CCP2 pin multiplexing.

**PIC18F2458  
PIC18F2553**

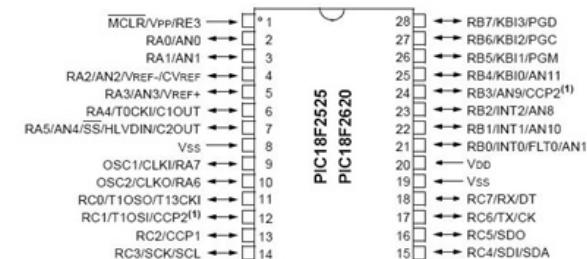


Note 1: RB3 is the alternate pin for the CCP2 pin multiplexing.

**PIC18F2480  
PIC18F2580**

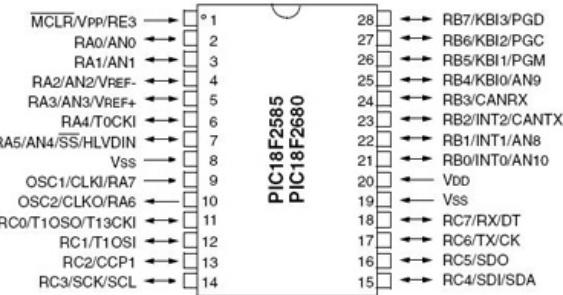
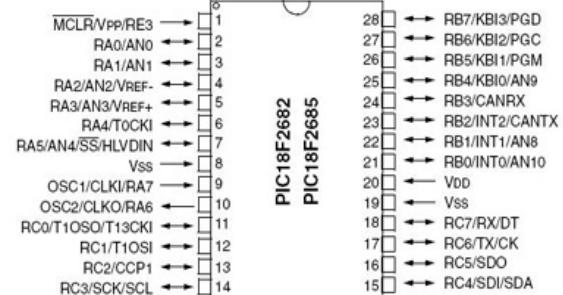
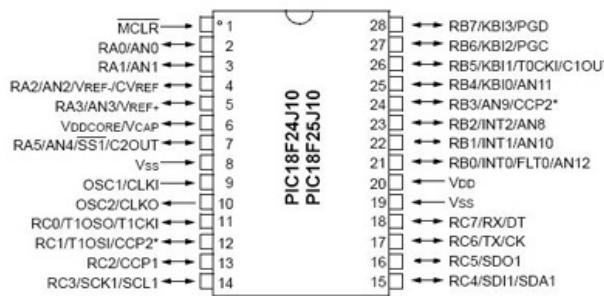
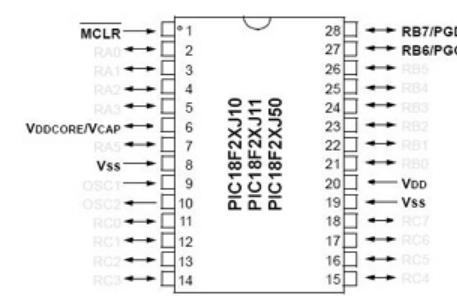


**PIC18F2525  
PIC18F2620**



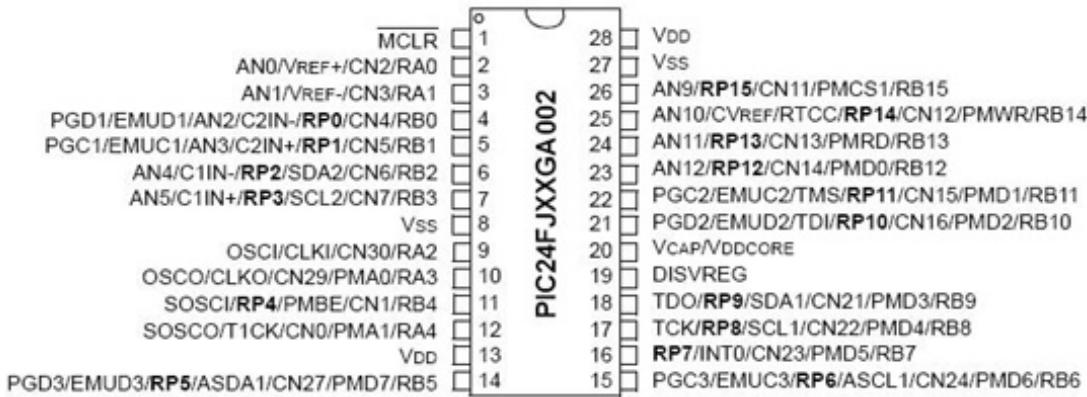
Note 1: RB3 is the alternate pin for the CCP2 pin multiplexing.

## Appendix C – Supported PICMicro™ devices and pin outs (cont'd)

<b>PIC18F2585</b> <b>PIC18F2680</b> 	<b>PIC18F2682</b> <b>PIC18F2685</b> 
<b>PIC18F24J10</b> <b>PIC18F25J10</b>  <p>Pin feature is dependent on device configuration</p>	<b>PIC18F2XJ10, PIC18F2XJ11</b> <b>PIC18F2XJ50</b> 

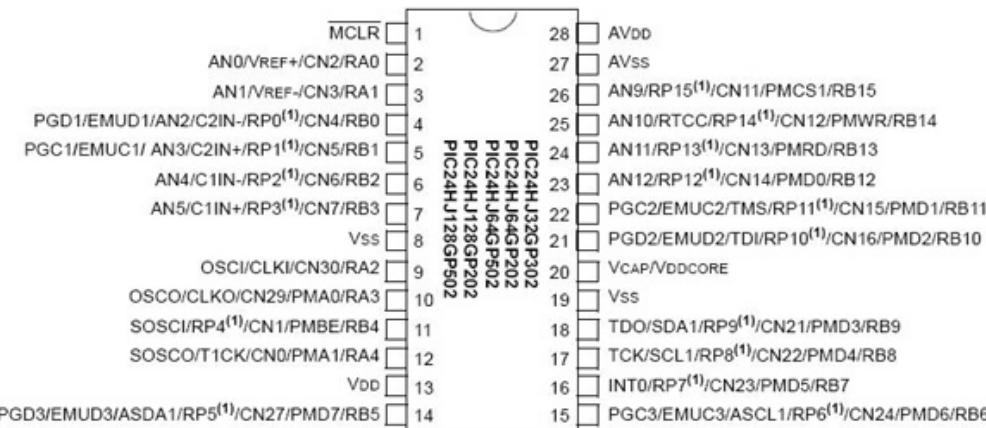
## Appendix C – Supported PICMicro™ devices and pin outs (cont'd)

### PIC24FJXXGA002



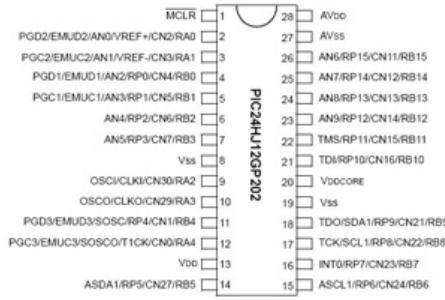
Legend: RPn represents remappable peripheral pins

### PIC24HJ32GP202, PIC24HJ64GP202, PIC24HJ64GP502 PIC24HJ128GP202, PIC24HJ128GP502

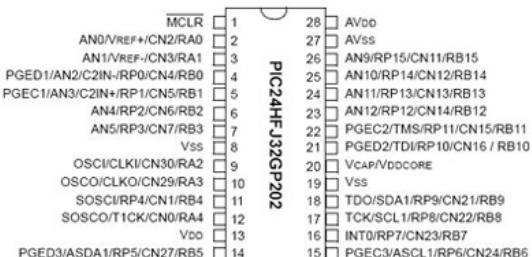


Note 1: The RPx pins can be used by any remappable peripheral

### PIC24HJ12GP202



### PIC24HJ32GP202



## Appendix C – Supported PICMicro™ devices and pin outs (cont'd)

### dsPIC30F1010

	MCLR	1	28	AVDD
	AN0/CMP1A/CN2/RB0	2	27	AVss
	AN1/CMP1B/CN3/RB1	3	26	PWM1L/RE0
	AN2/CMP1C/CMP2A/CN4/RB2	4	25	PWM1H/RE1
	AN3/CMP1D/CMP2B/CN5/RB3	5	24	PWM2L/RE2
	AN4/CMP2C/CN6/RB4	6	23	PWM2H/RE3
	AN5/CMP2D/CN7/RB5	7	22	RE4
	Vss	8	21	RE5
	OSC1/CLKI/RB6	9	20	Vdd
	OSC2/CLKO/RB7	10	19	Vss
PGD1/EMUD1/T2CK/U1ATX/CN1/RE7		11	18	PGC/EMUC/SDI1/SDA/U1RX/RF7
PGC1/EMUC1/EXTREF/T1CK/U1ARX/CN0/RE6		12	17	PGD/EMUD/SDO1/SCL/U1TX/RF8
Vdd		13	16	SFLT2/INT0/OCFLTA/RA9
PGD2/EMUD2/SCK1/SFLT3/INT2/RF6		14	15	PGC2/EMUC2/OC1/SFLT1/INT1/RD0

### dsPIC30F2010

	MCLR	1	28	AVDD
	EMUD3/AN0/VREF+/CN2/RB0	2	27	AVss
	EMUC3/AN1/VREF-/CN3/RB1	3	26	PWM1L/RE0
	AN2/SS1/CN4/RB2	4	25	PWM1H/RE1
	AN3/INDX/CN5/RB3	5	24	PWM2L/RE2
	AN4/QEA/IC7/CN6/RB4	6	23	PWM2H/RE3
	AN5/QEB/IC8/CN7/RB5	7	22	PWM3L/RE4
	Vss	8	21	PWM3H/RE5
	OSC1/CLKI	9	20	Vdd
	OSC2/CLKO/RC15	10	19	Vss
EMUD1/SOSCI/T2CK/U1ATX/CN1/RC13		11	18	PGC/EMUC/U1RX/SDI1/SDA/RF2
EMUC1/SOSCO/T1CK/U1ARX/CN0/RC14		12	17	PGD/EMUD/U1TX/SDO1/SCL/RF3
Vdd		13	16	FLTA/INT0/SCK1/OCFA/RE8
EMUD2/OC2/IC2/INT2/RD1		14	15	EMUC2/OC1/IC1/INT1/RD0

### dsPIC30F2012

	MCLR	1	28	AVDD
	EMUD3/AN0/VREF+/CN2/RB0	2	27	AVss
	EMUC3/AN1/VREF-/CN3/RB1	3	26	AN6/OCFA/RB6
	AN2/SS1/LVDIN/CN4/RB2	4	25	EMUD2/AN7/RB7
	AN3/CN5/RB3	5	24	AN8/OC1/RB8
	AN4/CN6/RB4	6	23	AN9/OC2/RB9
	AN5/CN7/RB5	7	22	CN17/RF4
	Vss	8	21	CN18/RF5
	OSC1/CLKI	9	20	Vdd
	OSC2/CLKO/RC15	10	19	Vss
EMUD1/SOSCI/T2CK/U1ATX/CN1/RC13		11	18	PGC/EMUC/U1RX/SDI1/SDA/RF2
EMUC1/SOSCO/T1CK/U1ARX/CN0/RC14		12	17	PGD/EMUD/U1TX/SDO1/SCL/RF3
Vdd		13	16	SCK1/INT0/RF6
IC2/INT2/RD9		14	15	EMUC2/IC1/INT1/RD8

## Appendix C – Supported PICMicro™ devices and pin outs (cont'd)

### dsPIC30F2020

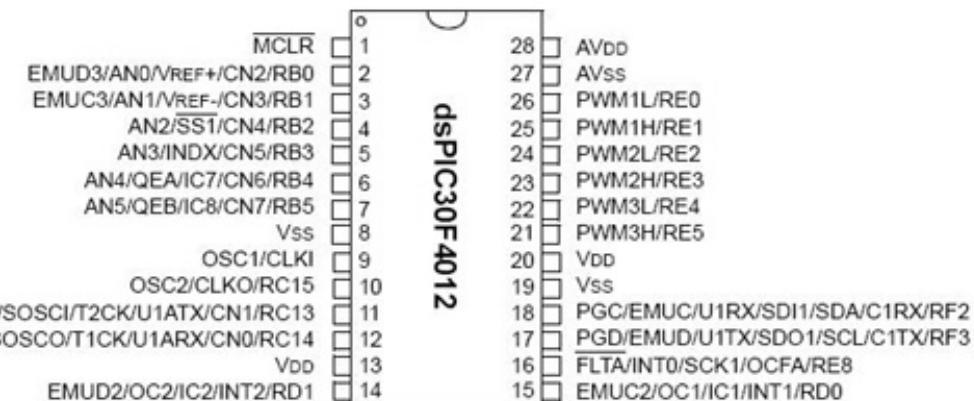
MCLR	1	28	AVdd
AN0/CMP1A/CN2/RB0	2	27	AVss
AN1/CMP1B/CN3/RB1	3	26	PWM1L/RE0
AN2/CMP1C/CMP2A/CN4/RB2	4	25	PWM1H/RE1
AN3/CMP1D/CMP2B/CN5/RB3	5	24	PWM2L/RE2
AN4/CMP2C/CMP3A/CN6/RB4	6	23	PWM2H/RE3
AN5/CMP2D/CMP3B/CN7/RB5	7	22	PWM3L/RE4
Vss	8	21	PWM3H/RE5
AN6/CMP3C/CMP4A/OSC1/CLKI/RB6	9	20	Vdd
AN7/CMP3D/CMP4B/OSC2/CLKO/RB7	10	19	Vss
PGD1/EMUD1/PWM4H/T2CK/U1ATX/CN1/RE7	11	18	PGC/EMUC/SDI1/SDA/U1RX/RF7
PGC1/EMUC1/EXTREF/PWM4L/T1CK/U1ARX/CN0/RE6	12	17	PGD/EMUD/SDO1/SCL/U1TX/RF8
Vdd	13	16	SFLT2/INT0/OCFLTA/RA9
PGD2/EMUD2/SCK1/SFLT3/OC2/INT2/RF6	14	15	PGC2/EMUC2/OC1/SFLT1/IC1/INT1/RD0

### dsPIC30F3010

MCLR	1	28	AVdd
EMUD3/AN0/VREF+/CN2/RB0	2	27	AVss
EMUC3/AN1/VREF-/CN3/RB1	3	26	PWM1L/RE0
AN2/SS1/CN4/RB2	4	25	PWM1H/RE1
AN3/INDX/CN5/RB3	5	24	PWM2L/RE2
AN4/QEA/IC7/CN6/RB4	6	23	PWM2H/RE3
AN5/QEB/IC8/CN7/RB5	7	22	PWM3L/RE4
Vss	8	21	PWM3H/RE5
OSC1/CLKI	9	20	Vdd
OSC2/CLKO/RC15	10	19	Vss
EMUD1/SOSCI/T2CK/U1ATX/CN1/RC13	11	18	PGC/EMUC/U1RX/SDI1/SDA/RF2
EMUC1/SOSCO/T1CK/U1ARX/CN0/RC14	12	17	PGD/EMUD/U1TX/SDO1/SCL/RF3
Vdd	13	16	FLTA/INT0/SCK1/OCFA/RE8
EMUD2/OC2/IC2/INT2/RD1	14	15	EMUC2/OC1/IC1/INT1/RD0

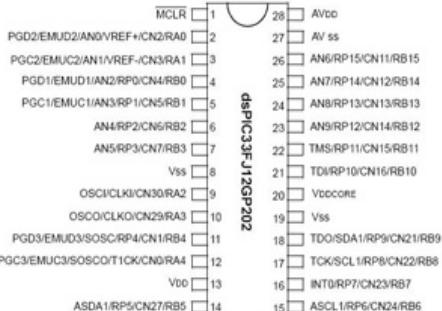
### dsPIC30F3013

MCLR	1	28	AVdd
EMUD3/AN0/VREF+/CN2/RB0	2	27	AVss
EMUC3/AN1/VREF-/CN3/RB1	3	26	AN6/OCFA/RB6
AN2/SS1/LVDIN/CN4/RB2	4	25	EMUD2/AN7/RB7
AN3/CN5/RB3	5	24	AN8/OC1/RB8
AN4/CN6/RB4	6	23	AN9/OC2/RB9
AN5/CN7/RB5	7	22	U2RX/CN17/RF4
Vss	8	21	U2TX/CN18/RF5
OSC1/CLKI	9	20	Vdd
OSC2/CLKO/RC15	10	19	Vss
EMUD1/SOSCI/T2CK/U1ATX/CN1/RC13	11	18	PGC/EMUC/U1RX/SDI1/SDA/RF2
EMUC1/SOSCO/T1CK/U1ARX/CN0/RC14	12	17	PGD/EMUD/U1TX/SDO1/SCL/RF3
Vdd	13	16	SCK1/INT0/RF6
IC2/INT2/RD9	14	15	EMUC2/IC1/INT1/RD8

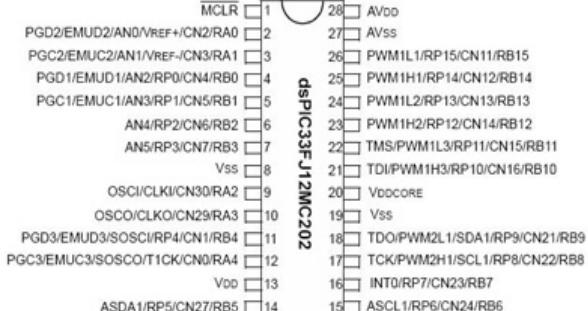
**Appendix C – Supported PICMicro™ devices and pin outs (cont'd)****dsPIC30F4012**

## Appendix C – Supported PICMicro™ devices and pin outs e (cont'd)

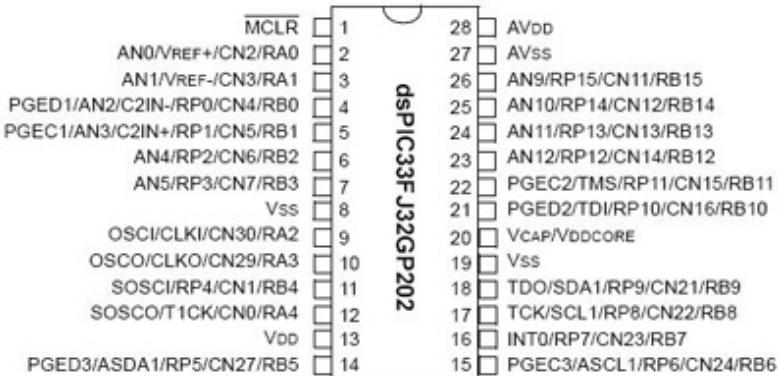
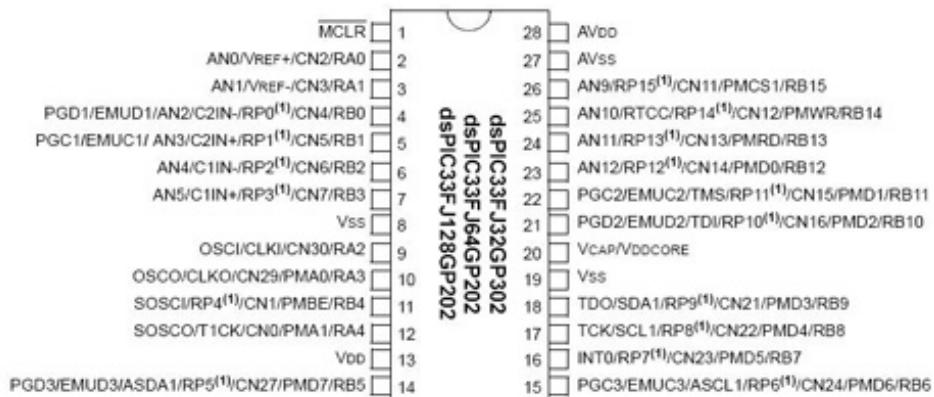
dsPIC33FJ12GP202



dsPIC33FJ12MC202



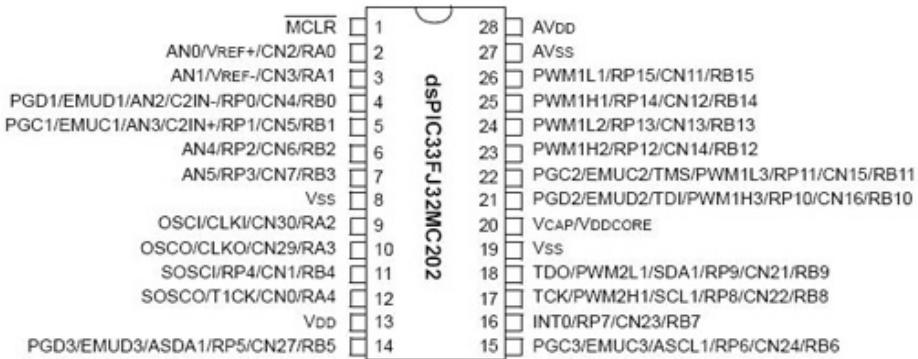
dsPIC33FJ32GP202

dsPIC33FJ32GP202, dsPIC33FJ64202  
dsPIC33FJ128GP202

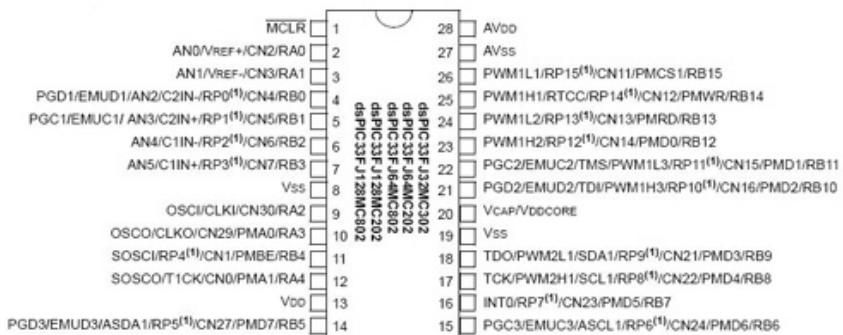
Note 1: The Rx pins can be used by any remappable peripheral.

## Appendix C – Supported PICMicro™ devices and pin outs (cont'd)

### dsPIC33FJ32MC202

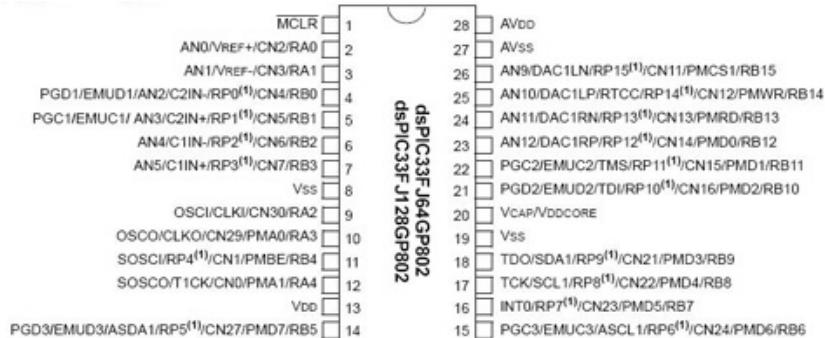


### dsPIC33FJ32MC302, dsPIC33FJ64MC202, dsPIC33FJ64MC802 dsPIC33FJ128MC202, dsPIC32FJ128MC802



Note 1: The Rx pins can be used by any remappable peripheral.

### dsPIC33FJ64GP202 dsPIC33FJ128GP802



Note 1: The Rx pins can be used by any remappable peripheral.

## **Revision History:**

July 2008, Original data sheet document for **ProtoPIC28**.

## **Notes:**

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