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chipKIT™ Max32™ Board Reference Manual

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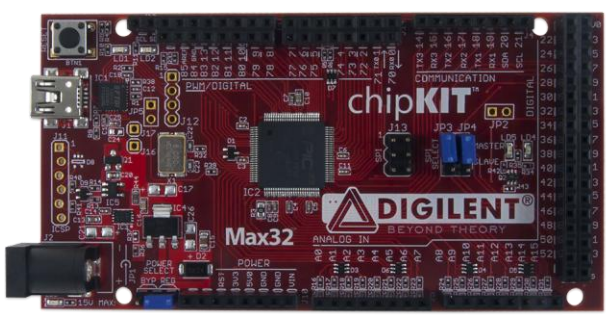
This manual applies to the chipKIT Max32 rev. E

Overview

The chipKIT Max32 is a microcontroller board based on the Microchip PIC32MX795F512L, a member of the 32-bit PIC32 microcontroller family. The Max32 is the same form factor as the Arduino™ Mega board and is compatible with many Arduino shields as well as larger shields for use with the Mega boards. The Max32 is easy to use and suitable for both beginners and advanced users experimenting with electronics and embedded control systems. It features a USB serial port interface for connection to the IDE and can be powered via USB or an external power supply.



The chipKIT Max32 board.

Features include:

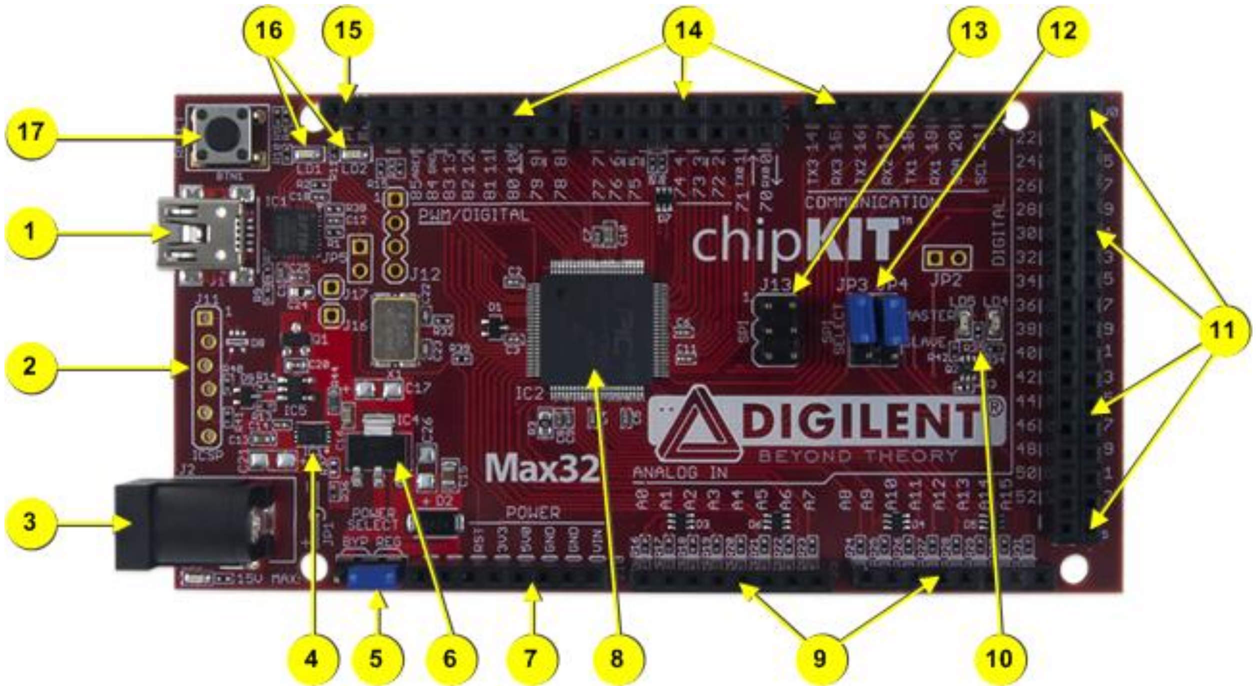
- A Microchip® PIC32MX795F512L microcontroller (80 MHz, 512K Flash, 128K RAM)
- 3.3V operating voltage
- 90mA typical operating current
- 7V to 15V input voltage (recommended)
- 20V input voltage (maximum)
- 83 available I/O pins
- 16 analog inputs
- 0V to 3.3V analog input voltage range
- +/-18mA DC current per pin
- a 10/100 Ethernet MAC
- a USB 2.0 full-speed OTG controller
- 2 CAN controllers

The Max32 can be programmed using the Multi-Platform Integrated Development Environment (MPIDE), an environment based on the original Arduino IDE and modified to support PIC32. It contains everything needed to start developing embedded applications. The Max32 has 83 I/O pins that support a number of peripheral functions, such as UART, SPI, I^2C ports, and pulse width modulated outputs. Sixteen of the I/O pins can be used as analog inputs or as digital inputs and outputs.

The PIC32 microcontroller on the Max32 also provides a 10/100 Ethernet MAC, USB 2.0 full-speed OTG controller, and two CAN controllers. An add-on board like the chipKIT Network Shield™ is needed to use these advanced peripherals. The Max32 can be powered via USB, an external AC-DC power adapter, or batteries.

1 chipKIT Max32 Hardware Overview

The Max32 board has the following hardware features:



1. **USB Connector for USB Serial Converter**

   This connects to a USB port on the PC to provide the communications port for the MPIDE to talk to the Max32 board. This can also be used to power the Max32 board when connected to the PC.

2. **J11: Microchip Debug Tool Connector**

   This connector is used to connect Microchip programmer/debugger tools, such as the PICkit™ 3, for in-circuit serial programming (ICSP). This allows the Max32 board to be used as a traditional microcontroller development board using the Microchip MPLAB® IDE.

3. **J2: External Power Connector**

   This is used to power the Max32 board from an external power supply. This is a 5.5mm x 2.1mm barrel connector. It is wired with the center terminal as the positive supply voltage. The power supply voltage must be in the range of 7V to 15V.

4. **Power Supply – 3.3V Regulator**

   Voltage regulator for the 3.3V power supply. This power supply can provide up to 500mA of current.

5. **JP1: Power Select Jumper**

   This jumper is used to route power from the external power connector through the on-board 5V voltage regulator or to bypass the 5V regulator. The REG position routes power through the 5V regulator. The BYP position bypasses the on-board 5V regulator. With this jumper in the BYP position, the maximum input voltage that can be applied at the external power connector is 6V.

6. Power Supply – 5V Regulator

This on-board 5V voltage regulator regulates the input voltage applied at the external power connector to 5V. This is used to power the 3.3V regulator and to provide 5V power to expansion shields. This regulator can provide up to 800mA of current.

7. J2: Shield Power Connector

This connector provides power to I/O expansion shields connected to the board.

8. PIC32 Microcontroller

The PIC32MX795F512L microcontroller is the main processor for the board.

9. J5, J7: Analog Signal Connectors

These connectors provides access to analog/digital I/O pins on the microcontroller.

10. User LED

LED connected to digital signal pin 13.

11. J6, J8, J9, J15: Digital Signal and Power Connectors

These are shown as four connectors in the Max32 schematic. There is a single connector loaded across all four when the board is assembled. These provide 5V power, ground, and access to digital I/O pins on the microcontroller to shields connected to the board.

12. JP3 & JP4: SPI Master/Slave Select Jumpers

These jumpers are used to switch the SPI signals for use of the Max32 board as an SPI master device or as an SPI slave device. Both jumpers should be switched together. Place the shorting blocks in the MASTER position for master operation and in the SLAVE position for slave operation. Normally, these jumpers are in the MASTER position.

13. J13: SPI Signal Connector

This connector provides alternative access to the SPI signals. This is used by some shields for access to the SPI bus.

14. J3, J4, J14: Digital Signal Connectors

These connectors provides access to digital I/O pins on the microcontroller.

15. J18 - I^{2}C

Dedicated I^{2}C signals. These signals are connected directly to I^{2}C1 on the microcontroller and are shared with pins 20 and 21 on connector J4.

16. Communications Status LEDs

These LEDs indicate activity on the USB serial interface.

17. Reset Button

This button can be used to reset the microcontroller, restarting operation from the boot loader.

2 chipKIT Max32 Jumper Settings

The chipKIT development platforms use a Microchip PIC32 microcontroller. These are 32-bit products that bring unprecedented features to the Arduino community. In order to maintain compatibility with existing hardware and software, additional jumpers and row headers are provided. This document describes the functionality of the jumpers listed in Fig. 2 below.

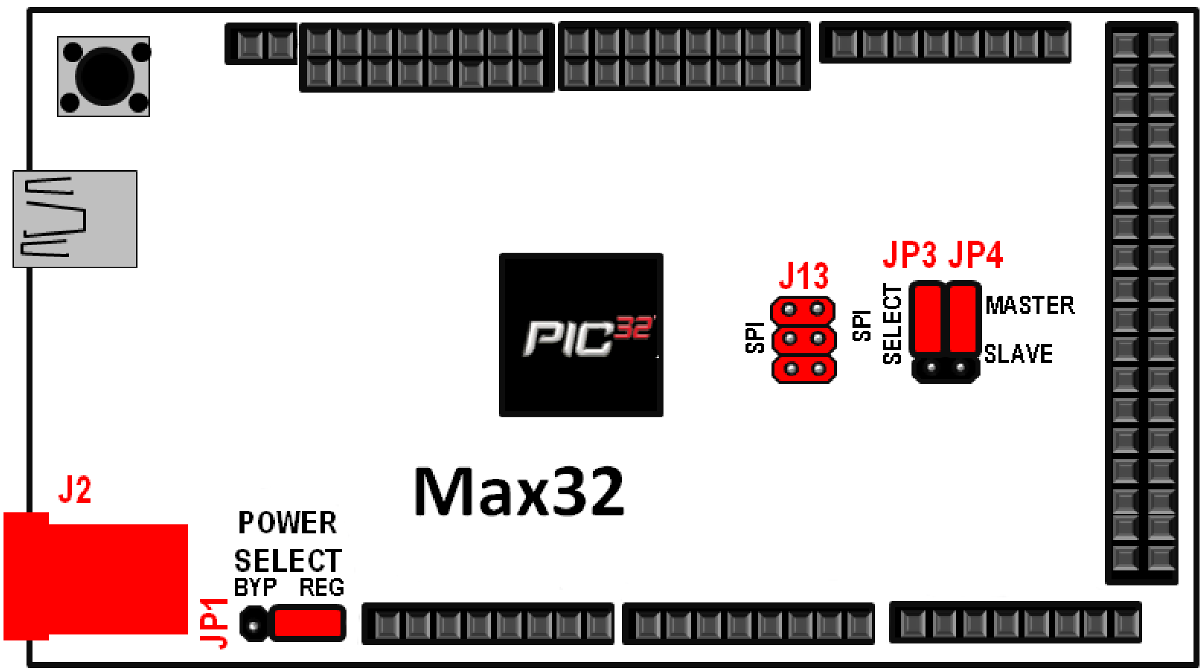
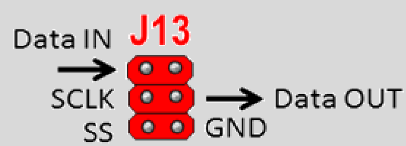
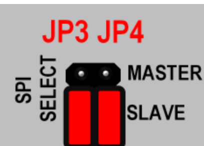
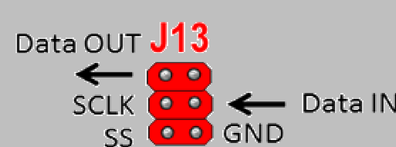


Figure 2. chipKIT Max32 Jumpers.

<table>
<tr><th>Jumper</th><th colspan="2">Function</th></tr>
<tr><td rowspan="3">JP1</td><td colspan="2">POWER SELECT: Used to connect/bypass the on-board 5V regulator when using a power supply connected to J2.</td></tr>
<tr><td>
J4 supply is regulated (i.e., 5V will be present on 5V pin).</td><td>
J4 supply bypasses regulator (i.e., Supply voltage will be present on 5V pin)</td></tr>
<tr><td colspan="2">Note: To protect the PIC32 MCU, a 3.3V on-board regulator will always be enabled regardless of JP2 settings.

Note: If you're not sure what POWER SELECT does, be safe and keep JP1 on the two right-most pins so the J2 supply is regulated.</td></tr>
<tr><td rowspan="3">JP3/JP4</td><td colspan="2">SPI SELECT: Used to configure the chipKIT as either a Master or Slave when using the SPI. The chipKIT board can be connected to another device or even another chipKIT through the SPI connector (J13).</td></tr>
<tr><td>
chipKIT configured as an SPI Master</td><td></td></tr>
<tr><td>
chipKIT configured as an SPI Slave</td><td></td></tr>
</table>

3 chipKIT Max32 Hardware Description

3.1 MPIDE and USB Serial Communication

The Max32 board is designed to be used with the Multi-Platform IDE (MPIDE). MPIDE is a modified version of the Arduino IDE that supports the PIC32 microprocessors and is fully backwards-compatible with the Arduino IDE. The MPIDE uses a serial communications port to communicate with a boot loader running on the Max32 board. The serial port on the Max32 board is implemented using an FTDI FT232R USB serial converter. Before attempting to use the MPIDE to communicate with the Max32, the appropriate USB device driver must be installed.

The Max32 board uses a standard mini-USB connector for connection to a USB port on the PC. When the MPIDE needs to communicate with the Max32 board, the board is reset and starts running the boot loader. The MPIDE then establishes communications with the boot loader and downloads the program to the board.

When the MPIDE opens the serial communications connection on the PC, the DTR pin on the FT232R chip is driven low. This pin is coupled through a capacitor to the MCLR pin on the PIC32 microcontroller. Driving the MCLR line low resets the microcontroller, restarting execution with the boot loader.

This automatic reset action (when the serial communications connection is opened) can be disabled. To disable this operation, there is a cuttable trace on the bottom of the board between the pins on JP5. JP5 is normally not loaded. If the trace between the pins on JP5 has been cut, the automatic reset operation can be restored by loading JP5 and inserting a shorting block across it.

Two red LEDs (LD1 and LD2) will blink when data is being sent or received between the Max32 and the PC over the serial connection.

The header connector J12 provides access to the other serial handshaking signals provided by the FT232R. Connector J12 is not loaded at the factory and can be loaded by the user to access these signals.

3.2 Power Supply

The Max32 is designed to be powered either via USB or from an external power supply. There is an automatic switchover circuit that causes the external supply to be used if both supplies are present.

The power supply section in the Max32 uses two voltage regulators. The first regulates the external voltage to 5V to power the VCC5V0 bus. The second regulates the VCC5V0 bus to 3.3V to provide power to the VCC3V3 bus that powers the PIC32 microcontroller.

The 5V voltage regulator is normally an NCP1117. The board is designed to be able to also use an LM1117, but the NCP1117 is the part normally used. The NCP1117 is rated for an output current of 1A (the LM1117 is rated for 800mA). The dropout voltage of the NCP1117 is a maximum of 1.2V at the rated output current (1.3V for the LM1117).

There is a reverse-polarity protection diode in the external power supply circuit. Considering the diode drop plus the forward drop across the regulator, the minimum input voltage to the regulator should be 7V to produce a reliable 5V output. The absolute maximum input voltage of both the NCP1117 and the LM1117 is 20V. The recommended maximum operating voltage is 15V.

For input voltages above 9V, the regulator will get extremely hot when drawing high currents. Both the NCP1117 and the LM1117 have output short circuit protection and internal thermal protection and will shut down automatically to prevent damage.

The 3.3V regulator is a Microchip MCP1725. This regulator is rated for a maximum output current of 500mA. The absolute maximum input voltage for the MCP1725 is 6V. This regulator has internal short circuit protection and thermal protection. It will get noticeably warm when the current consumed by the VCC3V3 bus is close to the 500mA maximum.

The 5V power bus VCC5V0 can be powered from one of three sources:

- The USB5V0 bus when the board is operating under USB power
- The output of the on-board 5V regulator when operating from an external 7V – 15V supply
- Directly from the external supply when operating from a regulated 5V external supply with jumper JP1 in the BYP position.

Switch-over from USB power to external power is done automatically and the external supply will be used if both are present.

Jumper JP1 is used to route the external power supply voltage through the on-board 5V regulator or directly to the VCC5V0 bus, bypassing the on-board 5V regulator. Normally, JP1 is in the REG position. This routes the external supply through the 5V regulator. Operation from an externally regulated 5V supply is provided by placing the jumper in the BYP position.

The forward drop across the MCP1725 is typically 210mV (350mV max) at 500mA output. With JP1 in the BYP position, this will allow correct operation of the 3.3V power supply from an input voltage down to 3.5V. This lets you power the board from batteries and other lower voltage power sources. In that case, the VCC5V0 power bus will not be powered at 5V.

Note: When JP2 is in the BYP position, do not apply more than 6V to the external power input. It can destroy the 3.3V regulator and possibly the PIC32 microcontroller as well.

The PIC32 microcontroller is rated to use a maximum of 98mA of current when operating at 80 MHz. This allows up to ~400mA from the VCC3V3 bus and up to 700mA from the VCC5V0 bus to power external devices.

The POWER connector J10 is used to provide power to shields connected to the Max32 board. The following pins are provided on this connector:

NC (pin 1): This pin is not used.

IOREF (pin 2): Provides a 3.3V reference voltage to the shield which the shield should observe as the maximum input pin voltage to the Max32.

P32_MCLR (pin 3): This connects to the MCLR pin on the PIC32 microcontroller and can be used to reset the PIC32.

VCC3V3 (pin 4): This routes the 3.3V power bus to shields. This pin can provide ~400mA.

VCC5V0 (pin 5): This routes the 5V power bus to shields. This pin can provide up to ~700mA to shields, however the total provided by pins 2 and 3 shouldn't exceed 800mA.

GND (pin 6, 7): This provides a common ground connection between the Max32 and the shields.

VIN (pin 8): This connects to the voltage provided at the external power supply connector. This can be used to provide unregulated input power to the shield. It can also be used to power the Max32 board from the shield instead of from the external power connector.

3. 3 5V Compatibility

The PIC32 microcontroller operates at 3.3V. The original Arduino boards operate at 5V, as do many Arduino shields.

There are two issues to consider when dealing with 5V compatibility for 3.3V logic. The first is protection of 3.3V inputs from damage caused by 5V signals. The second is whether the 3.3V output is high enough to be recognized as a logic high value by a 5V input.

The digital I/O pins on the PIC32 microcontroller are 5V tolerant. The analog capable I/O pins are not 5V tolerant. To provide 5V tolerance on those pins, the Max32 contains clamp diodes and current-limiting resistors to protect them from 5V input voltages.

The fact that all I/O pins are 5V tolerant means that it is safe to apply 5V logic levels to any pins on the board without risk of damaging the PIC32 microcontroller.

The minimum output high voltage of the PIC32 microcontroller is rated at 2.4V when sourcing 12mA of current. When driving a high impedance input (typical of CMOS logic) the output high voltage will be close to 3.3V. Some 5V devices will recognize this voltage as a logic high input, and some won't. Many 5V logic devices will work reliably with 3.3V inputs.

3. 4 Input/Output Connections

The Max32 board provides 83 of the I/O pins from the PIC32 microcontroller to pins on the input/output connectors J3, J4, J5, J7, J8, J9, and J14.

The PIC32 microcontroller can source or sink a maximum of 18mA on all digital I/O pins. However, to keep the output voltage within the specified voltage range (V_{OL} 0.4V, V_{OH} 2.4V), the pin current must be restricted to +7/-12mA. The maximum current that can be sourced or sunk across all I/O pins simultaneously is +/-200mA. The maximum voltage that can be applied to any I/O pin is 5.5V. For more detailed specifications, refer to the PIC32MX5XX/6XX/7XX data sheet available from www.microchip.com.

Connectors J3, J8, J9, and J14 are 2x8 female pin header connectors that provide digital I/O signals. Connector J4 is a 1x8 female pin header that provides digital I/O signals. Connectors J5 and J7 are 1x8 female pin headers that provide analog inputs as well as digital I/O signals.

Connectors J6 and J15 are two-pin headers that provide power and ground to shield boards. J6 provides two pins connected to the VCC5V0 bus and J15 provides two pins connected to GND.

Note that although J6, J8, J9, and J15 are shown as separate connectors on the schematic, a single connector part is loaded across all of them when the board is manufactured.

On connectors J3 and J14, the outer row (closer to the board edge) of pins corresponds to the I/O connector pins on an Arduino Mega or Mega 2560 board. The inner row of pins provides access to the extra I/O signals provided by the PIC32 microcontroller.

The chipKIT/Arduino system uses logical pin numbers to identify digital I/O pins on the connectors. The logical pin numbers for the I/O pins on the Max32 are 0 – 85. These pin numbers are labeled in the silk screen on the board.

The analog inputs on connectors J5 and J7 are also assigned digital pin numbers. Pins A0 – A7 on connector J5 are digital pins 54 – 61, and pins A8 – A15 on connector J5 are digital pins 62 – 69.

Pin numbers 70 – 85 are on the inner rows of connectors J14 and J3.

3. 5 Peripheral I/O Functions

The PIC32 microcontroller on the Max32 board provides a number of peripheral functions. The following peripherals are provided:

UART port 0: Asynchronous serial port. Pin 0 (RX0), Pin 1 (TX0). These pins are connected to I/O connector J14 and are also connected to the FT232R USB serial converter. It is possible to use these pins to connect to an external serial device when not using the USB serial interface. This uses UART1A (U1ARX, U1ATX) on the PIC32 microcontroller.

UART port 1: Asynchronous serial port. Pin 19 (RX1), Pin 18 (TX1). This uses UART1B (U1BRX, U1BTX) on the PIC32 microcontroller.

UART port 2: Asynchronous serial port. Pin 17 (RX2), Pin 16 (TX2). This uses UART3A (U3ARX, U3ATX) on the PIC32 microcontroller.

UART port 3: Asynchronous serial port. Pin 15 (RX3, Pin 14 (TX3). This uses UART3B (U3BRX, U3BTx) on the PIC32 microcontroller.

SPI: Synchronous serial port. Pin 53 (SS), Pin 51 (MOSI), Pin 50 (MISO), Pin 52 (SCK). This uses SPI2A (SS2A, SDI2A, SDO2A, SCK2A) on the PIC32 microcontroller. These signals also appear on connector J13. Jumpers JP3 and JP4 are used to select whether the Max32 operates as a Master (transmit on MOSI, receive on MISO) or a Slave (transmit on MISO, receive on MOSI) device. The shorting blocks on JP3 and JP4 are normally placed in the Master position for the Max32 to function as an SPI master.

I^{2}C: Synchronous serial interface. These signals are available on J18 and are shared with pins 21 (SCL) and pin 20 (SDA). This uses I2C1 (SDA1, SCL1) on the PIC32 microcontroller.

Note: The I^{2}C bus uses open collector drivers to allow multiple devices to drive the bus signals. This means that pull-up resistors must be provided to supply the logic high state for the signals. These pull-up resistors are not on the Max32 board and must be provided externally. The resistance of the pull-up resistor to use depends on the total number of devices on the bus, the length of wire, and the clock speed being used. It essentially depends on distributed capacitance on the bus. The higher the distributed capacitance and the faster the clock speed, the smaller the resistance should be. Values typically used are in the range of 2K to 10K ohms.

PWM: Pulse width modulated output. Pins 3 (OC1), 5 (OC2), 6 (OC3), 9 (OC4), and 10 (OC5).

External Interrupts: Pin 3 (INT0), Pin 2 (INT1), Pin 7 (INT2), Pin 21 (INT3), Pin 20 (INT4).

User LEDs: Two user LEDs are provided, Pin 13 (LD4) and Pin 86 (LD5). Pin 13 is shared between a connector pin and LD4. Pin 86 is dedicated to LD5 and is not shared with any connector pin. Driving the pin high turns the LED on, driving it low turns it off.

A/D Converter Reference: Labeled A, the left-most outer pin on connector J3. This is used to provide an external voltage reference to determine the input voltage range of the analog pins. The maximum voltage that can be applied to this pin is 3.3V. Note that this signal is duplicated on connector J8 and corresponds to digital I/O pin 44. If the A pin is being used as an analog reference, then pin 44 is not useable.

RTCC: real-time clock/calendar. The PIC32 microcontroller contains an RTCC circuit that can be used to maintain time and date information. The operation of the RTCC requires a 32.768 KHz frequency source. Pin 75 (SOSCI) is the clock input for the RTCC. A 32.768 KHz oscillator should be connected to this pin to allow use of the RTCC.

RESET: The PIC32 microcontroller is reset by bringing its MCLR pin low. The MCLR pin is connected to the P32_RST net on the circuit board.

As described earlier, resetting the PIC32 microcontroller can be initiated by the USB serial converter. The USB serial converter brings the DTR pin low to reset the microcontroller. Jumper JP5 can be used to enable/disable the ability for the USB serial converter to initiate a reset.

The P32_RST net is connected to pin 1 of power connector J10. This allows circuitry on a shield to reset the microcontroller, or to ensure that the circuitry on the shield is reset at the same time as the microcontroller.

Connector J13 provides access to the SPI bus. Pin 5 provides access to the SPI Slave Select signal (SS).

On Arduino boards, the corresponding connector is also used as an in-system programming connector as well as providing access to some of the SPI signals. On Arduino boards, pin 5 of this connector is connected to the reset net.

Some Arduino shields, notably, the Ethernet shield, connect J13 pin 5 to the reset net on pin 1 of connector J10. This causes the processor to be reset each time an attempt is made to access the SPI port. Jumper JP2 can be used to break the connection between J13 pin 5 and reset when using Arduino shields that make this connection. JP2 has a cuttable trace on the bottom of the board that can be cut to break the connection between SPI SS and reset. JP2 is not loaded at the factory. To restore the connection, solder a 2-pin header at the JP2 position and install a shorting block.

A reset button is at the upper left corner of the board. Pressing this button will reset the PIC32 microcontroller.

3.6 Advanced Peripheral Devices

The PIC32MX795F512L microcontroller on the Max32 board has several peripheral devices for advanced communications capabilities. These peripheral devices require additional hardware that isn't provided on the Max32 board. This additional hardware must be provided by a shield board (such as the Digilent chipKIT Network Shield) connected to the Max32.

These advanced peripheral functions make use of various I/O pins for their operation. Most of the I/O pins used by the advanced peripheral devices are located on connectors J8 and J9. When these pins are being used by the advanced peripheral functions they are not available for other uses.

USB: The USB OTG controller allows using the Max32 board to implement a USB device, USB host, or USB OTG host/device. The following pins are used by the USB interface: Pin 27 (D+), Pin 26 (D-), Pin 25 (USBID), Pin 24 (VBUS).

Pin 24 (VBUS) can be used by a self-powered USB device to monitor the presence of bus voltage on the USB bus. This pin on the PIC32 microcontroller is an analog input pin used by the USB controller, and is not useable as a user I/O pin even when not using the USB controller.

10/100 Ethernet MAC: The Ethernet MAC requires an external PHY to complete the implementation of an Ethernet network port. The Ethernet MAC constructs the digital format of packets being sent and performs the checking and buffering of packets being received. The PHY provides the physical interface and translates the digital signals used by the MAC into the analog voltages used on the Ethernet cable.

There are two common interfaces used between an Ethernet MAC and the PHY: MII and RMII. The MAC in the PIC32 supports either interface, but the Max32 board is designed to use the RMII interface.

The RMII Ethernet PHY interface uses the following pins: Pin 53 (EREFCLK), Pin 49 (EMDC), Pin 48 (EMDIO), Pin 47 (ETXEN), Pin 46 (ETXD0), 45 (ETXD1), Pin 43 (ECRSDV), Pin 42 (ERXD0), Pin 41 (ERXD1), Pin 40 (ERXERR), and Pin 7 (NRST).

CAN1, CAN2: The CAN controllers allow the Max32 to participate in one or two CAN (Controller Area Network) networks. CAN is a networking standard that was developed for use in the automotive industry and is now also use in building automation and other industrial applications. The CAN controllers in the PIC32 microcontroller require external CAN transceivers to connect to the network wiring.

The CAN1 interface uses the following pins: Pin 15 (AC1RX), Pin 14 (AC1TX). Note that these pins are also used by UART3.

The CAN2 interface uses the following pins: Pin 23 (AC2RX), Pin 21 (AC2TX).

The PIC32 microcontroller is designed to allow one of two sets of pins to be used by the CAN controllers to connect to the transceivers. The Max32 board is designed to use the alternate sets of pins.

3. 7 Microchip Development Tool Compatibility

In addition to being used with the MPIDE, the Max32 board can be used as a more traditional microcontroller development board using Microchip Development Tools.

Unloaded connector J11 on the left side of the board is used to connect to a Microchip development tool, such as the PICkit™3, for in-circuit serial programming (ICSP). The holes for JP3 are staggered so that a standard 100-mil-spaced 6-pin header can be press fit to the board without the need to solder it in place. Any Microchip development tool that supports the PIC32 microcontroller family, and can be connected via the same 6-pin interface as the PICkit3, can be used.

Typically, a right-angle male connector is used in J11 so that a PICkit3 can be attached coplanar with the Max32 board. If the connector is loaded from the top, the PICkit3 will be upright (button and LEDs visible). Alternatively, the connector can be loaded from the bottom. In this case, the PICkit3 will be upside down.

If J11 is loaded from the top, the PICkit3 will interfere with the USB connector and the external power connector. A short six-wire cable can be used between the PICkit3 and the Max32. If J11 is loaded from the bottom, the PICkit3 won't interfere with the USB and external power connectors.

The Microchip MPLAB® IDE or the MPLAB® X IDE can be used to program and debug code running on the Max32 board. These programs can be downloaded from www.microchip.com.

Using the Microchip development tools to program the Max32 board will cause the boot loader to be erased. To use the board with the MPIDE again, it is necessary to program the boot loader back onto the board. The boot loader source code and compiled image can be found in the MPIDE software download.

3.7.1 Pinout Table by Logical Pin Number

chipKIT Pin #	Connector Pin #	PIC32 Pin #	PIC32 Signal	Notes
0	J14-01	52	SDA1A/SDI1A/U1ARX/RF2	
1	J14-03	53	SCL1A/SDO1A/U1ATX/RF8	
2	J14-05	18	AERXD0/INT1/RE8	
3	J14-07	72	SDO1/OC1/INT0/RD0	
4	J14-09	74	SOSCO/T1CK/CN0/RC14	
5	J14-11	76	OC2/RD1	
6	J14-13	77	OC3/RD2	
7	J14-15	19	AERXD1/INT2/RE9	
8	J3-01	79	ETXD2/IC5/PMD12/RD12	
9	J3-03	78	OC4/RD3	
10	J3-05	81	OC5/PMWR/CN13/RD4	
11	J3-07	9	T5CK/SDI1/RC4	
12	J3-09	58	SCL2/RA2	
13	J3-11	59	SDA2/RA3	
14	J4-08	39	AC1TX/SCK3A/U3BTX/U3ARTS/RF13	

chipKIT Pin #	Connector Pin #	PIC32 Pin #	PIC32 Signal	Notes
15	J4-07	40	AC1RX/SS3A/U3BRX/U3ACTS/RF12	
16	J4-06	50	SCL3A/SDO3A/U3ATX/PMA8/CN18/RF5	
17	J4-05	49	SDA3A/SDI3A/U3ARX/PMA9/CN17/RF4	
18	J4-04	48	AETXD1/SCK1A/U1BTX/U1ARTS/CN21/RD15	
19	J4-03	47	AETXD0/SS1A/U1BRX/U1ACTS/CN20/RD14	
20	J4-02, J18-02	67	AETXEN/SDA1/INT4/RA15	
21	J4-01, J18-01	66	AETXCLK/SCL1/INT3/RA14	
22	J9-16	7	T3CK/AC2TX/RC2	
23	J9-15	8	T4CK/AC2RX/RC3	
24	J9-14	54	VBUS	
25	J9-13	51	USBID/RF3	
26	J9-12	56	D-/RG3	
27	J9-11	57	D+/RG2	
28	J9-10	1	AERXERR/RG15	
29	J9-09	11	ECRX/SDA2/SDI2A/U2ARX/PMA4/CN9/RG7	
30	J9-08	5	PMD7/RE7	
31	J9-07	4	PMD6/RE6	
32	J9-06	3	PMD5/RE5	
33	J9-05	100	PMD4/RE4	
34	J9-04	99	PMD3/RE3	
35	J9-03	98	PMD2/RE2	
36	J9-02	94	PMD1/RE1	
37	J9-01	93	PMD0/RE0	
38	J8-16	70	SCK1/IC3/PMCS2/PMA15/RD10	
39	J8-15	82	PMRD/CN14/RD5	
40	J8-14	35	AN11/EREXERR/AETXERR/PMA12/RB11	Also J7-04(65)
41	J8-13	42	AN13/ERXD1/AECOL/PMA10/RB13	Also J7-06(66)
42	J8-12	41	AN12/ERXD0/AECRS/PMA11/RB12	Also J7-05(67)
43	J8-11	12	ERXDV/AERXDV/ECRSDV/AECRSDV/SCL2A/SDO2A/ U2ATX/PMA3/CN10/RG8	Also JP3,JP4
44	J8-10	29	VREF+/CVREF+/AERXD3/PMA6/RA10	Also J3-15
45	J8-09	87	C1RX/ETXD1/PMD11/RF0	

chipKIT Pin #	Connector Pin #	PIC32 Pin #	PIC32 Signal	Notes
46	J8-08	88	C1TX/ETXD0/RMD10/RF1	
47	J8-07	83	ETXEN/PMD14/CN15/RD6	
48	J8-06	68	RTCC/EMDIO/AEMDIO/IC1/RD8	
49	J8-05	71	EMDC/AEMDC/IC4/PMCS1/PMA14/RD11	
50	J8-04	11	ECRX/SDA2/SDI2A/U2ARX/PMA4/CN9/RG7	Also JP3,JP4
51	J8-03	12	ERXDV/AERXDV/ECRSDV/AECRSDV/SCL2A/SDO2A/ U2ATX/PMA3/CN10/RG8	Also JP3,JP4
52	J8-02	10	ECOL/SCK2A/U2BTX/U2ARTS/PMA5/CN8/RG6	Also J13-03
53	J8-01	14	ERXCLK/AERXCLK/EREFCLK/AEREFCLK/SS2A/U2BRX/ U2ACTS/PMA2/CN11/RG9	Also J13-05
54	J5-01	25	PGED1/AN0/CN2/RB0	Also A0
55	J5-02	24	PGEC1/AN1/CN3/RB1	Also A1
56	J5-03	23	AN2/C2IN-/CN4/RB2	Also A2
57	J5-04	22	AN3/C2IN+/CN5/RB3	Also A3
58	J5-05	21	AN4/C1IN-/CN6/RB4	Also A4
59	J5-06	20	AN5/C1IN+/VBUSON/CN7/RB5	Also A5
60	J5-7	26	PGEC2/AN6/OCFA/RB6	Also A6
61	J5-8	27	PGED2/AN7/RB7	Also A7
62	J7-01	32	AN8/C1OUT/RB8	Also A8
63	J7-02	33	AN9/C2OUT/RB9	Also A9
64	J7-03	34	AN10/CVREFOUT/PMA13/RB10	Also A10
65	J7-04	35	AN11/EREXERR/AETXERR/PMA12/RB11	Also A11,J8-14(40)
66	J7-06	42	AN13/ERXD1/AECOL/PMA10/RB13	Also A12,J8-13(41)
67	J7-05	41	AN12/ERXD0/AECRS/PMA11/RB12	Also A13,J8-12(42)
68	J7-07	43	AN14/ERXD2/AETXD3/PMALH/PMA1/RB14	Also A14
69	J7-08	44	AN15/ERXD3/AETXD2/OCFB/PMALL/PMA0/CN12/RB15	Also A15
70	J14-02	17	TMS/RA0	
71	J14-04	38	TCK/RA1	
72	J14-06	60	TDI/RA4	
73	J14-08	61	TDO/RA5	
74	J14-10	69	SS1/IC2/RD9	

chipKIT Pin #	Connector Pin #	PIC32 Pin #	PIC32 Signal	Notes
75	J14-12	73	SOSCI/CN1/RC13	
76	J14-14	80	ETXD3/PMD13/CN19/RD13	
77	J14-16	84	ETXCLK/PMD15/CN16/RD7	
78	J3-02	89	C2TX/ETXERR/PMD9/RG1	
79	J3-04	90	C2RX/PMD8/RG0	
80	J3-06	91	TRCLK/RA6	
81	J3-08	92	TRD3/RA7	
82	J3-10	95	TRD2/RG14	
83	J3-12	96	TRD1/RG12	
84	J3-14	97	TRD0/RG13	
85	J3-16	28	VREF-/CVREF0/AERXD2/PMA7/RA9	

3.7.2 Pinout Table by Connector Pin

Connector Pin #	chipKIT Pin #	PIC32 Pin #	PIC32 Signal	Notes
J03-01	8	79	ETXD2/IC5/PMD12/RD12	
J03-02	78	89	C2TX/ETXERR/PMD9/RG1	
J03-03	9	78	OC4/RD3	
J03-04	79	90	C2RX/PMD8/RG0	
J03-05	10	81	OC5/PMWR/CN13/RD4	
J03-06	80	91	TRCLK/RA6	
J03-07	11	9	T5CK/SDI1/RC4	
J03-08	81	92	TRD3/RA7	
J03-09	12	58	SCL2/RA2	
J03-10	82	95	TRD2/RG14	
J03-11	13	59	SDA2/RA3	
J03-12	83	96	TRD1/RG12	
J03-13			GND	
J03-14	84	97	TRD0/RG13	
J03-15	44	29	VREF+/CVREF+/AERXD3/PMA6/RA10	AREF
J03-16	85	28	VREF-/CVREF0/AERXD2/PMA7/RA9	
J04-01	21	66	AETXCLK/SCL1/INT3/RA14	
J04-02	20	67	AETXEN/SDA1/INT4/RA15	
J04-03	19	47	AETXD0/SS1A/U1BRX/U1ACTS/CN20/RD14	

Connector Pin #	chipKIT Pin #	PIC32 Pin #	PIC32 Signal	Notes
J04-04	18	48	AETXD1/SCK1A/U1BTX/U1ARTS/CN21/RD15	
J04-05	17	49	SDA3A/SDI3A/U3ARX/PMA9/CN17/RF4	
J04-06	16	50	SCL3A/SDO3A/U3ATX/PMA8/CN18/RF5	
J04-07	15	40	AC1RX/SS3A/U3BRX/U3ACTS/RF12	
J04-08	14	39	AC1TX/SCK3A/U3BTX/U3ARTS/RF13	
J05-01	54	25	PGED1/AN0/CN2/RB0	Also A0
J05-02	55	24	PGEC1/AN1/CN3/RB1	Also A1
J05-03	56	23	AN2/C2IN-/CN4/RB2	Also A2
J05-04	57	22	AN3/C2IN+/CN5/RB3	Also A3
J05-05	58	21	AN4/C1IN-/CN6/RB4	Also A4
J05-06	59	20	AN5/C1IN+/VBUSON/CN7/RB5	Also A5
J05-07	60	26	PGEC2/AN6/OCFA/RB6	Also A6
J05-08	61	27	PGED2/AN7/RB7	Also A7
J07-01	62	32	AN8/C1OUT/RB8	Also A8
J07-02	63	33	AN9/C2OUT/RB9	Also A9
J07-03	64	34	AN10/CVREFOUT/PMA13/RB10	Also A10
J07-04	65	35	AN11/EREXERR/AETXERR/PMA12/RB11	Also A11, J08-14
J07-05	67	41	AN12/ERXD0/AECRS/PMA11/RB12	Also A12,42,J08-12
J07-06	66	42	AN13/ERXD1/AECOL/PMA10/RB13	Also A13, J08-13
J07-07	68	43	AN14/ERXD2/AETXD3/PMALH/PMA1/RB14	Also A14
J07-08	69	44	AN15/ERXD3/AETXD2/OCFB/PMALL/PMA0/CN12/RB15	Also A15
J08-01	53	14	ERXCLK/AERXCLK/EREFCLK/AEREFCLK/SS2A/U2BRX/U2ACTS/PMA2/CN11/RG9	Also J13-05
J08-02	52	10	ECOL/SCK2A/U2BTX/U2ARTS/PMA5/CN8/RG6	Also J13-03
J08-03	51	11	ECRX/SDA2/SDI2A/U2ARX/PMA4/CN9/RG7	Also JP3,JP4
J08-04	50	12	ERXDV/AERXDV/ECRSDV/AECRSDV/SCL2A/SDO2A/U2ATX/PMA3/CN10/RG8	Also JP3, JP4, J08-11
J08-05	49	71	EMDC/AEMDC/IC4/PMCS1/PMA14/RD11	
J08-06	48	68	RTCC/EMDIO/AEMDIO/IC1/RD8	
J08-07	47	83	ETXEN/PMD14/CN15/RD6	
J08-08	46	88	C1TX/ETXD0/RMD10/RF1	

Connector Pin #	chipKIT Pin #	PIC32 Pin #	PIC32 Signal	Notes
J08-09	45	87	C1RX/ETXD1/PMD11/RF0	
J08-10	44	29	VREF+/CVREF+/AERXD3/PMA6/RA10	
J08-11	43	12	ERXDV/AERXDV/ECRSDV/AECRSDV/SCL2A/SDO2A/U2ATX/ PMA3/CN10/RG8	Also JP3, JP4, J03-15
J08-15	39	82	PMRD/CN14/RD5	
J08-16	38	70	SCK1/IC3/PMCS2/PMA15/RD10	
J09-01	37	93	PMD0/RE0	
J09-02	36	94	PMD1/RE1	
J09-03	35	98	PMD2/RE2	
J09-04	34	99	PMD3/RE3	
J09-05	33	100	PMD4/RE4	
J09-06	32	3	PMD5/RE5	
J09-07	31	4	PMD6/RE6	
J09-08	30	5	PMD7/RE7	
J09-09	29	11	ECRX/SDA2/SDI2A/U2ARX/PMA4/CN9/RG7	Also JP3, JP4
J09-10	28	1	AERXERR/RG15	
J09-11	27	57	D+/RG2	
J09-12	26	56	D-/RG3	
J09-13	25	51	USBID/RF3	
J09-14	24	54	VBUS (note useable as I/O)	
J09-15	23	8	T4CK/AC2RX/RC3	
J09-16	22	7	T3CK/AC2TX/RC2	
J10-01		13	MCLR	
J10-02			VCC3V3	
J10-03			VCC5V0	
J10-04			GND	
J10-05			GND	
J10-06			VIN (external supply voltage)	
J14-01	0	52	SDA1A/SDI1A/U1ARX/RF2	
J14-02	70	17	TMS/RA0	
J14-03	1	53	SCL1A/SDO1A/U1ATX/RF8	
J14-04	71	38	TCK/RA1	
J14-05	2	18	AERXD0/INT1/RE8	
J14-06	72	60	TDI/RA4	

Connector Pin #	chipKIT Pin #	PIC32 Pin #	PIC32 Signal	Notes
J14-07	3	72	SDO1/OC1/INT0/RD0	
J14-08	73	61	TDO/RA5	
J14-09	4	74	SOSCO/T1CK/CN0/RC14	
J14-10	74	69	SS1/IC2/RD9	
J14-11	5	76	OC2/RD1	
J14-12	75	73	SOSCI/CN1/RC13	
J14-13	6	77	OC3/RD2	
J14-14	76	80	ETXD3/PMD13/CN19/RD13	
J14-15	7	19	AERXD1/INT2/RE9	
J14-16	77	84	ETXCLK/PMD15/CN16/RD7	
J18-01	21	66	AETXCLK/SCL1/INT3/RA14	
J18-02	20	67	AETXEN/SDA1/INT4/RA15	

3.7.3 Pinout Table by Microcontroller Pin

PIC32 Pin #	Connector Pin #	chipKIT Pin #	PIC32 Signal	Notes
1	J9-10	28	AERXERR/RG15	
2			VDD	
3	J9-06	32	PMD5/RE5	
4	J9-07	31	PMD6/RE6	
5	J9-08	30	PMD7/RE7	
6	n/c	n/c	T2CK/RC1	
7	J9-16	22	T3CK/AC2TX/RC2	
8	J9-15	23	T4CK/AC2RX/RC3	
9	J3-07	11	T5CK/SDI1/RC4	
10	J8-02	52	ECOL/SCK2A/U2BTX/U2ARTS/PMA5/CN8/RG6	Also J13-03
11	J9-09	29	ECRS/SDA2/SDI2A/U2ARX/PMA4/CN9/RG7	Also JP3, JP4
12	J8-11	43	ERXDV/AERXDV/ECRSDV/AECRSDV/SCL2A/SDO2A/ U2ATX/PMA3/CN10/RG8	Also JP3, JP4
13	J10-01		MCLR	
14	J8-01	53	ERXCLK/AERXCLK/EREFCLK/AEREFCLK/ SS2A/U2BRX/ U2ACTS/PMA2/CN11/RG9	Also J13-05
15			VSS	

PIC32 Pin #	Connector Pin #	chipKIT Pin #	PIC32 Signal	Notes
16			VDD	
17	J14-02	70	TMS/RA0	
18	J14-05	2	AERXD0/INT1/RE8	
19	J14-15	7	AERXD1/INT2/RE9	
20	J5-06	59	AN5/C1IN+/VBUSON/CN7/RB5	Also A5
21	J5-05	58	AN4/C1IN-/CN6/RB4	Also A4
22	J5-04	57	AN3/C2IN+/CN5/RB3	Also A3
23	J5-03	56	AN2/C2IN-/CN4/RB2	Also A2
24	J5-02	55	PGEC1/AN1/CN3/RB1	Also A1
25	J5-01	54	PGED1/AN0/CN2/RB0	Also A0
26	J5-7	60	PGEC2/AN6/OCFA/RB6	Also A6
27	J5-8	61	PGED2/AN7/RB7	Also A7
28	J3-16	85	VREF-/CVREF-/AERXD2/PMA7/RA9	
29	J8-10	44	VREF+/CVREF+/AERXD3/PMA6/RA10	Also J3-15
30			AVDD	
31			AVSS	
32	J7-01	62	AN8/C1OUT/RB8	Also A8
33	J7-02	63	AN9/C2OUT/RB9	Also A9
34	J7-03	64	AN10/CVREFOUT/PMA13/RB10	Also A10
35	J7-04	65	AN11/EREXERR/AETXERR/PMA12/RB11	Also A11, J8-14(40)
36			VSS	
37			VDD	
38	J14-04	71	TCK/RA1	
39	J4-08	14	AC1TX/SCK3A/U3BTX/U3ARTS/RF13	
40	J4-07	15	AC1RX/SS3A/U3BRX/U3ACTS/RF12	
41	J7-05	67	AN12/ERXD0/AECRS/PMA11/RB12	Also A12, J8-12(42)
42	J7-06	66	AN13/ERXD1/AECOL/PMA10/RB13	Also A13, J8-13(41)
43	J7-07	68	AN14/ERXD2/AETXD3/PMALH/PMA1/RB14	Also A14
44	J7-08	69	AN15/ERXD3/AETXD2/OCFB/PMALL/PMA0/CN12/RB15	Also A15
45			VSS	
46			VDD	
47	J4-03	19	AETXD0/SS1A/U1BRX/U1ACTS/CN20/RD14	

PIC32 Pin #	Connector Pin #	chipKIT Pin #	PIC32 Signal	Notes
48	J4-04	18	AETXD1/SCK1A/U1BTX/U1ARTS/CN21/RD15	
49	J4-05	17	SDA3A/SDI3A/U3ARX/PMA9/CN17/RF4	
50	J4-06	16	SCL3A/SDO3A/U3ATX/PMA8/CN18/RF5	
51	J9-13	25	USBID/RF3	
52	J14-01	0	SDA1A/SDI1A/U1ARX/RF2	
53	J14-03	1	SCL1A/SDO1A/U1ATX/RF8	
54	J9-14	24	VBUS	
55			VUSB	
56	J9-12	26	D-/RG3	
57	J9-11	27	D+/RG2	
58	J3-09	12	SCL2/RA2	
59	J3-11	13	SDA2/RA3	
60	J14-06	72	TDI/RA4	
61	J14-08	73	TDO/RA5	
62			VDD	
63			OSC1/CLKI/RC12	X1, system clock oscillator
64			OSC2/CLKO/RC15	X1, system clock oscillator
65			VSS	
66	J4-01, J18-01	21	AETXCLK/SCL1/INT3/RA14	
67	J4-02, J18-02	20	AETXEN/SDA1/INT4/RA15	
68	J8-06	48	RTCC/EMDIO/AEMDIO/IC1/RD8	
69	J14-10	74	SS1/IC2/RD9	
70	J8-16	38	SCK1/IC3/PMCS2/PMA15/RD10	
71	J8-05	49	EMDC/AEMDC/IC4/PMCS1/PMA14/RD11	
72	J14-07	3	SDO1/OC1/INT0/RD0	
73	J14-12	75	SOSCI/CN1/RC13	RTCC clock input
74	J14-09	4	SOSCO/T1CK/CN0/RC14	
75			VSS	
76	J14-11	5	OC2/RD1	
77	J14-13	6	OC3/RD2	
78	J3-03	9	OC4/RD3	
79	J3-01	8	ETXD2/IC5/PMD12/RD12	

PIC32 Pin #	Connector Pin #	chipKIT Pin #	PIC32 Signal	Notes
80	J14-14	76	ETXD3/PMD13/CN19/RD13	
81	J3-05	10	OC5/PMWR/CN13/RD4	
82	J8-15	39	PMRD/CN14/RD5	
83	J8-07	47	ETXEN/PMD14/CN15/RD6	
84	J14-16	77	ETXCLK/PMD15/CN16/RD7	
85			VCAP/VDDCORE	
86			VDD	
87	J8-09	45	C1RX/ETXD1/PMD11/RF0	
88	J8-08	46	C1TX/ETXD0/RMD10/RF1	
89	J3-02	78	C2TX/ETXERR/PMD9/RG1	
90	J3-04	79	C2RX/PMD8/RG0	
91	J3-06	80	TRCLK/RA6	
92	J3-08	81	TRD3/RA7	
93	J9-01	37	PMD0/RE0	
94	J9-02	36	PMD1/RE1	
95	J3-10	82	TRD2/RG14	
96	J3-12	83	TRD1/RG12	
97	J3-14	84	TRD0/RG13	
98	J9-03	35	PMD2/RE2	
99	J9-04	34	PMD3/RE3	
100	J9-05	33	PMD4/RE4	

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