

# chipKIT™ Pmod Shield-Uno Reference Manual

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## Overview

The chipKIT Pmod Shield-Uno is an input/output expansion board for use with the chipKIT Uno32™ and chipKIT uC32™. It provides the additional circuitry and connectors to allow Digilent peripheral modules (Pmods™) to be used with the Uno32 and uC32.

The Pmod Shield-Uno has five 2x6 Digilent Pmod connectors. It also provides access to the I/O connectors available on the Uno32 as well as connecting to the I<sup>2</sup>C bus supported by the Uno32 and uC32.

The Pmod Shield-Uno has the same form factor as the Uno32 and uC32 boards.

Features include:

- five 2x6 Digilent Pmod connectors
- one 6-pin header connector for SPI
- one I<sup>2</sup>C daisy chain connector
- 4 user LEDs
- Standard chipKIT Shield connectors

## Functional Description

The Pmod Shield-Uno is designed to be used with the chipKIT Uno32 board. When used in combination, the two boards provide the necessary supporting hardware and connectors to make use of most Digilent Pmods™. The rest of this document will only reference the Uno32, however, the shield can also be used with the chipKIT uC32.

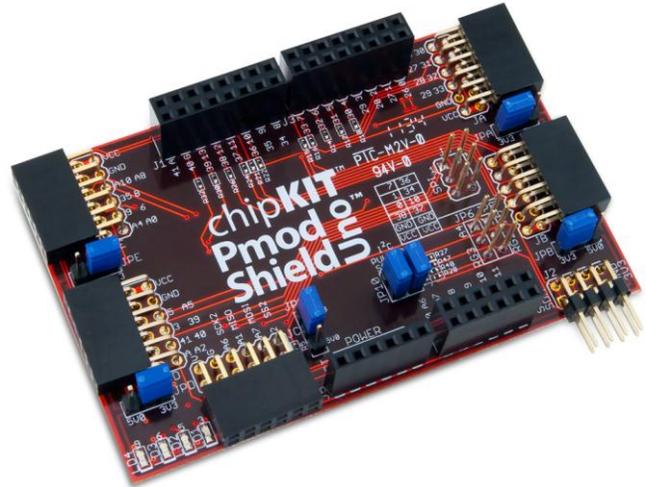
The Pmod Shield-Uno has the following connectors.

### J1 & J3: Digital Signal Pass-Through Connectors

This connector provides most of the signals used by the Uno32 board to the Pmod Shield-Uno board. The remaining signals are passed through the Pmod Shield-Uno.

### J6: SPI #2 Connector

This connector provides access to the SPI signals MISO, MOSI, SCK, and SS.



### JA-JE: Digilent Pmod Connectors

These connectors provide access to the signals of the Uno32 in a form factor which readily allows Digilent Pmods to be connected.

### J2: I<sup>2</sup>C #1 Daisy Chain Connector

This is a 2x4 pin header connector that provides access to the I<sup>2</sup>C signals SDA and SCL as well as power from the 3.3V power bus and ground. This can be used to extend the I<sup>2</sup>C bus off of the board and to power external I<sup>2</sup>C devices. Digilent has cables and a selection of I<sup>2</sup>C peripheral modules that can be accessed using this connector.

### J4: Analog Signal Pass-Through Connector

This connector passes the analog input pins on the Uno32 through the Pmod Shield-Uno board.

### J5: Power Pass-Through Connector

This connector passes the power connector from the Uno32 through the Pmod Shield-Uno board, and powers the Pmod Shield-Uno from the Uno32.

## I<sup>2</sup>C Busses and Connectors

The Inter-Integrated Circuit (I<sup>2</sup>C) Interface provides a medium speed (100K or 400K bps) synchronous serial communications bus. The I<sup>2</sup>C interface provides master and slave operation using either 7 bit or 10 bit device addressing. Each device is given a unique address, and the protocol provides the ability to address packets to a specific device or to broadcast packets to all devices on the bus. Refer to the Microchip PIC32MX3XX data sheet and the *PIC32 Family Reference Manual* for detailed information on configuring and using the I<sup>2</sup>C interface.

The PIC32MX320 microcontroller on the Uno32 provides for two independent I<sup>2</sup>C interfaces. The Pmod Shield-Uno is designed to provide access to both of these interfaces I<sup>2</sup>C #1 (SCL1, SDA1) and I<sup>2</sup>C #2 (SCL2, SDA2). I<sup>2</sup>C #1 is the bus accessed through the standard chipKIT Wire library. Connector J2 provides access to I<sup>2</sup>C port #1 while access to I<sup>2</sup>C port #2 is available on several of the connectors of the Pmod Shield-Uno.

Connector J2 can be used to extend the I<sup>2</sup>C busses off of the board to connect to external I<sup>2</sup>C devices. This is a standard 2x4 pin header connector with 0.100" spaced pins. It provides access to the I<sup>2</sup>C signals, SCL and SDA, plus VCC3V3 and ground. The VCC3V3 can be used to power external I<sup>2</sup>C devices.

The I<sup>2</sup>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. The Pmod Shield-Uno provides 2.2Kohm pull-up resistors on I<sup>2</sup>C #1.

Generally, only one set of pull-ups are used on the bus. Jumpers JP10 and JP11 can be used to disable the on-board pull-ups on I<sup>2</sup>C #1 if a different value is needed or some other device on the bus

is providing the pull-ups or if I<sup>2</sup>C #1 isn't being used and the pull-ups are interfering with the use of the pins. The on-board pull-ups are enabled by install shorting blocks on JP10 and JP11. Removing the shorting blocks disables the pull-ups.

Digilent has several small I/O modules available that can be connected using the I<sup>2</sup>C connector. These include a 3-axis accelerometer, 4-channel, 12-bit A/D converter, serial character LCD panel, 3-axis gyroscope, real-time clock/calendar, and an I/O expander.

## SPI Connector

The SPI connector pins are as follows: Pin 1 (MISO), Pin 3 (SCK), Pin 4 (MOSI), and Pin 5 (SS). These signals also appear on connector J8 of the Uno32.

Jumpers JP5 and JP7 on the Uno32 are used to select whether the Uno32 operates as a Master (transmit on MOSI, receive on MISO) or a Slave (transmit on MISO, receive on MOSI) device. The shorting blocks on JP5 and JP7 are normally placed in the Master position for the Uno32 to function as an SPI master. Also, jumper JP4 on the Uno32 is used to select PWM output (in RD4 position) or the SPI SS function on Pin 5 (in RG9 position).

## Appendix: chipKIT Pmod Shield-Uno Pinout Tables

### J1 Pins

Uno32 Pin #	PIC32 Pin #	Pin	Signal	Notes
8	44	J1-01	IC3/PMCS2/PMA15/INT3/RD10	
34	53	J1-02	PMRD/CN14/RD5	
9	51	J1-03	OC4/RD3	
35	45	J1-04	IC4/PMCS1/PMA14/INT4/RD11	
10	8	J1-05	SS2/PMA2/CN11/RG9	selected by JP4
10	52	J1-05	PMWR/OC5/IC5/CN13/RD4	selected by JP4
36	54	J1-06	CN15/RD6	
11	6	J1-07 or J1-09	SDO2/PMA3/CN10/RG8	selected by JP5/JP7
37	55	J1-08	CN16/RD7	
12	5	J1-09 or J1-07	SDI2/PMA5/CN8/RG7	selected by JP7/JP5
38	35	J1-10	U1RTS/BCLK1/SCK1/INT0/RF6	
13	4	J1-11	SCK2/PMA5/CN8/RG6	
39	31	J1-12	PMA9/U2RX/SDA2/CN17/RF4	
40	32	J1-14	PMA8/U2TX/SCL2/CN18/RF5	
42	16	J1-15	PGED1/PMA6/AN0/VREF+/CVREF+/CN2/RB0	
41	15	J1-16	PGC1/AN1/VREF-/CVREF-/CN3/RB1	

### J3 Pins

Uno32 Pin #	PIC32 Pin #	Pin	Signal	Notes
0	34	J3-01	U1RX/SDI1/RF2	
26	60	J3-02	PMD0/RE0	
1	33	J3-03	U1TX/SDO1/RF3	
27	61	J3-04	PMD1/RE1	
2	42	J3-05	IC1/RTCC/INT1/RD8	selected by JP4
28	62	J3-06	PMD2/RE2	selected by JP4
3	46	J3-07	OC1/RD0	
29	63	J3-08	PMD3/RE3	selected by JP5/JP7
4	59	J3-09	RF1	
30	64	J3-10	PMD4/RE4	selected by JP7/JP5
5	49	J3-11	OC2/RD1	
31	1	J3-12	PMD5/RE5	
6	50	J3-13	OC3/RD2	
32	2	J3-14	PMD6/RE6	
7	43	J3-15	IC2/U1CTS/INT2/RD9	
33	3	J3-16	PMD7/RE7	

## JA Pins

Uno32 Pin #	PIC32 Pin #	Pin	Signal	Notes
26	60	JA-01	PMD0/RE0	
27	61	JA-02	PMD1/RE1	
28	62	JA-03	PMD2/RE2	
29	63	JA-04	PMD3/RE3	
		JA-05	GND	
		JA-06	VCC 3V3 / 5V0	select with JPA
30	64	JA-07	PMD4/RE4	
31	1	JA-08	PMD5/RE5	
32	2	JA-09	PMD6/RE6	
33	3	JA-10	PMD7/RE7	
		JA-11	GND	
		JA-12	VCC 3V3 / 5V0	select with JPA

## JB Pins

Uno32 Pin #	PIC32 Pin #	Pin	Signal	Notes
7	43	JB-01	PMD0/RE0	
1	33	JB-02	PMD1/RE1	
0	34	JB-03	PMD2/RE2	
38	35	JB-04	PMD3/RE3	
		JB-05	GND	
		JB-06	VCC 3V3 / 5V0	select with JPB
36	54	JB-07	PMD4/RE4	
34	53	JB-08	PMD5/RE5	
10	52	JB-09	PMD6/RE6	
37	55	JB-10	PMD7/RE7	
		JB-11	GND	
		JB-12	VCC 3V3 / 5V0	select with JPB

## J2 Pins (I<sup>2</sup>C)

Uno32 Pin #	PIC32 Pin #	Pin	Signal	Notes
	37	J2-01	SCL1/RG2	
	37	J2-02	SCL1/RG2	
	36	J2-03	SDA1/RG3	
	36	J2-04	SDA1/RG3	
		J2-05	GND	
		J2-06	GND	
		J2-07	VDD	
		J2-08	VDD	

## J4 Pins

Uno32 Pin #	PIC32 Pin #	Pin	Signal	Notes
A00/14	14	J4-01	C2IN-/AN2/SS1/CN4/RB2	
A06/20	13	J4-02	C2IN+/AN3/CN5/RB3	
A01/15	11	J4-03	C1IN-/AN4/CN6/RB4	
A07/21	12	J4-04	C1IN+/AN5/CN7/RB5	
A02/16	21	J4-05	U2CTS/C1OUT/AN8/RB8	
A08/22	22	J4-06	PMA7/C2OUT/AN9/RB9	
A03/17	23	J4-07	TMS/CVREFOUT/PMA13/AN10/RB10	
A09/23	24	J4-08	TDO/PMA12/AN11/RB11	
A04/18	27	J4-09	TCK/PMA11/AN12/RB12	selected by JP6
	36	J4-09	SDA1/RG3	selected by JP6
A10/24	28	J4-10	TDI/PMA10/AN13/RB13	
A05/19	29	J4-11	PMALH/PMA1/U2RTS/AN14/RB14	selected by JP8
	37	J4-11	SCL1/RG2	selected by JP8
A11/25	30	J4-12	PMALL/PMA0/AN15/OCFB/CN12/RB15	

## JC Pins

Uno32 Pin #	PIC32 Pin #	Pin	Signal	Notes
10	8	JC-01	SS2/PMA2/CN11/RG9	selected by JP4
	6	JC-02	MOSI	
	5	JC-03	MISO	
13	4	JC-04	SCK2/PMA5/CN8/RG6	
		JC-05	GND	
		JC-06	VCC 3V3 / 5V0	select with JPC
2	42	JC-07	IC1/RTCC/INT1/RD8	
A07/21	12	JC-08	C1IN+/AN5/CN7/RB5	
A01/15	11	JC-09	C1IN-/AN4/CN6/RB4	
A06/20	13	JC-10	C2IN+/AN3/CN5/RB3	
		JC-11	GND	
		JC-12	VCC 3V3 / 5V0	select with JPC

## JD Pins

Uno32 Pin #	PIC32 Pin #	Pin	Signal	Notes
A02/16	21	JD-01	U2CTS/C1OUT/AN8/RB8	
40	32	JD-02	PMA8/U2TX/SCL2/CN18/RF5	
39	31	JD-03	PMA9/U2RX/SDA2/CN17/RF4	
A05/19	29	JD-04	PMALH/PMA1/U2RTS/AN14/RB14	
		JD-05	GND	
		JD-06	VCC 3V3 / 5V0	select with JPD
42	16	JD-07	PGED1/PMA6/AN0/VREF+/CVREF+/CN2/RB0	
41	15	JD-08	PGC1/AN1/VREF-/CVREF-/CN3/RB1	
3	46	JD-09	OC1/RD0	
5	49	JD-10	OC2/RD1	
		JD-11	GND	
		JD-12	VCC 3V3 / 5V0	select with JPD

## JE Pins

Uno32 Pin #	PIC32 Pin #	Pin	Signal	Notes
A00/14	14	JE-01	C2IN-/AN2/SS1/CN4/RB2	
6	50	JE-02	OC3/RD2	
8	44	JE-03	IC3/PMCS2/PMA15/INT3/RD10	
A08/22	22	JE-04	PMA7/C2OUT/AN9/RB9	
		JE-05	GND	
		JE-06	VCC 3V3 / 5V0	select with JPD
A04/18	27	JE-07	TCK/PMA11/AN12/RB12	
9	51	JE-08	OC4/RD3	
35	45	JE-09	IC4/PMCS1/PMA14/INT4/RD11	
A10/24	28	JE-10	TDI/PMA10/AN13/RB13	
		JE-11	GND	
		JE-12	VCC 3V3 / 5V0	select with JPD

## J6 Pins (SPI)

Uno32 Pin #	PIC32 Pin #	Pin	Signal	Notes
5	5	JE-01	MISO	
		JE-02	Unconnected	
13	4	JE-03	SCK2/PMA5/CN8/RG6	
6	6	JE-04	MOSI	
10	8	JE-05	SS2/PMA2/CN11/RG9	selected by JP4
		JE-06	GND	