Pmod Shield Reference Manual
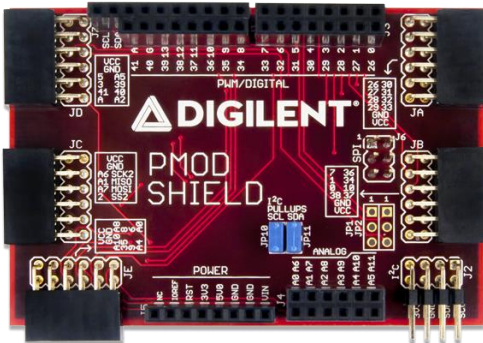
Revised May 17, 2017
This manual applies to the Pmod Shield rev. B

Overview

The Pmod Shield is an input/output expansion board for use with Digilent microcontrollers including the Wi-FIRE, the WF32, the uC32, and the retired Uno32. It provides the additional circuitry and five 2×6 Digilent Pmod connectors to allow Digilent peripheral modules (Pmods™) to be used with those boards or any other boards with the double-row Arduino styled headers. 2×4 I²C connectors and optional pullup resistors for the I²C bus are provided as well.

Features include:

- Five 2×6 Digilent Pmod connectors
- One 6-pin header connector for SPI
- One I2C daisy chain connector
- One 2-pin I2C connector
- Standard Digilent Shield connectors

The Pmod Shield.

1 Functional Description

The Pmod Shield is designed to be used with the Digilent boards with a shield connector including a number of Digilent microcontroller boards and the Digilent Arty boards. When used in combination, Pmod Shield provides the necessary supporting hardware and connectors to make use of most Digilent Pmods.

The Pmod Shield has the following connectors:

J1 & J3: Digital Signal Pass-Through Connectors

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

J2: I²C Daisy Chain Connector

- This is a 2×4 pin header connector that provides access to the I²C signals SDA and SCL as well as power from the 3.3V power bus and ground. This can be used to extend the I²C bus off of the board and to power external I²C devices. Digilent has cables and a selection of I²C peripheral modules that can be accessed using this connector.

J4: Analog Signal Pass-Through Connector

- This connector passes the analog input pins on the host through the Pmod Shield.

J5: Power Pass-Through Connector

- This connector passes the power connector from the host through the Pmod Shield, and powers the Pmod Shield from the host.

J6: Default SPI Connector

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

J7: I²C Connector

- This connector provides access to the same SCL and SDA pins provided on J2 but through a female header.

JA-JE: Digilent Pmod Connectors

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

2 I²C Busses and Connectors

The Inter-Integrated Circuit (I²C) Interface provides a medium speed (100K or 400K bps) synchronous serial communications bus. The I²C 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 I²C interface.

The PIC32MX320 microcontroller on the Uno32 provides for two independent I²C interfaces. The Pmod Shield is designed to provide access to both of these interfaces I²C #1 (SCL1, SDA1) and I²C #2 (SCL2, SDA2). I2C #1 is the bus accessed through the standard Arduino Wire library. Connector J2 provides access to I²C port #1 while access to I²C port #2 is available on several of the connectors of the Pmod Shield.

Connector J2 can be used to extend the I²C busses off of the board to connect to external I²C devices. This is a standard 2×4 pin header connector with 0.100" spaced pins. It provides access to the I²C signals, SCL and SDA, plus VCC3V3 and ground. The VCC3V3 can be used to power external I²C devices. SCL and SDA are also provided on header J7 as female pins.

The I²C 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. 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 I²C #1 if a different value is needed or some other device on the bus is providing the pull-ups or if I²C #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 I²C connector. These include a 3-axis accelerometer, 4-channel, 12-bit A/Dconverter, serial character LCD panel, 3-axis gyroscope, real-time clock/calendar, an I/O expander, and more.

3   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 Digilent host microcontroller boards. Jumpers are available on Digilent host microcontroller boards that can used to select whether the host operates as a Master (transmit on MOSI, receive on MISO) or a Slave (transmit on MISO, receive on MOSI) device. By default, the shorting blocks are normally placed in the Master position for the Uno32 to function as an SPI master. Also, a jumper is available on Digilent microcontroller boards that is used to select PWM output (in RD4 position) or the SPI SS function on Pin 5 (in RG9 position).

These same signals can also be accessed on the top row (pins 1-4) of Pmod header JC.

Appendix: Pmod Shield Pinout Tables

Header JA

Pmod Shield Pin	Pmod Shield Silk Screen Number	Wi-FIRE PIC32 Signal	WF32 PIC32 Signal	uC32 PIC32 Signal
JA1	26	EBID0/PMD0/RE0	PMD0/RE0	PMD0/RE0
JA2	27	EBID1/PMD1/RE1	PMD1/RE1	PMD1/RE1
JA3	28	EBID2/PMD2/RE2	PMD2/RE2	PMD2/RE2
JA4	29	EBID3/RPE3/PMD3/RE3	PMD3/RE3	PMD3/RE3
JA7	30	EBID4/AN18/PMD4/RE4	PMD4/RE4	PMD4/RE4
JA8	31	EBID5/AN17/RPE5/PMD5/RE5	PMD5/RE5	PMD5/RE5
JA9	32	BID6/AN16/PMD6/RE6	PMD6/RE6	PMD6/RE6
JA10	33	EBID7/AN15/PMD7/RE7	PMD7/RE7	PMD7/RE7

Header JB

Pmod Shield Pin	Pmod Shield Silk Screen Number	Wi-FIRE PIC32 Signal	WF32 PIC32 Signal	uC32 PIC32 Signal
JB1	7	AN26/AERXD1/RPE9/RE9	AERXD1/INT2/RE9	IC2/U1CTS/INT2/RD9
JB2	1	EBIRDY2/RPF8/SCL3/RF8	SCL3/SDO3/U1TX/RF8	U1TX/SDO1/RF3
JB3	0	EBIRDY3/RPF2/SDA3/RF2	SDA3/SDI3/U1RX/RF2	U1RX/SDI1/RF2

Pmod Shield Pin	Pmod Shield Silk Screen Number	Wi-FIRE PIC32 Signal	WF32 PIC32 Signal	uC32 PIC32 Signal
JB4	38	EBID12/ETXD2/RPD12/PMD12/RD12	T5CK/SDI1/RC4	U1RTS/BCLK1/SCK1/INT0/RF6
JB7	36	EBID10/ETXD0/RPF1/PMD10/RF1	ETXEN/PMD14/CN15/RD6	CN15/RD6
JB8	34	SQICS1/RPD5/RD5	PMRD/CN14/RD5	PMRD/CN14/RD5
JB9	10	AN11/C2INC/RPG9/PMA2/RG9	OC5/PMWR/CN13/RD4	PMWR/OC5/IC5/CN13/RD4
JB10	37	EBICS0/SCL2/RA2	ETXCLK/PMD15/CN16/RD7	CN16/RD7

Header JC

Pmod Shield Pin	Pmod Shield Silk Screen Number	Wi-FIRE PIC32 Signal	WF32 PIC32 Signal	uC32 PIC32 Signal
JC2	11 (MOSI)	RPD11/RD11	SCL4/SDO2/U3TX/PMA3/CN10/RG8	(SDO2/PMA3/CN10/RG8) or (SDI2/PMA5/CN9/RG7)
JC3	12 (MISO)	RPF0/PMD11/RF0	SDA4/SDI2/U3RX/PMA4/CN9/RG7	(SDI2/PMA5/CN9/RG7) or (SDO2/PMA3/CN10/RG8)
JC4	13 (SCK)	AN14/C1IND/ECOL/RPG6/SCK2/RG6	SCK2/U6TX/U3RTS/PMA5/CN8/RG6	SCK2/PMA5/CN8/RG6
JC7	2	AN25/AERXD0/RPE8/RE8	AERXD0/INT1/RE8	IC1/RTCC/INT1/RD8
JC8	A7	AN2/C2INB/RPB2/RB2	AN5/C1IN+/VBUSON/CN7/RB5	C1IN+/AN5/CN7/RB5
JC9	A1	EBIA7/AN49/RPB9/PMA7/RB9	AN4/C1IN-/CN6/RB4	C1IN-/AN4/CN6/RB4
JC10	A6	AN3/C2INA/RPB3/RB3	AN3/C2IN+/CN5/RB3	C2IN+/AN3/CN5/RB3

Header JD

Pmod Shield Pin	Pmod Shield Silk Screen Number	Wi-FIRE PIC32 Signal	WF32 PIC32 Signal	uC32 PIC32 Signal
JD1	A2	EBIA12/AN21/RPC2/PMA12/RC2	AN8/C1OUT/RB8	U2CTS/C1OUT/AN8/RB8
JD2	40	AN33/RPD15/SCK6/RD15	SCK3/U4TX/U1RTS/CN21/RD15	PMA8/U2TX/SCL2/CN18/RF5
JD3	39	AN32/RPD14/RD14	SS3/U4RX/U1CTS/CN20/RD14	PMA9/U2RX/SDA2/CN17/RF4
JD4	A5	AN12/RPG8/SCL4/PMA3/RG8	AN11/PMA12/RB11	PMALH/PMA1/U2RTS/AN14/RB14

Pmod Shield Pin	Pmod Shield Silk Screen Number	Wi-FIRE PIC32 Signal	WF32 PIC32 Signal	uC32 PIC32 Signal
JD7	A	VREF+/CVREF+/AN28/RA10	Vref+/CVref+/PMA6/RA10	PGED1/PMA6/AN0/VREF+/CVREF+/CN2/RB0
JD8	41	VREF-/CVREF-/AN27/RA9	Vref-/CVref-/PMA7/RA9	PGC1/AN1/VREF-/CVREF-/CN3/RB1
JD9	3	RPD0/RTCC/INT0/RD0	SDO1/OC1/INT0/RD0	OC1/RD0
JD10	5	RPD1/SCK1/RD1	OC2/RD1	OC2/RD1

Header JE

Pmod Shield Pin	Pmod Shield Silk Screen Number	Wi-FIRE PIC32 Signal	WF32 PIC32 Signal	uC32 PIC32 Signal
JE1	A0	AN45/C1INA/RPB5/RB5	AN2/C2IN-/CN4/RB2	C2IN-/AN2/SS1/CN4/RB2
JE2	6	EBID14/ETXEN/RPD2/PMD14/RD2	OC3/RD2	OC3/RD2
JE3	8	AETXCLK/RPA14/SCL1/RA14	AETXCLK/SCL1/INT3/RA14	IC3/PMCS2/PMA15/INT3/RD10
JE4	A8	AN4/C1INB/RB4	AN9/C2OUT/RB9	PMA7/C2OUT/AN9/RB9
JE7	A4	AN13/C1INC/RPG7/SDA4/PMA4/RG7	AN10/CVrefout/PMA13/RB10	TCK/PMA11/AN12/RB12
JE8	9	EBID15/ETXCLK/RPD3/PMD15/RD3	OC4/RD3	OC4/RD3
JE9	35	EBIA6/AN22/RPC1/PMA6/RC1	IC4/PMCS1/PMA14/RD11	IC4/PMCS1/PMA14/INT4/RD11
JE10	A10	AN48/RPB8/PMA10/RB8	AN14/PMA1/RB14	TDI/PMA10/AN13/RB13

Header J1

Pmod Shield Pin	Pmod Shield Silk Screen Number	Wi-FIRE PIC32 Signal	WF32 PIC32 Signal	uC32 PIC32 Signal
8	JE3	RPA14/SCL1/RA14	SCL1/INT3/RA14	IC3/PMCS2/PMA15/INT3/RD10
34	JB8	SQICS1/RPD5/RD5	PMRD/CN14/RD5	PMRD/CN14/RD5
9	JE8	RPD3/PMD15/RD3	OC4/RD3	OC4/RD3
35	JE9	EBIA6/AN22/RPC1/PMA6/RC1	IC4/PMCS1/PMA14/RD11	IC4/PMCS1/PMA14/INT4/RD11
10	JB9	EBIA2/AN11/RPG9/PMA2/RG9	OC5/PMWR/CN13/RD4	PMWR/OC5/IC5/CN13/RD4
36	JB7	EBID10/RPF1/PMD10/RF1	ETXEN/PMD14/CN15/RD6	CN15/RD6

Pmod Shield Pin	Pmod Shield Silk Screen Number	Wi-FIRE PIC32 Signal	WF32 PIC32 Signal	uC32 PIC32 Signal
11 (MOSI)	JC2	RPD11/RD11	SCL4/SDO2/U3TX/PMA3/CN10/RG8	(SDO2/PMA3/CN10/RG8) or (SDI2/PMA5/CN9/RG7)
37	JB10	EBICS0/SCL2/RA2	ETXCLK/PMD15/CN16/RD7	CN16/RD7
12 (MISO)	JC3	RPF0/PMD11/RF0	SDA4/SDI2/U3RX/PMA4/CN9/RG7	(SDI2/PMA5/CN9/RG7) or (SDO2/PMA3/CN10/RG8)
38	JB4	RPD12/PMD12/RD12	T5CK/SDI1/RC4	U1RTS/BCLK1/SCK1/INT0/RF6
12 (SCK)	JC4	AN14/C1IND/ECOL/RPG6/SCK2/RG6	SCK2/U6TX/U3RTS/PMA5/CN8/RG6	SCK2/PMA5/CN8/RG6
39	JD3	AN32/RPD14/RD14	SS3/U4RX/U1CTS/CN20/RD14	PMA9/U2RX/SDA2/CN17/RF4
G		GND	GND	GND
40	JD2	AN33/RPD15/SCK6/RD15	SCK3/U4TX/U1RTS/CN21/RD15	PMA8/U2TX/SCL2/CN18/RF5
A	JD7	VREF+/CVREF+/AN28/RA10	Vref+/CVref+/AERXD3/PMA6/RA10	PGED1/PMA6/AN0/VREF+/CVREF+/CN2/RB0
41	JD8	VREF-/CVREF-/AN27/RA9	Vref-/CVref-/AERXD2/PMA7/RA9	PGC1/AN1/VREF-/CVREF-/CN3/RB1

Header J2

Pmod Shield Silk Screen Number	Wi-FIRE PIC32 Signal	WF32 PIC32 Signal	uC32 PIC32 Signal
SCL	AN12/RPG8/SCL4/PMA3/RG8	SCL2/RA2	SCL1/RG2
SDA	AN13/RPG7/SDA4/PMA4/RG7	SDA2/RA3	SDA1/RG3
GND	GND	GND	GND
VCC	VCC	VCC	VCC

Header J3

Pmod Shield Silk Screen Number	Pmod Shield Pin	Wi-FIRE PIC32 Signal	WF32 PIC32 signal	uC32 PIC32 signal
0	JB3	RPF2/SDA3/RF2	SDA3/SDI3/U1RX/RF2	U1RX/SDI1/RF2
26	JA1	EBID0/PMD0/RE0	PMD0/RE0	PMD0/RE0
1	JB2	RPF8/SCL3/RF8	SCL3/SDO3/U1TX/RF8	U1TX/SDO1/RF3
27	JA2	EBID1/PMD1/RE1	PMD1/RE1	PMD1/RE1
2	JC7	AN25/RPE8/RE8	INT1/RE8	IC1/RTCC/INT1/RD8
28	JA3	EBID2/PMD2/RE2	PMD2/RE2	PMD2/RE2
3	JD9	RPD0/RTCC/INT0/RD0	SDO1/OC1/INT0/RD0	OC1/RD0
29	JA4	EBID3/RPE3/PMD3/RE3	PMD3/RE3	PMD3/RE3

Pmod Shield Silk Screen Number	Pmod Shield Pin	Wi-FIRE PIC32 Signal	WF32 PIC32 signal	uC32 PIC32 signal
4		EBIRDY1/SDA2/RA3	ETXD0/PMD10/RF1	RF1
30	JA7	EBID4/AN18/PMD4/RE4	PMD4/RE4	PMD4/RE4
5	JD10	RPD1/SCK1/RD1	OC2/RD1	OC2/RD1
31	JA8	EBID5/AN17/RPE5/PMD5/RE5	PMD5/RE5	PMD5/RE5
6	JE2	RPD2/PMD14/RD2	OC3/RD2	OC3/RD2
32	JA9	EBID6/AN16/PMD6/RE6	PMD6/RE6	PMD6/RE6
7	JB1	AN26/RPE9/RE9	INT2/RE9	IC2/U1CTS/INT2/RD9
33	JA10	EBID7/AN15/PMD7/RE7	PMD7/RE7	PMD7/RE7

Header J4

Pmod Shield Silk Screen Number	Pmod Shield Pin	Wi-FIRE PIC32 Signal	WF32 PIC32 signal	uC32 PIC32 signal
A0	JE1	AN45/C1INA/RPB5/RB5	AN2/C2IN-/CN4/RB2	C2IN-/AN2/SS1/CN4/RB2
A6	JC10	AN3/C2INA/RPB3/RB3	AN3/C2IN+/CN5/RB3	C2IN+/AN3/CN5/RB3
A1	JC9	EBIA7/AN49/RPB9/PMA7/RB9	AN4/C1IN-/CN6/RB4	C1IN-/AN4/CN6/RB4
A7	JC8	AN2/C2INB/RPB2/RB2	AN5/C1IN+/VBUSON/CN7/RB5	C1IN+/AN5/CN7/RB5
A2	JD1	EBIA12/AN21/RPC2/PMA12/RC2	AN8/C1OUT/RB8	U2CTS/C1OUT/AN8/RB8
A8	JE4	AN4/C1INB/RB4	AN9/C2OUT/RB9	PMA7/C2OUT/AN9/RB9
A3		EBIA0/AN10/RPB15/OCFB/PMA0/RB15	PGED1/AN0/CN2/RB0	TMS/CVREFOUT/PMA13/AN10/RB10
A9		PGEC1/AN1/RPB1/RB1	PGEC1/AN1/CN3/RB1	TDO/PMA12/AN11/RB11
A4	JE7	EBIA4/AN13/RPG7/SDA4/PMA4/RG7	AN10/CVrefout/PMA13/RB10	TCK/PMA11/AN12/RB12
A10	JE10	AN48/RPB8/PMA10/RB8	AN14/PMA1/RB14	TDI/PMA10/AN13/RB13
A5	JD4	EBIA3/AN12/RPG8/SCL4/PMA3/RG8	AN11/PMA12/RB11	PMALH/PMA1/U2RTS/AN14/RB14
A11	Pmod Shield Pin	PGED1/AN0/RPB0/RB0	AN15/PMALL/PMA0/CN12/RB15	PMALL/PMA0/AN15/OCFB/CN12/RB15

Header J5

Pin Function	Pmod Shield Pin	Wi-FIRE PIC32 Signal	WF32 PIC32 signal	uC32 PIC32 signal
Not Connected	J5-1			
IOREF	J5-2	3.3 V	3.3 V	3.3 V
RST	J5-3	P32_RST	P32_RST	P32_RST
3v3	J5-4	3.3 V	3.3 V	3.3 V
5V0	J5-5	5.0 V	5.0 V	5.0 V
GND	J5-6	GND	GND	GND

Pin Function	Pmod Shield Pin	Wi-FIRE PIC32 Signal	WF32 PIC32 signal	uC32 PIC32 signal
GND	J5-7	GND	GND	GND
VIN	J5-8	VIN	VIN	VEXT

Header J6

Pin Function	Pmod Shield Pin	Wi-FIRE PIC32 Signal	WF32 PIC32 signal	uC32 PIC32 signal
MISO	J6-1 (JC3)	RPF0/PMD11/RF0	SDA4/SDI2/U3RX/PMA4/CN9/RG7	(SDI2/PMA5/CN9/RG7) or (SDO2/PMA3/CN10/RG8)
	J6-2			
MOSI	J6-3 (JC2)	RPD11/RD11	SCL4/SDO2/U3TX/PMA3/CN10/RG8	(SDO2/PMA3/CN10/RG8) or (SDI2/PMA5/CN9/RG7)
SCK	J6-4 (JC4)	AN14/C1IND/ECOL/RPG6/SCK2/RG6	SCK2/U6TX/U3RTS/PMA5/CN8/RG6	SCK2/PMA5/CN8/RG6
10?	J6-5 (JB9)	EBIA2/AN11/RPG9/PMA2/RG9	OC5/PMWR/CN13/RD4	PMWR/OC5/IC5/CN13/RD4
	J6-6	GND	GND	GND

Header J7

Pmod Shield Silk Screen Number	Wi-FIRE PIC32 Signal	WF32 PIC32 signal	uC32 PIC32 signal
SCL	AN12/RPG8/SCL4/PMA3/RG8	SCL2/RA2	SCL1/RG2
SDA	AN13/RPG7/SDA4/PMA4/RG7	SDA2/RA3	SDA1/RG3