

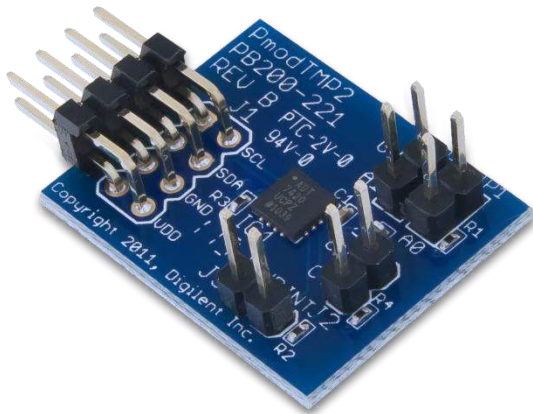
## PmodTMP2™ Reference Manual

Revised May 24, 2016

This manual applies to the PmodTMP2 rev. B

### Overview

The PmodTMP2 is an ambient temperature sensor powered by the [Analog Devices® ADT7420](#). Through the I<sup>2</sup>C interface, users may appreciate a resolution of 0.0078°C through 16 bits of data.



The PmodTMP2.

Features include:

- 16-bit ambient temperature sensor
- Typical accuracy better than 0.25°C
- 240 ms continuous conversion time
- Programmable over and under-temperature control pins
- No calibration required
- Small PCB size for flexible designs 1.0" × 0.8" (2.5 cm × 2.0 cm)
- 2×4-pin connector with I<sup>2</sup>C interface
- Follows [Digilent Pmod Interface Specification](#)
- Library and example code available in [resource center](#)

## 1 Functional Description

The PmodTMP2 uses an 8-pin connector that allows for communication via I<sup>2</sup>C, and provides pins to daisy-chain the PmodTMP2 to other I<sup>2</sup>C devices. The PmodTMP2 also provides two 2-pin headers for selecting the I<sup>2</sup>C address of the chip, and two 2-pin headers for controlling external devices based upon temperature thresholds defined by the user in software.

## 2 Interfacing with the Pmod

The PmodTMP2's onboard ADT7420 chip acts as a slave device using the industry standard I<sup>2</sup>C communication scheme. To communicate with the PmodTMP2 device the I<sup>2</sup>C master device must specify a slave address (0x48-0x4B) and a flag indicating whether the communication is a read (1) or a write (0). This is followed by the actual data transfer. For the ADT7420, the data transfer should consist of the address of the desired device register followed by the data to be written to the specified register. To read from a register the master must write the desired register address to ADT7420, then send an I<sup>2</sup>C restart condition, and send a new read request to the

ADT7420. If the master does not generate a restart condition prior to attempting the read, then the value written to the address register will be reset to 0x00.

As some registers stored 16-bit values as 8-bit register pairs, the ADT7420 will automatically increment the address register of the device when accessing certain registers such as the temperature registers and the threshold registers. This allows for the master to use a single read or write request to access both the low and high bytes of these registers. A complete listing of registers and their behavior can be found in the ADT7420 datasheet available on the Analog Devices web site.

Connector J1 – I2C Communications		
Pin	Signal	Description
1, 2	SCL	I2C Clock
3, 4	SDA	I2C Data
5, 6	GND	Power Supply Ground
7, 8	VCC	Power Supply (3.3V/5V)

Table 1. Interface connector signal description.

Header J1			Jumper Blocks		
Pin	Signal	Description	Jumper Block	State	Description
1 & 5	SCL	Serial Clock	JP1	Open/Shorted	Address bit 0 high/low
2 & 6	SDA	Serial Data	JP2	Open/Shorted	Address bit 1 high/low
3 & 7	GND	Power Supply Ground	User Outputs		
4 & 8	VCC	Positive Power Supply	Header Name	Pin Name	Description
			J2	CT	Critical Threshold Output
			J3	INT	Interrupt Output

Table 2. Pinout description table.

The I<sup>2</sup>C interface standard uses two signal lines. These are I<sup>2</sup>C data and I<sup>2</sup>C clock. These signals map to the serial data (SDA) and serial clock (SCL) respectively on the ADT7420.

Addresses		
JP2	JP1	Address
Open	Open	0x4B (0b1001011)
Open	Shorted	0x4A (0b1001010)
Shorted	Open	0x49 (0b1001001)
Shorted	Shorted	0x48 (0b1001000)

Table 3. I2C address selection.

The PmodTMP2 I<sup>2</sup>C bus can be set to use one of four valid addresses. The top five bits of the address are fixed, and the two least significant bits are taken from the jumper states of JP2 and JP1. JP2 corresponds to bit one of the address while JP1 corresponds to bit zero. An open jumper corresponds to a one in the address while a shorted jumper corresponds to a zero. For example, when JP2 and JP1 are open the device uses the address 0x4B (0b1001011).

## 2.1 Open Drain Outputs

The PmodTMP2 provides two open drain output headers for controlling external devices based upon current temperature thresholds. If the temperature leaves a range defined by registers  $T_{LOW}$  (0x06:0x07) and  $T_{HIGH}$  (0x04:0x05) then the INT pin on J3 can be driven low or high based upon the configuration of the device. Similarly, the CT pin on J2 can be driven low or high if the temperature exceeds a critical threshold defined in  $T_{CRIT}$  (0x08:0x09). Both of these pins are pulled up by 10KOhm resistors when they are not driven by the device. For details on their electrical specifications and configuration of the INT and CT pins please refer to the ADT7420 datasheet.

## 2.2 Quick Start Operation

When the PmodTMP2 is powered up, the onboard ADT7420 is in a mode that can be used as a simple temperature sensor without any initial configuration. By default, the device address register points to the temperature MSB register, so a two byte read without specifying a register will read the value of the temperature register from the device. The first byte read back will be the most significant byte (MSB) of the temperature data, and the second will be the least significant byte (LSB) of the data. These two bytes form a two's complement 16-bit integer, if the result is shifted to the right three bits and multiplied by 0.0625 the resulting signed floating point value will be a temperature reading in degrees Celsius.

For information on reading and writing to the other registers of the device, as well as notes on the accuracy of the temperature measurements please refer to the ADT7420 datasheet.