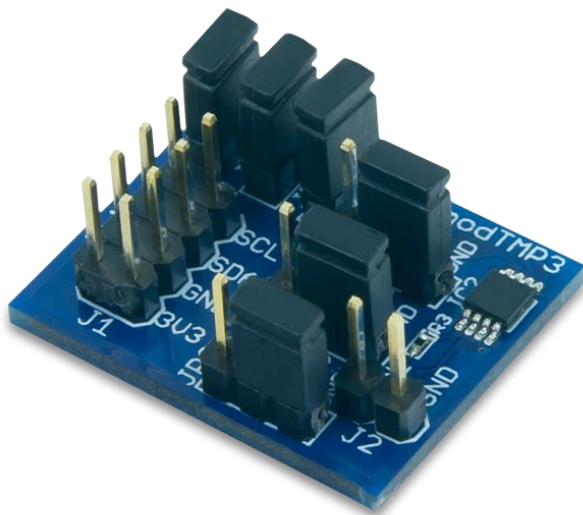# PmodTMP3™ Reference Manual

Revised April 8, 2016
This manual applies to the PmodTMP3 rev. A

Overview

The Digilent PmodTMP3 is a temperature sensor built around the Microchip TCN75AVUA.

Features include:

- Ambient temperature sensor with up to 12-bit resolution
- Typical accuracy of ±1 °C
- Programmable temperature alert pin
- Multiple jumpers for eight selectable addresses
- 30ms to 240ms typical conversion times
- Small PCB size for flexible designs 1.0" × 0.8" (2.54 cm × 2.0 cm)
- 2×4-pin port with I2C interface
- Follows Digilent Pmod Interface Specification

PmodTMP3

1 Functional Description

The PmodTMP3 uses an 8-pin connector that allows for communication via I^2C and provides pins to daisy-chain the PmodTMP3 to other I^2C devices. The PmodTMP3 also provides three 3-pin headers for selecting the I^2C address of the chip, and one 2-pin header for controlling external devices based upon temperature thresholds defined by the user in software. Temperature data measured by the device is formatted in two's compliment and may be programmed for a resolution of 9-bits to 12-bits through the configuration register on the TCN75AVUA.

2   I²C Interface

The TCN75AVUA on the PmodTMP3 acts as a slave device using I²C serial communication. To communicate with the PmodTMP3, the master device must specify a slave address (0x48-0x4F) 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 TCN75AVUA, 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 TCN75AVUA, then send an I2C restart condition, and send a read request to the TCN75AVUA.

Pin	Signal	Description
1, 2	SCL	I²C Clock
3, 4	SDA	I²C Data
5, 6	GND	Power Supply Ground
7, 8	3V3	Power Supply (3.3V)

Table 1. I2C interface connector signal description.

The I²C interface standard uses two signal lines. These are I²C data (SDA) and I²C clock (SCL). On the TCN75AVUA, both SDA and SCL are open-drain pins. For communication to be established, these pins must be connected to pull-up resistors. The PmodTMP3 has selectable pull-up resistors on jumpers JP4 and JP5. If the master device used to communicate with the PmodTMP3 does not have pull-up resistors on the SDA and SCL signals, both JP4 and JP5 must be shorted to establish communication via I²C. If the master device already has pull-up resistors, these jumpers may remain open.

JP4	JP5	Pull-Up State
Open	Open	Pull-ups disabled
Shorted	Shorted	Pull-ups enabled

Table 2. I²C Pull-up jumper settings.

3   I²C Address Selection

The PmodTMP3 I²C bus can be set to use one of eight valid addresses. The top four bits of the address are fixed, and the three least significant bits are specified by the states of jumpers JP1, JP2 and JP3. JP1 corresponds to bit zero of the address, JP2 corresponds to bit one of the address, and JP3 corresponds to bit two of the address. The address is set by shorting the AX pin on the PmodTMP3 (where X is the bit number) with either 3V3 or GND. Shorting a jumper in the GND position corresponds to a zero while shorting a jumper in the 3V3 position corresponds to a one.

JP3	JP2	JP1	Address
GND	GND	GND	0x48 (0b1001000)
GND	GND	3V3	0x49 (0b1001001)
GND	3V3	GND	0x4A (0b1001010)
GND	3V3	3V3	0x4B (0b1001011)
3V3	GND	GND	0x4C (0b1001100)
3V3	GND	3V3	0x4D (0b1001101)
3V3	3V3	GND	0x4E (0b1001110)
3V3	3V3	3V3	0x4F (0b1001111)

Table 3. Addresses.

4   Pinout Description Table

Header J1		
Pin	Signal	Description
1 & 5	SCL	Serial Clock
2 & 6	SDA	Serial Data
3 & 7	GND	Power Supply Ground
4 & 8	3V3	Positive Power Supply

Header J2		
Pin	Signal	Description
1	AL	Alert Pin
2	GND	Power Supply Ground

Jumper Blocks		
Jumper Block	State	Description
JP1	3V3/GND	Address bit 1 high/low
JP2	3V3/GND	Address bit 2 high/low
JP3	3V3/GND	Address bit 3 high/low
JP4	Enabled	SDA pull-up enabled
JP5	Enabled	SCL pull-up enabled
JP6	Enabled	Alert pull-up enabled

5   Open Drain Output

The PmodTMP3 provides a single open-drain header for controlling external devices based on current temperature thresholds. When the ambient temperature surpasses the value contained in the T_{SET} register, an alert can be signaled on the AL pin of header J2. The alert may be active low or high based upon the configuration of the device and the state of JP6. Shorting JP6 pulls up the AL pin by a 2.2kOhm resistor when it is not driven by the device. The alert signal may be configured to act as a comparator output or as an interrupt.

6   Quick Start Operation

When the PmodTMP3 is powered up, the onboard TCN75AVUA is in a mode that may be used as a temperature sensor without any initial configuration. The default mode of operation provides a continuous conversion, 9-bit resolution, and an active-low, comparator output alert. On power-up, the TCN75AVUA register pointer points to the Temperature register, so a two byte read without specifying a register will read the value of the temperature from the device from most significant byte (MSB) to least significant byte (LSB). For 9-bit resolution, the temperature in degrees Celsius may be calculated as a floating point value by shifting the temperature register data to the right seven bits and multiplying by 0.5.

For more information on the TCN75AVUA and reading or writing to other registers on the device, please refer to the TCN75AVUA datasheet available at www.microchip.com.