

# UM10751

## OM13488 8-bit GPIO Daughter Card User Manual

Rev. 1.0 — 11 October 2013

User manual

### Document information

Info	Content
<b>Keywords</b>	Fm+ Development Kit, OM13320, GPIO, OM13303
<b>Abstract</b>	Installation guide and User Manual for the OM13488 8-bit GPIO Daughter Card that connects to OM13320 Fm+ Development Kit. This board permits easy and simple evaluation of most of NXP's 8-bit I <sup>2</sup> C GPIO portfolio of products.



**Revision history**

Rev	Date	Description
1.0	20131011	Initial Release

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## 1. Introduction

The OM13488 8-bit I<sup>2</sup>C GPIO Daughter Card connects to the OM13320 Fm+ Development kit and permits easy evaluation of most of NXP's 8-bit I<sup>2</sup>C GPIO portfolio of products.

[Table 1](#) lists the supported devices.

The OM13488 8-bit I<sup>2</sup>C GPIO Daughter Card is shipped with no GPIO device soldered to the board. The user must purchase the device he is interested in evaluating in a TSSOP16 package (the ordering part number suffix should be "PW" and the package designation should be SOT403-1). These leaded packages should be relatively easy to solder to the board with a low wattage, fine tipped soldering iron.

**Table 1. Devices Supported by OM13488 8-bit I<sup>2</sup>C GPIO Daughter Card**

Device	Description	Orderable Part Number
PCA6408A	Low-voltage, 8-bit I <sup>2</sup> C-bus and SMBus I/O expander with interrupt output, reset, and configuration registers	PCA6408APW
PCA8574A	Remote 8-bit I/O expander for I <sup>2</sup> C-bus with interrupt	PCA8574APW
PCA8574	Remote 8-bit I/O expander for I <sup>2</sup> C-bus with interrupt	PCA8574PW
PCA9534	8-bit I <sup>2</sup> C-bus and SMBus low power I/O port with interrupt	PCA9534PW
PCA9538A	Low-voltage 8-bit I <sup>2</sup> C-bus I/O port with interrupt and reset	PCA9538APW
PCA9538	8-bit I <sup>2</sup> C-bus and SMBus low power I/O port with interrupt and reset	PCA9538PW
PCA9554A	8-bit I <sup>2</sup> C-bus and SMBus I/O port with interrupt	PCA9554APW
PCA9554B	Low-voltage 8-bit I <sup>2</sup> C-bus and SMBus low power I/O port with interrupt, weak pull-up	PCA9554BPW
PCA9554C	Low-voltage 8-bit I <sup>2</sup> C-bus and SMBus low power I/O port with interrupt, weak pull-up	PCA9554CPW
PCA9554	8-bit I <sup>2</sup> C-bus and SMBus I/O port with interrupt	PCA9554PW
PCA9670	Remote 8-bit I/O expander for Fm+ I <sup>2</sup> C-bus with reset	PCA9670PW
PCA9672	Remote 8-bit I/O expander for Fm+ I <sup>2</sup> C-bus with interrupt and reset	PCA9672PW
PCA9674A	Remote 8-bit I/O expander for Fm+ I <sup>2</sup> C-bus with interrupt	PCA9674APW
PCA9674	Remote 8-bit I/O expander for Fm+ I <sup>2</sup> C-bus with interrupt	PCA9674PW
PCAL6408A	Low-voltage translating, 8-bit I <sup>2</sup> C-bus/SMBus I/O expander with interrupt output, reset,	PCAL6408APW

Device	Description	Orderable Part Number
PCAL9538A	and configuration registers Low-voltage 8-bit I <sup>2</sup> C-bus and SMBus low power I/O port with interrupt, reset and Agile I/O	PCAL9538APW
PCAL9554B	Low-voltage 8-bit I <sup>2</sup> C-bus/SMBus low power I/O port with interrupt, weak pull-up and Agile I/O	PCAL9554BPW
PCAL9554C	Low-voltage 8-bit I <sup>2</sup> C-bus/SMBus low power I/O port with interrupt, weak pull-up and Agile I/O	PCAL9554CPW
PCF8574	Remote 8-bit I/O expander for I <sup>2</sup> C-bus with interrupt	PCF8574PW
PCF8574A	Remote 8-bit I/O expander for I <sup>2</sup> C-bus with interrupt	PCF8574APW

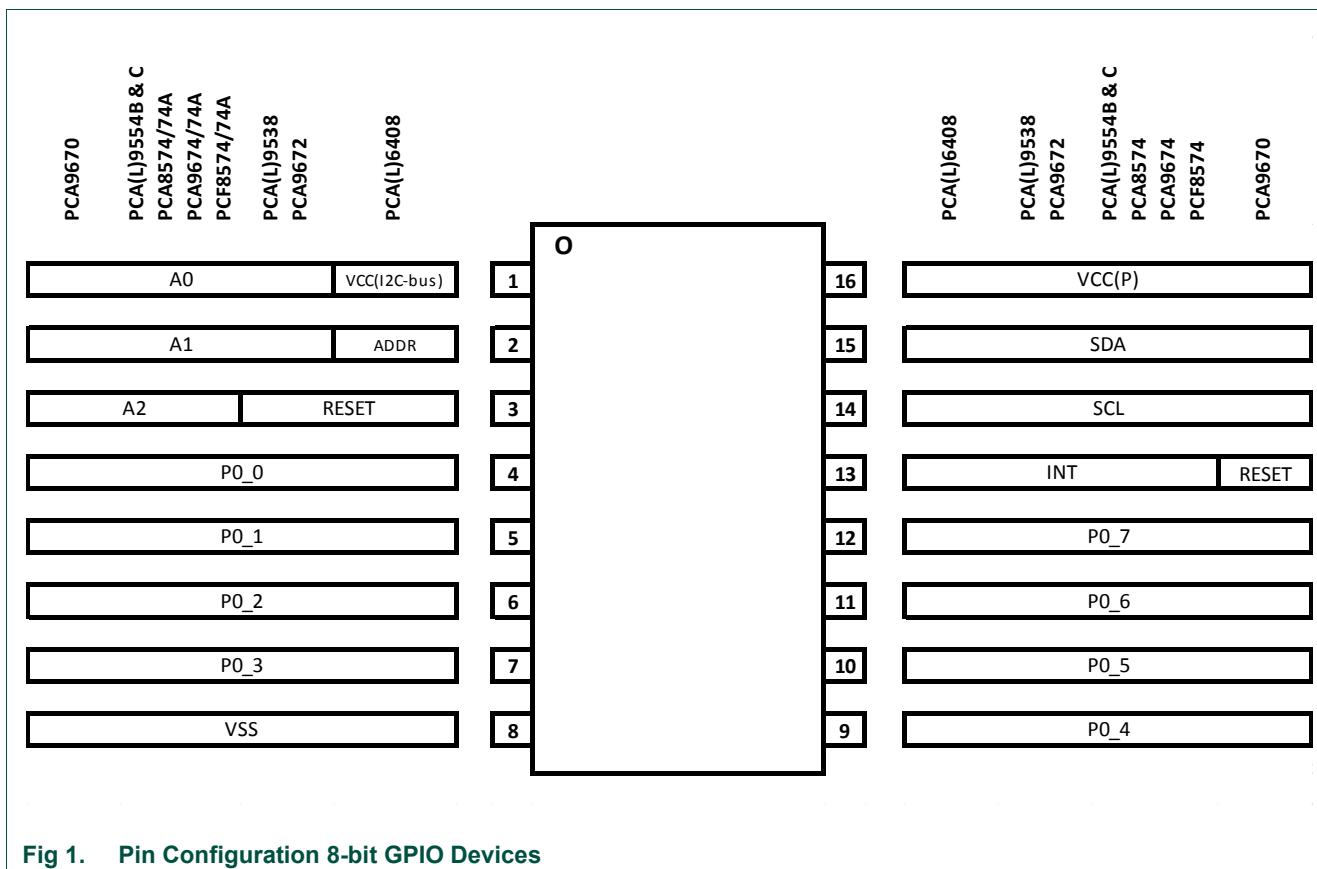
The pin configuration of these devices varies only a bit and the different pin selections are made via jumpers.

## 2. Features of the OM13488 8-bit GPIO Daughter Card

- Direct connection to OM13320 Fm+ Development kit
- Footprint for a TSSOP16 package, user solderable
- Jumper configuration accommodates most NXP 8-bit GPIO
- Flexible power supply configuration: 3.3V, 5V or external supply
- Direct connection to OM13303 GPIO Target board for I/O visualization
- Jumper configuration of device I<sup>2</sup>C address
- LED indicators for power and INT
- Scope ground connection loop

## 3. Pin Configuration of 8-bit GPIO Devices

The different 8-bit GPIO devices pin configurations differ only slightly between devices. See Fig 1 for a description of the different pinouts.



### 3.1 Power Supply Setup

Power supply voltages may be selected from the tester connector CN4 or the Fm+ board CN2. If one selects Fm+ CN2, either 3.3V or 5V can be chosen. Additionally, the PCA(L)6408 device implements two power supplies which are separately chosen, i.e. one can be 3.3V and the other 5V for voltage level translation evaluation. Both of these power supplies can be supplied externally by using TP1 and TP2 near the tester connector CN4. See the schematic section at the end of this document for more details.

The jumpers for power supply selection are JP2, JP3, and JP4

### 3.2 Reset, Interrupt, and Address pins selection

The Reset, Interrupt and Address pins are used in combinations on various devices. The selection matrix on the 8-bit GPIO board sends pins 2, 3, and 13 to determine if the pins are address or function on JP9, JP10, and JP11. Then, if they are determined address pins, JP1, JP7 and JP8 tie them to logic high or low. If they are determined to be function pins, the other position of JP9, JP10 and JP11 tie them to the correct connector function pins. See the schematic section at the end of this document for more details.

The logic high level for the address pins is VDDP.

## 4. Board Jumper Set Up

### 4.1 Power Supply Jumpers

The power supply selections for the OM13488 is very flexible and allows for detailed analysis and evaluation of all the NXP 8-bit GPIO devices. JP3 labeled PWR selects between 5V supplied from the tester connector CN4 (jumper between pin 2 and 3 labeled TSTR) and the Fm+ board connector CN2 (jumper between pin 1 and 2). If 3.3V or external power operation is desired, no jumper is required.

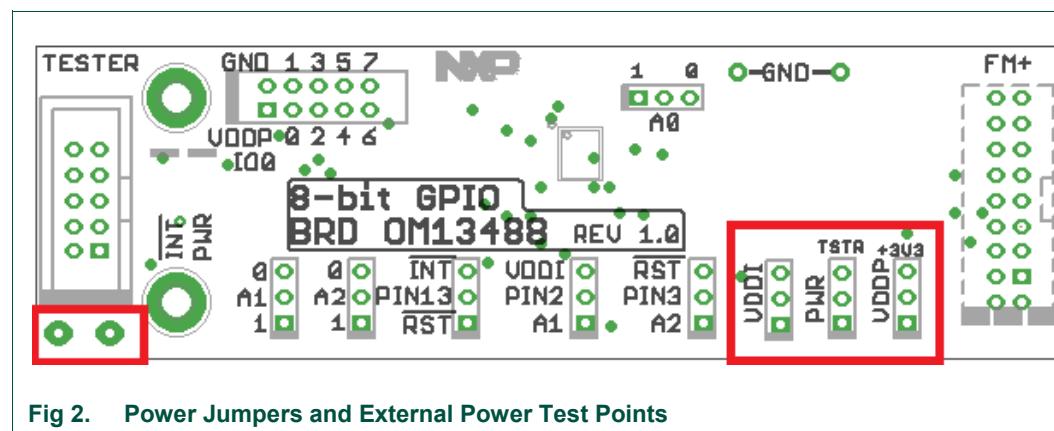
JP2 selects between 5V and 3.3V for a second power supply needed for PCA(L)6408A. If the device under test is not PCA(L)6408A, leave this jumper open.

JP4 selects between 5V and 3.3V for the main power supply on pin 16 of the device under test. Add a jumper between pins 2 & 3 for 3.3V or 1 & 2 for 5V.

For external power supply operation, do not jumper JP2, JP3 and JP4 and connect a voltage source to TP2 for the main power supply connected to pin 16 of the device under test.

Connect another external voltage source to TP1 if the device under test is PCA(L)6408A.

See the schematic section at the end of this document for more details.

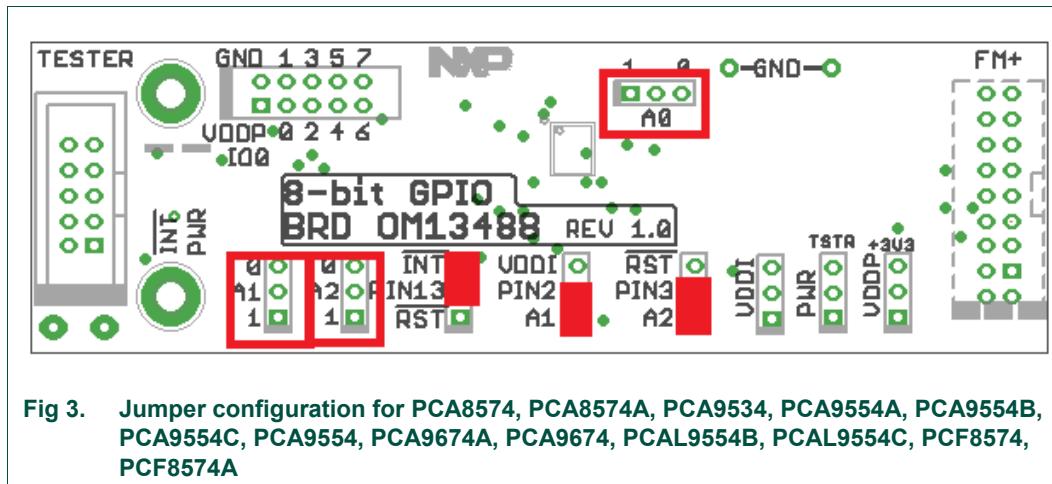


### 4.2 PCA8574, PCA8574A, PCA9534, PCA9554A, PCA9554B, PCA9554C, PCA9554, PCA9674A, PCA9674, PCAL9554B, PCAL9554C, PCF8574, PCF8574A

The PCA8557/A, PCA9534, PCA(L)5554x, PCA9674/A implement three address pins and INT. This configuration ignores the power supply setup, but normally, only JP4 with a jumper between pins 2 & 3 need be applied to power the device at 3.3V.

To configure the function pins, apply jumpers between pins 1 & 2 on JP10 and JP11 to configure device pin 2 and pin 3 as addresses. Apply a jumper between pins 2 & 3 on JP9 to configure device pin 13 as INT.

Then, apply jumpers to JP1, JP7 and JP8 to configure the desired I<sup>2</sup>C address. Logic high or logic low is labeled on the board.

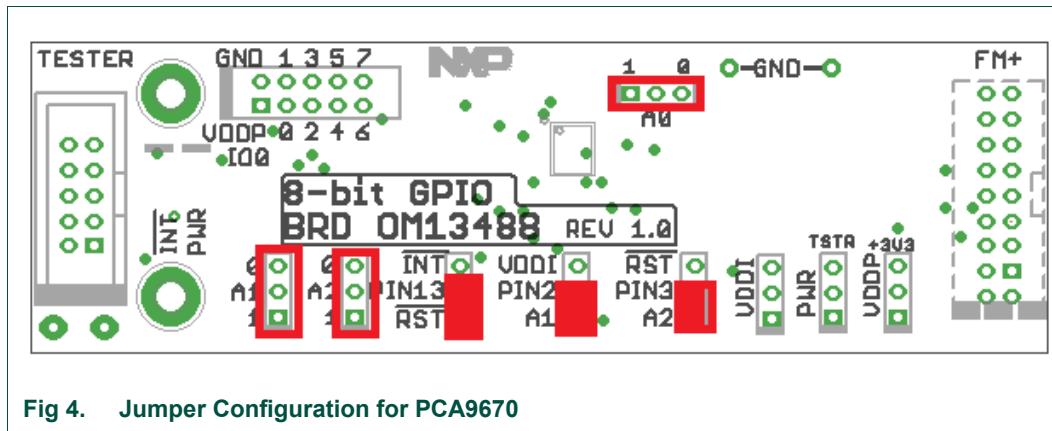


### 4.3 PCA9670

The PCA9670 implements three address pins and  $\overline{RST}$ . This configuration ignores the power supply setup, but normally, only JP4 with a jumper between pins 2 & 3 need be applied to power the device at 3.3V.

To configure the function pins, apply jumpers between pins 1 & 2 on JP9, JP10 and JP11 to configure pin 2 and pin 3 as addresses and pin 13 as  $\overline{RST}$ .

Then, apply jumpers to JP1, JP7 and JP8 to configure the desired I<sup>2</sup>C address. Logic high or logic low is labeled on the board.

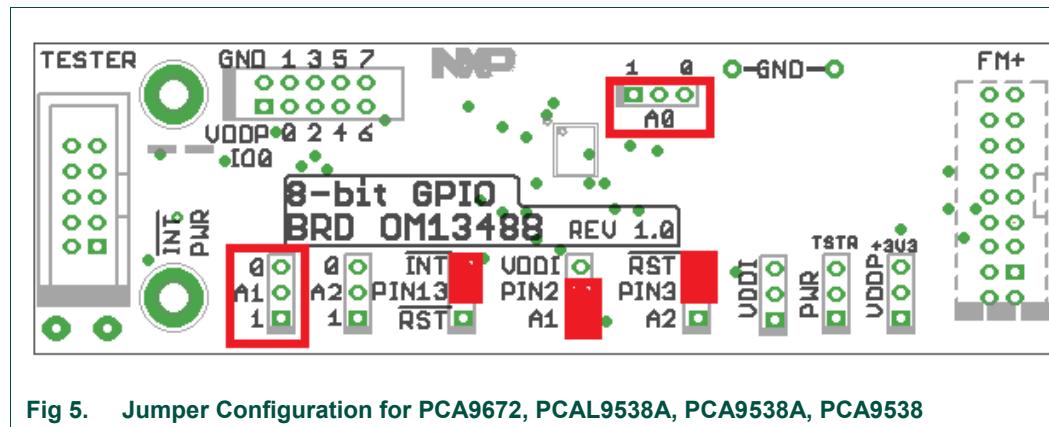


### 4.4 PCA9672, PCAL9538A, PCA9538A, PCA9538

The PCA9672 and PCA9538 series implement two address pins,  $\overline{RST}$  and  $\overline{INT}$ . This configuration ignores the power supply setup, but normally, only JP4 with a jumper between pins 2 & 3 need be applied to power the device at 3.3V.

To configure the function pins, apply jumpers between pins 2 & 3 on JP9 and JP11 to configure device pin 3 as RST and pin 13 as INT. Apply a jumper between pins 1 & 2 on JP10 to configure device pin 2 as an address.

Then, apply jumpers to JP1 and JP7 to configure the desired  $I^2C$  address. Logic high or logic low are labeled on the board. Leave JP8 open.



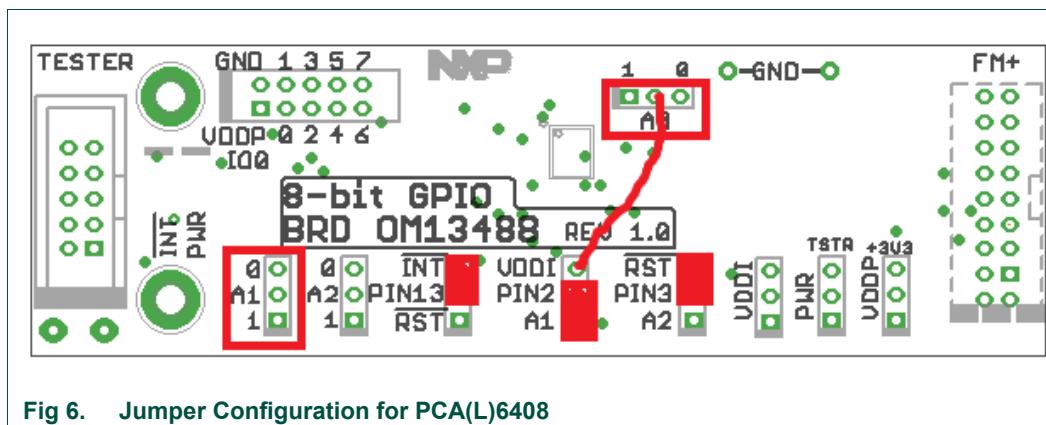
#### 4.5 PCAL6408A, PCA6408A

The PCA(L)6408A devices are level translating, Agile I/O Expanders with two power supplies, one address pin, RST and INT. The two power supplies may operate at different voltages to translate from the  $I^2C$ -bus voltage domain to a higher or lower I/O voltage. JP2 and JP4 may be set to the same or different voltages, or left open and external voltage sources connected to TP1 and TP2. Unfortunately, there is a slight labeling issue on this board. Device pin 1 is the VDDI power supply and is permanently connected to JP2 which selects between VDDP and ground. Use a wire to jumper between pin 2 of JP1 to pin 3 of JP10 which is the board VDDI. See the datasheet for more details on voltage level translation.

**Note** that the 10K pull up resistors SDA and SCL, R5 and R6, are connected to VDDP which may cause incorrect current readings if two different supplies are used.

To configure the function pins, apply jumpers between pins 2 & 3 on JP9 and JP11 to configure device pin 3 as RST and device pin 13 as INT.

There is a slight labeling issue on this board. Device pin 2 is the only address pin and JP10 should jumper pins 1 and 2 to route the address to JP7 (A1 instead of A0). Then, apply a jumper to JP7 to configure the desired  $I^2C$  address. Logic high or logic low are labeled on the board. Leave JP8 open.



## 5. Connector Pinouts

### 5.1 CN1 GPIO Target Board Connector

The OM13303 GPIO Target Board consists of eight LEDs and eight switches and connects directly to the 8-bit GPIO board through CN1. The switches and LEDs permit easy exercise of the I/O functionality of the device under test. The LEDs light red when the voltage on that channel is below  $VCC \times 0.3V$  and lights green when the voltage is above  $VCC \times 0.7V$ . The LEDs remain off when the voltage is between those two levels.

Table 2. CN1 GPIO Target Board Connector Pinout

CN1 Pin Number	Function	Board Connection
1	VDD	VDDP
2	Ground	GND
3	IO0	U1 pin 4
4	IO1	U1 pin 5
5	IO2	U1 pin 6
6	IO3	U1 pin 7
7	IO4	U1 pin 9
8	IO5	U1 pin 10
9	IO6	U1 pin 11
10	IO7	U1 pin 12

### 5.2 CN2 Fm+ Development Board Connector

The OM13488 can connect directly to the OM13320 Fm+ Development kit via CN2. This connector provides power, I<sup>2</sup>C signals and other ancillary signals.

**Note:** The connector on the Fm+ board is a male, shrouded 14 pin type, while the connector on the GPIO board is female, 18 pin.. The reason lies with the shroud around the 14 pin connector. To ensure correct mating of the female with the male, two pin positions on both of the female sides are unused.

**Table 3. CN2 Fm+ Board Connector**

CN2 Pin Number	Function	Board Connection
1	—	No connect
2	—	No connect
3	SCL	SCL Bus 1 to U1 pin 14
4	SDA2	SDA Bus 2 not used
5	INT	Interrupt to INT LED and JP9 pin 3
6	RESET	JP9 pin 1, JP11 pin 3
7	+5V	JP3 pin 1
8	+3.3V	JP2 pin 3 and JP4 pin 3
9	GND	
10	GND	
11	+3.3V	JP2 pin 3 and JP4 pin 3
12	+5V	JP3 pin 1
13	RESET	JP9 pin 1, JP11 pin 3
14	INT	Interrupt to INT LED and JP9 pin 3
15	SDA	SDA Bus 1 to U1 pin 15
16	SCL2	SCL Bus 2 not used
17	—	No connect
18	—	No connect

### 5.3 CN4 Tester Connector

Generation, inspection and logging of I<sup>2</sup>C-Bus data is easily achieved with third party development tools from Total Phase ([www.totalphase.com](http://www.totalphase.com)). There are two tools called Aardvark and Beagle that direct connect to this board through CN4.

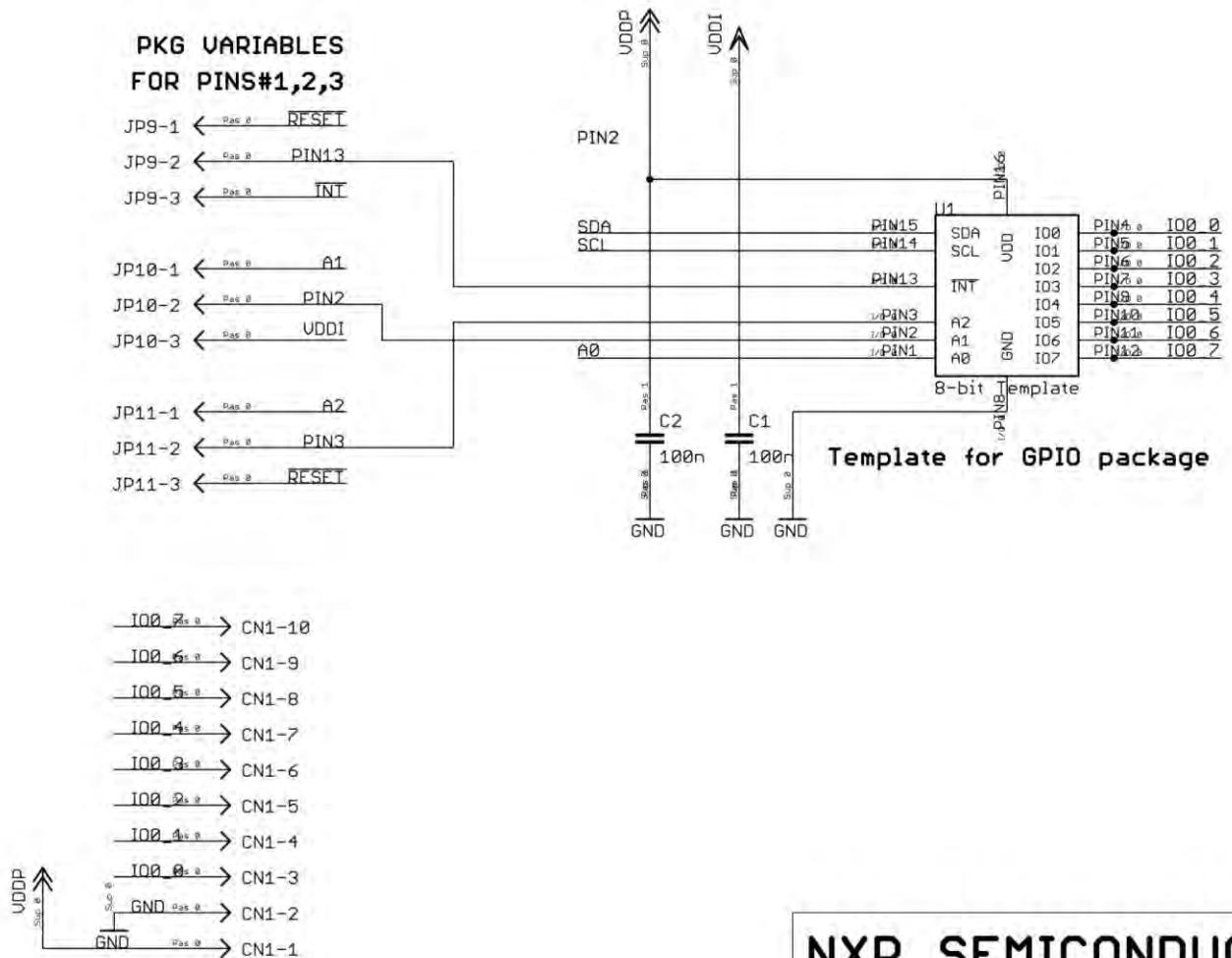
**Note:** Since SDA and SCL are both connected to the device under test, the Aardvark and the Fm+ Development board cannot be used simultaneously. The Beagle, a bus sniffer, does not have any issues.

**Table 4. CN4 Tester Connector**

CN4 Pin Number	Function	Board Connection
1	SCL	U1 pin 14
2	Ground	
3	SDA	U1 pin 15
4	+5V	JP3 pin 3
5	+5V	JP3 pin 3
6	+5V	JP3 pin 3
7	—	
8	—	
9	—	
10	Ground	

PKG VARIABLES  
FOR PINS#1,2,3

JP9-1	↓ DAS 8	RESET
JP9-2	↓ DAS 8	PIN13
JP9-3	↓ DAS 8	INT
JP10-1	↓ DAS 8	A1
JP10-2	↓ DAS 8	PIN2
JP10-3	↓ DAS 8	VDD1
JP11-1	↓ DAS 8	A2
JP11-2	↓ DAS 8	PIN3
JP11-3	↓ DAS 8	RESET



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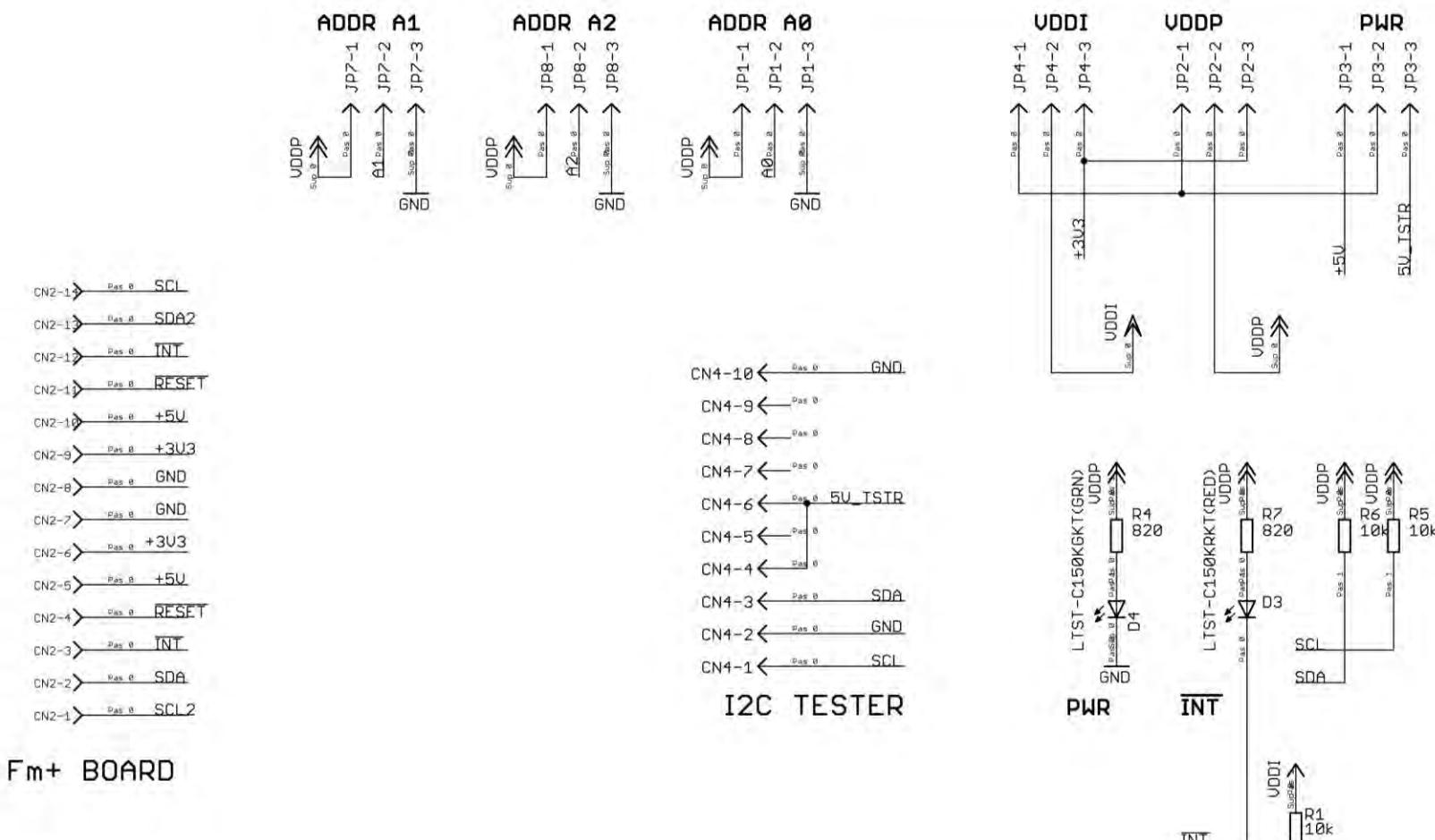
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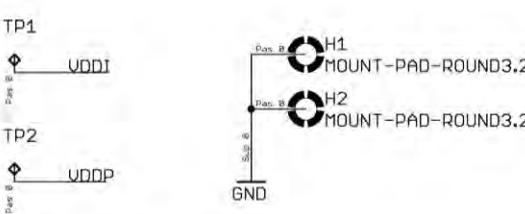
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## Fm+ BOARD



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