

## Evaluating the **ADuCM350** 16-Bit, Precision, Low Power Meter-on-a-Chip

### FEATURES

**ADuCM350** motherboard

Selection of daughter boards for analog front end and platform validation

3 power supply options: 2.5 V to 3.6 V from an external power supply, 5 V from interface/emulator board, or CR2032 battery connection

Interface options

UART and serial wire through 8-pin J-Link OB connector

Trace capability

Power indicator/general-purpose LEDs

Reset, download, and external interrupt push-buttons

Supercapacitor and thermistor capability

USB connectivity

8-pin connector to the interface/emulator board

Access to **ADuCM350** platform pins through Digital Header 1, Digital Header2, and CapTouch header

32.768 kHz external crystal and 16 MHz external crystal

### EVALUATION KIT CONTENTS

**EVAL-ADuCM350EBZ** board

USB-SWD/UART-EMUZ, also known as J-Link OB emulator

AFE daughter boards: **ADuCM350** switch mux configuration board, **ADuCM350** 4-wire bio Configuration 2 board

**ADuCM350** breakout board

**ADuCM350** GPIO test header board

USB cable

### ADDITIONAL EQUIPMENT AND SOFTWARE NEEDED

Evaluation software for the **ADuCM350** (download from the [ADuCM350 design resources](#) page)

Extra peripheral boards available for order: **Ev-ADuCM350AUDZ**, **Ev-ADuCM350DISZ**

See the [ADuCM350 design resources](#) page for more details

### SYSTEM REQUIREMENTS

Minimum requirement to run examples and applications

PC with USB 2.0 controller connection and 1 free COM port

Windows XP SP3 or later, Windows Vista, or Windows 7 or later

### ONLINE RESOURCES

Documents Needed

[ADuCM350](#) data sheet

[ADuCM350](#) hardware reference manual

[AN-1262](#), [AN-1263](#), [AN-1271](#), [AN-1281](#), [AN-1286](#),

[AN-1293](#), [AN-1302](#) application notes

[ADuCM350](#) software development kit quick start guide ([UG-677](#))

Required Software

[ADuCM350](#) software development kit (firmware/debug environment)

IAR Embedded Workbench for ARM (from Version 7.10+)

[ADuCM350](#) evaluation kit software platform (GUI software)

Design and Integration Files

[Schematics](#), [layout files](#), [bill of materials](#)

### TYPICAL SETUP

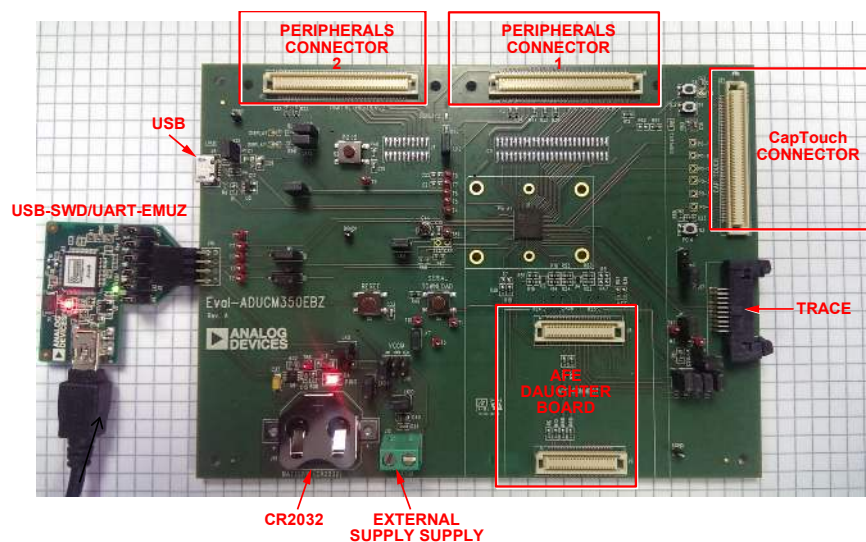


Figure 1. Typical Setup (USB-SWD/UART-EMUZ on Left and EVAL-ADuCM350EBZ on Right)

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**REVISION HISTORY**

**1/2018—Rev. 0 to Rev. A**

Added Limitations on Use and Liability Section..... 28

**5/2014—Revision 0: Initial Version**

## GENERAL DESCRIPTION

The [ADuCM350](#) is a 16 MHz ARM® Cortex-M3 processor with a high precision AFE specifically designed for high precision data acquisition.

The [ADuCM350](#) has a 16-bit precision analog core with four dedicated voltage measurement channels and up to eight current measurement channels. It has an integrated complex impedance measurement system and uses an integrated parameterizable waveform generator to generate complex waveforms. It uses an excitation amplifier control loop to perform accurate potentiostat type measurements and has a highly configurable switch matrix that allows application specific amplifier configuration.

The device has a large array of peripherals, including USB, CapTouch®, display, audio, and an array of serial interfaces and GPIOs.

The [ADuCM350](#) includes 384 kB of flash, 32 kB of SRAM, and 16 kB of flash configured as EEPROM.

The [EVAL-ADuCM350EBZ](#) kit provides scientists, system analyzers, and software developers a platform to migrate from sensor investigation and analysis to full ecosystem development. The evaluation kit consists of an [ADuCM350](#) motherboard and a selection of analog front end and digital peripheral daughter boards.

The evaluation kit is designed specifically to work with the [ADuCM350](#) software development kit (SDK) and the evaluation kit support package (EKSP)—both of which are available for download on the [ADuCM350 design resources](#) page.

The software development kit is designed to work with the IAR debugging environment only. The user guide for the [ADuCM350](#) SDK is available on the SDK installer.

An example of where the kit is downloaded follows: **C:\Analog Devices\ADuCM350BBCZ\Eval-ADUCM350EBZ\doc**

The SDK quick start guide and the EKSP user guide are available in the **Support Documentation** zipped folder.

## GETTING STARTED

### SOFTWARE INSTALLATION PROCEDURES

For software installation procedures, refer to the following [ADuCM350](#) software documentation for further details:

- For more information about the EKSP LabVIEW® GUI, refer to the EKSP user guide ([ADuCM350\\_Evaluation\\_Kit\\_Software\\_Platform.pdf](#)) within the **Documentation** folder of the software development kit.
- For more information about the SDK firmware/debug environment, refer to SDK user guide ([ADuCM350BBCZ\\_Software\\_Users\\_Guide.pdf](#)) within the **Documentation** folder of the software development kit and to the [ADuCM350](#) software development kit quick start guide, [UG-677](#).

### EVALUATION BOARD SETUP PROCEDURES

1. Plug the [ADuCM350](#) switch mux configuration board into the [ADuCM350](#) evaluation board, [EVAL-ADuCM350EBZ](#).
2. Plug the USB-SWD/UART-EMUZ board into J14 on the [ADuCM350](#) evaluation board, [EVAL-ADuCM350EBZ](#).
3. Plug the USB cable into the USB-SWD/UART-EMUZ board.

After the drivers are downloaded, you can begin communicating with the board.

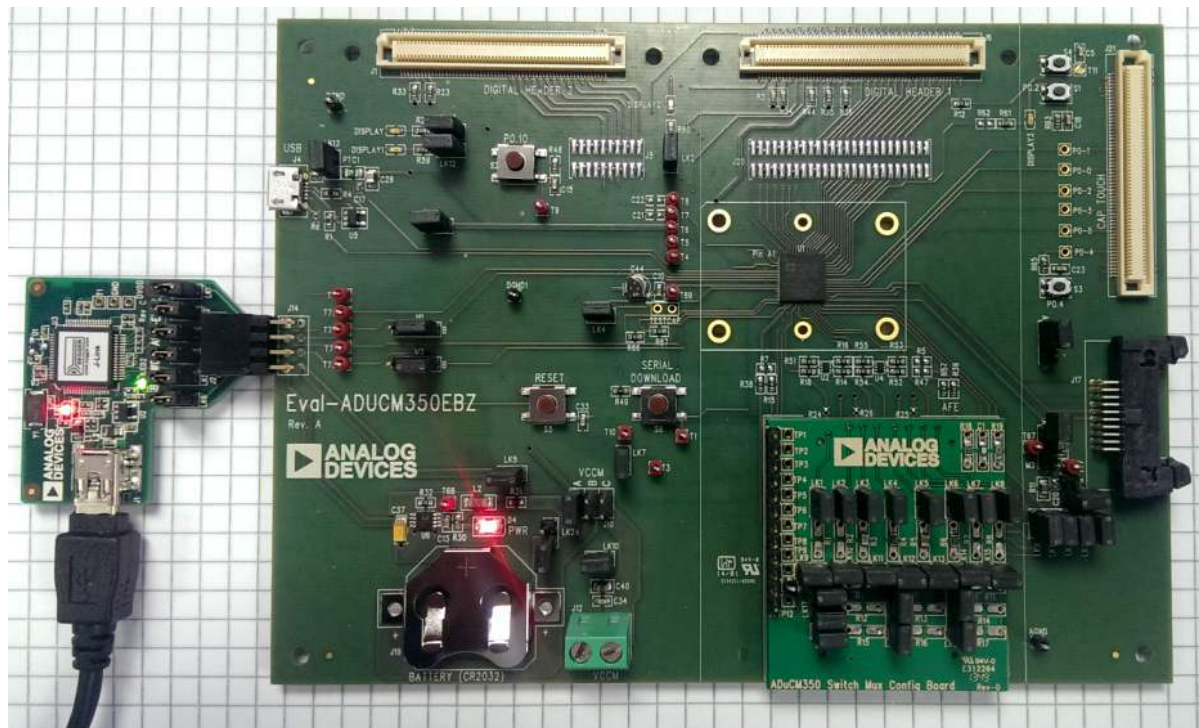


Figure 2. EVAL-ADuCM350EBZ Setup

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# EVALUATION BOARD HARDWARE

## POWER SUPPLIES

### VCCM\_ANA

Table 1 describes the three options for supplying power to the VCCM\_ANA pin.

Table 1. VCCM\_ANA Supply Options

Link J10 Position	VCCM_ANA Supply
A (Default Position)	Regulated 3.3 V from J3 wall socket supplied with board
B	CR2032 battery connection, J19
C	External supply

### VDD\_IO

Table 2 describes the two options for supplying power to the VDD\_IO pin.

Table 2. VDD\_IO Supply Options

Link M5 Position	VDD_IO Supply
A (Default Position)	From VCCM_ANA
B	Regulated 3.3 V from J3 wall socket (supplied with board)

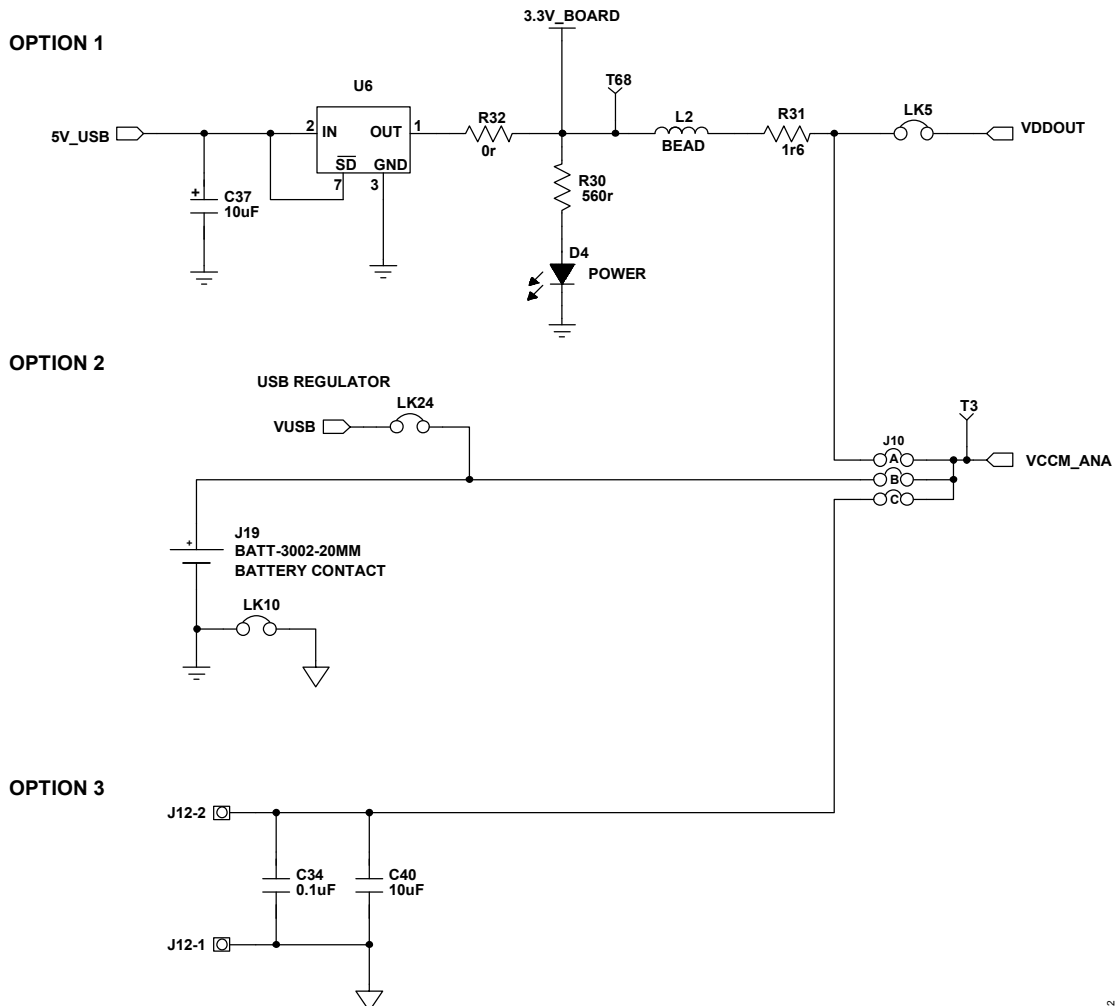
### VLCDVDD

Table 3 describes the three options for supplying power to the VLCDVDD pin.

Table 3. VLCDVDD Supply Options

LK14 Position <sup>1</sup>	VLCDVDD Supply
Inserted	Powered by VCCM
Open	Not powered

<sup>1</sup> The default position for LK14 is to be removed.



NOTES  
 1. LK24 IS NOT INSERTED BY DEFAULT.

Figure 3. Power Supply Schematic for VCCM\_ANA Pin  
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## JUMPER SETTINGS

Table 4. Link Option Functions

Link Number	Default Position	Function
LK1	Short	AN_A to AFE daughter board.
LK2	Open	LED GPIO functionality of P2.1.
LK3	Open	AN_B to AFE daughter board.
LK4	Short	Connect the supercapacitor to the VBACK pin.
LK6	Open	Thermistor voltage output measurement (AN_A).
LK7	Open	VCCM_DIG to VCCM_ANA external connection (connected internally on chip).
LK8	Short	LED GPIO functionality of P0.11.
LK9	Open	AN_C to AFE daughter board.
LK10	Short	AGND To DGND connector.
LK11	Open	AN_D to AFE daughter board.
LK12	Short	LED GPIO functionality of P4.2.
LK13	Short	VBUS link.
LK14	Open	Supply for VLCDVDD.
LK24	Open	VUSB to VCCM_ANA connector. The battery must be removed when this link is inserted.
M1	B	P0.6 selected for UART Tx.
M2	B	P0.7 selected For UART Rx.
M3	Open	AN_EXCITE used for thermistor operation.
M5	A	VDD_IO connection. When this link is in Position A, the VDD_IO supply is from VCCM_ANA.

# EVALUATION BOARD CIRCUITRY

## J-LINK OB EMULATOR

The J-Link OB emulator provides nonintrusive emulation via a serial wire and allows supply and UART communication with the ADuCM350 evaluation board (EVAL-ADuCM350EBZ). Figure 4 shows a top view of the emulator board. The J2 connector plugs into the ADuCM350 evaluation board (EVAL-ADuCM350EBZ). The J2 connector pinout is shown in Figure 5.

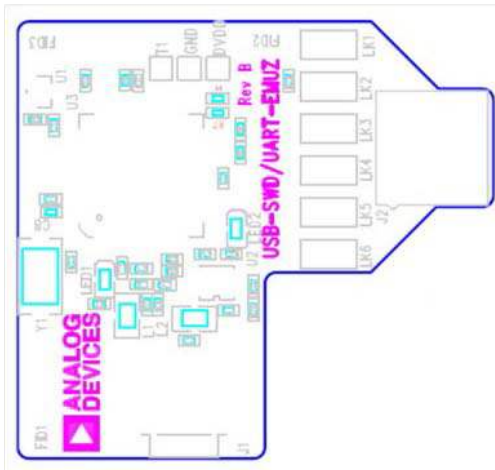


Figure 4. Emulator Top View

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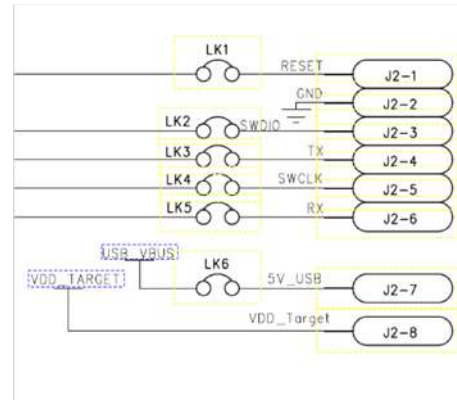


Figure 5. J2 Connector

For downloading and debugging, LK1, LK2, LK4, and LK6 must be inserted. LK3 and LK5 are required to communicate via UART. The required driver software for the J-Link OB can be downloaded from the Segger website. Ensure that you also install the virtual COM port drivers (see Figure 6).

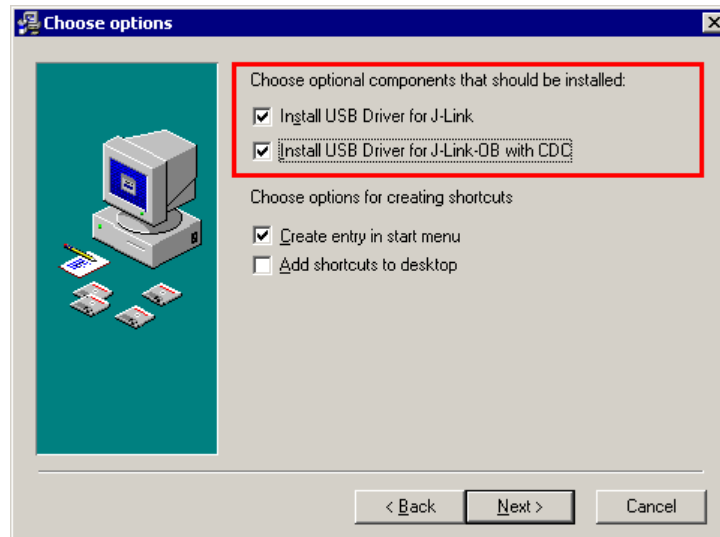


Figure 6. J-Link OB Download Options

**DIGITAL HEADER PAD LOOKUP TABLE**Table 5. Pinout for Digital Header 1 Pad (J20) on [EVAL-ADuCM350EBZ](#)

Top Row (from Left to Right)		Bottom Row (from Left to Right)	
Pin No.	Internal Connection	Pin No.	Internal Connection
J20-2	P2.1	J20-1	P2.0
J20-4	P2.3	J20-3	P2.2
J20-6	P2.5	J20-5	P2.4
J20-8	P1.0	J20-7	P1.1
J20-10	P1.2	J20-9	P1.3
J20-12	P1.4	J20-11	P1.5
J20-14	P1.6	J20-13	P1.7
J20-16	P3.8	J20-15	P1.9
J20-18	P3.3	J20-17	P3.9
J20-20	P1.11	J20-19	P1.8
J20-22	P1.13	J20-21	P1.10
J20-24	P1.15	J20-23	P1.12
J20-26	P2.11	J20-25	P1.14
J20-28	P2.12	J20-27	P2.10
J20-30	P2.15	J20-29	P2.9
J20-32	P3.10	J20-31	P2.8
J20-34	P2.13	J20-33	P2.7
J20-36	P3.11	J20-35	P2.6
J20-38	P3.0	J20-37	P2.14
J20-40	P3.1	J20-39	P3.2
J20-42	P3.5	J20-41	P3.4
J20-44	P3.7	J20-43	P3.6
J20-46	N/A	J20-45	N/A
J20-48	N/A	J20-47	N/A
J20-50	N/A	J20-49	N/A

Table 6. Pinout for Digital Header 2 Pad (J5) on [EVAL-ADuCM350EBZ](#)

Top Row (from Left to Right)		Bottom Row (from Left to Right)	
Pin No.	Internal Connection	Pin No.	Internal Connection
J5-19	N/A	J5-20	N/A
J5-17	N/A	J5-18	N/A
J5-15	N/A	J5-16	N/A
J5-13	N/A	J5-14	N/A
J5-11	P0.14	J5-12	P0.15
J5-9	P0.12	J5-10	P0.13
J5-7	P1.0	J5-8	P0.11
J5-5	P4.1	J5-6	P4.2
J5-3	P3.14	J5-4	P4.0
J5-1	P3.12	J5-2	P3.13



# ADUCM350 MOTHERBOARD SCHEMATICS

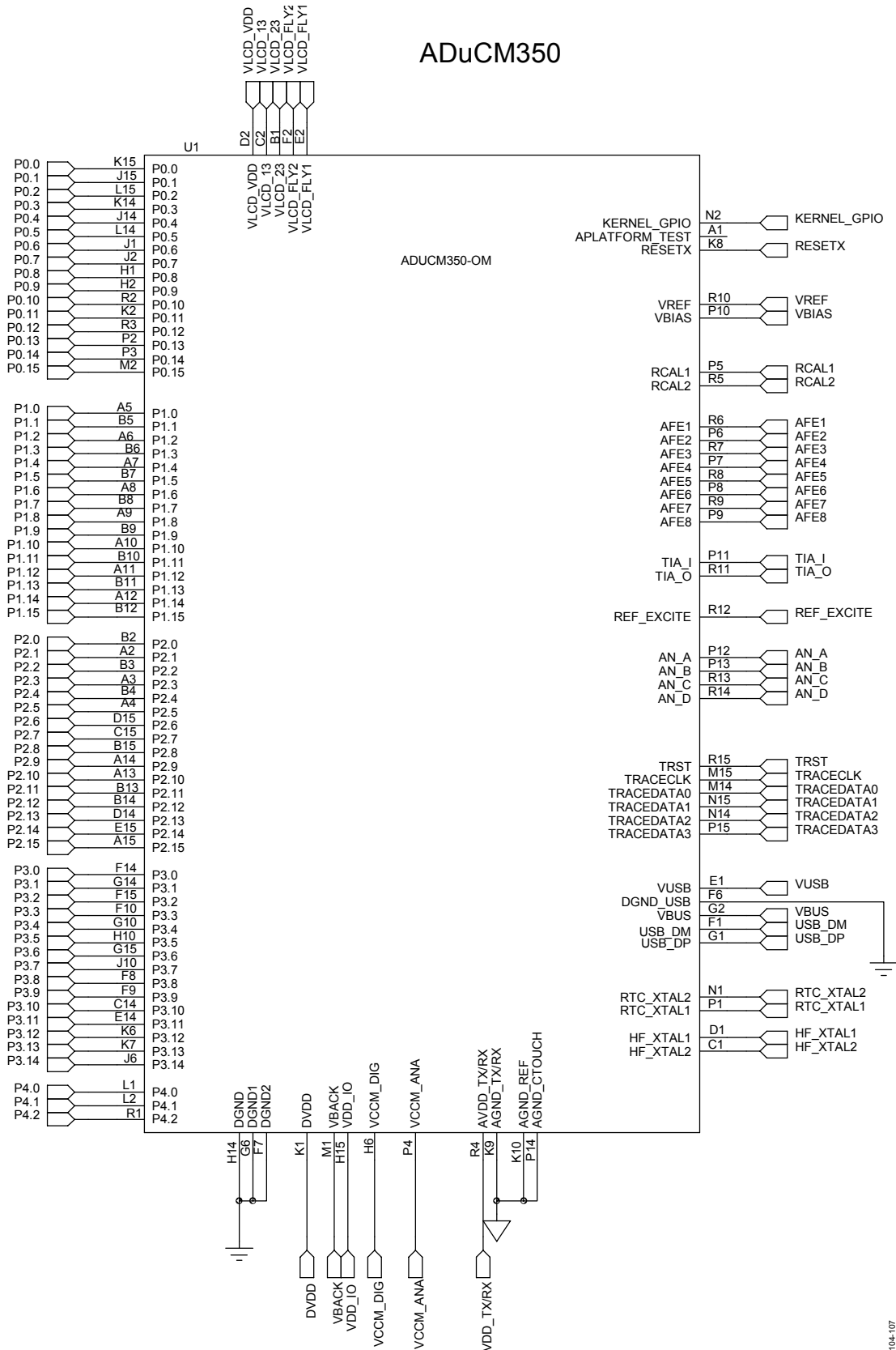
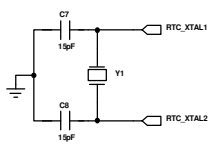


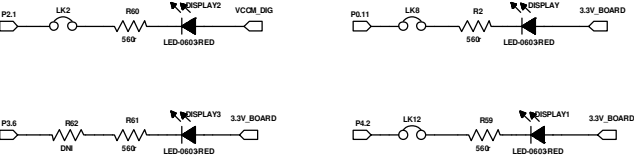
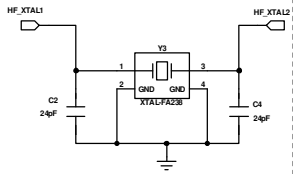
Figure 7. ADuCM350 Motherboard Schematic Device Drawing

LF 32kHz XTAL



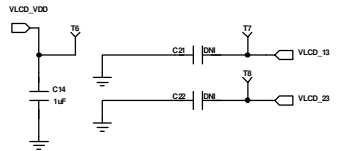
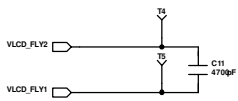
Layout: Needs To Be Near DUT  
Layout: Shielding on 16MHz

HF 16MHz XTAL



GPIO LEDs

LCD CHARGE PUMP



EXT INT

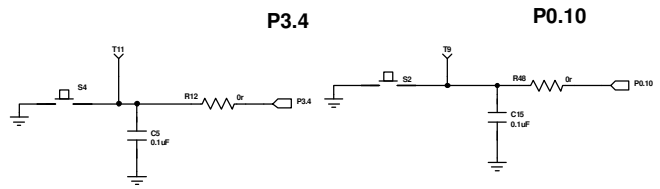


Figure 8. Digital Schematics 1

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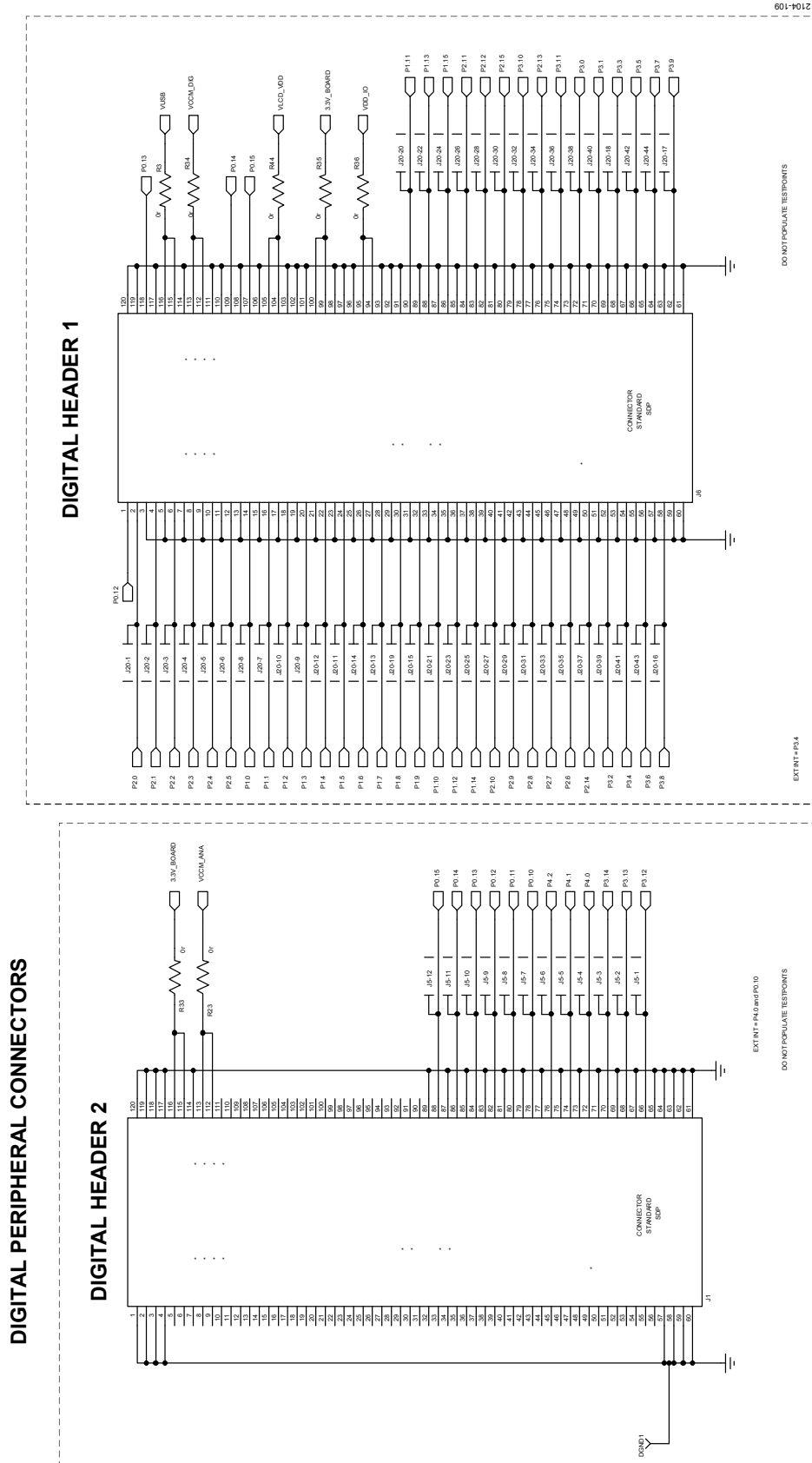
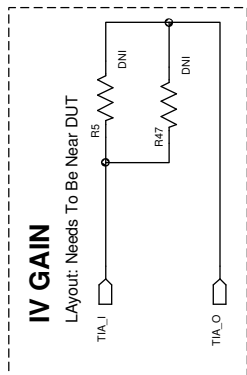
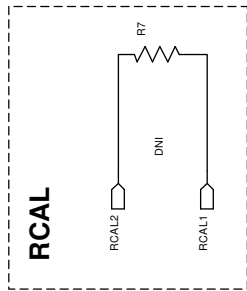


Figure 9. Digital Schematics 2



**AFE DAUGHTERCARD**

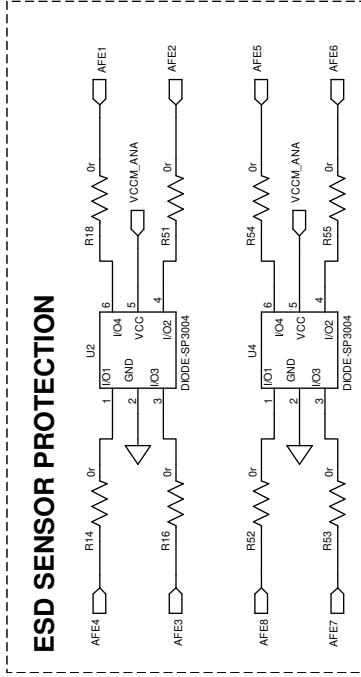
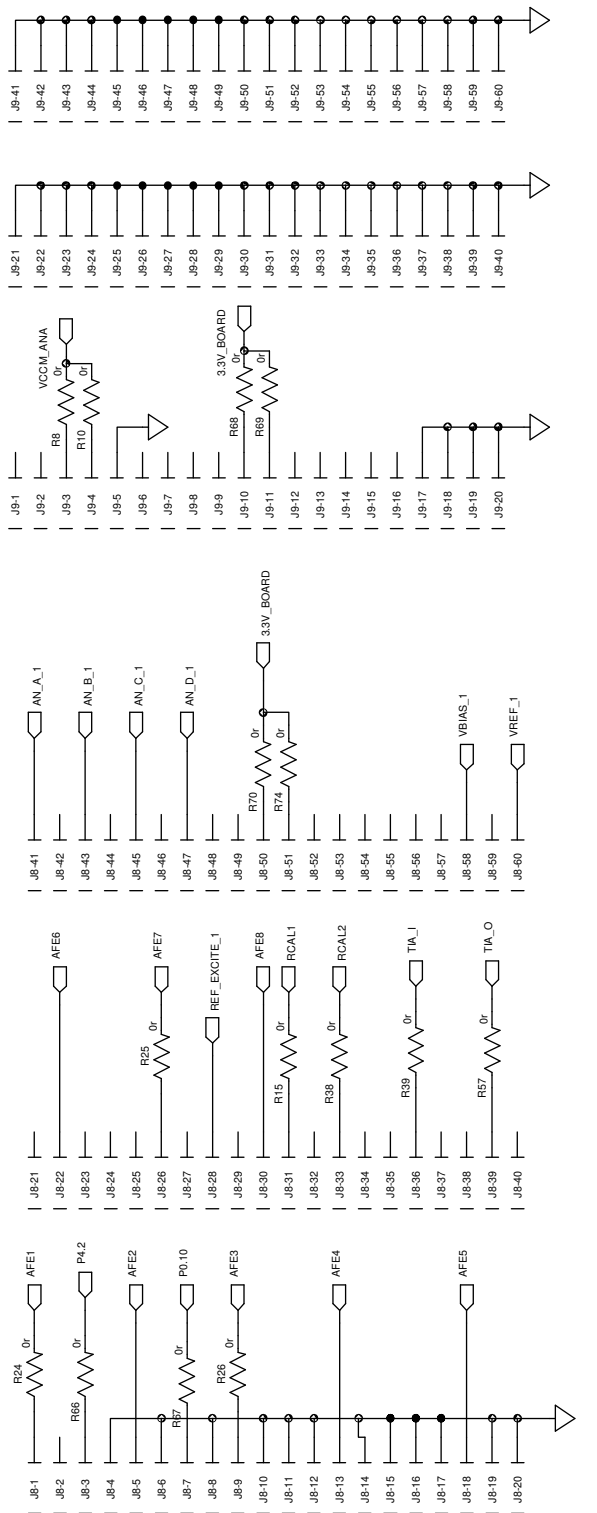


Figure 10. Analog Schematics 1

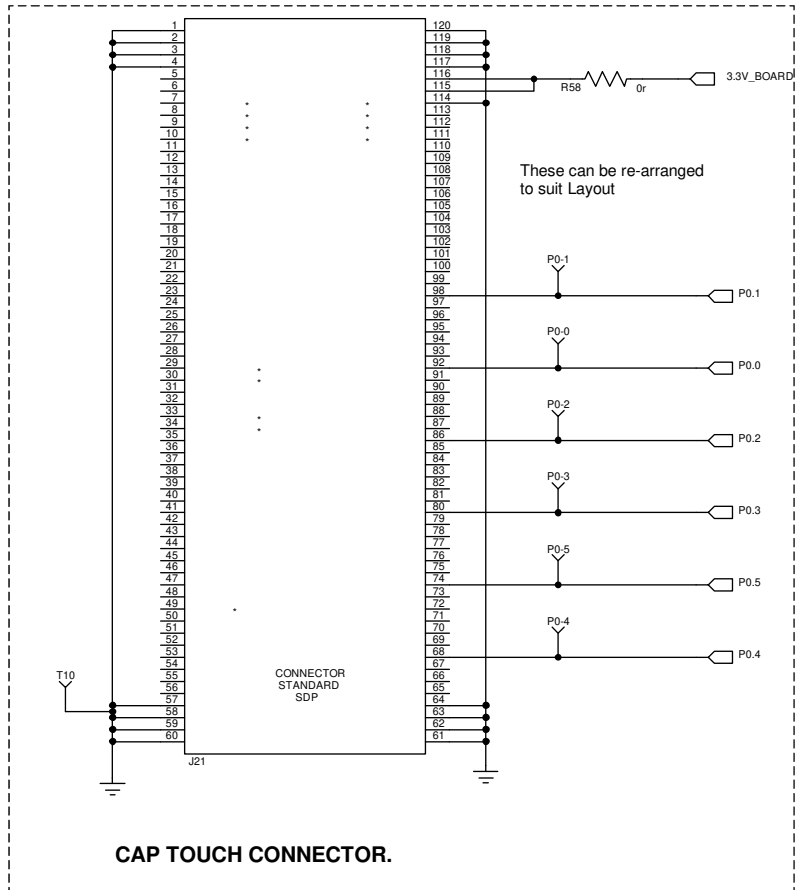
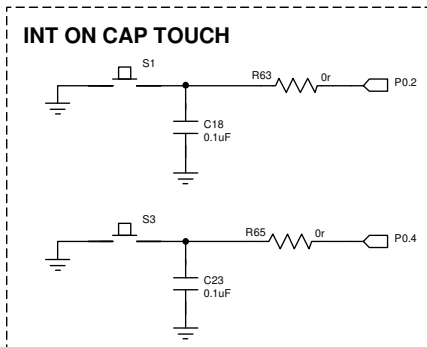
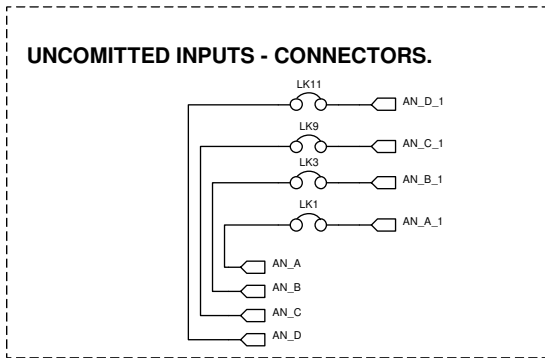
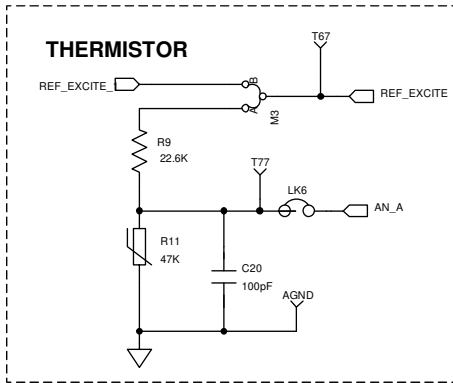


Figure 11. Analog Schematics 2

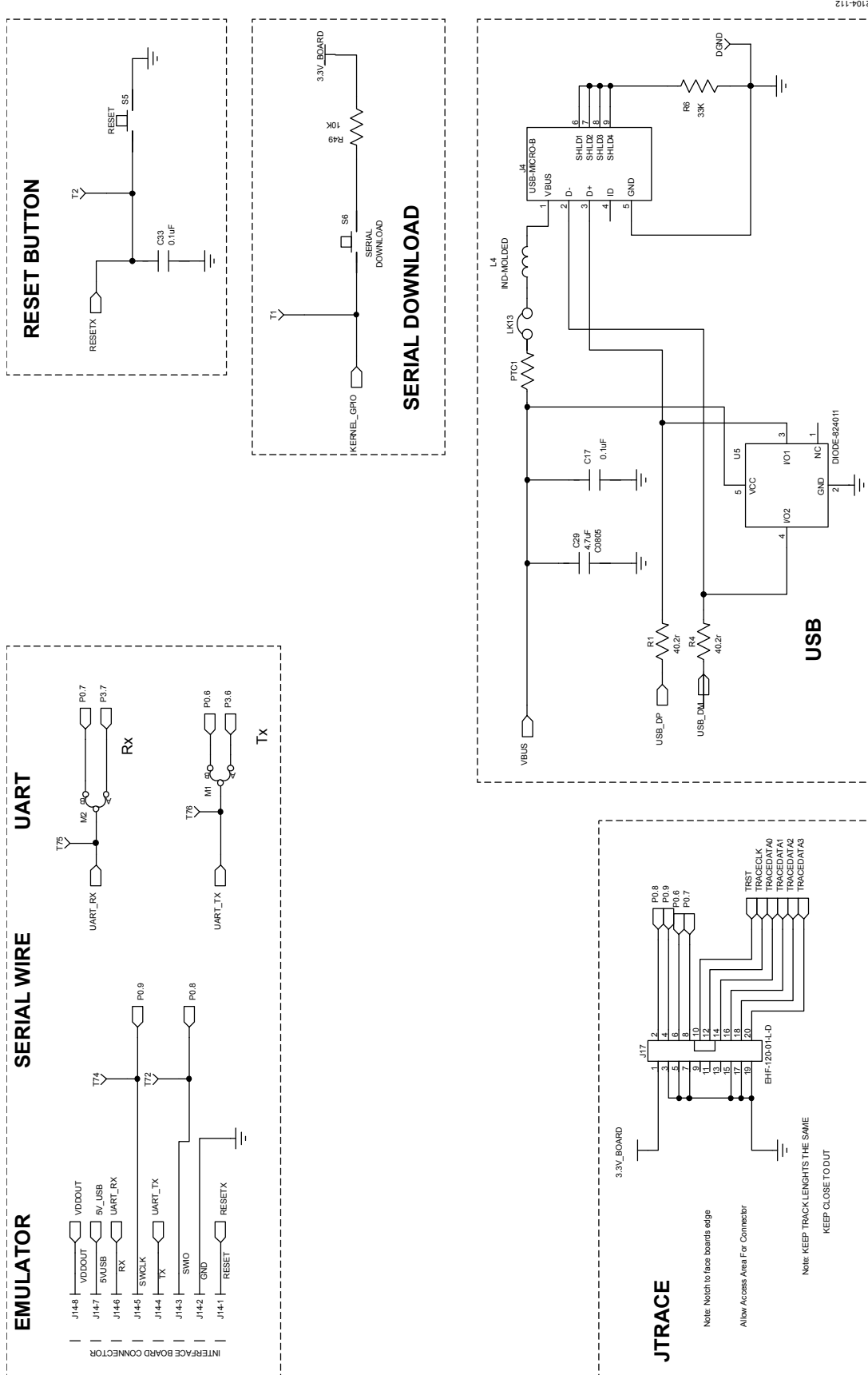
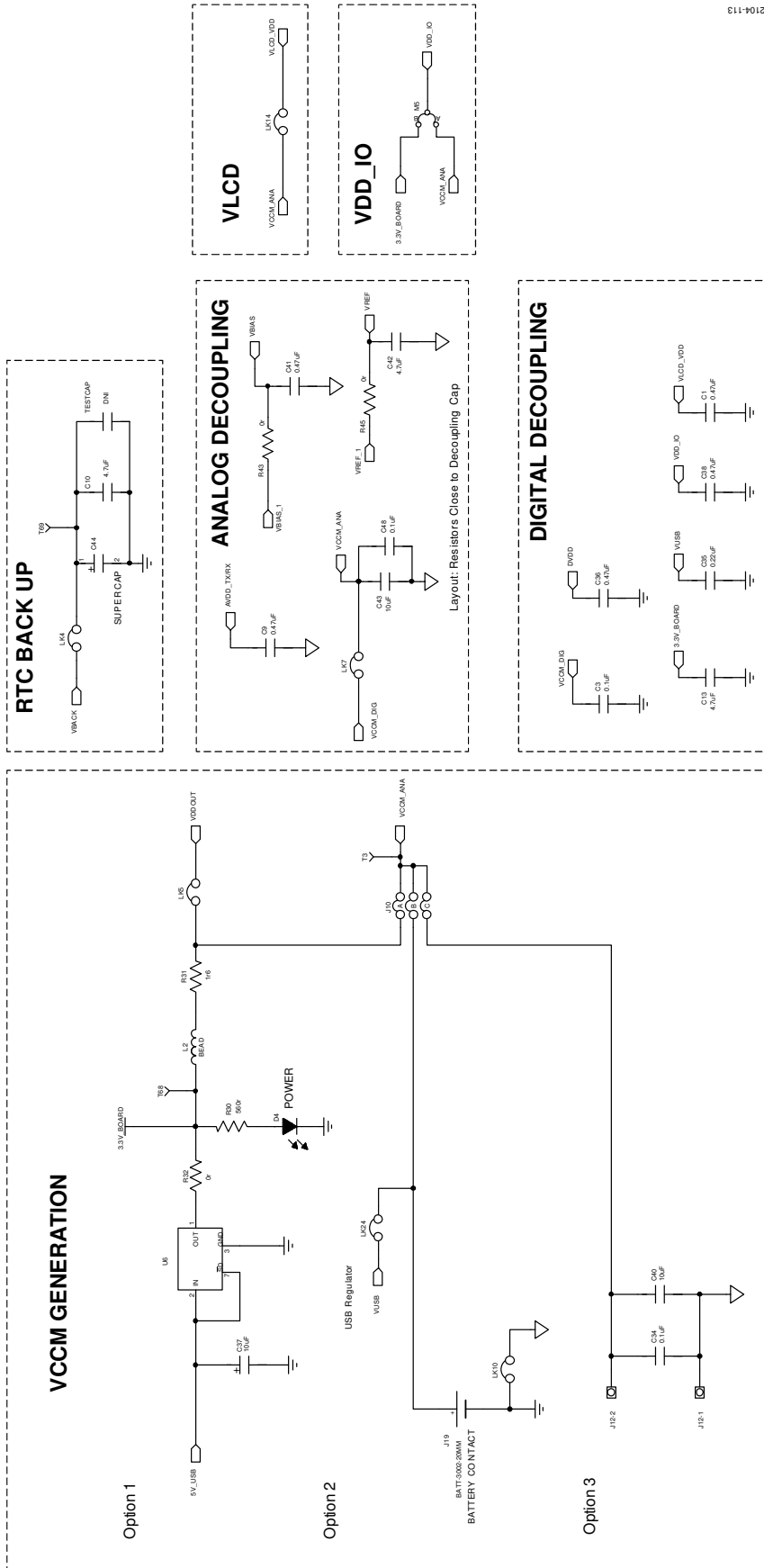


Figure 12. Interface



12104-113

Figure 13. Power  
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# ADUCM350 DAUGHTER BOARD SCHEMATICS

## ADUCM350 SWITCH MUX CONFIGURATION BOARD

MOTHERBOARD CONNECTOR—ALIGN J8 AND J9.

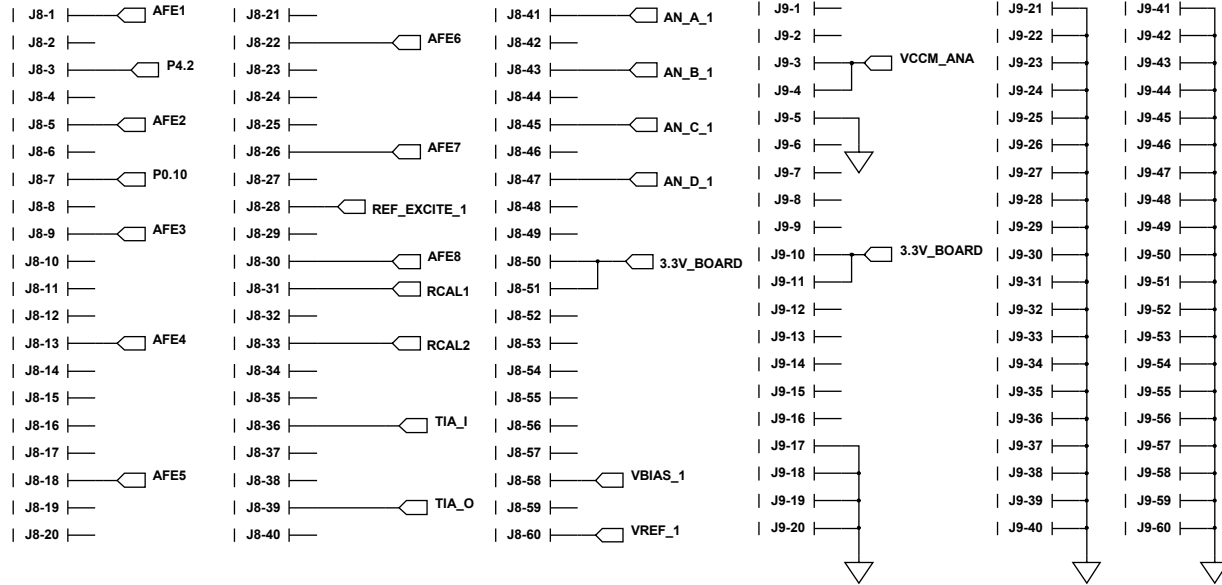
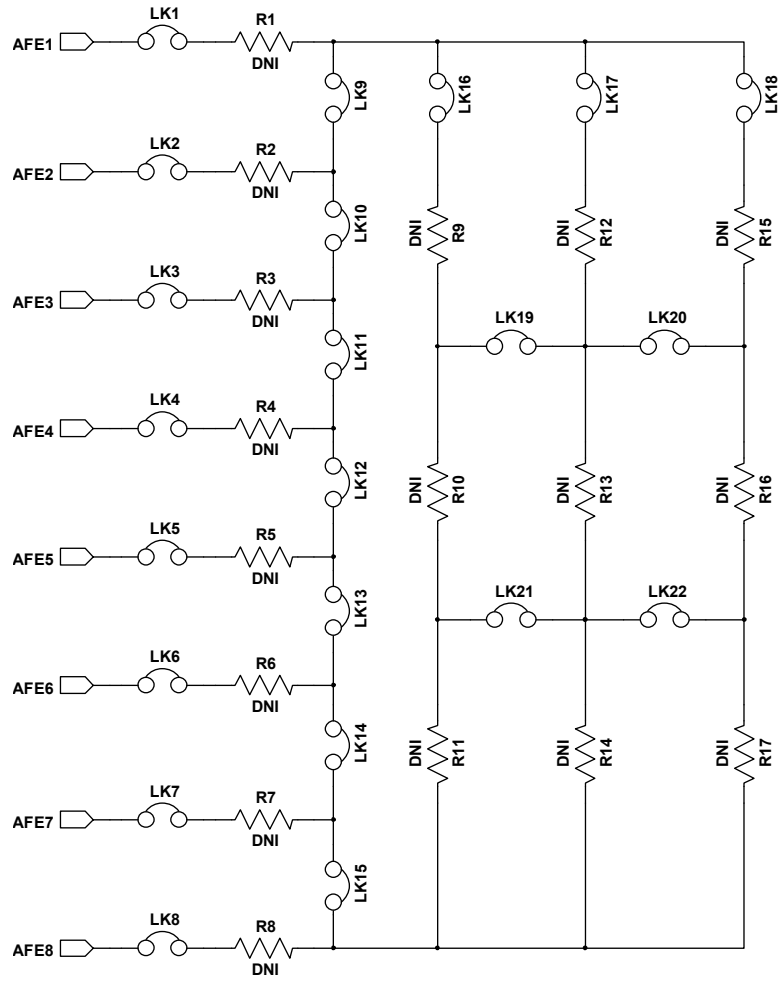


Figure 14. Switch Mux Configuration

12104-004





12104-005

Figure 15. Switch Mux Configuration—Sensor Hookup

**ADUCM350 4-WIRE BIO CONFIGURATION 2 BOARD**

MOTHERBOARD CONNECTOR—ALIGN J8 AND J9.

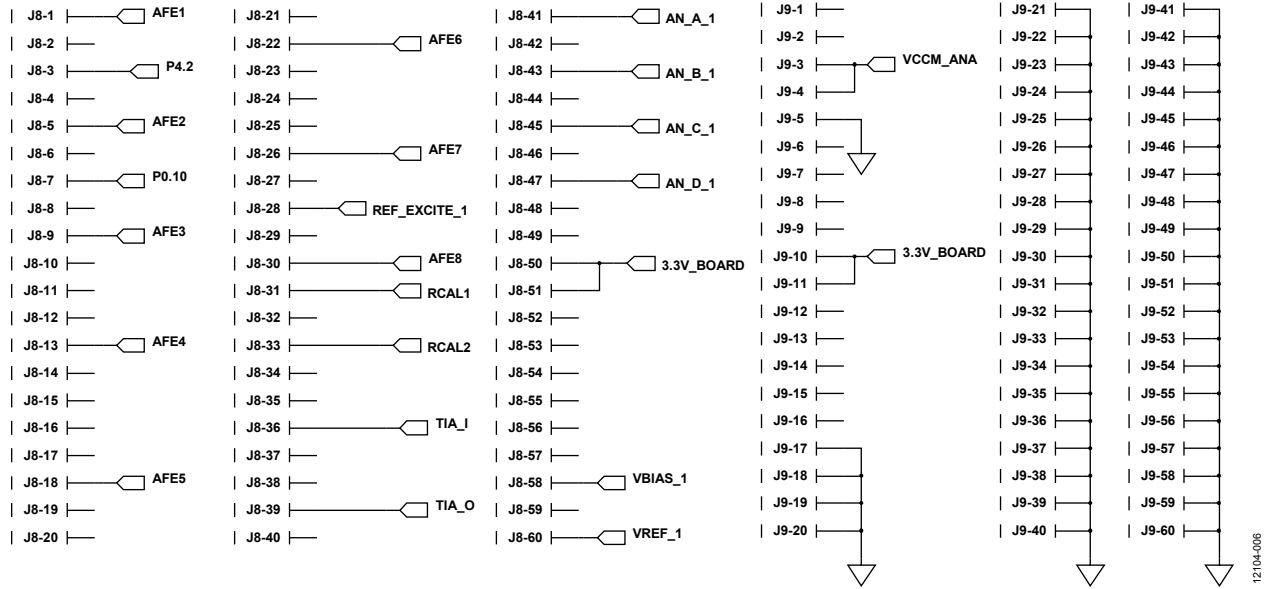


Figure 16. 4-Wire Bio Configuration Header Connections

**4 WIRE BIO IMPEDANCE CONFIGURATION**

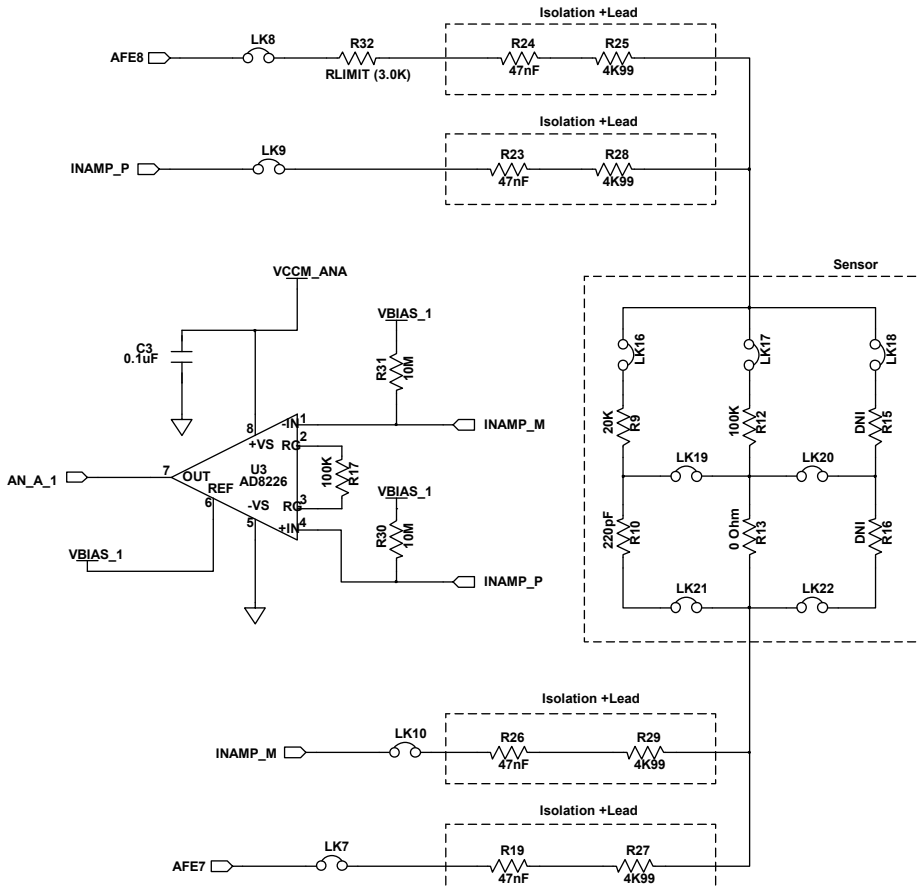
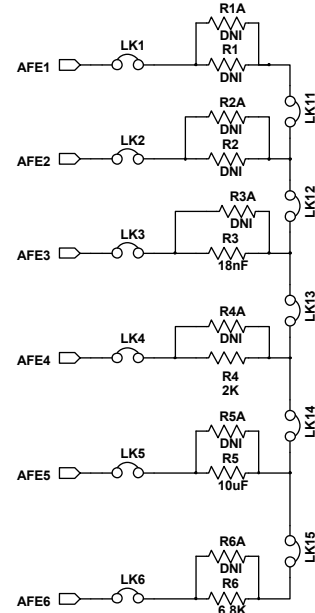


Figure 17. 4-Wire Bio Configuration Sensor Connections

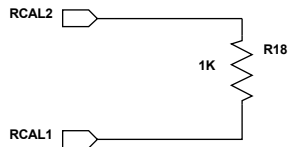
**UNCOMMITTED CONFIGURATION**



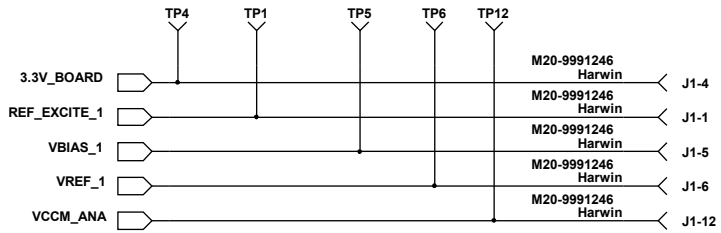
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RCAL



TEST POINTS



IV GAIN

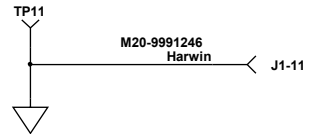
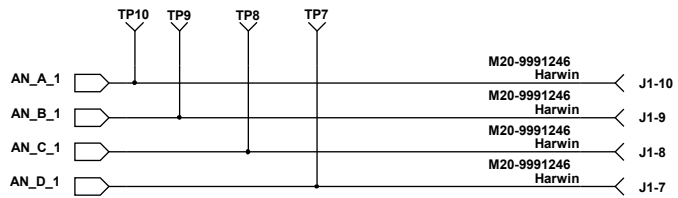
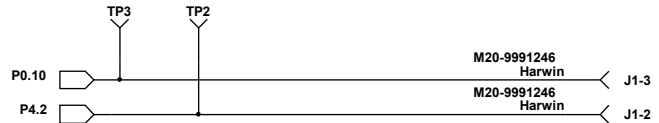
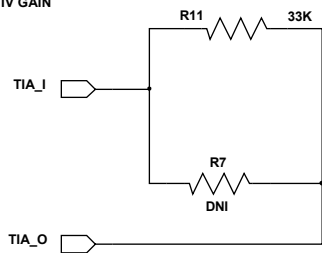


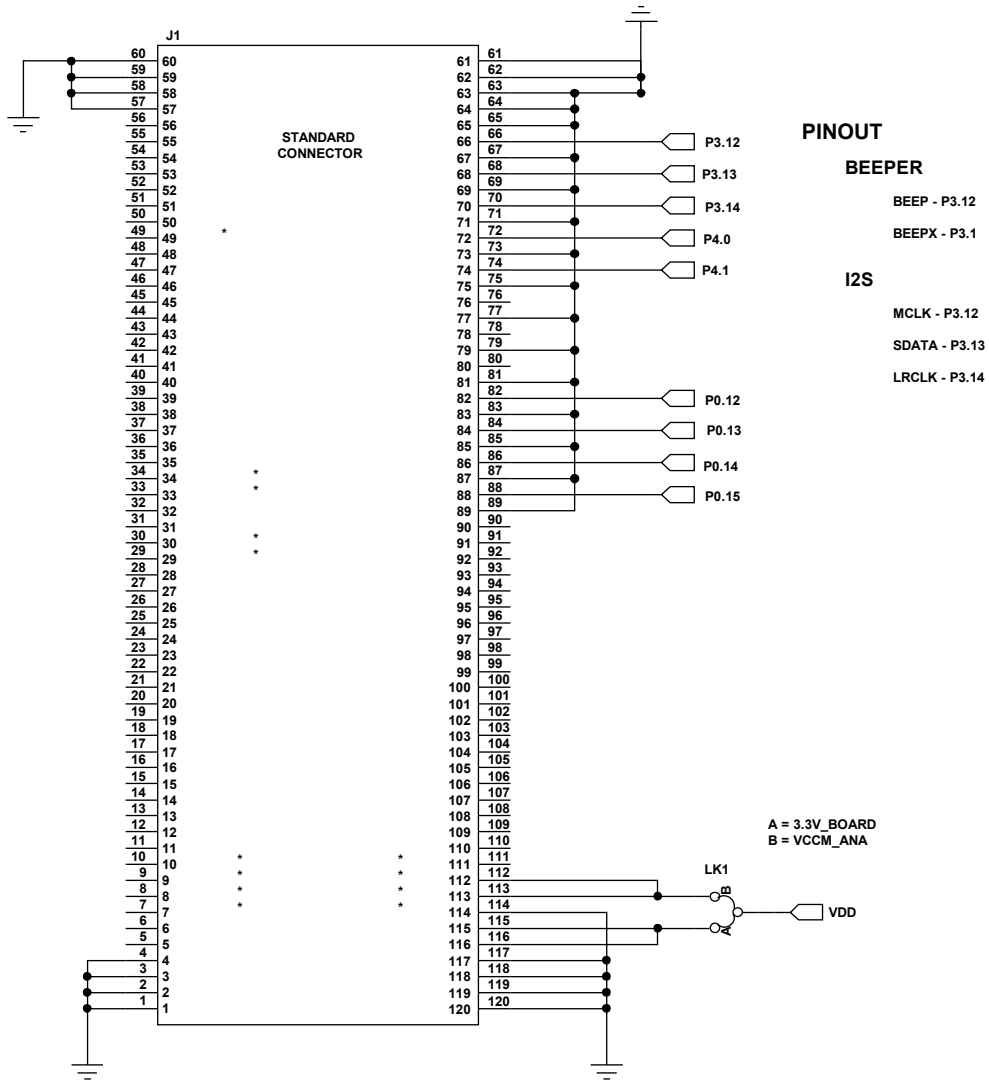
Figure 18. 4-Wire Bio Configuration Miscellaneous Connections

12104-008

**AUDIO DAUGHTER BOARD REFERENCE SCHEMATICS**

The Figure 19 schematic is connected to Digital Header 2 (J1) on the EVAL-ADuCM350EBZ board.

**BEEPER AND I2S AMPLIFIER**



EXT INT = P4.0 and P0.10

Figure 19. Audio Schematic

12104-009

Figure 20 is a reference schematic both for the beeper/piezoelectric buzzer setup and for the I<sup>2</sup>S setup using the SSM2518.

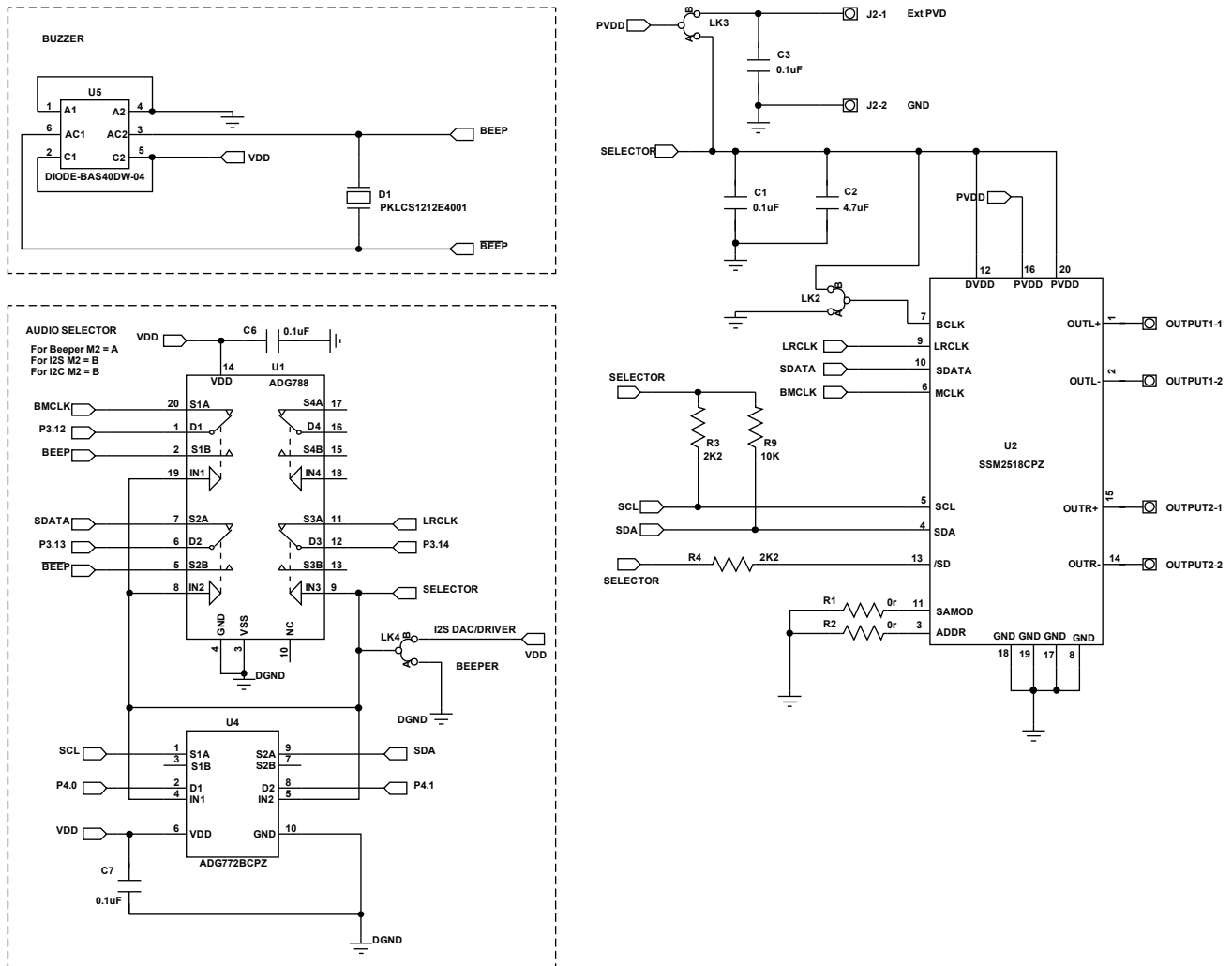


Figure 20. Audio Schematic

12104-010

**DISPLAY BOARD REFERENCE SCHEMATICS**

The Figure 21 schematic is the connector to Digital Header 1 (J6) on the EVAL-ADuCM350EBZ board.

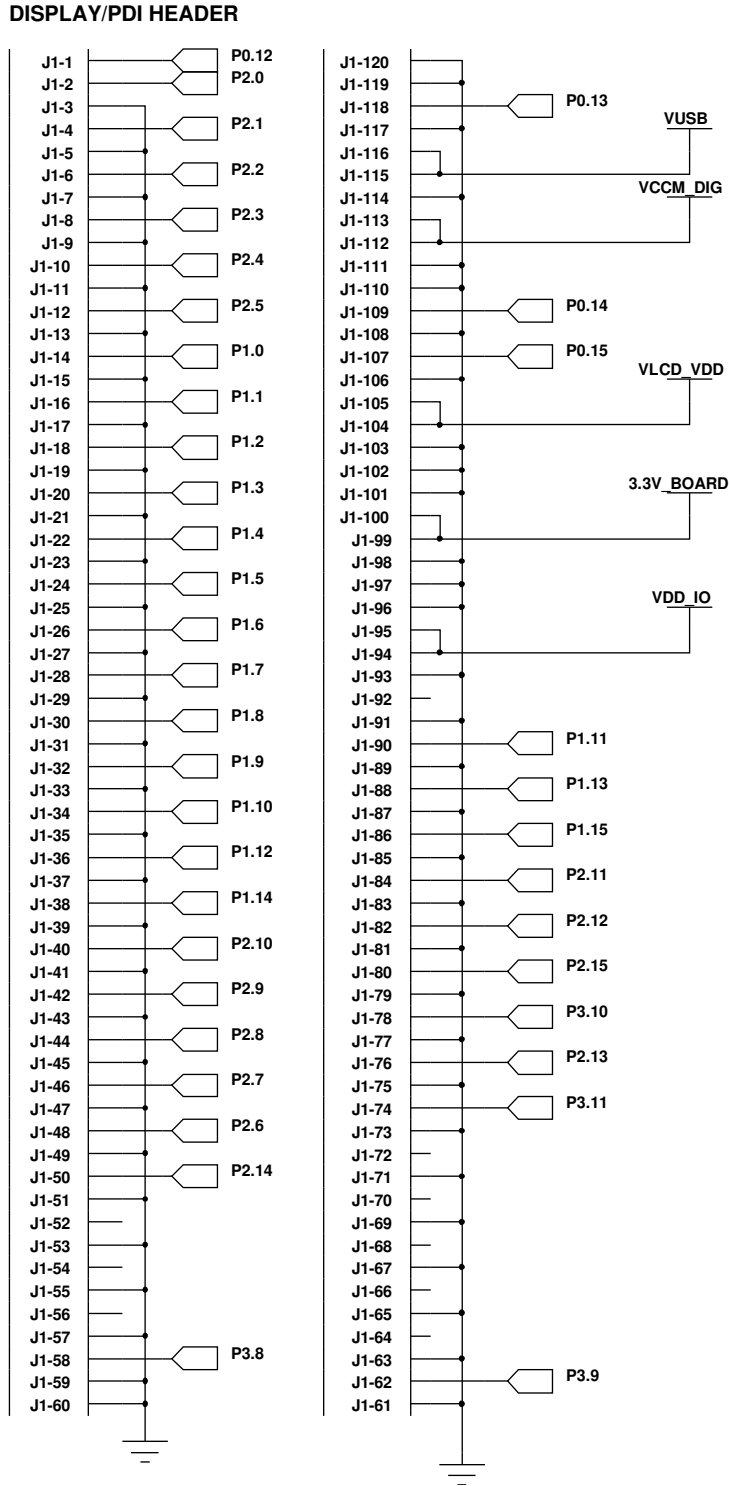


Figure 21. Display (LCD or TFT) Header Connector

12104-011

**TFT Display Reference Schematic**

The schematic shown in Figure 22 is used to connect to an INT035TFT or INT035TFT-TS thin film transistor LCD module from Displaytech Ltd.

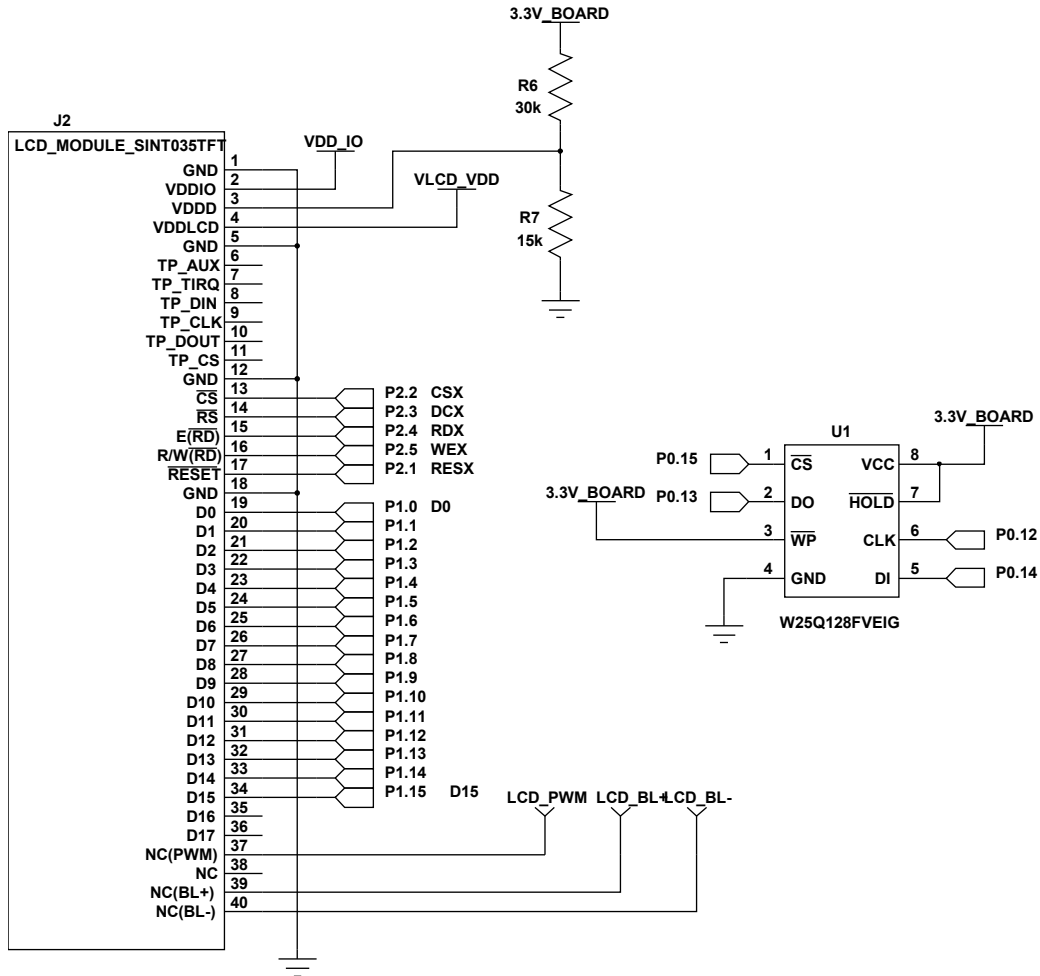


Figure 22. TFT Connector Displaytech Screen and External Flash Memory Schematic

12104-012

**LCD Segment Display Reference Schematic**

The schematic shown in Figure 23 is used to connect to a VIM-828 LCD segment display from Varitronix.

**CONNECTOR FOR VIM-828 - TO DISCUSS**

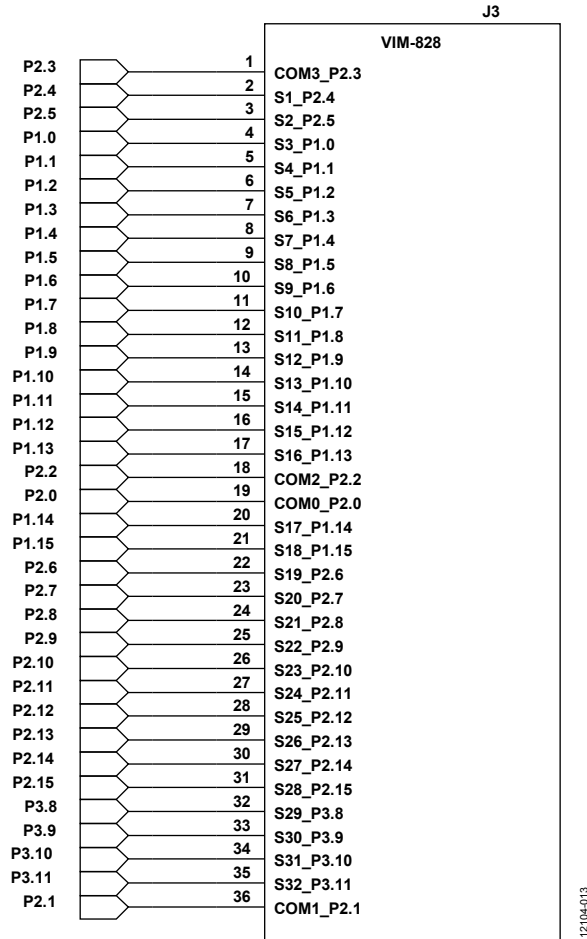


Figure 23. LCD Connector Schematic for VIM-828 LCD Segment Display



**BREAKOUT BOARD PIN CONNECTIONS**

If using the ADuCM350 breakout board, the connections shown in Figure 24 and Figure 25 are required.

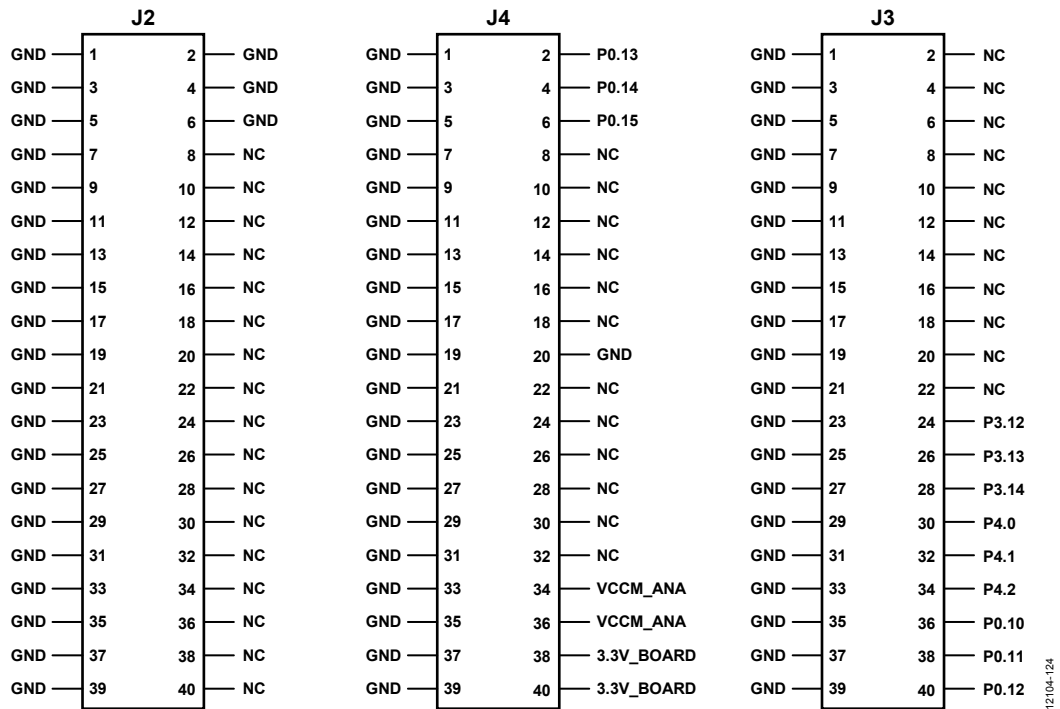


Figure 24. Breakout Board Connections for J1 on EVAL-ADuCM350EBZ with LK1 in Position B

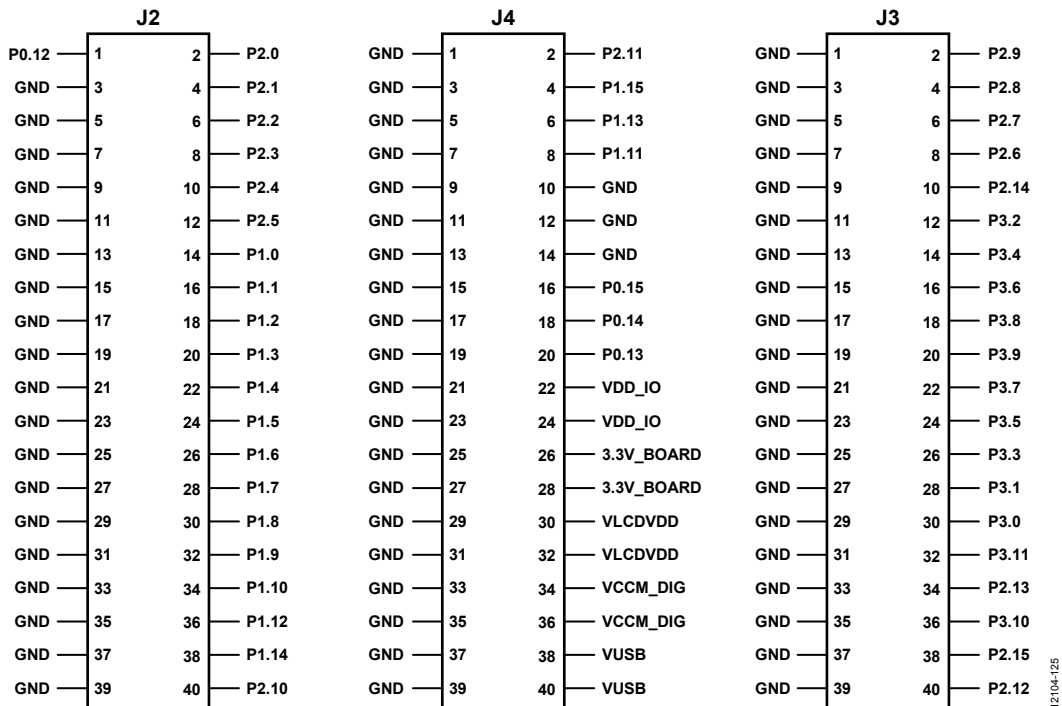


Figure 25. Breakout Board Connections for J1 on EVAL-ADuCM350EBZ with LK1 in Position A

**GPIO TEST HEADER BOARD**

The Figure 26 schematic is the connector to Digital Header 1 (J6) on the EVAL-ADuCM350EBZ board.

**DIGITAL HEADER 1**

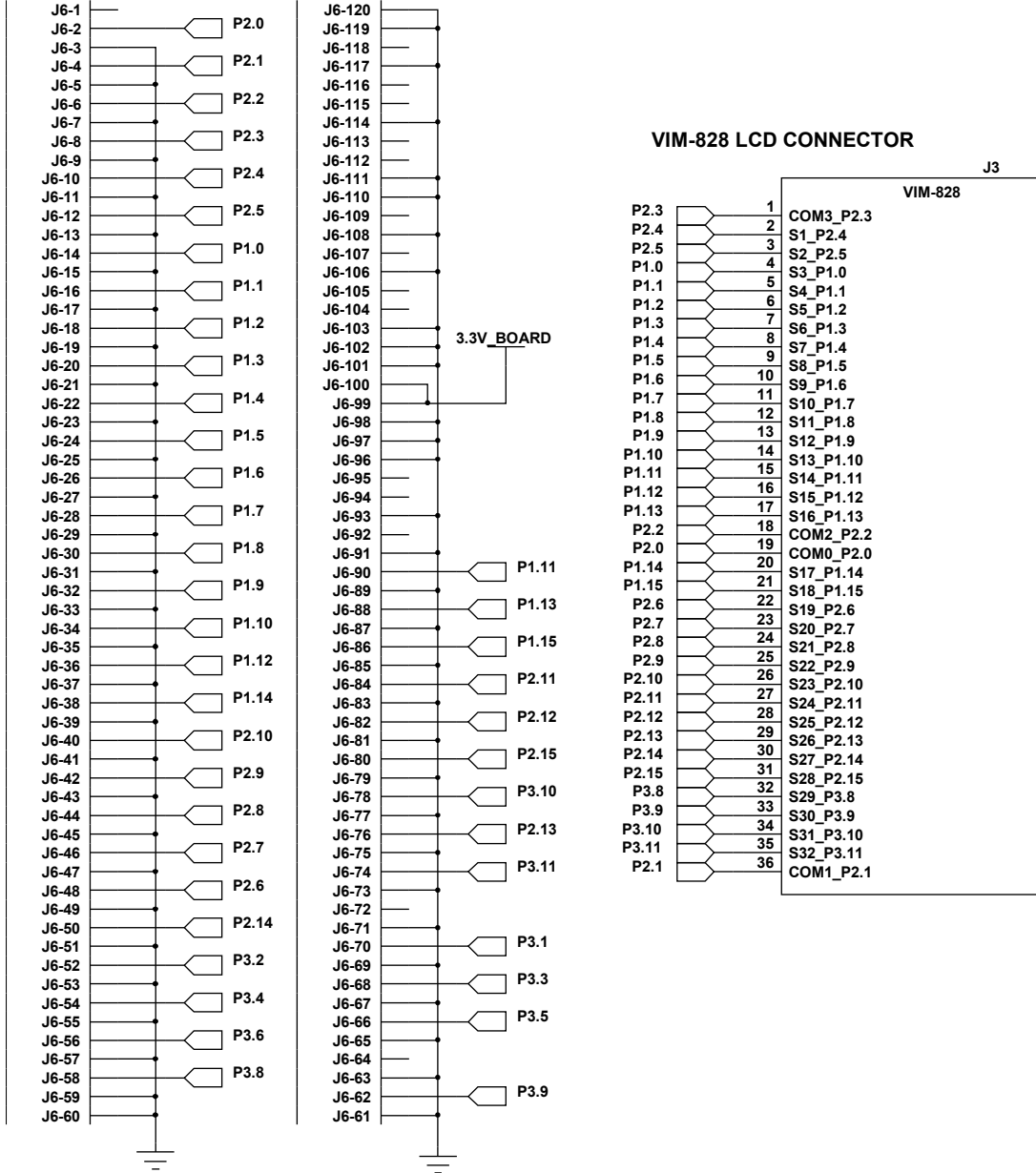


Figure 26. LCD Connector Schematic for VIM-828 LCD and Digital Header Schematic

12104-014

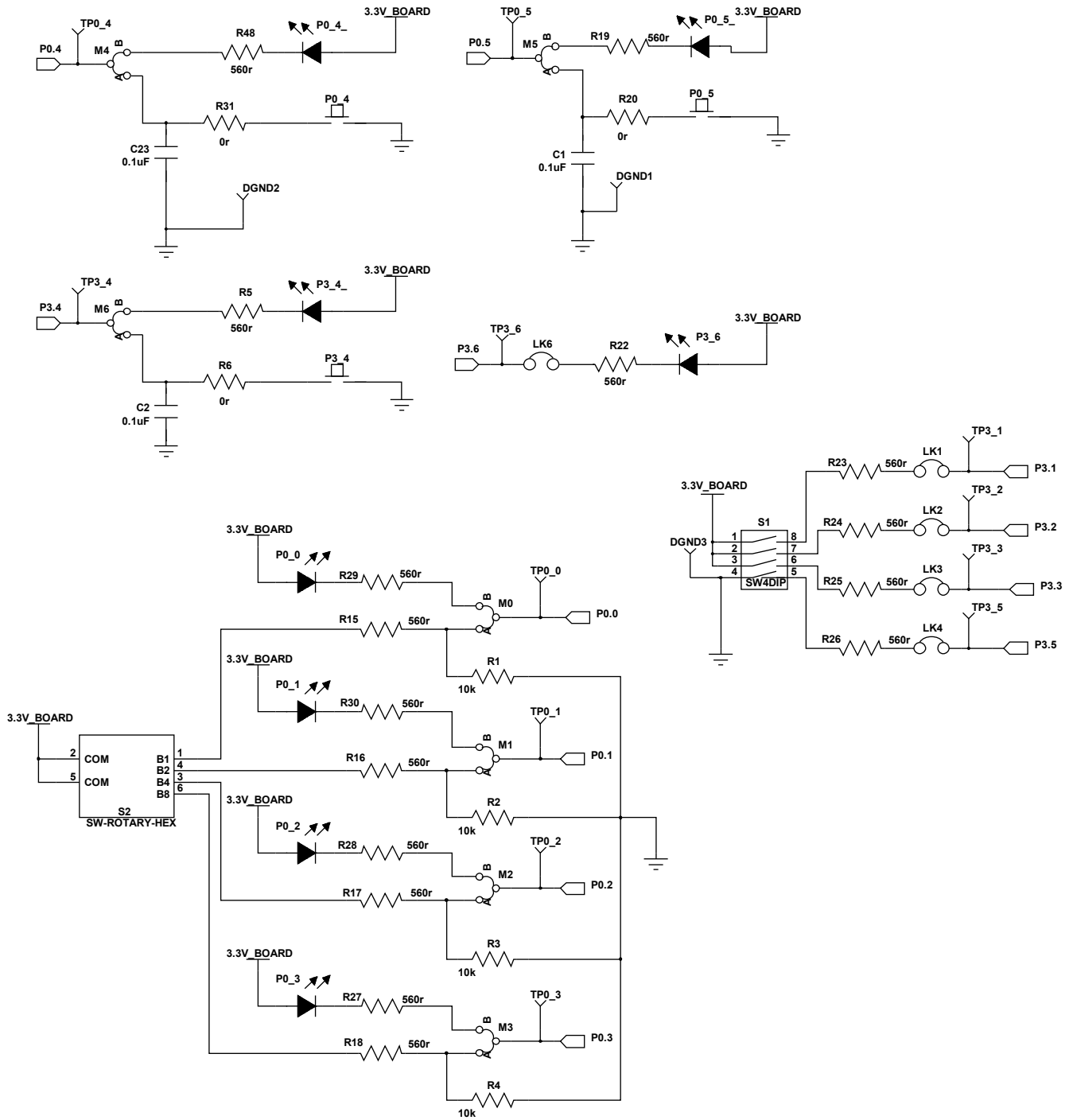


Figure 27. GPIO Evaluation Schematic

12104-015

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