EVAL-ADRD2121-EBZ

General Description

The EVAL-ADRD2121 is a hardware and software platform that enables high-speed asynchronous sampling of iSensor IMU data.

Output data is provided through a USB virtual serial port and/or a user SPI port to allow transparent augmentation of an existing IMU interface system.

Features and Benefits

- Enable Full Throughput, Buffered IMU Data Capture
- Supports ADIS16470 and ADIS16500 IMU
- 64 Bytes Buffer Entry Size (max) and 512 Frames (min)
- Baud Rate up to 1000000bps
- Small Footprint Enables Evaluation and Use of Compact IMUs
- Registers Accessible Through a Simple Command Line Interface (CLI)
- Python Library for Interfacing with CLI
  - Allows for Easy IMU Integration with an End User Application in Both Linux® and in Windows® Environments
- Option for External or USB Power (5V)
- Configuration Options Include
  - Buffer Overflow Setting (Stop Sampling vs. Delete Oldest)
  - Data Ready Input (from IMU) DIO Number
  - IMU Data-Ready Trigger Polarity
  - SCLK Frequency and Stall Time of SPI Between the EVAL-ADRD2121 and IMU
  - Standard SPI Settings Between the EVAL-ADRD2121 and a Host Computer

EV Kit Photo

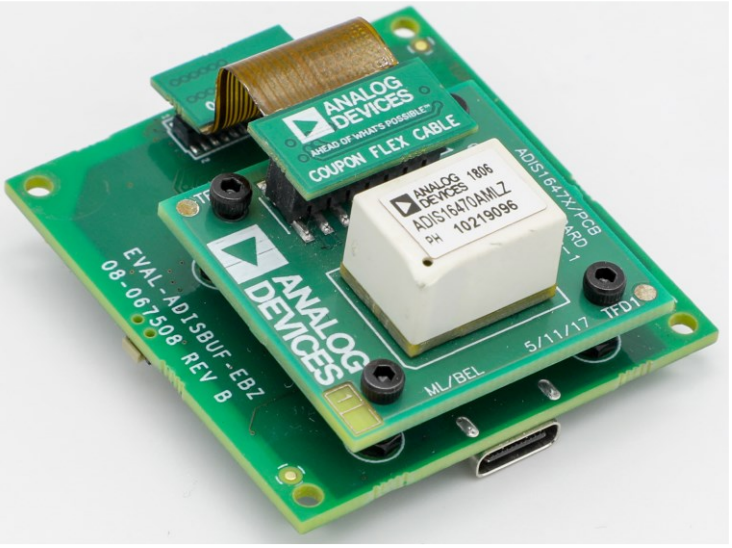


Figure 1. ADRD2121 with ADIS16470 IMU Breakout Board

One Analog Way, Wilmington, MA 01887-2356, U.S.A. | Tel: 781.329.4700

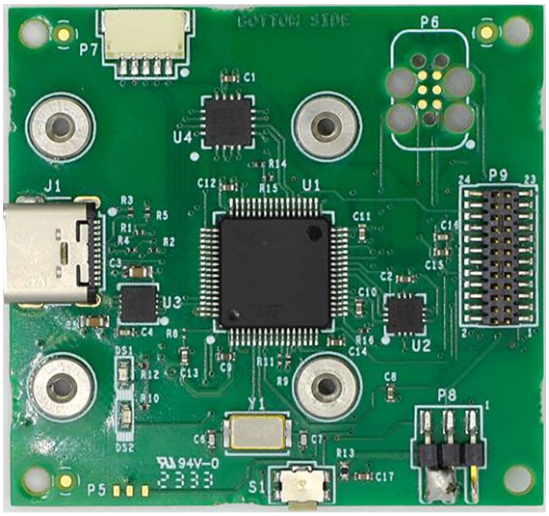


Figure 2. Bottom Side of the EVAL-ADRD2121 IMU Bufferboard

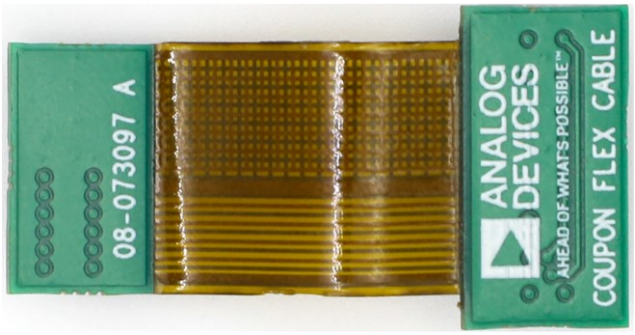


Figure 3. Flex Cable Board

Setup and Operation

This is the required hardware:

- 1x EVAL-ADRD2121-EBZ
- 1x ADIS16470 or ADIS16500 IMU breakout board

Note: The IMU boards are not included in the EVAL-ADRD2121_EBZ kit and must be purchased separately. Visit *analog.com* for more information.

Hardware Setup

The following mechanical components are included in the kit:

- 4x M2 10mm PCB standoffs
- 4x M2 15mm PCB standoffs
- 4x M2 5mm screws
- 4x M2 nuts

1. With the bottom side of the EVAL-ADRD2121 buffer board facing up, put the threaded portion of the four M2 15mm standoffs through the four outer mount holes of the EVAL-ADRD2121 IMU buffer boards. Then turn over the board and secure the standoffs in place using the four M2 nuts.

2. With the front side (i.e., the silkscreen side) of the EVAL-ADRD2121 board facing up, screw in the four M2 10mm standoffs into the 4 PEM nuts on the board.
3. Place the IMU breakout board on top of the four M2 10mm standoffs and screw in the four M2 screws through the four mount holes on the IMU board.
4. Connect the flex cable board to the EVAL-ADRD2121 buffer board and the IMU board and correctly align the pins.
5. Ensure the jumper connector is connected to the middle pin and the pin marked USB on P8. This configuration means the board can be powered by USB. configures the board as USB powered.
6. Connect one end of the included USB Type-C cable to the USB Type-C port on the EVAL-ADRD2121 buffer board and the other end to the host computer.

Software Setup

In a Linux environment, the connected device appears as a **/dev/ttyACMx** device, where x is a numeric designator that varies depending on the number of devices connected to the host computer.

Ensure the correct access permission is available for the device. For example, if the device appears as **/dev/ttyACM0**, run `sudo chmod 777 /dev/ttyACM0` to allow all users to read, write, and execute the serial device.

In a Windows environment, the connected device appears as a **COM port** device. Open the **Device Manager** to see which port number has been assigned to the board by the computer.

Open a terminal emulator software (i.e., PuTTy), and connect to the virtual serial port associated with the EVAL-ADRD2121 board. Specify the following parameters:

- COM port (i.e., COMx on Windows or /dev/ttyACMx on Linux)
- Baud rate: 115200

Other serial port settings can remain unchanged. In PuTTy, the defaults are:

- Data bits: 8
- Stop bits: 1
- Parity: None
- Flow control: None

If using PuTTy, once connected to the device, run the following commands to factory reset, clear fault, and flash update. To send each command, press **Enter** or the **Return** key.

```
freset
cmd 2
cmd 8
```

Note: When typing in commands in the terminal window, the **Backspace** key inputs another character rather than simply deleting the current input. The device does not recognize the command if the **Backspace** character is used.

Before proceeding to the IMU configuration, verify that the board status is OK. Run the following command:

```
status
```

If the board status is OK, the status command returns 0000. If the status is not 0000, (e.g., 1000 (FLASH_ERROR) or 4000 (FAULT_ERROR)), disconnect the board and repeat the steps outlined in this section.

IMU Configuration

Once the board is connected and the status is OK, proceed to the appropriate configuration steps depending on which IMU is used.

ADIS16470

```
##### CONFIGURE BUFFER BOARD #####
write 0 fd       #Access Page FD
write 10 14      #Set IMU SPI Stall to a 20us stall
write 11 20      #Set IMU SCLK to 562.5kHz
write 2 0       #Write to the BUF_CONFIG register - stop sampling when sensor data overflows, disable IMU BURST, disable BUF_BURST, IMU NOT implementing page addressing
write 3 0        #Upper 8-bits of BUF_CONFIG

##### CONFIGURE IMU #####
write 0 0        #Change the active page to page 0 (to access IMU)
write 64 4       #Set the datarate to 400SPS (Hz)
write 65 0       #Upper 8 bits

##### CONFIGURE BUFFER BOARD #####
write 0 FD       #Change the active page to page 253
write 2 2       #Write to the BUF_CONFIG register - stop sampling when sensor data overflows, enable IMU BURST, disable BUF_BURST, IMU NOT implementing page addressing
write 3 0        #Upper 8-bits of BUF_CONFIG
write 4 16       #Write the desired buffer size (for ADIS16470 11 16-bits)
write 5 0        #Upper 8-bits of BUF_LEN
write 8 11       #Set buffer board DR_POLARITY to rising edge, set DR_SELECT to DIO1
write 9 0        #Upper 8-bits of DIO_INPUT_CONFG

write A 1        #Pass DIO1 through to the host SPI connector
write B 0        #Upper 8-bits of DIO_OUTPUT_CONFIG
write C 6        #Set the buffer board watermark for 6 samples
write D 0        #Upper 8-bits of watermark
write 0 FE       #Change the active page to page 254
write 12 0        #Write the lower byte of the burst trigger command to the request buffer
write 13 68       #Write the upper byte of the burst trigger command to the request buffer
```

ADIS16500 (16-Bit Operation)

```
##### CONFIGURE BUFFER BOARD #####
write 0 fd      #Access Page FD
write 10 14     #Set IMU SPI to a 20us stall
write 11 20     #Set IMU SCLK to 562.5kHz
write 2 0       #Write to the BUF_CONFIG register - stop sampling when sensor data overflows, disable IMU BURST, disable BUF_BURST, IMU NOT implementing page addressing
write 3 0       #Upper 8-bits of BUF_CONFIG

##### CONFIGURE IMU #####
write 0 0       #Change the active page to page 0 (to access IMU)
write 64 0      #Set the datarate to 2000SPS (Hz)
write 65 0      #Upper 8 bits
write 60 c1     #Write to MSC_CTRL with 16-bit burst data, burst data has gyro and accel, enable Linear acceleration compensation for gyro, enable point of percussion alignment, DR polarity to Active high
write 61 0

##### CONFIGURE BUFFER BOARD #####
write 0 FD      #Change the active page to page 253
write 2 0       #Write to the BUF_CONFIG register - stop sampling when sensor data overflows, enable IMU BURST, disable BUF_BURST, IMU NOT implementing page addressing
write 3 0       #Upper 8-bits of BUF_CONFIG
write 4 16      #Write the desired buffer size (for ADIS16500 11 16-bits)
write 5 0       #Upper 8-bits of BUF_LEN
write 8 11       #Set buffer board data ready polarity to rising edge, set buffer board data ready to DIO1
write 9 0       #Upper 8-bits of DIO_INPUT_CONFG
write A 1       #Pass DIO1 through to the host SPI connector
write B 0       #Upper 8-bits of DIO_OUTPUT_CONFIG
write C 6       #Set the buffer board watermark for 6 samples
write D 0       #Upper 8-bits of watermark
write 0 FE      #Change the active page to page 254
write 12 0       #Write the lower byte of the burst trigger command to the request buffer
write 13 68      #Write the upper byte of the burst trigger command to the request buffer
```

ADIS16500 (32-Bit Operation)

```
##### CONFIGURE BUFFER BOARD #####
write 0 fd      #Access Page FD
write 10 14     #Set IMU SPI to a 20us stall
write 11 20     #Set IMU SCLK to 562.5kHz
write 2 0       #Write to the BUF_CONFIG register - stop sampling when sensor data overflows, disable IMU BURST, disable BUF_BURST, IMU NOT implementing page addressing
write 3 0       #Upper 8-bits of BUF_CONFIG

##### CONFIGURE IMU #####
write 0 0       #Change the active page to page 0 (to access IMU)
write 64 4      #Set the datarate to 400SPS (Hz)
write 65 0      #Upper 8 bits
write 60 c1     #Write to MSC_CTRL with 32-bit burst data, burst data has gyro and accel, enable Linear acceleration compensation for gyro, enable point of percussion alignment, DR polarity to Active high
write 61 2

##### CONFIGURE BUFFER BOARD #####
write 0 FD      #Change the active page to page 253
write 2 0       #Write to the BUF_CONFIG register - stop sampling when sensor data overflows, enable IMU BURST, disable BUF_BURST, IMU NOT implementing page addressing
write 3 0       #Upper 8-bits of BUF_CONFIG
write 4 22      #Write the desired buffer size (for ADIS16500 11 32-bits)
write 5 0       #Upper 8-bits of BUF_LEN
write 8 11       #Set buffer board data ready polarity to rising edge, set buffer board data ready to DIO1
write 9 0       #Upper 8-bits of DIO_INPUT_CONFG
write A 1       #Pass DIO1 through to the host SPI connector
write B 0       #Upper 8-bits of DIO_OUTPUT_CONFIG
write C 4       #Set the buffer board watermark for 4 samples
write D 0       #Upper 8-bits of watermark
write 0 FE      #Change the active page to page 254
write 12 0       #Write the lower byte of the burst trigger command to the request buffer
write 13 68      #Write the upper byte of the burst trigger command to the request buffer
```

Check IMU Product ID

Before proceeding with streaming data, check the IMU product ID using the following commands:

```
write 2 0
write 3 0
write 0 0
read 72
read 72
```

It returns 4056(HEX) for 16470 IMU and 4074(HEX) for 16500 IMU.

Stream Data

To start streaming, run the following commands:

```
readbuf
stream 1
```

Note: It is possible to input commands even when the board is already streaming data. Simply type in the commands.

To stop streaming, run the following commands:

```
stream 0
write 0 fd
```

Get Values for All Registers

To obtain values for all registers, run the following commands:

```
status
write 0 fd
read 0 7e
write 0 fe
read 0 7e
```

Note: As a good practice (but not required), after a register write, read the register to verify that the write command was executed properly (e.g., after `write 0 fd` , confirm by `read 0`).

Support Links

[link to FW repo: TBC]

[links to ROS1 and ROS2 repos: TBC]

Ordering Information

PART	TYPE
EVAL-ADRD2121-EBZ	EV Kit

#Denotes RoHS-compliant.

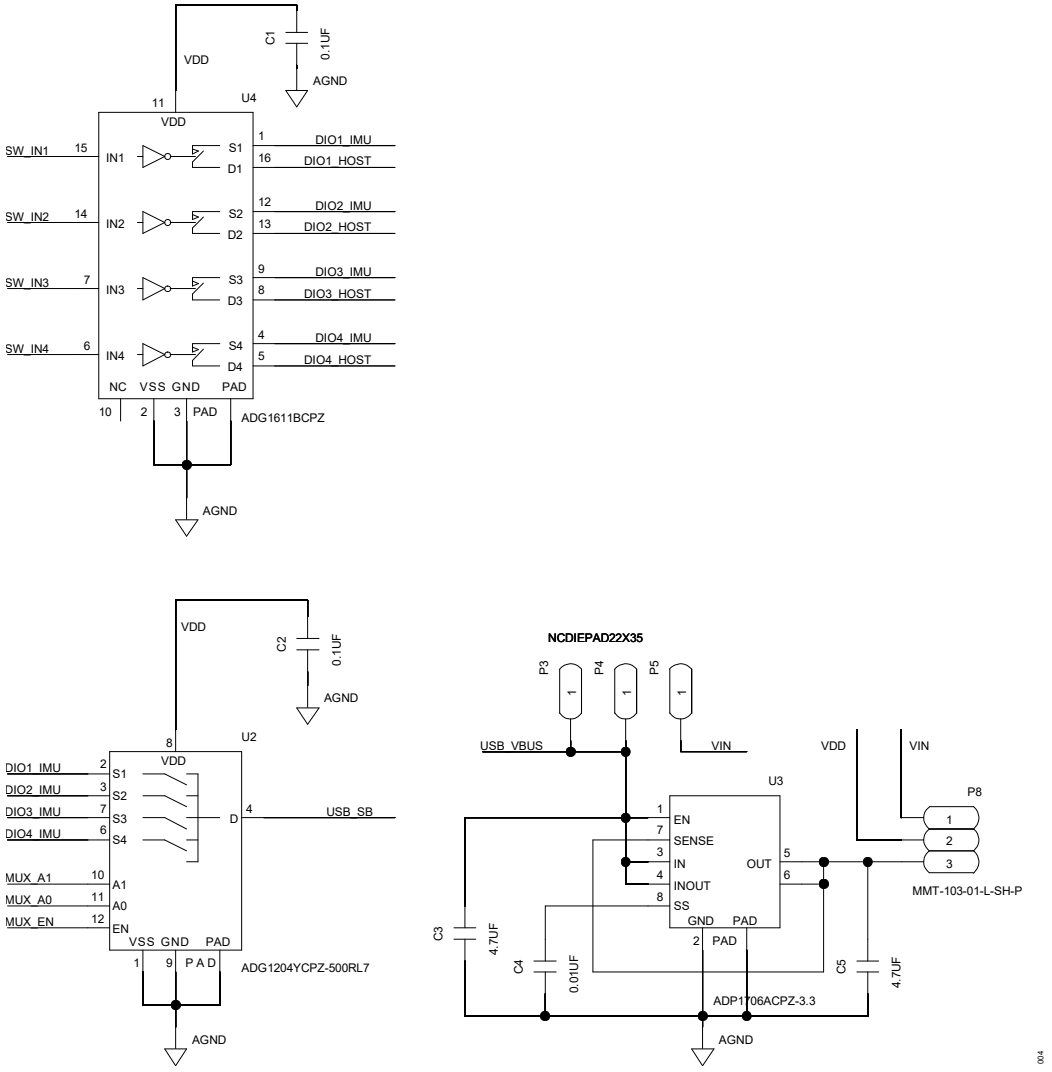
ADRD2121 EV Kit Bill of Materials

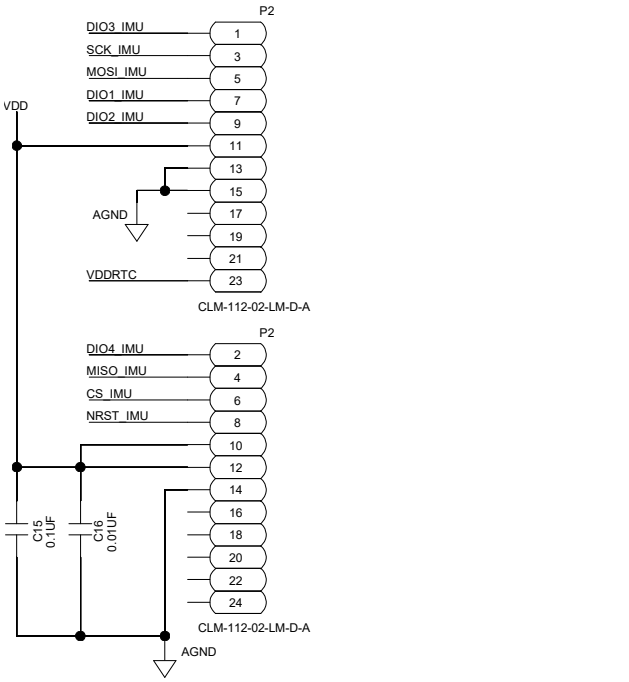
PART	QTY	DESCRIPTION
C1,C2,C8,C10,C11,C12,C13,C14,C15	9	CAP CER 0.1uF 50V 10% X5R 0402
C16	1	CAP CER 0.01uF 25V 10% X8R 0402
C17	1	CAP CER 0.1uF 16V 10% X7R 0402
C3,C5	2	CAP CER 4.7uF 16V 10% X6S 0603
C4	1	CAP CER 0.01uF 25V 5% X7R 0402
C6,C7	2	CAP CER 18pF 50V 5% C0G 0402
C9	1	CAP CER 1uF 25V 10% X5R 0402
DS1	1	LED GREEN CLEAR CHIP SMD, 571NM
DS2	1	LED RED CLEAR CHIP SMD , 621NM
J1	1	MOD USB TYPE-C CONNECTOR
P2	1	CONN-PCB 24POS RUGGED RELIABLE MICRO SKT, FEMALE DUAL ROW, 1MM PITCH, WITH ALIGNMENT PIN
P7	1	CONN-PCB 5POS DISCONNECTABLE INSULATION DISPLACEMENT HDR, 1MM PITCH SIDE ENTRY
P8	1	CONN-PCB 3POS UNSHROUDED HDR RA 2MM PITCH
P9	1	CONN-PCB 24POS BOARD STACKER HDR 1MM PITCH
R1,R4	2	RES SMD 22 Ohm 1% 1/20W 0201
R10,R12	2	RES SMD 330 Ohm 1% 1/20W 0201
R13	1	RES SMD 10K Ohm 1% 1/10W 0402 AEC-Q200
R14	1	RES SMD 3.3K Ohm 1% 1/20W 0201
R15,R16	2	RES SMD 10K Ohm 5% 1/20W 0201
R2,R3	2	RES SMD 5.1K Ohm 1% 1/20W 0201
R5	1	RES SMD 1.5K Ohm 5% 1/20W 0201
R9	1	RES SMD 0 Ohm 5% 1/20W 0201
S1	1	SWITCH TACTILE NO SPST 0.01A
U1	1	IC MCU 32-BIT ARM CORTEX M7 RISC 512KB FLASH 3.3V
U2	1	IC-ADI 4/1-CHANNEL MUX
U3	1	IC-ADI LOW DROPOUT CMOS LIN REG
U4	1	IC ADI QUAD SPST SWITCHES
Y1	1	IC CRYSTAL 8.0000MHZ 18PF
P6	1	CONN-PCB TAG-CONNECT IN CKT CABLE WITH RJ12 MODULAR PLUG
R11	1	RES SMD 0 Ohm 5% 1/20W 0201
R8	1	RES SMD 10K Ohm 5% 1/20W 0201
Shunt	1	SHUNT, JUMPER SKT ASSY 2MM PITCH 2POS BLACK
PEM Nut	4	PEM NUT, M2 X 0.4
Main PCB	1	PCB
Flex-Cable PCB	1	PCB
M2 10mm Standoff	4	STANDOFF, M2 X M2 THREAD, 10MM BODY, BRASS, MALE/FEMALE, 10MM STUD
M2 15mm Standoff	4	STANDOFF, M2 X M2 THREAD, 15MM BODY, BRASS, MALE/FEMALE, 15MM STUD

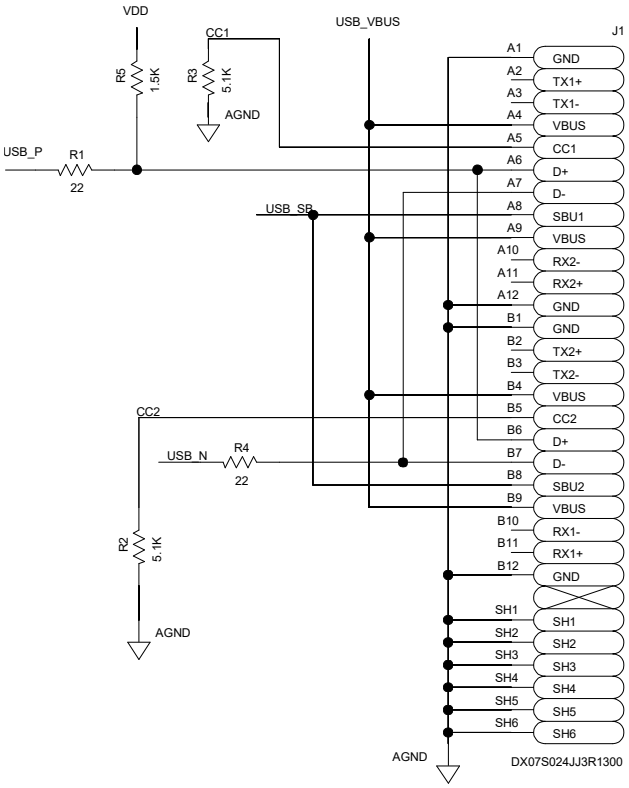
M2 5mm Screw	4	SCREW, M2X5MM STAINLESS PAN HEAD
M2 Nut	4	NUT, HEX A4 STAINLESS STEEL M2
USB-C Cable	1	USB 3.1 CABLE, MALE USB-C TO MALE USB-C CABLE, 1M

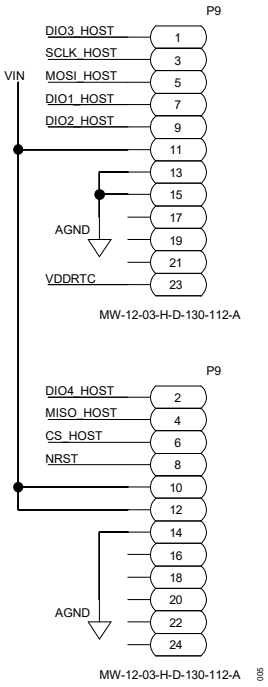
ADRD2121 EV Kit Schematic

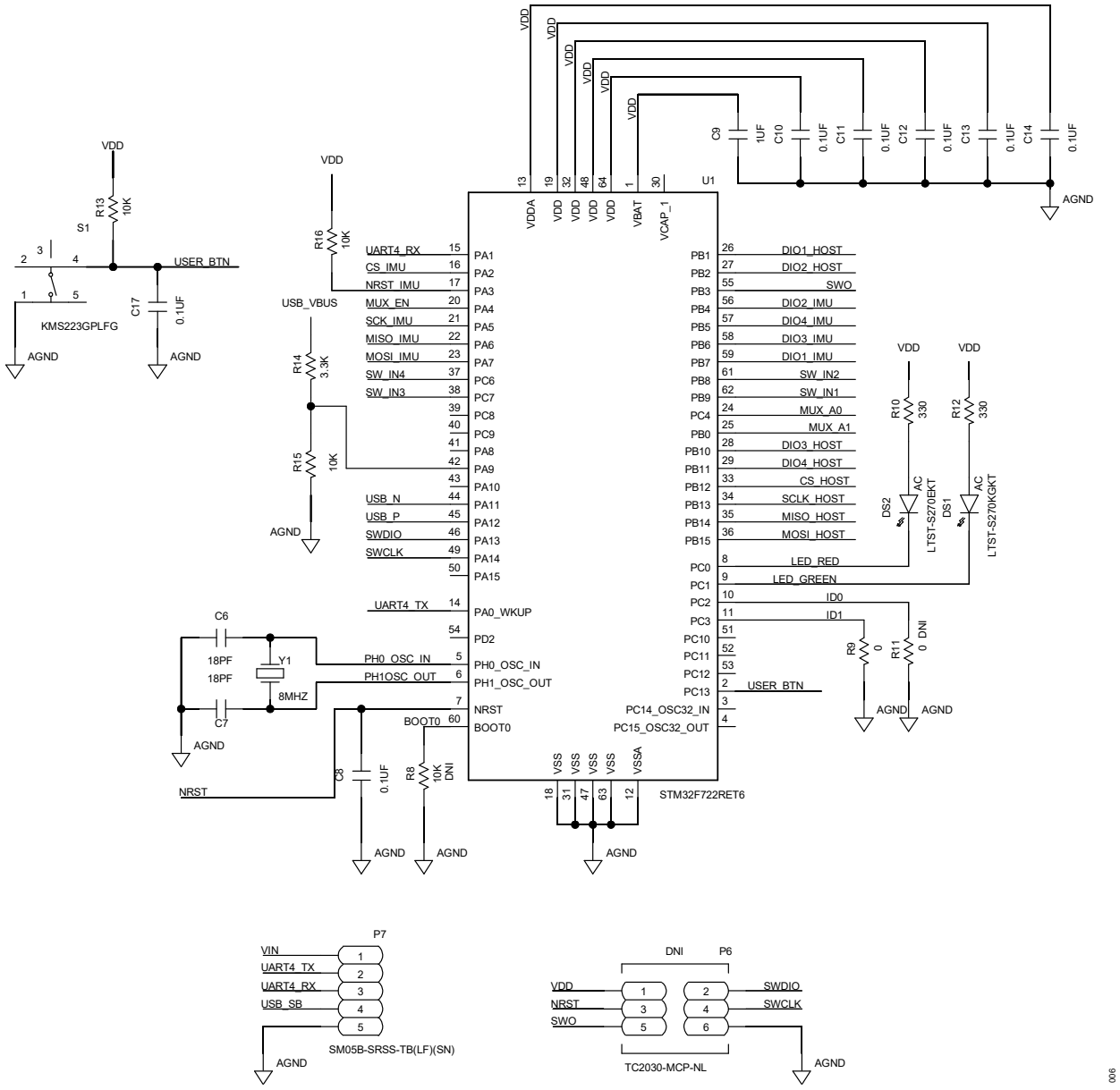
Main Board




P2
DIO3_IMU
SCK_IMU
MOSI_IMU
DIO1_IMU
DIO2_IMU
VDD
AGND
VDDRTC
1
3
5
7
9
11
13
15
17
19
21
23
CLM-112-02-LM-D-A
P2
DIO4_IMU
MISO_IMU
CS_IMU
NRST_IMU
C15
0.1UF
C16
0.01UF
2
4
6
8
10
12
14
16
18
20
22
24
CLM-112-02-LM-D-A
AGND

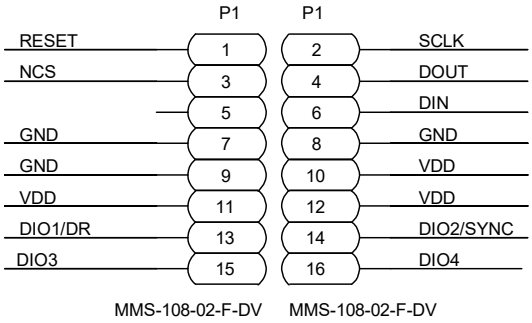

VDD
R5
1.5K
CC1
R3
5.1K
AGND
USB_VBUS
J1
USB_P
R1
22
USB_SB
CC2
USB_N
R4
22
R2
5.1K
AGND
A1
A2
A3
A4
A5
A6
A7
A8
A9
A10
A11
A12
B1
B2
B3
B4
B5
B6
B7
B8
B9
B10
B11
B12
SH1
SH2
SH3
SH4
SH5
SH6
GND
TX1+
TX1-
VBUS
CC1
D+
D-
SBU1
VBUS
RX2-
RX2+
GND
GND
TX2+
TX2-
VBUS
CC2
D+
D-
SBU2
VBUS
RX1-
RX1+
GND
SH1
SH2
SH3
SH4
SH5
SH6
AGND
DX07S024JJ3R1300


P9
DIO3_HOST
SCLK_HOST
MOSI_HOST
DIO1_HOST
DIO2_HOST
VIN
AGND
VDDRTC
1
3
5
7
9
11
13
15
17
19
21
23
MW-12-03-H-D-130-112-A
P9
DIO4_HOST
MISO_HOST
CS_HOST
NRST
2
4
6
8
10
12
14
16
18
20
22
24
AGND
MW-12-03-H-D-130-112-A
005

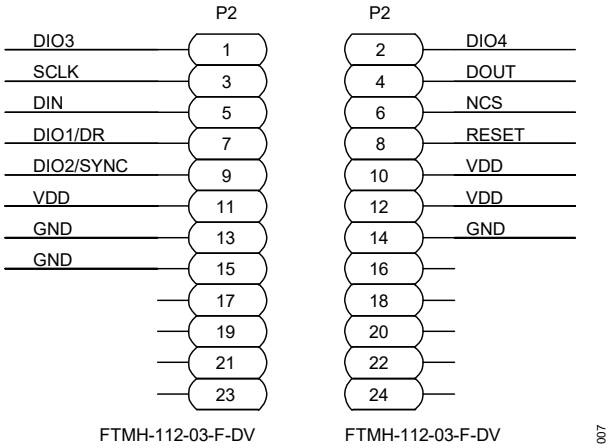

VDD
R13
10K
S1
USER_BTN
KMS223GPLFG
C17
0.1UF
AGND
R16
10K
UART4_RX
CS_IMU
NRST_IMU
MUX_EN
SCK_IMU
MISO_IMU
MOSI_IMU
SW_IN4
SW_IN3
USB_VBUS
R14
3.3K
R15
10K
USB_N
USB_P
SWDIO
SWCLK
C9
1UF
C10
0.1UF
C11
C12
C13
C14
U1
VDDA
VBAT
VCAP_1
PA1
PA2
PA3
PA4
PA5
PA6
PA7
PC6
PC7
PC8
PC9
PA8
PA9
PA10
PA11
PA12
PA13
PA14
PA15
PA0_WKUP
PD2
PH0_OSC_IN
PH1_OSC_OUT
NRST
BOOT0
PB1
PB2
PB3
PB4
PB5
PB6
PB7
PB8
PB9
PC4
PB0
PB10
PB11
PB12
PB13
PB14
PB15
PC0
PC1
PC2
PC3
PC10
PC11
PC12
PC13
PC14_OSC32_IN
PC15_OSC32_OUT
DIO1_HOST
DIO2_HOST
SWO
DIO2_IMU
DIO4_IMU
DIO3_IMU
DIO1_IMU
SW_IN2
SW_IN1
MUX_A0
MUX_A1
DIO3_HOST
DIO4_HOST
CS_HOST
SCLK_HOST
MISO_HOST
MOSI_HOST
LED_RED
LED_GREEN
ID0
ID1
USER_BTN
R10
330
R12
330
DS2
DS1
LTST-S270EKT
LTST-S270KGKT
R9
0
R11
0 DNI
C6
18PF
C7
18PF
Y1
8MHZ
C8
0.1UF
R8
10K
DNI
VSS
VSSA
STM32F722RET6
P7
VIN
UART4_TX
UART4_RX
USB_SB
SM05B-SRSS-TB(LF)(SN)
DNI
P6
VDD
NRST
SWO
SWDIO
SWCLK
TC2030-MCP-NL
006

Flex-Cable Board

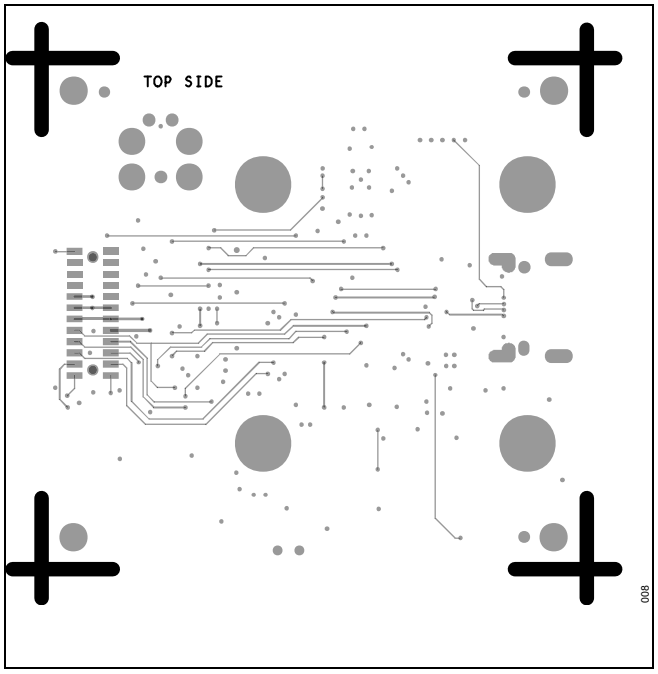
IMU SIDE, TWO ROW, 8P PER ROW, 2MM PITCH



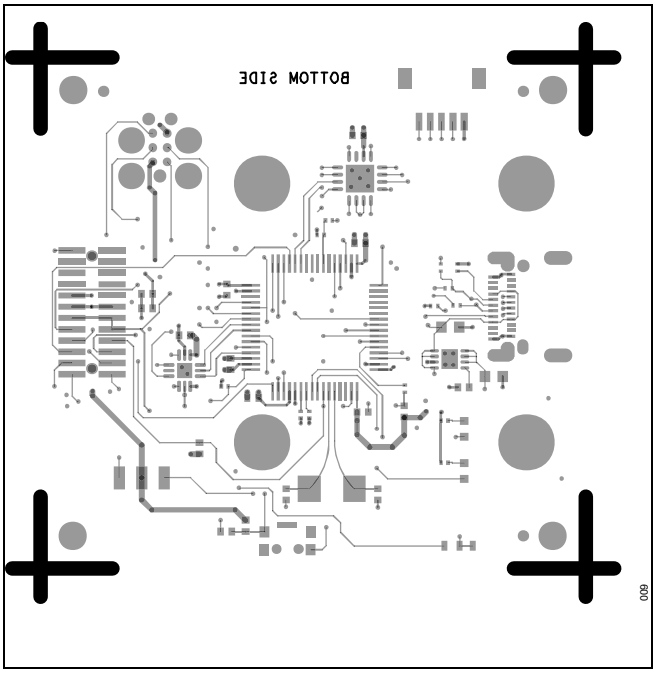
BUFFER BOARD SIDE, TWO ROW, 12P PER ROW, 1MM PITCH



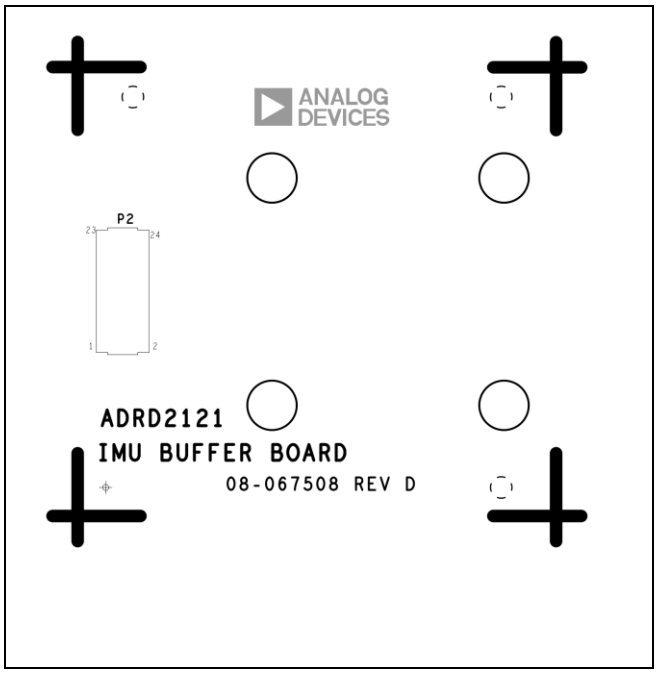
ADRD2121 EV Kit PCB Layout



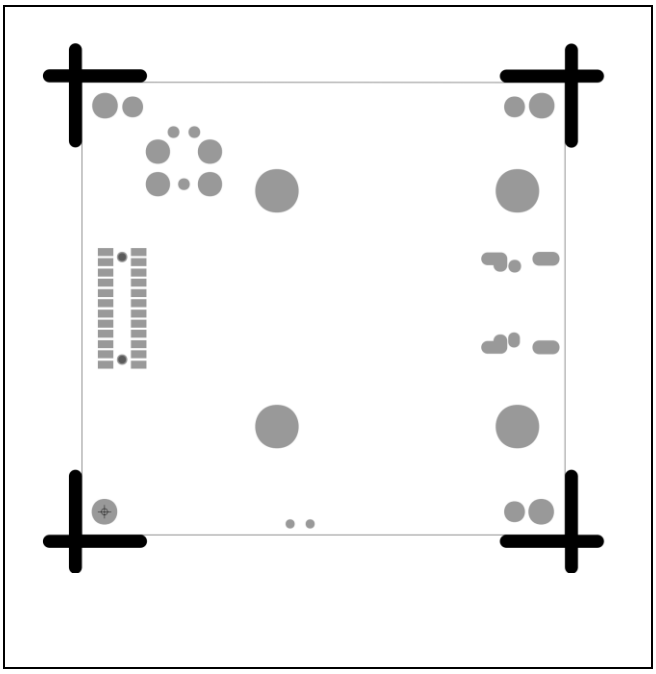
ADRD2121 EV Kit Layout—Layer 1 Primary



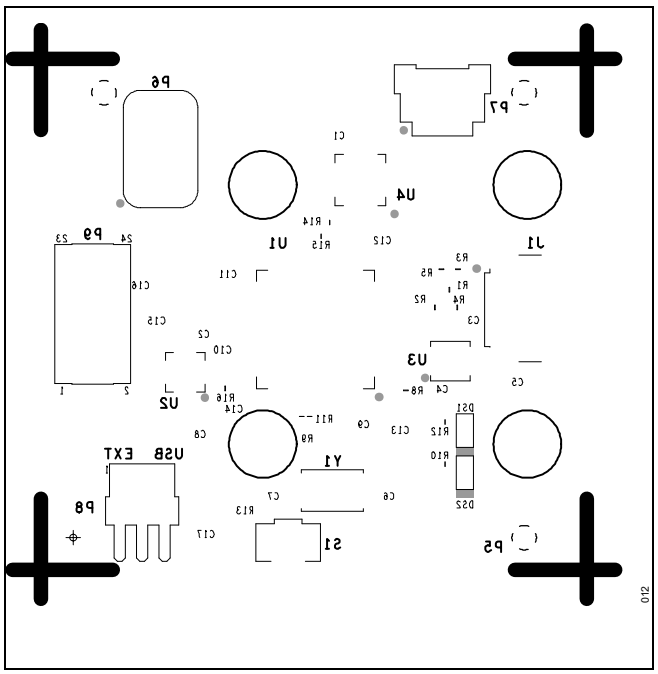
ADRD2121 EV Kit Layout—Layer 4 Secondary



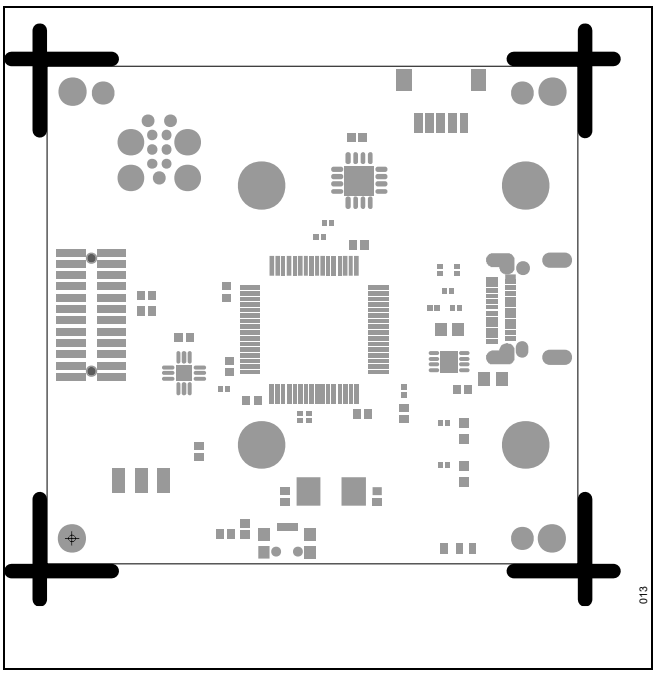
ADRD2121 EV Kit Layout—Silkscreen Primary



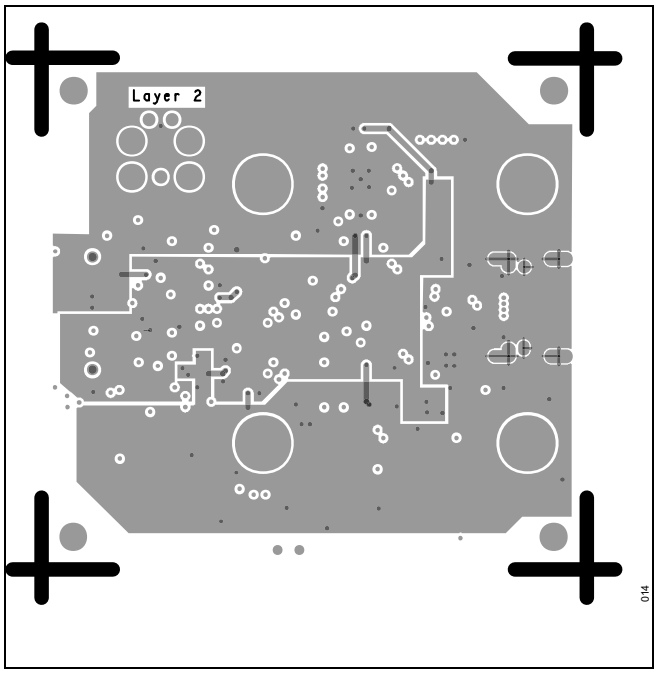
ADRD2121 EV Kit Layout—Soldermask Primary



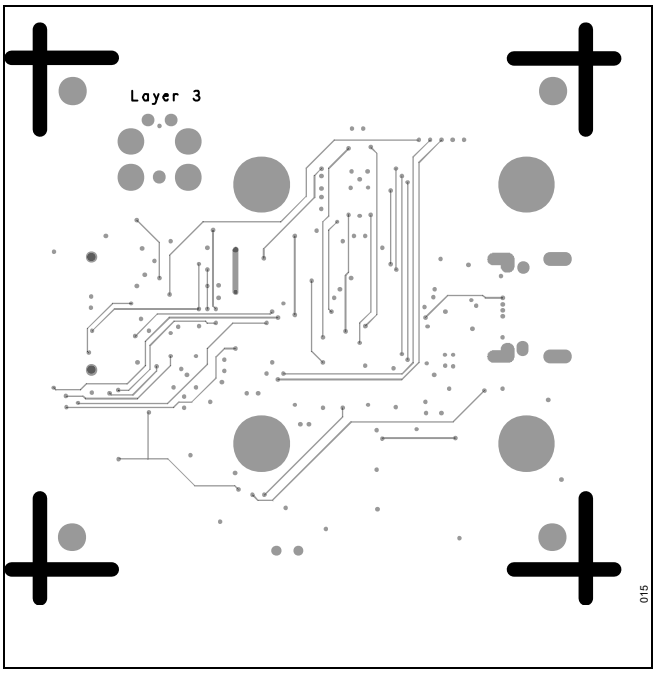
ADRD2121 EV Kit Layout—Silkscreen Secondary



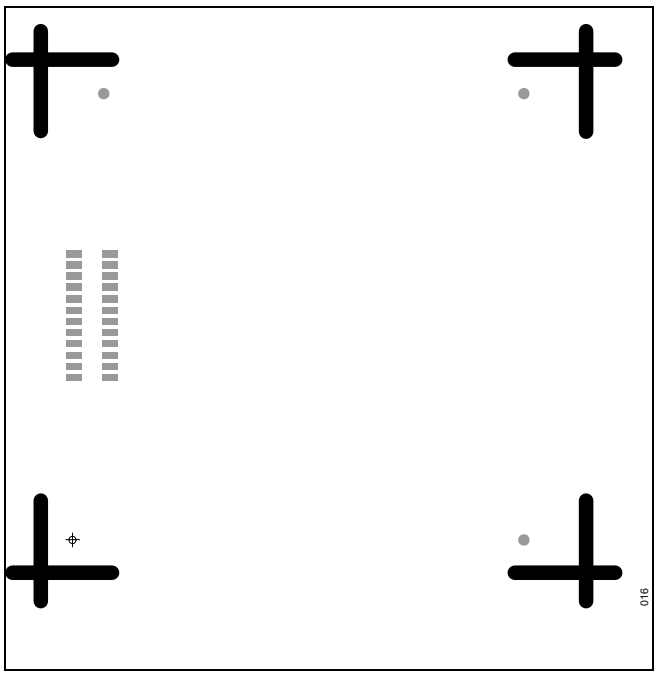
ADRD2121 EV Kit Layout—Soldermask Secondary



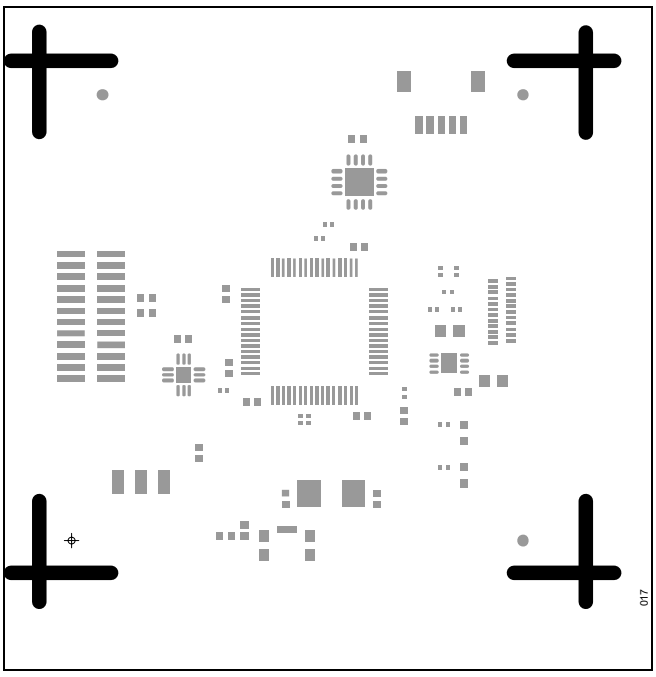
ADRD2121 EV Kit Layout—Layer 2 GND/PWR



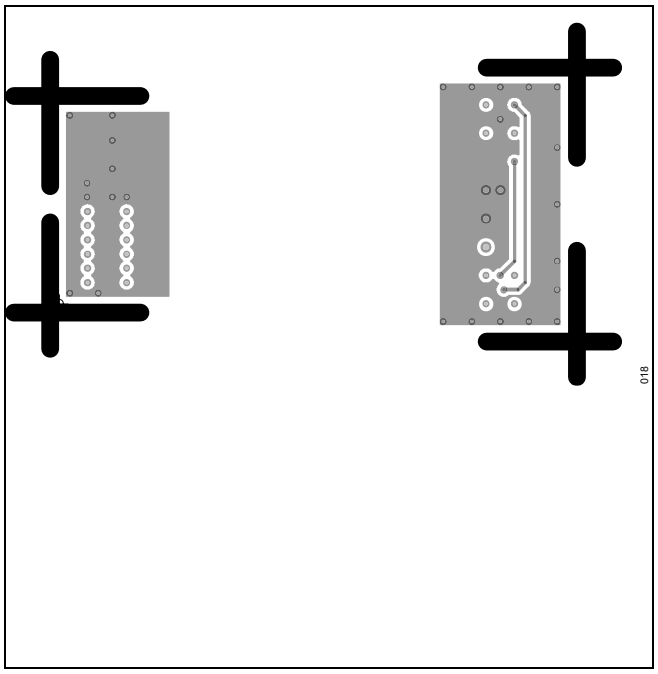
ADRD2121 EV Kit Layout—Layer 3 Signal



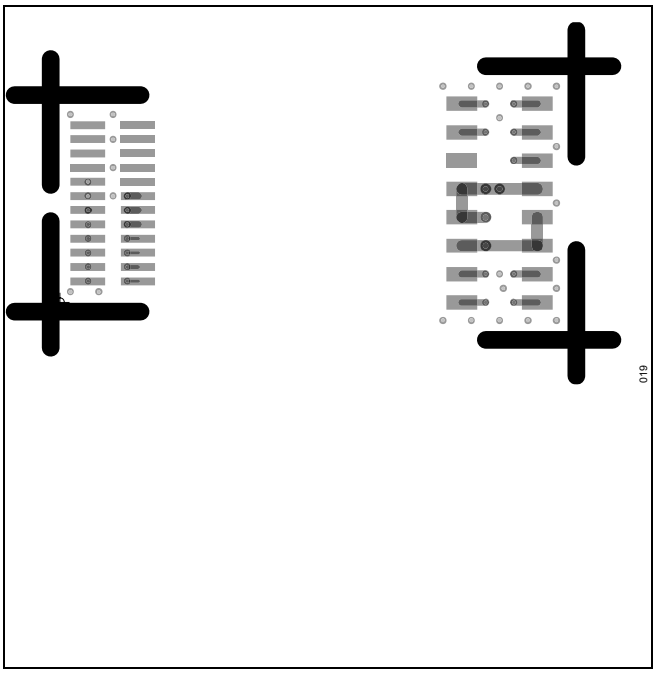
ADRD2121 EV Kit Layout—Pastemask Primary



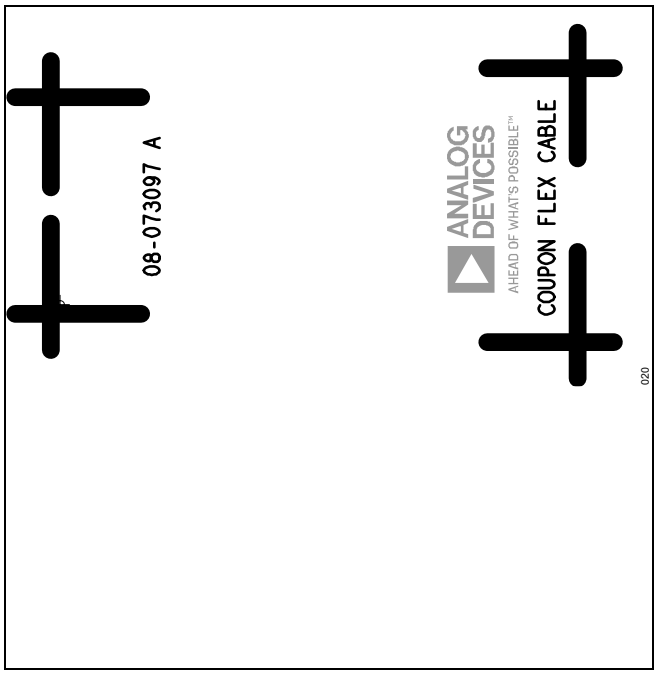
ADRD2121 EV Kit Layout—Pastemask Secondary



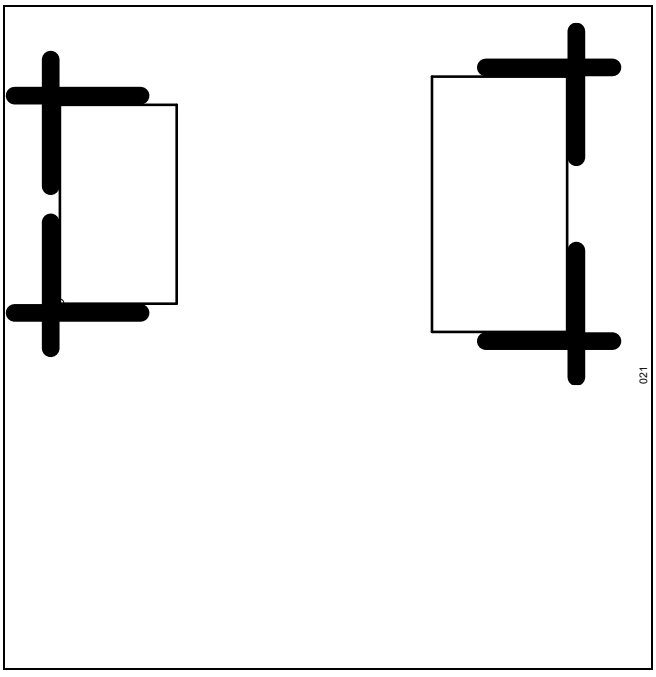
Flex-Cable Board Layout—L1 Primary



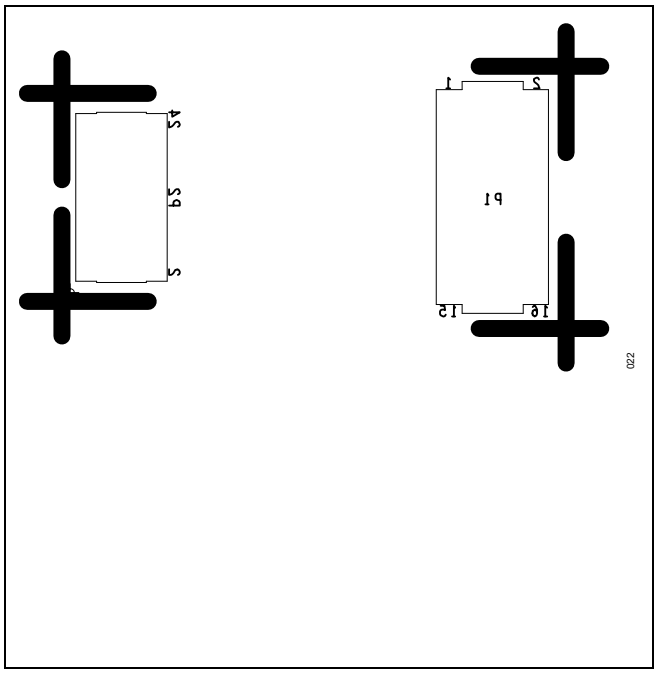
Flex-Cable Board Layout—L4 Secondary



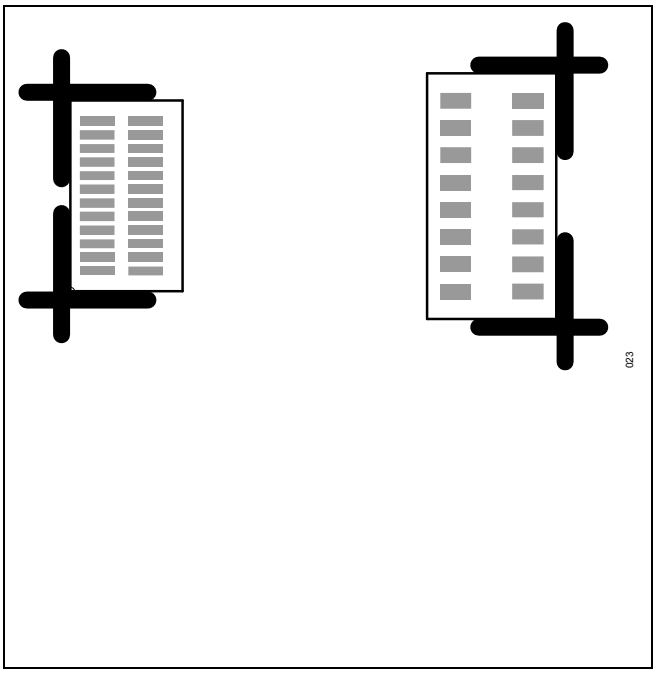
Flex-Cable Board Layout—Silkscreen Primary



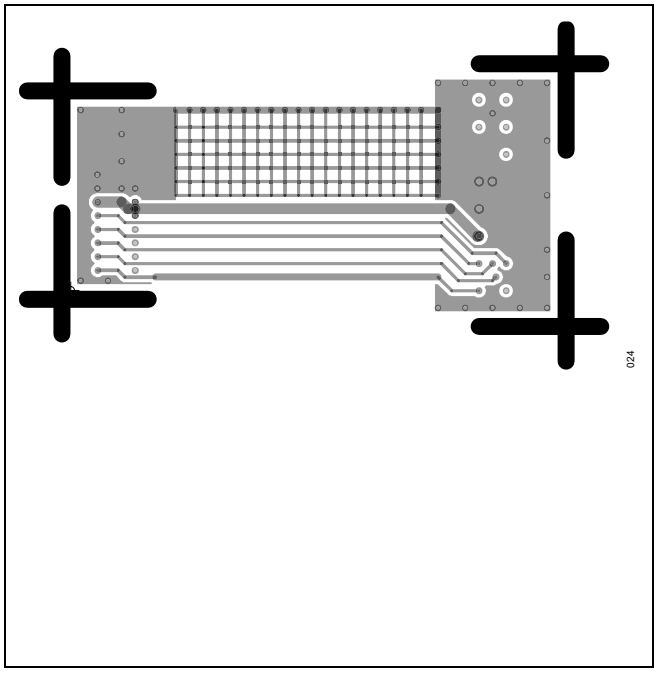
Flex-Cable Board Layout—Soldermask Primary



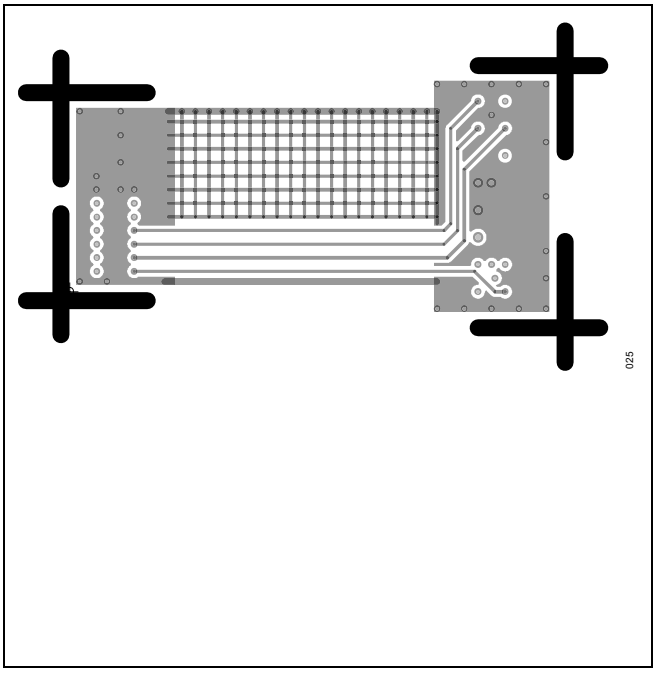
Flex-Cable Board Layout—Silkscreen Secondary



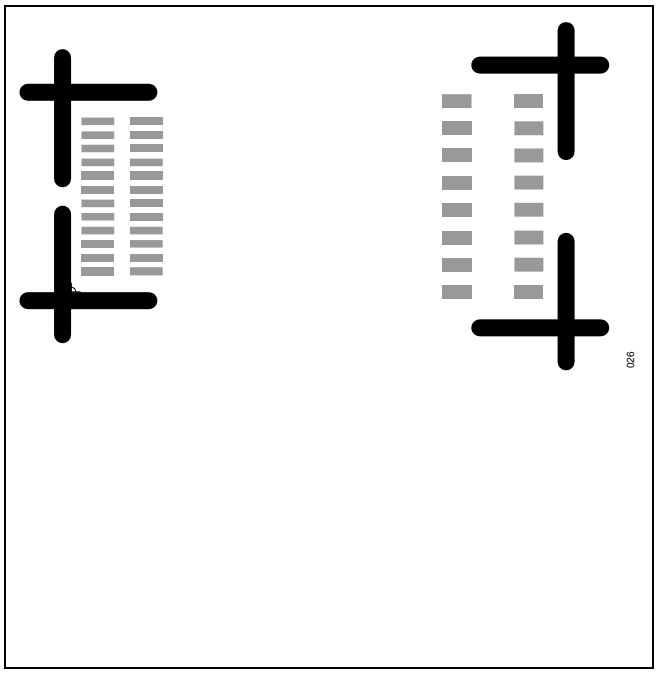
Flex-Cable Board Layout—Soldermask Secondary



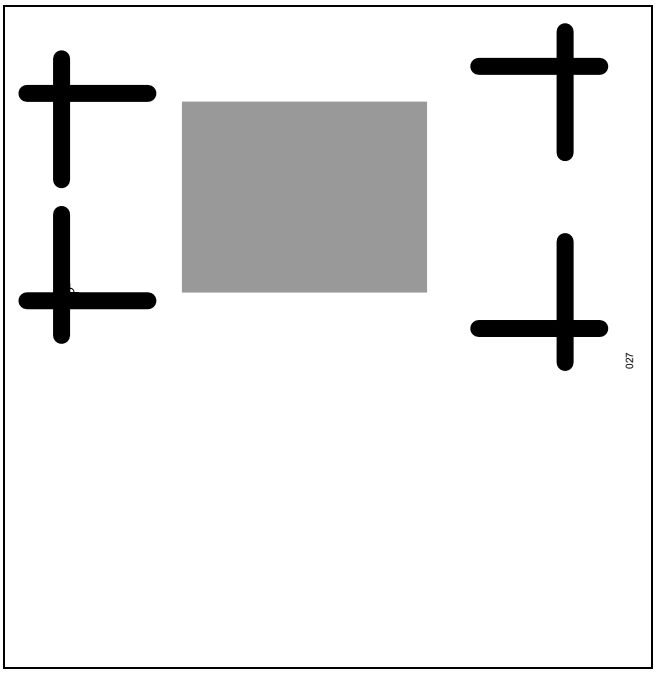
Flex-Cable Board Layout—L2 Internal SIG/GND



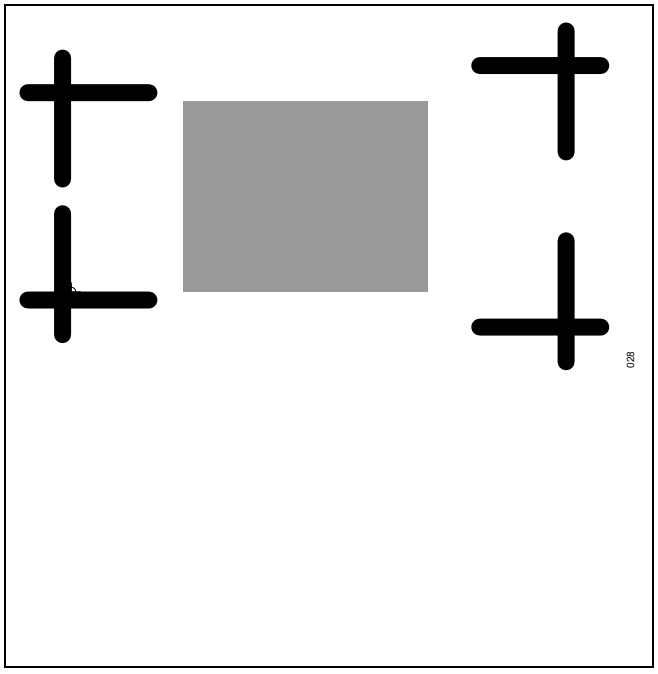
Flex-Cable Board Layout—L3 Internal SIG/GND



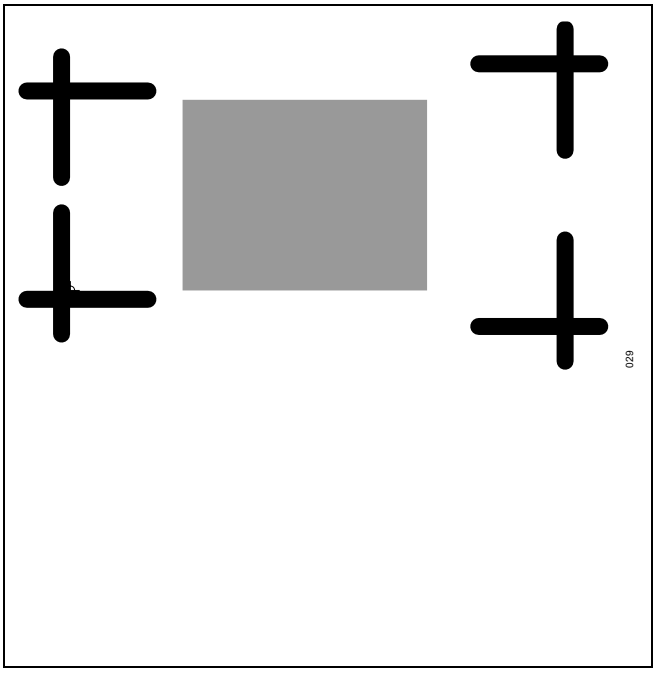
Flex-Cable Board Layout—Pastemask Secondary



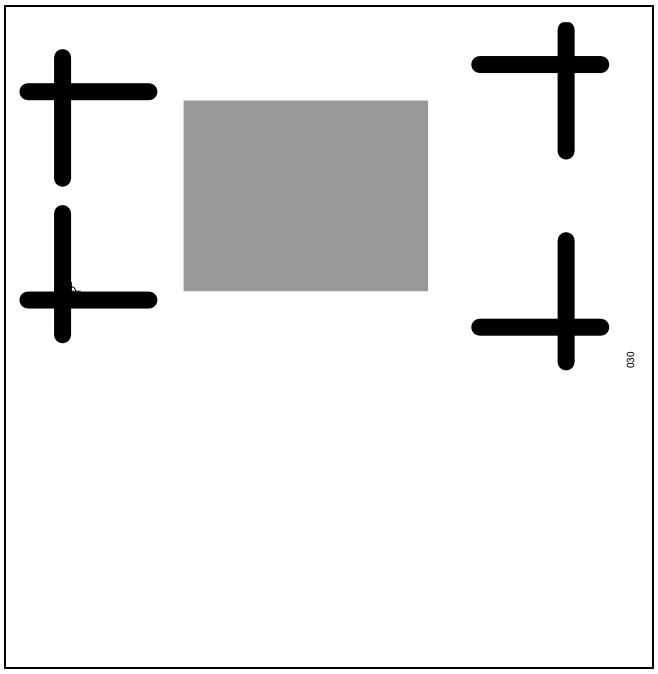
Flex-Cable Board Layout—Coverlay Primary



Flex-Cable Board Layout—Adhesive Primary



Flex-Cable Board Layout—Coverlay Secondary



Flex-Cable Board Layout—Adhesive Secondary

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	5/25	Initial release	—

Notes