

TI Designs

Display DevPack Design Guide



TI Designs

TI Designs provide the foundation that you need including methodology, testing and design files to quickly evaluate and customize the system. TI Designs help you accelerate your time to market.

Design Resources

TIDC-DEVPACK-DISPLAY	Tool Folder Containing Design Files
CC2650	Product Folder
CC2640	Product Folder
CC2630	Product Folder
CC2620	Product Folder
SensorTag	Product Folder
Debug DevPack	Product Folder

Design Features

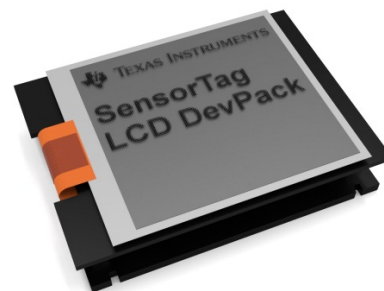
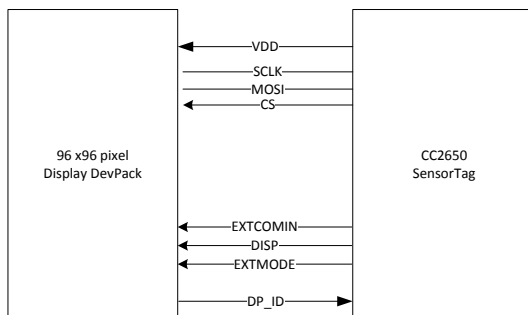
- Add a Display to Your SensorTag
- Offers a Low Power Graphical Display
- Enables Wearable and Display Applications
- Works With the SensorTag Application

Featured Applications

- Wearables
- Refrigerator Display
- Remote Display
- Debugging
- Weather Stations
- Sensor Nodes



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1 Key System Specifications

- 1.28" Graphical Display
- 96 × 96 Pixel Resolution
- Ultra-Low Power, Sharp® LS013B4DN04 Memory LC
- SPI Interface

2 System Description

Add a display to your SensorTag with the Display DevPack. Plug it into the SensorTag DevPack expansion header and expand your design with a 96 × 96 pixel graphical display. TI designed the display for wearable applications, weather stations, or any portable display application displaying information from the web.

The SensorTag battery powers DevPack based on ultra-low power, display technology with a typical current draw of 2 μ A.

2.1 CC2650

The Display Devpack demonstrates a low-power graphical display that interfaces with a CC2650 device. The CC2650 is a wireless MCU targeting *Bluetooth*® Smart™, ZigBee™ and 6LoWPAN, and ZigBee RF4CE remote control applications.

The device is a member of the CC26xx family of cost effective, ultra-low power, 2.4-GHz RF devices. Very low active RF and MCU current and low-power mode current consumption provide excellent battery life. This device operates on small coin-cell batteries and can be used with energy-harvesting applications.

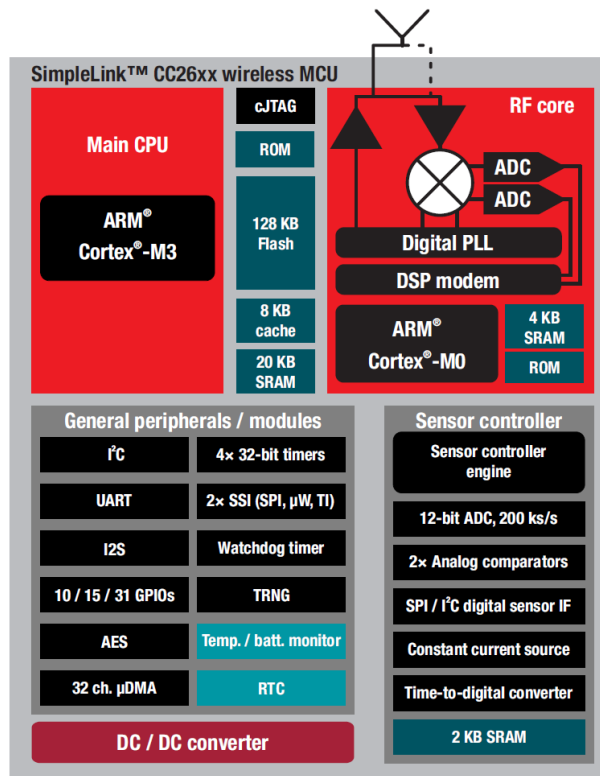


Figure 1. CC2650 Functional Block Diagram

3 Block Diagram

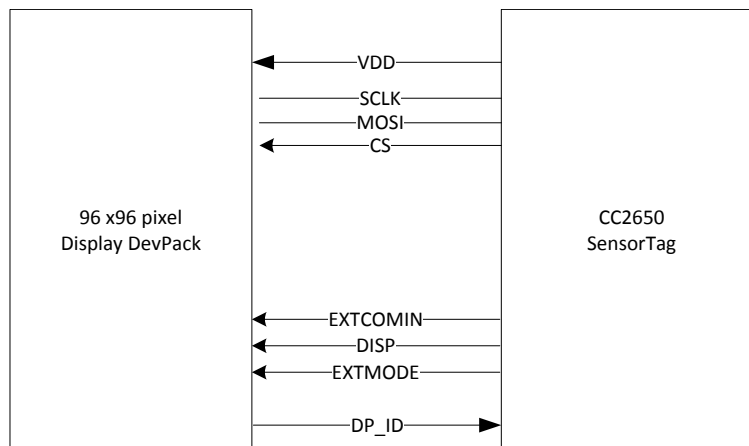


Figure 2. CC2650 and Display Block Diagram

4 System Design Theory

4.1 CC2650 SensorTag with Display DevPack

The SensorTag and Display DevPack is a complete development kit that requires no embedded software knowledge to start testing.

To get started, do the following:

1. Plug the Display DevPack into the SensorTag DevPack connector.
2. Connect the SensorTag to your smart phone using *Bluetooth* Smart.
3. Download the Display DevPack software from the application.
4. Control the display directly from your phone.

4.2 Embedded Software Development

The SensorTag includes open hardware and a software reference design for low cost and low-power IoT nodes. Use the SensorTag with the Debug DevPack for the lowest cost hardware development platform. You can easily port the SensorTag application between radio standards to quickly evaluate which wireless technology is best for your application.

4.3 Hardware Development

Use the SensorTag hardware as the development platform for your IoT project. The open hardware platform includes ten low-power sensors and the Display DevPack to develop and test your own sensors and display applications.

5 Getting Started Hardware

5.1 Plug the Display DevPack into the SensorTag

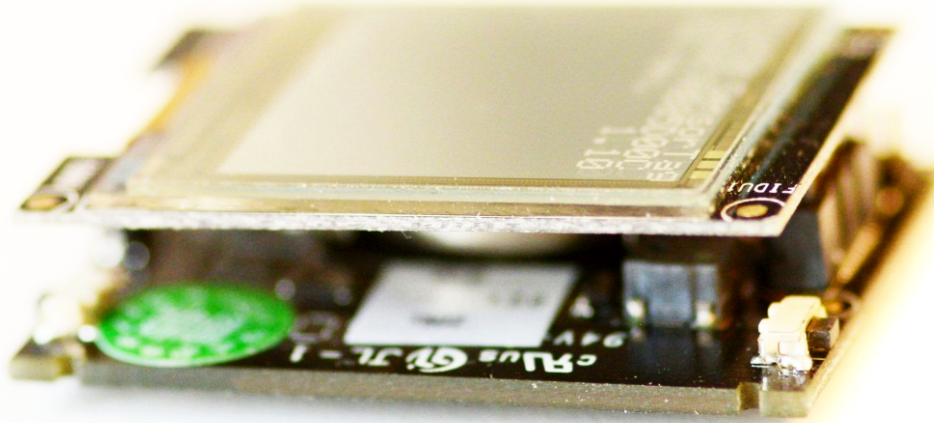


Figure 3. Plugging the Display DevPack into the SensorTag

5.2 Download the Display DevPack Firmware

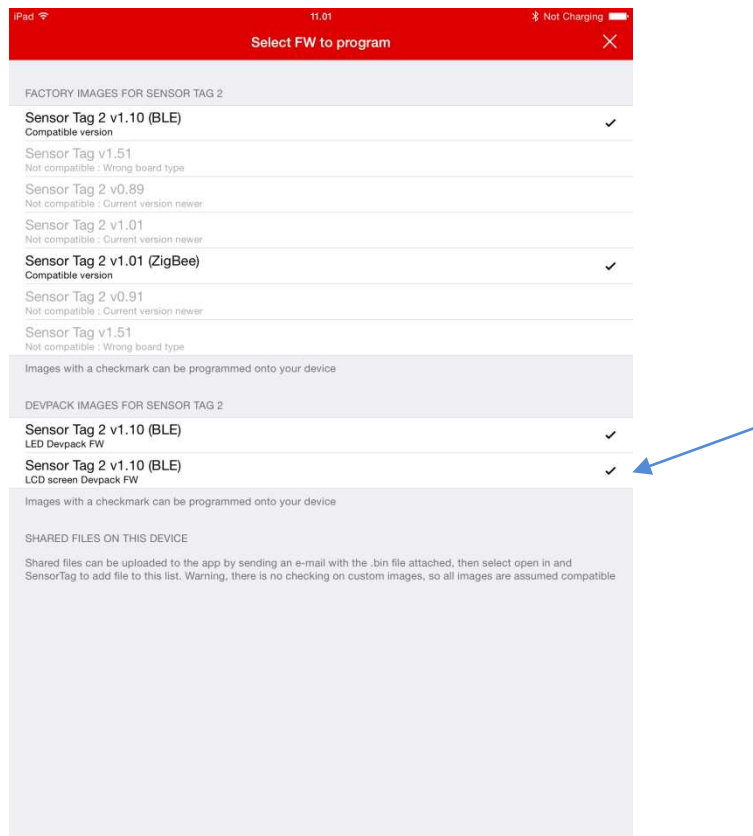


Figure 4. Downloading the Display DevPack Firmware

5.3 Enter Text into the SensorTag Application to display it on the LCD Screen

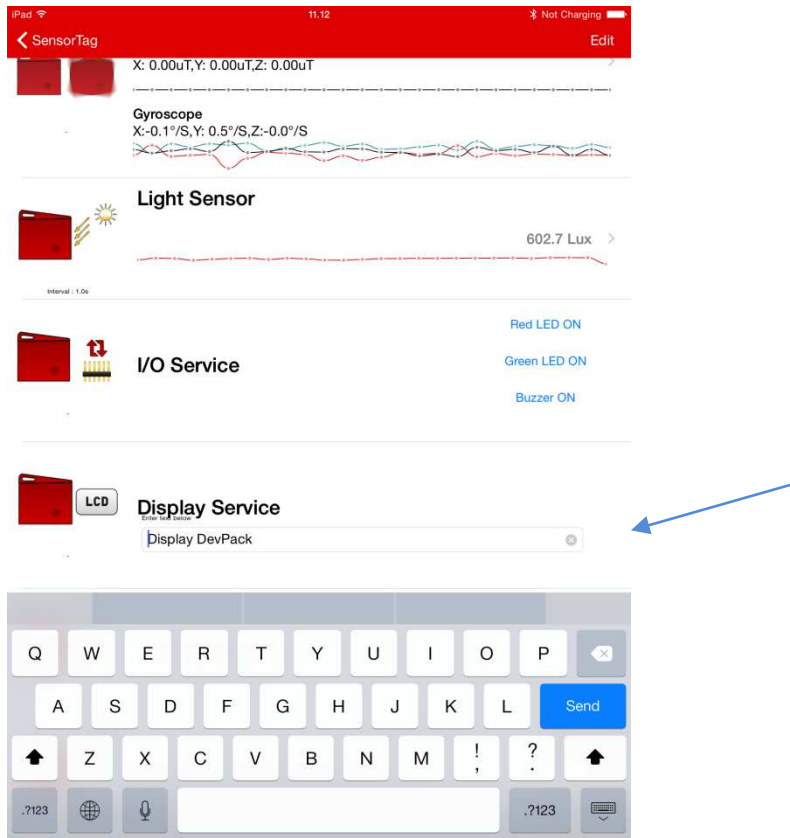


Figure 5. Writing Text to Send it to the Display

5.4 **Cut the Rubber Sleeve to Fit Your Application**

To cut the rubber sleeve to fit the display, use a sharp knife to cut carefully around the edge of the display.

NOTE: Cut only around display and not the entire PCB.

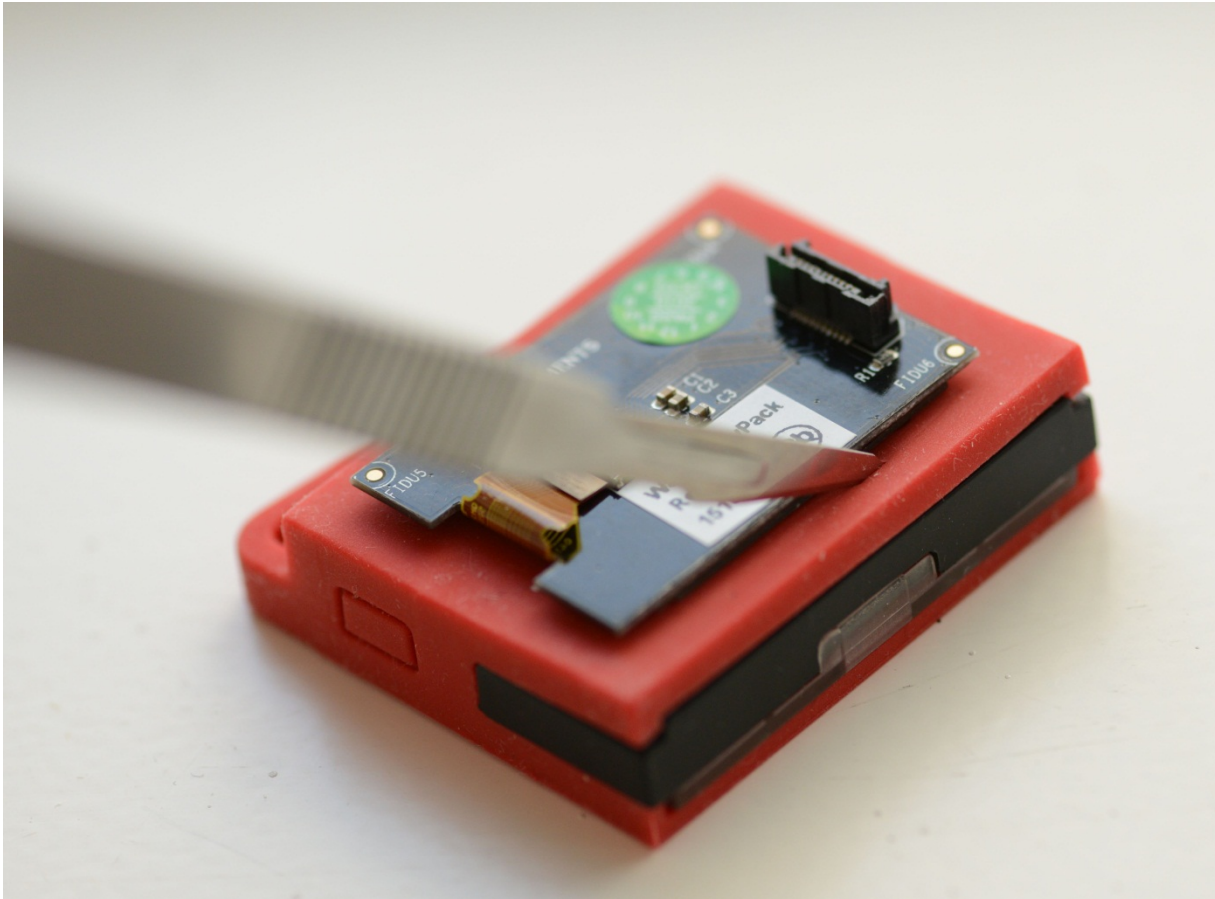


Figure 6. Cutting the Rubber Sleeve to Fit the Display

6 **Getting Started Firmware**

The *Bluetooth* Smart firmware for the SensorTag Display DevPack is included in the [Bluetooth low energy Stack examples \(BLE-STACK-2\)](#).

7 **Test Setup**

See [Section 5](#).

8 Design Files

8.1 Schematics

To download the schematics for each board, see the design files at <http://www.ti.com/tool/TIDC-DEVPACK-DISPLAY>.

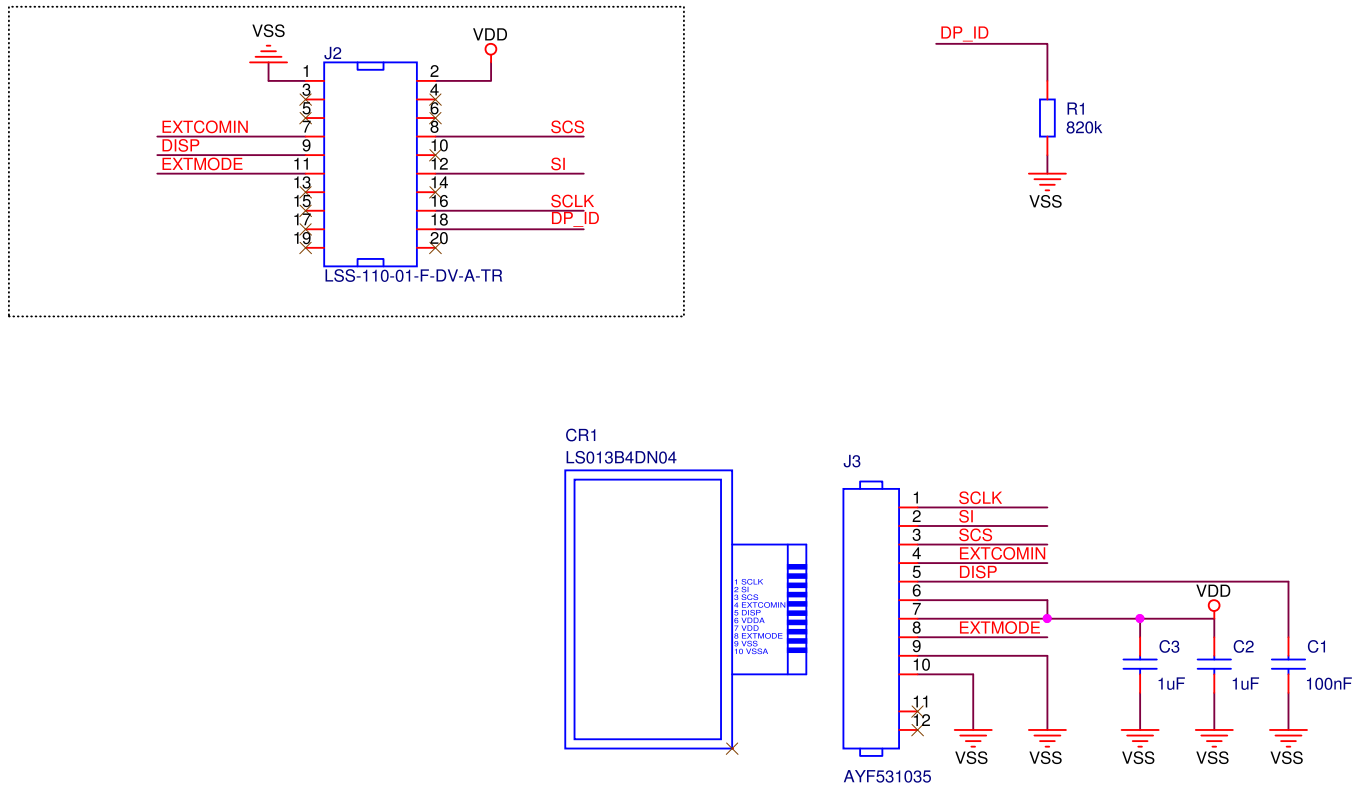


Figure 7. : Display DevPack Schematic

8.2 Bill of Materials

To download the bill of materials (BOM), see the design files at [TIDC-DEVPACK-DISPLAY](#).

Table 1. BOM

Designator	Quantity	Value	Description	Part Number	Manufacturer
C1	1	100 nF	CAPACITOR, CERAMIC X7R, 100 nF, 25 V, -10%/10%, -55°C/125°C, 0603, SMD	GRM188R71E104KA01D	MURATA
C2 C3	2	1 μ F	CAPACITOR, CERAMIC X5R, 1 μ F, 25 V, -10%/10%, -55°C/85°C, 0603, SMD	GRM188R61E105KA12D	MURATA
CR1	1	LS013B4DN04	OPTO, DISPLAY, LCD, 2.7 V TO 3.3 V, NOT APPLY	LS013B4DN04	SHARP
FIDU1 FIDU2 FIDU3 FIDU4 FIDU5 FIDU6	6	FIDU_1.27 mm	FIDUCIAL MARK, ROUND 1.27 mm		
J2	1	LSS-110-01-F-DV-A-TR	CONNECTOR, HEADER, HI-SPEED SOCKET, FEMALE, STRAIGHT, 2 ROWS ,20 PINS, PITCH 0.635 mm, SMD	LSS-110-01-F-DV-A-TR	SAMTEC
J3	1	AYF531035	CONNECTOR, FLEXI, FEMALE, RIGHT ANGLE, TOP AND BOTTOM DOUBLE CONTACTS, 1 ROW, 10 PINS, PITCH 0.5 mm, SMD	AYF531035	PANASONIC INDUSTRIAL
R1	1	820 k	RESISTOR, THICK FILM, 820 k, -1%/1%, 0.1 W, 75 V, -55°C/155°C, 0603, SMD	CRCW0603820KFKEA	VISHAY

8.3 PCB Layout Recommendations

The layout of this DevPack only uses digital signals at a relatively low data rate. The layout requires no special considerations.

8.3.1 Layout Prints

To download the layout prints for each board, see the design files at [TIDC-DEVPACK-DISPLAY](#).

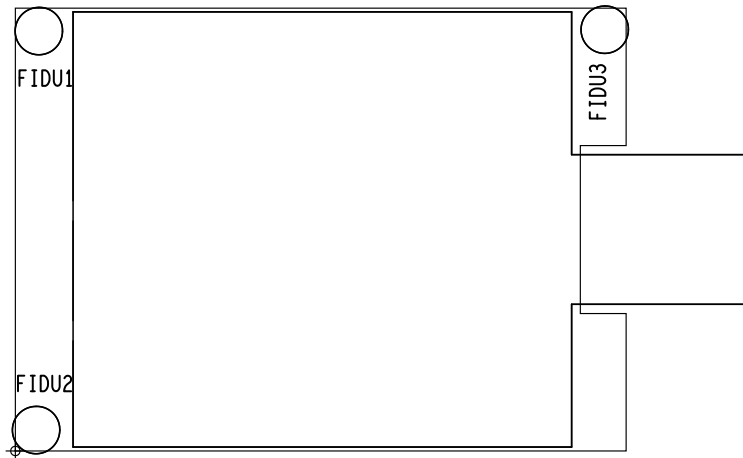


Figure 8. Top Silkscreen

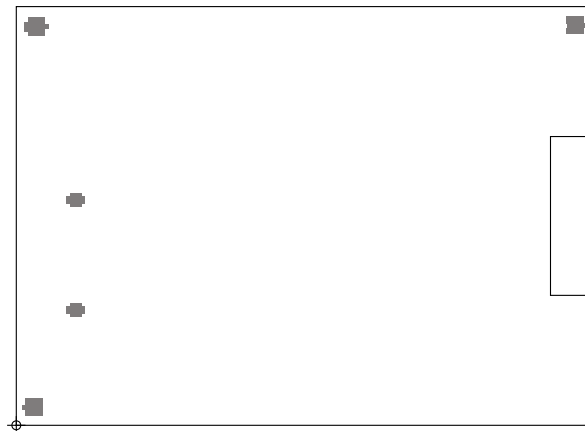


Figure 9. Top Solder Mask

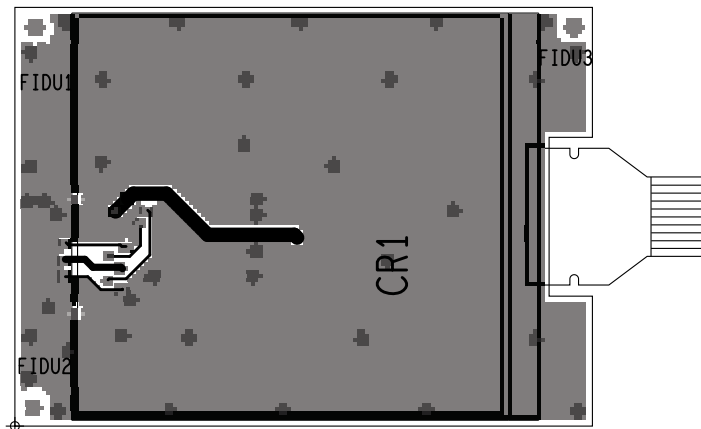


Figure 10. Top Layer

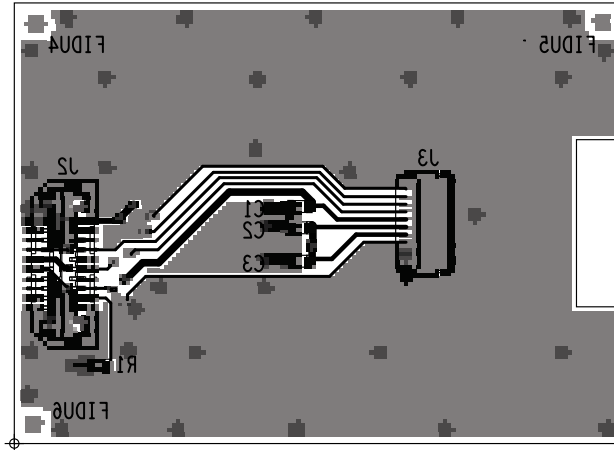


Figure 11. Bottom Layer

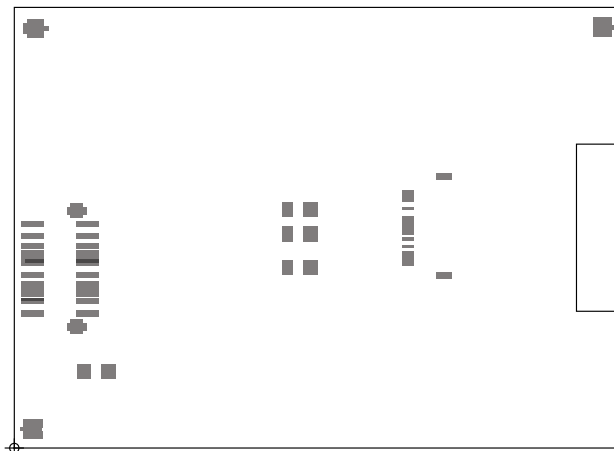


Figure 12. Bottom Solder Mask

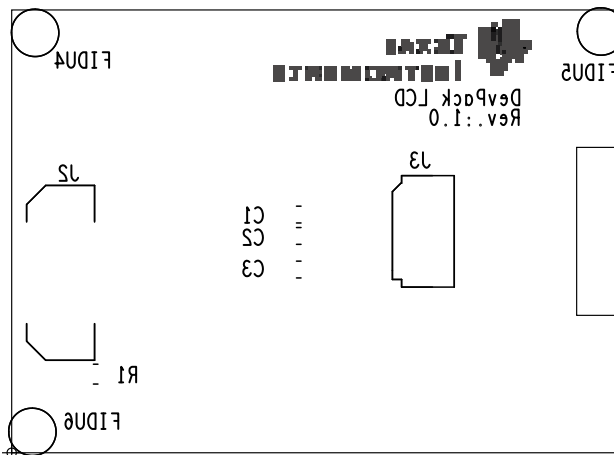


Figure 13. Bottom Silkscreen

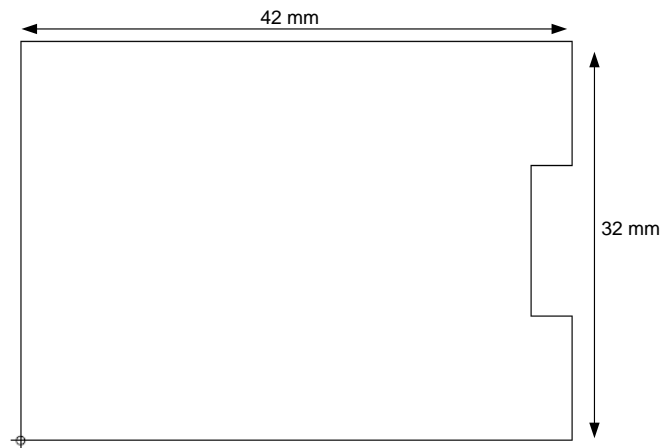


Figure 14. Mechanical Dimensions

8.4 Cadence Project

To download the Cadence project files, see the design files at [TIDC-DEVPACK-DISPLAY](#).

8.5 Layout Guidelines

To download the layout guidelines, see the design files at [TIDC-DEVPACK-DISPLAY](#).

8.6 Gerber Files

To download the Gerber files, see the design files at [TIDC-DEVPACK-DISPLAY](#).

8.7 Assembly Drawings

To download the Assembly Drawings for each board, see the design files at [TIDC-DEVPACK-DISPLAY](#).

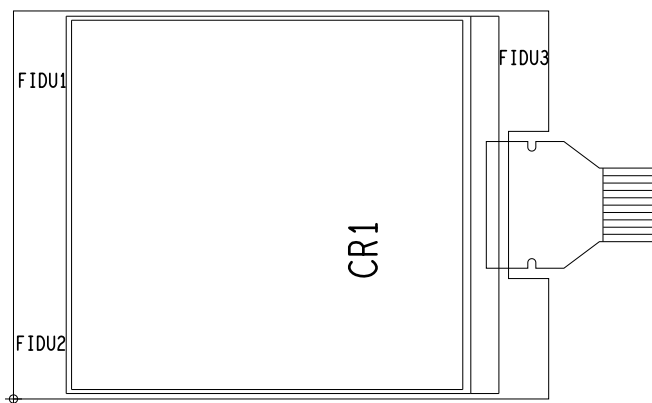


Figure 15. Assembly Top

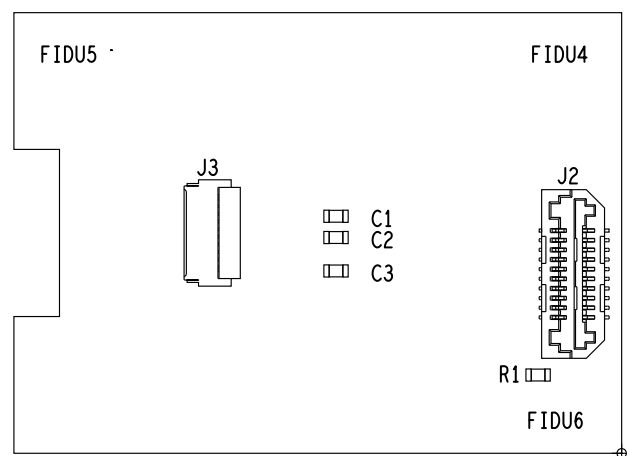


Figure 16. Assembly Bottom

8.8 Software Files

Associate this BLE stack to this TI Design: <http://www.ti.com/tool/ble-stack>.

9 References

1. CC26xx SimpleLink Wireless MCU Technical Reference Manual, ([SWCU117](#))
2. CC2650 SimpleLink™ Multistandard Wireless MCU, ([SWRS158](#))
3. CC2640 SimpleLink Bluetooth Smart Wireless MCU, ([SWRS176](#))
4. CC2630 SimpleLink 6LoWPAN / ZigBee Wireless MCU, ([SWRS177](#))
5. CC2620 SimpleLink ZigBee RF4CE Wireless MCU, ([SWRS156](#))

10 About the Author

JARLE BOE is a system applications manager at TI. He manages application specific designs like the SensorTag for *Bluetooth* Smart, ZigBee, and 6LoWPAN wireless applications. Jarle brings 18 years of experience from software engineering, hardware engineering, applications, and marketing projects.

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