Small Form Factor Design for BQ25150

The BMS013 is a small form factor design for the BQ25150. All key components for operation are laid out in a 12 mm^2 area. PCB is 30mm × 18 mm (1.2” × 0.7”).

The design functions as a small form factor demonstration and as a functional evaluation of the BQ25150. Each pin on the BQ25150 has a test point on the board, (including a connector for the EV2400 to allow for I^2C communication with the charger) and a 5-kΩ resistor on the TS pin.

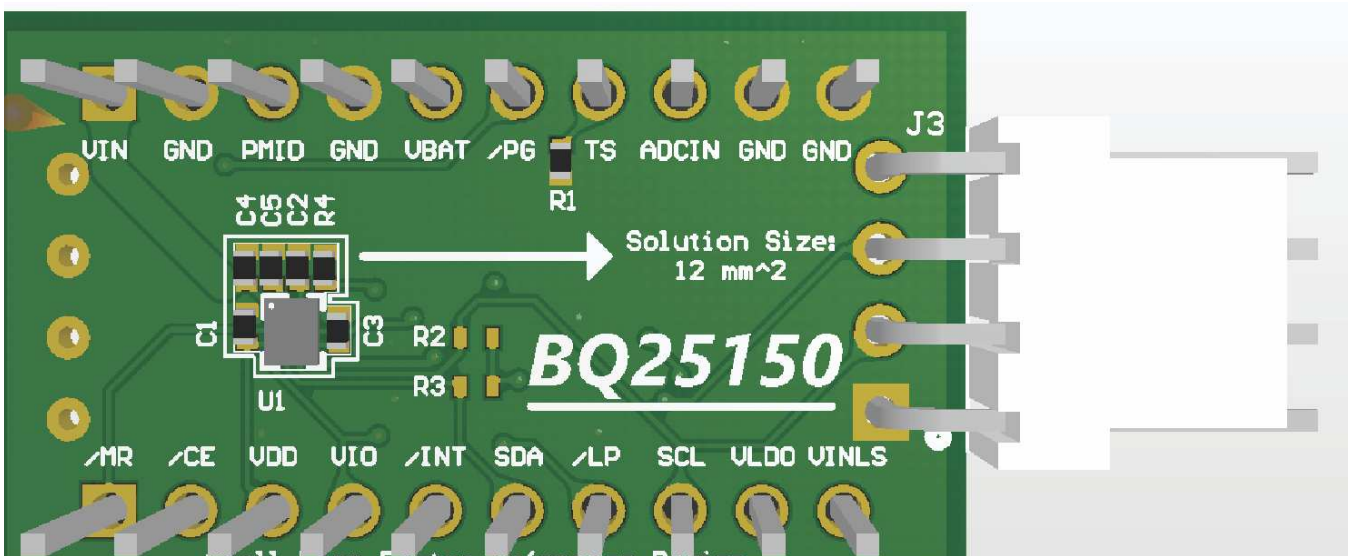

Figure 1. Board Front View

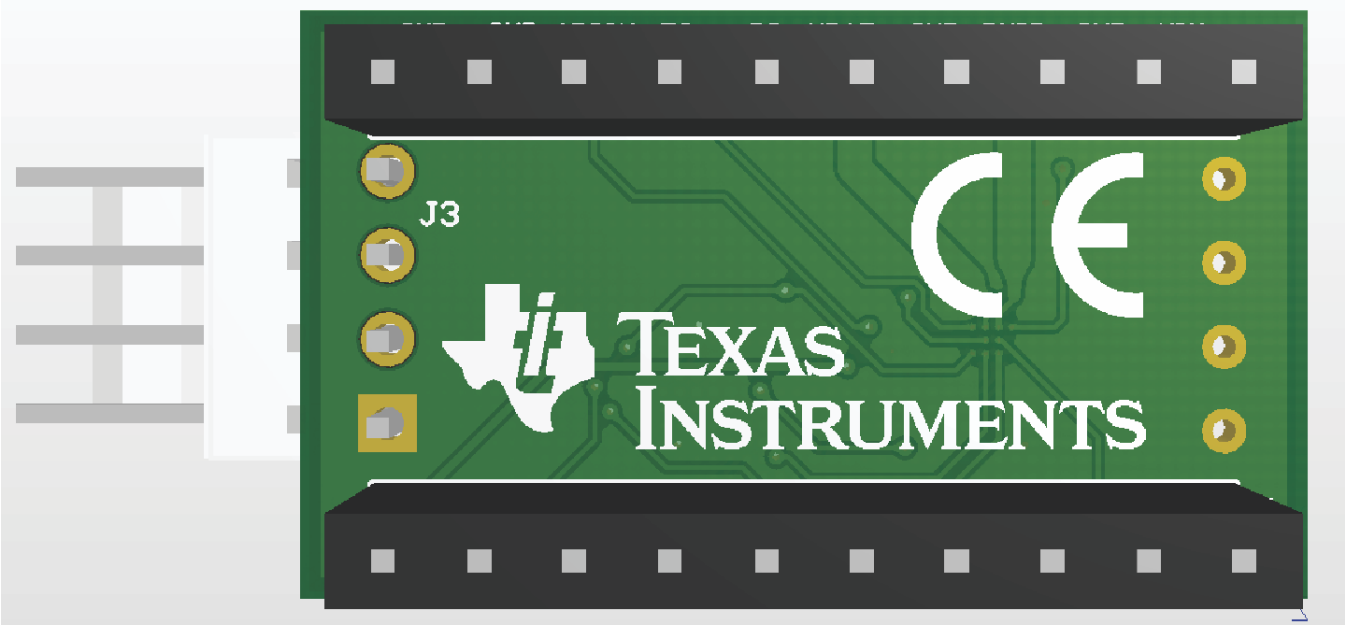

Figure 2. Board Back View

Trademarks

1 Overview

The purpose of this board is to demonstrate the smallest functional solution size of the BQ25150. The board includes capacitors on the VDD, IN, PMID, LDO, and BAT pins and a resistor from the IMAX pin to ground. While pads for 10-kΩ pullup resistors for the SDA and SCL pins are present on the board, the pullup resistors are not included in the solution size as they are shared on the I^2C bus with the rest of the system.

The 5-kΩ resistor on the TS pin simulates an attached battery pack at 25°C, which allows for normal operation. With the recommended setup of a 10-kΩ NTC attached in parallel with a 10-kΩ resistor, the equivalent resistance at 25°C is 5 kΩ. The 80-µA bias current produces a voltage of 0.4 V, which ensures that the charger operates normally.

Most of the board uses 6-mil traces (see below). The vias for the charger solder balls are small with a diameter of 10 mil and a hole size of 6 mil.

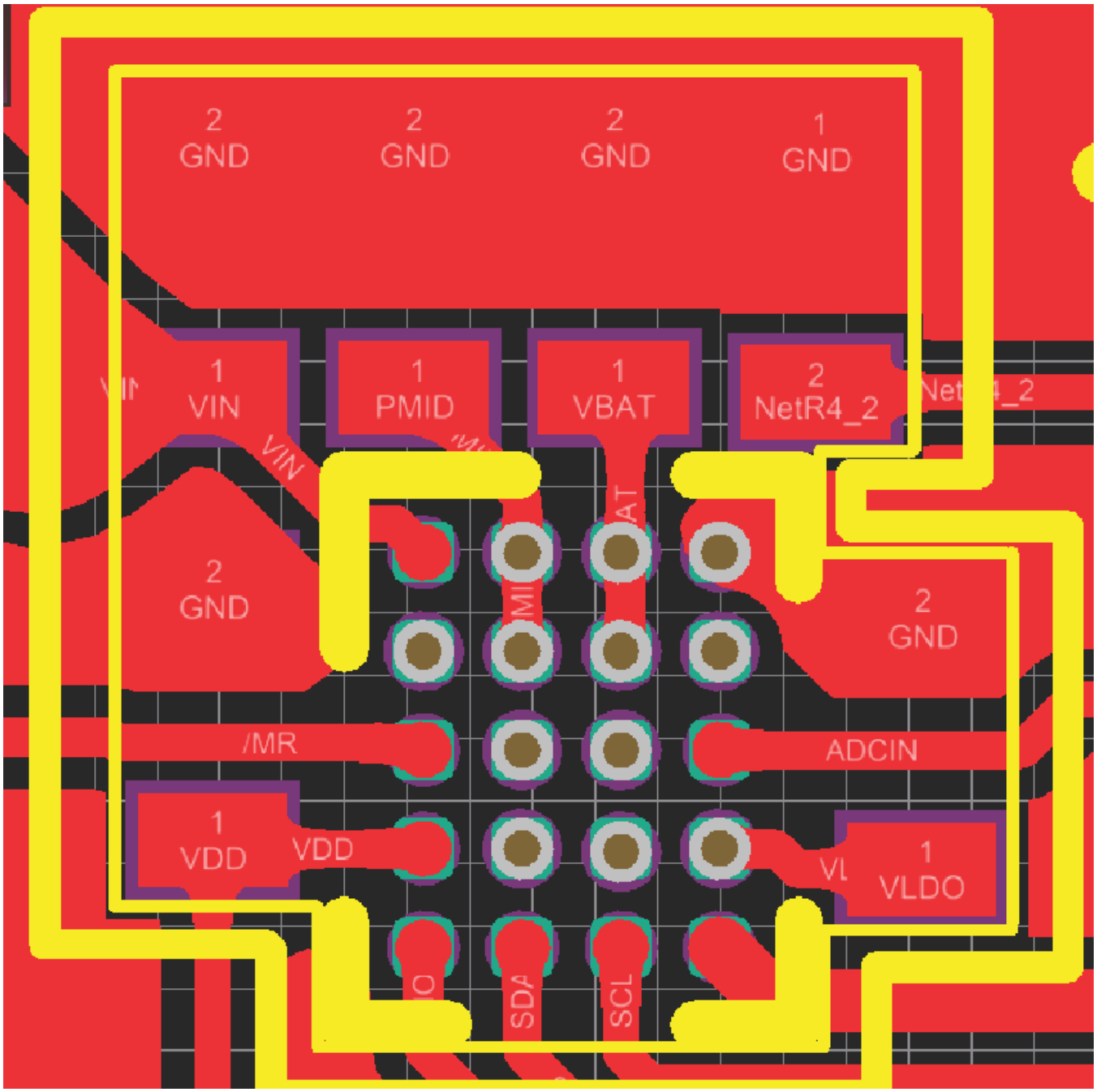

Figure 3. 10 mil / 6 mil Vias on the Solder Ball Pads and 6 mil Traces Away From Pads and Vias

Several higher power traces (VIN, PMID, and VBAT) have 40-mil traces to handle larger currents more efficiently.

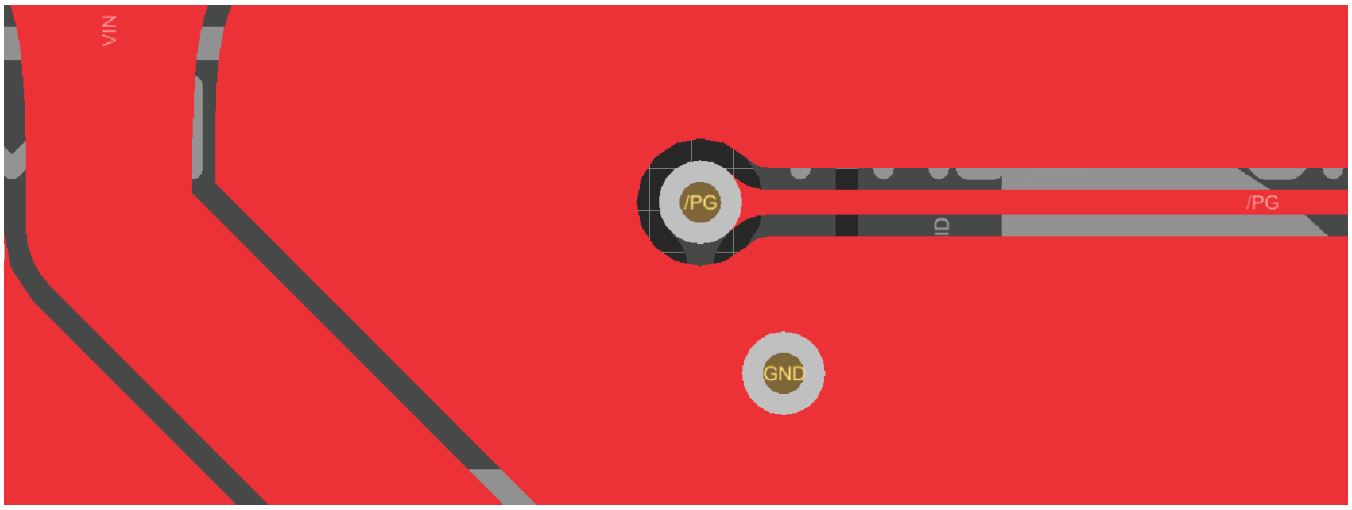

Figure 4. 40-mil VIN Trace (Left) Significantly Larger Than 6 mil / PG Trace (Center Right) for Current Capacity

1.1 Features of BQ25150

The BQ25150 charger has many useful features:

- Up to 500 mA charge current
- Termination current configurable down to 0.5 mA
- Adjustable battery voltage regulation to support different battery chemistries
- I^2C communication for monitoring and control
- Power path allows for charging battery and powering system simultaneously
- 12-bit ADC to monitor input voltage and current, battery voltage, battery temperature (via thermistor), and junction temperature as well as measurements from an external source
- I^2C configurable load switch or LDO (output programmable from 0.6 V to 3.7 V in 100-mV steps)

1.2 Test Results

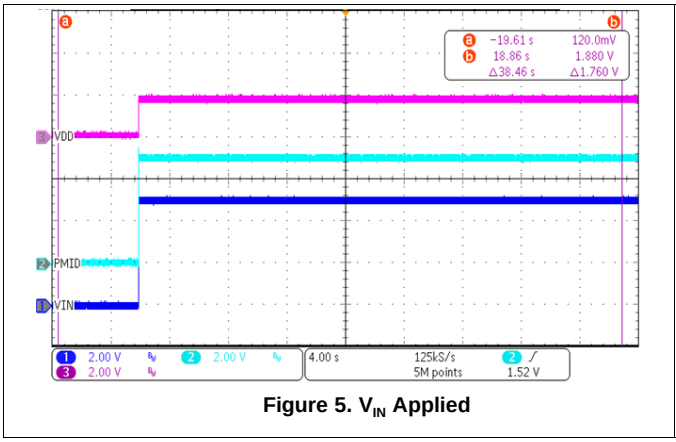

Figure 5. V_{IN} Applied

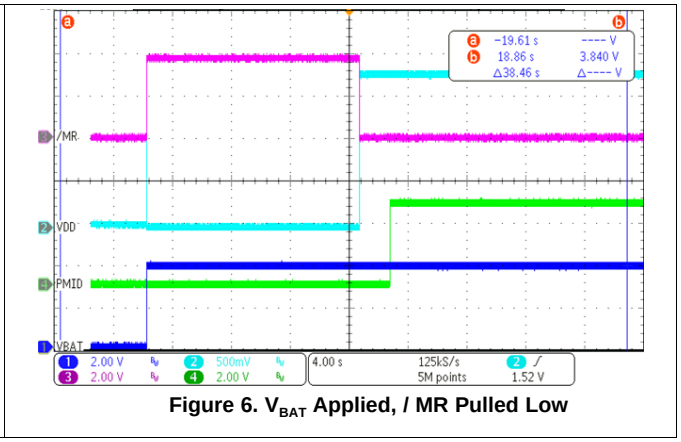

Figure 6. V_{BAT} Applied, / MR Pulled Low

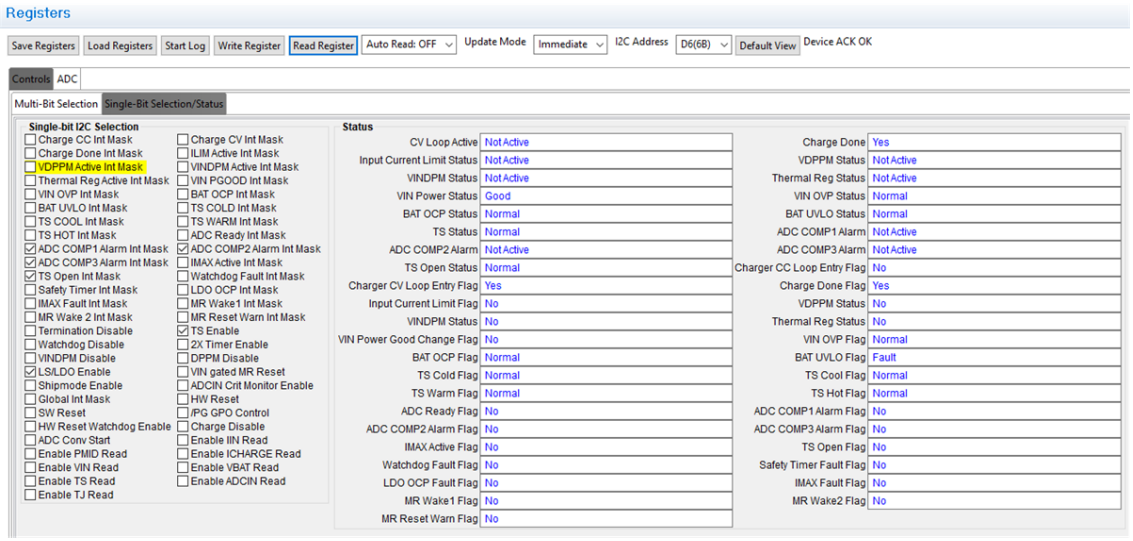

Figure 7. View of Registers

2 Schematic and Bill of Materials

2.1 Schematic

The components in the green box are required for operation and are included in the 12 mm^2 solution size (outlined by a white silkscreen box on the physical board). Components in the red box are not essential for operation and are present to facilitate the user's interactions with the board. Each charger pin has a corresponding pin on the board for monitoring purposes, a connector for I^2C communication with bqStudio software, and a 5-kΩ resistor on the TS pin disables the temperature monitoring function to allow for normal operation of the charger during evaluation. While pads are available for 10-kΩ pullup resistors for SDA and SCL pins, (R2 and R3) they are not populated on this board. The connector on the right edge of the board allows for I^2C control of the charger through an EV2400 module.

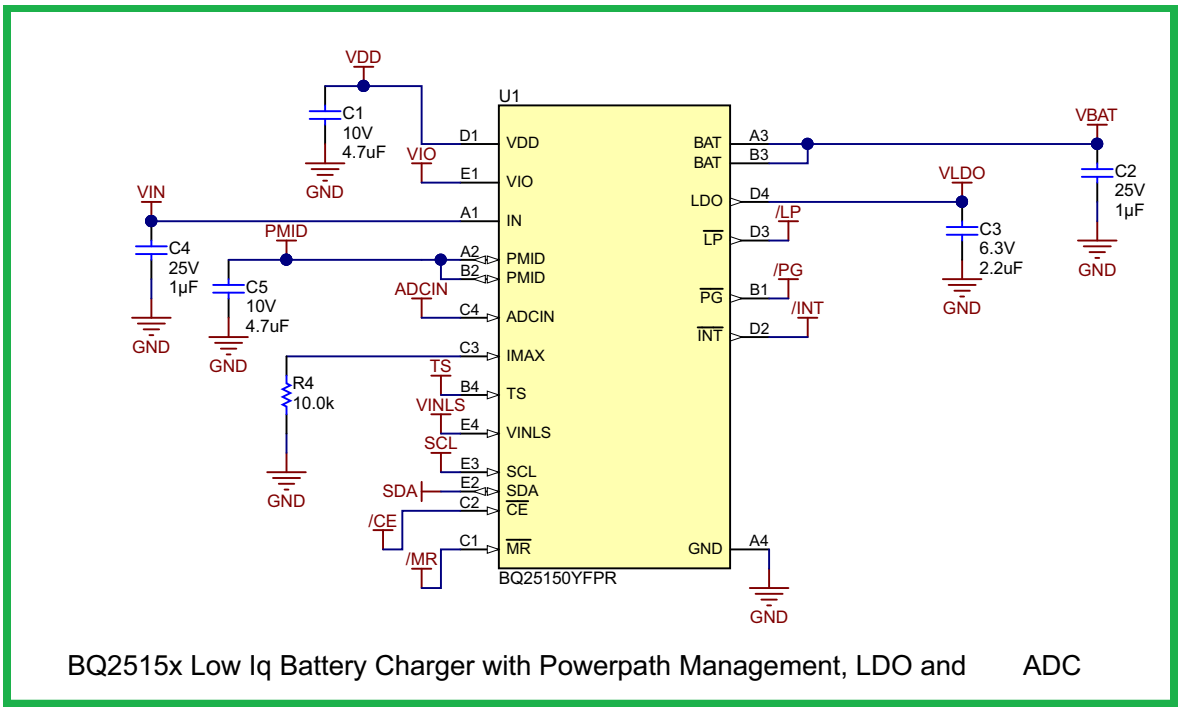

Figure 8. BQ25150 and Necessary Resistors and Capacitors

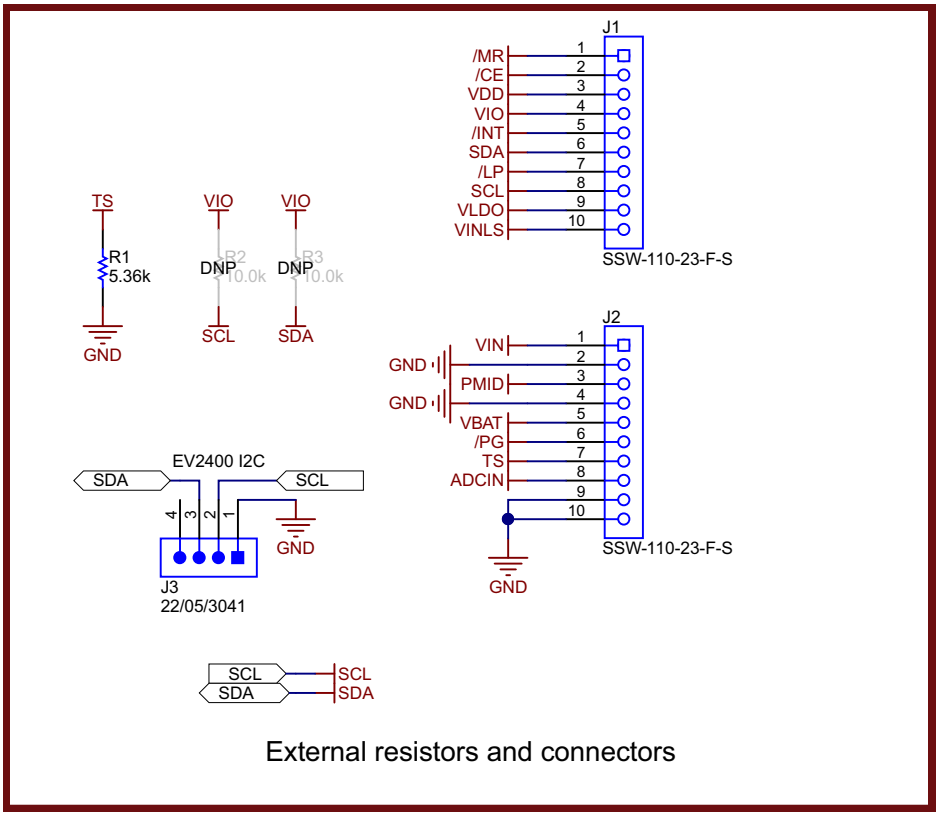

Figure 9. Connectors and Resistors External to Required Components

2.2 Bill of Materials

Table 1. Bill of Materials

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer	Alternate PartNumber	Alternate Manufacturer
C1, C5	2	4.7uF	CAP, CERM, 4.7 uF, 10 V, +/- 20%, X5R, 0402	0402	GRM155R61A475MEAAD	MuRata		
C2, C4	2	1uF	CAP, CERM, 1 µF, 25 V,+/- 20%, X5R, 0402	0402	GRM155R61E105MA12D	MuRata		
C3	1	2.2uF	CAP, CERM, 2.2 uF, 6.3 V, +/- 10%, X6S, 0402	0402	GRM155C80J225KE95D	MuRata		
J1, J2	2		Connector, Receptacle, 100mil, 10x1, Gold plated, TH	10x1 Receptacle	SSW-110-23-F-S	Samtec		
J3	1		Header (friction lock), 100mil, 4x1, R/A, TH	4x1 R/A Header	22/05/3041	Molex		
R1	1	5.36k	RES, 5.36 k, 1%, 0.063 W, 0402	0402	MCR01MZPF5361	Rohm		
R4	1	10.0k	RES, 10.0 k, 1%, 0.063 W, 0402	0402	RC0402FR-0710KL	Yageo America		
U1	1		BQ25150YFP, YFP0020ACAC (DSBGA-20)	YFP0020ACAC	BQ25150YFPR	Texas Instruments	BQ25150YFPT	Texas Instruments
R2, R3	0	10.0k	RES, 10.0 k, 1%, 0.063 W, 0402	0402	RC0402FR-0710KL	Yageo America		

3 PCB Layer Plots

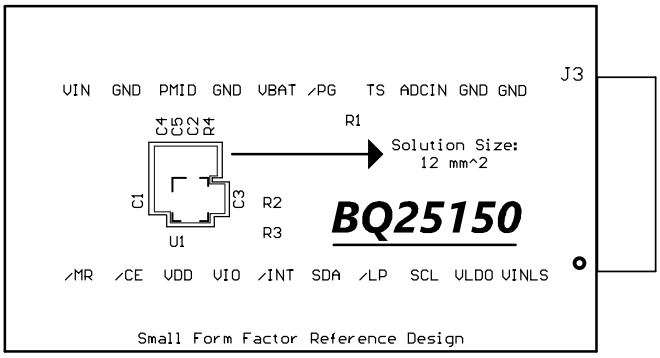

Figure 10. Top Overlay

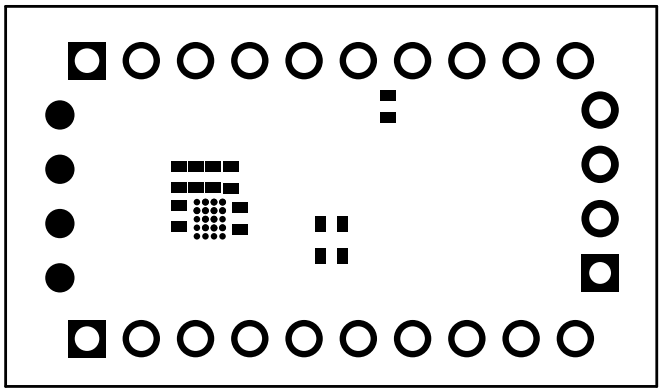

Figure 11. Top Solder Mask

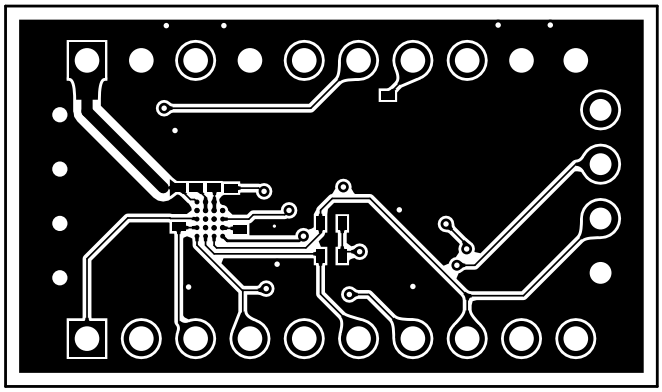

Figure 12. Top Layer

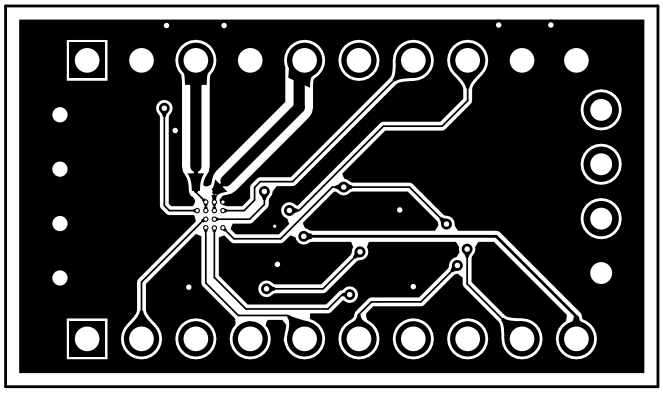

Figure 13. Bottom Layer

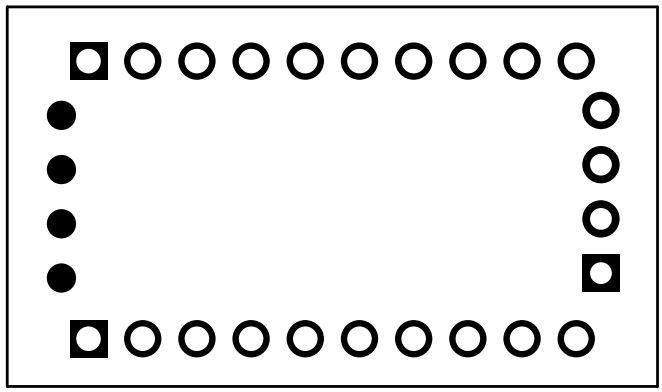

Figure 14. Bottom Solder Mask

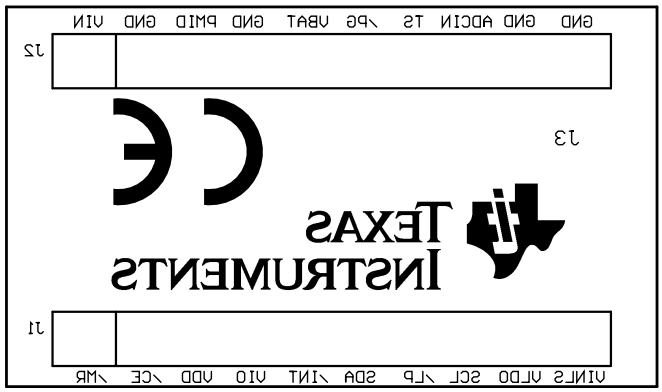

Figure 15. Bottom Overlay

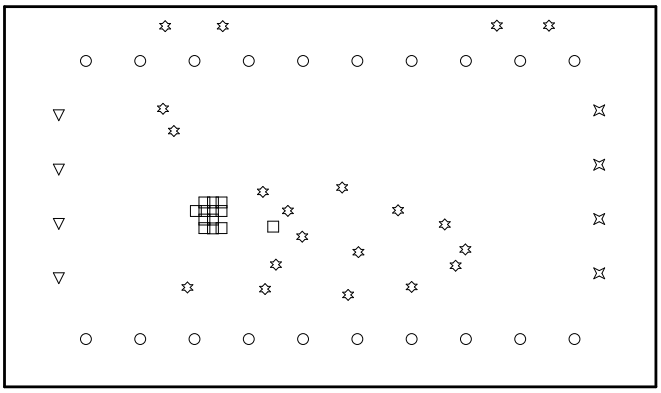

Figure 16. Drill Drawing

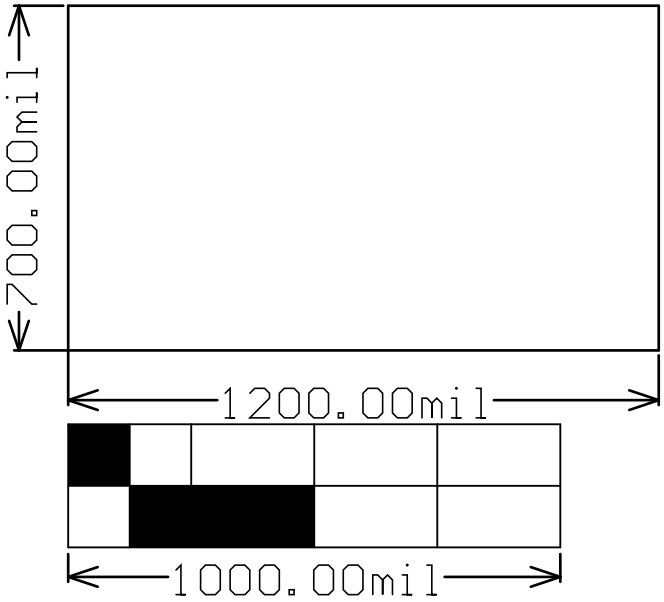

Figure 17. Board Dimensions (Image is not Actual Size)

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