# EV2013B-33-J_Q_G-00A

## 40V, 150mA, Low Quiescent Current Linear Regulator Evaluation Board

## DESCRIPTION

The EV2013B-33-J_Q_G-00A is an evaluation board for the MP2013BGQ-33, MPQ2013BGQ-33 and MPQ2013BGQ-33-AEC1, a low linear regulator that supplies power to systems with high voltage batteries. MP2013BGQ-33/MPQ2013BGQ-33/MPQ2013BGQ-33-AEC1 includes a wide 4.3V to 40V input range, low dropout voltage and low quiescent supply current. The low quiescent current and low dropout voltage allows operations at extremely low power levels. Therefore, the MP2013BGQ-33/MPQ2013BGQ-33/MPQ2013BGQ-33-AEC1 is ideal for the low power microcontrollers and the battery-powered equipments.

The EV2013B-33-J_Q_G-00A is a fully assembled and tested evaluation board. It generates a +3.3V output voltage at load current up to 150mA from a 4.3V to 40V input range.

## FEATURES

- 4.3V to 40V Input Range
- 150mA Specified Current
- 700mV Dropout at 150mA Load
- Output ±3% Accuracy for QFN8 Package
- Specified Current Limit
- Thermal Shutdown
- -40°C to +125°C Specified Junction Temperature Range
- Available in QFN8 (3x3mm) Package

## APPLICATIONS

- Industrial/Automotive Applications
- Portable/Battery-Powered Equipment
- Ultra low power Microcontrollers
- Cellular Handsets
- Medical Imaging



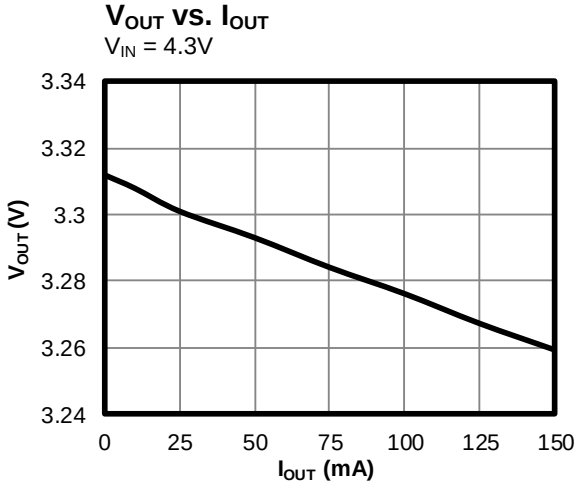
## ELECTRICAL SPECIFICATIONS

| Parameter | Symbol | Value | Units |
|---|---|---|---|
| Input Voltage | $V_{IN}$ | 4.3 – 40 | V |
| Output Voltage | $V_{OUT}$ | 3.3 | V |
| Output Current | $I_{OUT}$ | 150 | mA |

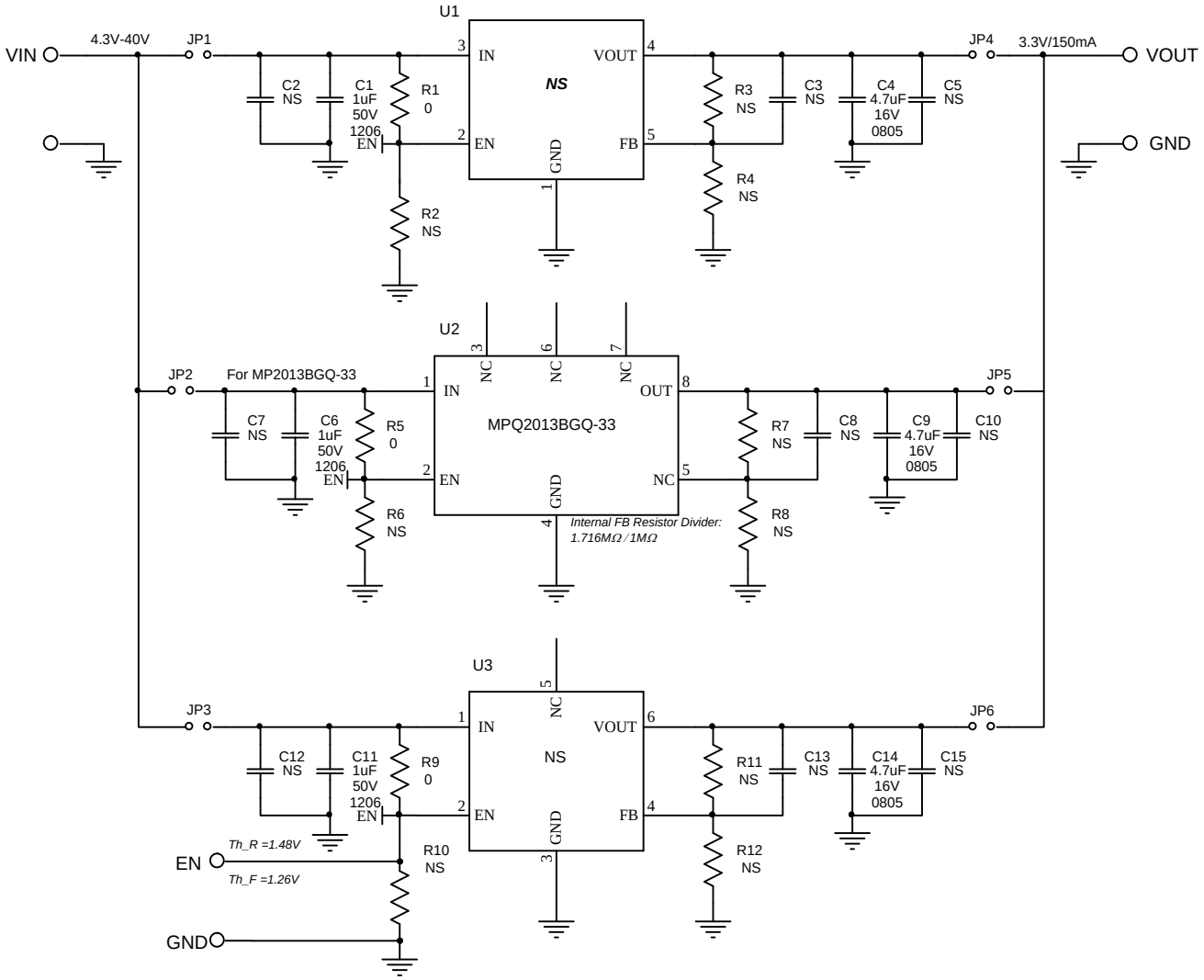
## EV2013B-33-J_Q_G-00A EVALUATION BOARD

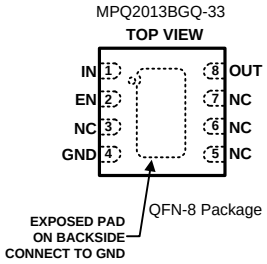

**(L x W x H) 2.5” x 2.5” x 0.4”**
**(6.35cm x 6.35cm x 1.0cm)**

| Board Number | MPS IC Number |
|---|---|
| EV2013B-33-J_Q_G-00A | MPQ2013BGQ-33 |



## EVALUATION BOARD SCHEMATIC



## EV2013B-33-J_Q_G-00A BILL OF MATERIALS

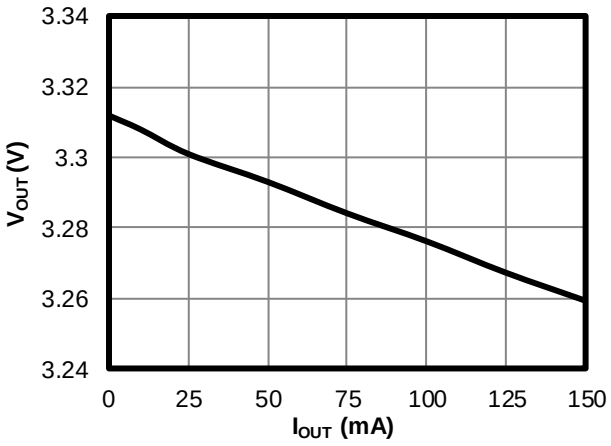
| Qty | RefDes | Value | Description | Package | Manufacturer | Manufactuer_P/N |
|---|---|---|---|---|---|---|
| 3 | C1, C6, C11 | 1μF | Ceramic Cap., 50V, X7R | 1206 | muRata | GRM31MR71H105KA88L |
| 3 | C3, C8, C13 | NS | | | | |
| 3 | C4, C9, C14 | 4.7μF | Ceramic Cap., 16V, X7R | 0805 | muRata | GCM21BR71C475KA73L |
| 6 | C2, C5, C7, C10, C12, C15 | NS | | | | |
| 3 | R1, R5, R9 | 0 | Film Res., 5% | 0603 | Yageo | RC0603JR-070RL |
| 9 | R2, R3, R4, R6, R7, R8, R10, R11, R12 | NS | | | | |
| 6 | JP1, JP2, JP, JP4, JP5, JP6 | | Jumper | | | |
| 1 | U1 | NS | | | | |
| 1 | U2 | | Linear Regulator | QFN8-3x3 | MPS | MPQ2013BGQ-33 |
| 1 | U3 | NS | | | | |
| 4 | VIN, GND, VOUT, GND | | 2.0 Golden Pin | | HZ | |
| 2 | EN, GND | | 2.54mm Test Pin | | any | |

## EVB TEST RESULTS

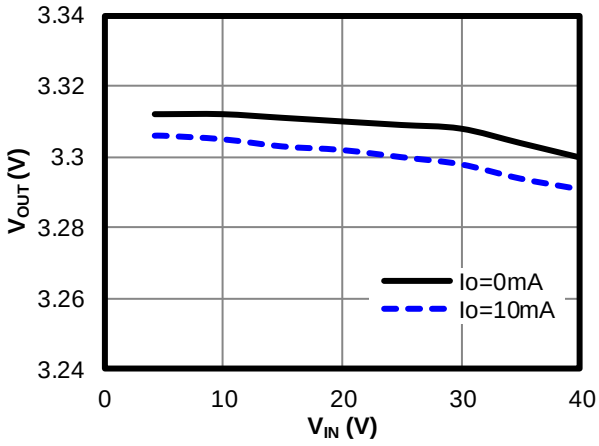
**$C_{IN}$ = 1µF, $C_{OUT}$ = 4.7µF, $V_{OUT}$ = 3.3V, $T_A$ = +25°C, unless otherwise noted**

### $V_{OUT}$ vs. $I_{OUT}$

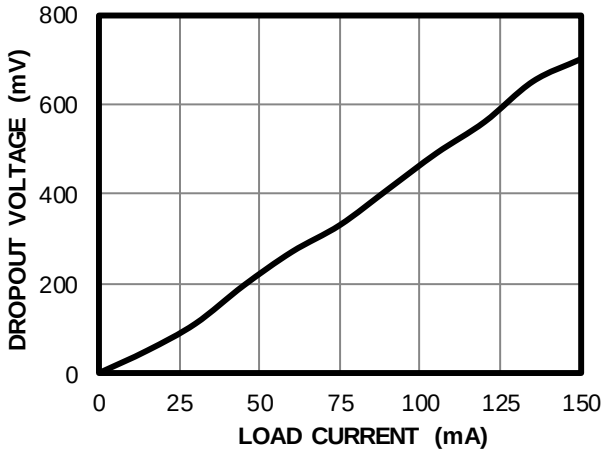
$V_{IN}$ = 4.3V




### $V_{OUT}$ vs. $V_{IN}$

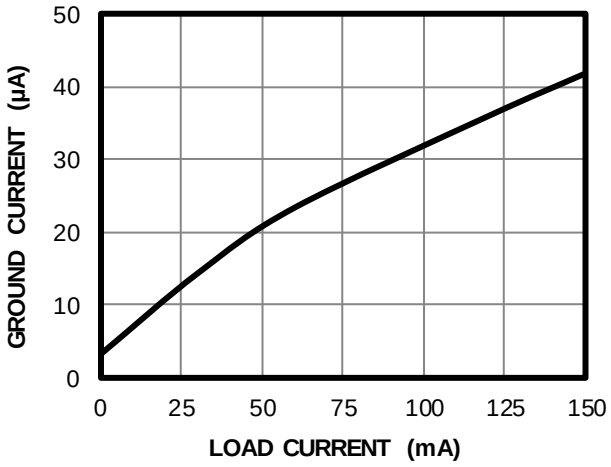



### Dropout Voltage vs. Load Current



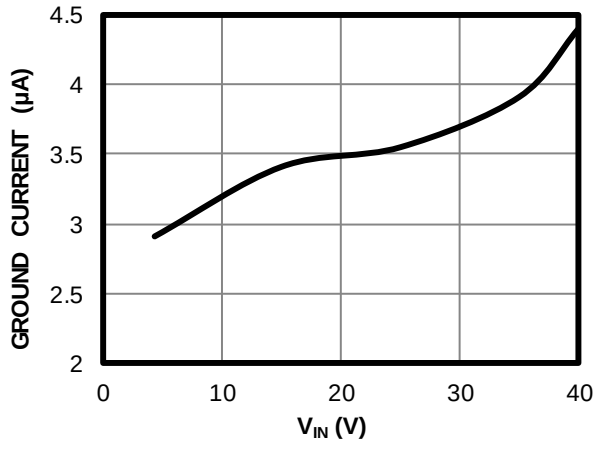

### Ground Current vs. Load Current

$V_{IN}$ = 4.3V



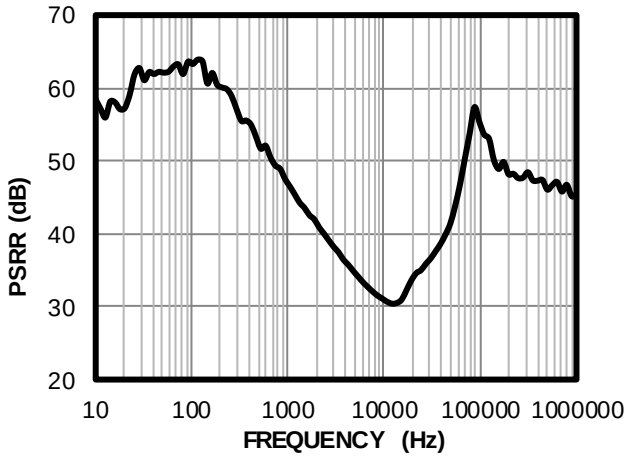

### Ground Current vs. $V_{IN}$

$I_{OUT}$ = 0mA




### PSRR vs. Frequency

$V_{IN}$ = 6V, $I_{OUT}$ = 0mA, $C_{IN}$ = 100pF

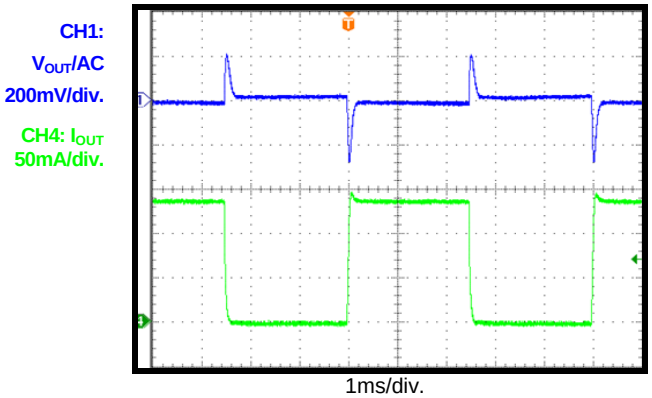


## EVB TEST RESULTS *(continued)*

**$C_{IN}$ = 1µF, $C_{OUT}$ = 4.7µF, $V_{OUT}$ = 3.3V, $T_A$ = +25°C, unless otherwise noted**

### Load Transient

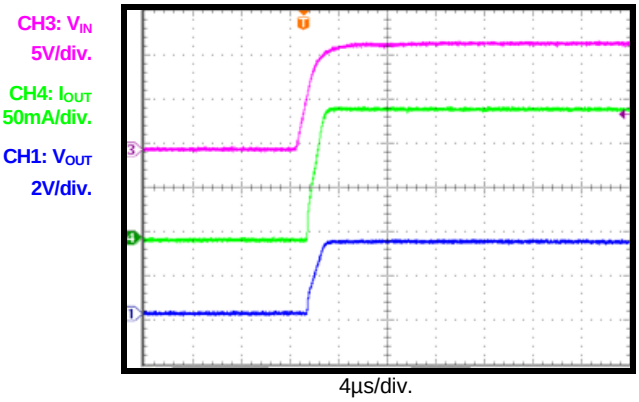
$V_{IN}$ = 12V, $I_{OUT}$ = 8 - 150mA




1ms/div.

### Start-Up through $V_{IN}$

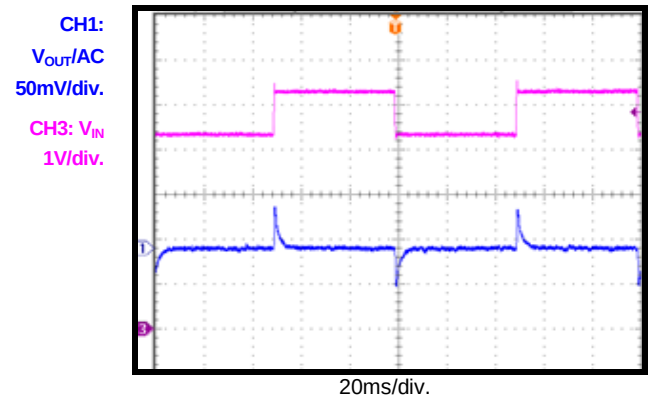
$V_{IN}$ = 12V, $I_{OUT}$ = 150mA




4µs/div.

### Line Transient

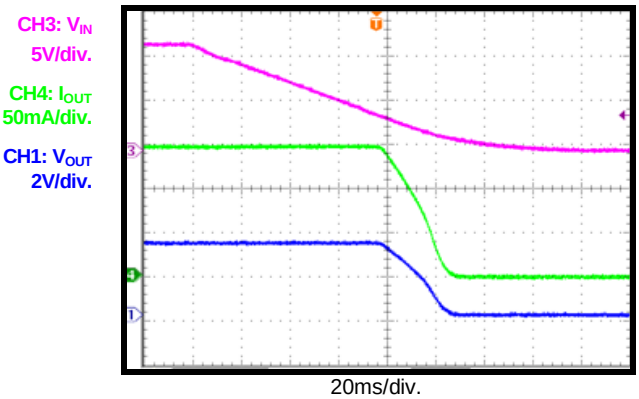
$V_{IN}$ = 4.3 - 5.3V, $I_{OUT}$ = 150mA




20ms/div.

### Shutdown through $V_{IN}$

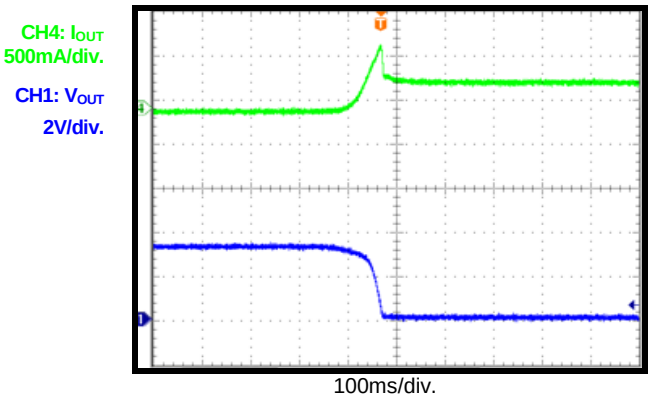
$V_{IN}$ = 12V, $I_{OUT}$ = 150mA




20ms/div.

### Short-Circuit Entry

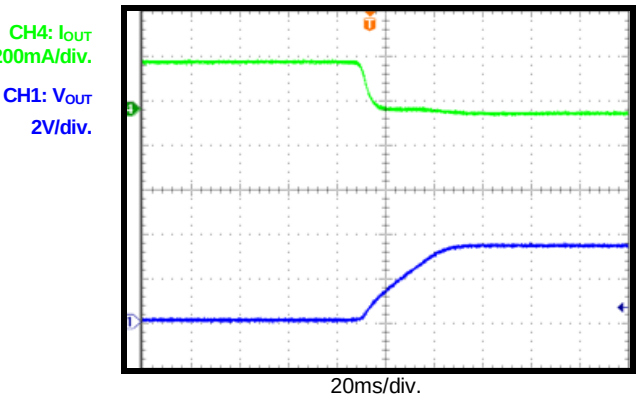
$V_{IN}$ = 12V, $I_{OUT}$ = 0mA to short-circuit




100ms/div.

### Short-Circuit Recovery

$V_{IN}$ = 12V, short-circuit to $I_{OUT}$ = 0mA



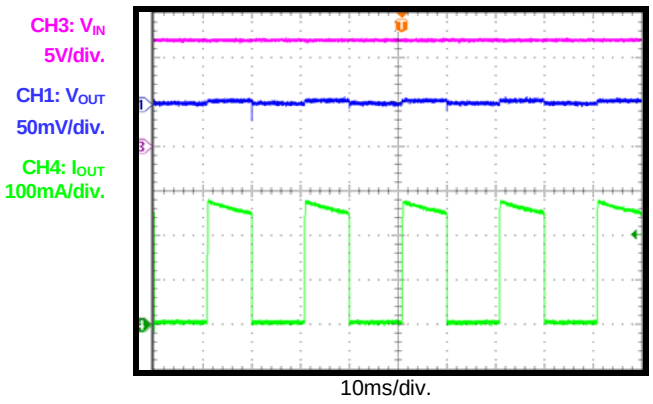

20ms/div.

## EVB TEST RESULTS *(continued)*

**$C_{IN}$ = 1µF, $C_{OUT}$ = 4.7µF, $V_{OUT}$ = 3.3V, $T_A$ = +25°C, unless otherwise noted**

### Short-Circuit Steady State

$V_{IN}$ = 12V



## PRINTED CIRCUIT BOARD LAYOUT

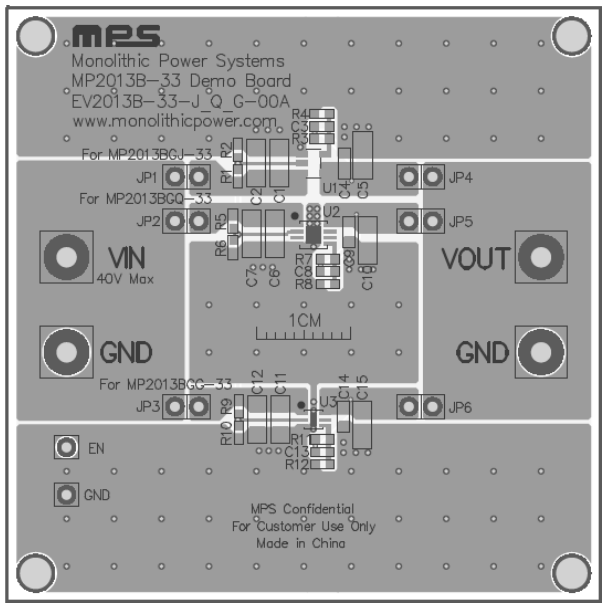



**Figure 1 – Top Silk & Top Layer**

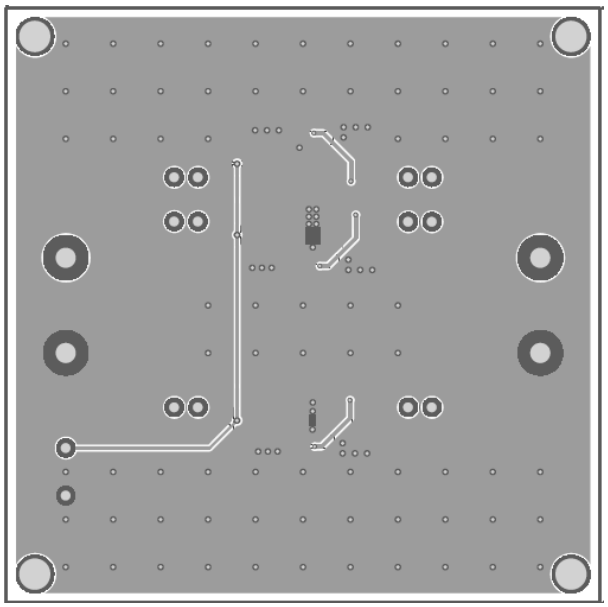


**Figure 2 – Bottom Layer**

## QUICK START GUIDE

1. Connect different jumpers to select different MPQ2013B-33 ICs with different packages for evaluation:

| Connected Jumpers | Selected IC |
|---|---|
| JP2, JP5 | MPQ2013BGQ-33 |

2. Connect the positive and negative terminals of the load to the $V_{OUT}$ and GND pins, respectively. Set load current between 0-150mA. Be aware that electronic loads represent a negative impedance to the regulator and if set to a too high current will trigger over-current-protection or short-current-protection.

   Note that MPQ2013BGQ-33 will start up with no load when JP2 is connected. JP5 is connected determines MPQ2013BGQ-33 to support load current. MPQ2013BGQ-33 starts up solely when remove R5 and connect JP2.

3. Preset the power supply output between 4.3V and 40V, and then turn it off. (If longer cables are used between the source and the EVB (>0.5m total), a damping capacitor should be installed at the input terminals. Especially when $V_{IN}\geq 24V$.)

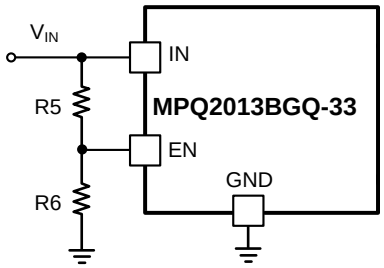
4. Connect the positive and negative terminals of the power supply output to the $V_{IN}$ and GND pins, respectively.

5. Turn the power supply on. The MPQ2013BGQ-33 will automatically startup. The default $V_{OUT}$ is 3.3V.

6. To use EN turning on/off MPQ2013BGQ-33, remove R5 first. Then give a voltage between EN and GND higher than 1.48V to turn on, lower than 1.26V to turn off.

7. Setting $V_{IN}$ UVLO

   To prevent part from operating at an insufficient power supply voltage, a resistor divider can be used to adjust the $V_{IN}$ UVLO point, R5/R6 for MPQ2013BGQ-33.




   If choose R5 first, then R6 can be calculated by below equation:

$$R6=R5/(V_{IN\_UVLO\_F}/EN_{TH\_F}-1)$$

   Where $V_{IN\_UVLO\_F}$ is desired $V_{IN}$ UVLO falling threshold, $EN_{TH\_F}$ is the EN falling threshold 1.26V. To limit the divider current, high value resistors are recommended. For example, if $V_{IN\_UVLO\_F}$ is set at 4.5V, R5=2MΩ and R6=778kΩ can be used.