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MB39C811-EVB-03

PMIC for Solar/Vibration Energy Harvesting, Evaluation Board Operation Guide

Doc. No. 002-08722 Rev. *B

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Preface



Purpose of this manual and intended readers

This manual explains how to use the evaluation board. Be sure to read this manual before using the product. For this product, please consult with sales representatives or support representatives.

Handling and use

Handling and use of this product and notes regarding its safe use are described in the manuals.

Follow the instructions in the manuals to use this product.

Keep this manual at hand so that you can refer to it anytime during use of this product.



Notice on this document

All information included in this document is current as of the date it is issued. Such information is subject to change without any prior notice.

Please confirm the latest relevant information with the sales representatives.

Caution of the products described in this document

The following precautions apply to the product described in this manual.

| | |
|--|---|
|  WARNING | Indicates a potentially hazardous situation which could result in death or serious injury and/or a fault in the user's system if the product is not used correctly. |
| Electric shock, Damage | Before performing any operation described in this manual, turn off all the power supplies to the system. Performing such an operation with the power on may cause an electric shock or device fault. |
| Electric shock, Damage | Once the product has been turned on, do not touch any metal part of it. Doing so may cause an electric shock or device fault. |
|  CAUTION | Indicates the presence of a hazard that may cause a minor or moderate injury, damages to this product or devices connected to it, or may cause to lose software resources and other properties such as data, if the device is not used appropriately. |
| Cuts, Damage | Before moving the product, be sure to turn off all the power supplies and unplug the cables. Watch your step when carrying the product. Do not use the product in an unstable location such as a place exposed to strong vibration or a sloping surface. Doing so may cause the product to fall, resulting in an injury or fault. |
| Cuts | The product contains sharp edges that are left unavoidably exposed, such as jumper plugs. Handle the product with due care not to get injured with such pointed parts. |
| Damage | Do not place anything on the product or expose the product to physical shocks. Do not carry the product after the power has been turned on. Doing so may cause a malfunction due to overloading or shock. |
| Damage | Since the product contains many electronic components, keep it away from direct sunlight, high temperature, and high humidity to prevent condensation. Do not use or store the product where it is exposed to much dust or a strong magnetic or electric field for an extended period of time. Inappropriate operating or storage environments may cause a fault. |
| Damage | Use the product within the ranges given in the specifications. Operation over the specified ranges may cause a fault. |
| Damage | To prevent electrostatic breakdown, do not let your finger or other object come into contact with the metal parts of any of the connectors. Before handling the product, touch a metal object (such as a door knob) to discharge any static electricity from your body. |
| Damage | When turning the power on or off, follow the relevant procedure as described in this document. Before turning the power on, in particular, be sure to finish making all the required connections. Furthermore, be sure to configure and use the product by following the instructions given in this document. Using the product incorrectly or inappropriately may cause a fault. |
| Damage | Always turn the power off before connecting or disconnecting any cables from the product. When unplugging a cable, unplug the cable by holding the connector part without pulling on the cable itself. Pulling the cable itself or bending it may expose or disconnect the cable core, resulting in a fault. |
| Damage | Because the product has no casing, it is recommended that it be stored in the original packaging. Transporting the product may cause a damage or fault. Therefore, keep the packaging materials and use them when re-shipping the product. |

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1. Description



The MB39C811-EVB-03 is the tiny evaluation board for the energy harvesting (Power Management) IC, MB39C811. This evaluation board is capable of accepting solar, piezoelectric, or any high impedance AC or DC source.

2. Evaluation Board Specification



Table 1. Evaluation Board Specification

| Parameter | Symbol | Condition | Min. | Typ. | Max. | Unit |
|----------------------|-----------------------------|--------------------------------------|------|------|------|------|
| Input voltage | VIN | - | 2.6 | - | 23 | V |
| Input slew rate | VIN | VIN ≥ 7V | - | - | 0.25 | V/ms |
| Input current | VIN | - | - | - | 100 | mA |
| AC pin input voltage | AC1-1,AC1-2, AC2-1,AC2-2 | - | - | - | 23 | V |
| AC pin input current | AC1-1,AC1-2, AC2-1,AC2-2 | - | - | - | 50 | mA |
| Output voltage | VOUT | See Table 4. Output Voltage Settings | 1.5 | - | 5 | V |
| Output current | VOUT | Up to 100mA | - | - | 100 | mA |
| UVLO release voltage | VOUT | JP3=L, JP2=L, JP1=L (1.5V) | 3.8 | 4.0 | 4.2 | V |
| | | JP3=L, JP2=L, JP1=H (1.8V) | | | | |
| | | JP3=L, JP2=H, JP1=L (2.5V) | | | | |
| | | JP3=L, JP2=H, JP1=H (3.3V) | 4.94 | 5.2 | 5.46 | V |
| | | JP3=H, JP2=L, JP1=L (3.6V) | | | | |
| | | JP3=H, JP2=L, JP1=H (4.1V) | | | | |
| | | JP3=H, JP2=H, JP1=L (4.5V) | 6.84 | 7.2 | 7.56 | V |
| | | JP3=H, JP2=H, JP1=H (5.0V) | | | | |
| Forward bias voltage | AC1-1,AC1-2, AC2-1,AC2-2 | IF=10 μA | 150 | 280 | 450 | mV |

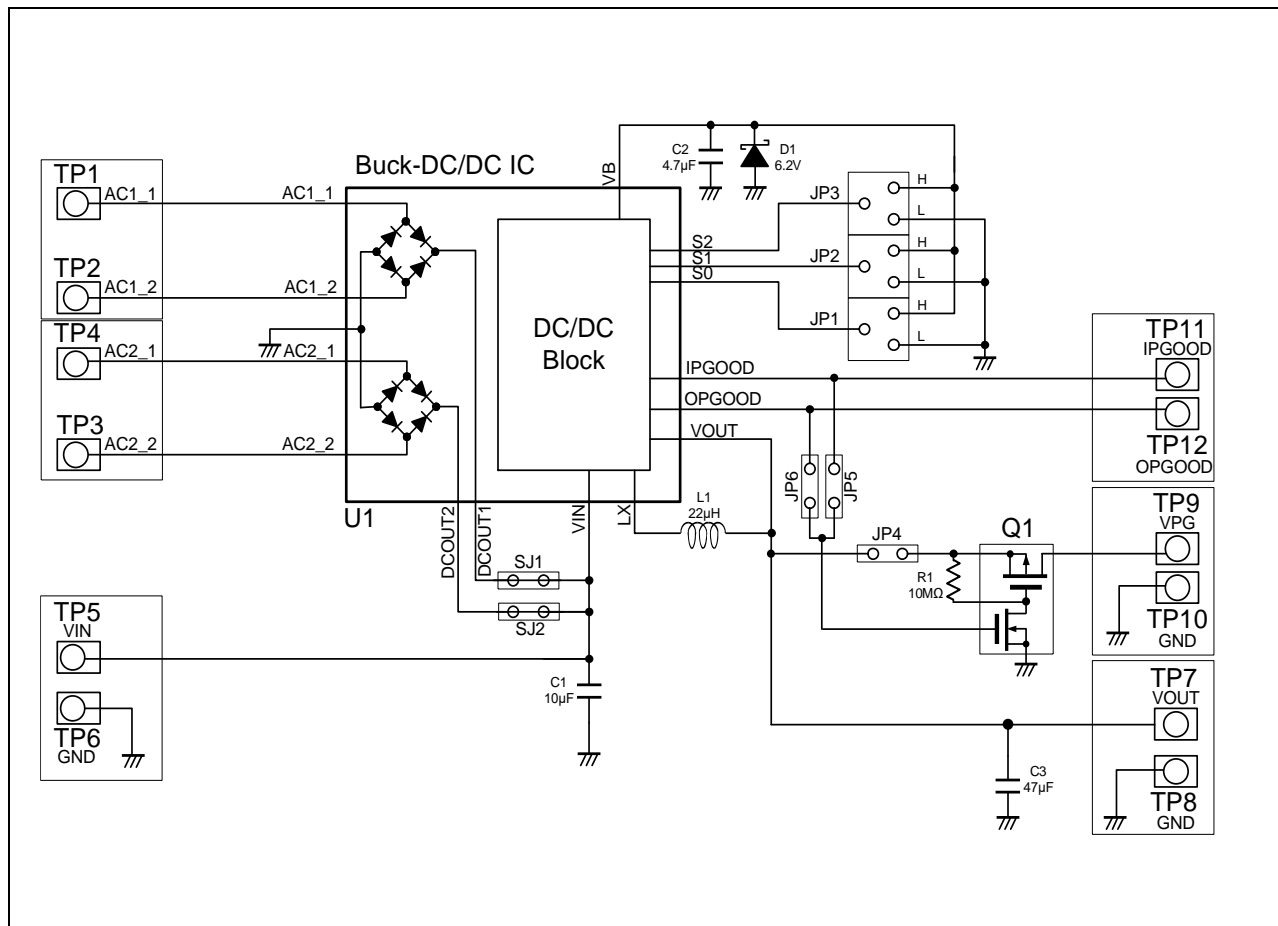
Please see the [MB39C811 datasheet](#) (DS405-00013) for more information.

Board size: 23mmx14mm

3. Block Diagram



Figure 1. Block Diagram



4. Pin Descriptions



4.1 Input/Output Pin Descriptions

Table 2. Input/Output Pin Descriptions

| Pin Number | Pin Symbol | I/O | Function Description |
|------------|------------|-----|--|
| TP1 | AC1-1 | I | Bridge rectifier 1, AC input 1 |
| TP2 | AC1-2 | I | Bridge rectifier 1, AC input 2 |
| TP4 | AC2-1 | I | Bridge rectifier 2, AC input 1 |
| TP3 | AC2-2 | I | Bridge rectifier 2, AC input 2 |
| TP5 | VIN | I | DC power input It supplies power through the bridge rectifier from DCOUT1/2 to the VIN pin. |
| TP6 | GND | - | GND pin |
| TP7 | VOUT | O | VOUT pin |
| TP8 | GND | - | GND pin |
| TP9 | VPG | O | Power Gating VOUT pin |
| TP10 | GND | - | GND pin |
| TP11 | IPGOOD | O | Input power good monitor pin |
| TP12 | OPGOOD | O | Output power good monitor pin |

4.2 Jumper Descriptions

Table 3. Jumper, Switch Descriptions

| Jumper, Switch | Function Description | Initial Setting |
|----------------|--|-----------------|
| SJ1 | Connection jumper between the DC output pin (DCOUT1) of bridge rectifier 1 and DC input pin (VIN) of DC/DC converter | Pattern short |
| SJ2 | Connection jumper between the DC output pin (DCOUT2) of bridge rectifier 2 and DC input pin (VIN) of DC/DC converter to "open/short" | Pattern short |
| JP1 | High/Low selecting switch for S0. See Table 4 | H |
| JP2 | High/Low selecting switch for S1. See Table 4. | H |
| JP3 | High/Low selecting switch for S2. See Table 4. | L |
| JP4 | Short between VOUT and Power Gating Circuit | Short |
| JP5 | Short between IPGOOD and Nch-Gate of Power Gating Circuit | Short |
| JP6 | Short between OPGOOD and Nch-Gate of Power Gating Circuit | Open |

*: Open/Short by soldering

Table 4. Output Voltage Settings

| S2 Pin (JP3) | S1 Pin (JP2) | S0 Pin (JP1) | Preset Output Voltage |
|--------------|--------------|--------------|-----------------------|
| L | L | L | 1.5 |
| L | L | H | 1.8 |
| L | H | L | 2.5 |
| L | H | H | 3.3 (Initial setting) |
| H | L | L | 3.6 |
| H | L | H | 4.1 |
| H | L | L | 4.5 |
| H | H | H | 5.0 |

5. Outside Drawing of Evaluation Board



Figure 2. Outside Drawing (Top)

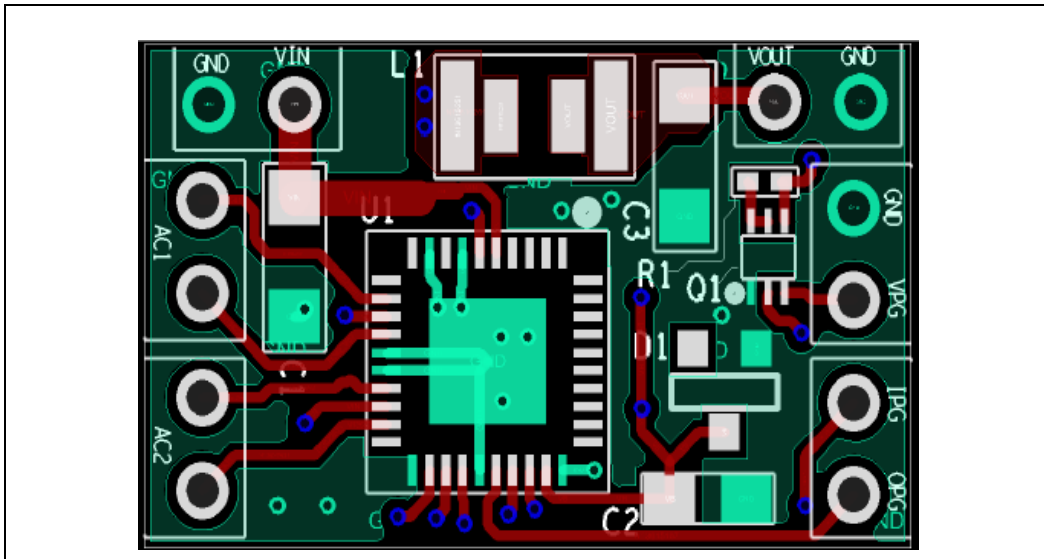
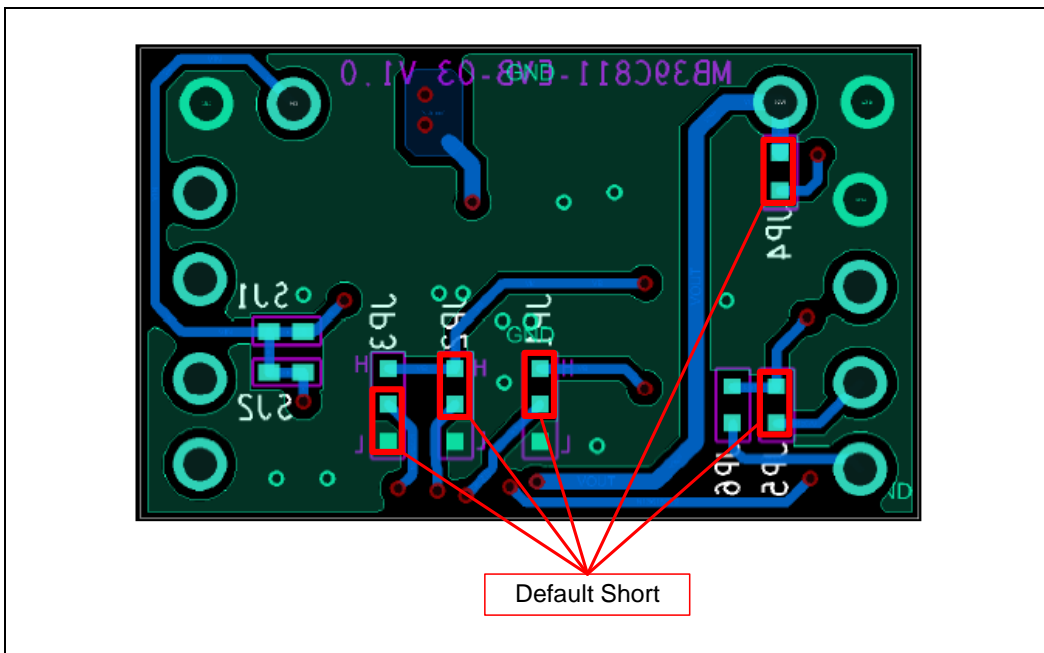


Figure 3. Outside Drawing (Bottom)



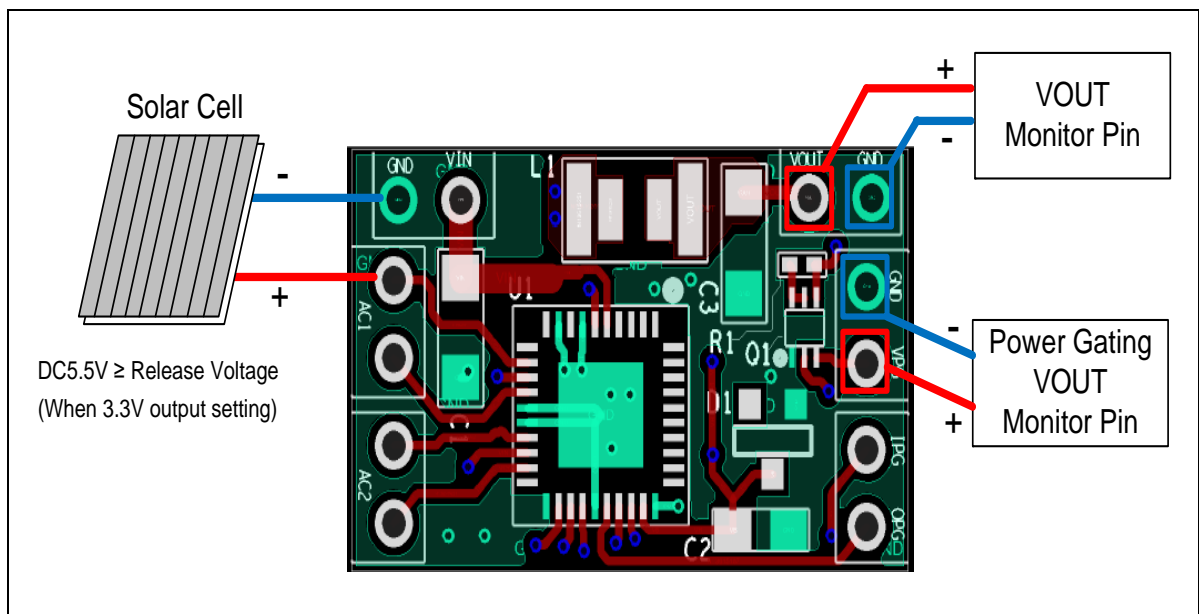
6. Setup and Verification



6.1 Solar (or Light) Energy Harvesting

1. To output 3.3V voltage to VOUT pin, input a DC 5.5V or more voltage into TP1 (AC1-1). Recommend solar cell of 8cells or more, if connect solar cell. The number of plus for UVLO release voltage (5.2Vtyp@3.3V setting) and the forward bias voltage of diode (0.28Vtyp) are required to start up (see the [Table 1](#)).
2. 3.3V is output to TP7 (VOUT) and TP9 (VPG).
3. To change the output voltage, change the jumper settings (see the [Table 4](#)) using soldering.

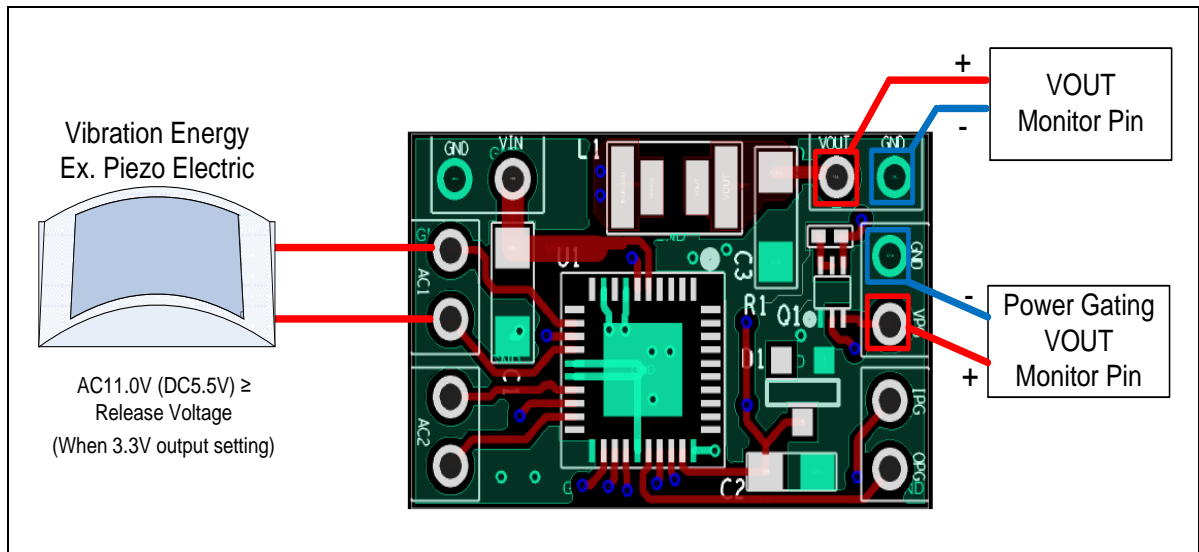
Figure 4. Solar (or Light) Energy Harvesting



6.2 Vibration Energy Harvesting

1. To output 3.3V voltage to VOUT pin, input AC 11V (DC5.5V) or more voltage into TP1 and TP2 (AC1-1 and AC1-2). The number of plus for UVLO release voltage (5.2Vtyp@3.3V setting) and the forward bias voltage of diode (0.28Vtyp) are required to start up (see the Table 1).
2. 3.3V is output to TP7 (VOUT) and TP9 (VPG).
3. To change the output voltage, change the jumper settings (see the Table 4) using soldering.

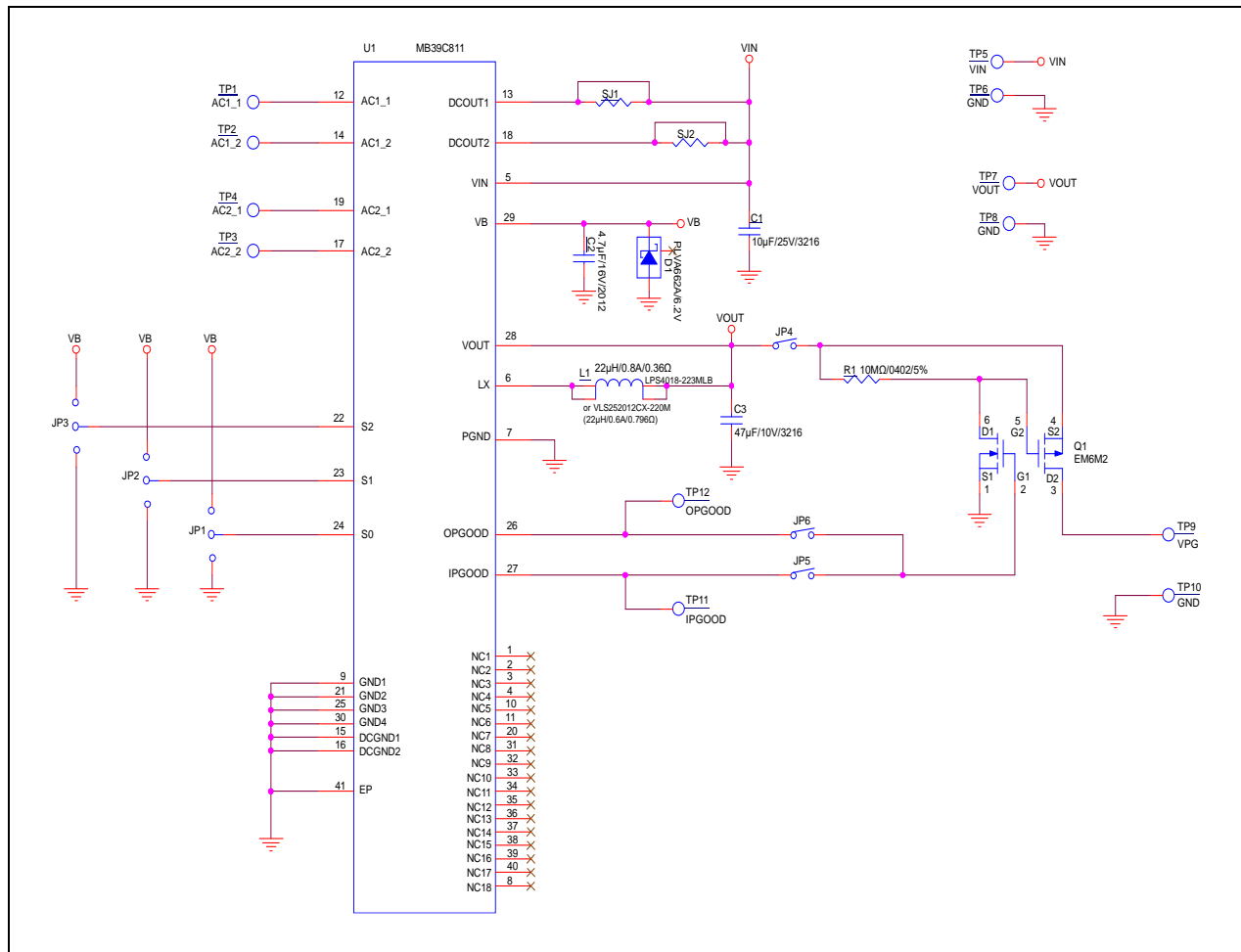
Figure 5. Vibration Energy Harvesting



7. Circuit Schematic



Figure 6. Circuit Schematic



8. Component List



Table 5. Component List

| No. | Qty. | Reference | Parts Number | Description | Manufacturer |
|-----|------|-----------|------------------------------------|------------------------------------|---------------|
| 1 | 1 | C1 | C3216X5R1E106MT | 10 μ F/25V | TDK |
| 2 | 1 | C2 | C2012JB1C475K | 4.7 μ F/16V | TDK |
| 3 | 1 | C3 | C3216X5R1A476M160AB | 47 μ F/10V | TDK |
| 4 | 1 | L1 | LPS4018-223MLB VLS252012CX-220M | 22 μ H/4018 22 μ H/2520 | Coilcraft TDK |
| 5 | 1 | M1 | MB39C811 | Energy Harvesting PMIC | Cypress |
| 6 | 1 | Q1 | EM6M2 | Nch+Pch MOSFET | ROHM |
| 7 | 1 | R1 | TRR01MZPJ106 | 10 M Ω 5% 0402 SMD | ROHM |
| 8 | 1 | D1 | PLVA662A | Voltage regulator diode | NXP |

These components are compliant with RoHS, but please ask each vender for details if necessary.

9. Silk and Layout



Figure 7. Silk and Layout

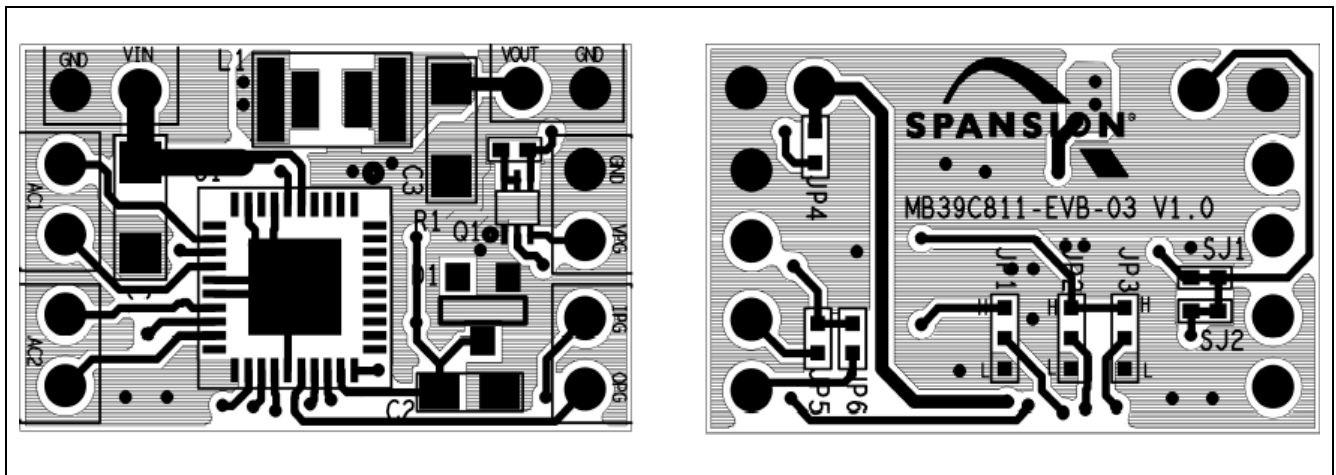


Figure 8. Layout

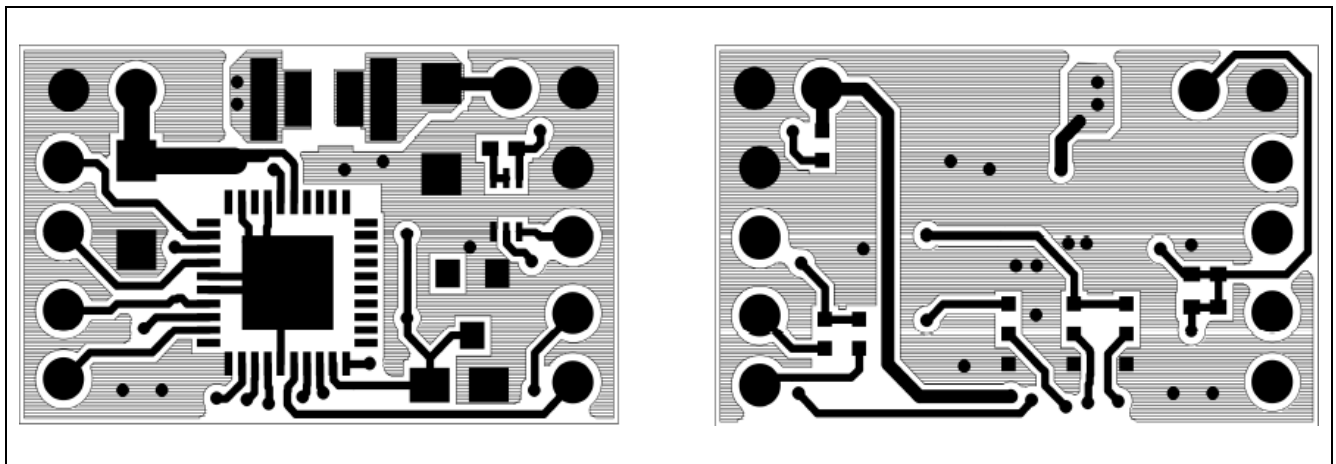
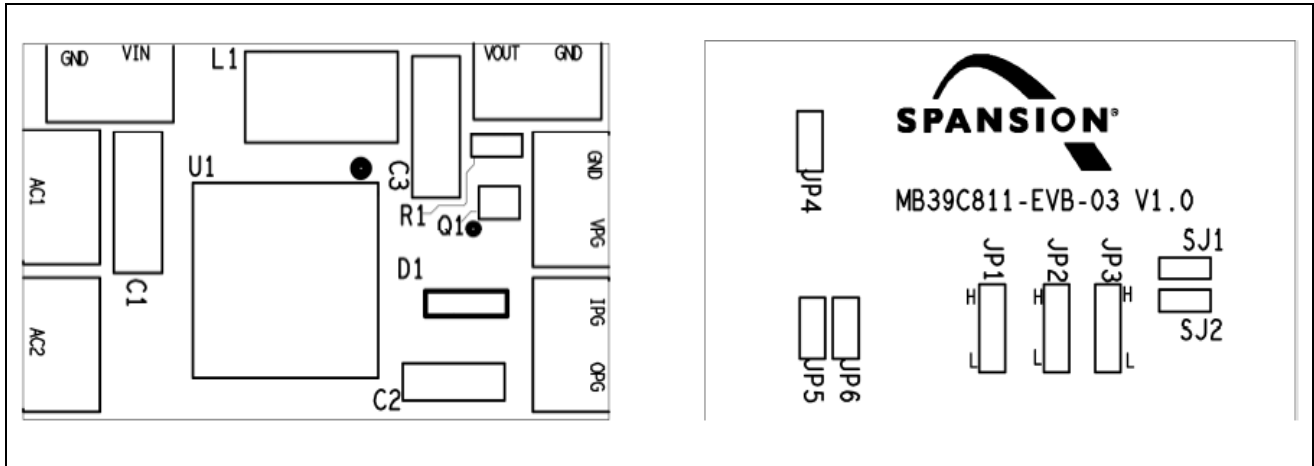


Figure 9. Silk



10. Ordering Information



Table 6. Ordering Information

| Part Number | EVb Revision | Note |
|-----------------|--------------|------|
| MB39C811-EVB-03 | Rev. 1.0 | --- |

11. Major Changes



Spansion Publication Number: MB39C811-EVB-03_SS901-00034-1v0-E

| Page | Section | Change Results |
|--------------|---------|-----------------|
| Revision 1.0 | | |
| - | - | Initial release |

Note: Please see Document Revision History for more Details

12. Revision History



Document Revision History

| Document Title: MB39C811-EVB-03, PMIC for Solar/Vibration Energy Harvesting, Evaluation Board Operation Guide | | | |
|---|------------|------------------|---|
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| Revision | Issue Date | Origin of Change | Description of Change |
| ** | 01/09/2015 | EIFU | Initial Release |
| *A | 05/04/2016 | EIFU | Updated to Cypress template. |
| *B | 12/11/2017 | EIFU | Updated Document Title to read as "MB39C811-EVB-03, PMIC for Solar/Vibration Energy Harvesting, Evaluation Board Operation Guide". Updated to new template. Completing Sunset Review. |