

## MAX77839 Evaluation Kit

## Evaluates: MAX77839 in WLP Package

### General Description

The MAX77839 evaluation kit (EV kit) provides a proven design to evaluate the MAX77839, a 2.5A buck-boost converter. The IC is capable of 1.8V to 5.5V input and is output voltage adjustable between 2.3V to 5.3V (through the SEL pin). The factory default output voltage of this EV kit is set at 3.3V. Output voltage can be adjusted by changing the SEL resistor value (R3). The GPIO pin is available to support the force PWM or power-OK (POK) function. The EV kit is compatible with any version of the MAX77839 WLP IC (MAX77839AEWC+ is the default).

### EV Kit Specifications and Default Configuration

With the default jumper settings listed in [Table 2](#) and the EV kit component value  $R_{SEL}$  (R3) = 0Ω, the MAX77839 EV kit is configured with the following settings:

- IC Part Number: MAX77839AEWL+T
- Switching Current Limit = 4.4A
- Active Discharge Enabled
- UVLO Rising = 1.8V, UVLO Falling = 1.73V

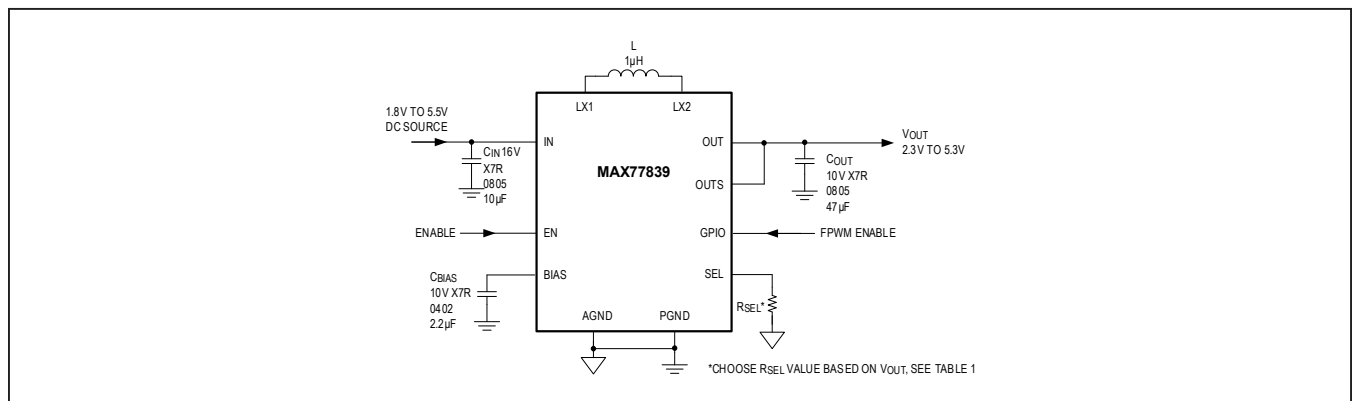
### Benefits and Features

- Sense Points for High-Accuracy Measurements
- Accessible Test Points for EN, POK, and OUTS
- Output Voltage Adjustable Using SEL
- FPWM and SKIP Mode Configurable (A and C options) (SKIP mode by default)
- POK Status Configurable (B and D options)
- Active Discharge Functionality
- UVLO Rising = 1.8V, UVLO Falling = 1.73V (MAX77839AEWC+)

[Ordering Information](#) appears at end of data sheet.

**Table 1. EV Kit Default Specifications**

| SPECIFICATION          | TEST CONDITIONS   | MIN | TYP | MAX  | UNIT |
|------------------------|---|-----|-----|------|------|
| Input Voltage          |   | 1.8 |     | 5.5  | V    |
| Output Voltage         | Configurable by SEL resistor R3 (see <a href="#">Table 3</a> ). | 2.3 |     | 5.3  | V    |
| Default Output Voltage |   |     | 3.3 |      | V    |
| Output Current         |   | 0   |     | 2.5  | A    |
| Switching Frequency    |   |     | 2.2 |      | MHz  |
| Current Limit          | A and B options   |     | 4.4 |      | A    |
| Peak Efficiency        | 3.3V <sub>IN</sub> , 3.3V <sub>OUT</sub> , 500mA load           |     |     | 96.0 | %    |



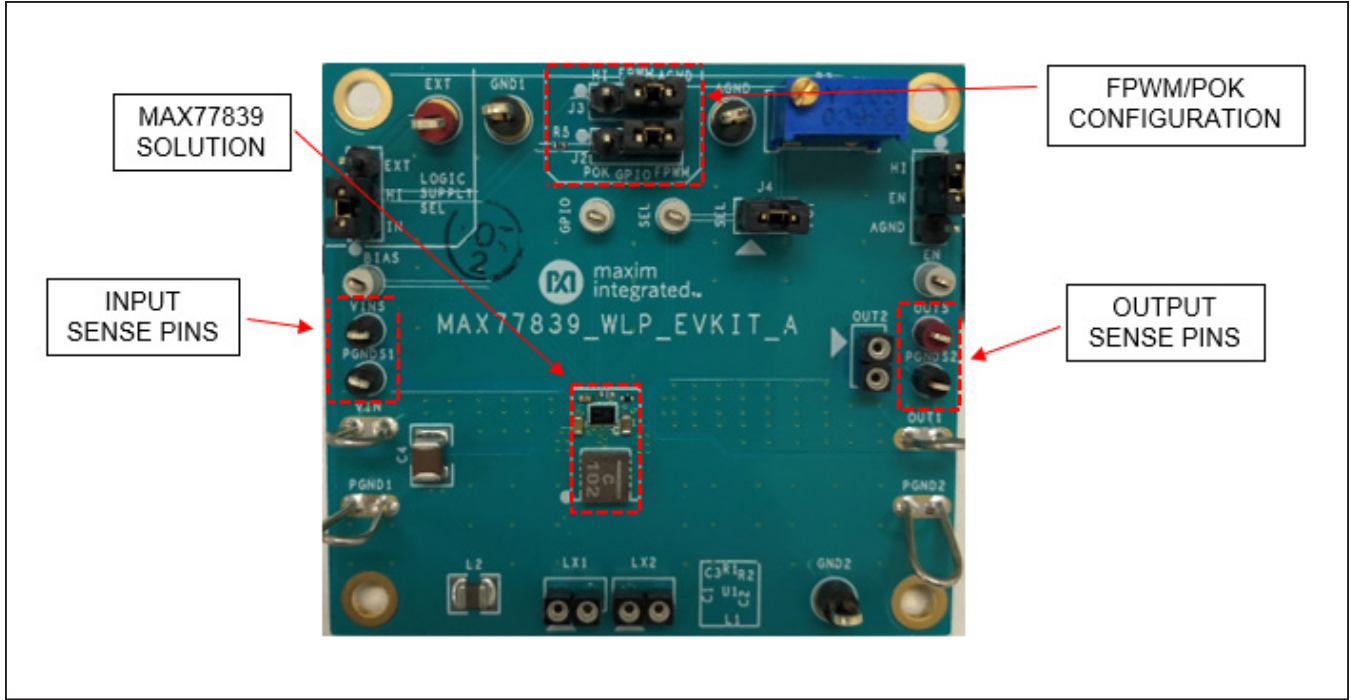


Figure 1. MAX77839 Evaluation Board

**Table 2. Default Shunt Positions and Jumper Descriptions**

| JUMPER | NODE OR FUNCTION | SHUNT POSITION | FUNCTION   |
|--------|------------------|----------------|--|
| J1     | EN               | 1-2*           | Connects EN to HI (MAX77839 is enabled by default)                                   |
| J2     | GPIO             | 1-2            | POK selection (options B and D)  |
|        |                  | 2-3*           | FPWM selection (options A and C)   |
| J3     | FPWM             | 1-2            | Enables FPWM function  |
|        |                  | 2-3*           | Enables SKIP mode function   |
| J4     | SEL              | 1-2*           | Configures output voltage using potentiometer R3. (0Ω = 3.3V <sub>OUT</sub> default) |
| J5     | LOGIC SUPPLY     | 1-2*           | Connects HI to VIN   |
|        |                  | 2-3            | Connects HI to External Supply (EXT)   |

\*Default position.

**Quick Start**

**Required Equipment**

- MAX77839 EV kit
- Adjustable DC power supply
- 1.8V DC power supply (optional)
- Digital multi-meters

**Setup Overview**

A typical bench setup for the MAX77839 EV kit is shown in [Figure 2](#).

**Procedure**

The EV kit is fully assembled and tested. Follow the steps below to verify board operation. Use twisted wires of appropriate gauge (20AWG) that are as short as possible to connect the load and power sources.

- 1) Ensure that the EV kit has the correct jumper settings, as shown in [Table 2](#).
- 2) Connect a DVM to the VINS and PGNDS1 sense pins to measure input voltage.
- 3) Connect a DVM to the OUTS and PGNDS2 sense pins to measure output voltage.
- 4) Apply a power supply set to 0V (100mA current limit) across the VIN and PGND1 terminals of the EV kit. Turn the supply on and increase the voltage to 3.8V.
- 5) Confirm the DVM connected to OUTS and PGNDS\_ OUT reads the default output voltage of the EV kit (3.3V).

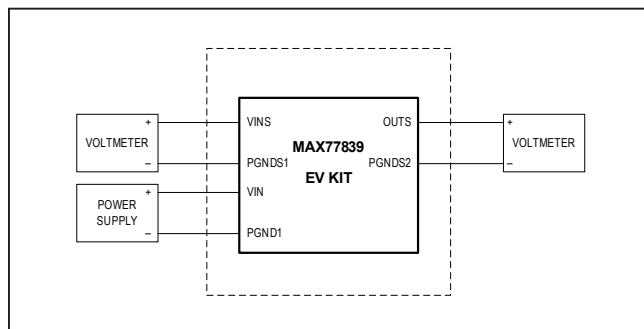


Figure 2. EV Kit Connection Block Diagram

**Table 3. MAX77839 R<sub>SEL</sub> Selection Table**

| V <sub>OUT</sub> (V) | R <sub>SEL</sub> (kΩ) |
|----------------------|-----------------------|
| 3.3                  | Short (0Ω)            |
| 2.3                  | 4.99                  |
| 2.4                  | 5.90                  |
| 2.5                  | 7.15                  |
| 2.6                  | 8.45                  |
| 2.7                  | 10.0                  |
| 2.8                  | 11.8                  |
| 2.9                  | 14.0                  |
| 3.0                  | 16.9                  |
| 3.1                  | 20.0                  |
| 3.2                  | 23.7                  |
| 3.4                  | 28.0                  |
| 3.5                  | 34.0                  |
| 3.6                  | 40.2                  |
| 3.7                  | 47.5                  |
| 3.8                  | 56.2                  |
| 3.9                  | 66.5                  |
| 4.0                  | 80.6                  |
| 4.1                  | 95.3                  |
| 4.2                  | 113                   |
| 4.3                  | 133                   |
| 4.4                  | 162                   |
| 4.5                  | 191                   |
| 4.6                  | 226                   |
| 4.7                  | 267                   |
| 4.8                  | 324                   |
| 4.9                  | 383                   |
| 5.0                  | 452                   |
| 5.1                  | 536                   |
| 5.2                  | 634                   |
| 5.3                  | 768                   |
| 2.85                 | 909 or Open           |

## MAX77839 Evaluation Kit

## Evaluates: MAX77839 in WLP Package

### Detailed Description of Hardware

The MAX77839 EV kit demonstrates the MAX77839 buck-boost. It regulates output from an input voltage range of 1.8V to 5.5V. The programmable output range is from 2.3V to 5.3V with 100mV steps. The EV kit is suited with a general DC input. [Table 2](#) lists jumpers and associated functions that are available on the EV kit.

The MAX77839 includes an SEL pin to configure the output voltage on startup. Resistors with tolerance 1% (or better) should be chosen for R3, with nominal values specified in [Table 3](#).

### High Temperature Testing

The MAX77839 is rated for operation under ambient temperatures up to +125°C. Note that not all components on the EV kit are rated for temperatures that high. Some ceramic capacitors experience extra leakage when put under temperatures higher than they are rated, and supply current readings for the IC might be larger than expected. Double check the components on the EV kit if testing at +125°C ambient temperatures.

List of capacitors not rated for +125°C:

- C2 (output capacitor)
- C4 (VIN bulk capacitor)

Consider replacing these components if IC operation at +125°C ambient temperature is an important use case.

### Test Points and Critical Node Measurement (VOUT and LX)

The EV kit comes with sockets pre-soldered onto the board for measuring the critical nodes VOUT, LX1, and LX2. Use these probe sockets to eliminate as much noise as possible when measuring the critical nodes (see example shown in [Figure 3](#)). To ensure best results, use a very short ground wire from the ground sleeve of the scope probe to the GND side of the probe socket, and use the bare tip of the probe directly to the signal side of the probe socket.

Following these guidelines gives the most accurate results when measuring parameters like output voltage ripple, switching waveforms, and load transient response.

### Evaluating Other MAX77839 Versions

The MAX77839 natively supports the FPWM and POK versions of the MAX77839. The EV kit is designed such that any version of the MAX77839 can be evaluated with the same hardware. To evaluate the POK versions of the MAX77839, replace the MAX77839 (U1) on the EV kit with the MAX77839BEWL+ or MAX77839DEWL+ IC (refer to the IC data sheet's Ordering Information). Remove J3 jumper and install J2 jumper (1-2). No other component changes are required to evaluate the POK versions.

### PCB Layout Guideline

Careful circuit board layout is critical to achieve low switching power losses and clean, stable operation. Refer to the PCB Layout Guideline section of the [MAX77839 data sheet](#).

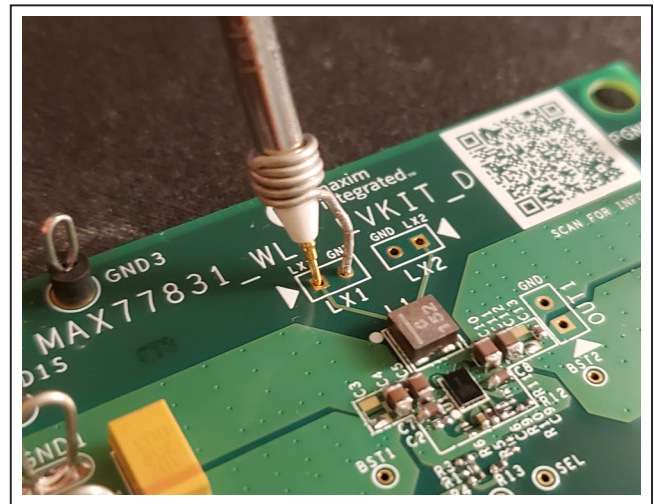


Figure 3. Probing Critical Nodes

Table 4. Usage of Critical Test Points

| LOAD TRANSIENT,<br>OUTPUT RIPPLE | LOAD REGULATION,<br>LINE REGULATION,<br>V <sub>OUT</sub> ACCURACY | EFFICIENCY     |               | SWITCHING NODE |     |
|----------------------------------|---|----------------|---------------|----------------|-----|
|                                  |   | OUTPUT VOLTAGE | INPUT VOLTAGE | LX1            | LX2 |
| OUT2                             | OUT5  | OUT5           | VIN5          | LX1            | LX2 |

Table 5. Component List

| PART   | QTY | MFG PART #          | MANUFACTURER              | DESCRIPTION  |
|--|-----|---------------------|---------------------------|--|
| C1   | 1   | GRM188D71A106MA73   | MURATA                    | 10 $\mu$ F $\pm$ 20%, 10V X7T CERAMIC CAPACITOR (0603)   |
| C2   | 1   | GRM188R60J476ME15   | MURATA                    | 47 $\mu$ F $\pm$ 20%, 6.3V X5R CERAMIC CAPACITOR (0603)  |
| C3   | 1   | GRM155R70J105MA12   | MURATA                    | 1 $\mu$ F $\pm$ 20%, 6.3V X7R CERAMIC CAPACITOR (0402)   |
| J1-J3, J5  | 2   | PBC03SAAN           | SULLINS ELECTRONICS CORP. | STRAIGHT CONNECTOR, 3 PINS   |
| J4   | 1   | PBC02SAAN           | SULLINS ELECTRONICS CORP. | STRAIGHT CONNECTOR, 2 PINS   |
| L1   | 1   | XAL4020-102ME       | COILCRAFT                 | 1 $\mu$ H $\pm$ 20%, ISAT=9.6A, DCR=13.25m $\Omega$  |
| R2   | 1   | ANY                 | ANY                       | 0 $\Omega$ , RESISTOR (0402)   |
| U1   | 1   | MAX77839AEWL+       | MAXIM                     | BUCK-BOOST (15 WLP), MAX77839AEWL+   |
| Components below this line are outside of the immediate MAX77839 evaluation circuit and solution silkscreen. |     |                     |                           |  |
| L2   | 1   | CIGT252010EH1R0M    | SAMSUNG ELECTRONICS       | INDUCTOR; SMT (1008); MAGNETICALLY SHIELDED; 1UH; TOL=+/-20%; 4.3A   |
| LX1, LX2, OUT2   | 3   | SS-102-TT-2         | SAMTEC                    | IC-SOCKET; SIP; STRAIGHT; PRECISION MACHINED SOCKET STRIP; OPEN FRAME; 2PINS; 100MIL                               |
| OUT1, PGND1, PGND2, VIN  | 4   | 9020 BUSS           | WEICO WIRE                | EVK KIT PARTS; MAXIM PAD; WIRE; NATURAL; SOLID; WEICO WIRE; SOFT DRAWN BUS TYPE-S; 20AWG                           |
| OUTS, VINS   | 2   | 5000                | KEYSTONE                  | TEST POINT; PIN DIA=0.1IN; TOTAL LENGTH=0.3IN; BOARD HOLE=0.04IN; RED; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;   |
| PGNDS1, PGNDS2   | 2   | 5001                | KEYSTONE                  | TEST POINT; PIN DIA=0.1IN; TOTAL LENGTH=0.3IN; BOARD HOLE=0.04IN; BLACK; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH; |
| PCB  | 1   | MAX77839 SOLDERDOWN | MAXIM                     | PCB:MAX77839SOLDERDOWN   |
| R3   | 1   | 3296Y-1-105LF       | BOURNS                    | RES; THROUGH HOLE-RADIAL LEAD; 1M; 10%; +/-100PPM/DEGC; 0.5W   |
| R5   | 0   | CRCW040215K0FK      | VISHAY DALE               | RESISTOR; 0402; 15K; 1%; 100PPM; 0.0625W; THICK FILM   |

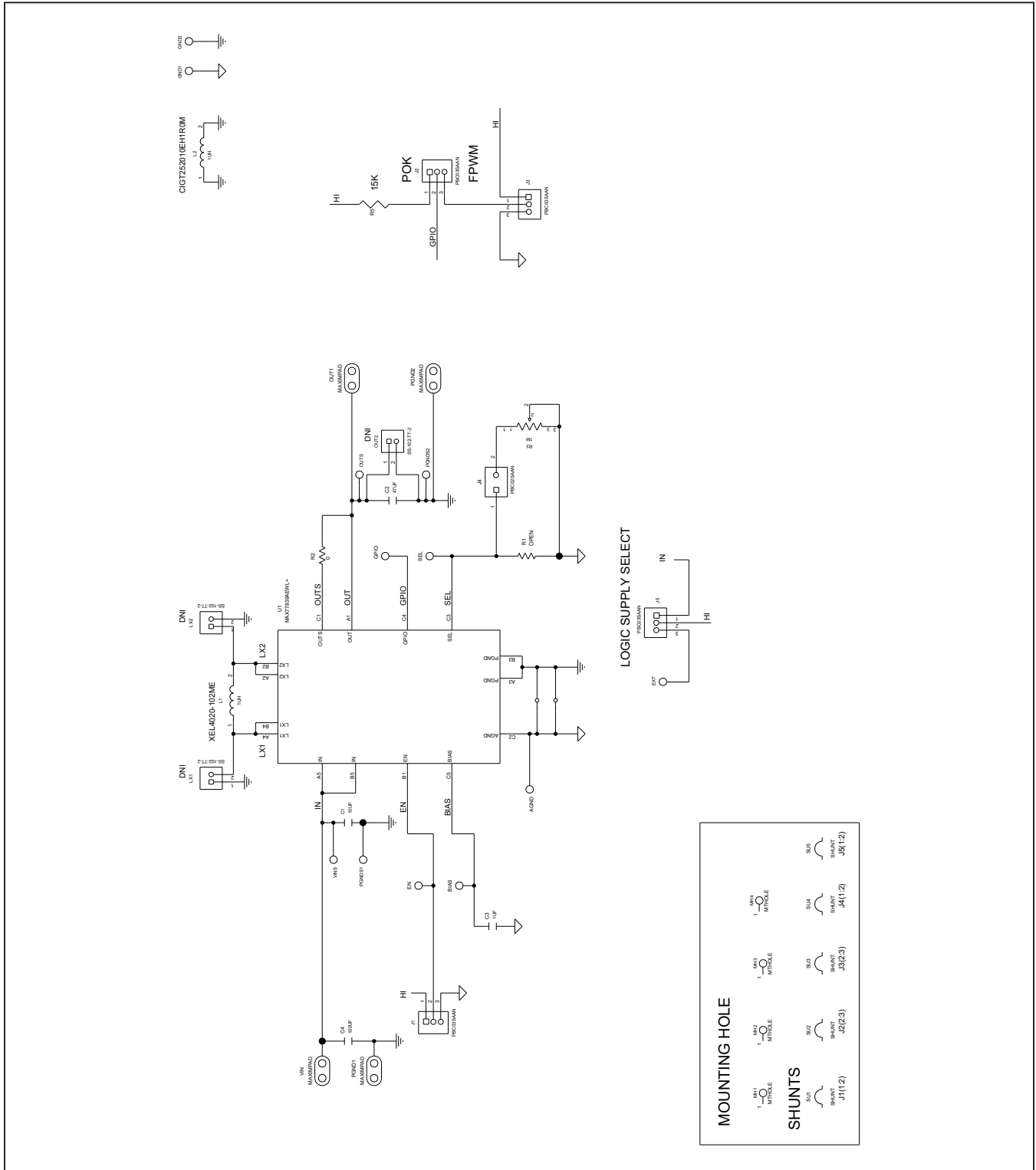
## Ordering Information

| PART            | U1 IC         | DEFAULT OUTPUT VOLTAGE | UVLO FALLING | UVLO RISING |
|-----------------|---------------|------------------------|--------------|-------------|
| MAX77839WEVKIT# | MAX77839AEWL+ | 3.3V                   | 1.73V        | 1.8V        |

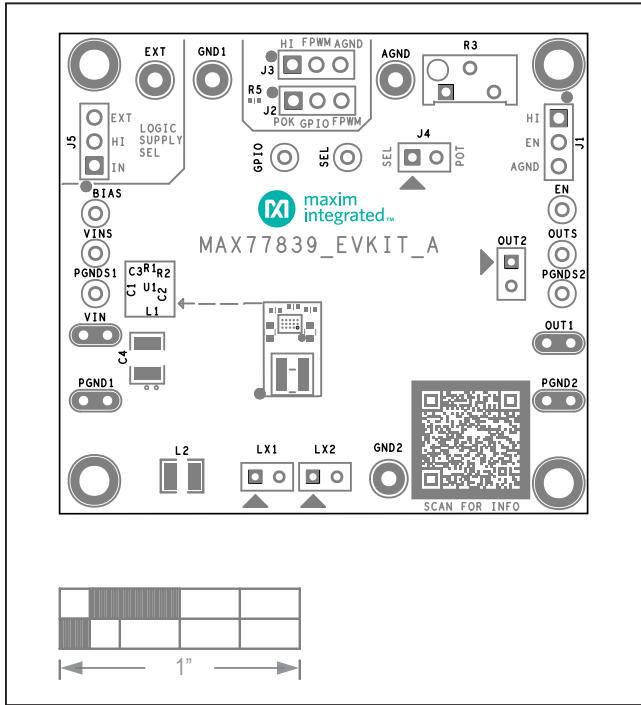
MAX77839 EV Kit Bill of Materials

| ITEM  | REF_DES                 | DNI/DNP | QTY | MFG PART #  | MANUFACTURER                          | VALUE         | DESCRIPTION   | COMMENTS |
|-------|-------------------------|---------|-----|---|---------------------------------------|---------------|---|----------|
| 1     | AGND, GND1, GND2        | -       | 3   | 5011  | KEYSTONE                              | N/A           | TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.445IN; BOARD HOLE=0.063IN; BLACK; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;                                   |          |
| 2     | BIAS, EN, GPIO, SEL     | -       | 4   | 5002  | KEYSTONE                              | N/A           | TEST POINT; PIN DIA=0.1IN; TOTAL LENGTH=0.3IN; BOARD HOLE=0.04IN; WHITE; PHOSPHOR BRONZE WIRE SILVER;   |          |
| 3     | C1                      | -       | 1   | GRM188D71A106MA73   | MURATA                                | 10UF          | CAP; SMT (0603); 10UF; 20%; 10V; X7T; CERAMIC   |          |
| 4     | C2                      | -       | 1   | GRM188R60J476ME15   | MURATA                                | 47UF          | CAP; SMT (0603); 47UF; 20%; 6.3V; X5R; CERAMIC  |          |
| 5     | C3                      | -       | 1   | GRM155R70J105MA12   | MURATA                                | 1UF           | CAP; SMT (0402); 1UF; 20%; 6.3V; X7R; CERAMIC   |          |
| 6     | C4                      | -       | 1   | C1210C107M9PAC;<br>C1210X5R6R3-107MNE;<br>GRM32ER60J107ME20;<br>C3225X5R0J107M250AC | KEMET;VENKEL LTD.;MURATA;TDK          | 100UF         | CAP; SMT (1210); 100UF; 20%; 6.3V; X5R; CERAMIC   |          |
| 7     | EXT                     | -       | 1   | 5010  | KEYSTONE                              | N/A           | TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.445IN; BOARD HOLE=0.063IN; RED; PHOSPHOR BRONZE WIRE SIL;   |          |
| 8     | J1-J3, J5               | -       | 4   | PBC03SAAN   | SULLINS                               | PBC03SAAN     | CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 3PINS; -65 DEGC TO +125 DEGC  |          |
| 9     | J4                      | -       | 1   | PBC02SAAN   | SULLINS ELECTRONICS CORP.             | PBC02SAAN     | EVKIT PART-CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 2PINS; -65 DEGC TO +125 DEGC;  |          |
| 10    | L1                      | -       | 1   | XEL4020-102ME   | COILCRAFT                             | 1UH           | EVKIT PART - INDUCTOR; SMT; COMPOSITE; 1UH; 20%; 9.6A;  |          |
| 11    | L2                      | -       | 1   | CIGT252010EH1R0M  | SAMSUNG ELECTRONICS                   | 1UH           | INDUCTOR; SMT (1008); MAGNETICALLY SHIELDED; 1UH; TOL=+/-20%; 4.3A  |          |
| 12    | OUT1, PGND1, PGND2, VIN | -       | 4   | 9020 BUSS   | WEICO WIRE                            | MAXIMPAD      | EVK KIT PARTS; MAXIM PAD; WIRE; NATURAL; SOLID; WEICO WIRE; SOFT DRAWN BUS TYPE-S; 20AWG  |          |
| 13    | OUTS, VINS              | -       | 2   | 5000  | KEYSTONE                              | N/A           | TEST POINT; PIN DIA=0.1IN; TOTAL LENGTH=0.3IN; BOARD HOLE=0.04IN; RED; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;  |          |
| 14    | PGNDS1, PGNDS2          | -       | 2   | 5001  | KEYSTONE                              | N/A           | TEST POINT; PIN DIA=0.1IN; TOTAL LENGTH=0.3IN; BOARD HOLE=0.04IN; BLACK; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;  |          |
| 15    | R2                      | -       | 1   | RC0402JR-070RL;<br>CR0402-16W-000RJT  | YAGEO PHYCOMP;VENKEL LTD.             | 0             | RES; SMT (0402); 0; 5%; JUMPER; 0.0630W   |          |
| 16    | R3                      | -       | 1   | 3296Y-1-105LF   | BOURNS                                | 1M            | RES; THROUGH HOLE-RADIAL LEAD; 1M; 10%; +/-100PPM/DEGC; 0.5W  |          |
| 17    | R5                      | -       | 1   | CRCW040215K0FK  | VISHAY DALE                           | 15K           | RES; SMT (0402); 15K; 1%; +/-100PPM/DEGC; 0.0630W   |          |
| 18    | SU1-SU5                 | -       | 5   | S1100-B;SX1100-B;STC02SYAN  | KYCON;KYCON;SULLINS ELECTRONICS CORP. | SX1100-B      | TEST POINT; JUMPER; STR; TOTAL LENGTH=0.24IN; BLACK; INSULATION=PBT;PHOSPHOR BRONZE CONTACT=GOLD PLATED   |          |
| 19    | U1                      | -       | 1   | MAX77839EWLA+   | MAXIM                                 | MAX77839EWLA+ | EVKIT PART - IC; 5.5V INPUT 4.4A/3.6A SWITCHING CURRENT 6MICRO-AMPERE IQ BUCK-BOOST CONVERTER; PACKAGE OUTLINE DRAWING 21-100441; PACKAGE CODE: W151K2Z+1 |          |
| 20    | PCB                     | -       | 1   | MAX77839WLPOLDERDOWN  | MAXIM                                 | PCB           | PCB:MAX77839WLPOLDERDOWN  | -        |
| 21    | LX1, LX2, OUT2          | DNP     | 0   | SS-102-TT-2   | SAMTEC                                | SS-102-TT-2   | IC-SOCKET; SIP; STRAIGHT; PRECISION MACHINED SOCKET STRIP; OPEN FRAME; 2PINS; 100MIL  |          |
| 22    | R1                      | DNP     | 0   | N/A   | N/A                                   | OPEN          | RESISTOR; 0402; OPEN; FORMFACTOR  |          |
| TOTAL |                         |         | 37  |   |                                       |               |   |          |

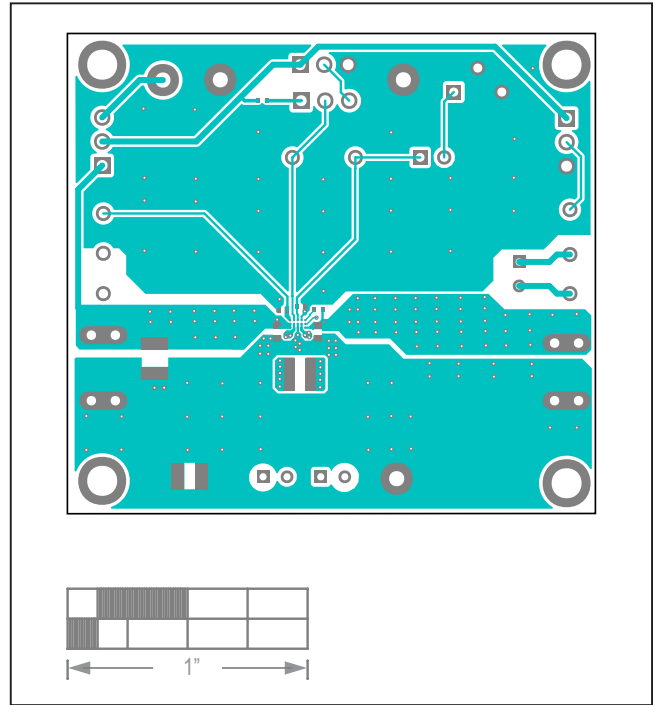
MAX77839 EV Kit Schematic



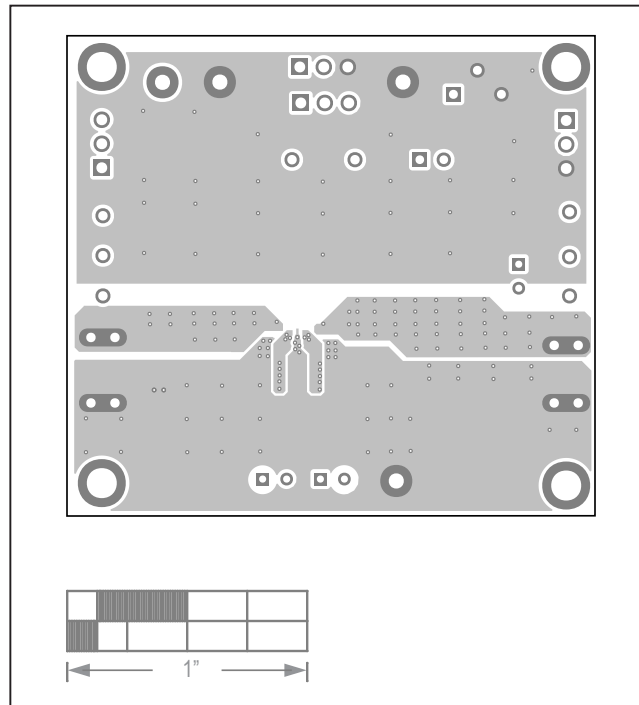
MAX77839 EV Kit PCB Layouts



MAX77839 EV Kit Component Placement Guide – Top Side



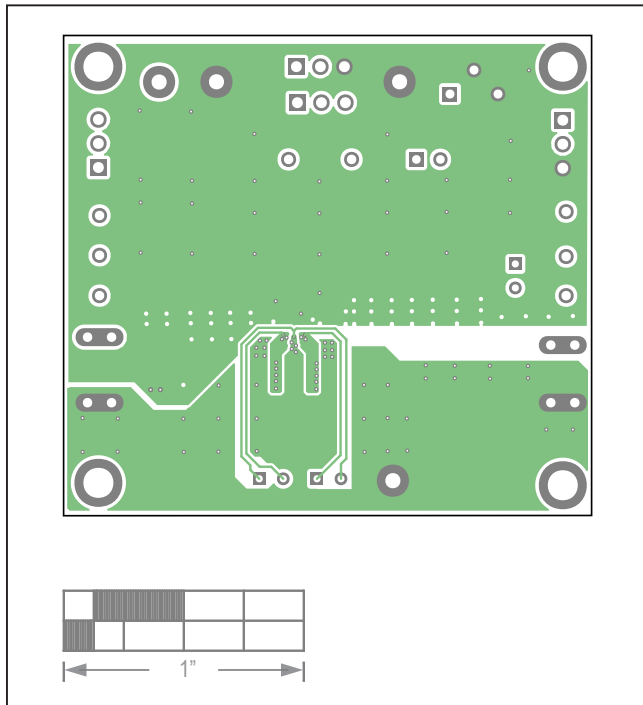
MAX77839 EV Kit PCB Layout – Top Side



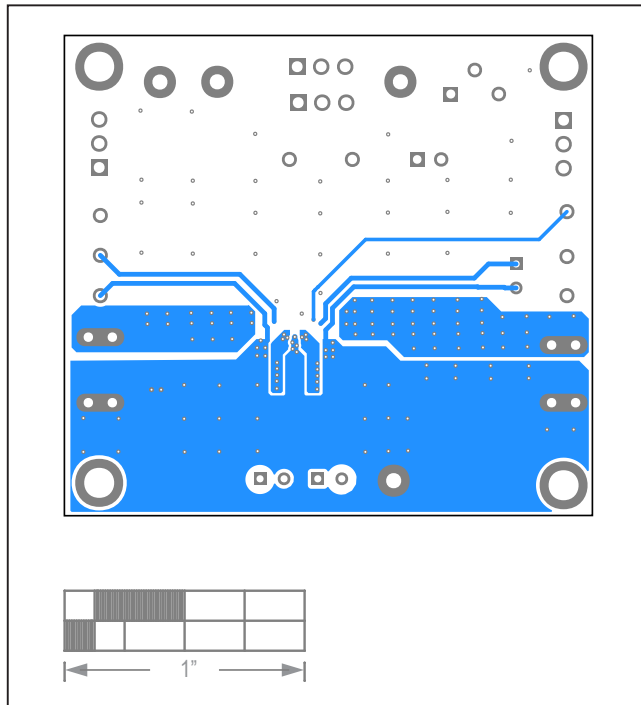
MAX77839 EV Kit PCB Layout – Layer 2



MAX77839 EV Kit PCB Layouts (continued)



MAX77839 EV Kit PCB Layout – Layer 3



MAX77839 EV Kit PCB Layout – Bottom Layer

## Revision History

| REVISION NUMBER | REVISION DATE | DESCRIPTION     | PAGES CHANGED |
|-----------------|---------------|-----------------|---------------|
| 0               | 12/20         | Initial release | —             |

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