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

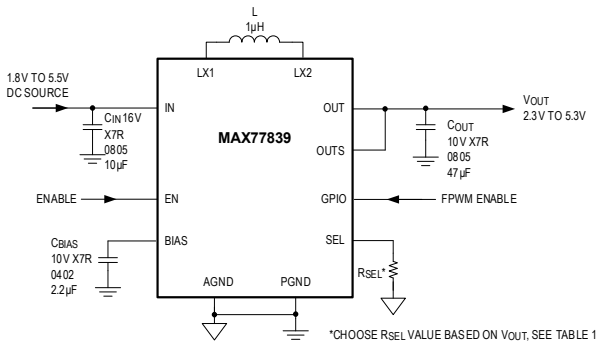
Benefits and Features

- 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 Table 3).	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	$3.3V_{IN}$, $3.3V_{OUT}$, 500mA load			96.0	%



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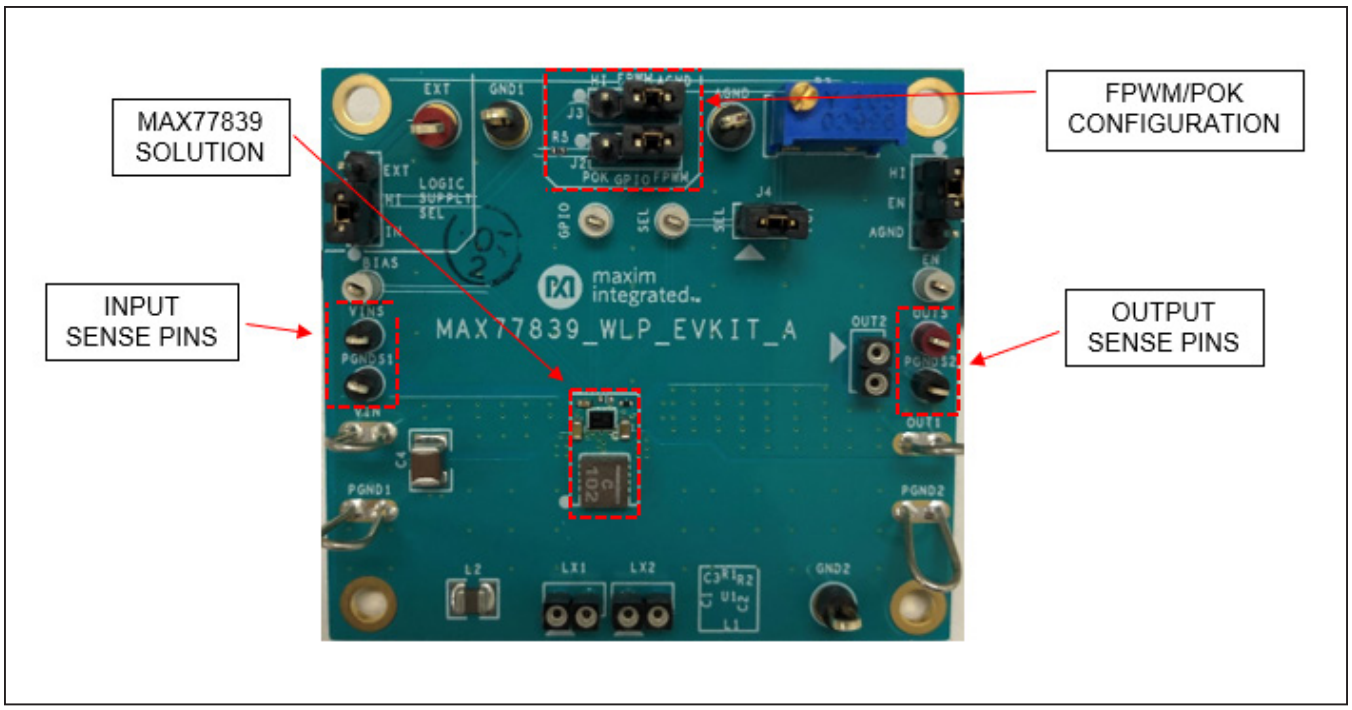


Figure 1. MAX77839 Evaluation Board

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_{OUT} 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).

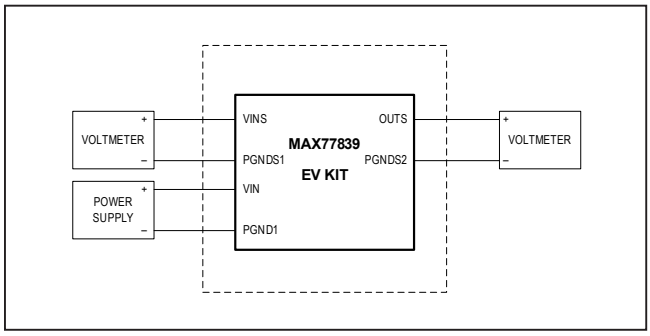


Figure 2. EV Kit Connection Block Diagram

Table 3. MAX77839 R_{SEL} Selection Table

V_{OUT} (V)	R_{SEL} (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

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**.

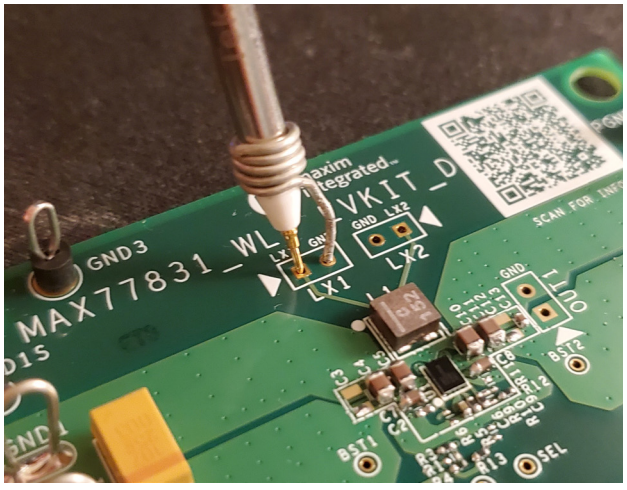


Figure 3. Probing Critical Nodes

Table 4. Usage of Critical Test Points

LOAD TRANSIENT, OUTPUT RIPPLE	LOAD REGULATION, LINE REGULATION, V_{OUT} 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	10µF ±20%, 10V X7T CERAMIC CAPACITOR (0603)
C2	1	GRM188R60J476ME15	MURATA	47µF ±20%, 6.3V X5R CERAMIC CAPACITOR (0603)
C3	1	GRM155R70J105MA12	MURATA	1µF ±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	1µH ±20%, ISAT=9.6A, DCR=13.25mΩ
R2	1	ANY	ANY	0Ω, 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

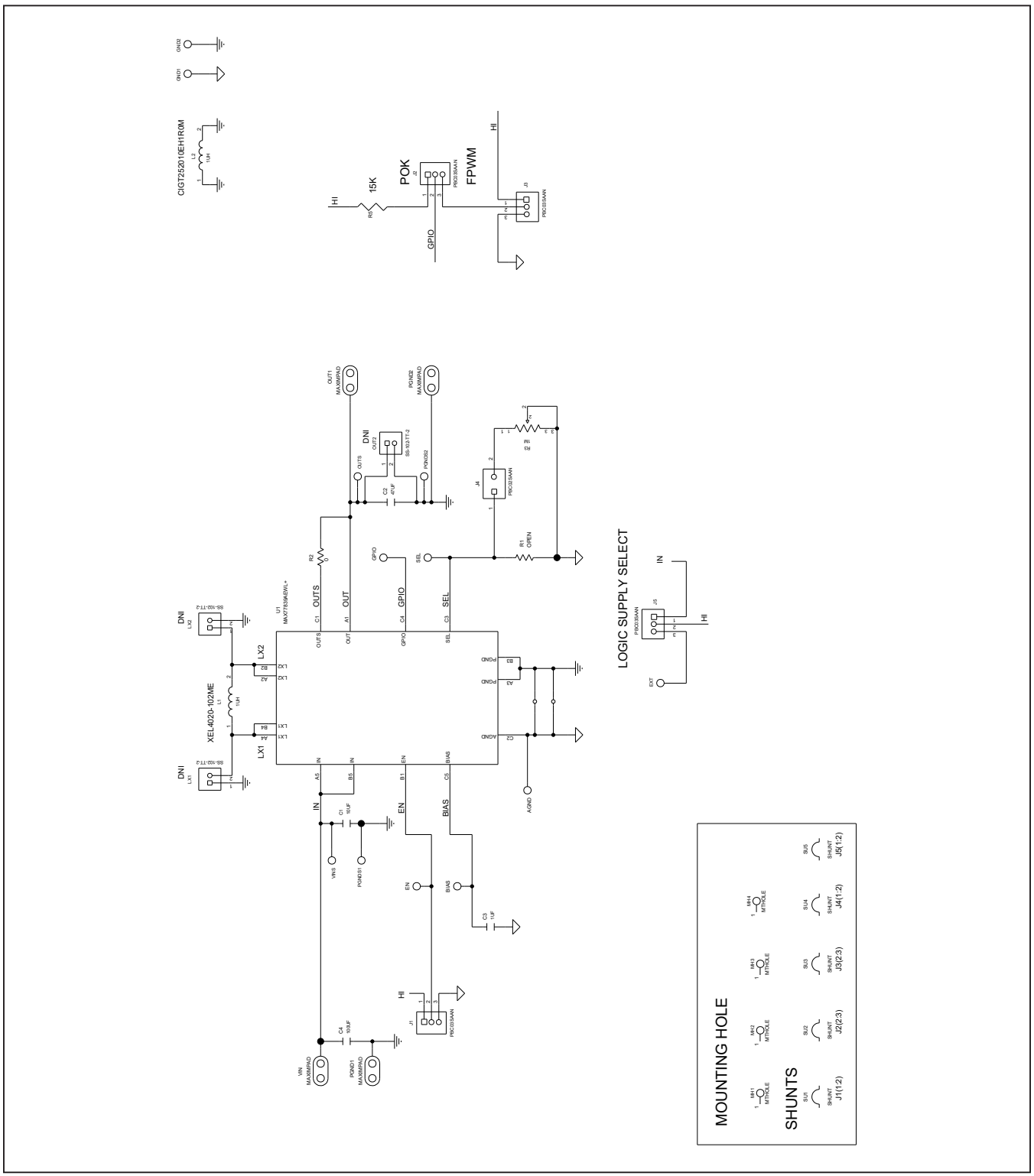
Ordering Information

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

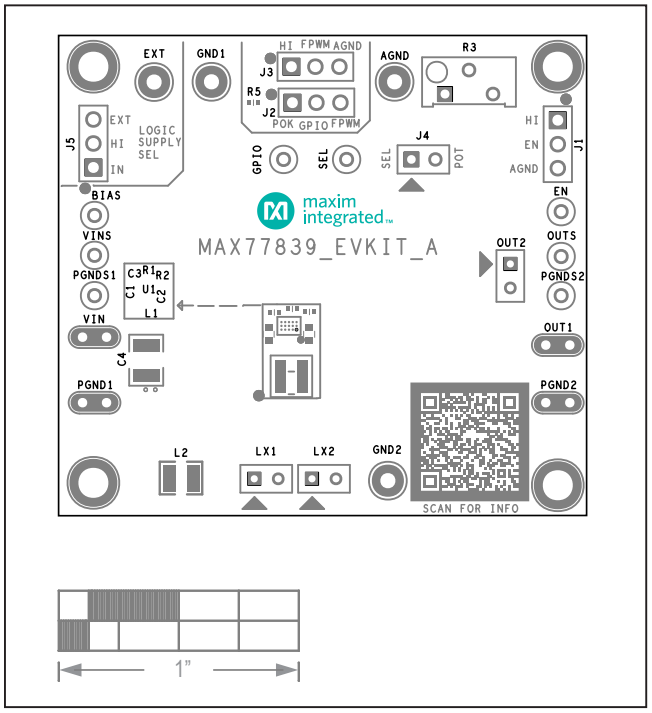
MAX77839 EV Kit Bill of Materials

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; C1210X5R6R3-107MNE; GRM32ER60J107ME20; 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; 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	MAX77839WLPSOLDERDOWN	MAXIM	PCB	PCB:MAX77839WLPSOLDERDOWN	-
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					

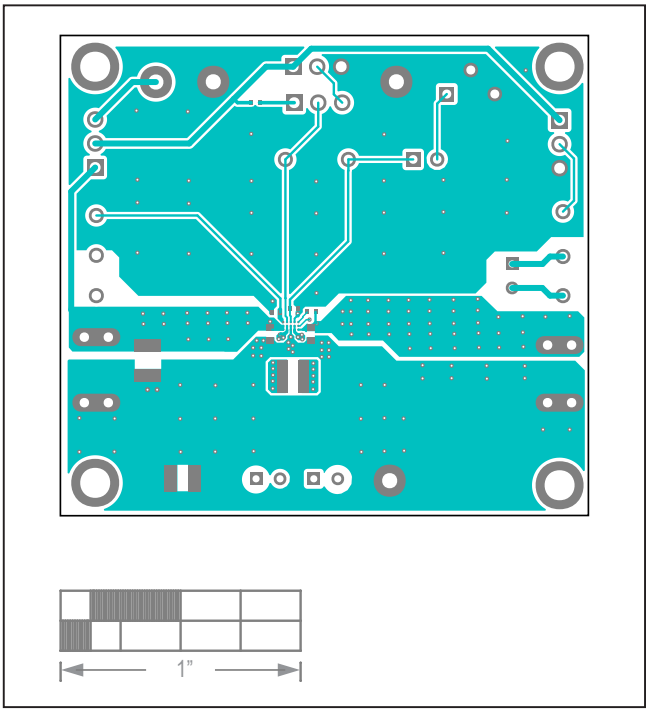
MAX77839 EV Kit Schematic



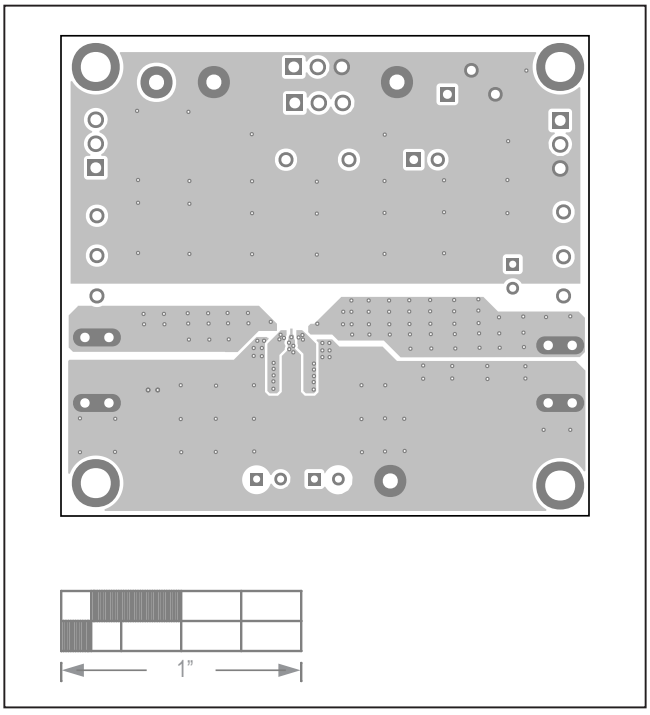
MAX77839 EV Kit PCB Layouts



MAX77839 EV Kit Component Placement Guide – Top Side

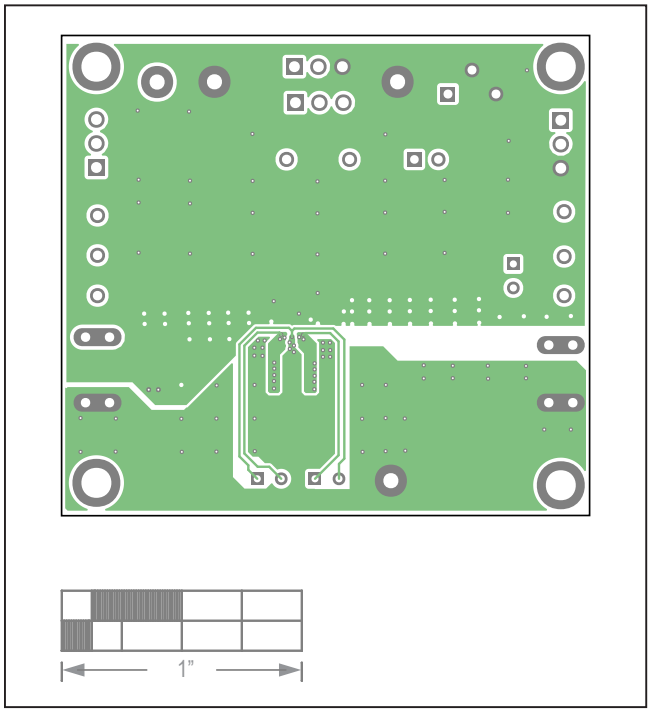


MAX77839 EV Kit PCB Layout – Top Side

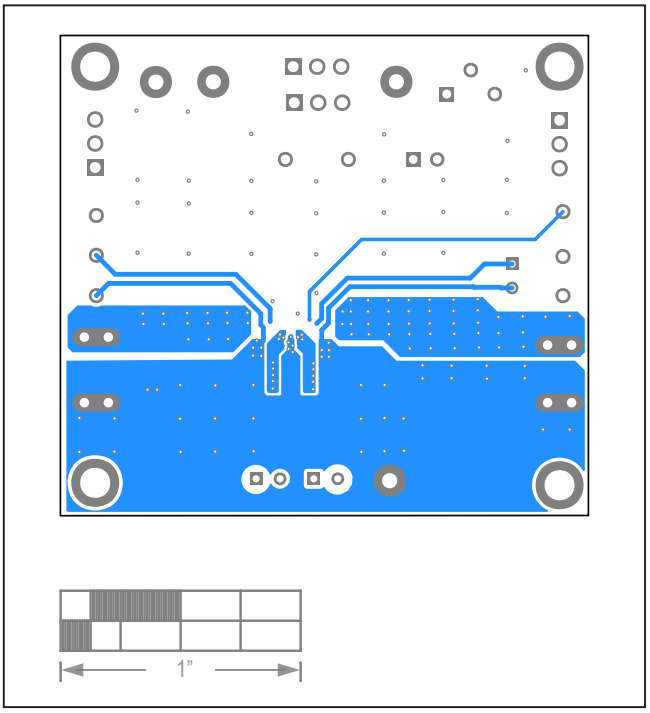


MAX77839 EV Kit PCB Layout – Layer 2

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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