



MAX8594 Evaluation Kit

General Description

The MAX8594 evaluation kit (EV kit) is a fully assembled and tested circuit board that evaluates the MAX8594 5-output PMIC with DC-DC core supply for low-cost PDAs. The MAX8594 COR1 4MHz step-down DC-DC converter supplies a pin-selectable 1V or 1.3V output at 250mA. A MAIN LDO supplies 3.3V at 500mA. A secure-digital (SD) card-slot output supplies 3.3V at 500mA, and a COR2 LDO supplies 1.8V at 50mA. Each output has its own logic-controlled enable. An LCD bias boost DC-DC converter features an on-board MOSFET and True Shutdown™ when off and has its own logic-controlled enable. A μP reset output clears 20ms (typ) after the COR1 output achieves regulation to ensure an orderly start. Included on the MAX8594, and available on the EV kit, are low-battery and dead-battery monitors. The MAX8594 EV kit operates from a 3.1V to a 5.5V supply.

Features

- ◆ Minimum External Components
- ◆ Efficient Step-Down DC-DC Powers CPU Core
- ◆ 1V/1.3V Selectable Core Voltage, 250mA
- ◆ Main LDO 3.3V, 500mA
- ◆ SD Card Output 3.3V, 500mA
- ◆ Second Core LDO 1.8V, 50mA
- ◆ High-Efficiency LCD Boost
- ◆ LCD 0V True Shutdown when Off
- ◆ Fully Assembled and Tested

Ordering Information

PART	TEMP RANGE	IC PACKAGE
MAX8594EVKIT	0°C to +70°C	24 Thin QFN 4mm x 4mm

Component List

DESIGNATION	QTY	DESCRIPTION
C1	1	1 μF $\pm 20\%$, 6.3V X5R ceramic capacitor (0402) TDK C1005X5R0J105M
C2, C3, C5, C7	4	4.7 μF $\pm 10\%$, 6.3V X5R ceramic capacitors (0603) TDK C1608X5R0J475K
C4, C6	2	2.2 μF $\pm 10\%$, 6.3V X5R ceramic capacitors (0603) TDK C1608X5R0J225K
C8	1	1 μF $\pm 10\%$, 25V X7R ceramic capacitor (1206) TDK C3216X7R1E105K
C9	1	47pF $\pm 10\%$, 50V C0G ceramic capacitor (0402) TDK C1005C0G1H470JT
C10	1	0.1 μF $\pm 10\%$, 10V X5R ceramic capacitor (0402) TDK C1005X5R1A104K

DESIGNATION	QTY	DESCRIPTION
D1	1	30V, 0.5A switching diode (SOD-123) International Rectifier MBR0530 (top mark IR530)
JU1-JU6	6	3-pin headers
L1	1	10 μH inductor (1210) Murata LQH32CN100K21
L2	1	2.2 μH inductor (1210) Murata LQH32CN2R2M53
R1	1	2.2M Ω $\pm 1\%$ resistor (0402)
R2	1	200k Ω $\pm 1\%$ resistor (0402)
R3	0	Open (0402)
R4, R5	2	Not installed, PC board shorts (0402)
R6, R7, R8	3	1M Ω $\pm 1\%$ resistors (0402)
U1	1	MAX8594ETG
None	6	Shunts

True Shutdown is a trademark of Maxim Integrated Products, Inc.



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Quick Start

Recommended Equipment

- One variable-DC power supply capable of supplying up to 5.5V at 2A
- Digital multimeter (DMM)
- Ammeter (optional)
- Various loads (optional)

Procedure

The MAX8594 EV kit is fully assembled and tested. Follow the steps below to verify board operation:

- 1) Preset the variable-DC power supply to 4V. Turn off the power supply. **Do not turn on the power supply until all connections are complete.**
- 2) Connect the positive lead of the 4V power supply to the BATT pad on the EV kit and connect the negative lead of the power supply to the GND pad on the EV kit.
- 3) To enable the MAIN output, verify that JU1 has a shunt connected to the ON position.
- 4) Verify that JU2, JU3, JU4, and JU6 have shunts connected to their OFF positions.
- 5) Turn on the power supply.
- 6) Use a voltmeter to verify the MAIN voltage (3.3V) by connecting the positive lead of the DMM to the MAIN pad on the EV kit and connecting the negative lead of the DMM to the GND pad on the EV kit.
- 7) Connect a load, if desired, from MAIN to GND. See Table 1 for maximum load currents.

- 8) To verify other outputs, move the shunt on the respective jumpers to the ON position and use a voltmeter to verify output voltages.
- 9) Connect loads from outputs COR1, COR2, and SDIG to GND, if desired. See Table 1 for maximum load currents.

Detailed Description

The MAX8594 EV kit provides one step-down DC-DC converter with 250mA output current capability and pin-selectable 1V or 1.3V output. Also included are three LDO outputs of 3.3V at MAIN, 3.3V at SDIG, 1.8V at COR2, and one adjustable boost LCD output set at 15V. Table 1 lists output voltages and maximum currents. The EV kit incorporates jumpers JU1, JU2, JU3, JU4, and JU6 to enable or disable MAIN, SDIG, COR1, COR2, and LCD, respectively, and JU5 to select COR1 output voltage. Tables 2 and 3 list the jumper functions.

Table 1. Output Voltages and Maximum Currents

OUTPUT	VOLTAGE (V)	MAXIMUM CURRENT (mA)
MAIN	3.3	500
SDIG	3.3	500
COR1	1 or 1.3	250
COR2	1.8	50
LCD	15 (Note 1)	5

Note 1: The EV kit is preset to 15V. The LCD output has a maximum-allowable voltage of 28V. If the EV kit is used to evaluate voltages above 15V, ensure that C8, C9, and D1 are capable of handling the higher voltage.

Table 2. JU1–JU4 and JU6 Jumper Functions

JUMPER (LABEL)	OUTPUT	ON SETTING (V)	OFF SETTING
JU1 (ENM)	MAIN	3.3*	0V/OFF
JU2 (ENSD)	SDIG	3.3	0V/OFF*
JU3 (ENC1)	COR1	1 or 1.3	0V/OFF*
JU4 (ENC2)	COR2	1.8	0V/OFF*
JU6 (ENLCD)	LCD	15 (Note 1)	0V/OFF*

*Default position

Note 1: The EV kit is preset to 15V. The LCD output has a maximum-allowable voltage of 28V. If the EV kit is used to evaluate voltages above 15V, ensure that C8, C9, and D1 are capable of handling the higher voltage.

Table 3. JU5 Jumper Function

JUMPER (LABEL)	OUTPUT	1V SETTING	1.3V SETTING
JU5 (CV)	COR1 Output Voltage Selection	1V	1.3V*

*Default position

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Evaluates: MAX8594

Evaluating Other Boost Voltages

The MAX8594 EV kit can be used to evaluate up to 28V at the boost output. The EV kit default boost output voltage is set to 15V. To generate other output voltages, replace feedback resistors R1 and R2. Select R2 in the 10kΩ to 200kΩ range.

$$R1 = R2 \times \left(\frac{V_{OUT}}{V_{LFB}} - 1 \right)$$

where $V_{LFB} = 1.25V$ and V_{OUT} can range from V_{IN} to 28V. The input bias current of LFB is typically only 5nA, allowing large-value resistors to be used. For less than 1% error, the current through R2 should be greater than 100 times the feedback input bias current (I_{LFB}).

Evaluating Other LBI and DBI Monitor Voltages

The DBI and LBI inputs monitor input voltage (usually a battery) and trigger the \overline{DBO} and \overline{LBO} outputs. With LBI and DBI connected to IN (default EV kit configuration), the LBI and DBI thresholds are internally set. For a rising input voltage, \overline{DBO} goes high when V_{IN} exceeds 3.3V and \overline{LBO} goes high when V_{IN} exceeds 3.7V. For a falling input voltage, \overline{LBO} goes low when V_{IN} falls below 3.3V and \overline{DBO} goes low when V_{IN} falls below 3.0V (refer also to the *Electrical Characteristics* table in the MAX8594 data sheet). Alternatively, the LBI and DBI thresholds can be set with external resistors R3, R4, and R5. R4 and R5 are shorted with a trace on

the board and must be cut before resistors are placed on the footprint. R3, R4, and R5 create one three-resistor-divider that can set both DBI and LBI according to the following equations (shown for setting falling thresholds). Choose the lower resistor of the divider chain (R3 in Figure 1) to be between 100kΩ and 250kΩ. The equations for the two upper divider-resistors as a function of each (falling) threshold are then:

$$R5 = R3 \times \frac{V_{LBFALL}}{1.125} \times \left(1 - \frac{1.25}{V_{DBFALL}} \right)$$

$$R4 = R3 \times \left(\frac{1.25 \times V_{LBFALL}}{1.125 \times V_{DBFALL}} - 1 \right)$$

where V_{DBFALL} and V_{LBFALL} are the desired falling thresholds to trigger the \overline{DBO} and \overline{LBO} outputs, respectively. Once those thresholds are selected, the rising DBI and LBI thresholds are then:

$$V_{DBRISE} = 1.375 \times \frac{R3 + R4 + R5}{R4 + R3}$$

$$V_{LBRISE} = 1.25 \times \frac{R3 + R4 + R5}{R3}$$

Component Suppliers

SUPPLIER	COMPONENT	PHONE	WEBSITE
International Rectifier	Diode	800-341-0392	www.irf.com
Murata	Inductors	814-237-1431	www.murata.com
TDK	Capacitors	888-835-6646	www.component.tdk.com
Vishay	Resistors	402-563-6866	www.vishay.com

Note: Indicate that you are using the MAX8594 EV kit when contacting these component suppliers.

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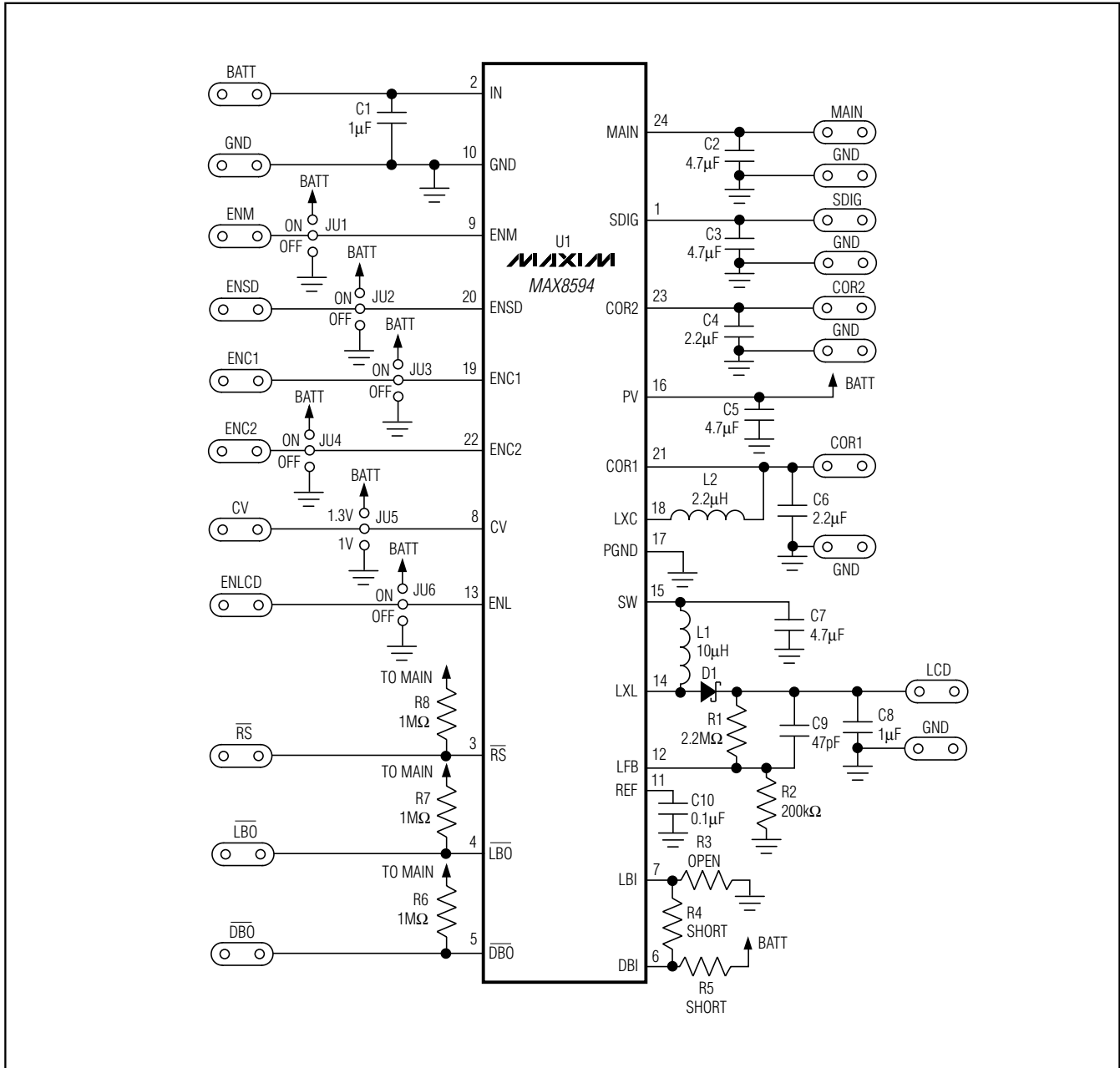


Figure 1. MAX8594 EV Kit Schematic

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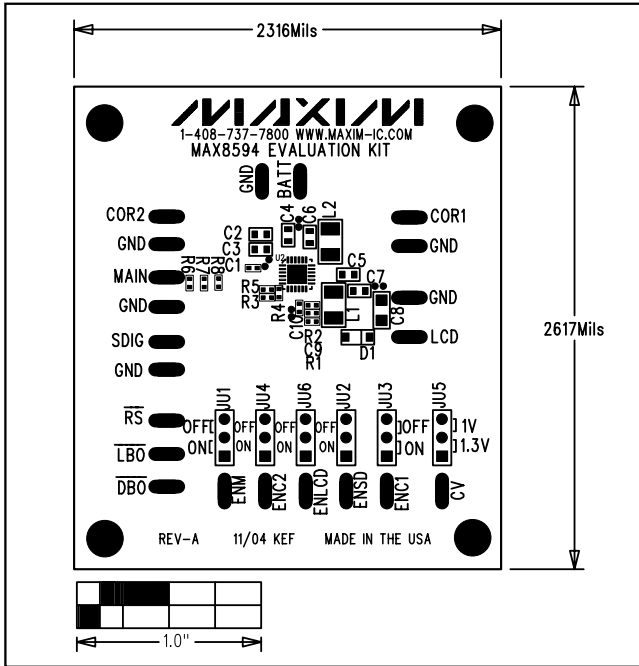


Figure 2. MAX8594 EV Kit Component Placement Guide—Component Side

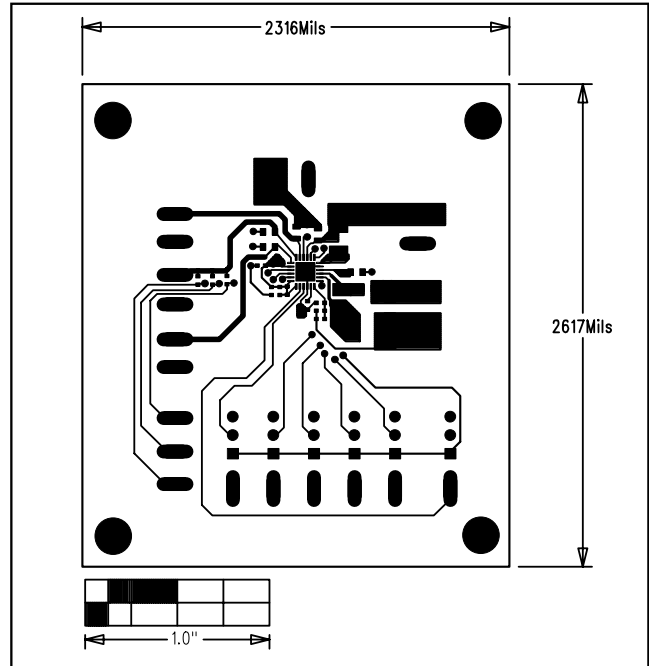


Figure 3. MAX8594 EV Kit PC Board Layout—Component Side

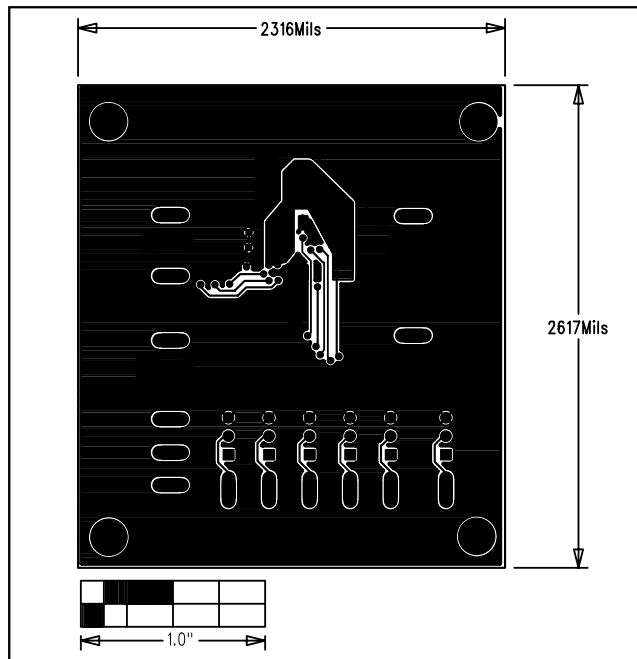


Figure 4. MAX8594 EV Kit PC Board Layout—Solder Side

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