19-5773; Rev 0; 3/11

MAX16946 Evaluation Kit

Evaluates: MAX16946

General Description

The MAX16946 evaluation kit (EV kit) is an assembled and tested PCB used to evaluate the MAX16946 high-voltage, high-side, current-sense LDO/switch. The EV kit demonstrates the device's open-drain fault signals ($\overline{OL}$, $\overline{SC}$), open-load and current-limiting threshold-setting inputs (OLT, LIM), LDO/switch operation and shutdown function ($\overline{SHDN}$), as well as the analog voltage output (AOUT).

The EV kit comes with a MAX16946GTE/V+ installed, which is the 16-pin TQFN package with an exposed pad.

Features

- **4.5V to 18V Input Range**
- **Tolerates Inputs Up to 45V**
- **Resistor-Adjustable Open-Load and Current-Limit Threshold**
- **Open-Drain, Open-Load Indicator Output ($\overline{OL}$)**
- **Open-Drain, Short-Circuit Indicator Output ($\overline{SC}$)**
- **Analog Current-Measurement Output**
- **Proven PCB Layout**
- **Fully Assembled and Tested**

Ordering Information

PART	TYPE
MAX16946EVKIT#	EV Kit

#Denotes RoHS compliant.

Component List

DESIGNATION	QTY	DESCRIPTION
C1	1	22µF ±50V aluminum electrolytic capacitor (8mm x 6.2mm) Panasonic EEETG1H220P
C2, C3, C5, C13, C14	5	0.1µF ±10%, 50V X7R ceramic capacitors (0603) TDK C1608X7R1H104K
C4	1	1µF ±10%, 25V X7R ceramic capacitor (0805) Murata GRM21BR71E105K
C6, C8	2	2.2µF ±10%, 25V X7R ceramic capacitors (1206) TDK C3216X7R1E225K
C7	1	15000pF ±10%, 16V X7R ceramic capacitor (0402) Murata GRM155R71C153K
C9	1	4700pF ±10%, 50V X7R ceramic capacitor (0603) Murata GRM188R71H472K
C10	1	33pF ±5%, 50V C0G ceramic capacitor (0603) Murata GRM1885C1H330J
C11	0	Not installed, ceramic capacitor (1206)
C12	1	1µF ±10%, 50V X7R ceramic capacitor (0805) Murata GRM21BR71H105K

DESIGNATION	QTY	DESCRIPTION
D1	1	50V, 1A Schottky diode (SMA) Diodes Inc. B150-13-F
D2	1	Red LED (0805)
D3	1	Yellow LED (0805)
D4	1	30V, 1A Schottky diode (SOD123) ON Semi MBR130T1G
IN, LIM, OLT, OUT, REF, SENS	6	Test points, red
JU1	1	5-pin header
JU2	1	4-pin header
JU3, JU4, JU5, JU6	4	2-pin headers
JU7	1	3-pin header
L1	1	1mH, 480mA inductor (10.5mm x 10.3mm) Sumida CDRH105RNP-102NC
L2, L3	0	Not installed, inductors (1206)
P1	1	50Ω BNC
P2	0	Not installed, BNC
Q1	1	npn prebiased transistor (3 SOT23) Diodes Inc. DDTC144ECA-7-F
R1	1	0.5Ω ±1% resistor (1206)
R2	1	10Ω ±5% resistor (0603)

Component List (continued)

DESIGNATION	QTY	DESCRIPTION
R3	1	33kΩ ±1% resistor (0603)
R4	1	86.6kΩ ±1% resistor (0603)
R5	1	30.1kΩ ±1% resistor (0603)
R6	1	18.7kΩ ±1% resistor (0603)
R7, R9	2	4.7kΩ ±1% resistors (0603)
R8	1	33.2kΩ ±1% resistor (0603)
R10	1	2.2kΩ ±5% resistor (0603)
R11	1	4.7kΩ ±5% resistor (0603)
R12	1	10kΩ ±5% resistor (0603)
R13, R14, R15	3	100kΩ ±5% resistors (0603)
R16	1	62kΩ ±5% resistor (0603)

DESIGNATION	QTY	DESCRIPTION
SW1	1	Pushbutton switch
U1	1	Current-sense LDO (16 TQFN-EP) Maxim MAX16946GTE/V+
U2	1	General-purpose timer (8 SO) Maxim ICM7555ESA+
U3	1	5V LDO (8 SO-EP) Maxim MAX15006BASA+
—	7	Shunts
—	1	PCB: MAX16946 EVALUATION KIT

Component Suppliers

SUPPLIER	PHONE	WEBSITE
Diodes Incorporated	805-446-4800	www.diodes.com
Murata Electronics North America, Inc.	770-436-1300	www.murata-northamerica.com
ON Semiconductor	602-244-6600	www.onsemi.com
Panasonic Corp.	800-344-2112	www.panasonic.com
Sumida Corp.	847-545-6700	www.sumida.com
TDK Corp.	847-803-6100	www.component.tdk.com

Note: *Indicate that you are using the MAX16946 when contacting these component suppliers.*

Quick Start

Required Equipment

- MAX16946 EV kit
- 18V, 200mA DC power supply
- Load
- Two voltmeters

Procedure

The EV kit is fully assembled and tested. Follow the steps below to verify board operation. **Caution: Do not turn on power supply until all connections are completed.**

1) Verify that all jumpers are in their default position, as shown in Table 1.
2) Adjust the power supply to 10V.
3) Adjust the load to 30mA.
4) Connect the power supply between the VIN and GND PCB pads on the EV kit.
5) Connect the load between the REG_OUT and GND PCB pads on the EV kit.
6) Connect the first voltmeter between the REG_OUT and GND PCB pads on the EV kit.
7) Connect the second voltmeter between the AOUT and GND PCB pads on the EV kit.
8) Enable the power supply and the load.
9) Verify that the first voltmeter displays 5V.
10) Verify that the second voltmeter displays 790mV.

Table 1. Jumper Descriptions (JU1–JU7)

JUMPER	SHUNT POSITION	DESCRIPTION
JU1	1-2*	Connects the FB pin of the device to the resistor-divider of R6 and R7, which sets the output voltage to 5V. JU3 must be installed for proper output.
	1-3	Connects the FB pin of the device to the resistor-divider of R8 and R9, which sets the output voltage to 8V. JU4 must be installed for proper output.
	1-4	Connects the FB pin of the device to GND, which configures the device as a switch.
	1-5	Connects the FB pin of the device to the REG pin of the device, which sets the output voltage to 8.5V.
JU2	1-2	Connects the $\overline{SHDN}$ pin of the device to the input voltage of the device for normal operation.
	1-3*	Connects the on-board pulse generator to the $\overline{SHDN}$ pin of the device, which allows the $\overline{OL}$ output to be cleared.
	1-4	Connects the $\overline{SHDN}$ pin of the device to ground for shutdown mode.
JU3	1-2*	Sets the output voltage to 5V. JU1 must be installed in the 1-2 position for proper output.
	Open	Disconnects the resistor-divider of R6 and R7 when JU1 is not in the 1-2 position.
JU4	1-2	Sets the output voltage to 8V. JU1 must be installed in the 1-3 position for proper output.
	Open*	Disconnects the resistor-divider of R8 and R9 when JU1 is not in the 1-3 position.
JU5	1-2*	Powers U3 by connecting the voltage supply that was applied at the VIN PCB pad on the EV kit.
	Open	User can apply an external supply to the pin of JU5 that is connected to U3.
JU6	1-2*	Connects 5V pullup voltage for $\overline{OL}$ and $\overline{SC}$ (LEDs D2 and D3).
	Open	LEDs D2 and D3 not used. The $\overline{SC}$ and $\overline{OL}$ PCB pads of the EV kit are used to monitor fault signals.
JU7	1-2	Connects the output pulse of U2 to pin JU2-3. JU2 must be in the 1-3 position for proper operation.
	2-3*	Connects the output pulse of Q1 to pin JU2-3. JU2 must be in the 1-3 position for proper operation.

**Default position.*

_Detailed Description of Hardware

The MAX16946 EV kit is an assembled and tested PCB used to evaluate the MAX16946 high-voltage, high-side, current-sense LDO/switch. The EV kit operates from a 4.5V to 18V DC supply voltage. The EV kit demonstrates the device's open-drain fault signals ($\overline{OL}$, $\overline{SC}$), open-load and current-limiting threshold-setting inputs (OLT, LIM), LDO/switch operation and shutdown function ($\overline{SHDN}$), as well as the analog voltage output (AOUT).

The EV kit provides LEDs D2 and D3 to facilitate the monitoring of the short-circuit, open-drain and open-load fault signals, respectively. The open-load threshold-setting input is set to approximately 16mA and the current-limiting threshold is set to approximately 150mA. The short-circuit detection threshold is set by 0.5Ω (R1) to 100mA. An on-board LDO (U3) is provided to support single-supply evaluation. The LDO is powered by the input voltage (VIN) and provides a 5V output used to power the fault indicator and pulse generator (U2).

Open-Drain Fault Signals ($\overline{OL}$, $\overline{SC}$)

The EV kit includes LED D2 to monitor the short-circuit fault signal and D3 to monitor the open-load fault signal. Both LED networks are driven by the on-board 5V LDO (U3). To monitor the indicator outputs by external means, remove the shunt from JU6 and connect the monitor system to the $\overline{OL}$ and $\overline{SC}$ PCB pads on the EV kit. Ensure that the monitoring system provides pullup resistors on the $\overline{OL}$ and $\overline{SC}$ open-drain indicator output signals.

Open-Load Threshold

The open-load threshold setting is configured by the resistor-divider between the device's REF and OLT pins and is set to 16mA by default.

LDO

When the shunt of JU1 is in the 1-2 position, the shunt of JU3 is installed, and the shunt of JU4 is not installed, the device is set as a 5V LDO through the resistor-divider of R6 and R7. When the shunt of JU1 is in the 1-3 position, the shunt of JU3 is not installed, and the shunt of JU4 is installed, the device is set as an 8V LDO through the resistor-divider of R8 and R9. To set the output to 8.5V, the shunt of JU1 must be in the 1-5 position, which connects the FB pin to REG.

Switch

The device is a switch when the shunt of JU1 is in the 1-4 position, which connects the FB pin to ground. The voltage applied at the input is approximately the voltage at the output.

Shutdown ($\overline{SHDN}$)

When the $\overline{SHDN}$ pin is pulled high, the EV kit is in normal operation. The EV kit can enter shutdown by placing the shunt of JU2 in the 1-4 position.

Pulse Generator

Once the open load is detected, the $\overline{OL}$ output latches low and the output voltage stays on. To unlatch the open-load indicator ($\overline{OL}$ back to high), place the shunt of JU2 in the 1-3 position and press the SW1 switch to apply a pulse less than 150µs at the $\overline{SHDN}$ pin of the device.

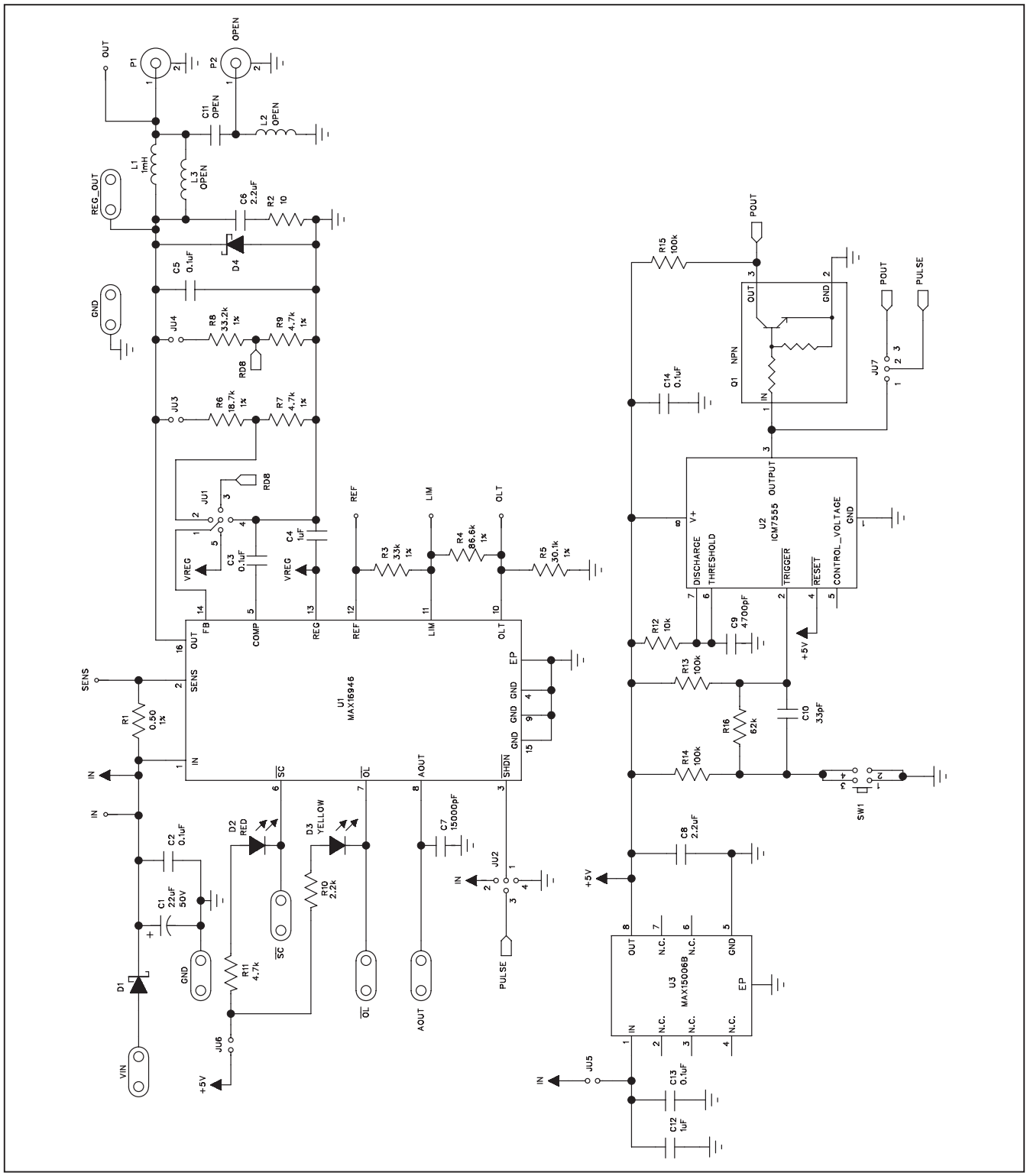

Figure 1. MAX16946 EV Kit Schematic

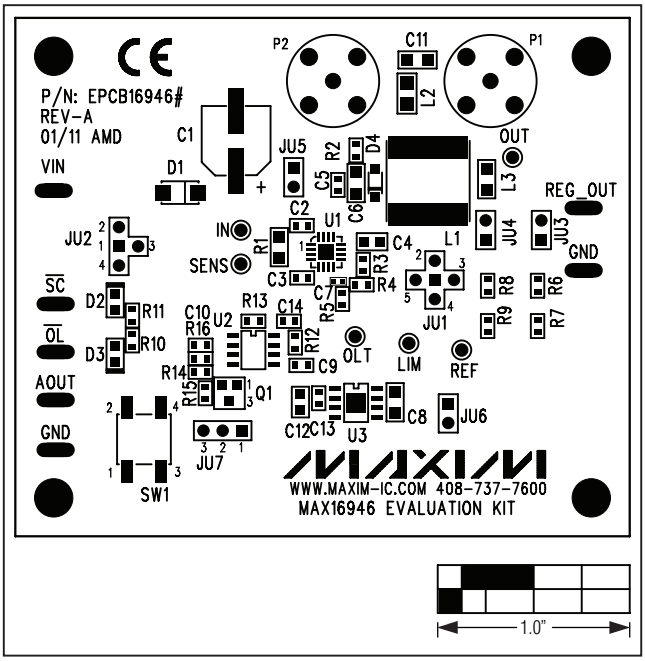

Figure 2. MAX16946 EV Kit Component Placement Guide—Component Side

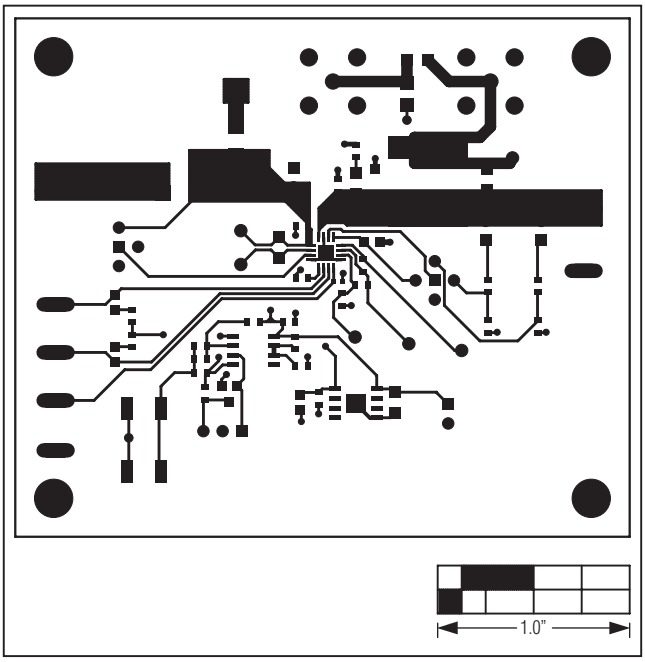

Figure 3. MAX16946 EV Kit PCB Layout—Component Side

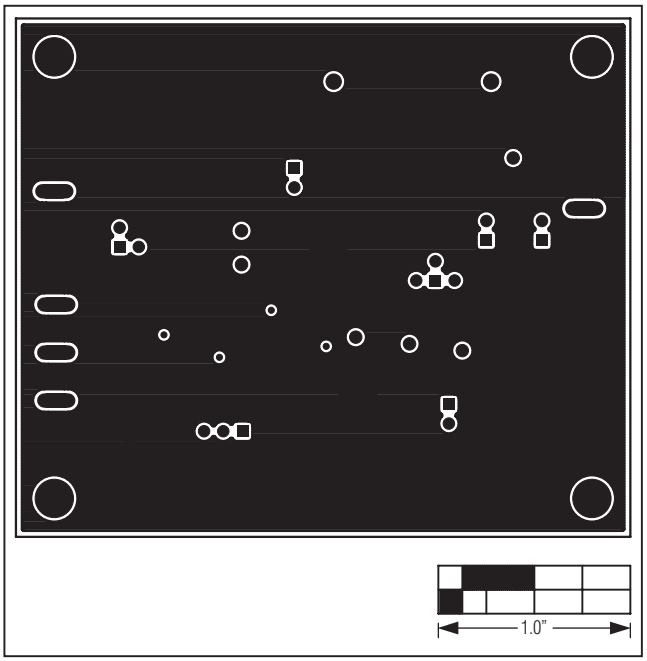

Figure 4. MAX16946 EV Kit PCB Layout—Inner Layer 2

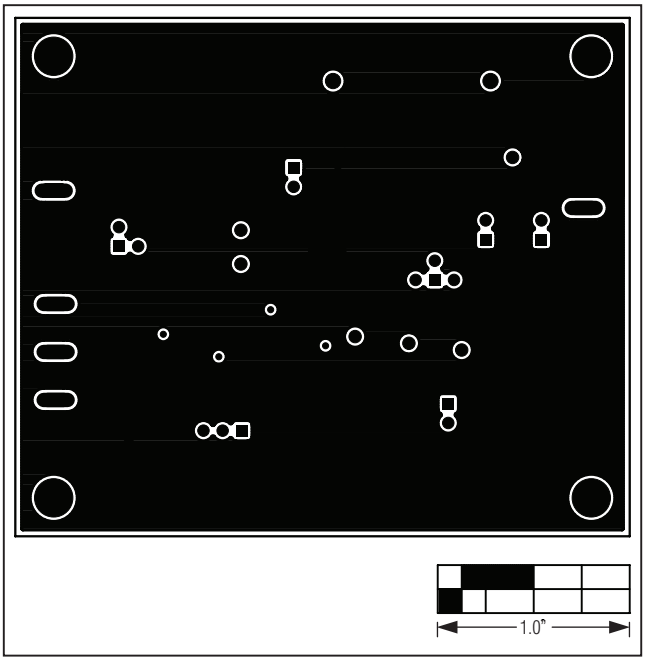

Figure 5. MAX16946 EV Kit PCB Layout—Inner Layer 3

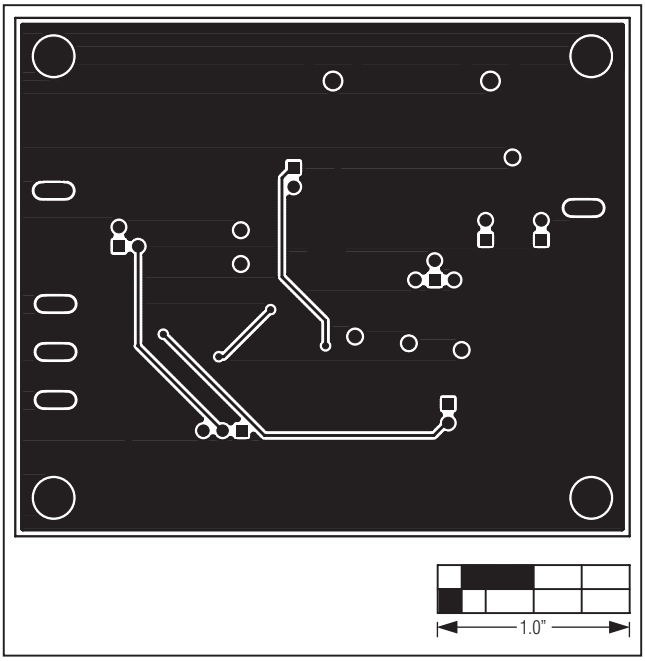

Figure 6. MAX16946 EV Kit PCB Layout—Solder Side

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	3/11	Initial release	—