19-6349; Rev 0; 5/12

MAX5986A Evaluation Kit
Evaluates: MAX5986A

General Description

The MAX5986A evaluation kit (EV kit) is a fully assembled and tested surface-mount circuit board featuring an Ethernet port, network powered-device (PD) interface controller circuit for -57V supply rail systems. The EV kit uses the MAX5986A IEEE® 802.3af/at-compliant network PD interface controller in a 16-pin TQFN package with an exposed pad. The IC is used in Power-over-LAN (PoL) applications requiring DC power from an Ethernet network port for PDs such as IP phones, wireless access nodes, and security cameras.

The EV kit receives power from IEEE 802.3af/at-compliant power-sourcing equipment (PSE). Refer to the MAX5952, MAX5965A/MAX5965B, and MAX5980 IC data sheets for PSE controllers. The PSE provides the required -36V to -57V DC power over an unshielded twisted-pair Ethernet network cable to the EV kit's RJ45 magnetic jack. The EV kit features a 1 x 1 Gigabit RJ45 magnetic jack and two active full-wave rectifiers (N101 and N102) for separating the DC power provided by an endspan or midspan Ethernet system.

The EV kit can also be powered by a wall adapter power source. The EV kit provides PCB pads to accept the output of a wall adapter power source. When a wall adapter power source is detected, it always takes precedence over the PSE source and allows the wall adapter to power the EV kit.

The EV kit demonstrates the full functionality of the IC, such as PD detection signature, PD classification signature, inrush current control, input undervoltage lockout (UVLO), and an integrated DC-DC step-down converter. The integrated step-down converter operates at a fixed 275kHz switching frequency, and is configured for a non-isolated +5V DC output that can deliver 768mA of current.

Warning: The EV kit is designed to operate with high voltages. Dangerous voltages are present on this EV kit and on equipment connected to it. Users who power up this EV kit or power the sources connected to it must be careful to follow safety procedures appropriately to work with high-voltage electrical equipment.

Under severe fault or failure conditions, this EV kit may dissipate large amounts of power, which could result in the mechanical ejection of a component or of component debris at high velocity. Operate this kit with care to avoid possible personal injury.

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Features

- **IEEE 802.3af/at-Compliant PD Interface Circuit**
- **PoE Classification 1**
- **-36V to -57V Input Range**
- **Demonstrates an Integrated 3.84W Step-Down DC-DC Converter**
- **+5V Output at 768mA**
- **Inrush Current Limit of 49mA (typ)**
- **Evaluates Endspan and Midspan Ethernet Systems**
- **Simplified Wall Adapter Interface**
- **Proven PCB Layout**
- **Fully Assembled and Tested**

***Ordering Information** appears at end of data sheet.*

Component List

DESIGNATION	QTY	DESCRIPTION
AUX, GND, LX, VCC, VDRV	5	Miniature white test points
C1, C3	2	0.1µF ±10%, 100V X7R ceramic capacitors (0603) Murata GRM188R72A104K
C2, C14	2	1µF ±10%, 100V X7R ceramic capacitors (1206) Murata GRM31CR72A105K
C4, C6	2	0.1µF ±10%, 50V X7R ceramic capacitors (0603) Murata GRM188R71H104K
C5	1	1µF ±10%, 25V X7R ceramic capacitor (0603) Murata GRM188R71E105K
C7, C10, C15	3	22µF ±10%, 10V X7R ceramic capacitors (1206) Murata GRM31CR71A226K
C8	1	10µF ±20%, 80V aluminum electrolytic capacitor (6.3mm x 7.7mm) Panasonic EEE-FK1K100XP
C9	0	Not installed, ceramic capacitor (0402)

For pricing, delivery, and ordering information, please contact Maxim Direct at 1-888-629-4642, or visit Maxim's website at www.maxim-ic.com.

Component List (continued)

DESIGNATION	QTY	DESCRIPTION
C11	0	Not installed, ceramic capacitor (0805)
C12, C13	0	Not installed, ceramic capacitors (0603)
D1	0	Not installed, Schottky diode (SMB)
D2, D101–D104	5	100V, 2A Schottky diodes (SMB) Diodes Inc. B2100
D5	0	Not installed, zener diode (SOD323)
D6	0	Not installed, transient voltage suppressor (SMB)
D105–D108	4	8.2V ±5%, 200mW zener diodes (SOD323) Fairchild MM3Z8V2C
L1	1	47µH, 1.15A inductor (8.3mm x 8.3mm) Sumida CDRH8D28NP-470NC
L2, L3	0	Not installed, common-mode chokes (9.5mm x 6mm)
N101, N102	2	100V, 3.5A dual n-channel MOSFETs (8 SO) Fairchild FDS89141
R1	1	0Ω ±5% resistor (0402)
R2	1	100kΩ ±1% resistor (0402)
R3	1	1kΩ ±1% resistor (0603)
R4	1	2.49kΩ ±1% resistor (0402)
R5	1	24.9kΩ ±1% resistor (0402)
R12	1	10Ω ±1% resistor (0603)
R13	1	10Ω ±1% resistor (0402)
R14	1	7.5kΩ ±1% resistor (0402)
R19	0	Not installed, resistor (0402)
R20–R23	4	0Ω ±5% resistors (0603)
R101–R104	4	499kΩ ±1% resistors (0402)
R105–R108	4	49.9kΩ ±1% resistors (0402)
RJ45	1	RJ45 MagJack 1G-Ethernet, 802.3af/at standard Bel Fuse Inc. 0826-1X1T-M1-F
U1	1	PD with integrated DC-DC converter (16 TQFN-EP*) Maxim MAX5986AETE+
—	1	PCB: MAX5986A EVALUATION KIT

**EP = Exposed pad.*

Component Suppliers

SUPPLIER	PHONE	WEBSITE
Bel Fuse Inc.	201-432-0463	www.belfuse.com
Diodes Incorporated	805-446-4800	www.diodes.com
Fairchild Semiconductor	888-522-5372	www.fairchildsemi.com
Murata Electronics North America, Inc.	770-436-1300	www.murata-northamerica.com
Panasonic Corp.	800-344-2112	www.panasonic.com
Sumida Corp.	847-545-6700	www.sumida.com

Note: *Indicate that you are using the MAX5986A when contacting these component suppliers.*

Quick Start

Required Equipment

- MAX5986A EV kit
- An IEEE 802.3af/at-compliant PSE and a Category 5e Ethernet network cable
- -48V, 1A capable DC power supply
- Voltmeter

Hardware Connections

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

1) Use one of the following methods to power the EV kit:
   a. **If network connectivity is required:** Connect a Category 5e Ethernet network cable from the EV kit input port RJ45 connector to the corresponding PSE Ethernet LAN connection that provides power to the EV kit.
   b. **If network connectivity is not required:** Connect a -48V DC power supply between the V- and V+ PCB pads on the EV kit. Connect the power-supply positive terminal to the V+ PCB pad and the negative terminal to the V- PCB pad.
2) Activate the PSE power supply or turn on the external DC power supply.
3) Using a voltmeter, verify that the EV kit provides +5V across the OUT and VSS PCB pads.

Detailed Description of Hardware

The MAX5986A EV kit features an Ethernet port and network PD interface controller circuit for -57V supply rail systems. The EV kit contains a MAX5986A IEEE 802.3af/at-compliant network PD interface controller in a 16-pin TQFN-EP package. The IC is used in PoL applications for powering PDs from an unshielded twisted-pair (UTP) Ethernet Category 5e network cable and PSE port using endspan or midspan Ethernet systems.

The EV kit receives power from an IEEE 802.3af/at-compliant PSE and a UTP cable connected to the EV kit's RJ45 magnetic jack. The EV kit uses a 1 x 1 gigabit RJ45 magnetic jack and two active full-wave bridge power rectifiers to separate the -57V DC power sent by the PSE. The EV kit can accept power from an endspan or midspan PSE network configuration.

The EV kit can also accept power from a wall adapter power source. When a wall adapter power source is detected between the WAD_IN and WAD_GND PCB pads, the IC's internal isolation switch disconnects VCC from VDD, which allows the wall adapter to supply power to the EV kit.

The EV kit demonstrates the full functionality of the IC such as PD detection signature, PD classification signature, inrush current control, and UVLO. Resistor R5 sets the PD detection and classification signatures. The EV kit is set to a Class 1 PD by resistor R5.

The EV kit's integrated DC-DC step-down converter is configured for a nonisolated output voltage of +5V and provides up to 768mA at the output while achieving up to 86.68% and 90.22% efficiencies at +36V and +12V input, respectively. The integrated step-down converter operates at a fixed 275kHz switching frequency.

Wall Adapter Power Source (WAD_IN, WAD_GND)

The EV kit can also accept power from a wall adapter power source. Use the WAD_IN (0V) and WAD_GND (-10V to -57V) PCB pads to connect the wall adapter power source. The wall adapter power source operating-voltage range must be within +10V to +57V for the EV kit.

When the wall adapter power source is above +10V it always takes precedence over the PSE source. Once the wall adapter power source is detected, the IC's internal isolation switch disconnects VCC from VDD. The wall adapter power is supplied to VCC (through diode D2) and VSS. Once it takes over, the classification process is disabled.

When the wall adapter power source is below +8.5V, the PSE provides power through the IC's VSS. Diode D2 prevents the PSE from back-driving the wall adapter power source when it is below +8.5V.

Undervoltage Lockout (UVLO)

The EV kit operates up to a -57V supply with a turn-on UVLO threshold (V_{ON}) at -37.6V and a turn-off UVLO threshold (V_{OFF}) at -30.0V. When the input voltage is above V_{ON}, the EV kit is enabled. When the input voltage goes below V_{OFF}, the EV kit is disabled.

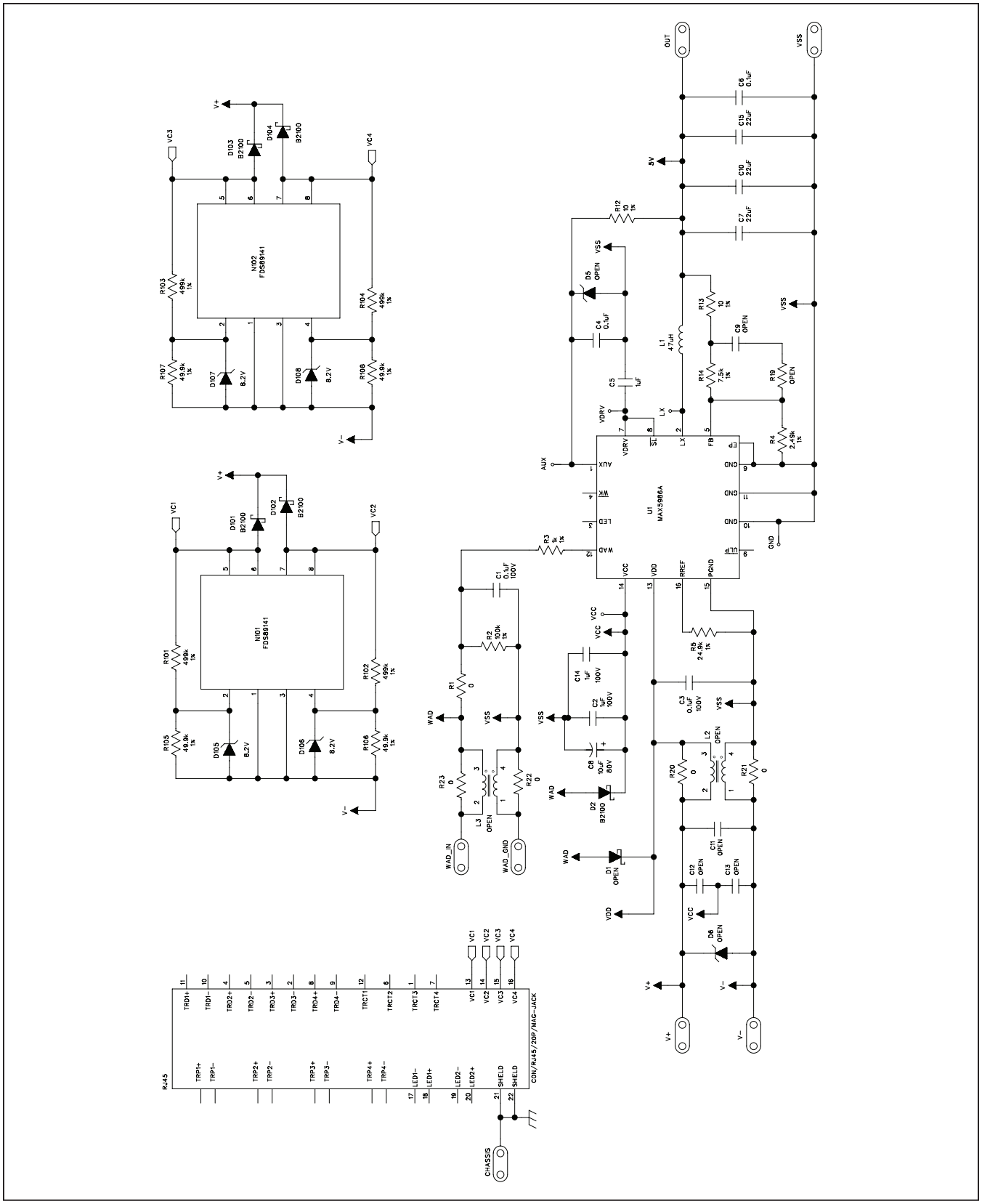


Figure 1. MAX5986A EV Kit Schematic

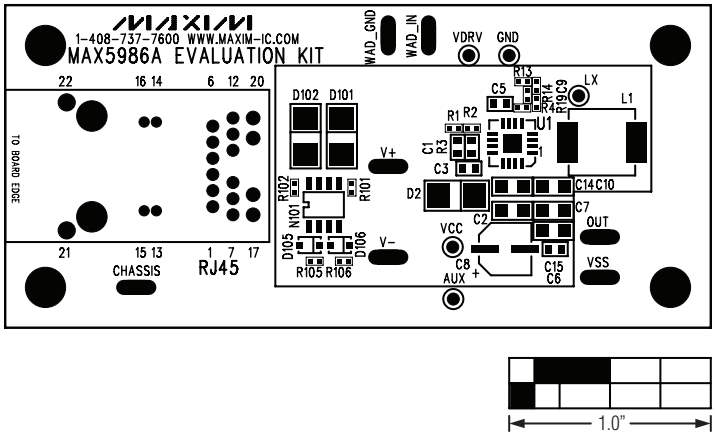


Figure 2. MAX5986A EV Kit Component Placement Guide—Component Side

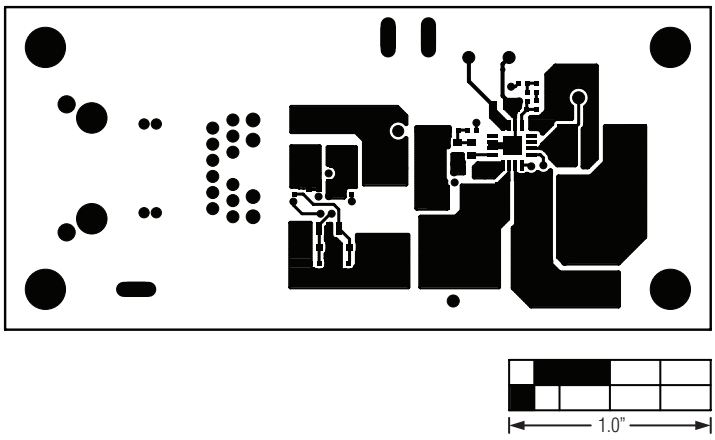


Figure 3. MAX5986A EV Kit PCB Layout—Component Side

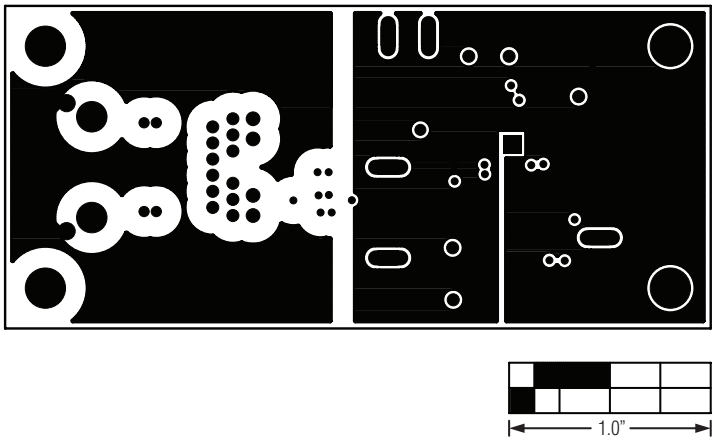


Figure 4. MAX5986A EV Kit PCB Layout—PGND Layer 2

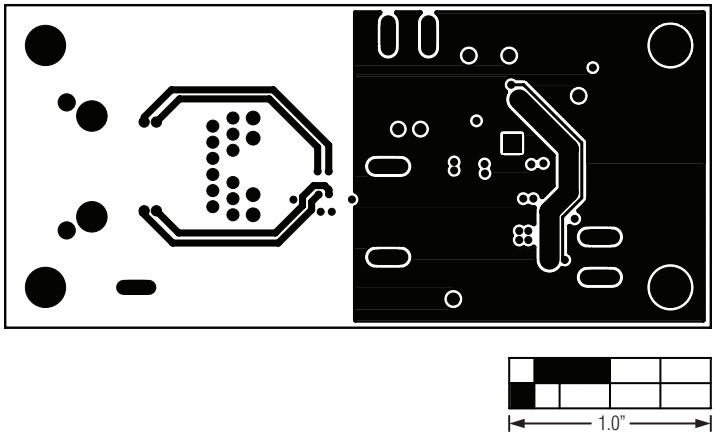


Figure 5. MAX5986A EV Kit PCB Layout—VCC Layer 3

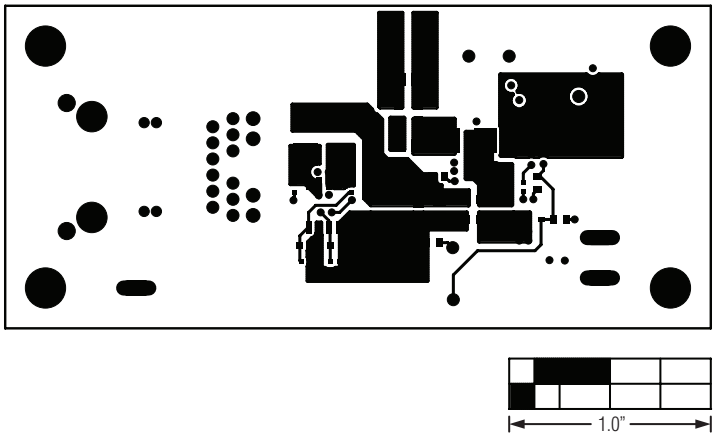


Figure 6. MAX5986A EV Kit PCB Layout—Solder Side

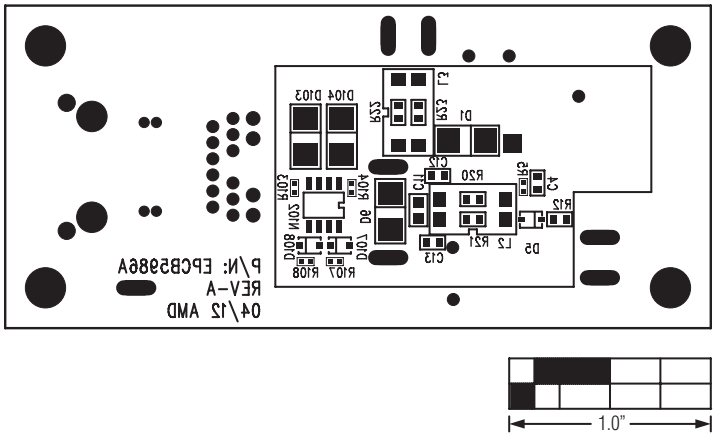


Figure 7. MAX5986A EV Kit Component Placement Guide—Solder Side

Ordering Information

PART	TYPE
MAX5986AEVKIT#	EV Kit

#Denotes RoHS compliant.

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	5/12	Initial release	—

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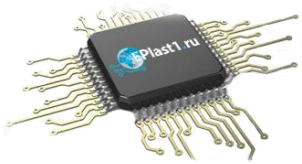
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