19-0842; Rev 0; 6/07

MAX16818 Evaluation Kit

Evaluates: MAX16818

General Description

The MAX16818 evaluation kit (EV kit) is a fully assembled and tested surface-mount printed-circuit board (PCB) designed to evaluate the MAX16818 pulse-width modulation (PWM) LED driver controller in a buck-boost configuration.

The MAX16818 EV kit operates from a DC supply voltage of 6V to 28V. The EV kit's output is configured to deliver at least 1A of current into an 18V series LED string. The LED brightness can be dimmed using a digital PWM signal.

The EV kit provides an option to configure the MAX16818 IC's overvoltage protection, switching frequency, and frequency compensation. The MAX16818 EV kit also features a 180° out-of-phase clock output PCB pad.

Features

- **6V to 28V Input-Voltage Range**
- **1A Output Current into an 18V LED String**
- **Pulse-Width Modulated LED Current Dimming**
- **Resistor-Adjustable Overvoltage Protection and Switching Frequency**
- **180° Out-of-Phase Clock Output**
- **Fully Assembled and Tested**

Ordering Information

PART	TEMP RANGE	IC PACKAGE
MAX16818EVKIT+	0°C to +70°C*	28 TQFN-EP**

+Denotes a lead-free and RoHS-compliant EV kit.

**This limited temperature range applies to the EV kit PCB only. The MAX16818 IC temperature range is -40°C to +125°C.*

***EP = Exposed paddle.*

Component List

DESIGNATION	QTY	DESCRIPTION
C1	1	2.2µF ±10%, 50V X7R ceramic capacitor (1206) Murata GRM31CR71H225K
C2	1	1µF ±20%, 50V X7R ceramic capacitor (0805) Murata GRM21BR71H105M
C3	1	4.7µF ±10%, 6.3V X7R ceramic capacitor (0603) Murata GRM188R70J475K
C4	1	0.47µF ±10%, 6.3V X7R ceramic capacitor (0603) Murata GRM188R70J474K
C5	1	1000pF ±10%, 50V X7R ceramic capacitor (0603) Murata GRM188R71H102K
C6, C7	2	10µF ±10%, 50V X7R ceramic capacitors (2220) Murata GRM55DR71H106K
C8, C10	0	Not installed, capacitors (0603)
C9	1	0.22µF ±10%, 16V X7R ceramic capacitor (0603) Murata GRM188R71C224K
C11	1	2200pF ±10%, 50V X7R ceramic capacitor (0603) Murata GRM188R71H222K

DESIGNATION	QTY	DESCRIPTION
C12	1	0.1µF ±10%, 16V X7R ceramic capacitor (0603) Murata GRM188R71C104K
C13	1	100pF ±5%, 50V C0G ceramic capacitor (0603) Murata GRM1885C1H101J
C14	1	100µF, 50V electrolytic capacitor (8mm x 10.2mm) Panasonic EEEFK1H101P
D1	1	60V, 2A Schottky diode (SMB) Diodes Inc. B260-13-F
JU1	1	3-pin header
JU2	1	2-pin header
L1	1	8.8µH, 4A$_{DC}$ inductor Sumida CDEP105-8R8
N1	1	40V, 4.9A n-channel MOSFET (SO8) Vishay Si4446DY
N2–N5	4	60V, 115mA n-channel MOSFETs (SOT23) Central Semiconductor 2N7002 LEAD-FREE
P1	1	-20V, -3.8A p-channel MOSFET (TSOP-6) Vishay Si3467DV-T1-E3

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
Q1	1	NPN bipolar transistor (SOT223) Fairchild Semiconductor PZT3904
Q2	1	PNP bipolar transistor (SOT23) Fairchild Semiconductor MMBT3906
R1	1	1kΩ ±1% resistor (1206)
R2	1	12.1kΩ ±1% resistor (0603)
R3, R7, R15, R16	4	10kΩ ±1% resistors (0603)
R4, R5	2	1Ω ±1% resistors (0603)
R6	1	4.99kΩ ±1% resistor (0402)
R8	1	221kΩ ±1% resistor (0402)
R9	1	100kΩ ±1% resistor (0402)
R10	1	12.4kΩ ±1% resistor (0402)
R11	1	105kΩ ±1% resistor (0603)
R12, R13	2	1kΩ ±5% resistors (0805)
R14	1	0.007Ω ±2%, 0.5W sense resistor (2010) IRC LRC-LRF2010LF-01-R007-G
R17	1	1kΩ ±1% resistor (0603)
R18	1	2kΩ ±1% resistor (0603)
R19	1	499Ω ±1% resistor (0603)
R20	1	0.11Ω ±1%, 0.5W sense resistor (1206) IRC LRC-LRC1206LF-01-R11-F
R21	1	30.1kΩ ±1% resistor (0603)
R22	1	40.2kΩ ±1% resistor (0603)
R23	1	100kΩ SMT cermet trimmer, 11 turns
U1	**1**	**MAX16818ATI+ (28-pin TQFN-EP, 5mm x 5mm)**
U2	1	Voltage-output, high-side current-sense amplifier MAX4073TAXK+ (5-pin SC70-5)
U3, U4	2	Low-voltage, adjustable precision shunt regulators (SOT23) Texas Instruments TL431AQDBZRQ1
—	2	Shunts
—	1	PCB: MAX16818 Evaluation Kit+

Component Suppliers

SUPPLIER	PHONE	WEBSITE
Central Semiconductor	631-435-1110	www.centralsemi.com
Diodes Inc.	805-446-4800	www.diodes.com
Fairchild Semiconductor	888-522-5372	www.fairchildsemi.com
IRC, Inc.	361-992-7900	www.irctt.com
Murata Mfg. Co., Ltd.	770-436-1300	www.murata.com
Panasonic Corp.	800-344-2112	www.panasonic.com
Sumida Corp.	847-545-6700	www.sumida.com
Vishay/Vitramon	203-268-6261	www.vishay.com

Note: *Indicate that you are using the MAX16818 when contacting these component suppliers.*

Quick Start

Recommended Equipment

Before beginning, the following equipment is needed:

- 6V to 28V, 5A DC power supply
- A series-connected LED string rated at 1A (maximum voltage on the string should not exceed 18V)
- A current probe to measure LED current
- One voltmeter

Procedure

The MAX16818 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) Verify that a shunt is installed across pins 2-3 of jumper JU1.
2) Verify that no shunt is installed across jumper JU2 (EV kit on).
3) Connect the anode end of the LED string to the LED+ pad.
4) Connect the cathode end of the LED string to the LED- pad.
5) Clip on the current probe across the string wires to measure the LED current.
6) Connect the positive terminal of the power supply to the VIN pad on the EV kit. Connect the negative terminal of the power supply to the PGND pad next to the VIN pad.
7) Turn on the power supply and increase the voltage to 6V or above.
8) Verify that the LED string current is approximately 1A. Adjust potentiometer R23 to obtain 1A.
9) Measure the voltage between the LED+ to LED- PCB pads.

Detailed Description

The MAX16818 EV kit is designed to evaluate the MAX16818 PWM LED driver controller in a buck-boost configuration. The EV kit PCB is designed with two layers and has 1oz copper traces. All components on the EV kit are installed on the top layer. The EV kit includes an on-board VCC regulating circuit for operation with input voltage between 6V to 8V. The EV kit also includes on-board output overvoltage protection circuitry to limit the output voltage.

Input-Voltage Range

The MAX16818 EV kit can operate from a DC supply voltage of 6V to 28V and requires at least 5A. The input-voltage range is jumper selectable (see the *Jumper Selection* section). Transistor Q1, shunt regulator U3, and resistors R1, R2, and R3 are used to regulate VCC to 5V when the input voltage to the EV kit is between 6V to 8V. If the minimum input voltage is 8V, jumper JU1 can be replaced by a shorting wire between pins 1-2. Transistor Q1, shunt regulator U3, and resistors R1, R2, and R3 can be omitted from the EV kit, saving components and reducing the required PCB space.

Output Current Range

The MAX16818 EV kit can deliver up to 1A into an 18V series LED string. The maximum output current is configurable by sense resistor R14. The LED current can be adjusted from 400mA to 1A using potentiometer R23.

LED Brightness Dimming

The LED brightness can be dimmed using a TTL PWM signal with a frequency range of 80Hz to 5kHz. Connect the TTL dimming signal to the PWMDIM and GND pads to control the brightness of the LEDs.

Output Overvoltage Protection

The MAX16818 EV kit features overvoltage protection circuitry to limit the voltage from LED+ to GND to 46V when the LED string is opened. The overvoltage protection circuitry consists of resistors R6–R10, transistor Q2, and shunt regulator U4. The overvoltage protection circuitry is nonlatching.

Switching Frequency

The MAX16818 EV kit switching frequency (f_{SW}) is configured to 600kHz by resistor R11. To reconfigure the MAX16818 switching frequency from 125kHz to 1.5MHz, replace resistor R11 using the equation below:

For $120k\Omega \le R11 \le 500k\Omega$

$$R11 = \frac{\left(6.25 \times 10^{10}\right)}{f_{SW}}$$

For $40k\Omega \le R11 \le 120k\Omega$

$$R11 = \frac{\left(6.40 \times 10^{10}\right)}{f_{SW}}$$

where f_{SW} is the desired switching frequency in Hz.

Note: Other component values may need to be changed for proper operation. Refer to the MAX16818 IC data sheet for additional information.

Clock Output

The MAX16818 EV kit also features a digital clock output that is 180° out-of-phase with respect to the high-side driver, N1. The clock output is available at the CLKOUT PCB pad.

Jumper Selection

Input-Voltage Range (VIN)

Jumper JU1 selects the input-voltage range for the MAX16818 EV kit (see Table 1 for shunt positions).

Table 1. JU1 Jumper Selection (IN)

SHUNT POSITION	IN PIN CONNECTED TO	VIN VOLTAGE RANGE
1-2	VIN	8V to 28V*
2-3**	VCC	6V to 28V
None (Not allowed)	No connect	0V

**When operating in the 8V to 28V input-voltage range, jumper JU1 can be replaced by a shorting wire between pins 1-2.*

***Default position.*

Output Enable (EN)

Jumper JU2 controls the output enable pin on the MAX16818 IC. The MAX16818 output enable pin (EN) is also connected to the overvoltage protection circuitry on the EV kit (see Table 2 for shunt positions).

Table 2. JU2 Jumper Selection (EN)

SHUNT POSITION	EN PIN CONNECTED TO	EV KIT FUNCTION
Installed	GND	Disabled
Not installed*	Overvoltage protection circuitry (R6–R10, Q2, U4)	Enabled

**Default position.*

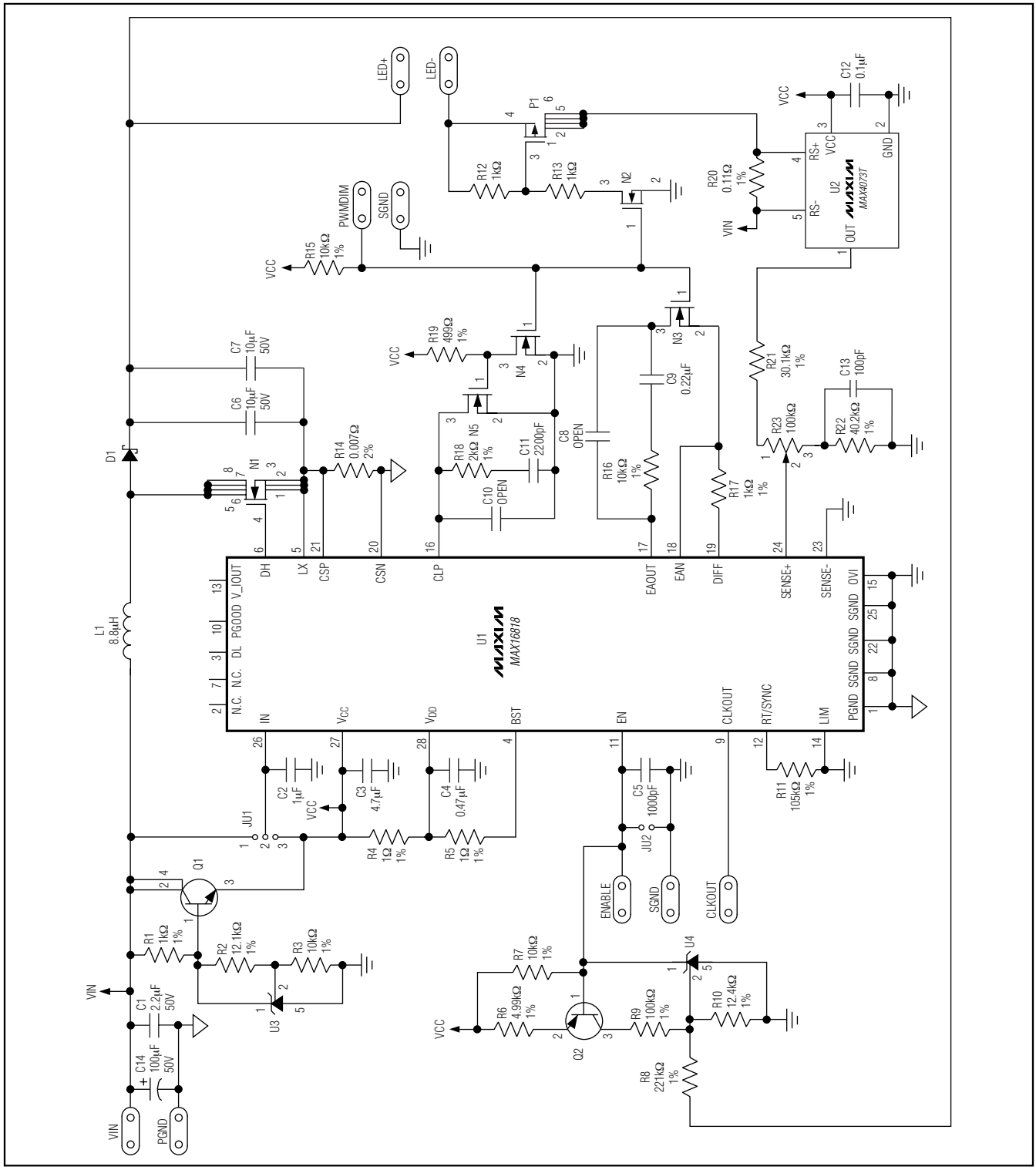


Figure 1. MAX16818 EV Kit Schematic

MAX16818 Evaluation Kit

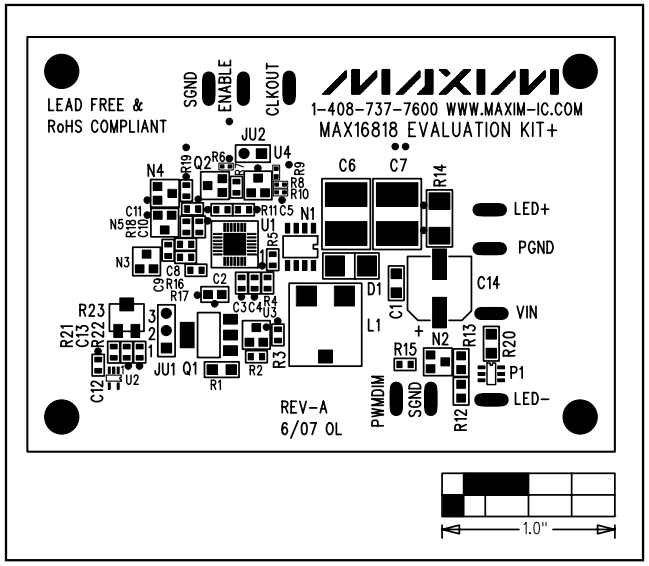


Figure 2. MAX16818 EV Kit Component Placement Guide—Component Side

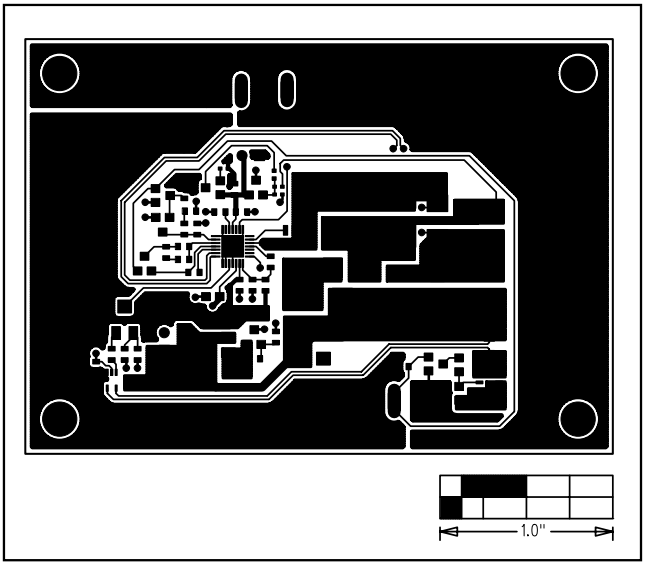


Figure 3. MAX16818 EV Kit PCB Layout—Component Side

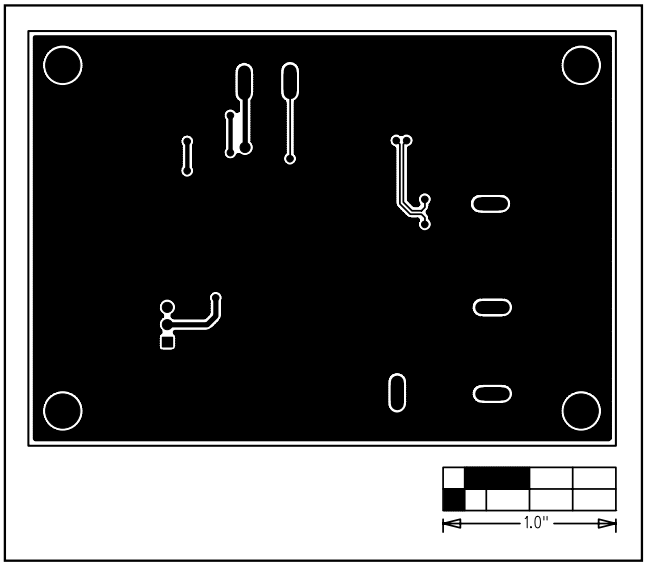


Figure 4. MAX16818 EV Kit PCB Layout—Solder Side

Maxim cannot assume responsibility for use of any circuitry other than circuitry entirely embodied in a Maxim product. No circuit patent licenses are implied. Maxim reserves the right to change the circuitry and specifications without notice at any time.

© 2007 Maxim Integrated Products MAXIM is a registered trademark of Maxim Integrated Products, Inc.