19-6273; Rev 0; 4/12

MAX17512 Evaluation Kit
Evaluates: MAX17512

General Description

The MAX17512 evaluation kit (EV kit) provides a proven design to evaluate the MAX17512 high-speed, constant on-time, valley current regulator IC. The EV kit operates from a 6.5V to 18V input voltage and can deliver output currents of up to 6A.

The IC allows implementation of high-efficiency switch-mode current sources. The IC accepts an analog voltage at the ICMD pin and regulates the valley of the output inductor current at a corresponding level. By implementing an external load current-sensing mechanism and correspondingly adjusting the current command voltage at the ICMD pin in closed-loop fashion, it is possible to implement a constant source current.

Features

- **Operates from a 6.5V to 18V Input Supply**
- **Delivers Up to 6A Output Current**
- **Enable/UVLO Input**
- **Resistor Programmable UVLO Threshold**
- **Open-Drain $\overline{FLT}$ Power-OK (POK) Output**
- **Overcurrent and Overtemperature Protection**
- **Proven PCB Layout**
- **Fully Assembled and Tested**

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

Component List

DESIGNATION	QTY	DESCRIPTION
C1	1	10μF ±10%, 25V X7R ceramic capacitor (1210) Murata GRM32DR71E106K TDK C3225X7R1E106M
C2, C5	2	2.2μF ±10%, 10V X7R ceramic capacitors (0805) Murata GRM21BR71A225K TDK C2012X5R1A225K
C3	1	0.1μF ±10%, 10V X7R ceramic capacitor (0402) Murata GRM155R71A104KA01D TDK C1005X5R1A104K
C4	1	1μF ±10%, 10V X5R ceramic capacitor (0603) Murata GRM188R61A105M TDK C1608X7R1A105K
C6	0	Not installed, ceramic capacitor (0603)
C7, C8	0	Not installed, ceramic capacitors (1210)
C9	1	0.22μF ±10%, 25V X7R ceramic capacitor (0603) Murata GRM188R71E224K TDK C1608X7R1E224K
C10	1	2.2μF ±10%, 50V X7R ceramic capacitor (1210) Murata GRM32ER72A225K TDK C3225X7R1H225K

DESIGNATION	QTY	DESCRIPTION
C11	1	10μF ±10%, 35V X7R ceramic capacitor (1210) Murata GRM32ER7YA106K Taiyo Yuden GMK325F106ZH
JU1	1	3-pin header
L1	1	8.2μH, 10.6A, 15.5mΩ inductor (13mm x 13mm x 6.5mm) Vishay IHLP5050FD-ER-8R2-M01
Q1, Q2	2	80V n-channel MOSFETs (8 SO) Vishay Si4110DY
R1	1	30.1kΩ ±1% resistor (0603)
R2	1	10kΩ ±1% resistor (0603)
R3	1	121kΩ ±1% resistor (0603)
R4	1	10kΩ ±5% resistor (0603)
R5, R6	2	10Ω ±5% resistors (0603)
R7–R11	5	0Ω resistors (0603)
U1	1	Current source (20 TQFN-EP*) Maxim MAX17512ATP+
U2	1	Half-bridge MOSFET driver (8 SO-EP*) Maxim MAX15019BASA+
—	1	Shunt
—	1	PCB: MAX17512 EVALUATION KIT

EP = Exposed pad.

Component Suppliers

SUPPLIER	PHONE	WEBSITE
Murata Electronics North America, Inc.	770-436-1300	www.murata-northamerica.com
Taiyo Yuden	800-348-2496	www.t-yuden.com
TDK Corp.	847-803-6100	www.component.tdk.com
Vishay	402-563-6866	www.vishay.com

Note: *Indicate that you are using the MAX17512 when contacting these component suppliers.*

Quick Start

Recommended Equipment

- MAX17512 EV kit
- 6.5V to 18V DC input power supply (VIN)
- 2V DC power supply (ICMD)
- Resistive load of 0.5Ω that can dissipate 20W power
- Ammeter

Procedure

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

1) Set the power supply (VIN) at a voltage between 6.5V and 18V. Disable the power supply.
2) Connect the positive terminal of the power supply to the VIN PCB pad and the negative terminal to the nearest PGND PCB pad.
3) Set the 2V DC power supply (ICMD) to a voltage between 0.4V and 1.94V. Disable the power supply.
4) Connect the positive terminal of the power supply to the ICMD PCB pad and the negative terminal to the nearest SGND PCB pad.
5) Connect the positive terminal of the ammeter to the VOUT PCB pad, the negative terminal to one terminal of the resistive load. Connect the other terminal of the resistive load to the nearest PGND PCB pad.
6) Verify that a shunt is installed across pins 1-2 on jumper JU1.
7) Turn on the DC power supply.
8) Verify that the ammeter is reading the average current corresponding to the current command voltage.

Table 1. Regulator Enable (EN/UVLO) Jumper JU1 Description

SHUNT POSITION	EN/UVLO PIN	IC OUTPUT
1-2*	Connected to center node of resistor-divider R1 and R2	Enabled, UVLO level set through R1 and R2 divider
2-3	Connected to GND	Disabled

**Default position.*

Detailed Description of Hardware

The MAX17512 EV kit provides a proven design to evaluate the MAX17512 high-speed, constant on-time, valley current regulator. The EV kit operates from a 6.5V to 18V input voltage and can deliver up to 6A. The EV kit includes an EN/UVLO PCB pad and jumper JU1 to enable control of the converter output. An additional $\overline{\text{FLT}}$ PCB pad is available for monitoring the open-drain logic output.

Regulator Enable/Undervoltage-Lockout Level (EN/UVLO)

The IC features an enable/undervoltage-lockout input (EN/UVLO). For normal operation, a shunt should be installed across pins 1-2 on jumper JU1. To disable the output, install a shunt across pins 2-3 on JU1 and the EN/UVLO pin is pulled to GND. See Table 1 for jumper JU1 settings.

Setting the UVLO Level

The IC offers an adjustable-input UVLO level. Set the voltage at which the device turns on with a resistive voltage-divider connected from VIN to GND. Connect the center node of the divider to EN/UVLO.

Choose R2 to be 10kΩ and then calculate R1 as follows:

$$R1 = R2 \times \left[\frac{V_{IN}}{1.23} - 1\right] \text{in k}\Omega$$

where R1 and R2 are in kΩ and V_{IN} is in volts.

Programming the Valley of the Output (RTON)

The IC employs a “modified constant on-time valley current-control scheme” (refer to the *Control Scheme* section in the MAX17512 IC data sheet) to control the valley of the ouput inductor current. The heart of this control scheme is the one-shot that sets the high-side switch on-time. This fast, low-jitter, adjustable one-shot includes circuitry that varies the on-time in response to the resistance value connected between the RTON pin and SGND terminals. To set the on-time, adjust resistor R3 on the EV kit. R3 can be calculated for a given on-time as follows:

$$R3 = 2520 / (t_{ON} - 36)$$

where t_{ON} is in ns.

Programming the Valley Current (ICMD)

The IC regulates the valley point of the output inductor current depending on the current-command voltage applied at the ICMD pin. For example, the device regulates the valley current to 5A ±250mA for 1.842V current-command voltage. The current-command voltage (V_{ICMD}) to be applied at the ICMD pin for a given inductor valley current (I_{VALLEY}) can be calculated as follows:

$$V_{ICMD} = [(I_{VALLEY} \times 0.28) + 0.442] \text{ in volts}$$

where I_{VALLEY} is in amps.

The device can deliver a maximum current of 6A and hence a clamp on the voltage on the current-command-voltage is incorporated. Therefore, the appropriate current-command voltage range is 0.442V to 2.15V, which corresponds to a valley current range of 220mA to 6A.

For a given current command voltage at the ICMD pin (V_{ICMD}) and constant on-time (t_{ON}) selected, the average inductor current ($I_{AVERAGE}$) can be calculated by using the following formula:

$$I_{AVERAGE} = [\{(V_{ICMD} - 0.442) \times 3.57\} + (0.5 \times V_{IN} \times t_{ON}/L)$$

where V_{ICMD} is the current command voltage applied at the ICMD pin, V_{IN} is the input voltage applied, t_{ON} is the constant on-time selected, and L is the output inductor selected.

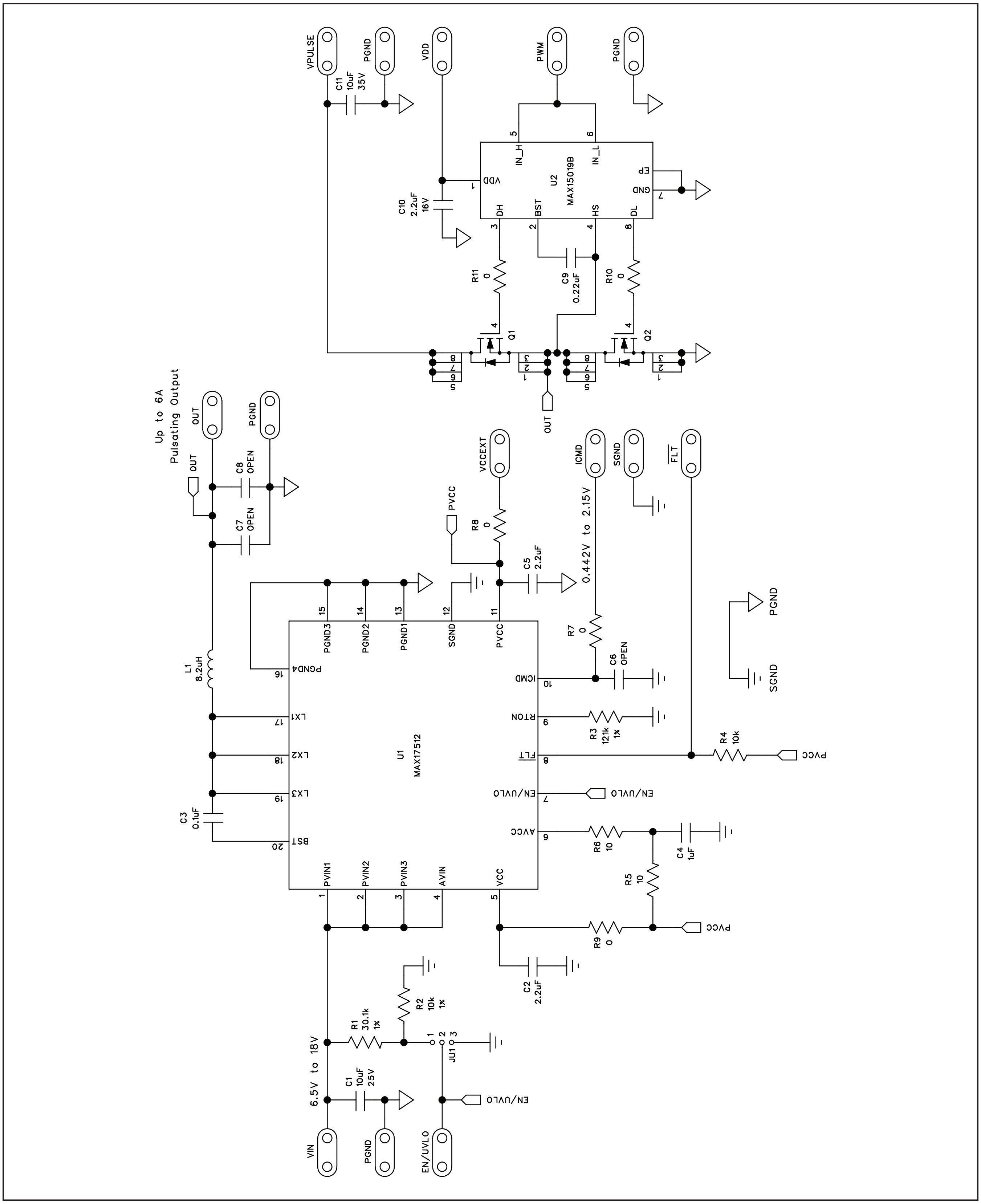

Figure 1. MAX17512 EV Kit Schematic

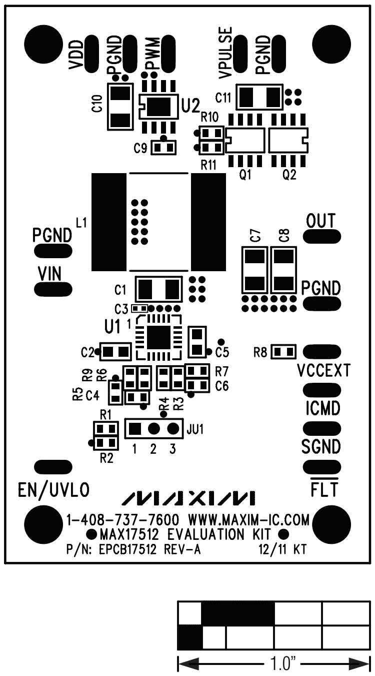

Figure 2. MAX17512 EV Kit Component Placement Guide—Component Side

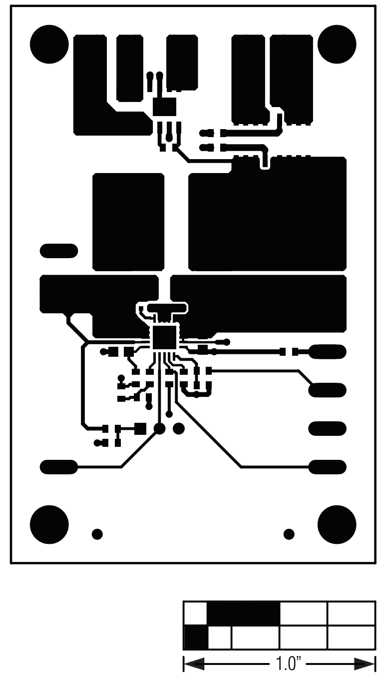

Figure 3. MAX17512 EV Kit PCB Layout—Component Side

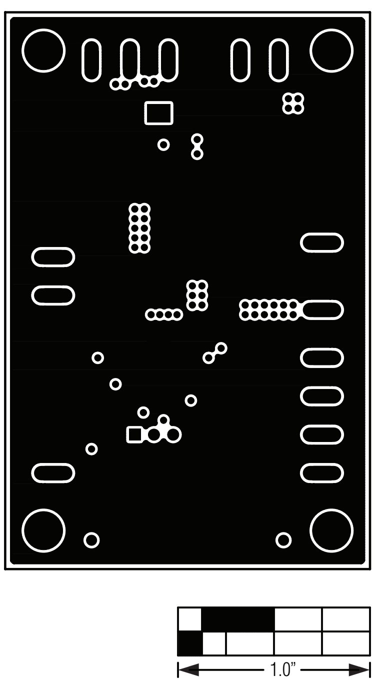

Figure 4. MAX17512 EV Kit PCB Layout—Layer 2

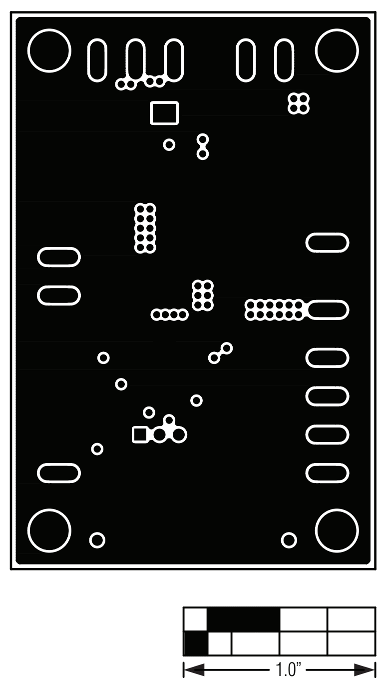

Figure 5. MAX17512 EV Kit PCB Layout—Layer 3

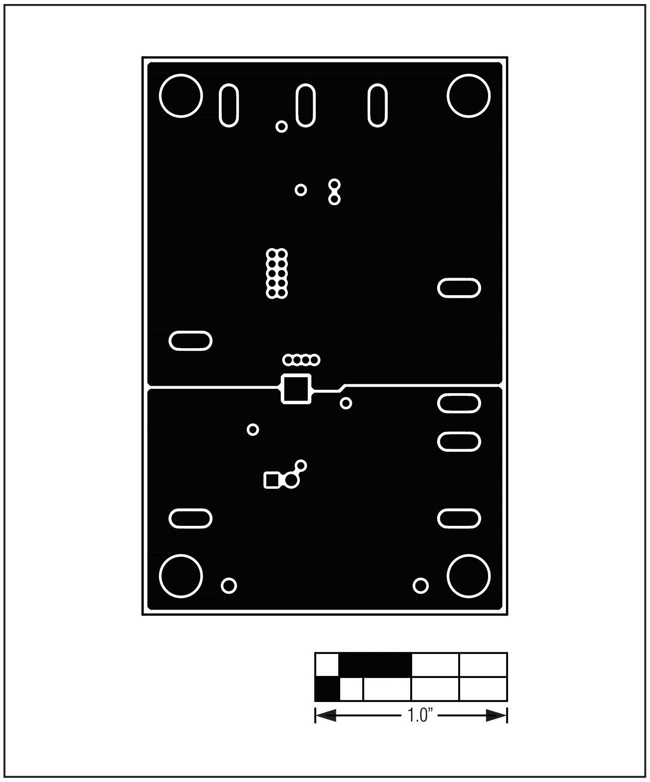

Figure 6. MAX17512 EV Kit PCB Layout—Layer 4

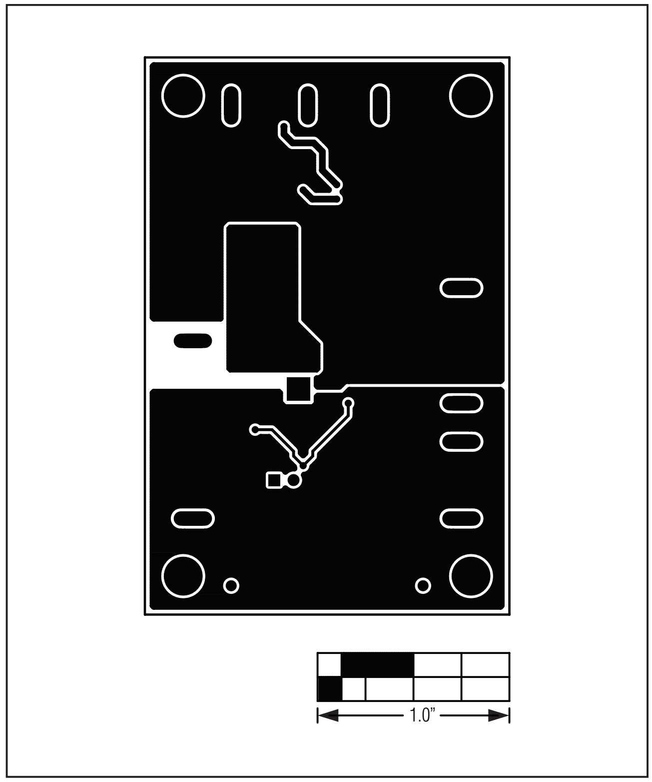

Figure 7. MAX17512 EV Kit PCB Layout—Layer 5

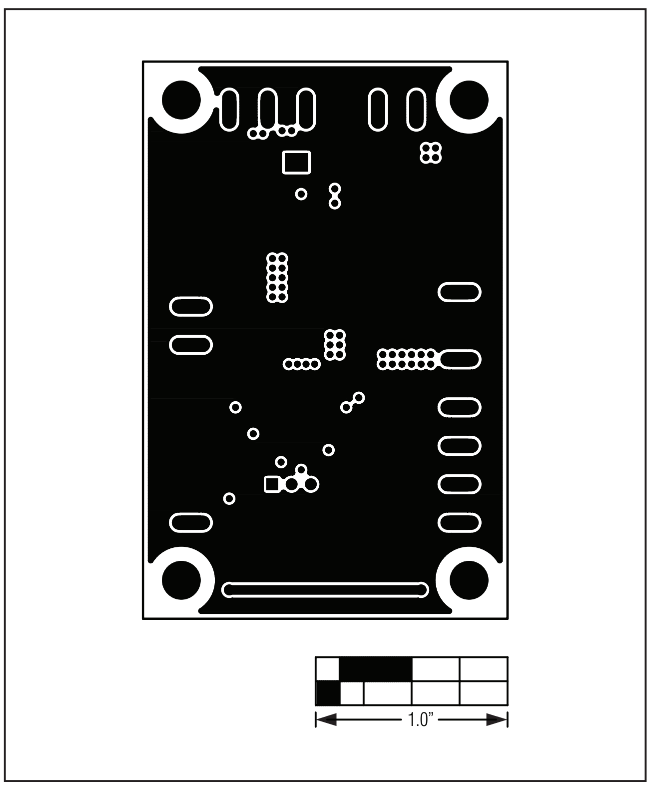

Figure 8. MAX17512 EV Kit PCB Layout—Solder Side

Ordering Information

PART	TYPE
MAX17512EVKIT#	EV Kit

#Denotes RoHS compliant.

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	4/12	Initial release	—