19-1914; Rev 1; 1/01

MAXIM

MAX5003 Evaluation Kit

Evaluates: MAX5003

General Description

The MAX5003 evaluation kit (EV kit) provides a regulated 5V output voltage up to 1A while operating from a +36V to +72V input voltage.

The MAX5003 EV kit is a fully assembled and tested surface-mount printed circuit (PC) board. It comes with the output voltage set to 5V. This EV kit is configured as a flyback converter, and can easily be configured for either isolated or nonisolated operation by selecting the state of a mechanical switch. Additionally, for systems in which the input and output ground references are not at the same potential and for which isolation is not desired, the user has the option to install a level-shifter (not supplied) in the controller feedback loop.

WARNING: 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 appropriate to working 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.

Features

- **5V at 1A Output**
- **+36V to +72V Input Voltage Range**
- **300kHz Switching Frequency**
- **Can be Configured for -48V Input and +5V Output**
- **Selectable Isolated or Nonisolated Operation**
- **Proven PC Board Layout**
- **Fully Assembled and Tested Surface-Mount Board**

Ordering Information

PART	TEMP. RANGE	IC PACKAGE
MAX5003EVKIT	0°C to +70°C*	16 QSOP

**With air flow.*

Component List

DESIGNATION	QTY	DESCRIPTION
C1	1	33µF, 100V electrolytic capacitor Sanyo 100MV33CZ
C2, C3	2	22µF, 10V ceramic capacitors Taiyo Yuden LMK432BJ226MM
C5	1	2200pF ±10% ceramic capacitor
C6	1	3900pF ±10% ceramic capacitor
C7	1	0.01µF ceramic capacitor
C8	1	10µF, 16V ceramic capacitor Taiyo Yuden EMK325BJ106MN
C9	1	100pF ±10% ceramic capacitor
C10	1	0.47µF ceramic capacitor
C11, C13, C17	3	0.1µF ceramic capacitors
C12	1	390pF ±10% ceramic capacitor
C16	1	4.7µF, 25V tantalum capacitor AVX TAJB475M025
D1	1	30V, 1A Schottky diode Fairchild MBRS130L
D2	1	Small-signal switching diode Central Semiconductor CMSD4448
N1	1	200V, 5.2A N-channel MOSFET International Rectifier IRF620S
Q1	0	Not installed
Q2	1	2N3904-type NPN transistor Central Semiconductor CMPT3904 or equivalent
R1	1	41.2kΩ ±1% resistor
R2	1	17.4kΩ ±1% resistor
R3	1	68kΩ ±5% resistor
R4, R22, R23	3	1MΩ ±5% resistors
R5	1	39kΩ ±5% resistor
R6	1	51kΩ ±5% resistor
R7	1	200kΩ ±5% resistor
R8, R15	2	43Ω ±5% resistors
R9	1	0.11Ω ±1%, 1/4W resistor Dale WSL-1206/0.11Ω/1%
R10	1	100Ω ±5% resistor
R11	1	100kΩ ±5% resistor
R12	1	20kΩ ±5% resistor
R13	1	1.3kΩ ±5% resistor
R14	1	240kΩ ±5% resistor
R16, R17	2	24.9kΩ ±1% resistors
R18	0	Not installed

Component List (continued)

DESIGNATION	QTY	DESCRIPTION
R19	0	Not installed
R20	1	680Ω ±5% resistor
R21	1	15Ω ±5% resistor
SW1	1	DPDT switch
SW2	1	SPDT switch
T1	1	65µH, 8:1:2.5 transformer Coiltronics CTX03-14502
U1	1	MAX5003EEE (16-pin QSOP)
U2	1	2.5V voltage reference Motorola TL431BCD
U3	1	Low-current optocoupler QT Opto MOC217
None	1	MAX5003 PC board
None	1	MAX5003 data sheet
None	1	MAX5003 EV kit data sheet

Component Suppliers

SUPPLIER	PHONE	FAX
AVX	803-946-0690	803-626-3123
Central Semiconductor	516-435-1110	516-435-1824
Coiltronics	561-241-7876	561-241-9339
Dale-Vishay	402-564-3131	402-563-6418
Fairchild	408-822-2000	408-822-2102
International Rectifier	310-322-3331	310-322-3332
Motorola	303-675-2140	303-675-2150
QT Optoelectronics	408-720-1440	408-720-0848
Sanyo	619-661-6835	619-661-1055
Taiyo Yuden	408-573-4150	408-573-4159

Note: *Please indicate that you are using the MAX5003 when contacting the above component suppliers.*

Quick Start

The MAX5003 EV kit is fully assembled and tested. Follow these steps to verify board operation in nonisolated mode. **Do not turn on the power supply until all connections are completed.**

1) Connect a +36V to +72V power supply to the pad labeled VIN. **Do not exceed 100V input voltage.** The ground connects to the GND pad (-48V).
2) Connect a voltmeter and load (if any) to the +5V pad.

Table 1. Switch/Jumper Functions

FUNCTION	SWITCH/ JUMPER	POSITION
Nonisolated, Non-level-shifted Feedback Mode (e.g., +48V input and +5V output)	SW1	NON
	SW2	DIR
	JU1	Closed* (default trace)
Nonisolated, Level-Shifted Feedback Mode (e.g., -48V input and +5V output)	SW1	NON
	SW2	LVL
	JU1	Open (Cut)
Isolated Feedback Mode (input and output supplies isolated from one another)	SW1	ISO
	SW2	LVL
	JU1	Open (Cut)

**Default setting*

3) Verify that switch SW1 is set to the NON position and SW2 is set to the DIR position. See Table 1 for a description of the switch settings.
4) Turn on the power and verify that the output voltage is +5V.
5) Refer to the *Isolated Feedback* section to modify the board for isolated operation. Refer to the *Nonisolated Level-Shifted Feedback* section to modify the board for operation with the input and output negative supplies at different potentials.

Detailed Description

Feedback Mode Selection

Switch SW1 selects the feedback configuration (isolated or nonisolated). If SW1 is set to the NON position, switch SW2 selects either direct feedback (for the case in which the input and output share the same ground) or level-shifted feedback. Switch SW2 is only effective when nonisolated feedback is selected. Jumper JU1 determines whether the input and output ground references are connected. Table 1 summarizes switch and jumper functions. **Do not operate switches SW1 and SW2 when power is applied to the EV kit because the controller can be damaged.**

Isolated Feedback

To configure the MAX5003 EV kit for isolated operation, turn off the power supply and cut the JU1 PC board trace. Set the SW1 switch to the ISO position, and set the SW2 switch to the LVL position (setting SW2 to the

LVL position disconnects the R1-R2 resistor-divider from the MAX5003's FB pin, as required for isolated operation). Turn the power supply back on and verify that the output voltage is still +5V. Note that for the isolated configuration, the output ground and the input ground may differ by as much as 500V. **Do not operate switches SW1 and SW2 when power is applied to the EV kit because the controller can be damaged.**

Nonisolated Level-Shifted Feedback

To configure the MAX5003 EV kit for operation in a system in which the negative terminal of the input power supply is at a more negative potential than the negative terminal of the output power supply (for example, in a -48V input to +5V output application), first turn off the power supply and cut the JU1 PC board trace. Set the SW1 switch to the NON position, and set the SW2 switch to the LVL position. Locate parts R18, R19, and Q1 (directly above jumper JU1 on the PC board). Solder the following parts into the R18, R19, and Q1 locations: R18 = 36.5kΩ ±1% resistor (1206), R19 = 12.4kΩ ±1% resistor (1206), and Q1 = 60V 2N2907-type PNP transistor (SOT23). Note that the initial DC output voltage accuracy and the temperature variation will be degraded in this configuration. **Do not operate switches SW1 and SW2 when power is applied to the EV kit because the controller can be damaged.**

Undervoltage Lockout and Shutdown

The MAX5003 EV kit is configured to go into undervoltage lockout when VIN drops below 32V. The MAX5003 does not have a shutdown pin, but the undervoltage lockout state is equivalent to a shutdown state. The MAX5003 EV kit contains a shutdown function consisting of an NPN switching transistor (Q2) that can pull the VINDIV pin to ground. To place the MAX5003 in undervoltage lockout, drive the SHDN pad with a +5V logic-high signal to turn on transistor Q2. For normal operation, the SHDN pad can be connected to ground or left unconnected. Note that the logic-high signal used to drive the SHDN pad is referenced to the negative side of the input supply. For more details regarding undervoltage lockout, refer to the MAX5003 data sheet.

Current Limiting

The MAX5003 EV kit has a current-limiting feature implemented by current-sense resistor R9. The MAX5003 turns off switching FET N1 when the voltage at the CS pin reaches 100mV. Since R9 is a 0.11Ω resistor, this limits the current in the transformer primary to 0.91A peak, which corresponds to a typical output short-circuit current of 4.5A. R10, a 100Ω resistor, is connected between the current-sense resistor and the CS pin to enable current-sense blanking after N1 is turned on, as described in the MAX5003 data sheet.

Layout Considerations

The MAX5003 EV kit layout is optimized for fast switching and high currents. The input and output power and ground traces must both be as short and wide as possible to minimize unwanted parasitic inductance. This board was not designed per UL spacing specifications.

MAX5003 Evaluation Kit

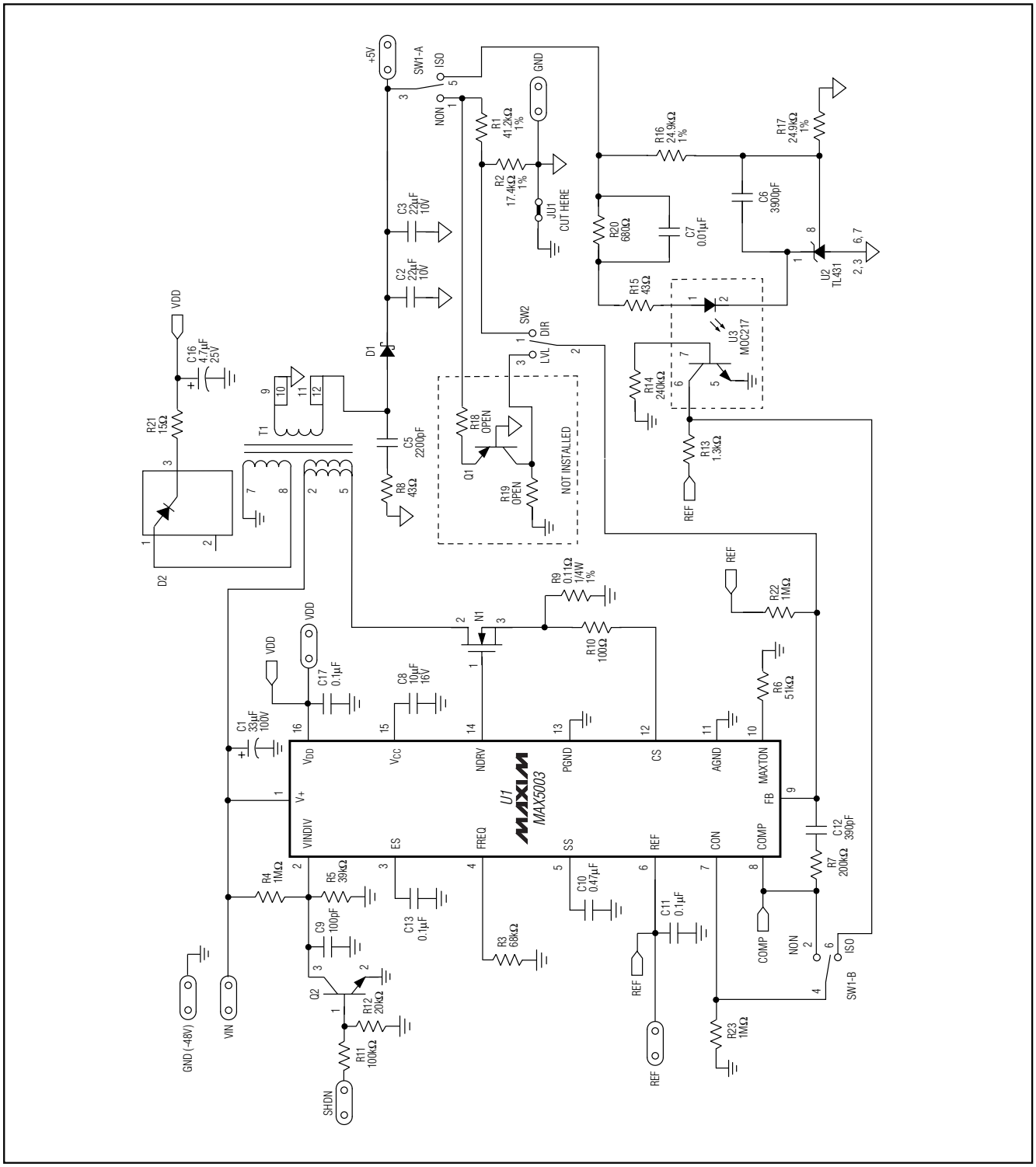

Figure 1. MAX5003 EV Kit Schematic

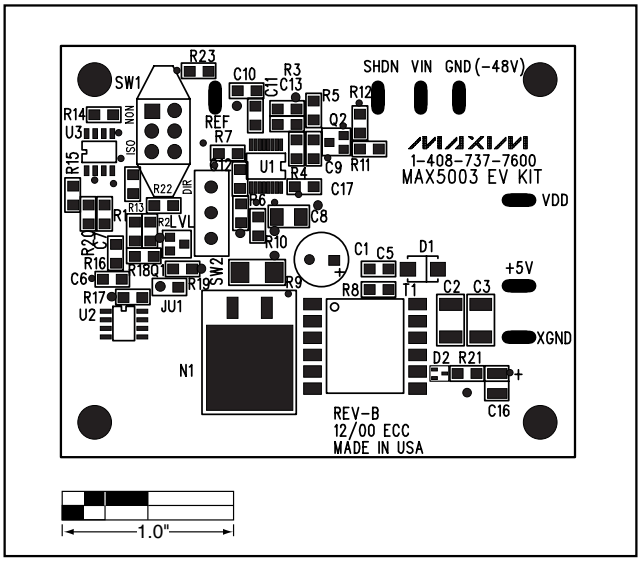

Figure 2. MAX5003 EV Kit Component Placement Guide—Component Side

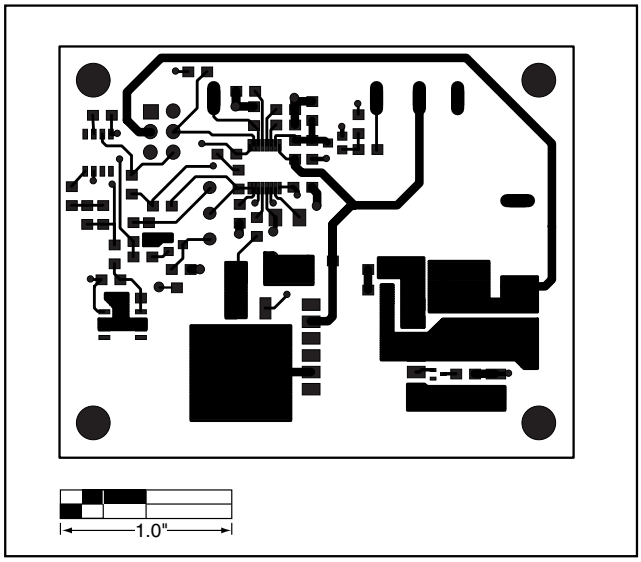

Figure 3. MAX5003 EV Kit PC Board Layout—Component Side

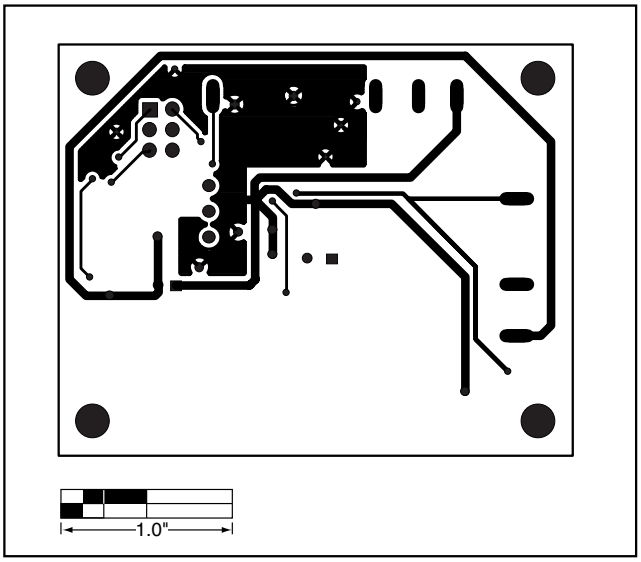

Figure 4. MAX5003 EV Kit PC Board Layout—Solder Side