

MAXIM

MAX5022 Evaluation Kit

Evaluates: MAX5022

General Description

The MAX5022 evaluation kit (EV kit) is a fully assembled and tested 5W flyback-converter circuit board. The power supply is configured for an isolated +5VDC output voltage that can supply up to 1A of current. The line input voltage range is from 85VAC to 265VAC or 120VDC to 375VDC.

The MAX5022 EV kit demonstrates high efficiency up to 80% at 262kHz switching frequency. This high efficiency is achieved by using a single transistor (MOSFET), flyback-converter topology providing output power up to 5W. The surface-mount transformer has a tertiary winding to power the MAX5022 IC after startup. An optocoupler along with the transformer provide input-to-output isolation up to 4500VDC.

Warning: The MAX5022 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 the power sources connected to it must be careful to follow safety procedures appropriate for 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 component debris at high velocity. Operate this kit with care to avoid possible personal injury.

Features

- ◆ 85VAC to 265VAC or 120VDC to 375VDC Input Range
- ◆ Isolated Output Voltage: +5VDC at 1A
- ◆ Input-to-Output Isolation Up to 4500VDC
- ◆ Fully Assembled and Tested
- ◆ Efficiency Up to 80%
- ◆ 2% Output Voltage Regulation Over Line and Load

Ordering Information

| PART | TEMP RANGE | IC PACKAGE |
|--------------|--------------|------------|
| MAX5022EVKIT | 0°C to +70°C | 6 SOT23-6 |

Component List

| DESIGNATION | QTY | DESCRIPTION |
|-------------|-----|---|
| C1, C9 | 2 | 10.0μF ±20%, 400V aluminum electrolytic capacitors (12.5mm x 13.5mm) Sanyo 400CV10FS |
| C2, C3 | 2 | 0.22μF ±20%, 50V X7R ceramic capacitors (1206) TDK C3216X7R1H224M |
| C4, C10 | 2 | 47μF ±20%, 6.3V aluminum organic capacitors (case V) Kemet A700V476M006AT018 |
| C5, C12 | 2 | 0.01μF ±10%, 16V X7R ceramic capacitors (0402) TDK C1005X7R1C103K |
| C6 | 1 | 0.1μF ±10%, 50V X7R ceramic capacitor (0603) TDK C1608X7R1H104K |

| DESIGNATION | QTY | DESCRIPTION |
|-------------|-----|---|
| C7 | 1 | 1000pF ±20%, 4KVAC (DE0910) Murata DE1E3KX102MA5BA01 |
| C8 | 1 | 8200pF ±10%, 50V X7R ceramic capacitor (0603) TDK C1608X7R1H822K |
| C11 | 1 | 1000pF ±10%, 630V X7R ceramic capacitor (1206) TDK C3216X7R2J102K |
| C13 | 1 | 2200pF ±10%, 50V X7R ceramic capacitor (0402) TDK C1005X7R1H222K |
| D1 | 1 | 250mA, 75V high-speed switching diode (SOT-23) Central Semiconductor CMPD914 |

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Component List (continued)

| DESIGNATION | QTY | DESCRIPTION |
|-------------|-----|---|
| D2 | 1 | 3A, 40V Schottky power rectifier (SMC) Central Semiconductor CSMH3-40 |
| D3 | 1 | 1000V, 1A full-wave diode bridge (SMDIP) Central Semiconductor CBR1-D100S |
| D4 | 1 | 600V, 1A ultra-fast rectifier (SMA) Central Semiconductor CMR1U-06M |
| D5 | 1 | 100V, 200mA small-signal diode (SOD-123) Fairchild Semiconductor MMSD4148 |
| F1 | 2 | 2AG and 5mm fuse clips Keystone 3519 |
| F1 | 1 | 1/4A 250V SLO-BLO fuse Littelfuse 229.250H |
| L1, L3 | 2 | Ferrite beads 220 Ω at 100MHz, 2A DCR = 0.050 Ω (0805) Murata BLM21PG221SN1 |
| L2 | 1 | 470 μ H, 240mA inductor Sumida CDRH73-471 |
| N1 | 1 | 1.8A, 600V, n-channel MOSFET (DPAK) Fairchild Semiconductor SSR2N60B |
| R1, R2 | 2 | 360k Ω \pm 5% resistors (1206) |

| DESIGNATION | QTY | DESCRIPTION |
|-------------|-----|--|
| R3 | 1 | 1.00k Ω \pm 1% resistor (0805) |
| R4 | 1 | 24.9k Ω \pm 1% resistor (0805) |
| R5 | 1 | 8.06k Ω \pm 1% resistor (0805) |
| R6 | 1 | 10 Ω \pm 5% resistor (0603) |
| R7 | 1 | 1.78 Ω \pm 1% resistor (1206) |
| R8 | 1 | 1.2k Ω \pm 5% resistor (1206) |
| R9 | 1 | 240k Ω \pm 5% resistor (0805) |
| R10 | 1 | 10 Ω \pm 5% resistor (0805) |
| R11 | 1 | 1.5k Ω \pm 1% resistor (0603) |
| R12 | 1 | 100k Ω \pm 5% resistor (1206) |
| R13 | 1 | 100 Ω \pm 5% resistor (0603) |
| TB1 | 1 | 2-point terminal block (0.2in center) |
| T1 | 1 | 480 μ H (primary:secondary:tertiary turns ratio 60:3:8) 5W transformer Cooper Electronic Technologies CTX03-15256 |
| U1 | 1 | MAX5022EUT-T (6-pin SOT23) |
| U2 | 1 | 70V, 100% to 200% CRT phototransistor (0.4in lead spacing) Fairchild CNY17-3.W |
| U3 | 1 | 1.24V precision shunt regulator (SOT23-5L) Texas Instruments TLV431AIDBV |
| — | 4 | Rubber bumpers |
| — | 1 | MAX5022 EV kit PC board |

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Component Suppliers

| SUPPLIER | PHONE | FAX | WEBSITE |
|-------------------------|--------------|----------------|-----------------------|
| Central Semiconductor | 631-435-1110 | 631-435-1824 | www.centralsemi.com |
| Cooper-Coiltronics | 561-752-5000 | 561-742-1178 | www.cooperet.com |
| Fairchild Semiconductor | 888-522-5372 | Local rep only | www.fairchildsemi.com |
| Kemet | 864-963-6300 | 864-963-6322 | www.kemet.com |
| Keystone Electronics | 800-221-5510 | 718-956-9040 | www.keyelco.com |
| Littelfuse | 847-824-1188 | 847-391-0894 | www.littelfuse.com |
| Murata | 770-436-1300 | 770-436-3030 | www.murata.com |
| Sanyo Electronic Device | 619-661-6835 | 619-661-1055 | www.sanyodevice.com |
| Sumida USA | 847-545-6700 | 847-545-6720 | www.sumida.com |
| TDK | 847-803-6100 | 847-390-4405 | www.component.tdk.com |

Note: Indicate that you are using the MAX5022 when contacting these component suppliers.

Quick Start

The MAX5022 EV kit is fully assembled and tested. Follow these steps to verify board operation.

Warning: Exercise CAUTION when connecting and measuring off-line voltages.

- Voltage at the primary side may be as high as 700VDC.
- Do not turn on the power supply until all connections are completed.
- Wear protective eye gear at all times.
- Do not touch any part of the circuit with bare hands or conductive materials while power is applied.
- Make sure all high-voltage capacitors are fully discharged before handling.

Recommended Equipment

- Isolation transformer
- Variac
- Voltmeter

VOUT Setup Procedure

- 1) Connect the positive lead of a DC voltmeter to the VOUT pad.
- 2) Connect the negative lead of a DC voltmeter to the GND pad.
- 3) Make sure that the isolation transformer is not powered up. Connect the variac to the output of the isolation transformer.
- 4) Connect one lead of an AC voltmeter to the wiper terminal of the variac.
- 5) Connect the other lead of the AC voltmeter to the "common" terminal of the variac.
- 6) Set the output voltage of the variac to 0VAC.
- 7) Connect the wiper terminal of the variac to the L terminal of TB1.
- 8) Connect the "common" terminal of the variac to the N terminal of TB1.
- 9) Connect a 50 Ω 1W resistor across the output.
- 10) Power up the isolation transformer, and gradually increase the voltage of the variac to 85VAC and up to 265VAC.
- 11) Verify that VOUT is +5V throughout the input voltage range of 85VAC to 265VAC.

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Detailed Description

The MAX5022 EV kit is an off-line 5W flyback converter, configured for +5VDC/1A output. A tertiary winding from the transformer is used to power the device during normal operation. The secondary winding provides the +5VDC output and can supply up to 1A.

This EV kit uses the MAX5022, a SOT23, current-mode, pulse width modulating (PWM) controller. This PWM controller varies the duty cycle to compensate for the variation in V_{IN} and the output load to maintain a constant output voltage. The duty cycle determines the on/off duration of the MOSFET (N1). The n-channel MOSFET is used as a switch to control the current through the primary winding of the transformer (T1).

The duty cycle is controlled by the feedback loop consisting of voltage-divider resistors (R4, R5), a shunt regulator (U3), an optocoupler (U2), and the PWM comparator inside the MAX5022. This network provides the isolated feedback, regulating the output voltage to $5V \pm 2\%$ with up to 4500VDC input-to-output isolation.

The MAX5022 senses the current going through the transformer's primary winding with a current-sense resistor (R7), and shuts down the output when the output current exceeds the current limit of 1.6A. The MAX5022 EV kit is protected against catastrophic failure with the fuse (F1).

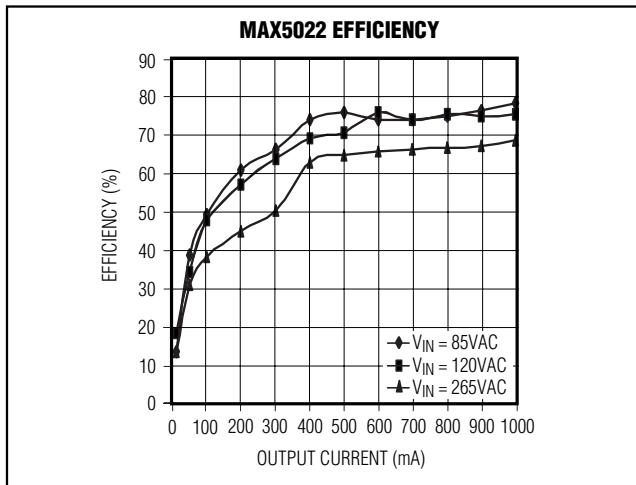


Figure 1. Efficiency Graph

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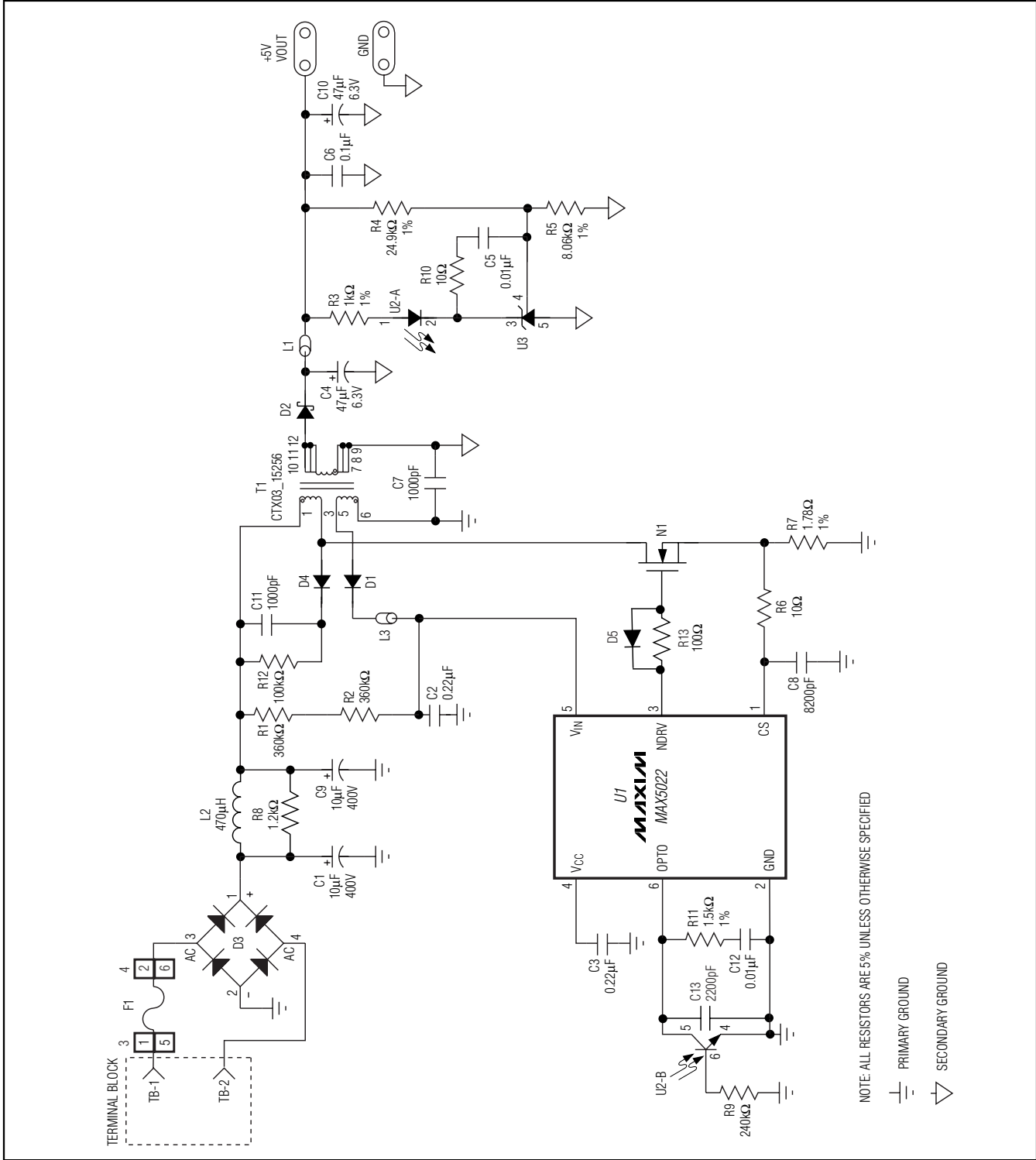


Figure 2. MAX5022 EV Kit Schematic

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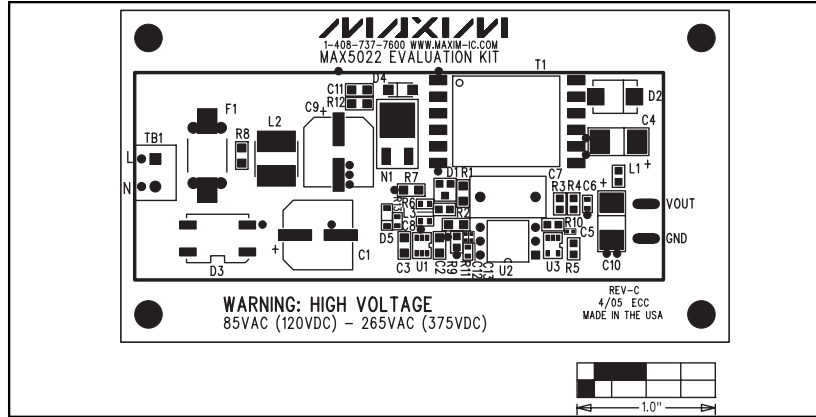


Figure 3. MAX5022 EV Kit Component Placement Guide—Component Side

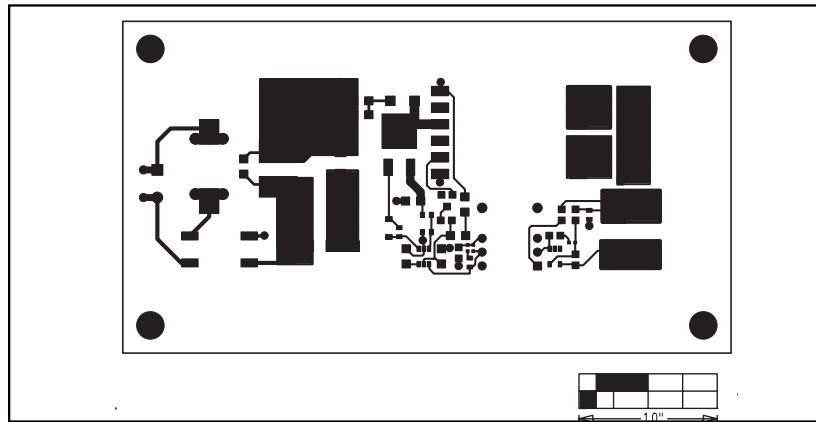


Figure 4. MAX5022 EV Kit PC Board Layout—Component Side

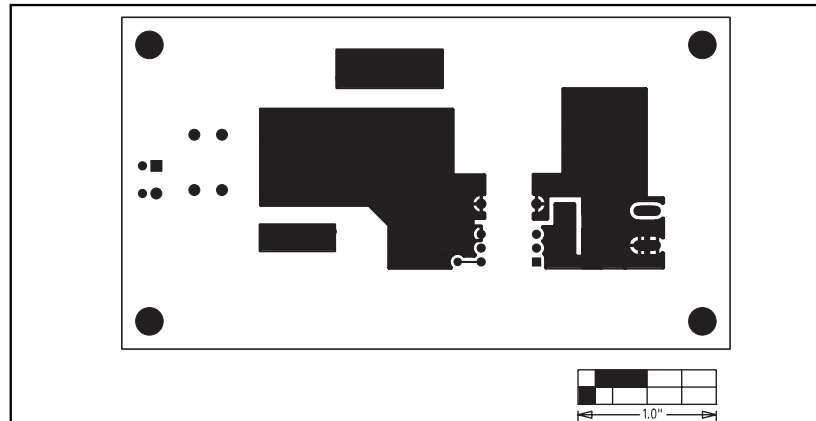


Figure 5. MAX5022 EV Kit PC Board Layout—Solder Side

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