

# 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 of 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	SOT23-6

### Component List

DESIGNATION	QTY	DESCRIPTION
C1, C9	2	10.0μF, 20%, 400V aluminum electrolytic capacitors (12.5 x 13.5) Sanyo 400CV10FS
C2, C3	2	0.22μF, 20%, 50V X7R ceramic capacitors (1206) Taiyo Yuden UMK316BJ224ML
C4, C10	2	47μF, 20%, 6.3V POSCAP capacitors (CASE V) Kemet A700V476M006AT
C5, C12	2	0.01μF, 10%, 16V X7R ceramic capacitor (0402) Taiyo Yuden EMK105BJ103KV
C6	1	0.1μF, 10%, 16V X7R ceramic capacitor (0603) Taiyo Yuden EMK107BJ104KA

DESIGNATION	QTY	DESCRIPTION
C7	1	1000pF, 20%, 4kVAC, X1/Y1 rated capacitor (DE0910) Murata DE0910E102M-KX
C8	1	8200pF, 10%, 50V X7R ceramic capacitor (0603) TDK C1608X7R1H822K
C11	1	1000pF, 10%, 630V X7R ceramic capacitor (1206) TDK C3216X7R2J102K
D1	1	250mA, 75V, high-speed switching diode (SOT23) Central Semiconductor Corp CMPD914
D2	1	3A, 40V, Schottky power rectifier (SMC) Central Semiconductor CSMH3-40

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## Component List (continued)

DESIGNATION	QTY	DESCRIPTION
D3	1	1000V, 1A, full wave diode bridge (SMDIP) Central Semiconductor CBR1-D100S
D4	1	600V, 1A ultrafast rectifier (SMA) Central Semiconductor CMR1U-06M
F1	1	1/4A, 250V SLO-BLO fuse Littelfuse 203.250G
L1, L3	2	Ferrite beads 220Ω at 100MHz, 2A DCR = 0.025Ω (0805) Murata BLM21P221SG
L2	1	470μH, 240mA inductor Sumida CDRH73-471
N1	1	2A, 600V, N-channel MOSFET (DPAK) International Rectifier IRFRC20
R1, R2	2	360kΩ ±5% resistors (1206)
R3	1	1.0kΩ ±1% resistor (0805)
R4	1	24.9kΩ ±1% resistor (0805)
R5	1	8.06kΩ ±1% resistor (0805)
R6	1	10Ω ±5% resistor (0603)
R7	1	1.78Ω ±1%, resistor (1206)
R8	1	1.2kΩ ±5% resistor (1206)

DESIGNATION	QTY	DESCRIPTION
R9	1	240kΩ ±5% resistor (0805)
R10	1	10Ω ±5% resistor (0805)
R11	1	1.5kΩ ±1% resistor (0603)
R12	1	100kΩ ±5% resistor (1206)
TB1	1	2-point terminal block (0.2in center) Mouser 506-2MV02
T1	1	480μH (primary:secondary:tertiary turns ratio 60:3:8), 5W transformer Cooper Electronic Technologies CTX03-15256
U1	1	MAX5022EUT (6-pin SOT23)
U2	1	70V, 100% to 200% CRT 5300VAC isolation phototransistor (DIP-6) Fairchild CNY 17-3.W
U3	1	1.24V precision shunt regulator (SOT23-5L) Texas Instruments TLV431AIDBV
None	4	Rubber bumpers 3M SJ-5003
None	1	MAX5022 PC board
None	1	MAX5021/MAX5022 data sheet
None	1	MAX5022 EV kit data sheet

## Component Suppliers

SUPPLIER	PHONE	FAX
Central Semiconductor	631-435-1110	631-435-1824
Cooper Electronic	561-752-5000	561-742-0134
Fairchild Semiconductor	888-522-5372	972-910-8036
International Rectifier	310-322-3331	310-252-7175
Kemet	864-963-6300	864-963-6322
Littelfuse	847-824-1188	847-391-0894
Murata	770-436-1300	770-436-3030
Sanyo USA	619-661-6835	619-661-1055
Sumida USA	847-545-6700	847-545-6720
Taiyo Yuden	408-573-4150	408-573-4159
TDK	847-803-6100	847-390-4405

**Note:** Please 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.

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## 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 50Ω 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.

## 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 VIN 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 ±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).

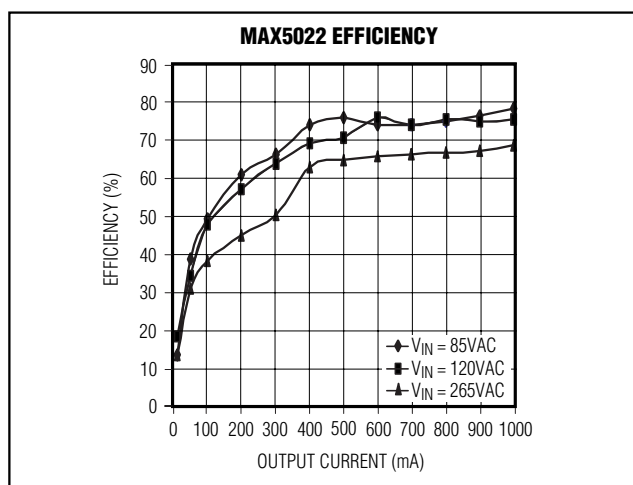


Figure 1. Efficiency Graph

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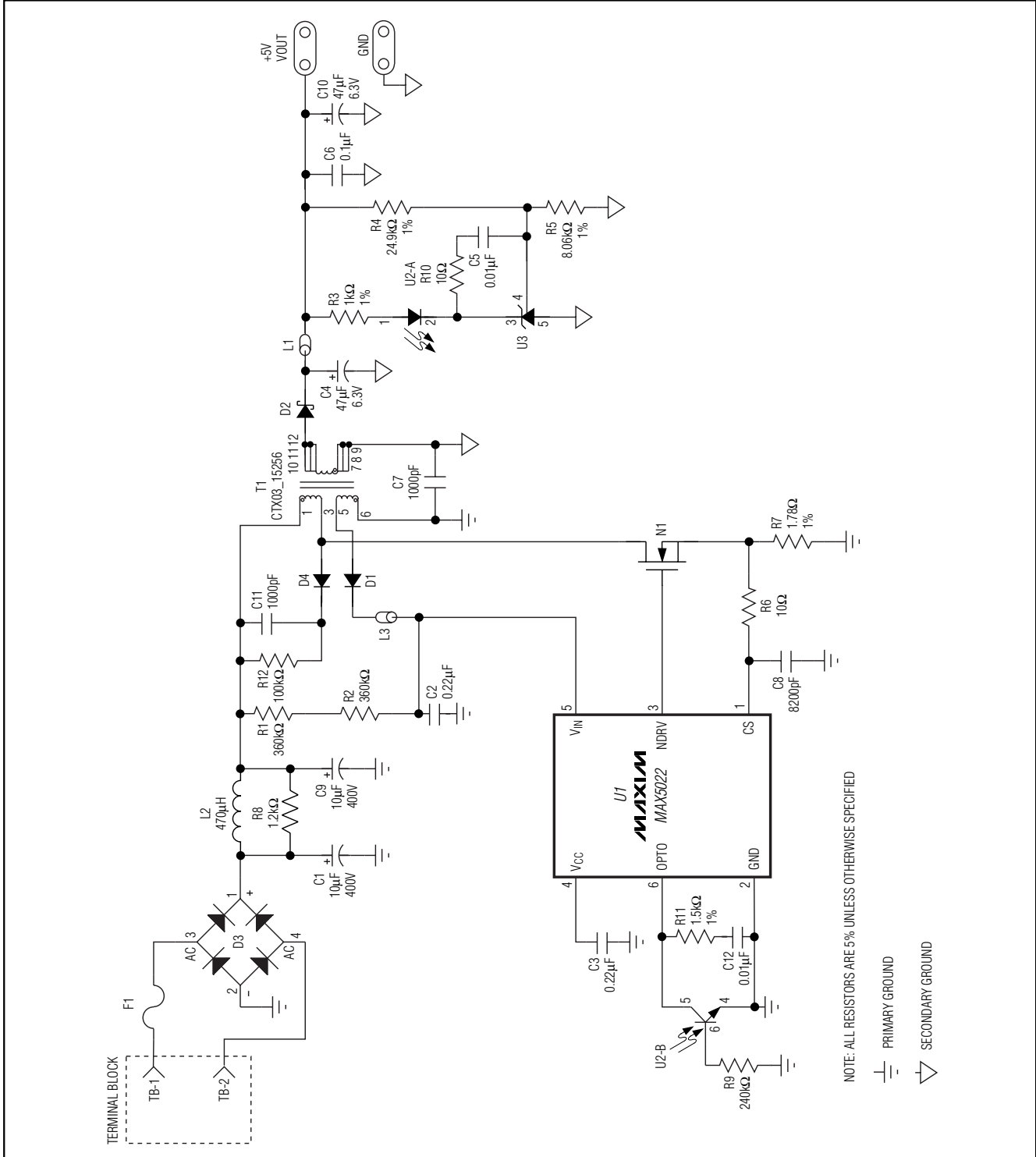


Figure 2. MAX5022 EV Kit Schematic

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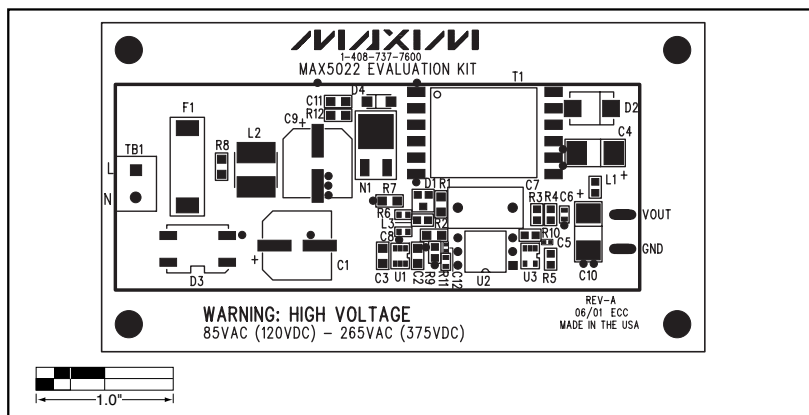


Figure 3. MAX5022 EV Kit Component Placement Guide—Component Side

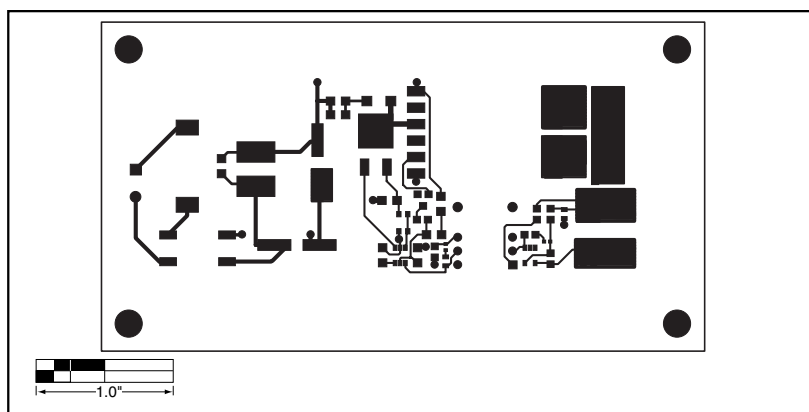


Figure 4. MAX5022 EV Kit PC Board Layout—Component Side

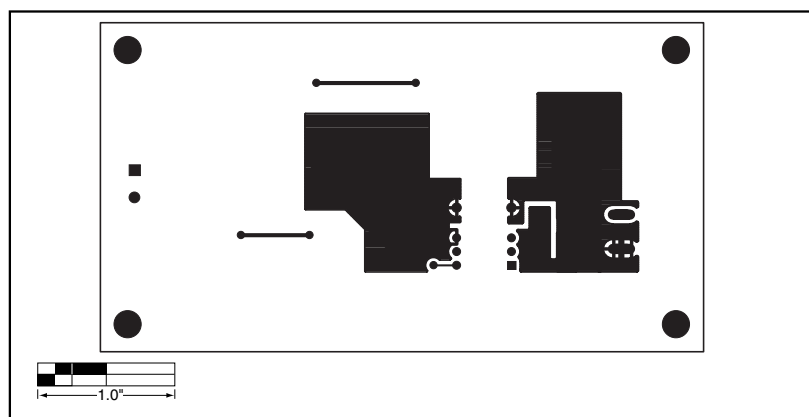


Figure 5. MAX5022 EV Kit PC Board Layout—Solder Side

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