19-3841; Rev 0; 10/05

MAX8716 Evaluation Kit

Evaluates: MAX8716

General Description

The MAX8716 evaluation kit (EV kit) demonstrates the MAX8716's standard application circuit. This dual-PWM synchronous DC-DC converter steps down high-voltage batteries and/or AC adapters, generating main supplies for notebook computers.

The MAX8716 EV kit provides dual +5V and +3.3V output voltages from +6V to +24V battery input range. It delivers up to 5A output current for the +5V output and 5A for the +3.3V output with 95% efficiency. The EV kit operates at 300kHz switching frequency and has superior line- and load-transient response.

This EV kit is a fully assembled and tested circuit board. Both outputs are adjustable between +1.0V and +5.5V by changing feedback resistors R19, R20, R21, and R22.

Features

- **+6V to +24V Input Voltage Range**
- **Output Voltages**
  +3.3V at 5A (Adjustable from +1.0V to +5.5V)
  +5.0V at 5A (Adjustable from +1.0V to +5.5V)
- **300kHz Switching Frequency**
- **Independently Selectable PWM, Skip, and Low-Noise-Mode Operation**
- **Independent Power-Good Outputs**
- **Low-Profile Components**
- **Fully Assembled and Tested**

Ordering Information

PART	TEMP RANGE	IC PACKAGE
MAX8716EVKIT	0°C to +70°C	24 Thin QFN (4mm x 4mm)

Component List

DESIGNATION	QTY	DESCRIPTION
C1, C3	2	10µF ±20%, 25V X5R ceramic capacitors (1210) TDK C3225X7R1E106M AVX 12103D106M Taiyo Yuden TMK325BJ106MM
C2	0	Not installed (1210)
C4, C6	0	Not installed (E case)
C5	1	220µF, 4V, 40mΩ low-ESR capacitor (D case) Sanyo 4TPC220M
C7	1	150µF, 6.3V, 40mΩ low-ESR capacitor (D case) Sanyo 6TPC150M
C9, C11, C14, C18	4	1µF ±20%, 10V X5R ceramic capacitors (0805) Taiyo Yuden LMK212BJ105KG or TDK C2012X7R1C105MKT
C10, C17	2	0.1µF ±10%, 50V X7R ceramic capacitors (0603) Murata GRM188R71H104K or equivalent
C12	1	0.22µF, 16V X5R ceramic capacitor (0805) Taiyo Yuden EMK212BJ224KG
C24, C25	0	Not installed (0603)
D1, D2	2	1A, 30V Schottky diodes Nihon EP10QY03 or Toshiba CRS02
D3	1	100mA, 30V dual Schottky diode (SOT23) common anode Central Semiconductor CMPSH-3A
JU1, JU2	2	4-pin headers
JU3, JU4	2	3-pin headers
JU5, JU6, JU12, JU14	0	Not installed (short jumpers)
L1, L2	2	5.7µH, 5.8A, 10.3mΩ power inductors Sumida CDEP105-5R7NC
N1, N3	2	n-channel MOSFETs (8-pin SO) Fairchild FDS6612A
N2, N4	2	n-channel MOSFETs (8-pin SO) Fairchild FDS6670A
R1, R2	2	0.007Ω ±1%, 1/2W resistors (2010) IRC LR2010-01-R0007-F or Dale WSL-2010-R0007F
R3	1	20Ω ±5% resistor (0805)
R4, R14	2	100kΩ ±5% resistors (0603)
R5, R6	0	Not installed (short PC trace) (0603)
R10, R16	2	3Ω ±5% resistors (0603)
R19–R24	0	Not installed (0603)
U1	1	MAX8716ETG (24-pin thin QFN 4mm x 4mm)
—	4	Shunts
—	1	MAX8716 rev B PC board

Component Suppliers

SUPPLIER	PHONE	WEBSITE
Central Semiconductor	631-435-1110	www.centralsemi.com
Dale-Vishay	402-564-3131	www.vishay.com
Fairchild	888-522-5372	www.fairchildsemi.com
IRC	361-992-7900	www.irctt.com
Kemet	864-963-6300	www.kemet.com
Murata	770-436-1300	www.murata.com
Nihon	847-843-7500	www.niec.co.jp
Sanyo	619-661-6835	www.sanyodevice.com
Sumida	847-545-6700	www.sumida.com
Taiyo Yuden	800-348-2496	www.t-yuden.com
TDK	847-803-6100	www.component.tdk.com
Toshiba	408-526-2459	www.toshiba.com

Note: *Indicate that you are using the MAX8716 when contacting these component suppliers.*

Quick Start

Recommended Equipment

Before you begin, the following equipment is needed. **Do not turn on the power until all connections are made:**

- +6V to +24V power supply, battery, or notebook AC adapter
- DC bias power supply, +5V at 100mA
- Dummy loads capable of sinking 5A each
- Digital multimeters (DMMs)
- 100MHz dual-trace oscilloscope

Procedure

1) Ensure that the circuit is connected correctly to the supplies and dummy loads prior to applying any power.
2) Verify that the shunts are across:
   (a) JU4 pins 1 and 2 (ON1 high, OUT1 (+3.3V) enabled)
   (b) JU3 pins 1 and 2 (ON2 high, OUT2 (+5.0V) enabled)
   (c) JU1 pins 1 and 2 ($\overline{SKIP1}$ high, OUT1 in forced-PWM mode)
   (d) JU2 pins 1 and 2 ($\overline{SKIP2}$ high, OUT2 in forced-PWM mode)
3) Turn on the battery power prior to +5V bias power; otherwise, the output UVLO timer times out and the FAULT latch is set, disabling the regulator outputs until +5V power is cycled or ON1/ON2 is toggled.
4) Verify that the output voltages are V_{OUT1} = +3.3V and V_{OUT2} = +5.0V

Detailed Description

Jumper Settings

Table 1. Jumper JU4 Functions (Output Voltage OUT1 Control)

JU4	ON1 PIN	OUT1
1 and 2 (default)	Connected to VDD	OUT1 is enabled, V_{OUT1} = 3.3V
2 and 3	Connected to GND	OUT1 is disabled
Not installed	ON1 must be driven by an external signal connected to ON1 pad	OUT1 operation depends on the external ON1 signal levels

Table 2. Jumper JU3 Functions (Output Voltage OUT2 Control)

JU3	ON2 PIN	OUT2
1 and 2 (default)	Connected to VDD	OUT2 is enabled, V_{OUT2} = 5.0V
2 and 3	Connected to GND	OUT2 is disabled
Not installed	ON2 must be driven by an external signal connected to ON2 pad	OUT2 operation depends on the external ON2 signal levels

Table 3. Jumper JU1 Functions (Low-Noise-Mode Control for OUT1)

JU1	$\overline{SKIP1}$ PIN	OPERATIONAL MODE
1 and 2 (default)	Connected to VDD	OUT1 is in forced-PWM mode (fixed frequency)
1 and 4	Connected to REF	OUT1 is in low-noise mode
1 and 3	Connected to GND	OUT1 is in pulse-skipping mode

Table 4. Jumper JU2 Functions (Low-Noise-Mode Control for OUT2)

JU2	$\overline{SKIP2}$ PIN	OPERATIONAL MODE
1 and 2 (default)	Connected to VDD	OUT2 is in forced-PWM mode (fixed frequency)
1 and 4	Connected to REF	OUT2 is in low-noise mode
1 and 3	Connected to GND	OUT2 is in pulse-skipping mode

Evaluating Other Output Voltages

The MAX8716 provides a fixed +3.3V output (OUT1) when FB1 is connected to VCC (R6 = 0) and a fixed +5.0V output (OUT2) when FB2 is connected to VCC (R5 = 0).

OUT1 and OUT2 can also be adjusted from +1.0V to +5.5V by using a resistive voltage-divider formed by R21, R22 (R6 = open) and R19, R20 (R5 = open). The MAX8716 regulates FB1 and FB2 to a fixed reference voltage (+1.0V).

The adjusted output voltages are:

$$V_{OUT1} = V_{FB1} (1 + R21 / R22)$$

where V_{FB1} = +1.0V, and:

$$V_{OUT2} = V_{FB2} (1 + R19 / R20)$$

where V_{FB2} = +1.0V.

MAX8716 Evaluation Kit

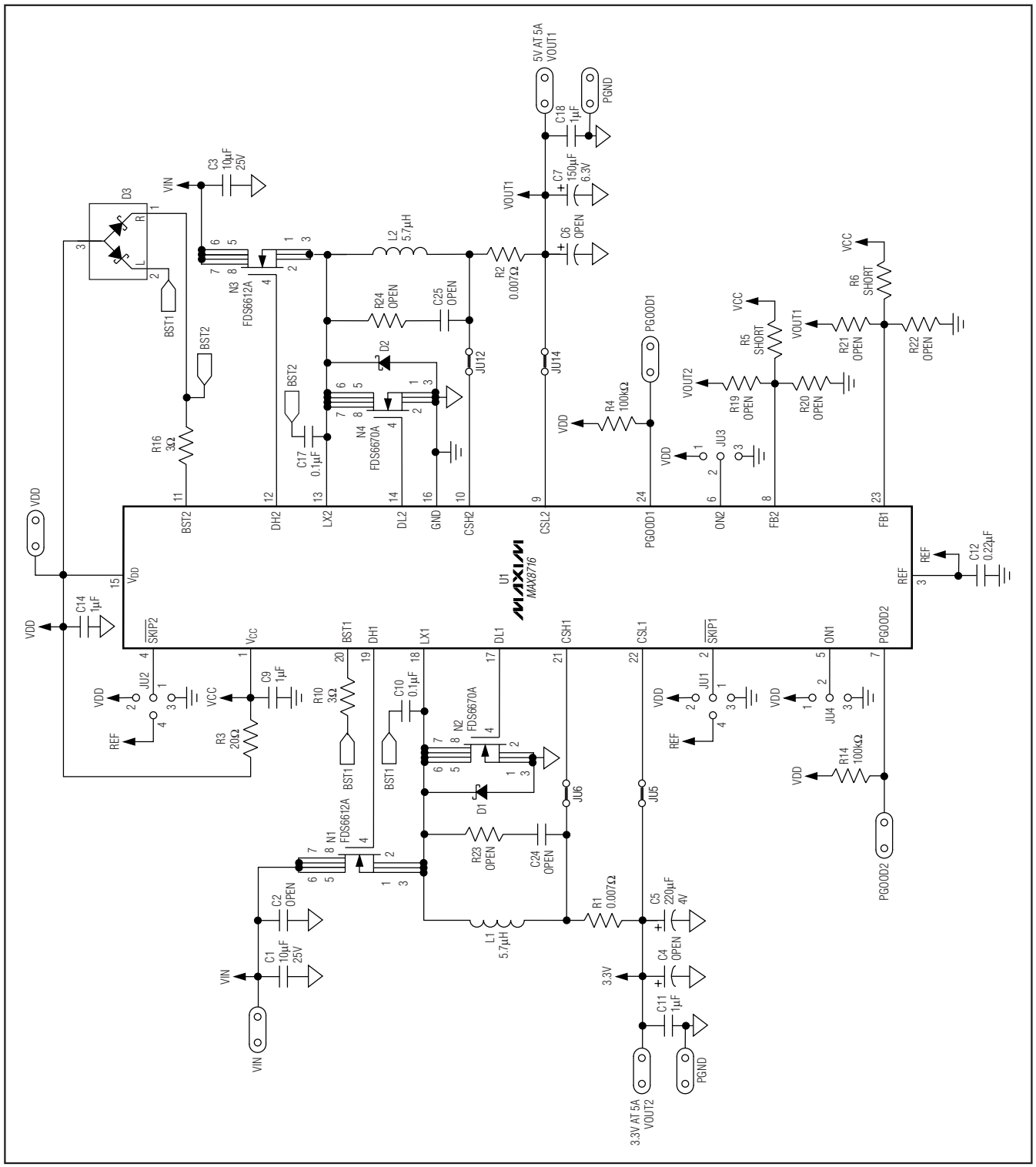

Figure 1. MAX8716 EV Kit Schematic

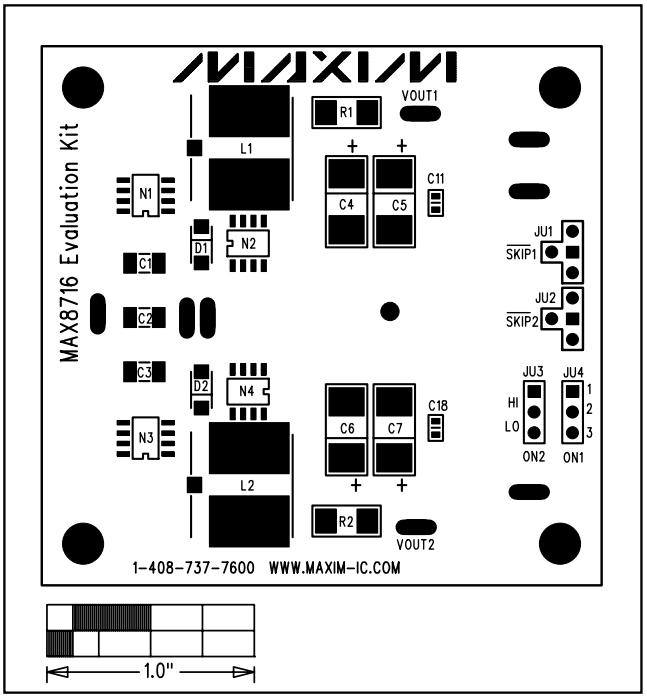

Figure 2. MAX8716 EV Kit Component Placement Guide—Component Side

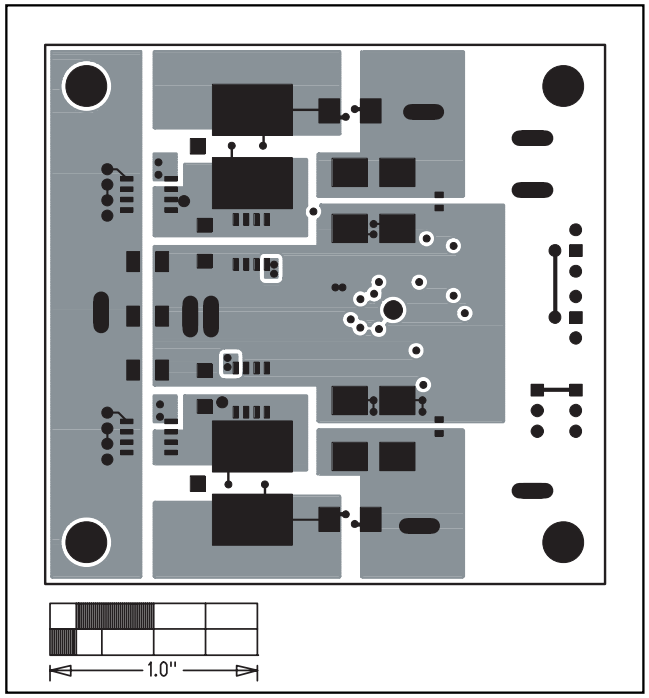

Figure 3. MAX8716 EV Kit PC Board Layout—Component Side

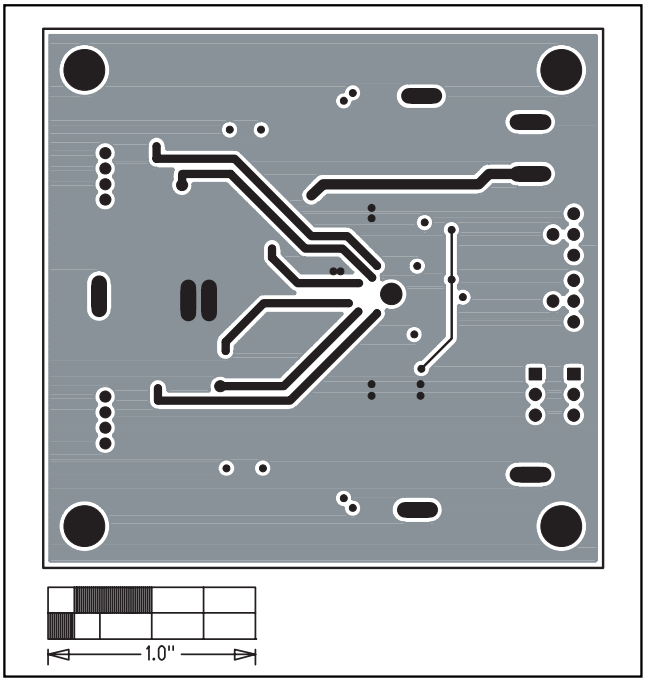

Figure 4. MAX8716 EV Kit PC Board Layout—Internal Layer 2, PGND/Signal Plane

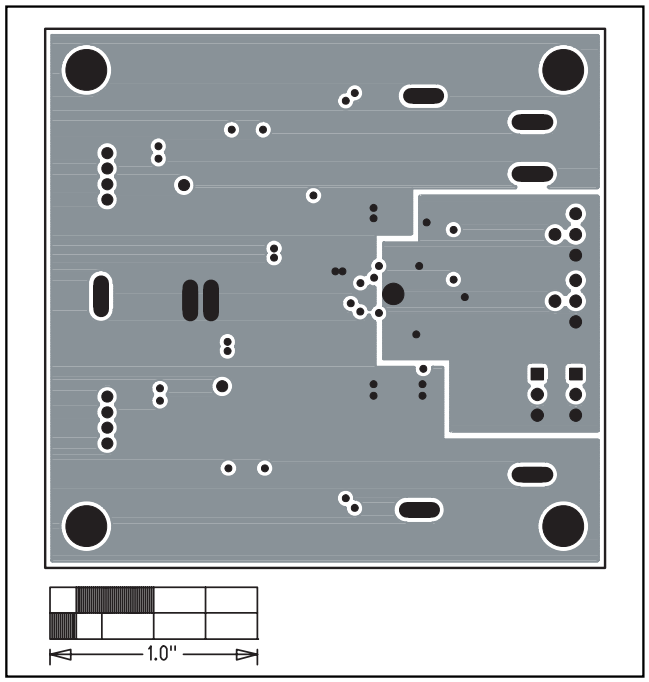

Figure 5. MAX8716 EV Kit PC Board Layout—Internal Layer 3, PGND/GND Layer

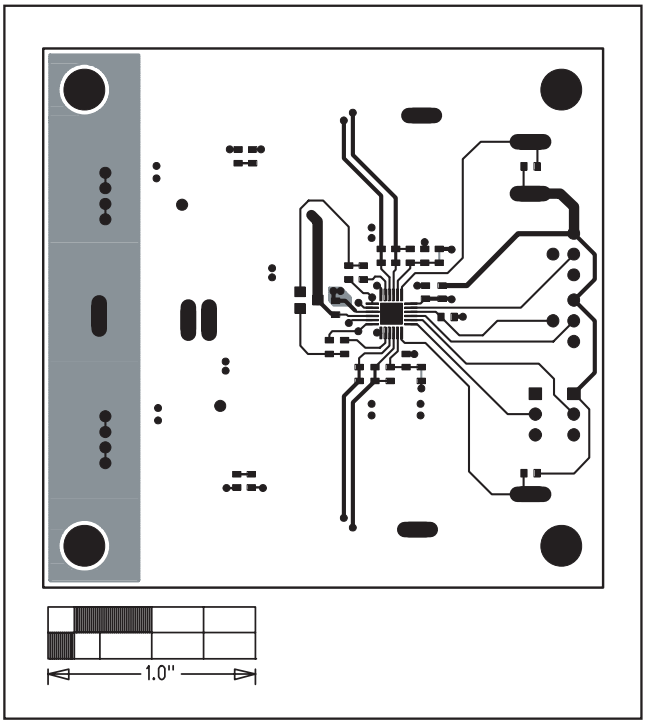

Figure 6. MAX8716 EV Kit PC Board Layout—Solder Side

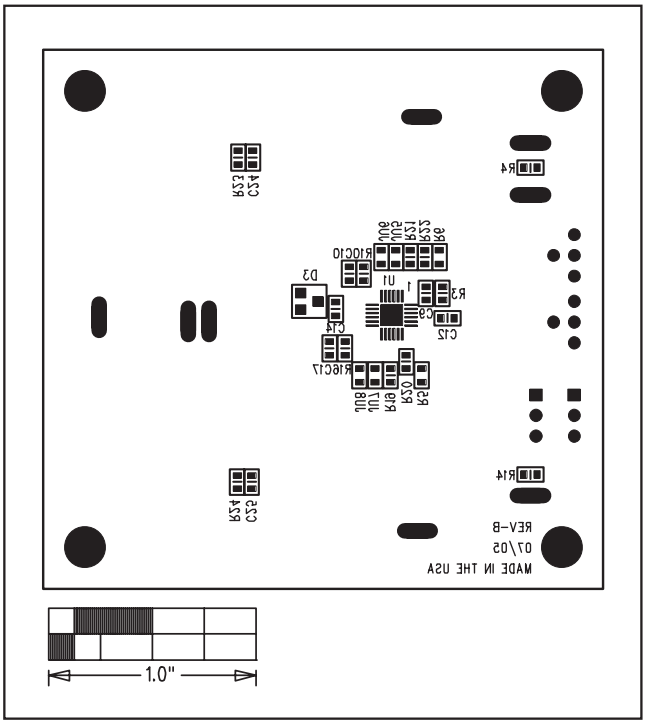

Figure 7. MAX8716 EV Kit Component Placement Guide—Solder Side