19-1971; Rev 2; 10/01

MAXIM

MAX1856 Evaluation Kit SLIC Power Supply

Evaluates: MAX1856

General Description

The MAX1856 evaluation kit (EV kit) is a fully assembled and tested surface-mount circuit board that contains an inverting transformer flyback DC-DC converter. The circuit is configured for two output voltages simultaneously: a -72V that can supply up to 100mA and a -24V that can supply up to 400mA. The input voltage may range from +8V to +24V. The circuit can be configured for -48V, and supply up to 200mA. When operating from a +5V input supply, the circuit can deliver up to 7.2W output power in either configuration.

The MAX1856 EV kit switching frequency is set at 250kHz but can range from 100kHz to 500kHz or may be driven by an external clock. The MAX1856 EV kit demonstrates low quiescent current and high efficiency (over 80%). The MAX1856 comes in the 10-pin µMAX package.

Features

- **+8V to +24V Input Range**
- **+5V Input Range at Up to 7.2W Output Power**
- **Output Voltages**
  - **VOUT1 = -72V at 100mA**
  - **VOUT2 = -24V at 400mA**
- **Configurable for -48V at 200mA Output**
- **100kHz to 500kHz Switching Frequency**
- **External Frequency Control**
- **Low-Cost Minimum Components with Flyback Design**
- **Fully Assembled and Tested**

Ordering Information

PART	TEMP RANGE	IC PACKAGE
MAX1856EVKIT	0°C to +70°C	10 µMAX

Component List

DESIGNATION	QTY	DESCRIPTION
C1	1	22µF, 100V aluminum electrolytic capacitor (8 x 11.5) Sanyo 100MV22AX
C2	1	100µF, 35V aluminum electrolytic capacitor (8 x 11.5) Sanyo 35MV100AX
C3, C4	2	10µF ±10%, 25V X5R ceramic capacitors (1812) Taiyo Yuden TMK432BJ106KM
C5	1	100pF ±10%, 200V COG ceramic capacitor (0805) Murata GRM40COG101K200
C6, C7	0	Not installed
C8	1	470pF ±10%, 200V X7R ceramic capacitor (0805) Murata GRM40X7R471K200
C9	1	1µF ±10%, 25V X7R ceramic capacitor (1206) Taiyo Yuden TMK316BJ105KL
C10, C13	2	1000pF ±5%, 50V NP0 ceramic capacitors (0805) AVX 0805-5A-102-JAT-2A
C11	1	1µF ±10%, 10V X7R ceramic capacitor (0805) Taiyo Yuden LMK212BJ105KG
C12	1	2.2µF ±10%, 10V ceramic capacitor (1206) Murata GRM42-6X7R225K010AD
D1	1	1A, 400V, ultra-fast-recovery diode (SMB) Central Semiconductor Corp CMR1U-04
D2	0	Not installed
D3	1	1A, 200V, ultra-fast-recovery diode (SMB) Central Semiconductor Corp CMR1U-02
T1	1	22µH, 1:2:2:2, 6.7A transformer Coiltronics CTX01-14853 or ICE Components ICA-0635

For pricing, delivery, and ordering information, please contact Maxim/Dallas Direct! at 1-888-629-4642, or visit Maxim's website at www.maxim-ic.com.

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Component List (continued)

DESIGNATION	QTY	DESCRIPTION
N1	1	3.8A, 55V, N-channel MOSFET (SOT223) International Rectifier IRLL2705
R1	1	200Ω ±5% resistor (2512)
R2, R3	0	Not installed
R4, R5	2	10Ω ±5% resistors (1206)
R6	1	0.033Ω ±1% resistor (2010) IRC LRC-LRF2010-01-R033-F or Dale WSL 2010 0.033Ω 1%
R7	1	100Ω ±5% resistor (0805)
R8	1	200kΩ ±1% resistor (0805)
R9	1	5.11kΩ ±1% resistor (0805)
R10	1	681kΩ ±1% resistor (0805)
R11	1	174kΩ ±1% resistor (0805)
R12	1	100kΩ ±5% resistor (0805)
R13	0	Not installed
U1	1	MAX1856EUB (10-pin µMAX)
JU1	1	2-pin header
None	1	Shunt (JU1)
None	1	MAX1856 PC board
None	1	MAX1856 data sheet
None	1	MAX1856 EV kit data sheet

Component Suppliers

SUPPLIER	PHONE	FAX
AVX	803-946-0690	803-626-3123
Central Semiconductor	631-435-1110	631-435-3388
Coiltronics	561-241-7876	561-241-9339
Dale Electronics Inc.	650-526-8333	650-965-1644
ICE Components	703-257-7740	703-257-7547
International Rectifier	310-322-3331	310-322-3332
IRC	650-367-9000	650-367-7158
Murata	814-237-1431	814-238-0490
Sanyo USA	619-661-6835	619-661-1055
Taiyo Yuden	408-573-4150	408-573-4159

Note: *Please indicate that you are using the MAX1856 when contacting these component suppliers.*

Quick Start

The MAX1856 EV kit is fully assembled and tested. Follow these steps to verify board operation. **Do not turn on the power supply until all connections are completed:**

Output VOUT1 and VOUT2

1) Verify that a shunt is across pins 1 and 2 of jumper JU1 (SYNC/$\overline{SHDN}$).
2) Connect a voltmeter to the VOUT1 pad.
3) Connect a +8V to +24V DC power supply to the VIN pad, with the voltage set to 0.
4) Connect the supply ground to the GND pad.
5) Turn on the power supply and gradually increase the input voltage through the +8V to +24V range.
6) Verify that VOUT1 is -72V throughout the +8V to +24V input voltage range.
7) Verify that VOUT2 is -24V throughout the +8V to +24V input voltage range.

Note: Exercise caution when measuring the -72V.

For instructions on reconfiguring VOUT1 to -48V, see *Evaluating -48V Output*.

Detailed Description

The MAX1856 EV kit is an inverted flyback DC-DC converter configured for two output voltages simultaneously. The transformer has a 1:2:2:2 turns ratio. The secondary has three taps to provide three different ratios of 1:2, 1:4, and 1:6. VOUT1 is connected to the 1:6 tap, providing -72V, which can supply up to 100mA. VOUT2 is connected to the 1:2 tap, providing -24V, which can supply up to 400mA. VOUT1 may be connected to the 1:4 tap to provide -48V and supply up to 200mA. The input voltage can range from +8V to +24V. The output voltage is determined by the following equation:

$$|V_{OUT}| = V_{IN} \times (N2 / N1) \times D/(1 - D)$$

where (N2 / N1) is the secondary/primary turns ratio of the transformer, and D is the duty cycle of the pulse-width-modulating (PWM) switching signal.

For a fixed turns ratio, the duty cycle (D), will vary to compensate for the variation in V_{IN} to maintain a constant output voltage.

For example, for (N2 / N1) = 6:1, as V_{IN} varies from +8V to +24V, D will vary from 60% to 33% to keep V_{OUT} constant at -72V.

When the input voltage drops to +5V, the total output power will fall to about 7.2W.

The MAX1856 EV kit switches at 250kHz but can be varied from 100kHz to 500kHz by the internal oscillator in combination with resistor R8 (R_{OSC}). The operating frequency may also be controlled by an external clock at the SYNC/$\overline{SHDN}$ pad. The external source must be a TTL level, and its maximum duty cycle may not exceed 45% for the 100kHz to 500kHz frequency range.

Jumper Selection

Shutdown Mode

The MAX1856 EV kit features a shutdown mode that reduces the MAX1856 quiescent current. The 2-pin jumper (JU1) selects the shutdown mode for the MAX1856. Table 1 lists the selectable jumper options.

Sync Mode

The MAX1856 EV kit features a synchronous mode that enables the operating frequency to be controlled by an external clock. To utilize the sync mode, remove the shunt on jumper JU1, and connect an external frequency source to the SYNC/SHDN pad. Select R8 as:

$$R_8(R_{OSC}) = \frac{1.15 \times 50M\Omega \times kHz}{f_{CLOCK}(kHz)}$$

The external frequency source must be a TTL level and have a 20% to 45% duty cycle.

Table 1. Jumper JU1 Functions

SHUNT LOCATION	SYNC/$\overline{SHDN}$ PIN	MAX1856 OUTPUT
1-2	Connected to VIN	MAX1856 enabled, VOUT1 = -72V, VOUT2 = -24V
None	No external frequency source connected to SYNC/$\overline{SHDN}$ pad	Shutdown mode, VOUT1 = VOUT2 = 0
None	External frequency source* connected to SYNC/$\overline{SHDN}$ pad	MAX1856 enabled, VOUT1 = -72V, VOUT2 = -24V

**External frequency source must have a duty cycle within the 20% to 45% range.*

Evaluating -48V Output

The MAX1856 EV kit's -72V (VOUT1) output may be reconfigured for -48V and supply up to 200mA of current. To configure the -72V (VOUT1) output to -48V, remove diode D1 and install diode D2 (Central Semiconductor CMR1U-02 recommended). Remove capacitor C5 and install capacitor C6 (100pF, 200V). Remove resistor R1 and install resistor R2 (470Ω, 0.5W). Replace resistor R10 with a 196kΩ ±1%, surface-mount (0805) resistor. Remove D3 and R11.

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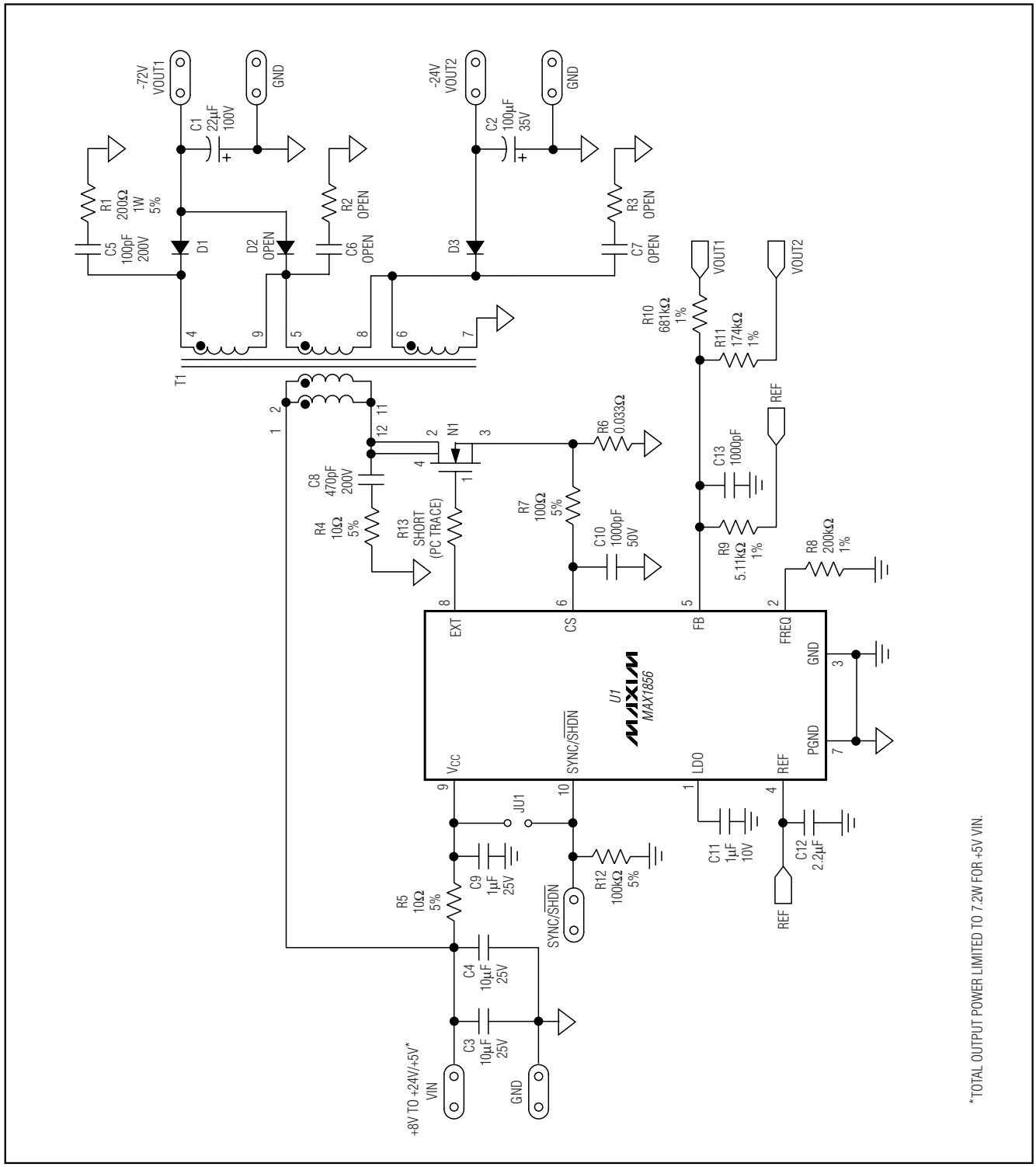


Figure 1. MAX1856 EV Kit Schematic

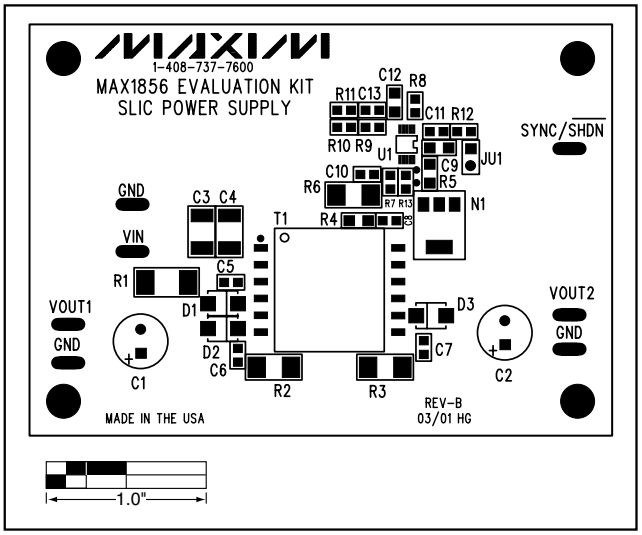


Figure 2. MAX1856 EV Kit Component Placement Guide—Component Side

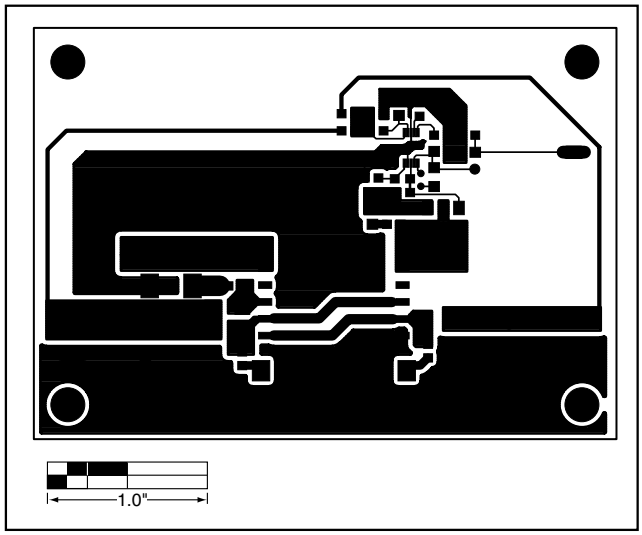


Figure 3. MAX1856 EV Kit PC Board Layout—Component Side

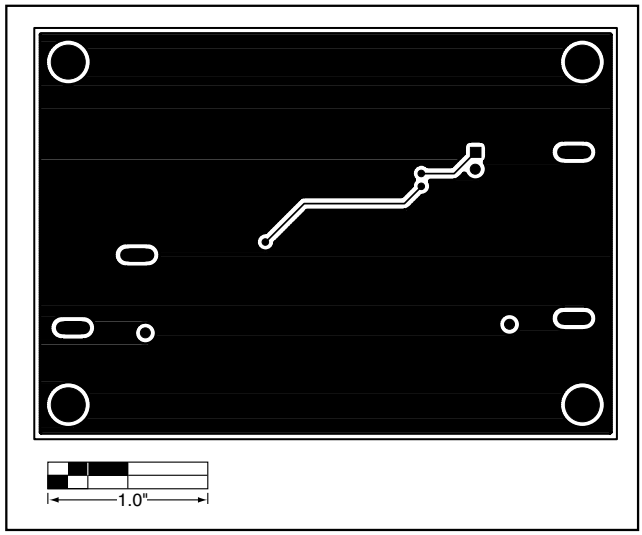


Figure 4. MAX1856 EV Kit PC Board Layout—Solder Side

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