19-1871; Rev 0; 12/00

MAXIM

MAX1747 Evaluation Kit

Evaluates: MAX1747

General Description

The MAX1747 evaluation kit (EV kit) is a fully assembled and tested surface-mount circuit board that contains three charge-pump regulators. The first one is a high-current step-up DC-DC converter and is configured for a +5V output that provides up to 200mA of current. The other two charge pumps are low-current charge pumps that generate positive and negative voltages. A +3.0VDC to +3.6VDC source can be utilized to power the EV kit input.

The low-current negative charge-pump circuit is configured for a -7V output; the low-current positive charge-pump circuit is configured for a +12V output. Both circuits provide up to 20mA of current. The high-current step-up DC-DC converter or the EV kit's input source can be used to power either or both charge pumps.

The MAX1747 EV kit demonstrates an inductorless and low profile (1.1mm max) solution. Operation up to 1.23MHz allows the use of tiny surface-mount components and provides fast transient response.

Features

- **Low-Profile Solution, 1.1mm max Height**
- **Three Charge-Pump Regulators**
  - **+5V Output at 200mA**
  - **+12V Output at 20mA**
  - **-7V Output at 20mA**
- **High-Current Output Regulated to ±1%**
- **Adjustable Outputs**
- **Integrated Power MOSFETs**
- **1µA Shutdown Current**
- **Switching Frequency Up to 1.23MHz**
- **Fast Transient Response**
- **Surface-Mount Components**
- **Fully Assembled and Tested**

Ordering Information

PART	TEMP.RANGE	IC PACKAGE
MAX1747EVKIT	0°C to +70°C	20 TSSOP

Component List

DESIGNATION	QTY	DESCRIPTION
C1, C2, C3, C17	4	4.7µF, 6.3V X7R ceramic capacitors (1210) Taiyo Yuden LMK325BJ475MD
C5, C7, C20, C21, C22	5	1µF, 16V X5R ceramic capacitors (1206) Murata GRM42-6X5R105K016
C6, C8, C14	3	0.47µF, 25V X7R ceramic capacitors (1206) Murata GRM42-6X7R474K025
C9, C11, C12, C15, C16, C19	6	0.1µF, 16V X7R ceramic capacitors (0603) Taiyo Yuden EMK107BJ104KA
C10	1	1500pF, 50V X7R ceramic capacitor (0603) Taiyo Yuden UMK107BJ152KZ
C13	1	0.22µF, 10V X7R ceramic capacitor (0603) Taiyo Yuden LMK107BJ224KA
C4, C18	0	Not installed (1210)

DESIGNATION	QTY	DESCRIPTION
D1–D4	4	200mA, 25V Schottky diodes (SOT23) Fairchild BAT54S
R1	1	150kΩ ±1% resistor (0805)
R2, R4, R6	3	49.9kΩ ±1% resistors (0805)
R3	1	432kΩ ±1% resistor (0805)
R5	1	280kΩ ±1% resistor (0805)
R7	0	Not installed (0805)
R8	1	107kΩ ±1% resistor (0805)
R10	1	1MΩ ±5% resistor (0805)
U1	1	MAX1747EUP (20 TSSOP)
JU1	1	2-pin header
JU2, JU3	2	3-pin headers
None	3	Shunts (JU1, JU2, JU3)
None	1	MAX1747 PC board
None	1	MAX1747 data sheet
None	1	MAX1747 EV kit data sheet

Component Suppliers

SUPPLIER	PHONE	FAX
Fairchild	408-822-2000	408-822-2102
Murata	814-237-1431	814-238-0490
Nihon	661-867-2555	661-867-2698
Taiyo Yuden	408-573-4150	408-573-4159

Note: *Please indicate that you are using the MAX1747 when contacting these component suppliers.*

Quick Start

The MAX1747 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

1) Connect a voltmeter to the VOUT pad.
2) Verify that shunts are present across pins 1 and 2 of jumpers JU2 (SUPN) and JU3 (SUPP). Verify that jumper JU1 ($\overline{SHDN}$) does not have a shunt installed.
3) Connect a +3.0VDC to +3.6VDC power supply to the VIN pad.
4) Connect the supply ground to the GND pad.
5) Turn on the power supply and verify that the high-current step-up DC-DC converter output (VOUT) is +5V.
6) Verify that the low-current negative charge pump output (VN) is -7V.
7) Verify that the low-current positive charge pump output (VP) is +12V.

For instructions on selecting the feedback resistors for other output voltages, see the *Evaluating Other Output Voltages* section. The input voltage range is +3.0V to +3.6V when selecting the output voltage.

Detailed Description

The MAX1747 EV kit contains a high-current step-up DC-DC converter and two low-current charge-pump circuits. The EV kit's voltage input range is from +3.0V to +3.6V as configured, and can be extended to operate in the +2.7V to +5.5V range. The high-current step-up DC-DC converter output voltage can be adjusted from +VIN to +5.5V with resistors.

The low-current negative charge pump provides -7V output; other negative output voltages can be evaluated by replacing two voltage feedback resistors. The output can be adjusted to -8V.

The low-current positive charge pump provides a +12V output (VP); other output voltages can be evaluated by replacing two voltage feedback resistors. The output can be adjusted up to +13V.

Jumper options allow either charge-pump circuit to be fed power from the EV kit's input (VIN) or the high-current step-up DC-DC converter output (VOUT).

The MAX1747 switching frequency is determined by resistor R8 and the voltage supplied to the EV kit input pad (VIN). Applying a voltage in the range of +3.0V to +3.6V to the VIN pad causes the switching frequency to operate in the 980kHz to 1.23MHz range, respectively.

An off-board CMOS or bipolar transistor can control the EV kit's shutdown feature.

Jumper Selection

Shutdown Mode

The MAX1747 EV kit features a shutdown mode that reduces the EV kit's quiescent current to less than 60µA (typ). The two-pin jumper, JU1, selects the shutdown modes for the MAX1747. Table 1 lists the selectable jumper options.

Table 1. Jumper JU1 Functions

SHUNT LOCATION	$\overline{SHDN}$ PIN	OUTPUT
None	Connected to VIN via R8	MAX1747 enabled, operation up to 1.23MHz
Installed	Connected to GND	Shutdown mode, VOUT = 0

A CMOS open-drain or bipolar open-collector transistor can be connected to the EV kit $\overline{SHDN}$ pad and ground to control the shutdown mode. The shunt for jumper JU1 must be removed for this feature to function.

Low-Current Negative Voltage Source

The MAX1747 EV kit features an option to choose which voltage source feeds the low-current negative charge-pump circuit. Jumper JU2 selects the input voltage source for pin SUPN on the MAX1747. Table 2 lists the options.

Table 2. Jumper JU2 Functions

SHUNT LOCATION	SUPN PIN	OPERATING MODE
1, 2	Connected to VOUT	VOUT voltage source feeds low-current negative input
2, 3	Connected to VIN	Input voltage source, VIN feeds low-current negative input

Low-Current Positive Voltage Efficiency

The MAX1747 EV kit features an option to improve the low-current positive charge pump efficiency for low output voltages at VP. Jumper JU3 selects the voltage source for the maximum pump voltage, and thus, maximum efficiency. Table 3 lists the options.

Table 3. Jumper JU3 Functions

SHUNT LOCATION	DIODE D1	OPERATING MODE
1, 2	Connected to VOUT	VP > 10V; VOUT feeds D1
2, 3	Connected to VIN	VP < 10V; VIN feeds D1

Evaluating Other Output Voltages

High-Current Step-Up DC-DC Converter Output Voltages (VOUT)

The MAX1747 EV kit's high-current step-up DC-DC converter output is set to +5V by feedback resistors (R1, R2). To generate output voltages other than +5V, select different external voltage-divider resistors (R1, R2). Refer to *Output Voltage Selection* in the MAX1747 data sheet for instructions on selecting the resistors.

Low-Current Negative Charge-Pump Output Voltages (VN)

The MAX1747 EV kit's low-current negative charge-pump output is set to -7V by feedback resistors (R5, R6). To generate output voltages other than -7V, select different external voltage-divider resistors (R5, R6). Refer to *Output Voltage Selection* in the MAX1747 data sheet for instructions on selecting the resistors. See Table 2 for the jumper selection of input voltage ranges.

Low-Current Positive Charge-Pump Output Voltages (VP)

The MAX1747 EV kit's low-current positive charge-pump output is set to +12V by feedback resistors (R3, R4). To generate output voltages other than +12V, select different external voltage-divider resistors (R3, R4). Refer to *Output Voltage Selection* in the MAX1747 data sheet for instructions on selecting the resistors.

Jumper JU4 is provided to improve the efficiency of the low-current positive charge pump for output voltages under 10V. See Table 3 for the jumper selection of output voltage ranges.

MAX1747 Evaluation Kit

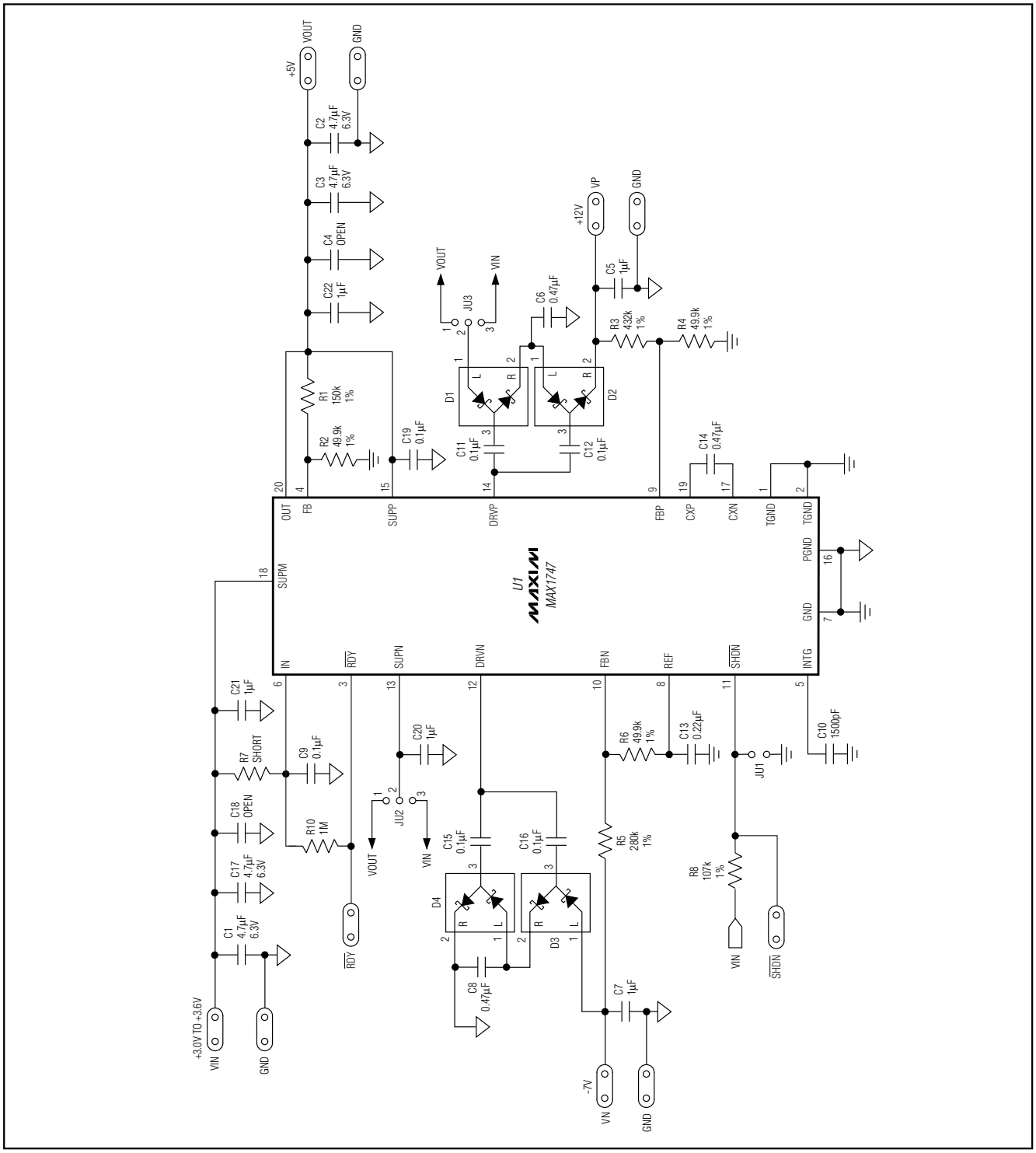

Figure 1. MAX1747 EV Kit Schematic

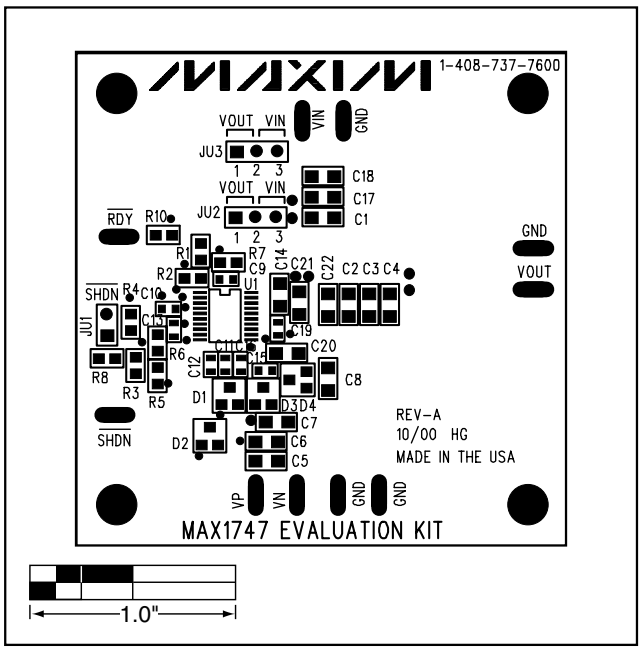

Figure 2. MAX1747 EV Kit Component Placement Guide—Component Side

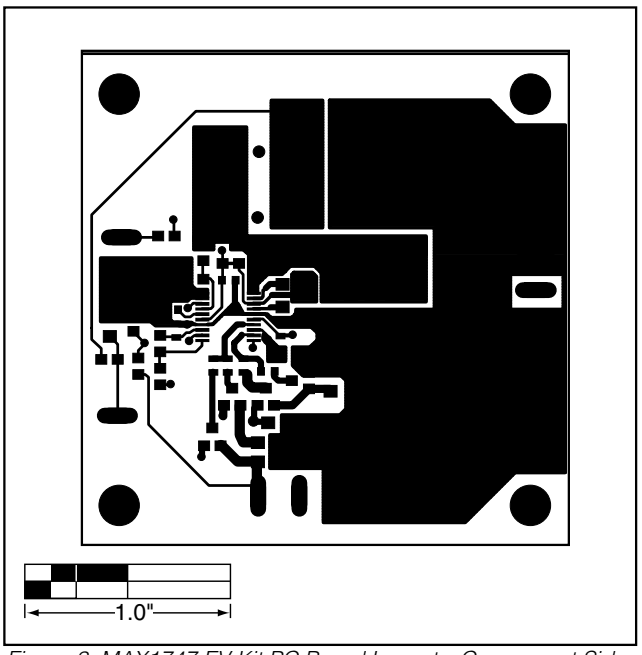

Figure 3. MAX1747 EV Kit PC Board Layout—Component Side

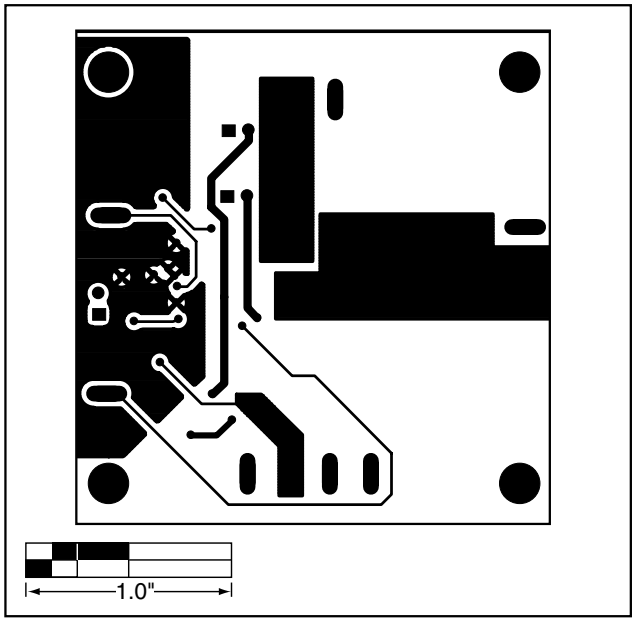

Figure 4. MAX1747 EV Kit PC Board Layout—Solder Side