



MAX8650 Evaluation Kit

General Description

The MAX8650 evaluation kit (EV kit) contains a fully assembled and tested circuit using the MAX8650 synchronous PWM step-down controller. The EV kit is designed to operate at 500kHz from a 10V to 24V input and provide an adjustable 3.3V output at up to 15A. It also allows the evaluation of other output voltages in the 0.7V to 5.5V range.

Features

- ◆ Up to 15A Output Current Capability
- ◆ 10V to 24V Input Voltage Range
- ◆ 3.3V Output Voltage (Adjustable 0.7V to 5.5V)
- ◆ 500kHz Switching Frequency
- ◆ Adjustable Output Overvoltage Protection
- ◆ On-Board Selectable Latch-Off or Automatic Recovery
- ◆ Surface-Mount Construction
- ◆ Fully Assembled and Tested

Ordering Information

PART	TEMP RANGE	IC PACKAGE
MAX8650EVKIT	0°C to +70°C	24 QSOP

Component List

DESIGNATION	QTY	DESCRIPTION
C1, C2, C3	3	10 μ F \pm 20%, 25V X5R ceramic capacitors (1210) TDK C3225X5R1E106M
C4	1	0.01 μ F \pm 20%, 50V X7R ceramic capacitor (0603) TDK C1608X7R1H103M
C5, C6	2	0.1 μ F \pm 20%, 50V X7R ceramic capacitors (0603) TDK C1608X7R1H104M
C7	1	220pF \pm 5%, 50V X7R ceramic capacitor (0603) TDK C1608X7R1H221J
C8, C17	0	Not installed, ceramic capacitors (0603)
C9, C10	2	150 μ F \pm 20%, 4V, 7m Ω low-ESR polymer capacitors (D-case) Panasonic EEFSD0G151R
C11, C14	2	0.47 μ F \pm 20%, 10V X5R ceramic capacitors (0603) TDK C1608X5R1A474M
C12	1	100pF \pm 5%, 50V X7R ceramic capacitor (0603) TDK C1608X7R1H101J
C13	1	4.7 μ F \pm 20%, 10V X5R ceramic capacitor (0603) TDK C1608X5R1A475M

DESIGNATION	QTY	DESCRIPTION
C15, C16	2	1 μ F \pm 20%, 25V X5R ceramic capacitors (0603) TDK C1608X5R1E105M
C18	0	Not installed, electrolytic capacitor (10mm x 12.5mm)
C19	0	Not installed, polymer capacitor (D-case)
D1	1	250mA, 100V switching diode (SOD-123) Central CMHD4448
D2	1	200mA, 40V Schottky diode (SOD-523) Central CMOS-4E
JU1	1	2-pin header
JU2, JU3	2	3-pin headers
L1	1	1.2 μ H, 18A power inductor TOKO FDA1254-1R2M or Cooper HCF1305-1R2
N1	1	n-channel MOSFET (SO-8) Fairchild FDS7296N3
N2	1	n-channel MOSFET (SO-8) Fairchild FDS7088SN3
R1	1	51.1k Ω \pm 1% resistor (0603)
R2	1	100k Ω \pm 5% resistor (0603)

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Component List (continued)

DESIGNATION	QTY	DESCRIPTION
R3, R17	0	Not installed, shorted by PC trace (0603)
R4, R16	0	Not installed, resistors (0603)
R5	1	17.4k Ω \pm 1% resistor (0603)
R6	1	130k Ω \pm 1% resistor (0603)
R7	1	20 Ω \pm 5% resistor (0603)
R8	1	220k Ω \pm 5% resistor (0603)
R9, R11	2	7.5k Ω \pm 1% resistors (0603)

DESIGNATION	QTY	DESCRIPTION
R10, R12	2	28k Ω \pm 1% resistors (0603)
R13	1	39.2k Ω \pm 1% resistor (0603)
R14	1	2.4k Ω \pm 5% resistor (0603)
R15	1	3.9k Ω \pm 5% resistor (0603)
U1	1	MAX8650EEG+ (24-pin QSOP)
—	3	Shunts
—	1	MAX8650 EV kit PC board

Component Suppliers

SUPPLIER	PHONE	WEBSITE
Central Semiconductor	631-435-1110	www.centalsemi.com
Copper	561-752-5000	www.cooperet.com
Fairchild	888-522-5372	www.fairchildsemi.com
Panasonic	714-373-7366	www.panasonic.com
TDK	847-803-6100	www.component.tdk.com
TOKO	847-297-0070	www.tokoam.com

Note: Indicate that you are using the MAX8650 when contacting these component suppliers.

Quick Start

Recommended Equipment

- Power supply capable of supplying 10V to 24V at 6A
- Load (up to 15A)
- Voltmeter

Procedure

The MAX8650 evaluation 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.**

- 1) Verify that there is a shunt across JU1 (REFIN = high, internal reference selected).
- 2) Verify that there is a shunt across JU2 pins 2 and 3 (MODE = low, automatic recovery current limit selected).
- 3) Verify that there is a shunt across JU3 pins 1 and 2 (EN = high, output enabled).

- 4) Connect a voltmeter and load (if any) from OUT to GND closest to the OUT pads.
- 5) Connect a 10V to 24V supply to the pads marked PIN and GND closest to the PIN pads.
- 6) Turn on the power supply and verify that the output voltage is 3.3V.

Detailed Description

Enable/Shutdown Selection

Jumper JU3 enables or disables the MAX8650. See Table 1 for JU3 settings.

Table 1. JU3 Settings (EN)

SHUNT LOCATION	MAX8650 OUTPUT
Pin 1-2 (default)	Enabled, $V_{OUT} = 3.3V$
Pin 2-3	Disabled (shutdown mode)

Current-Limit Operating Mode Selection

JU2 selects between automatic recovery current-limit and latch-off current-limit modes. To restart the EV kit after it latches off, cycle the input supply off then on. Refer to the MAX8650 IC data sheet for details of valley current limit and MODE operation. See Table 2 for JU2 settings.

Table 2. JU2 Settings (MODE)

SHUNT LOCATION	CURRENT-LIMIT MODE
Pin 2-3 (default)	Autorecovery mode
Pin 1-2	Latch-off mode

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Reference Input

JU1 provides the options to set the MAX8650 with an internal or an external reference. See Table 3 for JU1 settings.

Table 3. JU1 Settings (REFIN)

SHUNT LOCATION	REFIN PIN
Installed (default)	Connected to AVL, internal reference.
Not installed	Connected to REF_IN pad through a 20Ω resistor, external reference (connect the external reference signal to REF_IN pad).

POK

POK is an open-drain output on the MAX8650 that monitors the output voltage. When the output is above 92% of its nominal regulation voltage, POK is high impedance. When the output drops below 89% of its nominal regulation voltage, POK is pulled low. POK is also pulled low when the MAX8650 is shut down. To allow POK to be used as a logic-level output, a 100kΩ pullup resistor from POK to AVL is included in the EV kit.

EX_VL

The default setting of the MAX8650 EV kit accepts a 10V to 24V voltage input source. The MAX8650 operates from 4.8V to 28V input. Install a 220μF/35V electrolytic capacitor at C18 for input voltage from 25V to 28V. To

use an external VL, cut open the short on R17. To reduce the power dissipation at high input voltages, an external source can provide the high-side gate-drive current through the EX_VL pad with a voltage source from 4.5V to 6.5V with the R17 trace cut open.

Output Voltage

The default output voltage is set at 3.3V. To set the output voltage other than 3.3V, select R9 between 8kΩ and 14kΩ, then calculate R10 with the following equation:

$$R10 = R9 \times (V_{OUT} / V_{FB} - 1)$$

where V_{FB} is 0.7V.

Refer to the MAX8650 data sheet for selecting output inductor, capacitors, and compensation components for optimized performance. If using OVP, make the OVP setting match the new output voltage.

Frequency Setting and External Synchronization

The switching frequency of the EV kit is set to 500kHz. To change the operating frequency, change the value for R1. Refer to the *Switching Frequency and Synchronization* section in the MAX8650 IC data sheet. Recalculate the input and output filter values as well as new compensation values. When using an external synchronization, connect the external clock to FSX pad. If the signal is present at start, R1 and D1 can be eliminated, replace D1 with a short.

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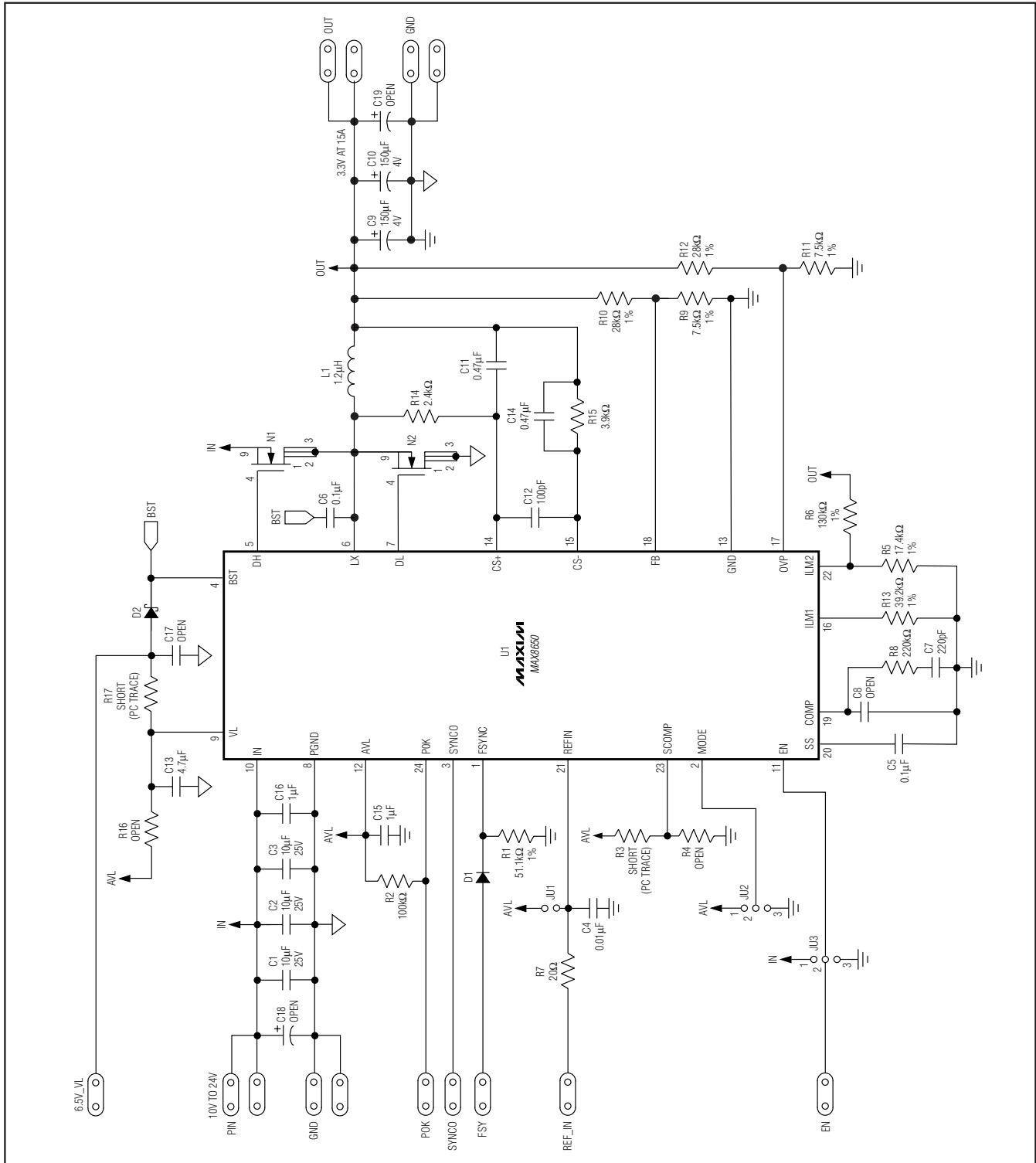


Figure 1. MAX8650 EV Kit Schematic

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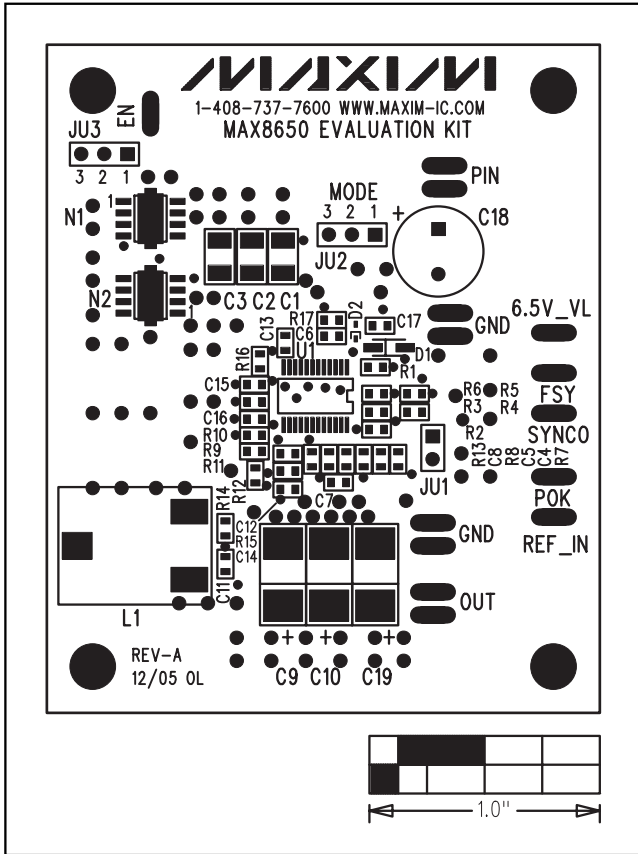


Figure 2. MAX8650 EV Kit Component Placement Guide—Component Side

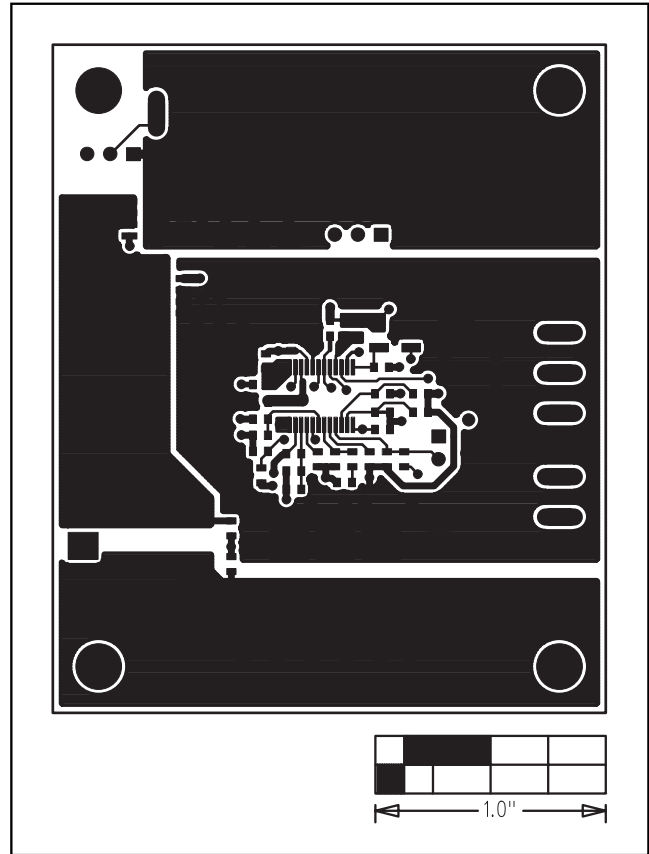


Figure 3. MAX8650 EV Kit PC Board Layout—Component Side

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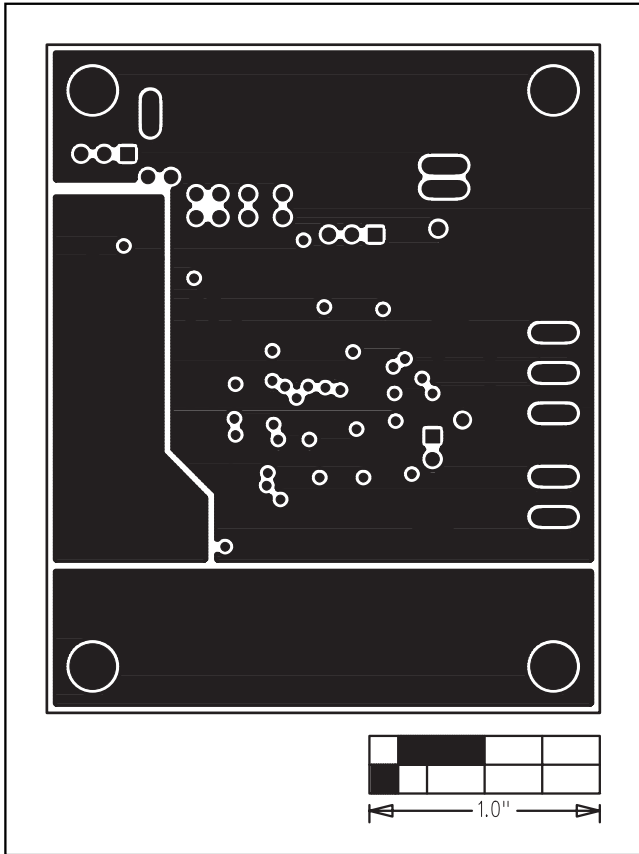


Figure 4. MAX8650 EV Kit PC Board Layout—Layer 2

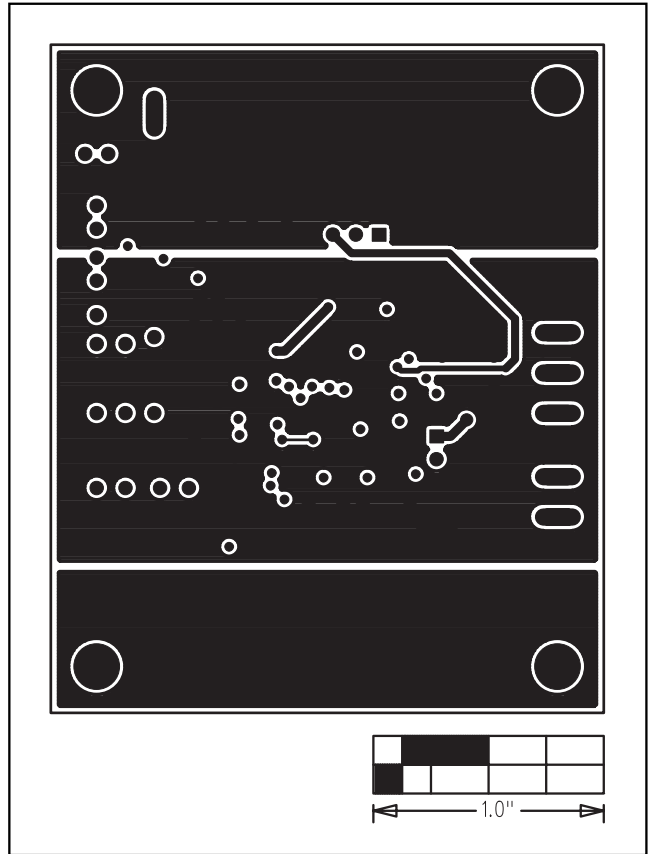


Figure 5. MAX8650 EV Kit PC Board Layout—Layer 3

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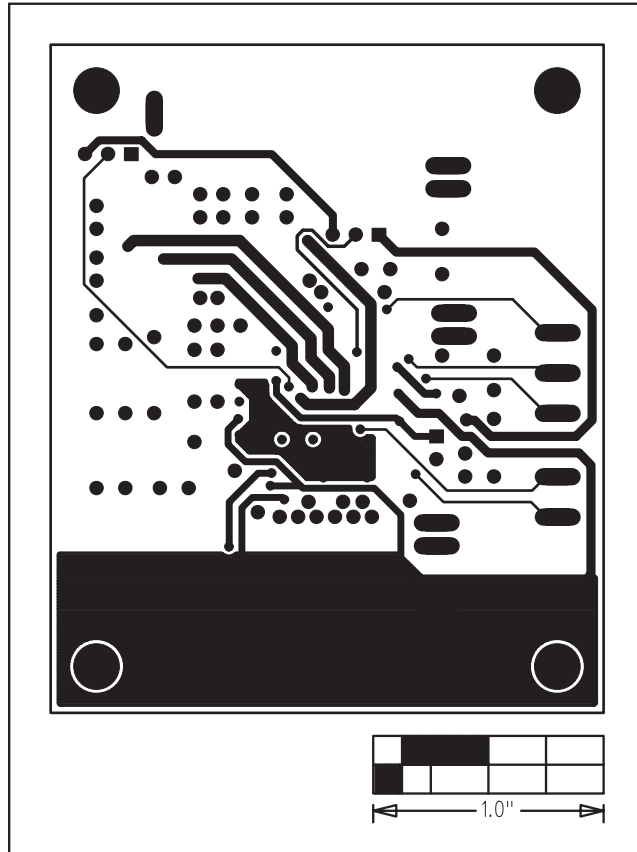


Figure 6. MAX8650 EV Kit PC Board Layout—Solder Side

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