19-1816; Rev 0; 10/00

MAXIM

MAX1757/MAX1758 Evaluation Kits

Evaluate: MAX1757/MAX1758

General Description

The MAX1757/MAX1758 evaluation kits (EV kits) are assembled and tested PC boards that implement a step-down, switching lithium-ion (Li+) battery charger. The MAX1757 EV kit can be set to charge 1- to 3-series cells, and the MAX1758 EV kit can be set to charge 1- to 4-series cells. The cell voltage can be set between 4.0V and 4.4V using standard 1% resistors while maintaining 1% overall regulation voltage accuracy. Three LEDs indicate the charging status.

The MAX1757/MAX1758 EV kits detect faulty cells and terminate charging. Two capacitors are used to set the charge termination, prequalification, and fault timeout periods. A user-supplied thermistor may be connected to either EV kit to monitor battery temperature and suspend charging for over-/undertemperature conditions.

Features

- **Complete Li+ Charging Solution up to 3-Series Cells (MAX1757) and 4-Series Cells (MAX1758)**
- **1.5A Battery-Charging Current**
- **Low Heat/High Efficiency**
- **300kHz PWM Operation**
- **Up to 14V Input Voltage Range (MAX1757)**
- **Up to 28V Input Voltage Range (MAX1758)**
- **28-Pin SSOP Package**
- **Surface-Mount Construction**
- **Fully Assembled and Tested**

Ordering Information

PART	IC PACKAGE
MAX1757EVKIT	28 SSOP
MAX1758EVKIT	28 SSOP

Component List

DESIGNATION	QTY	DESCRIPTION
C1, C2, C3, C7, C14, C17, C18	7	0.1µF, 50V X7R ceramic capacitors (0805) Murata GRM40-034X7R104K050 or Taiyo Yuden UMK212BJ104KG
C4	1	1µF, 10V X7R ceramic capacitor Taiyo Yuden LMK212BJ105MG or Murata GRM40X7R105K10
C5, C6, C19	3	1000pF, 50V X7R ceramic capacitors
C8, C9	2	0.1µF, 50V X7R ceramic capacitors (1206)
C10, C11	2	22µF, 35V, 0.300Ω, low-ESR tantalum capacitors AVX TPSE226M035R0300 or Kemet T495X226M035AS
C12	1	0.22µF, 50V X7R ceramic capacitor Taiyo Yuden UMK316BJ224ML
C13	1	4.7µF, 10V X5R ceramic capacitor Taiyo Yuden LMK316BJ475ML or Murata GRM42-6X5R475K10
C15	1	68µF, 20V, 0.150Ω, low-ESR tantalum capacitor AVX TPSE686M020R0150

DESIGNATION	QTY	DESCRIPTION
D1, D3	2	Diodes, 1N4148-type Fairchild MMSD4148, Vishay Liteon/Diodes, Inc. 1N4148W, or General Semiconductor 1N4148W
D2, D4	2	Schottky diodes, 3A, 30V Nihon EC31QS03L or Vishay Liteon/Diodes, Inc. B330A
JU1	1	2-pin header
JU2	1	3-pin header
JU3	1	3-pin header (MAX1757 EV kit)
		4-pin header (MAX1758 EV kit)
L1	1	22µH, 2.5A inductor Sumida CDRH104R-220NC
LED1, LED2	2	Light-emitting diodes (green), T1
LED3	1	Light-emitting diode (red), T1
R1	1	0.05Ω ±1%, 0.5W sense resistor Dale WSL-2010-R050F or IRC LRC-LR2010-01-R050-F
R2, R12	2	10kΩ ±5% resistors
R3–R6	0	Not installed
R7, R8	2	100kΩ ±1% resistors
R9, R10, R11	3	1kΩ ±5% resistors
R13, R14	2	4.7Ω ±5% resistors
U1	1	MAX1757EAI (MAX1757 EV kit)
		MAX1758EAI (MAX1758 EV kit)

Quick Start

The MAX1757/MAX1758 EV kits are fully assembled and tested surface-mount boards. Follow the steps below to verify board operation. **Do not turn on the power supply until all connections are completed. Observe all precautions on the battery manufacturer's data sheet. Use only lithium-ion (Li+) cells with this charger:**

1) Set jumper JU3 to indicate the number of cells in the battery pack (Table 1).
2) Place a shunt on jumper JU1 to disable the temperature monitoring functions.
3) Place a shunt across pins 1–2 on JU2 to enable the MAX1757 or MAX1758.
4) For the MAX1757, connect a +7VDC to +14VDC power supply with sufficient power rating across the VIN and GND pads.

   For the MAX1758, connect a +7VDC to +28VDC power supply with sufficient power rating across the VIN and GND pads.
5) Connect a lithium-ion (Li+) battery pack between the BATT+ and BATT- pads.
6) Turn on the power supply.
7) Verify that LEDs 1, 2, and 3 indicate the correct charging status.

Detailed Description

When battery charging is initiated, the charger enters the prequalification state. In this state, the batteries are charged at 1/10 of the programmed current limit while the charger measures the battery to determine if it can be charged. If the battery voltage is above 2.5V per cell, charging begins. At this time, the batteries are charged at a constant current (fast-charge state) or a constant voltage (full-charge state). The charger exits the full-charge state and enters the top-off state once the battery current drops to 10% of the fast-charge current, or the fast-charge timer expires. The charger remains in the top-off state for 45 minutes, after which charging is terminated.

Once charging is terminated, if the battery voltage drops 5% from the fully charged voltage, charging automatically restarts.

If at any time during charging, the thermistor input senses a temperature below 0°C or above +50°C, charging suspends until the temperature returns to a safe level. This kit is shipped with a 10kΩ resistor to disable the temperature monitoring function. If temperature monitoring is required, connect the appropriate thermistor (see *Jumper Selection* section).

If the charger is unable to enter the fast-charge or full-charge states, charging is terminated and the fault LED (red) lights to indicate a faulty battery.

For more information on the operation of the MAX1757 or MAX1758, refer to the *Detailed Description* sections of the MAX1757 and MAX1758 data sheets.

Charging Status

The three LEDs on the EV kit indicate the charging status:

- LED1 (FULL) indicates that the battery pack is being charged with a constant voltage.
- LED2 (FAST) indicates that the battery pack is being charged with a constant current.
- LED3 (FAULT) indicates that charging terminated abnormally.

Charging Current

The voltage at the ISETOUT pin sets the charging current to the battery. The MAX1757/MAX1758 EV kits are shipped with ISETOUT connected to REF. This sets the charging current to the full-scale value of 1.5A.

To change the charging current to a lower value, cut the trace shorting the two pads of R3 and install resistors for R3 and R4. Use the equations below to calculate the resistor values:

$$I_{CHG} = (R4 / (R3 + R4)) \times 1.5A$$

$$R3 = ((1.5A / I_{CHG}) - 1) \times R4$$

Use 100kΩ for R4.

Input Current

The input current limit is set by sense resistor R1 and by the voltage applied to the ISETIN pin. This sets the input current limit to 2A (100mV/50mΩ). The MAX1757/MAX1758 EV kits are shipped with ISETIN connected to REF and a 50mΩ sense resistor.

To change the input current limit to a lower value, cut the trace shorting the two pads of R5 and install resistors for R5 and R6. Use the equations below to calculate the resistor values:

$$I_{IN} = (R6 / (R5 + R6)) \times 2A$$

$$R5 = ((2A / I_{IN}) - 1) \times R6$$

Use 100kΩ for R6.

To further increase the input current limit, reduce the value of sense resistor R1.

Table 1. Jumper Selection

JUMPER	JUMPER POSITION	FUNCTION
JU1	Open	Open before connecting a thermistor from THERM to GND pads.
	Closed*	Bypasses THERM with a 10kΩ resistor.
JU2	1–2*	$\overline{SHDN}$ = high. MAX1757/MAX1758 enabled.
	2–3	$\overline{SHDN}$ = low. MAX1757/MAX1758 disabled.
	Open	Drive $\overline{SHDN}$ pad with an external signal.
JU3	1–2*	CELL = GND. Cell count = 1.
	1–3	CELL = VL. Cell count = 4. (MAX1758 only)
	1–4	CELL = REF. Cell count = 3.
	Open	CELL = Float. Cell count = 2.

** Default position*

Component Suppliers

SUPPLIER	PHONE	FAX
AVX	803-946-0690	803-626-3123
BC Components	803-772-2500	
Dale-Vishay	402-564-3131	402-563-6418
Fairchild	408-822-2000	408-822-2102
General Semiconductor	631-847-3000	631-847-3236
International Resistive Co. (IRC)	310-322-3331	310-322-3332
Kemet	408-986-0424	408-986-1442
Murata	814-237-1431	814-238-0490
Nihon	661-867-2555	661-867-2698
Sumida	847-956-0666	847-956-0702
Taiyo Yuden	408-573-4150	408-573-4159
Vishay Liteon/Diodes, Inc.	805-446-4800	805-446-4850

Note: *Please indicate that you are using the MAX1757 or MAX1758 when contacting these manufacturers.*

Jumper Selection

Jumper JU1 connects the thermistor input (THERM) to GND through a 10kΩ resistor, disabling temperature qualification. To enable temperature qualification (charging between 0°C and +50°C), remove the shunt from JU1 and connect a thermistor (BC Components part # 2322-640-63103 or equivalent) to the THERM and GND pads. For more information, refer to the MAX1757 and MAX1758 data sheets.

The EV kits can be placed in shutdown mode using jumper JU2. (See Table 1 for jumper settings.)

Jumper JU3 selects the number of series cells to be charged. (See Table 1 for jumper settings.)

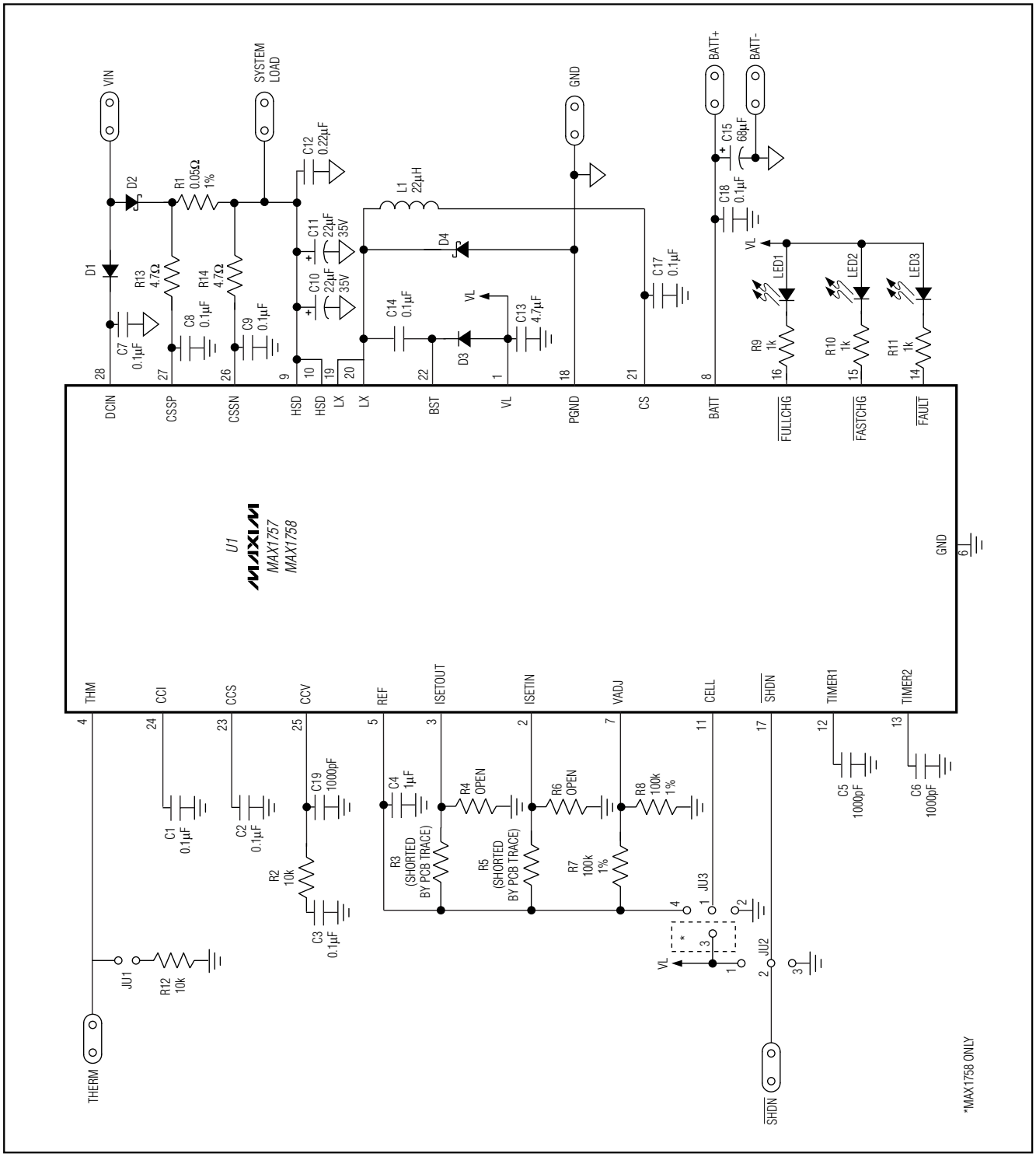

Figure 1. MAX1757/MAX1758 EV Kit Schematic

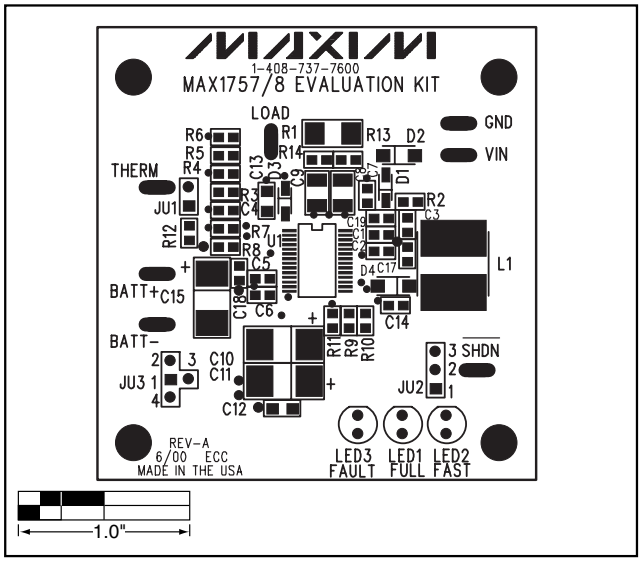

Figure 2. MAX1757/MAX1758 EV Kit Component Placement Guide—Component Side

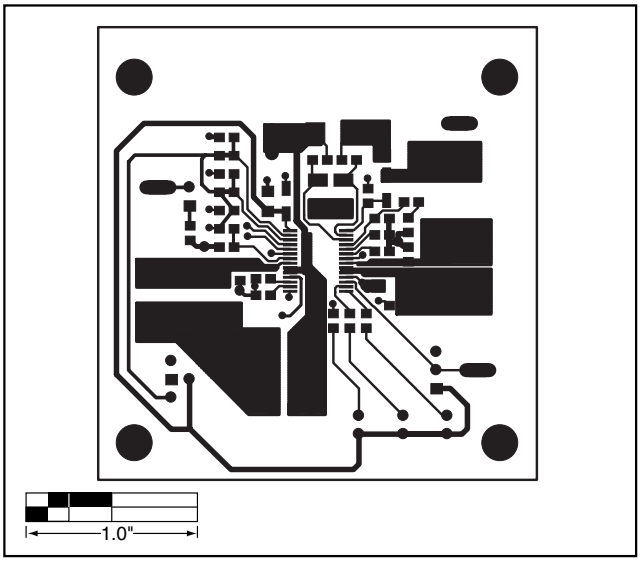

Figure 3. MAX1757/MAX1758 EV Kit PC Board Layout—Component Side

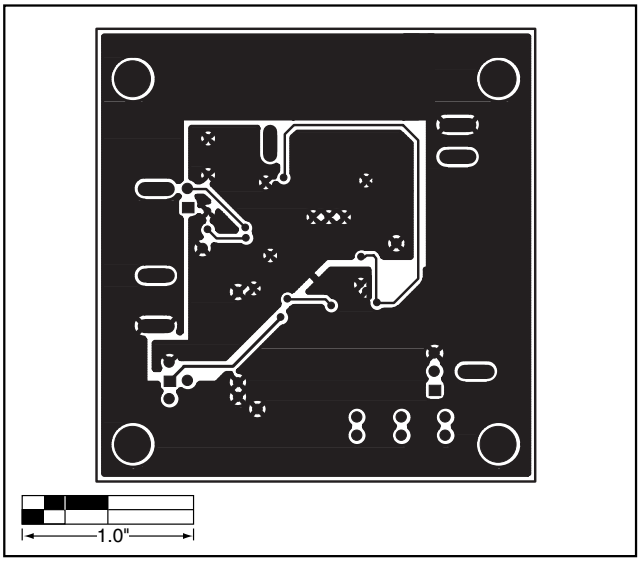

Figure 4. MAX1757/MAX1758 EV Kit PC Board Layout—Solder Side

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