MAX15091/MAX15091A Evaluation Kits

Evaluate: MAX15091/MAX15091A

General Description

The MAX15091 evaluation kit (EV kit) provides a proven design to evaluate the MAX15091 hot-swap controller with an integrated 9A MOSFET. The EV kit is configured to pass 9A in a 2.7V to 18V hot-swap application, thus providing a fully integrated solution. The EV kit uses the MAX15091ETI+ in a 5mm x 5mm, 28-pin TQFN package with a proven four-layer PCB design. As configured, the MAX15091 EV kit is optimized to operate at 12V.

The MAX15091A EV kit can be used to evaluate the MAX15091A and uses the MAX15091AETI+.

Ordering Information **appears at end of data sheet.**

Features

- 2.7V to 18V Operating Voltage Range
- 9A (typ) Configurable Load Current Capability
- Banana Jacks for Input and Output Voltage
- Programmable Slew-Rate Control
- Selectable/Configurable Circuit-Breaker Threshold
- Configurable Overvoltage/Undervoltage Lockout
- Programmable Time-Out Delay
- $\overline{\text{FAULT}}$ and PG Outputs
- Defined Safe Operation Area
- Proven PCB Layout
- Fully Assembled and Tested

Component List

DESIGNATION	QTY	DESCRIPTION
C1, C2	2	1µF ±10%, 25V X7R ceramic capacitors (0603) Murata GRM188R71E105K TDK C1608X5R1E105M
C3	1	5600pF ±10%, 50V X7R ceramic capacitor (0603) Murata GRM188R71H562K TDK C1608C0G1H562J
C4	1	0.047µF ±10%, 25V X7R ceramic capacitor (0603) Murata GRM188R71E473K TDK C1608X7R1E473K
C5	1	0.22µF ±10%, 25V X7R ceramic capacitor (0603) Murata GRM188R71E224K TDK C1608X7R1E224K
C6–C11	6	10µF ±10%, 25V X7R ceramic capacitors (1206) Murata GRM31CR71E106K TDK C3216X5R1E106M
C12	0	Not installed, ceramic capacitor (1206)
C13	0	Not installed, electrolytic capacitor (D = 11mm)
C14	0	Not installed, ceramic capacitor (0805)
CDLY, GATE, GDRV, REG, UV, VCC	6	Red test points
D1	1	18V, 600W transient voltage suppressor (SMB) Fairchild SMBJ18A
D2	0	Not installed, Schottky diode (SMA)
D3	0	Not installed, Schottky diode (SOD523)
GND (x2), IN, OUT	4	Banana jacks
JU1	1	3-pin header
JU2	1	2-pin header
Q1	1	30V, 94A n-channel MOSFET (DPAK) IRF IRLR8113TRPBF
R1	1	178kΩ ±1% resistor (0603)
R2	1	5.23kΩ ±1% resistor (0603)
R3	1	17.8kΩ ±1% resistor (0603)
R4	1	10Ω ±5% resistor (0603)
R5	1	24.9kΩ ±1% resistor (0603)

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Component List (continued)

DESIGNATION	QTY	DESCRIPTION
R6	1	1.62kΩ ±1% resistor (0603)
R7–R9	3	100kΩ ±5% resistors (0603)
R10	1	49.9Ω ±1% resistor (0603)
R11	1	50kΩ potentiometer
R12	1	0Ω resistor (0603)
R13	0	Not installed, resistor (1206)

DESIGNATION	QTY	DESCRIPTION
U1	1	9A hot-swap solution (28 TQFN) Maxim MAX15091ETI+ or Maxim MAX15091AETI+
U2	1	General-purpose timer (8 SO) Maxim ICM7555ISA
—	2	Shunts
—	1	PCB: MAX15091 EVKIT

Component Suppliers

SUPPLIER	PHONE	WEBSITE
Fairchild Semiconductor	888-522-5372	www.fairchildsemi.com
Murata Electronics North America, Inc.	770-436-1300	www.murata-northamerica.com
STMicroelectronics	408-452-8585	www.us.st.com
TDK Corp.	847-803-6100	www.component.tdk.com

Note: *Indicate that you are using the MAX15091 when contacting these component suppliers.*

Quick Start

Required Equipment

- MAX15091 EV kit
- 12V, 9A DC power supply
- Voltmeter

Procedure

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

1) Verify that a shunt is installed across pins 1-2 on jumper JU1.
2) Turn on the power supply and set the supply to 12V, then disable the power supply.
3) Connect the positive terminal of the power supply to the IN banana jack on the EV kit. Connect the negative terminal of the power supply to the GND banana jack.
4) Enable the power supply.
5) Verify that the voltage between the OUT and GND banana jacks is 12V.
6) Verify that the internal regulator voltage (REG) is 3.3V.
7) The EV kit is now ready for additional evaluation.

Detailed Description of Hardware

The MAX15091 EV kit provides a proven design to evaluate the MAX15091. The EV kit can be conveniently connected between the system power and the load using the banana jacks provided for the input and output. PCB pads are provided to monitor and control the device signals. The EV kits operate between 2.7V and 18V up to 9A load current capability.

Evaluating the MAX15091A

The MAX15091A EV kit can be used to evaluate the MAX15091A, with the MAX15091AETI+ installed. The MAX15091A is pin-to-pin compatible with the MAX15091. Refer to the MAX15091/MAX15091A IC data sheet for details on the MAX15091A.

Circuit Breaker (CB)

Jumper JU1 sets the current limit for the internal circuit breaker (CB) of the device. The CB pin can be connected to a fixed resistor (R5) or a potentiometer (R11) to set the current limit. See Table 1 for shunt positions.

The circuit-breaker threshold can be set according to the following formula:

$$I_{CB} = R_{CB} \times 0.36$$

where I_{CB} is in A and R_{CB} (the resistor between CB and ground) is in kΩ.

Table 1. JU1 Jumper Selection (CB)

SHUNT POSITION	CB PIN CONNECTED TO	CURRENT LIMIT
1-2*	R5	9A
2-3	R11	Adjustable

**Default position.*

Table 2. JU2 Jumper Selection ($\overline{EN}$)

SHUNT POSITION	$\overline{EN}$ PIN	TIME-OUT DELAY
Installed	Forced to GND	Bypassed
Not installed*	Set low when C5 is charged to 2/3 x OUT; timing is set by R7/C5	47ms (set by C4)

**Default position.*

Setting Time-Out Delay for $\overline{EN}$ (CDLY)

Capacitor C4 is used to set the time-out delay for $\overline{EN}$ to go low to prevent internal MOSFET shutdown after power-up. This is set at a rate of 1s/µF. The EV kit is configured for a 47ms time-out delay.

Delayed $\overline{EN}$

The IC's $\overline{EN}$ pin must be pulled low before the time-out delay set by capacitor C4 elapses. The EV kit provides a simple timer circuit comprised of U2, R7, and C5 to pull the $\overline{EN}$ pin low before the time-out delay. Once PG asserts as open-drain, R7 begins to charge C5 to the output voltage (OUT). When C5 charges to 2/3 x OUT, U2 pulls the $\overline{EN}$ pin low. The EV kit is configured to have $\overline{EN}$ pulled low after ~22ms.

Jumper JU2 is also provided to bypass the time-out delay and force $\overline{EN}$ low, if installed. See Table 2 for JU2 settings.

Setting the Output Slew Rate

An external capacitor (C3) is connected from GATE to GND on the IC to reduce the output slew rate during startup. During startup, a 5.7µA (typ) current is sourced to enhance the internal MOSFET with 10V/ms (typ). C3 can be calculated according to the following formula:

$$C3 = (I_{GATE} \times \Delta t)/\Delta V_{GATE}$$

where I_{GATE} is 5.7µA (typ), Δt is the desired slew rate, and ΔV_{GATE} is the voltage at the gate of the internal MOSFET at turn-on.

Undervoltage Lockout

The EV kit provides an option to configure the undervoltage-lockout threshold. The undervoltage-lockout threshold for the device is configured by the IN voltage level divided by R1 and (R2 + R3) at the UV pin. By default, the undervoltage-lockout threshold is set to 10.8V.

Overvoltage Lockout

The EV kit provides an option to configure the overvoltage-lockout threshold. The overvoltage-lockout threshold for the device is configured by the IN voltage level divided by (R1 + R2) and R3 at the OV pin. By default, the overvoltage-lockout threshold is set to 13.2V.

Current-Sense Output (ISENSE)

The IC's ISENSE pin is the output of an accurate current-sense amplifier and provides a source current proportional to the load current flowing into the main switch. The factory-trimmed current ratio is set to 170µA/A. On the EV kit, this allows producing a scaled voltage by routing resistor R6 from ISENSE to GND. This voltage signal then goes to an ADC and provides digitized information of the current supplied to the powered system.

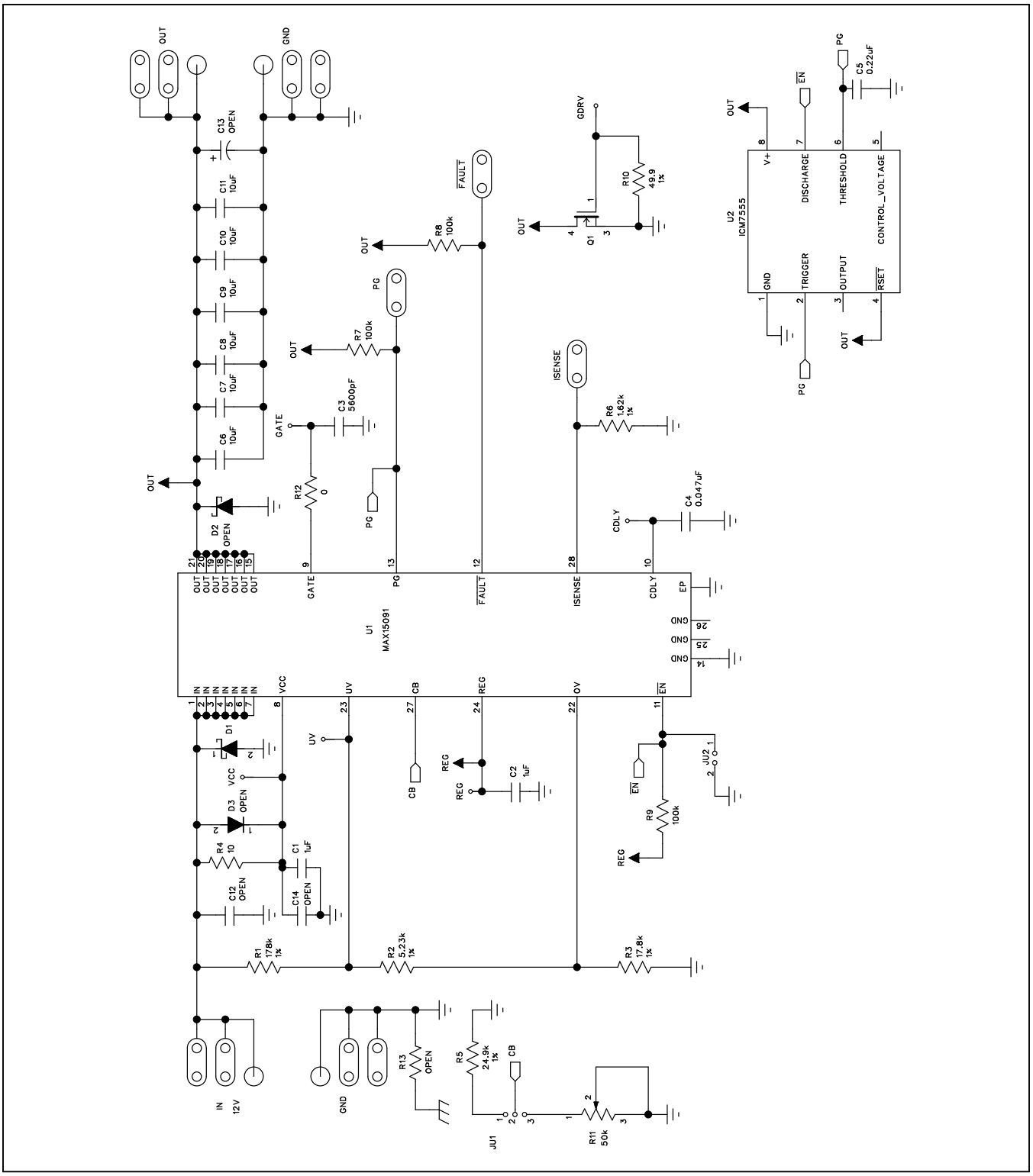

Figure 1. MAX15091 EV Kit Schematic

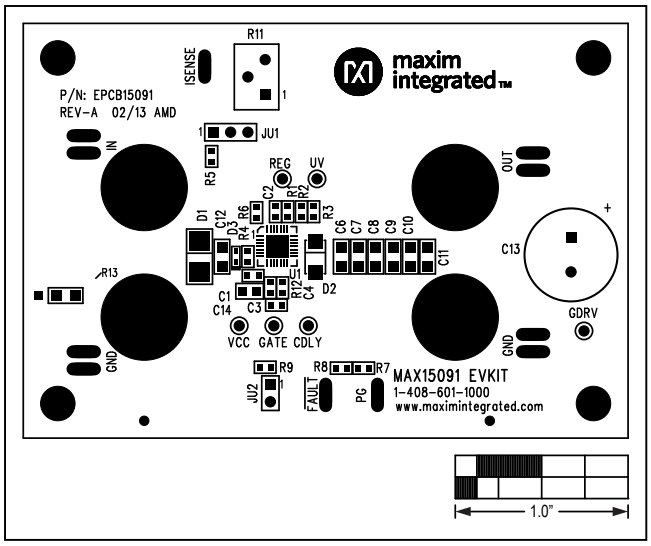

Figure 2. MAX15091 EV Kit Component Placement Guide—Component Side

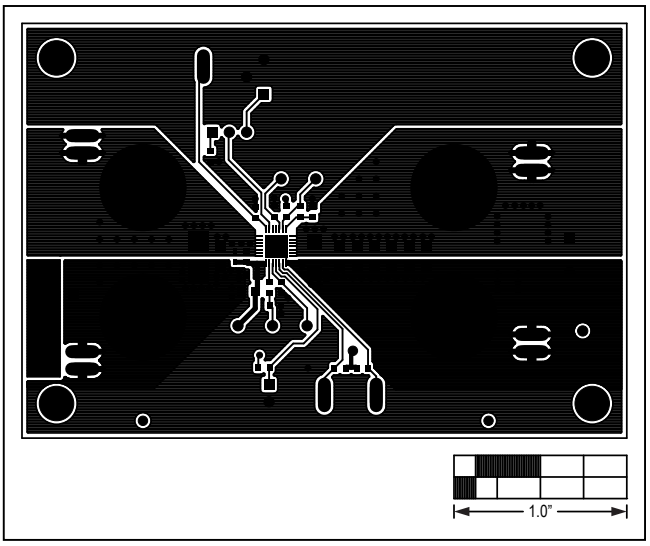

Figure 3. MAX15091 EV Kit PCB Layout—Component Side

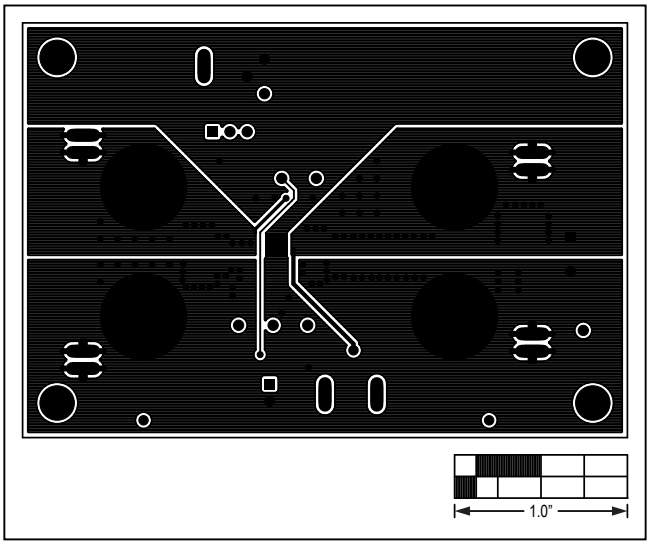

Figure 4. MAX15091 EV Kit PCB Layout— Layer 2 (PWR/GND)

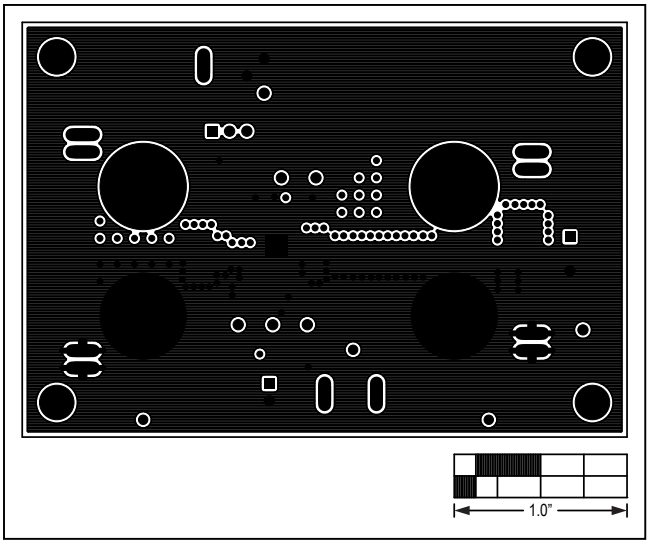

Figure 5. MAX15091 EV Kit PCB Layout—Layer 3 (GND)

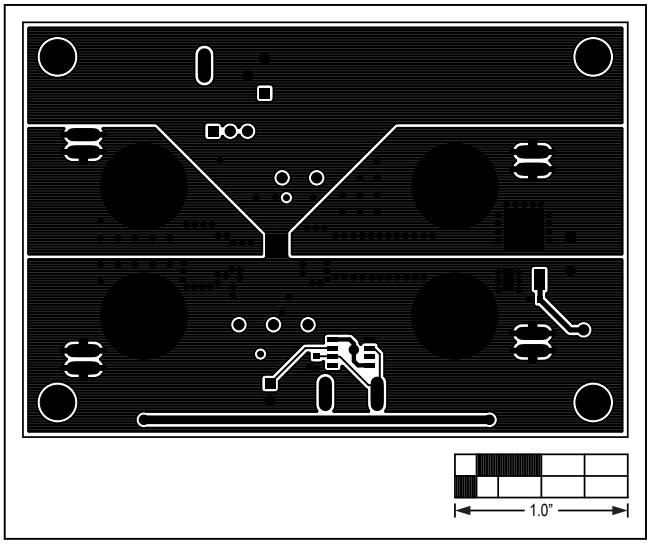

Figure 6. MAX15091 EV Kit PCB Layout—Solder Side

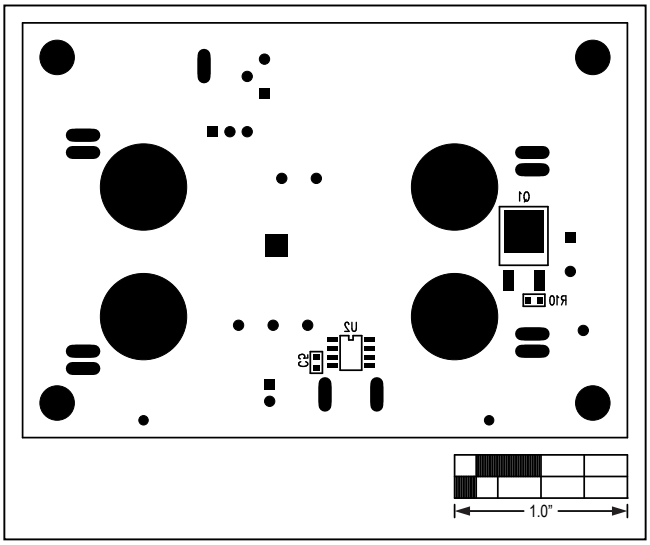

Figure 7. MAX15091 EV Kit Component Placement Guide—Solder Side

Ordering Information

PART	TYPE
MAX15091EVKIT#	EV Kit
MAX15091AEVKIT#*	EV Kit

#Denotes RoHS compliant.
**Future product—contact factory for availability.*

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	3/13	Initial release	—