Evaluates: MAX38890 3.0V Back-Up Voltage Application

MAX38890A Evaluation Kit

General Description

The MAX38890A evaluation kit (EV kit) evaluates the MAX38890 supercapacitor backup regulator, which is designed to transfer power between a supercapacitor and a system supply rail. When the main battery is present and the system voltage is above the minimum system voltage for charging, the MAX38890 charges the supercapacitor with a maximum average current of 2.5A.

Once the supercapacitor is charged, the circuit draws only 4µA of current while it maintains the supercapacitor in its ready state. When the main battery is removed, the MAX38890 draws power from the supercapacitor and regulates the system voltage to the set backup voltage with a programmed maximum peak inductor current of 5A. The MAX38890 is externally programmable for maximum supercapacitor voltage, system backup voltage, peak charging, and backup inductor currents.

Features

- 2.5V to 5.5V System Output Voltage Range
- 0.5V to 5.5V Supercapacitor Voltage Range
- Maximum 5A Peak Inductor Current Limit for Charging and Backup Modes
- Resistor Adjustable VSYS, VCAP Voltages
- Resistor Adjustable Charging and Backup Currents
- Proven Two-Layer, 2oz Copper PCB Layout
- Demonstrates Compact Solution Size
- Fully Assembled and Tested

MAX38890A EV Kit Files

FILE	DESCRIPTION
MAX38890A EV BOM	EV Kit Bill of Materials
MAX38890A EV PCB Layout	EV Kit Layout
MAX38890A EV Schematic	EV Kit Schematic

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

Quick Start

Required Equipment

- One MAX38890A EV kit
- One 6V, 5A DC power supply
- Two digital multimeters (DMM)

Procedure

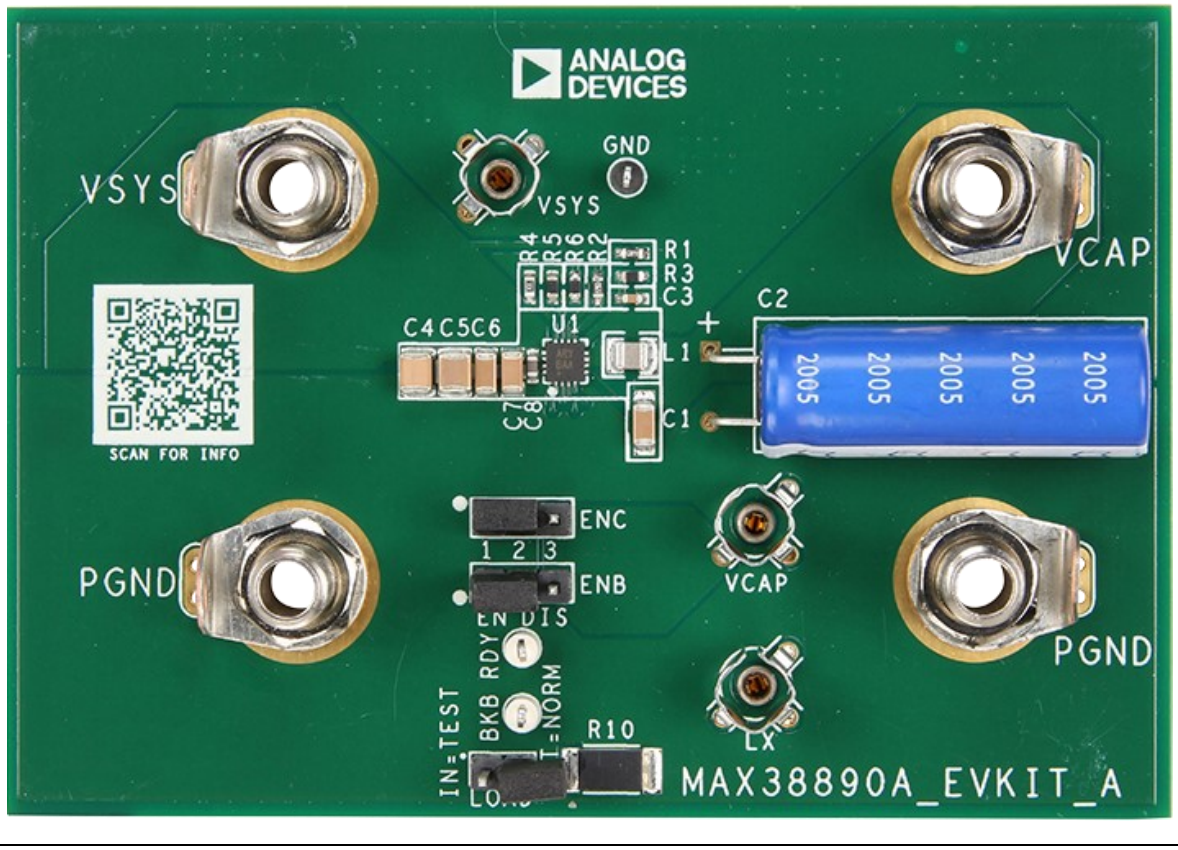
The EV kit is fully assembled and tested. Use the following steps to verify board operation.

Caution: Do not turn on the power supply until all connections are completed.

1. Verify that a shunt is installed onto pins 1 and 2 jumper ENC (charging enabled).
2. Verify that a shunt is installed onto pins 1 and 2 jumper ENB (backup enabled).
3. Verify that jumper LOAD is opened (No load is connected across VSYS and PGND).
4. Set the power supply output to 3.4V and disable the power supply.
5. Connect the power supply between the VSYS and PGND terminal posts.
6. Connect the first DMM between the VSYS and PGND terminal posts.
7. Connect the other DMM between the VCAP and PGND terminal posts.
8. Enable the power supply and verify that the supercapacitor voltage at VCAP is ramping up and settles to 2.7V.
9. Disable and disconnect the power supply from the VSYS and PGND terminal posts.
10. Verify that VSYS regulates to 3V, and the supercapacitor starts to discharge.
11. Install the shunt to jumper LOAD (This connects a 4.02Ω load across VSYS and PGND).
12. Verify that VSYS regulates to 3V while VCAP is ramping down to approximately 0.85V as the supercapacitor is discharging.
13. Verify that VSYS is 0V when VCAP drops below 0.85V.

319-100951; Rev 0; 11/22

MAX38890A EV Kit Photo



Detailed Description of Hardware

The MAX38890A EV kit provides a flexible circuit to evaluate the supercapacitor backup regulator. External components allow a wide range of system and supercapacitor voltages as well as charging and discharging currents.

Charger Enable Input (ENC)

The MAX38890A EV kit provides a jumper (ENC) to enable or disable the supercapacitor charging of the MAX38890, when VSYS is above the charging threshold. See *Table 1* for ENC jumper settings.

Table 1. ENC

SHUNT POSITION	DESCRIPTION
1-2*	EN = VSYS. Supercapacitor Charging Enabled
2-3	EN = PGND. Supercapacitor Charging Disabled

**Default position.*

System Backup Enable (ENB)

The MAX38890A EV kit provides a jumper (ENB) to enable or disable the MAX38890 system backup while VSYS drops below the backup threshold. See *Table 2* for ENB jumper settings.

Table 2. ENB

SHUNT POSITION	DESCRIPTION
1-2*	EN = VSYS. Backup Mode Enabled
2-3	EN = PGND. Backup Mode Disabled

**Default position.*

VSYS Load (LOAD)

The MAX38890A EV kit provides a jumper (LOAD) to connect a 4.02Ω resistive load across VSYS and PGND to simulate a supercapacitor discharging scenario during the test. See *Table 3* for LOAD jumper settings.

Table 3. LOAD

SHUNT POSITION	DESCRIPTION
1-2	A 4.02Ω resistive load is connected across VSYS and PGND
Any 1 pin only*	A 4.02Ω resistive load is not connected across VSYS and PGND

**Default position.*

Charge Mode

When the main battery is present, and the system voltage is above the minimum system voltage for charging, the MAX38890 charges the supercapacitor up to 2.7V with an average current of 2.5A.

Ready Mode

The MAX38890A EV kit maximum supercapacitor voltage is set to 2.7V by resistors R1, R2, and R3 with V_{FBCH} = 0.5V. Once the supercapacitor is charged to the set maximum charge voltage of 2.7V, the MAX38890 consumes only 4µA current. The MAX38890A EV kit provides an RDY test point to monitor the supercapacitor charge status. The RDY test point will be high when the voltage of the FBCR pin crosses the FBCR threshold (V_{TH_FBCR} = 0.5V) set by R1, R2, and R3. In this EV kit, the VCAP at which RDY goes high is 1.5V. Similarly, when the supercapacitor provides backup, the RDY flag goes low when the supercapacitor discharges below 1.5V.

Discharge (Backup) Mode

When the main battery is removed and V_{FBS} drops to 1.2V, the MAX38890 draws power from the supercapacitor and regulates the VSYS to the set backup voltage. The backup voltage is set to 3V by resistors R5 and R6 with V_{FBS} = 1.2V.

The MAX38890AEVKIT# EV kit provides a BKB test point to monitor the system backup status. BKB is pulled low when the system is backing up (the supercapacitor is discharging) and pulled high when the system is charging or in an idle state.

Charge/Backup Current Configuration

The MAX38890A EV kit provides a resistor R4 to configure the charge/backup peak inductor current.

The peak inductor current is set by resistor R4 connecting between the ISET and GND pins.

$$\text{Peak charging current } (I_{LX\_CHG}) = 5A \text{ x } (\frac{20K\Omega}{R4})$$

$$\text{Peak backup current } (I_{LX\_BU}) = 5A \text{ x } (\frac{20K\Omega}{R4})$$

Set R4 to 20kΩ to set inductor peak current limit as 5A.

Ordering Information

PART	TYPE
MAX38890AEVKIT#	EV Kit

#Denotes RoHS-compliance.

Component Suppliers

SUPPLIER	WEBSITE
AVX	www.avx.com
Kemet	www.kemet.com
Murata/TOKO	www.murata.com
Wurth Electronics	www.we-online.com

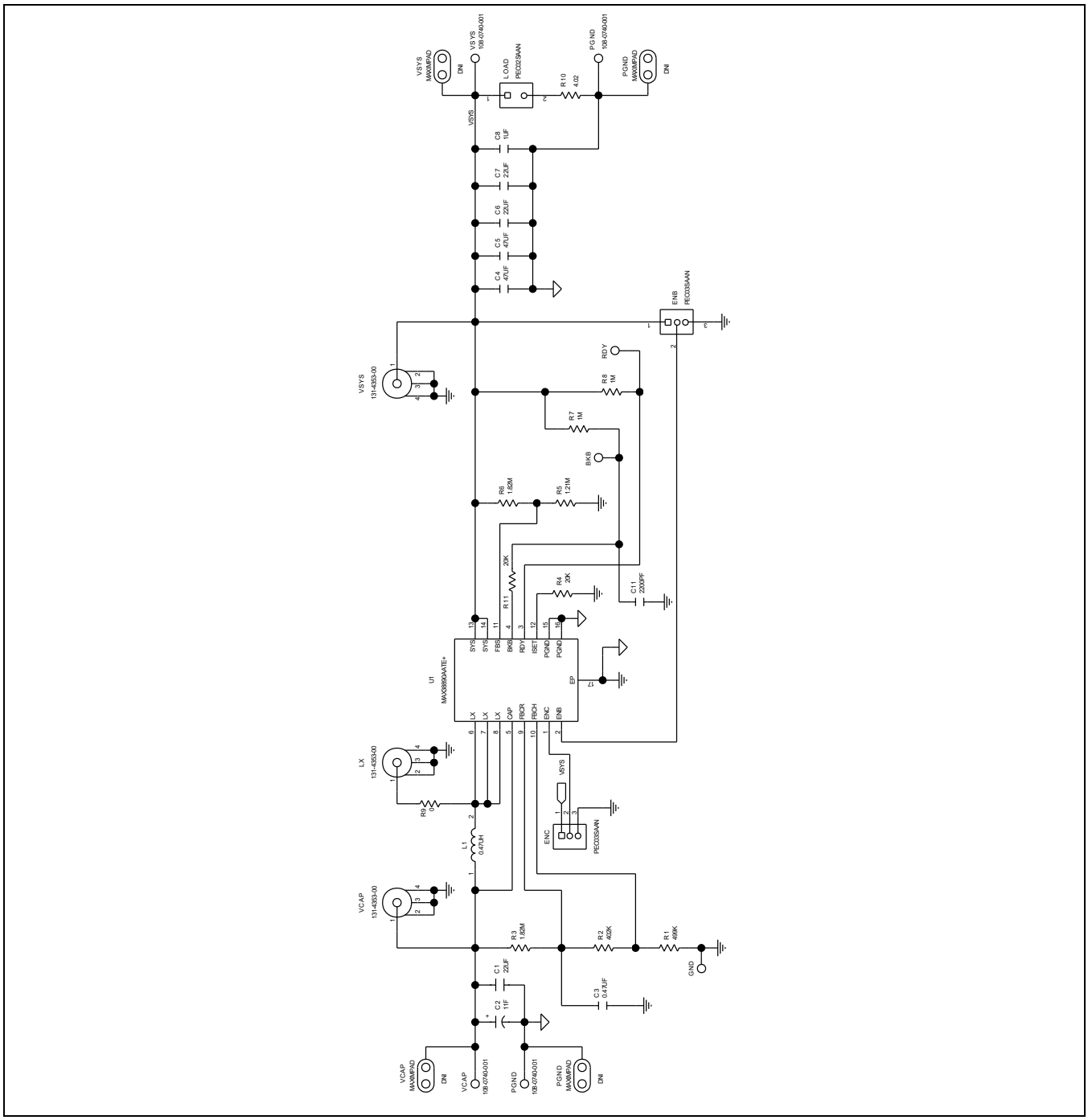
Note: *Indicate that you are using the MAX38890A when contacting these component suppliers.*

MAX38890A EV Kit Bill of Materials

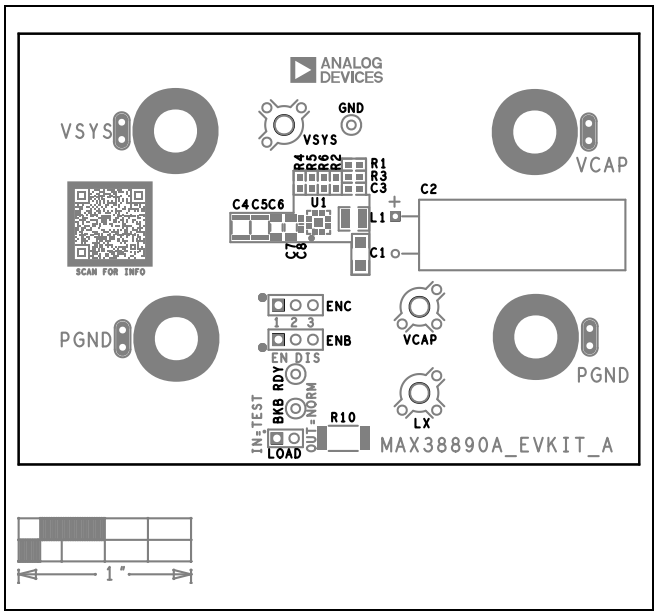
ITEM	REF_DES	QTY	VALUE	DESCRIPTION	MFG PART #	MANUFACTURER
1	BKB, RDY	2	N/A	TEST POINT; PIN DIA=0.1IN; TOTAL LENGTH=0.3IN; BOARD HOLE=0.04IN; WHITE; PHOSPHOR BRONZE WIRE SILVER;	5002	KEYSTONE
2	C1, C6, C7	3	22µF	CAP; SMT (1206); 22µF; 10%; 10V; X7R; CERAMIC	GCM31CR71A226KE02	MURATA
3	C2	1	11F	CAP; THROUGH HOLE-RADIAL LEAD; 11F; +30%/-10%; 2.7V; ALUMINUM-ELECTROLYTIC;	SCCS30B116SRBA1	AVX
4	C3	1	0.47µF	CAP; SMT (0603); 0.47µF; 10%; 16V; X7R; CERAMIC	C0603C474K4RAC; GRM188R71C474K; EMK107B7474KA; C1608X7R1C474K080AC	KEMET; MURATA; TAIYO YUDEN; TDK
5	C4, C5	2	47µF	CAP; SMT (1210); 47uF; 10%; 10V; X7R; CERAMIC	GRM32ER71A476KE15	MURATA
6	C8	1	1µF	CAP; SMT (0603); 1µF; 10%; 16V; X7R; CERAMIC	C0603C105K4RAC; C1608X7R1C105K080AC; EMK107B7105KA; CGA3E1X7R1C105K080AC ; 0603YC105KAT2A	KEMET; MURATA; TDK; TAIYO YUDEN; TDK; AVX
7	C11	1	2200pF	CAP; SMT (0603); 2200pF; 10%; 100V; X7R; CERAMIC	C0603C222K1RAC	KEMET
8	ENB, ENC	2	PEC03SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 3PINS	PEC03SAAN	SULLINS
9	GND	1	N/A	TEST POINT; PIN DIA=0.1IN; TOTAL LENGTH=0.3IN; BOARD HOLE=0.04IN; BLACK; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;	5001	KEYSTONE
10	L1	1	0.47µH	INDUCTOR; SMT (1008); METAL; 0.47µH; 20%; 4.9A	DFE252012F-R47M	MURATA
11	LOAD	1	PEC02SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 2PINS	PEC02SAAN	SULLINS
12	LX, VCAP, VSYS	3	131-4353-00	CONNECTOR; WIREMOUNT; CIRCUIT BOARD TEST POINT MINIATURE PROBE; STRAIGHT; 4PINS	131-4353-00	TEKTRONICS
13	PGND, TP1-TP3	4	108-0740-001	CONNECTOR; MALE; PANELMOUNT; BANANA JACK; STRAIGHT; 1PIN	108-0740-001	EMERSON NETWORK POWER
14	R1	1	499kΩ	RES; SMT (0603); 499kΩ; 1%; +/-100PPM/DEGC; 0.1000W	CRCW0603499KFK; ERJ-3EKF4993; RC0603FR-07499KL	VISHAY DALE; PANASONIC; YAGEO

15	R2	1	402kΩ	RES; SMT (0603); 402kΩ; 1%; +/-100PPM/DEGC; 0.1000W	CRCW06034023FK; ERJ-3EKF4023	VISHAY; PANASONIC
16	R3, R6	2	1.82MΩ	RES; SMT (0603); 1.82MΩ; 1%; +/-100PPM/DEGK; 0.1000W	CRCW06031M82FK	VISHAY
17	R4, R11	2	20kΩ	RES; SMT (0603); 20kΩ; 1%; +/-100PPM/DEGC; 0.1000W	MCR03EZPFX2002; ERJ-3EKF2002; CR0603-FX-2002ELF; CRCW060320K0FK	ROHM; PANASONIC; BOURNS; VISHAY DALE
18	R5	1	1.21MΩ	RES; SMT (0603); 1.21MΩ; 1%; +/-100PPM/DEGK; 0.1000W	CRCW06031M21FK	VISHAY
19	R7, R8	2	1MΩ	RES; SMT (0603); 1MΩ; 5%; +/-200PPM/DEGC; 0.1000W	CRCW06031M00JN	VISHAY DALE
20	R9	1	0Ω	RES; SMT (0603); 0Ω; JUMPER; JUMPER; 0.1000W	CRCW06030000Z0	VISHAY DALE
21	R10	1	4.02Ω	RES; SMT (2512); 4.02Ω; 1%; +/-200PPM/DEGK; 1W	CRCW25124R02FN	VISHAY DALE
22	SU1-SU3	3	SX1100-B	TEST POINT; JUMPER; STR; TOTAL LENGTH=0.24IN; BLACK; INSULATION=PBT; PHOSPHOR BRONZE CONTACT=GOLD PLATED	S1100-B; SX1100-B; STC02SYAN	KYCON; KYCON; SULLINS ELECTRONICS CORP.
23	U1	1	MAX38890AATE+	IC; REG; REVERSIBLE BUCK/BOOST REGULATOR; TQFN16-EP	MAX38890AATE+	ANALOG DEVICES
24	PCB	1	PCB	PCB:MAX38890A	MAX38890A	ANALOG DEVICES
25	J2-J5	0	MAXIMPAD	EVK KIT PARTS; MAXIM PAD; WIRE; NATURAL; SOLID; WEICO WIRE; SOFT DRAWN BUS TYPE-S; 20AWG	9020 BUSS	WEICO WIRE
TOTAL		39				

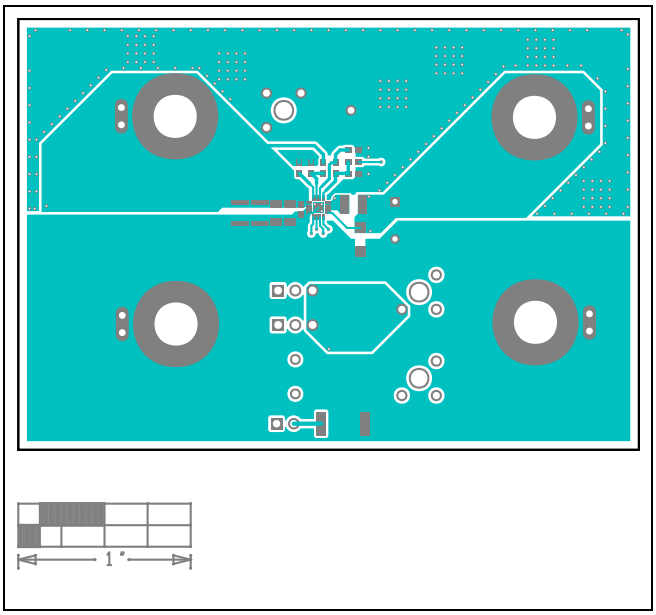
MAX38890A EV Kit Schematic



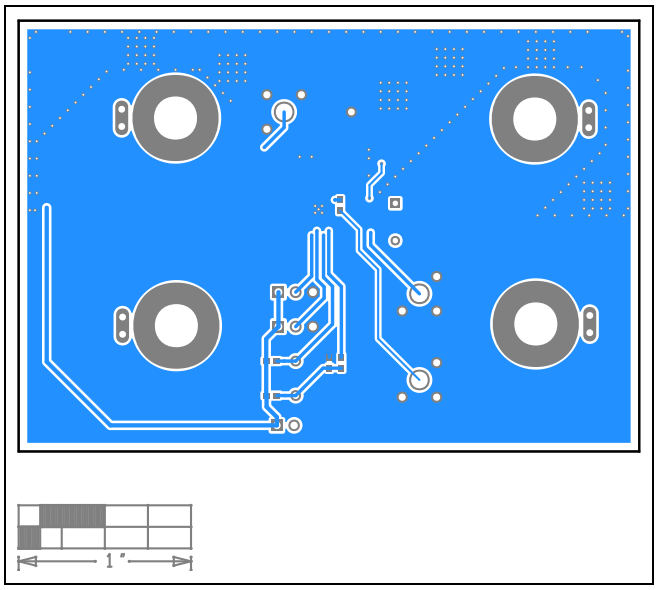
MAX38890A EV Kit PCB Layouts



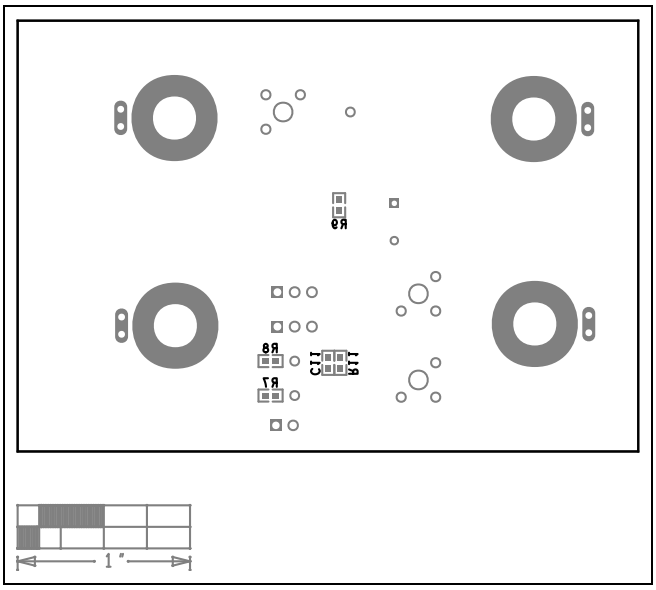
MAX38890A EV Kit Component Placement Guide—Top Silkscreen



MAX38890A EV Kit PCB Layout—Top



MAX38890A EV Kit PCB Layout—Bottom



MAX38890A EV Kit Component Placement Guide—Bottom Silkscreen

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	11/22	Release for Market Intro	—