

MAX38888 Evaluation Kit

Evaluates: MAX38888

General Description

The MAX38888 evaluation kit (EV kit) evaluates the MAX38888 IC. The MAX38888 is a super cap backup regulator designed to transfer power between a super cap and a system supply rail. When the main battery is present and above the minimum system supply voltage, the regulator charges the super cap at up to a 500mA rate. Once the super cap is charged, the circuit draws only 2.5µA of current while it maintains the super cap in its ready state. When the main battery is removed, the regulator prevents the system from dropping below the minimum operating voltage, discharging the super cap at up to a 2.5A rate. The MAX38888 is externally programmable for minimum and maximum super cap voltage, minimum system voltage, and maximum charge and discharge currents. The internal DC/DC converter requires only a 1µH inductor.

Features

- 2.99V to 3.36V System Output Voltage Range
- 1.42V to 2.71V Super Cap Voltage Range
- 2.5A Peak Discharge Current
- Resistor Adjustable Voltage and Current Thresholds
- Proven 2-Layer 2oz Copper PCB Layout
- Demonstrates Compact Solution Size
- Fully Assemble and Tested

MAX38888 EV Kit Files

| FILE | DESCRIPTION |
|------------------------|-------------------------|
| MAX38888 EV BOM | EV Kit Bill of Material |
| MAX38888 EV PCB Layout | EV Kit Layout |
| MAX38888 EV Schematic | EV Kit Schematic |

Ordering Information appears at end of data sheet.

Quick Start

Required Equipment

- MAX38888 EV kit
- 5V, 3A DC power supply
- One digital multimeter (DMM)

Procedure

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

- 1) Verify that a shunt is installed onto pins 1 and 2 jumper JU1 (EV kit enabled).
- 2) Verify that jumper JU2 is opened (No load is connected across VSYS and PGND).
- 3) Set the power supply output to 3.4V and disable the power supply.
- 4) Connect the power supply between the VSYS and PGND terminal posts.
- 5) Connect the DMM between the VSC and PGND terminal posts.
- 6) Enable the power supply and verify that super cap voltage at VSC is ramping up and stops at about 2.7V.
- 7) Disable and disconnect the power supply from the VSYS and PGND terminal posts.
- 8) Verify that VSYS drops to about 3V, and VSC drops to about 2.5V.
- 9) Install jumper JU2 (This connects a 51Ω load across VSYS and PGND).
- 10) Verify that VSYS remains at 3V while VSC is ramping down toward 1.5V.
- 11) Verify that VSYS is 0V when VSC drops below 1.5V.

Detailed Description of Hardware

The MAX38888 EV kit provides a flexible circuit to evaluate the super cap backup regulator. External components allow a wide range of system and super cap voltages as well as charging and discharging currents.

EN

The MAX38888 EV kit provides a jumper (JU1) to enable or disable the MAX38888. Refer to [Table 1](#) for JU1 jumper settings.

VSYS Load

The MAX38888 EV kit provides a jumper (JU2) to connect a 51Ω resistive load across VSYS and PGND to simulate a discharging scenario during test. Refer to [Table 2](#) for JU2 jumper settings.

Charge Mode

When the main battery is present and is above the minimum system supply voltage, the regulator charges the super cap at up to a 500mA rate. The MAX38888 EV Kit minimum system supply voltage is set to 3.36V, by resistors R5 and R6 with $V_{FBS} = 0.56V$.

Table 1. EN (JU1)

| JU1 SHUNT POSITION | DESCRIPTION |
|--------------------|--|
| 1-2* | Enabled. EN = VSYS |
| 2-3 | Disabled. EN = PGND |
| Not Installed | Enabled. EN = VSYS (through resistor R9) |

*Default position.

Table 2. VSYS Load (JU2)

| JU2 SHUNT POSITION | DESCRIPTION |
|--------------------|---|
| Installed | Test Mode: A 51Ω resistive load is connected across VSYS and PGND |
| Not Installed* | Normal Operating Mode |

*Default position.

Ready Mode

Once the super cap is charged to its maximum voltage, 2.7V, the circuit draws only 2.5μA of current while it maintains the super cap in its ready state. The MAX38888 EV Kit maximum super cap voltage is set to 2.7V, by resistors R1, R2, and R3 with $V_{FBCH} = 0.5V$,

Discharge Mode

When the main battery is removed, the regulator discharges the super cap at up to a 2.5A rate to prevent the system from dropping below the minimum operating voltage. The MAX38888 EV kit minimum operating voltage is set to 2.99V, by resistors R5 and R6 with $V_{FBS} = 0.5V$.

Preserve Mode

As the super cap is discharged toward its minimum voltage, 1.42V, the MAX38888 disconnects all circuitry from the super cap and draws only 2.5μA of current to preserve the remaining capacity for keeping alive the real-time clock, memory, or other low-level function. The MAX38888 EV Kit minimum super cap voltage is set to 1.42V, by resistors R1, R2, and R3 with $V_{FBCL} = 0.475V$.

Charge/Discharge Current Configuration

The MAX38888 EV Kit provides a resistor R4 to configure the charge/discharge current rate for the super cap.

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

$$I_{DISCHARGE} = 2.5A \times (20k\Omega/R4)$$

The super cap charging current is internally set to 1/5 of the discharge current.

$$I_{CHARGE} = 0.5A \times (20k\Omega/R4)$$

Choose a value of R4 between 20kΩ to 100kΩ to ensure accurate current compliance.

MAX38888 EV Kit Bill of Materials

| ITEM | REF_DES | DNI/DNP | QTY | MFG PART # | MANUFACTURER | VALUE | DESCRIPTION |
|-------|---------------|---------|-----|---|--|--------------|--|
| 1 | BKUPB, RDY | — | 2 | 5002 | KEystone | N/A | TEST POINT; PIN DIA = 0.1IN; TOTAL LENGTH = 0.3IN; BOARD HOLE = 0.04IN; WHITE; PHOSPHOR BRONZE WIRE SILVER; |
| 2 | C1 | — | 1 | GRM31CR71A226ME15 | MURATA | 22UF | CAPACITOR; SMT (1206); CERAMIC CHIP; 22UF; 10V; TOL = 20%; TG = -55°C TO +125°C; TC = X7R |
| 3 | C2 | — | 1 | SCCS30B116SRBA1 | AVX | 11F | CAP; THROUGH HOLE-RADIAL LEAD; 11F; +30%/-10%; 2.7V; ALUMINUM-ELECTROLYTIC ; |
| 4 | C3 | — | 1 | C0805C226M9PAC; GRM21BR60J226ME39; JMK212BJ226MG; CL21A226MQCLQN | KEMET;MURATA; TAIYO YUDEX; SAMSUNG ELECTRO-MECHANICS | 22UF | CAPACITOR; SMT (0805); CERAMIC CHIP; 22UF; 6.3V; TOL = 20%; TG = -55°C TO +125°C; TC = X5R |
| 5 | GND | — | 1 | 5001 | KEystone | N/A | TEST POINT; PIN DIA = 0.1IN; TOTAL LENGTH = 0.3IN; BOARD HOLE = 0.04IN; BLACK; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH; |
| 6 | JU1 | — | 1 | PEC03SAAN | SULLINS | PEC03SAAN | CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 3PINS |
| 7 | JU2 | — | 1 | PEC02SAAN | SULLINS | PEC02SAAN | CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 2PINS |
| 8 | L1 | — | 1 | 74437324010 | WURTH ELECTRONICS INC | 1UH | INDUCTOR; SMT; SHIELDED; 1UH; 20%; 5.00A |
| 9 | LX, VSC, VSYS | — | 3 | 131-4353-00 | TEKTRONICS | 131-4353-00 | CONNECTOR; WIREMOUNT; CIRCUIT BOARD TEST POINT MINIATURE PROBE; STRAIGHT; 4PINS |
| 10 | PGND, TP1-TP3 | — | 4 | 108-0740-001 | EMERSON NETWORK POWER | 108-0740-001 | CONNECTOR; MALE; PANELMOUNT; BANANA JACK; STRAIGHT; 1PIN |
| 11 | R1, R5 | — | 2 | CRCW0603499KFK | VISHAY DALE | 499K | RESISTOR; 0603; 499KΩ; 1%; 100PPM; 0.1W; THICK FILM |
| 12 | R2 | — | 1 | CRCW06034023FK | VISHAY DALE | 402K | RESISTOR; 0603; 402KΩ; 1%; 100PPM; 0.10W; THICK FILM |
| 13 | R3 | — | 1 | CRCW06031M80FK | VISHAY DALE | 1.8M | RESISTOR; 0603; 1.8MΩ; 1%; 100PPM; 0.10W; THICK FILM |
| 14 | R4 | — | 1 | MCR03EZPFX2002; ERJ-3EKF2002; CR0603-FX-2002ELF | ROHM;PANASONIC;BOURNS | 20K | RESISTOR; 0603; 20KΩ; 1%; 100PPM; 0.10W; THICK FILM |
| 15 | R6 | — | 1 | RMCF0603FT2M49 | STACKPOLE ELECTRONICS INC. | 2.49M | RES; SMT (0603); 2.49M; 1%; ±200PPM/DEGC; 0.10W |
| 16 | R7, R8 | — | 2 | CHPHT0603K1002FGT | VISHAY SFERNICE | 10K | RESISTOR; 0603; 10KΩ; 1%; 100PPM; 0.0125W; THICK FILM |
| 17 | R9 | — | 1 | CRCW06031M00FK; MCR03EZPFX1004 | VISHAY DALE;ROHM | 1M | RESISTOR; 0603; 1MΩ; 1%; 100PPM; 0.10W; THICK FILM |
| 18 | R10-R12 | — | 3 | CRCW06030000Z0 | VISHAY DALE | 0 | RESISTOR; 0603; 0Ω; 0%; JUMPER; 0.1W; THICK FILM |
| 19 | R13 | — | 1 | ERJ-14NF49R9U | PANASONIC | 49.9 | RESISTOR; 1210; 49.9Ω; 1%; 100PPM; 0.5W; THICK FILM |
| 20 | SU1, SU2 | — | 2 | S1100-B;SX1100-B | KYCON;KYCON | SX1100-B | TEST POINT; JUMPER; STR; TOTAL LENGTH = 0.24IN; BLACK; INSULATION = PBT;PHOSPHOR BRONZE CONTACT = GOLD PLATED |
| 21 | U1 | — | 1 | MAX38888ATD+ | MAXIM | MAX38888ATD+ | EVKIT PART - IC; REG; SUPER CAP REGULATOR; PACKAGE OUTLINE: 21-0137; PACKAGE CODE: T1433+1; LAND PATTERN: 90-0062; TDFN14-EP |
| 22 | PCB | — | 1 | MAX38888 | MAXIM | PCB | PCB:MAX38888 |
| 23 | J2-J5 | DNP | 0 | MAXIMPAD | N/A | MAXIMPAD | EVK KIT PARTS; MAXIM PAD; NO WIRE TO BE SOLDERED ON THE MAXIMPAD |
| 24 | C4 | DNP | 0 | N/A | N/A | OPEN | CAPACITOR; SMT (1210); OPEN; IPC MAXIMUM LAND PATTERN |
| TOTAL | | | 33 | | | | |

Component Suppliers

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

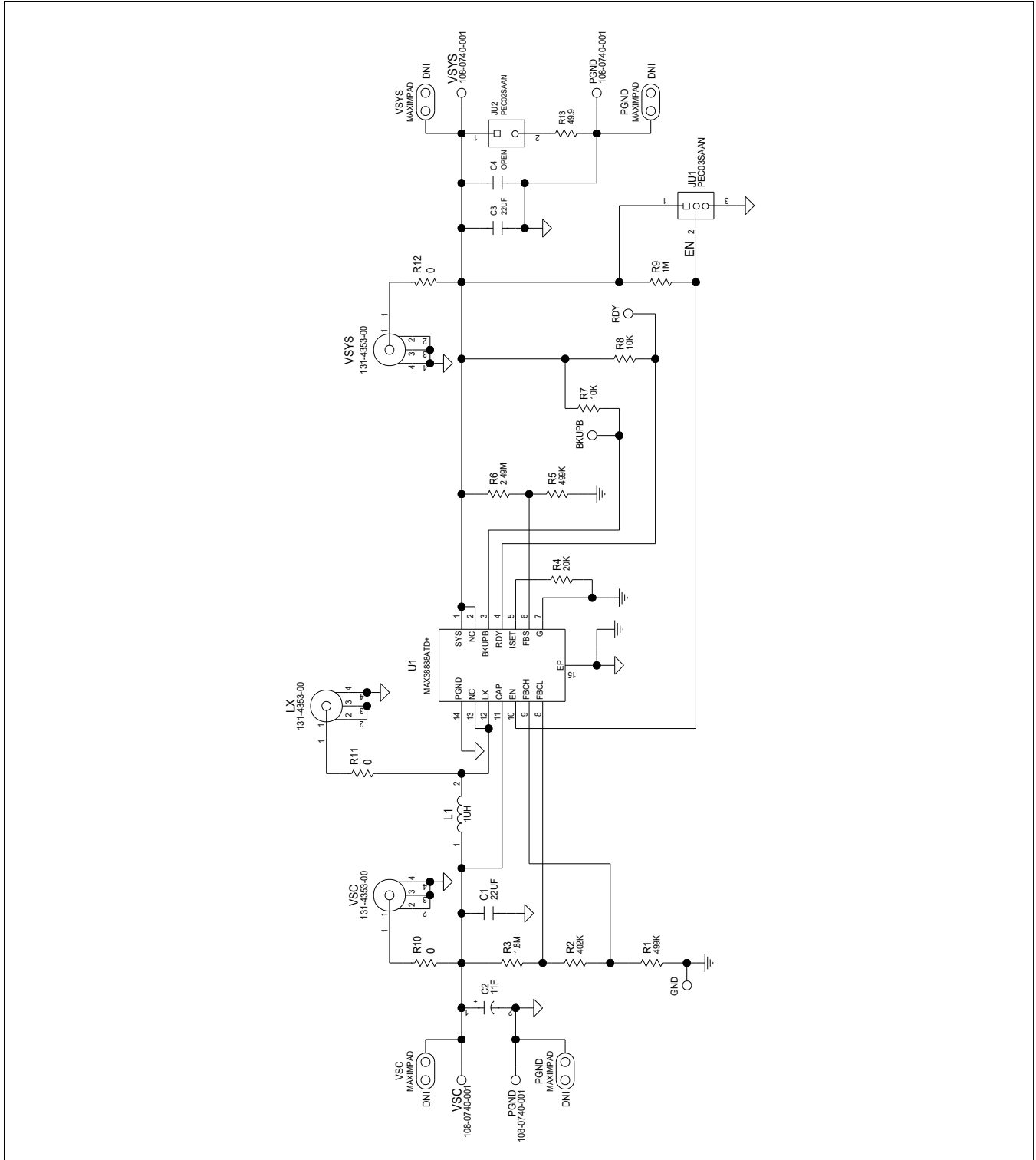
Note: Indicate that you are using the MAX38888 when contacting these component suppliers.

Ordering Information

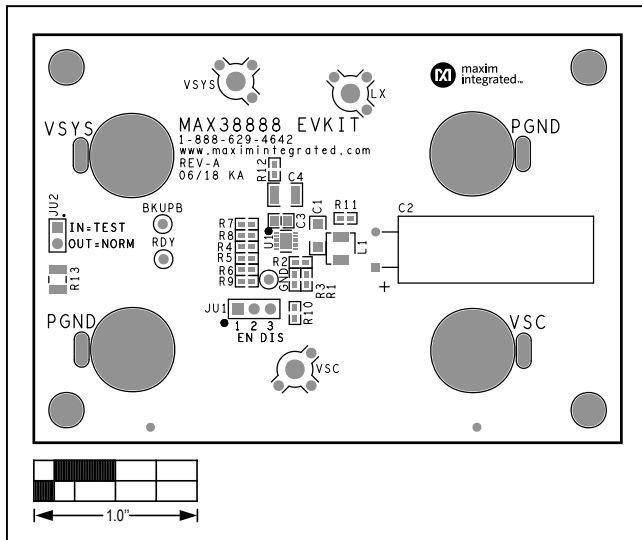
| PART | TYPE |
|----------------|-------|
| MAX38888EVKIT# | EVKIT |

#Denotes RoHS

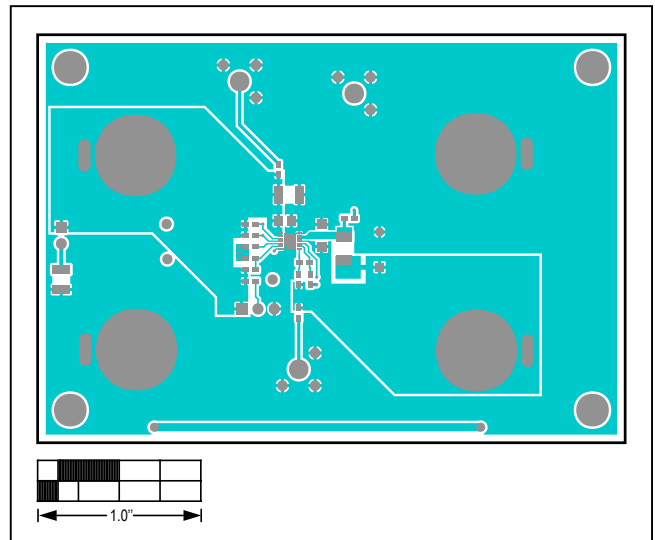
MAX38888 EV Kit Schematic



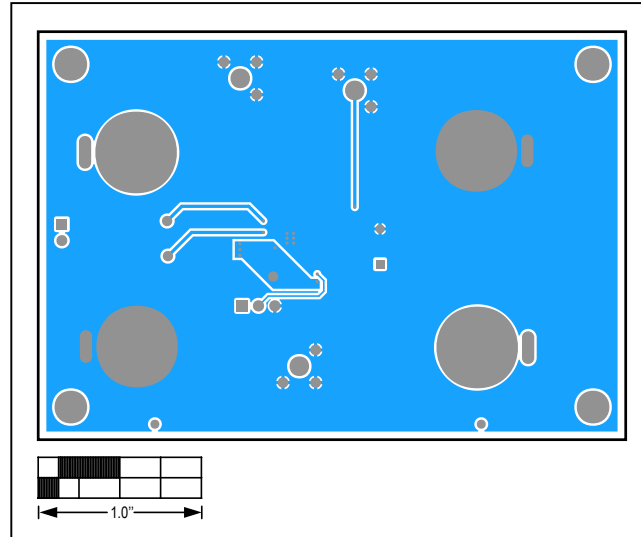
MAX38888 EV Kit PCB Layout Diagrams



MAX38888 EV Kit Component Placement Guide—
Top Silkscreen



MAX38888 EV Kit PCB Layout—Top Layer



MAX38888 EV Kit PCB Layout—Bottom Layer

Revision History

| REVISION NUMBER | REVISION DATE | DESCRIPTION | PAGES CHANGED |
|-----------------|---------------|--------------------------|---------------|
| 0 | 8/18 | Initial release | — |
| 1 | 7/19 | Deleted placeholder text | 1 |

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