

MAXM17900 Evaluation Kit

Evaluates: MAXM17900 5V Output-Voltage Application

General Description

The MAXM17900 evaluation kit (EV kit) is a demonstration circuit of the MAXM17900 ultra-small, high efficiency, current mode, synchronous step-down DC-DC switching power module. The EV kit operates over an input-voltage of 10V to 24V and provides up to 100mA load current with a 5V output voltage. The EV kit is programmed to switch at a frequency of 600kHz. The module is simple to use and easily configurable with minimal external components. It features cycle-by-cycle peak current-limit protection, undervoltage lockout (EN/UVLO), and thermal shutdown.

The EV kit comes with the compact 10-pin 2.6mm x 3mm x 1.5mm uSLIC™ package MAXM17900 module installed, and is rated to operate over the full industrial/automotive -40°C to +125°C temperature range. For full specifications, features and benefits of the IC, refer to the [MAXM17900 data sheet](#).

Features

- Wide 10V to 24V Input
- $\pm 1.75\%$ Feedback Voltage Accuracy
- Output: 5V, 100mA
- Internally Compensated
- All Ceramic Capacitors and Ultra-Compact Solution
- PFM or Force-PWM Mode of Operation
- Shutdown Current as Low as 1.2 μ A (typ)
- Programmable Soft-Start and Prebias Startup
- Open-Drain Power Good Output ($\overline{\text{RESET}}$ pin)
- Programmable EN/UVLO Threshold
- Hiccup Overcurrent Protection (OCP)
- Overtemperature Protection (OTP)
- -40°C to +125°C Industrial/Automotive Temperature Range
- Complies with CISPR22 (EN55022) Class B Conducted and Radiated Emissions
- Passes Drop, Shock, and Vibration Standards—JESD22-B103, B104, B111

Quick Start

Recommended Equipment

- MAXM17900EVKIT#, MAXM17900 evaluation kit
- 24V DC power supply
- Dummy load capable of sinking 100mA
- Digital voltmeter (DVM)
- 100MHz dual-trace oscilloscope

Procedure

The MAXM17900 EV kit is fully assembled and tested. Please follow the steps below to verify the board operation. **Caution: Do not turn on the power supply until all connections are completed.**

- 1) Set the power supply at a voltage between 10V and 24V. Disable the power supply.
- 2) Connect the positive and negative terminals of the power supply to VIN and GND PCB pads, respectively.
- 3) Connect the positive and negative terminals of the 100mA load to VOUT and GND PCB pads respectively, and set the load to 0A.
- 4) Connect the DVM across the VOUT PCB pad and the GND PCB pad closest to VOUT PCB pad.
- 5) Enable the input power supply.
- 6) Verify the DVM across output display 5V.
- 7) Increase the load up to 100mA to verify the output voltage is 5V using DVM.

Ordering Information appears at end of data sheet.

uSLIC is a trademark of Maxim Integrated Products, Inc.

Detailed Description of Hardware

The MAXM17900 EV kit is a proven circuit to demonstrate the high-voltage, high-efficiency, and compact solution size of the MAXM17900 synchronous step-down DC-DC power module. The output voltage is preset to 5V to operate from 10V to 24V input and provides up to 100mA load current. The optimal frequency is set at 600kHz to maximize efficiency and minimize component size. The EV kit includes two test points, TP1 for monitoring the LX and TP2 for measuring the $\overline{\text{RESET}}$ voltage.

Soft-Start Input (SS)

The module offers a fixed 5.1ms internal soft-start when the SS pin is left unconnected. When adjustable soft-start time is required, connect a capacitor from SS to GND to program the soft-start time. The minimum soft-start time is related to the output capacitance (C_{OUT}) and the output voltage (V_{OUT}) by the following equation:

$$t_{\text{SS}} > 0.05 \times C_{\text{OUT}} \times V_{\text{OUT}}$$

where t_{SS} is in milliseconds and C_{OUT} is in μF .

Soft-start time (t_{SS}) is related to the capacitor connected at SS (C_3) by the following equation:

$$C_3 = 6.25 \times t_{\text{SS}}$$

where t_{SS} is in ms and C_3 is in nF.

Mode Selection (MODE)

The device features a MODE pin for selecting either forced-PWM or PFM mode of operation. If the MODE pin is left unconnected, the device operates in PFM mode at light loads. If the MODE pin is grounded, the device

operates in a constant-frequency forced-PWM mode at all loads. The mode of operation cannot be changed on-the-fly during normal operation of the device. Refer to the MAXM17900 module datasheet for more information on the PWM and PFM modes of operation. [Table 1](#) shows the EV kit jumper settings that can be used to configure the desired mode of operation.

External Synchronization (RT/SYNC)

The RT/SYNC pin can be used to synchronize module's internal oscillator to an external system clock. Refer to the *External Synchronization* section in the **MAXM17900 data sheet** for additional information on configuring the external clock synchronization.

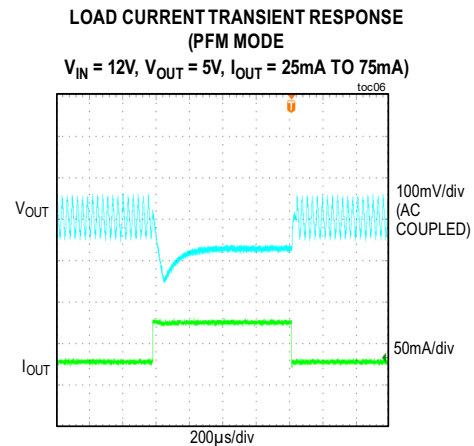
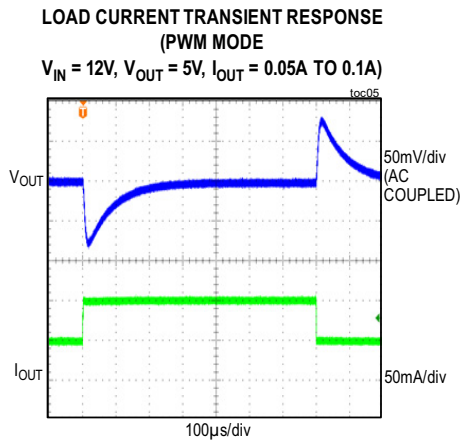
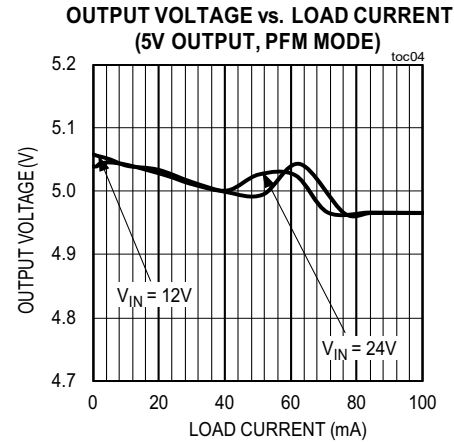
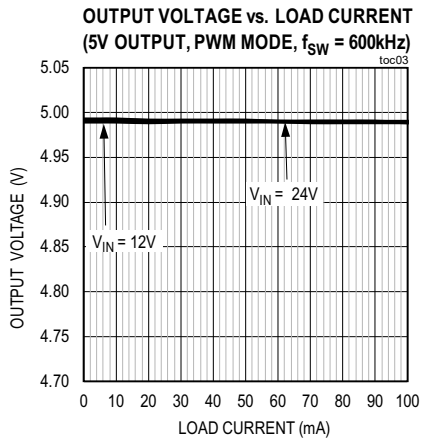
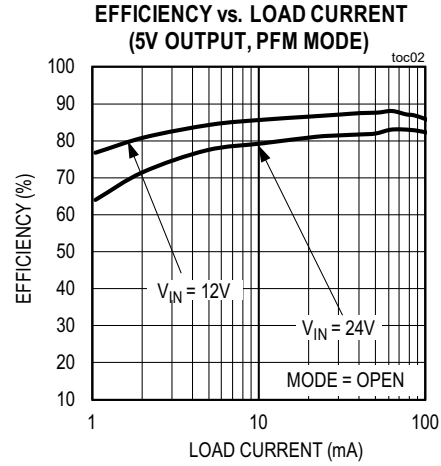
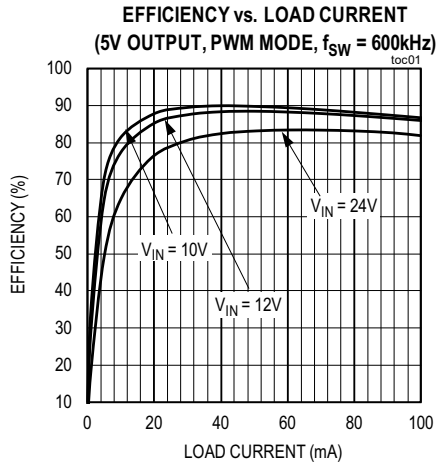
Reset Output ($\overline{\text{RESET}}$)

The module includes an open-drain $\overline{\text{RESET}}$ output to monitor output voltage. $\overline{\text{RESET}}$ should be pulled up with an external resistor to the desired external power supply less than or equal to 5.5V. $\overline{\text{RESET}}$ goes high-impedance 2ms after the output rises above 95% of its nominal set value and pulls low when the output voltage falls below 92% of the set nominal output voltage. $\overline{\text{RESET}}$ asserts low during the hiccup timeout period. In this EV kit, R7 resistor can be used to pull up the $\overline{\text{RESET}}$ to the output voltage.

Table 1. Mode Configuration (J1)

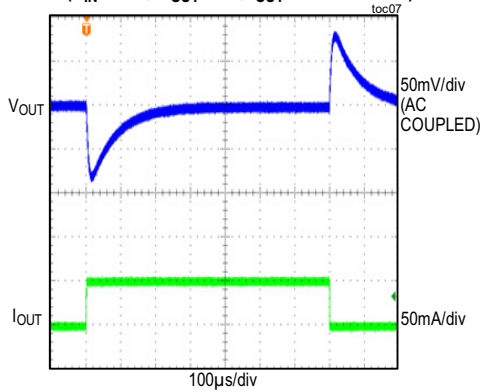
| POSITION | MODE PIN | MAXM17900 OPERATION |
|---------------|------------------|---------------------|
| 1-2 | Connected to GND | PWM mode |
| Not Installed | Open | PFM mode |

EV Kit Performance Report

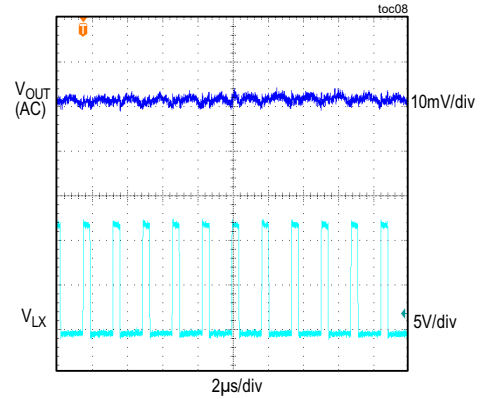


EV Kit Performance Report (continued)

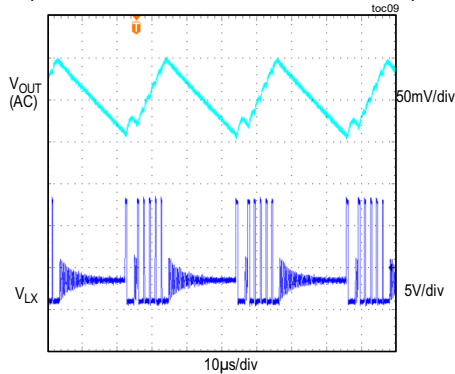
LOAD CURRENT TRANSIENT RESPONSE
($V_{IN} = 12V, V_{OUT} = 5V, I_{OUT} = 0A \text{ TO } 0.05A$)



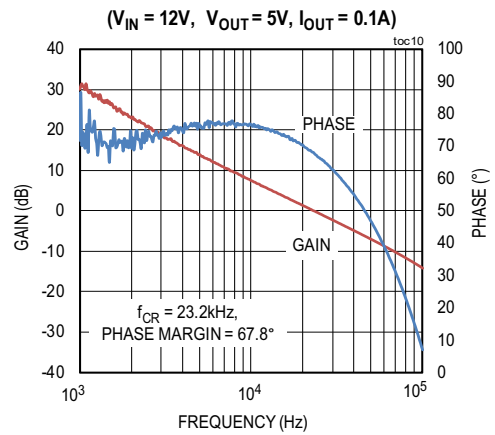
STEADY-STATE SWITCHING WAVEFORMS
(5V OUTPUT, 0.1A LOAD CURRENT, PWM MODE)



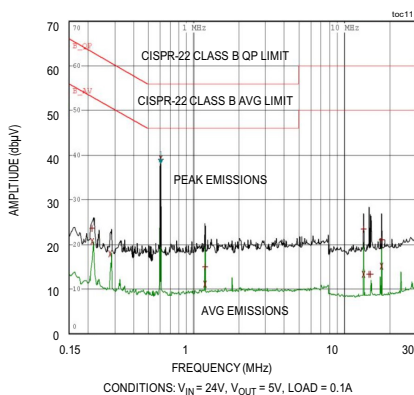
STEADY-STATE SWITCHING WAVEFORMS,
(5V OUTPUT, 0.02A LOAD CURRENT, PFM MODE)



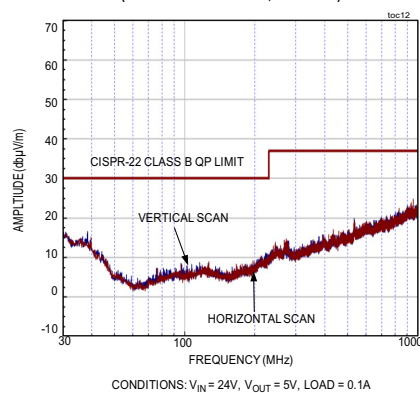
BODE PLOT



CONDUCTED EMISSION PLOT
(WITH FILTER $L = 10\mu H, C = 1\mu F$)



RADIATED EMISSION PLOT
(NO FILTER $L = \text{SHORT}, C = \text{OPEN}$)



MAXM17900 Evaluation Kit

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5V Output-Voltage Application

MAXM17900 EV Kit Bill of Materials

| S NO | DESIGNATION | QTY | DESCRIPTION | MANUFACTURER PARTNUMBER - 1 | MANUFACTURER PARTNUMBER - 1 |
|------|-------------|-----|---|---|--|
| 1 | C1 | 1 | CAPACITOR; SMT (0805); CERAMIC CHIP; 2.2UF; 50V; TOL=10%; MODEL=:; TG=-55 DEGC TO +125 DEGC; TC=X7R | TDK C2012X7R1H225K | |
| 2 | C2 | 1 | CAPACITOR; SMT (0805); CERAMIC CHIP; 10UF; 16V; TOL=10%; TG=-55 DEGC TO +105 DEGC; TC=X6S | MURATA GRM21BC81C106KA73 | |
| 3 | C5 | 1 | CAPACITOR; SMT (CASE_D); ALUMINUM-ELECTROLYTIC; 22UF; 50V; TOL=20%; TG=-40 DEGC TO +85 DEGC; AUTO | PANASONIC EEE-1HA220WAP | |
| 4 | C7, C11 | 2 | CAPACITOR; SMT (0402); CERAMIC CHIP; 0.1UF; 50V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R | TDK CGA2B3X7R1H104K;C1005X7R1H104K050BB | MURATA GRM155R71H104KE14;GCM155R71H104KE02 |
| 8 | R1 | 1 | RESISTOR; 0402; 261K OHM; 1%; 100PPM; 0.063W; METAL FILM | VISHAY DALE CRCW0402261KFK | |
| 9 | R2 | 1 | RESISTOR; 0402; 49.9K; 1%; 100PPM; 0.0625W; THICK FILM | VISHAY DALE CRCW040249K9FK | YAGEO 9C04021A4992FLHF3 |
| 10 | R3 | 1 | RESISTOR; 0402; 69.8K OHM; 1%; 100PPM; 0.10W; THICK FILM | PANASONIC ERJ-2RKF6982X | |
| 11 | R4 | 1 | RESISTOR; 0402; 3.01M OHM; 1%; 100PPM; 0.063W; METAL FILM | VISHAY DALE CRCW04023M01FK | |
| 12 | R5 | 1 | RESISTOR; 0402; 422K OHM; 1%; 100PPM; 0.063W; METAL FILM | VISHAY DALE CRCW0402422KFK | |
| 13 | R7 | 1 | RESISTOR; 0402; 100K OHM; 1%; 100PPM; 0.10W; THICK FILM | PANASONIC ERJ-2RKF1003X | |
| 16 | U1 | 1 | EVKIT PART-IC; PACKAGE. CODE: M102A3+1 | MAXM17900AMB+ | |
| 18 | C4 | 0 | PACKAGE OUTLINE 0805 NON-POLAR CAPACITOR | N/A | N/A |
| 19 | C3 | 0 | PACKAGE OUTLINE 0402 NON-POLAR CAPACITOR | N/A | N/A |

Ordering Information

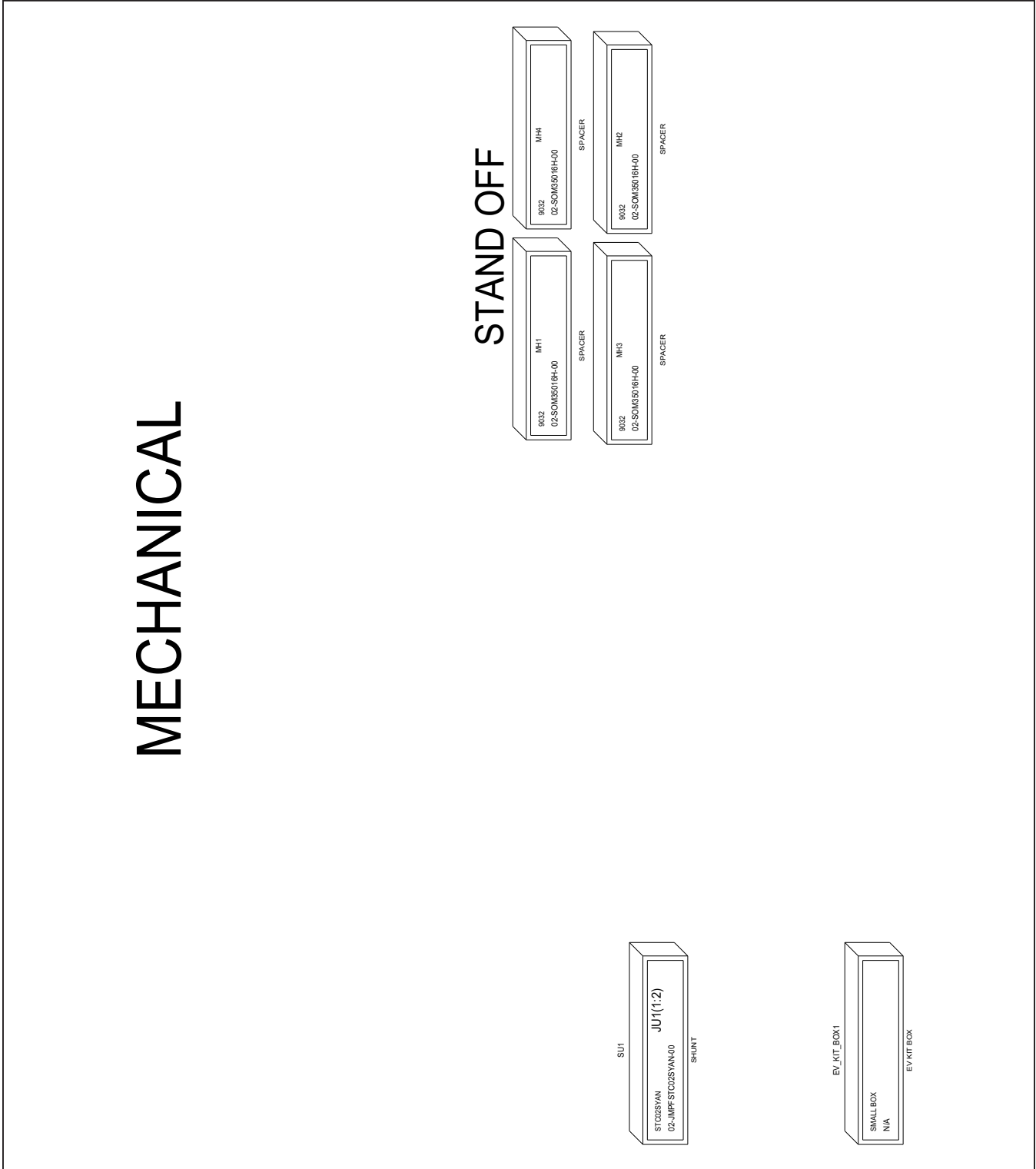
| PART | TYPE |
|-----------------|--------|
| MAXM17900EVKIT# | EV KIT |

#Denotes RoHS compliant.

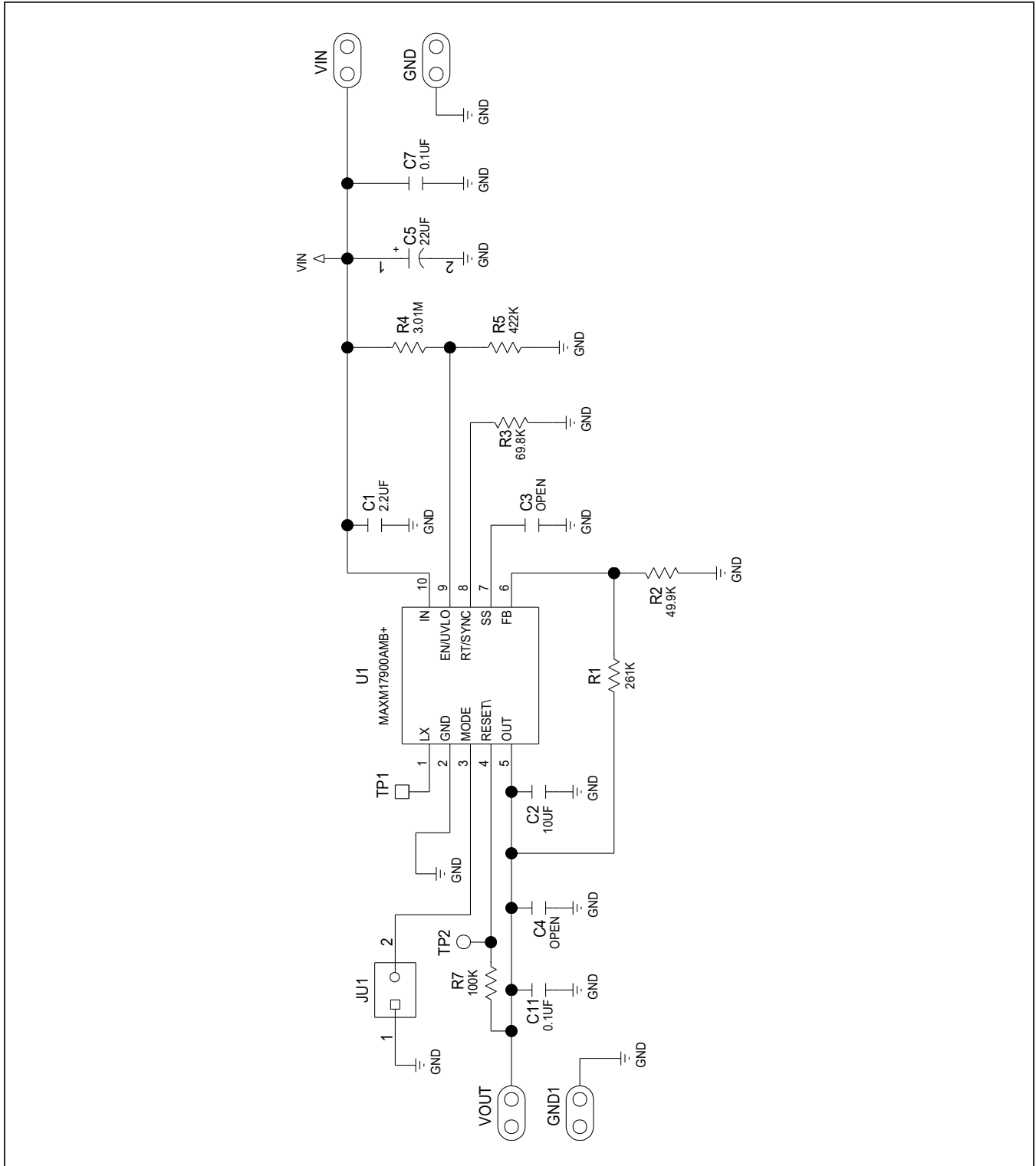
Component Suppliers

| SUPPLIER | WEBSITE |
|-----------------|--|
| Murata Americas | www.murata.com |
| Panasonic Corp. | www.panasonic.com |

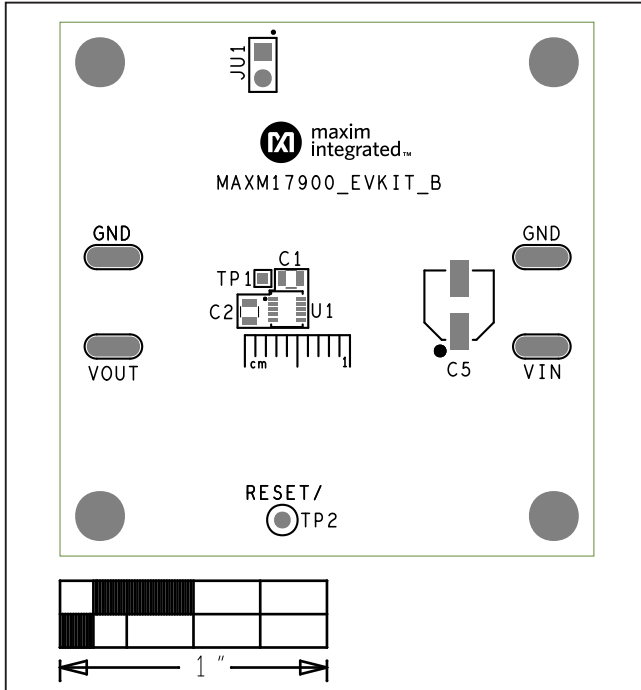
MAXM17900 EV Kit Schematic



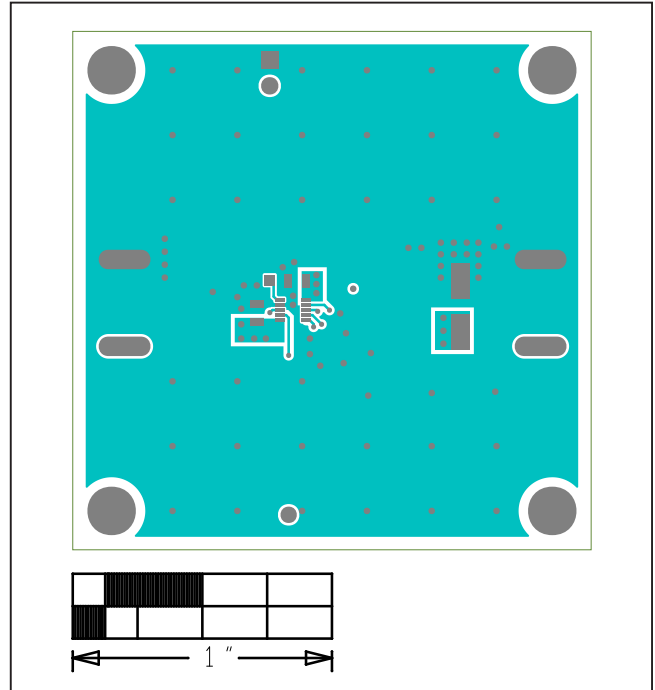
MAXM17900 EV Kit Schematic (continued)



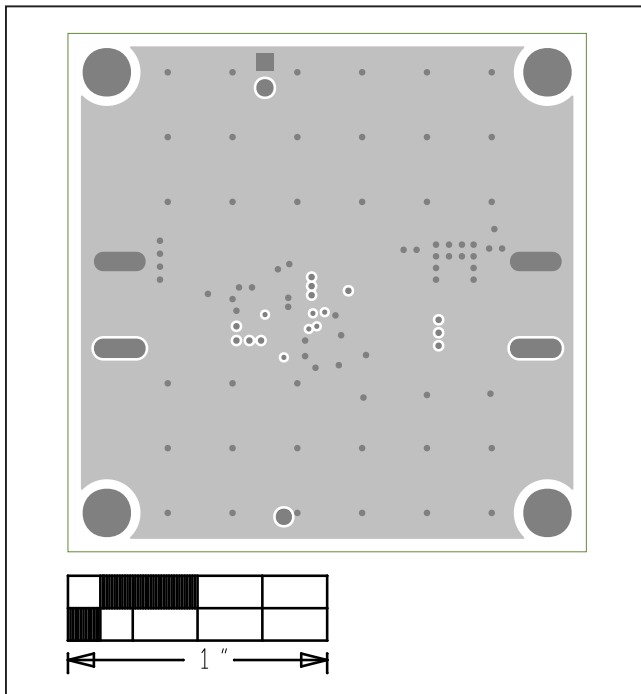
MAXM17900 EV Kit PCB Layouts



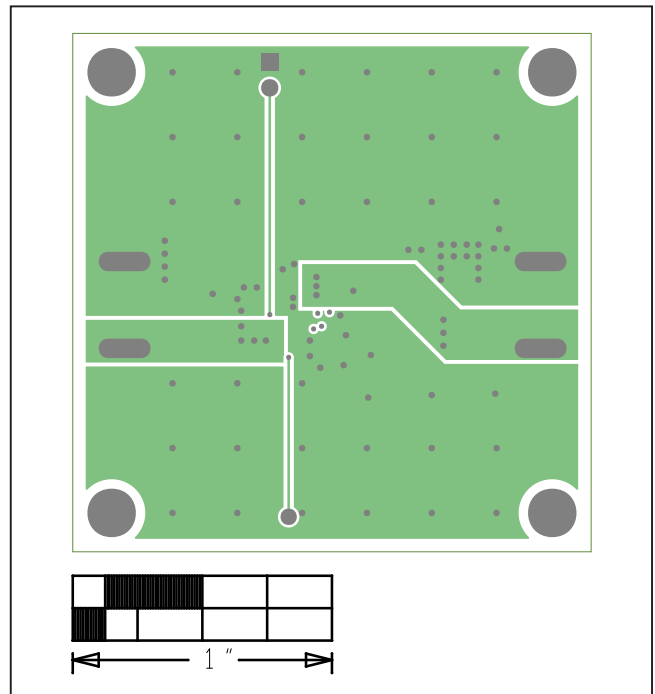
MAXM17900 EV Kit PCB—Silk Top



MAXM17900 EV Kit PCB—Top Layer

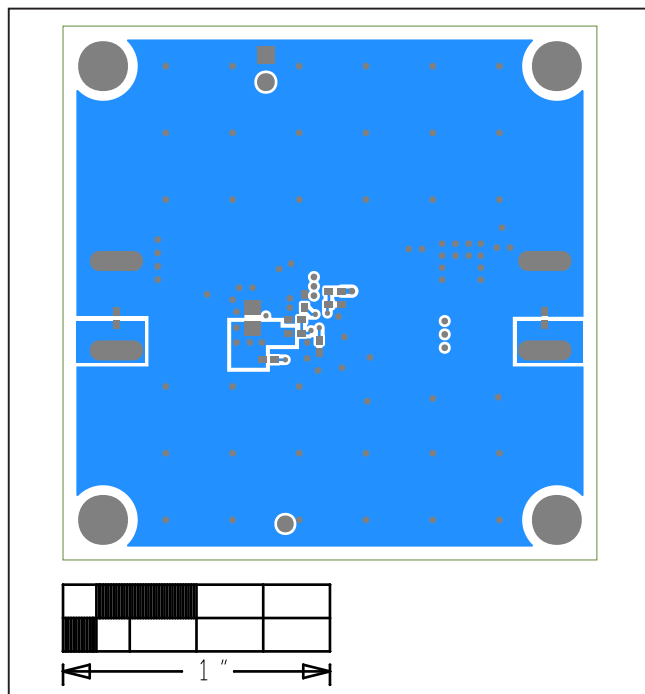


MAXM17900 EV Kit PCB—GND Layer

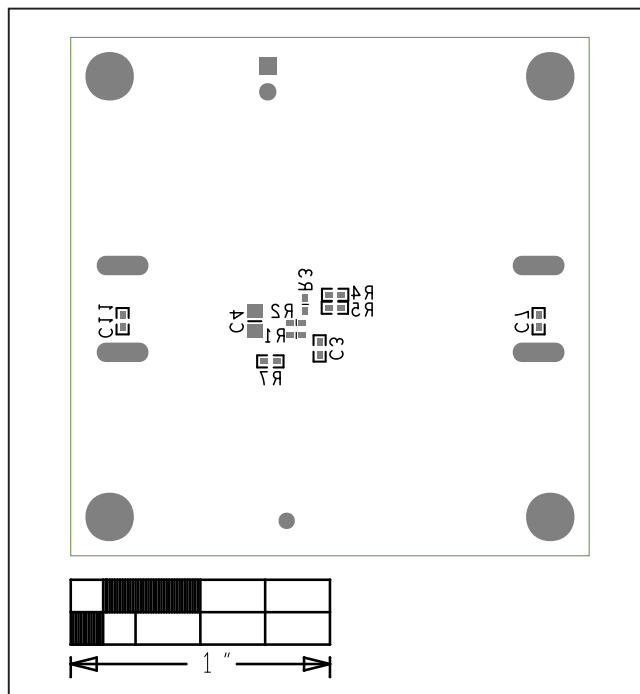


MAXM17900 EV Kit PCB—PWR Layer

MAXM17900 EV Kit PCB Layouts (continued)



MAXM17900 EV Kit PCB—Bottom Layer



MAXM17900 EV Kit PCB—Silk Bottom