Chipsmall

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General Description

The MAXM17502 evaluation kit (EV kit) is a demonstration circuit of the MAXM17502 high-voltage, high-efficiency, current mode, synchronous step-down DC-DC switching power module. The EV kit is designed to provide 5V with up to 1A load of current from a wide input-voltage range of 12V to 60V. The EV kit switches at an optimal 540kHz switching frequency to allow for small component and solution sizes while maintaining high performance. The EV kit provides a precision-enable input and an open-drain $\overline{RESET}$ output signal to provide a simple and reliable startup sequence. The EV kit also includes optional component footprints to program different output voltages, an adjustable input undervoltage-lockout, and a soft-start time to control inrush current during startup. The MAXM17502 module data sheet provides a complete description of the part and should be read in conjunction with this evaluation kit data sheet prior to modifying the demo circuit.

Features

- Highly Integrated Solution with an Integrated, Shielded Inductor
- Wide 12V to 60V Input Range
- Preset 5V Output Voltage
- Up to 1A Output Current
- High Efficiency 84% (V_{IN} = 24V, V_{OUT} = 5V at 1.0A)
- 540kHz Switching Frequency
- Enable/UVLO Input, Resistor-Programmable UVLO Threshold
- Adjustable Soft-Start Time
- Open-Drain $\overline{RESET}$ Output
- Internally Compensated
- Overcurrent and Overtemperature Protection
- Low-Profile, Surface-Mount Components
- Lead(Pb)-Free and RoHS Compliant
- Fully Assembled and Tested

Quick Start

Recommended Equipment

- MAXM17502 EV kit
- 60V DC power supply (V_{IN})
- Dummy load capable of sinking 1A
- Digital voltmeter (DVM)
- 100MHz dual-trace oscilloscope

Procedure

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

1) Set the power supply at a voltage between 12V and 60V. Disable the power supply.
2) Connect the positive and negative terminals of the power supply to IN and PGND PCB pads, respectively.
3) Connect the positive and negative terminals of the 1A load to OUT and PGND2 PCB pads, respectively, and set the load to 0A.
4) Connect the DVM across the OUT PCB pad and the PGND2 PCB pad.
5) Verify that no shunts are installed across pin 1-2 on jumper JU1 to enable UVLO (see Table 1 for details).
6) Enable the input power supply.
7) Verify the DVM display 5V.
8) Increase the load up to 1A to verify the DVM continue displaying 5V.

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

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Detailed Description of Hardware

The MAXM17502 EV kit is a proven circuit to demonstrate the high-voltage, high-efficiency, and compact solution-size of the synchronous step-down DC-DC power module. The output voltage is preset for 5V to operate from 12V to 60V and provides up to 1A load current. The optimal frequency is set at 540kHz to maximize efficiency and minimize component size. The EV kit includes JU1 to enable/disable UVLO of the device. The $\overline{\text{RESET}}$ PCB pad is also available for monitoring output voltage regulation to enable or disable the application circuit of the load. The electrolytic capacitor (C51) is required only when the V_{IN} power supply is situated far from the device circuit.

Soft-Start Input (SS)

The device integrates a 10nF soft-start capacitor to limit inrush current during startup. The minimum soft-start time is 1.8ms. The soft-start time can be increased by connecting an additional capacitor (C_{SS}) from SS to GND. The value of the additional capacitor can be calculated from the desired soft-start as follows:

$$C_{SS} = (5.55 \times t_{SS} - 10)$$

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

Programmable Undervoltage-Lockout (UVLO)

The EV kit offers an adjustable input undervoltage-lockout level by resistor dividers connecting between IN, EN/UVLO, and GND pins. For normal operation, a shunt should not be installed across pins 1-2 on JU1 to enable the output through an external pull up 3.3MΩ resistor from EN/UVLO pin to IN pin. To disable the output, install the shunt across pins 1-2 on JU1 to pull EN/UVLO pin to GND. See Table 1 for JU1 setting details. The EV kit also provides an optional R56 PCB footprint to program a UVLO threshold voltage at which an input voltage level device turns on. The R56 resistor can be calculated by the following equation:

$$R56 = \frac{4019.4}{(V_{INU} - 1.218)}$$

where V_{INU} is the input voltage at which the device is required to turn on and R56 unit is in kΩ.

Setting V_{OUT} with a Resistive Voltage-Divider at FB

The EV kit is preset for 5V and offers an adjustable output voltage range as low as 0.9V and up to 5V at 1A maximum load. The adjustable output voltage can be programmed by the set of resistor-dividers R1 and R2. Refer to the *Components Selection Table* of the MAXM17502 IC data sheet to select optimal component values for each specific input voltage range from 12V to 60V and an output voltage from 0.9V to 5V. To obtain an output voltage other than those provided in Table 1 of the MAXM17502 module data sheet, R1 and R2 need to be modified according to the equations described in *Setting the Output Voltage* section of the MAXM17502 data sheet.

Table 1. UVLO Enable/Disable Configuration (JU1)

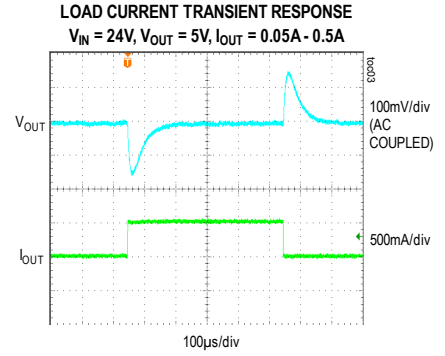| SHUNT POSITION	EN PIN	MAXM17502_OUTPUT
Installed	Connected to GND	Disable
Not installed*	Connected to VIN	Enable

Default position.

Typical Operating Characteristics

(V_{IN} = 12V - 60V, V_{OUT} = 5V, I_{OUT} = 0 –1A, T_A = +25°C, unless otherwise noted.)
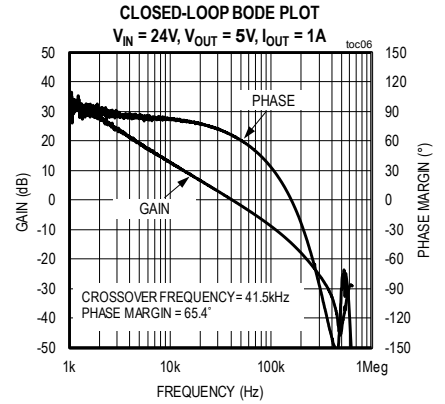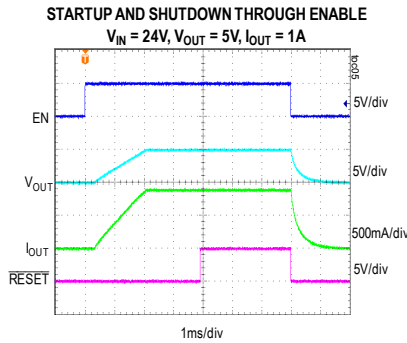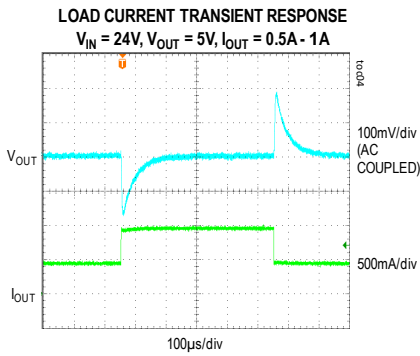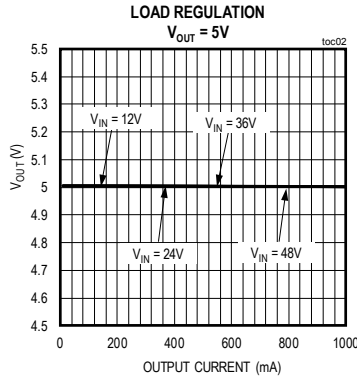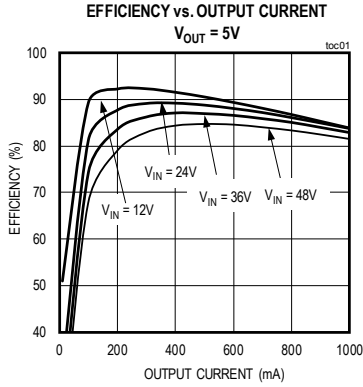
EFFICIENCY vs. OUTPUT CURRENT
V_{OUT} = 5V
toc01

LOAD REGULATION
V_{OUT} = 5V
toc02

LOAD CURRENT TRANSIENT RESPONSE
V_{IN} = 24V, V_{OUT} = 5V, I_{OUT} = 0.05A - 0.5A
toc03

LOAD CURRENT TRANSIENT RESPONSE
V_{IN} = 24V, V_{OUT} = 5V, I_{OUT} = 0.5A - 1A
toc04

STARTUP AND SHUTDOWN THROUGH ENABLE
V_{IN} = 24V, V_{OUT} = 5V, I_{OUT} = 1A
toc05

CLOSED-LOOP BODE PLOT
V_{IN} = 24V, V_{OUT} = 5V, I_{OUT} = 1A
toc06

CROSSOVER FREQUENCY= 41.5kHz
PHASE MARGIN = 65.4°

Component Suppliers

SUPPLIER	WEBSITE
Murata Americas	www.murata.com
NEC TOKIN America, Inc.	www.nec-tokinamerica.com
Panasonic Corp.	www.panasonic.com
SANYO Electric Co., Ltd.	www.sanyodevice.com
TDK Corp.	www.component.tdk.com
TOKO America, Inc.	www.tokoam.com

Note: Indicate that you are using the MAXM17502 when contacting these component suppliers.

MAXM17502 EV Kit Bill of Materials

| S.NO	Designation	VALUE	QTY	DESCRIPTION	MFG PART #	MANUFACTURER
1	C1	2.2UF	1	CAPACITOR; SMT (1206); CERAMIC CHIP; 2.2UF; 100V; TOL=10%; MODEL=GRM SERIES; TG=-55 DEGC TO +125 DEGC; TC=X7R	GRM31CR72A225KA73; KRM31KR72A225KH01	MURATA
2	C2	10UF	1	CAPACITOR; SMT (1210); CERAMIC CHIP; 10UF; 25V; TOL=10%; MODEL=; TG=-55 DEGC TO +125 DEGC; TC=X7R	C1210C106K3RAC; GRM32DR71E106K	KEMET/MURATA
3	C51	33UF	1	CAPACITOR; SMT (CASE_F); ALUMINUM-ELECTROLYTIC; 33UF; 80V; TOL=20%; MODEL=FK SERIES	EEE-FK1K330P	PANASONIC
4	GND, VOUT, PGND1, PGND2, PVIN1	MAXIMPAD	5	EVK KIT PARTS; MAXIM PAD; WIRE; NATURAL; SOLID; WEICO WIRE; SOFT DRAWN BUS TYPE-S; 20AWG	9020 BUSS	WEICO WIRE
5	JU1	PEC02SAAN	1	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 2PINS	PEC02SAAN	SULLINS
6	R1	75K	1	RESISTOR; 0603; 75K OHM; 1%; 100PPM; 0.10W; THICK FILM	ERJ-3EKF7502V	PANASONIC
7	R2	16.5K	1	RESISTOR; 0603; 16.5K OHM; 1%; 100PPM; 0.10W; METAL FILM	CRCW060316K5FK	VISHAY DALE
8	R55	3.3M	1	RESISTOR, 0603, 3.3M OHM, 1%, 100PPM, 0.10W, THICK FILM	CRCW06033M30FK	VISHAY DALE
9	SH1	STC02SYAN	1	TEST POINT; JUMPER; STR; TOTAL LENGTH=0.256IN; BLACK; INSULATION=PBT CONTACT=PHOSPHOR BRONZE; COPPER PLATED TIN OVERALL	STC02SYAN	SULLINS ELECTRONICS CORP.
10	TP1, TP3-TP5	N/A	4	TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.35IN; BOARD HOLE=0.063IN; RED; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH; RECOMMENDED FOR BOARD THICKNESS=0.062IN	5005	KEYSTONE
11	U1	MAXM17502	1	EVKIT PART-MODULE; PWRM; HIGH VOLTAGE; HIGH-EFFICIENCY STEP-DOWN POWER MODULE; LGA28-3EP	MAXM17502ALI+T	MAXIM
12		PCB	1	PCB: MAXM17502	MAXM17502	MAXIM

TOTAL   19

Ordering Information

PART	TYPE
MAXM17502EVKIT#	EV Kit

#Denotes lead(Pb)-free and RoHS compliant.

MAXM17502 EV Kit PCB Layout Diagrams
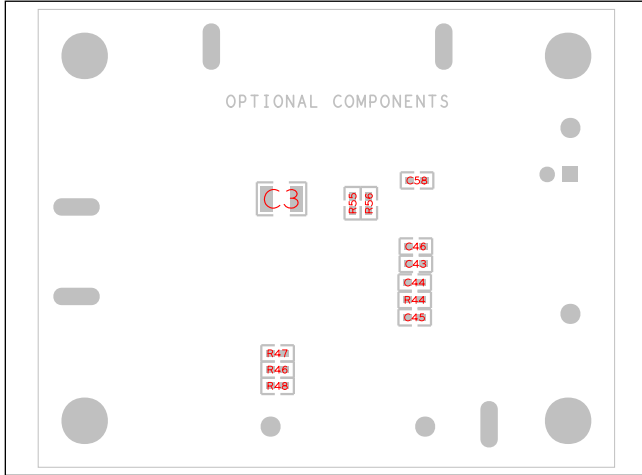
MAXM17502 EV Kit—Bottom
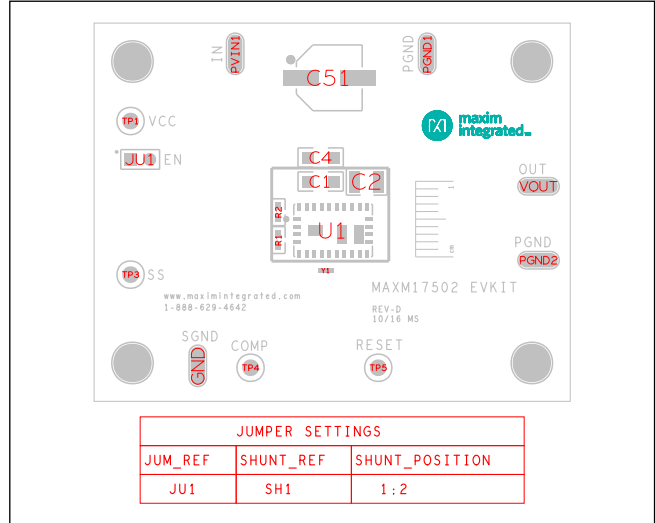
MAXM17502 EV Kit—Top

MAXM17502 EV Kit Schematic
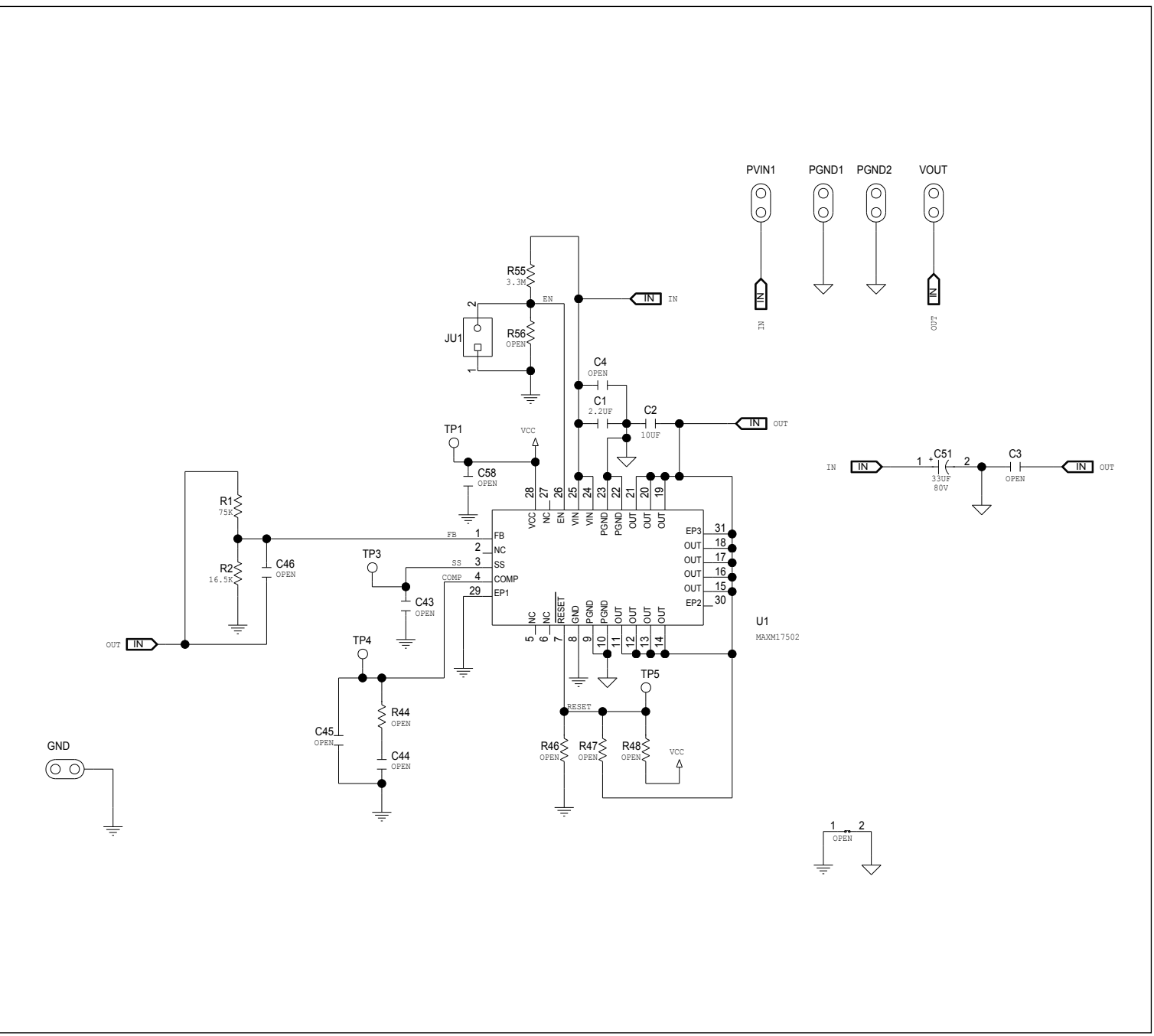
Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	4/17	Initial release	—