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Evaluates: MAX20071/MAX20072

MAX20072 Evaluation Kit

General Description

The MAX20072 evaluation kit (EV kit) demonstrates the performance and behavior of the MAX20071 and MAX20072 low-voltage step-down switching regulators.

The MAX20072 high-efficiency switching regulator family delivers up to 1A load current from 0.5V to 3.8V. The device operates from 2.7V to 5.5V, making it ideal for on-board point-of-load and post-regulation applications. Total output error is less than ±1.5% over load, line, and temperature. It features fixed-frequency PWM mode operation, with a switching frequency of 2.2MHz. The high operating frequency allows for all-ceramic capacitor design and other small-size external components.

The device provides an enable input (EN) and a power-good output (PG). The output voltage can be preset at the factory to allow customers to achieve ±1.5% output-voltage accuracy without using expensive 0.1% resistors. Alternatively, the output voltage can be set to any customer value by using two external resistors at the feedback with 0.5V internal reference. The device offers factory-programmable spread-spectrum switching and soft-start time.

The MAX20072 includes overtemperature shutdown and overcurrent limiting and is designed to continuously operate from -40°C to +125°C chip temperature.

Benefits and Features

- 2.7V to 5.5V Input Voltage Range
- 1.8V Output at 1A
- < 1µA Quiescent Current in Shutdown Mode
- High-Frequency Operation
  - 2.2MHz or External Clock Synchronization
- Compact System Size
  - Full Solution with External Reference Divider Occupies Only 40mm^2

Quick Start

Required Equipment

- MAX20072 EV kit
- 5V, 1A power supply
- Electronic load
- Digital multimeter

Procedure

The EV kit is fully assembled and tested. Follow the steps below to verify board operation:

1) Remove the shunt on jumper JU1 and place a shunt on jumper JU2.
2) Connect the power-supply (turned off) positive connection to VSUP and the negative connection to GND (closest connection to VSUP).
3) Connect the electronic load (turned off) positive connection to VOUT and the negative connection to GND (closest connection to VOUT).
4) Turn on the power supply at 5V, 1A current limit.
5) Place the shunt on jumper JU1.
6) Verify that the voltage across the output capacitor is 1.8V.
7) Activate the electronic load (for either 1.8Ω resistive load or 1A current load).
8) Verify that the voltage across the output capacitor is still 1.8V.

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

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Detailed Description

The MAX20072 EV kit comes fully assembled and tested. The EV kit comes installed with the MAX20072ATAA/V. Other variants, such as the MAX20071, can be tested on the same EV kit with IC replacement of U1. Testing a different configuration may require changes to external components for proper operation. Consult the MAX20071/MAX20072 IC data sheet for guidance on selecting external components.

Low-Voltage Step-Down Converter

The step-down converter is designed to operate from 2.7V to 5.5V input voltage. The output is regulated through either an external resistor-divider, or an internal reference preset at the factory. Fixed-output versions can be factory configured between 0.5V and 3.8V. The system has internal MOSFETs for reduced system footprint. The externally adjustable circuit implementation fits inside a 40mm^2 area.

Because the target application for this device is as a secondary regulator, capacitors C5 and C6 emulate the output capacitance of a primary regulator. Their values can be adjusted based on the expected characteristics of the primary regulator in a given application.

EV Kit Interface

Header JU1 connects between VSUP and the EN pin of the device and enables/disables the device's output. Populate the jumper to enable the device, or remove the jumper to disable it. The device can also be enabled or disabled by applying an active-high logic voltage on the EN test loop. If EN is left open, the device is placed in a shutdown state due to a weak internal pulldown on the pin.

Header JU2 connects between VSUP and the SYNC pin of the device and controls whether the device is placed in forced-PWM mode or skip mode. Populate the jumper to place the device into forced-PWM (FPWM) mode for all load levels. Remove the jumper to enable skip mode at low-load levels to improve efficiency.

Large test loops are installed on the EV kit for input/output power and grounds, as well as all digital signals. A smaller test point is also populated at a 10Ω injection resistor (R4) in the feedback network for phase and gain margin measurements.

Synchronization (SYNC)

The device has the ability to operate in either FPWM or skip mode of operation. The SYNC pin has a weak internal pulldown, defaulting to skip-mode operation. Populating header JU2 or applying a logic-high voltage to the SYNC test loop engages FPWM operation.

The device can also synchronize to an external clock signal. Applying a square wave to the SYNC test loop, which is directly connected to the device's SYNC pin, causes the device's MOSFETs to switch at the applied frequency. Valid frequency ranges are from 1.8MHz to 2.6MHz. Switching frequencies towards the end of this range may require changing the power inductor for proper operation. The device is also available with spread spectrum on the switching frequency.

Power-Good Signal (PG)

The device provides a signal to determine whether or not it is operating in normal conditions. An open-drain FET in the device is connected to the PG pin. The pin has a pullup resistor to the input power supply. As the pin is an open-drain FET, the unit can interface with other voltage levels if desired. The pin asserts a logic-low voltage if the device is either shut off or not operating in proper conditions. Output overvoltage/undervoltage, output overcurrent, input undervoltage, and overtemperature conditions are all flagged by this pin.

PCB Layout Guidelines

Good PCB layout is critical for proper system performance. The loop area of the DC-DC conversion circuitry must be minimized as much as possible. Place the PV input capacitor, power inductor, and output capacitor as close as possible to the device. PCB trace geometry should prioritize shorter traces over wider traces. The EV kit layout is designed to achieve an extremely small solution size (less than 40mm^2 area), while maintaining good DC-DC circuitry routing and grounding.

A low-impedance ground connection between the input and output capacitors is necessary (route through the ground pour on the exposed pad). Connect the exposed pad to ground. Place multiple vias in the pad and connect them to all other ground layers for optimal heat dissipation (failure to do so may result in the device repeatedly reaching thermal shutdown). Do not use separate power and analog grounds; use a single common ground, as high-frequency return currents flow directly under the corresponding traces.

Ordering Information

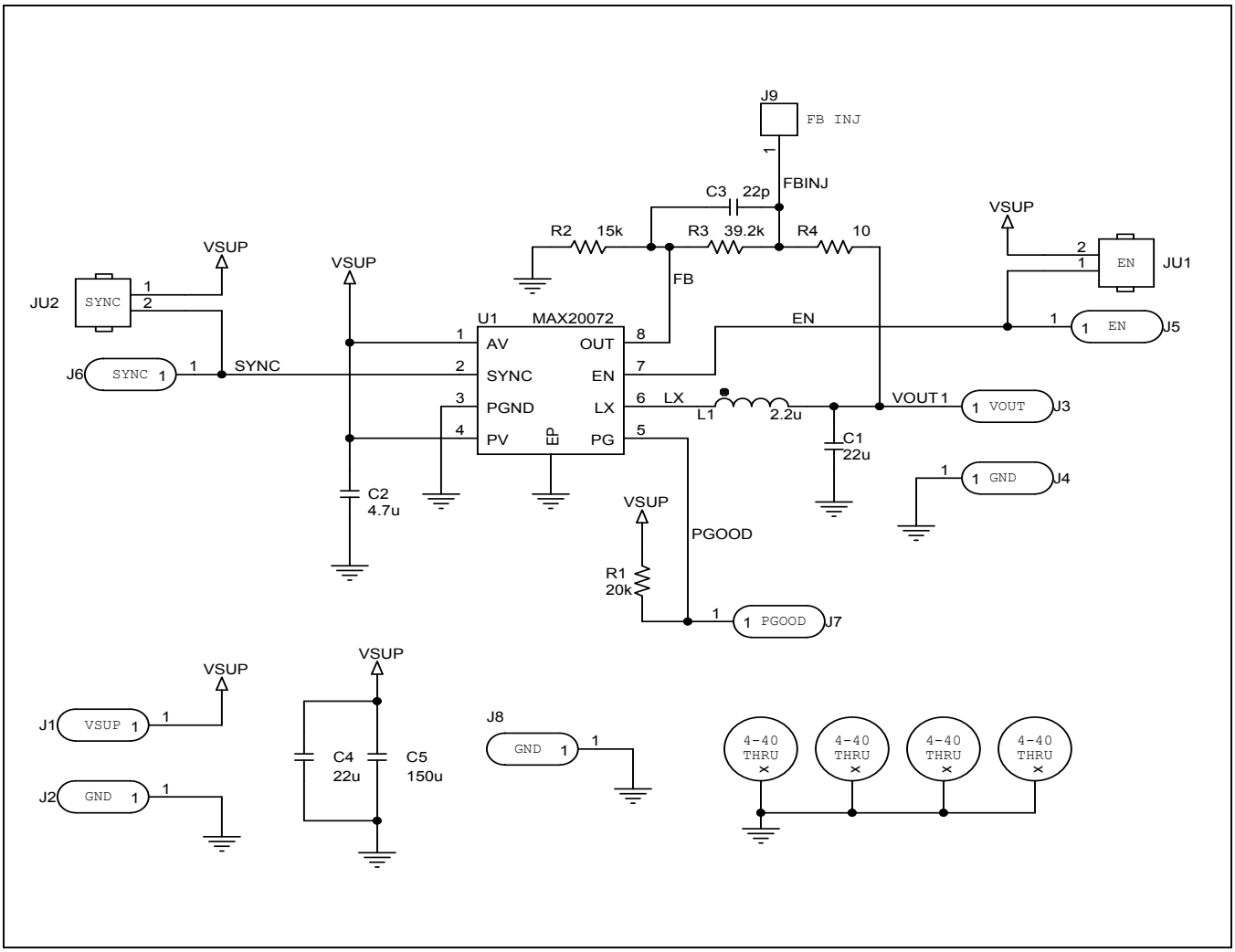
PART	TYPE
MAX20072EVKIT#	EV Kit

#Denotes RoHS compliant.

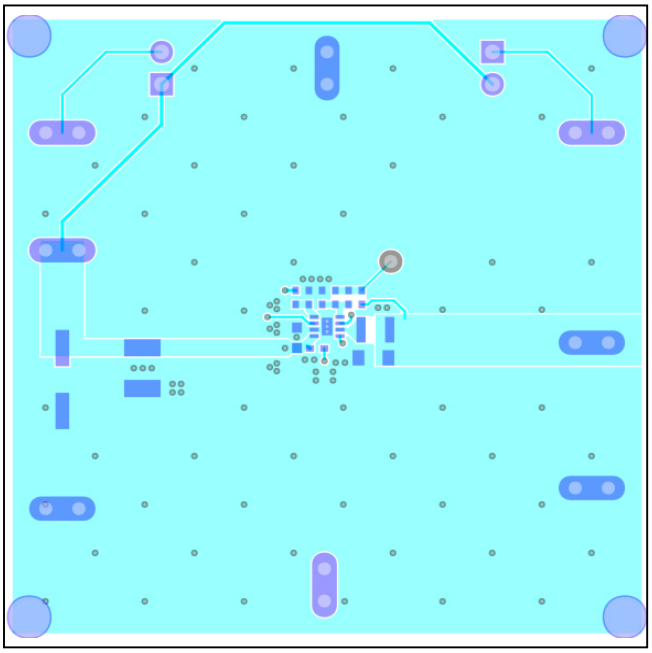
MAX20072 EV Kit Bill of Materials

REFERENCE	DESCRIPTION	MFG. NUMBER
C1	Capacitor, ceramic, 22 µF, 10V, X6S, 0805 size	Murata GRT21BC81A226ME13L
C2	Capacitor, ceramic, 4.7 µF, 16 V, X6S, 10%, 0603 size	Murata GRT188C81C475KE13D
C3	Capacitor, ceramic, 22 pF, 50 V, NP0, 0402 size	Murata GCM1555C1H220JA16D
C4	Capacitor, ceramic, 22 µF, 16 V, X7R, 1210 size	Murata GCJ32ER71C226KE01L
C5	Capacitor, electrolytic, 150 µF, 16 V, 20%, 6.3mm	Panasonic EEE-FPC151XAP
L1	Inductor, molded, 2.2µH	TDK TFM252010ALMA2R2M
R1	Resistor, 20 kohm, 1%, 0402 size	any
R2	Resistor, 15 kohm, 1%, 0402 size	any
R3	Resistor, 39.2 kohm, 1%, 0402 size	any
R4	Resistor, 10 ohm, 1%, 0402 size	any
U1	Low-voltage step-down converter	MAX20072AATA/V+

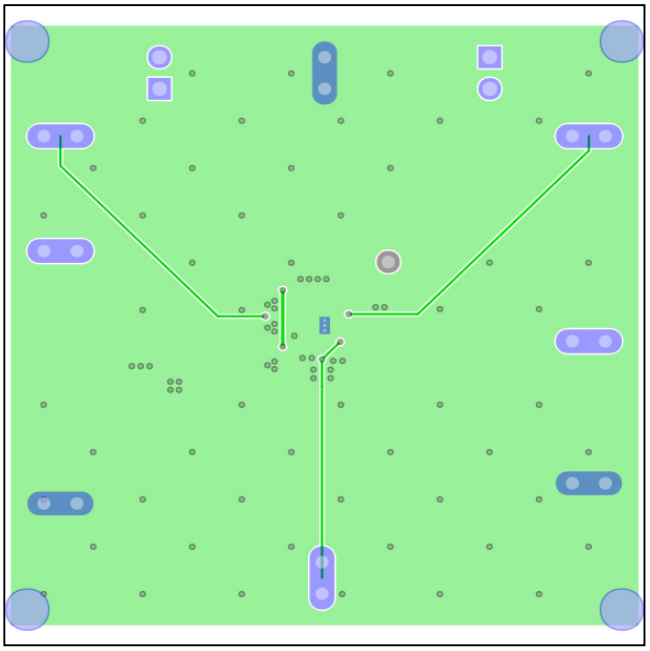
MAX20072 EV Kit Schematic



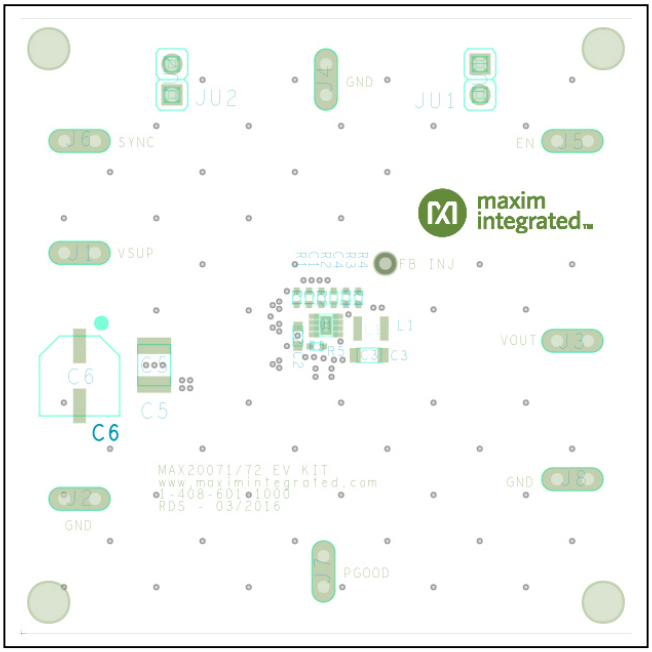
MAX20072 EV Kit PCB Layout Diagrams



Top Copper and Solder Mask



Bottom Copper and Solder Mask



Top Components and Labels

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	11/16	Initial release	—
1	5/18	Updated C1, C3, C4, R1 and deleted C6 and R5 in the *MAX20072 EV Kit Bill of Materials*	3