

MAX25431 Evaluation Kit

Evaluates: MAX25431

General Description

The MAX25431 evaluation kit (EV kit) is a fully assembled and tested application circuit for the MAX25431 current-mode buck-boost controller IC. The EV kit is designed to deliver up to 16A (max) input current with input voltages from 6V to 36V. The voltage quality can be monitored by observing the PGOOD signal.

The IC offers a 3V to 25V OUT programmable range. Switching frequency is adjustable from 220kHz to 2.2MHz, which allows for small external components, reduced output ripple, and guarantees no AM interference. The IC comes with a spread-spectrum frequency-modulation option designed to minimize EMI-radiated emissions and a SYNCOUT function that outputs 180° out-of-phase clock.

Features

- 6V to 36V Input Supply Range
- Delivers Up to 16A Input Current
- Enable Input
- Frequency Synchronization Output
- Voltage-Monitoring PGOOD Output
- BIAS Voltage-Monitoring Test Point
- Fully Assembled and Tested
- Proven PCB Layout

Ordering Information appears at end of data sheet.

Quick Start

Required Equipment

- MAX25431 EV kit
- 6V to 36V, 20A power supply
- Voltmeter
- Electronic load

Procedure

The MAX25431 EV kit is fully assembled and tested. Use the following steps to verify board operation:

- 1) Verify that all jumpers are in their default positions, as shown in [Table 1](#).
- 2) Connect the positive and negative terminals of the power supply to IN and GND test pads, respectively.
- 3) Set the power-supply voltage to 14V and 10A current limit.
- 4) Connect the positive terminal of the voltmeter to OUT and the negative terminal to GND2.
- 5) Turn on the power supply.
- 6) Verify that OUT is approximately 12V.

Additional Evaluation

- 7) Connect the positive terminal of the electronic load to OUT and the negative terminal to GND2.
- 8) Set the electronic load to 2A and turn on the load.
- 9) Verify output voltage on the voltmeter is 12V \pm 2%.
- 10) With the load still on, slowly reduce the input voltage from 14V to 8V. Verify output voltage on the voltmeter is 12V \pm 2%.

Detailed Description of Hardware

The MAX25431 EV kit provides a proven layout for the MAX25431 buck-boost controller IC. The IC accepts input voltage as high as 36V and can deliver high-load currents, with a 20A (max) input current in boost mode. The EV kit can handle an input-supply transient up to 40V. Various test points are included for evaluation. The EV kit comes installed with a 3mΩ current-sense resistor on the input (R1) and a 4mΩ sense resistor on the output (R2). This sets the input current limit to 16.67A and the runaway current limit to 18.75A. A higher current limit can be set by changing the sense resistors. An optional filter input (IN_FILTER) is provided to test designs with an additional input filter. The default EV kit comes with no filter installed, so input terminal IN must be used.

External Synchronization

The IC operates in fixed-PWM (FPWM) with spread spectrum enabled. The EV kit comes without the shunt installed on jumper, J3. The center pin of J3 can be used to synchronize to an external clock.

When evaluating the MAX25431ATGB on this EV kit, the SYNCOUT signal can be measured on the center pin of J3. The SKIP and FPWM silkscreen is used when evaluating other Maxim Integrated Buck-Boost controllers.

Output Monitoring (PGOOD)

The EV kit provides a power-good output test point (PGOOD) to monitor the status of the buck output (OUT). PGOOD is an open-drain output and is high impedance when the output voltage is in regulation. PGOOD is low impedance when the output voltage drops below 92% (typ) of its nominal regulated voltage. To obtain a logic

signal, pull up PGOOD to BIAS by installing a shunt on the PGOOD jumper.

Evaluating Other Voltages

The EV kit comes installed with the MAX25431ATGA/VY+ and is configured for 12V_{OUT} at a 420kHz switching frequency set for 16A (max) input current in boost mode. For evaluating other configurations, refer to the *Design Example* table in the MAX25431 IC data sheet. Other IC options for spread spectrum/SYNCOUT can be installed as well.

EMC Performance

EV kit provides a proven layout that is compliant with CISPR-25 requirements for EMC testing. The default EV kit (12V_{OUT}, 420kHz configuration) requires no additional filtering to meet the CISPR-25 EMC standards. The IC also comes with the spread-spectrum option, which can be ordered to improve EMC performance.

Specifications Summary

- V_{IN} (min): 6V
- V_{IN} (max): 36V
- V_{OUT}: 12V
- f_{SW}: 420kHz
- I_{OUT} (max): 5A
- Input Current: 16.67A peak current
- Runaway Current: 18.75A peak current
- SPS: On
- FSYNC: SYNCIN

Table 1. Default Jumper Settings

| JUMPER | DEFAULT SHUNT POSITION | FUNCTIONS |
|---------------|------------------------|---|
| J1 (EN) | ON-Middle | Buck-Boost enabled |
| J4 (PGOOD PU) | Installed | PGOOD pulls up to VBIAS when OUT is in regulation |
| J3 (SYNC) | Not Installed | MAX25431ATGA (Default): Apply the external clock input on center pin. MAX25431ATGB: The SYNCOUT signal can be measured on center pin |

Ordering Information

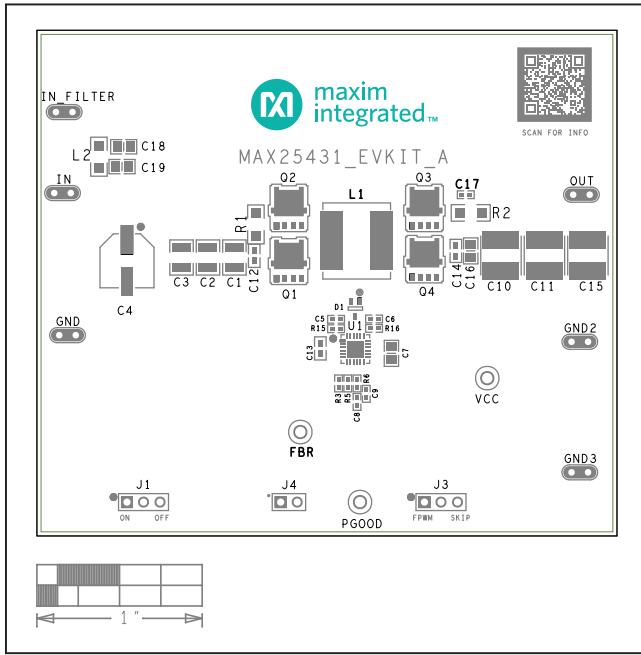
| PART | TYPE |
|----------------|--------------------------|
| MAX25431EVKIT# | 12V Output/420kHz EV kit |

#Denotes RoHS-compliance.

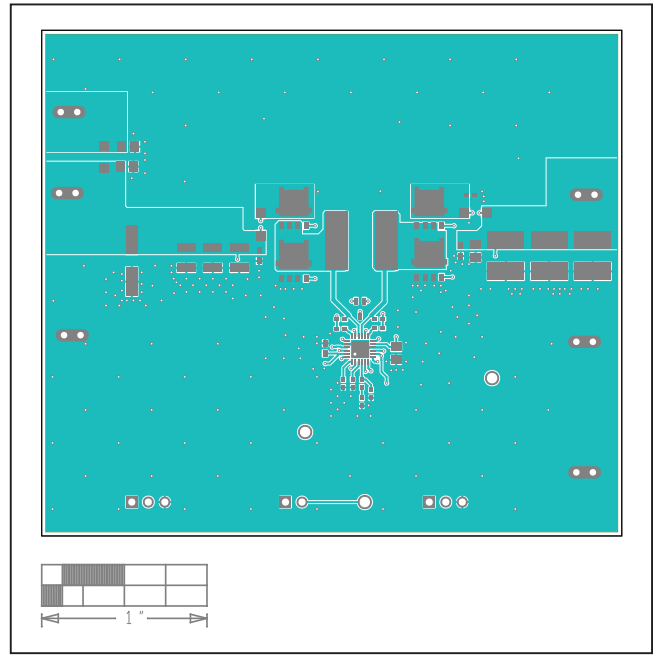
MAX25431 EV Kit Bill of Materials

| REF DES | MFG PART # | MANUFACTURER | DESCRIPTION |
|--|----------------------|----------------------|---|
| C1, C2, C3 | CGA6P3X7S1H106M | TDK | CAP CER 10UF 50V X7S 1210 |
| C4 | EEH-ZE1H680P | Panasonic | CAP ALUM POLY 68UF 20% 50V SMD |
| C5, C6, C17 | CGA2B3X7R1H104M050BB | TDK | CAP CER 0.1UF 50V X7R 0402 |
| C7 | CGA4J1X7R1V475K125AE | TDK | CAP CER 4.7UF 35V X7R 0805 |
| C8 | CGA2B2X7R1E103K050BA | TDK | CAP CER 10000PF 25V X7R 0402 |
| C9 | CGA1A2X7R1H101K030BA | TDK | CAP CER 100PF 50V X7R 0201 |
| L2 | - | - | Do Not Install |
| C10, C11, C15 | CKG57NX7R1E107M500JH | TDK | CAP CER 100uF, 25V, 2220, X7R |
| C12, C13, C14 | CGA3E3X7R1H474K080AE | TDK | CAP CER 0.47UF 50V X7R 0603 |
| C16 | CGA4J1X7R1V225M125AC | TDK | CAP CER 2.2UF 35V X7R 0805 |
| C18, C19 | - | - | Do Not Install |
| D1 | BAT54AWFILMY | ST Microelectronics | DIODE ARRAY SCHOTTKY 40V SOT323 |
| L1 | XAL1060-222E | Coilcraft | Inductor, 2.2uH |
| R1 | PMR18EZPFV3L00 | ROHM | RES 0.003 OHM 1% 1W 1206 |
| R2 | PMR18EZPFV4L00 | ROHM | RES 0.004 OHM 1% 1W 1206 |
| R3 | CRCW040247K0JNED | Vishay Dale | RES SMD 47K OHM 5% 1/16W 0402 |
| R5 | CRCW040273K2FKED | Vishay Dale | RES SMD 73.2K OHM 1% 1/16W 0402 |
| R6, R10 | ERA-2AEB103X | Panasonic | RES SMD 10K OHM 0.1% 1/16W 0402 |
| R11, R14, R15, R16 | CRCW04022R00JN | Vishay Dale | RES SMD 2 OHM 5% 1/16W 0402 |
| R7, R12, R13 | RC0402JR-070RL | Yageo | RES SMD 0 OHM JUMPER 1/16W 0402 |
| R8 | CRCW040220R0JNED | Vishay Dale | RES SMD 20 OHM 5% 1/16W 0402 |
| R9 | CRCW040286K6FK | Vishay Dale | RES SMD 86.6K OHM 1% 1/16W 0402 |
| R17 | CRCW060310K0JNEAC | Vishay Dale | RES SMD 10K OHM 5% 1/10W 0603 |
| R4 | - | - | Do Not Install |
| R18, R19, R20, R21 | - | - | Do Not Install |
| U1 | MAX25431ATGA/VY+ | Maxim Integrated | EVKIT PART - IC; CTRL; AUTOMOTIVE 40V; 55 MICROAMPERE IQ; 2.2MHZ; H-BRIDGE BUCK-BOOST CONTROLLER; TQFN24-EP |
| Q1, Q2, Q3, Q4 | NVMF55C460NL | ON Semiconductor | MOSFET N-CH 40V 21A 78A 5DFN |
| IN_FILTER, IN, OUT, GND, GND2, GND3 | 5020 | Keystone Electronics | TEST POINT PC LOW PRO W/OUT BASE |
| FBR, PGOOD, VCC | 5012 | Keystone Electronics | TEST POINT PC MULTI PURPOSE WHT |
| ENABLE, SYNC | PEC03SAAN | Sullins | CONN HEADER .100 SINGL STR 3POS |
| J4 | PEC02SAAN | Sullins | CONN HEADER .100 SINGL STR 2POS |

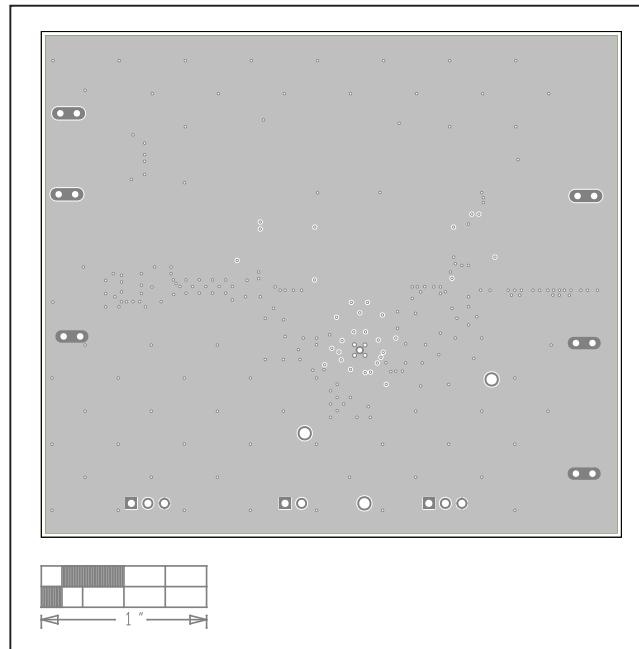
MAX25431 EV Kit PCB Layouts



MAX25431 EV Kit Component Placement Guide—Top Silkscreen

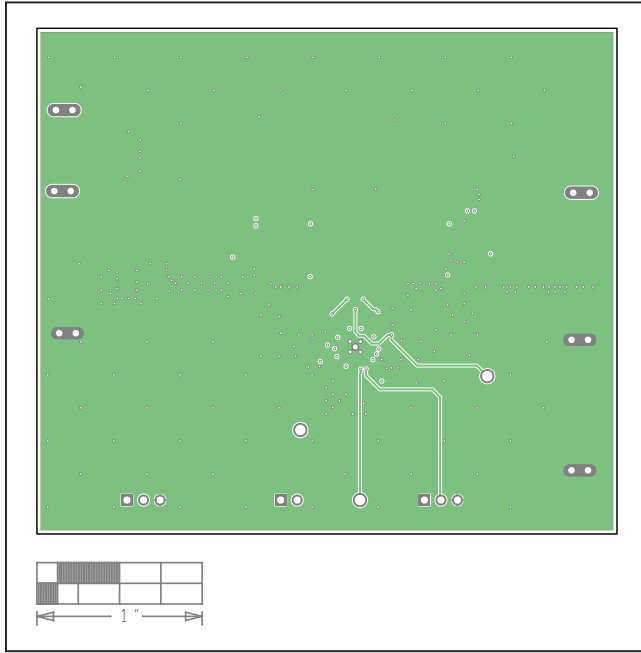


MAX25431 EV Kit PCB Layout—Top

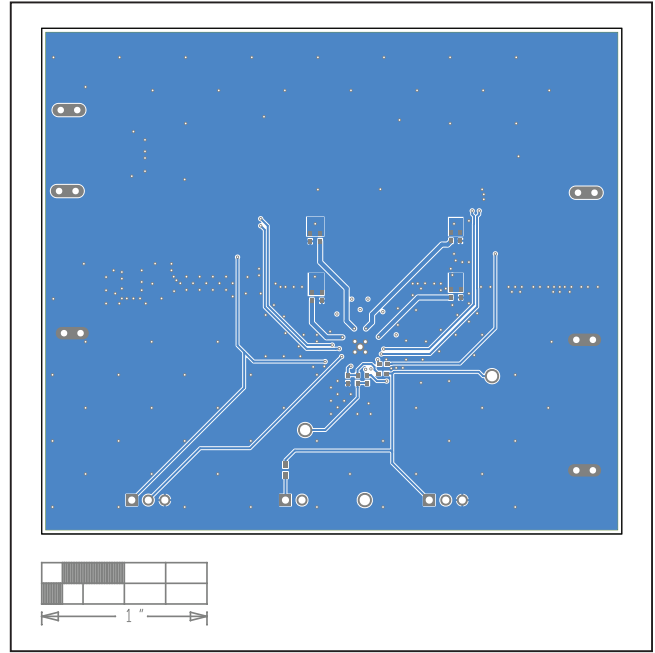


MAX25431 EV Kit PCB Layout—Layer 1

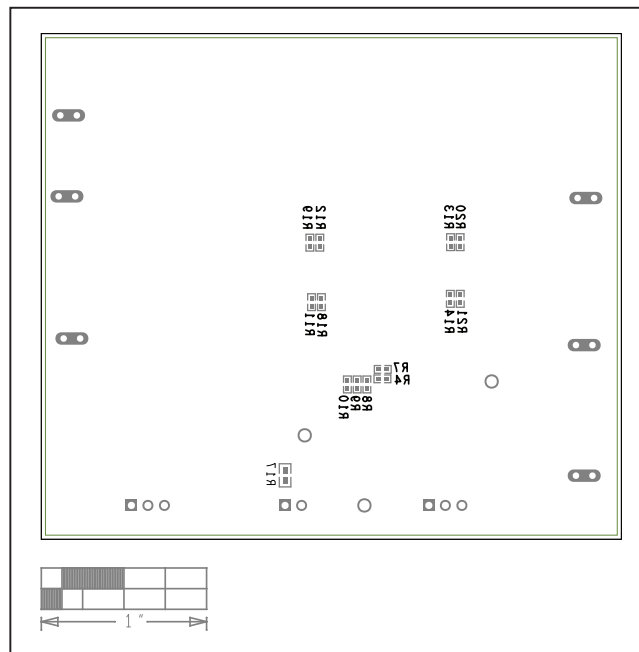
MAX25431 EV Kit PCB Layouts (continued)



MAX25431 EV Kit PCB Layout—Layer 2



MAX25431 EV Kit PCB Layout—Bottom



MAX25431 EV Kit Component Placement Guide—Bottom Silkscreen

Revision History

| REVISION NUMBER | REVISION DATE | DESCRIPTION | PAGES CHANGED |
|-----------------|---------------|-----------------|---------------|
| 0 | 7/20 | Initial release | — |

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