ADP5072CB-EVALZ User Guide

UG-1375

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Evaluating the ADP5072 DC to DC Switching Regulator

FEATURES

Input supply voltage range: 3 V to 5.5 V
Output voltage: ±15 V
Output current: up to 190 mA (V_{POS}), up to 90 mA (V_{NEG}), depending on V_{IN}

EVALUATION KIT CONTENTS

ADP5072CB-EVALZ evaluation board

ADDITIONAL EQUIPMENT NEEDED

DC power supply
Multimeters for voltage and current measurement
Electronic or resistive loads

GENERAL DESCRIPTION

The ADP5072CB-EVALZ evaluation board demonstrates the functionality of the ADP5072 dc to dc converter. The ADP5072 is a dual high performance dc to dc regulator that generates independently regulated positive and negative rails.

Use the board to evaluate simple device measurements, such as line regulation, load regulation, and efficiency. Device features can be demonstrated, such as selectable operating frequency, soft start, sequencing, and slew rate control.

For more details about the ADP5072, refer to the ADP5072 data sheet, which must be consulted in conjunction with this user guide when using the evaluation board.

ADP5072CB-EVALZ EVALUATION BOARD PHOTOGRAPH

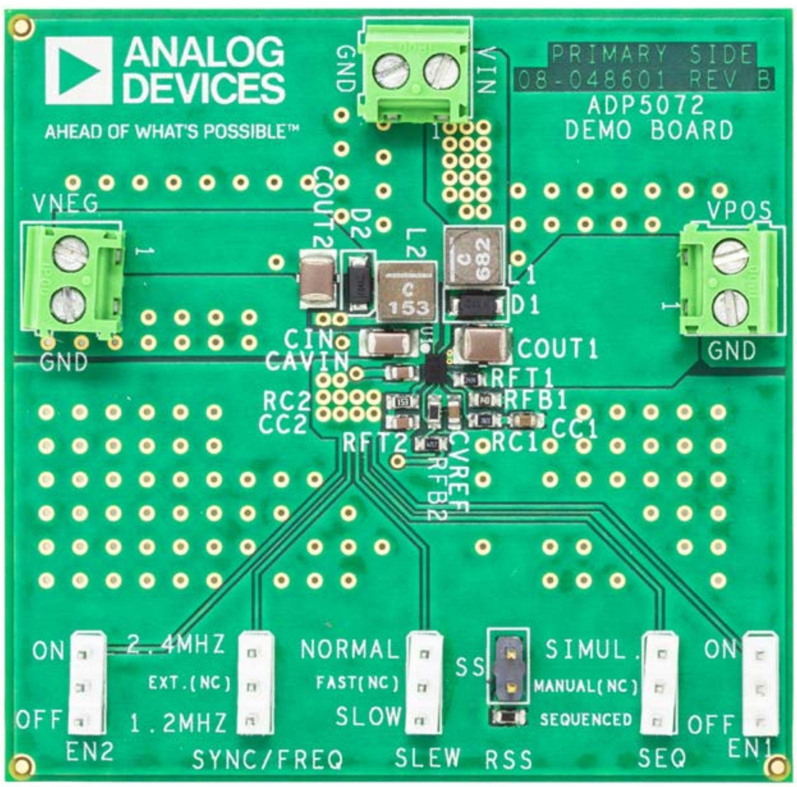

Figure 1.

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REVISION HISTORY

1/2019—Revision 0: Initial Version

EVALUATION BOARD HARDWARE

EVALUATION BOARD CONFIGURATIONS

The ADP5072CB-EVALZ evaluation board is configured to provide a ±15 V output from a 3 V to 5.5 V input. Table 2 lists the components for the ADP5072CB-EVALZ board. The evaluation board allows the end user to customize the design. Figure 2 outlines the board features available to the user.

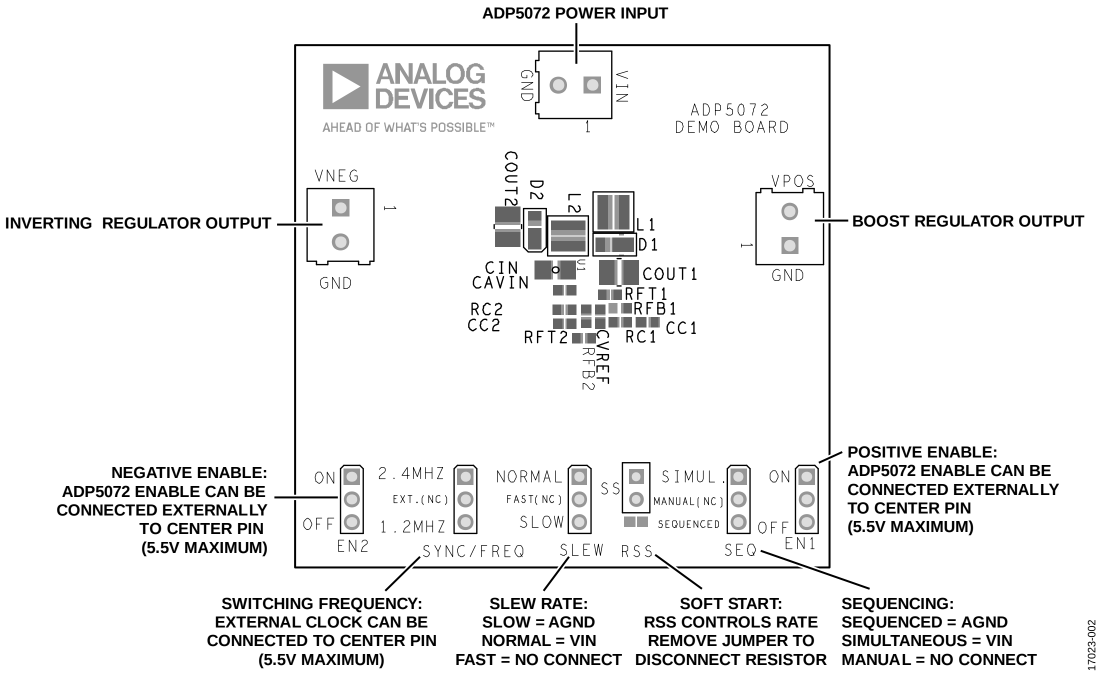

Figure 2. Outline of ADP5072CB-EVALZ Evaluation Board Features

Table 1. ADP5072CB-EVALZ Evaluation Board Connector Function Descriptions

Jumper/Connector Mnemonic	Description
VIN	Power supply to the ADP5072. In the default configuration, the power supply ranges from 3 V to 5.5 V.
VPOS	Output from boost regulator of the ADP5072. 15 V in default configuration.
VNEG	Output from inverting regulator of the ADP5072. −15 V in default configuration.
EN1	Boost regulator precision enable. The voltage of the EN1 pin is compared to an internal precision reference to enable the boost regulator output. Connect the EN1 jumper to the on position to turn on the boost regulator. Connect this jumper to the off position or remove this jumper to turn the regulator off (an internal pull-down is present in the ADP5072).
EN2	Inverting regulator precision enable. The voltage of the EN2 pin is compared to an internal precision reference to enable the inverting regulator output. Connect the EN2 jumper to the on position to turn on the inverting regulator. Connect this jumper to the off position or remove this jumper to turn the regulator off (an internal pull-down is present in the ADP5072).
SYNC/FREQ	Synchronization input and frequency setting. To set the switching frequency to 2.4 MHz, pull the SYNC pin high. To set the switching frequency to 1.2 MHz, pull the SYNC pin low. To synchronize the switching frequency, connect the SYNC pin to an external clock (5.5 V maximum).
SEQ	Start-up sequence control. For manual positive output voltage (V_{POS}) or negative output voltage (V_{NEG}) startup using an individual precision enabling pin, leave the SEQ pin open. For simultaneous V_{POS} and V_{NEG} startup when the EN2 pin rises, connect the SEQ pin to VIN (use the EN1 pin to enable internal references prior to startup if required). For a sequenced startup, pull the SEQ pin low. Use either EN1 or EN2 to enable V_{POS} or V_{NEG} and ensure that the corresponding supply is the first in sequence. Hold the other enable pin low.
SLEW	Driver stage slew rate control. The SLEW pin sets the slew rate for the SW1 and SW2 drivers. For the fastest slew rate (best efficiency), leave the SLEW pin open. For a normal slew rate, connect the SLEW pin to VIN. For the slowest slew rate (best noise performance), connect the SLEW pin to AGND.
RSS	Soft start programming. Leave the SS pin open to obtain the fastest soft start time. To program a slower soft start time, connect the RSS jumper. The RSS jumper connects the RSS resistor between the SS pin and AGND.

OUTPUT VOLTAGE MEASUREMENTS

For basic output voltage accuracy measurements, connect the evaluation board to a voltage source and a voltmeter. Use a resistor as the load for the regulator.

Ensure that the resistor has an adequate power rating to handle the expected power dissipation. Use an electronic load as an alternative. Ensure that the voltage source supplies enough current for the expected load levels, taking into account the device efficiency.

Follow these steps to connect to a voltage source and voltmeter:

1. Connect the negative (−) terminal of the voltage source to the GND terminal of the power input connector on the right side of the evaluation board.
2. Connect the positive (+) terminal of the voltage source to the VIN terminal of the power input connector on the right side of the evaluation board.
3. Connect a load between the VPOS or VNEG terminal and the GND terminal at the output connector (upper left and right of the printed circuit board (PCB)).
4. Connect the voltmeter across the selected output terminal and ground in parallel with the load resistor.
5. Turn the voltage source on. If the EN1 or EN2 jumper is in the on position, the respective boost or inverting regulator powers up.
6. Disconnect the SEQ jumper.

If the load current is large, the user must connect the voltmeter as close as possible to the output capacitor to reduce the effects of voltage drops due to PCB trace impedance.

If long power leads are used from the power supply, especially at higher loads, connect a large capacitor across the VIN terminals to prevent losses from lead inductance. Measure the input voltage at these terminals or use a power supply with a 4-wire supply and sense arrangement.

LINE REGULATION

For line regulation measurements, monitor the regulator output while its input is varied. For optimal line regulation, the output must change as little as possible with varying input levels. It is possible to repeat this measurement under different load conditions. During line regulation tests, keep the power supply leads short and remove any additional input capacitors. Figure 3 and Figure 4 show the typical line regulation performance of the ADP5072 at both the output and feedback pins.

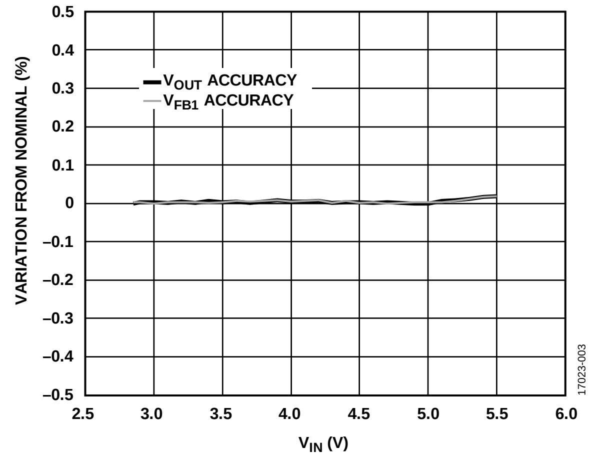

Figure 3. Boost Regulator Line Regulation, V_{POS} = 15 V, Switching Frequency (f_{SW}) = 1.2 MHz, 15 mA Load, T_A = 25°C

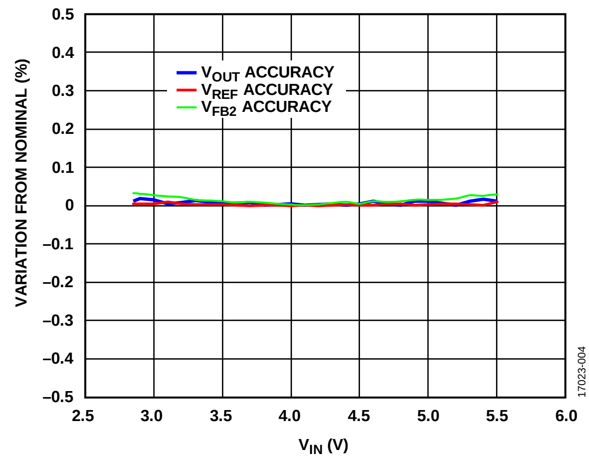

Figure 4. Inverting Regulator Line Regulation, V_{NEG} = −15 V, f_{SW} = 1.2 MHz, 15 mA Load, T_A = 25°C

LOAD REGULATION

For load regulation measurements, monitor the regulator output while the load is varied. For optimal load regulation, the output must change as little as possible with varying loads. The input voltage must be held constant during load regulation measurement. Figure 5 and Figure 6 show the typical load regulation performance of the ADP5072 at both the output and feedback pins. Keep power leads short during load regulation measurement and use a power supply with remote sense.

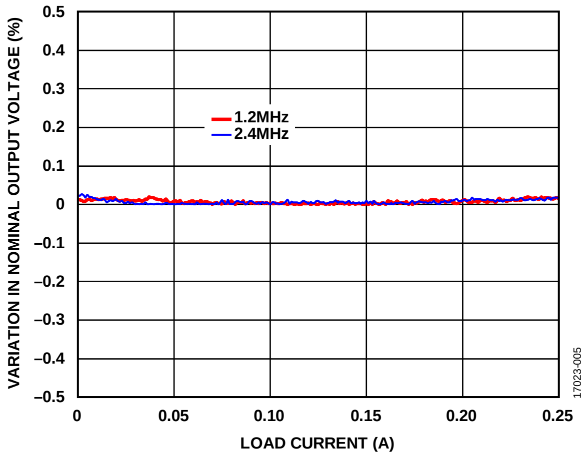

Figure 5. Boost Regulator Load Regulation, Input Supply Voltage Range (V_{IN}) = 5 V, V_{POS} = 15 V

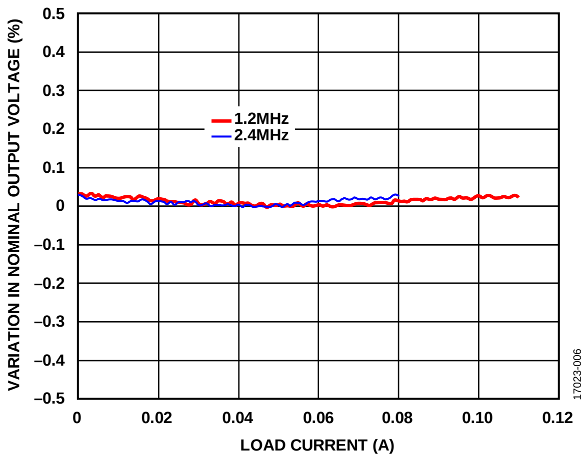

Figure 6. Inverting Regulator Load Regulation, V_{IN} = 5 V, V_{NEG} = –15 V

EFFICIENCY

For efficiency measurements, monitor the regulator input and output while the load is varied. The input voltage must be held constant during efficiency measurements. Keep power leads short during this test and use a power supply with remote sense. Connect ammeters in series with the input and output. Connect voltmeters to the PCB side of the ammeter and measure the voltage across the input and output terminals. For the best results, measure the voltage across the input and output capacitors. If possible, particularly at low current, trigger the meters simultaneously and set the meters to average readings for a period of a few hundred milliseconds or more. Averaging the readings removes the switching ripple and skip mode effects. Figure 7 and Figure 8 show typical efficiency curves using 3.3 V and 5 V inputs.

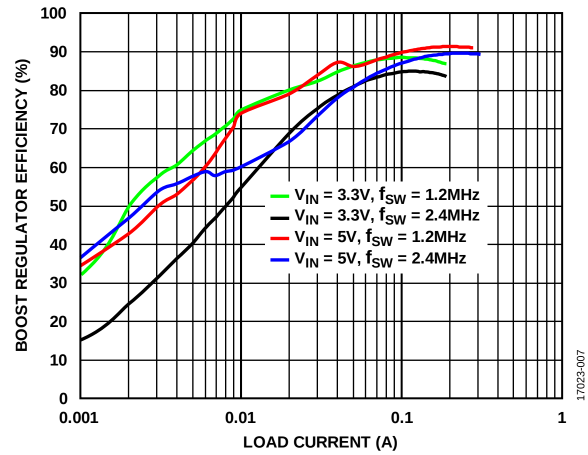

Figure 7. Boost Regulator Efficiency vs. Load Current, V_{POS} = 15 V, T_A = 25°C

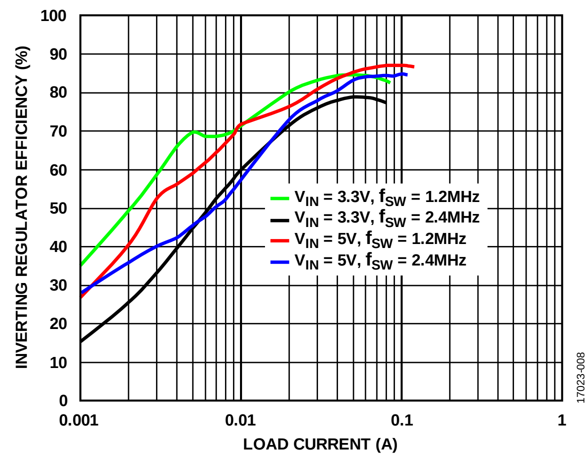

Figure 8. Inverting Regulator Efficiency vs. Load Current, V_{NEG} = –15 V, T_A = 25°C

EVALUATION BOARD SCHEMATIC

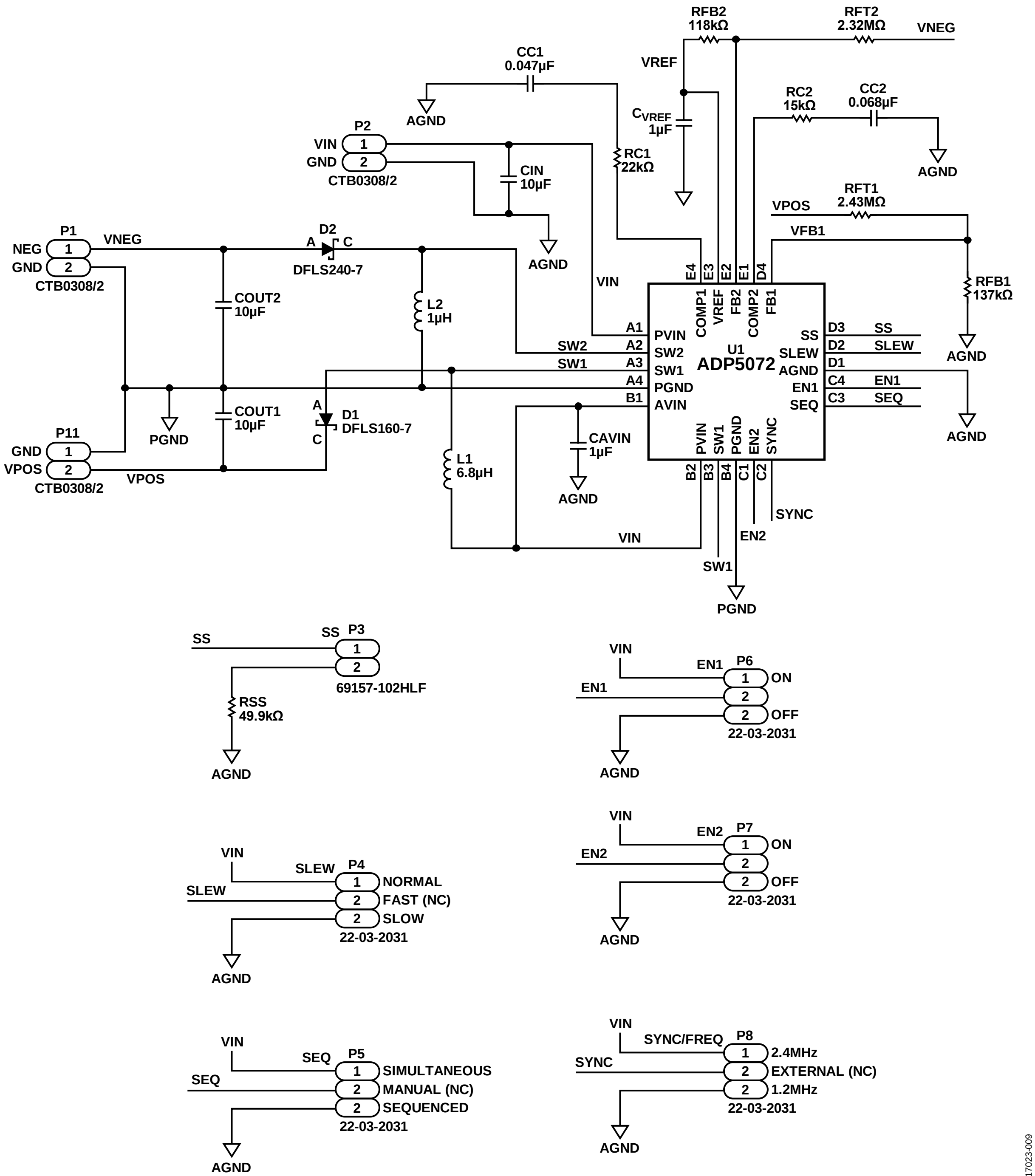

Figure 9. Evaluation Board Schematic for the ADP5072CB-EVALZ

ORDERING INFORMATION

BILL OF MATERIALS

Table 2.

Component	Package	Description	Value	Tolerance	Voltage	Part Number	Manufacturer
U1	WLCSP	ADP5072 WLCSP	ADP5072	Not applicable	Not applicable	Not applicable	Analog Devices, Inc.
COUT1	1210	V_{POS} capacitor	10 µF	10%	50 V	GRM32ER71H106KA12L	Murata
COUT2	1210	V_{NEG} capacitor	10 µF	10%	50 V	GRM32ER71H106KA12L	Murata
L1	XAL40xx	V_{POS} inductor	6.8 µH	20%	Not applicable	XAL4030-682ME	Coilcraft
L2	XAL40xx	V_{NEG} inductor	15 µH	20%	Not applicable	XAL4030-153ME	Coilcraft
D1	POWERDI123	V_{POS} diode	Schottky	Not applicable	40 V	DFLS160-7	Diodes Incorporated
D2	DSML110W70H39	V_{NEG} diode	Schottky	Not applicable	40 V	DFLS240-7	Diodes Incorporated
CC1	603	Boost regulator compensation capacitor	47 nF	10%	50 V	Not applicable	Not applicable
CC2	603	Inverting regulator compensation capacitor	68 nF	10%	100 V	Not applicable	Not applicable
RC1	603	Boost regulator compensation resistor	22 kΩ	1%	Not applicable	Not applicable	Not applicable
RC2	603	Inverting regulator compensation resistor	15 kΩ	1%	Not applicable	Not applicable	Not applicable
RFT1	805	V_{POS} top feedback resistor	2.43 MΩ	1%	Not applicable	Not applicable	Not applicable
RFB1	805	V_{POS} bottom feedback resistor	137 kΩ	1%	Not applicable	Not applicable	Not applicable
RFT2	805	V_{NEG} top feedback resistor	2.32 MΩ	1%	Not applicable	Not applicable	Not applicable
RFB2	805	V_{NEG} bottom feedback resistor	118 kΩ	1%	Not applicable	Not applicable	Not applicable
RSS	603	Soft start programming resistor	49.9 kΩ	1%	Not applicable	Not applicable	Not applicable
CIN	1206	C_{IN} capacitor	10 µF	10%	25 V	TMK316B7106KL-TD	Taiyo Yuden
CAVIN	603	C_{AVIN} capacitor	1 µF	10%	10 V	GRM188R71A105KA61D	Murata
CVREF	603	V_{REF} capacitor	1 µF	10%	10 V	GRM188R71A105KA61D	Murata

NOTES

ESD Caution

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

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