ADP5073CP-EVALZ/ADP5074CP-EVALZ User Guide
UG-1157

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Evaluating the ADP5073/ADP5074 DC-to-DC Switching Regulators

FEATURES

Input voltage range: 3 V to 13.2 V
Output voltage: −5 V
Output current
  ADP5073CP-EVALZ: 300 mA
  ADP5074CP-EVALZ: 600 mA
Demonstrates compact 18 mm × 14 mm layout

EVALUATION KIT CONTENTS

ADP5073CP-EVALZ or ADP5074CP-EVALZ evaluation board

ADDITIONAL EQUIPMENT NEEDED

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

GENERAL DESCRIPTION

The ADP5073CP-EVALZ and ADP5074CP-EVALZ evaluation boards demonstrate the functionality of the ADP5073 and ADP5074 dc-to-dc regulators, respectively.

Use either board to evaluate simple device measurements, such as line regulation, load regulation, and efficiency. Device features such as selectable operating frequency, soft start, and slew rate control can also be evaluated. The evaluation boards accept input voltages that are within tolerance of the standard 3.3 V and 12.0 V dc levels.

For more details about the dc-to-dc regulators, refer to the ADP5073 and ADP5074 data sheets, which must be consulted in conjunction with this user guide when using these evaluation boards.

Note that this user guide covers both the ADP5073CP-EVALZ and the ADP5074CP-EVALZ evaluation boards, but the data presented were gathered using the ADP5073CP-EVALZ.

EVALUATION BOARD PHOTOGRAPH

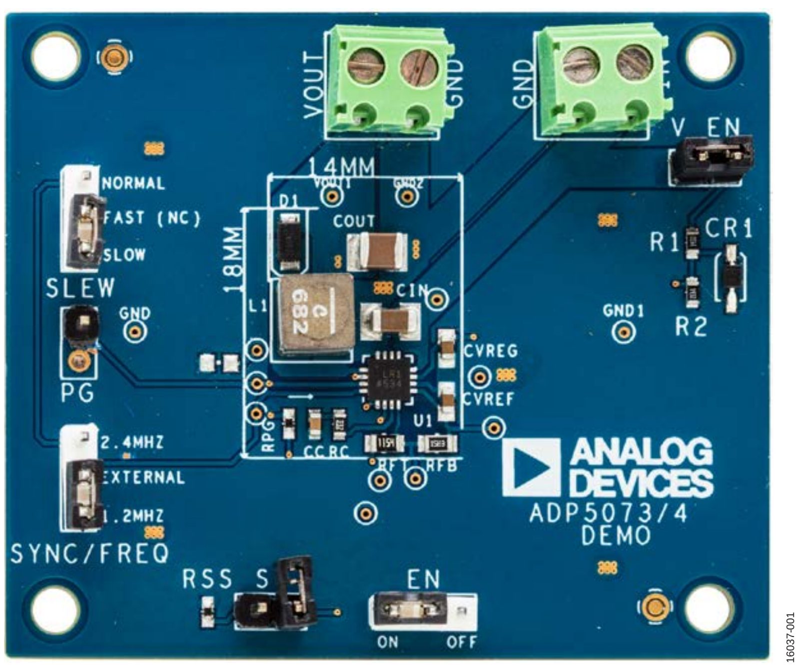

Figure 1. ADP5073/ADP5074 Evaluation Board

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REVISION HISTORY

9/2017—Revision 0: Initial Version

EVALUATION BOARD HARDWARE

EVALUATION BOARD CONFIGURATIONS

The ADP5073CP-EVALZ and the ADP5074CP-EVALZ evaluation boards are configured to provide a −5 V output from a +3 V to +13.2 V input.

Table 2 and Table 3 in the Ordering Information section of this user guide list the components for both the ADP5073CP-EVALZ and ADP5074CP-EVALZ boards, respectively.

The board allows the end user to customize the design. Refer to the ADP5073 and ADP5074 data sheets or to the corresponding ADIsimPower tool to obtain alternative component values.

Figure 2 shows the board features available to the user.

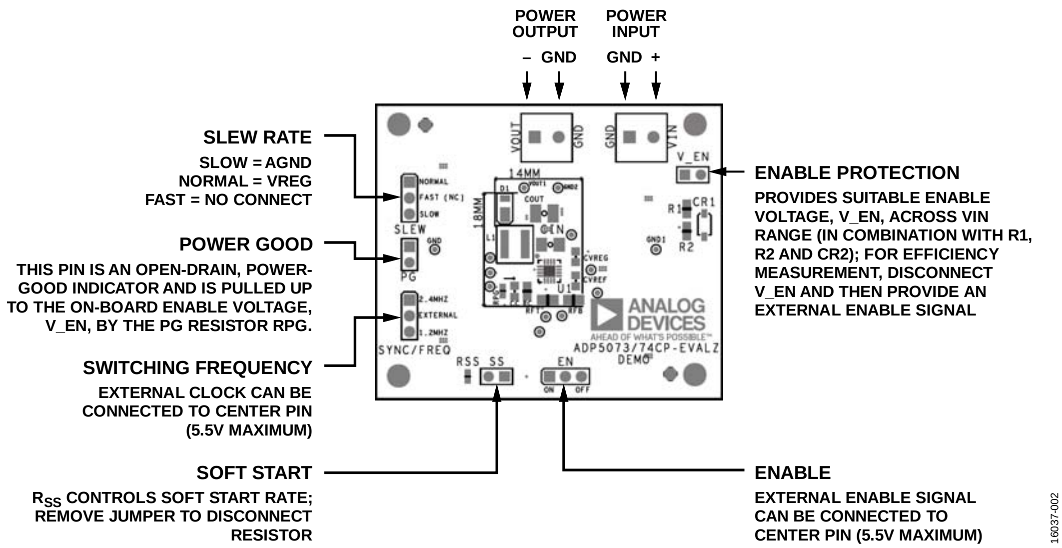

Figure 2. Outline of ADP5073/ADP5074 Evaluation Board Features

Table 1. ADP5073CP-EVALZ/ADP5074CP-EVALZ Function Descriptions

Jumper/Connector Mnemonic	Description
VIN	Power Supply to the ADP5073/ADP5074. In the default configuration, this ranges from 3 V to 13.2 V.
VOUT	Output from the ADP5073/ADP5074. VOUT is −5 V in default configuration.
V_EN	Provides a clamped enable voltage to allow operation using input voltages higher than 5.5 V, without damaging the EN pin. For efficiency measurements, remove this jumper and provide an enable signal from an external supply.
EN	Precision Enable. The EN pin is compared to an internal precision reference to enable the inverting regulator output. Connect this jumper to the on position to turn on the 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 ADP5073/ADP5074). An external enable can be connected to the center pin with a voltage from 1.2 V to 5.5 V.
SYNC/FREQ	Synchronization Input and Frequency Setting. To set the switching frequency to 2.4 MHz, pull the SYNC/FREQ pin high. To set the switching frequency to 1.2 MHz, pull the SYNC/FREQ pin low. To synchronize the switching frequency, connect the SYNC/FREQ pin to an external clock (5.5 V maximum).
SLEW	Driver Stage Slew Rate Control. The SLEW pin sets the slew rate for the SW pin driver. For the fastest slew rate (best efficiency), leave the SLEW pin open. For a normal slew rate, connect the SLEW pin to VREG. For the slowest slew rate (best electromagnetic interference (EMI) performance), connect the SLEW pin to GND.
SS	Soft Start Programming. Leave the SS pin open to obtain the fastest soft start time. To program a slower soft start time, connect this jumper. This jumper connects the RSS resistor between the SS pin and GND.
PG	Power-Good Output. This pin is an open-drain, power-good indicator and is pulled up to the on-board enable voltage, V_EN, by the RPG resistor.

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.
2. Connect the positive (+) terminal of the voltage source to the VIN terminal of the power input connector.
3. Connect a load between the VOUT terminal and GND terminal at the output connector.
4. Connect the voltmeter across the output terminal and ground in parallel with the load resistor.

Turn the voltage source on and move the EN jumper to the on position.

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 the printed circuit board (PCB) trace impedance.

If long power leads are used from the power supply, especially at higher loads, connect a large capacitor (10 µF or more) 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.

Keep power leads short when performing any output voltage measurements.

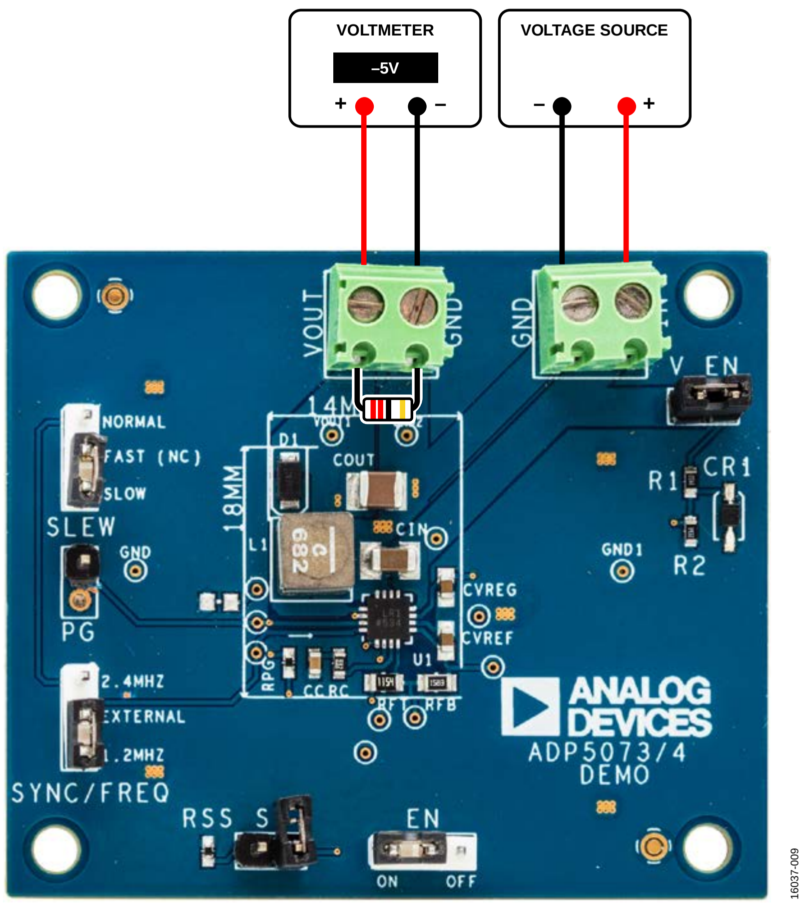

Figure 3. Output Voltage Measurement

LINE REGULATION

For line regulation measurements, monitor the regulator output while its input is varied. For good line regulation, the output should change very little with varying input levels. It is possible to repeat this measurement under different load conditions. Figure 4 and Figure 5 show the typical line regulation performance of the ADP5073.

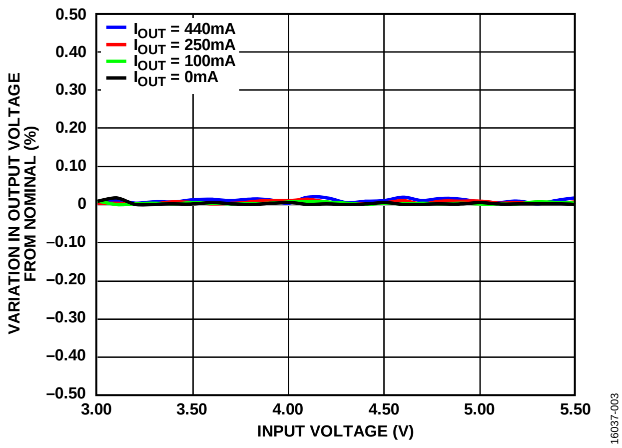

Figure 4. ADP5073 Line Regulation, V_{NEG} = −5 V, f_{SW} = 1.2 MHz, T_A = 25°C

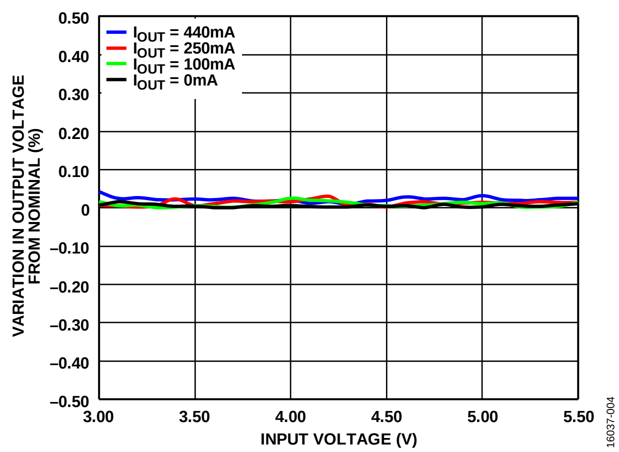

Figure 5. ADP5073 Line Regulation, V_{NEG} = −5 V, f_{SW} = 2.4 MHz, T_A = 25°C

LOAD REGULATION

For load regulation measurements, monitor the regulator output while the load is varied. For good load regulation, the output should change very little with varying loads. The input voltage must be held constant during this measurement. Figure 6 shows the typical load regulation performance of the ADP5073.

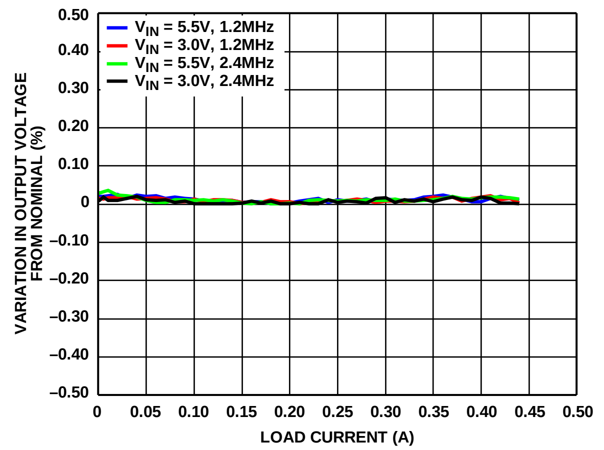

Figure 6. ADP5073 Load Regulation, V_{NEG} = −5 V, T_A = 25°C

EFFICIENCY

For efficiency measurements, monitor the regulator input and output while the load is varied. The input voltage must be held constant during this measurement. 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 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 shows the typical efficiency curves of ADP5073. Note that, to remove the impact to the efficiency of the divider resistors for the EN voltage, remove the V_EN jumper and the EN jumper and provide an enable signal to the EN pin from an external supply.

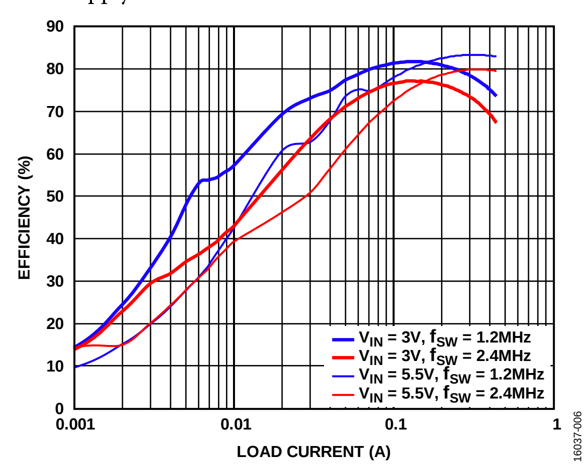

Figure 7. ADP5073 Efficiency vs. Load Current, V_{NEG} = −5 V, T_A = 25°C

EVALUATION BOARD SCHEMATICS

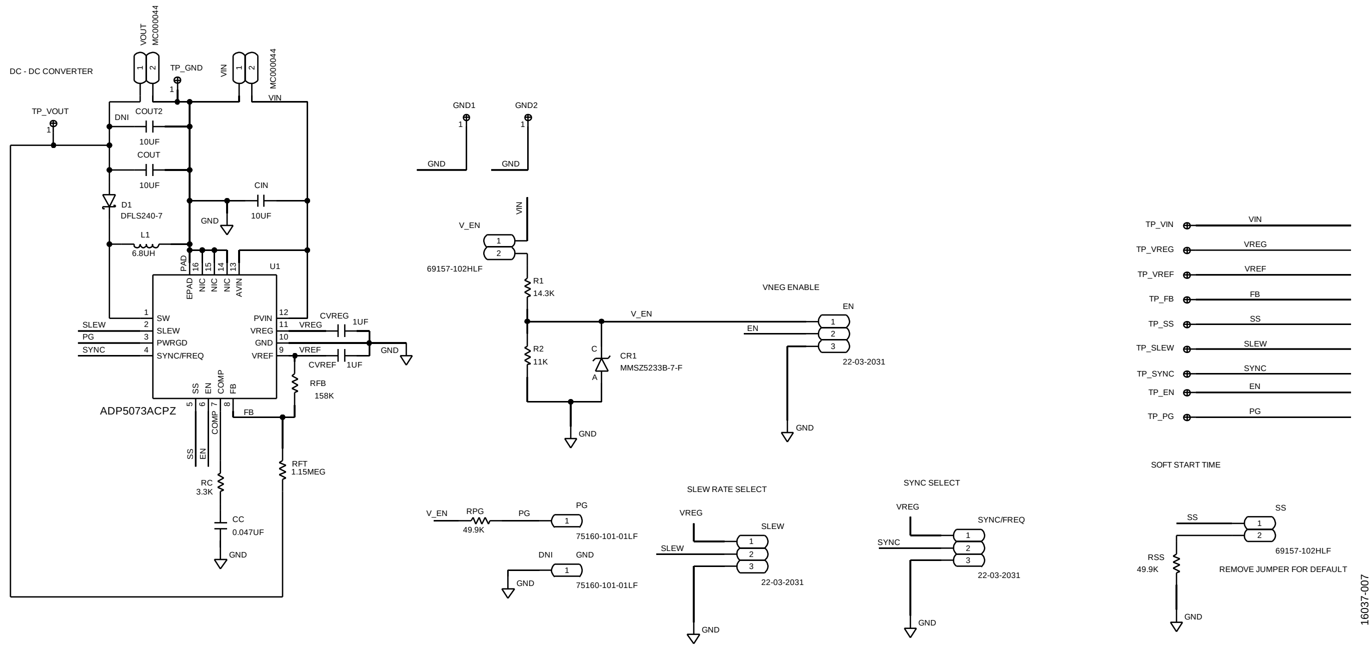

Figure 8. Evaluation Board Schematic for the ADP5073

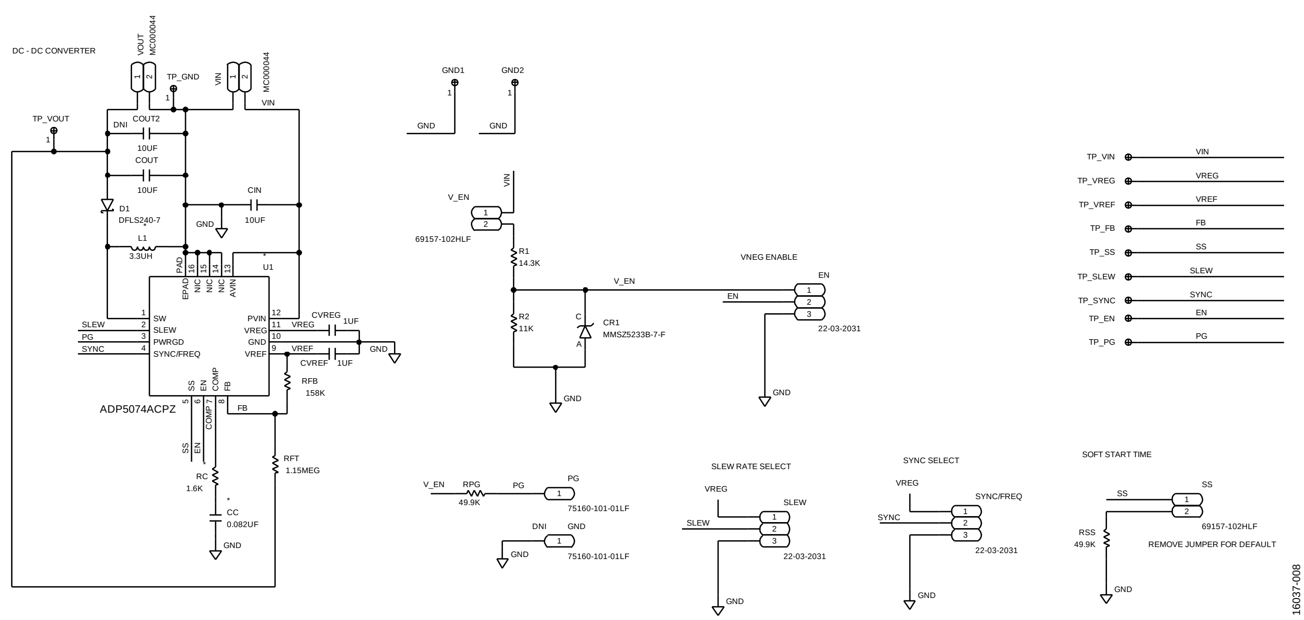

Figure 9. Evaluation Board Schematic for the ADP5074

ORDERING INFORMATION

BILL OF MATERIALS

Table 2. ADP5073CP-EVALZ Evaluation Board Components

Component	Package	Description	Value	Tolerance	Voltage	Part Number	Manufacturer
U1	16-lead LFCSP	ADP5073 dc-to-dc inverting regulator	ADP5073				Analog Devices, Inc.
COUT	1210	Output capacitor	10 µF	10%	50 V	GRM32ER71H106KA12L	Murata
COUT2	1210	Output capacitor	Not installed				
L1		Inverting regulator inductor	6.8 µH	20%		XAL5050-682MEB	Coilcraft
D1	PowerDI123	Inverting regulator Schottky diode	2 A		40 V	DFLS240L-7	Diodes, Inc.
CC	0603	Inverting regulator compensation capacitor	0.047 µF	10%	25 V	CC0603KRX7R7BB473	Yageo
RC	0603	Inverting regulator compensation resistor	3.3 kΩ	1%			
RFT	0805	Top feedback resistor	1.15 MΩ	1%			
RFB	0805	Bottom feedback resistor	158 kΩ	1%			
RPG	0402	Power-good pull-up resistor	49.9 kΩ	1%			
RSS	0402	Soft start programming resistor	49.9 kΩ	1%			
CIN	1206	Input capacitor	10 µF	10%	25 V	TMK316B7106KL-TD	Taiyo Yuden
CVREG	0603	Internal regulator capacitor	1 µF	10%	10 V	GRM188R71A105KA61D	Murata
CVREF	0603	Inverting regulator reference output capacitor	1 µF	10%	10 V	GRM188R71A105KA61D	Murata
R1	0603	Top resistor for enable voltage divider	14.3 kΩ	1%			
R2	0603	Bottom resistor for enable voltage divider	11 kΩ	1%			
CR1	SOD323	Zener diode for enable voltage divider	6 V			MMSZ5233BS-7-F	Diodes, Inc.

Table 3. ADP5074CP-EVALZ Evaluation Board Components

Component	Package	Description	Value	Tolerance	Voltage	Part Number	Manufacturer
U1	16-lead LFCSP	ADP5074 dc-to-dc inverting regulator	ADP5074				Analog Devices, Inc.
COUT	1210	Output capacitor	10 µF	10%	50 V	GRM32ER71H106KA12L	Murata
COUT2	1210	Output capacitor	Not installed				
L1		Inverting regulator inductor	3.3 µH	20%		XAL5030-332MEB	Coilcraft
D1	PowerDI123	Inverting regulator Schottky diode	2 A		40 V	DFLS240L-7	Diodes, Inc.
CC	0603	Inverting regulator compensation capacitor	0.082 µF	10%	16 V	0603YC823KAT2A	AVX
RC	0603	Inverting regulator compensation resistor	1.6 kΩ	1%			
RFT	0805	Top feedback resistor	1.15 MΩ	1%			
RFB	0805	Bottom feedback resistor	158 kΩ	1%			
RPG	0402	Power-good pull-up resistor	49.9 kΩ	1%			
RSS	0402	Soft start programming resistor	49.9 kΩ	1%			
CIN	1206	Input capacitor	10 µF	10%	25 V	TMK316B7106KL-TD	Taiyo Yuden
CVREG	0603	Internal regulator capacitor	1 µF	10%	10 V	GRM188R71A105KA61D	Murata
CVREF	0603	Inverting regulator reference output capacitor	1 µF	10%	10 V	GRM188R71A105KA61D	Murata
R1	0603	Top resistor for enable voltage divider	14.3 kΩ	1%			
R2	0603	Bottom resistor for enable voltage divider	11 kΩ	1%			
CR1	SOD323	Zener diode for enable voltage divider	6 V			MMSZ5233BS-7-F	Diodes, Inc.

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