

# MAX17681 Evaluation Kit

# Evaluates: MAX17681 for Isolated +7V or +5V Output Configuration

## General Description

The MAX17681EVKITD is a fully assembled and tested circuit board that demonstrates the performance of the MAX17681 high-efficiency, iso-buck DC-DC converter. The EV kit operates over a wide input-voltage range of 17V to 36V and uses primary-side feedback to regulate the output voltage. The EV kit has two output configurations. In the first configuration, the output is programmed to +7V at 200mA, with  $\pm 8\%$  output voltage regulation. The second configuration uses a post regulator (MAX17651) to produce +5V at 100mA with at least  $\pm 3\%$  regulation.

The EV kit comes installed with the MAX17681 in a 10-pin (3mm x 2mm) TDFN package and MAX17651 in a 6-lead TSOT package.

## Features

- 17V to 36V Input Voltage Range
- +7V, 200mA or +5V, 100mA Continuous Current
- EN/UVLO Input
- 200kHz Switching Frequency
- Overcurrent Protection
- No Optocoupler
- Delivers up to 1.4W Output Power
- Overtemperature Protection
- Proven PCB Layout

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

## Quick Start

### Recommended Equipment

- One 15V–60V DC, 0.5A power supply
- Two resistive loads of 200mA sink capacity
- Four digital multimeters (DMM)

**Caution: Do not turn on the power supply until all connections are completed.**

### Procedure

The EV kit comes with the default output configuration programmed to +7V.

### Test Procedure for +7V Output

- 1) Verify that J1 is open.
- 2) Verify that the R7 and R14 are not installed.
- 3) Set the power supply output to 24V. Disable the power supply.
- 4) Connect the positive terminal of the power supply to the  $V_{IN}$  PCB pad and the negative terminal to the nearest PGND PCB pad. Connect a 200mA resistive load across the +7V PCB pad and the GND0 PCB pad.
- 5) Connect a DMM configured in voltmeter mode across the +7V PCB pad and the nearest GND0 PCB pad.
- 6) Enable the input power supply.
- 7) Verify that output voltage is at +7V (with allowable tolerance of  $\pm 8\%$ ) with respect to GND0.
- 8) If required, vary the input voltage from 17V to 36V, and the load current from 0mA to 200mA and verify that output voltage is at +7V (with allowable tolerance of  $\pm 8\%$ ).

**Test Procedure for +5V Output**

- 1) Verify that J1 is open.
- 2) Place 0Ω resistors in R7. Place a 681k pack-out resistor (comes with EV kit package) in R14.
- 3) Set the input power supply output to 24V. Disable the power supply.
- 4) Connect the positive terminal of the power supply to the V<sub>IN</sub> PCB pad and the negative terminal to the nearest PGND PCB pad. Connect a 100mA resistive load across the +5V PCB pad and the GND0 PCB pad.
- 5) Connect a DMM configured in voltmeter mode across the +5V PCB pad and the nearest GND0 PCB pad.
- 6) Enable the input power supply.
- 7) Verify that output voltage is at +5V (with allowable tolerance of ±3%) with respect to GND0.
- 8) If required, vary the input voltage from 17V to 36V, and the load current from 0mA to 100mA and verify that output voltage is at +5V (with allowable tolerance of ±3%).

**Detailed Description**

The MAX17681EVKITD evaluation kit (EV kit) is a fully assembled and tested circuit board that demonstrates the performance of the MAX17681 high efficiency, iso-buck DC-DC converter designed to provide an isolated power up to 1.4W. The EV kit generates either +7V, 200mA or +5V, 100mA output from a 17V to 36V input supply. The EV kit features a forced PWM control scheme that provides constant switching-frequency of 200kHz operation at all load and line conditions.

The EV Kit includes an EN/UVLO PCB pad to monitor and program the EN/UVLO pin of the MAX17681. The V<sub>PR1</sub> PCB pad helps measure the regulated primary output voltage (V<sub>PR1</sub>). An additional RESET PCB pad is

available for monitoring the health of primary output voltage (V<sub>PR1</sub>). RESET pulls low if FB voltage drops below 92.5% of its set value. RESET goes high impedance 1024 clock cycles after FB voltage rises above 95.5% of its set value. The programmable soft-start feature allows users to reduce the input inrush current.

The iso-buck is a synchronous-buck-converter-based topology, useful for generating isolated outputs at low power level without using an optocoupler. The detailed procedure for setting the soft-start time, ENABLE/UVLO divider, primary output voltage (V<sub>PR1</sub>) selection, adjusting the primary output voltage, primary inductance selection, turns-ratio selection, output capacitor selection, output diode selection and external loop compensation are given in the MAX17681 IC data sheet. The post regulator, MAX17651 output voltage setting and the related additional information are detailed in MAX17651 IC data sheet.

**Enable Control (J1)**

The EN/UVLO pin on the device serves as an on/off control while also allowing the user to program the input undervoltage-lockout (UVLO) threshold. J1 configures the EV kit’s output for turn-on/turn-off control. Install a shunt across J1 pins 2-3 to disable V<sub>OUT</sub>. See [Table 1](#) for proper J1 configurations.

**NOTE 1:** The secondary output diodes D1 is rated to carry short-circuit current only for few 100’s of ms and is not rated to carry the continuous short-circuit current.

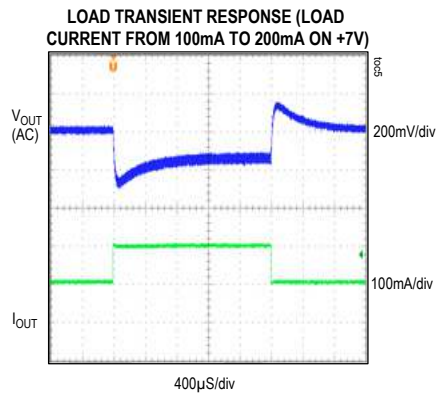
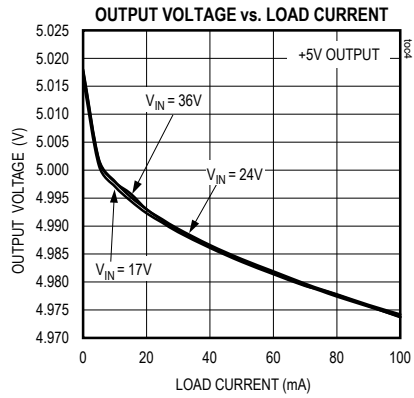
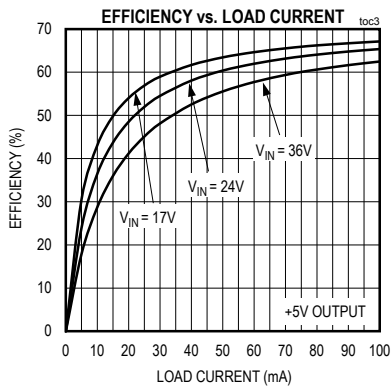
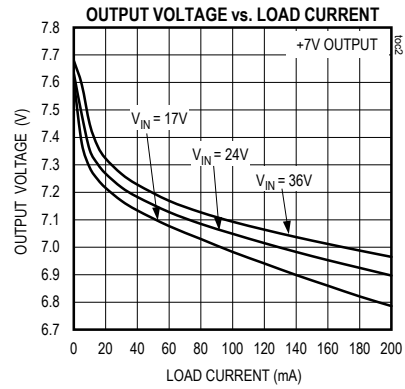
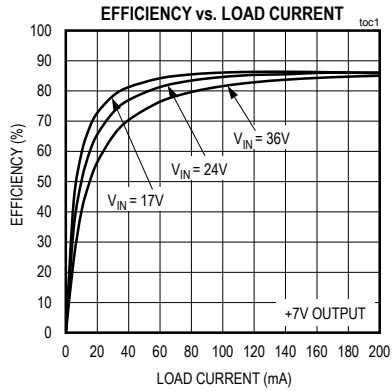
**NOTE 2:** The iso-buck converter typically needs 10% minimum load to regulate the output voltage. In this design, when the +7V rail is healthy, U3 sinks the minimum load current required to regulate the output voltages within ±8% regulation.

**Table 1. Enable Control (EN/UVLO) (J1) Jumper Settings**

| SHUNT POSITION | EN/UVLO PIN                                      | VOUT                               |
|----------------|--|------------------------------------|
| J1             |  |                                    |
| 1-2            | Connected to V <sub>IN</sub>                     | Always Enabled                     |
| 2-3            | Connected to GND                                 | Always Disabled                    |
| Open*          | Connected to midpoint of R1, R2 resistor-divider | Enabled at V <sub>IN</sub> ≥ 15.5V |

\*Default position.

EV Kit Performance Report



## MAX17681 Evaluation Kit

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+7V or +5V Output Configuration

### Component Suppliers

| SUPPLIER         | WEBSITE           |
|------------------|-------------------|
| Würth Elektronik | www.we-online.com |
| Murata Americas  | www.murata.com    |
| Panasonic Corp.  | www.panasonic.com |

**Note:** Indicate that you are using the MAX17681 when contacting these component suppliers.

### Component Information, PCB Layout, and Schematic

See the following links for component information, PCB layout diagrams, and schematic.

- [MAX17681D EV BOM](#)
- [MAX17681D EV PCB Layout](#)
- [MAX17681D EV Schematic](#)

### Ordering Information

| PART            | TYPE  |
|-----------------|-------|
| MAX17681EVKITD# | EVKIT |

#Denotes RoHS compliant.

## Revision History

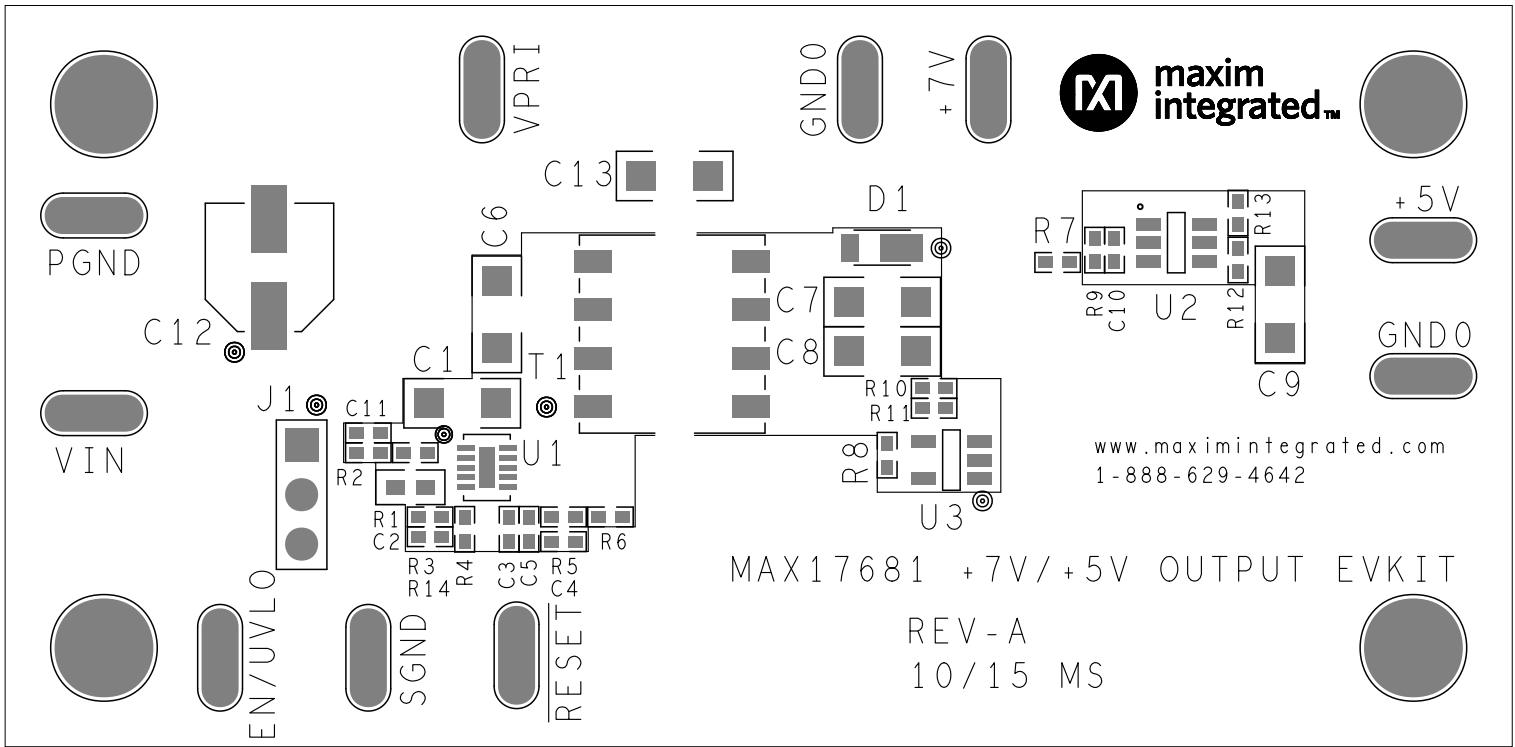
| REVISION NUMBER | REVISION DATE | DESCRIPTION   | PAGES CHANGED |
|-----------------|---------------|---|---------------|
| 0               | 2/16          | Initial release   | —             |
| 1               | 4/16          | Updated <i>General Description</i> and <i>Bill of Materials</i> | 1, 2          |

For pricing, delivery, and ordering information, please contact Maxim Direct at 1-888-629-4642, or visit Maxim Integrated's website at [www.maximintegrated.com](http://www.maximintegrated.com).

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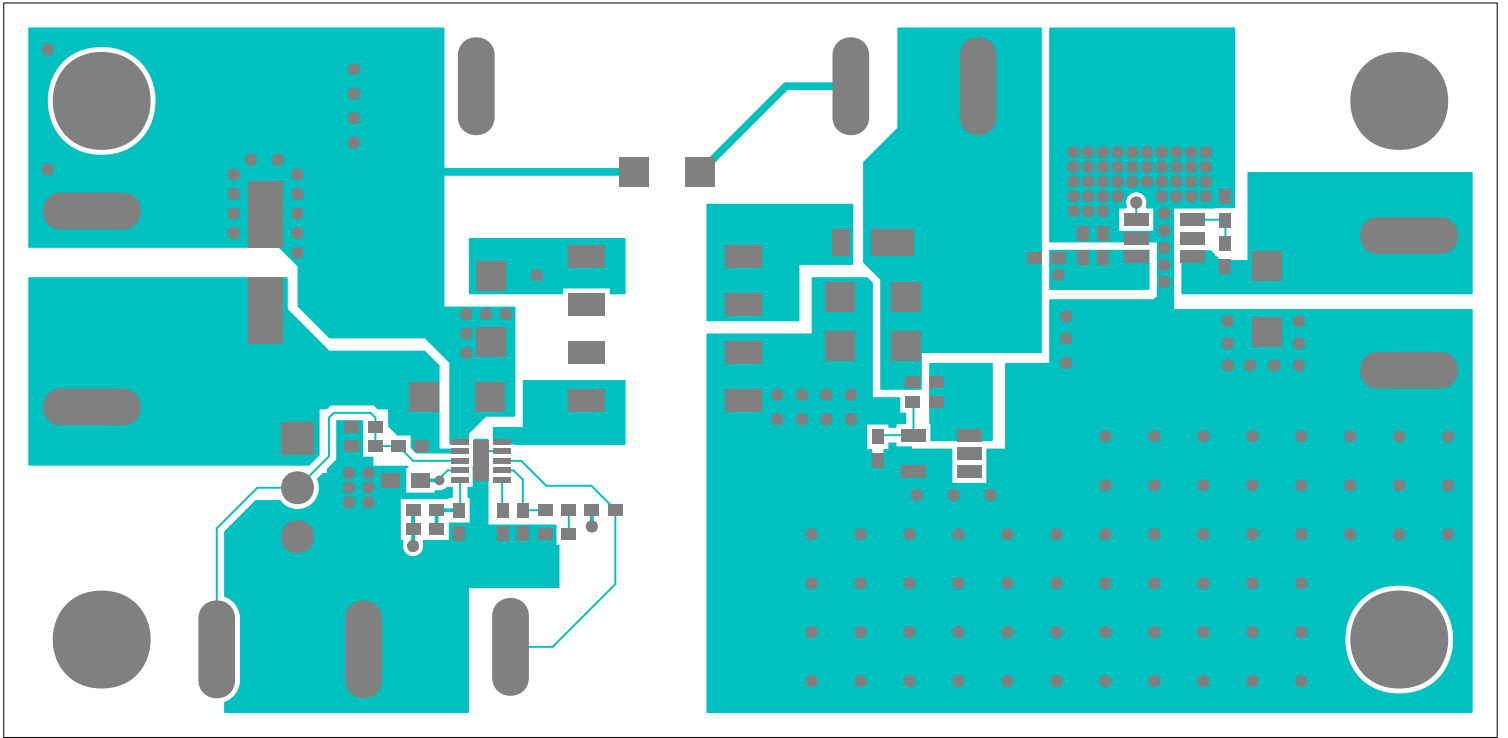
| S NO | Designation | Qty | Description   | Manufacturer Partnumber-1             | Manufacturer Partnumber-2     | Manufacturer Partnumber-3   | Manufacturer Partnumber-4    |
|------|-------------|-----|---|---------------------------------------|-------------------------------|-----------------------------|------------------------------|
| 1    | C1          | 1   | 1μF±10%, 50V,X7R Ceramic capacitor (1206)                       | Murata<br>GRM31CR71H105KA61           | KEMET C1206C105K5RAC          | Murata<br>GRM31MR71H105KA88 |                              |
| 2    | C2          | 1   | 1μF±10% 16V X7R Ceramic capacitor (0603)                        | Murata<br>GRM188R71C105KA12           | KEMET C0603C105K4RAC          | TDK C1608X7R1C105K          | TAIYO YUDEN<br>EMK107B7105KA |
| 3    | C3          | 1   | 0.033UFnF±10%,25V, X7R ceramic capacitor (0402)                 | Murata<br>GRM155R71E333KA88           |                               |                             |                              |
| 4    | C4          | 1   | 0.082UFnF±10%,16V, X7R ceramic capacitor (0402)                 | Murata GRM155R71C823K                 | KEMET C0402C823K4RAC          |                             |                              |
| 5    | C5          | 1   | 680pF±5%,50V,COG ceramic capacitor (0402)                       | Murata<br>GRM1555C1H681JA01           | VENKEL LTD C0402C0G500-681JNP |                             |                              |
| 6    | C6          | 1   | 10uF±10%,16V, X7R ceramic capacitor (1206)                      | Murata<br>GRM31CR71C106KAC7           |                               |                             |                              |
| 7    | C7, C8      | 2   | 4.7uF±10%,50V, X7R ceramic capacitor (1206)                     | Murata<br>GRM31CR71H475KA12           |                               |                             |                              |
| 8    | C9          | 1   | 2.2uF±10%,50V, X7R ceramic capacitor (1206)                     | Murata<br>GRM31CR71H225KA88           | TAIYO YUDEN<br>UMK316B7225K   |                             |                              |
| 9    | C10         | 1   | 0.1uF±10%, 25V, X7R ceramic capacitor(0402)                     | Murata<br>GRM155R71E104KE14           |                               |                             |                              |
| 10   | C11         | 1   | 0.01uF±10%, 50V, X7R ceramic capacitor (0402)                   | Murata<br>GRM155R71H103KA88           | KEMET C0402C103K5RAC          |                             |                              |
| 11   | C12         | 1   | 22uF, 20%, 50V, ALUMINUM ELECTROLYTIC CAPACITOR<br>6.60*6.60mm, | Panasonic EEEFK1H220P                 |                               |                             |                              |
| 12   | C13         | 1   | 1000pF±10%, 1500V, X7R ceramic capacitor (1206)                 | AVX 1206SC102KAT                      |                               |                             |                              |
| 13   | D1          | 1   | 100V/2A, PowerDI®123  | Diode Inc. DFLS2100                   |                               |                             |                              |
| 14   | J1          | 1   | 3-pin headers   | SULLINS ELECTRONICS<br>CORP PEC03SAAN |                               |                             |                              |
| 15   | R1          | 1   | 3.01M Ohm±1% resistor (0402)                                    | VISHAY DALE<br>CRCW04023M01FK         |                               |                             |                              |
| 16   | R2          | 1   | 261K Ohm±1% resistor (0402)                                     | VISHAY DALE<br>CRCW0402261KFK         |                               |                             |                              |
| 17   | R3          | 1   | 78.7K Ohm±1% resistor (0402)                                    | VISHAY DALE<br>CRCW040278K7FK         |                               |                             |                              |
| 18   | R4          | 1   | 10.5kΩ ±1% resistor (0402)                                      | PANASONIC ERJ-2RKF1052                |                               |                             |                              |
| 19   | R5          | 1   | 4.025kΩ ±1% resistor (0402)                                     | VISHAY CRCW04024K02FK                 | PANASONIC ERJ-2RKF4021X       |                             |                              |
| 20   | R6          | 1   | 100kΩ ±5% resistor (0402)                                       | PANASONIC ERJ-2GEJ104X                |                               |                             |                              |
| 21   | R7          | 1   | OPEN (0402)   |                                       |                               |                             |                              |

|    |     |   |   |                                     |                                  |  |  |
|----|-----|---|---|-------------------------------------|----------------------------------|--|--|
| 22 | R8  | 1 | 115kΩ ±1% resistor (0402)                         | VISHAY DALE<br>CRCW0402115KFK       |                                  |  |  |
| 23 | R9  | 1 | 22kΩ ±1% resistor (0402)                          | VISHAY DALE<br>CRCW040222K0FK       |                                  |  |  |
| 24 | R10 | 1 | 22Ω ±1% resistor (0402)                           | VISHAY DALE<br>CRCW040222R0FK       |                                  |  |  |
| 25 | R11 | 1 | 232kΩ ±1% resistor (0402)                         | VISHAY DALE<br>CRCW0402232KFK       |                                  |  |  |
| 26 | R12 | 1 | 432kΩ ±1% resistor (0402)                         | VISHAY DALE<br>CRCW0402432KFK       |                                  |  |  |
| 27 | R13 | 1 | 59kΩ ±1% resistor (0402)                          | VISHAY DALE<br>CRCW040259K0FK       | VENKEL LTD CR0402-16W-<br>5902FT |  |  |
| 28 | T1  | 1 | EP7, 8-pin SMT, 50μH,1.2A,(4-1):(6-7):(5-8)=1:1:1 | WURTH ELECTRONICS INC.<br>750342878 |                                  |  |  |
| 29 | U1  | 1 | MAX17681 TDFN10 3*2mm Iso buck DC-DC converter    | MAX17681ATB+                        |                                  |  |  |
| 30 | U2  | 1 | MAX17651 TSOT LDO                                 | MAX17651AZT+                        |                                  |  |  |
| 31 | U3  | 1 | Shunt regulator SOT25                             | Diode Inc. TL431BW5                 |                                  |  |  |

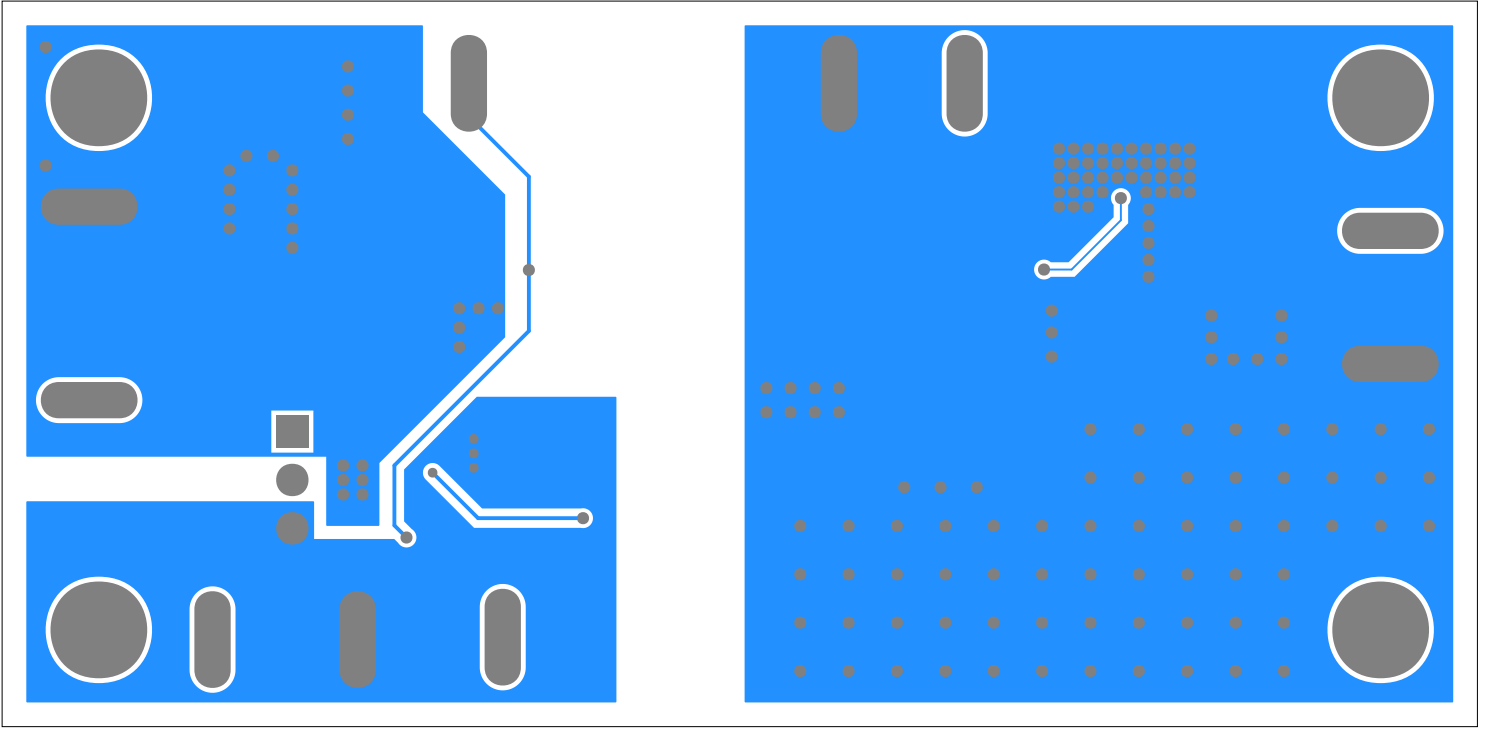


# TOP SILKSCREEN





**TOP**



**BOTTOM**

