

## MAX17690 No-Opto Flyback Evaluation Kit

## Evaluates: MAX17690 No-Opto Flyback with Secondary-Side Synchronous Rectification

### General Description

The MAX17690A evaluation kit (EV kit) is a fully assembled and tested circuit board that demonstrates the operation of an isolated 5W no-opto flyback DC-DC converter with secondary-side synchronous rectification. This circuit is implemented using the MAX17690, a no-opto, flyback controller in a 16-pin TQFN package with an exposed pad. The synchronous rectification on the secondary-side is enabled by replacing the secondary diode with a MOSFET to achieve 89.5% efficiency. The circuit uses the MAX17606, a secondary-side synchronous rectifier driver in a 6-pin SOT23 package for driving the secondary-side MOSFET.

The EV kit output is configured for an isolated +5V and provides up to 1A of output current. The EV kit is programmed to operate at a 150kHz switching frequency. The transformer provides the galvanic isolation between input and output, up to 1875V<sub>RMS</sub>. The EV kit regulates the output voltage within  $\pm 5\%$  over the line, load, and temperature without using the auxiliary winding/optocoupler for output voltage feedback.

### Features

- 18V to 36V Input Range
- Isolated Output: 5V/1A DC
- Compact Design with High Frequency (150kHz) Switching
- No Optocoupler/Third Winding Required to Derive Feedback Signal
- 90% Peak Efficiency
- Galvanic Isolation up to 1875V<sub>RMS</sub>
- Proven PCB Layout
- Fully Assembled and Tested
- Minimum Load for  $\pm 5\%$  Regulation: 1% of Full-Load

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

### Quick Start

#### Recommended Equipment

- One 18V–36V DC, 1A power supply
- 5W resistive load with 1A sink capacity
- Four digital multimeters (DMM)
- MAX17690EVKITA#

#### Warning

- Do not turn on the power supply until all connections are completed.
- Wear protective eye gear at all times.
- Do not touch any part of the circuit with bare hands/ conductive materials when powered up.
- Make sure all high-voltage capacitors are fully discharged before handling. Allow 5 minutes after disconnecting input power source before touching circuit parts.

#### Equipment Setup and Test Procedure

- 1) Set the power supply to +24VDC. Disable the power supply output.
- 2) Connect the positive terminal of the power supply to the VIN PCB pad and the negative terminal to the nearest PGND PCB pad. Connect the positive terminal of the electronic load to the VOUT PCB pad and the negative terminal to the nearest GND0 PCB pad.
- 3) Connect the resistive load across the output terminals.
- 4) Connect a DMM configured in voltmeter mode across the VOUT PCB pad and the nearest GND0 PCB pad.
- 5) Enable the power supply.
- 6) Verify that the output voltmeter displays 5V and, if required, measure the output current using a DMM programmed in ammeter mode.
- 7) If required, vary the input voltage from 18V to 36V, and the load current from 10mA to 1A. Verify that the output voltage is 5V  $\pm 5\%$ .

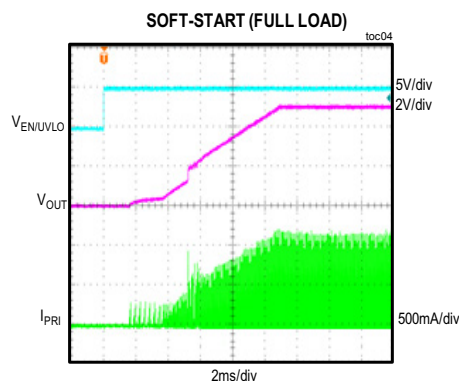
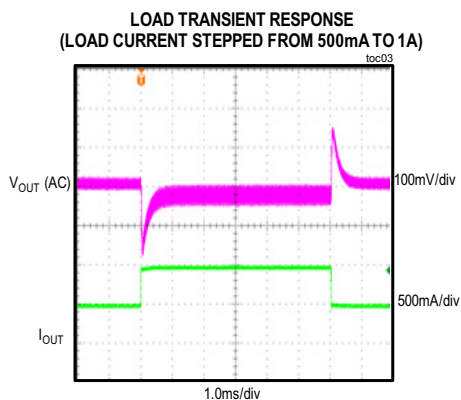
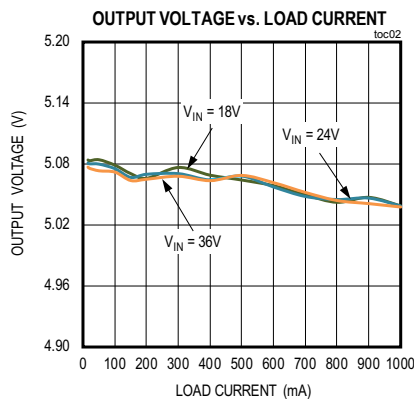
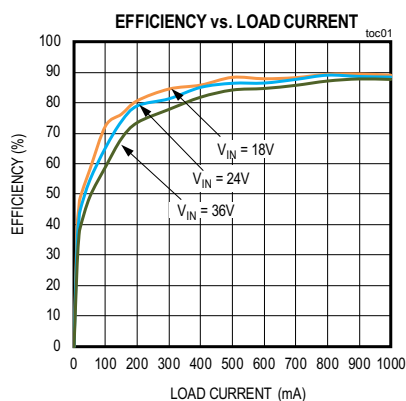
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### Detailed Description

The MAX17690 EV kit provides a proven design to evaluate the MAX17690, a high-efficiency no-opto DC-DC flyback controller. The device uses a novel sampling technique to eliminate the optocoupler/third winding in sensing the output voltage across the isolation boundary. The MAX17606, a secondary-side synchronous driver, is used, along with the MAX17690, to improve the converter efficiency.

This EV kit provides the programmable soft-start feature to limit the inrush current. The EN/UVLO is used to start the converter at the desired input voltage. The OVI is used to turn-off the converter at the desired input overvoltage level. The MAX17690 provides overcurrent and thermal protection. The details of soft-start time programming, programming the output voltage, peak-current-limit setting, switching frequency setting, and the EN/UVLO, OVI settings are described in the MAX17690 IC data sheet.

### EV Kit Performance Report



## Evaluates: MAX17690 No-Opto Flyback with Secondary-Side Synchronous Rectification

The MAX17606 has provision to program the turn-off trip point of the secondary synchronous rectifier. An external resistor (R18) connects the drain of the external MOSFET to IC's DRN pin. This resistor sets the turn-off trip point using the precise internal current source. After the synchronous rectifier is turned-off to avoid the false tripping due to DCM ringing, the MAX17606 programs the minimum turn-off time. The MAX17606 uses the resistor (R20) connected between TOFF pin to GND0 to program the minimum turn-off time. For selecting R18, R20 and other components related to MAX17606, refer the MAX17606 IC data sheet.

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## Component Suppliers

S NO	Designation	Qty	Description	Manufacturer Partnumber-1	Manufacturer Partnumber-2
1	C1	1	47µF±20%, 50V,ALUMINUM-ELECTROLYTIC SMT(CASE_D8)	PANASONIC EEEFK1H470P	
2	C2, C3	2	2.2µF±10% 100V X7R Ceramic capacitor (1210)	Murata GRM32ER72A225KA35	TDK CGA6N3X7R2A225K230
3	C4,C16,C17	3	2.2µF±10%,50V, X7R ceramic capacitor (0805)	TDK C2012X7R1H225K	
4	C5	1	2200pF, 10%, 100V, X7R ceramic capacitor (0402)	Murata GRM155R71C473KA01	
5	C6	1	0.047µF±10%,16V, X7R ceramic capacitor (0402)	Murata GRM155R71C473KA01	
6	C7	1	00.047µF±10%,50V, X7R ceramic capacitor (0402)	Murata GRM155R71H473KE14	
7	C8	1	470pF ±10%,50V, X7R ceramic capacitor (0402)	Murata GRM155R71H471K or GRM155R71H471KA01	KEMET C0402S471K5RAC
8	C9	1	220pF ±10%,100V, X7R ceramic capacitor (0402)	Murata GRM155R72A221KA01	
9	C10, C11	2	100µF±20%, 6.3V, X7S ceramic capacitor(1210)	Murata GRM32EC70J107ME15	
10	C12	1	OPEN (0402)		
11	C13	1	1000PF±10%, 1500V, 7R ceramic capacitor (1206)	AVX 1206SC102KAT	
12	C14	1	1µF±10%, 50V, X7R ceramic capacitor(0805)	Murata GRM21BR71H105KA12	SAMSUNG ELECTRONICS CL21B105KBFNNE
13	C15	1	0.01µF±10%, 50V, X7R ceramic capacitor(0402)	Murata GRM155R71H103KA88	TDK C0402C103K5RAC
14	D1	1	100V/2A, (POWERDI-123), DIODE	DIODES INCORPORATED DFLS2100	
15	D2	1	100V/0.3A, (SOD-123), DIODE	DIODES INCORPORATED 1N4148W-7-F	
16	D3	1	5.6V/1W, (SMA,DO-214AC), ZENER DIODE	DIODES INCORPORATED SMAZ5V6-FD1TR-ND	CENTRAL SEMICONDUCTOR CMZ5919B
17	Q1	1	150V/16A/69W, (POWER-56), MOSFET: NCH	FAIRCHILD SEMICONDUCTOR FDM586252	
18	Q2	1	30V/51A/62.5W, (POWERFLAT-56 ), MOSFET: NCH	ST MICROELECTRONICS STL51N3LLH5	
19	R1, R5	2	10kΩ ±1% resistor (0402)	VISHAY DALE CRCW040210K0FK	YAGEO PHICOMP RC0402FR-0710K
20	R2	1	280kΩ ±1% resistor (0402)	PANASONIC ERJ-2RKF2803X	
21	R3	1	10.7kΩ ±1% resistor (0402)	VISHAY DALE CRCW040210K7FK	
22	R4	1	274kΩ ±1% resistor (0402)	VISHAY DALE CRCW0402274KFK	
23	R6	1	124kΩ ±1% resistor (0402)	VISHAY DALE CRCW0402124KFK	
24	R7	1	60.4kΩ ±1% resistor (1206)	VISHAY CRCW120660K4FK	
25	R8	1	165kΩ ±1% resistor (0402)	VISHAY CRCW0402165KFK	
26	R9	1	33.2kΩ ±1% resistor (0402)	VISHAY DALE CRCW04023322FK	
27	R10	1	4.3kΩ ±5% resistor (0402)	YAGEO RC0402JR-074K3L	
28	R11	1	47Ω ±5% resistor (1210)	VISHAY DRALORIC CRCW121047R0JNEAHP	
29	R12	1	0.062Ω ±1% resistor (0805)	PANASONIC ERJ6BWF0R062	
30	R13,R19	2	OPEN (0402)		
31	R14	1	0Ω ±0% resistor (0402)	PANASONIC ERJ-2GE0R00X	
32	R15	1	3.74kΩ ±1% resistor (0402)	PANASONIC ERJ2RKF3741	
33	R16	1	2.2Ω ±1% resistor (0402 )	VISHAY DALE CRCW04022R20FK	
34	R17	1	10Ω ±1% resistor (0402 )	VISHAY DALE CRCW040210R0FK	YAGEO 9C04021A10R0FL
35	R18	1	2.49kΩ ±1% resistor (0402)	VISHAY DALE CRCW0402249FK	
36	R20	1	147kΩ ±1% resistor (0402)	VISHAY DALE CRCW0402147KFK	
37	R21	1	22Ω ±1% resistor (0402)	VISHAY DALE CRCW040222R0FK	
38	T1	1	EP10,8-pin SMT, 46.4µH,1.5A,(1-4):(5-8)=1:0.18	SUMIDA 12387-T104	
39	U1	1	MAX17690, TQFN16-EP, Flyback converters	MAX17690ATE+	
40	U2	1	MAX17606, TSOT23-6, Flyback converters	MAX17606AZT+	

## Component Suppliers

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

**Note:** Indicate that you are using the MAX17690A EV when contacting these component suppliers.

## Ordering Information

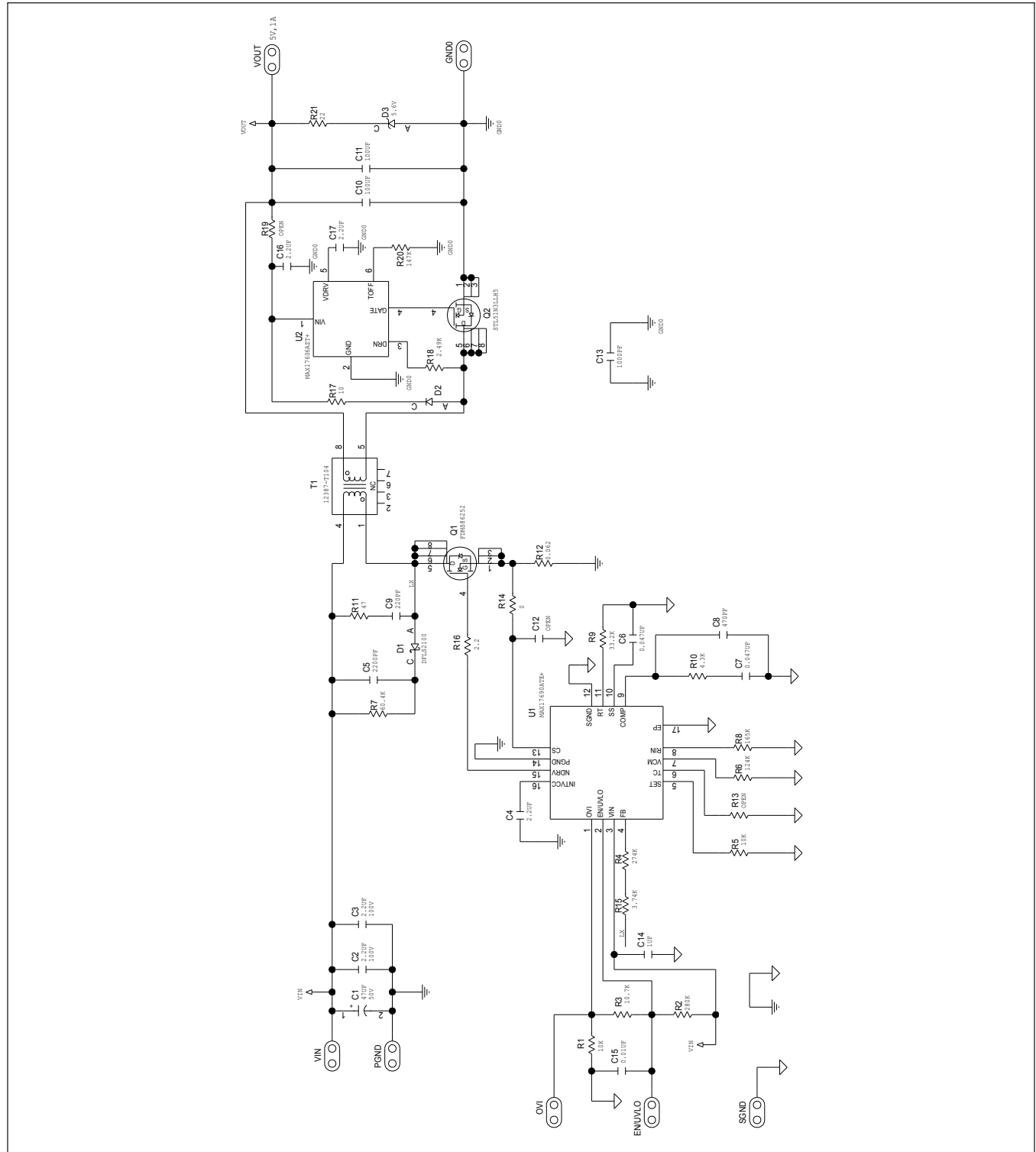
PART	TYPE
MAX17690EVKITA#	EV Kit

#Denotes RoHS compliant.

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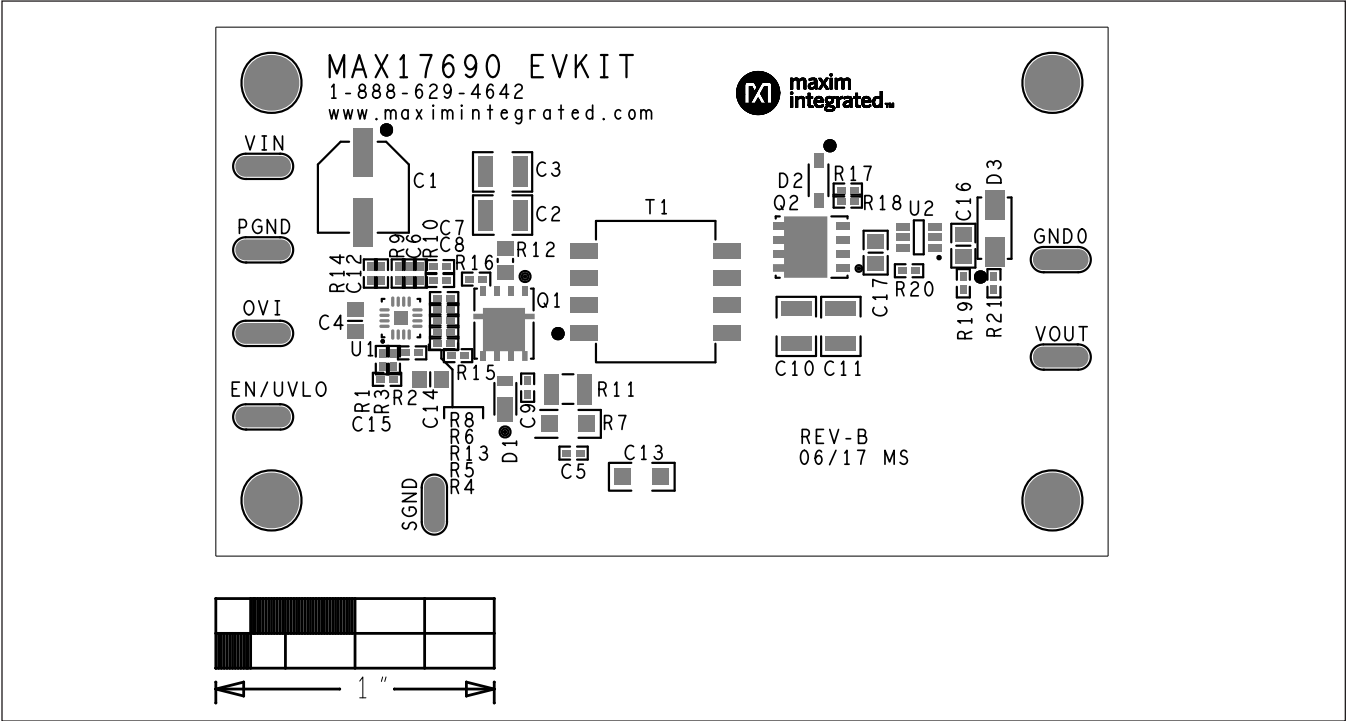
## MAX17690 EV Kit Schematic



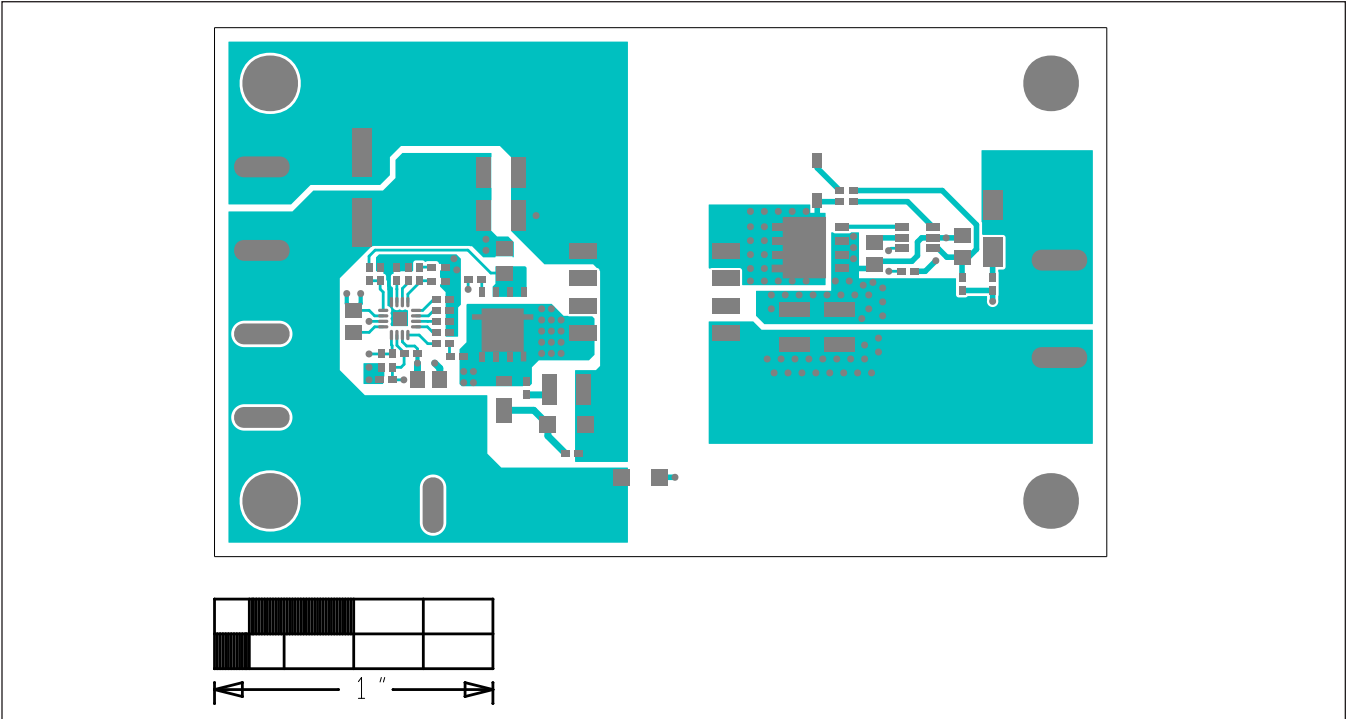
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MAX17690 EV Kit PCB Layout



Silk Topscreen

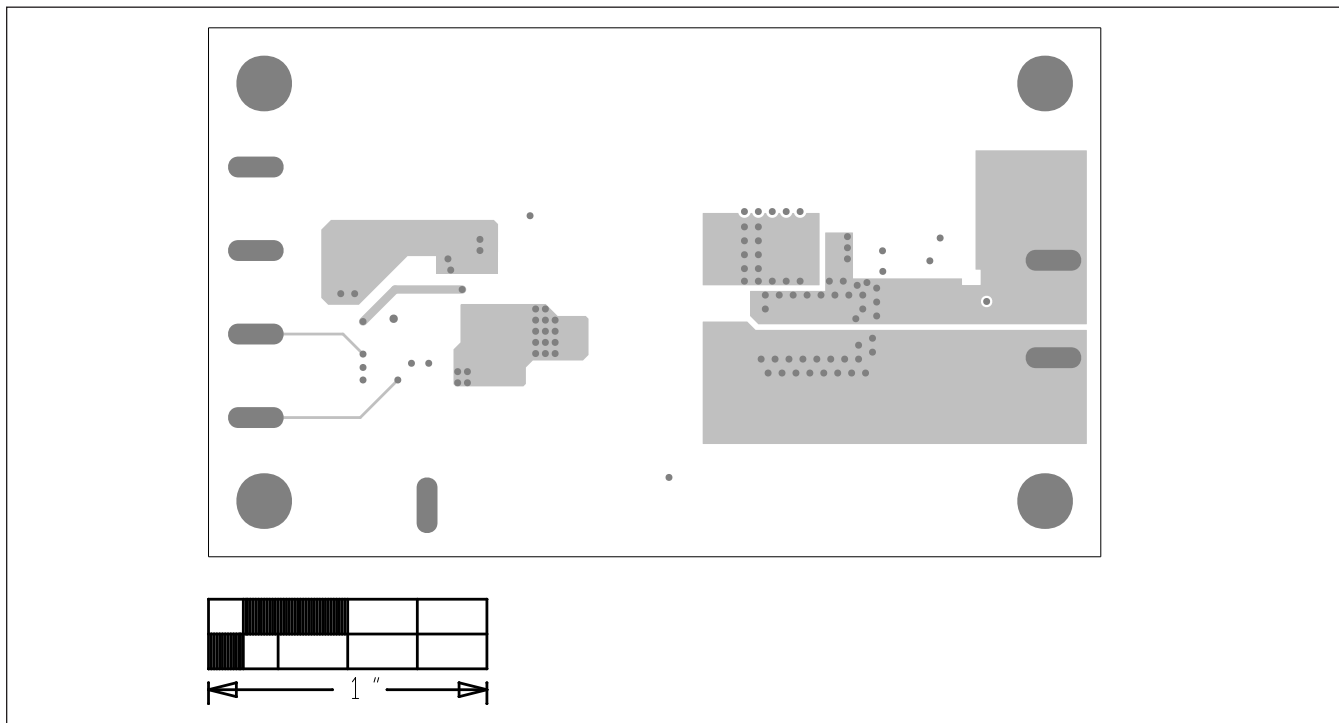


Top Layer

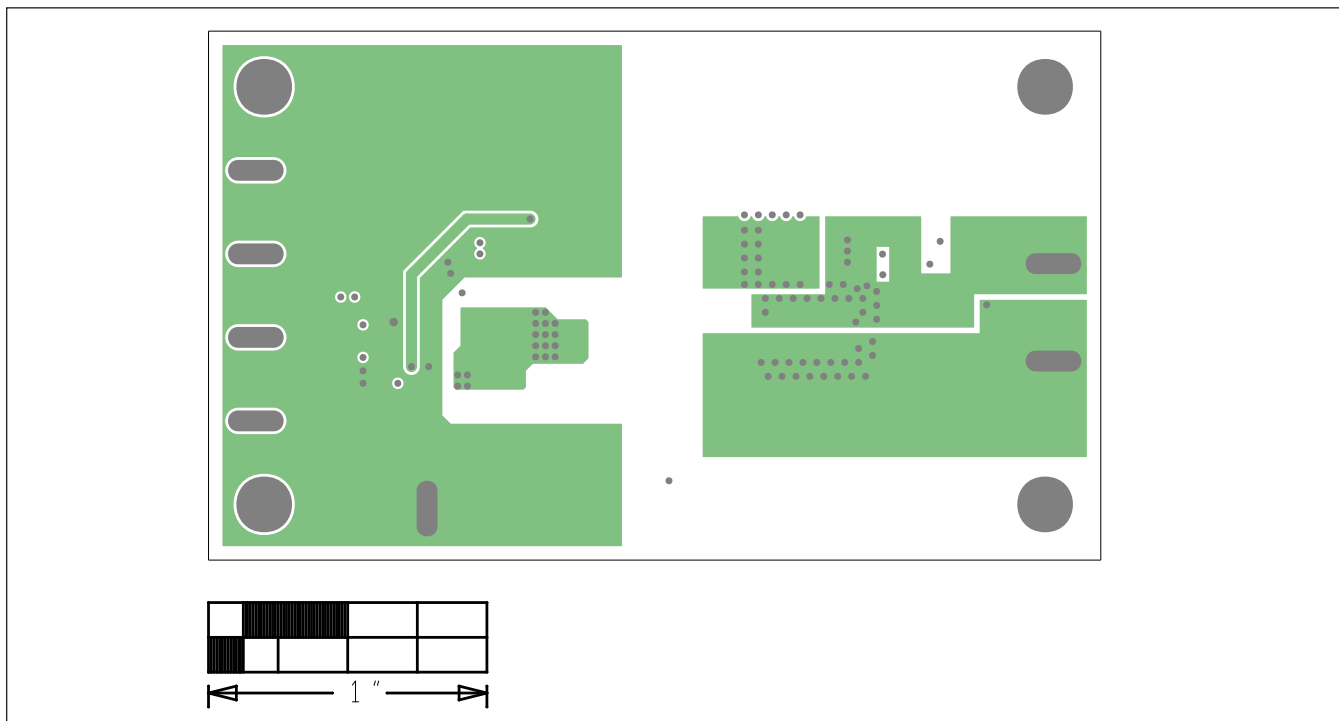
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## MAX17690 EV Kit PCB Layout (continued)

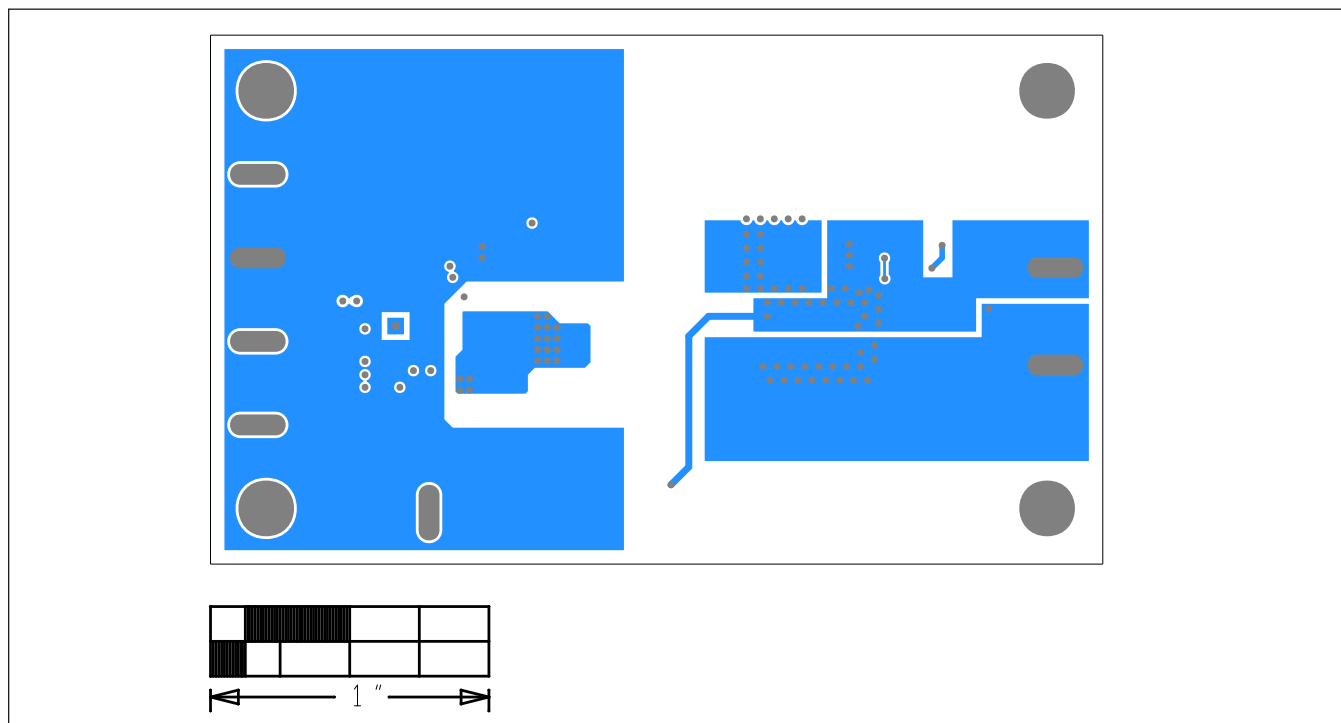


Ground Layer



Power Layer

MAX17690 EV Kit PCB Layout (continued)



Bottom Layer

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### Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	5/16	Initial release	—
1	7/17	Updated <i>Typical Operating Characteristics</i> , <i>Bill of Materials</i> , <i>Schematic</i> , <i>PCB Layout</i> , and efficiency percentage in the <i>General Description</i> section.	1–2, 4–6
2	11/17	Updated the <i>Bill of Materials</i>	3

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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