

## General Description

The MAX20034 evaluation kit (EV kit) is a fully assembled and tested application circuit that simplifies the evaluation of the MAX20034 high-efficiency 400kHz/2.2MHz, 36V, dual buck controller IC.

This EV kit operates from 3.5V to 42V supply and provides two synchronous step-down outputs by switching at 400kHz/2.2MHz, with each one 180° out of phase from the other. The frequency and output voltages can be adjusted using external resistors. SYNC input programmability enables three frequency modes for optimized performance: forced fixed-frequency operation, skip mode with ultra-low quiescent current, and synchronized external clock frequency.

## Benefits and Features

- Dual High-Voltage Step-Down Controllers to Minimize Board-Area Occupancy
- Meets Stringent OEM Module Power Consumption and Performance Specifications
- 17μA Quiescent Current in Skip Mode
- ±1.5% Output-Voltage Accuracy: 5.0V/3.3V, Fixed or Adjustable by External Resistor-Divider
- EMI Reduction Features and Adjustable Fixed-Frequency Operation to Reduce Signal Interference
- Optimized Application Layout and Components for Quick Design Implementation
- Jumpers and Test Points on Key Nodes for Simplified Evaluation
- Proven PCB Layout
- Fully Assembled and Tested

[Ordering Information](#) appears at end of data sheet.

## Quick Start

### Required Equipment

- MAX20034 EV kit
- Adjustable DC power supply (PS1)
- Two digital multimeters (DMM1 and DMM2)
- Two electronic loads (EL1 and EL2)

### Procedure

The EV kit is fully assembled and tested. Follow the steps below to verify board operation:

- 1) Verify that all jumpers are in their default positions, as shown in [Table 1](#).
- 2) Preset the power supply to 14V. Turn off the power supply.
- 3) Preset the electronic loads to 2.5A. Turn off the electronic loads.
- 4) Connect the positive lead of the power supply to the VBATT PCB pad on the EV kit; connect the negative lead to the neighboring PGND PCB pad.
- 5) Connect the positive terminal of electronic load EL1 to the VOUT1 PCB pad; connect the negative lead to the PGND1 pad.
- 6) Connect the positive terminal of electronic load EL2 to the VOUT2 PCB pad; connect the negative lead to the PGND2 PCB pad.
- 7) Turn on the power supply.
- 8) Verify that voltage across the VOUT1 and PGND1 PCB pads is 5V, and 3.3V between the VOUT2 and PGND2 PCB pads.
- 9) Turn on the electronic loads.
- 10) Verify that voltage across the VOUT1 and PGND1 PCB pads is 5V ±1.5%.
- 11) Verify that voltage across the VOUT2 and PGND2 PCB pads is 3.3V ±1.5%.
- 12) Turn off the electronic loads.
- 13) Turn off the power supply.

**Table 1. Default Jumper Settings**

JUMPER	DEFAULT SHUNT POSITION	FUNCTION
JU1_EN1	Pins 2-3	Enable for VOUT1
JU2_EN2	Pins 2-3	Enable for VOUT2
JU3_FSYNC	Pins 2-3	Mode selection between skip enabled and FPWM
JU4_PGOOD1	Installed	Connect PGOOD1 to BIAS by pullup resistor
JU5_PGOOD2	Installed	Connect PGOOD2 to BIAS by pullup resistor
JU6_EXTVCC	Pins 1-2	Connect EXTVCC to VOUT1, VOUT2, or AGND

**Note:** For 3-pin connectors, pin 1 is denoted by a silkscreen triangle.

## Detailed Description

The MAX20034 IC offers two high-voltage synchronous step-down controllers that operate at 180° out-of-phase. This device can be powered up by an input voltage supply from 3.5V to 42V and can operate in drop-out condition by running at 99% duty-cycle. It is intended for applications with mid- to high-power requirements that operate at a wide input voltage range such as during automotive cold-crank or engine stop-start conditions.

The IC features a power-OK monitor, overvoltage lock-out, and an undervoltage lockout. Its protection features include cycle-by-cycle current limit and thermal shutdown. It is specified for operation over the -40°C to +125°C automotive temperature range.

## Switching Frequency and External Synchronization

The IC can operate in two modes: forced-PWM (FPWM) or skip. Skip mode has better efficiency for light-load conditions, while FPWM has fixed switching frequency across all load conditions to prevent unwanted EMI interference. When SYNC is pulled low, the device operates in skip mode for light loads and in PWM mode for heavy loads. When SYNC is pulled high, the device is forced to operate in PWM across all load conditions.

SYNC pin can also be used to synchronize with an external clock frequency. In this case, MAX20034 operates at external clock frequency across all load conditions.

## Buck Output Monitoring (PGOOD1, PGOOD2)

The EV kit provides power-good output test points (TP\_PGOOD1 and TP\_PGOOD2) to monitor the status of the buck outputs (VOUT1 and VOUT2). The PGOOD1 and PGOOD2 are set to high impedance when the respective output voltages are in regulation. When the output voltages individually drop below 92% of its nominal regulated voltage, the corresponding PGOOD output is pulled to ground.

## Setting the Output Voltage in Buck Converters

Each of the outputs has its own feedback pins (FB1 and FB2), which can be used to externally adjust the output voltages between 1 to 10V.

For V<sub>OUT1</sub>, remove R1 and install a 0Ω resistor on R29. Use the following equation to calculate the required value of the resistors for R2 and R3:

$$R2 = R3 \left( \frac{V_{OUT1}}{V_{FB1}} - 1 \right)$$

where  $V_{FB1} = 1V$  (typ) and recommended  $R6 = 50k\Omega$ .

For V<sub>OUT2</sub>, remove R27 and install a 0Ω resistor on R31. Use the following equation to calculate the required value of the resistors for R25 and R26:

$$R25 = R26 \left( \frac{V_{OUT2}}{V_{FB2}} - 1 \right)$$

where  $V_{FB2} = 1V$  (typ) and recommended  $R6 = 50k\Omega$ .

### Evaluate 400kHz or 2.2MHz Operation

Order MAX20034HFEVKIT# to evaluate 2.2MHz operation.  
Order MAX20034EVKIT# to evaluate 400kHz operation.  
[Table 2](#) lists different component selections for 2.2MHz and 400kHz switching frequency (the other components remain the same).

**Table 2. Component Selections**

COMPONENT	f <sub>sw</sub> = 2.2MHz	f <sub>sw</sub> = 400kHz
C10/C28	820pF	1500pF
C12/C26	2pF	2pF
L1/L3	2.2μH	4.7μH
R9/R20	51.1kΩ	24.9kΩ
R19	12kΩ	73.2kΩ

### Ordering Information

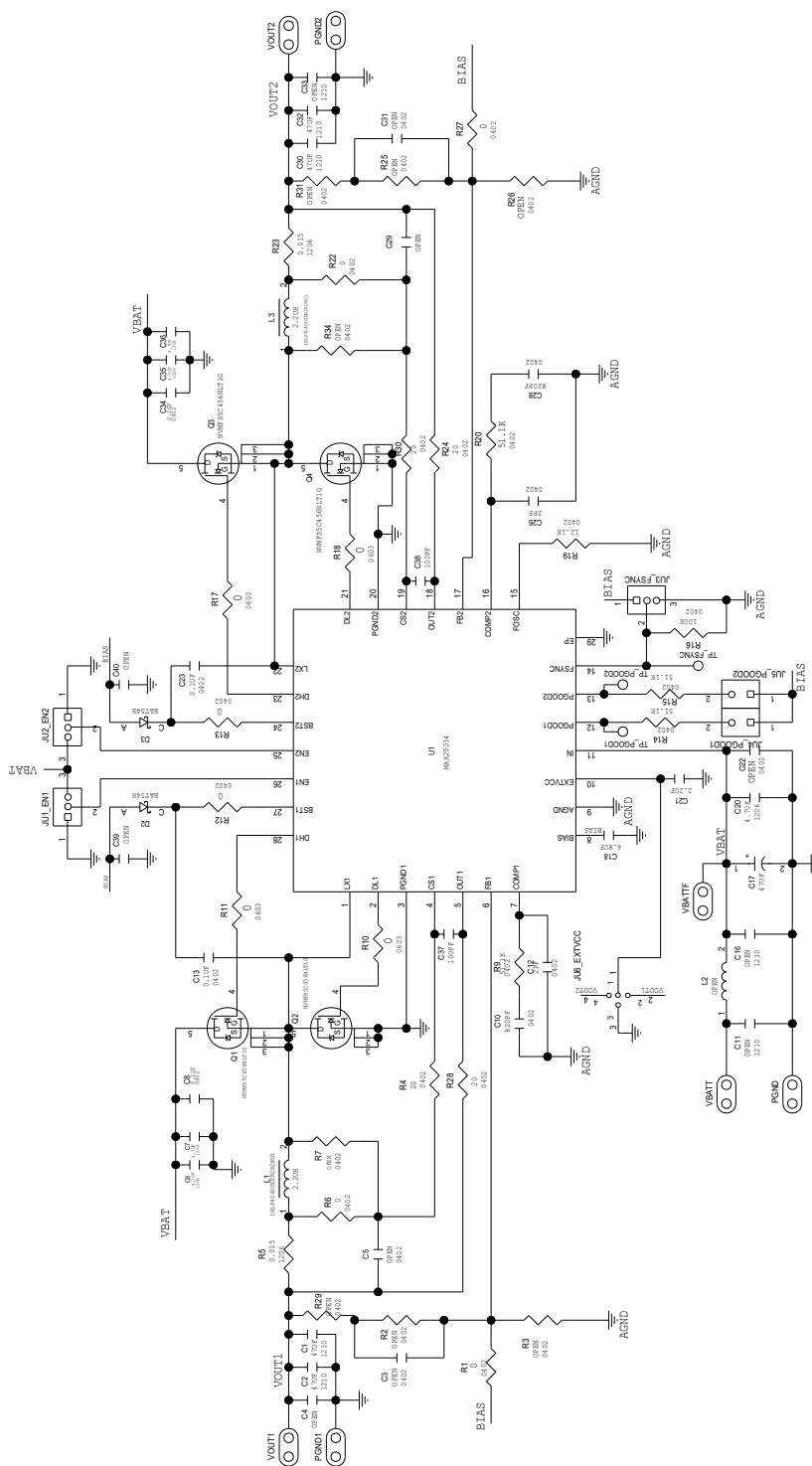
PART	TYPE	f <sub>sw</sub>
MAX20034EVKIT#	EV Kit	400kHz
MAX20034HFEVKIT#	EV Kit	2.2MHz

#Denotes RoHS compliant.

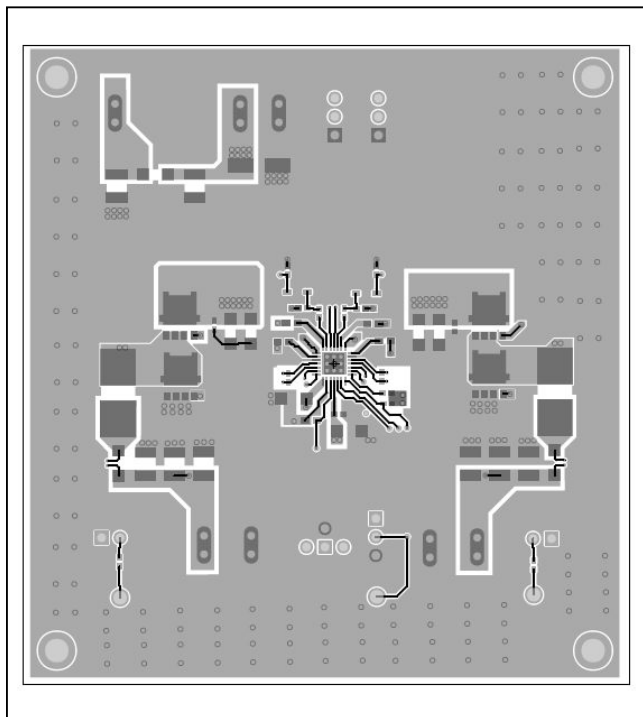
## MAX20034 EV Kit Bill of Materials

PART	QTY	DESCRIPTION	MFG PART #
C1, C2, C30, C32	4	CAPACITOR; SMT (1210); CERAMIC; 47UF; 10V; TOL=10%; MODEL=GRM SERIES; TG=-55 DEGC TO +125 DEGC; TC=X7R	MURATA, GRM32ER71A476KE15
C3, C5, C29, C31, C37-C40	8	CAPACITOR; SMT (0402); CERAMIC CHIP; 100PF; 50V; TOL=2%; TG=-55 DEGC TO +125 DEGC; TC=C0G	TDK, C1005C0G1H101G050
C4, C33	2	CAPACITOR; SMT (1210); CERAMIC; 47UF; 10V; TOL=10%; MODEL=GRM SERIES; TG=-55 DEGC TO +125 DEGC; TC=X7R	MURATA, GRM32ER71A476KE15
C6, C7, C20, C35, C36	5	CAPACITOR; SMT (1206); CERAMIC CHIP; 4.7UF; 50V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R; AUTO	TDK, CGA5L3X7R1H475K160AB
C8, C13, C23, C34	4	CAPACITOR; SMT (0402); CERAMIC CHIP; 0.1UF; 50V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R	TDK, CGA2B3X7R1H104K; C1005X7R1H104K050BB
C10, C28	2	CAPACITOR; SMT (0402); CERAMIC CHIP; 820PF; 50V; TOL=2%; TG=-55 DEGC TO +125 DEGC; TC=C0G	MURATA, GRM1555C1H821GA01
C11, C16	2	CAPACITOR; SMT (1210); CERAMIC CHIP; 4.7UF; 50V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R; AUTO	TDK, CGA6P3X7R1H475K
C12, C26	2	CAPACITOR; SMT (0402); CERAMIC CHIP; 2PF; 50V; TOL=0.1PF; TG=-55 DEGC TO +125 DEGC; TC=C0G	TDK, C1005C0G1H020B050
C17	1	CAPACITOR; SMT (CASE_D); ALUMINUM-ELECTROLYTIC; 47UF; 50V; TOL=20%; TG=-55 DEGC TO +105 DEGC; AUTO	PANASONIC, EEE-FT1H470AP
C18	1	CAPACITOR; SMT (1206); CERAMIC CHIP; 6.8UF; 16V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R	TDK, C1206C685K4RAC; C3216X7R1C685K160AC
C21	1	CAPACITOR; SMT (0603); CERAMIC CHIP; 2.2UF; 10V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R	MURATA, GRM188R71A225KE15; CL10B225KP8NNN
D2, D3	2	DIODE; SCH; SCHOTTKY DIODE; SMT (SOD-323); PIV=30V; IF=0.2A	ON SEMICONDUCTOR, BAT54H
JU1_EN1, JU2_EN2, JU3_FSYNC	3	CONNECTOR; THROUGH HOLE; TSW SERIES; SINGLE ROW; STRAIGHT; 3PINS	SAMTEC, TSW-103-07-T-S
JU4_PGOOD1, JU5_PGOOD2	2	CONNECTOR; THROUGH HOLE; TSW SERIES; SINGLE ROW; STRAIGHT; 2PINS; -55 DEGC TO +105 DEGC	SAMTEC, TSW-102-07-T-S
JU6_EXTVCC	1	EVKIT PART-CONNECTOR; MALE; THROUGH HOLE; TSW SERIES; SINGLE ROW; STRAIGHT; 4PINS	SAMTEC, TSW-104-07-L-S
L1, L3	2	EVKIT PART-INDUCTOR; SMT; SHIELDED; 2.2UH; TOL=+/-20%; 12A; NOTE: ALTERNATE FOOTPRINT IS CAPABLE TO HOST IHLP-4040DZ-01; IHLP-2525CZ-L7 AND XAL50XX SERIES	VISHAY DALE, IHLP4040DZER2R2M01
L2	1	INDUCTOR; SMT (1206); FERRITE-BEAD; 1000; TOL=+/-25%; 1A	FAIR-RITE, 2512061027Y1
PGND, PGND1, PGND2, VBATT, VBATTF, VOUT1, VOUT2	7	EVK KIT PARTS; MAXIM PAD; NO WIRE TO BE SOLDERED ON THE MAXIMPAD	MAXIMPAD
Q1, Q2, Q3, Q4	4	TRAN; POWER MOSFET; SINGLE N-CHANNEL; NCH; SO-8FL; PD- (55W); I-(87A); V-(40V)	ON SEMICONDUCTOR, NVMFS5C456NLT1G
R1, R6, R12, R13, R22, R27	6	RESISTOR; 0402; 0 OHM; 0%; JUMPER; 0.2W; THICK FILM	VISHAY DALE, CRCW04020000Z0EDHP
R2, R3, R7, R25, R26, R29, R31, R34	8	RESISTOR; 0402; 0 OHM; 0%; JUMPER; 0.2W; THICK FILM	VISHAY DALE, CRCW04020000Z0EDHP
R4, R24, R28, R30	4	RESISTOR; 0402; 20 OHM; 1%; 0.063W; THICK FILM	VISHAY DALE, CRCW040220R0FK
R5, R23	2	RESISTOR; 1206; 0.015 OHM; 1%; 100PPM; 0.5W; THICK FILM	LRC-LRF1206LF-01-R015F
R9, R14, R15, R20	4	RESISTOR; 0402; 51.1K OHM; 1%; 100PPM; 0.063W; THICK FILM	VISHAY DALE, CRCW040251K1FK
R10, R11, R17, R18	4	RESISTOR; 0603; 0 OHM; 0%; JUMPER; 0.1W; THICK FILM	VISHAY DALE, CRCW06030000Z0
R16	1	RESISTOR; 0402; 100K; 1%; 100PPM; 0.0625W; THICK FILM	VISHAY DALE, CRCW0402100KFK
R19	1	RESISTOR; 0402; 12.1K; 1%; 100PPM; 0.0625W; THICK FILM	VISHAY DALE, CRCW040212K1FK
TP_FSYNC, TP_PGOOD1, TP_PGOOD2	3	TESTPOINT WITH 1.80MM HOLE DIA, RED, MULTIPURPOSE; NOT FOR COLD TEST	KEYSTONE, 5010
U1	1	EVKIT PART-IC; AUTOMOTIVE START-STOP POWER SUPPLY; QFN28-EP; PACKAGE CODE: T2855Y-5C MAX20034ATIR/VY+	MAX20034
—	1	PCB: MAX20034EVKIT	MAX20034

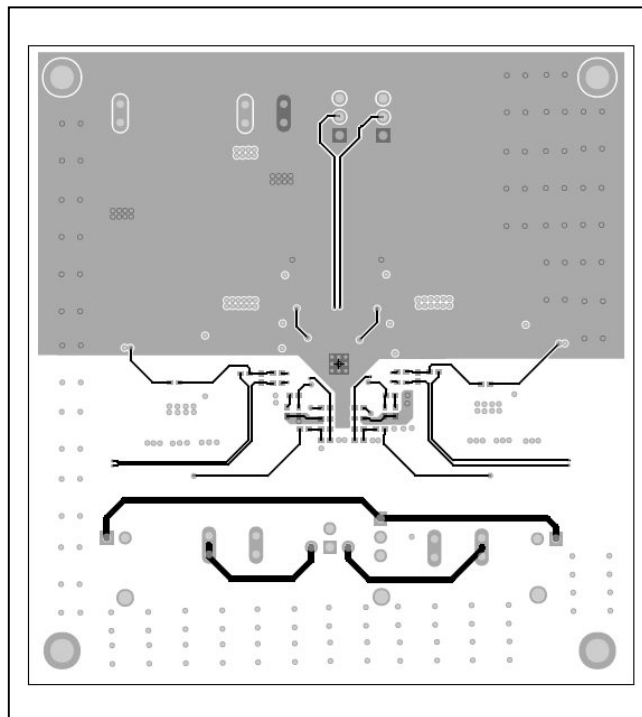
## MAX20034 EV Kit Schematic



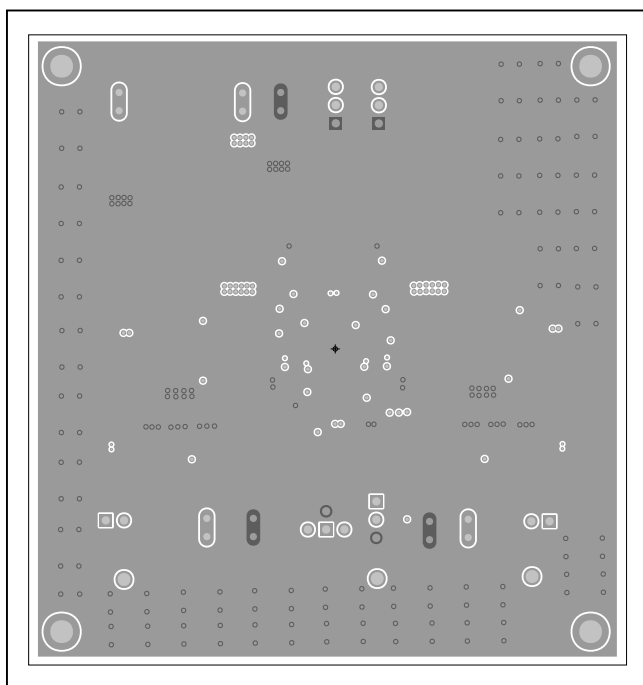
## MAX20034 EV Kit PCB Layouts



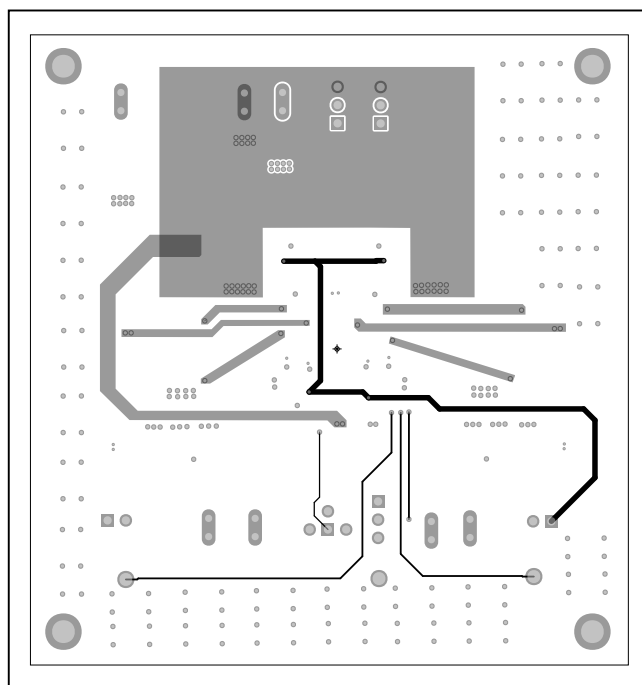
MAX20034 EV Kit PCB Layout—Top



MAX20034 EV Kit PCB Layout—Bottom

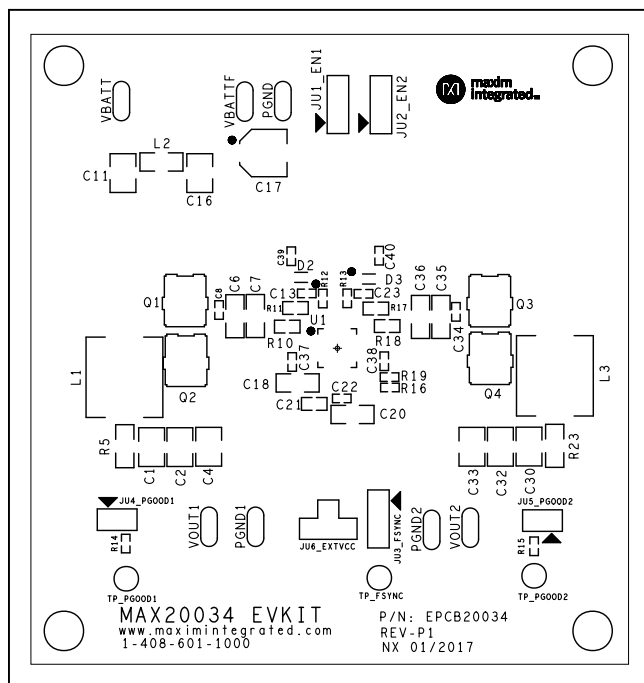


MAX20034 EV Kit PCB Layout—Internal2

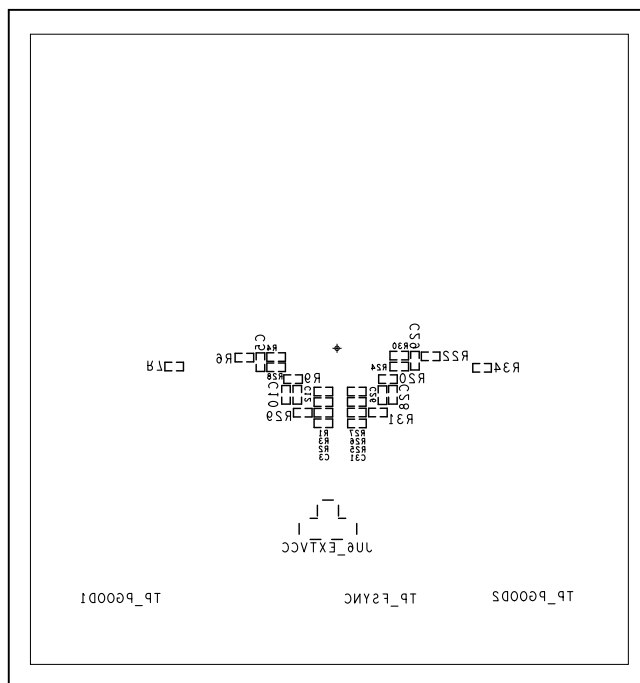


MAX20034 EV Kit PCB Layout—Internal3

## MAX20034 EV Kit PCB Layouts (continued)



MAX20034 EV Kit Component Placement Guide—Top Silkscreen



MAX20034 EV Kit Component Placement Guide—Bottom Silkscreen

## Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	11/17	Initial release	—

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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