

## General Description

The MAX20412 evaluation kit (EV kit) demonstrates the MAX20412 automotive 2-channel step-down controller. The EV kit operates over a 3V to 5.5V input range. Output 1 is set for 0.825V and up to 60A load and output 2 is set for 0.825V and up to 30A load.

## Benefits and Features

- Differential Remote Voltage Sensing
- 3V to 5.5V Input Supply Range
- I<sup>2</sup>C-Controlled 0.25V to 1.275V Output Voltage Range
- 2.2MHz Operation
- ±2% Output-Voltage Accuracy
- Power-Good Output
- Current-Mode, Forced-PWM, and Skip Operation
- Proven PCB Layout
- Fully Assembled and Tested

## EV Kit Contents

- MAX20412 EV Kit Board

## Quick Start

### Recommended Equipment

- MAX20412 EV kit
- 5V, 20A DC power supply
- Load capable of up to 60A
- Digital voltmeter (DVM)

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

## Procedure

The EV kit is fully assembled and tested. Follow the steps below to verify board operation. **Caution: Do not turn on supplies until all connections are completed.**

- 1) Verify that jumpers J1 and J4 have shunts placed across pins 1-2.
- 2) Connect the power supply between the PVDD and the PGND test points.
- 3) Preset the load to the desired level, up to 30A. Make sure the load is disabled.
- 4) Connect the electronic load between the OUT2 and the PGND test points. Use short high-gauge wires to ensure low voltage drop on the wires to help maintain voltage headroom on the load.
- 5) Connect the DVM between the V2 SNS and G SNS pins of J38.
- 6) Turn on the power supply.
- 7) Enable the electronic load.
- 8) Verify that the voltage at the OUT2 test point is approximately 0.825V.
- 9) Disable the load.
- 10) Turn off the power supply.
- 11) Disconnect the load from the OUT2 and the PGND test points.
- 12) Disconnect the DVM from the V2 SNS and G SNS pins.
- 13) Preset the load to the desired level, up to 60A. Make sure the load is disabled.
- 14) Connect the electronic load between the OUT1 and the PGND test points. Use short high-gauge wires to ensure low voltage drop on the wires to help maintain voltage headroom on the load.
- 15) Connect the DVM between the V1 SNS and G SNS pins of J39.
- 16) Turn on the power supply.
- 17) Enable the load.
- 18) Verify that the voltage at the OUT1 test point is approximately 0.825V.

## Detailed Description of Hardware

### EN1, EN2 Enable (J1, J4)

Place a shunt across pins 1-2 on jumper J1 for normal operation of output 1. Place a shunt across pins 1-2 on jumper J4 for normal operation of output 2. To disable either output, place the shunt across pins 2-3. When J1 and J4 are both shunted to GND, the IC is in shutdown mode and input current is reduced to 5µA (typ). See [Table 1](#).

### Synchronization Input/Output (SYNC)

The EV kit features a SYNC connection that allows for synchronization input or output. The function is set by the SO[1:0] bits, as defined in the MAX20412 IC data sheet. See [Table 2](#).

### I<sup>2</sup>C Slave Address (ADDR)

The EV kit provides jumper J3 to set the ADDR register. Pull-down resistor R1 is used to set ADDR = 0. If ADDR = 1 is desired, place a shunt across pins 1-2 on jumper J3. Refer to Table 1 in the MAX20412 IC data sheet for more details on the I<sup>2</sup>C slave address.

### Power-Good Output ( $\overline{\text{PGOOD}}$ )

The EV kit features an open-drain PG\_ output that asserts when the output voltage is between the PG\_UV and PG\_OV thresholds. PG\_ is asserted after the power-good active timeout period. An additional 220µs (typ) PG\_ delay exists following soft-start or DVS slewing. PG\_ is deasserted after a UV/OV propagation delay if the output voltage is outside the PG\_UV/OV thresholds. PG\_ is connected to a 10kΩ pullup resistor.

### V1 Sense/V2 Sense (J39/J38)

The EV kit provides output sense lines for VOUT1 and VOUT2 (V1 SNS and V2 SNS on J39 and J38). V SNS and G SNS are Kelvin connected to the output capacitors for accurate measurements, even under load. A ground reference pin is also provided.

### Output Voltage

Output voltage is selectable using the VID registers (refer to Table 10 in the MAX20412 IC data sheet). Be aware of the VIDMAX registers (Table 4 in the IC data sheet), as this might limit the maximum output voltage.

### OUT1 Single-Phase Operation

OUT1 can be configured for single-phase operation. Remove inductor L2. Move the 0Ω resistor from R16 to R9.

**Table 1. EN1, EN2 Configuration (J1, J4)**

SHUNT POSITION	DESCRIPTION
Pins 1-2	Connects the EN pin to the voltage at PVDD for normal operation
Pins 2-3	Connects the EN pin to ground to enter shutdown mode

*\*Default position.*

**Table 2. SYNC Settings**

BIT	BIT DESCRIPTION
SO[1:0]	<b>SYNC I/O Select</b>
	00 – Master: Input, rising edge starts cycle
	01 – Master: Input, falling edge starts cycle
	10 – Master: Output, falling edge starts cycle
	11 – Unused

## Ordering Information

PART	TYPE
MAX20412EVKIT#	EV Kit

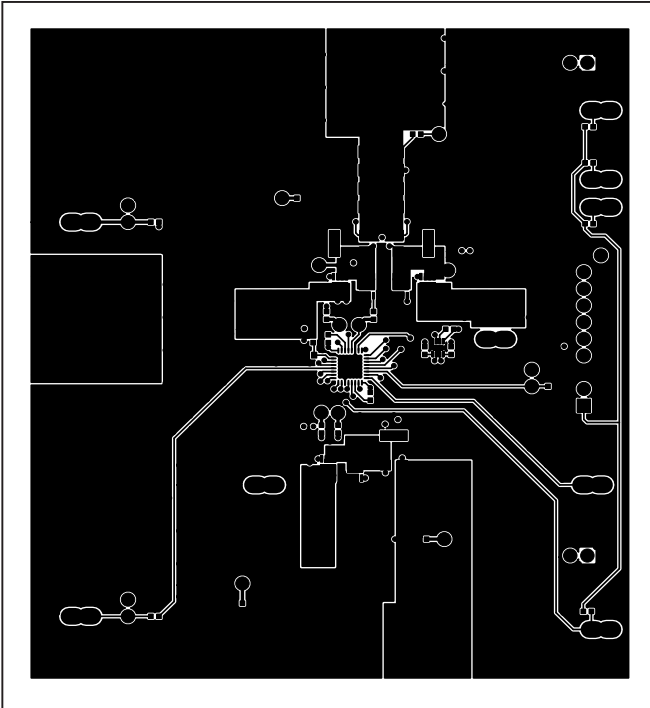
*#Denotes RoHS compliant.*

MAX20412 EV Kit Bill of Materials

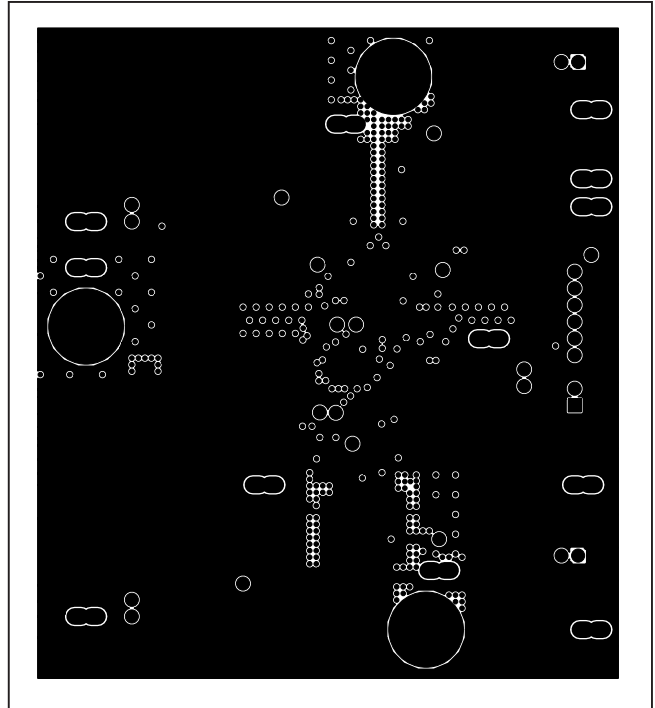
QTY	REFERENCE	DESCRIPTION	MFR	MFR P/N	DIGIKEY P/N	ALTERNATIVE
4	C1-3, C6	1uF 10%, 16V X7R Ceramic (0603)	TDK	CGA3E1X7R1C105K080AC	445-12539-2-ND	or equivalent 16V/25V
3	C4, C10, C11	100nF 10%, 16V X7R Ceramic (0402)	TDK	CGA2B1X7R1C104K050BC	445-5613-2-ND	or equivalent 16V/25V
12	C5, C7-9, C13-18, C21, C24	10uF 20%, 16V X7R Ceramic (1206)	TDK	CGA5L1X7R1C106M160AC	445-12903-1-ND	or equivalent 16V/25V and/or 10%
3	C12, C23, C25	18nF 5%, 50V X7R Ceramic (0402)	Murata	GCM155R71H183JA55D	GCM155R71H183JA55D-ND	or equivalent
16	C19, C22, C26, C28-40	47uF 20%, 4V X7S Ceramic (1206)	TDK	CGA5L1X7S0E476M	445-8037-1-ND	or equivalent
3	C20, C27, C50	47nF 10%, 16V X7R Ceramic (0402)	TDK	CGA2B2X7R1C473K050BA	445-5611-1-ND	or equivalent 16V/25V
1	C48	470uF 20%, 6.3V POSCAP (2917)	Panasonic	6TPB470M	P16619CT-ND	
5	J1, J3-4, J38-39	3-pin header, 2.54mm, comes in 36-40 pin strips (cut to fit)	Sullins	PEC36SAAN	S1012E-36-ND	or equivalent
2	(J1, J4)	Shunts	Kycon	SX1100-B		or equivalent
16	J2, J14, J17, J22-23, J27-37	WIRE, BUSS, 20G plated solid copper 0.25 inch U-shape wire loop				
1	J24	2x10 Right Angle Receptacle (0.1in)	Samtec	SSQ-110-02-T-D-RA	SAM1224-10-ND	or equivalent
3	L1-3	80nH, 1.5mΩ typ@25C, inductor	TDK	HPL505028F080KD3P		
6	Q1-6	MOSFET N-Ch, 1.6mΩ, 25V, 31A	Infineon	BSZ014NE2LS5IFATMA1		
7	R5-8, R10-11, R16	0Ω Resistor (0402)	Panasonic	ERJ-2GE0R00X	P0.0JTR-ND	or equivalent
3	R15, R24, R32	2Ω, 1% Resistor (0402)	Panasonic	ERJ-2GEJ2R0X	P2.0JTR-ND	or equivalent
3	R2, R19, R25	10Ω, 1% Resistor (0402)	Panasonic	ERJ-2RKF10R0X	P10.0LTR-ND	or equivalent
2	R26-27	100Ω, 1% Resistor (0402)	Panasonic	ERJ-2RKF1000X	P100LTR-ND	or equivalent
3	R13, R20-21	2.37kΩ, 1% Resistor (0402)	Panasonic	ERJ-2RKF2371X	P2.37KLTR-ND	or equivalent
3	R12, R17-18	3.09kΩ, 1% Resistor (0402)	Panasonic	ERJ-2RKF3091X	P3.09KLTR-ND	or equivalent
3	R14, R22-23	6.19kΩ, 1% Resistor (0402)	Panasonic	ERJ-2RKF6191X	P6.19KLTR-ND	or equivalent
6	R3-4, R28-31	10.0kΩ, 1% Resistor (0402)	Panasonic	ERJ-2RKF1002X	P10.0KLTR-ND	or equivalent
1	R1	100kΩ, 1% Resistor (0402)	Panasonic	ERJ-2RKF1003X	P100KLTR-ND	or equivalent
3	TH1-3	10kΩ, NTC Thermistor (0603)	TDK	NTCG163JX103DFTDS	445-174519-1-ND	NTCG163JF103FTDS (445-174516-1-ND)
1	U1	Automotive Step-Down Converter	Maxim	MAX20412ATJA/V+		
1	U2	MOSFET Driver	Maxim	MAX15492BGTAV+		
1	2 oz.	PCB: MAX20412 EVALUATION KIT#				
		<b>DO NOT INSTALL</b>				
8	C41-47, C49					
11	J5-13, J20-21	TP 1.27mm drill				
6	J15-16, J18-19, J25-26	Banana Jack				
1	R9					



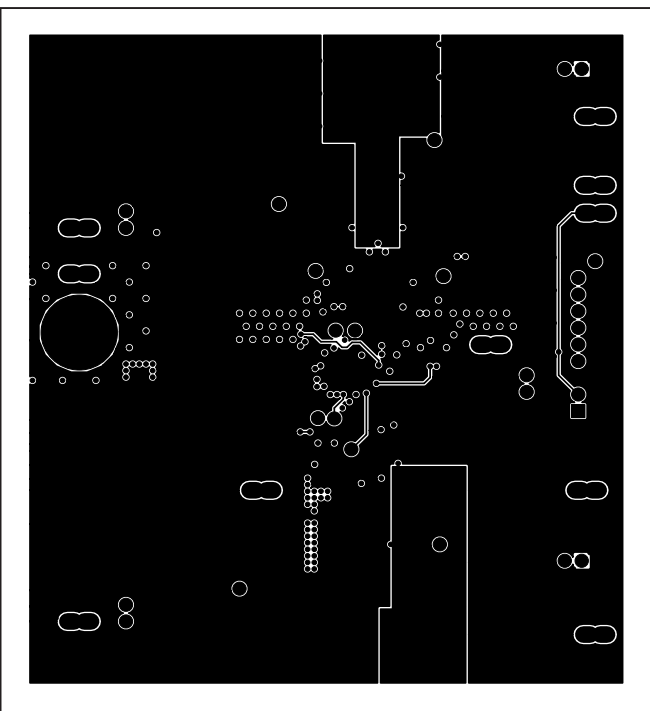
MAX20412 EV Kit PCB Layouts



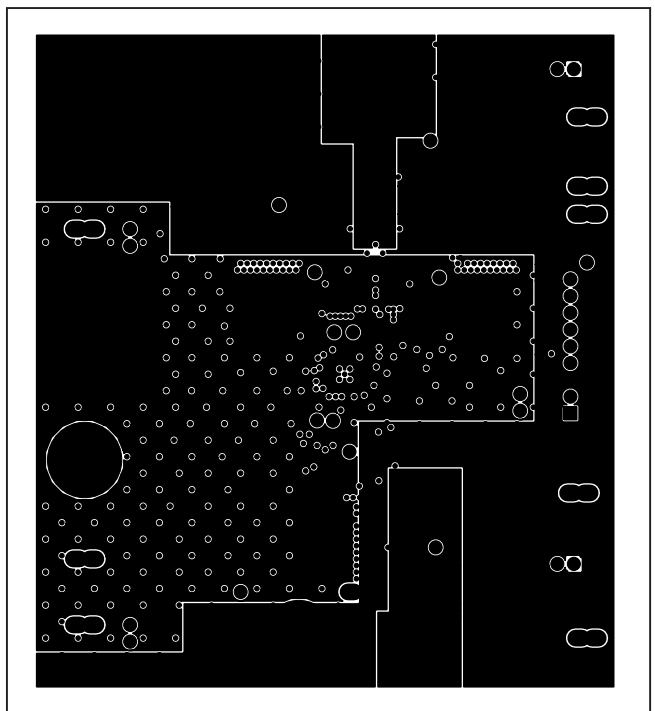
MAX20412 EV Kit—Top



MAX20412 EV Kit—Internal 1

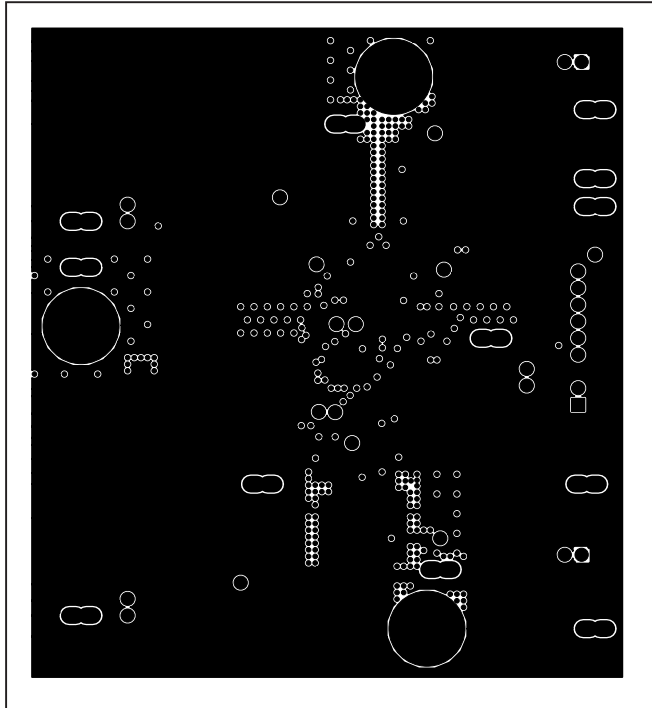


MAX20412 EV Kit—Internal 2

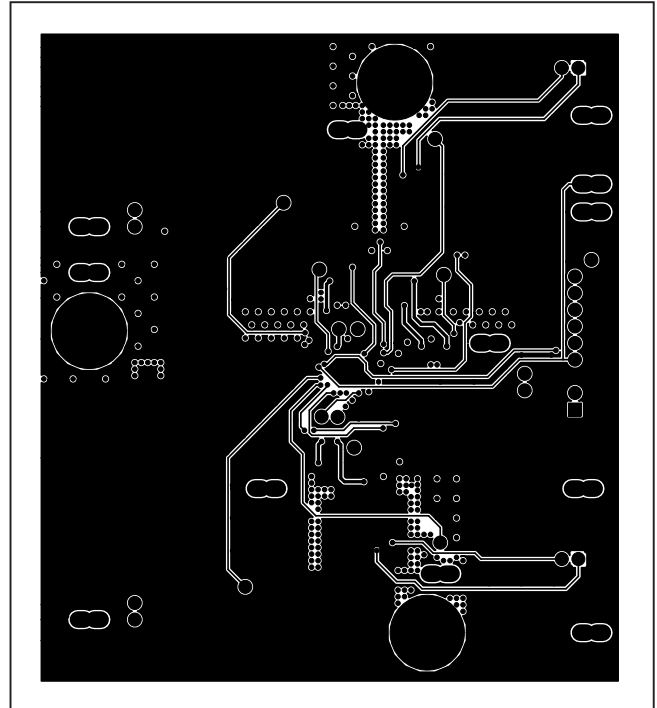


MAX20412 EV Kit—Internal 3

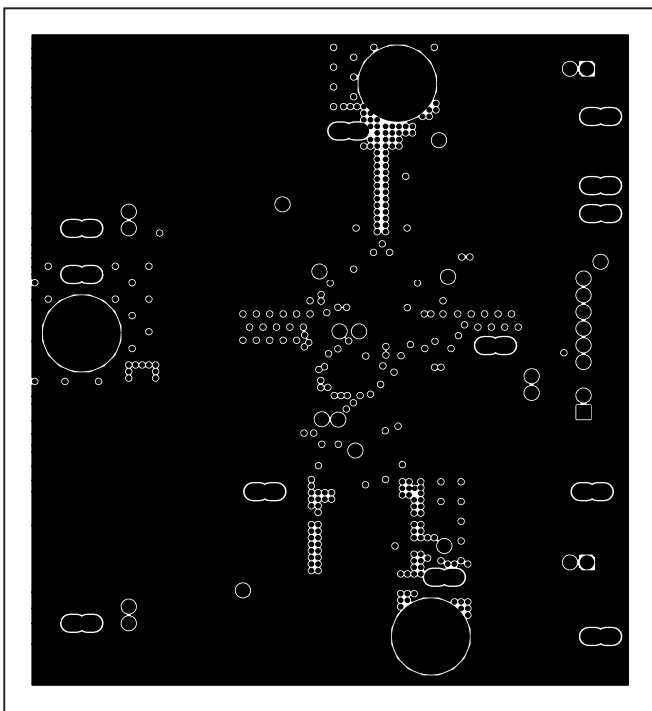
MAX20412 EV Kit PCB Layouts (continued)



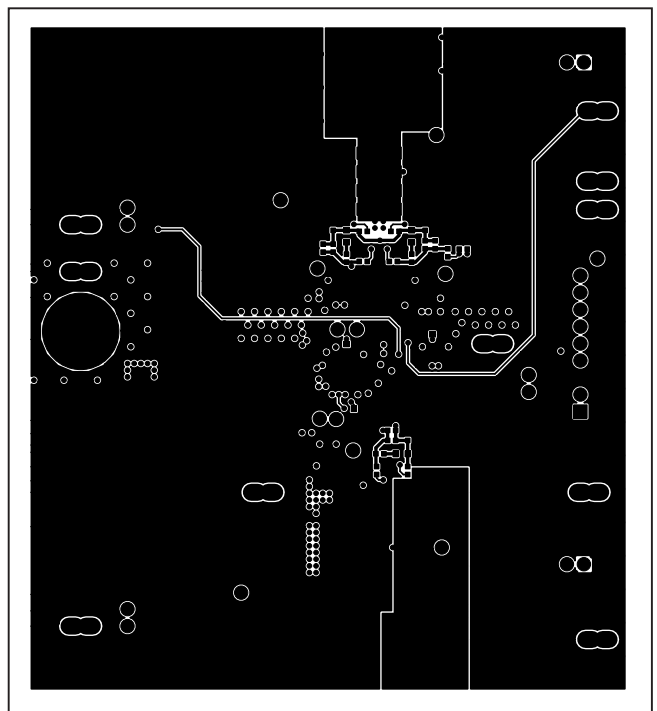
MAX20412 EV Kit—Internal 4



MAX20412 EV Kit—Internal 5

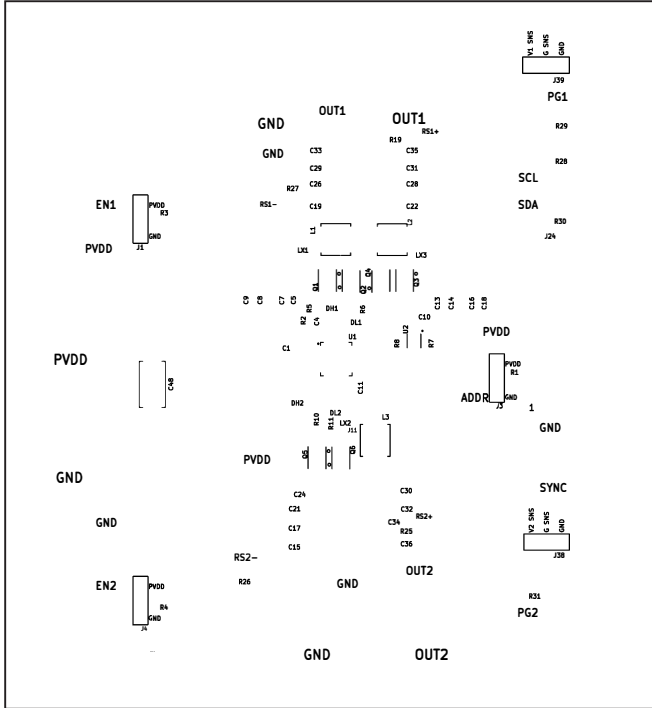


MAX20412 EV Kit—Internal 6

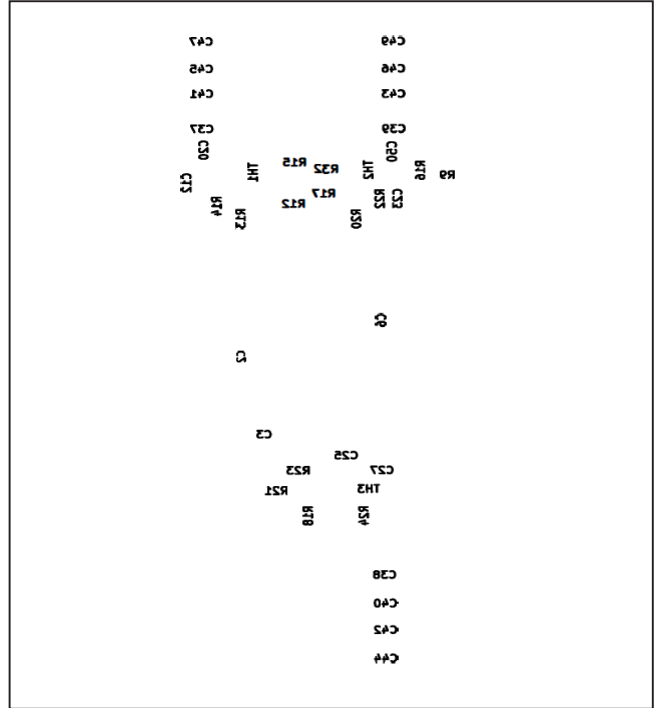


MAX20412 EV Kit—Bottom

MAX20412 EV Kit PCB Layouts (continued)



MAX20412 EV Kit—Top Silkscreen



MAX20412 EV Kit—Bottom Silkscreen

### Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	1/19	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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