

MAX20406 Evaluation Kit

Evaluates: MAX20404/MAX20405/
MAX20406

General Description

The MAX20406 evaluation kit (EV kit) provides a proven design to evaluate the MAX20406 automotive 2.1MHz synchronous buck converter with 10 μ A quiescent current. The standard EV kit PCB comes with a MAX20406AFOB/VY+ (2.1MHz, 3.3V) installed, as well as various test points and jumpers for evaluation. The EV kit output voltage is fixed and easily configured with minimum component changes. The default EV kit is designed to deliver up to 6A with input voltage 3V to 36V. Output voltage quality can be monitored by observing the PGOOD signal. The MAX20406 EV kit can also be used to evaluate the MAX20404 and MAX20405.

Benefits and Features

- Input Supply Range from 3V to 36V
- Output Voltage: 3.3V/5V Fixed and Adjustable from 0.8 to 10V
- Delivers up to 6A
- Frequency - Synchronization Input
- Enable Input
- Spread Spectrum Available
- Voltage Monitoring PGOOD Output Available
- Proven PCB Layout
- Fully Assembled and Tested

Ordering Information appears at end of data sheet.

Quick Start

Required Equipment

- MAX20406 EV Kit
- 36V, 6A Power Supply (PS)
- Appropriate Resistive Load, or an Electronic Load that can Sink 6A
- Digital Multimeter (DMM)
- Oscilloscope

Procedure

The EV kit comes 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) Connect the positive and negative terminals of the power supply to the VSUP_FILTER and GND test pads, respectively.
- 3) Set the power-supply voltage to 14V and current limit to 6A.
- 4) Turn on the power supply.
- 5) Using the DMM, verify the VOUT is approximately 3.3V.
- 6) Verify that the switching frequency is 2.1MHz (approx.) by monitoring the inductor switching voltage with the oscilloscope.

Additional Evaluation

- 7) Connect the positive and negative terminals of the electronic load to VOUT and GND3, respectively.
- 8) Set the electronic load to the desired current at or below 6A or use an equivalent resistive load with an appropriate power rating.
- 9) Adjust current limit on the power supply as necessary.
- 10) Turn on the power supply and electronic load.
- 11) Verify that voltage across the VOUT and GND3 is 3.3V.

Detailed Description of Hardware

The MAX20406 EV kit provides a proven layout for the MAX20406 synchronous buck regulator IC. The IC accepts input voltages as high as 36V and delivers up to 6A. The EV kit can handle an input supply transient up to 42V. Various test points are included for evaluation.

External Synchronization

The IC can operate in two modes: forced-PWM (FPWM) or skip mode. Skip mode has better efficiency for light-load conditions. When SYNC is pulled low, the IC operates in skip mode for light loads and PWM mode for larger loads. When SYNC is pulled high, the IC is forced to operate in PWM mode across all load conditions. SYNC can be used to synchronize with other supplies if a clock source is present. The IC is forced to operate in FPWM mode when SYNC is connected to a clock source.

Buck Output Monitoring (PGOOD)

The EV kit provides a power-good output test point (PGOOD) to monitor the status of the buck output (OUT). PGOOD is high impedance when the output is in regulation. PGOOD is low impedance when the output voltage drops below 7% (typ) of its nominal regulated voltage.

Programming Buck Output Voltage

The EV kit comes installed with MAX20406AFOB/VY+, which can provide a fixed 3.3V output voltage or an adjustable 0.8V-to-10V output voltage. To program V_{OUT} voltage, place appropriate resistors in the positions R7 and R8 according to the following equation:

$$R7 = R8 (V_{OUT}/V_{FB} - 1)$$

Where typically $V_{FB} = 0.8V$ and $R8 = 10k\sim 100k$.

Evaluating Other Variants

The EV kit comes installed with the 3.3V/2.1MHz, 6A variant (MAX20406AFOB/VY+). The other variants can be installed with minimal component changes.

Table 1. Default Jumper Settings

JUMPER	DEFAULT SHUNT POSITION	FUNCTIONS
ENABLE	1–2	Buck enabled
J1	1–2	Forced-PWM mode
J2	Installed	PGOOD TP pulled up to bias

Ordering Information

PART	TYPE
MAX20406EVKIT#	EV Kit

#Denotes RoHS compliant.

MAX20406 EV Kit Bill of Materials

PARTS COMMON TO ALL VARIANTS					
REF_DES	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION	
BIAS, FBR, GND2, GNDS, GNDS1-GNDS3, PGOOD, SYNCOUT, VEA, VSUPS	5012	KEystone	N/A	TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.445IN; BOARD HOLE=0.063IN; WHITE; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;	
C0	CGA6P3X7S1H106K250AB	TDK	10UF	CAP; SMT (1210); 10UF; 10%; 50V; X7S; CERAMIC	
C1, C2	CGA3E2X7R1H222K080AD	TDK	2200PF	CAP; SMT (0603); 2200PF; 10%; 50V; X7R; CERAMIC;	
C3	EEH-ZA1H101P	PANASONIC	100UF	CAP; SMT (CASE_G); 100UF; 20%; 50V; ALUMINUM-ELECTROLYTIC	
C4, C5	CGA5L3X7R1H475K160AB	TDK	4.7UF	CAP; SMT (1206); 4.7UF; 10%; 50V; X7R; CERAMIC	
C6, C9	UMK107BJ105KA	TAIYO YUDEN	1UF	CAP; SMT (0603); 1UF; 10%; 50V; X5R; CERAMIC	
C7, C8, C10, C17	CGA3E2X7R1H104K080AE	TDK	0.1UF	CAP; SMT (0603); 0.1UF; 10%; 50V; X7R; CERAMIC	
C11	GRM188Z71C225KE43	MURATA	2.2UF	CAP; SMT (0603); 2.2UF; 10%; 16V; X7R; CERAMIC	
ENABLE, J1	PEC03SAAN	SULLINS	PEC03SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 3PINS	
GND, GND3, VOUT, VSUP_FILTER	575-4	KEystone	575-4	RECEPTACLE; JACK; BANANA; 0.203IN [5.2MM] DIA X 0.218IN [5.5MM] L; 0.203D/0.218L; NICKEL PLATED BRASS	
J2	PEC02SAAN	SULLINS	PEC02SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 2PINS	
L0	BLM41PG600SH1	MURATA	60	INDUCTOR; SMT (1806); FERRITE-BEAD; 60 IMPEDANCE AT 100MHZ; 6A	
R2	ERA-2AEB103	PANASONIC	10K	RES; SMT (0402); 10K; 0.10%; +/-25PPM/DEGK; 0.0630W	
R4, R5	RC0402JR-070RL	YAGEO PHYCOMP	0	RES; SMT (0402); 0; 5%; JUMPER; 0.0630W	
C16				Do not install	
R6				Do not install	
R7, R8				Do not install	

2.1MHz VARIANT					
REF_DES	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION	
L1	XEL5030-102	COILCRAFT	1UH	INDUCTOR; SMT; 1UH	
L2 (For MAX20404/MAX20405/MAX20406)	XEL5030-102	COILCRAFT	1UH	INDUCTOR; SMT; 1UH	
C12, C15	CGA6P1X7R1C226M250AC	TDK	22UF	CAP; SMT (1210); 22UF; 10%; 16V; X7R; CERAMIC	
C13, C14				Do not install	

3MHz VARIANT					
REF_DES	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION	
L1	XEL5030-102	COILCRAFT	1UH	INDUCTOR; SMT; 1UH	
L2 (For MAX20406)	XEL5020-681	COILCRAFT	0.68UH	INDUCTOR; SMT; 0.68UH	
L2 (For MAX20404/MAX20405)	XEL4030-901	COILCRAFT	0.9UH	INDUCTOR; SMT; 0.9UH	
C12	CGA6P1X7R1C226M250AC	TDK	22UF	CAP; SMT (1210); 22UF; 10%; 16V; X7R; CERAMIC	
C15	CGA6P1X7R1E106K250AC	TDK	10UF	CAP; SMT (1210); 10UF; 10%; 25V; X7R; CERAMIC	
C13, C14				Do not install	

400kHz VARIANT					
REF_DES	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION	
L1	XEL5030-222	COILCRAFT	2.2UH	INDUCTOR; SMT; 2.2UH	
L2 (For MAX20406)	XEL6060-472	COILCRAFT	4.7UH	INDUCTOR; SMT; 4.7UH	
L2 (For MAX20404/MAX20405)	XEL6060-682	COILCRAFT	6.8UH	INDUCTOR; SMT; 6.8UH	
C12, C13, C15	GRT32EC81C476KE13	MURATA	47UF	CAP; SMT (1210); 47UF; 10%; 16V; X6S; CERAMIC	
C14				Do not install	

MAX20406 EV Kit Schematic Diagram

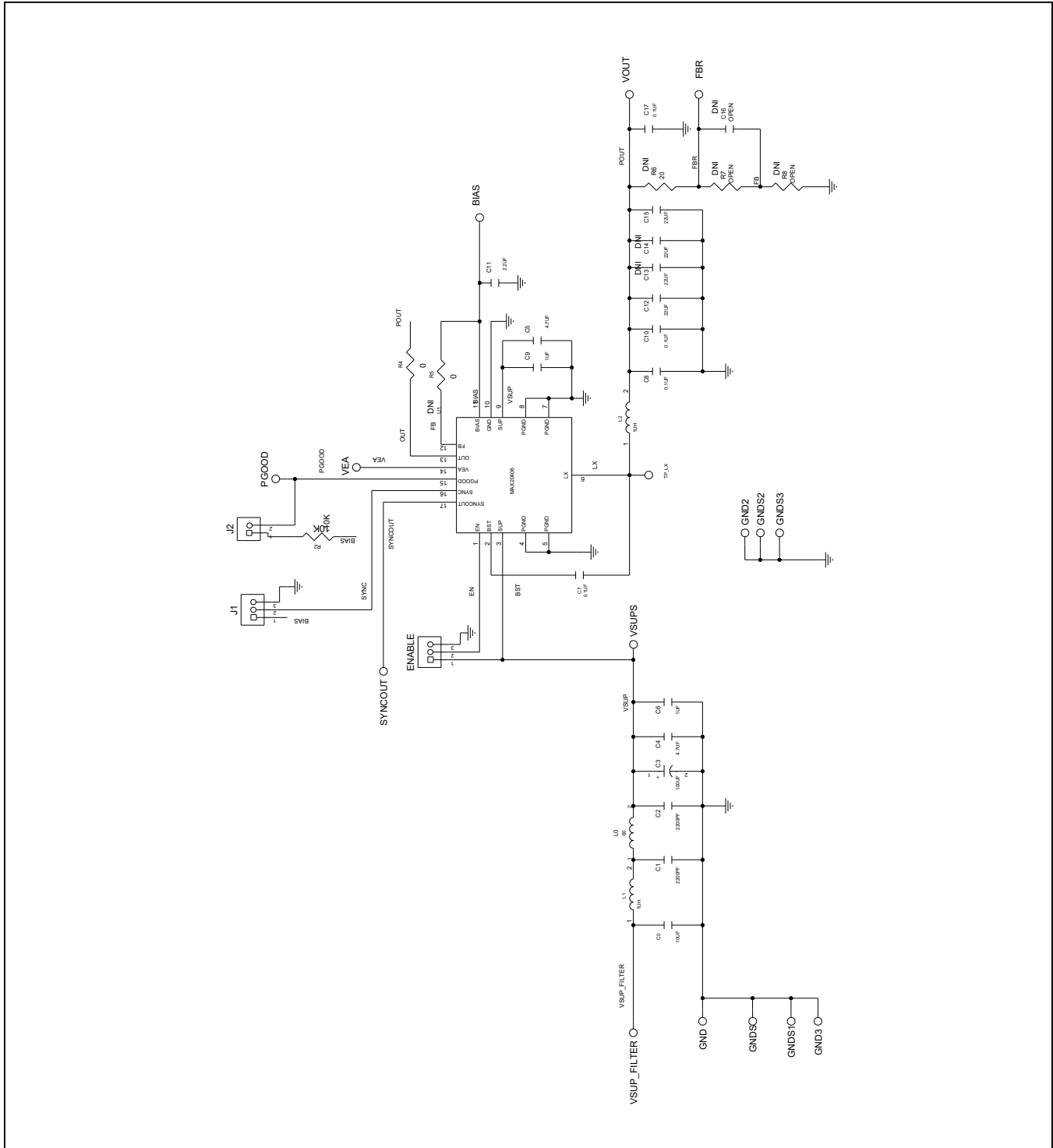
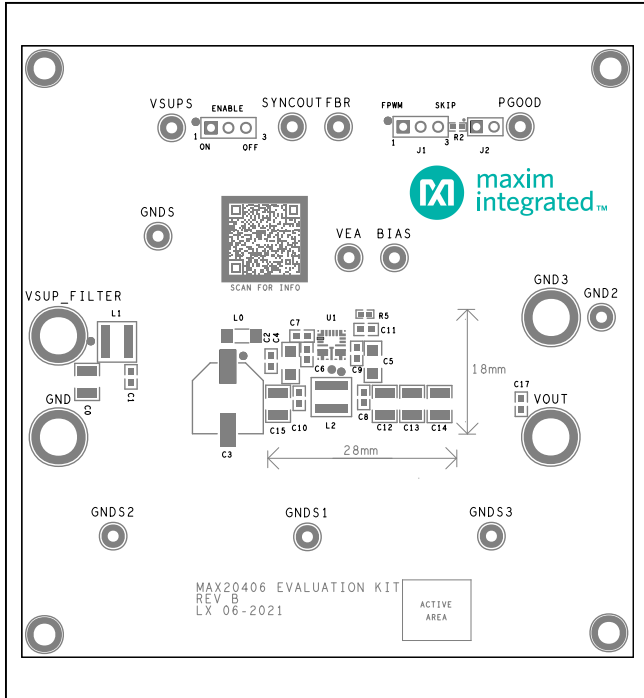
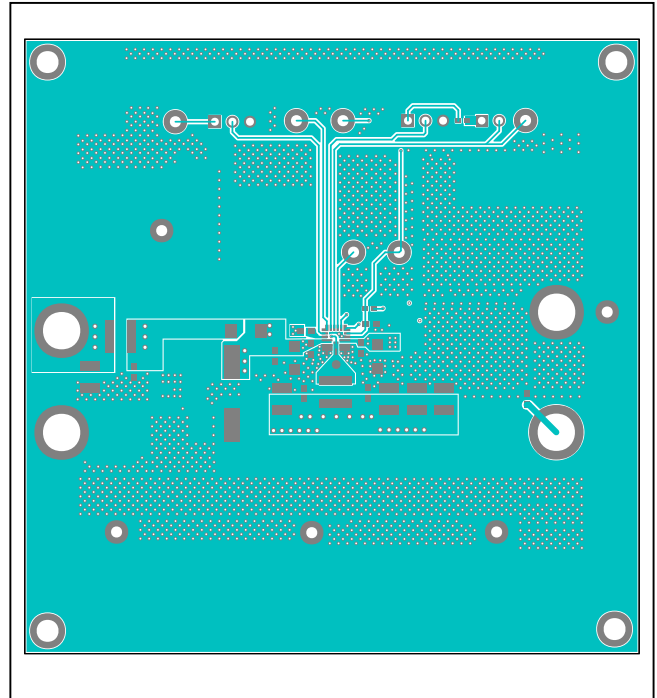


Figure 1. MAX20406 EV Kit Schematic

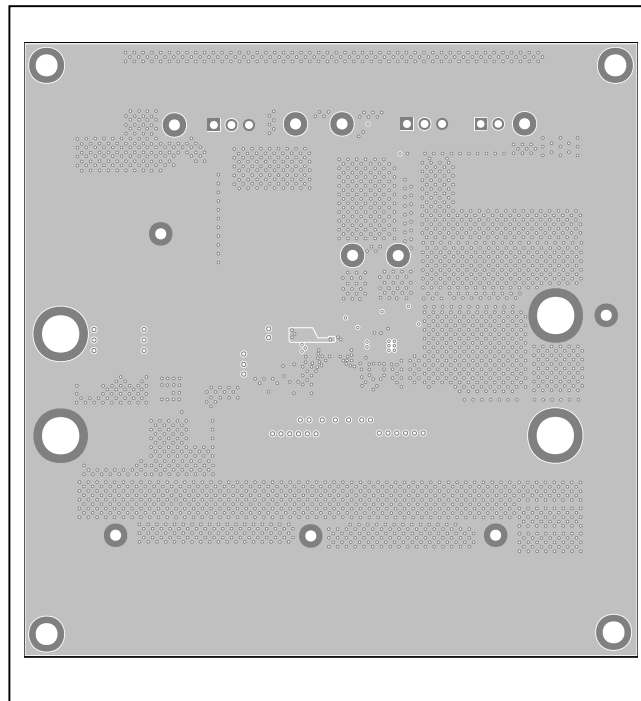
MAX20406 EV Kit PCB Layout Diagrams



MAX20406 EV Kit PCB Layout—Top Silkscreen

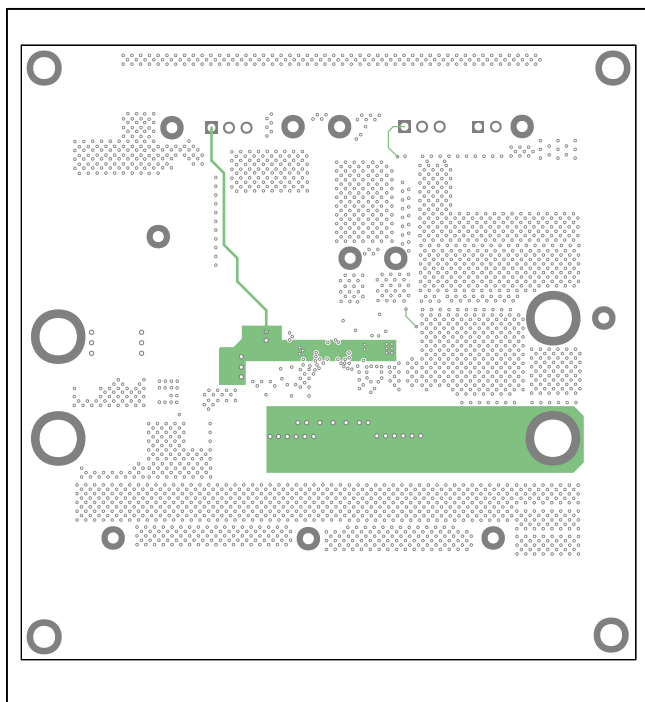


MAX20406 EV Kit PCB Layout—Top Layer

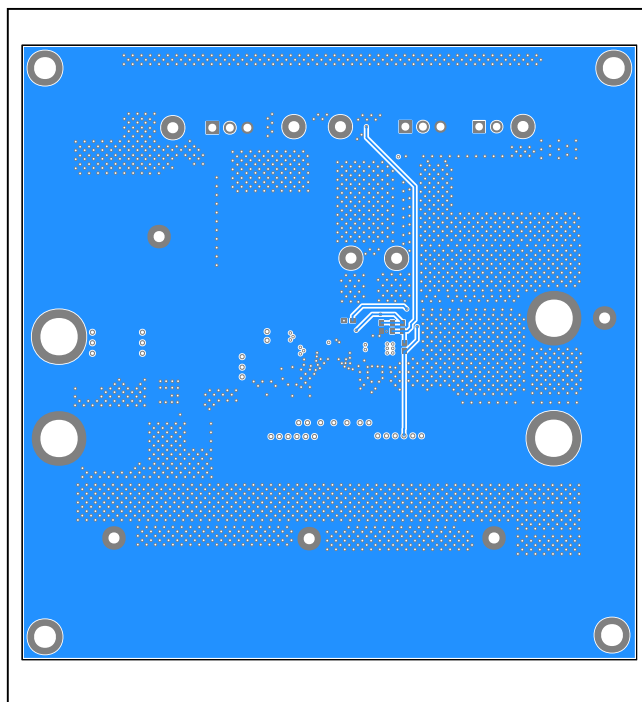


MAX20406 EV Kit PCB Layout—Internal Layer 2

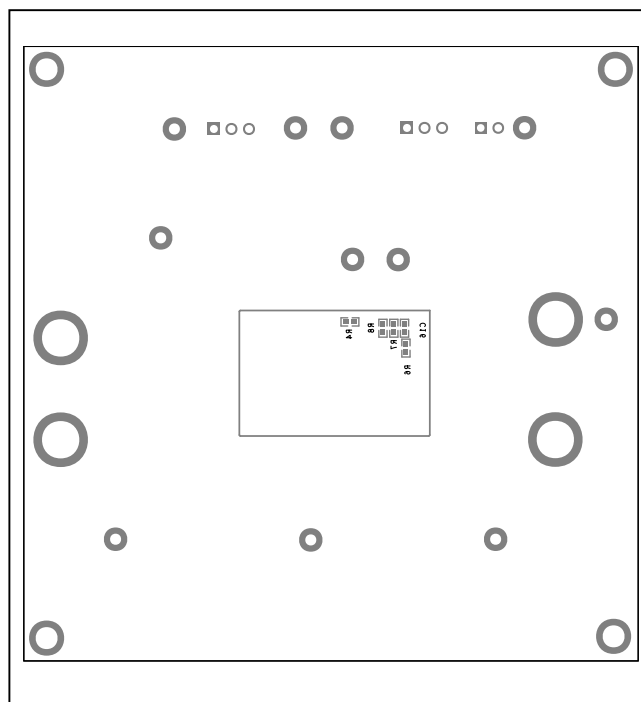
MAX20406 EV Kit PCB Layout Diagrams (continued)



MAX20406 EV Kit PCB Layout—Internal Layer 3



MAX20406 EV Kit PCB Layout—Bottom Layer



MAX20406 EV Kit PCB Layout—Bottom Silkscreen

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	9/19	Initial release	—
1	1/20	Updated title to MAX20404/MAX20405/MAX20406; updated BOM	1–7
2	3/21	Updated General Description, Quick Start, Detailed Description, BOM, and Layout Diagrams	1–6
3	7/21	Updated Procedure, Additional Evaluation, Detailed Description of Hardware, BOM, Schematic Diagram, and PCB Layout Diagrams	1–6

For pricing, delivery, and ordering information, please visit Maxim Integrated's online storefront at <https://www.maximintegrated.com/en/storefront/storefront.html>.

Maxim Integrated cannot assume responsibility for use of any circuitry other than circuitry entirely embodied in a Maxim Integrated product. No circuit patent licenses are implied. Maxim Integrated reserves the right to change the circuitry and specifications without notice at any time.