MAX22256 Evaluation Kit

Evaluates: MAX22256 (A/B/C)

General Description

The MAX22256 evaluation kit (EV kit) is a fully assembled and tested PCB that contains the MAX22256, a 15W isolated H-bridge DC-DC converter. The EV kit operates from a 5V to 36V DC power source and the onboard 1:1 turns-ratio transformer from Wurth sets the output voltage, operating up to a 1A current limit.

The EV kit provides greater than 90% overall efficiency at +24V between 2.2W and up to 8.3W output power using an H-bridge DC-DC converter topology. The MAX22256 EV kit operates in pulse width modulation (PWM) mode, by default. The transformer provides galvanic isolation with the output powered from a full-wave rectifier circuit, reducing the output-voltage ripple.

The EV kit circuit is configured as a full-wave rectifier with an output voltage that follows the input voltage, but is configurable for other topologies.

The EV kit comes with the MAX22256B installed but can be used to evaluate any version of the MAX22256 (MAX22256A, MAX22256B, and MAX22256C).

Features

- 5V to 36V Input Supply Range
- Up to 90% Efficiency
- Full-Wave Rectified Output
- Configurable for a Voltage Doubler, Full-Wave, and Half-Wave Rectifier
- Internal or External Clock Operation Option
- Designed for 1500V_{RMS} Isolation
- Proven PCB Layout
- Fully Assembled and Tested

Ordering Information *appears at end of data sheet.*

Quick Start

Required Equipment

- MAX22256 EV Kit
- 24V, 1A DC Power Supply
- Electronic Load Capable of 650mA or higher
- Ammeter
- Voltmeter

Procedure

The EV kit is fully assembled and tested. Follow the steps to verify board operation. **NOTE: Do not turn on the power supply until all connections are complete.**

1. Verify that jumpers J2 and J3 are in their default positions, as shown in *Table 1*.
2. Set the DC power supply to 24V.
3. Set the electronic load to 200mA and disable the output.
4. Connect the voltmeter between the VOUT and GND_ISO test points (TP9 and TP10, respectively) on the EV kit.
5. Connect the ammeter between the VOUT test point (TP9) on the EV kit and the positive terminal on the electronic load. The negative terminal on the electronic load is connected to the GND_ISO test point (TP10).
6. Connect the power supply between the VDD and GND test points (TP1 and TP5) on the EV kit.
7. Turn on the power supply.
8. DS2 then turns, indicating that the V_L voltage is present.
9. Enable the electronic load.
10. Verify that the ammeter reads approximately 200mA.
11. Verify that the voltmeter reads around 24V.

EV Kit Photo

19-100902; Rev 1; 5/22

ANALOG DEVICES

Table 1. Jumper Connection Guide

JUMPER	DEFAULT CONNECTION	FEATURE
J2	1-2	EN is high. The MAX22256 is disabled.
	2-3*	EN is low. The MAX22256 is enabled.
J3	Open	CLKI is open. Connect an external clock signal to CLKI.
	Closed*	CLKI is connected to ground. Internal clocking is enabled.

**Default options*

Detailed Description of Hardware

The MAX22256 EV kit is an isolated H-bridge DC-DC converter that provides an unregulated output that is two diode-voltage drops fewer than its input supply, with respect to the isolated ground. In the default configuration, the device circuit operates in a PWM configuration, and the maximum load is limited by the device and the onboard transformer. The MAX22256 is an integrated primary-side controller and H-bridge driver for isolated power-supply circuits. The device contains an onboard oscillator, protection circuitry, and internal MOSFETs to provide up to $650mA_{RMS}$ of current to the transformer's primary winding. The device can be operated using the internal 450kHz oscillator or driven by an external clock to synchronize multiple devices and control EMI behavior. Regardless of the clock source being used, an internal flip-flop stage guarantees a fixed 50% duty cycle, preventing DC current flow in the transformer as long as the clock's period is constant. The MAX22256 operates from a single-supply voltage and includes UVLO and an active-low enable input for controlled startup. If the input voltage at V_{DD} falls below 4.65V (typ) or the EN input is pulled above 2V, the device shuts down and ST1 and ST2 are high impedance.

The MAX22256 EV kit PCB is designed for $1500V_{RMS}$ isolation, with more than 300mil spacing between the GND and GND_ISO planes. The bottom PCB GND plane under device U1 is utilized as a thermal heatsink for power dissipation of the device's thermally enhanced TDFN package with exposed pad. Test points for GND and GND_ISO are provided on the PCB for probing the respective ground planes, or to connect the GND and GND_ISO planes for non-isolated evaluation of the circuit. This EV kit can be used to evaluate the MAX22256A, MAX22256B, and MAX22256C.

Clock Source

The MAX22256 has two modes of operation: internal oscillator or external clock. To use the internal 450kHz (typ) oscillator, place a shunt in the 1-2 position on jumper J2. When using an external clock, remove the shunt from J2 and apply a clock signal at the CLKI test point (TP4) on the EV kit. An internal flip-flop divides the external clock by two, generating a switching signal with a guaranteed 50% duty cycle. As a result, the ST1 and ST2 outputs switch at half the external clock frequency.

Overcurrent Limiting

Resistor R5 sets the current-limit threshold to $650mA_{RMS}$ (typ). To change the current-limit threshold, replace resistor R5 with a 0805 surface-mount resistor using the following equation:

$$R_{LIM}\ (k\Omega) = 1.2 \times 10^3 / I_{LIM}\ (mA)$$

where I_{LIM} is the desired current threshold in the range of $150mA_{RMS} < I_{LIM} < 650mA_{RMS}$.

An overcurrent or overtemperature condition triggers a fault on the device. During a fault condition, the FAULT pin asserts low and the red LED (DS1) on the EV kit board turns on.

Onboard LDO for Logic Supply

The EV kit features an onboard LDO (U1) to generate a 5V supply for the logic input/outputs and for powering the LED connected to FAULT. To use a voltage other than 5V, remove the R1 and R10 resistors and connect an external power supply to the V_L test point (TP12) and GND test point (TP5 or TP6).

PRELIMINARY

PWM vs. LLC Topology

The MAX22256 can operate in either a LLC or PWM power conversion topology. By default, the EV kit is configured in a PWM topology.

To use the MAX22256 EV kit in a LLC topology, place capacitors across the R23 and R24 pads. The onboard transformer is not optimized for LLC operation and it is recommend to use a low-leakage transformer optimized for LLC operation, such as the 750319825 by Wurth. Refer to the MAX22258 EV kit for component values when using a LLC topology with the 750319825 transformer.

Evaluating Other Transformer Configurations

The EV kit PCB layout provides an easy method to reconfigure the transformer T1 secondary windings for other configurations.

Output Snubbers

For V_{DD} voltages greater than 27V, use a simple RC snubber circuit on ST1 and ST2 to ensure that the peak voltage is less than 40V during switching.

Ordering Information

PART	TYPE
MAX22256EVKIT#	EV Kit

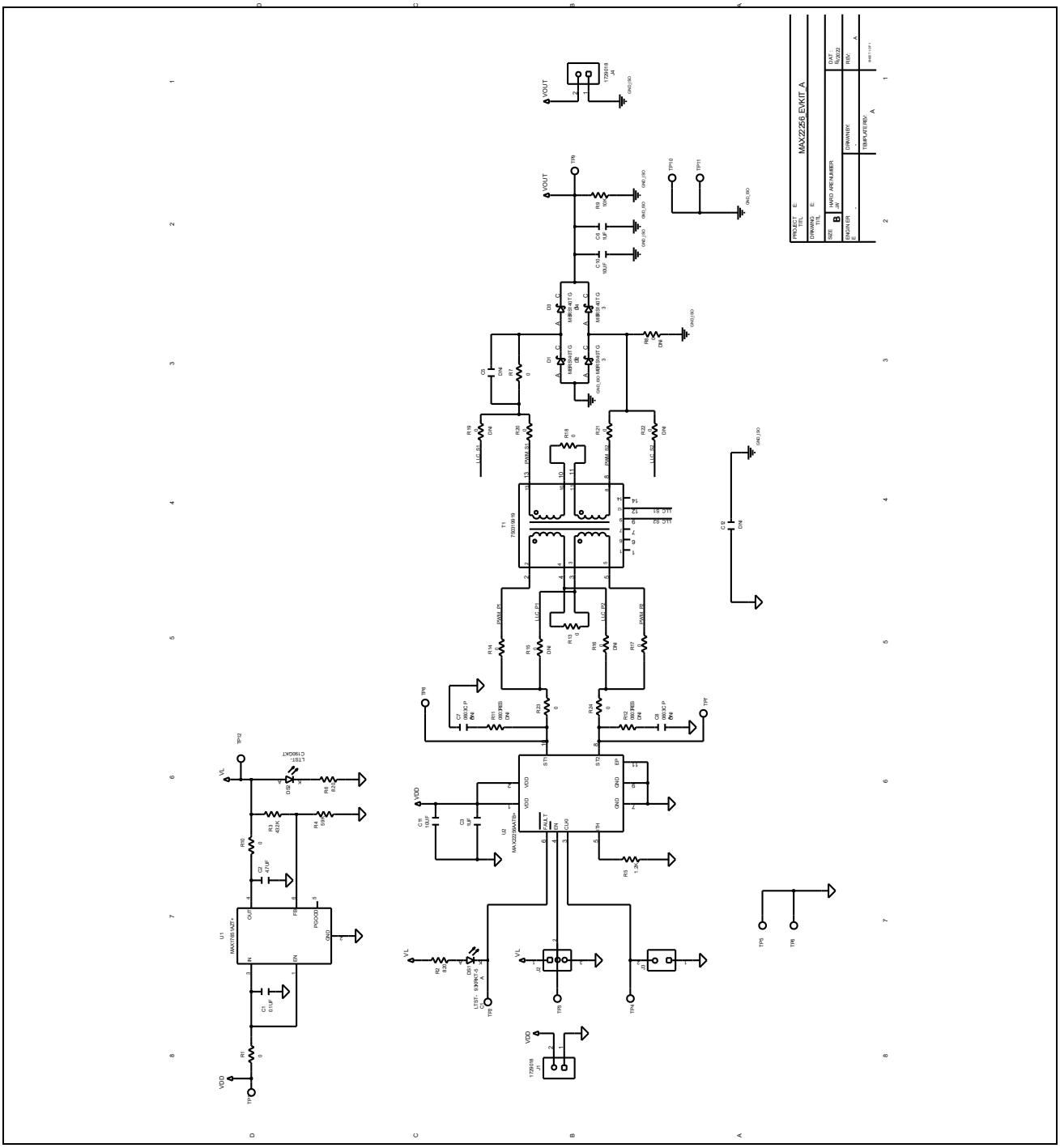
#Denotes RoHS-compliant.

MAX22256 EV Kit Bill of Materials

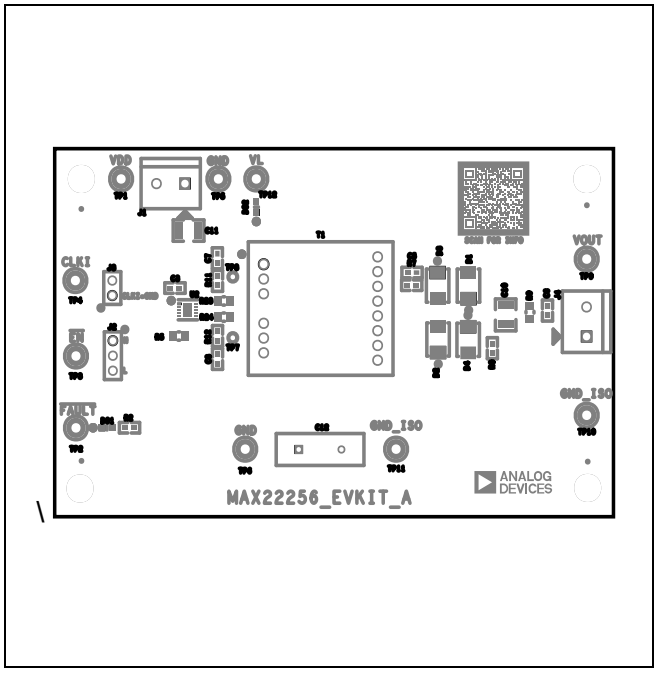
REF_DES	DNI/DNP	QTY	VALUE	DESCRIPTION
C1	-	1	0.1UF	CAP; SMT (0603); 0.1UF; 10%; 100V; X7R; CERAMIC
C2	-	1	4.7UF	CAP; SMT (0603); 4.7UF; 10%; 10V; X5R; CERAMIC
C3, C6	-	2	1UF	CAP; SMT (0603); 1UF; 10%; 50V; X7R; CERAMIC
C10, C11	-	2	10UF	CAP; SMT (1210); 10UF; 10%; 50V; X7R; CERAMIC
D1-D4	-	4	MBRS140T3G	DIODE; SCH; SMB (DO-214AA); PIV=40V; IF=1A ;
DS1	-	1	LTST-C193KRKT-5A	DIODE; LED; WATER CLEAR; RED; SMT; VF=2V; IF=0.005A
DS2	-	1	LTST-C190GKT	DIODE; LED; WATER CLEAR GREEN; SMT (0603); VF=2.1V; IF=0.03A; -55 DEGC TO +85 DEGC
J1, J4	-	2	1729018	CONNECTOR; FEMALE; THROUGH HOLE; GREEN TERMINAL BLOCK; RIGHT ANGLE; 2PINS
J2	-	1	TSW-103-23-G-S	CONNECTOR; THROUGH HOLE; SINGLE ROW; STRAIGHT; 3PINS; -55 DEGC TO +125 DEGC
J3	-	1	TSW-102-23-G-S	CONNECTOR; THROUGH HOLE; SINGLE ROW; STRAIGHT; 2PINS; -55 DEGC TO +125 DEGC
MH1-MH4	-	4	9032	MACHINE FABRICATED; ROUND-THRU HOLE SPACER; NO THREAD; M3.5; 5/8IN; NYLON
R1, R7, R10	-	3	0	RES; SMT (0603); 0; 5%; JUMPER; 0.1000W
R2, R6	-	2	820	RES; SMT (0603); 820; 1%; +/-100PPM/DEGC; 0.1000W
R3	-	1	432K	RES; SMT (0603); 432K; 1%; +/-100PPM/DEGC; 0.1000W
R4	-	1	59K	RES; SMT (0603); 59K; 1%; +/-100PPM/DEGC; 0.1000W
R5	-	1	1.2K	RES; SMT (0805); 1.2K; 1%; +/-100PPM/DEGC; 0.1250W
R9	-	1	10K	RES; SMT (0805); 10K; 1%; +/-100PPM/DEGC; 0.1250W
R13, R14, R17, R18, R20, R21	-	6	0	RES; SMT (0402); 0; 5%; JUMPER; 0.0630W
R23, R24	-	2	0	RES; SMT (0805); 0; JUMPER; JUMPER; 0.1250W
T1	-	1	7.5E+08	EVKIT PART - TRANSFORMER; 750319919; 14L TH; WURTH ELECTRONICS
TP1, TP12	-	2	N/A	TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.445IN; BOARD HOLE=0.063IN; RED; PHOSPHOR BRONZE WIRE SIL;
TP2-TP4, TP9	-	4	N/A	TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.445IN; BOARD HOLE=0.063IN; YELLOW; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;
TP5, TP6, TP10, TP11	-	4	N/A	TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.445IN; BOARD HOLE=0.063IN; BLACK; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;
U1	-	1	MAX17651AZT+	IC; REG; ULTRA-LOW QUIESCENT CURRENT; LINEAR REGULATOR; TSOT6
U2	-	1	MAX22256AATB+	EVKIT PART - IC; MAX22256AATB+; DRV; AUTOMOTIVE; 36V H-BRIDGE TRANSFORMER DRIVER FOR ISOLATED SUPPLIES; PACKAGE CODE: T1033Y+1C; PACKAGE OUTLINE DRAWING; 21-0137; PACKAGE LAND PATTERN: 90-0003; TDFN10-EP
PCB	-	1	PCB	PCB:MAX22256
C5, C7, C8	DNP	0	100PF	CAP; SMT (0603); 100PF; 5%; 100V; C0G; CERAMIC
C12	DNP	0	2200PF	CAP; THROUGH HOLE-RADIAL LEAD; 2200PF; 10%; 3000V; R; CERAMIC
R8	DNP	0	0	RES; SMT (0603); 0; 5%; JUMPER; 0.1000W
R11, R12	DNP	0	560	RES; SMT (0603); 560; 1%; +/-100PPM/DEGC; 0.1000W

R15, R16, R19, R22	DNP	0	0	RES; SMT (0402); 0; 5%; JUMPER; 0.0630W

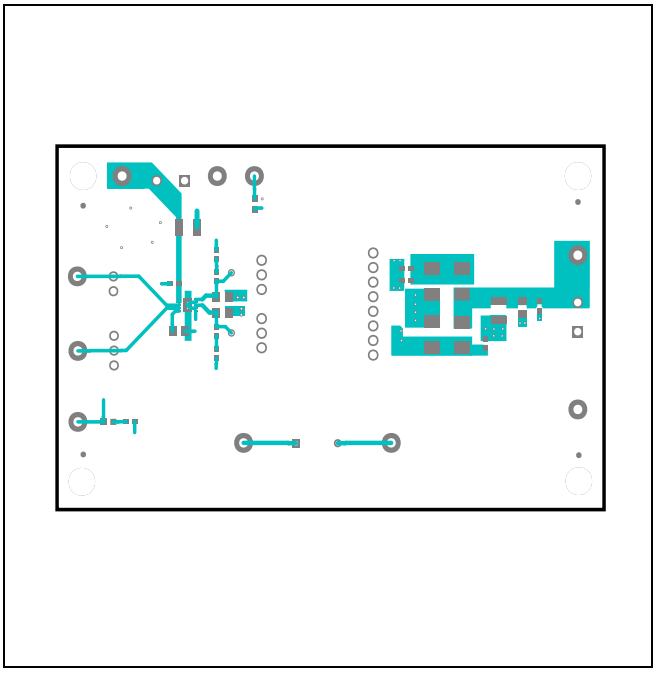
MAX22256 EV Kit Schematic



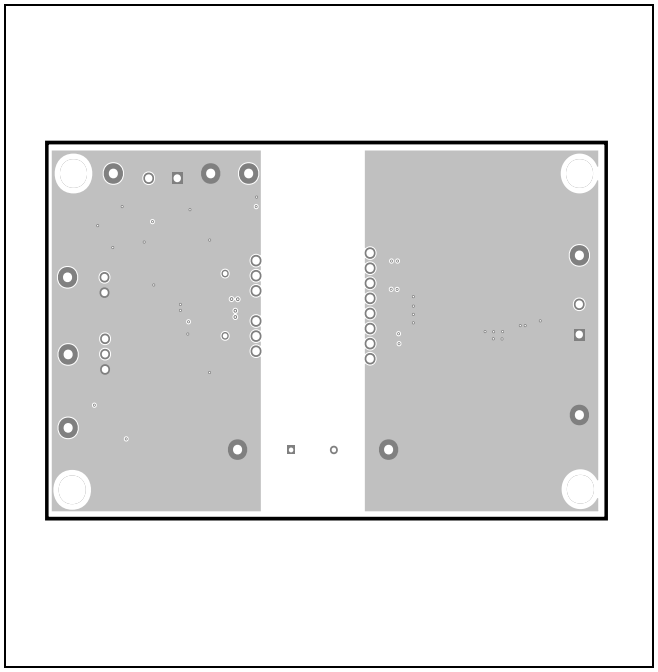
MAX22256 EV Kit PCB Layout



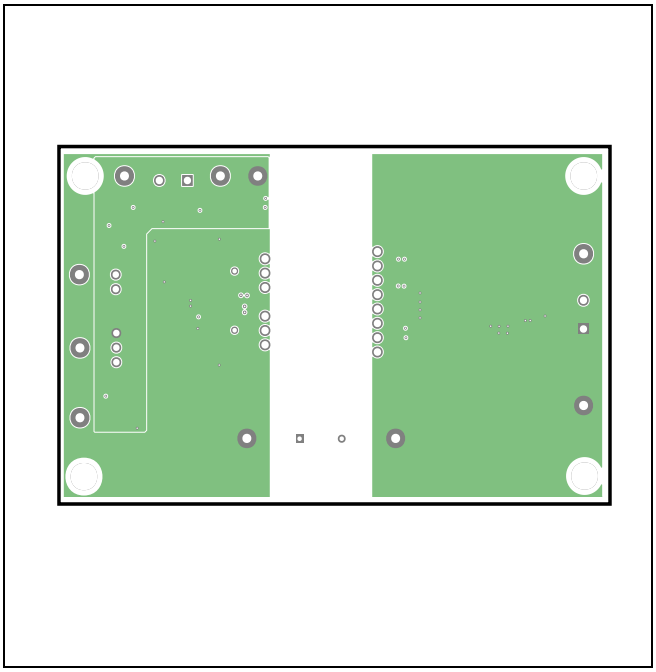
MAX22256 EV Kit PCB Layout—Top Silkscreen



MAX22256 EV Kit PCB Layout—Top Layer

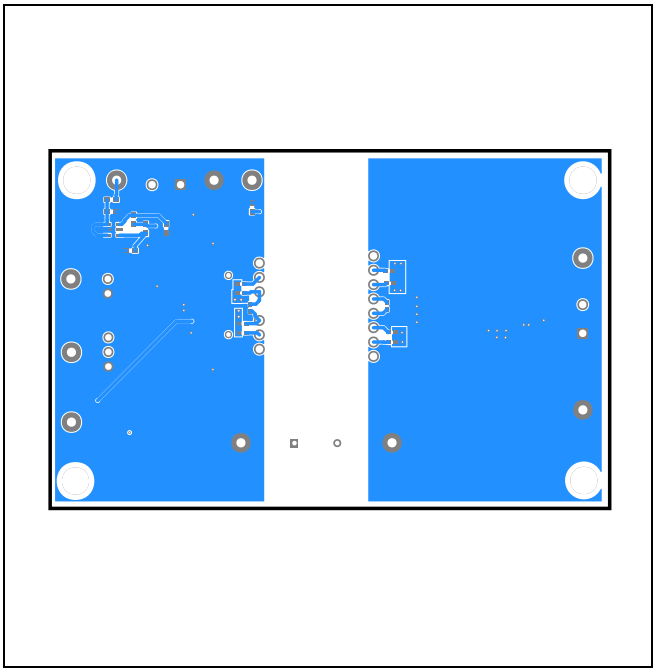


MAX22256 EV Kit PCB Layout—Layer 2

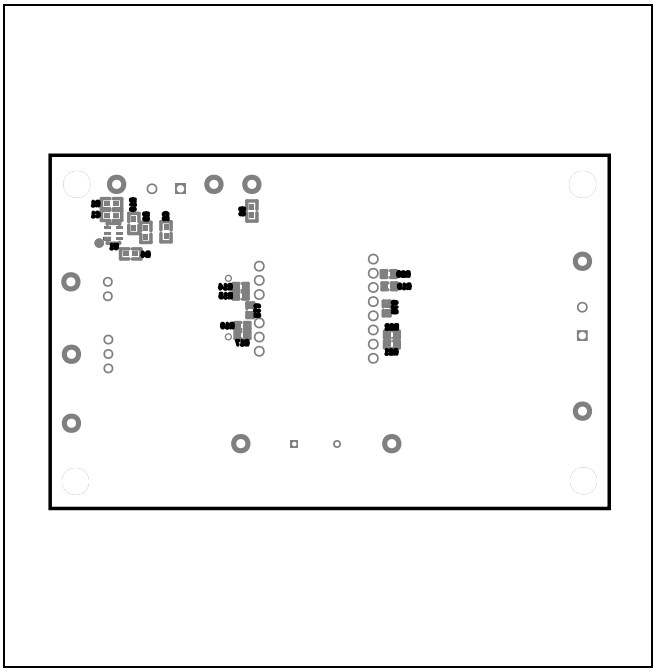


MAX22256 EV Kit PCB Layout—Layer 3

MAX22256 EV Kit PCB Layout (continued)



MAX22256 EV Kit PCB Layout—Bottom Layer



MAX22256 EV Kit PCB Layout—Bottom Silkscreen

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	3/22	Initial release	—
1	5/22	Updated title	1–8