

General Description

The MAX22258 evaluation kit (EV kit) is a fully assembled and tested PCB that contains the MAX22258, a 15W isolated H-bridge DC-DC converter. The EV kit operates from an 5V to 36V DC power source and the on-board 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 MAX22258 EV kit operates in LLC mode by default. Input-ripple current and radiated noise are minimized by the inherent balanced nature of the design with no interruption in the input current. 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.

Features and Benefits

- 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

- MAX22258 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

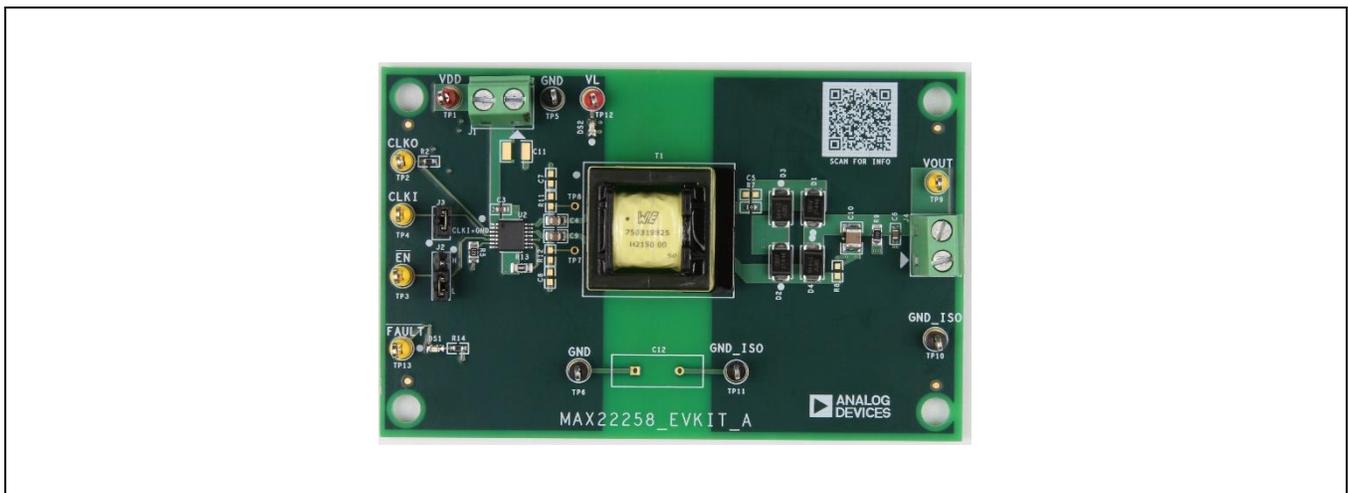


Table 1. Jumper Connection Guide

JUMPER	DEFAULT CONNECTION	FEATURE
J2	Open	CLKI is open. Connect an external clock signal to CLKI.
	Closed*	CLKI is connected to ground. Internal clocking is enabled.
J3	1-2	$\overline{\text{EN}}$ is high. The MAX22258 is disabled.
	2-3*	$\overline{\text{EN}}$ is low. The MAX22258 is enabled.

*Default options

Detailed Description of Hardware

The MAX22258 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 LLC configuration and the maximum load is limited by the device and the onboard transformer. The MAX22258 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 MAX22258 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 $\overline{\text{EN}}$ input is pulled above 2V, the device shuts down and ST1 and ST2 are high impedance.

The MAX22258 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.

Clock Source

The MAX22258 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.

The MAX22258 also features an open-drain clock output (CLKO). CLKO switches at the 450kHz (typ) switching frequency when CLKI is low (J2 jumper is closed), or at the frequency of the external clock applied to CLKI. Monitor the CLKO signal at the CLKO test point (TP2).

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:

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

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 $\overline{\text{FAULT}}$ pin asserts low and the red LED (DS1) on the EV kit board turns on.

Dead Time Control

The MAX22258 features a resistor-adjustable dead-time (t_{DEAD}). Adjust the dead time by changing the R13 resistor. For any given dead time, calculate the value for R13 as:

$$R13 \text{ (}\Omega\text{)} = (1.2 \times t_{DEAD}) \times (333 \times 10^9)$$

The default R13 resistance is 28k Ω , with a dead time on the MAX22258 EV kit of 70ns (typ).

Onboard LDO for Logic Supply

The EV kit features an on-board 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).

LLC vs. PWM Topology

The MAX22258 can operate in either a LLC or a pulse width modulated (PWM) power conversion topology. By default, the EV kit is configured in a LLC topology.

To use the MAX22258 EV kit in a PWM topology, short across the C4 and C9 capacitors. The onboard transformer is not optimized for PWM operation and has a low efficiency over the load range in this configuration. It is recommend to use a low-leakage transformer optimized for PWM operation, such as the 750319919 by Wurth.

Evaluating Other Transformer Configurations

The EV kit PCB layout provides an easy method to reconfigure the transformer T1 secondary windings for other configurations, including a half-wave rectifier, voltage doubler, bipolar outputs, and other full-wave rectifier 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

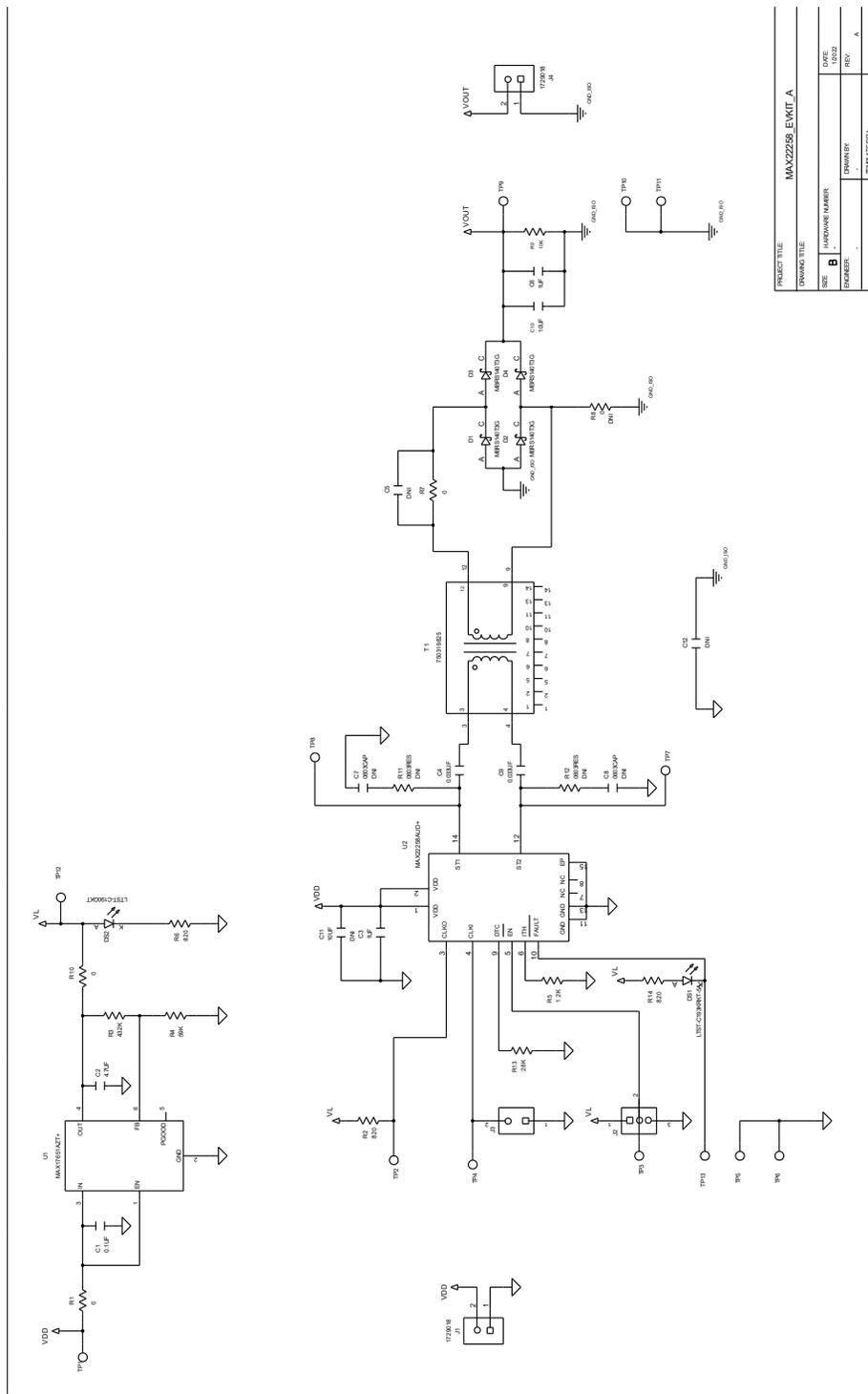
PART	TYPE
MAX22258EVKIT#	EV Kit

#Denotes RoHS-compliant.

MAX22258 EV Kit Bill of Materials

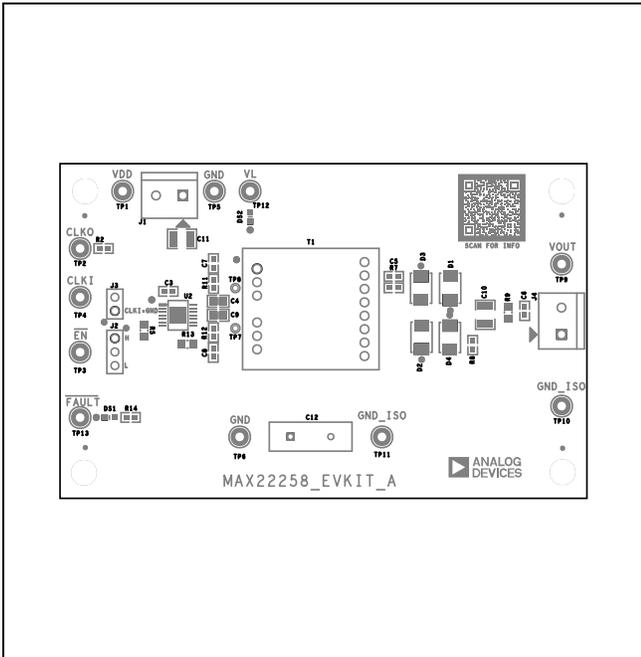
REFDES	DNI/DNP	QTY	VALUE	DESCRIPTION
C1	-	1	0.1UF	CAP; SMT (0603); 0.1UF; 10%; 100V; X7R; CERAMIC
C2	-	1	4.7UF	CAP; SMT (0603); 4.7UF; 10%; 10V; X5R; CERAMIC
C3, C6	-	2	1UF	CAP; SMT (0603); 1UF; 10%; 50V; X7R; CERAMIC
C4, C9	-	2	0.033UF	CAP; SMT (0805); 0.033UF; 10%; 100V; X7R; CERAMIC
C10	-	1	10UF	CAP; 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, R14	-	3	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	-	1	28K	RES; SMT (0805); 28K; 1%; +/-100PPM/DEGC; 0.1250W
T1	-	1	750319825	EVKIT PART - TRANSFORMER; 750319825; 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, TP13	-	5	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	MAX22258AUD+	DRV; COMPACT; 36V H-BRIDGE TRANSFORMER DRIVER FOR ISOLATED SUPPLIES; TSSOP14-EP; PACKAGE CODE: U14E+3C; PACKAGE OUTLINE: 21-0108; LAND PATTERN:90-0119
C5, C7, C8	-	1	100PF	CAP; SMT (0603); 100PF; 5%; 100V; C0G; CERAMIC
C11	DNP	0	10UF	CAP; SMT (1210); 10UF; 10%; 50V; X7R; 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

MAX22258 EV Kit Schematic

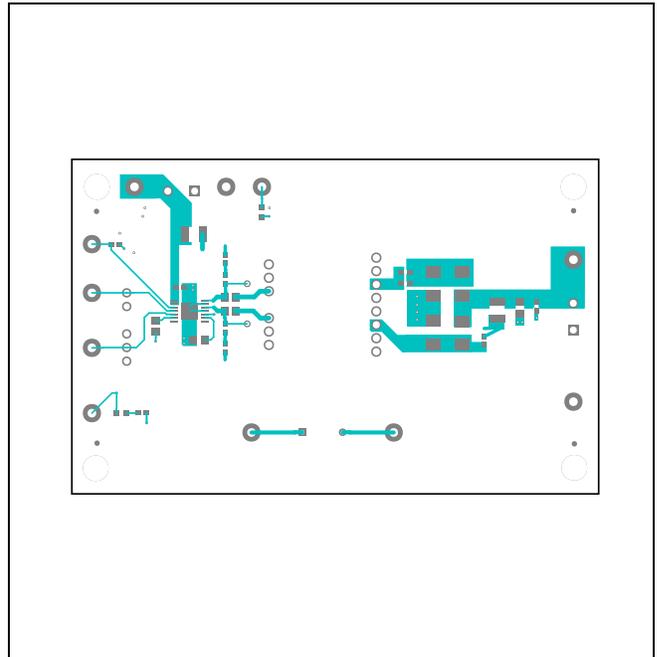


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DRAWING TITLE	
SIZE	B
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ENGINEER	
REV.	A
DATE	
APPROVED BY	

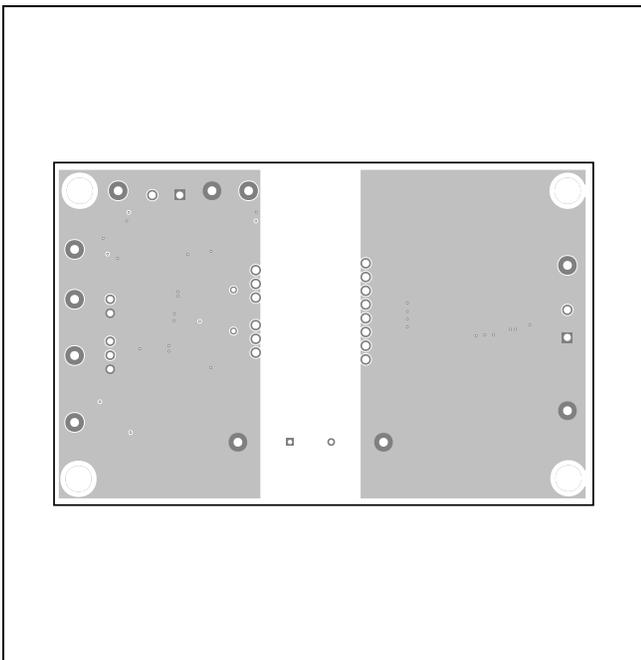
MAX22258 EV Kit PCB Layout



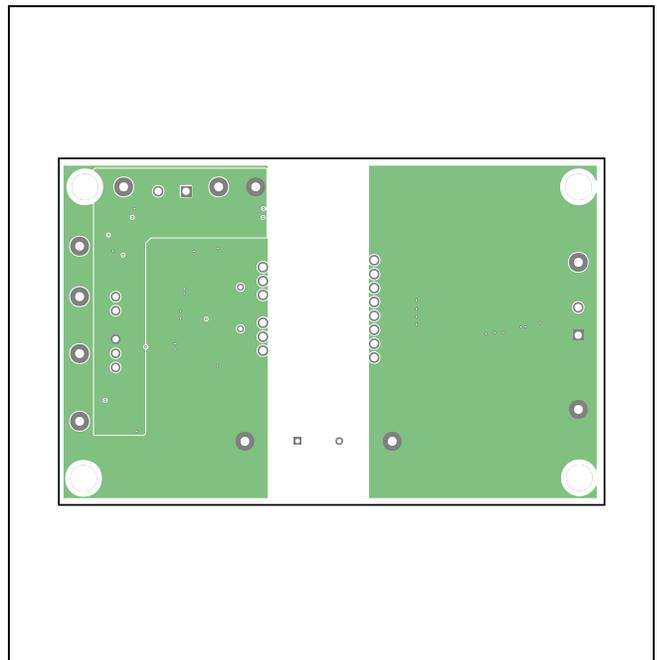
MAX22258 EV Kit PCB Layout—Top Silkscreen



MAX22258 EV Kit PCB Layout—Top Layer

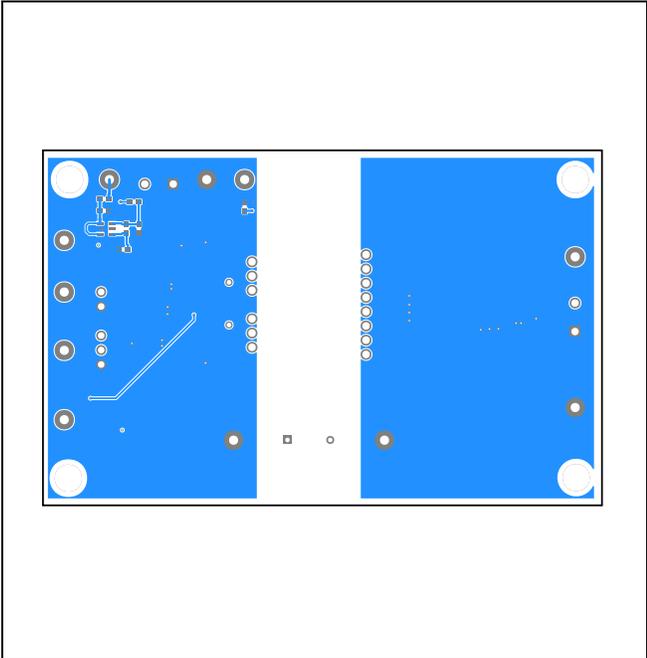


MAX22258 EV Kit PCB Layout—Layer 2

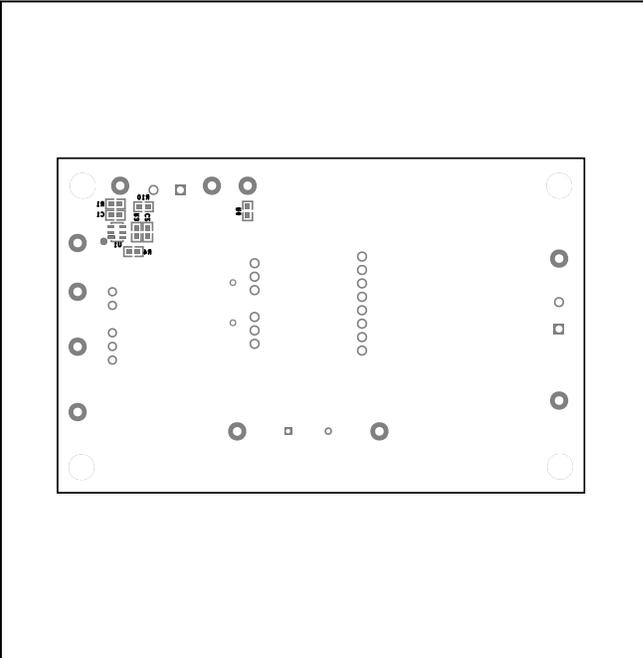


MAX22258 EV Kit PCB Layout—Layer 3

MAX0000 EV Kit PCB Layout (continued)



MAX22258 EV Kit PCB Layout—Bottom Layer



MAX22258 EV Kit PCB Layout—Bottom Silkscreen

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	3/22	Initial release	—

