19-3193; Rev 0, 2/04

MAX3738 Evaluation Kit

Evaluates: MAX3738

General Description

The MAX3738 evaluation kit (EV kit) is an assembled demonstration board that provides complete optical and electrical evaluation of the MAX3738.

The EV kit is composed of two independent sections, one optical and one electrical, on the PC board. The output of the electrical evaluation section is interfaced to an SMP connector that can be connected to a 50Ω terminated oscilloscope. The output of the optical evaluation section is configured for attachment to a laser/monitor diode.

Features

- **Fully Assembled and Tested**
- **Single +3.3V Power Supply Operation**
- **AC-Coupling Provided On-Board**
- **Allows Optical and Electrical Evaluation**

Ordering Information

PART	TEMP RANGE	IC-PACKAGE
MAX3738EVKIT	-40°C to +85°C	24 Thin QFN

Electrical Evaluation Component List

DESIGNATION	QTY	DESCRIPTION
C1, C2, C17, C19, C39, C41	6	0.1µF ±10% ceramic capacitors (0402)
C3, C6, C14, C16	4	0.01µF ±10% ceramic capacitors (0402)
C7, C9, C11, C32	4	0.01µF ±10% ceramic capacitors (0201)
C10	1	0.5pF ±10% ceramic capacitor (0201)
C4, C5, C12	3	470pF ±10% ceramic capacitors (0402)
C18, C36	1	10µF ±10% tantalum capacitor, case B
J7	1	SMP connector, Tensolite P698-2CC
J1, J2	2	SMA connectors, round, Johnson 142-0701-801
JU1, JU8, JU11, JU14, JU15, JU17-JU19	8	2-pin headers, 0.1in centers
JU12, JU13	2	4-pin headers, 0.1in centers
JU3-JU5	3	3-pin headers, 0.1in centers
J8, J13, J14, TP2-TP4, TP6, TP7, TP9, TP10, TP12, TP14-TP17	15	Test Points

DESIGNATION	QTY	DESCRIPTION
L2, L5	2	1.0µH inductor (1008LS) Coilcraft 1008CS-122XKBC
Q3	1	MOSFET (SOT23) Fairchild FDN306P
Q1	1	NPN transistor (SOT23) Zetex FMMT491A
Q2	1	PNP transistor (SOT23) Zetex FMMT591A
D1	1	LED, red T1 package
R23-R25, R28-R34, R41, R42, R49	—	Not installed
R11	1	4.99Ω ±1% resistor (0402)
R12, R13, R14	3	30.1Ω ±1% resistors (0402)
R50	1	75Ω ±1% resistor (0402)
R18	1	392Ω ±1% resistor (0402)
R10	1	511Ω ±1% resistor (0402)
R58	1	332Ω ±1% resistor (0402)
R61	1	3.32kΩ ±1% resistor (0402)
R8, R9	1	4.7kΩ ±1% resistor (0402)
R1-R3, R5, R6	5	100Ω ±1% resistor (0402)
R26	1	20kΩ Variable Resistor (3296W)
R4, R7, R27	3	50kΩ Variable Resistor (3296W)

For pricing, delivery, and ordering information, please contact Maxim/Dallas Direct! at 1-888-629-4642, or visit Maxim's website at www.maxim-ic.com.

Electrical Evaluation Component List (cont.)

DESIGNATION	QTY	DESCRIPTION
U2	1	MAX495ESA (8 SO)
U3	1	MAX3738ETJ (24 Thin QFN)
None	7	Shunts
None	1	MAX3738 EV board
None	1	MAX3738 data Sheet

Optical Evaluation Component List

DESIGNATION	QTY	DESCRIPTION
C23, C25, C28, C30, C31, C33, C40	7	0.01µF ±10% ceramic capacitors (0402)
C26, C29	2	0.01µF ±10% ceramic capacitors (0603)
C24*	1	8.2pF ±10% ceramic capacitor (0402)
C27, C34, C35	3	470pF ±10% ceramic capacitors (0402)
C20, C22, C37, C38	4	0.1µF ±10% ceramic capacitors (0402)
C21	1	10µF ±10% tantalum capacitor, case B
D3	—	Open, user-supplied laser
D4	1	LED, red T1 package
J4, J5	2	SMA connectors, round, Johnson 142-0701-801
JU16, JU20, JU30	3	2-pin headers, 0.1in centers
L4	1	Ferrite bead (0603) Murata BLM18GA601SN1
L3	1	1.0µH inductor (1008CS) Coilcraft 1008CS-122XKBC
Q4	1	MOSFET (SOT23) Fairchild FDN306P
Q6	1	NPN transistor (SOT23) Zetex FMMT491A

DESIGNATION	QTY	DESCRIPTION
R35-R38, R40, R43-R47	—	Not installed
R39*, R48	1	49.9Ω ±1% resistor (0402)
R54	1	10Ω ±1% resistor (0402)
R56	1	15Ω ±1% resistor (0402)
R59	1	511Ω ±1% resistor (0402)
R60	1	4.7kΩ ±1% resistor (0402)
R62	1	3.32kΩ ±5% resistor (0402)
R65	1	332Ω ±5% resistor (0402)
R63, R64, R68	3	100Ω ±5% resistor (0402)
R51-R53	—	Not installed
R55	1	20kΩ variable resistors Bourns 3296W
R57	1	50kΩ variable resistors Bourns 3296W
U4	1	MAX3738EGJ (32 QFN)
J3, J6, TP1, TP5, TP8, TP11, TP13, TP19, TP20, TP25-TPT27	12	Test points
None	1	Shunt
None	1	MAX3738 EV board
None	1	MAX3738 data sheet

*These components are part of the compensation network, which can reduce overshoot and ringing. Ringing due to parasitic series inductance of the laser may be eliminated with R39 and C24. Starting values for most coaxial lasers is R39 = 49.9Ω in series with C24 = 8.2pF. These values should be experimentally adjusted until the output waveform is optimised.

Component Suppliers

SUPPLIER	PHONE	FAX
AVX	803-946-0690	803-626-3123
Coilcraft	847-639-6400	847-639-1469
Murata	814-237-1431	814-238-0490
Zetex	516-543-7100	516-864-7630

Note: *Please indicate that you are using the MAX3738 when contacting these component suppliers.*

Quick Start

Electrical Evaluation

In the electrical configuration, an automatic power control (APC) test circuit is included to emulate a semiconductor laser with a monitor photodiode. Monitor diode current is provided by transistor Q2, which is controlled by an operational amplifier (U2). The APC test circuit consisting of U2 and Q2 applies the simulated monitor diode current (the DC laser current divided by a factor of 80) to the MD pin of the MAX3738.

1) Place shunts on JU1, JU3, JU4, JU5, JU12, JU13, and JU19 (Refer to Table 1 for details).

2) If the EV kit is to be used without the optional shutdown transistor (Q3), place a shunt on JU11.

3) Remove the shunt from JU15 to use the filter inductor.

4) Connect TX_DISABLE to GND with JU1 to enable the outputs.

5) Standard electrical tests have bias and modulation current separated. Check that R11 (between TP6 and TP7) is installed.

   Note: *When performing the following resistance checks, manually set the ohmmeter to a high range to avoid forward biasing the on-chip ESD protection diodes.*

6) Adjust R27, the R_{MODSET} potentiometer, for 25kΩ resistance between TP10 and ground.

7) Adjust R26, the R_{APCSET} potentiometer, for 25kΩ resistance between TP9 and ground.

8) Adjust R4, the R_{PC_MON} potentiometer, to set the maximum monitor diode current (I_{MDMAX}, see below). R_{PC_MON} can be measured from TP1 to ground. Connect the R_{PC_MON} using JU3.

$$R_{PC_MON} = \frac{V_{REF}}{I_{MDMAX}}$$

9) Adjust R7, the R_{BC_MON} potentiometer, to set the maximum bias current ($I_{BIASMAX}$, see below). R_{BC_MON} can be measured from TP2 to ground. Connect the R_{BC_MON} using JU4.

$$R_{BC_MON} = \frac{80 \times V_{REF}}{I_{BIASMAX}}$$

10) Apply a 2.7Gbps differential input signal (200mV_{P-P} to 2400mV_{P-P}) between SMA connectors J1 and J2 (IN+ and IN-).

11) Attach a high-speed oscilloscope with a 50Ω input to the SMP connector J7 (OUT+).

    Note: J7 has a DC voltage of approximately $V_{CC}/2$ and can have voltage swings greater than 1V. An attenuator might be needed to make the signal compatible with the oscilloscope.

12) Connect a +3.3V supply between **V_{CC}** and **GND** Adjust the power supply until the voltage between TP12 and ground is +3.3V.

13) Adjust R25 (R_{APCSET}) until the desired laser bias current is achieved.

$$I_{BIAS} = \frac{V_{TP7} - V_{TP6}}{4.9\Omega}$$

14) The MD and BIAS currents can be monitored at TP2 (V_{PC_MON}) and TP3 (V_{BC_MON}) using the equation below:

$$I_{MD} = \frac{V_{PC_MON}}{R_{PC_MON}}$$

$$I_{BIAS} = \frac{80 \times V_{BC_MON}}{R_{BC_MON}}$$

15) Adjust R27 until the desired laser modulation current is achieved. Measure I_{MOD} with the oscilloscope at J7 by;

$$I_{MOD} = \frac{\text{Signal Amplitude}\,(V_{P-P})}{15\Omega}$$

Optical Evaluation

For optical evaluation of the MAX3738, configure the evaluation kit as follows:

1) Remove shunt JU16 to use the filter inductor.

2) If the EV kit is to be used without the optional shutdown transistor (Q4), place a shunt on JU20.

3) To enable the outputs, connect TX_DISABLE to GND by placing a shunt on JU30.

4) The EV kit is designed to allow connection of a variety of possible laser/monitor diode pin configurations. Connect a TO-header style laser with monitor diode (Figure 1) as follows:

- Keeping its leads as short as possible, connect the laser diode to two of the three pads in the cutout portion on the top (component) side of the PC board. Solder the laser diode cathode to the center pad, and solder the anode to either of the other two pads (they are both connected to V_{CC} through the shutdown transistor (Q4)).
- Connect the monitor photodiode to two of the five pads on the bottom (solder) side of the PC board, directly below the laser diode pads. Connect the anode and cathode of the photodiode as shown in figure 1.

Note: When performing the following resistance checks, manually set the ohmmeter to a high range to avoid forward biasing the on-chip ESD protection diodes.

5) Adjust R57, the R_{MODSET} potentiometer, for maximum resistance (≈50kΩ) between TP19 and ground. This sets the modulation current to a low value (<10mA). (Refer to the *Design Procedure* section of the MAX3738 data sheet.)

6) Adjust R55, the R_{APCSET} potentiometer, for maximum resistance (≈50kΩ) between TP20 and ground. This sets the photodiode current to a low value (<18µA). (Refer to the *Design Procedure* section of the MAX3738 data sheet.)

WARNING: Consult your laser data sheet to ensure that 18µA of photodiode current and 10mA of modulation current does not correspond to excessive laser power.

7) Install R64, the R_{PC_MON} resistor, to set the maximum monitor diode current (I_{MDMAX}, see below).

$$R_{PC_MON} = \frac{V_{REF}}{I_{MDMAX}}$$

8) Install R63, the R_{BC_MON} resistor, to set the maximum bias current ($I_{BIASMAX}$, see below).

$$R_{BC_MON} = \frac{80 \times V_{REF}}{I_{BIASMAX}}$$

9) Apply a 2.7Gbps differential input signal (200mV_{P-P} to 2400mV_{P-P}) between SMA connectors J5 and J4 (IN+ and IN-).

10) Attach the laser diode fiber connector to an optical/electrical converter.

11) Connect a +3.3V supply between J3 (V_{CC}) and J6 (GND). Adjust the power supply until the voltage between TP15 and ground is +3.3V.

12) Adjust R55 (R_{APCSET}) until the desired average optical power is achieved.

13) The MD, MOD and BIAS currents can be monitored at TP27 (V_{PC_MON}) and TP26 (V_{BC_MON}) using the equations below:

$$I_{MD} = \frac{V_{PC_MON}}{R_{PC_MON}}$$

$$I_{BIAS} = \frac{80 \times V_{BC_MON}}{R_{BC_MON}}$$

Note: If the voltage at TP26 or TP27 exceeds 1.38V, the TX_FAULT signal will be asserted and latched.

14) Adjust R57 (R_{MODSET}) until the desired optical amplitude is achieved. Optical amplitude can be observed on an oscilloscope connected to an optical/electrical converter. Laser overshoot and ringing can be improved by appropriate selection of R39 and C24, as described in the *Design Procedure* section of the MAX3738 data sheet.

Table 1. Adjustment and Control Descriptions (see Quick Start first)

COMPONENT		NAME	FUNCTION
OPTICAL	ELECTRICAL		
D4	D1	Fault Indicator	LED is illuminated when a fault condition has occurred (Refer to the *Detailed Description* section of the MAX3735 data sheet).
JU16	JU15	—	Placing a shunt on JU15 or JU16 removes the inductor from the filter networks by shorting the inductor lead together. Remove shunts for normal operation.
—	JU13	—	Placing a shunt on JU13 connects the MODSET pin of the MAX3738 to the R_{MODSET} potentiometer. Select a fixed resistor value when testing over temperature.
JU30	JU1	TX_DISABLE	Enables/disables the output currents. Active low (shunt across JU1 or JU30 to enable output currents).
—	JU12	—	Placing a shunt on JU12connects the APCSET pin of the MAX3738 to the R_{APCSET} potentiometer. Select a fixed resistor value when testing over temperature.
JU20	JU11	—	Installing a jumper on JU11 or JU20 disables the optional shutdown transistors.
R40, R57	R27, R29, R30	R_{MODSET}	Adjusts the laser modulation current
R45, R55	R23, R24, R26	R_{APCSET}	Adjusts the monitor diode current level to be maintained by the APC loop
R51, R38	R31, JU14	$R_{MODBCOMP}$	Sets the K factor compensation of the modulation current. Leave open to make modulation current independent of bias current.
R52, R37	R32, JU18	R_{TH_TEMP}	Sets the threshold temperature above which modulation current increases with temperature.
R53, R36	R33, JU17	$R_{MODTCOMP}$	Sets the temperature coefficient of the modulation current. Leave open to make modulation current independent of temperature.

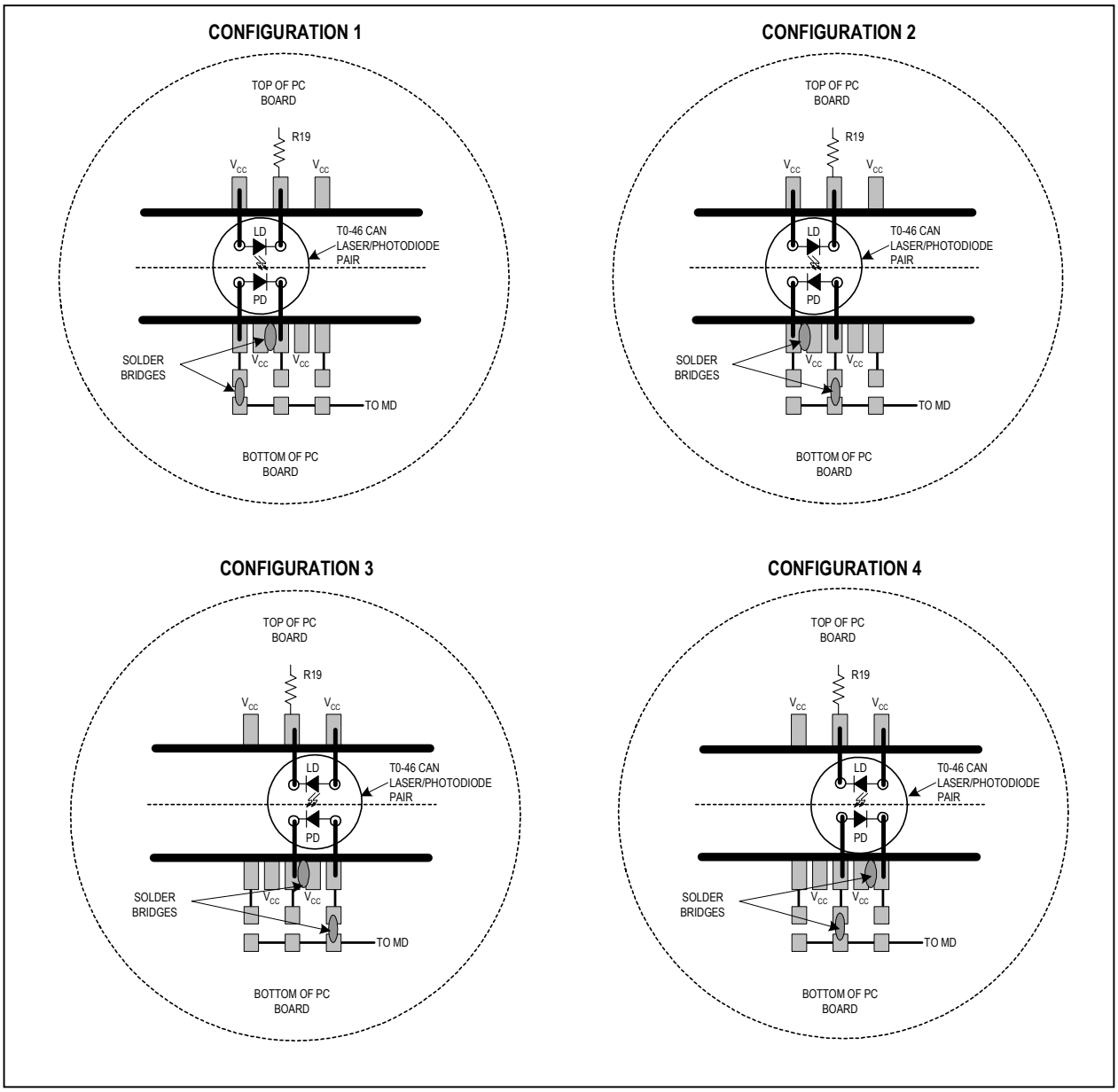

Figure 1. Attachment of Laser Diode/Monitor Diode to the MAX3738 EV Kit

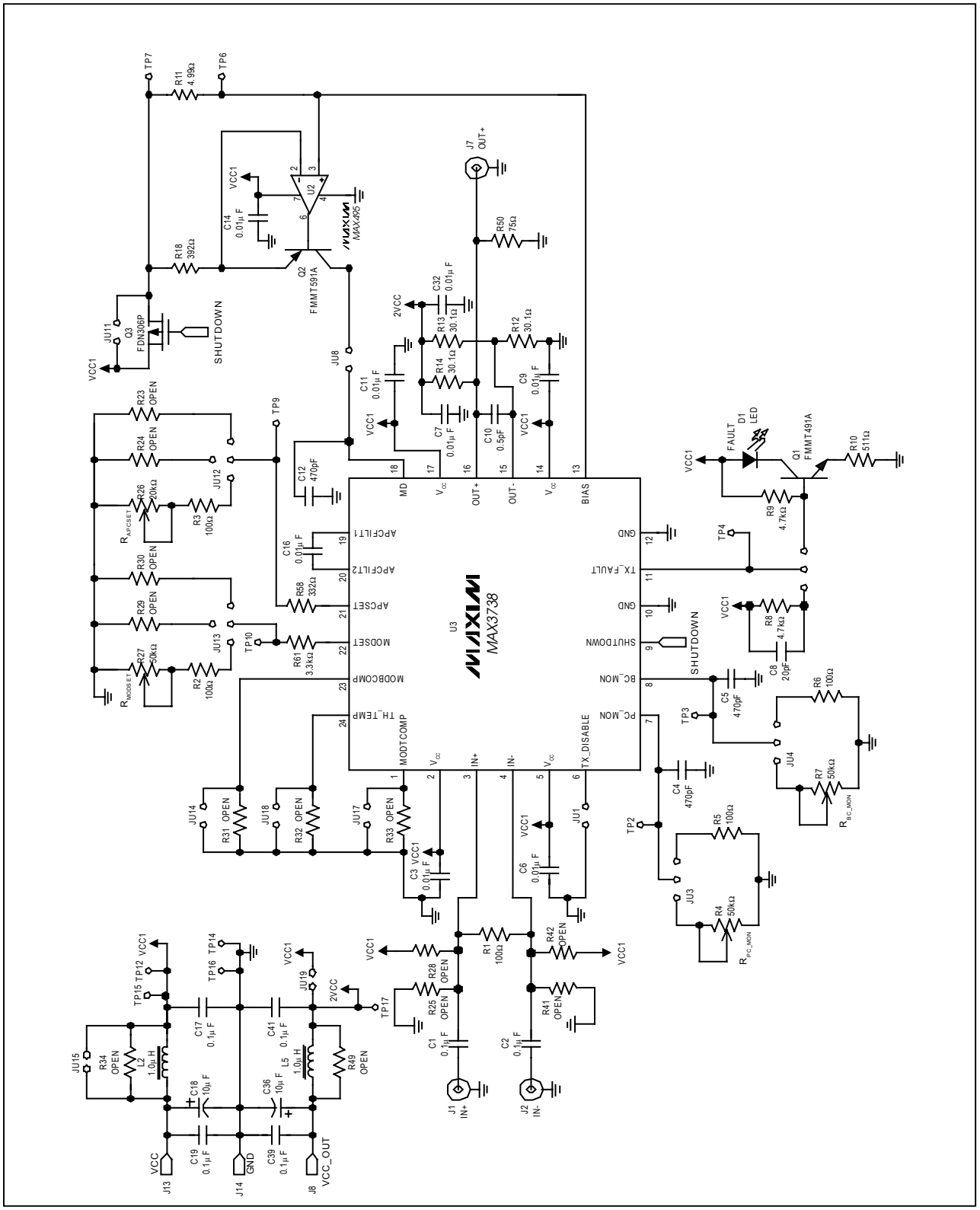

Figure 2. MAX3738 EV Kit Schematic—Electrical Configuration

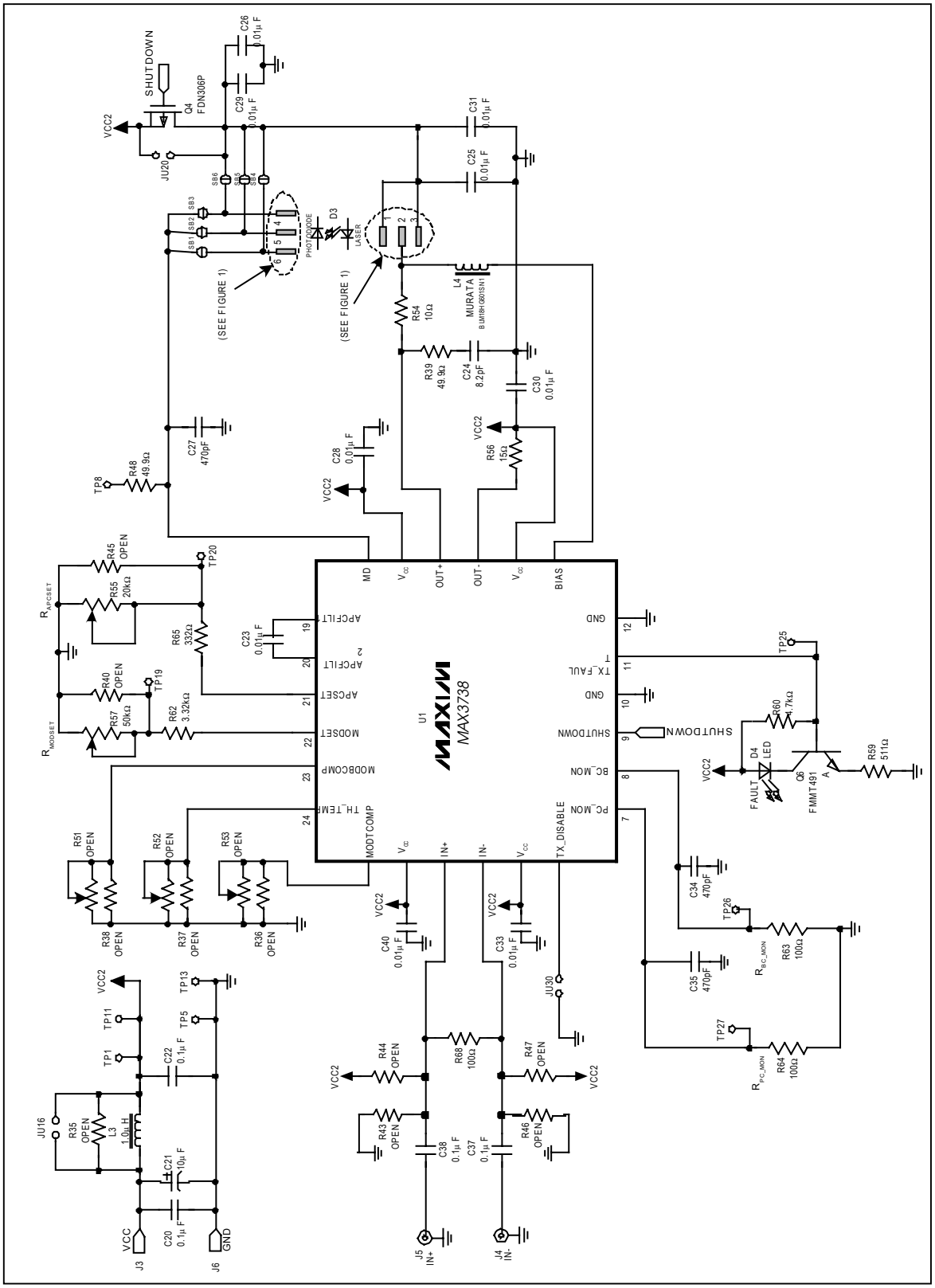

Figure 3. MAX3738 EV Kit Schematic—Optical Configuration

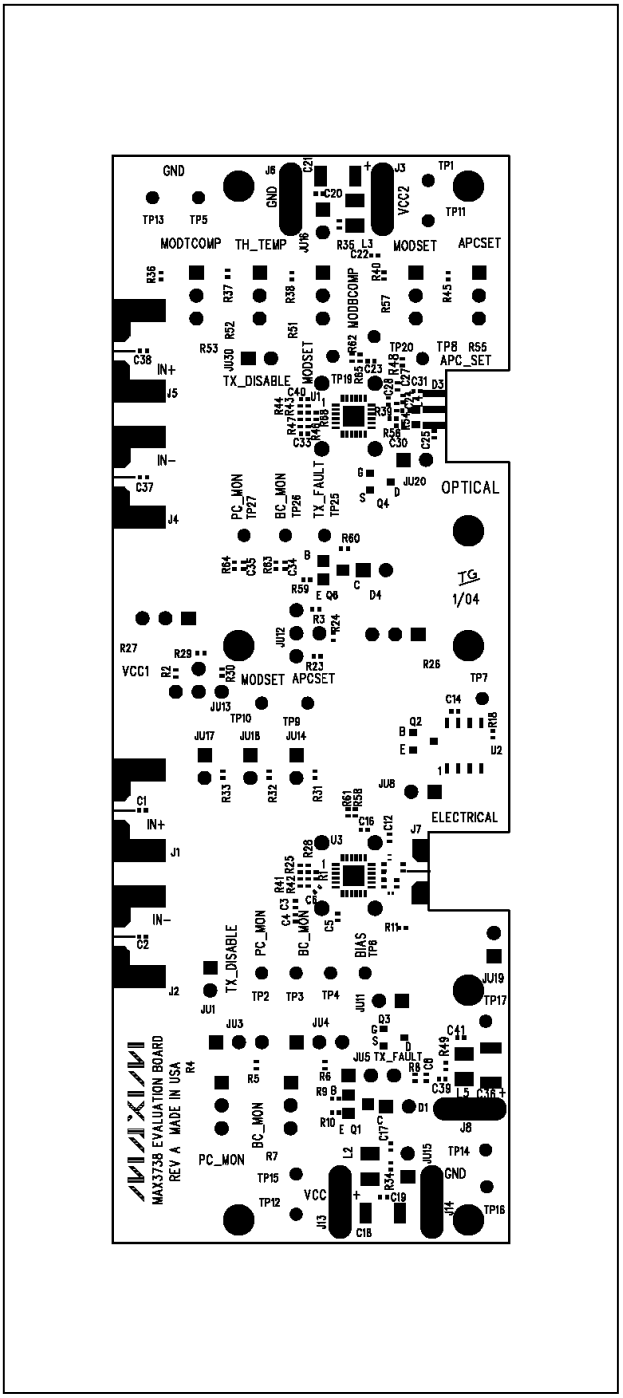

Figure 4. MAX3738 EV Kit PC Component Placement Guide-Component Side

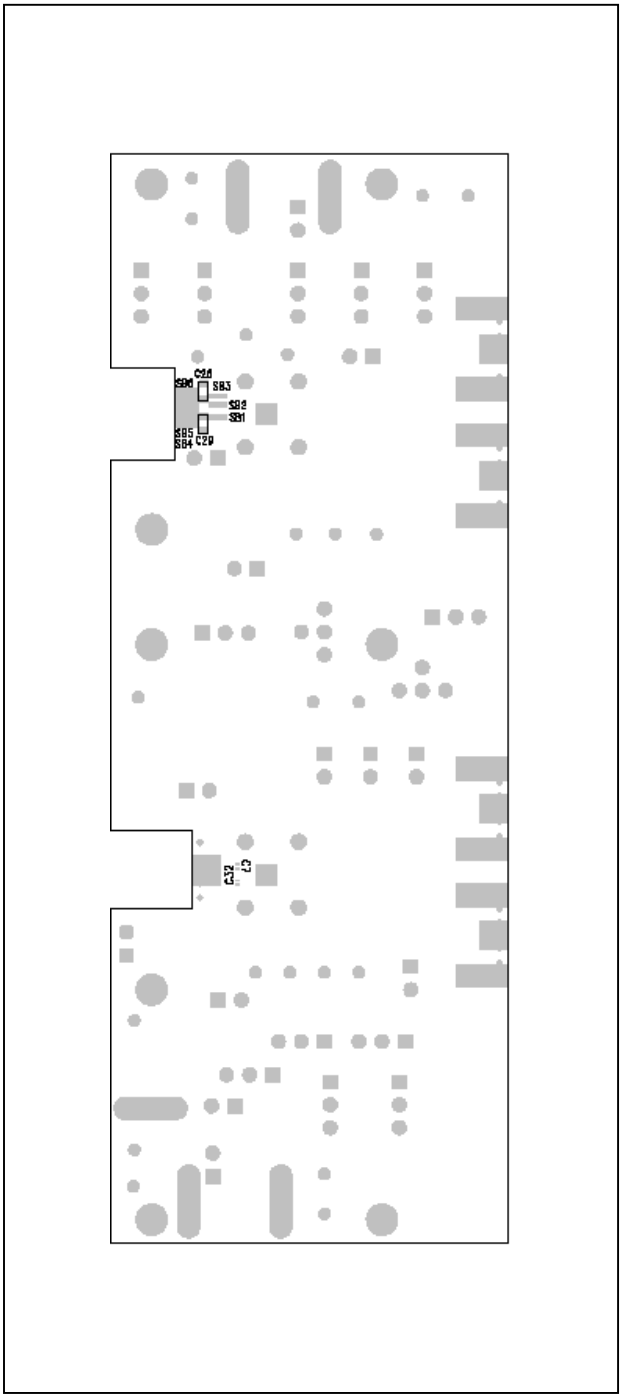

Figure 5: MAX3738 EV Kit PC Component Placement Guide-Solder Side

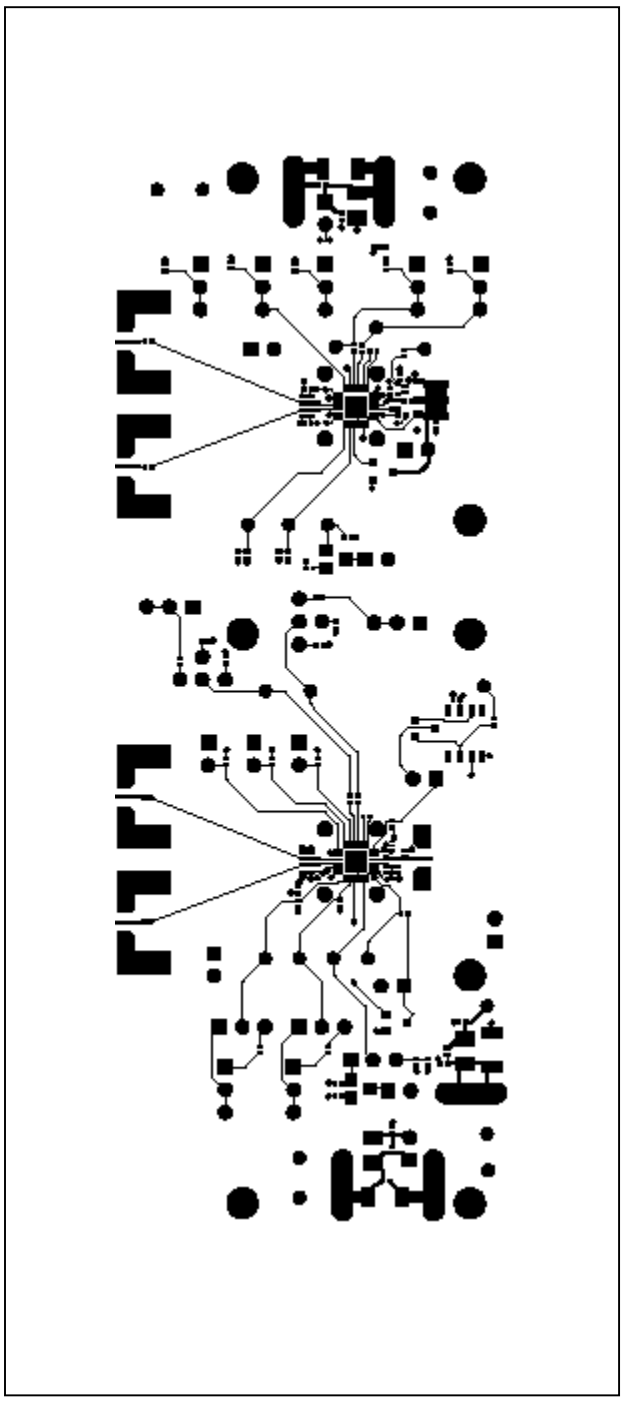

Figure 6. MAX3738 EV Kit PC Board Layout - Component Side

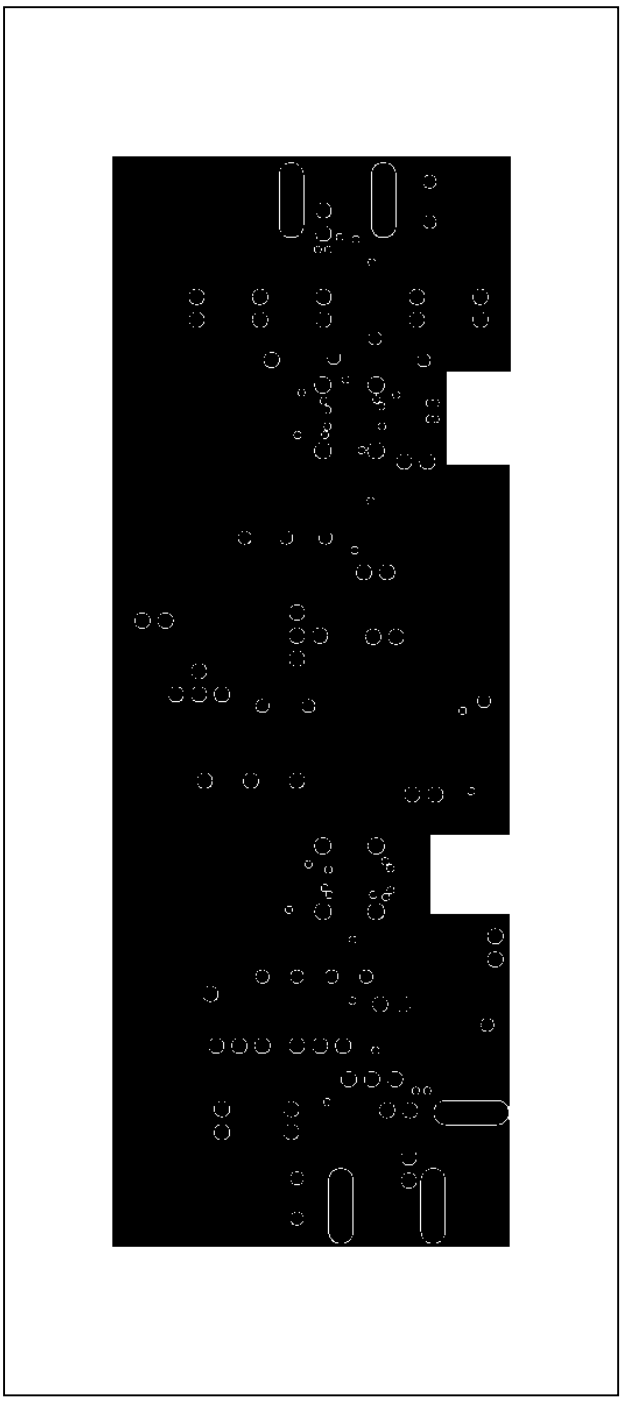

Figure 7: MAX3738 EV Kit PC Board Layout – Ground Plane

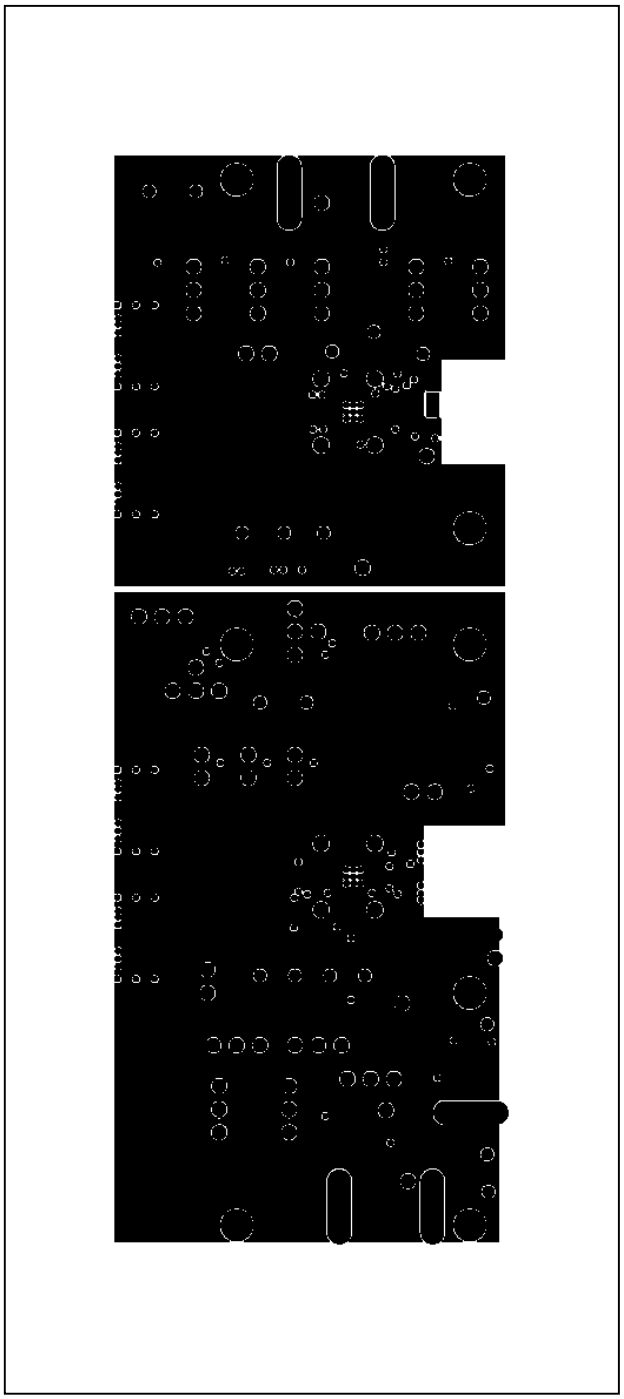

Figure 8: MAX3738 EV Kit PC Board Layout – Power Plane

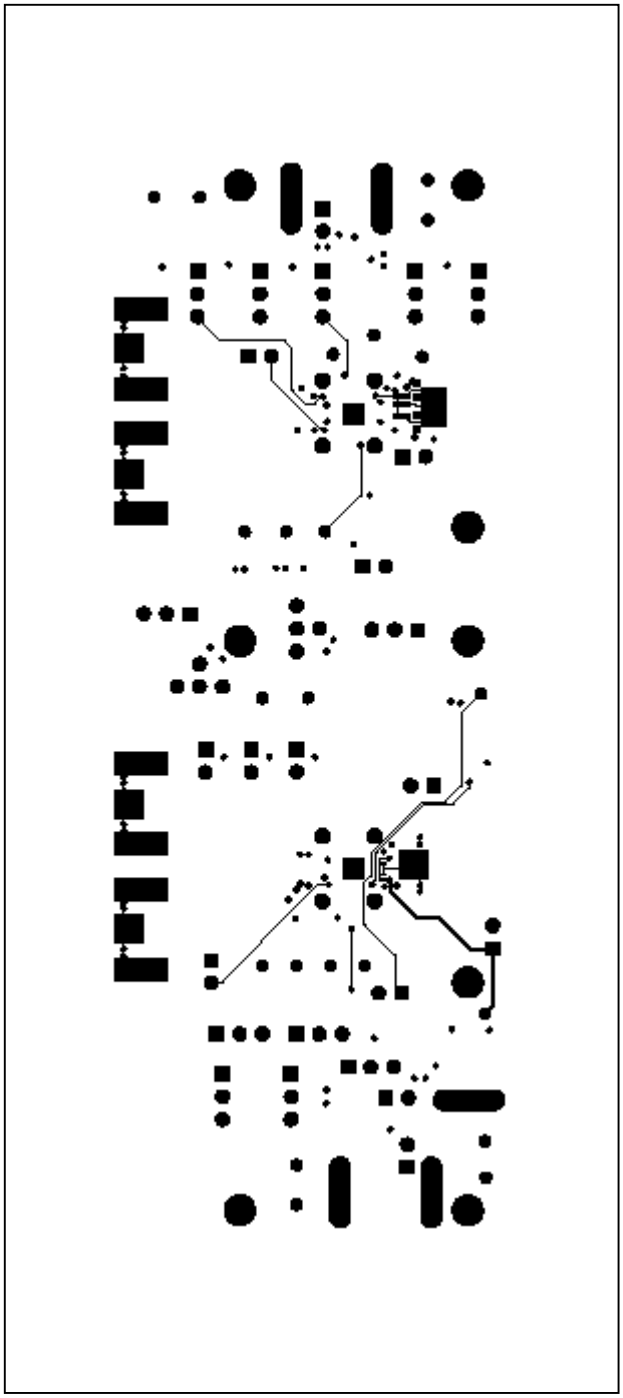

Figure 9: MAX3738 EV Kit PC Board Layout – Solder Side

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