Click here to ask an associate for production status of specific part numbers.

Evaluates: MAX40263

MAX40263 Evaluation Kit

General Description

The MAX40263 evaluation kit (EV kit) provides a proven design to evaluate the MAX40263 low-noise, low-power, low-bias-current dual operational amplifier with independent shutdown for each channel in a 10-pin QFN package. The EV kit circuit is preconfigured as noninverting amplifiers, but it can be adapted to other topologies by changing a few of components. The EV kit comes with a MAX40263AVB+ installed.

Features

- Accommodates Multiple Op-Amp Configurations
- Component Pads Allow for Sallen-Key Filter
- Accommodates Easy-to-Use Components
- Proven PCB Layout
- Fully Assembled and Tested

Quick Start

Required Equipment

- MAX40263 EV kit
- 1.7V to 5.5V, 1A DC power supply
- Precision voltage source
- Digital multimeter

Procedure

The EV kit is fully assembled and tested.

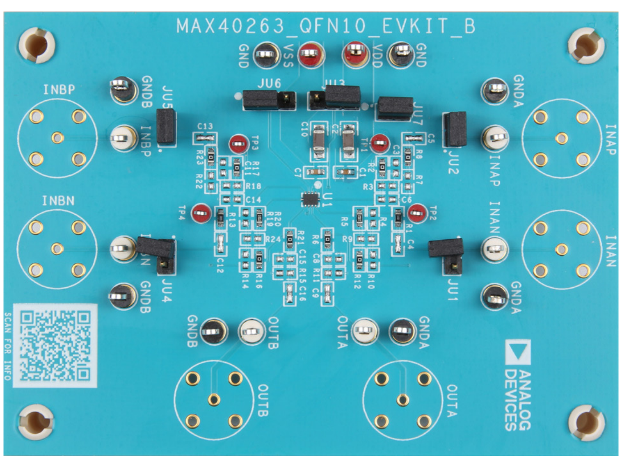
Caution: Do not turn on the power supply until all connections are completed.

Take channel A as an example, follow the steps below to verify board operation:

1) Verify that all jumpers (JU1–JU7) are in their default positions, as shown in Table 1.
2) Set the power supply to +5V, set the current limit to 1A. Connect the positive terminal of the power supply to V_{DD} and the negative terminal to GND.
3) Connect the positive terminal of the precision voltage source to INAP. Connect the negative terminal of the precision voltage source to GND. INAN is already connected to GND through jumper JU1.
4) Connect the DMM to monitor the voltage on OUTA. With the 10kΩ feedback resistors and 1kΩ series resistors, the gain of the noninverting amplifier is 11V/V.
5) Turn on the power supply.
6) Apply 100mV from the precision voltage sources. Observe the output at OUTA on the DMM that reads approximately 1.1V.

***Ordering Information* appears at end of data sheet.**

MAX40263 EV Kit Photo



MAX40263 EV Kit Files

FILE	DESCRIPTION
max40263_qfn10_evkit_b_Schematic	EVKIT SCHEMATIC
MAX40263_QFN10_EVKIT_B_MARKETING_PCB	EVKIT PCB LAYOUT
marketing_bom_max40263_qfn10_evkit_b	EVKIT BILL OF MATERIALS
max40263_qfn10_evkit_b_odb	EVKIT ODB

319-100878; Rev 1; 3/22

Detailed Description of Hardware

The MAX40263 EV kit provides a proven layout for the MAX40263 low-power op amp. The device is a single-supply op amp that is ideal for sensor interfaces, loop-powered systems, and various types of medical and data-acquisition instruments.

The default configuration for the device in the EV kit is noninverting configuration.

Op-Amp Configurations

The device is a single-supply op amp ideal for differential sensing, noninverting amplification, buffering, and filtering. A few common configurations are shown in the next few sections.

The following sections explain how to configure the op amp.

Power up requirement

MAX40263 has a built-in offset auto-calibration function during chip power-up, and an undesired offset can be obtained if the chip power-up speed is slow.

To achieve targeted low offset values, it is suggested to either (a) use a power supply with a fast slew rate (power supply settles in <10ms), or (b) power up the chip in the shutdown mode ($\overline{SHDNA}$ = $\overline{SHDNB}$ = low) and enable the chip ($\overline{SHDNA}$ = $\overline{SHDNB}$ = high) after the supply settles.

Noninverting Configuration

The EV kit comes preconfigured as a noninverting amplifier. The gain is set by the ratio of R5 and R1 for channel A (R13 and R20 for channel B). The EV kit comes preconfigured for a gain of +11V/V. The output voltage for the noninverting configuration is given by the equation below:

$$V_{OUTA} = \left(1 + \frac{R5}{R1}\right)(V_{INAP} \pm V_{OS})$$

$$V_{OUTB} = \left(1 + \frac{R20}{R13}\right)(V_{INBP} \pm V_{OS})$$

Inverting Configuration

To configure the EV kit as an inverting amplifier, remove the shunt on jumper JU1 and install a shunt on jumper JU2 and feed an input signal on the INAN PCB pad for channel A, or remove the shunt on jumper JU4 and install a shunt on jumper JU5 and feed an input signal on the INBN PCB pad for channel B.

Table 1. Jumper Descriptions

JUMPER	SHUNT POSITION	DESCRIPTION
JU1	Installed*	Connects INAN to GND
JU2	Not Installed*	Disconnects INAP from GND
JU3	1-2*	Connects $\overline{SHDNA}$ to VDD to make channel A into normal operation
	2-3	Connects $\overline{SHDNA}$ to GND to make channel A into shutdown operation
JU4	Installed*	Connects INBN to GND
JU5	Not Installed*	Disconnects INBP from GND
JU6	1-2*	Connects $\overline{SHDNB}$ to VDD to make channel B into normal operation
	2-3	Connects $\overline{SHDNB}$ to GND to make channel B into shutdown operation
JU7	Installed*	Connect V_{SS} to GND

Default position.

Differential Amplifier

To configure the channel A of the EV kit as a differential amplifier, replace R1, R2, R3, and R5 with appropriate resistors. When R1 = R2 and R3 = R5, the CMRR of the differential amplifier is determined by the matching of the resistor ratios R1/R2 and R3/R5.

$$V_{OUTA} = GAINA\,(V_{INAP} - V_{INAN})$$

where:

$$GAINA = \frac{R5}{R1} = \frac{R3}{R2}$$

In the same way, to configure the channel B of the EV kit as a differential amplifier, replace R13, R17, R18, and R20 with appropriate resistors. When R13 = R17 and R18 = R20, the CMRR of the differential amplifier is determined by the matching of the resistor ratios R13/R17 and R18/R20.

$$V_{OUTB} = GAINB\,(V_{INBP} - V_{INBN})$$

where:

$$GAINB = \frac{R20}{R13} = \frac{R18}{R17}$$

Sallen-Key Configuration

The Sallen-Key topology is ideal for filtering sensor signals with a second-order filter and acting as a buffer. Schematic complexity is reduced by combining the filter and buffer operations. The EV kit can be configured in a Sallen-Key topology by replacing and populating a few components. For channel A, the Sallen-Key topology can be configured as a unity-gain buffer by replacing R5 with a 0Ω resistor and removing resistor R1. The signal is noninverting and applied to INAP. The filter component pads are R2-R3 and R7-R8, where some must be populated with resistors and others with capacitors, and it is similar for channel B.

Lowpass Sallen-Key Filter: To configure the channel A as a lowpass Sallen-Key filter, remove the shunt from jumper JU1, populate the R2 and R8 pads with resistors, and populate the R3 and R7 pads with capacitors. The corner frequency and Q are then given by:

$$f_C = \frac{1}{2\pi\sqrt{R_{R2}R_{R8}C_{R3}C_{R7}}}$$

$$Q = \frac{\sqrt{R_{R2}R_{R8}C_{R3}C_{R7}}}{C_{R3}\left(R_{R2} + R_{R8}\right)}$$

To configure the channel B as a lowpass Sallen-Key filter, remove the shunt from jumper JU4, populate the R17 and R23 pads with resistors, and populate the R18 and R22 pads with capacitors. The corner frequency and Q are then given by:

$$f_C = \frac{1}{2\pi\sqrt{R_{R23}R_{R17}C_{R18}C_{R22}}}$$

$$Q = \frac{\sqrt{R_{R23}R_{R17}C_{R18}C_{R22}}}{C_{R18}\left(R_{R23} + R_{R17}\right)}$$

Highpass Sallen-Key Filter: To configure the channel A as a highpass Sallen-Key filter, remove the shunt from jumper JU1, populate the R3 and R7 pads with resistors, and populate the R2 and R8 pads with capacitors. The corner frequency and Q are then given by:

$$f_C = \frac{1}{2\pi\sqrt{R_{R3}R_{R7}C_{R2}C_{R8}}}$$

$$Q = \frac{\sqrt{R_{R3}R_{R7}C_{R2}C_{R8}}}{R_{R7}\left(C_{R2} + C_{R8}\right)}$$

To configure the channel B as a highpass Sallen-Key filter, remove the shunt from jumper JU4, populate the R18 and R22 pads with resistors, and populate the R23 and R17 pads with capacitors. The corner frequency and Q are then given by:

$$f_C = \frac{1}{2\pi\sqrt{R_{R18}R_{R22}C_{R23}C_{R17}}}$$

$$Q = \frac{\sqrt{R_{R18}R_{R22}C_{R23}C_{R17}}}{R_{R22}\left(C_{R23} + C_{R17}\right)}$$

Bandpass Sallen-Key Filter: To configure the channel A as bandpass Sallen-Key filter, remove the shunt from jumper JU1, replace R8, populate the R3 and R7 pads with resistors, and populate the C8 and R2 pads with capacitors. The corner frequency and Q are then given by:

$$f_C = \frac{\sqrt{R_{R7} + R_{R8}}}{2\pi\sqrt{C_{C8}C_{R2}R_{R3}R_{R7}R_{R8}}}$$

$$Q = \frac{\sqrt{\left(R_{R7} + R_{R8}\right)C_{C8}C_{R2}R_{R3}R_{R7}R_{R8}}}{R_{R7}R_{R8}\left(C_{R2} + C_{C8}\right) + R_{R3}C_{R2}\left(R_{R7} - R_{R8}\dfrac{R_{R5}}{R_{R1}}\right)}$$

To configure the channel B as Bandpass Sallen-Key filter, remove the shunt from jumper JU4, replace R23, populate the R18 and R22 pads with resistors, and populate the C15 and R17 pads with capacitors. The corner frequency and Q are then given by:

$$f_C = \frac{\sqrt{R_{R22} + R_{R23}}}{2\pi\sqrt{C_{C15}C_{R17}R_{R18}R_{R22}R_{R23}}}$$

$$Q = \frac{\sqrt{(R_{R22} + R_{R23})C_{C15}C_{R17}R_{R18}R_{R22}R_{R23}}}{R_{R22}R_{R23}(C_{R17} + C_{C15}) + R_{R18}C_{R17}\left(R_{R22} - R_{R23}\frac{R_{R20}}{R_{R13}}\right)}$$

Transimpedance Amplifier (TIA)

To configure the EV kit as a TIA, take channel A for example, place a shunt on jumper JU2 and replace R1 with 0Ω resistors. The output voltage of the TIA is the input current multiplied by the feedback resistor:

$$V_{OUTA} = -(I_{INA} + I_{BIAS}) \times R_{R5} \pm V_{OS}$$

where:

I_{INA} is the input current source applied at the INAN test point.

I_{BIAS} is the input bias current.

V_{OS} is the input offset voltage of the op amp.

Use a capacitor and 0Ω resistor at location R4 or R10 (and C8, if applicable) to stabilize the op amp by rolling off high-frequency gain due to a large cable capacitance.

Capacitive Loads

Some applications require driving large capacitive loads. Take channel A for example, the EV kit provides C8 and R6 pads for an optional capacitive-load driving circuit. C8 simulates the capacitive load while R6 acts as an isolation resistor to improve the op amp’s stability at higher capacitive loads. To improve the stability of the amplifier in such cases, replace R6 with a suitable resistor value to improve amplifier phase margin.

Component Suppliers

SUPPLIER	PHONE	WEBSITE
KEYSTONE	(516) 328-7500	www.keyelco.com/
WURTH ELECTRONICS INC	+1 877 6902207	www.we-ics.com
TDK	+81 3 67 78 10 00	www.tdk-electronics.tdk.com/
KEMET	+91-95131-45888	www.kemet.com/en/us.html
AVX	+1 (864) 967-2150	www.avx.com/
LITE-ON ELECTRONICS INC.	0515-83368598	www.liteon.com/en-us
SAMTEC	1-800-726-8329	www.samtec.com/
VISHAY	1-800-344-4539	www.vishay.com/
PANASONIC	0571-87257895	www.panasonic.cn/
BOURNS	+1 951-781-5500	www.bourns.com/
YAGEO	+886 2 6629 9999	www.yageo.com/en/Home
MAXIM	408-601-1000	www.maximintegrated.com/en.html

Note: Indicate that you are using the MAX40263 when contacting these component suppliers.

Ordering Information

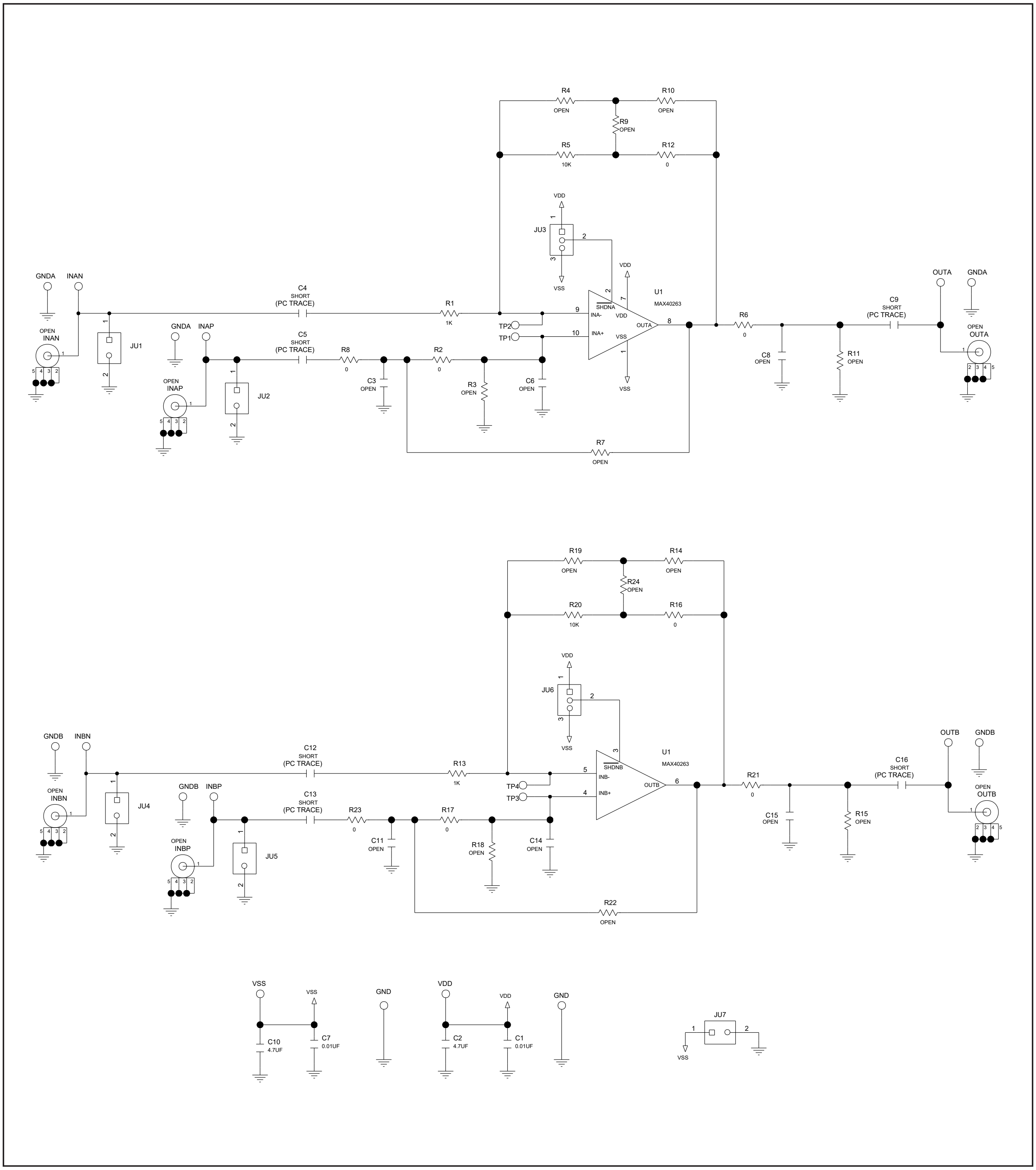
PART	TYPE
MAX40263EVKIT#	EV kit

#Denotes RoHS compliance.

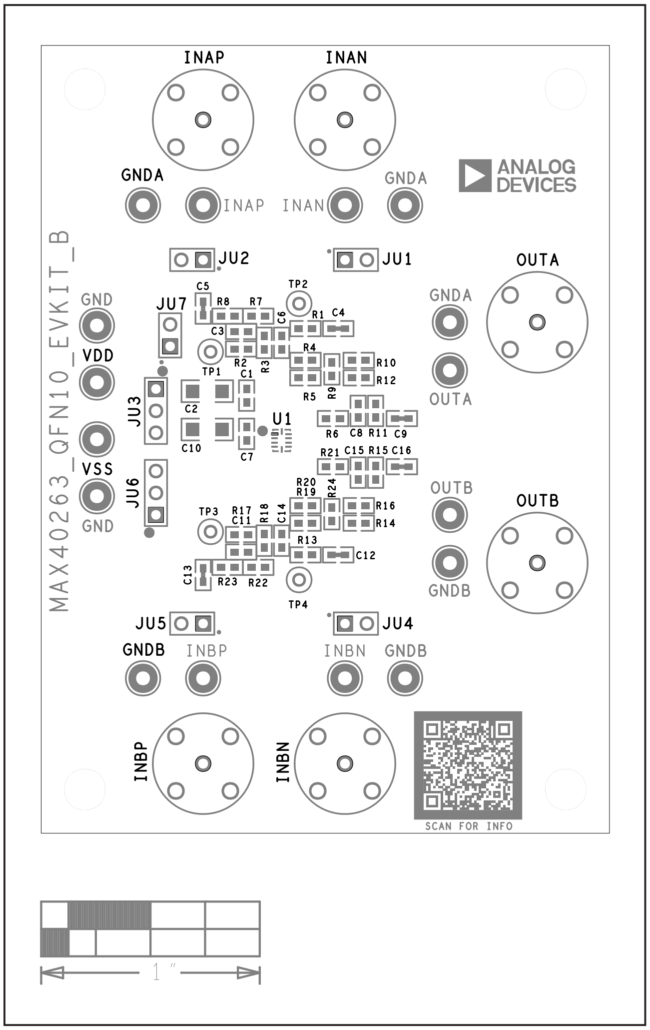
MAX40263 EV Kit Bill of Materials

ITEM	REF_DES	DNI/DNP	QTY	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION
1	C1, C7	-	2	C0603X7R500103JNP;C0603C103J5RAC	VENKEL LTD;KEMET	0.01UF	CAP; SMT (0603); 0.01UF; 5%; 50V; X7R; CERAMIC
2	C2, C10	-	2	GRM31CR71H475KA12;GRJ31CR71H475KE11; GXM31CR71H475KA10;UMK316AB7475KL; GRM31CR71H475KA12L	MURATA;MURATA;MURATA; TAIYO YUDEN;MURATA	4.7UF	CAP; SMT (1206); 4.7UF; 10%; 50V; X7R; CERAMIC
3	GNDA, GNDA_1, GNDA_2, GNDB, GNDB_1, GNDB_2, TP4_GND, TP5_GND	-	8	5011	KEYSTONE	N/A	TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.445IN; BOARD HOLE=0.063IN; BLACK; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;
4	INAN_1, INAP_1, INBN-_1, INBP_1, OUTA_1, OUTB_1	-	6	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;
5	JU1, JU2, JU4, JU5, JU7	-	5	PCC02SAAN	SULLINS	PCC02SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT THROUGH; 2PINS; -65 DEGC TO +125 DEGC
6	JU3, JU6	-	2	PCC03SAAN	SULLINS	PCC03SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT THROUGH; 3PINS; -65 DEGC TO +125 DEGC
7	MH1-MH4	-	4	9032	KEYSTONE	9032	MACHINE FABRICATED; ROUND-THRU HOLE SPACER; NO THREAD; M3.5; 5/8IN; NYLON
8	R1, R13	-	2	CRCW06031K00FK;ERJ-3EKF1001; CR0603AFX-1001ELF	VISHAY; PANASONIC;BOURNS	1K	RES; SMT (0603); 1K; 1%; +/-100PPM/DEGC; 0.1000W
9	R2, R6, R8, R12, R16, R17, R21, R23	-	8	RC1608J000CS;CR0603-J/-000ELF; RC0603JR-070RL	SAMSUNG ELECTRONICS; BOURNS;YAGEO PH	0	RES; SMT (0603); 0; 5%; JUMPER; 0.1000W
10	R5, R20	-	2	CRCW060310K0FK;ERJ-3EKF1002; AC0603FR-0710KL;RMCF0603FT10K0	VISHAY;PANASONIC;YAGEO; STACKPOLE	10K	RES; SMT (0603); 10K; 1%; +/-100PPM/DEGC; 0.1000W
11	SU1-SU7	-	7	S1100-B;SX1100-B;STC02SYAN	KYCON;KYCON; SULLINS ELECTRONICS CORP.	SX1100-B	TEST POINT; JUMPER; STR; TOTAL LENGTH=0.24IN; BLACK; INSULATION=PBT;PHOSPHOR BRONZE CONTACT=GOLD PLATED
12	TP1-TP4	-	4	5000	KEYSTONE	N/A	TEST POINT; PIN DIA=0.1IN; TOTAL LENGTH=0.3IN; BOARD HOLE=0.04IN; RED; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;
13	U1	-	1	MAX40263	MAXIM	MAX40263	EVKIT PART - IC; MAX40263; PACKAGE OUTLINE DRAWING: 21-0610; LAND PATTERN NUMBER: 90-0386; PACKAGE CODE:V101A2CN+1; UTQFN10
14	VDD, VSS	-	2	5010	KEYSTONE	N/A	TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.445IN; BOARD HOLE=0.063IN; RED; PHOSPHOR BRONZE WIRE SIL;
15	PCB	-	1	MAX40263QFN10	MAXIM	PCB	PCB:MAX40263QFN10
16	INAN, INAP, INBN, INBP, OUTA, OUTB	DNP	0	CN-BNC-011PG	FIRST TECH ELECTRONICS, CO.	CN-BNC-011PG	CONNECTOR; FEMALE; THROUGH HOLE; BNC JACK; STRAIGHT; 5PINS
17	C3, C6, C8, C11, C14, C15	DNP	0	N/A	N/A	OPEN	PACKAGE OUTLINE 0603 NON-POLAR CAPACITOR
18	C4, C5, C9, C12, C13, C16	DNP	0	N/A	N/A	SHORT	PACKAGE OUTLINE 0603 NON-POLAR CAPACITOR
19	R3, R4, R7, R9-R11, R14, R15, R18, R19, R22, R24	DNP	0	N/A	N/A	OPEN	PACKAGE OUTLINE 0603 RESISTOR
TOTAL			56				

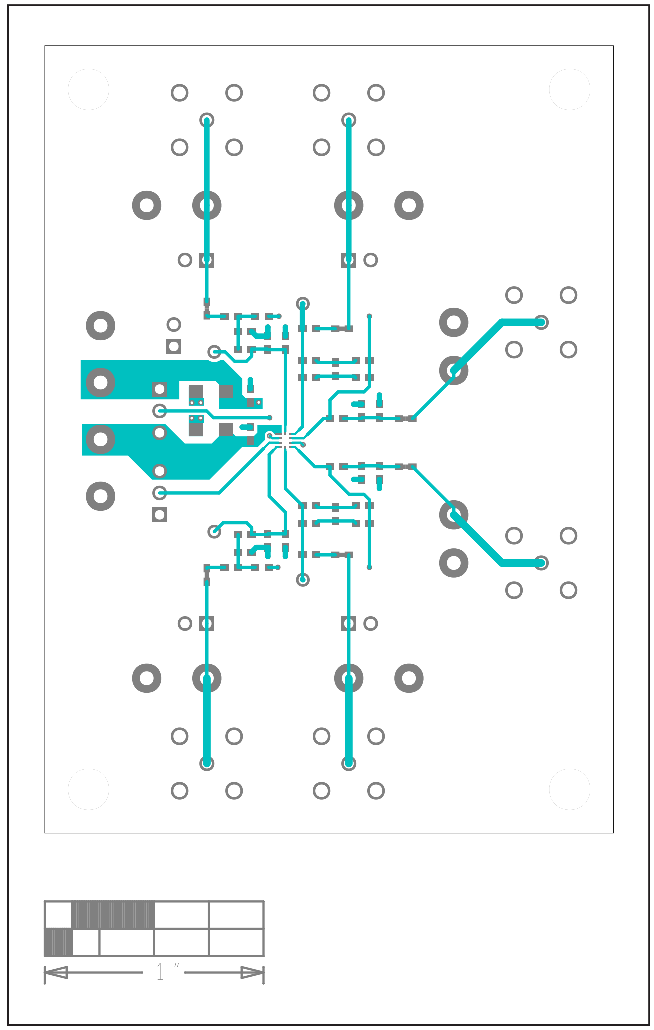
MAX40263 EV Kit Schematics



MAX40263 EV Kit PCB Layouts

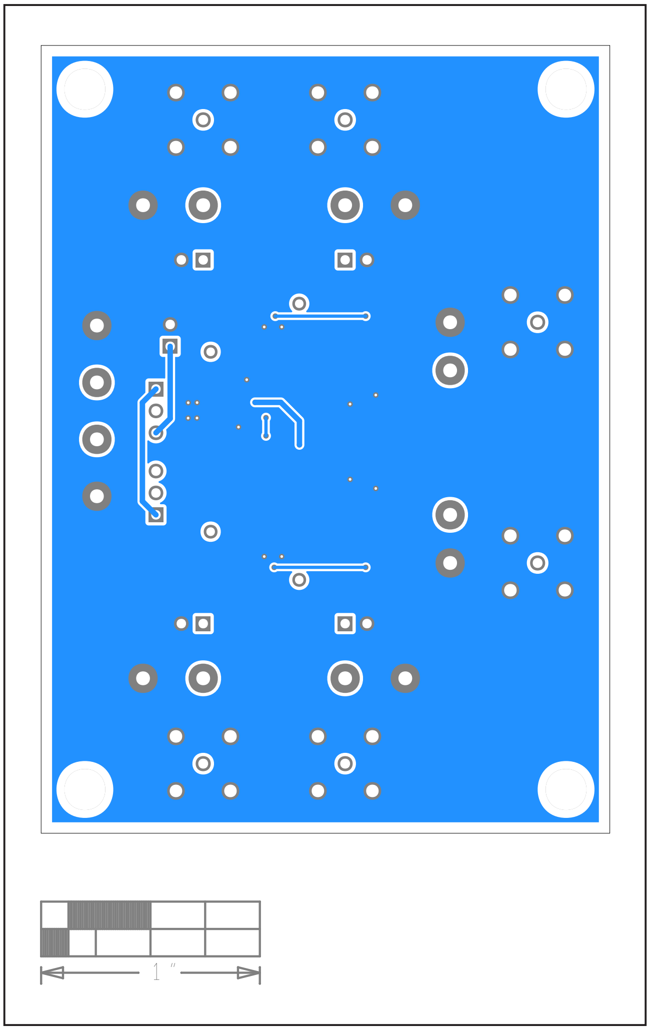


MAX40263 EV Kit Component Placement Guide—Top Silkscreen



MAX40263 EV Kit PCB Layout—Top

MAX40263 EV Kit PCB Layouts (continued)



MAX40263 EV Kit PCB Layout—Bottom