

## Evaluates: MAX49925

## MAX49925 Evaluation Kit

### General Description

The MAX49925 evaluation kit (EV kit) is a fully tested and assembled circuit that demonstrates the capabilities of the MAX49925, high-precision, high-voltage, bidirectional current sense amplifier for PWM applications, such as servo motor control and solenoid drive. The MAX49925 are ideal for 48V, or less BLDC, induction motor applications (such as robotics), pick-and-place machines, 3D prints, or other servo motor control systems. The MAX49925 has an extended protective immunity from -42V to +80V, providing protection against reverse battery and high voltage spikes. This also can reduce the BOM complexity at the system level since a smaller TVS might be required. The MAX49925 EV kit is available in a 2" x 2" PCB and operates over the automotive temperature range of -40°C to +125°C. This EV kit demonstrates the MAX49925 in a 10-pin TDFN package, with four gain options 10V/V, 20V/V, 50V/V, 100V/V by the combination of the Gain1 and Gain2 pins.

### Benefits and Features

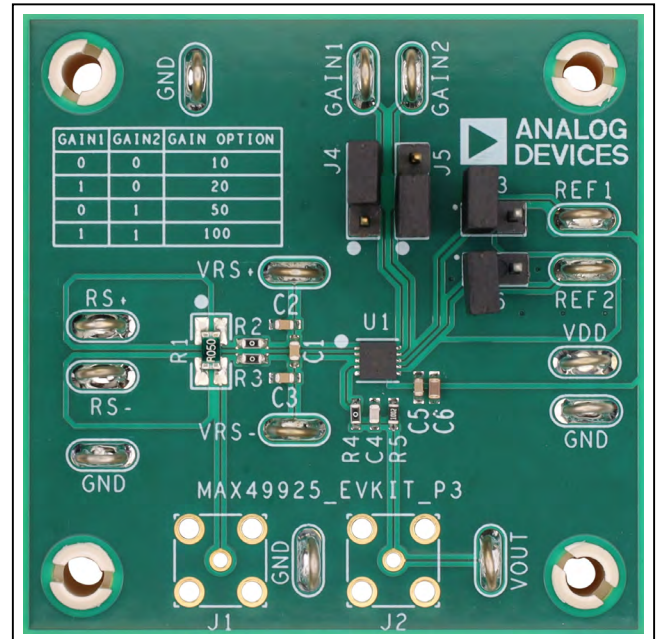
- Selectable Gain Options: 10V/V, 20V/V, 50V/V, 100V/V
- 5 $\mu$ V (Typ) Input Offset Voltage
- $\pm$ 0.3% (Max) Gain Error (Thin Film  $\sim$ 0.25%)
- -0.3V to +65V Input Common-Mode Range
- -40°C to +125°C Temperature Range
- 3mm x 3mm 10-pin TDFN with Side Wettable Flanks
- Proven 2" x 2" 2-Layer 2oz Copper PCB Layout
- Demonstrates Compact Solution Size
- Fully Assembled and Tested

[Ordering Information](#) appears at end of data sheet.

### MAX49925 EV Kit Files

FILE	DESCRIPTION
Max49925_evkit_p3_Schematic	EV Kit Schematic
MAX49925_EVKIT_P3_MARKETING_PCB	EV Kit PCB Layout
build_bom_max49925_evkit_p3	EV Kit Bill of Materials
Max49925_evkit_p3_odb	EV Kit ODB

### MAX49925 EV Kit Photo



## Quick Start

### Required Equipment

- MAX49925 EV kit
- 0 to 100V, 0.4A DC power supply for VCM input
- +3.3V, 100mA device DC power supply
- Electronic load capable of sinking 3A (HP6060B)
- One Agilent® 34401A 6 1/2 digital multimeter (DMM)
- One 3458 8 1/2 digital multimeter (DMM)

### Procedure

The MAX49925 EV kit is fully assembled and tested. Follow the steps to verify board operation: **Caution: Do not turn on the power supply or the electronic load until all the connections are complete.**

- 1) Connect a +3.3V supply and ground to VDD connector.
- 2) Set GAIN1 and GAIN2 as LH; Gain option has been set to 50V/V, see [Table 2](#) and [Table 3](#).
- 3) Connect the positive terminal of the 0 to 100V DC power supply to the RS- input and the negative terminal to the GND input.
- 4) Set the electronic load to sink 300mA.
- 5) Connect the positive terminal of the electronic load to the RS+ input and the negative terminal of the electronic load to the nearest GND input connection on the board.
- 6) Connect the positive terminal of the calibrator/ DC power supply to the REF1/REF2 input. Set the calibrator/DC power supply voltage output to  $VDD/2 = 1.65V$ .
- 7) Connect the 3458 8 1/2 digital multimeter between the test points VRS+ and VRS- to measure the differential input voltage across the inputs (VSENSE).
- 8) Connect the 34401A 6 1/2 digital multimeter across the OUT and REF1/REF2 test points to measure the MAX49925 output.
- 9) Turn on the power supplies and the calibrator, then the electronic load.
- 10) Enable the electronic load.
- 11) Verify that the 3458 8 1/2 digital multimeter displays  $300mA \times 50m\Omega = +15mV$  and that the 34401A 6 1/2 digital multimeter displays 2.25V.
- 12) Turn off the electronic load and set the electronic load to source 300mA.
- 13) Turn on the electronic load and verify that the 3458 8 1/2 digital multimeter displays -15mV and that the 34401A 6 1/2 digital multimeter displays 750mV.
- 14) EV kit is now ready for further testing.
- 15) After the functions are verified, do not forget to turn off the electronic load, calibrator, and power supply.

## Detailed Description of Hardware

The MAX49925 EV kit provides a proven design to evaluate the MAX49925 high-precision, high-voltage bidirectional current sense amplifier for PWM application. The device offers precision accuracy specifications of input offset voltage (VOS) less than 5 $\mu$ V (max) and gain error less than 0.3% (max).

The device has a proprietary input stage designed to reject high gradient PWM common mode voltage inputs while accurately monitoring the load current across its inputs.

## Theory of Operation

### Bidirectional Operation

The MAX49925 EV kit evaluates the MAX49925 bidirectional current sense amplifier. MAX49925 give more gain options by external gain selection pins. And give the output to different reference setting by external pins REF1 and REF2. The output is set to the VREF1/VREF2 voltage at no load.

The  $(VREF1+VREF2)/2$  voltage can either be from internal 1.65V reference voltage generated by internal resistor string or an external reference supplied at VREF1/VREF2 input. Current in the positive direction in reference to RS+ and RS- increases the output voltage from VREF1/VREF2 (V) and current in the negative direction decreases the output voltage from VREF1/VREF2 (V).

Hence, the output equation becomes:

$$V_{OUT} (V) = [(I_{LOAD}(A) \times R_{SENSE}(\Omega)) \times GAIN(V/V)] + (VREF1(V)+VREF2 (V))/2.$$

### External Reference

When choosing an external reference at the VREF input, it is recommended to choose  $VREF1/VREF2 (V) = (1/2) \times VDD (V)$  and the VDD (V) value must not exceed absolute maximum ratings.

**Table 1. Jumper Functions (J3, J6)**

JUMPER LABEL	DEFAULT POSITION	FUNCTION
J3	Installed	Output reference voltage generated by internal resistor string
	Not Installed*	Output reference voltage provided by external source
J6	Installed	Output reference voltage generated by internal resistor string
	Not Installed*	Output reference voltage provided by external source

\*Default Jumper Position.

**Table 2. Jumper Functions (J4, J5)**

JUMPER LABEL	SHUNT POSITION	GAIN 1 LOGIC STATE	GAIN 2 LOGIC STATE
J4	1-2	H	
	2-3*	L	
J5	1-2*		H
	2-3		L

\*Default Jumper Position.

**Table 3. GAIN Option Selected**

GAIN 1 LOGIC STATE	GAIN 2 LOGIC STATE	GAIN OPTION SELECTED
L	L	10V/V
H	L	20V/V
L	H	50V/V
H	H	100V/V

Note: Indicate that L is logic 0, H is logic 1

**Component Suppliers**

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

Note: Indicate that you are using the MAX49925 when contacting these component suppliers.

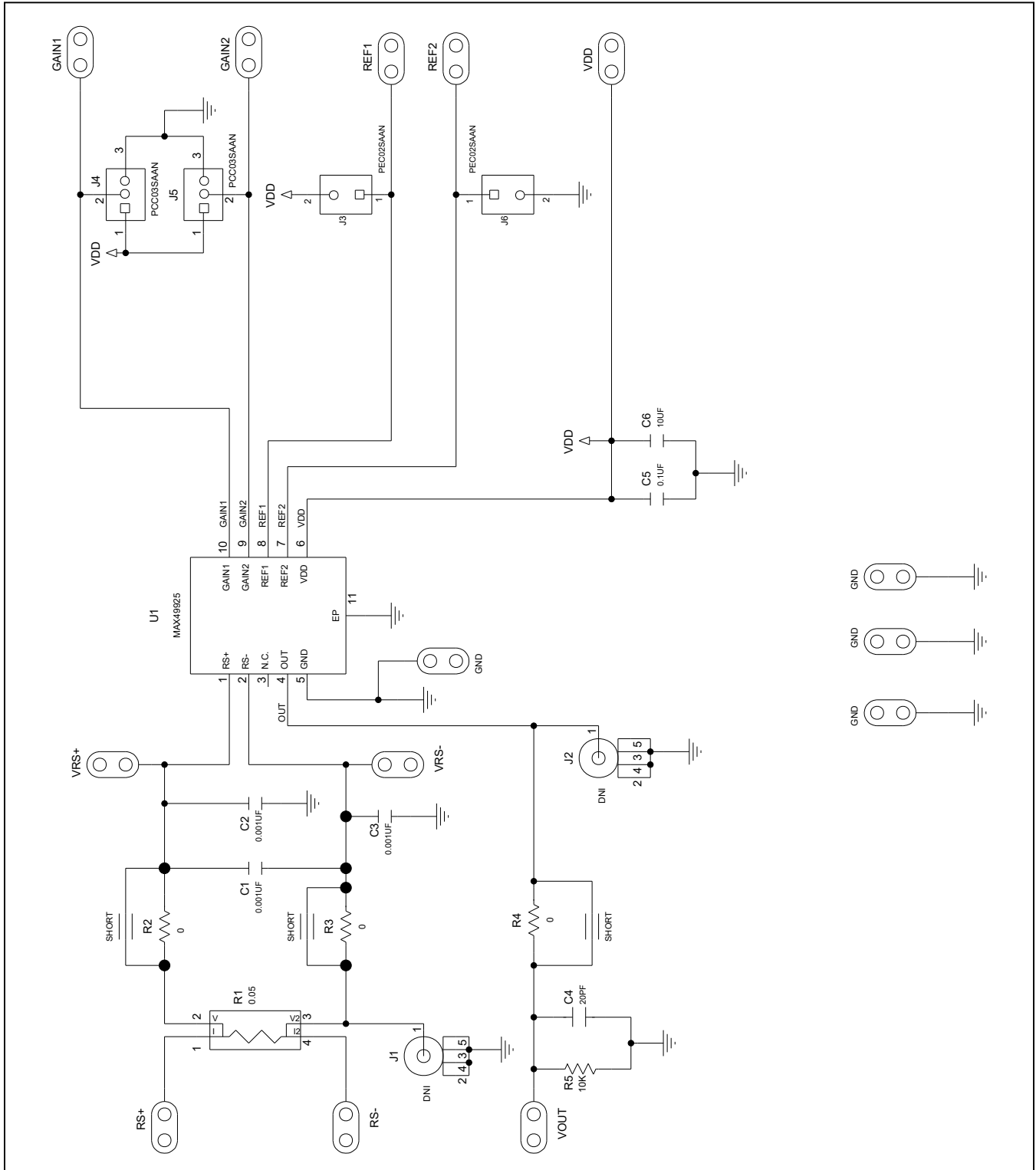
**Ordering Information**

PART	TYPE
MAX49925EVKIT#	EV Kit

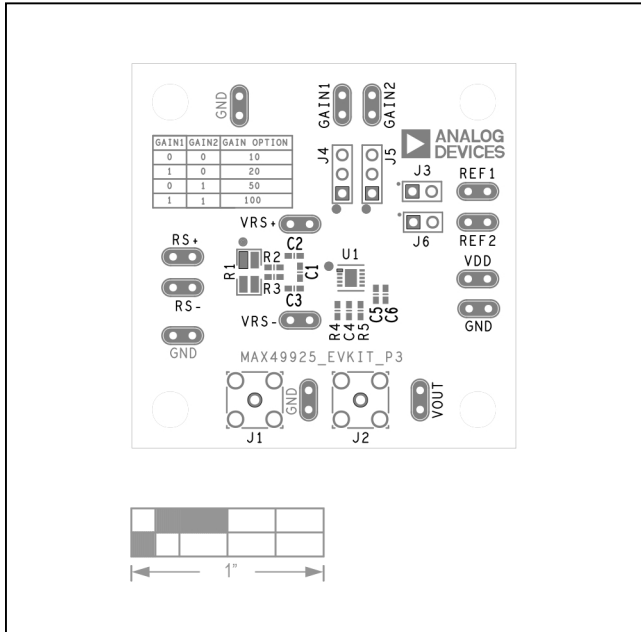
MAX49925 EV Kit Bill of Materials

ITEM	REF_DES	DNI/DNP	QTY	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION	COMMENTS
1	C1-C3	-	3	GRM188R72A102KA01; C1608X7R2A102K080AA	MURATA;TDK	0.001UF	CAP; SMT (0603); 0.001UF; 10%; 100V; X7R; CERAMIC	
2	C4	-	1	C0603C200J5GAC; GRM1885C1H200JA01	KEMET;MURATA	20PF	CAP; SMT (0603); 20PF; 5%; 50V; C0G; CERAMIC	
3	C5	-	1	C0603C104K8RAC	KEMET	0.1UF	CAP; SMT (0603); 0.1UF; 10%; 10V; X7R; CERAMIC	
4	C6	-	1	GRM188Z71A106KA73	MURATA	10UF	CAP; SMT (0603); 10UF; 10%; 10V; X7R; CERAMIC ;	
5	GAIN1, GAIN2, GND, GND_2- GND_4, REF1, REF2, RS+, RS-, VDD, VOUT, VRS+, VRS-	-	14	9020 BUSS	WEICO WIRE	MAXIMPAD	EVK KIT PARTS; MAXIM PAD; WIRE; NATURAL; SOLID; WEICO WIRE; SOFT DRAWN BUS TYPE-S; 20AWG	
6	J3, J6	-	2	PEC02SAAN	SULLINS	PEC02SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 2PINS	
7	J4, J5	-	2	PCC03SAAN	SULLINS	PCC03SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT THROUGH; 3PINS; -65 DEGC TO +125 DEGC	
8	MH1-MH4	-	4	9032	KEYSTONE	9032	MACHINE FABRICATED; ROUND-THRU HOLE SPACER; NO THREAD; M3.5; 5/8IN; NYLON	
9	R1	-	1	LVK12R050DE	OHMITE MFG CO.	0.05	RESISTOR; 1206; 0.05 OHM; 0.5%; 50PPM; 0.5W; METAL FILM	
10	R2-R4	-	3	CRCW06030000ZS; MCR03EZPJ000; ERJ-3GEY0R00; CR0603AJJ-000ELF	VISHAY;ROHM SEMICONDUCTOR; PANASONIC;BOURNS	0	RES; SMT (0603); 0; JUMPER; JUMPER; 0.1000W	
11	R5	-	1	CRG0603F10K	TE CONNECTIVITY	10K	RES; SMT (0603); 10K; 1%; +/-100PPM/DEGC; 0.1000W	
12	U1	-	1	MAX49925	ANALOG DEVICES	MAX49925	EVKIT PART - IC; OZ97; MAX49925; BI-DIRECTIONAL; WIDE POSITIVE AND NEGATIVE SENSING RANGE; CSA WITH PWM REJECTION; PACKAGE OUTLINE: 21- 100346; PACKAGE LAND PATTERN DRAWING: 90-0003; PACKAGE CODE: T1033Y+1C; TDFN10	
13	PCB	-	1	MAX49925	ANALOG DEVICES	PCB	PCB:MAX49925	-
14	J1, J2	DNP	0	142138	AMPHENOL RF	142138	CONNECTOR; FEMALE; THROUGH HOLE; SMB P.C. MOUNTING JACK; STRAIGHT; 5PINS	
TOTAL			35					

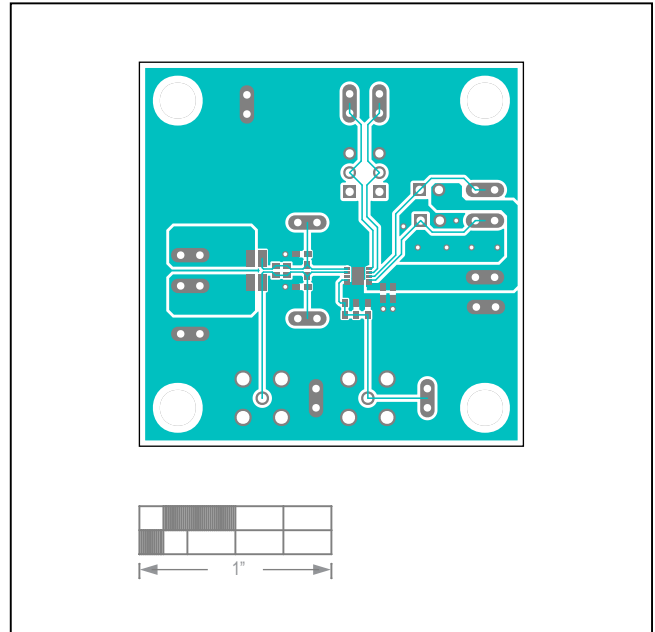
MAX49925 EV Kit PCB Schematics Diagram



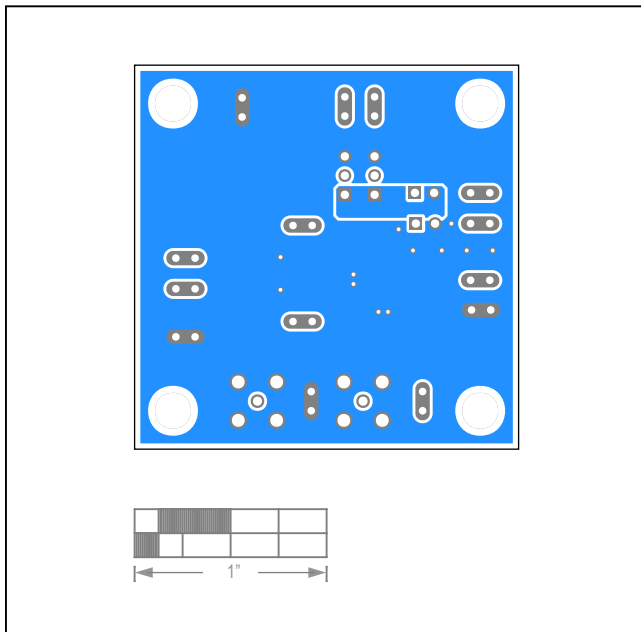
MAX49925 EV Kit PCB Layout Diagrams



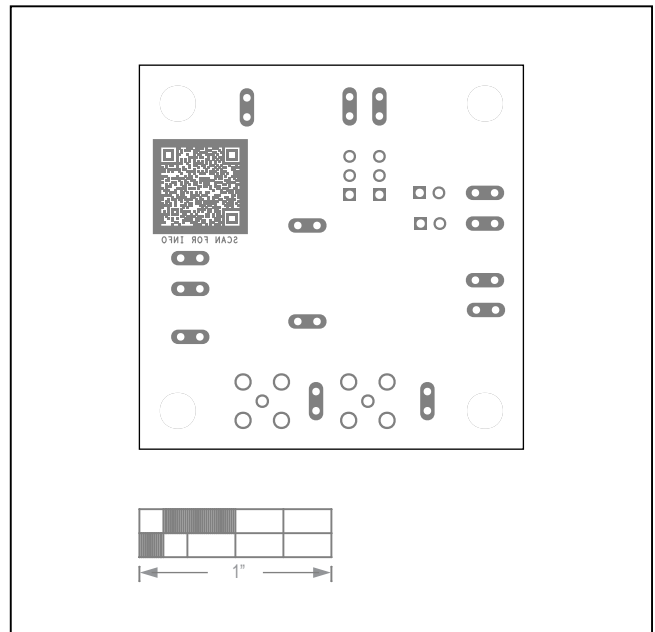
MAX49925 EV Kit PCB Layout—Top Silkscreen



MAX49925 EV Kit PCB Layout—Top



MAX49925 EV Kit PCB Layout—Bottom



MAX49925 EV Kit PCB Layout—Bottom Silkscreen

**Revision History**

<b>REVISION NUMBER</b>	<b>REVISION DATE</b>	<b>DESCRIPTION</b>	<b>PAGES CHANGED</b>
0	12/21	Initial Release	—
1	1/23	Updated board photo	1
2	2/23	Updated MAX49925 EV Kit Files table and MAX49925 EV Kit PCB Layout Diagrams (Top Silkscreen)	1, 6



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