

## MAX25210 Evaluation Kit

Evaluates: MAX25210

### General Description

The MAX25210 ultra-low quiescent current, high-voltage linear regulator family is ideal for use in automotive and battery-operated systems. The device operates from a 3.5V to 36V input voltage, delivers up to 300mA of load current, and consumes only 10 $\mu$ A of typical quiescent current at no load. The device consumes only 1.6 $\mu$ A current when in shutdown. The input is 40V transient tolerant and is designed to operate under load-dump conditions. The MAX25210 EV kit can be configured as either fixed output voltage (3.3V or 5V) or adjustable output voltage using an external resistive voltage divider.

The MAX25210 features an open-drain, active-low  $\overline{\text{RESET}}$  output with fixed thresholds offered at 93.5% and 87.5% of the output voltage. The  $\overline{\text{RESET}}$  output remains low for a fixed period of 60 $\mu$ s after the output voltage exceeds its threshold. The  $\overline{\text{RESET}}$  delay can be extended with an external capacitor.

The MAX25210 includes an enable input, short-circuit protection, and thermal shutdown. The MAX25210 operates over the -40°C to +125°C automotive temperature range.

The regulators are available in a space-saving, thermally enhanced, 3mm x 3mm, 8-pin TDFN, 2mm x 2mm, 8-pin TDFN, and 5mm x 4mm, 8-pin SO packages.

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

### Benefits and Features

- Enables System Designers to Meet Stringent Module Requirements for 100 $\mu$ A Quiescent Current
- Low 10 $\mu$ A Quiescent Current
- 300mA Output-Current Capability (300mA, 200mA, 100mA, and 50mA Variants)
- User-Selectable Output Voltage (3.3V or 5V Fixed and 0.6V to 11V Adjustable with External Resistive voltage Divider)
- Tiny Output Capacitors Reduce Board Space and BOM Cost
- Stable Operation with 2.2 $\mu$ F Output Capacitor
- Accurate  $\overline{\text{RESET}}$  Output with Adjustable Delay Eliminates Need for Separate Reset IC
- Open-Drain  $\overline{\text{RESET}}$  Output with Adjustable Delay
- Fixed-Reset Threshold Options: 87.5% or 93.5%
- Operates Through Cold-Crank Conditions
- Low-Dropout Voltage of 280mV at 200mA
- 3.5V to 36V Wide Input Voltage Range, 40V Load-Dump Tolerant
- Robust Performance in Automotive Environment
- Thermal and Short-Circuit Protection
- High-Voltage Enable Input (40V Load-Dump Tolerant)
- Operating -40°C to +125°C Temperature Range
- Automotive Qualified AEC-Q100

## Quick Start

### Required Equipment

- MAX25210 EV kit
- 5V to 40V, 300mA DC power supply
- Passive or electronic load capable of sinking 300mA
- Digital multimeter (DMM)

### Procedure

The EV kit is fully assembled and tested. To verify board operation, follow the steps:

- 1) Verify that shunts are installed across jumpers. For  $V_{OUT}$  TDFN 3X3: J1 (1-2), J2 (2-3), and J13 (DNI). For  $V_{OUT}$  SO: J3 (1-2), J4 (2-3), and J18 (DNI). For  $V_{OUT}$  TDFN 2X2: J23 (1-2), J24 (2-3), and J33 (DNI).
- 2) Set the DC power supply output to 14V and disable the output. Connect the positive and negative terminals of power supply connections to  $V_{IN}$  and GND respectively.
- 3) Connect the positive input of the DMM to the appropriate output pad on the EV kit, and the negative input of the DMM to the GND PCB pad on the EV kit to measure the output voltage.
- 4) Connect the passive or electronic load between the OUTPUT and GND pads. Set the load from  $0mA < I_{LOAD} < 300mA$ .
- 5) Enable the DC power-supply output.
- 6) Verify that the output voltage is 5V.

## Detailed Description of Hardware

The MAX25210 EV kit is a fully assembled and tested PCB for evaluating the MAX25210 300mA LDO regulator. The EV kit accommodates TDFN 3mm x 3mm, TDFN 2mm x 2mm, and SO 5mm x 4mm package version of the product. The EV kit operates from 3.5V to 36V and requires 300mA current. The LDO regulator has a fixed 3.3V or 5V output, however, it can also be configured between 0.6V and 11V using an external resistive feedback divider network. An open-drain RESET output changes from low to high whenever the OUTPUT voltage rises to 93.5% of its regulated output. When TIMEOUT is loaded with a 1000pF capacitor and OUTPUT exceeds its rising threshold voltage, RESET remains low for the 1.25ms reset timeout period and then goes high. A dedicated SMB jack (50Ω) is used for each package type to monitor the output and input voltage.

### Enable (J1)

Jumpers J1, J3, and J23 configure the EV kit's respective EN inputs for turn-on/off control. Install a shunt across pins 1-2 to enable the circuit output. Install a shunt across pins 2-3 to disable the outputs. The outputs can also be externally controlled by placing an independent voltage source at the ENABLE PCB pad when a shunt is not installed at J1, J3, and J23. See [Table 1](#) for proper configuration.

### Output Voltage Selection

Jumpers J2, J33, J4, J18, J24, and J33 configure the EV kit circuit to operate in fixed output-voltage or adjustable output-voltage mode. In fixed output-voltage mode, the output voltage is set to 3.3V or 5V using jumper J13, J18, J33. To configure the EV kit circuit for fixed output mode, install a shunt across pins 2-3 on jumper J2, J4, J24. Place a shunt across pins 1-2 on J13, J18, J33 for the 5V preset output. Place a shunt across pins 2-3 for the 3.3V preset output, see [Table 2](#).

In adjustable output-voltage mode, the output voltage is set using a resistor voltage divider network from the OUTPUT to SETOV pins. To configure the circuit for adjustable output-voltage mode, install a shunt across pins 1-2 on jumper J2, J4, J24 and remove the shunt at jumper J13, J18, J33. The output voltage can be set between 0.6V to 11V using surface-mount 0402 resistors R3 and R4, R5 and R6, R10 and R11. To set the output voltages, select R4, R6, R11 to be  $\leq 100k\Omega$  and use the following equation to compute R3, R5, R10:

$$\text{TDFN 3mm x 3mm } R3 = R4 \times \left( \frac{V_{OUT} \text{ TDFN3X3}}{V_{SETOV}} \right),$$

$$\text{TDFN 2mm x 2mm } R10 = R11 \times \left( \frac{V_{OUT} \text{ TDFN2X2}}{V_{SETOV}} \right),$$

$$\text{SO 5mm x 4mm } R5 = R6 \times \left( \frac{V_{OUT} \text{ TDFN2X2}}{V_{SETOV}} \right),$$

where  $V_{OUT}$  is the desired output voltage,  $V_{SETOV}$  is 0.6V, and R3, R10, R5 is in kΩ.

See [Table 2](#) for proper jumper configurations when operating the EV kit circuit in fixed or adjustable output voltage mode.

**Table 1. Enable Control (J1, J3, J23)**

SHUNT POSITION	ENABLE PIN	OUTPUT
1-2	Connected to $V_{IN}$	Enabled
2-3	Connected to GND	Disabled

**Table 2. Output Voltage Configuration (J2, J13, J4, J18, J24, J33)**

SHUNT POSITION		OUTPUT VOLTAGE
J2, J4, J24	J13, J18, J33	
1-2	Not Installed	Set by External Feedback Resistor R3, R4, R5, R6, R10, R11
2-3	1-2	5V
	2-3	3.3V

**Ordering Information**

PART	TYPE
MAX25210EVKIT#	EVKIT

#Denotes RoHS compliant.

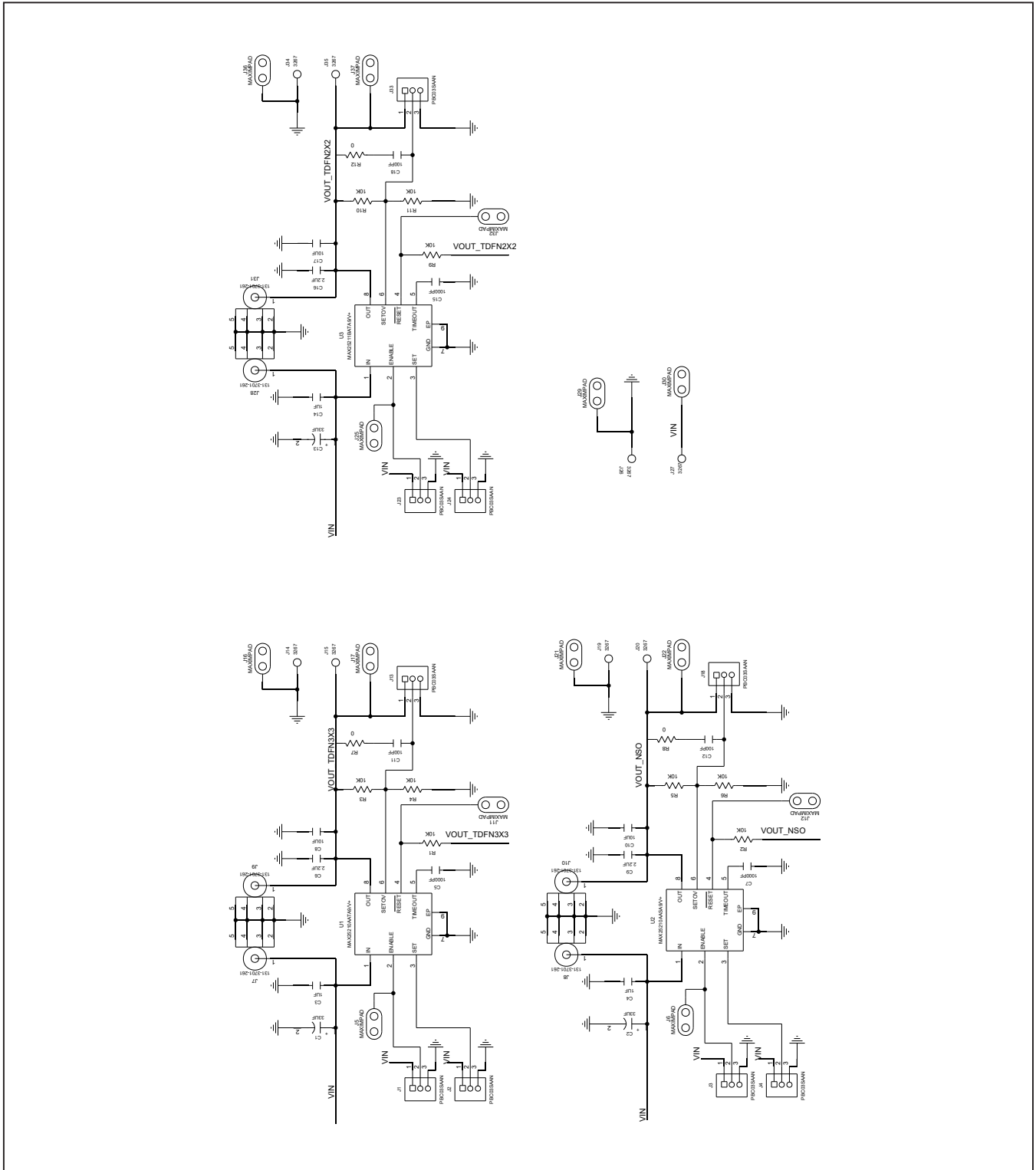
MAX25210 EV Kit Bill of Materials

ITEM	QTY	REF DES	MAXINV	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION	COMMENTS
1	2	C1, C13	20-0033U-FA21	EEH-2C1H330XP	PANASONIC	33UF	CAP; SMT (CASE_D8); 33UF; 20%; SOV; ALUMINUM-ELECTROLYTIC	
2	3	C3, C4, C14	20-0001U-04	GRM21BR71H105KA12; CL21B105KBFNNN; C2012X7R1H105K085AC; UMK212B7105KG; CGA4J3X7R1H105K125AB	MURATA;SAMSUNG ELECTRONICS;TDK;TAIY	1UF	CAPACITOR; SMT (0805); CERAMIC CHIP; 1UF; 50V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R	
3	3	C5, C7, C15	20-1000P-868	C0402C0G250-102KNP	VENKEL LTD.	1000PF	CAPACITOR; SMT (0402); CERAMIC CHIP; 1000PF; 25V; TOL=10%; MODEL=COG; TG=-55 DEGC TO +125 DEGC; TC=+; NOT RECOMMENDED FOR NEW DESIGN USE - 20-1000p-E7	
4	3	C6, C9, C16	20-002U2-CA95	08053C225KAT2A; TMK212B7225KG; GRM21BR71E225KA73; GRT21BR71E225KE13	AVX;TAIYO YUDEN;MURATA; MURATA	2.2UF	CAPACITOR; SMT (0805); CERAMIC CHIP; 2.2UF; 25V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R	
5	3	C8, C10, C17	20-0010U-A4	GRM31CR71E106KA12; CL31B106KAHNNN	MURATA;SAMSUNG ELECTRONICS	10UF	CAPACITOR; SMT (1206); CERAMIC CHIP; 10UF; 25V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R	
6	3	C11, C12, C18	20-0100P-26	C0402C101K5GAC; C100SC0G1H101K050BA	KEMET;TDK	100PF	CAPACITOR; SMT; 0402; CERAMIC; 100PF; 50V; 10%; COG; -55degC to +125degC; 0 +/-30PPM/degC	
7	9	J1-J4, J13, J18, J23, J24, J33	01-PBC03SAAN3P-21	PBC03SAAN	SULLINS	PBC03SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 3PINS; -65 DEGC TO +125 DEGC	
8	14	J5, J6, J11, J12, J16, J17, J21, J22, J25, J29, J30, J32, J36, J37	01-9020BUSS20AWG-00	9020 BUSS	WEICO WIRE	MAXIMPAD	EVK KIT PARTS; MAXIM PAD; WIRE; NATURAL; SOLID; WEICO WIRE; SOFT DRAWN BUS TYPE-S; 20AWG	
9	6	J7-J10, J28, J31	01-13137012615P-01	131-3701-261	JOHNSON COMPONENTS	131-3701-261	CONNECTOR; MALE; THROUGH HOLE; 50 OHM SMB PC MOUNT; JACK RECEPTACLE; STRAIGHT; SPINS	
10	8	J14, J15, J19, J20, J26, J27, J34, J35	01-32671P-80	3267	POMONA ELECTRONICS	3267	CONNECTOR; MALE; PANELMOUNT; STANDARD UNINSULATED BANANA JACK; STRAIGHT; 1PIN	
11	4	MH1-MH4	02-SOM35016H-00	9032	KEYSTONE	9032	MACHINE FABRICATED; ROUND-THRU HOLE SPACER; NO THREAD; M3.5; 5/8IN; NYLON	
12	9	R1-R6, R9-R11	80-0010K-23	CRCW040210K0FK; RC0402FR-0710KL	VISHAY DALE;YAGEO PHICOMP	10K	RESISTOR; 0402; 10K; 1%; 100PPM; 0.0625W; THICK FILM	
13	3	R7, R8, R12	80-0000R-26A	ERJ-2GE0R00	PANASONIC	0	RESISTOR; 0402; 0 OHM; 0%; JUMPER; 0.10W; THICK FILM	
14	1	U1	00-SAMPLE-01	MAX25210ATAA9/V+	MAXIM	MAX25210ATAA9/V+	EVKIT PART -IC; VREG; AUTOMOTIVE ULTRA LOW QUIESCENT CURRENT LINEAR REGULATOR FAMILY; NSQIC8 3MMx3MM; PACKAGE CODE: T833+3C; PACKAGE OUTLINE DRAWING: 21-0137; LAND PATTERN NUMBER: 90-0059	
15	1	U2	00-SAMPLE-02	MAX25210ASAA9/V+	MAXIM	MAX25210ASAA9/V+	EVKIT PART -IC; VREG; AUTOMOTIVE ULTRA LOW QUIESCENT CURRENT LINEAR REGULATOR FAMILY; NSQIC8 150MIL; PACKAGE CODE: S8E+12; PACKAGE OUTLINE DRAWING: 21-0111; LAND PATTERN NUMBER: 90-0150	
16	1	U3	00-SAMPLE-03	MAX25211ATAB9/V+	MAXIM	MAX25211ATAB9/V+	EVKIT PART -IC; VREG; AUTOMOTIVE ULTRA LOW QUIESCENT CURRENT LINEAR REGULATOR FAMILY; TDFN8-EP 2MMx2MM; SIDE WETTTABLE; PACKAGE CODE: T822Y+3C; PACKAGE OUTLINE DRAWING: 21-100185; LAND PATTERN NUMBER: 90-100070	
17	1	PCB	EPCB25210	MAX25210	MAXIM	PCB	PCB:MAX25210	-
TOTAL	74							

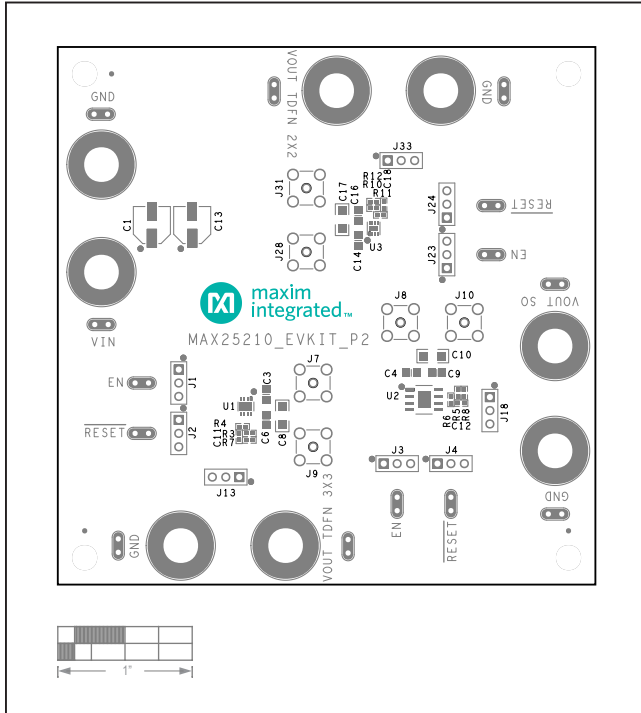
DO NOT PURCHASE(DNP)								
ITEM	QTY	REF DES	MAXINV	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION	COMMENTS
TOTAL	0							

PACKOUT (These are purchased parts but not assembled on PCB and will be shipped with PCB)								
ITEM	QTY	REF DES	MAXINV	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION	COMMENTS
TOTAL	0							

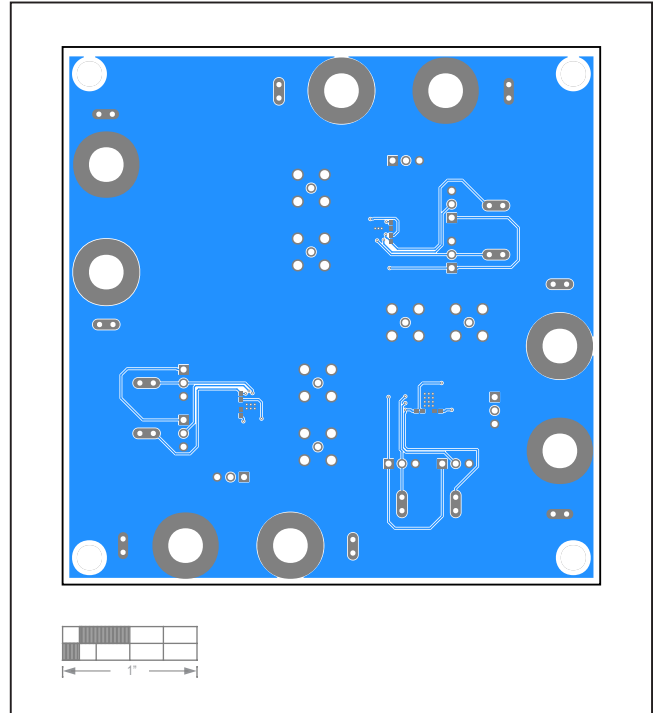
MAX25210 EV Kit Schematics



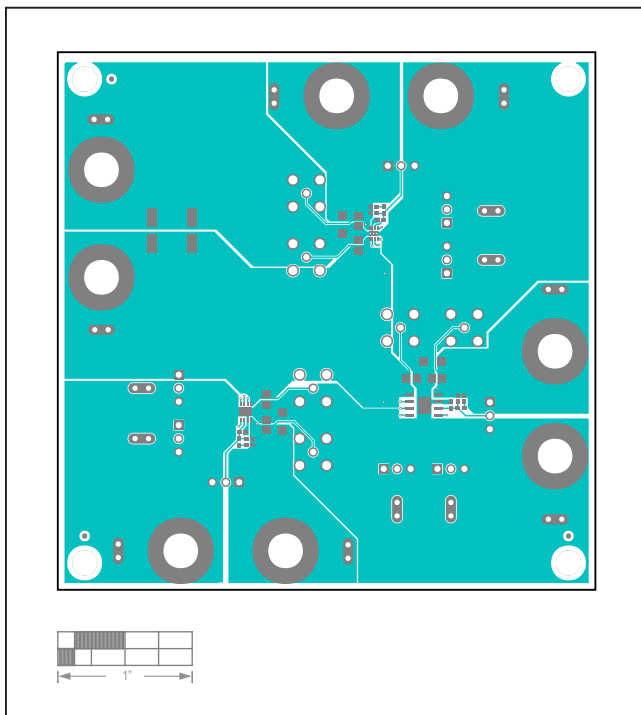
MAX25210 EV Kit PCB Layouts



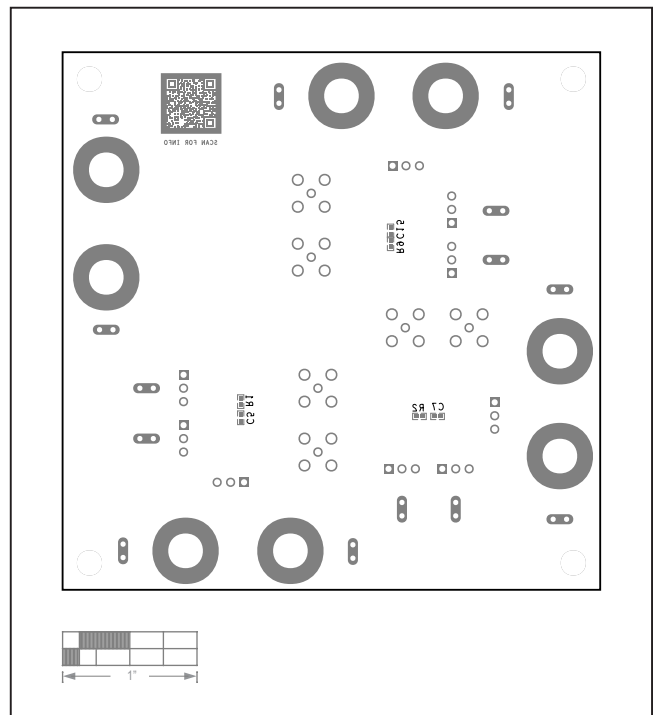
MAX25210 EV Kit PCB Layout—Top Silk Screen



MAX25210 EV Kit PCB Layout—Bottom Side



MAX25210 EV Kit PCB Layout—Top Side



MAX25210 EV Kit PCB Layout—Bottom Silk Screen

### Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	5/20	Initial release	—

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