MAX25520 Evaluation Kit

Evaluates: MAX25520

General Description

The MAX25520 evaluation kit (EV kit) is a fully assembled and tested surface-mount PCB used to evaluate the MAX25520 automotive 2-Channel TFT-LCD Power Supply. The output rails, AVDD and NAVDD, can be programmed independently or programmed to track each other by using a specific configuration. Independent enable pins allow complete flexibility in powering up and down the outputs. The outputs are protected against overcurrent and undervoltage.

The device incorporates a fully integrated current-mode boost converter and a current-mode inverter with external rectifier. The EV kit operates at one of two switching frequencies, 420kHz or 2.1MHz. Operation at 2.1MHz makes possible very compact dual-output power supplies.

The EV kit demonstrates the device's features of adjustable output voltage and fault protection.

Features

- 2.65V to 5.5V Input Range (4.5V to 5.5V for MAX25520ATEC)
- Default Output Voltages in Tracking Mode
  - 6.8V Output at 200mA (Boost Converter)
  - -6.8V Output at -200mA (Inverting Regulator)
- Optional Adjustable Output Voltages
  - Synchronous Boost Provides Positive Output at Up to 10.5V/200mA (+12V/200mA for MAX25520ATEC)
  - Inverter Output Provides Up to -10.5V/-200mA (-12V/-200mA for MAX25520ATEC)
- Components Fit the 2.1MHz Frequency (To use 420kHz frequency, hardware changes are required)
- Spread-Spectrum
- UV Diagnostics on All Outputs and Fault Detection
- Complete Sequencing Flexibility
- -40°C to +125°C Operating Temperature Range

Quick Start

Required Equipment

- MAX25520 EV kit
- 2.65V to 5.5V, 3A power supply
- Voltmeter

Procedure

The EV kit is fully assembled and tested. Follow the steps below to verify board operation.

1) Verify that shunts are installed across pins 1-2 on jumpers J1–J6.
2) Connect the positive terminal of the power supply to the TFT_POWER_IN pad and the negative terminal to the GND1 PCB pad.
3) Set the power supply TFT_POWER_IN at 5V.
4) Turn on the power supply.
5) Verify that the green LED (DS1) is on.
6) Verify that the red LED (DS2) is off (no faults condition).
7) Verify that the boost converter (AVDD PCB pad) is 6.8V.
8) Verify that the inverting converter (NAVDD PCB pad) is -6.8V.

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

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Detailed Description of Hardware

Jumper Setting

In the following tables, several jumper settings illustrate features of the MAX25520 EV kit.

ENN_SEL (J1)

It is possible to selectively enable/disable the negative output NAVDD (see Table 1).

ENP_SEL (J2)

It is possible to selectively enable/disable the positive output AVDD (see Table 2).

Power LED Enable (J3)

A green LED (DS1) is used to indicate that the EV kit is powered on.

The LED can be disconnected from the power supply, allowing precise current-consumption evaluation (see Table 3).

DVDD_SEL (J4)

DVDD can be connected to VIN or it is possible to connect an external DVDD (see Table 4).

GLOBAL_EN (J5)

It is possible to connect together ENN and ENP, only if one of ENN_SEL or ENP_SEL is Open or if both are in their default condition 1-2 (see Table 5).

Fault LED Enable (J6)

A red LED (DS2) is used to indicate a fault condition. The LED can be disconnected from the power supply, allowing precise current-consumption evaluation (see Table 6).

Table 1. Jumper Functions (J1)

SHUNT POSITION	ENN_SEL
1-2*	Connected to DVDD
2-3	Connected to GND
Open	Disconnected

**Default position.*

Table 2. Jumper Functions (J2)

SHUNT POSITION	ENP_SEL
1-2*	Connected to DVDD
2-3	Connected to GND
Open	Disconnected

**Default position.*

Table 3. Jumper Functions (J3)

SHUNT POSITION	PWR_LED_EN
1-2*	Connected
Open	Disconnected

**Default position.*

Table 4. Jumper Functions (J4)

SHUNT POSITION	DVDD_SEL
1-2*	DVDD connected to VIN
2-3	DVDD connected to EXT_DVDD
Open	Disconnected

**Default position.*

Table 5. Jumper Functions (J5)

SHUNT POSITION	GLOBAL_EN
1-2*	Connected
Open	Disconnected

**Default position.*

Table 6. Jumper Functions (J6)

SHUNT POSITION	LED_EN
1-2*	Connected
Open	Disconnected

**Default position.*

Changing Output Voltages

The MAX25520 includes a current-mode boost converter with an output switch that generates up to +10.5V and deliver up to 200mA. The boost converter's regulation voltage (AVDD) is set by the resistor divider connected between AVDD, FBP, and GND pin. Alternatively, the default AVDD output voltage (+6.8V) can be chosen by connecting FBP to V18.

The inverting buck-boost converter is of the current-mode type and can generate down to -10.5V output voltage and deliver up to -200mA. It is internally compensated.

The negative source-driver supply voltage (NAVDD) is either tightly regulated to -AVDD within ±34mV (when FBN is connected to IN) or its output voltage is set by the resistors connected between V18, FBN, and NAVDD.

Tracking Mode (Default)

When the MAX25520 EV kit is set to work in the default tracking mode, AVDD default value is 6.8V and NAVDD default value is -6.8V. To set this configuration see Table 7.

Tracking Mode with External Feedback

The output voltage of the boost converter can be adjusted using an external resistive voltage-divider. AVDD must be set to a value from 6V to 12V for MAX25520ATEC, NAVDD is automatically at the same value but negative.

Calculate the resistor values using the following equation:

$$R_5 + R_{16} = R_6 \times \left(\left(\frac{V_{AVDD}}{0.9} \right) - 1 \right)$$

where V_{AVDD} is the desired output voltage. To set this configuration see Table 8.

Independent Output Voltage Mode with External Feedback

The output voltage of the boost converter and the output voltage of the inverting buck-boost converter can be adjusted independently using external resistive voltage-dividers. AVDD must be set to a value from 6V to 12V for MAX25520ATEC, NAVDD must be set to a value (also different from AVDD) from -6V to -12V for MAX25520ATEC.

Table 7. Tracking Mode (Default)

COMPONENT	INSTALL/ DO NOT INSTALL (DNI)	NOTE
R4	Install	0Ω resistor installed between FBP and V18
R10	Install	0Ω resistor installed between FBN and VIN
R6	DNI	AVDD feedback
R5	DNI	AVDD feedback
R16	DNI	AVDD feedback
R8	DNI	NAVDD feedback
R11	DNI	NAVDD feedback
R17	DNI	NAVDD feedback

Table 8. Tracking Mode with External Feedback

COMPONENT	INSTALL/ DO NOT INSTALL (DNI)	NOTE
R4	DNI	0Ω resistor installed between FBP and V18
R10	Install	0Ω resistor installed between FBN and VIN
R6	Install	AVDD feedback
R5	Install	AVDD feedback
R16	Install	AVDD feedback
R8	DNI	NAVDD feedback
R11	DNI	NAVDD feedback
R17	DNI	NAVDD feedback

Calculate the resistor values using the following equations:

$$R_5 + R_{16} = R_6 \times \left(\left(\frac{V_{AVDD}}{0.9}\right) - 1\right)$$

$$R_{11} + R_{17} = R_8 \times \left(\left(\frac{V_{NAVDD}}{0.9}\right) - 1\right)$$

where V_{AVDD} and V_{NAVDD} are the desired output voltages. To set this configuration see Table 9.

Evaluation Kit Changes for Operation at FSW 420kHz

It is possible to set a switching frequency of 420kHz by choosing a different MAX25520 part number (MAX25520ATEA/V+). The standard EV kit components suit the 2.1MHz frequency. To use 420kHz, hardware changes are required (see Table 10).

Evaluation Kit Changes for Extended Voltage Range

Alternatively, it is possible to evaluate the extended voltage range device by replacing U1 with the MAX25220ATEC. The hardware changes in Table 11 are required.

Table 9. Independent Output Voltage Mode with External Feedback

COMPONENT	INSTALL/ DO NOT INSTALL (DNI)	NOTE
R4	DNI	0Ω resistor installed between FBP and V18
R10	DNI	0Ω resistor installed between FBN and VIN
R6	Install	AVDD feedback
R5	Install	AVDD feedback
R16	Install	AVDD feedback
R8	Install	NAVDD feedback
R11	Install	NAVDD feedback
R17	Install	NAVDD feedback

Table 10. EV Kit Hardware Changes for Operation at Frequency Switch (FSW) 420kHz

COMPONENT	FSW 2.1MHz	FSW 420kHz
L2	2.2µH	10µH
C19	DNI	10µF
L3	2.2µH	10µH
C26	DNI	10µF

Table 11. Tracking Mode with 12V External Feedback

COMPONENT	INSTALL/ DO NOT INSTALL (DNI)	NOTE
R4	DNI	0Ω resistor installed between FBP and V18
R10	Install	0Ω resistor installed between FBN and VIN
R6	10K	AVDD feedback
R5	68K	AVDD feedback
R16	56K	AVDD feedback
R8	DNI	NAVDD feedback
R11	DNI	NAVDD feedback
R17	DNI	NAVDD feedback

Ordering Information

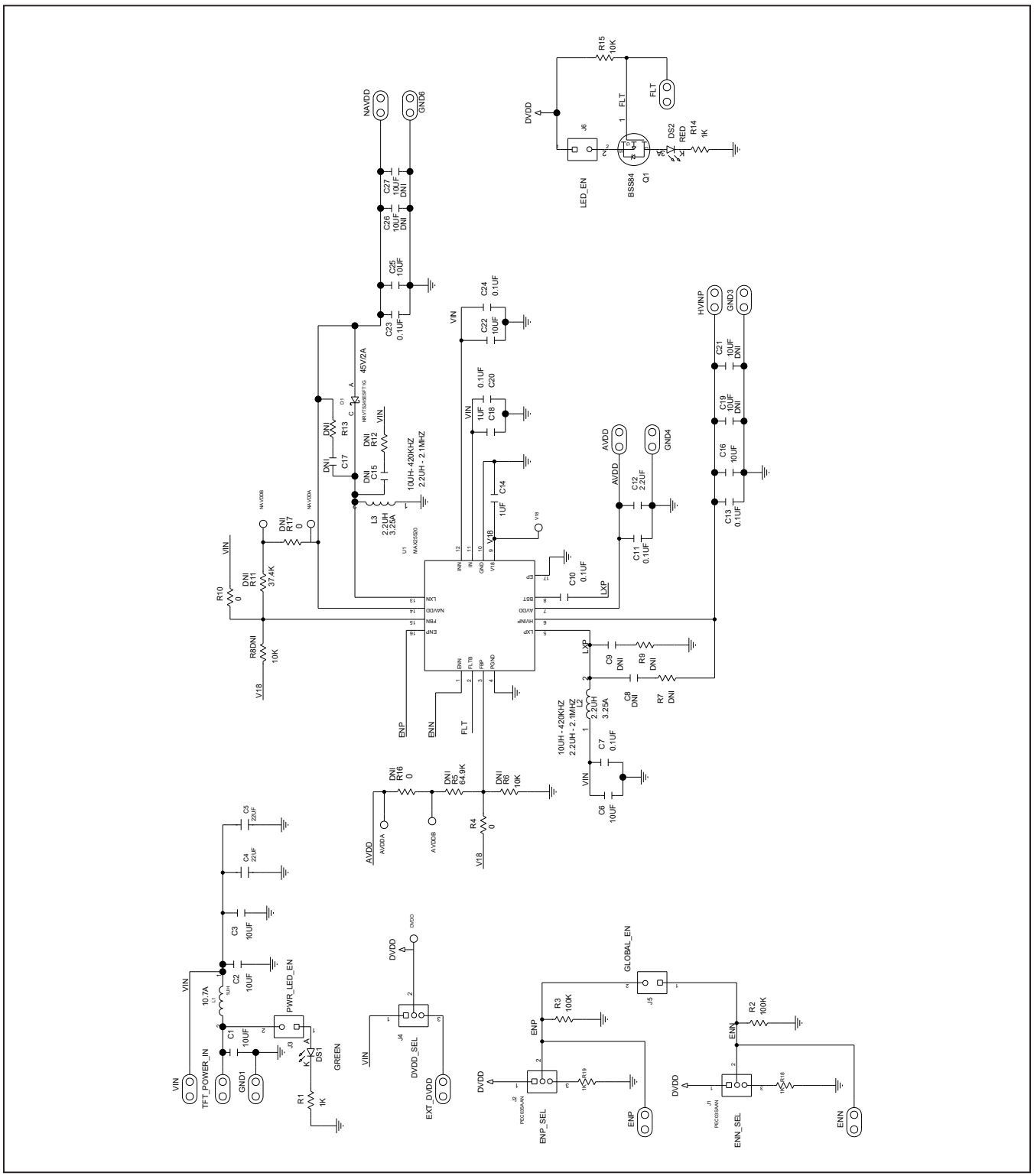
PART	TYPE
MAX25520EVKIT#	EV Kit

#Denotes RoHS compliance.

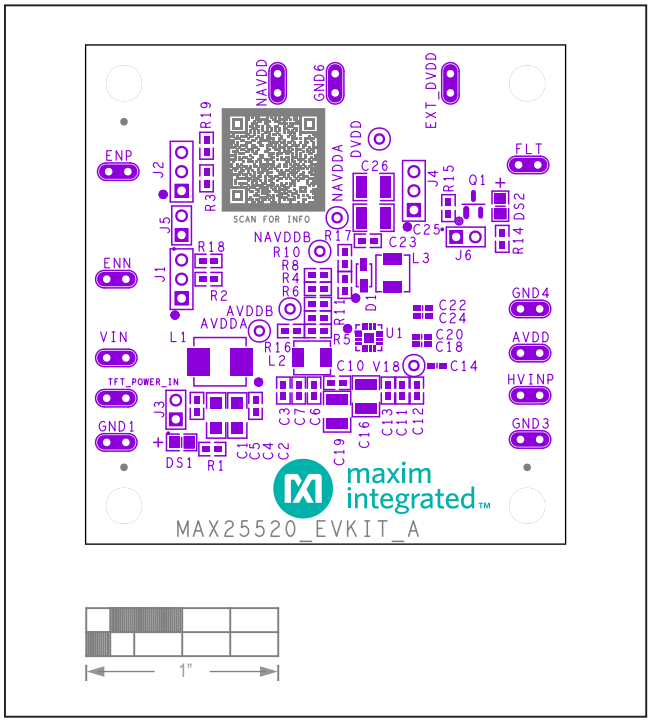
MAX25520 EV Kit Bill of Materials

DESIGNATION	DNI/DNP	QTY	MFG PART #	MANUFACTURER	DESCRIPTION
C1-C3, C6, C22	-	5	CL10B106MQ8NRN	SAMSUNG ELECTRONICS	10UF; 20%; 6.3V; X7R; CERAMIC CAPACITOR (0603)
C4, C5	-	2	EMK316BB7226ML	TAIYO YUDEN	22UF; 20%; 16V; X7R; CERAMIC CAPACITOR (1206)
C7, C10, C20, C24	-	4	GRM188R72A104KA35; GRM188R72A104K	MURATA	0.1UF; 10%; 100V; X7R; CERAMIC CAPACITOR (0603)
C11, C13, C23	-	3	C0603C104K8RAC	KEMET	0.1UF; 10%; 10V; X7R; CERAMIC CAPACITOR (0603)
C12	-	1	GRM188C71E225KE11	MURATA	2.2UF; 10%; 25V; X7S; CERAMIC CAPACITOR (0603)
C14, C18	-	2	GRM188R71E105KA12	MURATA	1UF; 10%; 25V; X7R; CERAMIC CAPACITOR (0603)
C16, C25	-	2	GCJ32ER71E106KA18	MURATA	10UF; 10%; 25V; X7R; CERAMIC CAPACITOR (1210)
D1	-	1	NRVTS245ESFT1G	ON SEMICONDUCTOR	DIODE; SCH; SMT (SOD-123FL); PIV=45V; IF=2.0A
DS1	-	1	LTST-C170GKT	LITE-ON ELECTRONICS INC	DIODE; LED; STANDARD; GREEN; SMT (0805); PIV=2.1V; IF=0.01A
DS2	-	1	LTST-C170EKT	LITE-ON ELECTRONICS INC	DIODE; LED; STANDARD; RED; SMT (0805); PIV=2.0V; IF=0.02A
J1, J2, J4	-	3	PEC03SAAN	SULLINS	CONNECTOR; MALE; THROUGH HOLE; 3PINS
J3, J5, J6	-	3	PEC02SAAN	SULLINS	CONNECTOR; MALE; THROUGH HOLE; 2PINS
L1	-	1	ETQ-P3M1R0YFN	PANASONIC	1UH; 20%; 10.7A; COMPOSITE INDUCTOR
L2, L3	-	2	74437324022	WURTH ELECTRONICS INC	2.2UH; 20%; 3.25A; SHIELDED INDUCTOR
MH1-MH4	-	4	9032	KEYSTONE	MACHINE FABRICATED; ROUND-THRU HOLE SPACER; NO THREAD; M3.5; 5/8IN; NYLON
Q1	-	1	BSS84	FAIRCHILD SEMICONDUCTOR	ENHANCEMENT MODE FIELD EFFECT TRANSISTOR, P-CHANNEL, SOT-23, PD=0.36W, ID=-0.13A, VDSS=-50V, -55degC TO +150degC
R1, R14, R18, R19	-	4	CR0603-FX-1001ELF	BOURNS	1K; 1%; +/-100PPM/DEGC; 0.1000W; RESISTOR (0603)
R2, R3	-	2	CRCW0603100KJN	VISHAY	100K; 5%; +/-200PPM/DEGC; 0.1000W; RESISTOR (0603)
R4, R10	-	2	RC1608J000CS	SAMSUNG ELECTRONICS	0; 5%; JUMPER; 0.1000W; RESISTOR (0603)
R15	-	1	CRCW060310K0FK	VISHAY DALE	10K; 1%; +/-100PPM/DEGC; 0.1000W; RESISTOR (0603)
U1	-	1	MAX25520ATEB/V+	MAXIM	IC AUTOMOTIVE 2-CHANNEL TFT-LCD POWER SUPPLY
C8, C9, C15, C17	DNP	0	0603YC101KAT2A	AVX	100PF; 10%; 16V; X7R; CERAMIC CAPACITOR(0603)
C19, C21, C26, C27	DNP	0	GCJ32ER71E106KA18	MURATA	10UF; 10%; 25V; X7R; CERAMIC CAPACITOR (1210)
R5	DNP	0	ERJ-3EKF6492	PANASONIC	64.9K; 1%; +/-100PPM/DEGC; 0.1000W; RESISTOR (0603)
R6, R8	DNP	0	CRCW060310K0FK	VISHAY DALE	10K; 1%; +/-100PPM/DEGC; 0.1000W; RESISTOR (0603)
R7, R9, R12, R13	DNP	0	ERJ-P03F10R0V	PANASONIC	10; 1%; +/-200PPM/DEGC; 0.2000W; RESISTOR (0603)
R11	DNP	0	CRCW060337K4FK	VISHAY DALE	37.4K; 1%; +/-100PPM/DEGK; 0.1000W; RESISTOR (0603)
R16, R17	DNP	0	RC1608J000CS	SAMSUNG ELECTRONICS	0; 5%; JUMPER; 0.1000W; RESISTOR (0603)
TOTAL		46			

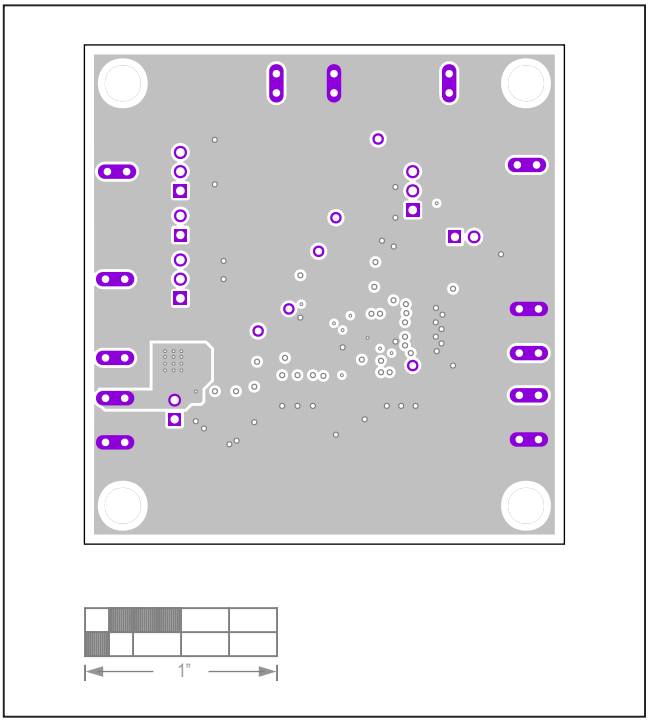
MAX25520 EV Kit Schematic



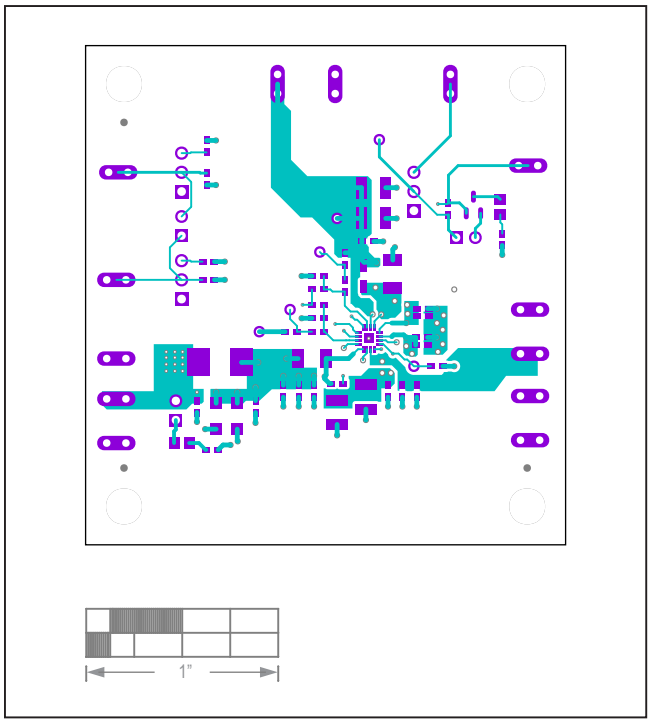
MAX25520 EV Kit PCB Layout Diagrams



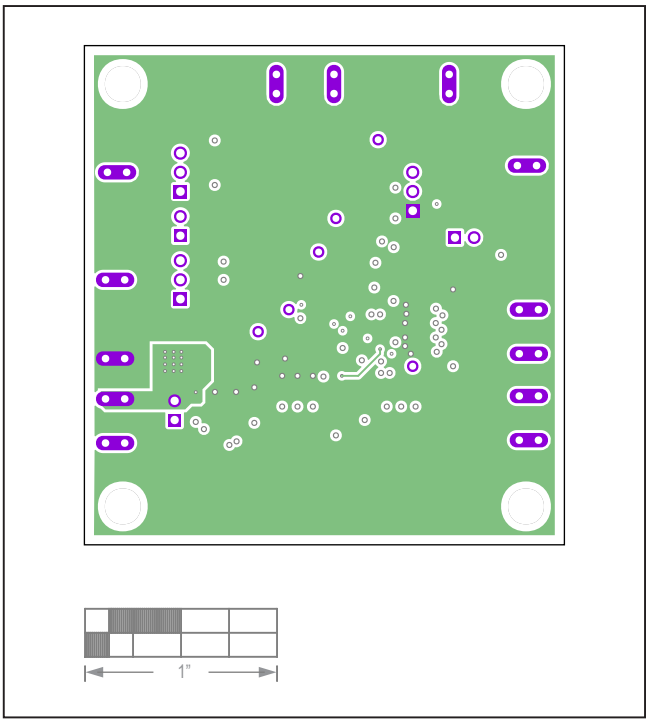
MAX25520 EV Kit PCB Layout—Top Silkscreen



MAX25520 EV Kit PCB Layout—Internal Layer 2

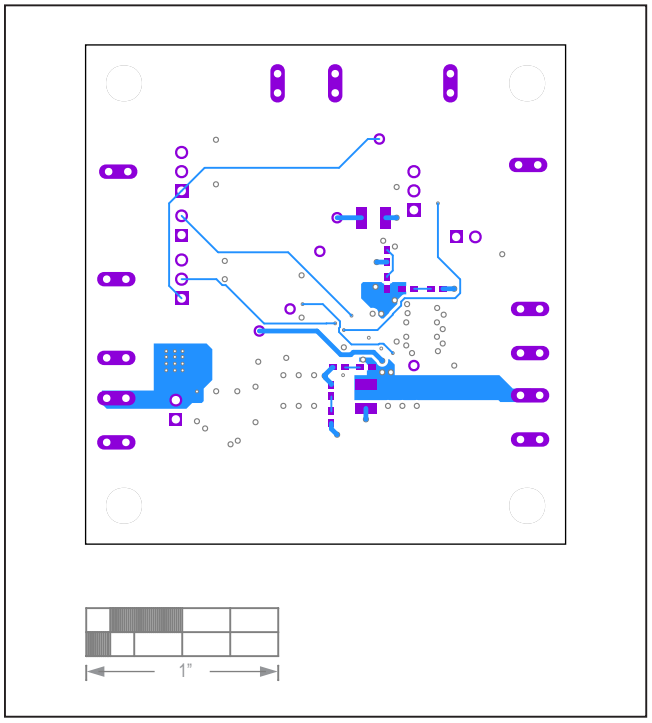


MAX25520 EV Kit PCB Layout—Top View

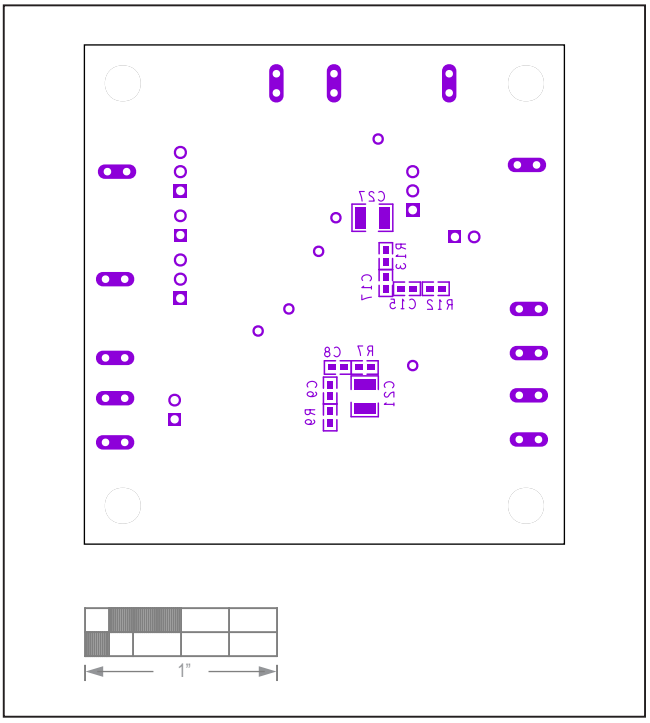


MAX25520 EV Kit PCB Layout—Internal Layer 3

MAX25520 EV PCB Layout Diagrams (continued)



MAX25520 EV Kit PCB Layout—Bottom View



MAX25520 EV Kit PCB Layout—Bottom Silkscreen

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	1/21	Initial release	—
1	2/21	Updated *Features* secton, *Tracking Mode with External Feedback* section, and *Independent Output Voltage Mode with External Feedback* section, Added *Evaluation Kit Changes for Extended Voltage Range* section	1, 3, 4

