

Evaluates: MAX25540

MAX25540 Evaluation Kit

General Description

The MAX25540 evaluation kit (EV kit) is a fully assembled and tested surface-mount PCB used to evaluate the MAX25540 automotive 4-output display-power solution. The MAX25540 is a 4-channel power management integrated circuit (PMIC) designed to accommodate the main rails used in modern automotive thin-film transistor (TFT) displays. The MAX25540 integrates a high-voltage buck converter that transforms battery voltages into a 3.3V intermediate rail. In addition, a high-voltage, always-on, low-quiescent-current linear regulator supplies power at 3.3V. The low-voltage section consists of a fully integrated DC/DC converter and a low dropout (LDO) running off the intermediate rail. The low-voltage DC/DC converter provides 1V, while the LDO produces 1.8V. A single START control pin initiates the start-up sequence, thereby simplifying device control. The MAX25540's external PMOSFET control block allows battery voltage to be switched to a downstream device, such as a backlight boost converter. The MAX25540 also embeds selectable switching frequencies with spread spectrum.

Benefits and Features

- High Integration
 - Complete Display Power Solution from Automotive Battery
 - One High-Voltage 2.1A Buck Converter (3.3V)
 - One High-Voltage 100mA Low-IQ Linear Regulator (3.3V)
 - One Low-Voltage 1.6A Buck Converter (1V)
 - One Low-Voltage 175mA Linear Regulator (1.8V)
 - Power-Good Outputs
- Robust and Low electromagnetic interference (EMI)
 - Programmable Switching Frequency
 - Internal Spread Spectrum Oscillator
 - Slew-Rate Controlled Switching
 - Thermal Shutdown Protection
- Proven PCB Layout
- Fully Assembled and Tested
- Automotive CISPR25 CLASS5 compliant
- -40°C to +105°C Operating Temperature Range

Quick Start

Required Equipment

- MAX25540 EV kit
- 4.5V to 36V, 2A 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-J2, J5-J7, J9, J12-J13, J19.
- 2) Verify that shunts are installed across pins 2-3 on jumpers J3, J10.
- 3) Connect the positive terminal of the power supply to the VIN PCB pad and the negative terminal to the GND1 PCB pad.
- 4) Set the power supply VIN to 12V.
- 5) Turn on the power supply.
- 6) Verify that the green LEDs (DS1, DS2, DS3, DS4, DS6) are all on.
- 7) Verify that the red LEDs (DS5, DS7, DS8) are all off.
- 8) The EV kit by default is equipped with the MAX25540GTP/V+, which regulates the following voltage rails:
 - 3.3V High-Voltage LDO
 - 3.3V High-Voltage Buck
 - 1V Low-Voltage Buck
 - 1.8V Low-Voltage LDO

Ordering Information appears at end of data sheet.

Detailed Description of Hardware

The jumper settings in the following tables show the features of the MAX25540 EV kit.

Power LEDs Enable (J7, J6)

The green LEDs (DS6, DS4) are used to indicate that the EV kit is powered on. DS6 on indicates that the input power is present and DS4 on indicates that the LDO1 output is on. The LEDs can be disconnected from the power supply, which allows a precise current-consumption evaluation. For more details, see the [Table 1](#).

Output power LEDs (J1, J2, J5)

The green LEDs (DS2, DS3, DS1) are used to indicate that the outputs are powered on. The LEDs can be disconnected from the power supply, which allows a precise current-consumption evaluation. For more details, see the [Table 2](#).

Digital Domain Voltage (J3)

The EV kit exposes the open-drain power-good signals (PG1, PGB and PGOOD) that are pulled up to what is referred to as the digital-domain voltage. Digital-domain voltage can be selected between the MAX25540 high-voltage LDO (LDO1) and an external voltage applied to the EXT_DVDD pad. For more details, see the [Table 3](#).

START, WAKE and FIN Enable (J8, J9, J10, J13)

The MAX25540 digital input signals START, WAKE, and FIN can be driven externally using the respective PADS or forced high/low with the J8, J10 and J13 jumpers. For more details, see the [Table 4](#).

For this application, it is advisable to connect START and WAKE together through the J9 jumper and drive only the START pin. For more details, see the [Table 5](#).

Table 1. Jumper Functions (J7, J6)

SHUNT POSITION	LED_EN (J7)	LDO1 (J6)
1-2*	DS6 connected	DS4 connected
Open	DS6 disconnected	DS4 disconnected

*Default position.

Table 2. Jumper Functions (J1, J2, J5)

SHUNT POSITION	HV_BUCK (J1)	LV_BUCK (J5)	LDO2 (J2)
1-2*	DS2 connected	DS1 connected	DS3 connected
Open	DS2 disconnected	DS1 disconnected	DS3 disconnected

*Default position.

Table 3. Jumper Functions (J3)

SHUNT POSITION	DIGITAL DOMAIN
1-2	EXT_DVDD
2-3*	LDO1

*Default position.

Table 4. Jumper Functions (J8, J10, J13)

SHUNT POSITION	WAKE (J8), FIN (J10), START (J13)
1-2*	High
2-3**	Low
Open***	Externally controlled

*Default position for J13.

**Default position for J10.

***Default position for J8.

Table 5. Jumper Functions (J9)

SHUNT POSITION	START=WAKE (J9)
1-2*	WAKE shorted to START
Open	WAKE externally controlled

*Default position.

Frequency Selection (J11, J12)

The jumpers J11 and J12 are used to select the switching frequency. Only one jumper can be installed at a time. For more details, see the [Table 6](#).

HV Buck 400kHz Switching-Frequency Operation

To operate the HV buck at 400kHz switching frequency, the C4 capacitor placeholder must be populated with a ceramic 22µF capacitor and the L1 inductor must be replaced with a 10µH inductor.

Table 6. Jumper Functions (J11, J12)

INSTALLED JUMPER	HV BUCK SWITCHING FREQUENCY	LV BUCK SWITCHING FREQUENCY
J11	400kHz	2MHz
J12*	2.2MHz	2.2MHz

*Default position.

Ordering Information

PART	TYPE
MAX25540EVKIT#	EV kit

#Denotes RoHS-compliant.

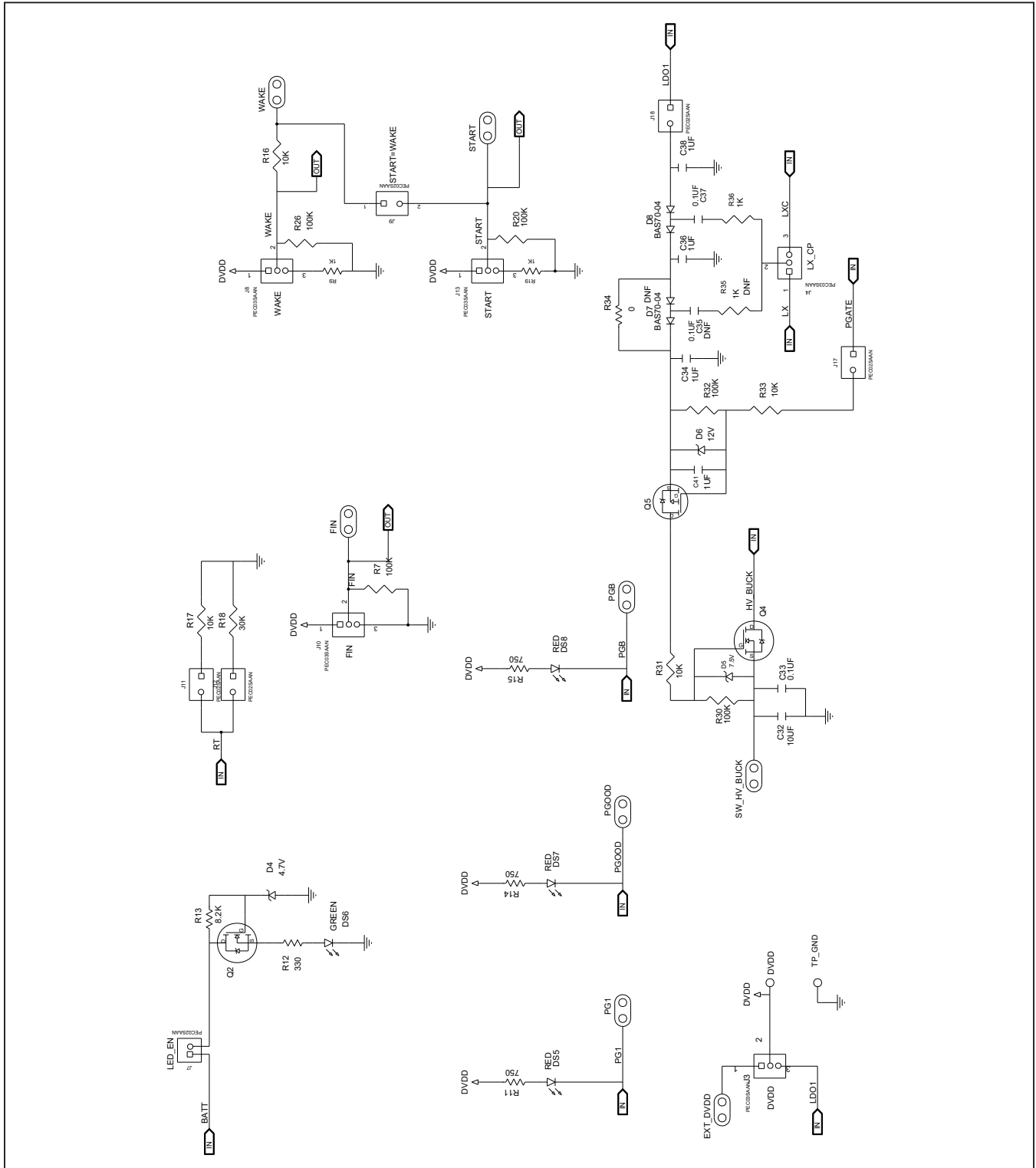
MAX25540 EV Kit Bill of Materials

ITEM	REF_DES	DNI/DNP	QTY	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION	COMMENTS
1	BATT, DVDD, TP_HV_BUCK, TP_LDO1, TP_LDO2, TP_LV_BUCK, TP_PGATE, VIN_FILTER	-	8	5005	KEystone	N/A	TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.35IN; BOARD HOLE=0.063IN; RED; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;	
2	C1, C9, C34, C36, C38, C41	-	6	GRM21BR71H105KA12; CL21B105KBFNNN; C2012X7R1H105K085AC; UMK212B7105KG	MURATA;SAMSUNG ELECTRONICS; TDK;TAIYO YUDEN	1UF	CAP; SMT (0805) 1UF; 10%; 50V; X7R; CERAMIC	
3	C2, C7, C8, C10, C18, C19, C22, C33, C37, C40	-	10	C1608X7S2A104K080AB	TDK	0.1UF	CAP; SMT (0603) 0.1UF; 10%; 100V; X7S; CERAMIC	
4	C5, C6, C23, C24, C39	-	5	GRM32ER71E226KE15; CL32B226KAJNFN; CL32B226KAJNNW; TMK325B7226KM; C1210C226K3RAC7210	MURATA;SAMSUNG;SAMSUNG; TAIYO YUDEN;KEMET	22UF	CAP; SMT (1210) 22UF; 10%; 25V; X7R; CERAMIC	
5	C13	-	1	MAL214699103E3	VISHAY BCCOMPONENTS	100UF	CAP; SMT; 100UF; 20%; 50V; CERAMIC	
6	C14	-	1	GRM188R71A105K; C0603X7R100-10S; C1608X7R1A105K080AC; LMK107B7105KA; CL10B105KP8NFN; LMK107B7105KAH; C0603C105K8RAC; 0603ZC105KAT2A	MURATA;VENKEL LTD;TDK; TAIYO YUDEN;SAMSUNG ELECTRONICS;TAIYO YUDEN;+KEMET;AVX	1UF	CAP; SMT (0603) 1UF; 10%; 10V; X7R; CERAMIC;	
7	C16	-	1	GRM155R71E104KE14; C1005X7R1E104K050BB; TMK105B7104KVH; CGJ2B3X7R1E104K050BB	MURATA;TDK;TAIYO YUDEN;TDK	0.1UF	CAP; SMT (0402) 0.1UF; 10%; 25V; X7R; CERAMIC	
8	C17	-	1	GRJ32ER71H106KE11	MURATA	10UF	CAP; SMT (1210) 10UF; 10%; 50V; X7R; CERAMIC	
9	C21	-	1	CGA4J1X7S1E106K125AC	TDK	10UF	CAP; SMT (0805) 10UF; 10%; 25V; X7S; CERAMIC	
10	C32	-	1	GRM32ER71J106KA12	MURATA	10UF	CAP; SMT (1210) 10UF; 10%; 63V; X7R; CERAMIC	
11	D1	-	1	PDS1040	DIODES INCORPORATED	PDS1040	DIODE; SCH; SMT (POWERDI-5); PIV=40V; IF=10A	
12	D2	-	1	B350A-13-F	DIODES INCORPORATED	B350A	DIODE; SCH; SMA (DO-214AC); PIV=50V; IF=3A	
13	D3	-	1	BZT52C18-7-F	DIODES INCORPORATED	18V	DIODE; ZNR; SMT (SOD-123); Vz=18V; Iz=0.005A; -65 DEGC TO +150 DEGC	
14	D4	-	1	BZX84C 4V7	FAIRCHILD SEMICONDUCTOR	4.7V	DIODE; ZNR; SMT (SOT-23); PIV=4.7V; IF=0.25A	
15	D5	-	1	BZT52C7V5-7-F	DIODES INCORPORATED	7.5V	DIODE; ZNR; SMT (SOD-123); Vz=7.5V; Iz=0.005A	
16	D6	-	1	MM3Z12VT1G	ON SEMICONDUCTOR	12V	DIODE; ZNR; SMT (SOD-323); PIV=12V; Iz=0.005A	
17	D8	-	1	BAS70-04FILM	STMICROELECTRONICS	BAS70-04	DIODE; SCHOTTKY SMALL SIGNAL; PIV=70V; IF(max)=0.070A; PD=0.25W	
18	DS1-DS4, DS6	-	5	LTST-C170GKT	LITE-ON ELECTRONICS INC	LTST-C170GKT	DIODE; LED; STANDARD; GREEN; SMT (0805); PIV=2.1V; IF=0.01A	GREEN
19	DS5, DS7, DS8	-	3	LTST-C170EKT	LITE-ON ELECTRONICS INC	LTST-C170EKT	DIODE; LED; STANDARD; RED; SMT (0805); PIV=2.0V; IF=0.02A	RED
20	EXT_DVDD, FIN, GND1-GND6, HV_BUCK, LDO1, LDO2, LV_BUCK, PG1, PGB, PGOOD, START, SW_HV_BUCK, SW_VIN, VIN, WAKE	-	20	9020 BUSS	WEICO WIRE	MAXIMPAD	EVK KIT PARTS; MAXIM PAD; WIRE; NATURAL; SOLID; WEICO WIRE; SOFT DRAWN BUS TYPE-S; 20AWG	
21	J1, J2, J5-J7, J9, J11, J12, J17-J19	-	11	PEC02SAAN	SULLINS ELECTRONICS CORP.	PEC02SAAN	EVKIT PART-CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 2PINS;	
22	J3, J4, J8, J10, J13	-	5	PEC03SAAN	SULLINS	PEC03SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 3PINS	
23	L1	-	1	74437346022	WURTH ELECTRONICS INC	2.2UH	INDUCTOR; SMT; SHIELDED; 2.2UH; 20%; 6.5A	
24	L2	-	1	74438357022	WURTH ELECTRONICS INC	2.2UH	INDUCTOR; SMT; SHIELDED; 2.2UH; TOL=+/-20%; 5.2A	
25	L3	-	1	VLS4012CX-1R0M-1	TDK	1UH	INDUCTOR; SMT; COMPOSITE; 1UH; 20%; 3.44A	
26	L4	-	1	74279223560	WURTH ELECTRONICS INC	56	INDUCTOR; SMT; FERRITE-BEAD; 56 AT 100MHZ; 10A	
27	Q1	-	1	SUM55P06-19L-E3	VISHAY SILICONIX	SUM55P06-19L-E3	TRAN; P-CHANNEL 60V D-S ENHANCEMENT MODE MOSFET; PCH; TO-263-3; PD-(3.75W); I(-SSA); V(-60V)	
28	Q2	-	1	BSS138LT1G	ON SEMICONDUCTOR	BSS138LT1G	TRAN; POWER MOSFET; N-CHANNEL; NCH; SOT-23; PD-(0.225W); I(0.2A); V(-50V)	

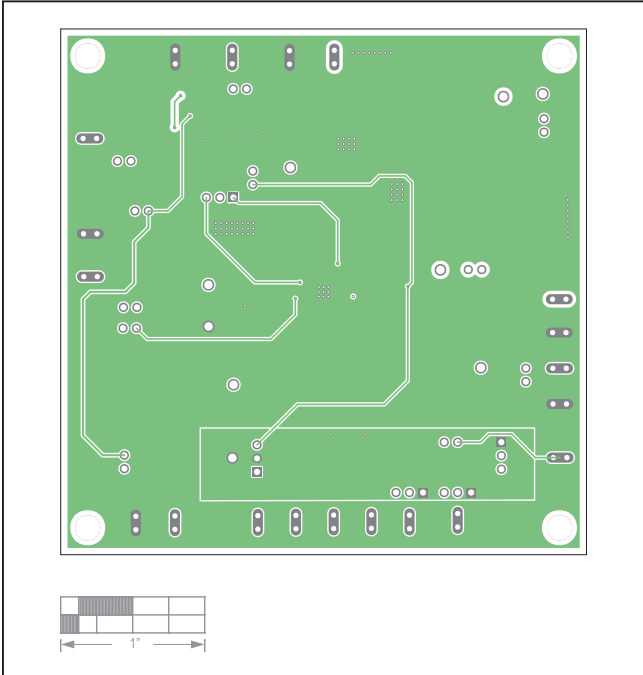
MAX25540 EV Kit Bill of Materials (continued)

ITEM	REF_DES	DNI/DNP	QTY	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION	COMMENTS
29	Q3, Q6	-	2	IRLML6346	INTERNATIONAL RECTIFIER	IRLML6346	TRAN: HEXFET POWER MOSFET; NCH; SOT-23; PD-(1.3W); I(0.00025A); V-(30V)	
30	Q4	-	1	SQ2310ES-T1_GE3	VISHAY SILICONIX	SQ2310ES-T1_GE3	TRAN: NCH; SOT-23; PD-(2W); I(6A); V-(20V)	
31	Q5	-	1	BSS84	FAIRCHILD SEMICONDUCTOR	BSS84	ENHANCEMENT MODE FIELD EFFECT TRANSISTOR, P-CHANNEL, SOT-23, PD=0.36W, ID=0.13A, VDSS=-50V, -55degC TO +150degC	
32	R1, R2, R8, R10, R12	-	5	CRCW0603330R0FK	VISHAY DALE	330	RES: SMT (0603); 330; 1%; +/-100PPM/DEGC; 0.1000W	
33	R5	-	1	ERJ-2GEOR00	PANASONIC	0	RES: SMT (0402); 0; JUMPER; JUMPER; 0.1000W	
34	R6	-	1	CRCW060318K0FK	VISHAY DALE	18K	RES: SMT (0603); 18K; 1%; +/-100PPM/DEGC; 0.1000W	
35	R7, R20, R22, R26, R30, R32, R37	-	7	CRCW0603100KFK; RC0603FR-07100KL; RC0603FR-13100KL; ERJ-3EKF1003; AC0603FR-07100KL	VISHAY DALE;YAGEO;YAGEO; PANASONIC	100K	RES: SMT (0603); 100K; 1%; +/-100PPM/DEGC; 0.1000W	
36	R9, R19, R36	-	3	CRCW06031K00FK; ERJ-3EKF1001; CR0603AFX-1001ELF	VISHAY; PANASONIC;BOURNS	1K	RES: SMT (0603); 1K; 1%; +/-100PPM/DEGC; 0.1000W	
37	R11, R14, R15	-	3	CRCW0603750R0FK; ERJ-3EKF7500	VISHAY DALE;PANASONIC	750	RES: SMT (0603); 750; 1%; +/-100PPM/DEGC; 0.1000W	
38	R13	-	1	CRCW08058K20FK	VISHAY DALE	8.2K	RES: SMT (0805); 8.2K; 1%; +/-100PPM/DEGC; 0.1250W	
39	R16, R17, R31, R33	-	4	CRCW060310K0FK; ERJ-3EKF1002; AC0603FR-0710KL; RMC0603FT10K0	VISHAY DALE;PANASONIC;YAGEO	10K	RES: SMT (0603); 10K; 1%; +/-100PPM/DEGC; 0.1000W	
40	R18	-	1	CRCW060330K0FK	VISHAY DALE	30K	RES: SMT (0603); 30K; 1%; +/-100PPM/DEGC; 0.1000W	
41	R34	-	1	CRCW06030000Z0	VISHAY DALE	0	RES: SMT (0603); 0; JUMPER; JUMPER; 0.1000W	
42	R50	-	1	CRCW06031K40FK	VISHAY DALE	1.4K	RES: SMT (0603); 1.4K; 1%; +/-100PPM/DEGC; 0.1000W	
43	SPACER1-SPACER4	-	4	9032	KEYSTONE	9032	MACHINE FABRICATED; ROUND-THRU HOLE SPACER; NO THREAD; M3.5; 5/8IN; NYLON	
44	TP_GND	-	1	5121	KEYSTONE	N/A	TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.35IN; BOARD HOLE=0.063IN; GREEN; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH	
45	U1	-	1	MAX25540GTP/V+	MAXIM	MAX25540GTP/V+	IC; PWARM; AUTOMOTIVE 4-OUTPUT DISPLAY POWER SOLUTION; PACKAGE OUTLINE: 21-100172; LAND PATTERN: 90-0409; TOFN20-EP	
46	PCB	-	1	MAX25540	MAXIM	PCB	PCB:MAX25540	
47	C3, C4	DNP	0	GRM32ER71E226KE15; CL32B226KAJNFN; CL32B226KAJNFW; TMK325B7226KM; C1210C226K3RAC7210	MURATA;SAMSUNG;SAMSUNG; TAIYO YUDEN;KEMET	22UF	CAP: SMT (1210); 22UF; 10%; 25V; X7R; CERAMIC	
48	C11, C12, C28, C29, C31, C35	DNP	0	C1608X7S2A104K080AB	TDK	0.1UF	CAP: SMT (0603); 0.1UF; 10%; 100V; X7S; CERAMIC	
49	C15, C26, C27, C30	DNP	0	GRJ32ER71H106KE11	MURATA	10UF	CAP: SMT (1210); 10UF; 10%; 50V; X7R; CERAMIC	
50	C20	DNP	0	CGA4J1X7S1E106K125AC	TDK	10UF	CAP: SMT (0805); 10UF; 10%; 25V; X7S; CERAMIC	
51	C25	DNP	0	MAL214699103E3	VISHAY BCCOMPONENTS	100UF	CAP: SMT; 100UF; 20%; 50V; CERAMIC	
52	D7	DNP	0	BAS70-04FILM	STMICROELECTRONICS	BAS70-04	DIODE, SCHOTTKY , SMALL SIGNAL, PIV=70V, IF(max)=0.070A, PD=0.25W	
53	R3, R4, R23, R24	DNP	0	CRCW06030000Z0	VISHAY DALE	0	RES: SMT (0603); 0; JUMPER; JUMPER; 0.1000W	
54	R35	DNP	0	CRCW06031K00FK; ERJ-3EKF1001; CR0603AFX-1001ELF	VISHAY; PANASONIC;BOURNS	1K	RES: SMT (0603); 1K; 1%; +/-100PPM/DEGC; 0.1000W	
TOTAL			131					

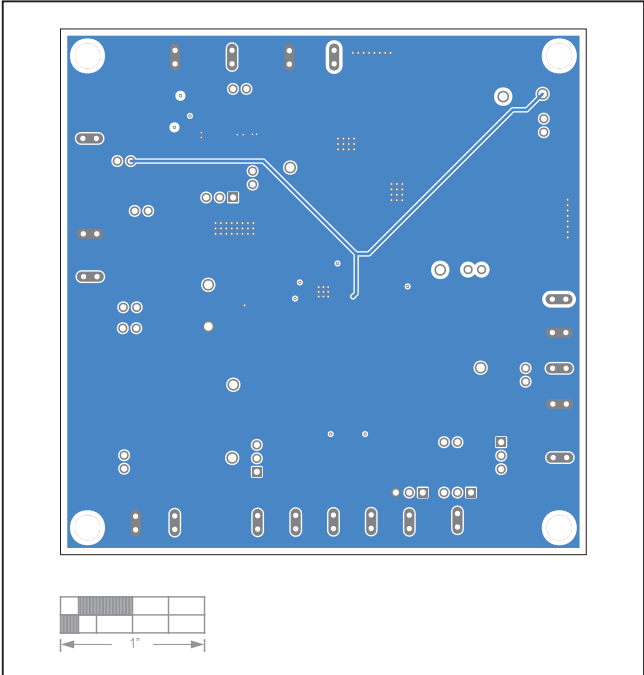
MAX25540 EV Kit Schematic Diagram (continued)



MAX25540 EV Kit PCB Layout Diagrams (continued)



MAX25540 EV Kit PCB Layout - Internal Layer 3



MAX25540 EV Kit PCB Layout - Bottom Layer

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	10/21	Initial release	—

