*Click **here** for production status of specific part numbers.*

MAX16923 Evaluation Kit

Evaluates: MAX16923/MAX16926

General Description

The MAX16923 evaluation kit (EV kit) is a fully assembled and tested surface-mount PCB used to evaluate the MAX16923 automotive 4-output display-power solution. The MAX16923 is a 4-channel power-management IC designed to accommodate the main rails used in modern automotive TFT displays. The MAX16923 integrates a high-voltage buck converter that transforms battery voltages into a 5V or 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 an LDO running off the intermediate rail. A single START control pin initiates the start-up sequence, thereby simplifying device control. The MAX16923's external PMOSFET control block allows battery voltage to be switched to a downstream device, such as a backlight boost converter. The MAX16923 also embeds a watchdog timer and selectable switching frequencies with spread spectrum.

Benefits and Features

- 4.5V to 36V Wide Input Voltage Range (40V Load-Dump Tolerant)
- One High-Voltage 2.1A Buck Converter (5V or 3.3V)
- One High-Voltage 100mA Low-IQ Linear Regulator (3.3V)
- One Low-Voltage 1.6A Buck Converter (3.3V, 1.8V, 1.2V, or 1.1V)
- One Low-Voltage 180mA Linear Regulator (3.3V, 1.8V, 1.5V or 1.1V)
- Power-Good Outputs
- Integrated Watchdog Timer
- Programmable Switching Frequency (400Khz, 440Khz, 2Mhz, 2.2MHz)
- Spread Spectrum
- Proven PCB Layout
- Automotive CISPR25 CLASS5 compliant
- Fully Assembled and Tested

Quick Start

Required Equipment

- MAX16923 EV kit
- 12V, 2A power supply

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, J16, J19.
2) Verify that shunts are installed across pins 2-3 on jumpers J3, J8, J10.
3) Connect the positive terminal of the power supply to the V_{IN} PCB pad and the negative terminal to the GND1 PCB pad.
4) Set the power supply V_{IN} to 12V.
5) Turn on the power supply.
6) Verify that the green LEDs (DS1, DS2, DS3, DS4, DS6) are all on.
7) The EV kit by default is equipped with the MAX16923GTPA, which regulates the following voltage rails:
   - 3.3V High-Voltage LDO
   - 5V High-Voltage Buck
   - 3.3V Low-Voltage Buck
   - 3.3V Low-Voltage LDO

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

319-100444; Rev 1; 4/20

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Detailed Description of Hardware

The jumper settings in the following tables illustrate features of the MAX16923 EV kit.

Digital Domain Voltage (J3)

The EV kit exposes 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 MAX16923 high-voltage LDO (LDO1) and an external voltage applied to the EXT_DVDD pad (see Table 1).

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

The MAX16923 digital input signals START, WAKE, and FIN can be driven externally using the respective PADS, or forced high/low with the J8, J9, and J10 jumpers.

Switching Frequency Selection (J11-J16)

Jumpers J11 to J16 are used to select the switching frequency and enable the watchdog functionality. Only one jumper can be installed at time, as shown in Table 3.

HV Buck 400/440Khz Switching-Frequency Operation

In order to operate the HV buck at 400Khz or 440Khz 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 1. Jumper Functions (J3)

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

**Default position.*

Table 2. Jumper Functions (J8, J9, J10)

SHUNT POSITION	MAX20084
1-2*	High
2-3**	Low
Open	Externally controlled

**Default position for J9.*

***Default position for J8 and J10.*

Table 3. Jumper Functions (J11-J16)

INSTALLED JUMPER	HV SWITCHING FREQUNCY	LV SWITCHING FREQUENCY	WHATCHDOG FUNCTIONALITY
J11	400Khz	2Mhz	Enabled
J12	440Khz	2.2Mhz	Enabled
J13	2Mhz	2Mhz	Enabled
J14	2.2Mhz	2.2Mhz	Enabled
J15	400Khz	2Mhz	Disabled
J16	2.2Mhz	2.2Mhz	Disabled

**Default position.*

Ordering Information

PART	TYPE
MAX16923EVKIT#	EV Kit

 # Denotes RoHS-compliant.

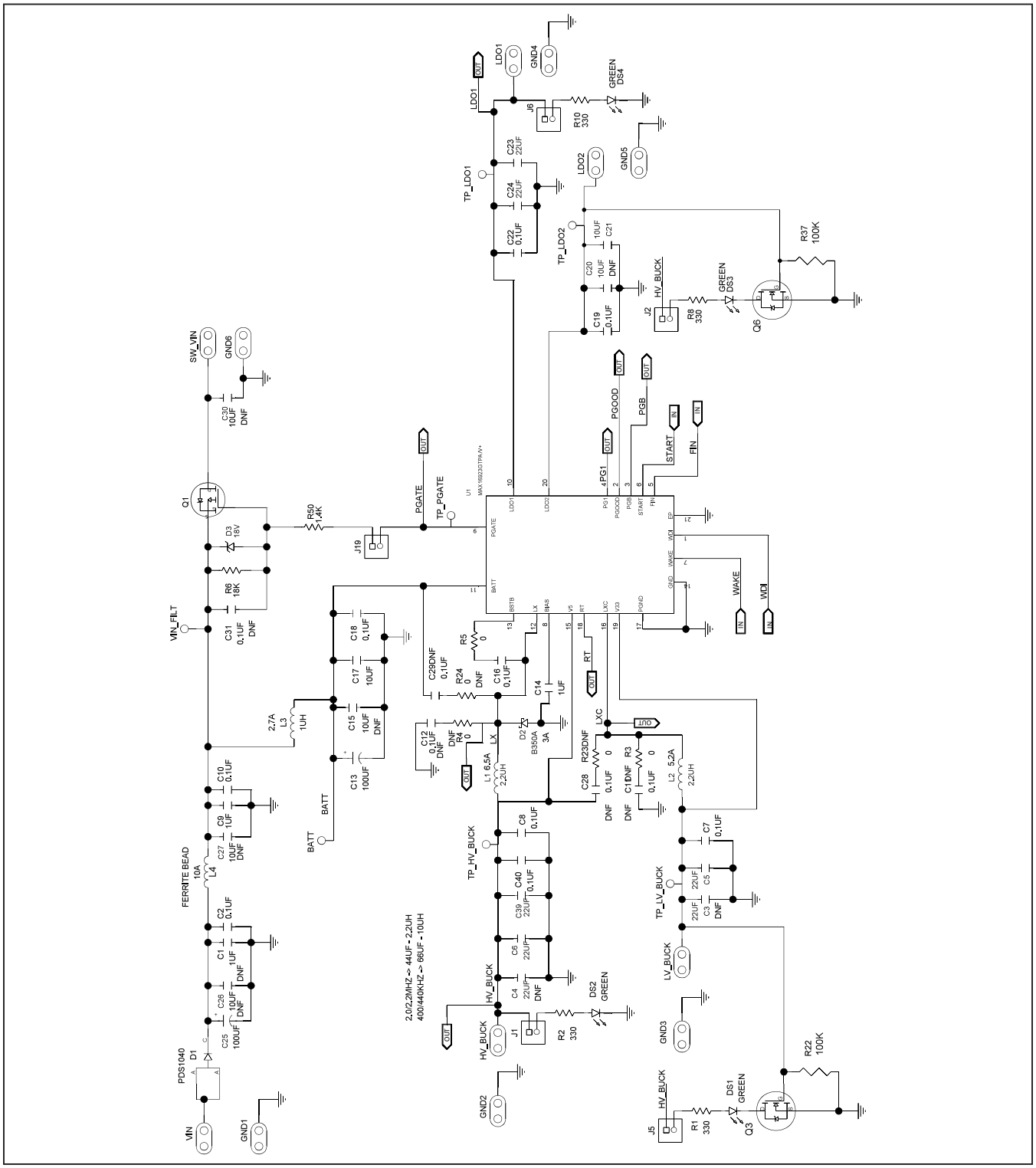
MAX16923 EV Kit Bill of Materials

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_FILT	-	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; 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	C2, C7, C8, C10, C18, C19, C22, C33, C37, C40	-	10	CGA3E3X7S2A104K080AB; C1608X7S2A104K080AB	TDK;TDK	0.1UF	CAPACITOR; SMT (0603); CERAMIC CHIP; 0.1UF; 100V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7S	
4	C5, C6, C23, C24, C39	-	5	GRM32ER71E226KE15; CL32B226KAJNFN; CL32B226KAJNNW; TMK325B7226KM	MURATA; SAMSUNG ELECTRO-MECHANICS;TA	22UF	CAPACITOR; SMT (1210); CERAMIC CHIP; 22UF; 25V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R	
5	C13	-	1	MAL214699103E3	VISHAY BCCOMPONENTS	100UF	CAPACITOR; SMT; ALUMINUM-ELECTROLYTIC; 100UF; 50V; TOL=20%	
6	C14	-	1	GRM188R71A105K; C0603X7R100-105; C1608X7R1A105K080AC; LMK107B7105KA; CL10B105KP8NFN; LMK107B7105KAH; C0603C105K8RAC	MURATA;VENKEL LTD; TDK;TAIYO YUDEN; SAMSUNG ELECTRONICS; TAIYO YUDEN;KEMET	1UF	CAPACITOR; SMT (0603); CERAMIC CHIP; 1UF; 10V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R;	
7	C16	-	1	GRM155R71E104KE14; C1005X7R1E104K050BB; TMK105B7104KVH; CGJ2B3X7R1E104K050BB	MURATA;TDK; TAIYO YUDEN;TDK	0.1UF	CAPACITOR; SMT (0402); CERAMIC CHIP; 0.1UF; 25V; TOL=10%; MODEL=GRM SERIES; TG=-55 DEGC TO +125 DEGC; TC=X7R	
8	C17	-	1	GRJ32ER71H106KE11	MURATA	10UF	CAPACITOR; SMT (1210); CERAMIC CHIP; 10UF; 50V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R	
9	C20, C21	-	2	TMK212BBJ106KG-T; CL21A106KAFN3N	TAIYO YUDEN; SAMSUNG ELECTRO-MECHANI	10UF	CAPACITOR; SMT (0805); CERAMIC CHIP; 10UF; 25V; TOL=10%; MODEL=; TG=-55 DEGC TO +85 DEGC; TC=X5R	
10	C32	-	1	GRM32ER71J106KA12	MURATA	10UF	CAPACITOR; SMT (1210); CERAMIC CHIP; 10UF; 63V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R	
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; Izm=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, WDI	-	21	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, J11-J19	-	14	PBC02SAAN	SULLINS ELECTRONICS CORP.	PBC02SAAN	EVKIT PART-CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 2PINS; -65 DEGC TO +125 DEGC;	
22	J3, J4, J8-J10	-	5	PEC03SAAN	SULLINS ELECTRONICS CORP.	PEC03SAAN	EVKIT PART-CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 3PINS; -65 DEGC TO +125 DEGC;	
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	VLF5010ST-1R0N2R5	TDK	1UH	INDUCTOR; SMT; MAGNETICALLY SHIELDED FERRITE BOBBIN CORE; 1UH; TOL=+/-30%; 2.7A; -40 DEGC TO +105 DEGC	
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-(-55A); V-(-60V)	

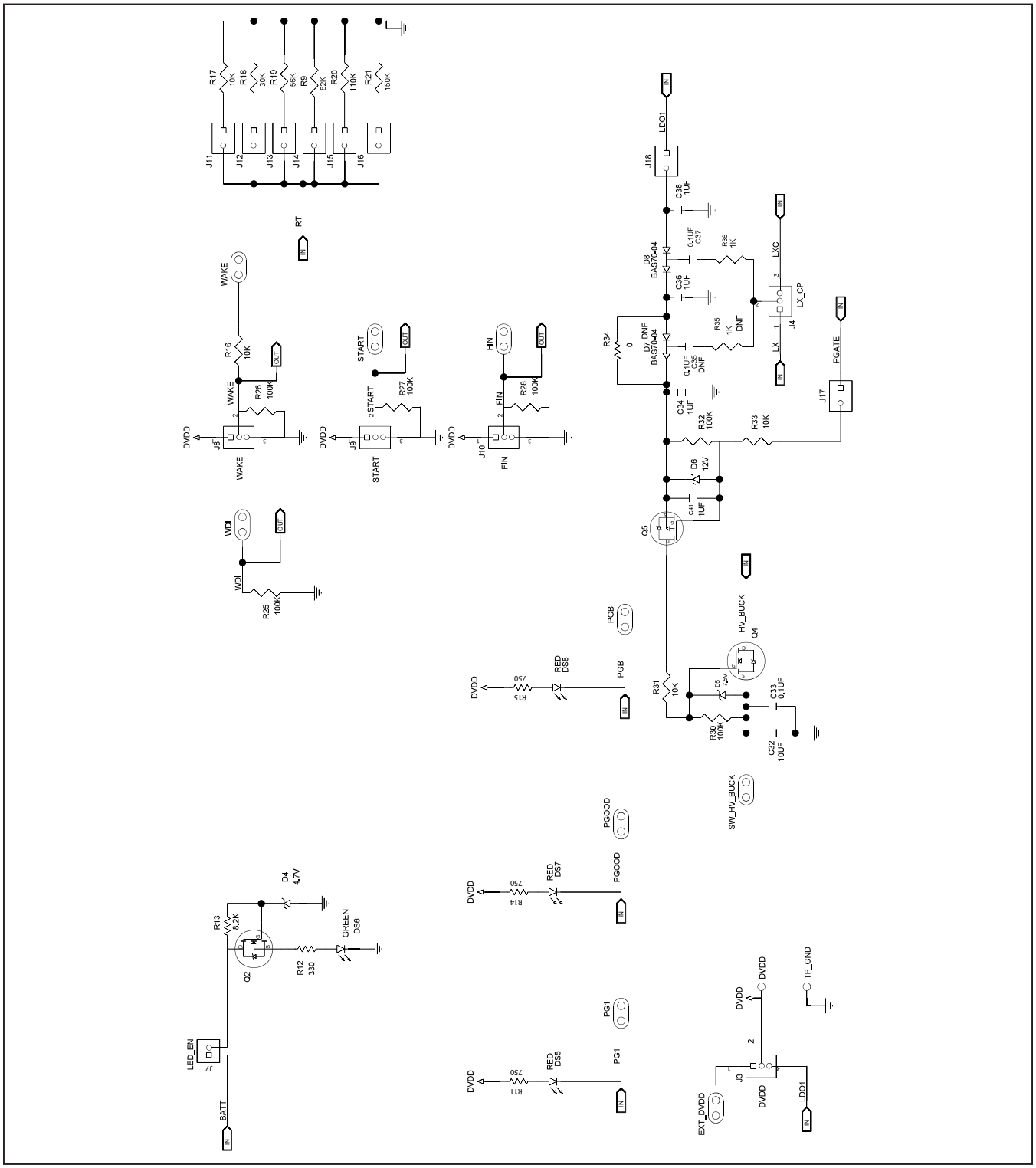
MAX16923 EV Kit Bill of Materials (continued)

ITEM	REF_DES	DNI/DNP	QTY	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION	COMMENTS
28	Q2	-	1	BSS138LT1G	ON SEMICONDUCTOR	BSS138LT1G	TRAN; POWER MOSFET; N-CHANNEL; NCH; SOT-23; PD-(0.225W); I-(0.2A); V-(50V)	
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	CRCW0603330RFK	VISHAY DALE	330	RESISTOR; 0603; 330 OHM; 1%; 100PPM; 0.10W; THICK FILM	
33	R5	-	1	ERJ-2GE0R00	PANASONIC	0	RESISTOR; 0402; 0 OHM; 0%; JUMPER; 0.10W; THICK FILM	
34	R6	-	1	CRCW060318K0FK	VISHAY DALE	18K	RESISTOR, 0603, 18K OHM, 1%, 100PPM, 0.10W, THICK FILM	
35	R9	-	1	CRCW060382K0FK	VISHAY DALE	82K	RESISTOR, 0603, 82K OHM, 1%, 100PPM, 0.10W, THICK FILM	
36	R11, R14, R15	-	3	CRCW0603750RFK; ERJ-3EKF7500	VISHAY DALE;PANASONIC	750	RESISTOR, 0603, 750 OHM, 1%, 100PPM, 0.10W, THICK FILM	
37	R13	-	1	CRCW08058K20FK	VISHAY DALE	8.2K	RESISTOR; 0805; 8.2K OHM; 1%; 100PPM; 0.125W; THICK FILM	
38	R16, R17, R31, R33	-	4	CRCW060310K0FK; ERJ-3EKF1002	VISHAY DALE;PANASONIC	10K	RESISTOR; 0603; 10K; 1%; 100PPM; 0.10W; THICK FILM	
39	R18	-	1	CRCW060330K0FK	VISHAY DALE	30K	RESISTOR; 0603; 30K OHM; 1%; 100PPM; 0.10W; THICK FILM	
40	R19	-	1	CRCW060356K0FK	VISHAY DALE	56K	RESISTOR, 0603, 56K OHM, 1%, 100PPM, 0.10W, THICK FILM	
41	R20	-	1	CRCW0603110KFK	VISHAY DALE	110K	RESISTOR, 0603, 110K, 1%, 100PPM, 0.10W, THICK FILM	
42	R21	-	1	CRCW0603150KFK	VISHAY DALE	150K	RESISTOR, 0603, 150K OHM,1%, 100PPM, 0.10W, THICK FILM	
43	R22, R25-R28, R30, R32, R37	-	8	CRCW0603100KFK; RC0603FR-07100KL; RC0603FR-13100KL; ERJ-3EKF1003; AC0603FR-07100KL	VISHAY DALE;YAGEO; YAGEO;PANASONIC	100K	RESISTOR; 0603; 100K; 1%; 100PPM; 0.10W; THICK FILM	
44	R34	-	1	CRCW06030000Z0	VISHAY DALE	0	RESISTOR; 0603; 0 OHM; 0%; JUMPER; 0.1W; THICK FILM	
45	R36	-	1	CRCW06031K00FK; ERJ-3EKF1001	VISHAY DALE;PANASONIC	1K	RESISTOR; 0603; 1K; 1%; 100PPM; 0.10W; THICK FILM	
46	R50	-	1	CRCW06031K40FK	VISHAY DALE	1.4K	RESISTOR; 0603; 1.4K OHM; 1%; 100PPM; 0.1W; THICK FILM	
47	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;	
48	U1	-	1	MAX16923GTPA/V+	MAXIM	MAX16923GTPA/V+	IC; PWRM; AUTOMOTIVE 4-OUTPUT DISPLAY POWER SOLUTION; TQFN20-EP; PACKAGE OUTLINE: 21-100172; LAND PATTERN: 90-0409	
49	PCB	-	1	MAX16923	MAXIM	PCB	PCB:MAX16923	-
50	C3, C4	DNP	0	GRM32ER71E226KE15; CL32B226KAJNFN; CL32B226KAJNNW; TMK325B7226KM	MURATA;SAMSUNG ELECTRO-MECHANICS;TA	22UF	CAPACITOR; SMT (1210); CERAMIC CHIP; 22UF; 25V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R	
51	C11, C12, C28, C29, C31, C35	DNP	0	CGA3E3X7S2A104K080AB; C1608X7S2A104K080AB	TDK;TDK	0.1UF	CAPACITOR; SMT (0603); CERAMIC CHIP; 0.1UF; 100V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7S	
52	C15, C26, C27, C30	DNP	0	GRJ32ER71H106KE11	MURATA	10UF	CAPACITOR; SMT (1210); CERAMIC CHIP; 10UF; 50V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R	
53	C25	DNP	0	MAL214699103E3	VISHAY BCCOMPONENTS	100UF	CAPACITOR; SMT; ALUMINUM-ELECTROLYTIC; 100UF; 50V; TOL=20%	
54	D7	DNP	0	BAS70-04FILM	STMICROELECTRONICS	BAS70-04	DIODE, SCHOTTKY , SMALL SIGNAL, PIV=70V, IF(max)=0.070A, PD=0.25W	
55	R3, R4, R23, R24	DNP	0	CRCW06030000Z0	VISHAY DALE	0	RESISTOR; 0603; 0 OHM; 0%; JUMPER; 0.1W; THICK FILM	
56	R35	DNP	0	CRCW06031K00FK; ERJ-3EKF1001	VISHAY DALE;PANASONIC	1K	RESISTOR; 0603; 1K; 1%; 100PPM; 0.10W; THICK FILM	

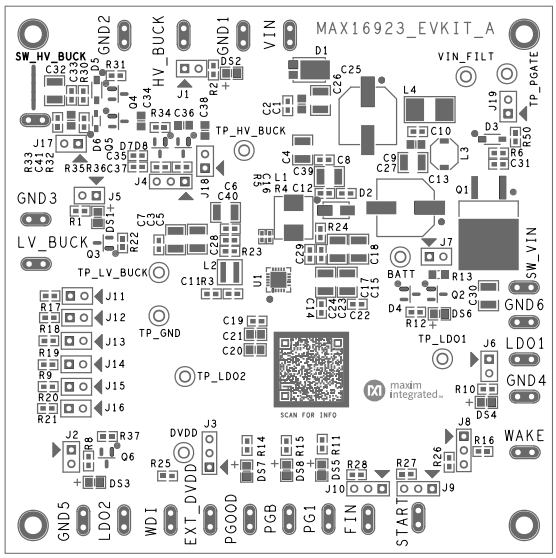
MAX16923 EV Kit Schematic



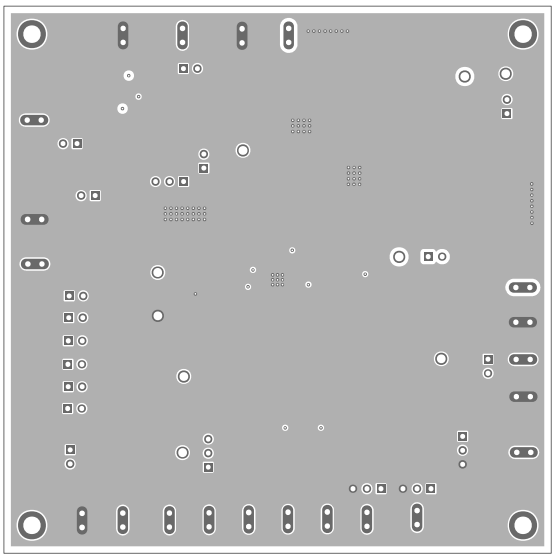
MAX16923 EV Kit Schematic (continued)



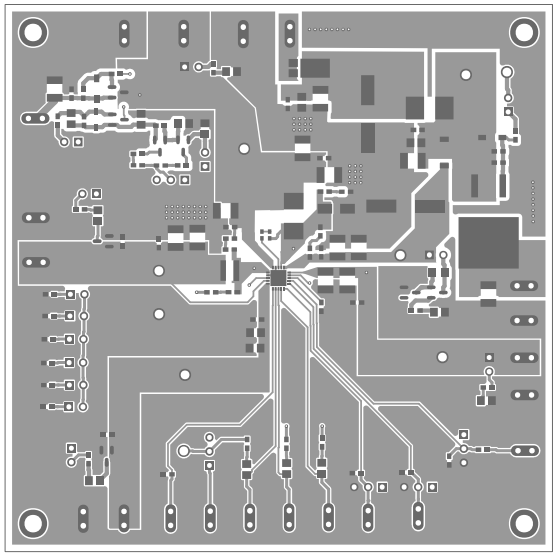
MAX16923 EV Kit Layout



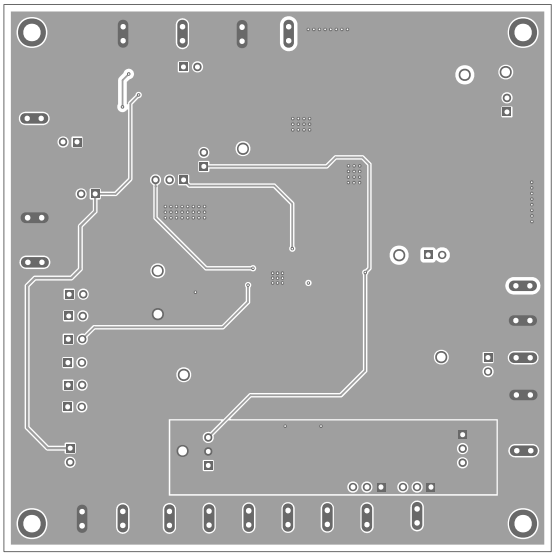
MAX16923 EV Kit PCB Layout - Silk_Top



MAX16923 EV Kit PCB Layout - Internal2

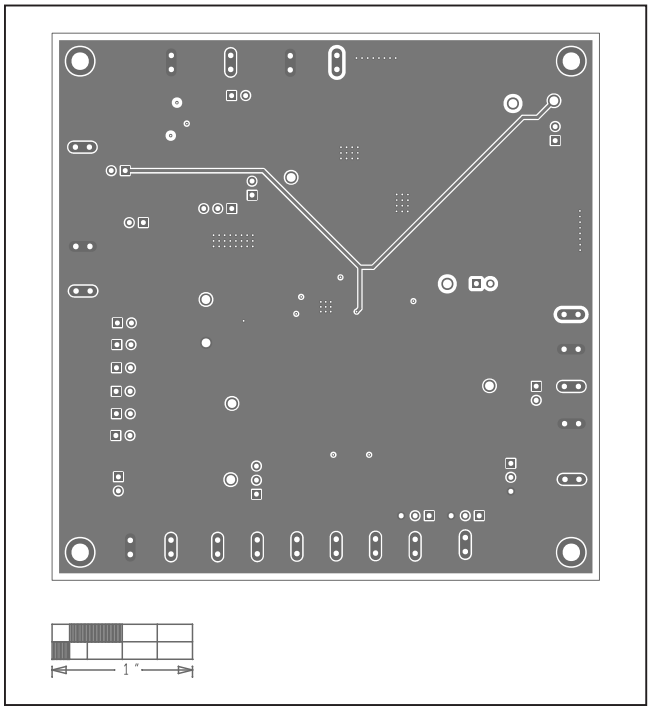


MAX16923 EV Kit PCB Layout - Top

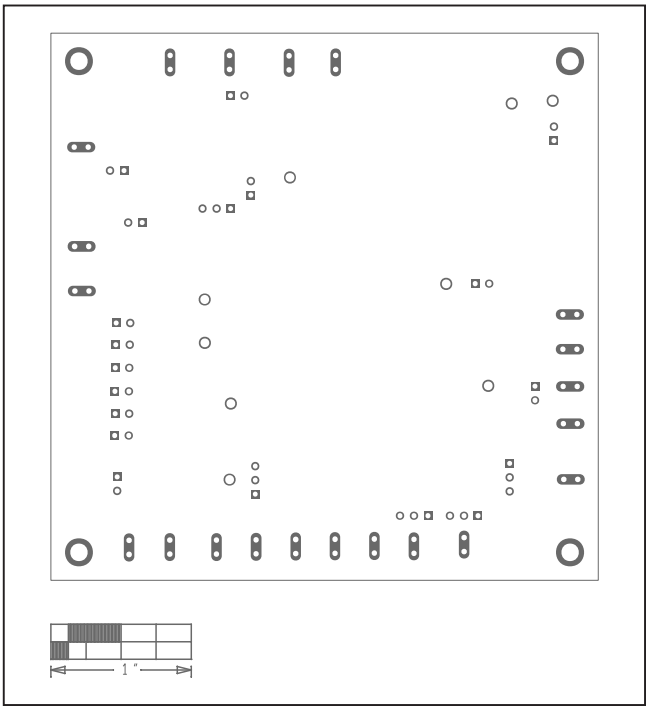


MAX16923 EV Kit PCB Layout - Internal3

MAX16923 EV Kit Layout (continued)



MAX16923 EV Kit PCB Layout - Bottom



MAX16923 EV Kit PCB Layout - Silk Bottom

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	9/19	Initial release	—
1	4/20	Added MAX16926 to header	1–8

For pricing, delivery, and ordering information, please visit Maxim Integrated's online storefront at https://www.maximintegrated.com/en/storefront/storefront.html.

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