

MAX16141 Evaluation Kit

Evaluates: MAX16141

General Description

The MAX16141 evaluation kit (EV kit) evaluates the MAX16141 IC family. The MAX16141 is a diode controller and protection device that protects systems against fault conditions, such as reverse-current, overcurrent, input over-voltage/undervoltage, short-circuit, and overtemperature. The MAX16141 EV kit comes with the MAX16141AAFV+ IC installed. The MAX16141 EV kit undervoltage/overvoltage thresholds are set to 8.6V/36.2V, respectively.

Features

- 8.6V to 36.2V Undervoltage/Overvoltage Thresholds
- Output Short-Circuit Protection
- Resistor Adjustable Overvoltage and Undervoltage Trip Threshold
- Proven 2-Layer, 2oz Copper PCB Layout
- Demonstrates Compact Solution Size
- Fully Assembled and Tested

MAX16141 EV Kit Files

FILE	DESCRIPTION
MAX16141 EV BOM	EV Kit Bill of Material
MAX16141 EV PCB Layout	EV Kit Layout
MAX16141 EV Schematic	EV Kit Schematic

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

Quick Start

Required Equipment

- MAX16141 EV kit
- 40V, 10A DC power supply
- One digital multimeter (DMM)

Procedure

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

Caution: Do not turn on power supply until all connections are completed.

- 1) Verify that shunts are installed onto their respective default positions for jumpers JU1–JU3 ([Table 1](#), [Table 2](#), and [Table 3](#)).
- 2) Connect the power supply between the IN and SYSGND terminal posts.
- 3) Connect the DMM between the OUT and SYSGND terminal posts.
- 4) Turn on the power supply.
- 5) Manually sweep the power supply from 8.6V to 36.2V. Verify that the output voltage at OUT approximately follows the input voltage at IN.
- 6) Increase the input voltage to 37V.
- 7) Verify that the output voltage is 0V (overvoltage protection)
- 8) Set the input voltage to 12V and verify that OUT is also about 12V.
- 9) Using an insulated shorting cable, take caution to hold the insulated parts of the shorting cable while shorting OUT to SYSGND, and verify that the output voltage is 0V (Short circuit protection).
- 10) Remove the shorting cable between OUT and SYSGND and verify that the output voltage is 12V.
- 11) Decrease the input voltage to 7V.
- 12) Verify that the output voltage is approximately 0V (undervoltage protection).

Detailed Description of Hardware

The MAX16141 EV kit evaluates the MAX16141 IC. The MAX16141 is a diode controller and protection device that protects systems against fault conditions such as reverse current, overcurrent, input overvoltage/undervoltage, short circuit and over temperature. The MAX16141 EV kit's undervoltage and overvoltage thresholds are configured to 8.6V and 36.2V, respectively.

The MAX16141 EV kit comes with the MAX16141ATE+ (16-TQFN) installed and is configured to operate normally between 8.6V and 36.2V. Under normal operation, the output follows the input. The output will shut down (0V) when the input is risen above 36.2V (i.e., 37V or higher), or drop below 8.6V (i.e., 7V or lower). The output will also shut down when the load at the output goes above 5A, or in an event of a short circuit at the output.

SHDN

The MAX16141 EV kit provides a jumper (JU1) to enable or disable the MAX16141. Refer to [Table 1](#) for JU1 jumper settings.

SLEEP

The MAX16141 EV kit provides a jumper (JU2) to pullup the active-low sleep mode input of the MAX16141. Refer to [Table 2](#) for JU2 jumper settings.

GATE Snubber

For applications that require slower gate rise time than what is achieved using a resistor from GRC to GND, an external resistor and capacitor (snubber) network can be added from GATE to GND. However, the recommended value is 1kΩ resistor in series with a 10nF cap.

The MAX16141 EV Kit provides a jumper (JU3) to add or remove the snubber at the power MOSFET gates. Refer to [Table 3](#) for jumper settings.

Table 1. SHDN (JU1)

JU1 SHUNT POSITION	DESCRIPTION
Installed*	Enabled. $\overline{\text{SHDN}} = \text{VCC}$ (through pullup resistor R12)
Not Installed	Disabled. $\overline{\text{SHDN}} = \text{SYSGND}$ (through internal pulldown)

*Default position.

Overvoltage Protection

The MAX16141 EV kit shuts down the output when the input voltage exceeds the upper input voltage limit set by resistors R11 and R9 between the TERM and OVSET pins of the MAX16141. Refer to the equation below to set the overvoltage limit for the MAX16141 EV kit.

$$R11 = ((\text{VOV_TH} \times R9) / V_{\text{TH}}) - (R9 + 700\Omega)$$

where,

VOV_TH is the desired overvoltage threshold.

R9 = 10kΩ

V_TH = 0.5V (typ) threshold for OVSET and 700Ω is the TERM switch typical resistance.

Undervoltage Protection

The MAX16141 EV kit shuts down the output when the input voltage drops below the lower input voltage limit set by resistors R10 and R8 between the TERM and UVSET pins of the MAX16141. Refer to the equation below to set the undervoltage limit for the MAX16141 EV kit.

$$R10 = ((V_{\text{UV_TH}} \times R8) / V_{\text{TH}}) - (R8 + 700\Omega)$$

where,

V_UV_TH is the desired undervoltage threshold.

R8 = 10kΩ

V_TH = 0.5V (typ) threshold for UVSET and 700Ω is the TERM switch typical resistance.

Table 2. SLEEP (JU2)

JU2 SHUNT POSITION	DESCRIPTION
Installed*	$\overline{\text{SLEEP}}$ (pullup through resistor R13)
Not Installed	$\overline{\text{SLEEP}}$ (floating)

*Default position.

Table 3. GATE Snubber (JU3)

JU3 SHUNT POSITION	DESCRIPTION
Installed	GATE snubber (R3 and C7) added
Not Installed*	GATE snubber (R3 and C7) removed

*Default position.

Note: Larger cap values will decrease the gate fall time during reverse-voltage fault.

Overcurrent Protection

The MAX16141 EV kit shuts down the output when the load current exceeds the current limit set by the OC_THRESHOLD (See MAX16141 IC data sheet) and the sense resistor R1 between the RS and OUT pins of the MAX16141. Refer to the equation below to set the overcurrent limit for the MAX16141 EV kit.

$$RSENSE = V(RS-OUT)/IOCTH$$

where,

RSENSE is the sense resistor between RS and OUT in Ω,
 V(RS-OUT) is the overcurrent threshold in V (refer to the IC data sheet for the proper value)

IOCTH is the desired overcurrent threshold in A.

Short-Circuit Protection

The MAX16141 EV kit shuts down the output in event the output is shorted to ground. The output will resume normal level, same as the input, when the short at the output is removed.

Evaluating other ICs in the MAX16141 Family

The MAX16141 EV kit comes with the MAX16141AAF/V+ installed. To evaluate other ICs in the MAX16141 IC family, replace U1 with the desired IC and refer to the MAX16141 IC data sheet for additional detail.

Component Suppliers

SUPPLIER	WEBSITE
Central Semiconductor	www.centalsemi.com
Kemet	www.kemet.com
Murata/TOKO	www.murata.com
NXP	www.nxp.com
ON Semiconductor	www.onsemi.com
Panasonic	www.we-online.com

Note: Indicate that you are using the MAX16141 when contacting these component suppliers.

Ordering Information

PART	TYPE
MAX16141EVKIT#	EV Kit

#Denotes RoHS

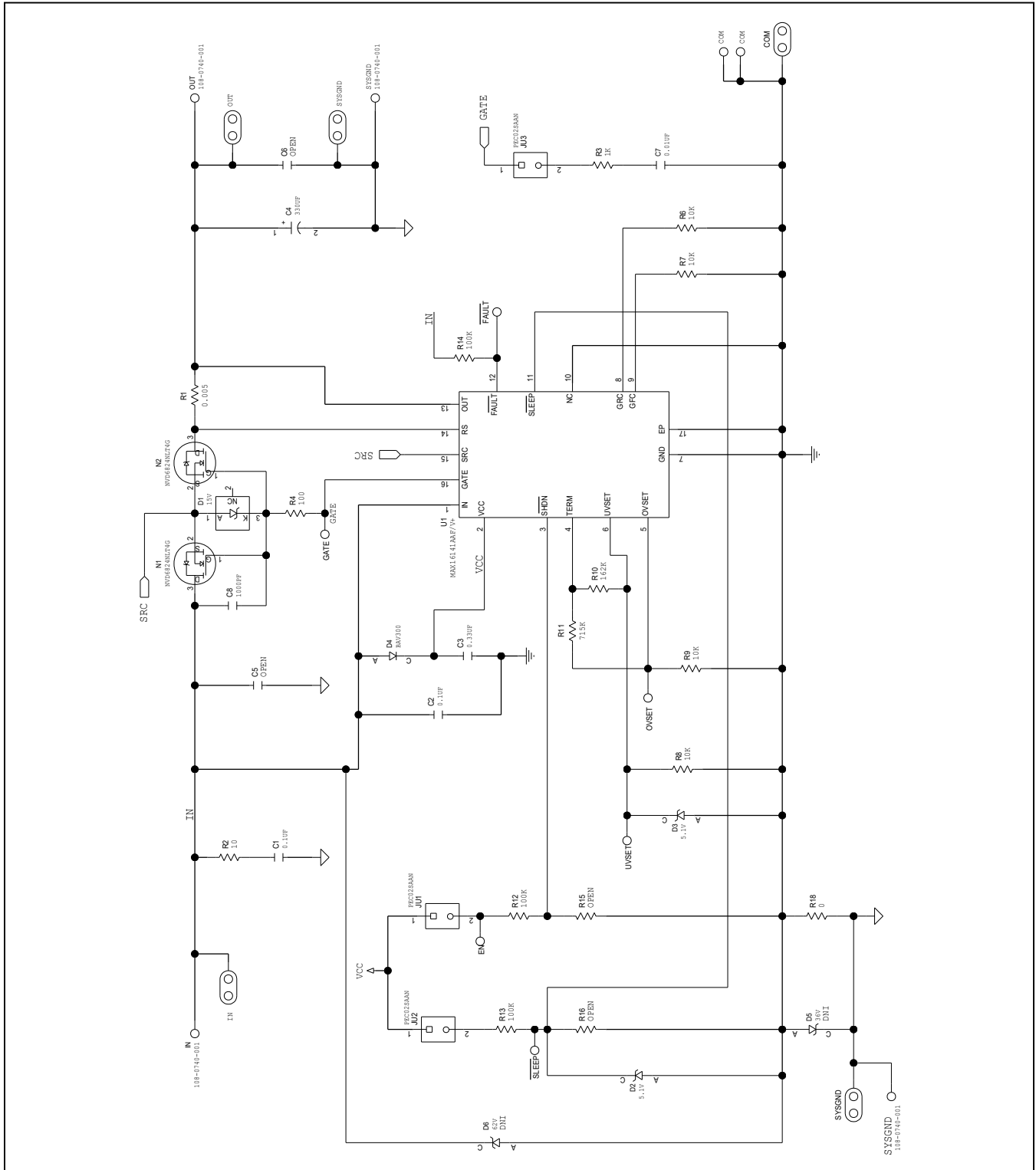
MAX16141 EV Kit Bill of Materials

ITEM	REF_DES	DN/DNP	QTY	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION	COMMENTS
1	C1, C2	-	2	GRM31CR72E104KW03	MURATA	0.1UF	CAPACITOR; SMT (1206); CERAMIC CHIP; 0.1UF; 250V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R	
2	C3	-	1	GRM43DR72E334KW01	MURATA	0.33UF	CAPACITOR; SMT (1812); CERAMIC CHIP; 0.33UF; 250V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R	
3	C4	-	1	EEE-FK1V331GP	PANASONIC	330UF	CAPACITOR; SMT (CASE_G); ALUMINUM-ELECTROLYTIC; 330UF; 35V; TOL=20%	
4	C7	-	1	C0805C103K1RAC; GRM21BR72A103KA01;08 055C103KAT2A	KEMET;MURATA;AVX	0.01UF	CAPACITOR; SMT (0805); CERAMIC CHIP; 0.01UF; 100V; TOL=10%; MODEL=; TG=-55 DEGC TO +125 DEGC; TC=X7R	
5	C8	-	1	GRM1885C1H102JA01; C1608COG1H102J080	MURATA;TDK	1000PF	CAPACITOR; SMT (0603); CERAMIC CHIP; 1000PF; 50V; TOL=5%; TG=-55 DEGC TO +125 DEGC	
6	COM_IN_PAD, OUT_PAD, SYSGND, SYSGND_PAD_OUT	-	5	MAXIMPAD	N/A	MAXIMPAD	EVK KIT PARTS; MAXIM PAD; NO WIRE TO BE SOLDERED ON THE MAXIMPAD	
7	COM_TP1, COM_TP2	-	2	5001	KEYSTONE	N/A	TEST POINT; PIN DIA=0.1IN; TOTAL LENGTH=0.3IN; BOARD HOLE=0.04IN; BLACK; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;	
8	D1	-	1	CMPZ5245B	CENTRAL SEMICONDUCTOR	15V	DIODE; ZNR; SMT (SOT-23); VZ=15V; IZ=0.0085A	
9	D2, D3	-	2	CMHZ5231B	CENTRAL SEMICONDUCTOR	5.1V	DIODE; ZNR; SMT (SOD-123); VZ=5.1V; IZ=0.02A	
10	D4	-	1	BAV300	VISHAY	BAV300	DIODE; SS; SMT (MICROMELF); PIV=60V; IF=0.25A	
11	EN, FAULT, GATE, OVSET, SLEEP, UVSET	-	6	5002	KEYSTONE	N/A	TEST POINT; PIN DIA=0.1IN; TOTAL LENGTH=0.3IN; BOARD HOLE=0.04IN; WHITE; PHOSPHOR BRONZE WIRE SILVER;	
12	IN_OUT, SYSGND_OUT, TP1	-	4	108-0740-001	EMERSON NETWORK POWER	108-0740-001	CONNECTOR; MALE; PANELMOUNT; BANANA JACK; STRAIGHT; 1PIN	
13	JU1-JU3	-	3	PEC02SAAN	SULLINS	PEC02SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 2PINS	
14	N1, N2	-	2	NVD6824NLT4G	ON SEMICONDUCTOR	NVD6824NLT4G	TRAN; POWER MOSFET; NCH; DPAK; PD-(90W); I(41A); V-(100V)	
15	R1	-	1	CSSH2728FT5L00	STACKPOLE ELECTRONICS INC.	0.005	RESISTOR; 2728; 0.005 OHM; 1%; 25PPM; 4W; METAL FOIL	
16	R2	-	1	CRCW121010R0FK	VISHAY DALE	10	RESISTOR; 1210; 10 OHM; 1%; 100PPM; 0.5W; THICK FILM	
17	R3	-	1	TNPW06031K00BE; RG1608P-102-B	VISHAY DALE;SUSUMU CO LTD.	1K	RESISTOR; 0603; 1K OHM; 0.1%; 25PPM; 0.10W; THICK FILM	
18	R4	-	1	RG1608P-101-B; ERA-3YEB101V	SUSUMU CO LTD.;PANASONIC	100	RESISTOR; 0603; 100 OHM; 0.1%; 25PPM; 0.1W; THICK FILM	
19	R6-R9	-	4	CHPHT0603K1002FGT	VISHAY SFERNICE	10K	RESISTOR; 0603; 10K OHM; 1%; 100PPM; 0.0125W; THICK FILM	
20	R10	-	1	CRCW0603162KFK	VISHAY DALE	162K	RESISTOR; 0603; 162K OHM; 1%; 100PPM; 0.1W; THICK FILM	

MAX16141 EV Kit Bill of Materials (continued)

ITEM	REF_DES	DN/DNP	QTY	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION	COMMENTS
21	R11	-	1	CRCW0603715KFK	VISHAY DALE	715K	RESISTOR; 0603; 715K OHM; 1%; 100PPM; 0.10W; METAL FILM	
22	R12-R14	-	3	ERJ-3EKF1003	PANASONIC	100K	RESISTOR; 0603; 100K OHM; 1%; 100PPM; 0.1W; THICK FILM	
23	R18	-	1	RC0402JR-070RL; CR0402-16W-000RJT	YAGEO PHYCOMP;VENKEL LTD.	0	RESISTOR; 0402; 0 OHM; 5%; JUMPER; 0.063W; THICK FILM	
24	SU1-SU3	-	3	S1100-B;SX1100-B	KYCON;KYCON	SX1100-B	TEST POINT; JUMPER; STR; TOTAL LENGTH=0.24IN; BLACK; INSULATION=PBT;PHOSPHOR BRONZE CONTACT=GOLD PLATED	
25	U1	-	1	MAX16141AAF/V+	MAXIM	MAX16141AAF/V+	EVKIT PART - IC; CONTROLLER; IDEAL DIODE CONTROLLER WITH VOLTAGE AND CURRENT CIRCUIT BREAKER; TQFN16-EP; PACKAGE OUTLINE NO.: 21-0139; PACKAGE CODE: T1644-4; PACKAGE LAND PATTERN: 90-0070	
26	PCB	-	1	MAX16141	MAXIM	PCB	PCB:MAX16141	-
27	D5	DNP	0	CMZ5938B	CENTRAL SEMICONDUCTOR	36V	DIODE; ZNR; SMA (DO-214AC); VZ=36V; IZ=0.0104A	
28	D6	DNP	0	CMZ5944B	CENTRAL SEMICONDUCTOR	62V	DIODE; ZNR; SMA (DO-214AC); VZ=62V; IZ=0.006A	
29	C5, C6	DNP	0	N/A	N/A	OPEN	PACKAGE OUTLINE 0805 NON-POLAR CAPACITOR	
30	R15, R16	DNP	0	N/A	N/A	OPEN	PACKAGE OUTLINE 0603 RESISTOR	
TOTAL			51					

MAX16141 EV Kit Schematics



Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	8/18	Initial release	—

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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MAXESSENTIAL01+

Description

The Essential Analog toolkit contains a unique collection of Maxim's high-performance, analog building block products. This curated group of parts represent a selection of Maxim's vast product lines, specific to 20 product categories, from key performance areas including power efficiency, precise measurement, reliable connectivity, and robust protection.

The ICs in the toolkit offer the breadth of each product category: low power, low noise, multi-channel, high resolution, high accuracy, and high speed. All these features empower your designs and bring value to your systems.

At 6.4cm x 8.9cm x 1.3cm, the box itself is small, lightweight, and easy to carry. Products are guarded from ESD using a gel and ESD-protected box.

A guide that labels each of the part types inside the box supports the toolkit. Go to the Maxim website to find more information for the individual part numbers.

When planning your next design, pick up an Essential Analog toolkit to review Maxim's high-performance analog products.

Key Features

- Small, 6.4cm x 8.9cm x 1.3cm Package
- ESD Protection-Lined Package
- Accelerate Your Design with Quick Access



What's Included in the Box?

Efficient Power				
Buck	Boost	Buck-Boost	LDO	Continua
MAX38640 MAX15026	MAX17225 MAX668	MAX77827 MAX77816	MAX38902B MAX1510	MAX38888
Precision Measurement				
ADC	DAC	Audio Amp	Op Amp	CSA
MAX11410 MAX11168	MAX5541 MAX5715	MAX98357A MAX98390	MAX40075 MAX40100	MAX44284 MAX40201
Rugged Connectivity				
RS-485	RS-232	CAN	BTR Switch	Wireless
MAX14780E MAX3485AE	MAX13235E MAX33250E	MAX13054A MAX33054E	MAX14778 MAX14763	MAX41460 MAX7034
Robust Protection				
Supervisor	Temp Sensor	Isolator	Ideal Diode/V _{REF}	RTC
MAX16150 MAX16140	MAX6680 MAX31875	MAX12930 MAX22445	MAX40203 MAX6078A	MAX31341B DS3231MZ