

# 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

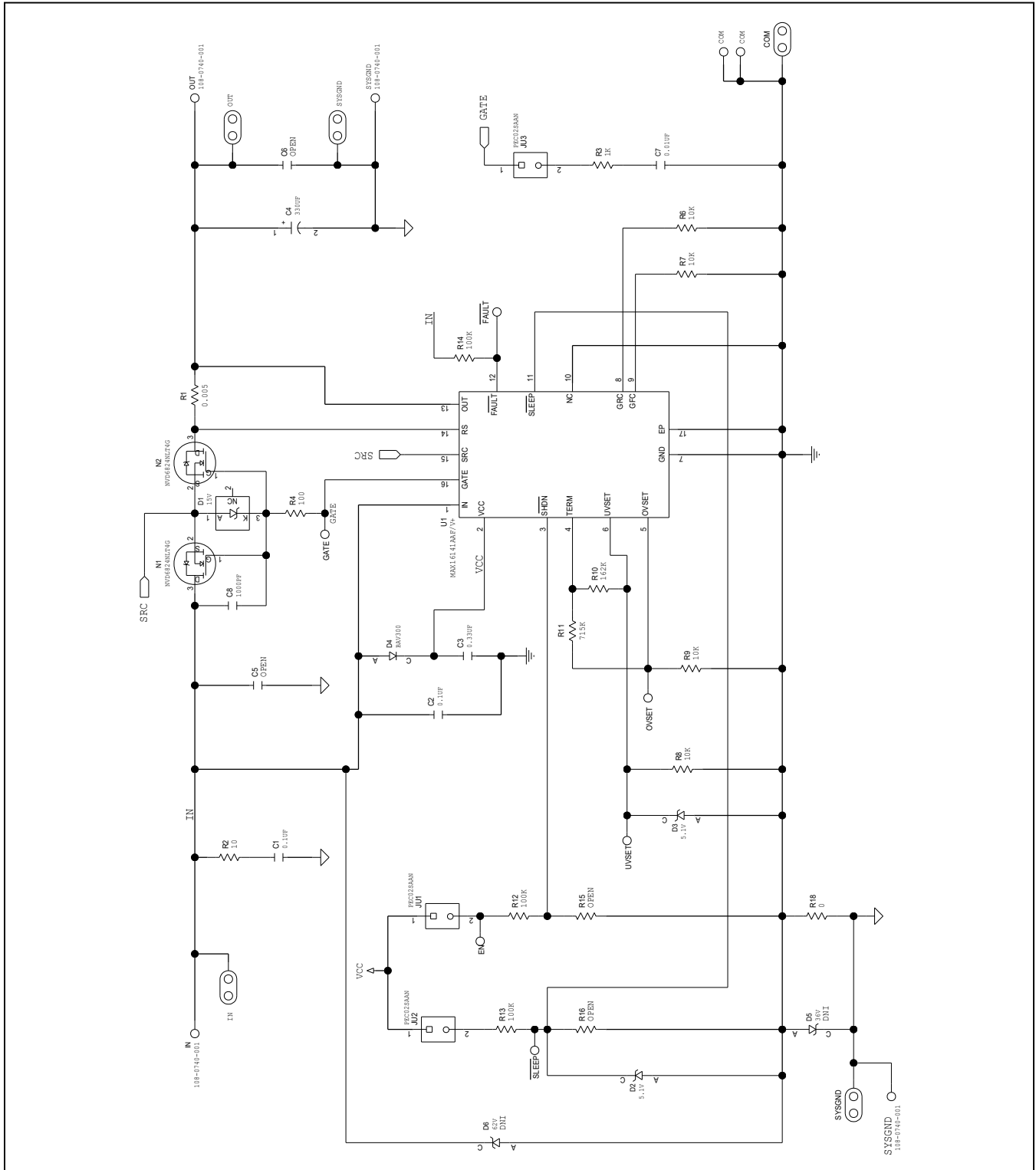
MAX16141 EV Kit Bill of Materials

| 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;<br>GRM21BR72A103KA01;08<br>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;<br>C1608COG1H102J080                 | MURATA;TDK                 | 1000PF       | CAPACITOR; SMT (0603); CERAMIC CHIP; 1000PF; 50V; TOL=5%; TG=-55 DEGC TO +125 DEGC                                 |          |
| 6    | COM_IN_PAD,<br>OUT_PAD, SYSGND,<br>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,<br>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,<br>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;<br>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;<br>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;<br>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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