# Power MOSFET, 57 A

**SOT-227**

## FEATURES

- Fully isolated package
- Easy to use and parallel
- Low on-resistance
- Dynamic dV/dt rating
- Fully avalanche rated
- Simple drive requirements
- Low gate charge device
- Low drain to case capacitance
- Low internal inductance
- Designed for industrial level
- UL approved file E78996
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912

Pb-free

RoHS COMPLIANT

| PRODUCT SUMMARY | |
|---|---|
| $V_{DSS}$ | 500 V |
| $R_{DS(on)}$ | 0.08 Ω |
| $I_D$ | 57 A |
| Type | Modules - MOSFET |
| Package | SOT-227 |

## DESCRIPTION

Third Generation Power MOSFETs from Vishay Semiconductors provide the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost-effectiveness.

The SOT-227 package is universally preferred for all commercial-industrial applications at power dissipation levels to approximately 500 W. The low thermal resistance of the SOT-227 contribute to its wide acceptance throughout the industry.

| ABSOLUTE MAXIMUM RATINGS | | | | |
|---|---|---|---|---|
| **PARAMETER** | **SYMBOL** | **TEST CONDITIONS** | **MAX.** | **UNITS** |
| Continuous drain current at $V_{GS}$ 10 V | $I_D$ | $T_C$ = 25 °C | 57 | A |
| | | $T_C$ = 100 °C | 36 | |
| Pulsed drain current | $I_{DM}$ (1) | | 228 | |
| Power dissipation | $P_D$ | $T_C$ = 25 °C | 625 | W |
| Linear derating factor | | | 5.0 | W/°C |
| Gate to source voltage | $V_{GS}$ | | ± 20 | V |
| Single pulse avalanche energy | $E_{AS}$ (2) | | 725 | mJ |
| Avalanche current | $I_{AR}$ (1) | | 57 | A |
| Repetitive avalanche energy | $E_{AR}$ (1) | | 62.5 | mJ |
| Peak diode recovery dV/dt | dV/dt (3) | | 10 | V/ns |
| Operating junction and storage temperature range | $T_J$, $T_{Stg}$ | | - 55 to + 150 | °C |
| Insulation withstand voltage (AC-RMS) | $V_{ISO}$ | | 2.5 | kV |
| Mounting torque | | M4 screw | 1.3 | Nm |

**Notes**

(1) Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)

(2) Starting $T_J$ = 25 °C, L = 446 µH, $R_g$ = 25 Ω, $I_{AS}$ = 57 A (see fig. 12)

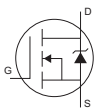
(3) $I_{SD} \leq$ 57 A, dI/dt ≤ 200 A/µs, $V_{DD} \leq V_{(BR)DSS}$, $T_J \leq$ 150 °C

| THERMAL AND MECHANICAL SPECIFICATIONS | | | | | | |
|---|---|---|---|---|---|---|
| **PARAMETER** | **SYMBOL** | **TEST CONDITIONS** | **MIN.** | **TYP.** | **MAX.** | **UNITS** |
| Junction and storage temperature range | $T_J$, $T_{Stg}$ | | - 55 | - | 150 | °C |
| Junction to case | $R_{thJC}$ | | - | - | 0.20 | °C/W |
| Case to heatsink | $R_{thCS}$ | Flat, greased surface | - | 0.05 | - | |
| Weight | | | - | 30 | - | g |
| Mounting torque | | | - | - | 1.3 | Nm |
| Case style | SOT-227 | | | | | |

| ELECTRICAL CHARACTERISTCS ($T_J$ = 25 °C unless otherwise noted) | | | | | | |
|---|---|---|---|---|---|---|
| **PARAMETER** | **SYMBOL** | **TEST CONDITIONS** | **MIN.** | **TYP.** | **MAX.** | **UNITS** |
| Drain to source breakdown voltage | $V_{(BR)DSS}$ | $V_{GS}$ = 0 V, $I_D$ = 1.0 mA | 500 | - | - | V |
| Breakdown voltage temperature coefficient | $\Delta V_{(BR)DSS}/\Delta T_J$ | Reference to 25 °C, $I_D$ = 1 mA | - | 0.62 | - | V/°C |
| Static drain to source on-resistance | $R_{DS(on)}$ (1) | $V_{GS}$ = 10 V, $I_D$ = 34 A | - | - | 0.08 | Ω |
| Gate threshold voltage | $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = 250 µA | 2.0 | - | 4.0 | V |
| Forward transconductance | $g_{fs}$ | $V_{DS}$ = 50 V, $I_D$ = 34 A | 43 | - | - | S |
| Drain to source leakage current | $I_{DSS}$ | $V_{DS}$ = 500 V, $V_{GS}$ = 0 V | - | - | 50 | µA |
| | | $V_{DS}$ = 400 V, $V_{GS}$ = 0 V, $T_J$ = 125 °C | - | - | 500 | |
| Gate to source forward leakage | $I_{GSS}$ | $V_{GS}$ = 20 V | - | - | 200 | nA |
| Gate to source reverse leakage | | $V_{GS}$ = - 20 V | - | - | - 200 | |
| Total gate charge | $Q_g$ | $I_D$ = 57 A<br>$V_{DS}$ = 400 V<br>$V_{GS}$ = 10 V; see fig. 6 and 13 (1) | - | 225 | 338 | nC |
| Gate to source charge | $Q_{gs}$ | | - | 51 | 77 | |
| Gate to drain ("Miller") charge | $Q_{gd}$ | | - | 98 | 147 | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD}$ = 250 V<br>$I_D$ = 57 A<br>$R_g$ = 2.0 Ω (internal)<br>$R_D$ = 4.3 Ω, see fig. 10 (1) | - | 32 | - | ns |
| Rise time | $t_r$ | | - | 152 | - | |
| Turn-off delay time | $t_{d(off)}$ | | - | 108 | - | |
| Fall time | $t_f$ | | - | 118 | - | |
| Internal source inductance | $L_S$ | Between lead, and center of die contact | - | 5.0 | - | nH |
| Input capacitance | $C_{iss}$ | $V_{GS}$ = 0 V<br>$V_{DS}$ = 25 V<br>f = 1.0 MHz, see fig. 5 | - | 10 000 | - | pF |
| Output capacitance | $C_{oss}$ | | - | 1500 | - | |
| Reverse transfer capacitance | $C_{rss}$ | | - | 50 | - | |

**Note**

(1) Pulse width ≤ 300 µs, duty cycle ≤ 2 %

| SOURCE-DRAIN RATINGS AND CHARACTERISTICS | | | | | | |
|---|---|---|---|---|---|---|
| **PARAMETER** | **SYMBOL** | **TEST CONDITIONS** | **MIN.** | **TYP.** | **MAX.** | **UNITS** |
| Continuous source current (body diode) | $I_S$ | MOSFET symbol showing the integral reverse p-n junction diode.  | - | - | 57 | A |
| Pulsed source current (body diode) | $I_{SM}$ (1) | | - | - | 228 | |
| Diode forward voltage | $V_{SD}$ (2) | $T_J$ = 25 °C, $I_S$ = 57 A, $V_{GS}$ = 0 V | - | - | 1.3 | V |
| Reverse recovery time | $t_{rr}$ | $T_J$ = 25 °C, $I_F$ = 57 A, dI/dt = 100 A/µs (2) | - | 901 | 1351 | ns |
| Reverse recovery charge | $Q_{rr}$ | | - | 15 | 23 | µC |
| Forward turn-on time | $t_{on}$ | Intrinsic turn-on time is negligible (turn-on is dominated by $L_S$ + $L_D$) | | | | |

**Notes**

(1) Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)

(2) Pulse width ≤ 300 µs, duty cycle ≤ 2 %

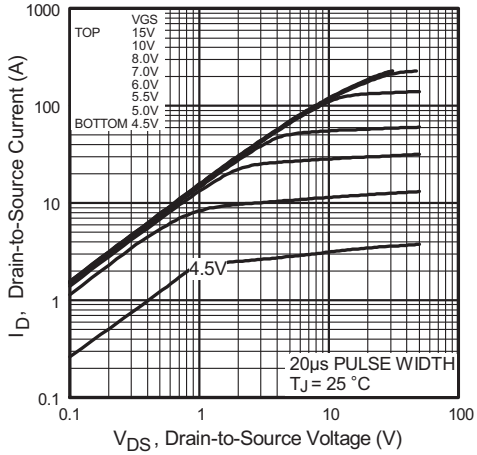



Fig. 1 - Typical Output Characteristics

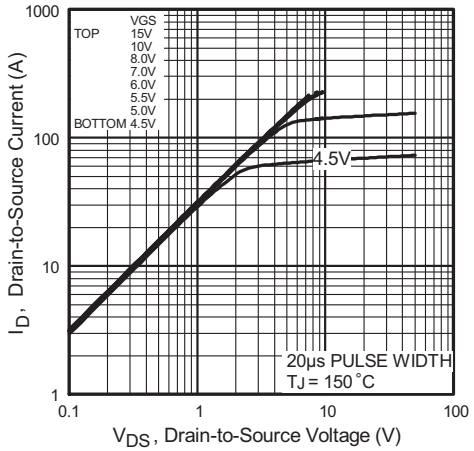



Fig. 2 - Typical Output Characteristics

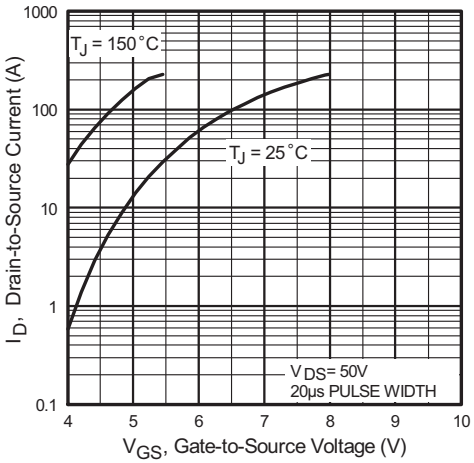



Fig. 3 - Typical Transfer Characteristics

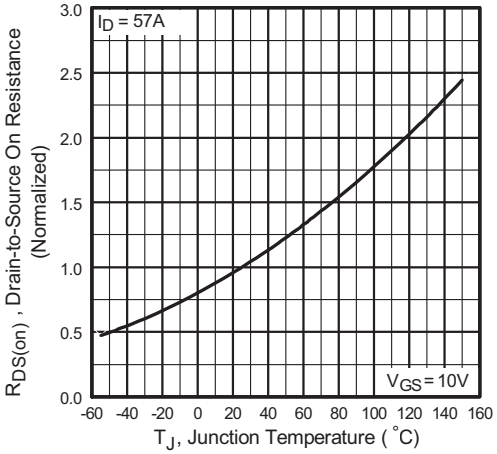



Fig. 4 - Normalized On-Resistance vs. Temperature

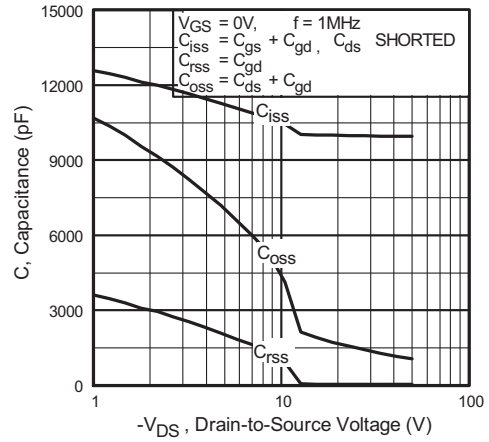



Fig. 5 - Typical Capacitance vs. Drain to Source Voltage

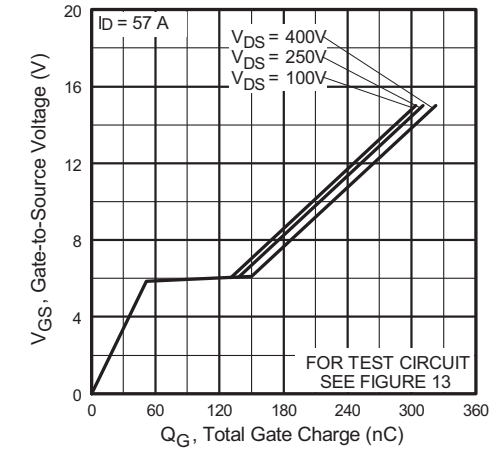



Fig. 6 - Typical Gate Charge vs. Gate to Source Voltage

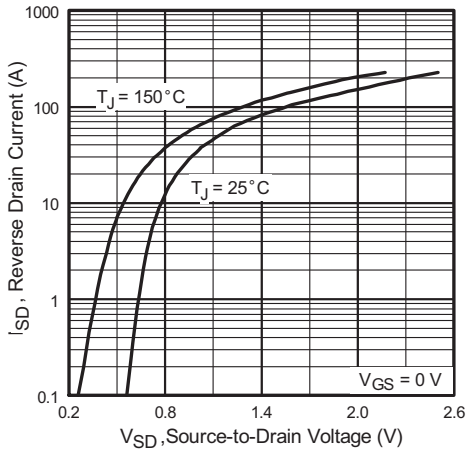



Fig. 7 - Typical Source Drain Diode Forward Voltage

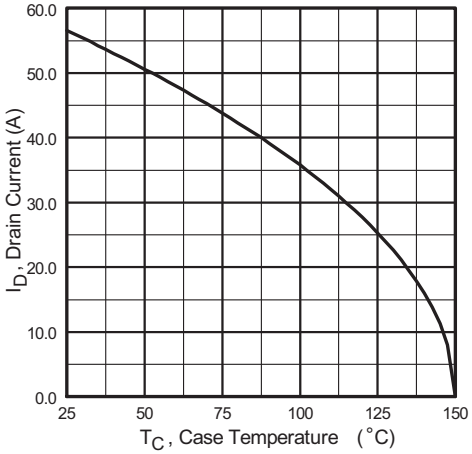



Fig. 9 - Maximum Drain Current vs. Case Temperature

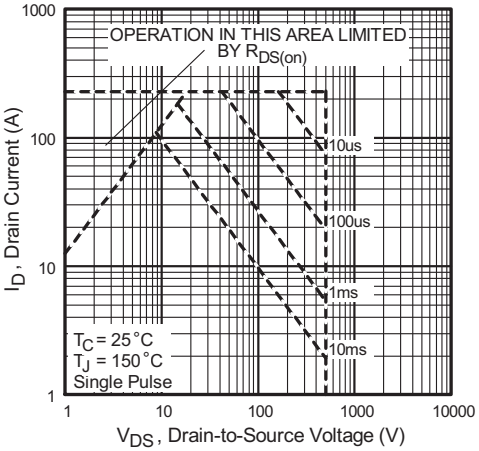



Fig. 8 - Maximum Safe Operating Area

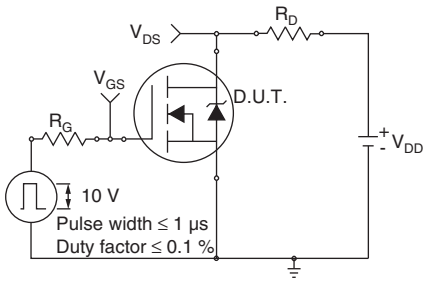



Fig. 10a - Switching Time Test Circuit

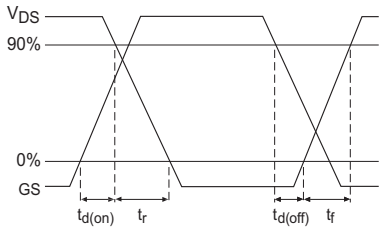



Fig. 10b - Switching Time Waveforms

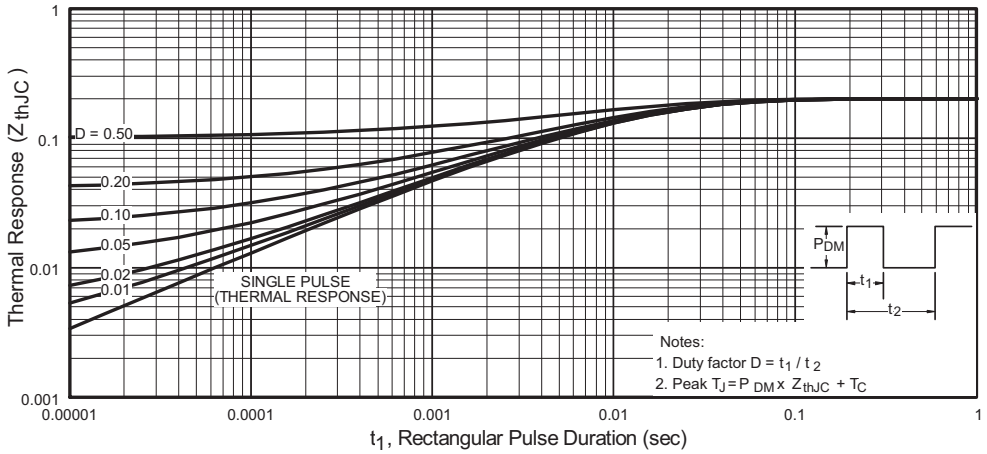



Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction to Case

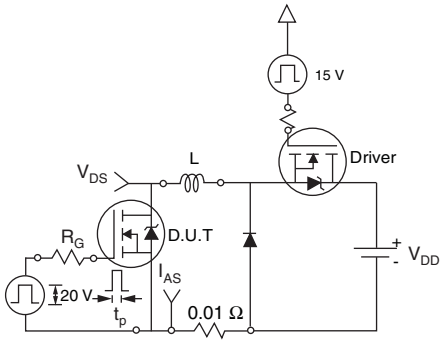



Fig. 12a - Unclamped Inductive Test Circuit

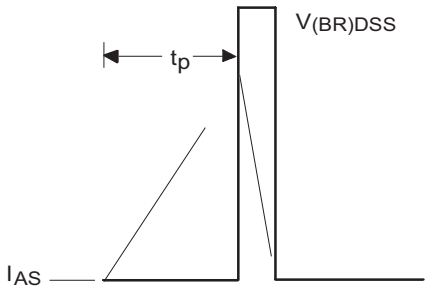



Fig. 12b - Unclamped Inductive Waveforms

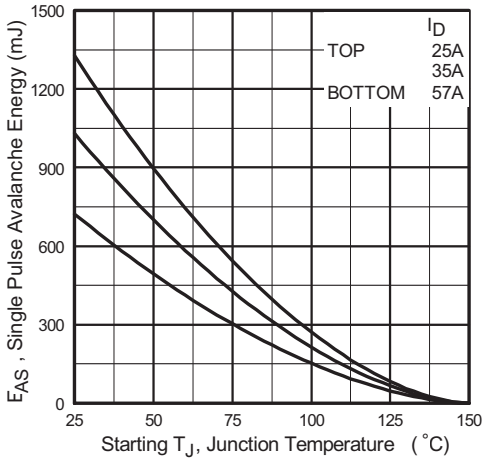



Fig. 12c - Maximum Avalanche Energy vs. Drain Current

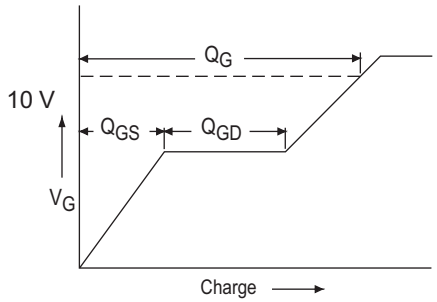



Fig. 13a - Basic Gate Charge Waveform

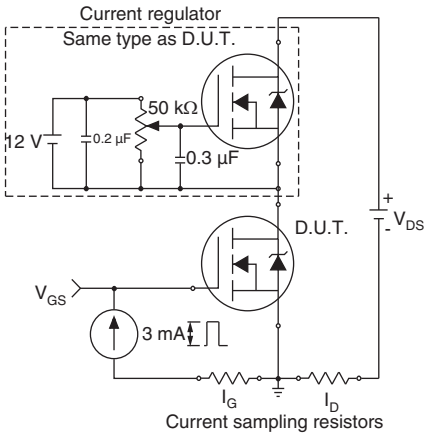



Fig. 13b - Gate Charge Test Circuit

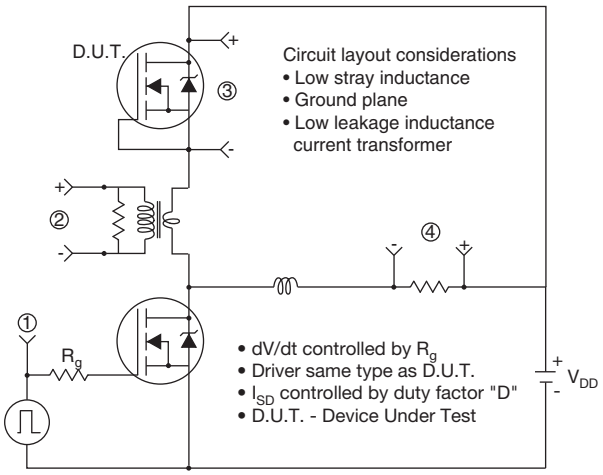
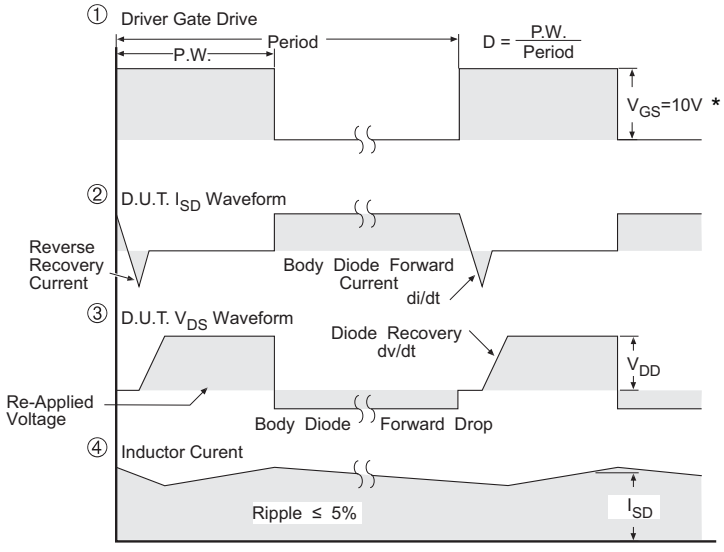



Fig. 13c - Peak Diode Recovery dV/dt Test Circuit




* $V_{GS}$ = 5V for Logic Level Devices

Fig. 14 - For N-Channel Power MOSFETs

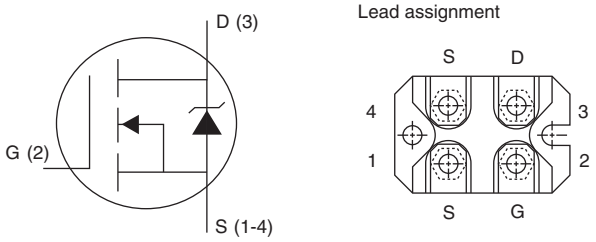
## ORDERING INFORMATION TABLE

Device code

| VS- | F | A | 57 | S | A | 50 | LC | P |
|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |

1 - Vishay Semiconductors product
2 - Power MOSFET
3 - Generation 3, MOSFET silicon, DBC construction
4 - Current rating (57 = 57 A)
5 - Single switch (see Circuit Configuration table)
6 - SOT-227
7 - Voltage rating (50 = 500 V)
8 - Low charge
9 - P = Lead (Pb)-free

## CIRCUIT CONFIGURATION

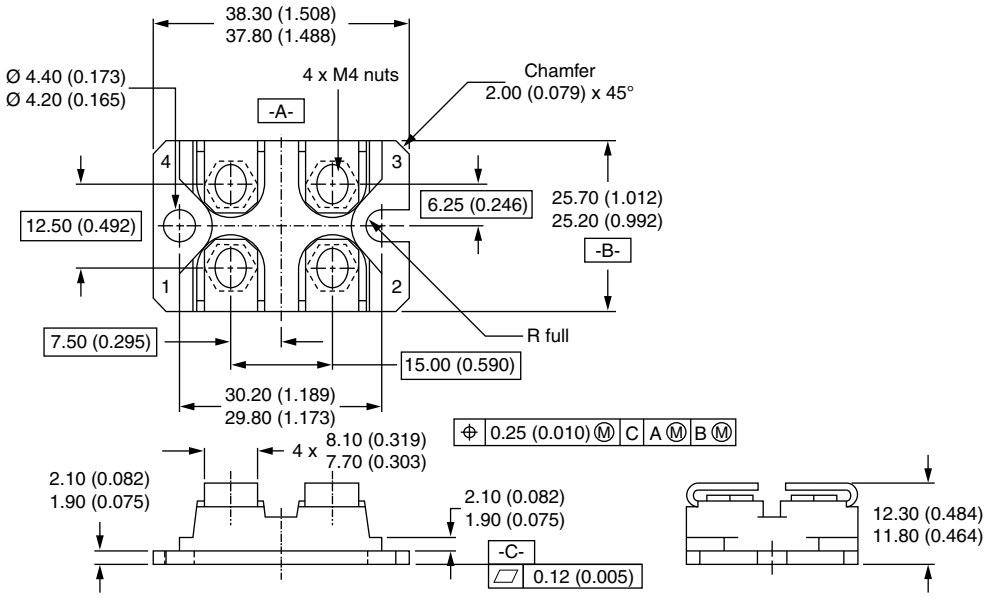
| CIRCUIT | CIRCUIT CONFIGURATION CODE | CIRCUIT DRAWING |
|---|---|---|
| Single switch no diode | S |  |



| LINKS TO RELATED DOCUMENTS | |
|---|---|
| Dimensions | www.vishay.com/doc?95036 |
| Packaging information | www.vishay.com/doc?95037 |

# SOT-227

**DIMENSIONS** in millimeters (inches)




**Notes**

- Dimensioning and tolerancing per ANSI Y14.5M-1982
- Controlling dimension: millimeter

# Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, “Vishay”), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay’s knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer’s responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and/or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer’s technical experts. Product specifications do not expand or otherwise modify Vishay’s terms and conditions of purchase, including but not limited to the warranty expressed therein.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.

# Material Category Policy

**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as RoHS-Compliant fulfill the definitions and restrictions defined under Directive 2011/65/EU of The European Parliament and of the Council of June 8, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (EEE) - recast, unless otherwise specified as non-compliant.**

**Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.**

**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as Halogen-Free follow Halogen-Free requirements as per JEDEC JS709A standards. Please note that some Vishay documentation may still make reference to the IEC 61249-2-21 definition. We confirm that all the products identified as being compliant to IEC 61249-2-21 conform to JEDEC JS709A standards.**

# Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

Vishay:
VS-FA57SA50LCP