

Power MOSFET, 57 A


SOT-227

RoHS
COMPLIANT

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

DESCRIPTION

Third Generation Power MOSFETs from Vishay HPP 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.

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

| ABSOLUTE MAXIMUM RATINGS | | | | |
|--|----------------------|-----------------------------------|---------------|---------------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | MAX. | UNITS |
| Continuous drain current at V_{GS} 10 V | I_D | $T_C = 25\text{ }^\circ\text{C}$ | 57 | A |
| | | $T_C = 100\text{ }^\circ\text{C}$ | 36 | |
| Pulsed drain current | $I_{DM}^{(1)}$ | | 228 | |
| Power dissipation | P_D | $T_C = 25\text{ }^\circ\text{C}$ | 625 | W |
| Linear derating factor | | | 5.0 | W/ $^\circ\text{C}$ |
| 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 | $^\circ\text{C}$ |
| 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 $T_J = 25\text{ }^\circ\text{C}$, $L = 446\text{ }\mu\text{H}$, $R_g = 25\text{ }\Omega$, $I_{AS} = 57\text{ A}$ (see fig. 12)
- (3) $I_{SD} \leq 57\text{ A}$, $dI/dt \leq 200\text{ A}/\mu\text{s}$, $V_{DD} \leq V_{(BR)DSS}$, $T_J \leq 150\text{ }^\circ\text{C}$

| THERMAL RESISTANCE | | | | |
|-------------------------------------|------------|------|------|-------|
| PARAMETER | SYMBOL | TYP. | MAX. | UNITS |
| Junction to case | R_{thJC} | - | 0.20 | °C/W |
| Case to sink, flat, greased surface | R_{thCS} | 0.05 | - | |

| ELECTRICAL CHARACTERISTICS ($T_J = 25\text{ °C}$ unless otherwise noted) | | | | | | |
|---|---------------------------------|--|------|--------|------|---------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNITS |
| Drain to source breakdown voltage | $V_{(BR)DSS}$ | $V_{GS} = 0\text{ V}, I_D = 1.0\text{ mA}$ | 500 | - | - | V |
| Breakdown voltage temperature coefficient | $\Delta V_{(BR)DSS}/\Delta T_J$ | Reference to $25\text{ °C}, I_D = 1\text{ mA}$ | - | 0.62 | - | V/°C |
| Static drain to source on-resistance | $R_{DS(on)}^{(1)}$ | $V_{GS} = 10\text{ V}, I_D = 34\text{ A}$ | - | - | 0.08 | Ω |
| Gate threshold voltage | $V_{GS(th)}$ | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$ | 2.0 | - | 4.0 | V |
| Forward transconductance | g_{fs} | $V_{DS} = 50\text{ V}, I_D = 34\text{ A}$ | 43 | - | - | S |
| Drain to source leakage current | I_{DSS} | $V_{DS} = 500\text{ V}, V_{GS} = 0\text{ V}$ | - | - | 50 | μA |
| | | $V_{DS} = 400\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ °C}$ | - | - | 500 | |
| Gate to source forward leakage | I_{GSS} | $V_{GS} = 20\text{ V}$ | - | - | 200 | nA |
| Gate to source reverse leakage | | $V_{GS} = -20\text{ V}$ | - | - | -200 | |
| Total gate charge | Q_g | $I_D = 57\text{ A}$ $V_{DS} = 400\text{ V}$ $V_{GS} = 10\text{ V}$; 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 | $t_{d(on)}$ | $V_{DD} = 250\text{ V}$ $I_D = 57\text{ A}$ $R_g = 2.0\text{ }\Omega$ (internal) $R_D = 4.3\text{ }\Omega$, 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} | $V_{GS} = 0\text{ V}$ $V_{DS} = 25\text{ V}$ $f = 1.0\text{ MHz}$, see fig. 5 | - | 10 000 | - | pF |
| Output capacitance | C_{oss} | | - | 1500 | - | |
| Reverse transfer capacitance | C_{rss} | | - | 50 | - | |

Note
⁽¹⁾ Pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$

| 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 | $V_{SD}^{(2)}$ | $T_J = 25\text{ °C}, I_S = 57\text{ A}, V_{GS} = 0\text{ V}$ | - | - | 1.3 | V |
| Reverse recovery time | t_{rr} | $T_J = 25\text{ °C}, I_F = 57\text{ A}, di/dt = 100\text{ A}/\mu\text{s}^{(2)}$ | - | 901 | 1351 | ns |
| Reverse recovery charge | Q_{rr} | | - | 15 | 23 | |
| 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 $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$

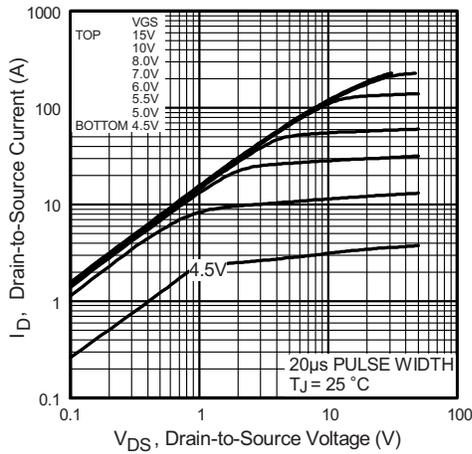


Fig. 1 - Typical Output Characteristics

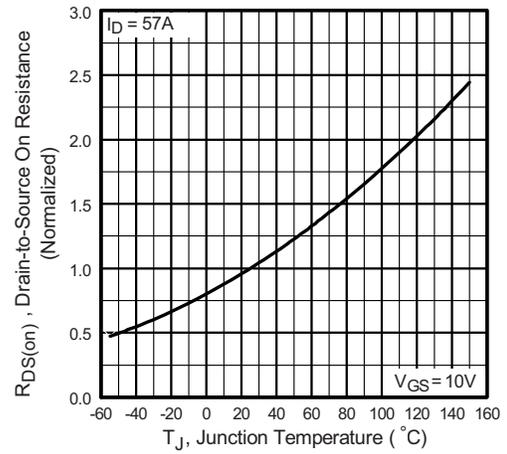


Fig. 4 - Normalized On-Resistance vs. Temperature

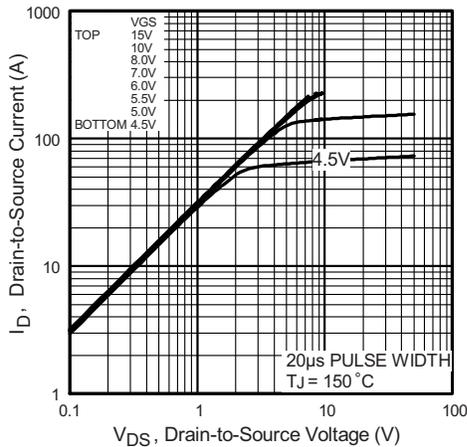


Fig. 2 - Typical Output Characteristics

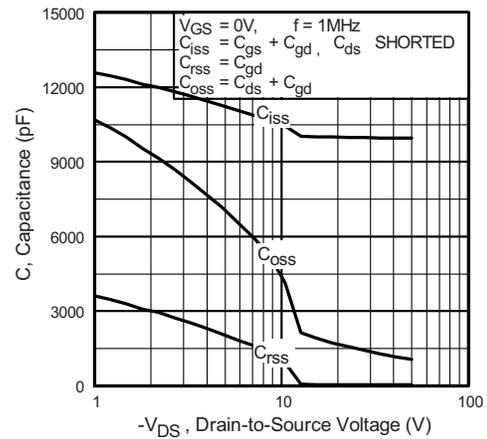


Fig. 5 - Typical Capacitance vs. Drain to Source Voltage

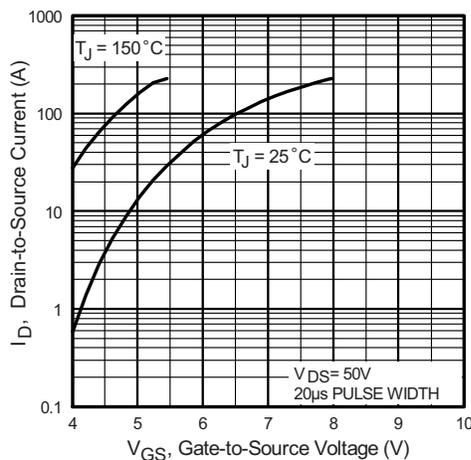


Fig. 3 - Typical Transfer Characteristics

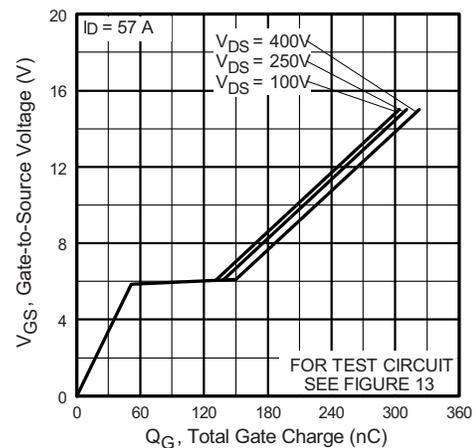


Fig. 6 - Typical Gate Charge vs. Gate to Source Voltage

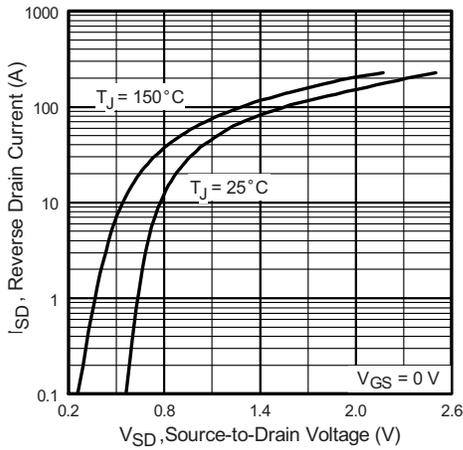


Fig. 7 - Typical Source Drain Diode Forward Voltage

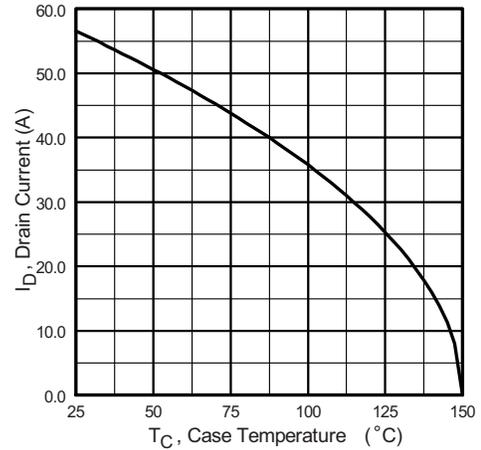


Fig. 9 - Maximum Drain Current vs. Case Temperature

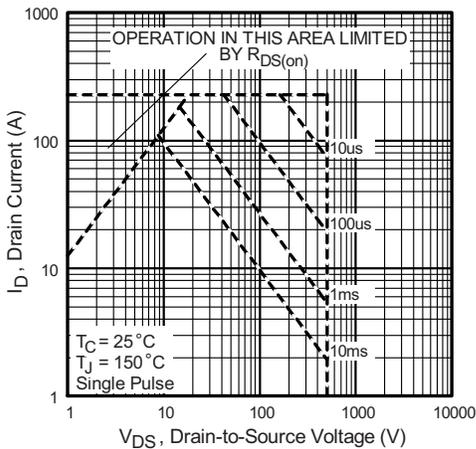


Fig. 8 - Maximum Safe Operating Area

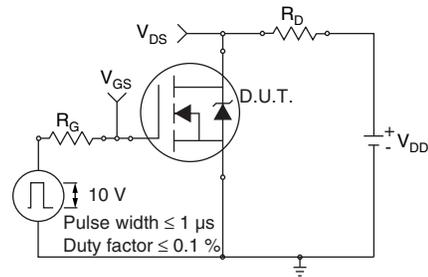


Fig. 10a - Switching Time Test Circuit

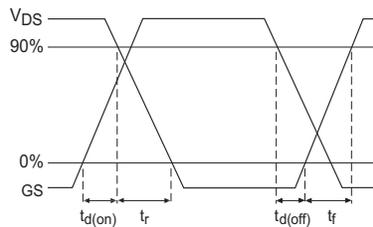


Fig. 10b - Switching Time Waveforms

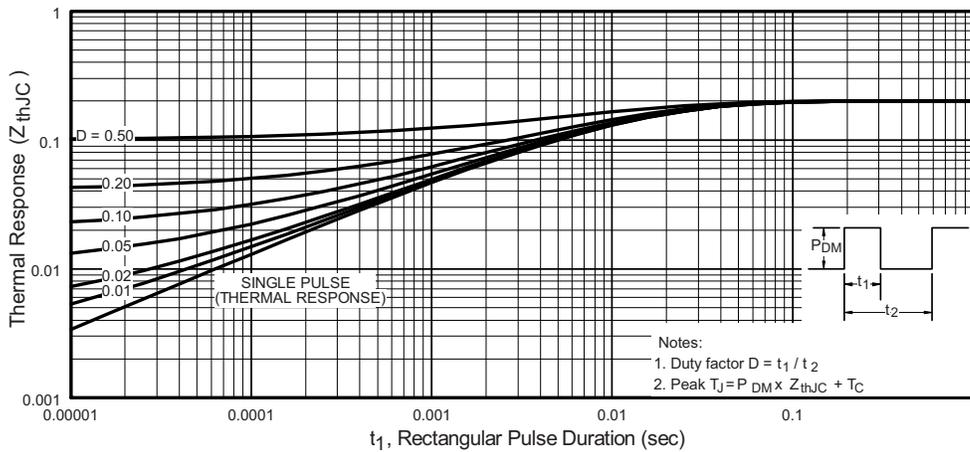


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction to Case

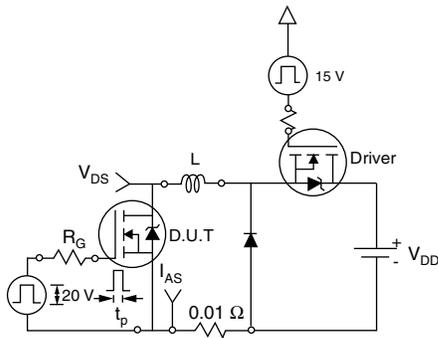


Fig. 12a - Unclamped Inductive Test Circuit

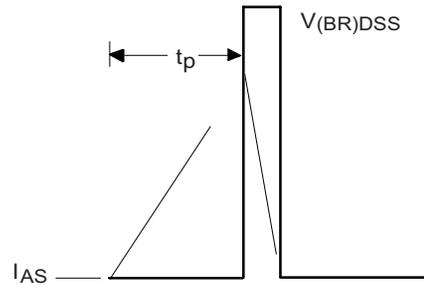


Fig. 12b - Unclamped Inductive Waveforms

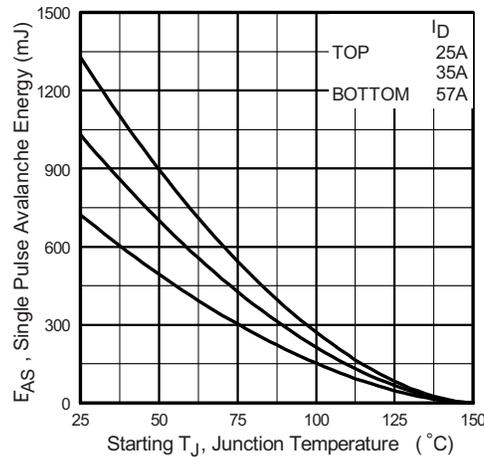


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

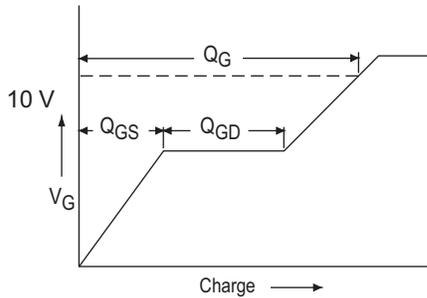


Fig. 13a - Basic Gate Charge Waveform

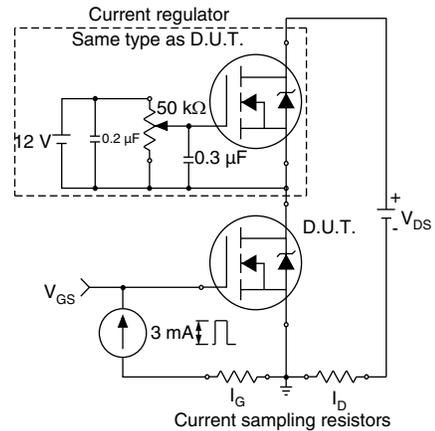


Fig. 13b - Gate Charge Test Circuit

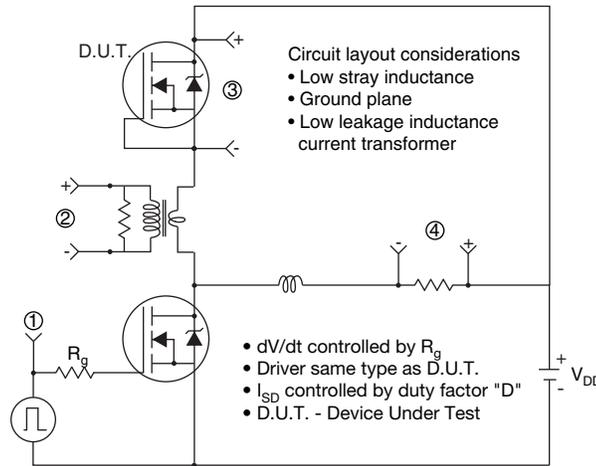
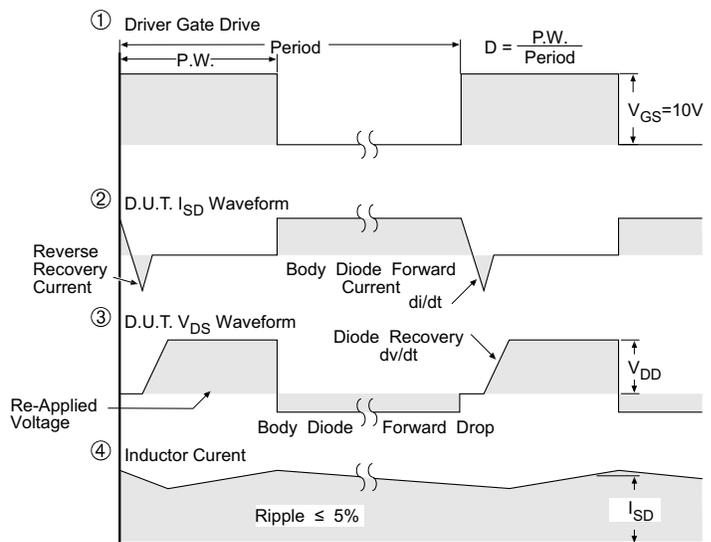


Fig. 13c - Peak Diode Recovery dV/dt Test Circuit



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

Fig. 14 - For N-Channel Power MOSFETs

ORDERING INFORMATION TABLE

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

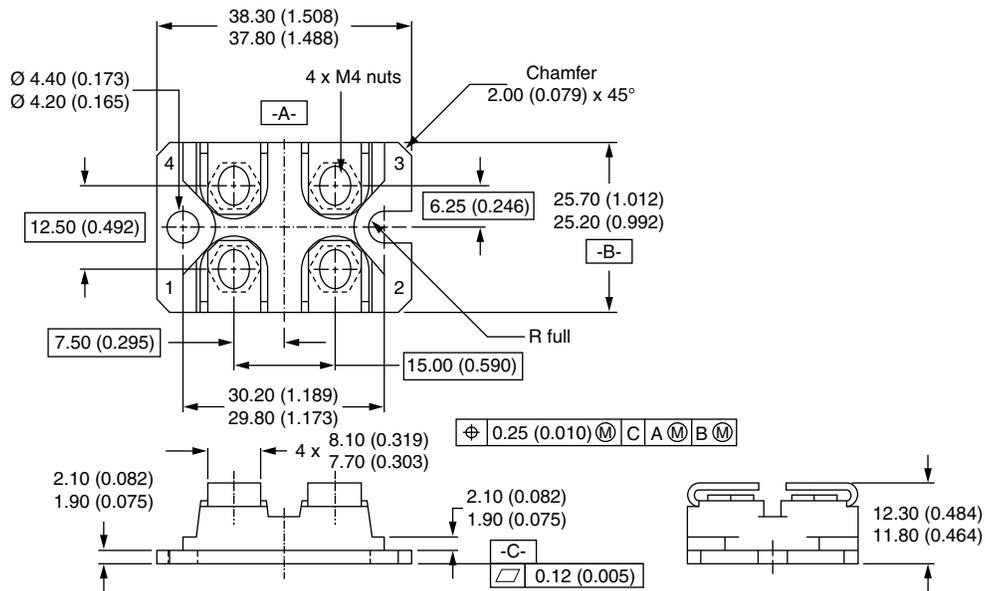
- 1** - Power MOSFET
- 2** - Generation 3, MOSFET silicon, DBC construction
- 3** - Current rating (57 = 57 A)
- 4** - Single switch (see Circuit Configuration table)
- 5** - SOT-227
- 6** - Voltage rating (50 = 500 V)
- 7** - Low charge
- 8** - P = Lead (Pb)-free

| 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



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