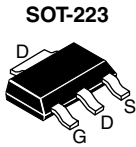


Power MOSFET



N-Channel MOSFET

FEATURES

- Surface-mount
- Available in tape and reel
- Dynamic dV/dt rating
- Logic-level gate drive
- $R_{DS(on)}$ specified at $V_{GS} = 4\text{ V}$ and 5 V
- Fast switching
- Ease of paralleling
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT
HALOGEN
FREE
Available

Marking code: LA

| PRODUCT SUMMARY | |
|---------------------------|------------------------------|
| V_{DS} (V) | 60 |
| $R_{DS(on)}$ (Ω) | $V_{GS} = 5.0\text{ V}$ 0.20 |
| Q_g max. (nC) | 8.4 |
| Q_{gs} (nC) | 3.5 |
| Q_{gd} (nC) | 6.0 |
| Configuration | Single |

DESCRIPTION

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

The SOT-223 package is designed for surface-mounting using vapor phase, infrared, or wave soldering techniques. Its unique package design allows for easy automatic pick-and-place as with other SOT or SOIC packages but has the added advantage of improved thermal performance due to an enlarged tab for heatsinking. Power dissipation of greater than 1.25 W is possible in a typical surface mount application.

| ORDERING INFORMATION | |
|---------------------------------|---|
| Package | SOT-223 |
| Lead (Pb)-free and halogen-free | SiHLL014TR-GE3 IRLL014TRPbF-BE3 a, b |
| Lead (Pb)-free | IRLL014TRPbF a |

Notes

- See device orientation
- “-BE3” denotes alternate manufacturing location

| ABSOLUTE MAXIMUM RATINGS ($T_C = 25\text{ }^\circ\text{C}$, unless otherwise noted) | | | |
|---|------------------|-----------------------------------|---------------------|
| PARAMETER | SYMBOL | LIMIT | UNIT |
| Drain-source voltage | V_{DS} | 60 | V |
| Gate-source voltage | V_{GS} | ± 10 | |
| Continuous drain current | V_{GS} at 10 V | $T_C = 25\text{ }^\circ\text{C}$ | A |
| | | $T_C = 100\text{ }^\circ\text{C}$ | |
| Pulsed drain current ^a | I_{DM} | 22 | W/ $^\circ\text{C}$ |
| Linear derating factor | | 0.025 | |
| Linear derating factor (PCB mount) ^e | | 0.017 | |
| Single pulse avalanche energy ^b | E_{AS} | 100 | mJ |
| Avalanche current ^a | I_{AR} | 2.7 | A |
| Repetitive avalanche energy ^a | E_{AR} | 0.31 | mJ |
| Maximum power dissipation | P_D | $T_C = 25\text{ }^\circ\text{C}$ | W |
| Maximum power dissipation (PCB mount) ^e | | $T_A = 25\text{ }^\circ\text{C}$ | |
| Peak diode recovery dv/dt ^c | dV/dt | 4.5 | V/ns |
| Operating junction and storage temperature range | T_J, T_{stg} | -55 to +150 | $^\circ\text{C}$ |
| Soldering recommendations (peak temperature) ^d | For 10 s | 300 | |

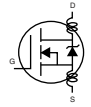

Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)
- $V_{DD} = 25\text{ V}$, starting $T_J = 25\text{ }^\circ\text{C}$, $L = 16\text{ mH}$, $R_g = 25\text{ }\Omega$, $I_{AS} = 2.7\text{ A}$ (see fig. 12)
- $I_{SD} \leq 10\text{ A}$, $dI/dt \leq 90\text{ A}/\mu\text{s}$, $V_{DD} \leq V_{DS}$, $T_J \leq 150\text{ }^\circ\text{C}$
- 1.6 mm from case
- When mounted on 1" square PCB (FR-4 or G-10 material)

| THERMAL RESISTANCE RATINGS | | | | | | |
|--|------------|------|------|------|------|--|
| PARAMETER | SYMBOL | MIN. | TYP. | MAX. | UNIT | |
| Maximum junction-to-ambient (PCB mount) ^a | R_{thJA} | - | - | 60 | °C/W | |
| Maximum junction-to-case (drain) | R_{thJC} | - | - | 40 | | |

Note

a. When mounted on 1" square PCB (FR-4 or G-10 material)

| SPECIFICATIONS ($T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted) | | | | | | | |
|---|---------------------|---|--|------|-------|-----------|---------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | | MIN. | TYP. | MAX. | UNIT |
| Static | | | | | | | |
| Drain-source breakdown voltage | V_{DS} | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$ | | 60 | - | - | V |
| V_{DS} temperature coefficient | $\Delta V_{DS}/T_J$ | Reference to $25\text{ }^\circ\text{C}$, $I_D = 1\text{ mA}$ | | - | 0.073 | - | V/°C |
| Gate-source threshold voltage | $V_{GS(th)}$ | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$ | | 1.0 | - | 2.0 | V |
| Gate-source leakage | I_{GSS} | $V_{GS} = \pm 10\text{ V}$ | | - | - | ± 100 | nA |
| Zero gate voltage drain current | I_{DSS} | $V_{DS} = 60\text{ V}, V_{GS} = 0\text{ V}$ | | - | - | 25 | μA |
| | | $V_{DS} = 48\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$ | | - | - | 250 | |
| Drain-source on-state resistance | $R_{DS(on)}$ | $V_{GS} = 5.0\text{ V}$ | $I_D = 1.6\text{ A}^b$ | - | - | 0.20 | Ω |
| | | $V_{GS} = 4.0\text{ V}$ | $I_D = 1.4\text{ A}^b$ | - | - | 0.28 | |
| Forward transconductance | g_{fs} | $V_{DS} = 25\text{ V}, I_D = 1.6\text{ A}$ | | 3.2 | - | - | S |
| Dynamic | | | | | | | |
| Input capacitance | C_{iss} | $V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1.0\text{ MHz}$, see fig. 5 | | - | 400 | - | pF |
| Output capacitance | C_{oss} | | | - | 170 | - | |
| Reverse transfer capacitance | C_{rss} | | | - | 42 | - | |
| Total gate charge | Q_g | $V_{GS} = 5.0\text{ V}$ | $I_D = 10\text{ A}, V_{DS} = 48\text{ V}$, see fig. 6 and 13 ^b | - | - | 8.4 | nC |
| Gate-source charge | Q_{gs} | | | - | - | 3.5 | |
| Gate-drain charge | Q_{gd} | | | - | - | 6.0 | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD} = 30\text{ V}, I_D = 10\text{ A}, R_g = 12\text{ }\Omega, R_D = 2.8\text{ }\Omega$, see fig. 10 ^b | | - | 9.3 | - | ns |
| Rise time | t_r | | | - | 110 | - | |
| Turn-off delay time | $t_{d(off)}$ | | | - | 17 | - | |
| Fall time | t_f | | | - | 26 | - | |
| Internal drain inductance | L_D | Between lead, 6 mm (0.25") from package and center of die contact  | | - | 4.0 | - | nH |
| Internal source inductance | L_S | | | - | 6.0 | - | |
| Drain-Source Body Diode Characteristics | | | | | | | |
| Continuous source-drain diode current | I_S | MOSFET symbol showing the integral reverse p-n junction diode  | | - | - | 2.7 | A |
| Pulsed diode forward current ^a | I_{SM} | | | - | - | 22 | |
| Body diode voltage | V_{SD} | $T_J = 25\text{ }^\circ\text{C}, I_S = 2.7\text{ A}, V_{GS} = 0\text{ V}^b$ | | - | - | 1.6 | V |
| Body diode reverse recovery time | t_{rr} | $T_J = 25\text{ }^\circ\text{C}, I_F = 10\text{ A}, di/dt = 100\text{ A}/\mu\text{s}^b$ | | - | 65 | 130 | ns |
| Body diode reverse recovery charge | Q_{rr} | | | - | 0.33 | 0.65 | μC |
| Forward turn-on time | t_{on} | Intrinsic turn-on time is negligible (turn-on is dominated by L_S and L_D) | | | | | |

Notes

- a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)
 b. Pulse width $\leq 300\text{ }\mu\text{s}$; duty cycle $\leq 2\%$

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

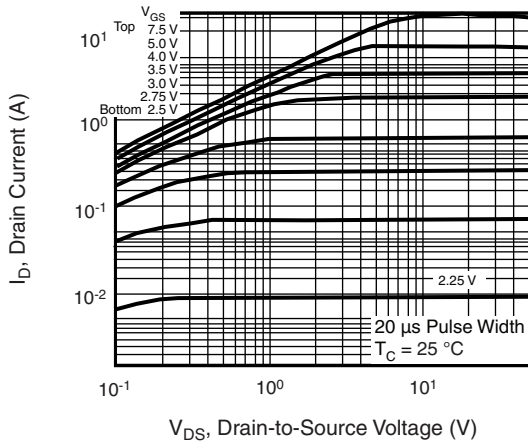


Fig. 1 - Typical Output Characteristics, $T_C = 25\text{ }^\circ\text{C}$

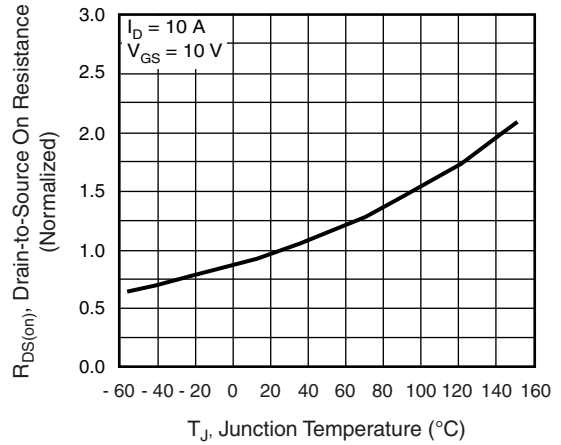


Fig. 4 - Normalized On-Resistance vs. Temperature

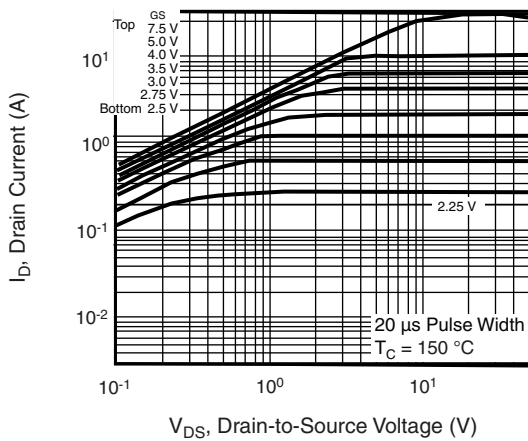


Fig. 2 - Typical Output Characteristics, $T_C = 150\text{ }^\circ\text{C}$

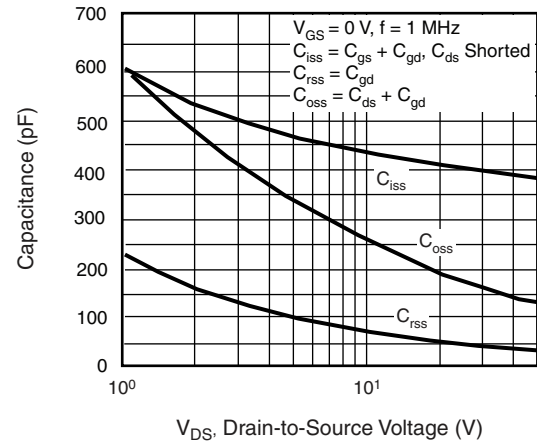


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

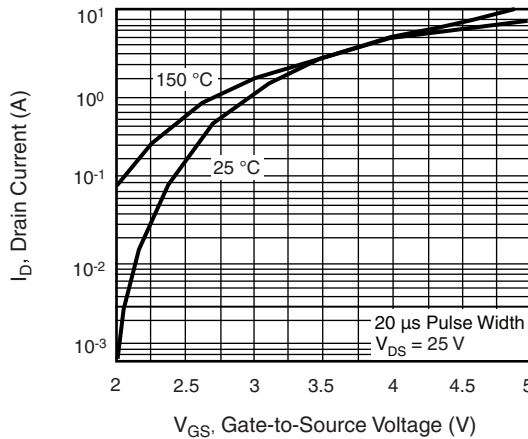


Fig. 3 - Typical Transfer Characteristics

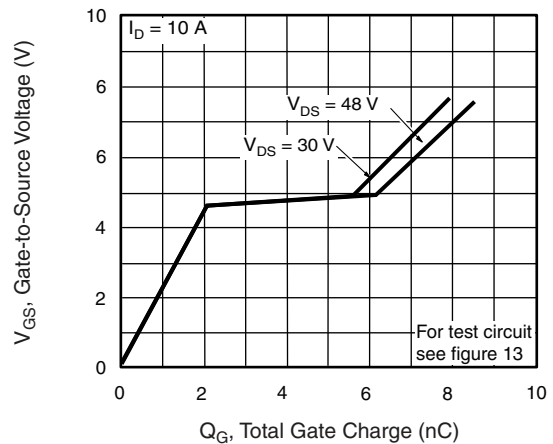


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

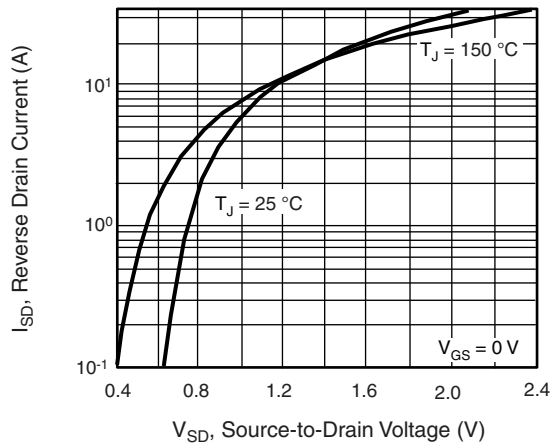


Fig. 7 - Typical Source-Drain Diode Forward Voltage

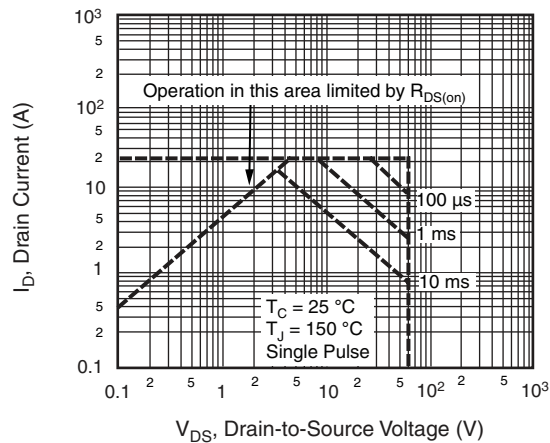


Fig. 8 - Maximum Safe Operating Area



Fig. 9 - Maximum Drain Current vs. Case Temperature

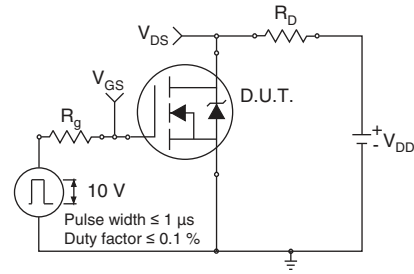


Fig. 10a - Switching Time Test Circuit

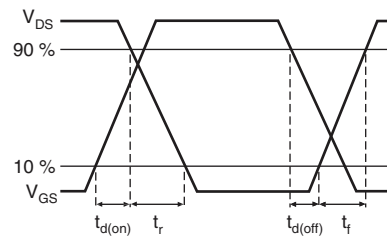


Fig. 10b - Switching Time Waveforms

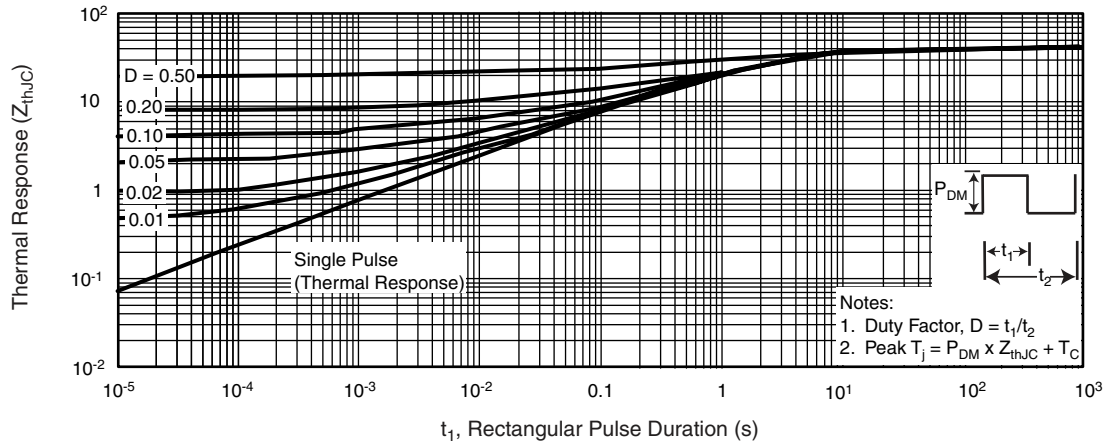


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

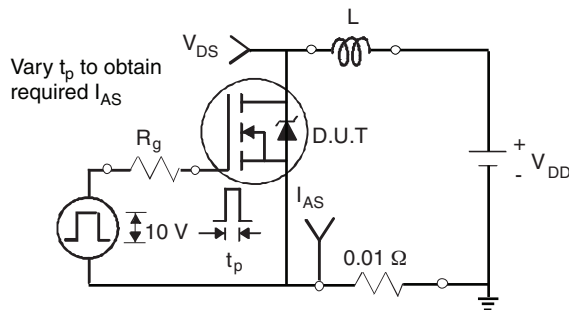


Fig. 12a - Unclamped Inductive Test Circuit

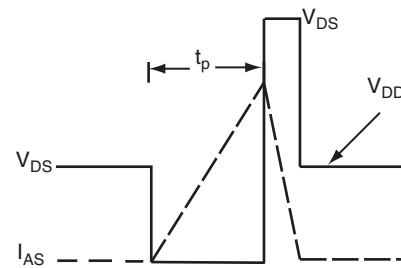


Fig. 12b - Unclamped Inductive Waveforms

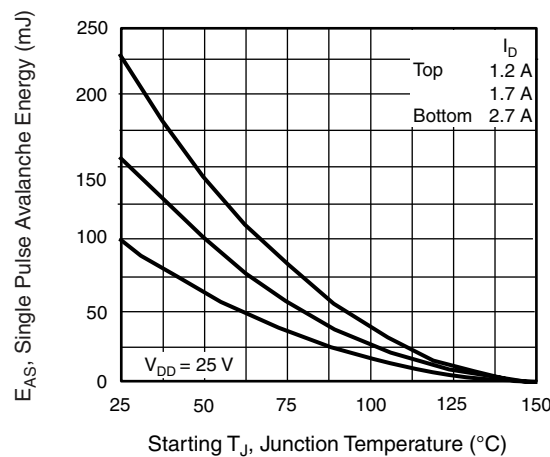


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

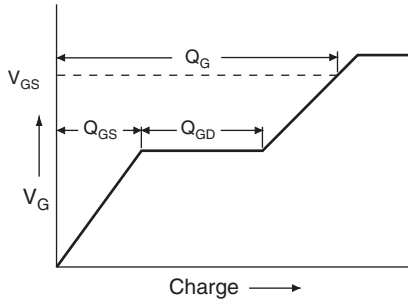


Fig. 13a - Basic Gate Charge Waveform

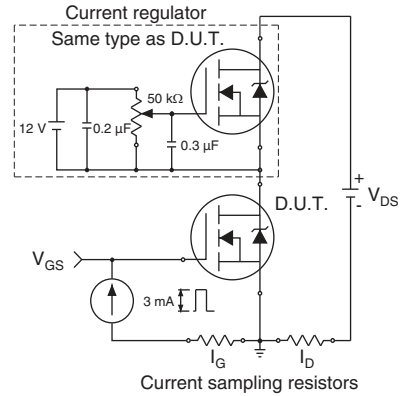
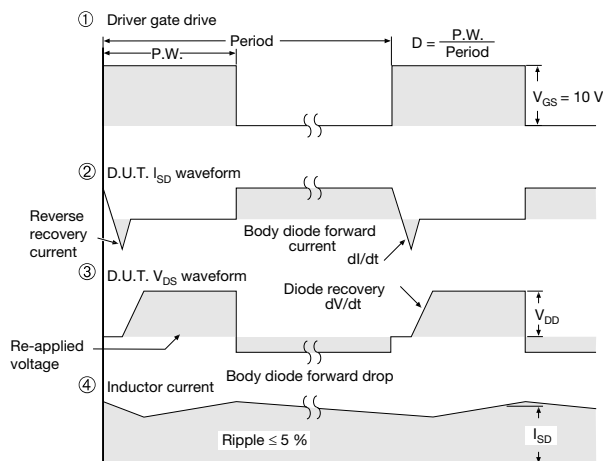
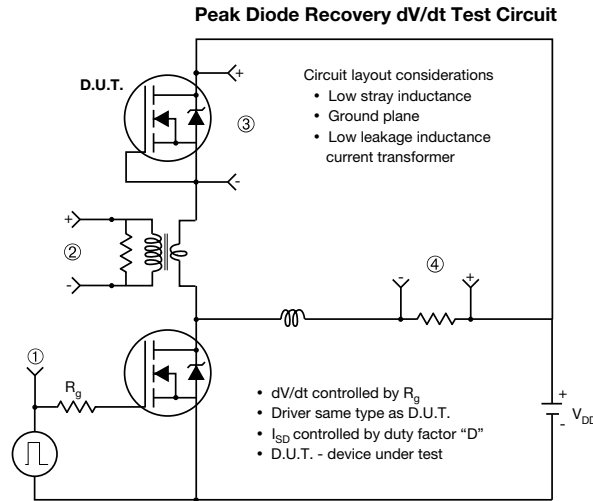


Fig. 13b - Gate Charge Test Circuit



Note
a. $V_{GS} = 5\text{ V}$ for logic level devices

Fig. 14 - For N-Channel

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SOT-223 (HIGH VOLTAGE)



| DIM. | MILLIMETERS | | INCHES | |
|----------|-------------|------|------------|-------|
| | MIN. | MAX. | MIN. | MAX. |
| A | 1.55 | 1.80 | 0.061 | 0.071 |
| B | 0.65 | 0.85 | 0.026 | 0.033 |
| B1 | 2.95 | 3.15 | 0.116 | 0.124 |
| C | 0.25 | 0.35 | 0.010 | 0.014 |
| D | 6.30 | 6.70 | 0.248 | 0.264 |
| E | 3.30 | 3.70 | 0.130 | 0.146 |
| e | 2.30 BSC | | 0.0905 BSC | |
| e1 | 4.60 BSC | | 0.181 BSC | |
| H | 6.71 | 7.29 | 0.264 | 0.287 |
| L | 0.91 | - | 0.036 | - |
| L1 | 0.061 BSC | | 0.0024 BSC | |
| θ | - | 10' | - | 10' |

ECN: S-82109-Rev. A, 15-Sep-08
DWG: 5969

Notes

1. Dimensioning and tolerancing per ASME Y14.5M-1994.
2. Dimensions are shown in millimeters (inches).
3. Dimension do not include mold flash.
4. Outline conforms to JEDEC outline TO-261AA.



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