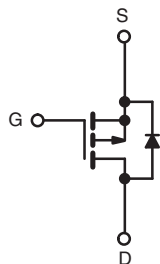
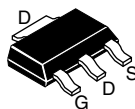


Power MOSFET

PRODUCT SUMMARY

| | | |
|---------------------------|-------------------|------|
| V_{DS} (V) | - 60 | |
| $R_{DS(on)}$ (Ω) | $V_{GS} = - 10$ V | 0.50 |
| Q_g (Max.) (nC) | 12 | |
| Q_{gs} (nC) | 3.8 | |
| Q_{gd} (nC) | 5.1 | |
| Configuration | Single | |

SOT-223


P-Channel MOSFET

FEATURES

- Surface Mount
- Available in Tape and Reel
- Dynamic dV/dt Rating
- Repetitive Avalanche Rated
- P-Channel
- Fast Switching
- Ease of Paralleling
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT
HALOGEN
FREE
Available

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 | SOT-223 |
|---------------------------------|---------------|----------------------------|
| Lead (Pb)-free and Halogen-free | SiHFL9014-GE3 | SiHFL9014TR-GE3 |
| Lead (Pb)-free | IRFL9014PbF | IRFL9014TRPbF ^a |
| | SiHFL9014-E3 | SiHFL9014T-E3 ^a |

Note

a. See device orientation.

ABSOLUTE MAXIMUM RATINGS ($T_C = 25$ °C, unless otherwise noted)

| PARAMETER | SYMBOL | LIMIT | UNIT |
|---|--------------------|----------------|------|
| Drain-Source Voltage | V_{DS} | - 60 | V |
| Gate-Source Voltage | V_{GS} | ± 20 | |
| Continuous Drain Current | V_{GS} at - 10 V | $T_C = 25$ °C | A |
| | | $T_C = 100$ °C | |
| Pulsed Drain Current ^a | I_{DM} | - 14 | W/°C |
| Linear Derating Factor | | 0.025 | |
| Linear Derating Factor (PCB Mount) ^e | | 0.017 | |
| Single Pulse Avalanche Energy ^b | E_{AS} | 140 | mJ |
| Repetitive Avalanche Current ^a | I_{AR} | - 1.8 | A |
| Repetitive Avalanche Energy ^a | E_{AR} | 0.31 | mJ |
| Maximum Power Dissipation | P_D | $T_C = 25$ °C | W |
| Maximum Power Dissipation (PCB Mount) ^e | | $T_A = 25$ °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 | °C |
| Soldering Recommendations (Peak Temperature) ^d | for 10 s | 300 | |

Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- $V_{DD} = - 25$ V, starting $T_J = 25$ °C, $L = 50$ mH, $R_g = 25$ Ω , $I_{AS} = - 1.8$ A (see fig. 12).
- $I_{SP} \leq - 6.7$ A, $dI/dt \leq 90$ A/ μ s, $V_{DD} \leq V_{DS}$, $T_J \leq 150$ °C.
- 1.6 mm from case.
- When mounted on 1" square PCB (FR-4 or G-10 material).

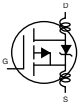

**THERMAL RESISTANCE RATINGS**

| PARAMETER | SYMBOL | TYP. | MAX. | UNIT |
|--|------------|------|------|------|
| Maximum Junction-to-Ambient (PCB Mount) ^a | R_{thJA} | - | 60 | °C/W |
| Maximum Junction-to-Case (Drain) | R_{thJC} | - | 40 | |

Note

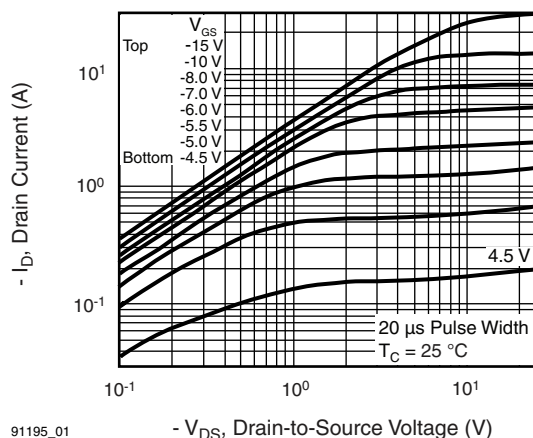
a. When mounted on 1" square PCB (FR-4 or G-10 material).

SPECIFICATIONS ($T_J = 25\text{ °C}$, unless otherwise noted)

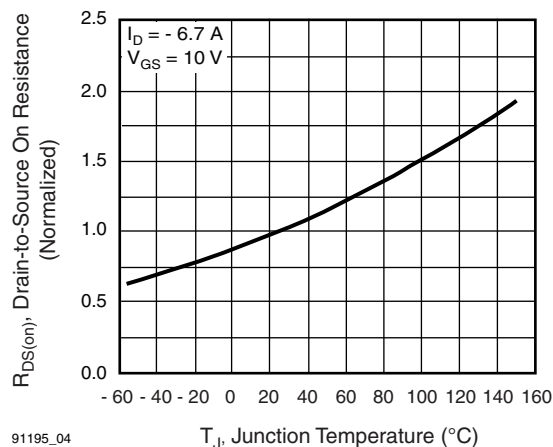
| PARAMETER | SYMBOL | TEST CONDITIONS | | MIN. | TYP. | MAX. | UNIT | | |
|---|---------------------|--|---|---|---------|-----------|---------------------|-------|----|
| Static | | | | | | | | | |
| Drain-Source Breakdown Voltage | V_{DS} | $V_{GS} = 0\text{ V}$, $I_D = 250\text{ }\mu\text{A}$ | | - 60 | - | - | V | | |
| V_{DS} Temperature Coefficient | $\Delta V_{DS}/T_J$ | Reference to $25\text{ }^\circ\text{C}$, $I_D = 1\text{ mA}$ | | - | - 0.059 | - | V/ $^\circ\text{C}$ | | |
| Gate-Source Threshold Voltage | $V_{GS(th)}$ | $V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$ | | - 2.0 | - | - 4.0 | V | | |
| Gate-Source Leakage | I_{GSS} | $V_{GS} = \pm 20\text{ V}$ | | - | - | ± 100 | nA | | |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS} = - 60\text{ V}$, $V_{GS} = 0\text{ V}$ | | - | - | - 100 | μA | | |
| | | $V_{DS} = - 48\text{ V}$, $V_{GS} = 0\text{ V}$, $T_J = 125\text{ }^\circ\text{C}$ | | - | - | - 500 | | | |
| Drain-Source On-State Resistance | $R_{DS(on)}$ | $V_{GS} = - 10\text{ V}$ | $I_D = 1.1\text{ A}^b$ | - | - | 0.50 | Ω | | |
| Forward Transconductance | g_{fs} | $V_{DS} = - 25\text{ V}$, $I_D = 1.1\text{ A}^b$ | | 1.3 | - | - | S | | |
| Dynamic | | | | | | | | | |
| Input Capacitance | C_{iss} | $V_{GS} = 0\text{ V}$, $V_{DS} = 25\text{ V}$, $f = 1.0\text{ MHz}$, see fig. 5 | | - | 270 | - | pF | | |
| Output Capacitance | C_{oss} | | | - | 170 | - | | | |
| Reverse Transfer Capacitance | C_{rss} | | | - | 31 | - | | | |
| Total Gate Charge | Q_g | $V_{GS} = - 10\text{ V}$ | $I_D = - 6.7\text{ A}$, $V_{DS} = - 48\text{ V}$, see fig. 6 and 13 ^b | - | - | 12 | nC | | |
| Gate-Source Charge | Q_{gs} | | | - | - | 3.8 | | | |
| Gate-Drain Charge | Q_{gd} | | | - | - | 5.1 | | | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD} = - 30\text{ V}$, $I_D = - 6.7\text{ A}$, $R_g = 24\text{ }\Omega$, $R_D = 4.0\text{ }\Omega$, see fig. 10 ^b | | - | 11 | - | ns | | |
| Rise Time | t_r | | | - | 63 | - | | | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | - | 9.6 | - | | | |
| Fall Time | t_f | | | - | 31 | - | | | |
| 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 | |  | | - | - | - 1.8 | A |
| Pulsed Diode Forward Current ^a | I_{SM} | | | | | - | - | - 14 | |
| Body Diode Voltage | V_{SD} | $T_J = 25\text{ }^\circ\text{C}$, $I_S = - 1.8\text{ A}$, $V_{GS} = 0\text{ V}^b$ | | - | - | - 5.5 | V | | |
| Body Diode Reverse Recovery Time | t_{rr} | $T_J = 25\text{ }^\circ\text{C}$, $I_F = - 6.7\text{ A}$, $dI/dt = 100\text{ A}/\mu\text{s}^b$ | | - | 80 | 160 | ns | | |
| Body Diode Reverse Recovery Charge | Q_{rr} | | | - | 0.096 | 0.19 | μC | | |
| Forward Turn-On Time | t_{on} | Intrinsic turn-on time is negligible (turn-on is dominated by L_S and L_D) | | | | | | | |

Notes

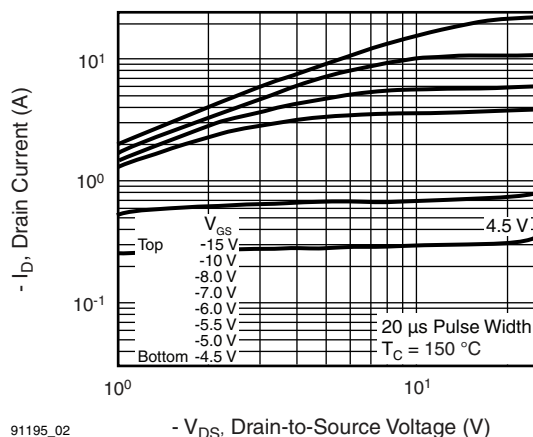
- a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
b. Pulse width $\leq 300\text{ }\mu\text{s}$; duty cycle $\leq 2\%$.

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)


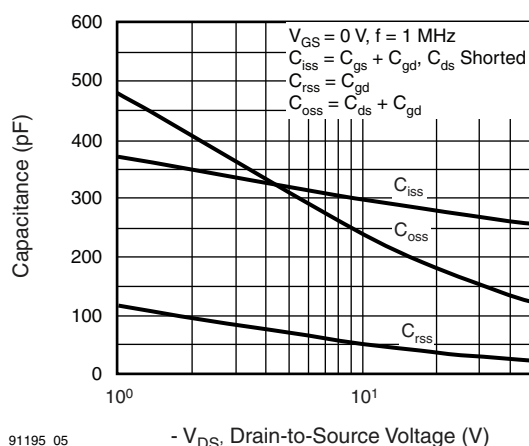
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Fig. 1 - Typical Output Characteristics, $T_C = 25^\circ\text{C}$


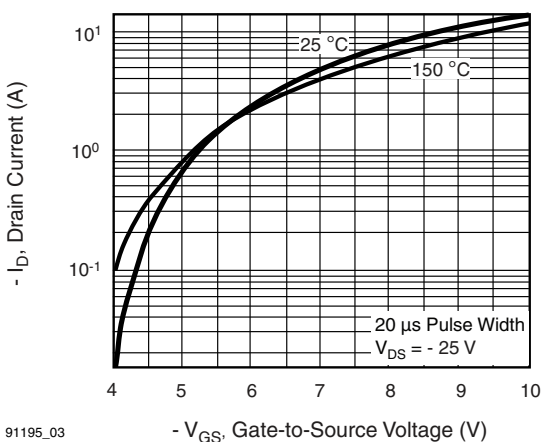
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Fig. 4 - Normalized On-Resistance vs. Temperature


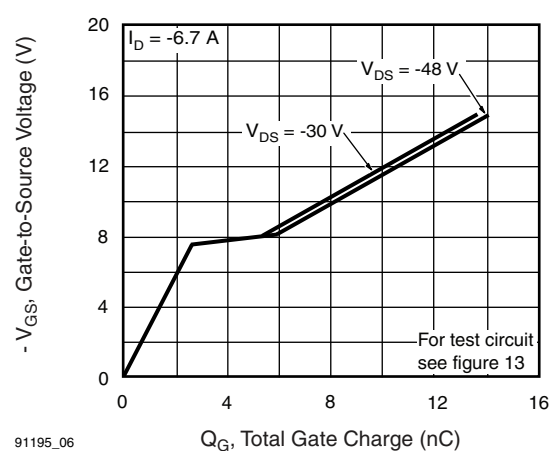
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Fig. 2 - Typical Output Characteristics, $T_C = 150^\circ\text{C}$


91195_05

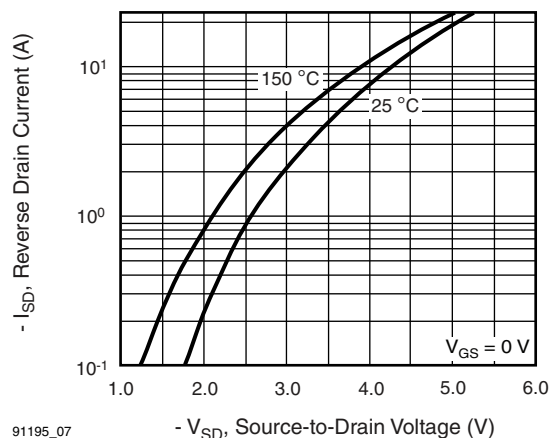
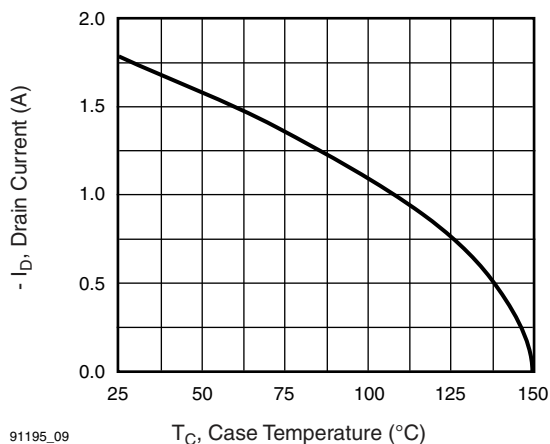
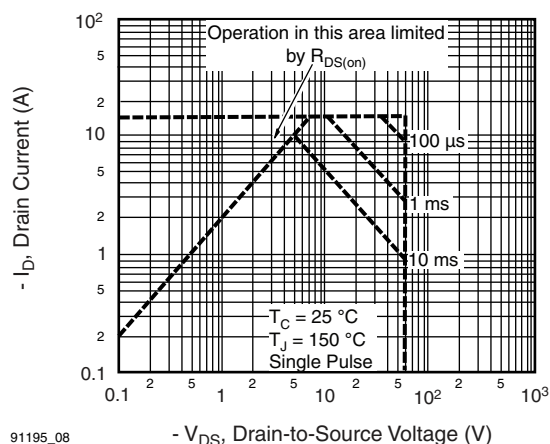
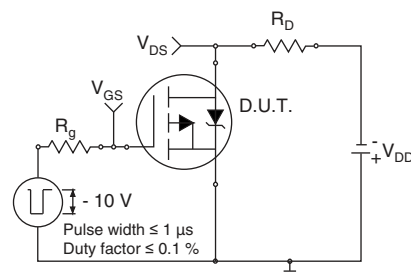
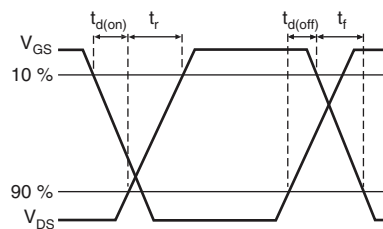
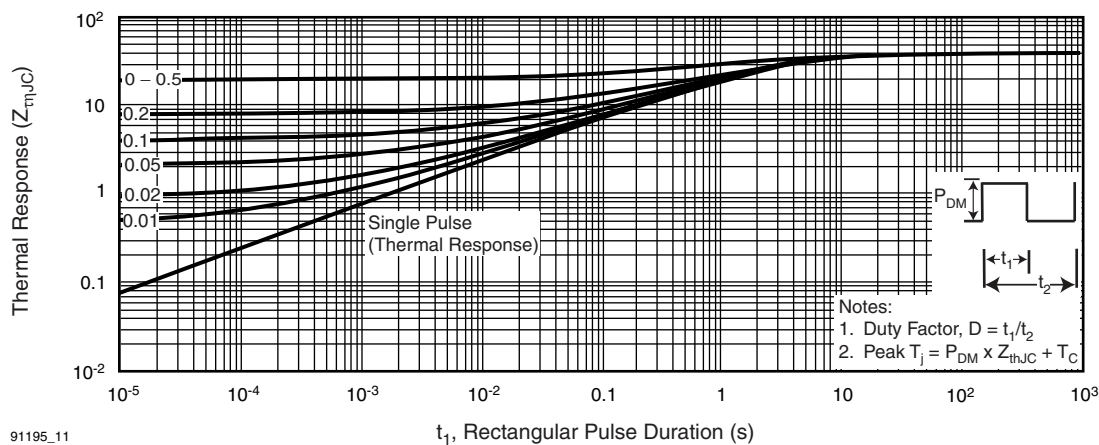
Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage


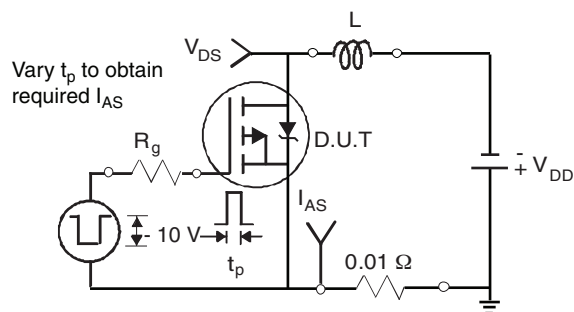
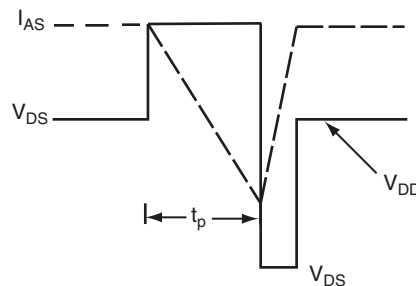
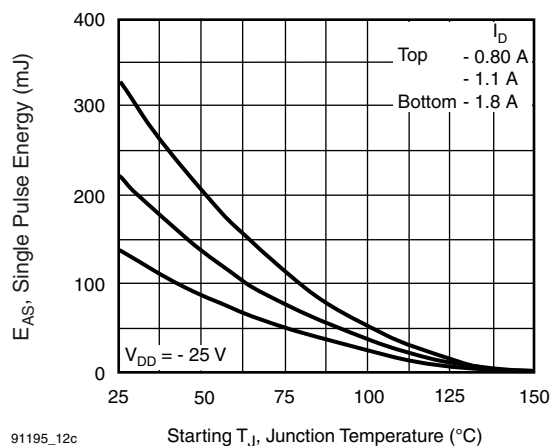
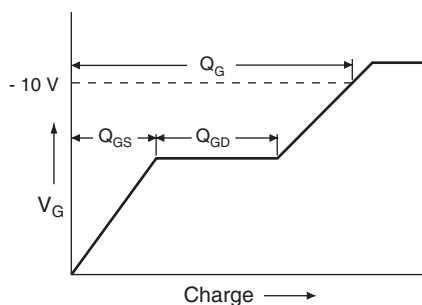
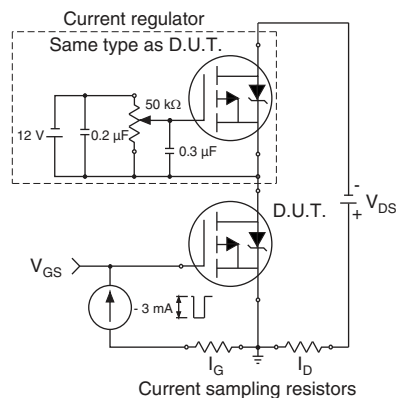
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Fig. 3 - Typical Transfer Characteristics


91195_06

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

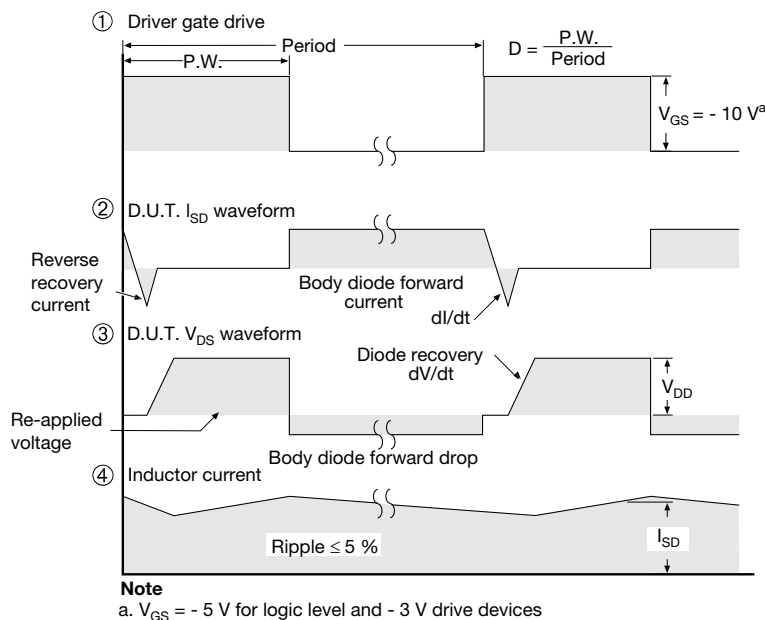
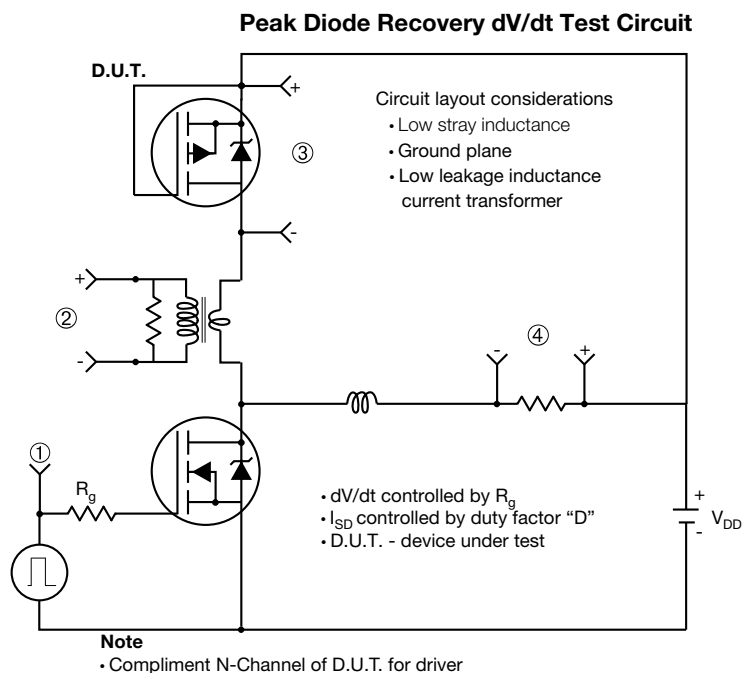
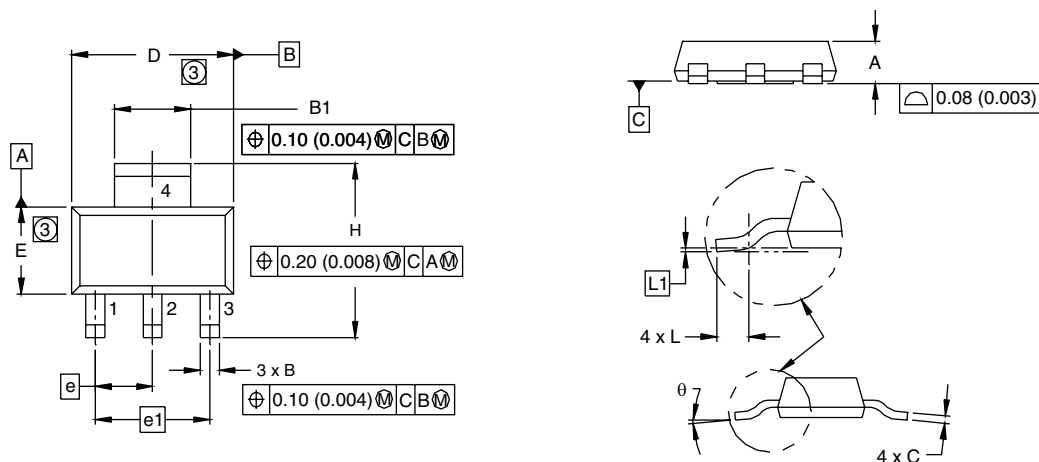


Fig. 14 - For P-Channel

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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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