

Power MOSFET



RoHS
COMPLIANT
HALOGEN
FREE
Available

| PRODUCT SUMMARY | | |
|---------------------------|-----------------|-----|
| V_{DS} (V) | 200 | |
| $R_{DS(on)}$ (Ω) | $V_{GS} = 10$ V | 1.5 |
| Q_g (Max.) (nC) | 8.2 | |
| Q_{gs} (nC) | 1.8 | |
| Q_{gd} (nC) | 4.5 | |
| Configuration | Single | |

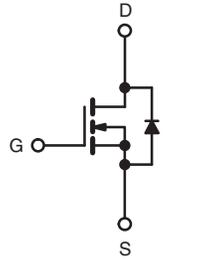
FEATURES

- Surface mount
- Available in tape and reel
- Dynamic dV/dt rating
- Repetitive avalanche rated
- Fast switching
- Ease of paralleling
- Simple drive requirements
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

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.



N-Channel MOSFET

Marking code: FC

| ORDERING INFORMATION | | |
|---------------------------------|--------------|-----------------------------|
| Package | SOT-223 | SOT-223 |
| Lead (Pb)-free and Halogen-free | SiHFL210-GE3 | SiHFL210TR-GE3 ^a |
| Lead (Pb)-free | IRFL210PbF | IRFL210TRPbF ^a |
| | SiHFL210-E3 | SiHFL210T-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} | 200 | 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} | 7.7 | W/°C |
| Linear Derating Factor | | 0.025 | |
| Linear Derating Factor (PCB Mount) ^e | | 0.017 | |
| Single Pulse Avalanche Energy ^b | E_{AS} | 50 | mJ |
| Repetitive Avalanche Current ^a | I_{AR} | 0.96 | A |
| Repetitive Avalanche Energy ^a | E_{AR} | 0.31 | mJ |
| Maximum Power Dissipation | P_D | $T_C = 25$ °C | W |
| | | $T_A = 25$ °C | |
| Peak Diode Recovery dV/dt ^c | dV/dt | 5.0 | 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).
- $V_{DD} = 50$ V, starting $T_J = 25$ °C, $L = 81$ mH, $R_G = 25$ Ω , $I_{AS} = 0.96$ A (see fig. 12).
- $I_{SD} \leq 3.3$ A, $dI/dt \leq 70$ 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 | MIN. | TYP. | MAX. | UNIT |
| Maximum Junction-to-Ambient (PCB Mount) ^a | R _{thJA} | - | - | 40 | °C/W |
| Maximum Junction-to-Case (Drain) | R _{thJC} | - | - | 60 | |

Note

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

| SPECIFICATIONS (T _J = 25 °C, unless otherwise noted) | | | | | | | |
|---|----------------------------------|--|--|------|------|-------|------|
| PARAMETER | SYMBOL | TEST CONDITIONS | | MIN. | TYP. | MAX. | UNIT |
| Static | | | | | | | |
| Drain-Source Breakdown Voltage | V _{DS} | V _{GS} = 0 V, I _D = 250 μA | | 200 | - | - | V |
| V _{DS} Temperature Coefficient | ΔV _{DS} /T _J | Reference to 25 °C, I _D = 1 mA | | - | 0.30 | - | V/°C |
| Gate-Source Threshold Voltage | V _{GS(th)} | V _{DS} = V _{GS} , I _D = 250 μA | | 2.0 | - | 4.0 | V |
| Gate-Source Leakage | I _{GSS} | V _{GS} = ± 20 V | | - | - | ± 100 | nA |
| Zero Gate Voltage Drain Current | I _{DSS} | V _{DS} = 200 V, V _{GS} = 0 V | | - | - | 25 | μA |
| | | V _{DS} = 160 V, V _{GS} = 0 V, T _J = 125 °C | | - | - | 250 | |
| Drain-Source On-State Resistance | R _{DS(on)} | V _{GS} = 10 V | I _D = 0.58 A ^b | - | - | 1.5 | Ω |
| Forward Transconductance | g _{fs} | V _{DS} = 50 V, I _D = 0.58 A | | 0.51 | - | - | S |
| Dynamic | | | | | | | |
| Input Capacitance | C _{iss} | V _{GS} = 0 V, V _{DS} = 25 V, f = 1.0 MHz, see fig. 5 | | - | 140 | - | pF |
| Output Capacitance | C _{oss} | | | - | 53 | - | |
| Reverse Transfer Capacitance | C _{rss} | | | - | 15 | - | |
| Total Gate Charge | Q _g | V _{GS} = 10 V | I _D = 3.3 A, V _{DS} = 160 V, see fig. 6 and 13 ^b | - | - | 8.2 | nC |
| Gate-Source Charge | Q _{gs} | | | - | - | 1.8 | |
| Gate-Drain Charge | Q _{gd} | | | - | - | 4.5 | |
| Turn-On Delay Time | t _{d(on)} | V _{DD} = 100 V, I _D = 3.3 A, R _g = 24 Ω, R _D = 30 Ω, see fig. 10 ^b | | - | 8.2 | - | ns |
| Rise Time | t _r | | | - | 17 | - | |
| Turn-Off Delay Time | t _{d(off)} | | | - | 14 | - | |
| Fall Time | t _f | | | - | 8.9 | - | |
| 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 | | - | - | 0.96 | A |
| Pulsed Diode Forward Current ^a | I _{SM} | | | - | - | 7.7 | |
| Body Diode Voltage | V _{SD} | T _J = 25 °C, I _S = 0.96 A, V _{GS} = 0 V ^b | | - | - | 2.0 | V |
| Body Diode Reverse Recovery Time | t _{rr} | T _J = 25 °C, I _F = 3.3 A, dI/dt = 100 A/μs ^b | | - | 150 | 310 | ns |
| Body Diode Reverse Recovery Charge | Q _{rr} | | | - | 0.60 | 1.4 | 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 ≤ 300 μs; duty cycle ≤ 2 %.



TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

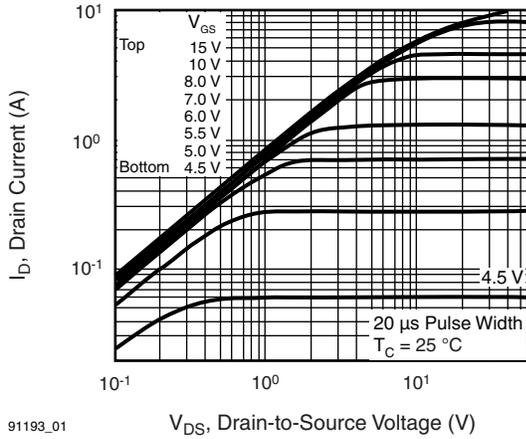


Fig. 1 - Typical Output Characteristics, $T_C = 25\text{ }^\circ\text{C}$

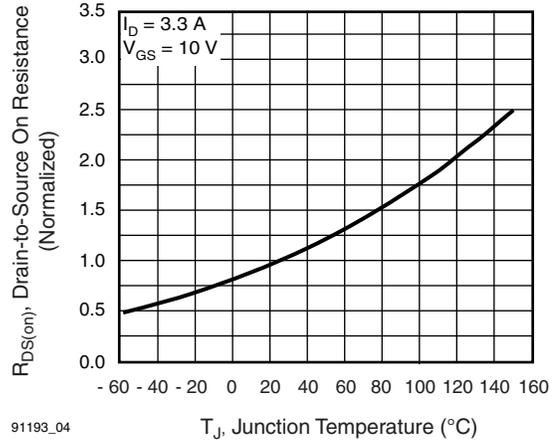


Fig. 4 - Normalized On-Resistance vs. Temperature

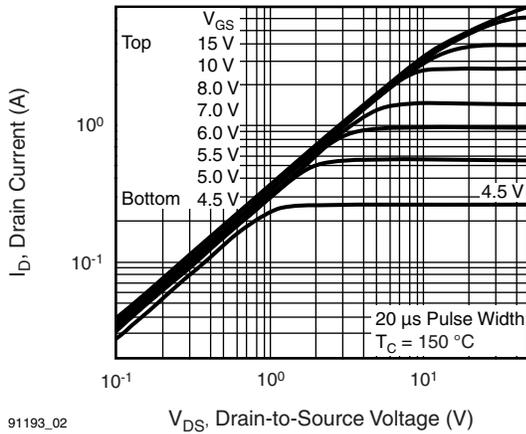


Fig. 2 - Typical Output Characteristics, $T_C = 150\text{ }^\circ\text{C}$

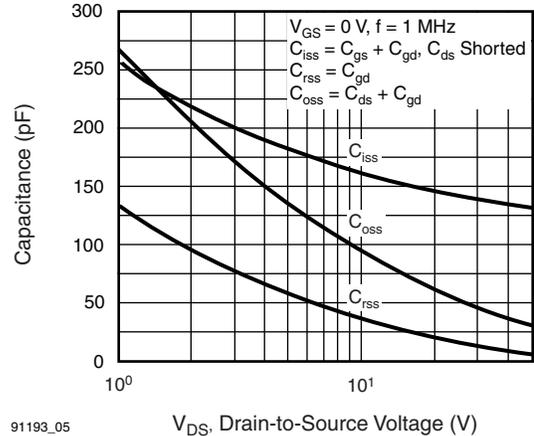


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

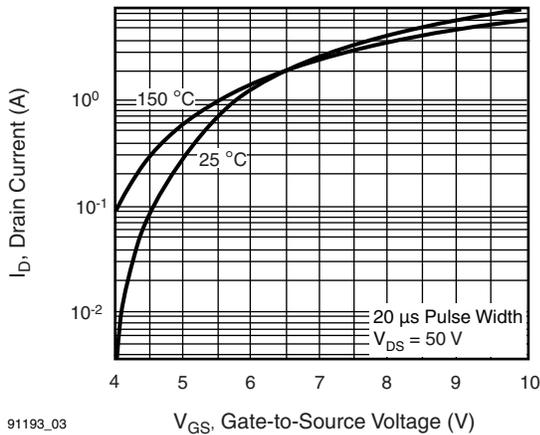


Fig. 3 - Typical Transfer Characteristics

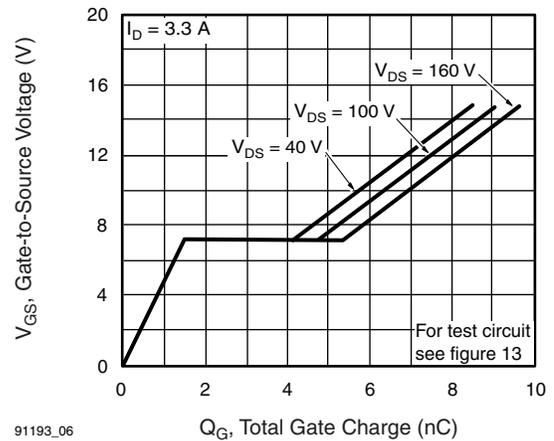


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

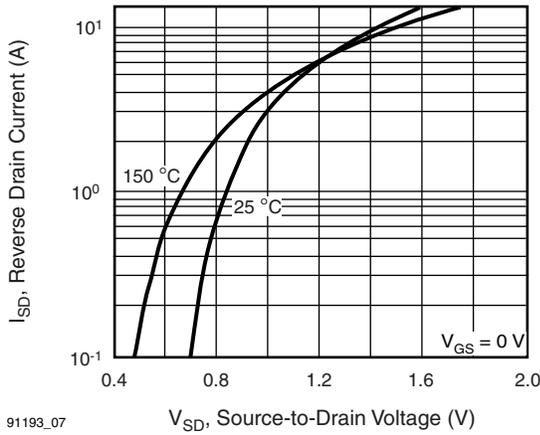


Fig. 7 - Typical Source-Drain Diode Forward Voltage

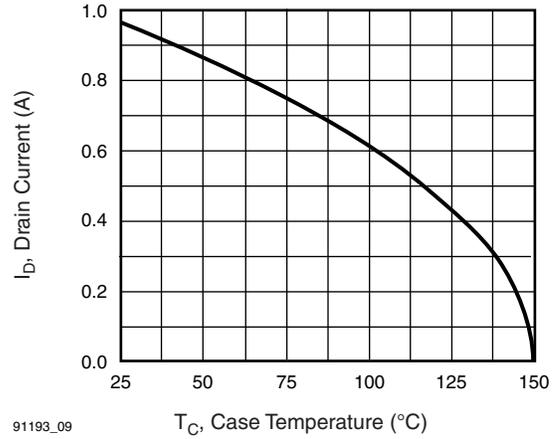


Fig. 9 - Maximum Drain Current vs. Case Temperature

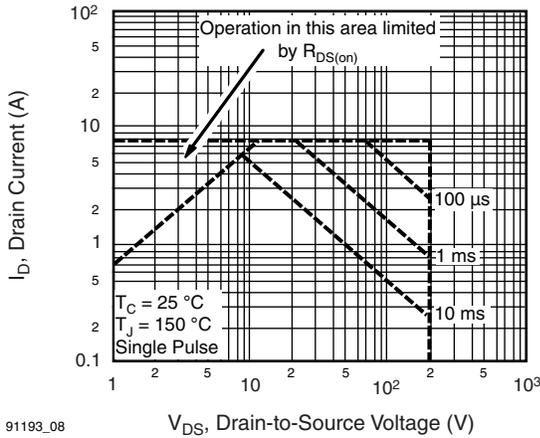


Fig. 8 - Maximum Safe Operating Area

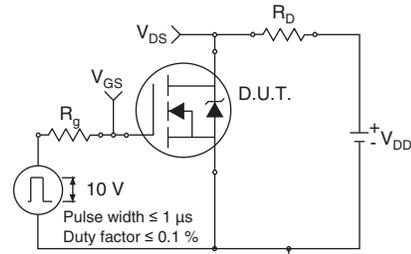


Fig. 10a - Switching Time Test Circuit

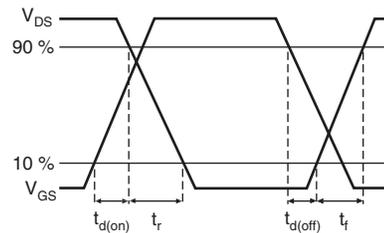


Fig. 10b - Switching Time Waveforms

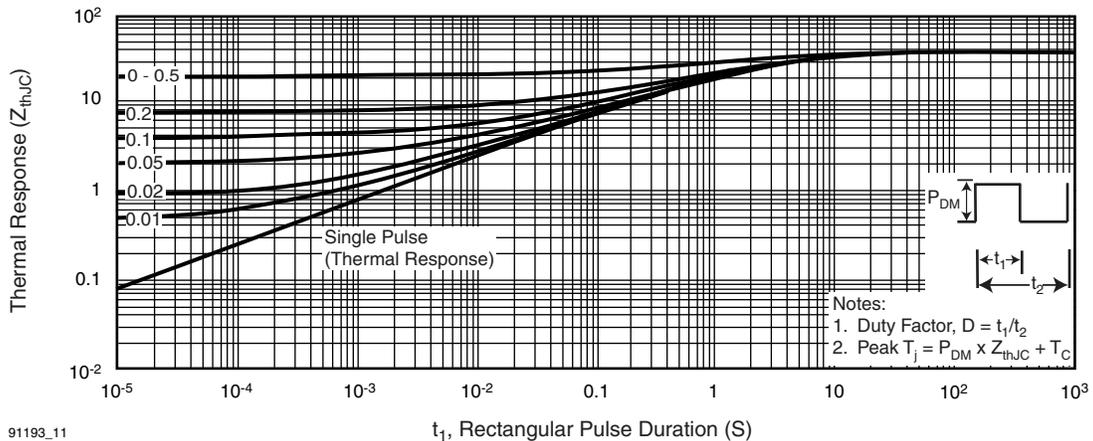


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

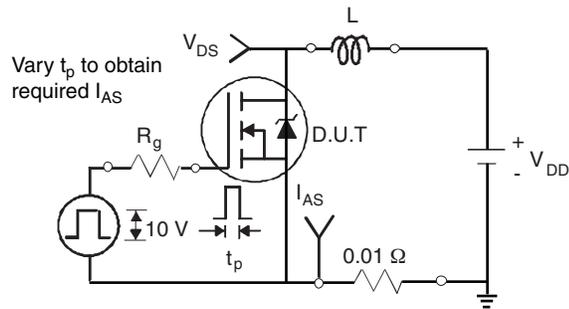


Fig. 12a - Unclamped Inductive Test Circuit

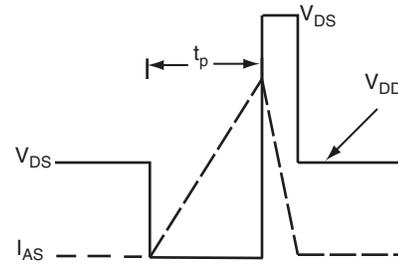
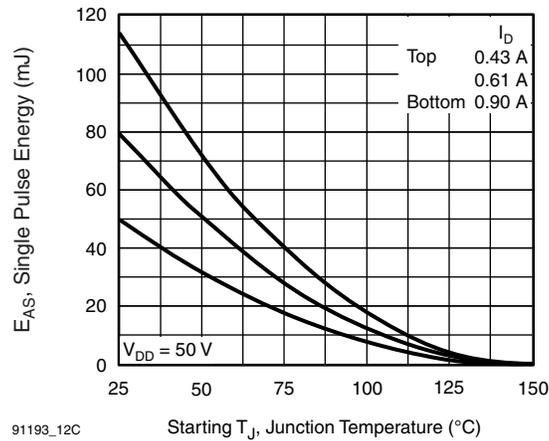


Fig. 12b - Unclamped Inductive Waveforms



91193_12C

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

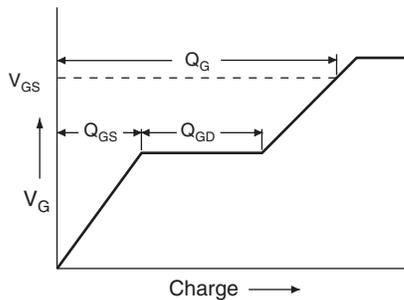


Fig. 13a - Basic Gate Charge Waveform

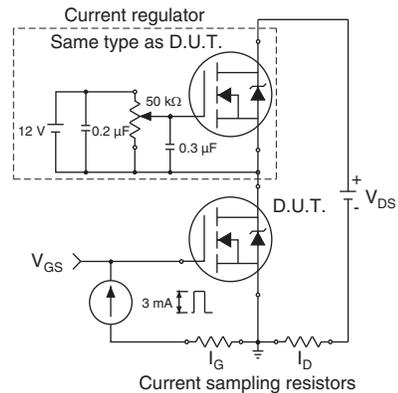


Fig. 13b - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit

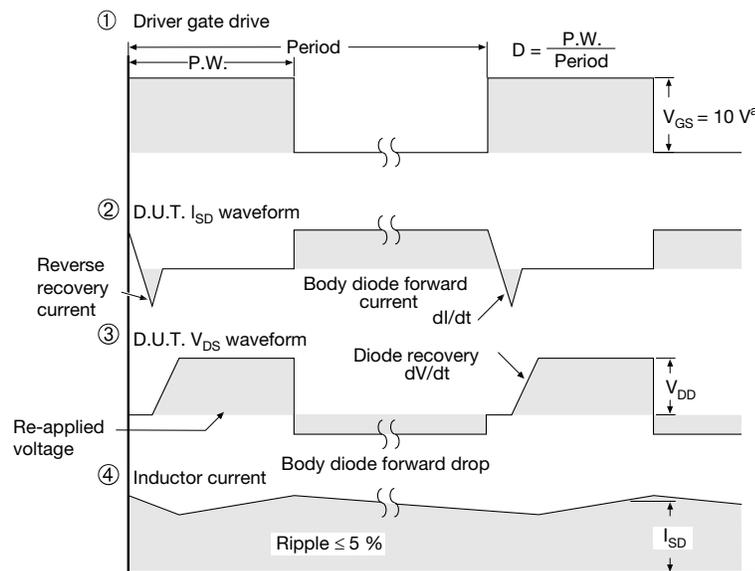
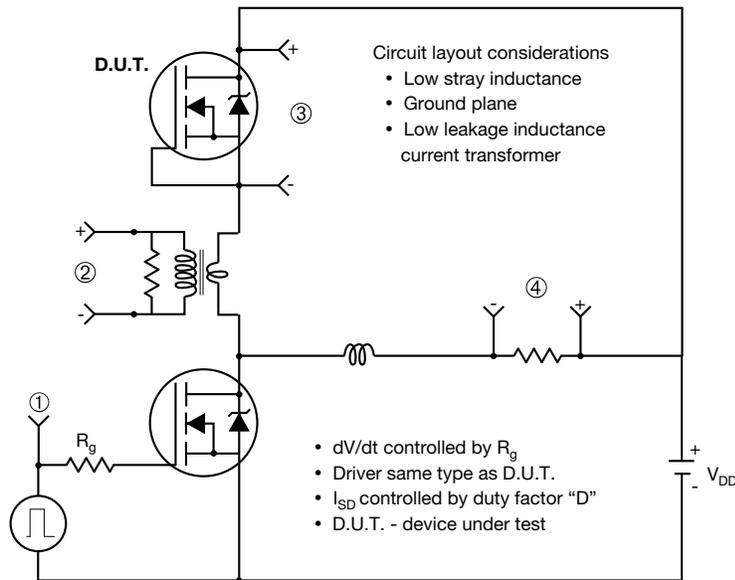
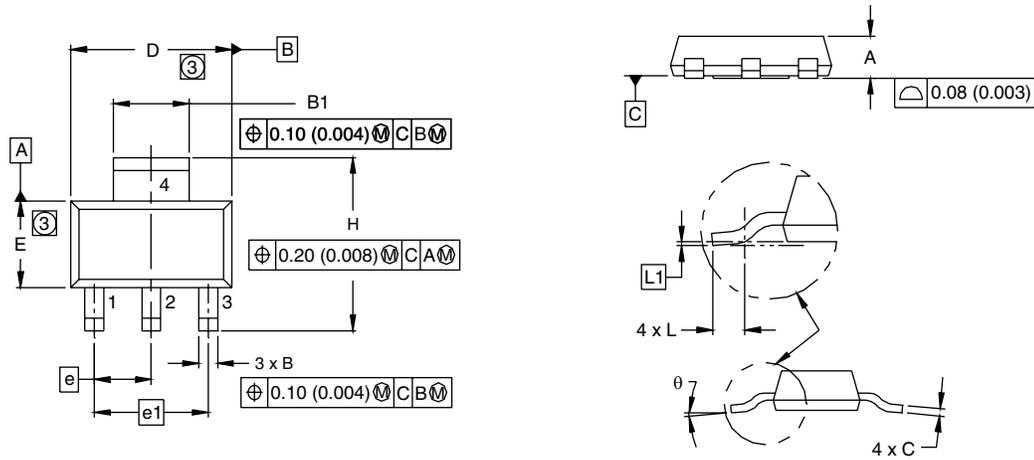


Fig. 14 - For N-Channel

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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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