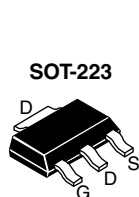


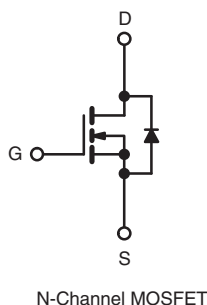
## Power MOSFET

### PRODUCT SUMMARY

|                           |                        |     |
|---------------------------|------------------------|-----|
| $V_{DS}$ (V)              | 250                    |     |
| $R_{DS(on)}$ ( $\Omega$ ) | $V_{GS} = 10\text{ V}$ | 2.0 |
| $Q_g$ (Max.) (nC)         | 8.2                    |     |
| $Q_{gs}$ (nC)             | 1.8                    |     |
| $Q_{gd}$ (nC)             | 4.5                    |     |
| Configuration             | Single                 |     |



Marking code: FD



### 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](http://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 | SiHFL214-GE3 | SiHFL214TR-GE3 <sup>a</sup> |
| Lead (Pb)-free                  | IRFL214PbF   | IRFL214TRPbF <sup>a</sup>   |
|                                 | SiHFL214-E3  | SiHFL214T-E3 <sup>a</sup>   |

#### Note

a. See device orientation.

### ABSOLUTE MAXIMUM RATINGS ( $T_C = 25\text{ }^\circ\text{C}$ , unless otherwise noted)

| PARAMETER                                                 | SYMBOL           | LIMIT                             | UNIT                |
|-----------------------------------------------------------|------------------|-----------------------------------|---------------------|
| Drain-Source Voltage                                      | $V_{DS}$         | 250                               | V                   |
| Gate-Source Voltage                                       | $V_{GS}$         | $\pm 20$                          |                     |
| 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 <sup>a</sup>                         | $I_{DM}$         | 6.3                               | W/ $^\circ\text{C}$ |
| Linear Derating Factor                                    |                  | 0.025                             |                     |
| Linear Derating Factor (PCB Mount) <sup>e</sup>           |                  | 0.017                             |                     |
| Single Pulse Avalanche Energy <sup>b</sup>                | $E_{AS}$         | 50                                | mJ                  |
| Repetitive Avalanche Current <sup>a</sup>                 | $I_{AR}$         | 0.79                              | A                   |
| Repetitive Avalanche Energy <sup>a</sup>                  | $E_{AR}$         | 0.31                              | mJ                  |
| Maximum Power Dissipation                                 | $P_D$            | $T_C = 25\text{ }^\circ\text{C}$  | W                   |
| Maximum Power Dissipation (PCB Mount) <sup>e</sup>        |                  | $T_A = 25\text{ }^\circ\text{C}$  |                     |
| Peak Diode Recovery $dV/dt$ <sup>c</sup>                  | $dV/dt$          | 4.8                               | V/ns                |
| Operating Junction and Storage Temperature Range          | $T_J, T_{stg}$   | -55 to +150                       | $^\circ\text{C}$    |
| Soldering Recommendations (Peak Temperature) <sup>d</sup> | for 10 s         | 300                               |                     |

#### Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- $V_{DD} = 50\text{ V}$ , starting  $T_J = 25\text{ }^\circ\text{C}$ ,  $L = 128\text{ mH}$ ,  $R_g = 25\text{ }\Omega$ ,  $I_{AS} = 0.79\text{ A}$  (see fig. 12).
- $I_{SD} \leq 2.7\text{ A}$ ,  $dI/dt \leq 65\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq V_{DS}$ ,  $T_J \leq 150\text{ }^\circ\text{C}$ .
- 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) <sup>a</sup> | $R_{thJA}$ | -    | -    | 60   | °C/W |
| Maximum Junction-to-Case (Drain)                     | $R_{thJC}$ | -    | -    | 40   |      |

**Note**

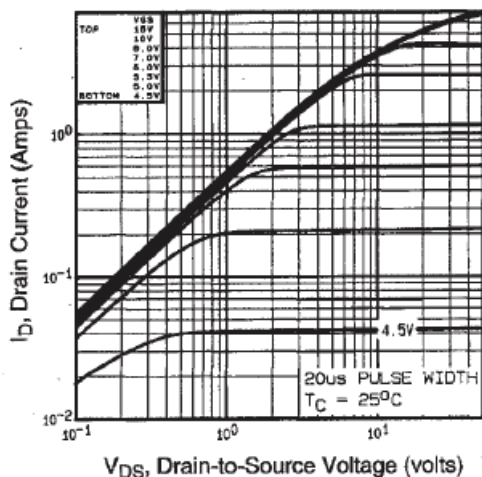
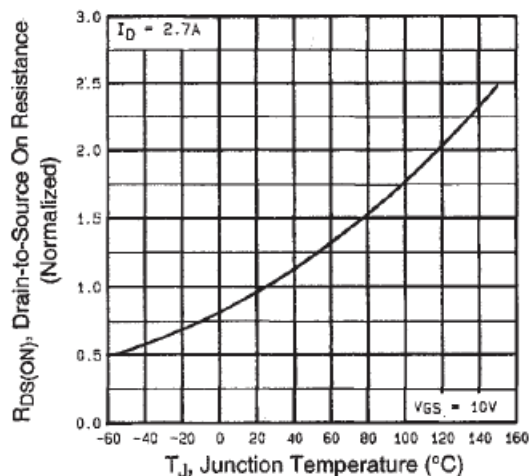
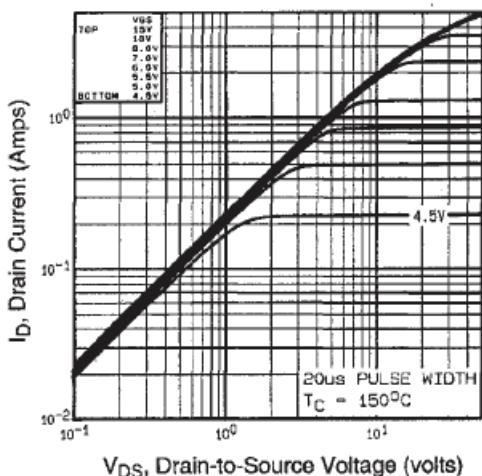
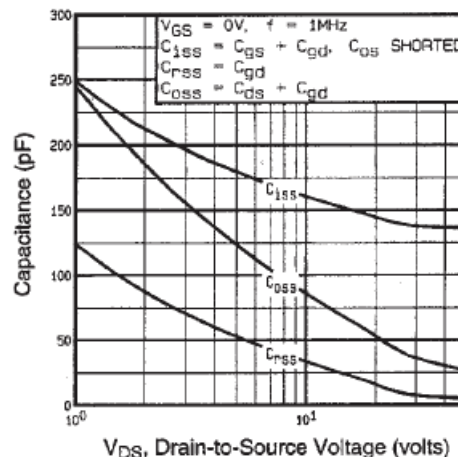
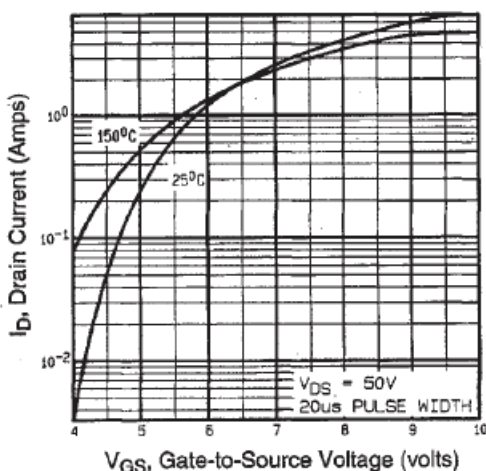
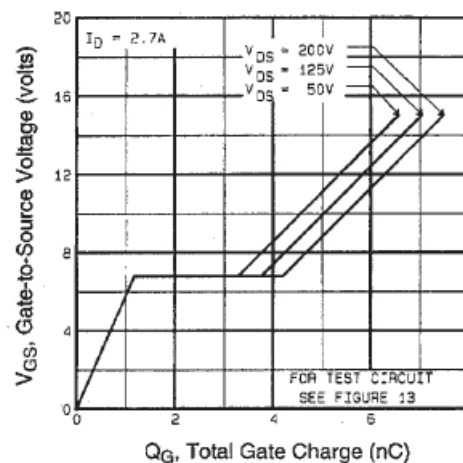
a. When mounted on 1" square PCB (FR-4 or G-10 material).

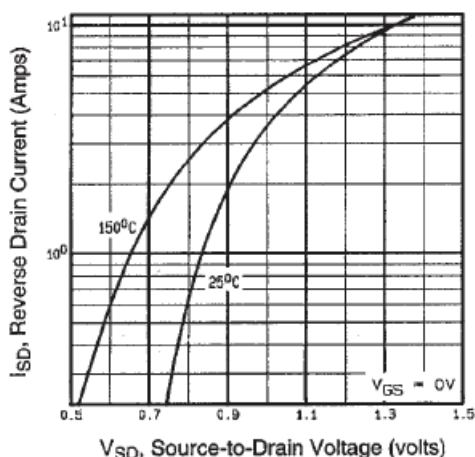
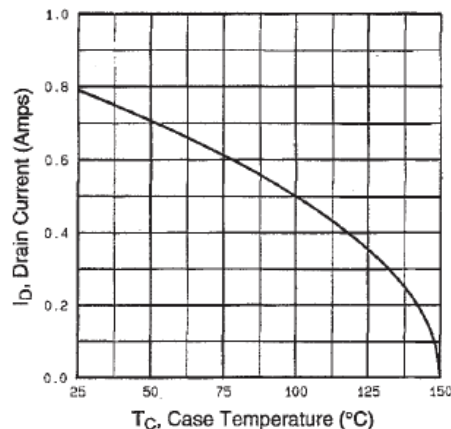
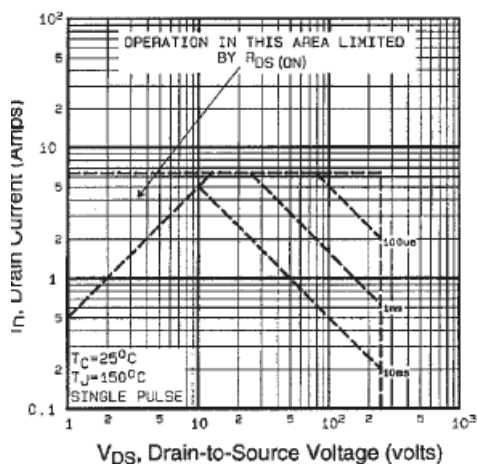
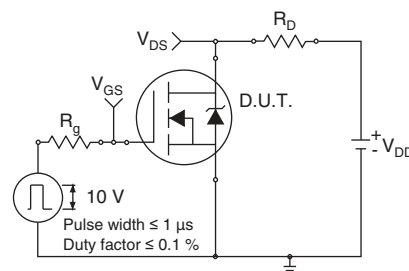
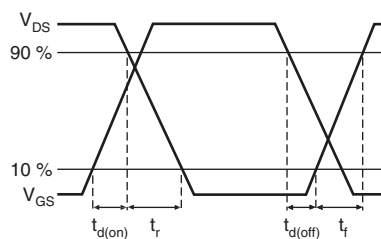
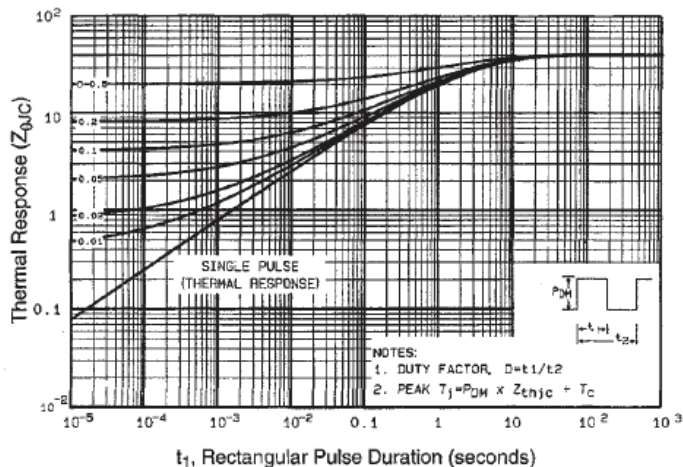
**SPECIFICATIONS** ( $T_J = 25\text{ °C}$ , unless otherwise noted)

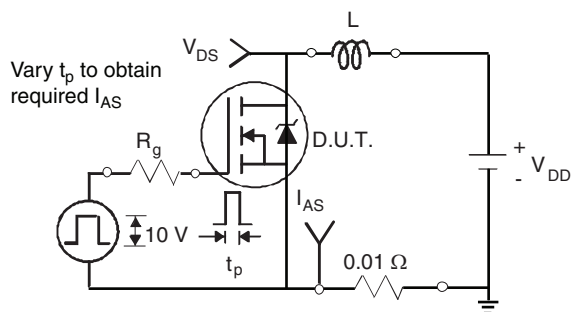
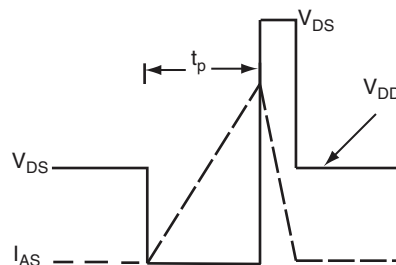
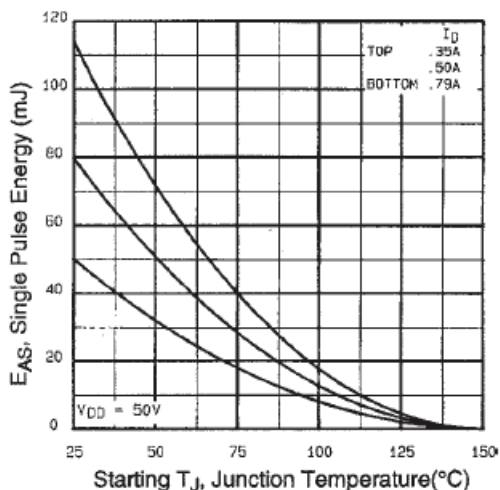
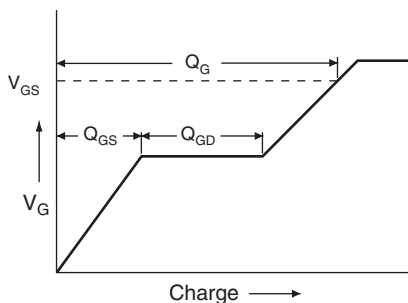
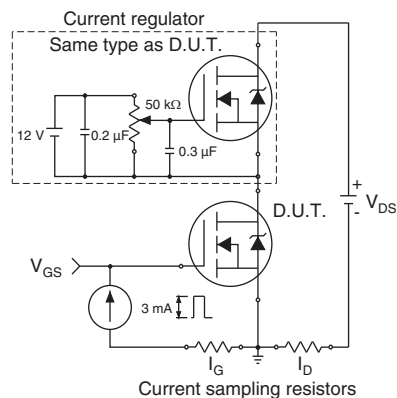
| PARAMETER                                 | SYMBOL              | TEST CONDITIONS                                                                                                                    |                                                                                    | MIN. | TYP. | MAX.      | UNIT                |
|-------------------------------------------|---------------------|------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|------|------|-----------|---------------------|
| Static                                    |                     |                                                                                                                                    |                                                                                    |      |      |           |                     |
| Drain-Source Breakdown Voltage            | $V_{DS}$            | $V_{GS} = 0\text{ V}$ , $I_D = 250\text{ }\mu\text{A}$                                                                             |                                                                                    | 250  | -    | -         | V                   |
| $V_{DS}$ Temperature Coefficient          | $\Delta V_{DS}/T_J$ | Reference to $25\text{ }^\circ\text{C}$ , $I_D = 1\text{ mA}$                                                                      |                                                                                    | -    | 0.39 | -         | 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                       | $I_{GSS}$           | $V_{GS} = \pm 20\text{ V}$                                                                                                         |                                                                                    | -    | -    | $\pm 100$ | nA                  |
| Zero Gate Voltage Drain Current           | $I_{DSS}$           | $V_{DS} = 250\text{ V}$ , $V_{GS} = 0\text{ V}$                                                                                    |                                                                                    | -    | -    | 25        | $\mu\text{A}$       |
|                                           |                     | $V_{DS} = 200\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 125\text{ }^\circ\text{C}$                                                |                                                                                    | -    | -    | 250       |                     |
| Drain-Source On-State Resistance          | $R_{DS(on)}$        | $V_{GS} = 10\text{ V}$                                                                                                             | $I_D = 0.47\text{ A}^b$                                                            | -    | -    | 2.0       | $\Omega$            |
| Forward Transconductance                  | $g_{fs}$            | $V_{DS} = 50\text{ V}$ , $I_D = 0.47\text{ A}$                                                                                     |                                                                                    | 0.50 | -    | -         | S                   |
| Dynamic                                   |                     |                                                                                                                                    |                                                                                    |      |      |           |                     |
| Input Capacitance                         | $C_{iss}$           | $V_{GS} = 0\text{ V}$ ,<br>$V_{DS} = 25\text{ V}$ ,<br>$f = 1.0\text{ MHz}$ , see fig. 5                                           |                                                                                    | -    | 140  | -         | pF                  |
| Output Capacitance                        | $C_{oss}$           |                                                                                                                                    |                                                                                    | -    | 42   | -         |                     |
| Reverse Transfer Capacitance              | $C_{rss}$           |                                                                                                                                    |                                                                                    | -    | 9.6  | -         |                     |
| Total Gate Charge                         | $Q_g$               | $V_{GS} = 10\text{ V}$                                                                                                             | $I_D = 2.7\text{ A}$ , $V_{DS} = 200\text{ V}$ ,<br>see fig. 6 and 13 <sup>b</sup> | -    | -    | 8.2       | nC                  |
| Gate-Source Charge                        | $Q_{gs}$            |                                                                                                                                    |                                                                                    | -    | -    | 1.8       |                     |
| Gate-Drain Charge                         | $Q_{gd}$            |                                                                                                                                    |                                                                                    | -    | -    | 4.5       |                     |
| Turn-On Delay Time                        | $t_{d(on)}$         | $V_{DD} = 125\text{ V}$ , $I_D = 2.7\text{ A}$ ,<br>$R_g = 24\text{ }\Omega$ , $R_D = 45\text{ }\Omega$ , see fig. 10 <sup>b</sup> |                                                                                    | -    | 7.0  | -         | ns                  |
| Rise Time                                 | $t_r$               |                                                                                                                                    |                                                                                    | -    | 7.6  | -         |                     |
| Turn-Off Delay Time                       | $t_{d(off)}$        |                                                                                                                                    |                                                                                    | -    | 16   | -         |                     |
| Fall Time                                 | $t_f$               |                                                                                                                                    |                                                                                    | -    | 7.0  | -         |                     |
| Internal Drain Inductance                 | $L_D$               | Between lead,<br>6 mm (0.25") from<br>package and center of<br>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<br>showing the<br>integral reverse<br>p - n junction diode                                                           |                                                                                    | -    | -    | 0.79      | A                   |
| Pulsed Diode Forward Current <sup>a</sup> | $I_{SM}$            |                                                                                                                                    |                                                                                    | -    | -    | 6.3       |                     |
| Body Diode Voltage                        | $V_{SD}$            | $T_J = 25\text{ }^\circ\text{C}$ , $I_S = 0.79\text{ A}$ , $V_{GS} = 0\text{ V}^b$                                                 |                                                                                    | -    | -    | 2.0       | V                   |
| Body Diode Reverse Recovery Time          | $t_{rr}$            | $T_J = 25\text{ }^\circ\text{C}$ , $I_F = 2.7\text{ A}$ , $dI/dt = 100\text{ A}/\mu\text{s}^b$                                     |                                                                                    | -    | 190  | 390       | ns                  |
| Body Diode Reverse Recovery Charge        | $Q_{rr}$            |                                                                                                                                    |                                                                                    | -    | 0.64 | 1.3       | $\mu\text{C}$       |
| Forward Turn-On Time                      | $t_{on}$            | Intrinsic turn-on time is negligible (turn-on is dominated by $L_S$ and $L_D$ )                                                    |                                                                                    |      |      |           |                     |

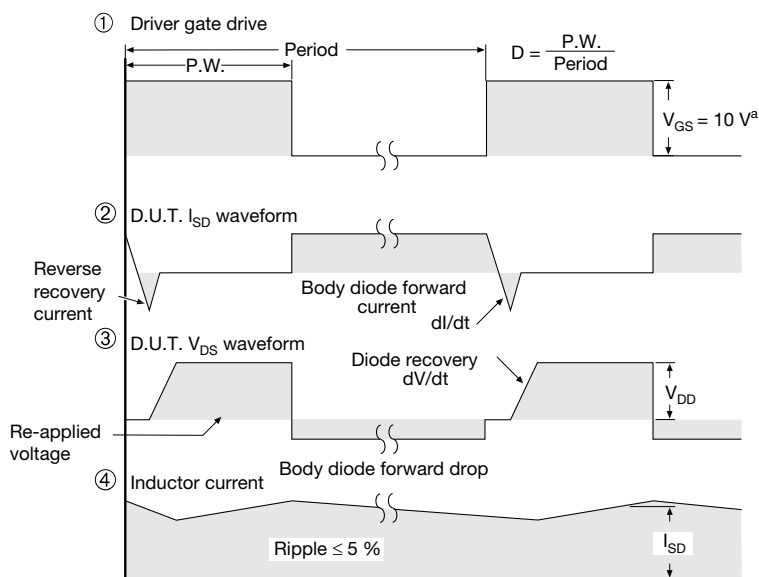
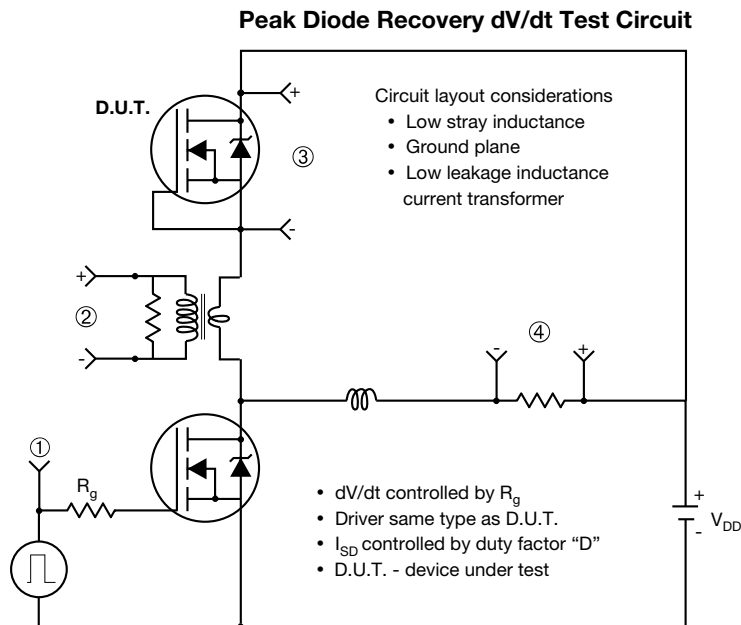
**Notes**

- 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**

**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**

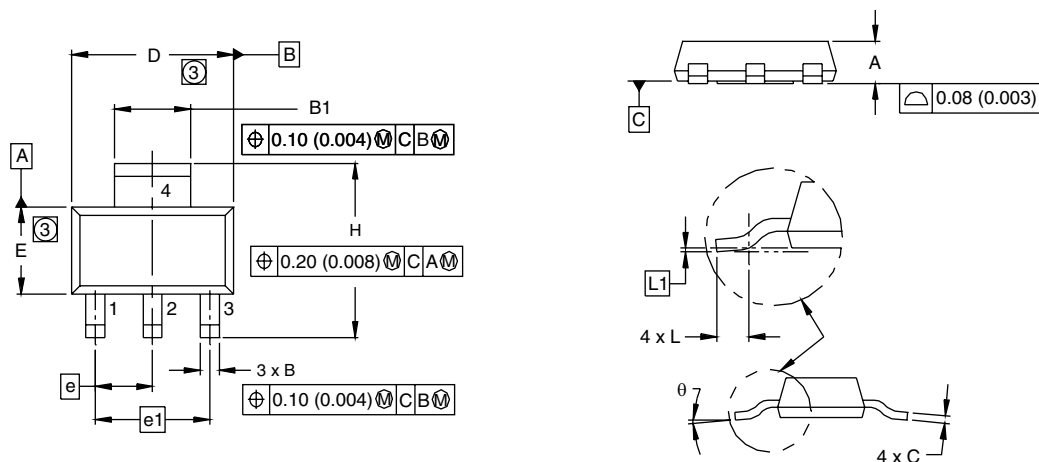

**Fig. 12a - Unclamped Inductive Test Circuit**

**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.14 - For N-Channel**

Vishay Siliconix maintains worldwide manufacturing capability. Products may be manufactured at one of several qualified locations. Reliability data for Silicon Technology and Package Reliability represent a composite of all qualified locations. For related documents such as package/tape drawings, part marking, and reliability data, see [www.vishay.com/ppg?91194](http://www.vishay.com/ppg?91194).

## 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<br>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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**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.**