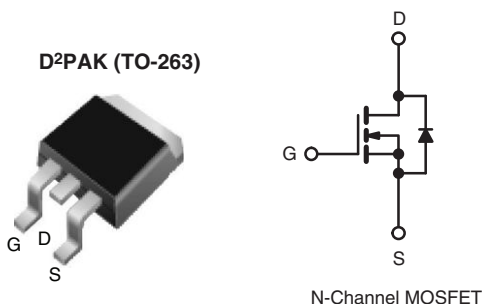


## Power MOSFET

### PRODUCT SUMMARY

|                           |                        |      |
|---------------------------|------------------------|------|
| $V_{DS}$ (V)              | 200                    |      |
| $R_{DS(on)}$ ( $\Omega$ ) | $V_{GS} = 10\text{ V}$ | 0.80 |
| $Q_g$ (Max.) (nC)         | 14                     |      |
| $Q_{gs}$ (nC)             | 3.0                    |      |
| $Q_{gd}$ (nC)             | 7.9                    |      |
| Configuration             | Single                 |      |



### FEATURES

- Halogen-free According to IEC 61249-2-21
- Definition
- Surface Mount
- Available in Tape and Reel
- Dynamic  $dV/dt$  Rating
- Repetitive Avalanche Rated
- Fast Switching
- Simple Drive Requirements
- Ease of Paralleling
- Compliant to RoHS Directive 2002/95/EC



**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 D<sup>2</sup>PAK (TO-263) is a surface mount power package capable of accommodating die size up to HEX-4. It provides the highest power capability and the lowest possible on-resistance in any existing surface mount package. The D<sup>2</sup>PAK (TO-263) is suitable for high current applications because of its low internal connection resistance and can dissipate up to 2.0 W in a typical surface mount application.

### ORDERING INFORMATION

| Package                         | D <sup>2</sup> PAK (TO-263) | D <sup>2</sup> PAK (TO-263)  | D <sup>2</sup> PAK (TO-263)  |
|---------------------------------|-----------------------------|------------------------------|------------------------------|
| Lead (Pb)-free and Halogen-free | SiHF620S-GE3                | SiHF620STRL-GE3 <sup>a</sup> | SiHF620STRR-GE3 <sup>a</sup> |
| Lead (Pb)-free                  | IRF620SPbF                  | IRF620STRLPbF <sup>a</sup>   | IRF620STRRPbF <sup>a</sup>   |
|                                 | SiHF620S-E3                 | SiHF620STL-E3 <sup>a</sup>   | SiHF620STR-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                               | $V_{DS}$       | 200                               | V                   |
| Gate-Source Voltage                                | $V_{GS}$       | $\pm 20$                          |                     |
| Continuous Drain Current                           | $I_D$          | $T_C = 25\text{ }^\circ\text{C}$  | A                   |
|                                                    |                | $T_C = 100\text{ }^\circ\text{C}$ |                     |
| Pulsed Drain Current <sup>a</sup>                  | $I_{DM}$       | 18                                |                     |
| Linear Derating Factor                             |                | 0.40                              | W/ $^\circ\text{C}$ |
| Linear Derating Factor (PCB Mount) <sup>e</sup>    |                | 0.025                             |                     |
| Single Pulse Avalanche Energy <sup>b</sup>         | $E_{AS}$       | 110                               | mJ                  |
| Avalanche Current <sup>a</sup>                     | $I_{AR}$       | 5.2                               | A                   |
| Repetitive Avalanche Energy <sup>a</sup>           | $E_{AR}$       | 5.0                               | 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>           | $dV/dt$        | 5.0                               | V/ns                |
| Operating Junction and Storage Temperature Range   | $T_J, T_{stg}$ | - 55 to + 150                     | $^\circ\text{C}$    |
| Soldering Recommendations (Peak Temperature)       | for 10 s       | 300 <sup>d</sup>                  |                     |

#### Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- $V_{DD} = 50\text{ V}$ , starting  $T_J = 25\text{ }^\circ\text{C}$ ,  $L = 6.1\text{ mH}$ ,  $R_g = 25\text{ }\Omega$ ,  $I_{AS} = 5.2\text{ A}$  (see fig. 12).
- $I_{SD} \leq 5.2\text{ A}$ ,  $dI/dt \leq 95\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq V_{DS}$ ,  $T_J \leq 150\text{ }^\circ\text{C}$ .
- 1.6 mm from case.
- When mounted on 1" square PCB (FR-4 or G-10 material).

\* Pb containing terminations are not RoHS compliant, exemptions may apply

## THERMAL RESISTANCE RATINGS

| PARAMETER                                            | SYMBOL     | TYP. | MAX. | UNIT |
|------------------------------------------------------|------------|------|------|------|
| Maximum Junction-to-Ambient                          | $R_{thJA}$ | -    | 62   | °C/W |
| Maximum Junction-to-Ambient (PCB Mount) <sup>a</sup> | $R_{thJA}$ | -    | 40   |      |
| Maximum Junction-to-Case (Drain)                     | $R_{thJC}$ | -    | 2.5  |      |

### 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)

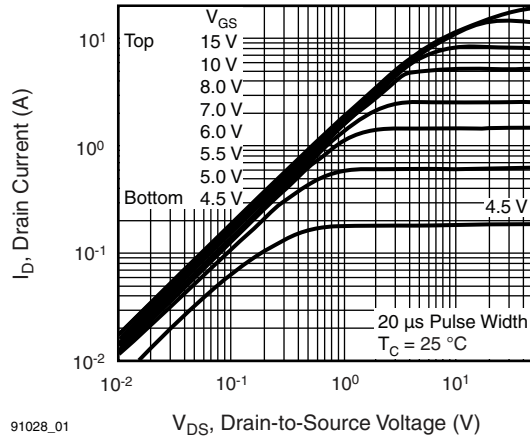
| PARAMETER                                 | SYMBOL                           | TEST CONDITIONS                                                                                                            |                                                                                      | MIN. | TYP. | MAX.  | UNIT |
|-------------------------------------------|----------------------------------|----------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|------|------|-------|------|
| Static                                    |                                  |                                                                                                                            |                                                                                      |      |      |       |      |
| Drain-Source Breakdown Voltage            | V <sub>DS</sub>                  | V <sub>GS</sub> = 0, I <sub>D</sub> = 250 μA                                                                               |                                                                                      | 200  | -    | -     | V    |
| V <sub>DS</sub> Temperature Coefficient   | ΔV <sub>DS</sub> /T <sub>J</sub> | Reference to 25 °C, I <sub>D</sub> = 1 mA                                                                                  |                                                                                      | -    | 0.29 | -     | V/°C |
| Gate-Source Threshold Voltage             | V <sub>GS(th)</sub>              | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA                                                                |                                                                                      | 2.0  | -    | 4.0   | V    |
| Gate-Source Leakage                       | I <sub>GSS</sub>                 | V <sub>GS</sub> = ± 20 V                                                                                                   |                                                                                      | -    | -    | ± 100 | nA   |
| Zero Gate Voltage Drain Current           | I <sub>DSS</sub>                 | V <sub>DS</sub> = 200 V, V <sub>GS</sub> = 0 V                                                                             |                                                                                      | -    | -    | 25    | μA   |
|                                           |                                  | V <sub>DS</sub> = 160 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 125 °C                                                    |                                                                                      | -    | -    | 250   |      |
| Drain-Source On-State Resistance          | R <sub>DS(on)</sub>              | V <sub>GS</sub> = 10 V                                                                                                     | I <sub>D</sub> = 3.1 A <sup>b</sup>                                                  | -    | -    | 0.80  | Ω    |
| Forward Transconductance                  | g <sub>fs</sub>                  | V <sub>DS</sub> = 50 V, I <sub>D</sub> = 3.1 A <sup>b</sup>                                                                |                                                                                      | 1.5  | -    | -     | S    |
| Dynamic                                   |                                  |                                                                                                                            |                                                                                      |      |      |       |      |
| Input Capacitance                         | C <sub>iss</sub>                 | V <sub>GS</sub> = 0 V,<br>V <sub>DS</sub> = 25 V,<br>f = 1.0 MHz, see fig. 5                                               |                                                                                      | -    | 260  | -     | pF   |
| Output Capacitance                        | C <sub>oss</sub>                 |                                                                                                                            |                                                                                      | -    | 100  | -     |      |
| Reverse Transfer Capacitance              | C <sub>rss</sub>                 |                                                                                                                            |                                                                                      | -    | 30   | -     |      |
| Total Gate Charge                         | Q <sub>g</sub>                   | V <sub>GS</sub> = 10 V                                                                                                     | I <sub>D</sub> = 4.8 A, V <sub>DS</sub> = 160 V,<br>see fig. 6 and 13 <sup>b</sup>   | -    | -    | 14    | nC   |
| Gate-Source Charge                        | Q <sub>gs</sub>                  |                                                                                                                            |                                                                                      | -    | -    | 3.0   |      |
| Gate-Drain Charge                         | Q <sub>gd</sub>                  |                                                                                                                            |                                                                                      | -    | -    | 7.9   |      |
| Turn-On Delay Time                        | t <sub>d(on)</sub>               | V <sub>DD</sub> = 100 V, I <sub>D</sub> = 4.8 A,<br>R <sub>g</sub> = 18 Ω, R <sub>D</sub> = 20 Ω, see fig. 10 <sup>b</sup> |                                                                                      | -    | 7.2  | -     | ns   |
| Rise Time                                 | t <sub>r</sub>                   |                                                                                                                            |                                                                                      | -    | 22   | -     |      |
| Turn-Off Delay Time                       | t <sub>d(off)</sub>              |                                                                                                                            |                                                                                      | -    | 19   | -     |      |
| Fall Time                                 | t <sub>f</sub>                   |                                                                                                                            |                                                                                      | -    | 13   | -     |      |
| Dynamic                                   |                                  |                                                                                                                            |                                                                                      |      |      |       |      |
| Internal Drain Inductance                 | L <sub>D</sub>                   | Between lead,<br>6 mm (0.25") from<br>package and center of<br>die contact                                                 |  | -    | 4.5  | -     | nH   |
| Internal Source Inductance                | L <sub>S</sub>                   |                                                                                                                            |                                                                                      | -    | 7.5  | -     |      |
| Drain-Source Body Diode Characteristics   |                                  |                                                                                                                            |                                                                                      |      |      |       |      |
| Continuous Source-Drain Diode Current     | I <sub>S</sub>                   | MOSFET symbol<br>showing the<br>integral reverse<br>p - n junction diode                                                   |  | -    | -    | 5.2   | A    |
| Pulsed Diode Forward Current <sup>a</sup> | I <sub>SM</sub>                  |                                                                                                                            |                                                                                      | -    | -    | 18    |      |
| Body Diode Voltage                        | V <sub>SD</sub>                  | T <sub>J</sub> = 25 °C, I <sub>S</sub> = 5.2 A, V <sub>GS</sub> = 0 V <sup>b</sup>                                         |                                                                                      | -    | -    | 1.8   | V    |
| Body Diode Reverse Recovery Time          | t <sub>rr</sub>                  | T <sub>J</sub> = 25 °C, I <sub>F</sub> = 4.8 A, dI/dt = 100 A/μs <sup>b</sup>                                              |                                                                                      | -    | 150  | 300   | ns   |
| Body Diode Reverse Recovery Charge        | Q <sub>rr</sub>                  |                                                                                                                            |                                                                                      | -    | 0.91 | 1.8   | μC   |
| Forward Turn-On Time                      | t <sub>on</sub>                  | Intrinsic turn-on time is negligible (turn-on is dominated by L <sub>S</sub> and L <sub>D</sub> )                          |                                                                                      |      |      |       |      |

### Notes

a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).

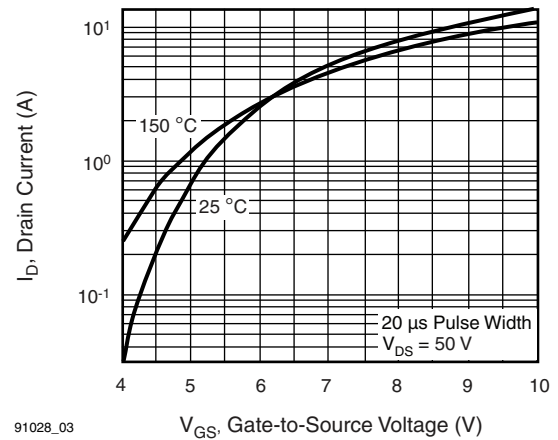
b. Pulse width  $\leq 300\text{ }\mu\text{s}$ ; duty cycle  $\leq 2\%$ .

## TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



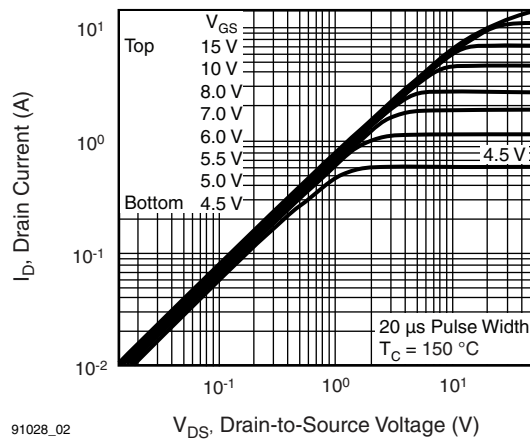
91028\_01

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



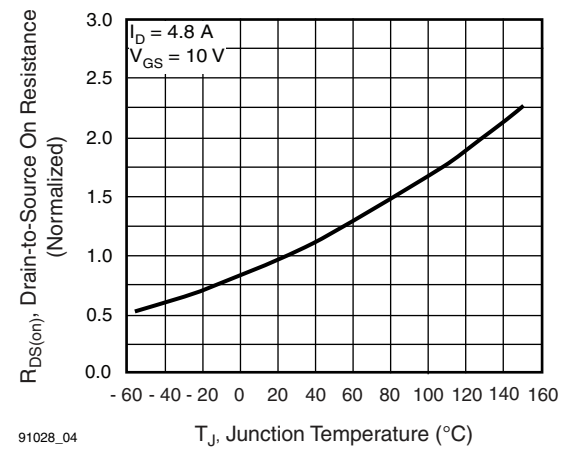
91028\_03

Fig. 3 - Typical Transfer Characteristics



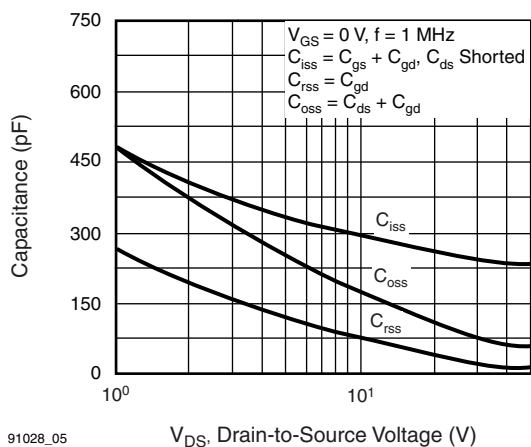
91028\_02

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



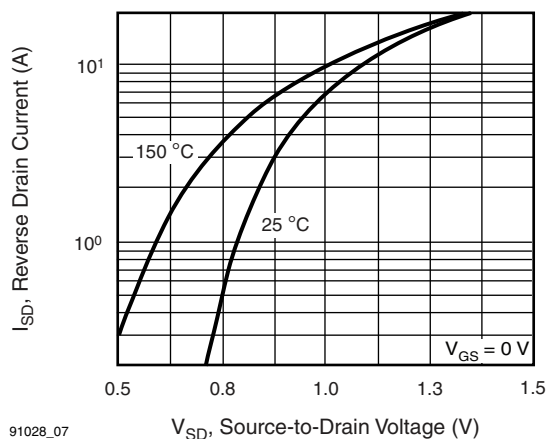
91028\_04

Fig. 4 - Normalized On-Resistance vs. Temperature



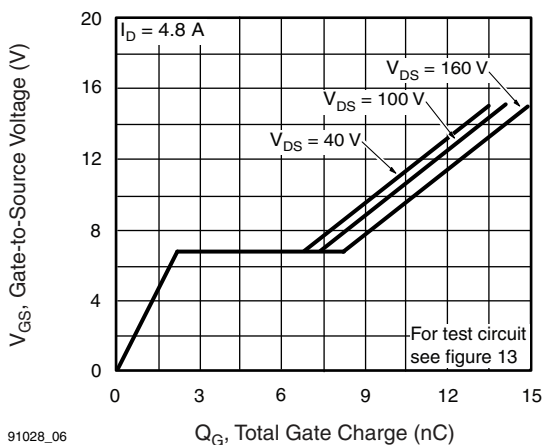
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**Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage**



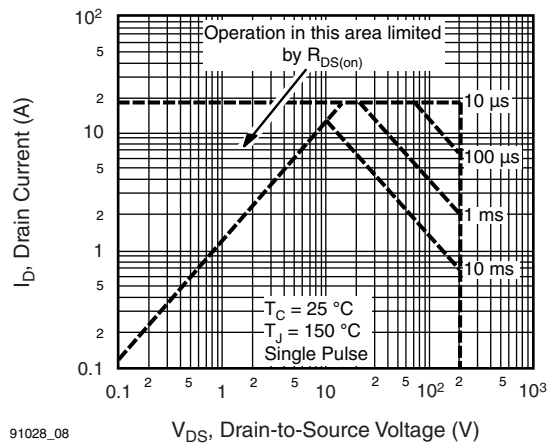
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**Fig. 7 - Typical Source-Drain Diode Forward Voltage**



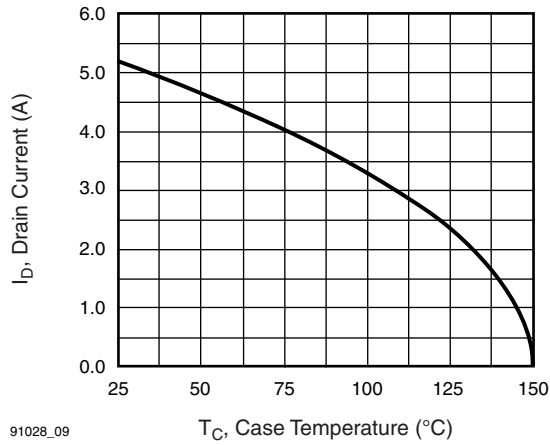
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**Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage**

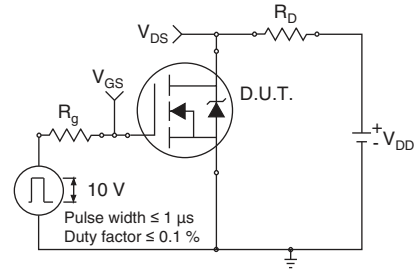


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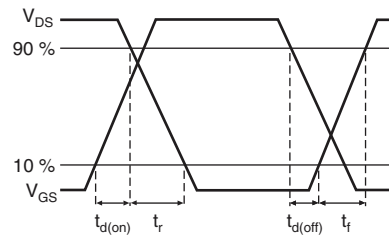
**Fig. 8 - Maximum Safe Operating Area**



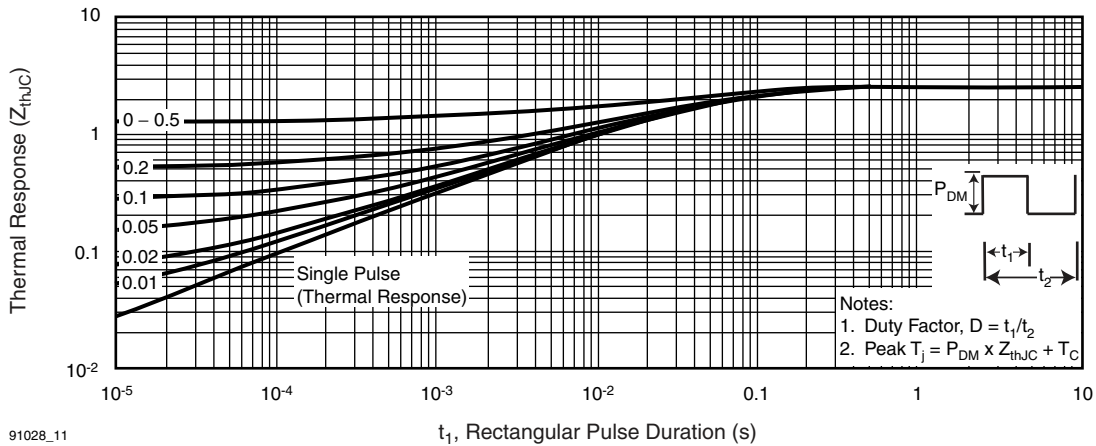
**Fig. 9 - Maximum Drain Current vs. Case Temperature**



**Fig. 10a - Switching Time Test Circuit**



**Fig. 10b - Switching Time Waveforms**



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

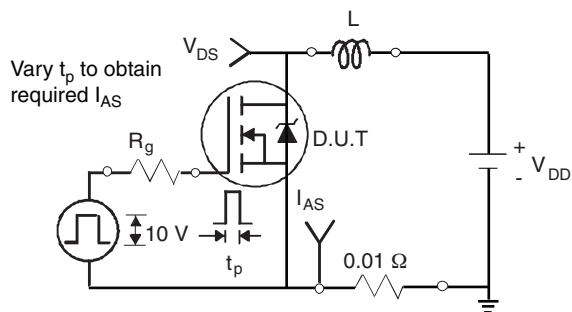


Fig. 12a - Unclamped Inductive Test Circuit

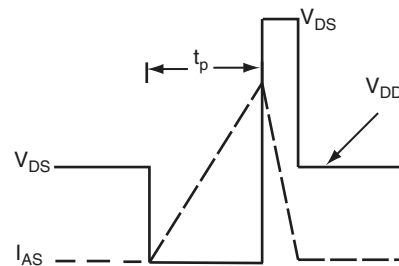


Fig. 12b - Unclamped Inductive Waveforms

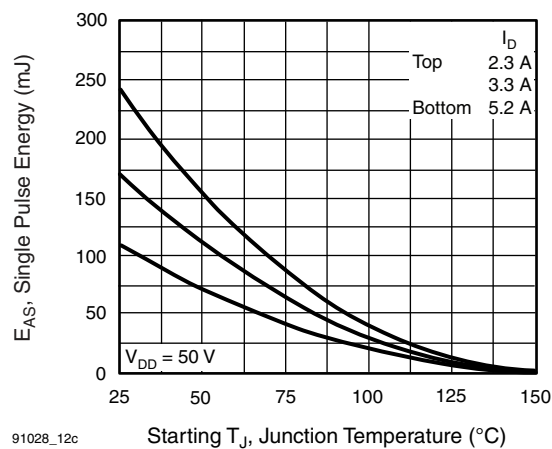


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

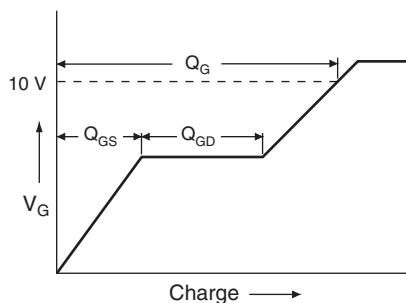


Fig. 13a - Basic Gate Charge Waveform

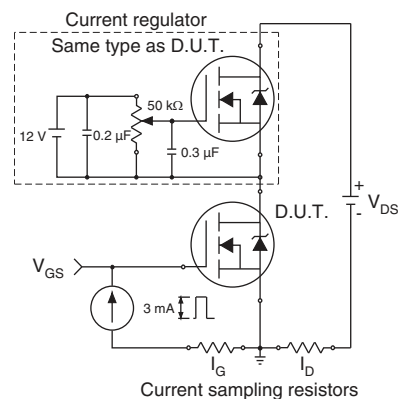
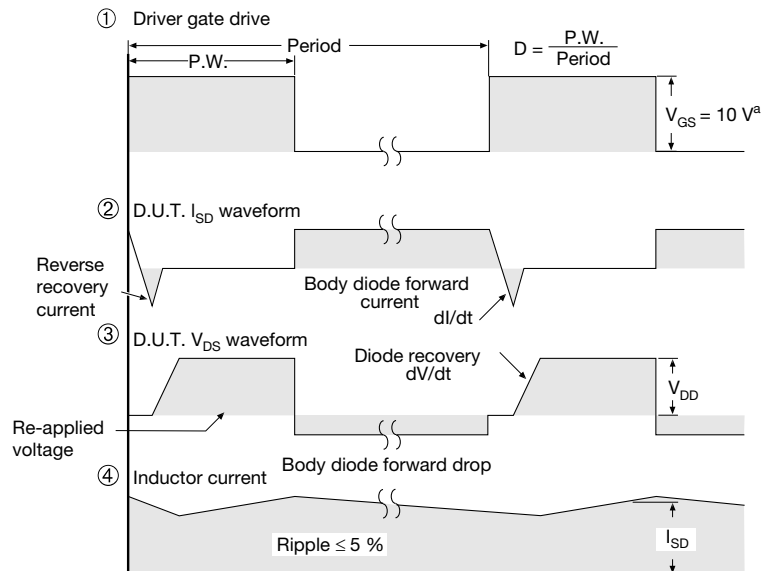
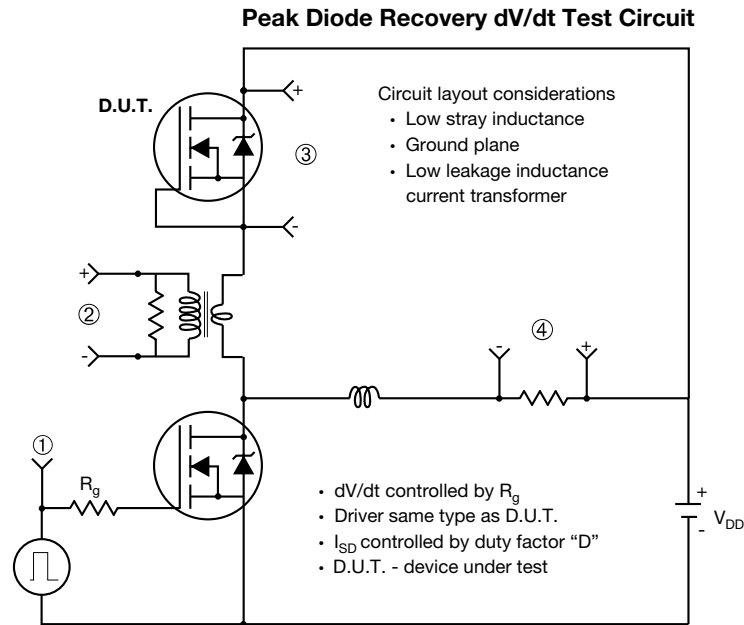


Fig. 13b - Gate Charge Test Circuit



**Note**

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

**Fig. 14 - For N-Channel**

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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.**

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