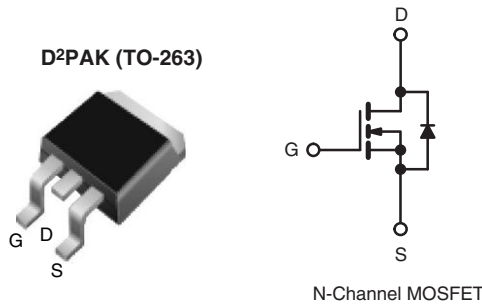


## Power MOSFET

| 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  | $V_{GS}$ at 10 V                 | $T_C = 25\text{ }^\circ\text{C}$  | 5.2              | A                   |
|   |                                  | $T_C = 100\text{ }^\circ\text{C}$ | 3.3              |                     |
| Pulsed Drain Current <sup>a</sup>   | $I_{DM}$                         |                                   | 18               | W/ $^\circ\text{C}$ |
| Linear Derating Factor  |                                  |                                   | 0.40             |                     |
| 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   | $T_C = 25\text{ }^\circ\text{C}$ |                                   | 50               | W                   |
|   | $T_A = 25\text{ }^\circ\text{C}$ |                                   | 3.0              |                     |
| 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       |
| Soldering Recommendations (Peak Temperature)  |                                  | for 10 s                          | 300 <sup>d</sup> | $^\circ\text{C}$    |

#### Notes

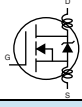
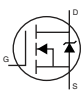
- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- $V_{DD} = 50\text{ V}$ , starting  $T_J = 25\text{ }^\circ\text{C}$ ,  $L = 6.1\text{ mH}$ ,  $R_g = 25\text{ }\Omega$ ,  $I_{AS} = 5.2\text{ A}$  (see fig. 12).
- $I_{SD} \leq 5.2\text{ A}$ ,  $dI/dt \leq 95\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq V_{DS}$ ,  $T_J \leq 150\text{ }^\circ\text{C}$ .
- 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**

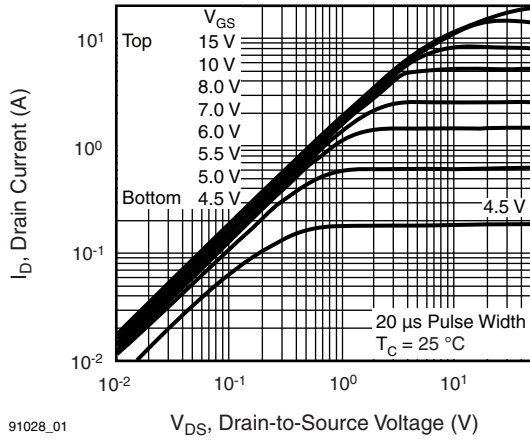
a. When mounted on 1" square PCB (FR-4 or G-10 material).

| SPECIFICATIONS ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted) |                     |  |  |      |      |                     |               |
|---|---------------------|--|--|------|------|---------------------|---------------|
| PARAMETER   | SYMBOL              | TEST CONDITIONS  |  | MIN. | TYP. | MAX. UNIT           |               |
| <b>Static</b>   |                     |  |  |      |      |                     |               |
| Drain-Source Breakdown Voltage  | $V_{DS}$            | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$  |  | 200  | -    | - V                 |               |
| $V_{DS}$ Temperature Coefficient  | $\Delta V_{DS}/T_J$ | Reference to $25\text{ }^\circ\text{C}$ , $I_D = 1\text{ mA}$  |  | -    | 0.29 | - V/°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   | $I_{GSS}$           | $V_{GS} = \pm 20\text{ V}$   |  | -    | -    | $\pm 100\text{ nA}$ |               |
| Zero Gate Voltage Drain Current   | $I_{DSS}$           | $V_{DS} = 200\text{ V}, V_{GS} = 0\text{ V}$   |  | -    | -    | 25 $\mu\text{A}$    |               |
|   |                     | $V_{DS} = 160\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$  |  | -    | -    | 250 $\mu\text{A}$   |               |
| Drain-Source On-State Resistance  | $R_{DS(on)}$        | $V_{GS} = 10\text{ V}$   | $I_D = 3.1\text{ A}^b$   | -    | -    | 0.80 $\Omega$       |               |
| Forward Transconductance  | $g_{fs}$            | $V_{DS} = 50\text{ V}, I_D = 3.1\text{ A}^b$   |  | 1.5  | -    | - S                 |               |
| <b>Dynamic</b>  |                     |  |  |      |      |                     |               |
| Input Capacitance   | $C_{iss}$           | $V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1.0\text{ MHz}$ , see fig. 5   |  | -    | 260  | -                   |               |
| Output Capacitance  | $C_{oss}$           |  |  | -    | 100  | -                   | pF            |
| Reverse Transfer Capacitance  | $C_{rss}$           |  |  | -    | 30   | -                   |               |
| Total Gate Charge   | $Q_g$               | $V_{GS} = 10\text{ V}$   | $I_D = 4.8\text{ A}, V_{DS} = 160\text{ V}$ , see fig. 6 and 13 <sup>b</sup> | -    | -    | 14                  |               |
| Gate-Source Charge  | $Q_{gs}$            |  |  | -    | -    | 3.0                 | nC            |
| Gate-Drain Charge   | $Q_{gd}$            |  |  | -    | -    | 7.9                 |               |
| Turn-On Delay Time  | $t_{d(on)}$         | $V_{DD} = 100\text{ V}, I_D = 4.8\text{ A}, R_g = 18\text{ }\Omega, R_D = 20\text{ }\Omega$ , see fig. 10 <sup>b</sup>                                 |  | -    | 7.2  | -                   |               |
| Rise Time   | $t_r$               |  |  | -    | 22   | -                   | ns            |
| Turn-Off Delay Time   | $t_{d(off)}$        |  |  | -    | 19   | -                   |               |
| Fall Time   | $t_f$               |  |  | -    | 13   | -                   |               |
| <b>Dynamic</b>  |                     |  |  |      |      |                     |               |
| Internal Drain Inductance   | $L_D$               | Between lead, 6 mm (0.25") from package and center of die contact  |  | -    | 4.5  | -                   |               |
| Internal Source Inductance  | $L_S$               |  |  | -    | 7.5  | -                   | nH            |
| <b>Drain-Source Body Diode Characteristics</b>                              |                     |  |  |      |      |                     |               |
| Continuous Source-Drain Diode Current                                       | $I_S$               | MOSFET symbol showing the integral reverse p - n junction diode    |  | -    | -    | 5.2                 |               |
| Pulsed Diode Forward Current <sup>a</sup>                                   | $I_{SM}$            |  |  | -    | -    | 18                  | A             |
| Body Diode Voltage  | $V_{SD}$            | $T_J = 25\text{ }^\circ\text{C}, I_S = 5.2\text{ A}, V_{GS} = 0\text{ V}^b$  |  | -    | -    | 1.8 V               |               |
| Body Diode Reverse Recovery Time  | $t_{rr}$            | $T_J = 25\text{ }^\circ\text{C}, I_F = 4.8\text{ A}, dI/dt = 100\text{ A}/\mu\text{s}^b$   |  | -    | 150  | 300                 |               |
| Body Diode Reverse Recovery Charge  | $Q_{rr}$            |  |  | -    | 0.91 | 1.8                 | $\mu\text{C}$ |
| Forward Turn-On Time  | $t_{on}$            | Intrinsic turn-on time is negligible (turn-on is dominated by $L_S$ and $L_D$ )  |  |      |      |                     |               |

**Notes**

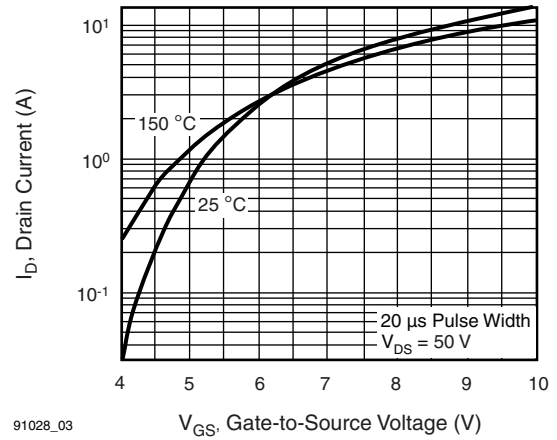
- a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- b. Pulse width  $\leq 300\text{ }\mu\text{s}$ ; duty cycle  $\leq 2\%$ .

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



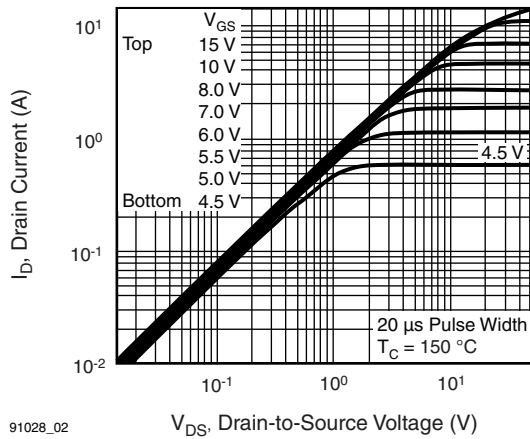
91028\_01

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



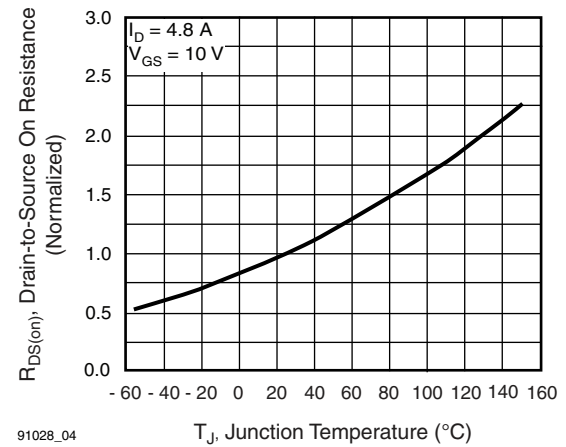
91028\_03

**Fig. 3 - Typical Transfer Characteristics**



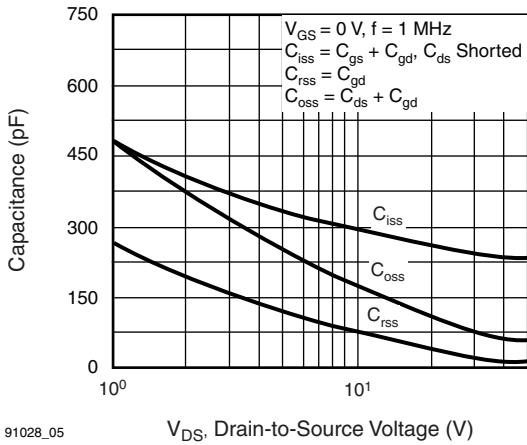
91028\_02

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



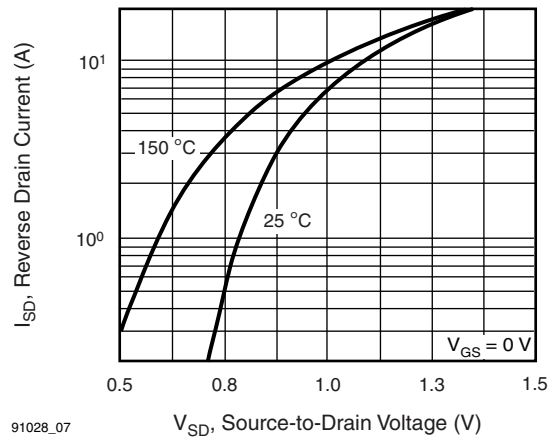
91028\_04

**Fig. 4 - Normalized On-Resistance vs. Temperature**



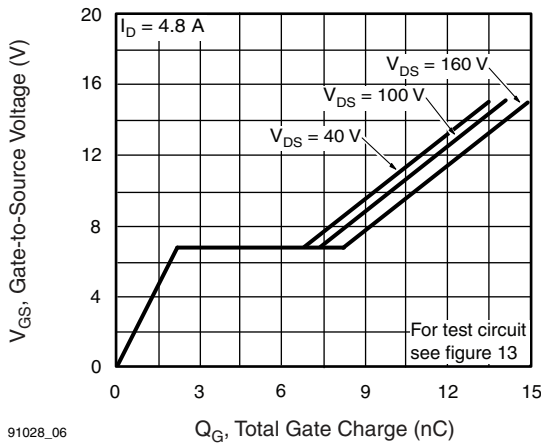
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**Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage**



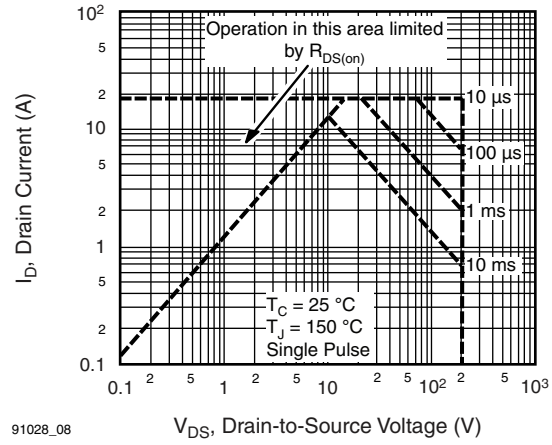
91028\_07

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



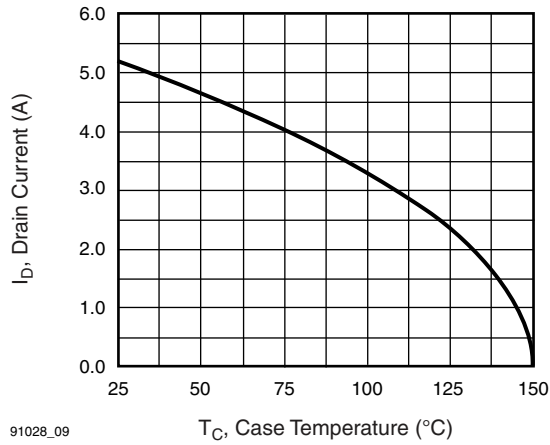
91028\_06

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

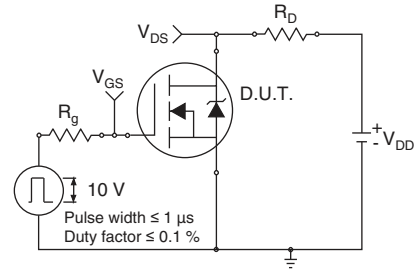


91028\_08

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



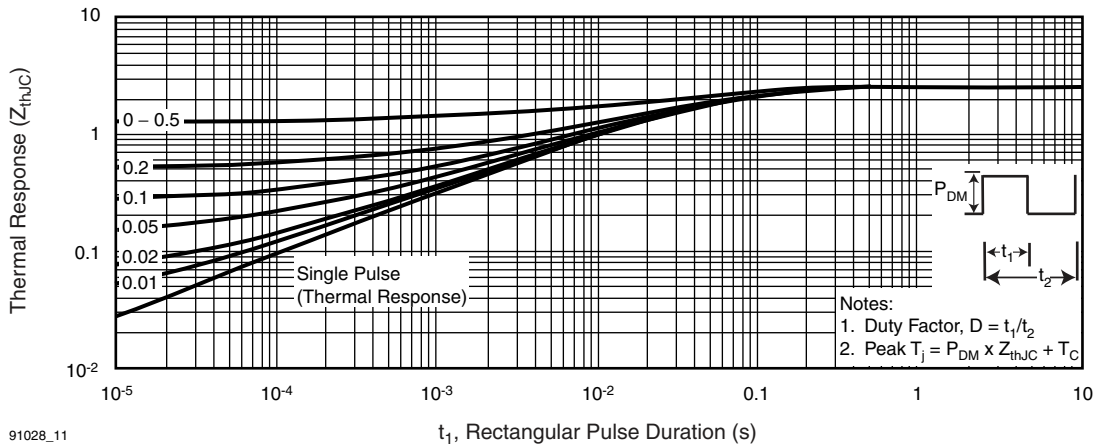
**Fig. 9 - Maximum Drain Current vs. Case Temperature**



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



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



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

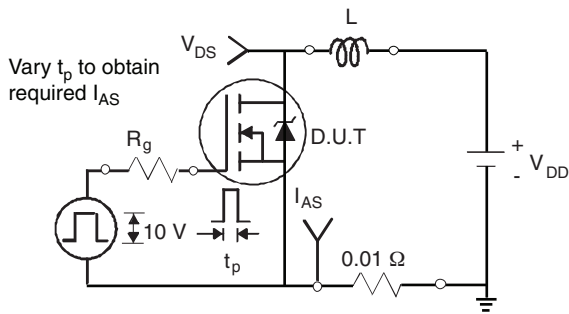


Fig. 12a - Unclamped Inductive Test Circuit



Fig. 12b - Unclamped Inductive Waveforms

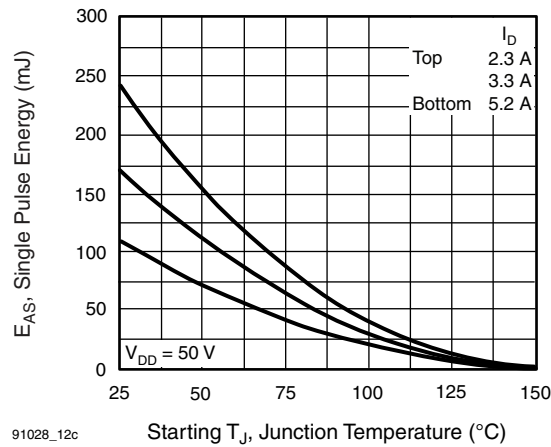


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

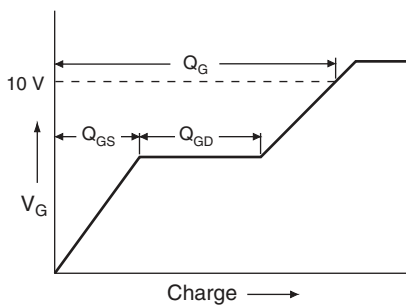


Fig. 13a - Basic Gate Charge Waveform

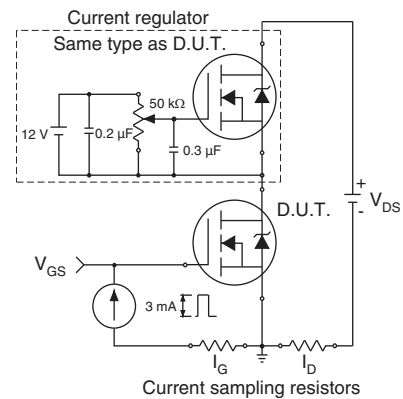
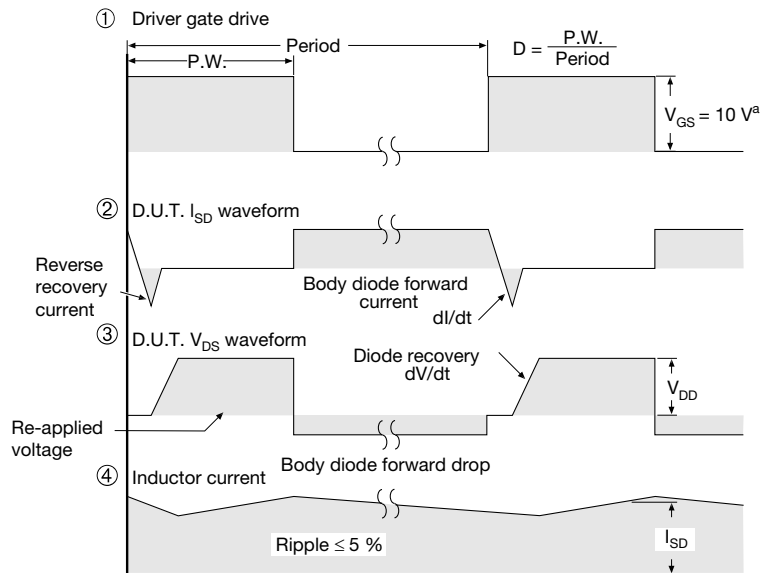
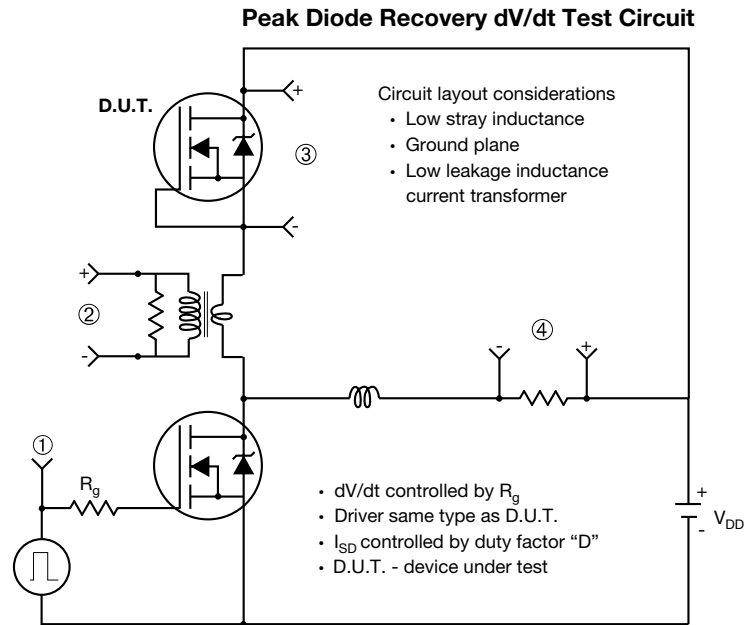


Fig. 13b - Gate Charge Test Circuit



**Note**

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

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

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**RECOMMENDED MINIMUM PADS FOR D<sup>2</sup>PAK: 3-Lead**



Recommended Minimum Pads  
Dimensions in Inches/(mm)

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