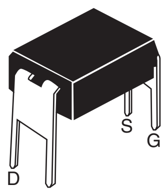
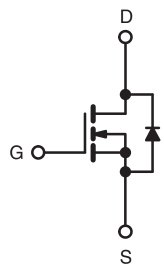
# Power MOSFET

| PRODUCT SUMMARY | | |
|---|---|---|
| $V_{DS}$ (V) | 100 | |
| $R_{DS(on)}$ ($\Omega$) | $V_{GS}$ = 10 V | 0.27 |
| $Q_g$ (Max.) (nC) | 16 | |
| $Q_{gs}$ (nC) | 4.4 | |
| $Q_{gd}$ (nC) | 7.7 | |
| Configuration | Single | |

HVMDIP




N-Channel MOSFET

## FEATURES

- Dynamic dV/dt Rating
- Repetitive Avalanche Rated
- For Automatic Insertion
- End Stackable
- 175 °C Operating Temperature
- Fast Switching
- Ease of Paralleling
- Compliant to RoHS Directive 2002/95/EC

Pb Available
RoHS*
COMPLIANT

## 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 4 pin DIP package is a low cost machine-insertable case style which can be stacked in multiple combinations on standard 0.1" pin centers. The dual drain serves as a thermal link to the mounting surface for power dissipation levels up to 1 W.

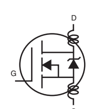
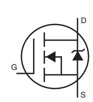
| ORDERING INFORMATION | |
|---|---|
| Package | HVMDIP |
| Lead (Pb)-free | IRFD123PbF |
| | SiHFD123-E3 |
| SnPb | IRFD123 |
| | SiHFD123 |

| ABSOLUTE MAXIMUM RATINGS ($T_A$ = 25 °C, unless otherwise noted) | | | | | |
|---|---|---|---|---|---|
| PARAMETER | | | SYMBOL | LIMIT | UNIT |
| Drain-Source Voltage | | | $V_{DS}$ | 100 | V |
| Gate-Source Voltage | | | $V_{GS}$ | ± 20 | |
| Continuous Drain Current | $V_{GS}$ at 10 V | $T_A$ = 25 °C | $I_D$ | 1.3 | A |
| | | $T_A$ = 100 °C | | 0.94 | |
| Pulsed Drain Current[a] | | | $I_{DM}$ | 10 | |
| Linear Derating Factor | | | | 0.0083 | W/°C |
| Single Pulse Avalanche Energy[b] | | | $E_{AS}$ | 100 | mJ |
| Repetitive Avalanche Current[a] | | | $I_{AR}$ | 1.3 | A |
| Repetitive Avalanche Energy[a] | | | $E_{AR}$ | 0.13 | mJ |
| Maximum Power Dissipation | $T_A$ = 25 °C | | $P_D$ | 1.3 | W |
| Peak Diode Recovery dV/dt[c] | | | dV/dt | 5.5 | V/ns |
| Operating Junction and Storage Temperature Range | | | $T_J$, $T_{stg}$ | - 55 to + 175 | °C |
| Soldering Recommendations (Peak Temperature) | for 10 s | | | 300[d] | |

**Notes**
a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
b. $V_{DD}$ = 25 V, starting $T_J$ = 25 °C, L = 22 mH, $R_g$ = 25 $\Omega$, $I_{AS}$ = 2.6 A (see fig. 12).
c. $I_{SD} \leq$ 9.2 A, dI/dt $\leq$ 110 A/μs, $V_{DD} \leq V_{DS}$, $T_J \leq$ 175 °C.
d. 1.6 mm from case.

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

| THERMAL RESISTANCE RATINGS | | | | |
|---|---|---|---|---|
| **PARAMETER** | **SYMBOL** | **TYP.** | **MAX.** | **UNIT** |
| Maximum Junction-to-Ambient | $R_{thJA}$ | - | 120 | °C/W |

| 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 | | 100 | - | - | V |
| $V_{DS}$ Temperature Coefficient | $\Delta V_{DS}/T_J$ | Reference to 25 °C, $I_D$ = 1 mA | | - | 0.13 | - | 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 | $I_{DSS}$ | $V_{DS}$ = 100 V, $V_{GS}$ = 0 V | | - | - | 25 | μA |
| | | $V_{DS}$ = 80 V, $V_{GS}$ = 0 V, $T_J$ = 150 °C | | - | - | 250 | |
| Drain-Source On-State Resistance | $R_{DS(on)}$ | $V_{GS}$ = 10 V | $I_D$ = 0.78 A[b] | - | - | 0.27 | Ω |
| Forward Transconductance | $g_{fs}$ | $V_{DS}$ = 50 V, $I_D$ = 0.78 A[b] | | 0.80 | - | - | S |
| **Dynamic** | | | | | | | |
| Input Capacitance | $C_{iss}$ | $V_{GS}$ = 0 V<br>$V_{DS}$ = 25 V<br>f = 1.0 MHz, see fig. 5 | | - | 360 | - | pF |
| Output Capacitance | $C_{oss}$ | | | - | 150 | - | |
| Reverse Transfer Capacitance | $C_{rss}$ | | | - | 34 | - | |
| Total Gate Charge | $Q_g$ | $V_{GS}$ = 10 V | $I_D$ = 9.2 A, $V_{DS}$ = 80 V<br>see fig. 6 and 13[b] | - | - | 16 | nC |
| Gate-Source Charge | $Q_{gs}$ | | | - | - | 4.4 | |
| Gate-Drain Charge | $Q_{gd}$ | | | - | - | 7.7 | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD}$ = 50 V, $I_D$ = 9.2 A<br>$R_g$ = 18 Ω, $R_D$ = 5.2 Ω, see fig. 10[b] | | - | 6.8 | - | ns |
| Rise Time | $t_r$ | | | - | 27 | - | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | - | 18 | - | |
| Fall Time | $t_f$ | | | - | 17 | - | |
| 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 |  | - | - | 1.3 | A |
| Pulsed Diode Forward Current[a] | $I_{SM}$ | | | - | - | 10 | |
| Body Diode Voltage | $V_{SD}$ | $T_J$ = 25 °C, $I_S$ = 1.3 A, $V_{GS}$ = 0 V[b] | | - | - | 2.5 | V |
| Body Diode Reverse Recovery Time | $t_{rr}$ | $T_J$ = 25 °C, $I_F$ = 9.2 A, dI/dt = 100 A/μs[b] | | - | 130 | 260 | ns |
| Body Diode Reverse Recovery Charge | $Q_{rr}$ | | | - | 0.65 | 1.3 | 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)

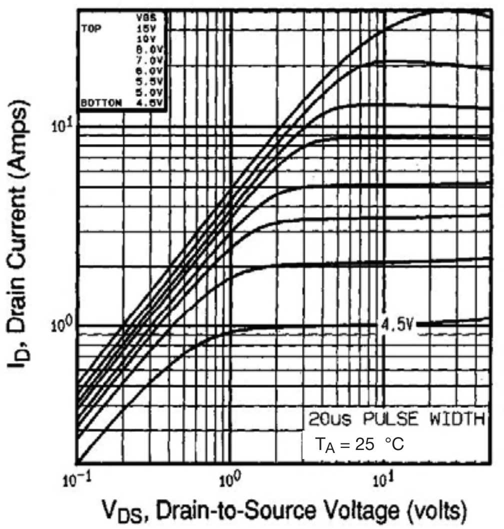



**Fig. 1 - Typical Output Characteristics, $T_A$ = 25 °C**

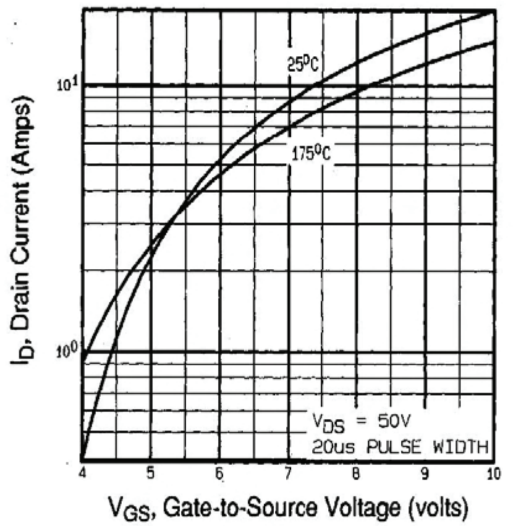



**Fig. 3 - Typical Transfer Characteristics**

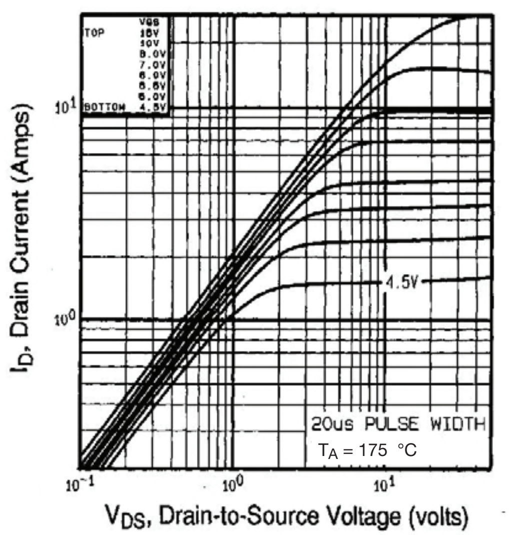



**Fig. 2 - Typical Output Characteristics, $T_A$ = 175 °C**

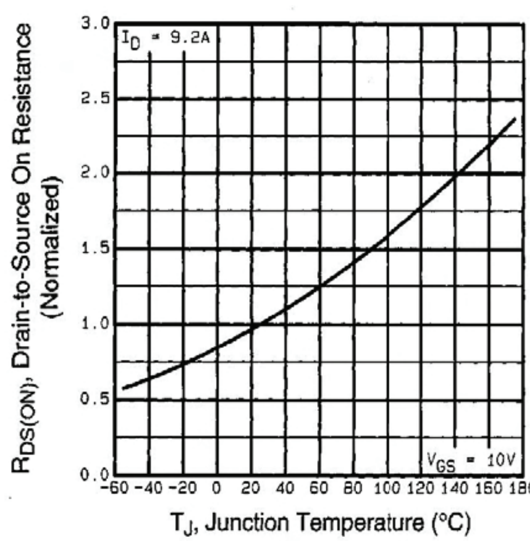



**Fig. 4 - Normalized On-Resistance vs. Temperature**

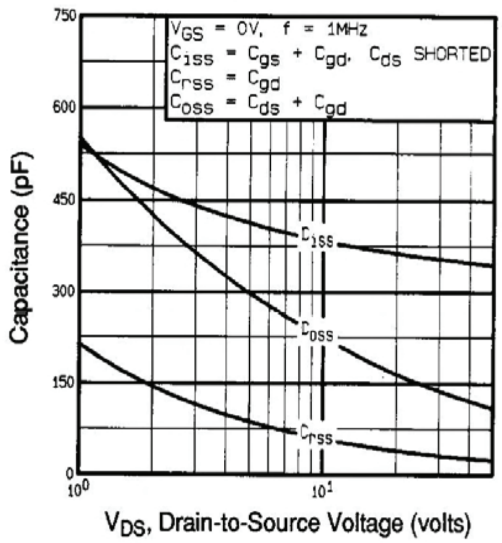



**Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage**

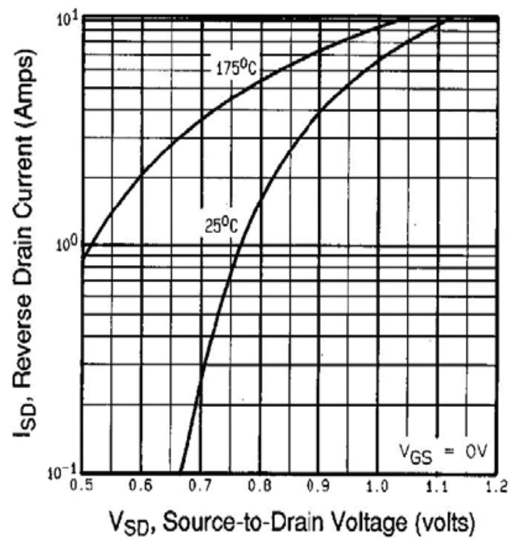



**Fig. 7 - Typical Source-Drain Diode Forward Voltage**

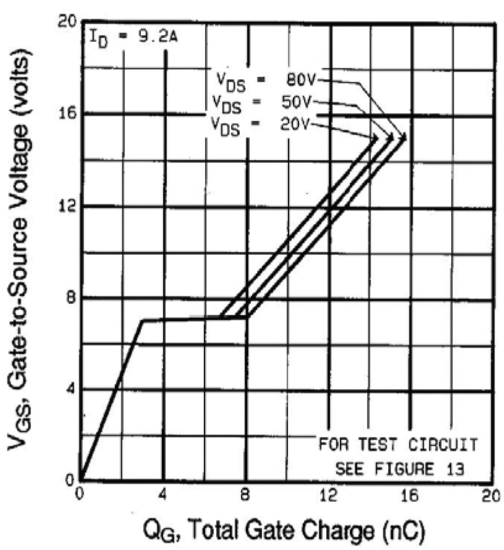



**Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage**

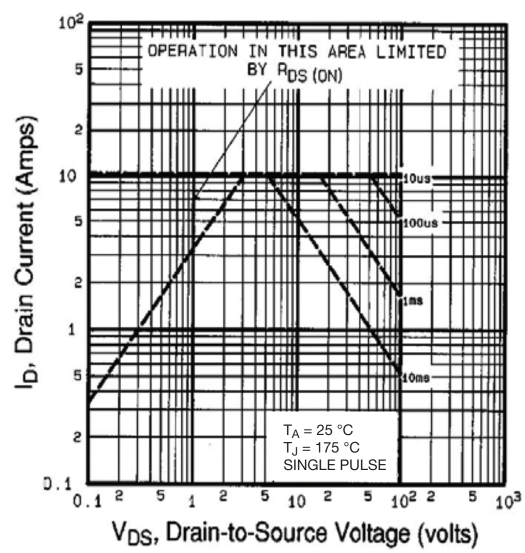



**Fig. 8 - Maximum Safe Operating Area**

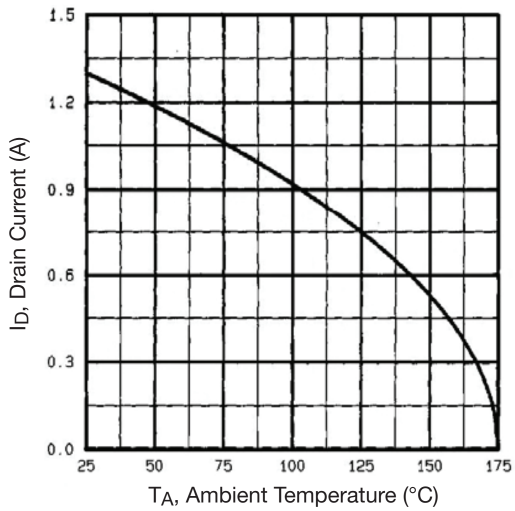



**Fig. 9 - Maximum Drain Current vs. Ambient Temperature**

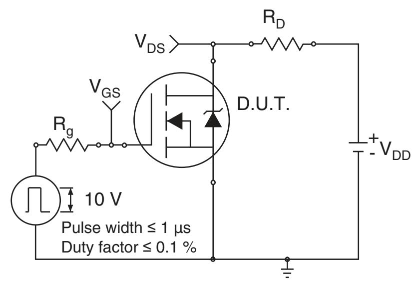



**Fig. 10a - Switching Time Test Circuit**

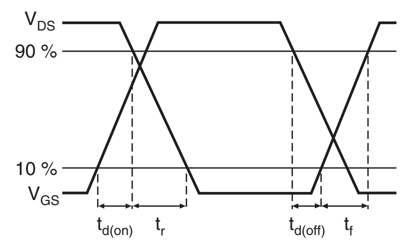



**Fig. 10b - Switching Time Waveforms**

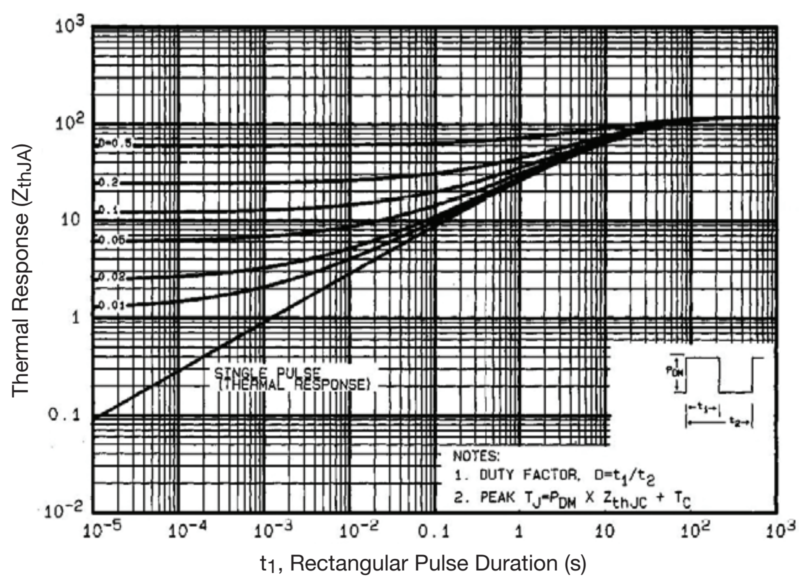



**Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Ambient**

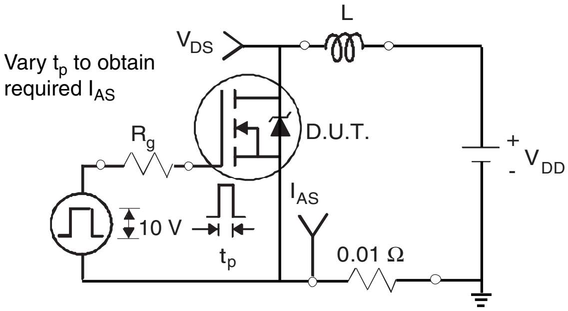



Fig. 12a - Unclamped Inductive Test Circuit

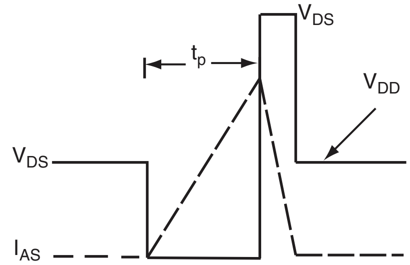



Fig. 12b - Unclamped Inductive Waveforms

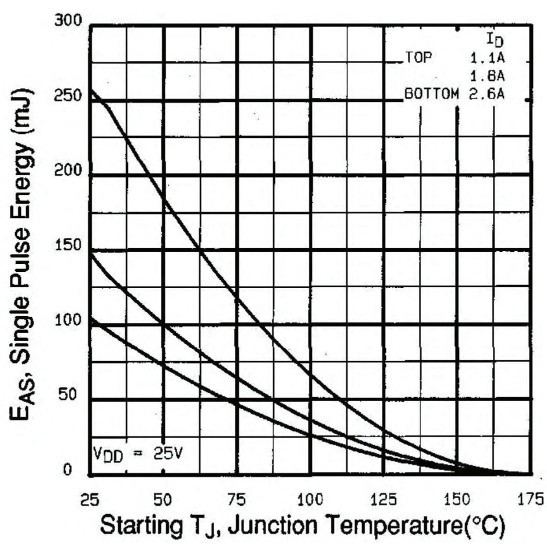



Fig. 12c - Maximum Avalanche Energy vs. Drain Current

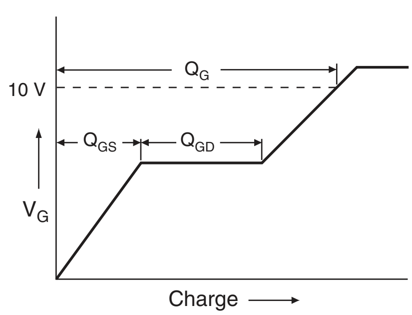



Fig. 13a - Basic Gate Charge Waveform

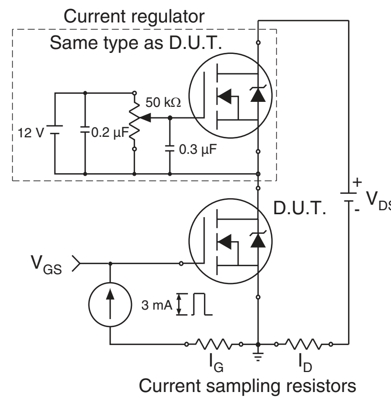
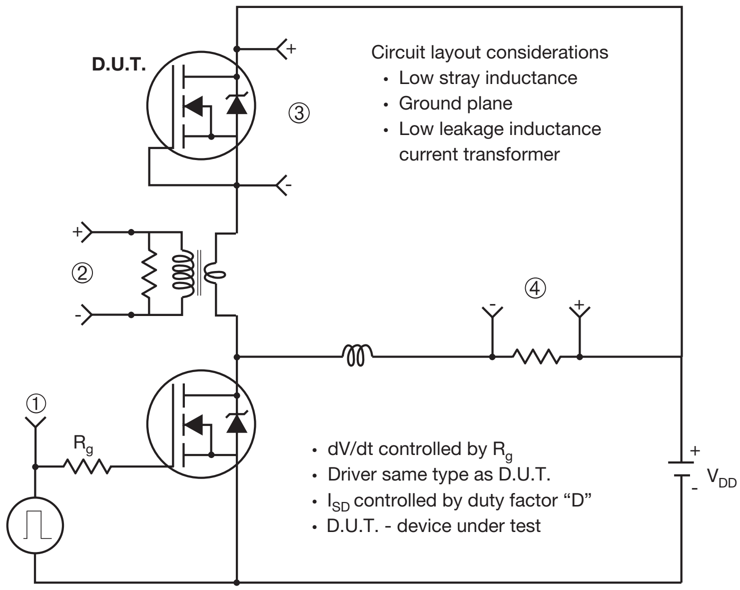
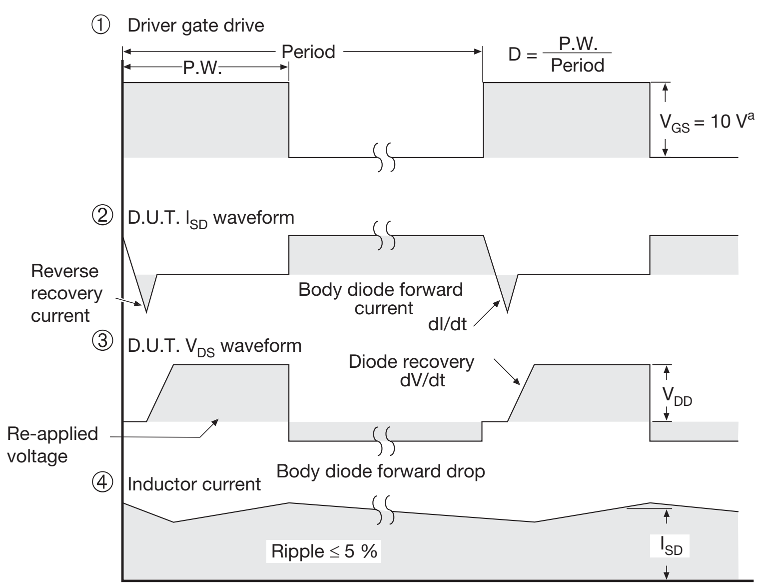



Fig. 13b - Gate Charge Test Circuit

### Peak Diode Recovery dV/dt Test Circuit




**Note**

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

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

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