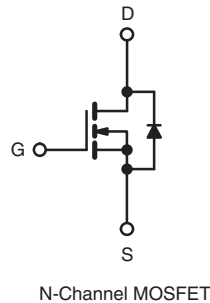
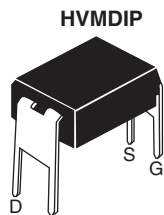


## Power MOSFET

| PRODUCT SUMMARY           |                 |     |
|---------------------------|-----------------|-----|
| $V_{DS}$ (V)              | 600             |     |
| $R_{DS(on)}$ ( $\Omega$ ) | $V_{GS} = 10$ V | 4.4 |
| $Q_g$ (Max.) (nC)         | 18              |     |
| $Q_{gs}$ (nC)             | 3.0             |     |
| $Q_{gd}$ (nC)             | 8.9             |     |
| Configuration             | Single          |     |



### FEATURES

- Dynamic  $dV/dt$  Rating
- Repetitive Avalanche Rated
- For Automatic Insertion
- End Stackable
- Fast Switching
- Ease of Paralleling
- Simple Drive Requirements
- Compliant to RoHS Directive 2002/95/EC



**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       | IRFDC20PbF  |
|                      | SiHFDC20-E3 |
| SnPb                 | IRFDC20     |
|                      | SiHFDC20    |



| ABSOLUTE MAXIMUM RATINGS ( $T_A = 25$ °C, unless otherwise noted) |                  |                |                  |      |
|---|------------------|----------------|------------------|------|
| PARAMETER   | SYMBOL           | LIMIT          | UNIT             |      |
| Drain-Source Voltage  | $V_{DS}$         | 600            | V                |      |
| Gate-Source Voltage   | $V_{GS}$         | $\pm 20$       |                  |      |
| Continuous Drain Current  | $V_{GS}$ at 10 V | $T_A = 25$ °C  | 0.32             | A    |
|   |                  | $T_A = 100$ °C | 0.20             |      |
| Pulsed Drain Current <sup>a</sup>                                 | $I_{DM}$         | 2.6            |                  |      |
| Linear Derating Factor  |                  | 0.0083         | W/°C             |      |
| Single Pulse Avalanche Energy <sup>b</sup>                        | $E_{AS}$         | 50             | mJ               |      |
| Repetitive Avalanche Current <sup>a</sup>                         | $I_{AR}$         | 0.32           | A                |      |
| Repetitive Avalanche Energy <sup>a</sup>                          | $E_{AR}$         | 0.10           | mJ               |      |
| Maximum Power Dissipation   | $T_A = 25$ °C    | $P_D$          | 1.0              | W    |
| Peak Diode Recovery $dV/dt^c$                                     |                  | $dV/dt$        | 3.0              | V/ns |
| Operating Junction and Storage Temperature Range                  |                  | $T_J, T_{stg}$ | - 55 to + 150    | °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).
- $V_{DD} = 50$  V, starting  $T_J = 25$  °C,  $L = 54$  mH,  $R_g = 25$   $\Omega$ ,  $I_{AS} = 1.3$  A (see fig. 12).
- $I_{SD} \leq 4.4$  A,  $dI/dt \leq 90$  A/ $\mu$ s,  $V_{DD} \leq V_{DS}$ ,  $T_J \leq 150$  °C.
- 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 ( $T_J = 25\text{ °C}$ , unless otherwise noted) |                     |  |   |      |      |           |               |
|---|---------------------|--|---|------|------|-----------|---------------|
| PARAMETER   | SYMBOL              | TEST CONDITIONS  |   | MIN. | TYP. | MAX.      | UNIT          |
| <b>Static</b>   |                     |  |   |      |      |           |               |
| Drain-Source Breakdown Voltage                                  | $V_{DS}$            | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$  |   | 600  | -    | -         | V             |
| $V_{DS}$ Temperature Coefficient                                | $\Delta V_{DS}/T_J$ | Reference to $25\text{ °C}$ , $I_D = 1\text{ mA}$  |   | -    | 0.88 | -         | 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   | $I_{GSS}$           | $V_{GS} = \pm 20\text{ V}$   |   | -    | -    | $\pm 100$ | nA            |
| Zero Gate Voltage Drain Current                                 | $I_{DSS}$           | $V_{DS} = 600\text{ V}, V_{GS} = 0\text{ V}$   |   | -    | -    | 25        | $\mu\text{A}$ |
|   |                     | $V_{DS} = 480\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ °C}$  |   | -    | -    | 250       |               |
| Drain-Source On-State Resistance                                | $R_{DS(on)}$        | $V_{GS} = 10\text{ V}$   | $I_D = 0.19\text{ A}^b$   | -    | -    | 4.4       | $\Omega$      |
| Forward Transconductance  | $g_{fs}$            | $V_{DS} = 50\text{ V}, I_D = 1.3\text{ A}^b$   |   | 1.4  | -    | -         | 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   |   | -    | 350  | -         | pF            |
| Output Capacitance  | $C_{oss}$           |  |   | -    | 48   | -         |               |
| Reverse Transfer Capacitance                                    | $C_{rss}$           |  |   | -    | 8.6  | -         |               |
| Total Gate Charge   | $Q_g$               | $V_{GS} = 10\text{ V}$   | $I_D = 2.0\text{ A}, V_{DS} = 360\text{ V}$ , see fig.6 and 13 <sup>b</sup> | -    | -    | 18        | nC            |
| Gate-Source Charge  | $Q_{gs}$            |  |   | -    | -    | 3.0       |               |
| Gate-Drain Charge   | $Q_{gd}$            |  |   | -    | -    | 8.9       |               |
| Turn-On Delay Time  | $t_{d(on)}$         | $V_{DD} = 300\text{ V}, I_D = 2.0\text{ A}, R_g = 18\text{ }\Omega, R_D = 150\text{ }\Omega$ , see fig. 10 <sup>b</sup>                                |   | -    | 10   | -         | ns            |
| Rise Time   | $t_r$               |  |   | -    | 23   | -         |               |
| Turn-Off Delay Time   | $t_{d(off)}$        |  |   | -    | 30   | -         |               |
| Fall Time   | $t_f$               |  |   | -    | 25   | -         |               |
| 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  | -         |               |
| <b>Drain-Source Body Diode Characteristics</b>                  |                     |  |   |      |      |           |               |
| Continuous Source-Drain Diode Current                           | $I_S$               | MOSFET symbol showing the integral reverse p - n junction diode    |   | -    | -    | 0.32      | A             |
| Pulsed Diode Forward Current <sup>a</sup>                       | $I_{SM}$            |  |   | -    | -    | 2.6       |               |
| Body Diode Voltage  | $V_{SD}$            | $T_J = 25\text{ °C}, I_S = 0.32\text{ A}, V_{GS} = 0\text{ V}^b$   |   | -    | -    | 1.6       | V             |
| Body Diode Reverse Recovery Time                                | $t_{rr}$            | $T_J = 25\text{ °C}, I_F = 2.0\text{ A}, di/dt = 100\text{ A}/\mu\text{s}^b$   |   | -    | 290  | 580       | ns            |
| Body Diode Reverse Recovery Charge                              | $Q_{rr}$            |  |   | -    | 0.67 | 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

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

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

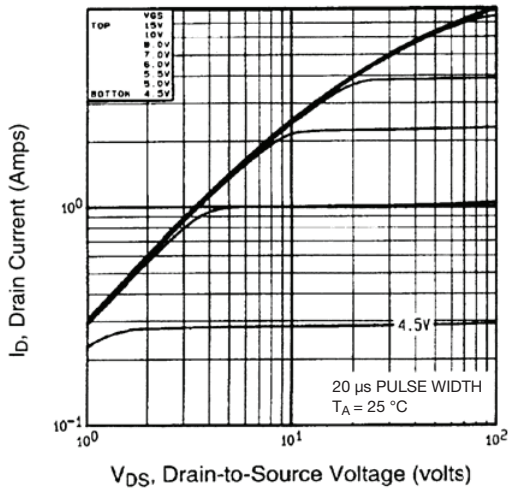


Fig. 1 - Typical Output Characteristics,  $T_A = 25\text{ }^\circ\text{C}$

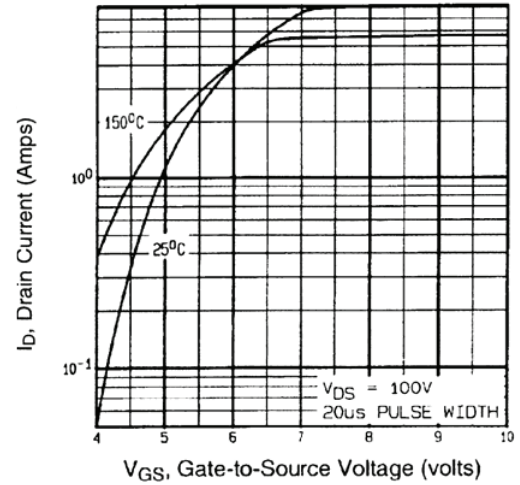


Fig. 3 - Typical Transfer Characteristics

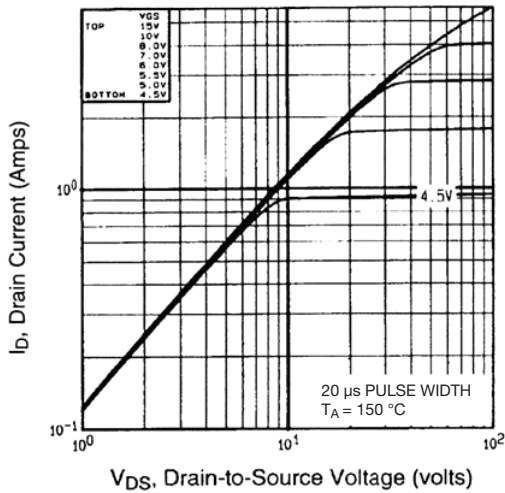


Fig. 2 - Typical Output Characteristics,  $T_A = 150\text{ }^\circ\text{C}$

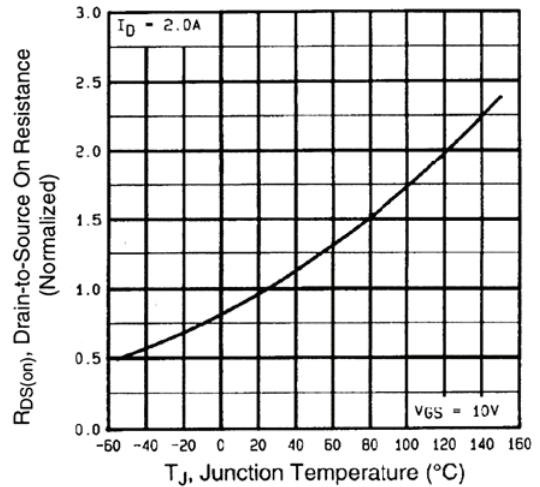


Fig. 4 - Normalized On-Resistance vs. Temperature

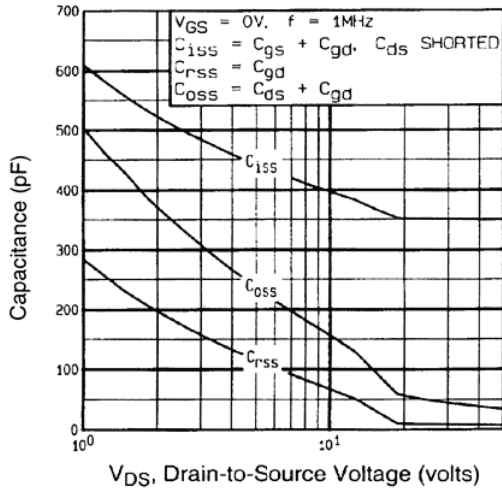


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

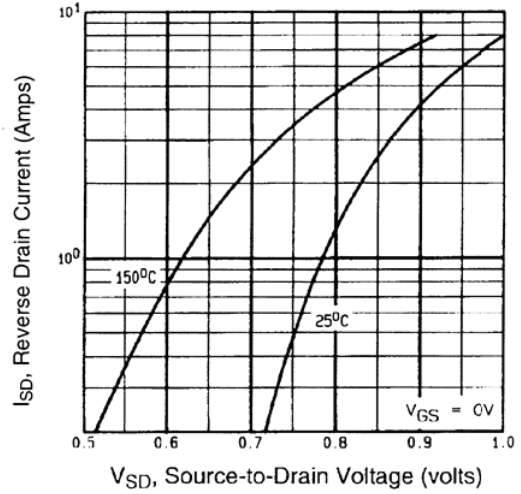


Fig. 7 - Typical Source-Drain Diode Forward Voltage

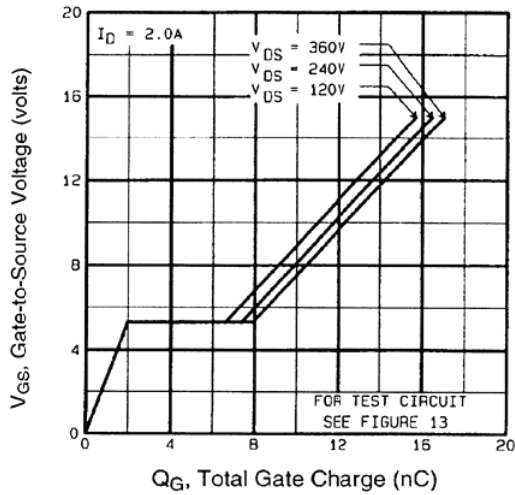


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

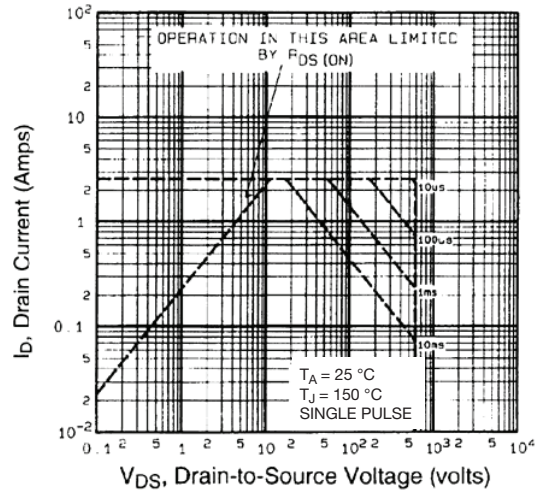


Fig. 8 - Maximum Safe Operating Area

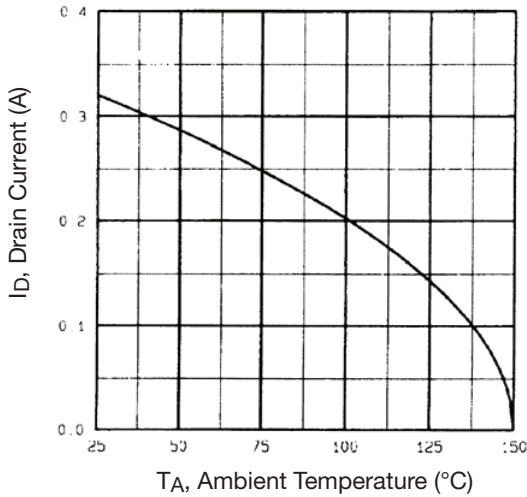


Fig. 9 - Maximum Drain Current vs. Ambient Temperature

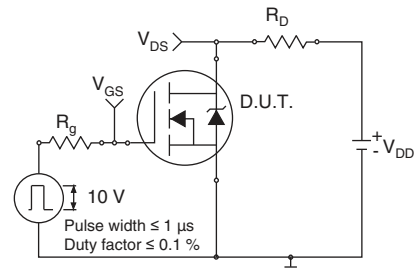


Fig. 10a - Switching Time Test Circuit

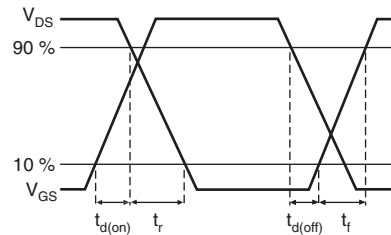


Fig. 10b - Switching Time Waveforms

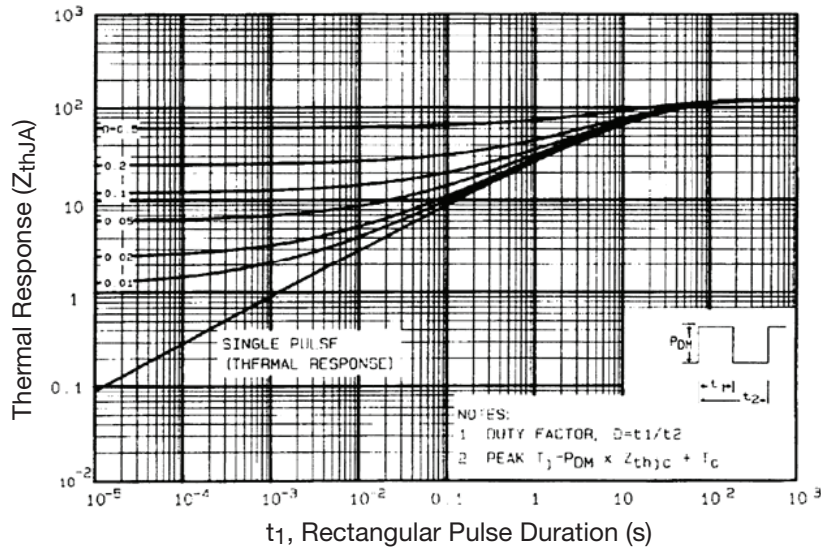


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

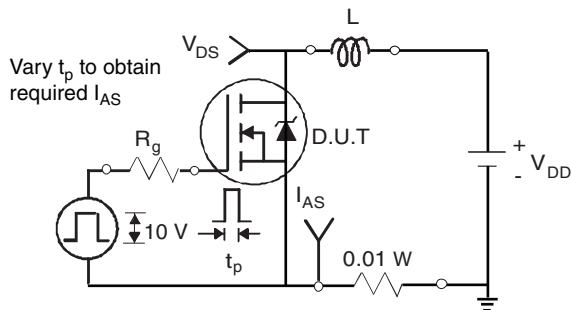


Fig. 12a - Unclamped Inductive Test Circuit

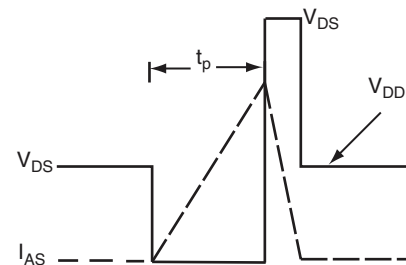


Fig. 12b - Unclamped Inductive Waveforms

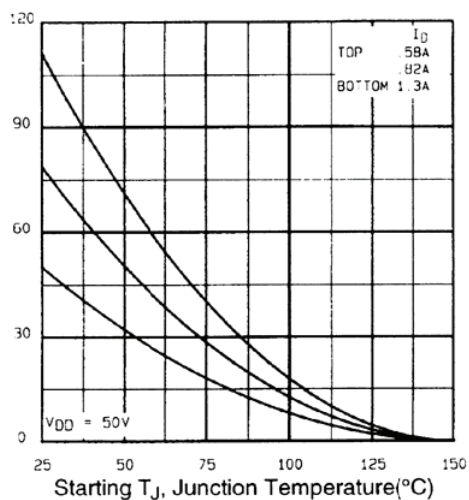


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

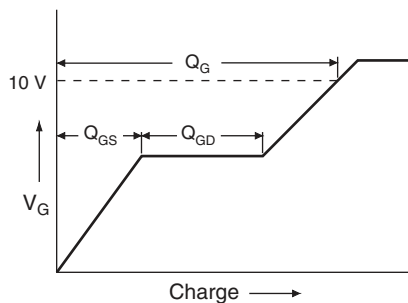


Fig. 13a - Basic Gate Charge Waveform

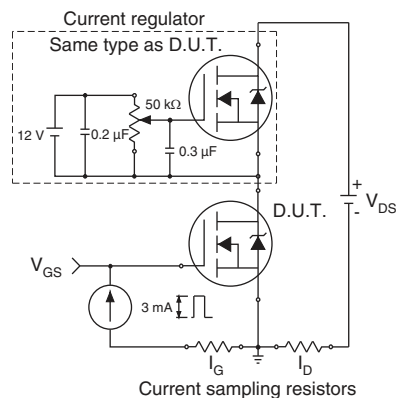
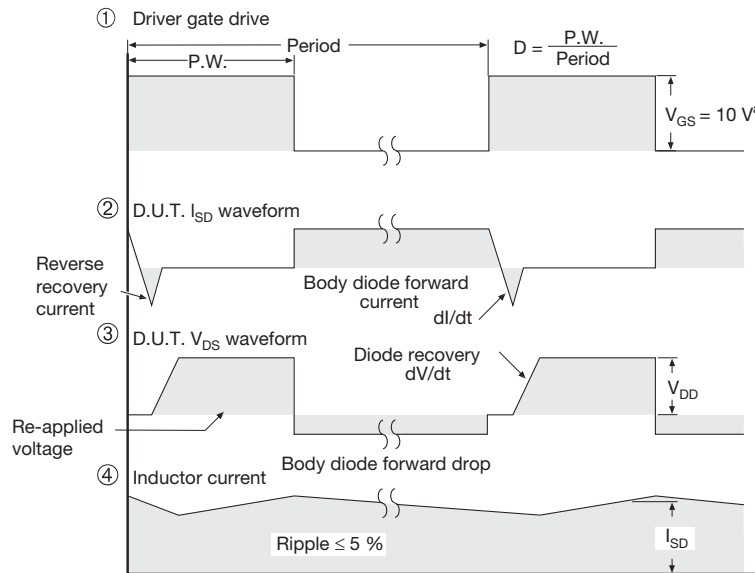
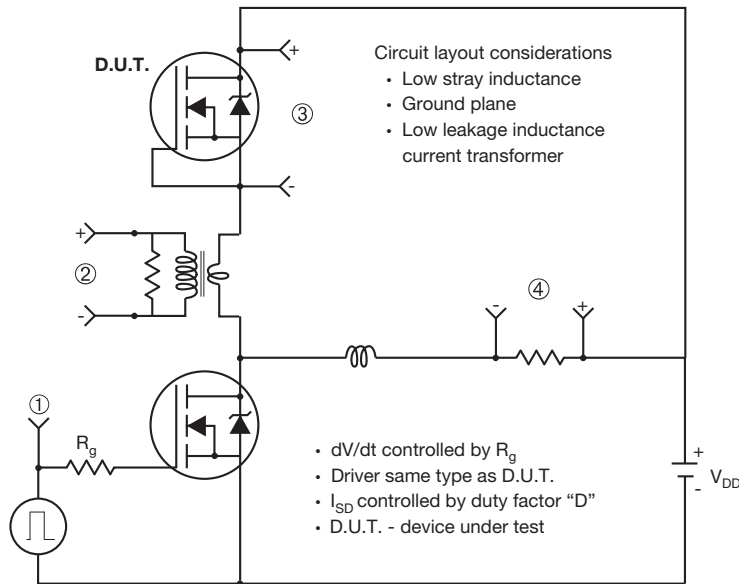


Fig. 13b - Gate Charge Test Circuit

### Peak Diode Recovery dV/dt Test Circuit



**Note**

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

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

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