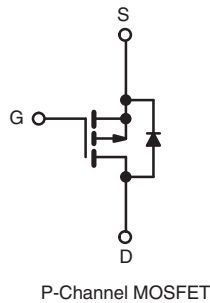
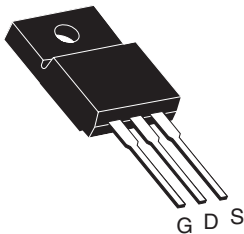


## Power MOSFET

| PRODUCT SUMMARY           |                  |      |
|---------------------------|------------------|------|
| $V_{DS}$ (V)              | - 100            |      |
| $R_{DS(on)}$ ( $\Omega$ ) | $V_{GS} = -10$ V | 0.30 |
| $Q_g$ (Max.) (nC)         | 38               |      |
| $Q_{gs}$ (nC)             | 6.8              |      |
| $Q_{gd}$ (nC)             | 21               |      |
| Configuration             | Single           |      |

**TO-220 FULLPAK**


### FEATURES

- Isolated Package
- High Voltage Isolation = 2.5 kV<sub>RMS</sub> (t = 60 s; f = 60 Hz)
- Sink to Lead Creepage Distance = 4.8 mm
- P-Channel
- 175 °C Operating Temperature
- Dynamic dV/dt Rating
- Low Thermal Resistance
- Lead (Pb)-free 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 TO-220 FULLPAK eliminates the need for additional insulating hardware in commercial-industrial applications. The moulding compound used provides a high isolation capability and a low thermal resistance between the tab and external heatsink. This isolation is equivalent to using a 100 micron mica barrier with standard TO-220 product. The FULLPAK is mounted to a heatsink using a single clip or by a single screw fixing.

| ORDERING INFORMATION |                |
|----------------------|----------------|
| Package              | TO-220 FULLPAK |
| Lead (Pb)-free       | IRFI9530GPbF   |
|                      | SiHFI9530G-E3  |
| SnPb                 | IRFI9530G      |
|                      | SiHFI9530G     |


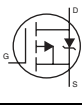
| ABSOLUTE MAXIMUM RATINGS $T_C = 25$ °C, unless otherwise noted |                    |                  |          |   |
|--|--------------------|------------------|----------|---|
| PARAMETER  | SYMBOL             | LIMIT            | UNIT     |   |
| Drain-Source Voltage   | $V_{DS}$           | - 100            | V        |   |
| Gate-Source Voltage  | $V_{GS}$           | $\pm 20$         |          |   |
| Continuous Drain Current                                       | $V_{GS}$ at - 10 V | $T_C = 25$ °C    | - 7.7    | A |
|  |                    | $T_C = 100$ °C   | - 5.4    |   |
| Pulsed Drain Current <sup>a</sup>                              | $I_{DM}$           | - 31             |          |   |
| Linear Derating Factor   |                    | 0.28             | W/°C     |   |
| Single Pulse Avalanche Energy <sup>b</sup>                     | $E_{AS}$           | 380              | mJ       |   |
| Repetitive Avalanche Current <sup>a</sup>                      | $I_{AR}$           | - 7.7            | A        |   |
| Repetitive Avalanche Energy <sup>a</sup>                       | $E_{AR}$           | 4.2              | mJ       |   |
| Maximum Power Dissipation                                      | $P_D$              | 42               | W        |   |
| Peak Diode Recovery dV/dt <sup>c</sup>                         | 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 <sup>d</sup> |          |   |
| Mounting Torque  | 6-32 or M3 screw   | 10               | lbf · in |   |
|  |                    | 1.1              | N · m    |   |

### Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- $V_{DD} = -25$  V, starting  $T_J = 25$  °C, L = 9.6 mH,  $R_G = 25$   $\Omega$ ,  $I_{AS} = -7.7$  A (see fig. 12).
- $I_{SD} \leq -7.7$  A,  $dI/dt \leq 140$  A/ $\mu$ s,  $V_{DD} \leq V_{DS}$ ,  $T_J \leq 175$  °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      | $R_{thJA}$ | -    | 65   | °C/W |
| Maximum Junction-to-Case (Drain) | $R_{thJC}$ | -    | 3.6  |      |

| 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   | $V_{DS}$            | $V_{GS} = 0\text{ V}$ , $I_D = 250\text{ }\mu\text{A}$  | - 100                | -      | -         | V             |
| $V_{DS}$ Temperature Coefficient   | $\Delta V_{DS}/T_J$ | Reference to $25\text{ }^\circ\text{C}$ , $I_D = 1\text{ mA}$   | -                    | - 0.10 | -         | 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  | $I_{DSS}$           | $V_{DS} = -100\text{ V}$ , $V_{GS} = 0\text{ V}$  | -                    | -      | - 100     | $\mu\text{A}$ |
|  |                     | $V_{DS} = -80\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 150\text{ }^\circ\text{C}$   | -                    | -      | - 500     |               |
| Drain-Source On-State Resistance   | $R_{DS(on)}$        | $V_{GS} = -10\text{ V}$ , $I_D = -4.6\text{ A}^b$   | -                    | -      | 0.30      | $\Omega$      |
| Forward Transconductance   | $g_{fs}$            | $V_{DS} = -50\text{ V}$ , $I_D = -4.6\text{ A}^b$   | 3.4                  | -      | -         | S             |
| <b>Dynamic</b>   |                     |   |                      |        |           |               |
| Input Capacitance  | $C_{iss}$           | $V_{GS} = 0\text{ V}$ ,<br>$V_{DS} = -25\text{ V}$ ,<br>$f = 1.0\text{ MHz}$ , see fig. 5   | -                    | 860    | -         | pF            |
| Output Capacitance   | $C_{oss}$           |   | -                    | 340    | -         |               |
| Reverse Transfer Capacitance   | $C_{rss}$           |   | -                    | 93     | -         |               |
| Drain to Sink Capacitance  | $C$                 |   | $f = 1.0\text{ MHz}$ | -      | 12        |               |
| Total Gate Charge  | $Q_g$               | $V_{GS} = -10\text{ V}$ , $I_D = -12\text{ A}$ , $V_{DS} = -80\text{ V}$ ,<br>see fig. 6 and 13 <sup>b</sup>  | -                    | -      | 38        | nC            |
| Gate-Source Charge   | $Q_{gs}$            |   | -                    | -      | 6.8       |               |
| Gate-Drain Charge  | $Q_{gd}$            |   | -                    | -      | 21        |               |
| Turn-On Delay Time   | $t_{d(on)}$         | $V_{DD} = -50\text{ V}$ , $I_D = -12\text{ A}$ ,<br>$R_G = 12\text{ }\Omega$ , $R_D = 3.9\text{ }\Omega$ ,<br>see fig. 10 <sup>b</sup>                          | -                    | 12     | -         | ns            |
| Rise Time  | $t_r$               |   | -                    | 52     | -         |               |
| Turn-Off Delay Time  | $t_{d(off)}$        |   | -                    | 31     | -         |               |
| Fall Time  | $t_f$               |   | -                    | 39     | -         |               |
| Internal Drain Inductance  | $L_D$               | Between lead,<br>6 mm (0.25") from<br>package and center of<br>die contact  | -                    | 4.5    | -         | nH            |
| Internal Source Inductance   | $L_S$               |   | -                    | 7.5    | -         |               |
| <b>Drain-Source Body Diode Characteristics</b>                           |                     |   |                      |        |           |               |
| Continuous Source-Drain Diode Current                                    | $I_S$               | MOSFET symbol<br>showing the<br>integral reverse<br>p - n junction diode    | -                    | -      | - 7.7     | A             |
| Pulsed Diode Forward Current <sup>a</sup>                                | $I_{SM}$            |   | -                    | -      | - 31      |               |
| Body Diode Voltage   | $V_{SD}$            | $T_J = 25\text{ }^\circ\text{C}$ , $I_S = -7.7\text{ A}$ , $V_{GS} = 0\text{ V}^b$  | -                    | -      | - 6.3     | V             |
| Body Diode Reverse Recovery Time   | $t_{rr}$            | $T_J = 25\text{ }^\circ\text{C}$ , $I_F = -12\text{ A}$ , $dI/dt = 100\text{ A}/\mu\text{s}^b$  | -                    | 120    | 240       | ns            |
| Body Diode Reverse Recovery Charge                                       | $Q_{rr}$            |   | -                    | 0.46   | 0.92      | $\mu\text{C}$ |
| 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

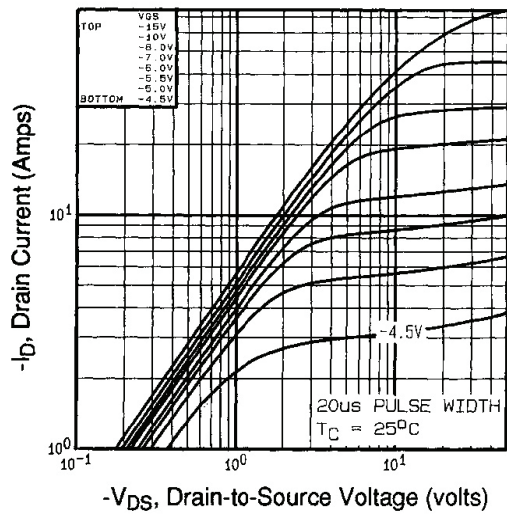


Fig. 1 - Typical Output Characteristics,  $T_C = 25^\circ\text{C}$

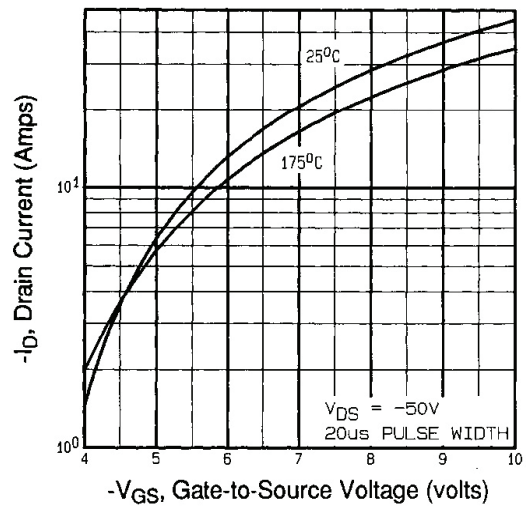


Fig. 3 - Typical Transfer Characteristics

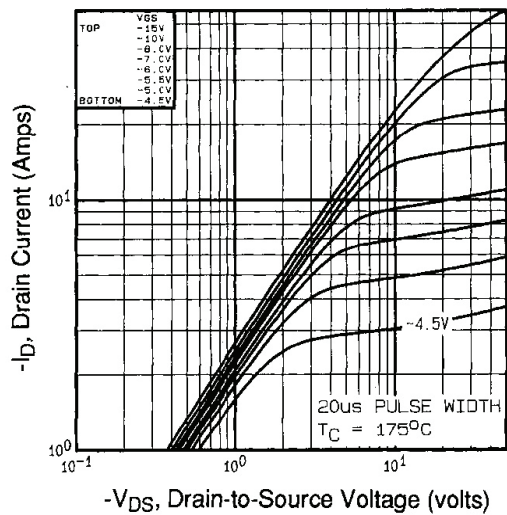


Fig. 2 - Typical Output Characteristics,  $T_C = 175^\circ\text{C}$

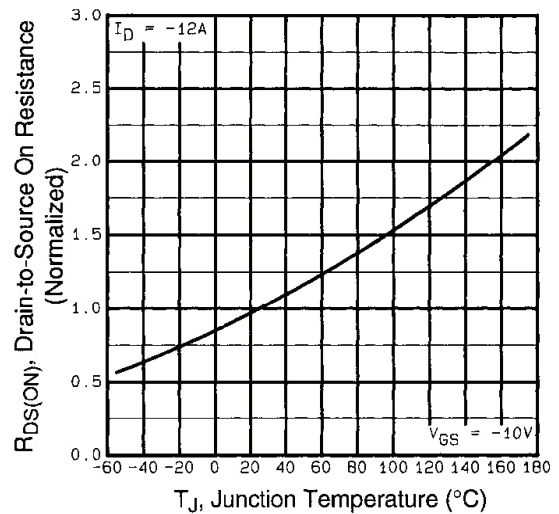


Fig. 4 - Normalized On-Resistance vs. Temperature

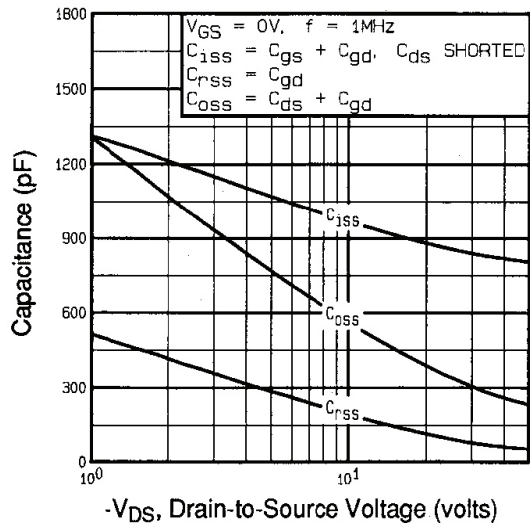


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

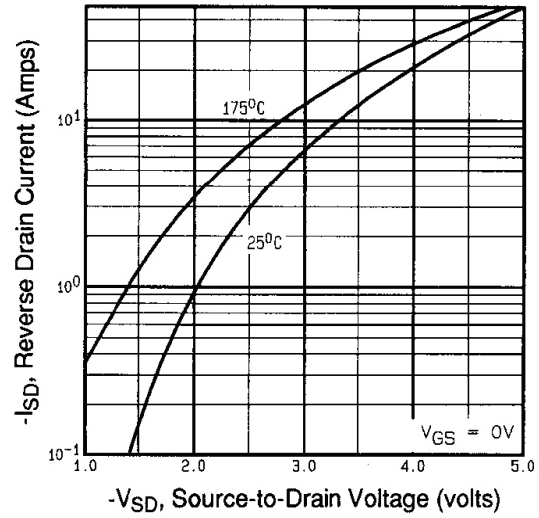


Fig. 7 - Typical Source-Drain Diode Forward Voltage

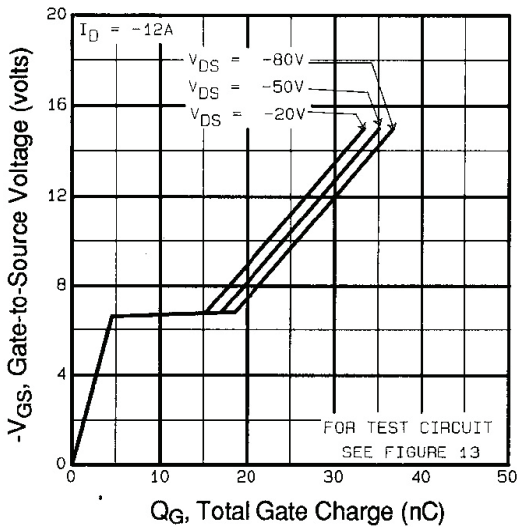


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

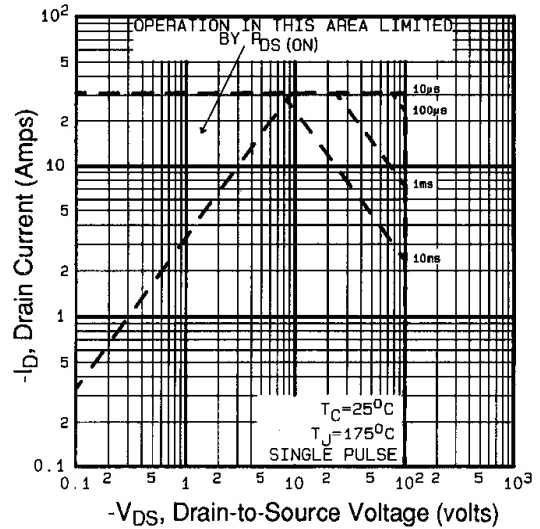


Fig. 8 - Maximum Safe Operating Area

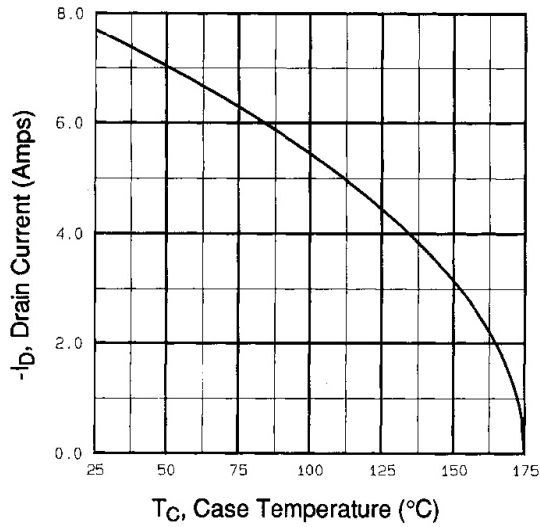


Fig. 9 - Maximum Drain Current vs. Case Temperature

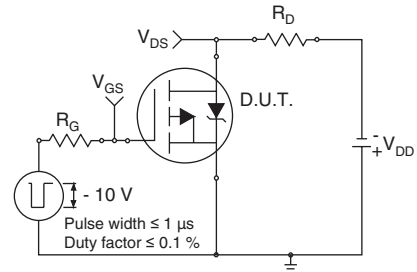


Fig. 10a - Switching Time Test Circuit

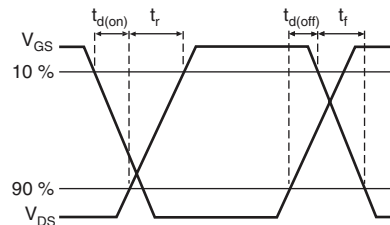


Fig. 10b - Switching Time Waveforms

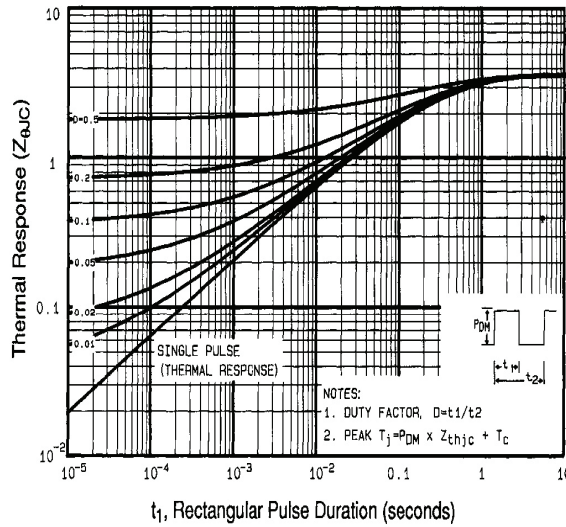


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

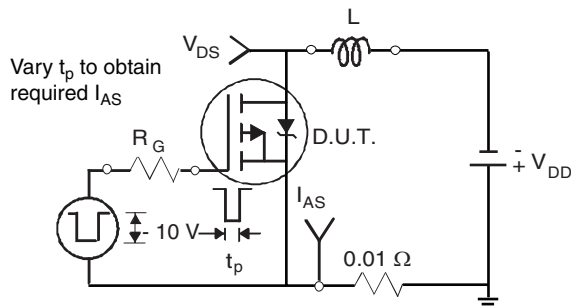


Fig. 12a - Unclamped Inductive Test Circuit

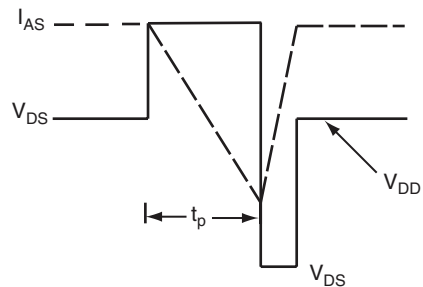


Fig. 12b - Unclamped Inductive Waveforms

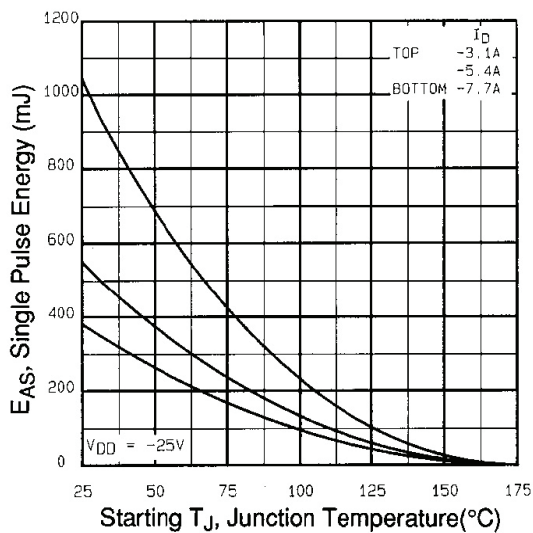


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

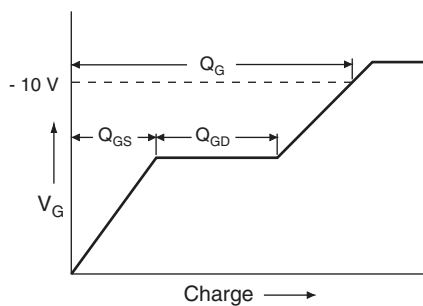


Fig. 13a - Basic Gate Charge Waveform

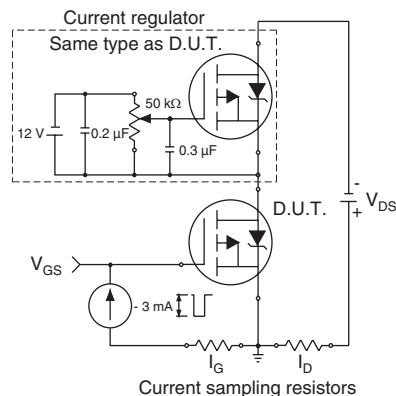
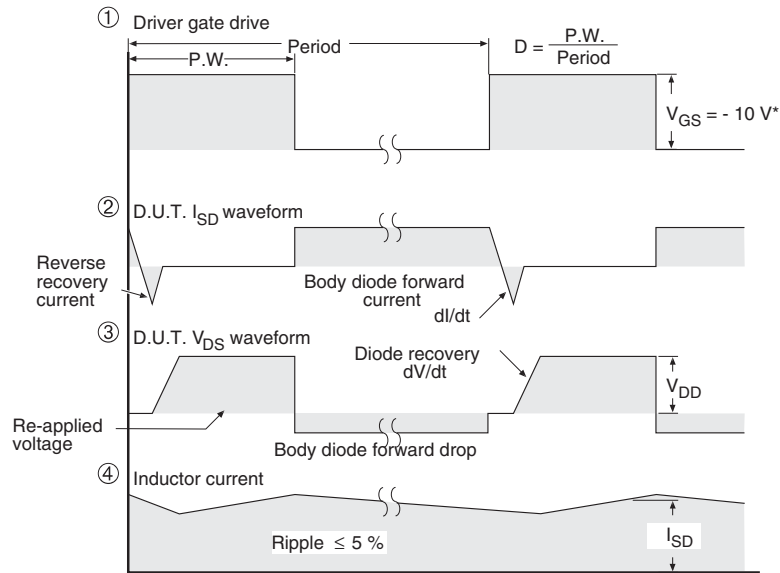
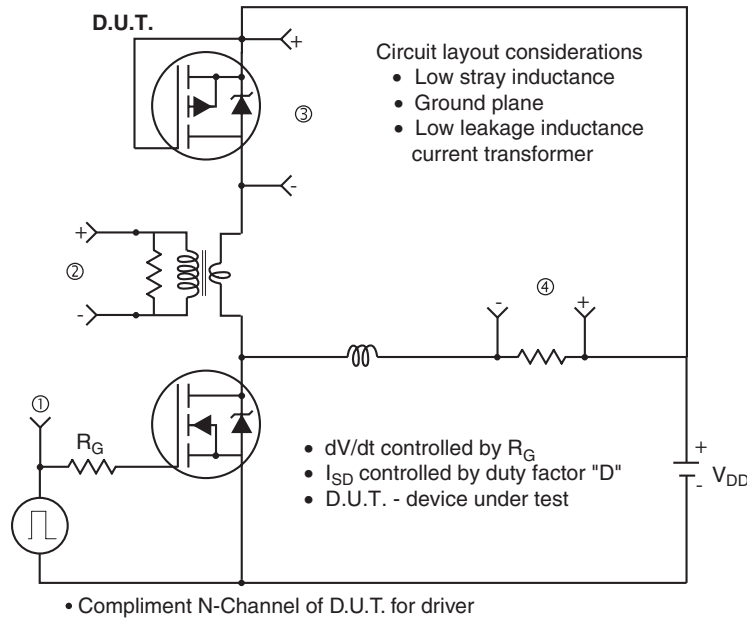


Fig. 13b - Gate Charge Test Circuit

## Peak Diode Recovery dV/dt Test Circuit



\*  $V_{GS} = -5V$  for logic level and  $-3V$  drive devices

**Fig.14 - For P-Channel**

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