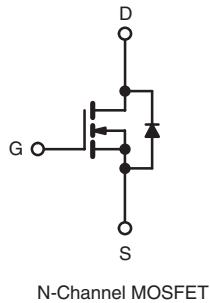
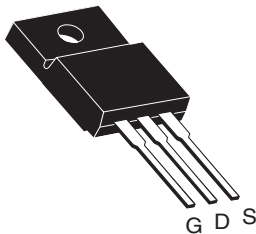


## Power MOSFET

| 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          |      |

**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
- 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 | IRFI520GPbF    |
|                | SiHFI520G-E3   |
| SnPb           | IRFI520G       |
|                | SiHFI520G      |

### 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    | A        |
|  |                  | $T_C = 100$ °C   |          |
| Pulsed Drain Current <sup>a</sup>                | $I_{DM}$         | 29               |          |
| Linear Derating Factor                           |                  | 0.24             | W/°C     |
| Single Pulse Avalanche Energy <sup>b</sup>       | $E_{AS}$         | 36               | mJ       |
| Repetitive Avalanche Current <sup>a</sup>        | $I_{AR}$         | 7.2              | A        |
| Repetitive Avalanche Energy <sup>a</sup>         | $E_{AR}$         | 3.7              | mJ       |
| Maximum Power Dissipation                        | $P_D$            | 37               | W        |
|  |                  | $T_C = 25$ °C    |          |
| 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)     |                  | 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 = 1.0 mH,  $R_G = 25$   $\Omega$ ,  $I_{AS} = 7.2$  A (see fig. 12).
- $I_{SD} \leq 9.2$  A,  $dI/dt \leq 110$  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) | $R_{thJC}$ | -    | 4.1  |      |

| 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 $25\text{ }^\circ\text{C}$ , $I_D = 1\text{ mA}$   | -                    | 0.13 | -         | 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  | $I_{DSS}$           | $V_{DS} = 100\text{ V}$ , $V_{GS} = 0\text{ V}$   | -                    | -    | 25        | $\mu\text{A}$ |
|  |                     | $V_{DS} = 80\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 150\text{ }^\circ\text{C}$  | -                    | -    | 250       |               |
| Drain-Source On-State Resistance   | $R_{DS(on)}$        | $V_{GS} = 10\text{ V}$ , $I_D = 4.3\text{ A}^b$   | -                    | -    | 0.27      | $\Omega$      |
| Forward Transconductance   | $g_{fs}$            | $V_{DS} = 50\text{ V}$ , $I_D = 4.3\text{ A}^b$   | 2.3                  | -    | -         | 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  | -                    | 360  | -         | pF            |
| Output Capacitance   | $C_{oss}$           |   | -                    | 150  | -         |               |
| Reverse Transfer Capacitance   | $C_{rss}$           |   | -                    | 34   | -         |               |
| Drain to Sink Capacitance  | $C$                 |   | $f = 1.0\text{ MHz}$ | -    | 12        |               |
| Total Gate Charge  | $Q_g$               | $V_{GS} = 10\text{ V}$ ,<br>$I_D = 9.2\text{ A}$ , $V_{DS} = 80\text{ V}$ ,<br>see fig. 6 and 13 <sup>b</sup>                         | -                    | -    | 16        | nC            |
| Gate-Source Charge   | $Q_{gs}$            |   | -                    | -    | 4.4       |               |
| Gate-Drain Charge  | $Q_{gd}$            |   | -                    | -    | 7.7       |               |
| Turn-On Delay Time   | $t_{d(on)}$         | $V_{DD} = 50\text{ V}$ , $I_D = 9.2\text{ A}$ ,<br>$R_G = 18\text{ }\Omega$ , $R_D = 5.2\text{ }\Omega$ ,<br>see fig. 10 <sup>b</sup> | -                    | 8.8  | -         | ns            |
| Rise Time  | $t_r$               |   | -                    | 30   | -         |               |
| Turn-Off Delay Time  | $t_{d(off)}$        |   | -                    | 19   | -         |               |
| Fall Time  | $t_f$               |   | -                    | 20   | -         |               |
| 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  | -                    | -    | 7.2       | A             |
| Pulsed Diode Forward Current <sup>a</sup>                                | $I_{SM}$            |   | -                    | -    | 29        |               |
| Body Diode Voltage   | $V_{SD}$            | $T_J = 25\text{ }^\circ\text{C}$ , $I_S = 7.2\text{ A}$ , $V_{GS} = 0\text{ V}^b$   | -                    | -    | 2.5       | V             |
| Body Diode Reverse Recovery Time   | $t_{rr}$            | $T_J = 25\text{ }^\circ\text{C}$ , $I_F = 9.2\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}^b$  | -                    | 130  | 260       | ns            |
| Body Diode Reverse Recovery Charge                                       | $Q_{rr}$            |   | -                    | 0.65 | 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**

- 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

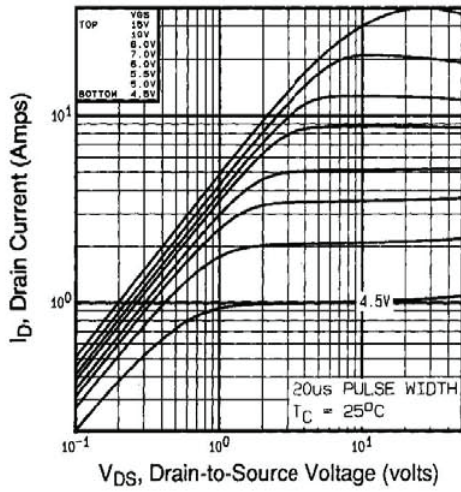


Fig. 1 - Typical Output Characteristics,  $T_C = 25\text{ }^\circ\text{C}$

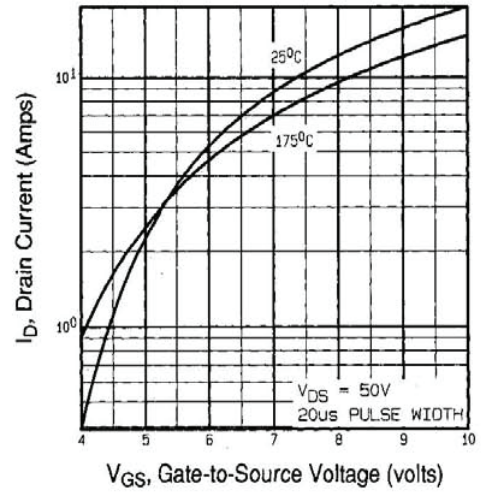


Fig. 3 - Typical Transfer Characteristics

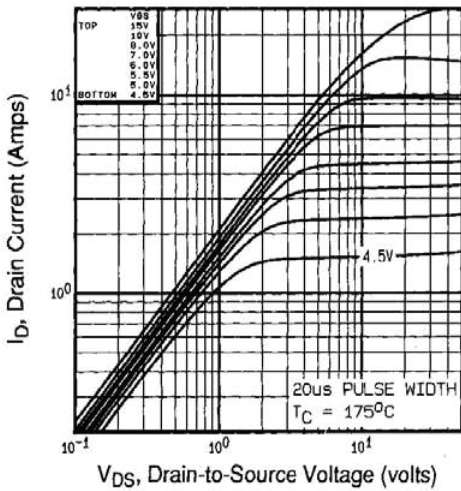


Fig. 2 - Typical Output Characteristics,  $T_C = 175\text{ }^\circ\text{C}$

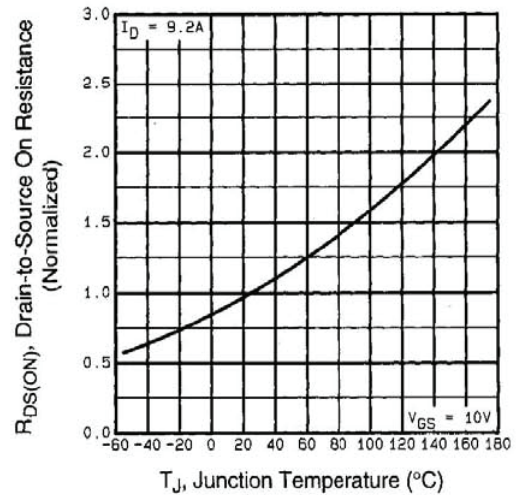


Fig. 4 - Normalized On-Resistance vs. Temperature

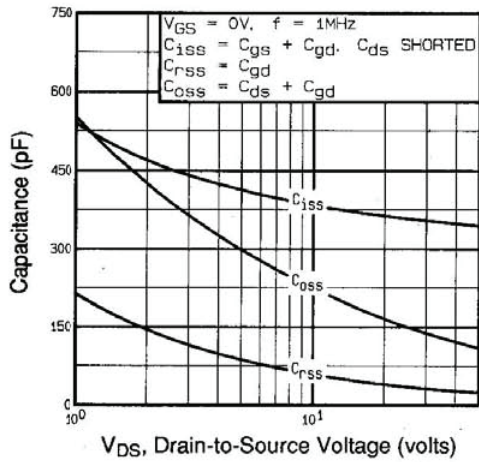


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

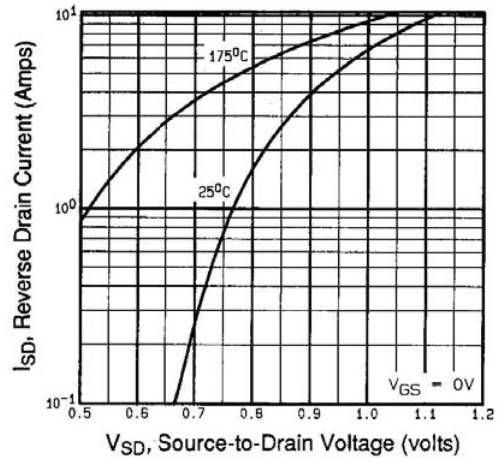


Fig. 7 - Typical Source-Drain Diode Forward Voltage

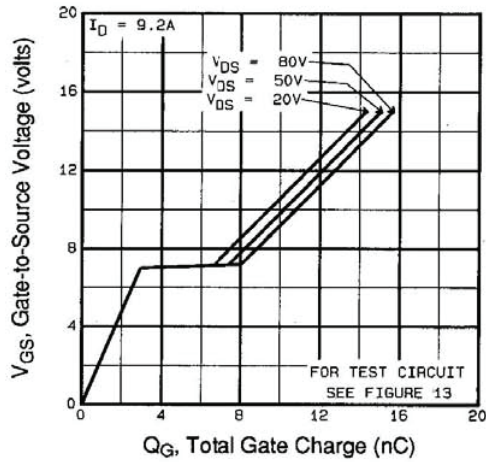


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

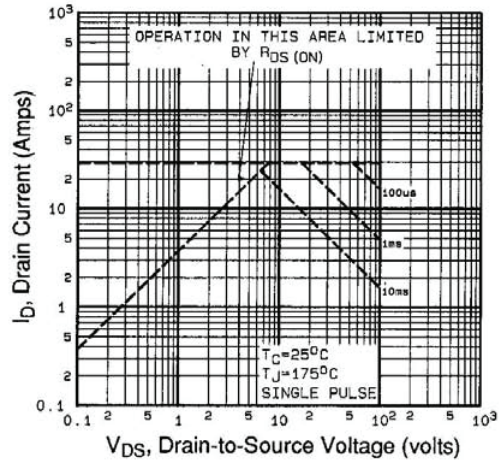


Fig. 5 - Fig. 8 - Maximum Safe Operating Area

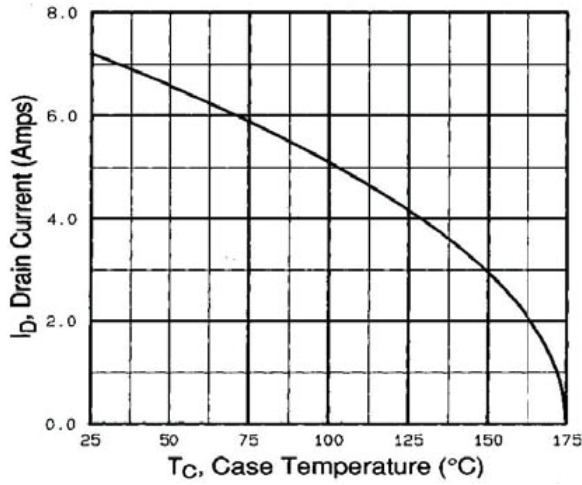


Fig. 9 - Maximum Drain Current vs. Case Temperature



Fig. 10a - Switching Time Test Circuit



Fig. 10b - Switching Time Waveforms

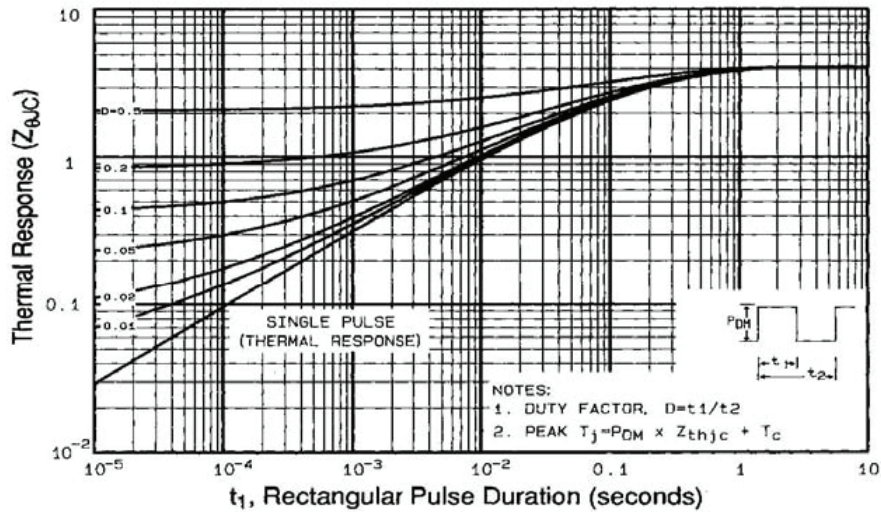


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

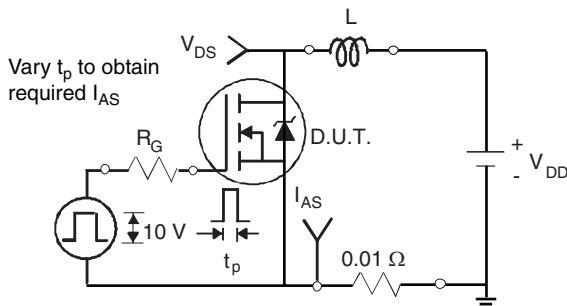


Fig. 12a - Unclamped Inductive Test Circuit

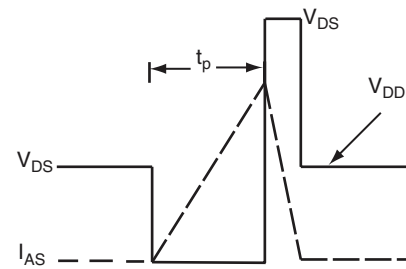


Fig. 12b - Unclamped Inductive Waveforms

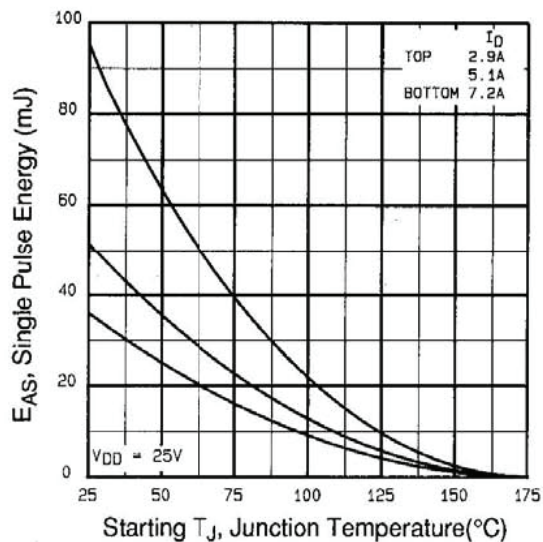


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

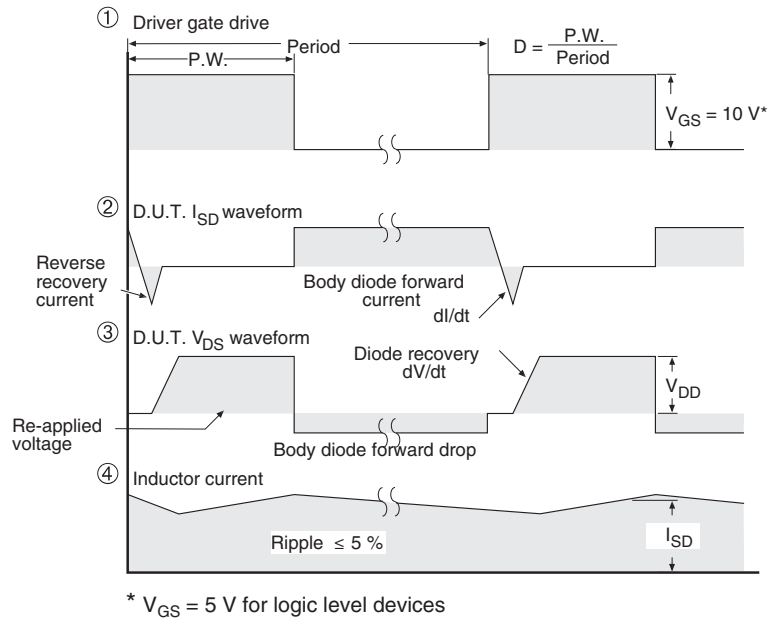
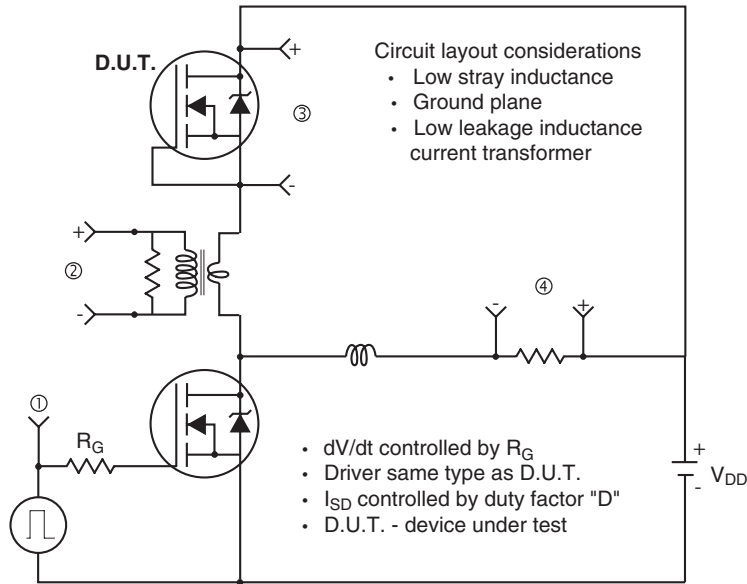


Fig. 13a - Basic Gate Charge Waveform



Fig. 13b - Gate Charge Test Circuit

## Peak Diode Recovery $dV/dt$ Test Circuit



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

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