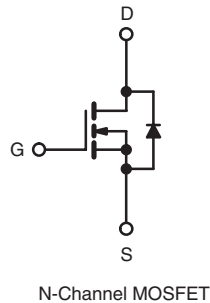


## Power MOSFET

### PRODUCT SUMMARY

|                           |                  |      |
|---------------------------|------------------|------|
| $V_{DS}$ (V)              | 200              |      |
| $R_{DS(on)}$ ( $\Omega$ ) | $V_{GS} = 5.0$ V | 0.40 |
| $Q_g$ (Max.) (nC)         | 40               |      |
| $Q_{gs}$ (nC)             | 5.5              |      |
| $Q_{gd}$ (nC)             | 24               |      |
| 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
- Logic-Level Gate Drive
- $R_{DS(on)}$  Specified at  $V_{GS} = 4$  V and 5V
- Fast Switching
- Ease of paralleling
- Lead (Pb)-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 TO-220 FULLPAK eliminates the need for additional insulating hardware in commercial-industrial applications. The molding 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 | IRLI630GPbF<br>SiHLI630G-E3 |
| SnPb           | IRLI630G<br>SiHLI630G       |

### ABSOLUTE MAXIMUM RATINGS $T_C = 25^\circ\text{C}$ , unless otherwise noted

| PARAMETER                                        | SYMBOL                             | LIMIT                     | UNIT                |
|--------------------------------------------------|------------------------------------|---------------------------|---------------------|
| Drain-Source Voltage                             | $V_{DS}$                           | 200                       | V                   |
| Gate-Source Voltage                              | $V_{GS}$                           | $\pm 10$                  |                     |
| Continuous Drain Current                         | $V_{GS} \text{ at } 5.0 \text{ V}$ | $T_C = 25^\circ\text{C}$  | A                   |
|                                                  |                                    | $T_C = 100^\circ\text{C}$ |                     |
| Pulsed Drain Current <sup>a</sup>                | $I_{DM}$                           | 25                        |                     |
| Linear Derating Factor                           |                                    | 0.28                      | W/ $^\circ\text{C}$ |
| Single Pulse Avalanche Energy <sup>b</sup>       | $E_{AS}$                           | 125                       | mJ                  |
| Repetitive Avalanche Current <sup>a</sup>        | $I_{AR}$                           | 6.2                       | A                   |
| Repetitive Avalanche Energy <sup>a</sup>         | $E_{AR}$                           | 3.5                       | mJ                  |
| Maximum Power Dissipation                        | $P_D$                              | 35                        | W                   |
| 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             | $^\circ\text{C}$    |
| 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  $T_J = 25^\circ\text{C}$ ,  $L = 2.4$  mH,  $R_G = 25 \Omega$ ,  $I_{AS} = 6.2$  A (see fig. 12).
- $I_{SD} \leq 9.0$  A,  $dI/dt \leq 120$  A/ $\mu\text{s}$ ,  $V_{DD} \leq V_{DS}$ ,  $T_J \leq 150^\circ\text{C}$ .
- 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  |      |

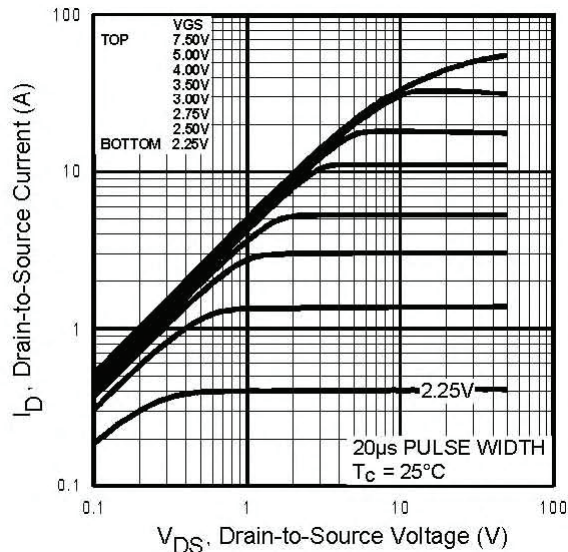
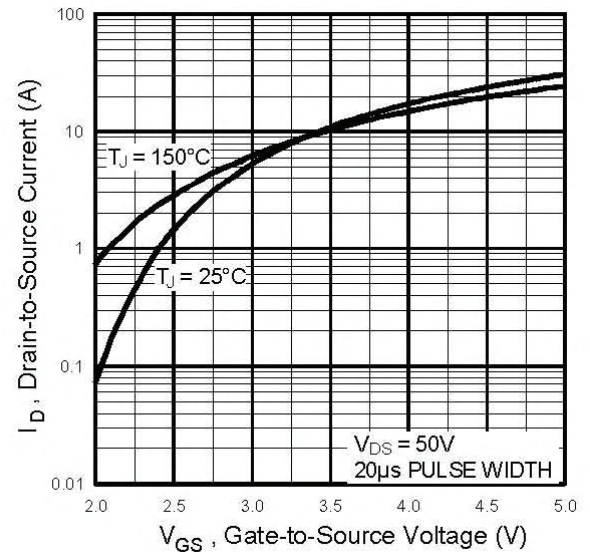
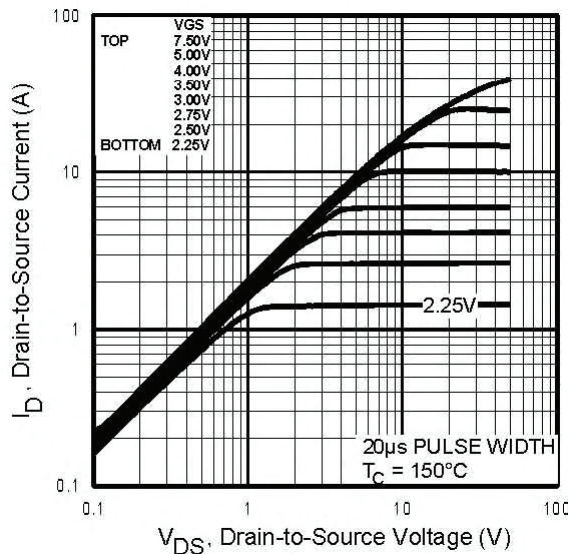
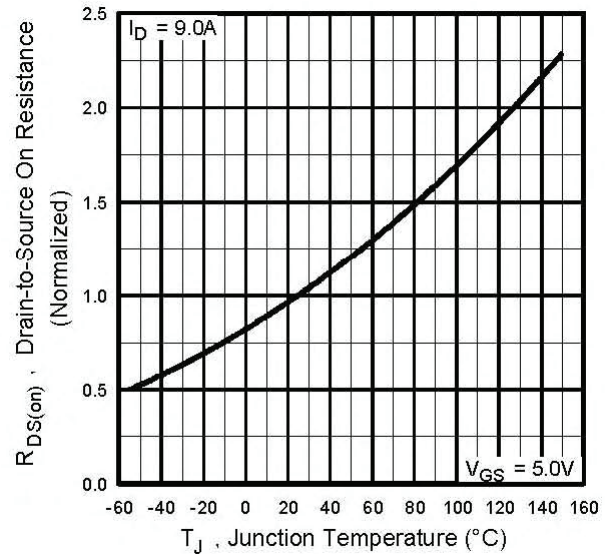
**SPECIFICATIONS**  $T_J = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted

| PARAMETER                                 | SYMBOL                           | TEST CONDITIONS                                                                                                               |                                                                                    | MIN. | TYP. | MAX.  | UNIT |
|-------------------------------------------|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|------|------|-------|------|
| Static                                    |                                  |                                                                                                                               |                                                                                    |      |      |       |      |
| Drain-Source Breakdown Voltage            | V <sub>DS</sub>                  | V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA                                                                                |                                                                                    | 200  | -    | -     | V    |
| V <sub>DS</sub> Temperature Coefficient   | ΔV <sub>DS</sub> /T <sub>J</sub> | Reference to 25 °C, I <sub>D</sub> = 1 mA                                                                                     |                                                                                    | -    | 0.27 | -     | V/°C |
| Gate-Source Threshold Voltage             | V <sub>GS(th)</sub>              | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA                                                                   |                                                                                    | 1.0  | -    | 2.0   | V    |
| Gate-Source Leakage                       | I <sub>GSS</sub>                 | V <sub>GS</sub> = ± 10 V                                                                                                      |                                                                                    | -    | -    | ± 100 | nA   |
| Zero Gate Voltage Drain Current           | I <sub>DSS</sub>                 | V <sub>DS</sub> = 200 V, V <sub>GS</sub> = 0 V                                                                                |                                                                                    | -    | -    | 25    | μA   |
|                                           |                                  | V <sub>DS</sub> = 160 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 125 °C                                                       |                                                                                    | -    | -    | 250   |      |
| Drain-Source On-State Resistance          | R <sub>DS(on)</sub>              | V <sub>GS</sub> = 5.0 V                                                                                                       | I <sub>D</sub> = 3.7 A <sup>b</sup>                                                | -    | -    | 0.40  | Ω    |
|                                           |                                  | V <sub>GS</sub> = 4.0 V                                                                                                       | I <sub>D</sub> = 3.1 A <sup>b</sup>                                                | -    | -    | 0.50  |      |
| Forward Transconductance                  | g <sub>fs</sub>                  | V <sub>DS</sub> = 50 V, I <sub>D</sub> = 5.4 A <sup>b</sup>                                                                   |                                                                                    | 4.8  | -    | -     | S    |
| Dynamic                                   |                                  |                                                                                                                               |                                                                                    |      |      |       |      |
| Input Capacitance                         | C <sub>iss</sub>                 | V <sub>GS</sub> = 0 V,<br>V <sub>DS</sub> = 25 V,<br>f = 1.0 MHz, see fig. 5                                                  |                                                                                    | -    | 1100 | -     | pF   |
| Output Capacitance                        | C <sub>oss</sub>                 |                                                                                                                               |                                                                                    | -    | 220  | -     |      |
| Reverse Transfer Capacitance              | C <sub>rss</sub>                 |                                                                                                                               |                                                                                    | -    | 70   | -     |      |
| Total Gate Charge                         | Q <sub>g</sub>                   | V <sub>GS</sub> = 10 V                                                                                                        | I <sub>D</sub> = 9.0 A, V <sub>DS</sub> = 160 V,<br>see fig. 6 and 13 <sup>b</sup> | -    | -    | 40    | nC   |
| Gate-Source Charge                        | Q <sub>gs</sub>                  |                                                                                                                               |                                                                                    | -    | -    | 5.5   |      |
| Gate-Drain Charge                         | Q <sub>gd</sub>                  |                                                                                                                               |                                                                                    | -    | -    | 24    |      |
| Turn-On Delay Time                        | t <sub>d(on)</sub>               | V <sub>DD</sub> = 100 V, I <sub>D</sub> = 9.0 A,<br>R <sub>G</sub> = 6.0 Ω, R <sub>D</sub> = 11Ω,<br>see fig. 10 <sup>b</sup> |                                                                                    | -    | 8.0  | -     | ns   |
| Rise Time                                 | t <sub>r</sub>                   |                                                                                                                               |                                                                                    | -    | 57   | -     |      |
| Turn-Off Delay Time                       | t <sub>d(off)</sub>              |                                                                                                                               |                                                                                    | -    | 38   | -     |      |
| Fall Time                                 | t <sub>f</sub>                   |                                                                                                                               |                                                                                    | -    | 33   | -     |      |
| Internal Drain Inductance                 | L <sub>D</sub>                   | Between lead,<br>6 mm (0.25") from<br>package and center of<br>die contact                                                    |                                                                                    | -    | 4.5  | -     | nH   |
| Internal Source Inductance                | L <sub>S</sub>                   |                                                                                                                               |                                                                                    | -    | 7.5  | -     |      |
| Drain-Source Body Diode Characteristics   |                                  |                                                                                                                               |                                                                                    |      |      |       |      |
| Continuous Source-Drain Diode Current     | I <sub>S</sub>                   | MOSFET symbol<br>showing the<br>integral reverse<br>p - n junction diode                                                      |                                                                                    | -    | -    | 6.2   | A    |
| Pulsed Diode Forward Current <sup>a</sup> | I <sub>SM</sub>                  |                                                                                                                               |                                                                                    | -    | -    | 25    |      |
| Body Diode Voltage                        | V <sub>SD</sub>                  | T <sub>J</sub> = 25 °C, I <sub>S</sub> = 6.2 A, V <sub>GS</sub> = 0 V <sup>b</sup>                                            |                                                                                    | -    | -    | 2.0   | V    |
| Body Diode Reverse Recovery Time          | t <sub>rr</sub>                  | T <sub>J</sub> = 25 °C, I <sub>F</sub> = 9.0 A, dI/dt = 100 A/μs <sup>b</sup>                                                 |                                                                                    | -    | 230  | 350   | ns   |
| Body Diode Reverse Recovery Charge        | Q <sub>rr</sub>                  |                                                                                                                               |                                                                                    | -    | 1.7  | 2.6   | μC   |
| Forward Turn-On Time                      | t <sub>on</sub>                  | Intrinsic turn-on time is negligible (turn-on is dominated by L <sub>S</sub> and L <sub>D</sub> )                             |                                                                                    |      |      |       |      |

**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,  $T_C = 150^\circ\text{C}$** 

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

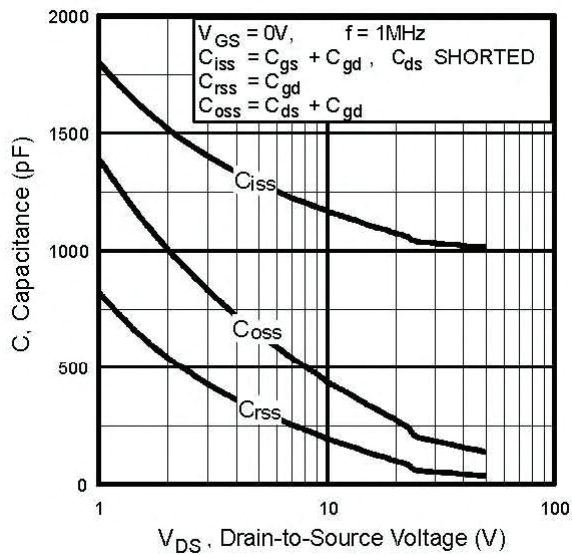


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

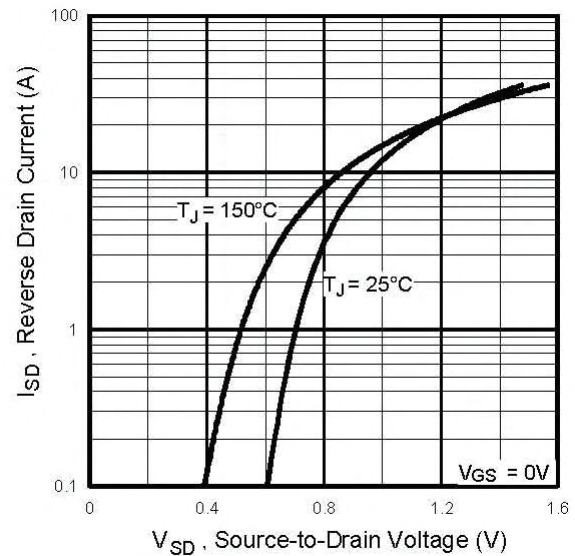


Fig. 7 - Typical Source-Drain Diode Forward Voltage

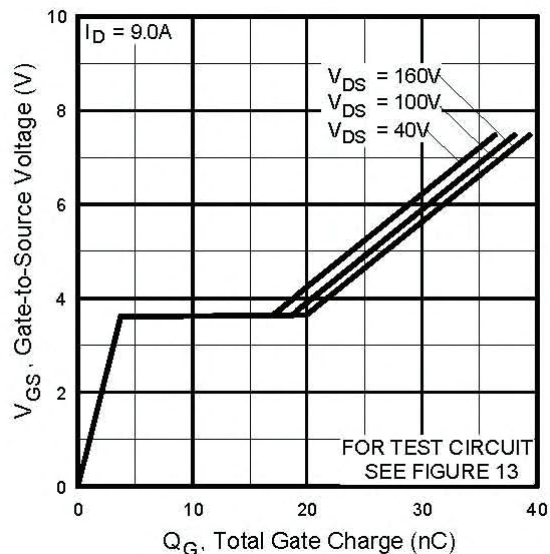


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

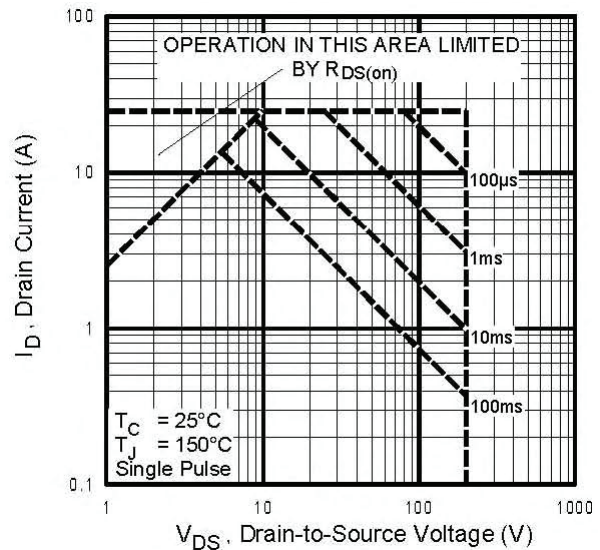
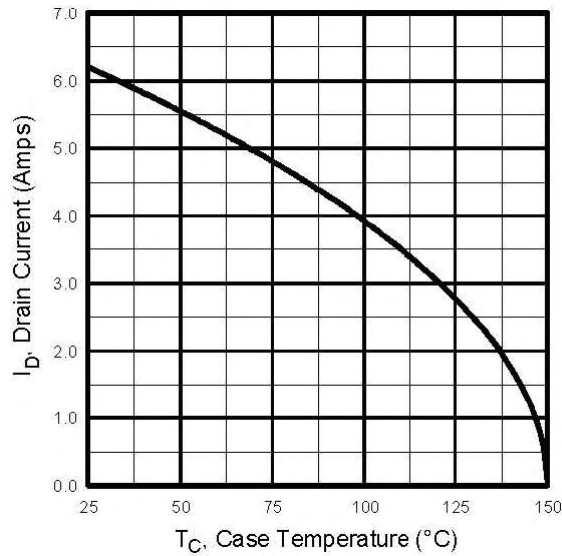
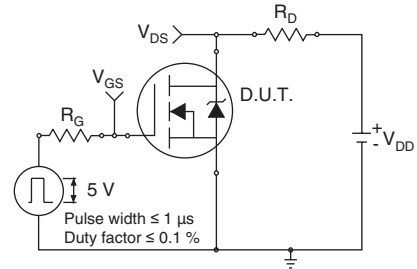


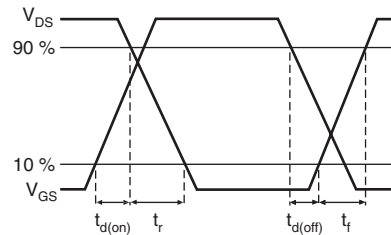
Fig. 8 - Maximum Safe Operating Area



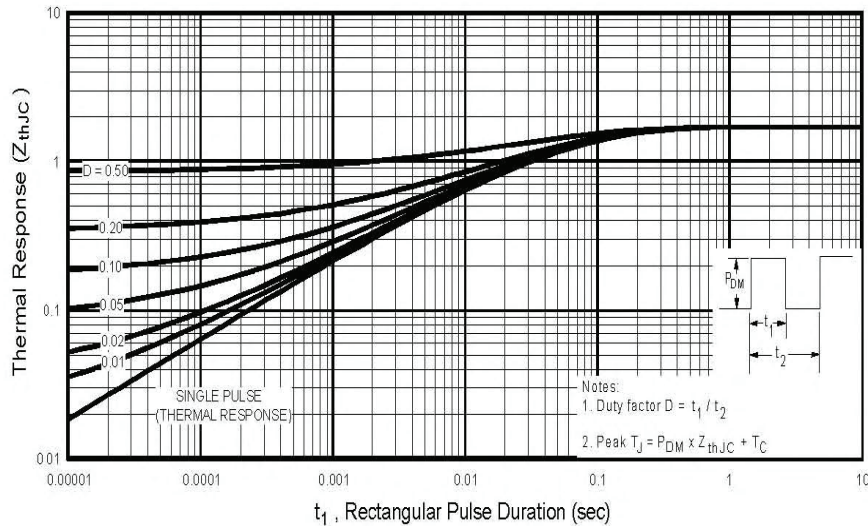
**Fig. 9 - Maximum Drain Current vs. Case Temperature**



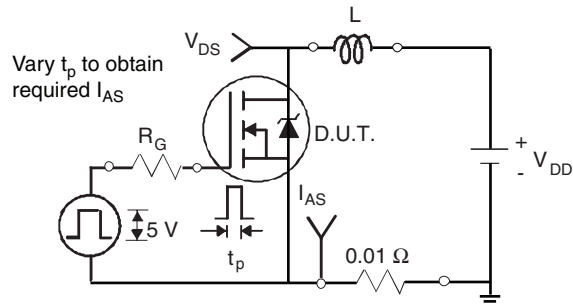
**Fig. 10a - Switching Time Test Circuit**



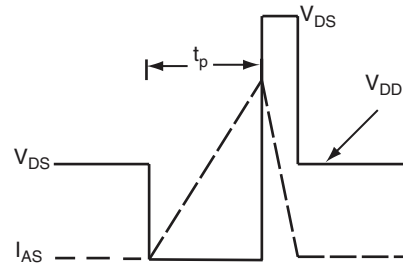
**Fig. 10b - Switching Time Waveforms**



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



**Fig. 12a - Unclamped Inductive Test Circuit**



**Fig. 12b - Unclamped Inductive Waveforms**

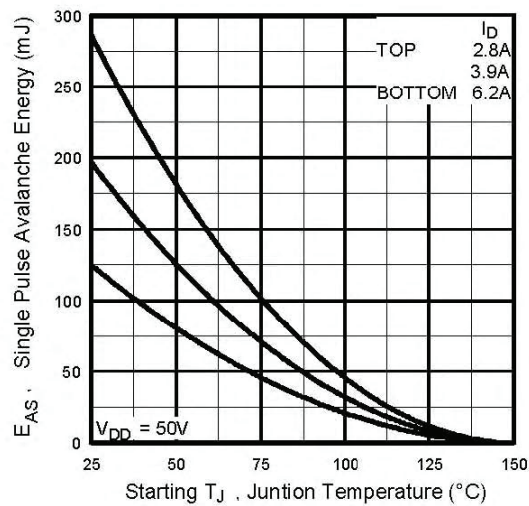


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

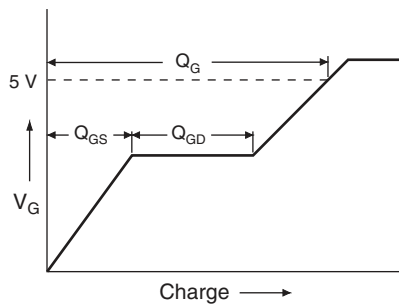


Fig. 13a - Basic Gate Charge Waveform

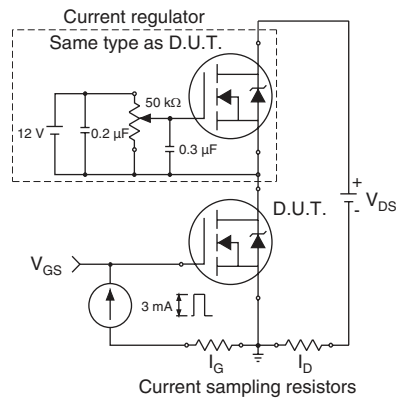
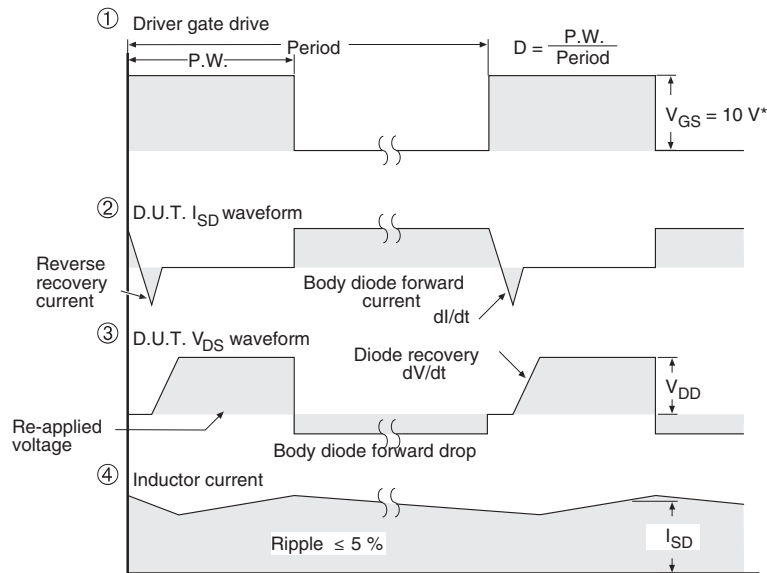
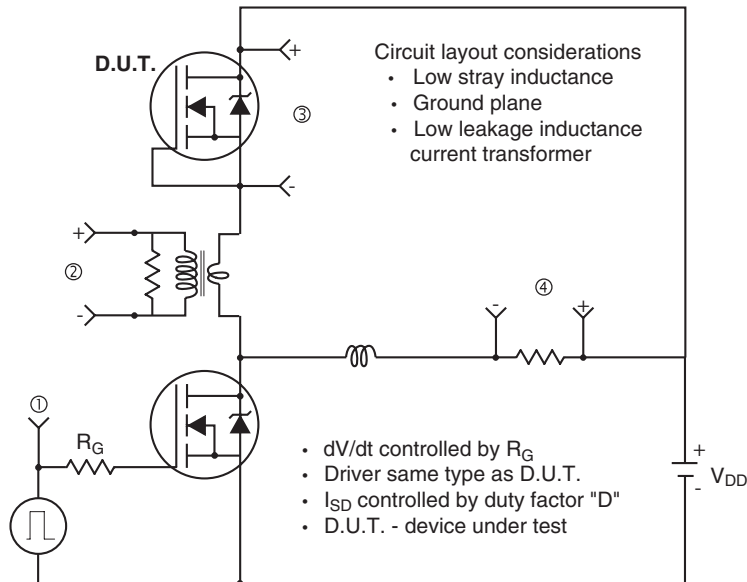


Fig. 13b - Gate Charge Test Circuit

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



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

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

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