

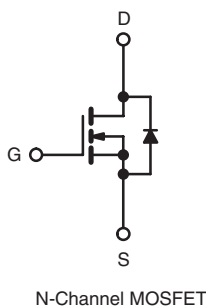
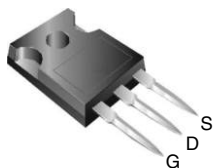


## Power MOSFET

## PRODUCT SUMMARY

|                           |                        |       |
|---------------------------|------------------------|-------|
| $V_{DS}$ (V)              | 250                    |       |
| $R_{DS(on)}$ ( $\Omega$ ) | $V_{GS} = 10\text{ V}$ | 0.125 |
| $Q_g$ (Max.) (nC)         | 100                    |       |
| $Q_{gs}$ (nC)             | 17                     |       |
| $Q_{gd}$ (nC)             | 44                     |       |
| Configuration             | Single                 |       |

TO-247



N-Channel MOSFET

## FEATURES

- Advanced Process Technology
- Dynamic  $dV/dt$  Rating
- 175 °C Operating Temperature
- Fully Avalanche Rated
- Fast Switching
- Ease of Paralleling
- Simple Drive Requirements
- Lead (Pb)-free Available

RoHS\*  
COMPLIANT

## DESCRIPTION

Fifth generation Power MOSFETs from Vishay utilize advanced processing techniques to achieve extremely low on-resistance per silicon area. This benefit, combined with the fast switching speed and ruggedized device design that these Power MOSFETs are well known for, provides the designer with an extremely efficient and reliable device for use in a wide variety of applications.

The TO-247 package is preferred for commercial-industrial applications where higher power levels preclude the use of TO-220 devices. The TO-247 is similar but superior to the earlier TO-218 package because of its isolated mounting hole.

## ORDERING INFORMATION

|                |                             |
|----------------|-----------------------------|
| Package        | TO-247                      |
| Lead (Pb)-free | IRFP254NPbF<br>SiHFP254N-E3 |
| SnPb           | IRFP254N<br>SiHFP254N       |

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

| PARAMETER                                        | SYMBOL           | LIMIT                               | UNIT                  |
|--------------------------------------------------|------------------|-------------------------------------|-----------------------|
| Drain-Source Voltage                             | $V_{DS}$         | 250                                 | V                     |
| Gate-Source Voltage                              | $V_{GS}$         | $\pm 20$                            |                       |
| Continuous Drain Current                         | $I_D$            | $T_C = 25\text{ }^{\circ}\text{C}$  | A                     |
|                                                  |                  | $T_C = 100\text{ }^{\circ}\text{C}$ |                       |
| Pulsed Drain Current <sup>a</sup>                | $I_{DM}$         | 92                                  |                       |
| Linear Derating Factor                           |                  | 1.5                                 | W/ $^{\circ}\text{C}$ |
| Single Pulse Avalanche Energy <sup>b</sup>       | $E_{AS}$         | 300                                 | mJ                    |
| Repetitive Avalanche Current <sup>a</sup>        | $I_{AR}$         | 14                                  | A                     |
| Repetitive Avalanche Energy <sup>a</sup>         | $E_{AR}$         | 22                                  | mJ                    |
| Maximum Power Dissipation                        | $P_D$            | 220                                 | W                     |
| Peak Diode Recovery $dV/dt$ <sup>c</sup>         | $dV/dt$          | 7.4                                 | V/ns                  |
| Operating Junction and Storage Temperature Range | $T_J, T_{stg}$   | - 55 to + 175                       | $^{\circ}\text{C}$    |
| 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

a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).

b. Starting  $T_J = 25\text{ }^{\circ}\text{C}$ ,  $L = 3.1\text{ mH}$ ,  $R_G = 25\text{ }\Omega$ ,  $I_{AS} = 14\text{ A}$ ,  $V_{GS} = 10\text{ V}$ .

c.  $I_{SD} \leq 14\text{ A}$ ,  $dI/dt \leq 460\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq V_{DS}$ ,  $T_J \leq 175\text{ }^{\circ}\text{C}$ .

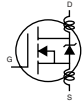
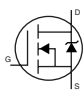
d. 1.6 mm from case.

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

**THERMAL RESISTANCE RATINGS**

| PARAMETER                           | SYMBOL     | TYP. | MAX. | UNIT |
|-------------------------------------|------------|------|------|------|
| Maximum Junction-to-Ambient         | $R_{thJA}$ | -    | 40   | °C/W |
| Case-to-Sink, Flat, Greased Surface | $R_{thCS}$ | 0.24 | -    |      |
| Maximum Junction-to-Case (Drain)    | $R_{thJC}$ | -    | 0.68 |      |

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

| PARAMETER                                 | SYMBOL              | TEST CONDITIONS                                                                                                                                                    |                                                                                                         | MIN. | TYP. | MAX.      | UNIT                  |
|-------------------------------------------|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|------|------|-----------|-----------------------|
| Static                                    |                     |                                                                                                                                                                    |                                                                                                         |      |      |           |                       |
| Drain-Source Breakdown Voltage            | $V_{DS}$            | $V_{GS} = 0\text{ V}$ , $I_D = 250\text{ }\mu\text{A}$                                                                                                             |                                                                                                         | 250  | -    | -         | V                     |
| $V_{DS}$ Temperature Coefficient          | $\Delta V_{DS}/T_J$ | Reference to $25\text{ }^{\circ}\text{C}$ , $I_D = 1\text{ mA}$                                                                                                    |                                                                                                         | -    | 0.33 | -         | V/ $^{\circ}\text{C}$ |
| 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           | $I_{DSS}$           | $V_{DS} = 250\text{ V}$ , $V_{GS} = 0\text{ V}$                                                                                                                    |                                                                                                         | -    | -    | 25        | $\mu\text{A}$         |
|                                           |                     | $V_{DS} = 200\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 150\text{ }^{\circ}\text{C}$                                                                              |                                                                                                         | -    | -    | 250       |                       |
| Drain-Source On-State Resistance          | $R_{DS(on)}$        | $V_{GS} = 10\text{ V}$                                                                                                                                             | $I_D = 14\text{ A}^b$                                                                                   | -    | -    | 0.125     | $\Omega$              |
| Forward Transconductance                  | $g_{fs}$            | $V_{DS} = 25\text{ V}$ , $I_D = 14\text{ A}$                                                                                                                       |                                                                                                         | 15   | -    | -         | S                     |
| Dynamic                                   |                     |                                                                                                                                                                    |                                                                                                         |      |      |           |                       |
| Input Capacitance                         | $C_{iss}$           | $V_{GS} = 0\text{ V}$ ,<br>$V_{DS} = 25\text{ V}$ ,<br>$f = 1.0\text{ MHz}$ , see fig. 5                                                                           |                                                                                                         | -    | 2040 | -         | pF                    |
| Output Capacitance                        | $C_{oss}$           |                                                                                                                                                                    |                                                                                                         | -    | 260  | -         |                       |
| Reverse Transfer Capacitance              | $C_{rss}$           |                                                                                                                                                                    |                                                                                                         | -    | 62   | -         |                       |
| Total Gate Charge                         | $Q_g$               | $V_{GS} = 10\text{ V}$                                                                                                                                             | $I_D = 14\text{ A}$ , $V_{DS} = 200\text{ V}$ ,<br>see fig. 6 and 13 <sup>b</sup>                       | -    | -    | 100       | nC                    |
| Gate-Source Charge                        | $Q_{gs}$            |                                                                                                                                                                    |                                                                                                         | -    | -    | 17        |                       |
| Gate-Drain Charge                         | $Q_{gd}$            |                                                                                                                                                                    |                                                                                                         | -    | -    | 44        |                       |
| Turn-On Delay Time                        | $t_{d(on)}$         |                                                                                                                                                                    | $V_{DD} = 125\text{ V}$ , $I_D = 14\text{ A}$ ,<br>$R_G = 3.6\text{ }\Omega$ , see fig. 10 <sup>b</sup> | -    | 14   | -         | ns                    |
| Rise Time                                 | $t_r$               |                                                                                                                                                                    |                                                                                                         | -    | 34   | -         |                       |
| Turn-Off Delay Time                       | $t_{d(off)}$        |                                                                                                                                                                    |                                                                                                         | -    | 37   | -         |                       |
| Fall Time                                 | $t_f$               | -                                                                                                                                                                  |                                                                                                         | 29   | -    |           |                       |
| Internal Drain Inductance                 | $L_D$               | Between lead,<br>6 mm (0.25") from<br>package and center of<br>die contact<br> |                                                                                                         | -    | 5.0  | -         | nH                    |
| Internal Source Inductance                | $L_S$               |                                                                                                                                                                    |                                                                                                         | -    | 13   | -         |                       |
| 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<br>   |                                                                                                         | -    | -    | 23        | A                     |
| Pulsed Diode Forward Current <sup>a</sup> | $I_{SM}$            |                                                                                                                                                                    |                                                                                                         | -    | -    | 92        |                       |
| Body Diode Voltage                        | $V_{SD}$            | $T_J = 25\text{ }^{\circ}\text{C}$ , $I_S = 14\text{ A}$ , $V_{GS} = 0\text{ V}^b$                                                                                 |                                                                                                         | -    | -    | 1.3       | V                     |
| Body Diode Reverse Recovery Time          | $t_{rr}$            | $T_J = 25\text{ }^{\circ}\text{C}$ , $I_F = 14\text{ A}$ , $dI/dt = 100\text{ A}/\mu\text{s}$                                                                      |                                                                                                         | -    | 210  | 310       | ns                    |
| Body Diode Reverse Recovery Charge        | $Q_{rr}$            |                                                                                                                                                                    |                                                                                                         | -    | 1.7  | 2.6       | nC                    |
| 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  $\leq 400\text{ }\mu\text{s}$ ; duty cycle  $\leq 2\%$ .

## TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

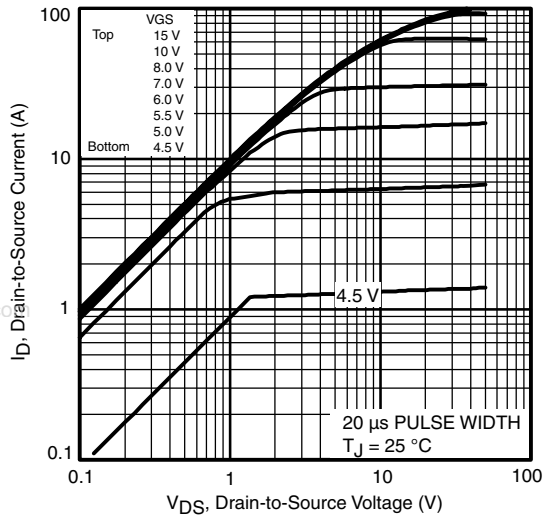


Fig. 1 - Typical Output Characteristics

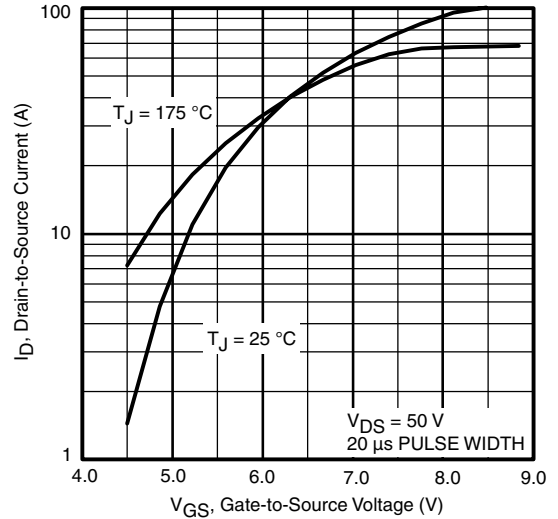


Fig. 3 - Typical Transfer Characteristics

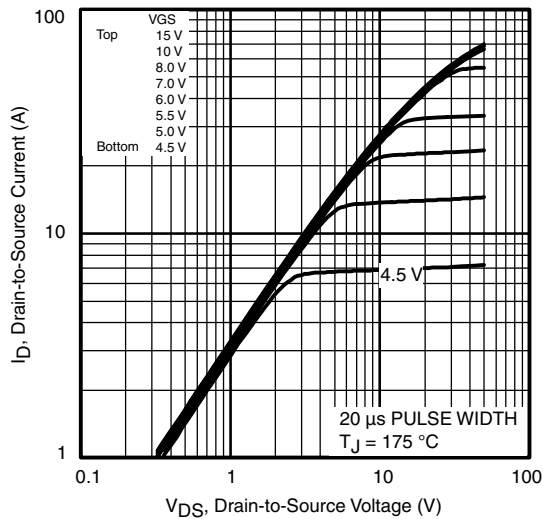


Fig. 2 - Typical Output Characteristics

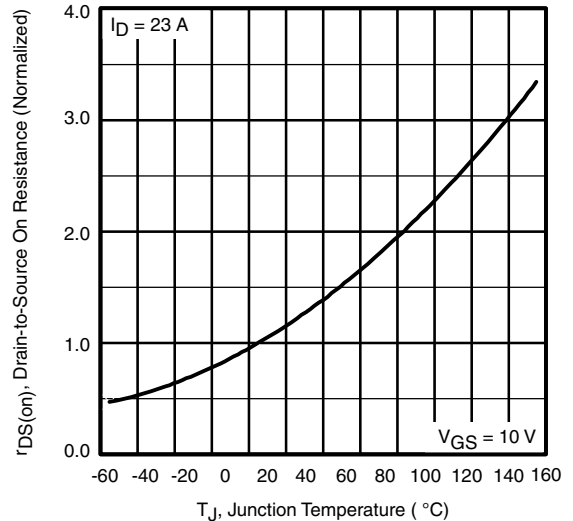
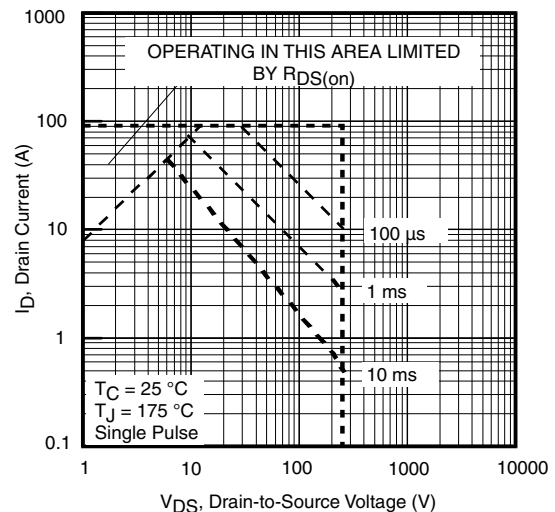
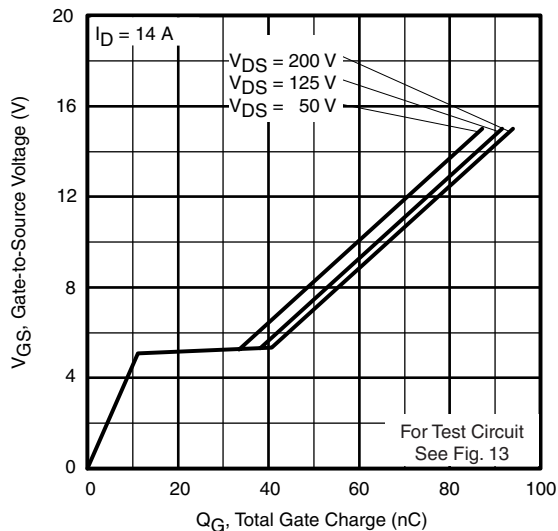
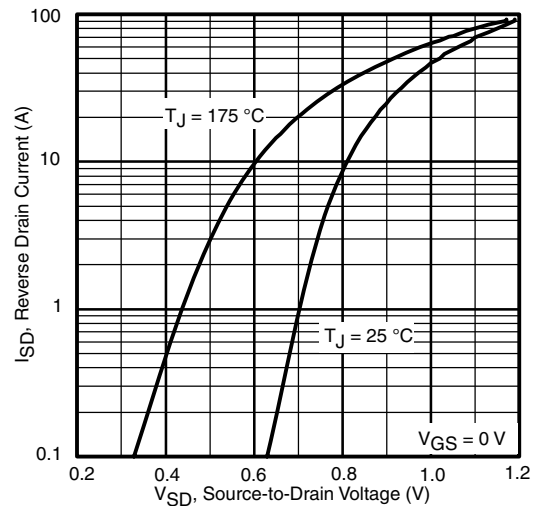
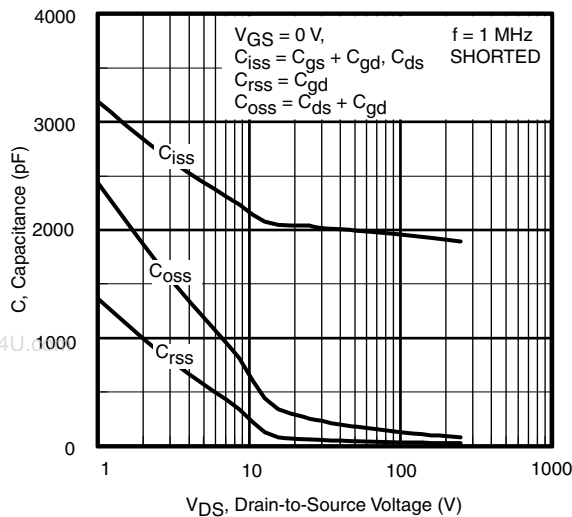


Fig. 4 - Normalized On-Resistance vs. Temperature



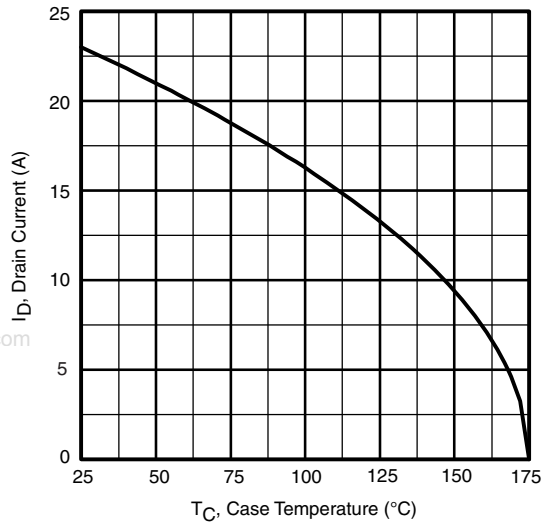


Fig. 9 - Maximum Drain Current vs. Case Temperature

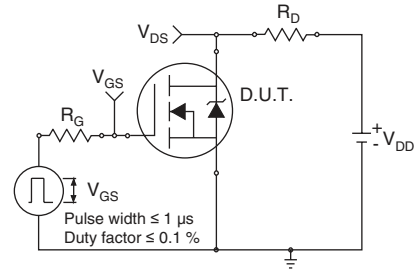


Fig. 10a - Switching Time Test Circuit

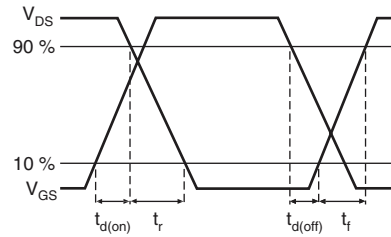


Fig. 10b - Switching Time Waveforms

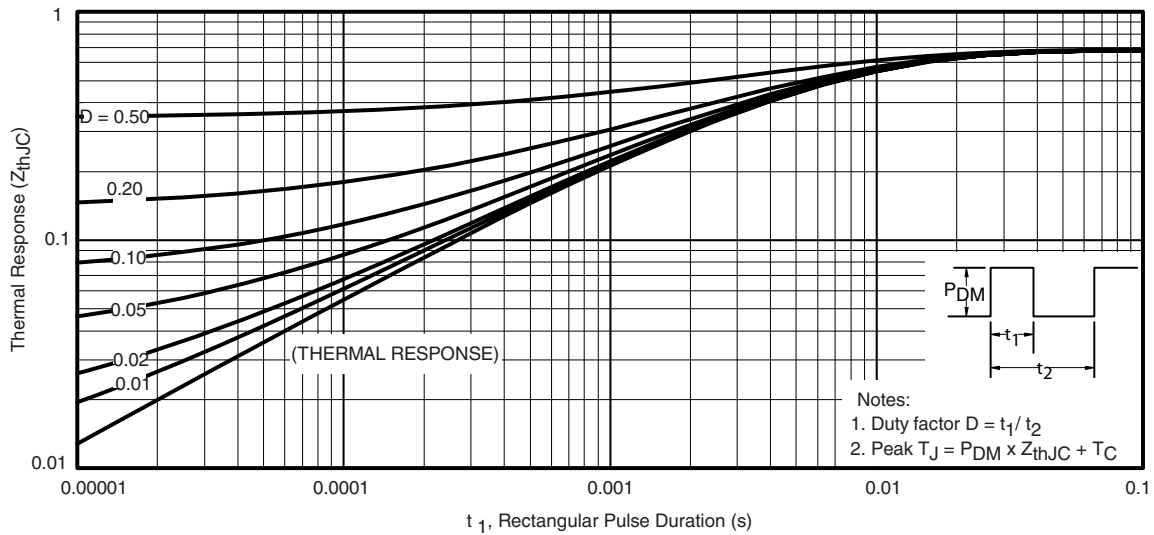


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

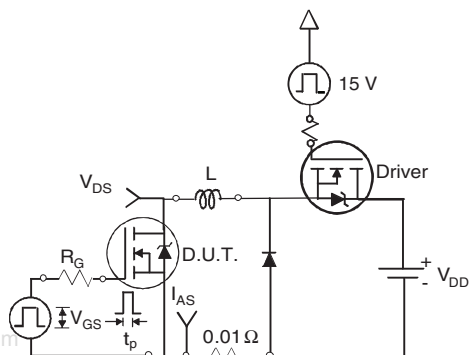


Fig. 12a - Unclamped Inductive Test Circuit

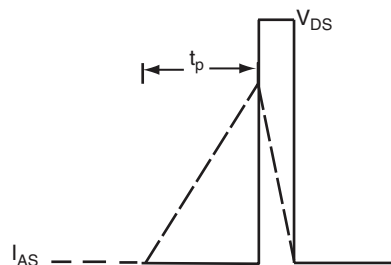


Fig. 12b - Unclamped Inductive Waveforms

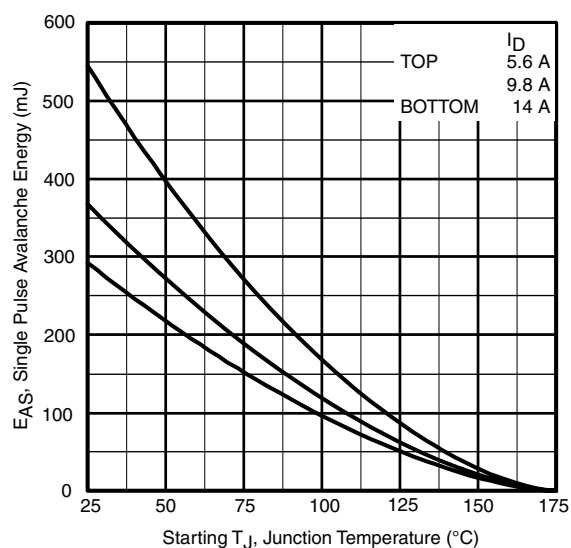


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

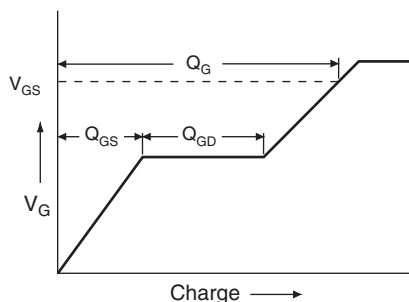


Fig. 13a - Basic Gate Charge Waveform

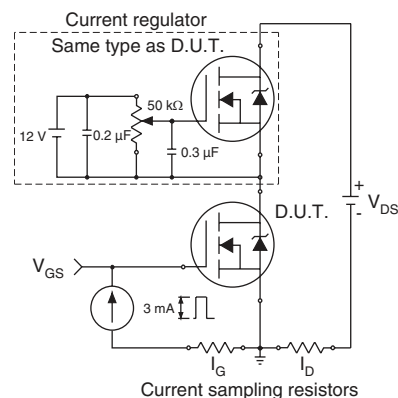
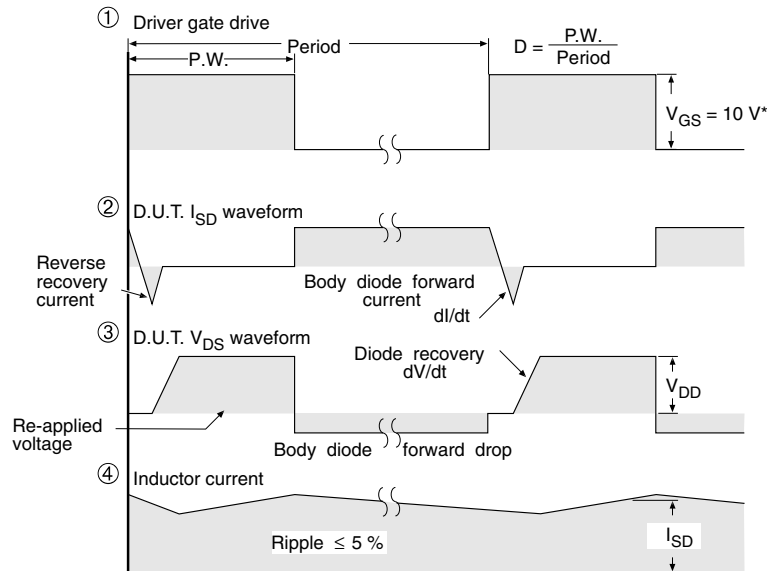
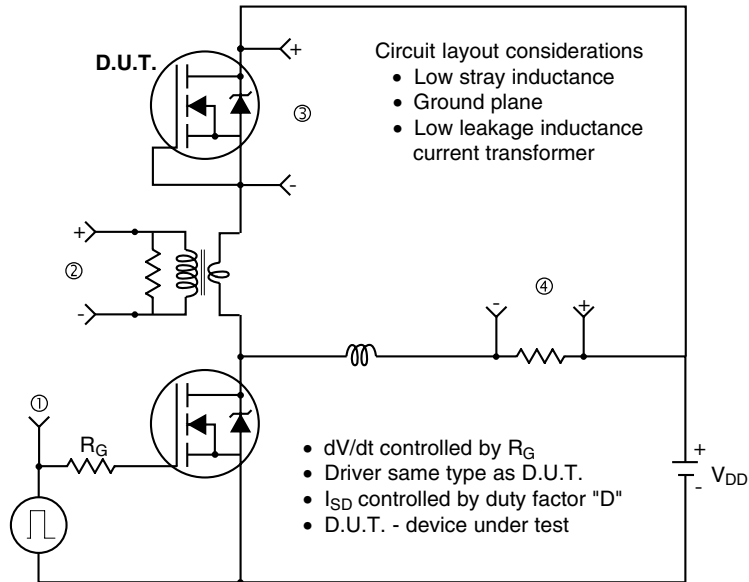


Fig. 13b - Gate Charge Test

## 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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