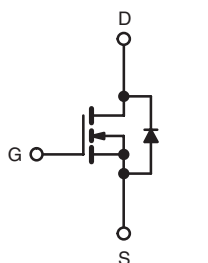
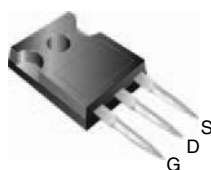


## Power MOSFET

### PRODUCT SUMMARY

|                           |                        |      |
|---------------------------|------------------------|------|
| $V_{DS}$ (V)              | 500                    |      |
| $R_{DS(on)}$ ( $\Omega$ ) | $V_{GS} = 10\text{ V}$ | 0.40 |
| $Q_g$ (Max.) (nC)         | 74                     |      |
| $Q_{gs}$ (nC)             | 19                     |      |
| $Q_{gd}$ (nC)             | 35                     |      |
| Configuration             | Single                 |      |

TO-247



N-Channel MOSFET

### FEATURES

- Ultra Low Gate Charge
- Reduced Gate Drive Requirement
- Enhanced 30 V  $V_{GS}$  Rating
- Reduced  $C_{iss}$ ,  $C_{oss}$ ,  $C_{rss}$
- Isolated Central Mounting Hole
- Dynamic  $dV/dt$  Rated
- Repetitive Avalanche Rated
- Lead (Pb)-free Available



**RoHS\***  
COMPLIANT

### DESCRIPTION

This new series of low charge Power MOSFETs achieve significantly lower gate charge over conventional MOSFETs. Utilizing advanced Power MOSFET technology the device improvements allow for reduced gate drive requirements, faster switching speeds and increased total system savings. These device improvements combined with the proven ruggedness and reliability of Power MOSFETs offer the designer a new standard in power transistors for switching 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 | IRFP450LCPbF<br>SiHFP450LC-E3 |
| SnPb           | IRFP450LC<br>SiHFP450LC       |

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

| PARAMETER                                        | SYMBOL           | LIMIT                             | UNIT                |
|--------------------------------------------------|------------------|-----------------------------------|---------------------|
| Drain-Source Voltage                             | $V_{DS}$         | 500                               | V                   |
| Gate-Source Voltage                              | $V_{GS}$         | $\pm 30$                          |                     |
| Continuous Drain Current                         | $V_{GS}$ at 10 V | $T_C = 25\text{ }^\circ\text{C}$  | A                   |
|                                                  |                  | $T_C = 100\text{ }^\circ\text{C}$ |                     |
| Pulsed Drain Current <sup>a</sup>                | $I_{DM}$         | 56                                |                     |
| Linear Derating Factor                           |                  | 1.5                               | W/ $^\circ\text{C}$ |
| Single Pulse Avalanche Energy <sup>b</sup>       | $E_{AS}$         | 760                               | mJ                  |
| Repetitive Avalanche Current <sup>a</sup>        | $I_{AR}$         | 14                                | A                   |
| Repetitive Avalanche Energy <sup>a</sup>         | $E_{AR}$         | 19                                | mJ                  |
| Maximum Power Dissipation                        | $P_D$            | 190                               | W                   |
| Peak Diode Recovery $dV/dt$ <sup>c</sup>         | $dV/dt$          | 3.5                               | 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<br>1.1                         |                     |

#### Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- $V_{DD} = 25\text{ V}$ , starting  $T_J = 25\text{ }^\circ\text{C}$ ,  $L = 7.0\text{ mH}$ ,  $R_G = 25\text{ }\Omega$ ,  $I_{AS} = 14\text{ A}$  (see fig. 12).
- $I_{SD} \leq 14\text{ A}$ ,  $dI/dt \leq 130\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq V_{DS}$ ,  $T_J \leq 150\text{ }^\circ\text{C}$ .
- 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         | $R_{thJA}$ | -    | 40   | °C/W |
| Case-to-Sink, Flat, Greased Surface | $R_{thCS}$ | 0.24 | -    |      |
| Maximum Junction-to-Case (Drain)    | $R_{thJC}$ | -    | 0.65 |      |

**SPECIFICATIONS**  $T_J = 25\text{ °C}$ , 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                                                                             |                                                                                   | 500  | -    | -     | 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                                                                                  |                                                                                   | -    | 0.59 | -     | 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                                                                |                                                                                   | 2.0  | -    | 4.0   | V    |
| Gate-Source Leakage                       | I <sub>GSS</sub>                 | V <sub>GS</sub> = ± 20 V                                                                                                   |                                                                                   | -    | -    | ± 100 | nA   |
| Zero Gate Voltage Drain Current           | I <sub>DSS</sub>                 | V <sub>DS</sub> = 500 V, V <sub>GS</sub> = 0 V                                                                             |                                                                                   | -    | -    | 25    | μA   |
|                                           |                                  | V <sub>DS</sub> = 400 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> = 10 V                                                                                                     | I <sub>D</sub> = 8.4 A <sup>b</sup>                                               | -    | -    | 0.40  | Ω    |
| Forward Transconductance                  | g <sub>fs</sub>                  | V <sub>DS</sub> = 50 V, I <sub>D</sub> = 8.4 A <sup>b</sup>                                                                |                                                                                   | 8.7  | -    | -     | 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                                               |                                                                                   | -    | 2200 | -     | pF   |
| Output Capacitance                        | C <sub>OSS</sub>                 |                                                                                                                            |                                                                                   | -    | 320  | -     |      |
| Reverse Transfer Capacitance              | C <sub>rss</sub>                 |                                                                                                                            |                                                                                   | -    | 28   | -     |      |
| Total Gate Charge                         | Q <sub>g</sub>                   | V <sub>GS</sub> = 10 V                                                                                                     | I <sub>D</sub> = 14 A, V <sub>DS</sub> = 400 V,<br>see fig. 6 and 13 <sup>b</sup> | -    | -    | 74    | nC   |
| Gate-Source Charge                        | Q <sub>gs</sub>                  |                                                                                                                            |                                                                                   | -    | -    | 19    |      |
| Gate-Drain Charge                         | Q <sub>gd</sub>                  |                                                                                                                            |                                                                                   | -    | -    | 35    |      |
| Turn-On Delay Time                        | t <sub>d(on)</sub>               | V <sub>DD</sub> = 250 V, I <sub>D</sub> = 14 A,<br>R <sub>G</sub> = 6.2 Ω, R <sub>D</sub> = 17 Ω, see fig. 10 <sup>b</sup> |                                                                                   | -    | 14   | -     | ns   |
| Rise Time                                 | t <sub>r</sub>                   |                                                                                                                            |                                                                                   | -    | 49   | -     |      |
| Turn-Off Delay Time                       | t <sub>d(off)</sub>              |                                                                                                                            |                                                                                   | -    | 30   | -     |      |
| Fall Time                                 | t <sub>f</sub>                   |                                                                                                                            |                                                                                   | -    | 30   | -     |      |
| Internal Drain Inductance                 | L <sub>D</sub>                   | Between lead,<br>6 mm (0.25") from<br>package and center of<br>die contact                                                 |                                                                                   | -    | 5.0  | -     | nH   |
| Internal Source Inductance                | L <sub>S</sub>                   |                                                                                                                            |                                                                                   | -    | 13   | -     |      |
| 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                                                   |                                                                                   | -    | -    | 14    | A    |
| Pulsed Diode Forward Current <sup>a</sup> | I <sub>SM</sub>                  |                                                                                                                            |                                                                                   | -    | -    | 56    |      |
| Body Diode Voltage                        | V <sub>SD</sub>                  | T <sub>J</sub> = 25 °C, I <sub>S</sub> = 14 A, V <sub>GS</sub> = 0 V <sup>b</sup>                                          |                                                                                   | -    | -    | 1.4   | V    |
| Body Diode Reverse Recovery Time          | t <sub>rr</sub>                  | T <sub>J</sub> = 25 °C, I <sub>F</sub> = 14 A, dI/dt = 100 A/μs <sup>b</sup>                                               |                                                                                   | -    | 580  | 870   | ns   |
| Body Diode Reverse Recovery Charge        | Q <sub>rr</sub>                  |                                                                                                                            |                                                                                   | -    | 5.1  | 7.7   | 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

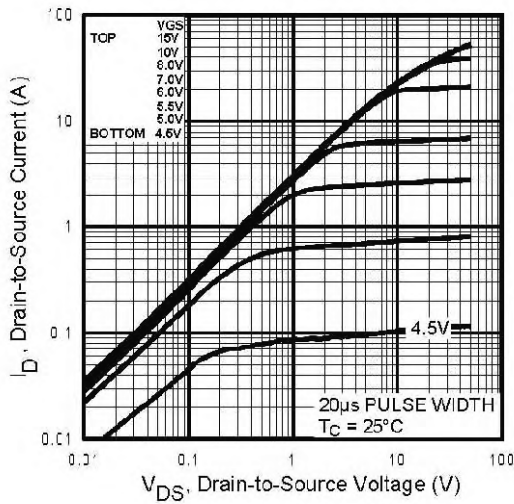


Fig. 1 - Typical Output Characteristics,  $T_C = 25^\circ\text{C}$

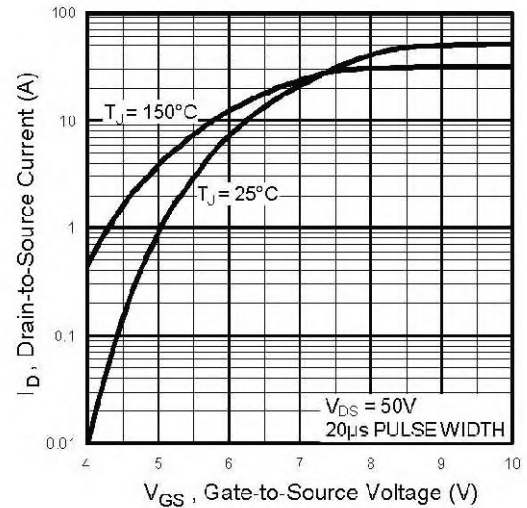


Fig. 3 - Typical Transfer Characteristics

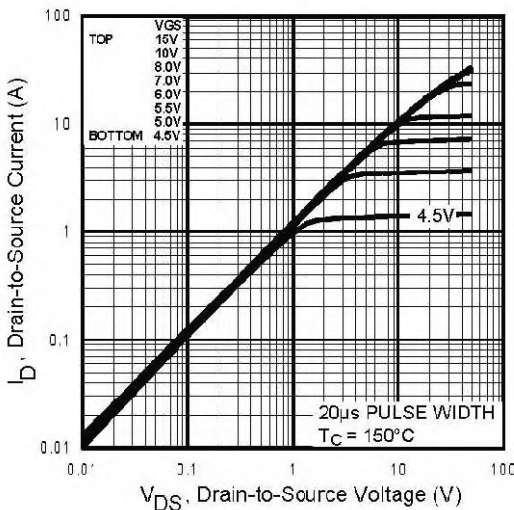


Fig. 2 - Typical Output Characteristics,  $T_C = 150^\circ\text{C}$

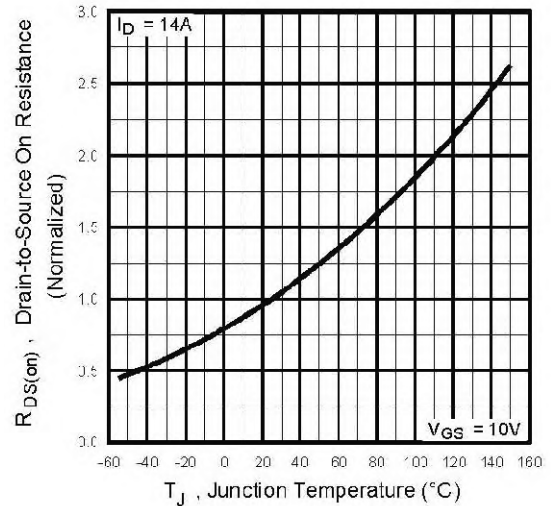


Fig. 4 - Normalized On-Resistance vs. Temperature

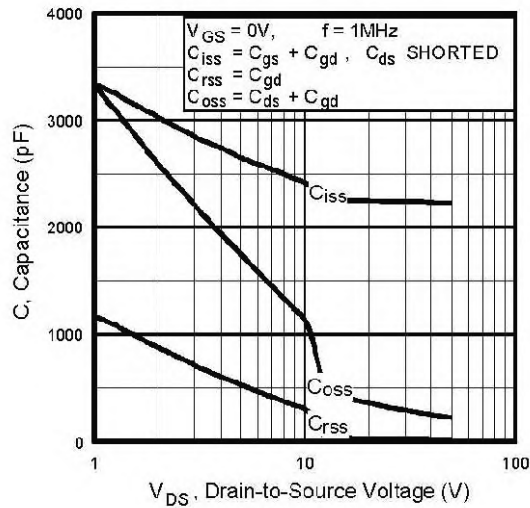


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

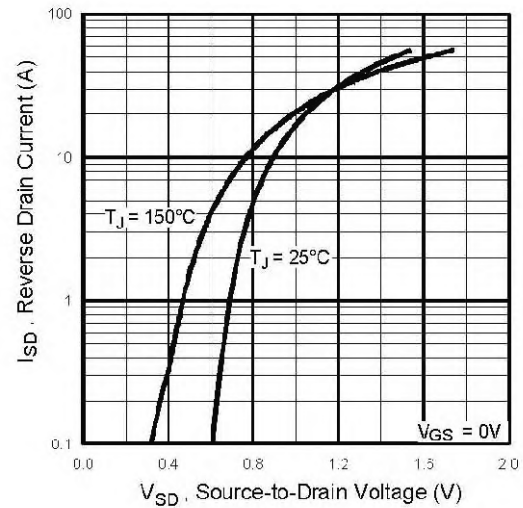


Fig. 7 - Typical Source-Drain Diode Forward Voltage

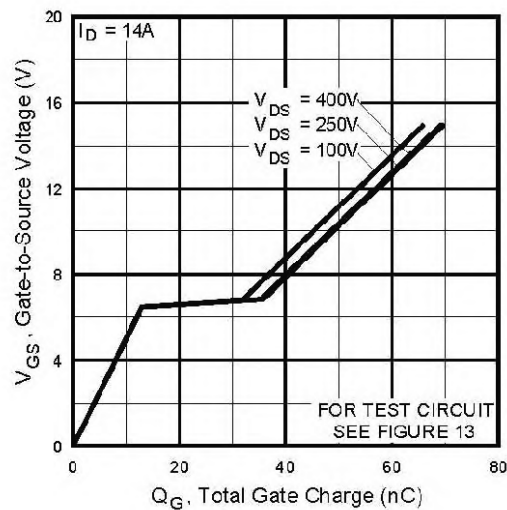


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

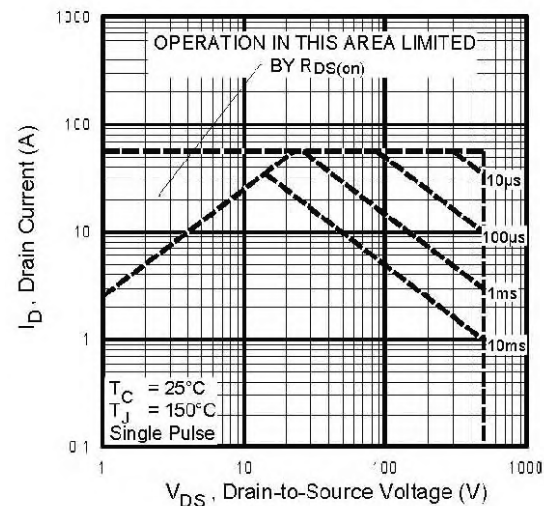


Fig. 8 - Maximum Safe Operating Area

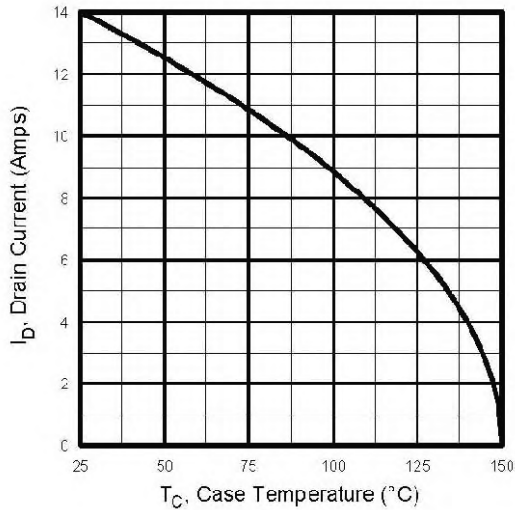


Fig. 9 - Maximum Drain Current vs. Case Temperature

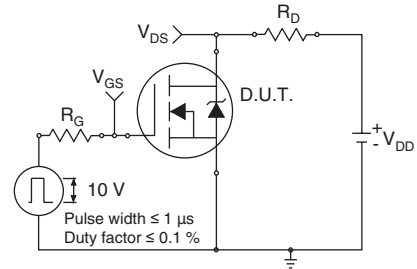


Fig. 10a - Switching Time Test Circuit

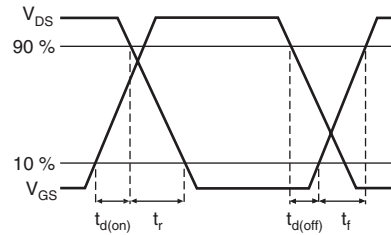


Fig. 10b - Switching Time Waveforms

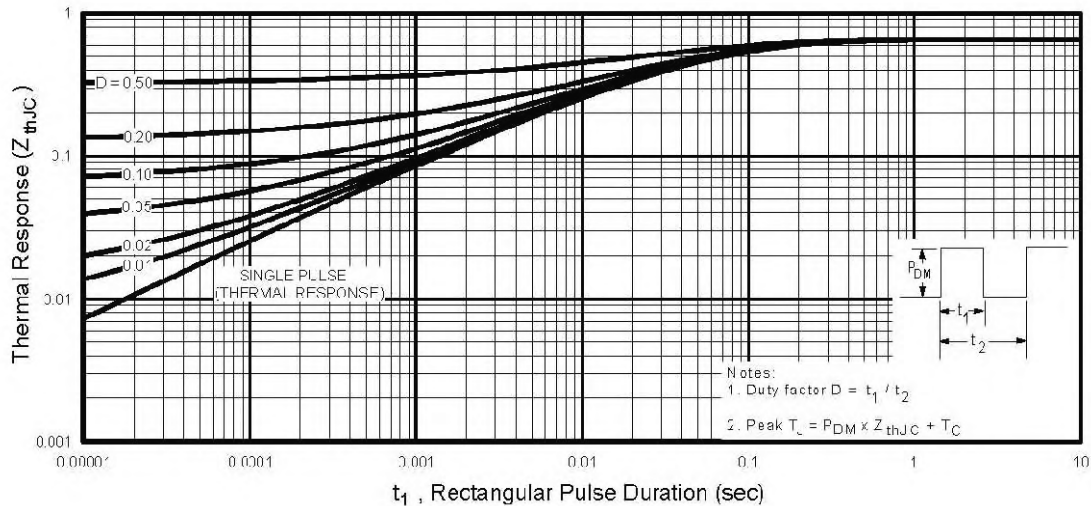


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

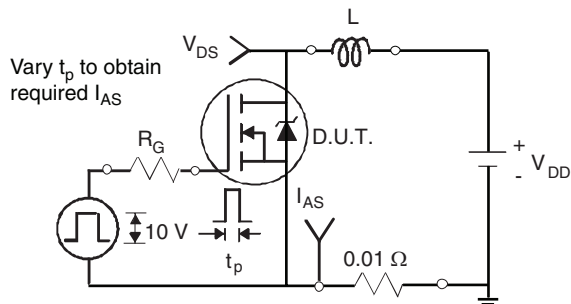


Fig. 12a - Unclamped Inductive Test Circuit

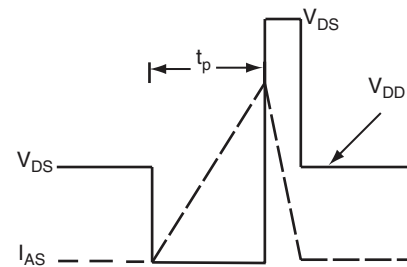


Fig. 12b - Unclamped Inductive Waveforms

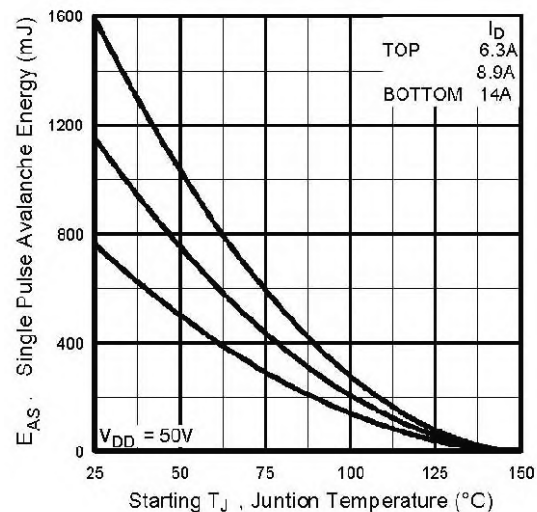


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

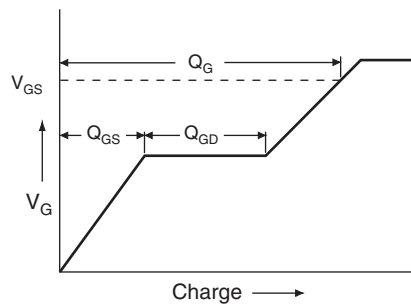


Fig. 13a - Basic Gate Charge Waveform

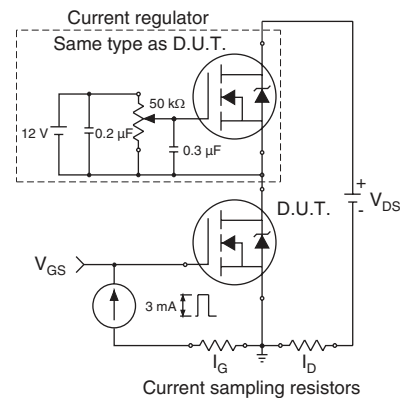


Fig. 13b - Gate Charge Test Circuit

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

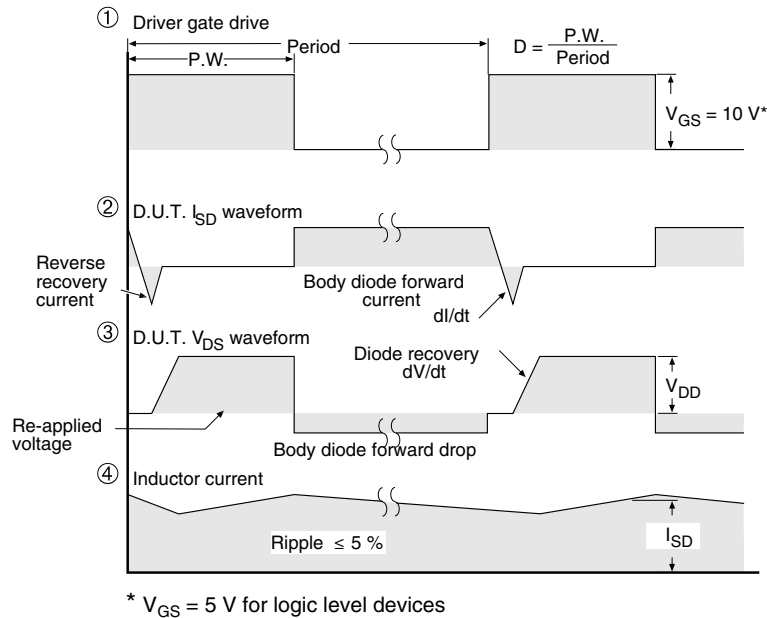
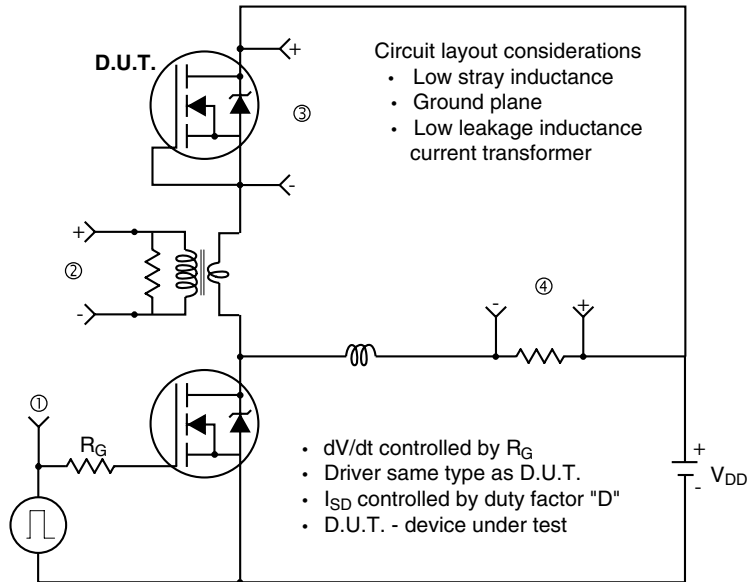


Fig. 14 - For N-Channel

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