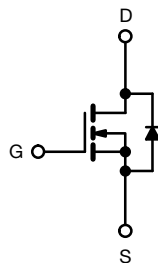
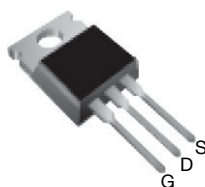


# Power MOSFET

**TO-220AB**


N-Channel MOSFET

## FEATURES

- Advanced process technology
- Ultra low on-resistance
- Dynamic dV/dt rating
- 175 °C operating temperature
- Fast switching
- Fully avalanche rated
- Drop in replacement of the IRFZ44, SiHFZ44 for linear / audio applications
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS\***  
Available

## Note

\* This datasheet provides information about parts that are RoHS-compliant and / or parts that are non RoHS-compliant. For example, parts with lead (Pb) terminations are not RoHS-compliant. Please see the information / tables in this datasheet for details

## DESCRIPTION

Advanced 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 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-220AB package is universally preferred for all commercial-industrial applications at power dissipation levels to approximately 50 W. The low thermal resistance and low package cost of the TO-220AB contribute to its wide acceptance throughout the industry.

## PRODUCT SUMMARY

|                            |                        |       |
|----------------------------|------------------------|-------|
| V <sub>DS</sub> (V)        | 60                     |       |
| R <sub>DS(on)</sub> (Ω)    | V <sub>GS</sub> = 10 V | 0.028 |
| Q <sub>g</sub> (Max.) (nC) | 67                     |       |
| Q <sub>gs</sub> (nC)       | 18                     |       |
| Q <sub>gd</sub> (nC)       | 25                     |       |
| Configuration              | Single                 |       |

## ORDERING INFORMATION

|                                 |                |
|---------------------------------|----------------|
| Package                         | TO-220AB       |
| Lead (Pb)-free                  | IRFZ44RPbF     |
| Lead (Pb)-free and halogen-free | IRFZ44RPbF-BE3 |

## ABSOLUTE MAXIMUM RATINGS (T<sub>C</sub> = 25 °C, unless otherwise noted)

| PARAMETER                                                 | SYMBOL                            | LIMIT                   | UNIT     |
|-----------------------------------------------------------|-----------------------------------|-------------------------|----------|
| Drain-source voltage                                      | V <sub>DS</sub>                   | 60                      | V        |
| Gate-source voltage                                       | V <sub>GS</sub>                   | ± 20                    |          |
| Continuous drain current                                  | V <sub>GS</sub> at 10 V           | T <sub>C</sub> = 25 °C  | A        |
|                                                           |                                   | T <sub>C</sub> = 100 °C |          |
| Pulsed drain current <sup>a</sup>                         | I <sub>DM</sub>                   | 200                     |          |
| Linear derating factor                                    |                                   | 1.0                     | W/°C     |
| Single pulse avalanche energy <sup>b</sup>                | E <sub>AS</sub>                   | 100                     | mJ       |
| Maximum power dissipation                                 | P <sub>D</sub>                    | 150                     | W        |
| Peak diode recovery dV/dt <sup>c</sup>                    | dV/dt                             | 4.5                     | V/ns     |
| Operating junction and storage temperature range          | T <sub>J</sub> , T <sub>stg</sub> | -55 to +175             | °C       |
| Soldering recommendations (peak temperature) <sup>d</sup> | For 10 s                          | 300                     |          |
| 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<sub>DD</sub> = 25 V, starting T<sub>J</sub> = 25 °C, L = 44 μH, R<sub>g</sub> = 25 Ω, I<sub>AS</sub> = 51 A (see fig. 12)
- I<sub>SD</sub> ≤ 51 A, dV/dt ≤ 250 A/μs, V<sub>DD</sub> ≤ V<sub>DS</sub>, T<sub>J</sub> ≤ 175 °C
- 1.6 mm from case
- Current limited by the package, (die current = 51 A)

**THERMAL RESISTANCE RATINGS**

| PARAMETER                           | SYMBOL     | TYP. | MAX. | UNIT |
|-------------------------------------|------------|------|------|------|
| Maximum junction-to-ambient         | $R_{thJA}$ | -    | 62   | °C/W |
| Case-to-sink, flat, greased surface | $R_{thCS}$ | 0.50 | -    |      |
| Maximum junction-to-case (drain)    | $R_{thJC}$ | -    | 1.0  |      |

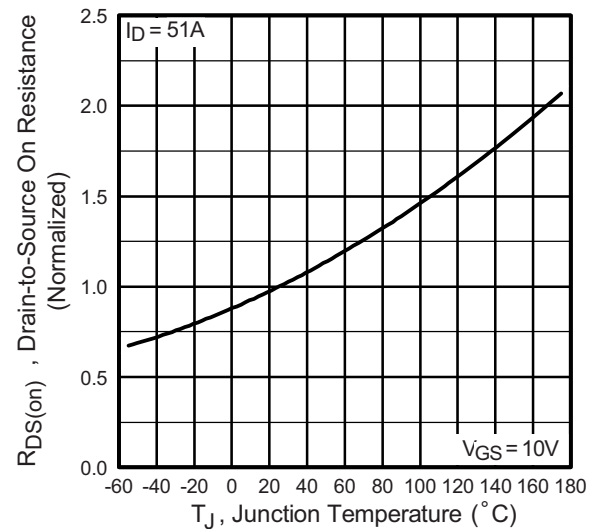
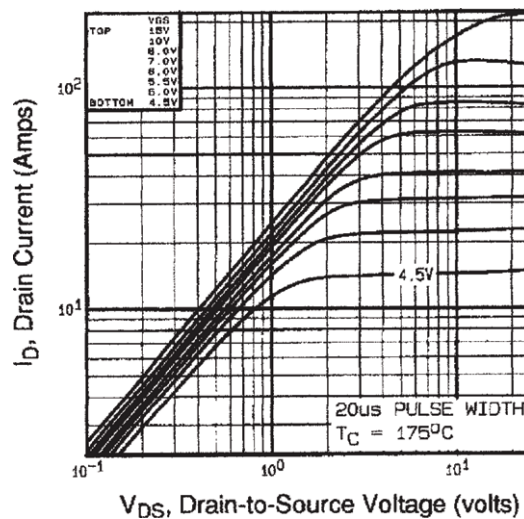
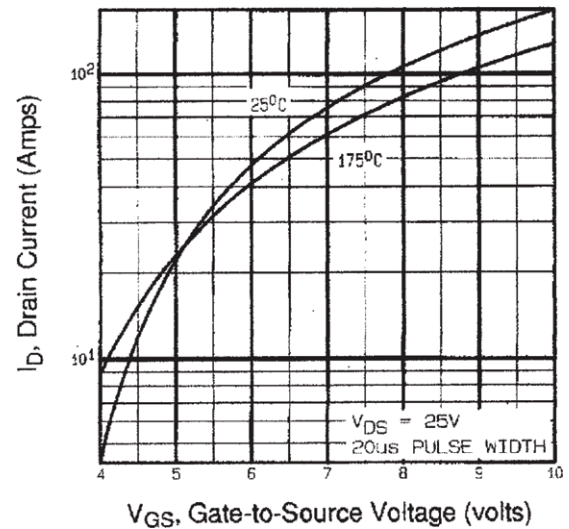
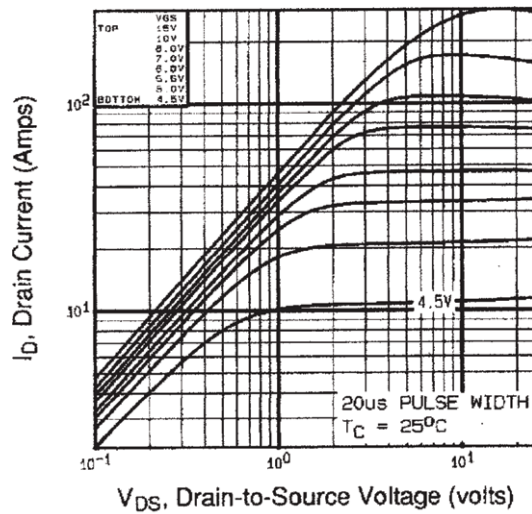
**SPECIFICATIONS** ( $T_J = 25^\circ\text{C}$ , unless otherwise noted)

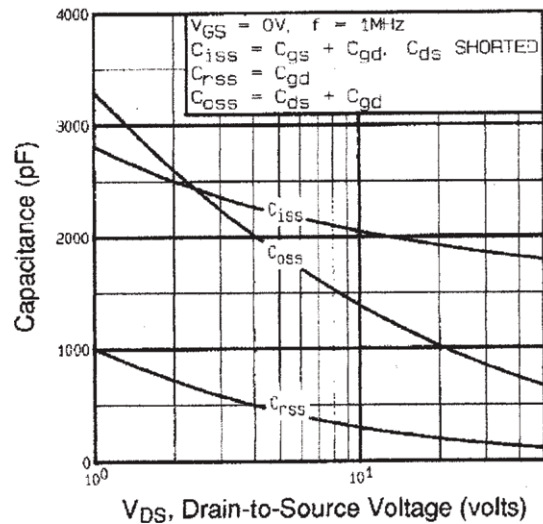
| PARAMETER                                 | SYMBOL                           | TEST CONDITIONS                                                                                                             |                                                                                  | MIN. | TYP.  | MAX.            | UNIT |
|-------------------------------------------|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|------|-------|-----------------|------|
| Static                                    |                                  |                                                                                                                             |                                                                                  |      |       |                 |      |
| Drain-source breakdown voltage            | V <sub>DS</sub>                  | V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA                                                                              |                                                                                  | 60   | -     | -               | 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                                                                                   |                                                                                  | -    | 0.060 | -               | 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                                                                                                      |                                                                                  | -    | -     | ± 100           | nA   |
| Zero gate voltage drain current           | I <sub>DSS</sub>                 | V <sub>DS</sub> = 60 V, V <sub>GS</sub> = 0 V                                                                               |                                                                                  | -    | -     | 25              | μA   |
|                                           |                                  | V <sub>DS</sub> = 48 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 150 °C                                                      |                                                                                  | -    | -     | 250             |      |
| Drain-source on-state resistance          | R <sub>DS(on)</sub>              | V <sub>GS</sub> = 10 V                                                                                                      | I <sub>D</sub> = 31 A <sup>b</sup>                                               | -    | -     | 0.028           | Ω    |
| Forward transconductance                  | g <sub>fs</sub>                  | V <sub>DS</sub> = 25 V, I <sub>D</sub> = 31 A <sup>b</sup>                                                                  |                                                                                  | 15   | -     | -               | 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                                                |                                                                                  | -    | 1900  | -               | pF   |
| Output capacitance                        | C <sub>oss</sub>                 |                                                                                                                             |                                                                                  | -    | 920   | -               |      |
| Reverse transfer capacitance              | C <sub>rss</sub>                 |                                                                                                                             |                                                                                  | -    | 170   | -               |      |
| Total gate charge                         | Q <sub>g</sub>                   | V <sub>GS</sub> = 10 V                                                                                                      | I <sub>D</sub> = 51 A, V <sub>DS</sub> = 48 V,<br>see fig. 6 and 13 <sup>b</sup> | -    | -     | 67              | nC   |
| Gate-source charge                        | Q <sub>gs</sub>                  |                                                                                                                             |                                                                                  | -    | -     | 18              |      |
| Gate-drain charge                         | Q <sub>gd</sub>                  |                                                                                                                             |                                                                                  | -    | -     | 25              |      |
| Turn-on delay time                        | t <sub>d(on)</sub>               | V <sub>DD</sub> = 30 V, I <sub>D</sub> = 51 A,<br>R <sub>g</sub> = 9.1 Ω, R <sub>D</sub> = 0.55 Ω, see fig. 10 <sup>b</sup> |                                                                                  | -    | 14    | -               | ns   |
| Rise time                                 | t <sub>r</sub>                   |                                                                                                                             |                                                                                  | -    | 110   | -               |      |
| Turn-off delay time                       | t <sub>d(off)</sub>              |                                                                                                                             |                                                                                  | -    | 45    | -               |      |
| Fall time                                 | t <sub>f</sub>                   |                                                                                                                             |                                                                                  | -    | 92    | -               |      |
| 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                                                    |                                                                                  | -    | -     | 50 <sup>c</sup> | A    |
| Pulsed diode forward current <sup>a</sup> | I <sub>SM</sub>                  |                                                                                                                             |                                                                                  | -    | -     | 200             |      |
| Body diode voltage                        | V <sub>SD</sub>                  | T <sub>J</sub> = 25 °C, I <sub>S</sub> = 51 A, V <sub>GS</sub> = 0 V <sup>b</sup>                                           |                                                                                  | -    | -     | 2.5             | V    |
| Body diode reverse recovery time          | t <sub>rr</sub>                  | T <sub>J</sub> = 25 °C, I <sub>F</sub> = 51 A, dI/dt = 100 A/μs <sup>b</sup>                                                |                                                                                  | -    | 120   | 180             | ns   |
| Body diode reverse recovery charge        | Q <sub>rr</sub>                  |                                                                                                                             |                                                                                  | -    | 0.53  | 0.80            | 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**

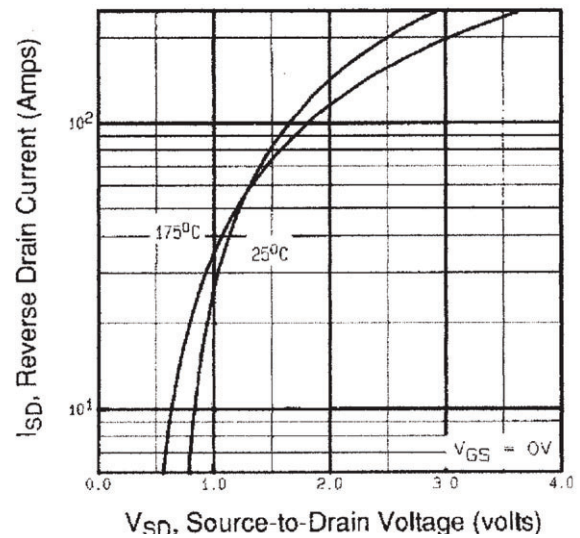
- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)
- Pulse width  $\leq 300\text{ }\mu\text{s}$ ; duty cycle  $\leq 2\%$
- Current limited by the package (die current = 51 A)

**TYPICAL CHARACTERISTICS** ( $25^\circ\text{C}$ , unless otherwise noted)

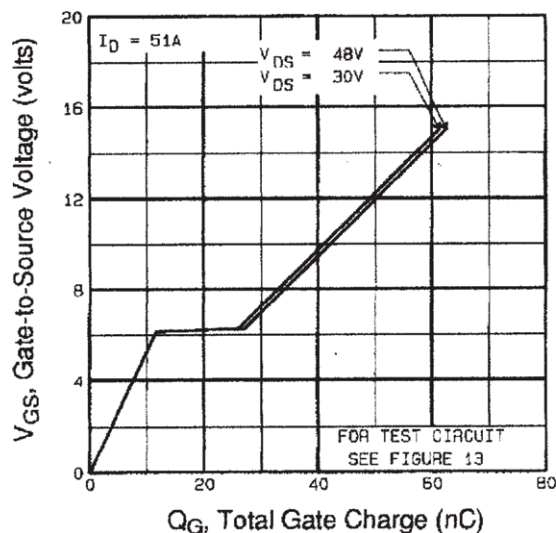




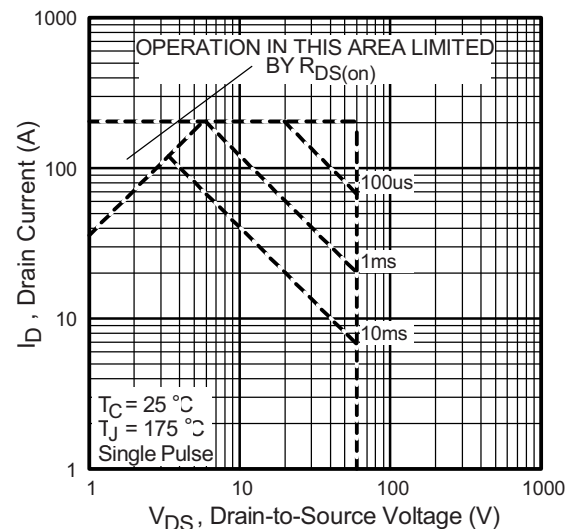
**Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage**



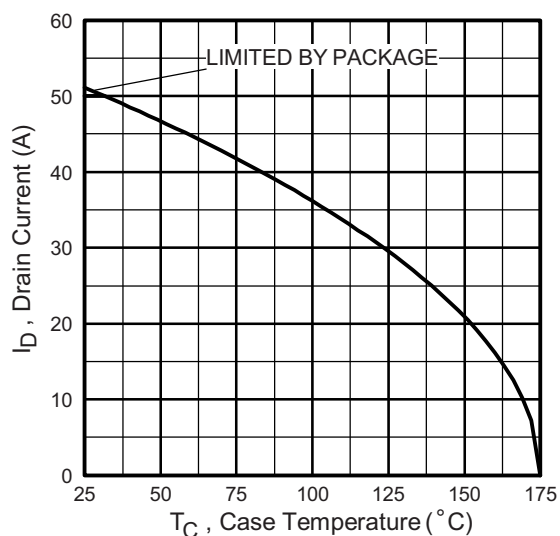
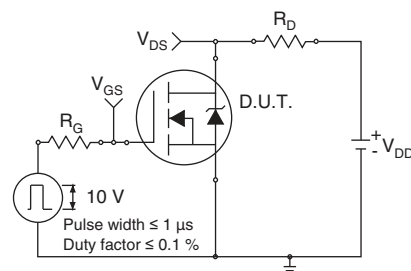
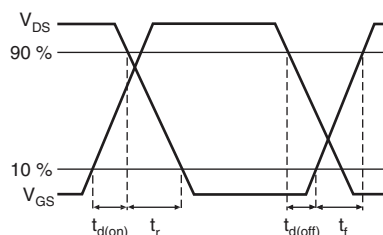
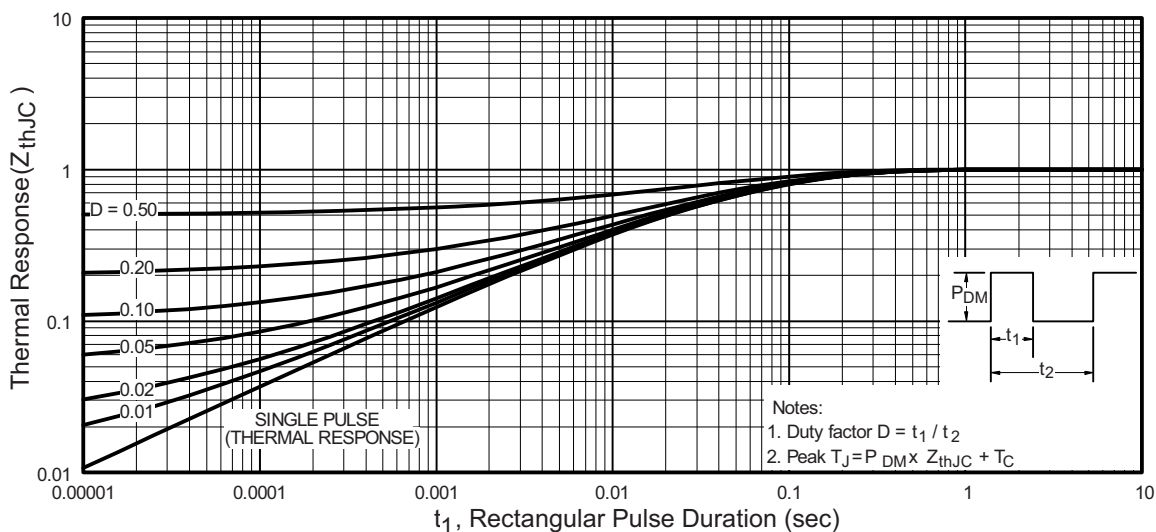
**Fig. 7 - Typical Source-Drain Diode Forward Voltage**

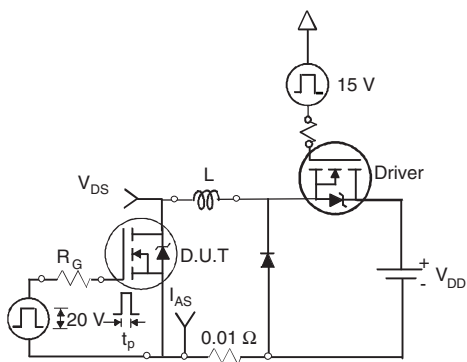
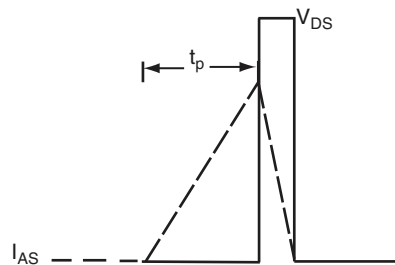
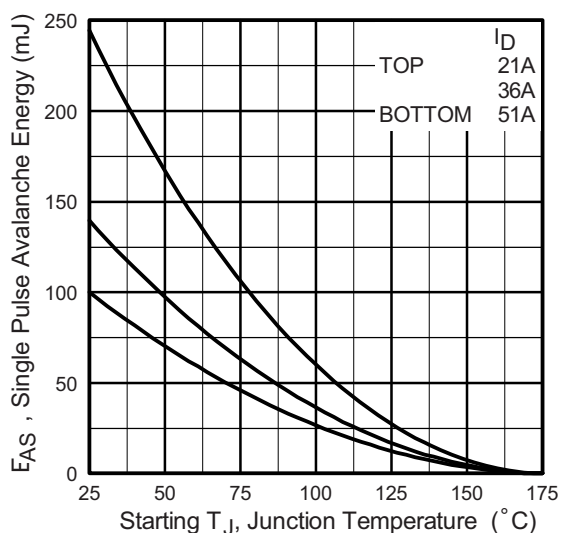
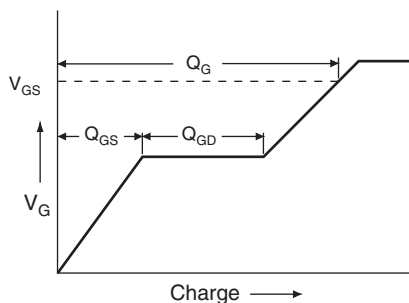
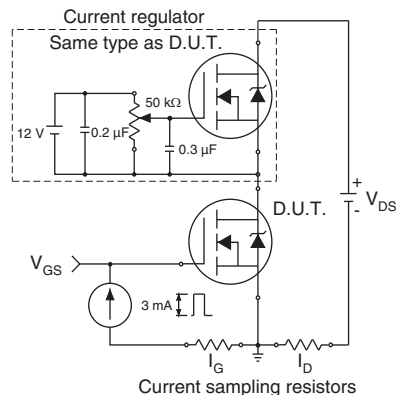


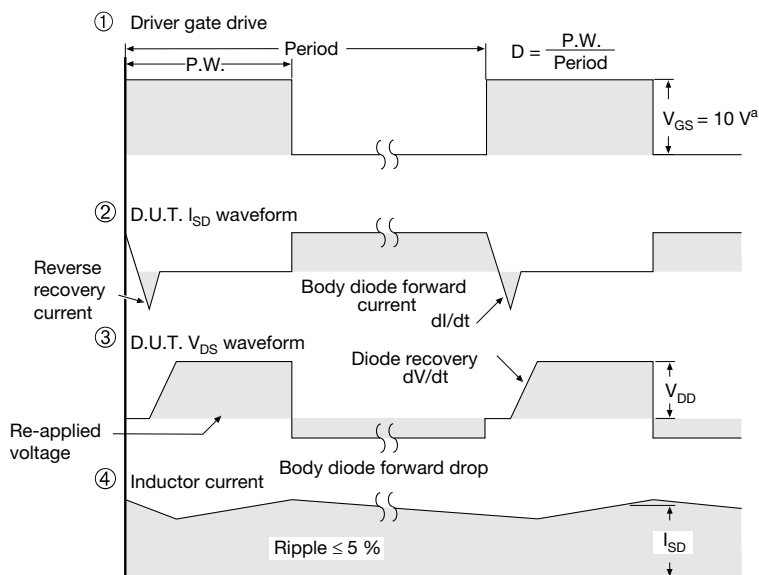
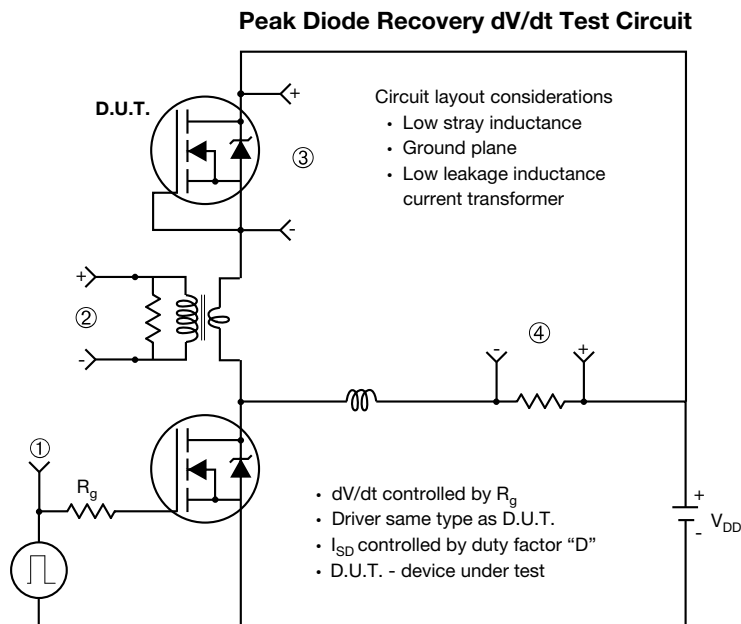
**Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage**



**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. 10 - 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**


**Note**

a.  $V_{GS} = 5 V$  for logic level devices

**Fig. 11 - For N-Channel**

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