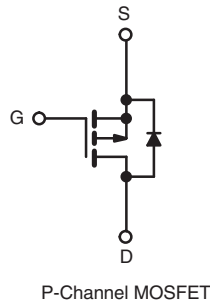
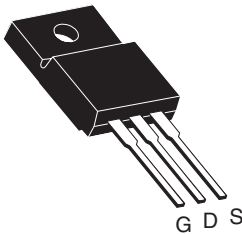


Power MOSFET

PRODUCT SUMMARY

| | | |
|---------------------------|------------------|------|
| V_{DS} (V) | - 60 | |
| $R_{DS(on)}$ (Ω) | $V_{GS} = -10$ V | 0.28 |
| Q_g (Max.) (nC) | 19 | |
| Q_{gs} (nC) | 5.4 | |
| Q_{gd} (nC) | 11 | |
| Configuration | Single | |

TO-220 FULLPAK


FEATURES

- Isolated Package
- High Voltage Isolation = 2.5 kV_{RMS} (t = 60 s; f = 60 Hz)
- Sink to Lead Creepage Distance = 4.8 mm
- P-Channel
- 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 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 | IRFI9Z24GPbF SiHFI9Z24G-E3 |
| SnPb | IRFI9Z24G SiHFI9Z24G |

ABSOLUTE MAXIMUM RATINGS $T_C = 25$ °C, unless otherwise noted

| PARAMETER | | | SYMBOL | LIMIT | UNIT |
|--|---------------------------|-------------------------|-----------------------------------|------------------|----------|
| Drain-Source Voltage | | | V _{DS} | - 60 | V |
| Gate-Source Voltage | | | V _{GS} | ± 20 | |
| Continuous Drain Current | V _{GS} at - 10 V | T _C = 25 °C | I _D | - 8.5 | A |
| | | T _C = 100 °C | | - 6.0 | |
| Pulsed Drain Current ^a | | | I _{DM} | - 34 | |
| Linear Derating Factor | | | | 0.24 | W/°C |
| Single Pulse Avalanche Energy ^b | | | E _{AS} | 200 | mJ |
| Repetitive Avalanche Current ^a | | | I _{AR} | - 8.5 | A |
| Repetitive Avalanche Energy ^a | | | E _{AR} | 3.7 | mJ |
| Maximum Power Dissipation | T _C = 25 °C | | P _D | 37 | W |
| Peak Diode Recovery dV/dt ^c | | | dV/dt | - 4.5 | V/ns |
| Operating Junction and Storage Temperature Range | | | T _J , T _{stg} | - 55 to + 175 | °C |
| Soldering Recommendations (Peak Temperature) | for 10 s | | | 300 ^d | |
| 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, $L = 3.2$ mH, $R_G = 25$ Ω , $I_{AS} = -8.5$ A (see fig. 12).
- $I_{SD} \leq -11$ A, $dI/dt \leq 140$ A/ μ 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 $T_J = 25\text{ °C}$, unless otherwise noted

| PARAMETER | SYMBOL | TEST CONDITIONS | | MIN. | TYP. | MAX. | UNIT |
|---|----------------------------------|--|--|-------|---------|-------|------|
| Static | | | | | | | |
| Drain-Source Breakdown Voltage | V _{DS} | V _{GS} = 0 V, I _D = - 250 μA | | - 60 | - | - | V |
| V _{DS} Temperature Coefficient | ΔV _{DS} /T _J | Reference to 25 °C, I _D = - 1 mA | | - | - 0.056 | - | V/°C |
| Gate-Source Threshold Voltage | V _{GS(th)} | V _{DS} = V _{GS} , I _D = - 250 μA | | - 2.0 | - | - 4.0 | V |
| Gate-Source Leakage | I _{GSS} | V _{GS} = ± 20 V | | - | - | ± 100 | nA |
| Zero Gate Voltage Drain Current | I _{DSS} | V _{DS} = - 60 V, V _{GS} = 0 V | | - | - | - 100 | μA |
| | | V _{DS} = - 48 V, V _{GS} = 0 V, T _J = 150 °C | | - | - | - 500 | |
| Drain-Source On-State Resistance | R _{DS(on)} | V _{GS} = - 10 V | I _D = - 5.1 A ^b | - | - | 0.28 | Ω |
| Forward Transconductance | g _{fs} | V _{DS} = - 25 V, I _D = - 5.1 A ^b | | 3.2 | - | - | S |
| Dynamic | | | | | | | |
| Input Capacitance | C _{iss} | V _{GS} = 0 V, V _{DS} = - 25 V, f = 1.0 MHz, see fig. 5 | | - | 570 | - | pF |
| Output Capacitance | C _{oss} | | | - | 360 | - | |
| Reverse Transfer Capacitance | C _{rss} | | | - | 65 | - | |
| Drain to Sink Capacitance | C | f = 1.0 MHz | | - | 12 | - | |
| Total Gate Charge | Q _g | V _{GS} = - 10 V | I _D = - 11 A, V _{DS} = - 48 V, see fig. 6 and 13 ^b | - | - | 19 | nC |
| Gate-Source Charge | Q _{gs} | | | - | - | 5.4 | |
| Gate-Drain Charge | Q _{gd} | | | - | - | 11 | |
| Turn-On Delay Time | t _{d(on)} | V _{DD} = - 30 V, I _D = - 11 A, R _G = 18 Ω, R _D = 2.5 Ω, see fig. 10 ^b | | - | 13 | - | ns |
| Rise Time | t _r | | | - | 68 | - | |
| Turn-Off Delay Time | t _{d(off)} | | | - | 15 | - | |
| Fall Time | t _f | | | - | 29 | - | |
| Internal Drain Inductance | L _D | Between lead, 6 mm (0.25") from package and center of die contact | | - | 4.5 | - | nH |
| Internal Source Inductance | L _S | | | - | 7.5 | - | |
| Drain-Source Body Diode Characteristics | | | | | | | |
| Continuous Source-Drain Diode Current | I _S | MOSFET symbol showing the integral reverse p - n junction diode | | - | - | - 8.5 | A |
| Pulsed Diode Forward Current ^a | I _{SM} | | | - | - | - 34 | |
| Body Diode Voltage | V _{SD} | T _J = 25 °C, I _S = - 8.5 A, V _{GS} = 0 V ^b | | - | - | - 6.3 | V |
| Body Diode Reverse Recovery Time | t _{rr} | T _J = 25 °C, I _F = - 11 A, dI/dt = 100 A/μs ^b | | - | 100 | 200 | ns |
| Body Diode Reverse Recovery Charge | Q _{rr} | | | - | 0.32 | 0.64 | μC |
| 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

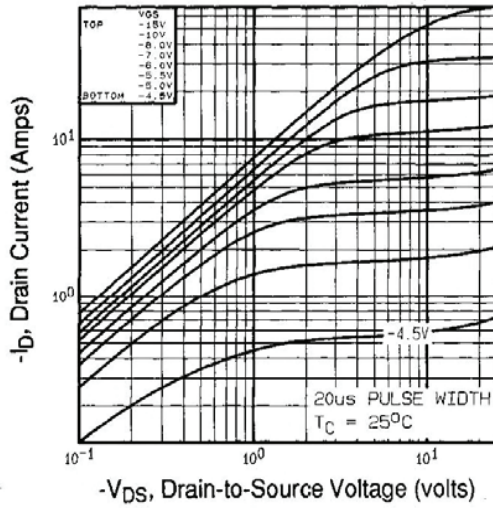


Fig. 1 - Typical Output Characteristics, $T_C = 25^\circ\text{C}$

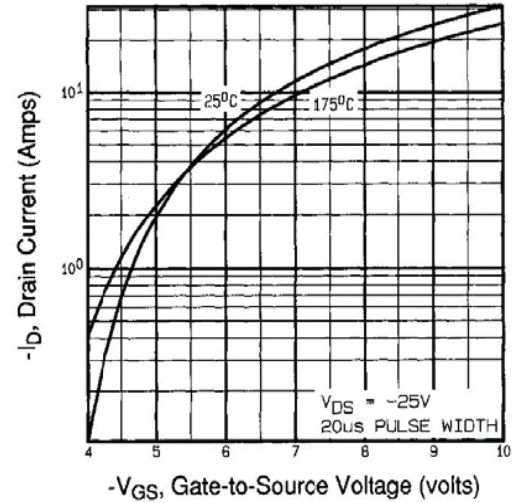


Fig. 3 - Typical Transfer Characteristics

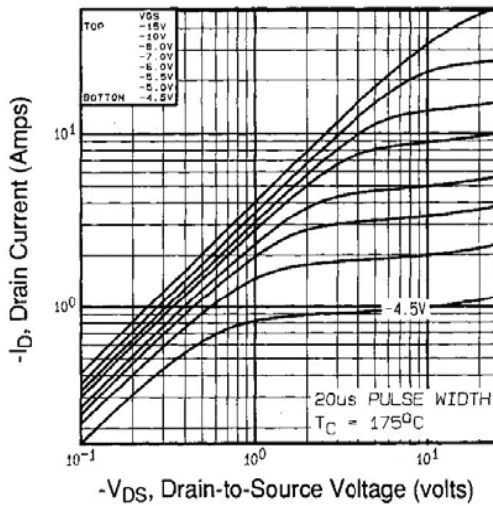


Fig. 2 - Typical Output Characteristics, $T_C = 175^\circ\text{C}$

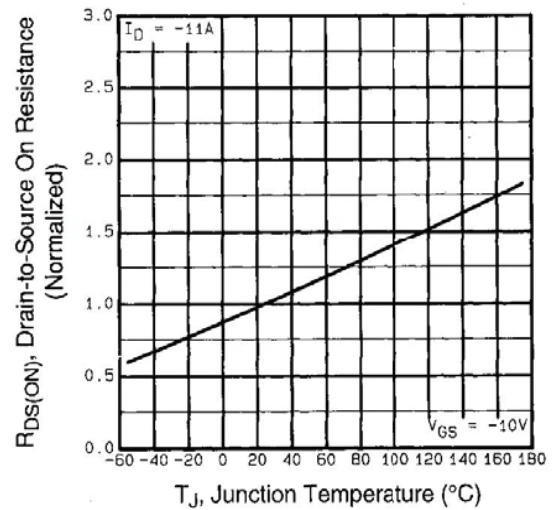


Fig. 4 - Normalized On-Resistance vs. Temperature

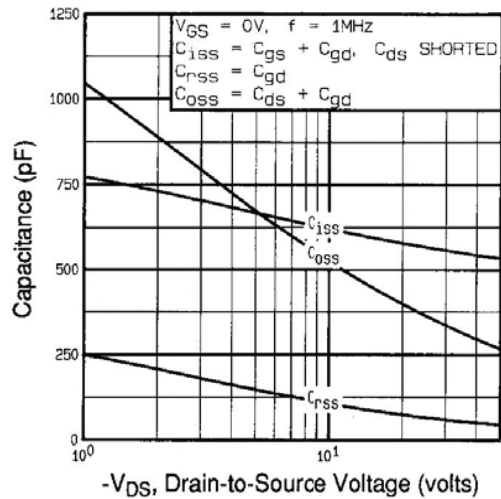


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

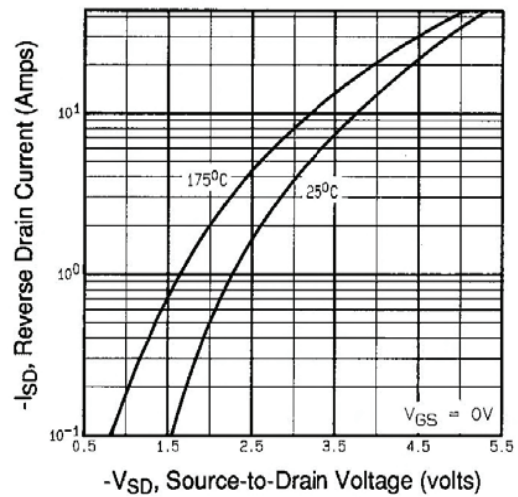


Fig. 7 - Typical Source-Drain Diode Forward Voltage

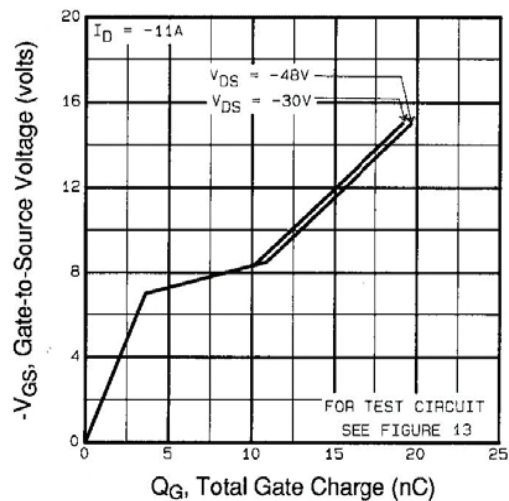


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

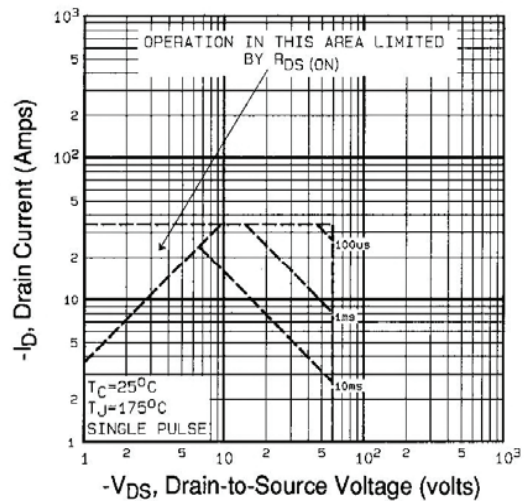


Fig. 8 - Maximum Safe Operating Area

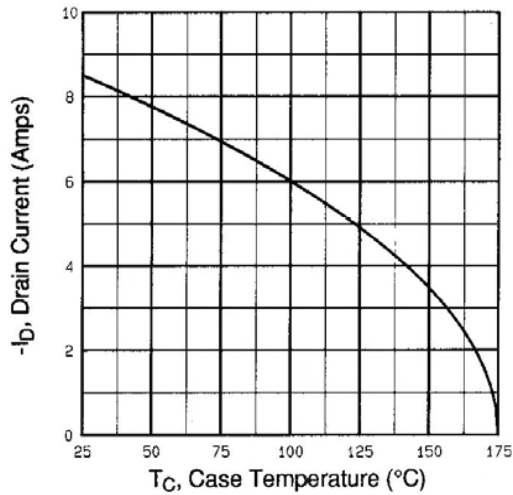


Fig. 9 - Maximum Drain Current vs. Case Temperature

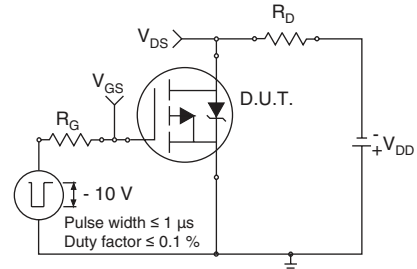


Fig. 10a - Switching Time Test Circuit

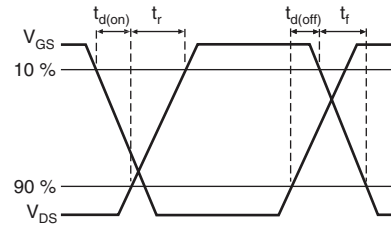


Fig. 10b - Switching Time Waveforms

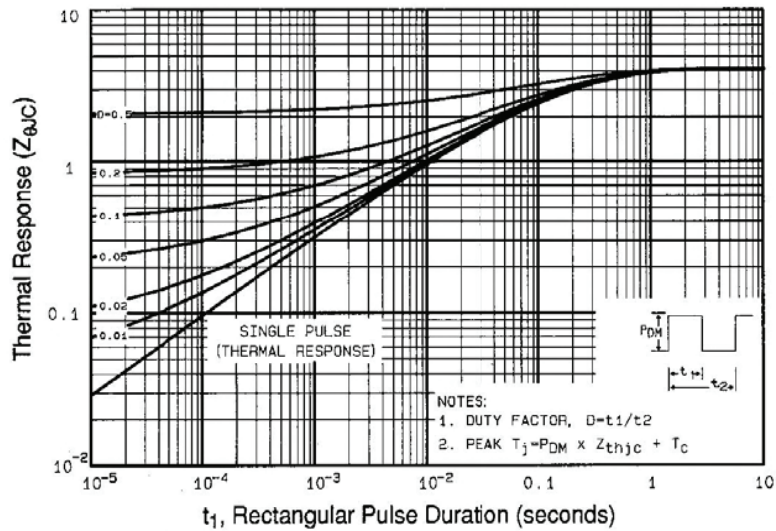


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

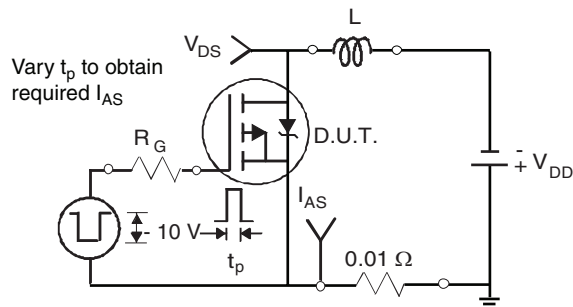


Fig. 12a - Unclamped Inductive Test Circuit

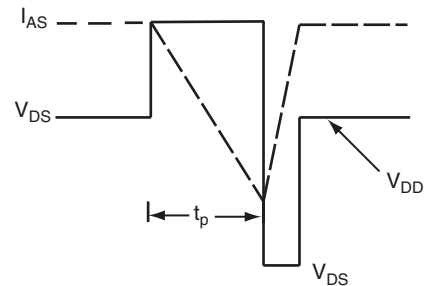


Fig. 12b - Unclamped Inductive Waveforms

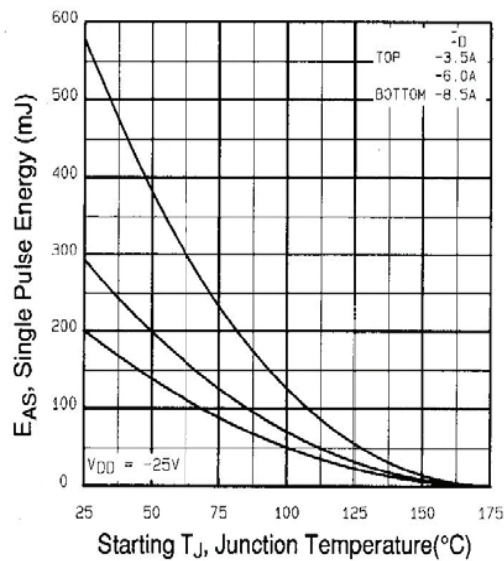


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

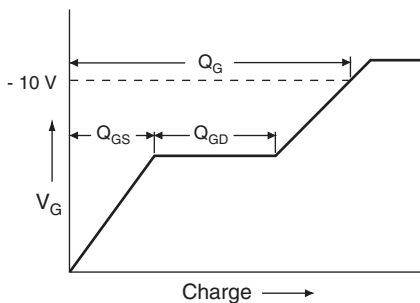


Fig. 13a - Basic Gate Charge Waveform

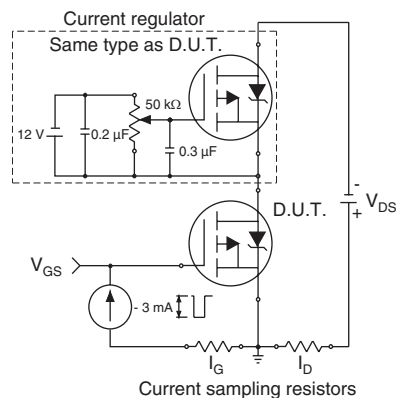
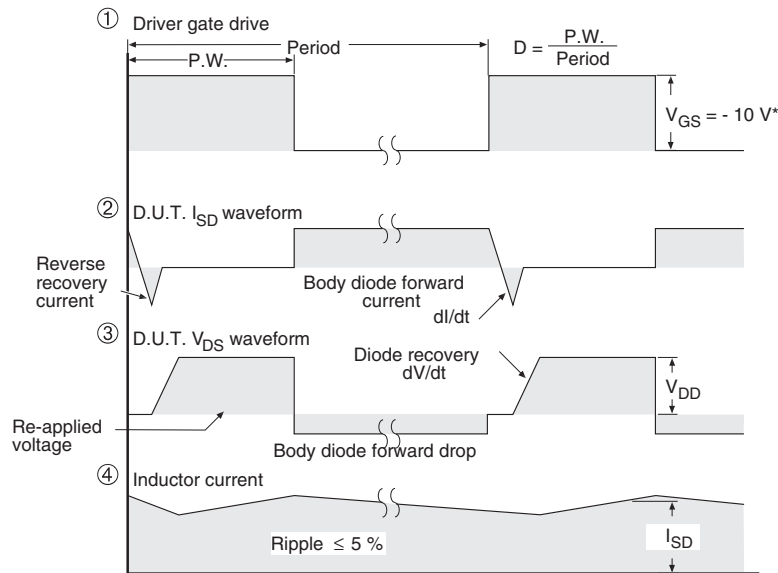
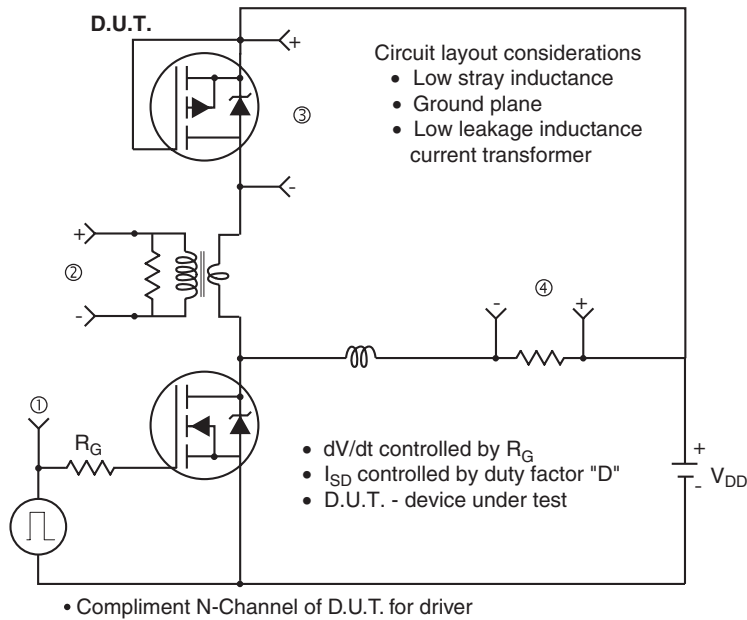


Fig. 13b - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit



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

Fig. 14 - For P-Channel

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