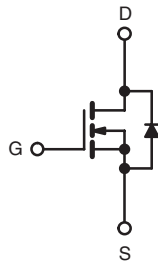
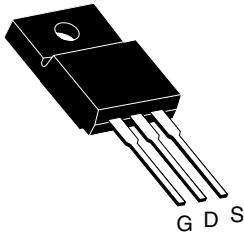


Power MOSFET

PRODUCT SUMMARY

| | | |
|---------------------------|------------------------|------|
| V_{DS} (V) | 600 | |
| $R_{DS(on)}$ (Ω) | $V_{GS} = 10\text{ V}$ | 0.75 |
| Q_g (Max.) (nC) | 49 | |
| Q_{gs} (nC) | 13 | |
| Q_{gd} (nC) | 20 | |
| Configuration | Single | |

TO-220 FULLPAK



N-Channel MOSFET

FEATURES

- Low Gate Charge Q_g Results in Simple Drive Requirement
- Improved Gate, Avalanche and Dynamic dV/dt Ruggedness
- Fully Characterized Capacitance and Avalanche Voltage and Current
- Compliant to RoHS directive 2002/95/EC



RoHS*
COMPLIANT

APPLICATIONS

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply
- High Speed Power Switching
- High Voltage Isolation = 2.5 kV_{RMS} ($t = 60\text{ s}$, $f = 60\text{ Hz}$)

TYPICAL SMPS TOPOLOGIES

- Single Transistor Forward
- Active Clamped Forward

ORDERING INFORMATION

| | |
|----------------|----------------|
| Package | TO-220 FULLPAK |
| Lead (Pb)-free | IRFIB6N60APbF |
| | SiHFIB6N60A-E3 |
| SnPb | IRFIB6N60A |
| | SiHFIB6N60A |

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

| PARAMETER | SYMBOL | LIMIT | UNIT |
|--|--------------------------|---------------------------|---------------------|
| Drain-Source Voltage | V_{DS} | 600 | V |
| Gate-Source Voltage | V_{GS} | ± 30 | |
| Continuous Drain Current | V_{GS} at 10 V | $T_C = 25^\circ\text{C}$ | I_D |
| | | $T_C = 100^\circ\text{C}$ | |
| Pulsed Drain Current ^a | I_{DM} | 37 | |
| Linear Derating Factor | | 0.48 | W/ $^\circ\text{C}$ |
| Single Pulse Avalanche Energy ^b | E_{AS} | 290 | mJ |
| Repetitive Avalanche Current ^a | I_{AR} | 9.2 | A |
| Repetitive Avalanche Energy ^a | E_{AR} | 6.0 | mJ |
| Maximum Power Dissipation | $T_C = 25^\circ\text{C}$ | P_D | 60 |
| Peak Diode Recovery dV/dt ^c | 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 ^d | |
| Mounting Torque | 6-32 or M3 screw | 10 | |
| | | 1.1 | N · m |

Notes


- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- Starting $T_J = 25^\circ\text{C}$, $L = 6.8\text{ mH}$, $R_G = 25\ \Omega$, $I_{AS} = 9.2\text{ A}$ (see fig. 12).
- $I_{SD} \leq 9.2\text{ A}$, $dI/dt \leq 50\text{ A}/\mu\text{s}$, $V_{DD} \leq V_{DS}$, $T_J \leq 150^\circ\text{C}$.
- 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} | - | 2.1 | |

SPECIFICATIONS $T_J = 25\text{ °C}$, unless otherwise noted

| PARAMETER | SYMBOL | TEST CONDITIONS | | MIN. | TYP. | MAX. | UNIT |
|---|-----------------------|--|--|------|------|-----------|----------------------|
| Static | | | | | | | |
| Drain-Source Breakdown Voltage | V_{DS} | $V_{GS} = 0\text{ V}$, $I_D = 250\text{ }\mu\text{A}$ | | 600 | - | - | V |
| V_{DS} Temperature Coefficient | $\Delta V_{DS}/T_J$ | Reference to $25\text{ }^\circ\text{C}$, $I_D = 1\text{ mA}^d$ | | - | 660 | - | mV/ $^\circ\text{C}$ |
| 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} | $V_{GS} = \pm 30\text{ V}$ | | - | - | ± 100 | nA |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS} = 600\text{ V}$, $V_{GS} = 0\text{ V}$ | | - | - | 25 | μA |
| | | $V_{DS} = 480\text{ V}$, $V_{GS} = 0\text{ V}$, $T_J = 125\text{ }^\circ\text{C}$ | | - | - | 250 | |
| Drain-Source On-State Resistance | $R_{DS(on)}$ | $V_{GS} = 10\text{ V}$ | $I_D = 3.3\text{ A}^b$ | - | - | 0.75 | Ω |
| Forward Transconductance | g_{fs} | $V_{DS} = 25\text{ V}$, $I_D = 5.5\text{ A}$ | | 5.5 | - | - | S |
| Dynamic | | | | | | | |
| Input Capacitance | C_{iss} | $V_{GS} = 0\text{ V}$, $V_{DS} = 25\text{ V}$, $f = 1.0\text{ MHz}$, see fig. 5 | | - | 1400 | - | pF |
| Output Capacitance | C_{oss} | | | - | 180 | - | |
| Reverse Transfer Capacitance | C_{rss} | | | - | 7.1 | - | |
| Output Capacitance | C_{oss} | $V_{GS} = 0\text{ V}$ | $V_{DS} = 1.0\text{ V}$, $f = 1.0\text{ MHz}$ | - | 1957 | - | pF |
| Effective Output Capacitance | $C_{oss\text{ eff.}}$ | | $V_{DS} = 480\text{ V}$, $f = 1.0\text{ MHz}$ | - | 49 | - | |
| | | | $V_{DS} = 0\text{ V to } 480\text{ V}^c$ | - | 96 | - | |
| Total Gate Charge | Q_g | $V_{GS} = 10\text{ V}$ | $I_D = 9.2\text{ A}$, $V_{DS} = 400\text{ V}$, see fig. 6 and 13 ^b | - | - | 49 | nC |
| Gate-Source Charge | Q_{gs} | | | - | - | 13 | |
| Gate-Drain Charge | Q_{gd} | | | - | - | 20 | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD} = 300\text{ V}$, $I_D = 9.2\text{ A}$, $R_G = 9.1\text{ }\Omega$, $R_D = 35.5\text{ }\Omega$, see fig. 10 ^b | | - | 13 | - | ns |
| Rise Time | t_r | | | - | 25 | - | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | - | 30 | - | |
| Fall Time | t_f | | | - | 22 | - | |
| Drain-Source Body Diode Characteristics | | | | | | | |
| Continuous Source-Drain Diode Current | I_S | MOSFET symbol showing the integral reverse p - n junction diode |  | - | - | 5.5 | A |
| Pulsed Diode Forward Current ^a | I_{SM} | | | - | - | 37 | |
| Body Diode Voltage | V_{SD} | $T_J = 25\text{ }^\circ\text{C}$, $I_S = 9.2\text{ A}$, $V_{GS} = 0\text{ V}^b$ | | - | - | 1.5 | V |
| Body Diode Reverse Recovery Time | t_{rr} | $T_J = 25\text{ }^\circ\text{C}$, $I_F = 9.2\text{ A}$, $dI/dt = 100\text{ A}/\mu\text{s}^b$ | | - | 530 | 800 | ns |
| Body Diode Reverse Recovery Charge | Q_{rr} | | | - | 3.0 | 4.4 | μC |
| Forward Turn-On Time | t_{on} | Intrinsic turn-on time is negligible (turn-on is dominated by L_S and L_D) | | | | | |

Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- Pulse width $\leq 300\text{ }\mu\text{s}$; duty cycle $\leq 2\%$.
- $C_{oss\text{ eff.}}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DS} .
- $t = 60\text{ s}$, $f = 60\text{ Hz}$.

TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

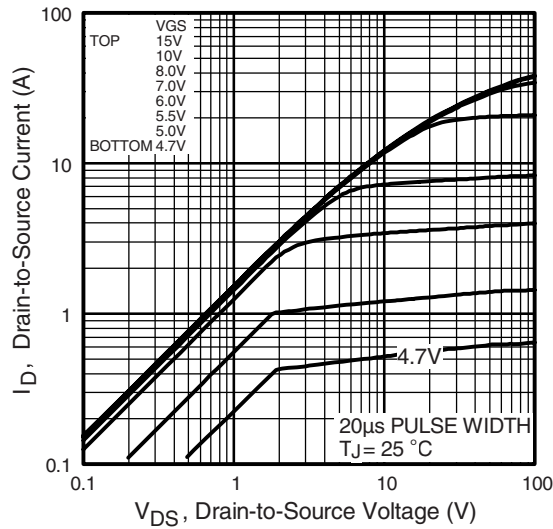


Fig. 1 - Typical Output Characteristics

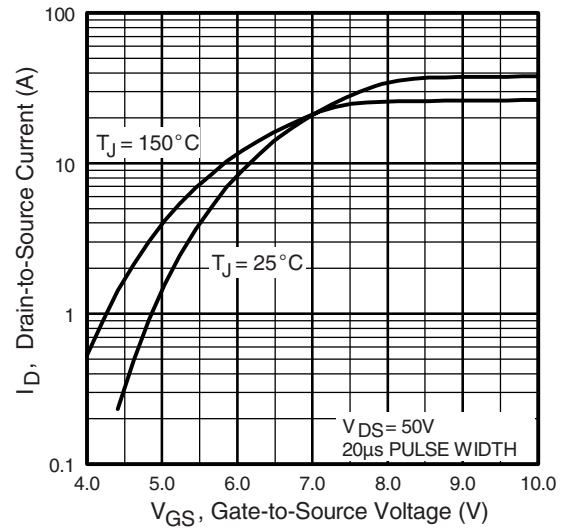


Fig. 3 - Typical Transfer Characteristics

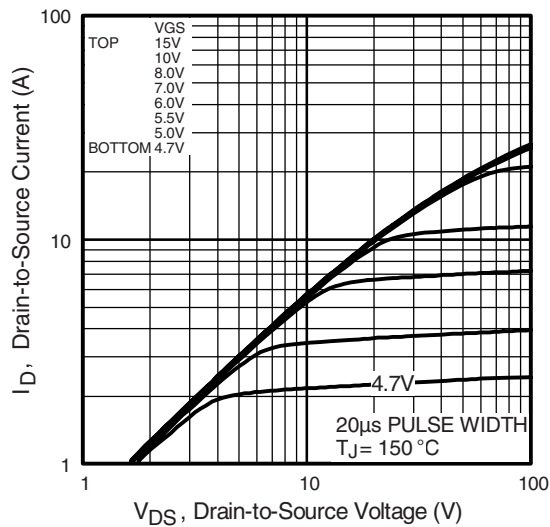


Fig. 2 - Typical Output Characteristics

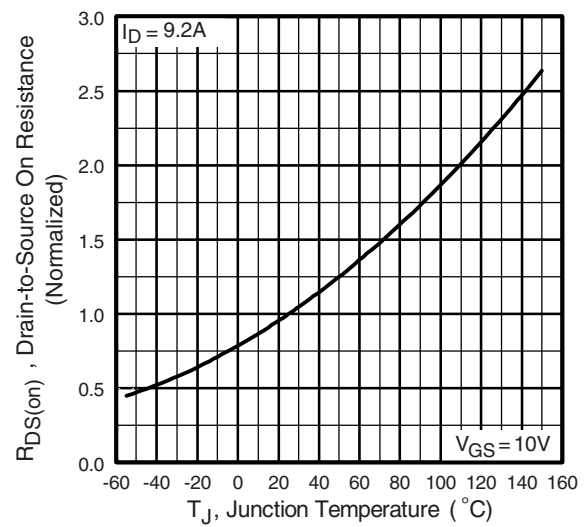


Fig. 4 - Normalized On-Resistance vs. Temperature

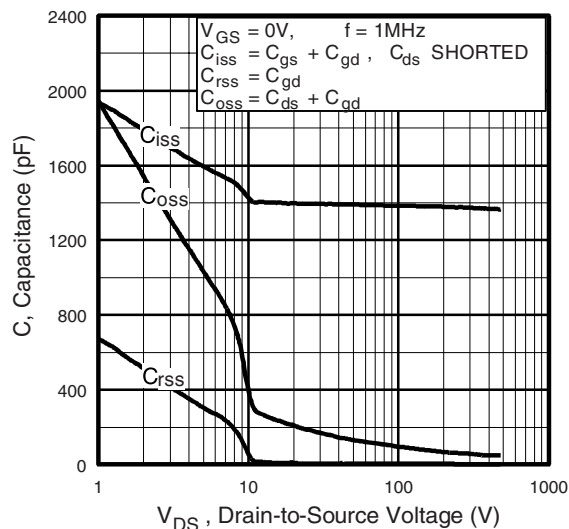


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

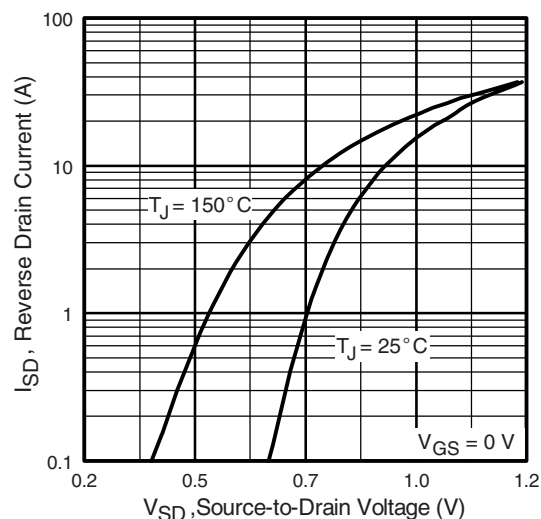


Fig. 7 - Typical Source-Drain Diode Forward Voltage

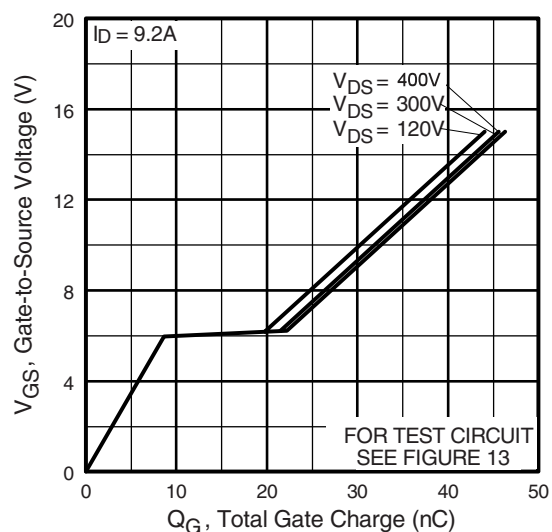


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

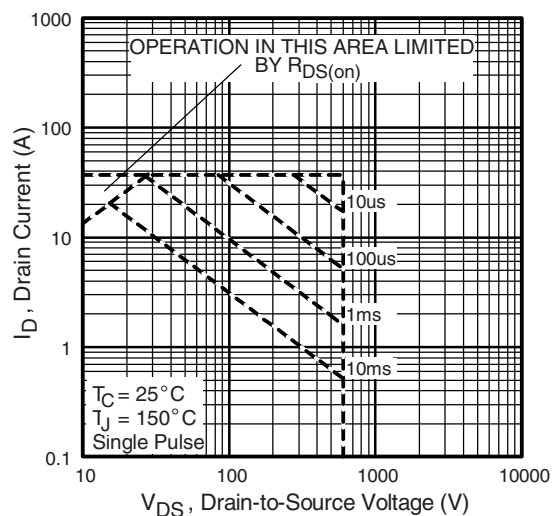


Fig. 8 - Maximum Safe Operating Area

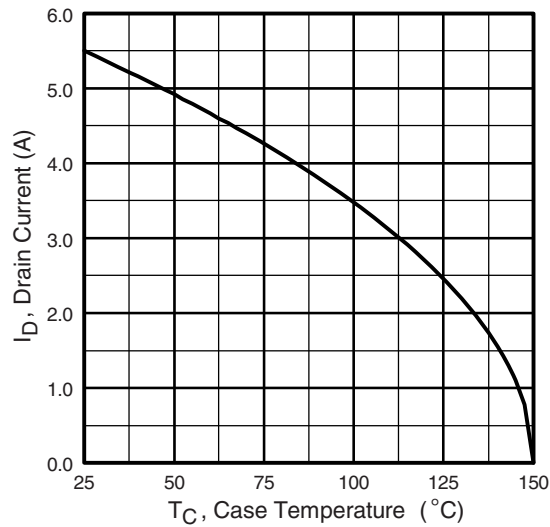


Fig. 9 - Maximum Drain Current vs. Case Temperature

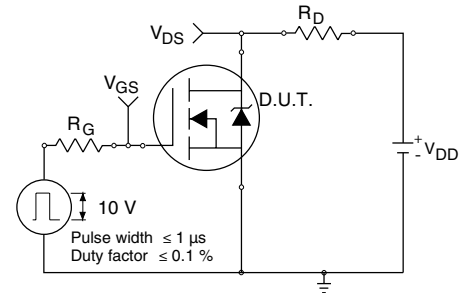


Fig. 10a - Switching Time Test Circuit

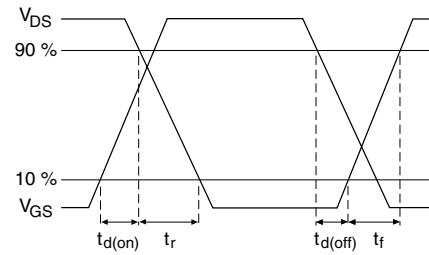


Fig. 10b - Switching Time Waveforms

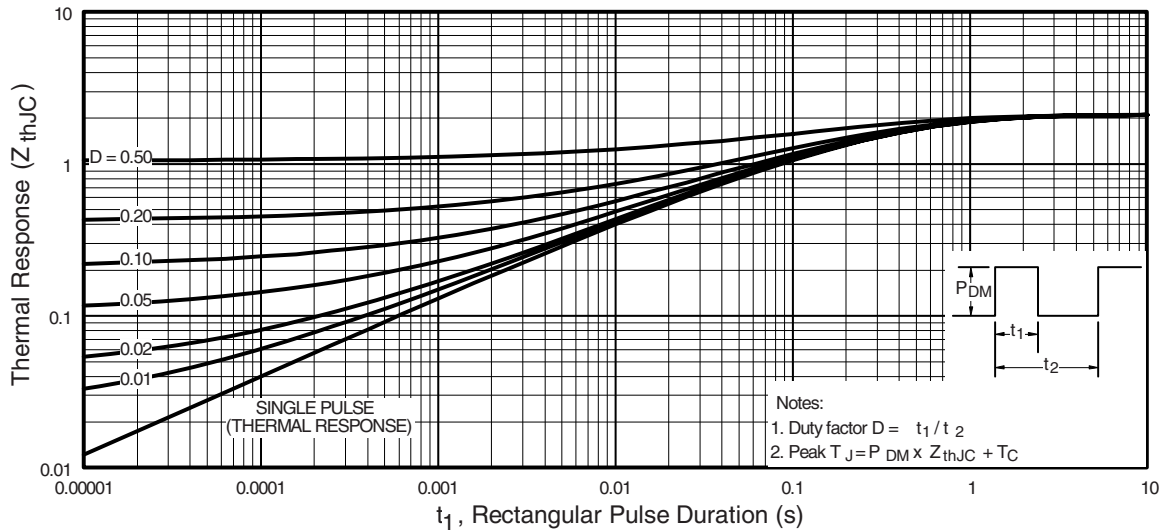


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

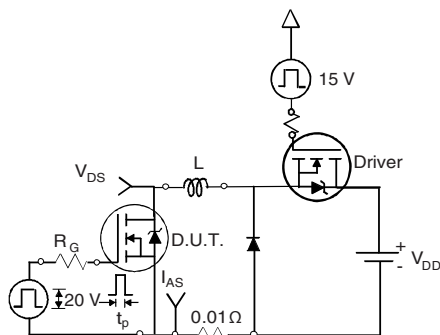


Fig. 12a - Unclamped Inductive Test Circuit

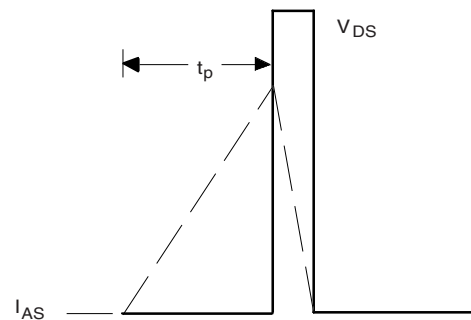


Fig. 12b - Unclamped Inductive Waveforms

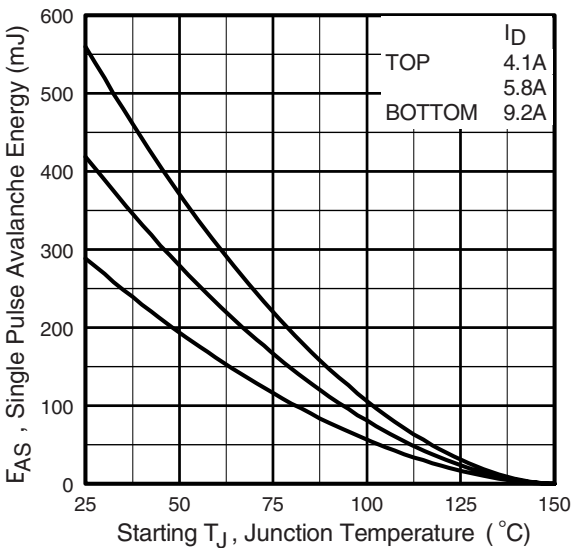


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

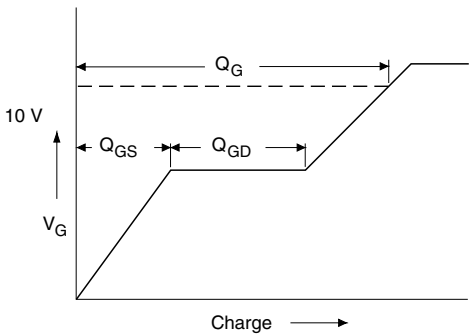


Fig. 13a - Basic Gate Charge Waveform

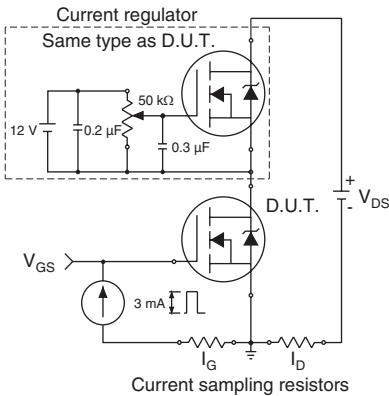


Fig. 13b - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit

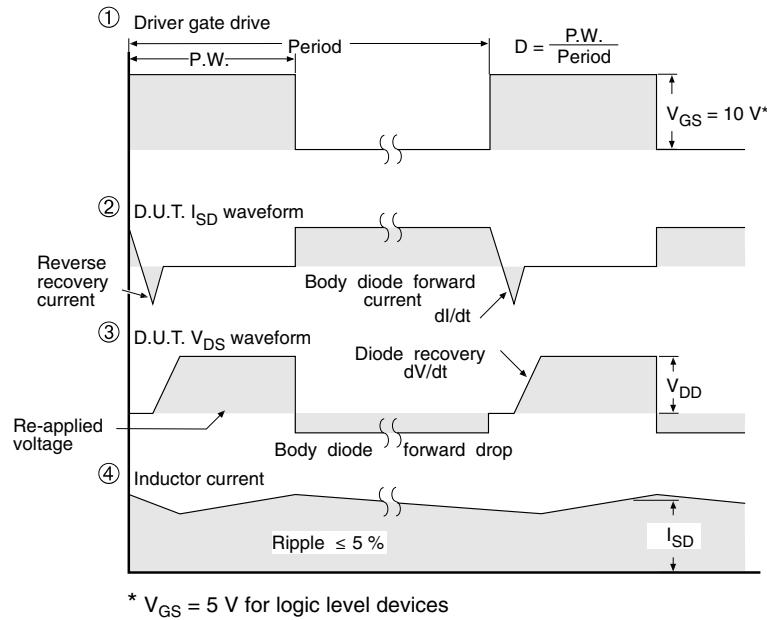
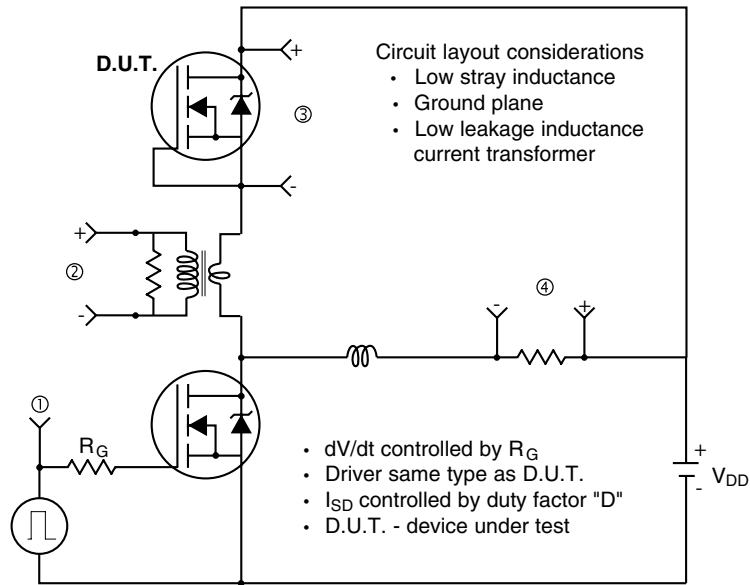


Fig. 14 - For N-Channel

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