

DTP7N50SJ-VB Datasheet

N-Channel 500V (D-S) Super Junction Power MOSFET

| PRODUCT SUMMARY | | |
|----------------------------|------------------------|------|
| V _{DS} (V) | 500 | |
| R _{DS(on)} (Ω) | V _{GS} = 10 V | 0.55 |
| Q _g (Max.) (nC) | 52 | |
| Q _{gs} (nC) | 13 | |
| Q _{gd} (nC) | 18 | |
| Configuration | Single | |

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
- Effective C_{oss} Specified
- Compliant to RoHS directive 2002/95/EC

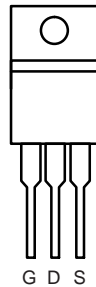


RoHS*
COMPLIANT

APPLICATIONS

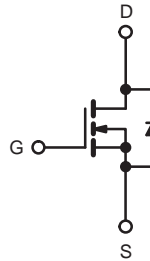
- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply

TO-220AB



G D S

Top View



N-Channel MOSFET

| ABSOLUTE MAXIMUM RATINGS T _C = 25 °C, unless otherwise noted | | | | | |
|---|-------------------------|-------------------------|-----------------------------------|------------------|-------|
| PARAMETER | | | SYMBOL | LIMIT | UNIT |
| Drain-Source Voltage | | | V _{DS} | 500 | V |
| Gate-Source Voltage | | | V _{GS} | ± 30 | |
| Continuous Drain Current | V _{GS} at 10 V | T _C = 25 °C | I _D | 7 | A |
| Continuous Drain Current | | T _C = 100 °C | | 4.2 | |
| Pulsed Drain Current ^{a, e} | | | I _{DM} | 44 | |
| Linear Derating Factor | | | | 0.48 | W/°C |
| Single Pulse Avalanche Energy ^{b, e} | | | E _{AS} | 275 | mJ |
| Repetitive Avalanche Current ^{a, e} | | | I _{AR} | 11 | A |
| Repetitive Avalanche Energy ^a | | | E _{AR} | 6.0 | mJ |
| Maximum Power Dissipation | T _C = 25 °C | | P _D | 60 | W |
| Peak Diode Recovery dV/dt ^c | | | dV/dt | 6.9 | V/ns |
| Operating Junction and Storage Temperature Range | | | T _J , T _{stg} | - 55 to + 150 | °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 °C, L = 4.5 mH, R_G = 25 Ω, I_{AS} = 11 A (see fig. 12).
- I_{SD} ≤ 11 A, di/dt ≤ 140 A/μs, V_{DD} ≤ V_{DS}, T_J ≤ 150 °C.
- 1.6 mm from case.
- Drain current limited by maximum junction temperature.

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

DTP11N50SJ-VB Datasheet

N-Channel 500V (D-S)Super Junction Power MOSFET

| PRODUCT SUMMARY | |
|--|--------------------------------|
| V _{DS} (V) at T _J max. | 500 |
| R _{DS(on)} at 25 °C (Ω) | V _{GS} = 10 V 0.380 |
| Q _g max. (nC) | 50 |
| Q _{gs} (nC) | 6 |
| Q _{gd} (nC) | 10 |
| Configuration | Single |

FEATURES

- Low figure-of-merit (FOM) R_{on} x Q_g
- Low input capacitance (C_{iss})
- Reduced switching and conduction losses
- Low gate charge (Q_g)
- Avalanche energy rated (UIS)

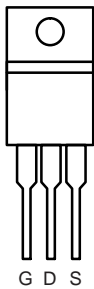
APPLICATIONS

- Computing
 - PC silver box / ATX power supplies
- Lighting
 - Two stage LED lighting
- Consumer electronics



RoHS
COMPLIANT
HALOGEN
FREE

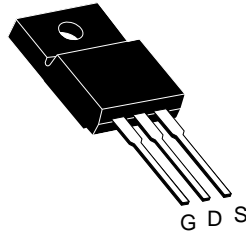
TO-220AB



G D S

Top View

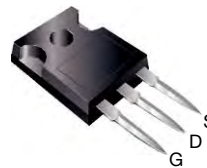
TO-220 FULLPAK



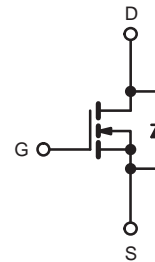
G D S

Top View

TO-247AC



Top View



N-Channel MOSFET


| ABSOLUTE MAXIMUM RATINGS (T _C = 25 °C, unless otherwise noted) | | | |
|---|---|-------------------------|------|
| PARAMETER | SYMBOL | LIMIT | UNIT |
| Drain-Source Voltage | V _{DS} | 500 | V |
| Gate-Source Voltage | V _{GS} | ± 30 | |
| Continuous Drain Current (T _J = 150 °C) | V _{GS} at 10 V | T _C = 25 °C | 11 |
| | | T _C = 100 °C | 6.6 |
| Pulsed Drain Current ^a | I _{DM} | 21 | A |
| Linear Derating Factor | | 0.91 | W/°C |
| Single Pulse Avalanche Energy ^b | E _{AS} | 103 | mJ |
| Maximum Power Dissipation | P _D | 114 | W |
| Operating Junction and Storage Temperature Range | T _J , T _{stg} | -55 to +150 | °C |
| Drain-Source Voltage Slope | V _{DS} = 0 V to 80 % V _{DS} | 70 | V/ns |
| Reverse Diode dV/dt ^d | | 27 | |
| Soldering Recommendations (Peak Temperature) ^c | for 10 s | 300 | °C |

Notes

- Repetitive rating; pulse width limited by maximum junction temperature.
- V_{DD} = 50 V, starting T_J = 25 °C, L = 28.2 mH, R_g = 25 Ω, I_{AS} = 2.7 A.
- 1.6 mm from case.
- I_{SD} ≤ I_D, dI/dt = 100 A/μs, starting T_J = 25 °C.

| THERMAL RESISTANCE RATINGS | | | | |
|----------------------------------|-------------------|------|------|------|
| PARAMETER | SYMBOL | TYP. | MAX. | UNIT |
| Maximum Junction-to-Ambient | R _{thJA} | - | 62 | °C/W |
| Maximum Junction-to-Case (Drain) | R _{thJC} | - | 1.1 | |

| 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 $T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted | | | | | | |
|--|-----------------------|--|---|------|-----------|---------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNIT |
| Static | | | | | | |
| Drain-Source Breakdown Voltage | V_{DS} | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$ | 500 | - | - | V |
| V_{DS} Temperature Coefficient | $\Delta V_{DS}/T_J$ | Reference to $25\text{ }^\circ\text{C}$, $I_D = 1\text{ mA}$ | - | 610 | - | mV/°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} | $V_{DS} = 500\text{ V}, V_{GS} = 0\text{ V}$ | - | - | 25 | μA |
| | | $V_{DS} = 400\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$ | - | - | 250 | |
| Drain-Source On-State Resistance | $R_{DS(on)}$ | $V_{GS} = 10\text{ V}, I_D = 4.0\text{ A}^b$ | - | 0.55 | - | Ω |
| Forward Transconductance | g_{fs} | $V_{DS} = 50\text{ V}, I_D = 6.6\text{ A}$ | 6.1 | - | - | S |
| Dynamic | | | | | | |
| Input Capacitance | C_{iss} | $V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1.0\text{ MHz}$, see fig. 5 | - | 1423 | - | μF |
| Output Capacitance | C_{oss} | | - | 208 | - | |
| Reverse Transfer Capacitance | C_{rss} | | - | 8.1 | - | |
| Output Capacitance | C_{oss} | $V_{GS} = 0\text{ V}$ | $V_{DS} = 1.0\text{ V}, f = 1.0\text{ MHz}$ | - | 2000 | - |
| | | | $V_{DS} = 400\text{ V}, f = 1.0\text{ MHz}$ | - | 55 | - |
| Effective Output Capacitance | $C_{oss\text{ eff.}}$ | $V_{DS} = 0\text{ V to } 400\text{ V}^c$ | - | 97 | - | |
| Total Gate Charge | Q_g | $V_{GS} = 10\text{ V}, I_D = 11\text{ A}, V_{DS} = 400\text{ V}$ see fig. 6 and 13 ^b | - | - | 52 | nC |
| Gate-Source Charge | Q_{gs} | | - | - | 13 | |
| Gate-Drain Charge | Q_{gd} | | - | - | 18 | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD} = 250\text{ V}, I_D = 11\text{ A}, R_G = 9.1\text{ }\Omega, R_D = 22\text{ }\Omega$, see fig. 10 ^b | - | 14 | - | ns |
| Rise Time | t_r | | - | 35 | - | |
| Turn-Off Delay Time | $t_{d(off)}$ | | - | 32 | - | |
| Fall Time | t_f | | - | 28 | - | |
| Drain-Source Body Diode Characteristics | | | | | | |
| Continuous Source-Drain Diode Current | I_S | MOSFET symbol showing the integral reverse p - n junction diode  | - | - | 7.0 | A |
| Pulsed Diode Forward Current ^a | I_{SM} | | - | - | 44 | |
| Body Diode Voltage | V_{SD} | $T_J = 25\text{ }^\circ\text{C}, I_S = 11\text{ A}, V_{GS} = 0\text{ V}^b$ | - | - | 1.5 | V |
| Body Diode Reverse Recovery Time | t_{rr} | $T_J = 25\text{ }^\circ\text{C}, I_F = 11\text{ A}, di/dt = 100\text{ A}/\mu\text{s}^b$ | - | 510 | 770 | ns |
| Body Diode Reverse Recovery Charge | Q_{rr} | | - | 3.4 | 5.1 | 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 $\leq 2\%$.
- c. $C_{oss\text{ eff.}}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DS} .

TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

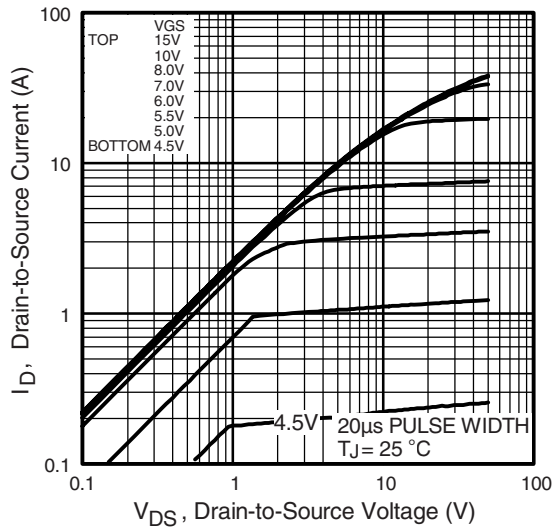


Fig. 1 - Typical Output Characteristics

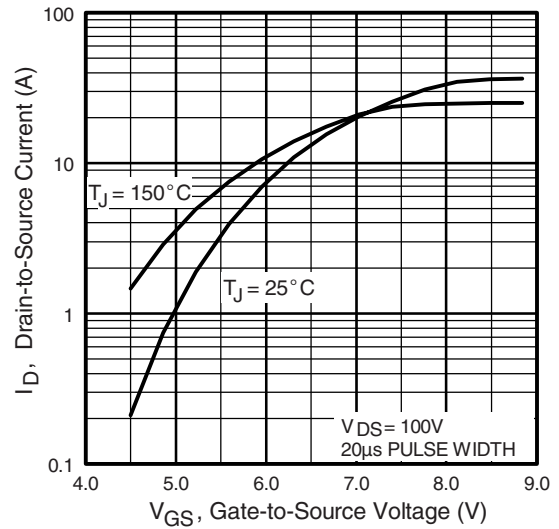


Fig. 3 - Typical Transfer Characteristics

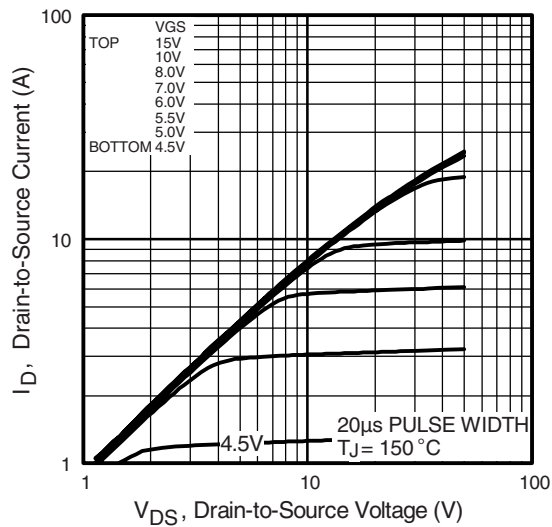


Fig. 2 - Typical Output Characteristics

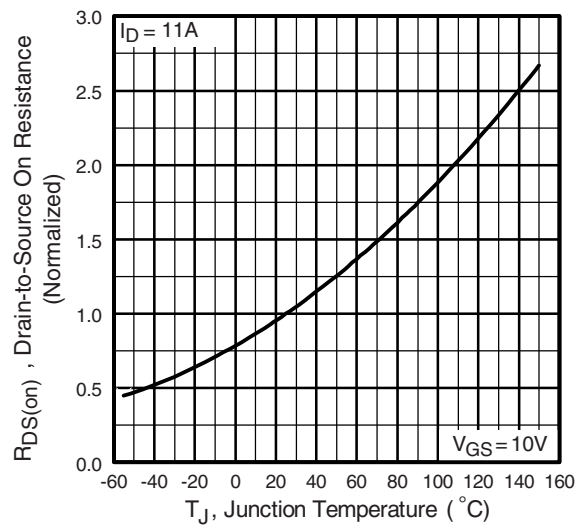


Fig. 4 - Normalized On-Resistance vs. Temperature

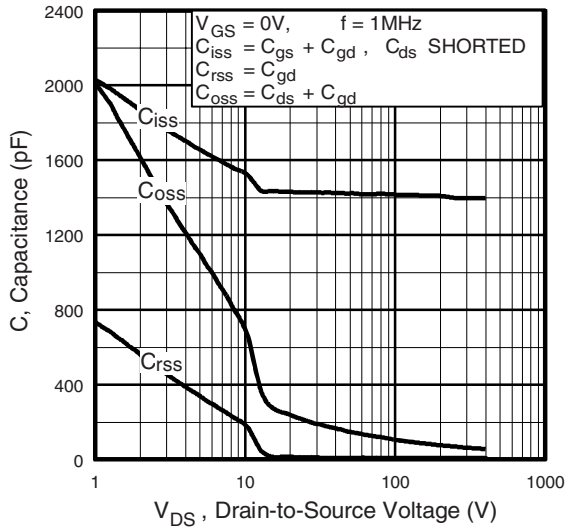


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

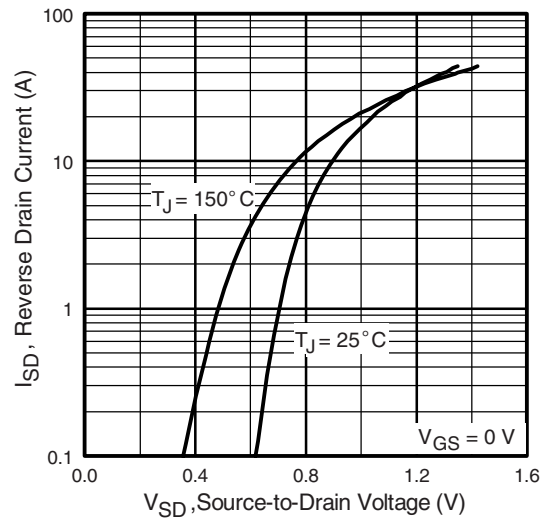


Fig. 7 - Typical Source-Drain Diode Forward Voltage

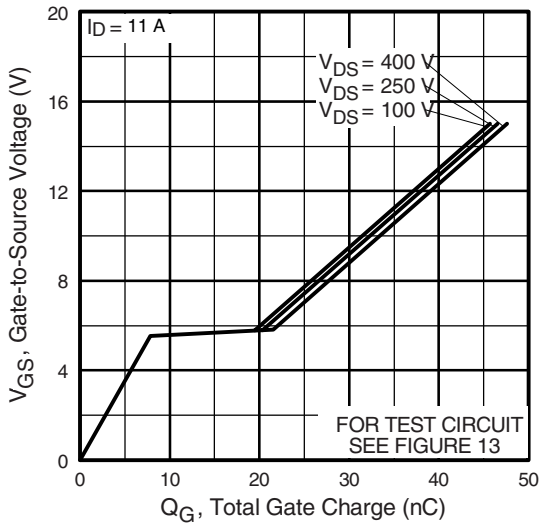


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

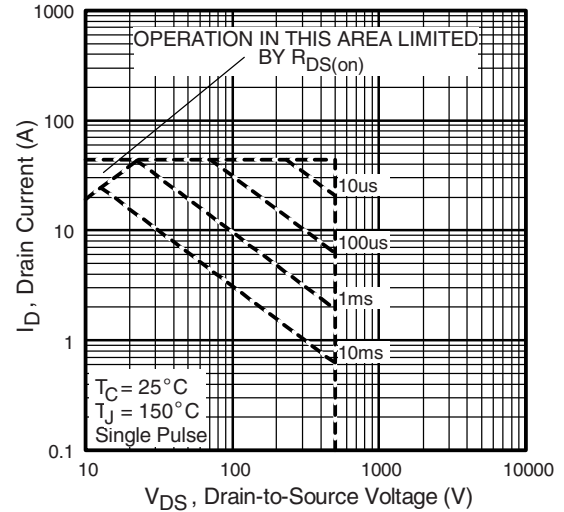


Fig. 8 - Maximum Safe Operating Area

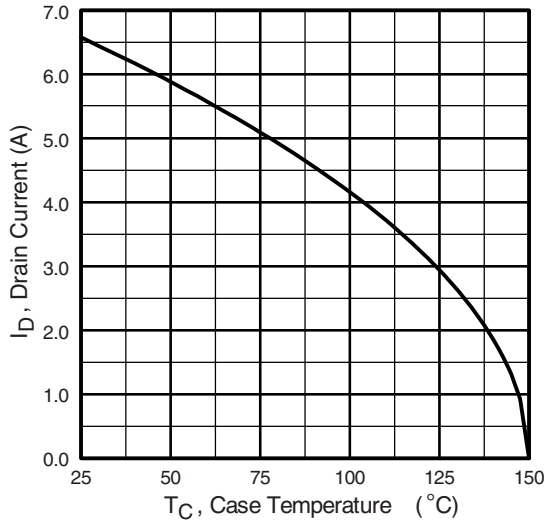


Fig. 9 - Maximum Drain Current vs. Case Temperature

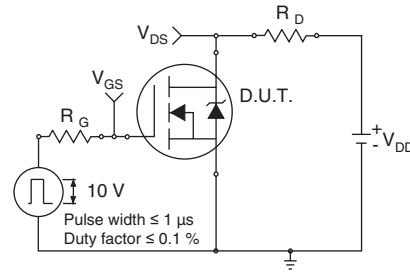


Fig. 10a - Switching Time Test Circuit

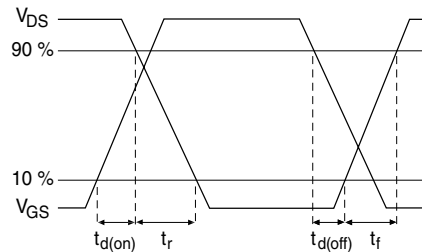


Fig. 10b - Switching Time Waveforms

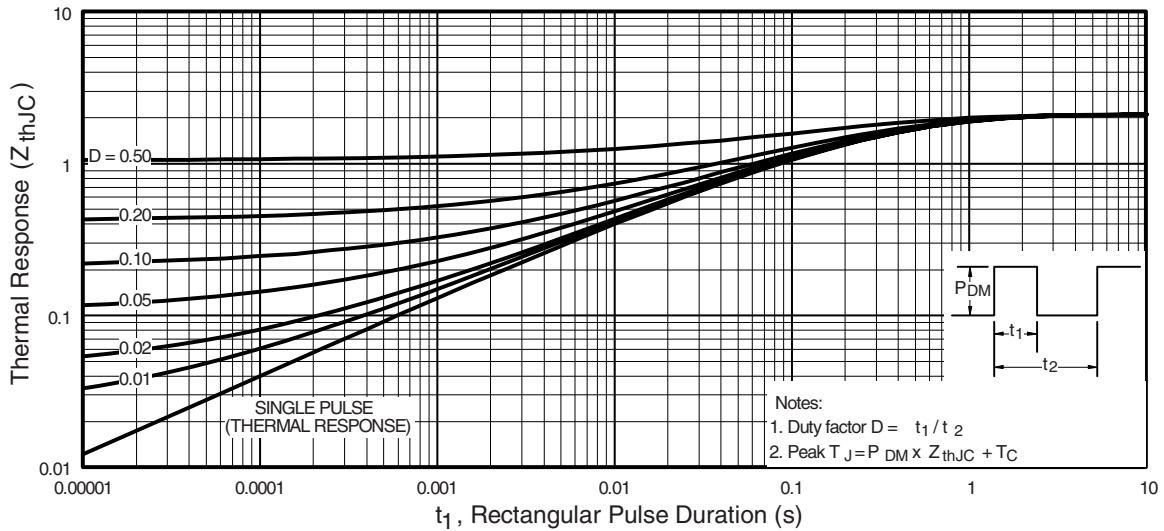


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

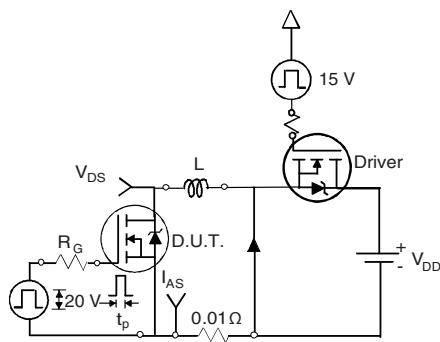


Fig. 12a - Unclamped Inductive Test Circuit

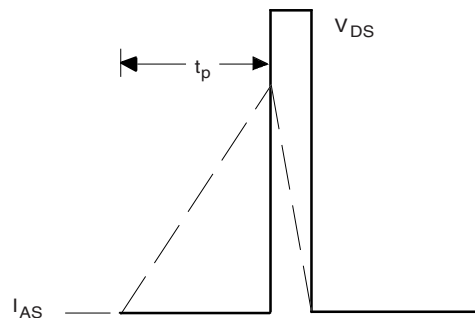


Fig. 12b - Unclamped Inductive Waveforms

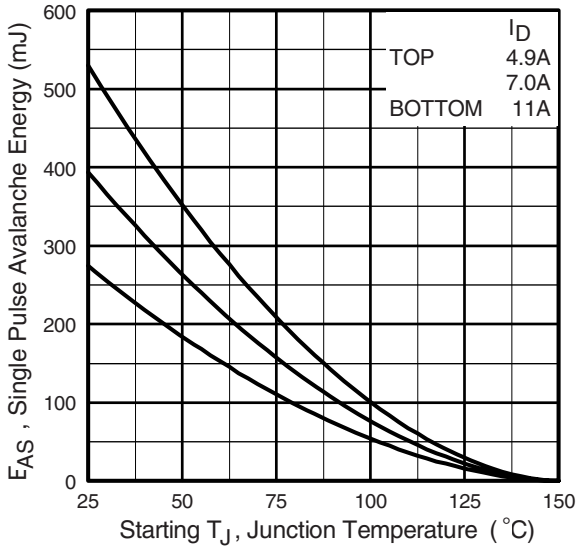


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

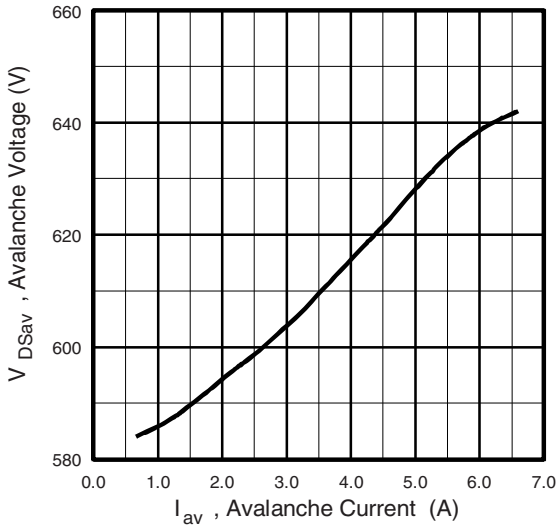


Fig. 12d - Typical Drain-to-Source Voltage vs. Avalanche Current

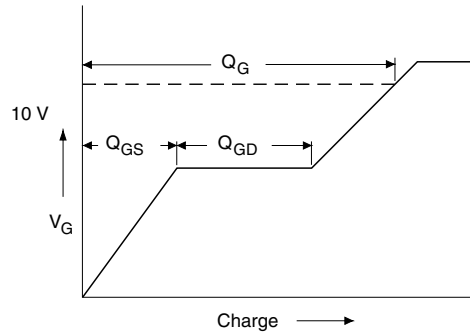


Fig. 13a - Basic Gate Charge Waveform

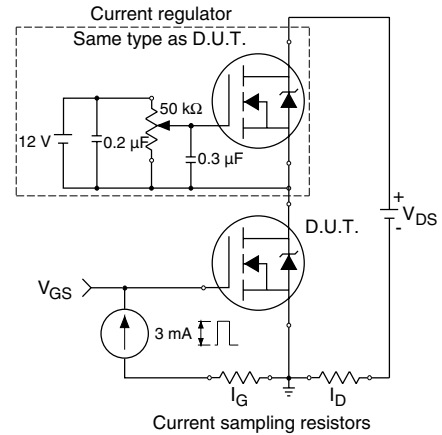
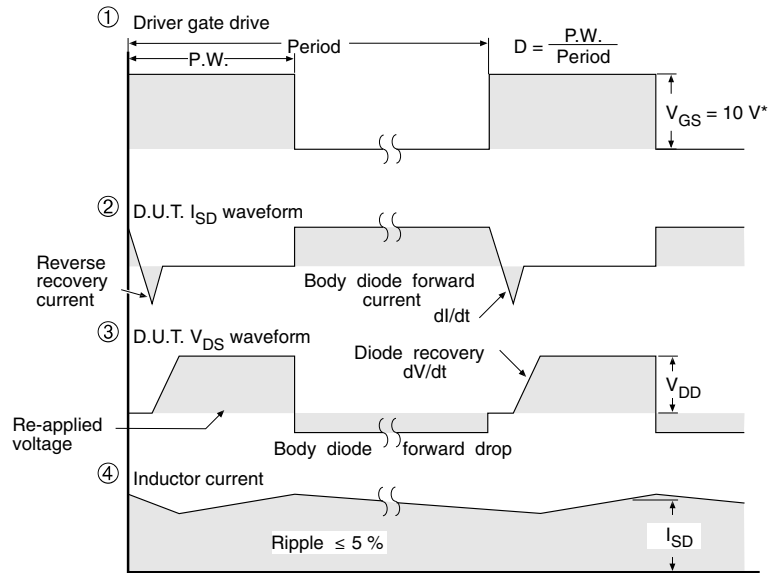
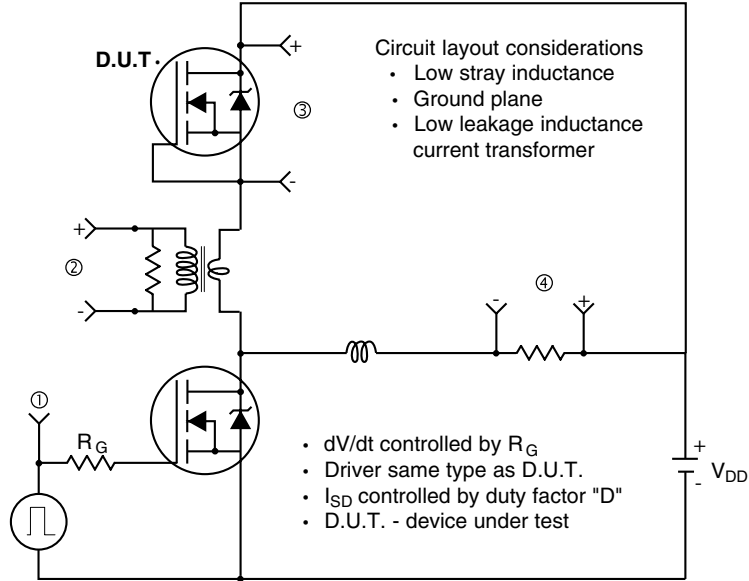


Fig. 13b - Gate Charge Test Circuit

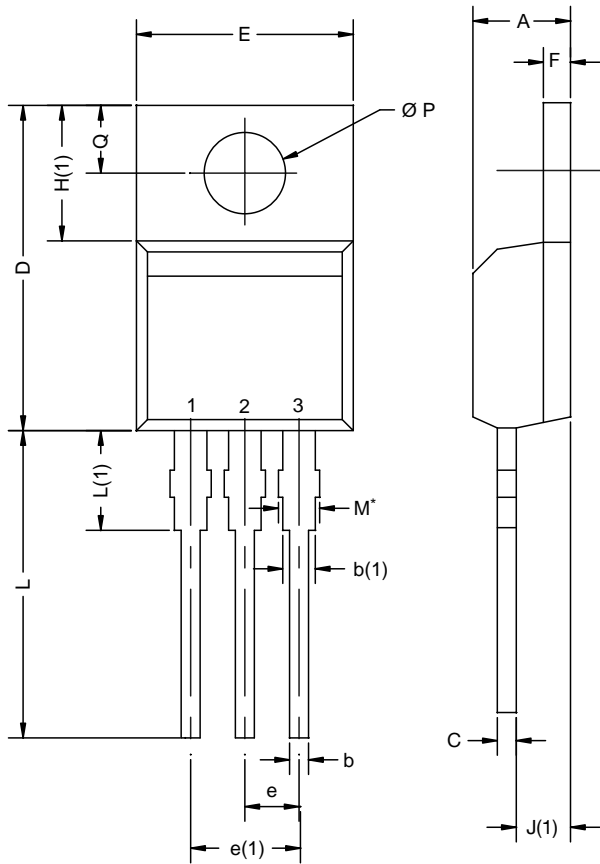
Peak Diode Recovery dV/dt Test Circuit



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

Fig. 14 - For N-Channel

TO-220AB



| DIM. | MILLIMETERS | | INCHES | |
|------|-------------|-------|--------|-------|
| | MIN. | MAX. | MIN. | MAX. |
| A | 4.25 | 4.65 | 0.167 | 0.183 |
| b | 0.69 | 1.01 | 0.027 | 0.040 |
| b(1) | 1.20 | 1.73 | 0.047 | 0.068 |
| c | 0.36 | 0.61 | 0.014 | 0.024 |
| D | 14.85 | 15.49 | 0.585 | 0.610 |
| E | 10.04 | 10.51 | 0.395 | 0.414 |
| e | 2.41 | 2.67 | 0.095 | 0.105 |
| e(1) | 4.88 | 5.28 | 0.192 | 0.208 |
| F | 1.14 | 1.40 | 0.045 | 0.055 |
| H(1) | 6.09 | 6.48 | 0.240 | 0.255 |
| J(1) | 2.41 | 2.92 | 0.095 | 0.115 |
| L | 13.35 | 14.02 | 0.526 | 0.552 |
| L(1) | 3.32 | 3.82 | 0.131 | 0.150 |
| Ø P | 3.54 | 3.94 | 0.139 | 0.155 |
| Q | 2.60 | 3.00 | 0.102 | 0.118 |

ECN: X12-0208-Rev. N, 08-Oct-12
DWG: 5471

Notes

* M = 1.32 mm to 1.62 mm (dimension including protrusion)
Heatsink hole for HVM

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