# N-Channel 200 V (D-S) MOSFET

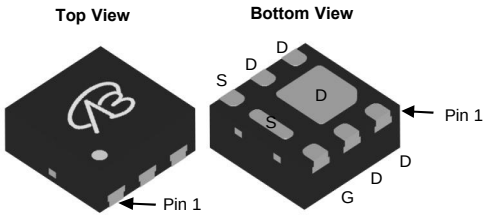
| PRODUCT SUMMARY | | |
|---|---|---|
| $V_{DS}$ (V) | 200 | |
| $R_{DS(on)}$ (Ω) | $V_{GS}$ = 10 V | 1.2 |
| $Q_g$ (Max.) (nC) | 8.2 | |
| $Q_{gs}$ (nC) | 1.8 | |
| $Q_{gd}$ (nC) | 4.5 | |
| Configuration | Single | |

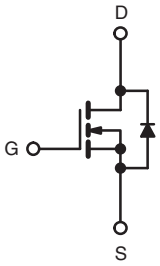
## FEATURES

- Available in tape and reel
- Dynamic dV/dt rating
- Repetitive avalanche rated
- Fast switching
- Ease of paralleling
- Simple drive requirements

RoHS COMPLIANT
HALOGEN FREE Available

DFN 2x2




N-Channel MOSFET

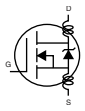
| ABSOLUTE MAXIMUM RATINGS ($T_C$ = 25 °C, unless otherwise noted) | | | | | |
|---|---|---|---|---|---|
| PARAMETER | | | SYMBOL | LIMIT | UNIT |
| Drain-Source Voltage | | | $V_{DS}$ | 200 | V |
| Gate-Source Voltage | | | $V_{GS}$ | ± 20 | |
| Continuous Drain Current | $V_{GS}$ at 10 V | $T_C$ = 25 °C | $I_D$ | 2.8 | A |
| | | $T_C$ = 100 °C | | 2.0 | |
| Pulsed Drain Current [a] | | | $I_{DM}$ | 8.4 | |
| Linear Derating Factor | | | | 0.025 | W/°C |
| Linear Derating Factor (PCB Mount) [e] | | | | 0.017 | |
| Single Pulse Avalanche Energy [b] | | | $E_{AS}$ | 50 | mJ |
| Repetitive Avalanche Current [a] | | | $I_{AR}$ | 0.96 | A |
| Repetitive Avalanche Energy [a] | | | $E_{AR}$ | 0.31 | mJ |
| Maximum Power Dissipation | $T_C$ = 25 °C | | $P_D$ | 3.1 | W |
| Maximum Power Dissipation (PCB Mount) [e] | $T_A$ = 25 °C | | | 2.0 | |
| 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 | °C |
| Soldering Recommendations (Peak Temperature) [d] | for 10 s | | | 300 | |

**Notes**
a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
b. $V_{DD}$ = 50 V, starting $T_J$ = 25 °C, L = 81 mH, $R_G$ = 25 Ω, $I_{AS}$ = 0.96 A (see fig. 12).
c. $I_{SD}$ ≤ 3.3 A, dI/dt ≤ 70 A/μs, $V_{DD}$ ≤ $V_{DS}$, $T_J$ ≤ 150 °C.
d. 1.6 mm from case.
e. When mounted on 1" square PCB (FR-4 or G-10 material).

| THERMAL RESISTANCE RATINGS | | | | | |
|---|---|---|---|---|---|
| **PARAMETER** | **SYMBOL** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| Maximum Junction-to-Ambient (PCB Mount) [a] | $R_{thJA}$ | - | - | 40 | °C/W |
| Maximum Junction-to-Case (Drain) | $R_{thJC}$ | - | - | 60 | |

**Note**

a. When mounted on 1" square PCB (FR-4 or G-10 material).

| **SPECIFICATIONS** ($T_J$ = 25 °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 | 200 | - | - | V |
| $V_{DS}$ Temperature Coefficient | $\Delta V_{DS}/T_J$ | Reference to 25 °C, $I_D$ = 1 mA | - | 0.30 | - | 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 | $I_{DSS}$ | $V_{DS}$ = 200 V, $V_{GS}$ = 0 V | - | - | 25 | µA |
| | | $V_{DS}$ = 160 V, $V_{GS}$ = 0 V, $T_J$ = 125 °C | - | - | 250 | |
| Drain-Source On-State Resistance | $R_{DS(on)}$ | $V_{GS}$ = 10 V, $I_D$ = 0.58 A [b] | - | 1.2 | - | Ω |
| Forward Transconductance | $g_{fs}$ | $V_{DS}$ = 50 V, $I_D$ = 0.58 A | 0.51 | - | - | S |
| **Dynamic** | | | | | | |
| Input Capacitance | $C_{iss}$ | $V_{GS}$ = 0 V, $V_{DS}$ = 25 V, f = 1.0 MHz, see fig. 5 | - | 140 | - | pF |
| Output Capacitance | $C_{oss}$ | | - | 53 | - | |
| Reverse Transfer Capacitance | $C_{rss}$ | | - | 15 | - | |
| Total Gate Charge | $Q_g$ | $V_{GS}$ = 10 V, $I_D$ = 3.3 A, $V_{DS}$ = 160 V, see fig. 6 and 13 [b] | - | - | 8.2 | nC |
| Gate-Source Charge | $Q_{gs}$ | | - | - | 1.8 | |
| Gate-Drain Charge | $Q_{gd}$ | | - | - | 4.5 | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD}$ = 100 V, $I_D$ = 3.3 A, $R_g$ = 24 Ω, $R_D$ = 30 Ω, see fig. 10 [b] | - | 8.2 | - | ns |
| Rise Time | $t_r$ | | - | 17 | - | |
| Turn-Off Delay Time | $t_{d(off)}$ | | - | 14 | - | |
| Fall Time | $t_f$ | | - | 8.9 | - | |
| Internal Drain Inductance | $L_D$ | Between lead, 6 mm (0.25") from package and center of die contact  | - | 4.0 | - | nH |
| Internal Source Inductance | $L_S$ | | - | 6.0 | - | |
| **Drain-Source Body Diode Characteristics** | | | | | | |
| Continuous Source-Drain Diode Current | $I_S$ | MOSFET symbol showing the integral reverse p - n junction diode  | - | - | 2.8 | A |
| Pulsed Diode Forward Current [a] | $I_{SM}$ | | - | - | 8.4 | |
| Body Diode Voltage | $V_{SD}$ | $T_J$ = 25 °C, $I_S$ = 0.96 A, $V_{GS}$ = 0 V [b] | - | - | 2.0 | V |
| Body Diode Reverse Recovery Time | $t_{rr}$ | $T_J$ = 25 °C, $I_F$ = 3.3 A, dI/dt = 100 A/µs [b] | - | 150 | 310 | ns |
| Body Diode Reverse Recovery Charge | $Q_{rr}$ | | - | 0.60 | 1.4 | µC |
| Forward Turn-On Time | $t_{on}$ | Intrinsic turn-on time is negligible (turn-on is dominated by $L_S$ and $L_D$) | | | | |

**Notes**

a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).

b. Pulse width ≤ 300 µs; duty cycle ≤ 2 %.

## TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

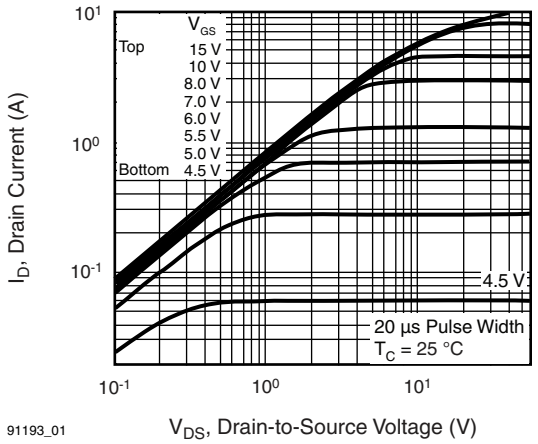



**Fig. 1 - Typical Output Characteristics, $T_C$ = 25 °C**

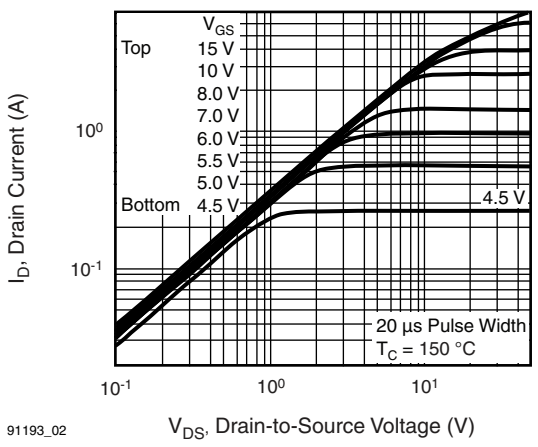



**Fig. 2 - Typical Output Characteristics, $T_C$ = 150 °C**

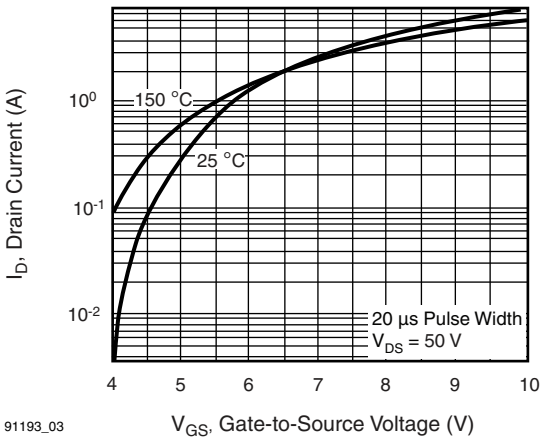



**Fig. 3 - Typical Transfer Characteristics**

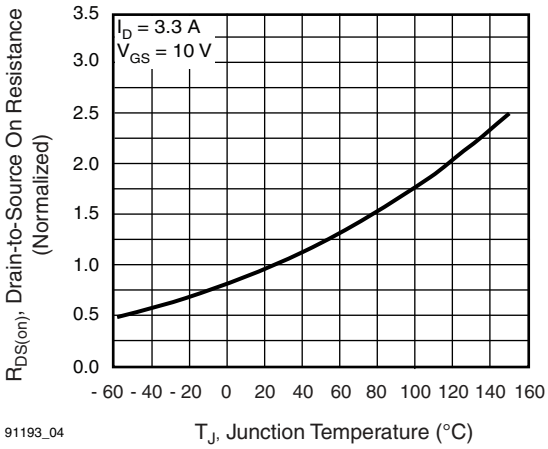



**Fig. 4 - Normalized On-Resistance vs. Temperature**

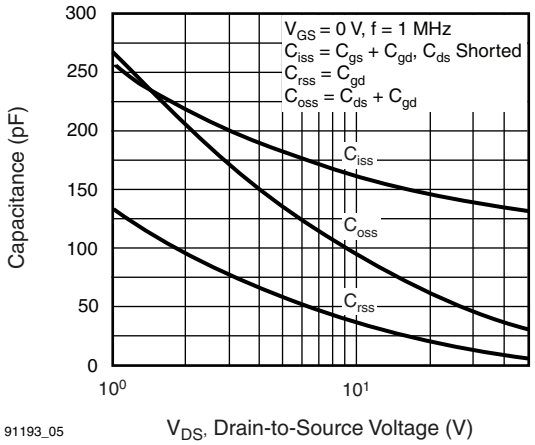



**Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage**

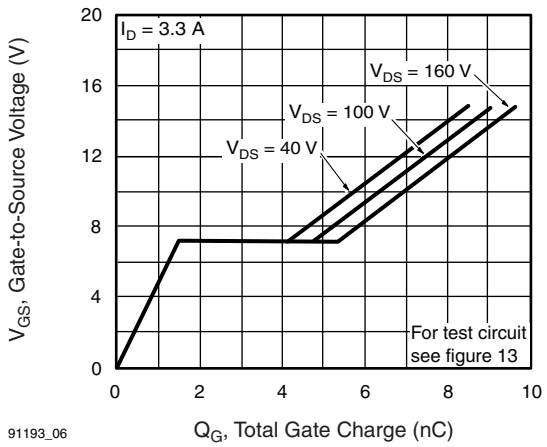



**Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage**

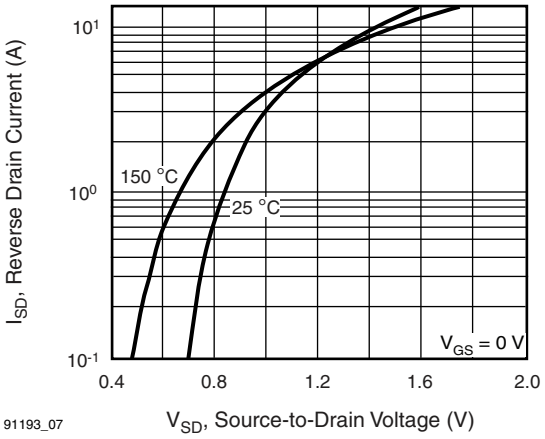



**Fig. 7 - Typical Source-Drain Diode Forward Voltage**

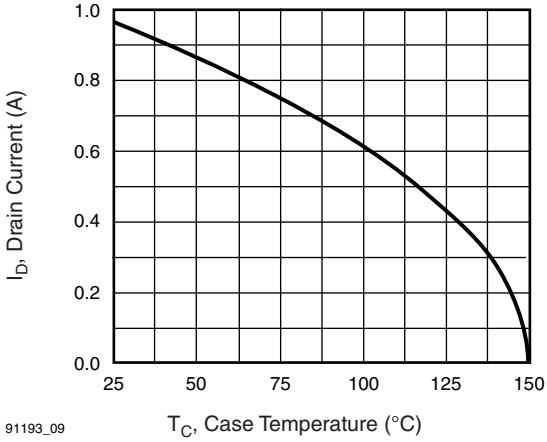



**Fig. 9 - Maximum Drain Current vs. Case Temperature**

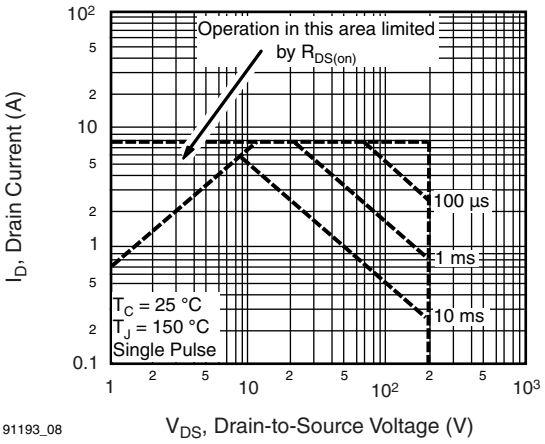



**Fig. 8 - Maximum Safe Operating Area**

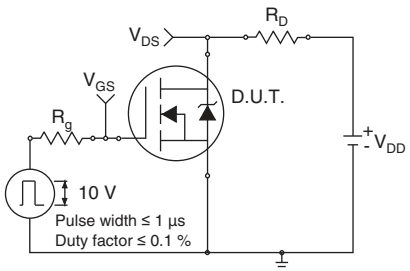



**Fig. 10a - Switching Time Test Circuit**

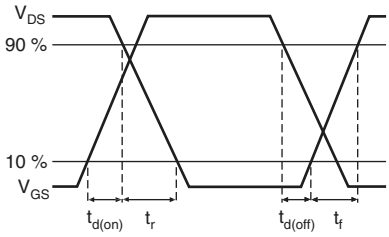



**Fig. 10b - Switching Time Waveforms**

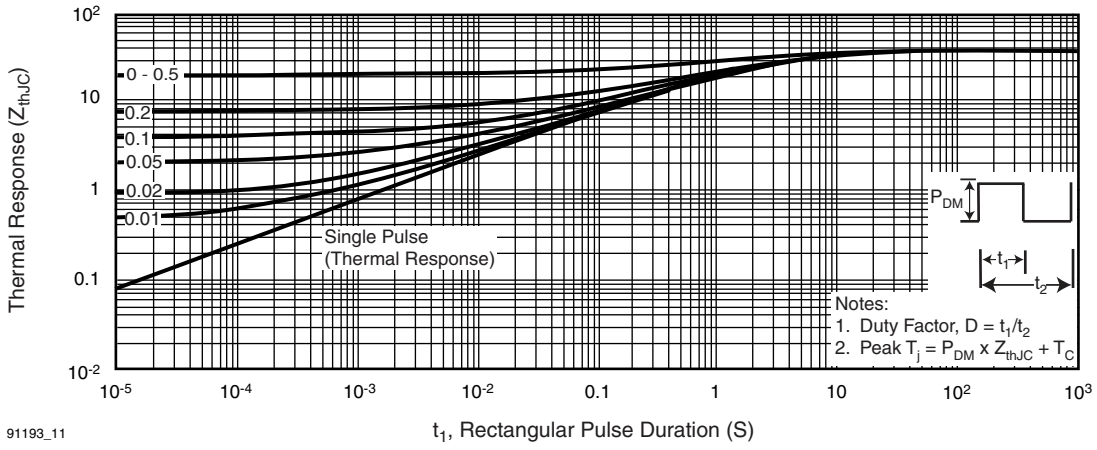



**Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case**

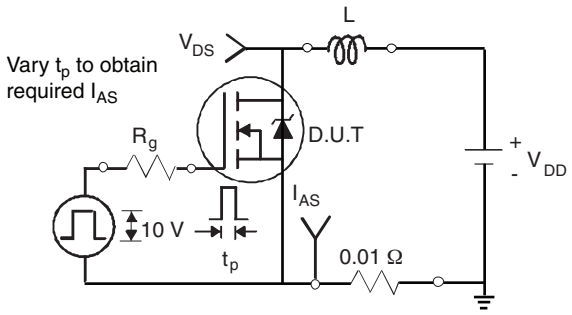



**Fig. 12a - Unclamped Inductive Test Circuit**

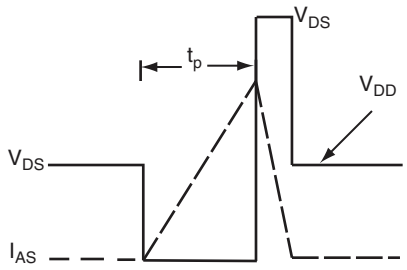



**Fig. 12b - Unclamped Inductive Waveforms**

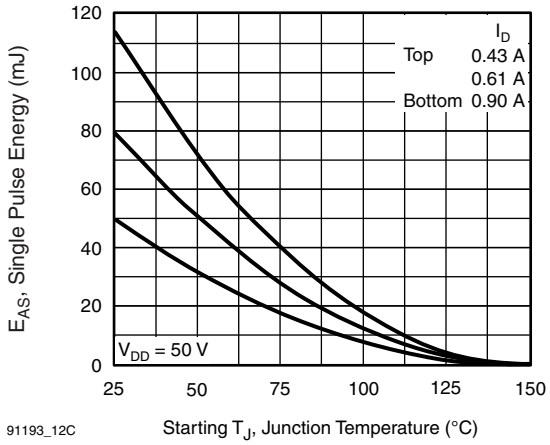



**Fig. 12c - Maximum Avalanche Energy vs. Drain Current**

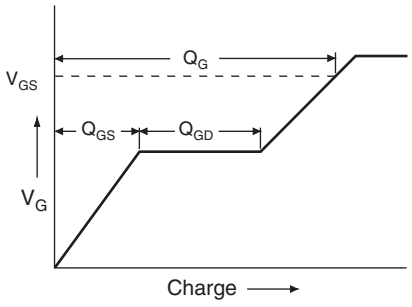



**Fig. 13a - Basic Gate Charge Waveform**

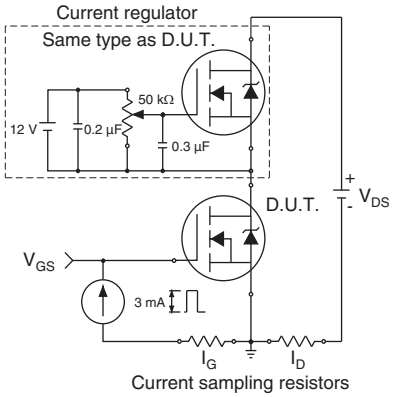
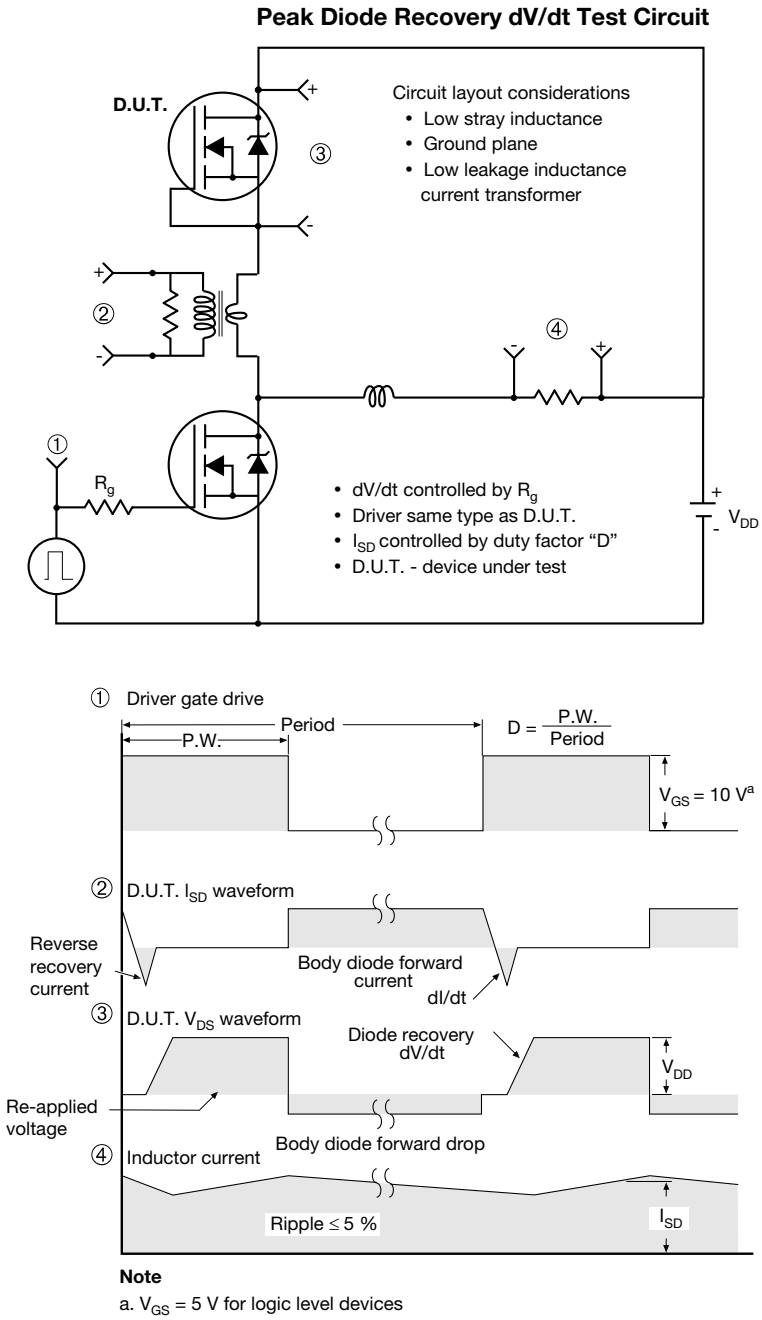



**Fig. 13b - Gate Charge Test Circuit**

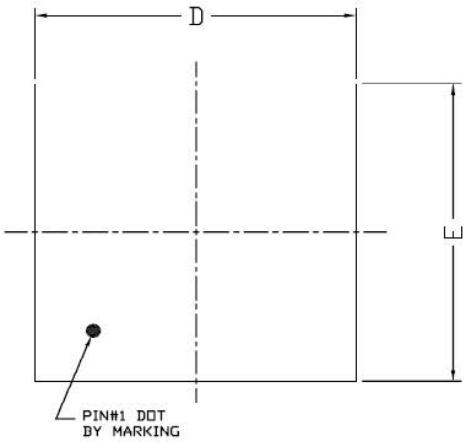


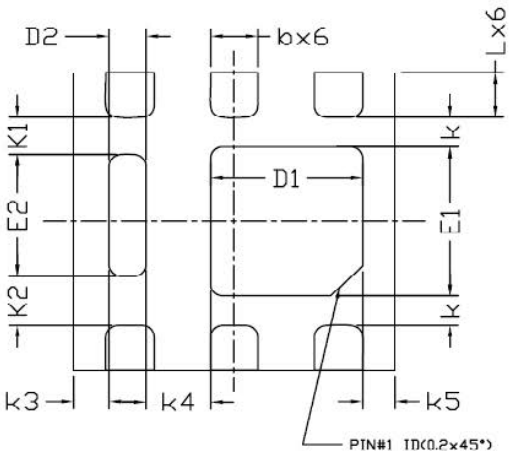

**Note**

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

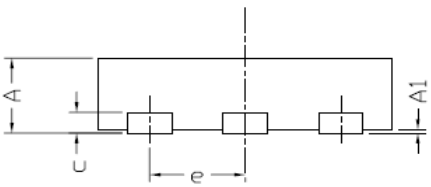
**Fig. 14 - For N-Channel**

# DFN2x2 _6L_EP1_S PACKAGE OUTLINE

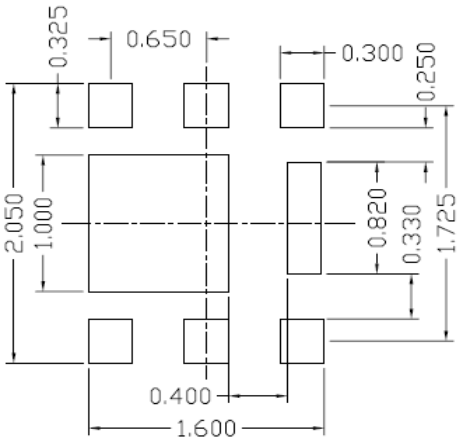



BOTTOM VIEW




RECOMMENDED LAND PATTERN




UNIT: mm

| SYMBOLS | DIMENSIONS IN MILLIMETERS | | | DIMENSIONS IN INCHES | | |
|---|---|---|---|---|---|---|
| | MIN | NOM | MAX | MIN | NOM | MAX |
| A | 0.50 | 0.55 | 0.60 | 0.020 | 0.022 | 0.024 |
| A1 | 0.00 | — | 0.05 | 0.000 | — | 0.002 |
| b | 0.25 | 0.30 | 0.35 | 0.010 | 0.012 | 0.014 |
| c | 0.152 REF | | | 0.006 REF | | |
| D | 1.90 | 2.00 | 2.10 | 0.075 | 0.079 | 0.083 |
| D1 | 0.85 | 0.95 | 1.05 | 0.033 | 0.037 | 0.041 |
| D2 | 0.13 | 0.23 | 0.33 | 0.005 | 0.009 | 0.013 |
| E | 1.90 | 2.00 | 2.10 | 0.075 | 0.079 | 0.083 |
| E1 | 0.90 | 1.00 | 1.10 | 0.035 | 0.039 | 0.043 |
| E2 | 0.72 | 0.82 | 0.92 | 0.028 | 0.032 | 0.036 |
| e | 0.65 BSC | | | 0.026 BSC | | |
| K | 0.20 BSC | | | 0.008 BSC | | |
| K1 | 0.25 BSC | | | 0.010 BSC | | |
| K2 | 0.33 BSC | | | 0.013 BSC | | |
| K3 | 0.22 BSC | | | 0.009 BSC | | |
| K4 | 0.40 BSC | | | 0.016 BSC | | |
| K5 | 0.20 BSC | | | 0.008 BSC | | |
| L | 0.25 | 0.30 | 0.35 | 0.010 | 0.012 | 0.014 |

NOTE
1. CONTROLLING DIMENSION IS MILLIMETER.
CONVERTED INCH DIMENSIONS ARE NOT NECESSARILY EXACT.

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