

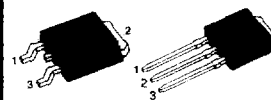
## FEATURES

- Avalanche Rugged Technology
- Rugged Gate Oxide Technology
- Lower Input Capacitance
- Improved Gate Charge
- Extended Safe Operating Area
- Lower Leakage Current : 25  $\mu$ A (Max.) @  $V_{DS} = 600V$
- Lower  $R_{DS(ON)}$  : 2.037  $\Omega$  (Typ.)

$$BV_{DSS} = 600 V$$

$$R_{DS(on)} = 2.5 \Omega$$

$$I_D = 4 A$$

**D<sup>2</sup>-PAK    P-PAK**

**1. Gate 2. Drain 3. Source**

## Absolute Maximum Ratings

| Symbol         | Characteristic                                                          | Value        | Units         |
|----------------|-------------------------------------------------------------------------|--------------|---------------|
| $V_{DSS}$      | Drain-to-Source Voltage                                                 | 600          | V             |
| $I_D$          | Continuous Drain Current ( $T_C=25^\circ C$ )                           | 4            | A             |
|                | Continuous Drain Current ( $T_C=100^\circ C$ )                          | 2.5          |               |
| $I_{DM}$       | Drain Current-Pulsed ①                                                  | 16           | A             |
| $V_{GS}$       | Gate-to-Source Voltage                                                  | $\pm 30$     | V             |
| $E_{AS}$       | Single Pulsed Avalanche Energy ②                                        | 262          | mJ            |
| $I_{AR}$       | Avalanche Current ①                                                     | 4            | A             |
| $E_{AR}$       | Repetitive Avalanche Energy ①                                           | 10           | mJ            |
| $dv/dt$        | Peak Diode Recovery $dv/dt$ ③                                           | 3.0          | V/ns          |
| $P_D$          | Total Power Dissipation ( $T_A=25^\circ C$ ) *                          | 3.1          | W             |
|                | Total Power Dissipation ( $T_C=25^\circ C$ )                            | 100          | W             |
|                | Linear Derating Factor                                                  | 0.8          | W/ $^\circ C$ |
| $T_J, T_{STG}$ | Operating Junction and Storage Temperature Range                        | - 55 to +150 | $^\circ C$    |
| $T_L$          | Maximum Lead Temp. for Soldering Purposes, 1/8" from case for 5-seconds | 300          |               |

## Thermal Resistance

| Symbol          | Characteristic        | Typ. | Max. | Units        |
|-----------------|-----------------------|------|------|--------------|
| $R_{\theta JC}$ | Junction-to-Case      | —    | 1.25 | $^\circ C/W$ |
| $R_{\theta JA}$ | Junction-to-Ambient * | —    | 40   |              |
| $R_{\theta JA}$ | Junction-to-Ambient   | —    | 62.5 |              |

\* When mounted on the minimum pad size recommended (PCB Mount).

**Electrical Characteristics** ( $T_c=25^\circ\text{C}$  unless otherwise specified)

| Symbol                 | Characteristic                          | Min. | Typ. | Max. | Units    | Test Condition                                                              |
|------------------------|-----------------------------------------|------|------|------|----------|-----------------------------------------------------------------------------|
| $BV_{DSS}$             | Drain-Source Breakdown Voltage          | 600  | —    | —    | V        | $V_{GS}=0V, I_D=250\mu A$                                                   |
| $\Delta BV/\Delta T_J$ | Breakdown Voltage Temp. Coeff.          | —    | 0.68 | —    | V/°C     | $I_D=250\mu A$ <b>See Fig 7</b>                                             |
| $V_{GS(th)}$           | Gate Threshold Voltage                  | 2.0  | —    | 4.0  | V        | $V_{DS}=5V, I_D=250\mu A$                                                   |
| $I_{GSS}$              | Gate-Source Leakage, Forward            | —    | —    | 100  | nA       | $V_{GS}=30V$                                                                |
|                        | Gate-Source Leakage, Reverse            | —    | —    | -100 |          | $V_{GS}=-30V$                                                               |
| $I_{DSS}$              | Drain-to-Source Leakage Current         | —    | —    | 25   | $\mu A$  | $V_{DS}=600V$                                                               |
|                        |                                         | —    | —    | 250  |          | $V_{DS}=480V, T_c=125^\circ\text{C}$                                        |
| $R_{DS(on)}$           | Static Drain-Source On-State Resistance | —    | —    | 2.5  | $\Omega$ | $V_{GS}=10V, I_D=2A$ ④                                                      |
| $g_{fs}$               | Forward Transconductance                | —    | 3.32 | —    | S        | $V_{DS}=50V, I_D=2A$ ④                                                      |
| $C_{iss}$              | Input Capacitance                       | —    | 545  | 710  | pF       | $V_{GS}=0V, V_{DS}=25V, f=1\text{MHz}$<br><b>See Fig 5</b>                  |
| $C_{oss}$              | Output Capacitance                      | —    | 63   | 75   |          |                                                                             |
| $C_{rss}$              | Reverse Transfer Capacitance            | —    | 25   | 30   |          |                                                                             |
| $t_{d(on)}$            | Turn-On Delay Time                      | —    | 14   | 40   | ns       | $V_{DD}=300V, I_D=4A,$<br>$R_G=12\Omega$<br><b>See Fig 13</b> ④ ⑤           |
| $t_r$                  | Rise Time                               | —    | 16   | 45   |          |                                                                             |
| $t_{d(off)}$           | Turn-Off Delay Time                     | —    | 49   | 110  |          |                                                                             |
| $t_f$                  | Fall Time                               | —    | 22   | 55   |          |                                                                             |
| $Q_g$                  | Total Gate Charge                       | —    | 25   | 34   | nC       | $V_{DS}=480V, V_{GS}=10V,$<br>$I_D=4A$<br><b>See Fig 6 &amp; Fig 12</b> ④ ⑤ |
| $Q_{gs}$               | Gate-Source Charge                      | —    | 4    | —    |          |                                                                             |
| $Q_{gd}$               | Gate-Drain("Miller") Charge             | —    | 11.9 | —    |          |                                                                             |

**Source-Drain Diode Ratings and Characteristics**

| Symbol   | Characteristic            | Min. | Typ. | Max. | Units   | Test Condition                            |
|----------|---------------------------|------|------|------|---------|-------------------------------------------|
| $I_S$    | Continuous Source Current | —    | —    | 4    | A       | Integral reverse pn-diode in the MOSFET   |
| $I_{SM}$ | Pulsed-Source Current ①   | —    | —    | 16   |         |                                           |
| $V_{SD}$ | Diode Forward Voltage ④   | —    | —    | 1.4  | V       | $T_J=25^\circ\text{C}, I_S=4A, V_{GS}=0V$ |
| $t_{rr}$ | Reverse Recovery Time     | —    | 350  | —    | ns      | $T_J=25^\circ\text{C}, I_F=4A$            |
| $Q_{rr}$ | Reverse Recovery Charge   | —    | 2.15 | —    | $\mu C$ | $di_F/dt=100A/\mu s$ ④                    |

**Notes ;**

- ① Repetitive Rating : Pulse Width Limited by Maximum Junction Temperature
- ②  $L=30\text{mH}, I_{AS}=4A, V_{DD}=50V, R_G=27\Omega$ , Starting  $T_J=25^\circ\text{C}$
- ③  $I_{SD}\leq 4A, di/dt\leq 100A/\mu s, V_{DD}\leq BV_{DSS}$ , Starting  $T_J=25^\circ\text{C}$
- ④ Pulse Test : Pulse Width = 250  $\mu s$ , Duty Cycle  $\leq 2\%$
- ⑤ Essentially Independent of Operating Temperature

Fig 1. Output Characteristics

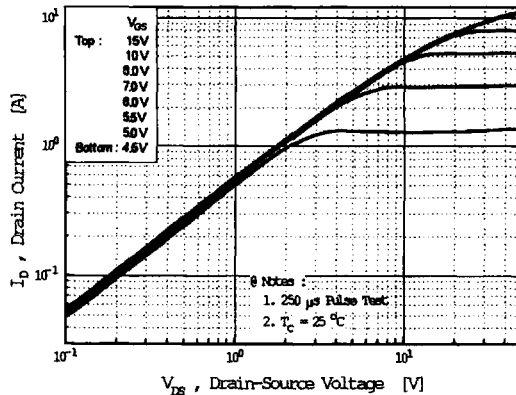


Fig 2. Transfer Characteristics

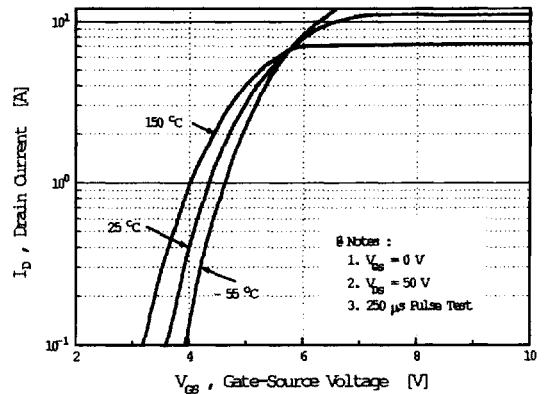


Fig 3. On-Resistance vs. Drain Current

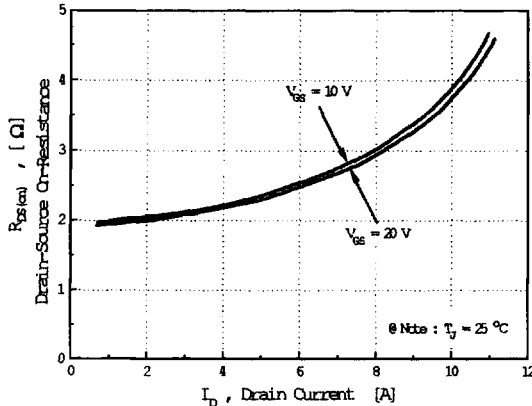


Fig 4. Source-Drain Diode Forward Voltage

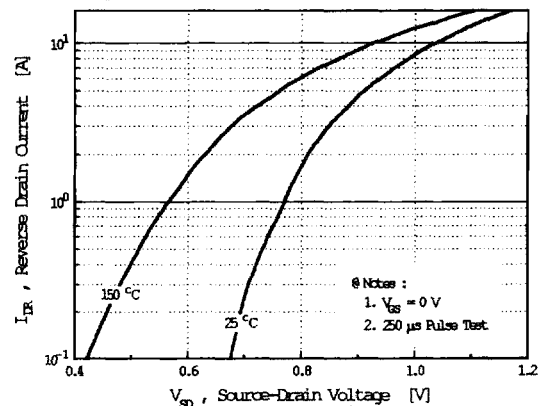


Fig 5. Capacitance vs. Drain-Source Voltage

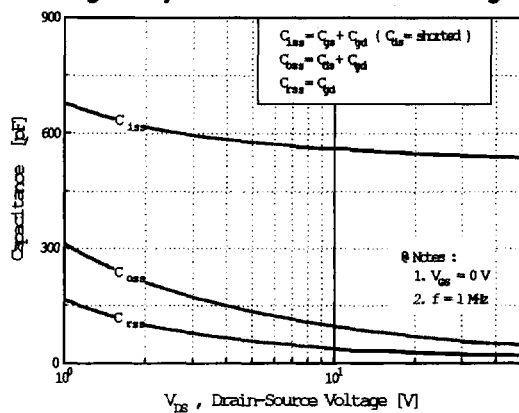
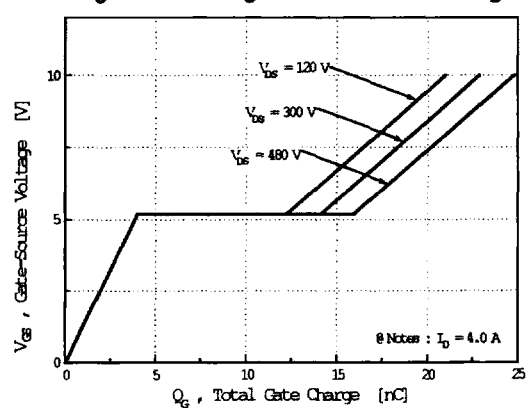
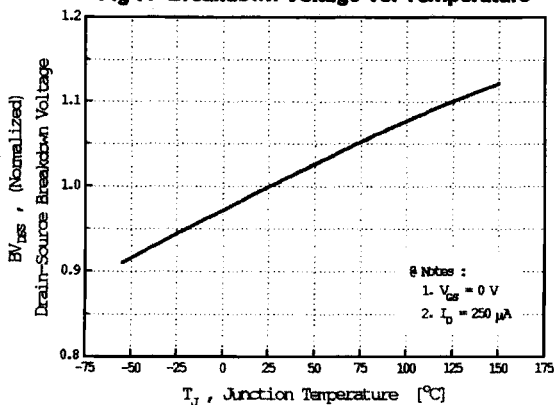


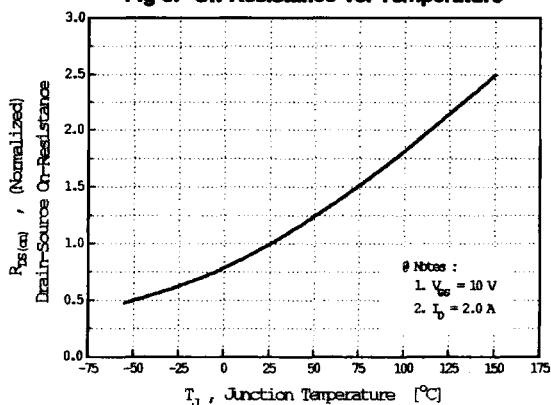
Fig 6. Gate Charge vs. Gate-Source Voltage



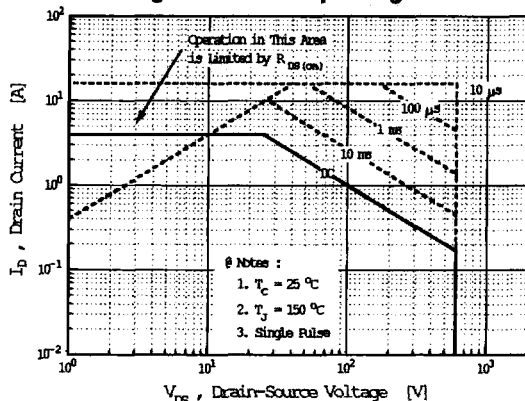
**Fig 7. Breakdown Voltage vs. Temperature**



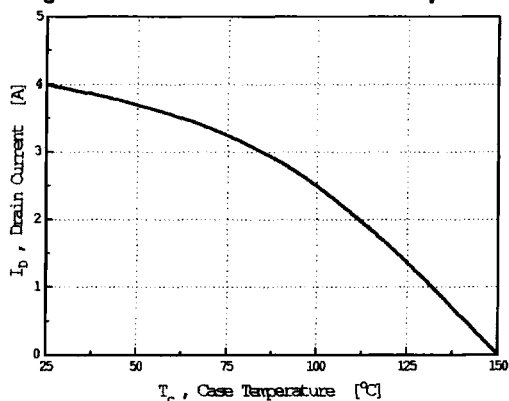
**Fig 8. On-Resistance vs. Temperature**



**Fig 9. Max. Safe Operating Area**



**Fig 10. Max. Drain Current vs. Case Temperature**



**Fig 11. Thermal Response**

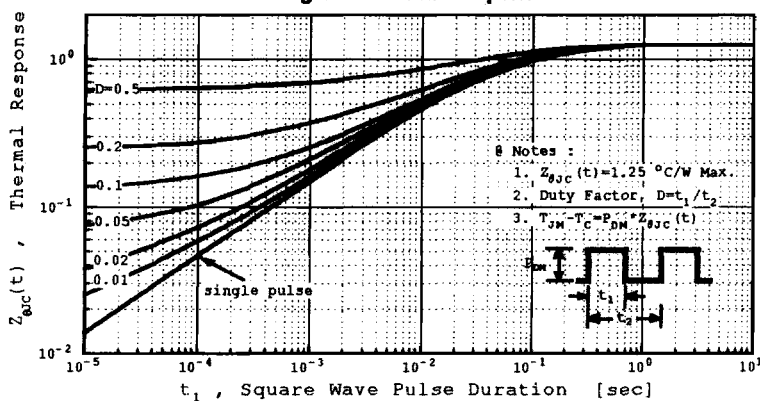


Fig 12. Gate Charge Test Circuit & Waveform

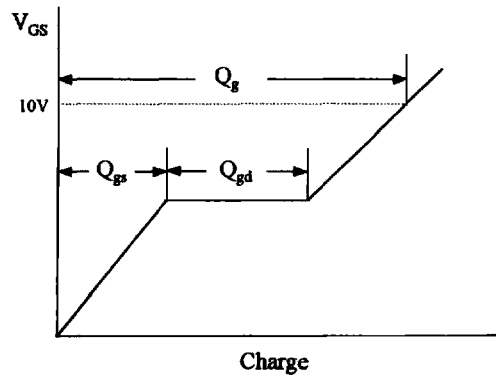
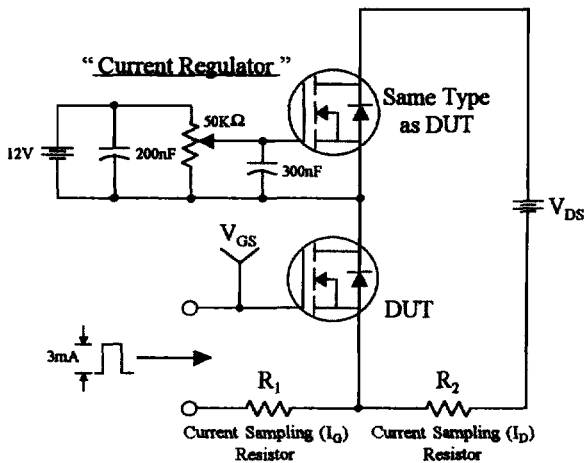


Fig 13. Resistive Switching Test Circuit & Waveforms

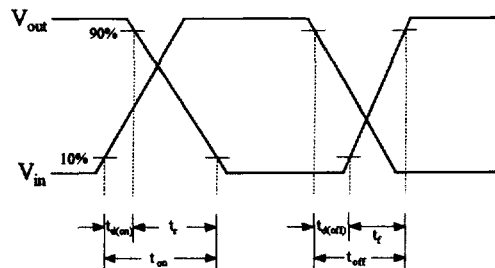
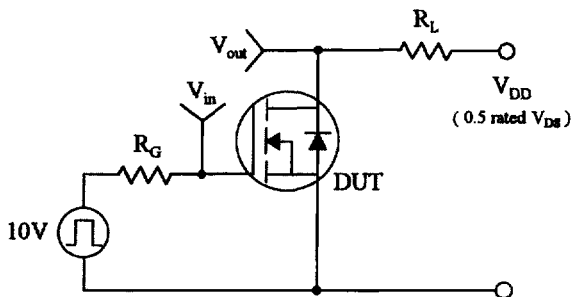


Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms

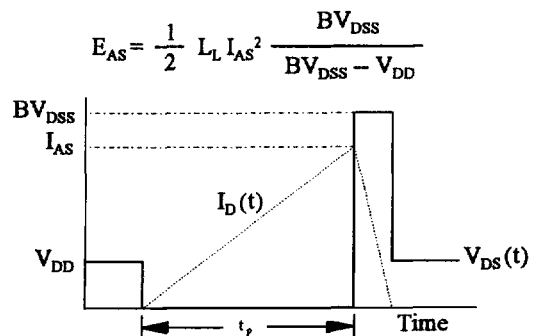
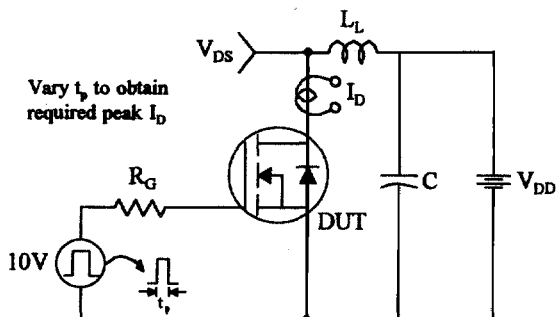


Fig 15. Peak Diode Recovery dv/dt Test Circuit &amp; Waveforms

