

## FEATURES

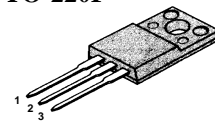
- Avalanche Rugged Technology
- Rugged Gate Oxide Technology
- Lower Input Capacitance
- Improved Gate Charge
- Extended Safe Operating Area
- Lower Leakage Current : 10  $\mu$ A (Max.) @  $V_{DS} = -200V$
- Low  $R_{DS(ON)}$  : 0.344  $\Omega$  (Typ.)

$$BV_{DSS} = -200 V$$

$$R_{DS(on)} = 0.5 \Omega$$

$$I_D = -6.2 A$$

TO-220F



1.Gate 2. Drain 3. Source

## Absolute Maximum Ratings

| Symbol         | Characteristic   | Value        | Units      |
|----------------|--|--------------|------------|
| $V_{DSS}$      | Drain-to-Source Voltage  | -200         | V          |
| $I_D$          | Continuous Drain Current ( $T_C=25^\circ C$ )                            | -6.2         | A          |
|                | Continuous Drain Current ( $T_C=100^\circ C$ )                           | -4.7         |            |
| $I_{DM}$       | Drain Current-Pulsed ①   | -25          | A          |
| $V_{GS}$       | Gate-to-Source Voltage   | $\pm 30$     | V          |
| $E_{AS}$       | Single Pulsed Avalanche Energy ②   | 256          | mJ         |
| $I_{AR}$       | Avalanche Current ①  | -6.2         | A          |
| $E_{AR}$       | Repetitive Avalanche Energy ①  | 4.0          | mJ         |
| dv/dt          | Peak Diode Recovery dv/dt ③  | -5.0         | V/ns       |
| $P_D$          | Total Power Dissipation ( $T_C=25^\circ C$ )                             | 40           | W          |
|                | Linear Derating Factor   | 0.32         |            |
| $T_J, T_{STG}$ | 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    | --   | 3.13 | $^\circ C/W$ |
| $R_{\theta JA}$ | Junction-to-Ambient | --   | 62.5 |              |

### 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          | -200 | --    | --   | V                   | $V_{GS}=0V, I_D=-250\mu A$  |
| $\Delta BV/\Delta T_J$ | Breakdown Voltage Temp. Coeff.          | --   | -0.16 | --   | V/ $^\circ\text{C}$ | $I_D=-250\mu A$ <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         | --   | --    | -10  | $\mu A$             | $V_{DS}=-200V$  |
|                        |   | --   | --    | -100 |                     | $V_{DS}=-160V, T_C=125^\circ\text{C}$   |
| $R_{DS(on)}$           | Static Drain-Source On-State Resistance | --   | --    | 0.5  | $\Omega$            | $V_{GS}=-10V, I_D=-3.1A$ ④  |
| $g_{fs}$               | Forward Transconductance                | --   | 5.8   | --   | $\Omega$            | $V_{DS}=-40V, I_D=-3.1A$ ④  |
| $C_{iss}$              | Input Capacitance                       | --   | 1220  | 1585 | pF                  | $V_{GS}=0V, V_{DS}=-25V, f=1\text{MHz}$<br><b>See Fig 5</b>                     |
| $C_{oss}$              | Output Capacitance                      | --   | 207   | 310  |                     |   |
| $C_{rss}$              | Reverse Transfer Capacitance            | --   | 81    | 120  |                     |   |
| $t_{d(on)}$            | Turn-On Delay Time                      | --   | 16    | 40   | ns                  | $V_{DD}=-100V, I_D=-11A,$<br>$R_G=9.1\Omega$<br><b>See Fig 13</b> ④ ⑤           |
| $t_r$                  | Rise Time                               | --   | 23    | 55   |                     |   |
| $t_{d(off)}$           | Turn-Off Delay Time                     | --   | 54    | 115  |                     |   |
| $t_f$                  | Fall Time                               | --   | 19    | 50   |                     |   |
| $Q_g$                  | Total Gate Charge                       | --   | 46    | 59   | nC                  | $V_{DS}=-160V, V_{GS}=-10V,$<br>$I_D=-11A$<br><b>See Fig 6 &amp; Fig 12</b> ④ ⑤ |
| $Q_{gs}$               | Gate-Source Charge                      | --   | 9.2   | --   |                     |   |
| $Q_{gd}$               | Gate-Drain( " Miller " ) Charge         | --   | 22.9  | --   |                     |   |

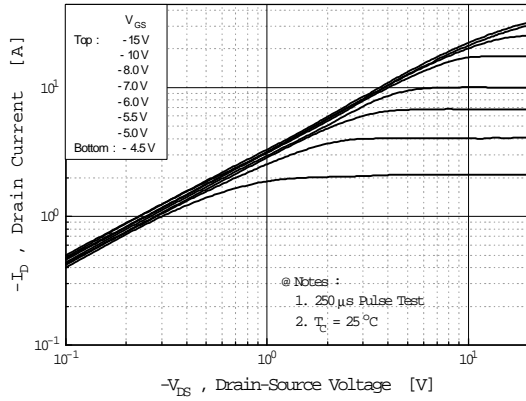
### Source-Drain Diode Ratings and Characteristics

| Symbol   | Characteristic            | Min. | Typ. | Max. | Units         | Test Condition                               |
|----------|---------------------------|------|------|------|---------------|--|
| $I_S$    | Continuous Source Current | --   | --   | -6.2 | A             | Integral reverse pn-diode in the MOSFET      |
| $I_{SM}$ | Pulsed-Source Current ①   | --   | --   | -25  |               |  |
| $V_{SD}$ | Diode Forward Voltage ④   | --   | --   | -5.0 | V             | $T_J=25^\circ\text{C}, I_S=-6.2A, V_{GS}=0V$ |
| $t_{rr}$ | Reverse Recovery Time     | --   | 180  | --   | ns            | $T_J=25^\circ\text{C}, I_F=-11A$             |
| $Q_{rr}$ | Reverse Recovery Charge   | --   | 1.24 | --   | $\mu\text{C}$ | $di_F/dt=100A/\mu\text{s}$ ④                 |

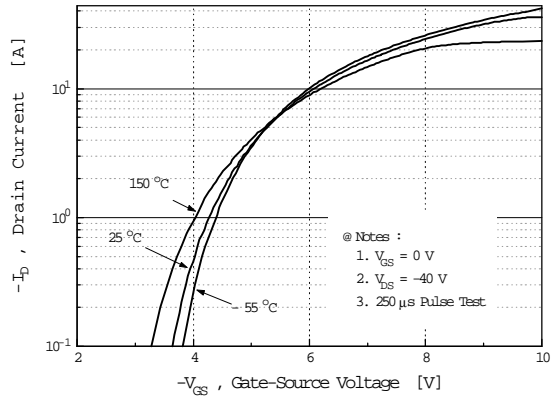
#### Notes ;

- ① Repetitive Rating : Pulse Width Limited by Maximum Junction Temperature
- ②  $L=10\text{mH}, I_{AS}=-6.2A, V_{DD}=-50V, R_G=27\Omega^*,$  Starting  $T_J=25^\circ\text{C}$
- ③  $I_{SD} \leq -11A, di/dt \leq 450A/\mu\text{s}, V_{DD} \leq BV_{DSS},$  Starting  $T_J=25^\circ\text{C}$
- ④ Pulse Test : Pulse Width = 250  $\mu\text{s}$ , Duty Cycle  $\leq 2\%$
- ⑤ Essentially Independent of Operating Temperature

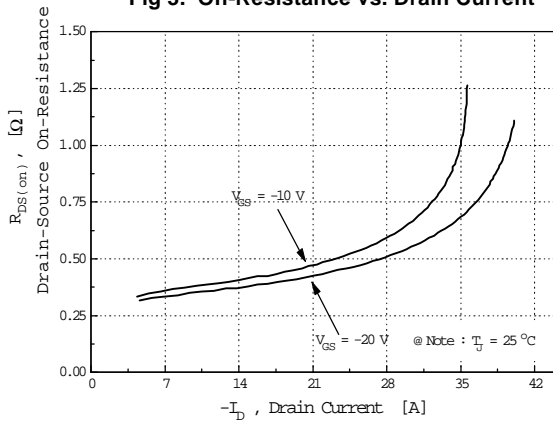
**Fig 1. Output Characteristics**



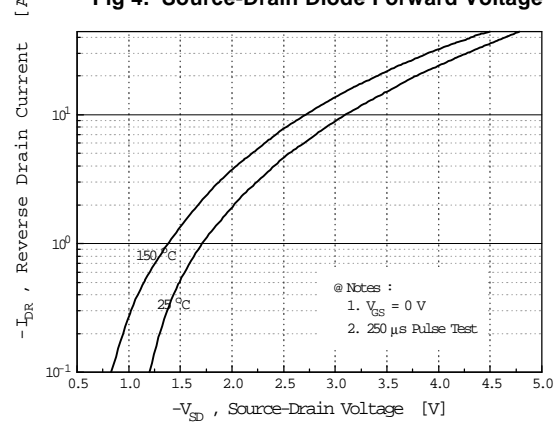
**Fig 2. Transfer Characteristics**



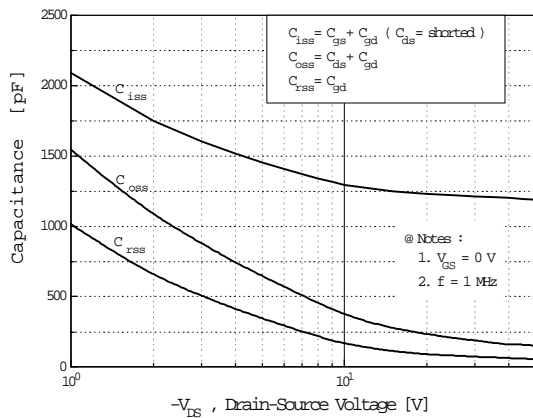
**Fig 3. On-Resistance vs. Drain Current**



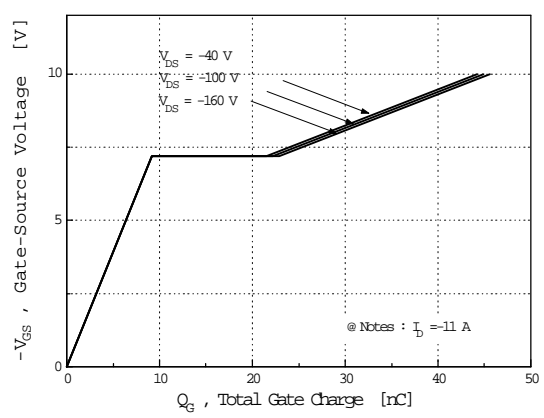
**Fig 4. Source-Drain Diode Forward Voltage**

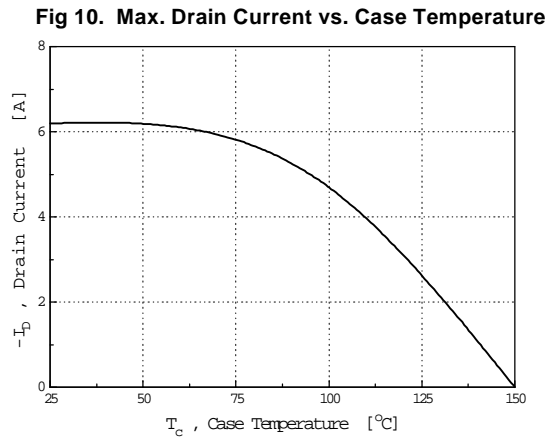
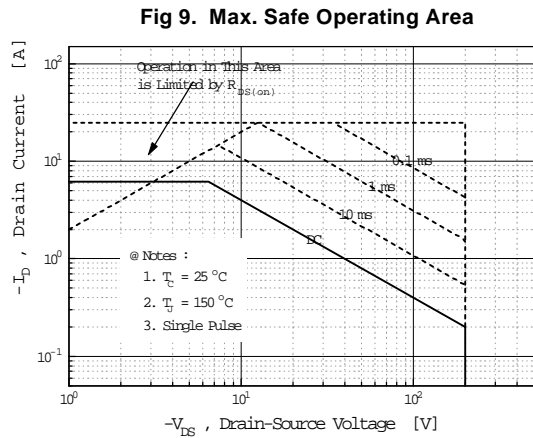
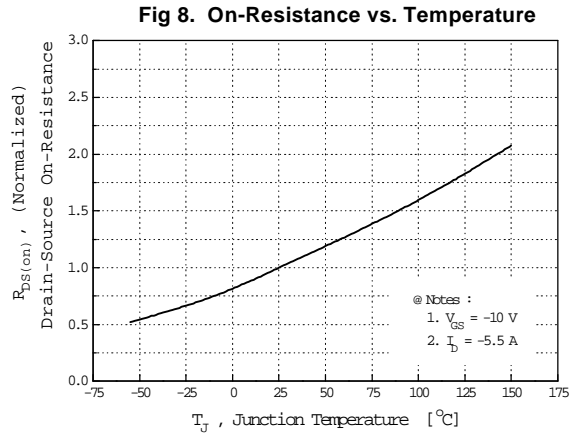
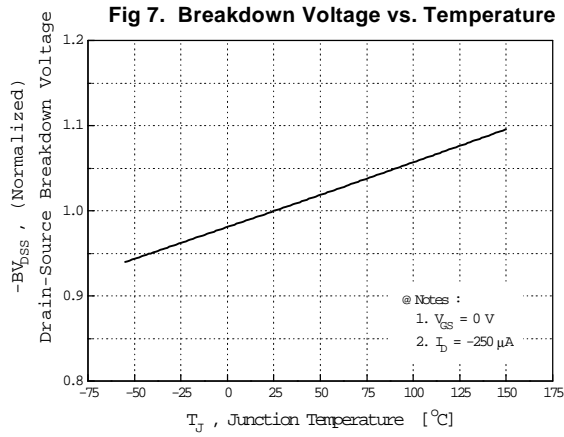


**Fig 5. Capacitance vs. Drain-Source Voltage**



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





**Fig 11. Thermal Response**

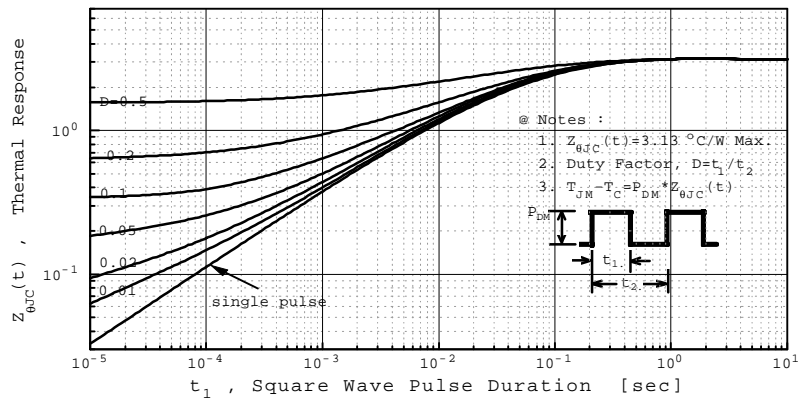


Fig 12. Gate Charge Test Circuit & Waveform

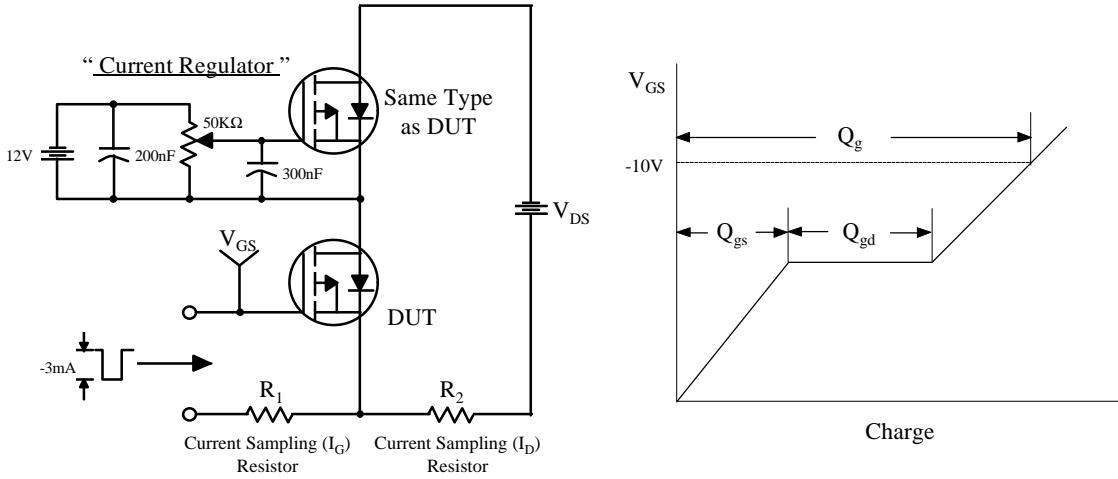


Fig 13. Resistive Switching Test Circuit & Waveforms

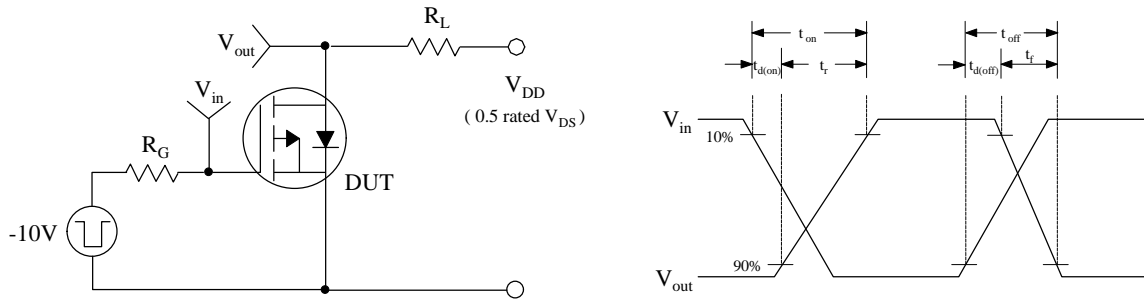


Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms

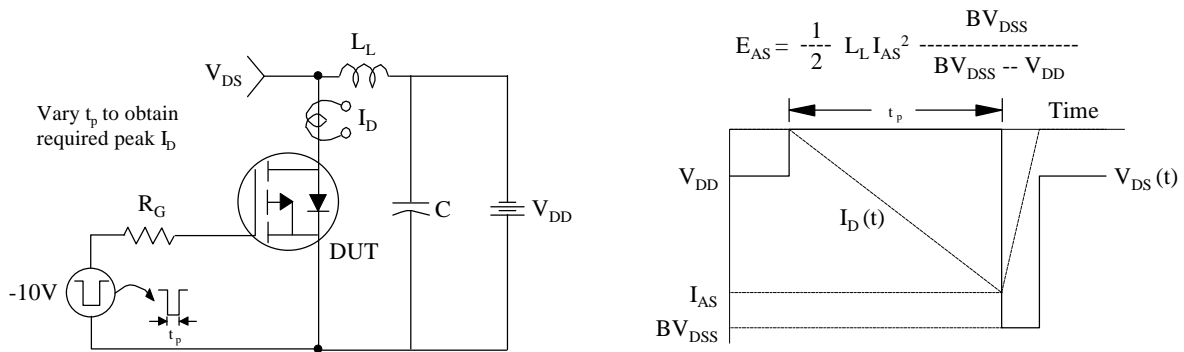
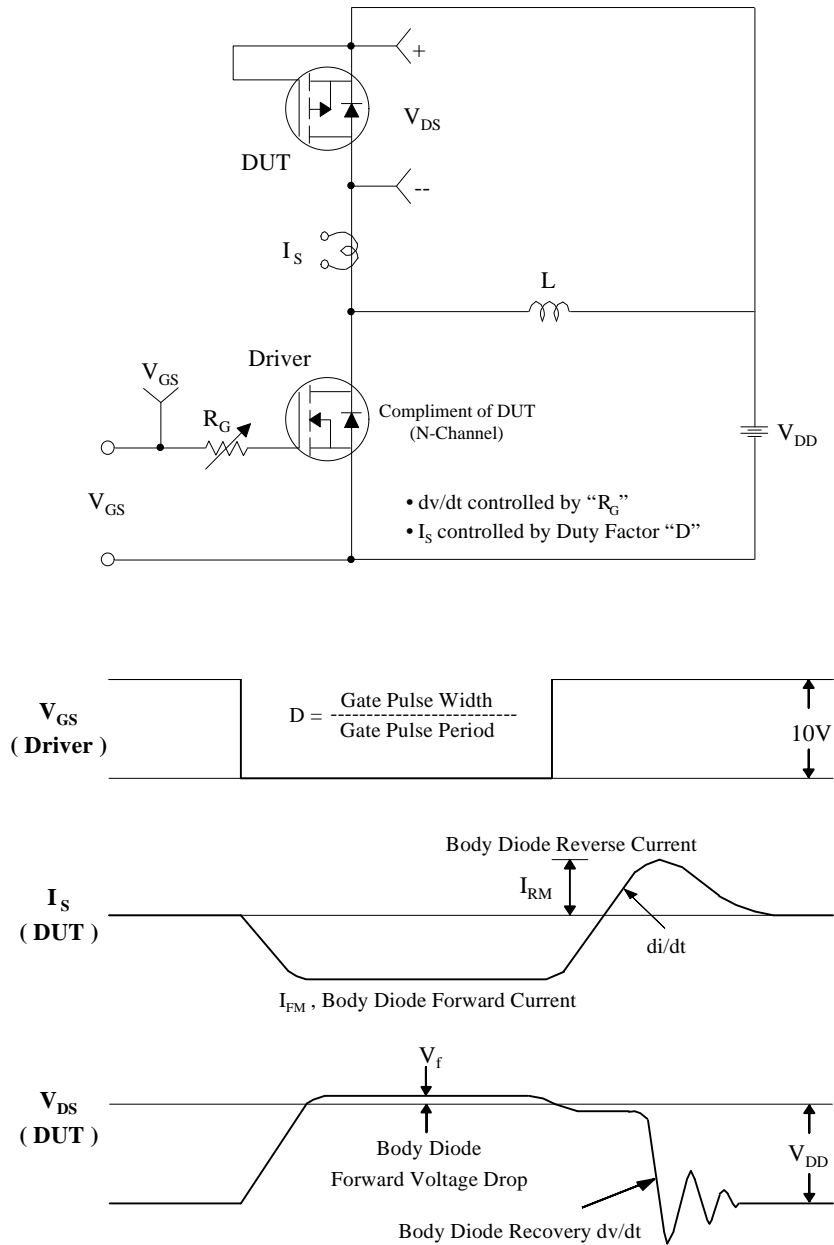


Fig 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



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| FACT™                | QST™          |      |
| FACT Quiet Series™   | Quiet Series™ |      |
| FAST®                | SuperSOT™-3   |      |
| FASTr™               | SuperSOT™-6   |      |
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