

## FEATURES

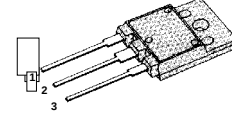
- ◆ Avalanche Rugged Technology
- ◆ Rugged Gate Oxide Technology
- ◆ Lower Input Capacitance
- ◆ Improved Gate Charge
- ◆ Extended Safe Operating Area
- ◆ Lower Leakage Current: 10 $\mu$ A (Max.) @  $V_{DS} = 500V$
- ◆ Lower  $R_{DS(on)}$ : 0.638 $\Omega$  (Typ.)

$$BV_{DSS} = 500 V$$

$$R_{DS(on)} = 0.85\Omega$$

$$I_D = 6.2 A$$

TO-3PF



1. Gate 2. Drain 3. Source

## Absolute Maximum Ratings

| Symbol         | Characteristic                                                          | Value        | Units               |
|----------------|-------------------------------------------------------------------------|--------------|---------------------|
| $V_{DSS}$      | Drain-to-Source Voltage                                                 | 500          | V                   |
| $I_D$          | Continuous Drain Current ( $T_C=25^\circ\text{C}$ )                     | 6.2          | A                   |
|                | Continuous Drain Current ( $T_C=100^\circ\text{C}$ )                    | 3.9          |                     |
| $I_{DM}$       | Drain Current-Pulsed (1)                                                | 34           | A                   |
| $V_{GS}$       | Gate-to-Source Voltage                                                  | $\pm 30$     | V                   |
| $E_{AS}$       | Single Pulsed Avalanche Energy (2)                                      | 641          | mJ                  |
| $I_{AR}$       | Avalanche Current (1)                                                   | 6.2          | A                   |
| $E_{AR}$       | Repetitive Avalanche Energy (1)                                         | 8.5          | mJ                  |
| dv/dt          | Peak Diode Recovery dv/dt (3)                                           | 3.5          | V/ns                |
| $P_D$          | Total Power Dissipation ( $T_C=25^\circ\text{C}$ )                      | 85           | W                   |
|                | Linear Derating Factor                                                  | 0.68         | W/ $^\circ\text{C}$ |
| $T_J, T_{STG}$ | Operating Junction and Storage Temperature Range                        | - 55 to +150 | $^\circ\text{C}$    |
| $T_L$          | 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    | --   | 1.46 | $^\circ\text{C/W}$ |
| $R_{\theta JA}$ | Junction-to-Ambient | --   | 40   |                    |

**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          | 500  | --   | --   | V          | $V_{GS}=0V, I_D=250\mu A$                                                       |
| $\Delta BV/\Delta T_J$ | Breakdown Voltage Temp. Coeff.          | --   | 0.66 | --   | 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         | --   | --   | 10   | $\mu A$    | $V_{DS}=500V$                                                                   |
|                        |                                         | --   | --   | 100  |            | $V_{DS}=400V, T_C=125^\circ\text{C}$                                            |
| $R_{DS(on)}$           | Static Drain-Source On-State Resistance | --   | --   | 0.85 | $\Omega$   | $V_{GS}=10V, I_D=3.1A$ (4)                                                      |
| $g_{fs}$               | Forward Transconductance                | --   | 5.73 | --   | $\text{S}$ | $V_{DS}=50V, I_D=3.1A$ (4)                                                      |
| $C_{iss}$              | Input Capacitance                       | --   | 1190 | 1550 | pF         | $V_{GS}=0V, V_{DS}=25V, f=1\text{MHz}$<br><b>See Fig 5</b>                      |
| $C_{oss}$              | Output Capacitance                      | --   | 150  | 175  |            |                                                                                 |
| $C_{rss}$              | Reverse Transfer Capacitance            | --   | 66   | 75   |            |                                                                                 |
| $t_{d(on)}$            | Turn-On Delay Time                      | --   | 18   | 45   | ns         | $V_{DD}=250V, I_D=8A,$<br>$R_G=9.1\Omega$<br><b>See Fig 13</b> (4) (5)          |
| $t_r$                  | Rise Time                               | --   | 22   | 55   |            |                                                                                 |
| $t_{d(off)}$           | Turn-Off Delay Time                     | --   | 83   | 175  |            |                                                                                 |
| $t_f$                  | Fall Time                               | --   | 30   | 70   |            |                                                                                 |
| $Q_g$                  | Total Gate Charge                       | --   | 57   | 74   | nC         | $V_{DS}=400V, V_{GS}=10V,$<br>$I_D=8A$<br><b>See Fig 6 &amp; Fig 12</b> (4) (5) |
| $Q_{gs}$               | Gate-Source Charge                      | --   | 7.5  | --   |            |                                                                                 |
| $Q_{gd}$               | Gate-Drain (. Miller. ) Charge          | --   | 28.4 | --   |            |                                                                                 |

**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) | --   | --   | 34   |         |                                             |
| $V_{SD}$ | Diode Forward Voltage (4) | --   | --   | 1.4  | V       | $T_J=25^\circ\text{C}, I_S=6.2A, V_{GS}=0V$ |
| $t_{rr}$ | Reverse Recovery Time     | --   | 370  | --   | ns      | $T_J=25^\circ\text{C}, I_F=8A$              |
| $Q_{rr}$ | Reverse Recovery Charge   | --   | 3.9  | --   | $\mu C$ | $di_F/dt=100A/\mu s$ (4)                    |

**Notes;**

- (1) Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature
- (2)  $L=30\text{mH}, I_{AS}=6.2A, V_{DD}=50V, R_G=27\Omega$ , Starting  $T_J=25^\circ\text{C}$
- (3)  $I_{SD} \leq 8A, di/dt \leq 160A/\mu s, V_{DD} \leq BV_{DSS}$ , 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

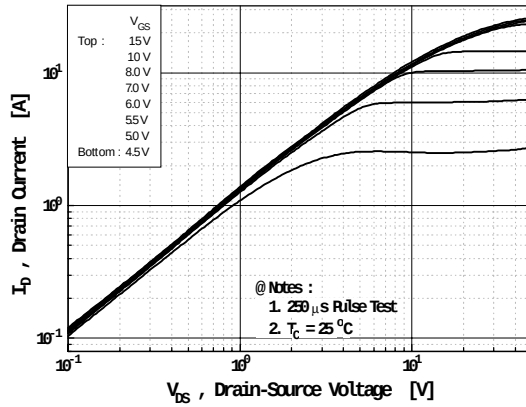


Fig 2. Transfer Characteristics

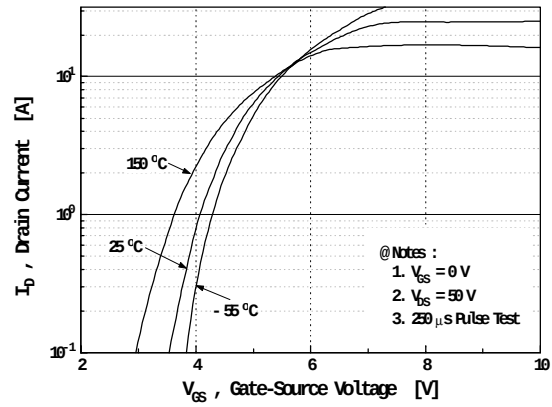


Fig 3. On-Resistance vs. Drain Current

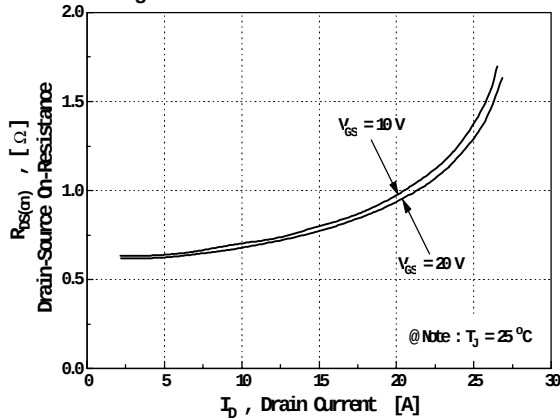


Fig 4. Source-Drain Diode Forward Voltage

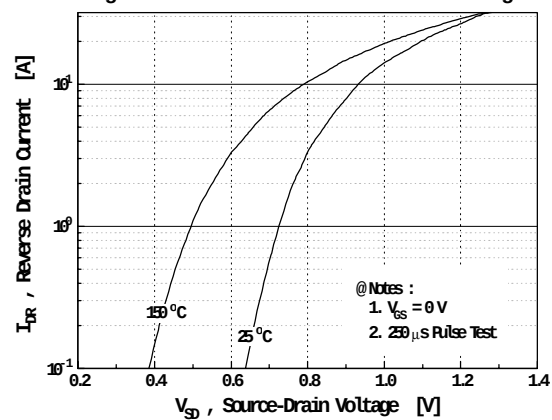


Fig 5. Capacitance vs. Drain-Source Voltage

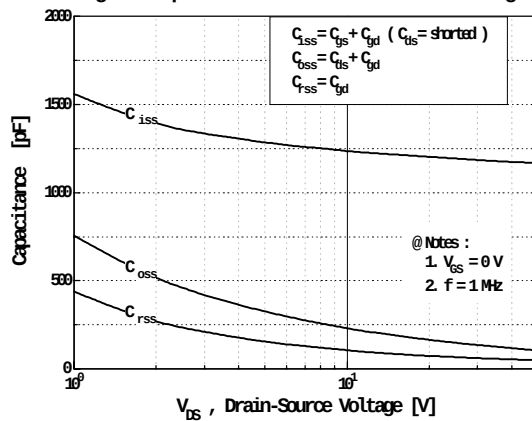


Fig 6. Gate Charge vs. Gate-Source Voltage

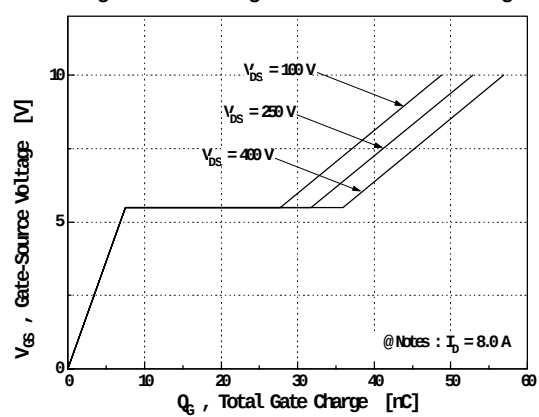


Fig 7. Breakdown Voltage vs. Temperature

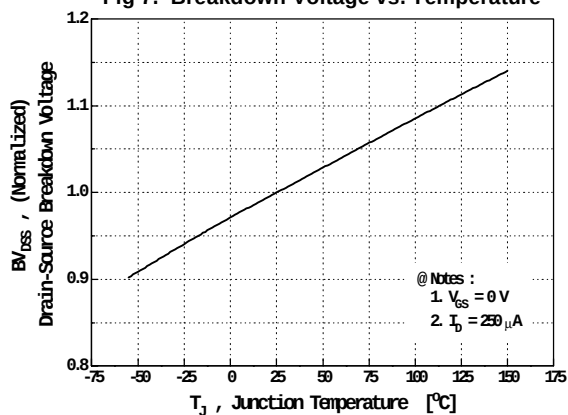


Fig 8. On-Resistance vs. Temperature

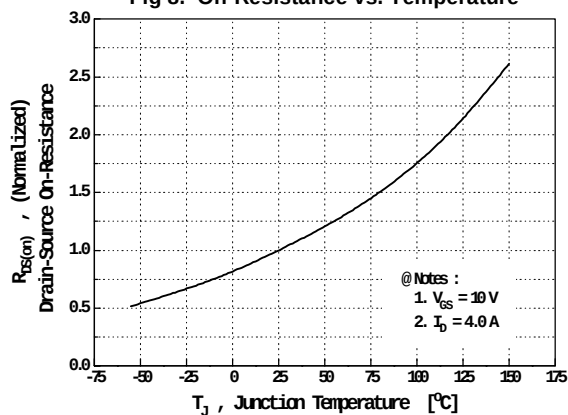


Fig 9. Max. Safe Operating Area

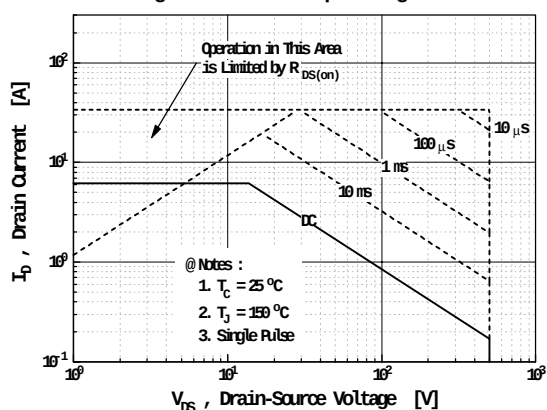


Fig 10. Max. Drain Current vs. Case Temperature

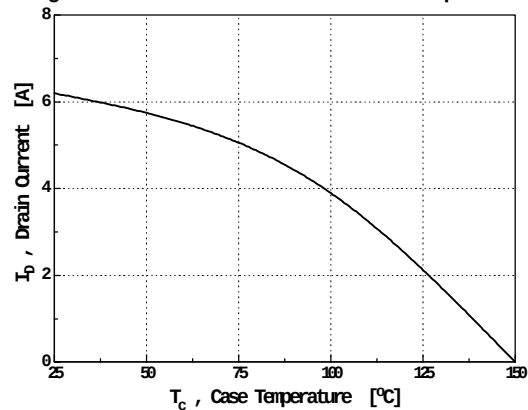
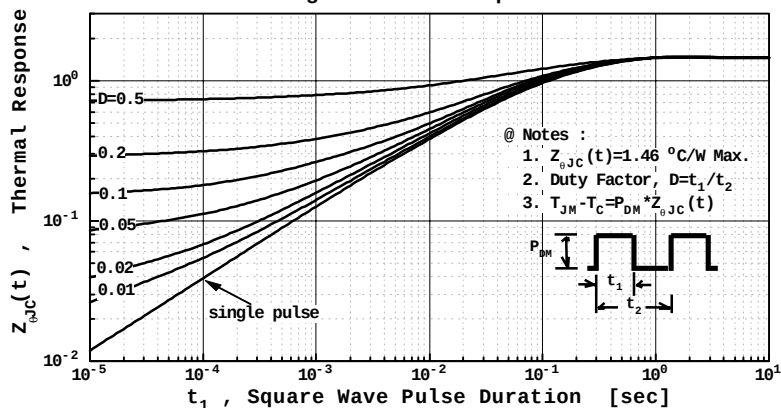
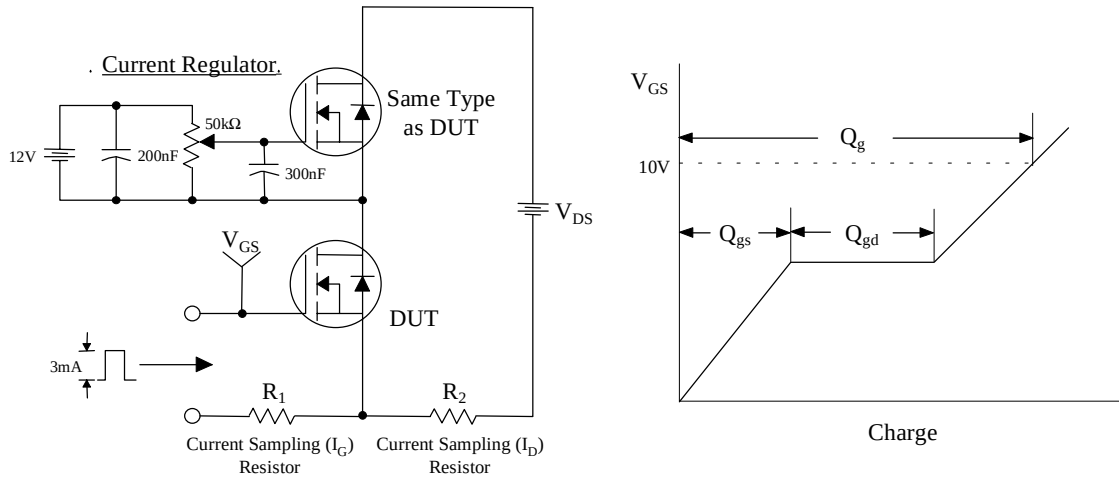


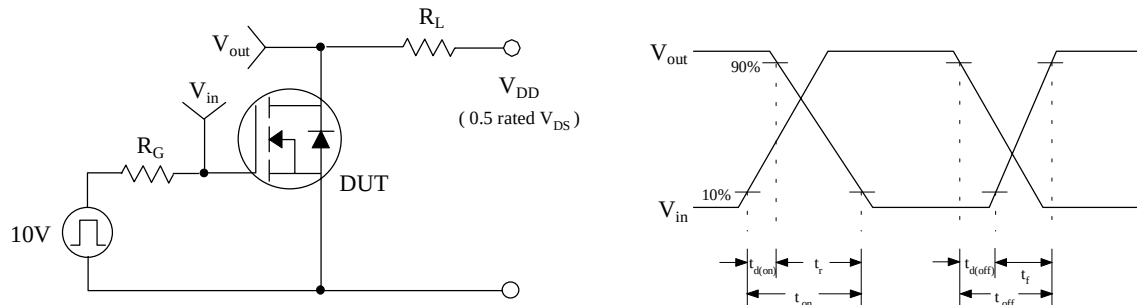
Fig 11. Thermal Response



**Fig 12. Gate Charge Test Circuit & Waveform**



**Fig 13. Resistive Switching Test Circuit & Waveforms**



**Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms**

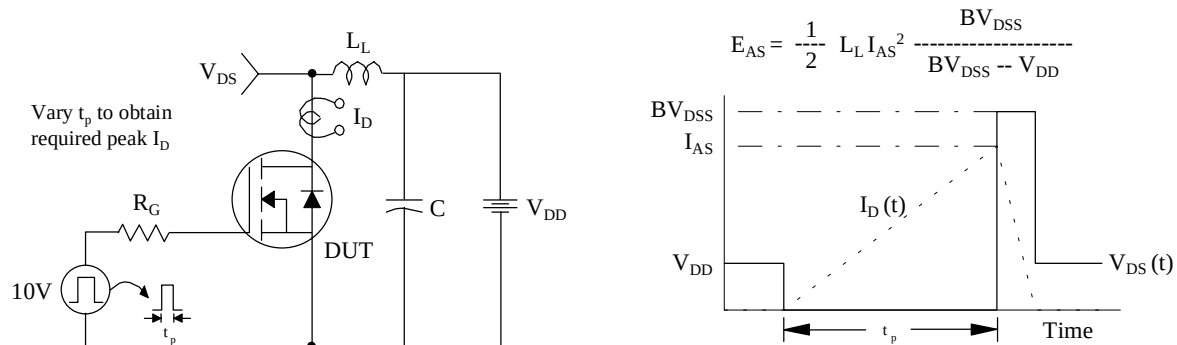
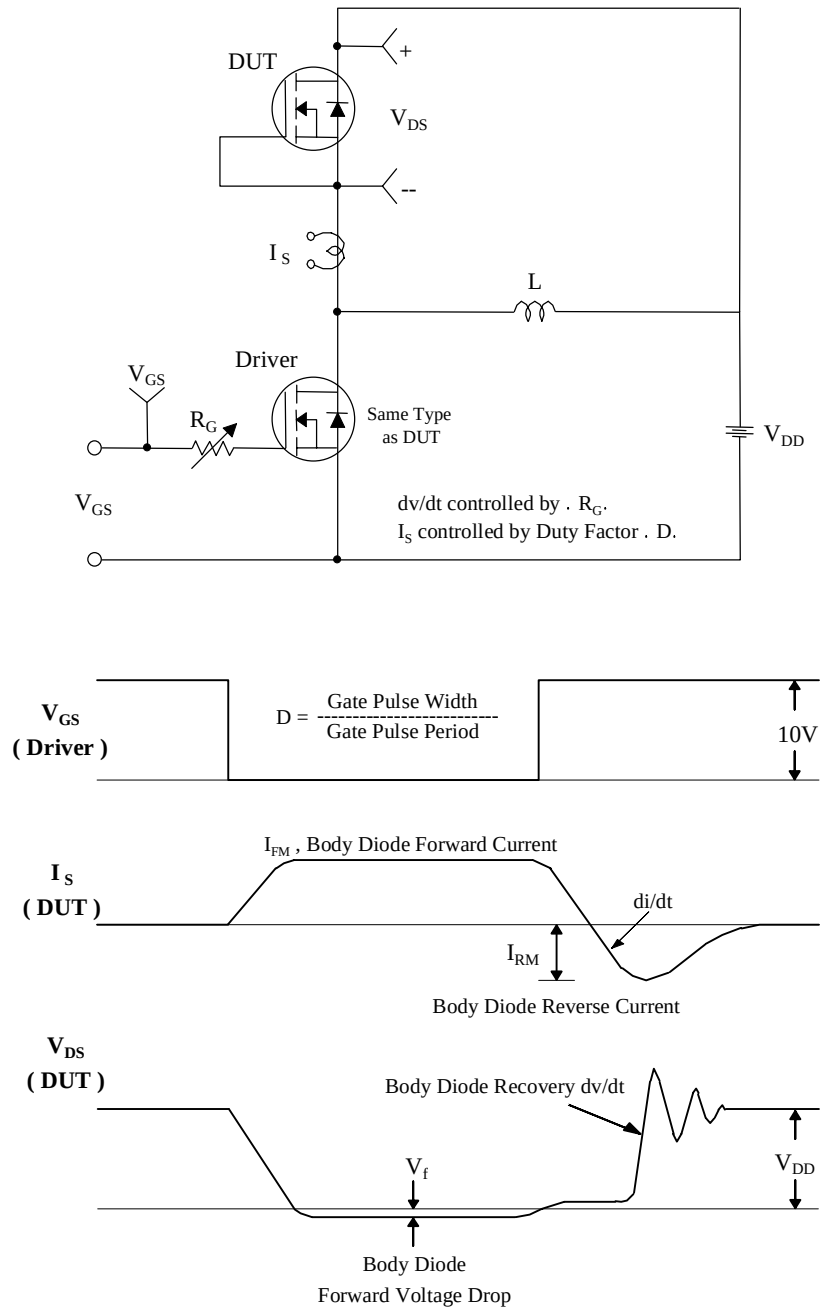


Fig 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



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| FACT™                | QS™           |
| FACT Quiet Series™   | Quiet Series™ |
| FAST®                | SuperSOT™-3   |
| FAST <sup>r</sup> ™  | SuperSOT™-6   |
| GTO™                 | SuperSOT™-8   |
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