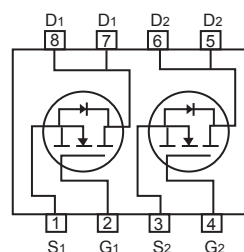
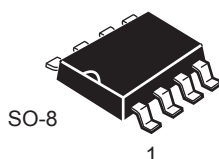


## Dual N-Channel Enhancement Mode Field Effect Transistor

PRELIMINARY

### FEATURES

- 60V, 9.0A,  $R_{DS(ON)} = 14.5m\Omega$  @  $V_{GS} = 10V$ .  
 $R_{DS(ON)} = 18.0m\Omega$  @  $V_{GS} = 4.5V$ .
- Super high dense cell design for extremely low  $R_{DS(ON)}$ .
- High power and current handling capability.
- Lead-free plating ; RoHS compliant.
- Surface mount Package.



### ABSOLUTE MAXIMUM RATINGS $T_A = 25^\circ\text{C}$ unless otherwise noted

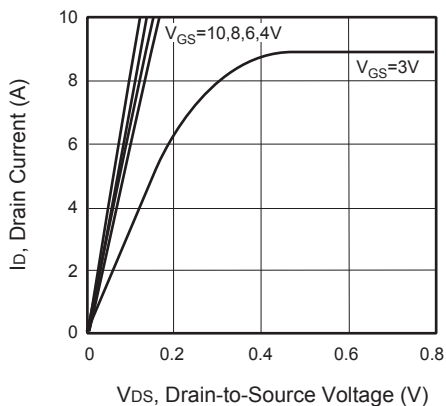
| Parameter                             | Symbol         | Limit      | Units            |
|---------------------------------------|----------------|------------|------------------|
| Drain-Source Voltage                  | $V_{DS}$       | 60         | V                |
| Gate-Source Voltage                   | $V_{GS}$       | $\pm 20$   | V                |
| Drain Current-Continuous              | $I_D$          | 9          | A                |
| Drain Current-Pulsed <sup>a</sup>     | $I_{DM}$       | 36         | A                |
| Maximum Power Dissipation             | $P_D$          | 2.0        | W                |
| Operating and Store Temperature Range | $T_J, T_{stg}$ | -55 to 150 | $^\circ\text{C}$ |

### Thermal Characteristics

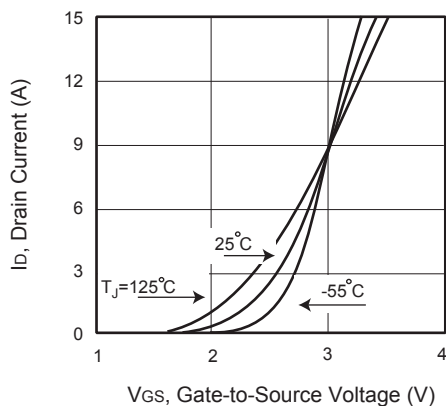
| Parameter                                            | Symbol          |      |                    |
|------------------------------------------------------|-----------------|------|--------------------|
| Thermal Resistance, Junction-to-Ambient <sup>b</sup> | $R_{\theta JA}$ | 62.5 | $^\circ\text{C/W}$ |

## Electrical Characteristics $T_A = 25^\circ\text{C}$ unless otherwise noted

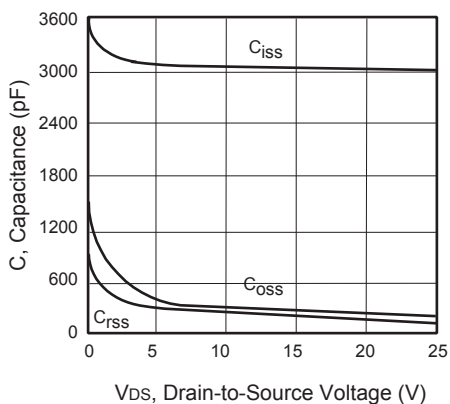
| Parameter                                                                                                                                                                                                                                                                                                                            | Symbol       | Test Condition                                               | Min | Typ  | Max  | Units     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|--------------------------------------------------------------|-----|------|------|-----------|
| Off Characteristics                                                                                                                                                                                                                                                                                                                  |              |                                                              |     |      |      |           |
| Drain-Source Breakdown Voltage                                                                                                                                                                                                                                                                                                       | $BV_{DSS}$   | $V_{GS} = 0V, I_D = 250\mu A$                                | 60  |      |      | V         |
| Zero Gate Voltage Drain Current                                                                                                                                                                                                                                                                                                      | $I_{DSS}$    | $V_{DS} = 60V, V_{GS} = 0V$                                  |     |      | 1    | $\mu A$   |
| Gate Body Leakage Current, Forward                                                                                                                                                                                                                                                                                                   | $I_{GSSF}$   | $V_{GS} = 20V, V_{DS} = 0V$                                  |     |      | 100  | nA        |
| Gate Body Leakage Current, Reverse                                                                                                                                                                                                                                                                                                   | $I_{GSSR}$   | $V_{GS} = -20V, V_{DS} = 0V$                                 |     |      | -100 | nA        |
| On Characteristics <sup>c</sup>                                                                                                                                                                                                                                                                                                      |              |                                                              |     |      |      |           |
| Gate Threshold Voltage                                                                                                                                                                                                                                                                                                               | $V_{GS(th)}$ | $V_{GS} = V_{DS}, I_D = 250\mu A$                            | 1   |      | 3    | V         |
| Static Drain-Source On-Resistance                                                                                                                                                                                                                                                                                                    | $R_{DS(on)}$ | $V_{GS} = 10V, I_D = 5.0A$                                   |     | 11   | 14.5 | $m\Omega$ |
| On-Resistance                                                                                                                                                                                                                                                                                                                        |              | $V_{GS} = 4.5V, I_D = 3.0A$                                  |     | 12.5 | 18   | $m\Omega$ |
| Dynamic Characteristics <sup>d</sup>                                                                                                                                                                                                                                                                                                 |              |                                                              |     |      |      |           |
| Input Capacitance                                                                                                                                                                                                                                                                                                                    | $C_{iss}$    | $V_{DS} = 25V, V_{GS} = 0V, f = 1.0\text{ MHz}$              |     | 3030 |      | pF        |
| Output Capacitance                                                                                                                                                                                                                                                                                                                   | $C_{oss}$    |                                                              |     | 215  |      | pF        |
| Reverse Transfer Capacitance                                                                                                                                                                                                                                                                                                         | $C_{rss}$    |                                                              |     | 140  |      | pF        |
| Switching Characteristics <sup>d</sup>                                                                                                                                                                                                                                                                                               |              |                                                              |     |      |      |           |
| Turn-On Delay Time                                                                                                                                                                                                                                                                                                                   | $t_{d(on)}$  | $V_{DD} = 48V, I_D = 4.5A, V_{GS} = 4.5V, R_{GEN} = 6\Omega$ |     | 33   | 66   | ns        |
| Turn-On Rise Time                                                                                                                                                                                                                                                                                                                    | $t_r$        |                                                              |     | 35   | 70   | ns        |
| Turn-Off Delay Time                                                                                                                                                                                                                                                                                                                  | $t_{d(off)}$ |                                                              |     | 70   | 140  | ns        |
| Turn-Off Fall Time                                                                                                                                                                                                                                                                                                                   | $t_f$        |                                                              |     | 25   | 50   | ns        |
| Total Gate Charge                                                                                                                                                                                                                                                                                                                    | $Q_g$        | $V_{DS} = 48V, I_D = 4.5A, V_{GS} = 4.5V$                    |     | 35   | 46   | nC        |
| Gate-Source Charge                                                                                                                                                                                                                                                                                                                   | $Q_{gs}$     |                                                              |     | 8    |      | nC        |
| Gate-Drain Charge                                                                                                                                                                                                                                                                                                                    | $Q_{gd}$     |                                                              |     | 15   |      | nC        |
| Drain-Source Diode Characteristics and Maximun Ratings                                                                                                                                                                                                                                                                               |              |                                                              |     |      |      |           |
| Drain-Source Diode Forward Current <sup>b</sup>                                                                                                                                                                                                                                                                                      | $I_S$        |                                                              |     |      | 1.6  | A         |
| Drain-Source Diode Forward Voltage <sup>c</sup>                                                                                                                                                                                                                                                                                      | $V_{SD}$     | $V_{GS} = 0V, I_S = 1.6A$                                    |     |      | 1.2  | V         |
| <div>Notes :<br/>a.Repetitive Rating : Pulse width limited by maximum junction temperature.<br/>b.Surface Mounted on FR4 Board, <math>t \leq 10\text{ sec.}</math><br/>c.Pulse Test : Pulse Width <math>\leq 300\mu s</math>, Duty Cycle <math>\leq 2\%</math>.<br/>d.Guaranteed by design, not subject to production testing.</div> |              |                                                              |     |      |      |           |



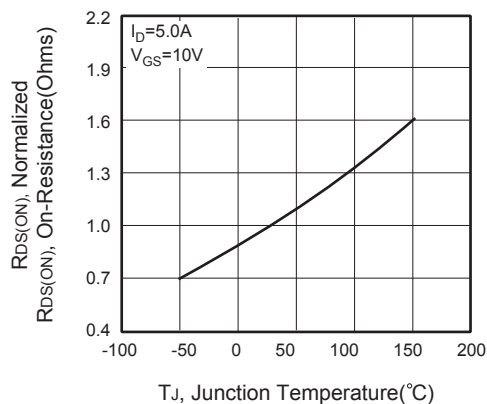
**Figure 1. Output Characteristics**



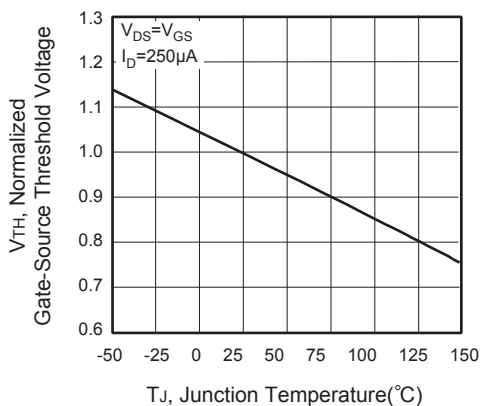
**Figure 2. Transfer Characteristics**



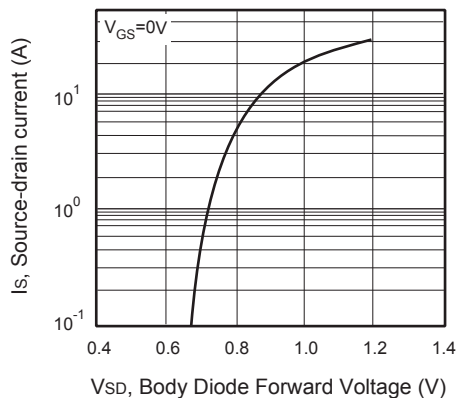
**Figure 3. Capacitance**



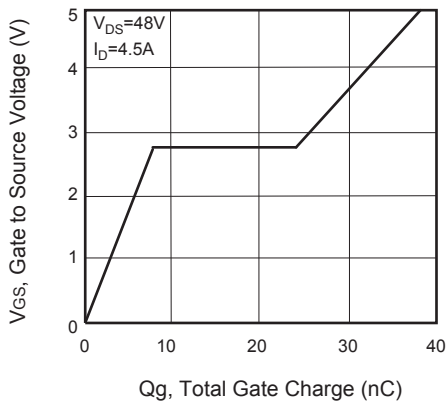
**Figure 4. On-Resistance Variation with Temperature**



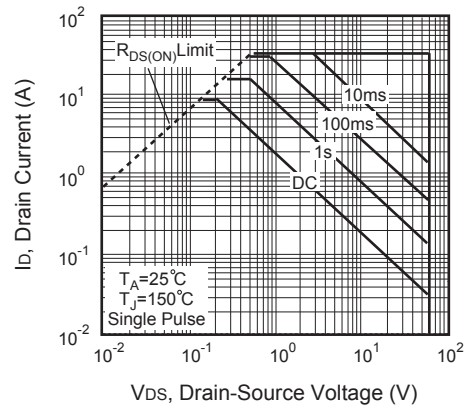
**Figure 5. Gate Threshold Variation with Temperature**



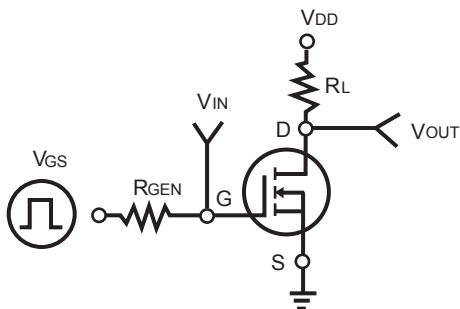
**Figure 6. Body Diode Forward Voltage Variation with Source Current**



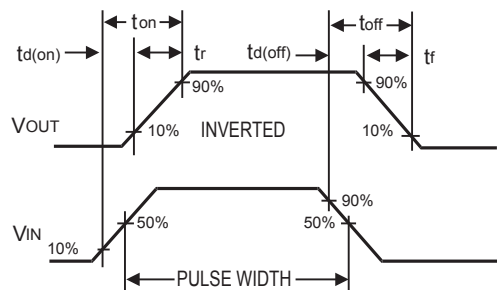
**Figure 7. Gate Charge**



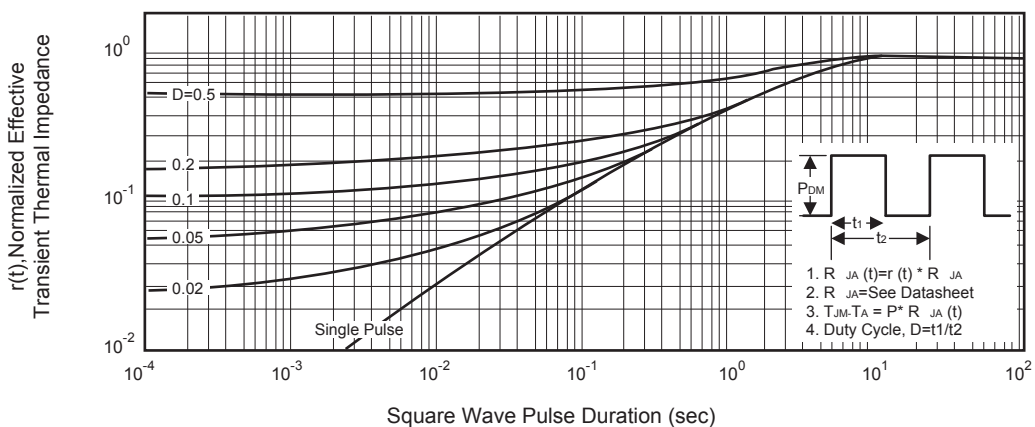
**Figure 8. Maximum Safe Operating Area**



**Figure 9. Switching Test Circuit**



**Figure 10. Switching Waveforms**



**Figure 11. Normalized Thermal Transient Impedance Curve**