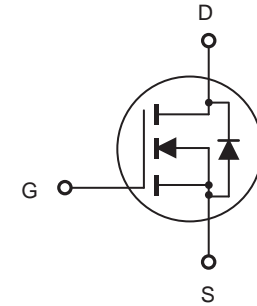
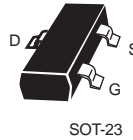


## N-Channel Enhancement Mode Field Effect Transistor

### FEATURES

- 20V, 4.5A,  $R_{DS(ON)} = 33m\Omega$  @  $V_{GS} = 4.5V$ .  
 $R_{DS(ON)} = 40m\Omega$  @  $V_{GS} = 2.5V$ .
- High dense cell design for extremely low  $R_{DS(ON)}$ .
- Rugged and reliable.
- Lead free product is acquired.
- SOT-23 package.



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

| Parameter                             | Symbol         | Limit      | Units            |
|---------------------------------------|----------------|------------|------------------|
| Drain-Source Voltage                  | $V_{DS}$       | 20         | V                |
| Gate-Source Voltage                   | $V_{GS}$       | $\pm 8$    | V                |
| Drain Current-Continuous              | $I_D$          | 4.5        | A                |
| Drain Current-Pulsed <sup>a</sup>     | $I_{DM}$       | 13.5       | A                |
| Maximum Power Dissipation             | $P_D$          | 1.25       | W                |
| Operating and Store Temperature Range | $T_J, T_{stg}$ | -55 to 150 | $^\circ\text{C}$ |

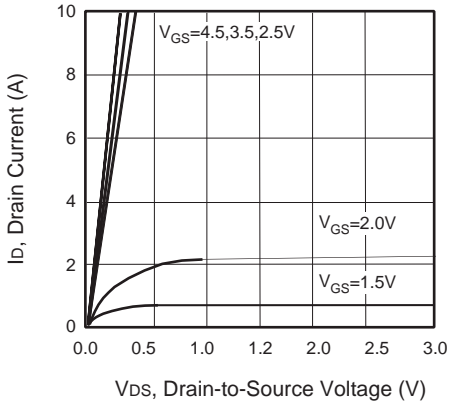
### Thermal Characteristics

| Parameter  | Symbol          | Limit | Units              |
|--|-----------------|-------|--------------------|
| Thermal Resistance, Junction-to-Ambient <sup>b</sup> | $R_{\theta JA}$ | 100   | $^\circ\text{C/W}$ |

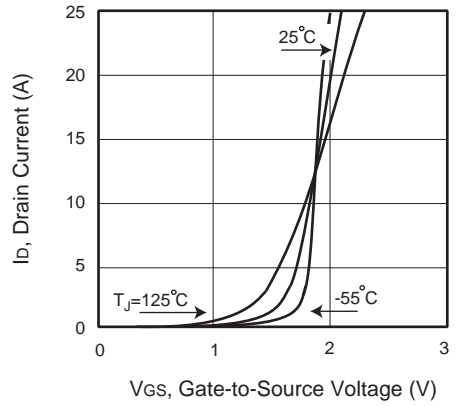


## Electrical Characteristics $T_A = 25^\circ\text{C}$ unless otherwise noted

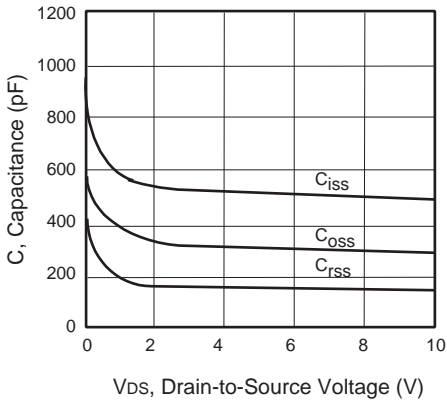
| Parameter  | Symbol       | Test Condition  | Min | Typ | Max  | Units     |    |
|--|--------------|---|-----|-----|------|-----------|----|
| <b>Off Characteristics</b>   |              |   |     |     |      |           |    |
| Drain-Source Breakdown Voltage   | $BV_{DSS}$   | $V_{GS} = 0V, I_D = 250\mu A$   | 20  |     |      | V         |    |
| Zero Gate Voltage Drain Current  | $I_{DSS}$    | $V_{DS} = 20V, V_{GS} = 0V$   |     |     | 1    | $\mu A$   |    |
| Gate Body Leakage Current, Forward   | $I_{GSSF}$   | $V_{GS} = 8V, V_{DS} = 0V$  |     |     | 100  | nA        |    |
| Gate Body Leakage Current, Reverse   | $I_{GSSR}$   | $V_{GS} = -8V, V_{DS} = 0V$   |     |     | -100 | nA        |    |
| <b>On Characteristics <sup>c</sup></b>   |              |   |     |     |      |           |    |
| Gate Threshold Voltage   | $V_{GS(th)}$ | $V_{GS} = V_{DS}, I_D = 250\mu A$                                       | 0.5 |     | 1.2  | V         |    |
| Static Drain-Source On-Resistance  | $R_{DS(on)}$ | $V_{GS} = 4.5V, I_D = 5.0A$   |     | 27  | 33   | $m\Omega$ |    |
|  |              | $V_{GS} = 2.5V, I_D = 4.5A$   |     | 33  | 40   | $m\Omega$ |    |
| Forward Transconductance   | $g_{FS}$     | $V_{DS} = 10V, I_D = 5.0A$  |     | 10  |      | S         |    |
| <b>Dynamic Characteristics <sup>d</sup></b>  |              |   |     |     |      |           |    |
| Input Capacitance  | $C_{iss}$    | $V_{DS} = 8V, V_{GS} = 0V, f = 1.0\text{ MHz}$                          |     | 500 |      | pF        |    |
| Output Capacitance   | $C_{oss}$    |   |     |     | 300  |           | pF |
| Reverse Transfer Capacitance   | $C_{rss}$    |   |     |     | 140  |           | pF |
| <b>Switching Characteristics <sup>d</sup></b>  |              |   |     |     |      |           |    |
| Turn-On Delay Time   | $t_{d(on)}$  | $V_{DD} = 10V, I_D = 1A, \square$<br>$V_{GS} = 4.5V, R_{GEN} = 6\Omega$ |     | 20  | 40   | ns        |    |
| Turn-On Rise Time  | $t_r$        |   |     | 18  | 40   | ns        |    |
| Turn-Off Delay Time  | $t_{d(off)}$ |   |     | 60  | 108  | ns        |    |
| Turn-Off Fall Time   | $t_f$        |   |     | 28  | 56   | ns        |    |
| Total Gate Charge  | $Q_g$        | $V_{DS} = 10V, I_D = 5.0A, V_{GS} = 4.5V$                               |     | 10  | 15   | nC        |    |
| Gate-Source Charge   | $Q_{gs}$     |   |     | 2.3 |      | nC        |    |
| Gate-Drain Charge  | $Q_{gd}$     |   |     | 2.9 |      | nC        |    |
| <b>Drain-Source Diode Characteristics and Maximum Ratings</b>  |              |   |     |     |      |           |    |
| Drain-Source Diode Forward Current <sup>b</sup>  | $I_S$        |   |     |     | 1.0  | A         |    |
| Drain-Source Diode Forward Voltage <sup>c</sup>  | $V_{SD}$     | $V_{GS} = 0V, I_S = 1A$   |     |     | 1.2  | V         |    |
| <b>Notes :</b> <input type="checkbox"/><br>a.Repetitive Rating : Pulse width limited by maximum junction temperature. <input type="checkbox"/><br>b.Surface Mounted on FR4 Board, $t \leq 10\text{ sec.}$ <input type="checkbox"/><br>c.Pulse Test : Pulse Width $\leq 300\mu s$ , Duty Cycle $\leq 2\%$ . <input type="checkbox"/><br>d.Guaranteed by design, not subject to production testing. <input type="checkbox"/><br><input type="checkbox"/> |              |   |     |     |      |           |    |



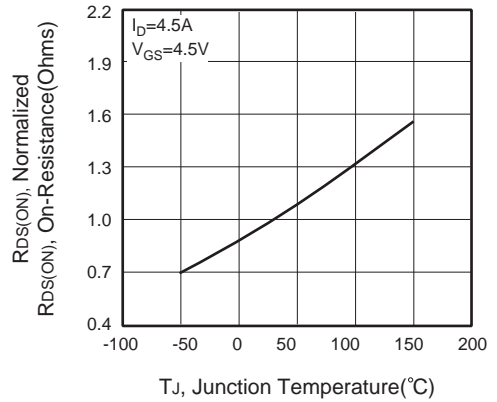
**Figure 1. Output Characteristics**



**Figure 2. Transfer Characteristics**



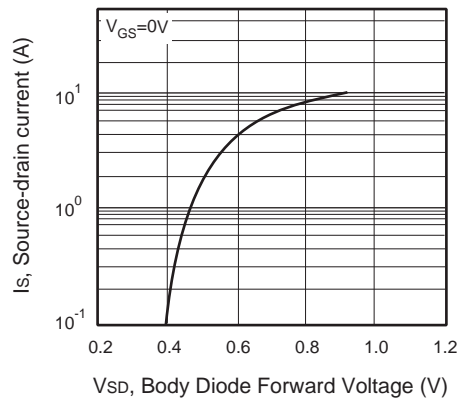
**Figure 3. Capacitance**



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



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



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

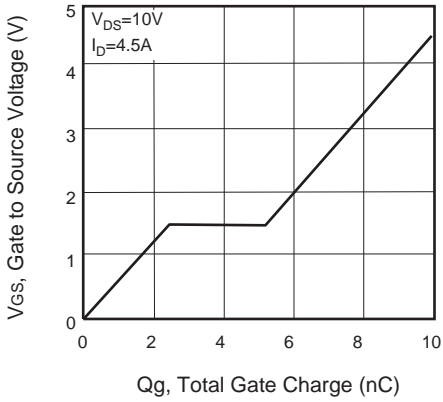


Figure 7. Gate Charge

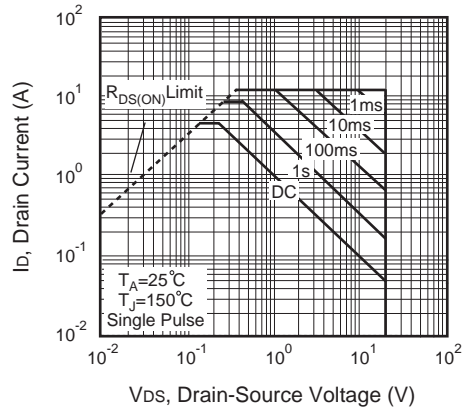


Figure 8. Maximum Safe Operating Area



Figure 9. Switching Test Circuit



Figure 10. Switching Waveforms

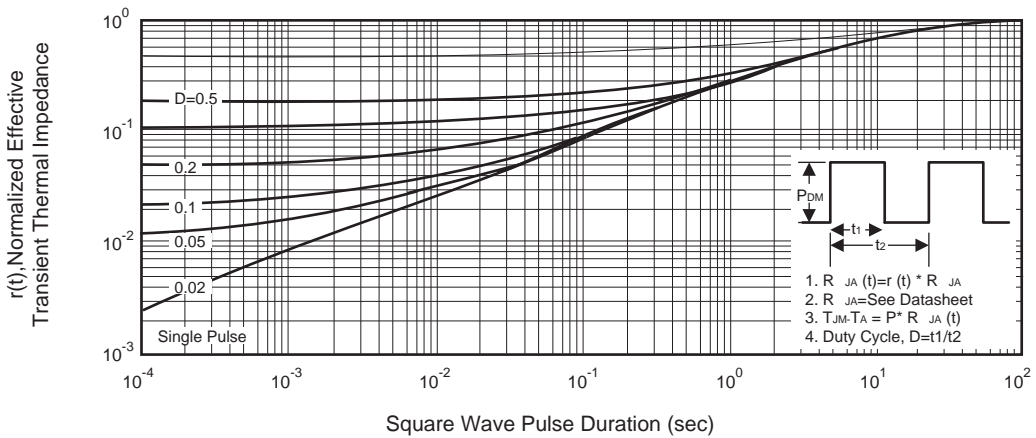


Figure 11. Normalized Thermal Transient Impedance Curve