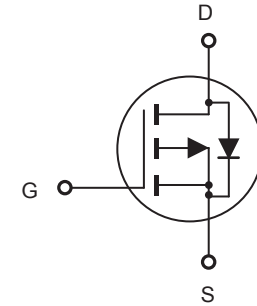
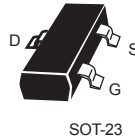


## P-Channel Enhancement Mode Field Effect Transistor

### FEATURES

- -20V, -3.8A,  $R_{DS(ON)} = 55m\Omega$  @ $V_{GS} = -4.5V$ .  
 $R_{DS(ON)} = 62m\Omega$  @ $V_{GS} = -2.5V$ .
- High dense cell design for extremely low  $R_{DS(ON)}$ .
- Rugged and reliable.
- Lead free product is acquired.
- SOT-23 package.



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

| Parameter                             | Symbol         | Limit      | Units      |
|---------------------------------------|----------------|------------|------------|
| Drain-Source Voltage                  | $V_{DS}$       | -20        | V          |
| Gate-Source Voltage                   | $V_{GS}$       | $\pm 12$   | V          |
| Drain Current-Continuous              | $I_D$          | -3.8       | A          |
| Drain Current-Pulsed <sup>a</sup>     | $I_{DM}$       | -15.2      | A          |
| Maximum Power Dissipation             | $P_D$          | 1.25       | W          |
| Operating and Store Temperature Range | $T_J, T_{stg}$ | -55 to 150 | $^\circ C$ |

### Thermal Characteristics

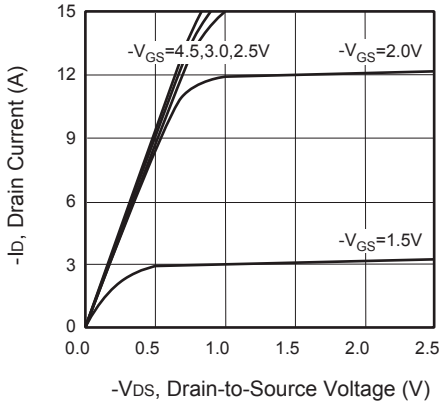
| Parameter  | Symbol          | Limit | Units        |
|--|-----------------|-------|--------------|
| Thermal Resistance, Junction-to-Ambient <sup>b</sup> | $R_{\theta JA}$ | 100   | $^\circ C/W$ |



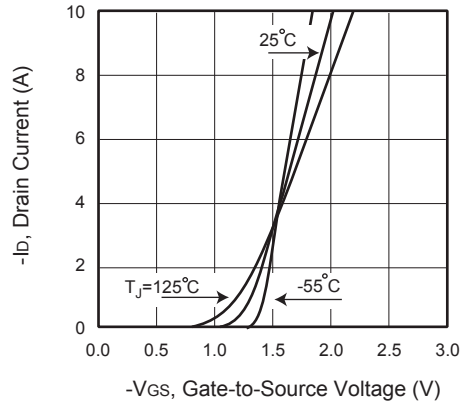
# CES2321

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

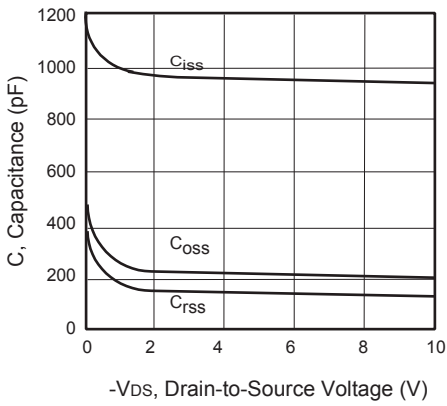
| Parameter   | Symbol       | Test Condition   | Min  | Typ | Max  | Units     |
|---|--------------|--|------|-----|------|-----------|
| <b>Off Characteristics</b>  |              |  |      |     |      |           |
| Drain-Source Breakdown Voltage  | $BV_{DSS}$   | $V_{GS} = 0V, I_D = -250\mu A$                                       | -20  |     |      | V         |
| Zero Gate Voltage Drain Current   | $I_{DSS}$    | $V_{DS} = -20V, V_{GS} = 0V$   |      |     | -1   | $\mu A$   |
| Gate Body Leakage Current, Forward  | $I_{GSSF}$   | $V_{GS} = 12V, V_{DS} = 0V$  |      |     | 100  | nA        |
| Gate Body Leakage Current, Reverse  | $I_{GSSR}$   | $V_{GS} = -12V, V_{DS} = 0V$   |      |     | -100 | nA        |
| <b>On Characteristics <sup>c</sup></b>  |              |  |      |     |      |           |
| Gate Threshold Voltage  | $V_{GS(th)}$ | $V_{GS} = V_{DS}, I_D = -250\mu A$                                   | -0.4 |     | -1.0 | V         |
| Static Drain-Source On-Resistance   | $R_{DS(on)}$ | $V_{GS} = -4.5V, I_D = -2.4A$  |      | 39  | 55   | $m\Omega$ |
|   |              | $V_{GS} = -2.5V, I_D = -2.0A$  |      | 47  | 62   | $m\Omega$ |
| Forward Transconductance  | $g_{FS}$     | $V_{DS} = -5V, I_D = -2.4A$  |      | 10  |      | S         |
| <b>Dynamic Characteristics <sup>d</sup></b>   |              |  |      |     |      |           |
| Input Capacitance   | $C_{iss}$    | $V_{DS} = -10V, V_{GS} = 0V,$<br>$f = 1.0 \text{ MHz}$               |      | 965 |      | pF        |
| Output Capacitance  | $C_{oss}$    |  |      | 200 |      | pF        |
| Reverse Transfer Capacitance  | $C_{rss}$    |  |      | 155 |      | pF        |
| <b>Switching Characteristics <sup>d</sup></b>   |              |  |      |     |      |           |
| Turn-On Delay Time  | $t_{d(on)}$  | $V_{DD} = -10V, I_D = -3.8A,$<br>$V_{GS} = -4.5V, R_{GEN} = 3\Omega$ |      | 15  | 30   | ns        |
| Turn-On Rise Time   | $t_r$        |  |      | 10  | 20   | ns        |
| Turn-Off Delay Time   | $t_{d(off)}$ |  |      | 40  | 80   | ns        |
| Turn-Off Fall Time  | $t_f$        |  |      | 13  | 26   | ns        |
| Total Gate Charge   | $Q_g$        | $V_{DS} = -10V, I_D = -3.8A,$<br>$V_{GS} = -4.5V$                    |      | 13  | 17   | nC        |
| Gate-Source Charge  | $Q_{gs}$     |  |      | 2.5 |      | nC        |
| Gate-Drain Charge   | $Q_{gd}$     |  |      | 3   |      | nC        |
| <b>Drain-Source Diode Characteristics and Maximum Ratings</b>   |              |  |      |     |      |           |
| Drain-Source Diode Forward Current <sup>b</sup>   | $I_S$        |  |      |     | -1   | A         |
| Drain-Source Diode Forward Voltage <sup>c</sup>   | $V_{SD}$     | $V_{GS} = 0V, I_S = -0.42A$  |      |     | -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, $t < 5 \text{ sec.}$ <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"/> |              |  |      |     |      |           |



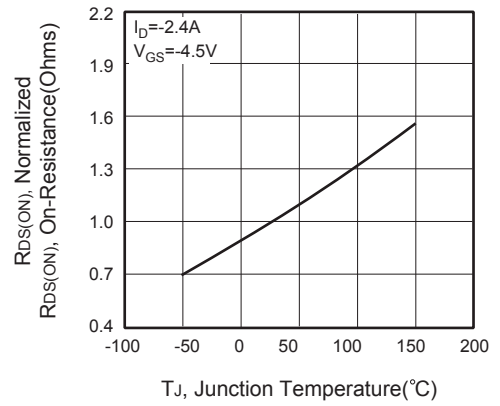
**Figure 1. Output Characteristics**



**Figure 2. Transfer Characteristics**



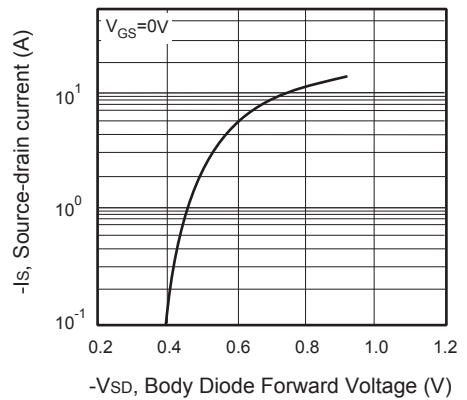
**Figure 3. Capacitance**



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



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



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

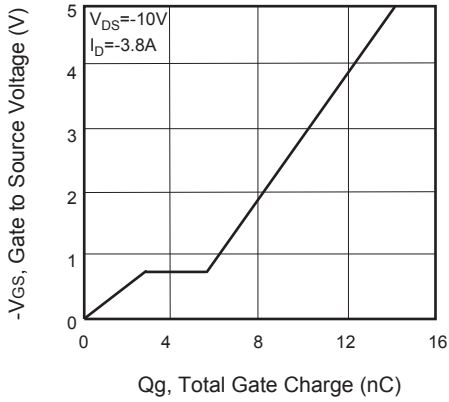


Figure 7. Gate Charge

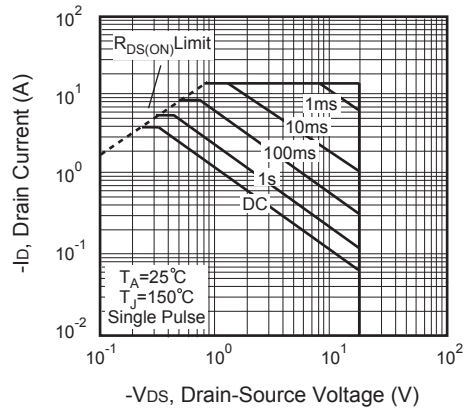


Figure 8. Maximum Safe Operating Area

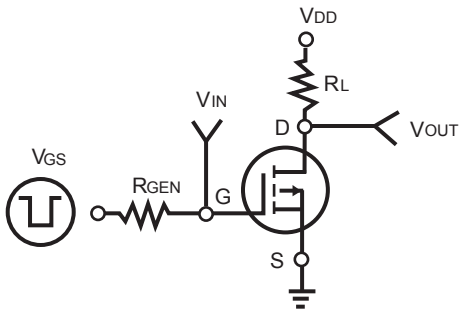


Figure 9. Switching Test Circuit



Figure 10. Switching Waveforms

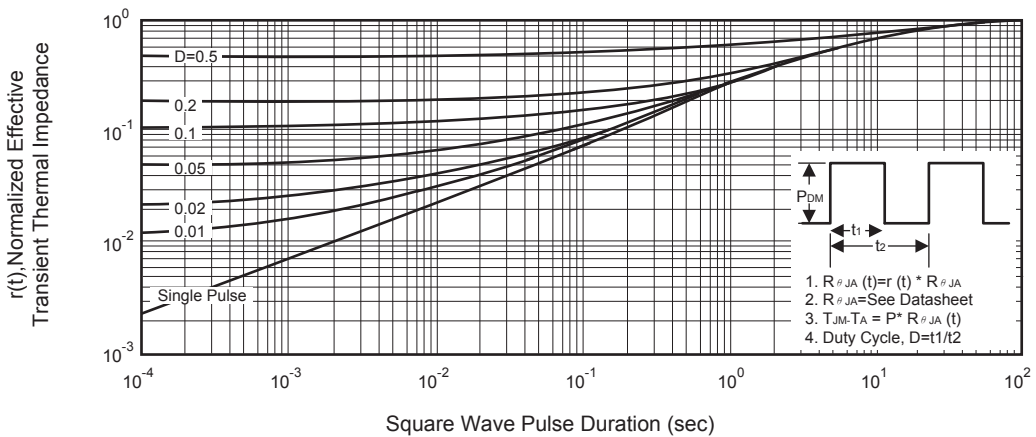


Figure 11. Normalized Thermal Transient Impedance Curve