

# CEP21A3/CEB21A3

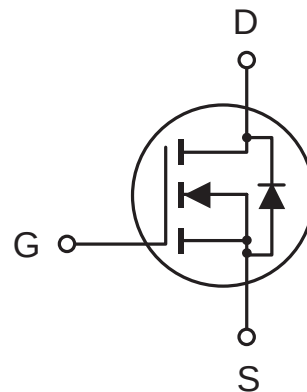
Nov. 2002

## N-Channel Logic Level Enhancement Mode Field Effect Transistor

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### FEATURES

- 30V , 20A ,  $R_{DS(ON)}=45m\Omega$  @ $V_{GS}=10V$ .  
 $R_{DS(ON)}=70m\Omega$  @ $V_{GS}=4.5V$ .
- Super high dense cell design for extremely low  $R_{DS(ON)}$ .
- High power and current handling capability.
- TO-220 & TO-263 package.



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

| Parameter                                                                             | Symbol         | Limit      | Unit                |
|---------------------------------------------------------------------------------------|----------------|------------|---------------------|
| Drain-Source Voltage                                                                  | $V_{DS}$       | 30         | V                   |
| Gate-Source Voltage                                                                   | $V_{GS}$       | $\pm 20$   | V                   |
| Drain Current-Continuous<br>-Pulsed                                                   | $I_D$          | 20         | A                   |
|                                                                                       | $I_{DM}$       | 60         | A                   |
| Drain-Source Diode Forward Current                                                    | $I_S$          | 20         | A                   |
| Maximum Power Dissipation @ $T_c=25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$          | 43         | W                   |
|                                                                                       |                | 0.29       | W/ $^\circ\text{C}$ |
| Operating and Storage Temperature Range                                               | $T_J, T_{STG}$ | -65 to 175 | $^\circ\text{C}$    |

### THERMAL CHARACTERISTICS

|                                         |                 |      |                    |
|-----------------------------------------|-----------------|------|--------------------|
| Thermal Resistance, Junction-to-Case    | $R_{\theta JC}$ | 3.5  | $^\circ\text{C/W}$ |
| Thermal Resistance, Junction-to-Ambient | $R_{\theta JA}$ | 62.5 | $^\circ\text{C/W}$ |

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## ELECTRICAL CHARACTERISTICS (Tc=25 °C unless otherwise noted)

| Parameter                              | Symbol              | Condition                                                                                          | Min | Typ <sup>c</sup> | Max  | Unit |
|----------------------------------------|---------------------|----------------------------------------------------------------------------------------------------|-----|------------------|------|------|
| OFF CHARACTERISTICS                    |                     |                                                                                                    |     |                  |      |      |
| Drain-Source Breakdown Voltage         | BV <sub>DSS</sub>   | V <sub>GS</sub> = 0V, I <sub>D</sub> =250μA                                                        | 30  |                  |      | V    |
| Zero Gate Voltage Drain Current        | I <sub>DSS</sub>    | V <sub>DS</sub> = 30V, V <sub>GS</sub> = 0V                                                        |     |                  | 1    | μA   |
| Gate-Body Leakage                      | I <sub>GSS</sub>    | V <sub>GS</sub> = ± 20V, V <sub>DS</sub> = 0V                                                      |     |                  | ±100 | nA   |
| ON CHARACTERISTICS <sup>a</sup>        |                     |                                                                                                    |     |                  |      |      |
| Gate Threshold Voltage                 | V <sub>GS(th)</sub> | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA                                         | 0.8 |                  | 2.5  | V    |
| Drain-Source On-State Resistance       | R <sub>DS(ON)</sub> | V <sub>GS</sub> = 10V, I <sub>D</sub> = 12A                                                        |     | 36               | 45   | mΩ   |
|                                        |                     | V <sub>GS</sub> = 4.5V, I <sub>D</sub> =15A                                                        |     | 55               | 70   | mΩ   |
| On-State Drain Current                 | I <sub>D(ON)</sub>  | V <sub>DS</sub> = 10V, V <sub>GS</sub> = 10V                                                       | 20  |                  |      | A    |
| Forward Transconductance               | g <sub>FS</sub>     | V <sub>DS</sub> = 10V, I <sub>D</sub> = 12A                                                        |     | 20               |      | S    |
| DYNAMIC CHARACTERISTICS <sup>b</sup>   |                     |                                                                                                    |     |                  |      |      |
| Input Capacitance                      | C <sub>ISS</sub>    | V <sub>DS</sub> =15V, V <sub>GS</sub> = 0V<br>f =1.0MHz                                            |     | 364              |      | pF   |
| Output Capacitance                     | C <sub>OSS</sub>    |                                                                                                    |     | 197              |      | pF   |
| Reverse Transfer Capacitance           | C <sub>RSS</sub>    |                                                                                                    |     | 62               |      | pF   |
| SWITCHING CHARACTERISTICS <sup>b</sup> |                     |                                                                                                    |     |                  |      |      |
| Turn-On Delay Time                     | t <sub>D(ON)</sub>  | V <sub>DD</sub> = 15V,<br>I <sub>D</sub> = 12A<br>V <sub>GS</sub> = 10V,<br>R <sub>GEN</sub> =2.5Ω |     | 12               | 25   | ns   |
| Rise Time                              | t <sub>r</sub>      |                                                                                                    |     | 5                | 15   | ns   |
| Turn-Off Delay Time                    | t <sub>D(OFF)</sub> |                                                                                                    |     | 14               | 30   | ns   |
| Fall Time                              | t <sub>f</sub>      |                                                                                                    |     | 14               | 30   | ns   |
| Total Gate Charge                      | Q <sub>g</sub>      | V <sub>DS</sub> = 15V,I <sub>D</sub> = 6A<br>V <sub>GS</sub> = 10V                                 |     | 10               | 15   | nC   |
| Gate-Source Charge                     | Q <sub>gs</sub>     |                                                                                                    |     | 2                |      | nC   |
| Gate-Drain Charge                      | Q <sub>gd</sub>     |                                                                                                    |     | 3                |      | nC   |

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## ELECTRICAL CHARACTERISTICS ( $T_c=25^{\circ}\text{C}$ unless otherwise noted)

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| Parameter                                             | Symbol   | Condition                              | Min | Typ | Max | Unit |
|-------------------------------------------------------|----------|----------------------------------------|-----|-----|-----|------|
| <b>DRAIN-SOURCE DIODE CHARACTERISTICS<sup>a</sup></b> |          |                                        |     |     |     |      |
| Diode Forward Voltage                                 | $V_{SD}$ | $V_{GS} = 0\text{V}, I_S = 12\text{A}$ |     | 0.9 | 1.3 | V    |

### Notes

a. Pulse Test: Pulse Width  $\leq 300 \mu\text{s}$ , Duty Cycle  $\leq 2\%$ .

b. Guaranteed by design, not subject to production testing.

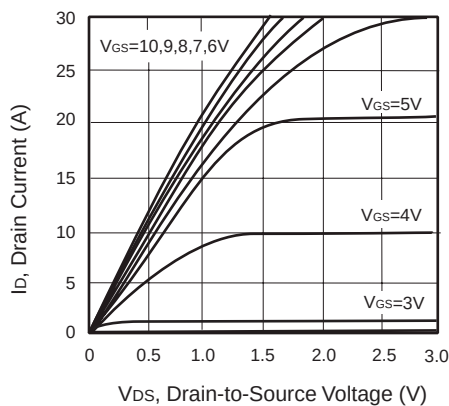


Figure 1. Output Characteristics

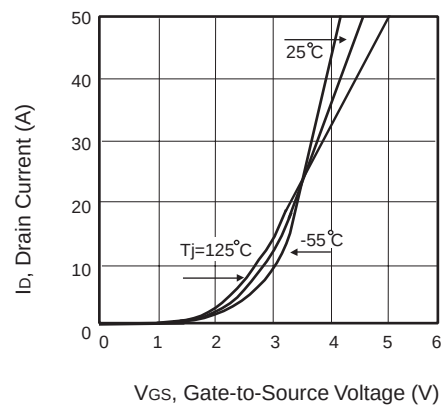


Figure 2. Transfer Characteristics

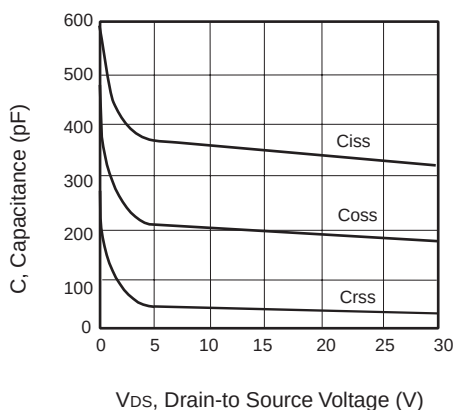


Figure 3. Capacitance

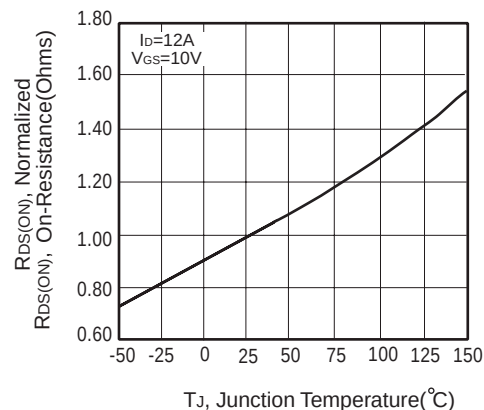
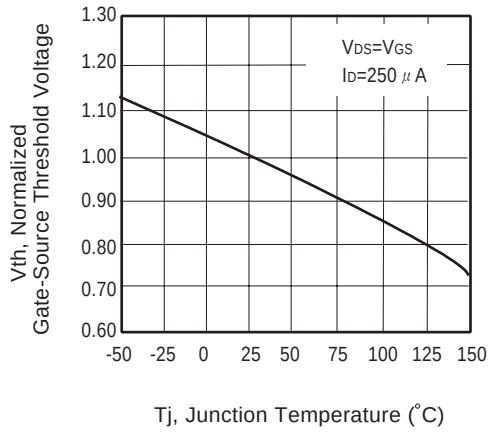


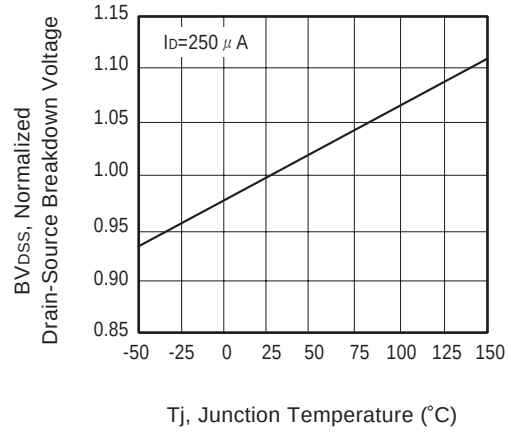
Figure 4. On-Resistance Variation with Temperature

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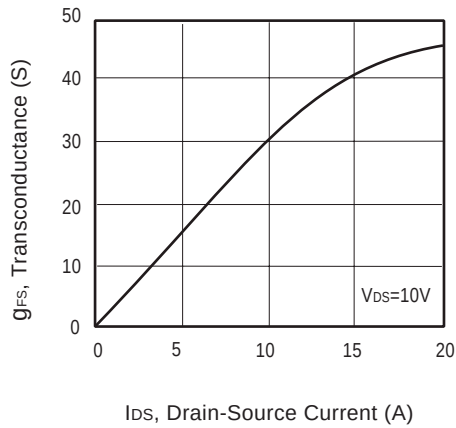
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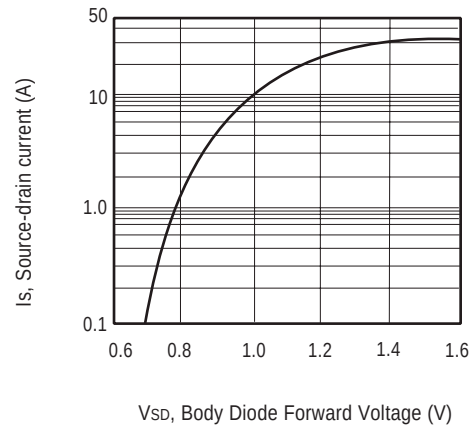
**Figure 5. Gate Threshold Variation with Temperature**



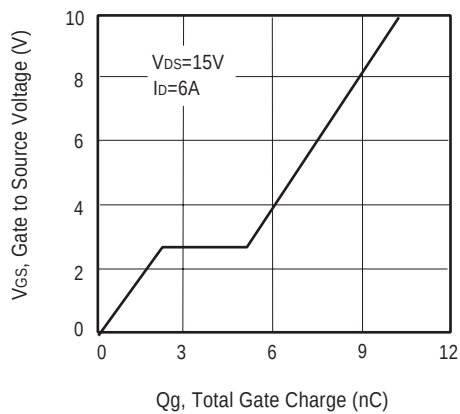
**Figure 6. Breakdown Voltage Variation with Temperature**



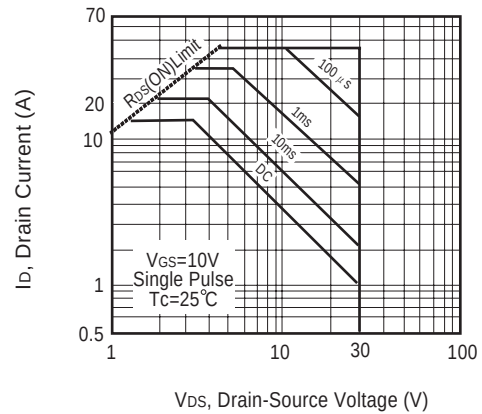
**Figure 7. Transconductance Variation with Drain Current**



**Figure 8. Body Diode Forward Voltage Variation with Source Current**



**Figure 9. Gate Charge**



**Figure 10. Maximum Safe Operating Area**

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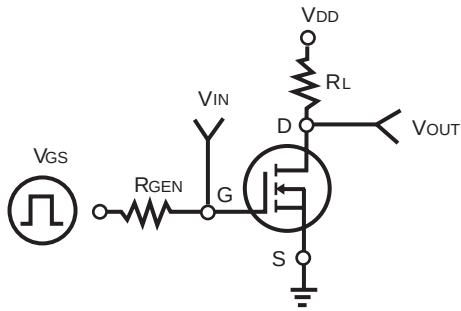


Figure 11. Switching Test Circuit

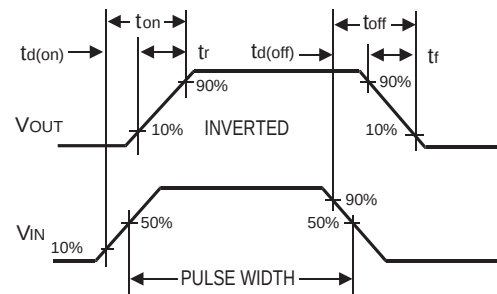


Figure 12. Switching Waveforms

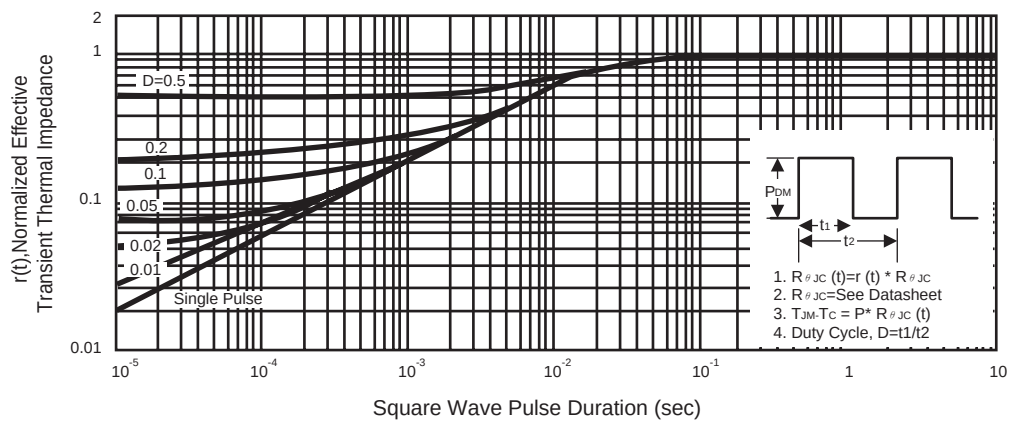


Figure 13. Normalized Thermal Transient Impedance Curve