



# CEP13N5/CEB13N5

## CEF13N5

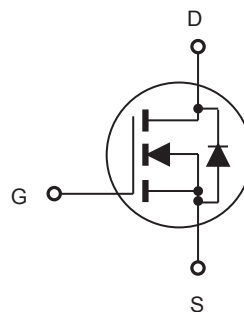
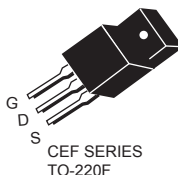
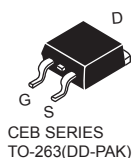
### N-Channel Enhancement Mode Field Effect Transistor

PRELIMINARY

### FEATURES

| Type    | V <sub>DSS</sub> | R <sub>DS(ON)</sub> | I <sub>D</sub>   | @V <sub>GS</sub> |
|---------|------------------|---------------------|------------------|------------------|
| CEP13N5 | 500V             | 0.48Ω               | 13A              | 10V              |
| CEB13N5 | 500V             | 0.48Ω               | 13A              | 10V              |
| CEF13N5 | 500V             | 0.48Ω               | 13A <sup>d</sup> | 10V              |

- Super high dense cell design for extremely low R<sub>DS(ON)</sub>.
- High power and current handling capability.
- Lead free product is acquired.



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

| Parameter                                                                     | Symbol                            | Limit      |                 | Units |
|-------------------------------------------------------------------------------|-----------------------------------|------------|-----------------|-------|
|                                                                               |                                   | TO-220/263 | TO-220F         |       |
| Drain-Source Voltage                                                          | V <sub>DS</sub>                   | 500        |                 | V     |
| Gate-Source Voltage                                                           | V <sub>GS</sub>                   | ±30        |                 | V     |
| Drain Current-Continuous @ $T_C = 25^{\circ}\text{C}$                         | I <sub>D</sub>                    | 13         | 13 <sup>d</sup> | A     |
| Drain Current-Continuous @ $T_C = 100^{\circ}\text{C}$                        | I <sub>D</sub>                    | 8          | 8 <sup>d</sup>  | A     |
| Drain Current-Pulsed <sup>a</sup>                                             | I <sub>DM</sub> <sup>e</sup>      | 52         | 52 <sup>d</sup> | A     |
| Maximum Power Dissipation @ $T_C = 25^{\circ}\text{C}$<br>- Derate above 25°C | P <sub>D</sub>                    | 214        | 60              | W     |
|                                                                               |                                   | 1.43       | 0.4             | W/°C  |
| Operating and Store Temperature Range                                         | T <sub>J</sub> , T <sub>stg</sub> | -55 to 175 |                 | °C    |

### Thermal Characteristics

| Parameter                               | Symbol           | Limit |     | Units |
|-----------------------------------------|------------------|-------|-----|-------|
| Thermal Resistance, Junction-to-Case    | R <sub>θJC</sub> | 0.7   | 2.5 | °C/W  |
| Thermal Resistance, Junction-to-Ambient | R <sub>θJA</sub> | 62.5  | 65  | °C/W  |

This is preliminary information on a new product in development now .  
Details are subject to change without notice .

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<http://www.cetsemi.com>



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## CEF13N5

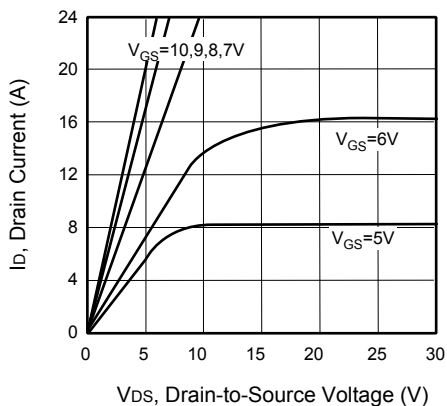
### Electrical Characteristics $T_C = 25^\circ\text{C}$ unless otherwise noted

| Parameter                                                                                                                                                                                                                                                                                                                                                                                                                                 | Symbol       | Test Condition                                                    | Min | Typ  | Max  | Units    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-------------------------------------------------------------------|-----|------|------|----------|
| Off Characteristics                                                                                                                                                                                                                                                                                                                                                                                                                       |              |                                                                   |     |      |      |          |
| Drain-Source Breakdown Voltage                                                                                                                                                                                                                                                                                                                                                                                                            | $BV_{DSS}$   | $V_{GS} = 0V, I_D = 250\mu A$                                     | 500 |      |      | V        |
| Zero Gate Voltage Drain Current                                                                                                                                                                                                                                                                                                                                                                                                           | $I_{DSS}$    | $V_{DS} = 500V, V_{GS} = 0V$                                      |     |      | 1    | $\mu A$  |
| Gate Body Leakage Current, Forward                                                                                                                                                                                                                                                                                                                                                                                                        | $I_{GSSF}$   | $V_{GS} = 30V, V_{DS} = 0V$                                       |     |      | 100  | nA       |
| Gate Body Leakage Current, Reverse                                                                                                                                                                                                                                                                                                                                                                                                        | $I_{GSSR}$   | $V_{GS} = -30V, V_{DS} = 0V$                                      |     |      | -100 | nA       |
| On Characteristics <sup>b</sup>                                                                                                                                                                                                                                                                                                                                                                                                           |              |                                                                   |     |      |      |          |
| Gate Threshold Voltage                                                                                                                                                                                                                                                                                                                                                                                                                    | $V_{GS(th)}$ | $V_{GS} = V_{DS}, I_D = 250\mu A$                                 | 2   |      | 4    | V        |
| Static Drain-Source On-Resistance                                                                                                                                                                                                                                                                                                                                                                                                         | $R_{DS(on)}$ | $V_{GS} = 10V, I_D = 6.5A$                                        |     | 0.38 | 0.48 | $\Omega$ |
| Forward Transconductance                                                                                                                                                                                                                                                                                                                                                                                                                  | $g_{FS}$     | $V_{DS} = 25V, I_D = 6.5A$                                        |     | 10   |      | S        |
| Dynamic Characteristics <sup>c</sup>                                                                                                                                                                                                                                                                                                                                                                                                      |              |                                                                   |     |      |      |          |
| Input Capacitance                                                                                                                                                                                                                                                                                                                                                                                                                         | $C_{iss}$    | $V_{DS} = 25V, V_{GS} = 0V,$<br>$f = 1.0\text{ MHz}$              |     | 2100 |      | pF       |
| Output Capacitance                                                                                                                                                                                                                                                                                                                                                                                                                        | $C_{oss}$    |                                                                   |     | 220  |      | pF       |
| Reverse Transfer Capacitance                                                                                                                                                                                                                                                                                                                                                                                                              | $C_{rss}$    |                                                                   |     | 7    |      | pF       |
| Switching Characteristics <sup>c</sup>                                                                                                                                                                                                                                                                                                                                                                                                    |              |                                                                   |     |      |      |          |
| Turn-On Delay Time                                                                                                                                                                                                                                                                                                                                                                                                                        | $t_{d(on)}$  | $V_{DD} = 250V, I_D = 13A,$<br>$V_{GS} = 10V, R_{GEN} = 25\Omega$ |     | 42   | 84   | ns       |
| Turn-On Rise Time                                                                                                                                                                                                                                                                                                                                                                                                                         | $t_r$        |                                                                   |     | 62   | 124  | ns       |
| Turn-Off Delay Time                                                                                                                                                                                                                                                                                                                                                                                                                       | $t_{d(off)}$ |                                                                   |     | 130  | 260  | ns       |
| Turn-Off Fall Time                                                                                                                                                                                                                                                                                                                                                                                                                        | $t_f$        |                                                                   |     | 25   | 50   | ns       |
| Total Gate Charge                                                                                                                                                                                                                                                                                                                                                                                                                         | $Q_g$        | $V_{DS} = 400V, I_D = 13A,$<br>$V_{GS} = 10V$                     |     | 50   | 66   | nC       |
| Gate-Source Charge                                                                                                                                                                                                                                                                                                                                                                                                                        | $Q_{gs}$     |                                                                   |     | 11   |      | nC       |
| Gate-Drain Charge                                                                                                                                                                                                                                                                                                                                                                                                                         | $Q_{gd}$     |                                                                   |     | 19   |      | nC       |
| Drain-Source Diode Characteristics and Maximum Ratings                                                                                                                                                                                                                                                                                                                                                                                    |              |                                                                   |     |      |      |          |
| Drain-Source Diode Forward Current                                                                                                                                                                                                                                                                                                                                                                                                        | $I_S^f$      |                                                                   |     |      | 13   | A        |
| Drain-Source Diode Forward Voltage <sup>b</sup>                                                                                                                                                                                                                                                                                                                                                                                           | $V_{SD}^g$   | $V_{GS} = 0V, I_S = 13A$                                          |     |      | 1.4  | V        |
| <b>Notes :</b><br>a.Repetitive Rating : Pulse width limited by maximum junction temperature .<br>b.Pulse Test : Pulse Width $\leq 300\mu s$ , Duty Cycle $\leq 2\%$ .<br>c.Guaranteed by design, not subject to production testing.<br>d.Limited only by maximum temperature allowed .<br>e.Pulse width limited by safe operating area .<br>f.Full package $I_{S(max)} = 6.6A$ .<br>g.Full package $V_{SD}$ test condition $I_S = 6.6A$ . |              |                                                                   |     |      |      |          |

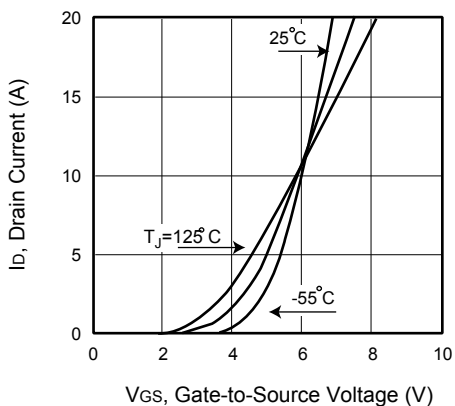


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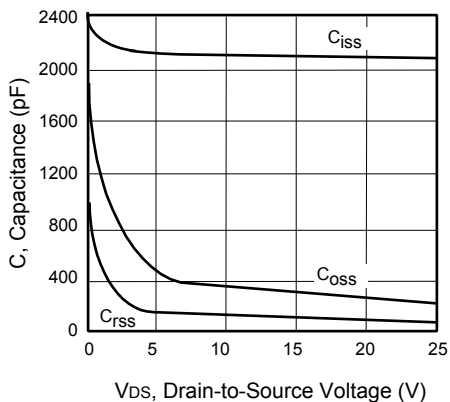
## CEF13N5



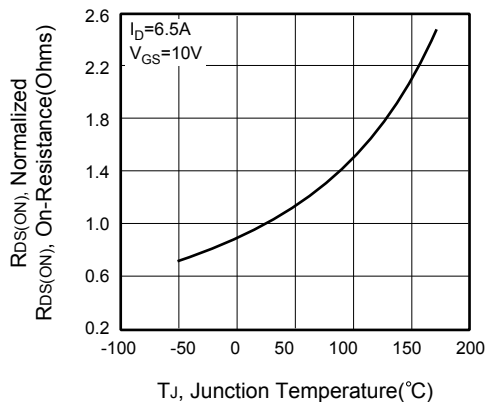
**Figure 1. Output Characteristics**



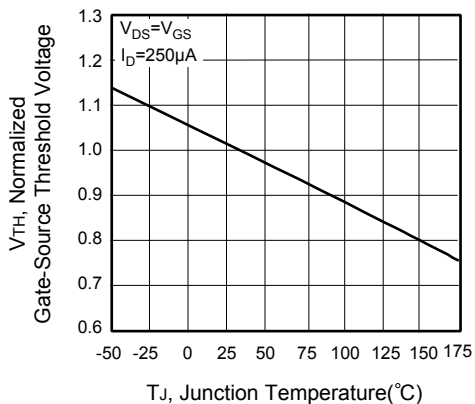
**Figure 2. Transfer Characteristics**



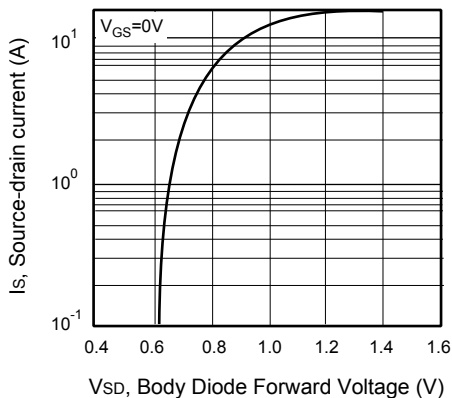
**Figure 3. Capacitance**



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



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



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



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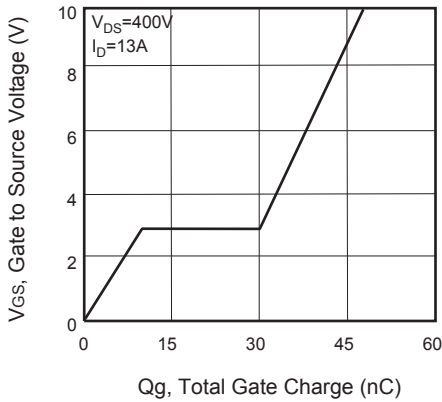


Figure 7. Gate Charge

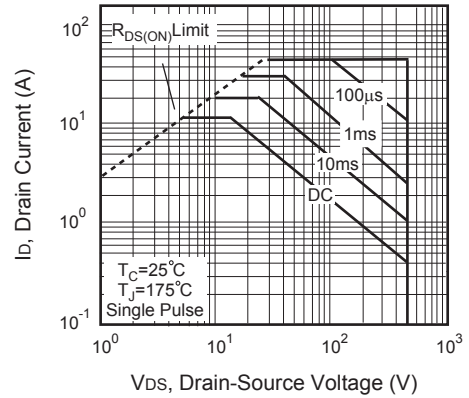


Figure 8. Maximum Safe Operating Area

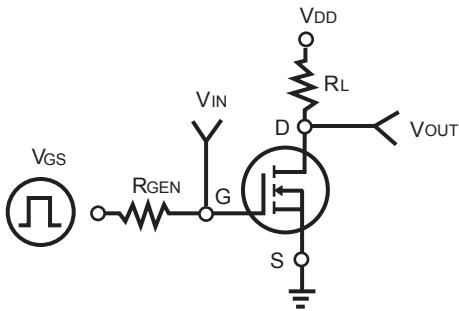


Figure 9. Switching Test Circuit



Figure 10. Switching Waveforms

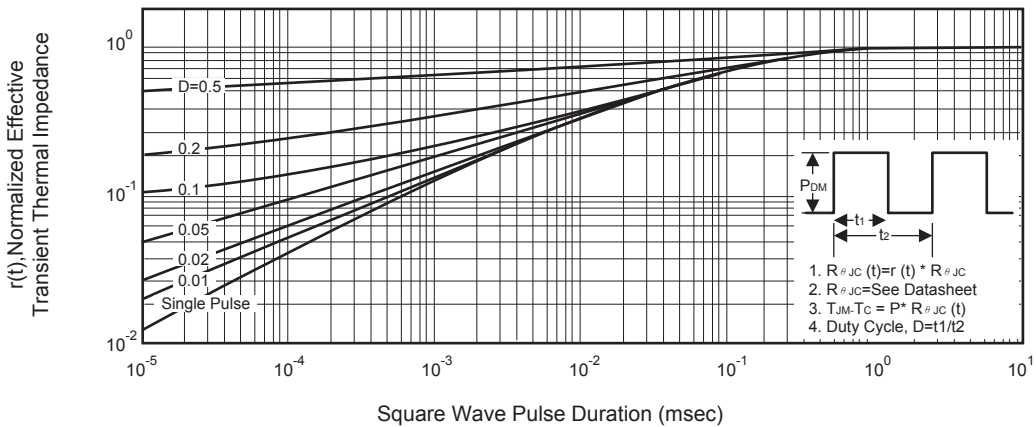


Figure 11. Normalized Thermal Transient Impedance Curve