

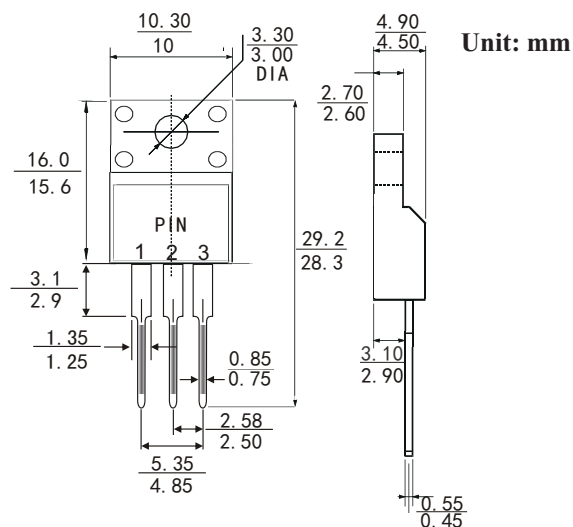
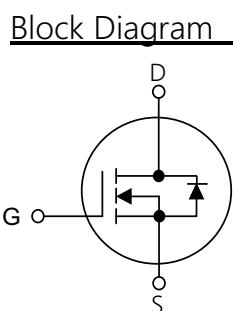
**TO-220F 16A, 650V N-CHANNEL POWER MOSFET**
**FEATURE**

- 650V, 16A  
 $R_{DS(ON)} < 0.62\Omega @ V_{GS} = 10V$
- Fast Switching
- Improved dv/dt Capability

**SYMBOL**

Pin Definition:

1. Gate
2. Drain
3. Source


**Absolute Maximum Ratings** (@  $T_C = 25^\circ\text{C}$  unless otherwise specified)

| Symbol          | Parameter                                              |                           | Value      | Units              |
|-----------------|--------------------------------------------------------|---------------------------|------------|--------------------|
| $V_{DS}$        | Drain-to-Source Voltage                                |                           | 650        | V                  |
| $V_{GS}$        | Gate-to-Source Voltage                                 |                           | $\pm 30$   | V                  |
| $I_D$           | Continuous Drain Current                               | $T_C = 25^\circ\text{C}$  | 16         | A                  |
|                 |                                                        | $T_C = 100^\circ\text{C}$ | 10         |                    |
| $I_{DM}$        | Pulsed Drain Current <sup>(1)</sup>                    |                           | 64         | A                  |
| $E_{AS}$        | Single Pulsed Avalanche Energy <sup>(2)</sup>          |                           | 845        | mJ                 |
| $P_D$           | Power Dissipation                                      | $T_C = 25^\circ\text{C}$  | 179        | W                  |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient <sup>(3)</sup> |                           | 60         | $^\circ\text{C/W}$ |
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case                   |                           | 0.7        |                    |
| $T_J, T_{STG}$  | Junction & Storage Temperature Range                   |                           | -55 to 150 | $^\circ\text{C}$   |

**Electrical Characteristics** ( $T_J = 25^\circ\text{C}$  unless otherwise specified)

| Symbol                                             | Parameter                                                | Conditions                                                                                    | Min. | Typ. | Max. | Unit |
|----------------------------------------------------|----------------------------------------------------------|-----------------------------------------------------------------------------------------------|------|------|------|------|
| Off Characteristics                                |                                                          |                                                                                               |      |      |      |      |
| V <sub>(BR)DSS</sub>                               | Drain-Source Breakdown Voltage                           | I <sub>D</sub> = 250μA, V <sub>GS</sub> = 0V                                                  | 650  | -    | -    | V    |
| I <sub>DSS</sub>                                   | Zero Gate Voltage Drain Current                          | V <sub>DS</sub> = 650V, V <sub>GS</sub> = 0V                                                  | -    | -    | 1.0  | μA   |
| I <sub>GSS</sub>                                   | Gate-Body Leakage Current                                | V <sub>DS</sub> = 0V, V <sub>GS</sub> = ±30V                                                  | -    | -    | ±100 | nA   |
| On Characteristics                                 |                                                          |                                                                                               |      |      |      |      |
| V <sub>GS(th)</sub>                                | Gate Threshold Voltage                                   | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA                                    | 2    |      | 4    | V    |
| R <sub>DS(ON)</sub>                                | Static Drain-Source ON-Resistance <sup>(4)</sup>         | V <sub>GS</sub> = 10V, I <sub>D</sub> = 8A                                                    | -    |      | 0.62 | Ω    |
| Dynamic Characteristics                            |                                                          |                                                                                               |      |      |      |      |
| C <sub>iss</sub>                                   | Input Capacitance                                        | V <sub>GS</sub> = 0V, V <sub>DS</sub> = 25V,<br>f = 1MHz                                      | -    | 2747 | -    | pF   |
| C <sub>oss</sub>                                   | Output Capacitance                                       |                                                                                               | -    | 224  | -    | pF   |
| C <sub>rss</sub>                                   | Reverse Transfer Capacitance                             |                                                                                               | -    | 27   | -    | pF   |
| Q <sub>g</sub>                                     | Total Gate Charge                                        | V <sub>GS</sub> = 0 to 10V<br>V <sub>DS</sub> = 520V, I <sub>D</sub> = 16A                    | -    | 62   | -    | nC   |
| Q <sub>gs</sub>                                    | Gate Source Charge                                       |                                                                                               | -    | 14   | -    | nC   |
| Q <sub>gd</sub>                                    | Gate Drain("Miller") Charge                              |                                                                                               | -    | 24   | -    | nC   |
|                                                    |                                                          |                                                                                               |      |      |      |      |
| Switching Characteristics                          |                                                          |                                                                                               |      |      |      |      |
| t <sub>d(on)</sub>                                 | Turn-On DelayTime                                        | V <sub>GS</sub> = 10V, V <sub>DD</sub> = 310V<br>I <sub>D</sub> = 16A, R <sub>GEN</sub> = 24Ω | -    | 38   | -    | ns   |
| t <sub>r</sub>                                     | Turn-On Rise Time                                        |                                                                                               | -    | 52   | -    | ns   |
| t <sub>d(off)</sub>                                | Turn-Off DelayTime                                       |                                                                                               | -    | 176  | -    | ns   |
| t <sub>f</sub>                                     | Turn-Off Fall Time                                       |                                                                                               | -    | 68   | -    | ns   |
| Drain-Source Diode Characteristics and Max Ratings |                                                          |                                                                                               |      |      |      |      |
| I <sub>S</sub>                                     | Maximum Continuous Drain to Source Diode Forward Current |                                                                                               | -    | -    | 16   | A    |
| I <sub>SM</sub>                                    | Maximum Pulsed Drain to Source Diode Forward Current     |                                                                                               | -    | -    | 64   | A    |
| V <sub>SD</sub>                                    | Drain to Source Diode Forward Voltage                    | V <sub>GS</sub> = 0V, I <sub>S</sub> = 16A                                                    | -    | -    | 1.2  | V    |
| trr                                                | Body Diode Reverse Recovery Time                         | I <sub>F</sub> = 16A, di/dt = 100A/us                                                         | -    | 476  | -    | ns   |
| Qrr                                                | Body Diode Reverse Recovery Charge                       |                                                                                               | -    | 6.9  | -    | μC   |

- Notes:
1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature.
  2.  $E_{AS}$  condition: Starting  $T_J = 25^\circ\text{C}$ ,  $V_{DD} = 50\text{V}$ ,  $V_G = 10\text{V}$ ,  $R_G = 25\Omega$ ,  $L = 10\text{mH}$ ,  $I_{AS} = 13\text{A}$
  3.  $R_{\theta JA}$  is measured with the device mounted on a minimum recommended pad of 2oz copper FR4 PCB
  4. Pulse Test: Pulse Width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 0.5\%$ .

## Typical Performance Characteristics

Figure 1: Output Characteristics

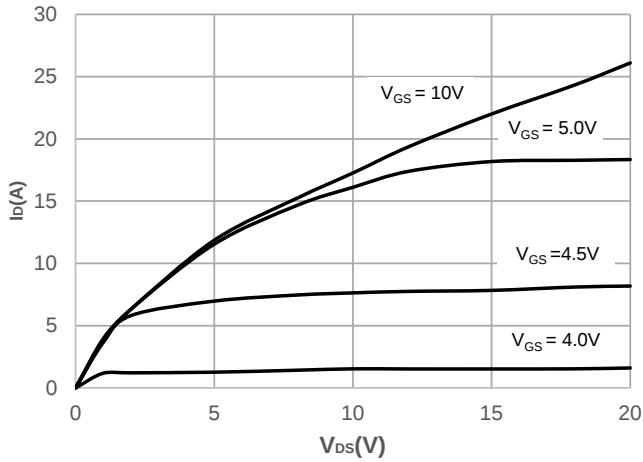


Figure 2: Typical Transfer Characteristics

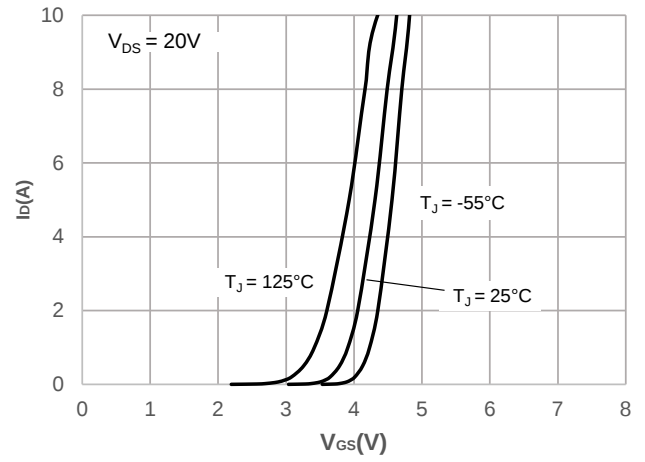


Figure 3: On-resistance vs. Drain Current

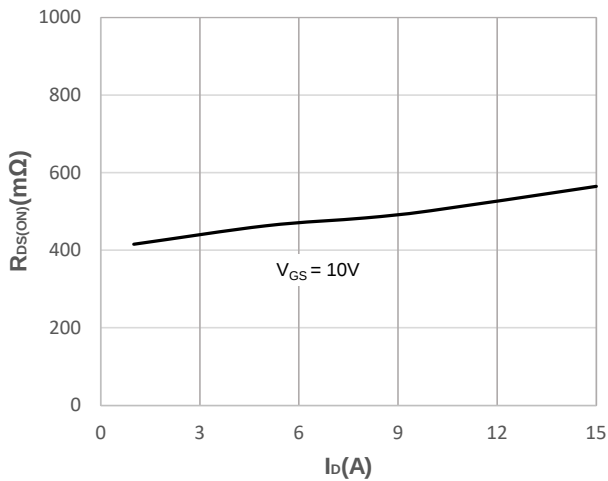


Figure 4: Body Diode Characteristics

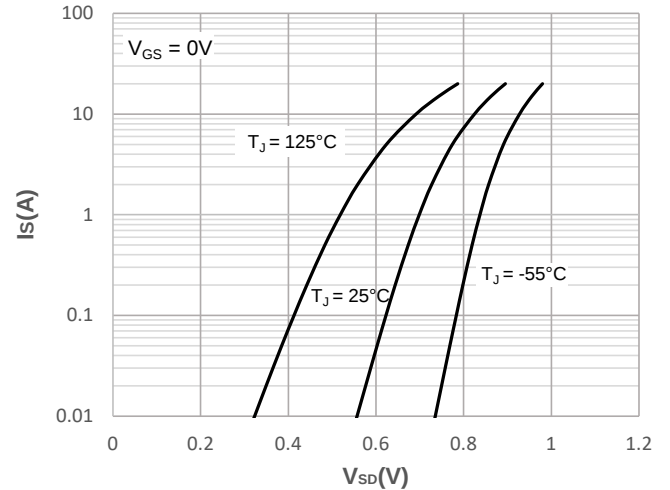


Figure 5: Gate Charge Characteristics

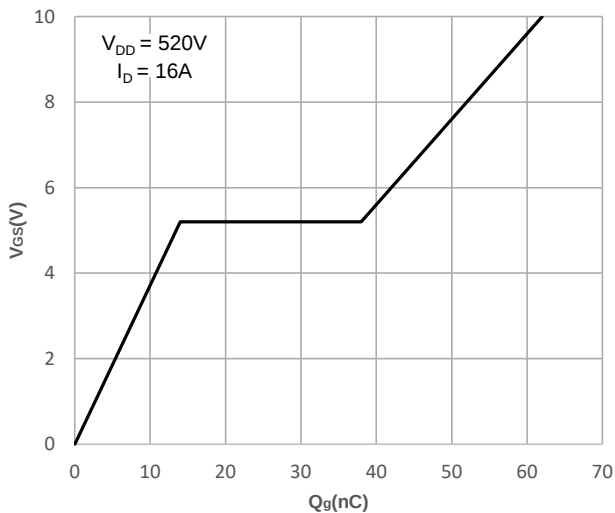
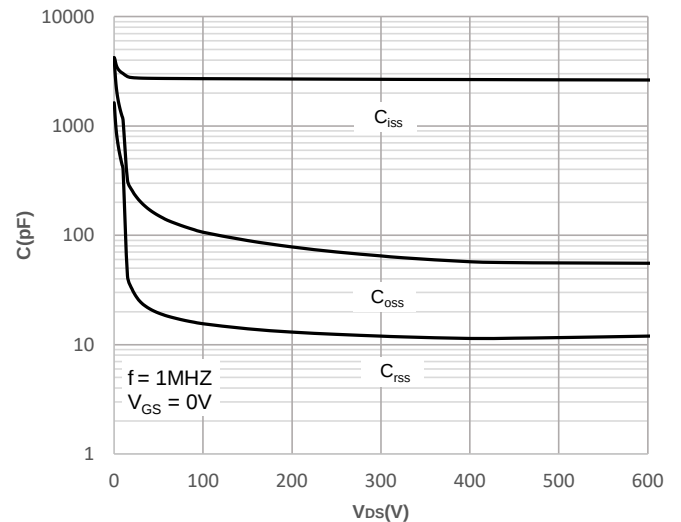


Figure 6: Capacitance Characteristics



## Typical Performance Characteristics

Figure 7: Normalized Breakdown voltage vs. Junction Temperature

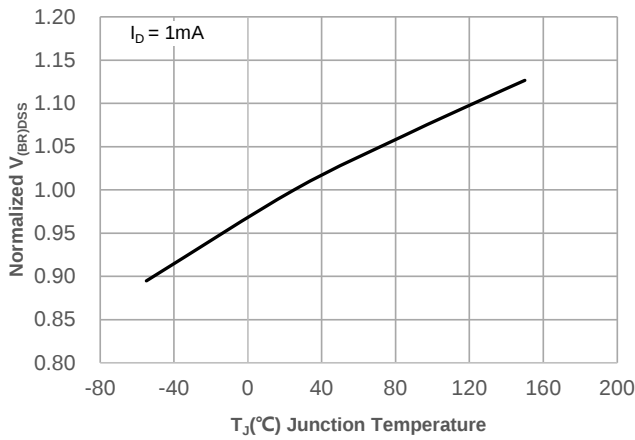


Figure 8: Normalized on Resistance vs. Junction Temperature

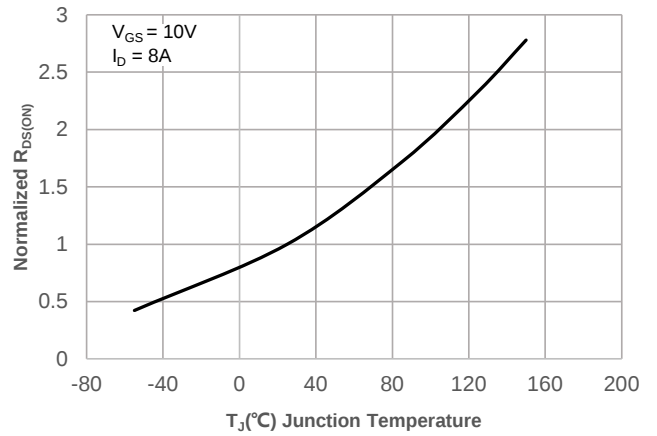


Figure 9: Maximum Safe Operating Area

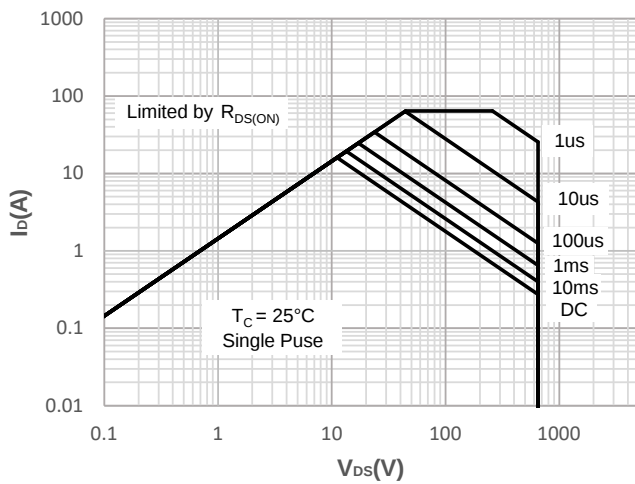


Figure 10: Maximum Continuous Driant Current vs. Case Temperature

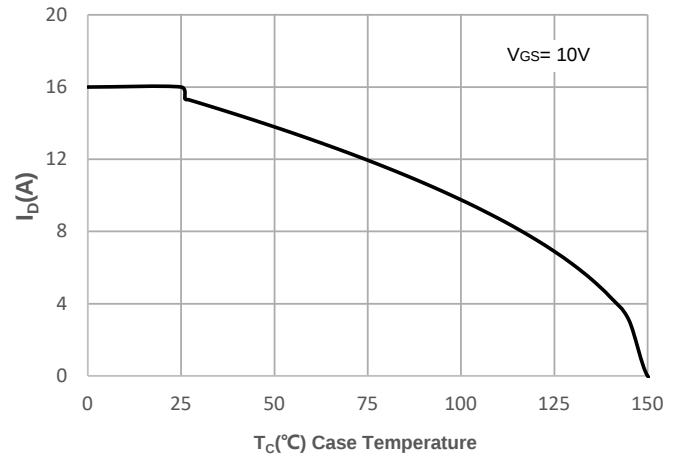


Figure 11: Normalized Maximum Transient Thermal Impedance

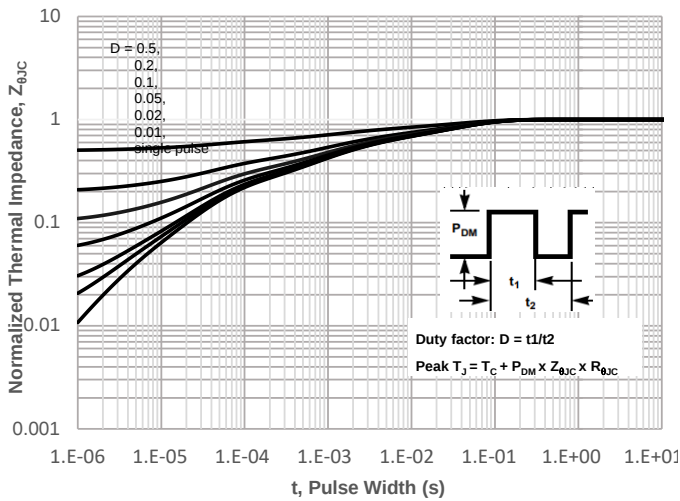


Figure 12: Peak Current Capacity

