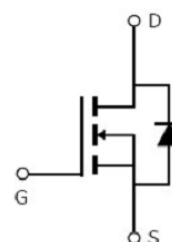


**Main Product Characteristics:**

|              |             |
|--------------|-------------|
| $V_{DSS}$    | 800V        |
| $R_{DS(on)}$ | 3.7Ω (typ.) |
| $I_D$        | 3A          |


**TO220F**

**Marking and pin Assignment**

**Schematic diagram**
**Features and Benefits:**

- Advanced MOSFET process technology
- Special designed for PWM, load switching and general purpose applications
- Ultra low on-resistance with low gate charge
- Fast switching and reverse body recovery
- 150°C operating temperature


**Description:**

It utilizes the latest processing techniques to achieve the high cell density and reduces the on-resistance with high repetitive avalanche rating. These features combine to make this design an extremely efficient and reliable device for use in power switching application and a wide variety of other applications.

**Absolute max Rating:**

| Symbol                   | Parameter  | Max.         | Units |
|--------------------------|--|--------------|-------|
| $I_D @ TC = 25^\circ C$  | Continuous Drain Current, $V_{GS} @ 10V$ ①       | 3            | A     |
| $I_D @ TC = 100^\circ C$ | Continuous Drain Current, $V_{GS} @ 10V$ ①       | 1.9          |       |
| $I_{DM}$                 | Pulsed Drain Current②                            | 12           |       |
| $P_D @ TC = 25^\circ C$  | Power Dissipation③                               | 39           | W     |
|                          | Linear Derating Factor                           | 0.31         | W/°C  |
| $V_{DS}$                 | Drain-Source Voltage                             | 800          | V     |
| $V_{GS}$                 | Gate-to-Source Voltage                           | ± 30         | V     |
| $E_{AS}$                 | Single Pulse Avalanche Energy @ L=67mH           | 322          | mJ    |
| $I_{AS}$                 | Avalanche Current @ L=67mH                       | 3.1          | A     |
| $T_J T_{STG}$            | Operating Junction and Storage Temperature Range | -55 to + 150 | °C    |

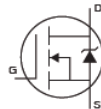
## Thermal Resistance

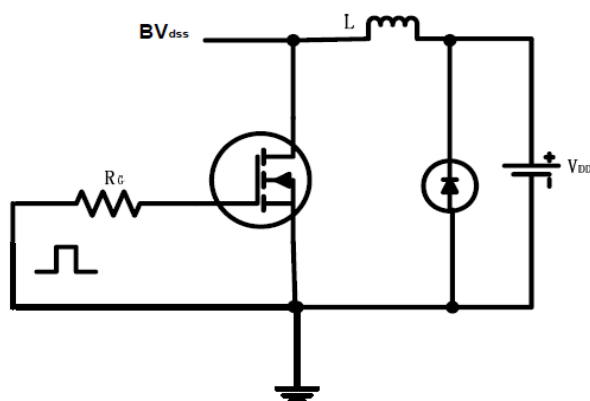
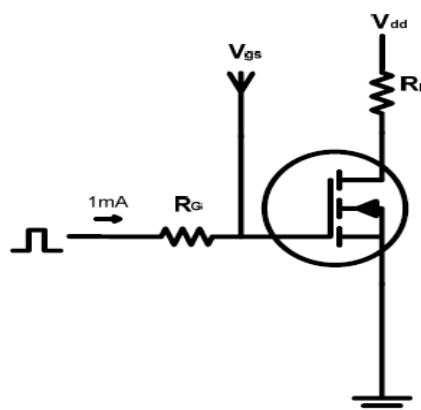
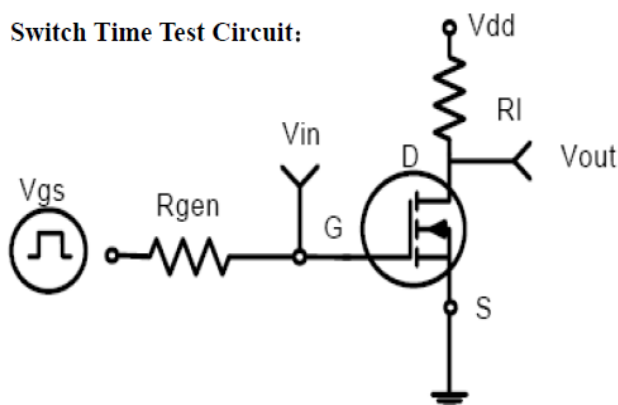
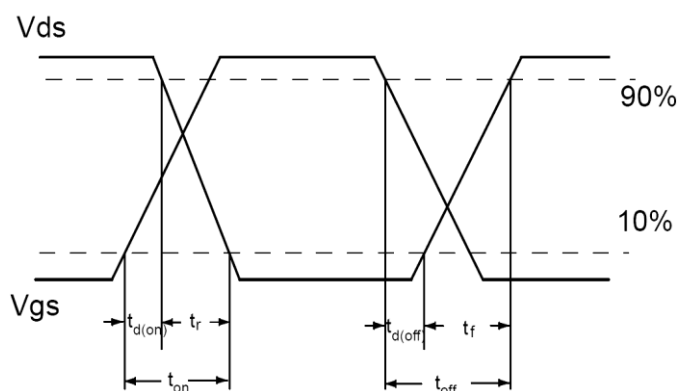
| Symbol          | Characterizes  | Typ. | Max. | Units                       |
|-----------------|--|------|------|-----------------------------|
| $R_{\theta JC}$ | Junction-to-case <sup>③</sup>                                | —    | 3.2  | $^{\circ}\text{C}/\text{W}$ |
| $R_{\theta JA}$ | Junction-to-ambient ( $t \leq 10\text{s}$ ) <sup>④</sup>     | —    | 62.5 | $^{\circ}\text{C}/\text{W}$ |
|                 | Junction-to-Ambient (PCB mounted, steady-state) <sup>④</sup> | —    | 40   | $^{\circ}\text{C}/\text{W}$ |

## Electrical Characterizes @ $T_A=25^{\circ}\text{C}$ unless otherwise specified

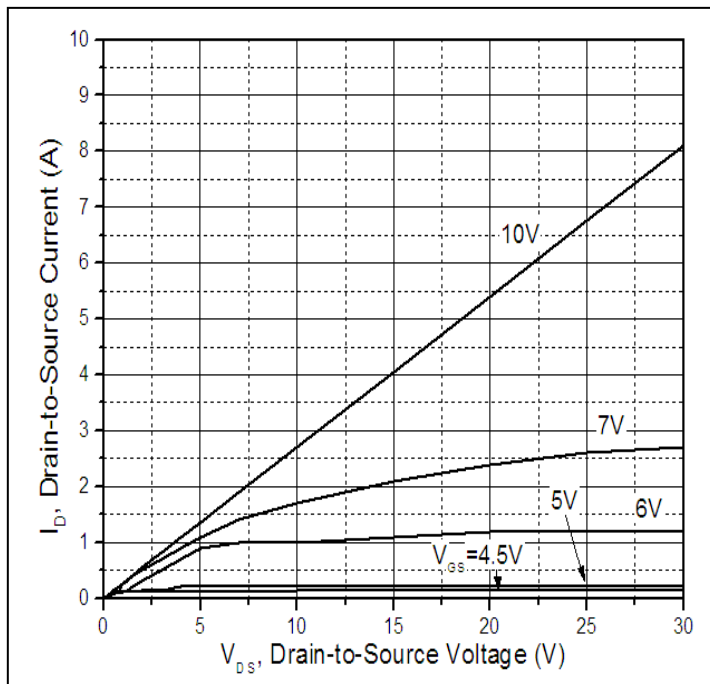
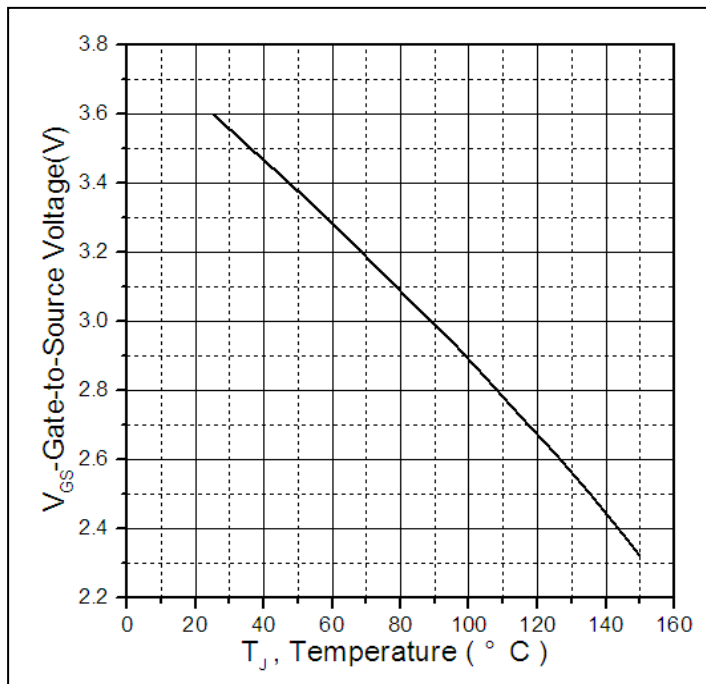
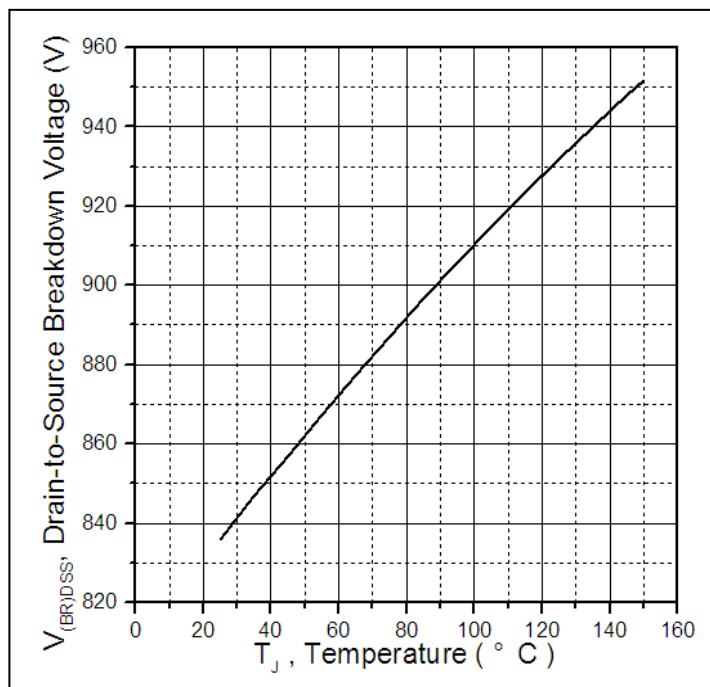
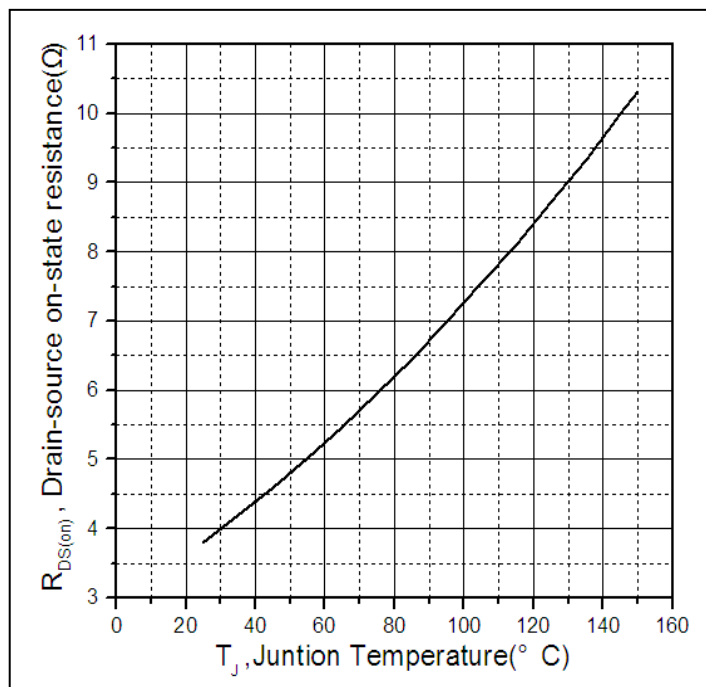
| Symbol        | Parameter                            | Min. | Typ. | Max. | Units         | Conditions  |
|---------------|--------------------------------------|------|------|------|---------------|---|
| $V_{(BR)DSS}$ | Drain-to-Source breakdown voltage    | 800  | —    | —    | V             | $V_{GS} = 0\text{V}, I_D = 250\mu\text{A}$  |
| $R_{DS(on)}$  | Static Drain-to-Source on-resistance | —    | 3.7  | 4.8  | $\Omega$      | $V_{GS}=10\text{V}, I_D = 1.5\text{A}$<br>$T_J = 125^{\circ}\text{C}$                                 |
|               |                                      | —    | 8.7  | —    |               |   |
| $V_{GS(th)}$  | Gate threshold voltage               | 2    | —    | 4    | V             | $V_{DS} = V_{GS}, I_D = 250\mu\text{A}$<br>$T_J = 125^{\circ}\text{C}$                                |
|               |                                      | —    | 2.6  | —    |               |   |
| $I_{DSS}$     | Drain-to-Source leakage current      | —    | —    | 1    | $\mu\text{A}$ | $V_{DS} = 800\text{V}, V_{GS} = 0\text{V}$<br>$T_J = 125^{\circ}\text{C}$                             |
|               |                                      | —    | —    | 50   |               |   |
| $I_{GSS}$     | Gate-to-Source forward leakage       | —    | —    | 100  | nA            | $V_{GS} = 30\text{V}$<br>$V_{GS} = -30\text{V}$   |
|               |                                      | —    | —    | -100 |               |   |
| $Q_g$         | Total gate charge                    | —    | 11.2 | —    | nC            | $I_D = 3\text{A},$<br>$V_{DS}=400\text{V},$<br>$V_{GS} = 10\text{V}$                                  |
| $Q_{gs}$      | Gate-to-Source charge                | —    | 3.3  | —    |               |   |
| $Q_{gd}$      | Gate-to-Drain("Miller") charge       | —    | 5.1  | —    |               |   |
| $t_{d(on)}$   | Turn-on delay time                   | —    | 12.4 | —    | ns            | $V_{GS}=10\text{V}, V_{DS}=400\text{V},$<br>$R_L=130\Omega,$<br>$R_{GEN}=25\Omega$<br>$I_D=3\text{A}$ |
| $t_r$         | Rise time                            | —    | 19.1 | —    |               |   |
| $t_{d(off)}$  | Turn-Off delay time                  | —    | 24.4 | —    |               |   |
| $t_f$         | Fall time                            | —    | 16.7 | —    |               |   |
| $C_{iss}$     | Input capacitance                    | —    | 404  | —    | pF            | $V_{GS} = 0\text{V}$<br>$V_{DS} = 25\text{V}$<br>$f = 1\text{MHz}$                                    |
| $C_{oss}$     | Output capacitance                   | —    | 54.4 | —    |               |   |
| $C_{rss}$     | Reverse transfer capacitance         | —    | 4.75 | —    |               |   |

## Source-Drain Ratings and Characteristics

| Symbol   | Parameter                                 | Min. | Typ. | Max. | Units | Conditions   |
|----------|---|------|------|------|-------|--|
| $I_S$    | Continuous Source Current<br>(Body Diode) | —    | —    | 3    | A     | MOSFET symbol showing the integral reverse p-n junction diode.  |
| $I_{SM}$ | Pulsed Source Current<br>(Body Diode)     | —    | —    | 12   | A     |  |
| $V_{SD}$ | Diode Forward Voltage                     | —    | 0.86 | 1.4  | V     | $I_S=3\text{A}, V_{GS}=0\text{V}$  |
| $t_{rr}$ | Reverse Recovery Time                     | —    | 989  | —    | ns    | $T_J = 25^{\circ}\text{C}, I_F = 3\text{A},$<br>$di/dt = 100\text{A}/\mu\text{s}$  |
| $Q_{rr}$ | Reverse Recovery Charge                   | —    | 2405 | —    | nC    |  |

**Test circuits and Waveforms**
**EAS test circuits:**

**Gate charge test circuit:**

**Switch Time Test Circuit:**

**Switch Waveforms:**

**Notes:**

- ① The maximum current rating is limited by bond-wires.
- ② Repetitive rating; pulse width limited by max. junction temperature.
- ③ The power dissipation PD is based on max. junction temperature, using junction-to-case thermal resistance.
- ④ The value of  $R_{\theta JA}$  is measured with the device mounted on 1in 2 FR-4 board with 2oz. Copper, in a still air environment with  $T_A = 25^\circ\text{C}$

**Typical electrical and thermal characteristics**

**Figure 1: Typical Output Characteristics**

**Figure 2. Gate to source cut-off voltage**

**Figure 3. Drain-to-Source Breakdown Voltage Vs. Case Temperature**

**Figure 4: Normalized On-Resistance Vs. Case Temperature**

Typical electrical and thermal characteristics

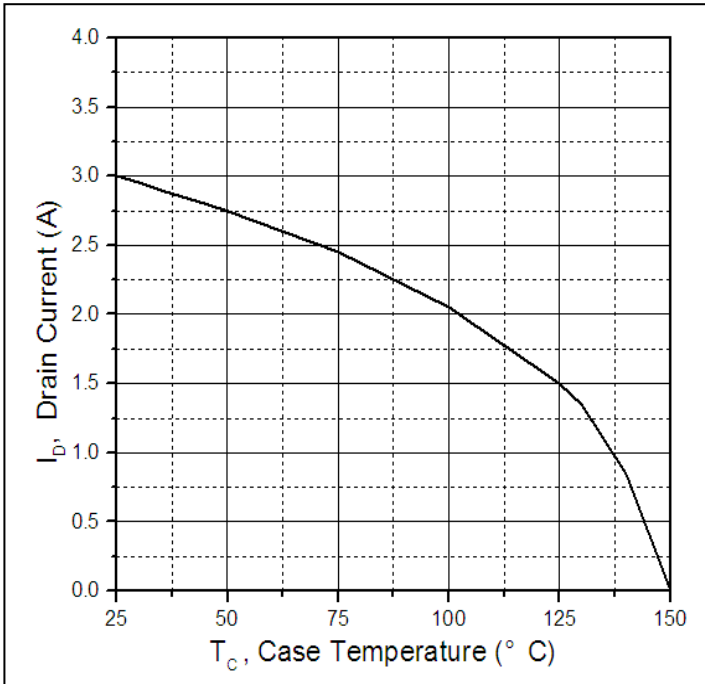


Figure 5. Maximum Drain Current Vs. Case Temperature

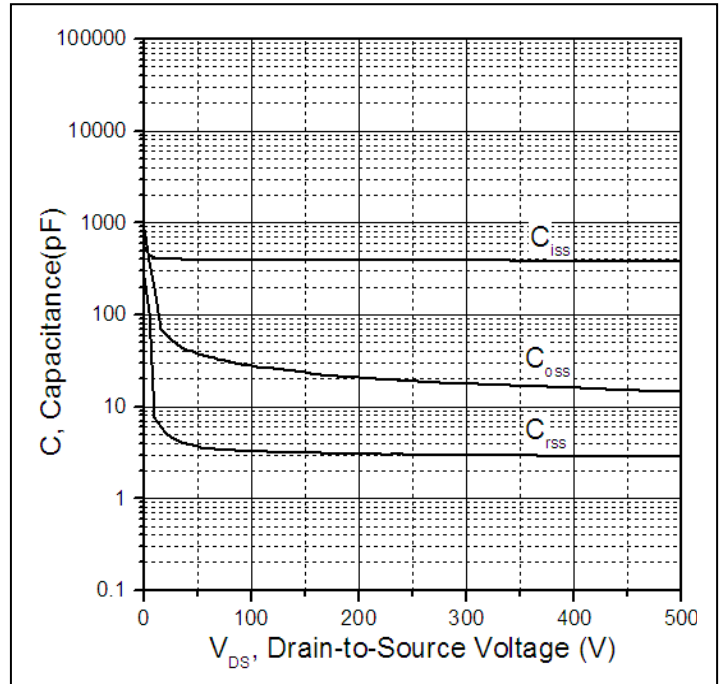


Figure 6. Typical Capacitance Vs. Drain-to-Source Voltage

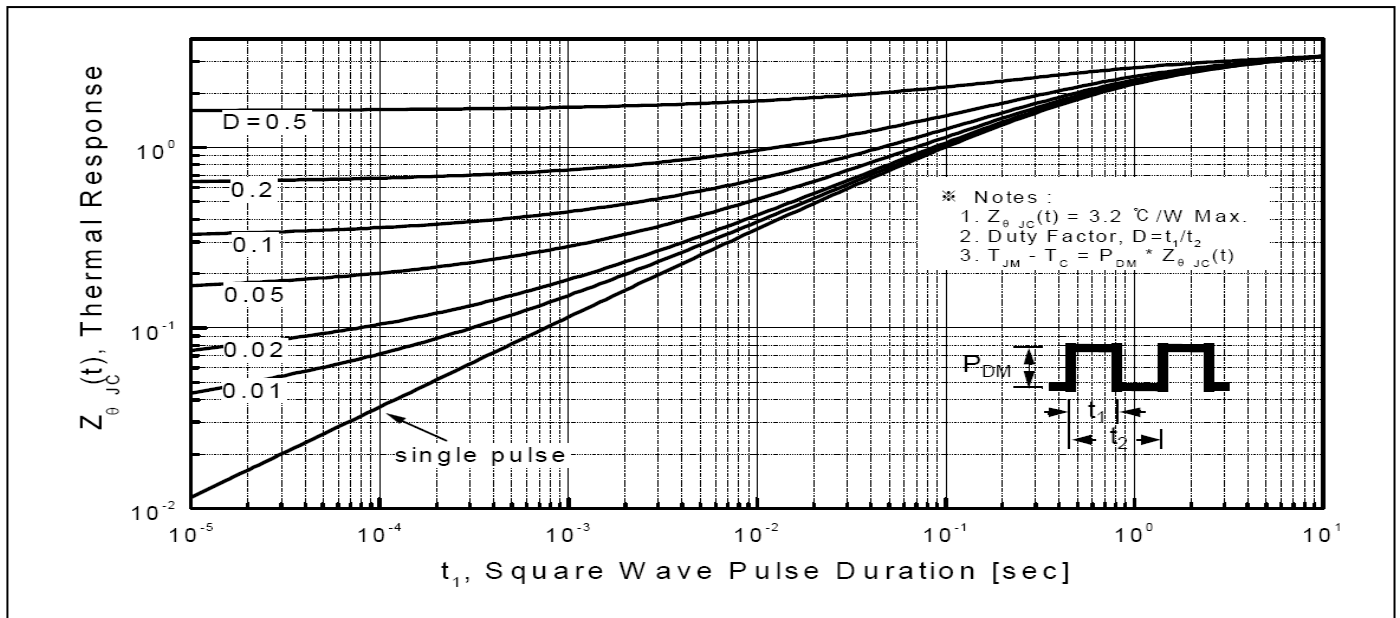
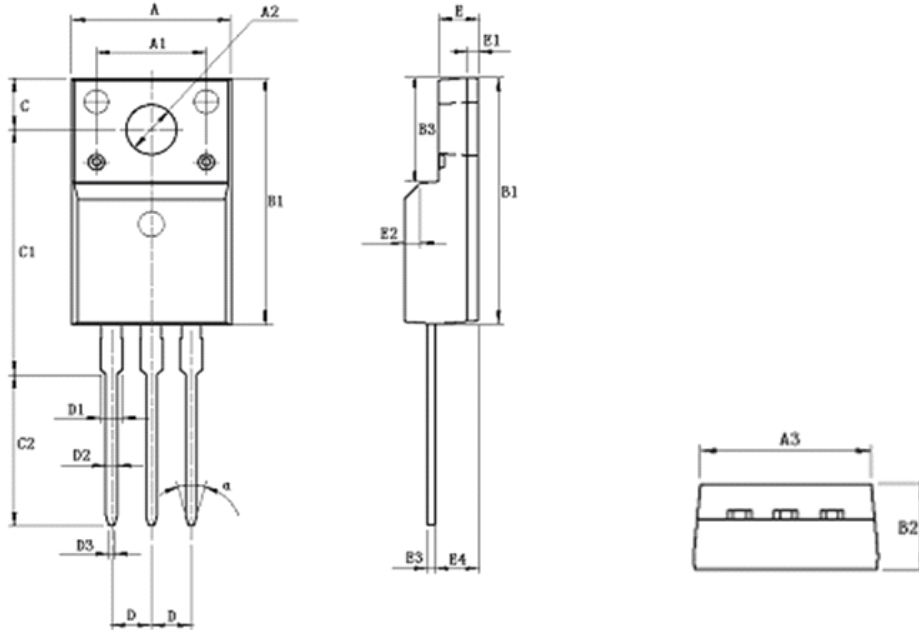


Figure7. Maximum Effective Transient Thermal Impedance, Junction-to-Case

**Mechanical Data:**
**TO220F PACKAGE OUTLINE DIMENSION**


| Symbol   | Dimension In Millimeters |        |        | Dimension In Inches |       |       |
|----------|--------------------------|--------|--------|---------------------|-------|-------|
|          | Min                      | Nom    | Max    | Min                 | Nom   | Max   |
| A        | 9.960                    | 10.160 | 10.360 | 0.392               | 0.400 | 0.408 |
| A1       | 7.000                    |        |        | 0.276               | 0.000 | 0.000 |
| A2       | 3.080                    | 3.180  | 3.280  | 0.121               | 0.125 | 0.129 |
| A3       | 9.260                    | 9.460  | 9.660  | 0.365               | 0.372 | 0.380 |
| B1       | 15.670                   | 15.870 | 16.070 | 0.617               | 0.625 | 0.633 |
| B2       | 4.500                    | 4.700  | 4.900  | 0.177               | 0.185 | 0.193 |
| B3       | 6.480                    | 6.680  | 6.880  | 0.255               | 0.263 | 0.271 |
| C        | 3.200                    | 3.300  | 3.400  | 0.126               | 0.130 | 0.134 |
| C1       | 15.600                   | 15.800 | 16.000 | 0.614               | 0.622 | 0.630 |
| C2       | 9.550                    | 9.750  | 9.950  | 0.376               | 0.384 | 0.392 |
| D        | 2.54 (TYP)               |        |        | 1.00 (TYP)          |       |       |
| D1       | -                        | -      | 1.470  | -                   | -     | 0.058 |
| D2       | 0.700                    | 0.800  | 0.900  | 0.028               | 0.031 | 0.035 |
| D3       | 0.250                    | 0.350  | 0.450  | 0.010               | 0.014 | 0.018 |
| E        | 2.340                    | 2.540  | 2.740  | 0.092               | 0.100 | 0.108 |
| E1       | 0.700                    |        |        | 0.028               |       |       |
| E2       | 1.0*45 <sup>0</sup>      |        |        | 1.0*45 <sup>0</sup> |       |       |
| E3       | 0.450                    | 0.500  | 0.600  | 0.018               | 0.020 | 0.024 |
| E4       | 2.560                    | 2.760  | 2.960  | 0.101               | 0.109 | 0.117 |
| $\Theta$ | 30 <sup>0</sup>          |        |        | 30 <sup>0</sup>     |       |       |

**Ordering and Marking Information****Device Marking: SSF3N80F**

Package (Available)  
TO220F  
Operating Temperature Range  
C : -55 to 150 °C

**Devices per Unit**

| Package Type | Units/Tube | Tubes/Inner Box | Units/Inner Box | Inner Boxes/Carton Box | Units/Carton Box |
|--------------|------------|-----------------|-----------------|------------------------|------------------|
| TO220F       | 50         | 20              | 1000            | 6                      | 6000             |

**Reliability Test Program**

| Test Item                           | Conditions  | Duration                             | Sample Size         |
|-------------------------------------|---|--------------------------------------|---------------------|
| High Temperature Reverse Bias(HTRB) | $T_j=125^{\circ}\text{C}$ to $150^{\circ}\text{C}$ @ 80% of Max $V_{DSS}/V_{CES}/V_R$ | 168 hours<br>500 hours<br>1000 hours | 3 lots x 77 devices |
| High Temperature Gate Bias(HTGB)    | $T_j=150^{\circ}\text{C}$ @ 100% of Max $V_{GSS}$                                     | 168 hours<br>500 hours<br>1000 hours | 3 lots x 77 devices |

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