# N-Channel Enhancement Mode Power MOSFET

## Description

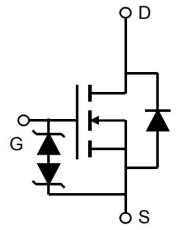
The GC380N60F**E** uses advanced super junction technology and design to provide excellent Ros(on), low gate charge and operation. This device is suitable for industry's AC-DC SMPS requirement for PFC, AC/DC power conversion, and industrial power application.

## General Features

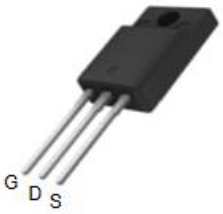
- $V_{DS}$ 600V
- $I_D$ (at $V_{GS}$ = 10V) 11A
- $R_{DS(ON)}$ (at $V_{GS}$ = 10V) < 380mΩ
- 100% Avalanche Tested
- RoHS Compliant
- ESD (HBM) : 6.5KV

## Application

- Power switch
- DC/DC converters




Schematic diagram




TO-220F

## Ordering Information

| Device | Package | Marking | Packaging |
|---|---|---|---|
| GC380N60FE | TO-220F | GC380N60 | 50pcs/Tube |

## Absolute Maximum Ratings $T_C$ = 25ºC, unless otherwise noted

| Parameter | | Symbol | Value | Unit |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DS}$ | 600 | V |
| Continuous Drain Current | $T_C$ = 25ºC | $I_D$ | 11 | A |
| | $T_C$ = 100ºC | | 7 | |
| Pulsed Drain Current (note1) | | $I_{DM}$ | 33 | A |
| Gate-Source Voltage | | $V_{GS}$ | ±30 | V |
| Power Dissipation | | $P_D$ | 31 | W |
| Single pulse avalanche energy （note2） | | $E_{AS}$ | 11 | mJ |
| Operating Junction and Storage Temperature Range | | $T_J$, $T_{stg}$ | -55 To 150 | ºC |

## Thermal Resistance

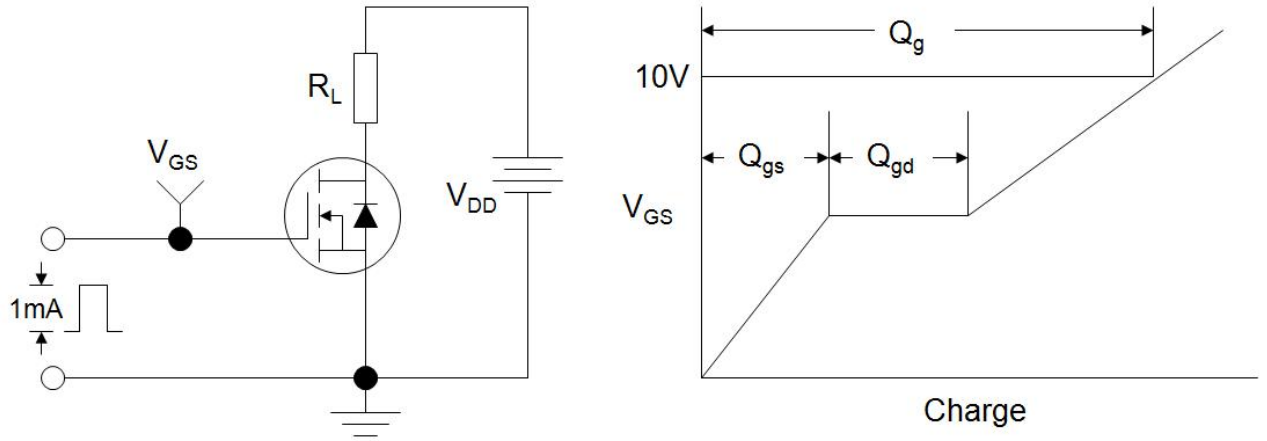
| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance, Junction-to-Ambient | $R_{thJA}$ | 80 | ºC/W |
| Thermal Resistance, Junction-to-Case | $R_{thJC}$ | 4 | ºC/W |

| **Specifications** $T_J$ = 25ºC, unless otherwise noted | | | | | | |
|---|---|---|---|---|---|---|
| **Parameter** | **Symbol** | **Test Conditions** | **Value** | | | **Unit** |
| | | | **Min.** | **Typ.** | **Max.** | |
| **Static Parameters** | | | | | | |
| Drain-Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS}$ = 0V, $I_D$ = 250μA | 600 | -- | -- | V |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$ = 600V, $V_{GS}$ = 0V | -- | -- | 1 | μA |
| Gate-Source Leakage | $I_{GSS}$ | $V_{GS}$ = ±30V | -- | -- | ±10 | μA |
| Gate-Source Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = 250μA | 3.0 | 3.5 | 4.0 | V |
| Drain-Source On-Resistance | $R_{DS(on)}$ | $V_{GS}$ = 10V, $I_D$ = 4.5A | -- | 320 | 380 | mΩ |
| Forward Transconductance | $g_{FS}$ | $V_{DS}$ = 20V, $I_D$ = 4.5A | -- | 6 | -- | S |
| **Dynamic Parameters** | | | | | | |
| Input Capacitance | $C_{iss}$ | $V_{GS}$ = 0V, $V_{DS}$ = 300V, f = 1.0MHz | -- | 500 | -- | pF |
| Output Capacitance | $C_{oss}$ | | -- | 19 | -- | |
| Reverse Transfer Capacitance | $C_{rss}$ | | -- | 1.7 | -- | |
| Total Gate Charge | $Q_g$ | $V_{DD}$ = 300V, $I_D$ = 4.5A, $V_{GS}$ = 10V | -- | 17 | -- | nC |
| Gate-Source Charge | $Q_{gs}$ | | -- | 4 | -- | |
| Gate-Drain Charge | $Q_{gd}$ | | -- | 8 | -- | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DD}$ = 300V, $I_D$ = 4.5A, $R_G$ = 10Ω | -- | 11 | -- | ns |
| Turn-on Rise Time | $t_r$ | | -- | 24 | -- | |
| Turn-off Delay Time | $t_{d(off)}$ | | -- | 51 | -- | |
| Turn-off Fall Time | $t_f$ | | -- | 25 | -- | |
| **Drain-Source Body Diode Characteristics** | | | | | | |
| Continuous Body Diode Current | $I_S$ | $T_C$ = 25ºC | -- | -- | 11 | A |
| Body Diode Voltage | $V_{SD}$ | $T_J$ = 25ºC, $I_{SD}$ = 4.5A, $V_{GS}$ = 0V | -- | -- | 1.2 | V |
| Reverse Recovery Charge | Qrr | $I_F$ = 4.5A, $V_{GS}$ = 0V di/dt=100A/us | -- | 1.7 | -- | μC |
| Reverse Recovery Time | Trr | | -- | 206 | -- | ns |

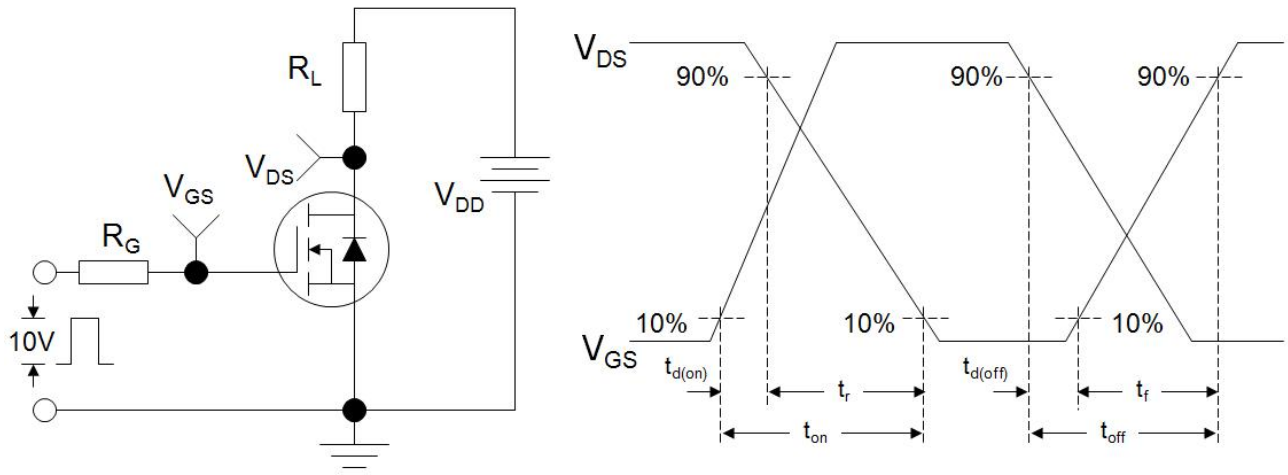
**Notes**

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. EAS condition : Tj=25℃ ,VDD=50V,VGS=10V,L=10mH,Rg=25Ω
   The table shows the minimum avalanche energy, which is 31mJ when the device is tested until failure
3. Identical low side and high side switch with identical $R_G$

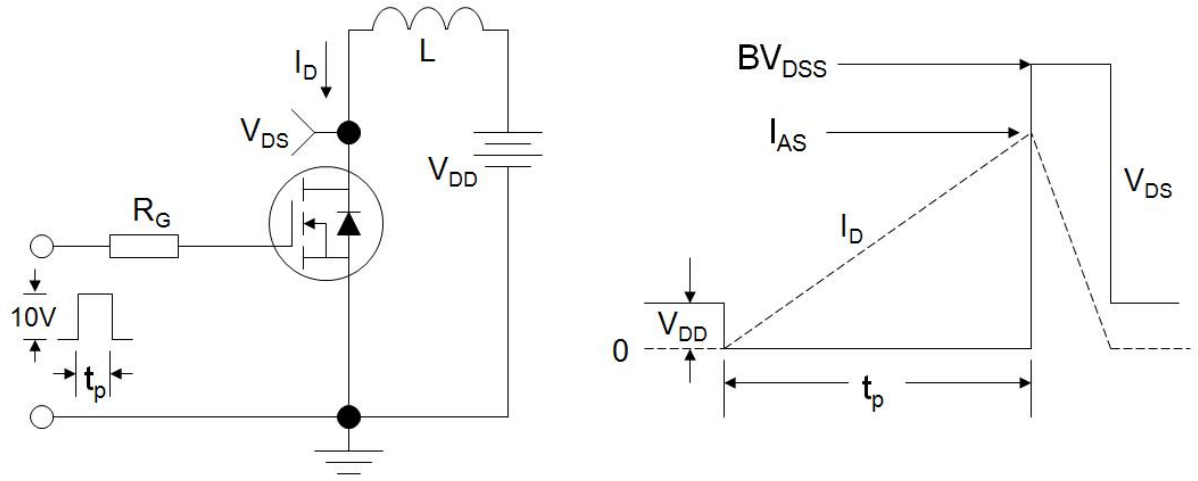
**Gate Charge Test Circuit**




**Switch Time Test Circuit**




**EAS Test Circuit**



## Typical Characteristics $T_J$ = 25ºC, unless otherwise noted

**Figure 1. Output Characteristics**

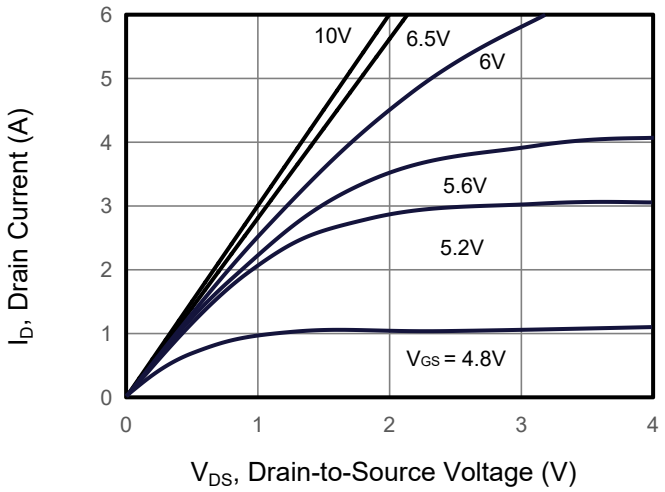



**Figure 2. Transfer Characteristics**

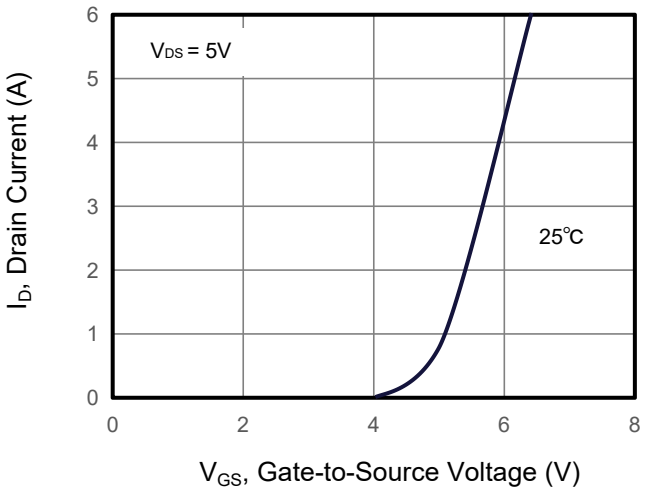



**Figure 3. Drain Source On Resistance**

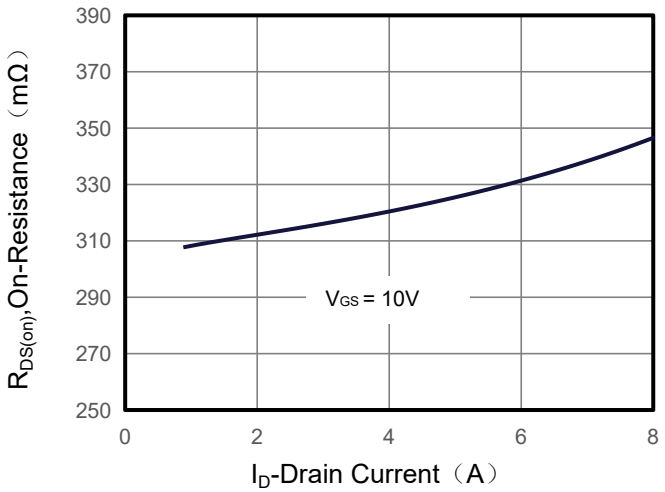



**Figure 4. Gate Charge**

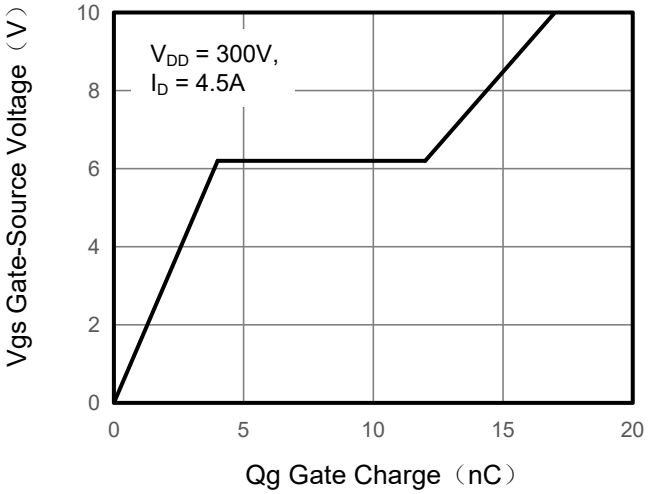



**Figure 5. Capacitance**

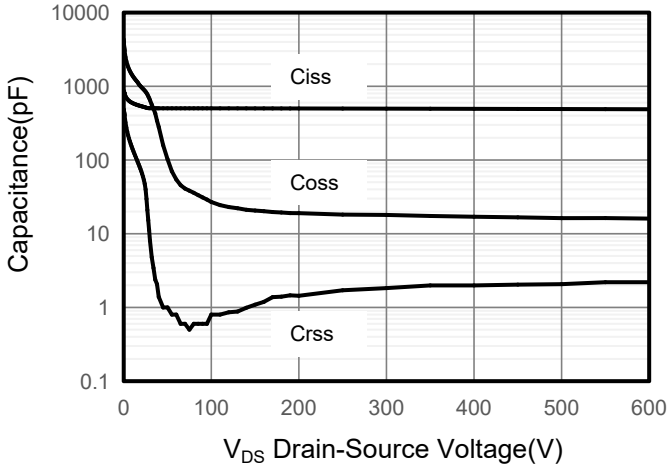
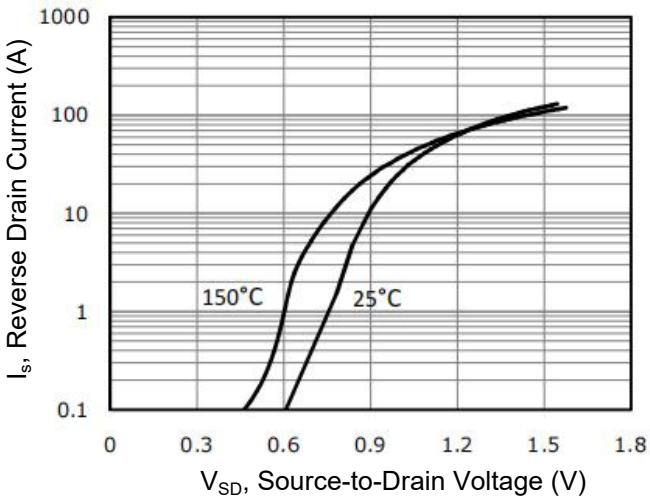



**Figure 6. Source-Drain Diode Forward**



**Typical Characteristics** $T_J$ = 25ºC, unless otherwise noted

**Figure 7. Drain-Source On-Resistance**

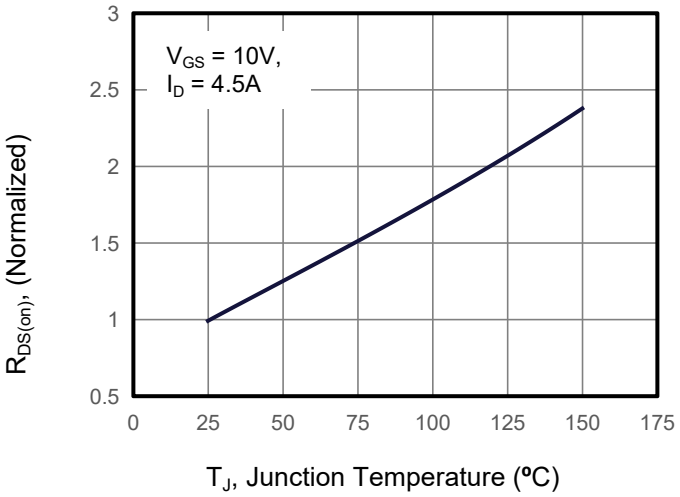



**Figure 8. Safe Operation Area**

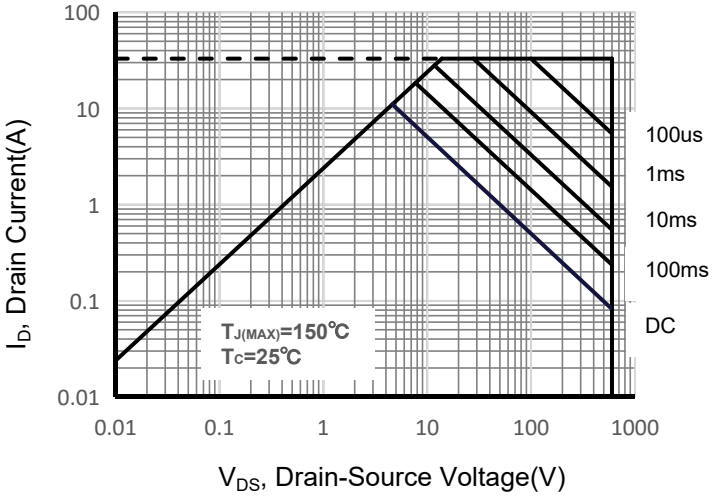



**Figure 9. Maximum Continuous Drain Current vs Case Temperature**

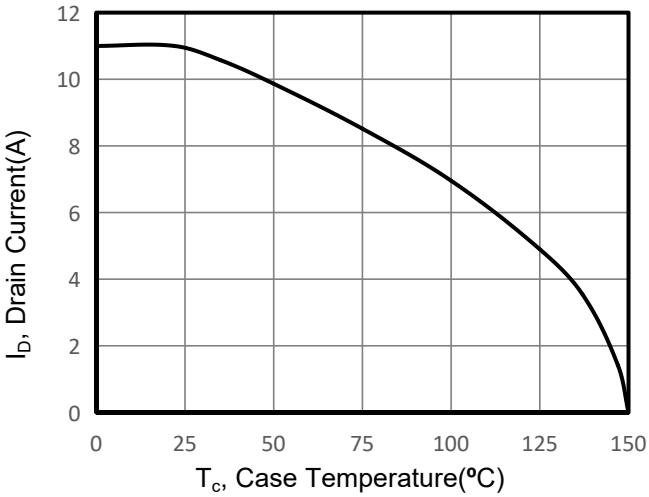
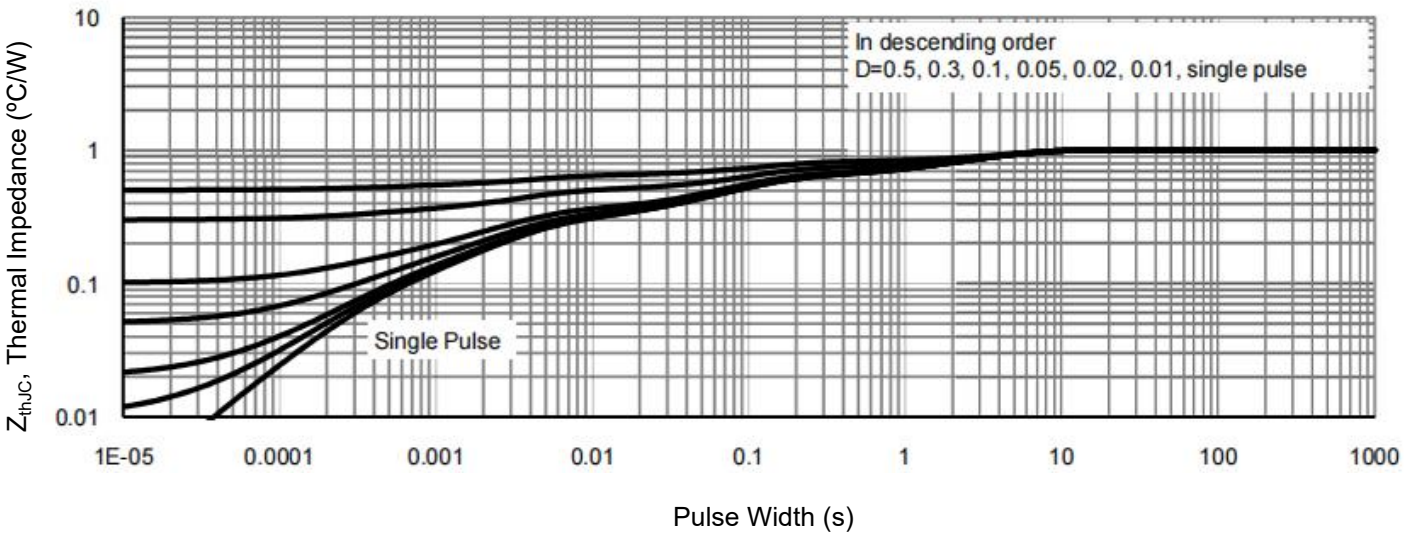
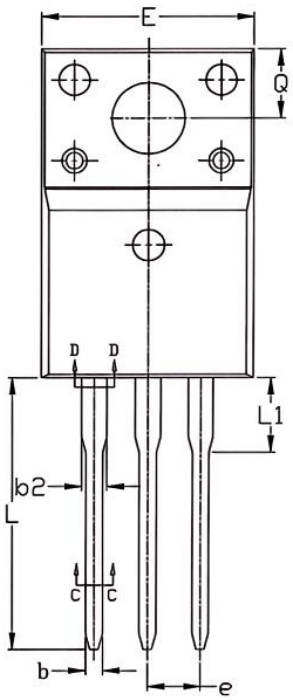


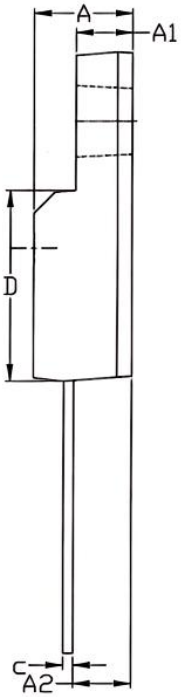

**Figure 10. Normalized Maximum Transient Thermal Impedance**



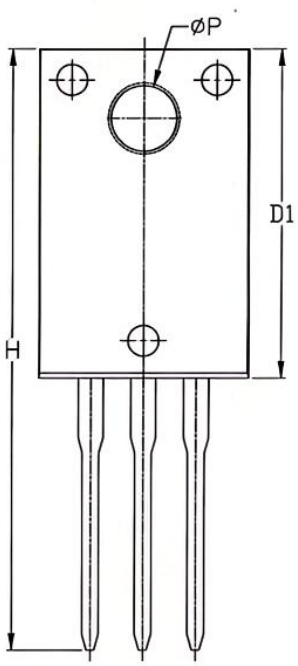
## TO-220F Package Information



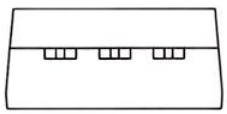

TOP VIEW




SIDE VIEW(Right)




BOTTOM VIEW



SIDE VIEW(Front)

| DIM / SYMBOL | MIN. | NOM. | MAX. |
|---|---|---|---|
| A | 4.600 | 4.700 | 4.800 |
| A1 | 2.600 | 2.700 | 2.800 |
| A2 | 2.660 | 2.760 | 2.860 |
| b | 0.740 | 0.840 | 0.940 |
| b1 | 0.700 | 0.800 | 0.900 |
| b2 | 1.140 | 1.240 | 1.340 |
| b3 | 1.100 | 1.200 | 1.300 |
| c | 0.440 | 0.540 | 0.640 |
| c1 | 0.400 | 0.500 | 0.600 |
| D | 9.090 | 9.190 | 9.290 |
| D1 | 15.770 | 15.870 | 15.970 |
| E | 10.060 | 10.160 | 10.260 |
| e | 2.540 BSC. | | |
| H | 28.800 | 29.000 | 29.200 |
| L | 12.930 | 13.130 | 13.330 |
| L1 | 3.400 | 3.600 | 3.800 |
| øP | 3.080 | 3.180 | 3.280 |
| Q | 3.150 | 3.350 | 3.550 |