

## General Description

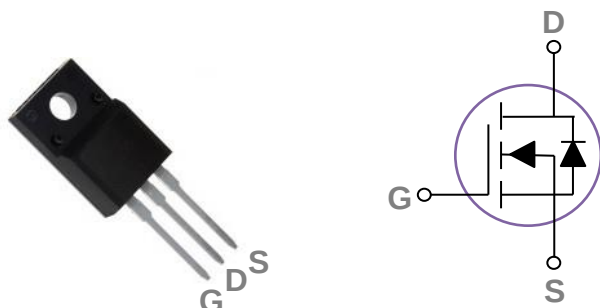
These N-Channel enhancement mode power field effect transistors are planar stripe, DMOS technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency switch mode power supply

| BVDSS | RDSON | ID  |
|-------|-------|-----|
| 200V  | 130mΩ | 20A |

## Features

- Improved dv/dt capability
- Fast switching
- 100% EAS Guaranteed
- Green Device Available

## TO220F Pin Configuration



## Applications

- High efficient switched mode power supplies
- TV Power
- Adapter/charger
- Networking
- PV Inverter / UPS

## Absolute Maximum Ratings $T_c=25^{\circ}\text{C}$ unless otherwise noted

| Symbol    | Parameter                                                | Rating     | Units                 |
|-----------|----------------------------------------------------------|------------|-----------------------|
| $V_{DS}$  | Drain-Source Voltage                                     | 200        | V                     |
| $V_{GS}$  | Gate-Source Voltage                                      | $\pm 30$   | V                     |
| $I_D$     | Drain Current – Continuous ( $T_c=25^{\circ}\text{C}$ )  | 20         | A                     |
|           | Drain Current – Continuous ( $T_c=100^{\circ}\text{C}$ ) | 13         | A                     |
| $I_{DM}$  | Drain Current – Pulsed <sup>1</sup>                      | 80         | A                     |
| EAS       | Single Pulse Avalanche Energy <sup>2</sup>               | 420        | mJ                    |
| IAS       | Single Pulse Avalanche Current <sup>2</sup>              | 29         | A                     |
| $P_D$     | Power Dissipation ( $T_c=25^{\circ}\text{C}$ )           | 25         | W                     |
|           | Power Dissipation – Derate above $25^{\circ}\text{C}$    | 0.2        | W/ $^{\circ}\text{C}$ |
| $T_{STG}$ | Storage Temperature Range                                | -55 to 150 | $^{\circ}\text{C}$    |
| $T_J$     | Operating Junction Temperature Range                     | -55 to 150 | $^{\circ}\text{C}$    |

## Thermal Characteristics

| Symbol          | Parameter                              | Typ. | Max. | Unit                        |
|-----------------|----------------------------------------|------|------|-----------------------------|
| $R_{\theta JA}$ | Thermal Resistance Junction to ambient | ---  | 62   | $^{\circ}\text{C}/\text{W}$ |
| $R_{\theta JC}$ | Thermal Resistance Junction to Case    | ---  | 5    | $^{\circ}\text{C}/\text{W}$ |

## Electrical Characteristics (T<sub>J</sub>=25 °C, unless otherwise noted)

### Off Characteristics

| Symbol            | Parameter                      | Conditions                                                        | Min. | Typ. | Max. | Unit |
|-------------------|--------------------------------|-------------------------------------------------------------------|------|------|------|------|
| BV <sub>DSS</sub> | Drain-Source Breakdown Voltage | V <sub>GS</sub> =0V, I <sub>D</sub> =250μA                        | 200  | ---  | ---  | V    |
| I <sub>DSS</sub>  | Drain-Source Leakage Current   | V <sub>DS</sub> =200V, V <sub>GS</sub> =0V, T <sub>J</sub> =25°C  | ---  | ---  | 1    | μA   |
|                   |                                | V <sub>DS</sub> =160V, V <sub>GS</sub> =0V, T <sub>J</sub> =125°C | ---  | ---  | 10   | μA   |
| I <sub>GSS</sub>  | Gate-Source Leakage Current    | V <sub>GS</sub> =±30V, V <sub>DS</sub> =0V                        | ---  | ---  | ±100 | nA   |

### On Characteristics

|                     |                                   |                                                          |     |     |     |    |
|---------------------|-----------------------------------|----------------------------------------------------------|-----|-----|-----|----|
| R <sub>DS(ON)</sub> | Static Drain-Source On-Resistance | V <sub>GS</sub> =10V, I <sub>D</sub> =8A                 | --- | 100 | 130 | mΩ |
| V <sub>GS(th)</sub> | Gate Threshold Voltage            | V <sub>GS</sub> =V <sub>DS</sub> , I <sub>D</sub> =250μA | 3   | 4   | 5   | V  |
| g <sub>fs</sub>     | Forward Transconductance          | V <sub>DS</sub> =30V, I <sub>D</sub> =5A                 | --- | 6.5 | --- | S  |

### Dynamic and switching Characteristics

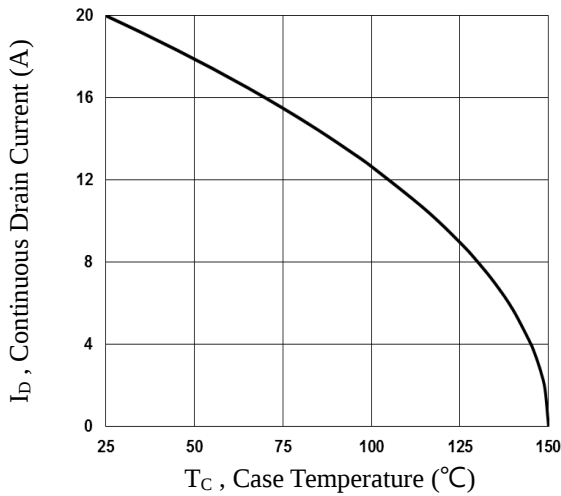
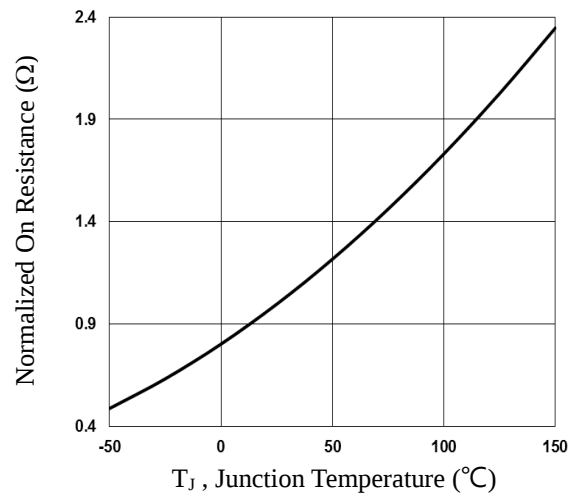
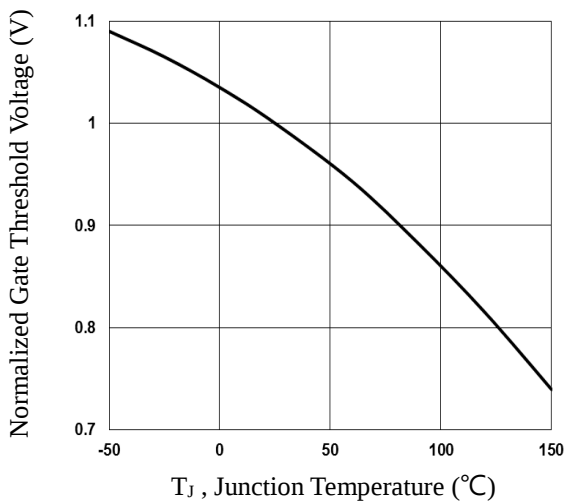
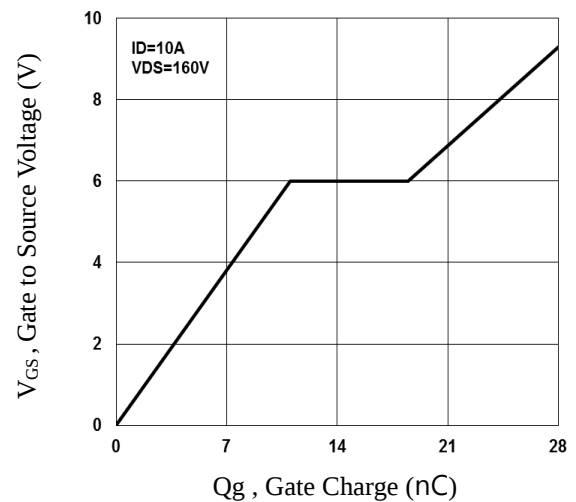
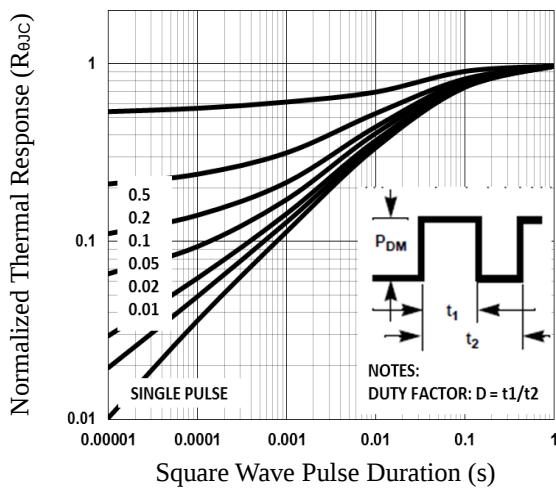
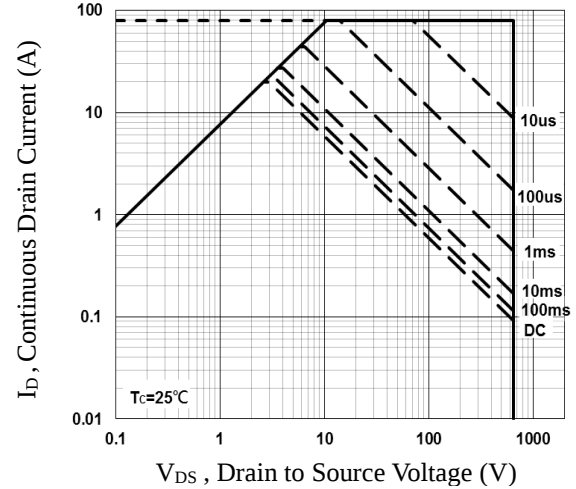
|                     |                                    |                                                                                        |     |      |      |    |
|---------------------|------------------------------------|----------------------------------------------------------------------------------------|-----|------|------|----|
| Q <sub>g</sub>      | Total Gate Charge <sup>3,4</sup>   | V <sub>DS</sub> =160V, V <sub>GS</sub> =10V, I <sub>D</sub> =10A                       | --- | 30   | 60   | nC |
| Q <sub>gs</sub>     | Gate-Source Charge <sup>3,4</sup>  |                                                                                        | --- | 7.5  | 115  |    |
| Q <sub>gd</sub>     | Gate-Drain Charge <sup>3,4</sup>   |                                                                                        | --- | 11   | 22   |    |
| T <sub>d(on)</sub>  | Turn-On Delay Time <sup>3,4</sup>  | V <sub>DD</sub> =100V, V <sub>GS</sub> =10V, R <sub>G</sub> =6Ω<br>I <sub>D</sub> =10A | --- | 22   | 44   | ns |
| T <sub>r</sub>      | Rise Time <sup>3,4</sup>           |                                                                                        | --- | 4    | 8    |    |
| T <sub>d(off)</sub> | Turn-Off Delay Time <sup>3,4</sup> |                                                                                        | --- | 44   | 88   |    |
| T <sub>f</sub>      | Fall Time <sup>3,4</sup>           |                                                                                        | --- | 6    | 12   |    |
| C <sub>iss</sub>    | Input Capacitance                  | V <sub>DS</sub> =25V, V <sub>GS</sub> =0V, F=1MHz                                      | --- | 1330 | 2600 | pF |
| C <sub>oss</sub>    | Output Capacitance                 |                                                                                        | --- | 195  | 380  |    |
| C <sub>rss</sub>    | Reverse Transfer Capacitance       |                                                                                        | --- | 21   | 40   |    |
| R <sub>g</sub>      | Gate resistance                    | V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, F=1MHz                                       | --- | 2.3  | 4.6  | Ω  |

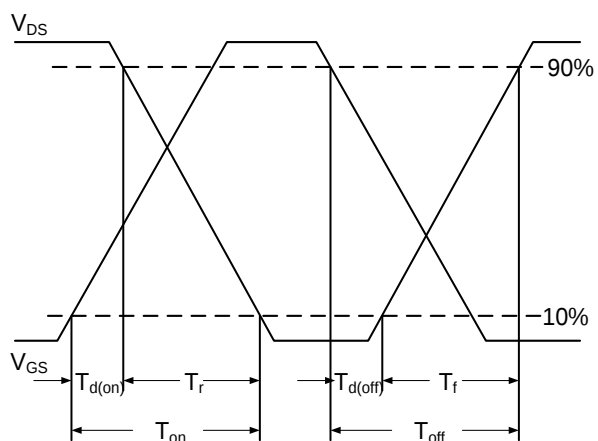
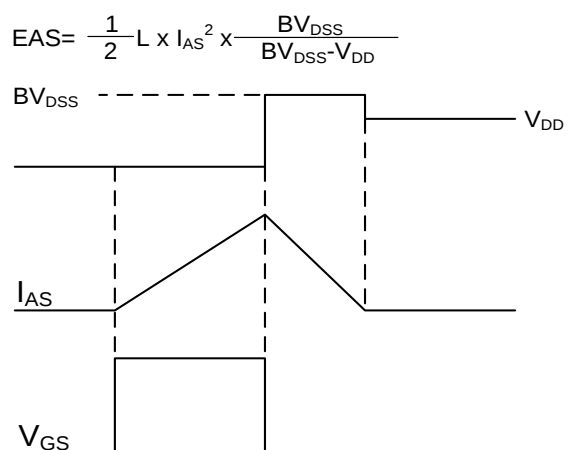
### Drain-Source Diode Characteristics and Maximum Ratings

| Symbol          | Parameter                            | Conditions                                                                      | Min. | Typ. | Max. | Unit |
|-----------------|--------------------------------------|---------------------------------------------------------------------------------|------|------|------|------|
| I <sub>S</sub>  | Continuous Source Current            | V <sub>G</sub> =V <sub>D</sub> =0V, Force Current                               | ---  | ---  | 20   | A    |
| I <sub>SM</sub> | Pulsed Source Current                |                                                                                 | ---  | ---  | 40   | A    |
| V <sub>SD</sub> | Diode Forward Voltage                | V <sub>GS</sub> =0V, I <sub>S</sub> =1A, T <sub>J</sub> =25°C                   | ---  | ---  | 1    | V    |
| t <sub>rr</sub> | Reverse Recovery Time <sup>3</sup>   | V <sub>GS</sub> =0V, I <sub>S</sub> =10A, dI/dt=100A/μs<br>T <sub>J</sub> =25°C | ---  | 125  | ---  | ns   |
| Q <sub>rr</sub> | Reverse Recovery Charge <sup>3</sup> |                                                                                 | ---  | 610  | ---  | nC   |

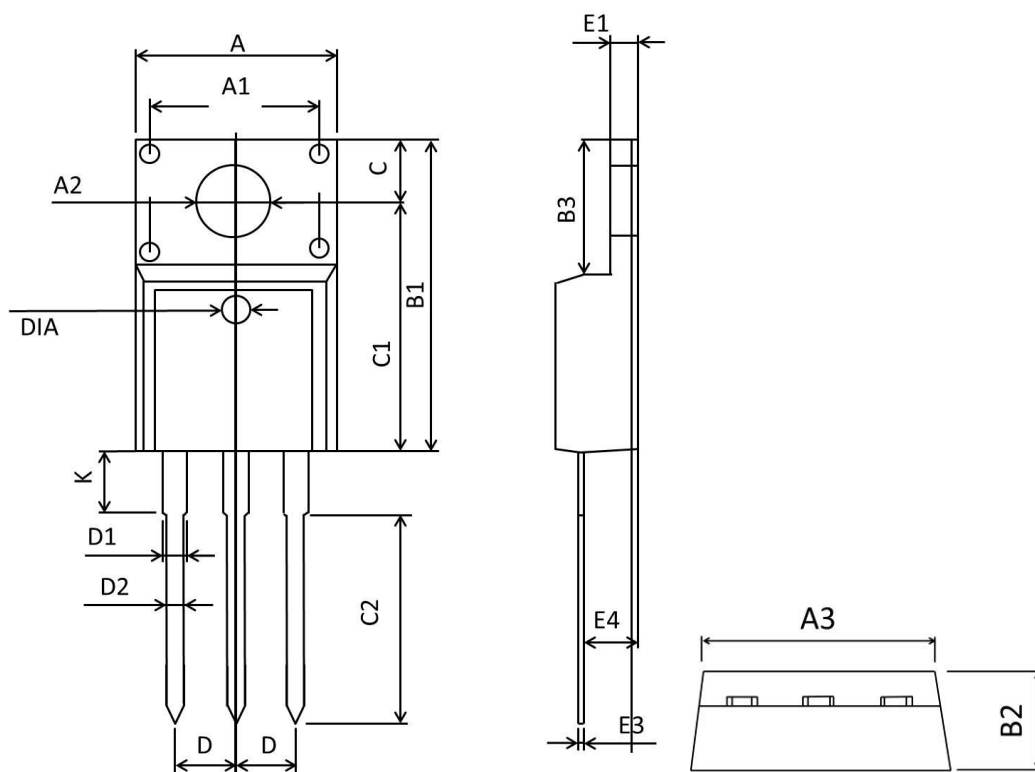
Note :

1. Repetitive Rating : Pulsed width limited by maximum junction temperature.
2. V<sub>DD</sub>=50V, V<sub>GS</sub>=10V, L=1mH, I<sub>AS</sub>=29A., R<sub>G</sub>=25Ω, Starting T<sub>J</sub>=25°C.
3. The data tested by pulsed, pulse width ≤ 300μs, duty cycle ≤ 2%.
4. Essentially independent of operating temperature.


**Fig.1 Continuous Drain Current vs.  $T_C$** 

**Fig.2 Normalized  $R_{DS(on)}$  vs.  $T_J$** 

**Fig.3 Normalized  $V_{th}$  vs.  $T_J$** 

**Fig.4 Gate Charge Waveform**

**Fig.5 Normalized Transient Impedance**

**Fig.6 Maximum Safe Operation Area**


**Fig.7 Switching Time Waveform**

**Fig.8 EAS Waveform**

## TO220F PACKAGE INFORMATION



| Symbol | Dimensions In Millimeters |        | Dimensions In Inches |       |
|--------|---------------------------|--------|----------------------|-------|
|        | Min                       | Max    | Min                  | Max   |
| A      | 9.860                     | 10.460 | 0.389                | 0.411 |
| A1     | 6.900                     | 7.100  | 0.272                | 0.279 |
| A2     | 3.100                     | 3.500  | 0.123                | 0.137 |
| B1     | 9.500                     | 9.900  | 0.375                | 0.389 |
| B2     | 4.500                     | 4.900  | 0.178                | 0.192 |
| B3     | 6.480                     | 6.880  | 0.256                | 0.271 |
| C      | 3.100                     | 3.500  | 0.123                | 0.137 |
| C1     | 12.270                    | 12.870 | 0.484                | 0.506 |
| C2     | 12.580                    | 13.380 | 0.496                | 0.526 |
| D      | 2.490                     | 2.590  | 0.099                | 0.101 |
| D1     | 1.070                     | 1.470  | 0.043                | 0.057 |
| D2     | 0.700                     | 0.900  | 0.028                | 0.035 |
| K      | 2.900                     | 3.300  | 0.115                | 0.129 |
| E1     | 2.340                     | 2.740  | 0.093                | 0.107 |
| E3     | 0.400                     | 0.600  | 0.016                | 0.023 |
| E4     | 2.560                     | 2.960  | 0.101                | 0.116 |
| DIA    | 1.45                      | 1.55   | 0.058                | 0.061 |