

### General Description

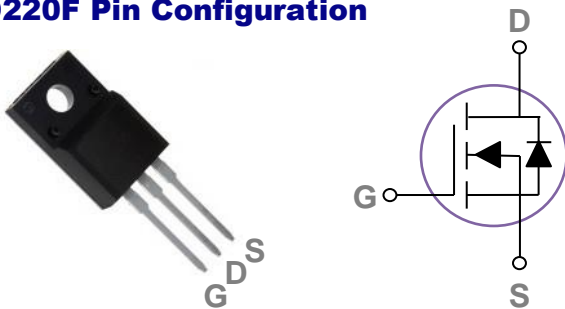
These N-Channel enhancement mode power field effect transistors are using trench DMOS technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These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

|       |       |     |
|-------|-------|-----|
| BVDSS | RDSON | ID  |
| 115V  | 8mΩ   | 60A |

### Features

- 115V,60A,  $R_{DS(ON)} = 8m\Omega$  @  $V_{GS} = 10V$
- Improved  $dv/dt$  capability
- Fast switching
- 100% EAS Guaranteed
- Green Device Available

### TO220F Pin Configuration



### Applications

- Networking
- Load Switch
- LED applications
- Quick Charger

### Absolute Maximum Ratings $T_C=25^\circ C$ unless otherwise noted

| Symbol    | Parameter  | Rating     | Units |
|-----------|--|------------|-------|
| $V_{DS}$  | Drain-Source Voltage                             | 115        | V     |
| $V_{GS}$  | Gate-Source Voltage                              | +20 / -12  | V     |
| $I_D$     | Drain Current – Continuous ( $T_C=25^\circ C$ )  | 60         | A     |
|           | Drain Current – Continuous ( $T_C=100^\circ C$ ) | 38         | A     |
| $I_{DM}$  | Drain Current – Pulsed <sup>1</sup>              | 240        | A     |
| EAS       | Single Pulse Avalanche Energy <sup>2</sup>       | 266        | mJ    |
| IAS       | Single Pulse Avalanche Current <sup>2</sup>      | 73         | A     |
| $P_D$     | Power Dissipation ( $T_C=25^\circ C$ )           | 75         | W     |
|           | Power Dissipation – Derate above $25^\circ C$    | 0.6        | W/°C  |
| $T_{STG}$ | Storage Temperature Range                        | -55 to 150 | °C    |
| $T_J$     | Operating Junction Temperature Range             | -55 to 150 | °C    |

### Thermal Characteristics

| Symbol          | Parameter                              | Typ. | Max. | Unit |
|-----------------|--|------|------|------|
| $R_{\theta JA}$ | Thermal Resistance Junction to ambient | ---  | 62   | °C/W |
| $R_{\theta JC}$ | Thermal Resistance Junction to Case    | ---  | 1.68 | °C/W |

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

| Symbol     | Parameter                      | Conditions                                     | Min. | Typ. | Max. | Unit    |
|------------|--------------------------------|--|------|------|------|---------|
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}=0V, I_D=250\mu A$                      | 115  | ---  | ---  | V       |
| $I_{DSS}$  | Drain-Source Leakage Current   | $V_{DS}=115V, V_{GS}=0V, T_J=25^\circ\text{C}$ | ---  | ---  | 1    | $\mu A$ |
|            |                                | $V_{DS}=92V, V_{GS}=0V, T_J=125^\circ\text{C}$ | ---  | ---  | 10   | $\mu A$ |
| $I_{GSS}$  | Gate-Source Leakage Current    | $V_{GS}=20V, V_{DS}=0V$                        | ---  | ---  | 100  | nA      |

**On Characteristics**

|              |  |                               |     |     |      |           |
|--------------|--|-------------------------------|-----|-----|------|-----------|
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance <sup>3</sup> | $V_{GS}=10V, I_D=20A$         | --- | 6.6 | 8    | $m\Omega$ |
|              |  | $V_{GS}=4.5V, I_D=10A$        | --- | 9   | 11.5 | $m\Omega$ |
| $V_{GS(th)}$ | Gate Threshold Voltage                         | $V_{GS}=V_{DS}, I_D=250\mu A$ | 1.2 | 1.8 | 2.5  | V         |
| gfs          | Forward Transconductance                       | $V_{DS}=10V, I_D=3A$          | --- | 17  | ---  | S         |

**Dynamic and switching Characteristics**

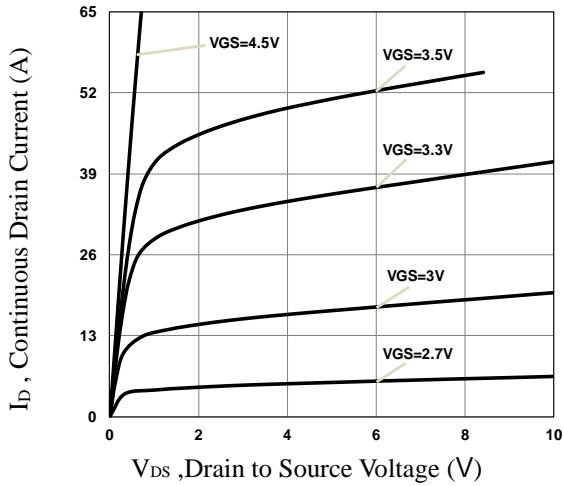
|              |                                     |  |     |      |      |          |
|--------------|-------------------------------------|--|-----|------|------|----------|
| $Q_g$        | Total Gate Charge <sup>3, 4</sup>   | $V_{DS}=60V, V_{GS}=10V, I_D=30A$              | --- | 70   | 105  | nC       |
| $Q_{gs}$     | Gate-Source Charge <sup>3, 4</sup>  |  | --- | 14   | 21   |          |
| $Q_{gd}$     | Gate-Drain Charge <sup>3, 4</sup>   |  | --- | 16   | 24   |          |
| $T_{d(on)}$  | Turn-On Delay Time <sup>3, 4</sup>  | $V_{DS}=60V, V_{GS}=10V, R_G=6\Omega, I_D=30A$ | --- | 22   | 35   | ns       |
| $T_r$        | Rise Time <sup>3, 4</sup>           |  | --- | 25   | 40   |          |
| $T_{d(off)}$ | Turn-Off Delay Time <sup>3, 4</sup> |  | --- | 35   | 55   |          |
| $T_f$        | Fall Time <sup>3, 4</sup>           |  | --- | 18   | 30   |          |
| $C_{iss}$    | Input Capacitance                   | $V_{DS}=60V, V_{GS}=0V, F=1\text{MHz}$         | --- | 4500 | 6700 | pF       |
| $C_{oss}$    | Output Capacitance                  |  | --- | 350  | 520  |          |
| $C_{rss}$    | Reverse Transfer Capacitance        |  | --- | 10   | 20   |          |
| $R_g$        | Gate Resistance                     | $V_{GS}=0V, V_{DS}=0V, F=1\text{MHz}$          | --- | 1.7  | ---  | $\Omega$ |

**Drain-Source Diode Characteristics and Maximum Ratings**

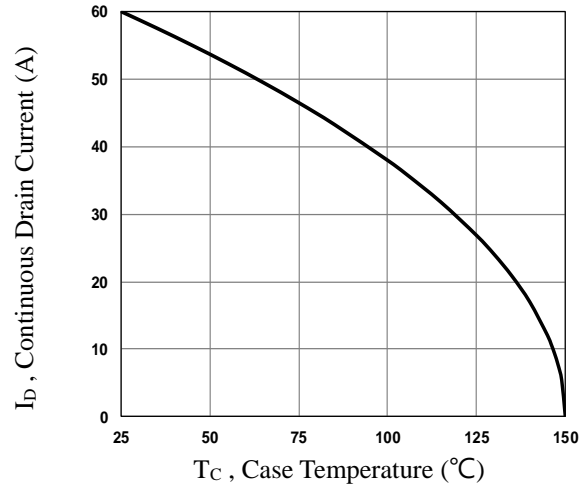
| Symbol   | Parameter                            | Conditions                                | Min.                                     | Typ. | Max. | Unit |
|----------|--------------------------------------|---|--|------|------|------|
| $I_S$    | Continuous Source Current            | $V_G=V_D=0V, \text{Force Current}$        | ---                                      | ---  | 60   | A    |
| $I_{SM}$ | Pulsed Source Current                |   | ---                                      | ---  | 120  | A    |
| $V_{SD}$ | Diode Forward Voltage                | $V_{GS}=0V, I_S=1A, T_J=25^\circ\text{C}$ | ---                                      | ---  | 1    | V    |
| $t_{rr}$ | Reverse Recovery Time <sup>3</sup>   | $V_R=100V, I_S=10A$                       | ---                                      | 66   | ---  | ns   |
| $Q_{rr}$ | Reverse Recovery Charge <sup>3</sup> |   | $di/dt=100A/\mu s, T_J=25^\circ\text{C}$ | ---  | 130  | ---  |

Note :

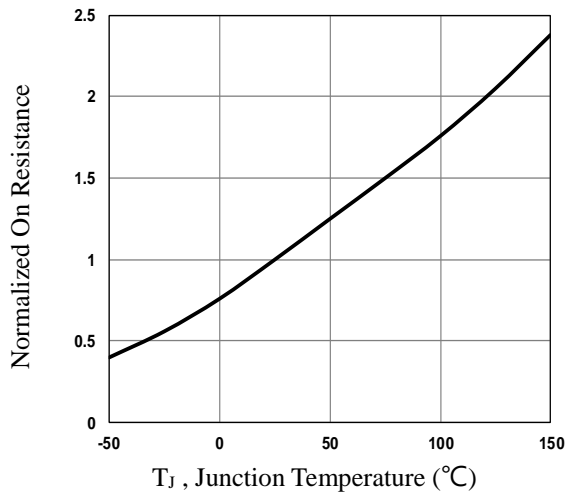
1. Repetitive Rating : Pulsed width limited by maximum junction temperature.
2.  $V_{DD}=50V, V_{GS}=10V, L=0.1mH, I_{AS}=73A, R_G=25\Omega, \text{Starting } T_J=25^\circ\text{C}$ .
3. The data tested by pulsed , pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$ .
4. Essentially independent of operating temperature.



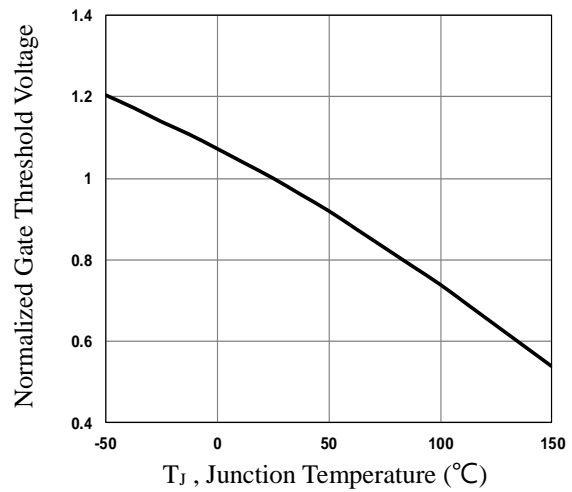
**Fig.1 Typical Output Characteristics**



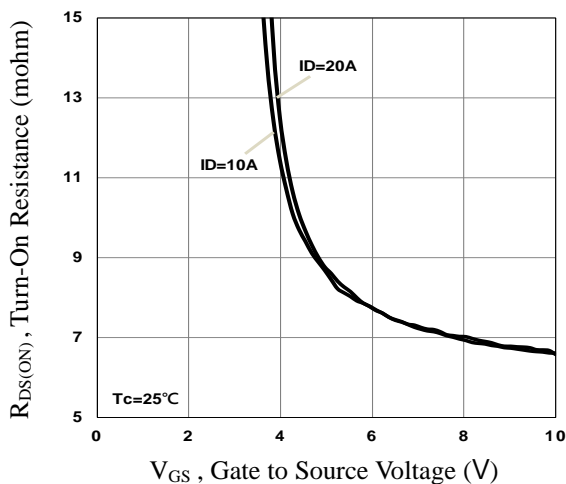
**Fig.2 Continuous Drain Current vs. T<sub>c</sub>**



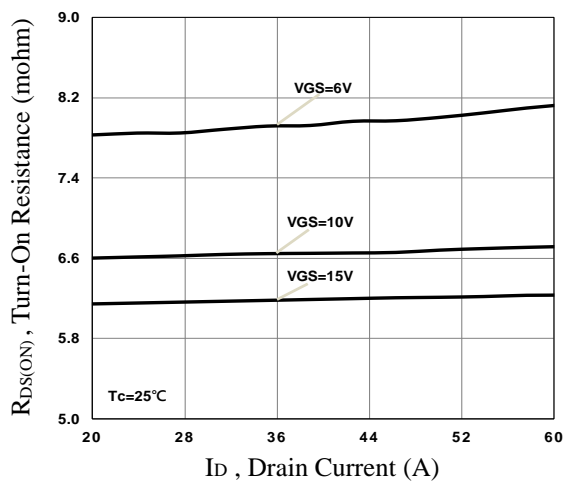
**Fig.3 Normalized R<sub>DS(on)</sub> vs. T<sub>j</sub>**



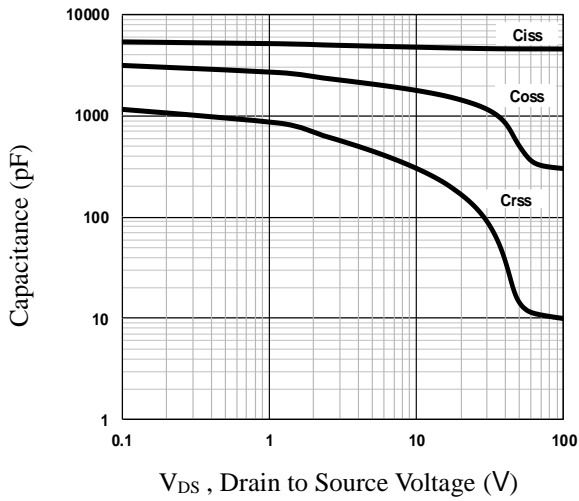
**Fig.4 Normalized V<sub>th</sub> vs. T<sub>j</sub>**



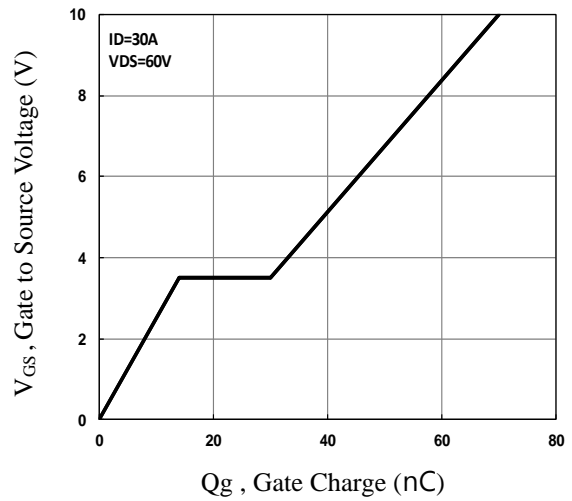
**Fig.5 Turn-On Resistance vs. V<sub>GS</sub>**



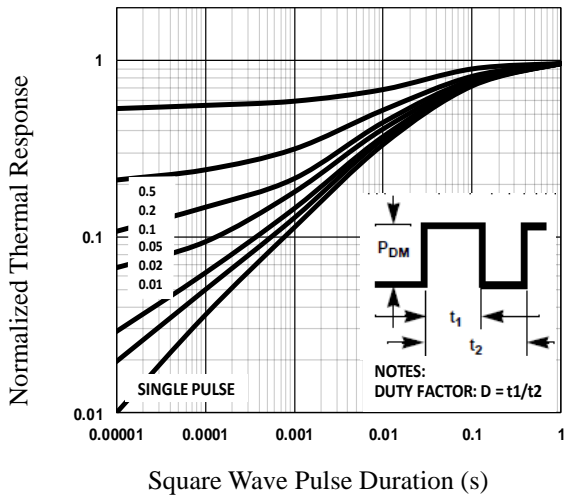
**Fig.6 Turn-On Resistance vs. I<sub>D</sub>**



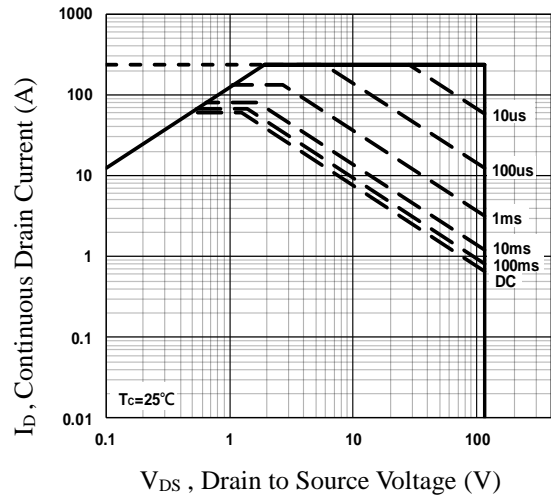
**Fig.7 Capacitance Characteristics**



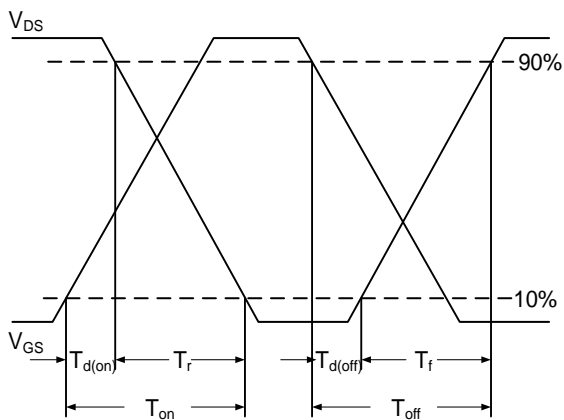
**Fig.8 Gate Charge Characteristics**



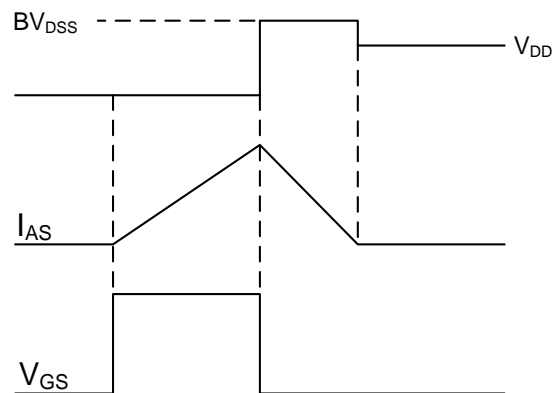
**Fig.9 Normalized Transient Impedance**



**Fig.10 Maximum Safe Operation Area**

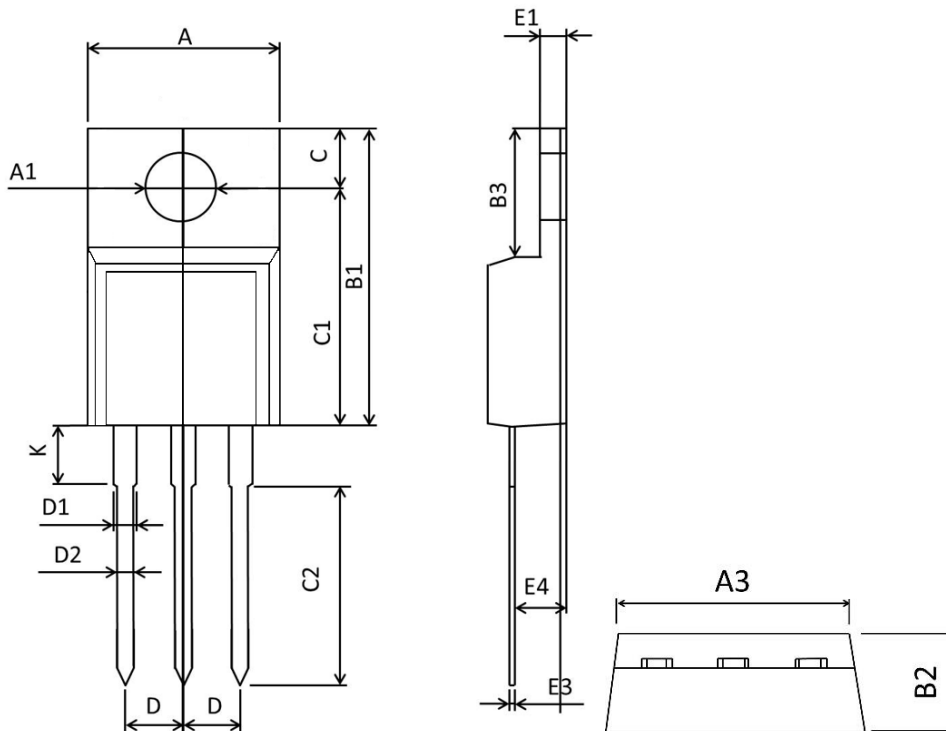


**Fig.11 Switching Time Waveform**



**Fig.12 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     | 3.100                     | 3.500  | 0.122                | 0.138 |
| B1     | 15.450                    | 16.300 | 0.608                | 0.642 |
| B2     | 4.400                     | 5.000  | 0.173                | 0.197 |
| B3     | 6.280                     | 7.100  | 0.247                | 0.280 |
| C      | 3.100                     | 3.500  | 0.122                | 0.138 |
| C1     | 12.270                    | 12.870 | 0.483                | 0.507 |
| C2     | 9.600                     | 10.520 | 0.378                | 0.414 |
| D      | 2.540BSC                  |        | 0.1BSC               |       |
| D1     | 1.070                     | 1.470  | 0.042                | 0.058 |
| D2     | 0.600                     | 1.000  | 0.024                | 0.039 |
| K      | 2.800                     | 3.500  | 0.110                | 0.138 |
| E1     | 2.340                     | 2.740  | 0.092                | 0.108 |
| E3     | 0.350                     | 0.650  | 0.014                | 0.026 |
| E4     | 2.460                     | 2.960  | 0.097                | 0.117 |