

■ **Features**

- 650V, 12A, $R_{DS(ON)} = 0.6\Omega @ V_{GS} = 10V$
- Improved dv/dt capability
- Fast switching
- 100% EAS Guaranteed
- Green Device Available

■ **Applications**

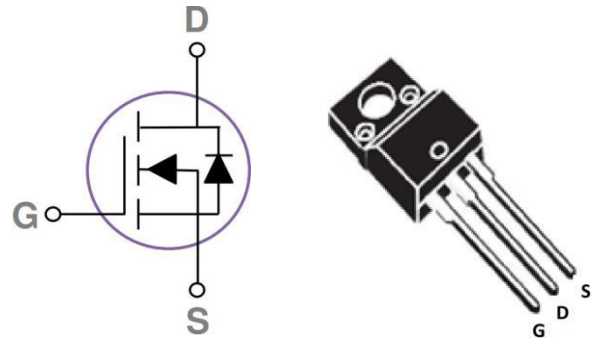
- Networking
- Load Switch
- LED applications
- Quick Charger

■ **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.

■ **Product Summary**



| | | |
|------------|--------------|-------|
| BV_{DSS} | $R_{DS(ON)}$ | I_D |
| 650V | 0.6ohm | 12A |

■ **Absolute Maximum Ratings** $T_c=25^\circ C$ unless otherwise noted

| Parameter | Symbol | Rating | Unit |
|--------------------------------|---------------------------|------------|---------------|
| Drain-Source Voltage | V_{DS} | 650 | V |
| Gate-Source Voltage | V_{GS} | ± 30 | V |
| Continuous Drain Current | $I_D @ T_c=25^\circ C$ | 12 | A |
| | $I_D @ T_c=100^\circ C$ | 7.6 | A |
| Pulsed Drain Current | I_{DM} | 50 | A |
| Single Pulse Avalanche Energy | EAS | 720 | mJ |
| Single Pulse Avalanche Current | IAS | 20 | A |
| Power Dissipation- | Derate above $25^\circ C$ | 0.31 | W/ $^\circ C$ |
| Power Dissipation | $T_c=25^\circ C$ | 50 | W |
| Operating Junction Temperature | T_J | -55 to 150 | $^\circ C$ |
| Storage Temperature | T_{STG} | -55 to 150 | $^\circ C$ |

■ **Thermal Resistance**

| Parameter | Symbol | Min. | Typ. | Max. | Unit |
|---|------------|------|------|------|--------------|
| Thermal resistance, junction - case | R_{thJC} | --- | --- | 2.6 | $^\circ C/W$ |
| Thermal Resistance Junction to ambient | R_{thJA} | --- | --- | 62 | $^\circ C/W$ |
| Soldering temperature, wave soldering for 10s | T_{sold} | --- | --- | 265 | $^\circ C$ |

■ **Electronic Characteristics** T_J =25°C unless otherwise noted

Off Characteristics

| Parameter | Condition | Symbol | Min. | Typ. | Max. | Unit |
|--------------------------------|--|-------------------|------|------|------|------|
| Drain-Source Breakdown Voltage | V _{GS} =0V, I _D =250uA | BV _{DSS} | 650 | 700 | --- | V |
| Drain-Source Leakage Current | V _{DS} =650V, V _{GS} =0V | I _{DSS} | --- | --- | 1 | uA |
| | V _{DS} =520V, V _{GS} =0V | | --- | --- | 10 | |
| Gate- Source Leakage Current | V _{GS} =±30V, V _{DS} =0V | I _{GSS} | --- | --- | ±100 | nA |

On Characteristics

| Parameter | Condition | Symbol | Min. | Typ. | Max. | Unit |
|-----------------------------------|--|---------------------|------|------|------|------|
| Static Drain-source On Resistance | V _{GS} =10V, I _D =5A | R _{DS(ON)} | --- | 0.55 | 0.6 | Ω |
| Gate Threshold Voltage | V _{GS} =V _{DS} , I _D =250uA | V _{GS(TH)} | 2.0 | 3.0 | 4.0 | V |
| Forward Transconductance | V _{DS} =40V, I _D =10A | g _{FS} | --- | 2.8 | --- | S |

Dynamic and switching Characteristics

| Parameter | Condition | Symbol | Min. | Typ. | Max. | Unit |
|------------------------------|--|---------------------|------|------|------|------|
| Total Gate Charge | V _{DS} =520V | Q _g | --- | 20 | --- | nC |
| Gate-Source Charge | V _{GS} =10V | Q _{gs} | --- | 8.6 | --- | |
| Gate-Drain Charge | I _D =10A | Q _{gd} | --- | 45 | --- | |
| Turn-On Delay Time | V _{DD} =300V | T _{d(on)} | --- | 45 | --- | ns |
| Rise Time | V _{GS} =10V | T _r | --- | 65 | --- | |
| Turn-Off Delay Time | R _G =25Ω | T _{d(off)} | --- | 80 | --- | |
| Fall Time | I _D =10A | T _f | --- | 41 | --- | |
| Input capacitance | V _{DS} =25V | C _{iss} | --- | 1350 | --- | pF |
| Output capacitance | V _{GS} =0V | C _{oss} | --- | 130 | --- | |
| Reverse transfer capacitance | F=1MHz | C _{rss} | --- | 5.6 | --- | |
| Gate resistance | V _{DS} =0V, V _{GS} =0V, F=1MHz | R _g | --- | 1.2 | 2.4 | Ω |

Drain-Source Diode Characteristics and Maximum Ratings

| Parameter | Condition | Symbol | Min. | Typ. | Max. | Unit |
|-------------------------|--|-----------------|------|------|------|------|
| Diode Forward Voltage | V _{GS} =0V, I _S =10A | V _{SD} | --- | 0.72 | 1.4 | V |
| Reverse Recovery Time | I _F =10A, di/dt=40A/μs, | trr | --- | 491 | --- | nS |
| Reverse Recovery Charge | V _{DS} =100V | Q _r | --- | 2296 | --- | nC |

Note:

1. Repetitive Rating: Pulsed width limited by maximum junction temperature.
2. V_{DD}=650V, V_{GS}=10V, L=1mH, I_{AS}=10A., R_G=25Ω, Starting T_J=25°C.
3. The data tested by pulsed, pulse width ≦ 300us, duty cycle ≦ 2%.
4. Essentially independent of operating temperature.

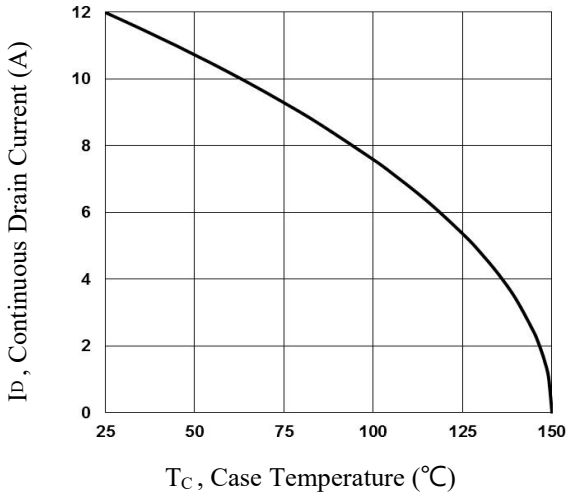


Fig.1 Continuous Drain Current vs. T_c

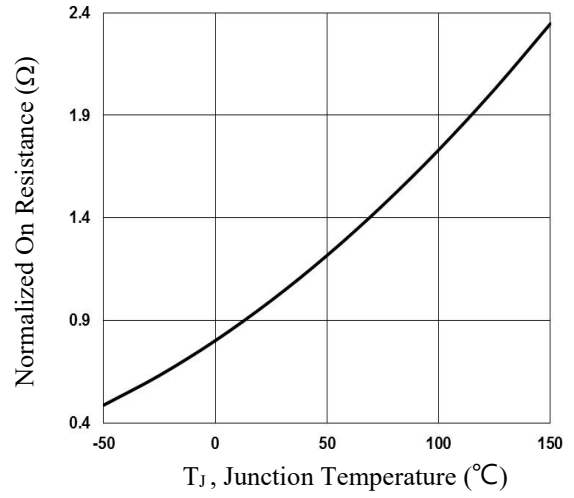


Fig.2 Normalized R_{DSon} vs. T_j

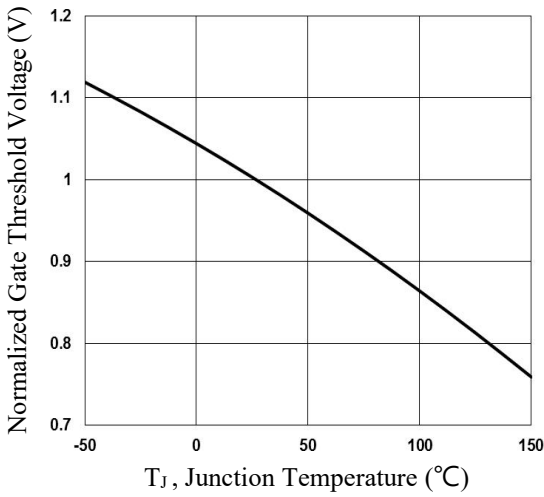


Fig.3 Normalized V_{th} vs. T_j

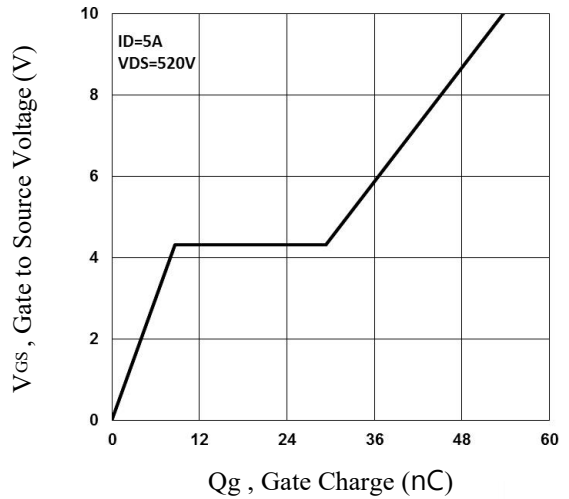


Fig.4 Gate Charge Waveform

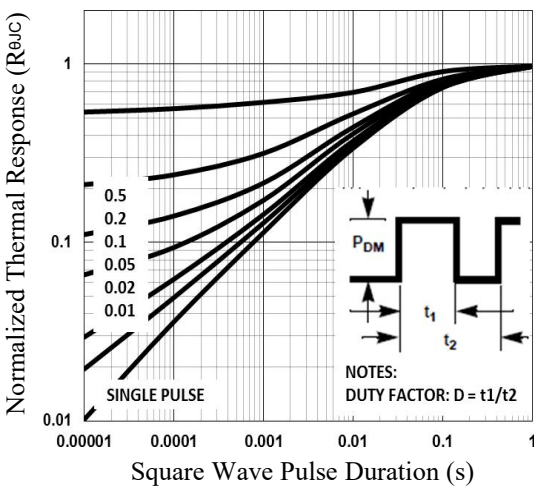


Fig.5 Normalized Transient Impedance

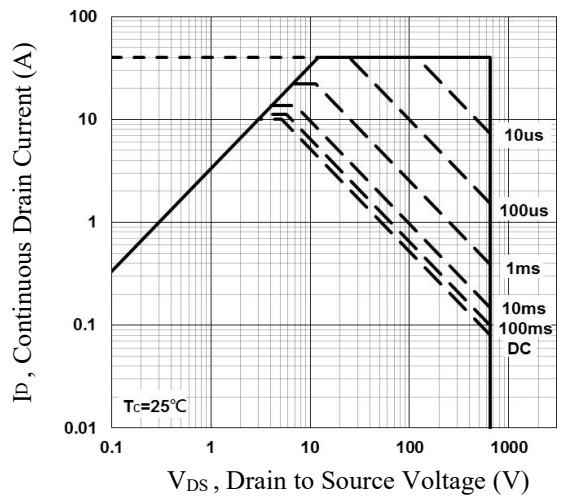


Fig.6 Maximum Safe Operation Area

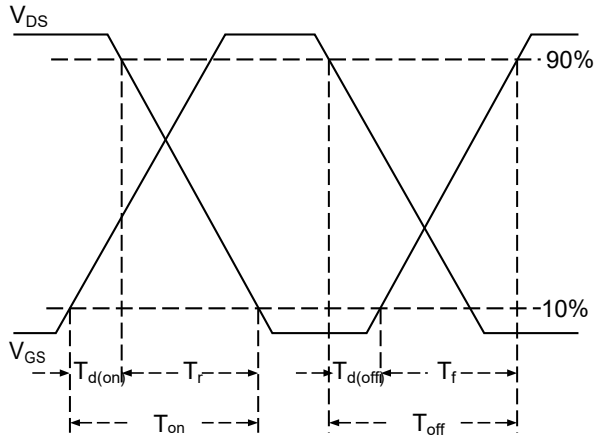


Fig.7 Switching Time Waveform

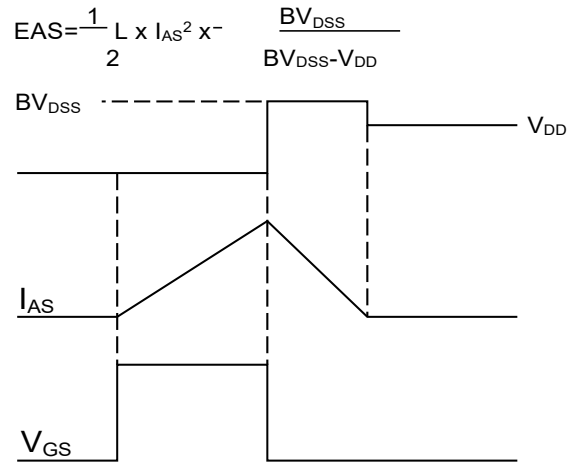
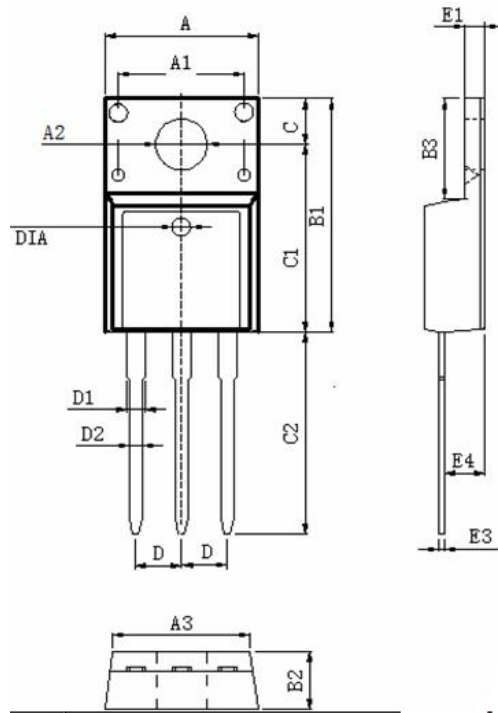


Fig.8 EAS Waveform

TO-220F PACKAGE INFORMATION



| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|---------------------------|--------------|----------------------|----------------|
| | MAX | MIN | MAX | MIN |
| A | 10.460 | 9.860 | 0.412 | 0.388 |
| A1 | 7.100 | 6.900 | 0.280 | 0.272 |
| A2 | 3.500 | 3.100 | 0.138 | 0.122 |
| A3 | 9.900 | 9.500 | 0.390 | 0.374 |
| B1 | 16.170 | 15.570 | 0.637 | 0.613 |
| B2 | 4.900 | 4.500 | 0.193 | 0.177 |
| B3 | 6.880 | 6.480 | 0.271 | 0.255 |
| C | 3.500 | 3.100 | 0.138 | 0.122 |
| C1 | 12.870 | 12.270 | 0.507 | 0.483 |
| C2 | 13.380 | 12.580 | 0.527 | 0.495 |
| D | 2.590 | 2.490 | 0.102 | 0.098 |
| D1 | 1.470 | 1.070 | 0.058 | 0.042 |
| D2 | 0.900 | 0.700 | 0.035 | 0.028 |
| E1 | 2.740 | 2.340 | 0.108 | 0.092 |
| E3 | 0.600 | 0.400 | 0.024 | 0.016 |
| E4 | 2.960 | 2.560 | 0.117 | 0.101 |
| DIA | Φ1.5 TYP. | deep0.1 TYP. | Φ0.059 TYP. | deep0.004 TYP. |