

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 | R _{DS(ON)} | ID |
| 60V | 2.2mΩ | 170A |

Features

- 60V, 170A, R_{DS(ON)} = 2.2mΩ @ V_{GS} = 10V
- Improved dv/dt capability
- Fast switching
- 100% EAS Guaranteed
- Green Device Available

TO220 Pin Configuration



Applications

- Motor Drive
- Power Tools
- LED Lighting
- Quick Charger

Absolute Maximum Ratings T_C=25°C unless otherwise noted

| Symbol | Parameter | Rating | Units |
|------------------|--|------------|-------|
| V _{DS} | Drain-Source Voltage | 60 | V |
| V _{GS} | Gate-Source Voltage | ±20 | V |
| I _D | Drain Current – Continuous (T _C =25°C) | 170 | A |
| | Drain Current – Continuous (T _C =100°C) | 105 | A |
| I _{DM} | Drain Current – Pulsed ¹ | 680 | A |
| EAS | Single Pulse Avalanche Energy ² | 1065 | mJ |
| IAS | Single Pulse Avalanched Current ² | 146 | A |
| P _D | Power Dissipation (T _C =25°C) | 208 | W |
| | Power Dissipation – Derate above 25°C | 1.67 | 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 _{θJA} | Thermal Resistance Junction to ambient | --- | 62 | °C/W |
| R _{θJC} | Thermal Resistance Junction to Case | --- | 0.6 | °C/W |

Electrical Characteristics (T_J=25 °C, unless otherwise noted)
Off Characteristics

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|-------------------------------------|---|--|------|-------|------|------|
| BV _{DSS} | Drain-Source Breakdown Voltage | V _{GS} =0V, I _D =250uA | 60 | --- | --- | V |
| ΔBV _{DSS} /ΔT _J | BV _{DSS} Temperature Coefficient | Reference to 25°C, I _D =1mA | --- | 0.043 | --- | V/°C |
| I _{DSS} | Drain-Source Leakage Current | V _{DS} =60V, V _{GS} =0V, T _J =25°C | --- | --- | 1 | uA |
| | | V _{DS} =48V, V _{GS} =0V, T _J =125°C | --- | --- | 10 | uA |
| I _{GSS} | Gate-Source Leakage Current | V _{GS} =±20V, V _{DS} =0V | --- | --- | ±100 | nA |

On Characteristics

| | | | | | | |
|----------------------|--|--|-----|------|-----|-------|
| R _{DS(ON)} | Static Drain-Source On-Resistance ³ | V _{GS} =10V, I _D =20A | --- | 1.4 | 2.2 | mΩ |
| | | V _{GS} =6V, I _D =15A | --- | 1.8 | 2.6 | mΩ |
| V _{GS(th)} | Gate Threshold Voltage | V _{GS} =V _{DS} , I _D =250uA | 1.5 | 2.3 | 3.5 | V |
| ΔV _{GS(th)} | V _{GS(th)} Temperature Coefficient | | --- | -4.7 | --- | mV/°C |
| g _{fs} | Forward Transconductance | V _{DS} =10V, I _D =5A | --- | 25 | --- | S |

Dynamic and switching Characteristics

| | | | | | | |
|---------------------|-------------------------------------|--|-----|-------|-------|----|
| Q _g | Total Gate Charge ^{3, 4} | V _{DS} =48V, V _{GS} =10V, I _D =10A | --- | 293 | 450 | nC |
| Q _{gs} | Gate-Source Charge ^{3, 4} | | --- | 61.8 | 93 | |
| Q _{gd} | Gate-Drain Charge ^{3, 4} | | --- | 123 | 185 | |
| T _{d(on)} | Turn-On Delay Time ^{3, 4} | V _{DD} =15V, V _{GS} =10V, R _G =3.3Ω I _D =1A | --- | 45.4 | 90 | ns |
| T _r | Rise Time ^{3, 4} | | --- | 122.2 | 145 | |
| T _{d(off)} | Turn-Off Delay Time ^{3, 4} | | --- | 175.4 | 350 | |
| T _f | Fall Time ^{3, 4} | | --- | 36.6 | 72 | |
| C _{iss} | Input Capacitance | V _{DS} =25V, V _{GS} =0V, F=1MHz | --- | 16920 | 33000 | pF |
| C _{oss} | Output Capacitance | | --- | 1361 | 2700 | |
| C _{rss} | Reverse Transfer Capacitance | | --- | 424 | 840 | |
| R _g | Gate resistance | V _{GS} =0V, V _{DS} =0V, F=1MHz | --- | 1.6 | --- | Ω |

Drain-Source Diode Characteristics and Maximum Ratings

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|-----------------|------------------------------------|---|------|------|------|------|
| I _S | Continuous Source Current | V _G =V _D =0V, Force Current | --- | --- | 170 | A |
| I _{SM} | Pulsed Source Current ³ | | --- | --- | 340 | A |
| V _{SD} | Diode Forward Voltage ³ | V _{GS} =0V, I _S =1A, T _J =25°C | --- | --- | 1 | V |

Note :

1. Repetitive Rating : Pulsed width limited by maximum junction temperature.
2. V_{DD}=25V, V_{GS}=10V, L=0.1mH, I_{AS}=146A, 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.

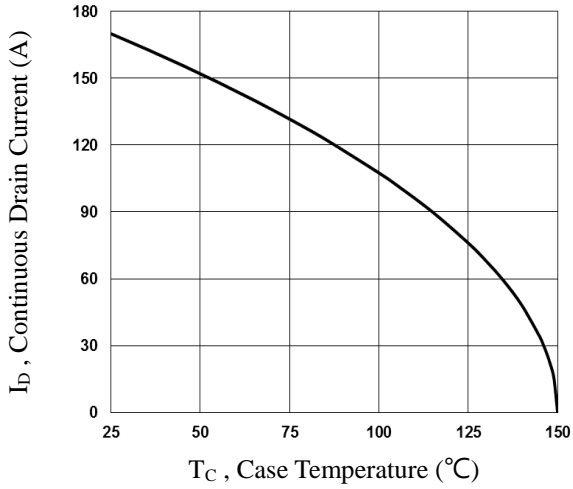


Fig.1 Continuous Drain Current vs. T_c

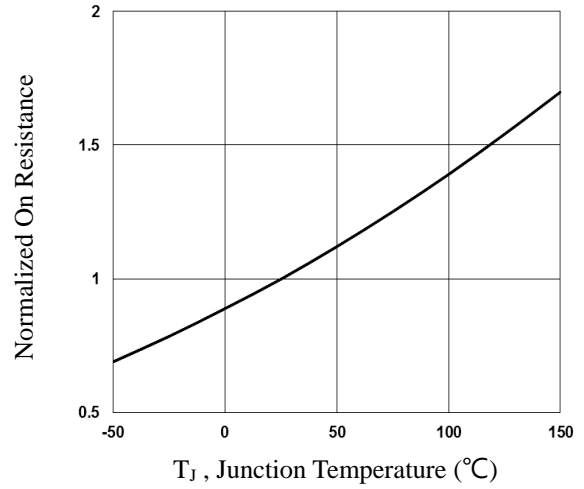


Fig.2 Normalized $R_{DS(on)}$ vs. T_j

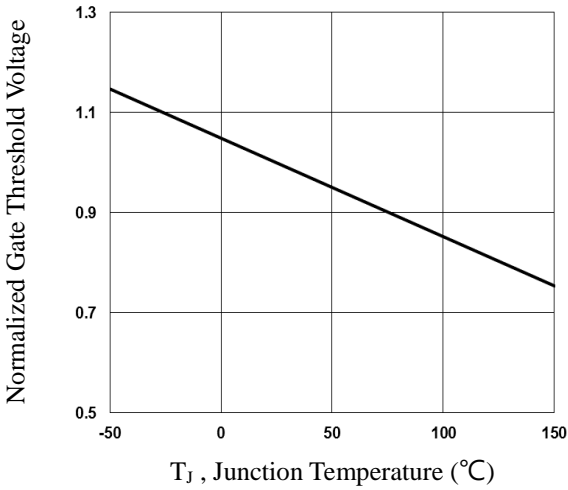


Fig.3 Normalized V_{th} vs. T_j

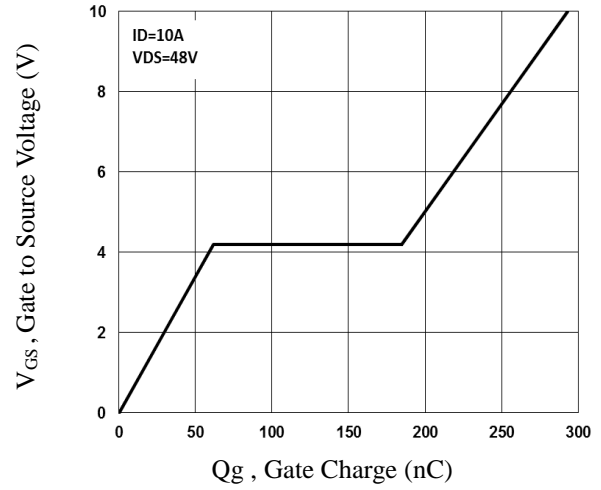


Fig.4 Gate Charge Waveform

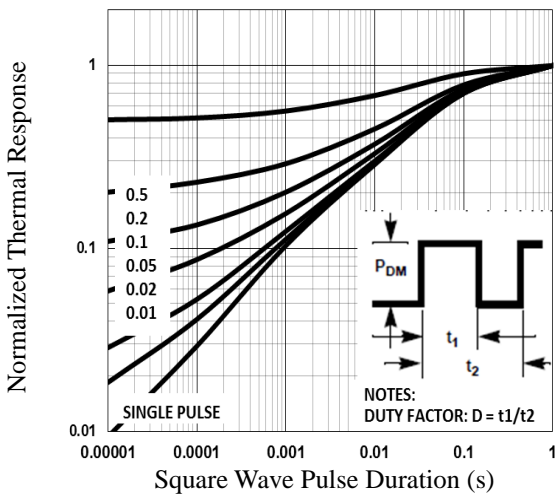


Fig.5 Normalized Transient Response

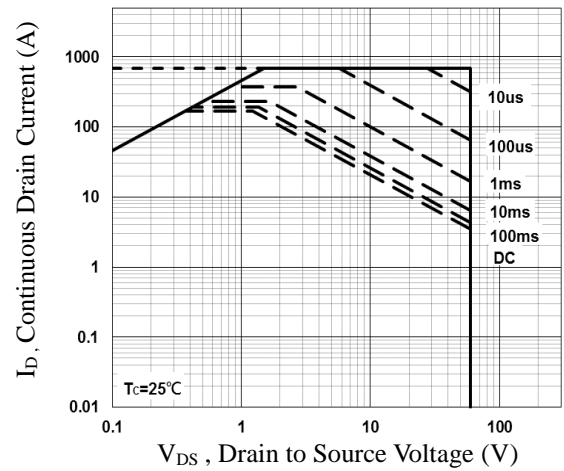


Fig.6 Maximum Safe Operation Area



Fig.7 Switching Time Waveform

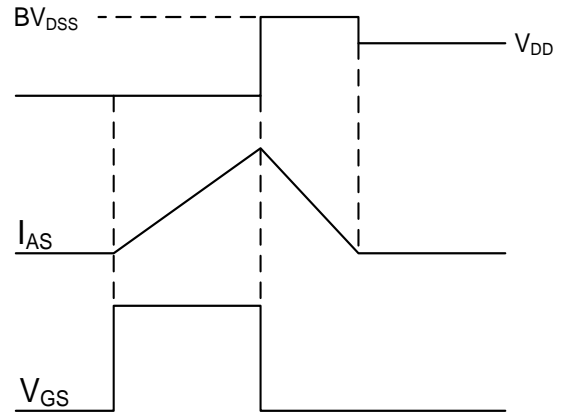
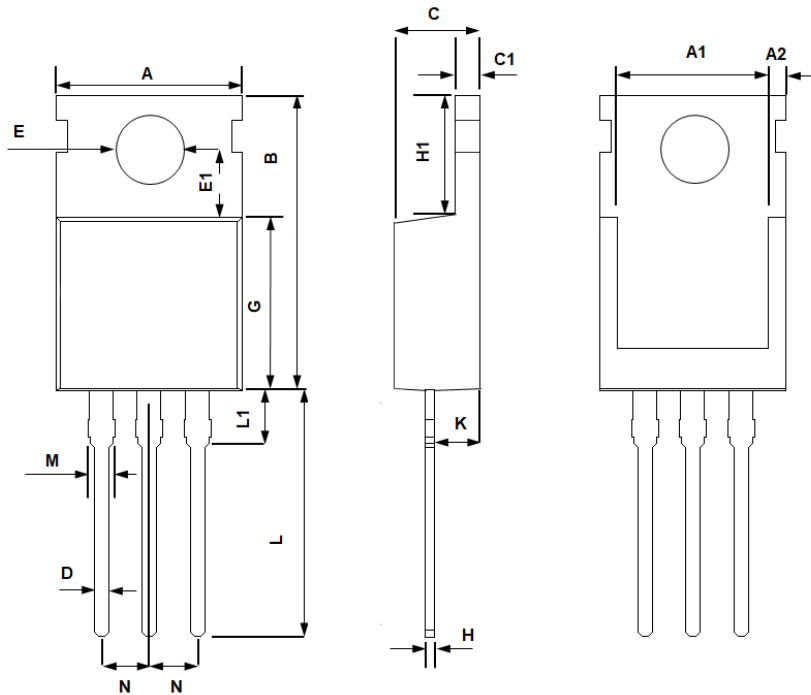


Fig.8 EAS Waveform

TO220 PACKAGE INFORMATION



| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|---------------------------|--------|----------------------|-------|
| | MAX | MIN | MAX | MIN |
| A | 10.400 | 9.700 | 0.409 | 0.382 |
| A1 | 8.900 | 7.400 | 0.350 | 0.291 |
| A2 | 1.400 | 0.800 | 0.055 | 0.031 |
| B | 16.500 | 14.500 | 0.650 | 0.571 |
| C | 4.750 | 4.200 | 0.187 | 0.165 |
| C1 | 1.500 | 1.100 | 0.059 | 0.043 |
| D | 1.000 | 0.600 | 0.039 | 0.024 |
| E | 4.000 | 3.300 | 0.157 | 0.130 |
| E1 | 3.800 | 3.400 | 0.150 | 0.134 |
| G | 9.400 | 8.400 | 0.370 | 0.331 |
| H | 0.600 | 0.200 | 0.024 | 0.008 |
| H1 | 6.850 | 6.200 | 0.270 | 0.244 |
| K | 2.850 | 2.100 | 0.112 | 0.083 |
| L | 14.000 | 12.500 | 0.551 | 0.492 |
| L1 | 4.000 | 2.700 | 0.157 | 0.106 |
| M | 1.750 | 1.100 | 0.069 | 0.043 |
| N | 2.640 | 2.440 | 0.104 | 0.096 |