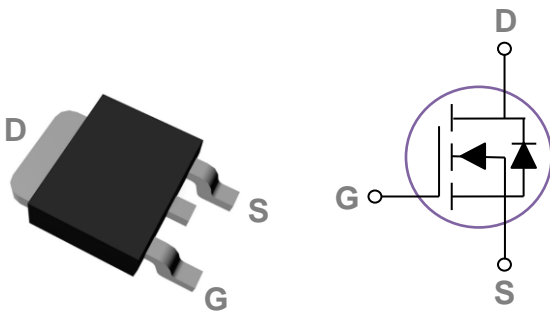


### General Description

These N-Channel enhancement mode power field effect transistors are using super junction MOS 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.

### TO252 Pin Configuration



|       |       |    |
|-------|-------|----|
| BVDSS | RDSON | ID |
| 650V  | 580mΩ | 8A |

### Features

- 650V,8A,  $R_{DS(ON)} = 580m\Omega @ V_{GS} = 10V$
- Improved  $dv/dt$  capability
- Fast switching
- 100% EAS Guaranteed
- Green Device Available

### Applications

- PFC Power Supply Stages
- Motor Control
- DC-DC Converters
- Adapter

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

| Symbol    | Parameter  | Rating     | Units         |
|-----------|--|------------|---------------|
| $V_{DS}$  | Drain-Source Voltage                             | 650        | V             |
| $V_{GS}$  | Gate-Source Voltage                              | $\pm 30$   | V             |
| $I_D$     | Drain Current – Continuous ( $T_c=25^\circ C$ )  | 8          | A             |
|           | Drain Current – Continuous ( $T_c=100^\circ C$ ) | 5          | A             |
| $I_{DM}$  | Drain Current – Pulsed <sup>1</sup>              | 32         | A             |
| EAS       | Single Pulse Avalanche Energy                    | 170        | mJ            |
| $P_D$     | Power Dissipation ( $T_c=25^\circ C$ )           | 65         | W             |
|           | Power Dissipation – Derate above $25^\circ C$    | 0.52       | W/ $^\circ C$ |
| $T_{STG}$ | Storage Temperature Range                        | -55 to 150 | $^\circ C$    |
| $T_J$     | Operating Junction Temperature Range             | -55 to 150 | $^\circ C$    |

### Thermal Characteristics

| Symbol          | Parameter                              | Typ. | Max. | Unit         |
|-----------------|--|------|------|--------------|
| $R_{\theta JA}$ | Thermal Resistance Junction to ambient | ---  | 62   | $^\circ C/W$ |
| $R_{\theta JC}$ | Thermal Resistance Junction to Case    | ---  | 1.93 | $^\circ C/W$ |

**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 | $V_{GS}=0V, I_D=1mA$                            | 650  | ---  | ---       | V             |
| $I_{DSS}$  | Drain-Source Leakage Current   | $V_{DS}=650V, V_{GS}=0V, T_J=25^\circ\text{C}$  | ---  | ---  | 1         | $\mu\text{A}$ |
|            |                                | $V_{DS}=520V, V_{GS}=0V, T_J=100^\circ\text{C}$ | ---  | ---  | 10        | $\mu\text{A}$ |
| $I_{GSS}$  | Gate-Source Leakage Current    | $V_{GS}=\pm 30V, V_{DS}=0V$                     | ---  | ---  | $\pm 100$ | nA            |

**On Characteristics**

|              |                                   |                                     |     |     |     |            |
|--------------|-----------------------------------|-------------------------------------|-----|-----|-----|------------|
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}=10V, I_D=2A$                | --- | 530 | 580 | m $\Omega$ |
| $V_{GS(th)}$ | Gate Threshold Voltage            | $V_{GS}=V_{DS}, I_D=250\mu\text{A}$ | 2   | 3   | 4   | V          |

**Dynamic and switching Characteristics<sup>2</sup>**

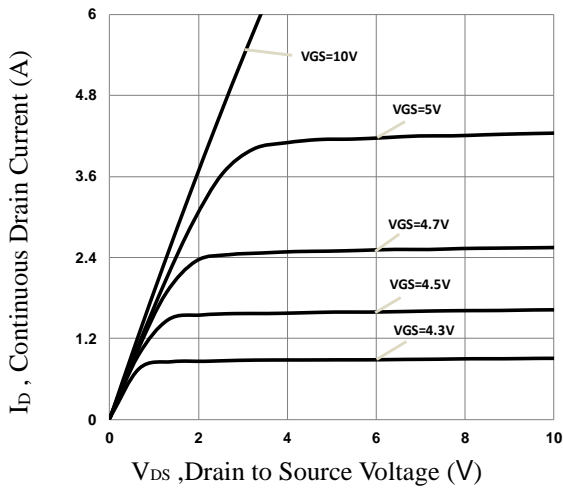
|              |                              |   |     |     |     |          |
|--------------|------------------------------|---|-----|-----|-----|----------|
| $Q_g$        | Total Gate Charge            | $V_{DS}=350V, V_{GS}=10V, I_D=8A$               | --- | 14  | 21  | nC       |
| $Q_{gs}$     | Gate-Source Charge           |   | --- | 2   | 3   |          |
| $Q_{gd}$     | Gate-Drain Charge            |   | --- | 12  | 18  |          |
| $T_{d(on)}$  | Turn-On Delay Time           | $V_{DS}=350V, V_{GS}=10V, R_G=25\Omega, I_D=8A$ | --- | 14  | 21  | ns       |
| $T_r$        | Rise Time                    |   | --- | 34  | 51  |          |
| $T_{d(off)}$ | Turn-Off Delay Time          |   | --- | 48  | 72  |          |
| $T_f$        | Fall Time                    |   | --- | 25  | 38  |          |
| $C_{iss}$    | Input Capacitance            | $V_{DS}=350V, V_{GS}=0V, F=1\text{MHz}$         | --- | 450 | 675 | pF       |
| $C_{oss}$    | Output Capacitance           |   | --- | 16  | 24  |          |
| $C_{rss}$    | Reverse Transfer Capacitance |   | --- | 2   | 5   |          |
| $R_g$        | Gate resistance              | $V_{GS}=0V, V_{DS}=0V, F=1\text{MHz}$           | --- | 27  | --- | $\Omega$ |

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

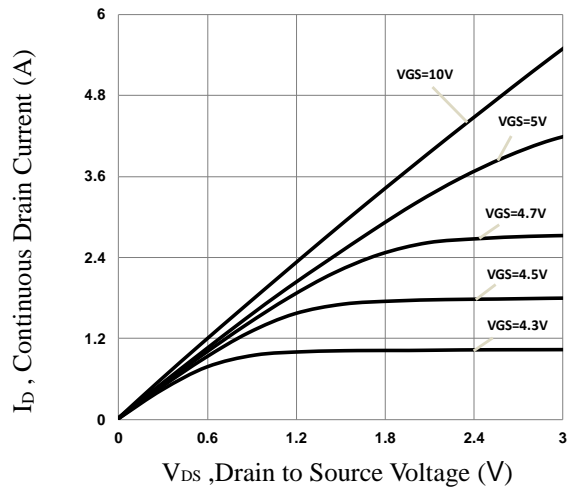
| Symbol   | Parameter                 | Conditions                                     | Min. | Typ. | Max. | Unit          |
|----------|---------------------------|--|------|------|------|---------------|
| $I_S$    | Continuous Source Current | $V_G=V_D=0V, \text{Force Current}$             | ---  | ---  | 8    | A             |
| $I_{SM}$ | Pulsed Source Current     |  | ---  | ---  | 16   | A             |
| $V_{SD}$ | Diode Forward Voltage     | $V_{GS}=0V, I_S=1A, T_J=25^\circ\text{C}$      | ---  | ---  | 1.2  | V             |
| $t_{rr}$ | Reverse Recovery Time     | $V_R=400V, I_S=4A$                             | ---  | 230  | ---  | ns            |
| $Q_{rr}$ | Reverse Recovery Charge   | $di/dt=100A/\mu\text{s}, T_J=25^\circ\text{C}$ | ---  | 2    | ---  | $\mu\text{C}$ |

Note :

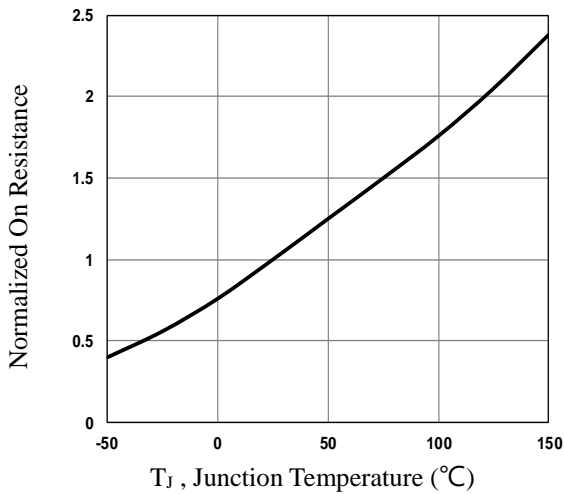
1. Repetitive Rating : Pulsed width limited by maximum junction temperature.
2. Essentially independent of operating temperature.



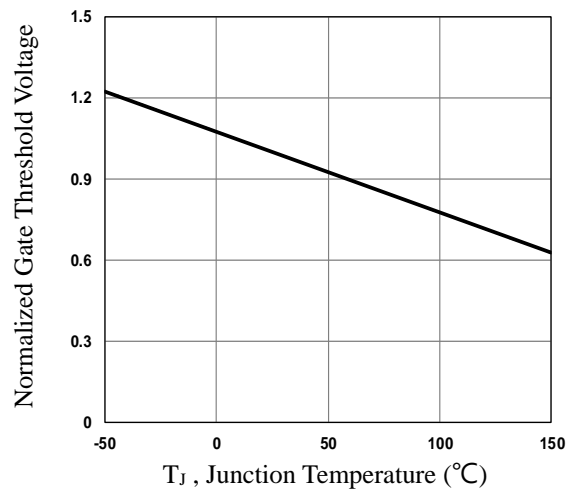
**Fig.1 Typical Output Characteristics**



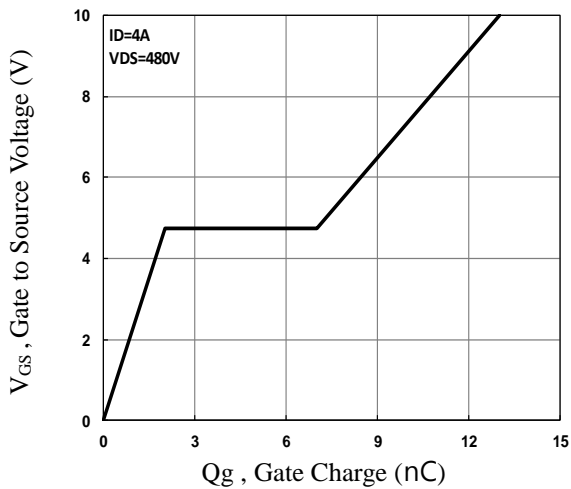
**Fig.2 Typical Output Characteristics**



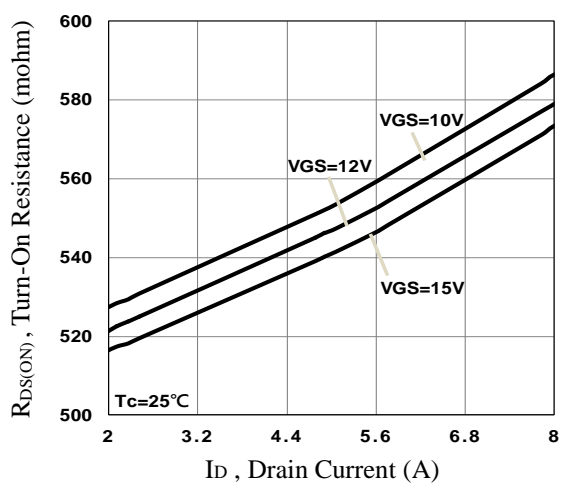
**Fig.3 Normalized  $R_{DS(on)}$  vs.  $T_J$**



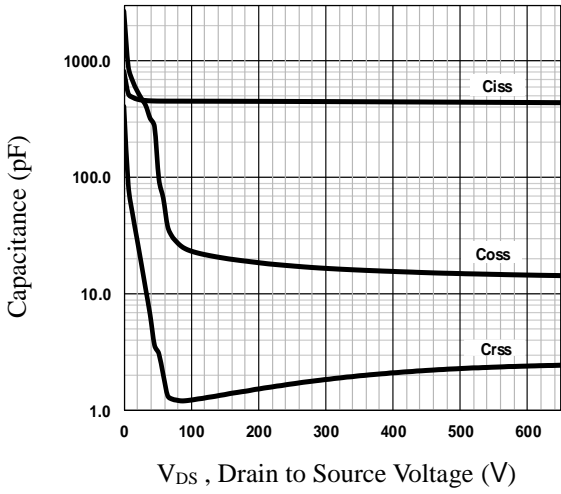
**Fig.4 Normalized  $V_{th}$  vs.  $T_J$**



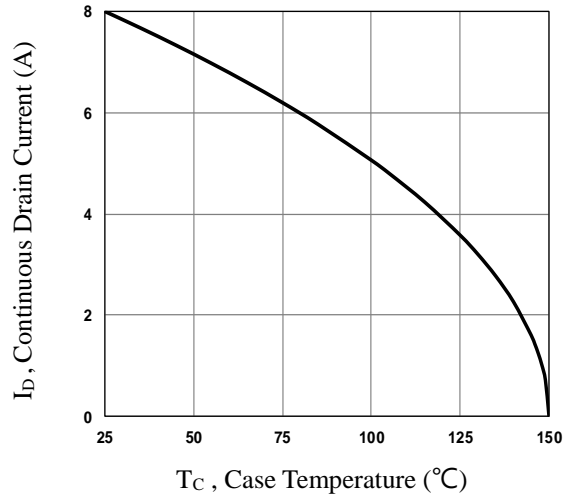
**Fig.5 Gate Charge Characteristics**



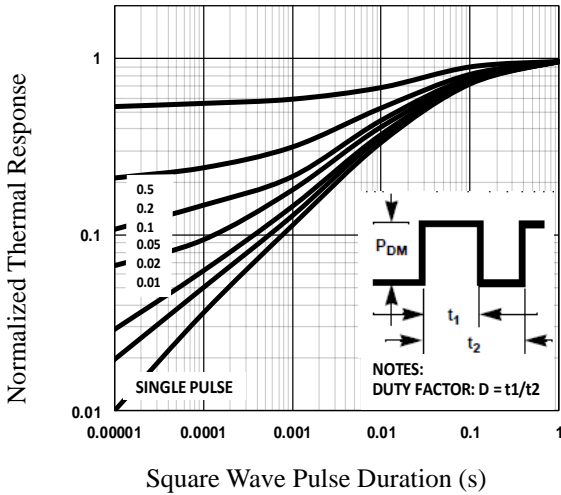
**Fig.6 Turn-On Resistance vs.  $I_D$**



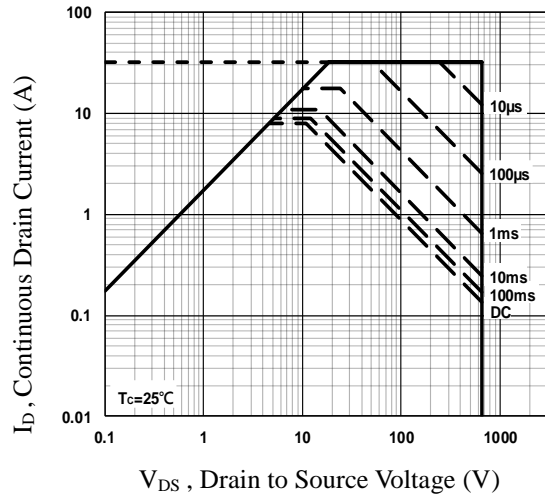
**Fig.7 Capacitance Characteristics**



**Fig.8 Continuous Drain Current vs. T<sub>c</sub>**



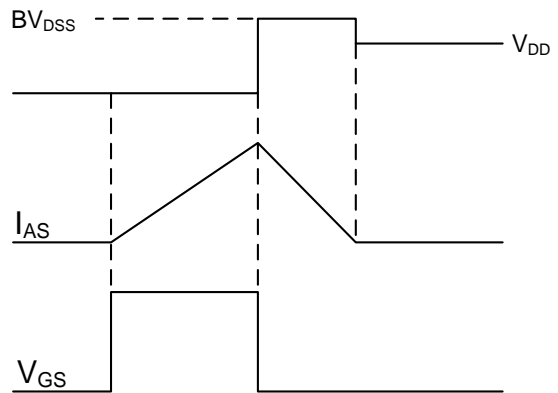
**Fig.9 Normalized Transient Impedance**



**Fig.10 Maximum Safe Operation Area**



**Fig.11 Switching Time Waveform**



**Fig.12 EAS Waveform**

## TO252 PACKAGE INFORMATION



| Symbol | Dimensions In Millimeters |       | Dimensions In Inches |       |
|--------|---------------------------|-------|----------------------|-------|
|        | MAX                       | MIN   | MAX                  | MIN   |
| A      | 2.450                     | 2.150 | 0.096                | 0.085 |
| A1     | 1.200                     | 0.900 | 0.047                | 0.035 |
| A2     | 0.250                     | 0.000 | 0.010                | 0.000 |
| B      | 6.800                     | 6.300 | 0.268                | 0.248 |
| C      | 0.600                     | 0.350 | 0.024                | 0.014 |
| C1     | 0.600                     | 0.380 | 0.024                | 0.015 |
| D      | 5.500                     | 5.100 | 0.217                | 0.201 |
| E      | 2.400                     | 2.000 | 0.094                | 0.079 |
| F      | 1.150                     | 0.600 | 0.045                | 0.024 |
| F1     | 0.900                     | 0.500 | 0.035                | 0.020 |
| L      | 10.400                    | 9.400 | 0.409                | 0.370 |
| L1     | 3.100                     | 2.400 | 0.122                | 0.094 |
| L2     | 6.300                     | 5.300 | 0.248                | 0.209 |
| L3     | 1.200                     | 0.600 | 0.047                | 0.024 |
| θ      | 9°                        | 3°    | 9°                   | 3°    |