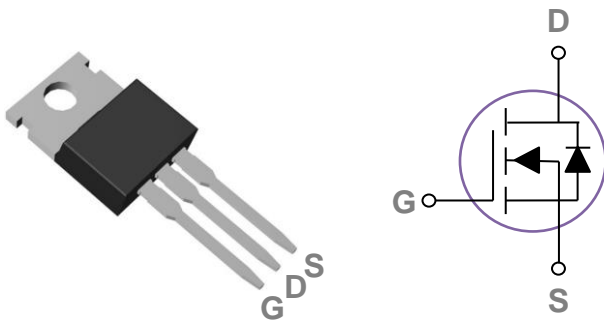


### General Description

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.

### TO220 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 <sup>2</sup>	170	mJ
$P_D$	Power Dissipation ( $T_c=25^\circ C$ )	75	W
	Power Dissipation – Derate above $25^\circ C$	0.6	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	---	1.68	$^\circ C/W$

**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	$\text{m}\Omega$
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS}=V_{DS}, I_D=250\mu\text{A}$	2	3	4	V

**Dynamic and switching Characteristics**

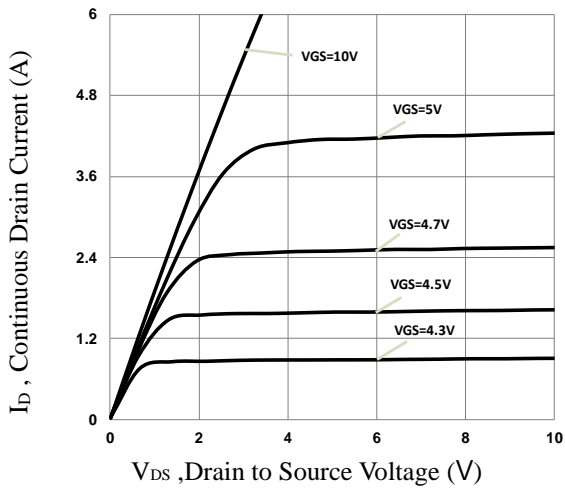
$Q_g$	Total Gate Charge <sup>3, 4</sup>	$V_{DS}=350V, V_{GS}=10V, I_D=8A$	---	14	21	nC
$Q_{gs}$	Gate-Source Charge <sup>3, 4</sup>		---	2	3	
$Q_{gd}$	Gate-Drain Charge <sup>3, 4</sup>		---	12	18	
$T_{d(on)}$	Turn-On Delay Time <sup>3, 4</sup>	$V_{DS}=350V, V_{GS}=10V, R_G=25\Omega, I_D=8A$	---	14	21	ns
$T_r$	Rise Time <sup>3, 4</sup>		---	34	51	
$T_{d(off)}$	Turn-Off Delay Time <sup>3, 4</sup>		---	48	72	
$T_f$	Fall Time <sup>3, 4</sup>		---	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**

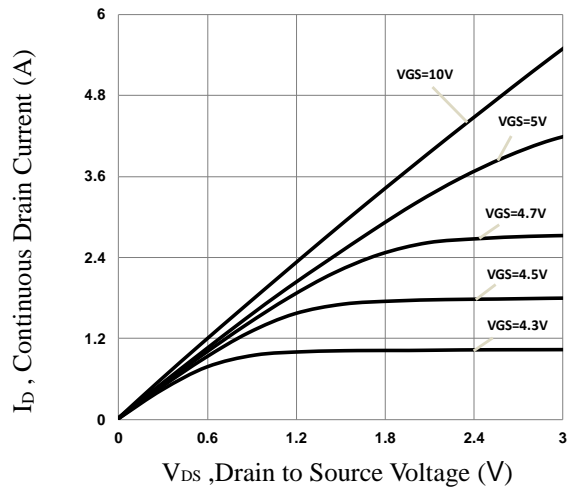
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$I_S$	Continuous Source Current	$V_G=V_D=0V, \text{Force Current}$	---	---	8	A
$I_{SM}$	Pulsed Source Current		---	---	16	A
$V_{SD}$	Diode Forward Voltage	$V_{GS}=0V, I_S=1A, T_J=25^\circ\text{C}$	---	---	1.2	V
$t_{rr}$	Reverse Recovery Time	$V_R=400V,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

Note :

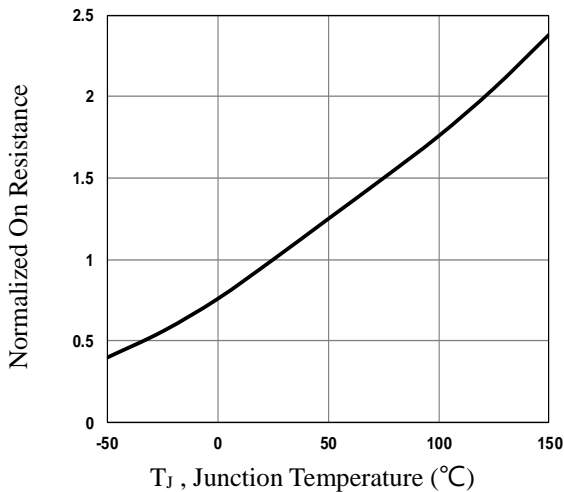
1. Repetitive Rating : Pulsed width limited by maximum junction temperature.
2. The data tested by pulsed , pulse width  $\leq 300\mu\text{s}$  , duty cycle  $\leq 2\%$ .
3. Essentially independent of operating temperature.



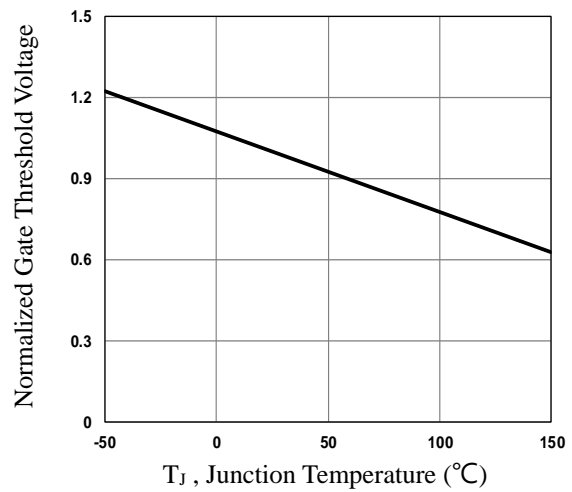
**Fig.1 Typical Output Characteristics**



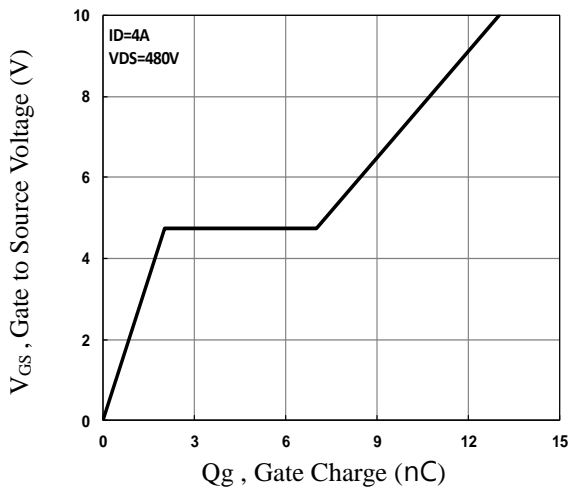
**Fig.2 Typical Output Characteristics**



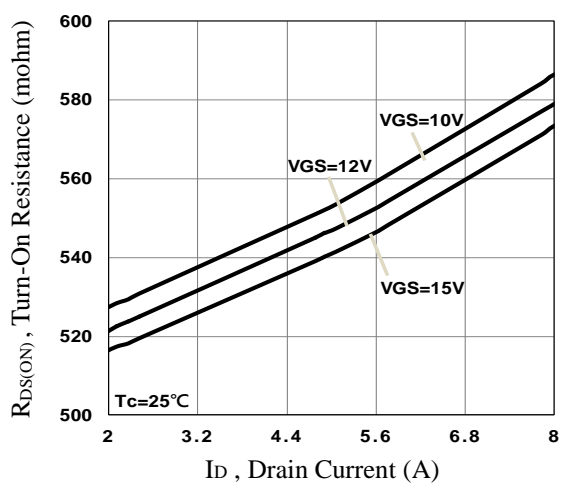
**Fig.3 Normalized  $R_{DS(on)}$  vs.  $T_J$**



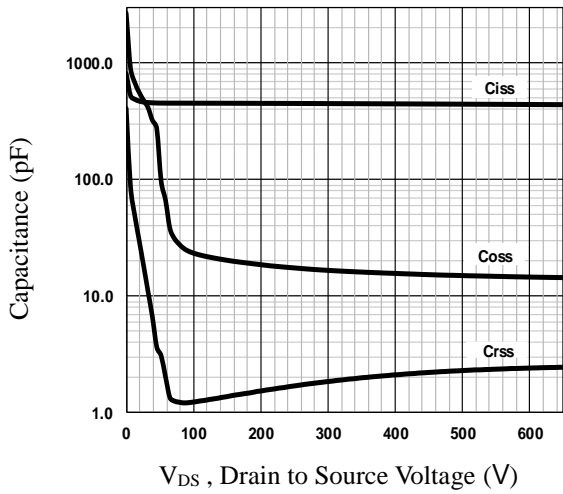
**Fig.4 Normalized  $V_{th}$  vs.  $T_J$**



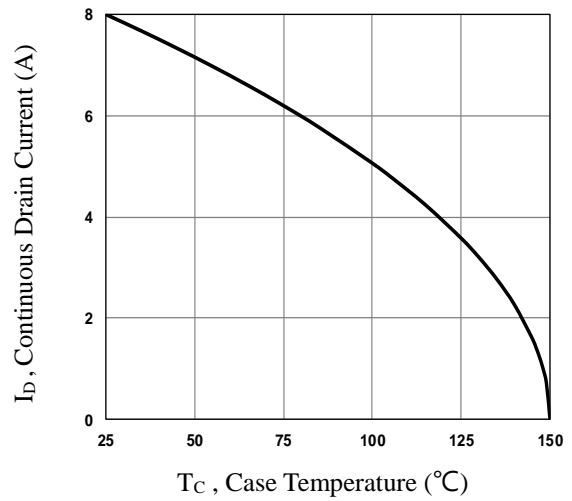
**Fig.5 Gate Charge Characteristics**



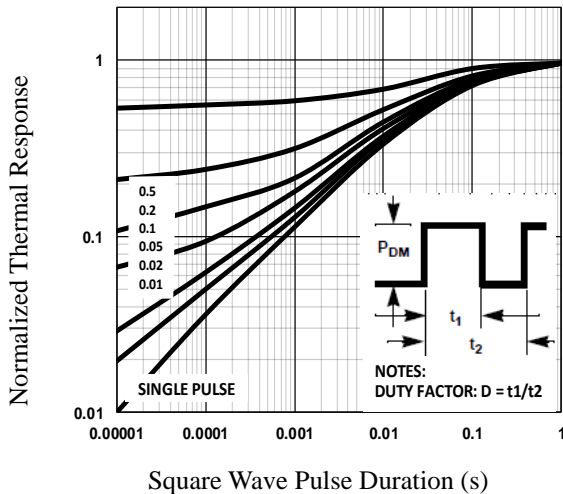
**Fig.6 Turn-On Resistance vs.  $I_D$**



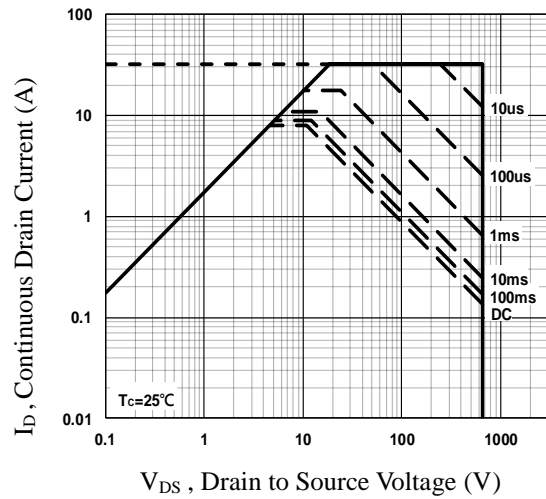
**Fig.7 Capacitance Characteristics**



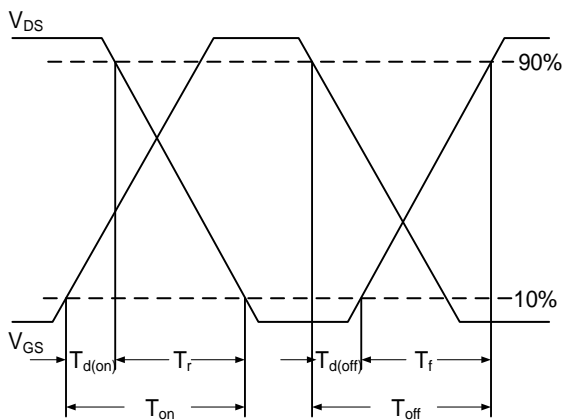
**Fig.8 Continuous Drain Current vs. T<sub>c</sub>**



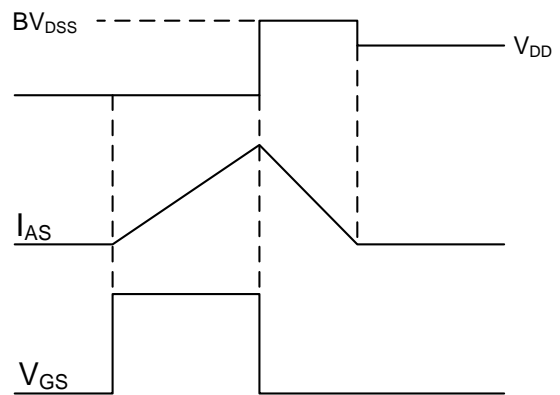
**Fig.9 Normalized Transient Impedance**



**Fig.10 Maximum Safe Operation Area**



**Fig.11 Switching Time Waveform**



**Fig.12 EAS Waveform**

## 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