

General Description

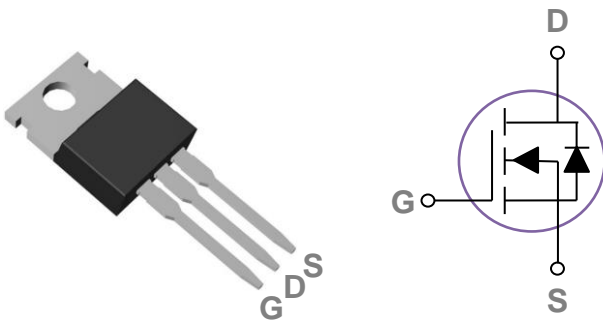
These N-Channel enhancement mode power field effect transistors are using Super Junction technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These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

BVDSS	RDSON	ID
650V	360mΩ	11A

Features

- 650V, 11A, $R_{DS(ON)} = 360m\Omega @ V_{GS} = 10V$
- Improved dv/dt capability
- Fast switching
- 100% EAS Guaranteed
- Green Device Available

TO220 Pin Configuration



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	± 30	V
I_D	Drain Current – Continuous ($T_C=25^\circ C$)	11	A
	Drain Current – Continuous ($T_C=100^\circ C$)	6.9	A
I_{DM}	Drain Current – Pulsed ¹	44	A
EAS	Single Pulse Avalanche Energy	210	mJ
P_D	Power Dissipation ($T_C=25^\circ C$)	95	W
	Power Dissipation – Derate above $25^\circ C$	0.76	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	---	62.5	$^\circ C/W$
$R_{\theta JC}$	Thermal Resistance Junction to Case	---	1.32	$^\circ C/W$

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	μA
		$V_{DS}=520V, V_{GS}=0V, T_J=125^\circ\text{C}$	---	---	10	μA
I_{GSS}	Gate-Source Leakage Current	$V_{GS}=\pm 30V, V_{DS}=0V$	---	---	± 100	nA

On Characteristics

$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS}=10V, I_D=4A$	---	320	360	$m\Omega$
$V_{GS(th)}$	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 ^{2,3}	$V_{DS}=480V, V_{GS}=10V, I_D=6A$	---	21	32	nC
Q_{gs}	Gate-Source Charge ^{2,3}		---	4	6	
Q_{gd}	Gate-Drain Charge ^{2,3}		---	7	11	
$T_{d(on)}$	Turn-On Delay Time ^{2,3}	$V_{DD}=480V, V_{GS}=10V, R_G=25\Omega$ $I_D=6A$	---	18	27	ns
T_r	Rise Time ^{2,3}		---	41	62	
$T_{d(off)}$	Turn-Off Delay Time ^{2,3}		---	110	165	
T_f	Fall Time ^{2,3}		---	39	59	
C_{iss}	Input Capacitance	$V_{DS}=100V, V_{GS}=0V, F=1\text{MHz}$	---	670	1005	pF
C_{oss}	Output Capacitance		---	30	45	
C_{rss}	Reverse Transfer Capacitance		---	1.5	5.3	
R_g	Gate resistance	$V_{GS}=0V, V_{DS}=0V, F=1\text{MHz}$	---	20	---	Ω

Drain-Source Diode Characteristics and Maximum Ratings

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I_S	Continuous Source Current	$V_G=V_D=0V, \text{Force Current}$	---	---	11	A
I_{SM}	Pulsed Source Current		---	---	22	A
V_{SD}	Diode Forward Voltage	$V_{GS}=0V, I_S=6A, T_J=25^\circ\text{C}$	---	---	1.4	V
t_{rr}	Reverse Recovery Time ²	$V_R=400V, I_S=10A,$ $di/dt=100A/\mu\text{s}, T_J=25^\circ\text{C}$	---	320	---	ns
Q_{rr}	Reverse Recovery Charge ²		---	3.8	---	μC

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.

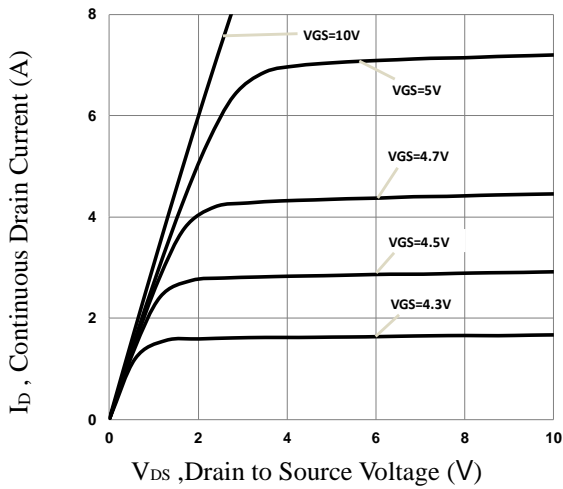


Fig.1 Typical Output Characteristics

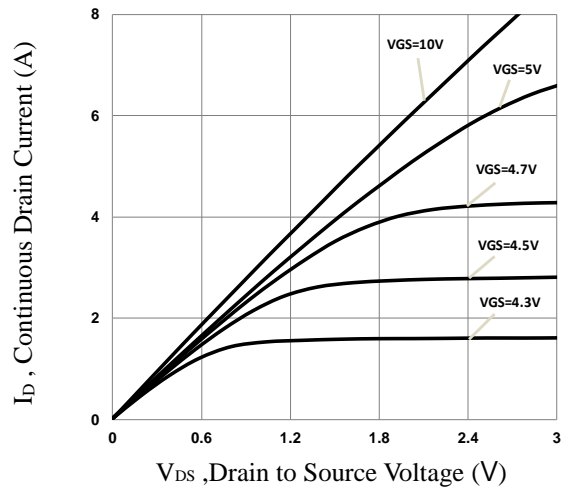


Fig.2 Typical Output Characteristics

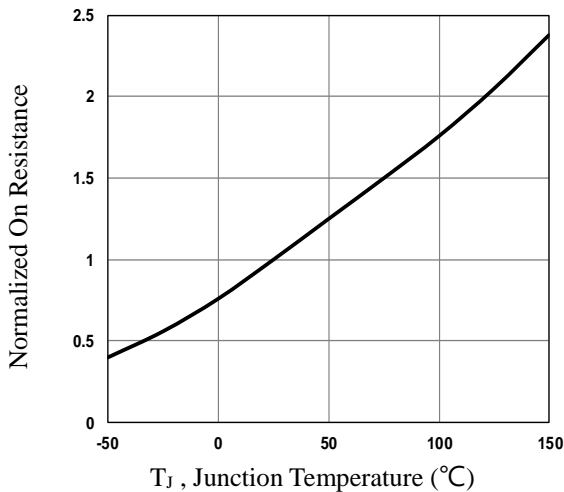


Fig.3 Normalized $R_{DS(on)}$ vs. T_J

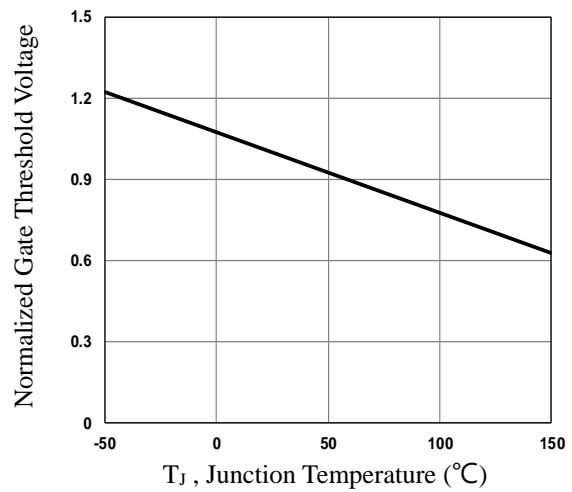


Fig.4 Normalized V_{th} vs. T_J

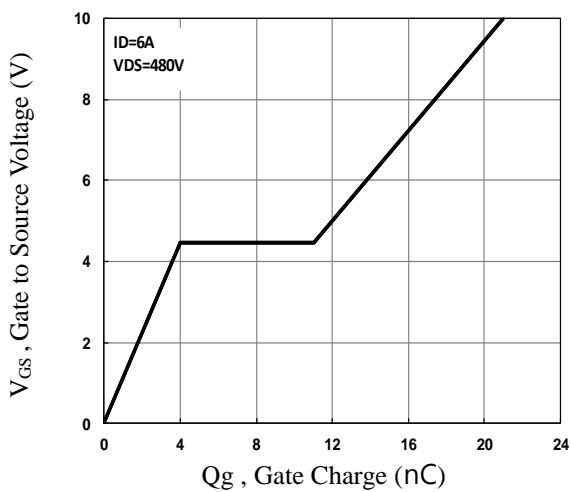


Fig.5 Gate Charge Characteristics

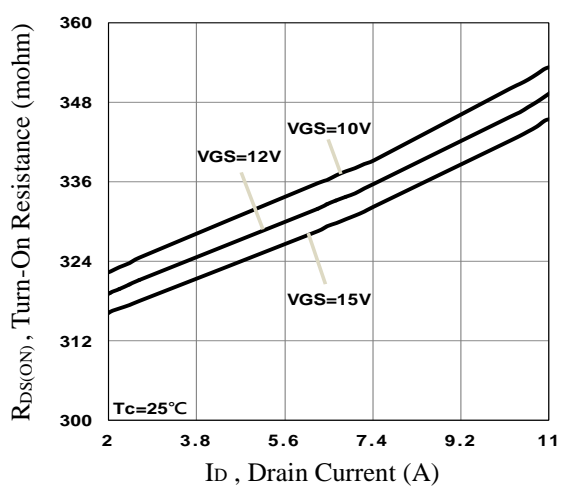


Fig.6 Turn-On Resistance vs. I_D

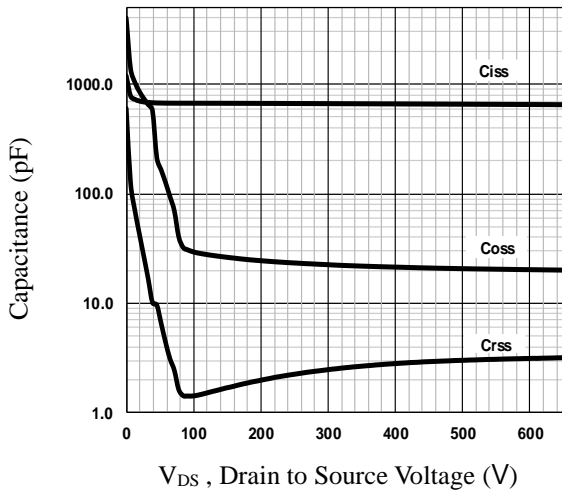


Fig.7 Capacitance Characteristics

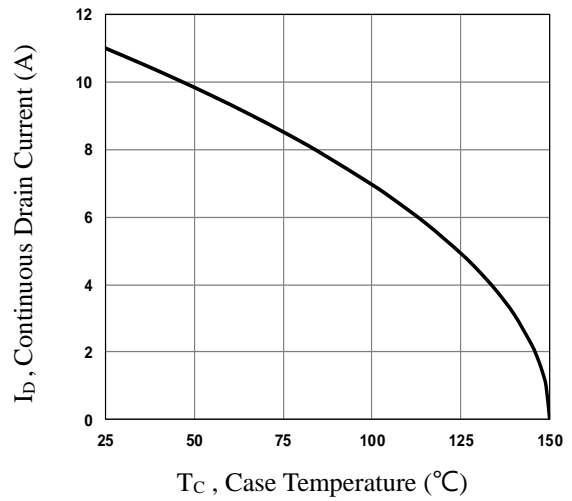


Fig.8 Continuous Drain Current vs. T_c

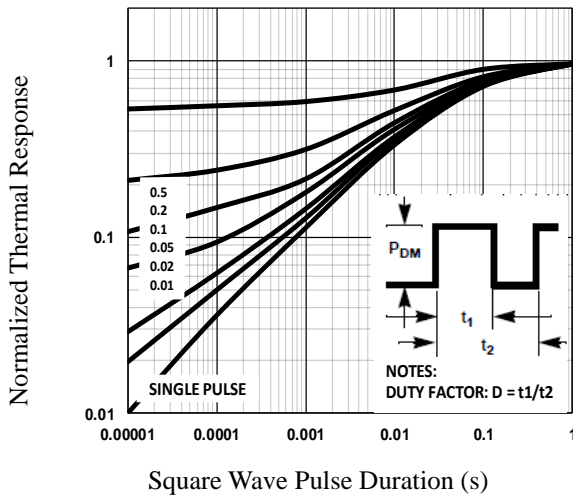


Fig.9 Normalized Transient Impedance

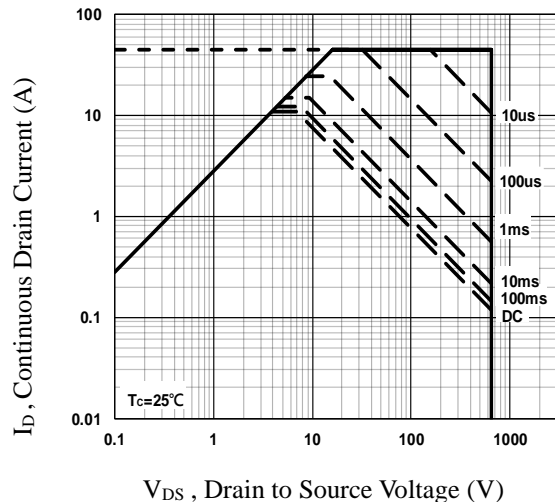


Fig.10 Maximum Safe Operation Area

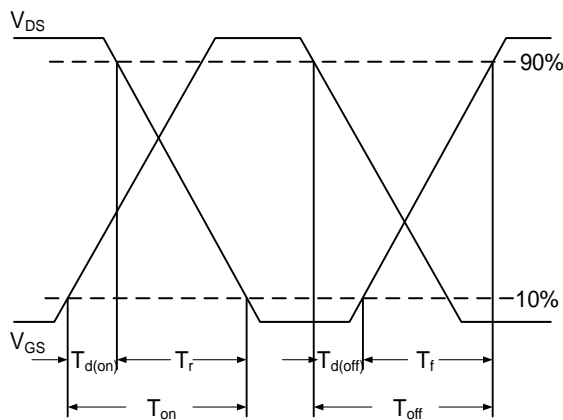


Fig.11 Switching Time Waveform

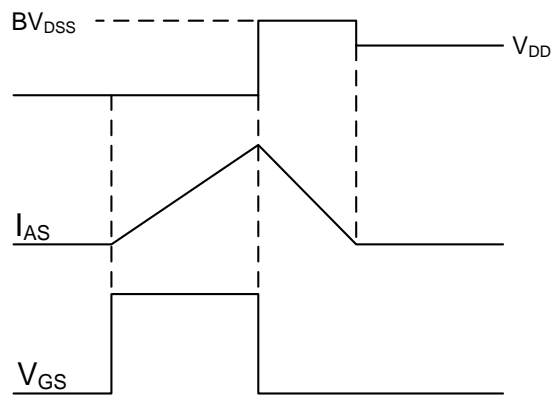


Fig.12 EAS Waveform

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