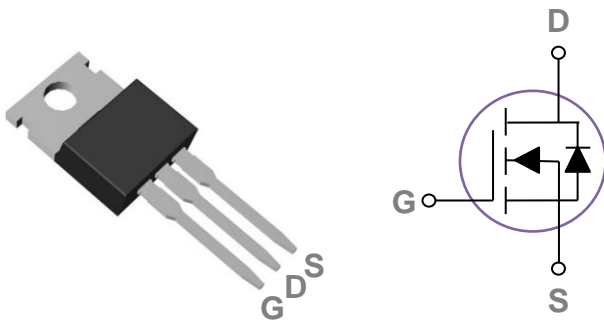


General Description

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	320mΩ	14A

Features

- 650V, 14A, $R_{DS(ON)} = 320m\Omega @ V_{GS} = 10V$
- 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 $T_c=25^\circ\text{C}$ 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 ($T_c=25^\circ\text{C}$)	14	A
	Drain Current – Continuous ($T_c=100^\circ\text{C}$)	8.8	A
I_{DM}	Drain Current – Pulsed ¹	56	A
EAS	Single Pulse Avalanche Energy ²	290	mJ
P_D	Power Dissipation ($T_c=25^\circ\text{C}$)	114	W
	Power Dissipation – Derate above 25°C	0.91	W/ $^\circ\text{C}$
T_{STG}	Storage Temperature Range	-55 to 150	$^\circ\text{C}$
T_J	Operating Junction Temperature Range	-55 to 150	$^\circ\text{C}$

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Unit
$R_{\theta JA}$	Thermal Resistance Junction to ambient	---	62	$^\circ\text{C}/\text{W}$
$R_{\theta JC}$	Thermal Resistance Junction to Case	---	1.1	$^\circ\text{C}/\text{W}$

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 =1mA	650	---	---	V
I _{DSS}	Drain-Source Leakage Current	V _{DS} =650V, V _{GS} =0V, T _J =25°C	---	---	1	uA
		V _{DS} =520V, V _{GS} =0V, T _J =100°C	---	---	10	uA
I _{GSS}	Gate-Source Leakage Current	V _{GS} =±30V, V _{DS} =0V	---	---	±100	nA

On Characteristics

R _{DS(ON)}	Static Drain-Source On-Resistance	V _{GS} =10V, I _D =6A	---	270	320	mΩ
V _{GS(th)}	Gate Threshold Voltage	V _{GS} =V _{DS} , I _D =250uA	2	3	4	V

Dynamic and switching Characteristics

Q _g	Total Gate Charge ^{3,4}	V _{DS} =350V, V _{GS} =10V, I _D =14A	---	26	40	nC
Q _{gs}	Gate-Source Charge ^{3,4}		---	5	8	
Q _{gd}	Gate-Drain Charge ^{3,4}		---	18	26	
T _{d(on)}	Turn-On Delay Time ^{3,4}	V _{DS} =350V, V _{GS} =10V, R _G =25Ω I _D =14A	---	20	30	ns
T _r	Rise Time ^{3,4}		---	43	65	
T _{d(off)}	Turn-Off Delay Time ^{3,4}		---	91	137	
T _f	Fall Time ^{3,4}		---	42	63	
C _{iss}	Input Capacitance	V _{DS} =350V, V _{GS} =0V, F=1MHz	---	910	1360	pF
C _{oss}	Output Capacitance		---	28	45	
C _{rss}	Reverse Transfer Capacitance		---	2.4	5	
R _g	Gate resistance	V _{GS} =0V, V _{DS} =0V, F=1MHz	---	7	---	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	---	---	14	A
I _{SM}	Pulsed Source Current		---	---	28	A
V _{SD}	Diode Forward Voltage	V _{GS} =0V, I _S =1A, T _J =25°C	---	---	1.2	V
t _{rr}	Reverse Recovery Time	V _R =400V, I _S =10A	---	330	---	ns
Q _{rr}	Reverse Recovery Charge	di/dt=100A/μs, T _J =25°C	---	4.1	---	uC

Note :

1. Repetitive Rating : Pulsed width limited by maximum junction temperature.
2. The data tested by pulsed, pulse width ≤ 300us, duty cycle ≤ 2%.
3. Essentially independent of operating temperature.

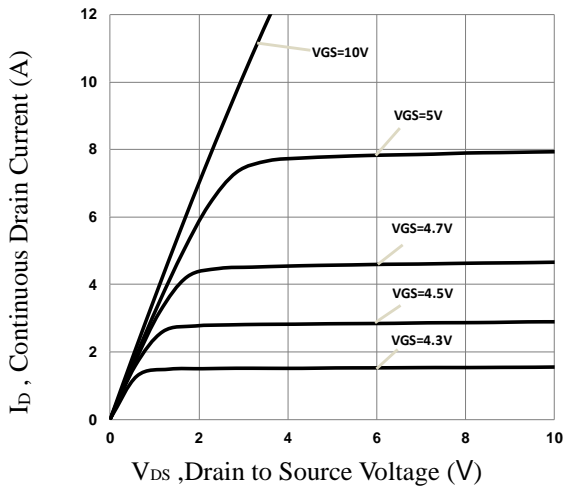


Fig.1 Typical Output Characteristics

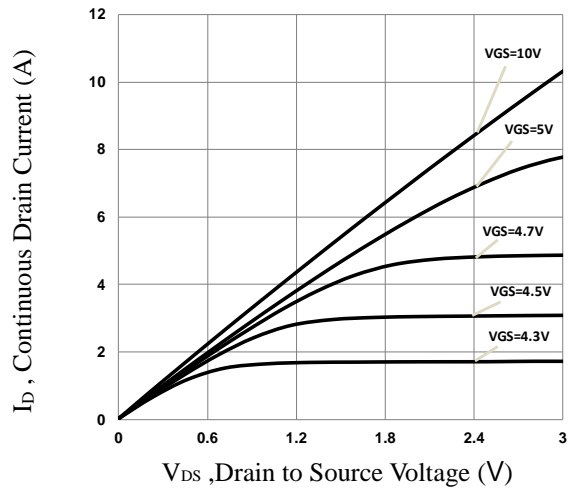


Fig.2 Typical Output Characteristics

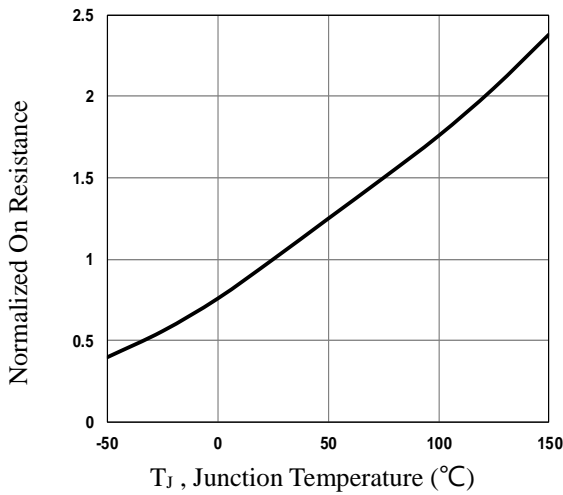


Fig.3 Normalized $R_{DS(on)}$ vs. T_J

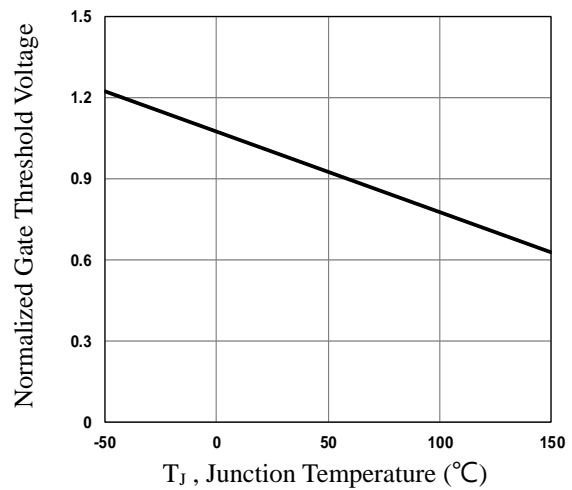


Fig.4 Normalized V_{th} vs. T_J

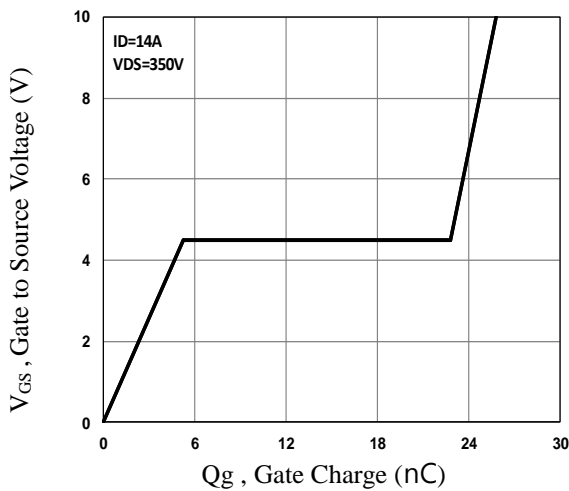


Fig.5 Gate Charge Characteristics

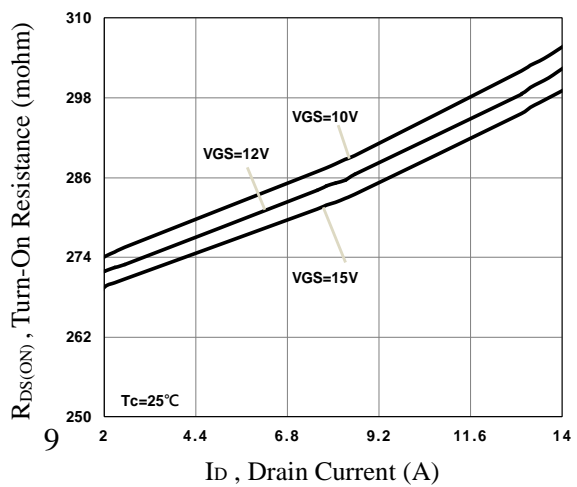


Fig.6 Turn-On Resistance vs. I_D

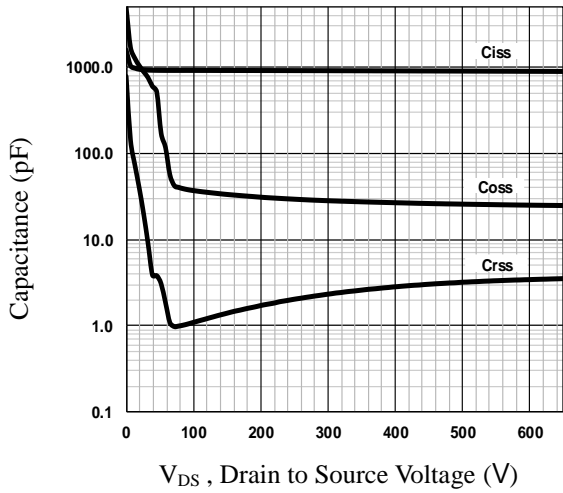


Fig.7 Capacitance Characteristics

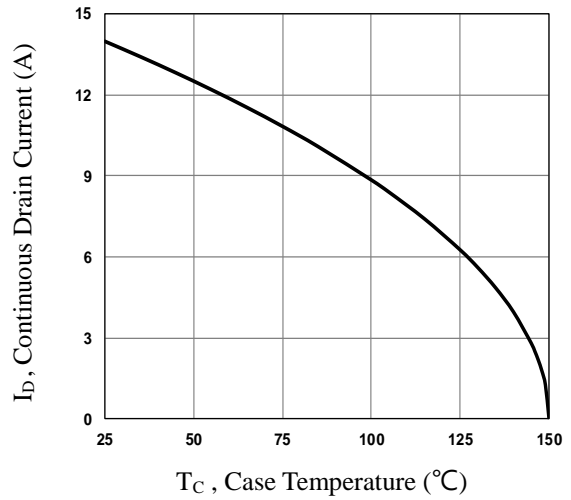


Fig.8 Continuous Drain Current vs. T_c

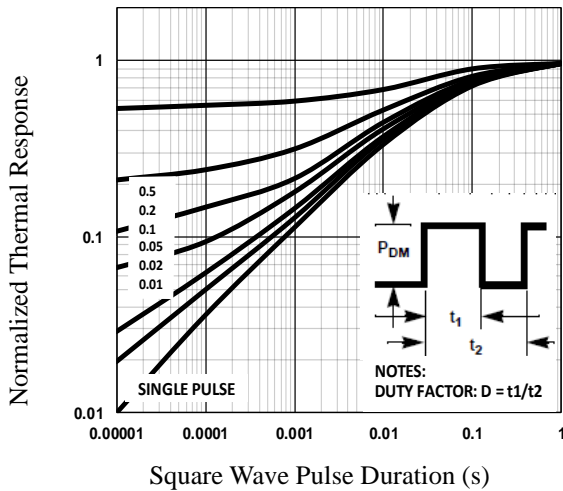


Fig.9 Normalized Transient Impedance

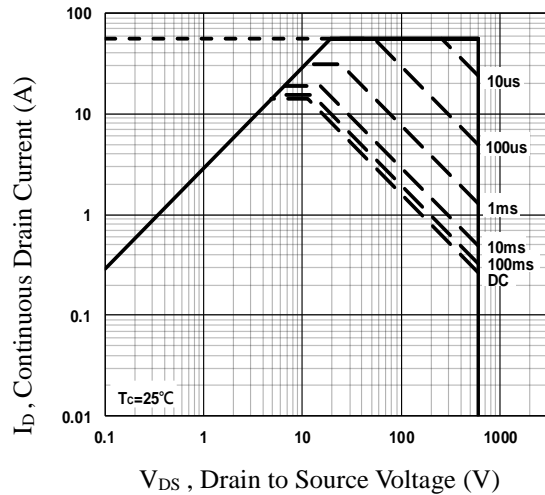


Fig.10 Maximum Safe Operation Area

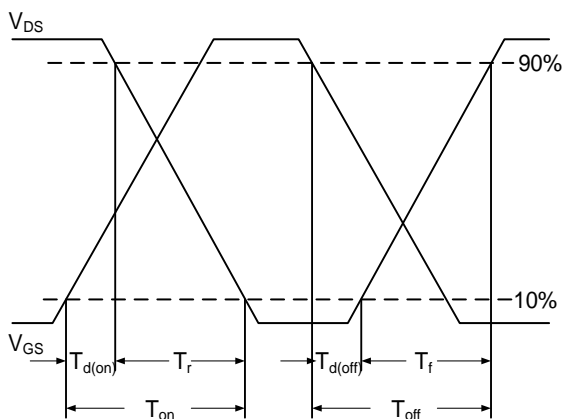


Fig.11 Switching Time Waveform

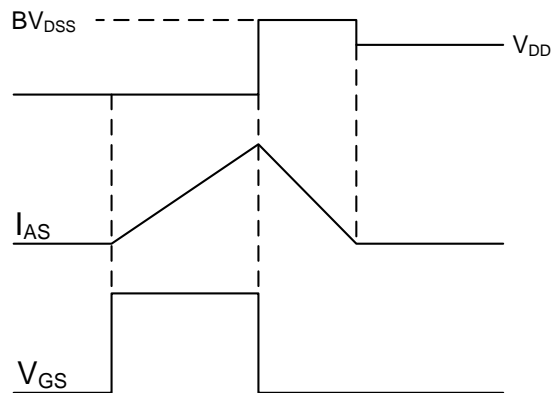
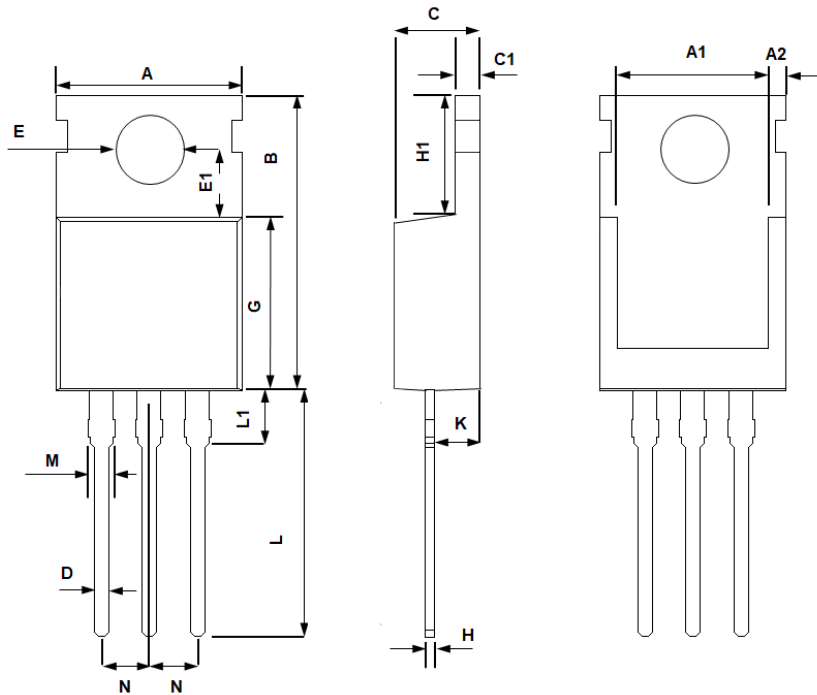


Fig.12 EAS Waveform

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