



650V N-Channel MOSFETs

General Description

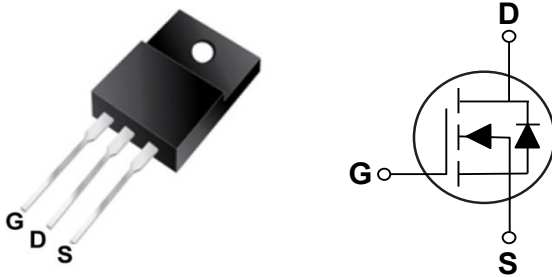
These N-Channel enhancement mode power field effect transistors are using SJ-MOS technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices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

BV_{DSS}	$R_{DS(ON)}$	I_D
650 V	190 m Ω	16.5 A

Features

- $R_{DS(ON)} \leq 190m\Omega @ V_{GS}=10V$
- Improved dv/dt Capability
- Fast Switching
- Green Device Available

TO-220F Pin Configuration



Applications

- Switching Mode Power Supplies
- PWM Motor Controls
- LED Lighting
- 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 ($T_C=25^\circ C$)	16.5	A
I_{DM}	Drain Current – Pulsed (NOTE 1)	49.5	A
EAS	Single Pulse Avalanche Energy (NOTE 2)	480	mJ
P_D	Power Dissipation ($T_C=25^\circ C$)	52	W
T_J	Operating Junction Temperature Range	-55 to 150	$^\circ C$
T_{STG}	Storage Temperature Range	-55 to 150	$^\circ C$
Marking Code		NAB190	

Thermal Characteristics

Symbol	Parameter	Rating	Unit
$R_{\theta JA}$	Thermal Resistance Junction to Ambient	70	$^\circ C/W$
$R_{\theta JC}$	Thermal Resistance Junction to Case	2.4	$^\circ C/W$

**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	650	---	---	V
I _{DSS}	Drain-Source Leakage Current	V _{DS} =650V, V _{GS} =0V	---	---	1	uA
I _{GSS}	Gate-Source Leakage Current	V _{GS} =±30V, V _{DS} =0V	---	---	±100	nA

On Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
R _{DS(ON)}	Static Drain-Source On-Resistance	V _{GS} =10V, I _D =10A	---	---	190	mΩ
V _{GS(th)}	Gate Threshold Voltage	V _{GS} =V _{DS} , I _D =250uA	2.5	---	4.5	V
g _{fs}	Forward Transconductance	V _{DS} =10V, I _D =10A	---	18.7	---	S

Dynamic and switching Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Q _g	Total Gate Charge	V _{DS} =325V, V _{GS} =10V, I _D =16.5A	---	33.8	---	nC
Q _{gs}	Gate-Source Charge		---	7.8	---	
Q _{gd}	Gate-Drain Charge		---	12.9	---	
T _{d(on)}	Turn-On Delay Time	V _{DD} =325V, R _G =25Ω, I _D =16.5A, V _{GS} =10V	---	30	---	nS
T _r	Rise Time		---	41	---	
T _{d(off)}	Turn-Off Delay Time		---	130	---	
T _f	Fall Time		---	31	---	
C _{iss}	Input Capacitance	V _{DS} =100V, V _{GS} =0V, F=1MHz	---	1484	---	pF
C _{OSS}	Output Capacitance		---	66	---	
C _{rSS}	Reverse Transfer Capacitance		---	1	---	

Drain-Source Diode Characteristics and Ratings

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I _S	Continuous Body Diode Current		---	---	16.5	A
I _{SM}	Pulsed Diode Forward Current		---	---	49.5	A
V _{SD}	Diode Forward Voltage	V _{GS} =0V, I _S =15A	---	---	1.3	V

NOTES :

1. Repetitive Rating : Pulsed width limited by maximum junction temperature.
2. L=60H, I_{AS}=4A, V_{DD}=50V, R_G=25Ω.
3. The data tested by pulsed, pulse width ≤ 300us, duty cycle ≤ 2%.
4. Essentially independent of operating temperature.



Characteristics Curves

FIG. 1- Transfer Characteristics

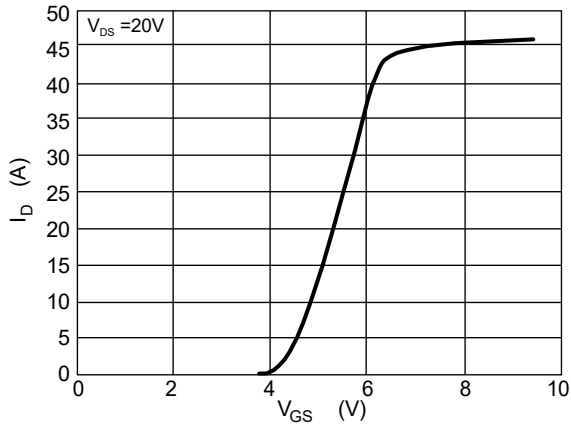


FIG. 2- $V_{GS(th)}$ (Normalized) vs. T_J

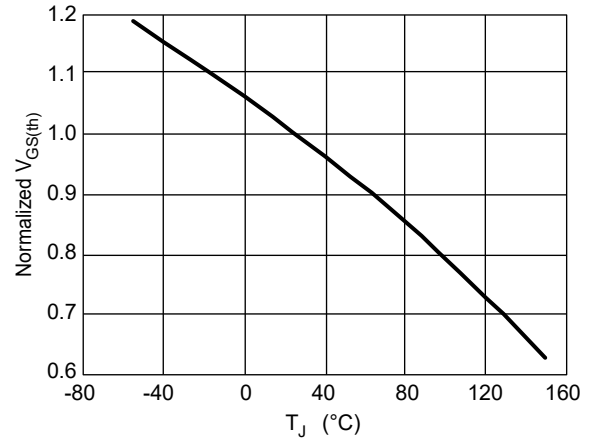


FIG. 3- $R_{DS(on)}$ (Normalized) vs. T_J

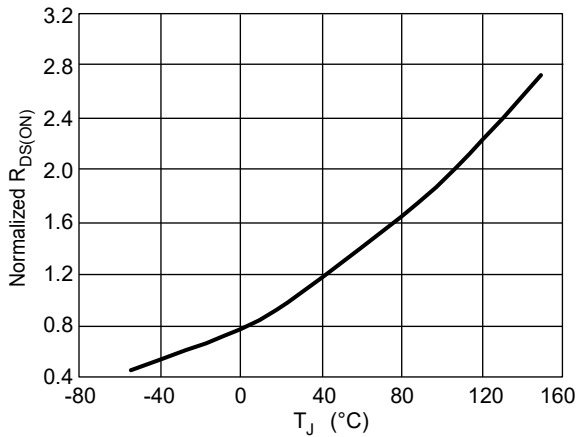


FIG. 4- $R_{DS(on)}$ vs. I_D

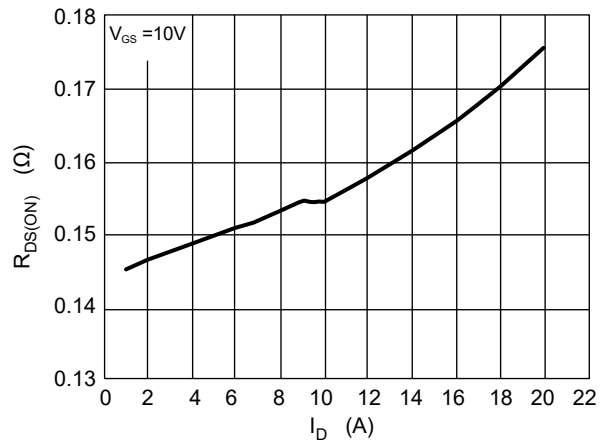


FIG. 5- BV_{DSS} (Normalized) vs. T_J

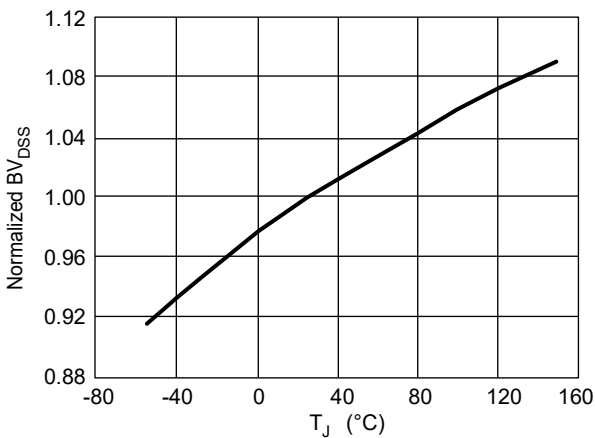
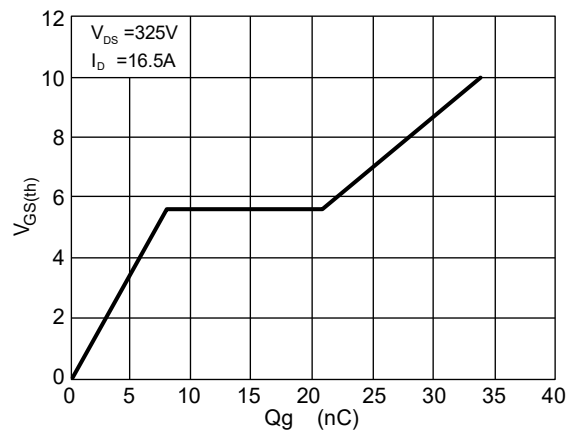


FIG. 6- Gate Charge Characteristics





Characteristics Curves

FIG. 7- Diode Forward Characteristics

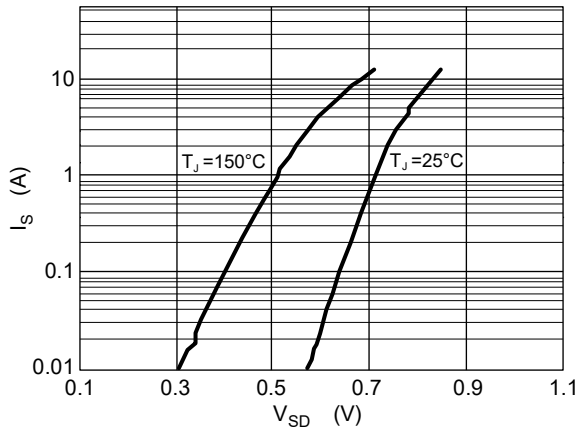


FIG. 8- Safe Operating Area

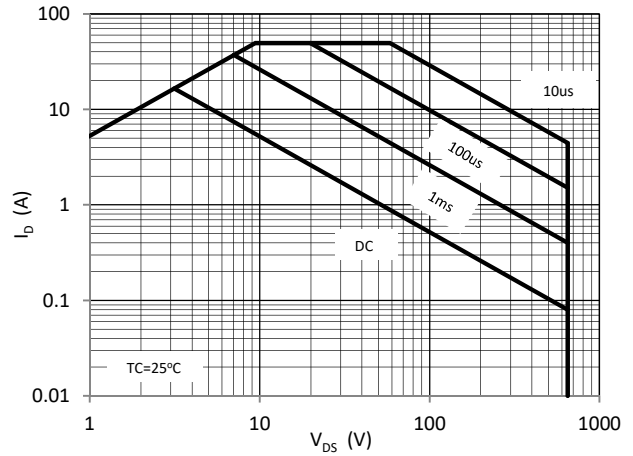
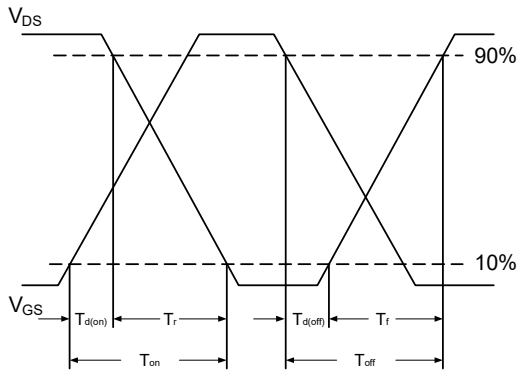
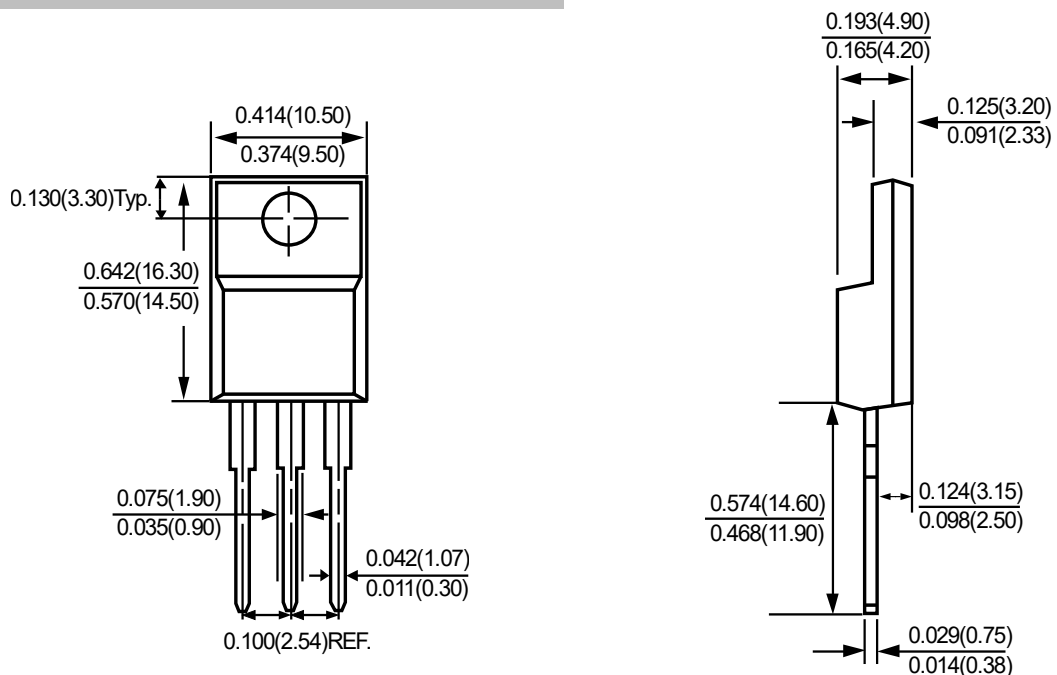


FIG. 9- Switching Time Waveform



Package Outline Dimensions



TO-220F

Dimensions in inches and (millimeters)



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