



## 650V N-Channel MOSFETs

### General Description

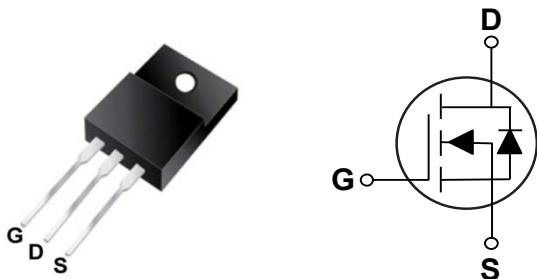
These N-Channel enhancement mode power field effect transistors are using trench DMOS technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These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

$BV_{DSS}$	$R_{DS(ON)}$	$I_D$
650 V	120 m $\Omega$	19.3 A

### Features

- $R_{DS(ON)} \leq 120m\Omega @ V_{GS}=10V$
- Improved dv/dt Capability
- Fast Switching
- Green Device Available

TO-220F Pin Configuration



### Applications

- LED Power Supply
- Electronic Ballast
- High Frequency Switching Mode Power Supply

### 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	$\pm 30$	V
$I_D$	Drain Current – Continuous ( $T_C=25^\circ\text{C}$ )	19.3	A
$I_{DM}$	Drain Current – Pulsed (NOTE 1)	57.9	A
EAS	Single Pulse Avalanche Energy (NOTE 2)	250	mJ
$P_D$	Power Dissipation ( $T_C=25^\circ\text{C}$ )	45	W
$T_J$	Operating Junction Temperature Range	-55 to 150	$^\circ\text{C}$
$T_{STG}$	Storage Temperature Range	-55 to 150	$^\circ\text{C}$
Marking Code		NAB120	

### Thermal Characteristics

Symbol	Parameter	Rating	Unit
$R_{\theta JA}$	Thermal Resistance Junction to Ambient	47.6	$^\circ\text{C/W}$
$R_{\theta JC}$	Thermal Resistance Junction to Case	2.78	$^\circ\text{C/W}$

**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	$V_{GS}=0V, I_D=250\mu A$	650	---	---	V
$I_{DSS}$	Drain-Source Leakage Current	$V_{DS}=650V, V_{GS}=0V$	---	---	1	$\mu A$
$I_{GSS}$	Gate-Source Leakage Current	$V_{GS}=\pm 30V, V_{DS}=0V$	---	---	$\pm 100$	nA

**On Characteristics**

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS}=10V, I_D=15A$	---	---	120	m $\Omega$
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS}=V_{DS}, I_D=250\mu A$	2.5	---	4.5	V
gfs	Forward Transconductance	$V_{DS}=10V, I_D=15A$	---	20.9	---	S

**Dynamic and switching Characteristics**

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$Q_g$	Total Gate Charge	$V_{DS}=520V, V_{GS}=10V, I_D=19A$	---	58	---	nC
$Q_{gs}$	Gate-Source Charge		---	19	---	
$Q_{gd}$	Gate-Drain Charge		---	19	---	
$T_{d(on)}$	Turn-On Delay Time	$V_{DD}=325V, R_G=25\Omega, I_D=19A, V_{GS}=10V$	---	41	---	nS
$T_r$	Rise Time		---	75	---	
$T_{d(off)}$	Turn-Off Delay Time		---	165	---	
$T_f$	Fall Time		---	68	---	
$C_{iss}$	Input Capacitance	$V_{DS}=100V, V_{GS}=0V, F=1\text{MHz}$	---	2598	---	pF
$C_{oss}$	Output Capacitance		---	96	---	
$C_{riss}$	Reverse Transfer Capacitance		---	44	---	

**Drain-Source Diode Characteristics and Ratings**

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$I_S$	Continuous Body Diode Current		---	---	19.3	A
$I_{SM}$	Pulsed Diode Forward Current		---	---	57.9	A
$V_{SD}$	Diode Forward Voltage	$V_{GS}=0V, I_S=15A$	---	---	1.2	V
$t_{rr}$	Reverse Recovery Time	$V_R=400V, I_S=I_F,$	---	365	---	nS
$Q_{rr}$	Reverse Recovery Charge	$di_F/dt=100A/\mu s$	---	5.9	---	$\mu C$

**NOTES :**

1. Repetitive Rating : Pulsed width limited by maximum junction temperature.
2.  $I_{AS}=5A, V_{DD}=50V, R_G=25\Omega$ .
3. The data tested by pulsed , pulse width  $\leq 300\mu s$  , duty cycle  $\leq 2\%$ .
4. Essentially independent of operating temperature.



### Characteristics Curves

FIG. 1- Transfer Characteristics

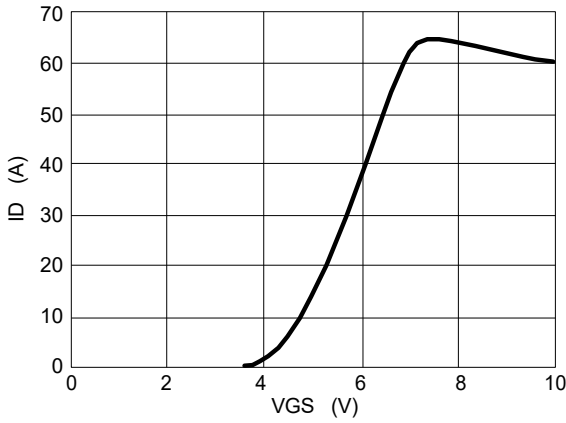


FIG. 2-  $R_{DS(on)}$  vs.  $I_D$

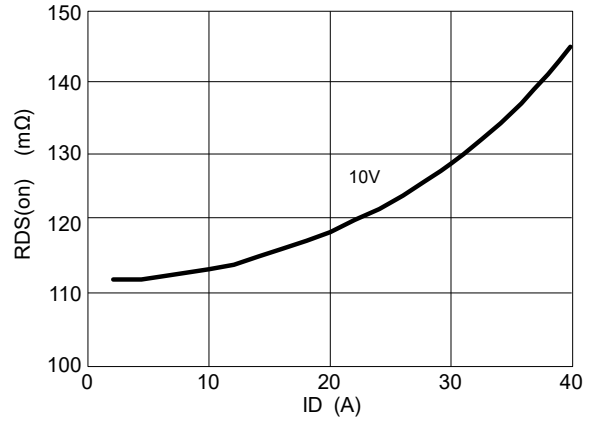


FIG. 3-  $R_{DS(on)}$  (Normalized) vs.  $T_J$

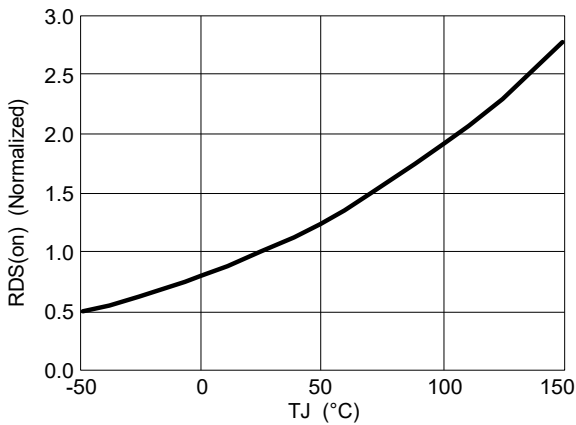


FIG. 4-  $BV_{DSS}$  (Normalized) vs.  $T_J$

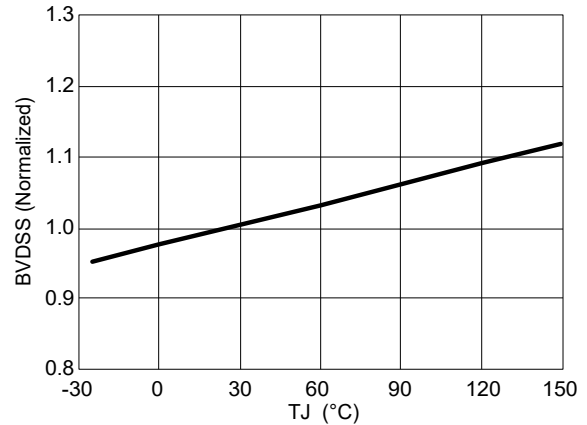


FIG. 5- Gate Charge Characteristics

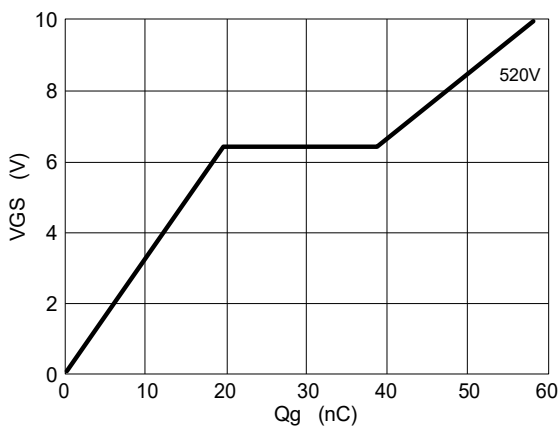
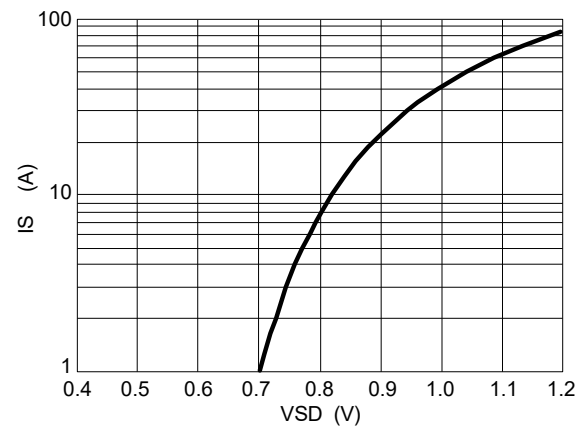


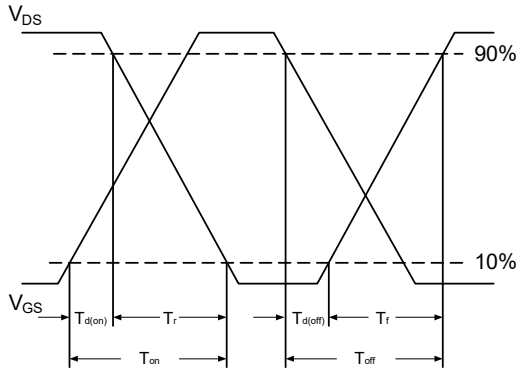
FIG. 6- Diode Forward Characteristics



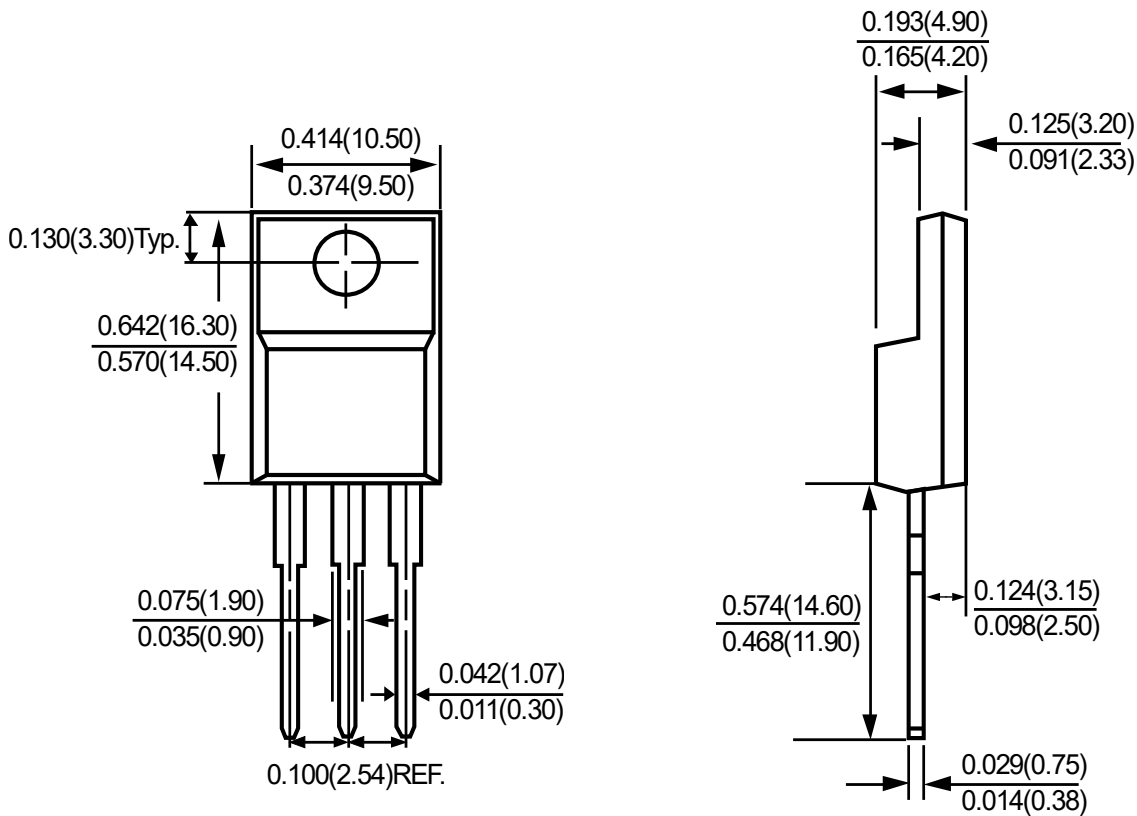


### Characteristics Curves

FIG. 7- Switching Time Waveform



### Package Outline Dimensions



### TO-220F

Dimensions in inches and (millimeters)



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