

60V N-Channel MOSFETs

General Description

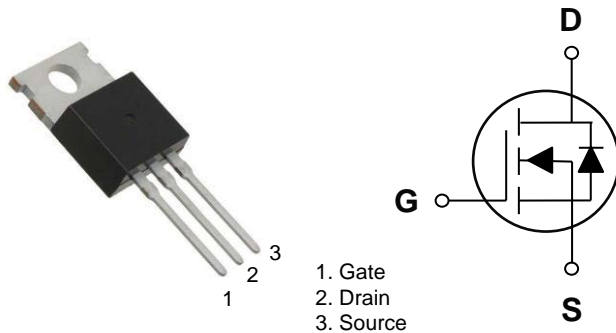
These N-Channel enhancement mode power field effect transistors are using trench DMOS technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These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

BVDSS	RDSON	ID
60V	2.2mΩ	170A

Features

- 60V, 170A, $R_{DS(ON)} = 2.2m\Omega$ @ $V_{GS} = 10V$
- Improved dv/dt capability
- Fast switching
- 100% EAS Guaranteed
- Green Device Available

TO-220 Pin Configuration



Applications

- Motor Drive
- Power Tools
- LED Lighting
- Quick Charger

Absolute Maximum Ratings ($T_c=25^\circ C$ unless otherwise noted)

Symbol	Parameter	Rating	Units
V_{DS}	Drain-Source Voltage	60	V
V_{GS}	Gate-Source Voltage	± 20	V
I_D	Drain Current – Continuous ($T_c=25^\circ C$)	170	A
	Drain Current – Continuous ($T_c=100^\circ C$)	105	A
I_{DM}	Drain Current – Pulsed ¹	680	A
EAS	Single Pulse Avalanche Energy ²	1065	mJ
IAS	Single Pulse Avalanched Current ²	146	A
P_D	Power Dissipation ($T_c=25^\circ C$)	208	W
	Power Dissipation – Derate above $25^\circ C$	1.67	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	---	0.6	$^\circ C/W$



FTK6970P

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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	$V_{GS}=0V, I_D=250\mu A$	60	---	---	V
$\Delta BV_{DSS}/\Delta T_J$	BV_{DSS} Temperature Coefficient	Reference to 25°C , $I_D=1\text{mA}$	---	0.043	---	V/ $^\circ\text{C}$
I_{DSS}	Drain-Source Leakage Current	$V_{DS}=60V, V_{GS}=0V, T_J=25^\circ\text{C}$	---	---	1	μA
		$V_{DS}=48V, V_{GS}=0V, T_J=125^\circ\text{C}$	---	---	10	μA
I_{GSS}	Gate-Source Leakage Current	$V_{GS}=\pm 20V, V_{DS}=0V$	---	---	± 100	nA

On Characteristics

$R_{DS(ON)}$	Static Drain-Source On-Resistance ³	$V_{GS}=10V, I_D=20A$	---	1.4	2.2	m Ω
		$V_{GS}=6V, I_D=15A$	---	1.8	2.6	m Ω
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS}=V_{DS}, I_D=250\mu A$	1.5	2.3	3.5	V
$\Delta V_{GS(th)}$	$V_{GS(th)}$ Temperature Coefficient		---	-4.7	---	mV/ $^\circ\text{C}$
g_{fs}	Forward Transconductance	$V_{DS}=10V, I_D=5A$	---	25	---	S

Dynamic and switching Characteristics

Q_g	Total Gate Charge ^{3, 4}	$V_{DS}=48V, V_{GS}=10V, I_D=10A$	---	293	450	nC
Q_{gs}	Gate-Source Charge ^{3, 4}		---	61.8	93	
Q_{gd}	Gate-Drain Charge ^{3, 4}		---	123	185	
$T_{d(on)}$	Turn-On Delay Time ^{3, 4}	$V_{DD}=15V, V_{GS}=10V, R_G=3.3\Omega$ $I_D=1A$	---	45.4	90	ns
T_r	Rise Time ^{3, 4}		---	122.2	145	
$T_{d(off)}$	Turn-Off Delay Time ^{3, 4}		---	175.4	350	
T_f	Fall Time ^{3, 4}		---	36.6	72	
C_{iss}	Input Capacitance	$V_{DS}=25V, V_{GS}=0V, F=1\text{MHz}$	---	16920	33000	pF
C_{oss}	Output Capacitance		---	1361	2700	
C_{rss}	Reverse Transfer Capacitance		---	424	840	
R_g	Gate resistance	$V_{GS}=0V, V_{DS}=0V, F=1\text{MHz}$	---	1.6	---	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	---	---	170	A
I_{SM}	Pulsed Source Current ³		---	---	340	A
V_{SD}	Diode Forward Voltage ³	$V_{GS}=0V, I_S=1A, T_J=25^\circ\text{C}$	---	---	1	V

Note :

1. Repetitive Rating : Pulsed width limited by maximum junction temperature.
2. $V_{DD}=25V, V_{GS}=10V, L=0.1\text{mH}, I_{AS}=146A, R_G=25\Omega$, Starting $T_J=25^\circ\text{C}$.
3. The data tested by pulsed, pulse width $\leq 300\mu\text{s}$, duty cycle $\leq 2\%$.
4. Essentially independent of operating temperature.

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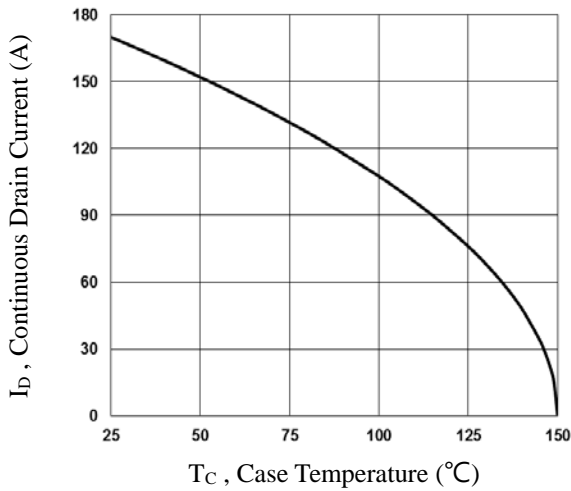


Fig.1 Continuous Drain Current vs. T_c

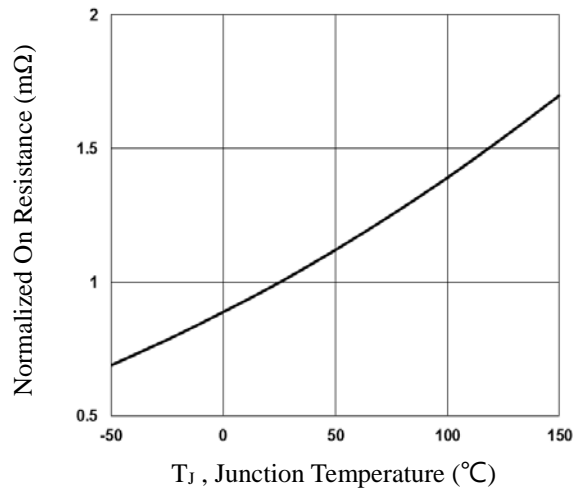


Fig.2 Normalized $R_{DS(on)}$ vs. T_j

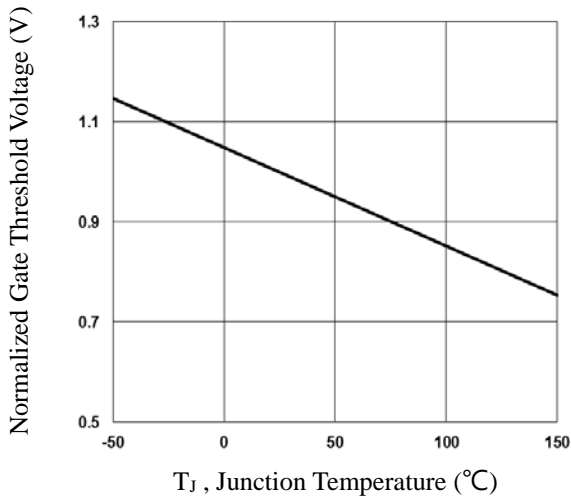


Fig.3 Normalized V_{th} vs. T_j

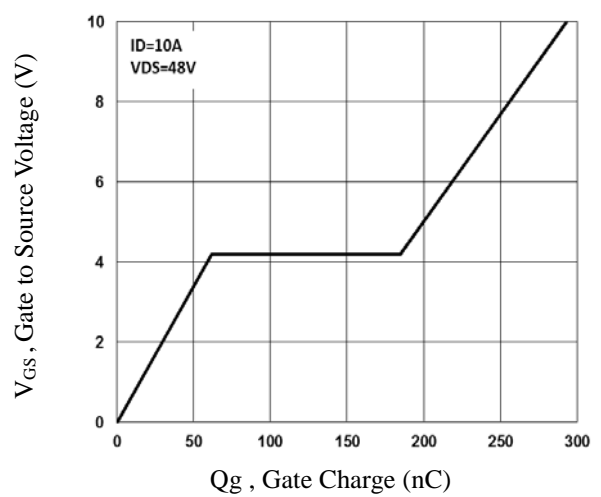


Fig.4 Gate Charge Waveform

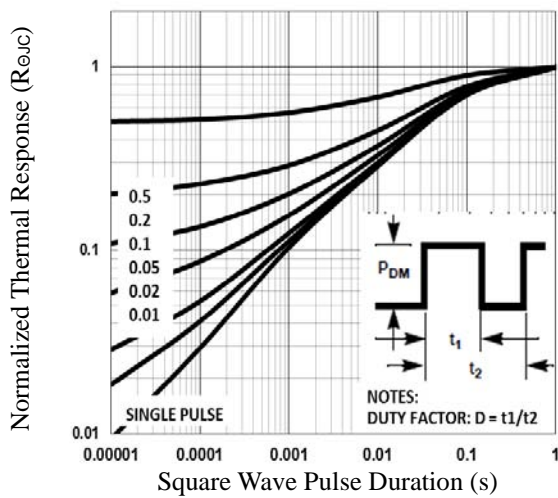


Fig.5 Normalized Transient Response

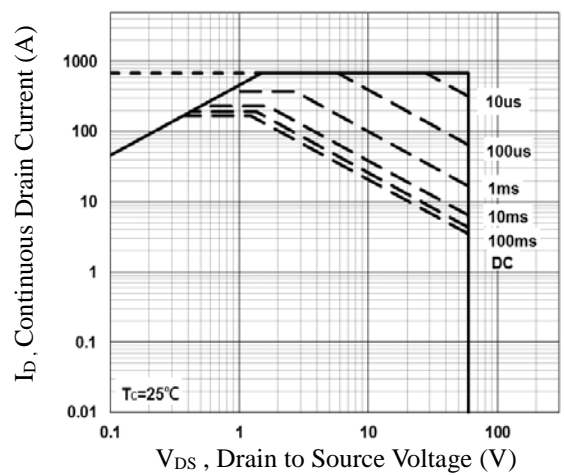


Fig.6 Maximum Safe Operation Area

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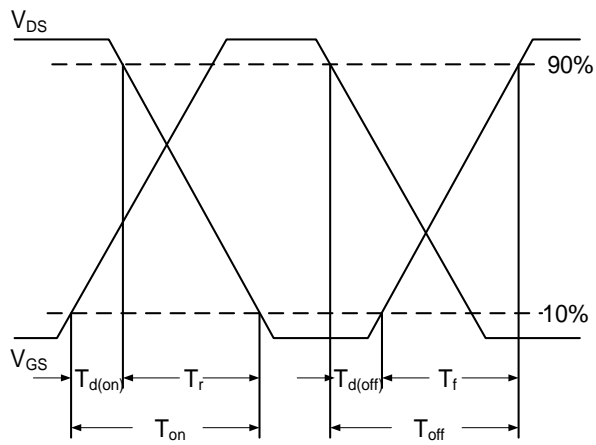


Fig.7 Switching Time Waveform

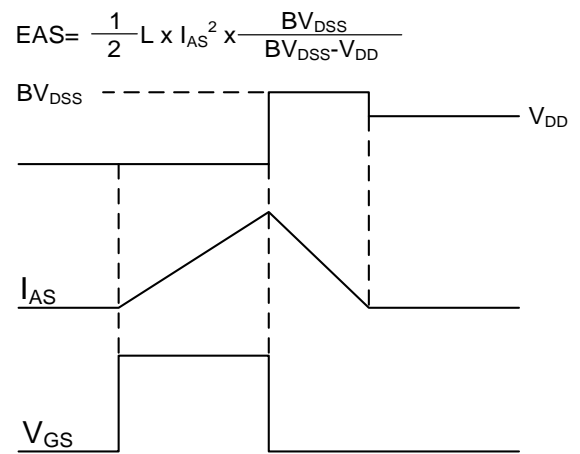
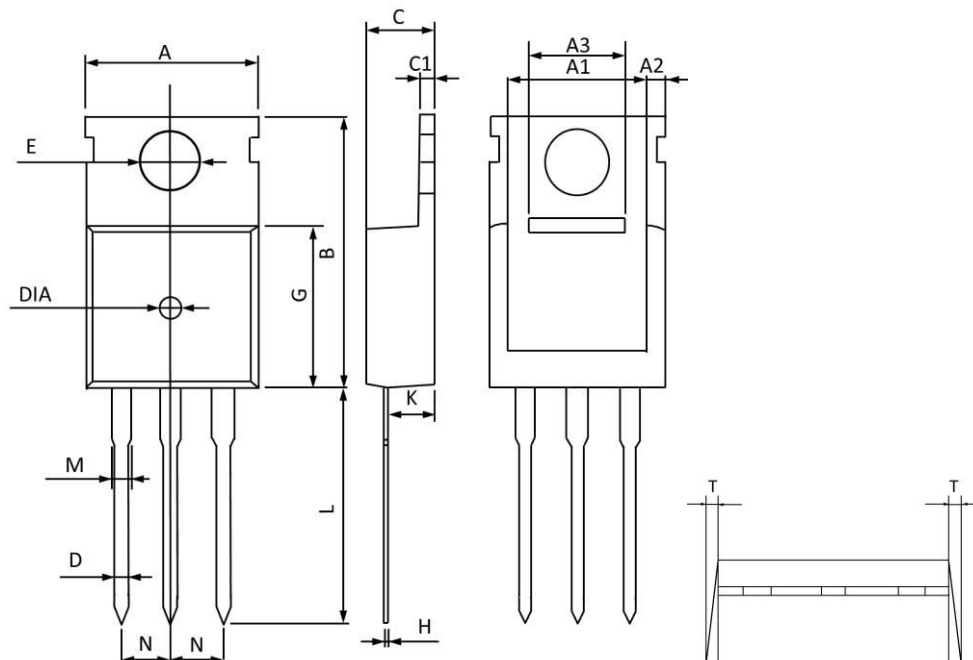


Fig.8 EAS Waveform

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TO-220 PACKAGE INFORMATION



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MAX	MIN	MAX	MIN
A	10.300	9.700	0.406	0.382
A1	8.840	8.440	0.348	0.332
A2	1.250	1.050	0.049	0.041
A3	5.300	5.100	0.209	0.201
B	16.200	15.400	0.638	0.606
C	4.680	4.280	0.184	0.169
C1	1.500	1.100	0.059	0.043
D	1.000	0.600	0.039	0.024
E	3.800	3.400	0.150	0.134
G	9.300	8.700	0.366	0.343
H	0.600	0.400	0.024	0.016
K	2.700	2.100	0.106	0.083
L	13.600	12.800	0.535	0.504
M	1.500	1.100	0.059	0.043
N	2.590	2.490	0.102	0.098
T	W0.35		W0.014	
DIA	Φ1.5 TYP.	deep0.2 TYP.	Φ0.059 TYP.	deep0.008 TYP.