60V N-Channel MOSFETs

PDF6960

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	6mΩ	60A

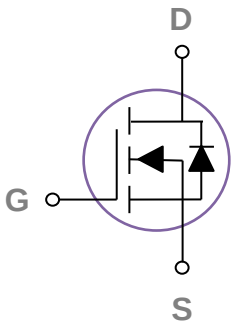
Features

- *60V,60A, RDS(ON)=6mΩ @VGS = 10V*
- *Improved dv/dt capability*
- *Fast switching*
- *100% EAS Guaranteed*
- *Green Device Available*

Ap

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

TO220F Pin Configuration



Absolute Maximum Ratings Tc=25℃ 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℃)	60	A
	Drain Current – Continuous (T_C=100℃)	38	A
I_{DM}	Drain Current – Pulsed[1]	240	A
EAS	Single Pulse Avalanche Energy[2]	181	mJ
IAS	Single Pulse Avalanched Current[2]	60.1	A
P_D	Power Dissipation (T_C=25℃)	40.3	W
	Power Dissipation – Derate above 25℃	0.32	W/℃
T_{STG}	Storage Temperature Range	-55 to 150	℃
T_J	Operating Junction Temperature Range	-55 to 150	℃

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Unit
$R_{\theta JA}$	Thermal Resistance Junction to ambient	---	62	℃/W
$R_{\theta JC}$	Thermal Resistance Junction to Case	---	3.1	℃/W

Electrical Characteristics (T_J=25 ℃, unless otherwise noted)

Off Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS}=0V , I_D=250uA	60	---	---	V
$\triangle BV_{DSS}/\triangle T_J$	BV_{DSS} Temperature Coefficient	Reference to 25℃ , I_D=1mA	---	0.036	---	V/℃
I_{DSS}	Drain-Source Leakage Current	V_{DS}=60V , V_{GS}=0V , T_J=25℃	---	---	1	uA
		V_{DS}=48V , V_{GS}=0V , T_J=125℃	---	---	10	uA
I_{GSS}	Gate-Source Leakage Current	V_{GS}=±20V , V_{DS}=0V	---	---	±100	nA

On Characteristics

$R_{DS(ON)}$	Static Drain-Source On-Resistance[3]	V_{GS}=10V , I_D=20A	---	5.1	6	mΩ
		V_{GS}=4.5V , I_D=10A	---	5.9	7.5	mΩ
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS}=V_{DS} , I_D =250uA	1.2	1.6	2.5	V
$\triangle V_{GS(th)}$	$V_{GS(th)}$ Temperature Coefficient		---	-5.08	---	mV/℃
gfs	Forward Transconductance	V_{DS}=10V , I_D=3A	---	15	---	S

Dynamic and switching Characteristics

Q_g	Total Gate Charge[3,4]	V_{DS}=30V , V_{GS}=4.5V , I_D=10A	---	32.8	65	nC
Q_{gs}	Gate-Source Charge[3,4]		---	10.8	20	
Q_{gd}	Gate-Drain Charge[3,4]		---	11.6	22	
$T_{d(on)}$	Turn-On Delay Time[3,4]	V_{DD}=15V , V_{GS}=10V , R_G=3.3Ω I_D=1A	---	20	40	ns
T_r	Rise Time[3,4]		---	14.2	28	
$T_{d(off)}$	Turn-Off Delay Time[3,4]		---	61.2	122	
T_f	Fall Time[3,4]		---	16.8	34	
C_{iss}	Input Capacitance	V_{DS}=25V , V_{GS}=0V , F=1MHz	---	4740	7110	pF
C_{oss}	Output Capacitance		---	325	488	
C_{rss}	Reverse Transfer Capacitance		---	161	332	
R_g	Gate resistance	V_{GS}=0V, V_{DS}=0V, F=1MHz	---	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	---	---	60	A
I_{SM}	Pulsed Source Current[3]		---	---	120	A
V_{SD}	Diode Forward Voltage[3]	V_{GS}=0V , I_S=1A , T_J=25℃	---	---	1	V

Note :
1. Repetitive Rating : Pulsed width limited by maximum junction temperature.
2. V_{DD}=25V,V_{GS}=10V,L=0.1mH,I_{AS}=60.1A.,R_G=25Ω,Starting T_J=25℃.
3. The data tested by pulsed , pulse width ≦ 300us , duty cycle ≦ 2%.
4. Essentially independent of operating temperature.

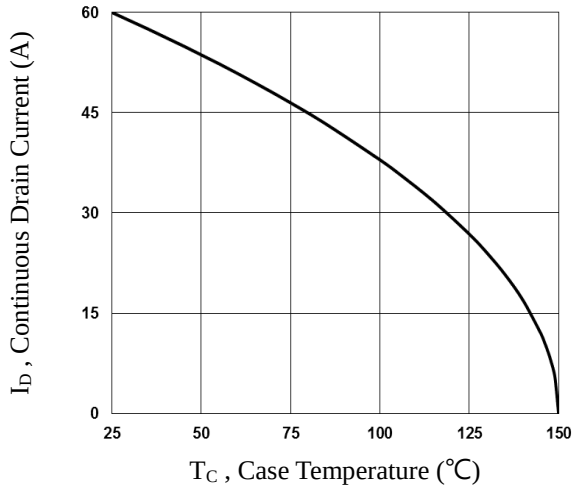


Fig.1 Continuous Drain Current vs. T_C

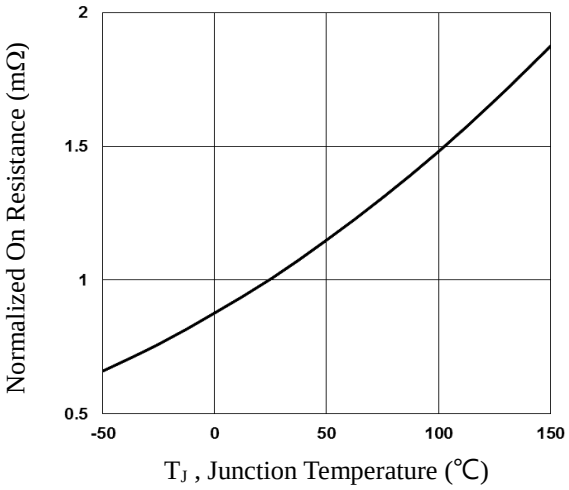


Fig.2 Normalized RDSON vs. T_J

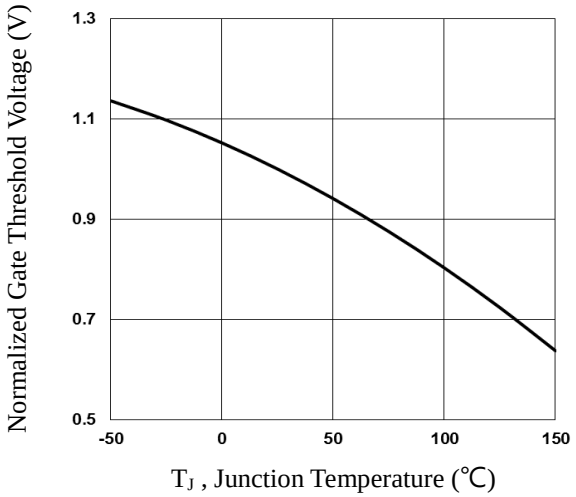


Fig.3 Normalized V_{th} vs. T_J

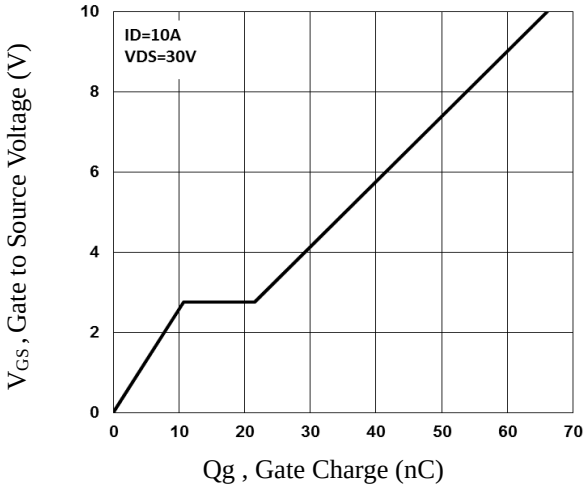


Fig.4 Gate Charge Waveform

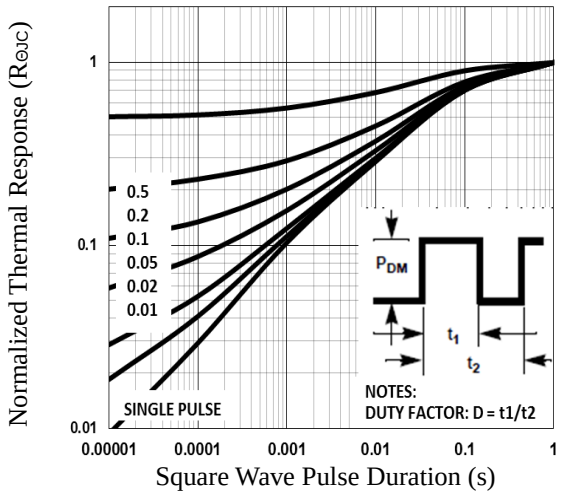


Fig.5 Normalized Transient Response

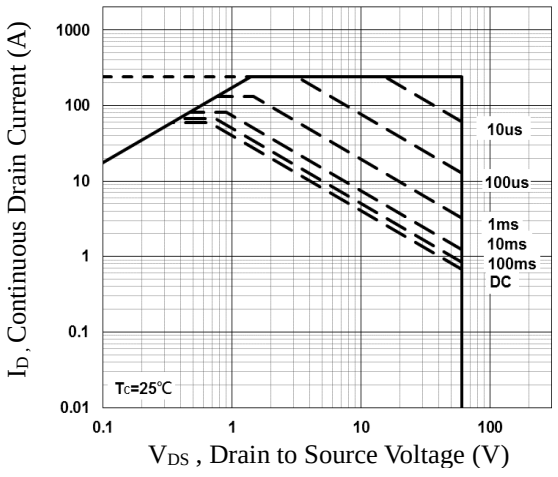


Fig.6 Maximum Safe Operation Area

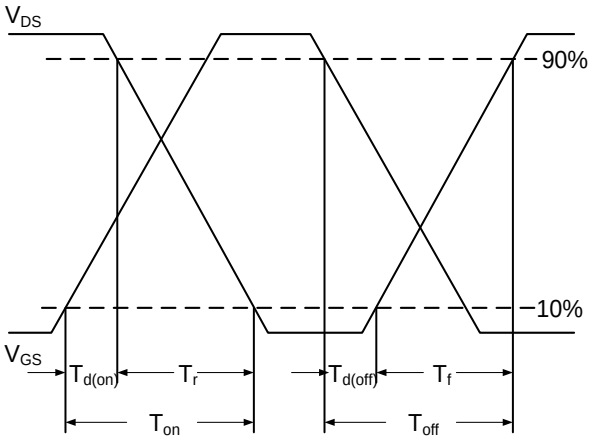


Fig.7 Switching Time Waveform

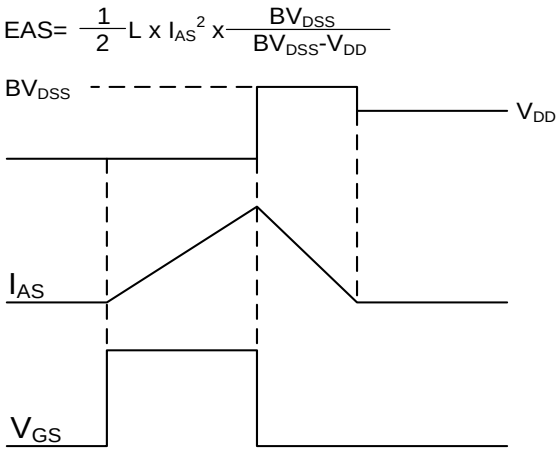
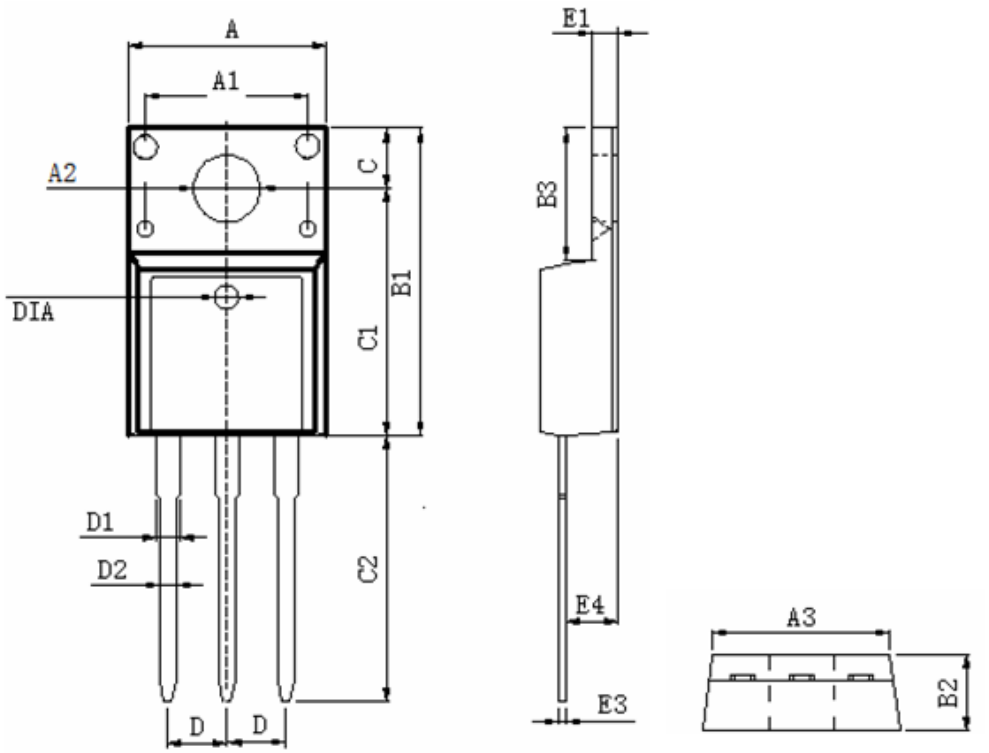


Fig.8 EAS Waveform

TO220F PACKAGE INFORMATION



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MAX	MIN	MAX	MIN
A	10.460	9.860	0.412	0.388
A1	7.100	6.900	0.280	0.272
A2	3.500	3.100	0.138	0.122
A3	9.900	9.500	0.390	0.374
B1	16.170	15.570	0.637	0.613
B2	4.900	4.500	0.193	0.177
B3	6.880	6.480	0.271	0.255
C	3.500	3.100	0.138	0.122
C1	12.870	12.270	0.507	0.483
C2	13.380	12.580	0.527	0.495
D	2.590	2.490	0.102	0.098
D1	1.470	1.070	0.058	0.042
D2	0.900	0.700	0.035	0.028
E1	2.740	2.340	0.108	0.092
E3	0.600	0.400	0.024	0.016
E4	2.960	2.560	0.117	0.101
DIA	Φ1.5 TYP.	deep0.1 TYP.	Φ0.059 TYP.	deep0.004 TYP.