

■ **Features**

- 500V, 13A,  $R_{DS(ON)} = 0.38\Omega @ V_{GS} = 10V$
- Improved dv/dt capability
- Fast switching
- 100% EAS Guaranteed
- Green Device Available

■ **Applications**

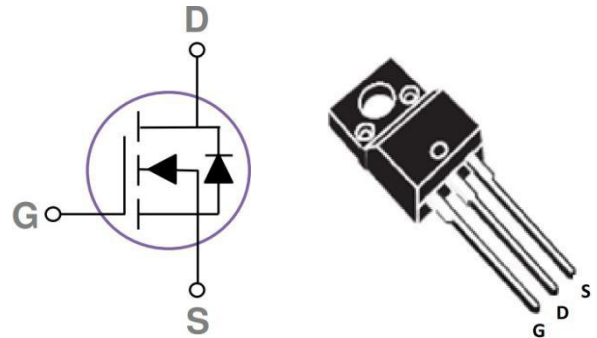
- Networking
- Load Switch
- LED applications
- Quick Charger

■ **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.

■ **Product Summary**



$BV_{DSS}$	$R_{DS(ON)}$	$I_D$
500V	0.38ohm	13A

■ **Absolute Maximum Ratings**  $T_c=25^\circ C$  unless otherwise noted

Parameter	Symbol	Rating	Unit
Drain-Source Voltage	$V_{DS}$	500	V
Gate-Source Voltage	$V_{GS}$	$\pm 30$	V
Continuous Drain Current	$I_D @ T_c=25^\circ C$	13	A
	$I_D @ T_c=100^\circ C$	8.5	A
Pulsed Drain Current	$I_{DM}$	55	A
Single Pulse Avalanche Energy	EAS	900	mJ
Single Pulse Avalanche Current	IAS	20	A
Power Dissipation-	Derate above $25^\circ C$	0.31	W/ $^\circ C$
Power Dissipation	$T_c=25^\circ C$	50	W
Operating Junction Temperature	$T_J$	-55 to 150	$^\circ C$
Storage Temperature	$T_{STG}$	-55 to 150	$^\circ C$

■ **Thermal Resistance**

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal resistance, junction - case	$R_{thJC}$	---	---	2.6	$^\circ C/W$
Thermal Resistance Junction to ambient	$R_{thJA}$	---	---	62	$^\circ C/W$
Soldering temperature, wave soldering for 10s	$T_{sold}$	---	---	265	$^\circ C$

■ **Electronic Characteristics** T<sub>J</sub> =25°C unless otherwise noted

**Off Characteristics**

Parameter	Condition	Symbol	Min.	Typ.	Max.	Unit
Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V, I <sub>D</sub> =250uA	BV <sub>DSS</sub>	500	550	---	V
Drain-Source Leakage Current	V <sub>DS</sub> =500V, V <sub>GS</sub> =0V	I <sub>DSS</sub>	---	---	1	uA
	V <sub>DS</sub> =400V, V <sub>GS</sub> =0V		---	---	10	
Gate- Source Leakage Current	V <sub>GS</sub> =±30V, V <sub>DS</sub> =0V	I <sub>GSS</sub>	---	---	±100	nA

**On Characteristics**

Parameter	Condition	Symbol	Min.	Typ.	Max.	Unit
Static Drain-source On Resistance	V <sub>GS</sub> =10V, I <sub>D</sub> =6.5A	R <sub>DS(ON)</sub>	---	0.34	0.38	Ω
Gate Threshold Voltage	V <sub>GS</sub> =V <sub>DS</sub> , I <sub>D</sub> =250uA	V <sub>GS(TH)</sub>	2.0	3.0	4.0	V
Forward Transconductance	V <sub>DS</sub> =15V, I <sub>D</sub> =6.5A	g <sub>FS</sub>	---	13	---	S

**Dynamic and switching Characteristics**

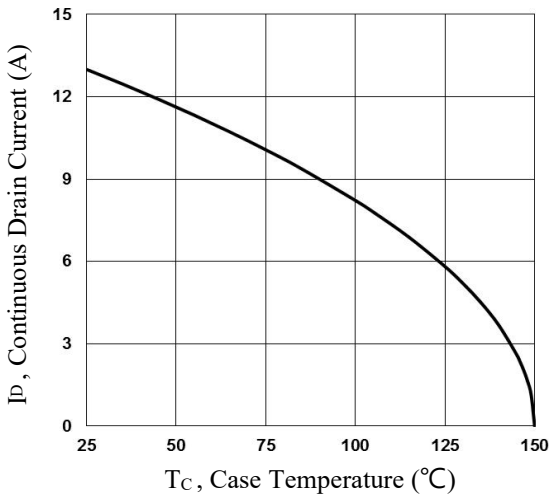
Parameter	Condition	Symbol	Min.	Typ.	Max.	Unit
Total Gate Charge	V <sub>DS</sub> =400V	Q <sub>g</sub>	---	35	---	nC
Gate-Source Charge	V <sub>GS</sub> =10V	Q <sub>gs</sub>	---	8.6	---	
Gate-Drain Charge	I <sub>D</sub> =10A	Q <sub>gd</sub>	---	15	---	
Turn-On Delay Time	V <sub>DD</sub> =300V	T <sub>d(on)</sub>	---	30	---	ns
Rise Time	V <sub>GS</sub> =10V	T <sub>r</sub>	---	21	---	
Turn-Off Delay Time	R <sub>G</sub> =25Ω	T <sub>d(off)</sub>	---	70	---	
Fall Time	I <sub>D</sub> =10A	T <sub>f</sub>	---	40	---	
Input capacitance	V <sub>DS</sub> =25V	C <sub>iss</sub>	---	1800	---	pF
Output capacitance	V <sub>GS</sub> =0V	C <sub>oss</sub>	---	160	---	
Reverse transfer capacitance	F=1MHz	C <sub>rss</sub>	---	10	---	
Gate resistance	V <sub>DS</sub> =0V, V <sub>GS</sub> =0V, F=1MHz	R <sub>g</sub>	---	1.2	2.4	Ω

**Drain-Source Diode Characteristics and Maximum Ratings**

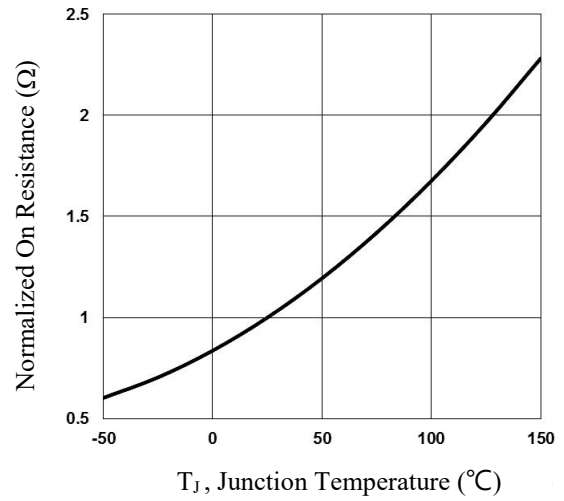
Parameter	Condition	Symbol	Min.	Typ.	Max.	Unit
Diode Forward Voltage	V <sub>GS</sub> =0V, I <sub>S</sub> =10A	V <sub>SD</sub>	---	0.72	1.4	V
Reverse Recovery Time	I <sub>F</sub> =10A, di/dt=40A/μs,	t <sub>rr</sub>	---	502	---	nS
Reverse Recovery Charge	V <sub>DS</sub> =100V	Q <sub>rr</sub>	---	4800	---	nC

Note:

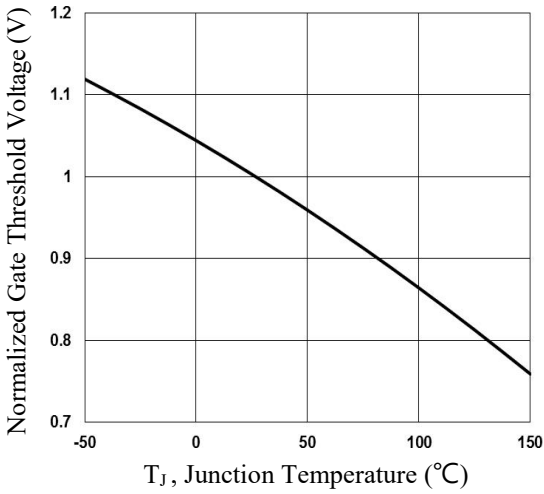
1. Repetitive Rating: Pulsed width limited by maximum junction temperature.
2. V<sub>DD</sub>=500V, V<sub>GS</sub>=10V, L=10mH, I<sub>AS</sub>=10A., R<sub>G</sub>=25Ω, Starting T<sub>J</sub>=25°C.
3. The data tested by pulsed, pulse width ≦ 300us, duty cycle ≦ 2%.
4. Essentially independent of operating temperature.



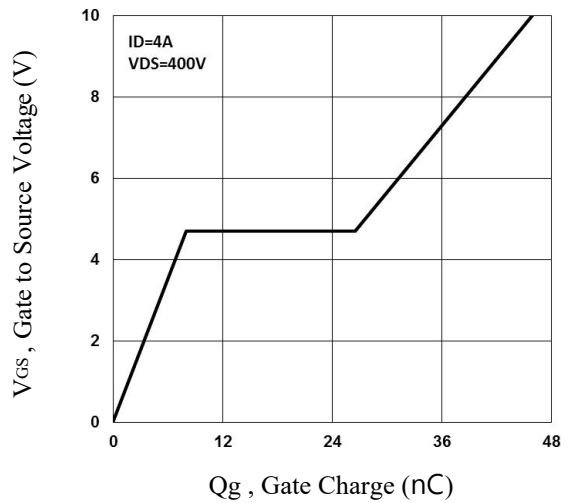
**Fig.1 Continuous Drain Current vs.  $T_c$**



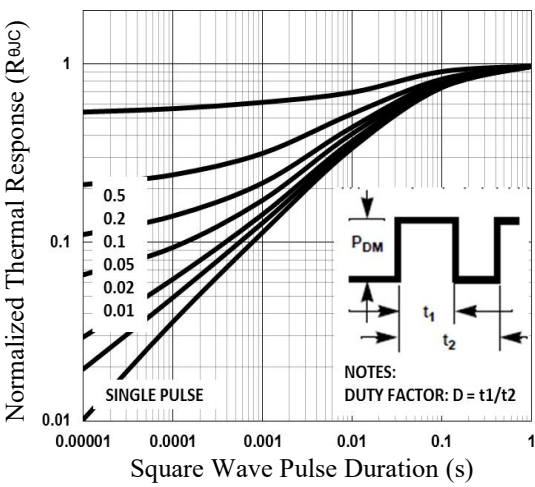
**Fig.2 Normalized  $R_{DS(on)}$  vs.  $T_j$**



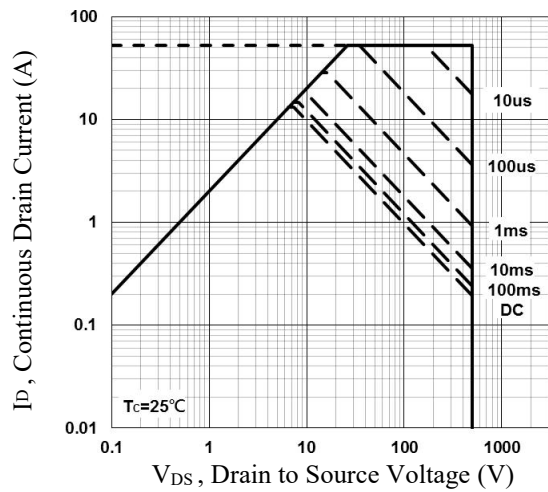
**Fig.3 Normalized  $V_{th}$  vs.  $T_j$**



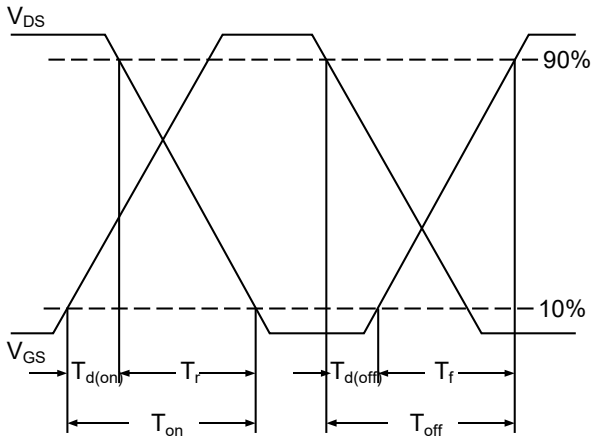
**Fig.4 Gate Charge Waveform**



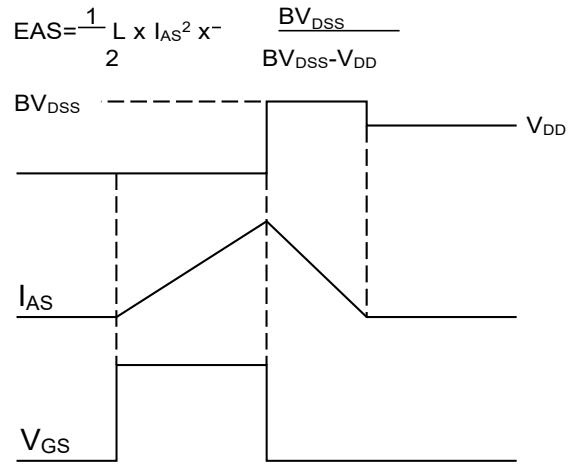
**Fig.5 Normalized Transient Impedance**



**Fig.6 Maximum Safe Operation Area**

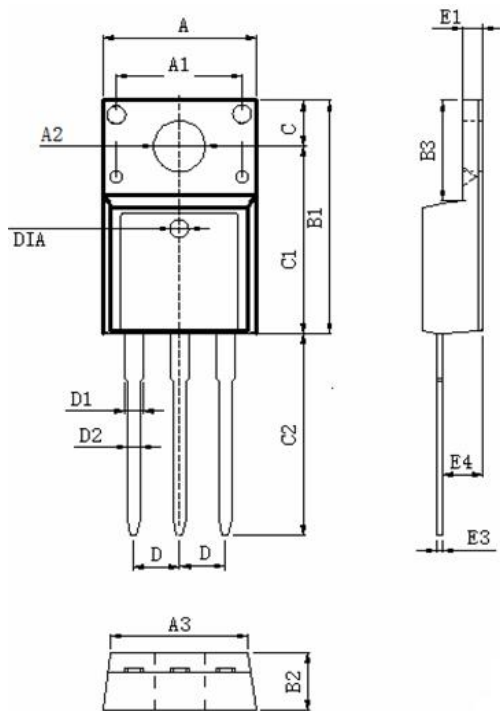


**Fig.7 Switching Time Waveform**



**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.