N-Channel Trench Power MOSFET

General Description

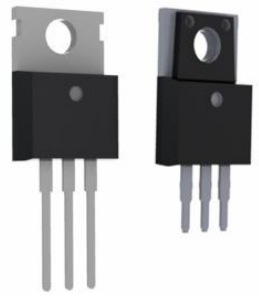
The 48N88 is N-channel MOS Field Effect Transistor designed for high current switching applications. Rugged E_{AS} capability and ultra low $R_{DS(ON)}$ is suitable for PWM, load switching especially for E-Bike controller applications.

Features

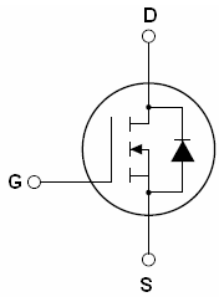
- V_{DS}=70V； I_D=92A@ V_{GS}=10V；
  $R_{DS(ON)}$<6.6mΩ @ V_{GS}=10V
- Special Designed for E-Bike Controller Application
- Ultra Low On-Resistance
- High UIS and UIS 100% Test

Application

- 48V E-Bike Controller Applications
- Hard Switched and High Frequency Circuits
- Uninterruptible Power Supply



To-220 TO-220N
Top View



Schematic Diagram

V_{DS} = 70V

I_D = 92A

$R_{DS(ON)}$ = 5.5mΩ

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
CS48N88	CS48N88	TO-220	-	-	-
CSN48N88	CSN48N88	TO-220N	-	-	-

Table 1. Absolute Maximum Ratings (TA=25℃)

Symbol	Parameter	Value	Unit
V_{DS}	Drain-Source Voltage (V_{GS}=0V）	70	V
V_{GS}	Gate-Source Voltage (V_{DS}=0V)	±25	V
$I_{D\ (DC)}$	Drain Current (DC) at Tc=25℃	92	A
$I_{D\ (DC)}$	Drain Current (DC) at Tc=100℃	65	A
$I_{DM\ (pluse)}$	Drain Current-Continuous@ Current-Pulsed **(Note 1)**	368	A
dv/dt	Peak Diode Recovery Voltage	8.8	V/ns
P_D	Maximum Power Dissipation(Tc=25℃)	120	W
	Derating Factor	0.8	W/℃
E_{AS}	Single Pulse Avalanche Energy **(Note 2)**	506	mJ
T_J,T_{STG}	Operating Junction and Storage Temperature Range	-55 To 175	℃

Notes 1.Repetitive Rating: Pulse width limited by maximum junction temperature

2.E_{AS} condition:T_J=25℃,V_{DD}=33V,V_G=10V

Table 2. Thermal Characteristic

Symbol	Parameter	Value	Max	Unit
$R_{\theta JC}$	Thermal Resistance,Junction-to-Case	---	1.25	℃/W

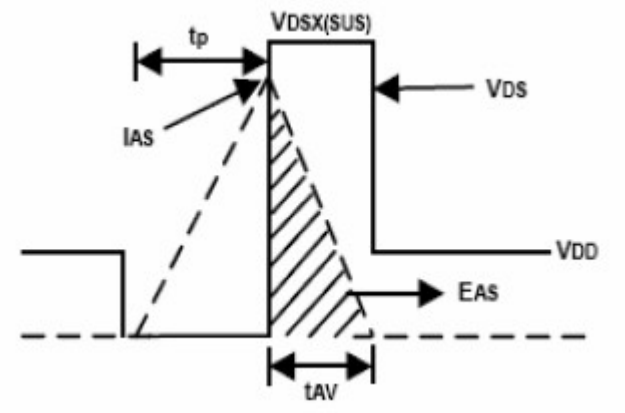
Table 3. Electrical Characteristics (TA=25℃unless otherwise noted)

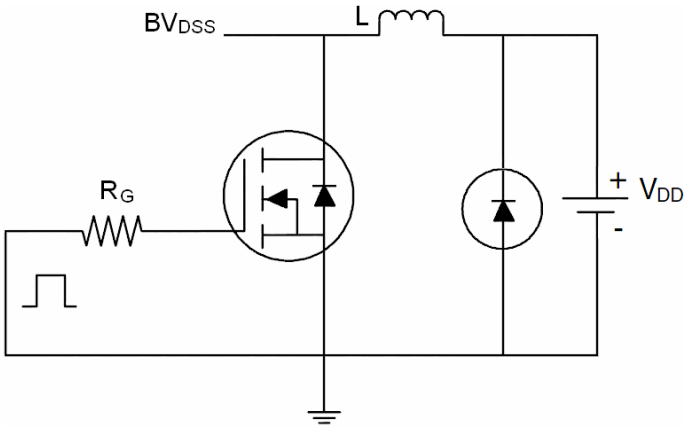
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
On/Off States						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS}=0V I_D=250μA	70			V
I_{DSS}	Zero Gate Voltage Drain Current(Tc=25℃)	V_{DS}=68V,V_{GS}=0V			1	μA
I_{DSS}	Zero Gate Voltage Drain Current(Tc=125℃)	V_{DS}=68V,V_{GS}=0V			10	μA
I_{GSS}	Gate-Body Leakage Current	V_{GS}=±25V,V_{DS}=0V			±100	nA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS},I_D=250μA	2		4	V
$R_{DS(ON)}$	Drain-Source On-State Resistance	V_{GS}=10V, I_D=40A		5.5	6.6	mΩ
Dynamic Characteristics						
g_{FS}	Forward Transconductance	V_{DS}=10V,I_D=15A	20			S
C_{iss}	Input Capacitance	V_{DS}=25V,V_{GS}=0V, f=1.0MHz		4060		pF
C_{oss}	Output Capacitance			385		pF
C_{rss}	Reverse Transfer Capacitance			292		pF
Q_g	Total Gate Charge	V_{DS}=50V,I_D=40A, V_{GS}=10V		102		nC
Q_{gs}	Gate-Source Charge			20		nC
Q_{gd}	Gate-Drain Charge			49		nC
Switching Times						
$t_{d(on)}$	Turn-on Delay Time	V_{DD}=30V,I_D=2A,R_L=15Ω V_{GS}=10V,R_G=2.5Ω		24		nS
t_r	Turn-on Rise Time			32		nS
$t_{d(off)}$	Turn-Off Delay Time			69		nS
t_f	Turn-Off Fall Time			31		nS
Source-Drain Diode Characteristics						
I_{SD}	Source-Drain Current(Body Diode)			92		A
I_{SDM}	Pulsed Source-Drain Current(Body Diode)			368		A
V_{SD}	Forward On Voltage**(Note 1)**	T_J=25℃,I_{SD}=40A,V_{GS}=0V		0.87	0.99	V
t_{rr}	Reverse Recovery Time**(Note 1)**	T_J=25℃,I_F=75A di/dt=100A/μs		28		nS
Q_{rr}	Reverse Recovery Charge**(Note 1)**			39		nC
t_{on}	Forward Turn-on Time	Intrinsic turn-on time is negligible(turn-on is dominated by L_S+L_D)				

Notes 1.Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 1.5%, R_G=25Ω, Starting T_J=25℃

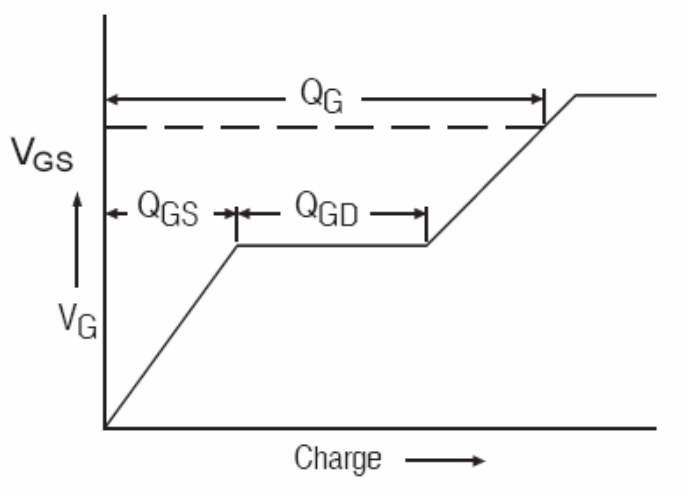
Test Circuit

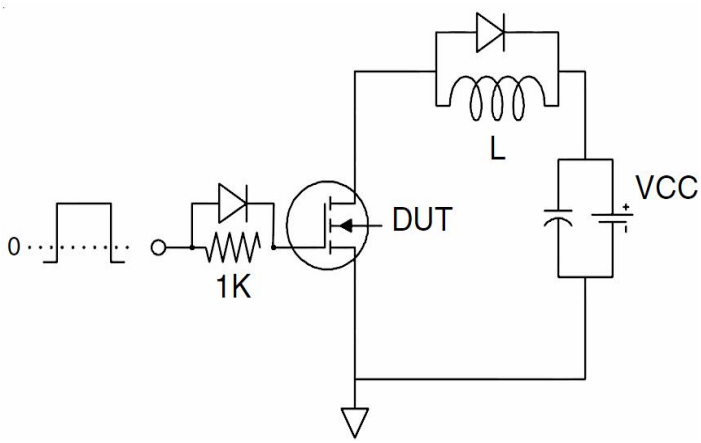
1）E_{AS} Test Circuits



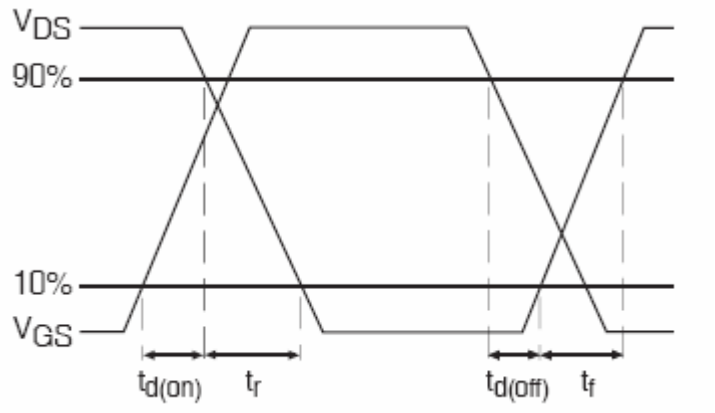


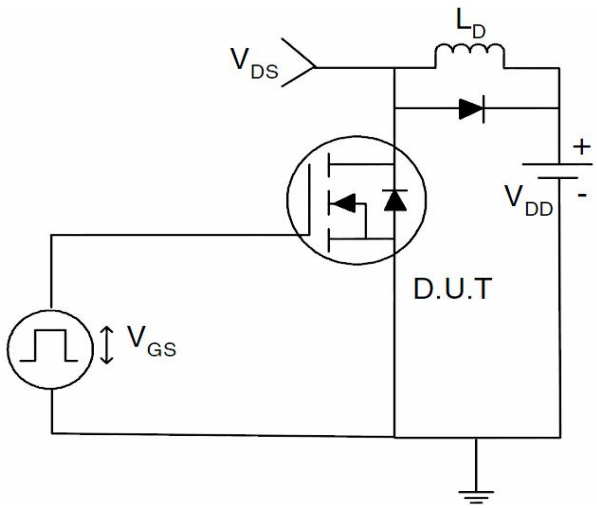
2）Gate Charge Test Circuit:





3）Switch Time Test Circuit：





TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (Curves)

Figure1. Output Characteristics

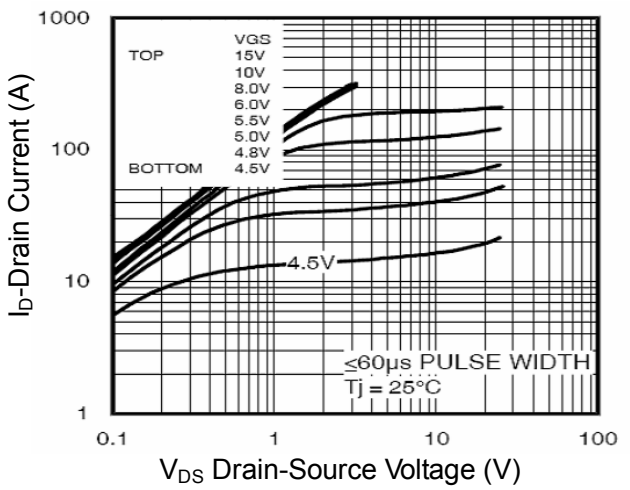


Figure2. Transfer Characteristics

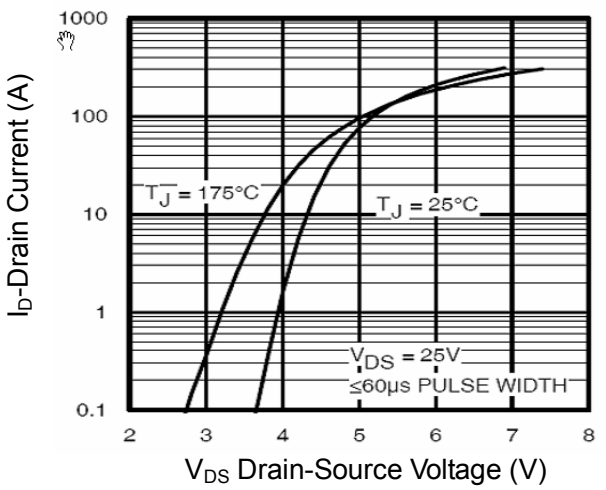


Figure3. BVDSS vs Junction Temperature

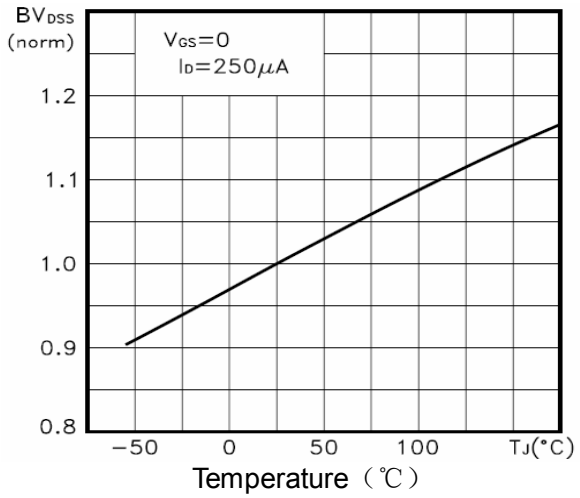


Figure4. ID vs Junction Temperature

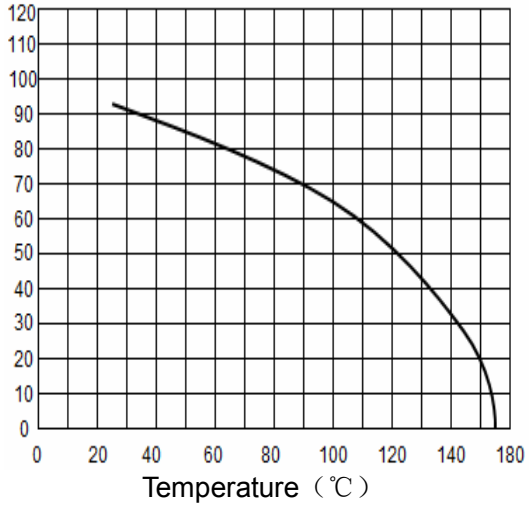


Figure5. VGS(th) vs Junction Temperature

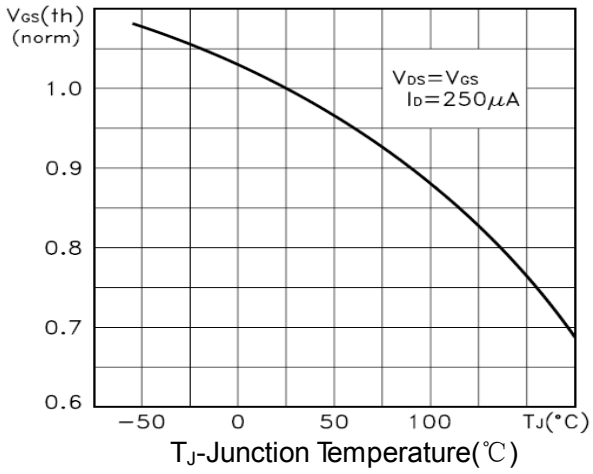


Figure6. Rdson Vs Junction Temperature

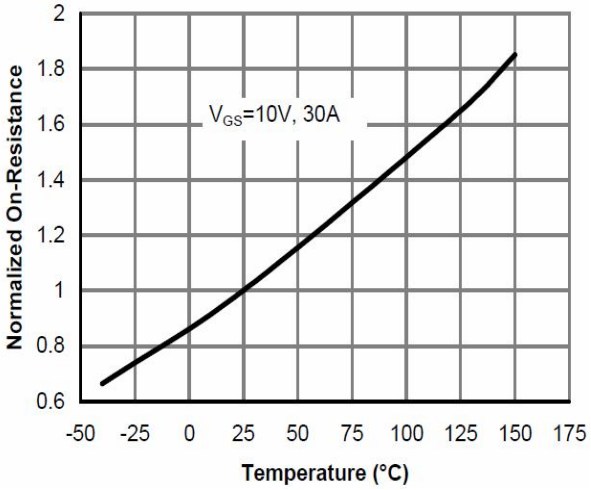


Figure7. Gate Charge

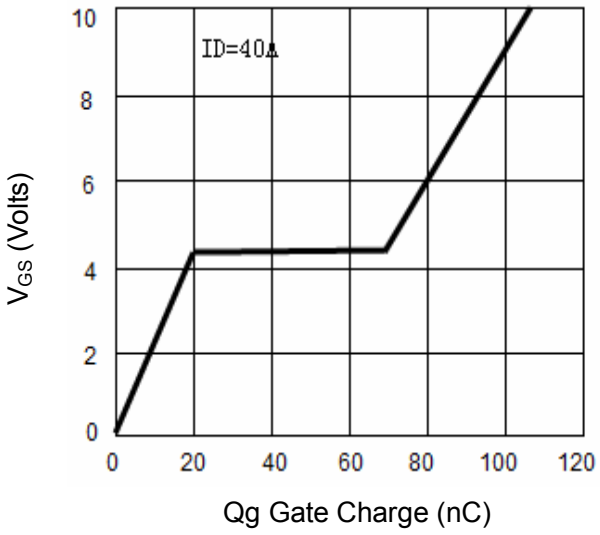


Figure8. Capacitance vs Vds

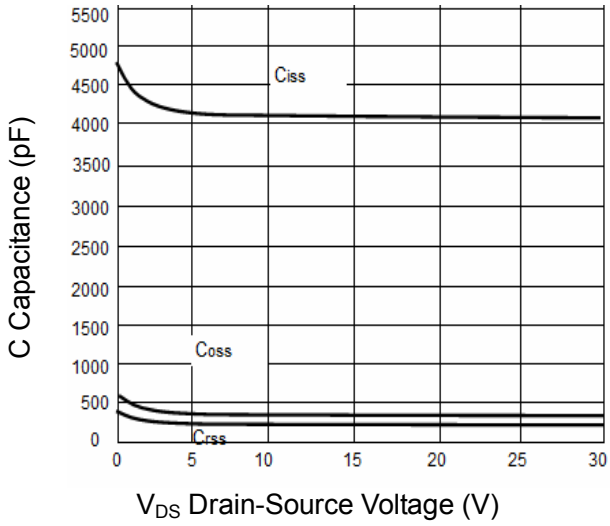


Figure9. Source- Drain Diode Forward

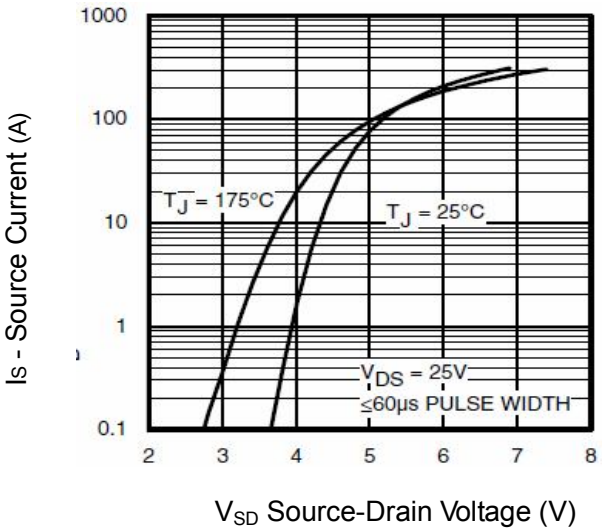


Figure10. Safe Operation Area

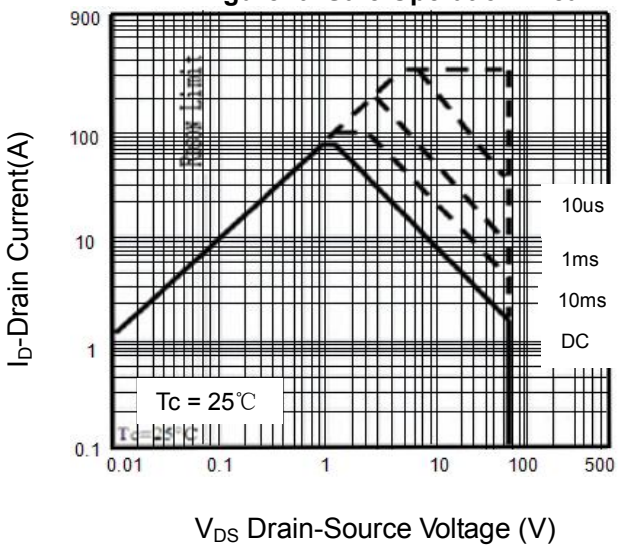
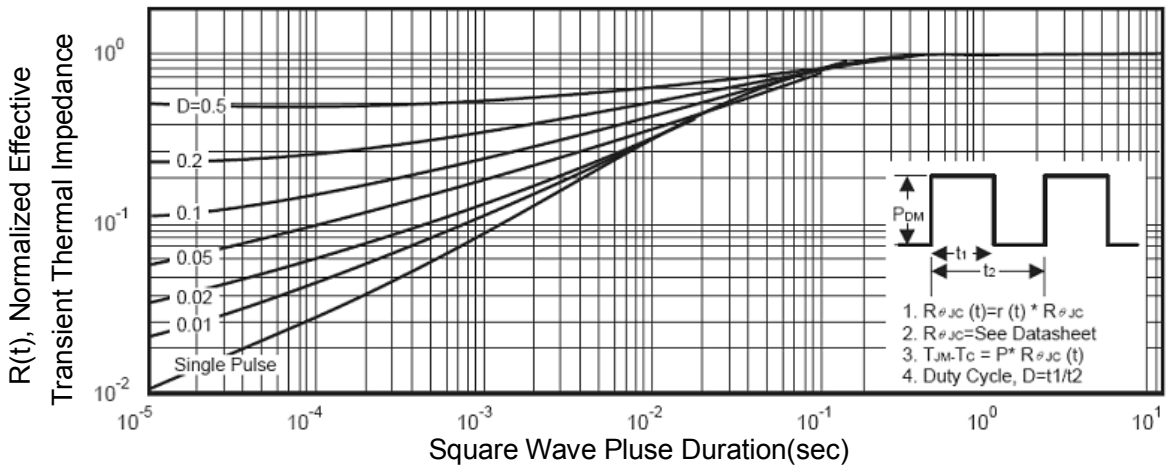
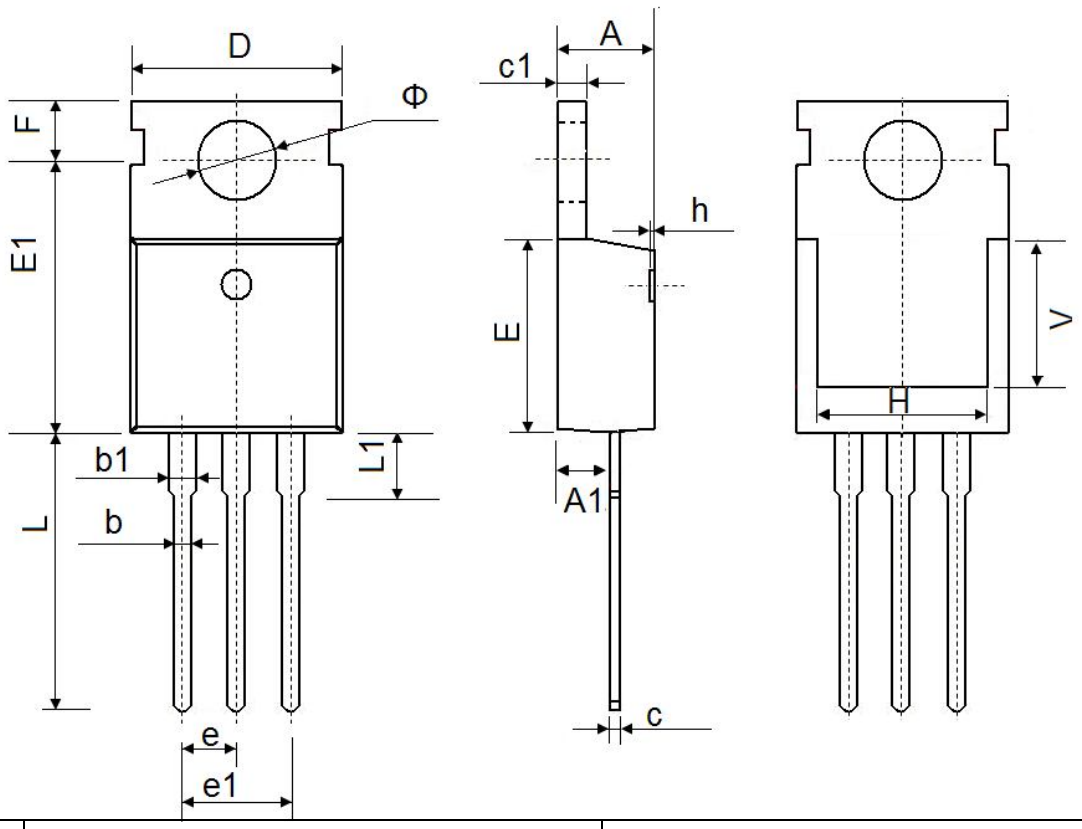


Figure11. Normalized Maximum Transient Thermal Impedance



TO-220 Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max
A	4.300	4.700	0.169	0.185
A1	2.200	2.600	0.087	0.102
b	0.700	0.950	0.028	0.037
b1	1.170	1.410	0.046	0.056
c	0.450	0.650	0.018	0.026
c1	1.200	1.400	0.047	0.055
D	9.600	10.400	0.378	0.409
E	8.8500	9.750	0.348	0.384
E1	12.650	12.950	0.498	0.510
e	2.540 TYP.		0.100TYP.	
e1	4.980	5.180	0.196	0.204
F	2.650	2.950	0.104	0.116
H	7.900	8.100	0.311	0.319
h	0.000	0.300	0.000	0.012
L	12.750	14.300	0.502	0.563
L1	2.850	3.950	0.112	0.156
V	7.500 REF.		0.295 REF.	
Φ	3.400	4.000	0.134	0.157