N-Channel Trench Power MOSFET

General Description

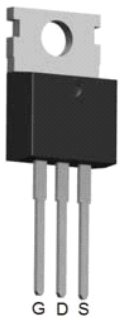
The HM70N78 is N-channel MOS Field Effect Transistor designed for high current switching applications. Rugged E_{AS} capability and ultra low $R_{DS(ON)}$ is suitable for PWM, load switching especially for E-Bike controller applications.

Features

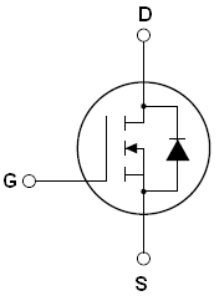
- V_{DS}=70V； I_D=78A@ V_{GS}=10V；
  $R_{DS(ON)}$<6.2mΩ @ V_{GS}=10V
- Special Designed for E-Bike Controller Application
- Ultra Low On-Resistance
- High UIS and UIS 100% Test

Application

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



To-220 Top View



Schematic Diagram

V_{DSS} = 70 V

I_{DSS} = 78 A

$R_{DS(ON)}$ = 5.8 mΩ

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
HM70N78	HM70N78	TO-220	-	-	-

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℃	78	A
$I_{D\ (DC)}$	Drain Current (DC) at Tc=100℃	75	A
$I_{DM\ (pluse)}$	Drain Current-Continuous@ Current-Pulsed **(Note 1)**	310	A
dv/dt	Peak Diode Recovery Voltage	30	V/ns
P_D	Maximum Power Dissipation(Tc=25℃)	130	W
	Derating Factor	1.9	W/℃
E_{AS}	Single Pulse Avalanche Energy **(Note 2)**	360	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,I_D=48.5A

Table 2. Thermal Characteristic

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance,Junction-to-Case	0.6	℃/W

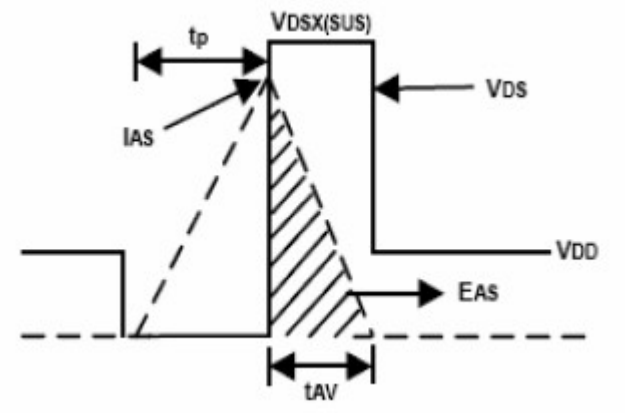
Table 3. Electrical Characteristics (TA=25℃unless otherwise noted)

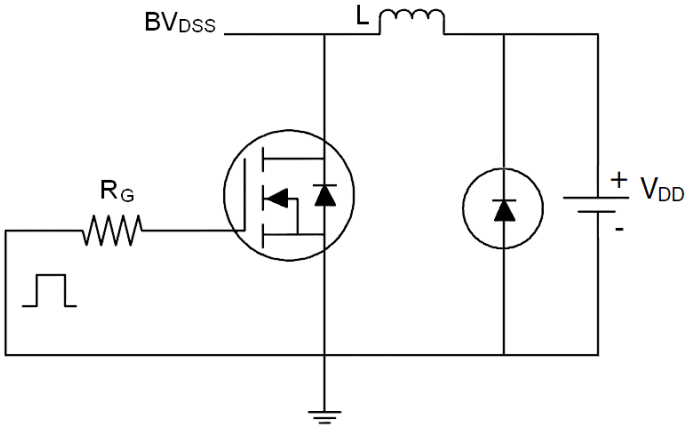
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
On/Off States						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS}=0V I_D=250μA		70		V
I_{DSS}	Zero Gate Voltage Drain Current(Tc=25℃)	V_{DS}=68V,V_{GS}=0V			1	μA
I_{DSS}	Zero Gate Voltage Drain Current(Tc=125℃)	V_{DS}=68V,V_{GS}=0V			1	μA
I_{GSS}	Gate-Body 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		5.8	6.2	mΩ
Dynamic Characteristics						
g_{FS}	Forward Transconductance	V_{DS}=10V,I_D=40A		28		S
C_{iss}	Input Capacitance	V_{DS}=25V,V_{GS}=0V, f=1.0MHz		3311		pF
C_{oss}	Output Capacitance			846		pF
C_{rss}	Reverse Transfer Capacitance			451		pF
Q_g	Total Gate Charge	V_{DS}=30V,I_D=30A, V_{GS}=10V		67		nC
Q_{gs}	Gate-Source Charge			13		nC
Q_{gd}	Gate-Drain Charge			18		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		11		nS
t_r	Turn-on Rise Time			13		nS
$t_{d(off)}$	Turn-Off Delay Time			22		nS
t_f	Turn-Off Fall Time			27		nS
Source-Drain Diode Characteristics						
I_{SD}	Source-Drain Current(Body Diode)			80		A
I_{SDM}	Pulsed Source-Drain Current(Body Diode)			320		A
V_{SD}	Forward On Voltage**(Note 1)**	T_J=25℃,I_{SD}=40A,V_{GS}=0V		0.8	0.95	V
t_{rr}	Reverse Recovery Time**(Note 1)**	T_J=25℃,I_F=75A di/dt=100A/μs		40		nS
Q_{rr}	Reverse Recovery Charge**(Note 1)**			81		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℃

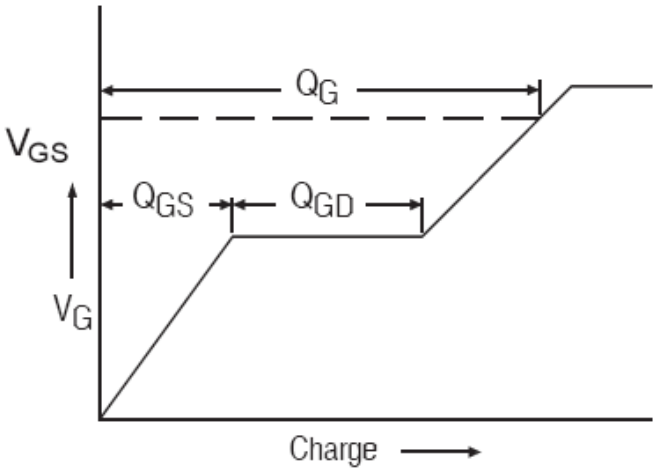
Test Circuit

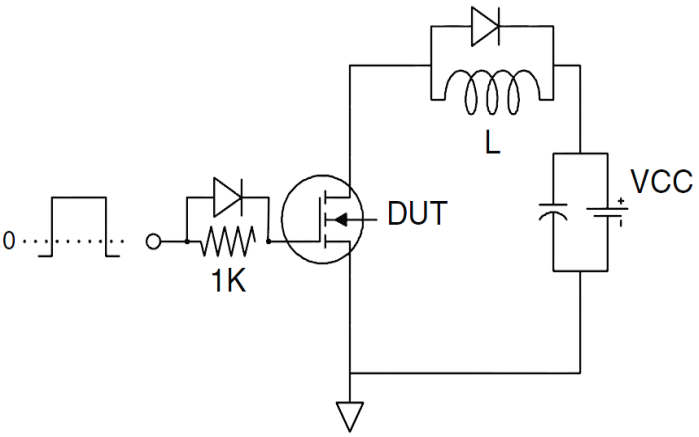
1）E_{AS} Test Circuits



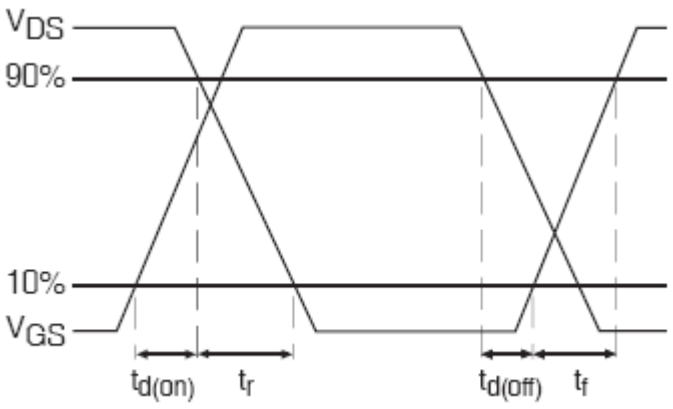


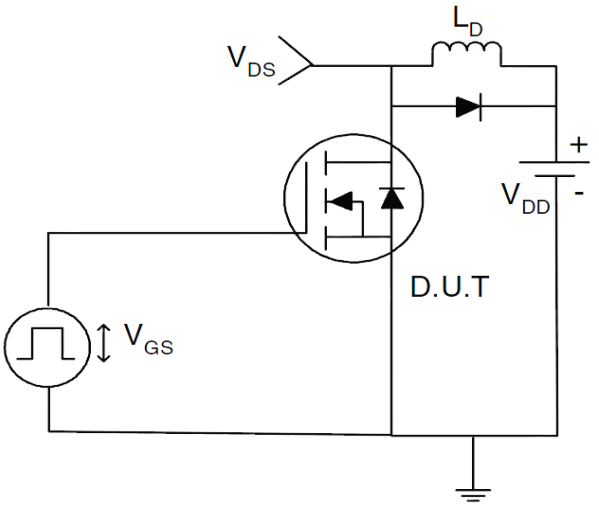
2）Gate Charge Test Circuit:





3）Switch Time Test Circuit:





TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (Curves)

Figure1. Safe Operating Area

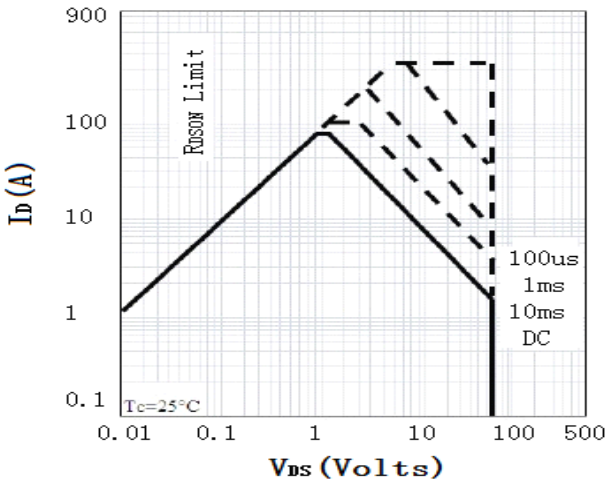


Figure2. Source-Drain Diode Forward Voltage

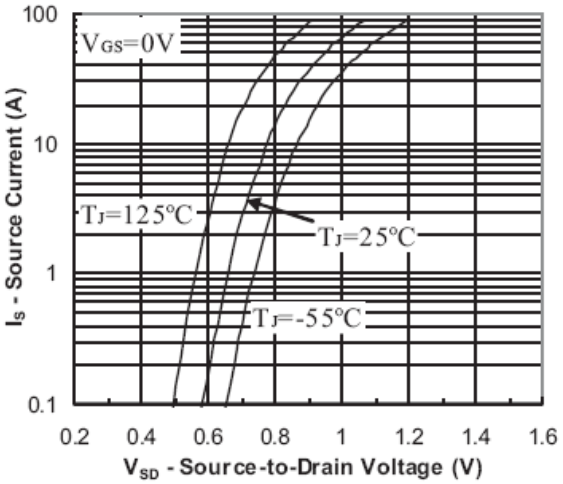


Figure3. Output Characteristics

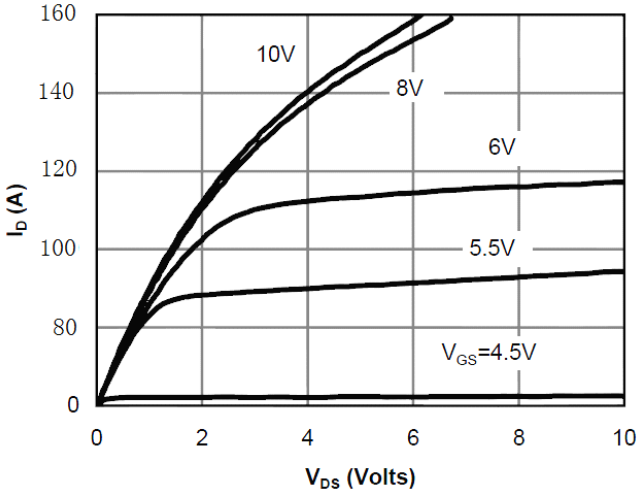


Figure4. Transfer Characteristics

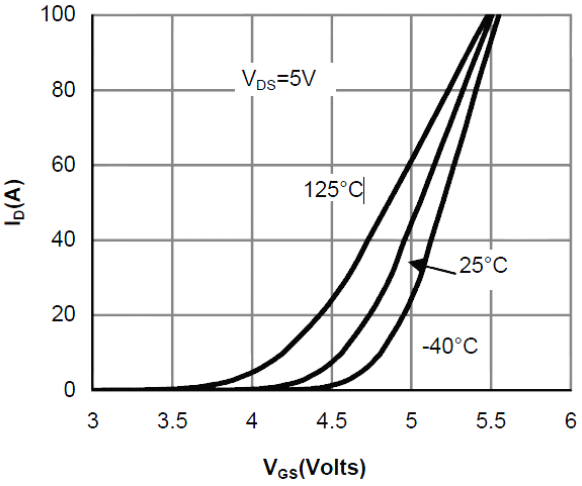


Figure5. Static Drain-Source On Resistance

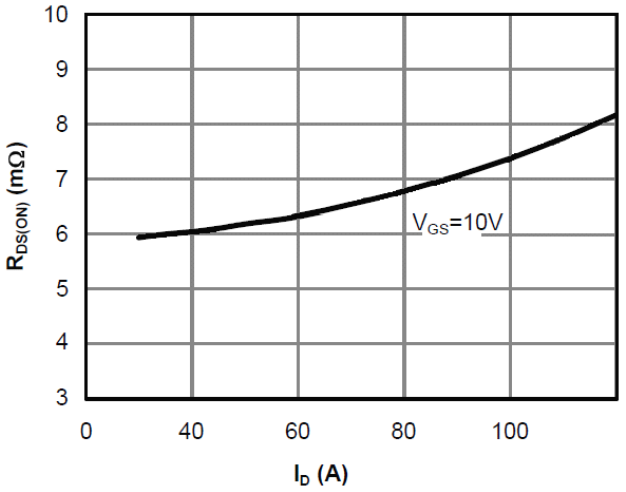


Figure6. $R_{DS(ON)}$ vs Junction Temperature

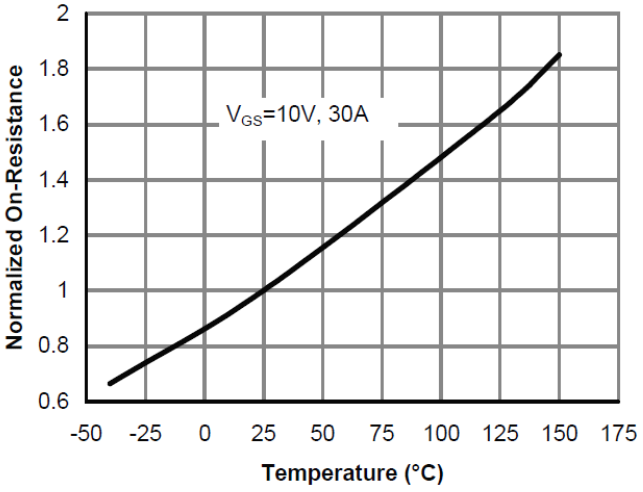
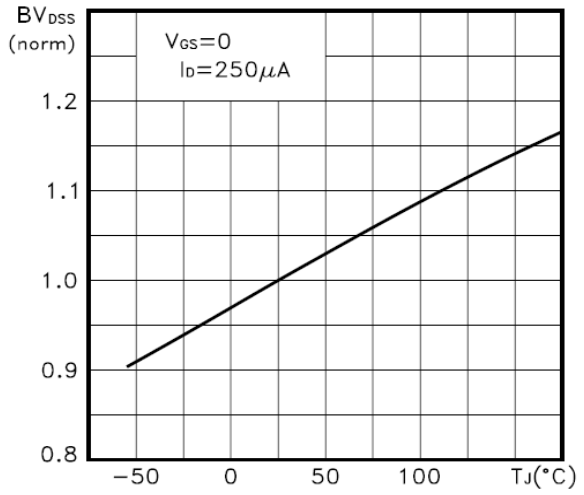
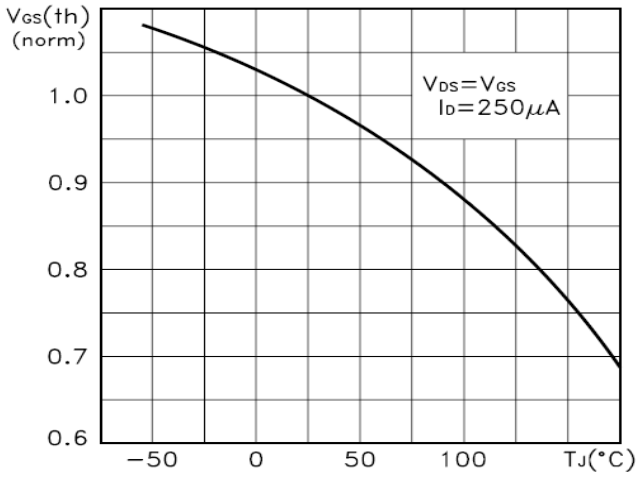


Figure7. BV_{DSS} vs Junction Temperature



Temperature（℃）

Figure8. $V_{GS(th)}$ vs Junction Temperature



Temperature（℃）

Figure9. Gate Charge Waveforms

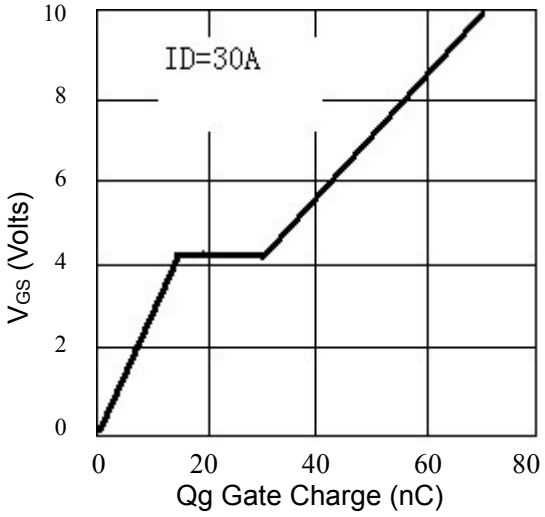


Figure10. Capacitance

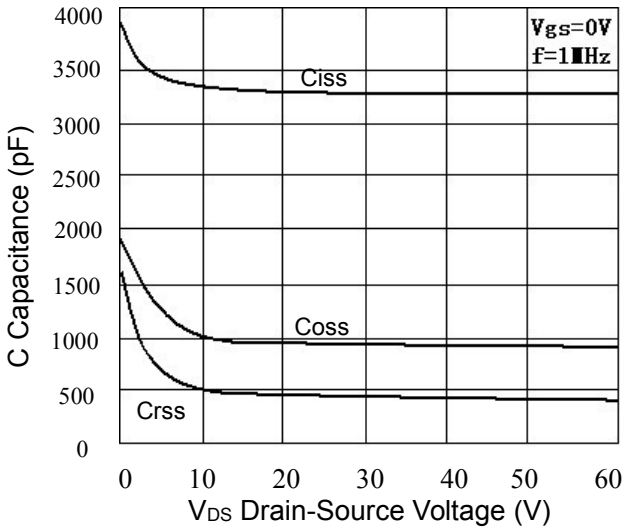
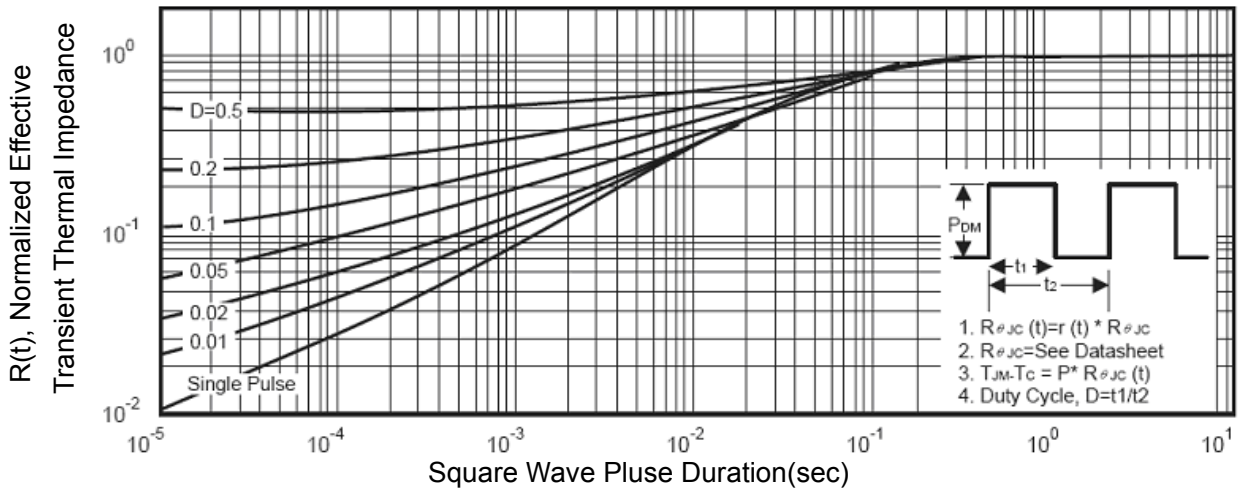
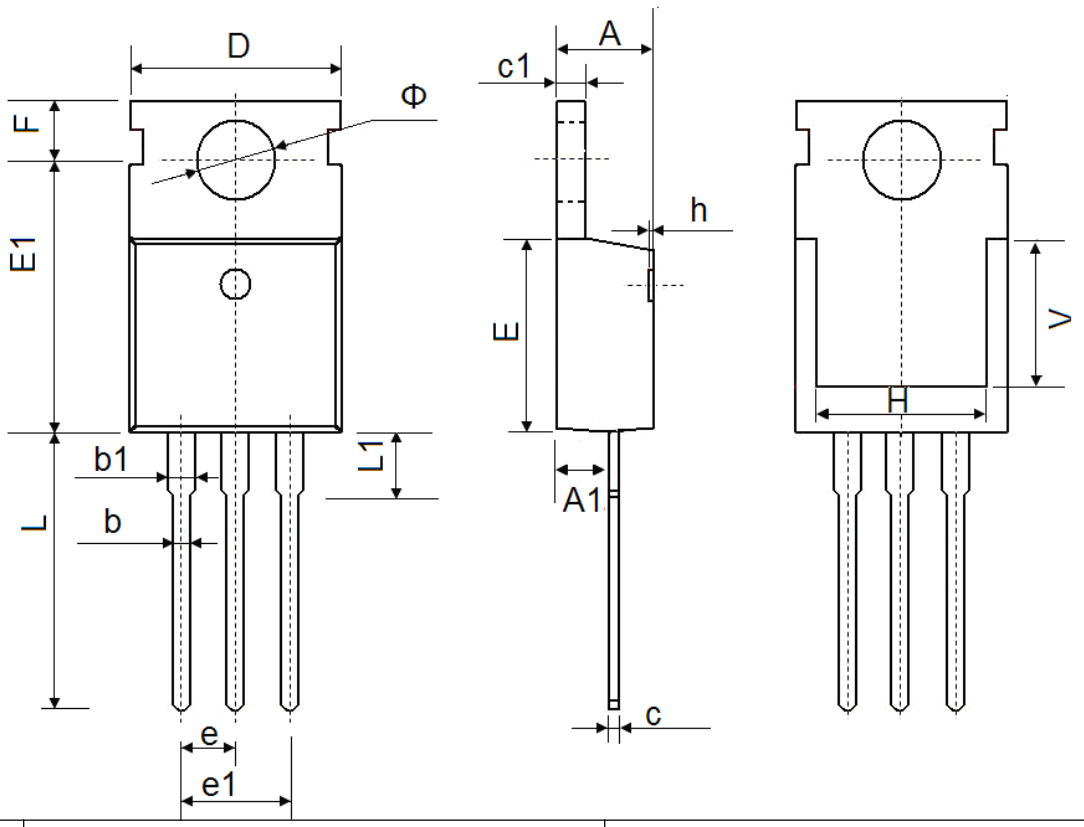


Figure11. Normalized Maximum Transient Thermal Impedance



TO-220 Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max
A	4.400	4.600	0.173	0.181
A1	2.250	2.550	0.089	0.100
b	0.710	0.910	0.028	0.036
b1	1.170	1.370	0.046	0.054
c	0.330	0.650	0.013	0.026
c1	1.200	1.400	0.047	0.055
D	9.910	10.250	0.390	0.404
E	8.9500	9.750	0.352	0.384
E1	12.650	12.950	0.498	0.510
e	2.540 TYP.		0.100 TYP.	
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	12.900	13.400	0.508	0.528
L1	2.850	3.250	0.112	0.128
V	7.500 REF.		0.295 REF.	
Φ	3.400	3.800	0.134	0.150