

## N-Channel Trench Power MOSFET

### General Description

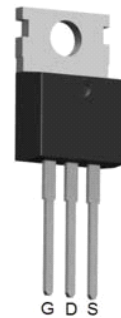
The HM70N75 is N-channel MOS Field Effect Transistor designed for high current switching applications. Rugged EAS capability and ultra low  $R_{DS(ON)}$  is suitable for PWM, load switching especially for E-Bike controller applications.

### Features

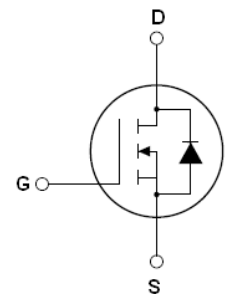
- $V_{DS}=70V$ ;  $I_D=75A@V_{GS}=10V$ ;  
 $R_{DS(ON)}<7.2m\Omega @V_{GS}=10V$
- Special Designed for E-Bike Controller Application
- Ultra Low On-Resistance
- High UIS and UIS 100% Test

### Application

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



To-220 Top View



Schematic Diagram

$$V_{DSS} = 70 V$$

$$I_{DSS} = 75 A$$

$$R_{DS(ON)} = 6.9 m\Omega$$

### Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
HM70N75	HM70N75	TO-220	-	-	-

Table 1. Absolute Maximum Ratings (TA=25°C)

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 $T_c=25^\circ C$	75	A
$I_{D(DC)}$	Drain Current (DC) at $T_c=100^\circ C$	72	A
$I_{DM(pluse)}$	Drain Current-Continuous@ Current-Pulsed (Note 1)	300	A
dv/dt	Peak Diode Recovery Voltage	30	V/ns
$P_D$	Maximum Power Dissipation( $T_c=25^\circ C$ )	110	W
	Derating Factor	1.9	W/°C
EAS	Single Pulse Avalanche Energy (Note 2)	360	mJ
$T_J, T_{STG}$	Operating Junction and Storage Temperature Range	-55 To 175	°C

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

2. EAS condition:  $T_J=25^\circ C, V_{DD}=33V, V_G=10V, I_b=48.5A$

**Table 2. Thermal Characteristic**

Symbol	Parameter	Value	Unit
R <sub>θJC</sub>	Thermal Resistance, Junction-to-Case	0.6	°C/W

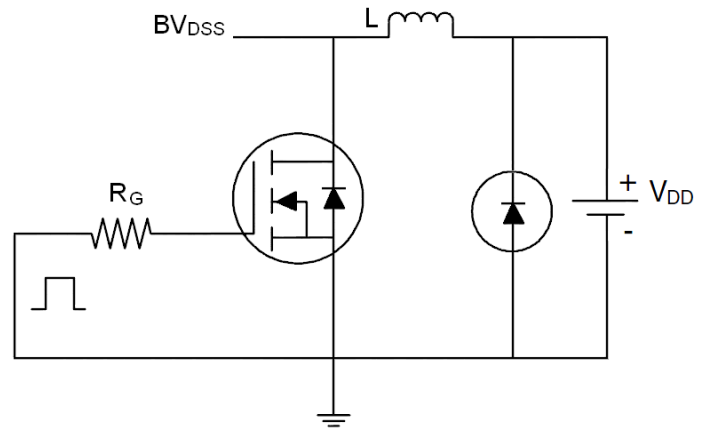
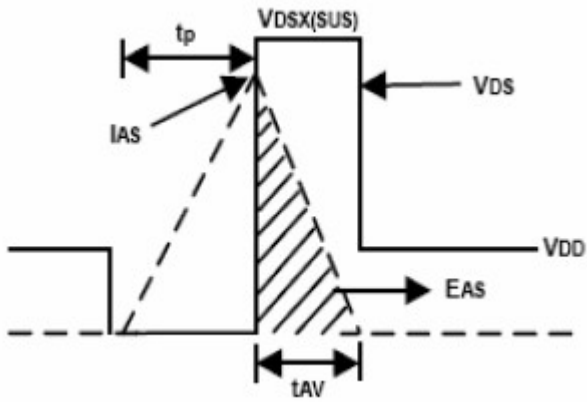
**Table 3. Electrical Characteristics (TA=25°C unless otherwise noted)**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>On/Off States</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V, I <sub>D</sub> =250μA		70		V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current(Tc=25°C)	V <sub>DS</sub> =68V, V <sub>GS</sub> =0V			1	μA
I <sub>DSS</sub>	Zero Gate Voltage Drain Current(Tc=125°C)	V <sub>DS</sub> =68V, V <sub>GS</sub> =0V			1	μA
I <sub>GSS</sub>	Gate-Body Leakage Current	V <sub>GS</sub> =±25V, V <sub>DS</sub> =0V			±100	nA
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA	2		4	V
R <sub>DS(ON)</sub>	Drain-Source On-State Resistance	V <sub>GS</sub> =10V, I <sub>D</sub> =40A		6.9	7.2	mΩ
<b>Dynamic Characteristics</b>						
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> =10V, I <sub>D</sub> =40A		28		S
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> =25V, V <sub>GS</sub> =0V, f=1.0MHz		3489		pF
C <sub>oss</sub>	Output Capacitance			821		pF
C <sub>rss</sub>	Reverse Transfer Capacitance			430		pF
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> =30V, I <sub>D</sub> =30A, V <sub>GS</sub> =10V		57		nC
Q <sub>gs</sub>	Gate-Source Charge			11		nC
Q <sub>gd</sub>	Gate-Drain Charge			15		nC
<b>Switching Times</b>						
t <sub>d(on)</sub>	Turn-on Delay Time	V <sub>DD</sub> =30V, I <sub>D</sub> =2A, R <sub>L</sub> =15Ω V <sub>GS</sub> =10V, R <sub>G</sub> =2.5Ω		9		nS
t <sub>r</sub>	Turn-on Rise Time			11		nS
t <sub>d(off)</sub>	Turn-Off Delay Time			19		nS
t <sub>f</sub>	Turn-Off Fall Time			23		nS
<b>Source-Drain Diode Characteristics</b>						
I <sub>SD</sub>	Source-Drain Current(Body Diode)			80		A
I <sub>SDM</sub>	Pulsed Source-Drain Current(Body Diode)			320		A
V <sub>SD</sub>	Forward On Voltage <b>(Note 1)</b>	T <sub>J</sub> =25°C, I <sub>SD</sub> =40A, V <sub>GS</sub> =0V		0.8	0.95	V
t <sub>rr</sub>	Reverse Recovery Time <b>(Note 1)</b>	T <sub>J</sub> =25°C, I <sub>F</sub> =75A di/dt=100A/μs		34		nS
Q <sub>rr</sub>	Reverse Recovery Charge <b>(Note 1)</b>			69		nC
t <sub>on</sub>	Forward Turn-on Time	Intrinsic turn-on time is negligible(turn-on is dominated by L <sub>S</sub> +L <sub>D</sub> )				

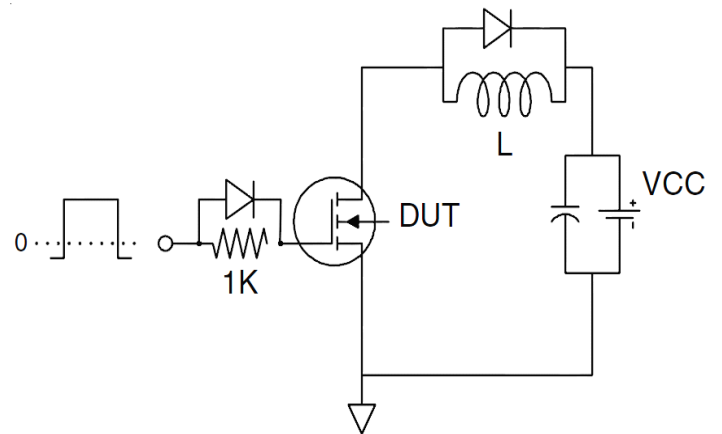
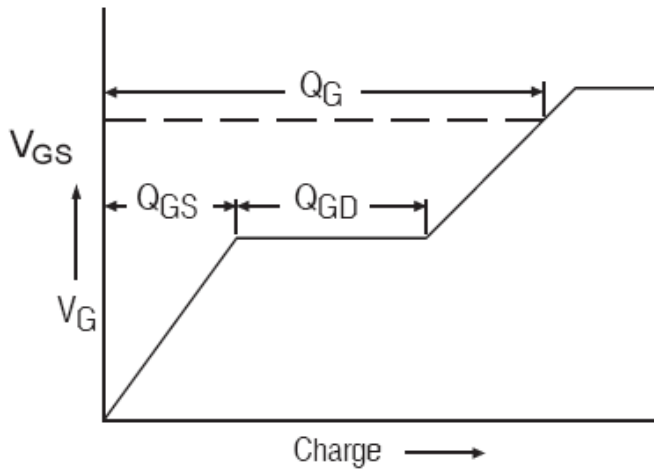
Notes 1. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 1.5%, R<sub>G</sub>=25Ω, Starting T<sub>J</sub>=25°C

## Test Circuit

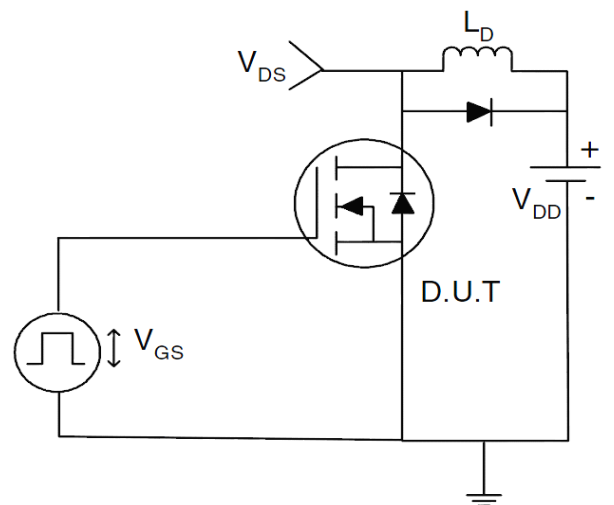
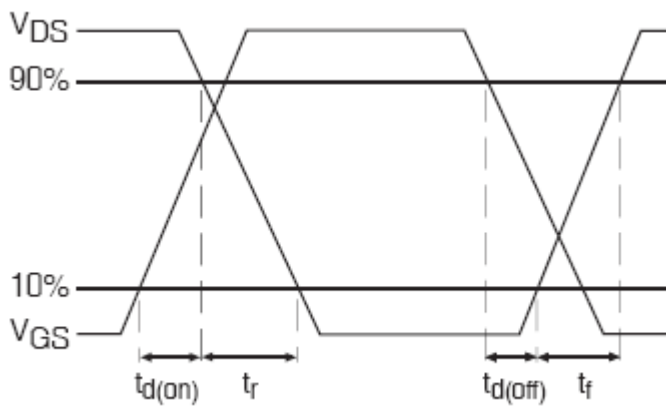
### 1) $E_{AS}$ Test Circuits



### 2) Gate Charge Test Circuit:



### 3) Switch Time Test Circuit:



TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (Curves)

Figure1. Safe Operating Area

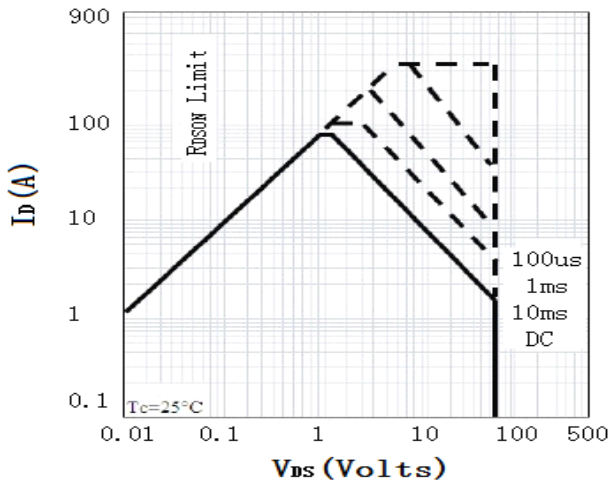


Figure2. Source-Drain Diode Forward Voltage

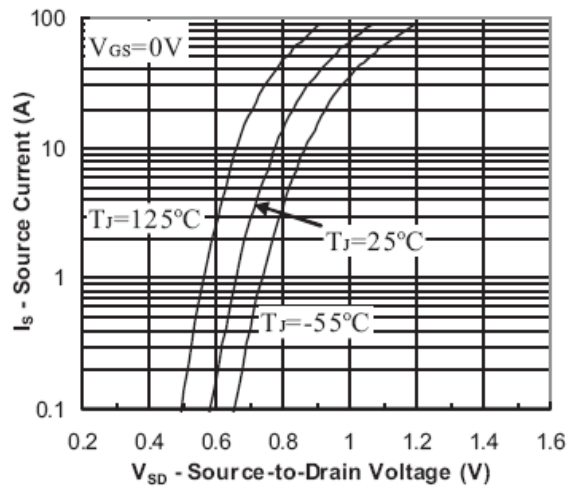


Figure3. Output Characteristics

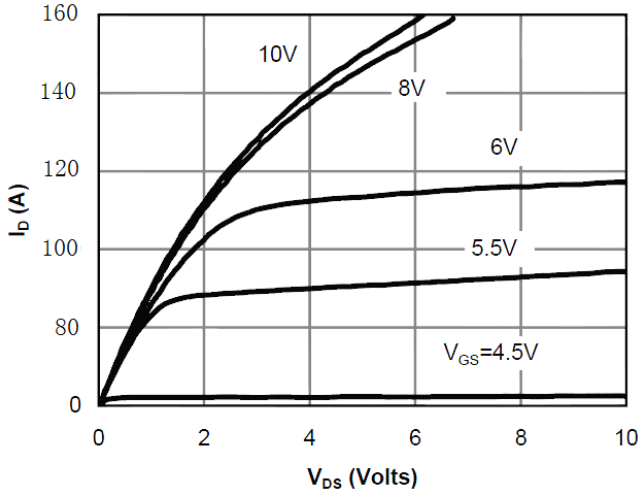


Figure4. Transfer Characteristics

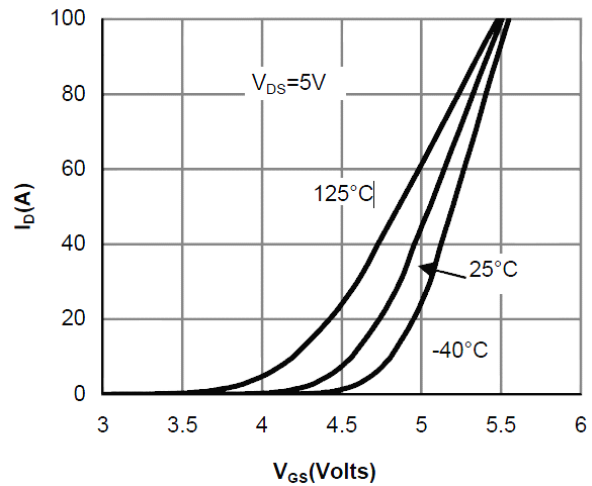


Figure5. Static Drain-Source On Resistance

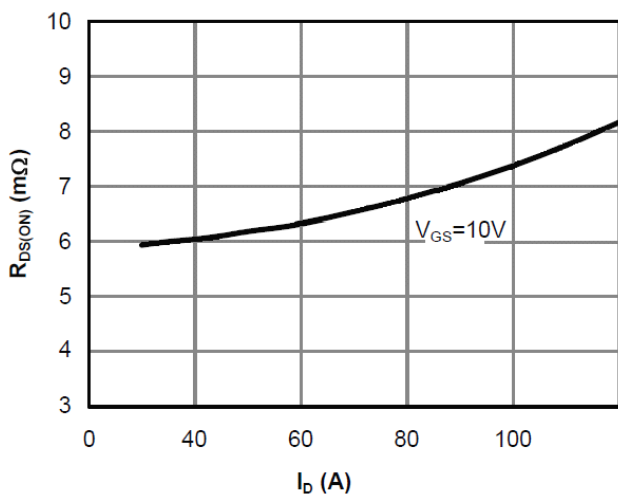


Figure6. RDS(ON) vs Junction Temperature

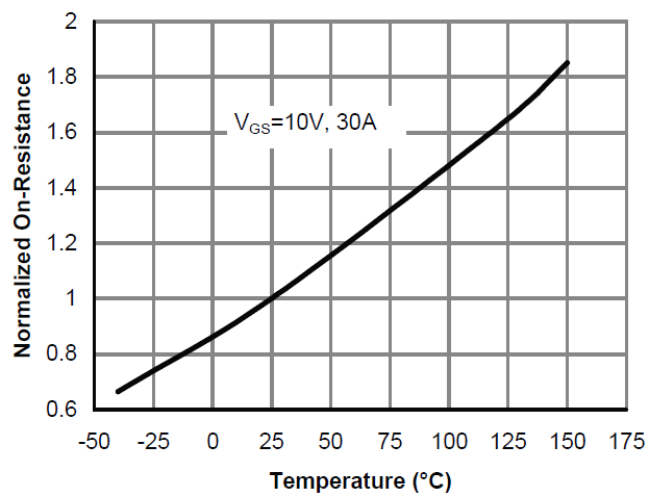


Figure7.  $V_{DS}$  vs Junction Temperature

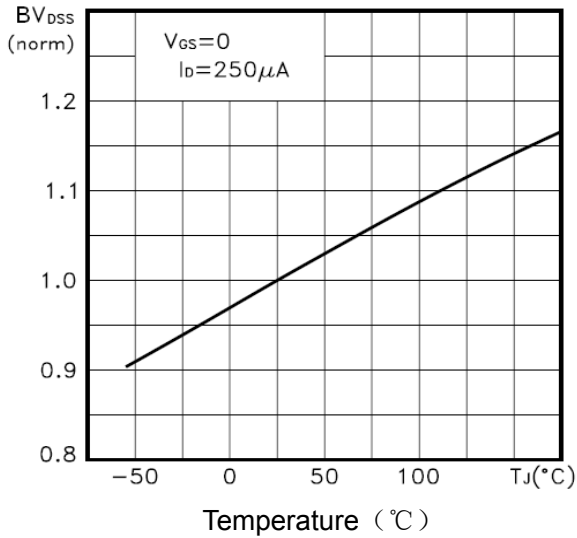


Figure8.  $V_{GS(th)}$  vs Junction Temperature

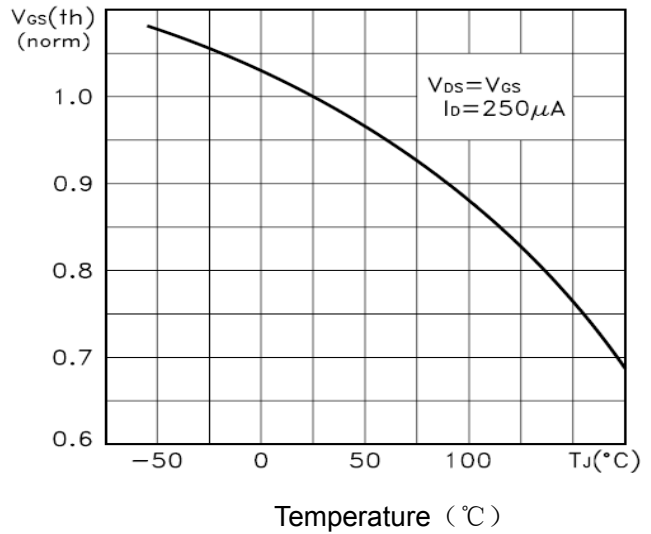


Figure9. Gate Charge Waveforms

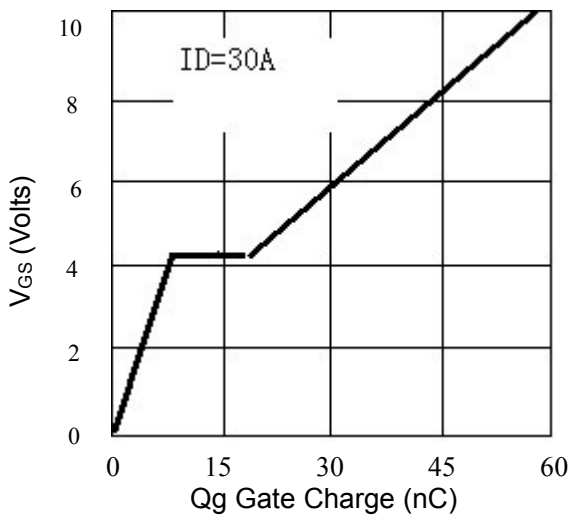


Figure10. Capacitance

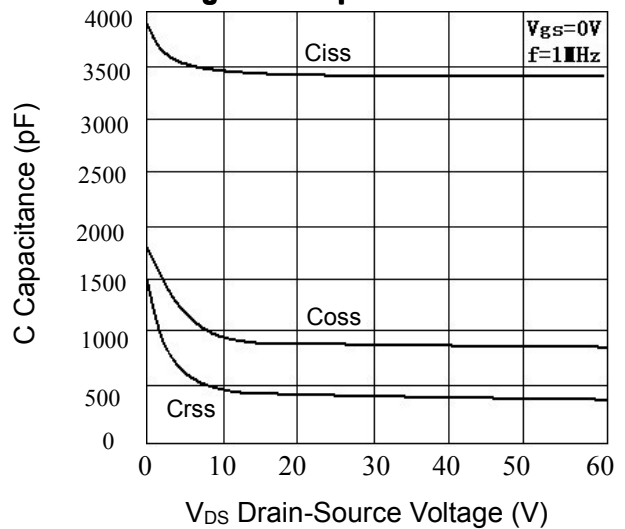
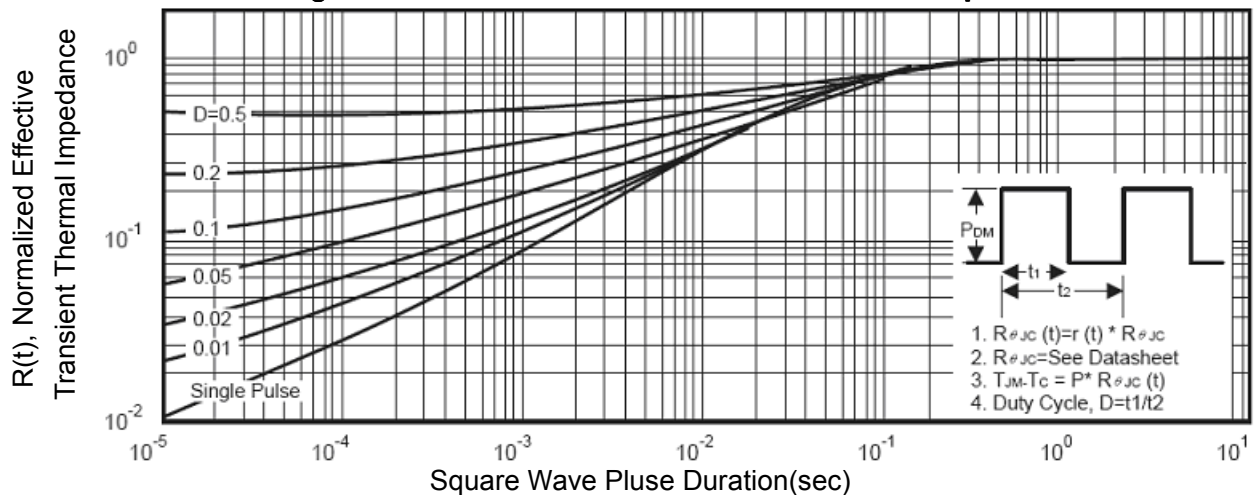
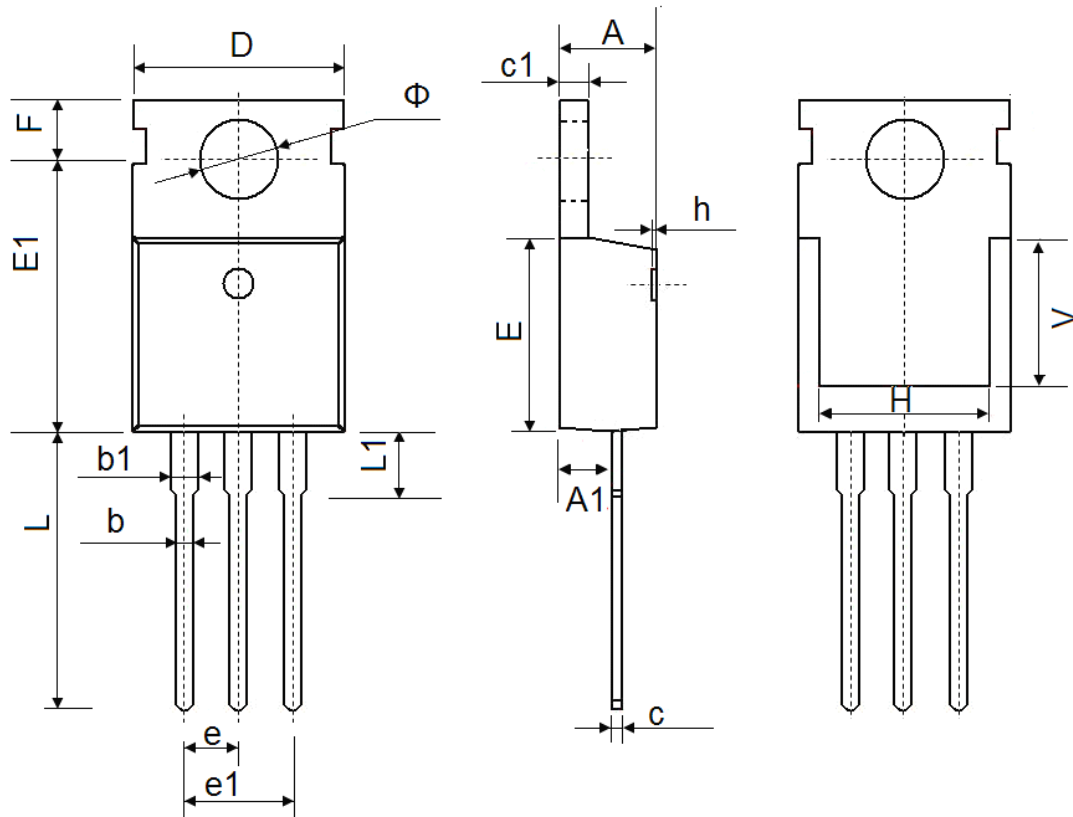


Figure11. Normalized Maximum Transient Thermal Impedance



### 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.	
$\Phi$	3.400	3.800	0.134	0.150