

N-Channel Trench Power MOSFET

General Description

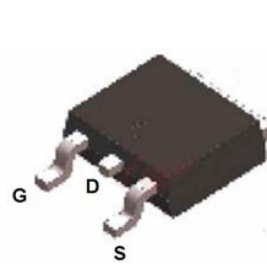
The HM70N90D is N-channel MOS Field Effect Transistor designed for high current switching applications. Rugged E_{AS} capability and ultra low $R_{DS(ON)}$ is suitable for PWM, load switching especially for E-Bike controller applications.

Features

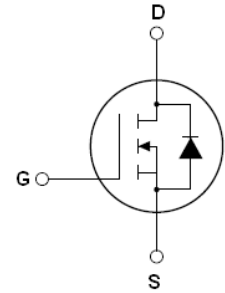
- $V_{DS}=70V$; $I_D=90A@V_{GS}=10V$;
 $R_{DS(ON)}<5.2m\Omega @V_{GS}=10V$
- Special Designed for E-Bike Controller Application
- Ultra Low On-Resistance
- High UIS and UIS 100% Test

Application

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



TO-263-2L top view



Schematic diagram

$$V_{DSS} = 70V$$

$$I_{DSS} = 90A$$

$$R_{DS(ON)} = 4.8m\Omega$$

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
HM70N90D	HM70N90D	TO-263-2L	-	-	-

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 $T_c=25^\circ C$	90	A
$I_D (DC)$	Drain Current (DC) at $T_c=100^\circ C$	63	A
$I_{DM} (pluse)$	Drain Current-Continuous@ Current-Pulsed (Note 1)	320	A
dv/dt	Peak Diode Recovery Voltage	30	V/ns
P_D	Maximum Power Dissipation($T_c=25^\circ C$)	145	W
	Derating Factor	1.9	W/°C
E_{AS}	Single Pulse Avalanche Energy (Note 2)	590	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. E_{AS} condition: $T_J=25^\circ C$, $V_{DD}=33V$, $V_G=10V$, $I_D=48.5A$

Table 2. Thermal Characteristic

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

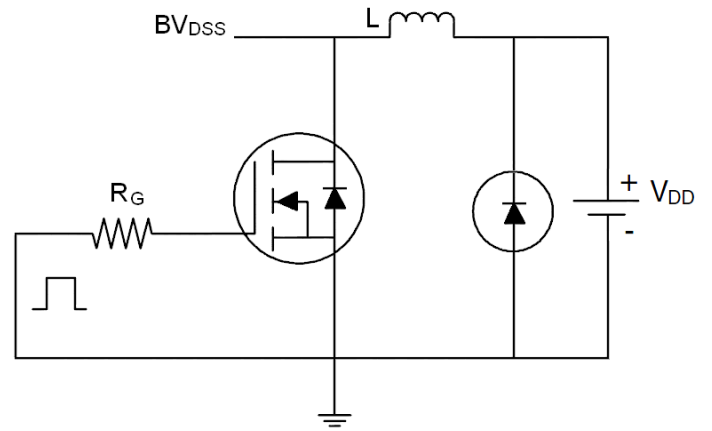
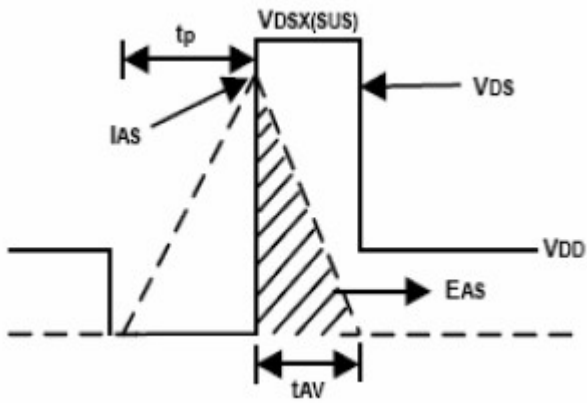
Table 3. Electrical Characteristics (TA=25 $^{\circ}\text{C}$ unless otherwise noted)

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		4.8	5.2	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		4858		pF
C _{oss}	Output Capacitance			883		pF
C _{rss}	Reverse Transfer Capacitance			486		pF
Q _g	Total Gate Charge	V _{DS} =30V,I _D =30A, V _{GS} =10V		81		nC
Q _{gs}	Gate-Source Charge			15		nC
Q _{gd}	Gate-Drain Charge			22		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		13		nS
t _r	Turn-on Rise Time			15		nS
t _{d(off)}	Turn-Off Delay Time			27		nS
t _f	Turn-Off Fall Time			32		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		49		nS
Q _{rr}	Reverse Recovery Charge ^(Note 1)			97		nC
t _{on}	Forward Turn-on Time	Intrinsic turn-on time is negligible(turn-on is dominated by L _S +L _D)				

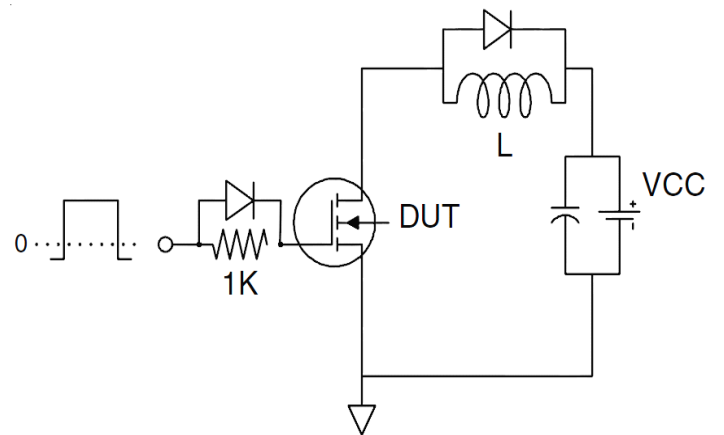
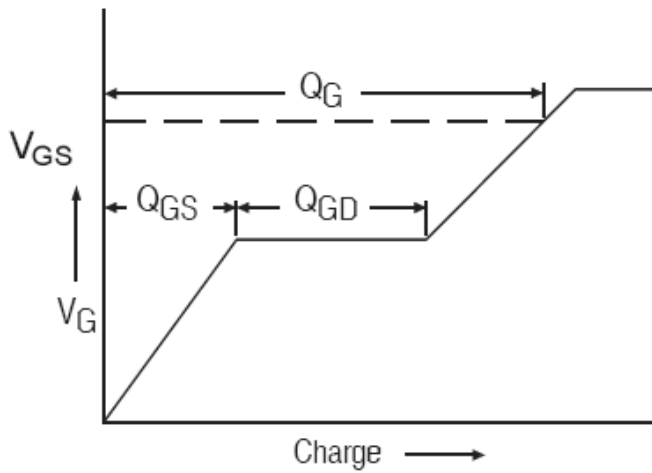
Notes 1. Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 1.5\%$, $R_G=25\Omega$, Starting $T_J=25^{\circ}\text{C}$

Test Circuit

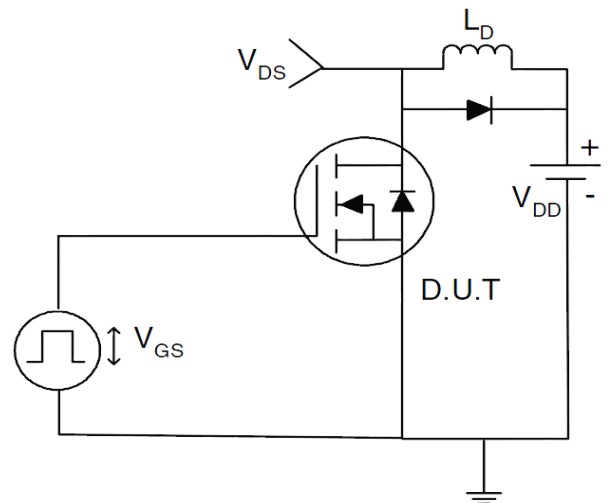
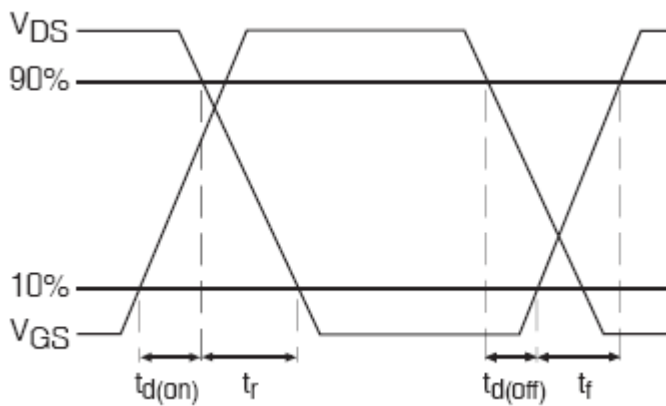
1) E_{AS} Test Circuits



2) Gate Charge Test Circuit:



3) Switch Time Test Circuit:



TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (Curves)

Figure1. Safe Operating Area

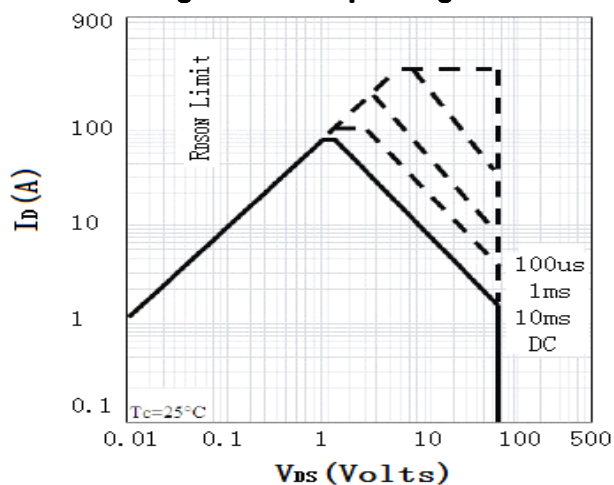


Figure2. Source-Drain Diode Forward Voltage

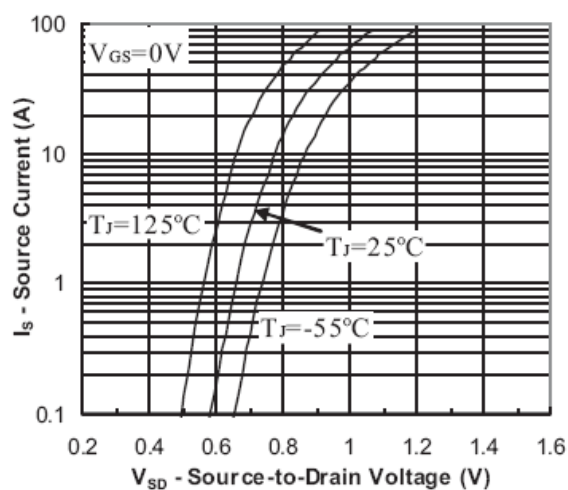


Figure3. Output Characteristics

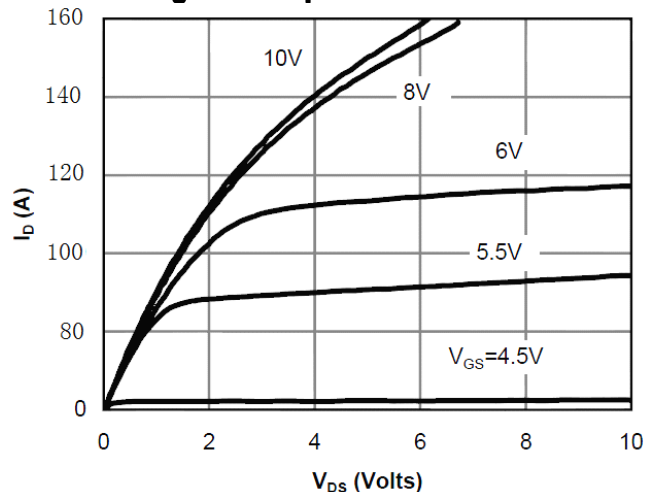


Figure4. Transfer Characteristics

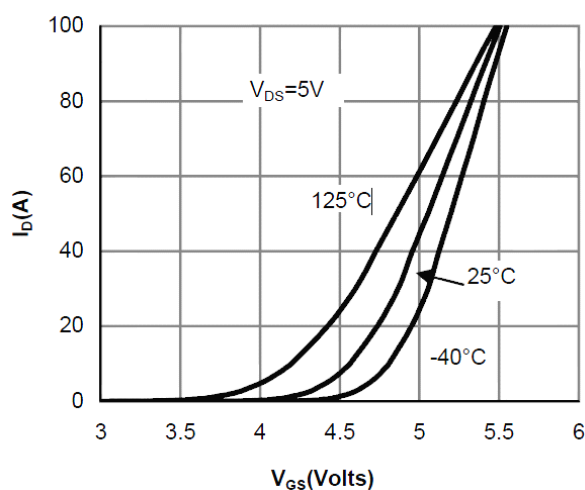


Figure5. Static Drain-Source On Resistance

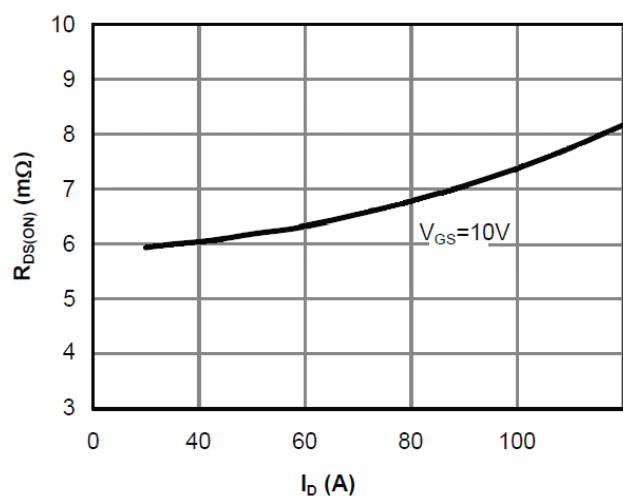


Figure6. $R_{DS(ON)}$ vs Junction Temperature

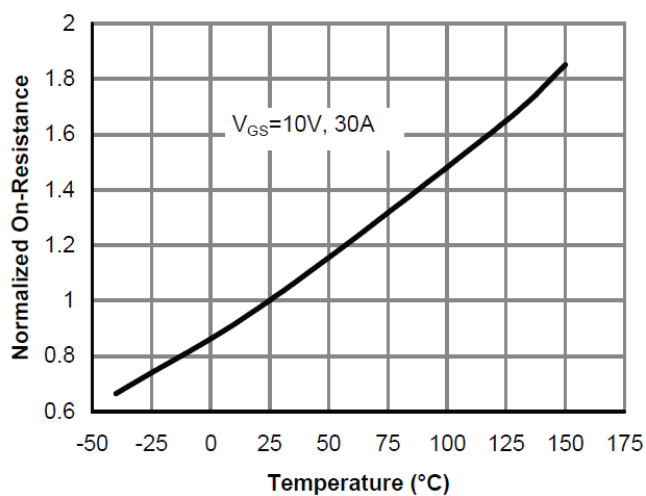


Figure7. BV_{DSS} vs Junction Temperature

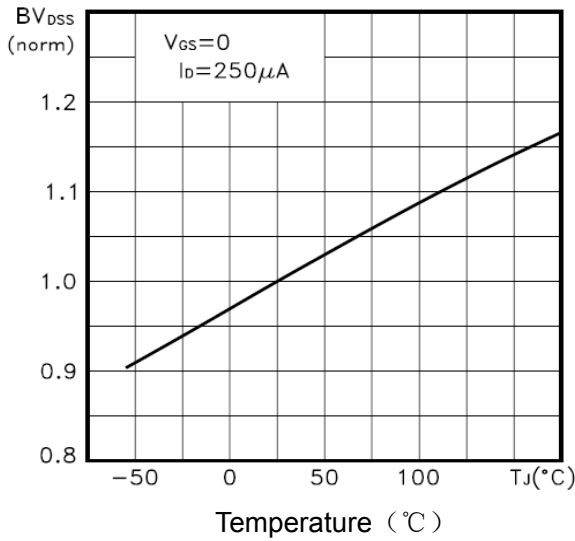


Figure8. $V_{GS(th)}$ vs Junction Temperature

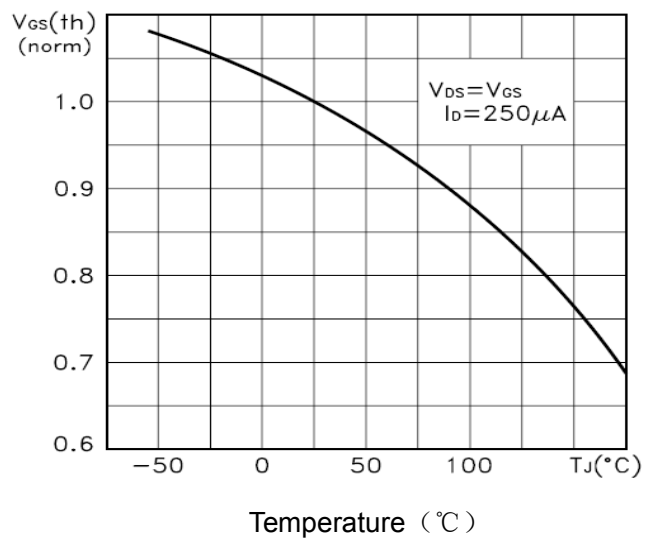


Figure9. Gate Charge Waveforms

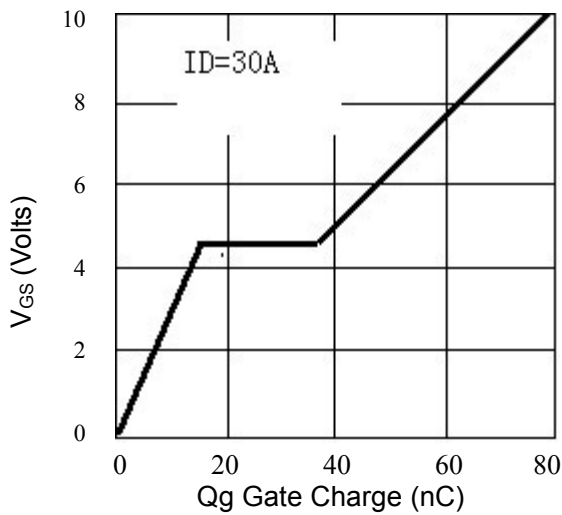


Figure10. Capacitance

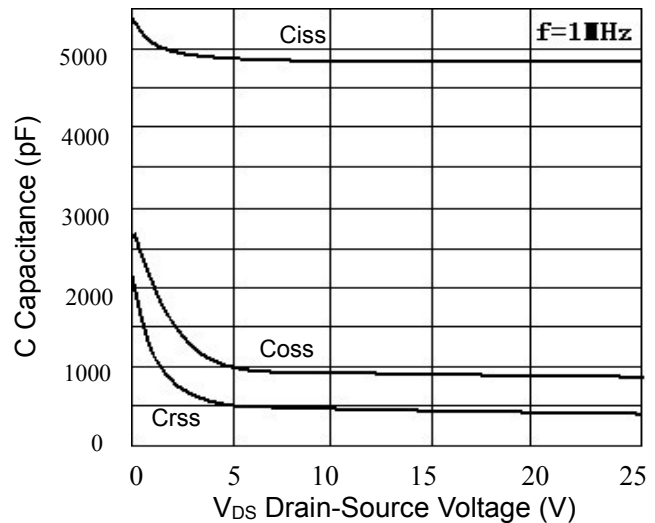
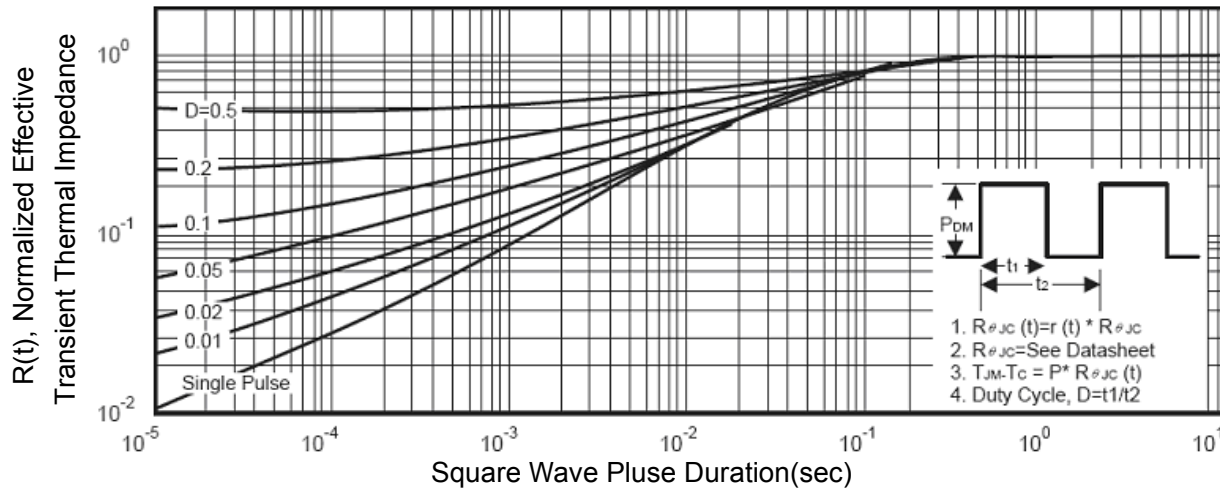
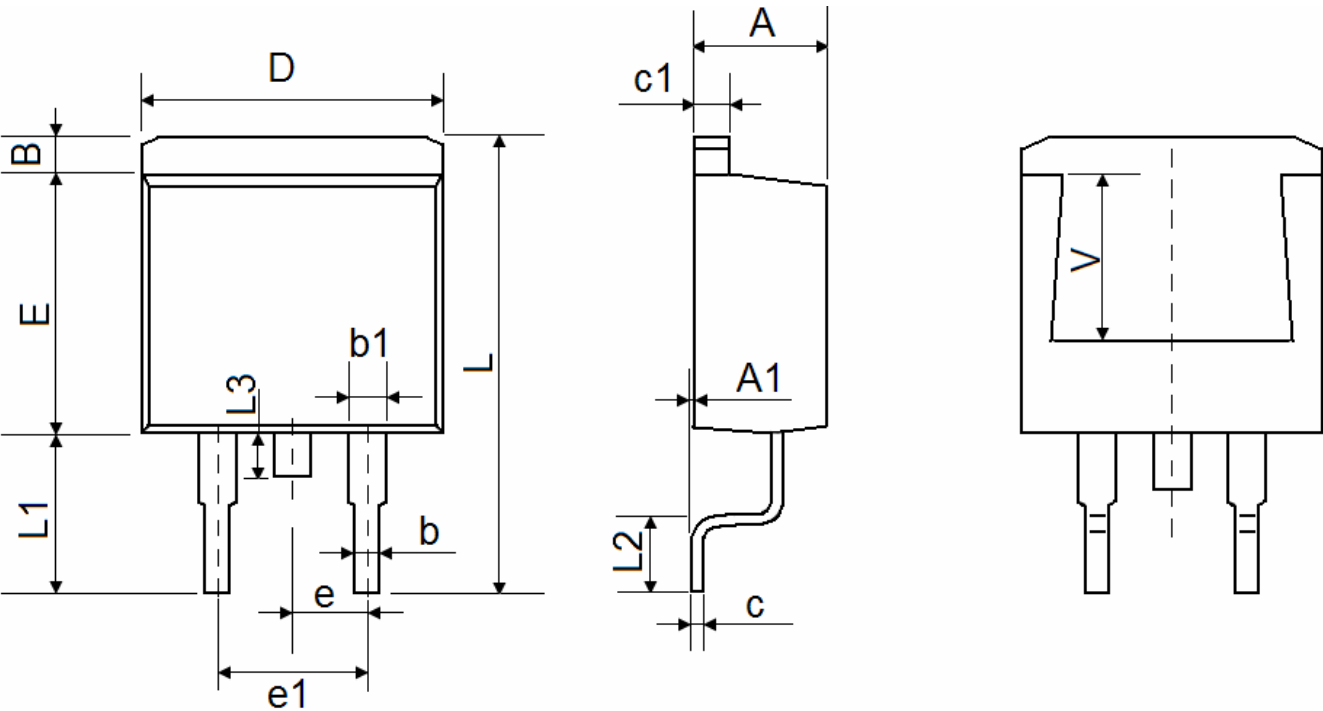


Figure11. Normalized Maximum Transient Thermal Impedance



TO-263-2L Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.470	4.670	0.176	0.184
A1	0.000	0.150	0.000	0.006
B	1.170	1.370	0.046	0.054
b	0.710	0.910	0.028	0.036
b1	1.170	1.370	0.046	0.054
c	0.310	0.530	0.012	0.021
c1	1.170	1.370	0.046	0.054
D	10.010	10.310	0.394	0.406
E	8.500	8.900	0.335	0.350
e	2.540 TYP.		0.100 TYP.	
e1	4.980	5.180	0.196	0.204
L	15.050	15.450	0.593	0.608
L1	5.080	5.480	0.200	0.216
L2	2.340	2.740	0.092	0.108
L3	1.300	1.700	0.051	0.067
V	5.600 REF		0.220 REF	