

## N-Channel Enhancement Mode Power MOSFET

### Description

The HM90N07F uses advanced trench technology and design to provide excellent  $R_{DS(ON)}$  with low gate charge. It can be used in a wide variety of applications.

### General Features

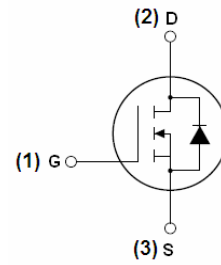
- $V_{DS} = \bar{I} \in V, I_D = 90A$   
 $R_{DS(ON)} < 7.0m\Omega @ V_{GS}=10V$  (Typ:5.7m $\Omega$ )
- High density cell design for ultra low  $R_{ds(on)}$
- Fully characterized avalanche voltage and current
- Good stability and uniformity with high  $E_{AS}$
- Excellent package for good heat dissipation
- Special process technology for high ESD capability

### Application

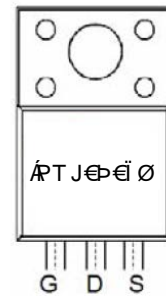
- Power switching application
- Hard switched and high frequency circuits
- Uninterruptible power supply

**100% UIS TESTED!**

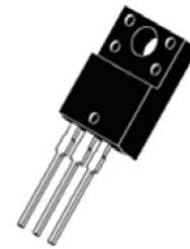
**100%  $\Delta V_{ds}$  TESTED!**



Schematic diagram



Marking and pin assignment



TO-220F top view

### Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
HM90N07F	HM90N07F	TO-220:	-	-	-

### Absolute Maximum Ratings ( $T_c=25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	$\bar{I} \in$	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Drain Current-Continuous	$I_D$	90	A
Drain Current-Continuous( $T_C=100^\circ\text{C}$ )	$I_{D(100^\circ\text{C})}$	62	A
Pulsed Drain Current	$I_{DM}$	310	A
Maximum Power Dissipation	$P_D$	160	W
Derating factor		1.1	W/ $^\circ\text{C}$
Single pulse avalanche energy <sup>(Note 5)</sup>	$E_{AS}$	450	mJ
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 175	$^\circ\text{C}$

## Thermal Characteristic

Thermal Resistance, Junction-to-Case <sup>(Note 2)</sup>	$R_{\theta JC}$	0.9	°C/W
Thermal Resistance, Junction-to-Ambient <sup>(Note 2)</sup>	$R_{\theta JA}$	60	°C/W

## Electrical Characteristics ( $T_c=25^{\circ}\text{C}$ unless otherwise noted)

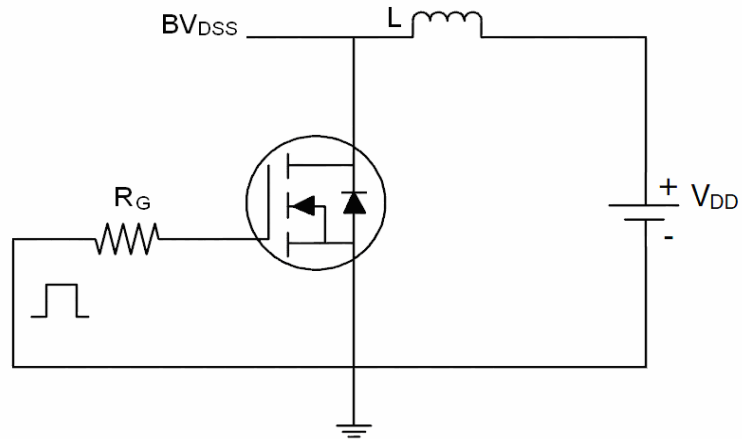
Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	B <sub>VDSS</sub>	V <sub>GS</sub> =0V I <sub>D</sub> =250μA	70	73	-	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =Ī €V,V <sub>GS</sub> =0V	-	-	1	μA
Gate-Body Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> =±20V,V <sub>DS</sub> =0V	-	-	±100	nA
On Characteristics <sup>(Note 3)</sup>						
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> ,I <sub>D</sub> =250μA	2	2.9	4	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =30A	-	5.7	7.0	mΩ
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =10V,I <sub>D</sub> =100A	25	-	-	S
Dynamic Characteristics <sup>(Note4)</sup>						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =25V,V <sub>GS</sub> =0V, F=1.0MHz	-	3400	-	PF
Output Capacitance	C <sub>oss</sub>		-	310	-	PF
Reverse Transfer Capacitance	C <sub>rss</sub>		-	221	-	PF
Switching Characteristics <sup>(Note 4)</sup>						
Turn-on Delay Time	t <sub>d(on)</sub>	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	-	15	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	11	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	52	-	nS
Turn-Off Fall Time	t <sub>f</sub>		-	13	-	nS
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =30V,I <sub>D</sub> =30A, V <sub>GS</sub> =10V	-	94	-	nC
Gate-Source Charge	Q <sub>gs</sub>		-	16	-	nC
Gate-Drain Charge	Q <sub>gd</sub>		-	24	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage <sup>(Note 3)</sup>	V <sub>SD</sub>	V <sub>GS</sub> =0V,I <sub>S</sub> =90A	-	-	1.2	V
Diode Forward Current <sup>(Note 2)</sup>	I <sub>S</sub>		-	-	90	A
Reverse Recovery Time	t <sub>rr</sub>	T <sub>J</sub> = 25°C, I <sub>F</sub> =90A di/dt = 100A/μs <sup>(Note3)</sup>	-	33		nS
Reverse Recovery Charge	Q <sub>rr</sub>		-	54		nC
Forward Turn-On Time	ton	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				

## Notes:

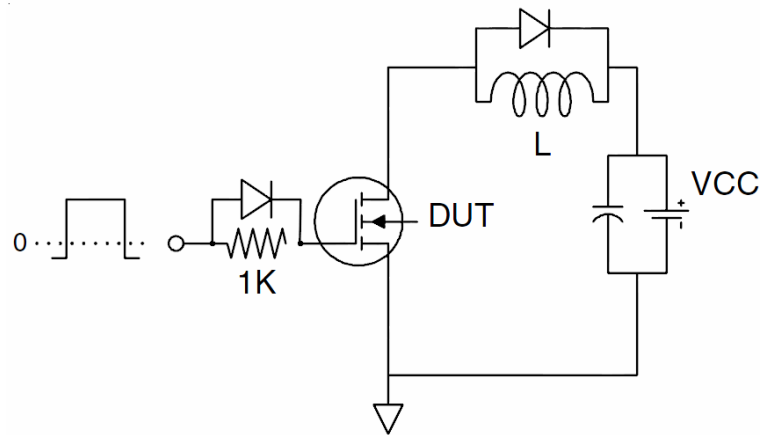
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production
5. EAS condition:  $T_J=25^{\circ}\text{C}, V_{DD}=35V, V_G=10V, L=0.5mH, R_g=25\Omega$

## Test Circuit

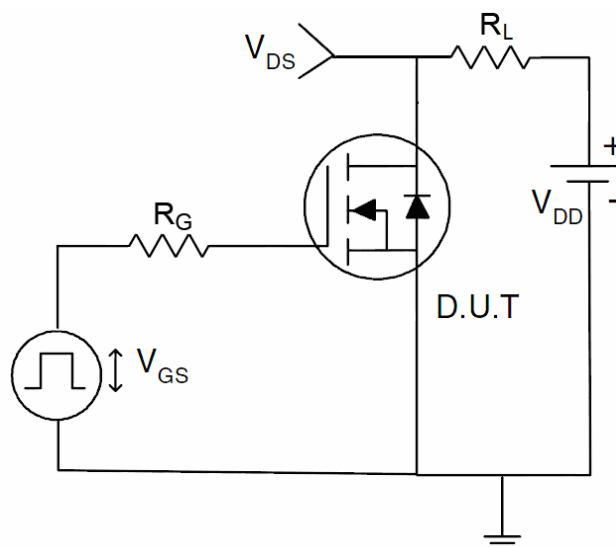
### 1) EAS test Circuit



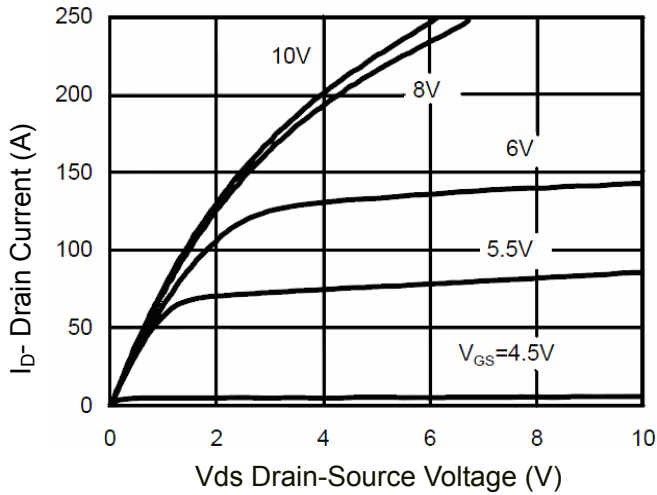
### 2) Gate charge test Circuit



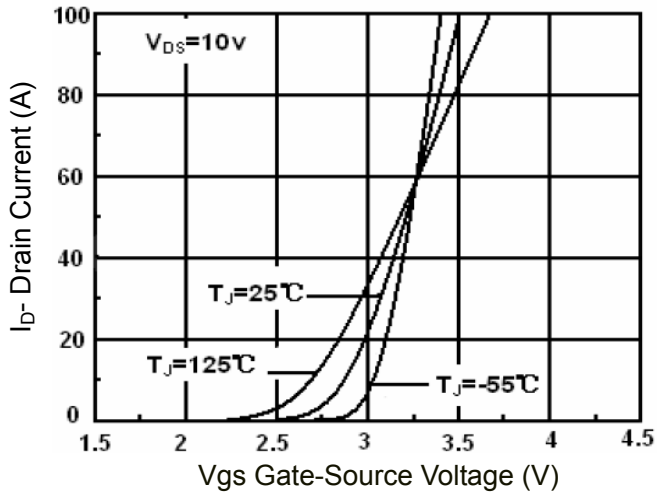
### 3) Switch Time Test Circuit



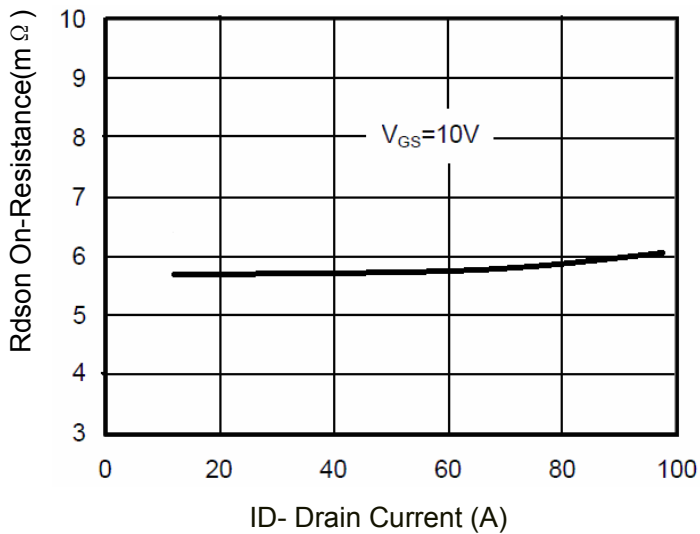
## Typical Electrical and Thermal Characteristics (Curves)



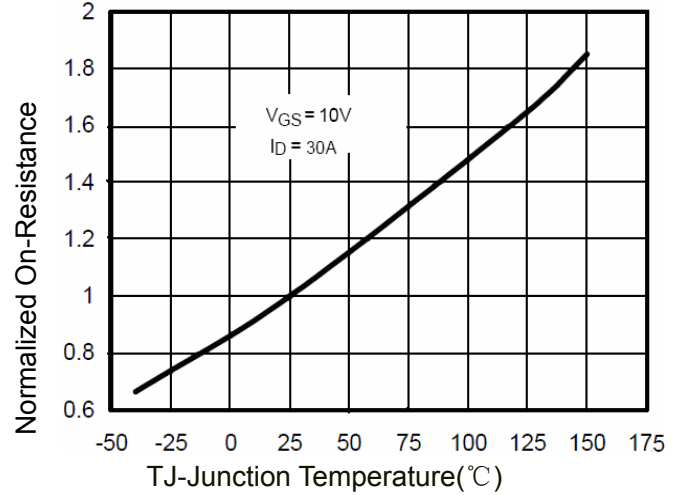
**Figure 1 Output Characteristics**



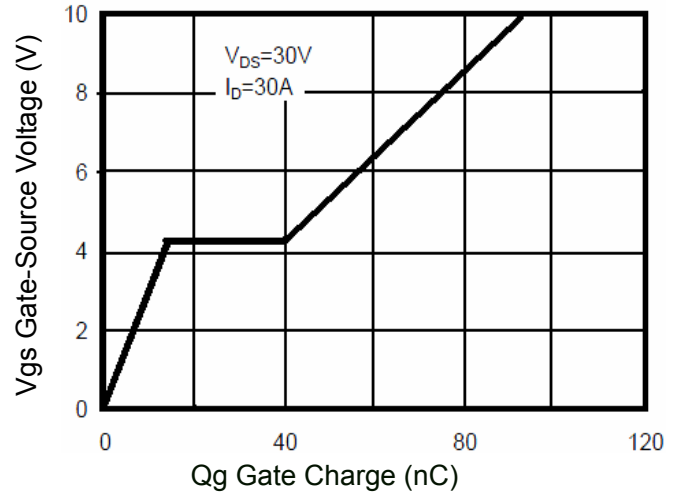
**Figure 2 Transfer Characteristics**



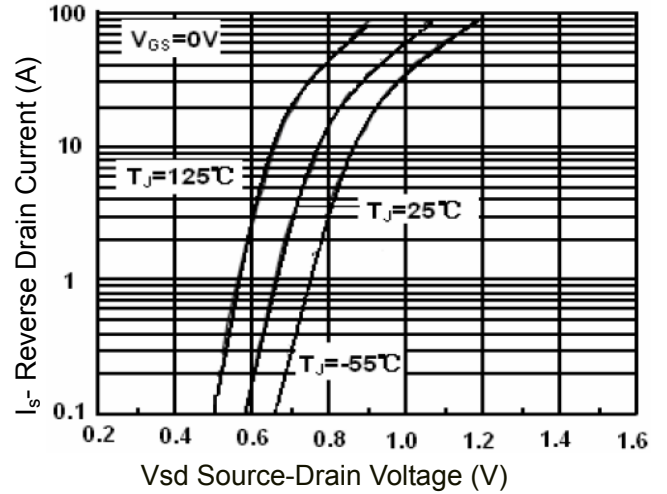
**Figure 3  $R_{DS(on)}$ - Drain Current**



**Figure 4  $R_{DS(on)}$ -Junction Temperature**



**Figure 5 Gate Charge**



**Figure 6 Source- Drain Diode Forward**

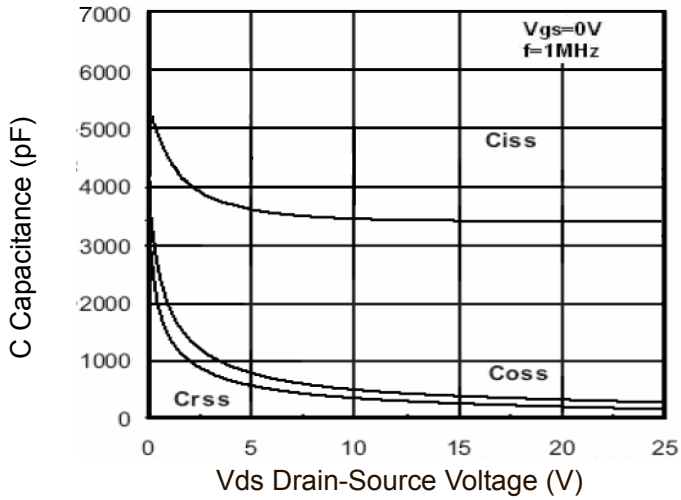


Figure 7 Capacitance vs Vds

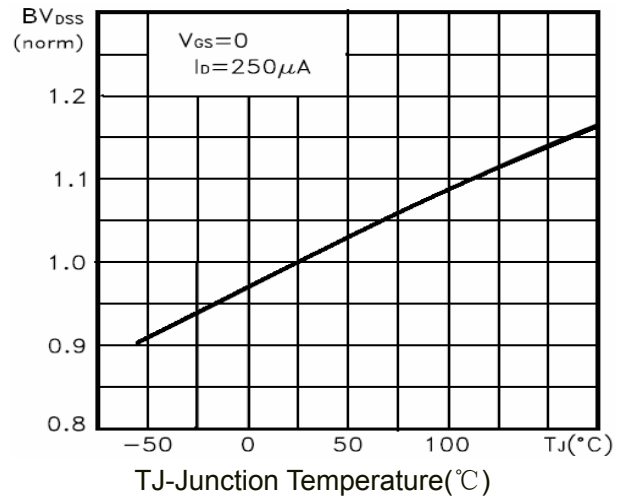


Figure 9  $BV_{DSS}$  vs Junction Temperature

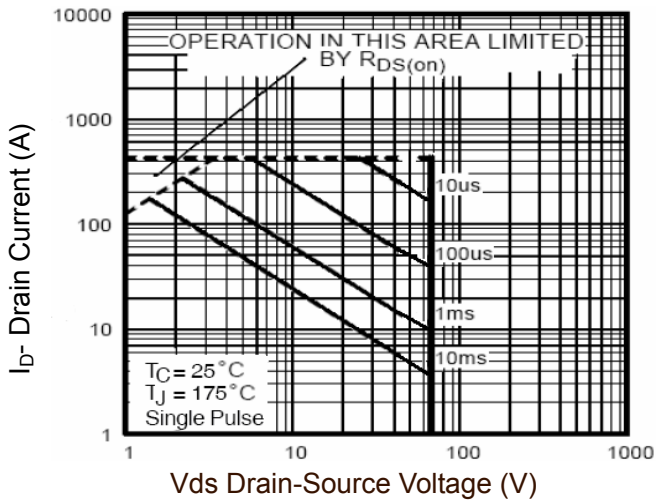


Figure 8 Safe Operation Area

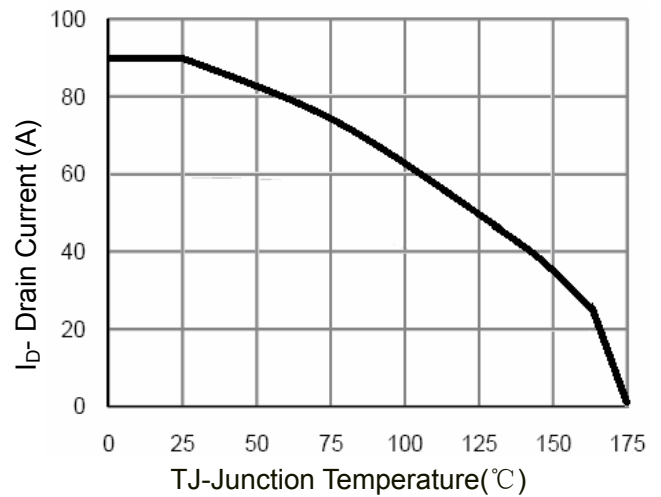


Figure 10 Current vs Junction Temperature

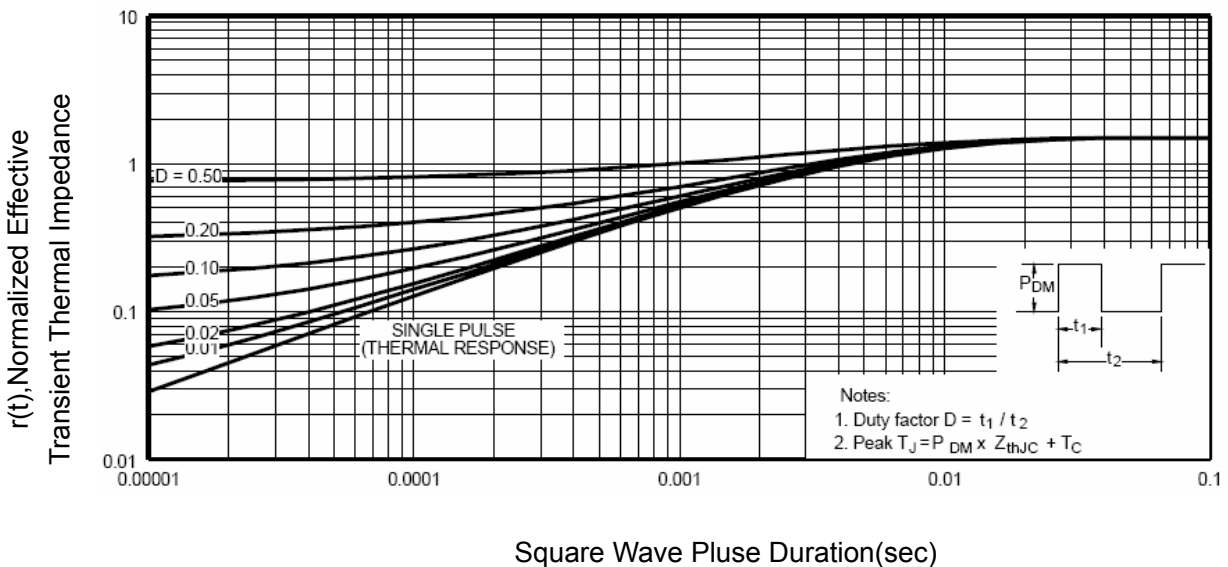
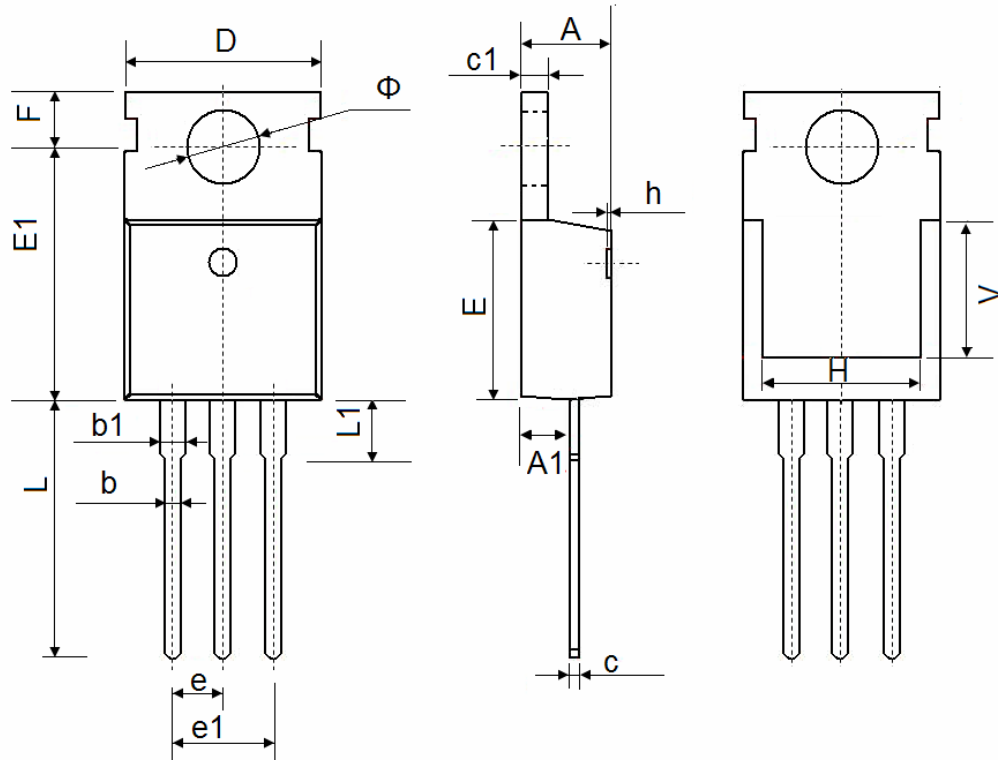


Figure 11 Normalized Maximum Transient Thermal Impedance

TO-220-3L 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