

## NCE N-Channel Super Trench Power MOSFET

### Description

The NCEP6090 uses **Super Trench** technology that is uniquely optimized to provide the most efficient high frequency switching performance. Both conduction and switching power losses are minimized due to an extremely low combination of  $R_{DS(ON)}$  and  $Q_g$ . This device is ideal for high-frequency switching and synchronous rectification.

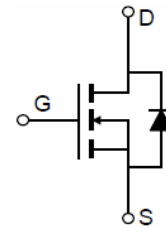
### General Features

- $V_{DS} = 60V, I_D = 90A$   
 $R_{DS(ON)} < 6.9m\Omega @ V_{GS}=10V$  (Typ:6.4m $\Omega$ )
- Excellent gate charge x  $R_{DS(on)}$  product
- Very low on-resistance  $R_{DS(on)}$
- Pb-free lead plating
- 100% UIS tested

### Application

- DC/DC Converter
- Ideal for high-frequency switching and synchronous rectification

**100% UIS TESTED!**  
**100%  $\Delta V_d$ s TESTED!**



Schematic diagram



Marking and pin assignment



TO-220-3L top view

### Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
NCEP6090	NCEP6090	TO-220-3L	-	-	-

### Absolute Maximum Ratings ( $T_C=25^\circ C$ unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	60	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Drain Current-Continuous (Silicon Limited)	$I_D$	90	A
Drain Current-Continuous( $T_C=100^\circ C$ )	$I_D(100^\circ C)$	63.6	A
Pulsed Drain Current	$I_{DM}$	360	A
Maximum Power Dissipation	$P_D$	100	W
Derating factor		0.67	W/ $^\circ C$
Single pulse avalanche energy <sup>(Note 5)</sup>	$E_{AS}$	320	mJ
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 175	$^\circ C$

### Thermal Characteristic

Thermal Resistance, Junction-to-Case <sup>(Note 2)</sup>	$R_{\theta JC}$	1.50	$^\circ C/W$
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**Electrical Characteristics (T<sub>C</sub>=25°C unless otherwise noted)**

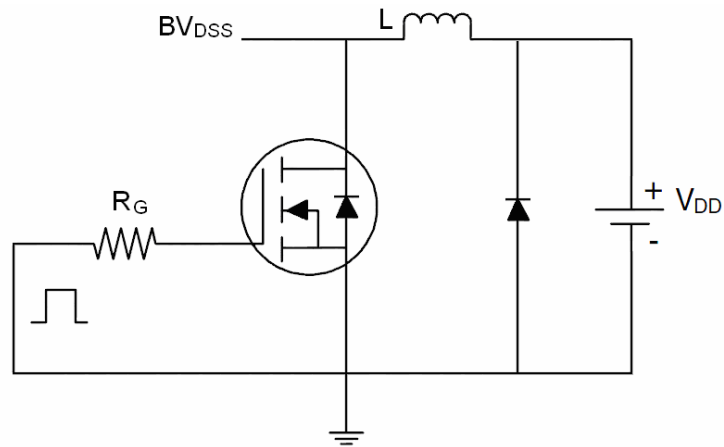
Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V I <sub>D</sub> =250μA	60		-	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =60V, V <sub>GS</sub> =0V	-	-	1	μA
Gate-Body Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V	-	-	±100	nA
<b>On Characteristics</b> (Note 3)						
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA	2	3	4	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =45A	-	6.4	6.9	mΩ
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =5V, I <sub>D</sub> =45A	-	35	-	S
<b>Dynamic Characteristics</b> (Note4)						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =30V, V <sub>GS</sub> =0V, F=1.0MHz	-	1700	-	PF
Output Capacitance	C <sub>oss</sub>		-	345	-	PF
Reverse Transfer Capacitance	C <sub>rss</sub>		-	8	-	PF
<b>Switching Characteristics</b> (Note 4)						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =30V, I <sub>D</sub> =45A V <sub>GS</sub> =10V, R <sub>G</sub> =4.7Ω	-	8	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	2	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	29	-	nS
Turn-Off Fall Time	t <sub>f</sub>		-	4	-	nS
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =30V, I <sub>D</sub> =45A, V <sub>GS</sub> =10V	-	26.9		nC
Gate-Source Charge	Q <sub>gs</sub>		-	9.4		nC
Gate-Drain Charge	Q <sub>gd</sub>		-	4.6		nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage (Note 3)	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =45A	-		1.2	V
Diode Forward Current (Note 2)	I <sub>S</sub>		-	-	90	A
Reverse Recovery Time	t <sub>rr</sub>	T <sub>J</sub> = 25°C, I <sub>F</sub> = I <sub>S</sub> di/dt = 100A/μs (Note3)	-	38		nS
Reverse Recovery Charge	Q <sub>rr</sub>		-	48		nC

**Notes:**

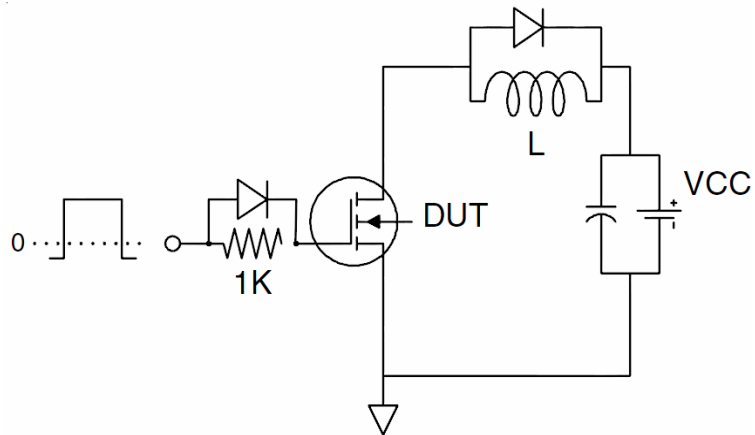
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board, t ≤ 10 sec.
3. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.
4. Guaranteed by design, not subject to production
5. EAS condition : T<sub>J</sub>=25°C, V<sub>DD</sub>=30V, V<sub>G</sub>=10V, L=0.5mH, R<sub>G</sub>=25Ω

**Test Circuit**

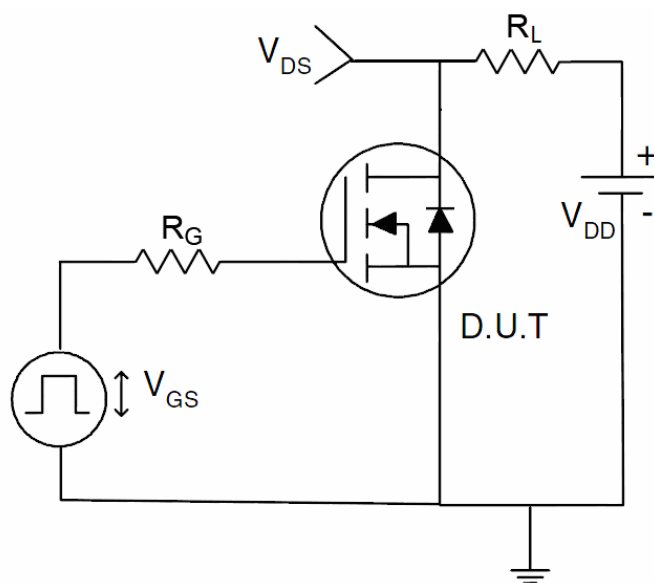
**1) E<sub>AS</sub> test Circuit**



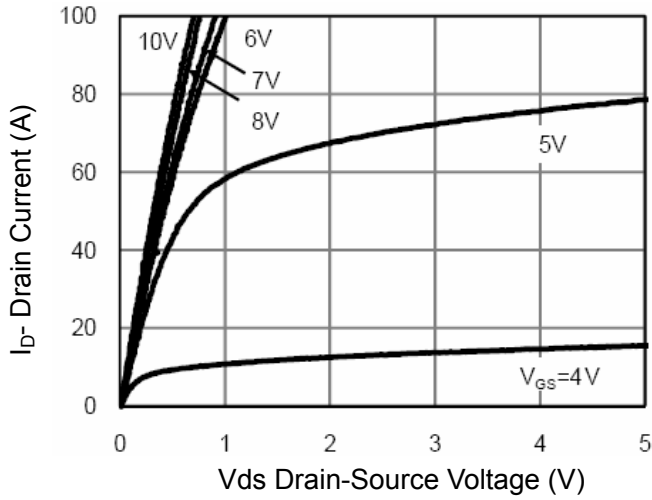
**2) Gate charge test Circuit**



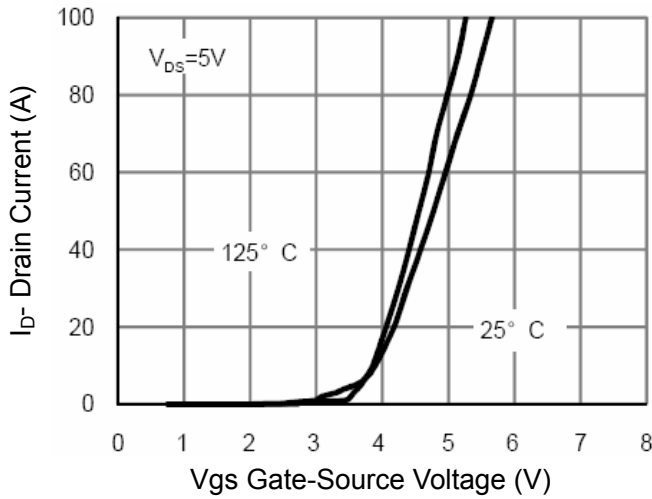
**3) Switch Time Test Circuit**



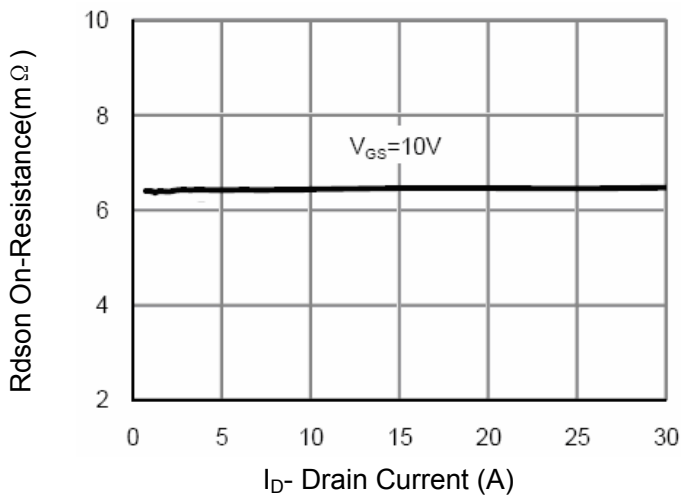
**Typical Electrical and Thermal Characteristics**



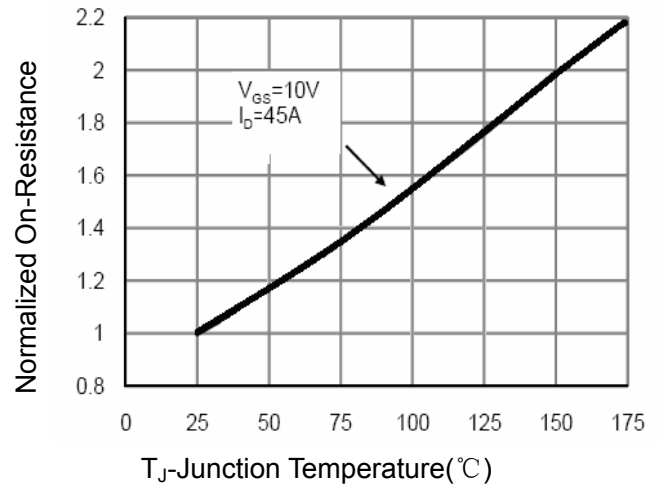
**Figure 1 Output Characteristics**



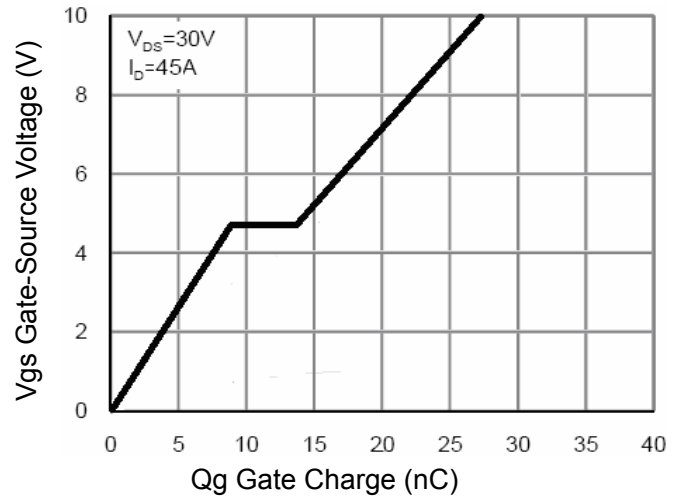
**Figure 2 Transfer Characteristics**



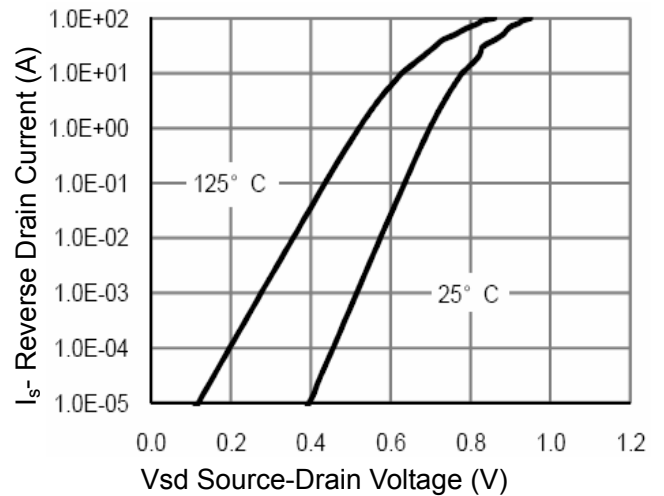
**Figure 3  $R_{DS(on)}$ - Drain Current**



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



**Figure 5 Gate Charge**



**Figure 6 Source- Drain Diode Forward**

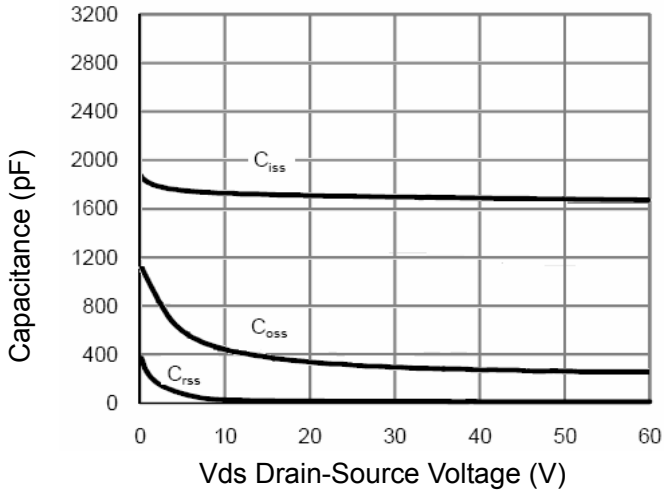


Figure 7 Capacitance vs Vds

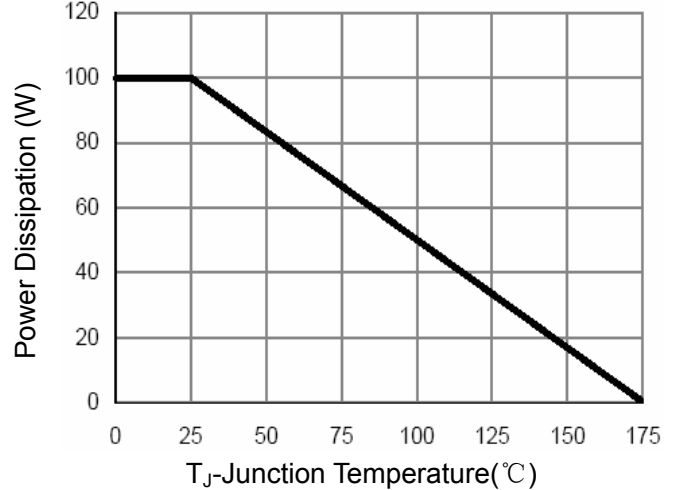


Figure 9 Power De-rating

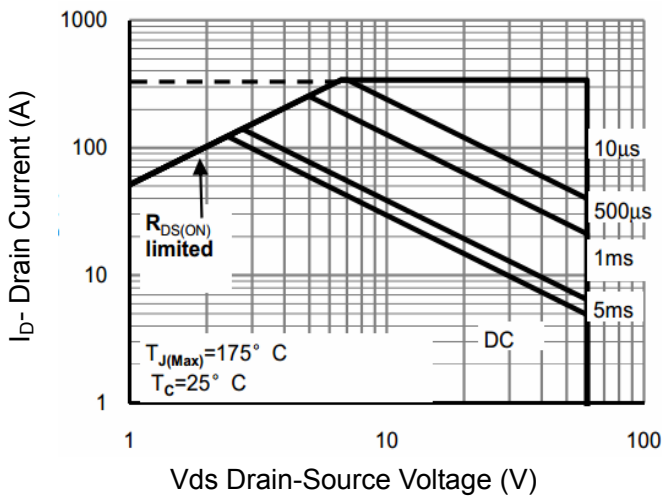


Figure 8 Safe Operation Area

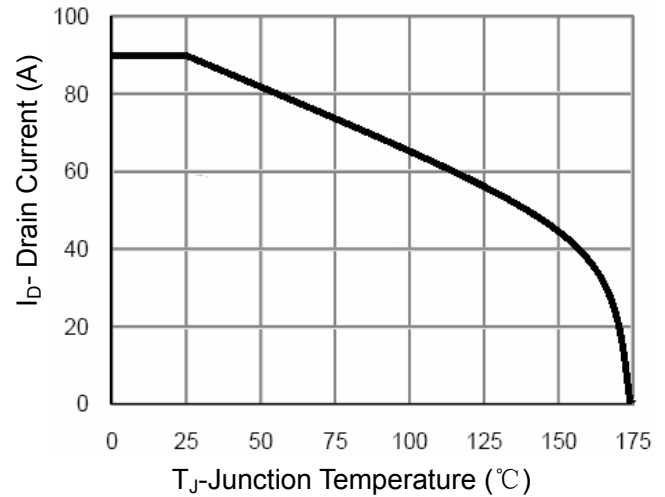


Figure 10 Current De-rating

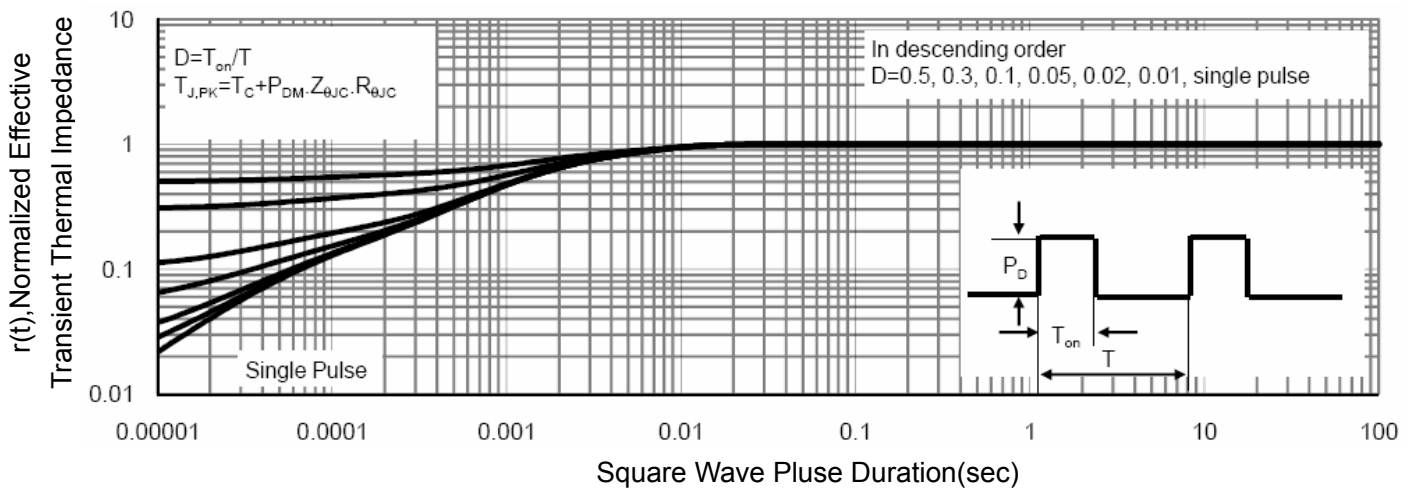
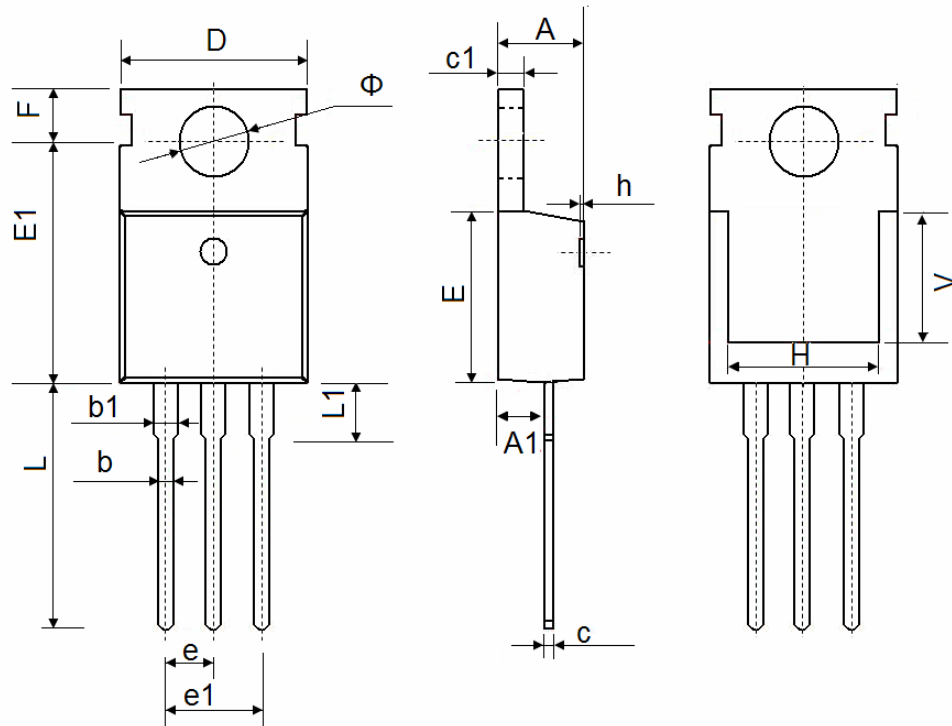


Figure 11 Normalized Maximum Transient Thermal Impedance

**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

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