

## NCE N-Channel Super Trench Power MOSFET

### Description

The NCEP12T12D 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

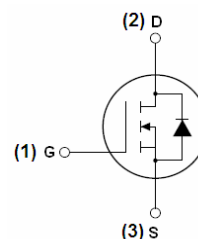
- $V_{DS} = 120V, I_D = 129A$   
 $R_{DS(ON)} < 5.3m\Omega @ V_{GS} = 10V$
- Excellent gate charge x  $R_{DS(on)}$  product
- Very low on-resistance  $R_{DS(on)}$
- 175 °C operating temperature
- Pb-free lead plating
- 100% UIS tested

### Application

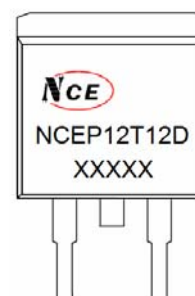
- DC/DC Converter
- Ideal for high-frequency switching and synchronous rectification

**100% UIS TESTED!**

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



Schematic diagram



Marking and pin assignment



TO-263-2L top view

### Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
NCEP12T12D	NCEP12T12D	TO-263-2L	-	-	-

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	120	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Drain Current-Continuous	$I_D$	129	A
Drain Current-Continuous( $T_C = 100^\circ\text{C}$ )	$I_D(100^\circ\text{C})$	92	A
Pulsed Drain Current	$I_{DM}$	480	A
Maximum Power Dissipation	$P_D$	185	W
Derating factor		1.3	W/ $^\circ\text{C}$
Single pulse avalanche energy (Note 5)	$E_{AS}$	1000	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>	$R_{\theta JC}$	0.8	$^{\circ}C/W$
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## Electrical Characteristics ( $T_C=25^{\circ}C$ unless otherwise noted)

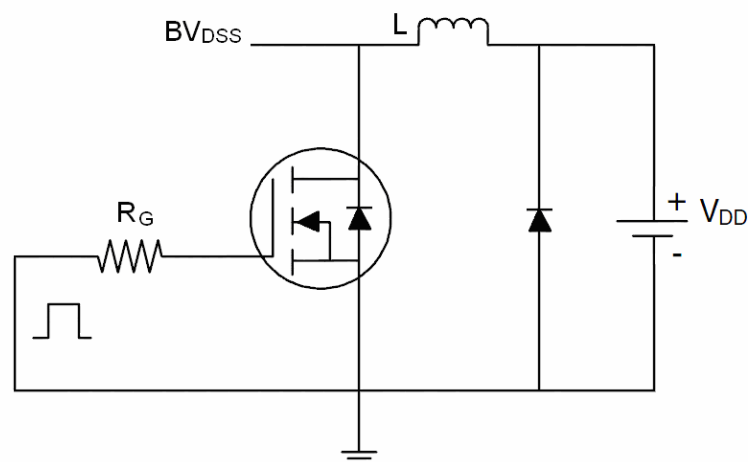
Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V I <sub>D</sub> =250μA	120		-	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =120V, V <sub>GS</sub> =0V	-	-	1	μA
Gate-Body Leakage Current	I <sub>GSS</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	2.5	3.3	4.5	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =60A	-	4.8	5.3	mΩ
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =10V, I <sub>D</sub> =60A	60	-	-	S
Dynamic Characteristics <sup>(Note4)</sup>						
Input Capacitance	C <sub>ISS</sub>	V <sub>DS</sub> =50V, V <sub>GS</sub> =0V, F=1.0MHz	-	5600	-	PF
Output Capacitance	C <sub>OSS</sub>		-	641	-	PF
Reverse Transfer Capacitance	C <sub>rss</sub>		-	28	-	PF
Switching Characteristics <sup>(Note 4)</sup>						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =60V, I <sub>D</sub> =60A V <sub>GS</sub> =10V, R <sub>G</sub> =4.7Ω	-	16	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	67	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	45	-	nS
Turn-Off Fall Time	t <sub>f</sub>		-	14	-	nS
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =60V, I <sub>D</sub> =60A, V <sub>GS</sub> =10V	-	84.7		nC
Gate-Source Charge	Q <sub>gs</sub>		-	30.6		nC
Gate-Drain Charge	Q <sub>gd</sub>		-	18.3		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> =129A	-		1.2	V
Diode Forward Current <sup>(Note 2)</sup>	I <sub>S</sub>		-	-	129	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 <sup>(Note3)</sup>	-	60		nS
Reverse Recovery Charge	Q <sub>rr</sub>		-	140		nC

## Notes:

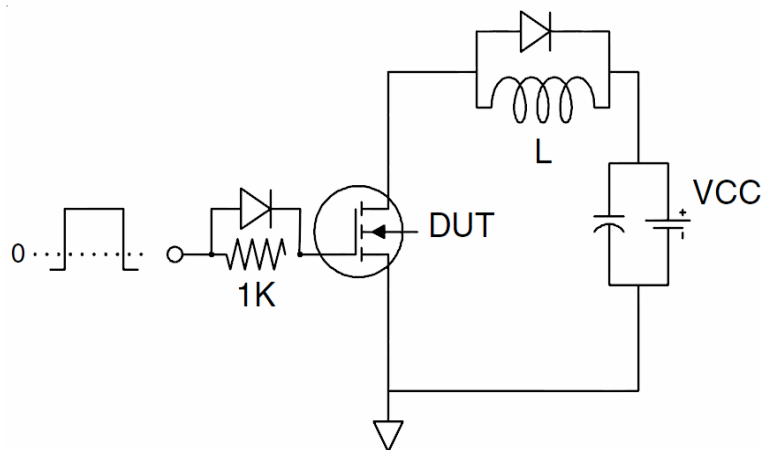
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production
5. EAS condition :  $T_J=25^{\circ}C, V_{DD}=50V, V_G=10V, L=0.5mH, R_g=25\Omega$

## Test Circuit

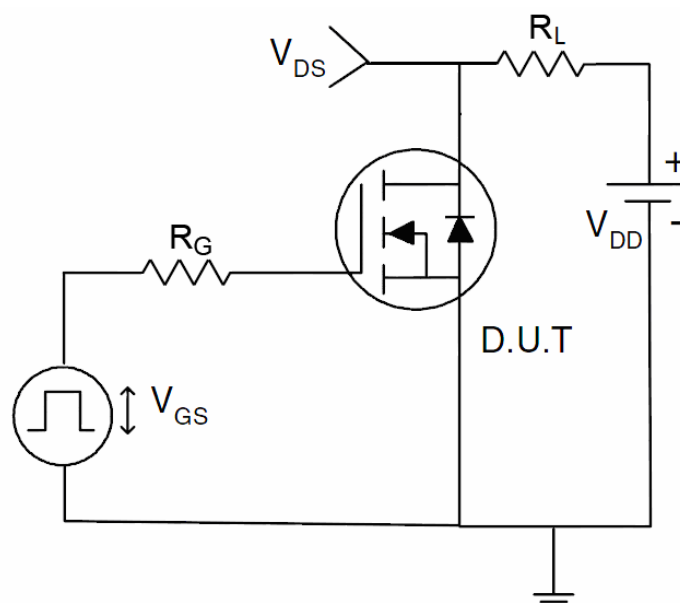
### 1) $E_{AS}$ test Circuit



### 2) Gate charge test Circuit



### 3) Switch Time Test Circuit



## Typical Electrical and Thermal Characteristics

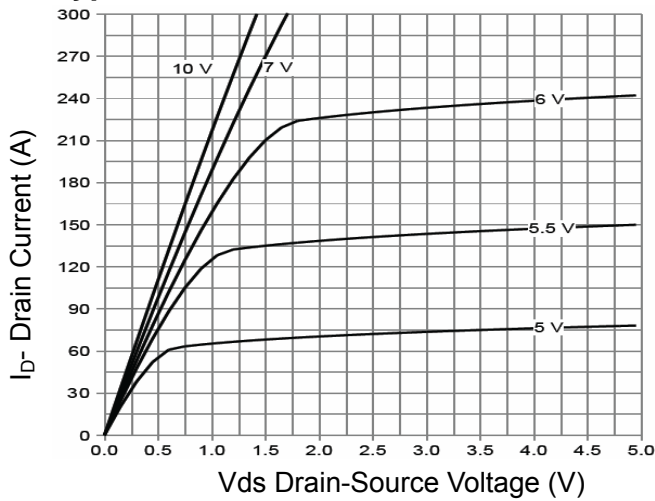


Figure 1 Output Characteristics

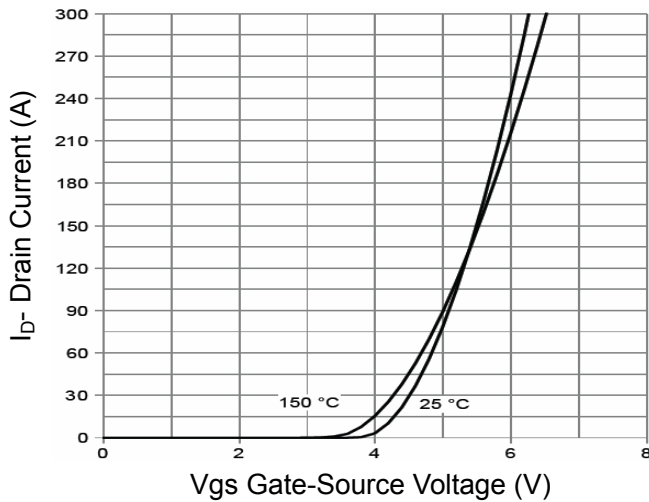


Figure 2 Transfer Characteristics

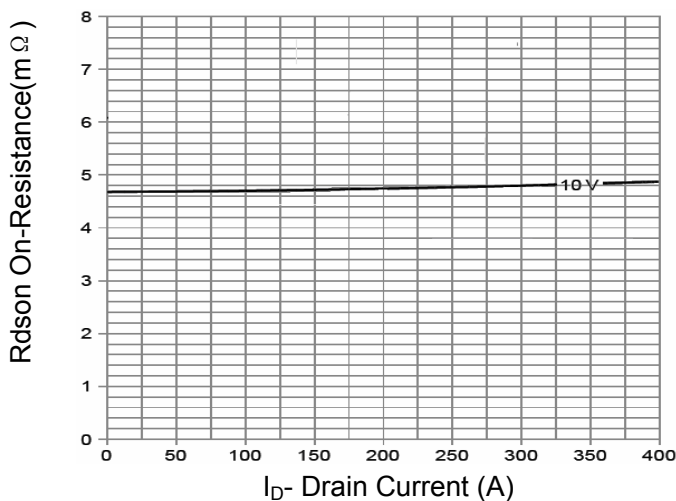


Figure 3  $R_{DS(on)}$ - Drain Current

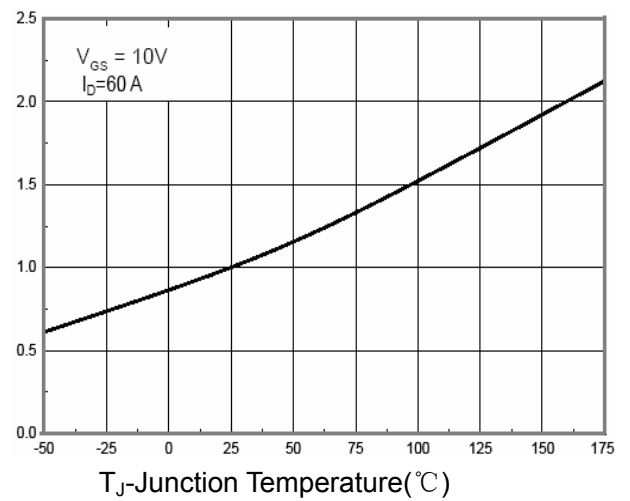


Figure 4  $R_{DS(on)}$ -Junction Temperature

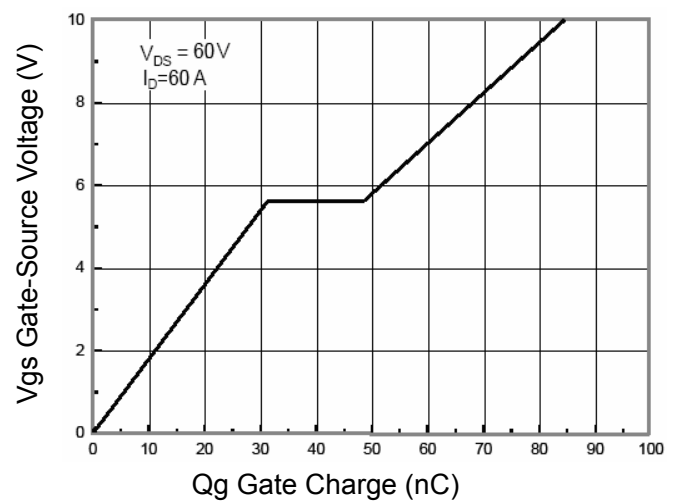


Figure 5 Gate Charge

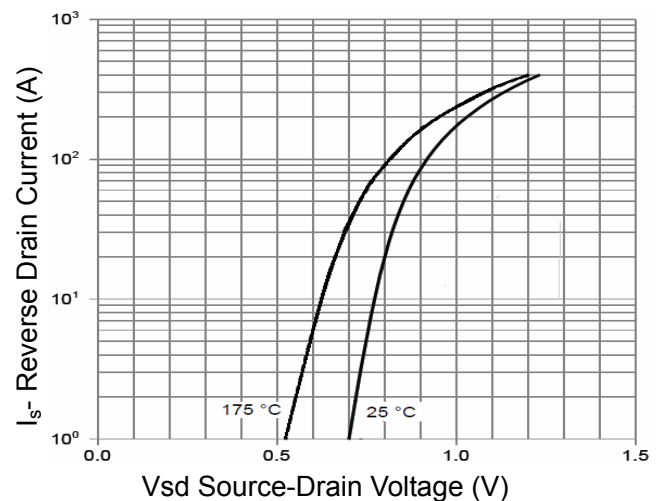


Figure 6 Source- Drain Diode Forward

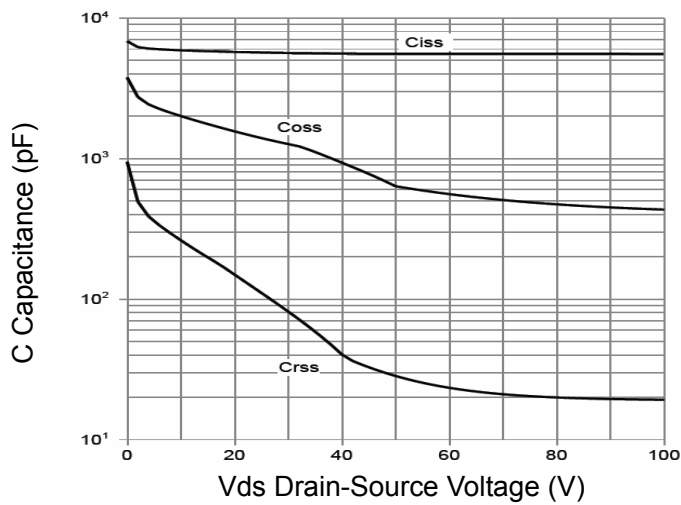


Figure 7 Capacitance vs Vds

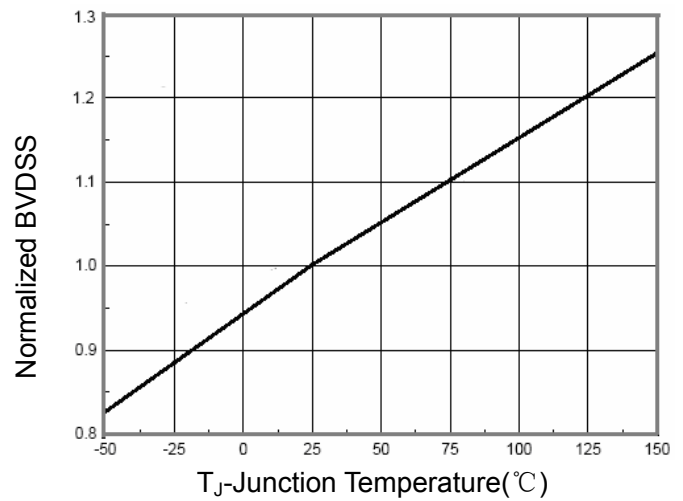


Figure 9  $BV_{DSS}$  vs Junction Temperature

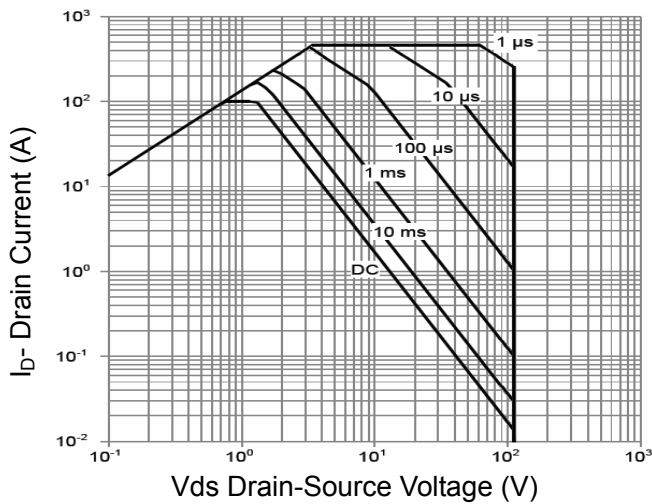


Figure 8 Safe Operation Area

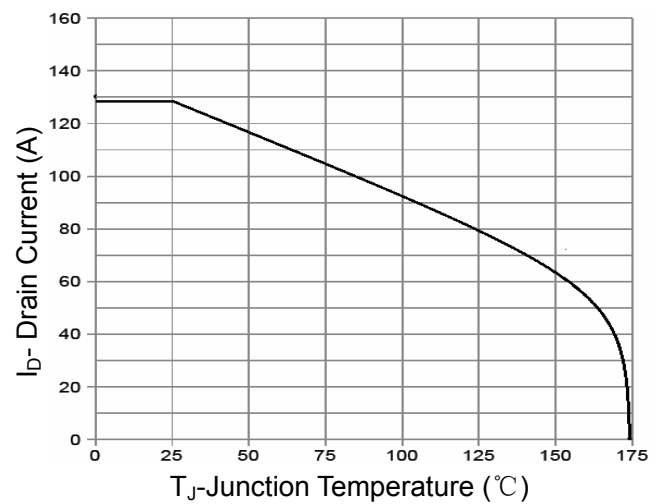


Figure 10 Current De-rating

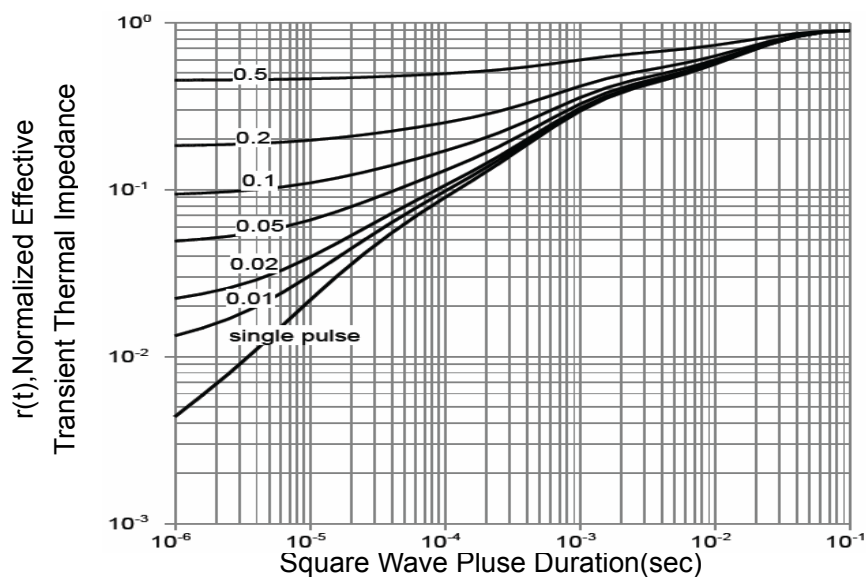
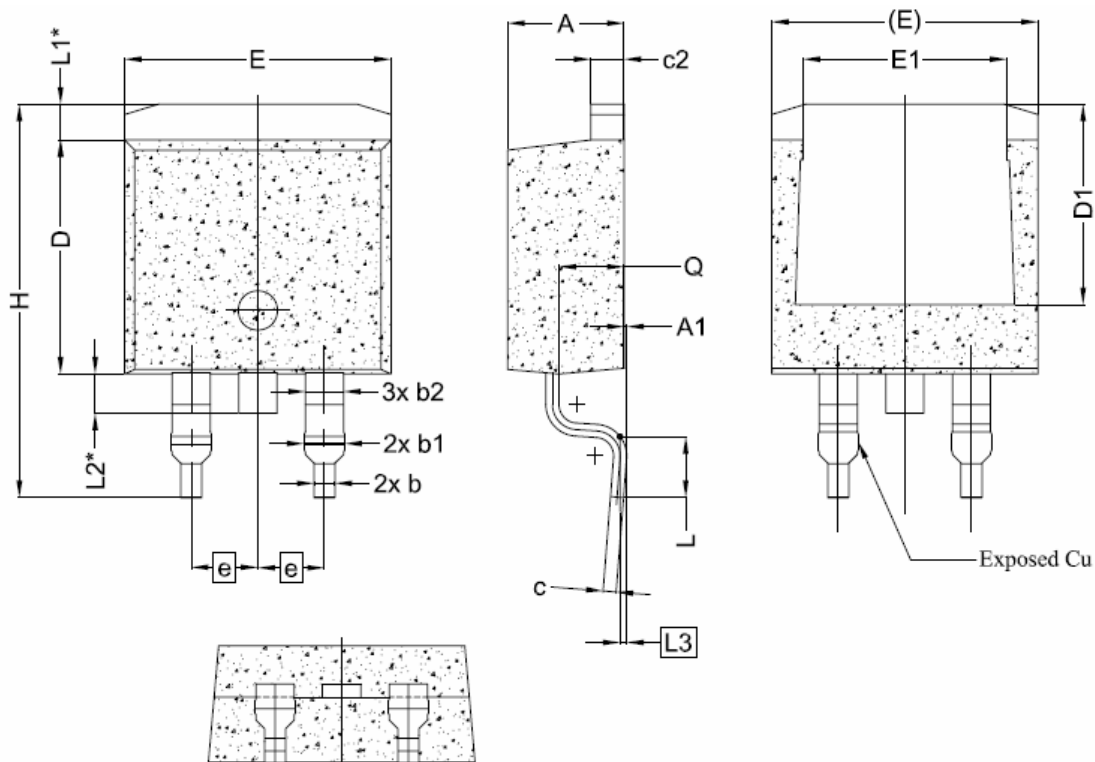


Figure 11 Normalized Maximum Transient Thermal Impedance

## TO-263-2L Package Information



Symbol	Dimensions In Millimeters		
	Min.	Nom.	Max.
A	4.24	4.44	4.64
A1	0.00	0.10	0.25
b	0.70	0.80	0.90
b1	1.20	1.55	1.75
b2	1.20	1.45	1.70
c	0.40	0.50	0.60
c2	1.15	1.27	1.40
D	8.82	8.92	9.02
D1	6.86	7.65	-
E	9.96	10.16	10.36
E1	6.89	7.77	7.89
e	2.54BSC		
H	14.61	15.00	15.88
L	1.78	2.32	2.79
L1	1.36 REF.		
L2	1.50 REF.		
L3	0.25 BSC		
Q	2.30	2.48	2.70

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