

## NCE N-Channel Super Trench Power MOSFET

### Description

The NCEP60T18D 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.

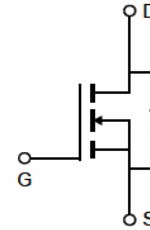
### General Features

- $V_{DS} = 60V, I_D = 180A$   
 $R_{DS(ON)} < 3.2m\Omega @ V_{GS}=10V$  (Typ:2.8m $\Omega$ )
- Excellent gate charge x  $R_{DS(on)}$  product
- Very low on-resistance  $R_{DS(on)}$
- 150 °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%  $\Delta V_d$ s 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
NCEP60T18D	NCEP60T18D	TO-263-2L	-	-	-

### 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)	$I_D$	180	A
Drain Current-Continuous( $T_C=100^\circ C$ )	$I_D(100^\circ C)$	126	A
Pulsed Drain Current	$I_{DM}$	720	A
Maximum Power Dissipation	$P_D$	220	W
Derating factor		1.47	W/ $^\circ C$
Single pulse avalanche energy <sup>(Note 5)</sup>	$E_{AS}$	1036	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>	$R_{\theta JC}$	0.68	$^\circ C/W$
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## Electrical Characteristics ( $T_C=25^\circ\text{C}$ unless otherwise noted)

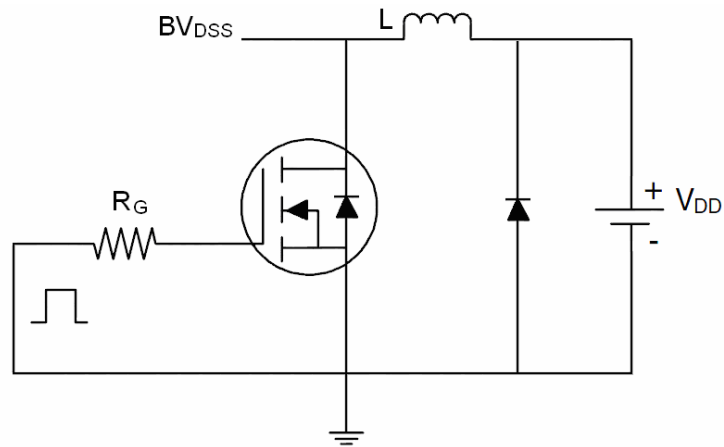
Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	60		-	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=60V, V_{GS}=0V$	-	-	1	$\mu A$
Gate-Body Leakage Current	$I_{GSS}$	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	$\pm 100$	nA
<b>On Characteristics</b> (Note 3)						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	2.0	3.0	4.0	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_D=20A$	-	2.8	3.2	m $\Omega$
Forward Transconductance	$g_{FS}$	$V_{DS}=5V, I_D=20A$	50	-	-	S
<b>Dynamic Characteristics</b> (Note 4)						
Input Capacitance	$C_{iss}$	$V_{DS}=30V, V_{GS}=0V,$ $F=1.0\text{MHz}$	-	4500	-	PF
Output Capacitance	$C_{oss}$		-	965	-	PF
Reverse Transfer Capacitance	$C_{rss}$		-	24	-	PF
<b>Switching Characteristics</b> (Note 4)						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=30V, I_D=20A$ $V_{GS}=10V, R_G=4.7\Omega$	-	6	-	nS
Turn-on Rise Time	$t_r$		-	11	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	23	-	nS
Turn-Off Fall Time	$t_f$		-	3	-	nS
Total Gate Charge	$Q_g$	$V_{DS}=30V, I_D=20A,$ $V_{GS}=10V$	-	70	-	nC
Gate-Source Charge	$Q_{gs}$		-	18.6	-	nC
Gate-Drain Charge	$Q_{gd}$		-	15.3	-	nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage (Note 3)	$V_{SD}$	$V_{GS}=0V, I_S=180A$	-		1.2	V
Diode Forward Current (Note 2)	$I_S$		-	-	180	A
Reverse Recovery Time	$t_{rr}$	$T_J = 25^\circ\text{C}, I_F = I_S$ $di/dt = 100A/\mu\text{s}$ (Note 3)	-	50		nS
Reverse Recovery Charge	$Q_{rr}$		-	66		nC

### Notes:

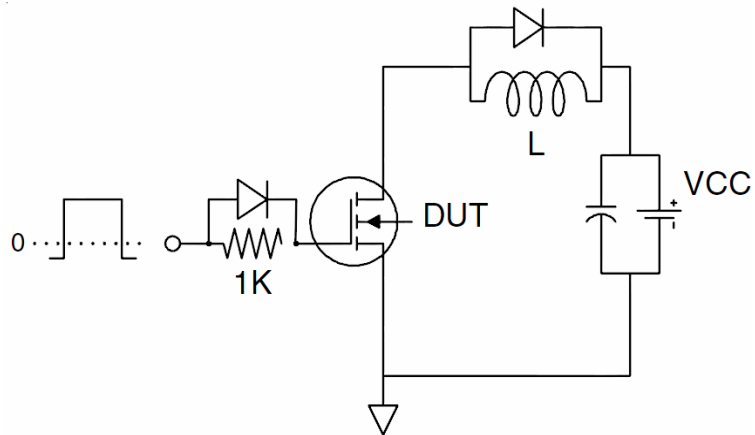
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production
5. EAS condition :  $T_J=25^\circ\text{C}, V_{DD}=30V, V_G=10V, L=0.5\text{mH}, R_g=25\Omega$

## Test Circuit

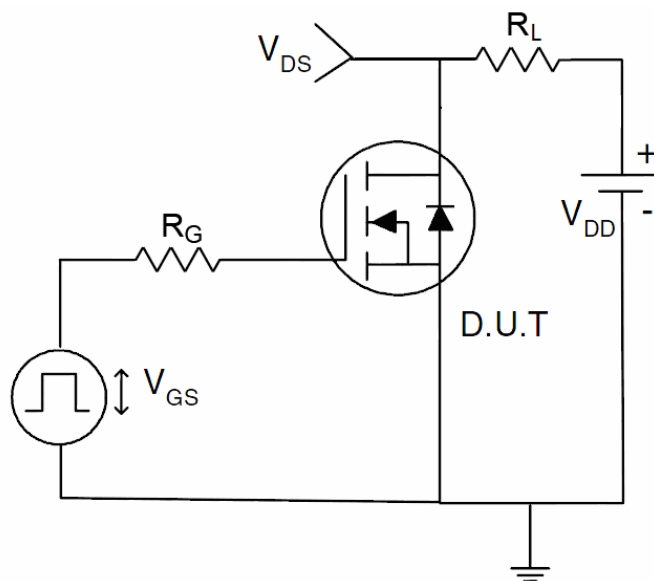
### 1) $E_{AS}$ test Circuit



### 2) Gate charge test Circuit



### 3) Switch Time Test Circuit



Typical Electrical and Thermal Characteristics

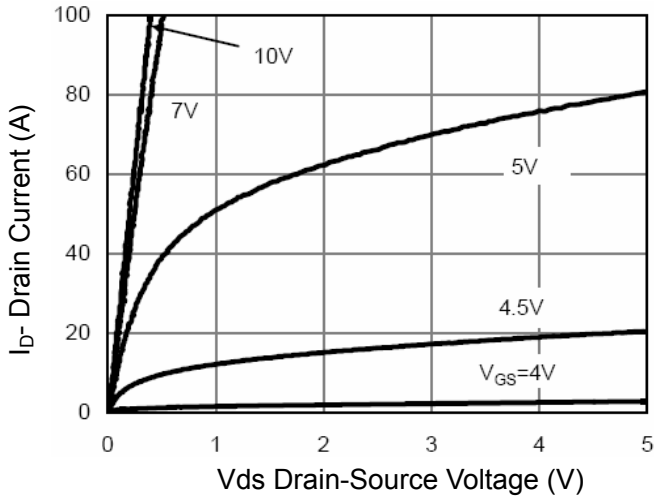


Figure 1 Output Characteristics

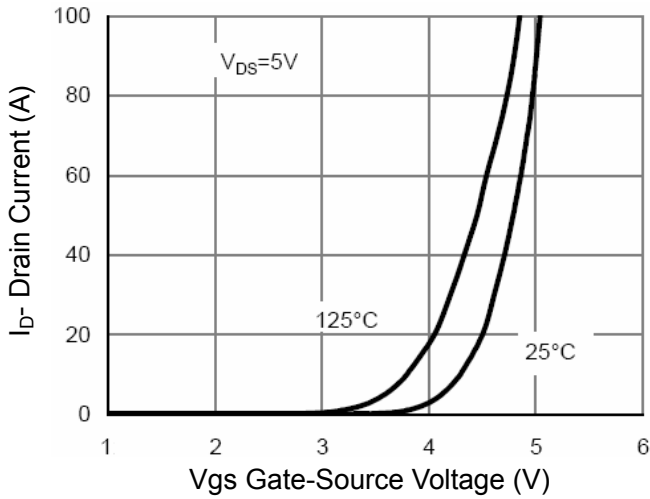


Figure 2 Transfer Characteristics

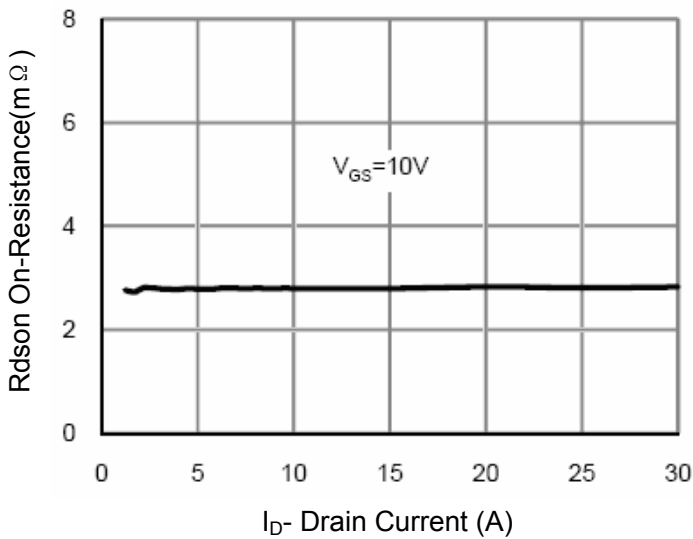


Figure 3 Rdson- Drain Current

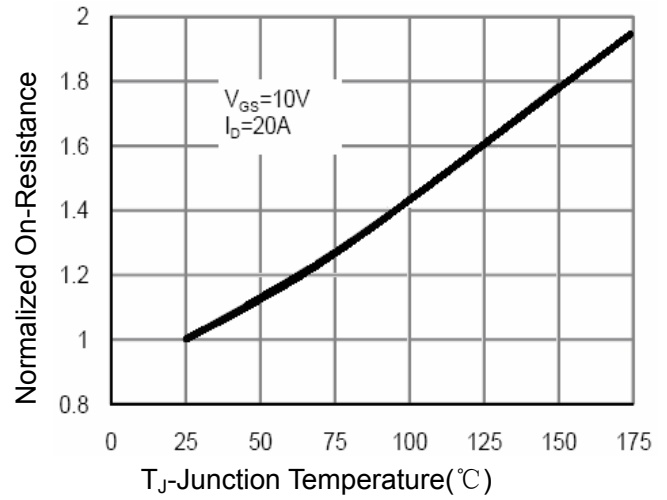


Figure 4 Rdson-Junction Temperature

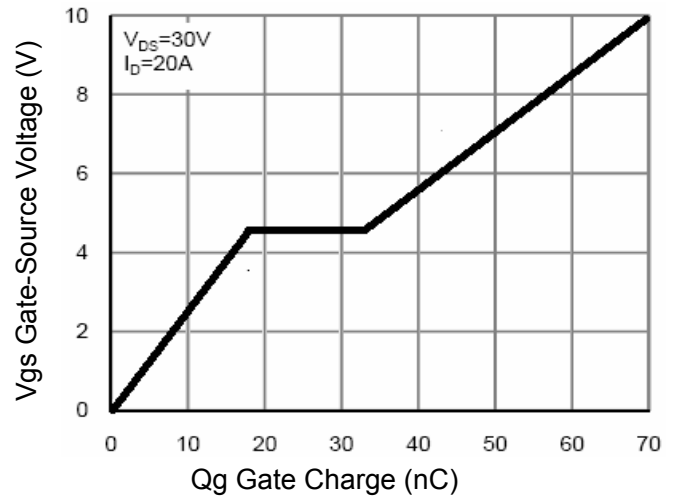


Figure 5 Gate Charge

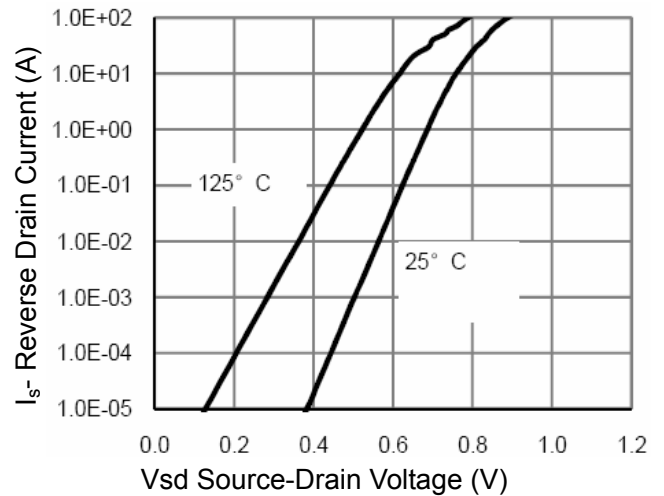


Figure 6 Source- Drain Diode Forward

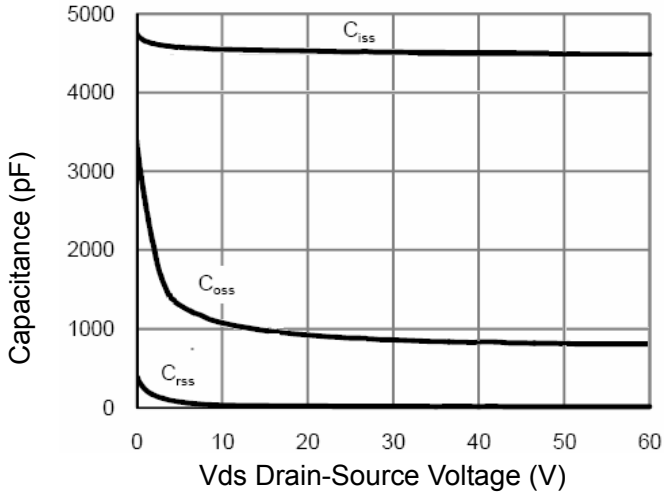


Figure 7 Capacitance vs Vds

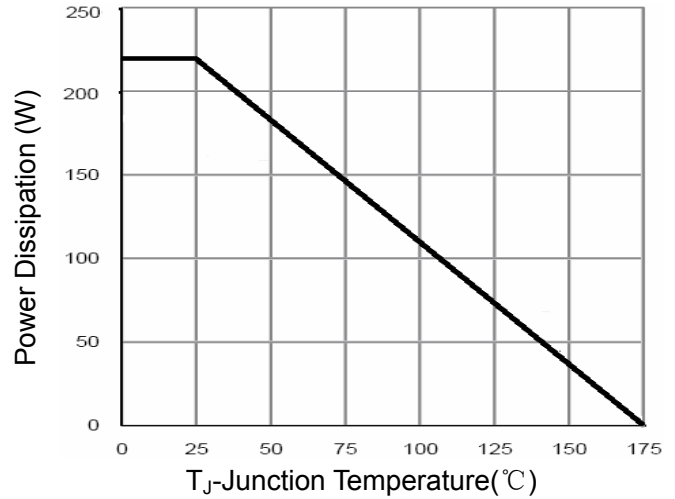


Figure 9 Power De-rating

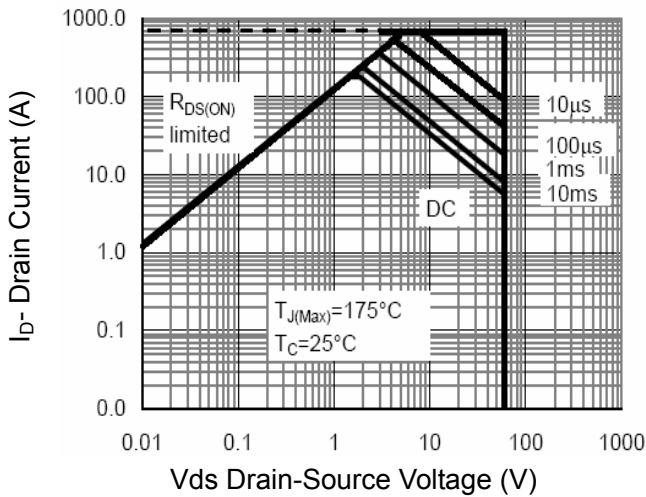


Figure 8 Safe Operation Area

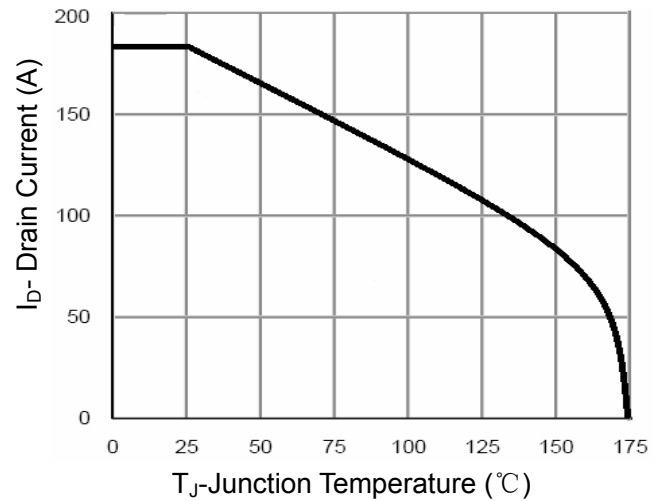


Figure 10 Current De-rating

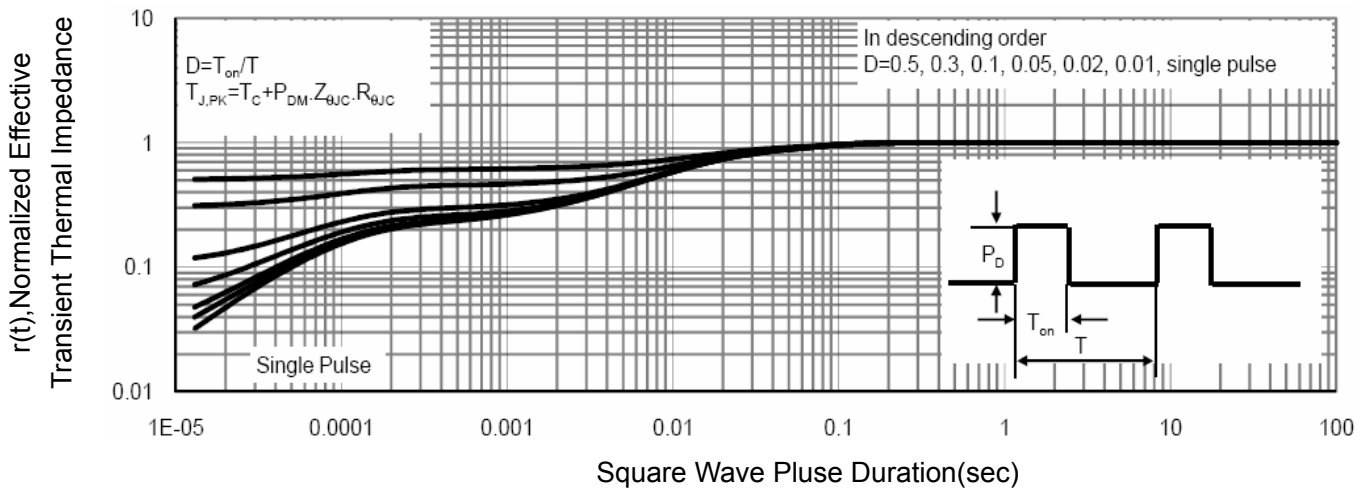
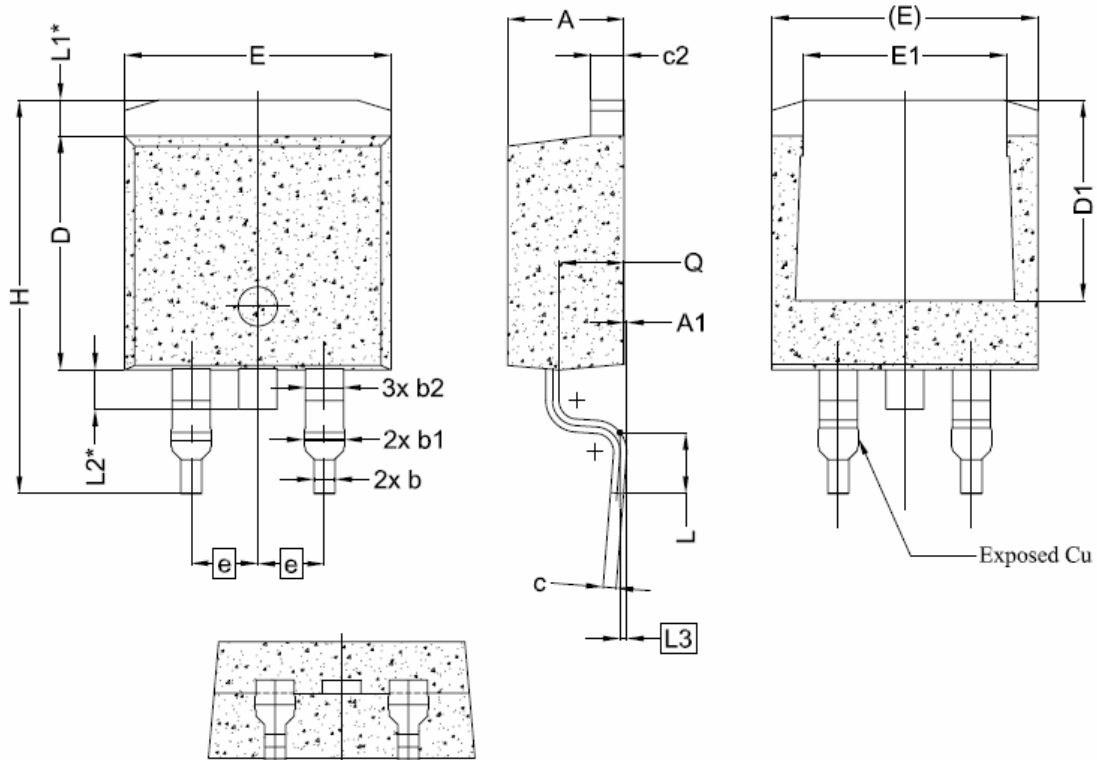
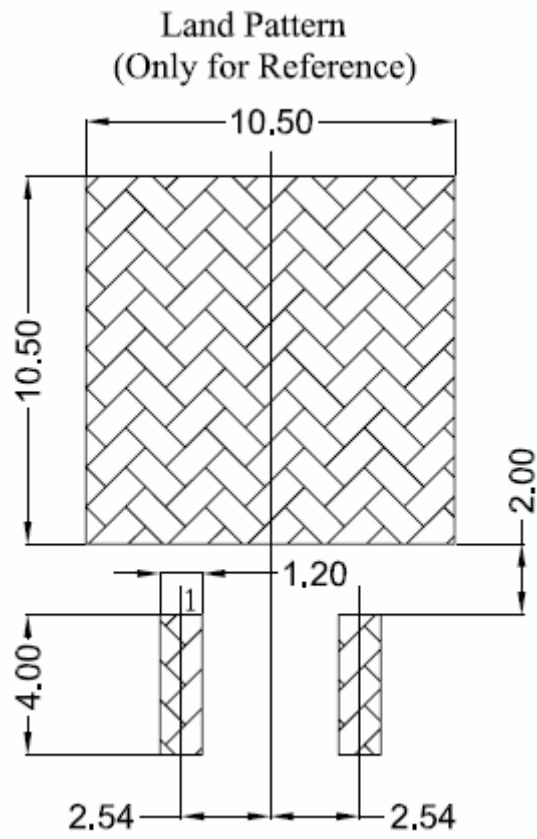


Figure 11 Normalized Maximum Transient Thermal Impedance

**TO-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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