

## NCE N-Channel Super Trench Power MOSFET

### Description

The NCEP60T15AG 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.

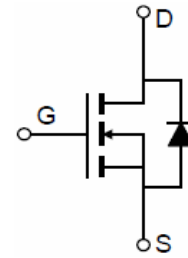
### General Features

- $V_{DS} = 60V, I_D = 150A$
- $R_{DS(ON)} < 3.0m\Omega @ V_{GS}=10V$  (Typ:2.7m $\Omega$ )
- $R_{DS(ON)} < 3.3m\Omega @ V_{GS}=4.5V$  (Typ:2.9m $\Omega$ )
- 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

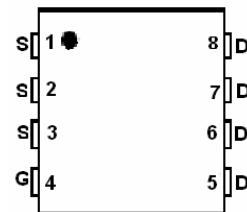
### Application

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

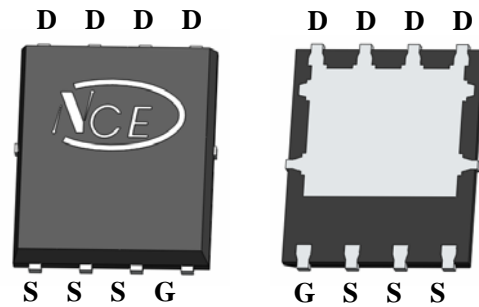
**100% UIS TESTED!**  
**100%  $\Delta V_{ds}$  TESTED!**



Schematic diagram



Marking and pin assignment



Top View

Bottom View

### Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
NCEP60T15AG	NCEP60T15AG	DFN5X6-8L	-	-	-

### 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)	$I_D$	150	A
Drain Current-Continuous( $T_C=100^\circ C$ )	$I_D(100^\circ C)$	105	A
Pulsed Drain Current	$I_{DM}$	600	A
Maximum Power Dissipation	$P_D$	200	W
Derating factor		1.6	W/ $^\circ C$
Single pulse avalanche energy <sup>(Note 5)</sup>	$E_{AS}$	819	mJ
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 150	$^\circ C$

**Thermal Characteristic**

Thermal Resistance, Junction-to-Case <sup>(Note 2)</sup>	$R_{\theta JC}$	0.625	$^{\circ}C/W$
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**Electrical Characteristics ( $T_C=25^{\circ}C$  unless otherwise noted)**

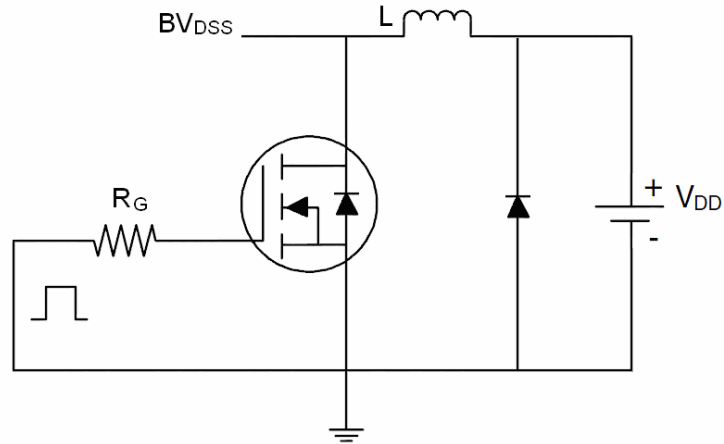
Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	60		-	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=60V, V_{GS}=0V$	-	-	1	$\mu A$
Gate-Body Leakage Current	$I_{GSS}$	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	$\pm 100$	nA
<b>On Characteristics</b> <sup>(Note 3)</sup>						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	1.2	1.8	2.4	V
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS}=10V, I_D=20A$	-	2.7	3.0	m $\Omega$
		$V_{GS}=4.5V, I_D=20A$	-	3.1	3.5	m $\Omega$
Forward Transconductance	$g_{FS}$	$V_{DS}=5V, I_D=20A$	50	-	-	S
<b>Dynamic Characteristics</b> <sup>(Note 4)</sup>						
Input Capacitance	$C_{iss}$	$V_{DS}=30V, V_{GS}=0V,$ $F=1.0MHz$	-	5500	5900	PF
Output Capacitance	$C_{oss}$		-	955	1000	PF
Reverse Transfer Capacitance	$C_{rss}$		-	25	30	PF
<b>Switching Characteristics</b> <sup>(Note 4)</sup>						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=30V, I_D=75A$ $V_{GS}=10V, R_G=4.7\Omega$	-	7	-	nS
Turn-on Rise Time	$t_r$		-	12	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	25	-	nS
Turn-Off Fall Time	$t_f$		-	4	-	nS
Total Gate Charge	$Q_g$	$V_{DS}=30V, I_D=75A,$ $V_{GS}=10V$	-	88	98	nC
Gate-Source Charge	$Q_{gs}$		-	13	15	nC
Gate-Drain Charge	$Q_{gd}$		-	14	16	nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage <sup>(Note 3)</sup>	$V_{SD}$	$V_{GS}=0V, I_S=150A$	-		1.2	V
Diode Forward Current <sup>(Note 2)</sup>	$I_S$		-	-	150	A
Reverse Recovery Time	$t_{rr}$	$T_J = 25^{\circ}C, I_F = I_S$ $di/dt = 100A/\mu s$ <sup>(Note 3)</sup>	-	56		nS
Reverse Recovery Charge	$Q_{rr}$		-	80		nC

**Notes:**

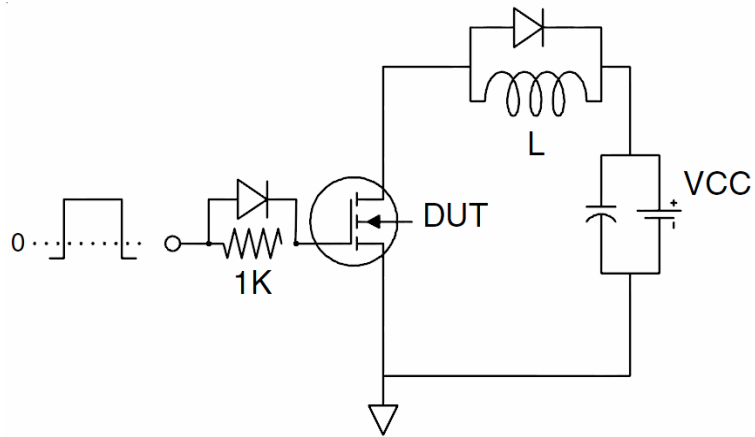
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production
5. EAS condition :  $T_J=25^{\circ}C, V_{DD}=30V, V_G=10V,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

**Test Circuit**

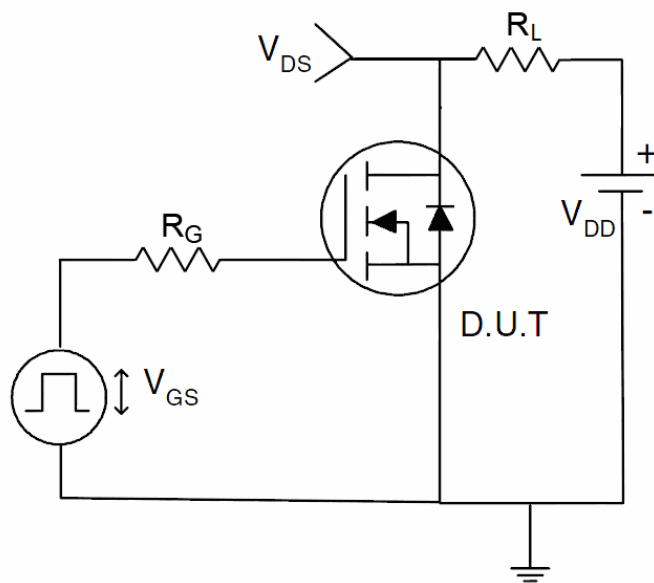
**1) E<sub>AS</sub> test Circuit**



**2) Gate charge test Circuit**



**3) Switch Time Test Circuit**



Typical Electrical and Thermal Characteristics

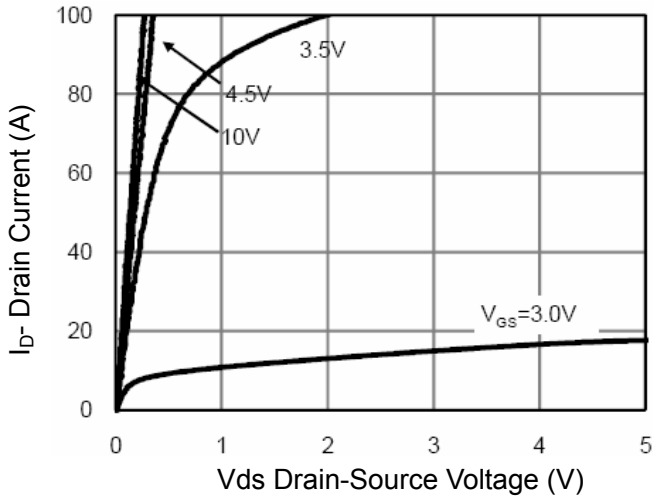


Figure 1 Output Characteristics

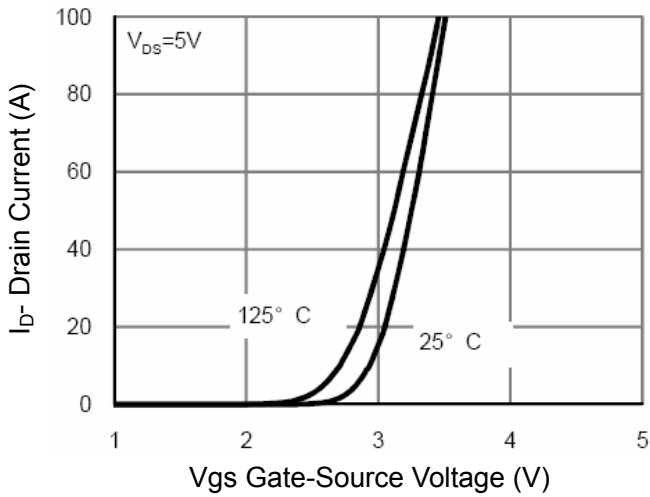


Figure 2 Transfer Characteristics

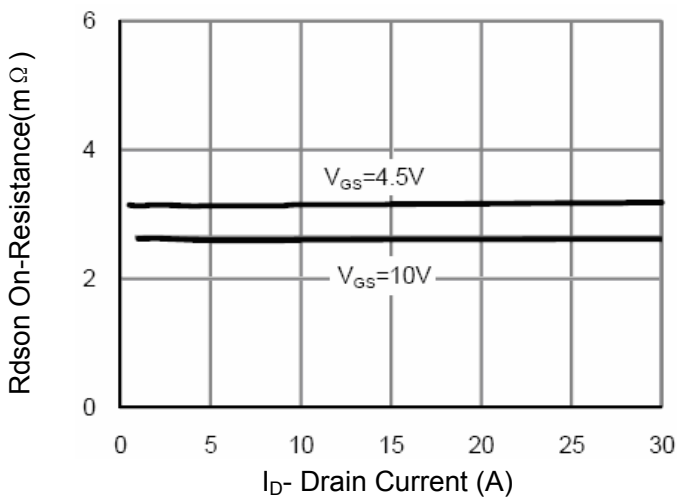


Figure 3 Rds(on)- Drain Current

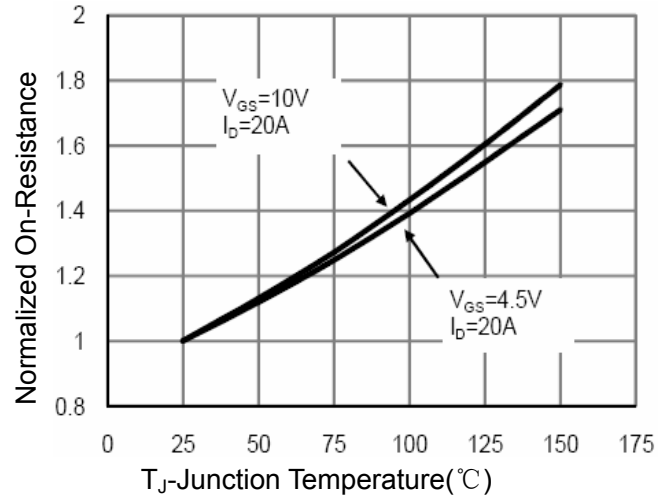


Figure 4 Rds(on)-Junction Temperature

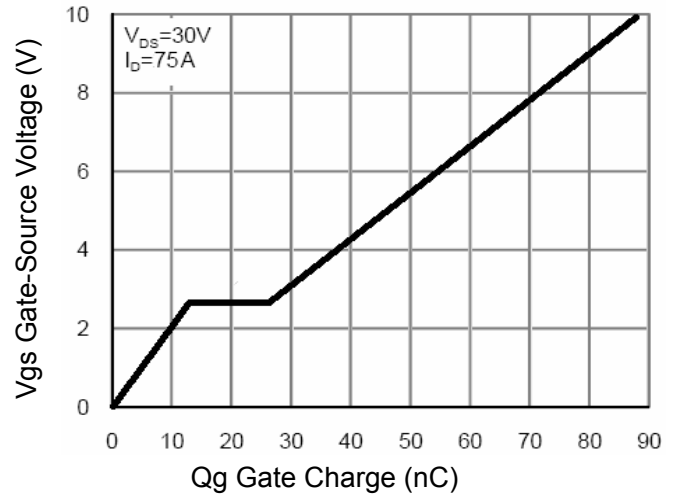


Figure 5 Gate Charge

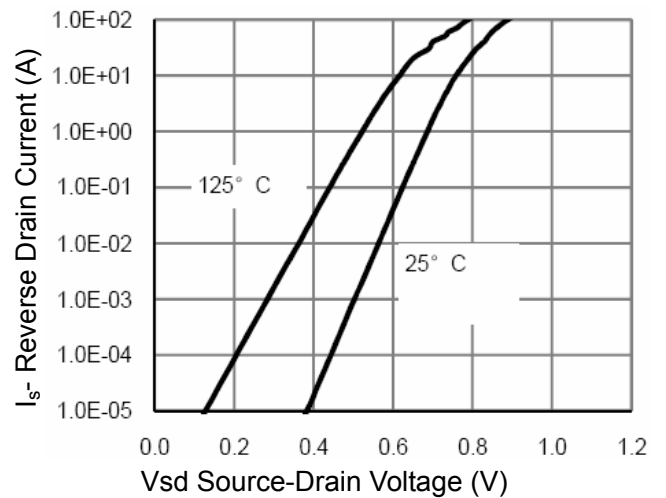


Figure 6 Source- Drain Diode Forward

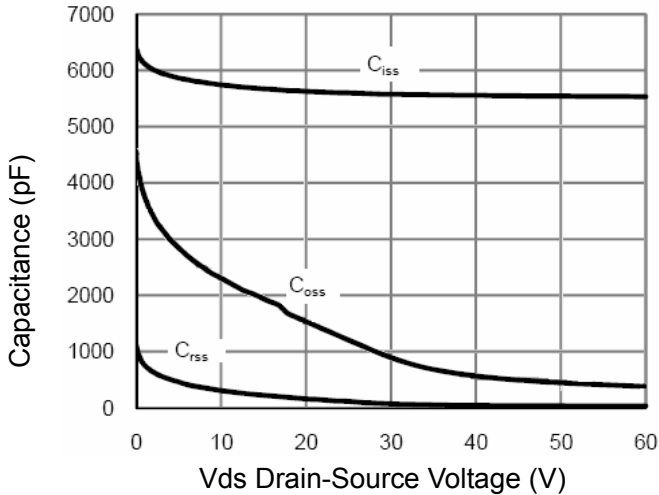


Figure 7 Capacitance vs Vds

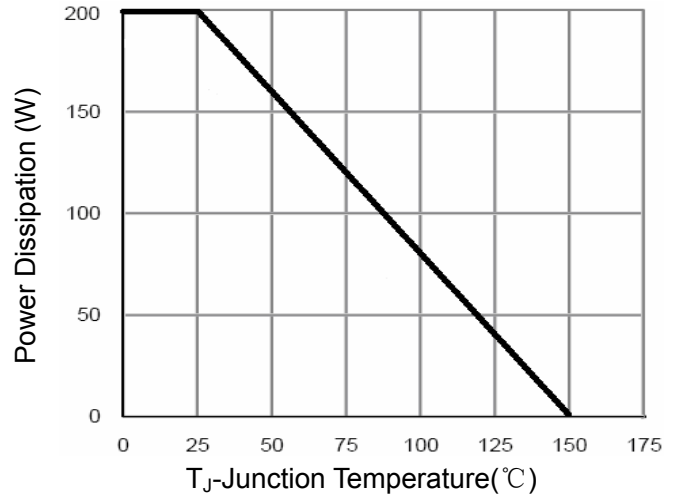


Figure 9 Power De-rating

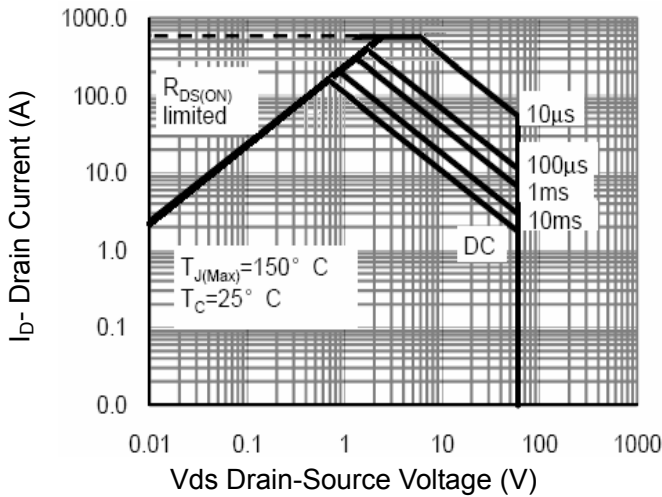


Figure 8 Safe Operation Area

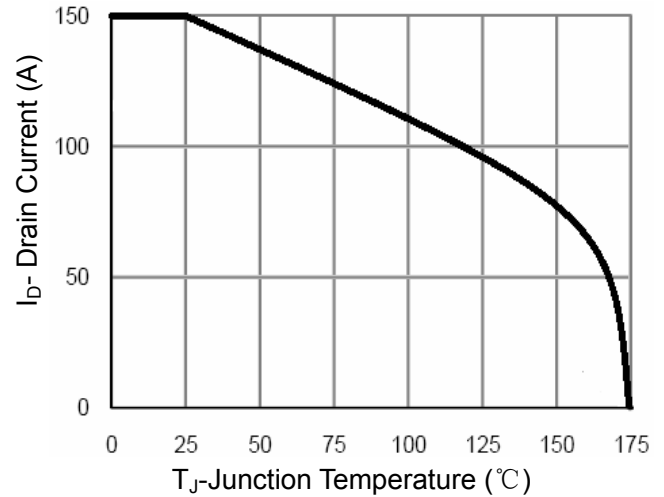


Figure 10 Current De-rating

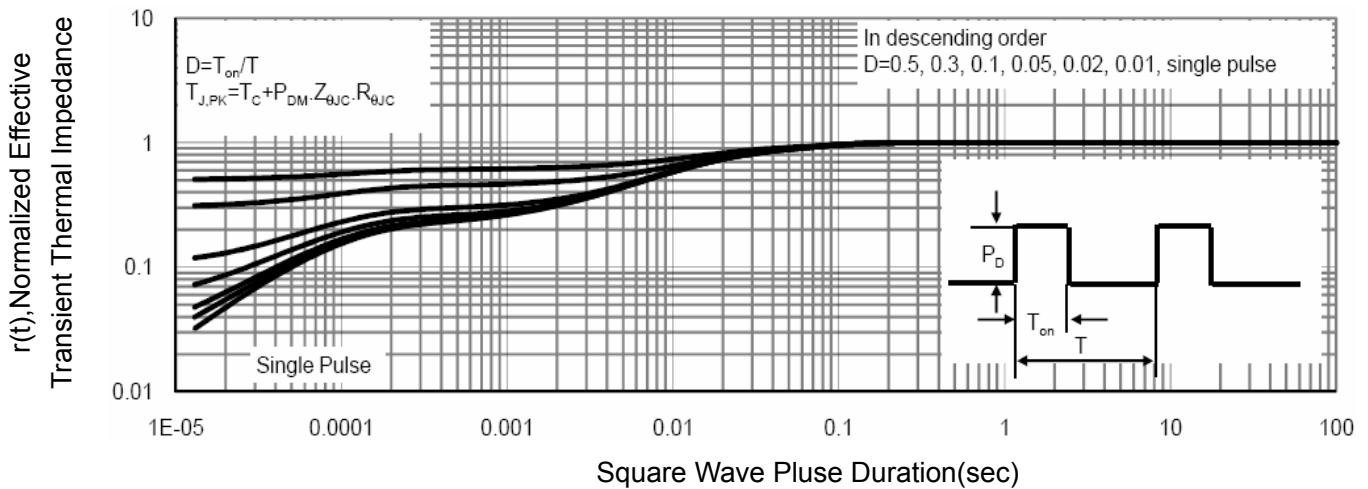
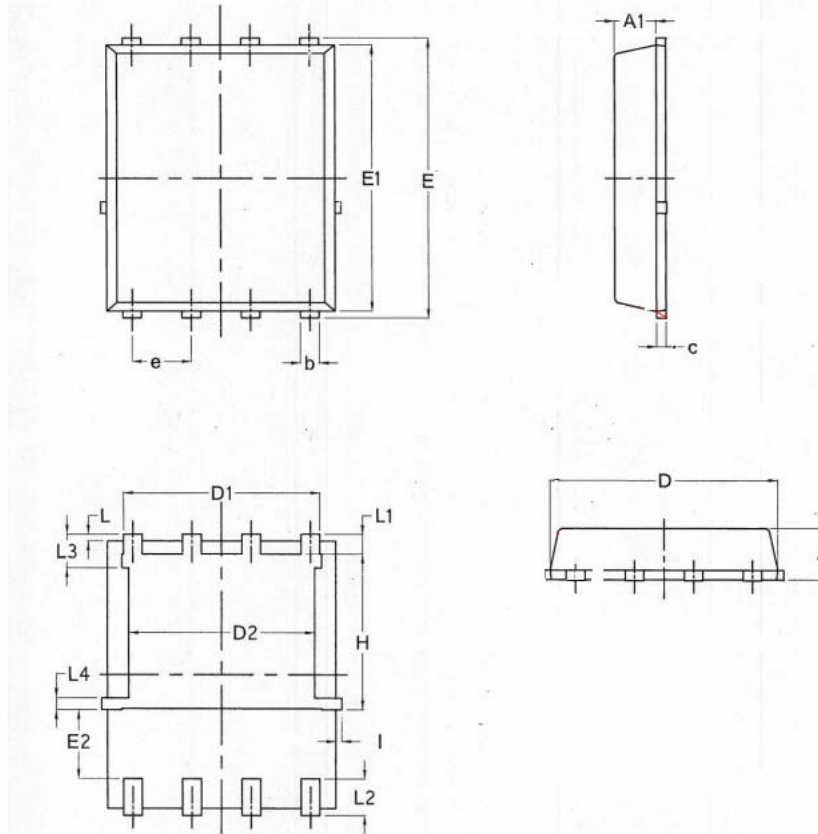


Figure 11 Normalized Maximum Transient Thermal Impedance

**DFN5X6-8L Package Information**


Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	0.90	1.10	1.17	0.0354	0.0433	0.0461
A1	0.824	0.897	0.97	0.0324	0.0353	0.0382
b	0.33	0.41	0.50	0.0130	0.0161	0.0197
C	0.150	0.20	0.250	0.0059	0.0079	0.0098
D	4.80	4.90	5.00	0.1890	0.1929	0.1969
D1	3.91	4.22	4.36	0.1539	0.1661	0.1717
D2	3.85	4.00	4.15	0.1516	0.1575	0.1634
E	5.90	60.5	6.15	0.2323	0.2382	0.2421
E1	5.65	5.76	5.85	0.2224	0.2268	0.2303
E2	1.10	/	/	0.0433	/	/
e	1.27 BSC			0.050 BSC		
L	0.05	0.15	0.25	0.0020	0.0059	0.0098
L1	0.38	0.425	0.50	0.0150	0.0167	0.0197
L2	0.51	0.785	0.86	0.0201	0.0309	0.0339
L3	0.55	0.70	0.85	0.0217	0.0276	0.0335
L4	0.10	0.25	0.40	0.0039	0.0098	0.0157
H	3.25	3.35	3.58	0.1280	0.1319	0.1409
I	0	/	0.18	0	/	0.0071

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