

## NCE N-Channel Enhancement Mode Power MOSFET

### Description

The NCE6020AQ 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.

### Application

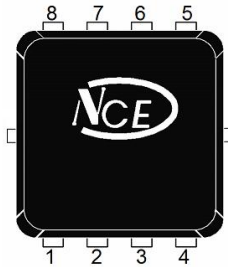
- Power switching application
- Hard switched and high frequency circuits
- Uninterruptible power supply

### General Features

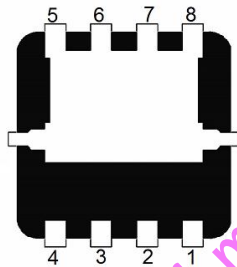
- $V_{DS} = 60V, I_D = 20A$   
 $R_{DS(ON)} < 23m\Omega @ V_{GS}=10V$   
 $R_{DS(ON)} < 30m\Omega @ V_{GS}=4.5V$
- High power and current handling capability
- Fully characterized avalanche voltage and current
- Lead free product is acquired
- Surface mount package

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

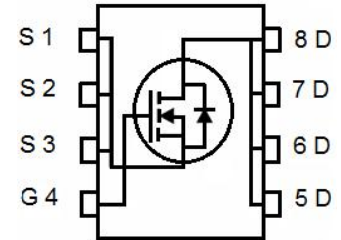
### DFN 3.3X3.3



Top View



Bottom View



Schematic Diagram

### Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
NCE6020AQ	NCE6020AQ	DFN3.3X3.3-8L	-	-	-

### Absolute Maximum Ratings ( $T_A=25^\circ C$ 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	$I_D$	20	A
Drain Current-Continuous( $T_C=100^\circ C$ )	$I_D(100^\circ C)$	14	A
Pulsed Drain Current <sup>(Note 1)</sup>	$I_{DM}$	60	A
Maximum Power Dissipation	$P_D$	20	W
Single pulse avalanche energy <sup>(Note 5)</sup>	$E_{AS}$	72	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>	$R_{\theta JC}$	6.3	$^\circ C/W$
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## Electrical Characteristics (T<sub>A</sub>=25°C unless otherwise noted)

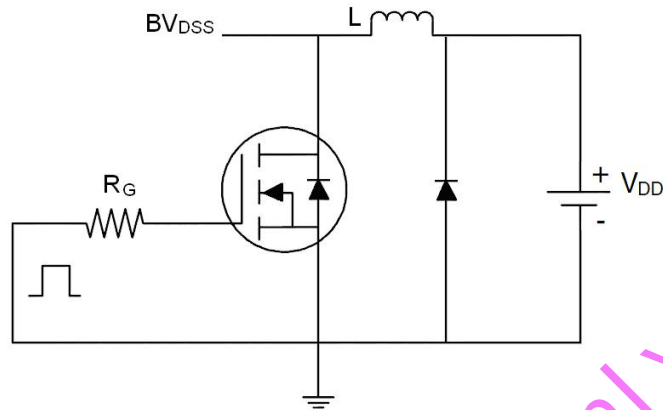
Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V, I <sub>D</sub> =250μA	60	-	-	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =60V, V <sub>GS</sub> =0V	-	-	1	μA
Gate-Body Leakage Current	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	1.2	1.6	2.5	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =10A	-	20	23	mΩ
		V <sub>GS</sub> =4.5V, I <sub>D</sub> =10A		25	30	
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =5V, I <sub>D</sub> =10A	11	-	-	S
<b>Dynamic Characteristics</b> (Note 4)						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =30V, V <sub>GS</sub> =0V, F=1.0MHz	-	973.2	-	PF
Output Capacitance	C <sub>oss</sub>		-	61.2	-	PF
Reverse Transfer Capacitance	C <sub>rss</sub>		-	58.8	-	PF
<b>Switching Characteristics</b> (Note 4)						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =30V, R <sub>L</sub> =3Ω	-	7	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	20	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>	V <sub>GS</sub> =10V, R <sub>G</sub> =3Ω	-	16	-	nS
Turn-Off Fall Time	t <sub>f</sub>		-	23	-	nS
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =30V, I <sub>D</sub> =10A, V <sub>GS</sub> =10V	-	25		nC
Gate-Source Charge	Q <sub>gs</sub>		-	4.5		nC
Gate-Drain Charge	Q <sub>gd</sub>		-	6.5		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> =10A	-		1.2	V
Diode Forward Current (Note 2)	I <sub>S</sub>		-	-	20	A
Reverse Recovery Time	t <sub>rr</sub>	T <sub>J</sub> = 25°C, I <sub>F</sub> =10A	-	29	-	nS
Reverse Recovery Charge	Q <sub>rr</sub>	di/dt = 100A/μs (Note 3)	-	49	-	nC
Forward Turn-On Time	t <sub>on</sub>	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				

### Notes:

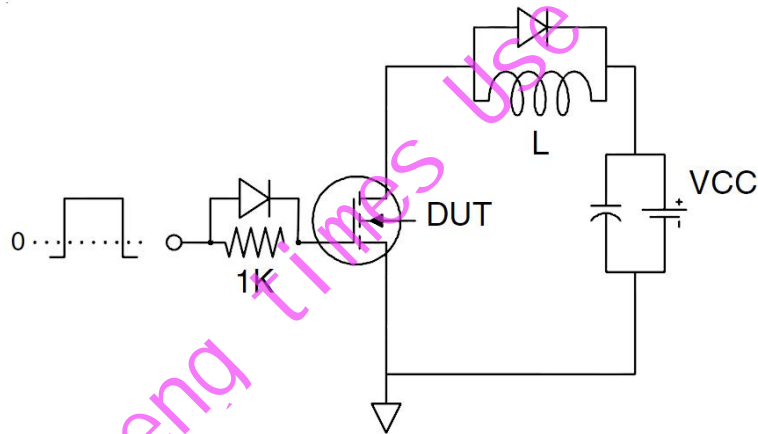
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board, t ≤ 10 sec.
3. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.
4. Guaranteed by design, not subject to production
5. EAS condition: T<sub>J</sub>=25°C, V<sub>DD</sub>=30V, V<sub>G</sub>=10V,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

## Test Circuit

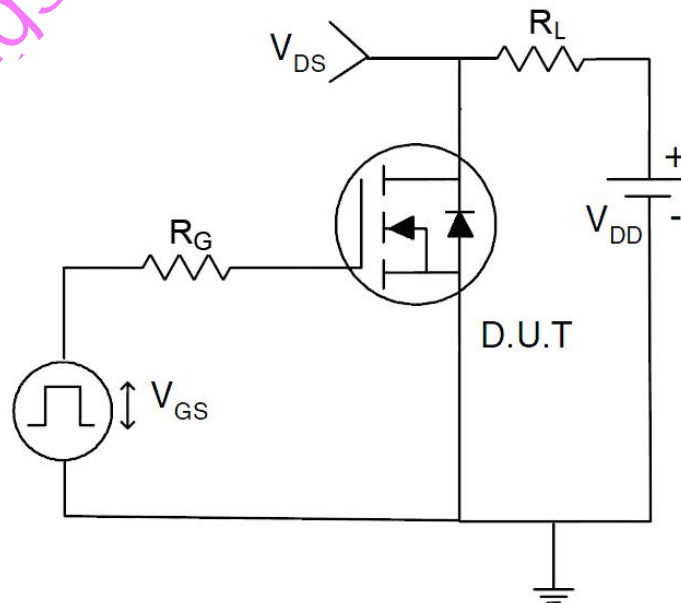
### 1) $E_{AS}$ test Circuit



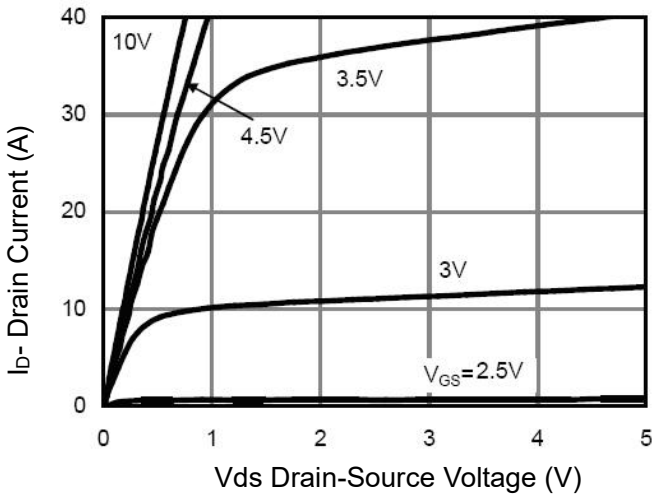
### 2) Gate charge test Circuit



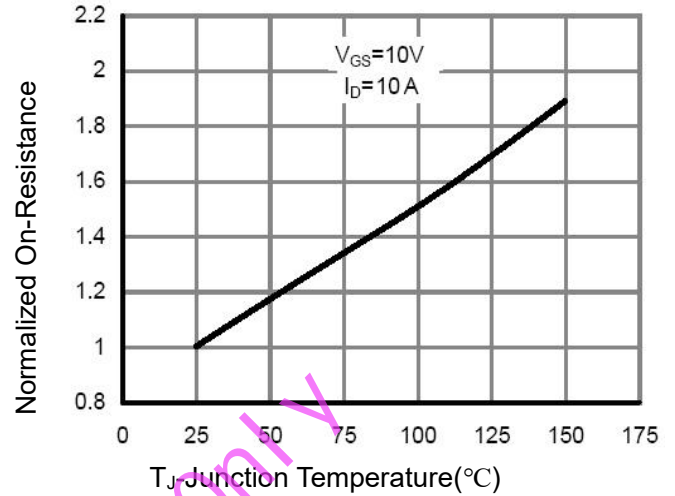
### 3) Switch Time Test Circuit



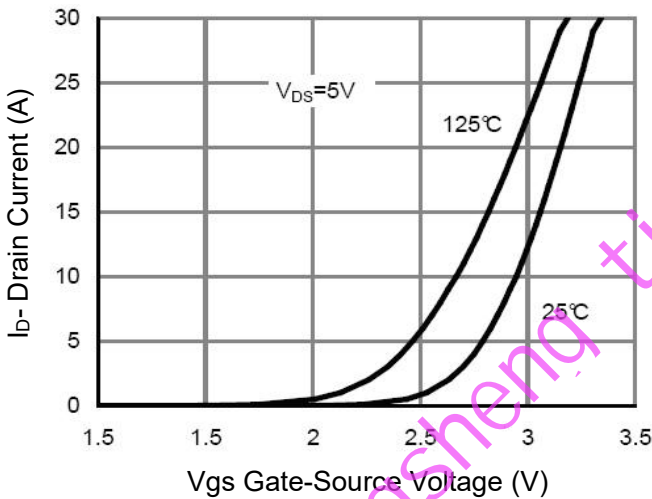
**Typical Electrical and Thermal Characteristics (Curves)**



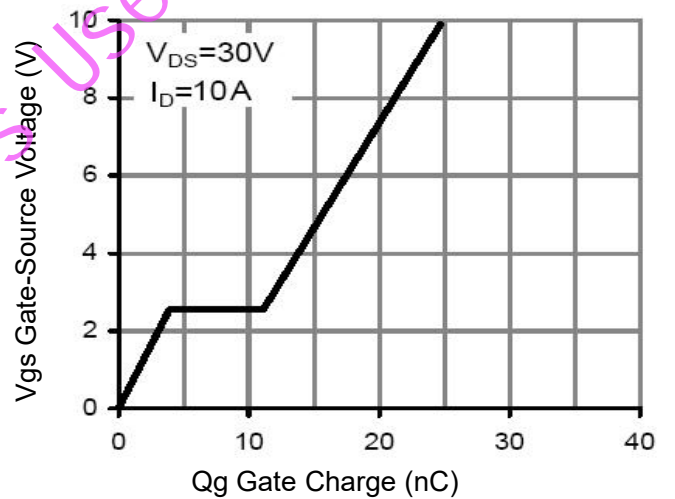
**Figure 1 Output Characteristics**



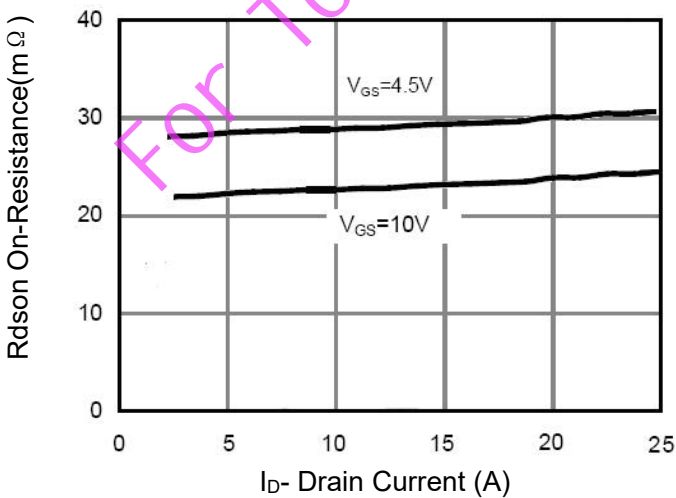
**Figure 4  $R_{ds(on)}$ -Junction Temperature**



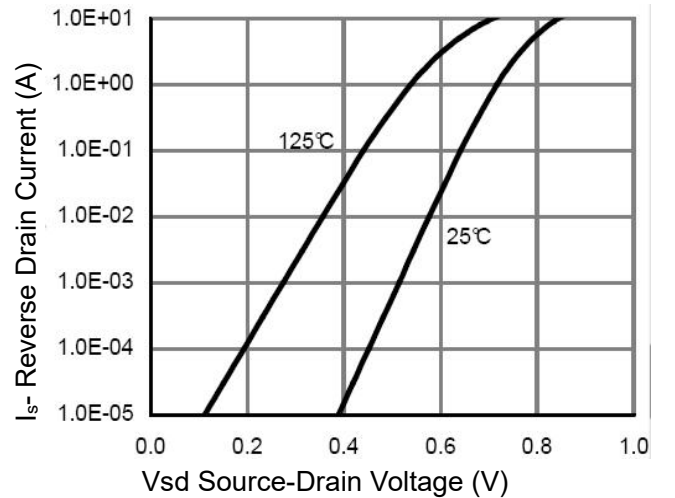
**Figure 2 Transfer Characteristics**



**Figure 5 Gate Charge**



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



**Figure 6 Source- Drain Diode Forward**

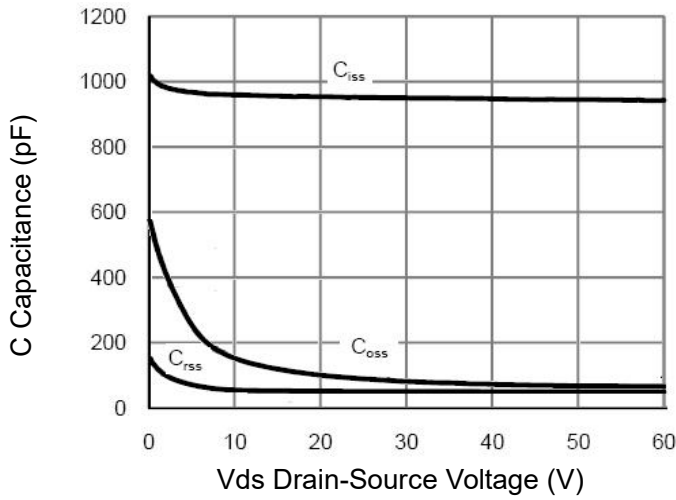


Figure 7 Capacitance vs Vds

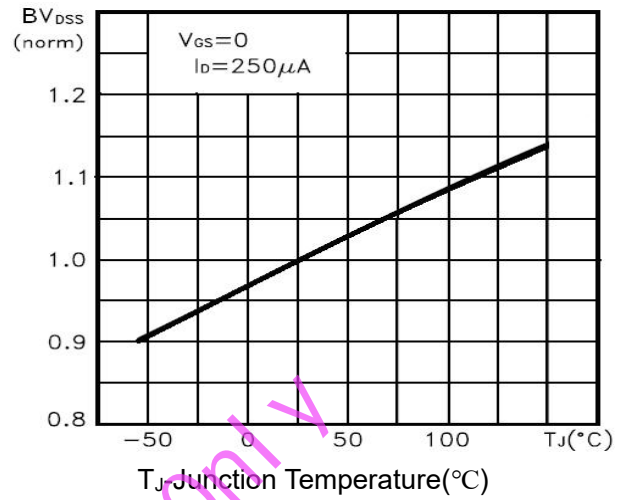


Figure 9  $BV_{dss}$  vs Junction Temperature

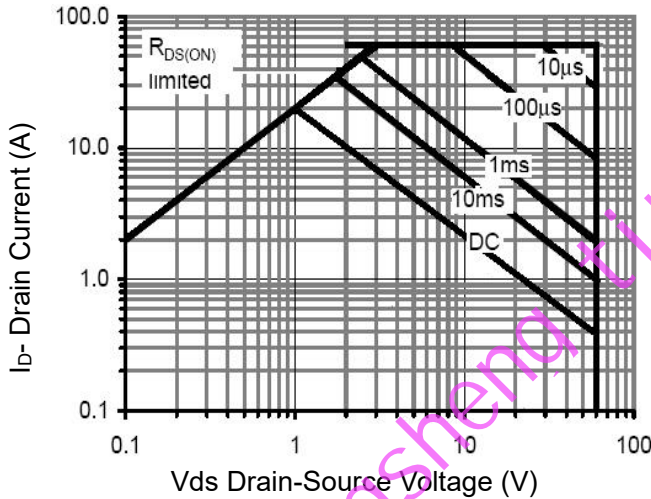


Figure 8 Safe Operation Area

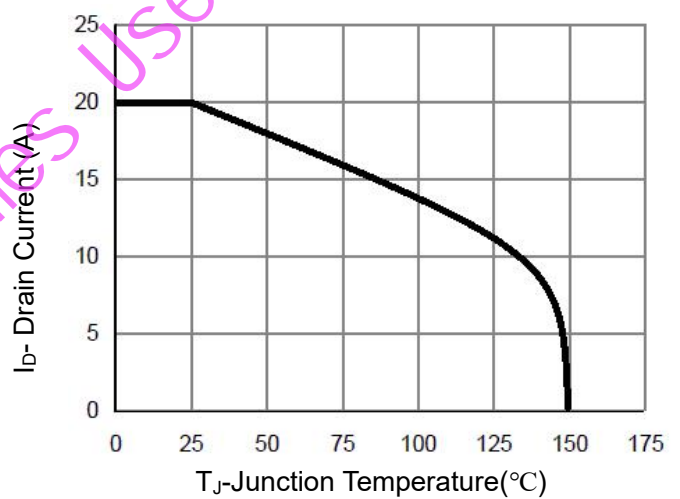


Figure 10 Current De-rating

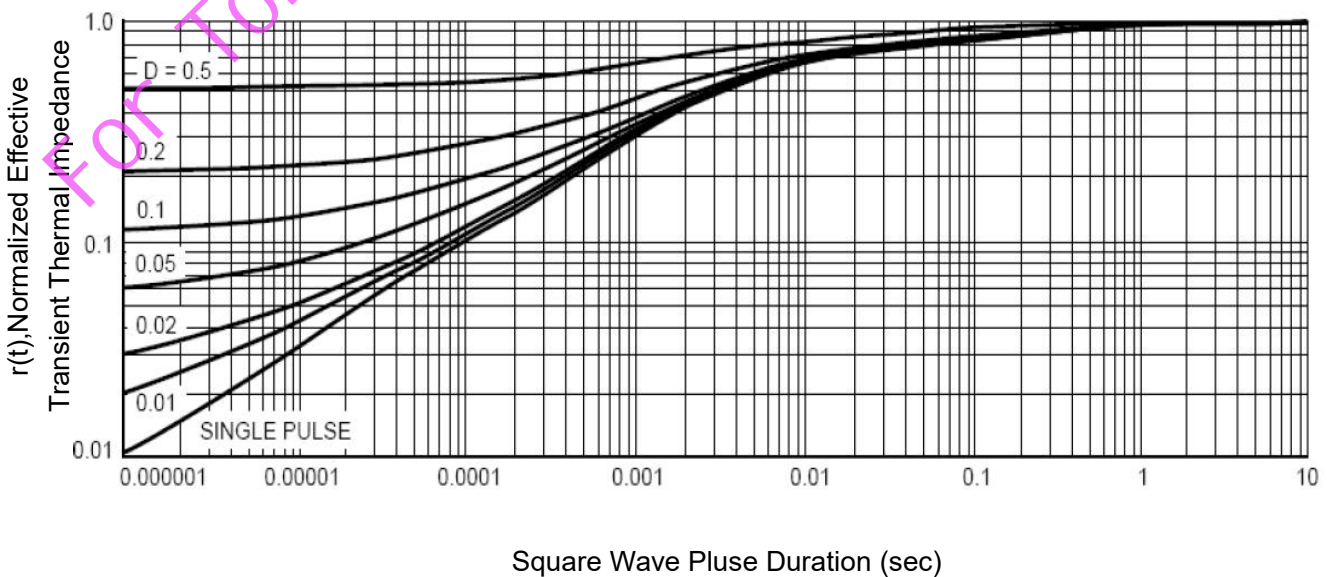
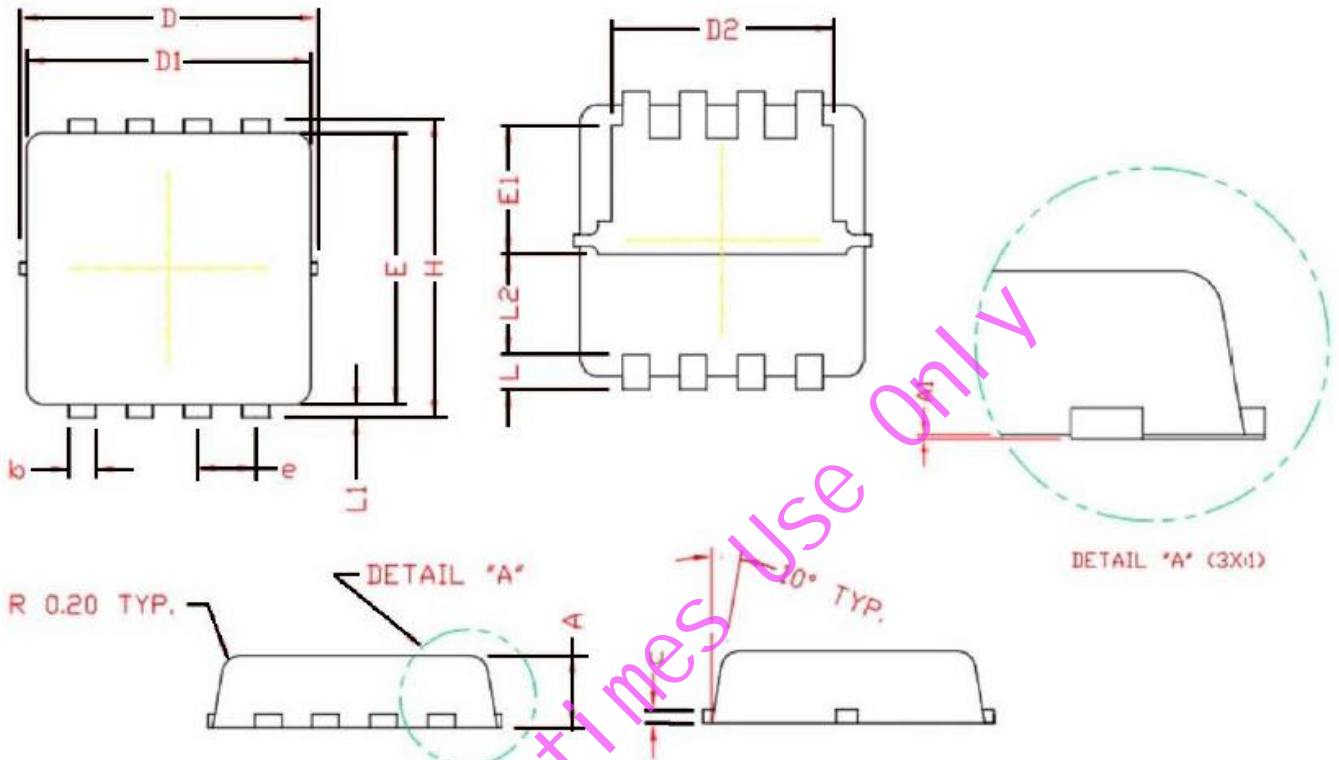


Figure 12 Normalized Maximum Transient Thermal Impedance

DFN3.3X3.3-8L Package Information



COMMON DIMENSIONS  
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	0.70	0.80	0.90
A1	0.00	0.03	0.05
b	0.24	0.30	0.35
c	0.10	0.15	0.20
D	3.25	3.32	3.40
D1	3.05	3.15	3.25
D2	2.40	2.50	2.60
E	3.00	3.10	3.20
E1	1.35	1.45	1.55
e	0.65 BSC.		
H	3.20	3.30	3.40
L	0.30	0.40	0.50
L1	0.10	0.15	0.20
L2	1.13 REF.		

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