

## NCE N-Channel Super Trench Power MOSFET

### Description

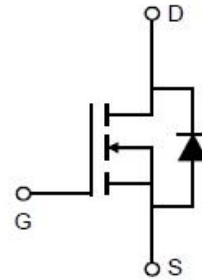
The NCEP40T15GU uses **Super Trench** technology that is uniquely optimized to provide the most efficient high frequency switching performance. Both conduction and switching power losses are minimized due to an extremely low combination of  $R_{DS(ON)}$  and  $Q_g$ . This device is ideal for high-frequency switching and synchronous rectification.

### General Features

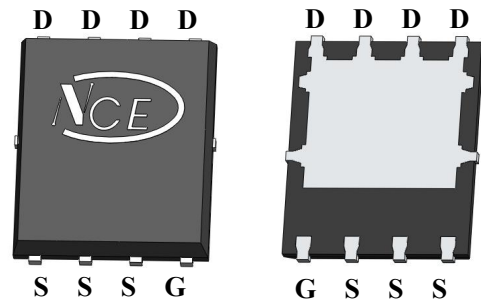
- $V_{DS} = 40V, I_D = 150A$   
 $R_{DS(ON)} = 1.09m\Omega$  (typical) @  $V_{GS} = 10V$   
 $R_{DS(ON)} = 1.5m\Omega$  (typical) @  $V_{GS} = 4.5V$
- Excellent gate charge x  $R_{DS(on)}$  product(FOM)
- Very low on-resistance  $R_{DS(on)}$
- 150 °C operating temperature
- Pb-free lead plating
- 100% UIS tested

### Application

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



Schematic Diagram



Top View

Bottom View

**100% UIS TESTED!**

**100% ΔVds TESTED!**

### Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
P40T15GU	NCEP40T15GU	DFN5X6-8L	-	-	-

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	40	V
Gate-Source Voltage	$V_{GS}$	±20	V
Drain Current-Continuous (Silicon Limited)	$I_D$	150	A
Drain Current-Continuous( $T_c = 100^\circ C$ )	$I_D(100^\circ C)$	106	A
Pulsed Drain Current	$I_{DM}$	600	A
Maximum Power Dissipation	$P_D$	135	W
Derating factor		1.1	W/°C
Single pulse avalanche energy (Note 1)	$E_{AS}$	1500	mJ
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 150	°C

## Thermal Characteristic

Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	0.93	$^{\circ}C/W$
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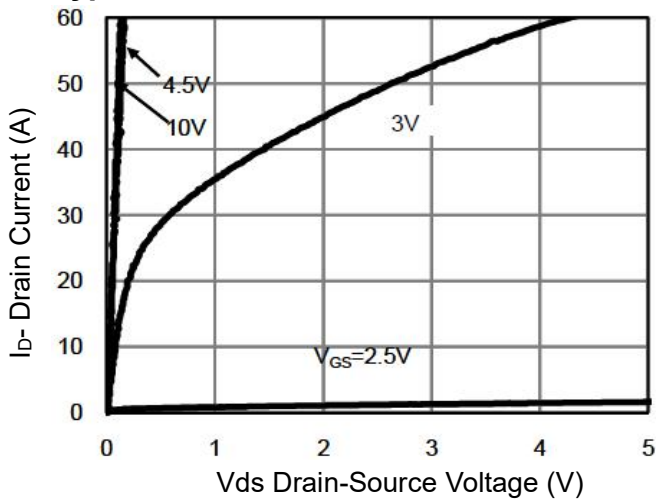
## Electrical Characteristics ( $T_C=25^{\circ}C$ unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	40		-	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=40V, V_{GS}=0V$	-	-	1	$\mu A$
Gate-Body Leakage Current	$I_{GSS}$	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	$\pm 100$	nA
<b>On Characteristics</b>						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	1.0	1.5	2.2	V
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS}=10V, I_D=20A$	-	1.09	1.35	m $\Omega$
		$V_{GS}=4.5V, I_D=20A$	-	1.5	1.85	m $\Omega$
Gate resistance	$R_G$	$V_{DS}=0V, V_{GS}=0V, F=1.0MHz$	-	2.0	-	$\Omega$
Forward Transconductance	$g_{FS}$	$V_{DS}=5V, I_D=20A$		80	-	S
<b>Dynamic Characteristics</b>						
Input Capacitance	$C_{iss}$	$V_{DS}=20V, V_{GS}=0V,$ $F=1.0MHz$	-	5200	-	PF
Output Capacitance	$C_{oss}$		-	1700	-	PF
Reverse Transfer Capacitance	$C_{rss}$		-	85	-	PF
<b>Switching Characteristics</b> (Note 2)						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=20V, I_D=20A$ $V_{GS}=10V, R_G=1.6\Omega$	-	12	-	nS
Turn-on Rise Time	$t_r$		-	6.5	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	49	-	nS
Turn-Off Fall Time	$t_f$		-	8	-	nS
Total Gate Charge	$Q_g$	$V_{DS}=20V, I_D=20A,$ $V_{GS}=10V$	-	91	-	nC
Gate-Source Charge	$Q_{gs}$		-	13	-	nC
Gate-Drain Charge	$Q_{gd}$		-	16	-	nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage	$V_{SD}$	$V_{GS}=0V, I_S=75A$	-		1.2	V
Diode Forward Current	$I_S$		-	-	150	A
Reverse Recovery Time	$t_{rr}$	$T_J = 25^{\circ}C, I_F = I_S$	-		30	nS
Reverse Recovery Charge	$Q_{rr}$	$di/dt = 100A/\mu s$	-		110	nC

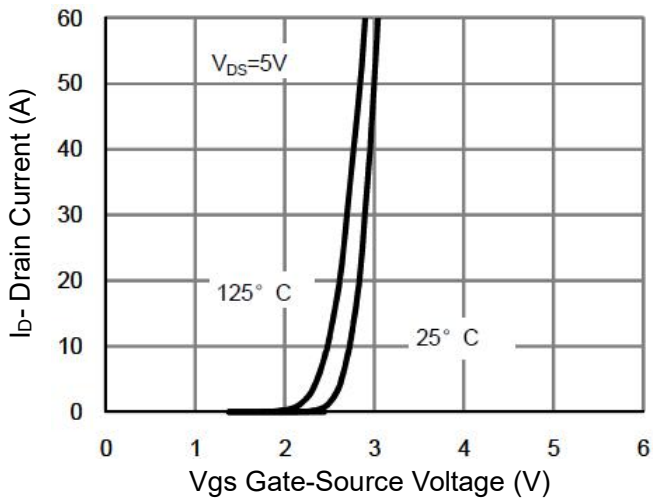
### Notes:

1. EAS condition :  $T_J=25^{\circ}C, V_{DD}=20V, V_G=10V, L=0.5mH, R_G=25\Omega$
2. Guaranteed by design, not subject to production
3. These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of  $T_J(MAX)=150^{\circ}C$ . The SOA curve provides a single pulse rating.

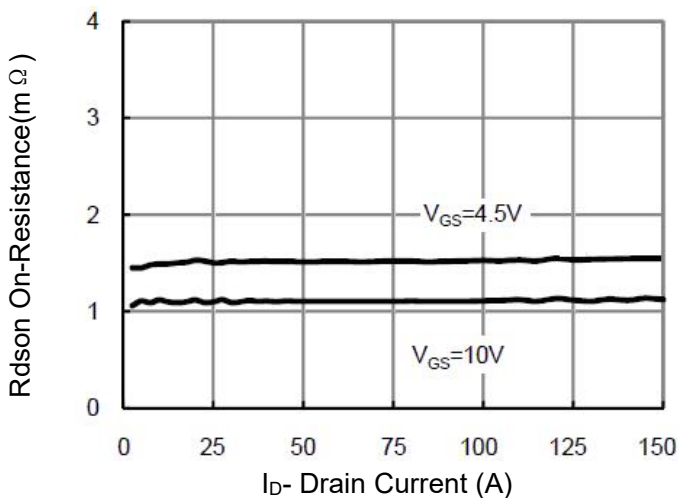
## Typical Electrical and Thermal Characteristics



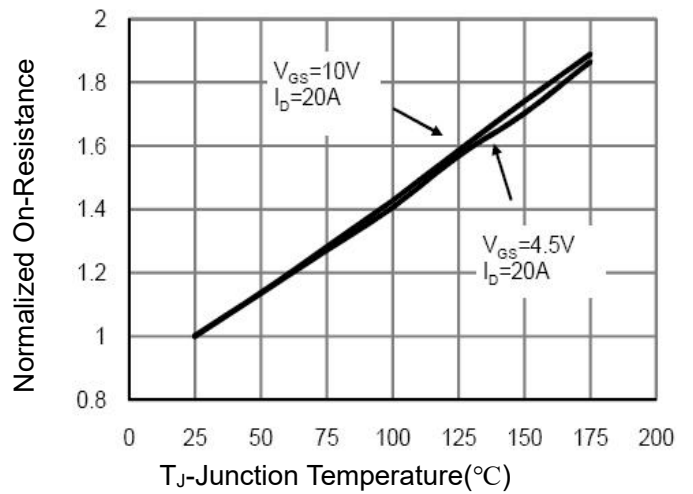
**Figure 1 Output Characteristics**



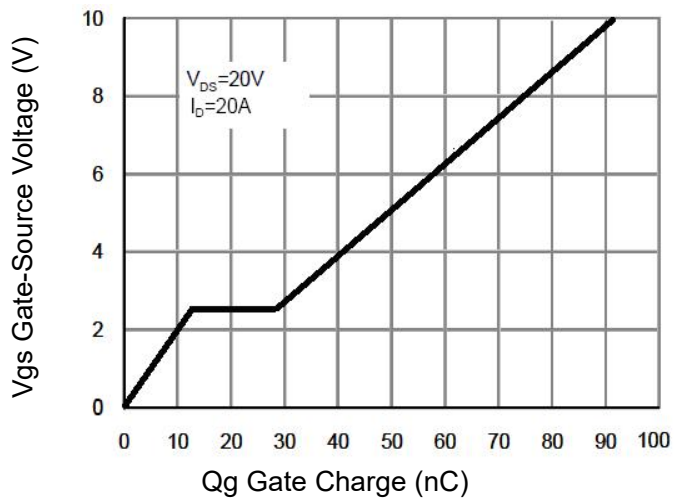
**Figure 2 Transfer Characteristics**



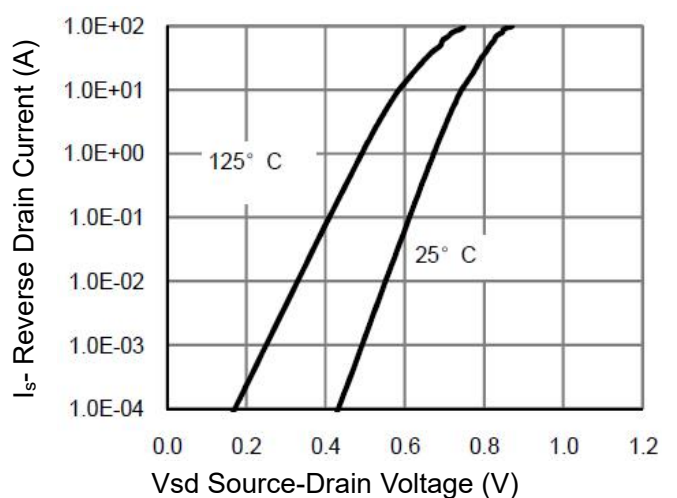
**Figure 3 Rdson- Drain Current**



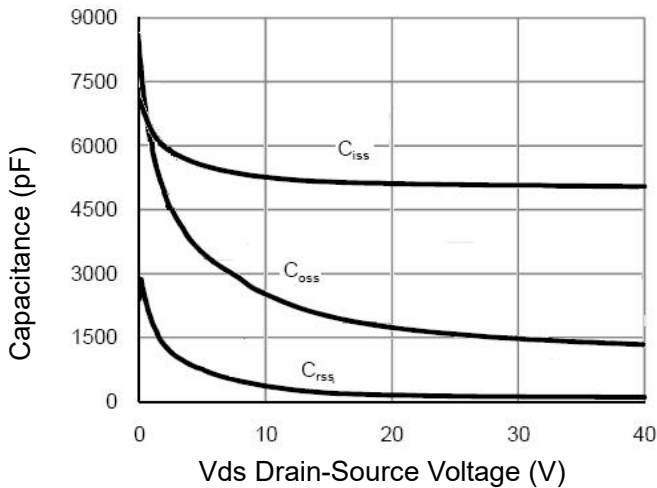
**Figure 4 Rdson-Junction Temperature**



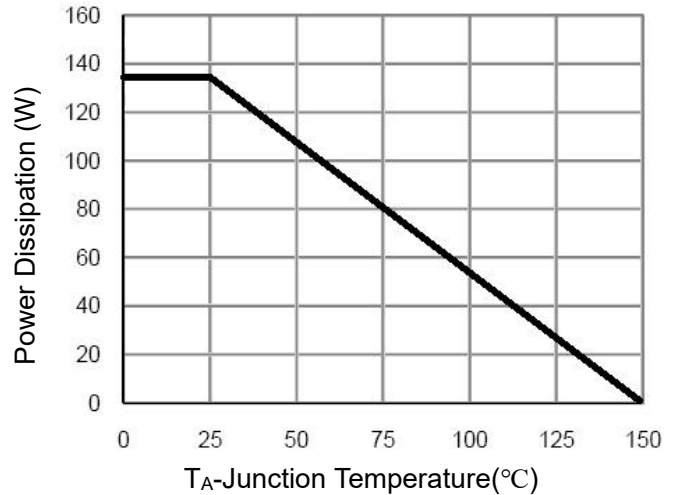
**Figure 5 Gate Charge**



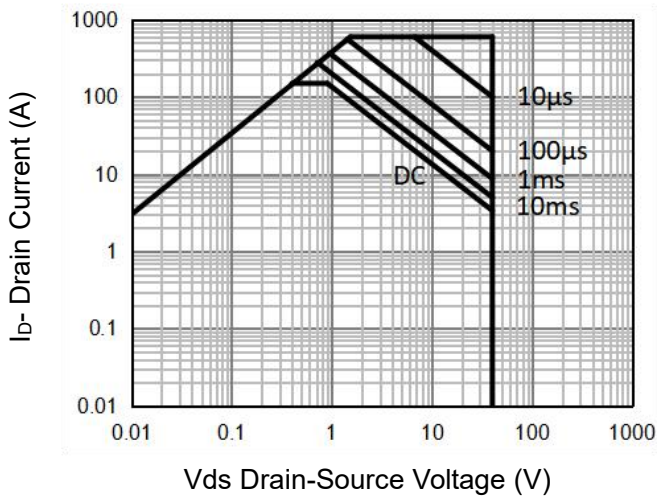
**Figure 6 Source- Drain Diode Forward**



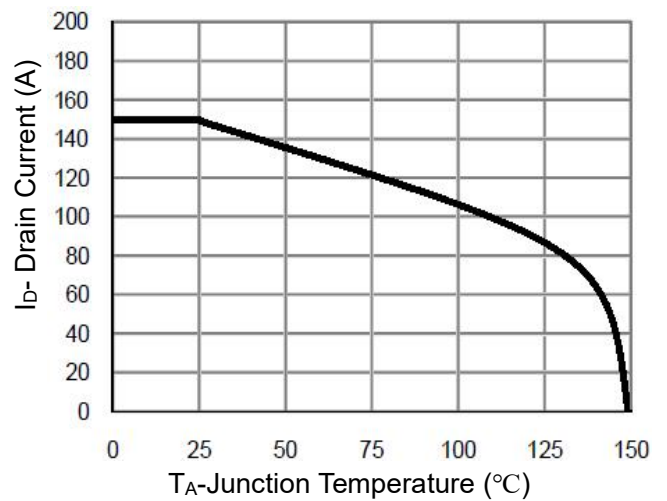
**Figure 7 Capacitance vs Vds**



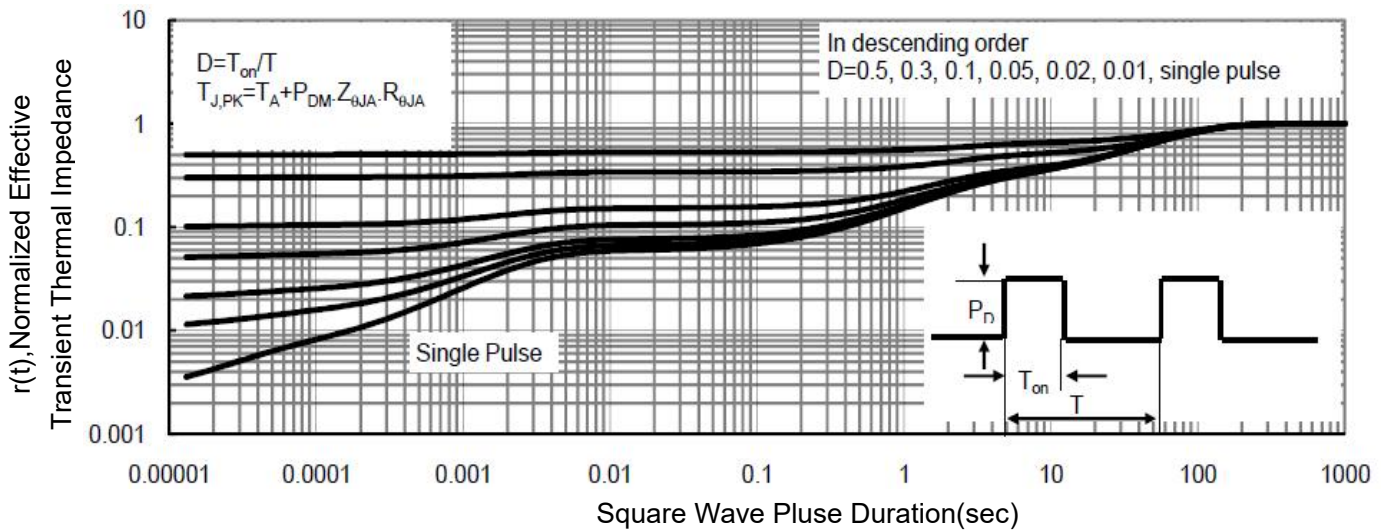
**Figure 9 Power De-rating**



**Figure 8 Safe Operation Area<sup>(Note3)</sup>**

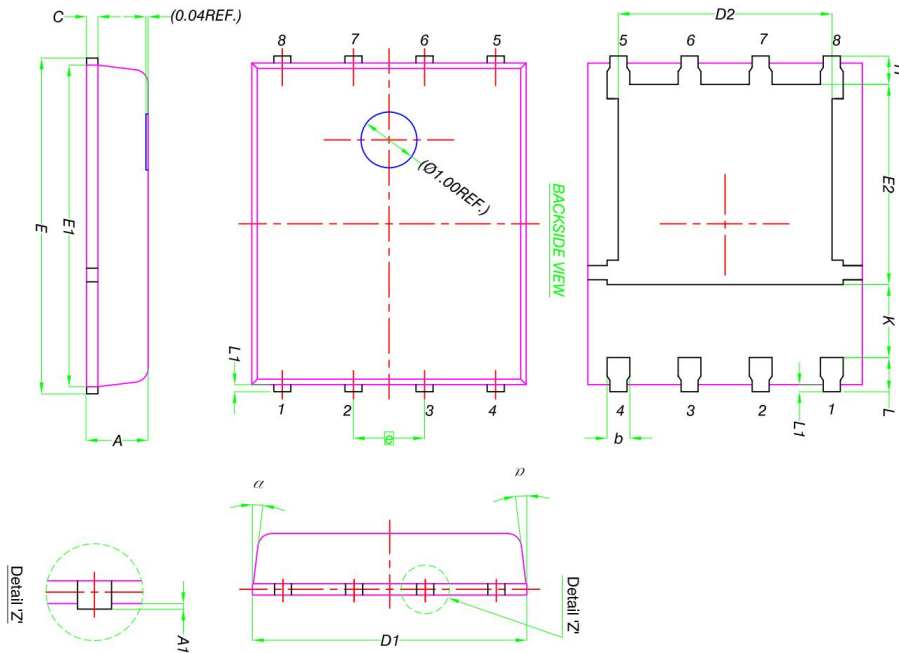


**Figure 10 Current De-rating**

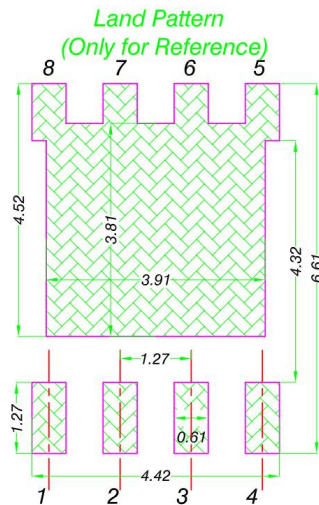


**Figure 11 Normalized Maximum Transient Thermal Impedance**

## DFN5X6-8L(G) Package Information



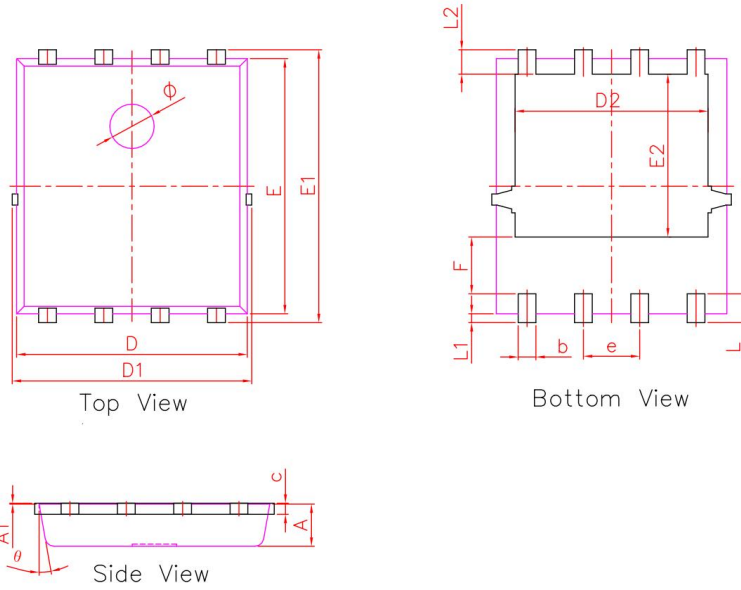
DIM.	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.90	1.00	1.10
A1	0	-	0.05
b	0.33	0.41	0.51
C	0.20	0.25	0.30
D1	4.80	4.90	5.00
D2	3.61	3.81	3.96
E	5.90	6.00	6.10
E1	5.70	5.75	5.80
E2	3.38	3.58	3.78
[e]	1.27 BSC		
H	0.41	0.51	0.61
K	1.10	-	-
L	0.51	0.61	0.71
L1	0.06	0.13	0.20
α	0°	-	12°



Note:

1. All Dimension Are In mm.
2. Package Body Sizes Exclude Mold Flash, Protrusion Or Gate Burrs.  
Mold Flash, Protrusion Or Gate Burrs Shall Not Exceed 0.10 mm Per Side.
3. Package Body Sizes Determined At The Outermost Extremes Of The Plastic Body Exclusive Of Mold Flash, Tie Bar, Tie Bar Burrs, Gate Burrs And Interlead Flash,  
But Including Any Mismatch Between The Top And Bottom Of The Plastic Body.
4. The Package Top May Be Smaller Than The Package Bottom.

## DFN5X6-8L(E) Package Information



PDFN5X6-8L			
DIM.	MIN.	NOM.	MAX.
A	0.90	0.95	1.00
A1	0.00	0.02	0.05
b	0.35	0.40	0.50
c	0.20	0.25	0.30
D	5.10	5.20	5.30
D1	5.10	5.40	5.50
D2	4.25	4.35	4.45
e	1.27 BSC		
E	5.70	5.75	5.80
E1	6.00	6.15	6.30
E2	3.57	3.67	3.77
F	1.18	1.28	1.38
L	0.55	0.65	0.75
L1	0.15	0.20	0.25
L2	0.45	0.55	0.65
$\phi$	0.90	1.00	1.10
$\theta$	8°	10°	12°
All dimensions in millimeters			



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