

## NCE N-Channel Super Trench II Power MOSFET

### Description

The series of devices uses **Super Trench II** 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.

### Application

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

### General Features

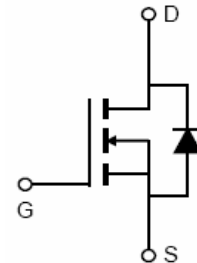
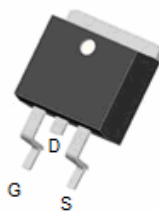
- $V_{DS} = 100V, I_D = 135A$   
 $R_{DS(ON)} = 3.65m\Omega$ , typical (TO-220) @  $V_{GS} = 10V$   
 $R_{DS(ON)} = 3.5m\Omega$ , typical (TO-263) @  $V_{GS} = 10V$
- Excellent gate charge x  $R_{DS(on)}$  product(FOM)
- Very low on-resistance  $R_{DS(on)}$
- 175 °C operating temperature
- **Pb-free lead plating**
- **Pb-free Mold Compound**

**100% UIS TESTED!**  
**100% ΔVds TESTED!**

TO-220



TO-263



Schematic Diagram

### Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
NCEP039N10M	NCEP039N10M	TO-220	-	-	-
NCEP039N10MD	NCEP039N10MD	TO-263	-	-	-

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	100	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Drain Current-Continuous	$I_D$	135	A
Drain Current-Continuous( $T_C = 100^\circ C$ )	$I_D(100^\circ C)$	108	A
Pulsed Drain Current	$I_{DM}$	540	A
Maximum Power Dissipation	$P_D$	220	W
Derating factor		1.47	W/°C
Avalanche Current <sup>(Note 1)</sup>	$I_{AR}$	55	A
Single pulse avalanche energy <sup>(Note 5)</sup>	$E_{AS}$	1156	mJ
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 175	°C

### Thermal Characteristic

Thermal Resistance, Junction-to-Case <sup>(Note 2)</sup>	$R_{\theta JC}$	0.68	°C/W
Thermal Resistance, Junction-to-Ambient <sup>(Note 2)</sup>	$R_{\theta JA}$	50	°C/W

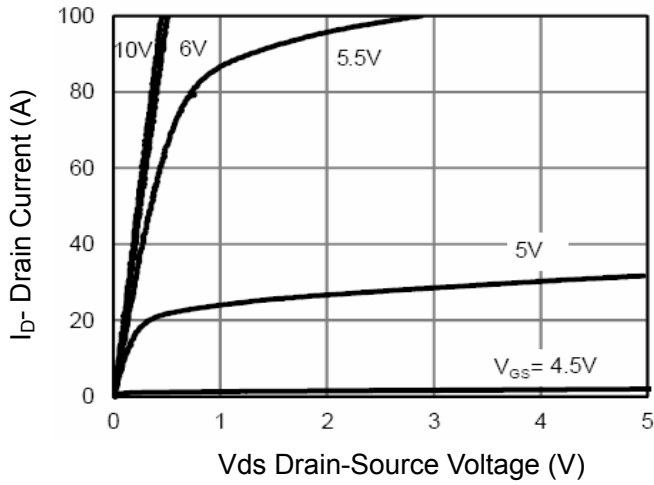
## Electrical Characteristics ( $T_C=25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit	
<b>Off Characteristics</b>							
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	100		-	V	
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=100V, V_{GS}=0V$	-	-	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	$R_{DS(on)}$	$V_{GS}=10V, I_D=65A$	TO-220	-	3.65	3.9	m $\Omega$
			TO-263		3.5	3.9	m $\Omega$
Gate resistance	$R_G$		-	1.5	-	$\Omega$	
Forward Transconductance	$g_{FS}$	$V_{DS}=5V, I_D=65A$		90	-	S	
<b>Dynamic Characteristics</b> (Note 4)							
Input Capacitance	$C_{iss}$	$V_{DS}=50V, V_{GS}=0V,$ $F=1.0MHz$	-	7450	9685	PF	
Output Capacitance	$C_{oss}$		-	618	803	PF	
Reverse Transfer Capacitance	$C_{rss}$		-	37	60	PF	
<b>Switching Characteristics</b> (Note 4)							
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=50V, I_D=65A$ $V_{GS}=10V, R_G=1.6\Omega$	-	20	-	nS	
Turn-on Rise Time	$t_r$		-	11.5	-	nS	
Turn-Off Delay Time	$t_{d(off)}$		-	48	-	nS	
Turn-Off Fall Time	$t_f$		-	10	-	nS	
Total Gate Charge	$Q_g$	$V_{DS}=50V, I_D=65A,$ $V_{GS}=10V$	-	116	150	nC	
Gate-Source Charge	$Q_{gs}$		-	39	50	nC	
Gate-Drain Charge	$Q_{gd}$		-	32	42	nC	
<b>Drain-Source Diode Characteristics</b>							
Diode Forward Voltage (Note 3)	$V_{SD}$	$V_{GS}=0V, I_S=65A$	-		1.2	V	
Diode Forward Current (Note 2)	$I_S$		-	-	135	A	
Reverse Recovery Time	$t_{rr}$	$T_J = 25^\circ\text{C}, I_F = I_S$ $di/dt = 100A/\mu s$ (Note 3)	-	76	-	nS	
Reverse Recovery Charge	$Q_{rr}$		-	150	-	nC	

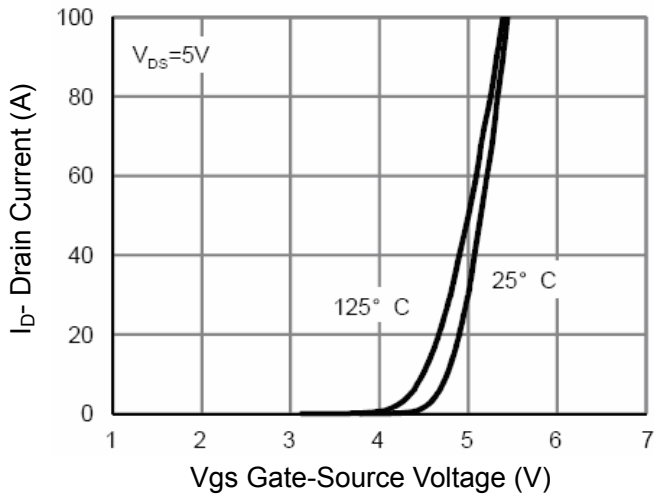
### Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. The value of  $R_{\theta JA}$  is measured with the device mounted on 1in2 FR-4 board with 2oz. Copper, in a still air environment with  $T_A = 25^\circ\text{C}$ . The value in any given application depends on the user's specific board design, and the maximum temperature of  $175^\circ\text{C}$  may be used if the PCB allows it.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production
5. EAS condition :  $T_J=25^\circ\text{C}, V_{DD}=50V, V_G=10V, L=0.5mH, R_G=25\Omega$

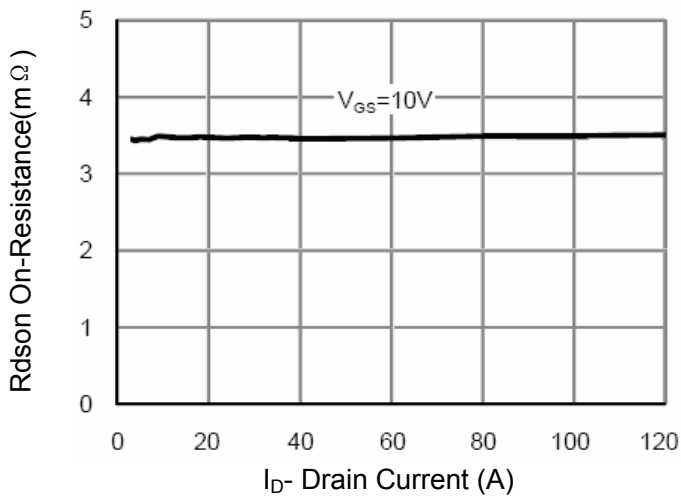
## Typical Electrical and Thermal Characteristics



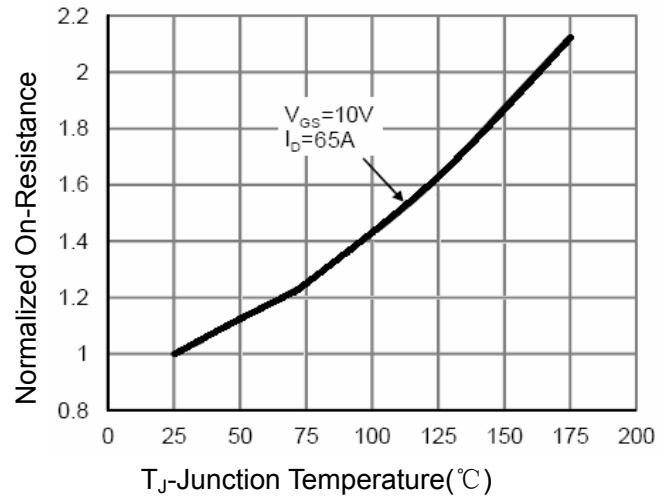
**Figure 1 Output Characteristics**



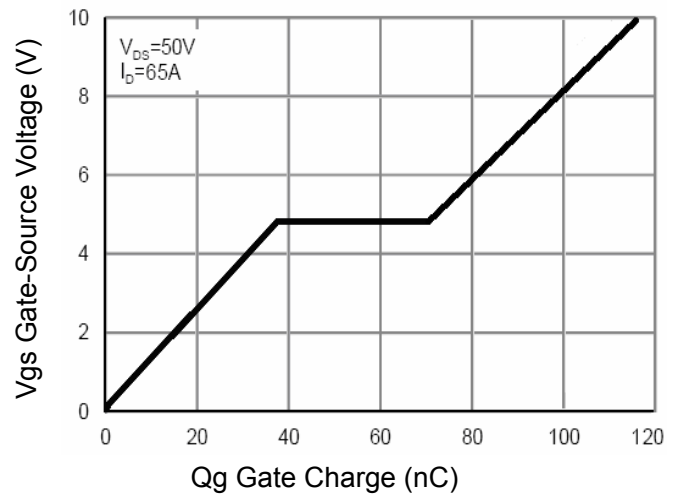
**Figure 2 Transfer Characteristics**



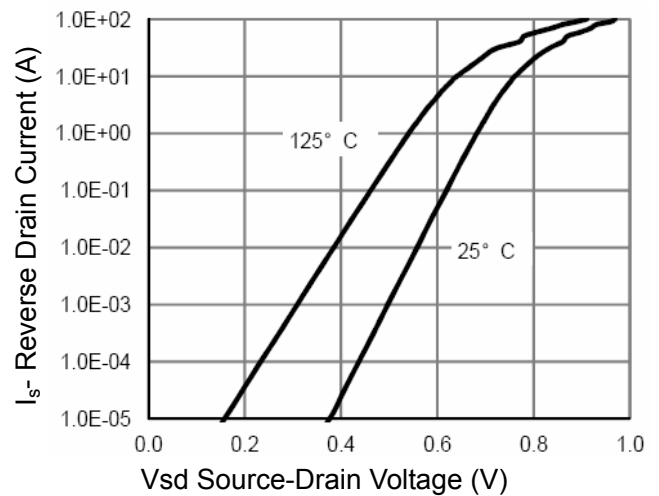
**Figure 3 Rdson- Drain Current**



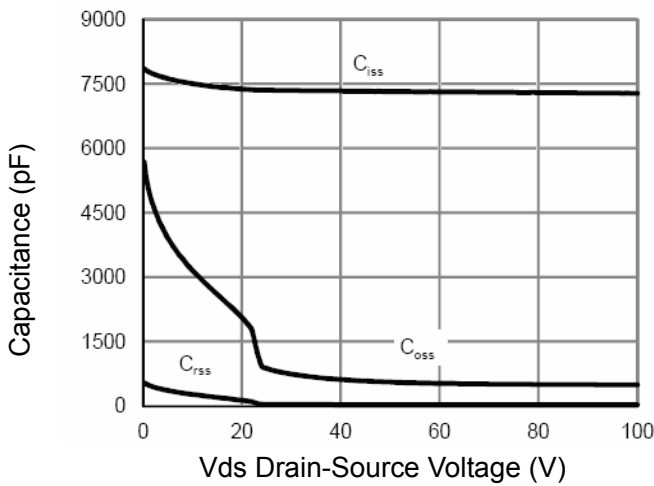
**Figure 4 Rdson-Junction Temperature**



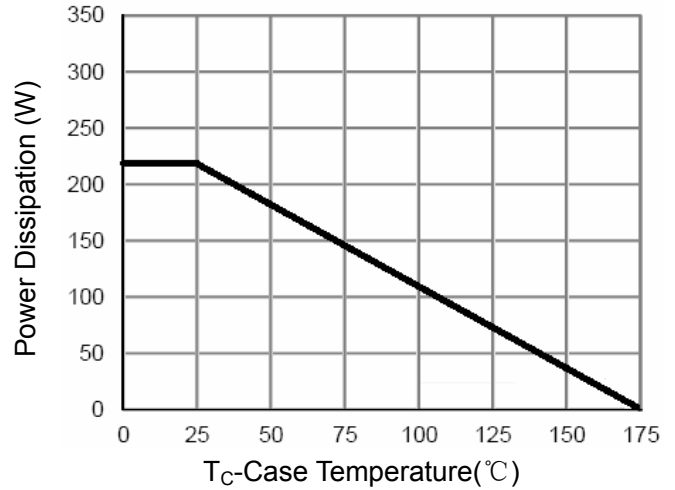
**Figure 5 Gate Charge**



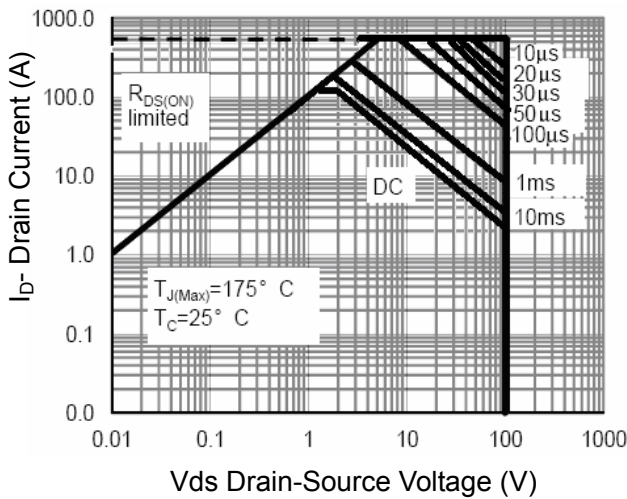
**Figure 6 Source- Drain Diode Forward**



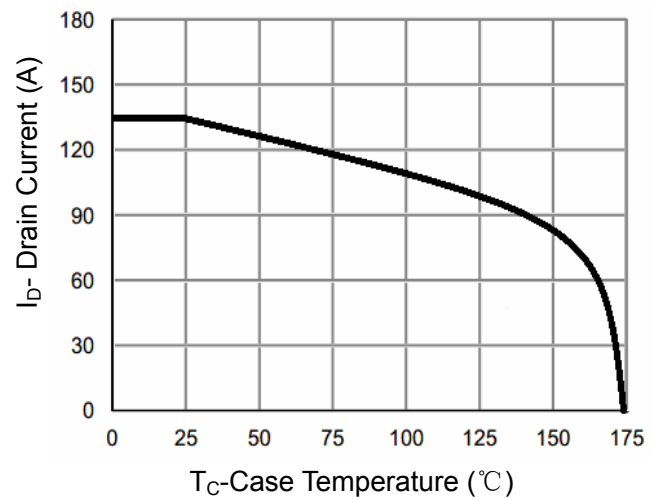
**Figure 7 Capacitance vs Vds**



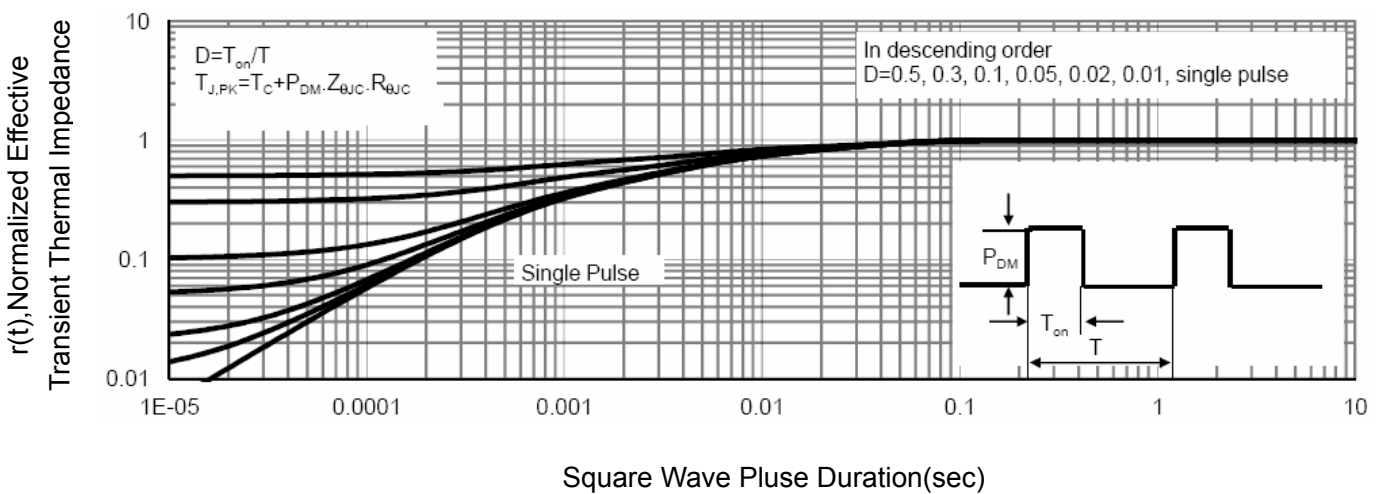
**Figure 9 Power De-rating**



**Figure 8 Safe Operation Area**

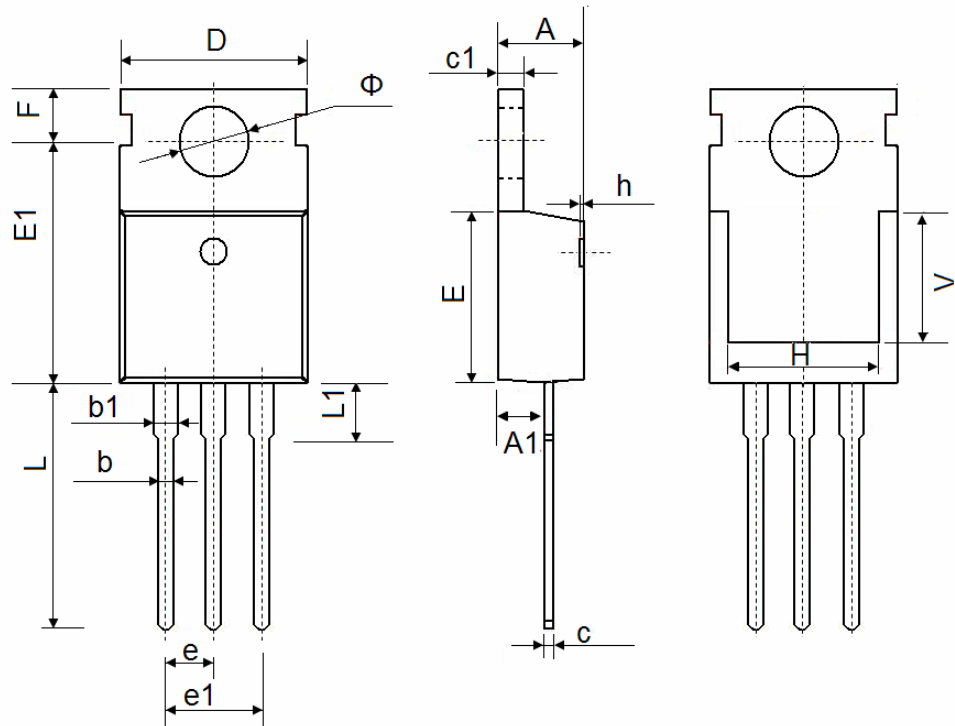


**Figure 10 Current De-rating**



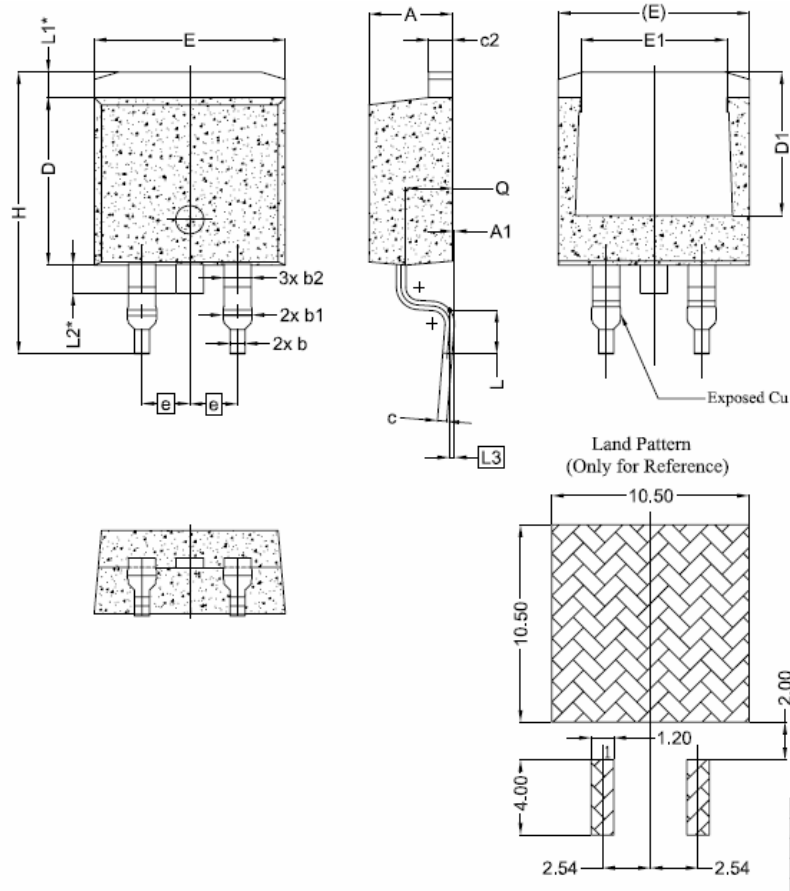
**Figure 11 Normalized Maximum Transient Thermal Impedance**

## TO-220-3L Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.400	4.600	0.173	0.181
A1	2.250	2.550	0.089	0.100
b	0.710	0.910	0.028	0.036
b1	1.170	1.370	0.046	0.054
c	0.330	0.650	0.013	0.026
c1	1.200	1.400	0.047	0.055
D	9.910	10.250	0.390	0.404
E	8.9500	9.750	0.352	0.384
E1	12.650	12.950	0.498	0.510
e	2.540 TYP.		0.100 TYP.	
e1	4.980	5.180	0.196	0.204
F	2.650	2.950	0.104	0.116
H	7.900	8.100	0.311	0.319
h	0.000	0.300	0.000	0.012
L	12.900	13.400	0.508	0.528
L1	2.850	3.250	0.112	0.128
V	6.900 REF.		0.276 REF.	
Φ	3.400	3.800	0.134	0.150

## TO-263-2L Package Information



SYMBOL	DIMENSIONS		
	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	2.54 BSC		
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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