

## 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

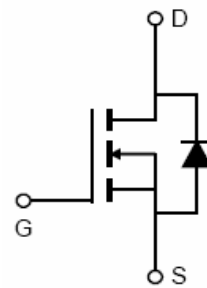
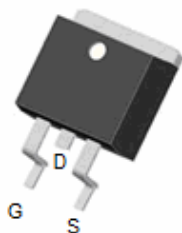
- $V_{DS} = 100V, I_D = 110A$   
 $R_{DS(ON)} = 5.4m\Omega$ , typical (TO-220) @  $V_{GS} = 10V$   
 $R_{DS(ON)} = 5.2m\Omega$ , typical (TO-263) @  $V_{GS} = 10V$
- Excellent gate charge x  $R_{DS(on)}$  product (FOM)
- Very low on-resistance  $R_{DS(on)}$
- 175 °C operating temperature
- Pb-free lead plating

**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 |
|----------------|-------------|----------------|-----------|------------|----------|
| NCEP055N10     | NCEP055N10  | TO-220         | -         | -          | -        |
| NCEP055N10D    | NCEP055N10D | 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                          | $I_D$              | 110        | A    |
| Drain Current-Continuous ( $T_C = 100^\circ C$ )  | $I_D(100^\circ C)$ | 72         | A    |
| Pulsed Drain Current                              | $I_{DM}$           | 440        | A    |
| Maximum Power Dissipation                         | $P_D$              | 150        | W    |
| Derating factor                                   |                    | 1.0        | W/°C |
| Single pulse avalanche energy <sup>(Note 5)</sup> | $E_{AS}$           | 680        | 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> | $R_{\theta JC}$ | 1.0 | $^{\circ}\text{C}/\text{W}$ |
|--|-----------------|-----|-----------------------------|

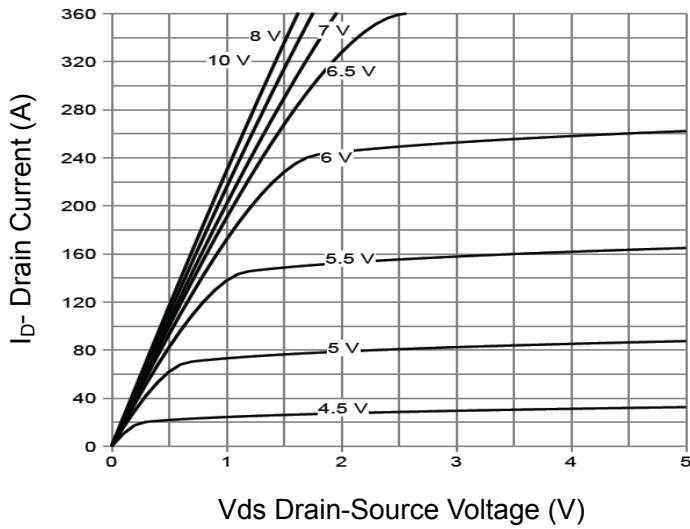
## Electrical Characteristics ( $T_C=25^{\circ}\text{C}$ unless otherwise noted)

| 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> <sup>(Note 3)</sup>        |              |   |        |      |           |         |            |
| 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                     | $R_{DS(on)}$ | $V_{GS}=10V, I_D=55A$   | TO-220 | -    | 5.4       | 5.7     | m $\Omega$ |
|  |              |   | TO-263 |      | 5.2       | 5.7     | m $\Omega$ |
| Forward Transconductance                             | $g_{FS}$     | $V_{DS}=5V, I_D=55A$  |        | 60   | -         | S       |            |
| <b>Dynamic Characteristics</b> <sup>(Note 4)</sup>   |              |   |        |      |           |         |            |
| Input Capacitance                                    | $C_{iss}$    | $V_{DS}=50V, V_{GS}=0V,$<br>$F=1.0\text{MHz}$                                     | -      | 3850 | -         | PF      |            |
| Output Capacitance                                   | $C_{oss}$    |   | -      | 410  | -         | PF      |            |
| Reverse Transfer Capacitance                         | $C_{rss}$    |   | -      | 20   | -         | PF      |            |
| <b>Switching Characteristics</b> <sup>(Note 4)</sup> |              |   |        |      |           |         |            |
| Turn-on Delay Time                                   | $t_{d(on)}$  | $V_{DD}=50V, I_D=55A$<br>$V_{GS}=10V, R_G=1.6\Omega$                              | -      | 21   | -         | nS      |            |
| Turn-on Rise Time                                    | $t_r$        |   | -      | 61   | -         | nS      |            |
| Turn-Off Delay Time                                  | $t_{d(off)}$ |   | -      | 40   | -         | nS      |            |
| Turn-Off Fall Time                                   | $t_f$        |   | -      | 12   | -         | nS      |            |
| Total Gate Charge                                    | $Q_g$        | $V_{DS}=50V, I_D=55A,$<br>$V_{GS}=10V$  | -      | 72   | -         | nC      |            |
| Gate-Source Charge                                   | $Q_{gs}$     |   | -      | 21   |           | nC      |            |
| Gate-Drain Charge                                    | $Q_{gd}$     |   | -      | 22   |           | nC      |            |
| <b>Drain-Source Diode Characteristics</b>            |              |   |        |      |           |         |            |
| Diode Forward Voltage <sup>(Note 3)</sup>            | $V_{SD}$     | $V_{GS}=0V, I_S=50A$  | -      |      | 1.2       | V       |            |
| Diode Forward Current <sup>(Note 2)</sup>            | $I_S$        |   | -      | -    | 100       | A       |            |
| Reverse Recovery Time                                | $t_{rr}$     | $T_J = 25^{\circ}\text{C}, I_F = I_S$<br>$di/dt = 100A/\mu s$ <sup>(Note 3)</sup> | -      | 67   | -         | nS      |            |
| Reverse Recovery Charge                              | $Q_{rr}$     |   | -      | 137  | -         | nC      |            |

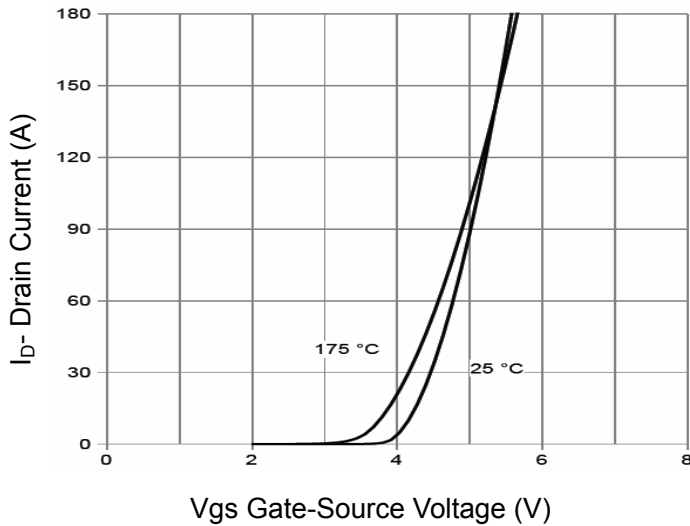
### Notes:

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 :  $T_J=25^{\circ}\text{C}, V_{DD}=50V, V_G=10V, L=0.5\text{mH}, R_g=25\Omega$

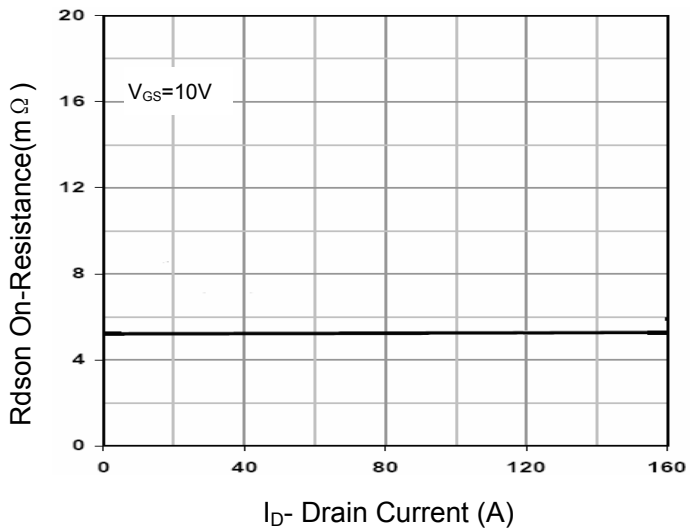
## Typical Electrical and Thermal Characteristics



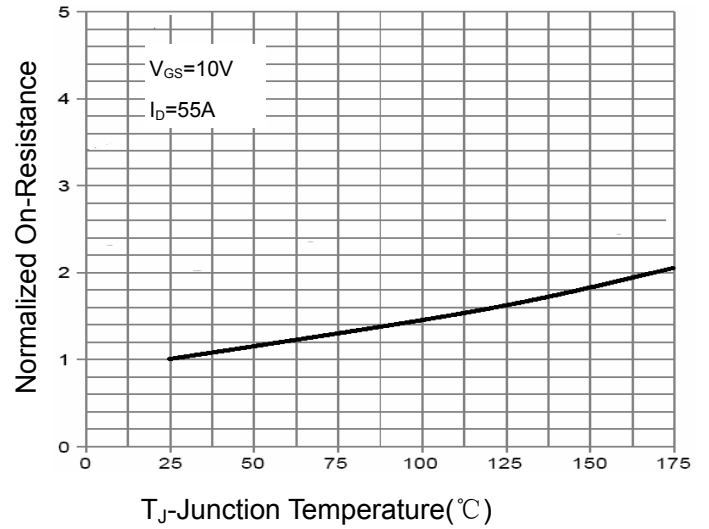
**Figure 1 Output Characteristics**



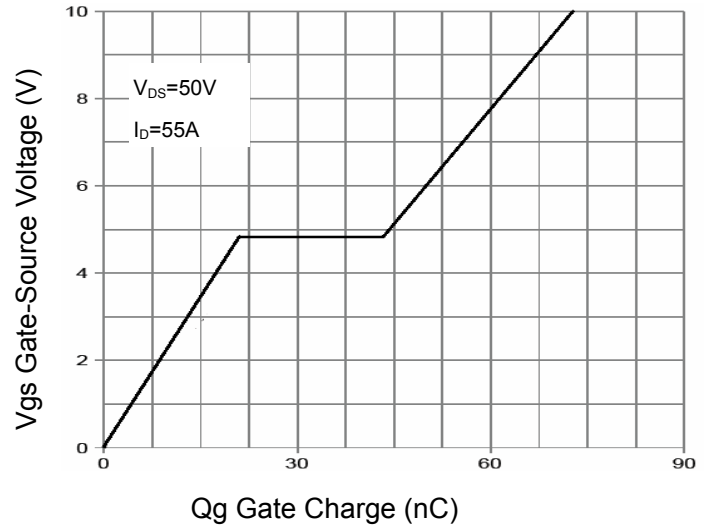
**Figure 2 Transfer Characteristics**



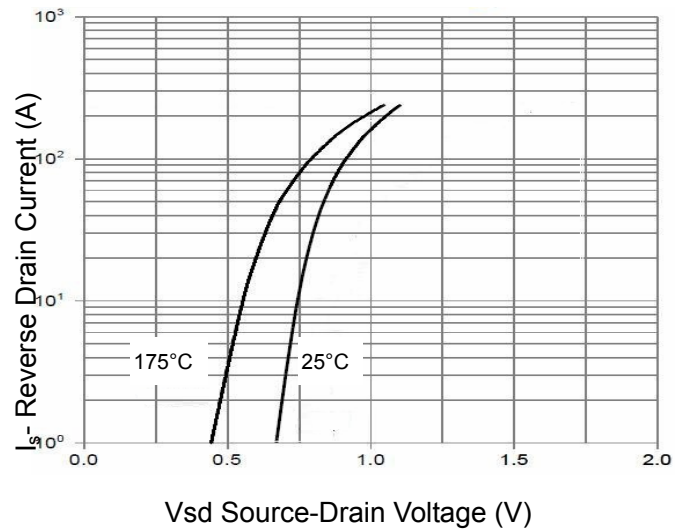
**Figure 3 Rdson- Drain Current**



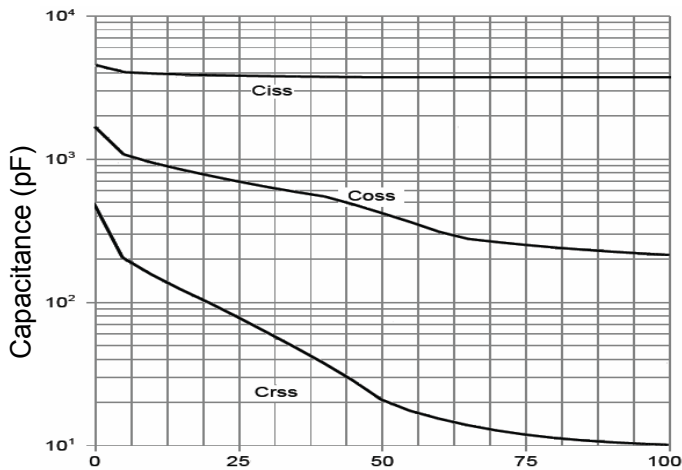
**Figure 4 Rdson-Junction Temperature**



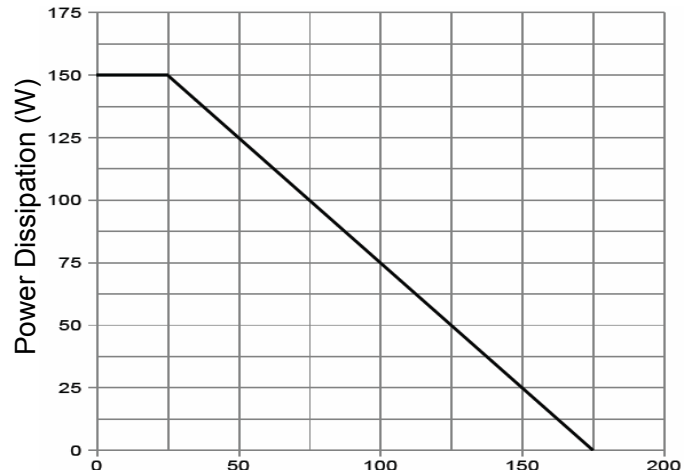
**Figure 5 Gate Charge**



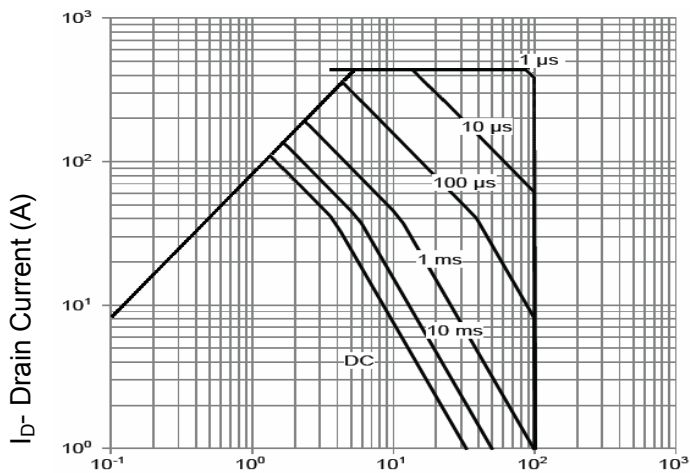
**Figure 6 Source- Drain Diode Forward**



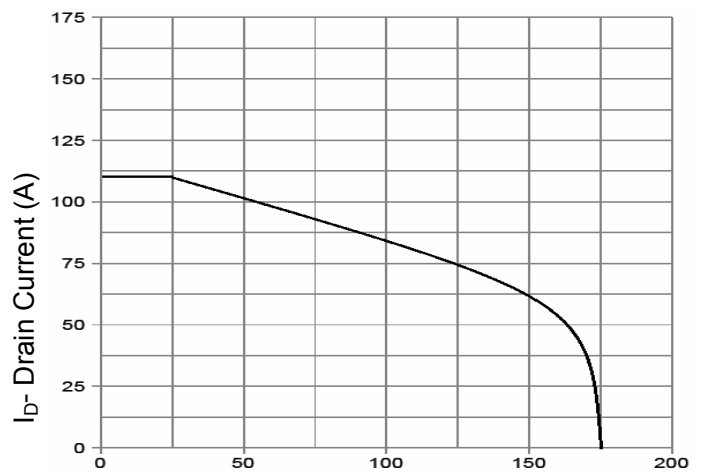
Vds Drain-Source Voltage (V)  
**Figure 7 Capacitance vs Vds**



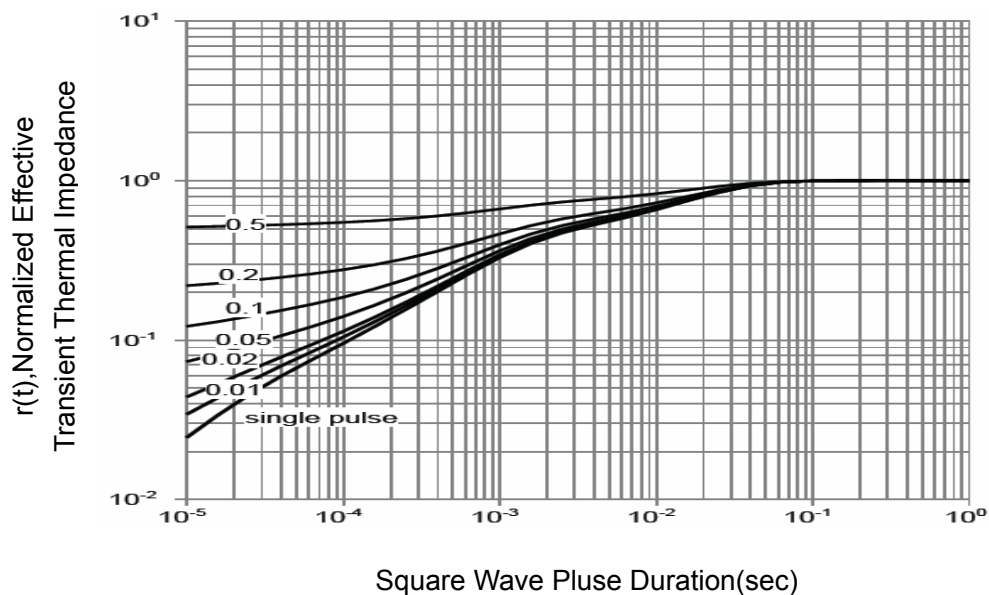
T<sub>J</sub>-Junction Temperature(°C)  
**Figure 9 Power De-rating**



Vds Drain-Source Voltage (V)  
**Figure 8 Safe Operation Area**



T<sub>J</sub>-Junction Temperature (°C)  
**Figure 10 Current De-rating**



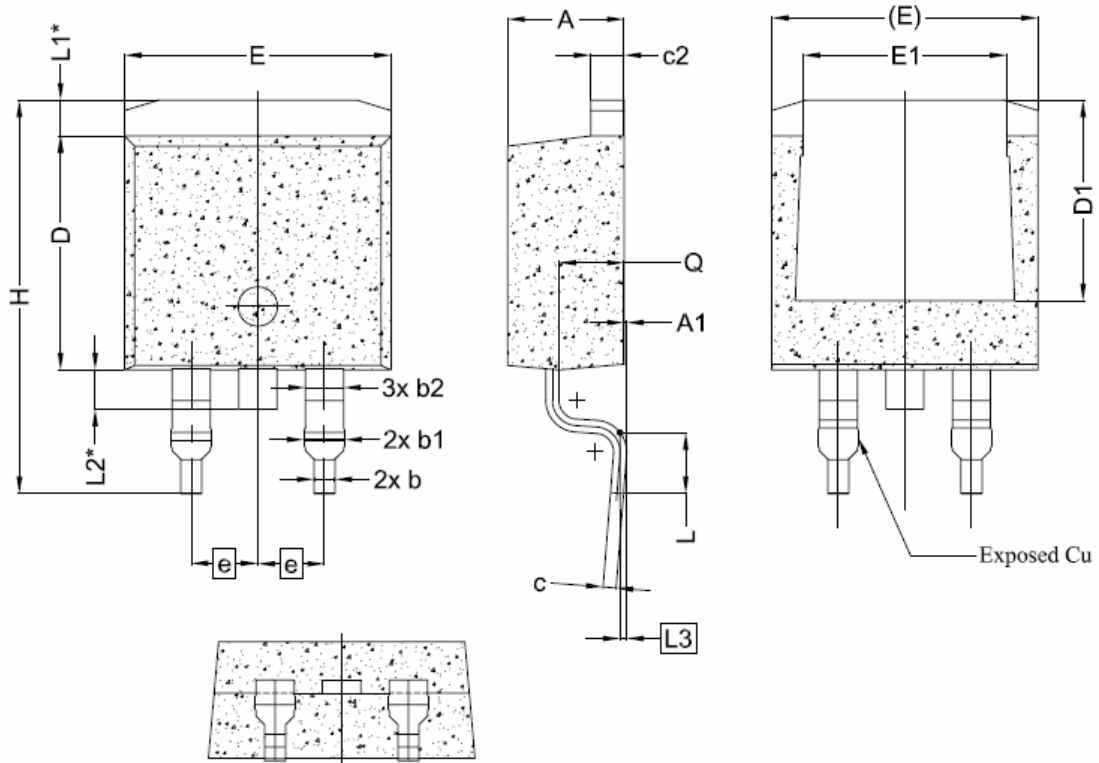
Square Wave Pulse Duration(sec)  
**Figure 11 Normalized Maximum Transient Thermal Impedance**

## 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 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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