

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

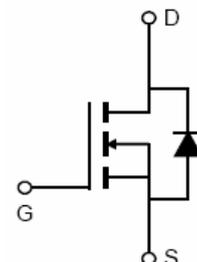
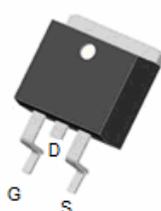
- $V_{DS} = 100V, I_D = 135A$
 $R_{DS(ON)} = 3.65m\Omega$, typical (TO-220) @ $V_{GS} = 10V$
 $R_{DS(ON)} = 3.5m\Omega$, typical (TO-263) @ $V_{GS} = 10V$
- Excellent gate charge x $R_{DS(on)}$ product(FOM)
- Very low on-resistance $R_{DS(on)}$
- 175 °C operating temperature
- **Pb-free lead plating**
- **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} | ± 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/ $^\circ C$ |
| Avalanche Current ^(Note 1) | I_{AR} | 55 | A |
| Single pulse avalanche energy ^(Note 5) | E_{AS} | 1156 | mJ |
| Operating Junction and Storage Temperature Range | T_J, T_{STG} | -55 To 175 | $^\circ C$ |

Thermal Characteristic

| | | | |
|---|-----------------|------|--------------|
| Thermal Resistance, Junction-to-Case ^(Note 2) | $R_{\theta JC}$ | 0.68 | $^\circ C/W$ |
| Thermal Resistance, Junction-to-Ambient ^(Note 2) | $R_{\theta JA}$ | 50 | $^\circ C/W$ |

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

| Parameter | Symbol | Condition | Min | Typ | Max | Unit | |
|---|--------------|--|--------|------|-----------|----------|------------|
| Off Characteristics | | | | | | | |
| 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 | μA | |
| Gate-Body Leakage Current | I_{GSS} | $V_{GS}=\pm 20V, V_{DS}=0V$ | - | - | ± 100 | nA | |
| On Characteristics (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 Ω |
| | | | TO-263 | | 3.5 | 3.9 | m Ω |
| Gate resistance | R_G | | - | 1.5 | - | Ω | |
| Forward Transconductance | g_{FS} | $V_{DS}=5V, I_D=65A$ | | 90 | - | S | |
| Dynamic Characteristics (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 | |
| Switching Characteristics (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 | |
| Drain-Source Diode Characteristics | | | | | | | |
| 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°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

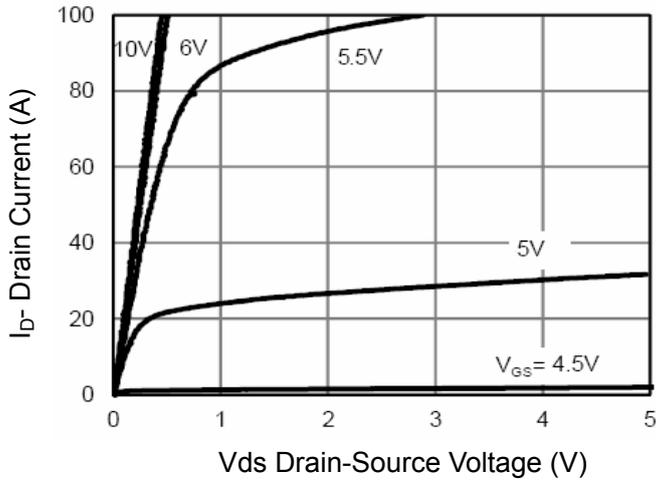


Figure 1 Output Characteristics

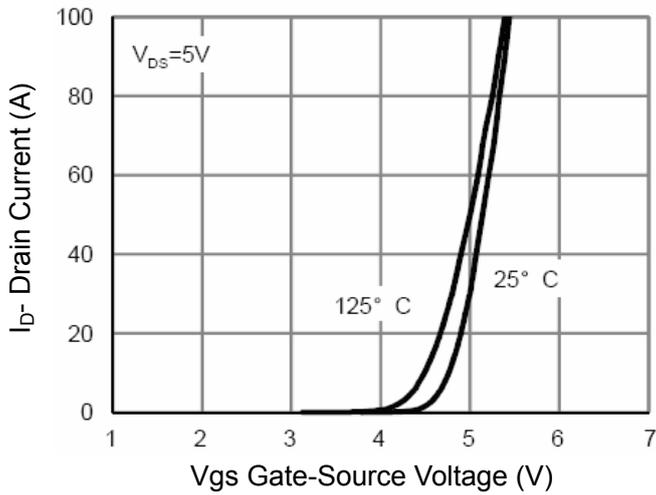


Figure 2 Transfer Characteristics

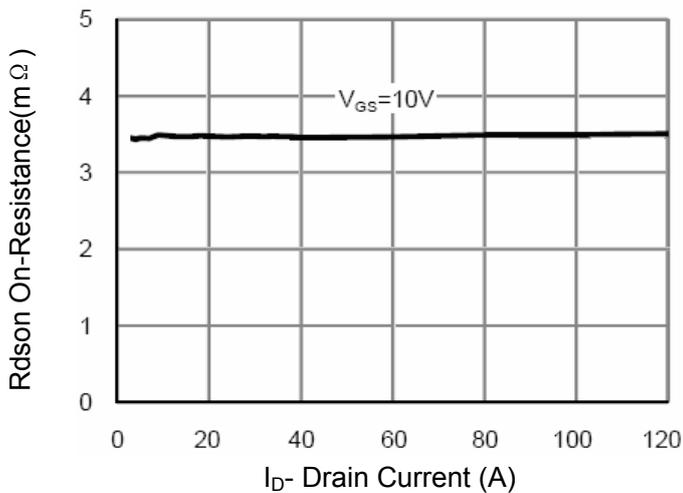


Figure 3 Rdson- Drain Current

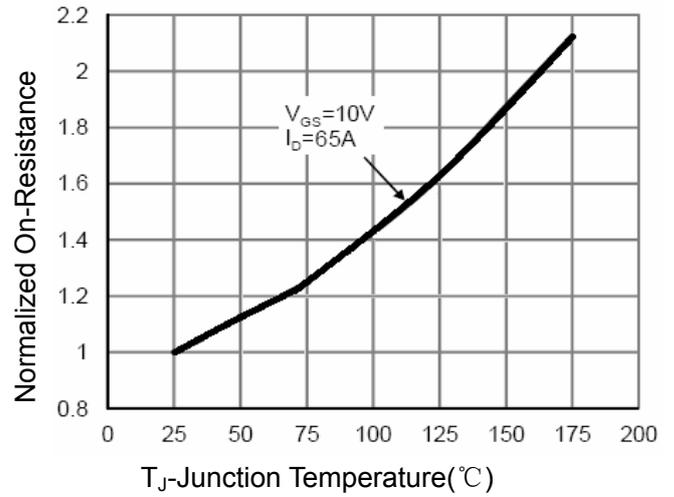


Figure 4 Rdson-Junction Temperature

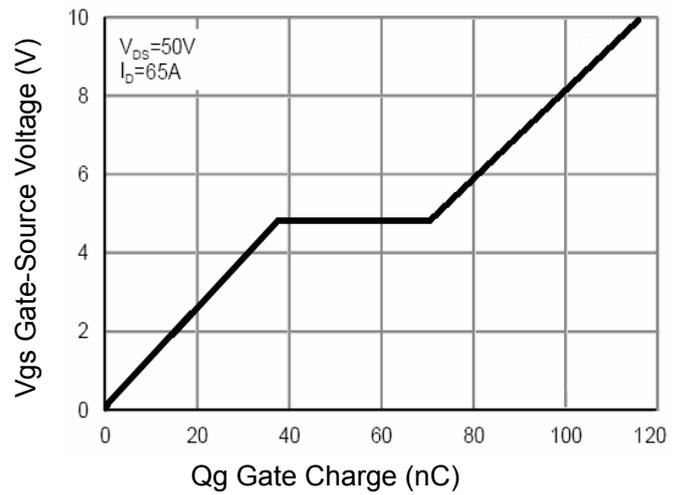


Figure 5 Gate Charge

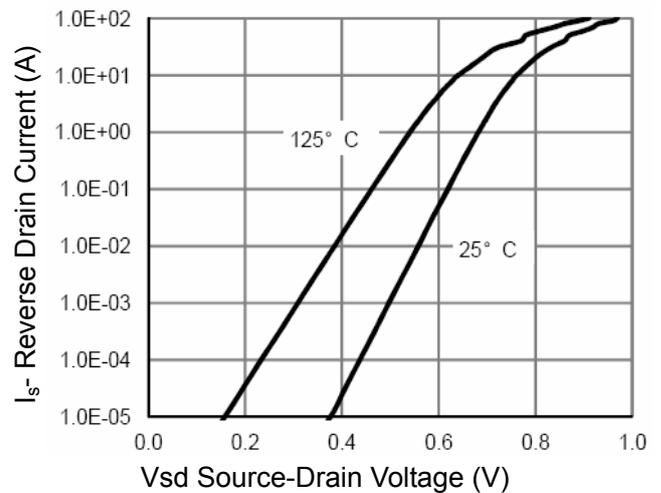


Figure 6 Source- Drain Diode Forward

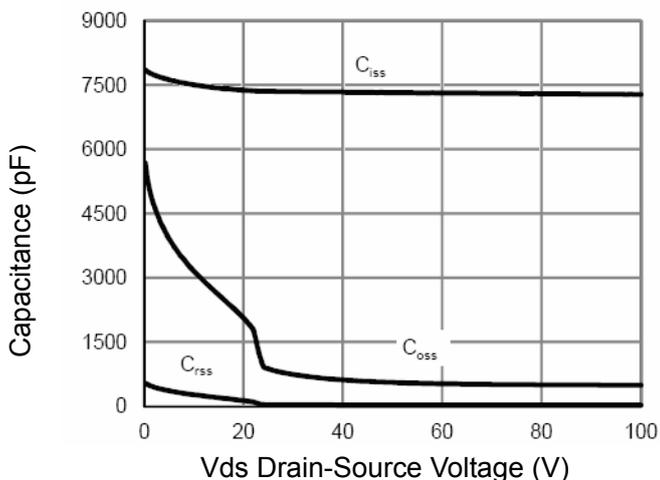


Figure 7 Capacitance vs Vds

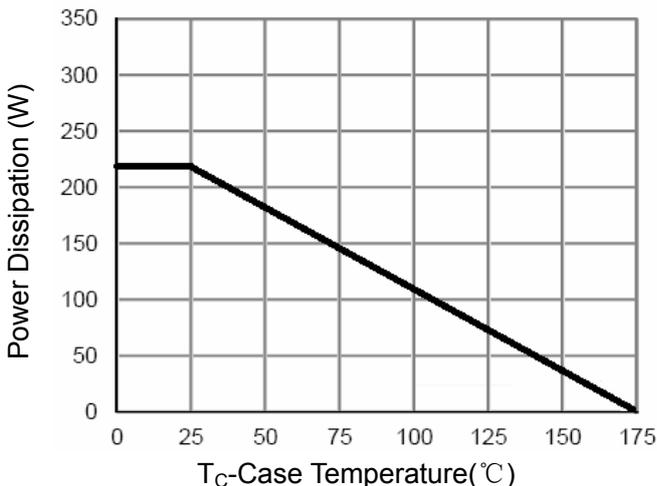


Figure 9 Power De-rating

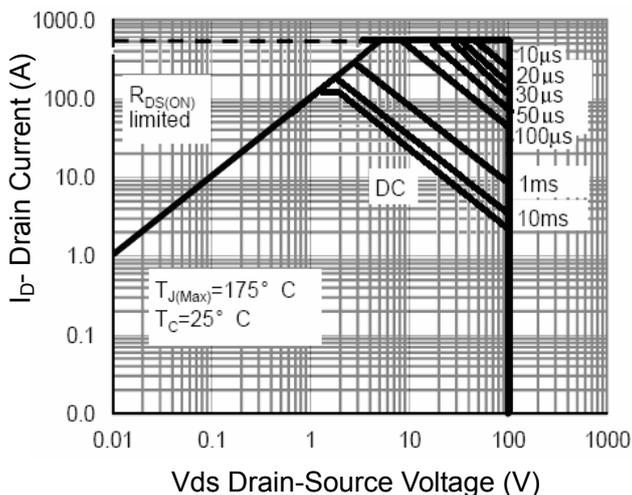


Figure 8 Safe Operation Area

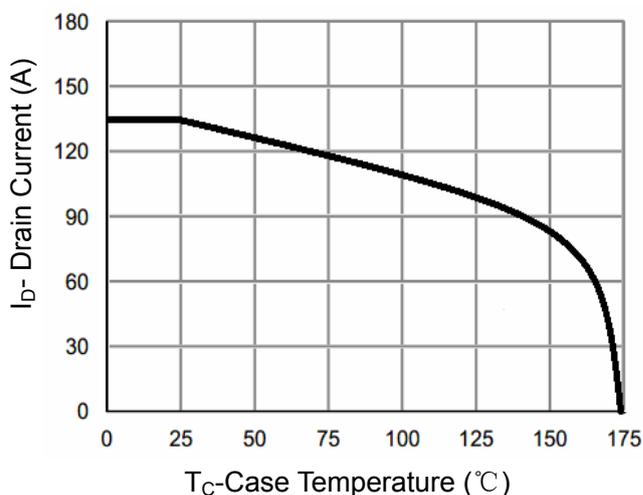


Figure 10 Current De-rating

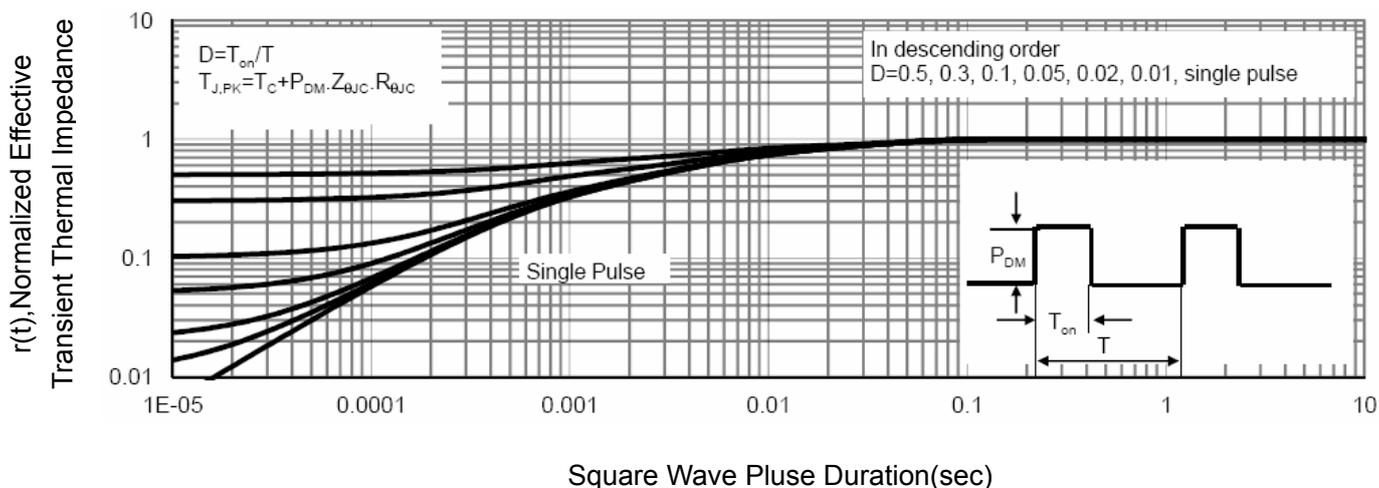
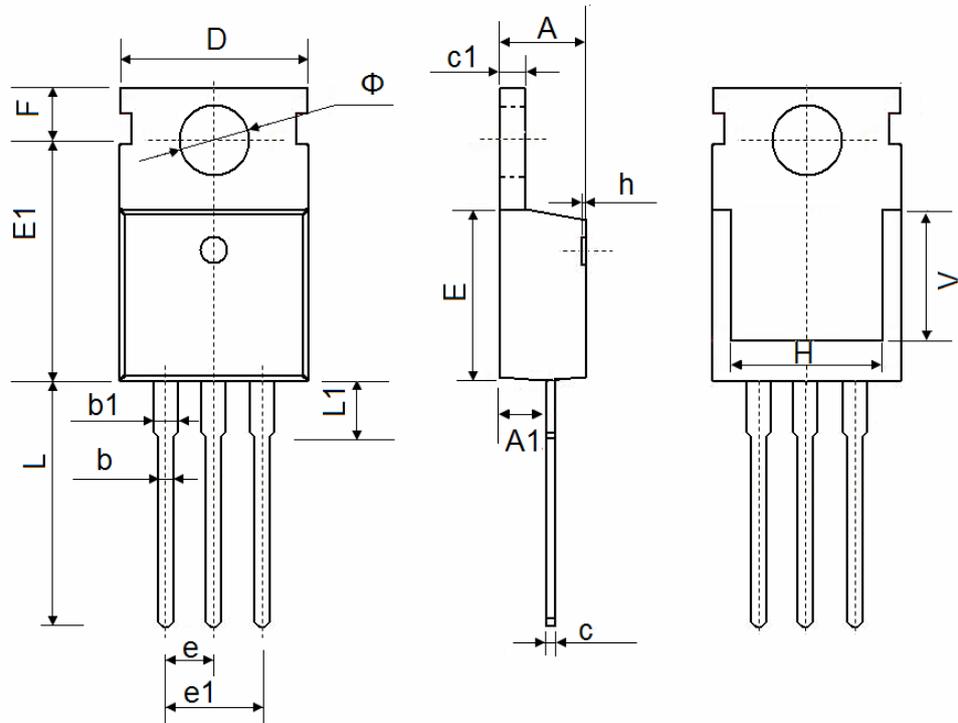


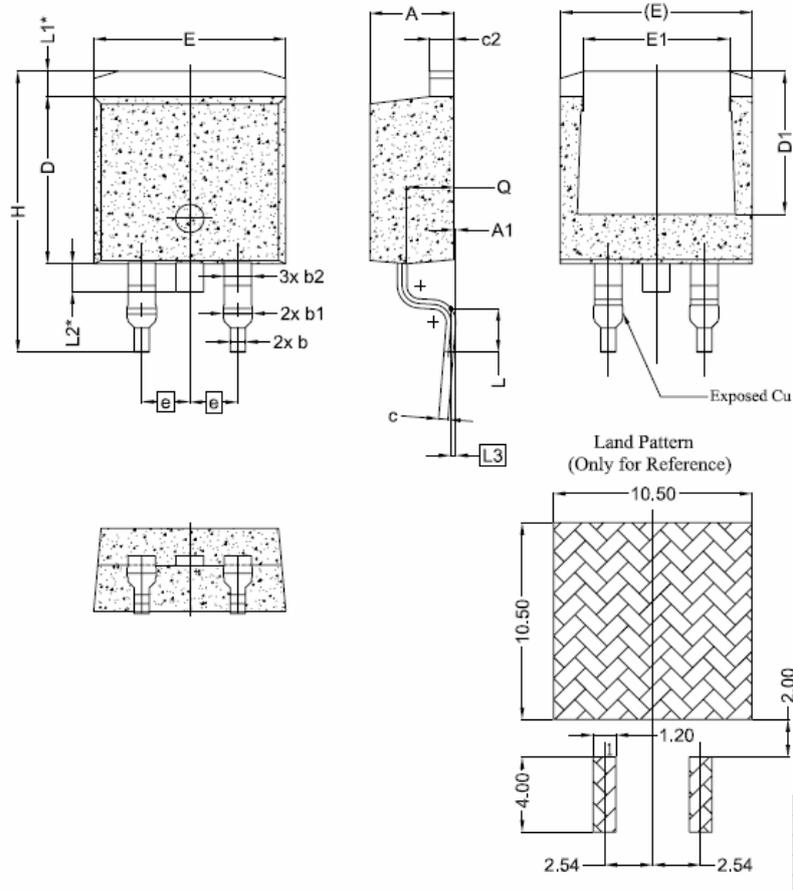
Figure 11 Normalized Maximum Transient Thermal Impedance

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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