# 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

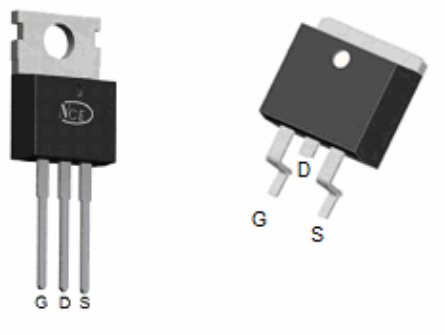
- DC/DC Converter
- Ideal for high-frequency switching and synchronous rectification

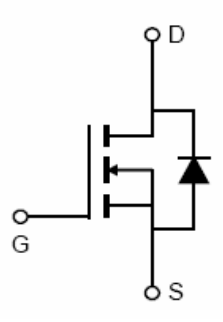
## General Features

- $V_{DS}$ =85V,$I_D$ =160A
  $R_{DS(ON)}$=3.10mΩ , typical (TO-220)@ $V_{GS}$=10V
  $R_{DS(ON)}$=2.95mΩ , 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 |
|---|---|---|---|---|---|
| NCEP033N85 | NCEP033N85 | TO-220 | - | - | - |
| NCEP033N85D | NCEP033N85D | TO-263 | - | - | - |

## Absolute Maximum Ratings ($T_C$=25℃unless otherwise noted)

| Parameter | Symbol | Limit | Unit |
|---|---|---|---|
| Drain-Source Voltage | $V_{DS}$ | 85 | V |
| Gate-Source Voltage | $V_{GS}$ | ±20 | V |
| Drain Current-Continuous | $I_D$ | 160 | A |
| Drain Current-Continuous($T_C$=100℃) | $I_D$ (100℃) | 112 | A |
| Pulsed Drain Current | $I_{DM}$ | 640 | A |
| Maximum Power Dissipation | $P_D$ | 220 | W |
| Derating factor | | 1.47 | W/℃ |
| Single pulse avalanche energy (Note 5) | $E_{AS}$ | 1295 | mJ |
| Operating Junction and Storage Temperature Range | $T_J$,$T_{STG}$ | -55 To 175 | ℃ |

## Thermal Characteristic

| | | | |
|---|---|---|---|
| Thermal Resistance,Junction-to-Case (Note 2) | $R_{\theta JC}$ | 0.68 | ℃/W |

## Electrical Characteristics ($T_C$=25℃unless otherwise noted)

| Parameter | Symbol | Condition | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | $V_{GS}$=0V $I_D$=250μA | | 85 | | - | V |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$=85V,$V_{GS}$=0V | | - | - | 1 | μA |
| Gate-Body Leakage Current | $I_{GSS}$ | $V_{GS}$=±20V,$V_{DS}$=0V | | - | - | ±100 | nA |
| **On Characteristics** (Note 3) | | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$,$I_D$=250μA | | 2.0 | 3.0 | 4.0 | V |
| Drain-Source On-State Resistance | $R_{DS(ON)}$ | $V_{GS}$=10V, $I_D$=80A | TO-220 | - | 3.1 | 3.3 | mΩ |
| | | | TO-263 | | 2.95 | 3.3 | mΩ |
| Gate resistance | $R_G$ | | | - | 1.9 | - | Ω |
| Forward Transconductance | $g_{FS}$ | $V_{DS}$=5V,$I_D$=80A | | | 90 | - | S |
| **Dynamic Characteristics** (Note4) | | | | | | | |
| Input Capacitance | $C_{lss}$ | $V_{DS}$=40V,$V_{GS}$=0V, F=1.0MHz | | - | 7200 | - | PF |
| Output Capacitance | $C_{oss}$ | | | - | 1100 | - | PF |
| Reverse Transfer Capacitance | $C_{rss}$ | | | - | 24 | - | PF |
| **Switching Characteristics** (Note 4) | | | | | | | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DD}$=40V,$I_D$=80A $V_{GS}$=10V,$R_G$=1.6Ω | | - | 21 | - | nS |
| Turn-on Rise Time | $t_r$ | | | - | 12.5 | - | nS |
| Turn-Off Delay Time | $t_{d(off)}$ | | | - | 48 | - | nS |
| Turn-Off Fall Time | $t_f$ | | | - | 12 | - | nS |
| Total Gate Charge | $Q_g$ | $V_{DS}$=40V,$I_D$=80A, $V_{GS}$=10V | | - | 115 | - | nC |
| Gate-Source Charge | $Q_{gs}$ | | | - | 39 | | nC |
| Gate-Drain Charge | $Q_{gd}$ | | | - | 32 | | nC |
| **Drain-Source Diode Characteristics** | | | | | | | |
| Diode Forward Voltage (Note 3) | $V_{SD}$ | $V_{GS}$=0V,$I_S$=80A | | - | | 1.2 | V |
| Diode Forward Current (Note 2) | $I_S$ | | | - | - | 160 | A |
| Reverse Recovery Time | $t_{rr}$ | $T_J$ = 25°C, $I_F$ = 80A di/dt = 100A/μs (Note3) | | - | 80 | - | nS |
| Reverse Recovery Charge | Qrr | | | - | 147 | - | nC |

## 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 : Tj=25℃,$V_{DD}$=40V,$V_G$=10V,L=0.5mH,Rg=25Ω

## Typical Electrical and Thermal Characteristics

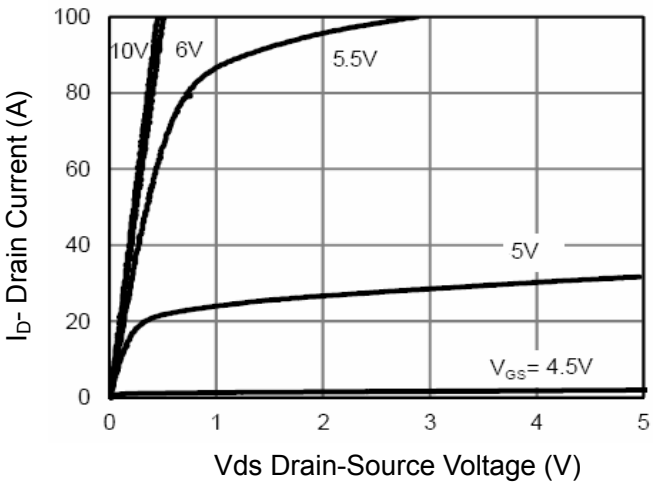



**Figure 1 Output Characteristics**

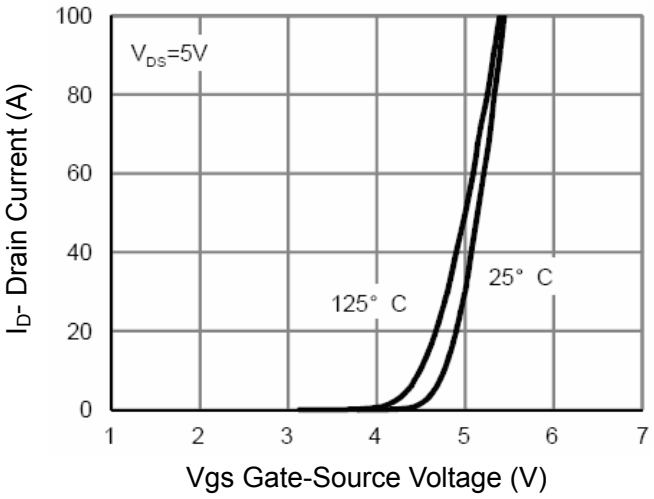



**Figure 2 Transfer Characteristics**

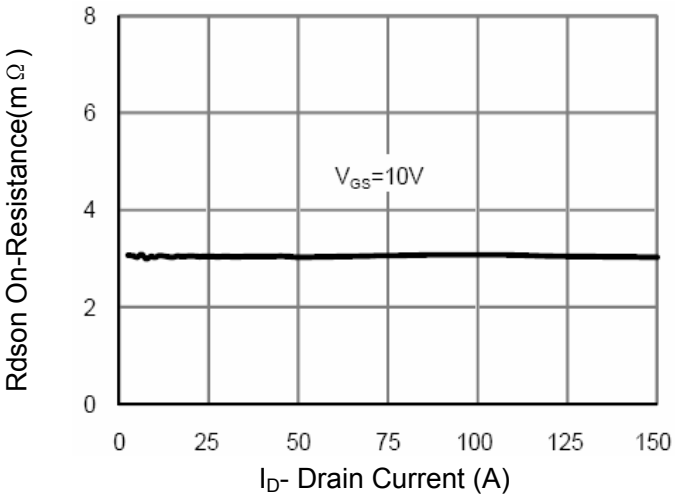



**Figure 3 Rdson- Drain Current**

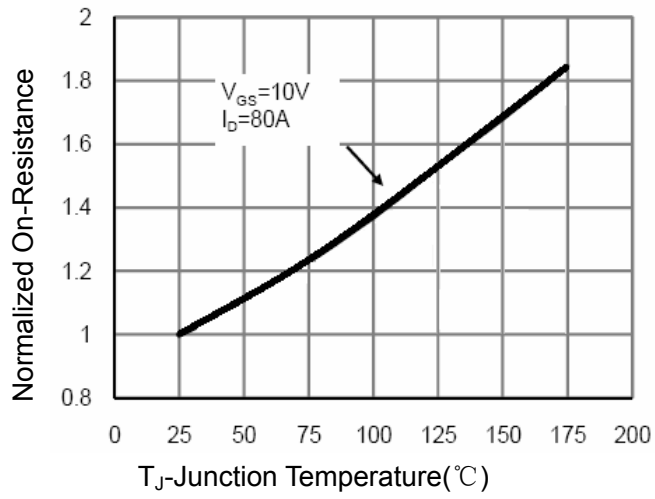



**Figure 4 Rdson-Junction Temperature**

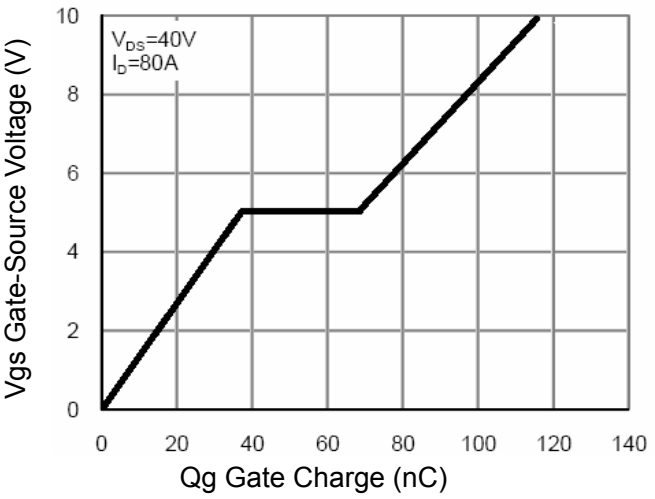



**Figure 5 Gate Charge**

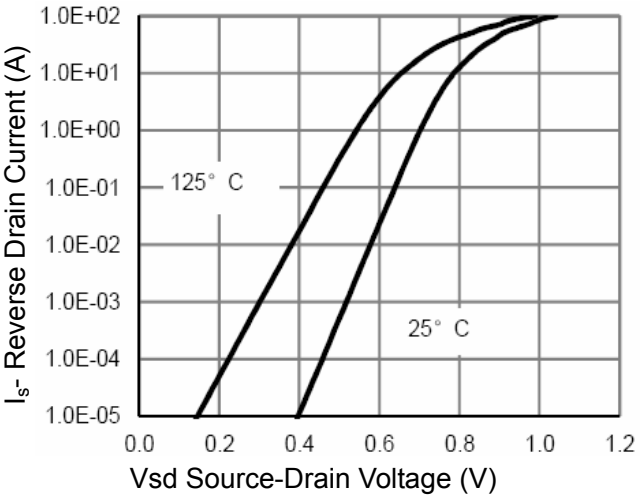



**Figure 6 Source- Drain Diode Forward**

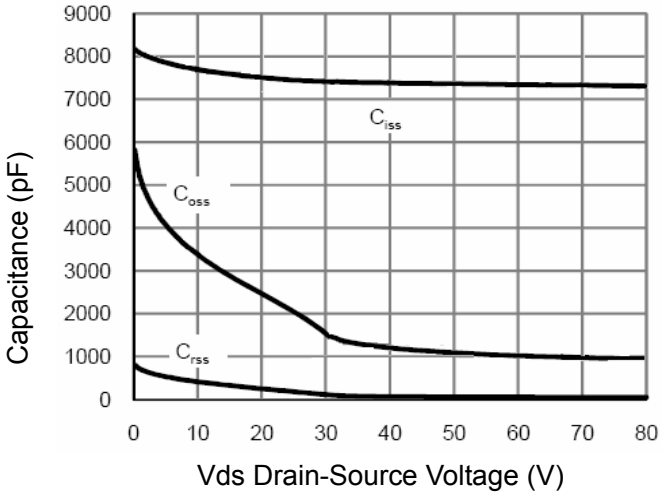



**Figure 7 Capacitance vs Vds**

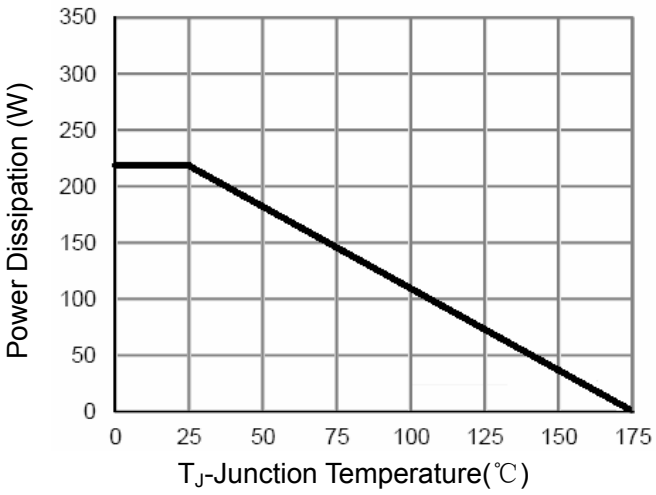



**Figure 9 Power De-rating**

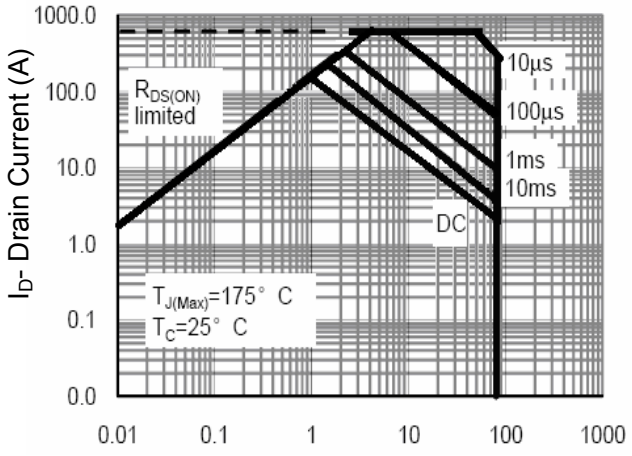



**Figure 8 Safe Operation Area**

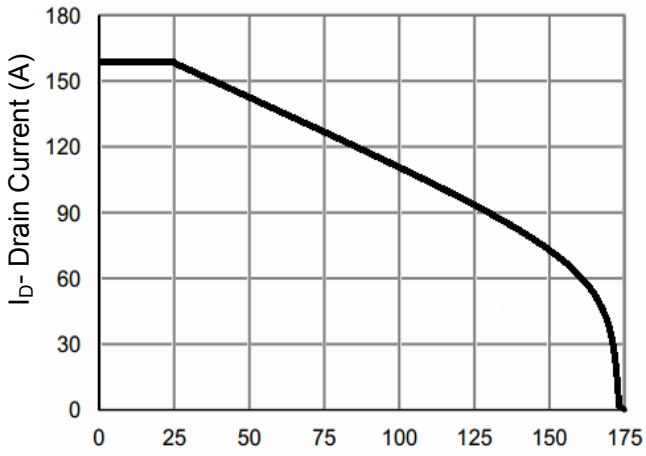



**Figure 10 Current De-rating**

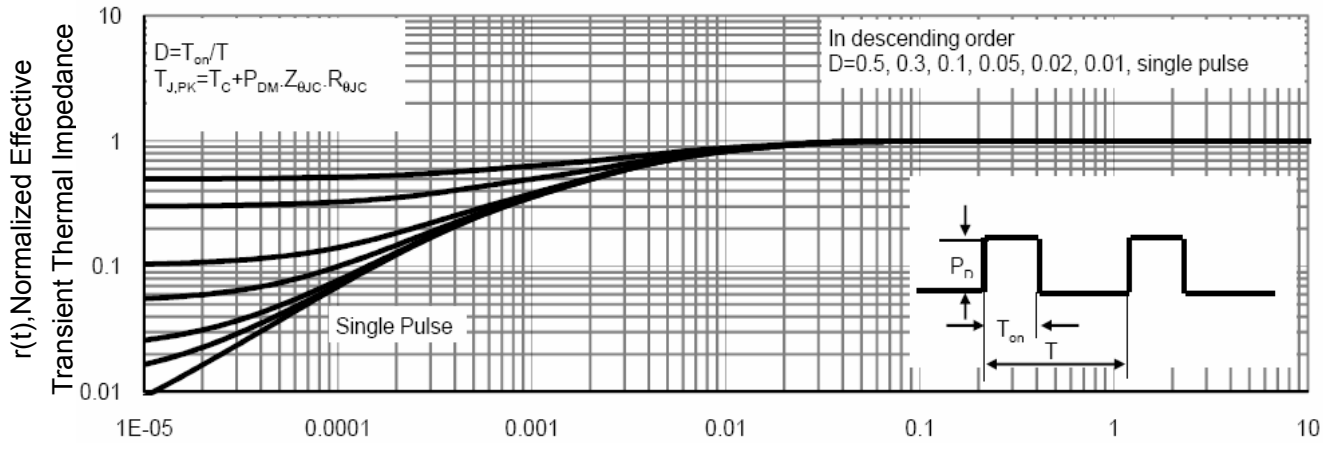
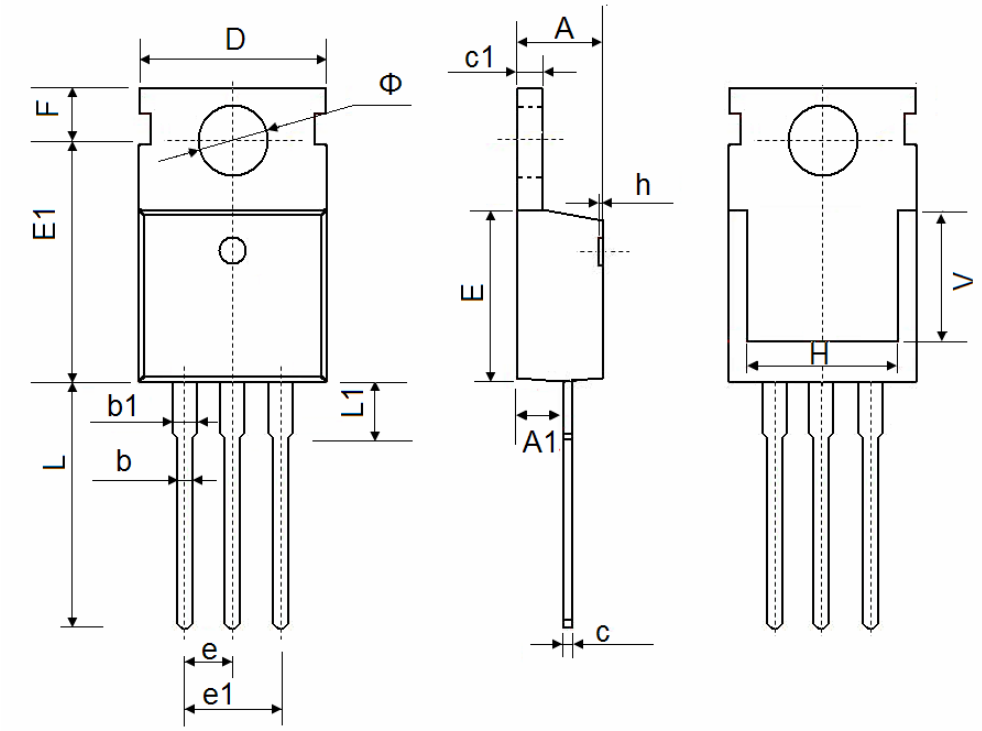


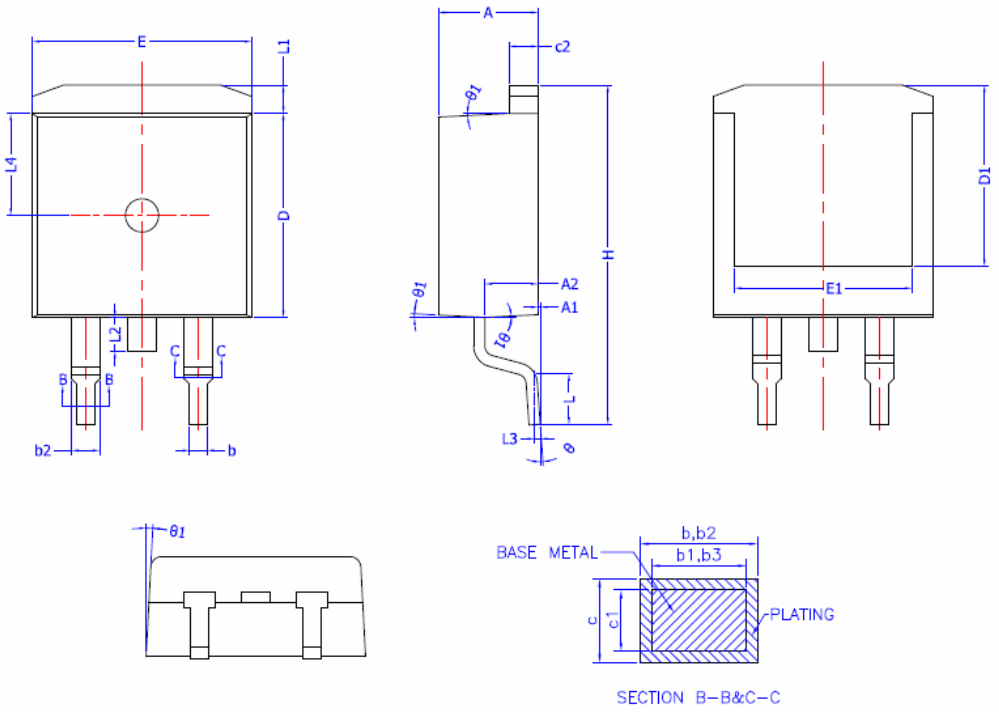

**Figure 11 Normalized Maximum Transient Thermal Impedance**

## 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




COMMON DIMENSIONS
(UNITS OF MEASURE =MILLIMETER)

| SYMBOL | MIN | NOM | MAX |
|---|---|---|---|
| A | 4.40 | 4.50 | 4.60 |
| A1 | 0 | 0.10 | 0.25 |
| A2 | 2.20 | 2.40 | 2.60 |
| b | 0.76 | — | 0.89 |
| b1 | 0.75 | 0.80 | 0.85 |
| b2 | 1.23 | — | 1.37 |
| b3 | 1.22 | 1.27 | 1.32 |
| c | 0.47 | — | 0.60 |
| c1 | 0.46 | 0.51 | 0.56 |
| c2 | 1.25 | 1.30 | 1.35 |
| D | 9.10 | 9.20 | 9.30 |
| D1 | 8.00 | — | — |
| E | 9.80 | 9.90 | 10.00 |
| E1 | 7.80 | — | — |
| e | 2.54 BSC | | |
| H | 14.90 | 15.30 | 15.70 |
| L | 2.00 | 2.30 | 2.60 |
| L1 | 1.17 | 1.27 | 1.40 |
| L2 | — | — | 1.75 |
| L3 | 0.25BSC | | |
| L4 | 4.60 REF | | |
| θ | 0° | — | 8° |
| θ1 | 1° | 3° | 5° |

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