

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

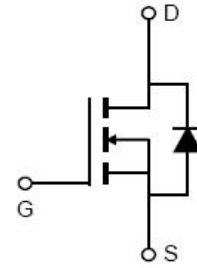
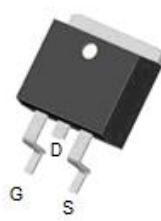
- DC/DC Converter
- Ideal for high-frequency switching and synchronous rectification

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/ $^\circ C$ |
| Single pulse avalanche energy (Note 1) | E_{AS} | 730 | mJ |
| Operating Junction and Storage Temperature Range | T_J, T_{STG} | -55 To 175 | $^\circ C$ |

Thermal Characteristic

| | | | |
|--------------------------------------|-----------------|------|--------------|
| Thermal Resistance, Junction-to-Case | $R_{\theta JC}$ | 0.68 | $^\circ C/W$ |
|--------------------------------------|-----------------|------|--------------|

Electrical Characteristics (T_c=25°C unless otherwise noted)

| Parameter | Symbol | Condition | Min | Typ | Max | Unit | |
|---|---------------------|---|--------|------|------|------|----|
| Off Characteristics | | | | | | | |
| Drain-Source Breakdown Voltage | BV _{DSS} | V _{GS} =0V, I _D =250μA | 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} =±20V, V _{DS} =0V | - | - | ±100 | nA | |
| On Characteristics | | | | | | | |
| 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 =65A | TO-220 | - | 3.65 | 3.9 | mΩ |
| | | | TO-263 | | 3.5 | 3.9 | mΩ |
| Gate resistance | R _G | | - | 1.5 | - | Ω | |
| Forward Transconductance | g _{FS} | V _{DS} =5V, I _D =65A | | 90 | - | S | |
| Dynamic Characteristics | | | | | | | |
| Input Capacitance | C _{iss} | V _{DS} =50V, V _{GS} =0V, F=1.0MHz | - | 9500 | - | PF | |
| Output Capacitance | C _{oss} | | - | 650 | - | PF | |
| Reverse Transfer Capacitance | C _{rss} | | - | 40 | - | PF | |
| Switching Characteristics (Note 2) | | | | | | | |
| Turn-on Delay Time | t _{d(on)} | V _{DD} =50V, I _D =65A V _{GS} =10V, R _G =1.6Ω | - | 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 | - | 125 | - | nC | |
| Gate-Source Charge | Q _{gs} | | - | 40.5 | - | nC | |
| Gate-Drain Charge | Q _{gd} | | - | 33 | - | nC | |
| Drain-Source Diode Characteristics | | | | | | | |
| Diode Forward Voltage | V _{SD} | V _{GS} =0V, I _S =65A | - | | 1.2 | V | |
| Diode Forward Current | I _S | | - | - | 135 | A | |
| Reverse Recovery Time | t _{rr} | T _J = 25°C, I _F = I _S | - | 76 | - | nS | |
| Reverse Recovery Charge | Q _{rr} | di/dt = 100A/μs | - | 150 | - | nC | |

Notes:

1. EAS condition : T_j=25°C, V_{DD}=50V, V_G=10V, L=0.5mH, R_G=25Ω
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)=175° C. The SOA curve provides a single pulse rating.

Typical Electrical and Thermal Characteristics

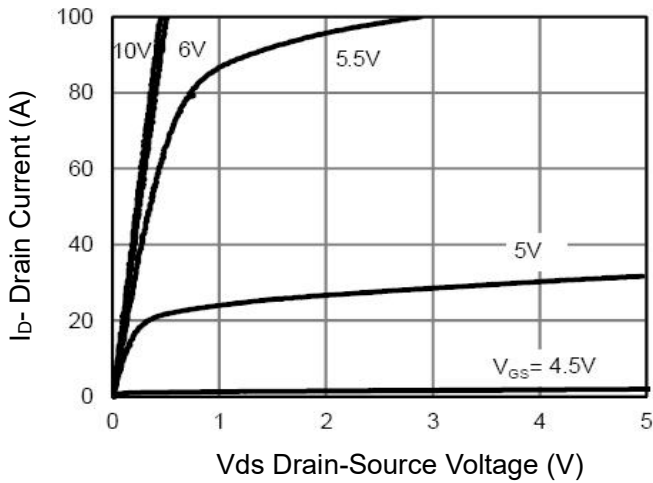


Figure 1 Output Characteristics

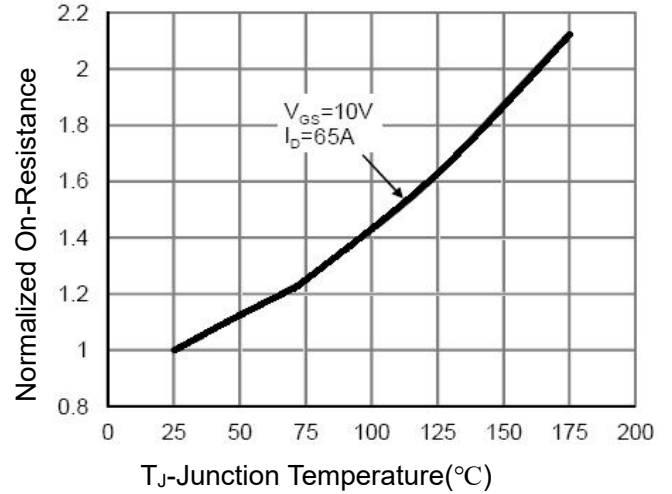


Figure 4 Rdson-Junction Temperature

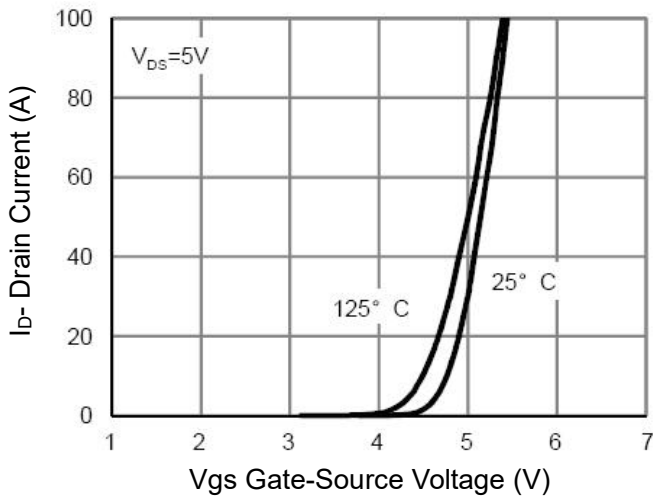


Figure 2 Transfer Characteristics

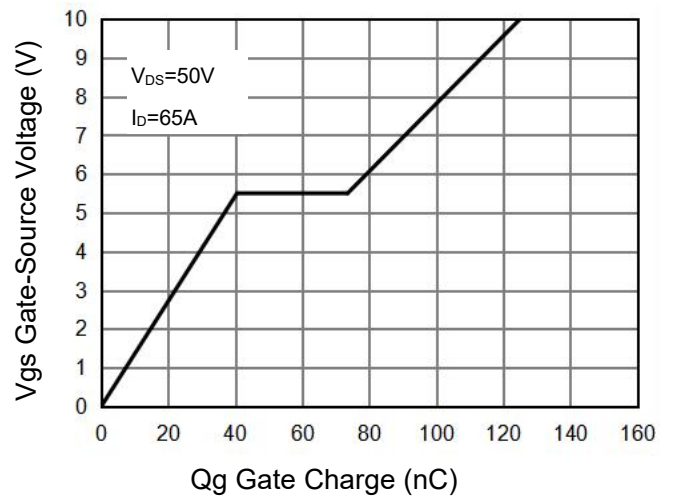


Figure 5 Gate Charge

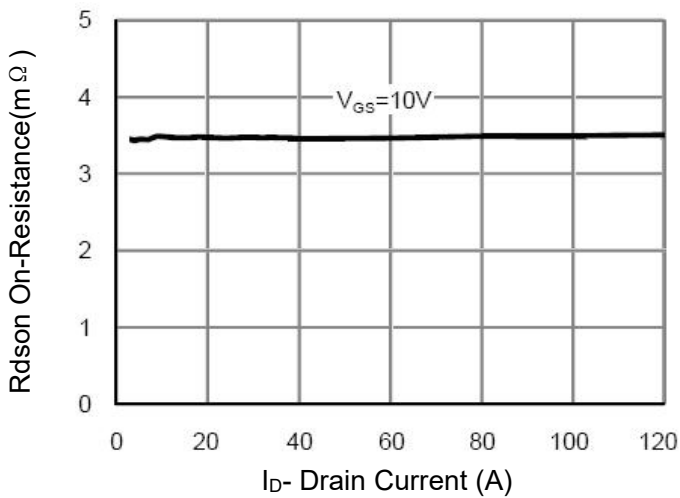


Figure 3 Rdson- Drain Current

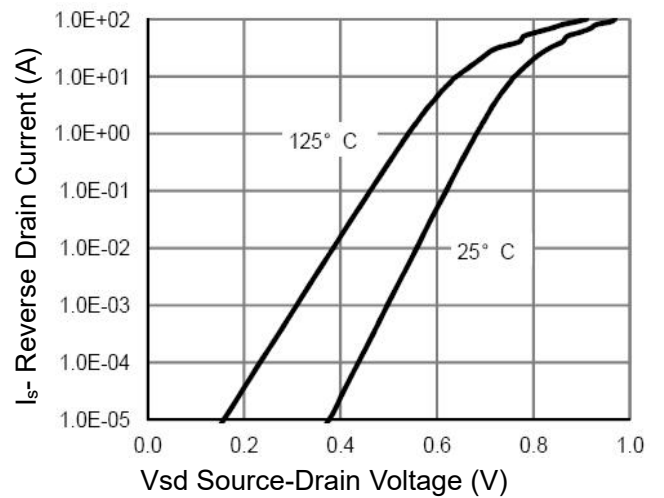


Figure 6 Source- Drain Diode Forward

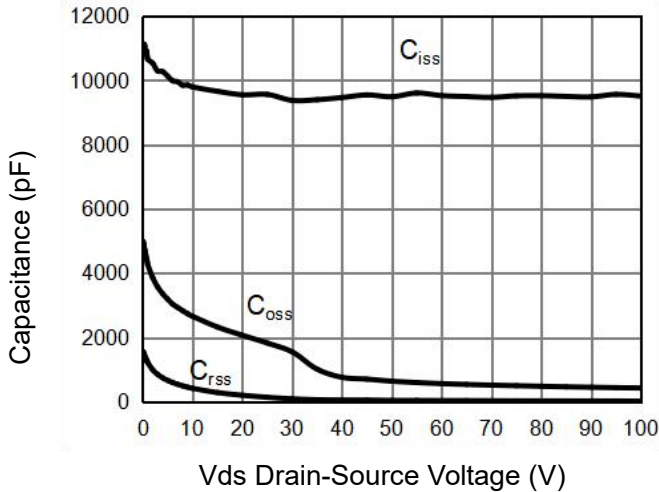


Figure 7 Capacitance vs Vds

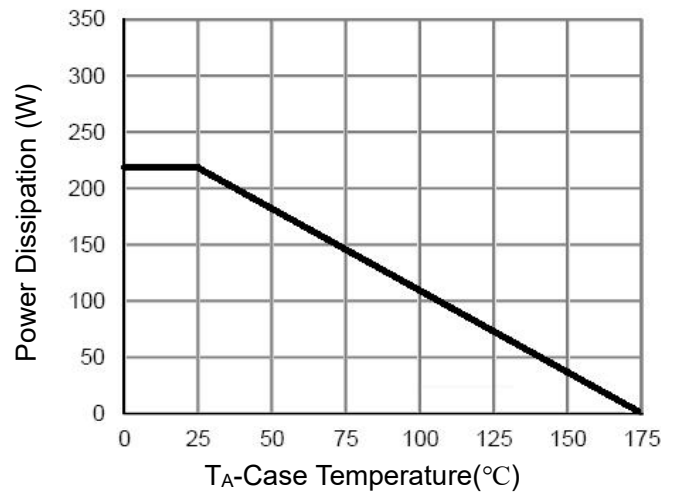


Figure 9 Power De-rating

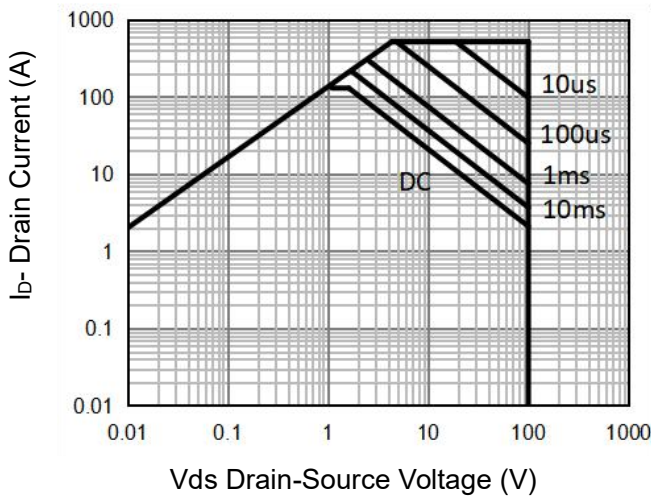


Figure 8 Safe Operation Area

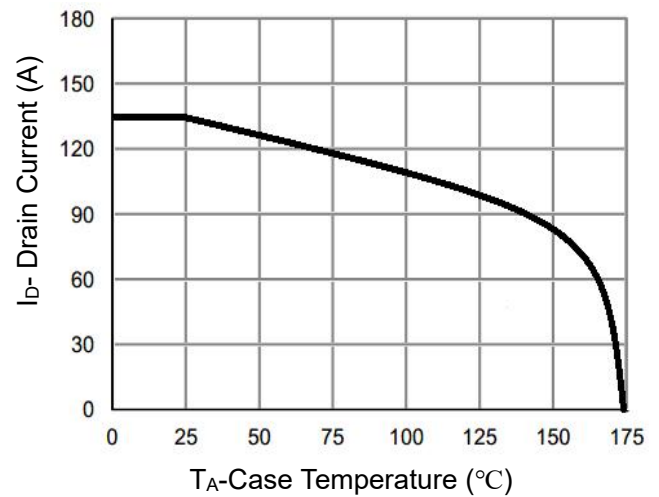


Figure 10 Current De-rating

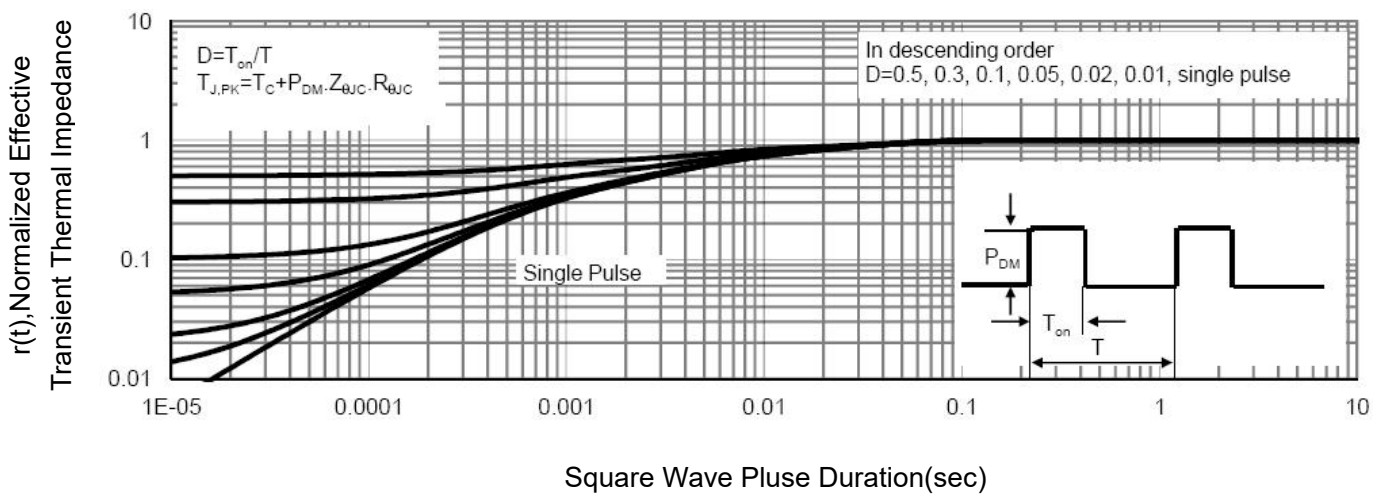
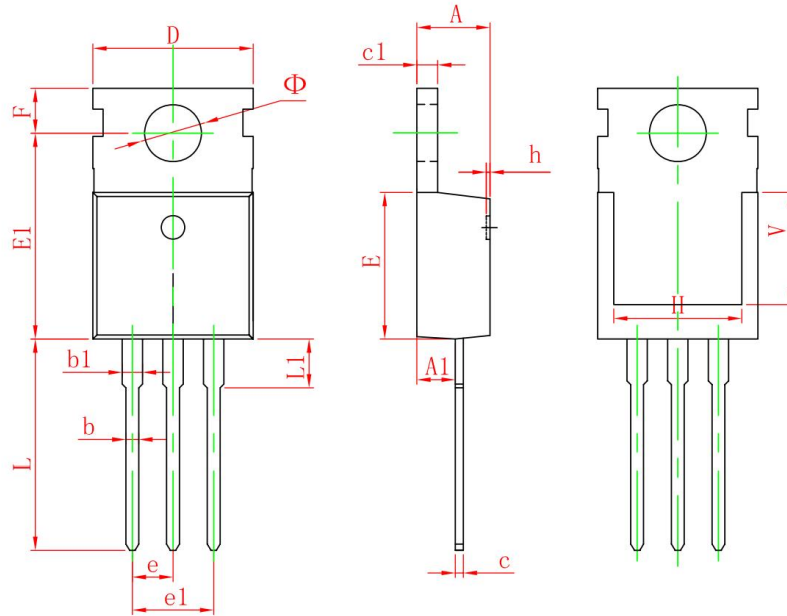


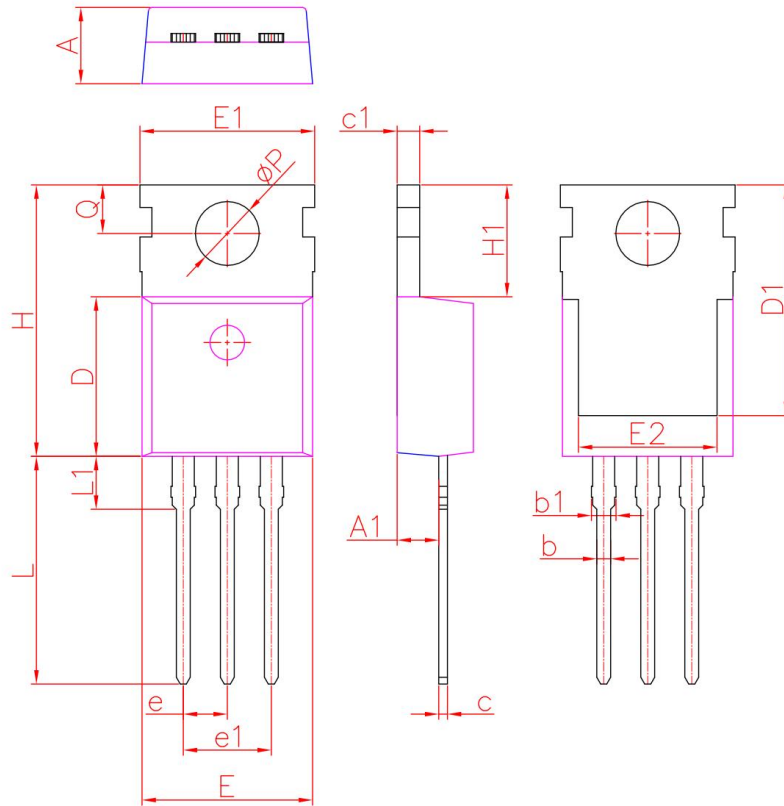
Figure 11 Normalized Maximum Transient Thermal Impedance

TO-220-3L(C) Package Information



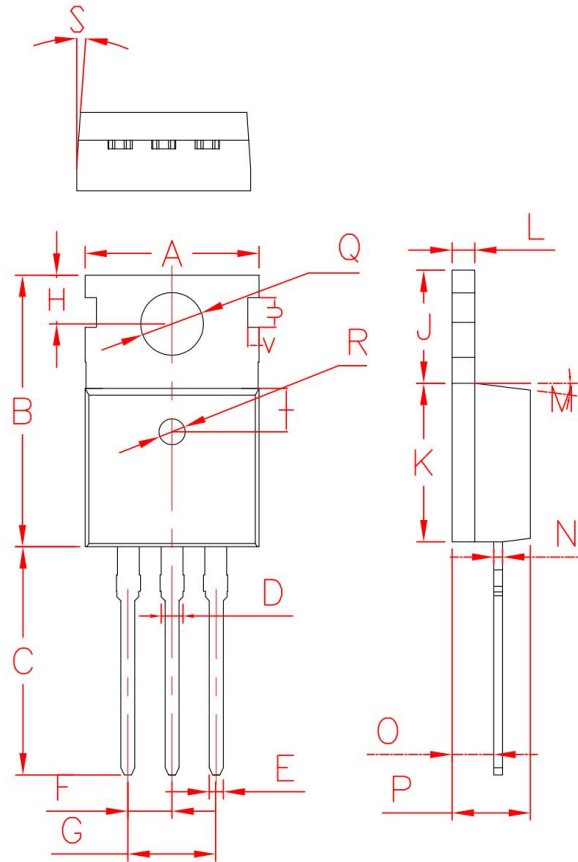
| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|---------------------------|--------|----------------------|-------|
| | Min. | Max. | Min. | Max. |
| A | 4.400 | 4.600 | 0.173 | 0.181 |
| A1 | 2.250 | 2.550 | 0.089 | 0.100 |
| b | 0.710 | 0.910 | 0.028 | 0.036 |
| b1 | 1.170 | 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 | 8.950 | 9.750 | 0.352 | 0.384 |
| E1 | 12.650 | 13.050 | 0.498 | 0.514 |
| 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-220-3L(E) Package Information



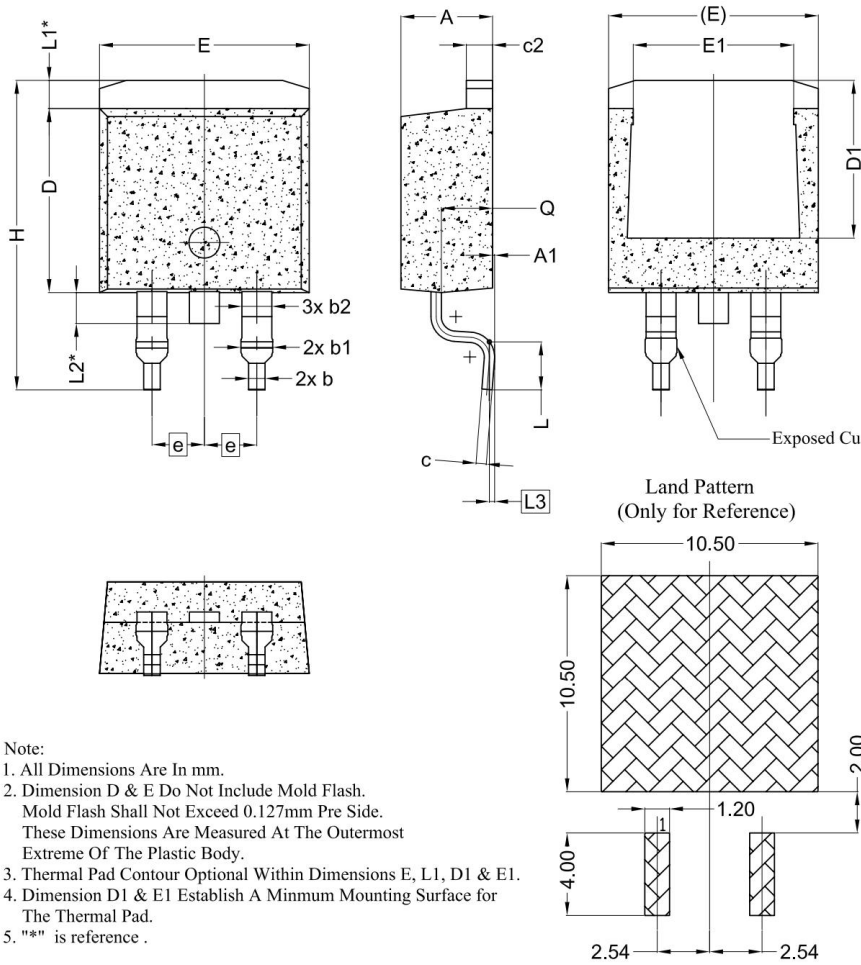
| TO220 | | | |
|-------------------------------|---------|-------|-------|
| DIM. | MIN. | NOM. | MAX. |
| A | 4.20 | 4.40 | 4.60 |
| A1 | 2.25 | 2.40 | 2.55 |
| b | 0.70 | 0.80 | 0.90 |
| b1 | 1.17 | 1.27 | 1.37 |
| c | 0.33 | 0.50 | 0.65 |
| c1 | 1.20 | 1.30 | 1.40 |
| D | 8.95 | 9.20 | 9.75 |
| D1 | 13.10 | 13.30 | 13.50 |
| E | 9.74 | 9.84 | 10.04 |
| E1 | 9.91 | 10.08 | 10.25 |
| E2 | 7.90 | 8.00 | 8.10 |
| e | 2.54BSC | | |
| e1 | 5.08BSC | | |
| H | 15.45 | 15.65 | 15.85 |
| H1 | 6.30 | 6.45 | 6.60 |
| L | 12.90 | 13.13 | 13.40 |
| L1 | 2.85 | 3.05 | 3.25 |
| Q | 2.65 | 2.80 | 2.95 |
| øP | 3.40 | 3.68 | 3.80 |
| All dimensions in millimeters | | | |

TO-220-3L(S) Package Information



| Symbol | Min | Non | Max |
|--------|-------|-------|-------|
| A | 9.80 | 10.00 | 10.20 |
| B | 15.40 | 15.60 | 15.80 |
| C | 12.75 | 13.10 | 13.45 |
| D | 1.18 | 1.31 | 1.44 |
| E | 0.70 | 0.80 | 0.90 |
| F | 2.42 | 2.54 | 2.66 |
| G | 4.84 | 5.08 | 5.32 |
| H | 2.73 | 2.80 | 2.87 |
| I | 2.40 | 2.50 | 2.60 |
| J | 6.40 | 6.50 | 6.60 |
| K | 9.00 | 9.10 | 9.20 |
| L | 1.29 | 1.30 | 1.32 |
| M | 6.5° | 7.0° | 7.5° |
| N | 0.48 | 0.50 | 0.56 |
| O | 2.35 | 2.4 | 2.5 |
| P | 4.4 | 4.5 | 4.7 |
| Q | 3.5 | 3.6 | 3.63 |
| R | 1.4 | 1.5 | 1.6 |
| S | 2° | 2.5° | 3° |
| U | 1.65 | 1.75 | 1.85 |
| V | 0.58 | 0.68 | 0.78 |

TO-263-2L Package Information



- Note:
1. All Dimensions Are In mm.
 2. Dimension D & E Do Not Include Mold Flash.
Mold Flash Shall Not Exceed 0.127mm Pre Side.
These Dimensions Are Measured At The Outermost Extreme Of The Plastic Body.
 3. Thermal Pad Contour Optional Within Dimensions E, L1, D1 & E1.
 4. Dimension D1 & E1 Establish A Minmum Mounting Surface for The Thermal Pad.
 5. "*" is reference .

| 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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