# NCE N-Channel Super Trench Power MOSFET

## Description

The series of devices uses **Super Trench** 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

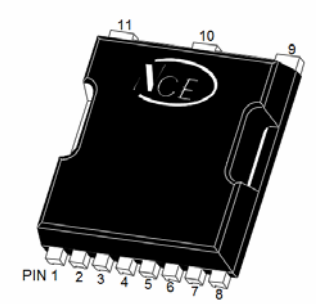
## General Features

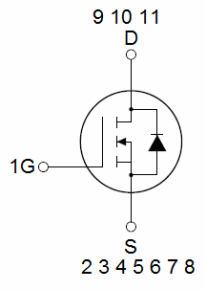
- $V_{DS}$ =150V,$I_D$ =170A
  $R_{DS(ON)}$=5.0mΩ , typical@ $V_{GS}$=10V
- Excellent gate charge x $R_{DS(on)}$ product(FOM)
- Very low on-resistance $R_{DS(on)}$
- 175 °C operating temperature
- Pb-free lead plating

***100% UIS TESTED!***

***100% ΔVds TESTED!***

**TOLL**




**Schematic Diagram**

## Package Marking and Ordering Information

| Device Marking | Device | Device Package | Reel Size | Tape width | Quantity |
|---|---|---|---|---|---|
| NCEP15T14LL | NCEP15T14LL | TOLL | - | - | - |

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

| Parameter | Symbol | Limit | Unit |
|---|---|---|---|
| Drain-Source Voltage | $V_{DS}$ | 150 | V |
| Gate-Source Voltage | $V_{GS}$ | ±20 | V |
| Drain Current-Continuous ($T_C$=25℃) | $I_D$ ($T_C$=25℃) | 170 | A |
| Drain Current-Continuous($T_C$=100℃) | $I_D$ ($T_C$ =100℃) | 120 | A |
| Drain Current-Continuous ($T_A$=25℃) | $I_D$ ($T_A$=25℃) | 16 | A |
| Pulsed Drain Current (Note 1) | $I_{DM}$ | 680 | A |
| Maximum Power Dissipation ($T_C$=25℃) | $P_D$ ($T_C$=25℃) | 380 | W |
| Maximum Power Dissipation ($T_A$=25℃) | $P_D$($T_A$=25℃) | 3.75 | W |
| Derating factor | | 2.5 | W/℃ |
| Single pulse avalanche energy (Note 5) | $E_{AS}$ | 1300 | mJ |
| Operating Junction and Storage Temperature Range | $T_J$,$T_{STG}$ | -55 To 175 | ℃ |

## Thermal Characteristic

| | | | |
|---|---|---|---|
| Thermal Resistance,Junction-to-Case (Note 2) | $R_{\theta JC}$ | 0.4 | ℃/W |
| Thermal Resistance,Junction-to-Ambient (Note 2) | $R_{\theta JA}$ | 40 | ℃/W |

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

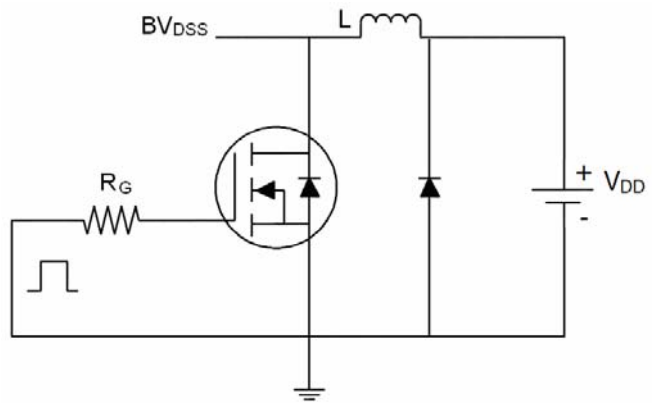
| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | $V_{GS}$=0V $I_D$=250μA | 150 | | - | V |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$=150V,$V_{GS}$=0V | - | - | 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, $I_D$=85A | - | 5 | 5.8 | mΩ |
| Gate resistance | $R_G$ | F=1.0MHz | - | 5.0 | - | Ω |
| Forward Transconductance | $g_{FS}$ | $V_{DS}$=10V,$I_D$=85A | 70 | - | - | S |
| **Dynamic Characteristics** (Note4) | | | | | | |
| Input Capacitance | $C_{lss}$ | $V_{DS}$=75V,$V_{GS}$=0V, F=1.0MHz | - | 5500 | 7150 | PF |
| Output Capacitance | $C_{oss}$ | | - | 690 | 890 | PF |
| Reverse Transfer Capacitance | $C_{rss}$ | | - | 24 | 31 | PF |
| **Switching Characteristics** (Note 4) | | | | | | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DD}$=75V,$I_D$=85A $V_{GS}$=10V,$R_G$=4.7Ω | - | 26 | - | nS |
| Turn-on Rise Time | $t_r$ | | - | 36 | - | nS |
| Turn-Off Delay Time | $t_{d(off)}$ | | - | 47 | - | nS |
| Turn-Off Fall Time | $t_f$ | | - | 15 | - | nS |
| Total Gate Charge | $Q_g$ | $V_{DS}$=75V,$I_D$=85A, $V_{GS}$=10V | - | 80 | 104 | nC |
| Gate-Source Charge | $Q_{gs}$ | | - | 32 | 41 | nC |
| Gate-Drain Charge | $Q_{gd}$ | | - | 22 | 28 | nC |
| **Drain-Source Diode Characteristics** | | | | | | |
| Diode Forward Voltage (Note 3) | $V_{SD}$ | $V_{GS}$=0V,$I_F$=85 | - | | 1.2 | V |
| Diode Forward Current (Note 2) | $I_S$ | | - | - | 170 | A |
| Reverse Recovery Time | $t_{rr}$ | $T_J$ = 25°C, $I_F$ = $I_S$ di/dt = 100A/μs (Note3) | - | 146 | | nS |
| Reverse Recovery Charge | Qrr | | - | 485 | | nC |

## Notes:

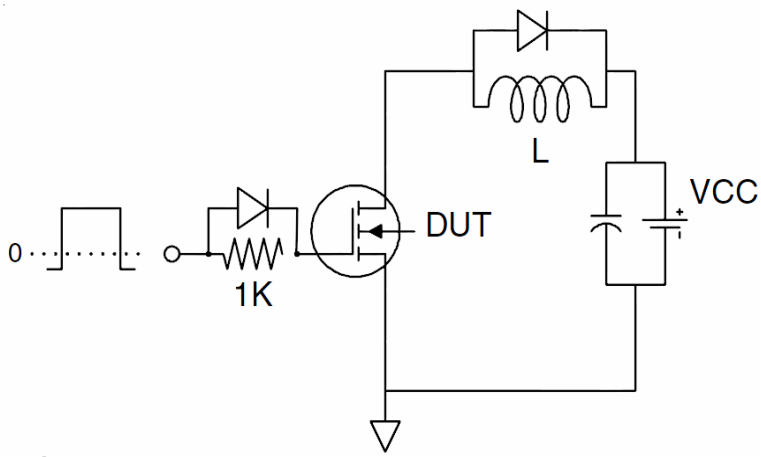
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. The value of $R_{\theta JA}$ is measured with the device mounted on 1in2 FR-4 board with 2oz. Copper, in a still air environment with $T_A$ =25° C. The value in any given application depends on the user's specific board design,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

## Test Circuit

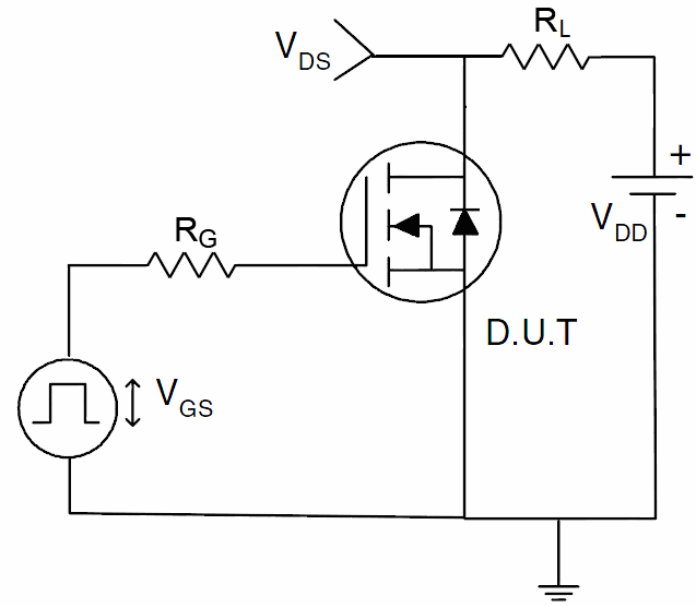
### 1) $E_{AS}$ test Circuit




### 2) Gate charge test Circuit




### 3) Switch Time Test Circuit



## Typical Electrical and Thermal Characteristics

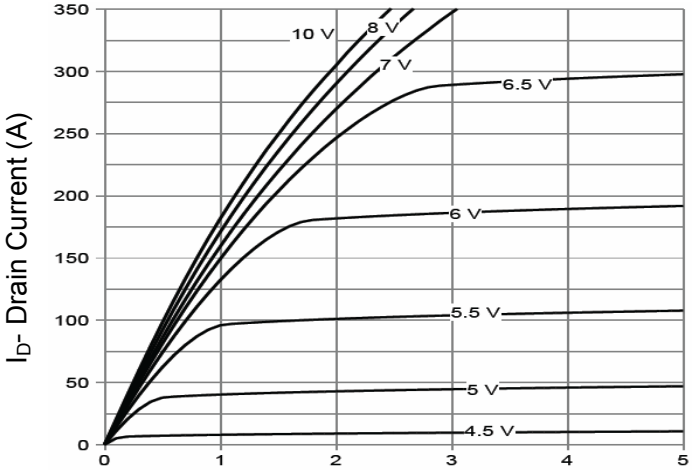



**Figure 1 Output Characteristics**

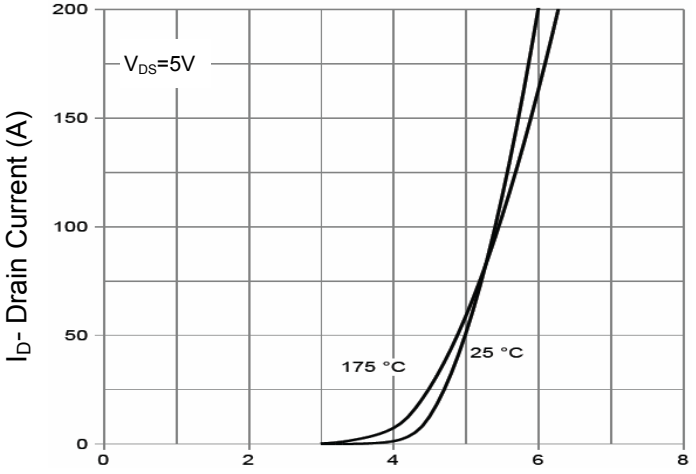



**Figure 2 Transfer Characteristics**

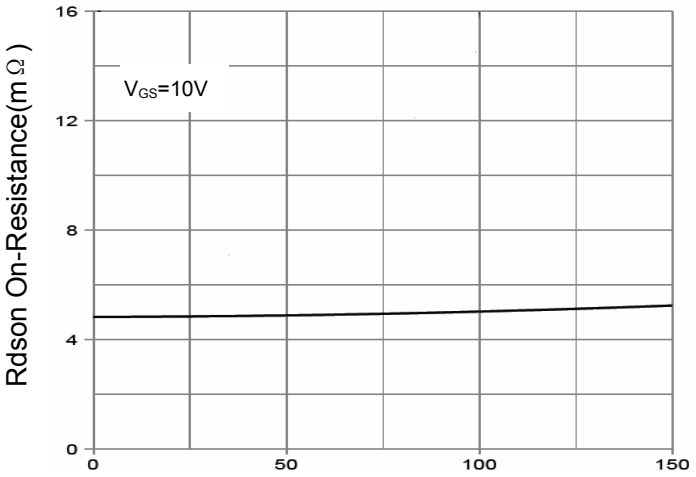



**Figure 3 Rdson- Drain Current**

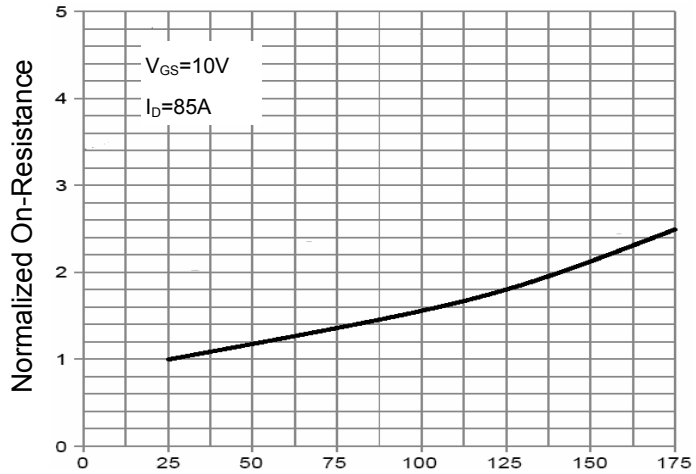



**Figure 4 Rdson-JunctionTemperature**

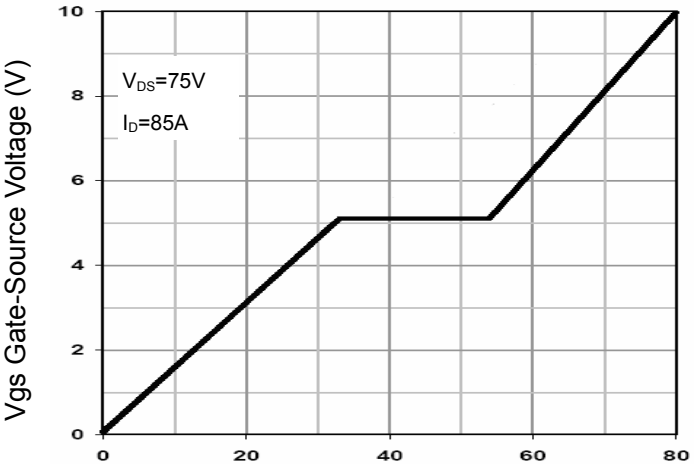



**Figure 5 Gate Charge**

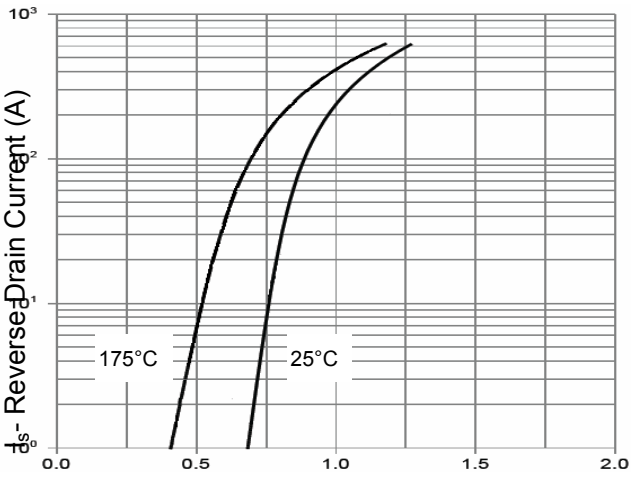



**Figure 6 Source- Drain Diode Forward**

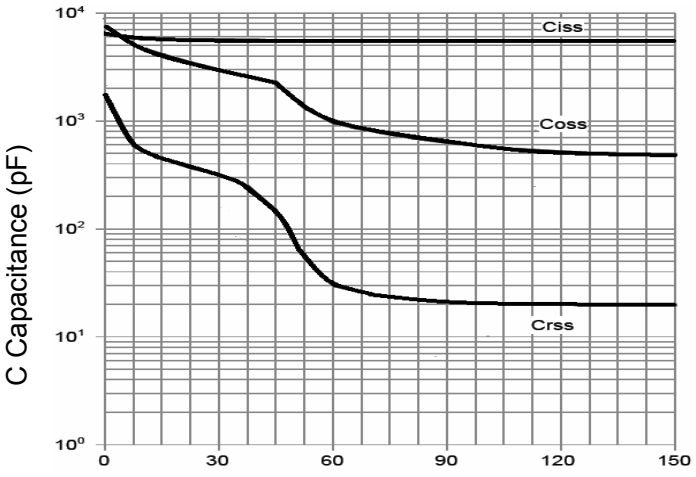



**Figure 7 Capacitance vs Vds**

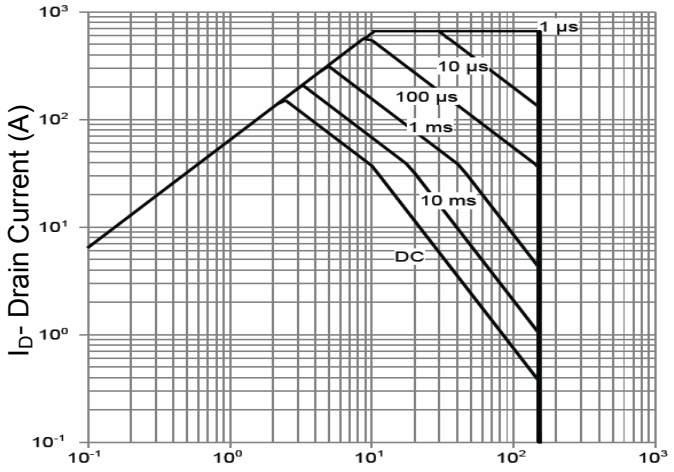



**Figure 8 Safe Operation Area**

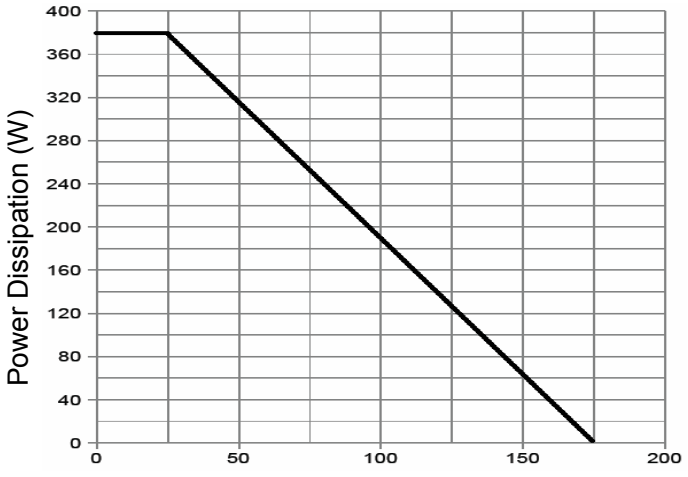



**Figure 9 Power De-rating**

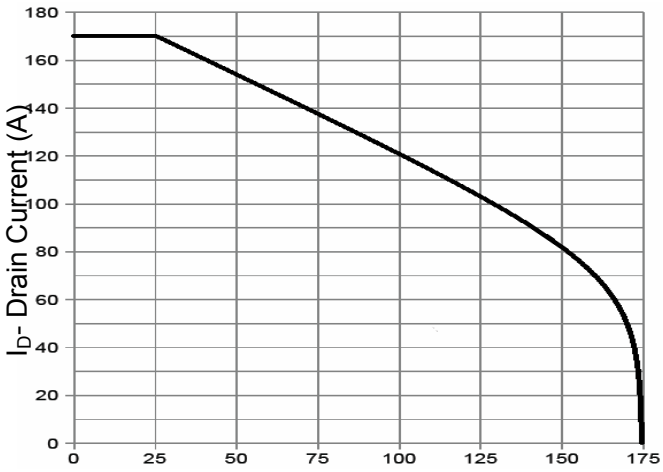



**Figure 10 Current De-rating**

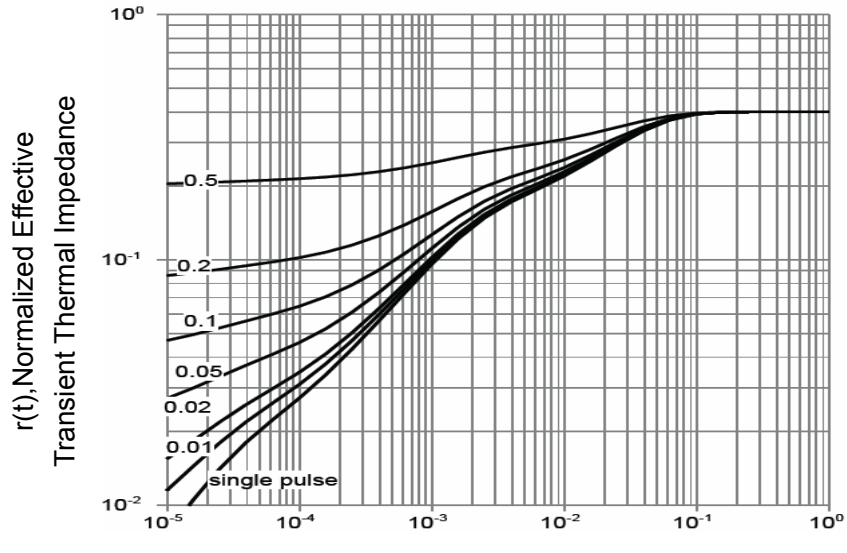
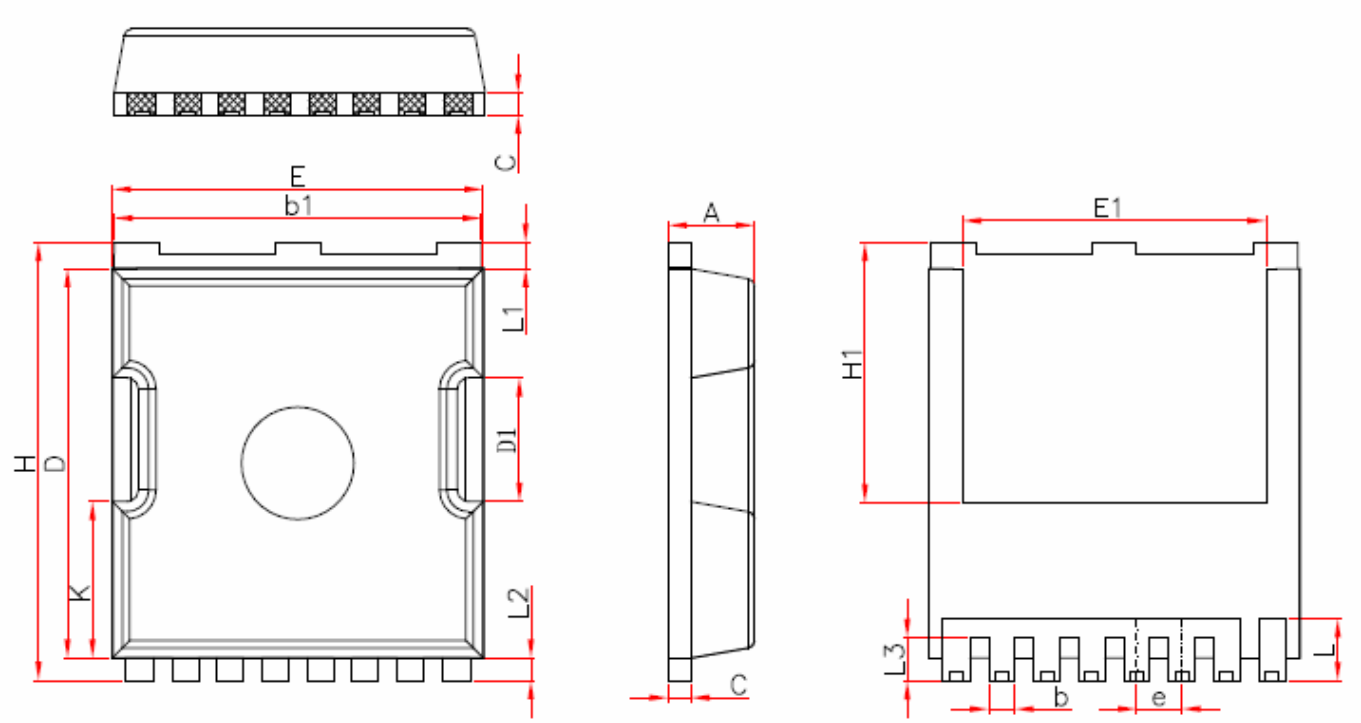



**Figure 11 Normalized Maximum Transient Thermal Impedance**

## TOLL Package Information




| Symbol | Millimeters | | |
|---|---|---|---|
| | Min. | Nom. | Max. |
| A | 2.20 | 2.30 | 2.40 |
| b | 0.65 | 0.75 | 0.85 |
| b1 | 9.70 | 9.80 | 9.90 |
| C | 0.50 | 0.60 | 0.70 |
| D | 10.30 | 10.40 | 10.50 |
| D1 | 3.15 | 3.3 | 3.45 |
| E | 9.70 | 9.90 | 10.10 |
| E1 | 8.00 | 8.10 | 8.20 |
| e | 1.10 | 1.20 | 1.30 |
| H | 11.6 | 11.7 | 11.8 |
| H1 | 6.85 | 6.95 | 7.05 |
| K | 4.08 | 4.18 | 4.28 |
| L | 1.60 | 1.65 | 2.10 |
| L1 | 0.60 | 0.70 | 0.80 |
| L2 | 0.50 | 0.60 | 0.70 |
| L3 | 1.05 | 1.20 | 1.30 |

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