

## NCE N-Channel Super Trench Power MOSFET

### Description

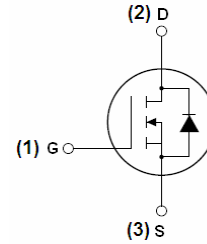
The NCEP02T10T uses **Super Trench** technology that is uniquely optimized to provide the most efficient high frequency switching performance. Both conduction and switching power losses are minimized due to an extremely low combination of  $R_{DS(ON)}$  and  $Q_g$ . This device is ideal for high-frequency switching and synchronous rectification.

### General Features

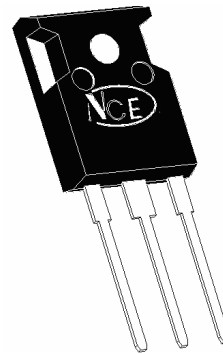
- $V_{DS} = 200V, I_D = 100A$   
 $R_{DS(ON)} < 11m\Omega @ V_{GS} = 10V$
- Excellent gate charge x  $R_{DS(on)}$  product
- Very low on-resistance  $R_{DS(on)}$
- 175 °C operating temperature
- Pb-free lead plating
- 100% UIS tested

### Application

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



Schematic diagram



TO-247 top view

**100% UIS TESTED!**

**100% ΔVds TESTED!**

### Package Marking and Ordering Information

| Device Marking | Device     | Device Package | Reel Size | Tape width | Quantity |
|----------------|------------|----------------|-----------|------------|----------|
| NCEP02T10T     | NCEP02T10T | TO-247-3L      | -         | -          | -        |

### Absolute Maximum Ratings ( $T_C = 25^\circ C$ unless otherwise noted)

| Parameter   | Symbol             | Limit      | Unit |
|---|--------------------|------------|------|
| Drain-Source Voltage                              | $V_{DS}$           | 200        | V    |
| Gate-Source Voltage                               | $V_{GS}$           | $\pm 20$   | V    |
| Drain Current-Continuous                          | $I_D$              | 100        | A    |
| Drain Current-Continuous( $T_C = 100^\circ C$ )   | $I_D(100^\circ C)$ | 70.7       | A    |
| Pulsed Drain Current                              | $I_{DM}$           | 400        | A    |
| Maximum Power Dissipation                         | $P_D$              | 300        | W    |
| Derating factor                                   |                    | 2          | W/°C |
| Single pulse avalanche energy <sup>(Note 5)</sup> | $E_{AS}$           | 1216       | 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> | $R_{\theta JC}$ | 0.5 | °C/W |
|--|-----------------|-----|------|

## Electrical Characteristics (T<sub>C</sub>=25°C unless otherwise noted)

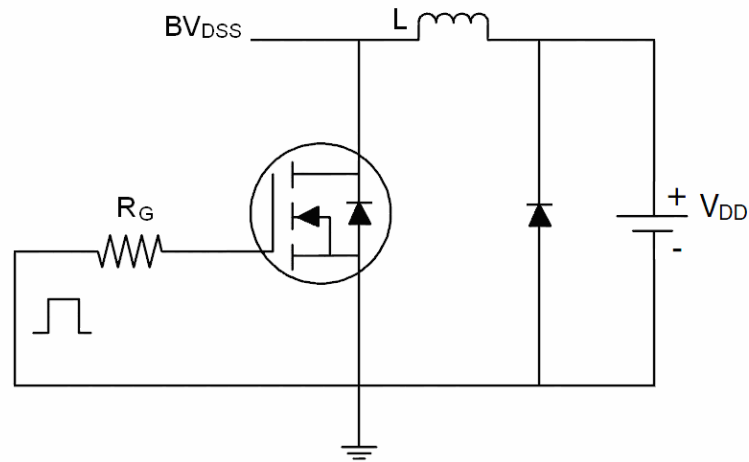
| Parameter                                 | Symbol              | Condition  | Min | Typ   | Max  | Unit |
|---|---------------------|--|-----|-------|------|------|
| <b>Off Characteristics</b>                |                     |  |     |       |      |      |
| Drain-Source Breakdown Voltage            | BV <sub>DSS</sub>   | V <sub>GS</sub> =0V I <sub>D</sub> =250μA  | 200 |       | -    | V    |
| Zero Gate Voltage Drain Current           | I <sub>DSS</sub>    | V <sub>DS</sub> =200V, V <sub>GS</sub> =0V   | -   | -     | 1    | μA   |
| Gate-Body Leakage Current                 | I <sub>GSS</sub>    | V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V   | -   | -     | ±100 | nA   |
| <b>On Characteristics</b> (Note 3)        |                     |  |     |       |      |      |
| Gate Threshold Voltage                    | V <sub>GS(th)</sub> | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA                                 | 2.5 |       | 4.5  | V    |
| Drain-Source On-State Resistance          | R <sub>DS(ON)</sub> | V <sub>GS</sub> =10V, I <sub>D</sub> =50A  | -   | 9.5   | 11   | mΩ   |
| Forward Transconductance                  | g <sub>FS</sub>     | V <sub>DS</sub> =10V, I <sub>D</sub> =50A  | 70  | -     | -    | S    |
| <b>Dynamic Characteristics</b> (Note 4)   |                     |  |     |       |      |      |
| Input Capacitance                         | C <sub>iss</sub>    | V <sub>DS</sub> =100V, V <sub>GS</sub> =0V,<br>F=1.0MHz                                  | -   | 4200  | -    | PF   |
| Output Capacitance                        | C <sub>oss</sub>    |  | -   | 333.1 | -    | PF   |
| Reverse Transfer Capacitance              | C <sub>rss</sub>    |  | -   | 8.8   | -    | PF   |
| <b>Switching Characteristics</b> (Note 4) |                     |  |     |       |      |      |
| Turn-on Delay Time                        | t <sub>d(on)</sub>  | V <sub>DD</sub> =100V, I <sub>D</sub> =50A<br>V <sub>GS</sub> =10V, R <sub>G</sub> =4.7Ω | -   | 18    | -    | nS   |
| Turn-on Rise Time                         | t <sub>r</sub>      |  | -   | 26    | -    | nS   |
| Turn-Off Delay Time                       | t <sub>d(off)</sub> |  | -   | 41    | -    | nS   |
| Turn-Off Fall Time                        | t <sub>f</sub>      |  | -   | 11    | -    | nS   |
| Total Gate Charge                         | Q <sub>g</sub>      | V <sub>DS</sub> =100V, I <sub>D</sub> =50A,<br>V <sub>GS</sub> =10V                      | -   | 63.2  |      | nC   |
| Gate-Source Charge                        | Q <sub>gs</sub>     |  | -   | 24    |      | nC   |
| Gate-Drain Charge                         | Q <sub>gd</sub>     |  | -   | 16.4  |      | nC   |
| <b>Drain-Source Diode Characteristics</b> |                     |  |     |       |      |      |
| Diode Forward Voltage (Note 3)            | V <sub>SD</sub>     | V <sub>GS</sub> =0V, I <sub>S</sub> =100A  | -   |       | 1.2  | V    |
| Diode Forward Current (Note 2)            | I <sub>S</sub>      |  | -   | -     | 100  | A    |
| Reverse Recovery Time                     | t <sub>rr</sub>     | T <sub>J</sub> = 25°C, I <sub>F</sub> = 50A<br>di/dt = 100A/μs (Note 3)                  | -   | 140   |      | nS   |
| Reverse Recovery Charge                   | Q <sub>rr</sub>     |  | -   | 600   |      | nC   |

### Notes:

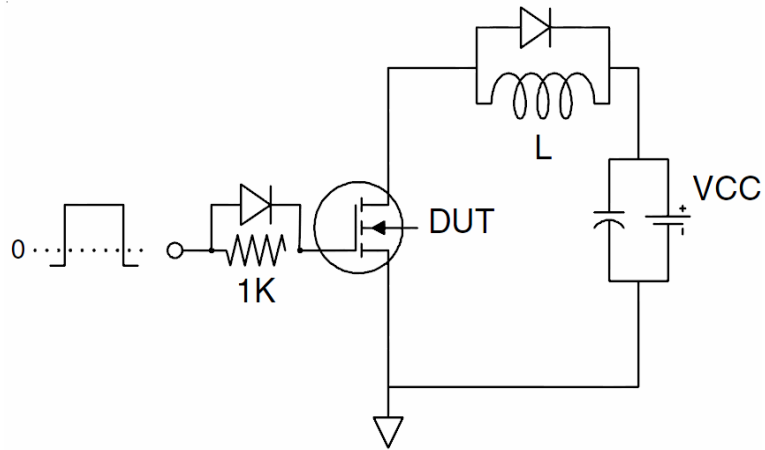
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board, t ≤ 10 sec.
3. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.
4. Guaranteed by design, not subject to production
5. EAS condition : T<sub>J</sub>=25°C, V<sub>DD</sub>=50V, V<sub>G</sub>=10V, L=0.5mH, R<sub>G</sub>=25Ω

**Test Circuit**

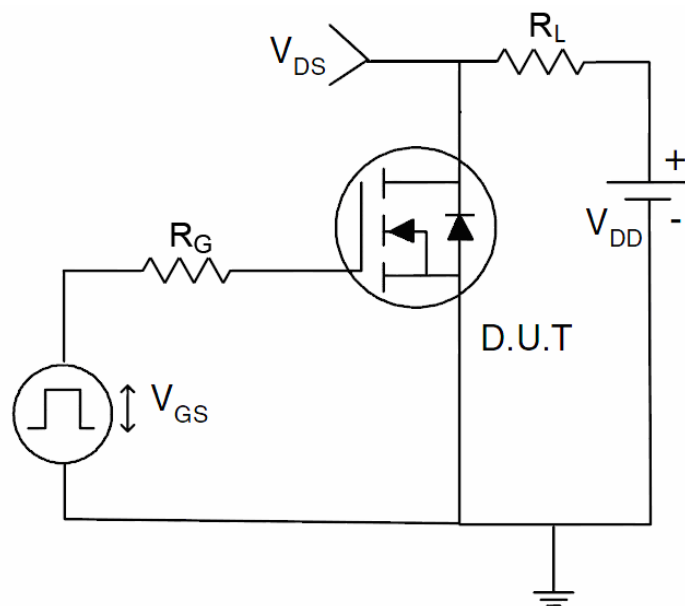
**1)  $E_{AS}$  test Circuit**



**2) Gate charge test Circuit**



**3) Switch Time Test Circuit**



Typical Electrical and Thermal Characteristics

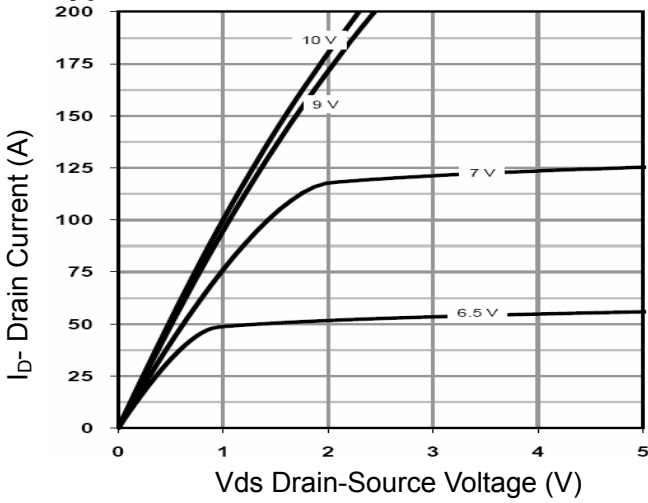


Figure 1 Output Characteristics

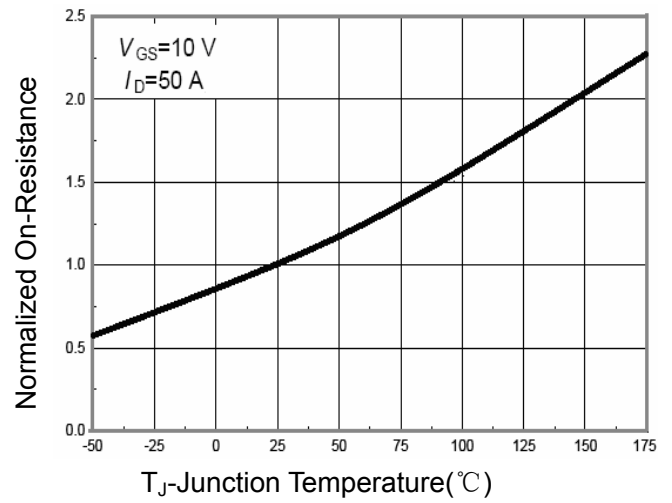


Figure 4 Rds(on)-Junction Temperature

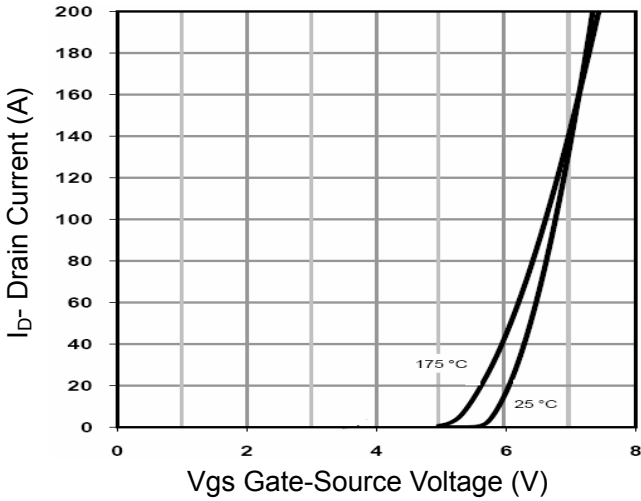


Figure 2 Transfer Characteristics

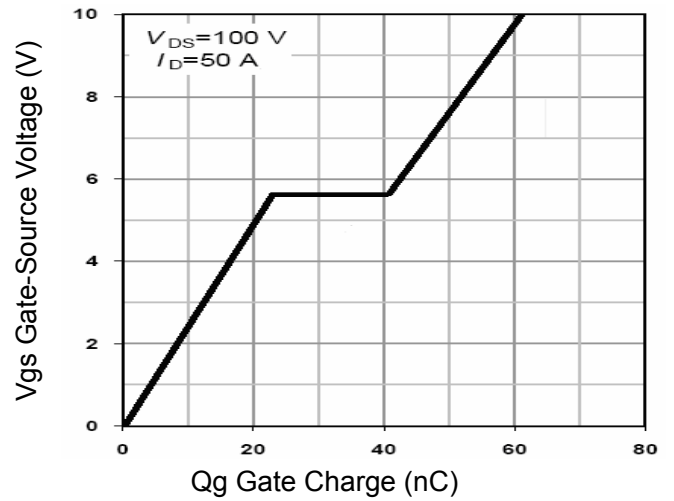


Figure 5 Gate Charge

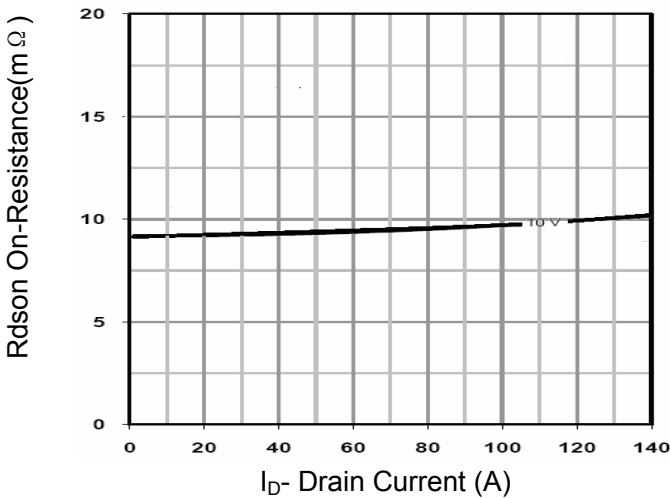


Figure 3 Rds(on)- Drain Current

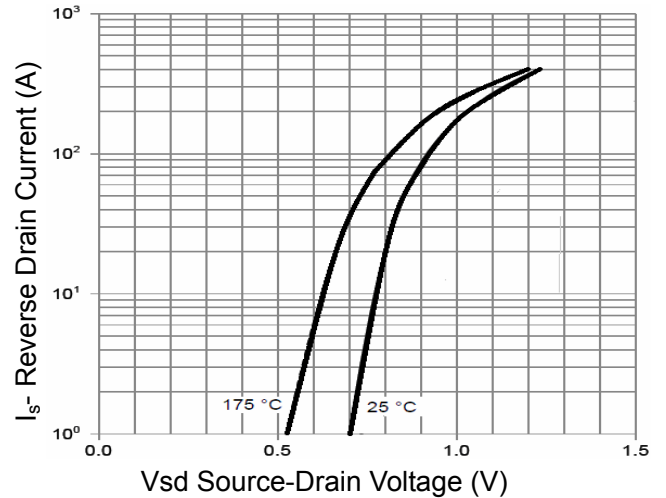


Figure 6 Source- Drain Diode Forward

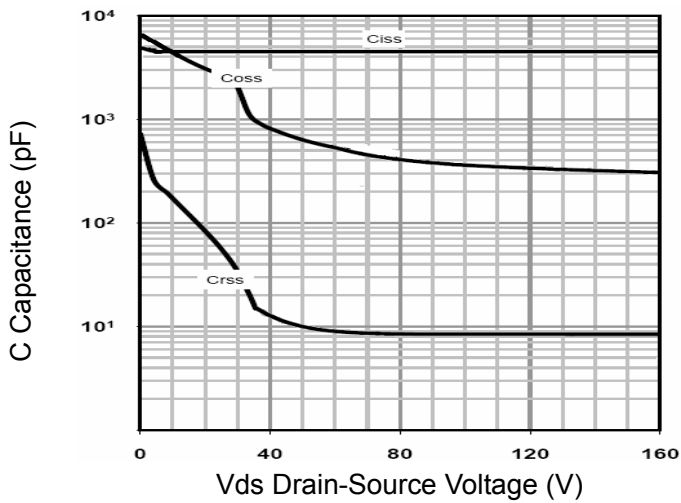


Figure 7 Capacitance vs Vds

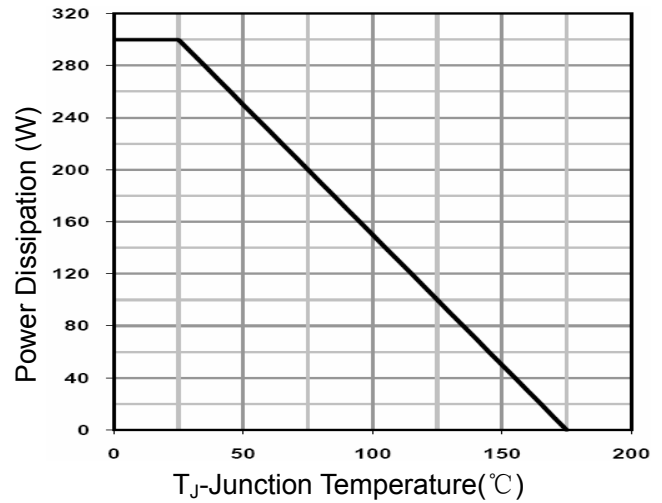


Figure 9 Power De-rating

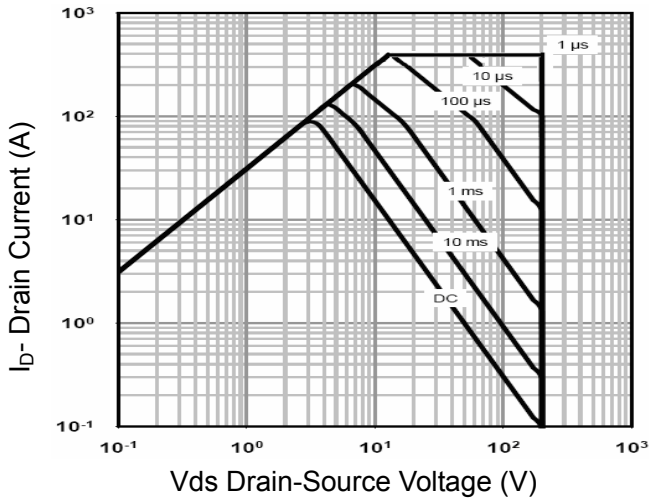


Figure 8 Safe Operation Area

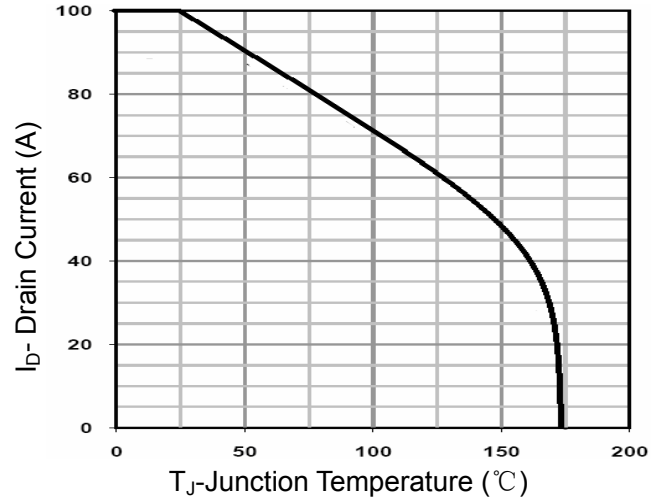


Figure 10 Current De-rating

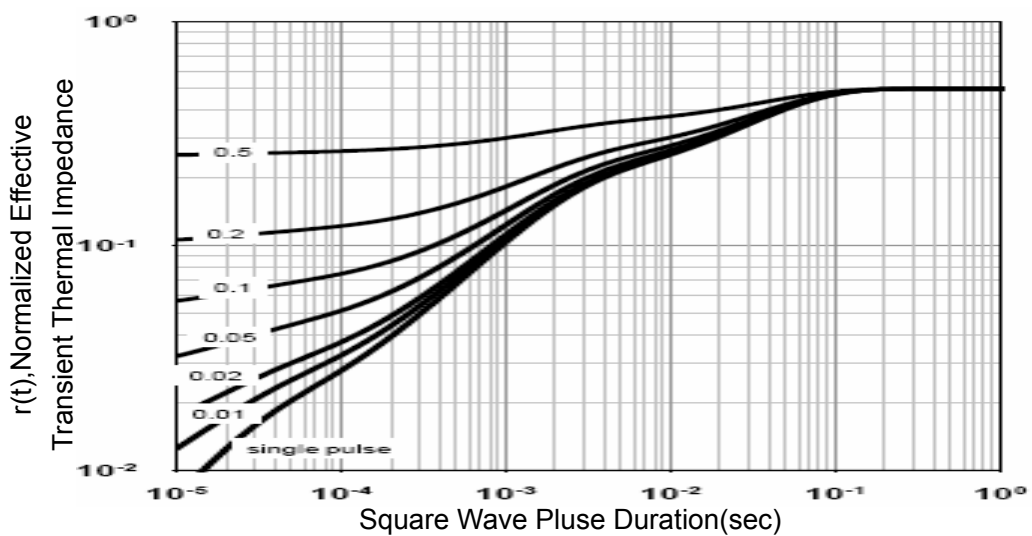
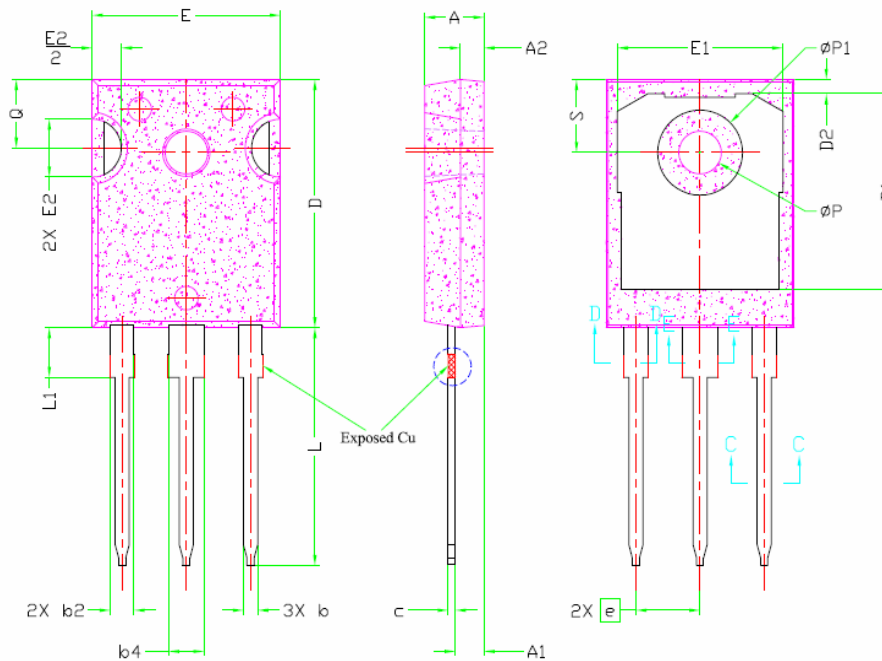


Figure 11 Normalized Maximum Transient Thermal Impedance

TO-247 Package Information



| Symbol | Dimensions In Millimeters |       |       |
|--------|---------------------------|-------|-------|
|        | Min.                      | Nom.  | Max.  |
| A      | 4.83                      | 5.02  | 5.21  |
| A1     | 2.29                      | 2.41  | 2.55  |
| A2     | 1.50                      | 2.00  | 2.49  |
| b      | 1.12                      | 1.20  | 1.33  |
| b1     | 1.12                      | 1.20  | 1.28  |
| b2     | 1.91                      | 2.00  | 2.39  |
| b3     | 1.91                      | 2.00  | 2.34  |
| b4     | 2.87                      | 3.00  | 3.22  |
| b5     | 2.87                      | 3.00  | 3.18  |
| c      | 0.55                      | 0.60  | 0.69  |
| c1     | 0.55                      | 0.60  | 0.65  |
| D      | 20.80                     | 20.95 | 21.1  |
| D1     | 16.25                     | 16.55 | 17.65 |
| D2     | 0.51                      | 1.19  | 1.35  |
| E      | 15.75                     | 15.94 | 16.13 |
| E1     | 13.46                     | 14.02 | 14.16 |
| E2     | 4.32                      | 4.91  | 5.49  |
| e      | 5.44BSC                   |       |       |
| L      | 19.81                     | 20.07 | 20.32 |
| L1     | 4.10                      | 4.19  | 4.40  |
| Q      | 5.39                      | 5.79  | 6.20  |
| ΦP     | 3.56                      | 3.61  | 3.65  |
| S      | 6.04                      | 6.17  | 6.30  |

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