

## 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

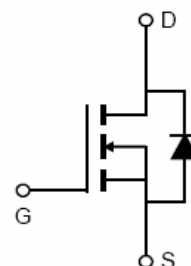
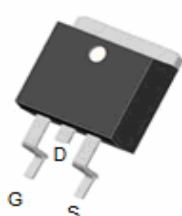
- $V_{DS} = 150V, I_D = 70A$   
 $R_{DS(ON)} = 13.5m\Omega$  (typical) @  $V_{GS} = 10V$
- Excellent gate charge x  $R_{DS(on)}$  product(FOM)
- Very low on-resistance  $R_{DS(on)}$
- 175 °C operating temperature
- Pb-free lead plating

**100% UIS TESTED!**  
**100%  $\Delta V_{ds}$  TESTED!**

TO-220



TO-263



Schematic Diagram

### Package Marking and Ordering Information

| Device Marking | Device    | Device Package | Reel Size | Tape width | Quantity |
|----------------|-----------|----------------|-----------|------------|----------|
| NCEP1570       | NCEP1570  | TO-220         |           |            |          |
| NCEP1570D      | NCEP1570D | TO-263         | -         | -          | -        |

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

| Parameter                                         | Symbol             | Limit      | Unit          |
|---------------------------------------------------|--------------------|------------|---------------|
| Drain-Source Voltage                              | $V_{DS}$           | 150        | V             |
| Gate-Source Voltage                               | $V_{GS}$           | $\pm 20$   | V             |
| Drain Current-Continuous                          | $I_D$              | 70         | A             |
| Drain Current-Continuous( $T_C = 100^\circ C$ )   | $I_D(100^\circ C)$ | 49         | A             |
| Pulsed Drain Current                              | $I_{DM}$           | 280        | A             |
| Maximum Power Dissipation                         | $P_D$              | 200        | W             |
| Derating factor                                   |                    | 1.33       | W/ $^\circ C$ |
| Single pulse avalanche energy <sup>(Note 5)</sup> | $E_{AS}$           | 672        | mJ            |
| Operating Junction and Storage Temperature Range  | $T_J, T_{STG}$     | -55 To 175 | $^\circ C$    |

## Thermal Characteristic

|                                                          |                 |      |                      |
|----------------------------------------------------------|-----------------|------|----------------------|
| Thermal Resistance, Junction-to-Case <sup>(Note 2)</sup> | $R_{\theta JC}$ | 0.75 | $^{\circ}\text{C/W}$ |
|----------------------------------------------------------|-----------------|------|----------------------|

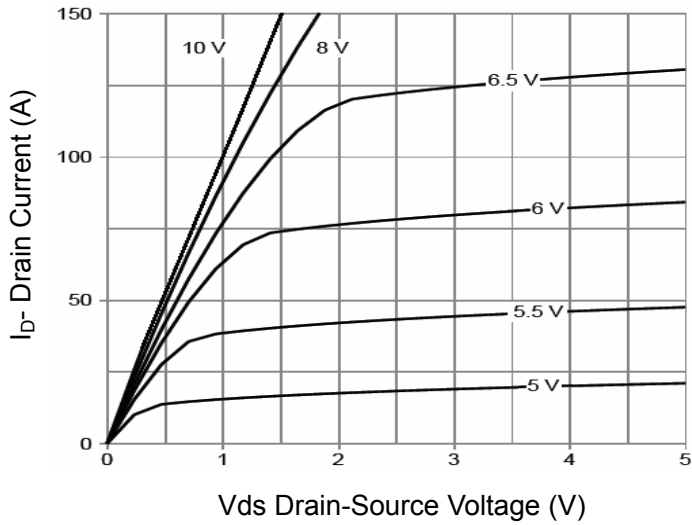
## Electrical Characteristics ( $T_A=25^{\circ}\text{C}$ unless otherwise noted)

| Parameter                          | Symbol              | Condition                                                                             | Min | Typ  | Max  | Unit |
|------------------------------------|---------------------|---------------------------------------------------------------------------------------|-----|------|------|------|
| Off Characteristics                |                     |                                                                                       |     |      |      |      |
| Drain-Source Breakdown Voltage     | BV <sub>DSS</sub>   | V <sub>GS</sub> =0V I <sub>D</sub> =250μA                                             | 150 | -    | -    | V    |
| Zero Gate Voltage Drain Current    | I <sub>DSS</sub>    | V <sub>DS</sub> =150V, 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   |
| On Characteristics (Note 3)        |                     |                                                                                       |     |      |      |      |
| Gate Threshold Voltage             | V <sub>GS(th)</sub> | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA                              | 2.0 | 3.1  | 4.0  | V    |
| Drain-Source On-State Resistance   | R <sub>DS(ON)</sub> | V <sub>GS</sub> =10V, I <sub>D</sub> =35A                                             | -   | 13.5 | 15   | mΩ   |
| Forward Transconductance           | g <sub>FS</sub>     | V <sub>DS</sub> =5V, I <sub>D</sub> =35A                                              | -   | 58   | -    | S    |
| Dynamic Characteristics (Note4)    |                     |                                                                                       |     |      |      |      |
| Input Capacitance                  | C <sub>iss</sub>    | V <sub>DS</sub> =75V, V <sub>GS</sub> =0V,<br>F=1.0MHz                                | -   | 2000 | -    | PF   |
| Output Capacitance                 | C <sub>oss</sub>    |                                                                                       | -   | 280  | -    | PF   |
| Reverse Transfer Capacitance       | C <sub>rss</sub>    |                                                                                       | -   | 16   | -    | PF   |
| Switching Characteristics (Note 4) |                     |                                                                                       |     |      |      |      |
| Turn-on Delay Time                 | t <sub>d(on)</sub>  | V <sub>DD</sub> =75V, I <sub>D</sub> =35A<br>V <sub>GS</sub> =10V, R <sub>G</sub> =3Ω | -   | 12.5 | -    | nS   |
| Turn-on Rise Time                  | t <sub>r</sub>      |                                                                                       | -   | 3.8  | -    | nS   |
| Turn-Off Delay Time                | t <sub>d(off)</sub> |                                                                                       | -   | 14   | -    | nS   |
| Turn-Off Fall Time                 | t <sub>f</sub>      |                                                                                       | -   | 3.5  | -    | nS   |
| Total Gate Charge                  | Q <sub>g</sub>      | V <sub>DS</sub> =75V, I <sub>D</sub> =35A,<br>V <sub>GS</sub> =10V                    | -   | 35   | -    | nC   |
| Gate-Source Charge                 | Q <sub>gs</sub>     |                                                                                       | -   | 11.8 | -    | nC   |
| Gate-Drain Charge                  | Q <sub>gd</sub>     |                                                                                       | -   | 9.9  | -    | nC   |
| Drain-Source Diode Characteristics |                     |                                                                                       |     |      |      |      |
| Diode Forward Voltage (Note 3)     | V <sub>SD</sub>     | V <sub>GS</sub> =0V, I <sub>S</sub> =35A                                              | -   | -    | 1.2  | V    |
| Diode Forward Current (Note 2)     | I <sub>S</sub>      |                                                                                       | -   | -    | 70   | A    |
| Reverse Recovery Time              | t <sub>rr</sub>     | T <sub>J</sub> = 25°C, I <sub>F</sub> = 35A<br>di/dt = 100A/μs (Note3)                | -   | 105  | -    | nS   |
| Reverse Recovery Charge            | Q <sub>rr</sub>     |                                                                                       | -   | 160  | -    | nC   |

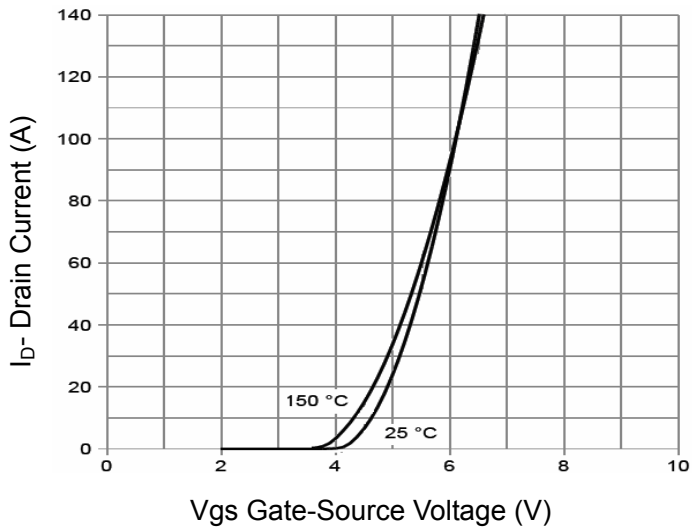
## Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec. The value of  $R_{\theta JA}$  is measured with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with  $T_A = 25^{\circ}\text{C}$ . the maximum allowed junction temperature of  $150^{\circ}\text{C}$ . The value in any given application depends on the user's specific board design.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production
5.  $E_{AS}$  condition :  $T_J=25^{\circ}\text{C}, V_{DD}=50V, V_G=10V, L=0.5mH, R_g=25\Omega$

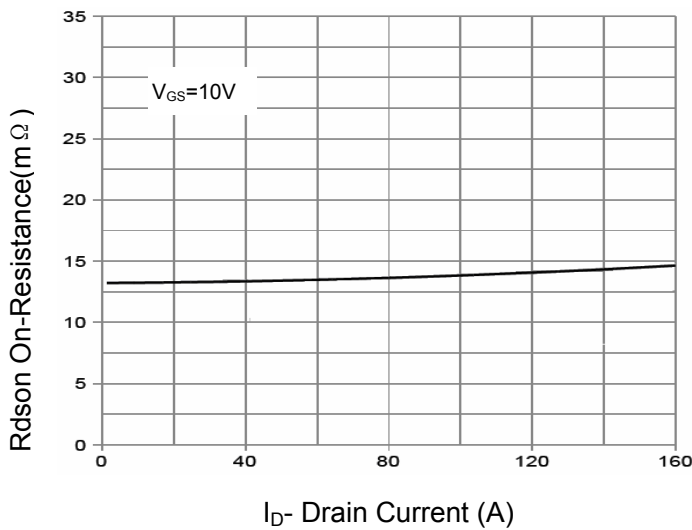
## Typical Electrical and Thermal Characteristics



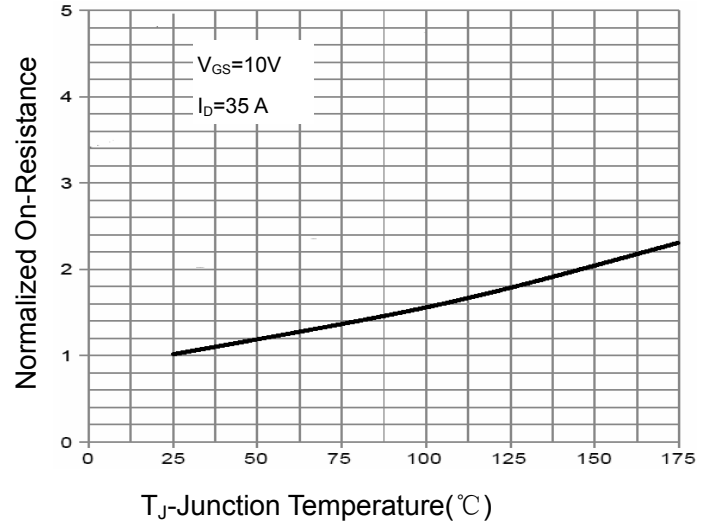
**Figure 1 Output Characteristics**



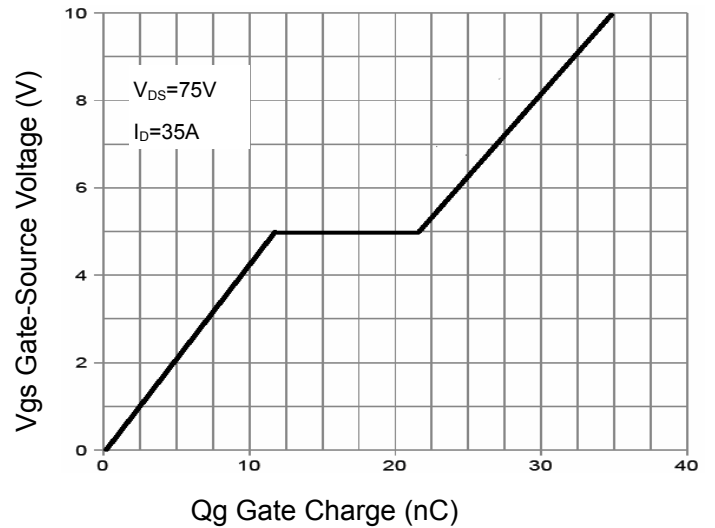
**Figure 2 Transfer Characteristics**



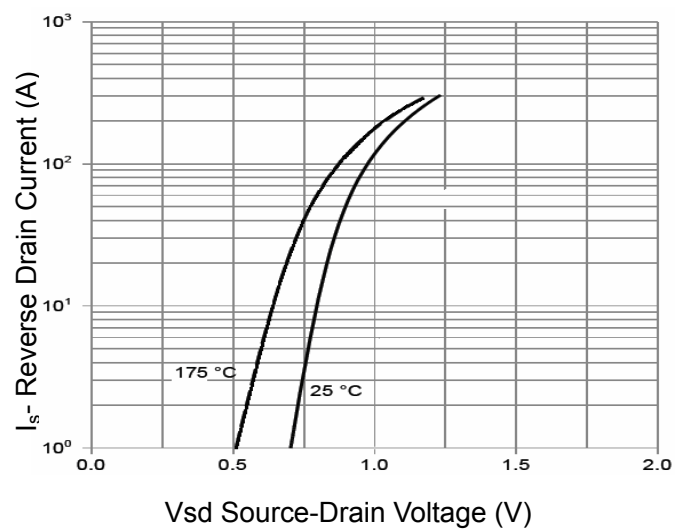
**Figure 3  $R_{DS(on)}$ - Drain Current**



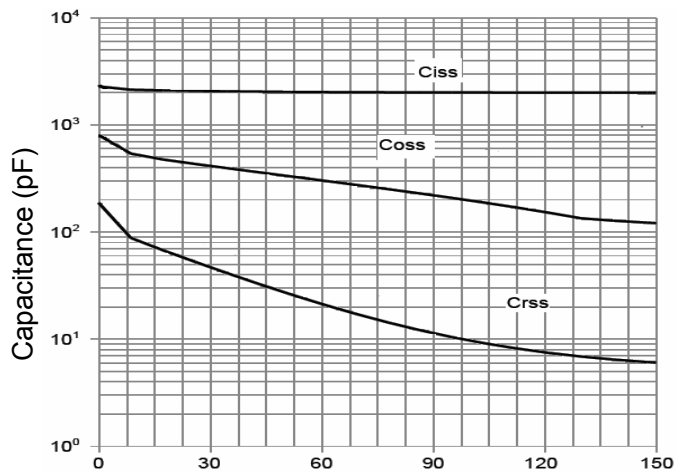
**Figure 4  $R_{DS(on)}$ -Junction Temperature**



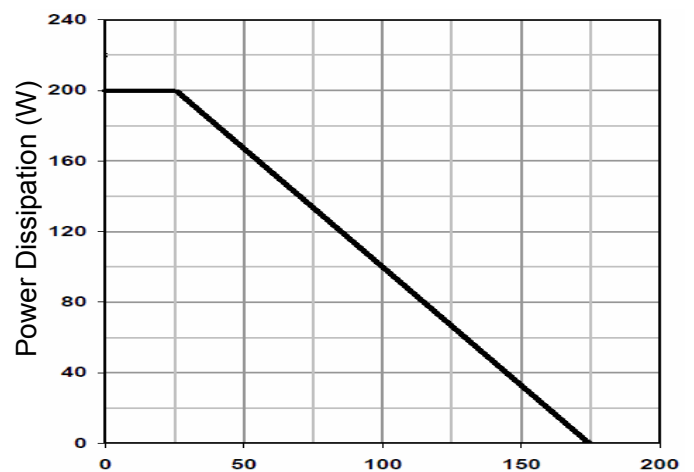
**Figure 5 Gate Charge**



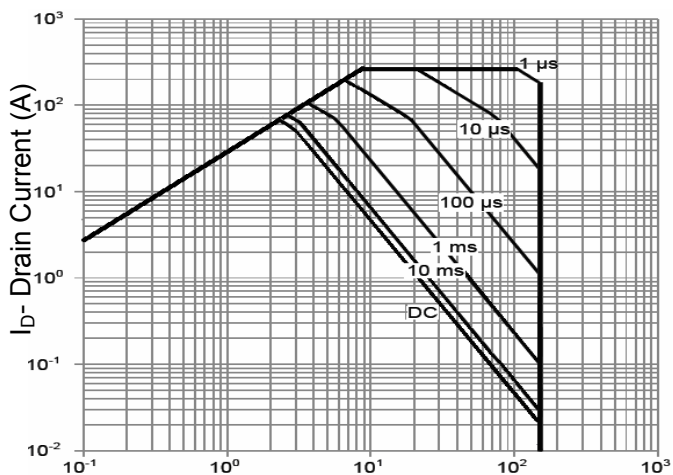
**Figure 6 Source- Drain Diode Forward**



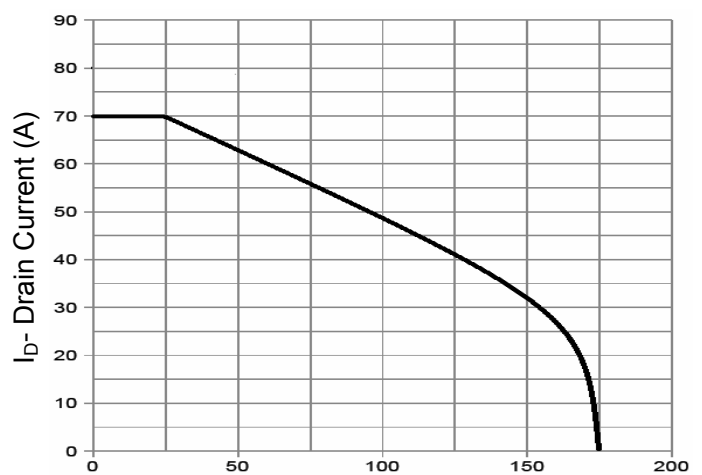
Vds Drain-Source Voltage (V)  
**Figure 7 Capacitance vs Vds**



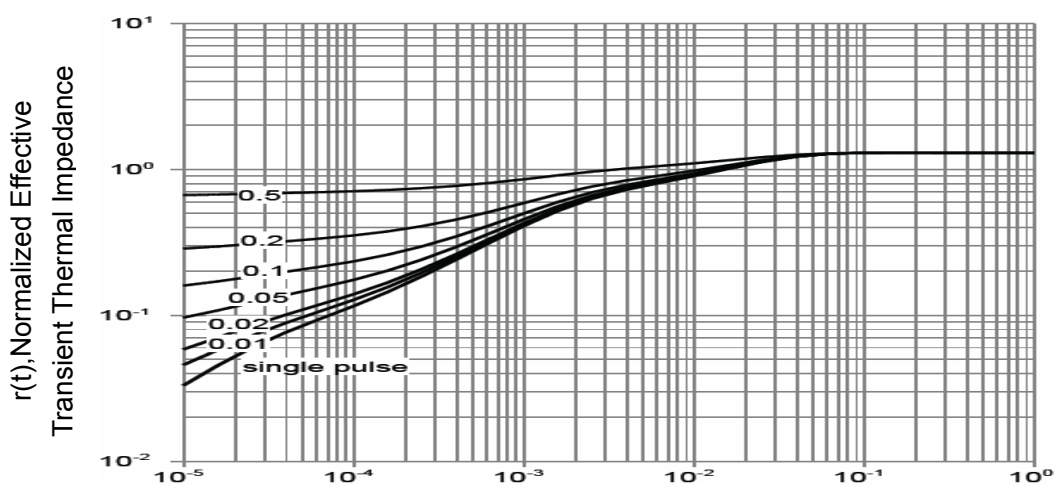
T<sub>J</sub>-Junction Temperature(°C)  
**Figure 9 Power De-rating**



Vds Drain-Source Voltage (V)  
**Figure 8 Safe Operation Area**

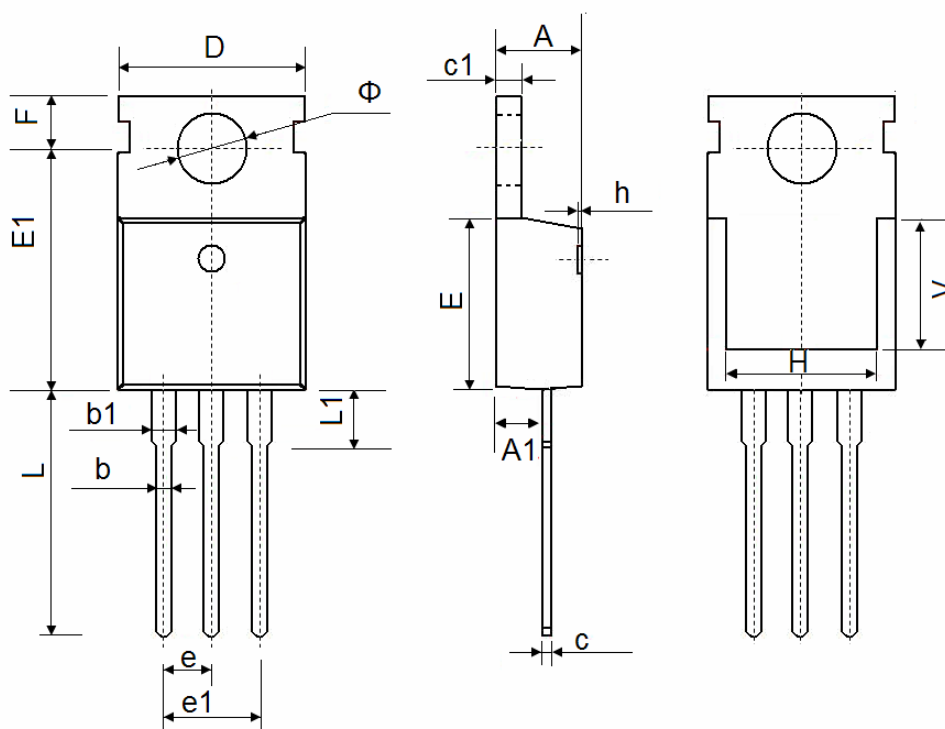


T<sub>J</sub>-Junction Temperature (°C)  
**Figure 10 Current De-rating**



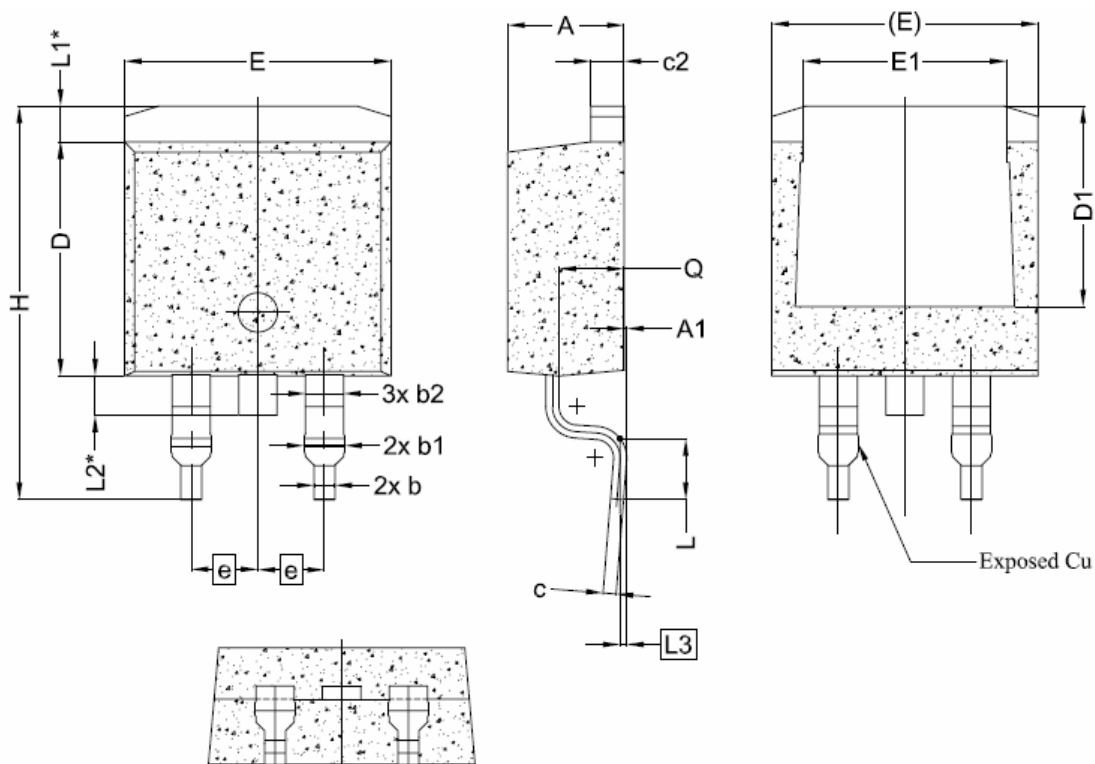
Square Wave Pluse Duration(sec)  
**Figure 11 Normalized Maximum Transient Thermal Impedance**

## 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 In Millimeters |       |       |
|--------|---------------------------|-------|-------|
|        | 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      | 2.54BSC                   |       |       |
| 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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