

## NCE N-Channel Super Trench Power MOSFET

### Description

The NCEP0112AS 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.

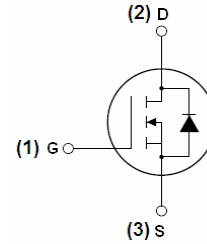
### General Features

- $V_{DS} = 100V, I_D = 12A$   
 $R_{DS(ON)} = 9.9m\Omega$  (typical) @  $V_{GS} = 10V$   
 $R_{DS(ON)} = 11.5m\Omega$  (typical) @  $V_{GS} = 4.5V$
- Excellent gate charge x  $R_{DS(on)}$  product(FOM)
- Very low on-resistance  $R_{DS(on)}$
- 150 °C operating temperature
- Pb-free lead plating
- 100% UIS tested

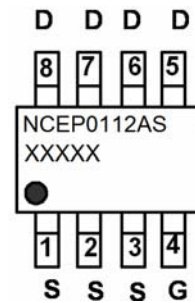
### Application

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

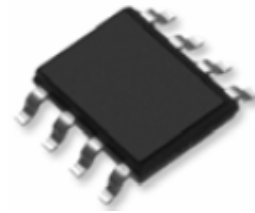
**100% UIS TESTED!**



Schematic diagram



Marking and pin assignment



SOP-8 top view

### Package Marking and Ordering Information

| Device Marking | Device     | Device Package | Reel Size | Tape width | Quantity   |
|----------------|------------|----------------|-----------|------------|------------|
| NCEP0112AS     | NCEP0112AS | SOP-8          | Ø330mm    | 12mm       | 2500 units |

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

| Parameter   | Symbol             | Limit      | Unit          |
|---|--------------------|------------|---------------|
| Drain-Source Voltage                              | $V_{DS}$           | 100        | V             |
| Gate-Source Voltage                               | $V_{GS}$           | $\pm 20$   | V             |
| Drain Current-Continuous                          | $I_D$              | 12         | A             |
| Drain Current-Continuous( $T_C = 100^\circ C$ )   | $I_D(100^\circ C)$ | 8          | A             |
| Pulsed Drain Current                              | $I_{DM}$           | 48         | A             |
| Maximum Power Dissipation                         | $P_D$              | 3.5        | W             |
| Derating factor                                   |                    | 0.028      | W/ $^\circ C$ |
| Single pulse avalanche energy <sup>(Note 5)</sup> | $E_{AS}$           | 152        | mJ            |
| Operating Junction and Storage Temperature Range  | $T_J, T_{STG}$     | -55 To 150 | $^\circ C$    |

**Thermal Characteristic**

|   |                 |    |               |
|---|-----------------|----|---------------|
| Thermal Resistance, Junction-to-Ambient <sup>(Note 2)</sup> | $R_{\theta JA}$ | 36 | $^{\circ}C/W$ |
|---|-----------------|----|---------------|

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

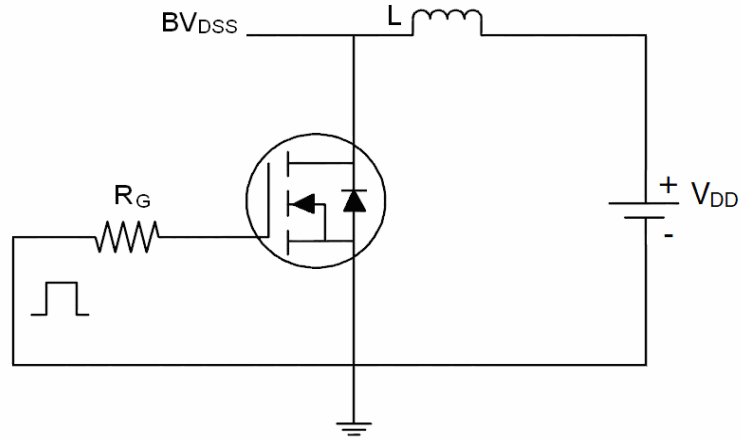
| Parameter  | Symbol       | Condition  | Min | Typ  | Max       | Unit       |
|--|--------------|--|-----|------|-----------|------------|
| <b>Off Characteristics</b>                           |              |  |     |      |           |            |
| Drain-Source Breakdown Voltage                       | $BV_{DSS}$   | $V_{GS}=0V, I_D=250\mu A$  | 100 | -    | -         | V          |
| Zero Gate Voltage Drain Current                      | $I_{DSS}$    | $V_{DS}=100V, V_{GS}=0V$   | -   | -    | 1         | $\mu A$    |
| Gate-Body Leakage Current                            | $I_{GSS}$    | $V_{GS}=\pm 20V, V_{DS}=0V$  | -   | -    | $\pm 100$ | nA         |
| <b>On Characteristics</b> <sup>(Note 3)</sup>        |              |  |     |      |           |            |
| Gate Threshold Voltage                               | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=250\mu A$  | 1.0 | 1.7  | 2.2       | V          |
| Drain-Source On-State Resistance                     | $R_{DS(on)}$ | $V_{GS}=10V, I_D=12A$  | -   | 9.9  | 13        | m $\Omega$ |
|  |              | $V_{GS}=4.5V, I_D=12A$   | -   | 11.5 | 15        | m $\Omega$ |
| Forward Transconductance                             | $g_{FS}$     | $V_{DS}=10V, I_D=12A$  | -   | 30   | -         | S          |
| <b>Dynamic Characteristics</b> <sup>(Note 4)</sup>   |              |  |     |      |           |            |
| Input Capacitance                                    | $C_{iss}$    | $V_{DS}=50V, V_{GS}=0V,$<br>$F=1.0MHz$                                     | -   | 3050 | -         | PF         |
| Output Capacitance                                   | $C_{oss}$    |  | -   | 274  | -         | PF         |
| Reverse Transfer Capacitance                         | $C_{rss}$    |  | -   | 17.8 | -         | PF         |
| <b>Switching Characteristics</b> <sup>(Note 4)</sup> |              |  |     |      |           |            |
| Turn-on Delay Time                                   | $t_{d(on)}$  | $V_{DD}=50V, I_D=12A$<br>$V_{GS}=10V, R_G=1.6\Omega$                       | -   | 11   | -         | nS         |
| Turn-on Rise Time                                    | $t_r$        |  | -   | 7    | -         | nS         |
| Turn-Off Delay Time                                  | $t_{d(off)}$ |  | -   | 30   | -         | nS         |
| Turn-Off Fall Time                                   | $t_f$        |  | -   | 4    | -         | nS         |
| Total Gate Charge                                    | $Q_g$        | $V_{DS}=50V, I_D=12A,$<br>$V_{GS}=10V$                                     | -   | 45   | -         | nC         |
| Gate-Source Charge                                   | $Q_{gs}$     |  | -   | 11.6 | -         | nC         |
| Gate-Drain Charge                                    | $Q_{gd}$     |  | -   | 6    | -         | nC         |
| <b>Drain-Source Diode Characteristics</b>            |              |  |     |      |           |            |
| Diode Forward Voltage <sup>(Note 3)</sup>            | $V_{SD}$     | $V_{GS}=0V, I_S=12A$   | -   | -    | 1.2       | V          |
| Diode Forward Current <sup>(Note 2)</sup>            | $I_S$        |  | -   | -    | 12        | A          |
| Reverse Recovery Time                                | $t_{rr}$     | $T_J = 25^{\circ}C, I_F = I_S$<br>$di/dt = 100A/\mu s$ <sup>(Note 3)</sup> | -   | 78   | -         | nS         |
| Reverse Recovery Charge                              | $Q_{rr}$     |  | -   | 149  | -         | nC         |

**Notes:**

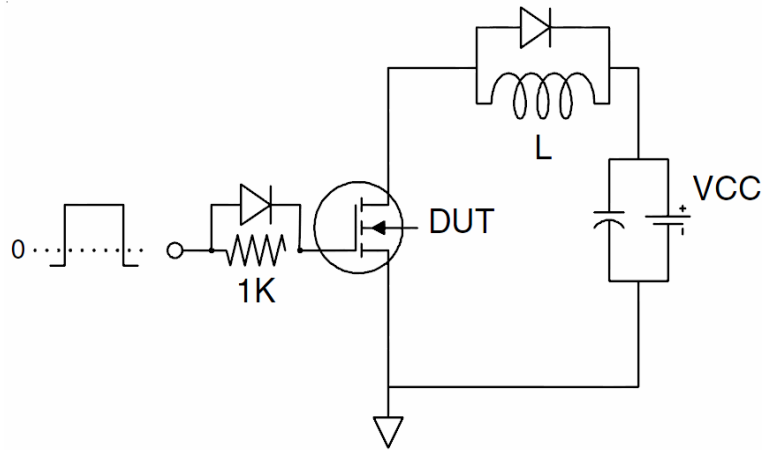
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production
5. EAS condition :  $T_J=25^{\circ}C, V_{DD}=50V, V_G=10V, L=0.5mH, R_g=25\Omega$

**Test Circuit**

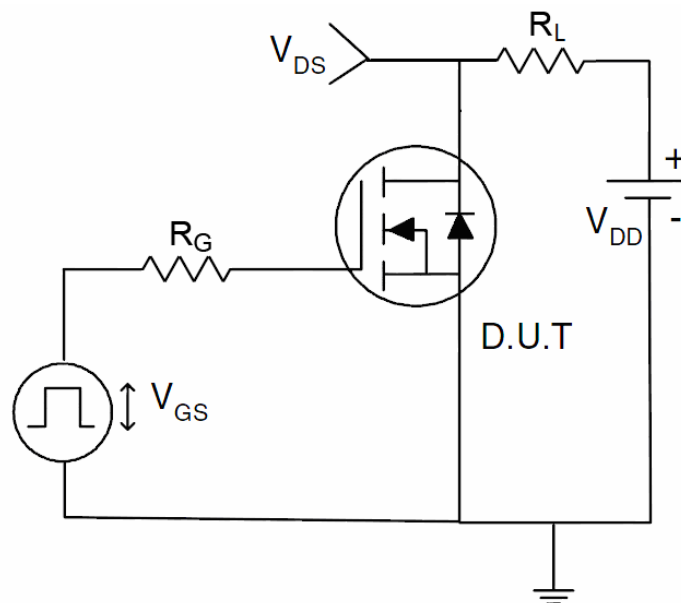
**1) E<sub>AS</sub> test Circuit**



**2) Gate charge test Circuit**



**3) Switch Time Test Circuit**



Typical Electrical and Thermal Characteristics

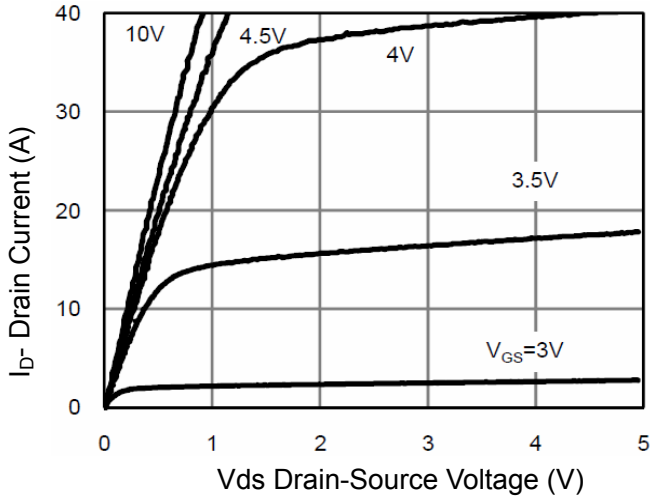


Figure 1 Output Characteristics

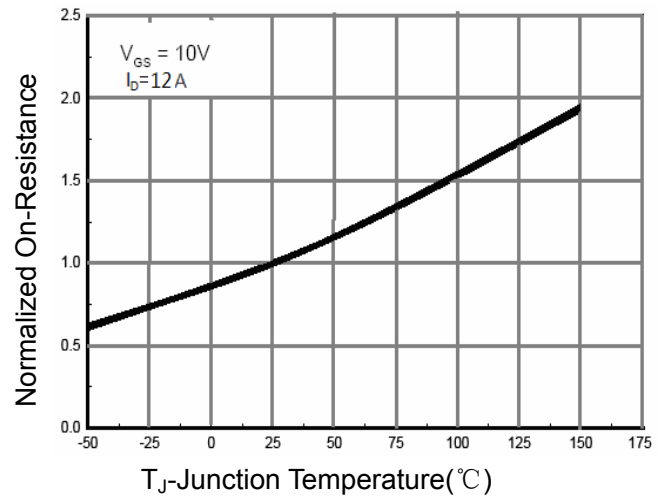


Figure 4  $R_{dson}$ -Junction Temperature

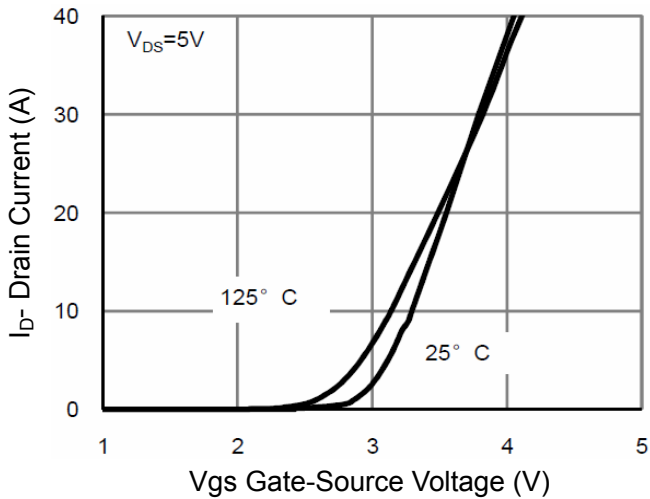


Figure 2 Transfer Characteristics

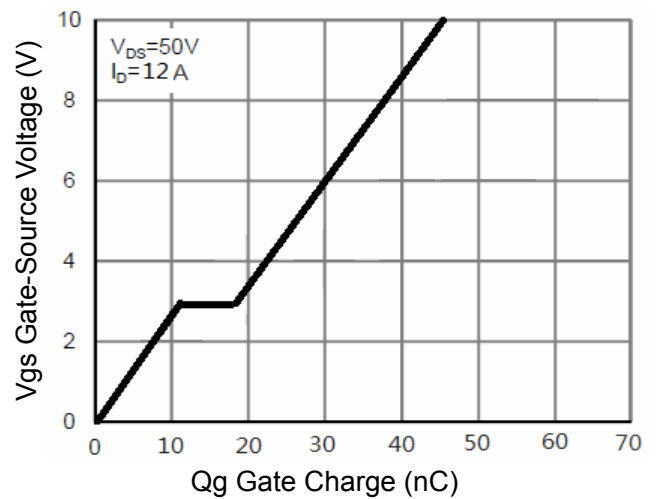


Figure 5 Gate Charge

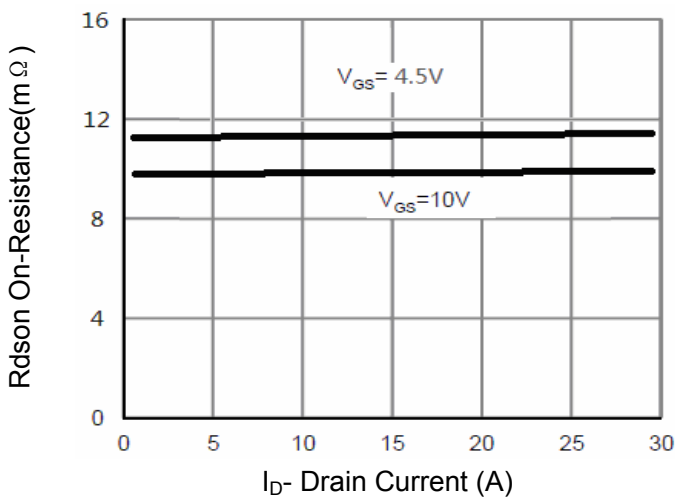


Figure 3  $R_{dson}$ - Drain Current

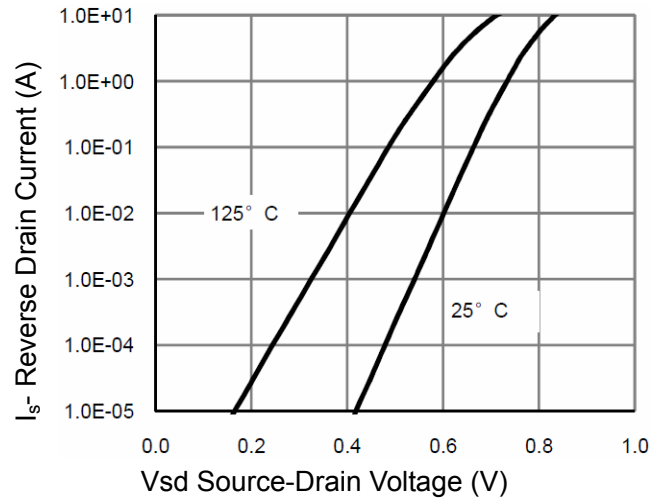


Figure 6 Source- Drain Diode Forward

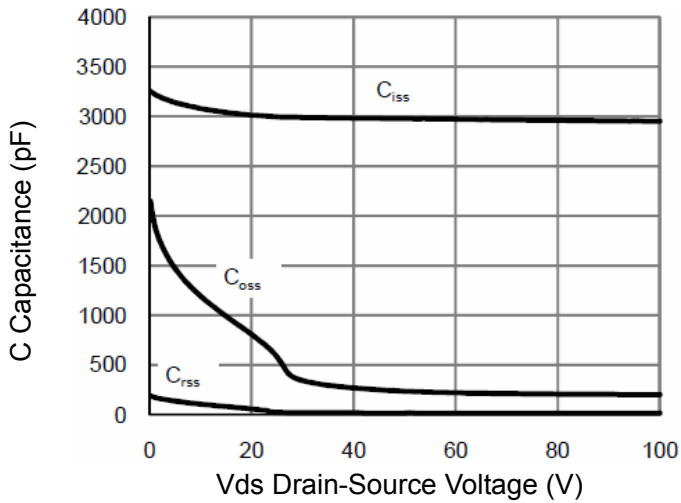


Figure 7 Capacitance vs Vds

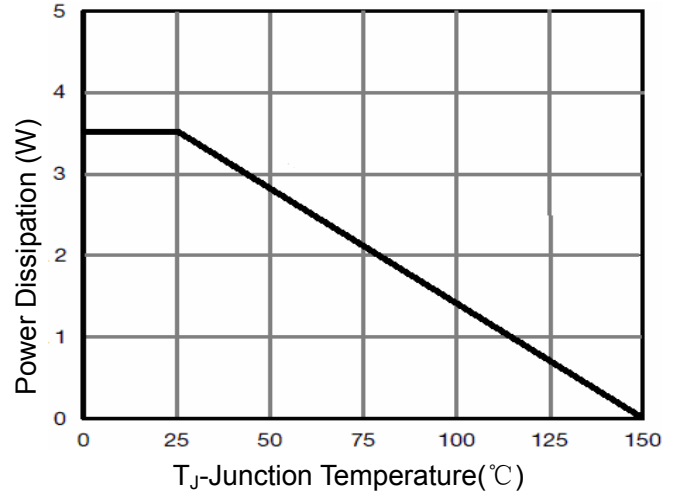


Figure 9 Power De-rating

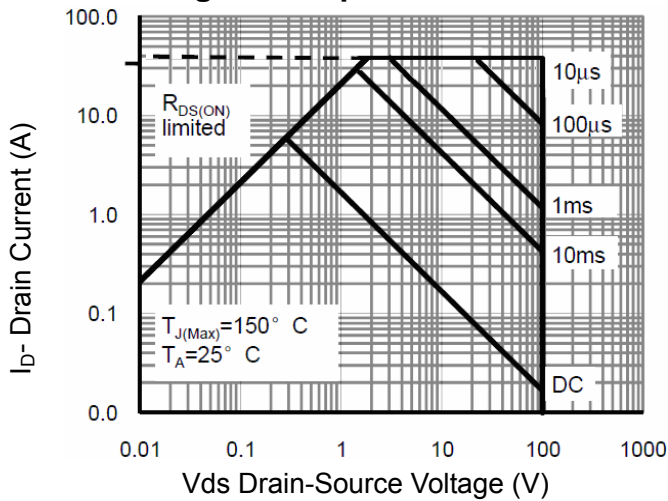


Figure 8 Safe Operation Area

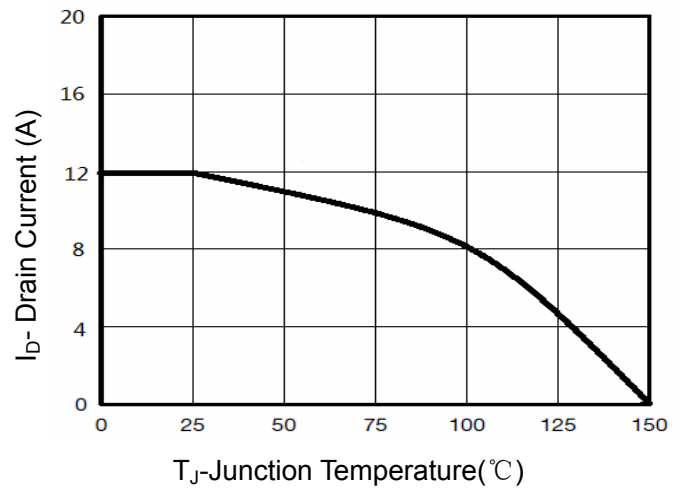


Figure 10 Current De-rating

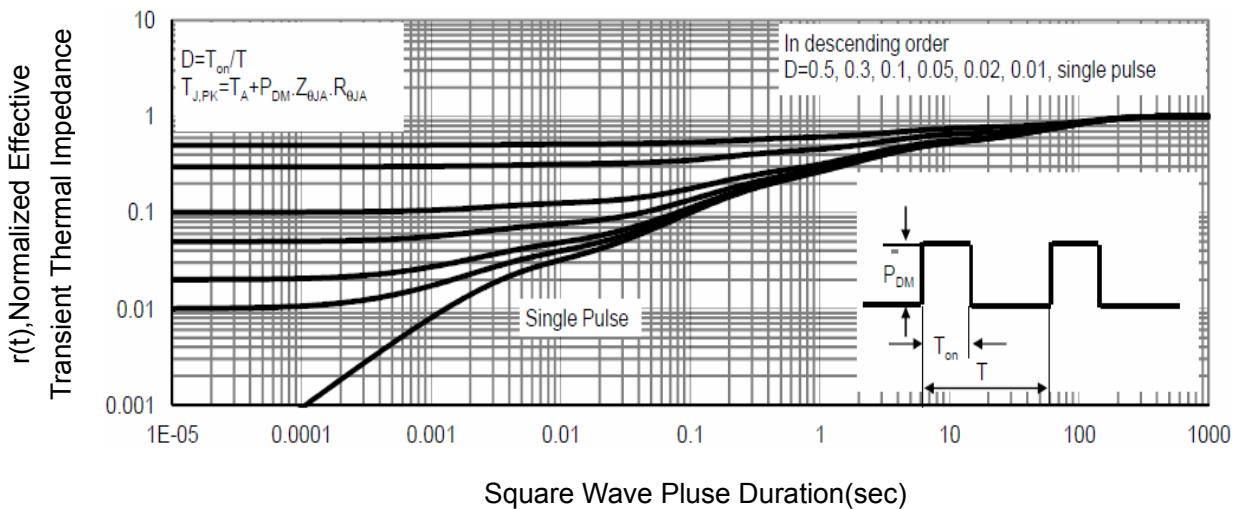
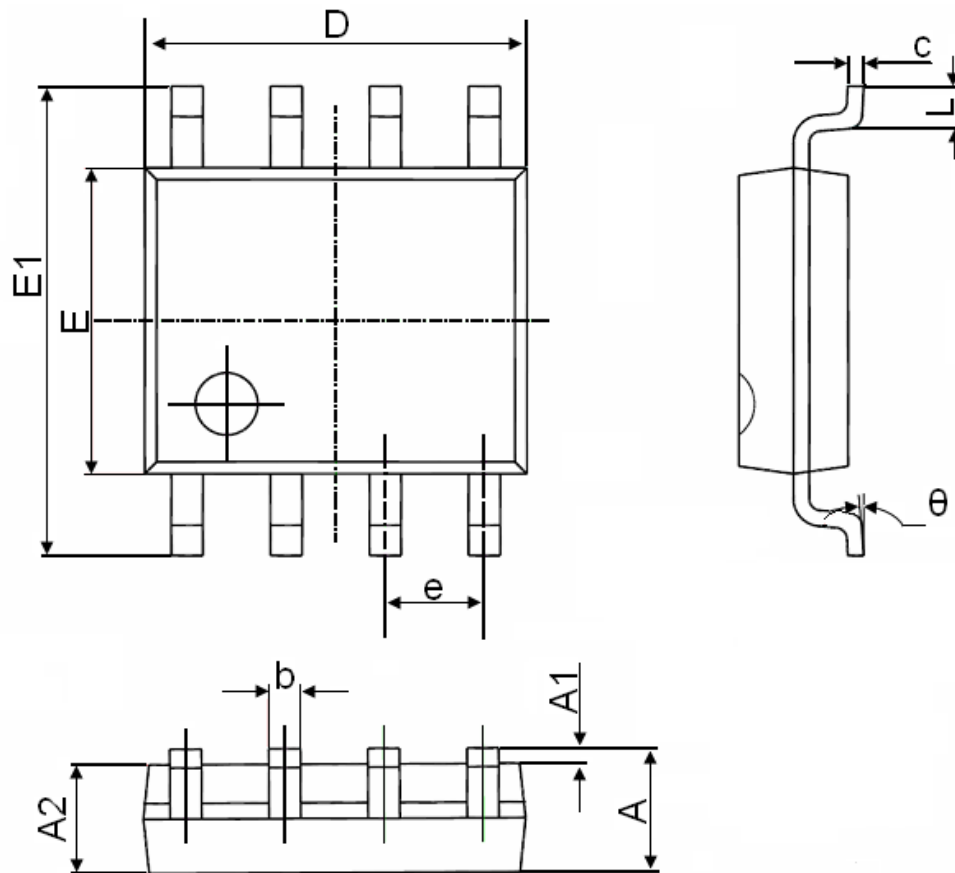


Figure 11 Normalized Maximum Transient Thermal Impedance

**SOP-8 Package Information**


| Symbol   | Dimensions In Millimeters |       | Dimensions In Inches |       |
|----------|---------------------------|-------|----------------------|-------|
|          | Min.                      | Max.  | Min.                 | Max.  |
| A        | 1.350                     | 1.750 | 0.053                | 0.069 |
| A1       | 0.100                     | 0.250 | 0.004                | 0.010 |
| A2       | 1.350                     | 1.550 | 0.053                | 0.061 |
| b        | 0.330                     | 0.510 | 0.013                | 0.020 |
| c        | 0.170                     | 0.250 | 0.006                | 0.010 |
| D        | 4.700                     | 5.100 | 0.185                | 0.200 |
| E        | 3.800                     | 4.000 | 0.150                | 0.157 |
| E1       | 5.800                     | 6.200 | 0.228                | 0.244 |
| e        | 1.270(BSC)                |       | 0.050(BSC)           |       |
| L        | 0.400                     | 1.270 | 0.016                | 0.050 |
| $\theta$ | 0°                        | 8°    | 0°                   | 8°    |

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