

## NCE N-Channel Enhancement Mode Power MOSFET

### Description

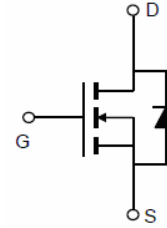
The NCE6005AN uses advanced trench technology and design to provide excellent  $R_{DS(ON)}$  with low gate charge. It can be used in a wide variety of applications.

### General Features

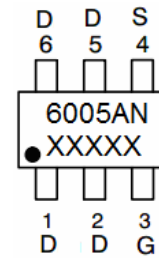
- $V_{DS}=60V, I_D=5A$   
 $R_{DS(ON)} < 35m\Omega @ V_{GS}=10V$  (Typ.26m $\Omega$ )  
 $R_{DS(ON)} < 45m\Omega @ V_{GS}=4.5V$  (Typ.32m $\Omega$ )
- High density cell design for ultra low  $R_{dson}$
- Fully characterized avalanche voltage and current
- Good stability and uniformity with high  $E_{AS}$
- Excellent package for good heat dissipation
- Special process technology for high ESD capability

### Application

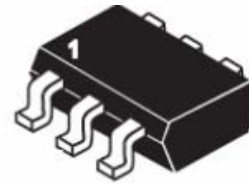
- Power switching application
- Hard switched and high frequency circuits
- Uninterruptible power supply



Schematic diagram



Marking and pin assignment



SOT23-6L top view

### Package Marking and Ordering Information

| Device Marking | Device    | Device Package | Reel Size | Tape width | Quantity   |
|----------------|-----------|----------------|-----------|------------|------------|
| 6005AN         | NCE6005AN | SOT23-6L       | Ø180mm    | 8 mm       | 3000 units |

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

| Parameter  | Symbol             | Limit      | Unit       |
|--|--------------------|------------|------------|
| Drain-Source Voltage                             | $V_{DS}$           | 60         | V          |
| Gate-Source Voltage                              | $V_{GS}$           | $\pm 20$   | V          |
| Drain Current-Continuous                         | $I_D$              | 5          | A          |
| Drain Current-Continuous( $T_C=100^\circ C$ )    | $I_D(100^\circ C)$ | 3.5        | A          |
| Pulsed Drain Current                             | $I_{DM}$           | 24         | A          |
| Maximum Power Dissipation                        | $P_D$              | 2          | W          |
| 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> | $R_{\theta JA}$ | 62.5 | $^\circ C/W$ |
|---|-----------------|------|--------------|

**Electrical Characteristics (T<sub>A</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   | 60  | -   | -    | V    |
| Zero Gate Voltage Drain Current           | I <sub>DSS</sub>    | V <sub>DS</sub> =60V, 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                               | 1.2 | 1.6 | 2.5  | V    |
| Drain-Source On-State Resistance          | R <sub>DS(on)</sub> | V <sub>GS</sub> =10V, I <sub>D</sub> =5A   | -   | 26  | 35   | mΩ   |
|   | R <sub>DS(on)</sub> | V <sub>GS</sub> =4.5V, I <sub>D</sub> =5A  | -   | 32  | 45   | mΩ   |
| Forward Transconductance                  | g <sub>FS</sub>     | V <sub>DS</sub> =5V, I <sub>D</sub> =5A  | 11  | -   | -    | S    |
| <b>Dynamic Characteristics</b> (Note 4)   |                     |  |     |     |      |      |
| Input Capacitance                         | C <sub>iss</sub>    | V <sub>DS</sub> =30V, V <sub>GS</sub> =0V,<br>F=1.0MHz                                 | -   | 979 | -    | PF   |
| Output Capacitance                        | C <sub>oss</sub>    |  | -   | 120 | -    | PF   |
| Reverse Transfer Capacitance              | C <sub>rss</sub>    |  | -   | 100 | -    | PF   |
| <b>Switching Characteristics</b> (Note 4) |                     |  |     |     |      |      |
| Turn-on Delay Time                        | t <sub>d(on)</sub>  | V <sub>DD</sub> =30V, R <sub>L</sub> =6.7Ω<br>V <sub>GS</sub> =10V, R <sub>G</sub> =3Ω | -   | 10  | -    | nS   |
| Turn-on Rise Time                         | t <sub>r</sub>      |  | -   | 3   | -    | nS   |
| Turn-Off Delay Time                       | t <sub>d(off)</sub> |  | -   | 21  | -    | nS   |
| Turn-Off Fall Time                        | t <sub>f</sub>      |  | -   | 5   | -    | nS   |
| Total Gate Charge                         | Q <sub>g</sub>      | V <sub>DS</sub> =30V, I <sub>D</sub> =5A,<br>V <sub>GS</sub> =10V                      | -   | 22  | -    | nC   |
| Gate-Source Charge                        | Q <sub>gs</sub>     |  | -   | 3.3 | -    | nC   |
| Gate-Drain Charge                         | Q <sub>gd</sub>     |  | -   | 5.2 | -    | 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> =5A  | -   | -   | 1.2  | V    |
| Diode Forward Current (Note 2)            | I <sub>S</sub>      |  | -   | -   | 5    | A    |

**Notes:**

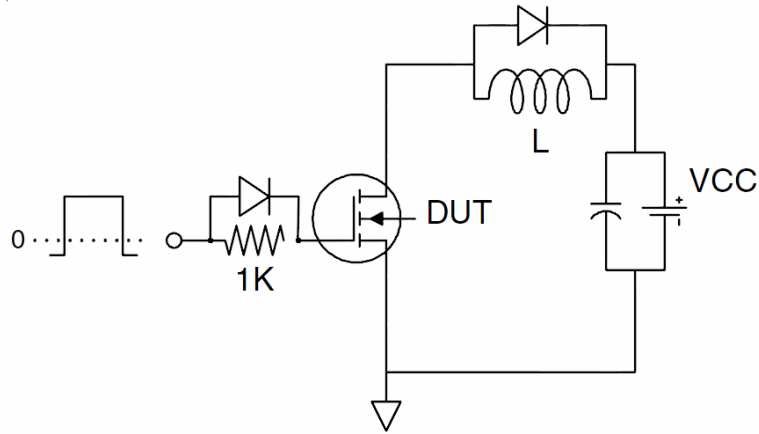
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board, t ≤ 10 sec.
3. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.
4. Guaranteed by design, not subject to production
5. EAS condition: T<sub>j</sub>=25°C, V<sub>DD</sub>=30V, V<sub>G</sub>=10V, L=0.5mH, R<sub>G</sub>=25Ω

## Test Circuit

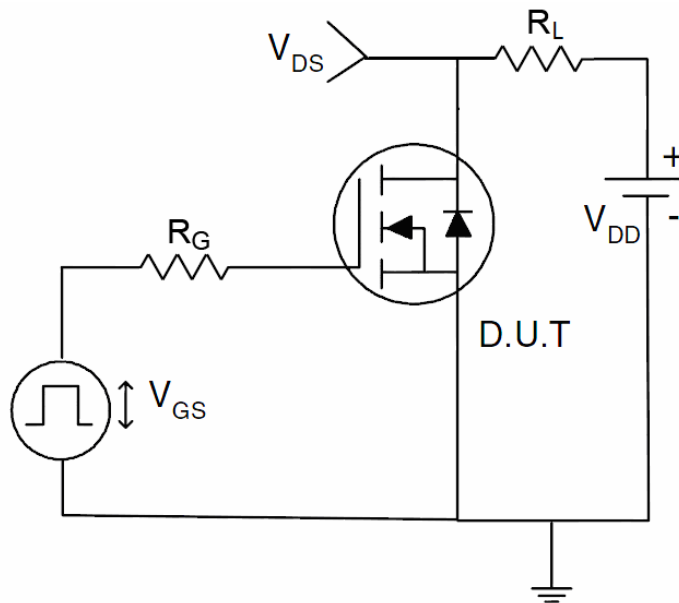
### 1) E<sub>AS</sub> test Circuit



### 2) Gate charge test Circuit



### 3) Switch Time Test Circuit



Typical Electrical and Thermal Characteristics (Curves)

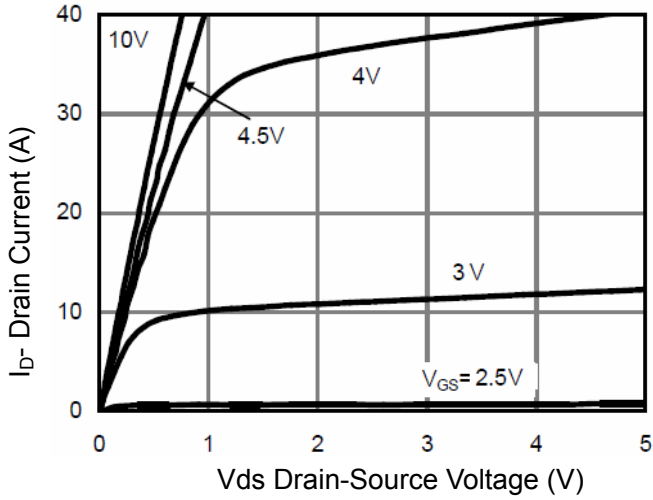


Figure 1 Output Characteristics

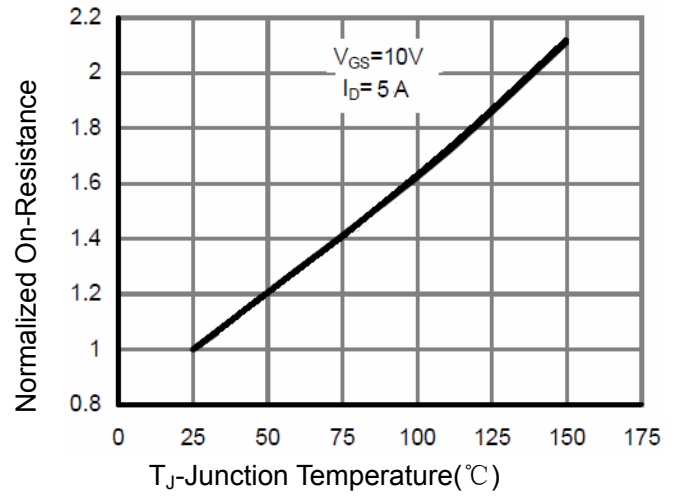


Figure 4  $R_{dson}$ -Junction Temperature

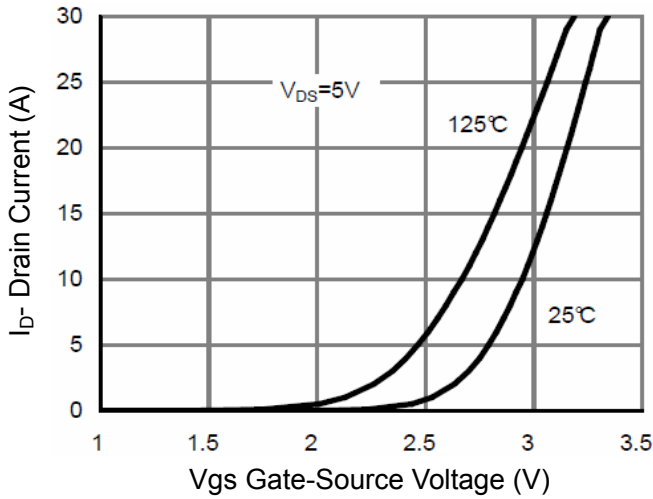


Figure 2 Transfer Characteristics

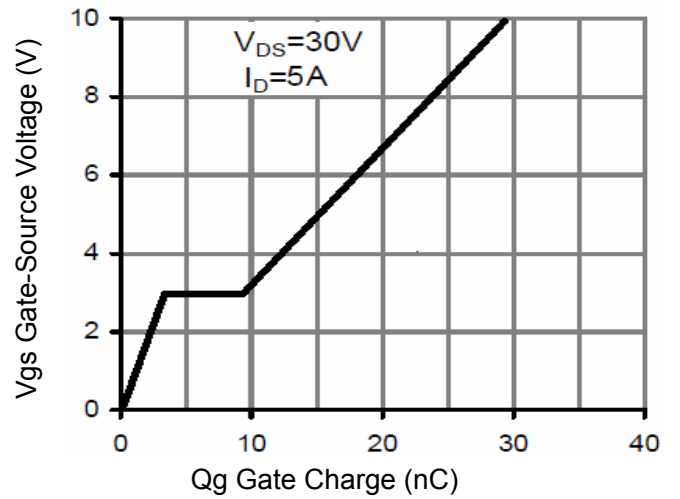


Figure 5 Gate Charge

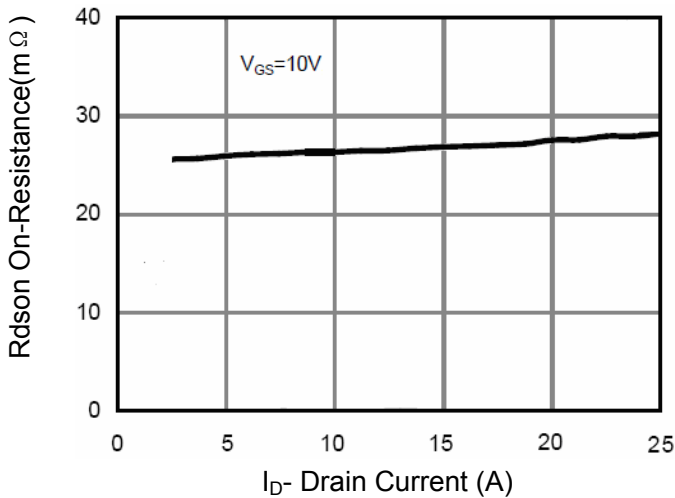


Figure 3  $R_{dson}$ - Drain Current

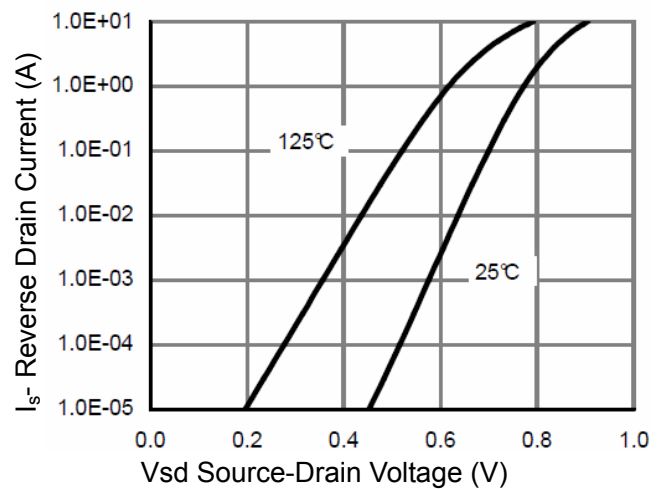


Figure 6 Source- Drain Diode Forward

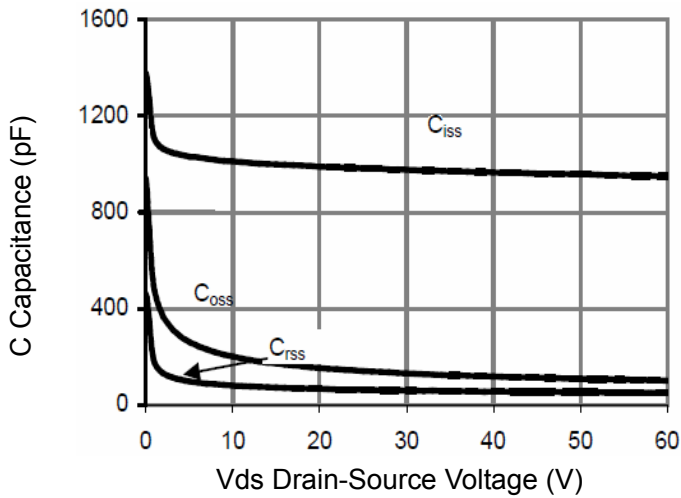


Figure 7 Capacitance vs Vds

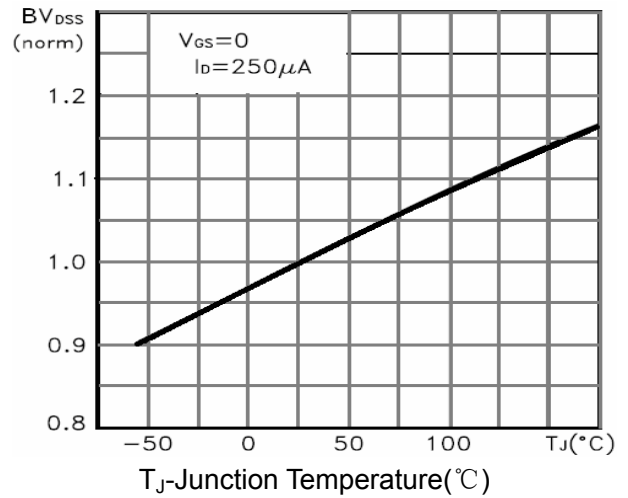


Figure 9  $BV_{DSS}$  vs Junction Temperature

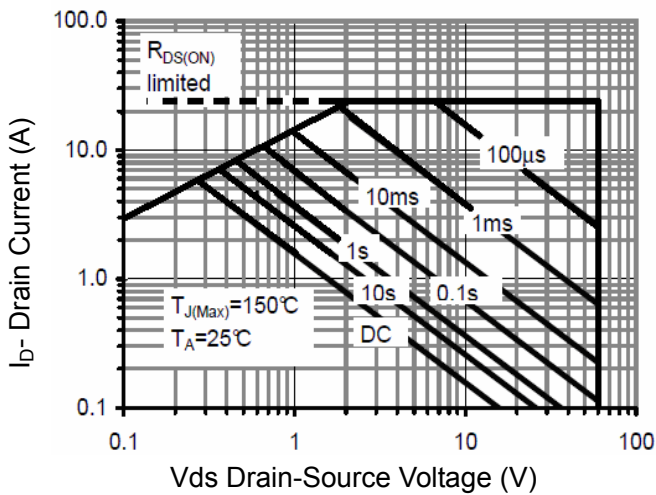


Figure 8 Safe Operation Area

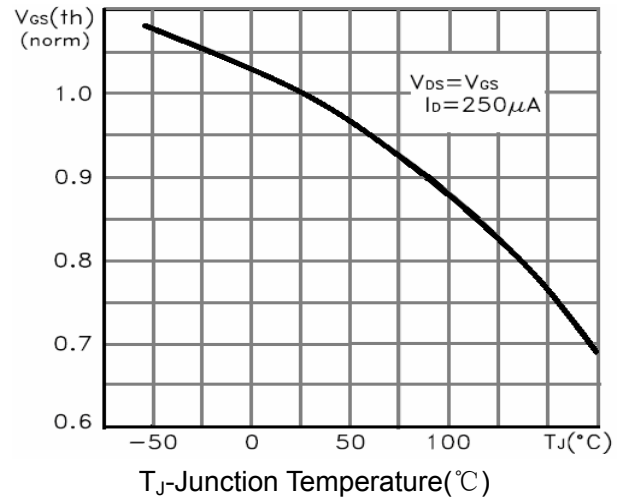


Figure 10  $V_{GS(th)}$  vs Junction Temperature

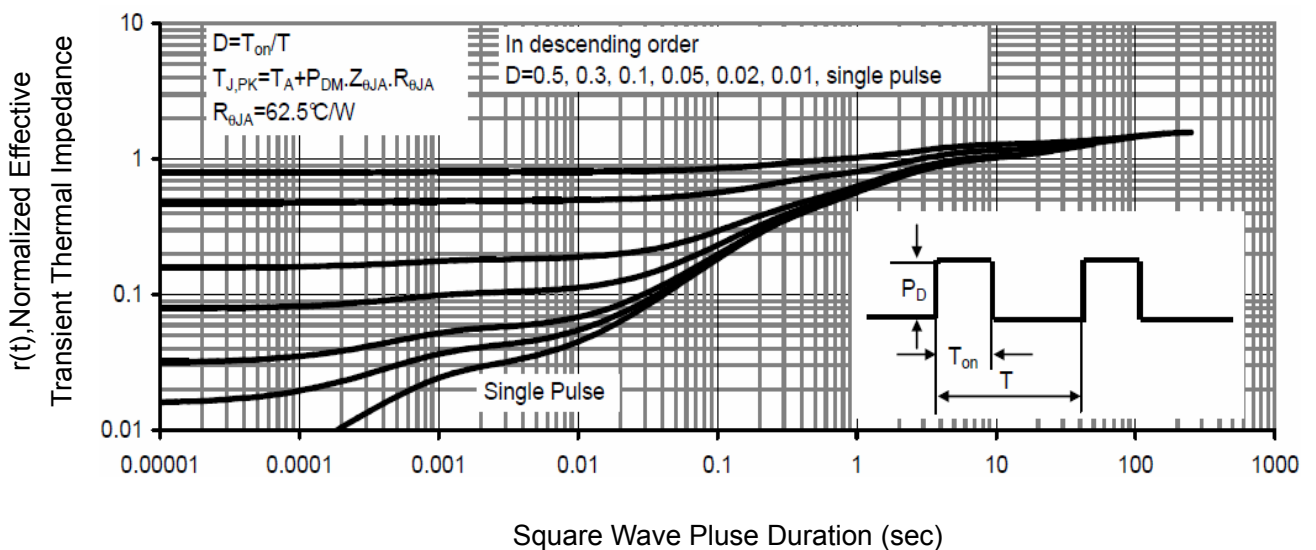
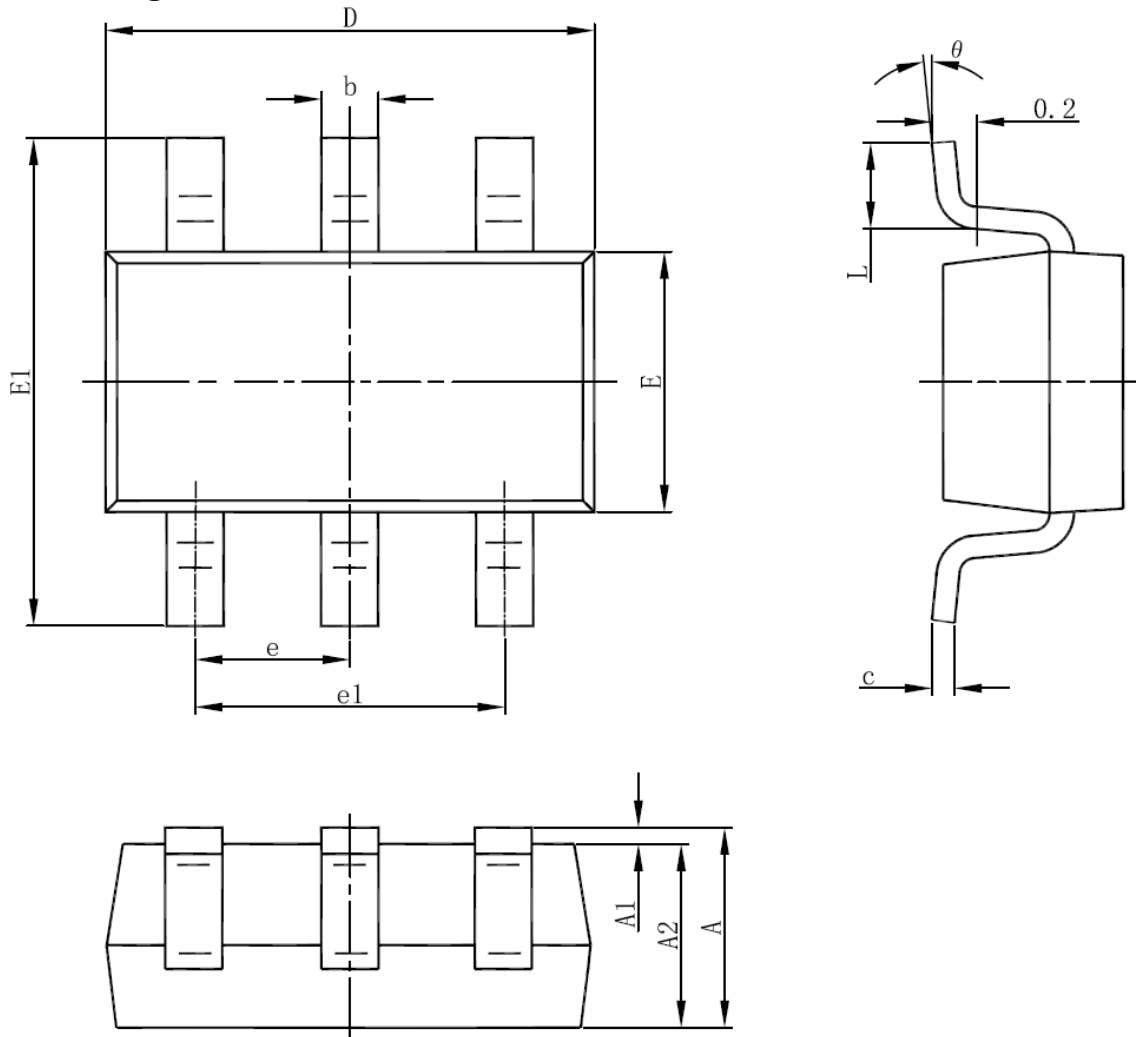


Figure 11 Normalized Maximum Transient Thermal Impedance

## SOT23-6L Package Information



| Symbol | Dimensions In Millimeters |       | Dimensions In Inches |       |
|--------|---------------------------|-------|----------------------|-------|
|        | Min                       | Max   | Min                  | Max   |
| A      | 1.050                     | 1.250 | 0.041                | 0.049 |
| A1     | 0.000                     | 0.100 | 0.000                | 0.004 |
| A2     | 1.050                     | 1.150 | 0.041                | 0.045 |
| b      | 0.300                     | 0.500 | 0.012                | 0.020 |
| c      | 0.100                     | 0.200 | 0.004                | 0.008 |
| D      | 2.820                     | 3.020 | 0.111                | 0.119 |
| E      | 1.500                     | 1.700 | 0.059                | 0.067 |
| E1     | 2.650                     | 2.950 | 0.104                | 0.116 |
| e      | 0.950(BSC)                |       | 0.037(BSC)           |       |
| e1     | 1.800                     | 2.000 | 0.071                | 0.079 |
| L      | 0.300                     | 0.600 | 0.012                | 0.024 |
| θ      | 0°                        | 8°    | 0°                   | 8°    |

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