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## NCE N-Channel Enhancement Mode Power MOSFET

### Description

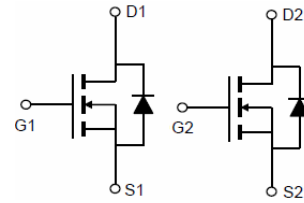
The NCE6005AS uses advanced trench technology and design to provide excellent  $R_{DS(ON)}$  with low gate charge. It can be used in a wide variety of applications.

### 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  $R_{DS(on)}$
- 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

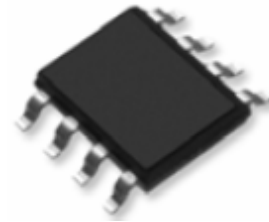
- Power switching application
- Hard switched and high frequency circuits
- Uninterruptible power supply



Schematic diagram



Marking and pin assignment



SOP-8 top view

### Package Marking and Ordering Information

| Device Marking | Device    | Device Package | Reel Size | Tape width | Quantity   |
|----------------|-----------|----------------|-----------|------------|------------|
| NCE6005AS      | NCE6005AS | SOP-8          | Ø330mm    | 12mm       | 2500 units |

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

| Parameter                                        | Symbol              | Limit      | Unit        |
|--------------------------------------------------|---------------------|------------|-------------|
| Drain-Source Voltage                             | $V_{DS}$            | 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 (Note 2) | $R_{\theta JA}$ | 62.5 | $^{\circ}C/W$ |
|--------------------------------------------------|-----------------|------|---------------|

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

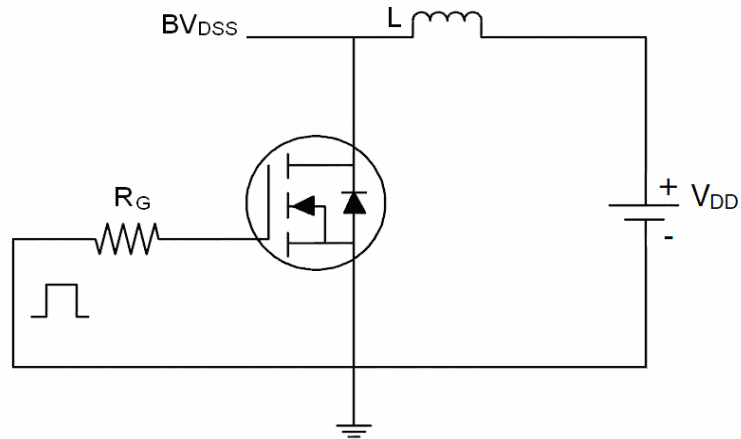
| Parameter                                     | Symbol              | Condition                                                                              | Min | Typ | Max  | Unit |
|-----------------------------------------------|---------------------|----------------------------------------------------------------------------------------|-----|-----|------|------|
| Off Characteristics                           |                     |                                                                                        |     |     |      |      |
| 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   |
| On Characteristics <sup>(Note 3)</sup>        |                     |                                                                                        |     |     |      |      |
| 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    |
| Dynamic Characteristics <sup>(Note4)</sup>    |                     |                                                                                        |     |     |      |      |
| 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   |
| Switching Characteristics <sup>(Note 4)</sup> |                     |                                                                                        |     |     |      |      |
| 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 | -   | 5.2 | -    | nS   |
| Turn-on Rise Time                             | t <sub>r</sub>      |                                                                                        | -   | 3   | -    | nS   |
| Turn-Off Delay Time                           | t <sub>d(off)</sub> |                                                                                        | -   | 17  | -    | nS   |
| Turn-Off Fall Time                            | t <sub>f</sub>      |                                                                                        | -   | 2.5 | -    | 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   |
| Drain-Source Diode Characteristics            |                     |                                                                                        |     |     |      |      |
| Diode Forward Voltage <sup>(Note 3)</sup>     | V <sub>SD</sub>     | V <sub>GS</sub> =0V, I <sub>S</sub> =5A                                                | -   |     | 1.2  | V    |
| Diode Forward Current <sup>(Note 2)</sup>     | I <sub>S</sub>      |                                                                                        | -   | -   | 5    | A    |
| Forward Turn-On Time                          | t <sub>on</sub>     | Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)                   |     |     |      |      |

**Notes:**

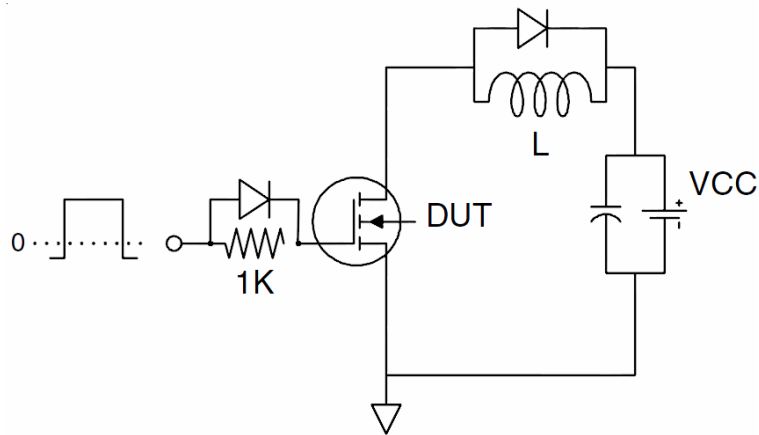
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board, t ≤ 10 sec.
3. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.
4. Guaranteed by design, not subject to production
5. EAS condition: T<sub>J</sub>=25°C, V<sub>DD</sub>=30V, V<sub>G</sub>=10V,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

## Test Circuit

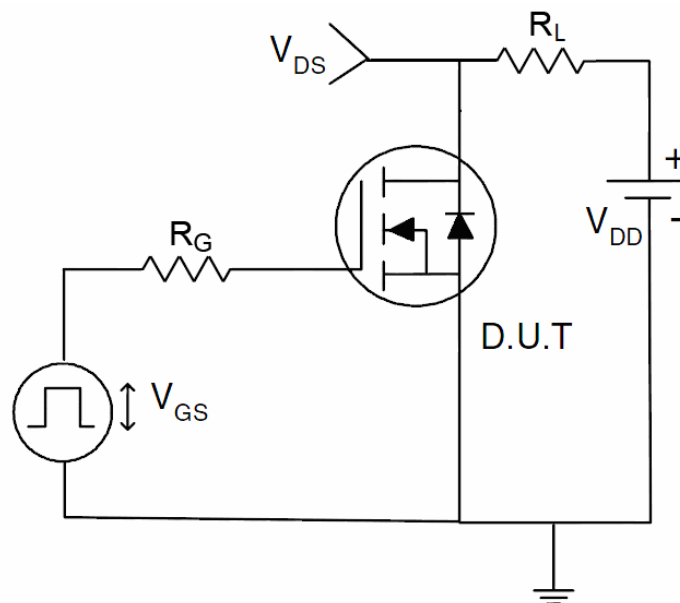
### 1) $E_{AS}$ test Circuit



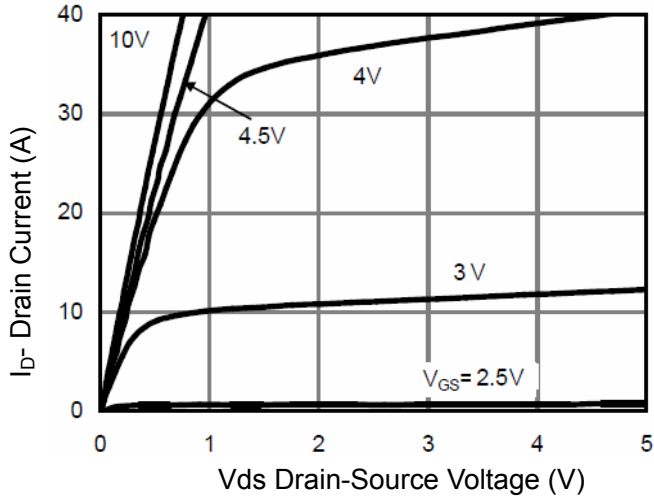
### 2) Gate charge test Circuit



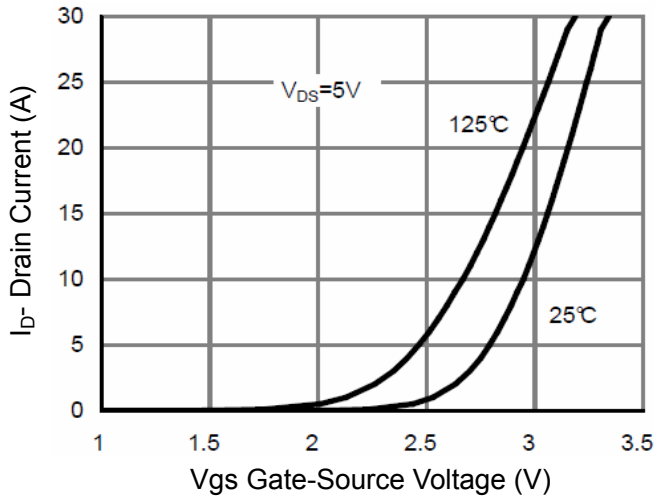
### 3) Switch Time Test Circuit



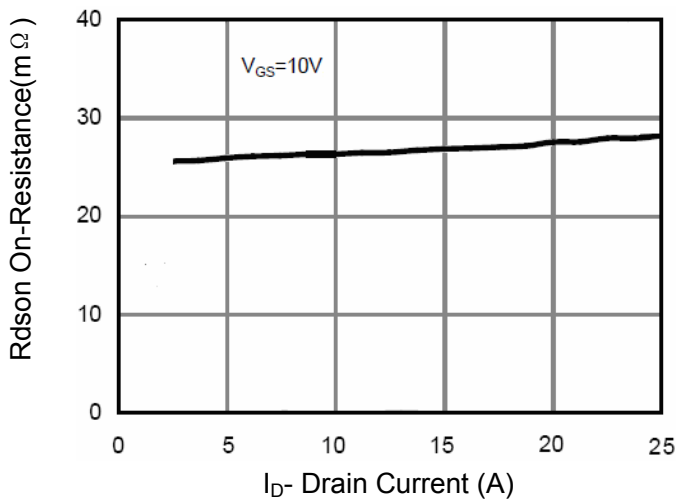
## Typical Electrical and Thermal Characteristics (Curves)



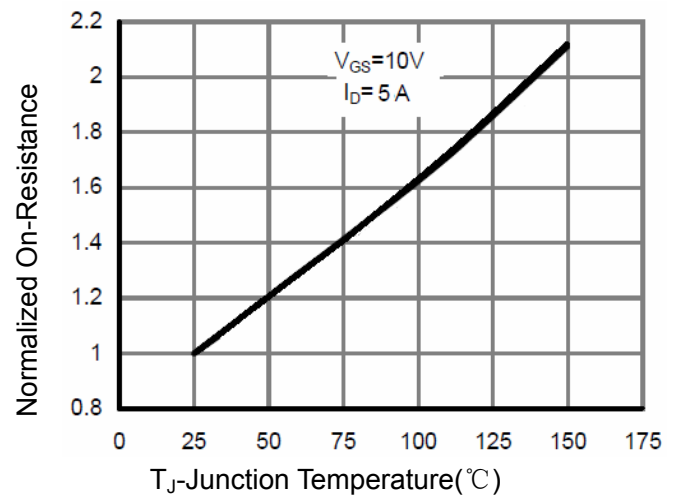
**Figure 1 Output Characteristics**



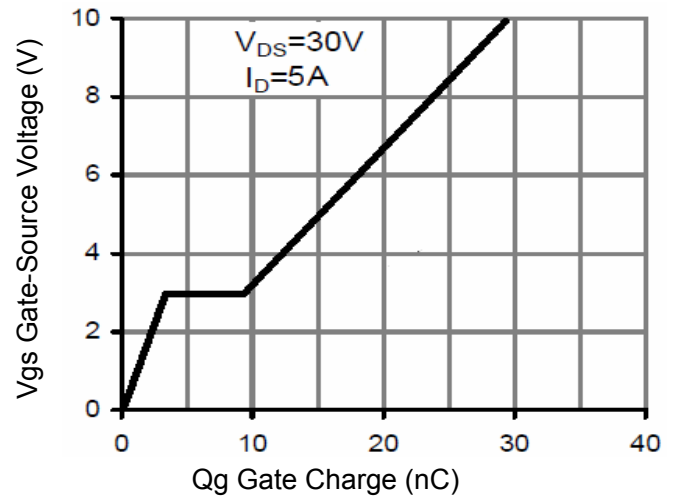
**Figure 2 Transfer Characteristics**



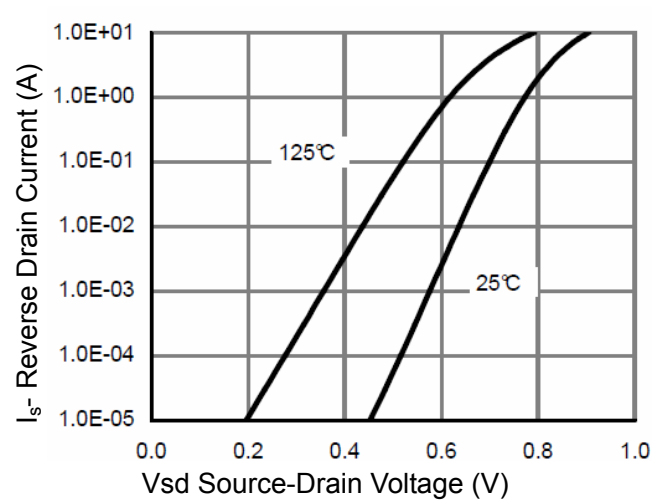
**Figure 3 Rdson- Drain Current**



**Figure 4 Rdson-Junction Temperature**



**Figure 5 Gate Charge**



**Figure 6 Source- Drain Diode Forward**

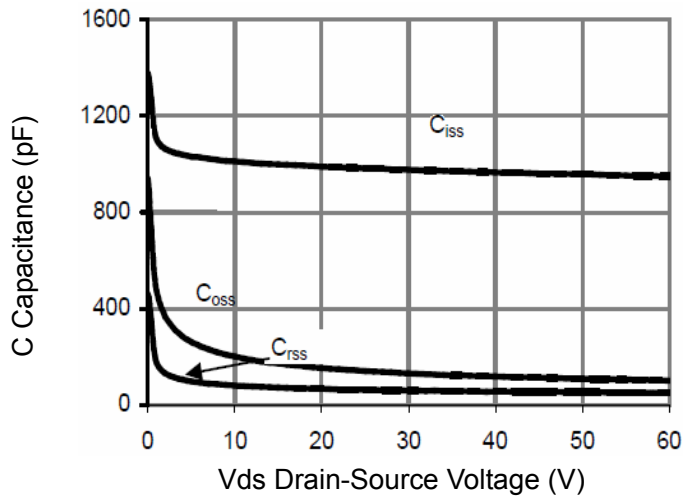


Figure 7 Capacitance vs Vds

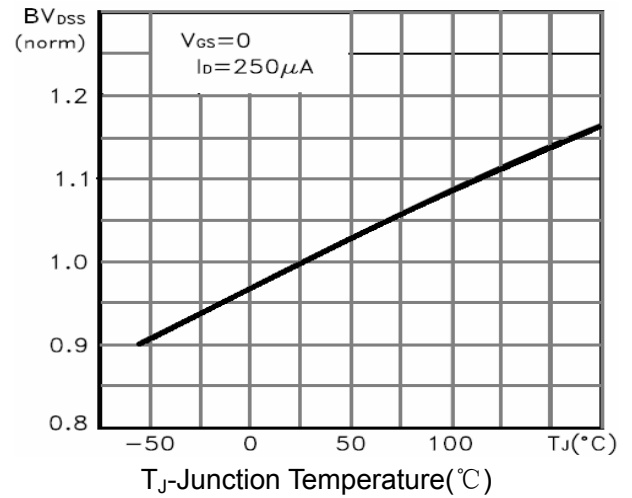
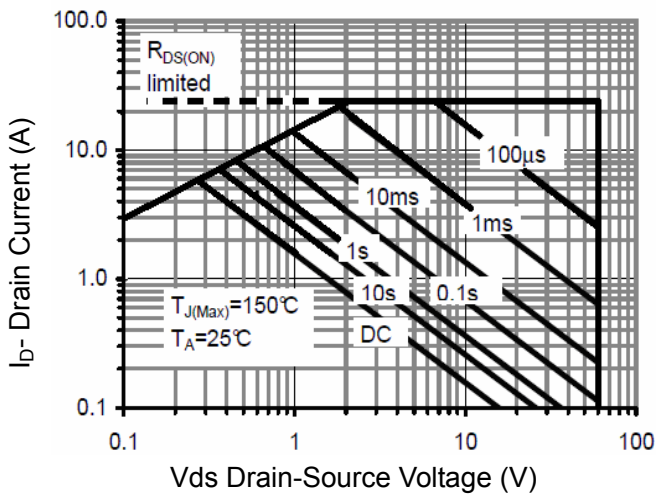

Figure 9  $BV_{DSS}$  vs Junction Temperature


Figure 8 Safe Operation Area

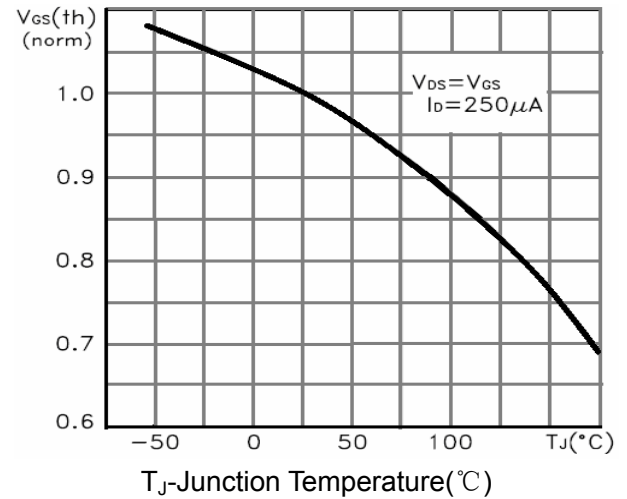
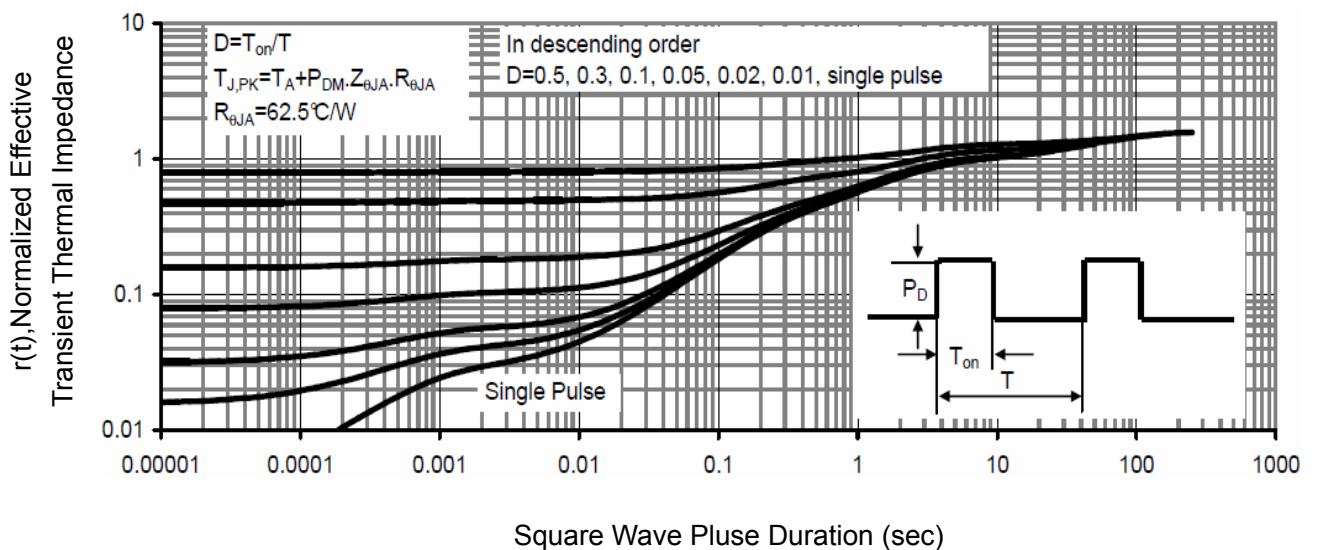
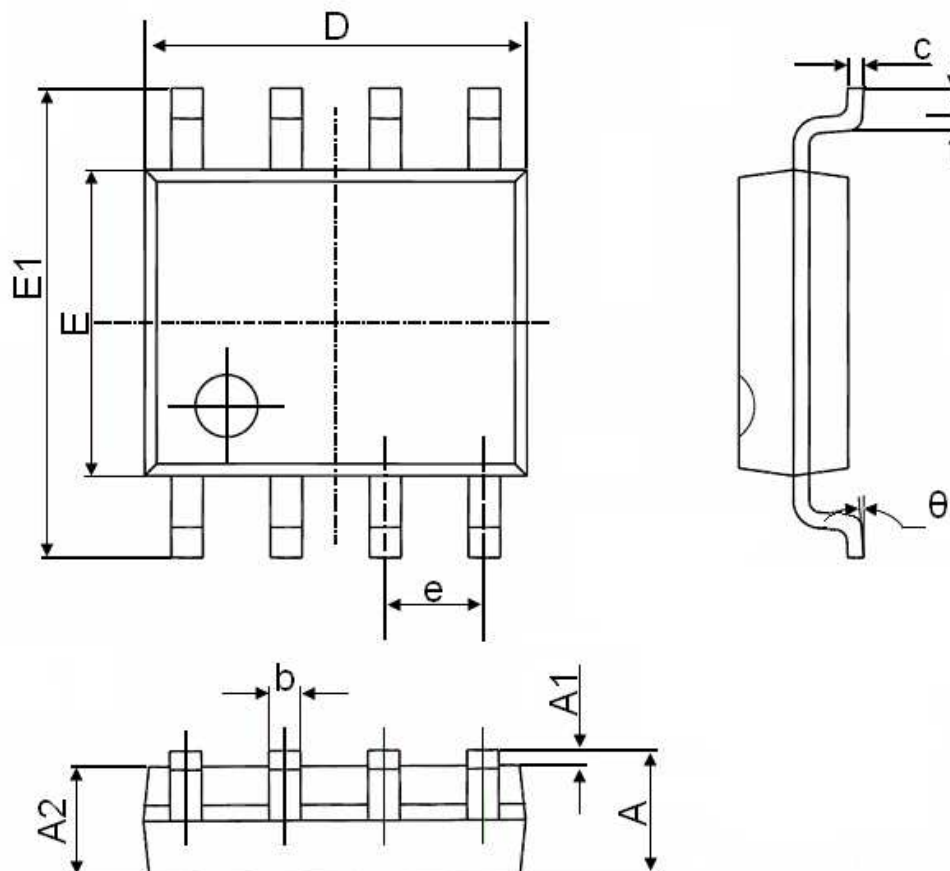

Figure 10  $V_{GS(th)}$  vs Junction Temperature


Figure 11 Normalized Maximum Transient Thermal Impedance

## 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 |
| θ      | 0°                        | 8°    | 0°                   | 8°    |

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