

SuperMOS –TO-252 100V  $BV_{DSS}$ ,  $7.1m\Omega$   $R_{DS(on)}$ , N-channel MOSFET

## 1. Description

The NCEP0178AK-ES is N-Channel enhancement MOS Field Effect Transistor. Using advanced technology and design to provide excellent  $R_{DS(on)}$  with low gate charge. Device is suitable for use in DC-DC conversion, power switch and charging circuit. Standard Product NCEP0178AK-ES is Pb-free.

## 2. Features

- 100V,  $R_{DS(on)}=7.1m\Omega$ (TYP.) @ $V_{GS}=10V$
- High density cell design for low  $R_{DS(on)}$
- Material: Halogen free
- Reliable and rugged
- Avalanche Rated
- Low leakage current

## 3. Applications

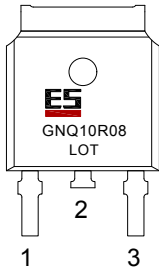
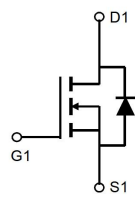
- PWM applications
- Load switch
- Power management in portable/desktop PCs
- DC/DC conversion

100% UIS TESTED

## 4. Ordering Information

| Part Number   | Package | Marking      | Material     | Packing     | Quantity per reel | Flammability Rating | Reel Size |
|---------------|---------|--------------|--------------|-------------|-------------------|---------------------|-----------|
| NCEP0178AK-ES | TO-252  | GNQ10R08/LOT | Halogen free | Tape & Reel | 2,500 PCS         | UL 94V-0            | 13 inches |

## 5. Pin Configuration and Functions

| Pin | Function | Outline                                                                             | Circuit Diagram                                                                       |
|-----|----------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 1   | Gate     |  |  |
| 3   | Source   |                                                                                     |                                                                                       |
| 2   | Drain    |                                                                                     |                                                                                       |

## 6. Specification

### Absolute Maximum Rating & Thermal Characteristics

Ratings at 25 °C ambient temperature unless otherwise specified.

| Parameter                                     |                          | Symbol     | Limit      | Unit |
|-----------------------------------------------|--------------------------|------------|------------|------|
| Drain-Source Voltage                          |                          | $BV_{DSS}$ | 100        | V    |
| Gate-Source Voltage                           |                          | $V_{GS}$   | ±20        | V    |
| Continuous Drain Current                      | $T_C=25^{\circ}\text{C}$ | $I_D$      | 83         | A    |
|                                               | $T_C=75^{\circ}\text{C}$ |            | 64         |      |
| Maximum Power Dissipation                     |                          | $P_D$      | 96         | W    |
| Pulsed Drain Current                          |                          | $I_{DM}$   | 332        | A    |
| Avalanche Current, Single Pulsed <sup>a</sup> |                          | $I_{AS}$   | 23         | A    |
| Avalanche Energy, Single Pulsed <sup>a</sup>  |                          | $E_{AS}$   | 132        | mJ   |
| Operating Junction Temperature                |                          | $T_J$      | 150        | °C   |
| Lead Temperature                              |                          | $T_L$      | 260        | °C   |
| Storage Temperature Range                     |                          | $T_{stg}$  | -55 to 150 | °C   |

### Thermal resistance ratings

| Single Operation                    |                 |         |         |      |
|-------------------------------------|-----------------|---------|---------|------|
| Parameter                           | Symbol          | Typical | Maximum | Unit |
| Junction-to-Case Thermal Resistance | $R_{\theta JC}$ |         | 1.3     | °C/W |

Note:

a:  $T_J=25^{\circ}\text{C}$ ,  $V_{DD}=50\text{V}$ ,  $V_G=10\text{V}$ ,  $L=0.5\text{mH}$ ,  $R_g=25\Omega$

## Electrical Characteristics

At TA = 25°C unless otherwise specified

| Parameter                                 | Symbol              | Test Conditions                                                                        | Min. | Typ. | Max. | Unit |
|-------------------------------------------|---------------------|----------------------------------------------------------------------------------------|------|------|------|------|
| OFF CHARACTERISTICS                       |                     |                                                                                        |      |      |      |      |
| Drain-to-Source Breakdown Voltage         | BV <sub>DSS</sub>   | V <sub>GS</sub> =0V, I <sub>D</sub> =250uA                                             | 100  |      |      | V    |
| Zero Gate Voltage Drain Current           | I <sub>DSS</sub>    | V <sub>DS</sub> =100V, V <sub>GS</sub> =0V                                             |      |      | 1    | uA   |
| Gate-to-source Leakage Current            | I <sub>GSS</sub>    | V <sub>DS</sub> =0V, V <sub>GS</sub> =±20V                                             |      |      | ±100 | nA   |
| ON CHARACTERISTICS                        |                     |                                                                                        |      |      |      |      |
| Gate Threshold Voltage                    | V <sub>GS(TH)</sub> | V <sub>GS</sub> =V <sub>DS</sub> , I <sub>D</sub> =250uA                               | 2.0  | 3.0  | 4.0  | V    |
| Drain-to-source On-resistance             | R <sub>DS(on)</sub> | V <sub>GS</sub> =10V, I <sub>D</sub> =30A                                              |      | 7.1  | 8.0  | mΩ   |
| Forward transconductance                  | g <sub>fs</sub>     | V <sub>DS</sub> =5V, I <sub>D</sub> =30A                                               |      | 65   |      | S    |
| CHARGES, CAPACITANCES AND GATE RESISTANCE |                     |                                                                                        |      |      |      |      |
| Input Capacitance                         | C <sub>ISS</sub>    | V <sub>GS</sub> =0V, f=1MHz,<br>V <sub>DS</sub> =50V                                   |      | 1895 |      | pF   |
| Output Capacitance                        | C <sub>OSS</sub>    |                                                                                        |      | 575  |      |      |
| Reverse Transfer Capacitance              | C <sub>RSS</sub>    |                                                                                        |      | 12   |      |      |
| Total Gate Charge                         | Q <sub>G(TOT)</sub> | V <sub>GS</sub> =10V, V <sub>DS</sub> =50V,<br>I <sub>D</sub> =30A                     |      | 28.5 |      | nC   |
| Gate-to-Source Charge                     | Q <sub>GS</sub>     |                                                                                        |      | 10   |      |      |
| Gate-to-Drain Charge                      | Q <sub>GD</sub>     |                                                                                        |      | 4.2  |      |      |
| SWITCHING CHARACTERISTICS                 |                     |                                                                                        |      |      |      |      |
| Turn-On Delay Time                        | t <sub>d(ON)</sub>  | V <sub>GS</sub> =10V, V <sub>DS</sub> =50V,<br>I <sub>D</sub> =30A, R <sub>G</sub> =3Ω |      | 17   |      | ns   |
| Rise Time                                 | t <sub>r</sub>      |                                                                                        |      | 20   |      |      |
| Turn-Off Delay Time                       | t <sub>d(OFF)</sub> |                                                                                        |      | 68   |      |      |
| Fall Time                                 | t <sub>f</sub>      |                                                                                        |      | 21   |      |      |
| BODY DIODE CHARACTERISTICS                |                     |                                                                                        |      |      |      |      |
| Forward Voltage                           | V <sub>SD</sub>     | V <sub>GS</sub> =0V, I <sub>S</sub> =30A                                               |      | 0.9  | 1.5  | V    |

## 7. Typical Characteristic

Figure 1. On-Region Characteristics

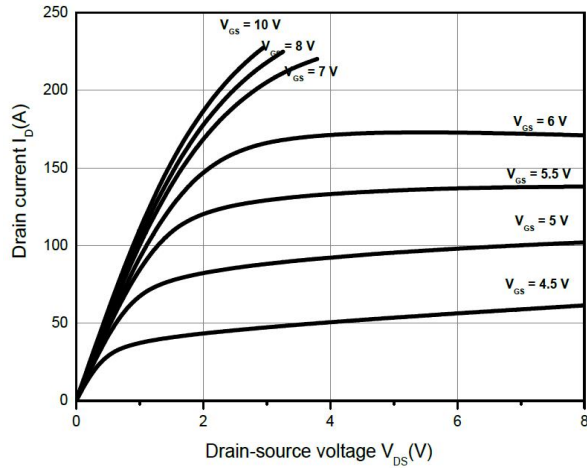


Figure 2. Transfer Characteristics

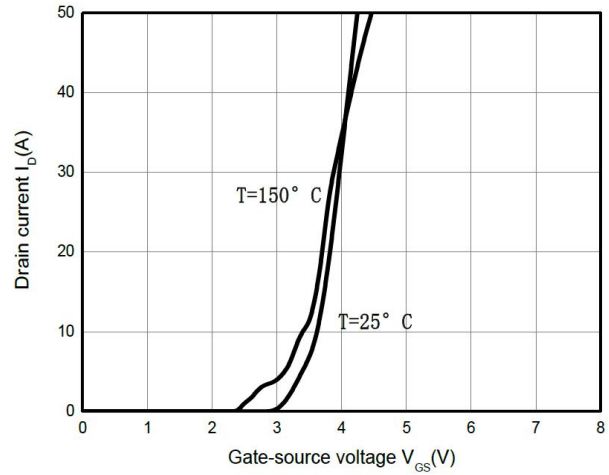


Figure 3. Body-Diode Characteristics

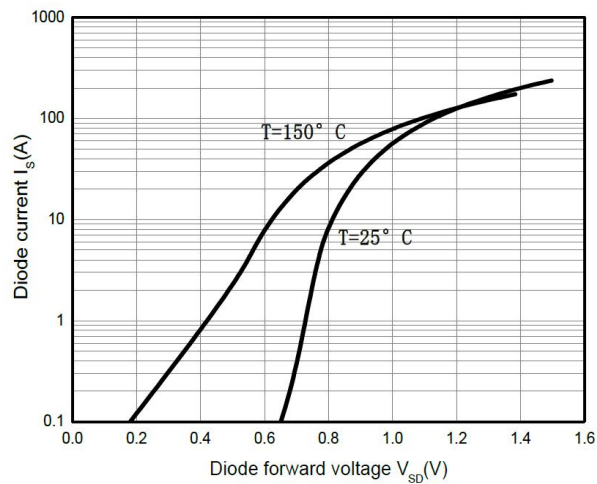


Figure 4. On-Resistance Variation vs. Drain Current

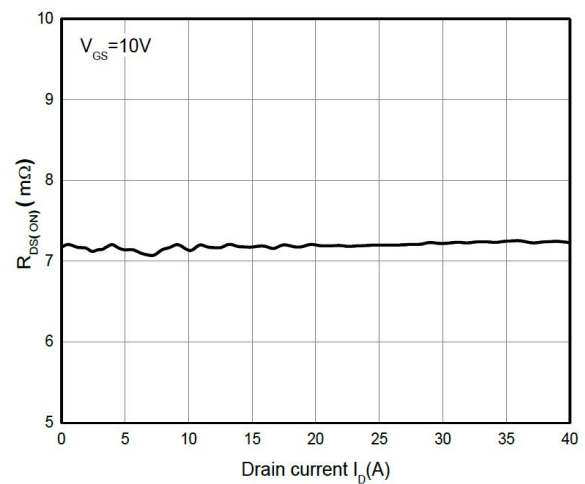
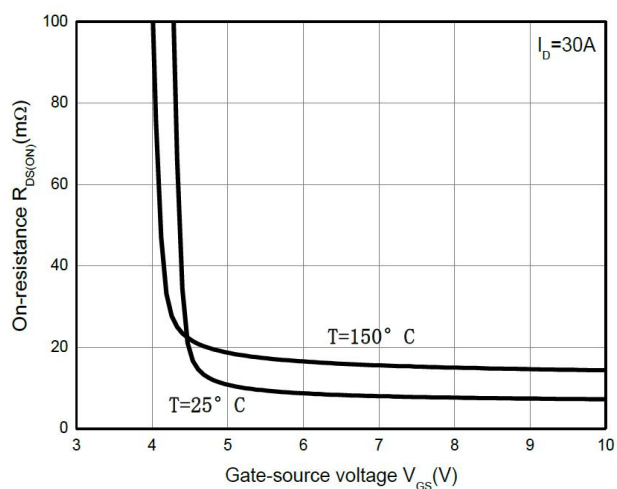
Figure 5.  $R_{DS(on)}$  vs. Gate Voltage

Figure 6. On-Resistance vs. Temperature

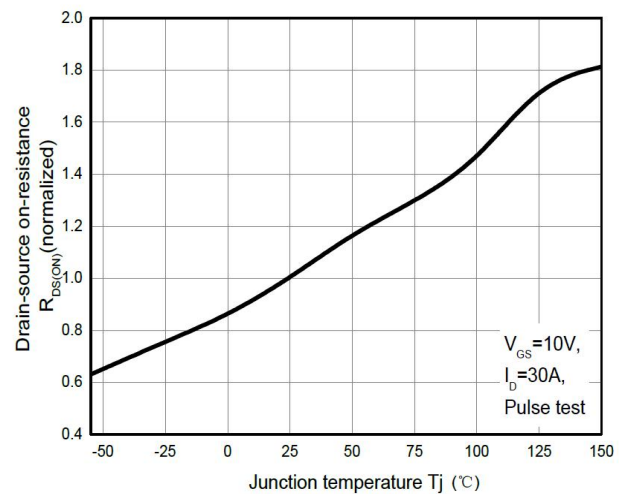


Figure 7. Threshold Voltage vs. Temperature

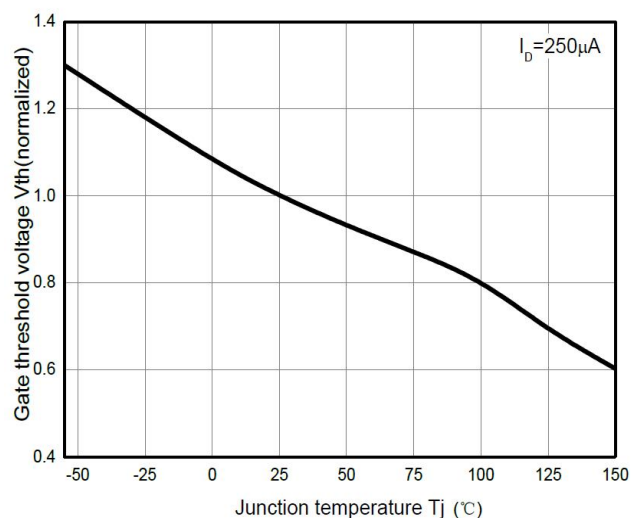


Figure 8. Breakdown Voltage vs. Temperature

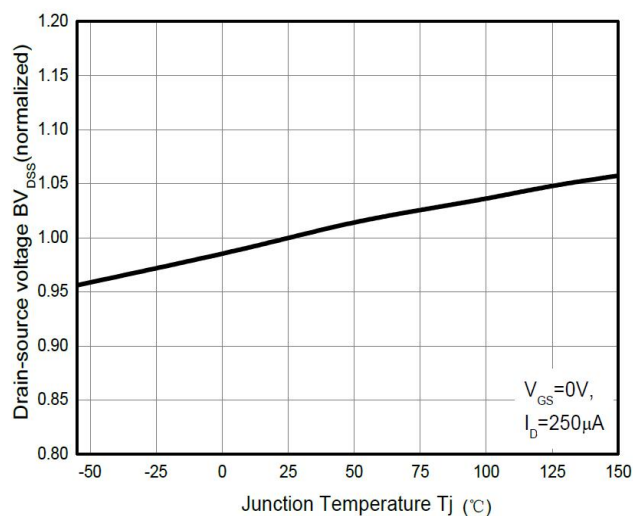


Figure 9. Capacitance Characteristics

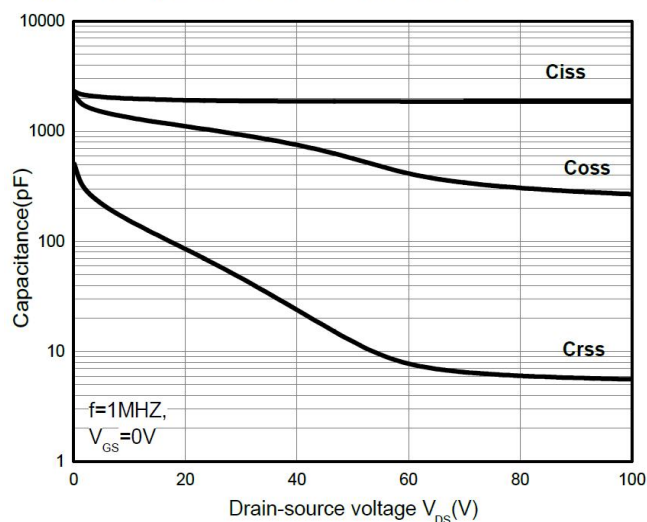


Figure 10. Gate Charge Characteristics

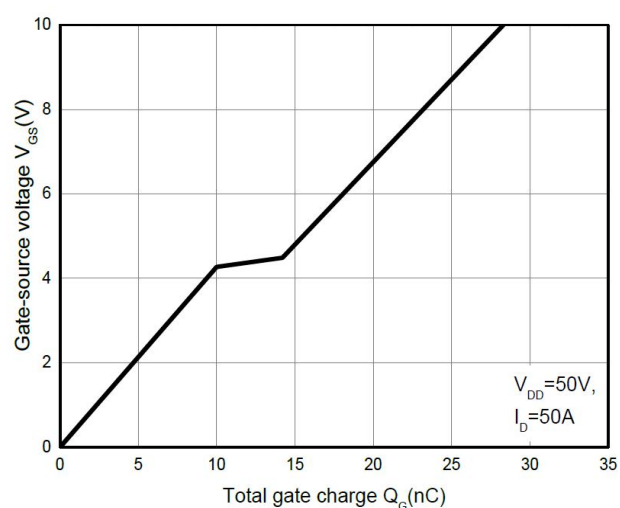


Figure 11. Drain Current Derating

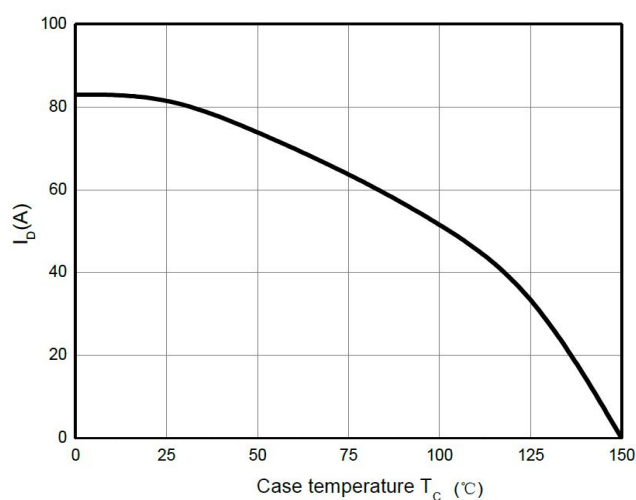


Figure 12. Power Dissipation vs. Temperature

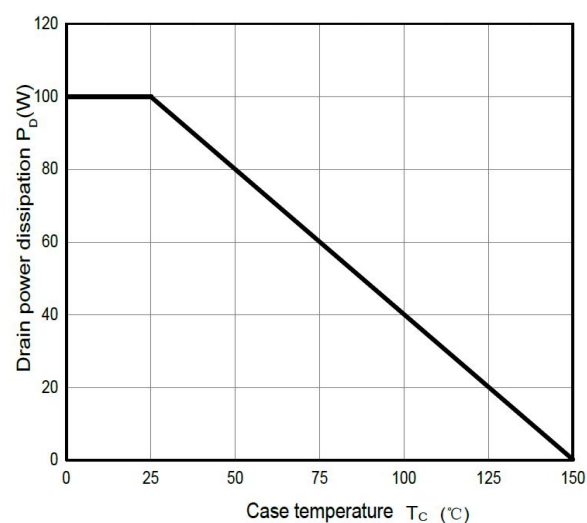


Figure 13.Maximum Safe Operating Area

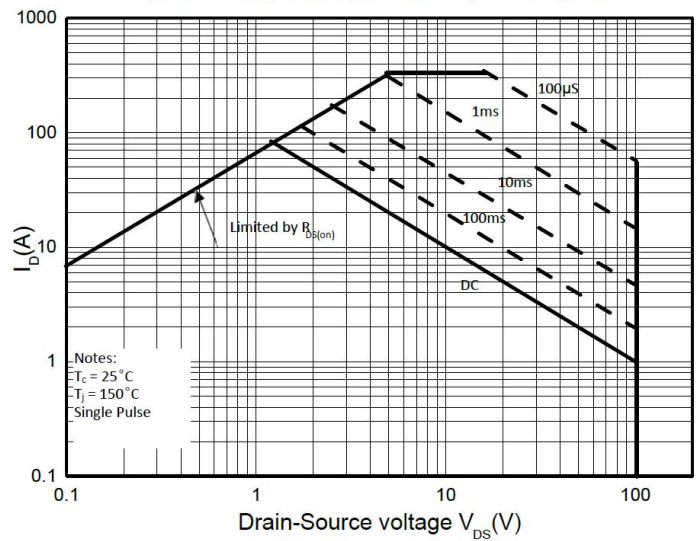
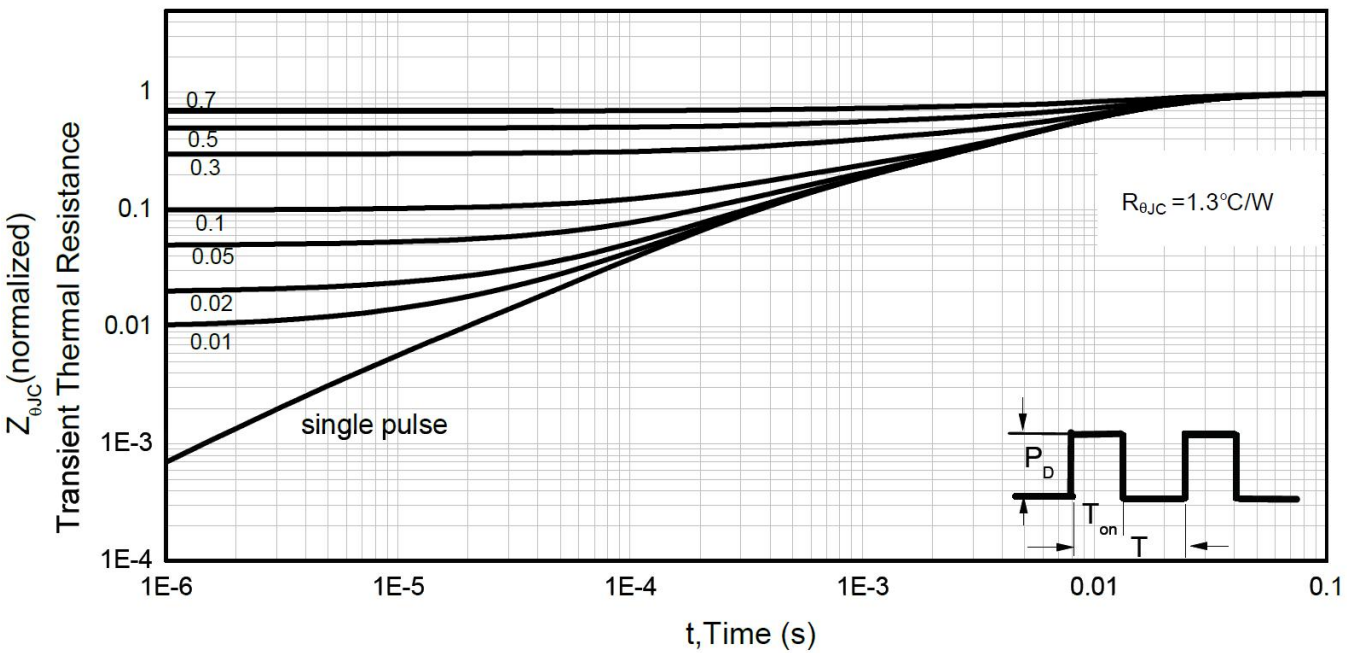
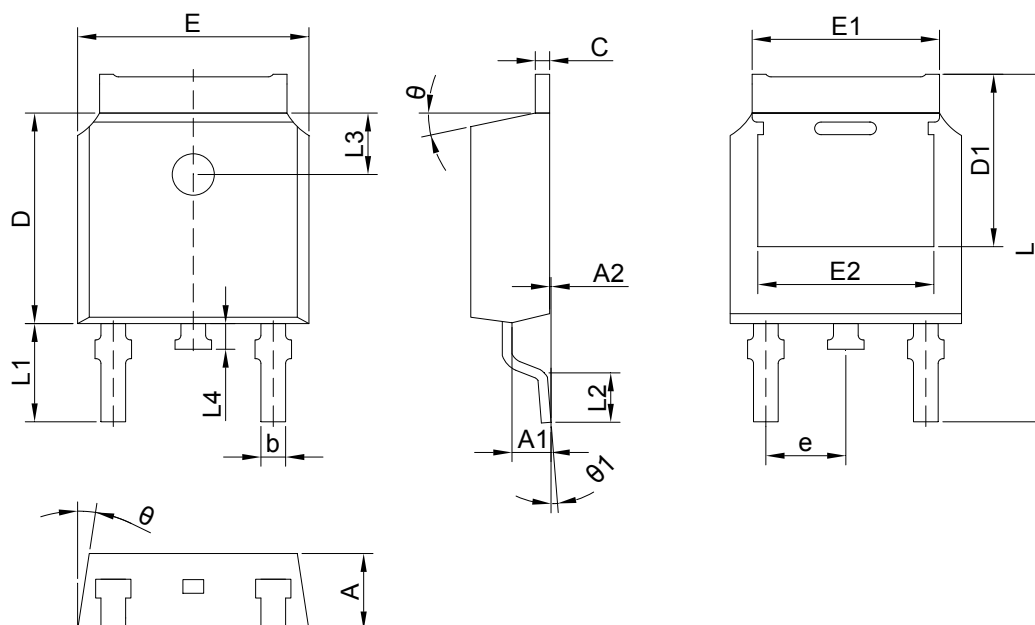


Figure 14. Normalized Maximum Transient Thermal Impedance ( $R_{thJC}$ )



## 8. Dimension (TO-252)



| COMMON DIMENSIONS CUNITS MEASURE=MILLIMETER |      |      |      |        |           |       |       |
|---------------------------------------------|------|------|------|--------|-----------|-------|-------|
| SYMBOL                                      | MIN  | TYP  | MAX  | SYMBOL | MIN       | TYP   | MAX   |
| A                                           | 2.10 | 2.30 | 2.50 | E2     | 4.63      | 4.83  | 5.03  |
| A1                                          | 0.97 | 1.07 | 1.17 | L      | 9.90      | 10.10 | 10.30 |
| A2                                          | 0.00 | -    | 0.12 | L1     | 2.74      | 2.94  | 3.14  |
| b                                           | 0.66 | 0.76 | 0.86 | L2     | 1.40      | 1.50  | 1.70  |
| C                                           | 0.45 | 0.51 | 0.60 | L3     | 1.65      | 1.80  | 1.95  |
| D                                           | 5.90 | 6.10 | 6.30 | L4     | 0.60      | 0.80  | 1.00  |
| D1                                          | 5.10 | 5.30 | 5.45 | e      | 2.286 BSC |       |       |
| E                                           | 6.40 | 6.60 | 6.80 | θ      | 5°        | 7°    | 10°   |
| E1                                          | 5.10 | 5.33 | 5.45 | θ1     | 0°        | -     | 3°    |

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