

## NCE N-Channel Enhancement Mode Power MOSFET

### Description

The NCE5055K 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

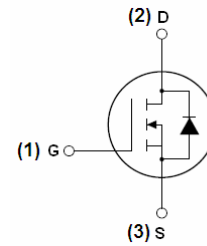
- $V_{DS} = 50V, I_D = 55A$   
 $R_{DS(ON)} < 12m\Omega @ V_{GS} = 10V$   
 $R_{DS(ON)} < 18m\Omega @ V_{GS} = 4.5V$
- High density cell design for ultra low  $R_{dson}$
- Fully characterized avalanche voltage and current
- Good stability and uniformity with high  $E_{AS}$
- Excellent package for good heat dissipation
- Special process technology for high ESD capability

### Application

- Load switching
- Hard switched and high frequency circuits
- Uninterruptible power supply

**100% UIS TESTED!**

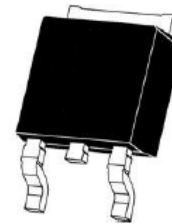
**100%  $\Delta V_d$ s TESTED!**



Schematic diagram



Marking and pin assignment



TO-252-2L top view

### Package Marking and Ordering Information

| Device Marking | Device   | Device Package | Reel Size | Tape width | Quantity |
|----------------|----------|----------------|-----------|------------|----------|
| NCE5055K       | NCE5055K | TO-252-2L      | -         | -          | -        |

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

| Parameter   | Symbol             | Limit      | Unit          |
|---|--------------------|------------|---------------|
| Drain-Source Voltage                              | $V_{DS}$           | 50         | V             |
| Gate-Source Voltage                               | $V_{GS}$           | $\pm 20$   | V             |
| Drain Current-Continuous                          | $I_D$              | 55         | A             |
| Drain Current-Continuous( $T_C = 100^\circ C$ )   | $I_D(100^\circ C)$ | 38.9       | A             |
| Pulsed Drain Current                              | $I_{DM}$           | 200        | A             |
| Maximum Power Dissipation                         | $P_D$              | 65         | W             |
| Derating factor                                   |                    | 0.43       | W/ $^\circ C$ |
| Single pulse avalanche energy <sup>(Note 5)</sup> | $E_{AS}$           | 230        | 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> | $R_{\theta JC}$ | 2.3 | $^\circ C/W$ |
|--|-----------------|-----|--------------|

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

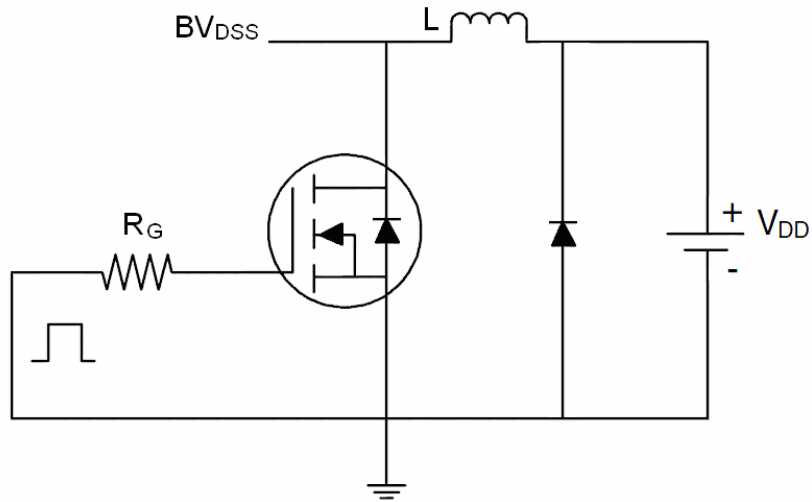
| Parameter                                 | Symbol              | Condition  | Min | Typ  | Max  | Unit |
|---|---------------------|--|-----|------|------|------|
| <b>Off Characteristics</b>                |                     |  |     |      |      |      |
| Drain-Source Breakdown Voltage            | BV <sub>DSS</sub>   | V <sub>GS</sub> =0V, I <sub>D</sub> =250μA   | 50  | -    | -    | V    |
| Zero Gate Voltage Drain Current           | I <sub>DSS</sub>    | V <sub>DS</sub> =45V, 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 (Note 3)</b>        |                     |  |     |      |      |      |
| Gate Threshold Voltage                    | V <sub>GS(th)</sub> | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA                             | 1.2 | 1.9  | 2.5  | V    |
| Drain-Source On-State Resistance          | R <sub>DS(ON)</sub> | V <sub>GS</sub> =10V, I <sub>D</sub> =20A  | -   | 9.6  | 12.5 | mΩ   |
|   |                     | V <sub>GS</sub> =4.5V, I <sub>D</sub> =15A   |     | 12.5 | 17   |      |
| Forward Transconductance                  | g <sub>FS</sub>     | V <sub>DS</sub> =5V, I <sub>D</sub> =20A   | 20  | -    | -    | S    |
| <b>Dynamic Characteristics (Note4)</b>    |                     |  |     |      |      |      |
| Input Capacitance                         | C <sub>iss</sub>    | V <sub>DS</sub> =25V, V <sub>GS</sub> =0V,<br>F=1.0MHz                               | -   | 1760 | -    | PF   |
| Output Capacitance                        | C <sub>oss</sub>    |  | -   | 169  | -    | PF   |
| Reverse Transfer Capacitance              | C <sub>rss</sub>    |  | -   | 123  | -    | PF   |
| <b>Switching Characteristics (Note 4)</b> |                     |  |     |      |      |      |
| Turn-on Delay Time                        | t <sub>d(on)</sub>  | V <sub>DD</sub> =25V, R <sub>L</sub> =1Ω<br>V <sub>GS</sub> =10V, R <sub>G</sub> =3Ω | -   | 6.1  | -    | nS   |
| Turn-on Rise Time                         | t <sub>r</sub>      |  | -   | 17   | -    | nS   |
| Turn-Off Delay Time                       | t <sub>d(off)</sub> |  | -   | 29   | -    | nS   |
| Turn-Off Fall Time                        | t <sub>f</sub>      |  | -   | 16.5 | -    | nS   |
| Total Gate Charge                         | Q <sub>g</sub>      | V <sub>DS</sub> =25V, I <sub>D</sub> =20A,<br>V <sub>GS</sub> =10V                   | -   | 35.4 |      | nC   |
| Gate-Source Charge                        | Q <sub>gs</sub>     |  | -   | 4.3  |      | nC   |
| Gate-Drain Charge                         | Q <sub>gd</sub>     |  | -   | 10.5 |      | 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> =20A   | -   |      | 1.2  | V    |
| Diode Forward Current (Note 2)            | I <sub>S</sub>      |  | -   | -    | 55   | A    |
| Reverse Recovery Time                     | t <sub>rr</sub>     | T <sub>J</sub> = 25 °C, I <sub>F</sub> = 20A<br>di/dt = 100A/μs (Note3)              | -   | 29   | -    | nS   |
| Reverse Recovery Charge                   | Q <sub>rr</sub>     |  | -   | 26   | -    | nC   |

**Notes:**

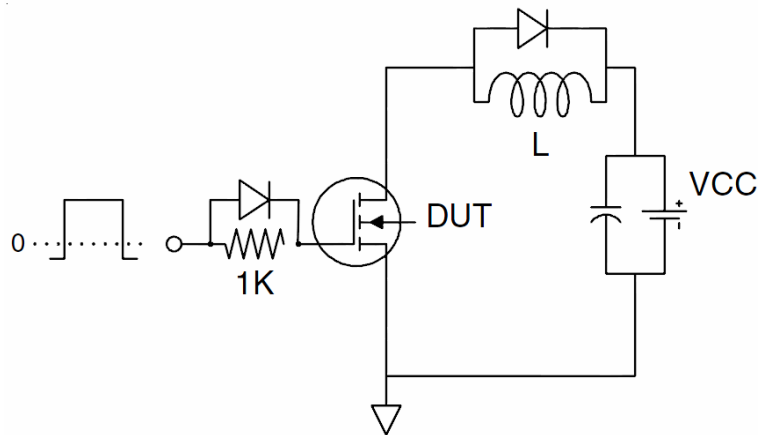
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board, t ≤ 10 sec.
3. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.
4. Guaranteed by design, not subject to production
5. E<sub>AS</sub> condition : T<sub>J</sub>=25 °C, V<sub>DD</sub>=20V, V<sub>G</sub>=10V, L=0.5mH, R<sub>G</sub>=25Ω,

Test circuit

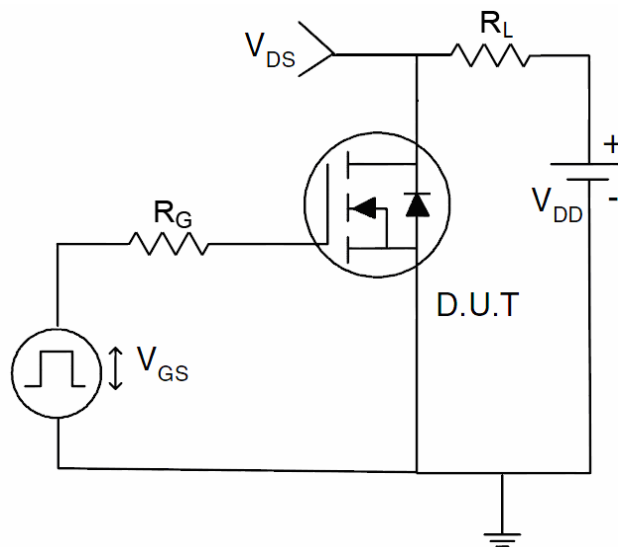
1)  $E_{AS}$  Test Circuit



2) Gate Charge Test Circuit



3) Switch Time Test Circuit



Typical Electrical and Thermal Characteristics (Curves)

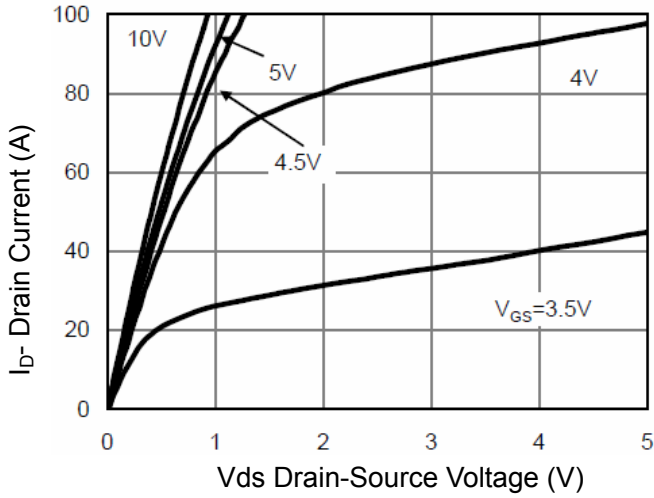


Figure 1 Output Characteristics

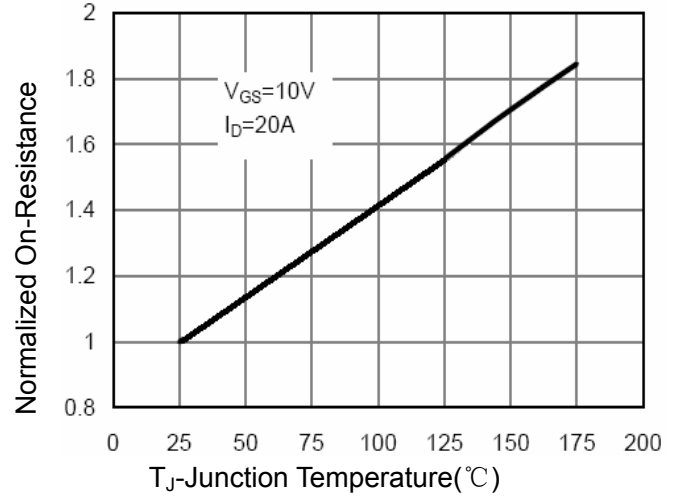


Figure 4  $R_{dson}$ -Junction Temperature

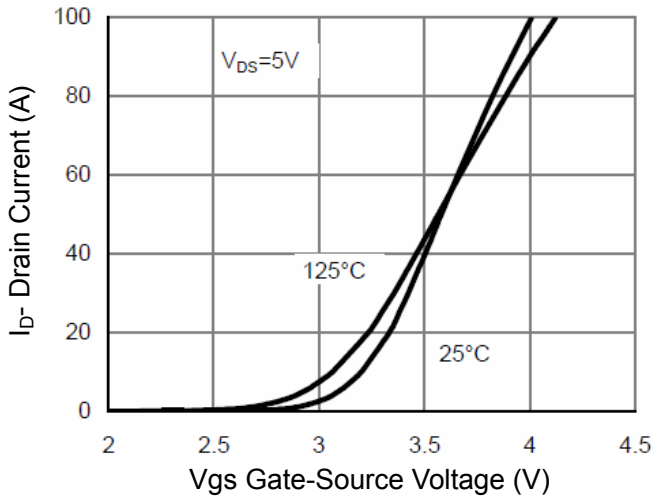


Figure 2 Transfer Characteristics

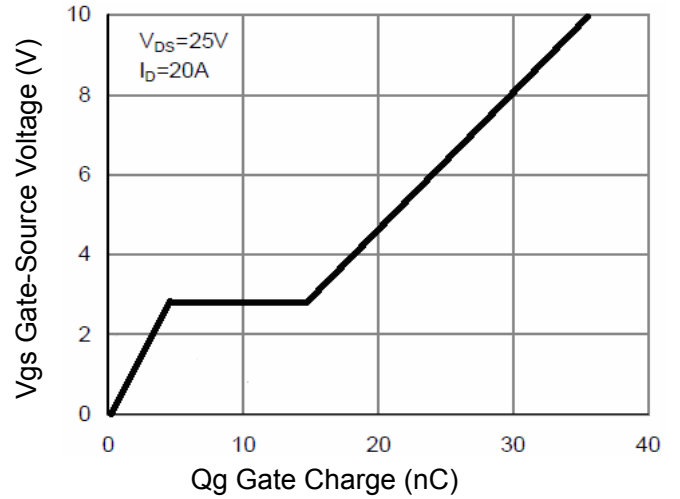


Figure 5 Gate Charge

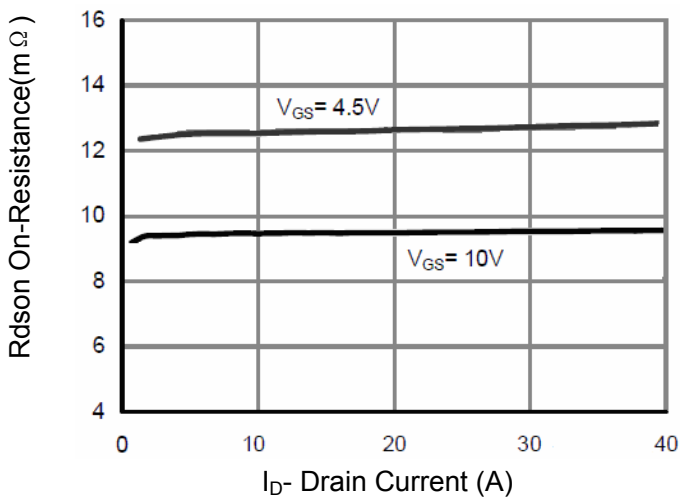


Figure 3  $R_{dson}$ - Drain Current

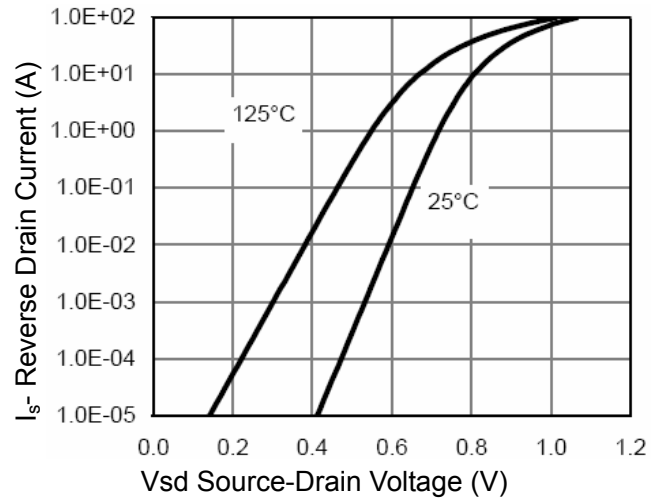


Figure 6 Source- Drain Diode Forward

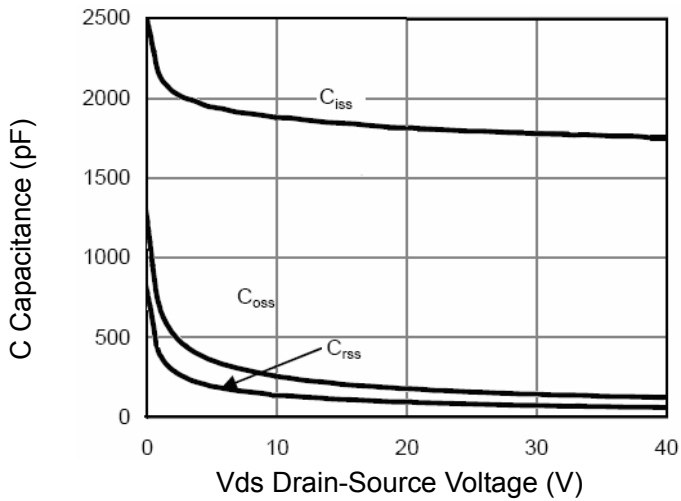


Figure 7 Capacitance vs Vds

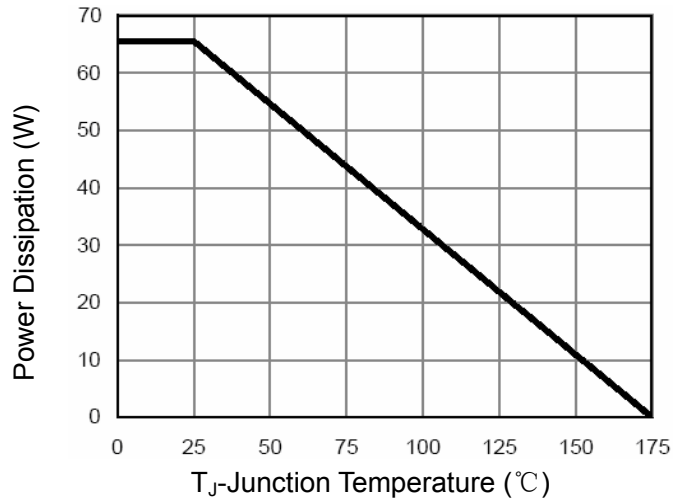


Figure 9 Power De-rating

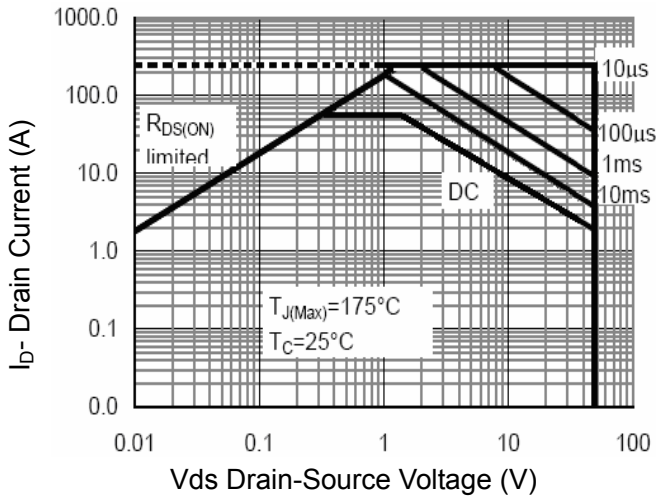


Figure 8 Safe Operation Area

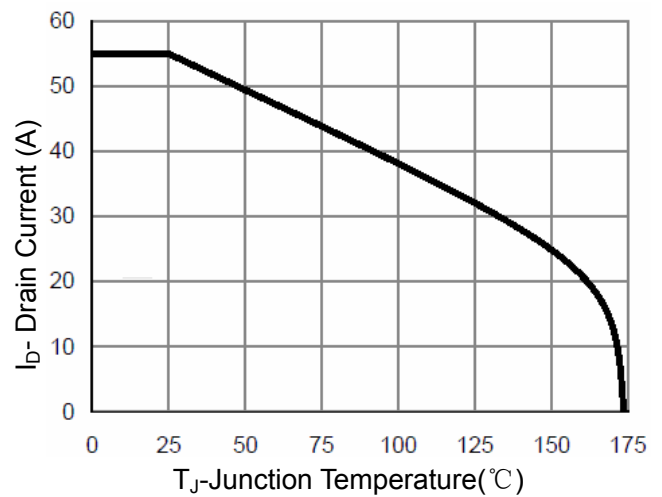


Figure 10 Current De-rating

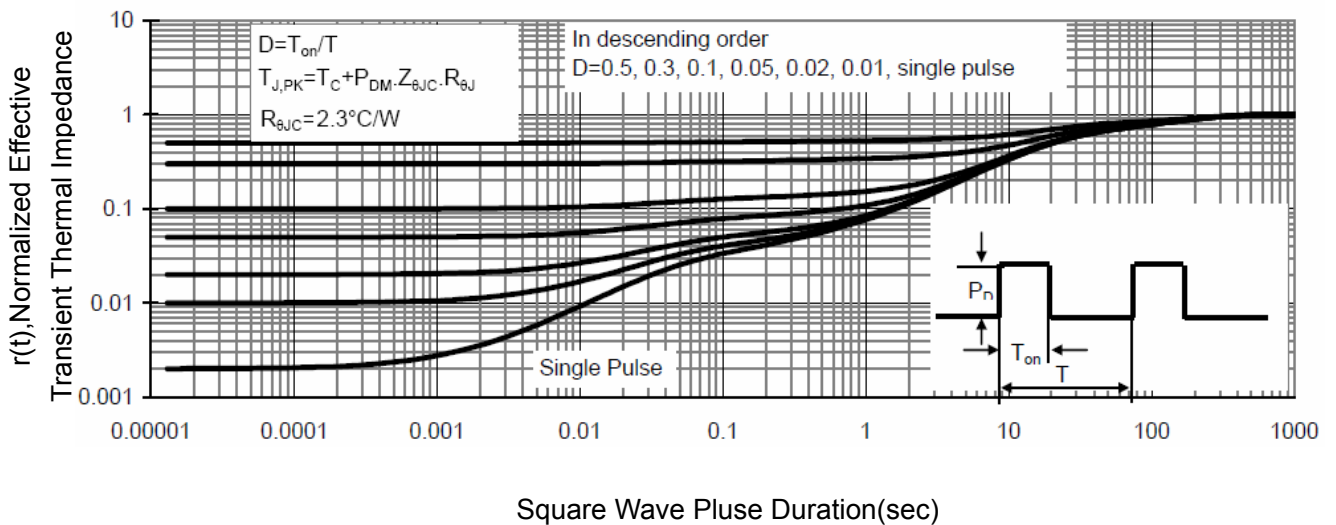
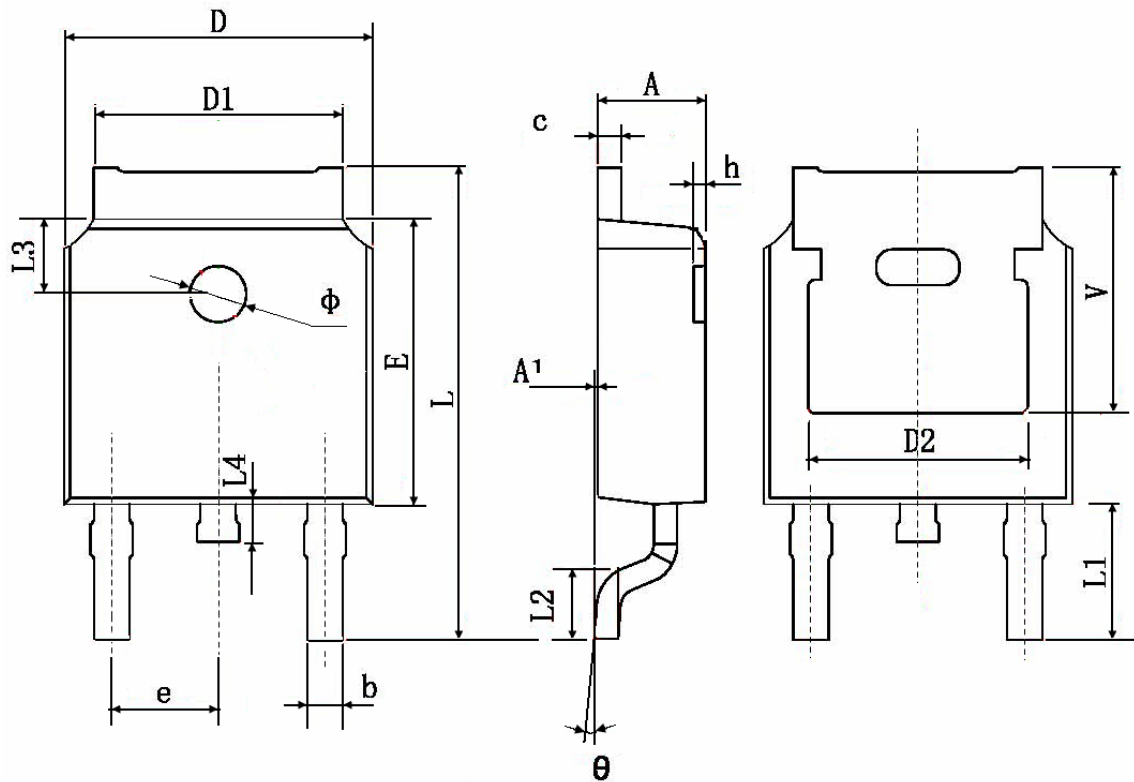


Figure 11 Normalized Maximum Transient Thermal Impedance

**TO-252 Package Information**


| Symbol | Dimensions In Millimeters |        | Dimensions In Inches |       |
|--------|---------------------------|--------|----------------------|-------|
|        | Min.                      | Max.   | Min.                 | Max.  |
| A      | 2.200                     | 2.400  | 0.087                | 0.094 |
| A1     | 0.000                     | 0.127  | 0.000                | 0.005 |
| b      | 0.660                     | 0.860  | 0.026                | 0.034 |
| c      | 0.460                     | 0.580  | 0.018                | 0.023 |
| D      | 6.500                     | 6.700  | 0.256                | 0.264 |
| D1     | 5.100                     | 5.460  | 0.201                | 0.215 |
| D2     | 4.830 TYP.                |        | 0.190 TYP.           |       |
| E      | 6.000                     | 6.200  | 0.236                | 0.244 |
| e      | 2.186                     | 2.386  | 0.086                | 0.094 |
| L      | 9.800                     | 10.400 | 0.386                | 0.409 |
| L1     | 2.900 TYP.                |        | 0.114 TYP.           |       |
| L2     | 1.400                     | 1.700  | 0.055                | 0.067 |
| L3     | 1.600 TYP.                |        | 0.063 TYP.           |       |
| L4     | 0.600                     | 1.000  | 0.024                | 0.039 |
| φ      | 1.100                     | 1.300  | 0.043                | 0.051 |
| θ      | 0°                        | 8°     | 0°                   | 8°    |
| h      | 0.000                     | 0.300  | 0.000                | 0.012 |
| V      | 5.350 TYP.                |        | 0.211 TYP.           |       |

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