

## NCE N-Channel Enhancement Mode Power MOSFET

### Description

The NCE5080K 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

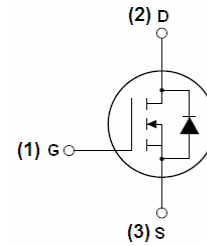
- $V_{DS} = 50V, I_D = 80A$   
 $R_{DS(ON)} < 7.5m\Omega @ V_{GS} = 10V$   
 $R_{DS(ON)} < 9m\Omega @ V_{GS} = 4.5V$
- High density cell design for ultra low  $R_{dson}$
- Fully characterized avalanche voltage and current
- Good stability and uniformity with high  $E_{AS}$
- Excellent package for good heat dissipation
- Special process technology for high ESD capability

### Application

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

**100% UIS TESTED!**

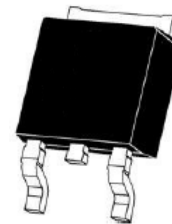
**100%  $\Delta V_d$ s TESTED!**



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 |
|----------------|----------|----------------|-----------|------------|----------|
| NCE5080K       | NCE5080K | 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                          | $I_D$              | 80         | A             |
| Drain Current-Continuous( $T_C = 100^\circ C$ )   | $I_D(100^\circ C)$ | 56.5       | A             |
| Pulsed Drain Current                              | $I_{DM}$           | 320        | A             |
| Maximum Power Dissipation                         | $P_D$              | 100        | W             |
| Derating factor                                   |                    | 0.67       | W/ $^\circ C$ |
| Single pulse avalanche energy <sup>(Note 5)</sup> | $E_{AS}$           | 400        | 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> | $R_{\theta JC}$ | 1.5 | $^\circ C/W$ |
|--|-----------------|-----|--------------|

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

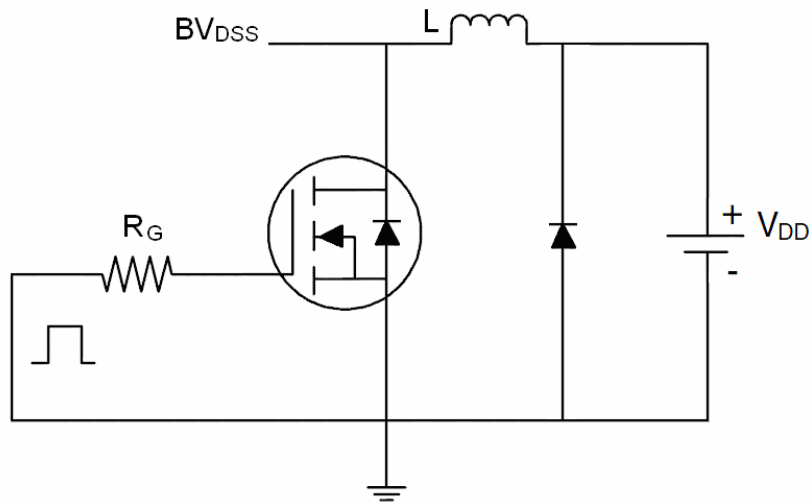
| Parameter                                 | Symbol       | Condition   | Min | Typ  | Max       | Unit       |
|---|--------------|---|-----|------|-----------|------------|
| <b>Off Characteristics</b>                |              |   |     |      |           |            |
| Drain-Source Breakdown Voltage            | $BV_{DSS}$   | $V_{GS}=0V, I_D=250\mu A$   | 50  | -    | -         | V          |
| Zero Gate Voltage Drain Current           | $I_{DSS}$    | $V_{DS}=50V, V_{GS}=0V$   | -   | -    | 1         | $\mu A$    |
| Gate-Body Leakage Current                 | $I_{GSS}$    | $V_{GS}=\pm 20V, V_{DS}=0V$   | -   | -    | $\pm 100$ | nA         |
| <b>On Characteristics (Note 3)</b>        |              |   |     |      |           |            |
| Gate Threshold Voltage                    | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=250\mu A$                                       | 1.0 | 1.5  | 2.5       | V          |
| Drain-Source On-State Resistance          | $R_{DS(on)}$ | $V_{GS}=10V, I_D=20A$   | -   | 5.6  | 7.5       | m $\Omega$ |
|   |              | $V_{GS}=4.5V, I_D=15A$  | -   | 6.7  | 9         |            |
| Forward Transconductance                  | $g_{FS}$     | $V_{DS}=5V, I_D=20A$  | -   | 20   | -         | S          |
| <b>Dynamic Characteristics (Note4)</b>    |              |   |     |      |           |            |
| Input Capacitance                         | $C_{iss}$    | $V_{DS}=25V, V_{GS}=0V,$<br>$F=1.0MHz$                              | -   | 3600 | -         | PF         |
| Output Capacitance                        | $C_{oss}$    |   | -   | 340  | -         | PF         |
| Reverse Transfer Capacitance              | $C_{rss}$    |   | -   | 230  | -         | PF         |
| <b>Switching Characteristics (Note 4)</b> |              |   |     |      |           |            |
| Turn-on Delay Time                        | $t_{d(on)}$  | $V_{DD}=25V, R_L=1\Omega$<br>$V_{GS}=10V, R_G=3\Omega$              | -   | 12   | -         | nS         |
| Turn-on Rise Time                         | $t_r$        |   | -   | 30   | -         | nS         |
| Turn-Off Delay Time                       | $t_{d(off)}$ |   | -   | 45   | -         | nS         |
| Turn-Off Fall Time                        | $t_f$        |   | -   | 31   | -         | nS         |
| Total Gate Charge                         | $Q_g$        | $V_{DS}=25V, I_D=20A,$<br>$V_{GS}=10V$                              | -   | 65   | -         | nC         |
| Gate-Source Charge                        | $Q_{gs}$     |   | -   | 13   | -         | nC         |
| Gate-Drain Charge                         | $Q_{gd}$     |   | -   | 20   | -         | nC         |
| <b>Drain-Source Diode Characteristics</b> |              |   |     |      |           |            |
| Diode Forward Voltage (Note 3)            | $V_{SD}$     | $V_{GS}=0V, I_S=20A$  | -   | -    | 1.2       | V          |
| Diode Forward Current (Note 2)            | $I_S$        |   | -   | -    | 80        | A          |
| Reverse Recovery Time                     | $t_{rr}$     | $T_J = 25^\circ\text{C}, I_F = 20A$<br>$di/dt = 100A/\mu s$ (Note3) | -   | 36   | -         | nS         |
| Reverse Recovery Charge                   | $Q_{rr}$     |   | -   | 48   | -         | nC         |

**Notes:**

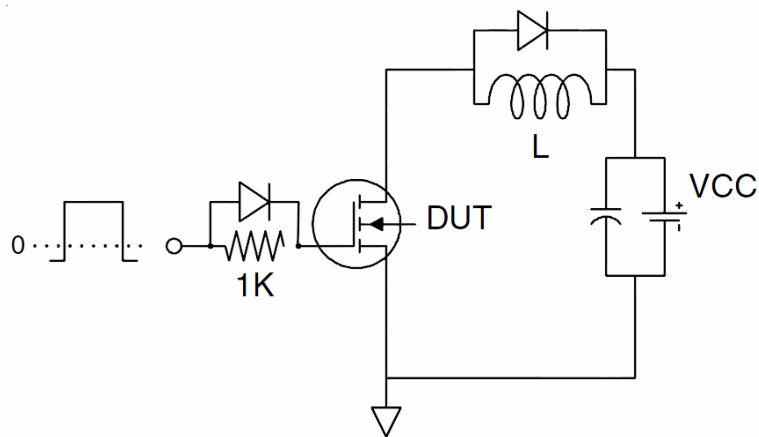
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production
5.  $E_{AS}$  condition :  $T_J=25^\circ\text{C}, V_{DD}=25V,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

Test circuit

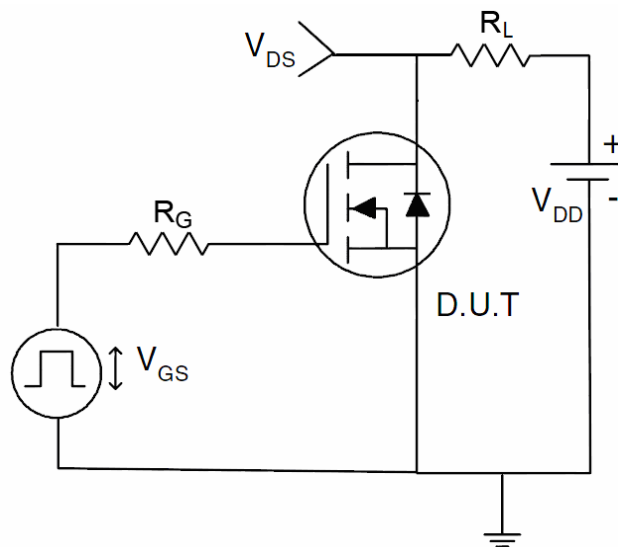
1) E<sub>AS</sub> Test Circuit



2) Gate Charge Test Circuit



3) Switch Time Test Circuit



Typical Electrical and Thermal Characteristics (Curves)

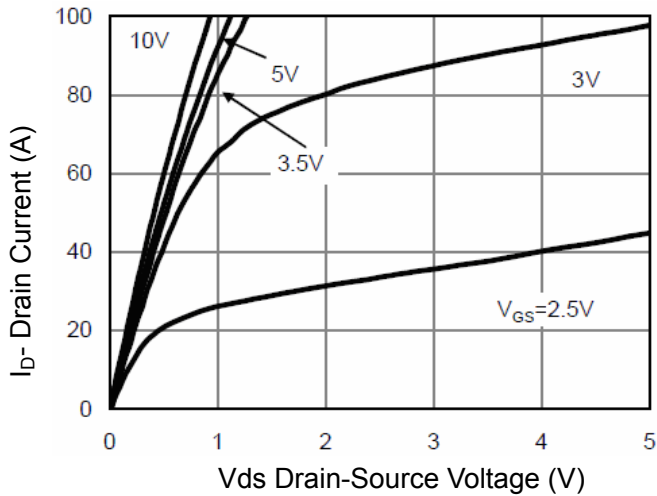


Figure 1 Output Characteristics

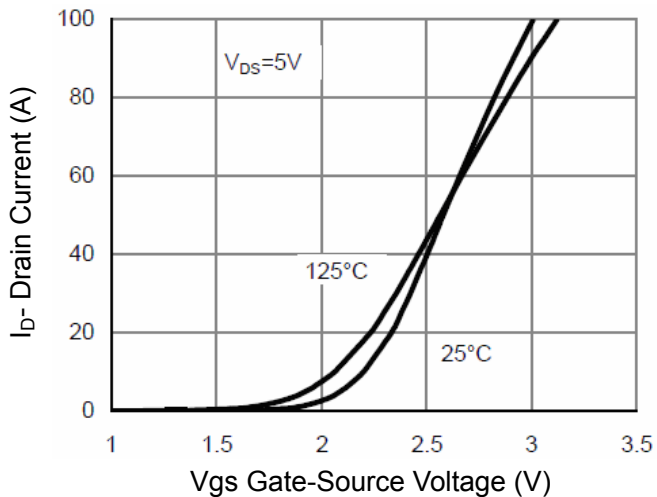


Figure 2 Transfer Characteristics

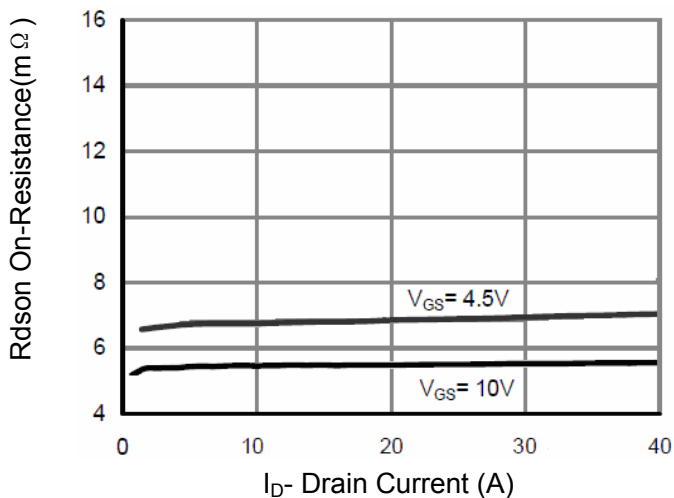


Figure 3 Rdson- Drain Current

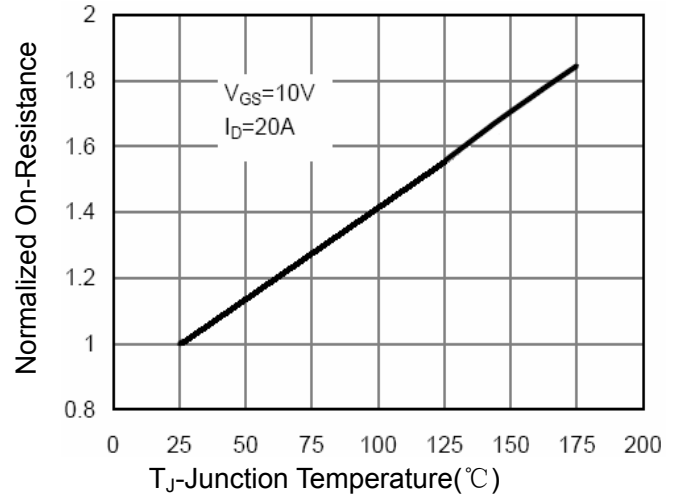


Figure 4 Rdson-Junction Temperature

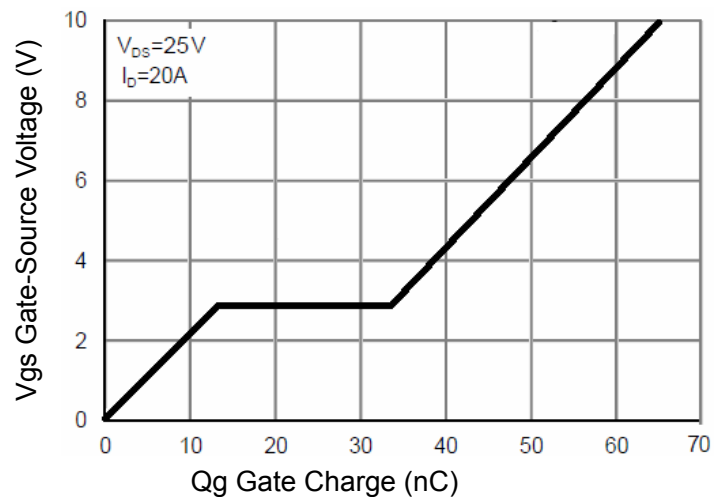


Figure 5 Gate Charge

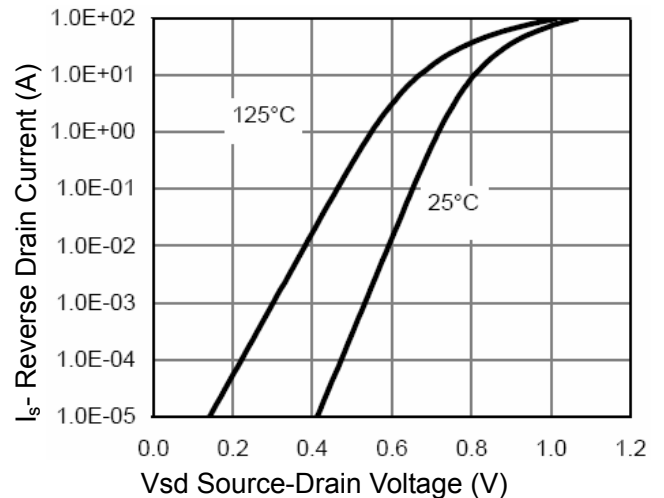


Figure 6 Source- Drain Diode Forward

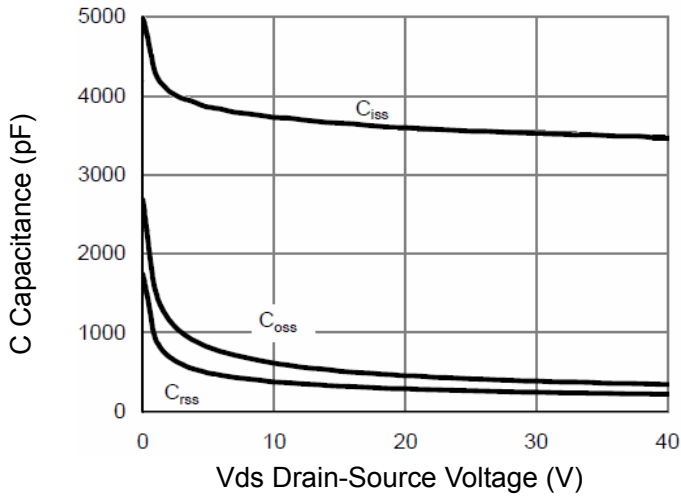


Figure 7 Capacitance vs Vds

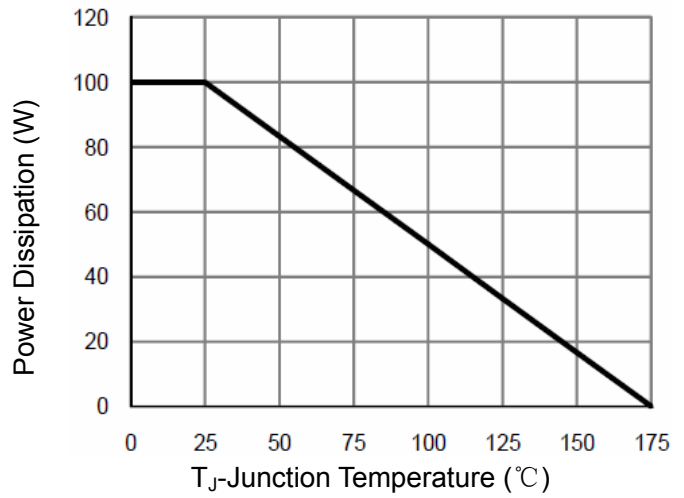


Figure 9 Power De-rating

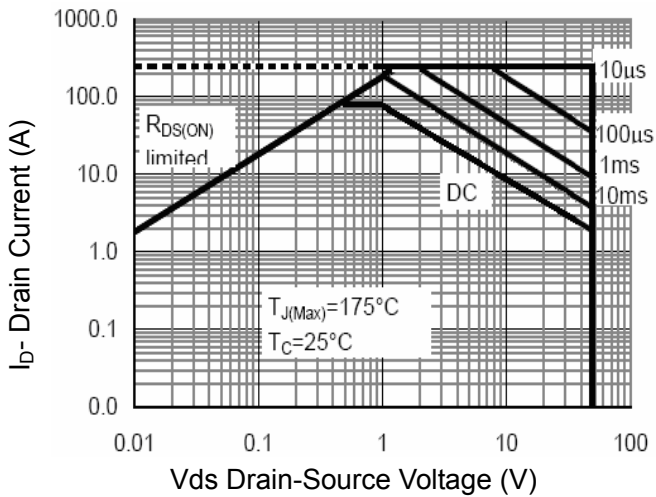


Figure 8 Safe Operation Area

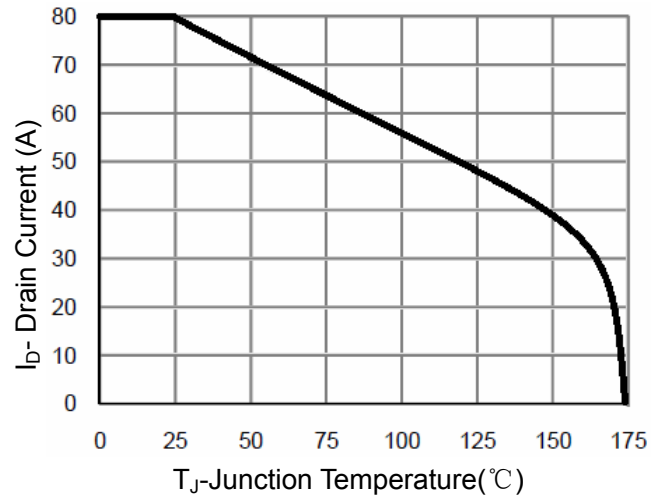


Figure 10 Current De-rating

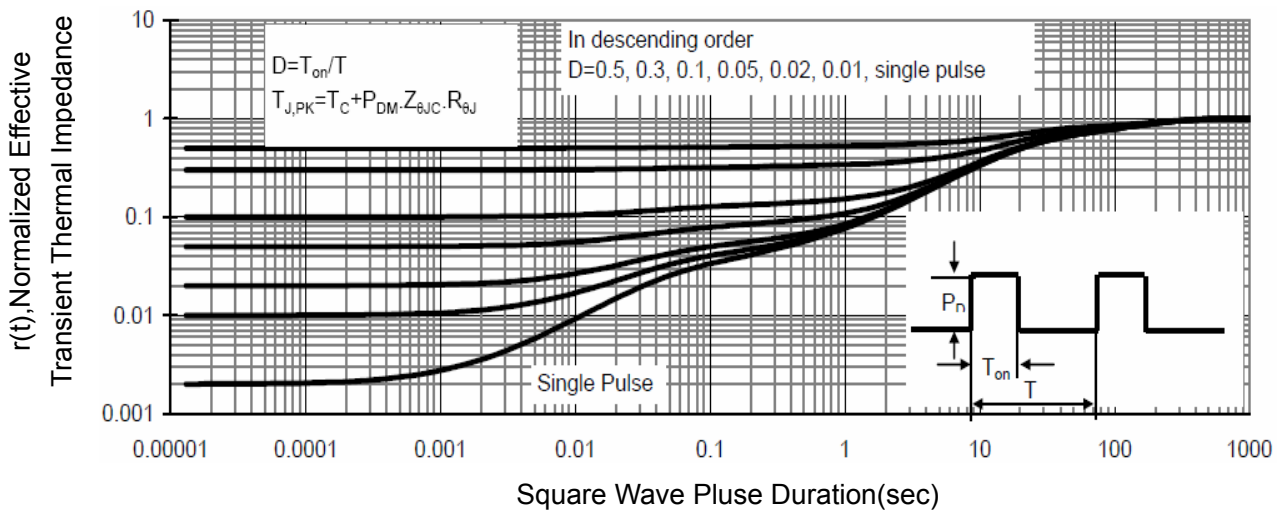
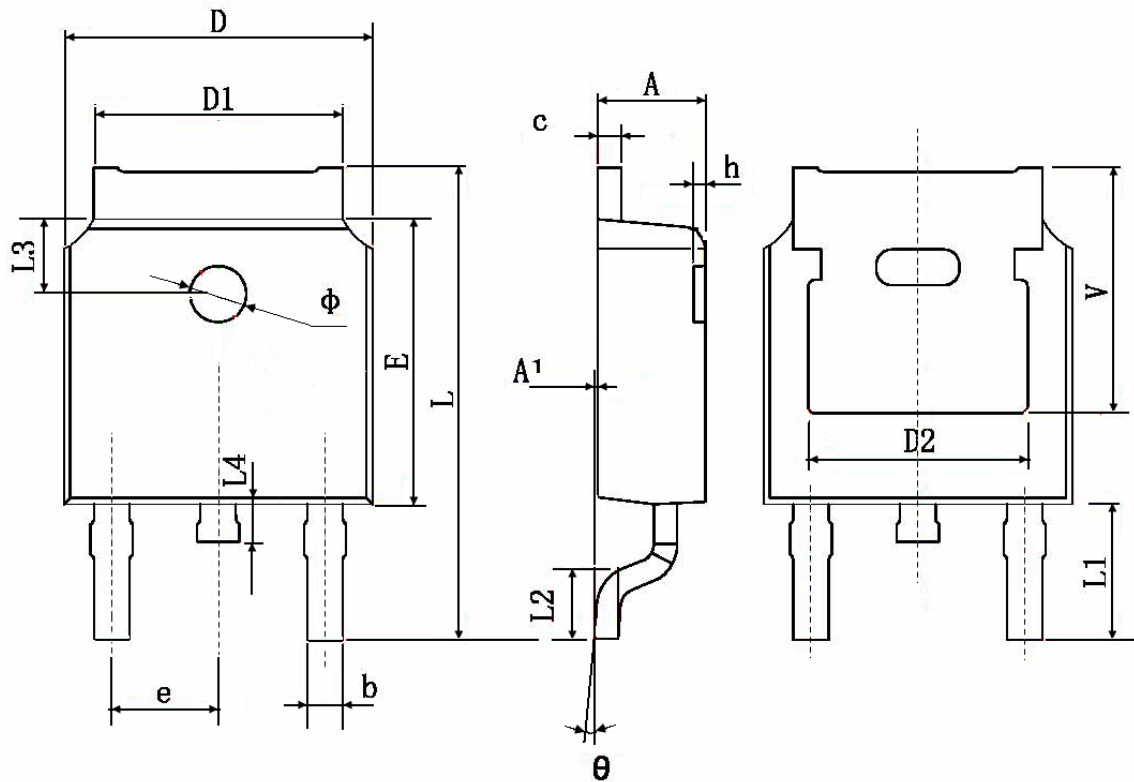


Figure 11 Normalized Maximum Transient Thermal Impedance

**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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