

# 60V(D-S) N-Channel Enhancement Mode Power MOS FET

## General Features

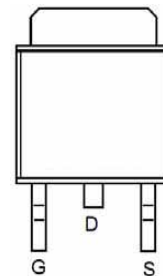
- $V_{DS} = 60V, I_D = 75A$   
 $R_{DS(ON)} < 11.5m\Omega @ V_{GS}=10V$  (Typ:9.1m $\Omega$ )
- High density cell design for ultra low  $R_{dson}$
- Fully characterized avalanche voltage and current
- Good stability and uniformity with high  $E_{AS}$
- Excellent package for good heat dissipation
- Special process technology for high ESD capability



**Lead Free**

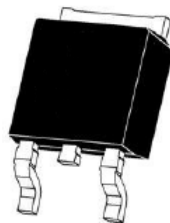
## Application

- Power switching application
- Hard switched and high frequency circuits
- Uninterruptible Power Supply

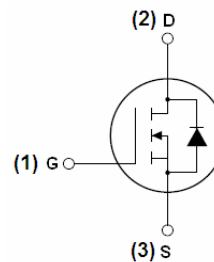


Marking and pin assignment

## PIN Configuration



TO-252-2L top view



Schematic diagram

## Package Marking and Ordering Information

| Device Marking | Device   | Device Package | Reel Size | Tape width | Quantity |
|----------------|----------|----------------|-----------|------------|----------|
| MSN0675D       | MSN0675D | TO-252-2L      | -         | -          | -        |

## Absolute Maximum Ratings ( $T_C=25^{\circ}C$ 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                          | $I_D$               | 75         | A              |
| Drain Current-Continuous( $T_C=100^{\circ}C$ )    | $I_D(100^{\circ}C)$ | 50         | A              |
| Pulsed Drain Current                              | $I_{DM}$            | 300        | A              |
| Maximum Power Dissipation                         | $P_D$               | 110        | W              |
| Derating factor                                   |                     | 0.73       | W/ $^{\circ}C$ |
| Single pulse avalanche energy <sup>(Note 5)</sup> | $E_{AS}$            | 450        | 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> | $R_{\theta JC}$ | 1.36 | $^{\circ}C/W$ |
|----------------------------------------------------------|-----------------|------|---------------|

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

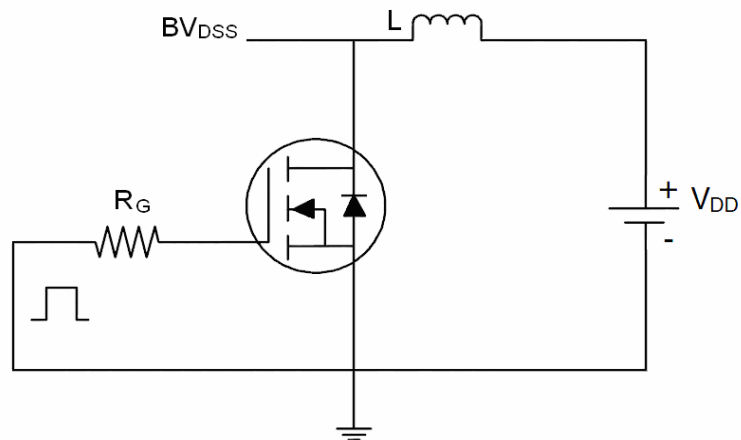
| Parameter                                     | Symbol       | Condition                                                                 | Min | Typ  | Max       | Unit       |
|-----------------------------------------------|--------------|---------------------------------------------------------------------------|-----|------|-----------|------------|
| Off Characteristics                           |              |                                                                           |     |      |           |            |
| Drain-Source Breakdown Voltage                | $BV_{DSS}$   | $V_{GS}=0V$ $I_D=250\mu A$                                                | 60  | 68   | -         | V          |
| Zero Gate Voltage Drain Current               | $I_{DSS}$    | $V_{DS}=60V, V_{GS}=0V$                                                   | -   | -    | 1         | $\mu A$    |
| Gate-Body Leakage Current                     | $I_{GSS}$    | $V_{GS}=\pm 20V, V_{DS}=0V$                                               | -   | -    | $\pm 100$ | nA         |
| On Characteristics <sup>(Note 3)</sup>        |              |                                                                           |     |      |           |            |
| Gate Threshold Voltage                        | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=250\mu A$                                             | 2   | 3    | 4         | V          |
| Drain-Source On-State Resistance              | $R_{DS(ON)}$ | $V_{GS}=10V, I_D=30A$                                                     | -   | 9.1  | 11.5      | m $\Omega$ |
| Forward Transconductance                      | $g_{FS}$     | $V_{DS}=25V, I_D=30A$                                                     | 20  | -    | -         | S          |
| Dynamic Characteristics <sup>(Note4)</sup>    |              |                                                                           |     |      |           |            |
| Input Capacitance                             | $C_{ISS}$    | $V_{DS}=25V, V_{GS}=0V,$<br>$F=1.0MHz$                                    | -   | 2350 | -         | PF         |
| Output Capacitance                            | $C_{OSS}$    |                                                                           | -   | 237  | -         | PF         |
| Reverse Transfer Capacitance                  | $C_{RSS}$    |                                                                           | -   | 205  | -         | PF         |
| Switching Characteristics <sup>(Note 4)</sup> |              |                                                                           |     |      |           |            |
| Turn-on Delay Time                            | $t_{d(on)}$  | $V_{DD}=30V, I_D=2A, R_L=15\Omega$<br>$V_{GS}=10V, R_G=2.5\Omega$         | -   | 16   | -         | nS         |
| Turn-on Rise Time                             | $t_r$        |                                                                           | -   | 10   | -         | nS         |
| Turn-Off Delay Time                           | $t_{d(off)}$ |                                                                           | -   | 45   | -         | nS         |
| Turn-Off Fall Time                            | $t_f$        |                                                                           | -   | 12   | -         | nS         |
| Total Gate Charge                             | $Q_g$        | $V_{DS}=30V, I_D=30A,$<br>$V_{GS}=10V$                                    | -   | 50   | -         | nC         |
| Gate-Source Charge                            | $Q_{gs}$     |                                                                           | -   | 12   | -         | nC         |
| Gate-Drain Charge                             | $Q_{gd}$     |                                                                           | -   | 16   | -         | nC         |
| Drain-Source Diode Characteristics            |              |                                                                           |     |      |           |            |
| Diode Forward Voltage <sup>(Note 3)</sup>     | $V_{SD}$     | $V_{GS}=0V, I_S=30A$                                                      | -   | -    | 1.2       | V          |
| Diode Forward Current <sup>(Note 2)</sup>     | $I_S$        |                                                                           | -   | -    | 75        | A          |
| Reverse Recovery Time                         | $t_{rr}$     | $T_J = 25^{\circ}C, I_F = 75A$<br>$di/dt = 100A/\mu s$ <sup>(Note3)</sup> | -   | 28   |           | nS         |
| Reverse Recovery Charge                       | $Q_{rr}$     |                                                                           | -   | 49   |           | nC         |
| Forward Turn-On Time                          | $t_{on}$     | Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)      |     |      |           |            |

**Notes:**

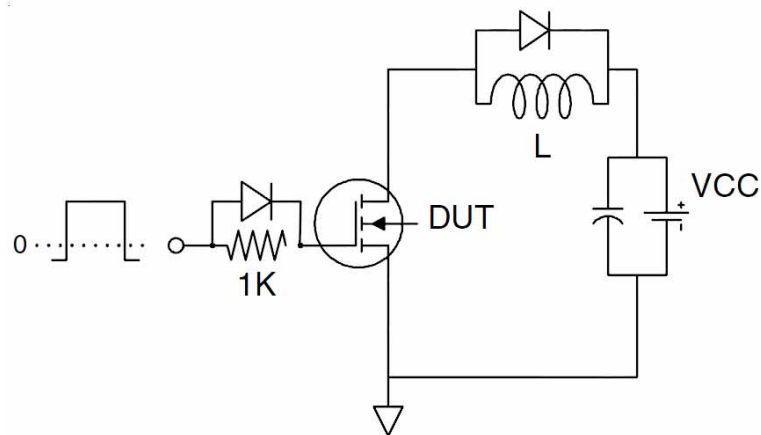
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production
5.  $E_{AS}$  condition :  $T_J=25^{\circ}\text{C}, V_{DD}=30V, V_G=10V, L=0.5mH, R_g=25\Omega$

## Test Circuit

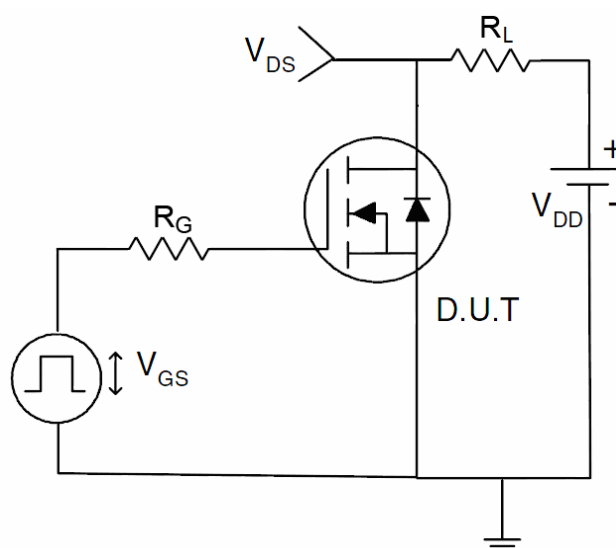
### 1) $E_{AS}$ test Circuit



### 2) Gate charge test Circuit



### 3) Switch Time Test Circuit



# Typical Electrical and Thermal Characteristics (Curves)

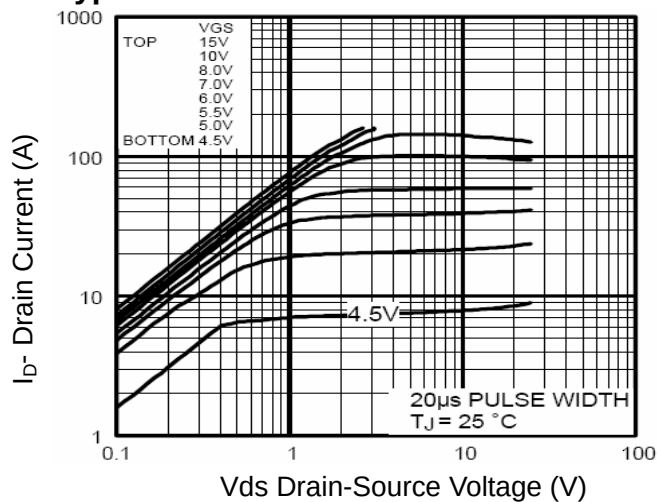


Figure 1 Output Characteristics

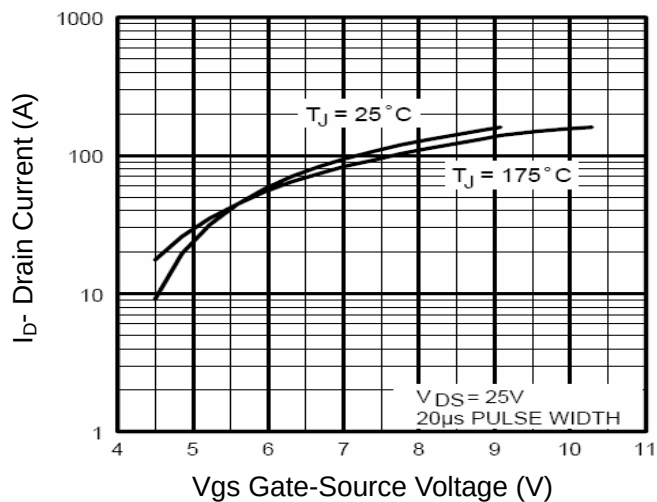


Figure 2 Transfer Characteristics

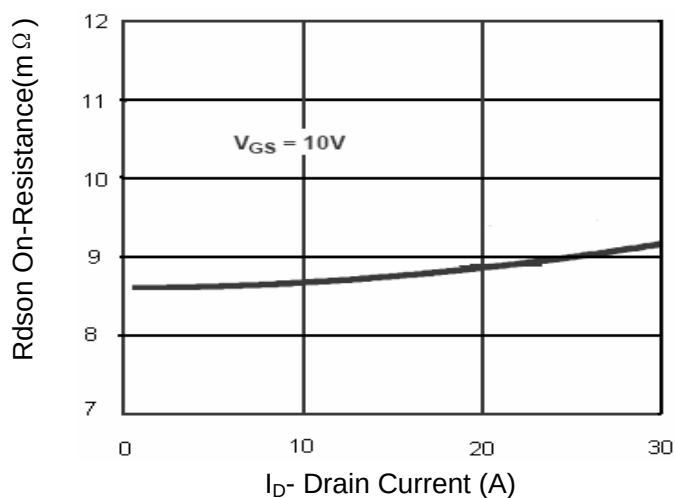


Figure 3 Rdson- Drain Current

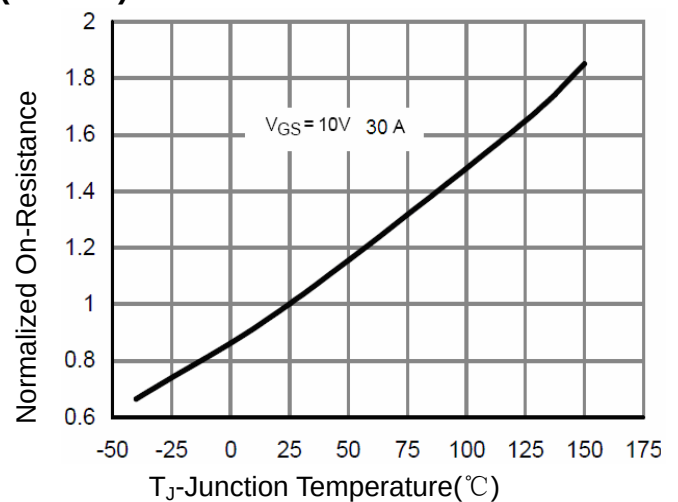


Figure 4 Rdson-Junction Temperature

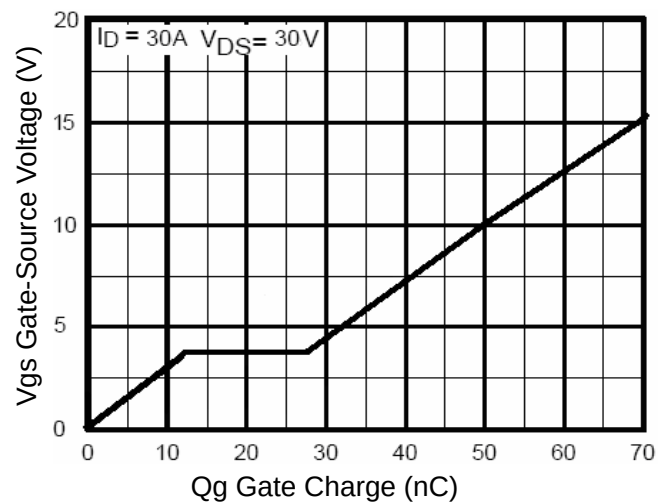


Figure 5 Gate Charge

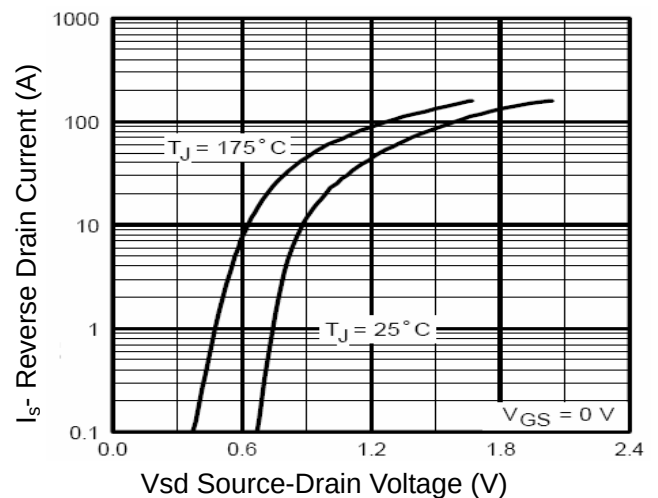


Figure 6 Source- Drain Diode Forward

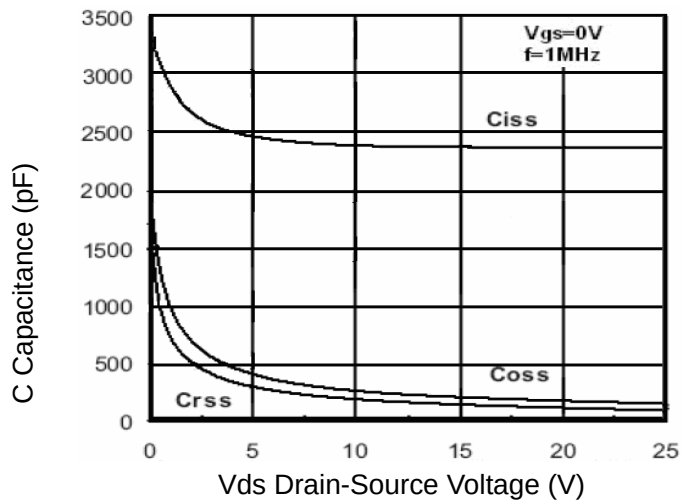


Figure 7 Capacitance vs Vds

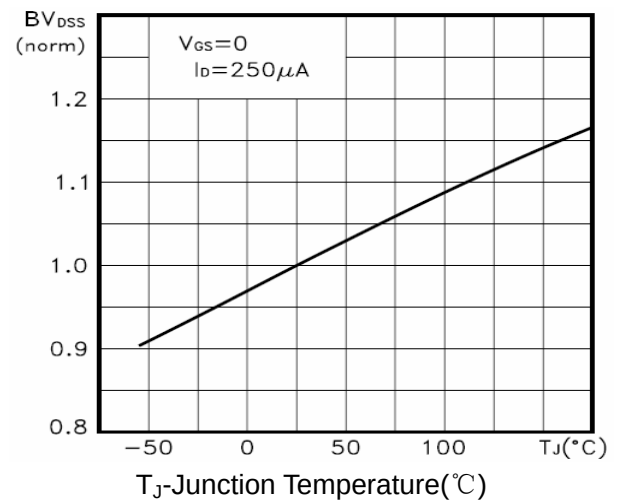


Figure 9  $BV_{DSS}$  vs Junction Temperature

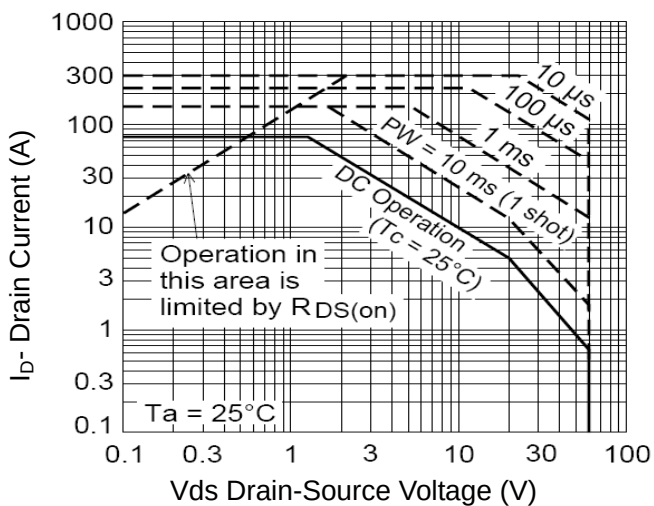


Figure 8 Safe Operation Area

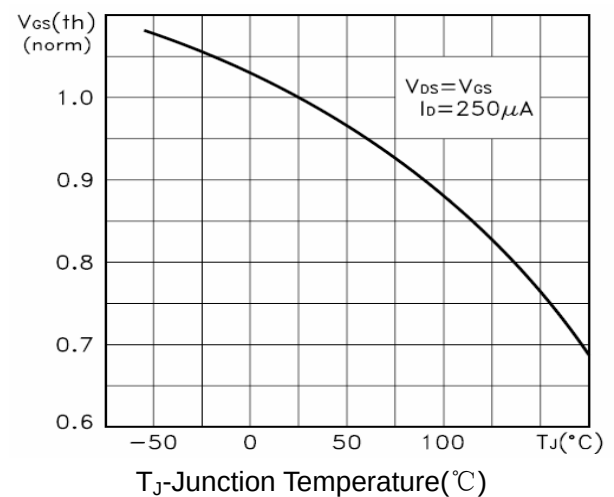


Figure 10  $V_{GS(th)}$  vs Junction Temperature

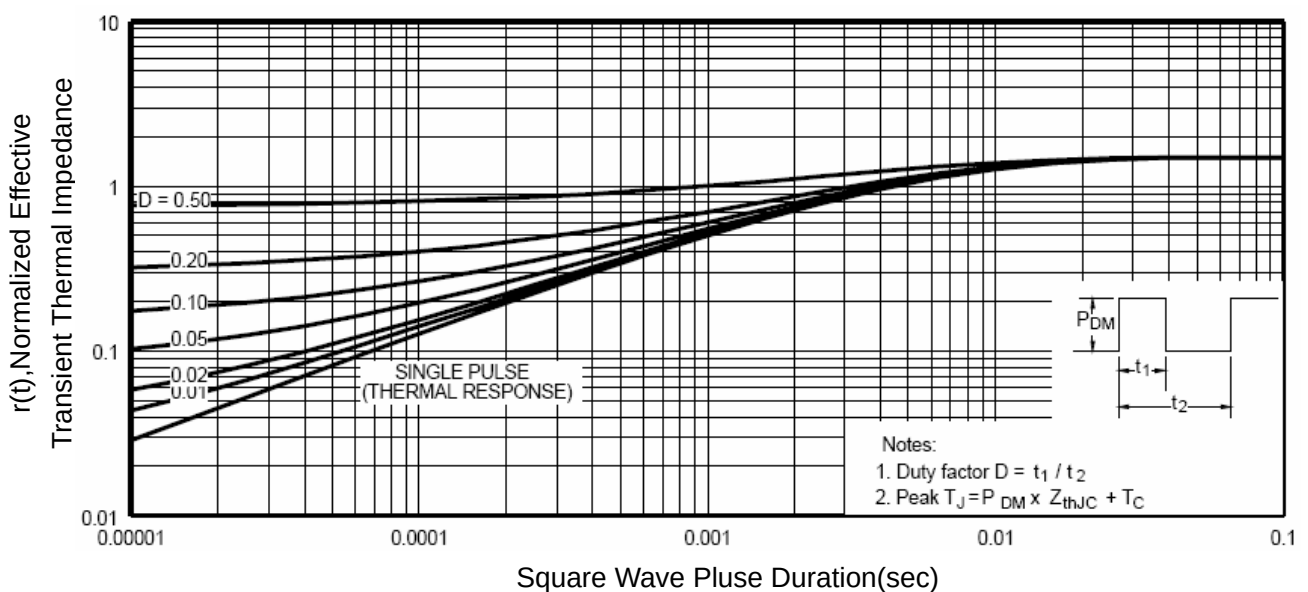
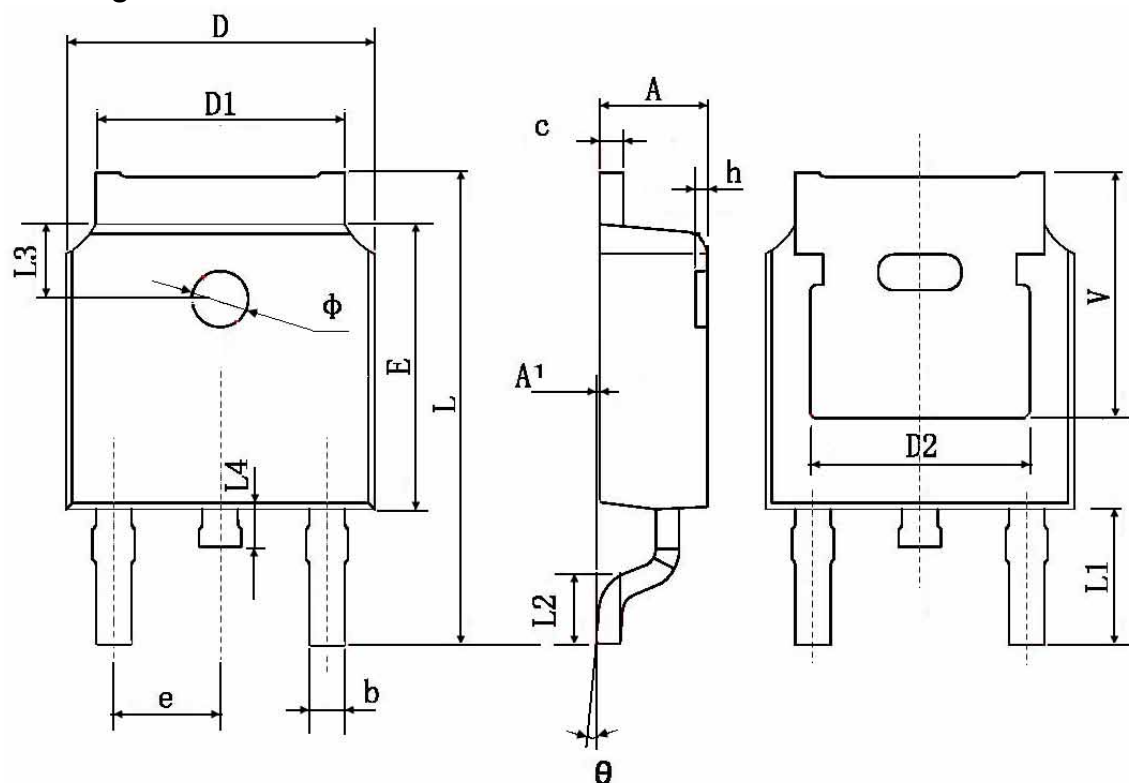


Figure 11 Normalized Maximum Transient Thermal Impedance

# 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.           |       |