

## P-Channel Enhancement Mode Power MOSFET

### Description

The HM5P25K 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

- $V_{DS} = -250V, I_D = -5A$   
 $R_{DS(ON)} = 950m\Omega(Typ) @ V_{GS} = -10V$  (Typ.=1250mR)

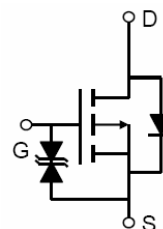
- Super high dense cell design
- Advanced trench process technology
- Reliable and rugged
- High density cell design for ultra low On-Resistance

### Application

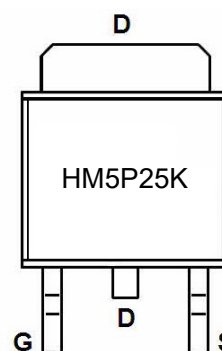
- Portable equipment and battery powered systems

**100% UIS TESTED!**

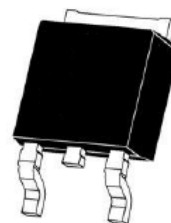
**100%  $\Delta V_{ds}$  TESTED!**



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   |
|----------------|---------|----------------|-----------|------------|------------|
| HM5P25K        | HM5P25K | TO-252-2L      | Ø330mm    | 12mm       | 2500 units |

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

| Parameter                                        | Symbol             | Limit      | Unit          |
|--------------------------------------------------|--------------------|------------|---------------|
| Drain-Source Voltage                             | $V_{DS}$           | -250       | 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                             | $I_{DM}$           | -15        | A             |
| Maximum Power Dissipation                        | $P_D$              | 160        | W             |
| Derating factor                                  |                    | 1.3        | W/ $^\circ C$ |
| Operating Junction and Storage Temperature Range | $T_J, T_{STG}$     | -55 To 150 | $^\circ C$    |

## Thermal Characteristic

|                                                          |                 |     |                      |
|----------------------------------------------------------|-----------------|-----|----------------------|
| Thermal Resistance, Junction-to-Case <sup>(Note 2)</sup> | $R_{\theta jc}$ | 0.8 | $^{\circ}\text{C/W}$ |
|----------------------------------------------------------|-----------------|-----|----------------------|

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

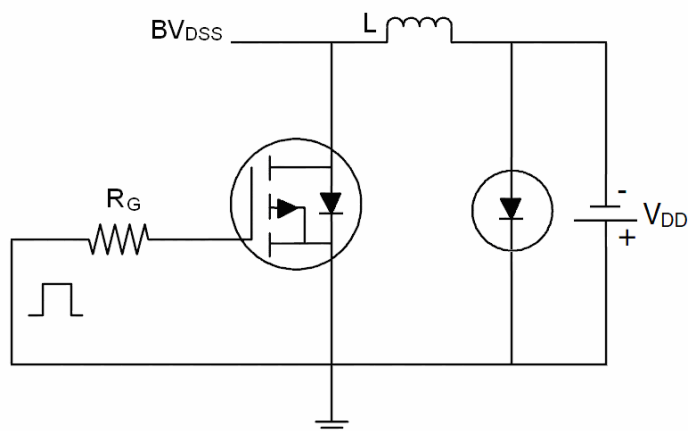
| Parameter                                     | Symbol              | Condition                                                                                  | Min  | Typ  | Max  | Unit |
|-----------------------------------------------|---------------------|--------------------------------------------------------------------------------------------|------|------|------|------|
| Off Characteristics                           |                     |                                                                                            |      |      |      |      |
| Drain-Source Breakdown Voltage                | BV <sub>DSS</sub>   | V <sub>GS</sub> =0V I <sub>D</sub> =-250μA                                                 | -145 | -155 | -    | V    |
| Zero Gate Voltage Drain Current               | I <sub>DSS</sub>    | V <sub>DS</sub> =-145V,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                                                  | -    | -    | ±10  | μA   |
| 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                                   | -2   | -3   | -4   | V    |
| Drain-Source On-State Resistance              | R <sub>DS(ON)</sub> | V <sub>GS</sub> =-10V, I <sub>D</sub> =-20A                                                | -    | 950  | -    | mΩ   |
| Forward Transconductance                      | g <sub>FS</sub>     | V <sub>DS</sub> =-5V,I <sub>D</sub> =-20A                                                  | 5    | -    | -    | S    |
| Dynamic Characteristics <sup>(Note4)</sup>    |                     |                                                                                            |      |      |      |      |
| Input Capacitance                             | C <sub>iss</sub>    | V <sub>DS</sub> =-75V,V <sub>GS</sub> =0V,<br>F=1.0MHz                                     | -    | 7650 | -    | PF   |
| Output Capacitance                            | C <sub>oss</sub>    |                                                                                            | -    | 148  | -    | PF   |
| Reverse Transfer Capacitance                  | C <sub>rss</sub>    |                                                                                            | -    | 131  | -    | PF   |
| Switching Characteristics <sup>(Note 4)</sup> |                     |                                                                                            |      |      |      |      |
| Turn-on Delay Time                            | t <sub>d(on)</sub>  | V <sub>DD</sub> =-75V,I <sub>D</sub> =-20A<br>V <sub>GS</sub> =-10V,R <sub>GEN</sub> =9.1Ω | -    | 17   | -    | nS   |
| Turn-on Rise Time                             | t <sub>r</sub>      |                                                                                            | -    | 80   | -    | nS   |
| Turn-Off Delay Time                           | t <sub>d(off)</sub> |                                                                                            | -    | 45   | -    | nS   |
| Turn-Off Fall Time                            | t <sub>f</sub>      |                                                                                            | -    | 65   | -    | nS   |
| Total Gate Charge                             | Q <sub>g</sub>      | V <sub>DS</sub> =-75V,I <sub>D</sub> =-20A,<br>V <sub>GS</sub> =-10V                       | -    | 137  | -    | nC   |
| Gate-Source Charge                            | Q <sub>gs</sub>     |                                                                                            | -    | 25   | -    | nC   |
| Gate-Drain Charge                             | Q <sub>gd</sub>     |                                                                                            | -    | 28   | -    | 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> =-11A                                                   | -    | -    | -1.2 | V    |
| Diode Forward Current <sup>(Note 2)</sup>     | I <sub>S</sub>      | -                                                                                          | -    | -    | -5   | A    |
| Reverse Recovery Time                         | t <sub>rr</sub>     | TJ = 25°C, IF =-11A                                                                        | -    | 90   | -    | nS   |
| Reverse Recovery Charge                       | Q <sub>rr</sub>     | di/dt = 100A/μs <sup>(Note3)</sup>                                                         | -    | 105  | -    | nC   |

## Notes:

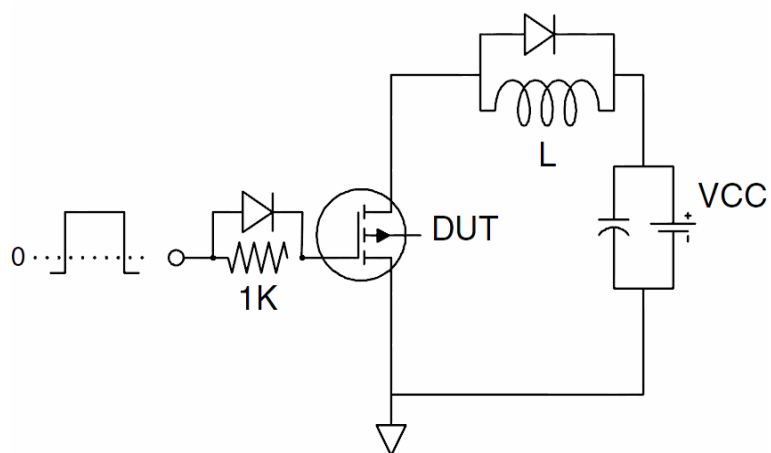
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production
5. EAS condition:  $T_J=25^{\circ}\text{C}, V_{DD}=-75V, V_G=-10V, L=0.5mH, R_g=25\Omega$

## Test Circuit

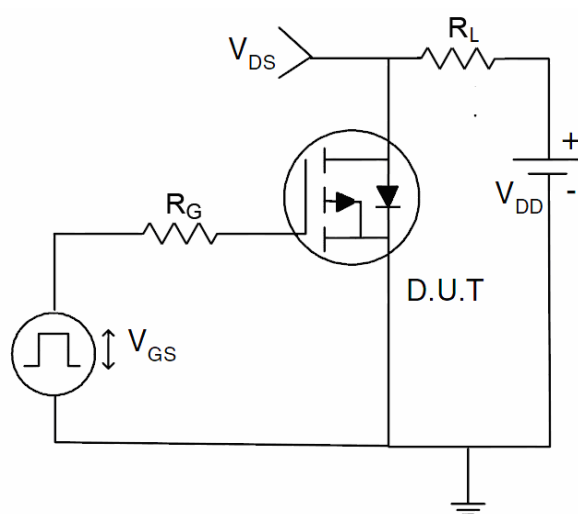
### 1) $E_{AS}$ Test Circuit



### 2) Gate Charge Test Circuit



### 3) Switch Time Test Circuit



## Typical Electrical and Thermal Characteristics (Curves)

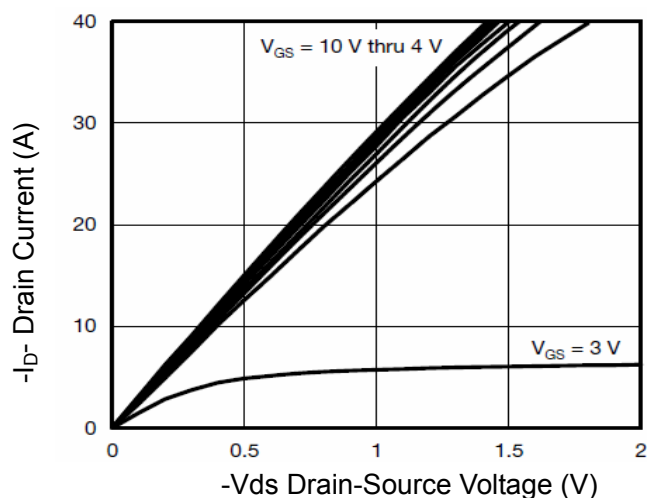


Figure 1 Output Characteristics

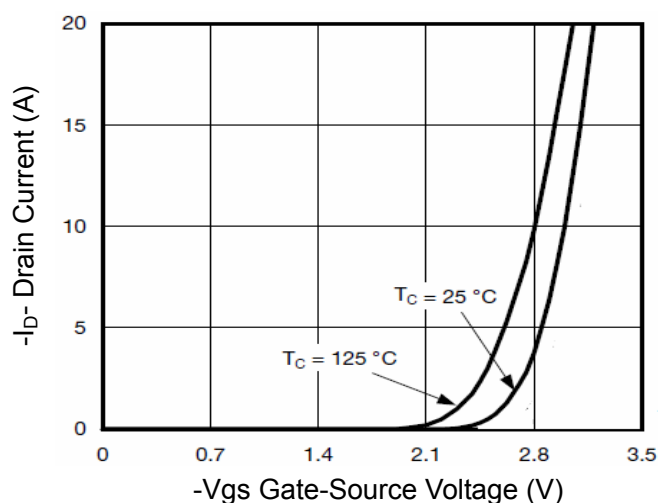


Figure 2 Transfer Characteristics

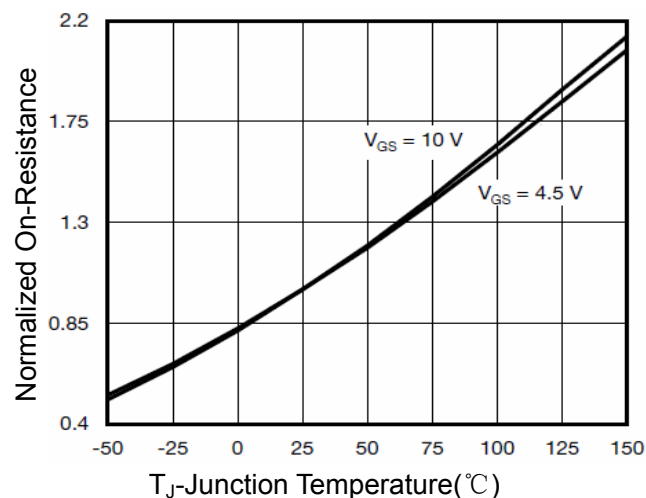


Figure 4  $R_{DS(on)}$ -Junction Temperature

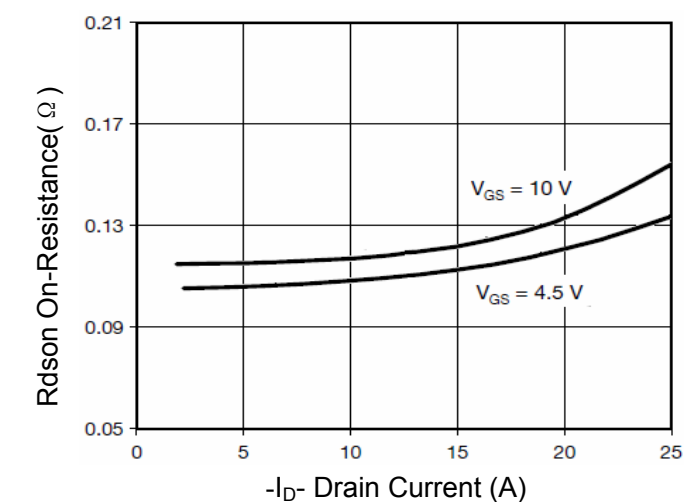


Figure 3  $R_{DS(on)}$ - Drain Current

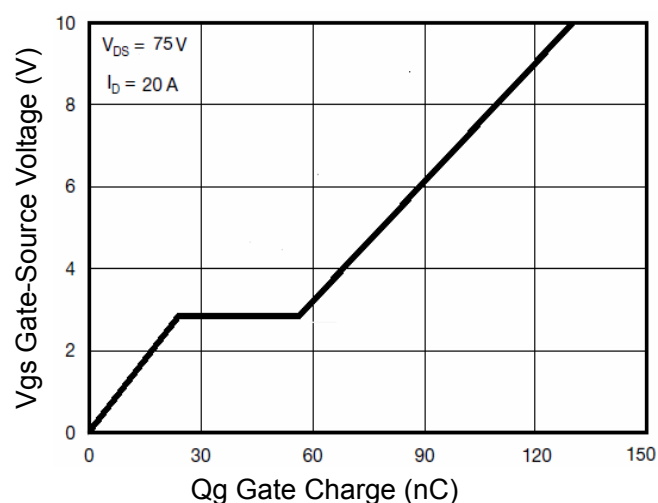


Figure 5 Gate Charge

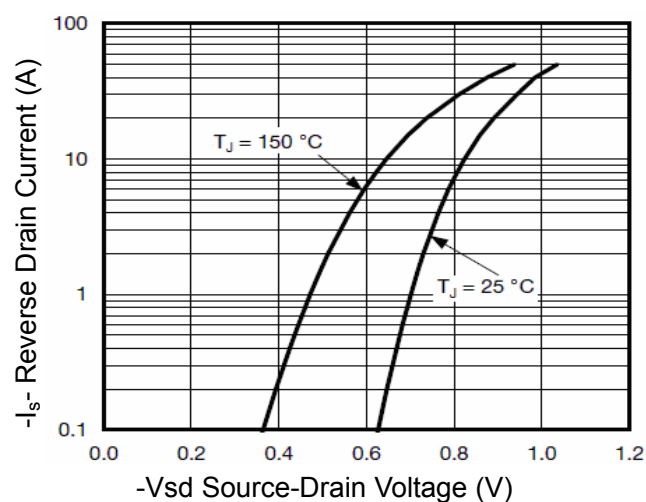


Figure 6 Source- Drain Diode Forward

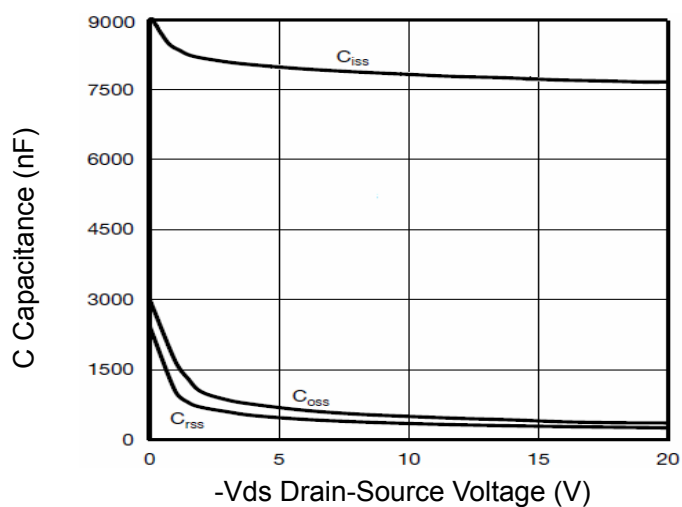


Figure 7 Capacitance vs Vds

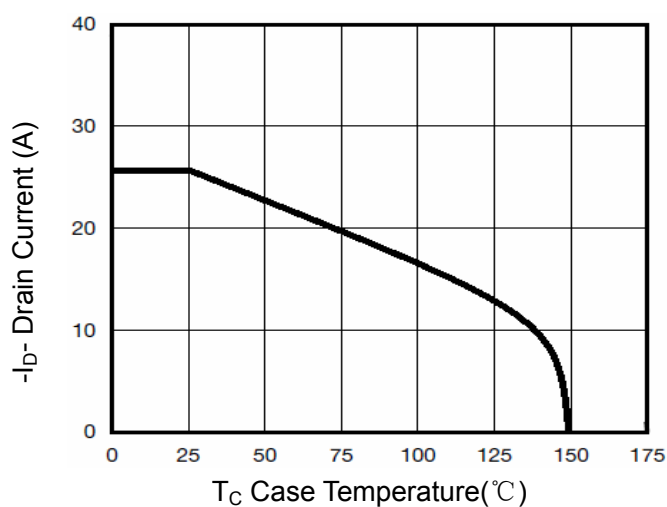


Figure 9 Drain Current vs Case Temperature

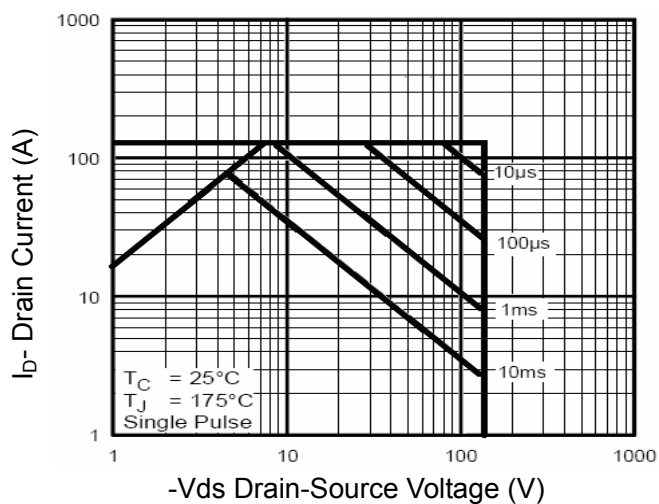


Figure 8 Safe Operation Area

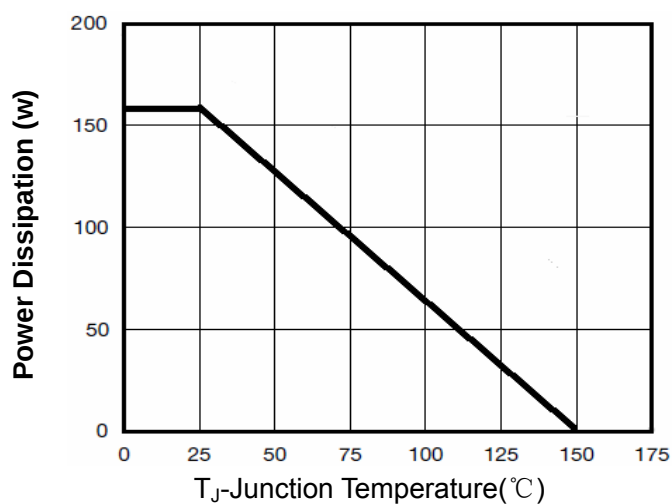


Figure 10 Power De-rating

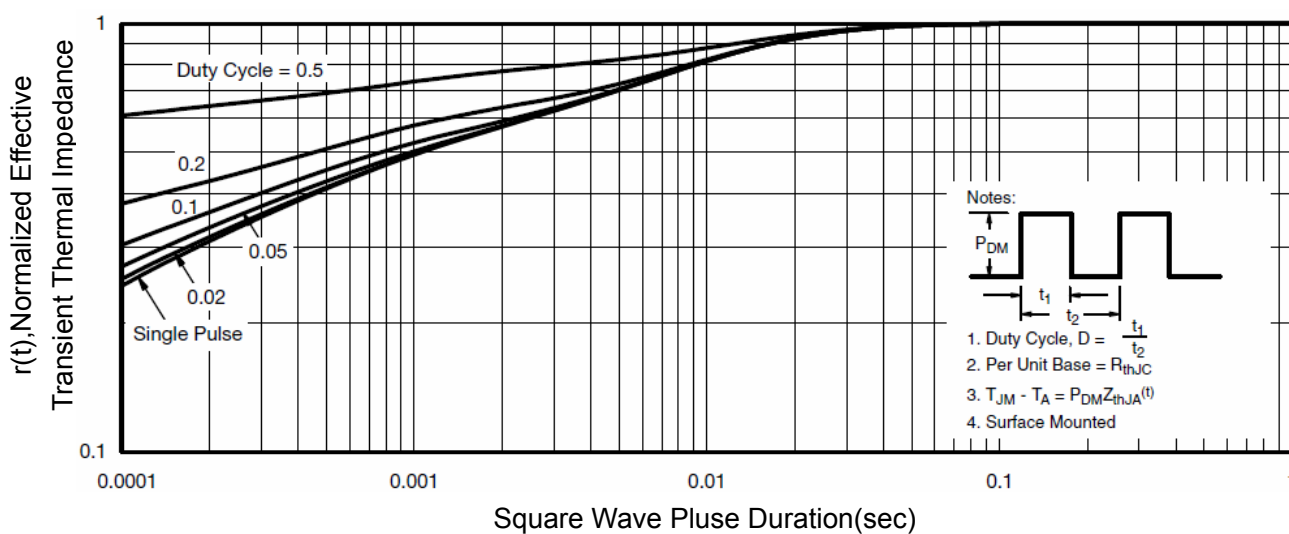
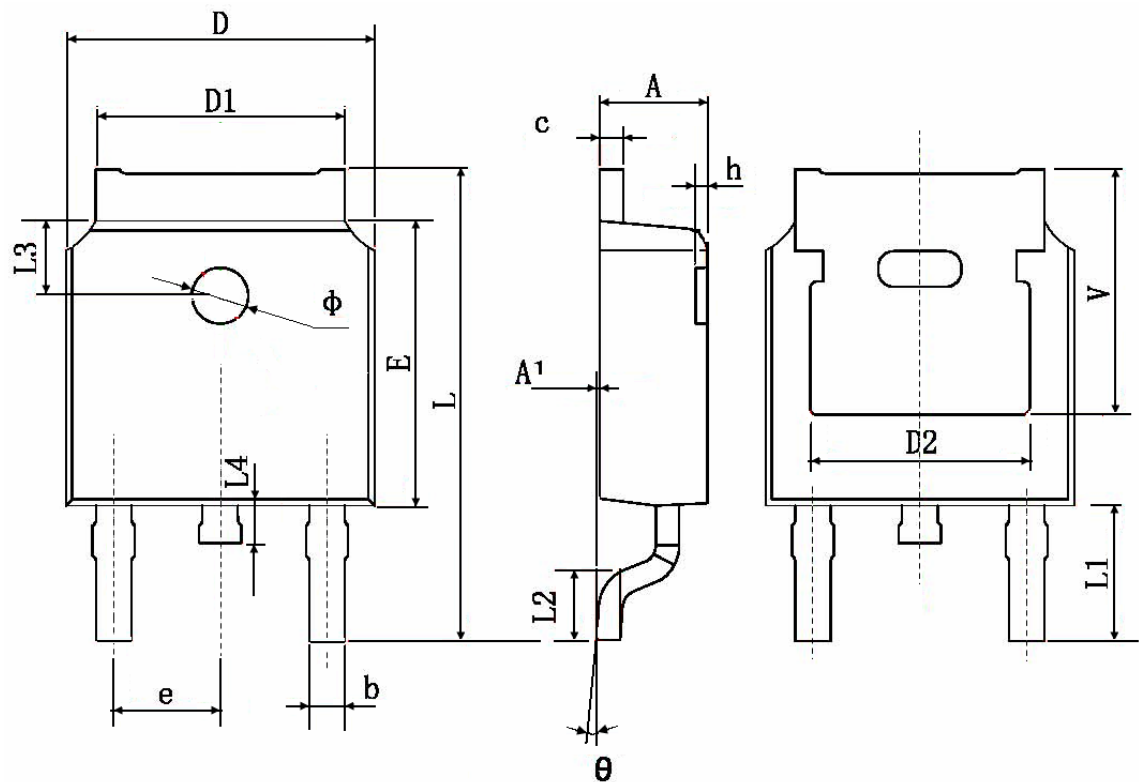


Figure 11 Normalized Maximum Transient Thermal Impedance

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     | 4.83 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.           |       |