

## N-Channel Enhancement Mode Power MOSFET

### DESCRIPTION

The HM3710K 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

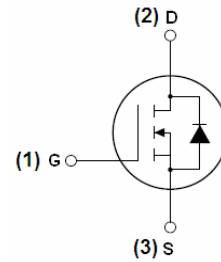
- $V_{DS} = 100V, I_D = 57A$   
 $R_{DS(ON)} < 16m\Omega @ V_{GS}=10V$  (Typ:12m $\Omega$ )
- Special process technology for high ESD capability
- High density cell design for ultra low  $R_{dson}$
- Fully characterized Avalanche voltage and current
- Good stability and uniformity with high  $E_{AS}$
- Excellent package for good heat dissipation

### Application

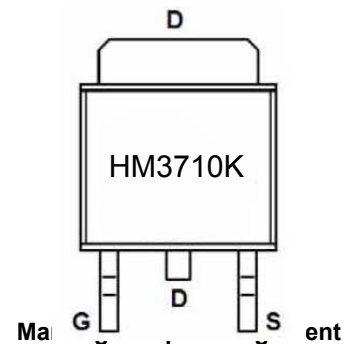
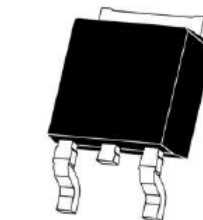
- Power switching application
- Hard Switched and High Frequency Circuits
- Uninterruptible Power Supply

**100% UIS TESTED!**

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



Schematic diagram



TO-252-2L top view

### Package Marking And Ordering Information

| Device Marking | Device  | Device Package | Reel Size | Tape width | Quantity |
|----------------|---------|----------------|-----------|------------|----------|
| HM3710K        | HM3710K | TO-252-2L      |           |            |          |

### Absolute Maximum Ratings (TA=25°C unless otherwise noted)

| Parameter                                        | Symbol             | Limit      | Unit          |
|--------------------------------------------------|--------------------|------------|---------------|
| Drain-Source Voltage                             | $V_{DS}$           | 100        | V             |
| Gate-Source Voltage                              | $V_{GS}$           | $\pm 20$   | V             |
| Drain Current-Continuous                         | $I_D$              | 57         | A             |
| Drain Current-Continuous( $T_C=100^\circ C$ )    | $I_D(100^\circ C)$ | 40         | A             |
| Pulsed Drain Current                             | $I_{DM}$           | 190        | A             |
| Maximum Power Dissipation                        | $P_D$              | 170        | W             |
| Derating factor                                  |                    | 1.13       | W/ $^\circ C$ |
| Single pulse avalanche energy (Note 5)           | $E_{AS}$           | 580        | mJ            |
| Operating Junction and Storage Temperature Range | $T_J, T_{STG}$     | -55 To 175 | $^\circ C$    |

## Thermal Characteristic

|                                              |                 |      |                      |
|----------------------------------------------|-----------------|------|----------------------|
| Thermal Resistance, Junction-to-Case(Note 2) | $R_{\theta JC}$ | 0.88 | $^{\circ}\text{C/W}$ |
|----------------------------------------------|-----------------|------|----------------------|

## Electrical Characteristics (TA=25°C unless otherwise noted)

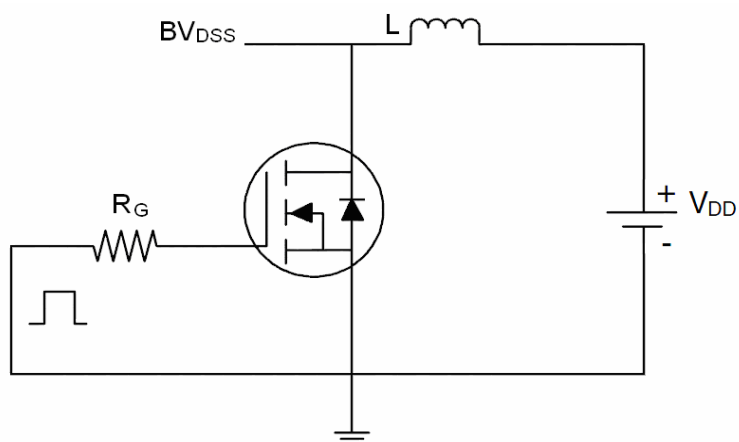
| Parameter                          | Symbol              | Condition                                                                               | Min | Typ  | Max  | Unit |
|------------------------------------|---------------------|-----------------------------------------------------------------------------------------|-----|------|------|------|
| Off Characteristics                |                     |                                                                                         |     |      |      |      |
| Drain-Source Breakdown Voltage     | BV <sub>DSS</sub>   | V <sub>GS</sub> =0V I <sub>D</sub> =250μA                                               | 100 | 110  | -    | V    |
| Zero Gate Voltage Drain Current    | I <sub>DSS</sub>    | V <sub>DS</sub> =100V,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   |
| On Characteristics (Note 3)        |                     |                                                                                         |     |      |      |      |
| 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> =28A                                               | -   | 12   | 16   | mΩ   |
| Forward Transconductance           | g <sub>FS</sub>     | V <sub>DS</sub> =25V,I <sub>D</sub> =28A                                                | 32  | -    | -    | S    |
| Dynamic Characteristics (Note4)    |                     |                                                                                         |     |      |      |      |
| Input Capacitance                  | C <sub>ISS</sub>    | V <sub>DS</sub> =25V,V <sub>GS</sub> =0V,<br>F=1.0MHz                                   | -   | 4400 | -    | PF   |
| Output Capacitance                 | C <sub>OSS</sub>    |                                                                                         | -   | 320  | -    | PF   |
| Reverse Transfer Capacitance       | C <sub>RSS</sub>    |                                                                                         | -   | 240  | -    | PF   |
| Switching Characteristics (Note 4) |                     |                                                                                         |     |      |      |      |
| Turn-on Delay Time                 | t <sub>d(on)</sub>  | V <sub>DD</sub> =50V,I <sub>D</sub> =28A<br>V <sub>GS</sub> =10V,R <sub>GEN</sub> =2.5Ω | -   | 12   | -    | nS   |
| Turn-on Rise Time                  | t <sub>r</sub>      |                                                                                         | -   | 55   | -    | nS   |
| Turn-Off Delay Time                | t <sub>d(off)</sub> |                                                                                         | -   | 45   | -    | nS   |
| Turn-Off Fall Time                 | t <sub>f</sub>      |                                                                                         | -   | 47   | -    | nS   |
| Total Gate Charge                  | Q <sub>g</sub>      | V <sub>DS</sub> =80V,I <sub>D</sub> =28A,<br>V <sub>GS</sub> =10V                       | -   | 95   | -    | nC   |
| Gate-Source Charge                 | Q <sub>gs</sub>     |                                                                                         | -   | 18   | -    | nC   |
| Gate-Drain Charge                  | Q <sub>gd</sub>     |                                                                                         | -   | 25   | -    | nC   |
| Drain-Source Diode Characteristics |                     |                                                                                         |     |      |      |      |
| Diode Forward Voltage (Note 3)     | V <sub>SD</sub>     | V <sub>GS</sub> =0V,I <sub>S</sub> =28A                                                 | -   | 0.85 | 1.2  | V    |
| Diode Forward Current (Note 2)     | I <sub>S</sub>      |                                                                                         | -   | -    | 57   | A    |
| Reverse Recovery Time              | t <sub>rr</sub>     | TJ = 25°C, IF = 28A                                                                     | -   | 36   | -    | nS   |
| Reverse Recovery Charge            | Q <sub>rr</sub>     | di/dt = 100A/μs(Note3)                                                                  | -   | 56   | -    | nC   |
| Forward Turn-On Time               | t <sub>on</sub>     | Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)                    |     |      |      |      |

## Notes:

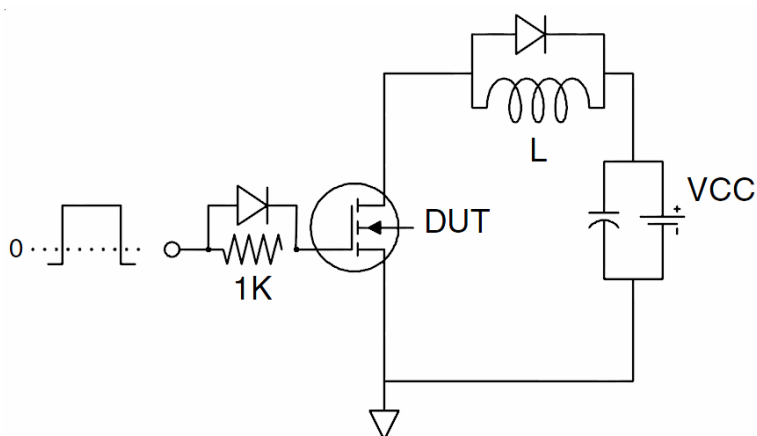
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production
5. EAS condition:  $T_J=25^{\circ}\text{C}, V_{DD}=50V, V_G=10V, L=0.5mH, R_g=25\Omega$

## Test circuit

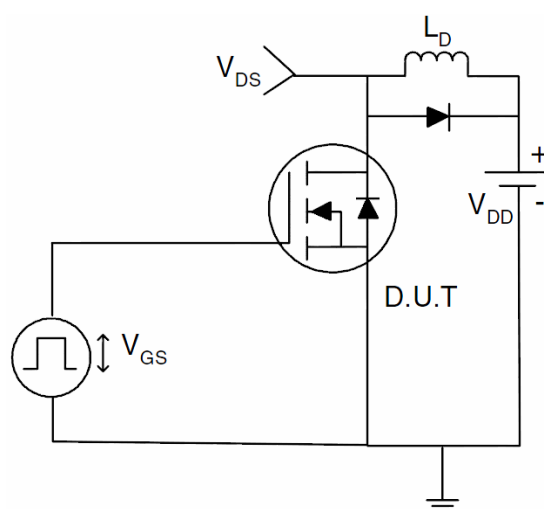
### 1) $E_{AS}$ test Circuits



### 2) Gate charge test Circuit:



### 3) Switch Time Test Circuit:



## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (Curves)

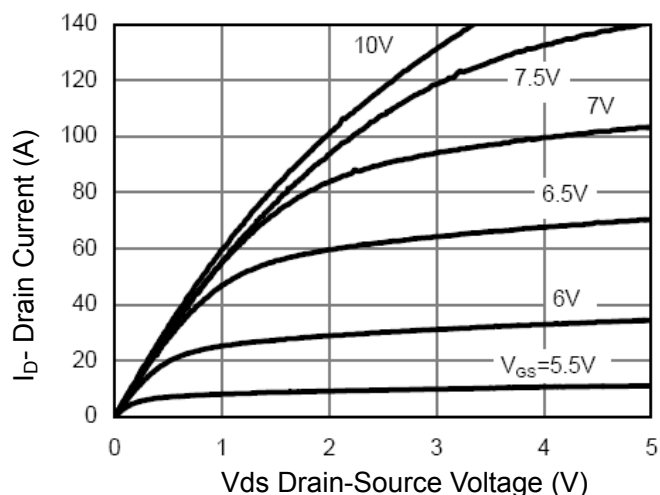


**Figure 1 Output Characteristics**

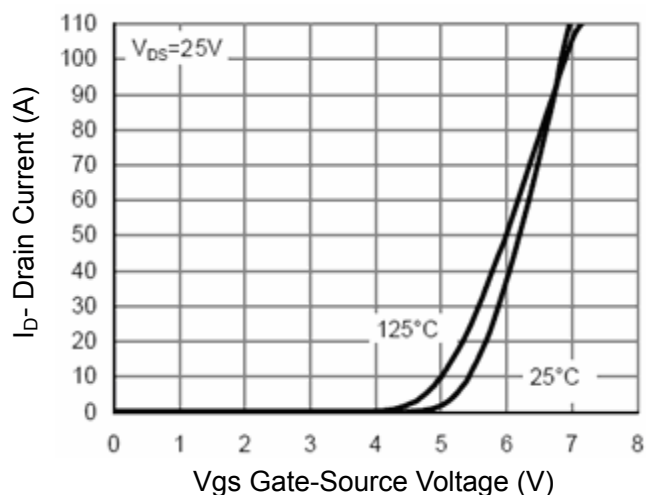


**Figure 2 Transfer Characteristics**

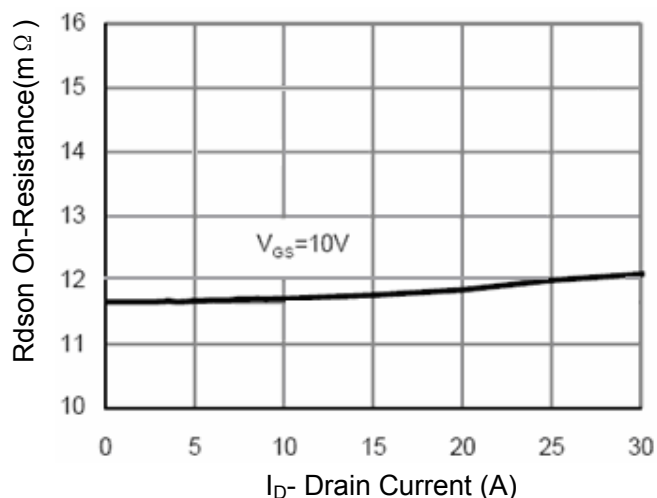


**Figure 3  $R_{DS(on)}$ - Drain Current**

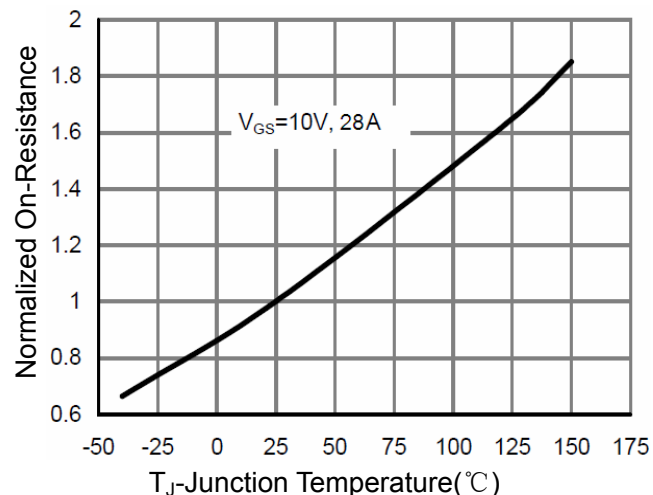


**Figure 4  $R_{DS(on)}$ -Junction Temperature**

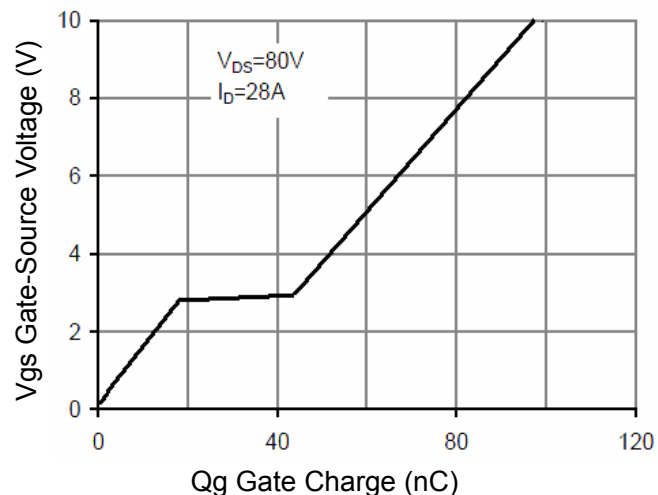


**Figure 5 Gate Charge**

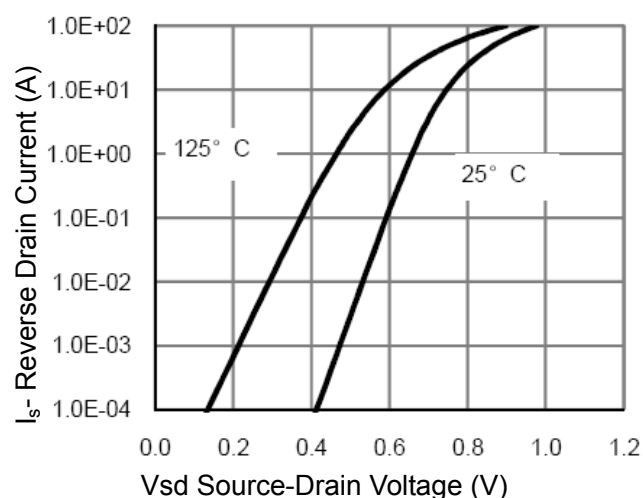


**Figure 6 Source- Drain Diode Forward**

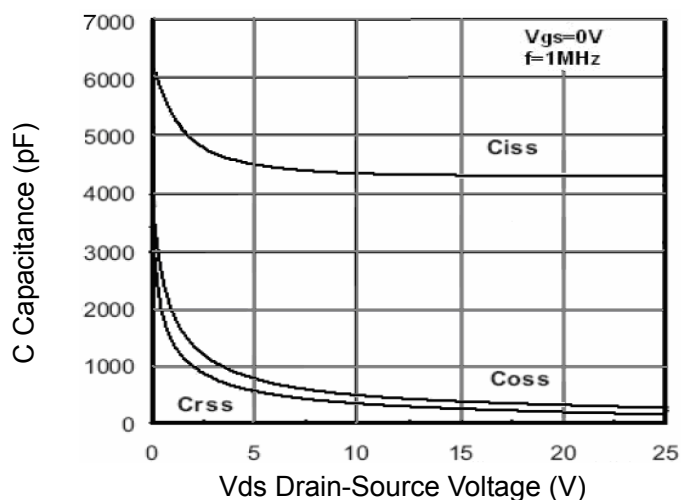


Figure 7 Capacitance vs Vds

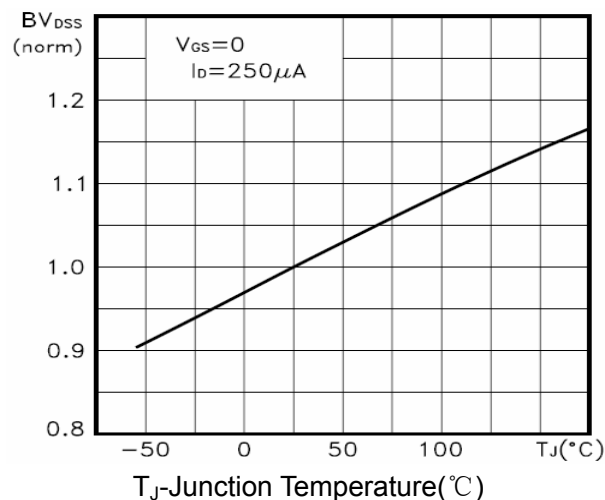


Figure 9  $BV_{DSS}$  vs Junction Temperature

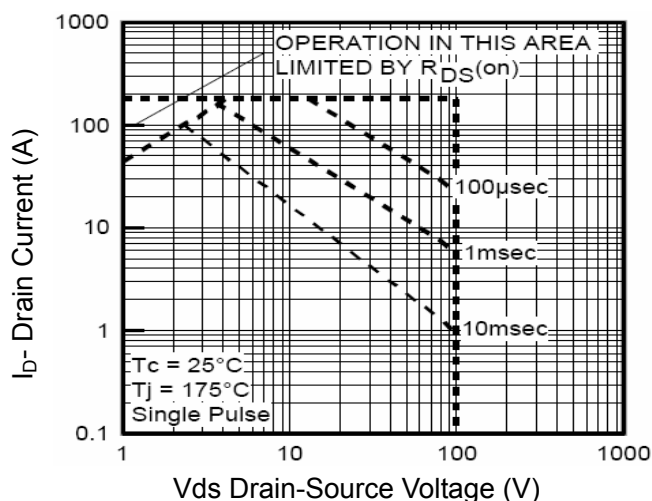


Figure 8 Safe Operation Area

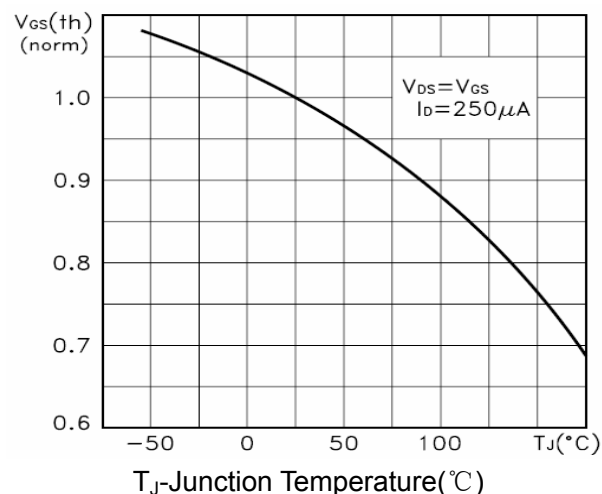


Figure 10  $V_{GS(th)}$  vs Junction Temperature

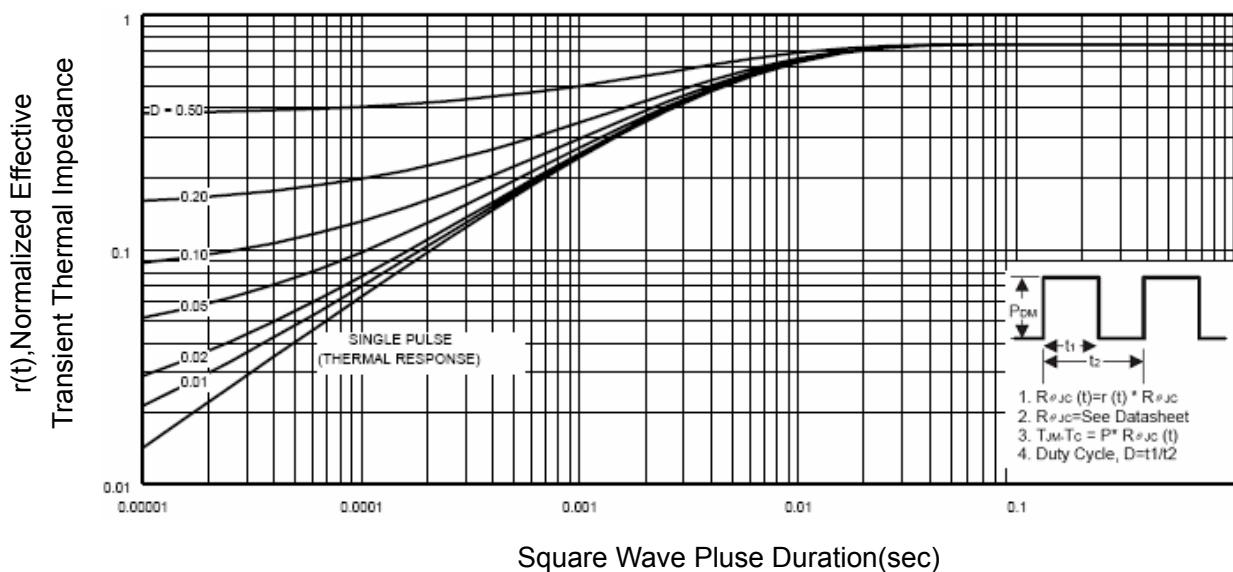
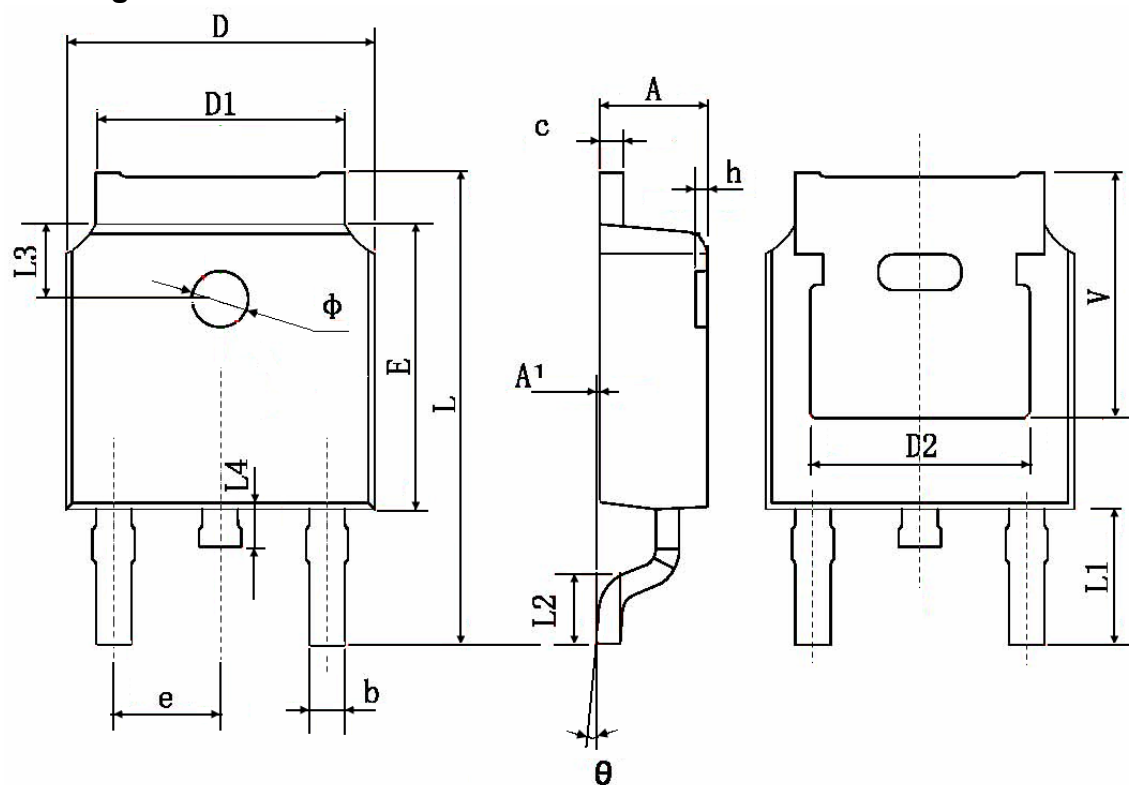


Figure 11 Normalized Maximum Transient Thermal Impedance

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     | 0.483 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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