

## P-Channel Enhancement Mode Power MOSFET

### DESCRIPTION

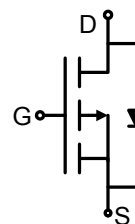
The HM25P03D uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge and operation with gate voltages as low as 4.5V.

### GENERAL FEATURES

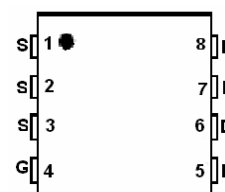
- $V_{DS} = -30V, I_D = -25A$   
 $R_{DS(ON)} < 35m\Omega @ V_{GS} = -4.5V$   
 $R_{DS(ON)} < 20m\Omega @ V_{GS} = -10V$
- High Power and current handing capability
- Lead free product is acquired
- Surface Mount Package

### Application

- Battery Switch
- Load switch
- Power management



Schematic diagram



Marking and pin assignment

### Package Marking And Ordering Information

| Device Marking | Device   | Device Package | Reel Size | Tape width | Quantity   |
|----------------|----------|----------------|-----------|------------|------------|
| HM25P03D       | HM25P03D | DFN5X6-8L      | Ø330mm    | 12mm       | 2500 units |

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

| Parameter                                        | Symbol         | Limit      | Unit |
|--------------------------------------------------|----------------|------------|------|
| Drain-Source Voltage                             | $V_{DS}$       | -30        | V    |
| Gate-Source Voltage                              | $V_{GS}$       | ±20        | V    |
| Drain Current-Continuous                         | $I_D$          | -25        | A    |
| Drain Current-Pulsed (Note 1)                    | $I_{DM}$       | -75        | A    |
| Maximum Power Dissipation                        | $P_D$          | 50         | W    |
| Operating Junction and Storage Temperature Range | $T_J, T_{STG}$ | -55 To 150 | °C   |

### Thermal Characteristic

|                                                  |                 |    |      |
|--------------------------------------------------|-----------------|----|------|
| Thermal Resistance, Junction-to-Ambient (Note 2) | $R_{\theta JA}$ | 40 | °C/W |
|--------------------------------------------------|-----------------|----|------|

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

| Parameter                      | Symbol     | Condition                  | Min | Typ | Max | Unit |
|--------------------------------|------------|----------------------------|-----|-----|-----|------|
| <b>Off Characteristics</b>     |            |                            |     |     |     |      |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | $V_{GS}=0V, I_D=-250\mu A$ | -30 | -33 | -   | V    |

|                                    |                     |                                                                                            |    |      |      |    |
|------------------------------------|---------------------|--------------------------------------------------------------------------------------------|----|------|------|----|
| Zero Gate Voltage Drain Current    | I <sub>DSS</sub>    | V <sub>DS</sub> =-30V, 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                                  | -1 | -1.5 | -3   | V  |
| Drain-Source On-State Resistance   | R <sub>DS(ON)</sub> | V <sub>GS</sub> =-10V, I <sub>D</sub> =-10A                                                | -  | 15   | 20   | mΩ |
|                                    |                     | V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-7.0A                                              | -  | 21   | 35   | mΩ |
| Forward Transconductance           | g <sub>FS</sub>     | V <sub>DS</sub> =-15V, I <sub>D</sub> =-9.1A                                               | 10 | -    | -    | S  |
| Dynamic Characteristics (Note4)    |                     |                                                                                            |    |      |      |    |
| Input Capacitance                  | C <sub>iss</sub>    | V <sub>DS</sub> =-15V, V <sub>GS</sub> =0V,<br>F=1.0MHz                                    | -  | 1600 | -    | PF |
| Output Capacitance                 | C <sub>oss</sub>    |                                                                                            | -  | 350  | -    | PF |
| Reverse Transfer Capacitance       | C <sub>rss</sub>    |                                                                                            | -  | 300  | -    | PF |
| Switching Characteristics (Note 4) |                     |                                                                                            |    |      |      |    |
| Turn-on Delay Time                 | t <sub>d(on)</sub>  | V <sub>DD</sub> =-15V, I <sub>D</sub> =-1A,<br>V <sub>GS</sub> =-10V, R <sub>GEN</sub> =6Ω | -  | 10   | -    | nS |
| Turn-on Rise Time                  | t <sub>r</sub>      |                                                                                            | -  | 15   | -    | nS |
| Turn-Off Delay Time                | t <sub>d(off)</sub> |                                                                                            | -  | 110  | -    | nS |
| Turn-Off Fall Time                 | t <sub>f</sub>      |                                                                                            |    | 70   | -    | nS |
| Total Gate Charge                  | Q <sub>g</sub>      | V <sub>DS</sub> =-15V, I <sub>D</sub> =-9.1A<br>V <sub>GS</sub> =-10V                      | -  | 30   | -    | nC |
| Gate-Source Charge                 | Q <sub>gs</sub>     |                                                                                            | -  | 5.5  | -    | nC |
| Gate-Drain Charge                  | Q <sub>gd</sub>     |                                                                                            | -  | 8    | -    | nC |
| Drain-Source Diode Characteristics |                     |                                                                                            |    |      |      |    |
| Diode Forward Voltage (Note 3)     | V <sub>SD</sub>     | V <sub>GS</sub> =0V, I <sub>S</sub> =-2.1A                                                 | -  | -    | -1.2 | V  |

## 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

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

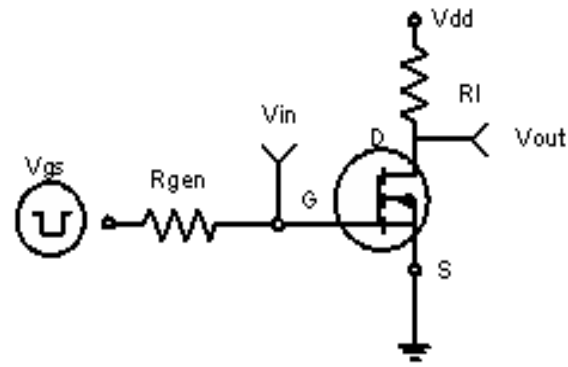


Figure 1: Switching Test Circuit

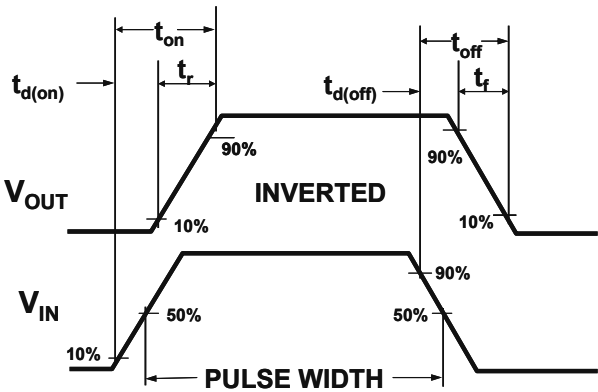


Figure 2: Switching Waveforms

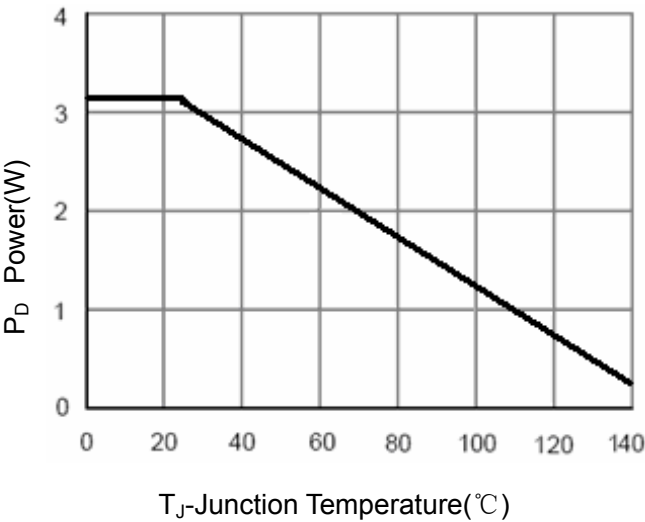


Figure 3 Power Dissipation

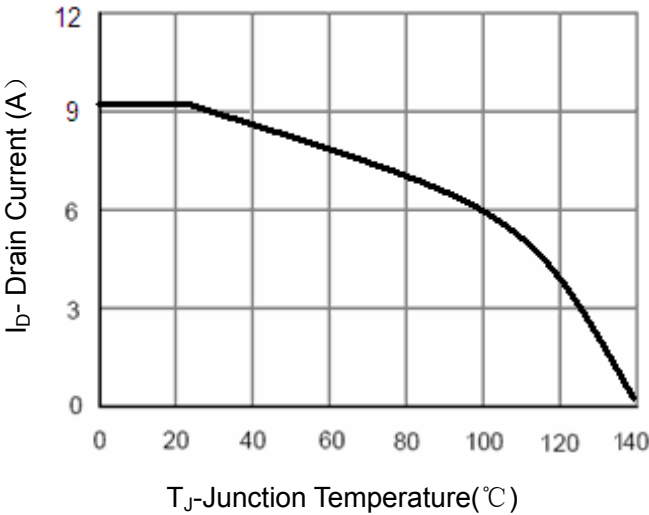


Figure 4 Drain Current

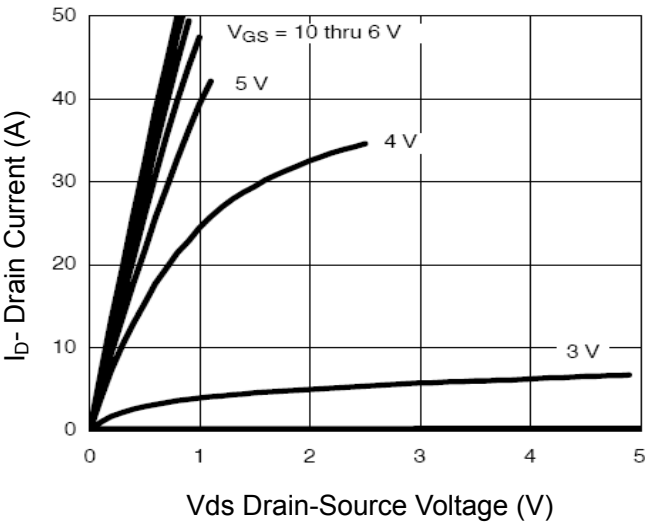


Figure 5 Output CHARACTERISTICS

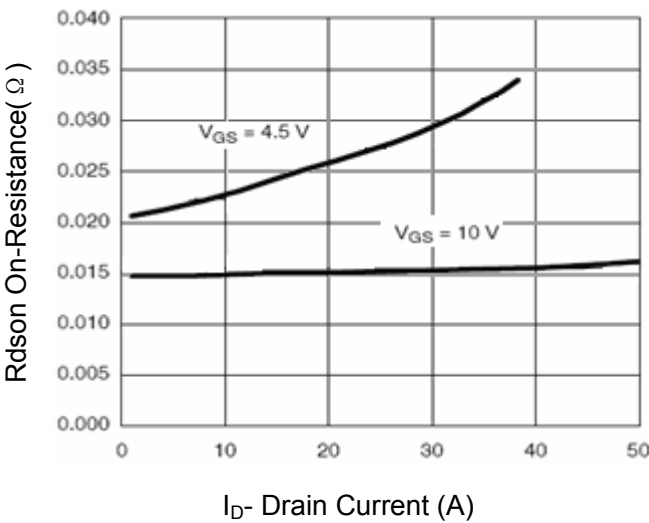
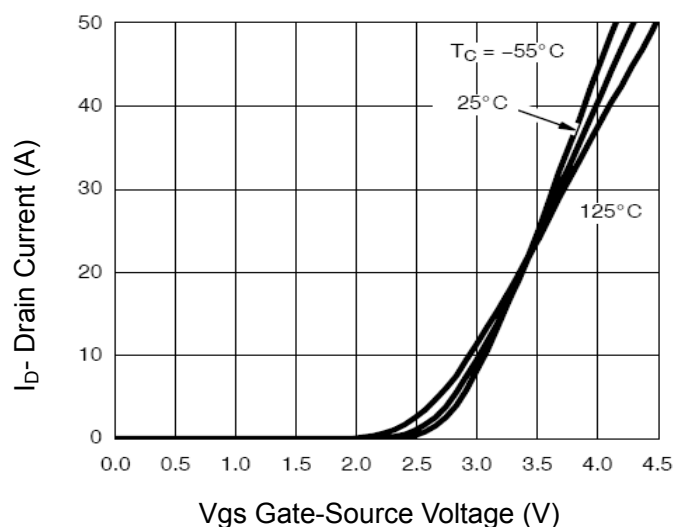
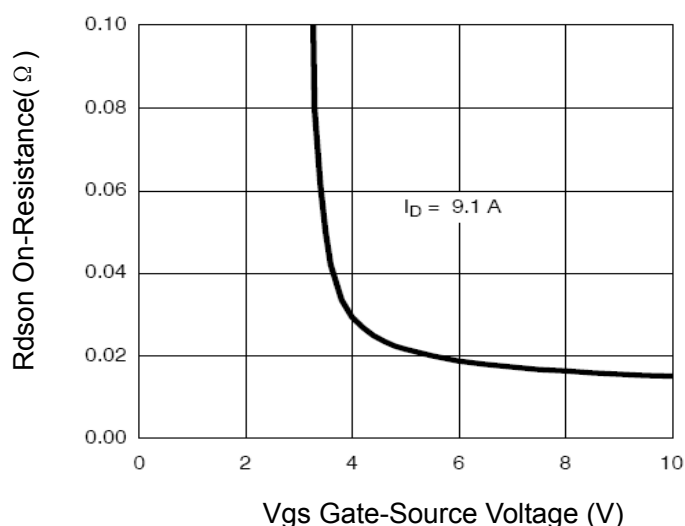


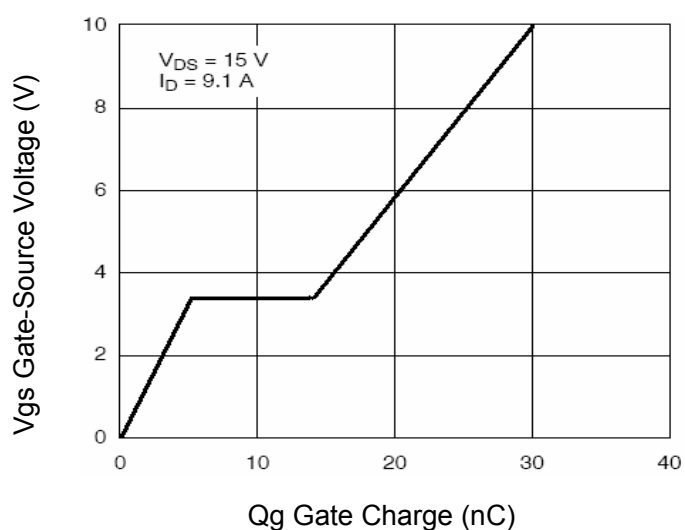
Figure 6 Drain-Source On-Resistance



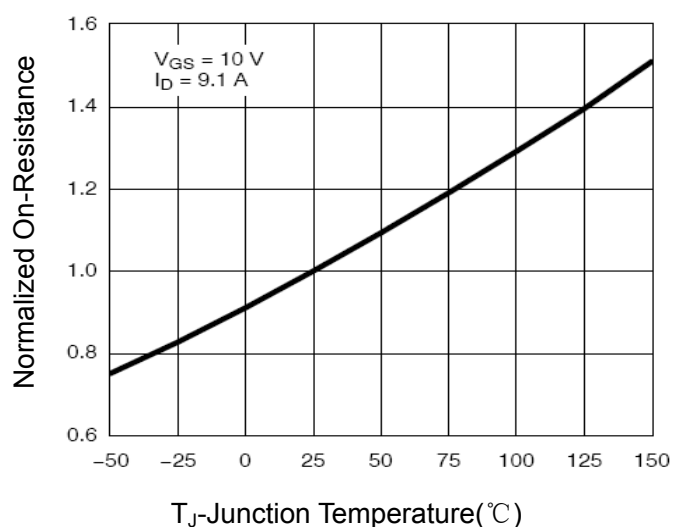
**Figure 7 Transfer Characteristics**



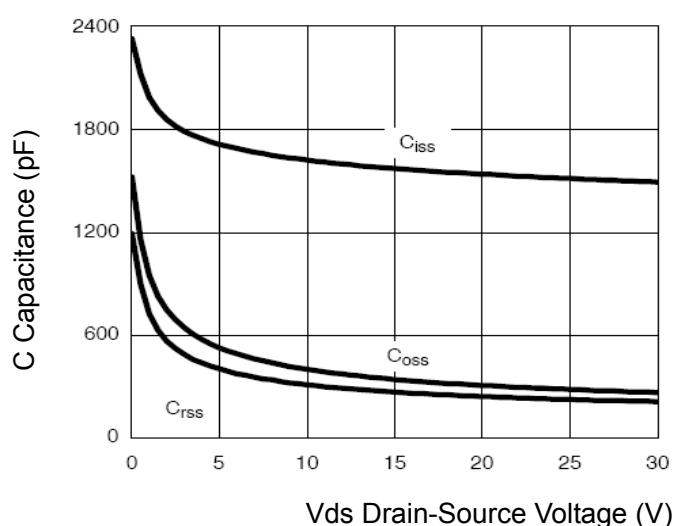
**Figure 9 Rdson vs Vgs**



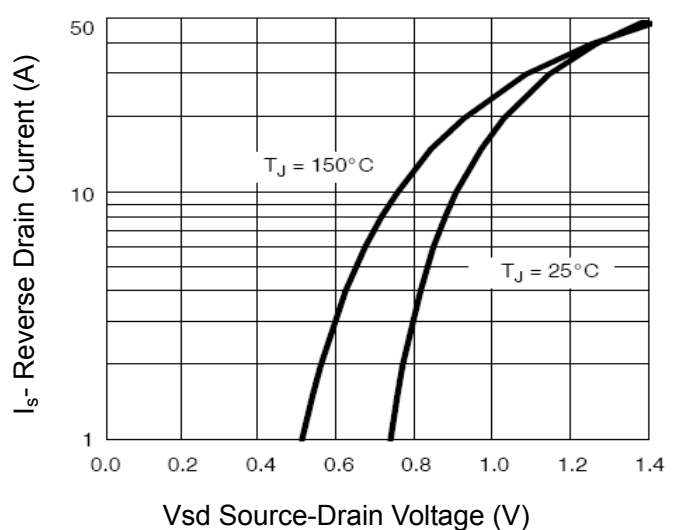
**Figure 11 Gate Charge**



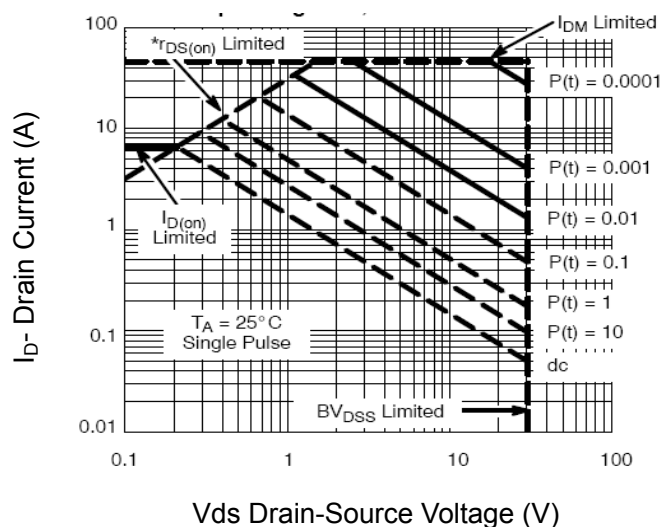
**Figure 8 Drain-Source On-Resistance**



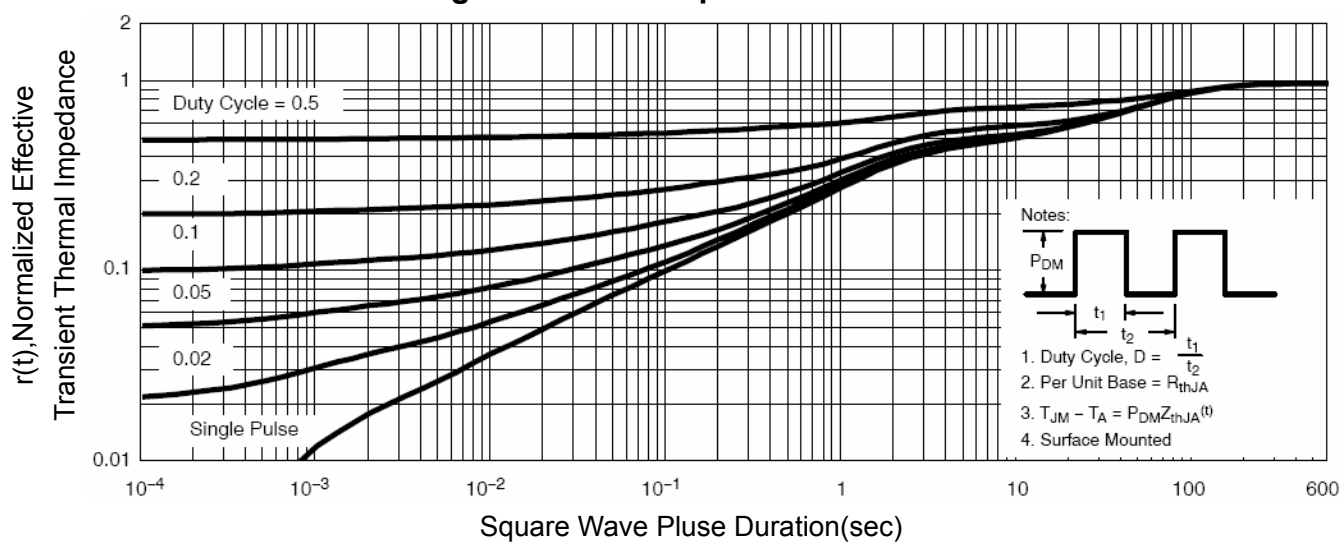
**Figure 10 Capacitance vs Vds**



**Figure 12 Source- Drain Diode Forward**

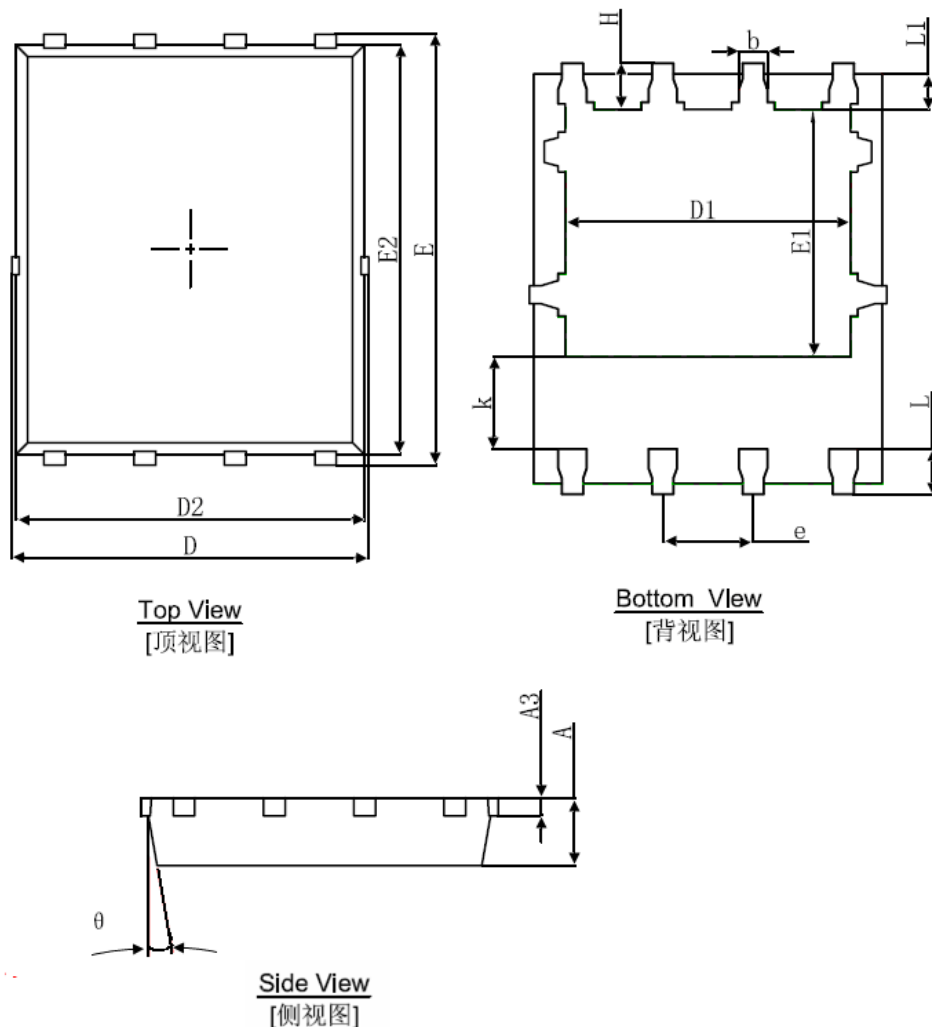


**Figure 13 Safe Operation Area**



**Figure 14 Normalized Maximum Transient Thermal Impedance**

DFN5X6-8L Package Information



| Symbol   | Dimensions In Millimeters |       | Dimensions In Inches |       |
|----------|---------------------------|-------|----------------------|-------|
|          | Min.                      | Max.  | Min.                 | Max.  |
| A        | 0.900                     | 1.000 | 0.035                | 0.039 |
| A3       | 0.254REF.                 |       | 0.010REF.            |       |
| D        | 4.944                     | 5.096 | 0.195                | 0.201 |
| E        | 5.974                     | 6.126 | 0.235                | 0.241 |
| D1       | 3.910                     | 4.110 | 0.154                | 0.162 |
| E1       | 3.375                     | 3.575 | 0.133                | 0.141 |
| D2       | 4.824                     | 4.976 | 0.190                | 0.196 |
| E2       | 5.674                     | 5.826 | 0.223                | 0.229 |
| k        | 1.190                     | 1.390 | 0.047                | 0.055 |
| b        | 0.350                     | 0.450 | 0.014                | 0.018 |
| e        | 1.270TYP.                 |       | 0.050TYP.            |       |
| L        | 0.559                     | 0.711 | 0.022                | 0.028 |
| L1       | 0.424                     | 0.576 | 0.017                | 0.023 |
| H        | 0.574                     | 0.726 | 0.023                | 0.029 |
| $\theta$ | 8°                        | 12°   | 8°                   | 12°   |