

## N-Channel Enhancement Mode Power MOSFET

### Description

The HM10N15D 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

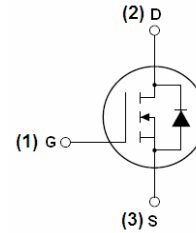
- $V_{DS} = 150V, I_D = 10A$   
 $R_{DS(ON)} < 75m\Omega @ V_{GS}=10V$  (Typ:62m $\Omega$ )  
 $R_{DS(ON)} < 80m\Omega @ V_{GS}=4.5V$  (Typ:68m $\Omega$ )
- High density cell design for ultra low  $R_{dson}$
- Fully characterized avalanche voltage and current
- Good stability and uniformity with high  $E_{AS}$
- Excellent package for good heat dissipation

### Application

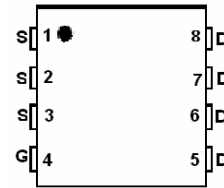
- Boost converters
- LED backlighting
- Uninterruptible power supply

**100% UIS TESTED!**

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



Schematic diagram



Marking and pin assignment

### Package Marking and Ordering Information

| Device Marking | Device   | Device Package | Reel Size | Tape width | Quantity |
|----------------|----------|----------------|-----------|------------|----------|
| HM10N15D       | HM10N15D | DFN5X6-8L      | -         | -          | -        |

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

| Symbol                    | Parameter   | Limit      | Unit                |
|---------------------------|---|------------|---------------------|
| $V_{DS}$                  | Drain-Source Voltage                                | 150        | V                   |
| $V_{GS}$                  | Gate-Source Voltage                                 | $\pm 20$   | V                   |
| $I_D$                     | Drain Current-Continuous                            | 10         | A                   |
| $I_D (100^\circ\text{C})$ | Drain Current-Continuous( $T_C=100^\circ\text{C}$ ) | 7          | A                   |
| $I_{DM}$                  | Pulsed Drain Current                                | 30         | A                   |
| $P_D$                     | Maximum Power Dissipation                           | 90         | W                   |
|                           | Derating factor                                     | 0.6        | W/ $^\circ\text{C}$ |
| $E_{AS}$                  | Single pulse avalanche energy <sup>(Note 5)</sup>   | 80         | mJ                  |
| $T_J, T_{STG}$            | Operating Junction and Storage Temperature Range    | -55 To 175 | $^\circ\text{C}$    |

## Thermal Characteristic

|                 |  |     |      |
|-----------------|--|-----|------|
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case <sup>(Note 2)</sup> | 1.7 | °C/W |
|-----------------|--|-----|------|

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

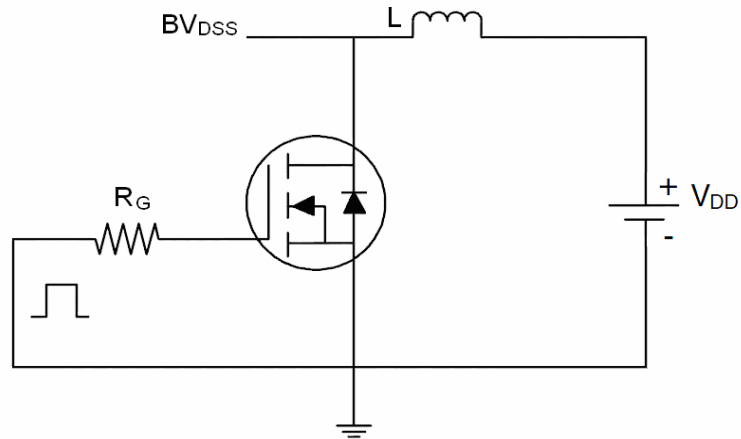
| Symbol  |   | Parameter                                  | Condition  | Min | Typ  | Max  | Unit |
|---|---|--|--|-----|------|------|------|
| Off Characteristics                           |   |  |  |     |      |      |      |
| BV <sub>DSS</sub>                             | Drain-Source Breakdown Voltage            |  | V <sub>GS</sub> =0V I <sub>D</sub> =250μA  | 150 | 165  | -    | V    |
| I <sub>DSS</sub>                              | Zero Gate Voltage Drain Current           |  | V <sub>DS</sub> =150V, V <sub>GS</sub> =0V   | -   | -    | 1    | μA   |
| I <sub>GSS</sub>                              | Gate-Body Leakage Current                 |  | V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V   | -   | -    | ±100 | nA   |
| On Characteristics <sup>(Note 3)</sup>        |   |  |  |     |      |      |      |
| V <sub>GS(th)</sub>                           | Gate Threshold Voltage                    |  | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA                               | 1.2 | 1.6  | 2.5  | V    |
| R <sub>DS(ON)</sub>                           | Drain-Source On-State Resistance          | V <sub>GS</sub> =10V, I <sub>D</sub> =10A  | -  | 62  | 75   | mΩ   |      |
|   |   | V <sub>GS</sub> =4.5V, I <sub>D</sub> =10A | -  | 68  | 80   | mΩ   |      |
| g <sub>FS</sub>                               | Forward Transconductance                  |  | V <sub>DS</sub> =5V, I <sub>D</sub> =10A   | -   | 20   | -    | S    |
| Dynamic Characteristics <sup>(Note4)</sup>    |   |  |  |     |      |      |      |
| C <sub>iss</sub>                              | Input Capacitance                         |  | V <sub>DS</sub> =75V, V <sub>GS</sub> =0V,<br>F=1.0MHz                                 | -   | 2500 | -    | PF   |
| C <sub>oss</sub>                              | Output Capacitance                        |  |  | -   | 68   | -    | PF   |
| C <sub>rss</sub>                              | Reverse Transfer Capacitance              |  |  | -   | 54   | -    | PF   |
| Switching Characteristics <sup>(Note 4)</sup> |   |  |  |     |      |      |      |
| t <sub>d(on)</sub>                            | Turn-on Delay Time                        |  | V <sub>DD</sub> =75V, R <sub>L</sub> =5Ω<br>V <sub>GS</sub> =10V, R <sub>GEN</sub> =3Ω | -   | 18.5 | -    | nS   |
| t <sub>r</sub>                                | Turn-on Rise Time                         |  |  | -   | 10   | -    | nS   |
| t <sub>d(off)</sub>                           | Turn-Off Delay Time                       |  |  | -   | 22   | -    | nS   |
| t <sub>f</sub>                                | Turn-Off Fall Time                        |  |  | -   | 8    | -    | nS   |
| Q <sub>g</sub>                                | Total Gate Charge                         |  | V <sub>DS</sub> =75V, I <sub>D</sub> =10A,<br>V <sub>GS</sub> =10V                     | -   | 60   | -    | nC   |
| Q <sub>gs</sub>                               | Gate-Source Charge                        |  |  | -   | 7.1  | -    | nC   |
| Q <sub>gd</sub>                               | Gate-Drain Charge                         |  |  | -   | 17   | -    | nC   |
| Drain-Source Diode Characteristics            |   |  |  |     |      |      |      |
| V <sub>SD</sub>                               | Diode Forward Voltage <sup>(Note 3)</sup> |  | V <sub>GS</sub> =0V, I <sub>S</sub> =10A   | -   | -    | 1.2  | V    |
| I <sub>S</sub>                                | Diode Forward Current <sup>(Note 2)</sup> |  | -  | -   | -    | 10   | A    |
| t <sub>rr</sub>                               | Reverse Recovery Time                     |  | T <sub>J</sub> = 25°C, I <sub>F</sub> = 10A<br>di/dt = 100A/μs <sup>(Note3)</sup>      | -   | 34   | -    | nS   |
| Q <sub>rr</sub>                               | Reverse Recovery Charge                   |  |  | -   | 55   | -    | nC   |
| t <sub>on</sub>                               | Forward Turn-On Time                      |  | Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)                   |     |      |      |      |

## Notes:

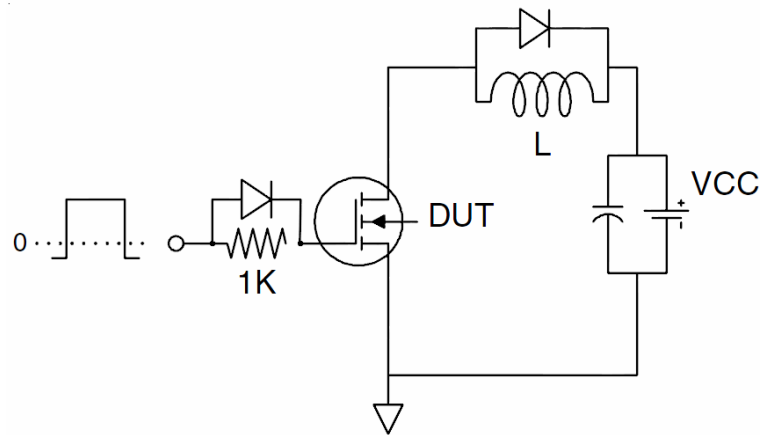
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production
5. EAS condition:  $T_J=25^{\circ}\text{C}, V_{DD}=50V,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

## Test Circuit

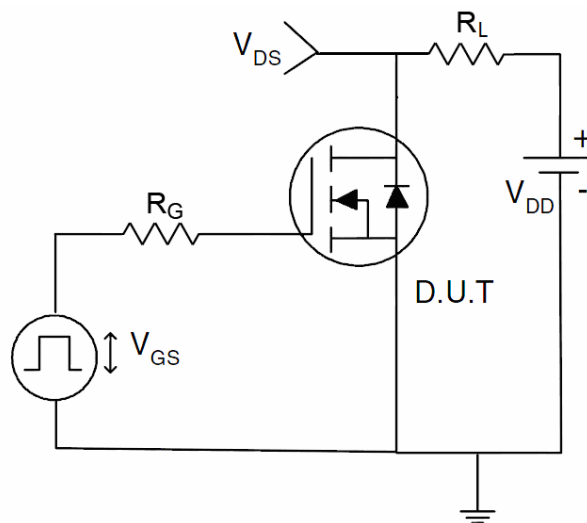
### 1) $E_{AS}$ Test Circuit



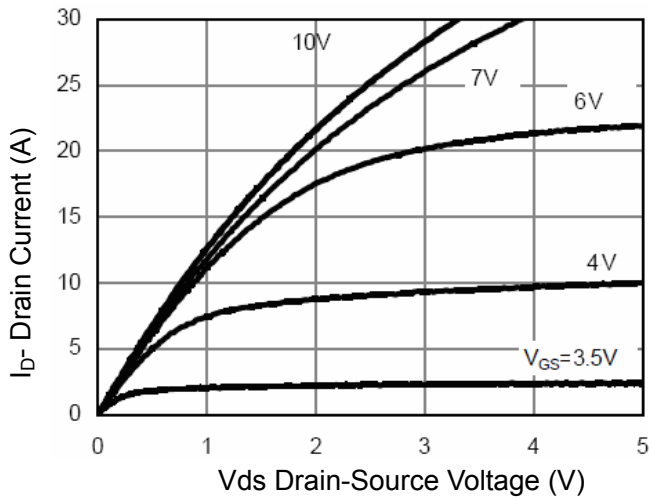
### 2) Gate Charge Test Circuit



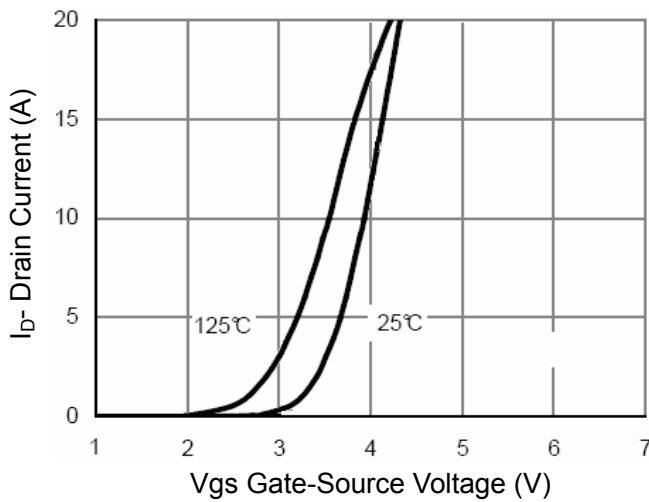
### 3) Switch Time Test Circuit



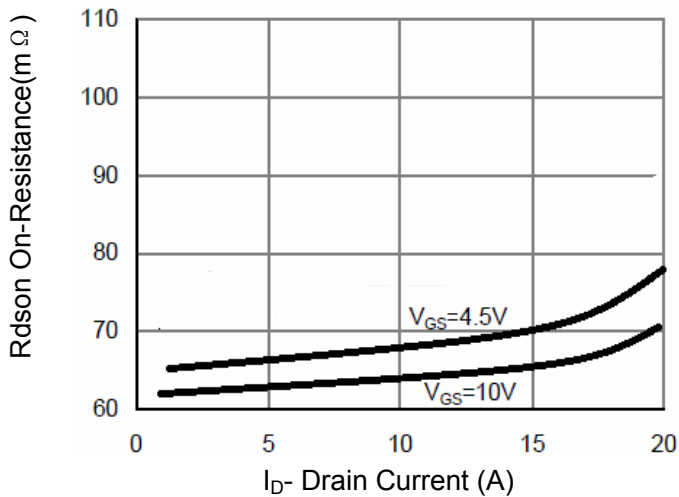
## Typical Electrical and Thermal Characteristics (Curves)



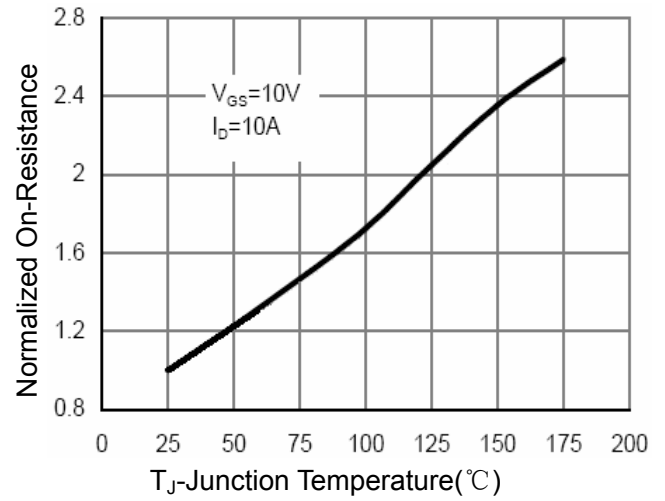
**Figure 1 Output Characteristics**



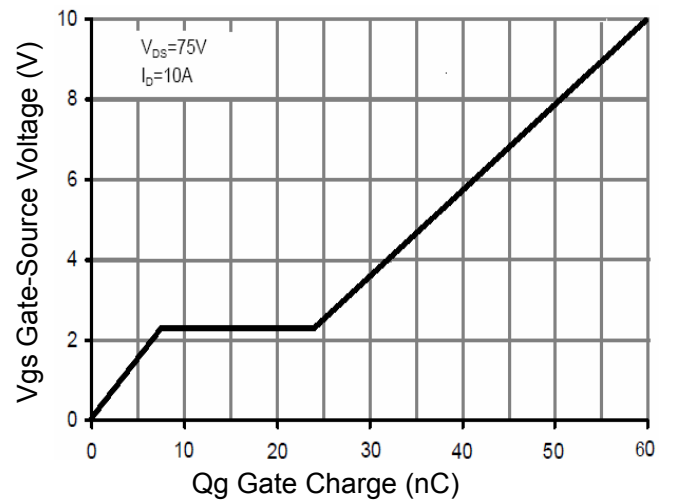
**Figure 2 Transfer Characteristics**



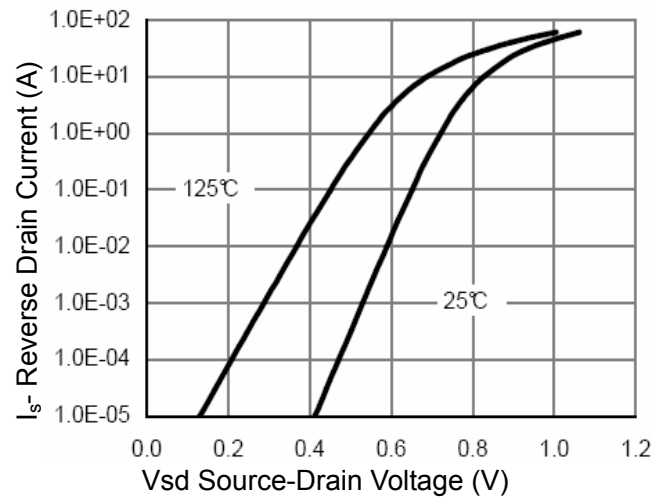
**Figure 3  $R_{DS(on)}$ - Drain Current**



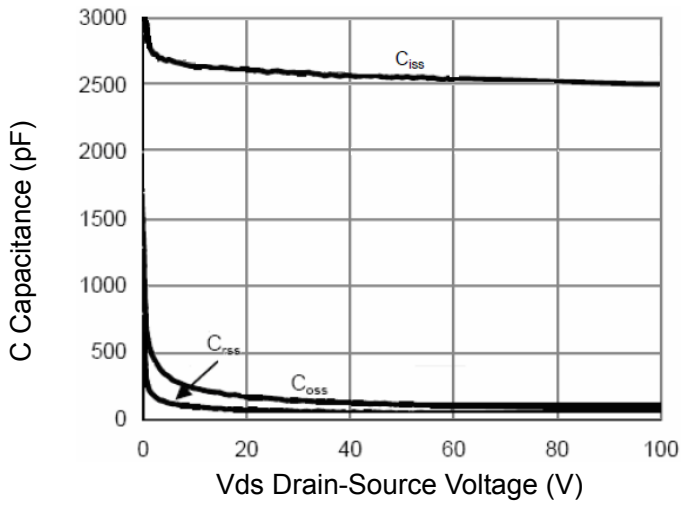
**Figure 4  $R_{DS(on)}$ -Junction Temperature**



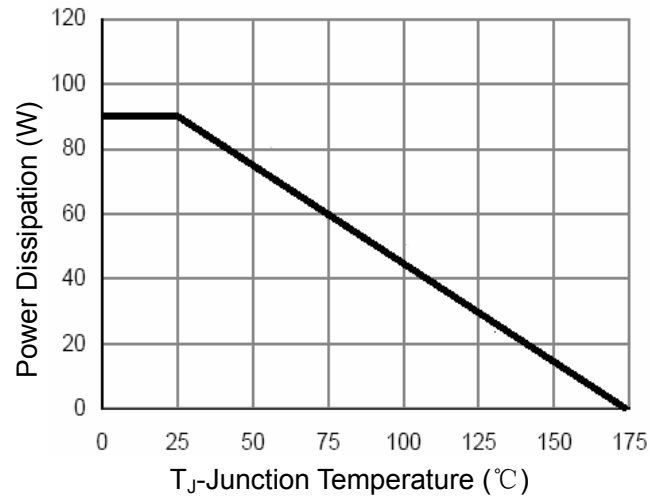
**Figure 5 Gate Charge**



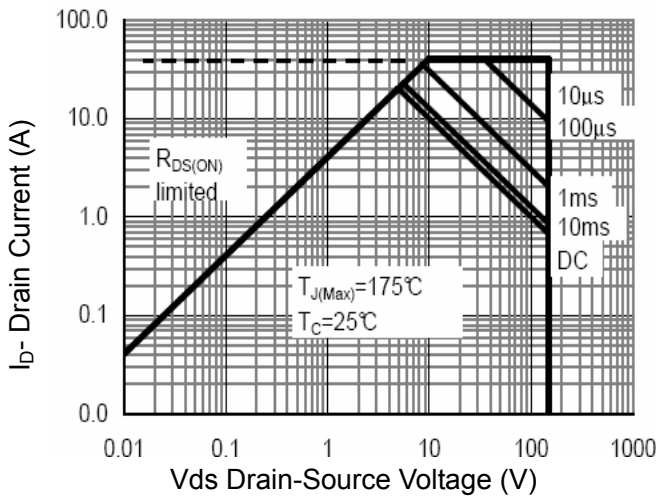
**Figure 6 Source- Drain Diode Forward**



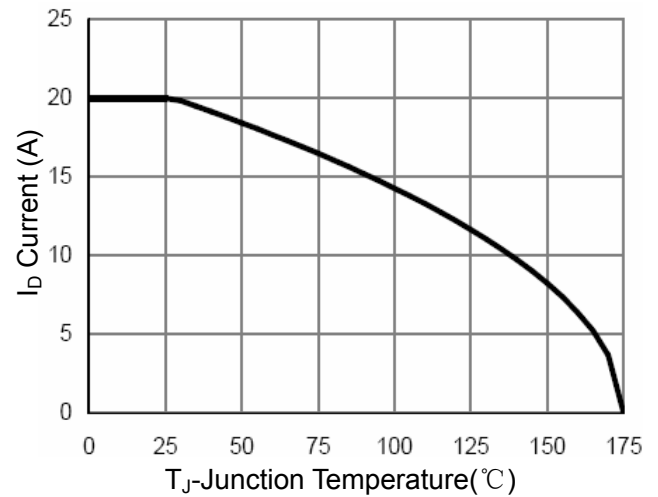
**Figure 7 Capacitance vs Vds**



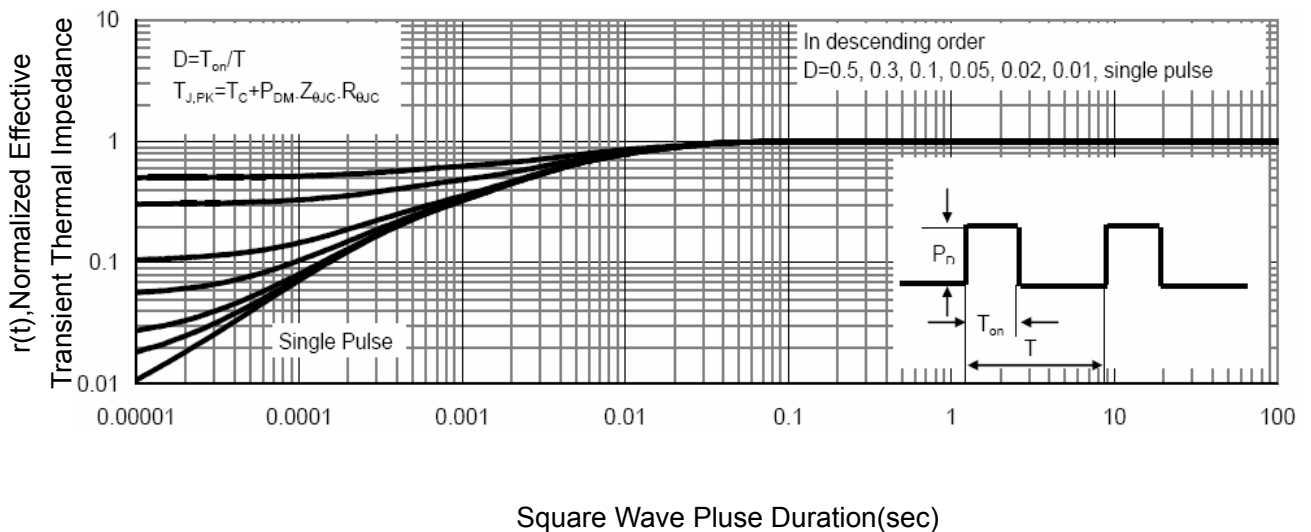
**Figure 9 Power De-rating**



**Figure 8 Safe Operation Area**

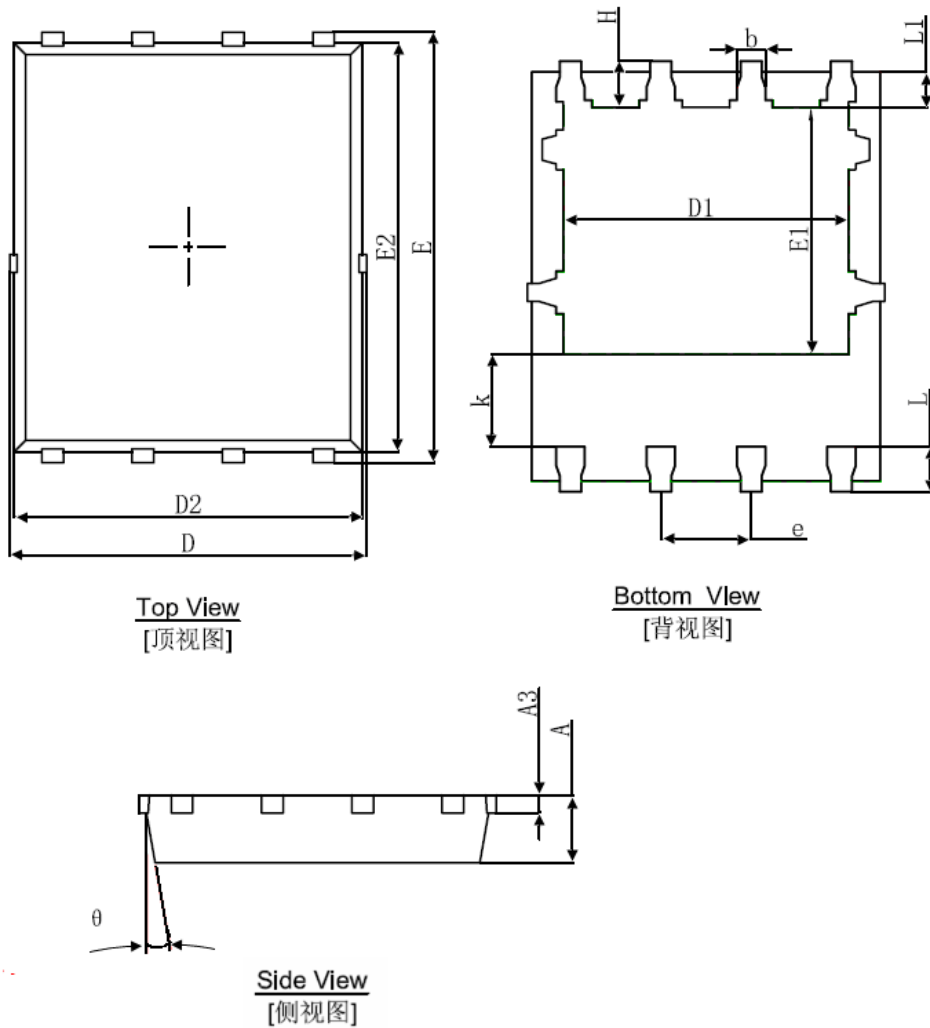


**Figure 10 ID Current- Junction Temperature**



**Figure 11 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 |
| θ      | 8°                        | 12°   | 8°                   | 12°   |

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