

## N-Channel Enhancement Mode Power MOSFET

### Description

The HM80N03GA 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.

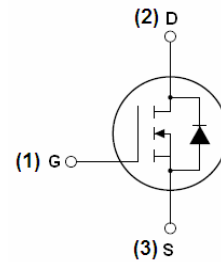
### General Features

- $V_{DS} = 30V, I_D = 80A$   
 $R_{DS(ON)} = 4.1m\Omega$  (typical) @  $V_{GS} = 10V$   
 $R_{DS(ON)} = 7m\Omega$  (typical) @  $V_{GS} = 4.5V$
- 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

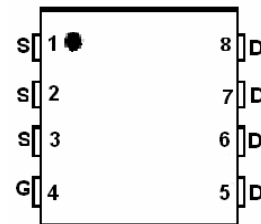
### Application

- Power switching application
- Hard switched and high frequency circuits
- Uninterruptible power supply

**100% UIS TESTED!**



Schematic diagram



Marking and pin assignment



DFN5X6-8L top view

### Package Marking and Ordering Information

| Device Marking | Device    | Device Package | Reel Size | Tape width | Quantity |
|----------------|-----------|----------------|-----------|------------|----------|
| HM80N03GA      | HM80N03GA | DFN5X6-8L      | -         | -          | -        |

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

| Parameter                                         | Symbol              | Limit      | Unit          |
|---------------------------------------------------|---------------------|------------|---------------|
| Drain-Source Voltage                              | $V_{DS}$            | 30         | V             |
| Gate-Source Voltage                               | $V_{GS}$            | $\pm 20$   | V             |
| Drain Current-Continuous                          | $I_D$               | 80         | A             |
| Drain Current-Continuous ( $T_C = 100^\circ C$ )  | $I_D (100^\circ C)$ | 56         | A             |
| Pulsed Drain Current                              | $I_{DM}$            | 240        | A             |
| Maximum Power Dissipation                         | $P_D$               | 83         | W             |
| Derating factor                                   |                     | 0.56       | W/ $^\circ C$ |
| Single pulse avalanche energy <sup>(Note 5)</sup> | $E_{AS}$            | 306        | 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> | $R_{\theta JC}$ | 1.8 | °C/W |
|----------------------------------------------------------|-----------------|-----|------|

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

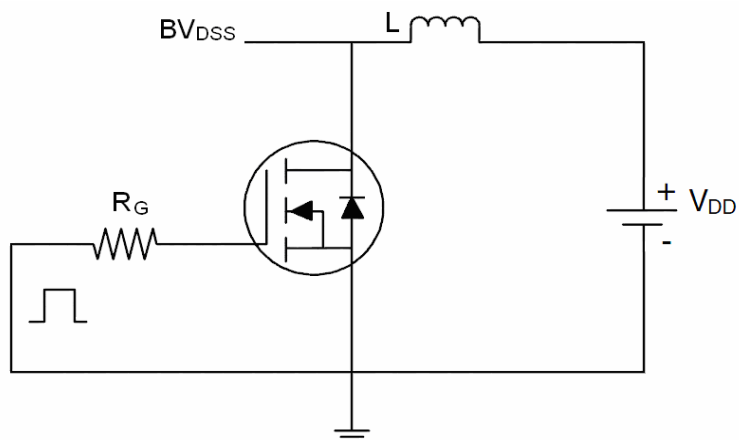
| Parameter                                         | Symbol              | Condition                                                                                 | Min | Typ  | Max  | Unit |
|---------------------------------------------------|---------------------|-------------------------------------------------------------------------------------------|-----|------|------|------|
| Off Characteristics                               |                     |                                                                                           |     |      |      |      |
| Drain-Source Breakdown Voltage                    | BV <sub>DSS</sub>   | V <sub>GS</sub> =0V I <sub>D</sub> =250μA                                                 | 30  | -    | -    | 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 <small>(Note 3)</small>        |                     |                                                                                           |     |      |      |      |
| Gate Threshold Voltage                            | V <sub>GS(th)</sub> | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA                                  | 1.2 | 1.6  | 2.0  | V    |
| Drain-Source On-State Resistance                  | R <sub>DS(ON)</sub> | V <sub>GS</sub> =10V, I <sub>D</sub> =30A                                                 | -   | 4.1  | 6    | mΩ   |
|                                                   |                     | V <sub>GS</sub> =4.5V, I <sub>D</sub> =24A                                                | -   | 7    | 10   |      |
| Forward Transconductance                          | g <sub>FS</sub>     | V <sub>DS</sub> =5V, I <sub>D</sub> =24A                                                  | 20  | -    | -    | S    |
| Dynamic Characteristics <small>(Note4)</small>    |                     |                                                                                           |     |      |      |      |
| Input Capacitance                                 | C <sub>iss</sub>    | V <sub>DS</sub> =15V, V <sub>GS</sub> =0V,<br>F=1.0MHz                                    | -   | 2330 | -    | PF   |
| Output Capacitance                                | C <sub>oss</sub>    |                                                                                           | -   | 460  | -    | PF   |
| Reverse Transfer Capacitance                      | C <sub>rss</sub>    |                                                                                           | -   | 230  | -    | PF   |
| Switching Characteristics <small>(Note 4)</small> |                     |                                                                                           |     |      |      |      |
| Turn-on Delay Time                                | t <sub>d(on)</sub>  | V <sub>DD</sub> =10V, I <sub>D</sub> =30A<br>V <sub>GS</sub> =10V, R <sub>GEN</sub> =2.7Ω | -   | 20   | -    | nS   |
| Turn-on Rise Time                                 | t <sub>r</sub>      |                                                                                           | -   | 15   | -    | nS   |
| Turn-Off Delay Time                               | t <sub>d(off)</sub> |                                                                                           | -   | 60   | -    | nS   |
| Turn-Off Fall Time                                | t <sub>f</sub>      |                                                                                           | -   | 10   | -    | nS   |
| Total Gate Charge                                 | Q <sub>g</sub>      | V <sub>DS</sub> =10V, I <sub>D</sub> =30A,<br>V <sub>GS</sub> =10V                        | -   | 51   | -    | nC   |
| Gate-Source Charge                                | Q <sub>gs</sub>     |                                                                                           | -   | 14   | -    | nC   |
| Gate-Drain Charge                                 | Q <sub>gd</sub>     |                                                                                           | -   | 11   | -    | nC   |
| Drain-Source Diode Characteristics                |                     |                                                                                           |     |      |      |      |
| Diode Forward Voltage <small>(Note 3)</small>     | V <sub>SD</sub>     | V <sub>GS</sub> =0V, I <sub>S</sub> =24A                                                  | -   | -    | 1.2  | V    |
| Diode Forward Current <small>(Note 2)</small>     | I <sub>S</sub>      |                                                                                           | -   | -    | 80   | A    |
| Reverse Recovery Time                             | t <sub>rr</sub>     | T <sub>J</sub> = 25°C, I <sub>F</sub> = 30A<br>di/dt = 100A/μs <small>(Note3)</small>     | -   | 32   | 50   | nS   |
| Reverse Recovery Charge                           | Q <sub>rr</sub>     |                                                                                           | -   | 12   | 20   | nC   |
| Forward Turn-On Time                              | t <sub>on</sub>     | Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)                      |     |      |      |      |

### Notes:

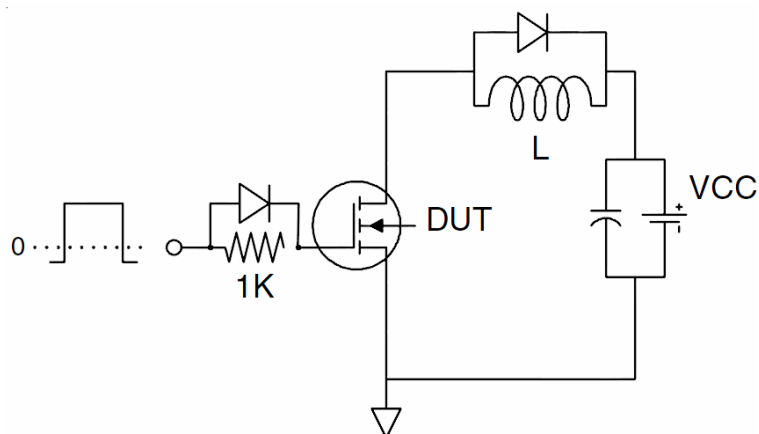
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production
5. EAS condition:  $T_J=25^{\circ}\text{C}, V_{DD}=15V, V_G=10V, L=0.5mH, R_g=25\Omega, I_{AS}=35A$

## Test Circuit

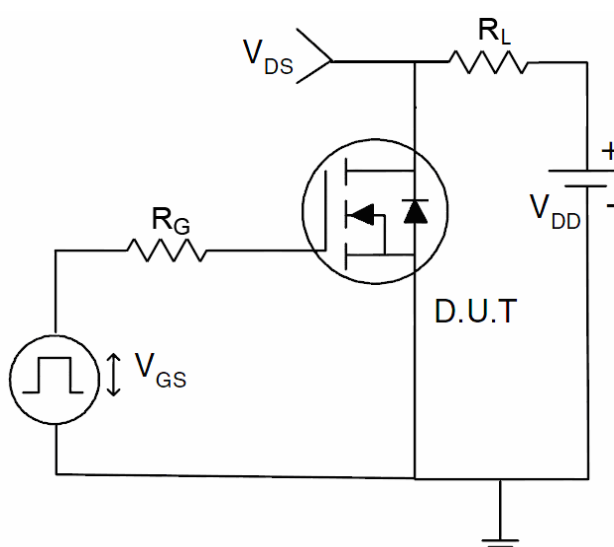
### 1) $E_{AS}$ Test Circuits



### 2) Gate Charge Test Circuit:



### 3) Switch Time Test Circuit:



## Typical Electrical and Thermal Characteristics (Curves)

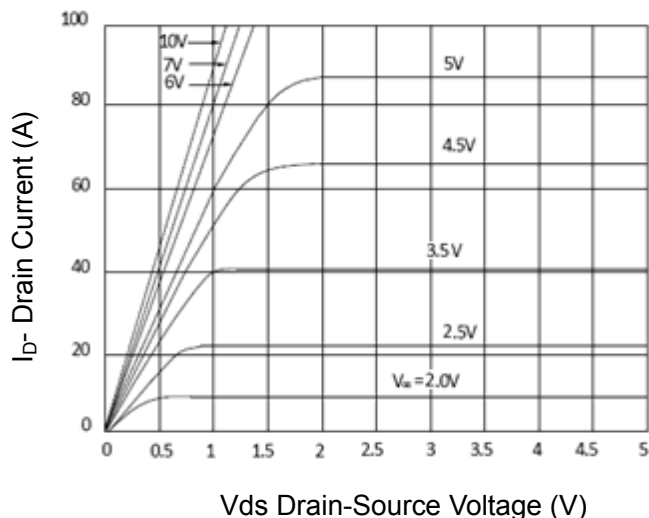


Figure 1 Output Characteristics

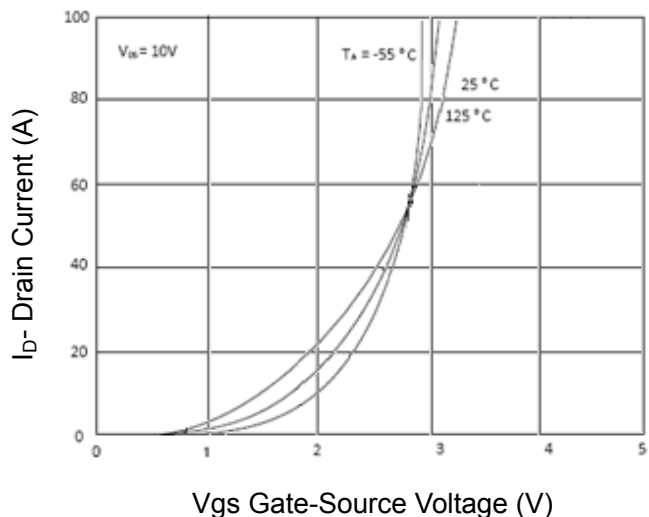


Figure 2 Transfer Characteristics

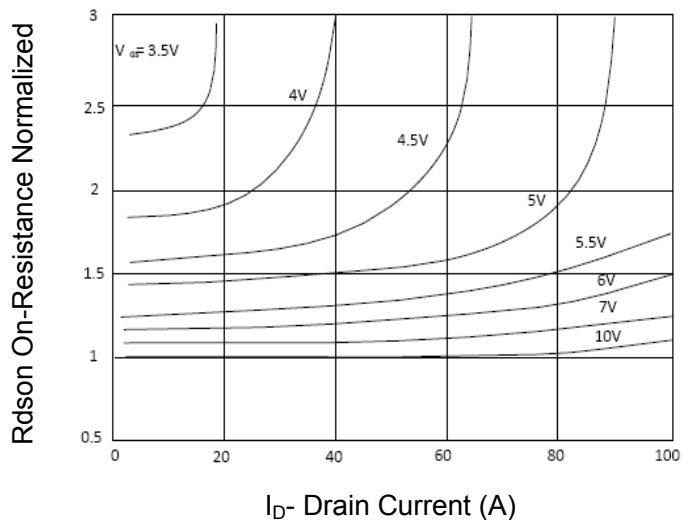


Figure 3  $R_{DS(on)}$ - Drain Current

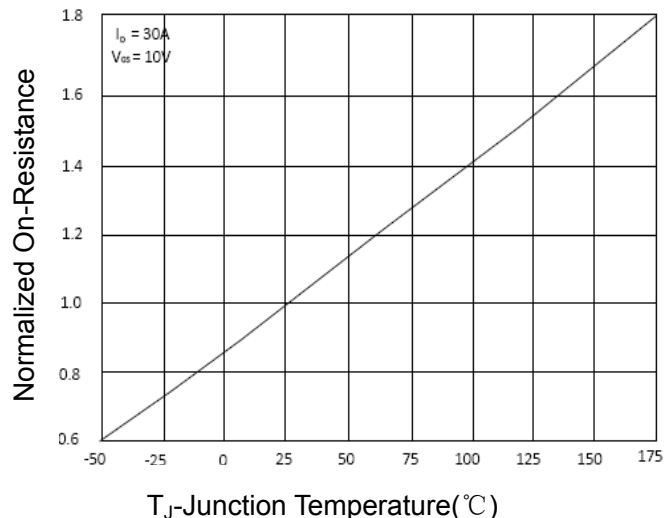


Figure 4  $R_{DS(on)}$ -Junction Temperature

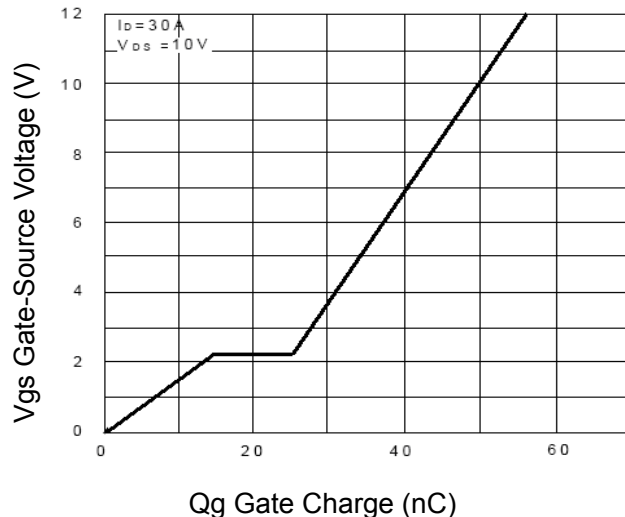


Figure 5 Gate Charge

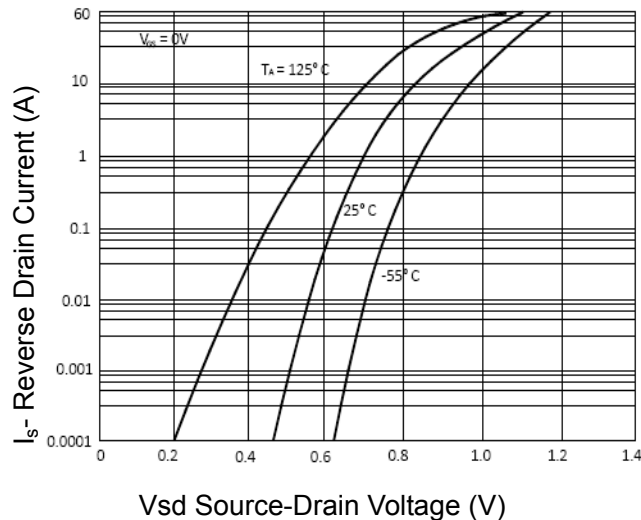


Figure 6 Source- Drain Diode Forward

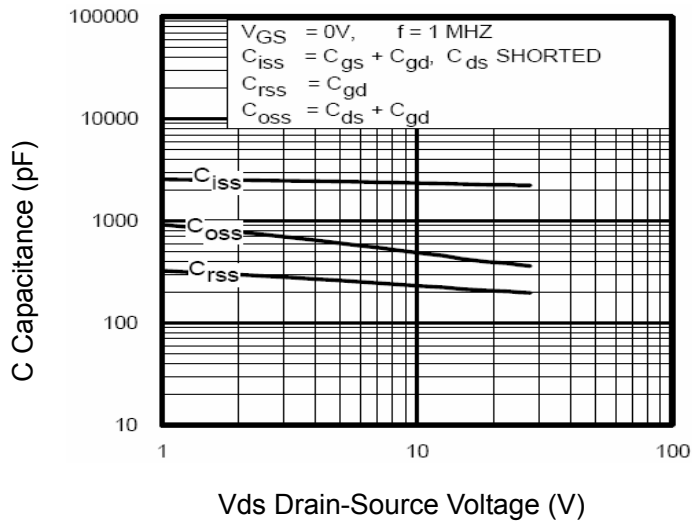


Figure 7 Capacitance vs Vds

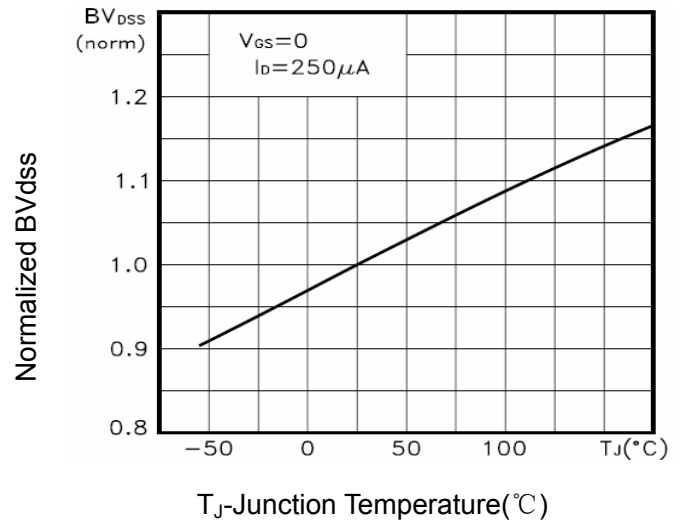


Figure 9 BV<sub>DSS</sub> vs Junction Temperature

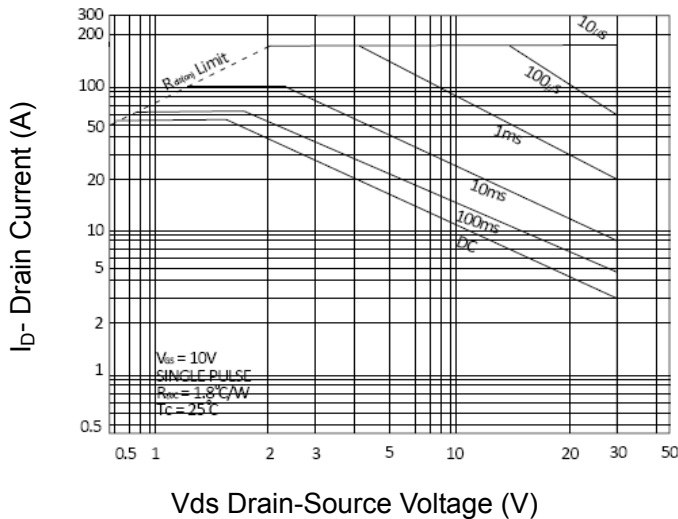


Figure 8 Safe Operation Area

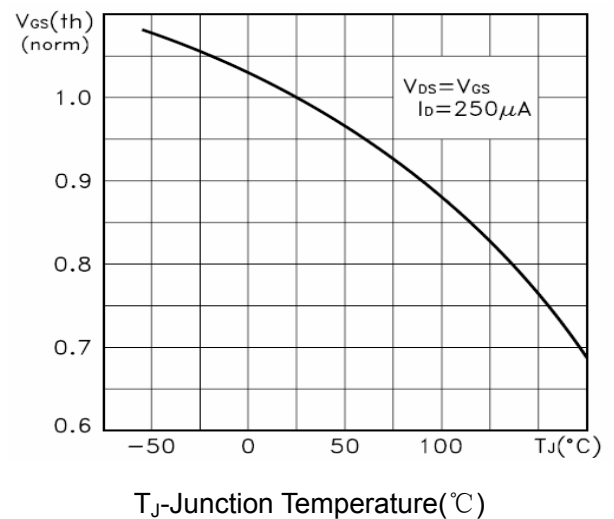


Figure 10 V<sub>GS(th)</sub> vs Junction Temperature

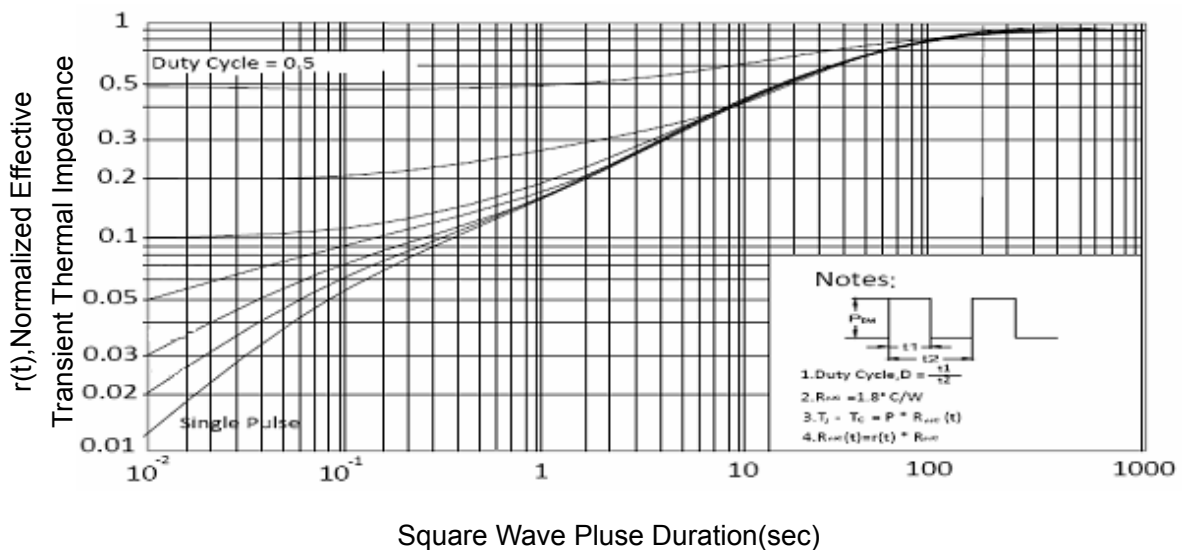
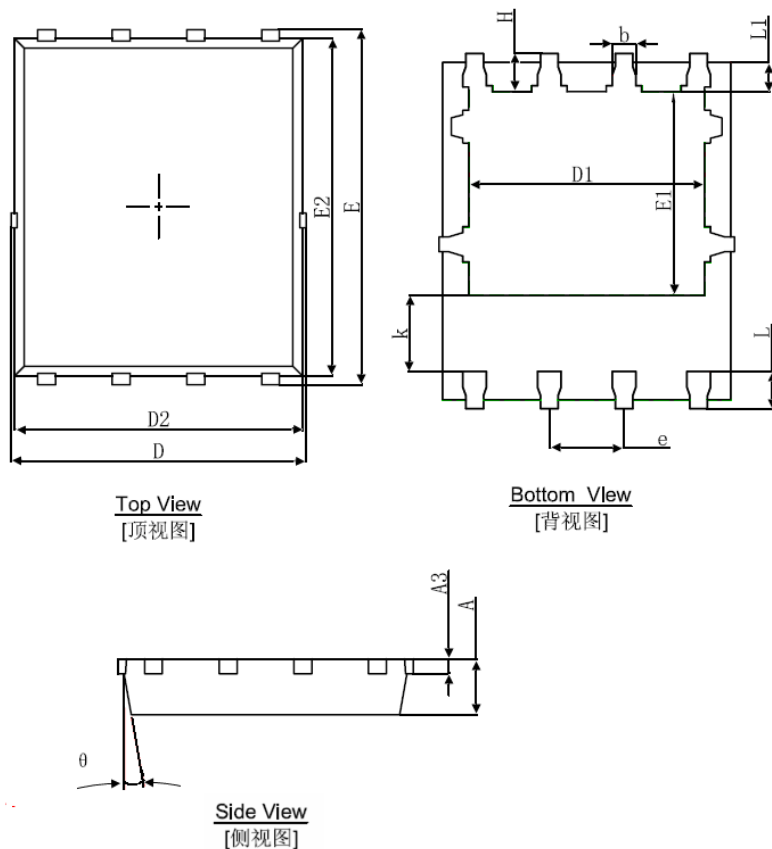


Figure 11 Normalized Maximum Transient Thermal Impedance

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 |
| $\theta$ | 8°                        |       | 8°                   |       |