

## NCE P-Channel Enhancement Mode Power MOSFET

### Description

The NCE30P50G 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.

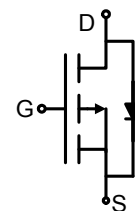
### General Features

- $V_{DS} = -30V, I_D = -50A$   
 $R_{DS(ON)} < 7m\Omega @ V_{GS} = -10V$
- High density cell design for ultra low  $R_{DS(on)}$
- Fully characterized avalanche voltage and current
- Good stability and uniformity with high  $E_{AS}$
- Excellent package for good heat dissipation
- Special process technology for high ESD capability

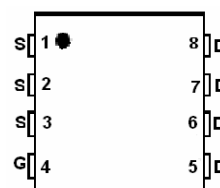
### Application

- Battery and loading switching

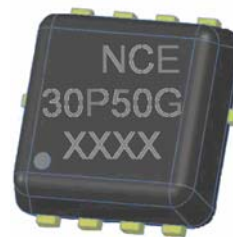
**100% UIS TESTED!**



Schematic diagram



Marking and pin assignment



DFN 5x6 EP top view

### Package Marking and Ordering Information

| Device Marking | Device    | Device Package | Reel Size | Tape width | Quantity |
|----------------|-----------|----------------|-----------|------------|----------|
| NCE30P50G      | NCE30P50G | DFN 5x6 EP     | -         | -          | -        |

### Absolute Maximum Ratings ( $T_C = 25^\circ\text{C}$ 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                          | $I_D$          | -50        | A                   |
| Pulsed Drain Current                              | $I_{DM}$       | -70        | A                   |
| Maximum Power Dissipation                         | $P_D$          | 35         | W                   |
| Derating factor                                   |                | 0.28       | W/ $^\circ\text{C}$ |
| Single pulse avalanche energy <sup>(Note 5)</sup> | $E_{AS}$       | 300        | mJ                  |
| Operating Junction and Storage Temperature Range  | $T_J, T_{STG}$ | -55 To 150 | $^\circ\text{C}$    |

### Thermal Characteristic

|                                                          |                 |     |                    |
|----------------------------------------------------------|-----------------|-----|--------------------|
| Thermal Resistance, Junction-to-Case <sup>(Note 2)</sup> | $R_{\theta JC}$ | 3.6 | $^\circ\text{C/W}$ |
|----------------------------------------------------------|-----------------|-----|--------------------|

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

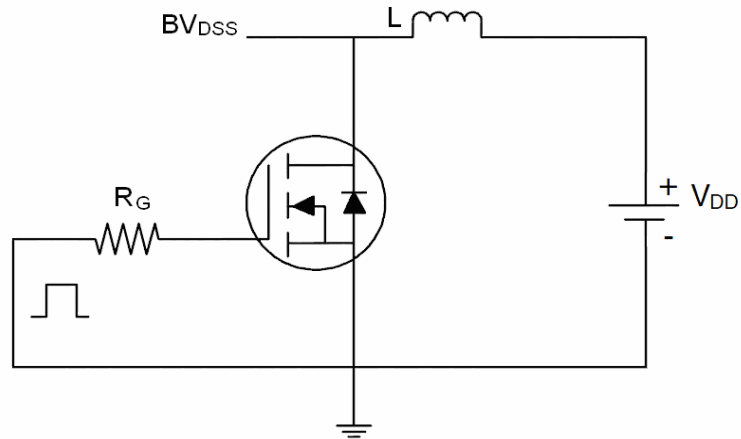
| Parameter                                     | Symbol              | Condition                                                                                  | Min | Typ   | Max  | Unit |
|-----------------------------------------------|---------------------|--------------------------------------------------------------------------------------------|-----|-------|------|------|
| Off Characteristics                           |                     |                                                                                            |     |       |      |      |
| Drain-Source Breakdown Voltage                | BV <sub>DSS</sub>   | V <sub>GS</sub> =0V I <sub>D</sub> =-250μA                                                 | -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 <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                                  | -1  | -1.5  | -2.2 | V    |
| Drain-Source On-State Resistance              | R <sub>DS(ON)</sub> | V <sub>GS</sub> =-10V, I <sub>D</sub> =-10A                                                | -   | 4.4   | 7    | mΩ   |
| Forward Transconductance                      | g <sub>FS</sub>     | V <sub>DS</sub> =-10V, I <sub>D</sub> =-15A                                                | -   | 20    | -    | S    |
| Dynamic Characteristics <sup>(Note4)</sup>    |                     |                                                                                            |     |       |      |      |
| Input Capacitance                             | C <sub>ISS</sub>    | V <sub>DS</sub> =-15V, V <sub>GS</sub> =0V,<br>F=1.0MHz                                    | -   | 3590  | -    | PF   |
| Output Capacitance                            | C <sub>OSS</sub>    |                                                                                            | -   | 695   | -    | PF   |
| Reverse Transfer Capacitance                  | C <sub>rss</sub>    |                                                                                            | -   | 665   | -    | PF   |
| Switching Characteristics <sup>(Note 4)</sup> |                     |                                                                                            |     |       |      |      |
| Turn-on Delay Time                            | t <sub>d(on)</sub>  | V <sub>DD</sub> =-15V, I <sub>D</sub> =-10A<br>V <sub>GS</sub> =-10V, R <sub>GEN</sub> =6Ω | -   | 13    | -    | nS   |
| Turn-on Rise Time                             | t <sub>r</sub>      |                                                                                            | -   | 12    | -    | nS   |
| Turn-Off Delay Time                           | t <sub>d(off)</sub> |                                                                                            | -   | 50    | -    | nS   |
| Turn-Off Fall Time                            | t <sub>f</sub>      |                                                                                            | -   | 14    | -    | nS   |
| Total Gate Charge                             | Q <sub>g</sub>      | V <sub>DS</sub> =-15V, I <sub>D</sub> =-10A,<br>V <sub>GS</sub> =-10V                      | -   | 84    | -    | nC   |
| Gate-Source Charge                            | Q <sub>gs</sub>     |                                                                                            | -   | 11.7  | -    | nC   |
| Gate-Drain Charge                             | Q <sub>gd</sub>     |                                                                                            | -   | 25    | -    | 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> =-10A                                                  | -   | -0.85 | -1.2 | V    |
| Diode Forward Current <sup>(Note 2)</sup>     | I <sub>S</sub>      |                                                                                            | -   | -     | -50  | A    |
| Reverse Recovery Time                         | t <sub>rr</sub>     | T <sub>J</sub> = 25°C, I <sub>F</sub> = -10A<br>di/dt = 100A/μs(Note3)                     | -   | -     | 45   | nS   |
| Reverse Recovery Charge                       | Q <sub>rr</sub>     |                                                                                            | -   | -     | 43   | nC   |
| Forward Turn-On Time                          | t <sub>on</sub>     | Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)                       |     |       |      |      |

### Notes:

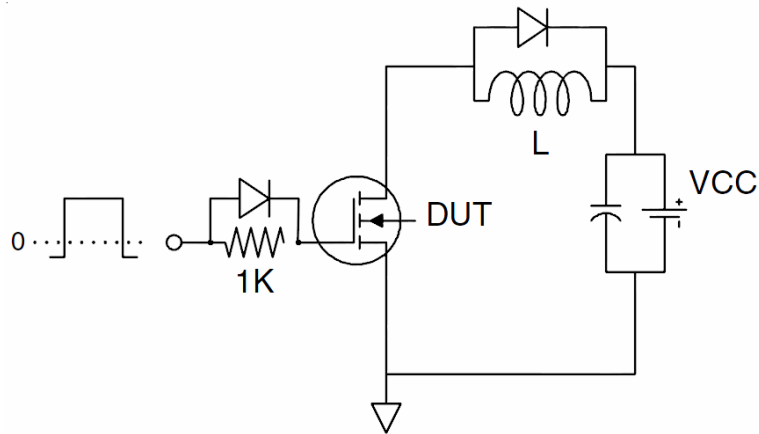
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production
5. EAS condition:  $T_J=25^\circ C, V_{DD}=-15V, V_G=-10V,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

## Test Circuit

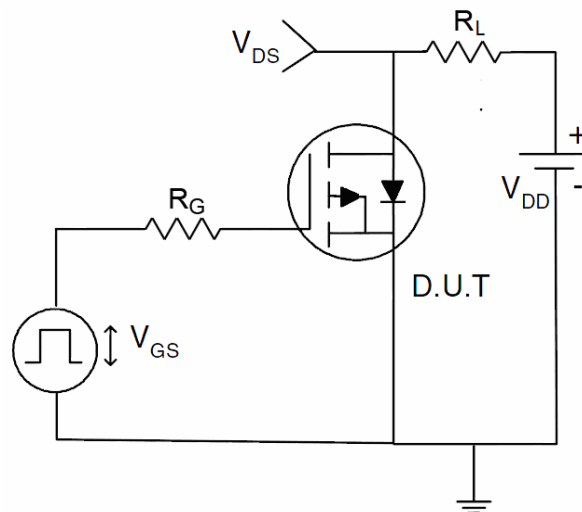
### 1) $E_{AS}$ Test Circuits



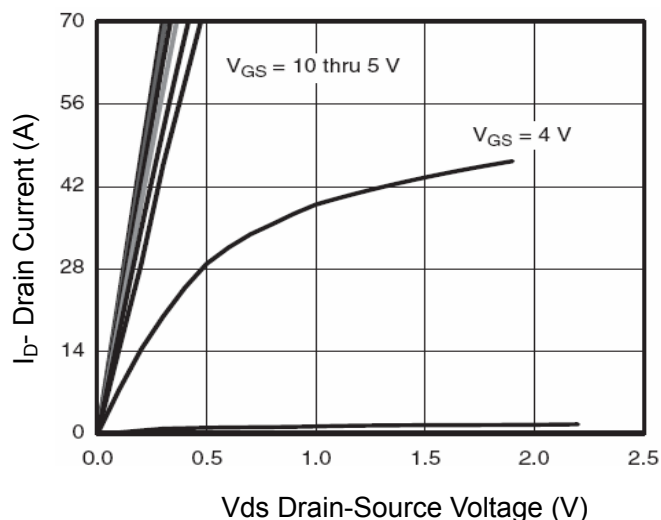
### 2) Gate Charge Test Circuit



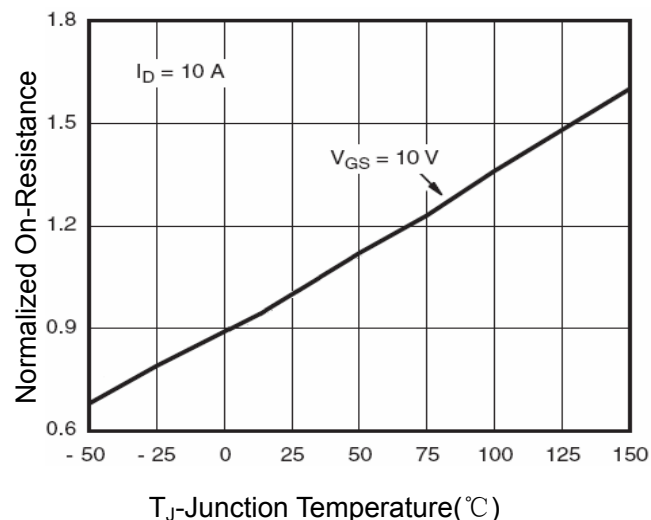
### 3) Switch Time Test Circuit



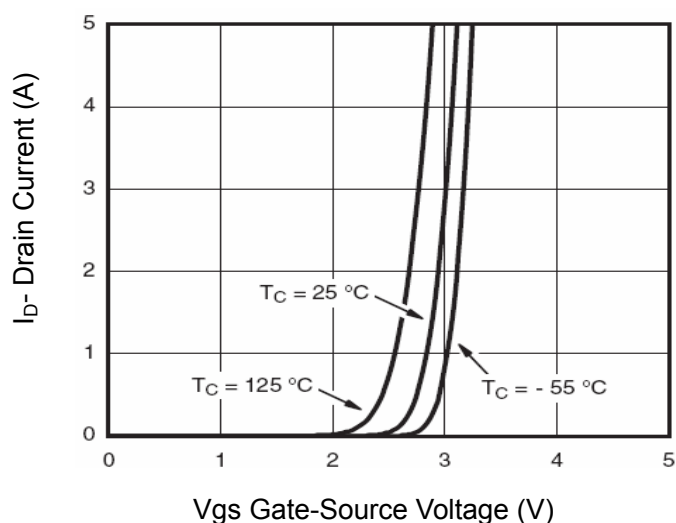
## Typical Electrical and Thermal Characteristics (Curves)



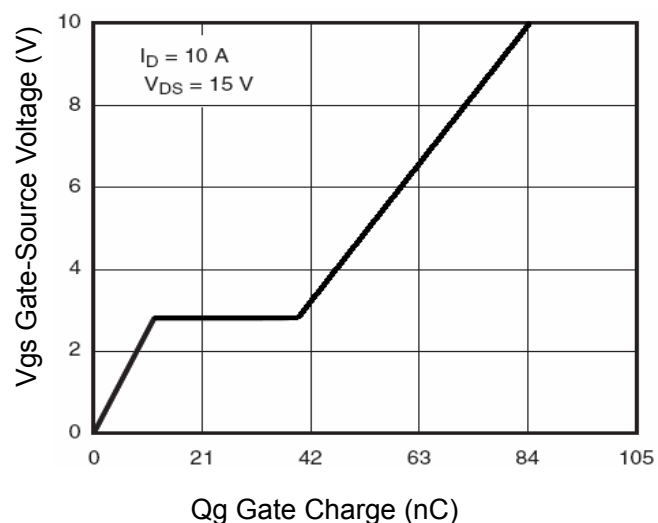
**Figure 1 Output Characteristics**



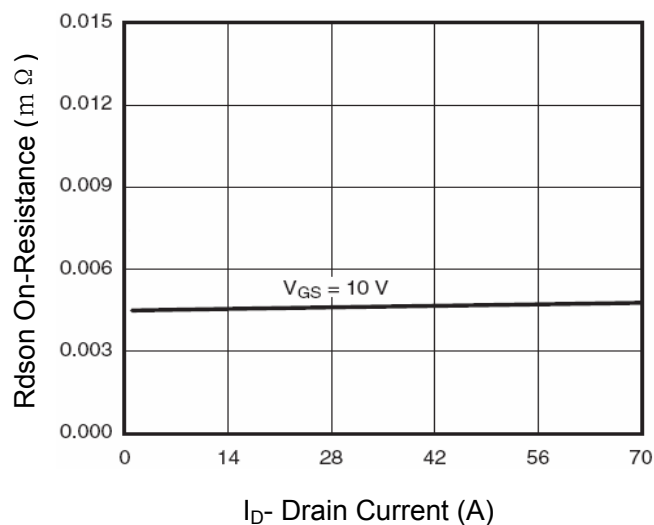
**Figure 4 Rdson-Junction Temperature**



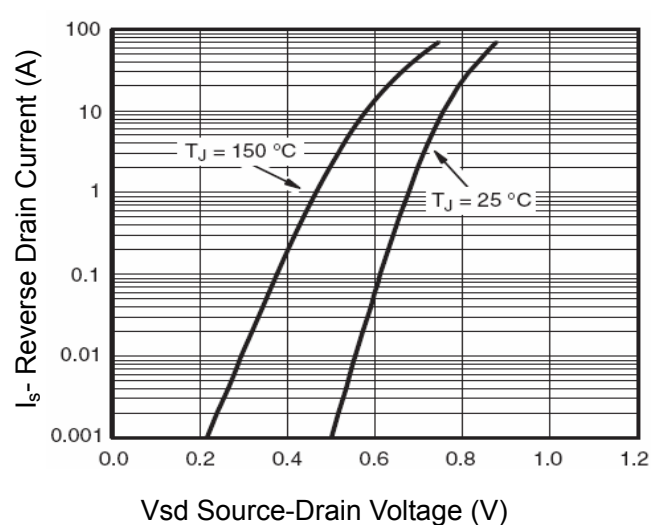
**Figure 2 Transfer Characteristics**



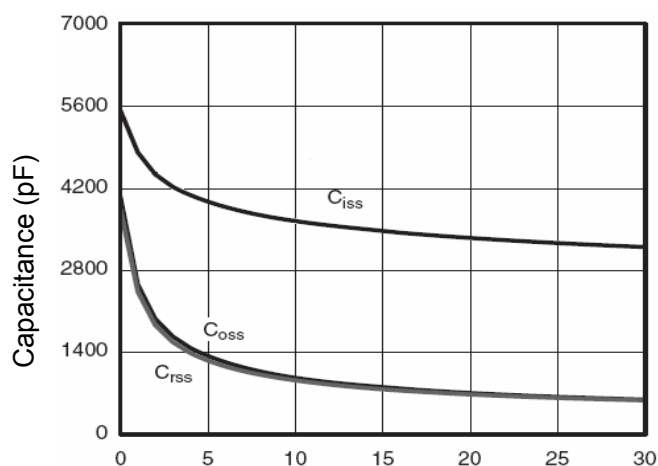
**Figure 5 Gate Charge**



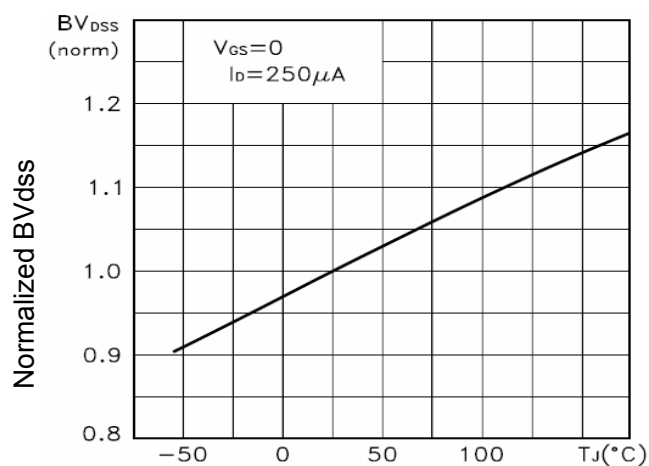
**Figure 3 Rdson- Drain Current**



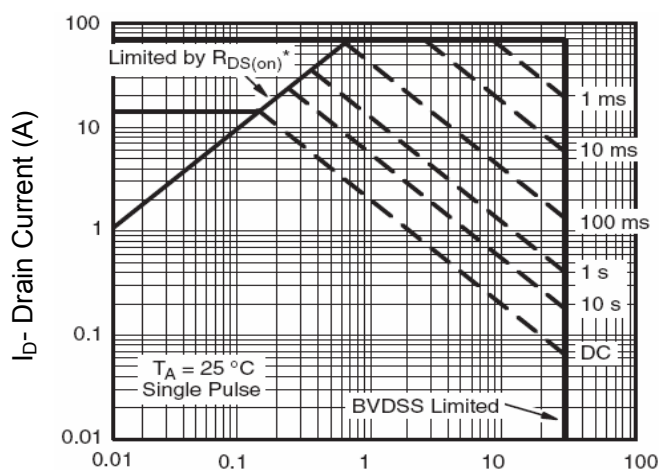
**Figure 6 Source- Drain Diode Forward**



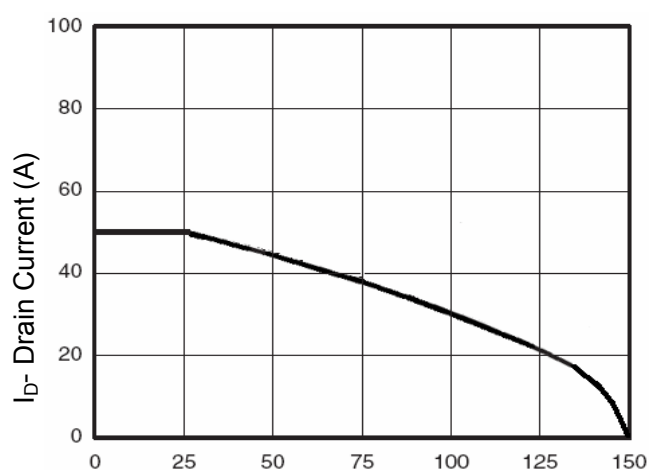
Vds Drain-Source Voltage (V)  
**Figure 7 Capacitance vs Vds**



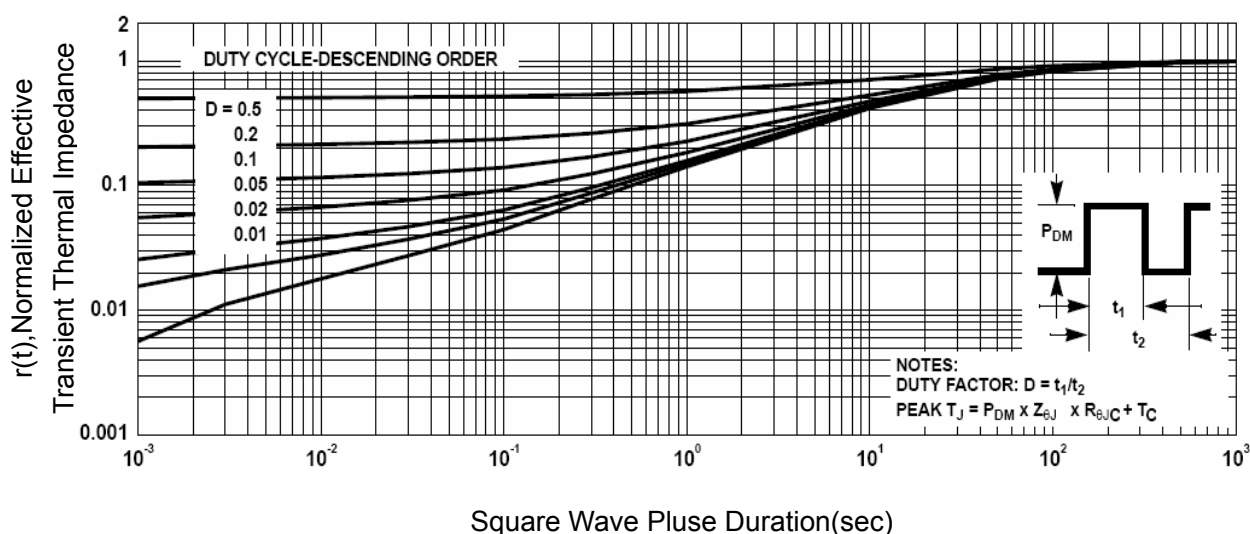
TJ-Junction Temperature(°C)  
**Figure 9 BV<sub>DSS</sub> vs Junction Temperature**



Vds Drain-Source Voltage (V)  
**Figure 8 Safe Operation Area**

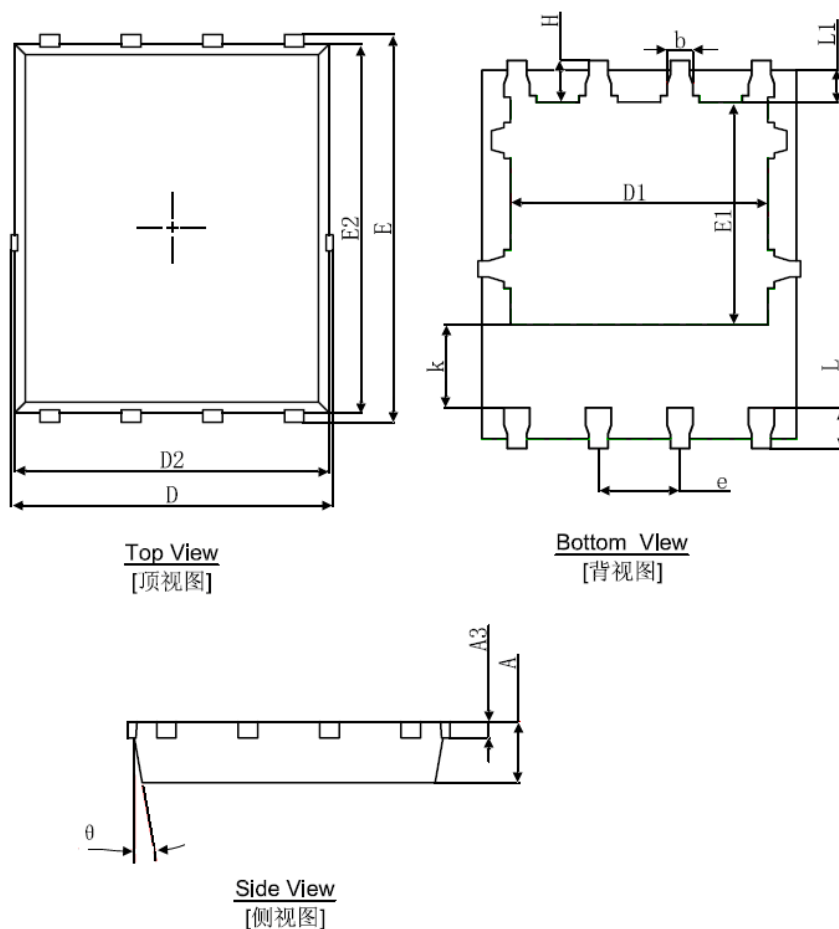


TJ-Junction Temperature(°C)  
**Figure 10 ID Current Derating vs Junction Temperature**



**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      | 0.035                     | 0.450 | 0.014                | 0.018 |
| e      | 1.270(TYP.)               |       | 0.050(TYP.)          |       |
| 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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