

## 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.

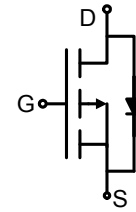
### General Features

- $V_{DS} = -30V, I_D = -50A$   
 $R_{DS(ON)} < 7m\Omega @ V_{GS} = -10V$
- 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

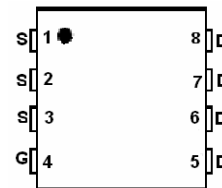
### Application

- 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 ( $T_C = 25^\circ C$ 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                              | $I_{DM}$       | -200       | A             |
| Maximum Power Dissipation                         | $P_D$          | 35         | W             |
| Derating factor                                   |                | 0.28       | W/ $^\circ C$ |
| 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 | $^\circ C$    |

### Thermal Characteristic

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

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

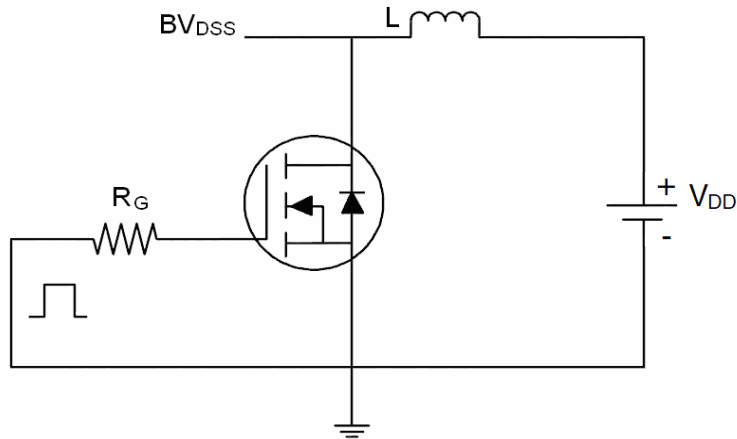
| Parameter                                 | Symbol       | Condition  | Min | Typ   | Max       | Unit       |
|---|--------------|--|-----|-------|-----------|------------|
| <b>Off Characteristics</b>                |              |  |     |       |           |            |
| Drain-Source Breakdown Voltage            | $BV_{DSS}$   | $V_{GS}=0V, I_D=-250\mu A$   | -30 | -33   | -         | V          |
| Zero Gate Voltage Drain Current           | $I_{DSS}$    | $V_{DS}=-30V, V_{GS}=0V$   | -   | -     | 1         | $\mu A$    |
| Gate-Body Leakage Current                 | $I_{GSS}$    | $V_{GS}=\pm 20V, V_{DS}=0V$  | -   | -     | $\pm 100$ | nA         |
| <b>On Characteristics (Note 3)</b>        |              |  |     |       |           |            |
| Gate Threshold Voltage                    | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=-250\mu A$                                       | -1  | -1.5  | -2.2      | V          |
| Drain-Source On-State Resistance          | $R_{DS(ON)}$ | $V_{GS}=-10V, I_D=-10A$  | -   | 4.4   | 7         | m $\Omega$ |
| Forward Transconductance                  | $g_{FS}$     | $V_{DS}=-10V, I_D=-15A$  | -   | 20    | -         | S          |
| <b>Dynamic Characteristics (Note4)</b>    |              |  |     |       |           |            |
| Input Capacitance                         | $C_{iss}$    | $V_{DS}=-15V, V_{GS}=0V,$<br>$F=1.0MHz$                              | -   | 3590  | -         | PF         |
| Output Capacitance                        | $C_{oss}$    |  | -   | 695   | -         | PF         |
| Reverse Transfer Capacitance              | $C_{rss}$    |  | -   | 665   | -         | PF         |
| <b>Switching Characteristics (Note 4)</b> |              |  |     |       |           |            |
| Turn-on Delay Time                        | $t_{d(on)}$  | $V_{DD}=-15V, I_D=-10A$<br>$V_{GS}=-10V, R_{GEN}=6\Omega$            | -   | 13    | -         | nS         |
| Turn-on Rise Time                         | $t_r$        |  | -   | 12    | -         | nS         |
| Turn-Off Delay Time                       | $t_{d(off)}$ |  | -   | 50    | -         | nS         |
| Turn-Off Fall Time                        | $t_f$        |  | -   | 14    | -         | nS         |
| Total Gate Charge                         | $Q_g$        | $V_{DS}=-15V, I_D=-10A,$<br>$V_{GS}=-10V$                            | -   | 84    | -         | nC         |
| Gate-Source Charge                        | $Q_{gs}$     |  | -   | 11.7  | -         | nC         |
| Gate-Drain Charge                         | $Q_{gd}$     |  | -   | 25    | -         | nC         |
| <b>Drain-Source Diode Characteristics</b> |              |  |     |       |           |            |
| Diode Forward Voltage (Note 3)            | $V_{SD}$     | $V_{GS}=0V, I_S=-10A$  | -   | -0.85 | -1.2      | V          |
| Diode Forward Current (Note 2)            | $I_S$        |  | -   | -     | -50       | A          |
| Reverse Recovery Time                     | $t_{rr}$     | $T_J = 25^\circ C, I_F = -10A$<br>$di/dt = 100A/\mu s$ (Note3)       | -   | -     | 45        | nS         |
| Reverse Recovery Charge                   | $Q_{rr}$     |  | -   | -     | 43        | nC         |
| Forward Turn-On Time                      | $t_{on}$     | Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD) |     |       |           |            |

**Notes:**

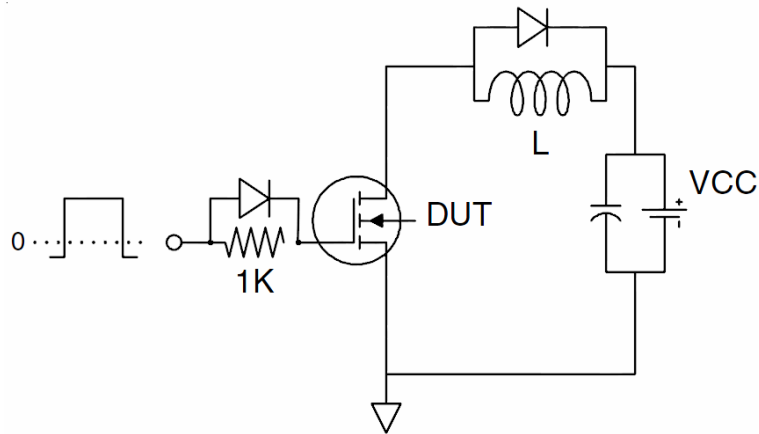
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production
5. EAS condition:  $T_J=25^\circ C, V_{DB}=-15V, V_G=-10V,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

## Test Circuit

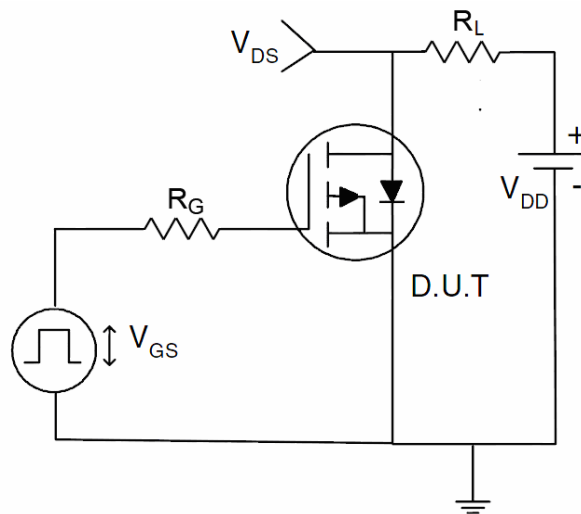
### 1) E<sub>AS</sub> Test Circuits



### 2) Gate Charge Test Circuit



### 3) Switch Time Test Circuit



## Typical Electrical and Thermal Characteristics (Curves)

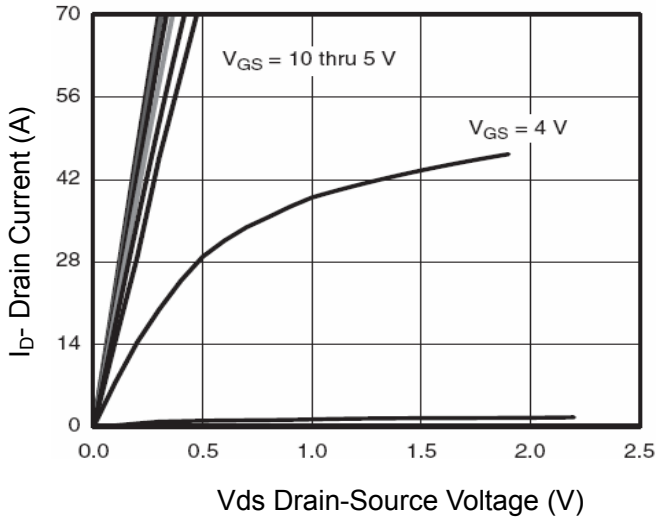


Figure 1 Output Characteristics

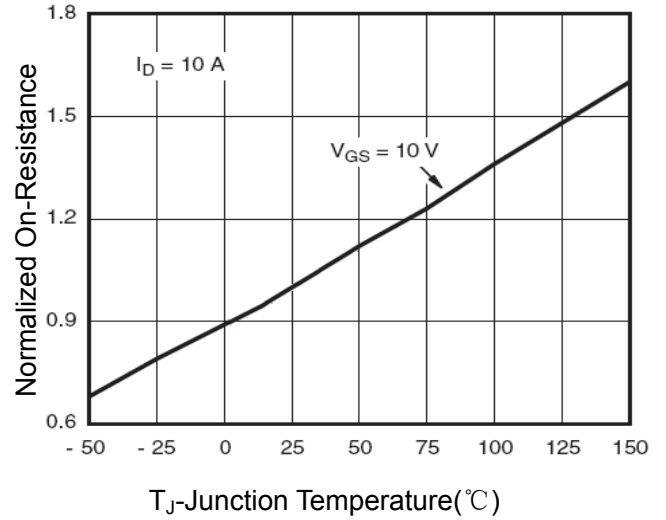


Figure 4  $R_{dson}$ -Junction Temperature

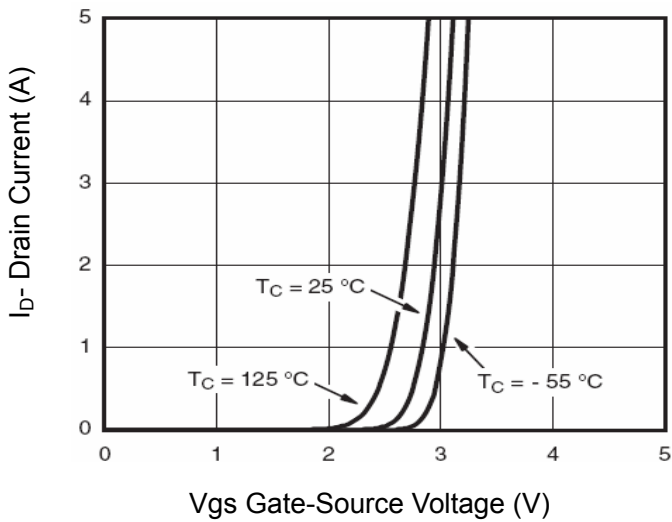


Figure 2 Transfer Characteristics

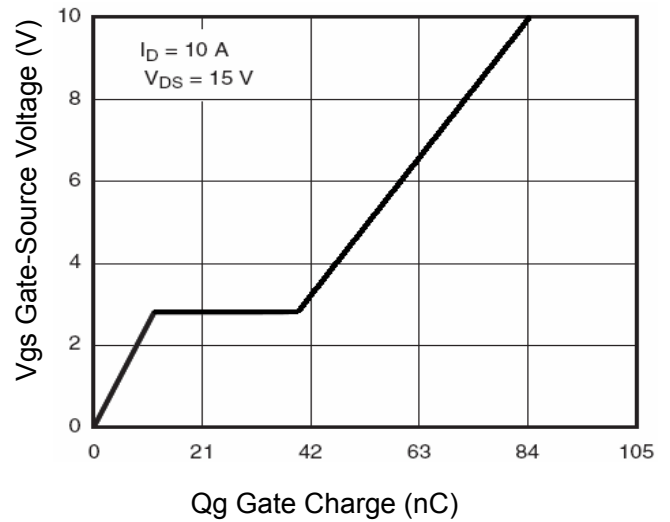


Figure 5 Gate Charge

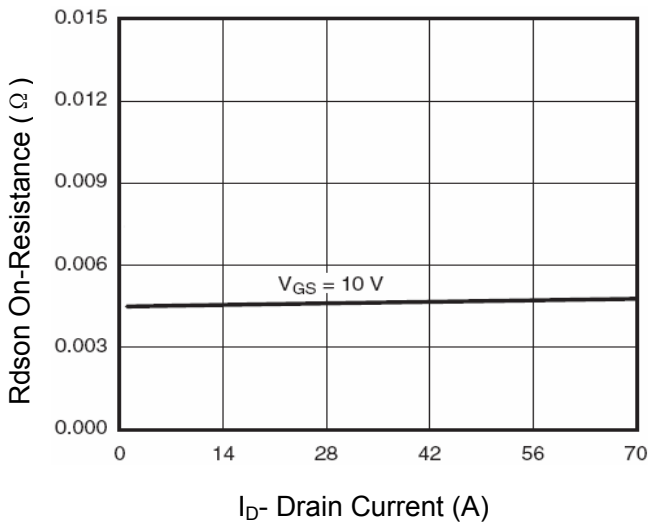


Figure 3  $R_{dson}$ - Drain Current

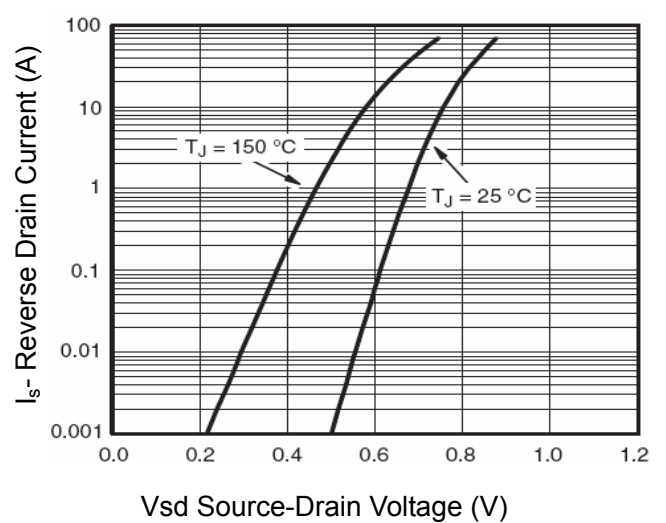


Figure 6 Source- Drain Diode Forward

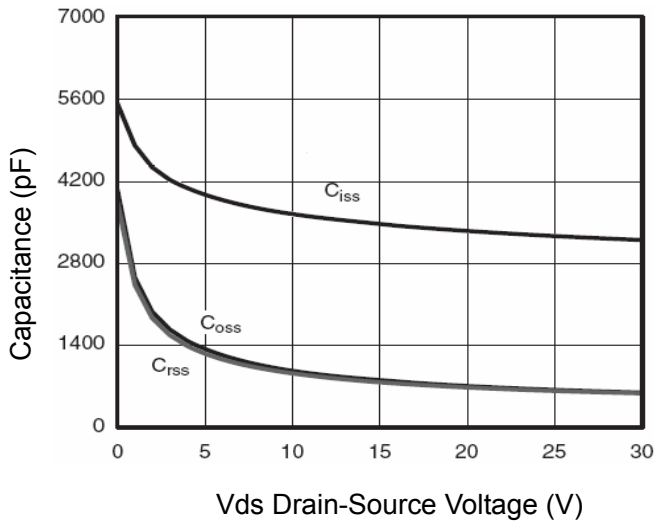


Figure 7 Capacitance vs Vds

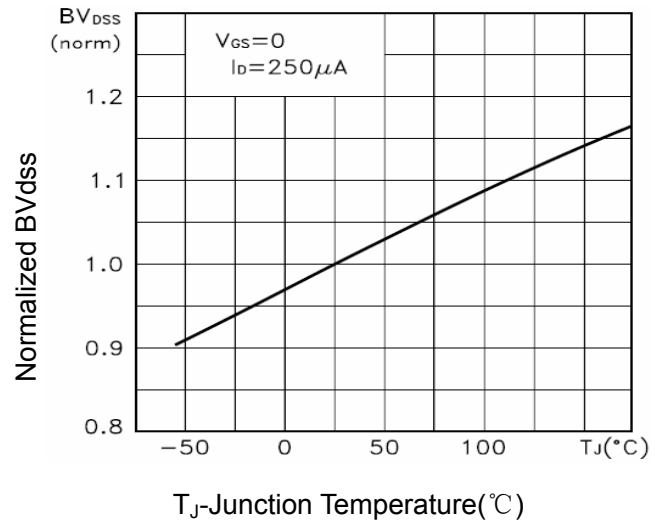


Figure 9  $BV_{DSS}$  vs Junction Temperature

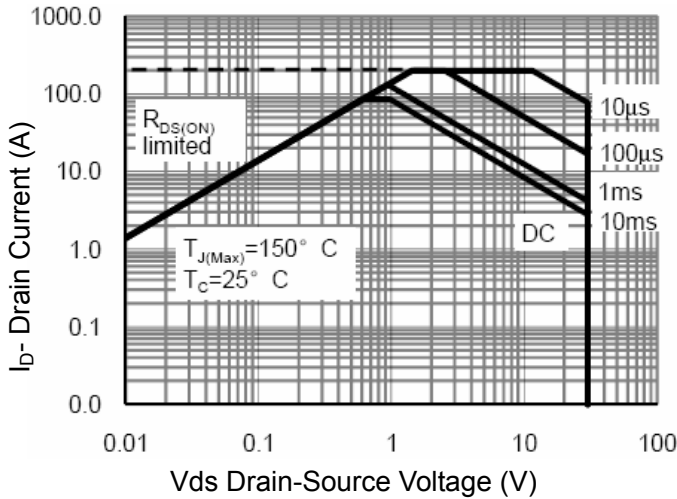


Figure 8 Safe Operation Area

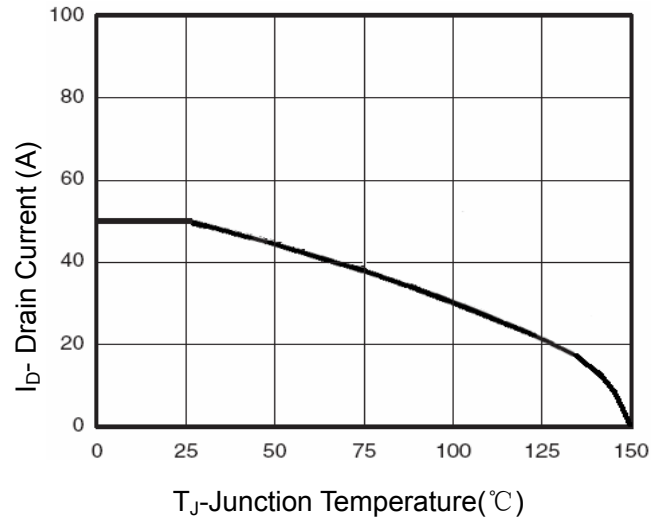


Figure 10  $I_D$  Current Derating vs Junction

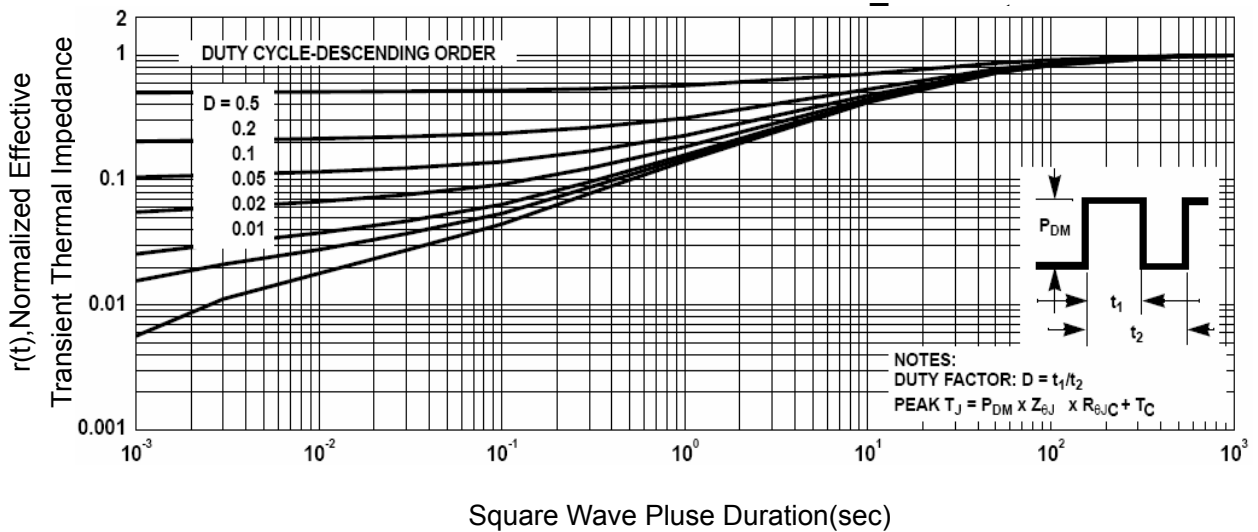
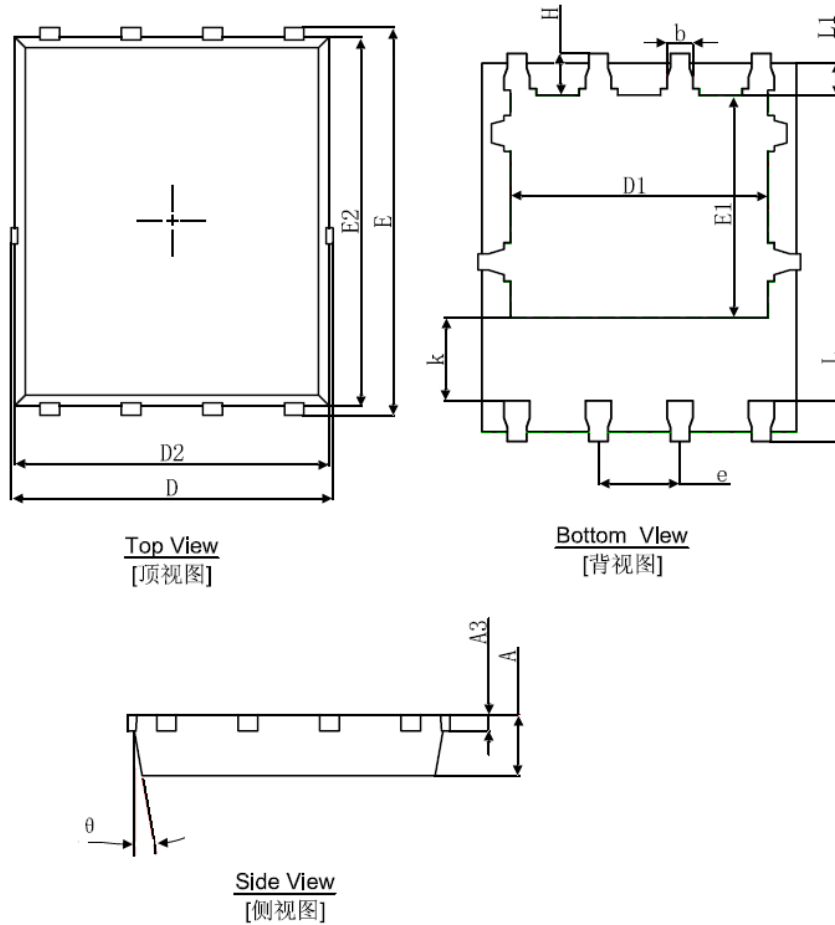


Figure 11 Normalized Maximum Transient Thermal Impedance

**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 |
| $\theta$ | 8°                        | 12°   | 8°                   | 12°   |

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