

## N-Channel Enhancement Mode Power MOSFET

### Description

The HM30N04Q 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

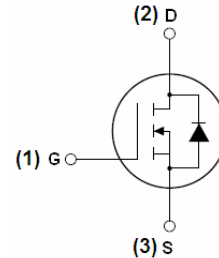
- $V_{DS} = 40V, I_D = 30A$   
 $R_{DS(ON)} = 7.6m\Omega$  (Typ) @  $V_{GS} = 10V$   
 $R_{DS(ON)} = 9.8m\Omega$  (Typ) @  $V_{GS} = 4.5V$
- High density cell design for ultra low  $R_{dson}$
- Fully characterized avalanche voltage and current
- Good stability and uniformity with high  $E_{AS}$
- Excellent package for good heat dissipation
- Special process technology for high ESD capability

### Application

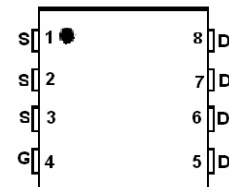
- Load switching
- Hard switched and high frequency circuits
- Uninterruptible power supply

**100% UIS TESTED!**

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



Schematic diagram



DFN3X3-8L top view

### Package Marking and Ordering Information

| Device Marking | Device   | Device Package | Reel Size | Tape width | Quantity |
|----------------|----------|----------------|-----------|------------|----------|
| HM30N04Q       | HM30N04Q | DFN3X3-8L      | -         | -          | -        |

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

| Parameter                                         | Symbol              | Limit      | Unit          |
|---------------------------------------------------|---------------------|------------|---------------|
| Drain-Source Voltage                              | $V_{DS}$            | 40         | V             |
| Gate-Source Voltage                               | $V_{GS}$            | $\pm 20$   | V             |
| Drain Current-Continuous                          | $I_D$               | 30         | A             |
| Drain Current-Continuous( $T_C = 100^\circ C$ )   | $I_D (100^\circ C)$ | 21         | A             |
| Pulsed Drain Current                              | $I_{DM}$            | 100        | A             |
| Maximum Power Dissipation                         | $P_D$               | 65         | W             |
| Derating factor                                   |                     | 0.43       | W/ $^\circ C$ |
| Single pulse avalanche energy <sup>(Note 5)</sup> | $E_{AS}$            | 400        | 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> | $R_{\theta JC}$ | 2.3 | $^{\circ}\text{C/W}$ |
|----------------------------------------------------------|-----------------|-----|----------------------|

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

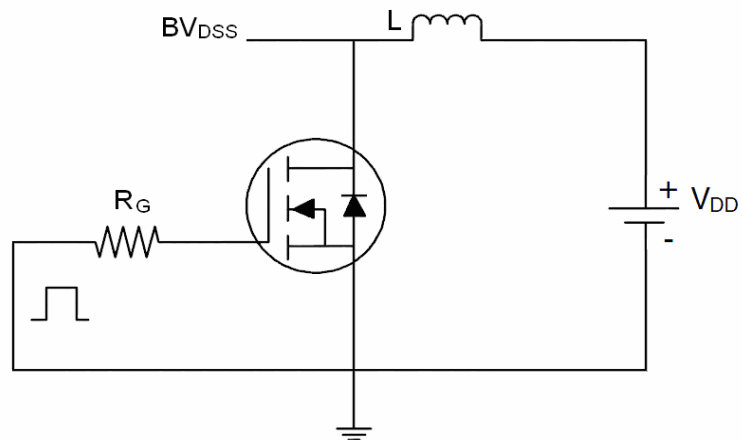
| Parameter                                     | Symbol              | Condition                                                                                             | Min | Typ  | Max  | Unit |
|-----------------------------------------------|---------------------|-------------------------------------------------------------------------------------------------------|-----|------|------|------|
| Off Characteristics                           |                     |                                                                                                       |     |      |      |      |
| Drain-Source Breakdown Voltage                | BV <sub>DSS</sub>   | V <sub>GS</sub> =0V I <sub>D</sub> =250μA                                                             | 40  | 45   | -    | V    |
| Zero Gate Voltage Drain Current               | I <sub>DSS</sub>    | V <sub>DS</sub> =40V,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                                               | 1.2 | 1.8  | 2.4  | V    |
| Drain-Source On-State Resistance              | R <sub>DS(ON)</sub> | V <sub>GS</sub> =10V, I <sub>D</sub> =20A                                                             | -   | 7.6  | 9.9  | mΩ   |
|                                               |                     | V <sub>GS</sub> =4.5V, I <sub>D</sub> =20A                                                            | -   | 9.8  | 14.7 | mΩ   |
| Forward Transconductance                      | g <sub>FS</sub>     | V <sub>DS</sub> =10V,I <sub>D</sub> =20A                                                              | 15  | -    | -    | S    |
| Dynamic Characteristics <sup>(Note4)</sup>    |                     |                                                                                                       |     |      |      |      |
| Input Capacitance                             | C <sub>iss</sub>    | V <sub>DS</sub> =20V,V <sub>GS</sub> =0V,<br>F=1.0MHz                                                 | -   | 1800 | -    | PF   |
| Output Capacitance                            | C <sub>oss</sub>    |                                                                                                       | -   | 280  | -    | PF   |
| Reverse Transfer Capacitance                  | C <sub>rss</sub>    |                                                                                                       | -   | 190  | -    | PF   |
| Switching Characteristics <sup>(Note 4)</sup> |                     |                                                                                                       |     |      |      |      |
| Turn-on Delay Time                            | t <sub>d(on)</sub>  | V <sub>DD</sub> =20V,I <sub>D</sub> =2A,R <sub>L</sub> =1Ω<br>V <sub>GS</sub> =10V,R <sub>G</sub> =3Ω | -   | 6.4  | -    | nS   |
| Turn-on Rise Time                             | t <sub>r</sub>      |                                                                                                       | -   | 17.2 | -    | nS   |
| Turn-Off Delay Time                           | t <sub>d(off)</sub> |                                                                                                       | -   | 29.6 | -    | nS   |
| Turn-Off Fall Time                            | t <sub>f</sub>      |                                                                                                       | -   | 16.8 | -    | nS   |
| Total Gate Charge                             | Q <sub>g</sub>      | V <sub>DS</sub> =20V,I <sub>D</sub> =20A,<br>V <sub>GS</sub> =10V                                     | -   | 29   |      | nC   |
| Gate-Source Charge                            | Q <sub>gs</sub>     |                                                                                                       | -   | 4.5  |      | nC   |
| Gate-Drain Charge                             | Q <sub>gd</sub>     |                                                                                                       | -   | 6.4  |      | 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                                                               | -   |      | 1.2  | V    |
| Diode Forward Current <sup>(Note 2)</sup>     | I <sub>S</sub>      |                                                                                                       | -   | -    | 30   | A    |
| Reverse Recovery Time                         | t <sub>rr</sub>     | T <sub>J</sub> = 25°C, I <sub>F</sub> = 20A<br>di/dt = 100A/μs <sup>(Note3)</sup>                     | -   | 29   | -    | nS   |
| Reverse Recovery Charge                       | Q <sub>rr</sub>     |                                                                                                       | -   | 26   | -    | nC   |
| Forward Turn-On Time                          | t <sub>on</sub>     | Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)                                  |     |      |      |      |

### Notes:

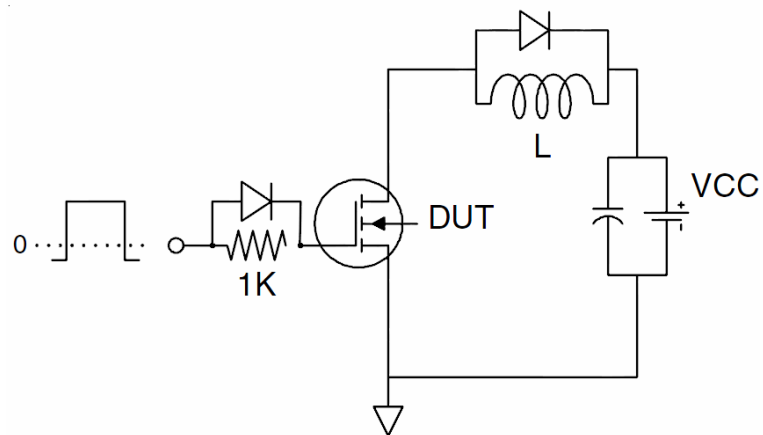
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production
5.  $E_{AS}$  condition :  $T_J=25^{\circ}\text{C}, V_{DD}=20V, V_G=10V, L=1\text{mH}, R_g=25\Omega$ ,

## Test circuit

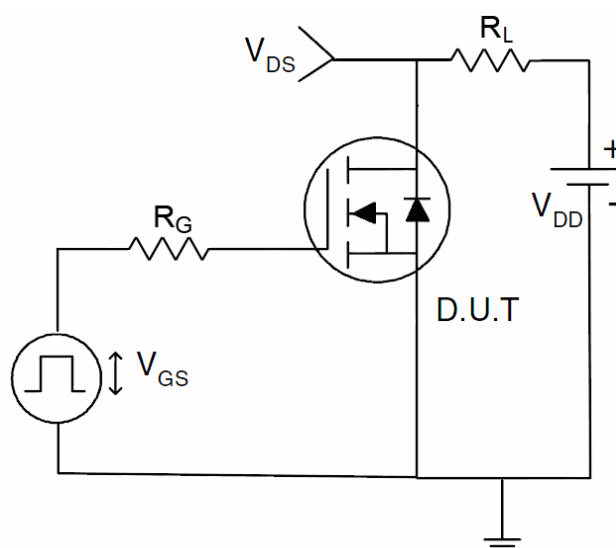
### 1) $E_{AS}$ Test Circuit



### 2) Gate Charge Test Circuit



### 3) Switch Time Test Circuit



# Typical Electrical and Thermal Characteristics (Curves)

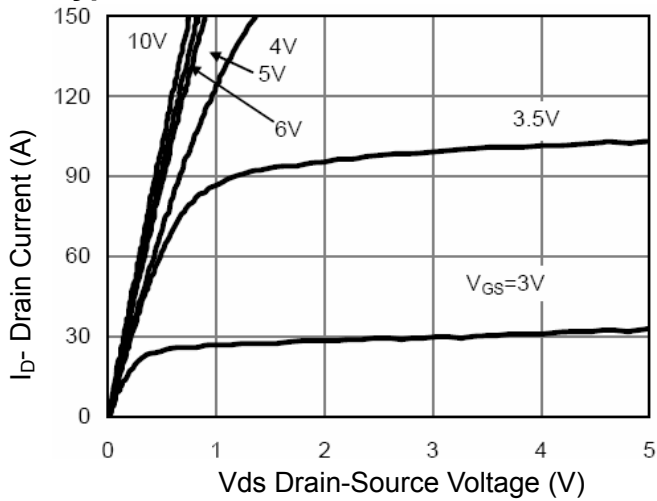


Figure 1 Output Characteristics

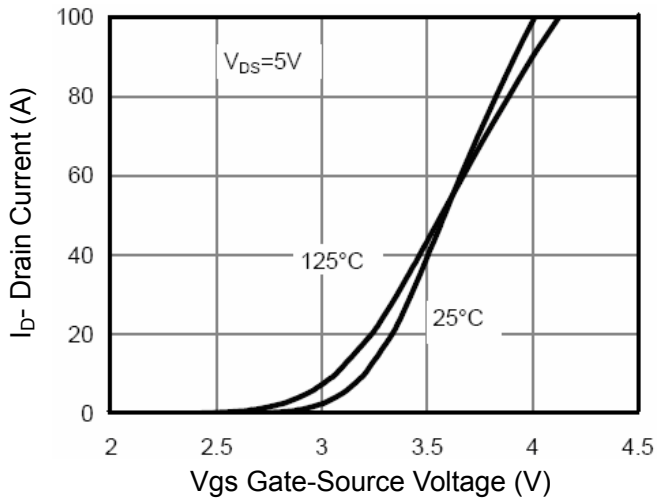


Figure 2 Transfer Characteristics

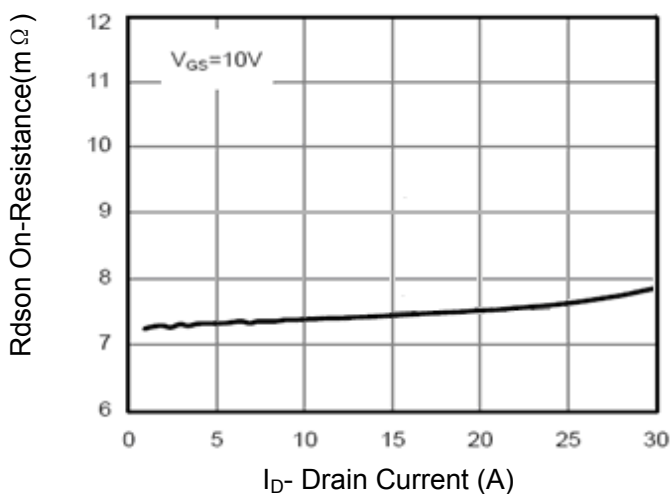


Figure 3  $R_{DS(on)}$ - Drain Current

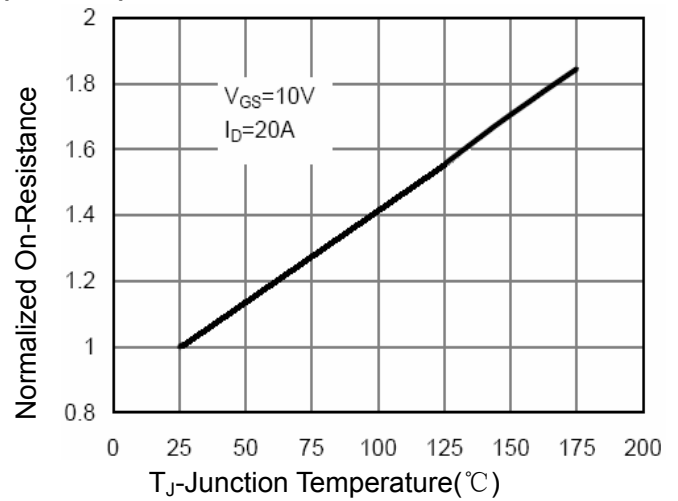


Figure 4  $R_{DS(on)}$ -Junction Temperature

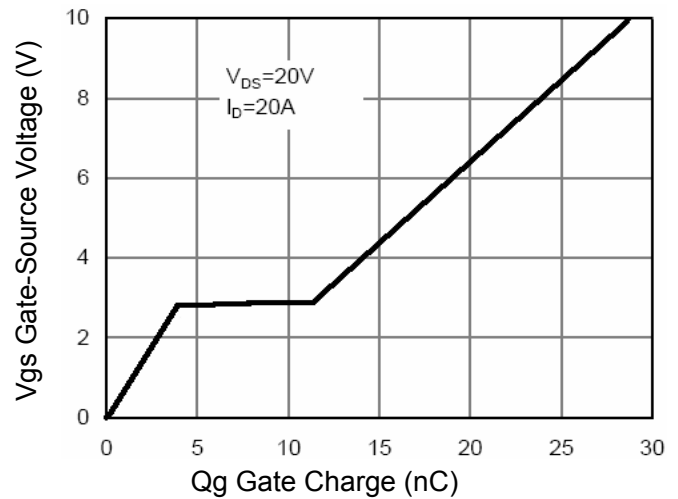


Figure 5 Gate Charge

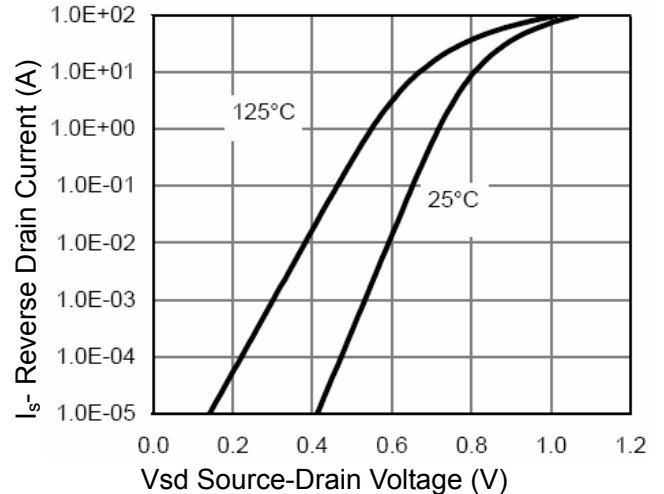


Figure 6 Source- Drain Diode Forward

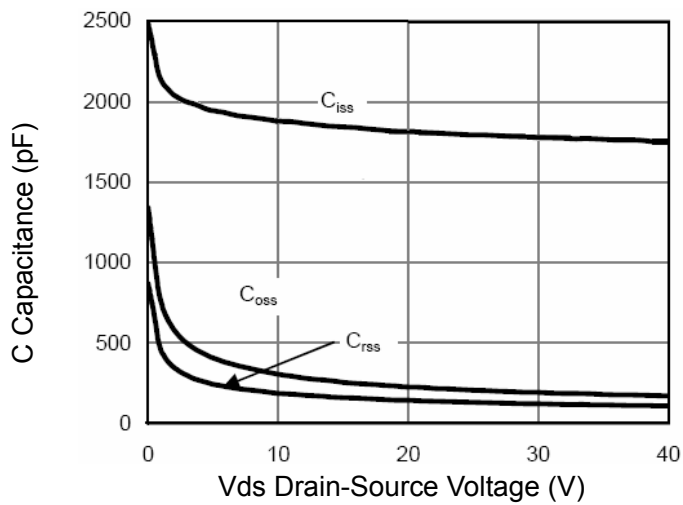


Figure 7 Capacitance vs Vds

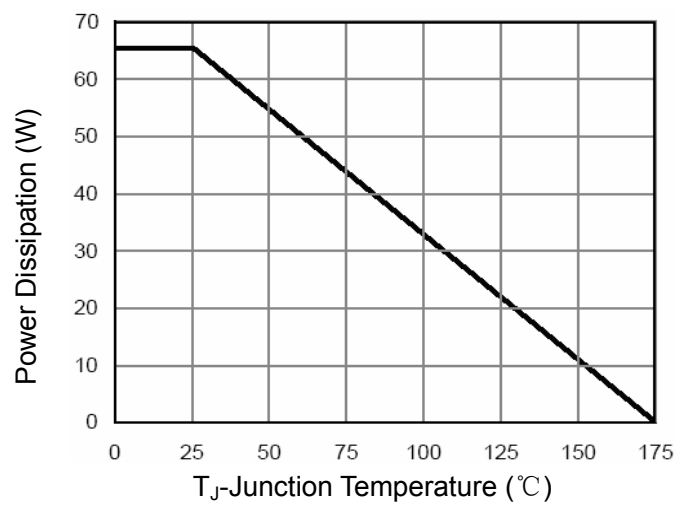


Figure 9 Power De-rating

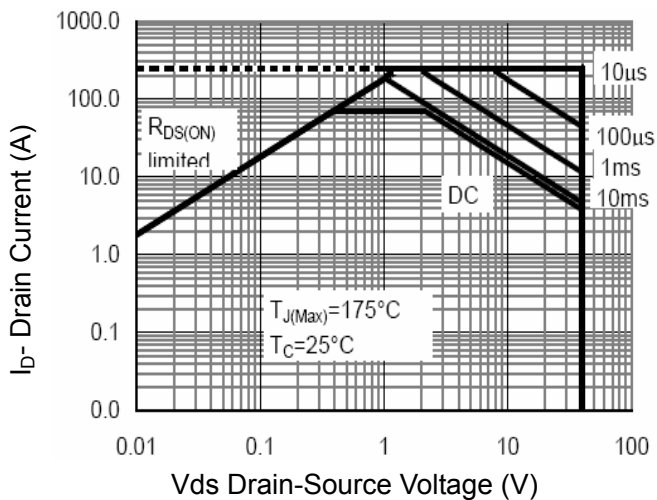


Figure 8 Safe Operation Area

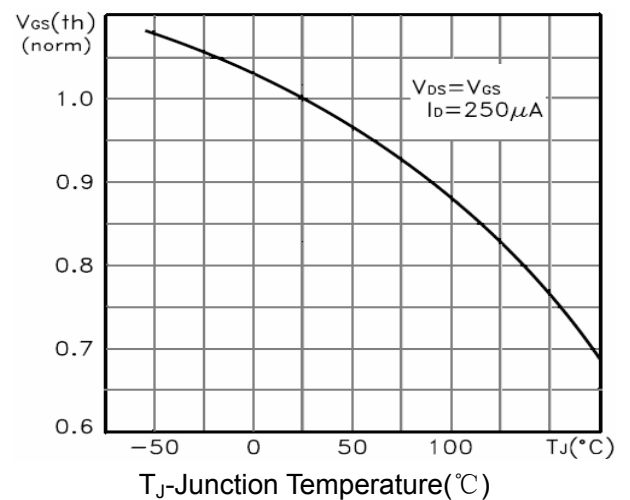


Figure 10  $V_{GS(th)}$  vs Junction Temperature

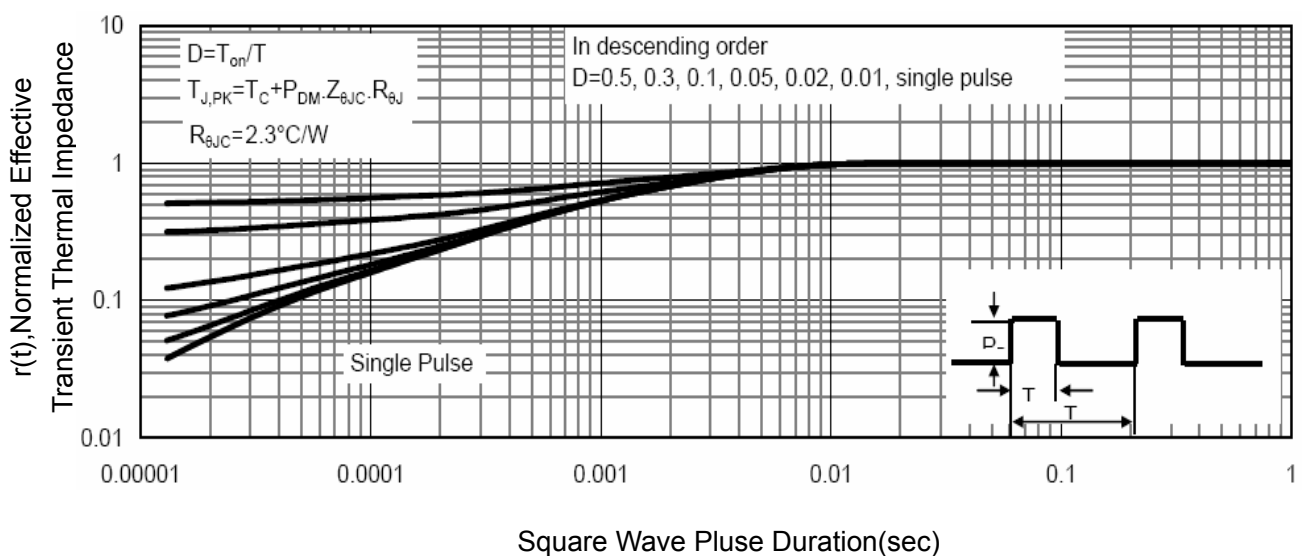
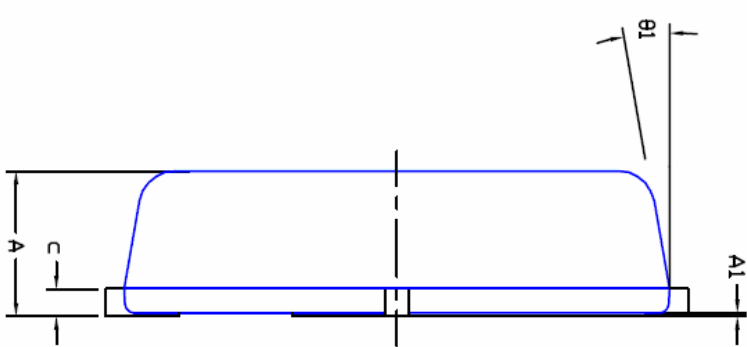
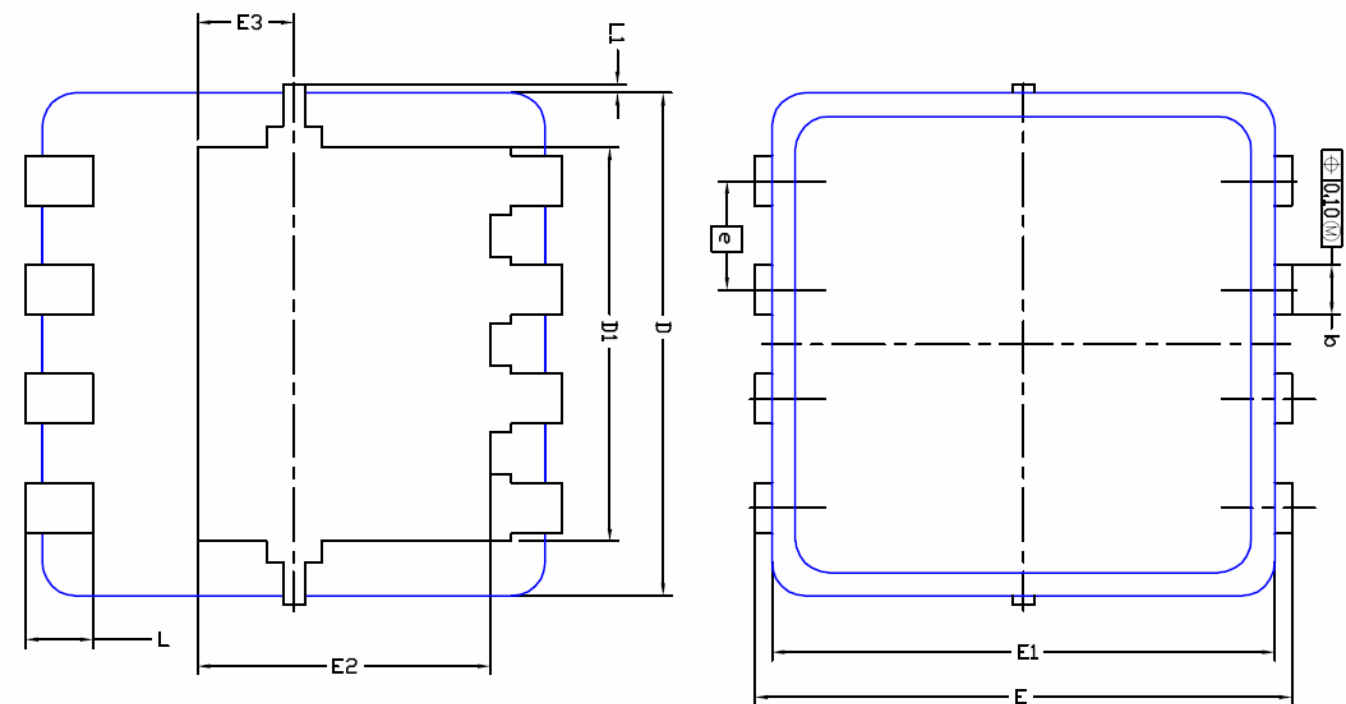


Figure 11 Normalized Maximum Transient Thermal Impedance

DFN3X3 EP Package Information



| DIM. | MILLIMETERS |       |       | INCHES    |        |        |
|------|-------------|-------|-------|-----------|--------|--------|
|      | MIN         | NOM   | MAX   | MIN       | NOM    | MAX    |
| A    | 0.700       | 0.80  | 0.900 | 0.0276    | 0.0315 | 0.0354 |
| A1   | 0.00        | ---   | 0.05  | 0.000     | ---    | 0.002  |
| b    | 0.24        | 0.30  | 0.35  | 0.009     | 0.012  | 0.014  |
| c    | 0.10        | 0.152 | 0.25  | 0.004     | 0.006  | 0.010  |
| D    | 3.00 BSC    |       |       | 0.118 BSC |        |        |
| D1   | 2.35 BSC    |       |       | 0.093 BSC |        |        |
| E    | 3.20 BSC    |       |       | 0.126 BSC |        |        |
| E1   | 3.00 BSC    |       |       | 0.118 BSC |        |        |
| E2   | 1.75 BSC    |       |       | 0.069 BSC |        |        |
| E3   | 0.575 BSC   |       |       | 0.023 BSC |        |        |
| e    | 0.65 BSC    |       |       | 0.026 BSC |        |        |
| L    | 0.30        | 0.40  | 0.50  | 0.0118    | 0.0157 | 0.0197 |
| L1   | 0           | ---   | 0.100 | 0         | ---    | 0.004  |
| θ1   | 0°          | 10°   | 12°   | 0°        | 10°    | 12°    |