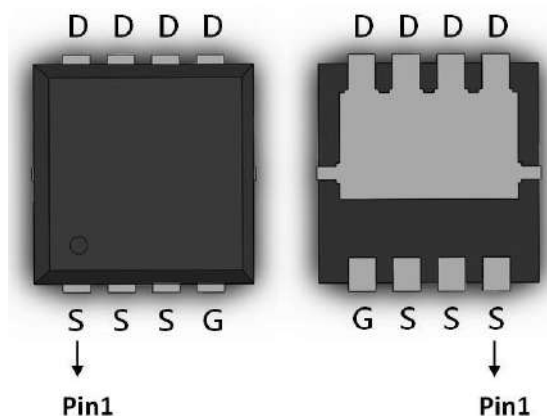


## N-Channel Enhancement Mode Power MOSFET

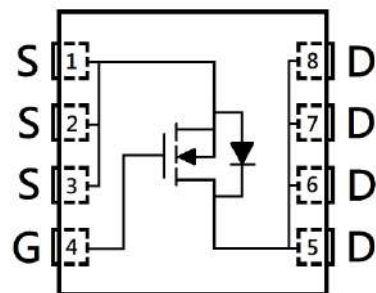
### Features:

- Low Gate Charge
- Fast Switching Characteristic

DFN3×3



|                                                  |             |
|--------------------------------------------------|-------------|
| $BV_{DSS}$                                       | 40V         |
| $I_D @ V_{GS}=10V, T_C=25^\circ C$               | 17A         |
| $I_D @ V_{GS}=10V, T_A=25^\circ C$               | 10A         |
| $R_{DS(ON)} \text{ typ. @ } V_{GS}=10V, I_D=10A$ | 6m $\Omega$ |
| $R_{DS(ON)} \text{ typ. @ } V_{GS}=4.5V, I_D=8A$ | 9m $\Omega$ |



G : Gate S : Source D : Drain

### Ordering Information

| Device      | Package                                                   | Shipping               |
|-------------|-----------------------------------------------------------|------------------------|
| KSPB6D2N04R | DFN3×3<br>(Pb-free lead plating and halogen-free package) | 3000 pcs / Tape & Reel |

## Absolute Maximum Ratings (T<sub>A</sub>=25°C)

| Parameter                                                                                |                          | Symbol                            | Limits          | Unit |    |
|------------------------------------------------------------------------------------------|--------------------------|-----------------------------------|-----------------|------|----|
| Drain-Source Voltage                                                                     |                          | V <sub>DS</sub>                   | 40              | V    |    |
| Gate-Source Voltage                                                                      |                          | V <sub>GS</sub>                   | ±20             |      |    |
| Continuous Drain Current @ V <sub>GS</sub> =10V, T <sub>C</sub> =25°C (silicon limit) *a |                          | I <sub>D</sub>                    | 29              | A    |    |
| Continuous Drain Current @ V <sub>GS</sub> =10V, T <sub>C</sub> =25°C (package limit) *a |                          |                                   | 17              |      |    |
| Continuous Drain Current @ V <sub>GS</sub> =10V, T <sub>C</sub> =100°C *a                |                          |                                   | 17              |      |    |
| Continuous Drain Current @ V <sub>GS</sub> =10V, T <sub>A</sub> =25°C *b                 |                          |                                   | 10              |      |    |
| Continuous Drain Current @ V <sub>GS</sub> =10V, T <sub>A</sub> =70°C *b                 |                          |                                   | 8               |      |    |
| Pulsed Drain Current *c                                                                  |                          |                                   | I <sub>DM</sub> |      | 68 |
| Continuous Body Diode Forward Current @ T <sub>C</sub> =25°C *a                          |                          | I <sub>S</sub>                    | 12.5            |      | mJ |
| Pulsed Body Diode Forward Current @ T <sub>C</sub> =25°C *a                              |                          | I <sub>SM</sub>                   | 68              |      |    |
| Avalanche Current @ L=0.1mH                                                              |                          | I <sub>AS</sub>                   | 15              |      |    |
| Avalanche Energy @ L=0.5mH                                                               |                          | E <sub>AS</sub>                   | 16              | W    |    |
| Total Power Dissipation                                                                  | T <sub>C</sub> =25°C *a  | P <sub>D</sub>                    | 15              |      |    |
|                                                                                          | T <sub>C</sub> =100°C *a |                                   | 6               |      |    |
|                                                                                          | T <sub>A</sub> =25°C *b  |                                   | 1.7             |      |    |
|                                                                                          | T <sub>A</sub> =70°C *b  |                                   | 1.1             |      |    |
| Operating Junction and Storage Temperature Range                                         |                          | T <sub>J</sub> , T <sub>stg</sub> | -55~+150        | °C   |    |

## Thermal Data

| Parameter                                  | Symbol           | Steady State | Unit |
|--------------------------------------------|------------------|--------------|------|
| Thermal Resistance, Junction-to-case       | R <sub>θJC</sub> | 8.4          | °C/W |
| Thermal Resistance, Junction-to-ambient *b | R <sub>θJA</sub> | 72           |      |

Note:

- \*a. The power dissipation P<sub>D</sub> is based on T<sub>J(MAX)</sub>=150°C, using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heatsinking is used.
- \*b. The value of R<sub>θJA</sub> is measured with the device mounted on 1 in<sup>2</sup> FR -4 board with 2 oz. copper, in a still air environment with T<sub>A</sub>=25°C. The power dissipation P<sub>D</sub> is based on R<sub>θJA</sub> and the maximum allowed junction temperature of 150°C. The value in any given application depends on the user's specific board design.
- \*c. Repetitive rating, pulse width limited by junction temperature T<sub>J(MAX)</sub>=150°C. Ratings are based on low frequency and low duty cycles to keep initial T<sub>J</sub>=25°C.

## Electrical Characteristics (T<sub>A</sub>=25°C, unless otherwise specified)

| Symbol                    | Min. | Typ. | Max. | Unit | Test Conditions                                                                      |
|---------------------------|------|------|------|------|--------------------------------------------------------------------------------------|
| Static                    |      |      |      |      |                                                                                      |
| BV <sub>DSS</sub>         | 40   | -    | -    | V    | V <sub>GS</sub> =0V, I <sub>D</sub> =250μA                                           |
| V <sub>GS(th)</sub>       | 1    | -    | 2.5  |      | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA                             |
| G <sub>FS</sub>           | -    | 19   | -    | S    | V <sub>DS</sub> =5V, I <sub>D</sub> =10A                                             |
| I <sub>GSS</sub>          | -    | -    | ±100 | nA   | V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V                                           |
| I <sub>DSS</sub>          | -    | -    | 1    | μA   | V <sub>DS</sub> =32V, V <sub>GS</sub> =0V                                            |
| R <sub>DS(ON)</sub>       | -    | 6    | 7.8  | mΩ   | V <sub>GS</sub> =10V, I <sub>D</sub> =10A                                            |
|                           | -    | 9    | 12.5 |      | V <sub>GS</sub> =4.5V, I <sub>D</sub> =8A                                            |
| Dynamic                   |      |      |      |      |                                                                                      |
| C <sub>iss</sub>          | -    | 750  | -    | pF   | V <sub>DS</sub> =20V, V <sub>GS</sub> =0V, f=1MHz                                    |
| C <sub>oss</sub>          | -    | 370  | -    |      |                                                                                      |
| C <sub>rss</sub>          | -    | 37   | -    |      |                                                                                      |
| R <sub>g</sub>            | -    | 0.7  | -    | Ω    | f=1MHz                                                                               |
| Q <sub>g</sub> *1, 2      | -    | 6.6  | -    | nC   | V <sub>DS</sub> =20V, I <sub>D</sub> =10A, V <sub>GS</sub> =4.5V                     |
| Q <sub>g</sub> *1, 2      | -    | 14   | -    |      | V <sub>DS</sub> =20V, I <sub>D</sub> =10A, V <sub>GS</sub> =10V                      |
| Q <sub>gs</sub> *1, 2     | -    | 2.8  | -    |      |                                                                                      |
| Q <sub>gd</sub> *1, 2     | -    | 2.5  | -    |      |                                                                                      |
| t <sub>d(ON)</sub> *1, 2  | -    | 9    | -    | ns   | V <sub>DS</sub> =20V, I <sub>D</sub> =10A, V <sub>GS</sub> =10V, R <sub>GS</sub> =1Ω |
| t <sub>r</sub> *1, 2      | -    | 13   | -    |      |                                                                                      |
| t <sub>d(OFF)</sub> *1, 2 | -    | 25   | -    |      |                                                                                      |
| t <sub>f</sub> *1, 2      | -    | 6.2  | -    |      |                                                                                      |
| Source-Drain Diode        |      |      |      |      |                                                                                      |
| V <sub>SD</sub> *1        | -    | 0.83 | 1.2  | V    | I <sub>S</sub> =10A, V <sub>GS</sub> =0V                                             |
| t <sub>rr</sub>           | -    | 15   | -    | ns   | I <sub>F</sub> =10A, dI <sub>F</sub> /dt=100A/μs                                     |
| Q <sub>rr</sub>           | -    | 5    | -    | nC   |                                                                                      |

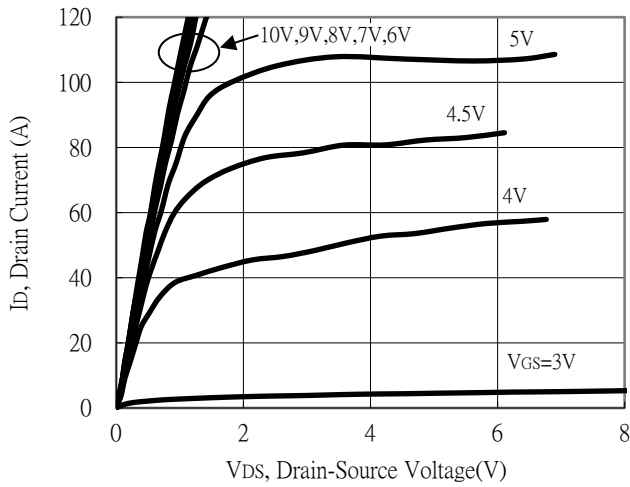
Note:

\*1. Pulse Test : Pulse Width ≤300μs, Duty Cycle≤2%

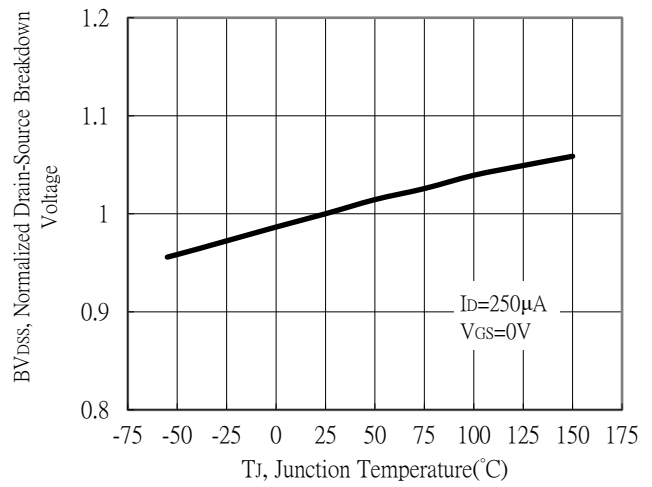
\*2. Independent of operating temperature

## Typical Characteristics

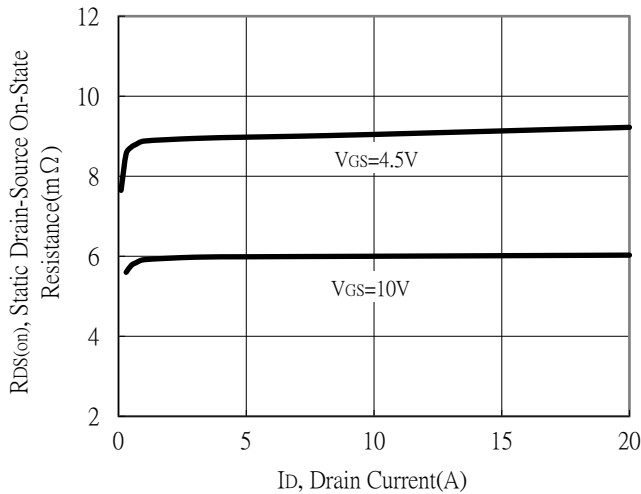
Typical Output Characteristics



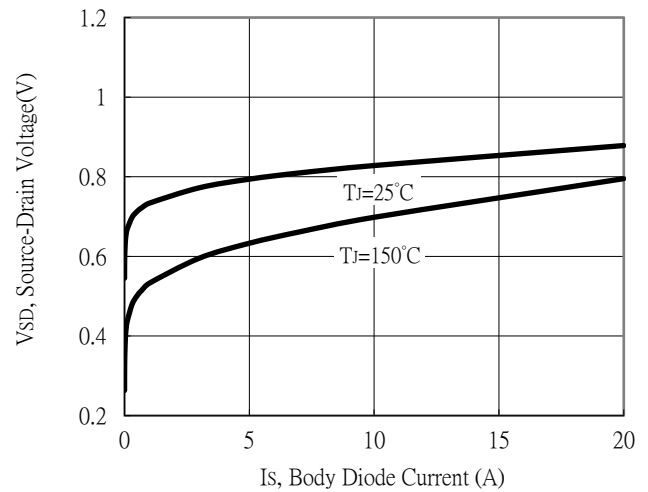
Breakdown Voltage vs Ambient Temperature



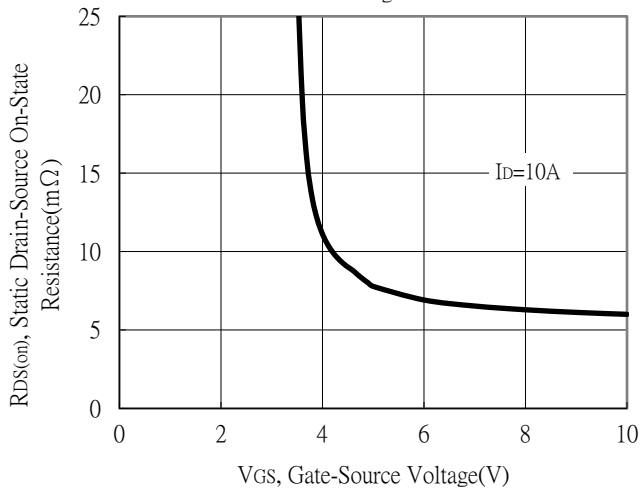
Static Drain-Source On-State resistance vs Drain Current



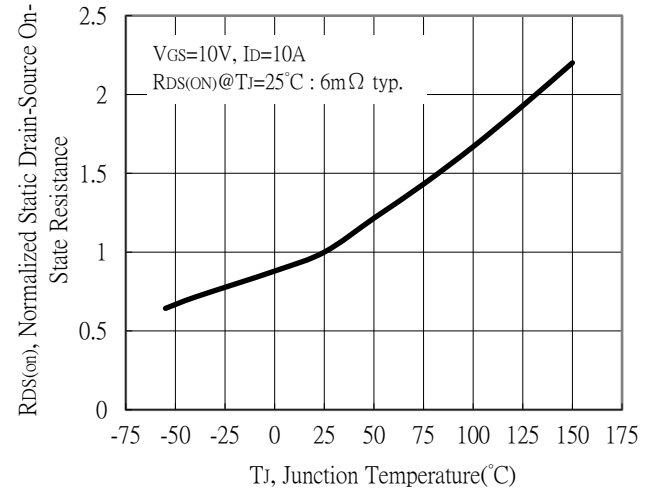
Body Diode Current vs Source-Drain Voltage



Static Drain-Source On-State Resistance vs Gate-Source Voltage

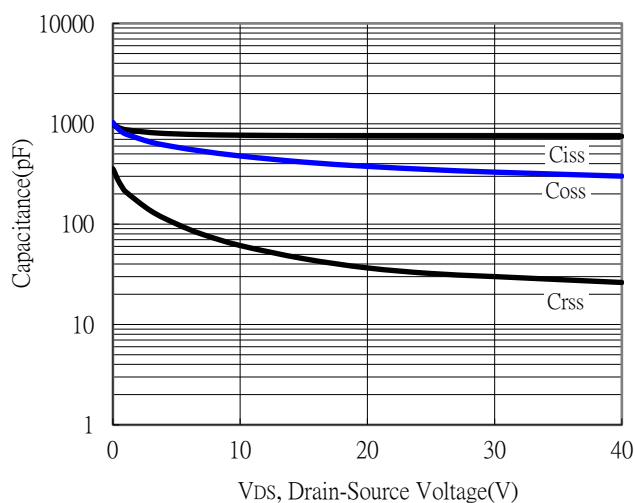


Drain-Source On-State Resistance vs Junction Temperature

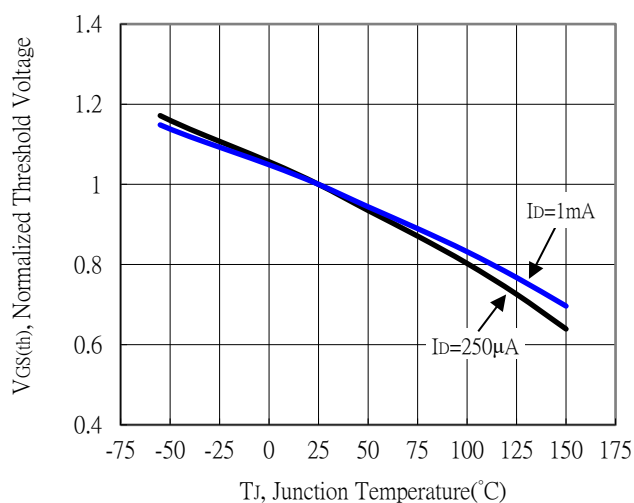


## Typical Characteristics (Cont.)

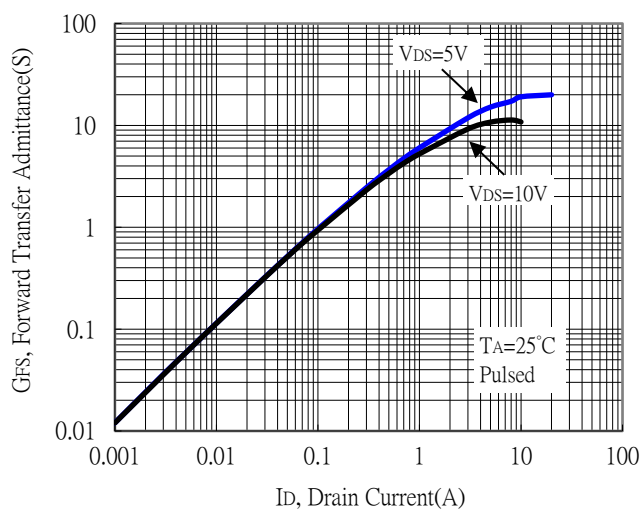
Capacitance vs Drain-to-Source Voltage



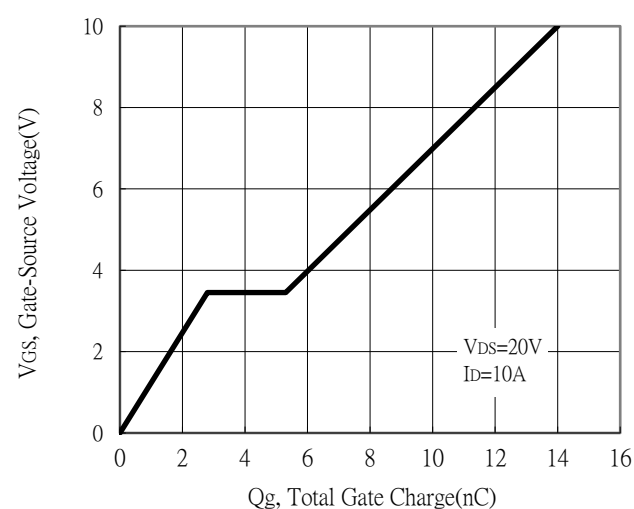
Threshold Voltage vs Junction Temperature



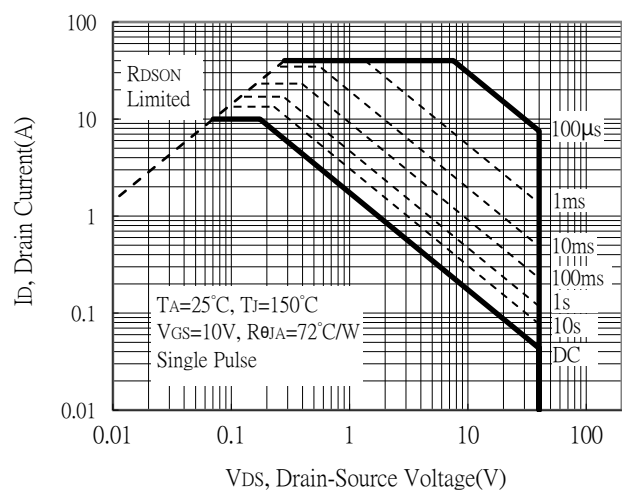
Forward Transfer Admittance vs Drain Current



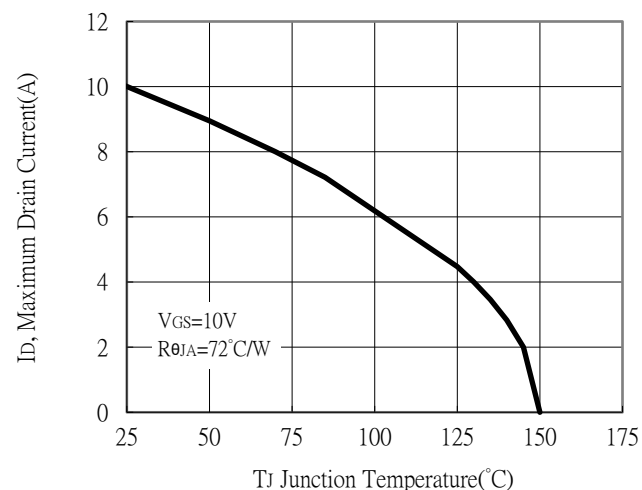
Gate Charge Characteristics



Maximum Safe Operating Area

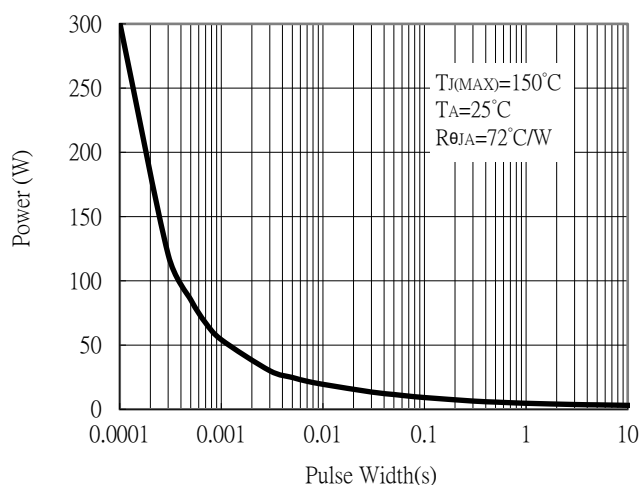


Maximum Drain Current vs Junction Temperature

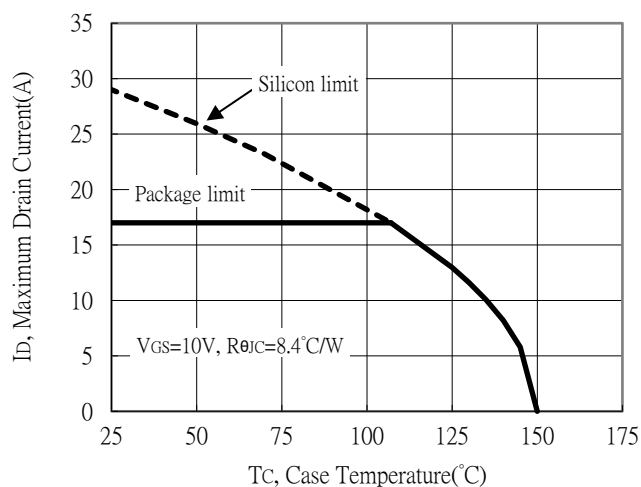


## Typical Characteristics (Cont.)

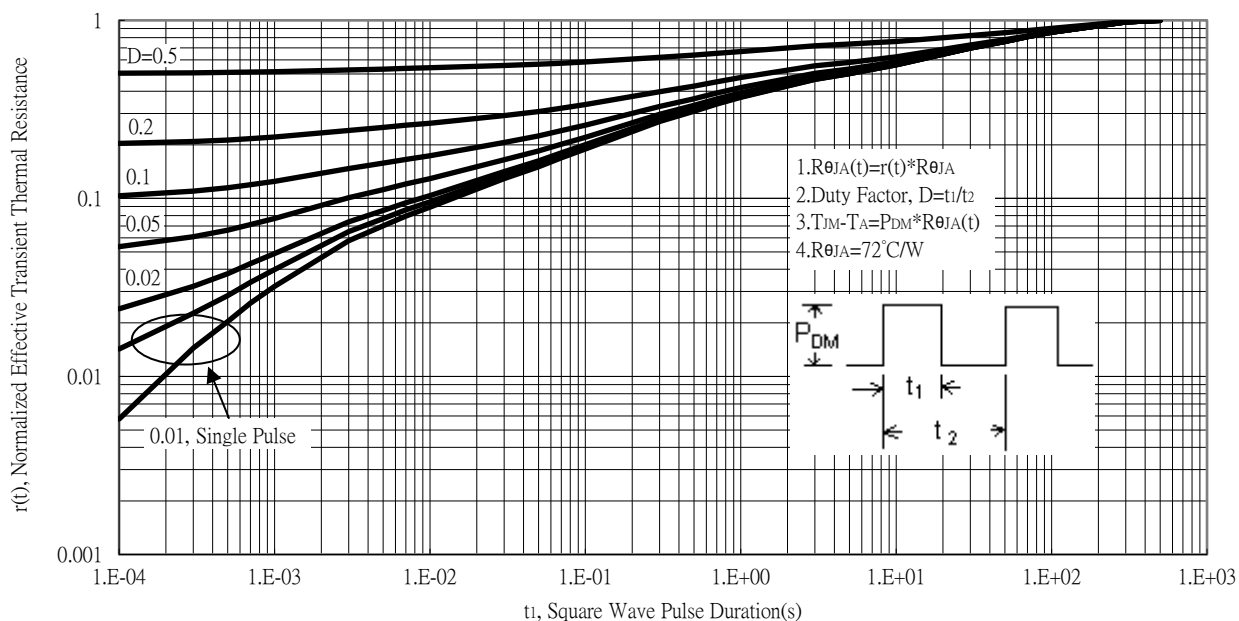
Single Pulse Power Rating, Junction to Ambient



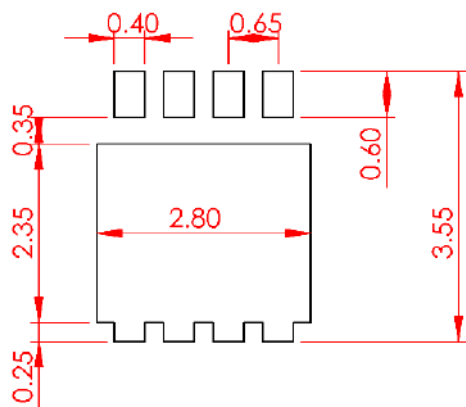
Maximum Drain Current vs Case Temperature



Transient Thermal Response Curves

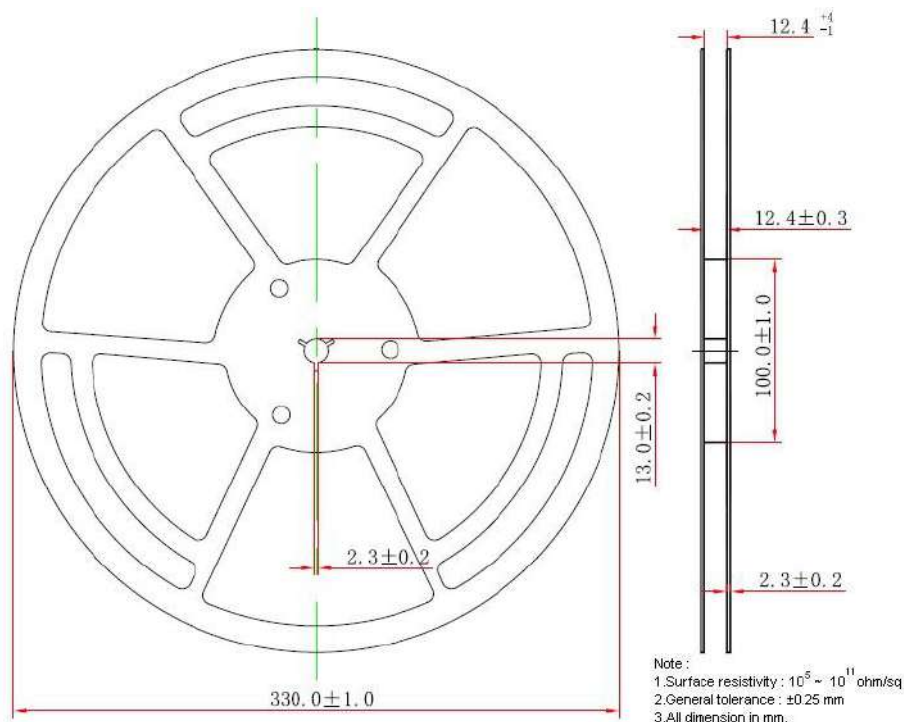


## Recommended Soldering Footprint

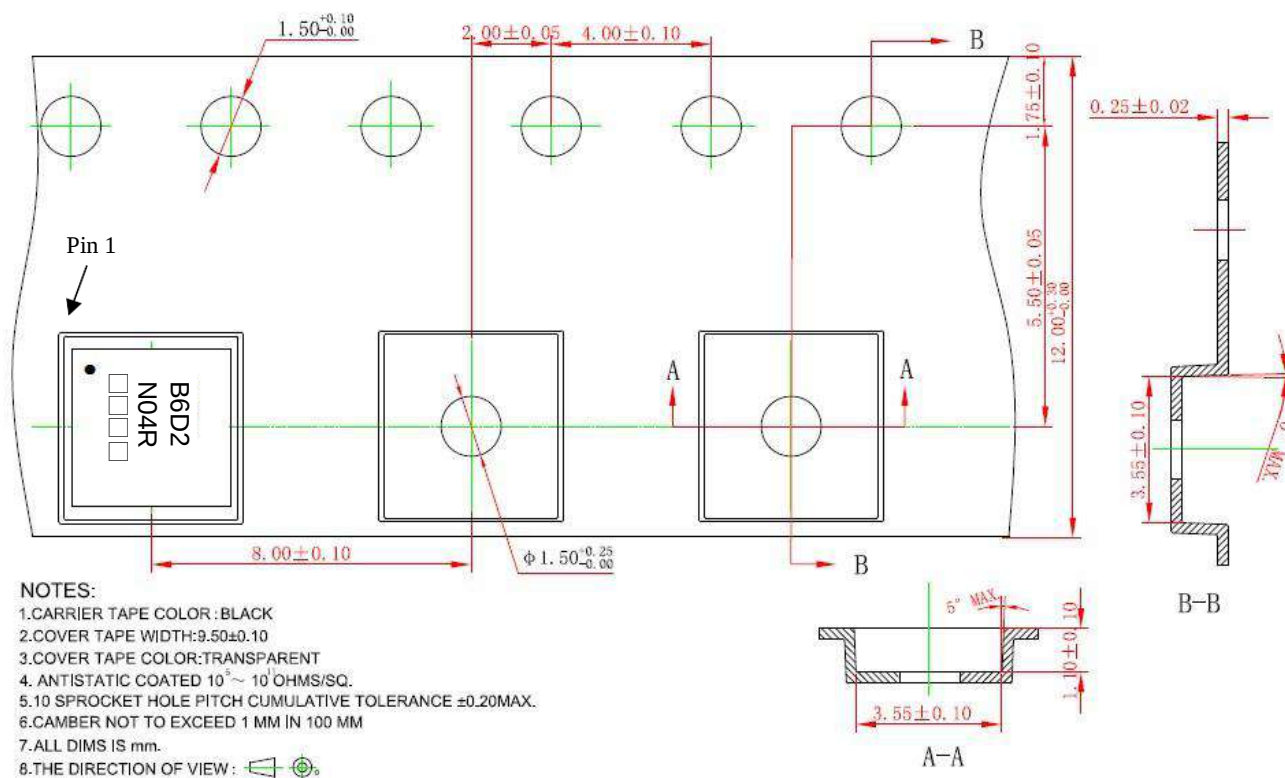


Unit : mm

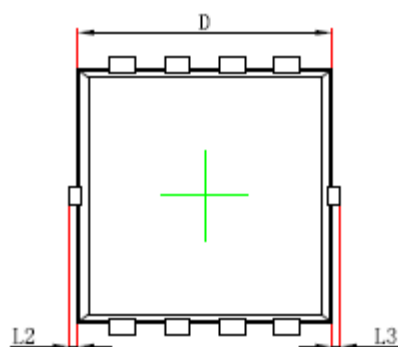
## Reel Dimension



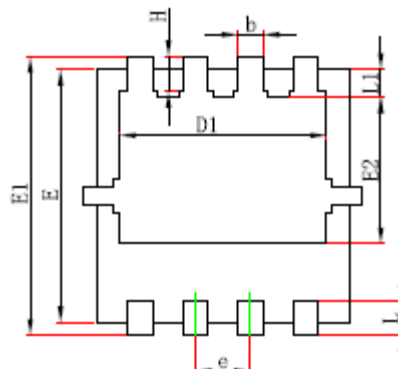
## Carrier Tape Dimension



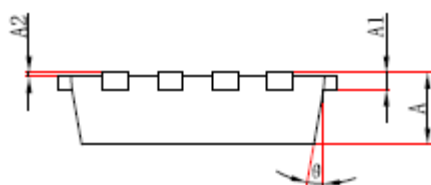
## DFN3x3 Dimension (C forming)



Top View



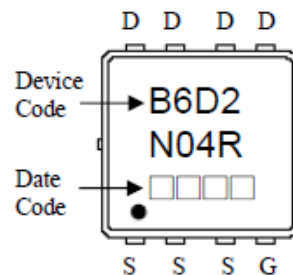
Bottom View



Side View

8-Lead DFN3x3 Plastic Package

Marking:



Date Code(counting from left to right) :

1<sup>st</sup> code: year code, the last digit of Christian year

2<sup>nd</sup> code : month code, Jan→A, Feb→B, Mar→C,

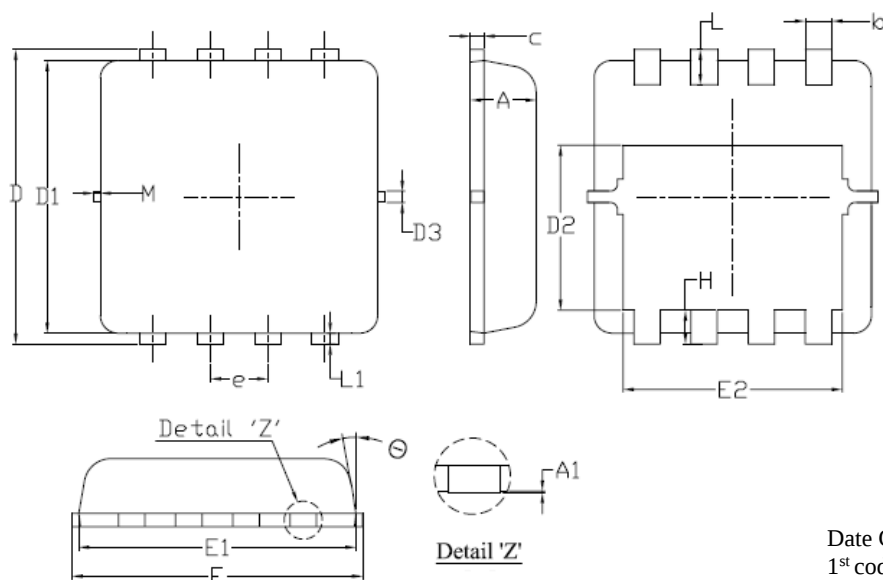
Apr→D, May→E, Jun→F, Jul→G, Aug→H,

Sep→J, Oct→K, Nov→L, Dec→M

3<sup>rd</sup> and 4<sup>th</sup> codes : production serial number, 01~99

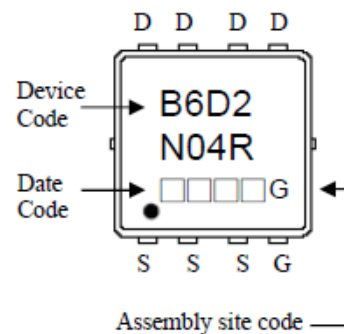
| DIM | Inches |       | Millimeters |       | DIM | Inches |       | Millimeters |       |
|-----|--------|-------|-------------|-------|-----|--------|-------|-------------|-------|
|     | Min.   | Max.  | Min.        | Max.  |     | Min.   | Max.  | Min.        | Max.  |
| A   | 0.026  | 0.033 | 0.650       | 0.850 | e   | 0.022  | 0.030 | 0.550       | 0.750 |
| A1  | 0.006  | REF   | 0.152       | REF   | L   | 0.012  | 0.020 | 0.300       | 0.500 |
| A2  | 0.000  | 0.002 | 0.000       | 0.050 | L1  | 0.007  | 0.019 | 0.180       | 0.480 |
| D   | 0.114  | 0.122 | 2.900       | 3.100 | L2  | 0.000  | 0.004 | 0.000       | 0.100 |
| D1  | 0.091  | 0.102 | 2.300       | 2.600 | L3  | 0.000  | 0.004 | 0.000       | 0.100 |
| E   | 0.114  | 0.122 | 2.900       | 3.100 | H   | 0.012  | 0.020 | 0.315       | 0.515 |
| E1  | 0.124  | 0.136 | 3.150       | 3.450 | θ   | 9°     | 13°   | 9°          | 13°   |
| E2  | 0.060  | 0.076 | 1.535       | 1.935 |     |        |       |             |       |
| b   | 0.008  | 0.016 | 0.200       | 0.400 |     |        |       |             |       |

## DFN3x3 Dimension (G forming)



8-Lead DFN3x3 Plastic Package

Marking:



Date Code(counting from left to right) :

- 1<sup>st</sup> code: year code, the last digit of Christian year  
 2<sup>nd</sup> code : month code, Jan→A, Feb→B, Mar→C,  
 Apr→D, May→E, Jun→F, Jul→G, Aug→H,  
 Sep→J, Oct→K, Nov→L, Dec→M  
 3<sup>rd</sup> and 4<sup>th</sup> codes : production serial number, 01~99

| DIM | Millimeters |      | Inches |       | DIM | Millimeters |      | Inches |       |
|-----|-------------|------|--------|-------|-----|-------------|------|--------|-------|
|     | Min.        | Max. | Min.   | Max.  |     | Min.        | Max. | Min.   | Max.  |
| A   | 0.70        | 0.80 | 0.028  | 0.031 | E2  | 2.39        | 2.59 | 0.094  | 0.102 |
| A1  | 0.00        | 0.05 | 0.000  | 0.002 | e   | 0.65        | BSC  | 0.026  | BSC   |
| b   | 0.25        | 0.35 | 0.010  | 0.014 | H   | 0.30        | 0.50 | 0.012  | 0.020 |
| c   | 0.10        | 0.25 | 0.004  | 0.010 | L   | 0.30        | 0.50 | 0.012  | 0.020 |
| D   | 3.25        | 3.45 | 0.128  | 0.136 | L1  | 0.13        | TYP  | 0.005  | TYP   |
| D1  | 3.00        | 3.20 | 0.118  | 0.126 | θ   | -           | 12°  | -      | 12°   |
| D2  | 1.78        | 1.98 | 0.070  | 0.077 | M   | -           | 0.15 | -      | 0.006 |
| D3  | 0.13        | TYP  | 0.005  | TYP   |     |             |      |        |       |
| E   | 3.00        | 3.40 | 0.118  | 0.134 |     |             |      |        |       |
| E1  | 3.00        | 3.20 | 0.118  | 0.126 |     |             |      |        |       |