

**N-Channel Enhancement Mode Power MOSFET**

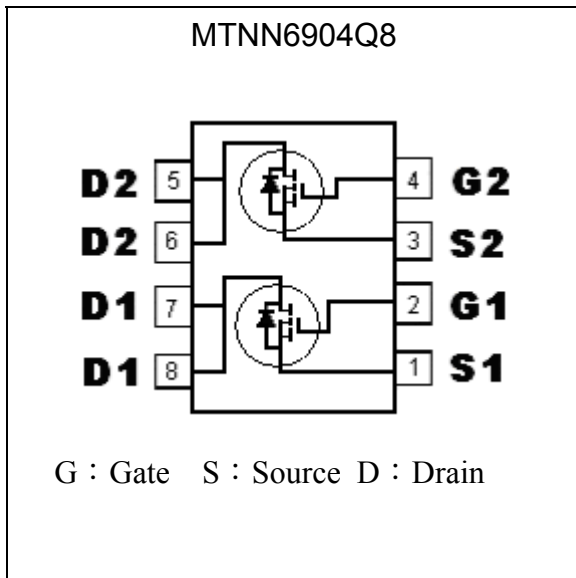
# MTNN6904Q8

|                                   | FET1           | FET 2         |
|-----------------------------------|----------------|---------------|
| $BV_{DSS}$                        | 40V            | 40V           |
| $I_D@T_A=25^{\circ}C, V_{GS}=10V$ | 8.7A           | 10.3A         |
| $R_{DSON(TYP.)}@V_{GS}=10V$       | 11.7m $\Omega$ | 7.4m $\Omega$ |
| $R_{DSON(TYP.)}@V_{GS}=4.5V$      | 15.5m $\Omega$ | 9.2m $\Omega$ |

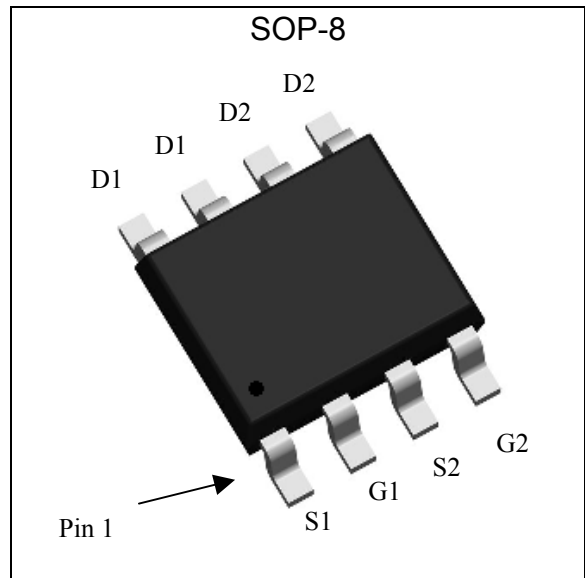
**Features**

- Simple drive requirement
- Low on-resistance
- Fast switching speed
- Two N-ch MOSFETs in a package
- Pb-free lead plating package

**Equivalent Circuit**

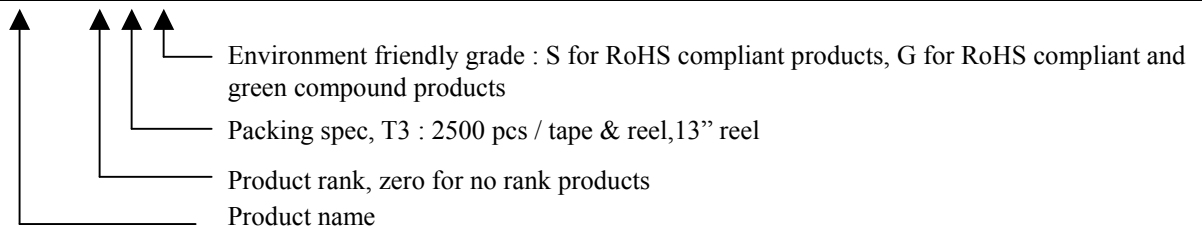


**Outline**



**Ordering Information**

| Device            | Package  | Shipping               |
|-------------------|--|------------------------|
| MTNN6904Q8-0-T3-G | SOP-8<br>(Pb-free lead plating & halogen-free package) | 2500 pcs / Tape & Reel |





**Absolute Maximum Ratings (Ta=25°C)**

| Parameter  | Symbol                            | Limits   |        | Unit   |
|--|-----------------------------------|----------|--------|--------|
|  |                                   | N-CH 1   | N-CH 2 |        |
| Drain-Source Voltage   | V <sub>DS</sub>                   | 40       | 40     | V      |
| Gate-Source Voltage  | V <sub>GS</sub>                   | ±20      | ±20    |        |
| Continuous Drain Current @ TA=25 °C, V <sub>GS</sub> =10V (Note 1) | I <sub>D</sub>                    | 8.7      | 10.3   | A      |
| Continuous Drain Current @ TA=70 °C, V <sub>GS</sub> =10V (Note 1) |                                   | 7.0      | 8.2    |        |
| Pulsed Drain Current (Note 2&3)                                    | I <sub>DM</sub>                   | 40       | 40     |        |
| Total Power Dissipation @ TA=25 °C<br>Linear Derating Factor       | P <sub>D</sub>                    | 2        |        | W      |
|  |                                   | 0.016    |        | W / °C |
| Operating Junction and Storage Temperature Range                   | T <sub>j</sub> ; T <sub>stg</sub> | -55~+150 |        | °C     |

**Thermal Data**

| Parameter                                    | Symbol           | Value         | Unit |
|--|------------------|---------------|------|
| Thermal Resistance, Junction-to-case, max    | R <sub>θJA</sub> | 20            | °C/W |
| Thermal Resistance, Junction-to-ambient, max | R <sub>θJC</sub> | 62.5 (Note 1) |      |
|  |                  | 114 (Note 4)  |      |

- Note : 1. Surface mounted on 1 in<sup>2</sup> copper pad of FR-4 board, pulse width≤10s; 135°C/W when mounted on minimum copper pad.  
 2. Pulse width limited by maximum junction temperature.  
 3. Pulse width≤300μs, duty cycle≤2%.  
 4. Surface mounted on minimum copper pad, pulse width≤10s.

**Characteristics (Tj=25°C, unless otherwise specified)**

**N-Channel MOSFET 1**

| Symbol               | Min. | Typ. | Max. | Unit | Test Conditions  |
|----------------------|------|------|------|------|--|
| <b>Static</b>        |      |      |      |      |  |
| BV <sub>DSS</sub>    | 40   | -    | -    | V    | V <sub>GS</sub> =0V, I <sub>D</sub> =250μA   |
| V <sub>GS(th)</sub>  | 1.0  | -    | 2.5  |      | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> =250μA                              |
| G <sub>FS</sub>      | -    | 10   | -    | S    | V <sub>DS</sub> =10V, I <sub>D</sub> =5A   |
| I <sub>GSS</sub>     | -    | -    | ±100 | nA   | V <sub>GS</sub> =±20V  |
| I <sub>DSS</sub>     | -    | -    | 1    | μA   | V <sub>DS</sub> =32V, V <sub>GS</sub> =0V  |
|                      | -    | -    | 25   |      | V <sub>DS</sub> =32V, V <sub>GS</sub> =0V, T <sub>j</sub> =85°C                        |
| *R <sub>DS(ON)</sub> | -    | 11.7 | 16   | mΩ   | V <sub>GS</sub> =10V, I <sub>D</sub> =8A   |
|                      | -    | 15.5 | 21   |      | V <sub>GS</sub> =4.5V, I <sub>D</sub> =6A  |
| <b>Dynamic</b>       |      |      |      |      |  |
| *Q <sub>g</sub>      | -    | 13.8 | -    | nC   | I <sub>D</sub> =8A, V <sub>DS</sub> =20V, V <sub>GS</sub> =10V                         |
| *Q <sub>gs</sub>     | -    | 2.5  | -    |      |  |
| *Q <sub>gd</sub>     | -    | 2.6  | -    |      |  |
| *td(ON)              | -    | 7.8  | -    | ns   | V <sub>DS</sub> =20V, I <sub>D</sub> =8A, V <sub>GS</sub> =10V,<br>R <sub>G</sub> =1 Ω |
| *tr                  | -    | 14.4 | -    |      |  |
| *td(OFF)             | -    | 27.4 | -    |      |  |
| *tf                  | -    | 8.8  | -    |      |  |



|                           |   |      |     |    |   |
|---------------------------|---|------|-----|----|---|
| Ciss                      | - | 656  | -   | pF | V <sub>GS</sub> =0V, V <sub>DS</sub> =30V, f=1MHz |
| Coss                      | - | 97   | -   |    |   |
| Crss                      | - | 46   | -   |    |   |
| Rg                        | - | 2.8  | -   | Ω  | f=1MHz  |
| <b>Source-Drain Diode</b> |   |      |     |    |   |
| *I <sub>S</sub>           | - | -    | 2.3 | A  |   |
| *I <sub>SM</sub>          | - | -    | 9.2 |    |   |
| *V <sub>SD</sub>          | - | 0.72 | 1   | V  | I <sub>S</sub> =1A, V <sub>GS</sub> =0V           |
| *trr                      | - | 10.5 | -   | ns | I <sub>F</sub> =1A, dI <sub>F</sub> /dt=100A/μs   |
| *Qrr                      | - | 4.5  | -   | nC |   |

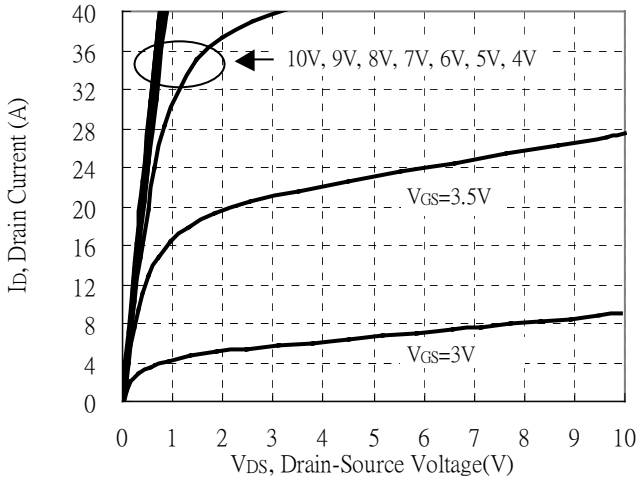
**N-Channel MOSFET 2**

| Symbol                    | Min. | Typ. | Max. | Unit | Test Conditions   |
|---------------------------|------|------|------|------|---|
| <b>Static</b>             |      |      |      |      |   |
| 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                            |
| GFS                       | -    | 10   | -    | S    | V <sub>DS</sub> =10V, I <sub>D</sub> =5A  |
| I <sub>GSS</sub>          | -    | -    | ±100 | nA   | V <sub>GS</sub> =±20V   |
| I <sub>DSS</sub>          | -    | -    | 1    | μA   | V <sub>DS</sub> =32V, V <sub>GS</sub> =0V   |
|                           | -    | -    | 25   |      | V <sub>DS</sub> =32V, V <sub>GS</sub> =0V, T <sub>j</sub> =85°C                     |
| R <sub>DS(ON)*</sub>      | -    | 7.4  | 10.5 | mΩ   | V <sub>GS</sub> =10V, I <sub>D</sub> =10A   |
|                           | -    | 9.2  | 12.5 |      | V <sub>GS</sub> =4.5V, I <sub>D</sub> =8A   |
| <b>Dynamic</b>            |      |      |      |      |   |
| *Q <sub>g</sub>           | -    | 32.5 | -    | nC   | I <sub>D</sub> =10A, V <sub>DS</sub> =20V, V <sub>GS</sub> =10V                     |
| *Q <sub>gs</sub>          | -    | 4.8  | -    |      |   |
| *Q <sub>gd</sub>          | -    | 7.5  | -    |      |   |
| *t <sub>d(ON)</sub>       | -    | 12.6 | -    | ns   | V <sub>DS</sub> =20V, I <sub>D</sub> =10A, V <sub>GS</sub> =10V, R <sub>G</sub> =1Ω |
| *tr                       | -    | 16.8 | -    |      |   |
| *t <sub>d(OFF)</sub>      | -    | 46.8 | -    |      |   |
| *tf                       | -    | 8.4  | -    |      |   |
| Ciss                      | -    | 1438 | -    | pF   | V <sub>DS</sub> =30V, V <sub>GS</sub> =0V, f=1MHz                                   |
| Coss                      | -    | 168  | -    |      |   |
| Crss                      | -    | 124  | -    |      |   |
| Rg                        | -    | 2    | -    | Ω    | f=1MHz  |
| <b>Source-Drain Diode</b> |      |      |      |      |   |
| *I <sub>S</sub>           | -    | -    | 2.3  | A    |   |
| *I <sub>SM</sub>          | -    | -    | 9.2  |      |   |
| *V <sub>SD</sub>          | -    | 0.71 | 1    | V    | I <sub>S</sub> =1A, V <sub>GS</sub> =0V   |
| *trr                      | -    | 14.3 | -    | ns   | I <sub>F</sub> =1A, dI <sub>F</sub> /dt=100A/μs                                     |
| *Qrr                      | -    | 7.4  | -    | nC   |   |

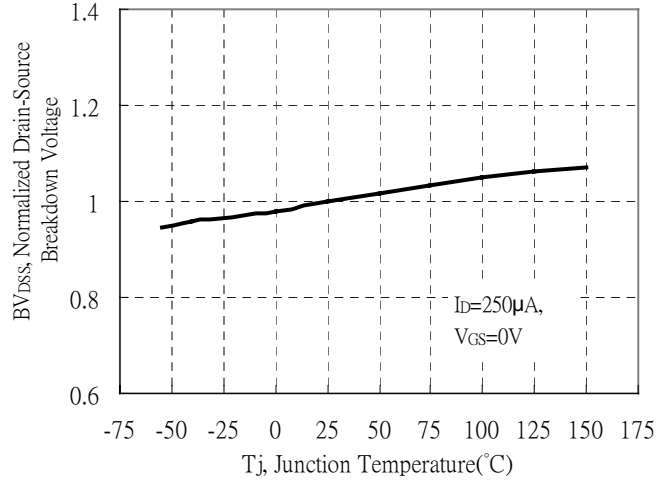
\*Pulse Test : Pulse Width ≤300μs, Duty Cycle ≤2%

## N-CH MOSFET 1, Typical Characteristics

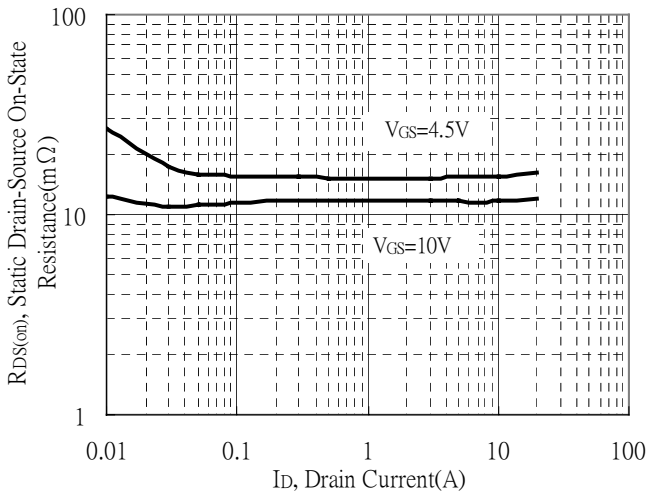
Typical Output Characteristics



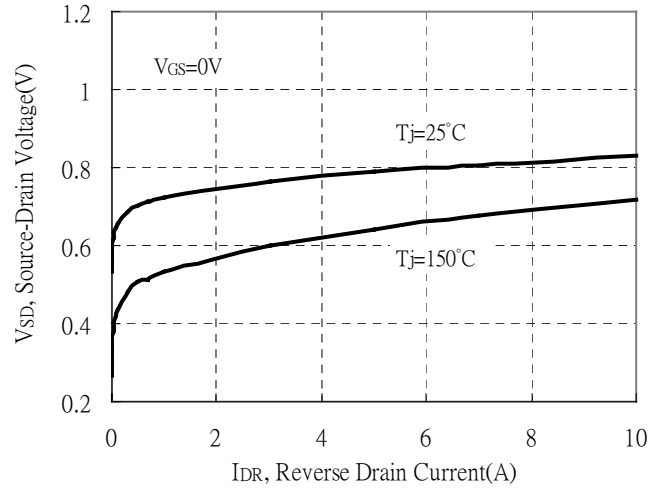
Breakdown Voltage vs Ambient Temperature



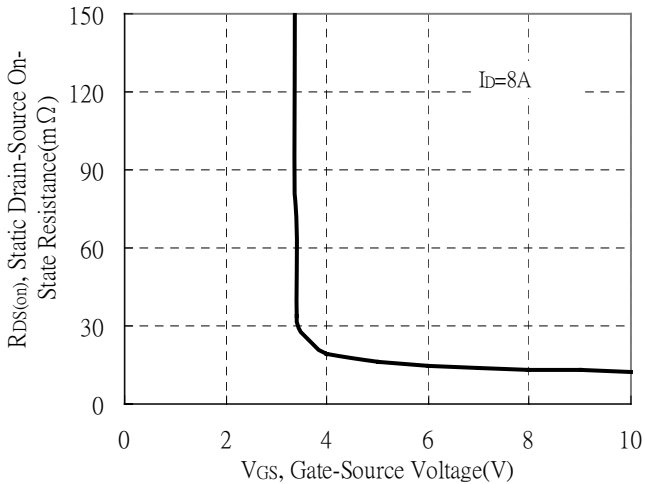
Static Drain-Source On-State resistance vs Drain Current



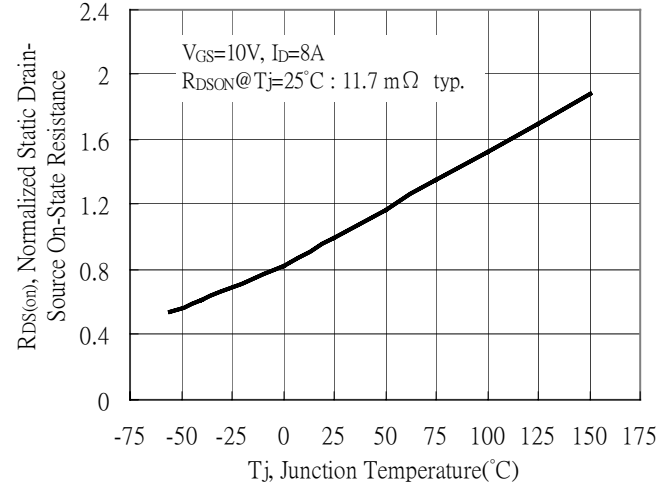
Reverse Drain Current vs Source-Drain Voltage



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



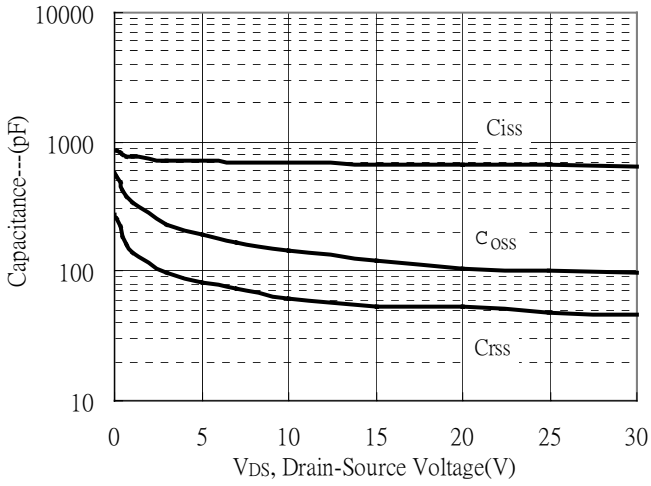
Drain-Source On-State Resistance vs Junction Temperature



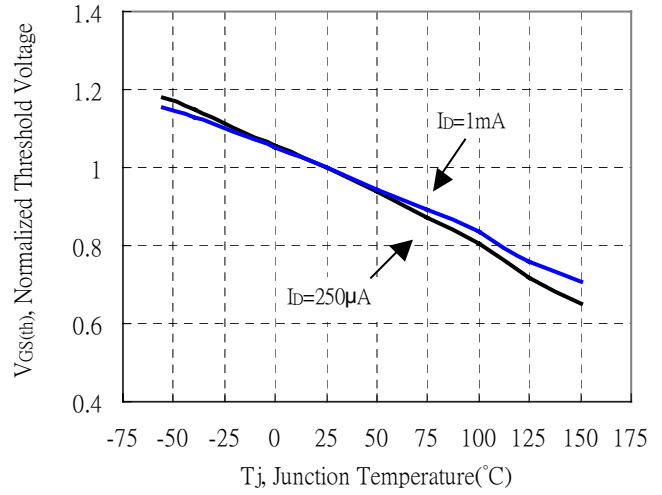


**N-CH MOSFET 1, Typical Characteristics (Cont.)**

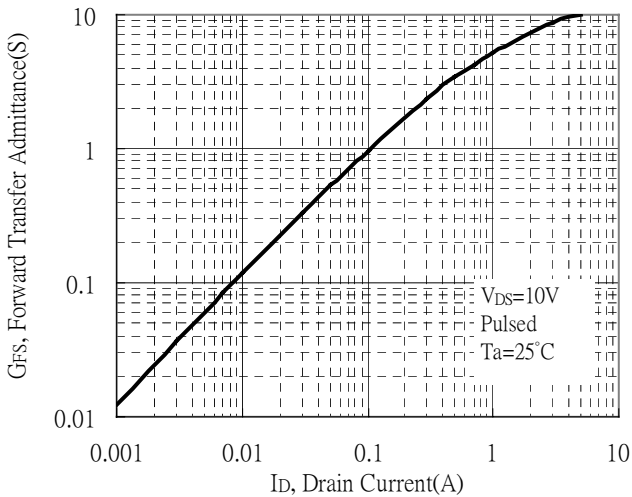
Capacitance vs Drain-to-Source Voltage



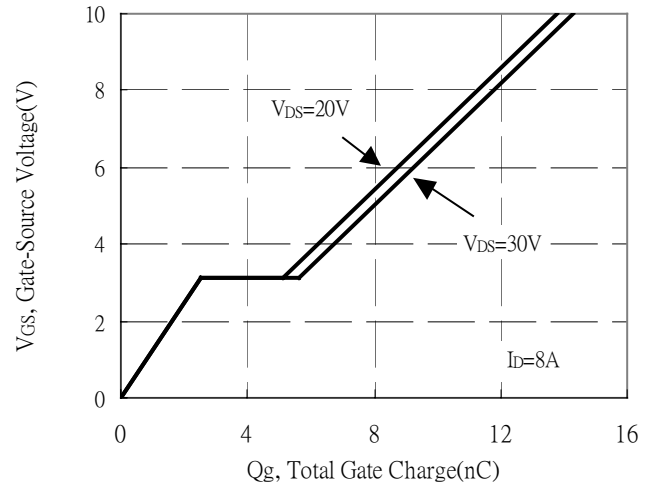
Threshold Voltage vs Junction Temperature



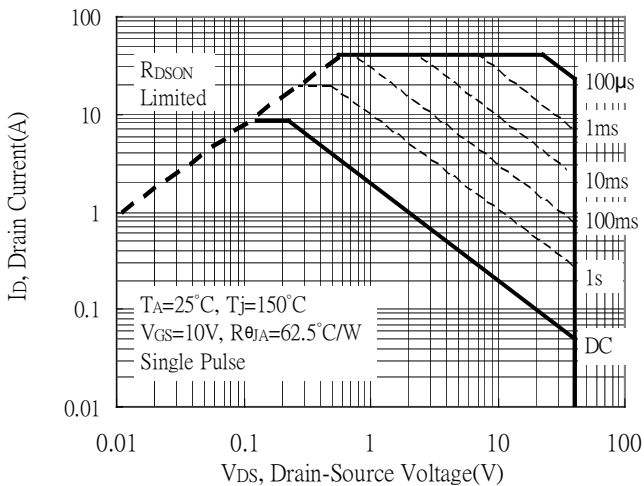
Forward Transfer Admittance vs Drain Current



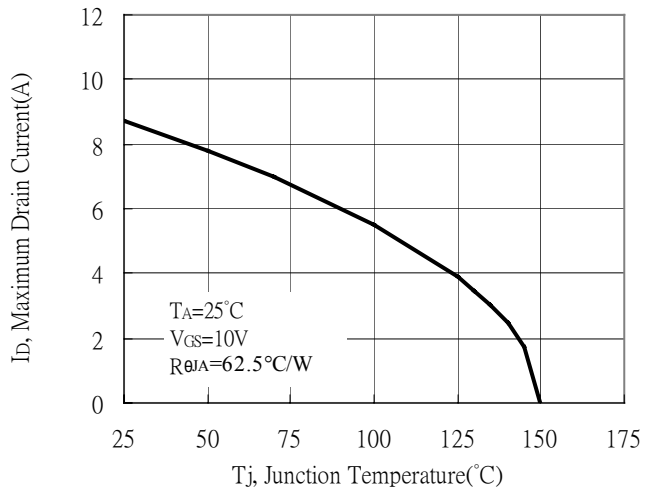
Gate Charge Characteristics



Maximum Safe Operating Area



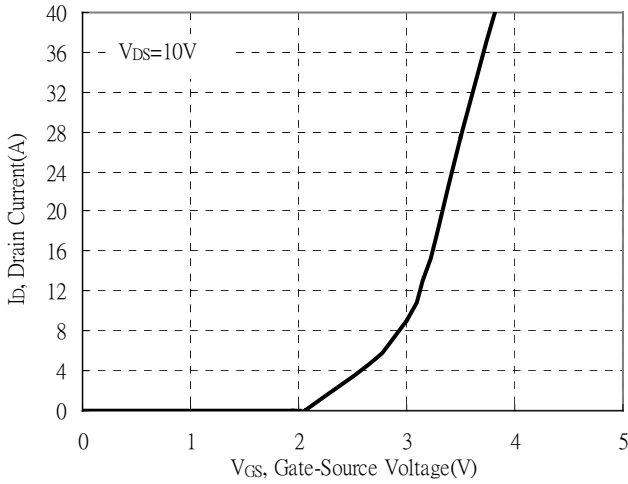
Maximum Drain Current vs Junction Temperature



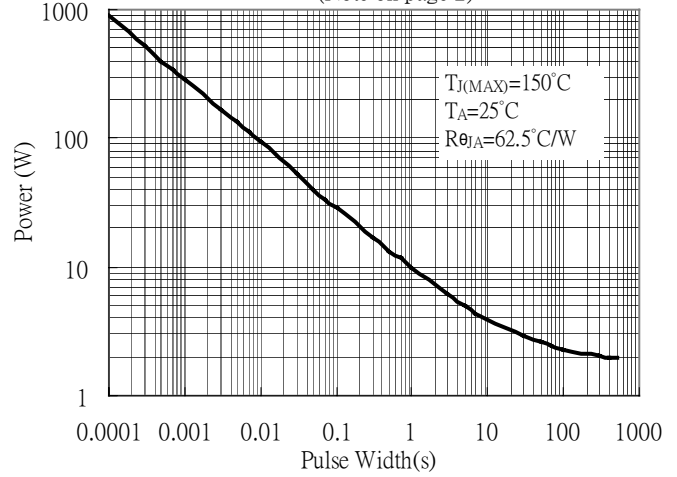


**N-CH MOSFET 1, Typical Characteristics (Cont.)**

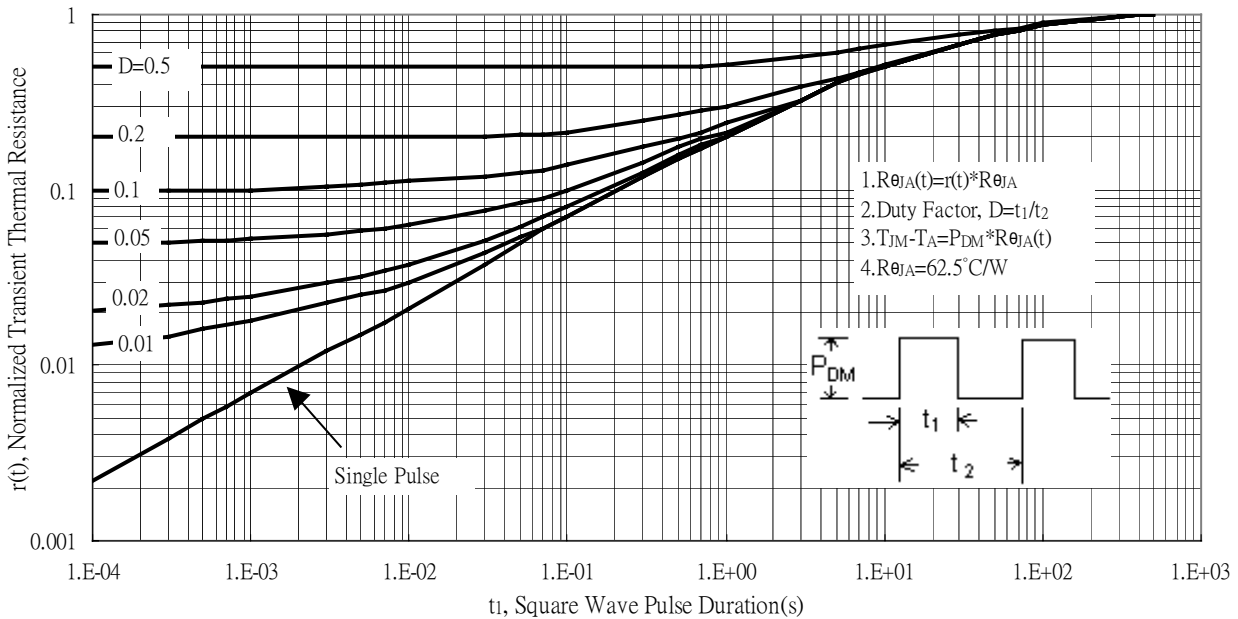
Typical Transfer Characteristics



Single Pulse Power Rating, Junction to Ambient  
 (Note on page 2)

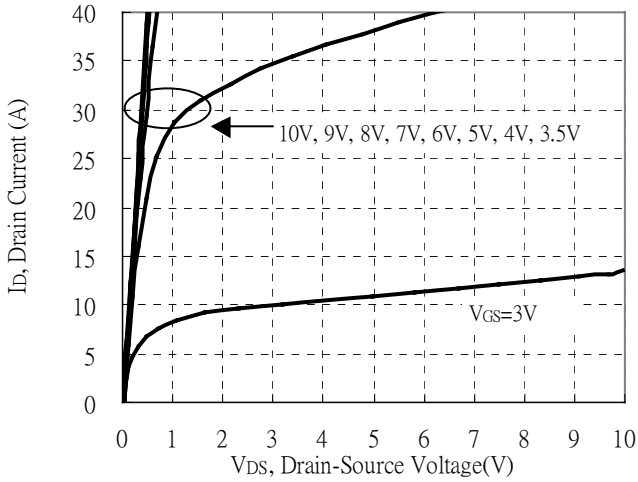


Transient Thermal Response Curves

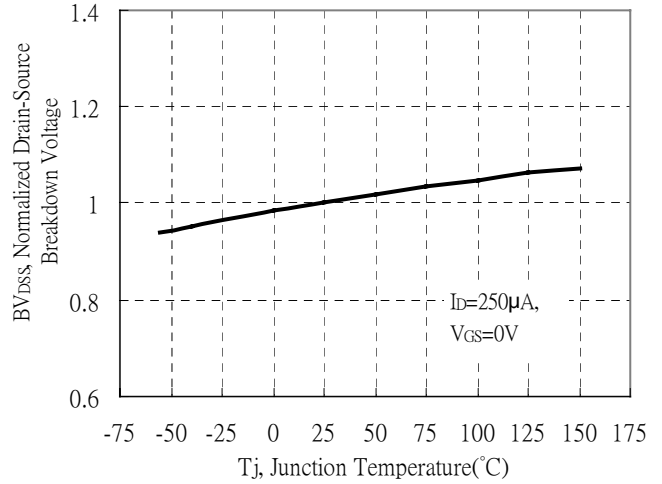


**N-CH MOSFET 2, Typical Characteristics**

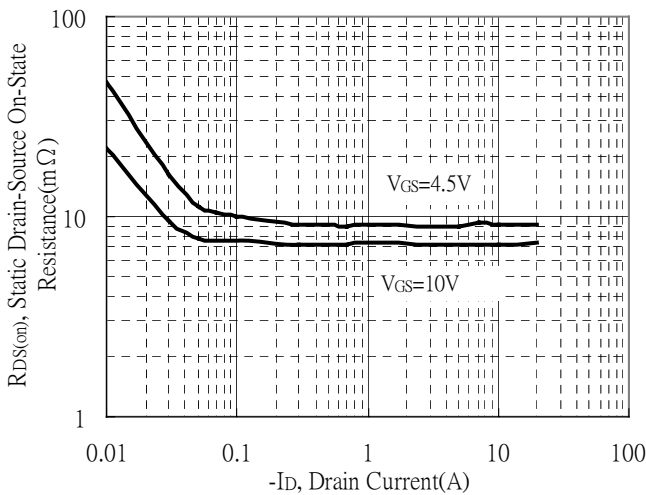
Typical Output Characteristics



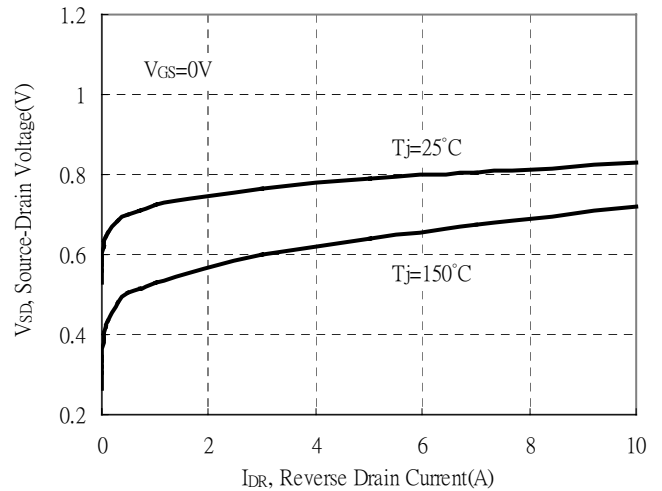
Breakdown Voltage vs Ambient Temperature



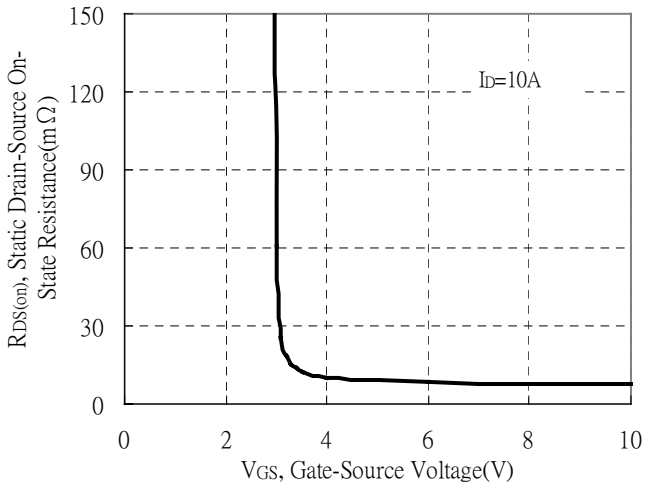
Static Drain-Source On-State resistance vs Drain Current



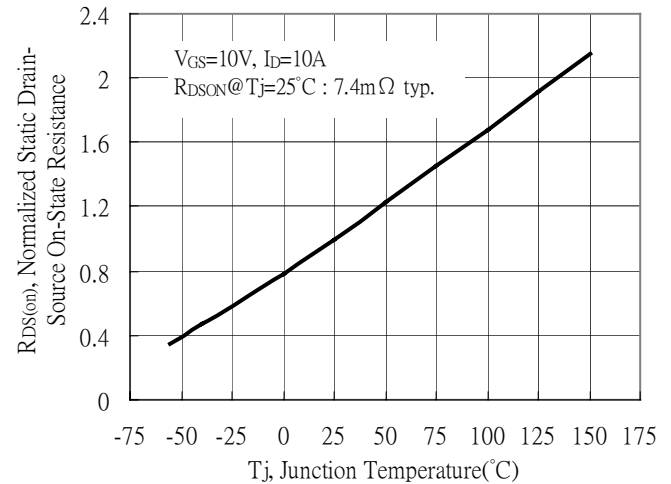
Reverse Drain Current vs Source-Drain Voltage



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

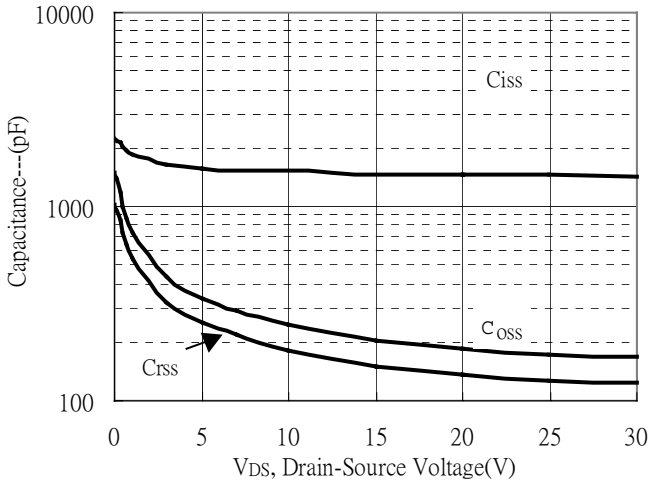


Drain-Source On-State Resistance vs Junction Temperature

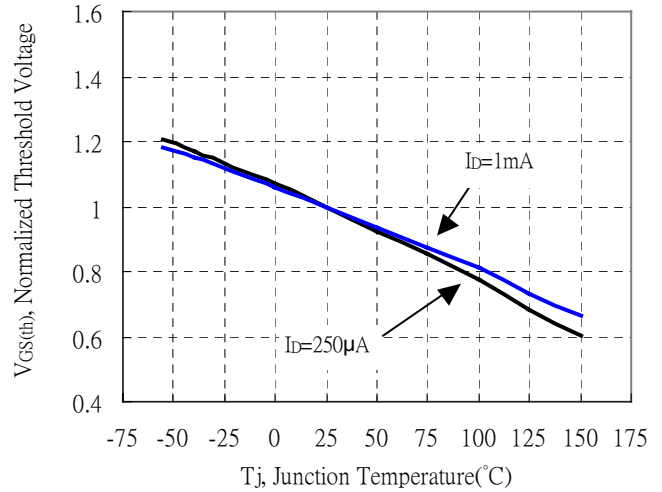


**N-CH MOSFET 2, Typical Characteristics (Cont.)**

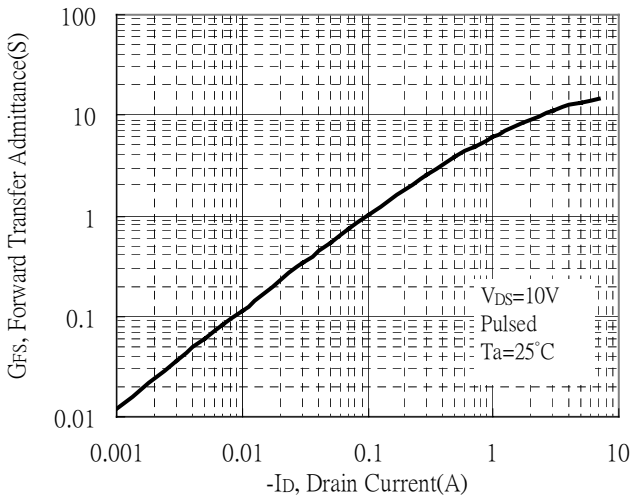
Capacitance vs Drain-to-Source Voltage



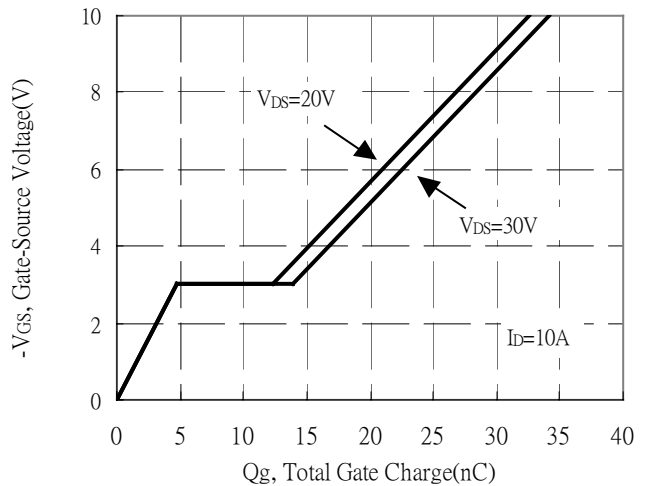
Threshold Voltage vs Junction Temperature



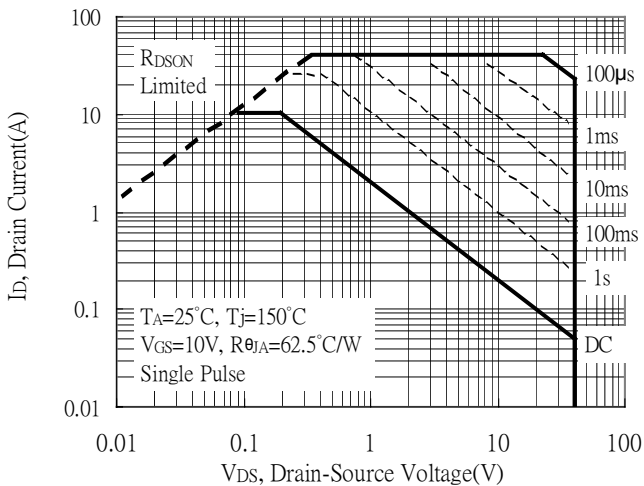
Forward Transfer Admittance vs Drain Current



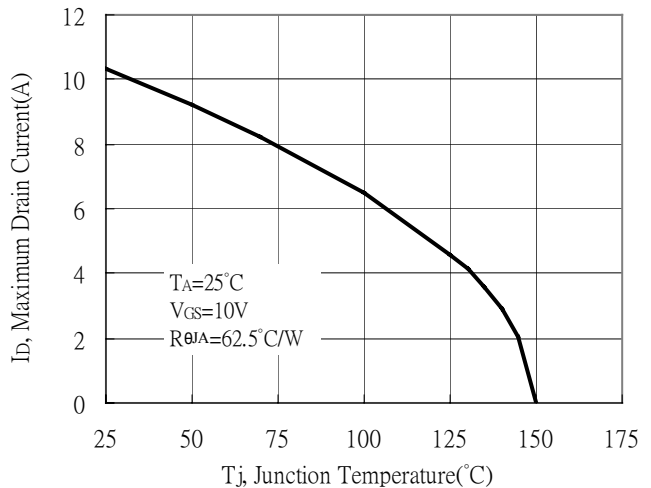
Gate Charge Characteristics



Maximum Safe Operating Area



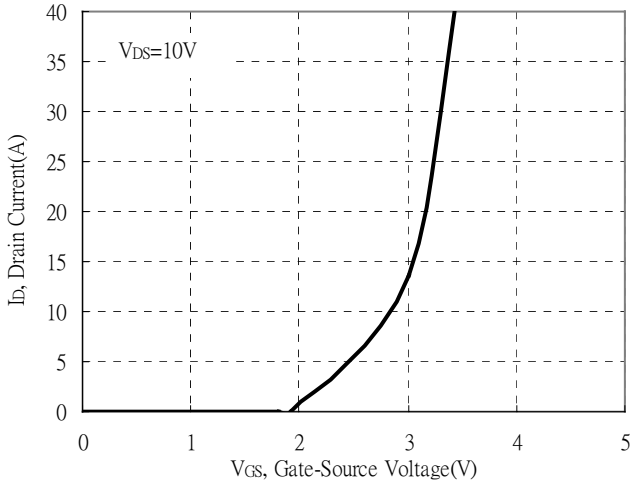
Maximum Drain Current vs Junction Temperature



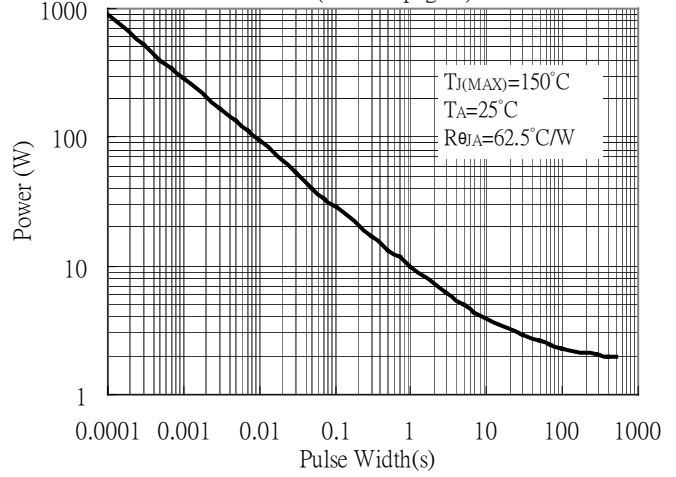


**N-CH MOSFET 2, Typical Characteristics (Cont.)**

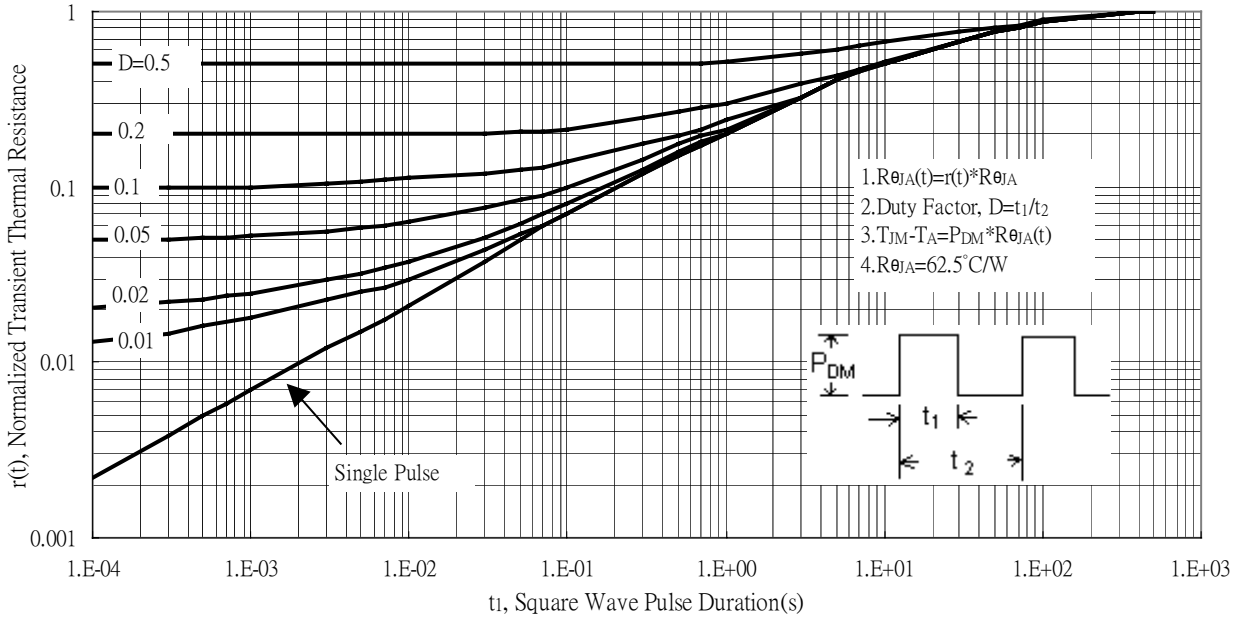
Typical Transfer Characteristics



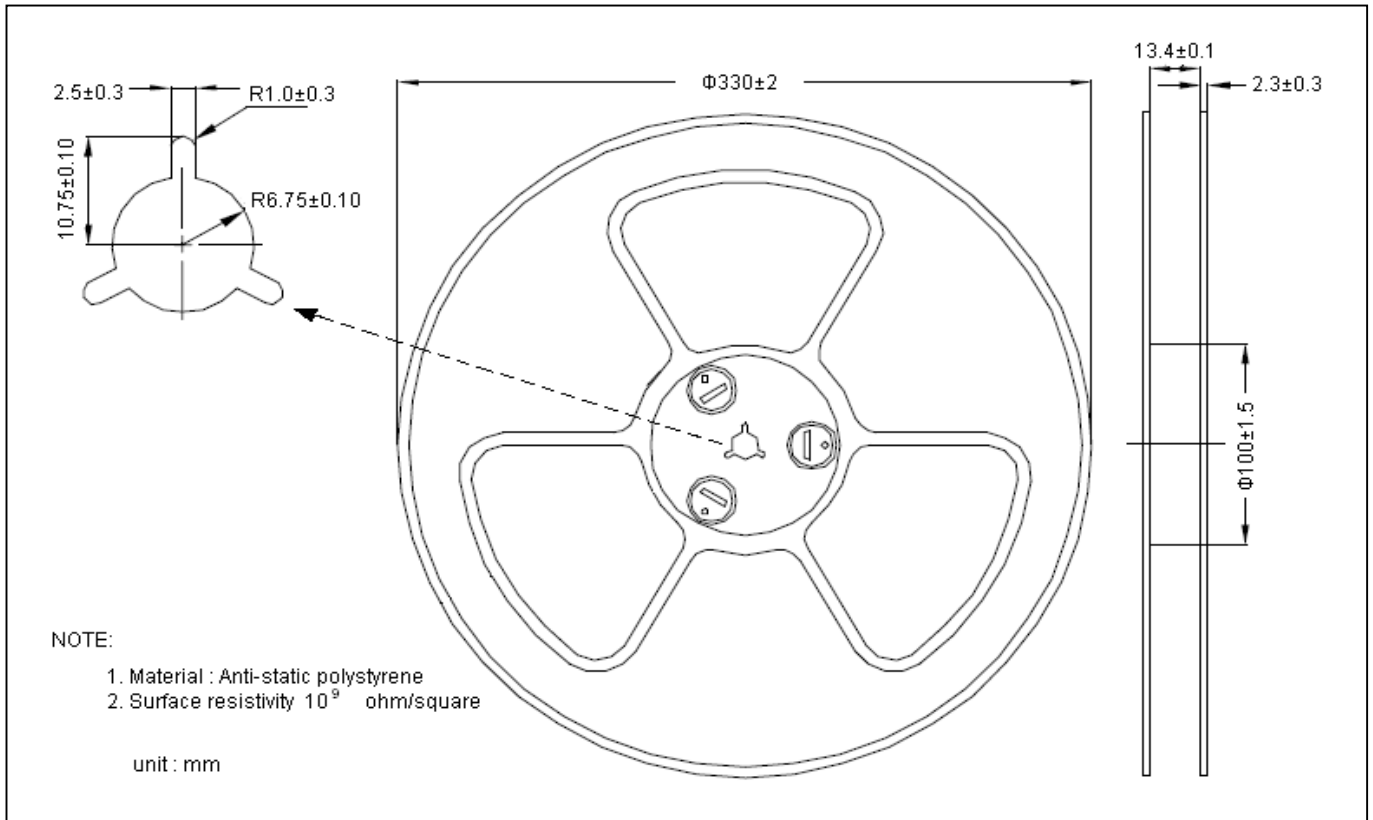
Single Pulse Power Rating, Junction to Ambient  
 (Note on page 2)



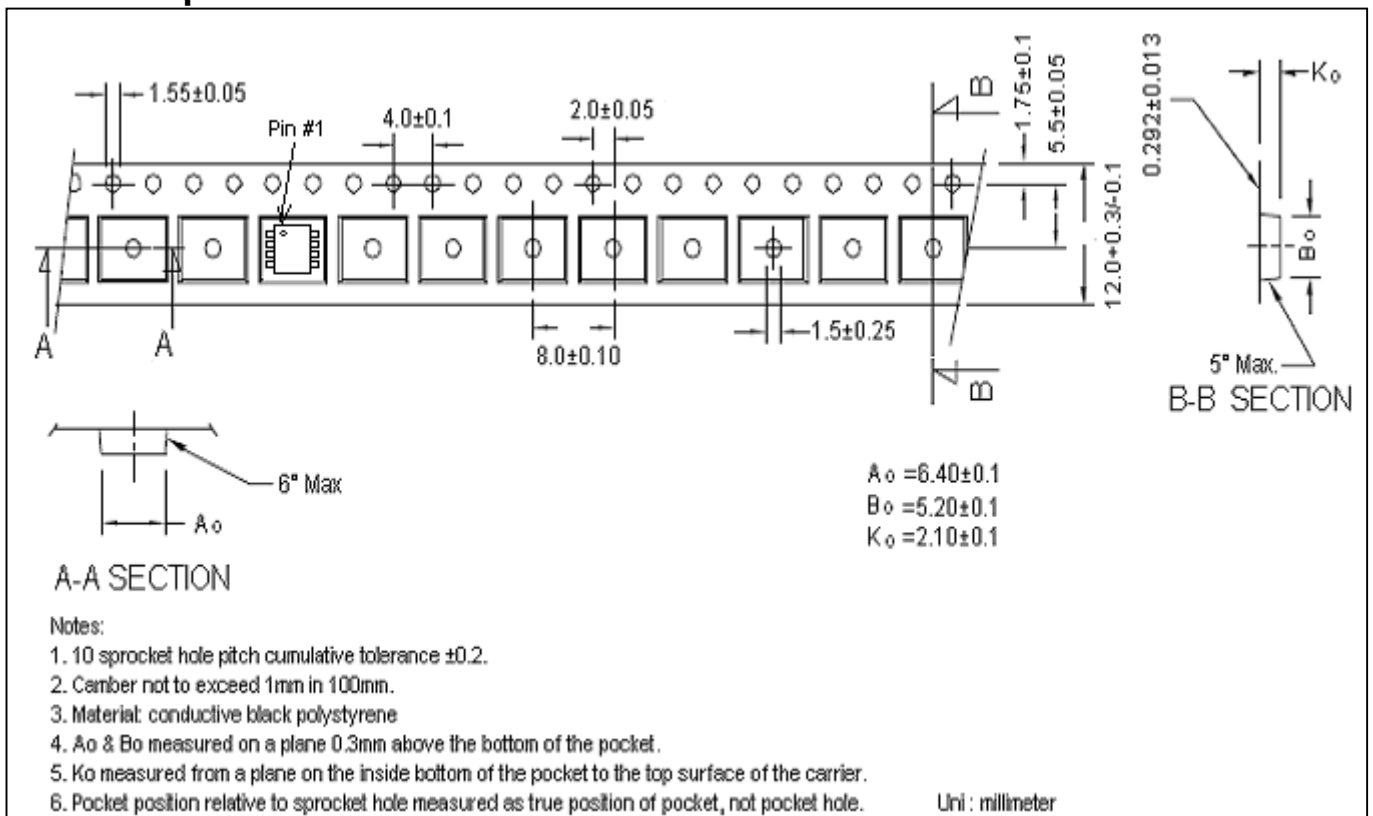
Transient Thermal Response Curves



**Reel Dimension**



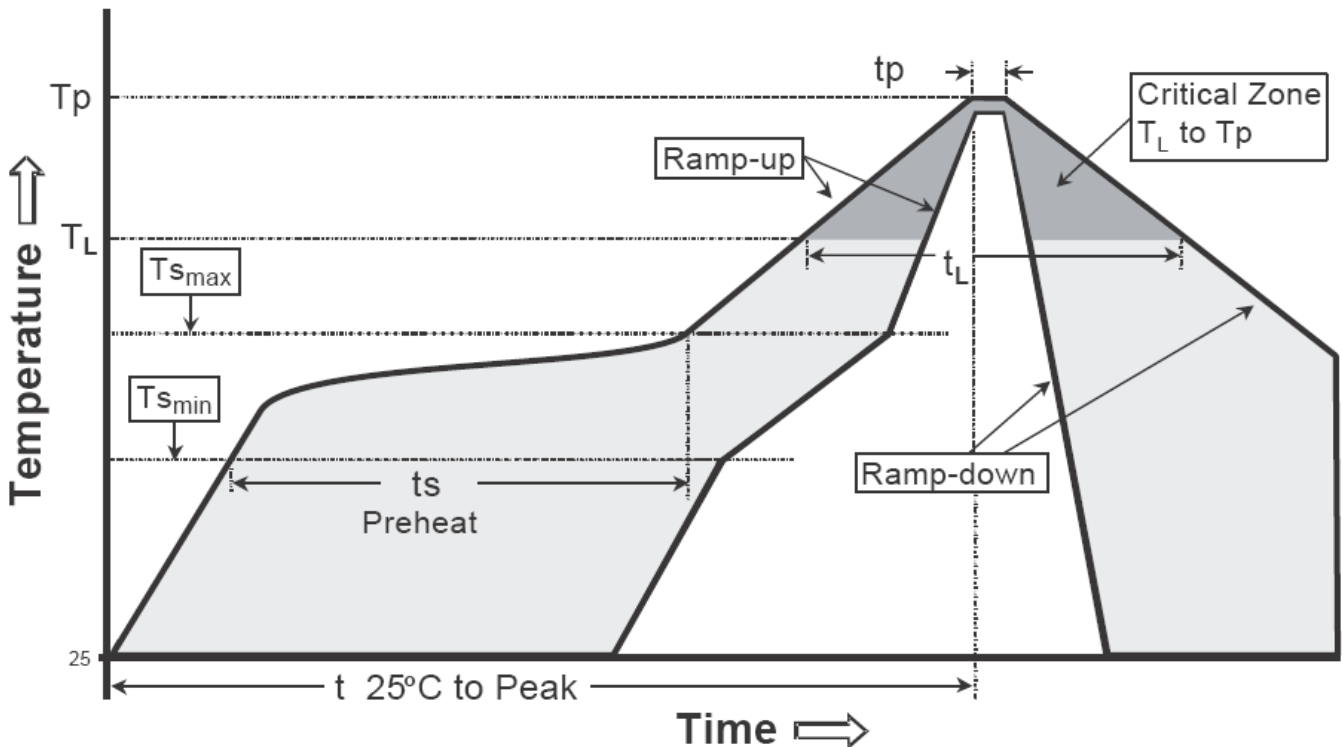
**Carrier Tape Dimension**



**Recommended wave soldering condition**

|                 |                  |                 |
|-----------------|------------------|-----------------|
| Product         | Peak Temperature | Soldering Time  |
| Pb-free devices | 260 +0/-5 °C     | 5 +1/-1 seconds |

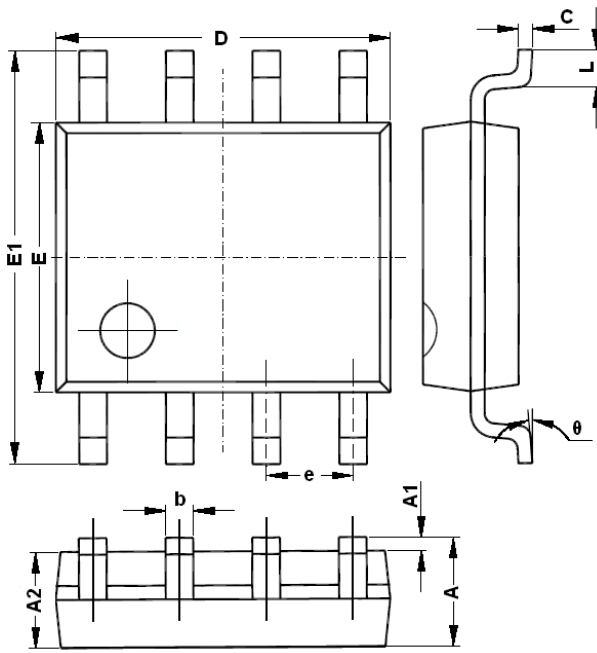
**Recommended temperature profile for IR reflow**



| Profile feature   | Sn-Pb eutectic Assembly | Pb-free Assembly |
|---|-------------------------|------------------|
| Average ramp-up rate (Ts <sub>max</sub> to T <sub>p</sub> ) | 3°C/second max.         | 3°C/second max.  |
| Preheat   |                         |                  |
| -Temperature Min(T <sub>s</sub> min)                        | 100°C                   | 150°C            |
| -Temperature Max(T <sub>s</sub> max)                        | 150°C                   | 200°C            |
| -Time(t <sub>s</sub> min to t <sub>s</sub> max)             | 60-120 seconds          | 60-180 seconds   |
| Time maintained above:                                      |                         |                  |
| -Temperature (T <sub>L</sub> )                              | 183°C                   | 217°C            |
| - Time (t <sub>L</sub> )                                    | 60-150 seconds          | 60-150 seconds   |
| Peak Temperature(T <sub>p</sub> )                           | 240 +0/-5 °C            | 260 +0/-5 °C     |
| Time within 5°C of actual peak temperature(t <sub>p</sub> ) | 10-30 seconds           | 20-40 seconds    |
| Ramp down rate  | 6°C/second max.         | 6°C/second max.  |
| Time 25 °C to peak temperature                              | 6 minutes max.          | 8 minutes max.   |

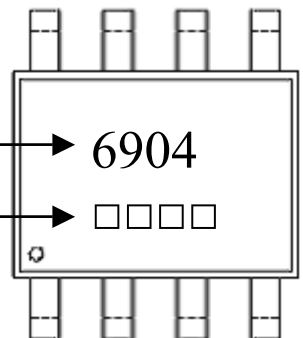
Note : All temperatures refer to topside of the package, measured on the package body surface.

**SOP-8 Dimension**



The diagram shows three views of an 8-lead SOP-8 package: a top view with dimensions D, E, and E1; a side view with dimensions C, L, and  $\theta$ ; and a bottom view with dimensions A, A1, A2, and b.

**Marking:**



Device Name → **6904**

Date Code → □ □ □ □

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

**8-Lead SOP-8 Plastic Package**  
 CYStek Package Code: Q8

| DIM | Millimeters |       | Inches |       | DIM      | Millimeters |       | Inches |       |
|-----|-------------|-------|--------|-------|----------|-------------|-------|--------|-------|
|     | Min.        | Max.  | Min.   | Max.  |          | Min.        | Max.  | Min.   | Max.  |
| A   | 1.350       | 1.750 | 0.053  | 0.069 | E        | 3.800       | 4.000 | 0.150  | 0.157 |
| A1  | 0.100       | 0.250 | 0.004  | 0.010 | E1       | 5.800       | 6.200 | 0.228  | 0.244 |
| A2  | 1.350       | 1.550 | 0.053  | 0.061 | e        | 1.270       | (BSC) | 0.050  | (BSC) |
| b   | 0.330       | 0.510 | 0.013  | 0.020 | L        | 0.400       | 1.270 | 0.016  | 0.050 |
| c   | 0.170       | 0.250 | 0.006  | 0.010 | $\theta$ | 0           | 8°    | 0      | 8°    |
| D   | 4.700       | 5.100 | 0.185  | 0.200 |          |             |       |        |       |

**Notes:** 1.Controlling dimension: millimeters.  
 2.Maximum lead thickness includes lead finish thickness, and minimum lead thickness is the minimum thickness of base material.  
 3.If there is any question with packing specification or packing method, please contact your local CYStek sales office.

**Material:**

- Lead: Pure tin plated.
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0.

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