

## 2N- and 2P-Channel Enhancement Mode MOSFET

### Description

The MTC9930Q8 consists of two N-channel and two P-channel enhancement-mode MOSFET in a single SOP-8 package, providing the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost-effectiveness.

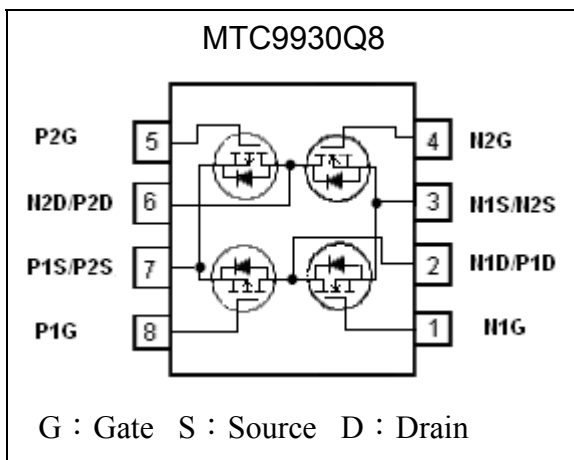
The SOP-8 package is universally preferred for all commercial-industrial surface mount applications.

### Features

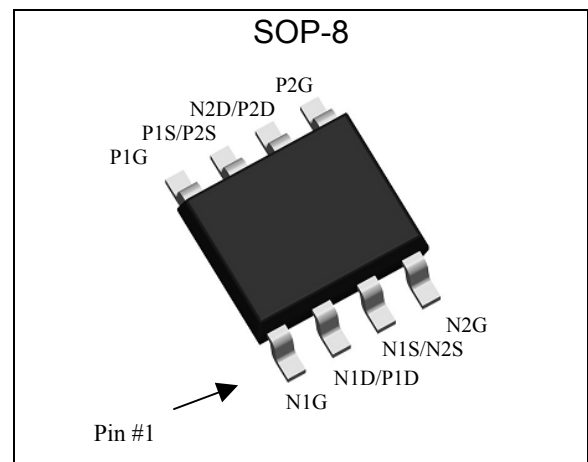
- Simple drive requirement
- Low on-resistance
- Fast switching speed
- Pb-free lead plating and halogen-free package

|                    | N-CH         | P-CH         |
|--------------------|--------------|--------------|
| $BV_{DSS}$         | 30V          | -30V         |
| $I_D$              | 6A           | -4.4A        |
| $R_{DS(on)(TYP.)}$ | 17m $\Omega$ | 35m $\Omega$ |

### Equivalent Circuit

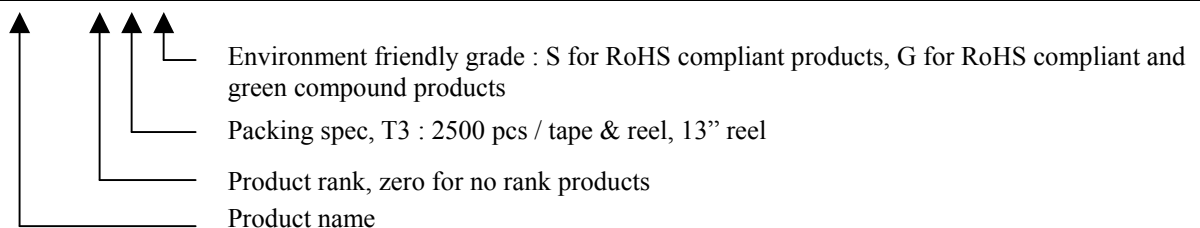


### Outline



### Ordering Information

| Device           | Package                                                  | Shipping               |
|------------------|----------------------------------------------------------|------------------------|
| MTC9930Q8-0-T3-G | SOP-8<br>(Pb-free lead plating and halogen-free package) | 2500 pcs / tape & reel |



## Absolute Maximum Ratings (T<sub>C</sub>=25°C, unless otherwise noted)

| Parameter                                        |                                                    | Symbol                            | Limits    |           | Unit |
|--------------------------------------------------|----------------------------------------------------|-----------------------------------|-----------|-----------|------|
|                                                  |                                                    |                                   | N-channel | P-channel |      |
| Drain-Source Breakdown Voltage                   |                                                    | BV <sub>DSS</sub>                 | 30        | -30       | V    |
| Gate-Source Voltage                              |                                                    | V <sub>GS</sub>                   | ±25       | ±25       |      |
| Continuous Drain Current<br>(Note 2)             | T <sub>A</sub> =25 °C, V <sub>GS</sub> =10V (-10V) | I <sub>D</sub>                    | 6         | -4.4      | A    |
|                                                  | T <sub>A</sub> =70 °C, V <sub>GS</sub> =10V (-10V) |                                   | 4.8       | -3.5      |      |
| Pulsed Drain Current (Note 1)                    |                                                    | I <sub>DM</sub>                   | 24        | -20       |      |
| Power Dissipation                                | T <sub>A</sub> =25°C                               | P <sub>D</sub>                    | 1.38      |           | W    |
|                                                  | T <sub>A</sub> =70°C                               |                                   | 0.88      |           |      |
| 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>θJC</sub> | 36          | °C/W |
| Thermal Resistance, Junction-to-ambient, max | R <sub>θJA</sub> | 90 (Note 2) |      |

Note : 1.Pulse width limited by maximum junction temperature.

2.Surface mounted on 1 in<sup>2</sup> copper pad of FR-4 board, pulse width≤10s.

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

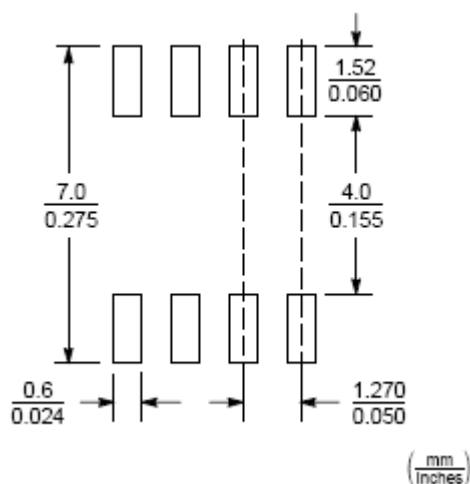
| Symbol               | Min. | Typ. | Max. | Unit | Test Conditions                                                                    |
|----------------------|------|------|------|------|------------------------------------------------------------------------------------|
| Static               |      |      |      |      |                                                                                    |
| BV <sub>DSS</sub>    | 30   | -    | -    | 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                           |
| I <sub>GSS</sub>     | -    | -    | ±100 | nA   | V <sub>GS</sub> =±25V, V <sub>DS</sub> =0V                                         |
| I <sub>DSS</sub>     | -    | -    | 1    | μA   | V <sub>DS</sub> =30V, V <sub>GS</sub> =0V                                          |
|                      | -    | -    | 25   |      | V <sub>DS</sub> =24V, V <sub>GS</sub> =0V, T <sub>j</sub> =70°C                    |
| *R <sub>DS(ON)</sub> | -    | 17   | 24   | mΩ   | I <sub>D</sub> =5A, V <sub>GS</sub> =10V                                           |
|                      | -    | 21   | 30   |      | I <sub>D</sub> =3A, V <sub>GS</sub> =4.5V                                          |
| *G <sub>FS</sub>     | -    | 6.7  | -    | S    | V <sub>DS</sub> =5V, I <sub>D</sub> =5A                                            |
| Dynamic              |      |      |      |      |                                                                                    |
| C <sub>iss</sub>     | -    | 496  | 750  | pF   | V <sub>DS</sub> =25V, V <sub>GS</sub> =0V, f=1MHz                                  |
| C <sub>oss</sub>     | -    | 61   | -    |      |                                                                                    |
| C <sub>rss</sub>     | -    | 47   | -    |      |                                                                                    |
| *t <sub>d(ON)</sub>  | -    | 6.2  | -    | ns   | V <sub>DS</sub> =15V, I <sub>D</sub> =1A, V <sub>GS</sub> =10V, R <sub>G</sub> =6Ω |
| *t <sub>r</sub>      | -    | 17.2 | -    |      |                                                                                    |
| *t <sub>d(OFF)</sub> | -    | 30.2 | -    |      |                                                                                    |
| *t <sub>f</sub>      | -    | 7.6  | -    |      |                                                                                    |
| *Q <sub>g</sub>      | -    | 5.6  | 9    | nC   | V <sub>DS</sub> =15V, I <sub>D</sub> =6A, V <sub>GS</sub> =4.5V                    |
| *Q <sub>gs</sub>     | -    | 1.9  | -    |      |                                                                                    |
| *Q <sub>gd</sub>     | -    | 2.1  | -    |      |                                                                                    |
| Body Diode           |      |      |      |      |                                                                                    |
| *V <sub>SD</sub>     | -    | 0.78 | 1.2  | V    | V <sub>GS</sub> =0V, I <sub>S</sub> =1.2A                                          |
| *t <sub>rr</sub>     | -    | 7.7  | -    | ns   | I <sub>F</sub> =5A, dI <sub>F</sub> /dt=100A/μs                                    |
| *Q <sub>rr</sub>     | -    | 3.3  | -    | nC   |                                                                                    |

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

**P-Channel Electrical Characteristics** (T<sub>c</sub>=25°C, unless otherwise specified)

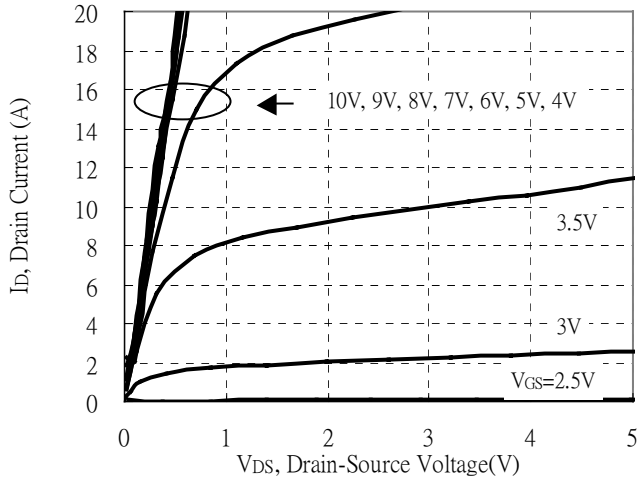
| Symbol               | Min. | Typ.  | Max. | Unit | Test Conditions                                                                       |
|----------------------|------|-------|------|------|---------------------------------------------------------------------------------------|
| Static               |      |       |      |      |                                                                                       |
| BV <sub>DSS</sub>    | -30  | -     | -    | 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                             |
| I <sub>GSS</sub>     | -    | -     | ±100 | nA   | V <sub>GS</sub> =±25V, V <sub>DS</sub> =0V                                            |
| I <sub>DSS</sub>     | -    | -     | -1   | μA   | V <sub>DS</sub> =-30V, V <sub>GS</sub> =0V                                            |
|                      | -    | -     | -25  |      | V <sub>DS</sub> =-24V, V <sub>GS</sub> =0V, T <sub>j</sub> =70°C                      |
| *R <sub>DS(ON)</sub> | -    | 35    | 48   | mΩ   | I <sub>D</sub> =-4A, V <sub>GS</sub> =-10V                                            |
|                      | -    | 46    | 70   |      | I <sub>D</sub> =-2A, V <sub>GS</sub> =-4.5V                                           |
| *G <sub>FS</sub>     | -    | 7.8   | -    | S    | V <sub>DS</sub> =-10V, I <sub>D</sub> =-5A                                            |
| Dynamic              |      |       |      |      |                                                                                       |
| C <sub>iss</sub>     | -    | 597   | 900  | pF   | V <sub>DS</sub> =-25V, V <sub>GS</sub> =0V, f=1MHz                                    |
| C <sub>oss</sub>     | -    | 63    | -    |      |                                                                                       |
| C <sub>rss</sub>     | -    | 51    | -    |      |                                                                                       |
| *t <sub>d(ON)</sub>  | -    | 5.6   | -    | ns   | V <sub>DS</sub> =-15V, I <sub>D</sub> =-1A, V <sub>GS</sub> =-10V, R <sub>G</sub> =6Ω |
| *t <sub>r</sub>      | -    | 17.6  | -    |      |                                                                                       |
| *t <sub>d(OFF)</sub> | -    | 64.4  | -    |      |                                                                                       |
| *t <sub>f</sub>      | -    | 33.8  | -    |      |                                                                                       |
| *Q <sub>g</sub>      | -    | 6.7   | 11   | nC   | V <sub>DS</sub> =-15V, I <sub>D</sub> =-4.4A, V <sub>GS</sub> =-4.5V                  |
| *Q <sub>gs</sub>     | -    | 2.2   | -    |      |                                                                                       |
| *Q <sub>gd</sub>     | -    | 2.5   | -    |      |                                                                                       |
| Body Diode           |      |       |      |      |                                                                                       |
| *V <sub>SD</sub>     | -    | -0.78 | -1.2 | V    | V <sub>GS</sub> =0V, I <sub>S</sub> =-1.2A                                            |
| *t <sub>rr</sub>     | -    | 7.7   | -    | ns   | I <sub>F</sub> =-4.5A, dI <sub>F</sub> /dt=100A/μs                                    |
| *Q <sub>rr</sub>     | -    | 3.0   | -    | nC   |                                                                                       |

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

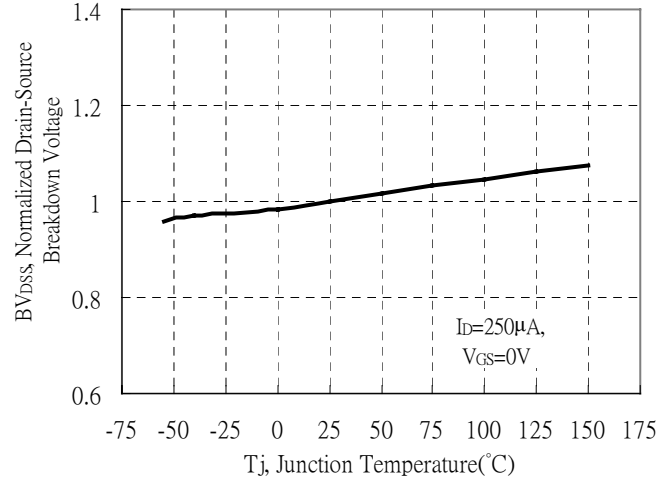
**Recommended Soldering Footprint**


## Typical Characteristics : Q1( N-channel )

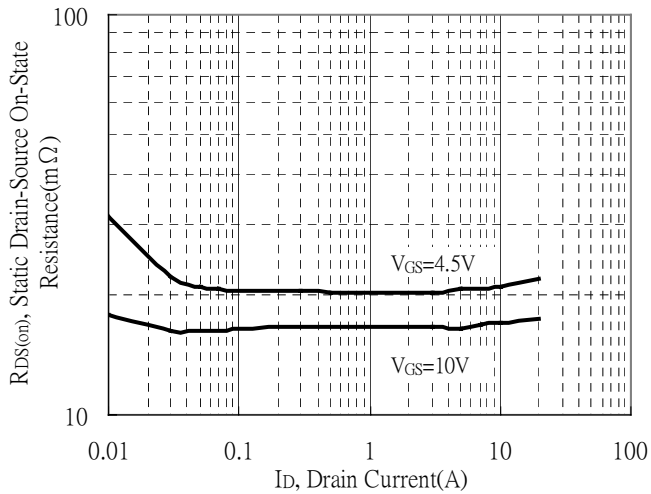
Typical Output Characteristics



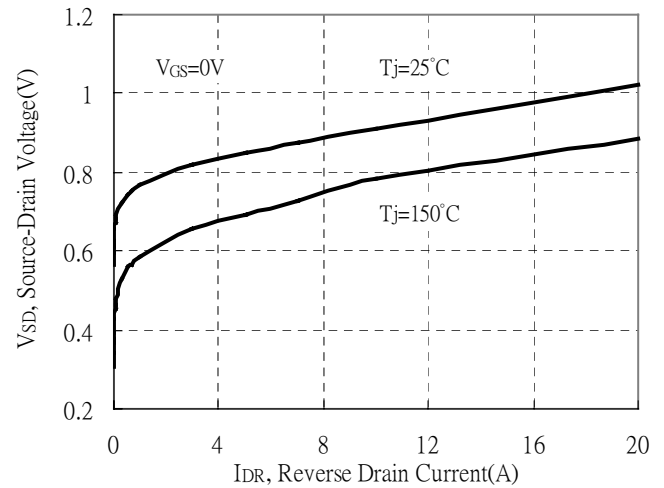
Breakdown Voltage vs Ambient Temperature



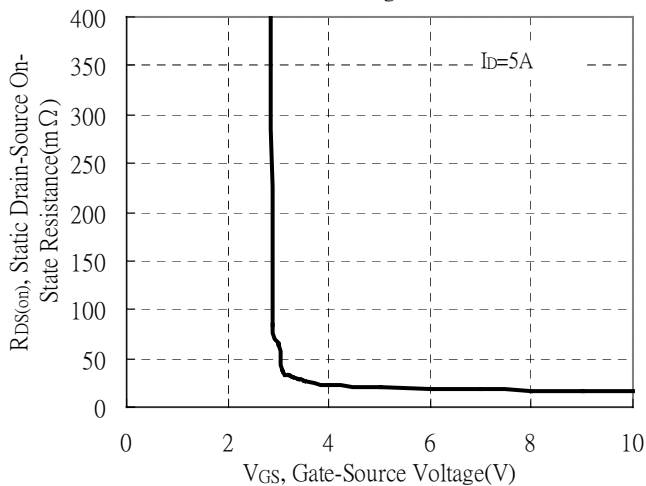
Static Drain-Source On-State resistance vs Drain Current



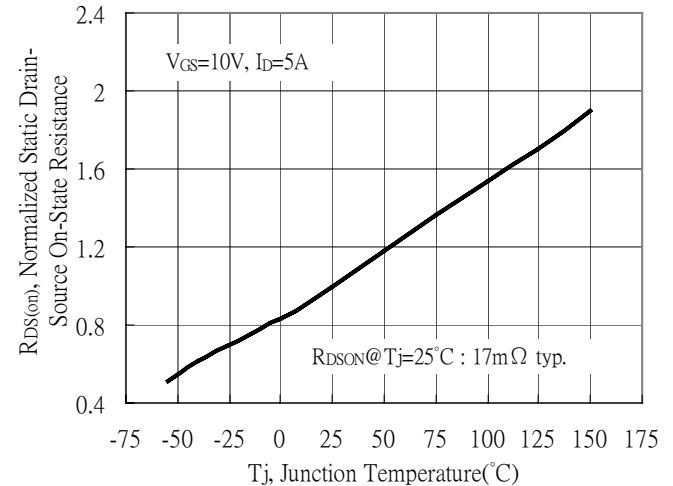
Reverse Drain Current vs Source-Drain Voltage



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

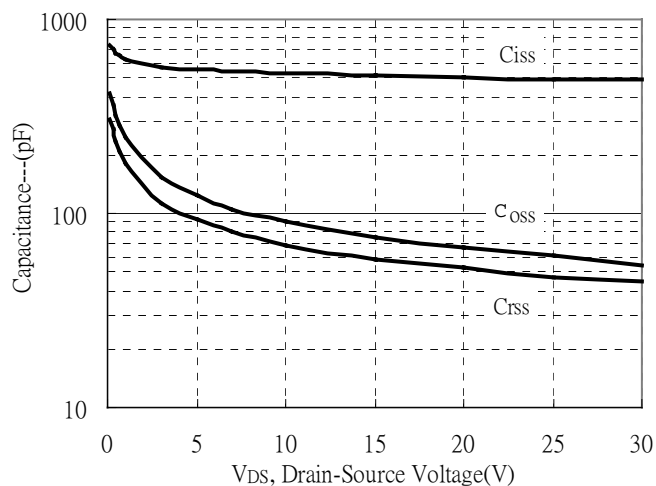


Drain-Source On-State Resistance vs Junction Temperature

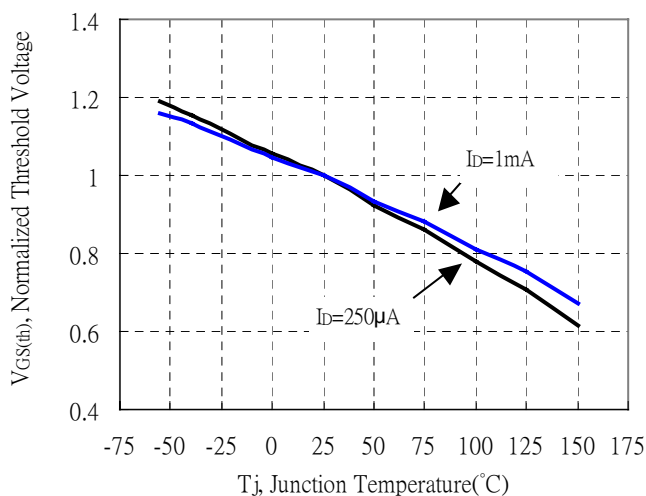


## Typical Characteristics(Cont.) : Q1( N-channel)

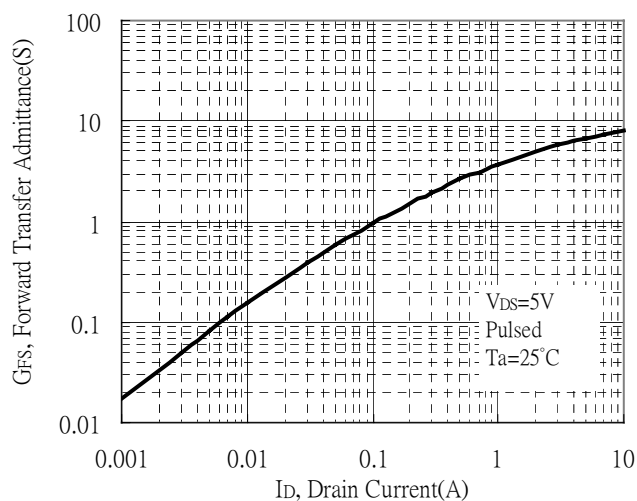
Capacitance vs Drain-to-Source Voltage



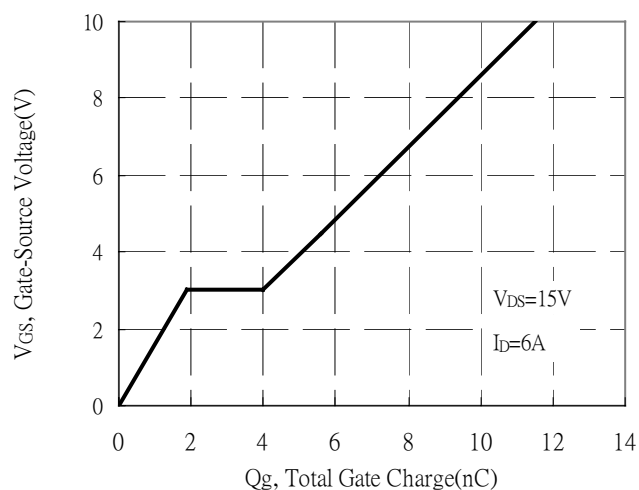
Threshold Voltage vs Junction Temperature



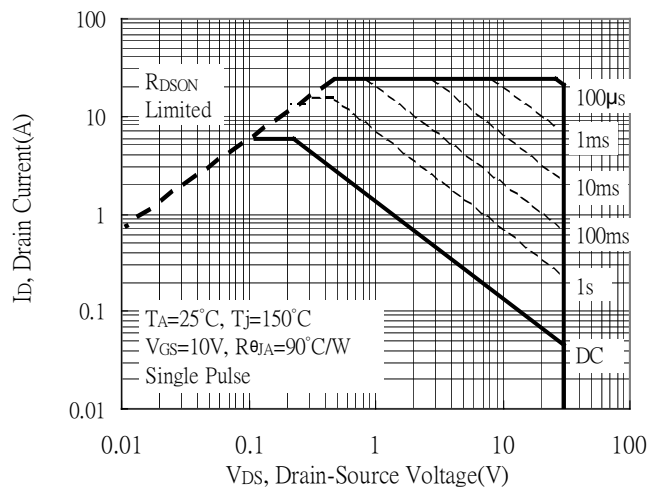
Forward Transfer Admittance vs Drain Current



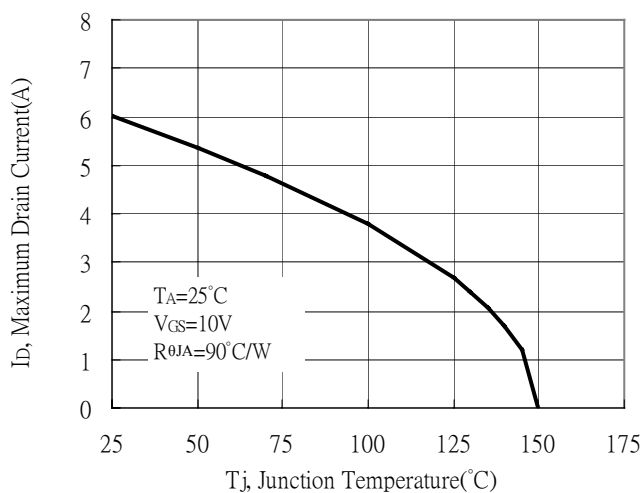
Gate Charge Characteristics



Maximum Safe Operating Area

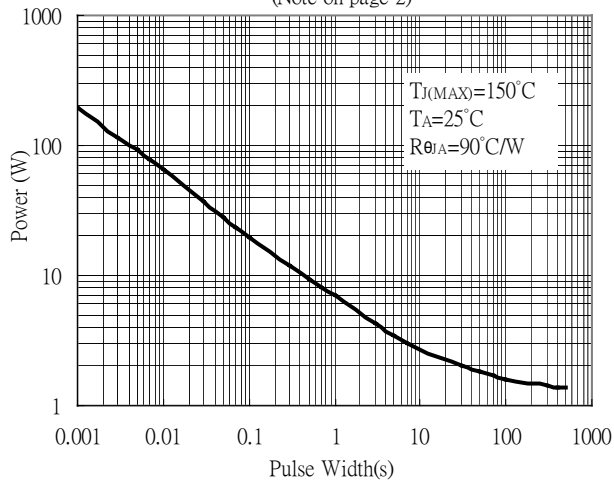


Maximum Drain Current vs Junction Temperature

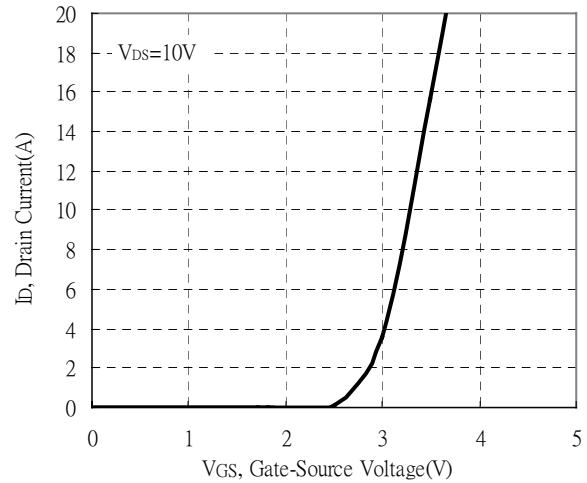


## Typical Characteristics(Cont.) : Q1( N-channel)

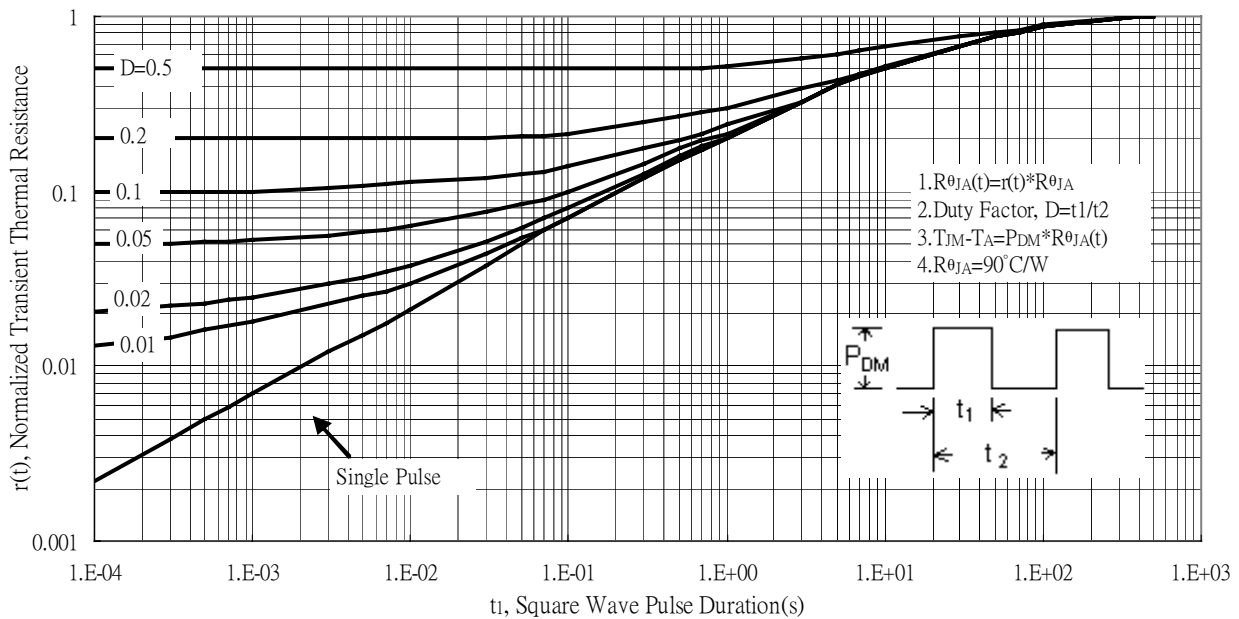
Single Pulse Power Rating, Junction to Ambient  
(Note on page 2)



Typical Transfer Characteristics

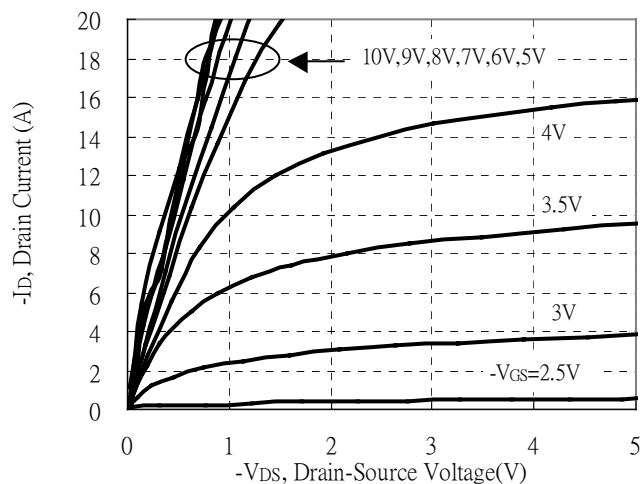


Transient Thermal Response Curves

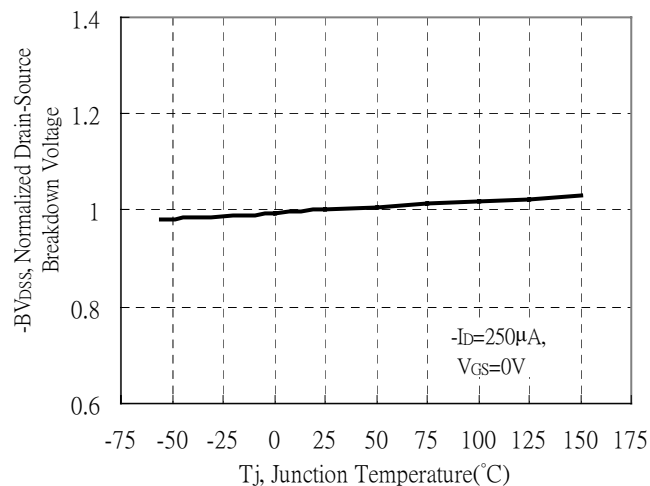


## Typical Characteristics : Q2( P-channel)

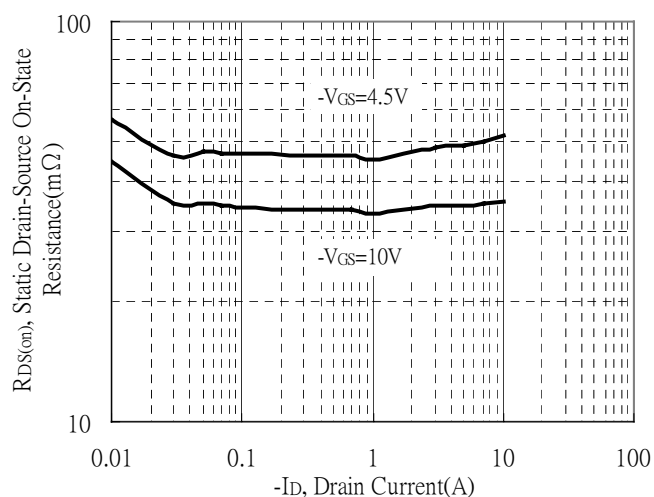
Typical Output Characteristics



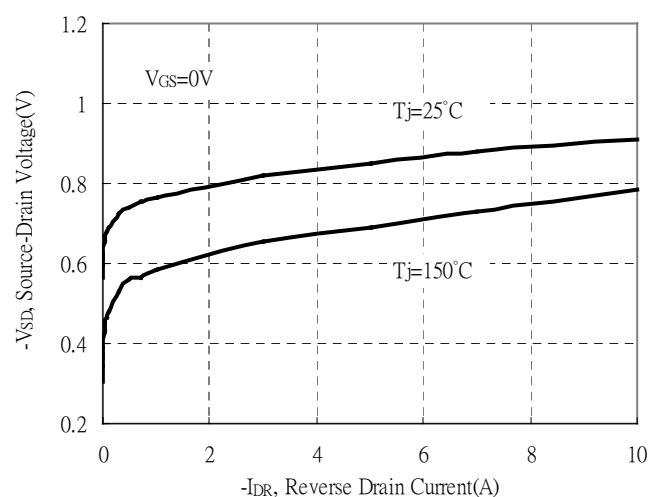
Breakdown Voltage vs Ambient Temperature



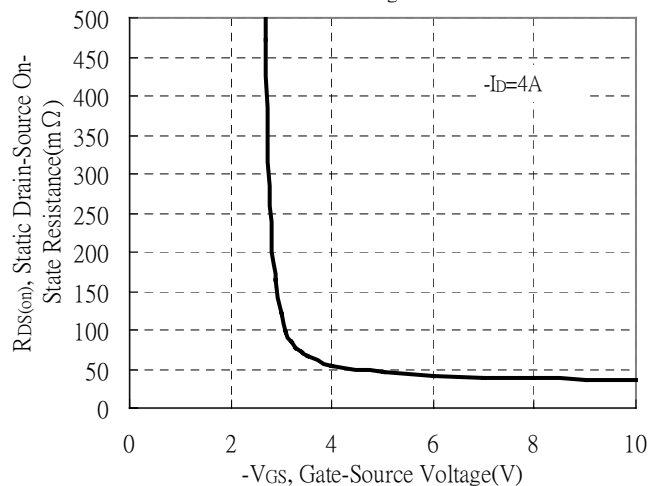
Static Drain-Source On-State resistance vs Drain Current



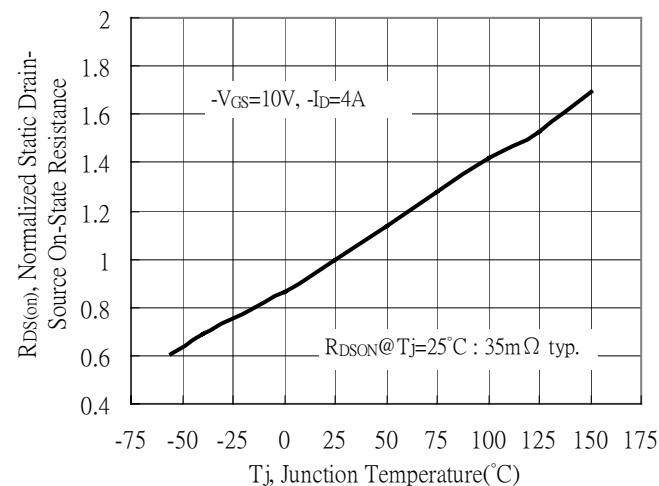
Reverse Drain Current vs Source-Drain Voltage



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

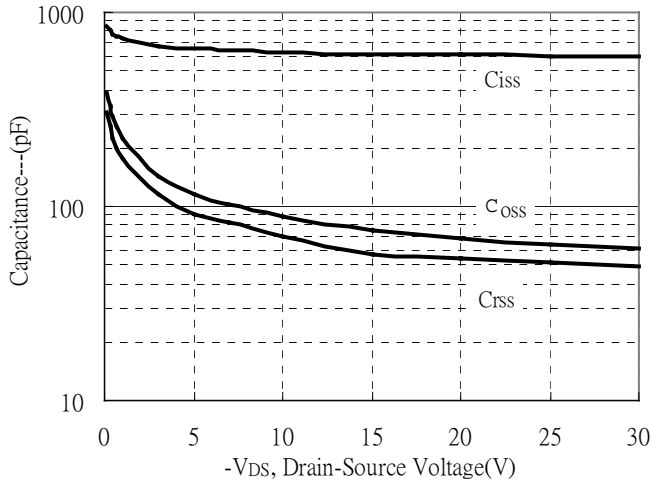


Drain-Source On-State Resistance vs Junction Temperature

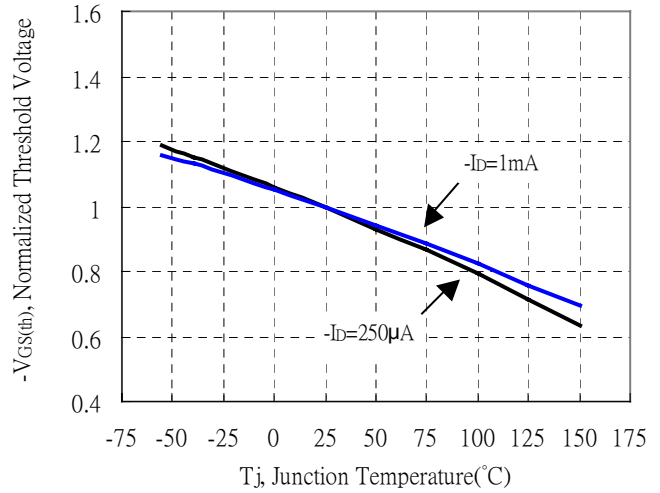


## Typical Characteristics(Cont.) : Q2(P-channel)

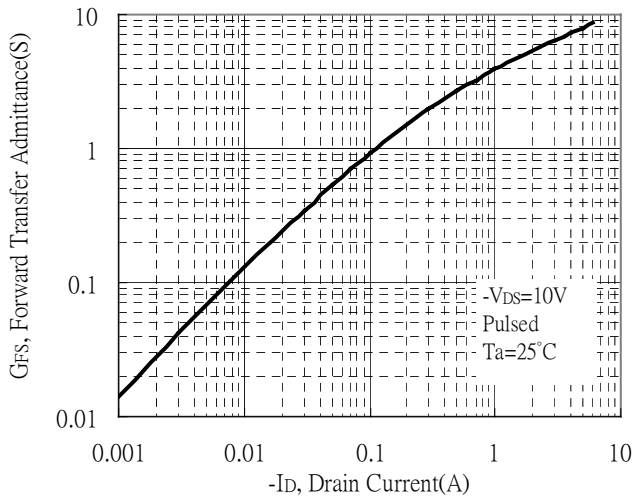
Capacitance vs Drain-to-Source Voltage



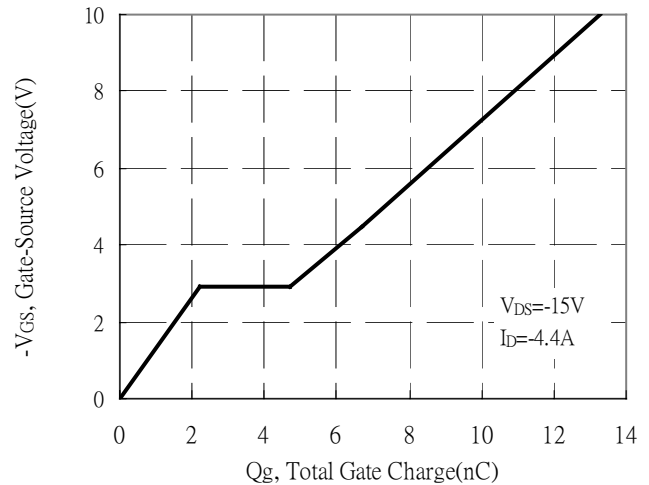
Threshold Voltage vs Junction Temperature



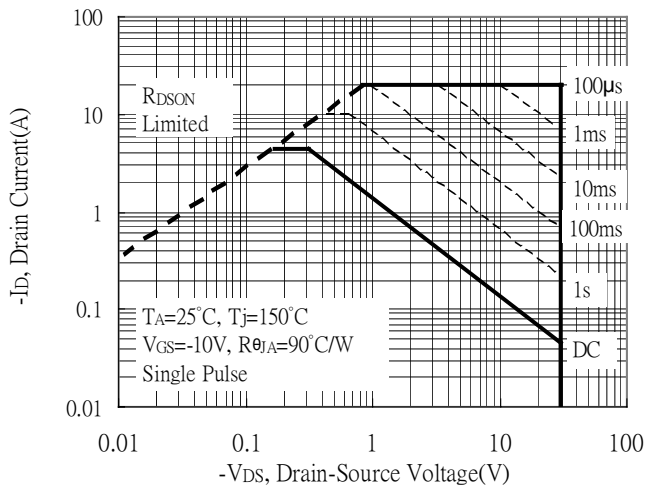
Forward Transfer Admittance vs Drain Current



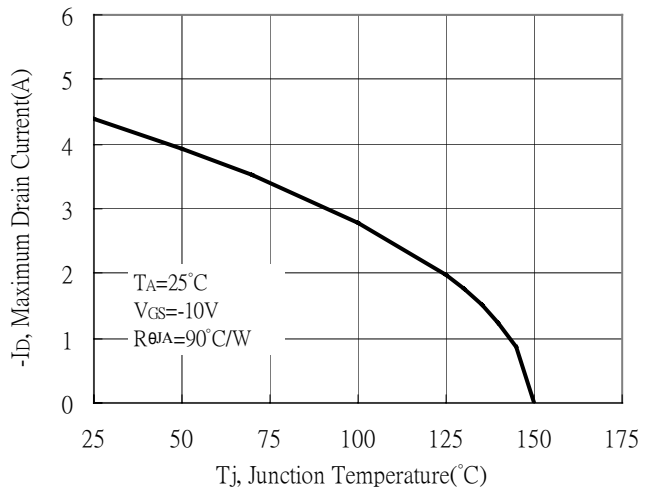
Gate Charge Characteristics



Maximum Safe Operating Area



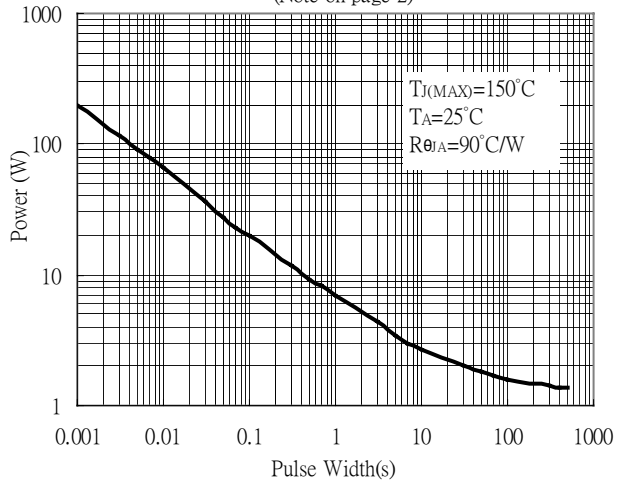
Maximum Drain Current vs Junction Temperature



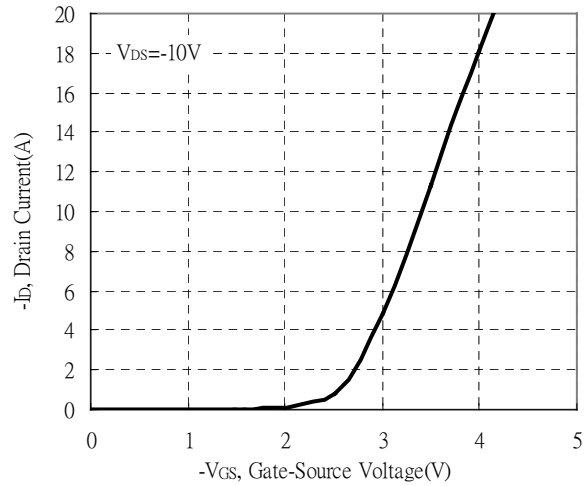


## Typical Characteristics(Cont.) : Q2(P-channel)

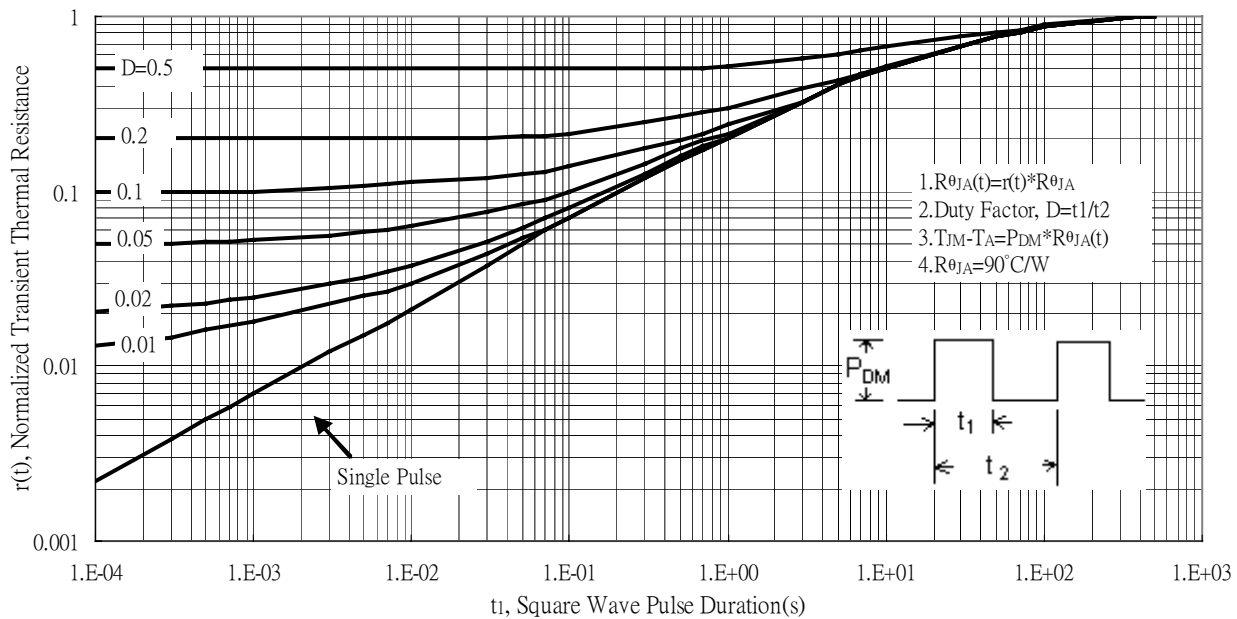
Single Pulse Power Rating, Junction to Ambient  
(Note on page 2)



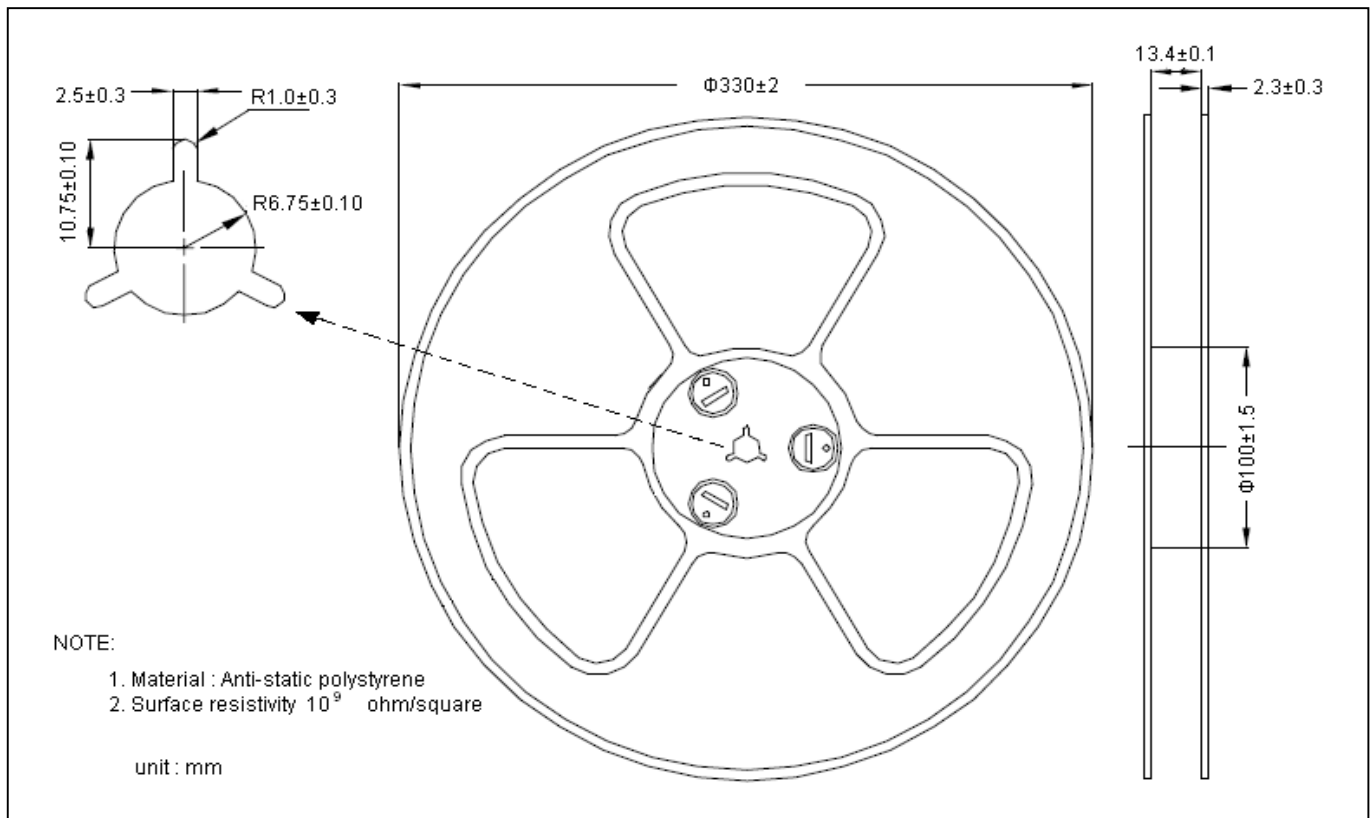
Typical Transfer Characteristics



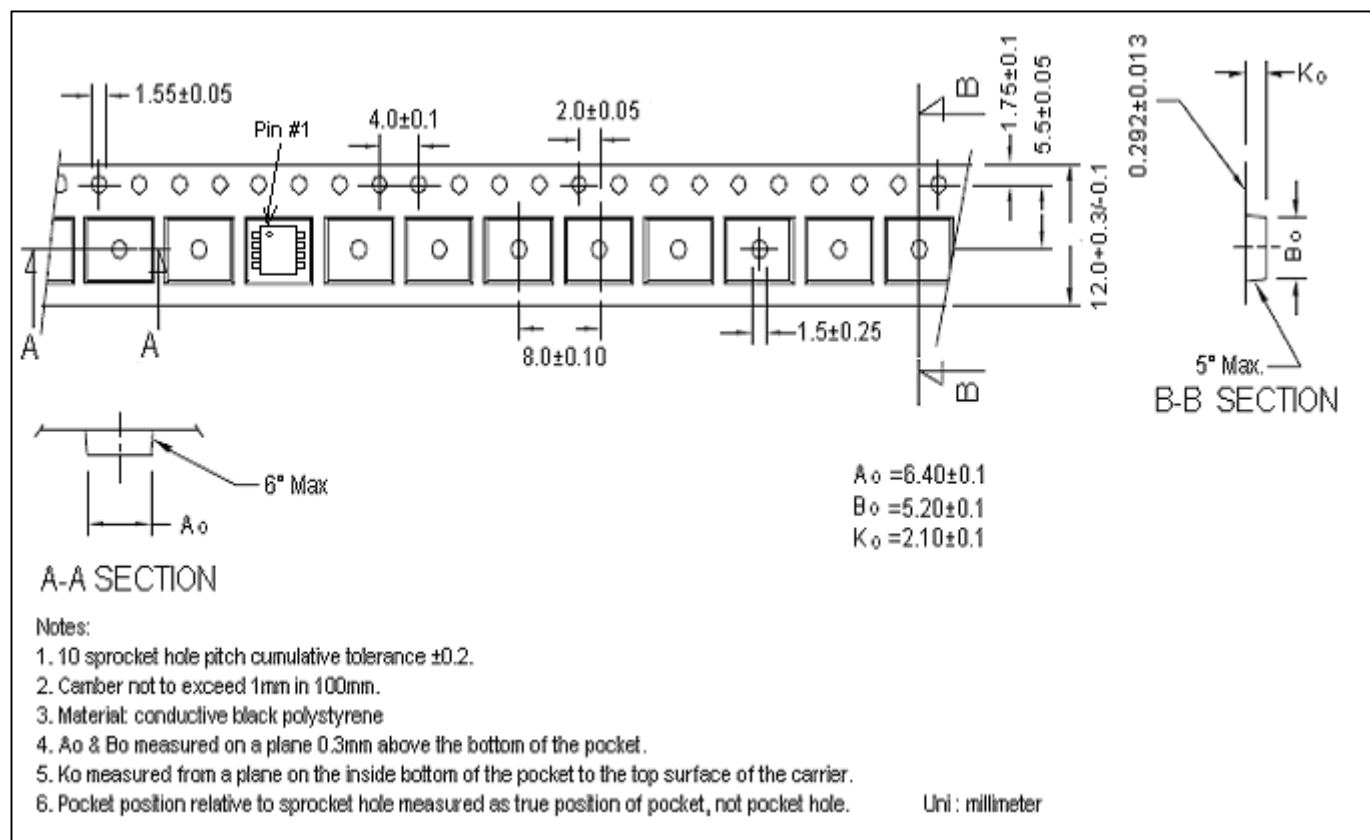
Transient Thermal Response Curves



## Reel Dimension



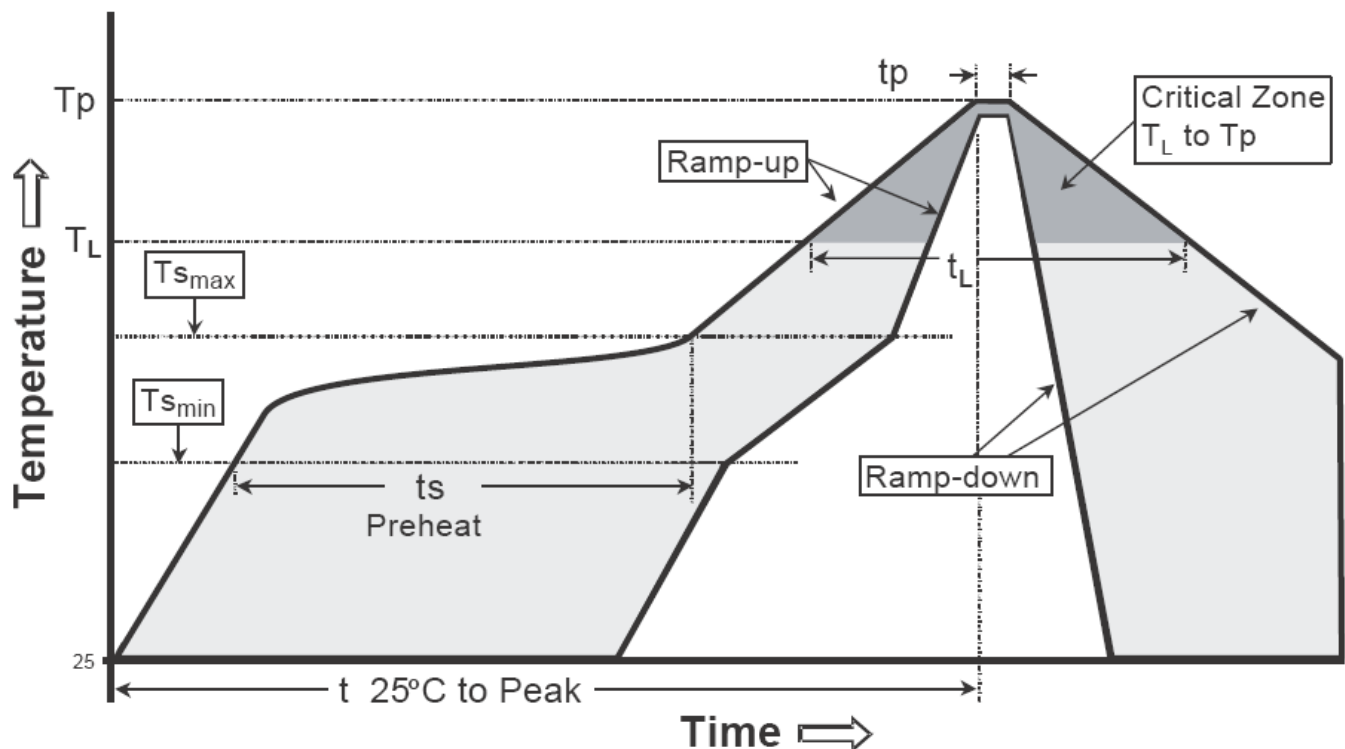
## Carrier Tape Dimension



## Recommended wave soldering condition

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

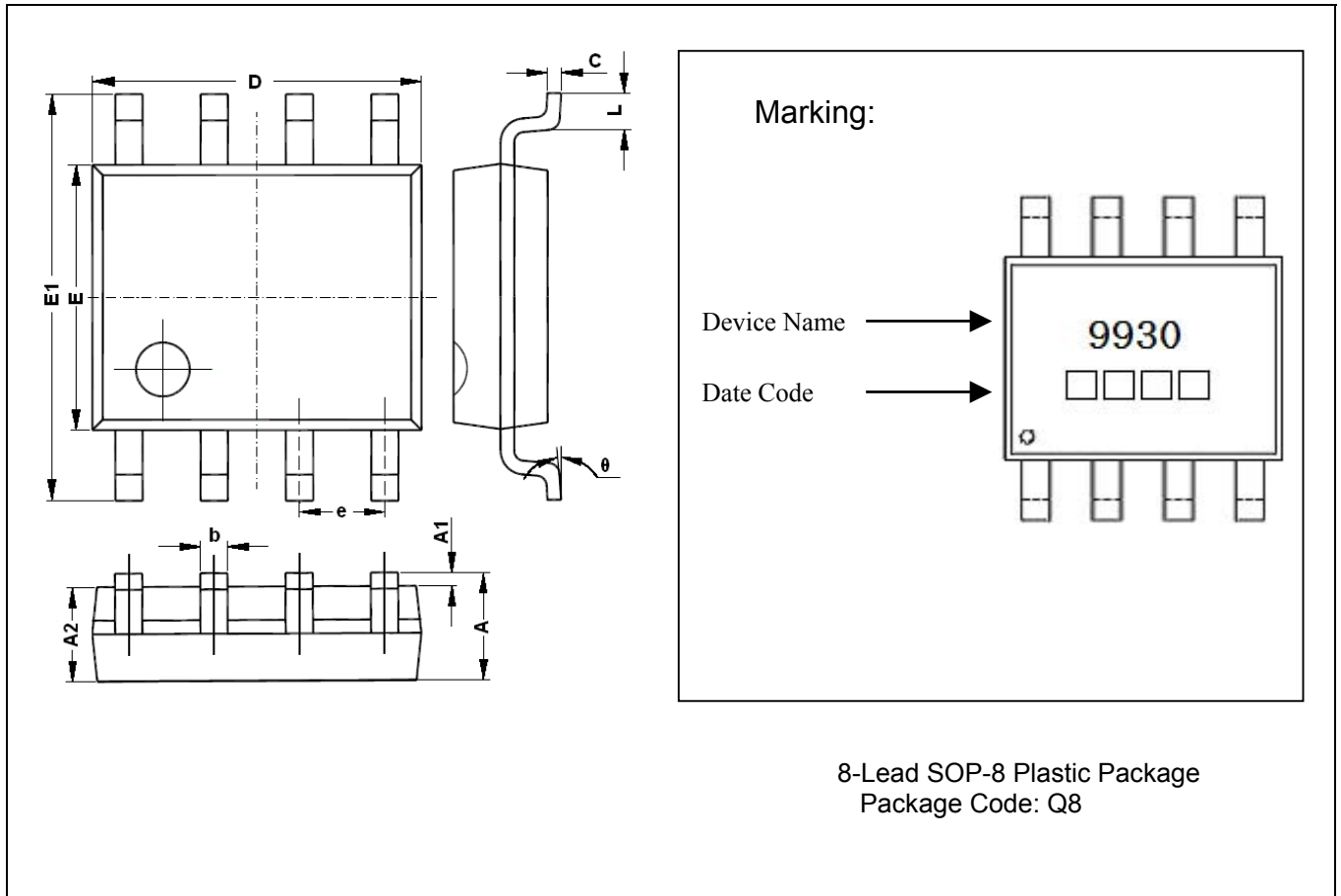
## Recommended temperature profile for IR reflow



| Profile feature                                | Sn-Pb eutectic Assembly | Pb-free Assembly |
|------------------------------------------------|-------------------------|------------------|
| Average ramp-up rate (Tsmax to Tp)             | 3°C/second max.         | 3°C/second max.  |
| Preheat                                        |                         |                  |
| -Temperature Min(Ts min)                       | 100°C                   | 150°C            |
| -Temperature Max(Ts max)                       | 150°C                   | 200°C            |
| -Time(ts min to ts max)                        | 60-120 seconds          | 60-180 seconds   |
| Time maintained above:                         |                         |                  |
| -Temperature (TL)                              | 183°C                   | 217°C            |
| - Time (tL)                                    | 60-150 seconds          | 60-150 seconds   |
| Peak Temperature(TP)                           | 240 +0/-5 °C            | 260 +0/-5 °C     |
| Time within 5°C of actual peak temperature(tp) | 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



| 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 | θ   | 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.

### Material:

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