## N- AND P-Channel Enhancement Mode MOSFET

# MTC4503Q8

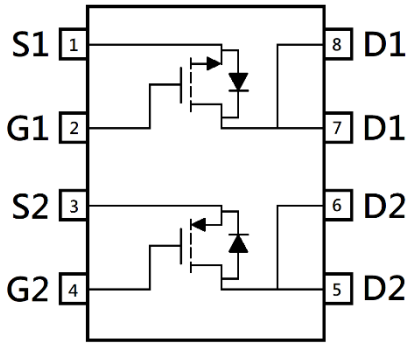
## Features

- Low On Resistance
- Low Gate Charge
- Fast Switching Characteristic

| | N-CH | P-CH |
|---|---|---|
| $BV_{DSS}$ | 30V | -30V |
| $I_D$@$V_{GS}$=(-)10V, $T_C$=25˚C | 12A | -10A |
| $I_D$@$V_{GS}$=(-)10V, $T_A$=25˚C | 6A | -5A |
| $R_{DS(ON)}$ typ. @$V_{GS}$=(-)10V | 15 mΩ | 25mΩ |
| $R_{DS(ON)}$ typ. @$V_{GS}$=(-)4.5V | 20mΩ | 38mΩ |

## Equivalent Circuit

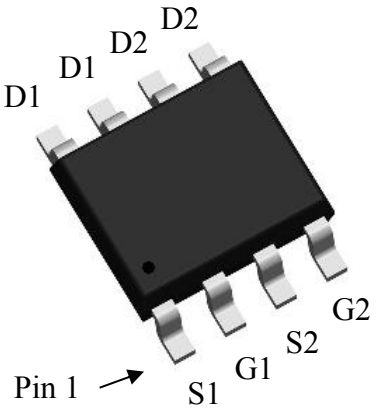
MTC4503Q8




G : Gate S : Source D : Drain

## Outline

SOP-8




## Ordering Information

| Device | Package | Shipping |
|---|---|---|
| MTC4503Q8-0-TF-G | SOP-8<br>(Pb-free lead plating and halogen-free package) | 4000 pcs / Tape & Reel |

- Environment friendly grade : S for RoHS compliant products, G for RoHS compliant and green compound products
- Packing spec, TF: 4000 pcs / tape & reel, 13” reel
- Product rank, zero for no rank products
- Product name

## Absolute Maximum Ratings ($T_A$=25°C)

| Parameter | | Symbol | Limits N-CH | Limits P-CH | Unit |
|---|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DS}$ | 30 | -30 | V |
| Gate-Source Voltage | | $V_{GS}$ | ±20 | ±20 | V |
| Continuous Drain Current @ $V_{GS}$=(-)10V, $T_C$=25°C | *a | $I_D$ | 12 | -10 | A |
| Continuous Drain Current @ $V_{GS}$=(-)10V, $T_C$=100°C | *a | $I_D$ | 8 | -6 | A |
| Continuous Drain Current @ $V_{GS}$=(-)10V, $T_A$=25°C | *b | $I_D$ | 6 | -5 | A |
| Continuous Drain Current @ $V_{GS}$=(-)10V, $T_A$=70°C | *b | $I_D$ | 5 | -4 | A |
| Pulsed Drain Current | *c | $I_{DM}$ | 24 | -20 | A |
| Continuous Body Diode Forward Current @ $T_C$=25°C | *a | $I_S$ | 4 | -4 | A |
| Avalanche Current @ L=0.1mH | | $I_{AS}$ | 10 | -15 | A |
| Avalanche Energy @ L=0.5mH | | $E_{AS}$ | 9 | 16 | mJ |
| Total Power Dissipation | $T_C$=25°C *a | $P_D$ | 5.7 | | W |
| Total Power Dissipation | $T_C$=100°C *a | $P_D$ | 2.3 | | W |
| Total Power Dissipation | $T_A$=25°C *b | $P_D$ | 1.5 | | W |
| Total Power Dissipation | $T_A$=70°C *b | $P_D$ | 1 | | W |
| Operating Junction and Storage Temperature Range | | $T_J$, $T_{stg}$ | -55~+150 | | °C |

## Thermal Data

| Parameter | | Symbol | Steady State | Unit |
|---|---|---|---|---|
| Thermal Resistance, Junction-to-case | | $R_{\theta JC}$ | 22 | °C/W |
| Thermal Resistance, Junction-to-ambient | *b | $R_{\theta JA}$ | 86 | °C/W |

Note:

*a. The power dissipation $P_D$ is based on $T_{J(MAX)}$=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 $R_{\theta JA}$ is measured with the device mounted on 1 in² FR-4 board with 2 oz. copper, in a still air environment with $T_A$=25°C. The power dissipation $P_D$ is based on $R_{\theta JA}$ 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 $T_{J(MAX)}$=150°C. Ratings are based on low frequency and low duty cycles to keep initial $T_J$=25°C.

## N-Channel Electrical Characteristics ($T_A$=25°C, unless otherwise specified)

| Symbol | Min. | Typ. | Max. | Unit | Test Conditions |
|---|---|---|---|---|---|
| **Static** | | | | | |
| $BV_{DSS}$ | 30 | - | - | V | $V_{GS}$=0V, $I_D$=250μA |
| $V_{GS(th)}$ | 1 | - | 2.5 | | $V_{DS}$=$V_{GS}$, $I_D$=250μA |
| $G_{FS}$ | - | 5.4 | - | S | $V_{DS}$=10V, $I_D$=3A |
| $I_{GSS}$ | - | - | ±100 | nA | $V_{GS}$=±20V, $V_{DS}$=0V |
| $I_{DSS}$ | - | - | 1 | μA | $V_{DS}$=24V, $V_{GS}$=0V |
| $R_{DS(ON)}$ | - | 15 | 19 | mΩ | $V_{GS}$=10V, $I_D$=6A |
| | - | 20 | 26 | | $V_{GS}$=4.5V, $I_D$=4A |
| **Dynamic** | | | | | |
| Ciss | - | 510 | - | pF | $V_{DS}$=15V, $V_{GS}$=0V, f=1MHz |
| Coss | - | 75 | - | | |
| Crss | - | 58 | - | | |
| Rg | - | 4.5 | - | Ω | f=1MHz |
| Qg *1, 2 | - | 13 | - | nC | $V_{DS}$=15V, $I_D$=6A, $V_{GS}$=10V |
| Qgs *1, 2 | - | 1.6 | - | | |
| Qgd *1, 2 | - | 2.5 | - | | |
| $t_{d(ON)}$ *1, 2 | - | 5.6 | - | ns | $V_{DS}$=15V, $I_D$=6A, $V_{GS}$=10V, $R_{GS}$=1Ω |
| tr *1, 2 | - | 7.5 | - | | |
| $t_{d(OFF)}$ *1, 2 | - | 26 | - | | |
| $t_f$ *1, 2 | - | 4.5 | - | | |
| **Source-Drain Diode** | | | | | |
| $V_{SD}$ *1 | - | 0.85 | 1.2 | V | $I_S$=6A, $V_{GS}$=0V |
| trr | - | 7 | - | ns | $I_F$=6A, $dI_F/dt$=100A/μs |
| Qrr | - | 3 | - | nC | |

Note:
*1. Pulse Test : Pulse Width ≤300μs, Duty Cycle≤2%
*2. Independent of operating temperature

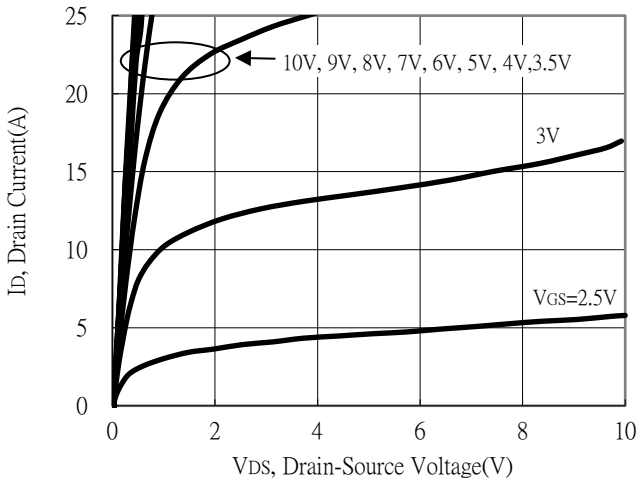
## P-Channel Electrical Characteristics ($T_A$=25°C, unless otherwise specified)

| Symbol | Min. | Typ. | Max. | Unit | Test Conditions |
|---|---|---|---|---|---|
| **Static** | | | | | |
| $BV_{DSS}$ | -30 | - | - | V | $V_{GS}$=0V, $I_D$=-250μA |
| $V_{GS(th)}$ | -1 | - | -2.5 | | $V_{DS}$=$V_{GS}$, $I_D$=-250μA |
| $G_{FS}$ | - | 5.7 | - | S | $V_{DS}$=-10V, $I_D$=-5A |
| $I_{GSS}$ | - | - | ±100 | nA | $V_{GS}$=±20V, $V_{DS}$=0V |
| $I_{DSS}$ | - | - | -1 | μA | $V_{DS}$=-24V, $V_{GS}$=0V |
| $R_{DS(ON)}$ | - | 25 | 34 | mΩ | $V_{GS}$=-10V, $I_D$=-5A |
| | - | 38 | 49 | | $V_{GS}$=-4.5V, $I_D$=-4A |
| **Dynamic** | | | | | |
| Ciss | - | 1000 | - | pF | $V_{DS}$=-15V, $V_{GS}$=0V, f=1MHz |
| Coss | - | 110 | - | | |
| Crss | - | 95 | - | | |
| Rg | - | 22 | - | Ω | f=1MHz |
| Qg *1, 2 | - | 20 | - | nC | $V_{DS}$=-15V, $I_D$=-5A, $V_{GS}$=-10V |
| Qgs *1, 2 | - | 3.8 | - | | |
| Qgd *1, 2 | - | 4 | - | | |
| $t_{d(ON)}$ *1, 2 | - | 8.2 | - | ns | $V_{DS}$=-15V, $I_D$=-5A, $V_{GS}$=-10V, $R_{GS}$=10Ω |
| tr *1, 2 | - | 18 | - | | |
| $t_{d(OFF)}$ *1, 2 | - | 65 | - | | |
| $t_f$ *1, 2 | - | 28 | - | | |
| **Source-Drain Diode** | | | | | |
| $V_{SD}$ *1 | - | -0.85 | -1.2 | V | $I_S$=-5A, $V_{GS}$=0V |
| trr | - | 11 | - | ns | $I_F$=-5A, $dI_F/dt$=100A/μs |
| Qrr | - | 6 | - | nC | |

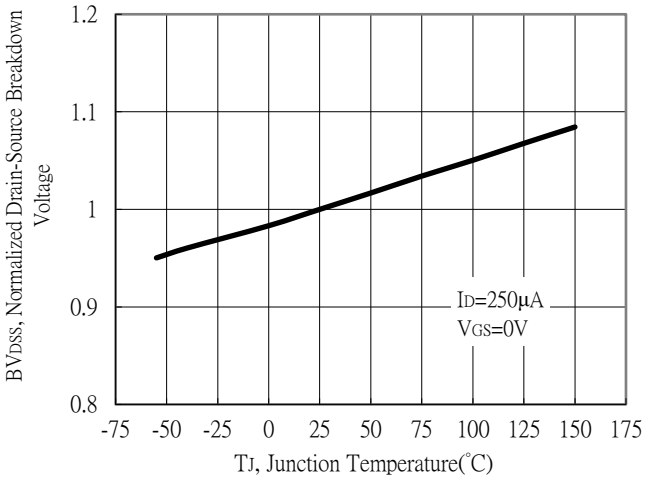
Note:
*1. Pulse Test : Pulse Width ≤300μs, Duty Cycle≤2%
*2. Independent of operating temperature

## Typical Characteristics : Q1( N-channel )

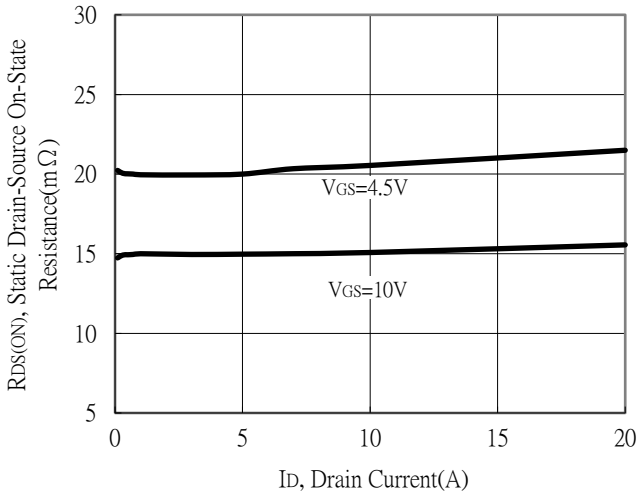
Typical Output Characteristics



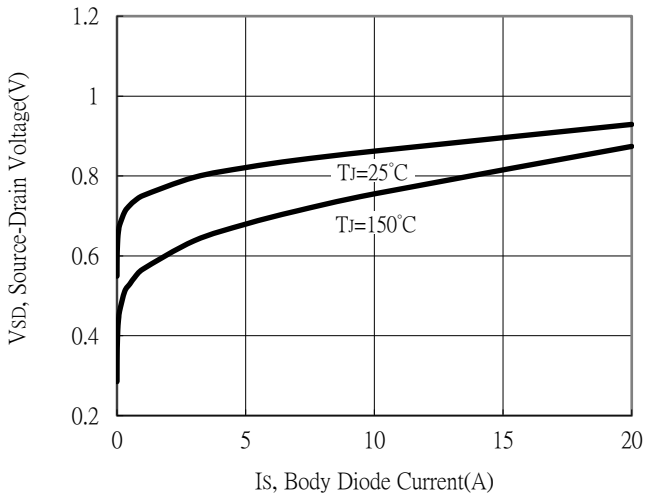

Breakdown Voltage vs Ambient Temperature



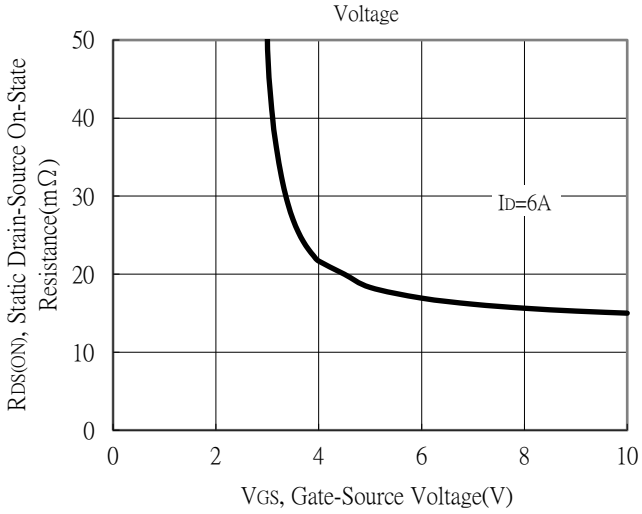

Static Drain-Source On-State resistance vs Drain Current



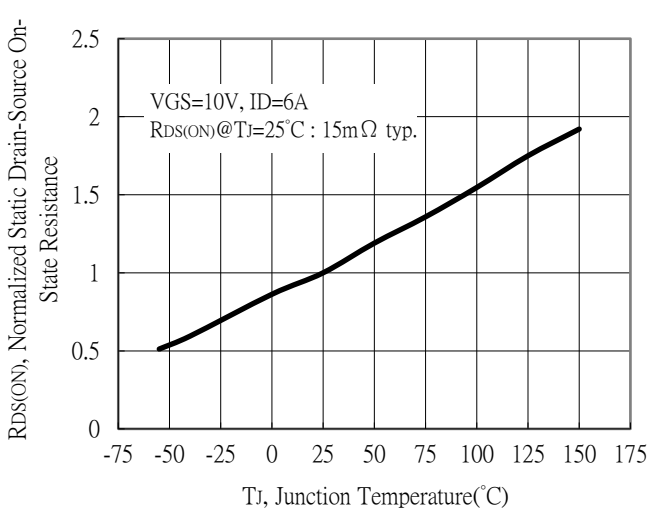

Body Diode Current vs Source-Drain Voltage




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

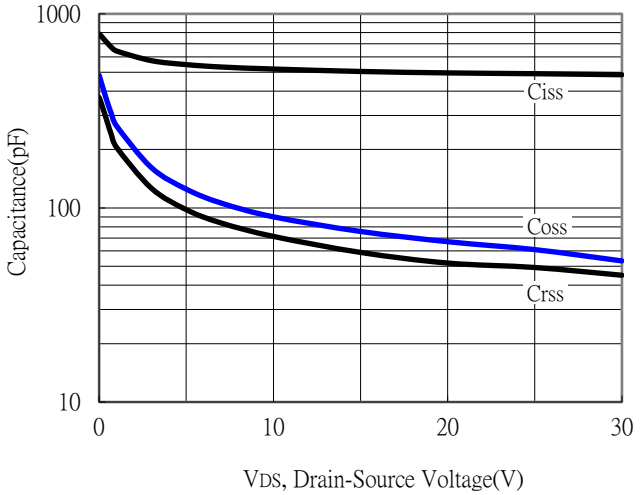



Drain-Source On-State Resistance vs Junction Temperature

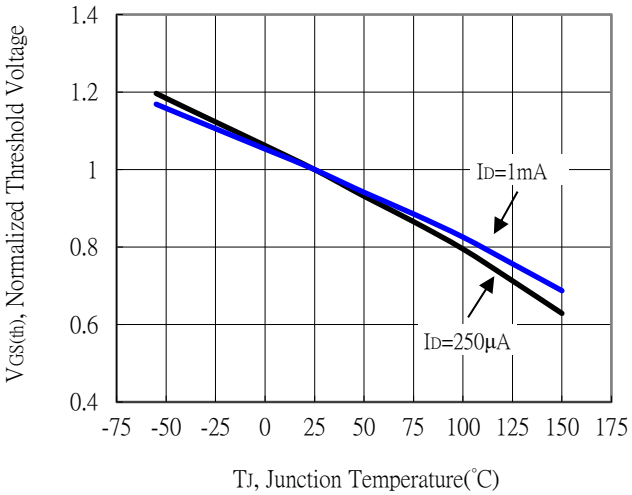


## Typical Characteristics (Cont.) : Q1( N-channel)

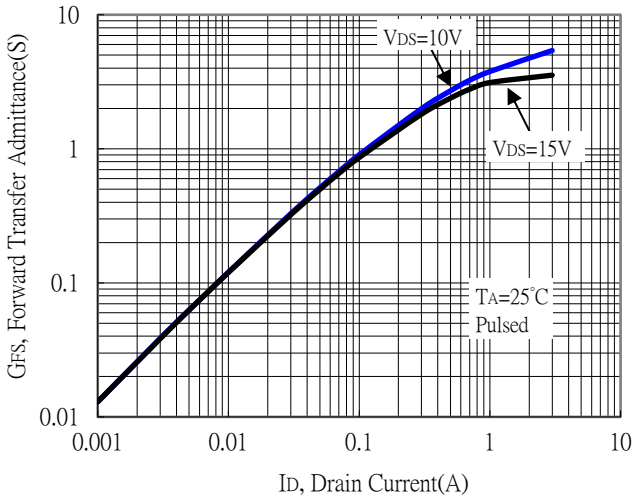
Capacitance vs Drain-to-Source Voltage



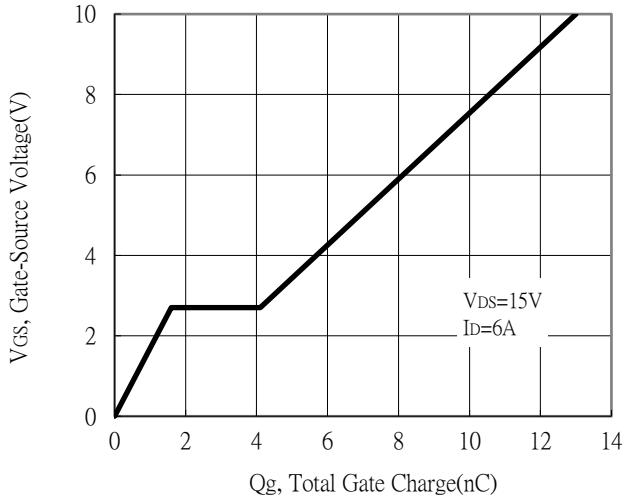

Threshold Voltage vs Junction Temperature



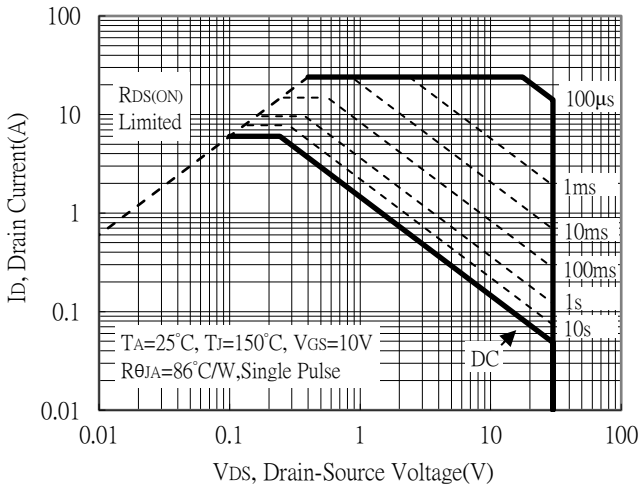

Forward Transfer Admittance vs Drain Current



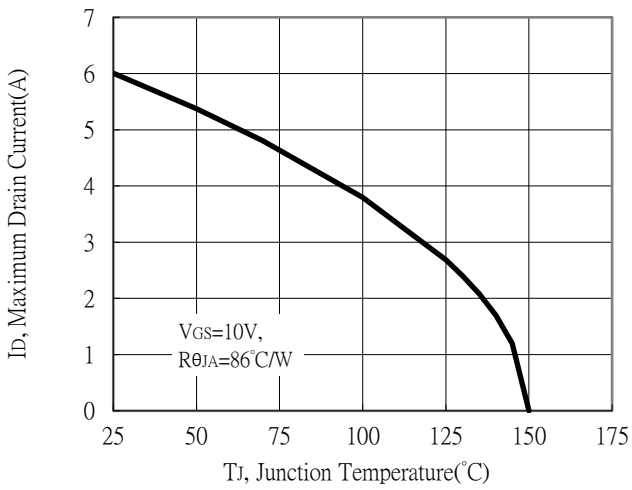

Gate Charge Characteristics



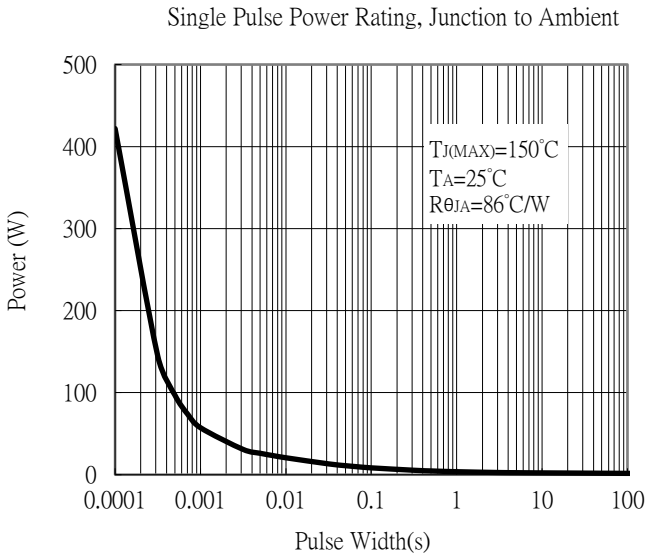

Maximum Safe Operating Area

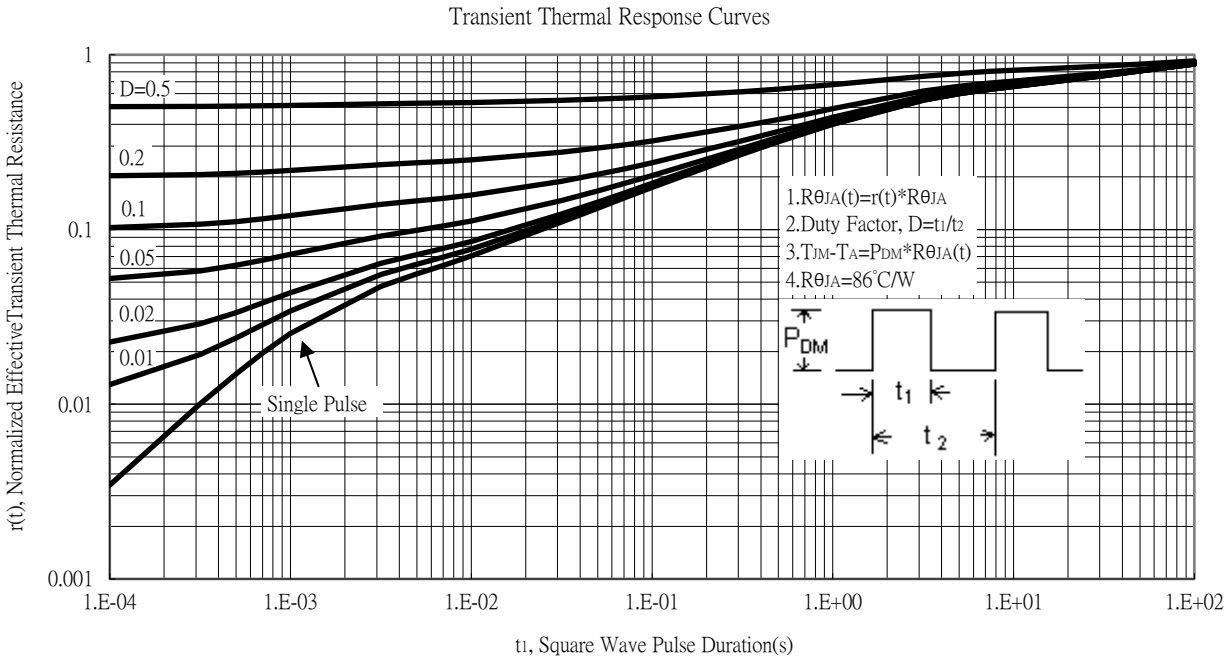



Maximum Drain Current vs Junction Temperature



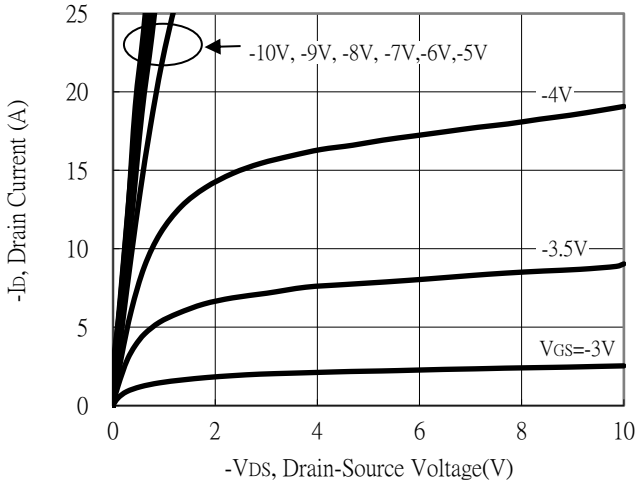
## Typical Characteristics (Cont.) : Q1( N-channel)



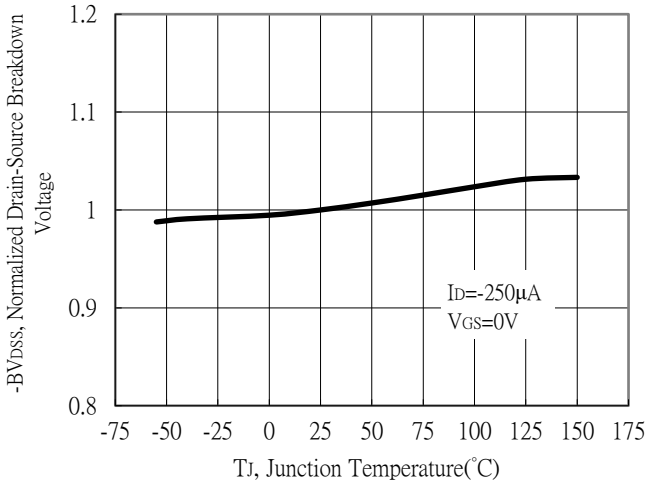



## Typical Characteristics : Q2( P-channel)

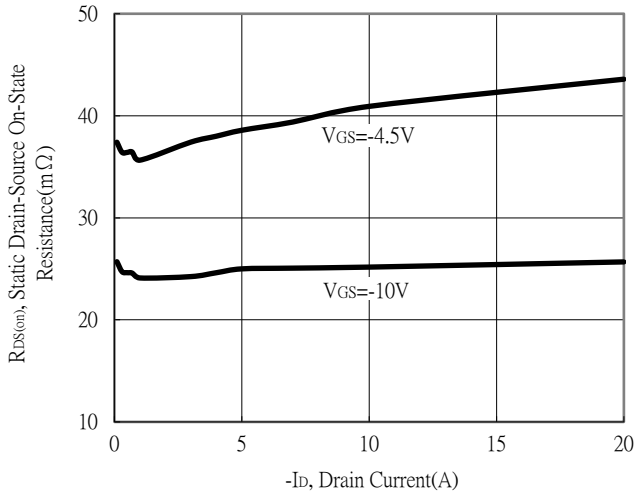
Typical Output Characteristics



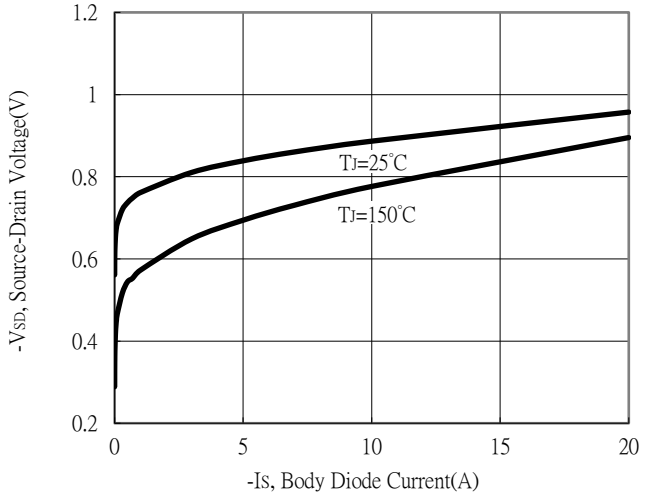

Breakdown Voltage vs Ambient Temperature



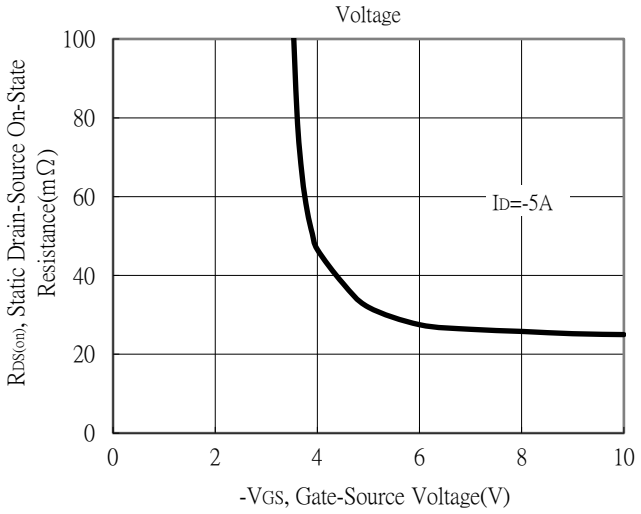

Static Drain-Source On-State resistance vs Drain Current



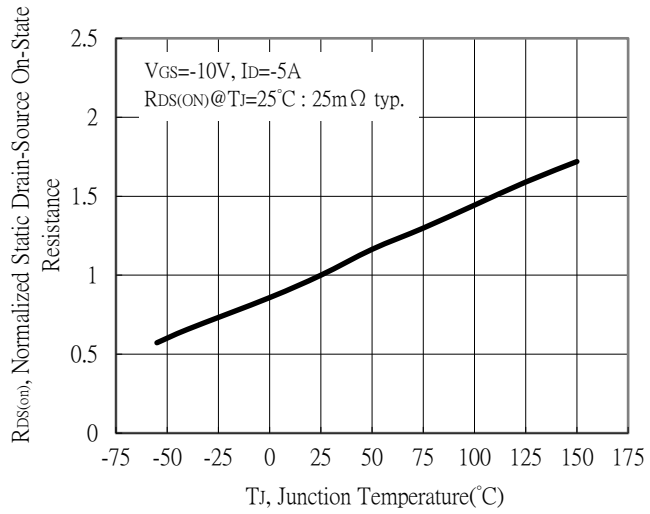

Body Diode Current vs Source-Drain Voltage




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

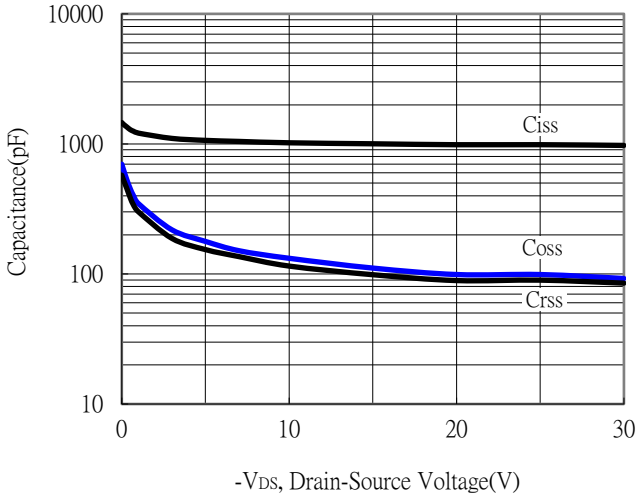



Drain-Source On-State Resistance vs Junction Temperature

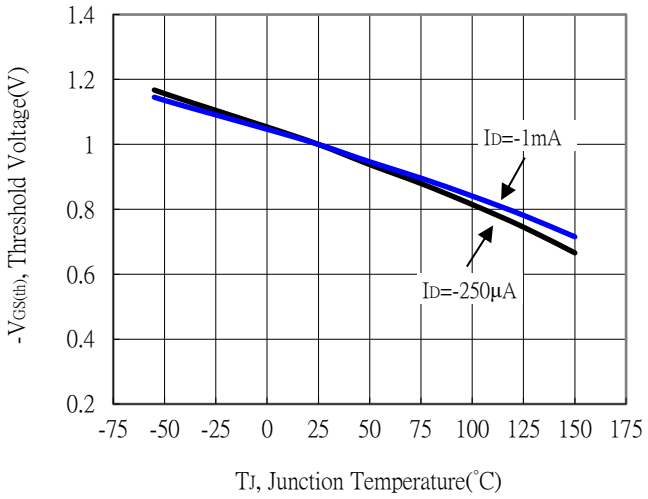


## Typical Characteristics (Cont.) : Q2(P-channel)

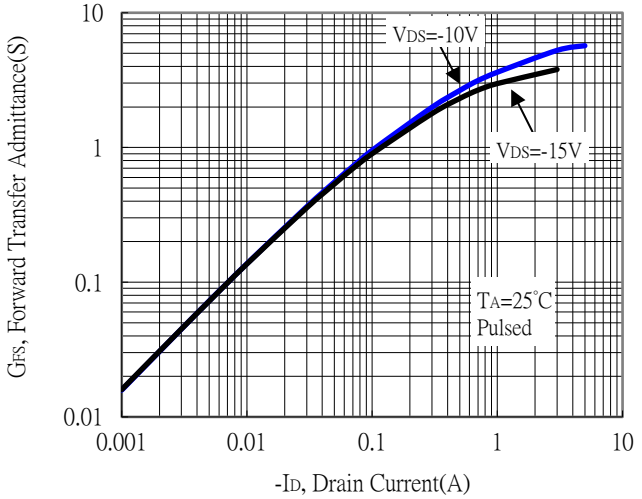
Capacitance vs Drain-to-Source Voltage



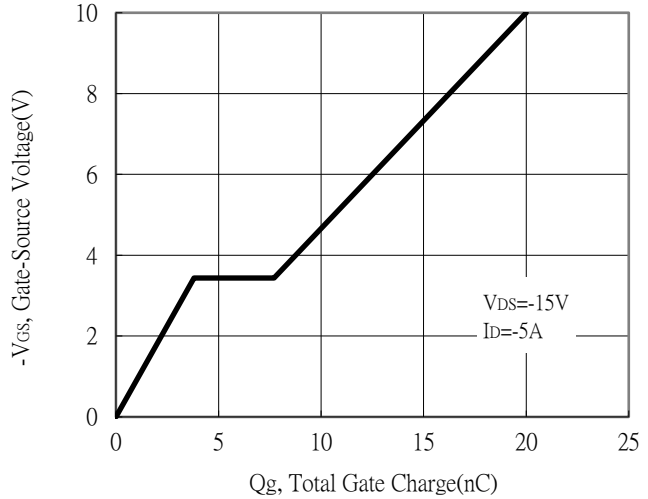

Threshold Voltage vs Junction Temperature



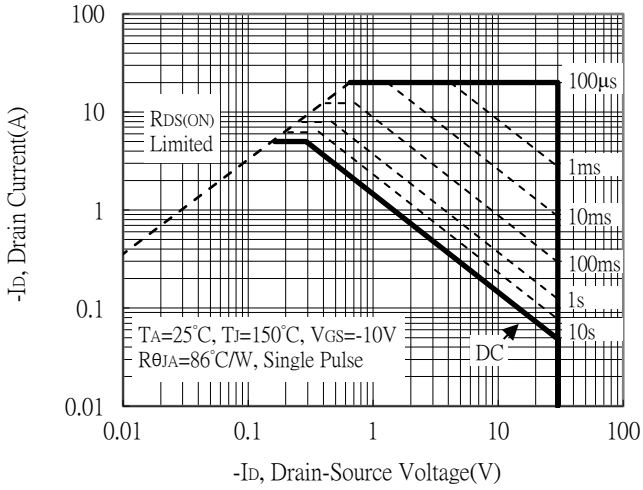

Forward Transfer Admittance vs Drain Current



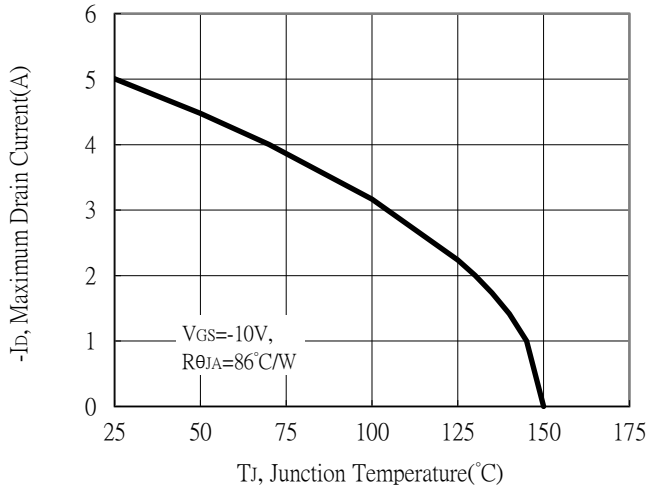

Gate Charge Characteristics



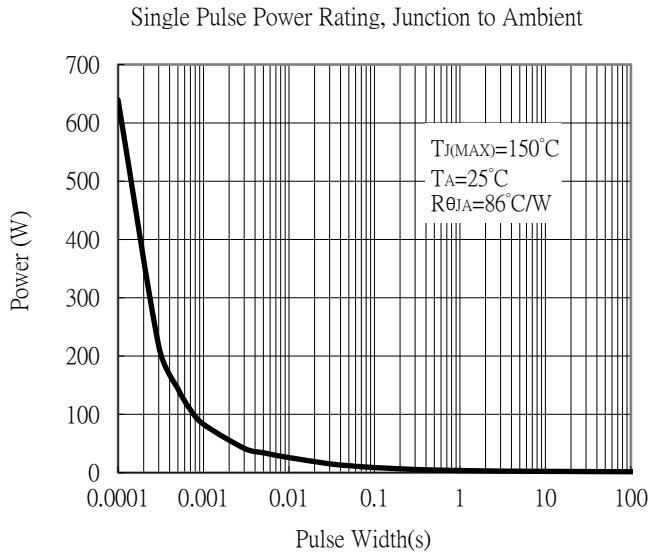

Maximum Safe Operating Area

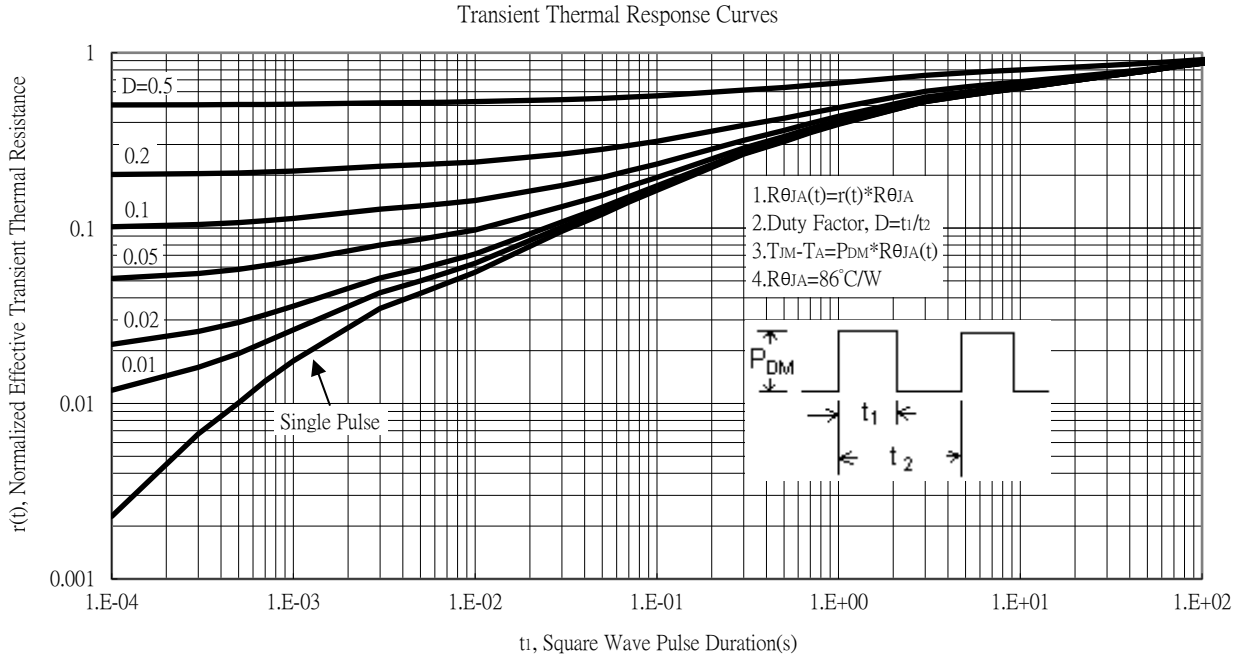



Maximum Drain Current vs Junction Temperature

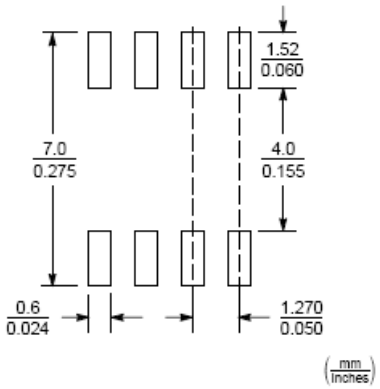


## Typical Characteristics (Cont.) : Q2(P-channel)

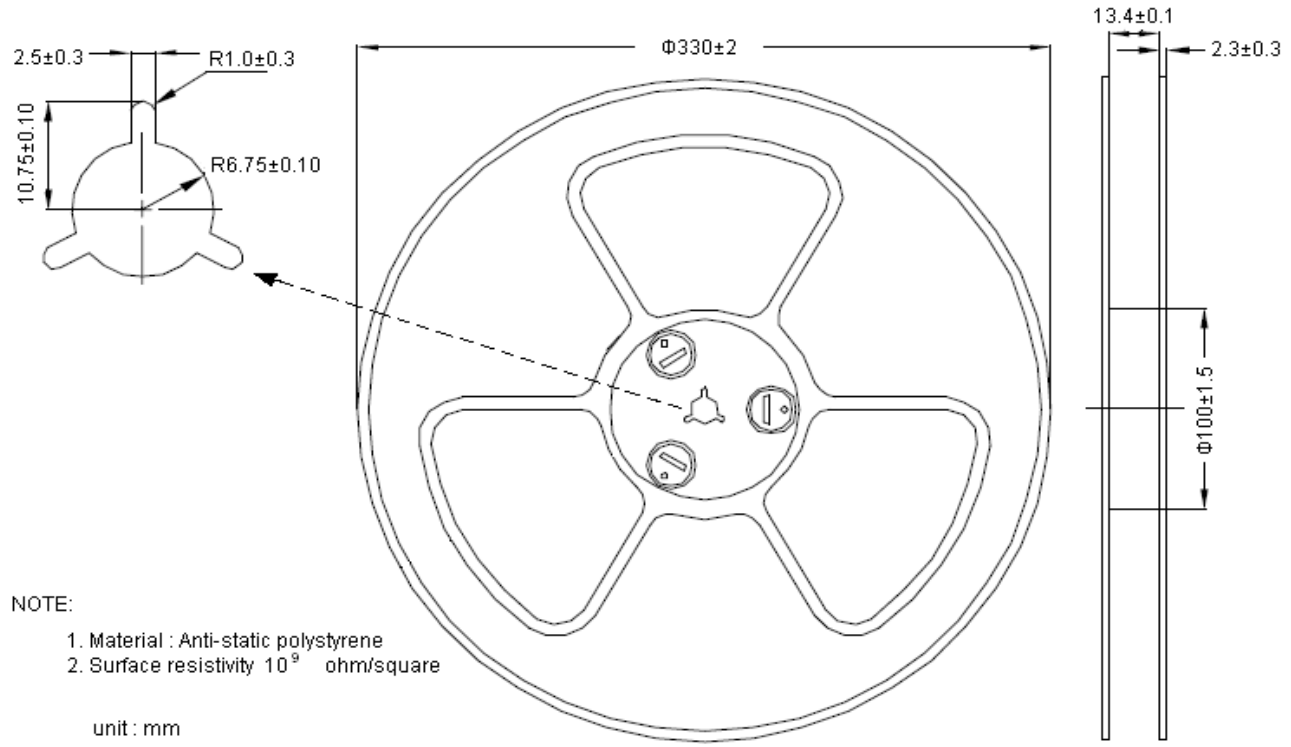



## Recommended Soldering Footprint



## Reel Dimension

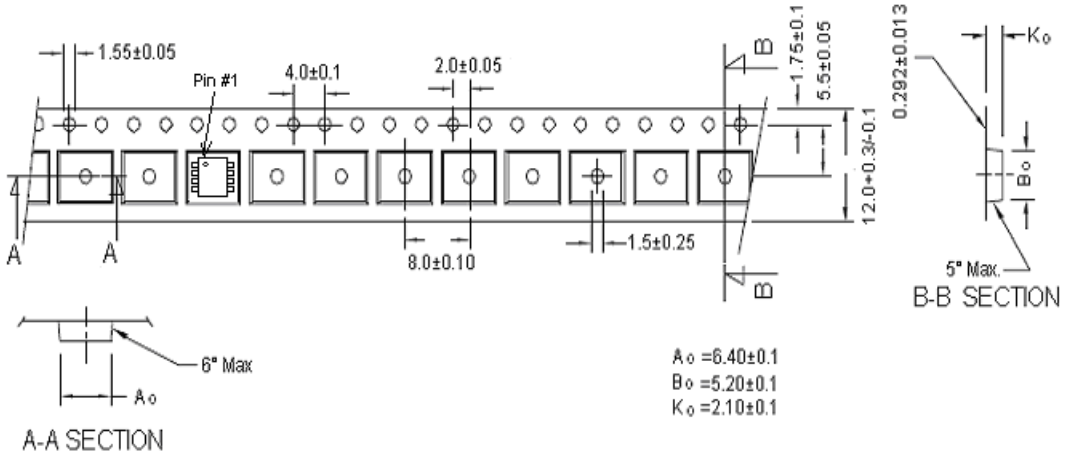



NOTE:

1. Material : Anti-static polystyrene
2. Surface resistivity $10^9$ ohm/square

unit : mm

## Carrier Tape Dimension




Notes:

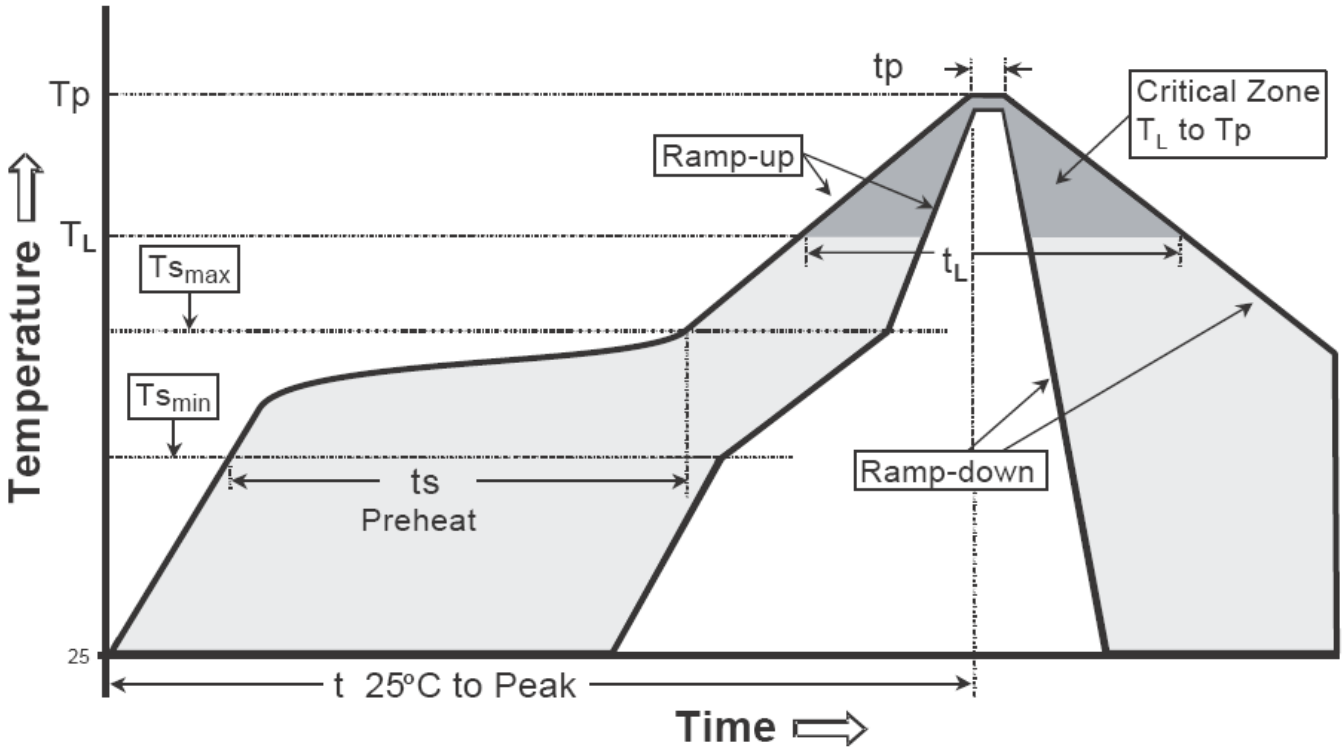
1. 10 sprocket hole pitch cumulative tolerance ±0.2.
2. Camber not to exceed 1mm in 100mm.
3. Material: conductive black polystyrene
4. Ao & Bo measured on a plane 0.3mm above the bottom of the pocket.
5. Ko measured from a plane on the inside bottom of the pocket to the top surface of the carrier.
6. Pocket position relative to sprocket hole measured as true position of pocket, not pocket hole.

Uni : millimeter

## Recommended wave soldering condition

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

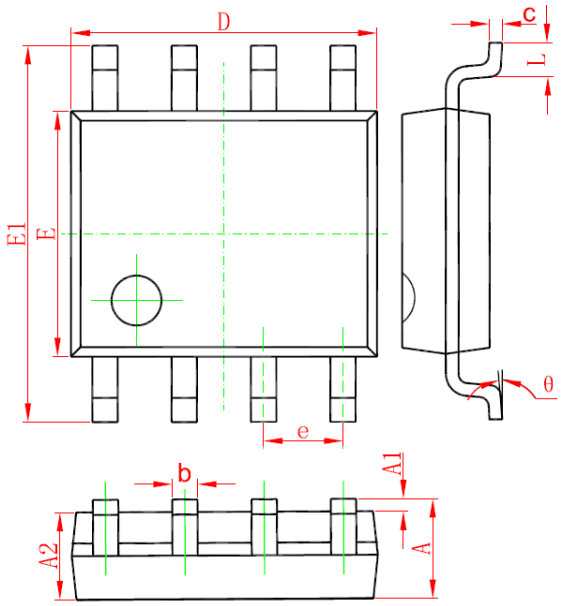
## Recommended temperature profile for IR reflow




| 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<br>−Temperature Min($T_S$ min)<br>−Temperature Max($T_S$ max)<br>−Time($t_{s\,min}$ to $t_{s\,max}$) | 100°C<br>150°C<br>60-120 seconds | 150°C<br>200°C<br>60-180 seconds |
| Time maintained above:<br>−Temperature ($T_L$)<br>− Time ($t_L$) | 183°C<br>60-150 seconds | 217°C<br>60-150 seconds |
| Peak Temperature($T_P$) | 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. |

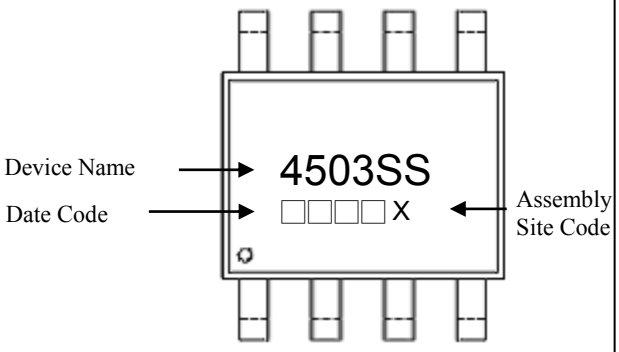
Note : All temperatures refer to topside of the package, measured on the package body surface.

## SOP-8 Dimension




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

Marking:




Date Code(counting from left to right) :
1st code: year code, the last digit of Christian year
2nd 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
3rd and 4th codes : production serial number, 01~99

Assembly Site Code : blank→ Site 1, G →Site 2

*: Typical

| 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 | | *0.050 | |
| 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.
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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