## N- AND P-Channel Logic Level Enhancement Mode MOSFET

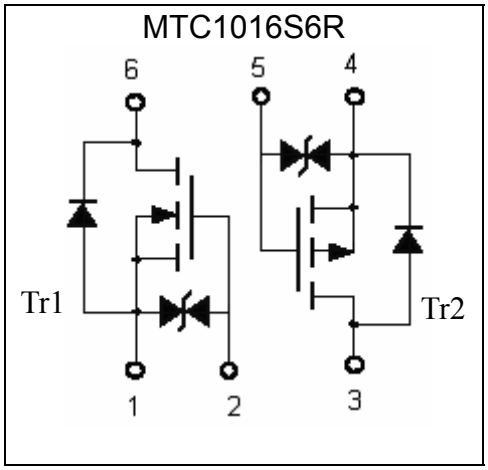
# MTC1016S6R

| | N-CH | P-CH |
|---|---|---|
| $BV_{DSS}$ | 20V | -20V |
| $I_D$ | 0.82A | -0.57A |
| $R_{DSON}$(typ.) @$V_{GS}$=(-)4.5V | 0.30Ω | 0.61Ω |
| $R_{DSON}$(typ.) @$V_{GS}$=(-)2.5V | 0.43Ω | 1.00Ω |
| $R_{DSON}$(typ.) @$V_{GS}$=(-)1.8V | 0.63Ω | 1.64Ω |

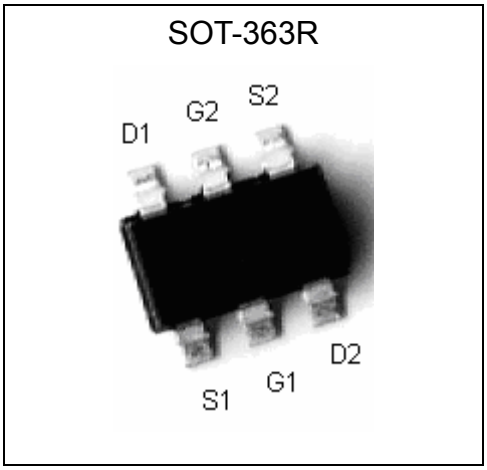
## Features

- Low on-resistance
- ESD protected
- High speed switching
- Low-voltage drive
- Pb-free package

## Equivalent Circuit




## Outline




## The following characteristics apply to both Tr1 and Tr2

## Absolute Maximum Ratings ($T_A$=25°C, unless otherwise noted)

| Parameter | Symbol | Limits | | Unit |
|---|---|---|---|---|
| | | N-channel | P-channel | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | 20 | -20 | V |
| Gate-Source Voltage | $V_{GS}$ | ±8 | ±8 | V |
| Continuous Drain Current @$T_A$=25 °C, $V_{GS}$=4.5V(-4.5V) | $I_D$ | 0.82 | -0.57 | A |
| Continuous Drain Current @$T_A$=70 °C, $V_{GS}$=4.5V(-4.5V) | $I_D$ | 0.66 | -0.46 | A |
| Pulsed Drain Current (Note 1) | $I_{DM}$ | 3.4 | -2.3 | A |
| Power Dissipation @$T_A$=25°C | $P_D$ | 0.30 | | W |
| Power Dissipation @$T_A$=70°C | | 0.18 | | |
| Operating Junction and Storage Temperature Range | Tj; Tstg | -55~+150 | | °C |

Note : 1. Pulse width limited by maximum junction temperature.
2. Pulse width≤ 300μs, duty cycle≤2%.
3.Surface mounted on minimum pad of FR-4 board, t≤5s.

## Thermal Performance

| Parameter | Symbol | Limit | Unit |
|---|---|---|---|
| Thermal Resistance, Junction-to-Ambient(PCB mounted) (Note) | Rth,ja | 415 | °C/W |

Note : Surface mounted on minimum pad of FR-4 board, t≤5s.

## N-Channel Electrical Characteristics (Tj=25°C, unless otherwise noted)

| Symbol | Min. | Typ. | Max. | Unit | Test Conditions |
|---|---|---|---|---|---|
| **Static** | | | | | |
| $BV_{DSS}$ | 20 | - | - | V | $V_{GS}$=0, $I_D$=250μA |
| $V_{GS(th)}$ | 0.5 | 0.8 | 1.2 | | $V_{DS}$=$V_{GS}$, $I_D$=250μA |
| $I_{GSS}$ | - | - | ±5 | μA | $V_{GS}$=±8V, $V_{DS}$=0 |
| $I_{DSS}$ | - | - | 1 | | $V_{DS}$=20V, $V_{GS}$=0 |
| | - | - | 10 | | $V_{DS}$=16V, $V_{GS}$=0 (Tj=70°C) |
| *$R_{DS(ON)}$ | - | 0.30 | 0.40 | Ω | $V_{GS}$=4.5V, $I_D$=600mA |
| | - | 0.43 | 0.56 | | $V_{GS}$=2.5V, $I_D$=400mA |
| | - | 0.63 | 0.82 | | $V_{GS}$=1.8V, $I_D$=350mA |
| *$G_{FS}$ | - | 1.1 | - | S | $V_{DS}$=10V, $I_D$=400mA |
| **Dynamic** | | | | | |
| Ciss | - | 58.5 | - | pF | $V_{DS}$=16V, $V_{GS}$=0, f=1MHz |
| Coss | - | 12.3 | - | | |
| Crss | - | 7.8 | - | | |
| $t_{d(ON)}$ | - | 6 | - | ns | $V_{DS}$=10V, $I_D$=250mA, $V_{GS}$=4.5V, $R_G$=10Ω |
| $t_r$ | - | 6 | - | | |
| $t_{d(OFF)}$ | - | 26 | - | | |
| $t_f$ | - | 20 | - | | |
| Qg | - | 0.79 | - | nC | $V_{DS}$=10V, $I_D$=250mA, $V_{GS}$=4.5V |
| Qgs | - | 0.09 | - | | |
| Qgd | - | 0.27 | - | | |
| **Source-Drain Diode** | | | | | |
| *$I_S$ | - | - | 0.82 | A | |
| *$I_{SM}$ | - | - | 3.4 | | |
| *$V_{SD}$ | - | 0.75 | 1.0 | V | $V_{GS}$=0V, $I_S$=150mA |

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

## P-Channel Electrical Characteristics (Tj=25°C, unless otherwise noted)

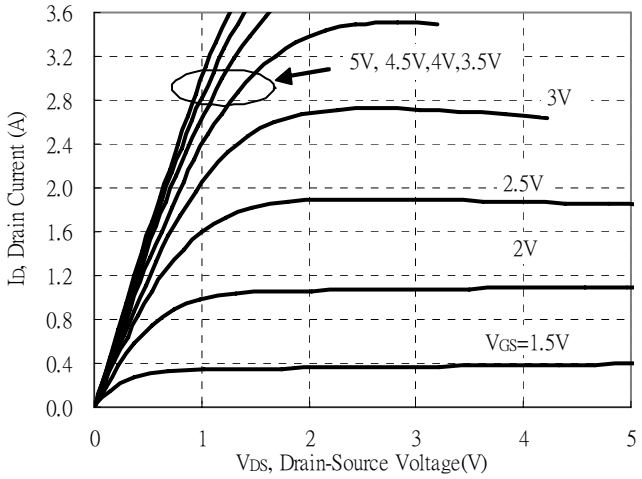
| Symbol | Min. | Typ. | Max. | Unit | Test Conditions |
|---|---|---|---|---|---|
| **Static** | | | | | |
| $BV_{DSS}$ | -20 | - | - | V | $V_{GS}$=0, $I_D$=-250μA |
| $V_{GS(th)}$ | -0.5 | -0.8 | -1.2 | V | $V_{DS}$=$V_{GS}$, $I_D$=-250μA |
| $I_{GSS}$ | - | - | ±5 | μA | $V_{GS}$=±8V, $V_{DS}$=0 |
| $I_{DSS}$ | - | - | -1 | | $V_{DS}$=-20V, $V_{GS}$=0 |
| | - | - | -10 | | $V_{DS}$=-16V, $V_{GS}$=0 (Tj=70°C) |
| *$R_{DS(ON)}$ | - | 0.61 | 0.75 | Ω | $V_{GS}$=-4.5V, $I_D$=-430mA |
| | - | 0.65 | 0.96 | | $V_{GS}$=-4V, $I_D$=-300mA |
| | - | 1.00 | 1.30 | | $V_{GS}$=-2.5V, $I_D$=-300mA |
| | - | 1.64 | 2.20 | | $V_{GS}$=-1.8V, $I_D$=-150mA |
| *$G_{FS}$ | - | 0.7 | - | S | $V_{DS}$=-10V, $I_D$=-250mA |
| **Dynamic** | | | | | |
| Ciss | - | 54.7 | - | pF | $V_{DS}$=-16V, $V_{GS}$=0, f=1MHz |
| Coss | - | 16.6 | - | | |
| Crss | - | 11.9 | - | | |
| $t_{d(ON)}$ | - | 6 | - | ns | $V_{DS}$=-10V, $I_D$=-250mA, $V_{GS}$=-4.5V, $R_G$=10Ω |
| $t_r$ | - | 10 | - | | |
| $t_{d(OFF)}$ | - | 23 | - | | |
| $t_f$ | - | 28 | - | | |
| Qg | - | 1.13 | - | nC | $V_{DS}$=-10V, $I_D$=-250mA, $V_{GS}$=-4.5V |
| Qgs | - | 0.09 | - | | |
| Qgd | - | 0.42 | - | | |
| **Source-Drain Diode** | | | | | |
| *$I_S$ | - | - | -0.57 | A | |
| *$I_{SM}$ | - | - | -2.3 | | |
| *$V_{SD}$ | - | -0.79 | -1.2 | V | $V_{GS}$=0V, $I_S$=-150mA |

## Ordering Information

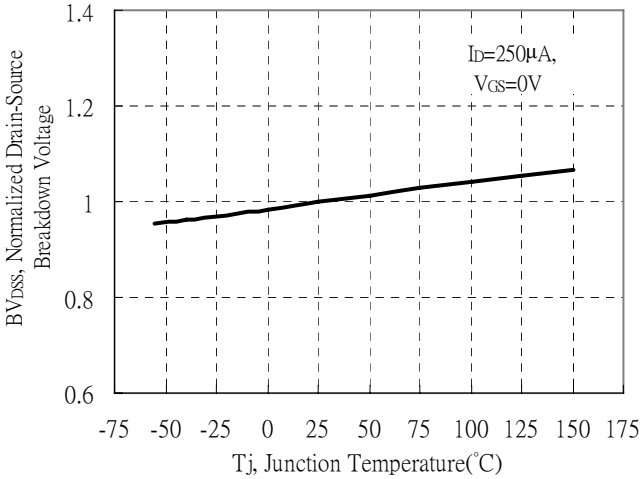
| Device | Package | Shipping | Marking |
|---|---|---|---|
| MTC1016S6R | SOT-363<br>(Pb-free lead plating and Halogen-free package) | 3000 pcs / Tape & Reel | CA1 |

## N-Channel Typical Characteristics

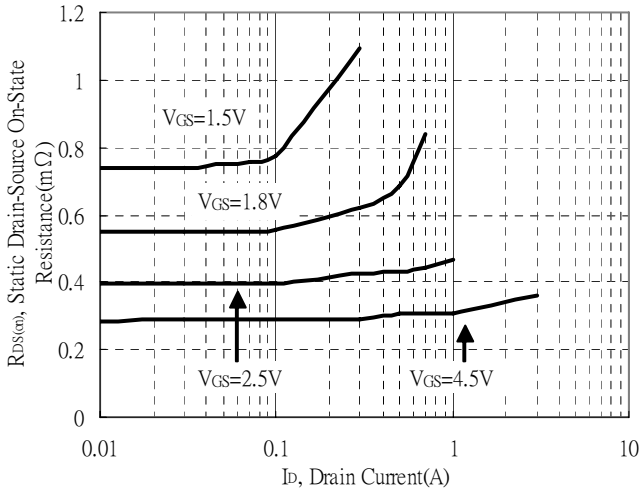
Typical Output Characteristics



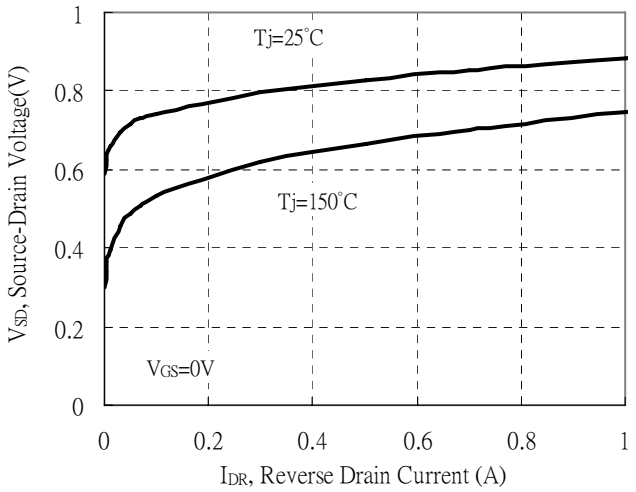

Brekdown Voltage vs Ambient Temperature



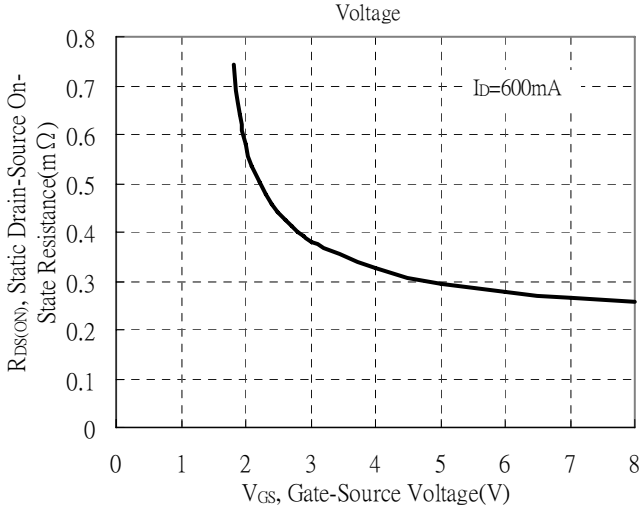

Static Drain-Source On-State resistance vs Drain Current



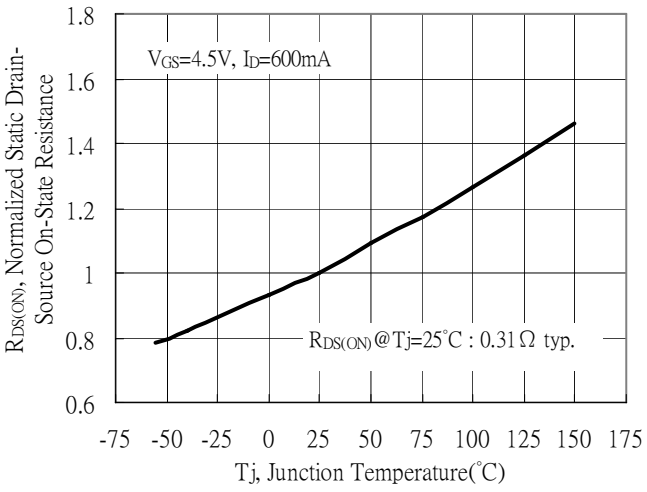

Reverse Drain Current vs Source-Drain Voltage




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

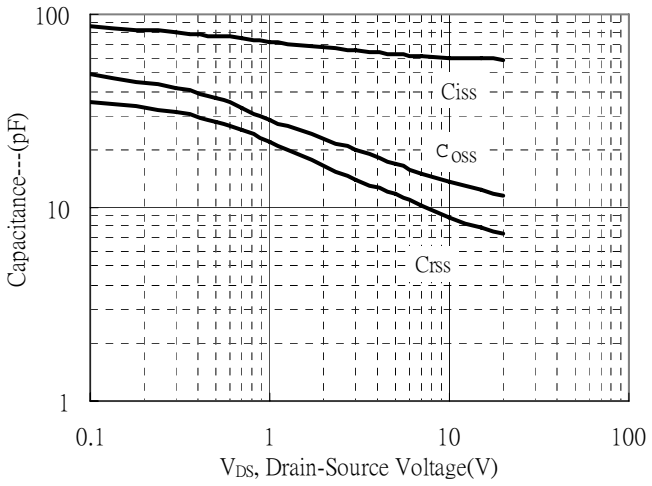



Drain-Source On-State Resistance vs Junction Tempearture

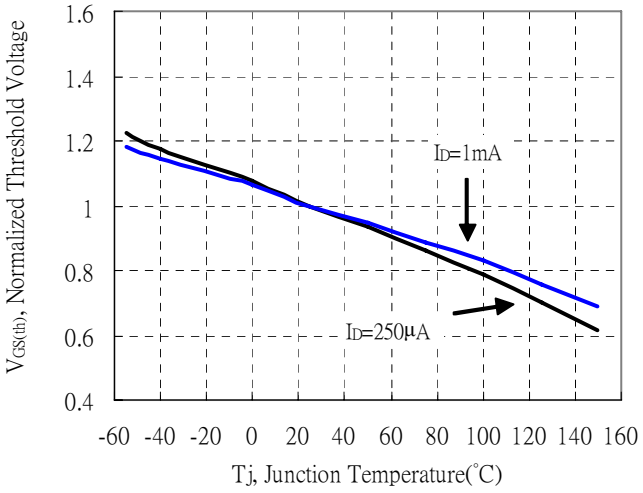


## N-Channel Typical Characteristics(Cont.)

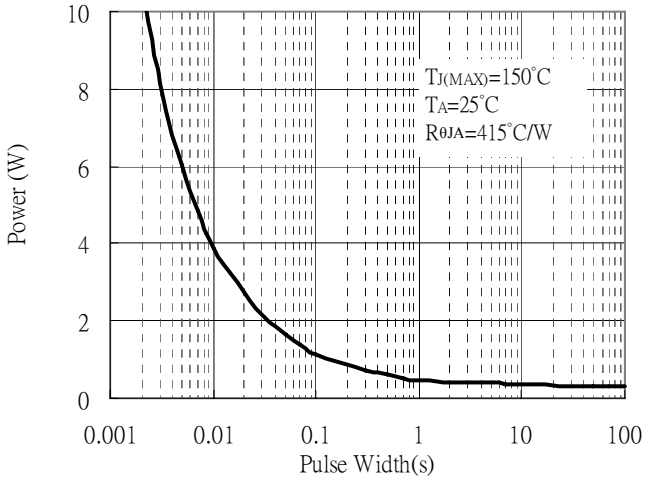
Capacitance vs Drain-to-Source Voltage



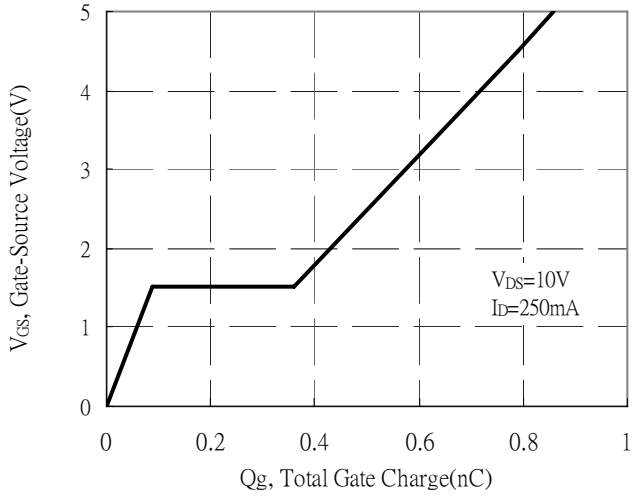

Threshold Voltage vs Junction Tempearture



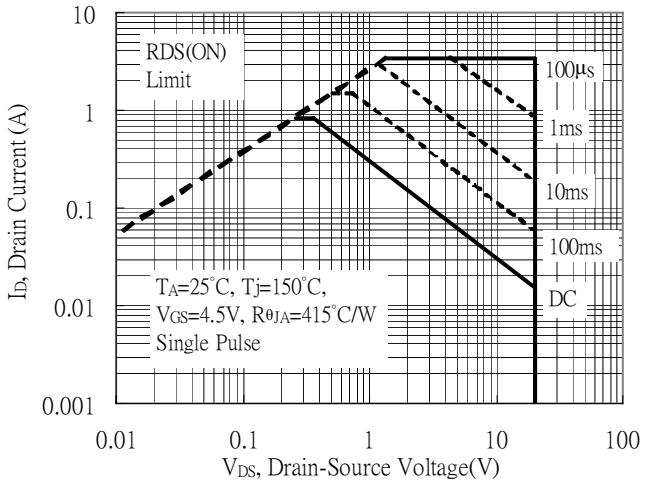

Single Pulse Power Rating, Junction to Ambient
(Note on page 2)



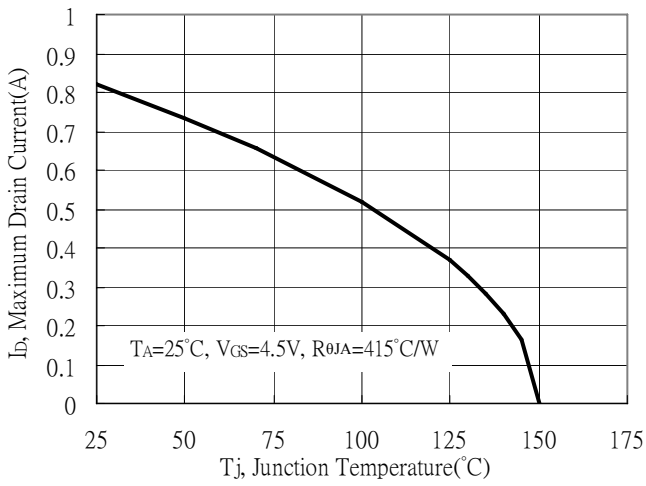

Gate Charge Characteristics




Maximum Safe Operating Area

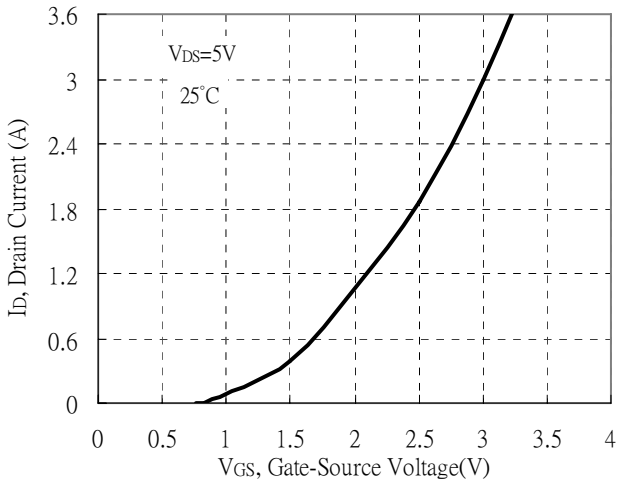



Maximum Drain Current vs JunctionTemperature

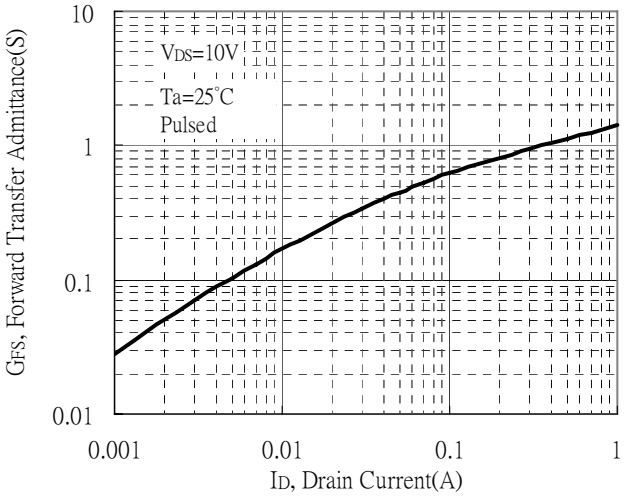


## N-Channel Typical Characteristics(Cont.)

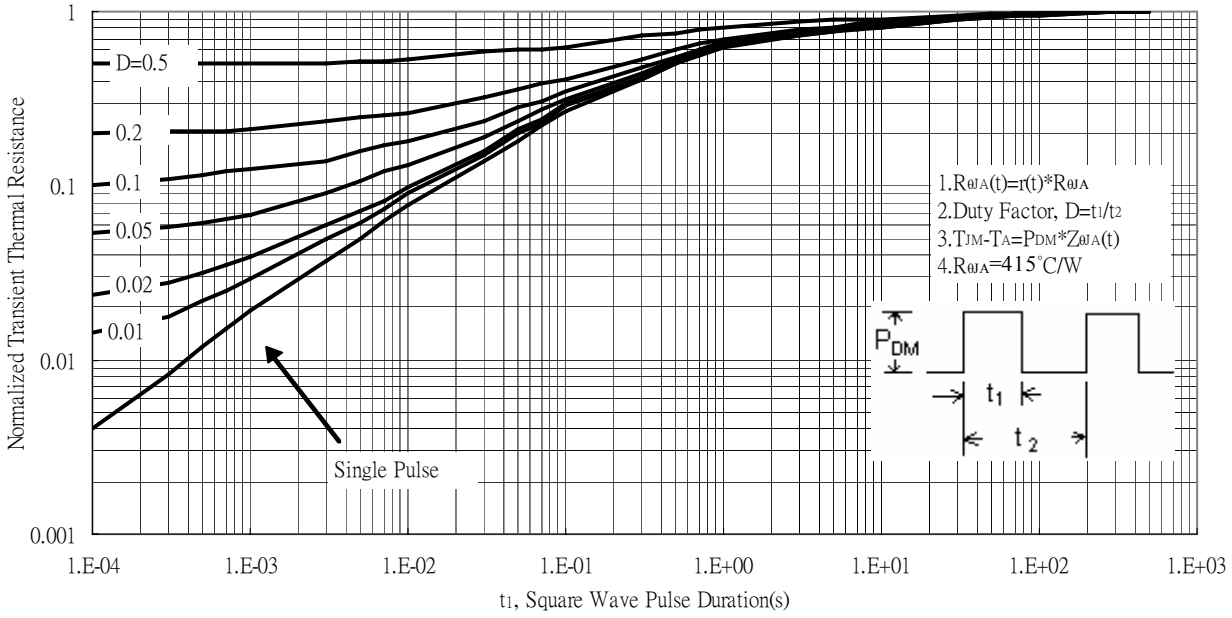
Typical Transfer Characteristics




Forward Transfer Admittance vs Drain Current

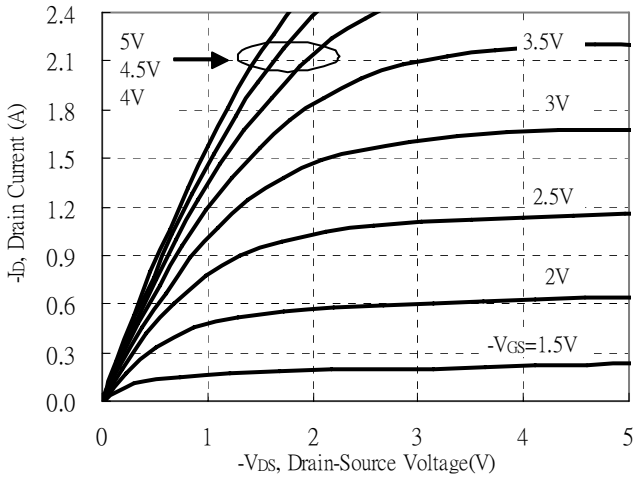



Transient Thermal Response Curves

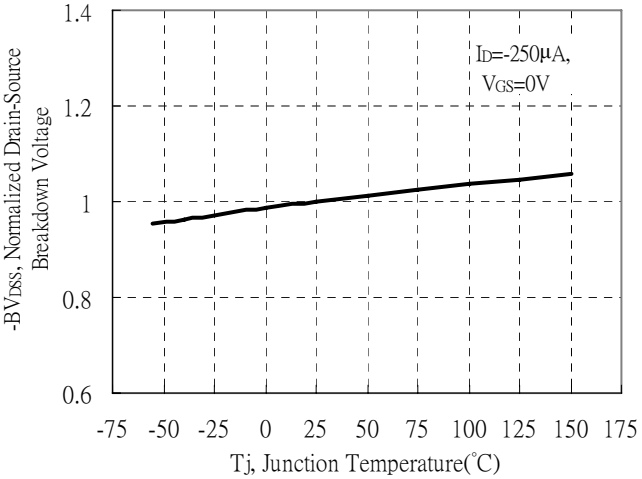


## P-Channel Typical Characteristics

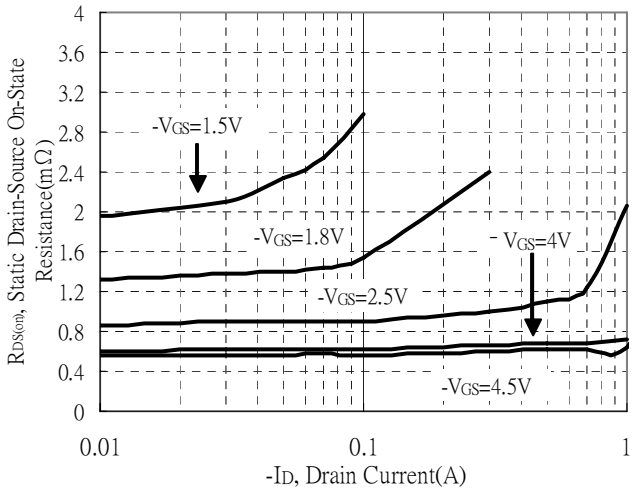
Typical Output Characteristics



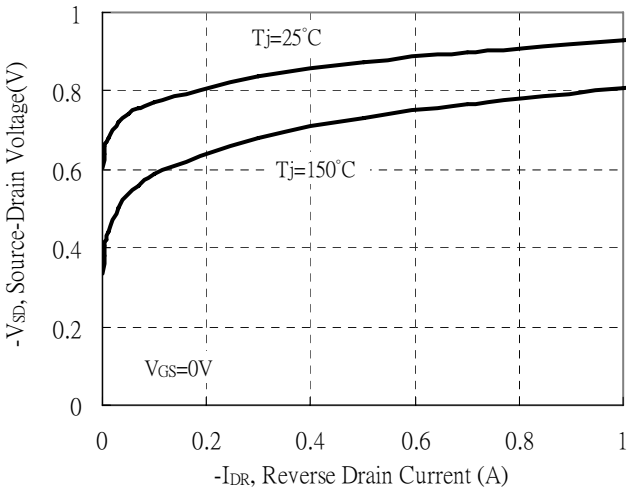

Brekdown Voltage vs Ambient Temperature



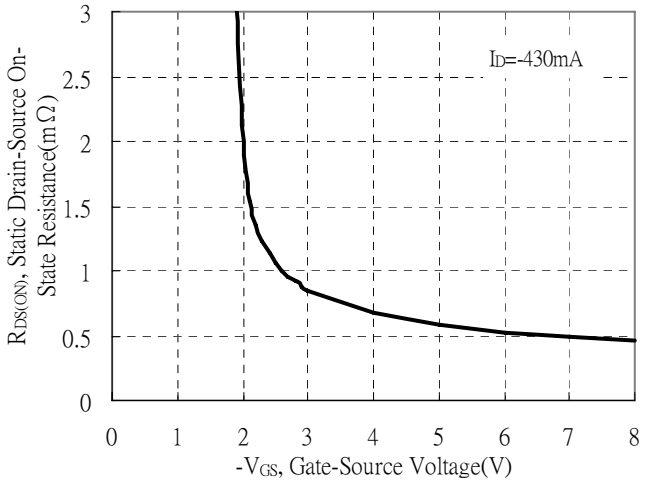

Static Drain-Source On-State resistance vs Drain Current



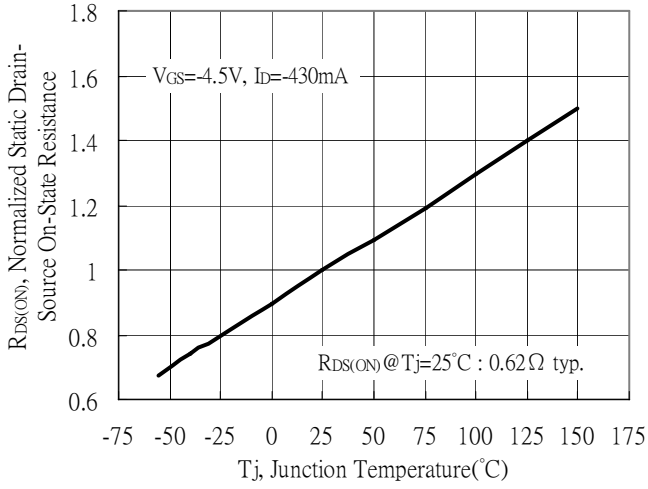

Reverse Drain Current vs Source-Drain Voltage




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

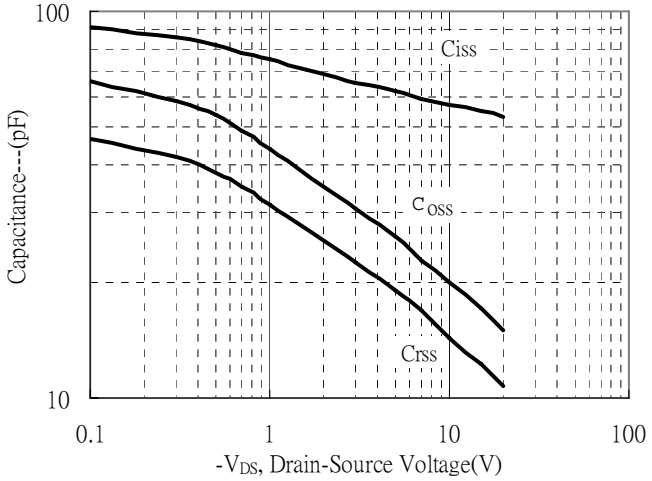



Drain-Source On-State Resistance vs Junction Tempearture

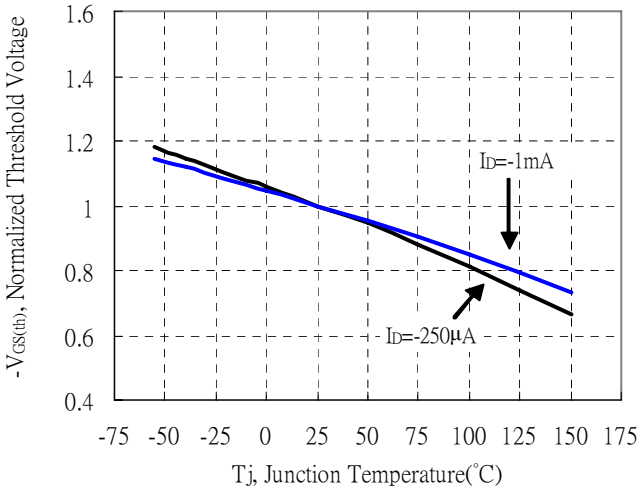


## P-Channel Typical Characteristics(Cont.)

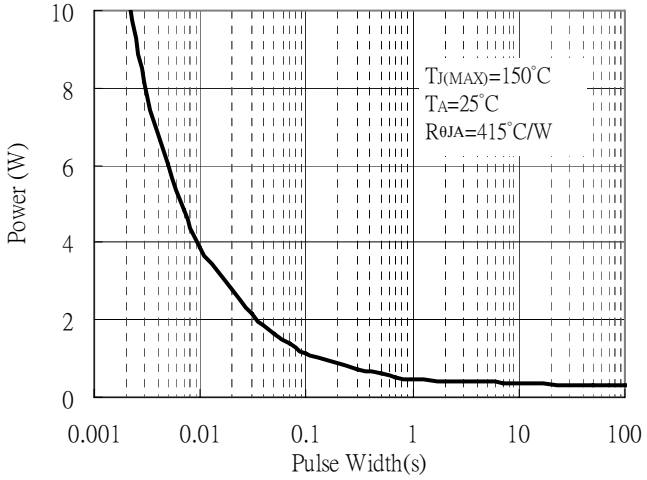
Capacitance vs Drain-to-Source Voltage



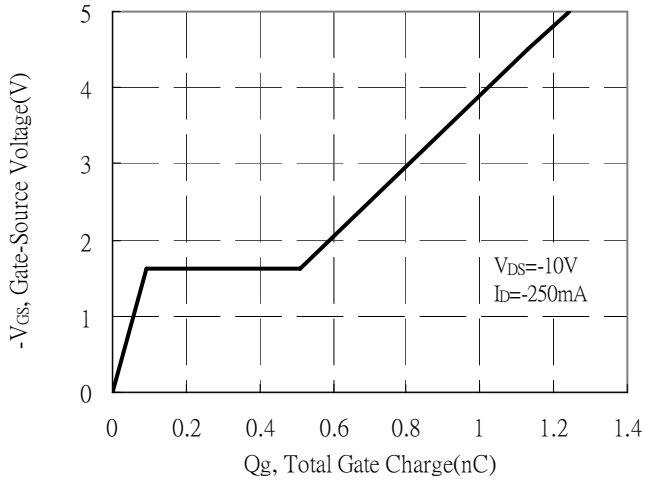

Threshold Voltage vs Junction Tempearture



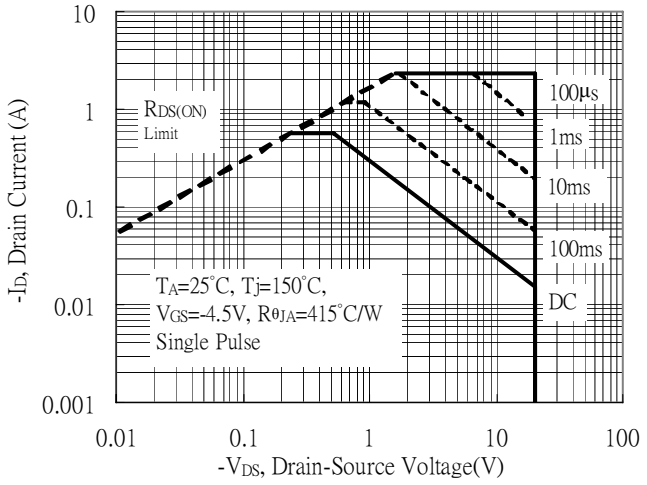

Single Pulse Power Rating, Junction to Ambient
(Note on page 2)



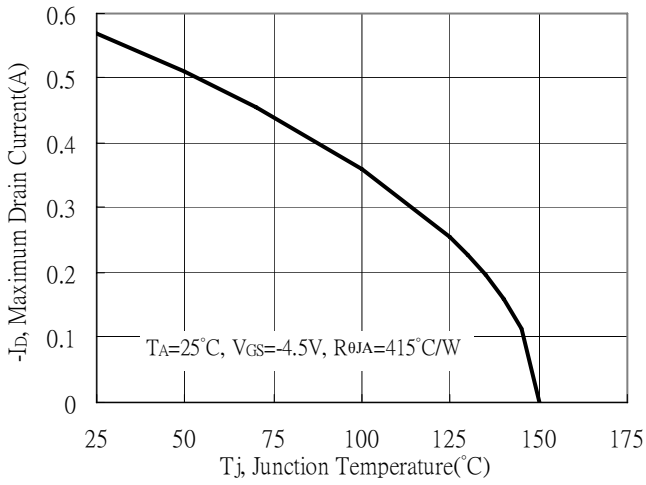

Gate Charge Characteristics




Maximum Safe Operating Area

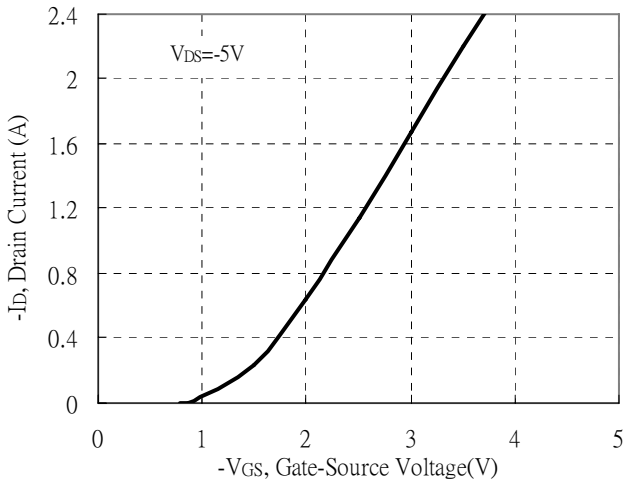



Maximum Drain Current vs JunctionTemperature

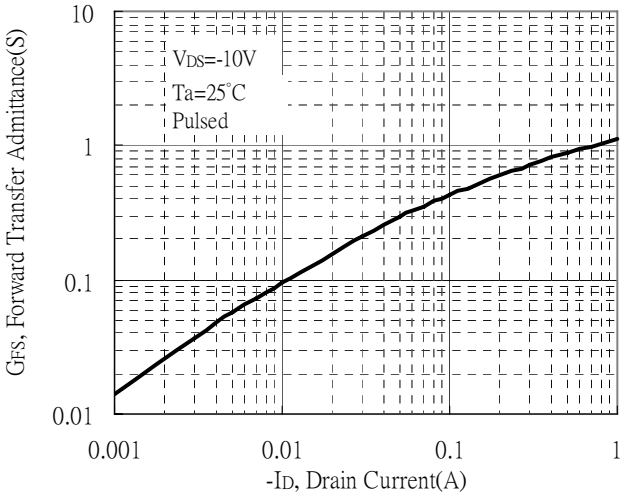


## P-Channel Typical Characteristics(Cont.)

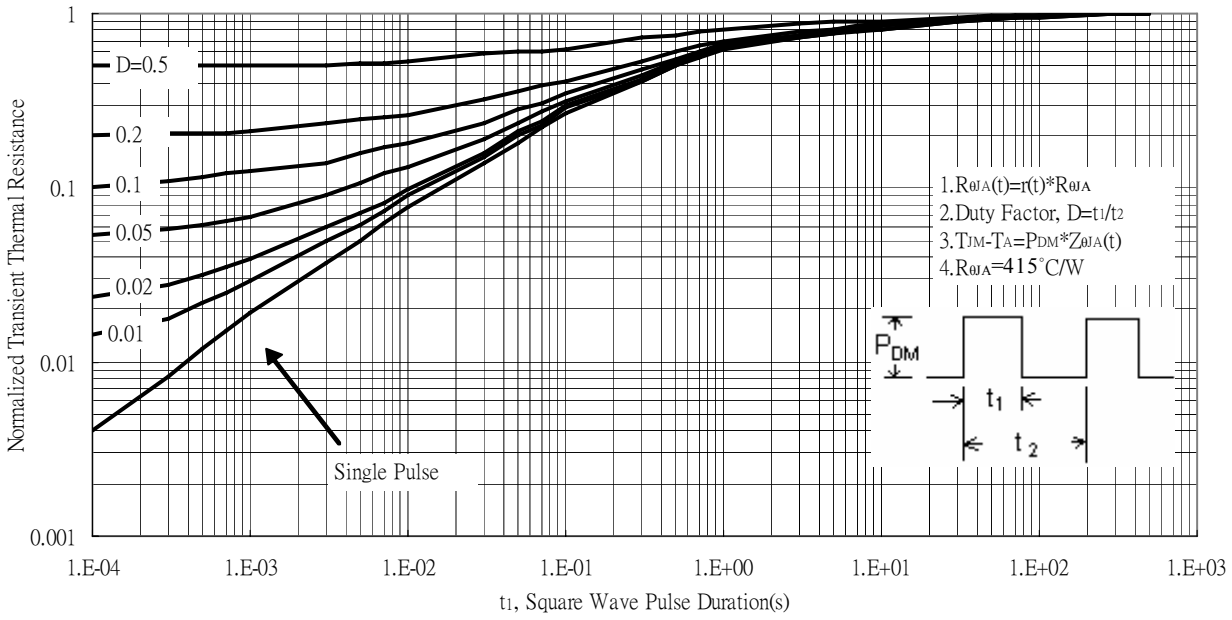
Typical Transfer Characteristics



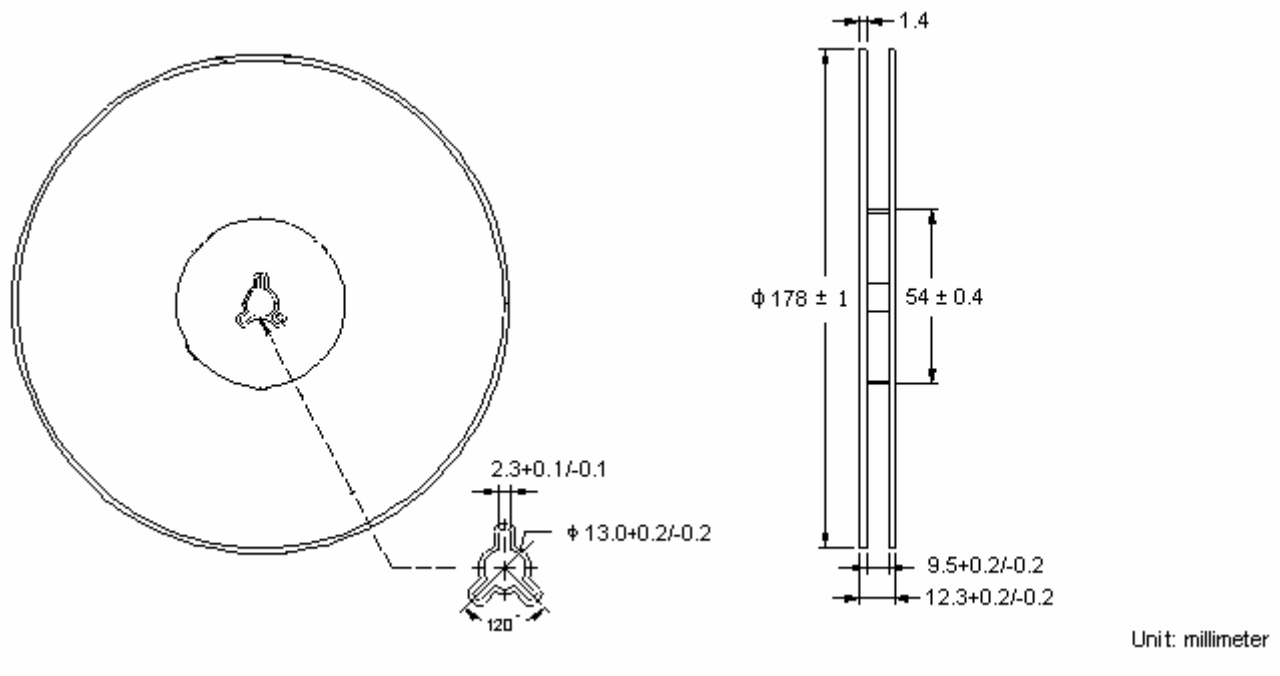

Forward Transfer Admittance vs Drain Current



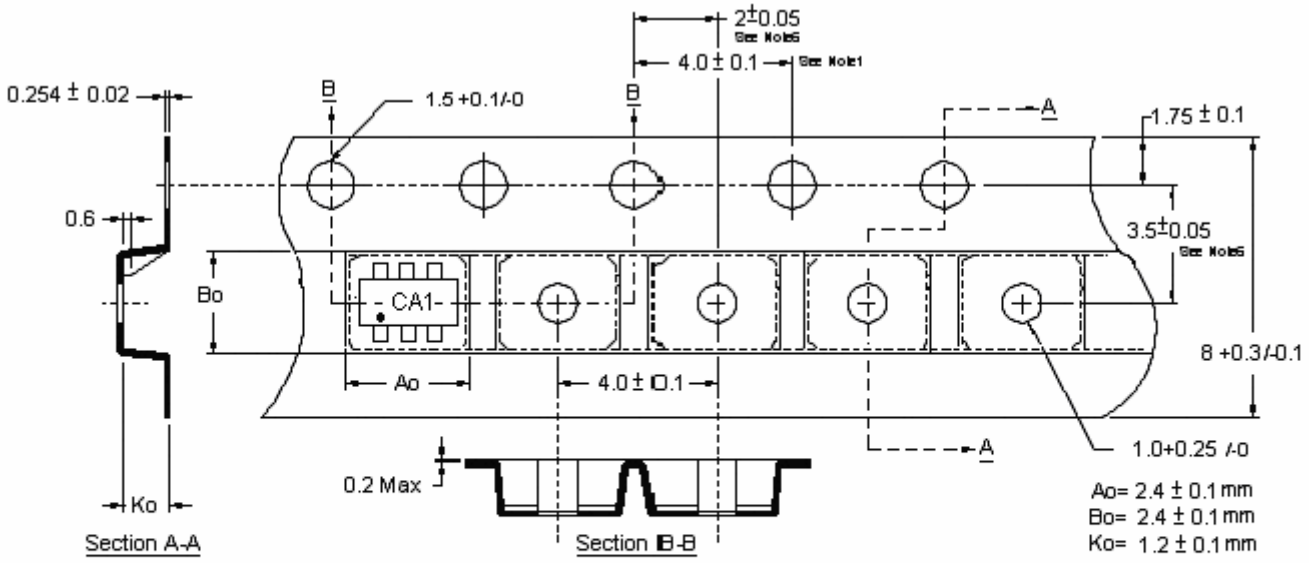

Transient Thermal Response Curves



## Reel Dimension




## Carrier Tape Dimension



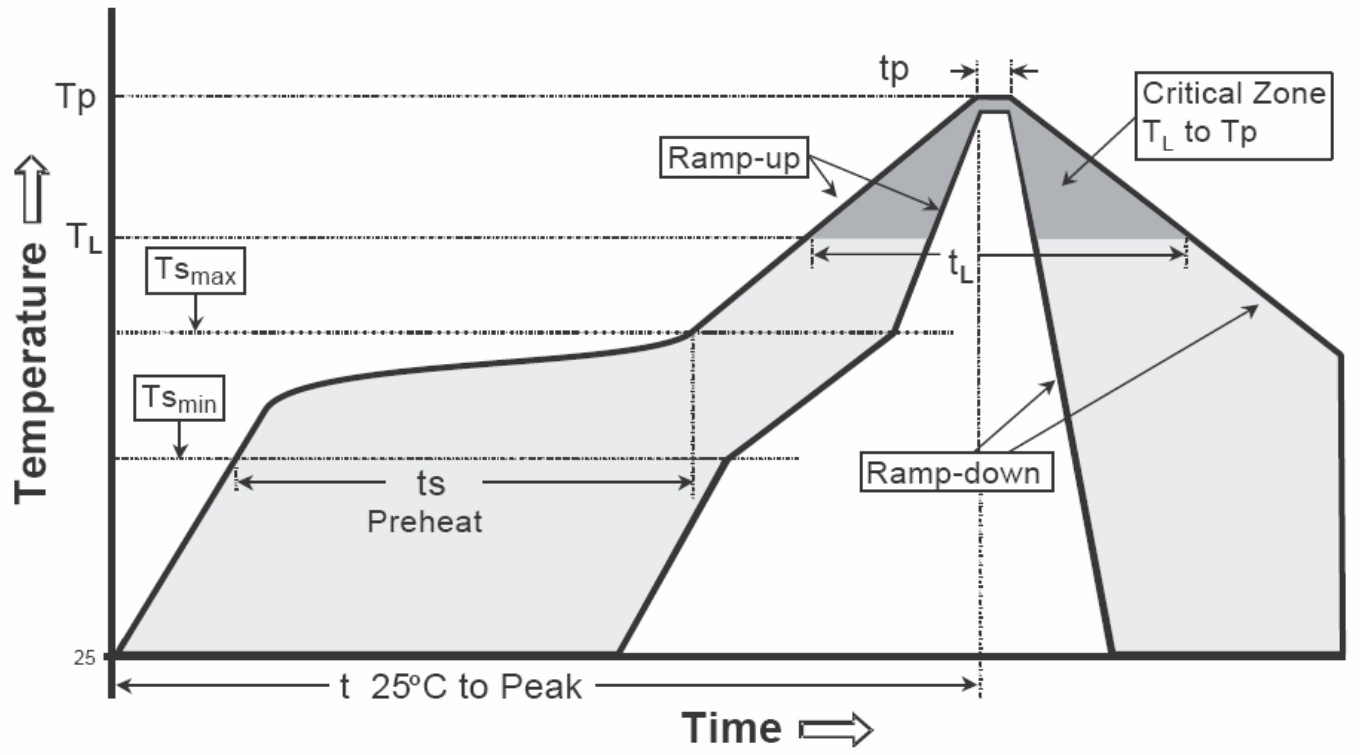

Notes:
1. 10 sprocket hole pitch cumulative tolerace ±0.2.
2. Camber not to exceed 1mm in 100mm.
3. Material: Conductive Black Polystyrene.
4. Ao & Bo measured on a plane 0.3mm above the bottom of the pocket.
5. Ko measured from a plane on the inside bottom of the pocket to the top surface of the carrier.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

Unit : millimeter

## Recommended wave soldering condition

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

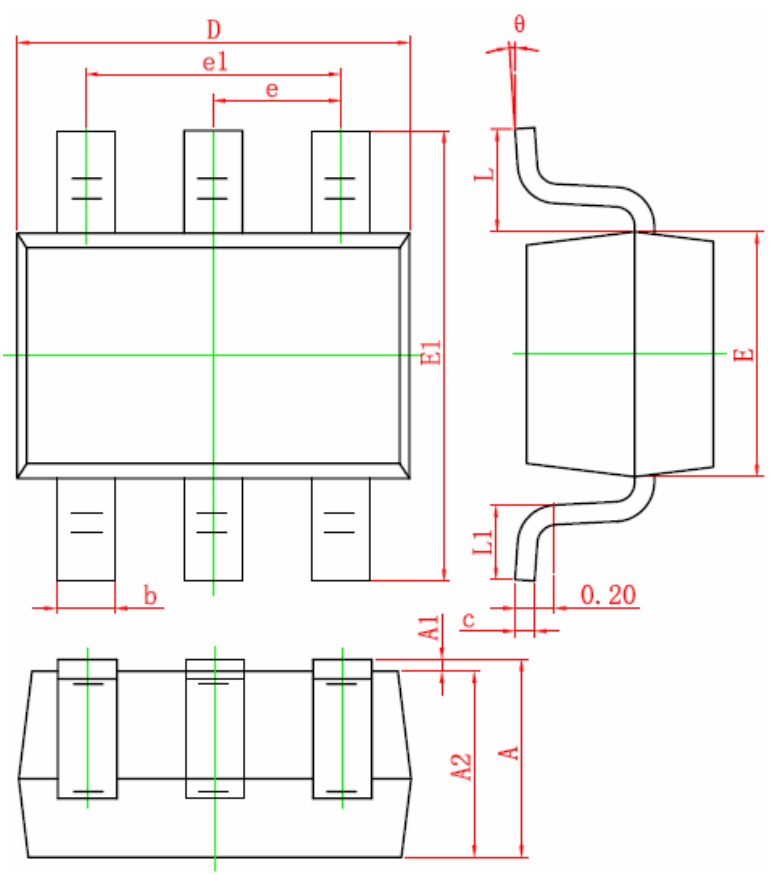
## Recommended temperature profile for IR reflow



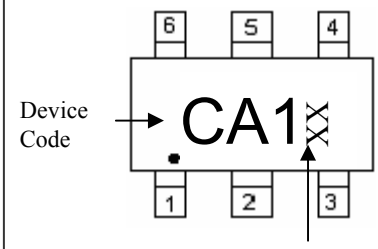

| Profile feature | Sn-Pb eutectic Assembly | Pb-free Assembly |
|---|---|---|
| Average ramp-up rate (Tsmax to Tp) | 3°C/second max. | 3°C/second max. |
| Preheat<br>−Temperature Min($T_S$ min)<br>−Temperature Max($T_S$ max)<br>−Time($t_{s\ min}$ to $t_{s\ max}$) | <br>100°C<br>150°C<br>60-120 seconds | <br>150°C<br>200°C<br>60-180 seconds |
| Time maintained above:<br>−Temperature ($T_L$)<br>− Time ($t_L$) | <br>183°C<br>60-150 seconds | <br>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.

## SOT-363 Dimension




Marking:




6-Lead SOT-363R Plastic
Surface Mounted Package
CYStek Package Code: S6R

Style:
Pin 1. Source1 (S1)
Pin 2. Gate1 (G1)
Pin 3. Drain2 (D2)
Pin 4. Source2 (S2)
Pin 5. Gate2 (G2)
Pin 6. Drain1 (D1)

| DIM | Millimeters | | Inches | | DIM | Millimeters | | Inches | |
|---|---|---|---|---|---|---|---|---|---|
| | Min. | Max. | Min. | Max. | | Min. | Max. | Min. | Max. |
| A | 0.900 | 1.100 | 0.035 | 0.043 | E1 | 2.150 | 2.450 | 0.085 | 0.096 |
| A1 | 0.000 | 0.100 | 0.000 | 0.004 | e | 0.650 TYP | | 0.026 TYP | |
| A2 | 0.900 | 1.000 | 0.035 | 0.039 | e1 | 1.200 | 1.400 | 0.047 | 0.055 |
| b | 0.150 | 0.350 | 0.006 | 0.014 | L | 0.525 REF | | 0.021 REF | |
| c | 0.080 | 0.150 | 0.003 | 0.006 | L1 | 0.260 | 0.460 | 0.010 | 0.018 |
| D | 2.000 | 2.200 | 0.079 | 0.087 | θ | 0° | 8° | 0° | 8° |
| E | 1.150 | 1.350 | 0.045 | 0.053 | | | | | |

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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