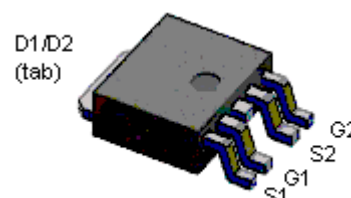


## N & P-Channel Enhancement Mode Power MOSFET

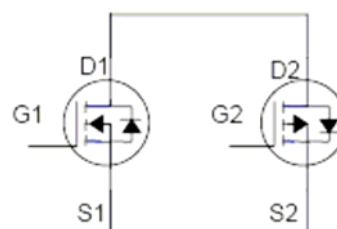
### Features:

- Low Gate Charge
- Simple Drive Requirement
- RoHS compliant & Halogen-free package

TO-252-4L



|  | N-CH            | P-CH            |
|--|-----------------|-----------------|
| $BV_{DSS}$                               | 40V             | -40V            |
| $I_D @ V_{GS}=10V(-10V), T_A=25^\circ C$ | 5.2A            | -4.9A           |
| $I_D @ V_{GS}=10V(-10V), T_C=25^\circ C$ | 21A             | -20A            |
| $R_{DS(on)}(typ.) @ V_{GS}=(-)10V$       | 20.9 m $\Omega$ | 35.8 m $\Omega$ |
| $R_{DS(on)}(typ.) @ V_{GS}=(-)4.5V$      | 30.1 m $\Omega$ | 46.2 m $\Omega$ |



G : Gate D : Drain S : Source

### Absolute Maximum Ratings ( $T_A=25^\circ C$ , unless otherwise noted)

| Parameter  | Symbol         | Limits    |           | Unit       |
|--|----------------|-----------|-----------|------------|
|  |                | N-channel | P-channel |            |
| Drain-Source Voltage   | $V_{DS}$       | 40        | -40       | V          |
| Gate-Source Voltage  | $V_{GS}$       | $\pm 20$  | $\pm 20$  |            |
| Continuous Drain Current @ $T_C=25^\circ C, V_{GS}=10V(-10V)$ (Note1)  | $I_D$          | 21        | -20       | A          |
| Continuous Drain Current @ $T_C=100^\circ C, V_{GS}=10V(-10V)$ (Note1) |                | 14.9      | -14.1     |            |
| Continuous Drain Current @ $T_A=25^\circ C, V_{GS}=10V(-10V)$ (Note4)  |                | 5.2       | -4.9      |            |
| Continuous Drain Current @ $T_A=70^\circ C, V_{GS}=10V(-10V)$ (Note4)  |                | 4.2       | -3.9      |            |
| Pulsed Drain Current *1 (Note3)  | $I_{DM}$       | 30        | -30       |            |
| Avalanche Current  | $I_{AS}$       | 6.5       | -9.3      |            |
| Avalanche Energy @ $L=0.5mH, V_{GS}=10V(-10V), I_{AS}=6.5A(-9.3A)$     | $E_{AS}$       | 10.6      | 21.6      | mJ         |
| Total Power Dissipation ( $T_C=25^\circ C$ ) (Note1)                   | $P_D$          | 25        |           | W          |
| Total Power Dissipation ( $T_C=100^\circ C$ ) (Note1)                  |                | 12.5      |           |            |
| Total Power Dissipation ( $T_A=25^\circ C$ ) (Note2)                   | $P_{DSM}$      | 2.4       |           |            |
| Total Power Dissipation ( $T_A=70^\circ C$ ) (Note2)                   |                | 1.7       |           |            |
| Operating Junction and Storage Temperature Range                       | $T_j, T_{stg}$ | -55~+175  |           | $^\circ C$ |

## Thermal Data

| Parameter  | Symbol       | Value | Unit |
|--|--------------|-------|------|
| Thermal Resistance, Junction-to-case, max            | $R_{th,j-c}$ | 6     | °C/W |
| Thermal Resistance, Junction-to-ambient, max (Note2) | $R_{th,j-a}$ | 62.5  |      |
| Thermal Resistance, Junction-to-ambient, max (Note4) |              | 90    |      |

- Note : 1. The power dissipation  $P_D$  is based on  $T_{J(MAX)}=175^\circ\text{C}$ , using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heatsinking is used.
2. The value of  $R_{\theta JA}$  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  $T_A=25^\circ\text{C}$ . The power dissipation  $P_{DSM}$  is based on  $R_{\theta JA}$  and the maximum allowed junction temperature of  $150^\circ\text{C}$ . The value in any given application depends on the user's specific board design.
3. Repetitive rating, pulse width limited by junction temperature  $T_{J(MAX)}=175^\circ\text{C}$ . Ratings are based on low frequency and low duty cycles to keep initial  $T_J=25^\circ\text{C}$ .
4. When mounted on the minimum pad size recommended (PCB mount),  $t \leq 10s$ .

## N-CH Characteristics (Tc=25°C, unless otherwise specified)

| Symbol                    | Min. | Typ. | Max.      | Unit       | Test Conditions                               |
|---------------------------|------|------|-----------|------------|---|
| <b>Static</b>             |      |      |           |            |   |
| $BV_{DSS}$                | 40   | -    | -         | V          | $V_{GS}=0V, I_D=250\mu A$                     |
| $V_{GS(th)}$              | 1.0  | -    | 2.5       |            | $V_{DS}=V_{GS}, I_D=250\mu A$                 |
| $I_{GSS}$                 | -    | -    | $\pm 100$ | nA         | $V_{GS}=\pm 20V, V_{DS}=0V$                   |
| $I_{DSS}$                 | -    | -    | 1         | $\mu A$    | $V_{DS}=32V, V_{GS}=0V$                       |
|                           | -    | -    | 10        |            | $V_{DS}=30V, V_{GS}=0V, T_J=55^\circ\text{C}$ |
| $R_{DS(ON)} *1$           | -    | 20.9 | 28        | m $\Omega$ | $V_{GS}=10V, I_D=10A$                         |
|                           | -    | 30.1 | 38        |            | $V_{GS}=4.5V, I_D=4A$                         |
| $G_{FS} *1$               | -    | 7.7  | -         | S          | $V_{DS}=5V, I_D=5A$                           |
| <b>Dynamic</b>            |      |      |           |            |   |
| $Q_g *1$                  | -    | 11.2 | -         | nC         | $V_{DS}=20V, I_D=5A, V_{GS}=10V$              |
| $Q_{GS} *1$               | -    | 2.3  | -         |            |   |
| $Q_{gd} *1$               | -    | 2.1  | -         |            |   |
| $t_{d(ON)} *1$            | -    | 7    | -         | ns         | $V_{DS}=20V, I_D=1A, V_{GS}=10V, R_G=6\Omega$ |
| $t_r *1$                  | -    | 17   | -         |            |   |
| $t_{d(OFF)} *1$           | -    | 23.8 | -         |            |   |
| $t_f *1$                  | -    | 6.6  | -         |            |   |
| $C_{iss}$                 | -    | 604  | -         | pF         | $V_{DS}=15V, V_{GS}=0V, f=1\text{MHz}$        |
| $C_{oss}$                 | -    | 56   | -         |            |   |
| $C_{rss}$                 | -    | 45   | -         |            |   |
| <b>Source-Drain Diode</b> |      |      |           |            |   |
| $I_S *1$                  | -    | -    | 5         | A          |   |
| $I_{SM} *2$               | -    | -    | 30        |            |   |
| $V_{SD} *1$               | -    | 0.74 | 1         | V          | $I_S=1A, V_{GS}=0V$                           |
| $t_{rr} *1$               | -    | 5.9  | -         | ns         | $I_F=5A, V_{GS}=0, dI_F/dt=100A/\mu s$        |
| $Q_{rr} *1$               | -    | 2.4  | -         | nC         |   |

Note : \*1.Pulse Test : Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$

\*2.Pulse width limited by maximum junction temperature.

**P-CH Characteristics (Tc=25°C, unless otherwise specified)**

| 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                             |
| 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  |
|                           | -    | -     | -10  |      | V <sub>DS</sub> =-30V, V <sub>GS</sub> =0V, T <sub>j</sub> =55°C                      |
| R <sub>DS(ON)</sub> *1    | -    | 35.8  | 45   | mΩ   | V <sub>GS</sub> =-10V, I <sub>D</sub> =-7A  |
|                           | -    | 46.2  | 60   |      | V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-4A   |
| G <sub>FS</sub> *1        | -    | 10    | -    | S    | V <sub>DS</sub> =-5V, I <sub>D</sub> =-4.9A   |
| <b>Dynamic</b>            |      |       |      |      |   |
| Q <sub>g</sub> *1         | -    | 19.2  | -    | nC   | V <sub>DS</sub> =-20V, I <sub>D</sub> =-4.9A, V <sub>GS</sub> =-10V                   |
| Q <sub>gs</sub> *1        | -    | 3.2   | -    |      |   |
| Q <sub>gd</sub> *1        | -    | 2.9   | -    |      |   |
| t <sub>d(ON)</sub> *1     | -    | 7     | -    | ns   | V <sub>DS</sub> =-20V, I <sub>D</sub> =-1A, V <sub>GS</sub> =-10V, R <sub>G</sub> =6Ω |
| t <sub>r</sub> *1         | -    | 16.6  | -    |      |   |
| t <sub>d(OFF)</sub> *1    | -    | 87    | -    |      |   |
| t <sub>f</sub> *1         | -    | 64.4  | -    |      |   |
| C <sub>iss</sub>          | -    | 1053  | -    | pF   | V <sub>DS</sub> =-15V, V <sub>GS</sub> =0V, f=1MHz                                    |
| C <sub>oss</sub>          | -    | 98    | -    |      |   |
| C <sub>rss</sub>          | -    | 74    | -    |      |   |
| <b>Source-Drain Diode</b> |      |       |      |      |   |
| I <sub>s</sub> *1         | -    | -     | -4.9 | A    |   |
| I <sub>SM</sub> *2        | -    | -     | -30  |      |   |
| V <sub>SD</sub> *1        | -    | -0.74 | -1   | V    | I <sub>S</sub> =-1A, V <sub>GS</sub> =0V  |
| t <sub>rr</sub> *1        | -    | 8.3   | -    | ns   | I <sub>F</sub> =-5A, V <sub>GS</sub> =0, dI <sub>F</sub> /dt=100A/μs                  |
| Q <sub>rr</sub> *1        | -    | 3.4   | -    | nC   |   |

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

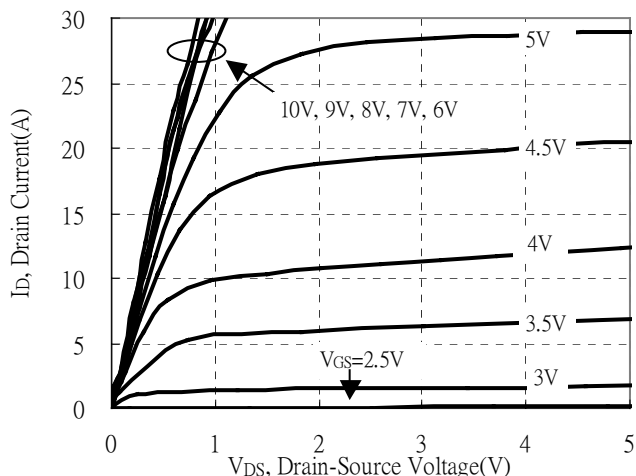
\*2.Pulse width limited by maximum junction temperature.

**Ordering Information**

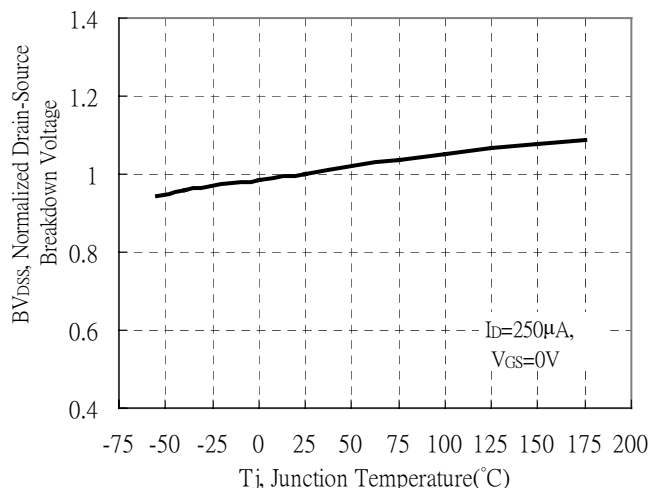
| Device   | Package   | Shipping               |
|----------|---|------------------------|
| KJB25C04 | TO-252<br>(RoHS compliant & Halogen-free package) | 3000 pcs / Tape & Reel |

### Q1, N-CH Typical Characteristics

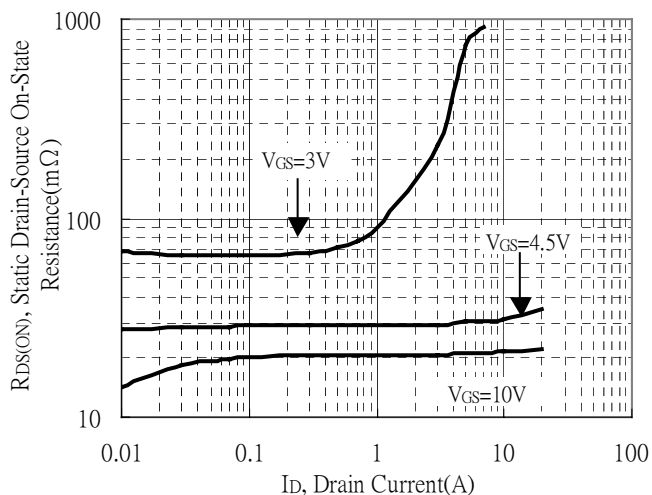
Typical Output Characteristics



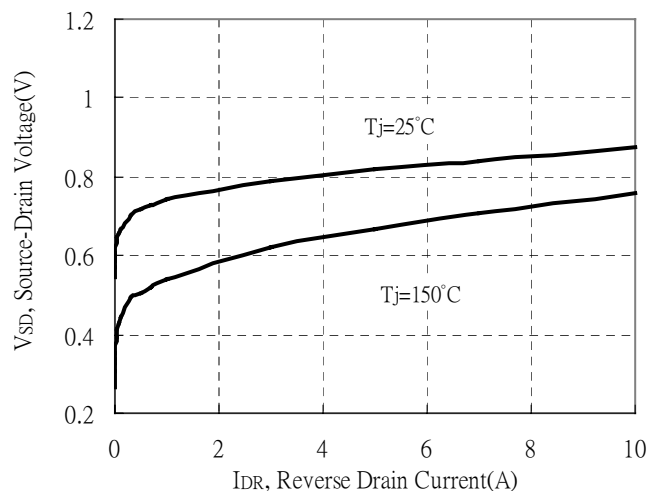
Brekdown Voltage vs Ambient Temperature



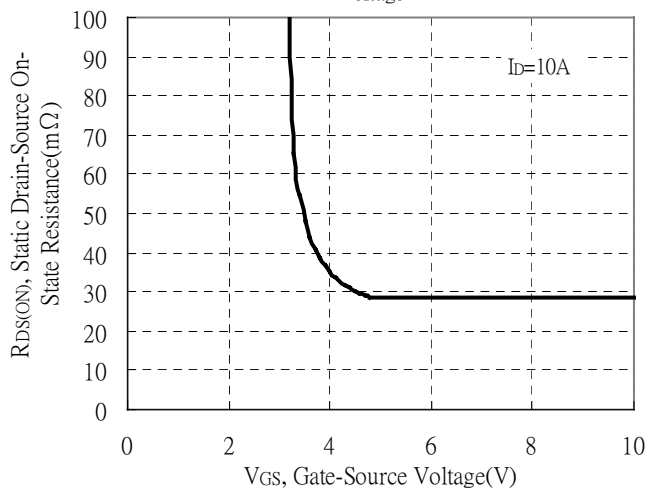
Static Drain-Source On-State resistance vs Drain Current



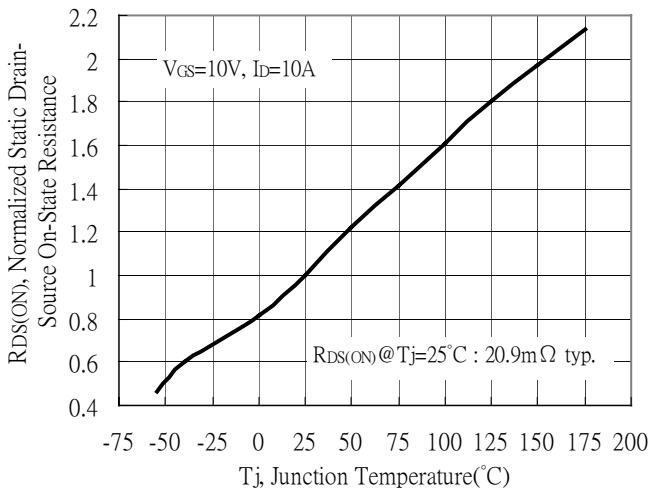
Reverse Drain Current vs Source-Drain Voltage



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

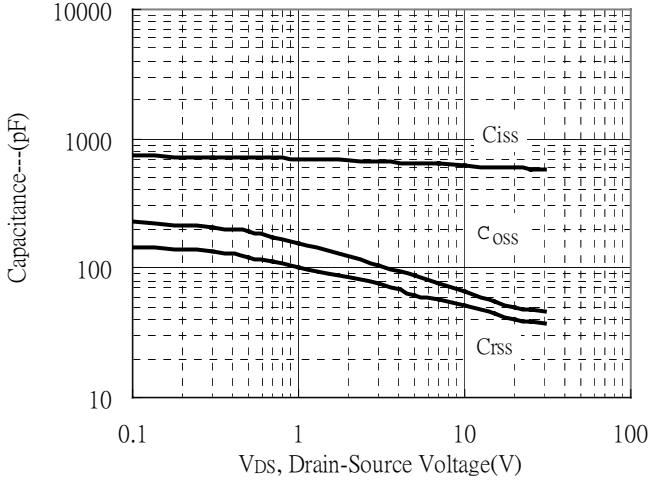


Drain-Source On-State Resistance vs Junction Temperature

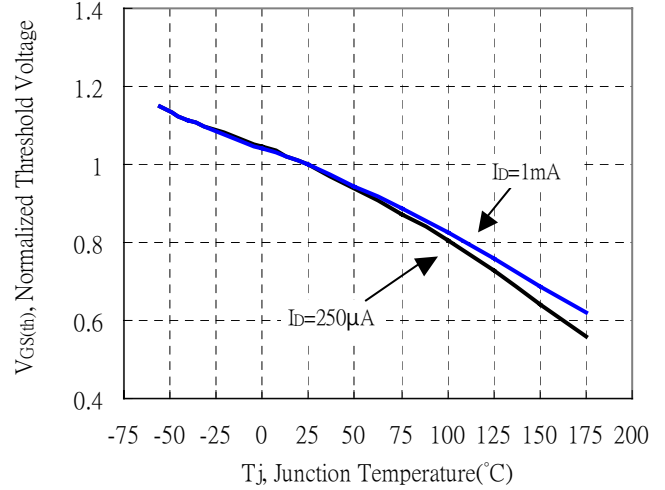


**Q1, N-CH Typical Characteristics(Cont.)**

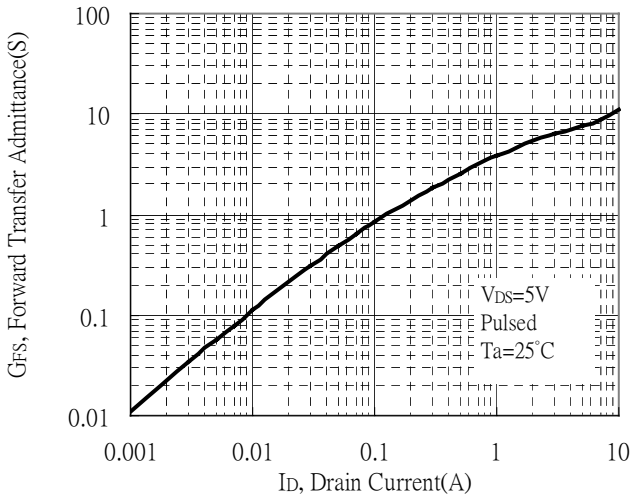
Capacitance vs Drain-to-Source Voltage



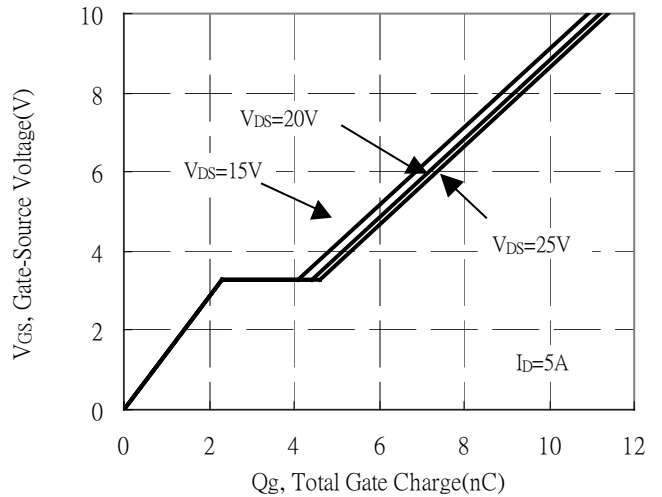
Threshold Voltage vs Junction Temperature



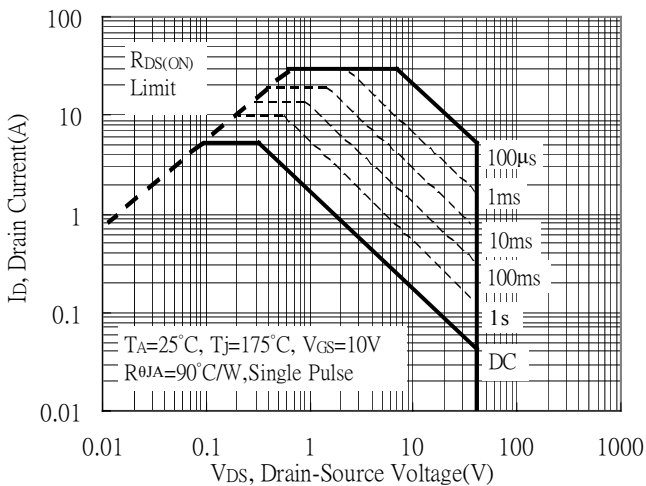
Forward Transfer Admittance vs Drain Current



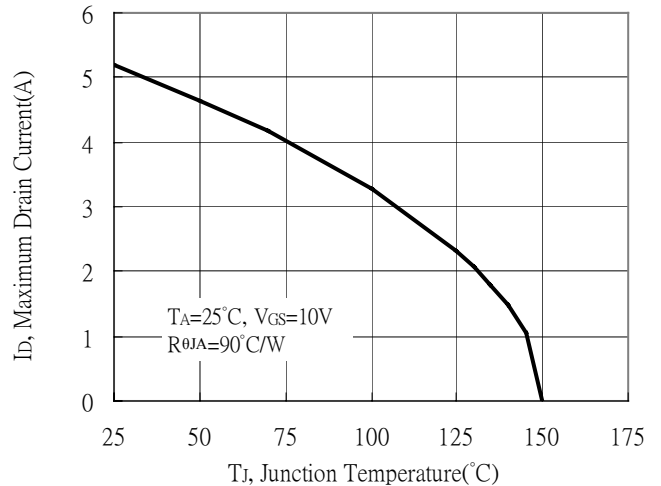
Gate Charge Characteristics



Maximum Safe Operating Area

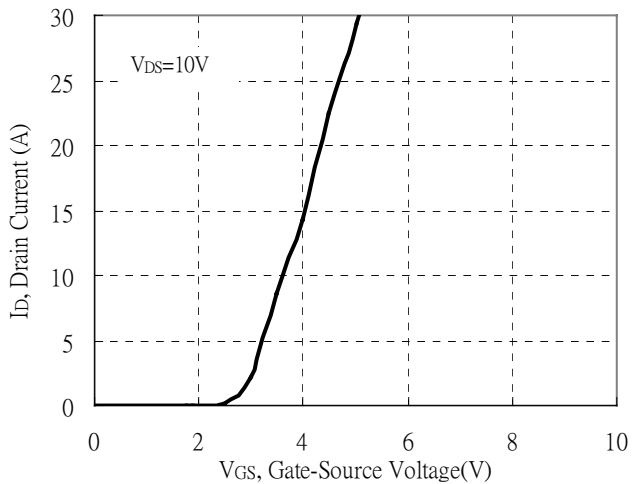


Maximum Drain Current vs Junction Temperature

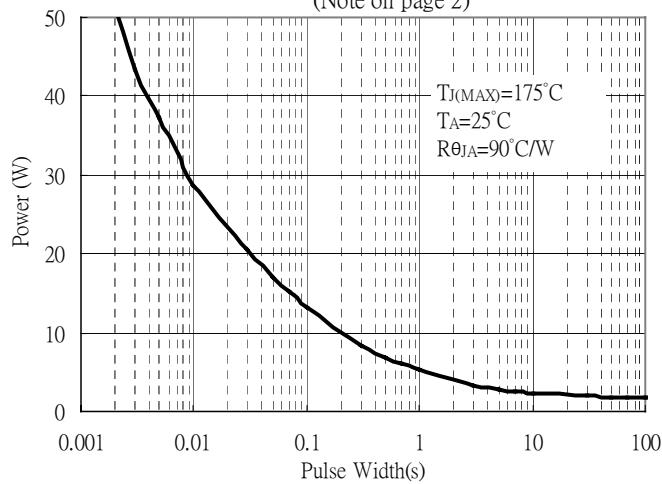


**Q1, N-CH Typical Characteristics(Cont.)**

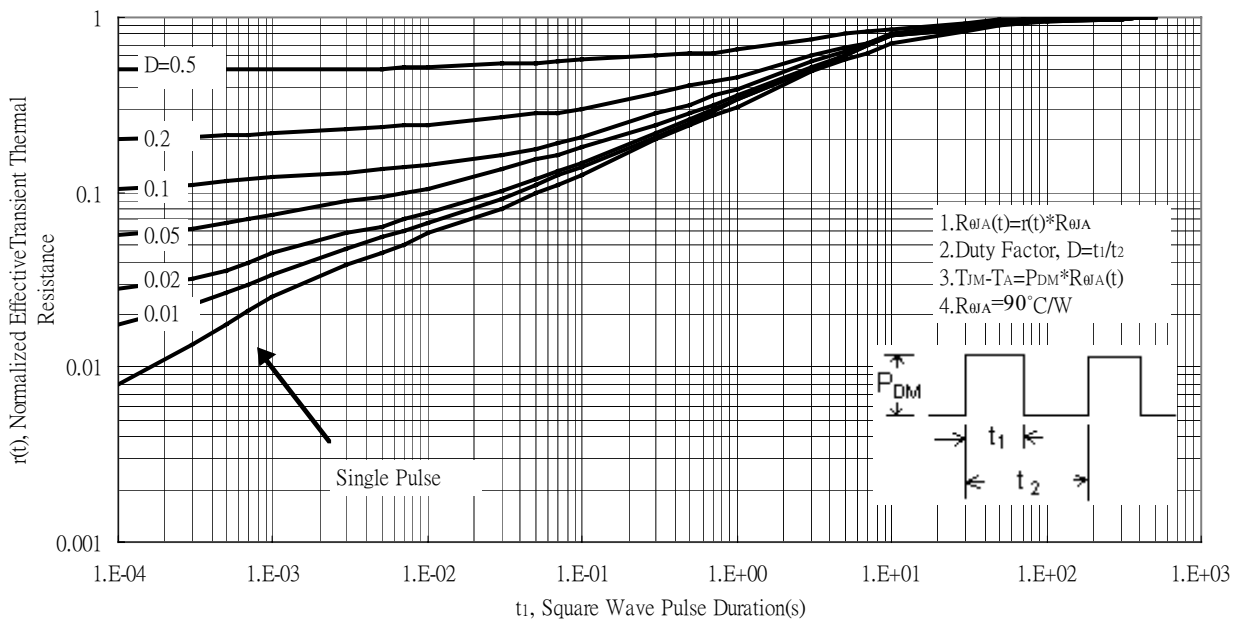
Typical Transfer Characteristics



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

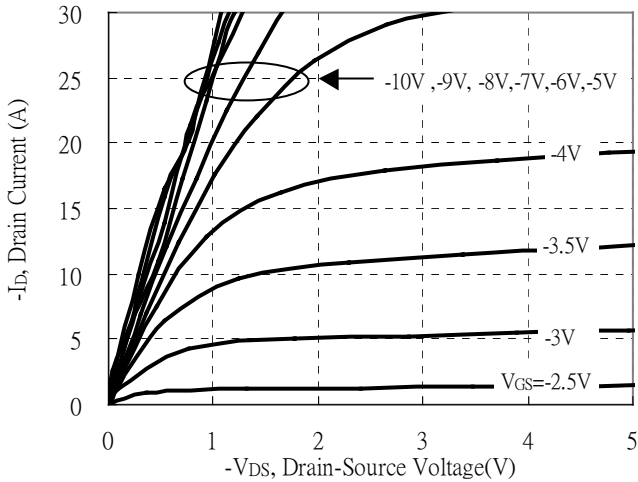


Transient Thermal Response Curves

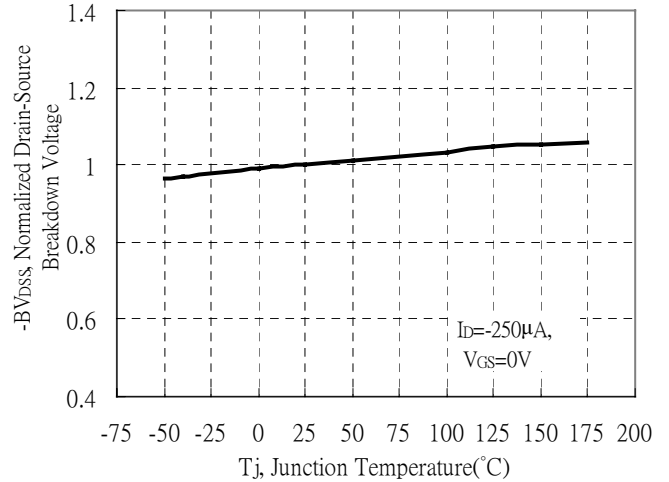


## Q2, P-CH Typical Characteristics

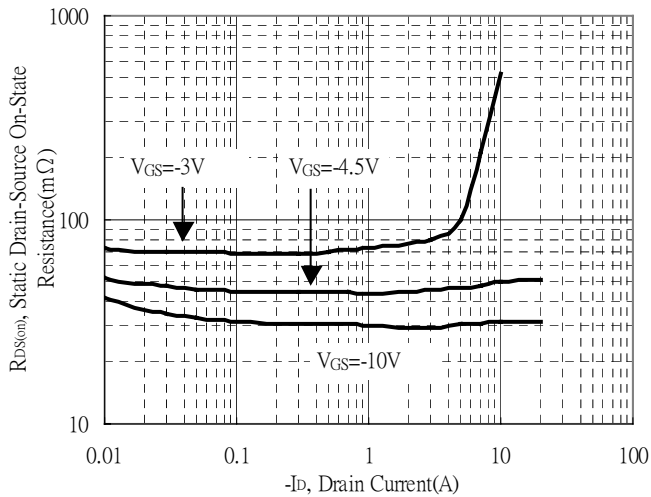
Typical Output Characteristics



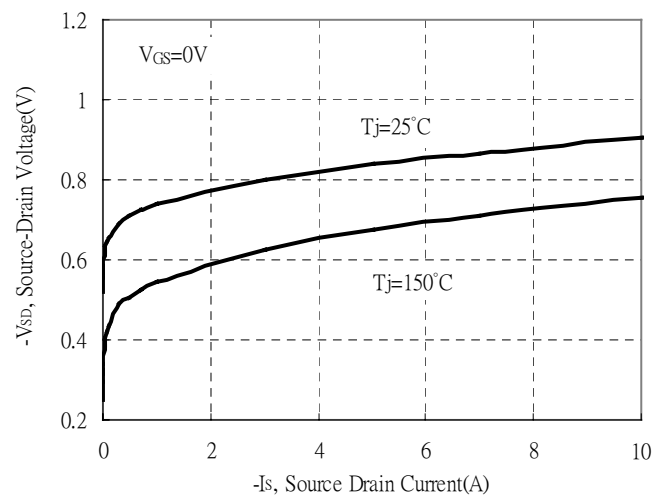
Brekdown Voltage vs Ambient Temperature



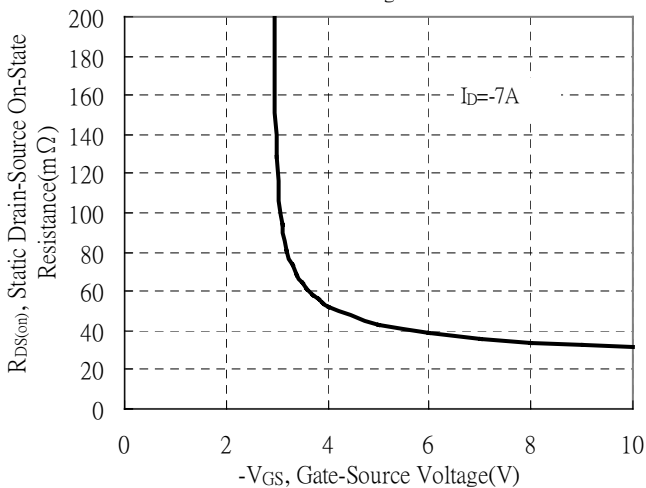
Static Drain-Source On-State resistance vs Drain Current



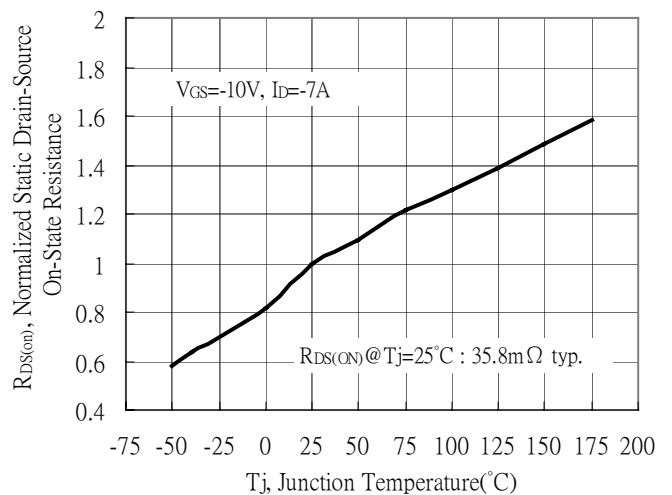
Source Drain Current vs Source-Drain Voltage



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

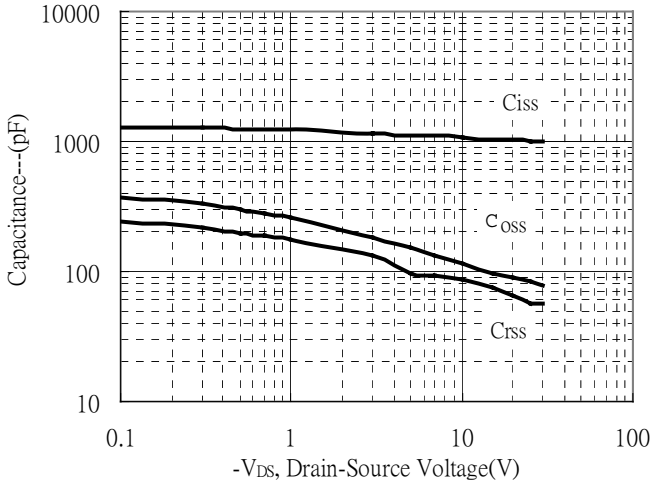


Drain-Source On-State Resistance vs Junction Temperature

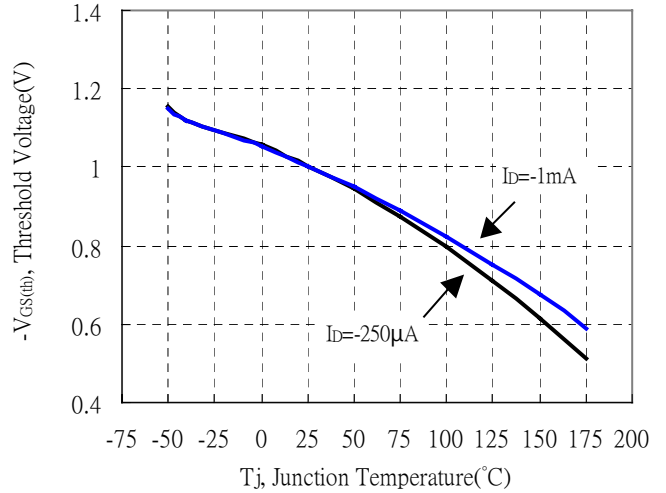


**Q2, P-CH Typical Characteristics(Cont.)**

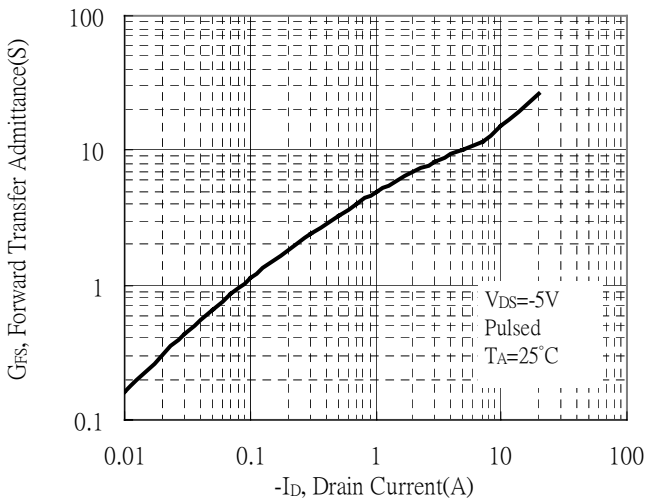
Capacitance vs Drain-to-Source Voltage



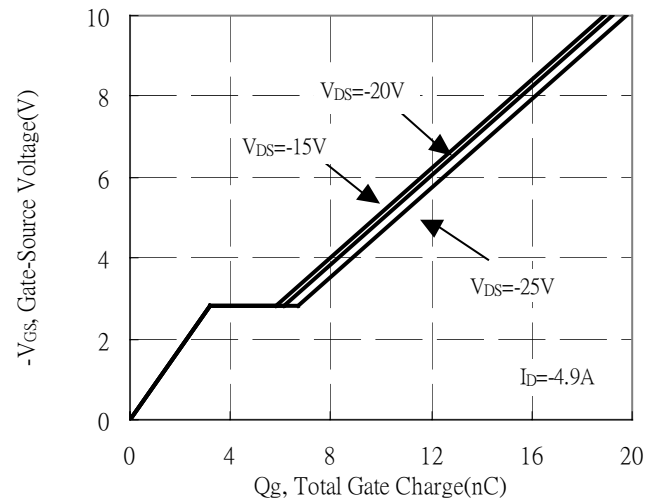
Threshold Voltage vs Junction Temperature



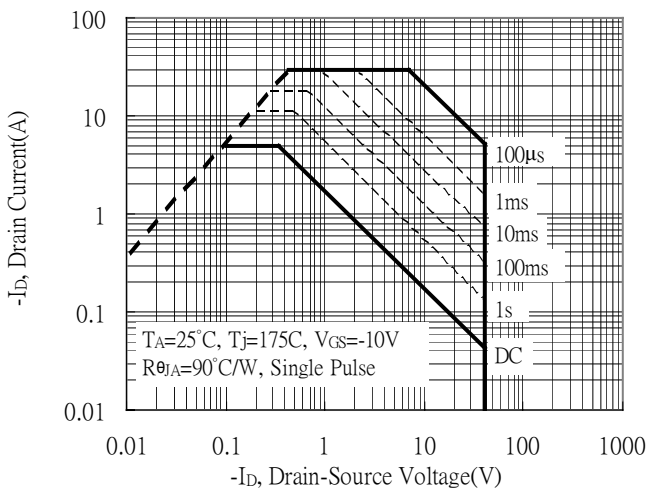
Forward Transfer Admittance vs Drain Current



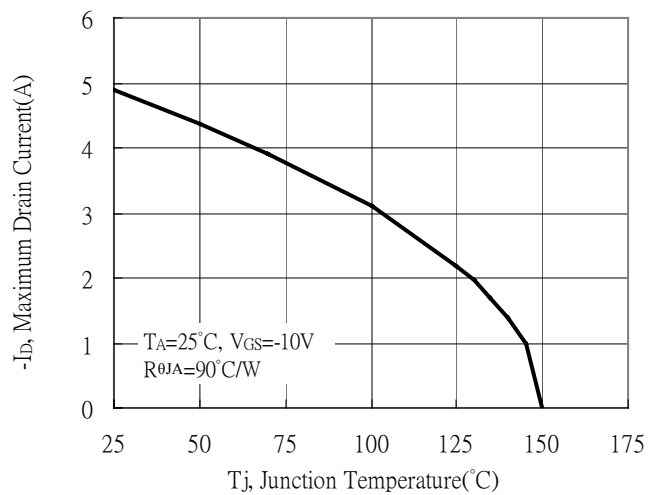
Gate Charge Characteristics



Maximum Safe Operating Area



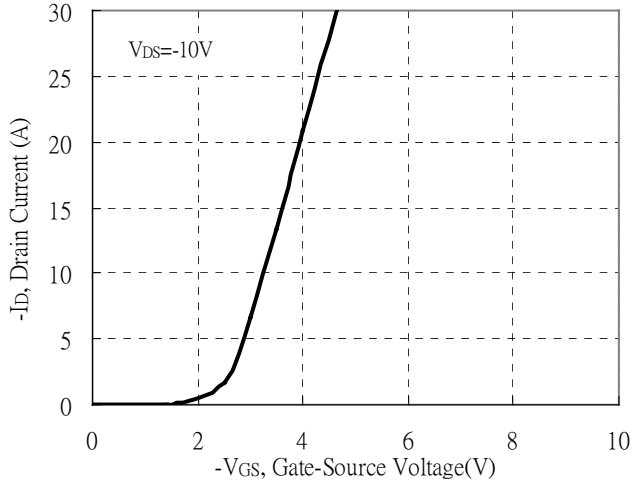
Maximum Drain Current vs Junction Temperature



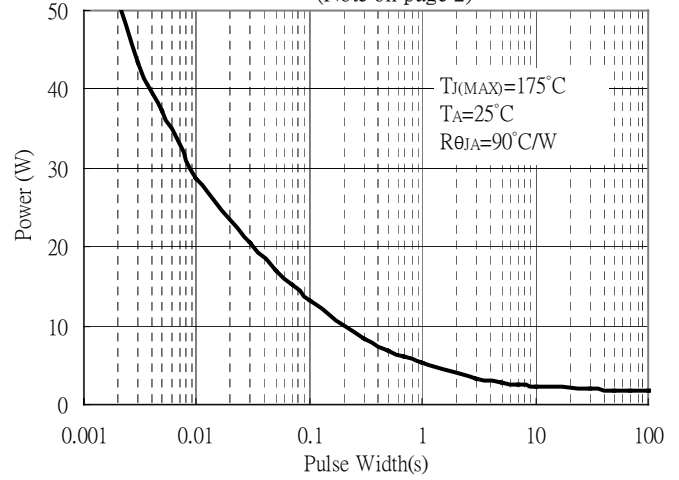


**Q2, P-CH Typical Characteristics(Cont.)**

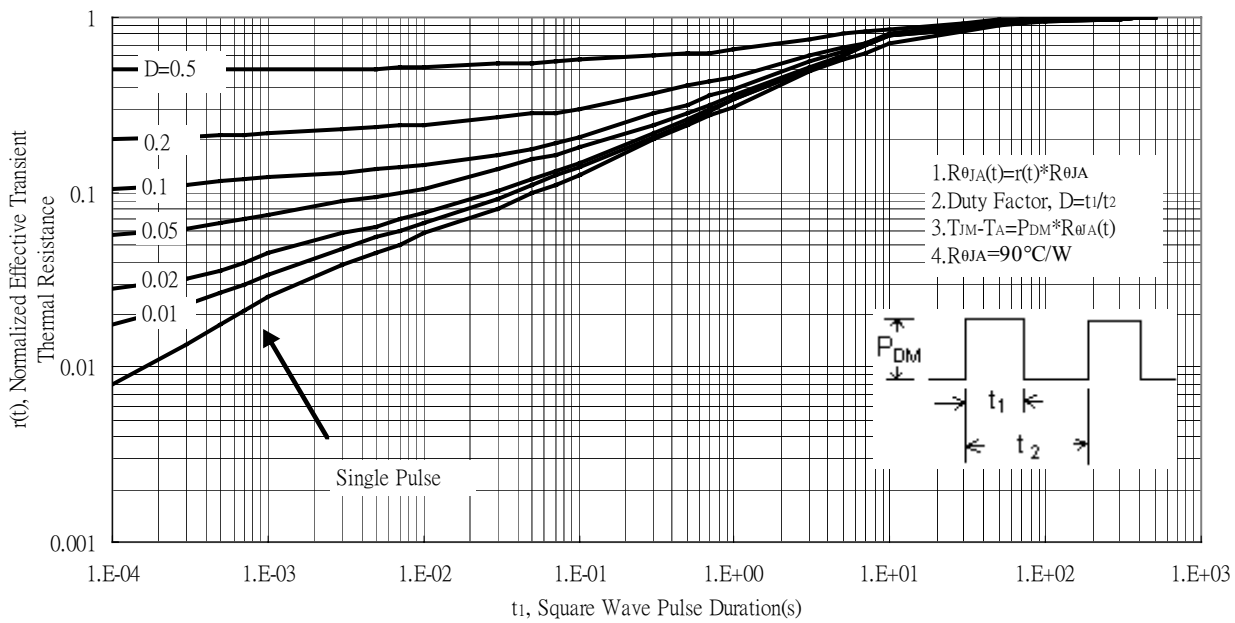
Typical Transfer Characteristics



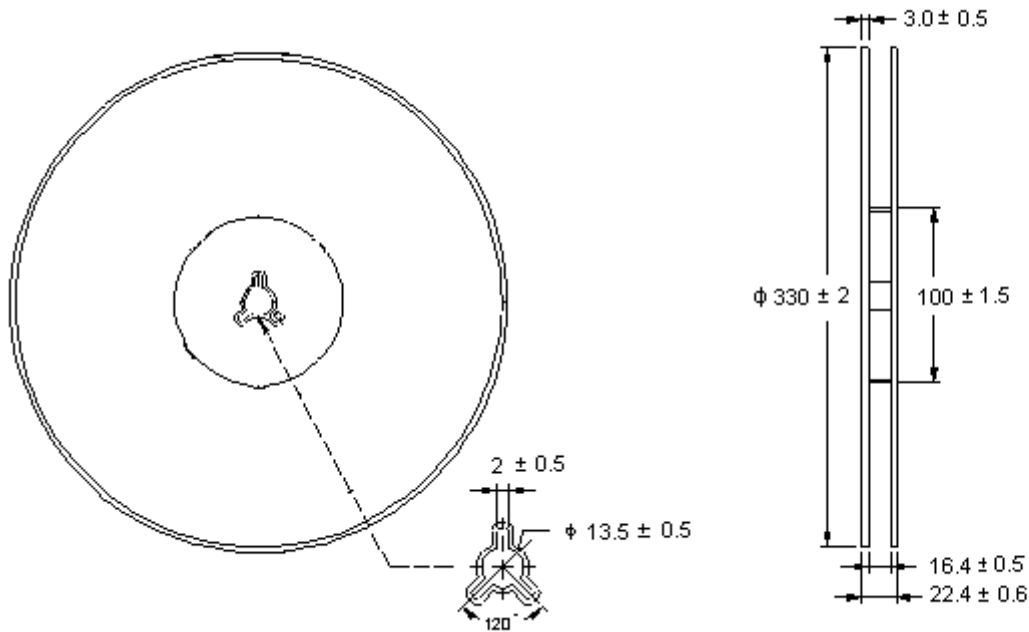
Single Pulse Power Rating, Junction to Ambient  
(Note on page 2)



Transient Thermal Response Curves

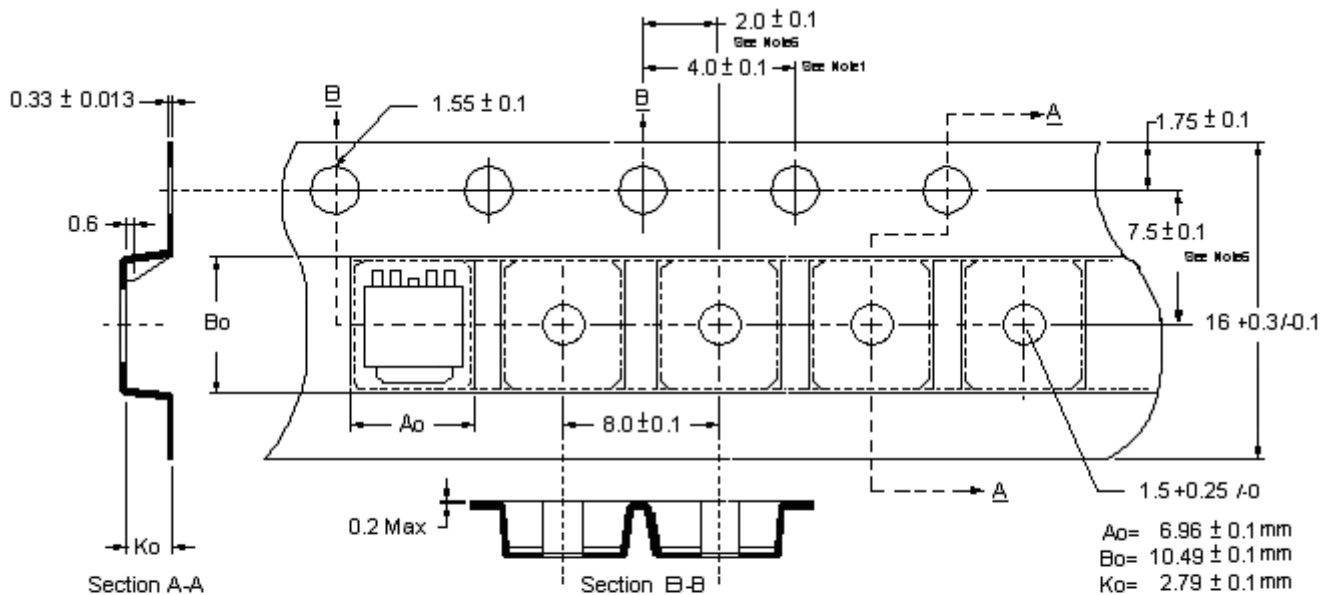


## Reel Dimension



Unit: millimeter

## Carrier Tape Dimension

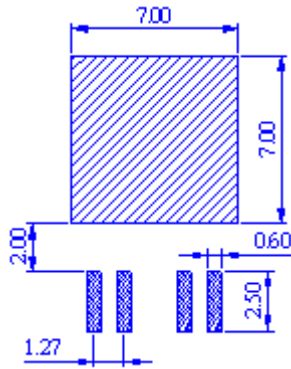


### Notes:

1. 10 sprocket hole pitch cumulative tolerance  $\pm 0.2$ .
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.

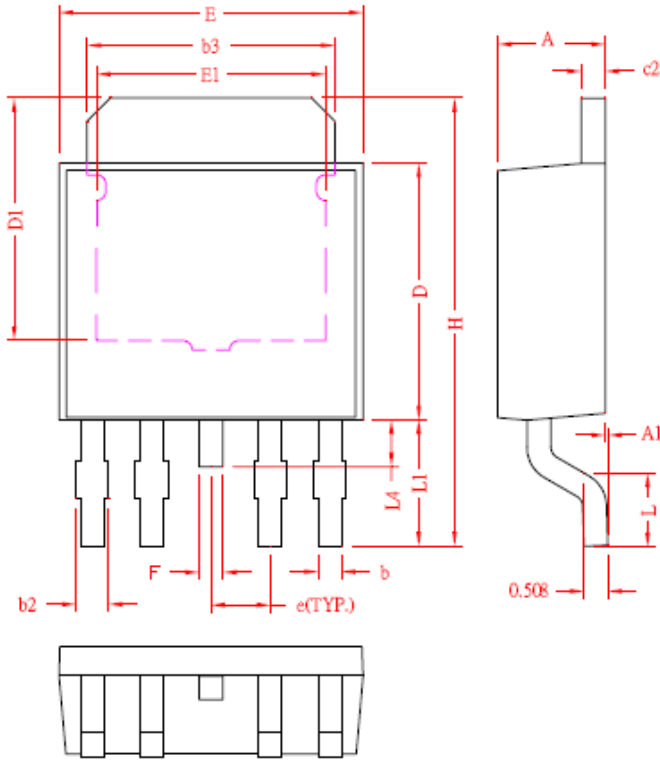
unit : millimeter

### Recommended soldering footprint

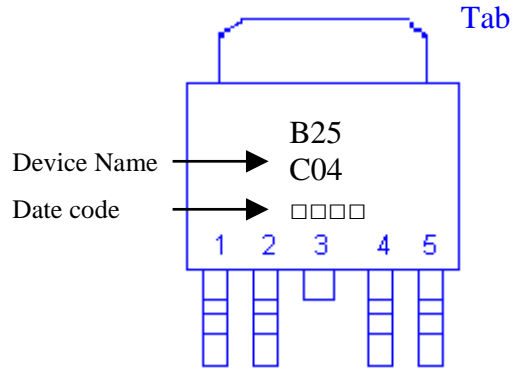


Unit : mm

**TO-252 Dimension**



Marking:



Style: Pin 1.Soure 1 2.Gate 1 3.&Tab  
 Drain 1& Drain 2 4. Source 2 5. Gate 2

4-Lead TO-252 Plastic Surface Mount Package

| DIM | Inches |        | Millimeters |      | DIM | Inches |        | Millimeters |       |
|-----|--------|--------|-------------|------|-----|--------|--------|-------------|-------|
|     | Min.   | Max.   | Min.        | Max. |     | Min.   | Max.   | Min.        | Max.  |
| A   | 0.0866 | 0.0945 | 2.20        | 2.40 | E   | 0.2520 | 0.2677 | 6.40        | 6.80  |
| A1  | 0.0000 | 0.0059 | 0.00        | 0.15 | E1  | 0.1500 | -      | 3.81        | -     |
| b   | 0.0157 | 0.0236 | 0.40        | 0.60 | e   | 0.0500 | REF    | 1.27        | REF   |
| b2  | 0.0199 | 0.0315 | 0.50        | 0.80 | F   | 0.0157 | 0.0236 | 0.40        | 0.60  |
| b3  | 0.2047 | 0.2165 | 5.20        | 5.50 | H   | 0.3701 | 0.4016 | 9.40        | 10.20 |
| c2  | 0.0177 | 0.0217 | 0.45        | 0.55 | L   | 0.0551 | 0.0697 | 1.40        | 1.77  |
| D   | 0.2126 | 0.2283 | 5.40        | 5.80 | L1  | 0.0945 | 0.1181 | 2.40        | 3.00  |
| D1  | 0.1799 | -      | 4.57        | -    | L4  | 0.0315 | 0.0472 | 0.80        | 1.20  |