

|       |      |
|-------|------|
| $V_R$ | 650V |
| $I_F$ | 4A   |
| $Q_C$ | 11nC |

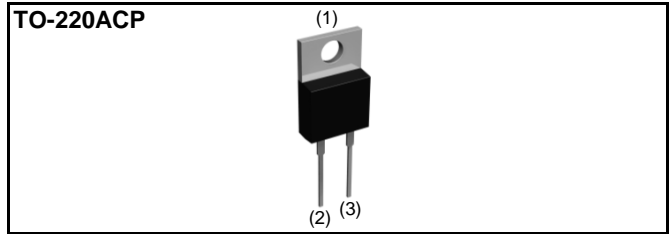
### ●Features

- 1) Shorter recovery time
- 2) Reduced temperature dependence
- 3) High-speed switching possible
- 4) High surge current capability

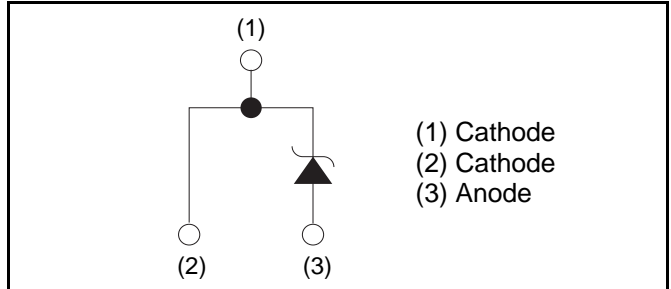
### ●Construction

Silicon carbide epitaxial planar type

### ●Outline



### ●Inner circuit



### ●Packaging specifications

| Type | Packaging                 | Tube     |
|------|---------------------------|----------|
|      | Reel size (mm)            | -        |
|      | Tape width (mm)           | -        |
|      | Basic ordering unit (pcs) | 50       |
|      | Packing code              | C9       |
|      | Marking                   | SCS304AP |

### ●Absolute maximum ratings ( $T_j = 25^\circ\text{C}$ )

| Parameter  | Symbol        | Value  | Unit             |                      |
|--|---------------|--|------------------|----------------------|
| Reverse voltage (repetitive peak)                        | $V_{RM}$      | 650  | V                |                      |
| Reverse voltage (DC)                                     | $V_R$         | 650  | V                |                      |
| Continuous forward current ( $T_c = 140^\circ\text{C}$ ) | $I_F$         | 4  | A                |                      |
| Surge non-repetitive forward current                     | $I_{FSM}$     | PW=10ms sinusoidal, $T_j=25^\circ\text{C}$             | 27               | A                    |
|  |               | PW=10ms sinusoidal, $T_j=150^\circ\text{C}$            | 22               | A                    |
|  |               | PW=10μs square, $T_j=25^\circ\text{C}$                 | 100              | A                    |
| Repetitive peak forward current                          | $I_{FRM}$     | 20 <sup>*1</sup>                                       | A                |                      |
| $i^2t$ value   | $\int i^2 dt$ | $1 \leq PW \leq 10\text{ms}$ , $T_j=25^\circ\text{C}$  | 3.6              | $\text{A}^2\text{s}$ |
|  |               | $1 \leq PW \leq 10\text{ms}$ , $T_j=150^\circ\text{C}$ | 2.4              | $\text{A}^2\text{s}$ |
| Total power dissipation                                  | $P_D$         | 34 <sup>*2</sup>                                       | W                |                      |
| Junction temperature                                     | $T_j$         | 175  | $^\circ\text{C}$ |                      |
| Range of storage temperature                             | $T_{stg}$     | -55 to +175  | $^\circ\text{C}$ |                      |

\*1  $T_c=100^\circ\text{C}$ ,  $T_j=150^\circ\text{C}$ , Duty cycle=10% \*2  $T_c=25^\circ\text{C}$

### ●Electrical characteristics (T<sub>j</sub> = 25°C)

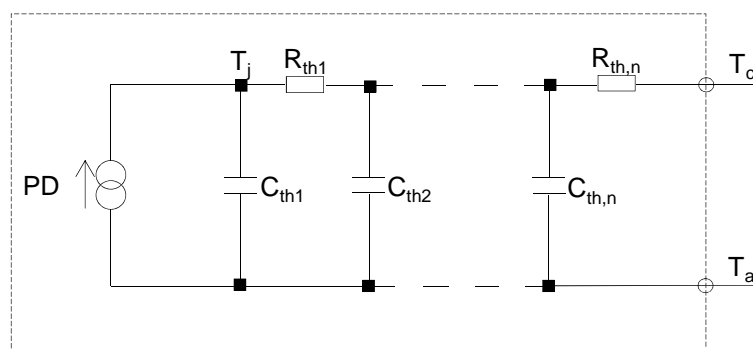
| Parameter                       | Symbol           | Conditions                                  | Values |       |      | Unit |
|---------------------------------|------------------|---|--------|-------|------|------|
|                                 |                  |   | Min.   | Typ.  | Max. |      |
| DC blocking voltage             | V <sub>DC</sub>  | I <sub>R</sub> =20μA                        | 650    | -     | -    | V    |
| Forward voltage                 | V <sub>F</sub>   | I <sub>F</sub> =4A, T <sub>j</sub> =25°C    | -      | 1.35  | 1.50 | V    |
|                                 |                  | I <sub>F</sub> =4A, T <sub>j</sub> =150°C   | -      | 1.44  | 1.71 | V    |
|                                 |                  | I <sub>F</sub> =4A, T <sub>j</sub> =175°C   | -      | 1.50  | -    | V    |
| Reverse current                 | I <sub>R</sub>   | V <sub>R</sub> =650V, T <sub>j</sub> =25°C  | -      | 0.012 | 20   | μA   |
|                                 |                  | V <sub>R</sub> =650V, T <sub>j</sub> =150°C | -      | 0.8   | 80   | μA   |
|                                 |                  | V <sub>R</sub> =650V, T <sub>j</sub> =175°C | -      | 2.4   | -    | μA   |
| Total capacitance               | C                | V <sub>R</sub> =1V, f=1MHz                  | -      | 200   | -    | pF   |
|                                 |                  | V <sub>R</sub> =650V, f=1MHz                | -      | 18    | -    | pF   |
| Total capacitive charge         | Q <sub>C</sub>   | V <sub>R</sub> =400V, di/dt=350A/μs         | -      | 11    | -    | nC   |
| Switching time                  | t <sub>C</sub>   | V <sub>R</sub> =400V, di/dt=350A/μs         | -      | 14    | -    | ns   |
| Non-repetitive Avaranche Energy | E <sub>ava</sub> | L=1mH                                       | -      | 48    | -    | mJ   |

### ●Thermal characteristics

| Parameter          | Symbol               | Conditions | Values |      |      | Unit |
|--------------------|----------------------|------------|--------|------|------|------|
|                    |                      |            | Min.   | Typ. | Max. |      |
| Thermal resistance | R <sub>th(j-c)</sub> | -          | -      | 3.0  | 4.4  | °C/W |

### ●Typical Transient Thermal Characteristics

| Symbol           | Value    | Unit | Symbol           | Value    | Unit |
|------------------|----------|------|------------------|----------|------|
| R <sub>th1</sub> | 3.91E-02 | K/W  | C <sub>th1</sub> | 1.01E-04 | Ws/K |
| R <sub>th2</sub> | 3.76E-01 |      | C <sub>th2</sub> | 4.02E-04 |      |
| R <sub>th3</sub> | 2.54E+00 |      | C <sub>th3</sub> | 1.19E-03 |      |



●Electrical characteristic curves

Fig.1  $V_F - I_F$  Characteristics

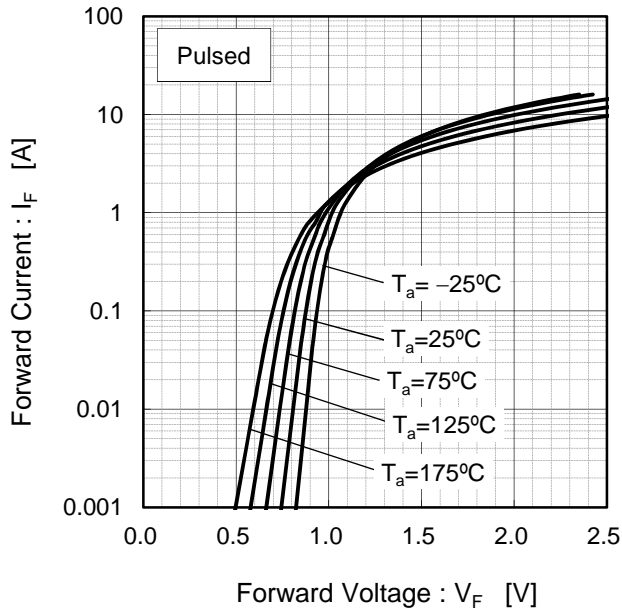


Fig.2  $V_F - I_F$  Characteristics

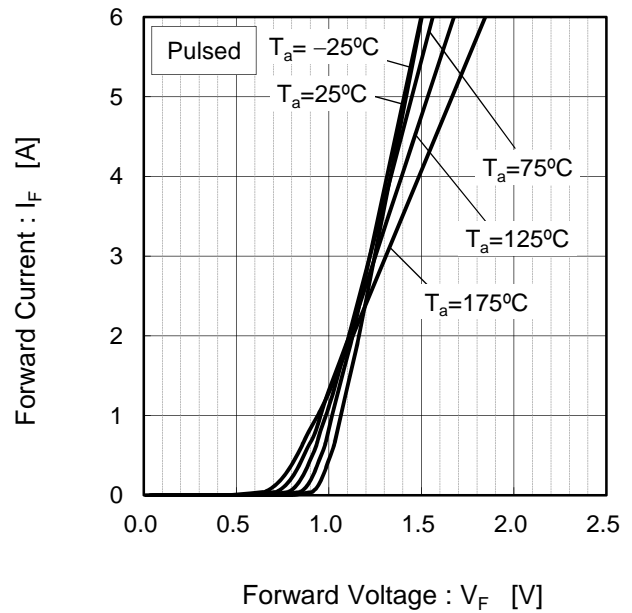


Fig.3  $V_R - I_R$  Characteristics

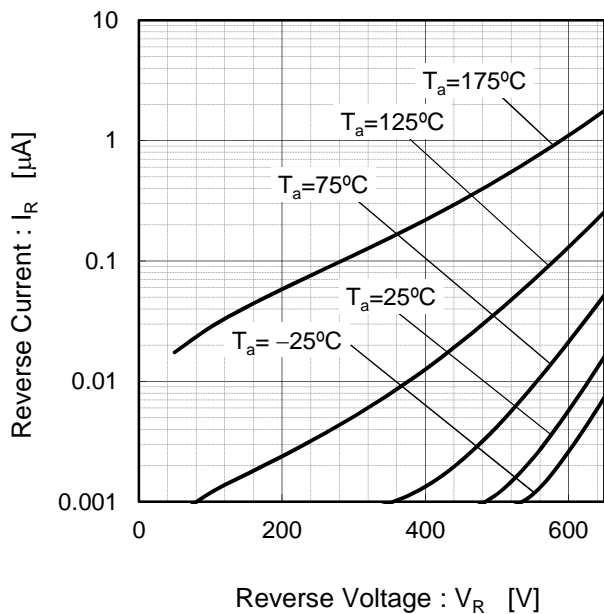
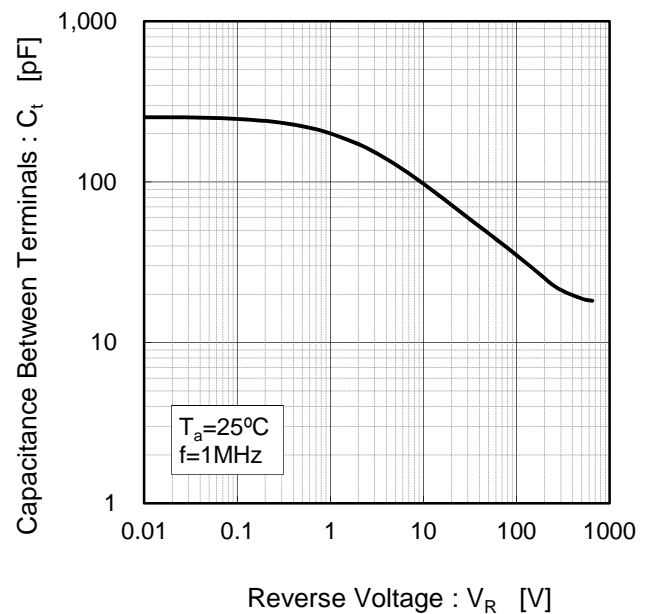


Fig.4  $V_R - C_t$  Characteristics



●Electrical characteristic curves

Fig.5 Typical Transient Thermal Resistance vs. Pulse Width

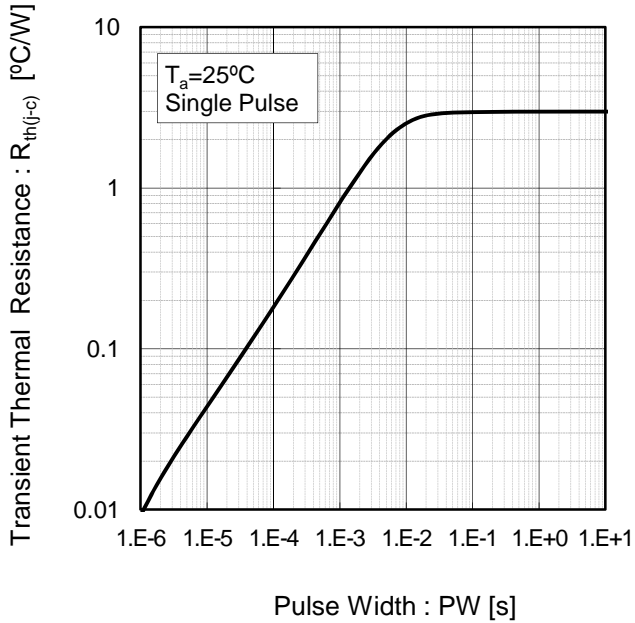


Fig.6 Power Dissipation

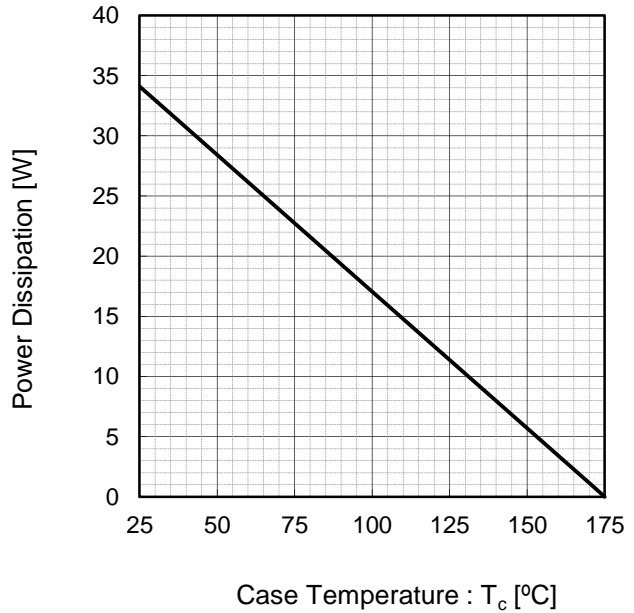
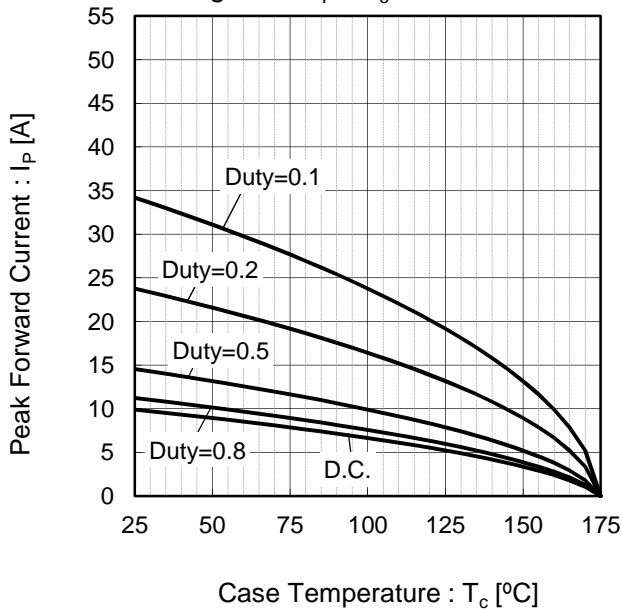
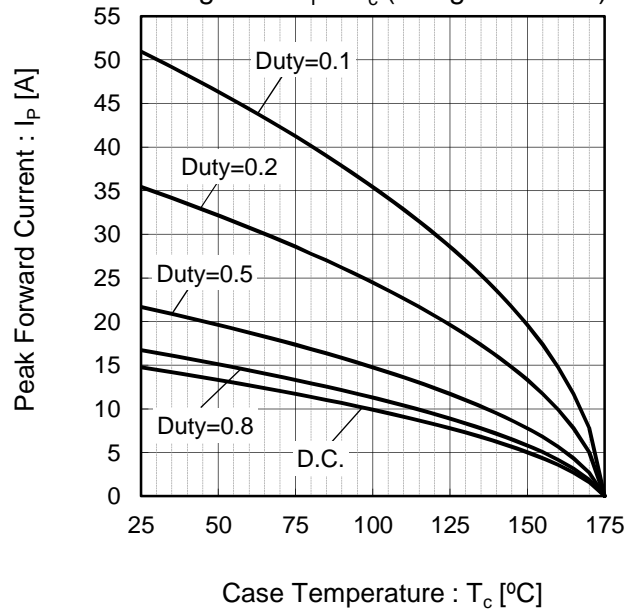


Fig.7\*3 Maximum peak forward current derating curve  $I_P - T_c$



\*3 Based on max Vf, max  $R_{th(j-c)}$   
Valid for switching of above 10kHz,  
excluding D.C. curve.

Fig.8\*4 Typical peak forward current derating curve  $I_P - T_c$  (Not guaranteed)



\*4 Based on typ Vf, typ  $R_{th(j-c)}$   
Typical value, not guaranteed  
Valid for switching of above 10kHz,  
excluding D.C. curve

●Electrical characteristic curves

Fig.9 Surge non-repetitive forward current vs. Pulse width (Sinusoidal waveform)

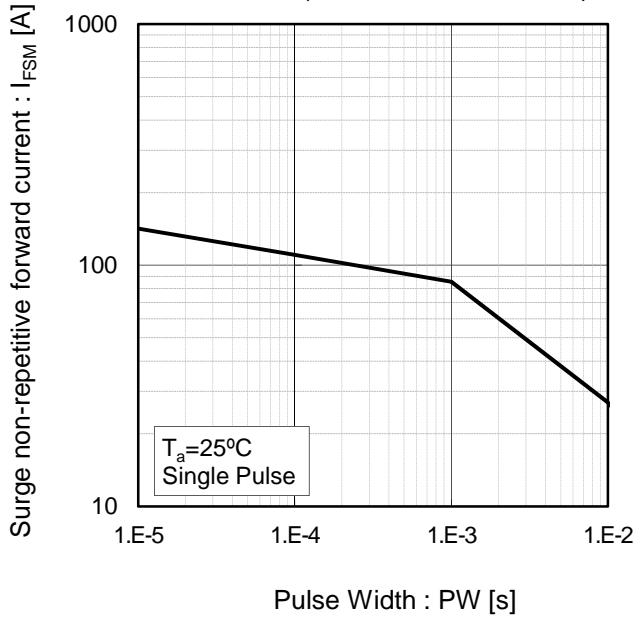
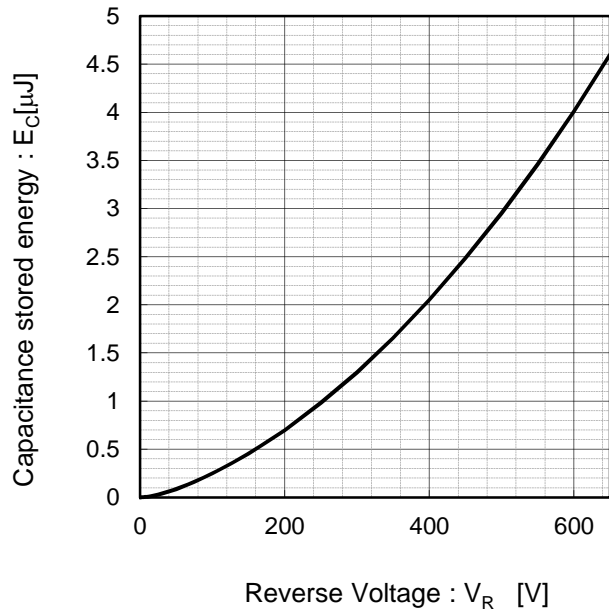
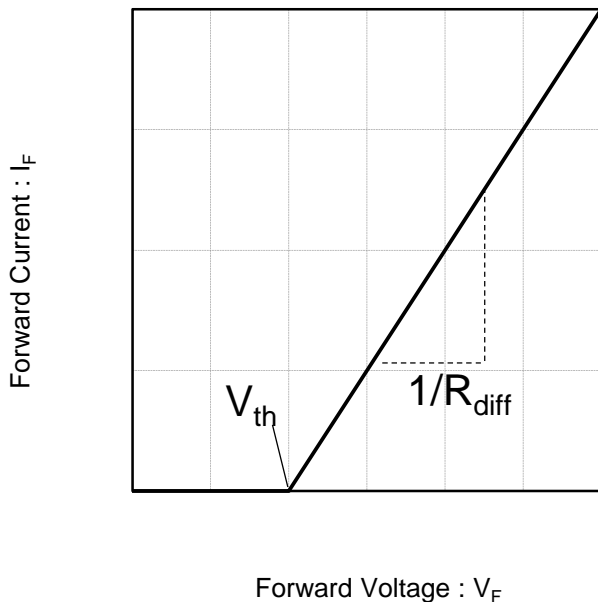


Fig.10 Typical capacitance store energy



●Simplified forward characteristic model

Fig.11 Equivalent forward current curve



$$V_F = V_{th} + R_{diff} I_F$$

$$V_{th}(T_j) = a_0 + a_1 T_j$$

$$R_{diff}(T_j) = b_0 + b_1 T_j + b_2 T_j^2$$

| Symbol         | Typical Value | Unit              |
|----------------|---------------|-------------------|
| a <sub>0</sub> | 9.66E-01      | V                 |
| a <sub>1</sub> | -1.10E-0.3    | V/°C              |
| b <sub>0</sub> | 8.80E-02      | Ω                 |
| b <sub>1</sub> | 1.87E-04      | Ω/°C              |
| b <sub>2</sub> | 1.92E-06      | Ω/°C <sup>2</sup> |

T<sub>j</sub> in °C; -55 °C < T<sub>j</sub> < 175 °C ; I<sub>F</sub> < 8 A

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