

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

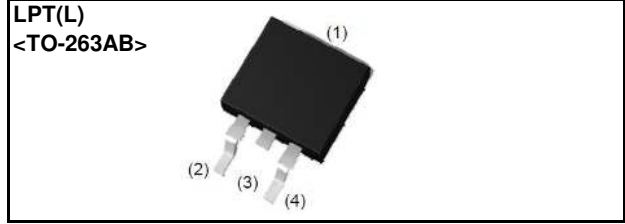
### ●Features

- 1) Low forward voltage
- 2) Negligible recovery time/current
- 3) Temperature independent switching behavior
- 4) High surge current capability
- 5) Low leakage current

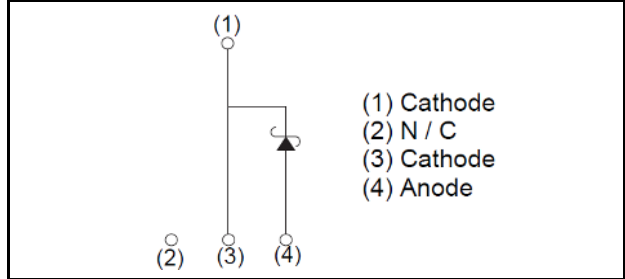
### ●Applications

- Switch Mode Power Supply
- Uninterruptible Power Supply
- Solar Inverter
- Motor Drive
- Air Conditioner
- EV Charger

### ●Outline



### ●Inner circuit



### ●Packaging specifications

| Type | Packaging                 | Embossed tape |
|------|---------------------------|---------------|
|      | Reel size (mm)            | 330           |
|      | Tape width (mm)           | 24            |
|      | Basic ordering unit (pcs) | 1.000         |
|      | Packing code              | TLL           |
|      | Marking                   | SCS304AJ      |

### ●Absolute maximum ratings ( $T_{vj}=25^{\circ}\text{C}$ unless otherwise specified)

| Parameter  |   | Symbol        | Value            | Unit                 |
|--|---|---------------|------------------|----------------------|
| Reverse voltage (repetitive peak)                                      |   | $V_{RM}$      | 650              | V                    |
| Reverse voltage (DC)   |   | $V_R$         | 650              | V                    |
| Continuous forward current ( $T_c=145^{\circ}\text{C}$ )* <sup>1</sup> |   | $I_F$         | 4                | A                    |
| Surge non-repetitive forward current                                   | PW=10ms sinusoidal, $T_{vj}=25^{\circ}\text{C}$             | $I_{FSM}$     | 27               | A                    |
|  | PW=10ms sinusoidal, $T_{vj}=150^{\circ}\text{C}$            |               | 22               | A                    |
|  | PW=10μs square, $T_{vj}=25^{\circ}\text{C}$                 |               | 100              | A                    |
| Repetitive peak forward current  |   | $I_{FRM}$     | 21* <sup>2</sup> | A                    |
| $i^2t$ value   | $1 \leq PW \leq 10\text{ms}$ , $T_{vj}=25^{\circ}\text{C}$  | $\int i^2 dt$ | 3                | $\text{A}^2\text{s}$ |
|  | $1 \leq PW \leq 10\text{ms}$ , $T_{vj}=150^{\circ}\text{C}$ |               | 2                | $\text{A}^2\text{s}$ |
| Total power dissipation  |   | $P_D$         | 37* <sup>3</sup> | W                    |
| Virtual junction temperature   |   | $T_{vj}$      | 175              | $^{\circ}\text{C}$   |
| Range of storage temperature   |   | $T_{stg}$     | -55 to +175      | $^{\circ}\text{C}$   |

\*1 Limited by maximum  $T_{vj}$  and for Max.  $R_{thJC}$ . \*2  $T_c=100^{\circ}\text{C}$ ,  $T_{vj}=150^{\circ}\text{C}$ , Duty cycle=10% \*3  $T_c=25^{\circ}\text{C}$

**●Electrical characteristics** ( $T_{vj}=25^{\circ}\text{C}$  unless otherwise specified)

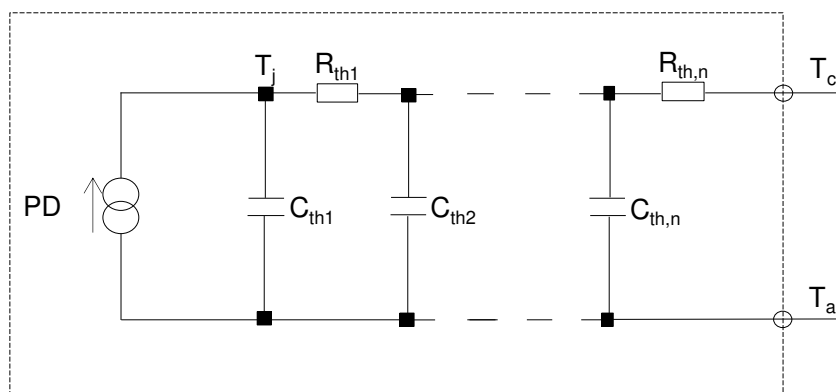
| Parameter                       | Symbol    | Conditions                                       | Values |       |      | Unit          |
|---------------------------------|-----------|--|--------|-------|------|---------------|
|                                 |           |  | Min.   | Typ.  | Max. |               |
| DC blocking voltage             | $V_{DC}$  | $I_R=20\mu\text{A}$                              | 650    | -     | -    | V             |
| Forward voltage                 | $V_F$     | $I_F=4\text{A}, T_{vj}=25^{\circ}\text{C}$       | -      | 1.35  | 1.50 | V             |
|                                 |           | $I_F=4\text{A}, T_{vj}=150^{\circ}\text{C}$      | -      | 1.44  | 1.71 | V             |
|                                 |           | $I_F=4\text{A}, T_{vj}=175^{\circ}\text{C}$      | -      | 1.50  | -    | V             |
| Reverse current                 | $I_R$     | $V_R=650\text{V}, T_{vj}=25^{\circ}\text{C}$     | -      | 0.012 | 20   | $\mu\text{A}$ |
|                                 |           | $V_R=650\text{V}, T_{vj}=150^{\circ}\text{C}$    | -      | 0.8   | 80   | $\mu\text{A}$ |
|                                 |           | $V_R=650\text{V}, T_{vj}=175^{\circ}\text{C}$    | -      | 2.4   | -    | $\mu\text{A}$ |
| Total capacitance               | C         | $V_R=1\text{V}, f=1\text{MHz}$                   | -      | 200   | -    | pF            |
|                                 |           | $V_R=650\text{V}, f=1\text{MHz}$                 | -      | 18    | -    | pF            |
| Total capacitive charge         | $Q_C$     | $V_R=400\text{V}, di/dt=350\text{A}/\mu\text{s}$ | -      | 11    | -    | nC            |
| Switching time                  | $t_C$     | $V_R=400\text{V}, di/dt=350\text{A}/\mu\text{s}$ | -      | 14    | -    | ns            |
| Non-repetitive Avaranche Energy | $E_{ava}$ | $L=1\text{mH}$                                   | -      | 48    | -    | mJ            |

**●Thermal characteristics**

| Parameter          | Symbol     | Conditions | Values |      |      | Unit |
|--------------------|------------|------------|--------|------|------|------|
|                    |            |            | Min.   | Typ. | Max. |      |
| Thermal resistance | $R_{thJC}$ | -          | -      | 2.8  | 4.0  | K/W  |

**●Typical Transient Thermal Characteristics**

| Symbol    | Value    | Unit | Symbol    | Value    | Unit |
|-----------|----------|------|-----------|----------|------|
| $R_{th1}$ | 4.18E-01 | K/W  | $C_{th1}$ | 8.87E-05 | Ws/K |
| $R_{th2}$ | 2.37E+00 |      | $C_{th2}$ | 1.19E-03 |      |
| $R_{th3}$ | 1.02E-02 |      | $C_{th3}$ | 2.99E-01 |      |



●Electrical characteristic curves

Fig.1  $V_F - I_F$  Characteristics

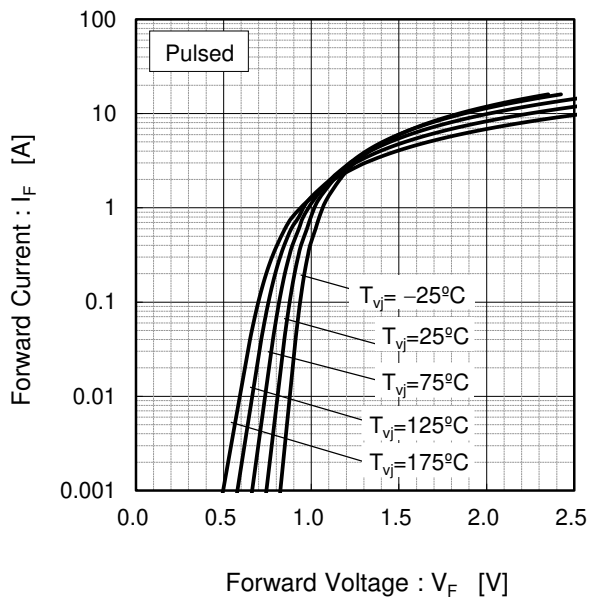


Fig.2  $V_F - I_F$  Characteristics

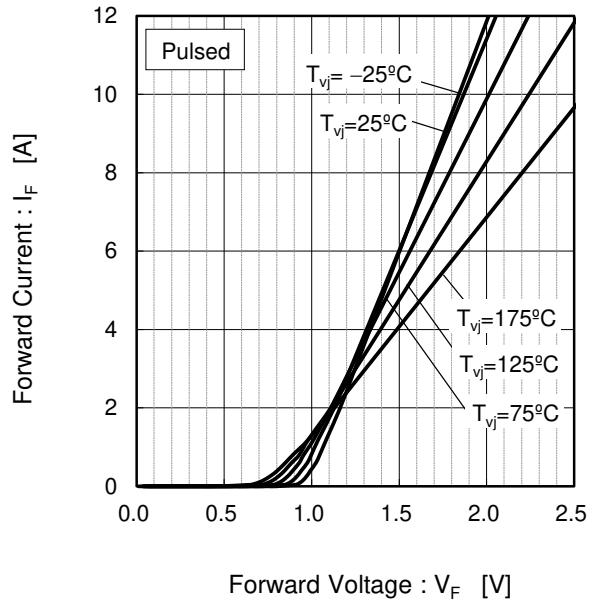


Fig.3  $V_R - I_R$  Characteristics

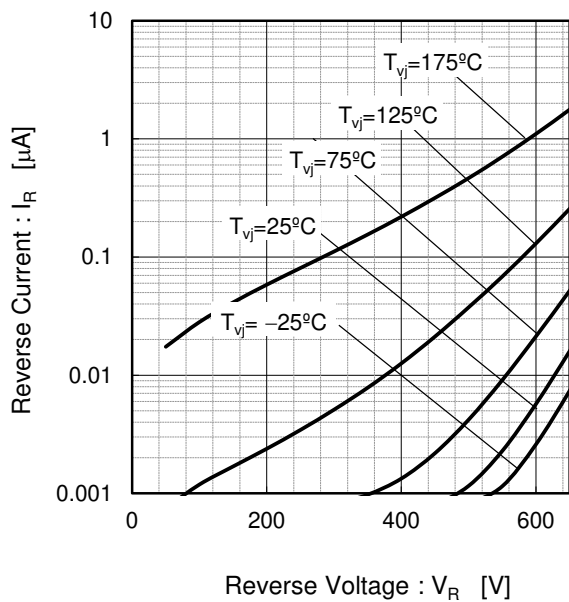
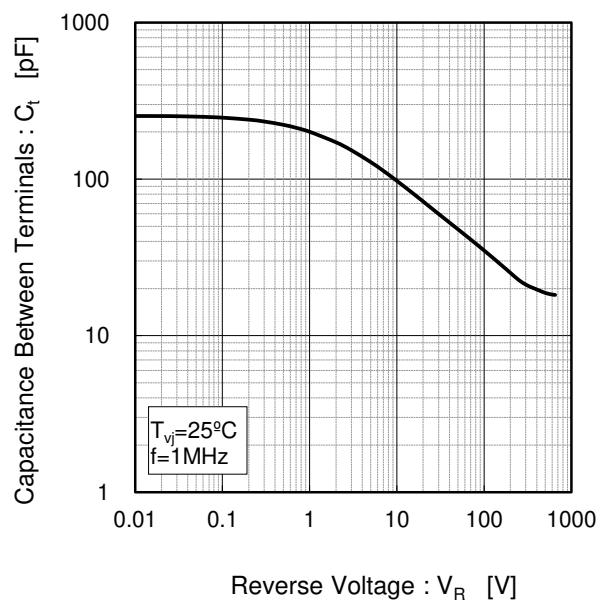


Fig.4  $V_R - C_t$  Characteristics



●Electrical characteristic curves

Fig.5 Typical Transient Thermal Resistance vs. Pulse Width

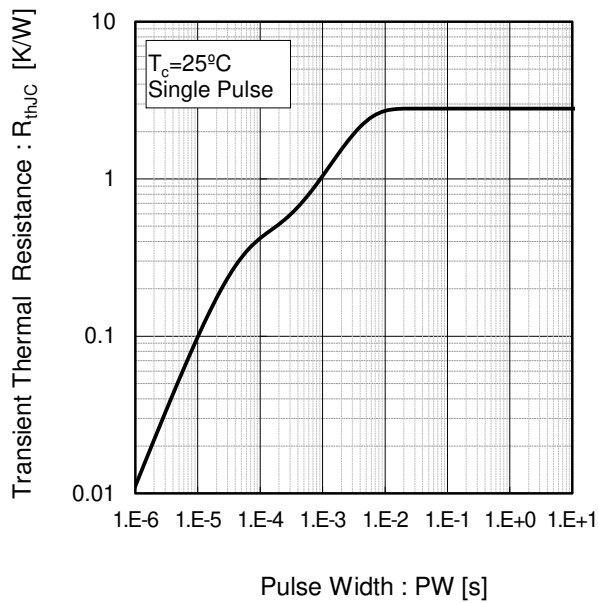


Fig.6 Power Dissipation

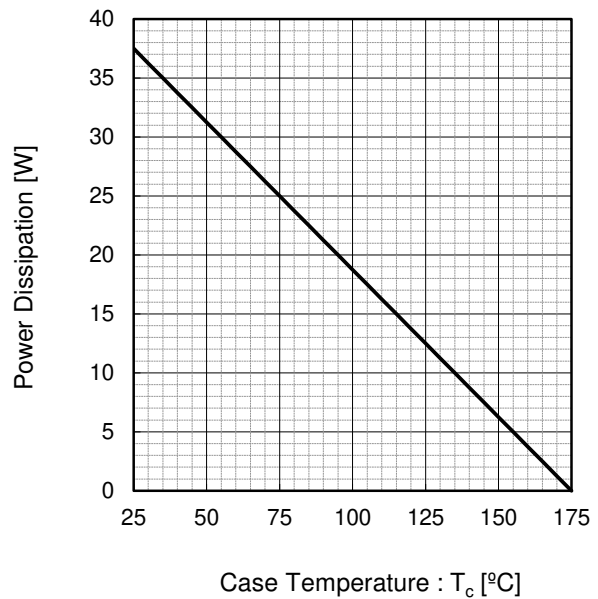
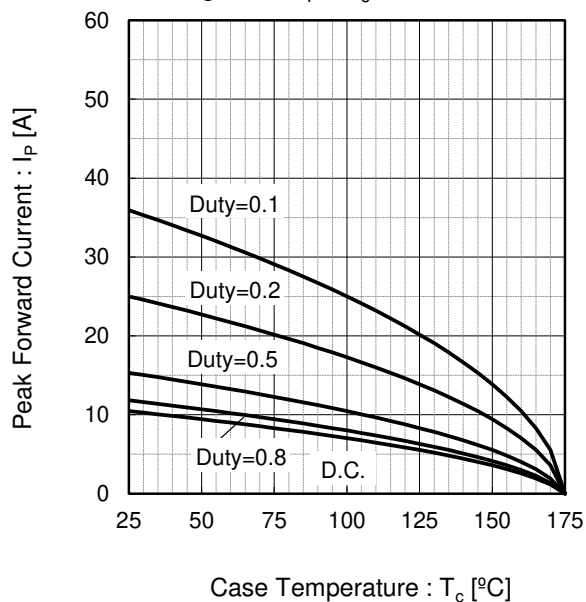
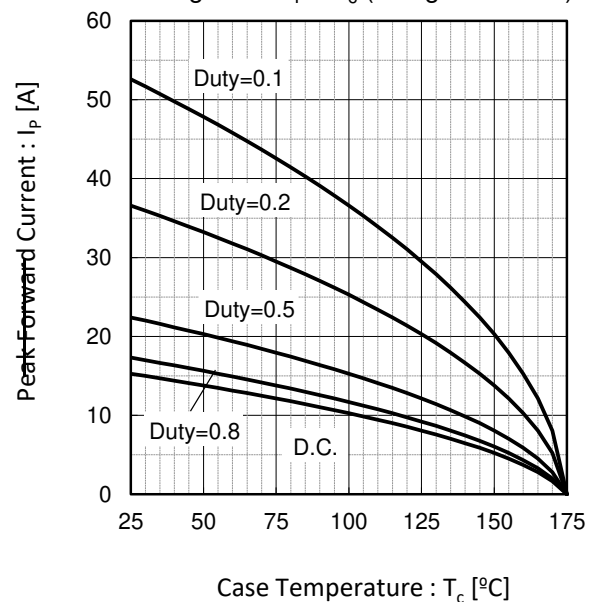


Fig.7\*4 Maximum peak forward current derating curve  $I_P - T_c$



\*4 Based on max Vf, max  $R_{thJC}$   
Valid for switching of above 10kHz,  
excluding D.C. curve.

Fig.8\*5 Typical peak forward current derating curve  $I_P - T_c$  (Not guaranteed)



\*5 Based on typ Vf, typ  $R_{thJC}$   
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)

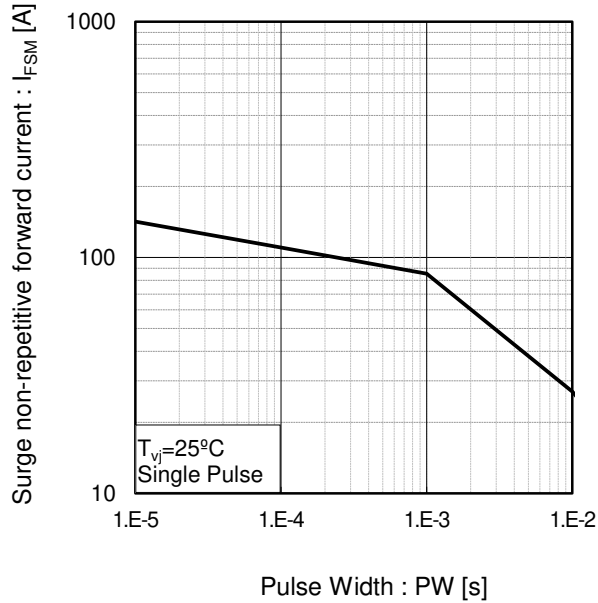
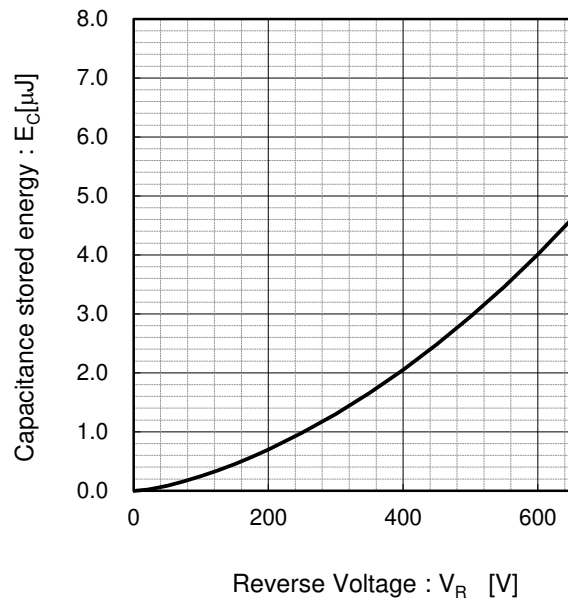
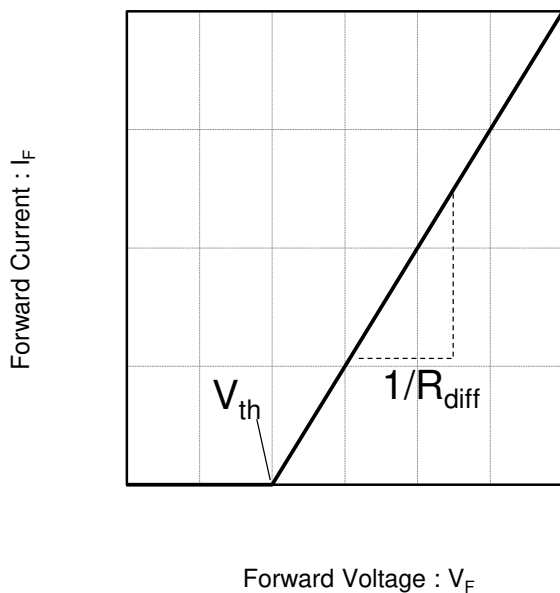


Fig.10 Typical capacitance store energy



●Simplified forward characteristic model

Fig.11 Equivalent forward current curve



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

$$V_{th} ( T_{vj} ) = a_0 + a_1 T_{vj}$$

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

| Symbol         | Typical Value | Unit              |
|----------------|---------------|-------------------|
| a <sub>0</sub> | 9.66E-01      | V                 |
| a <sub>1</sub> | -1.10E-03     | 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>vj</sub> in °C; -55 °C < T<sub>vj</sub> < 175°C ; I<sub>F</sub> < 8 A

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