

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

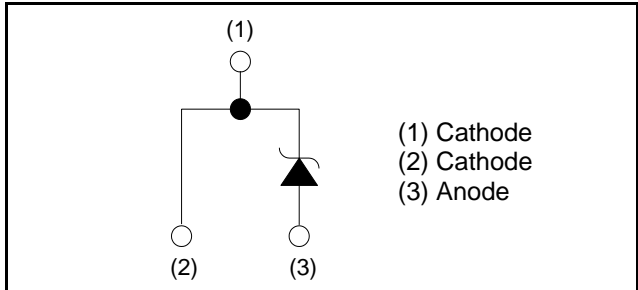
Silicon carbide epitaxial planar type

●Outline

TO-220ACP



●Inner circuit



●Packaging specifications

Type	Packaging	Tube
	Reel size (mm)	-
	Tape width (mm)	-
	Basic ordering unit (pcs)	50
	Packing code	C9
	Marking	SCS304AH

●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 ($T_c = 140^{\circ}\text{C}$)*1		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}	20*2	A
i^2t value	$1 \leq PW \leq 10\text{ms}$, $T_{vj}=25^{\circ}\text{C}$	$\int i^2 dt$	3.6	A^2s
	$1 \leq PW \leq 10\text{ms}$, $T_{vj}=150^{\circ}\text{C}$		2.4	A^2s
Total power dissipation		P_D	34*3	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)

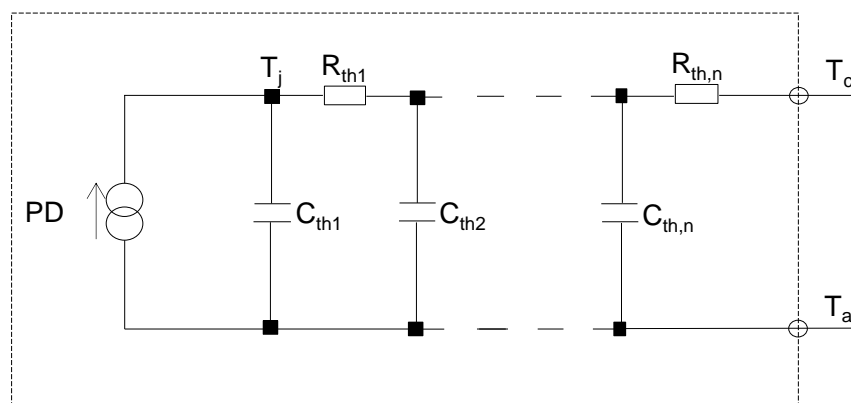
Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
DC blocking voltage	V_{DC}	$I_R=20\mu\text{A}$	650	-	-	V
Forward voltage	V_F	$I_F=4\text{A}, T_{vj}=25^{\circ}\text{C}$	-	1.35	1.50	V
		$I_F=4\text{A}, T_{vj}=150^{\circ}\text{C}$	-	1.44	1.71	V
		$I_F=4\text{A}, T_{vj}=175^{\circ}\text{C}$	-	1.50	-	V
Reverse current	I_R	$V_R=650\text{V}, T_{vj}=25^{\circ}\text{C}$	-	0.012	20.0	μA
		$V_R=650\text{V}, T_{vj}=150^{\circ}\text{C}$	-	0.8	80	μA
		$V_R=650\text{V}, T_{vj}=175^{\circ}\text{C}$	-	2.4	-	μA
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}	-	-	3.0	4.4	K/W

●Typical Transient Thermal Characteristics

Symbol	Value	Unit	Symbol	Value	Unit
R_{th1}	3.91×10^{-2}	K/W	C_{th1}	1.01×10^{-4}	Ws/K
R_{th2}	3.76×10^{-1}		C_{th2}	4.02×10^{-4}	
R_{th3}	2.54×10^0		C_{th3}	1.19×10^{-3}	



●Electrical characteristic curves

Fig.1 $V_F - I_F$ Characteristics

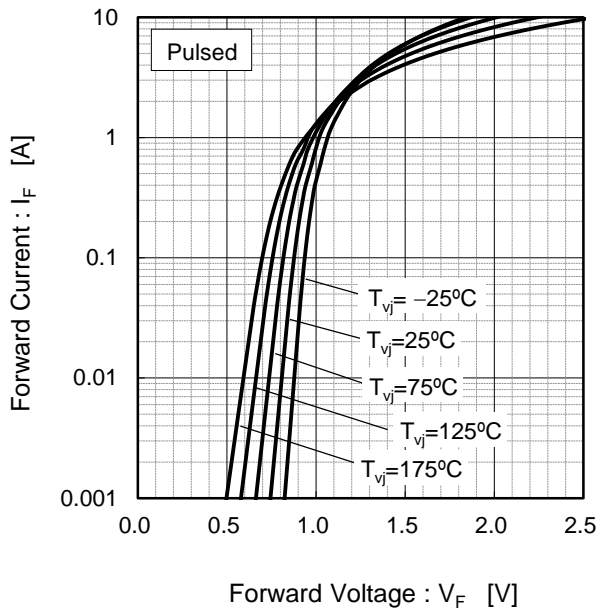


Fig.2 $V_F - I_F$ Characteristics

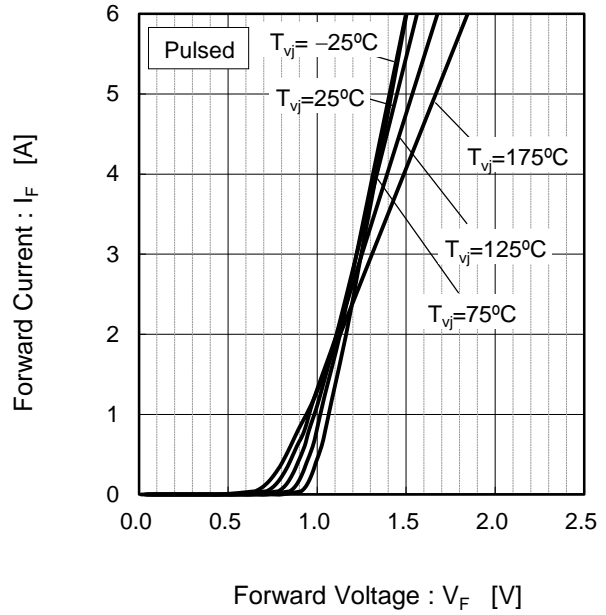


Fig.3 $V_R - I_R$ Characteristics

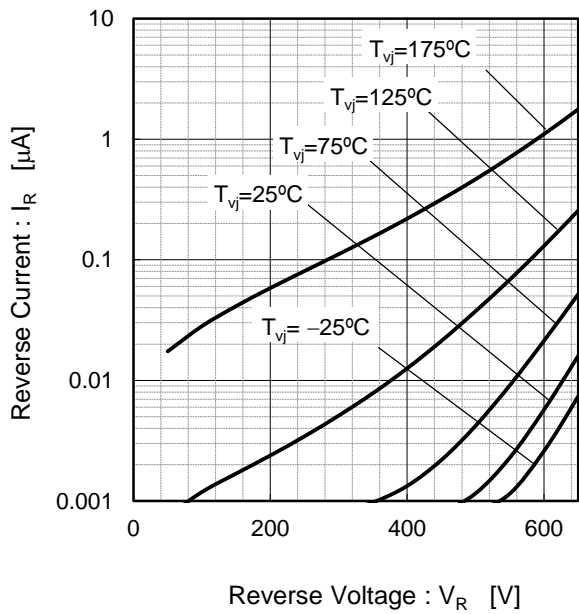
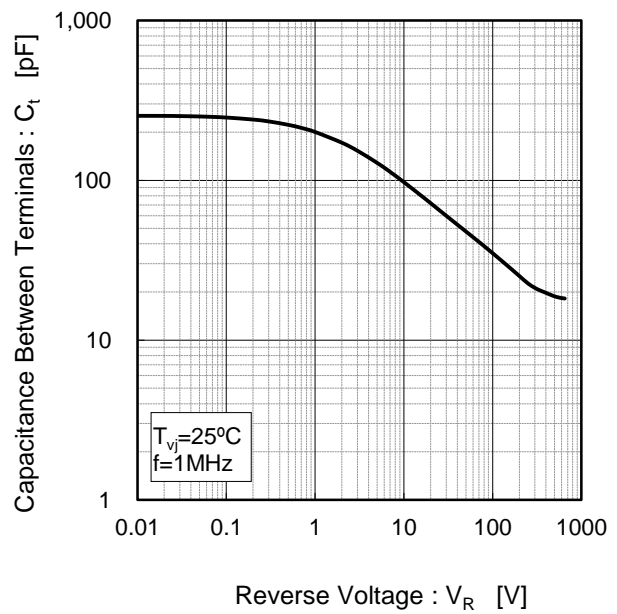


Fig.4 $V_R - C_t$ Characteristics



●Electrical characteristic curves

Fig.5 Typical Transient Thermal Resistance vs. Pulse Width

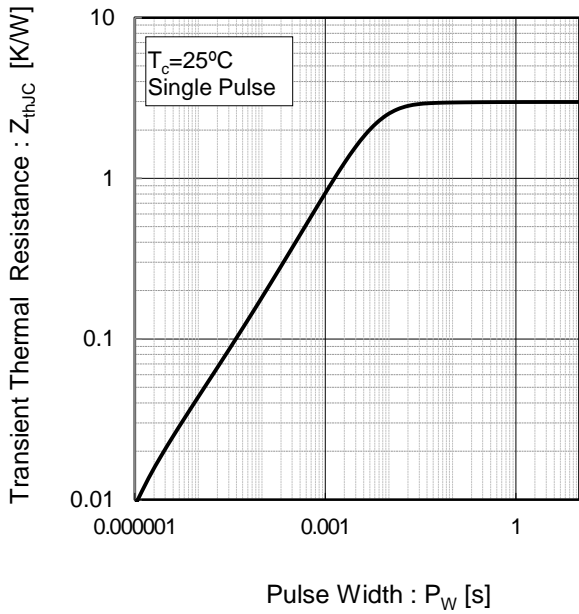


Fig.6 Power Dissipation

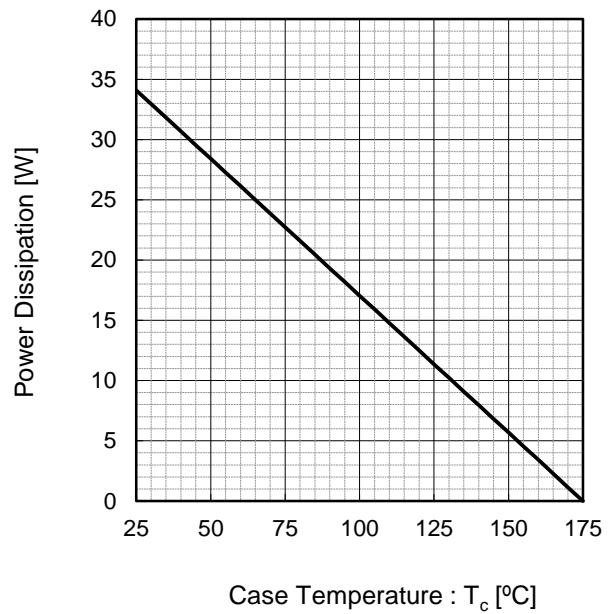
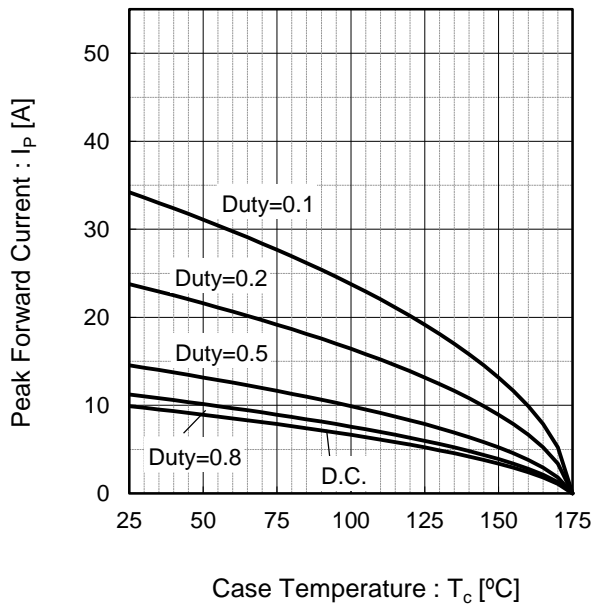
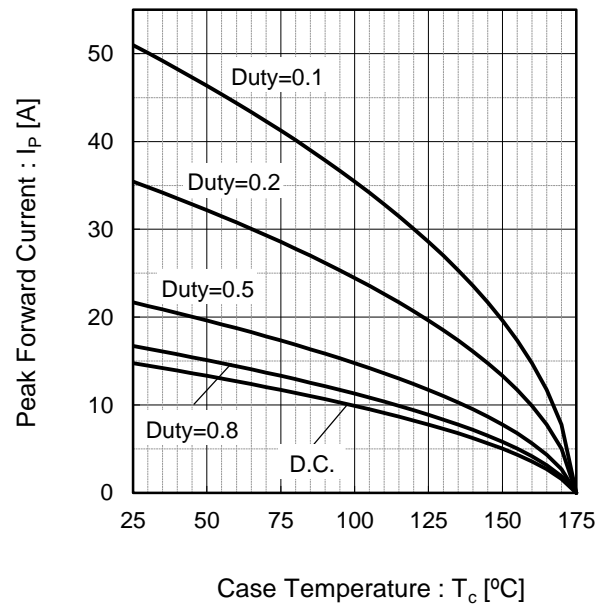


Fig.7*4 Maximum peak forward current derating curve $I_P - T_c$



*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)

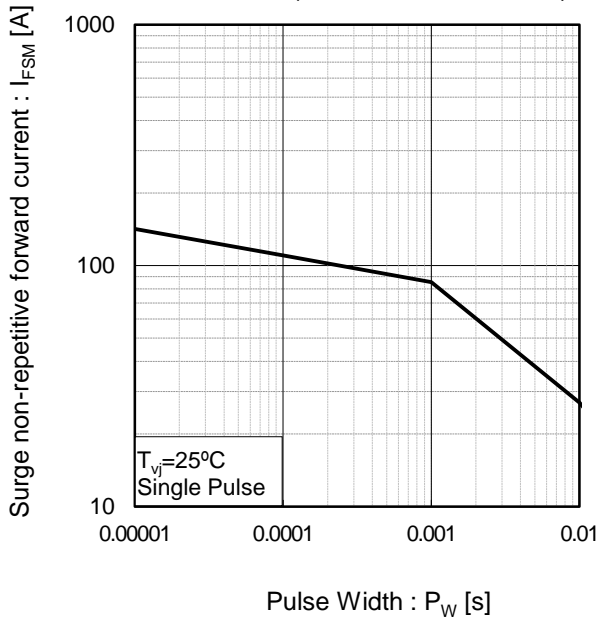
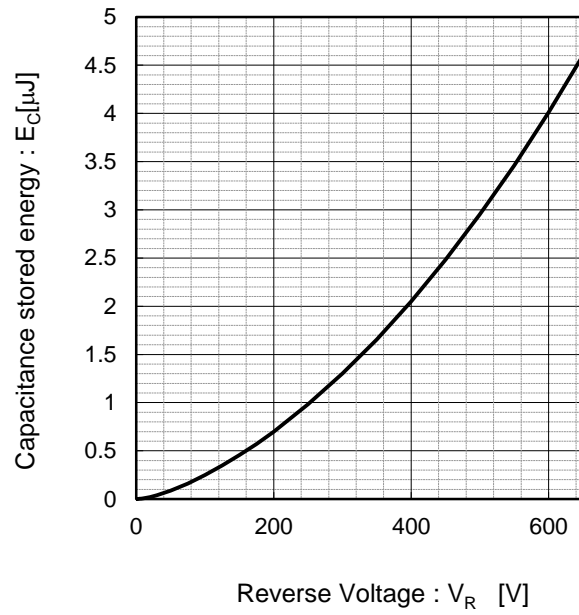
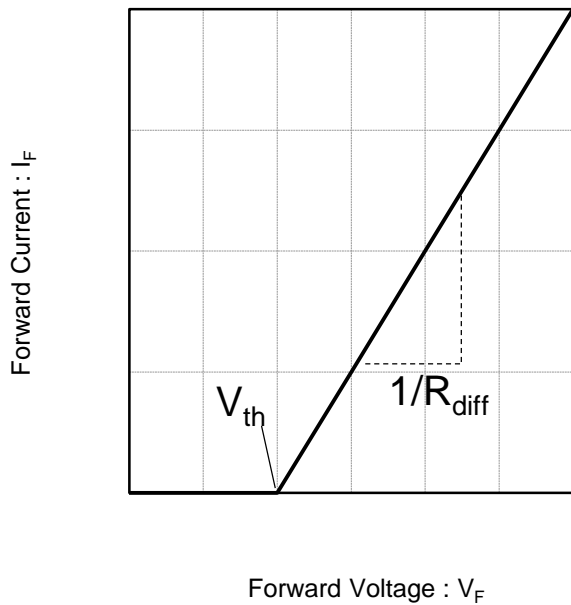


Fig.10 Typical capacitance store energy



●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_0	9.66×10^{-1}	V
a_1	-1.1×10^{-3}	V/°C
b_0	8.80×10^{-2}	Ω
b_1	1.87×10^{-4}	$\Omega/^\circ\text{C}$
b_2	1.92×10^{-6}	$\Omega/^\circ\text{C}^2$

T_{vj} in °C; $-55\text{ }^\circ\text{C} < T_{vj} < 175\text{ }^\circ\text{C}$; $I_F < 8\text{ A}$

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