



# THE DATASHEET OF SCS304AHGC9



$V_R$	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

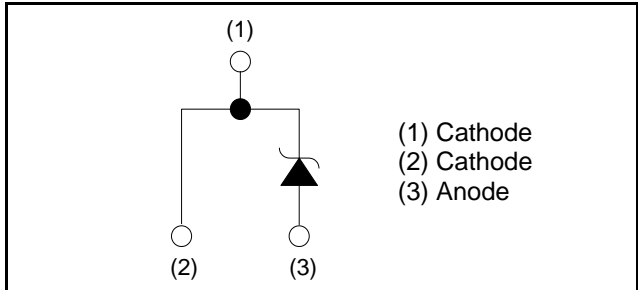
Silicon carbide epitaxial planar type

### ●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=10 $\mu\text{s}$ square, $T_{vj}=25^{\circ}\text{C}$		100	A
Repetitive peak forward current		$I_{FRM}$	20*2	A
$i^2t$ value	$1 \leq \text{PW} \leq 10\text{ms}$ , $T_{vj}=25^{\circ}\text{C}$	$\int i^2 dt$	3.6	$\text{A}^2\text{s}$
	$1 \leq \text{PW} \leq 10\text{ms}$ , $T_{vj}=150^{\circ}\text{C}$		2.4	$\text{A}^2\text{s}$
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)

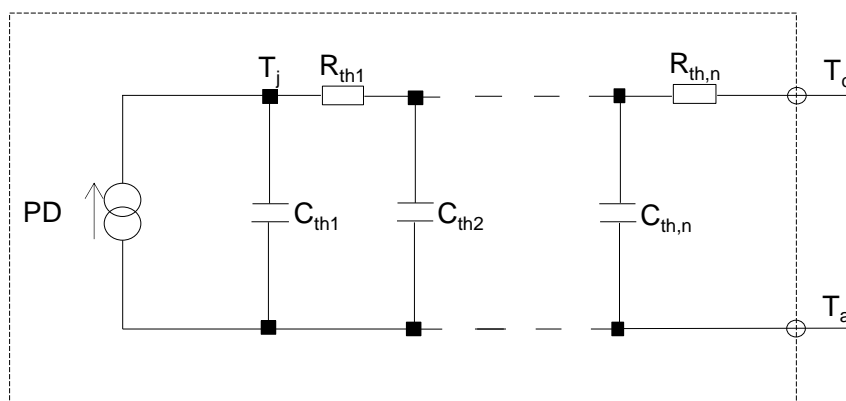
Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
DC blocking voltage	$V_{DC}$	$I_R=20\mu\text{A}$	650	-	-	V
Forward voltage	$V_F$	$I_F=4\text{A}, T_{vj}=25^{\circ}\text{C}$	-	1.35	1.50	V
		$I_F=4\text{A}, T_{vj}=150^{\circ}\text{C}$	-	1.44	1.71	V
		$I_F=4\text{A}, T_{vj}=175^{\circ}\text{C}$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

**●Typical Transient Thermal Characteristics**

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



●Electrical characteristic curves

Fig.1  $V_F - I_F$  Characteristics

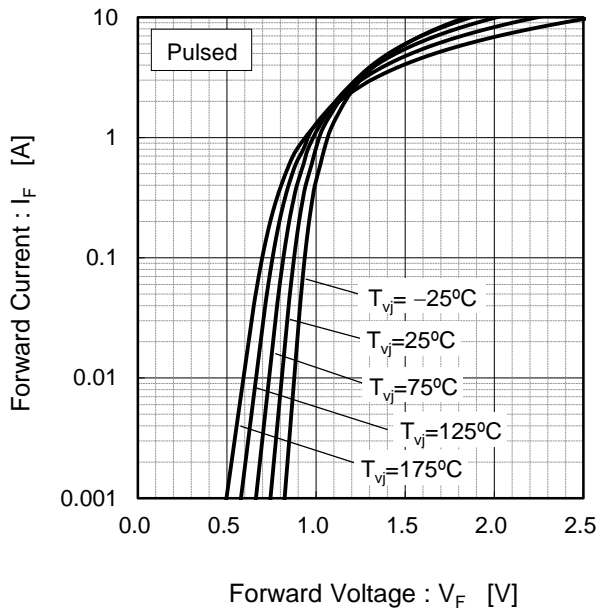


Fig.2  $V_F - I_F$  Characteristics

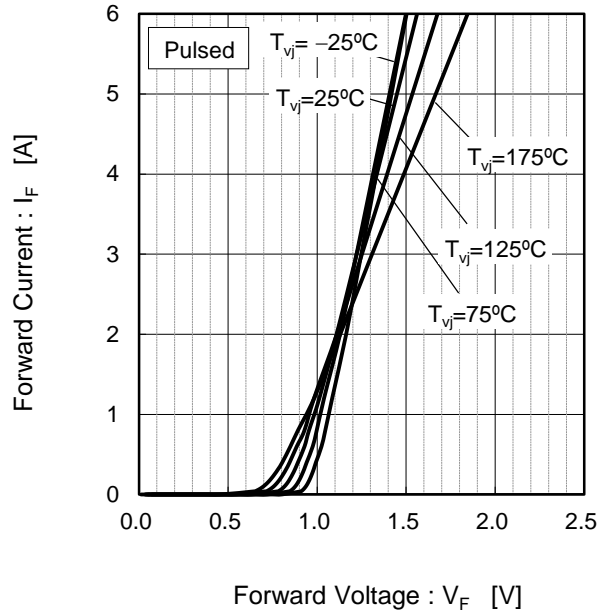


Fig.3  $V_R - I_R$  Characteristics

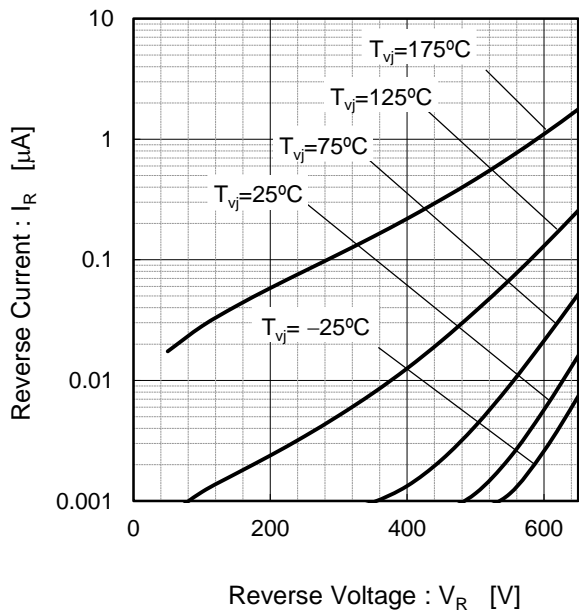
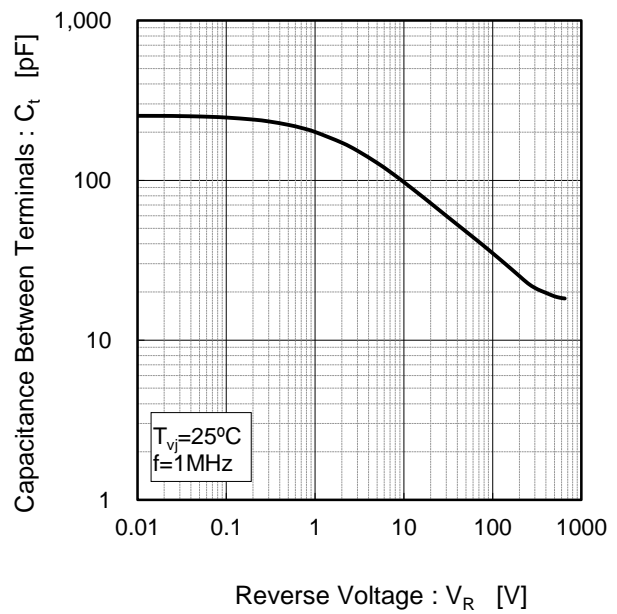


Fig.4  $V_R - C_t$  Characteristics



●Electrical characteristic curves

Fig.5 Typical Transient Thermal Resistance vs. Pulse Width

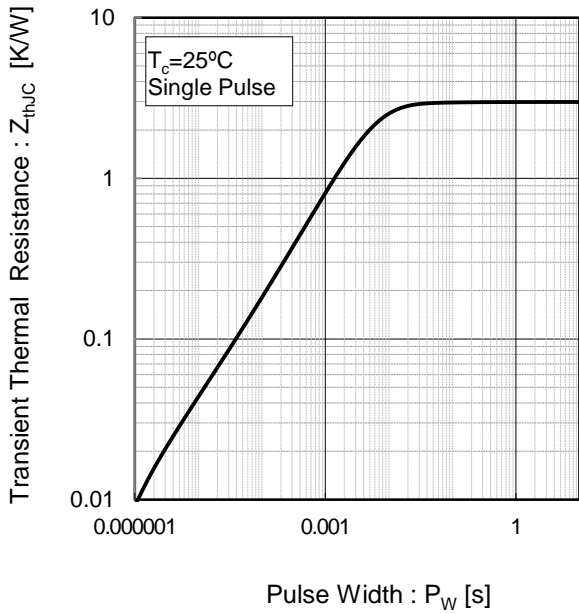


Fig.6 Power Dissipation

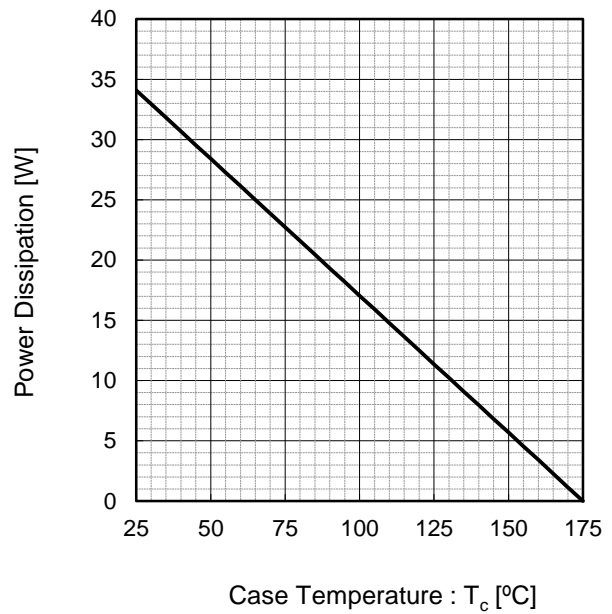
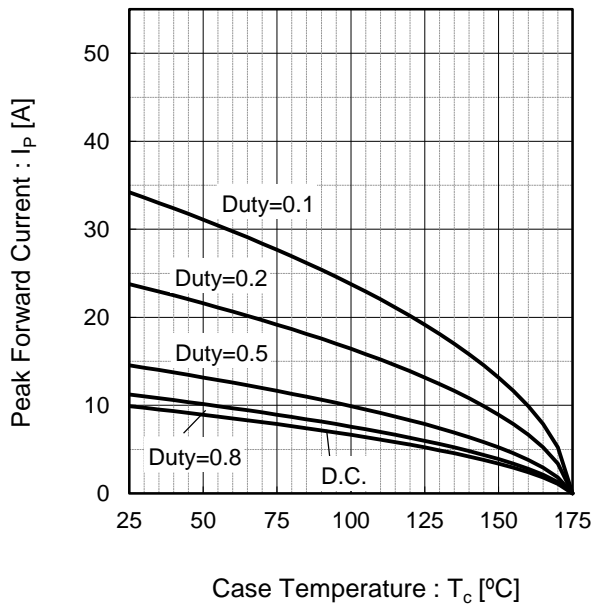
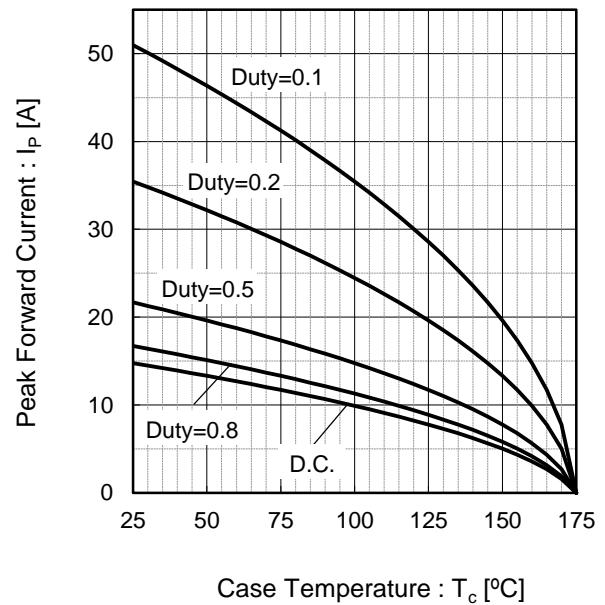


Fig.7\*4 Maximum peak forward current derating curve  $I_P - T_c$



\*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)

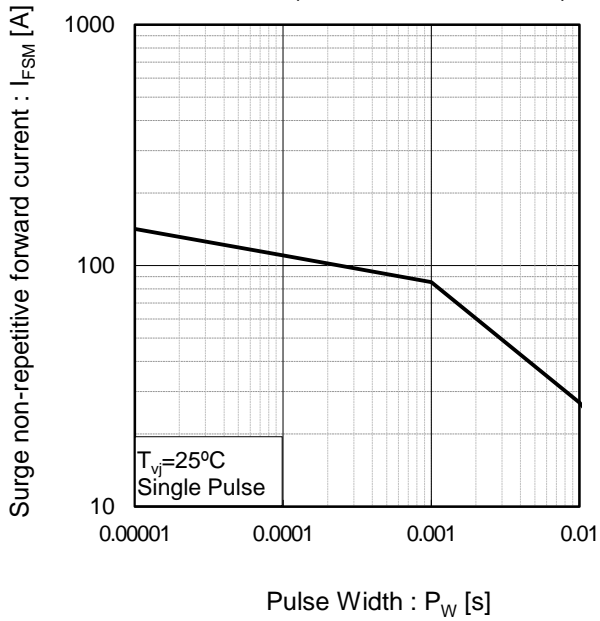
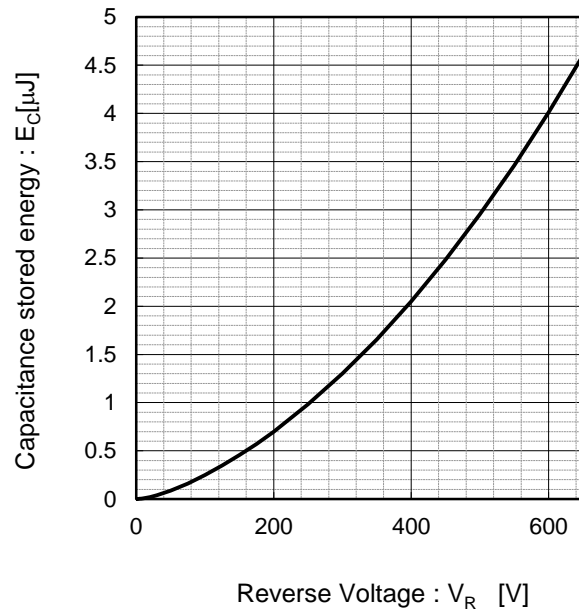
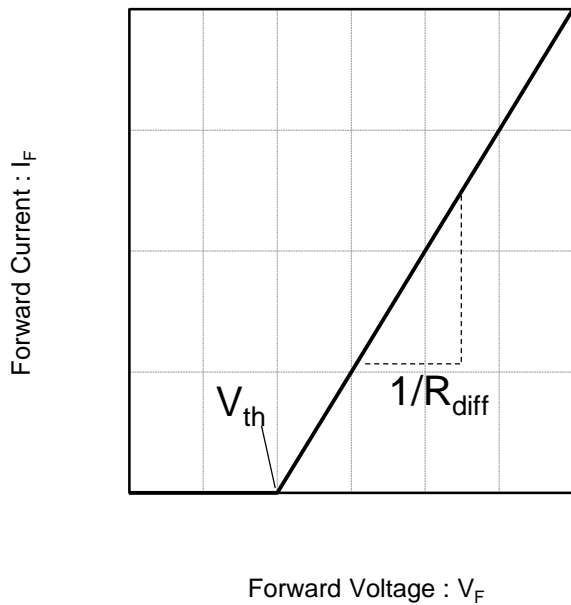


Fig.10 Typical capacitance store energy



●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
$a_0$	$9.66 \times 10^{-1}$	V
$a_1$	$-1.1 \times 10^{-3}$	V/°C
$b_0$	$8.80 \times 10^{-2}$	$\Omega$
$b_1$	$1.87 \times 10^{-4}$	$\Omega/^\circ\text{C}$
$b_2$	$1.92 \times 10^{-6}$	$\Omega/^\circ\text{C}^2$

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

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