

V_R	650V
I_F	20A
Q_C	47nC

●Features

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

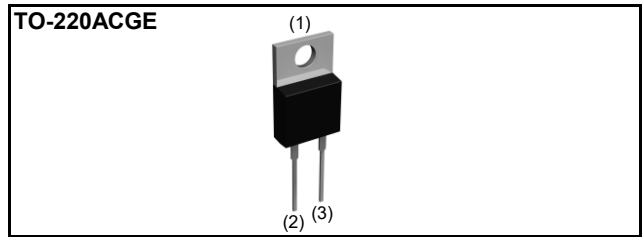
●Applications

- Factory Automation
- PV Power Conditioner
- Wireless Charger
- EV Charger Station

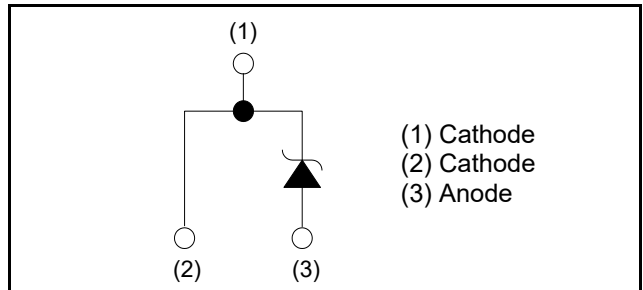
●Construction

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	C16
	Marking	SCS320AG

●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 ($T_c=125^{\circ}\text{C}$)*1	I_F	20	A	
Surge non-repetitive forward current	I_{FSM}	PW=10ms sinusoidal, $T_{vj}=25^{\circ}\text{C}$	123	A
		PW=10ms sinusoidal, $T_{vj}=150^{\circ}\text{C}$	104	A
		PW=10μs square, $T_{vj}=25^{\circ}\text{C}$	450	A
Repetitive peak forward current	I_{FRM}	81*2	A	
i^2t value	$\int i^2 dt$	$1 \leq PW \leq 10\text{ms}$, $T_{vj}=25^{\circ}\text{C}$	75	A^2s
		$1 \leq PW \leq 10\text{ms}$, $T_{vj}=150^{\circ}\text{C}$	54	A^2s
Total power dissipation	P_D	115*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)

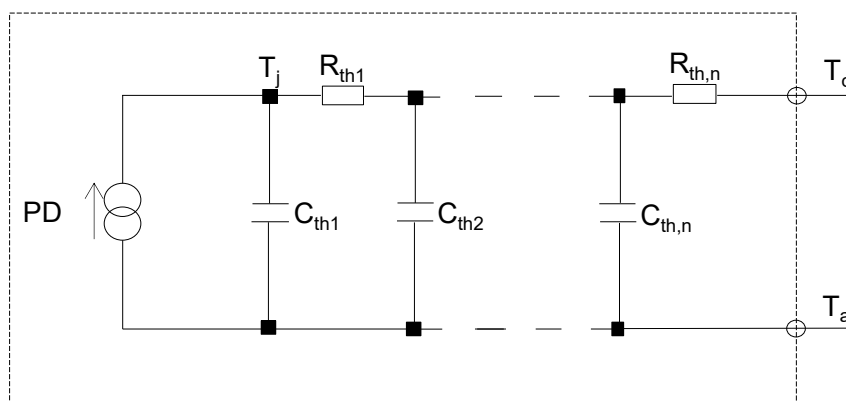
Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
DC blocking voltage	V_{DC}	$I_R = 100\mu\text{A}$	650	-	-	V
Forward voltage	V_F	$I_F = 20\text{A}, T_{vj} = 25^{\circ}\text{C}$	-	1.35	1.50	V
		$I_F = 20\text{A}, T_{vj} = 150^{\circ}\text{C}$	-	1.44	1.71	V
		$I_F = 20\text{A}, T_{vj} = 175^{\circ}\text{C}$	-	1.50	-	V
Reverse current	I_R	$V_R = 650\text{V}, T_{vj} = 25^{\circ}\text{C}$	-	0.06	100	μA
		$V_R = 650\text{V}, T_{vj} = 150^{\circ}\text{C}$	-	4	400	μA
		$V_R = 650\text{V}, T_{vj} = 175^{\circ}\text{C}$	-	12	-	μA
Total capacitance	C	$V_R = 1\text{V}, f = 1\text{MHz}$	-	1000	-	pF
		$V_R = 650\text{V}, f = 1\text{MHz}$	-	91	-	pF
Total capacitive charge	Q_C	$V_R = 400\text{V}, di/dt = 350\text{A}/\mu\text{s}$	-	47	-	nC
Switching time	t_C	$V_R = 400\text{V}, di/dt = 350\text{A}/\mu\text{s}$	-	25	-	ns
Non-repetitive Avaranche Energy	E_{ava}	$L = 1\text{mH}$	-	220	-	mJ

●Thermal characteristics

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Thermal resistance	R_{thJC}	-	-	0.87	1.3	K/W

●Typical Transient Thermal Characteristics

Symbol	Value	Unit	Symbol	Value	Unit
R_{th1}	8.13×10^{-4}	K/W	C_{th1}	9.17×10^{-5}	Ws/K
R_{th2}	4.07×10^{-2}		C_{th2}	5.94×10^{-4}	
R_{th3}	8.31×10^{-1}		C_{th3}	1.68×10^{-3}	



●Electrical characteristic curves

Fig.1 $V_F - I_F$ Characteristics

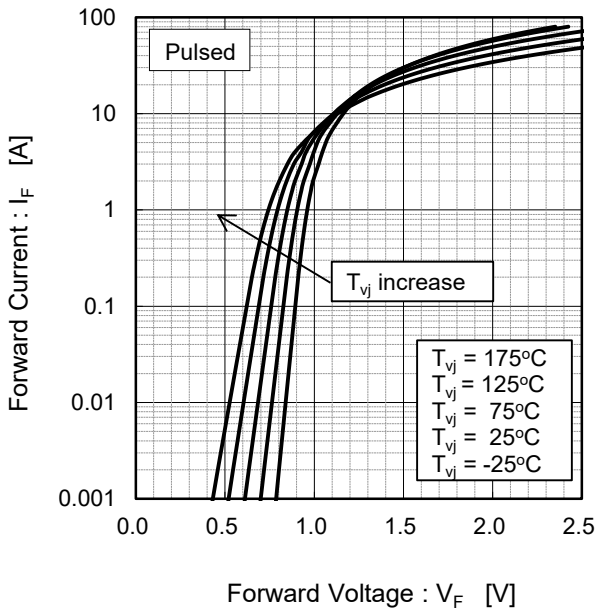


Fig.2 $V_F - I_F$ Characteristics

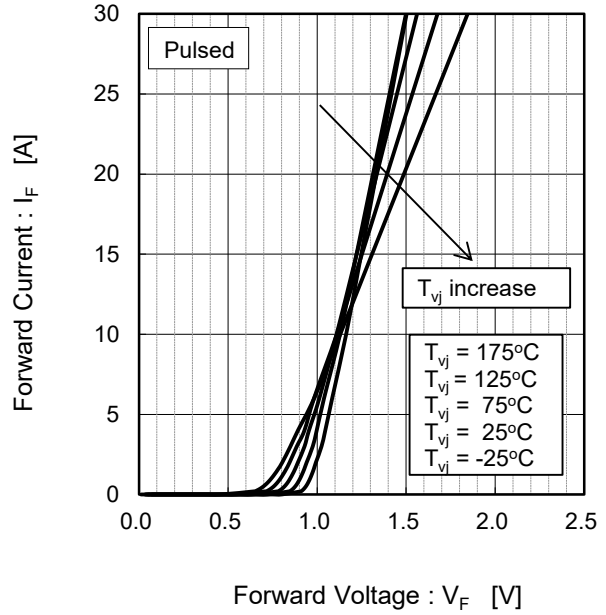


Fig.3 $V_R - I_R$ Characteristics

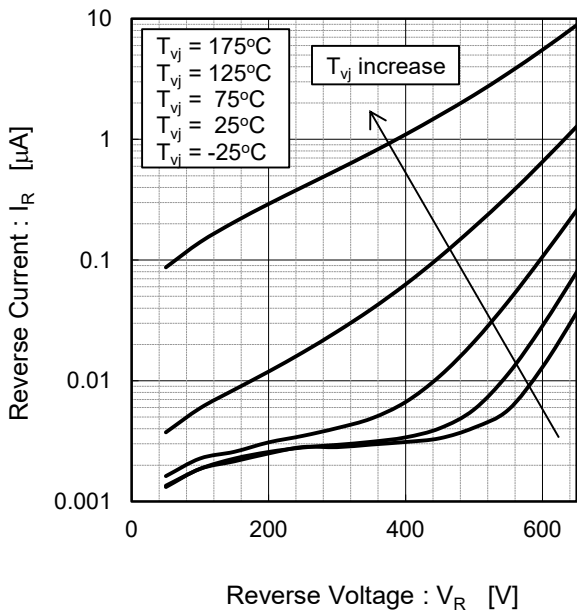
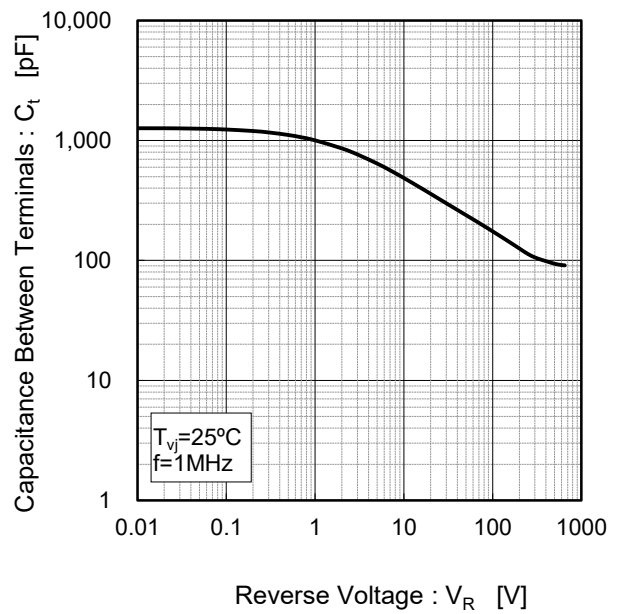


Fig.4 $V_R - C_t$ Characteristics



●Electrical characteristic curves

Fig.5 Typical Transient Thermal Resistance vs. Pulse Width

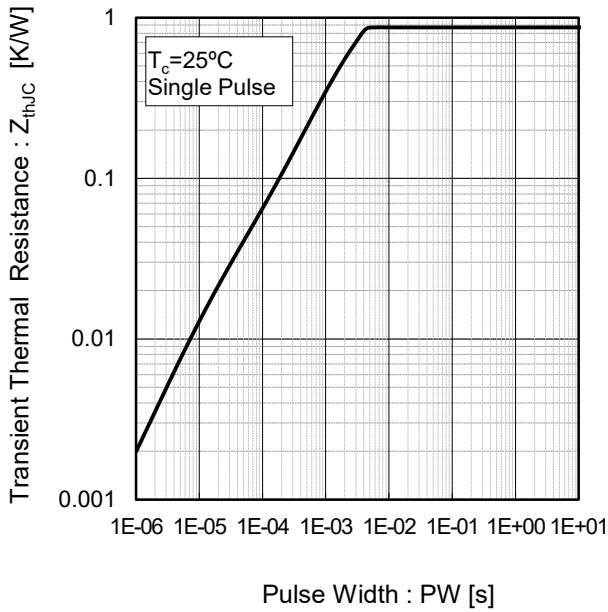


Fig.6 Power Dissipation

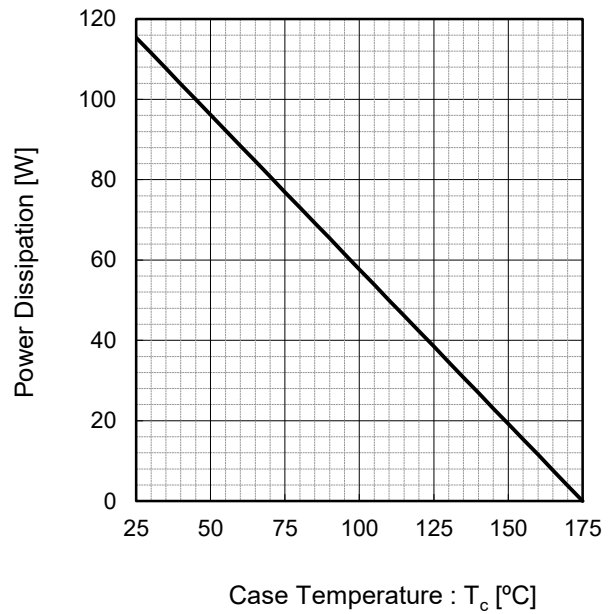
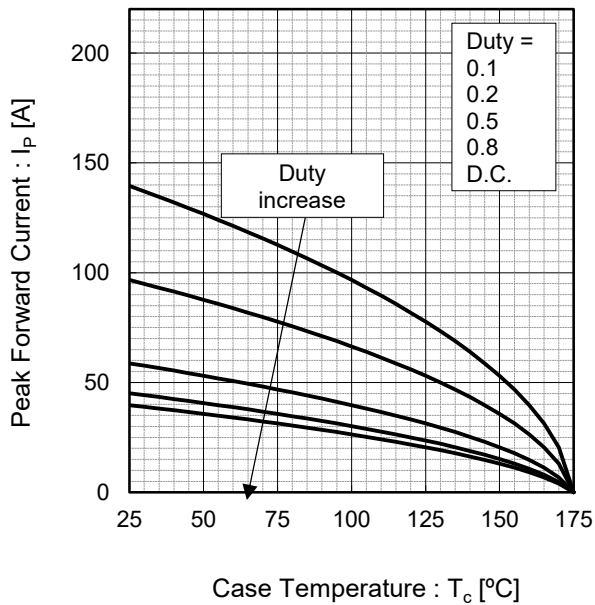
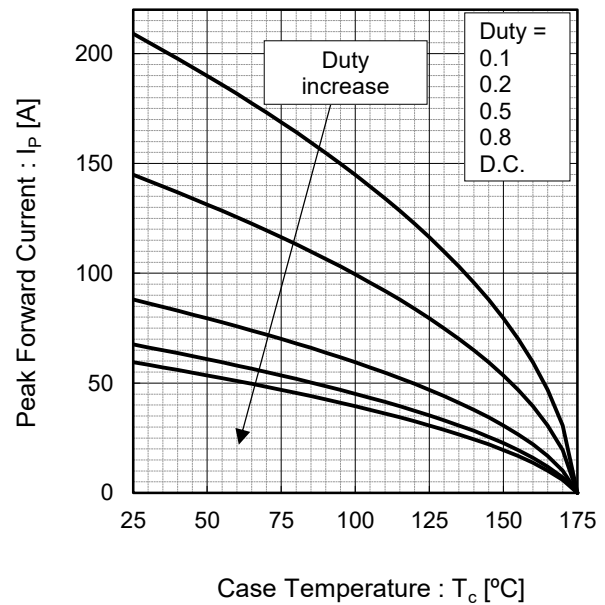


Fig.7*4 Maximum peak forward current derating curve $I_P - T_c$



*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)

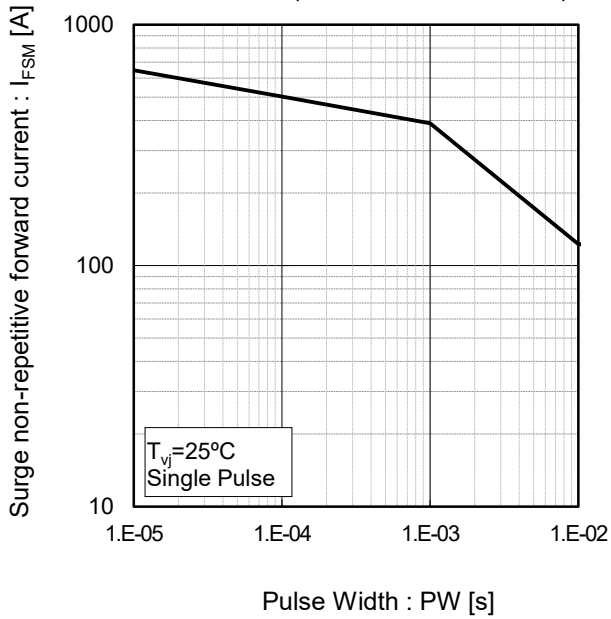
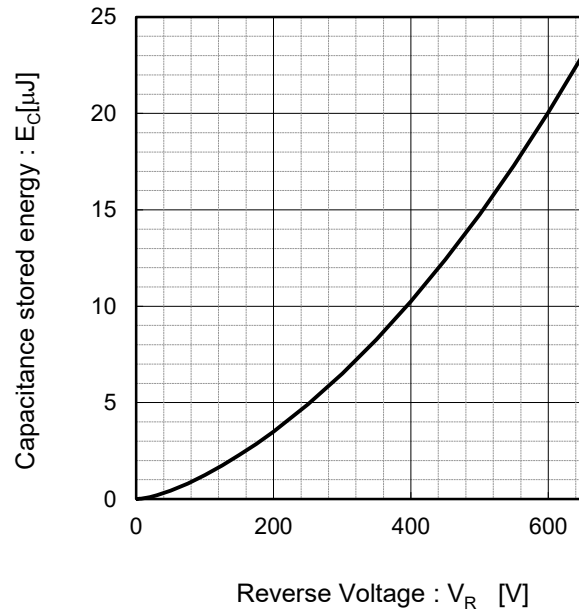
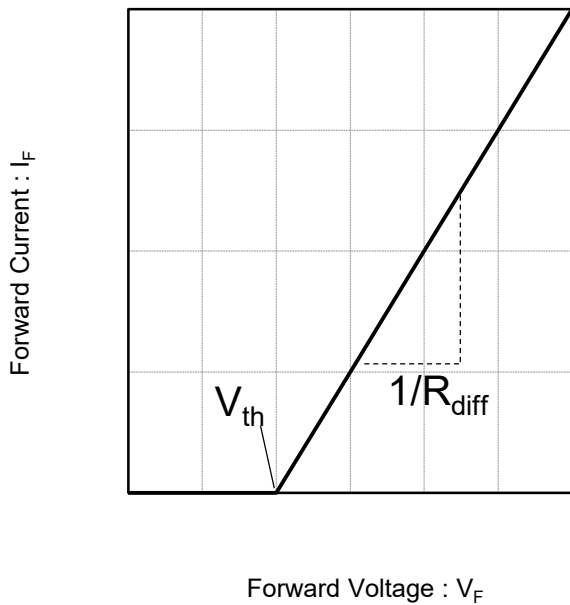


Fig.10 Typical capacitance store energy



●Simplified forward characteristic model

Fig.11 Equivalent forward current curve



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

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

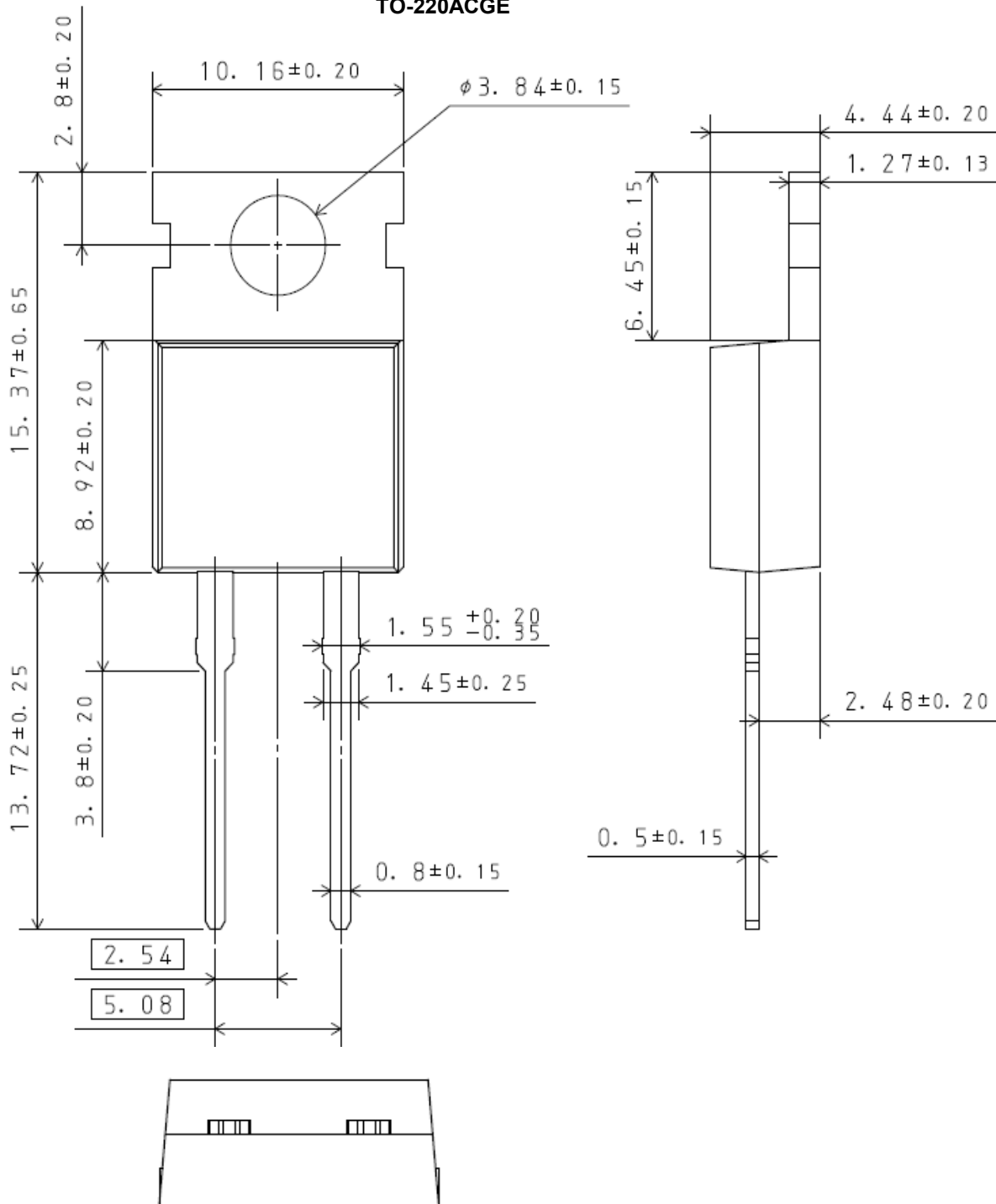
$$R_{diff}(T_{vj}) = b_0 + b_1 T_{vj} + b_2 T_{vj}^2$$

Symbol	Typical Value	Unit
a_0	9.66×10^{-1}	V
a_1	-1.1×10^{-3}	V/°C
b_0	1.76×10^{-2}	Ω
b_1	3.73×10^{-5}	Ω/°C
b_2	3.84×10^{-7}	Ω/°C ²

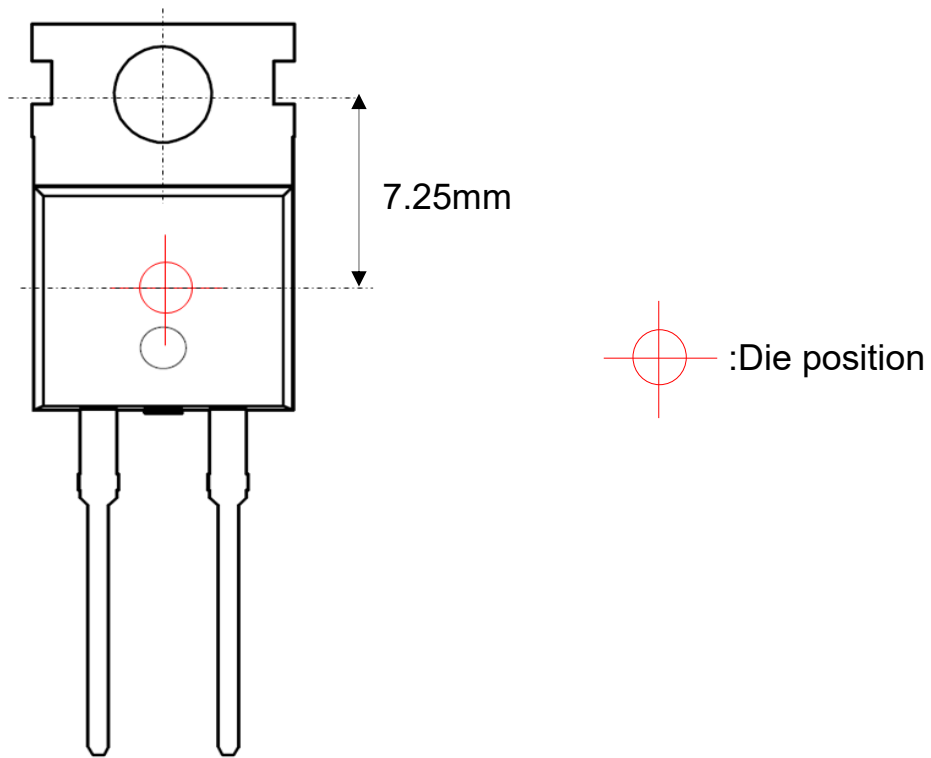
T_{vj} in °C; $-55\text{ °C} < T_{vj} < 175\text{ °C}$; $I_F < 40\text{ A}$

●Dimensions* (Unit : mm) *Dimensions do not include mold flash, protrusion or gate burrs.

TO-220ACGE



●Die Bonding Layout



- Front view of the packaging.
- Dimensions are design values.
- If the heat sink is to be installed, it should be in contact with the die bonding point.

Unit: mm

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