

$V_R$	650V
$I_F$	20A/40A*
$Q_C$	31nC(Per leg)

(\*Per leg/ Both legs)

### ●Features

- 1) Low forward voltage
- 2) Negligible recovery time/current
- 3) Temperature independent switching behavior

### ●Applications

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

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

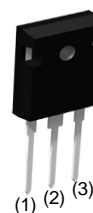
Parameter	Symbol	Value	Unit
Reverse voltage (repetitive peak)	$V_{RM}$	650	V
Reverse voltage (DC)	$V_R$	650	V
Continuous forward current *4 ( $T_c = 129^\circ\text{C}$ )	$I_F$	20/40	A
Surge non-repetitive forward current *4	$I_{FSM}$	PW=10ms sinusoidal, $T_j=25^\circ\text{C}$	67/130
		PW=10ms sinusoidal, $T_j=150^\circ\text{C}$	53/100
		PW=10μs square, $T_j=25^\circ\text{C}$	260/520
Repetitive peak forward current *4	$I_{FRM}$	81/160*2	A
$i^2t$ value*4	$\int i^2 dt$	PW=10ms, $T_j=25^\circ\text{C}$	22/91
		PW=10ms, $T_j=150^\circ\text{C}$	14/56
Total power dissipation *4	$P_D$	130/270*3	W
Junction temperature	$T_j$	175	$^\circ\text{C}$
Range of storage temperature	$T_{stg}$	-55 to +175	$^\circ\text{C}$

\*1 Tolerances of dimensions and packing specifications slightly differ between TO-247 and TO-247N, which is unlikely to influence compatibility for mounting. Please refer to corresponding specifications of dimensions for more details.

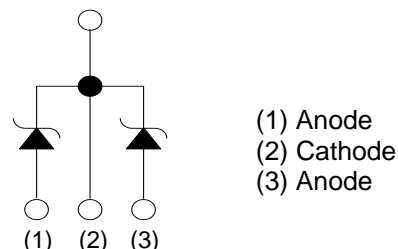
\*2  $T_c=100^\circ\text{C}$ ,  $T_j=150^\circ\text{C}$ , Duty cycle=10% \*3  $T_c=25^\circ\text{C}$  \*4 Per leg/ Both legs

### ●Outline

TO-247  
TO-247N



### ●Inner circuit



### ●Packaging specifications\*1

Package	TO-247	TO-247N
Type	Packing	Tube
	Reel size (mm)	-
	Tape width (mm)	-
	Basic ordering unit (pcs)	30
	Packing code	C C11
	Marking	SCS240AE2

**●Electrical characteristics** ( $T_j = 25^\circ\text{C}$ ) (Per Leg)

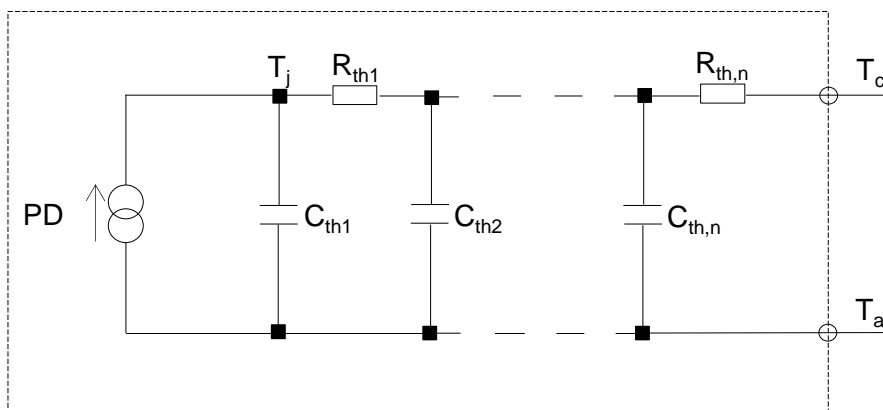
Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
DC blocking voltage	$V_{DC}$	$I_R = 4.0\text{mA}$	650	-	-	V
Forward voltage	$V_F$	$I_F = 20\text{A}, T_j = 25^\circ\text{C}$	-	1.35	1.55	V
		$I_F = 20\text{A}, T_j = 150^\circ\text{C}$	-	1.55	-	V
		$I_F = 20\text{A}, T_j = 175^\circ\text{C}$	-	1.63	-	V
Reverse current	$I_R$	$V_R = 600\text{V}, T_j = 25^\circ\text{C}$	-	4	400	$\mu\text{A}$
		$V_R = 600\text{V}, T_j = 150^\circ\text{C}$	-	60	-	$\mu\text{A}$
		$V_R = 600\text{V}, T_j = 175^\circ\text{C}$	-	140	-	$\mu\text{A}$
Total capacitance	$C$	$V_R = 1\text{V}, f = 1\text{MHz}$	-	730	-	pF
		$V_R = 600\text{V}, f = 1\text{MHz}$	-	74	-	pF
Total capacitive charge	$Q_C$	$V_R = 400\text{V}, di/dt = 350\text{A}/\mu\text{s}$	-	31	-	nC
Switching time	$t_C$	$V_R = 400\text{V}, di/dt = 350\text{A}/\mu\text{s}$	-	19	-	ns

**●Thermal characteristics**

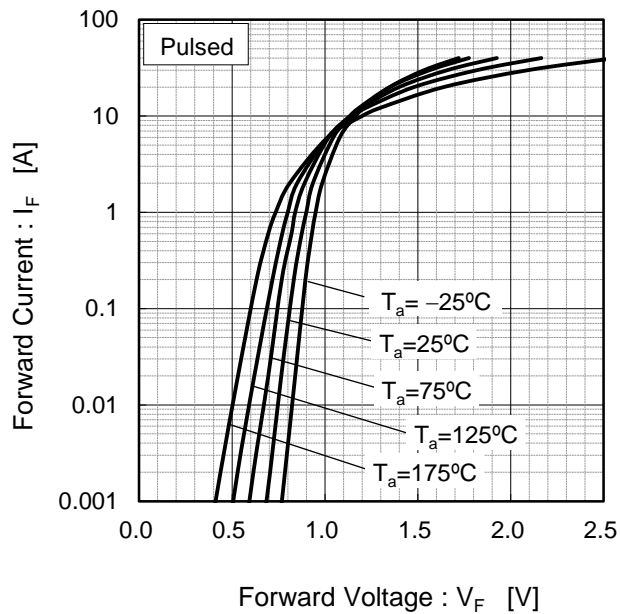
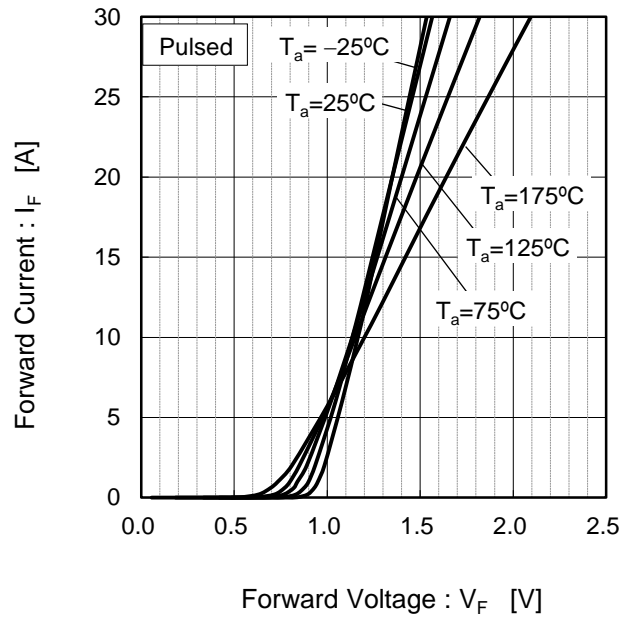
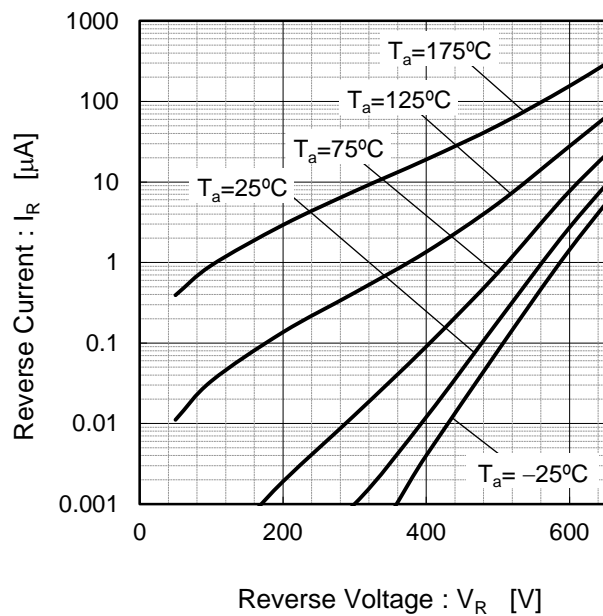
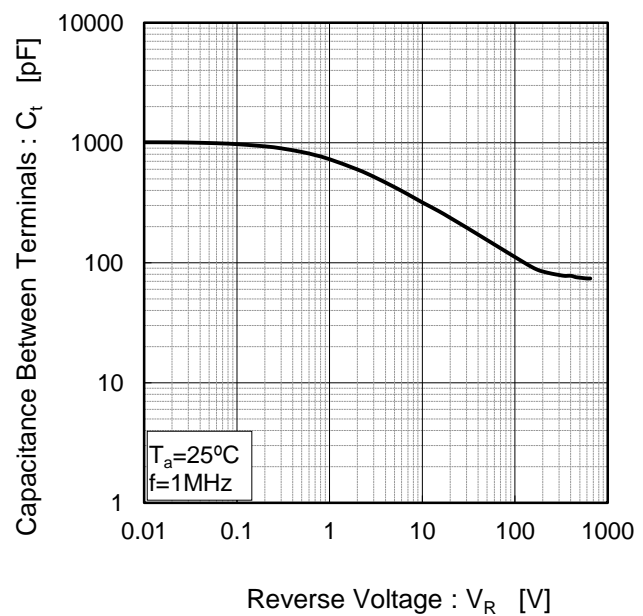
Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Thermal resistance	$R_{th(j-c)}$	Per Leg	-	0.92	1.1	$^\circ\text{C}/\text{W}$
		Both Legs	-	0.46	0.55	$^\circ\text{C}/\text{W}$

**●Typical Transient Thermal Characteristics (Per Leg)**

Symbol	Value	Unit	Symbol	Value	Unit
$R_{th1}$	$1.94 \times 10^{-1}$	K/W	$C_{th1}$	$3.08 \times 10^{-3}$	Ws/K
$R_{th2}$	$7.23 \times 10^{-1}$		$C_{th2}$	$8.36 \times 10^{-3}$	
$R_{th3}$	$5.52 \times 10^{-3}$		$C_{th3}$	$1.03 \times 10^0$	



## ●Electrical characteristic curves

Fig.1  $V_F - I_F$  Characteristics (Per Leg)Fig.2  $V_F - I_F$  Characteristics (Per Leg)Fig.3  $V_R - I_R$  Characteristics (Per Leg)Fig.4  $V_R - C_t$  Characteristics (Per Leg)

## ●Electrical characteristic curves

Fig.5 Typical Transient Thermal Resistance vs. Pulse Width (Per Leg)

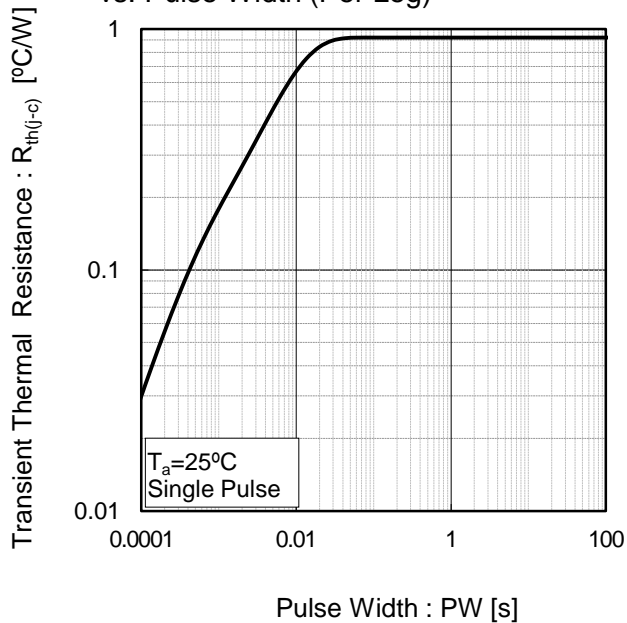


Fig.6 Power Dissipation (Per Leg)

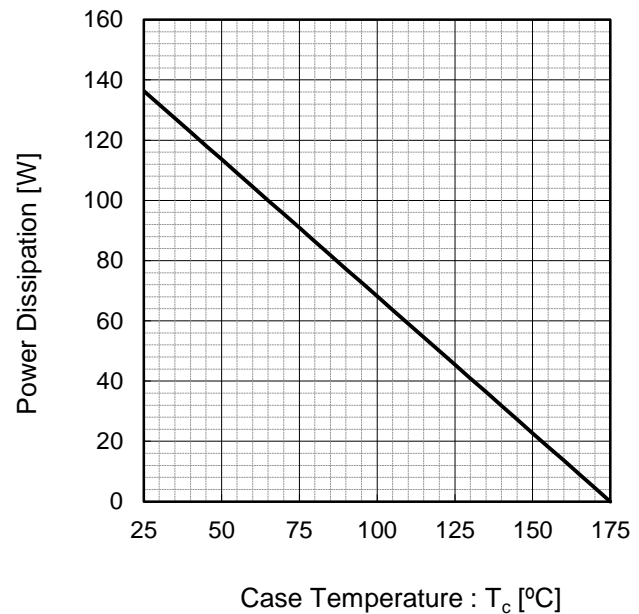
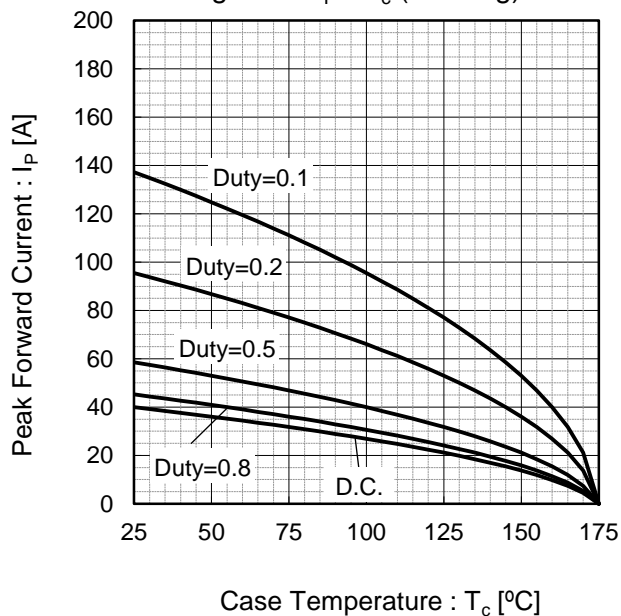
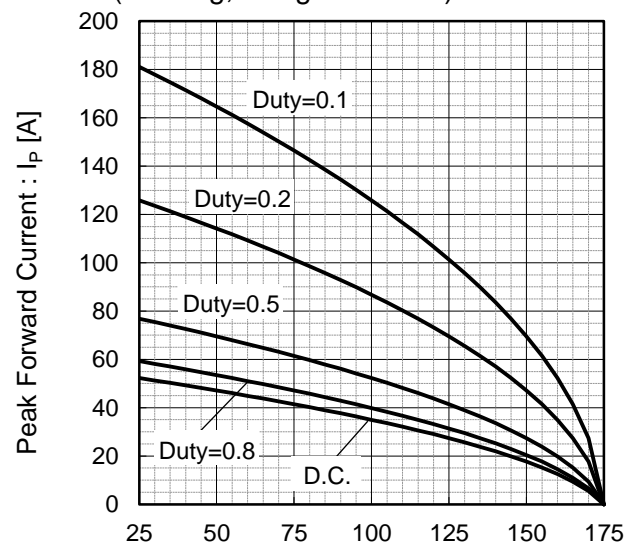


Fig.7\*5 Maximum peak forward current derating curve  $I_P - T_c$  (Per Leg)



Case Temperature :  $T_c$  [°C]  
 \*5 Based on max  $V_f$ , max  $R_{th(j-c)}$   
 Valid for switching of above 10kHz,  
 excluding D.C. curve.

Fig.8\*6 Typical peak forward current derating curve  $I_P - T_c$  (Per Leg, Not guaranteed)



Case Temperature :  $T_c$  [°C]  
 \*6 Based on typ  $V_f$ , 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) (Per Leg)

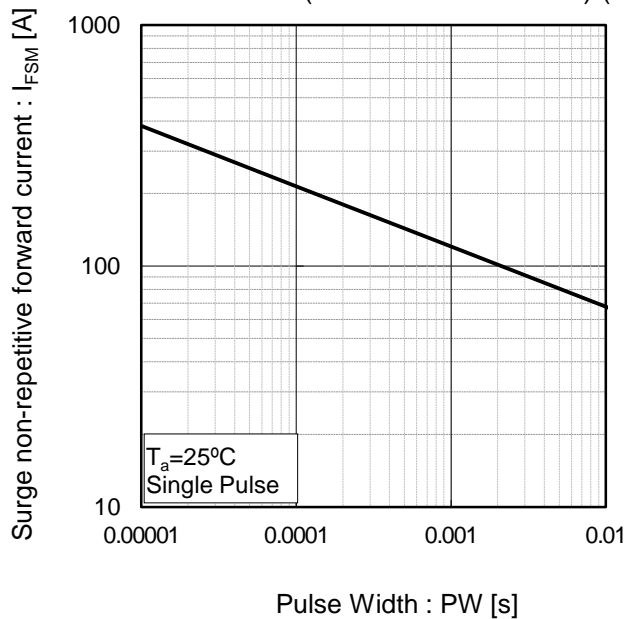
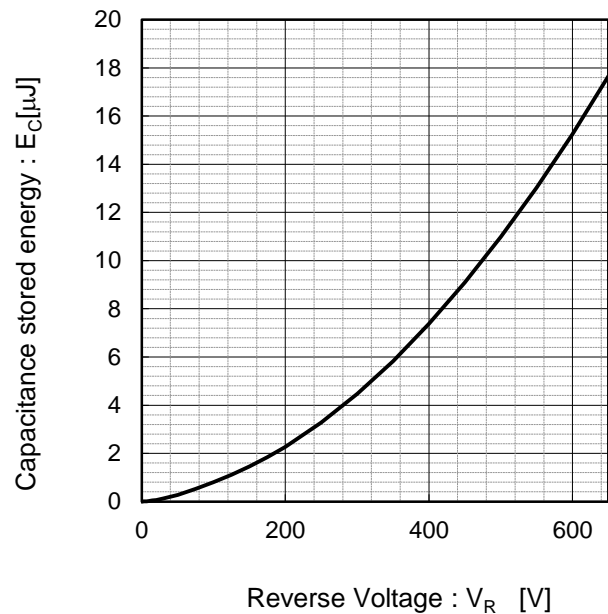
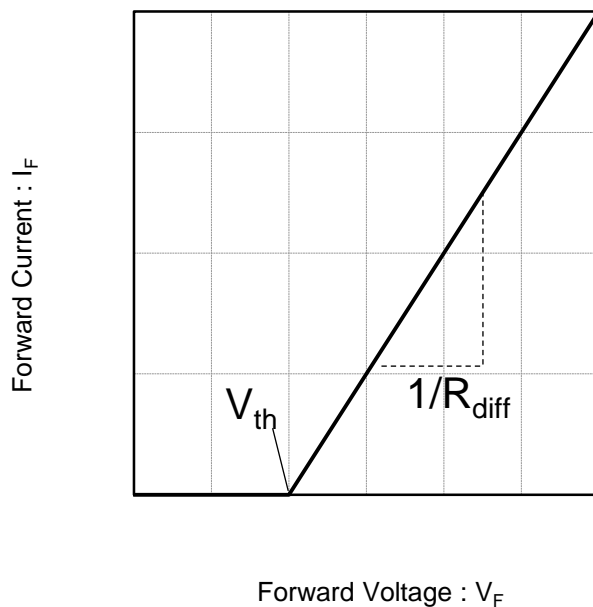


Fig.10 Typical capacitance store energy (Per Leg)



## ●Simplified forward characteristic model (Per Leg)

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
$a_0$	$9.35 \times 10^{-1}$	V
$a_1$	$-1.12 \times 10^{-3}$	V/°C
$b_0$	$1.99 \times 10^{-2}$	Ω
$b_1$	$5.10 \times 10^{-5}$	Ω/°C
$b_2$	$5.40 \times 10^{-7}$	Ω/°C <sup>2</sup>

$T_j$  in °C;  $-55^\circ\text{C} < T_j < 175^\circ\text{C}$ ;  $I_F < 40\text{ A}$

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