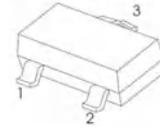




## FEATURES

- High Collector Current.
- Complementary to S9012.
- Excellent hFE Linearity.

### SOT-23



- 1.BASE  
2.EMITTER  
3.COLLECTOR

### Marking

Type number	Marking code
S9013	J3

## MAXIMUM RATINGS AND ELECTRICAL CHARACTERISTICS

### MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector–Emitter Voltage	$V_{CE0}$	25	Vdc
Collector–Base Voltage	$V_{CB0}$	40	Vdc
Emitter–Base Voltage	$V_{EB0}$	5.0	Vdc
Collector Current — Continuous	$I_c$	500	mAdc

### THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Total Device Dissipation FR– 5 Board, (1) $T_A = 25^\circ\text{C}$	$P_D$	300	mW
Junction and Storage Temperature	$T_J, T_{stg}$	- 55 to +150	$^\circ\text{C}$

### CLASSIFICATION OF hFE

Rank	L	H	J
Range	120-200	200-350	300-400

**ELECTRICAL CHARACTERISTICS (TA = 25°C unless otherwise noted.)**

**OFF CHARACTERISTICS**

Characteristic	Symbol	Min	Max	Unit
Collector–Emitter Breakdown Voltage(3) ( $I_C = 1.0 \text{ mA}$ , $I_B = 0$ )	$V_{(BR)CEO}$	25	–	Vdc
Collector–Base Breakdown Voltage ( $I_C = 100 \mu\text{A}$ , $I_E = 0$ )	$V_{(BR)CBO}$	40	–	Vdc
Emitter–Base Breakdown Voltage ( $I_E = 100 \mu\text{A}$ , $I_C = 0$ )	$V_{(BR)EBO}$	5.0	–	Vdc
Collector cut-off current ( $V_{CB} = 40 \text{ Vdc}$ , $I_E = 0$ )	$I_{CBO}$	–	0.1	$\mu\text{A}$
Collector cut-off current ( $V_{CE} = 20 \text{ Vdc}$ , $I_B = 0$ )	$I_{CEO}$	–	0.1	$\mu\text{A}$
Emitter cut-off current ( $V_{EB} = 5 \text{ Vdc}$ , $I_C = 0$ )	$I_{EBO}$	–	0.1	$\mu\text{A}$

1. FR–5 = 1.0 x 0.75 x 0.062 in.
2. Alumina = 0.4 x 0.3 x 0.024 in. 99.5% alumina.
3. Pulse Test: Pulse Width <300  $\mu\text{s}$ , Duty Cycle <2.0%.

**ON CHARACTERISTICS**

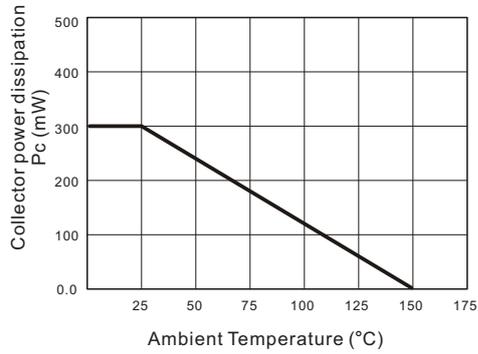
Characteristic	Symbol	Min	Max	Unit
DC Current Gain	$h_{FE}$			—
( $I_C = 50 \text{ mA}$ , $V_{CE} = 1 \text{ Vdc}$ )		120	400	
( $I_C = 500 \text{ mA}$ , $V_{CE} = 1 \text{ Vdc}$ )		40	—	
Collector–Emitter Saturation Voltage ( $I_C = 500 \text{ mA}$ , $I_B = 50 \text{ mA}$ )(3)	$V_{CE(sat)}$	—	0.6	Vdc
Base–Emitter Saturation Voltage(3)	$V_{BE(sat)}$			Vdc
( $I_C = 500 \text{ mA}$ , $I_B = 50 \text{ mA}$ )		—	1.2	
Base-emitter voltage ( $V_{CB} = 1\text{V}$ , $I_C = 10\text{mA}$ )	$V_{BE}$	—	0.7	

**SMALL–SIGNAL CHARACTERISTICS**

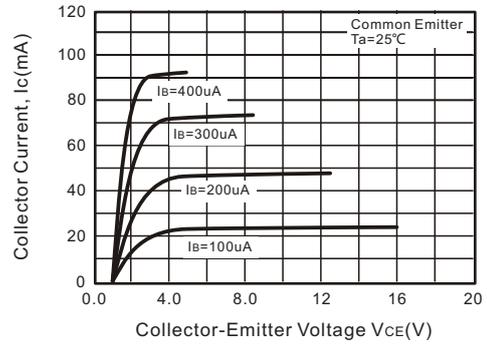
Current–Gain — Bandwidth Product ( $I_C = 20\text{mA}$ , $V_{CE} = 6.0\text{Vdc}$ , $f = 30\text{MHz}$ )	$f_T$	150	–	MHz
Collector output capacitance ( $V_{CB} = 6.0\text{Vdc}$ , $I_E = 0$ , $f = 1.0 \text{ MHz}$ )	$C_{ob}$	–	8.0	pF

**RATING AND CHARACTERISTIC CURVES**

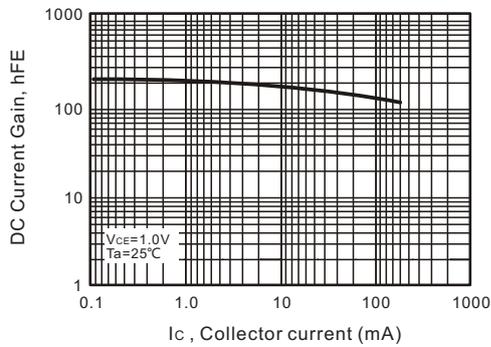
**Fig.1 Power Derating Curve**



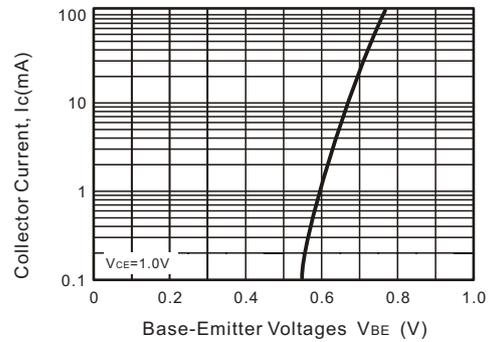
**Fig.2 Static characteristics**



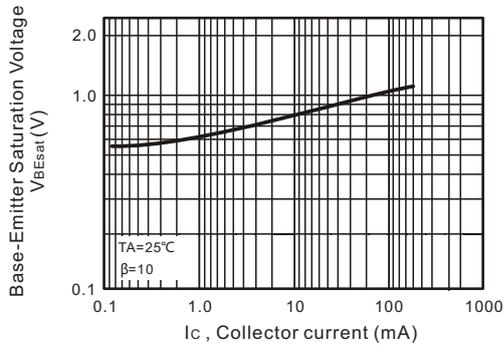
**Fig.3 hFE--Ic**



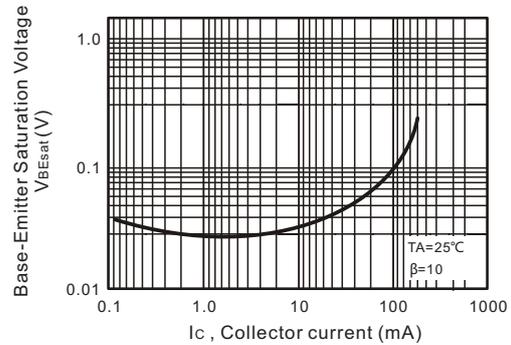
**Fig.4 Ic--VBE**



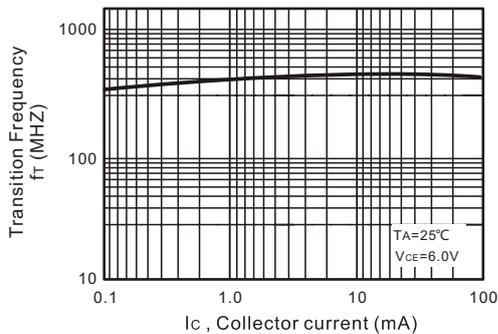
**Fig.5 VBEsat--Ic**



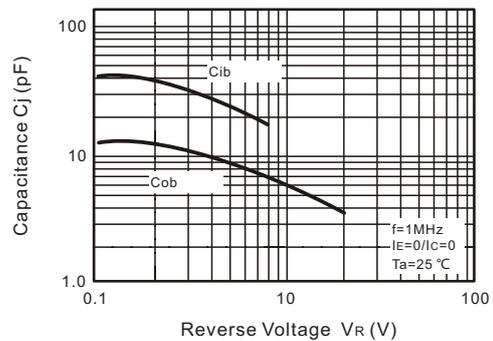
**Fig.6 VCEsat--Ic**



**Fig.7 ft--Ic**

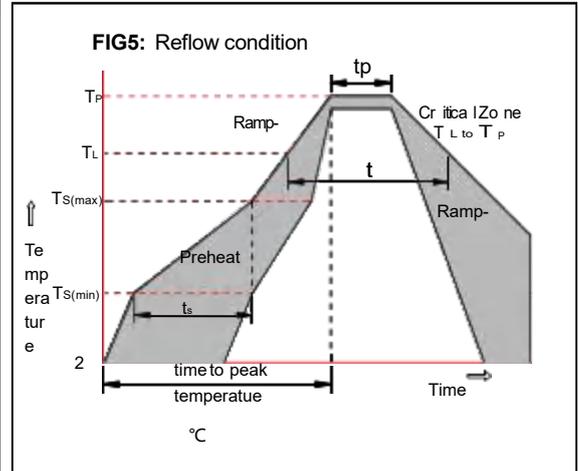


**Fig.8 Cob/Cib--Vcb/VEB**



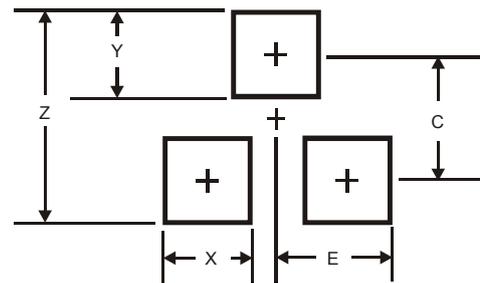
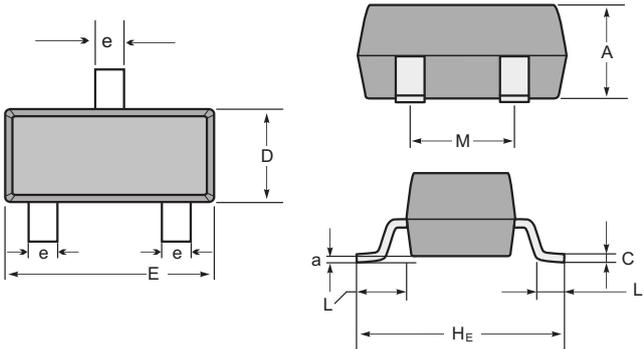
Soldering parameters

Reflow Condition		Pb-Free assembly (see as below)
Pre Heat	-Temperature Min ( $T_{s(min)}$ )	+150°C
	-Temperature Max ( $T_{s(max)}$ )	+200°C
	-Time (Min to Max) (ts)	60-180 secs.
Average ramp up rate (Liquid us Temp ( $T_L$ ) to peak)		3°C/sec. Max
$T_{s(max)}$ to $T_L$ - Ramp-up Rate		3°C/sec. Max
Reflow	-Temperature ( $T_L$ ) (Liquid us)	+217°C
	-Temperature ( $t_L$ )	60-150 secs.
Peak Temp ( $T_P$ )		+260(+0/-5)°C
Time within 5°C of actual Peak Temp ( $t_p$ )		30 secs. Max
Ramp-down Rate		6°C/sec. Max
Time 25°C to Peak Temp ( $T_P$ )		8 min. Max
Do not exceed		+260°C



Package Dimensions & Suggested Pad Layout

SOT23

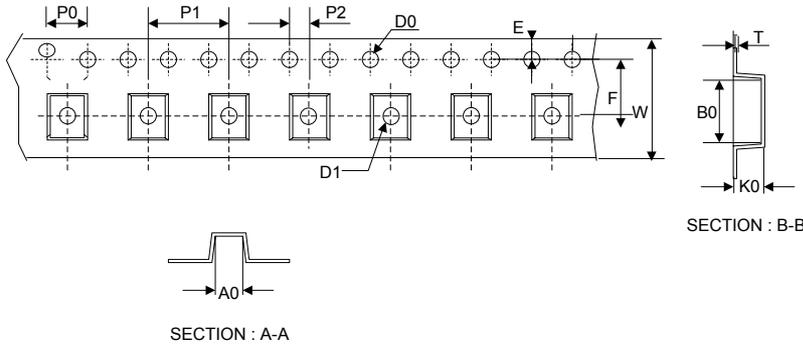
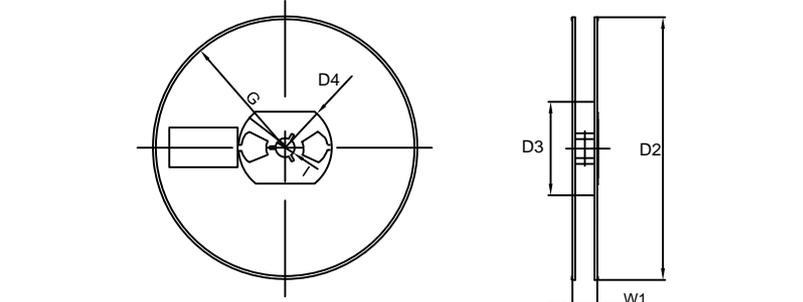


SOT-23 mechanical data

UNIT	A	C	D	E	He	e	M	L	L <sub>1</sub>	a	
mm	max	1.1	0.15	1.4	3.0	2.6	0.5	1.95	0.55 (ref)	0.36 (ref)	0.0
	min	0.9	0.08	1.2	2.8	2.2	0.3	1.7			0.15
mil	max	43	6	55	118	102	20	77	22 (ref)	14 (ref)	0.0
	min	35	3	47	110	87	12	67			6

Dimensions	SOT23
Z	2.9
X	0.8
Y	0.9
C	2.0
E	1.35

Tape & reel specification

Tape	Symbol	Dimension (mm)	
	P0	4.00±0.10	
	P1	4.00±0.10	
	P2	2.00±0.10	
	D0	1.55±0.10	
	D1	1.05±0.10	
	E	1.55±0.10	
	F	3.60±0.10	
	W	8.00±0.10	
	A0	3.80±0.20	
	B0	3.25±0.20	
	K0	1.45±0.10	
	T	0.25±0.05	
	<p>7" Reel</p> 	D2	178.0±3.0
		D3	55Min.
D4		R24.0±3.0	
G		R82.0±3.0	
I		13.0±2.0	
W1		11.0±3.0	
Quantity: 3000PCS			