



PBRN113Z series

NPN 800 mA, 40 V BISS RETs; R1 = 1 k Ω , R2 = 10 k Ω

Rev. 01 — 26 February 2007

Product data sheet

1. Product profile

1.1 General description

800 mA NPN low V_{CEsat} Breakthrough In Small Signal (BISS) Resistor-Equipped Transistors (RET) family in small plastic packages.

Table 1. Product overview

Type number	Package		
	Nexperia	JEITA	JEDEC
PBRN113ZK	SOT346	SC-59A	TO-236
PBRN113ZS ^[1]	SOT54	SC-43A	TO-92
PBRN113ZT	SOT23	-	TO-236AB

[1] Also available in SOT54A and SOT54 variant packages (see [Section 2](#)).

1.2 Features

- 800 mA output current capability
- High current gain h_{FE}
- Built-in bias resistors
- Simplifies circuit design
- Low collector-emitter saturation voltage V_{CEsat}
- Reduces component count
- Reduces pick and place costs
- $\pm 10\%$ resistor ratio tolerance

1.3 Applications

- Digital application in automotive and industrial segments
- Medium current peripheral driver
- Switching loads

1.4 Quick reference data

Table 2. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CEO}	collector-emitter voltage	open base	-	-	40	V
I_O	output current		^[1]			
	PBRN113ZK, PBRN113ZT		-	-	600	mA
	PBRN113ZS		-	-	800	mA

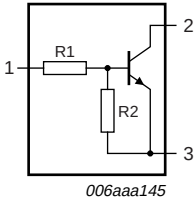
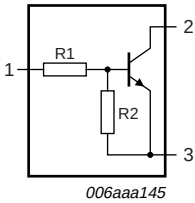
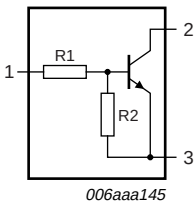
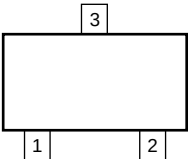
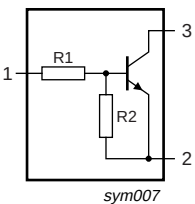
Table 2. Quick reference data ...continued

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I _{ORM}	repetitive peak output current					
	PBRN113ZK, PBRN113ZT	t _p ≤ 1 ms; δ ≤ 0.33	-	-	800	mA
R1	bias resistor 1 (input)		0.7	1	1.3	kΩ
R2/R1	bias resistor ratio		9	10	11	

[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.

2. Pinning information

Table 3. Pinning

Pin	Description	Simplified outline	Symbol
SOT54			
1	input (base)	 001aab347	 006aaa145
2	output (collector)		
3	GND (emitter)		
SOT54A			
1	input (base)	 001aab348	 006aaa145
2	output (collector)		
3	GND (emitter)		
SOT54 variant			
1	input (base)	 001aab447	 006aaa145
2	output (collector)		
3	GND (emitter)		
SOT23; SOT346			
1	input (base)	 006aaa144	 sym007
2	GND (emitter)		
3	output (collector)		

3. Ordering information

Table 4. Ordering information

Type number	Package		
	Name	Description	Version
PBRN113ZK	SC-59A	plastic surface-mounted package; 3 leads	SOT346
PBRN113ZS ^[1]	SC-43A	plastic single-ended leaded (through hole) package; 3 leads	SOT54
PBRN113ZT	-	plastic surface-mounted package; 3 leads	SOT23

[1] Also available in SOT54A and SOT54 variant packages (see [Section 2](#) and [Section 9](#)).

4. Marking

Table 5. Marking codes

Type number	Marking code ^[1]
PBRN113ZK	G5
PBRN113ZS	N113ZS
PBRN113ZT	*7L

[1] * = -: made in Hong Kong
 * = p: made in Hong Kong
 * = t: made in Malaysia
 * = W: made in China

5. Limiting values

Table 6. Limiting values

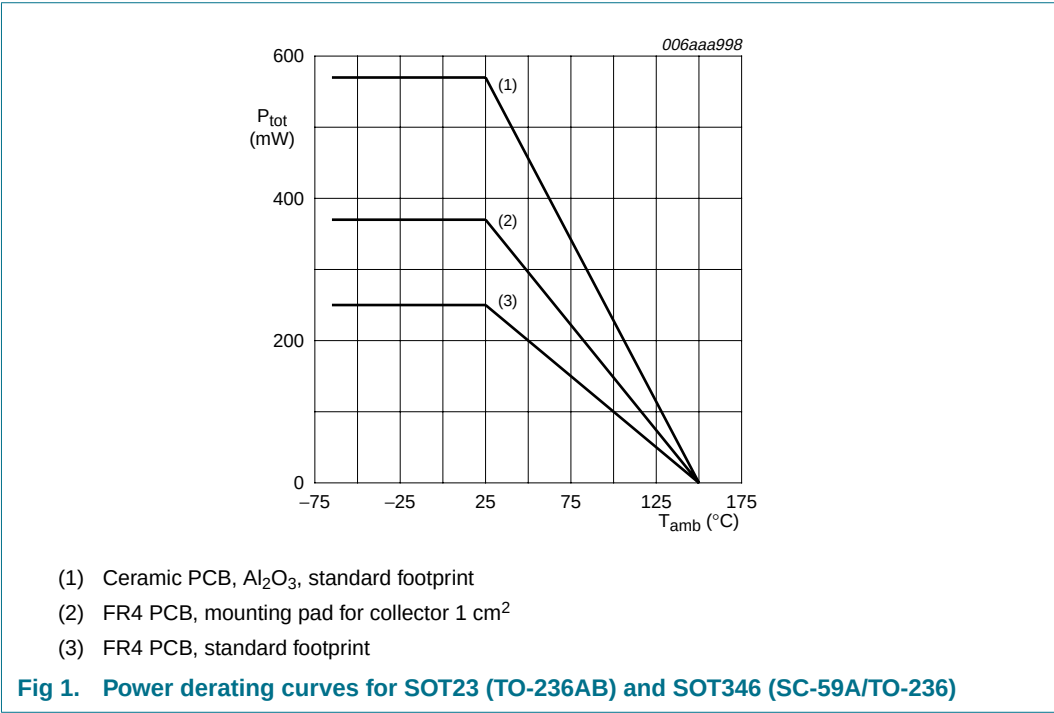
In accordance with the Absolute Maximum Rating System (IEC 60134).

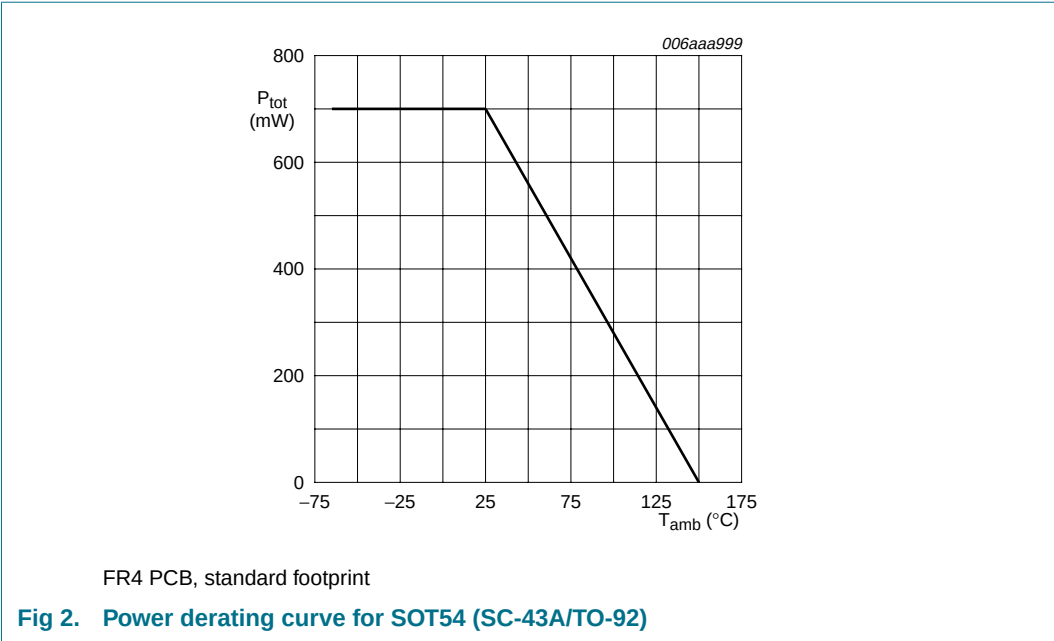
Symbol	Parameter	Conditions	Min	Max	Unit
V_{CBO}	collector-base voltage	open emitter	-	40	V
V_{CEO}	collector-emitter voltage	open base	-	40	V
V_{EBO}	emitter-base voltage	open collector	-	5	V
V_I	input voltage				
	positive		-	+10	V
	negative		-	-5	V
I_O	output current				
	PBRN113ZK, PBRN113ZT		^[1] -	600	mA
			^{[2][3]} -	700	mA
	PBRN113ZS		^[1] -	800	mA
I_{ORM}	repetitive peak output current				
	PBRN113ZK, PBRN113ZT	$t_p \leq 1 \text{ ms}; \delta \leq 0.33$	-	800	mA

Table 6. Limiting values ...continued
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
P _{tot}	total power dissipation	T _{amb} ≤ 25 °C			
	PBRN113ZK, PBRN113ZT		[1] -	250	mW
			[2] -	370	mW
			[3] -	570	mW
	PBRN113ZS		[1] -	700	mW
T _j	junction temperature		-	150	°C
T _{amb}	ambient temperature		−65	+150	°C
T _{stg}	storage temperature		−65	+150	°C

- [1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.
[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm².
[3] Device mounted on a ceramic PCB, Al₂O₃, standard footprint.



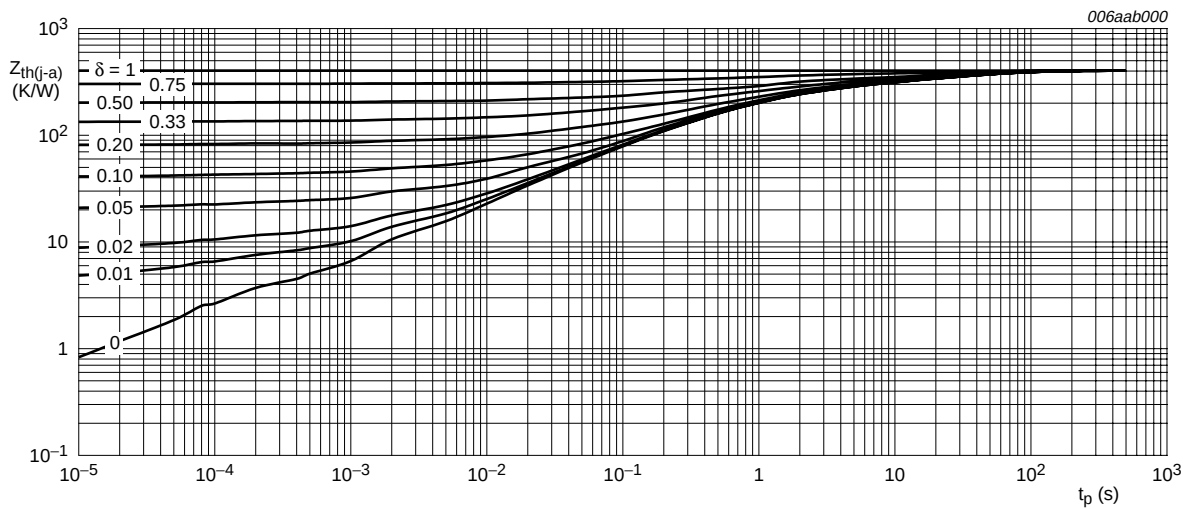


6. Thermal characteristics

Table 7. Thermal characteristics

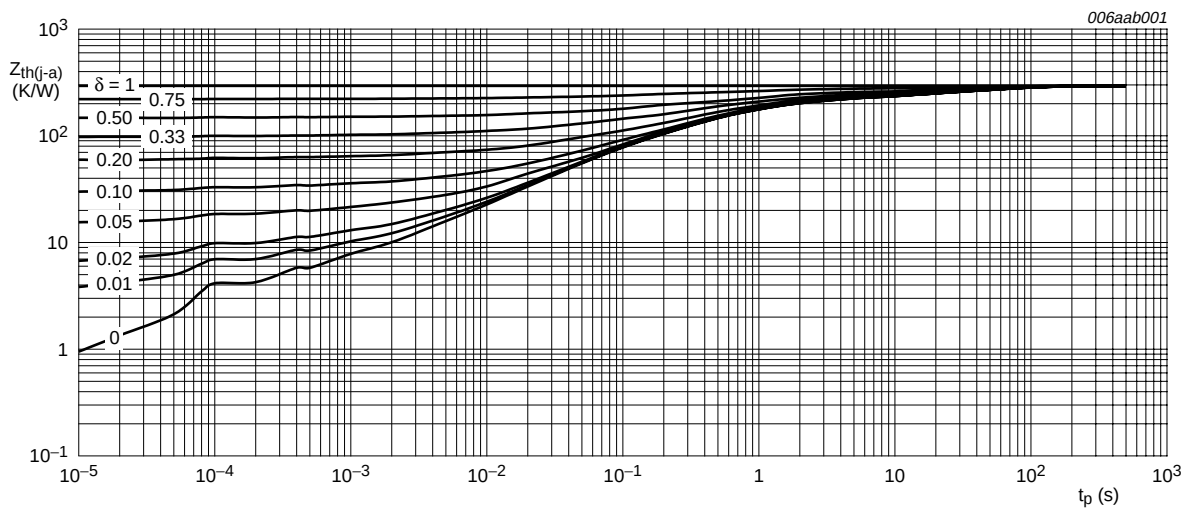
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air				
			[1]	-	-	500 K/W
			[2]	-	-	338 K/W
			[3]	-	-	219 K/W
			[1]	-	-	179 K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point					
		PBRN113ZK, PBRN113ZT	-	-	105	K/W

- [1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.
- [2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm².
- [3] Device mounted on a ceramic PCB, Al₂O₃, standard footprint.



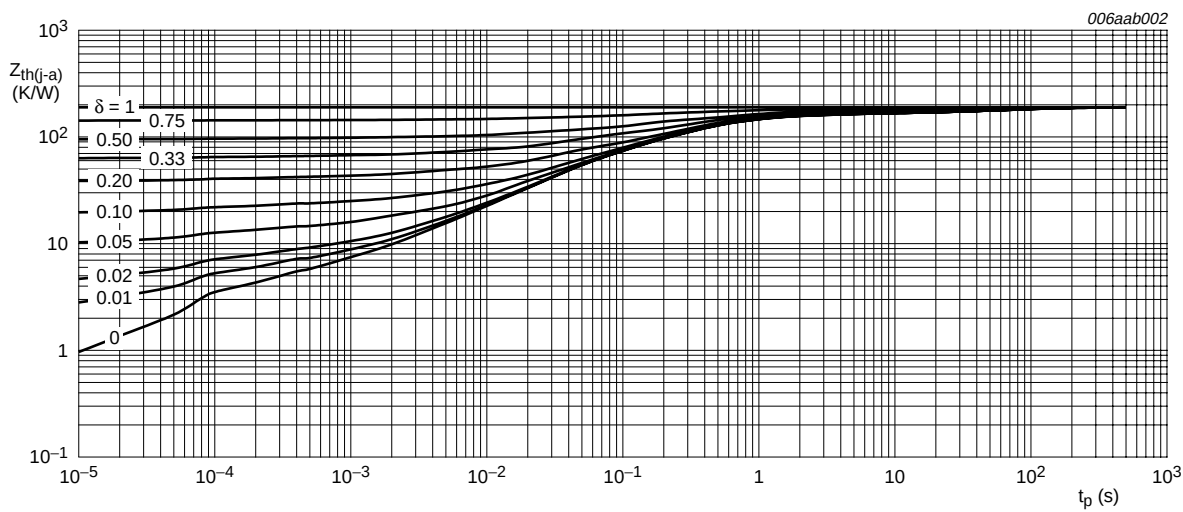
FR4 PCB, standard footprint

Fig 3. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT23 (TO-236AB) and SOT346 (SC-59A/TO-236); typical values



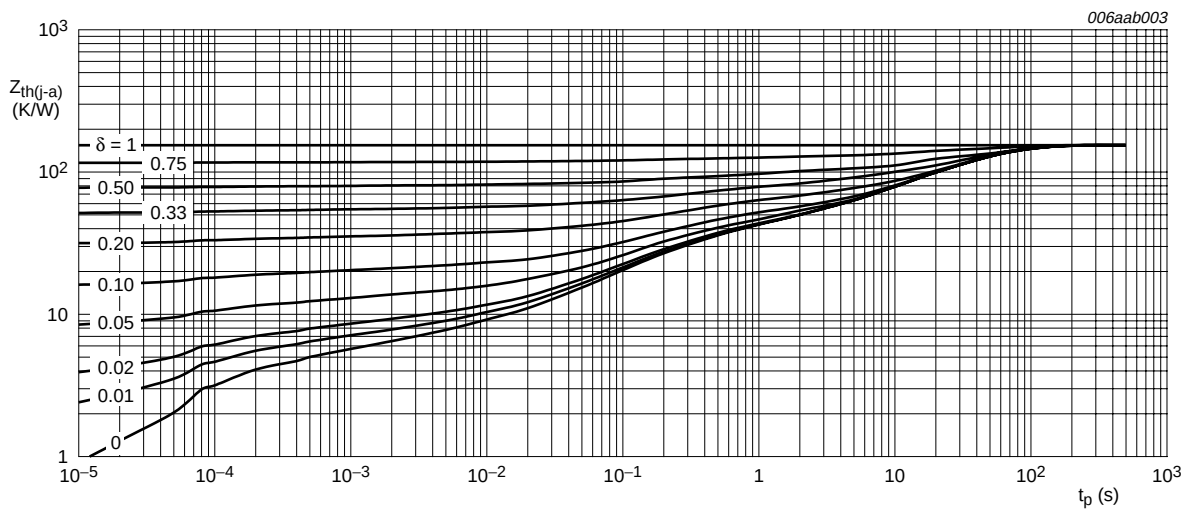
FR4 PCB, mounting pad for collector 1 cm²

Fig 4. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT23 (TO-236AB) and SOT346 (SC-59A/TO-236); typical values



Ceramic PCB, Al_2O_3 , standard footprint

Fig 5. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT23 (TO-236AB) and SOT346 (SC-59A/TO-236); typical values



FR4 PCB, standard footprint

Fig 6. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT54 (SC-43A/TO-92); typical values

7. Characteristics

Table 8. Characteristics

$T_{amb} = 25\text{ }^{\circ}\text{C}$ unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{CBO}	collector-base cut-off current	$V_{CB} = 30\text{ V};$ $I_E = 0\text{ A}$	-	-	100	nA
I_{CEO}	collector-emitter cut-off current	$V_{CE} = 30\text{ V};$ $I_B = 0\text{ A}$	-	-	0.5	μA
I_{EBO}	emitter-base cut-off current	$V_{EB} = 5\text{ V};$ $I_C = 0\text{ A}$	-	-	0.8	mA
h_{FE}	DC current gain	$V_{CE} = 5\text{ V};$ $I_C = 50\text{ mA}$	300	450	-	
		$V_{CE} = 5\text{ V};$ $I_C = 300\text{ mA}$	[1] 500	750	-	
		$V_{CE} = 5\text{ V};$ $I_C = 600\text{ mA}$	[1] 500	720	-	
		$V_{CE} = 5\text{ V};$ $I_C = 800\text{ mA}$	[1] 450	650	-	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 50\text{ mA};$ $I_B = 2.5\text{ mA}$	-	25	35	mV
		$I_C = 200\text{ mA};$ $I_B = 10\text{ mA}$	-	60	85	mV
		$I_C = 500\text{ mA};$ $I_B = 10\text{ mA}$	[1] -	160	220	mV
		$I_C = 600\text{ mA};$ $I_B = 6\text{ mA}$	[1] -	270	550	mV
		$I_C = 800\text{ mA};$ $I_B = 8\text{ mA}$	[1] -	0.56	1.15	V
$V_{I(off)}$	off-state input voltage	$V_{CE} = 5\text{ V};$ $I_C = 100\text{ }\mu\text{A}$	0.3	0.5	1	V
$V_{I(on)}$	on-state input voltage	$V_{CE} = 0.3\text{ V};$ $I_C = 20\text{ mA}$	0.4	0.7	1.4	V
R1	bias resistor 1 (input)		0.7	1	1.3	k Ω
R2/R1	bias resistor ratio		9	10	11	
C_c	collector capacitance	$V_{CB} = 10\text{ V};$ $I_E = I_e = 0\text{ A};$ $f = 1\text{ MHz}$	-	7	-	pF

[1] Pulse test: $t_p \leq 300\text{ }\mu\text{s}$; $\delta \leq 0.02$.

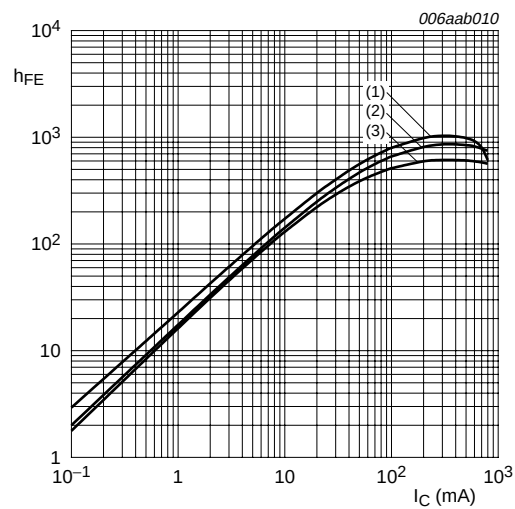


Fig 7. DC current gain as a function of collector current; typical values

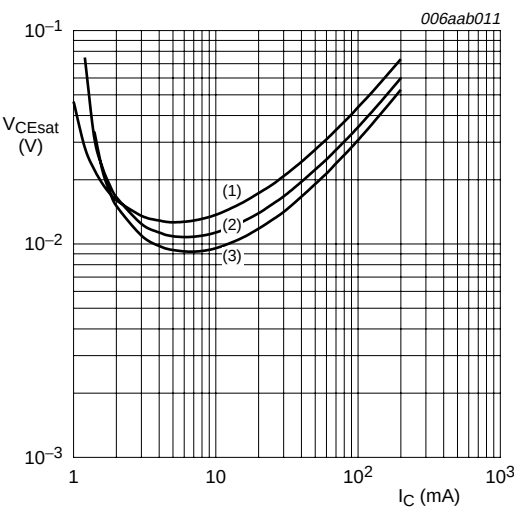


Fig 8. Collector-emitter saturation voltage as a function of collector current; typical values

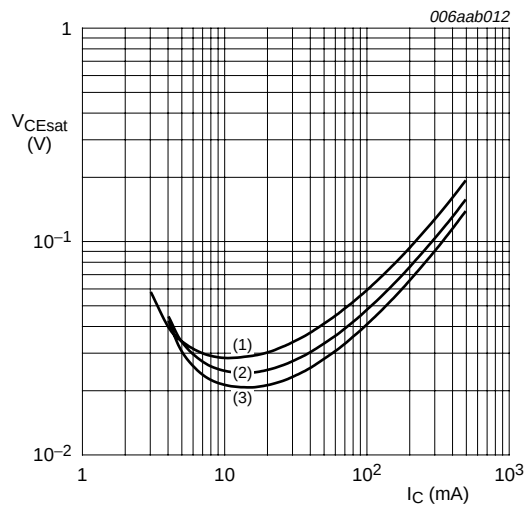


Fig 9. Collector-emitter saturation voltage as a function of collector current; typical values

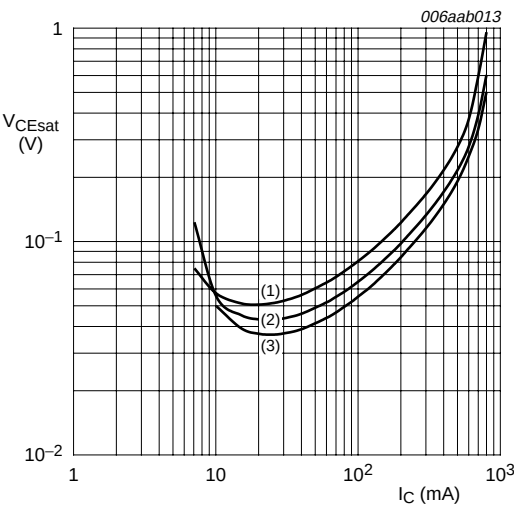
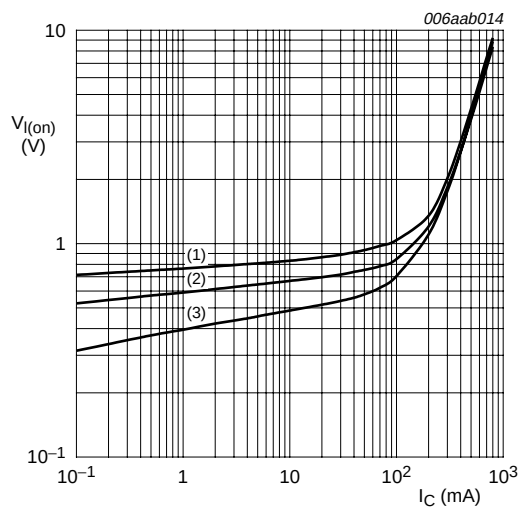
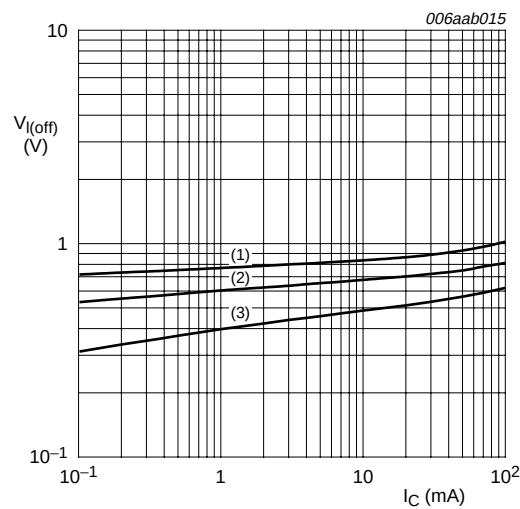


Fig 10. Collector-emitter saturation voltage as a function of collector current; typical values



- $V_{CE} = 0.3\text{ V}$
- (1) $T_{amb} = -40\text{ }^{\circ}\text{C}$
 - (2) $T_{amb} = 25\text{ }^{\circ}\text{C}$
 - (3) $T_{amb} = 100\text{ }^{\circ}\text{C}$

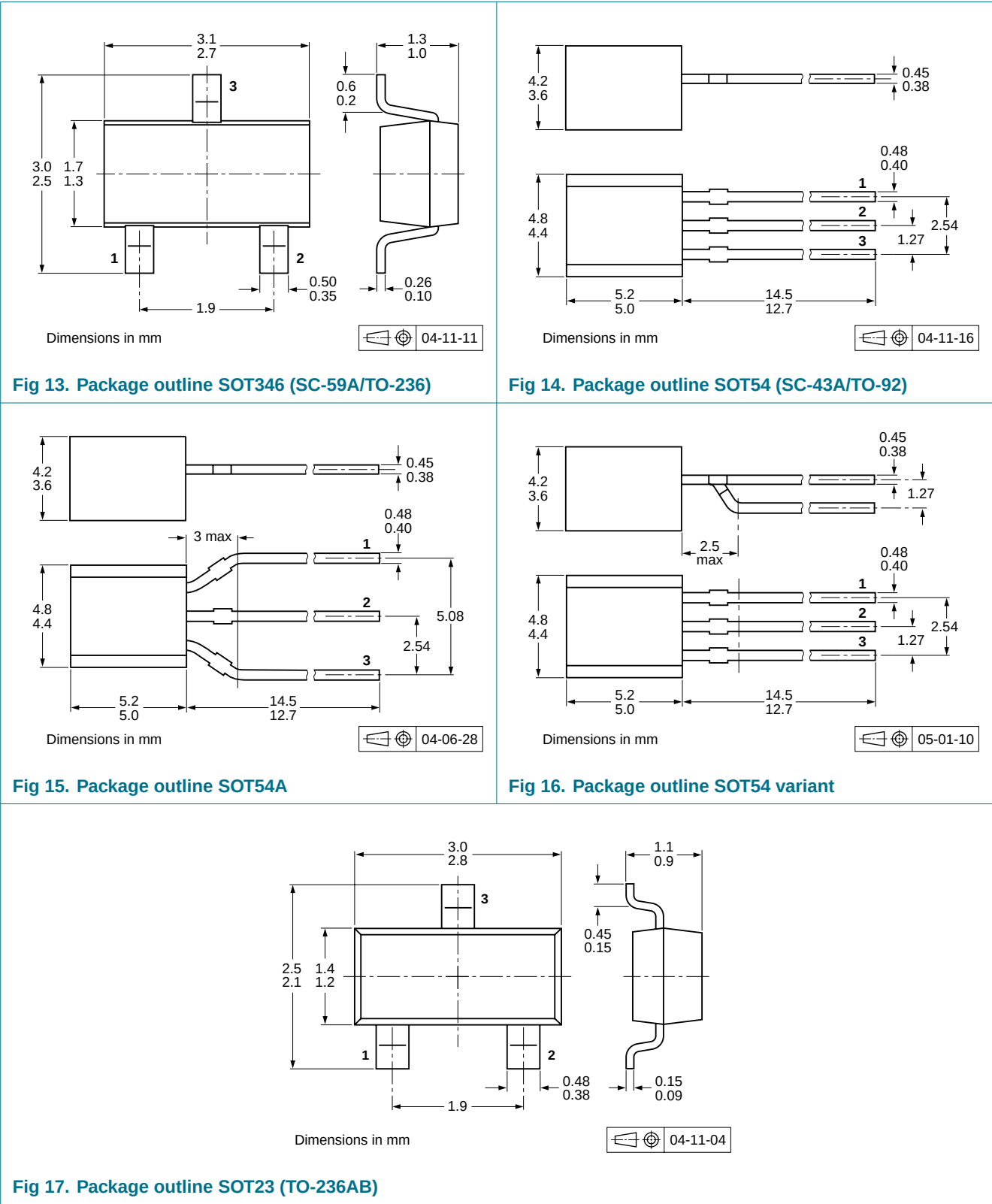
Fig 11. On-state input voltage as a function of collector current; typical values



- $V_{CE} = 5\text{ V}$
- (1) $T_{amb} = -40\text{ }^{\circ}\text{C}$
 - (2) $T_{amb} = 25\text{ }^{\circ}\text{C}$
 - (3) $T_{amb} = 100\text{ }^{\circ}\text{C}$

Fig 12. Off-state input voltage as a function of collector current; typical values

8. Package outline



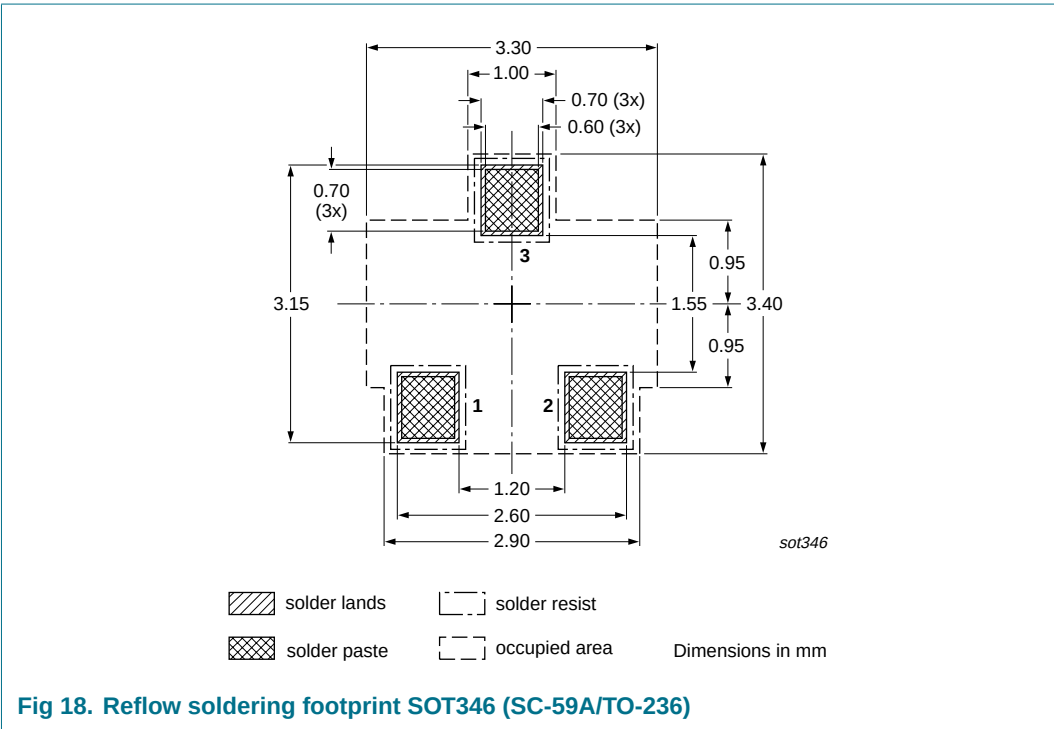
9. Packing information

Table 9. Packing methods
The indicated -xxx are the last three digits of the 12NC ordering code.[\[1\]](#)

Type number	Package	Description	Packing quantity		
			3000	5000	10000
PBRN113ZK	SOT346	4 mm pitch, 8 mm tape and reel	-115	-	-135
PBRN113ZS	SOT54	bulk, straight leads	-	-412	-
	SOT54A	tape and reel, wide pitch	-	-	-116
		tape ammopack, wide pitch	-	-	-126
	SOT54 variant	bulk, delta pinning	-	-112	-
PBRN113ZT	SOT23	4 mm pitch, 8 mm tape and reel	-215	-	-235

[1] For further information and the availability of packing methods, see [Section 13](#).

10. Soldering



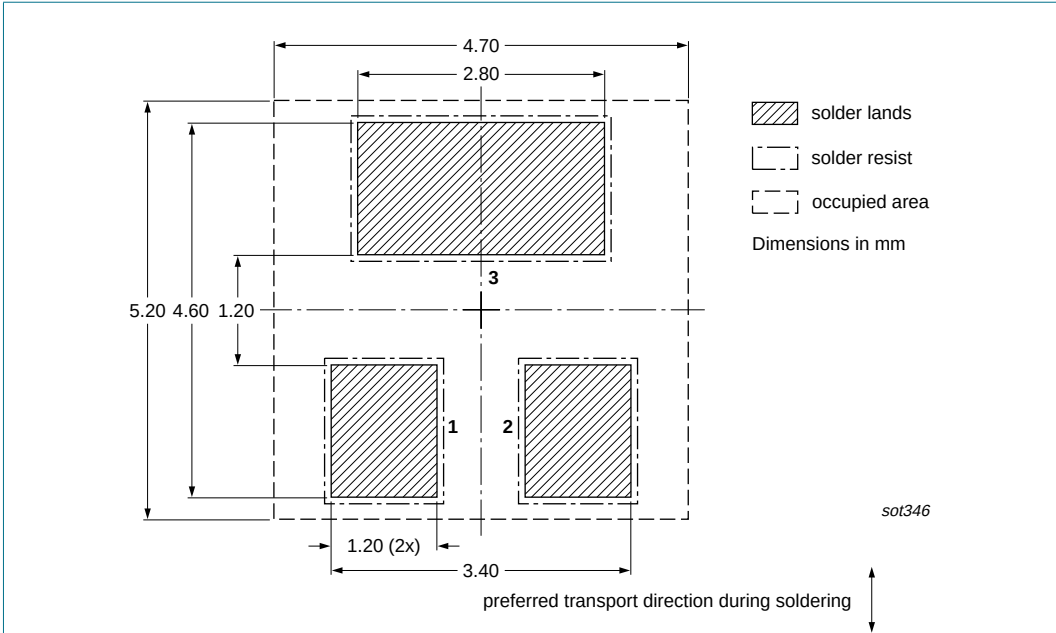


Fig 19. Wave soldering footprint SOT346 (SC-59A/TO-236)

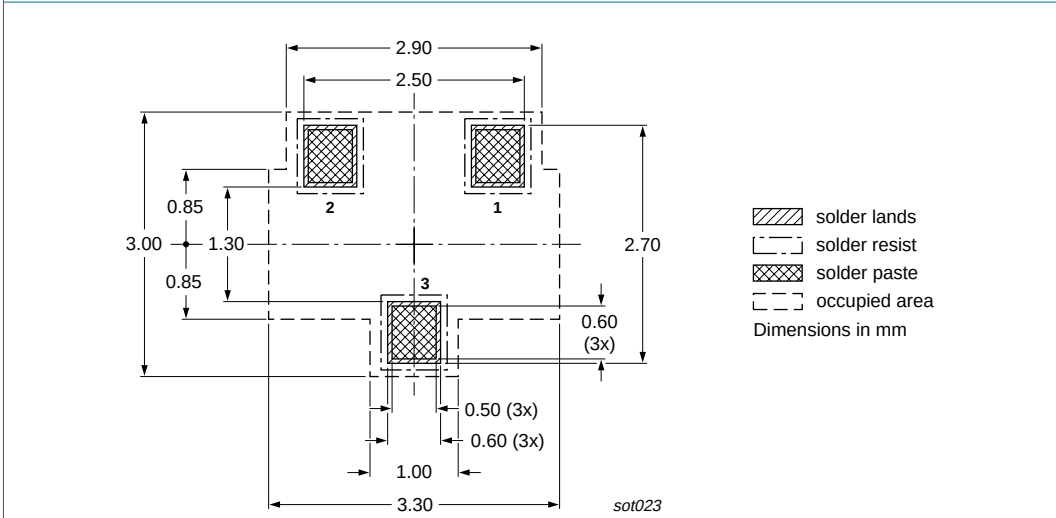
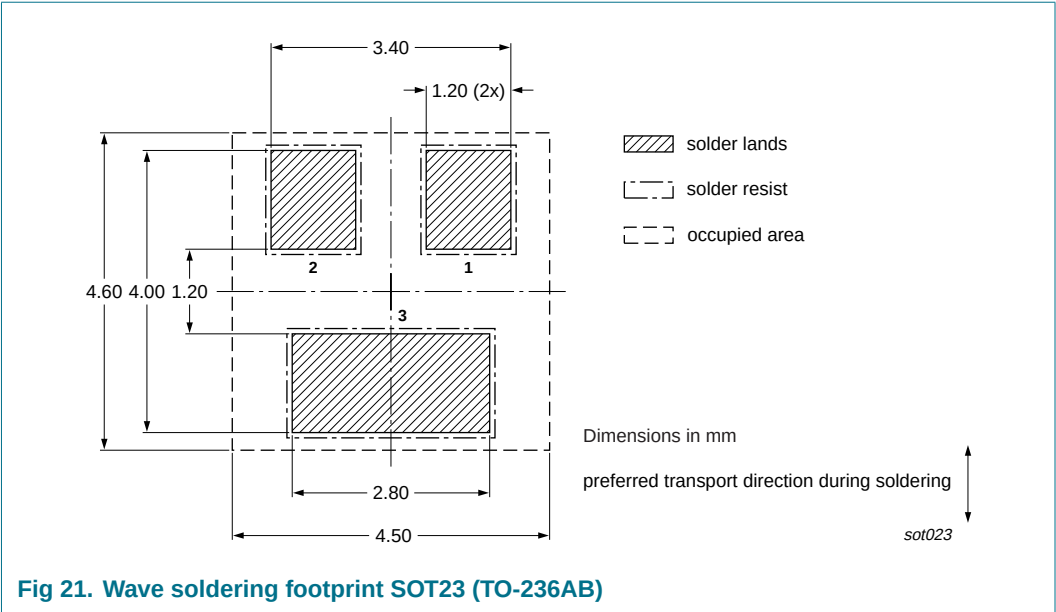


Fig 20. Reflow soldering footprint SOT23 (TO-236AB)



11. Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PBRN113Z_SER_1	20070226	Product data sheet	-	-

12. Legal information

12.1 Data sheet status

Document status ^{[1][2]}	Product status ^[3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

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