nexperia

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Kind regards,

Team Nexperia

PBRN113Z series

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

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		
	NXP	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
- ±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

founded by Philips

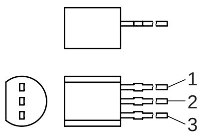
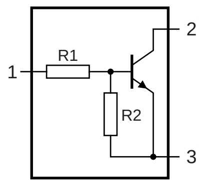
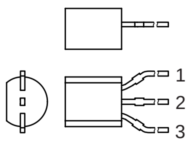
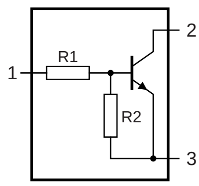
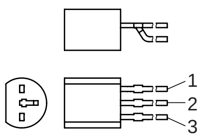
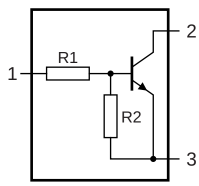
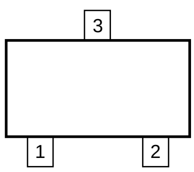
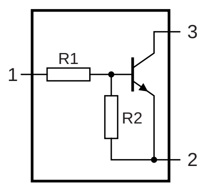
Table 2. Quick reference data *...continued*

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{ORM}	repetitive peak output current					
	PBRN113ZK, PBRN113ZT	$t_p \leq 1$ ms; $\delta \leq 0.33$	-	-	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	$t_p \leq 1$ ms; $\delta \leq 0.33$		-	800	mA

Table 6. Limiting values *…continued*

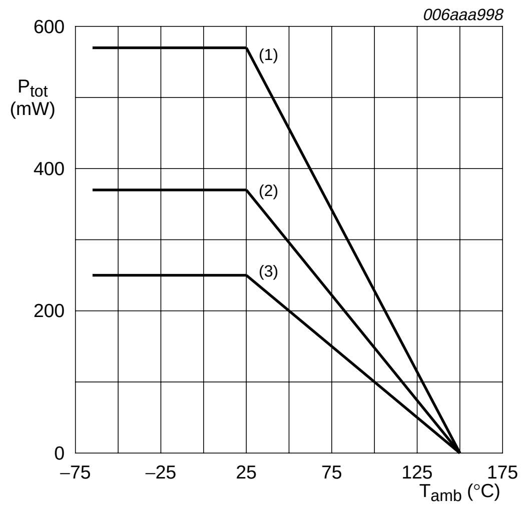
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions		Min	Max	Unit
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °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 cm^2.

[3] Device mounted on a ceramic PCB, Al_2O_3, standard footprint.

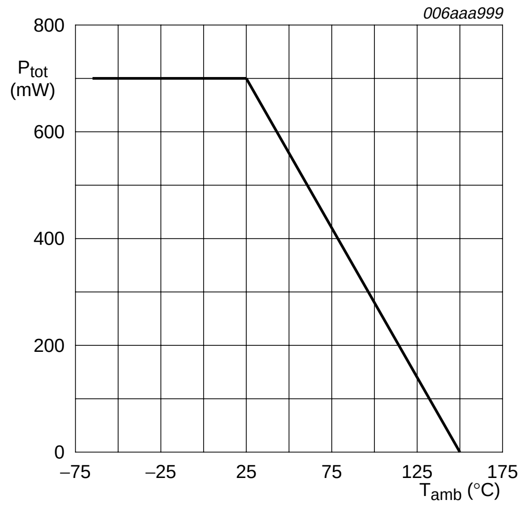


(1) Ceramic PCB, Al_2O_3, standard footprint

(2) FR4 PCB, mounting pad for collector 1 cm^2

(3) FR4 PCB, standard footprint

Fig 1. Power derating curves for SOT23 (TO-236AB) and SOT346 (SC-59A/TO-236)



FR4 PCB, standard footprint

Fig 2. Power derating curve for SOT54 (SC-43A/TO-92)

6. Thermal characteristics

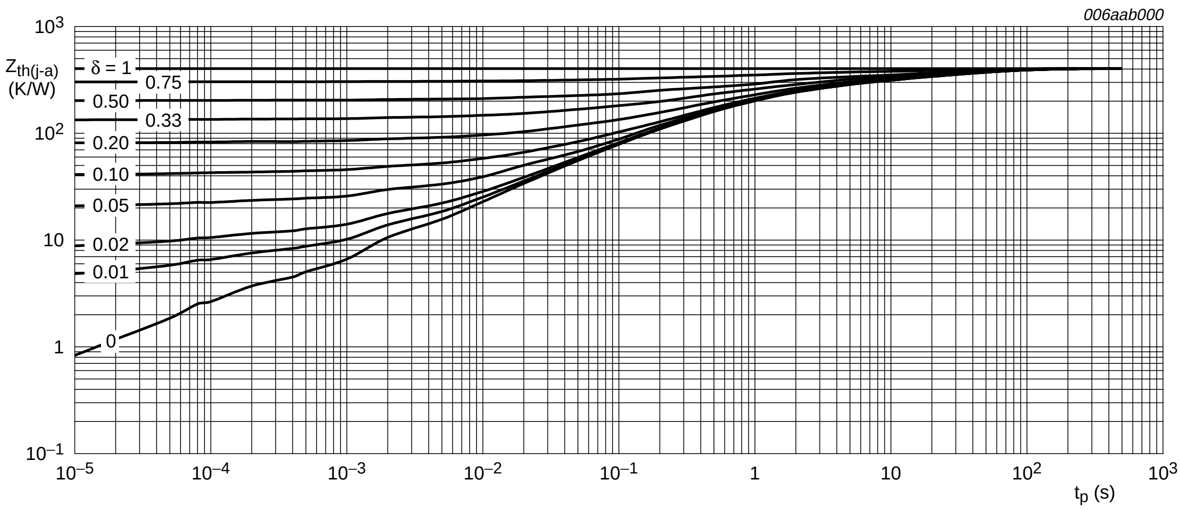
Table 7. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air					
	PBRN113ZK, PBRN113ZT		[1]	-	-	500	K/W
			[2]	-	-	338	K/W
			[3]	-	-	219	K/W
	PBRN113ZS		[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.

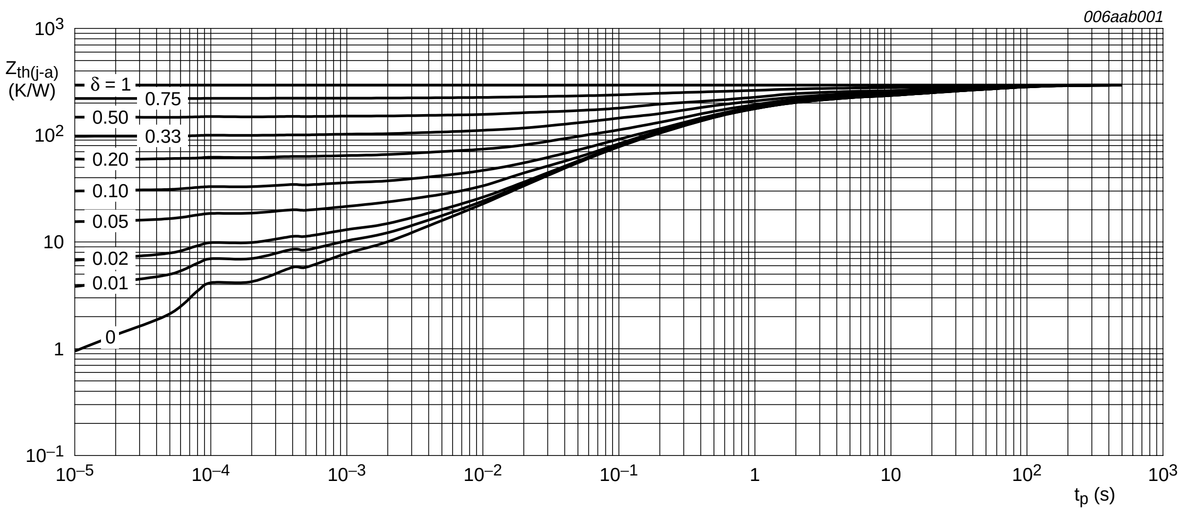
[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm^2.

[3] Device mounted on a ceramic PCB, Al_2O_3, standard footprint.



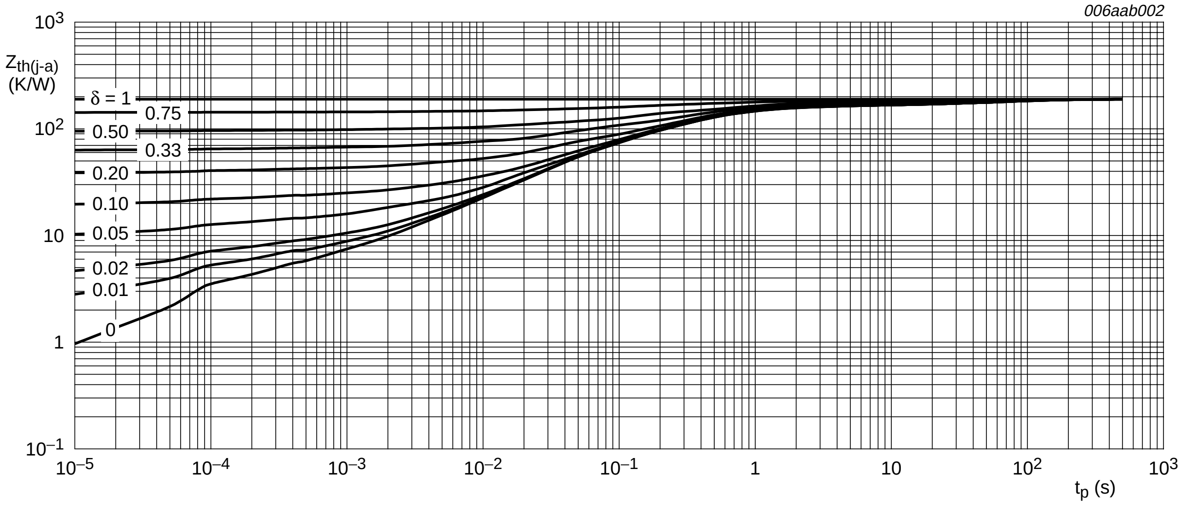
FR4 PCB, standard footprint

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



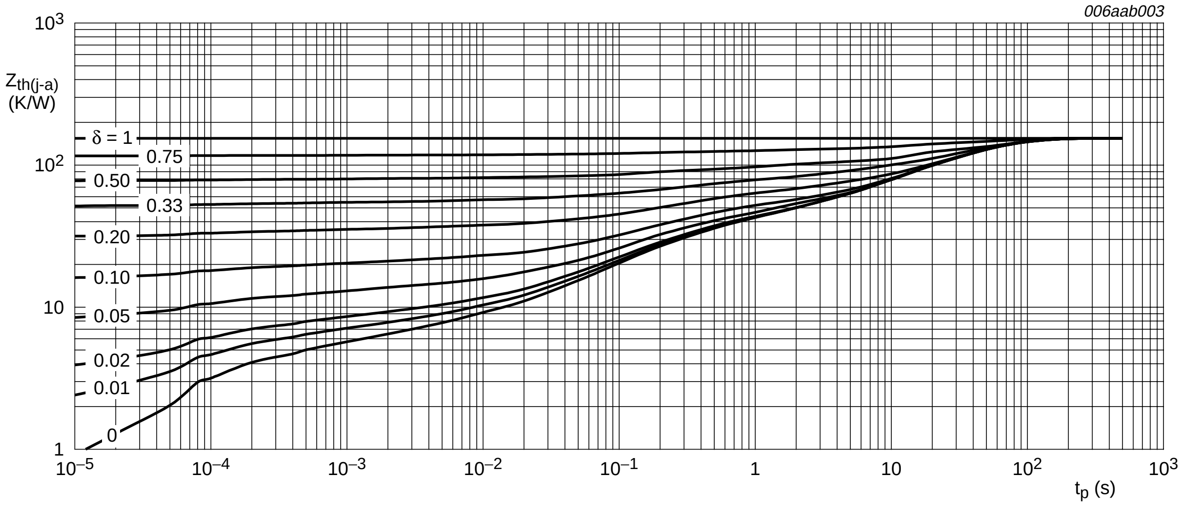
FR4 PCB, mounting pad for collector 1 cm^2

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

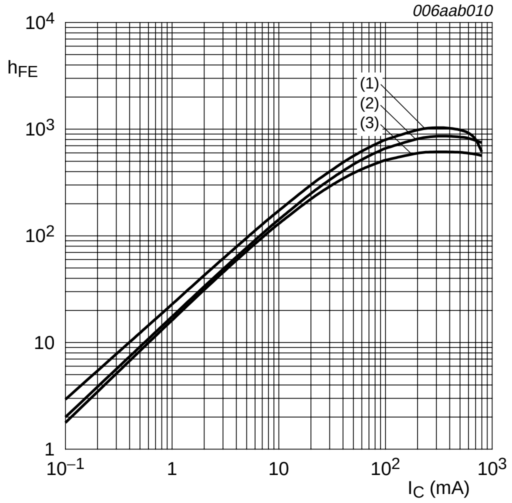
7. Characteristics

Table 8. Characteristics

T_{amb} = 25 °C unless otherwise specified.

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

[1] Pulse test: $t_p \leq 300$ μs; $\delta \leq 0.02$.



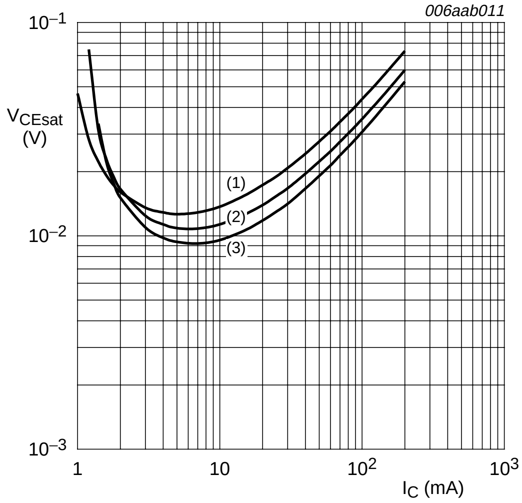
V_{CE} = 5 V

(1) T_{amb} = 100 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = −40 °C

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



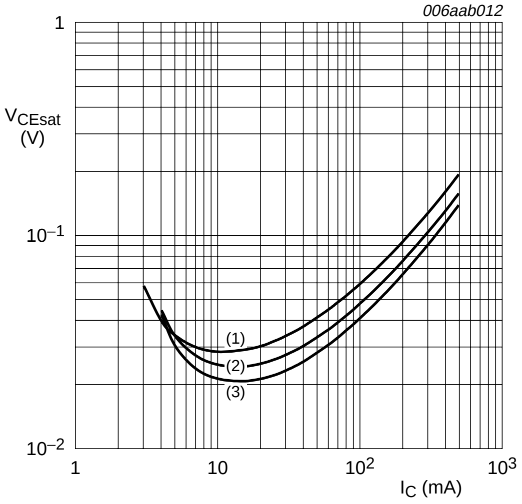
I_C/I_B = 20

(1) T_{amb} = 100 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = −40 °C

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



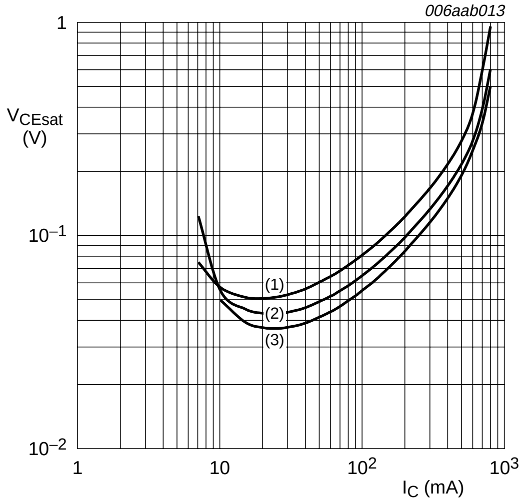
I_C/I_B = 50

(1) T_{amb} = 100 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = −40 °C

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



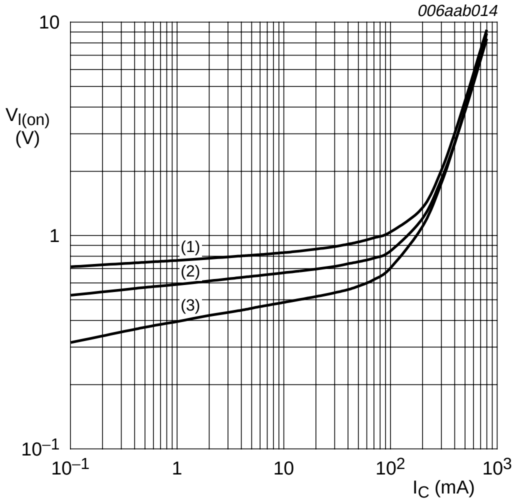
I_C/I_B = 100

(1) T_{amb} = 100 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = −40 °C

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



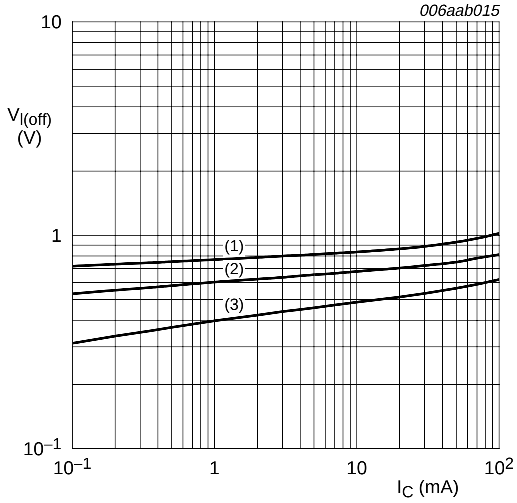
V_{CE} = 0.3 V

(1) T_{amb} = –40 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = 100 °C

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



V_{CE} = 5 V

(1) T_{amb} = –40 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = 100 °C

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

8. Package outline

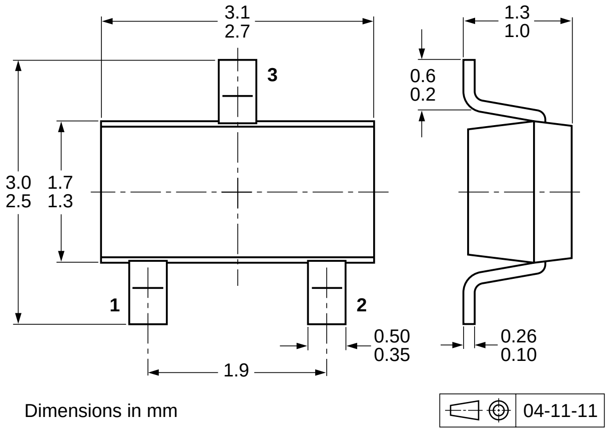


Fig 13. Package outline SOT346 (SC-59A/TO-236)

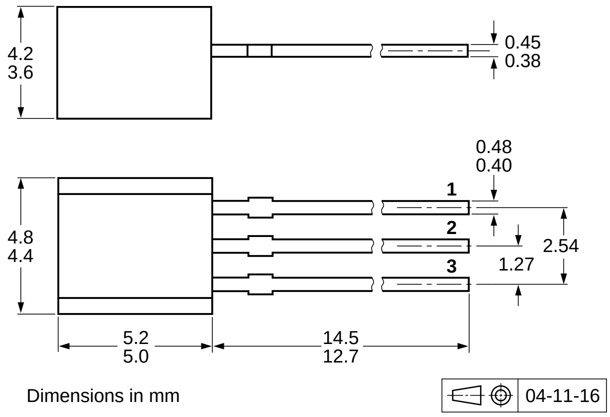


Fig 14. Package outline SOT54 (SC-43A/TO-92)

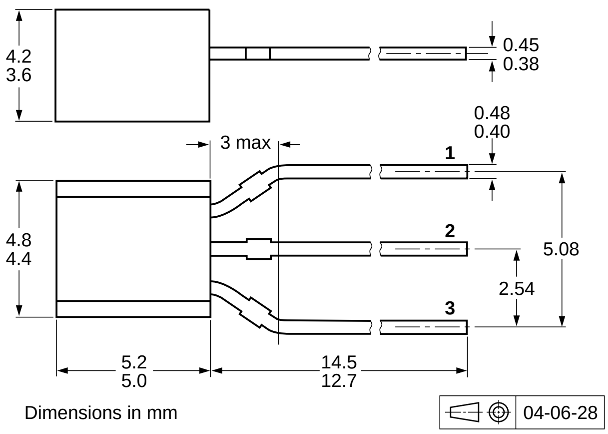


Fig 15. Package outline SOT54A

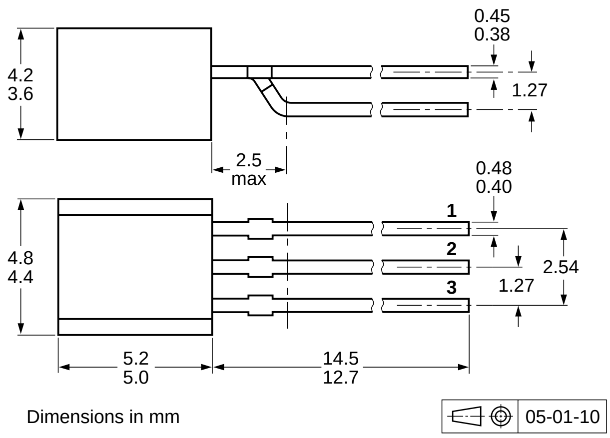


Fig 16. Package outline SOT54 variant

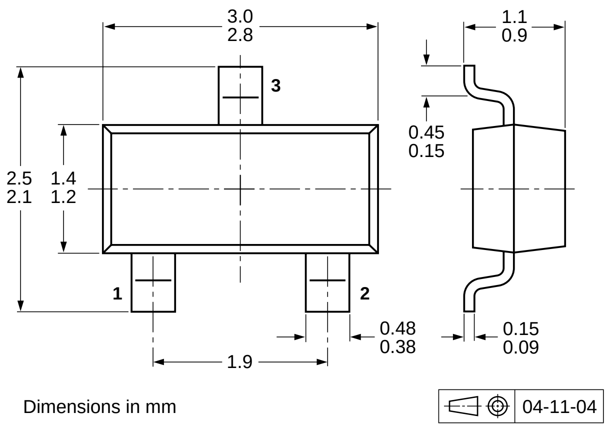


Fig 17. Package outline SOT23 (TO-236AB)

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

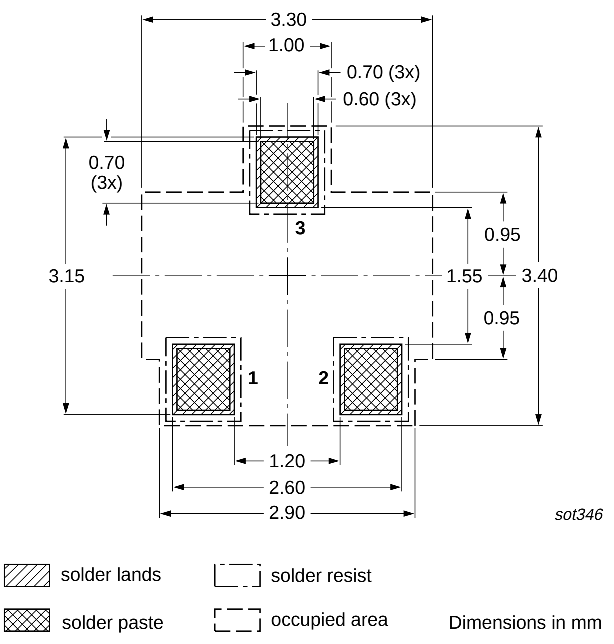


Fig 18. Reflow soldering footprint SOT346 (SC-59A/TO-236)

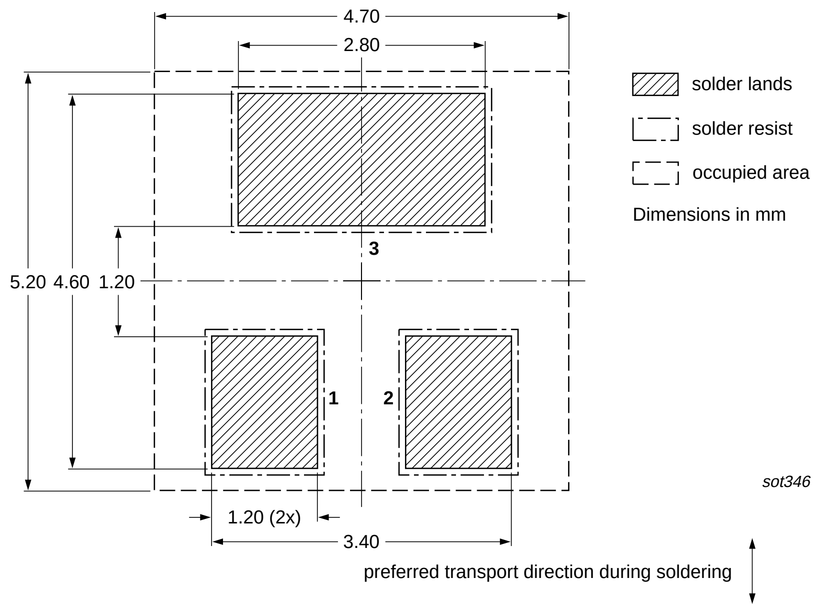


Fig 19. Wave soldering footprint SOT346 (SC-59A/TO-236)

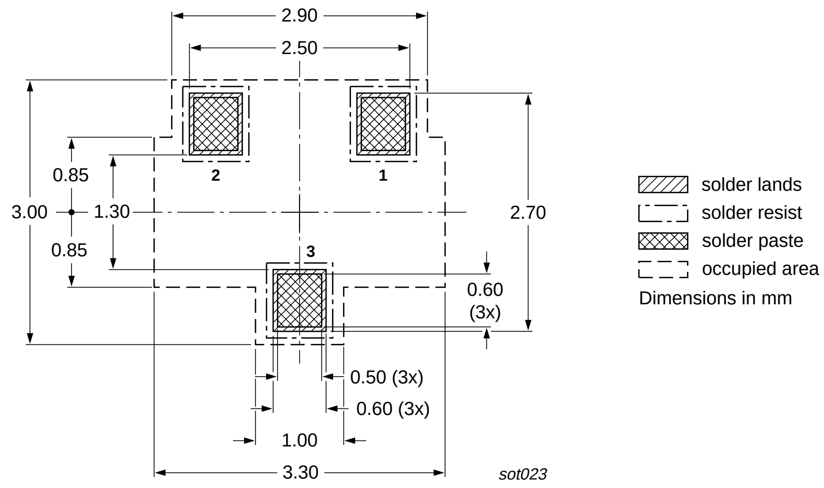


Fig 20. Reflow soldering footprint SOT23 (TO-236AB)

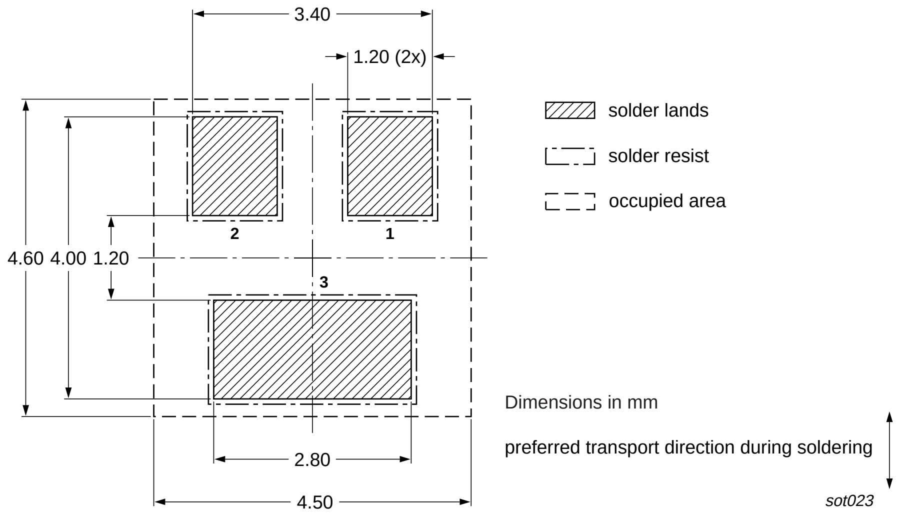


Fig 21. Wave soldering footprint SOT23 (TO-236AB)

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".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL http://www.nxp.com.

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14. Contents

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Document identifier: PBRN113Z_SER_1