PDTD123EU

50 V, 500 mA NPN resistor-equipped transistor

17 April 2024 **Product data sheet**

1. General description

NPN Resistor-Equipped Transistor (RET) in a very small SOT323 (SC-70) Surface-Mounted Device (SMD) plastic package.

PNP complement: PDTB123EU

2. Features and benefits

- 500 mA output current capability
- Built-in bias resistors
- Simplifies circuit design
- Reduces component count
- ± 10 % resistor ratio tolerance
- High temperature applications up to 175 °C
- AEC-Q101 qualified

3. Applications

- Controlling IC inputs
- Cost-saving alternative to BC817 series in digital applications
- Switching loads

4. Quick reference data

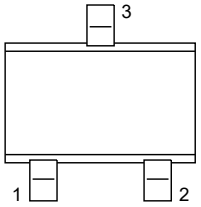
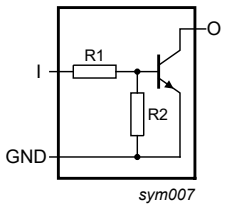
Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{CEO}	collector-emitter voltage	open base		-	-	50	V
I_O	output current			-	-	500	mA
R1	bias resistor 1 (input)			1.54	2.2	2.86	kΩ
R2/R1	bias resistor ratio			0.9	1	1.1	

nexperia

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	I	input (base)	 SC-70 (SOT323)	
2	GND	ground (emitter)		
3	O	output (collector)		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PDTD123EU	SC-70	plastic, surface-mounted package; 3 leads; 1.3 mm pitch; 2 mm x 1.25 mm x 0.95 mm body	SOT323

7. Marking

Table 4. Marking codes

Type number	Marking code[1]
PDTD123EU	ZR%

[1] % = placeholder for manufacturing site code

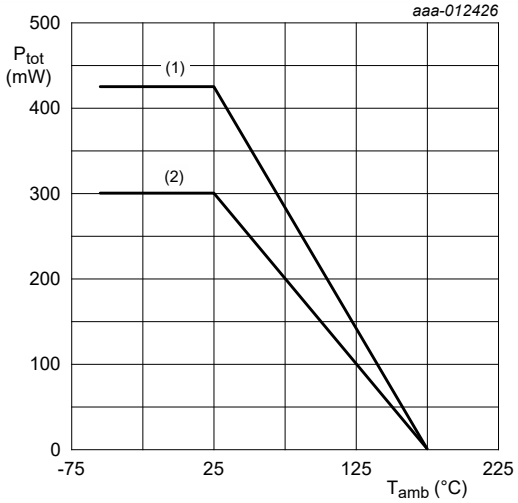
8. Limiting values

Table 5. 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		-	50	V
V_{CEO}	collector-emitter voltage	open base		-	50	V
V_{EBO}	emitter-base voltage	open collector		-	10	V
V_I	input voltage			-10	12	V
I_O	output current			-	500	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	[1]	-	300	mW
			[2]	-	425	mW
T_j	junction temperature			-	175	°C
T_{amb}	ambient temperature			-55	175	°C
T_{stg}	storage temperature			-55	175	°C

[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided, 35 µm copper, tin-plated and standard footprint.
[2] Device mounted on an FR4 PCB, 4-layer copper, tin-plated and standard footprint.



(1) FR4 PCB, 4-layer copper, standard footprint
(2) FR4 PCB, single-sided copper, tin-plated and standard footprint

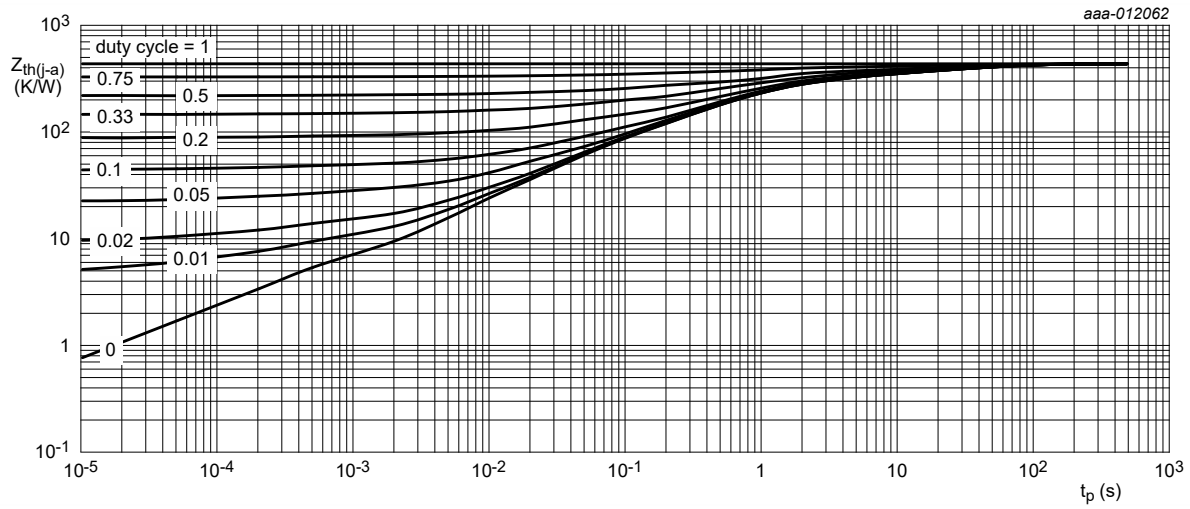
Fig. 1. Power derating curves

9. Thermal characteristics

Table 6. Thermal characteristics

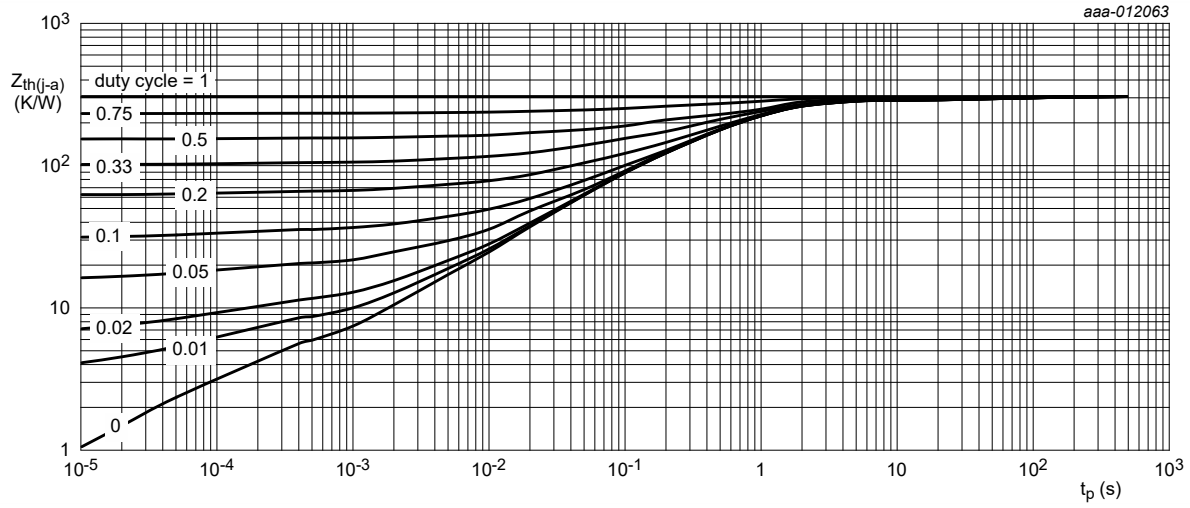
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	500	K/W
			[2]	-	-	353	K/W

[1] Device mounted on an FR4 PCB, single-sided, 35 µm copper, tin-plated and standard footprint.
[2] Device mounted on an FR4 PCB, 4-layer copper, tin-plated and standard footprint.



FR4 PCB, single-sided copper, tin-plated and standard footprint

Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT323/SC-70; typical values



FR4 PCB, 4-layer copper, tin-plated and standard footprint.

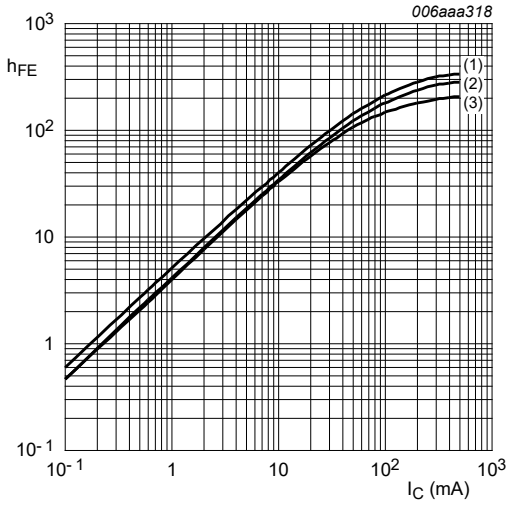
Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration for SOT323/SC-70; typical values

10. Characteristics

Table 7. Characteristics

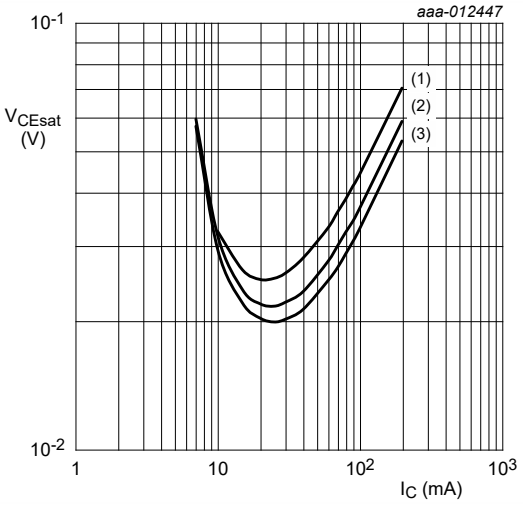
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
I_{CBO}	collector-base cut-off current	V_{CB} = 40 V; I_E = 0 A; T_{amb} = 25 °C		-	-	100	nA
		V_{CB} = 50 V; I_E = 0 A; T_{amb} = 25 °C		-	-	100	nA
I_{CEO}	collector-emitter cut-off current	V_{CE} = 50 V; I_B = 0 A; T_{amb} = 25 °C		-	-	0.5	µA
I_{EBO}	emitter-base cut-off current	V_{EB} = 5 V; I_C = 0 A; T_{amb} = 25 °C		-	-	2	mA
h_{FE}	DC current gain	V_{CE} = 5 V; I_C = 50 mA; T_{amb} = 25 °C		40	-	-	
V_{CEsat}	collector-emitter saturation voltage	I_C = 50 mA; I_B = 2.5 mA; T_{amb} = 25 °C		-	-	100	mV
$V_{I(off)}$	off-state input voltage	V_{CE} = 5 V; I_C = 100 µA; T_{amb} = 25 °C		0.6	1.1	1.8	V
$V_{I(on)}$	on-state input voltage	V_{CE} = 0.3 V; I_C = 20 mA; T_{amb} = 25 °C		1	1.5	2	V
R1	bias resistor 1 (input)			1.54	2.2	2.86	kΩ
R2/R1	bias resistor ratio			0.9	1	1.1	
C_c	collector capacitance	V_{CB} = 10 V; I_E = 0 A; i_e = 0 A; f = 1 MHz; T_{amb} = 25 °C		-	7	-	pF
f_T	transition frequency	V_{CE} = 5 V; I_C = 50 mA; f = 100 MHz; T_{amb} = 25 °C	[1]	-	225	-	MHz

[1] Characteristics of built-in transistor.



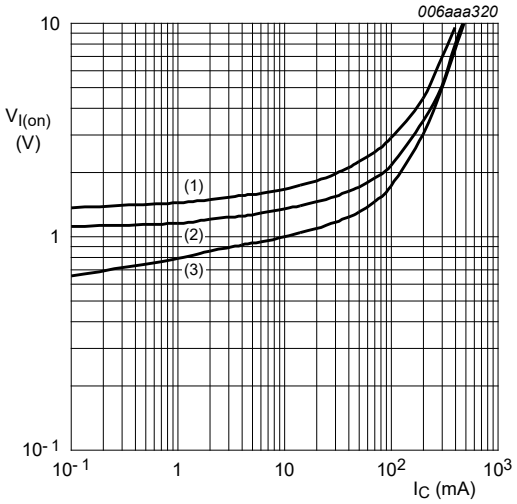
V_{CE} = 5 V
(1) T_{amb} = 100 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = -40 °C

Fig. 4. DC current gain as a function of collector current; typical values



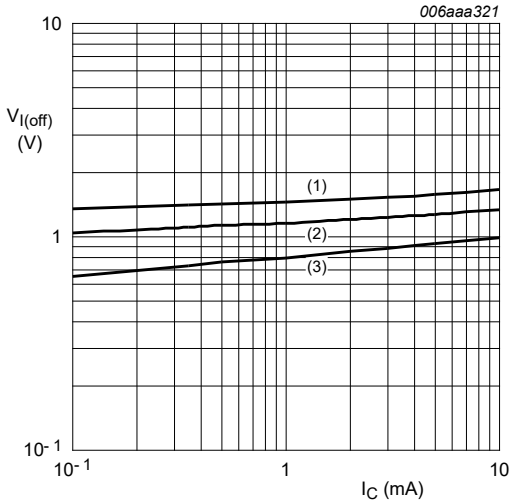
I_C/I_B = 20
(1) T_{amb} = 100 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = -40 °C

Fig. 5. Collector-emitter saturation voltage as a function of collector current; typical values



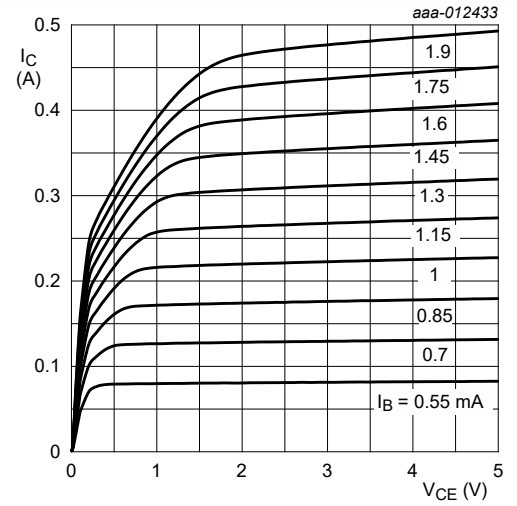
V_{CE} = 0.3 V
(1) T_{amb} = -40 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = 100 °C

Fig. 6. On-state input voltage as a function of collector current; typical values



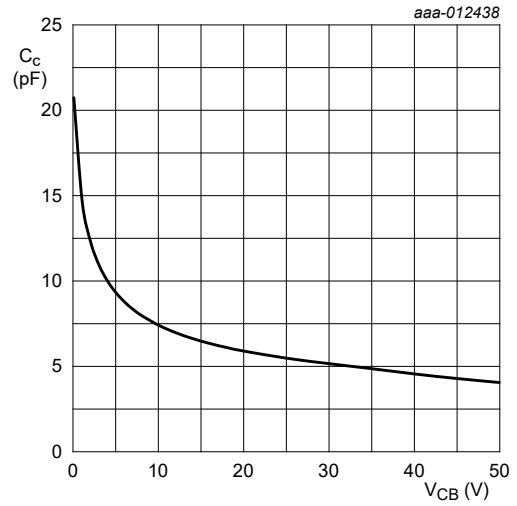
V_{CE} = 5 V
(1) T_{amb} = -40 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = 100 °C

Fig. 7. Off-state input voltage as a function of collector current; typical values



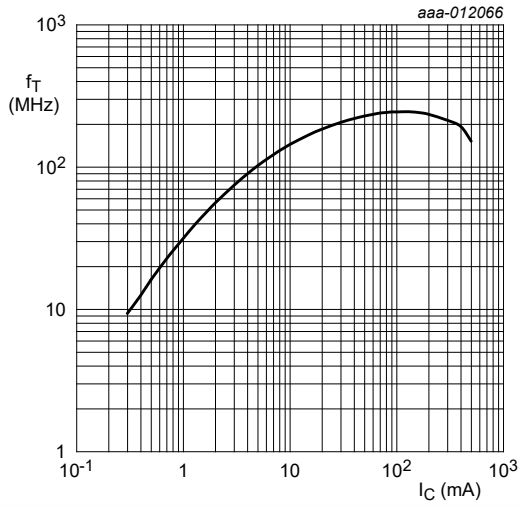
T_{amb} = 25 °C

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



f = 1 MHz
T_{amb} = 25 °C

Fig. 9. Collector capacitance as a function of collector-base voltage; typical values



T_{amb} = 25 °C
V_{CE} = 5 V

Fig. 10. Transition frequency as a function of collector current; typical values of built-in transistor

11. Test information

Quality information

This product has been qualified in accordance with the Automotive Electronics Council (AEC) standard Q101 - *Stress test qualification for discrete semiconductors*, and is suitable for use in automotive applications.

12. Package outline

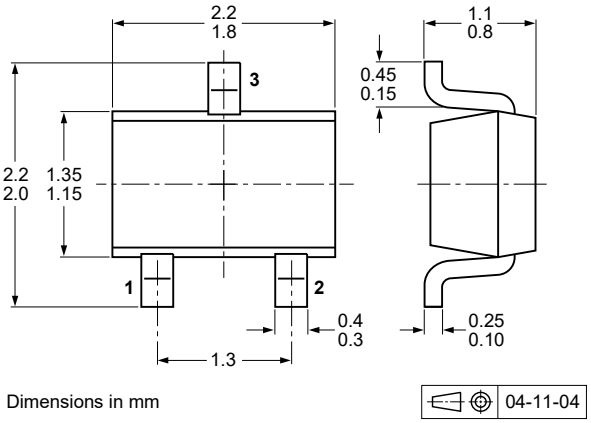


Fig. 11. Package outline SC-70 (SOT323)

13. Soldering

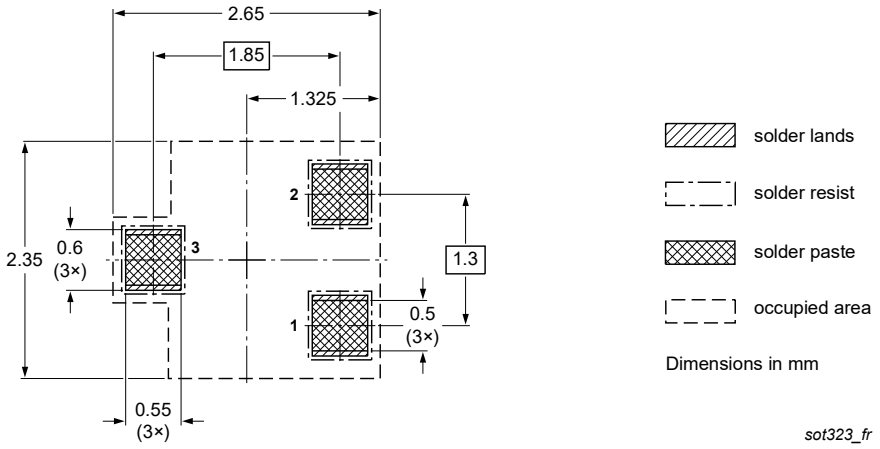


Fig. 12. Reflow soldering footprint for SC-70 (SOT323)

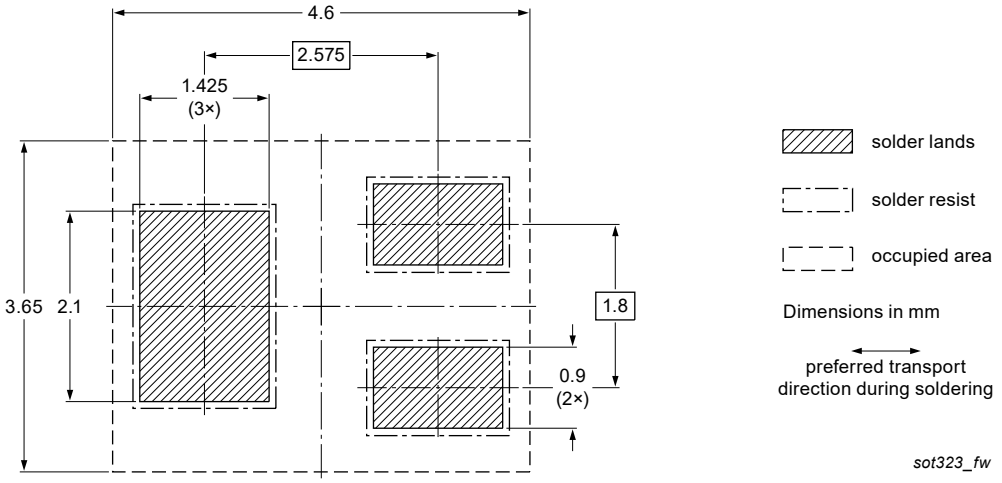


Fig. 13. Wave soldering footprint for SC-70 (SOT323)

14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PDTD123EU v.2	20240417	Product data sheet	-	PDTD1XXXU_SER v.1
Modifications:	• Family data sheet reduced to single type data sheet.			
PDTD1XXXU_SER v.1	20140513	Product data sheet	-	-

15. Legal information

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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Date of release: 17 April 2024

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