



# NHDTA123JU/143ZU/114YU series

80 V, 100 mA PNP resistor-equipped transistors

Rev. 1 — 16 July 2020

Product data sheet

## 1. General description

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

Table 1. Product overview

Type number	R1	R2	Package		NPN complement:
	k $\Omega$	k $\Omega$	Nexperia	JEITA	
NHDTA123JU	2.2	47	SOT323	SC-70	NHDTC123JU
NHDTA143ZU	4.7	47			NHDTC143ZU
NHDTA114YU	10	47			NHDTC114YU

## 2. Features and benefits

- 100 mA output current capability
- High breakdown voltage
- Built-in resistors
- Simplifies circuit design
- Reduces component count
- Reduces pick and place costs
- AEC-Q101 qualified

## 3. Applications

- Digital applications
- Cost saving alternative for BC856 series in digital applications
- Controlling IC inputs
- Switching loads

## 4. Quick reference data

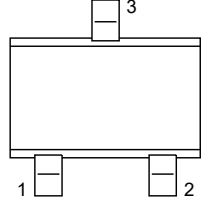
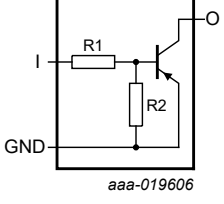
Table 2. Quick reference data

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CEO}$	collector-emitter voltage	open base	-	-	-80	V
$I_O$	output current		-	-	-100	mA

## 5. Pinning information

Table 3. Pinning

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

## 6. Ordering information

Table 4. Ordering information

Type number	Package		
	Name	Description	Version
NHDTA123JU	SC-70	plastic surface-mounted package; 3 leads	SOT323
NHDTA143ZU			
NHDTA114YU			

## 7. Marking

Table 5. Marking

Type number	Marking code [1]
NHDTA123JU	5H%
NHDTA143ZU	5K%
NHDTA114YU	5G%

[1] % = placeholder for manufacturing site code

## 8. Limiting values

**Table 6. Limiting values**

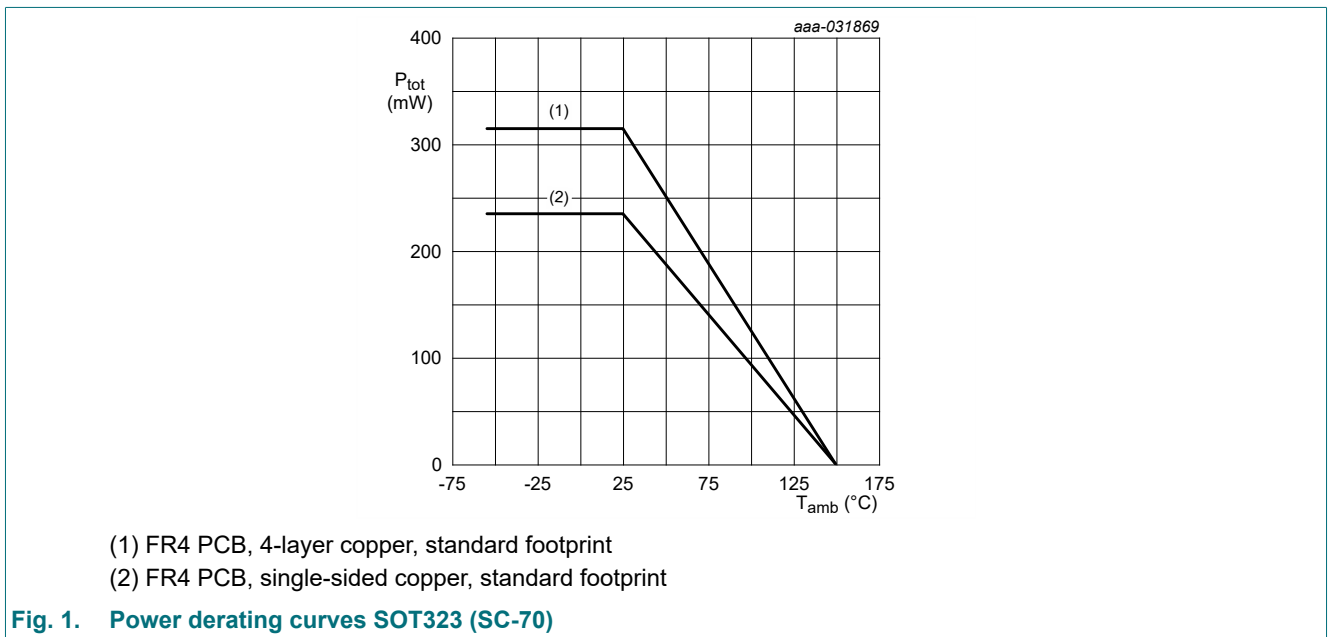
In accordance with the Absolute Maximum Rating System (IEC 60134).

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

Symbol	Parameter	Conditions	Min	Max	Unit	
$V_{CBO}$	collector-base voltage	open emitter	-	-80	V	
$V_{CEO}$	collector-emitter voltage	open base	-	-80	V	
$V_{EBO}$	emitter-base voltage	open collector	-	-7	V	
$V_i$	input voltage					
	NHDTA123JU		-20	+7	V	
	NHDTA143ZU		-30	+7	V	
	NHDTA114YU		-40	+7	V	
$I_O$	output current		-	-100	mA	
$P_{tot}$	total power dissipation	$T_{amb} \leq 25\text{ °C}$	[1]	-	235	mW
			[2]	-	315	mW
$T_j$	junction temperature		-	150	°C	
$T_{amb}$	ambient temperature		-55	150	°C	
$T_{stg}$	storage temperature		-65	150	°C	

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

[2] Device mounted on an FR4 Printed-Circuit-Board (PCB); 4-layer copper; tin-plated and standard footprint.



**Fig. 1. Power derating curves SOT323 (SC-70)**

## 9. Thermal characteristics

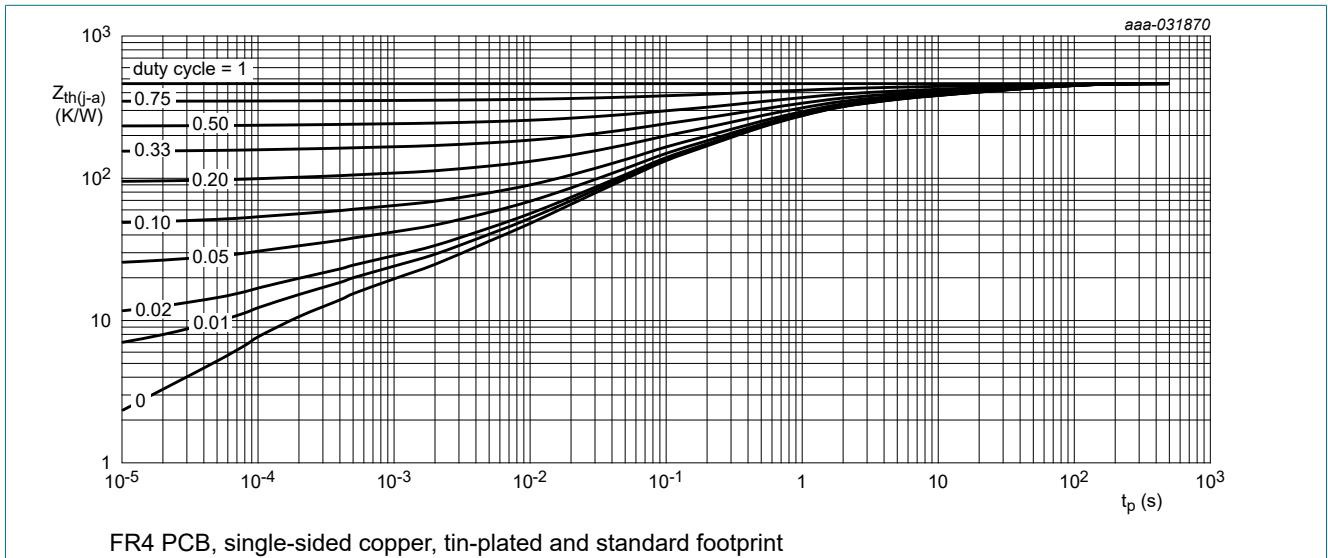
**Table 7. Thermal characteristics**

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

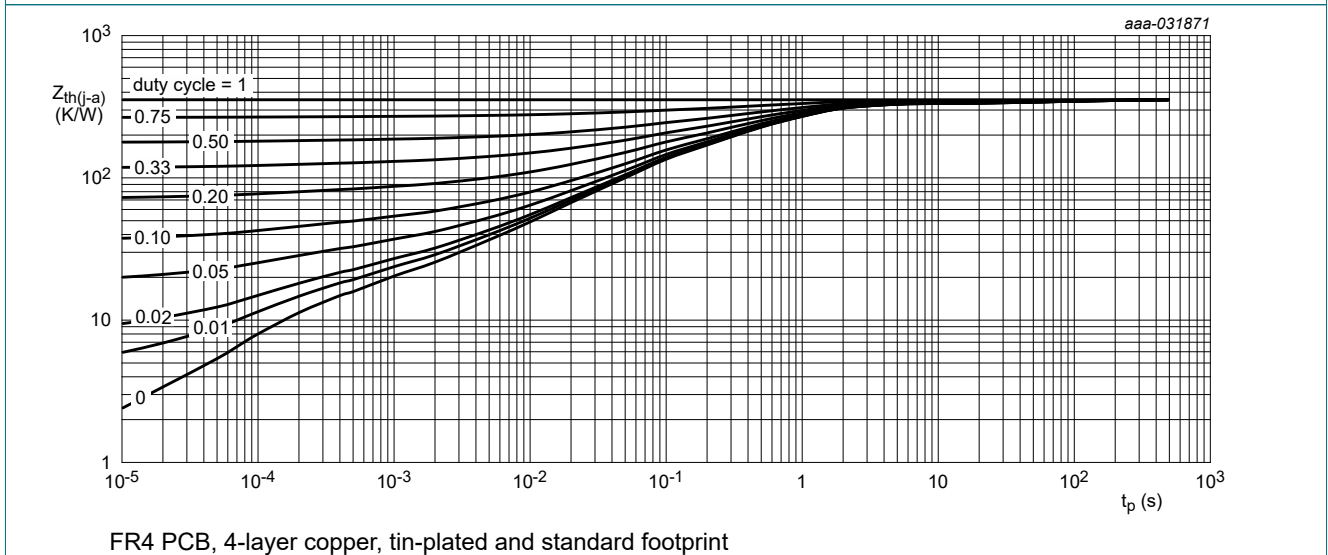
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	532	K/W
			[2]	-	-	397	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	-	150	K/W

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

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



**Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values**



**Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values**

## 10. Characteristics

**Table 8. Characteristics**
 $T_{amb} = 25\text{ °C}$  unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{(BR)CBO}$	collector-base breakdown voltage	$I_C = -100\text{ }\mu\text{A}$ ; $I_E = 0\text{ A}$	-80	-	-	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	$I_C = -2\text{ mA}$ ; $I_B = 0\text{ A}$	-80	-	-	V
$I_{CBO}$	collector-base cut-off current	$V_{CB} = -80\text{ V}$ ; $I_E = 0\text{ A}$	-	-	-100	nA
$I_{CEO}$	collector-emitter cut-off current	$V_{CE} = -60\text{ V}$ ; $I_B = 0\text{ A}$	-	-	-100	nA
		$V_{CE} = -60\text{ V}$ ; $I_B = 0\text{ A}$ ; $T_j = 150\text{ °C}$	-	-	-5	$\mu\text{A}$
$I_{EBO}$	emitter-base cut-off current					
	NHDTA123JU	$V_{EB} = -7\text{ V}$ ; $I_C = 0\text{ A}$	-	-	-270	$\mu\text{A}$
	NHDTA143ZU		-	-	-260	$\mu\text{A}$
	NHDTA114YU		-	-	-230	$\mu\text{A}$
$h_{FE}$	DC current gain	$V_{CE} = -5\text{ V}$ ; $I_C = -10\text{ mA}$	100	-	-	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = -10\text{ mA}$ ; $I_B = -0.5\text{ mA}$	-	-	-100	mV
$V_{I(off)}$	off-state input voltage					
	NHDTA123JU	$V_{CE} = -5\text{ V}$ ; $I_C = -100\text{ }\mu\text{A}$	-	-595	-500	mV
	NHDTA143ZU		-	-625	-500	mV
	NHDTA114YU		-	-690	-500	mV
$V_{I(on)}$	on-state input voltage					
	NHDTA123JU	$V_{CE} = -0.3\text{ V}$ ; $I_C = -10\text{ mA}$	-1.2	-0.81	-	V
	NHDTA143ZU		-1.4	-0.95	-	V
	NHDTA114YU		-1.6	-1.22	-	V
R1	bias resistor 1 (input)		[1]			
	NHDTA123JU		1.54	2.2	2.86	k $\Omega$
	NHDTA143ZU		3.3	4.7	6.1	k $\Omega$
	NHDTA114YU		7	10	13	k $\Omega$
R2/R1	bias resistor ratio		[1]			
	NHDTA123JU		17	21	26	
	NHDTA143ZU		8	10	12	
	NHDTA114YU		3.7	4.7	5.7	
$f_T$	transition frequency	$V_{CE} = -5\text{ V}$ ; $I_C = -10\text{ mA}$ ; $f = 100\text{ MHz}$	[2]	150	-	MHz
$C_c$	collector capacitance	$V_{CB} = -10\text{ V}$ ; $I_E = I_e = 0\text{ A}$ ; $f = 1\text{ MHz}$	-	-	3	pF

[1] See section "Test information" for resistor calculation and test conditions

[2] Characteristics of built-in transistor

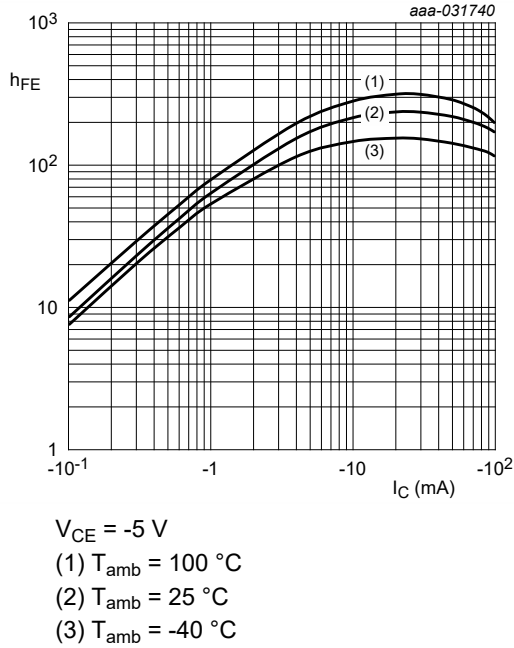


Fig. 4. NHDTA123JU: DC current gain as a function of collector current; typical values

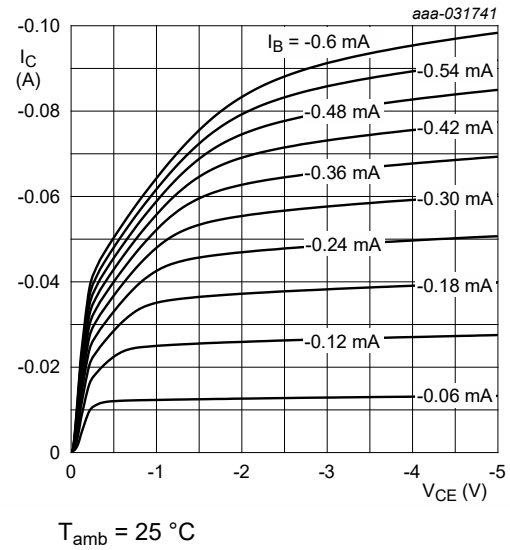


Fig. 5. NHDTA123JU: Collector current as a function of collector-emitter voltage; typical values

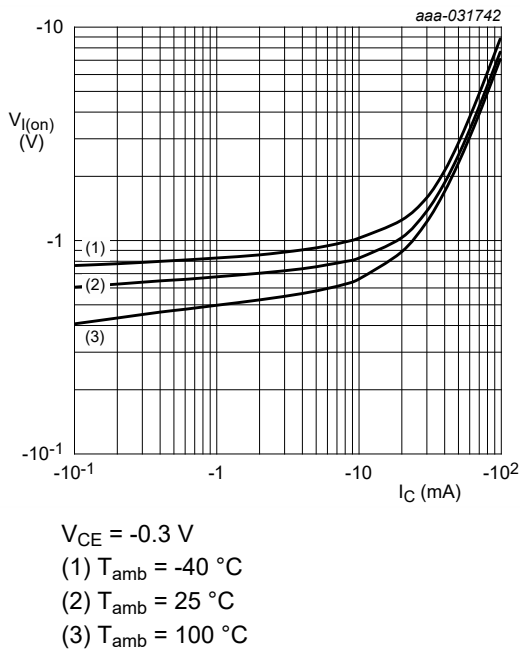


Fig. 6. NHDTA123JU: On-state input voltage as a function of collector current; typical values

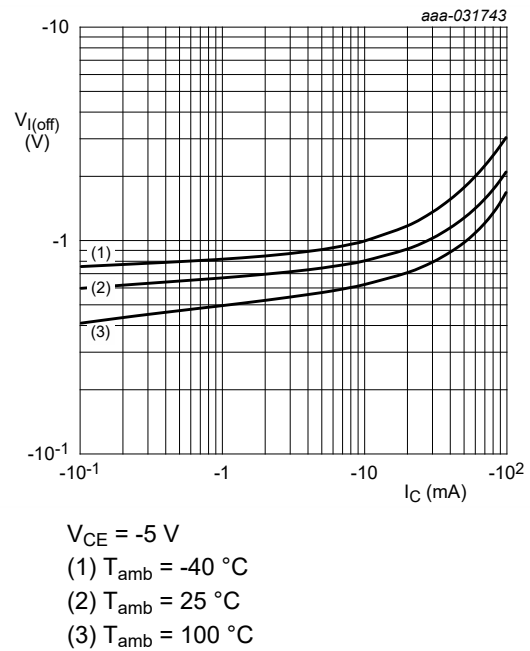
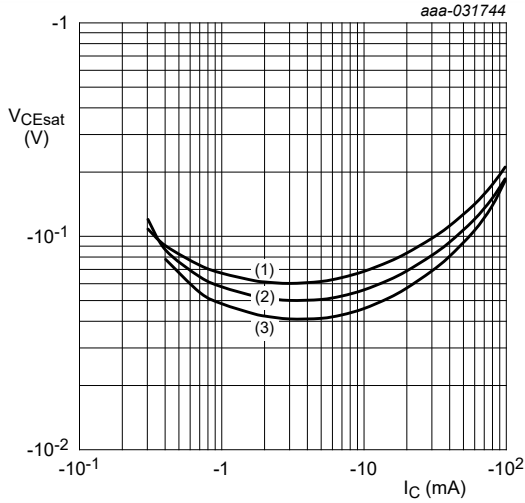


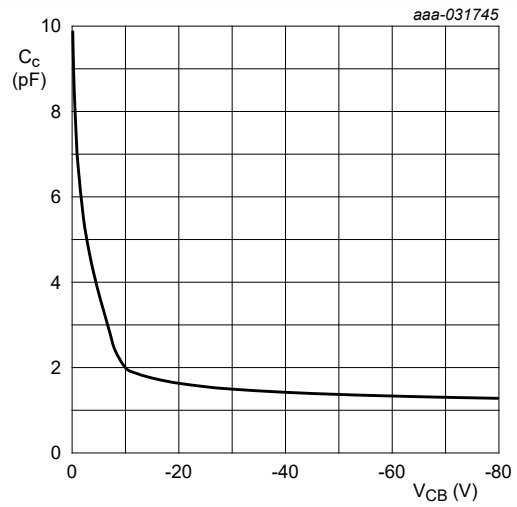
Fig. 7. NHDTA123JU: Off-state input voltage as a function of collector current; typical values



$I_C/I_B = 20$

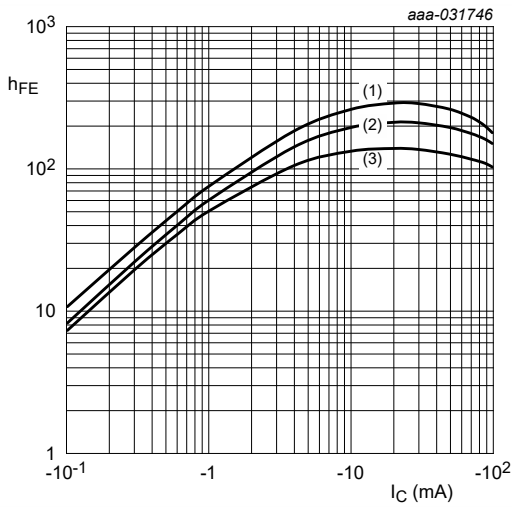
- (1)  $T_{amb} = 100\text{ °C}$
- (2)  $T_{amb} = 25\text{ °C}$
- (3)  $T_{amb} = -40\text{ °C}$

**Fig. 8. NHDTA123JU: Collector-emitter saturation voltage as a function of collector current; typical values**



$f = 1\text{ MHz}$   
 $T_{amb} = 25\text{ °C}$

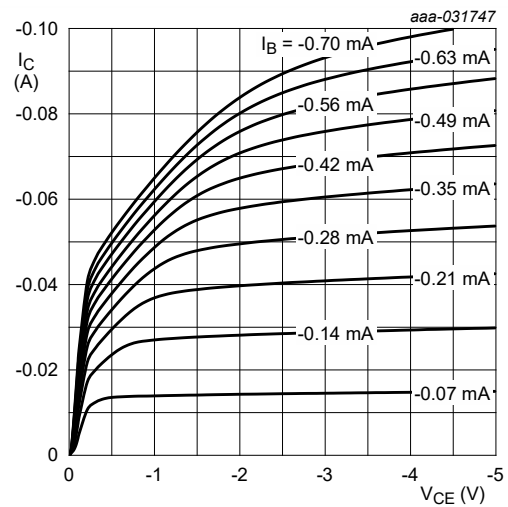
**Fig. 9. NHDTA123JU: Collector capacitance as a function of collector-base voltage; typical values**



$V_{CE} = -5\text{ V}$

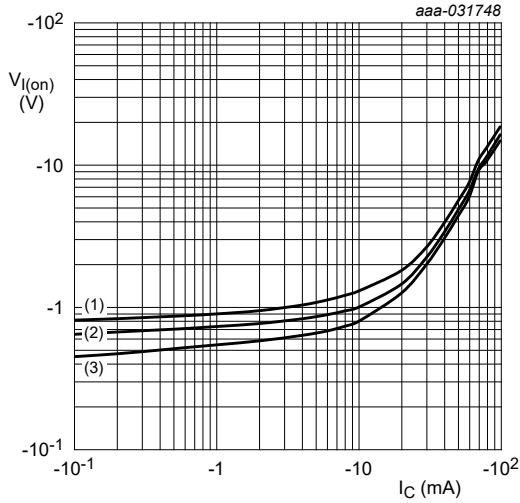
- (1)  $T_{amb} = 100\text{ °C}$
- (2)  $T_{amb} = 25\text{ °C}$
- (3)  $T_{amb} = -40\text{ °C}$

**Fig. 10. NHDTA143ZU: DC current gain as a function of collector current; typical values**



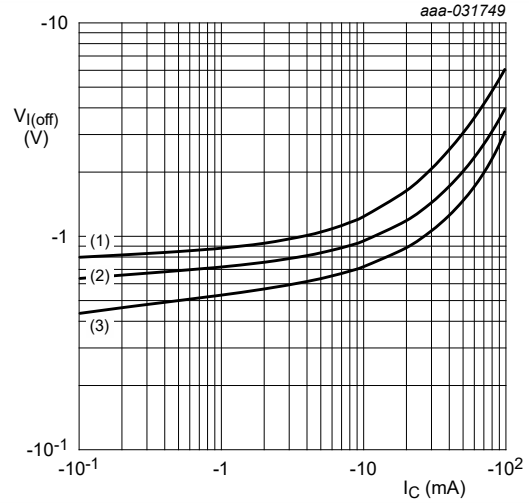
$T_{amb} = 25\text{ °C}$

**Fig. 11. NHDTA143ZU: Collector current as a function of collector-emitter voltage; typical values**



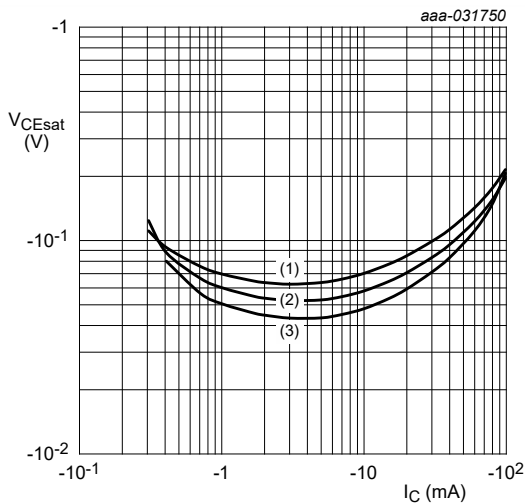
$V_{CE} = -0.3 \text{ V}$   
 (1)  $T_{amb} = -40 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = 100 \text{ }^\circ\text{C}$

**Fig. 12. NHDTA143ZU: On-state input voltage as a function of collector current; typical values**



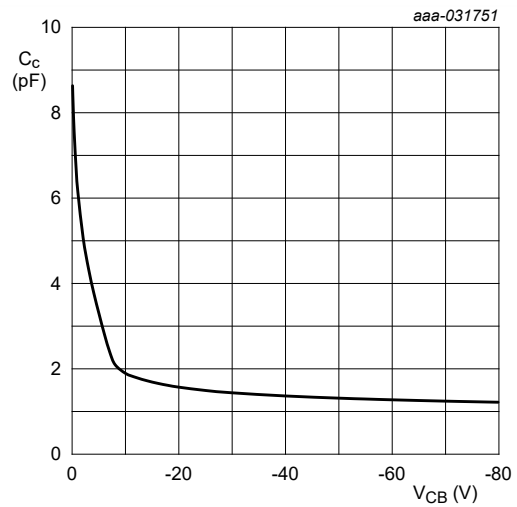
$V_{CE} = -5 \text{ V}$   
 (1)  $T_{amb} = -40 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = 100 \text{ }^\circ\text{C}$

**Fig. 13. NHDTA143ZU: Off-state input voltage as a function of collector current; typical values**



$I_C/I_B = 20$   
 (1)  $T_{amb} = 100 \text{ }^\circ\text{C}$   
 (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$   
 (3)  $T_{amb} = -40 \text{ }^\circ\text{C}$

**Fig. 14. NHDTA143ZU: Collector-emitter saturation voltage as a function of collector current; typical values**



$f = 1 \text{ MHz}$   
 $T_{amb} = 25 \text{ }^\circ\text{C}$

**Fig. 15. NHDTA143ZU: Collector capacitance as a function of collector-base voltage; typical values**



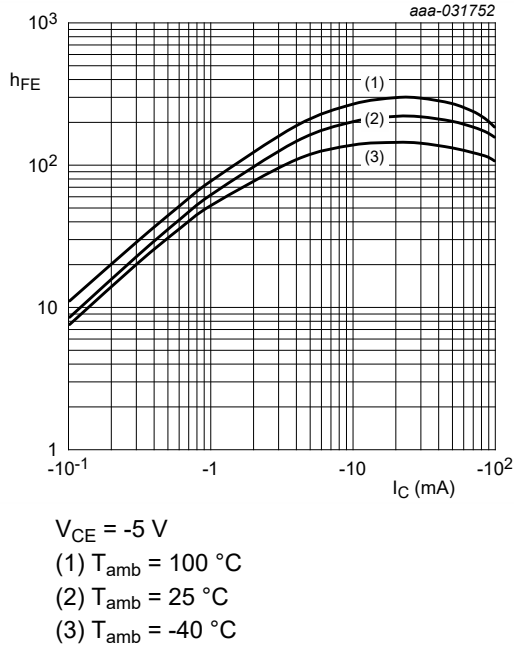


Fig. 16. NHDTA114YU: DC current gain as a function of collector current; typical values

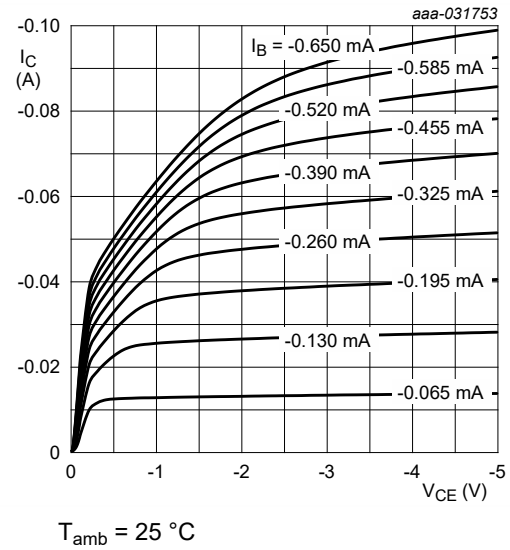


Fig. 17. NHDTA114YU: Collector current as a function of collector-emitter voltage; typical values

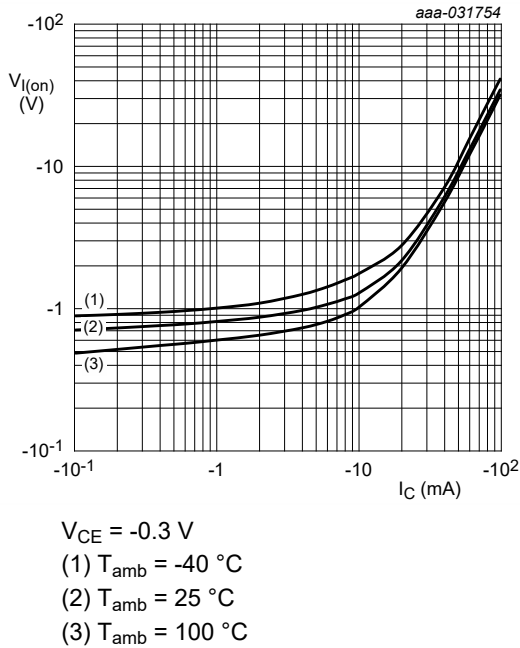


Fig. 18. NHDTA114YU: On-state input voltage as a function of collector current; typical values

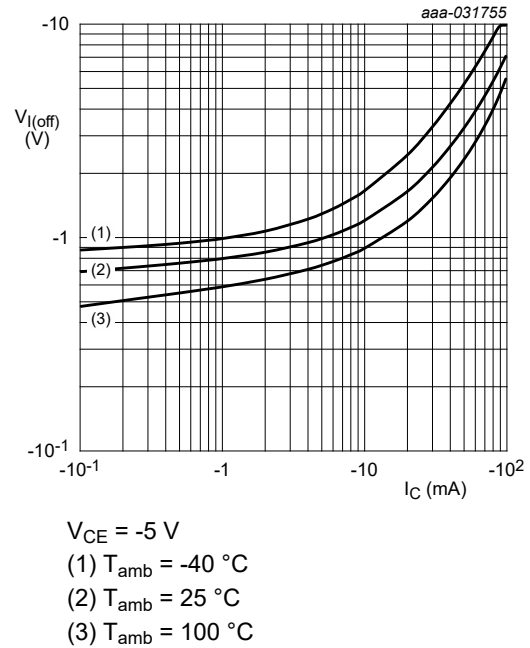
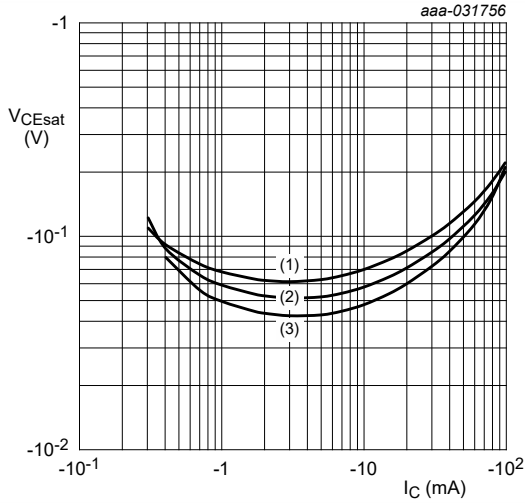


Fig. 19. NHDTA114YU: Off-state input voltage as a function of collector current; typical values



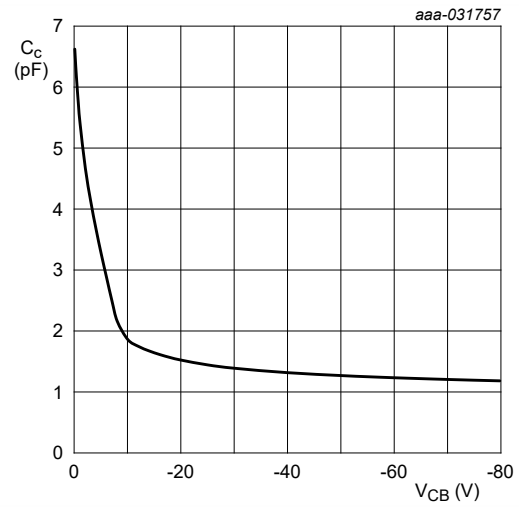
$I_C/I_B = 20$

(1)  $T_{amb} = 100\text{ }^\circ\text{C}$

(2)  $T_{amb} = 25\text{ }^\circ\text{C}$

(3)  $T_{amb} = -40\text{ }^\circ\text{C}$

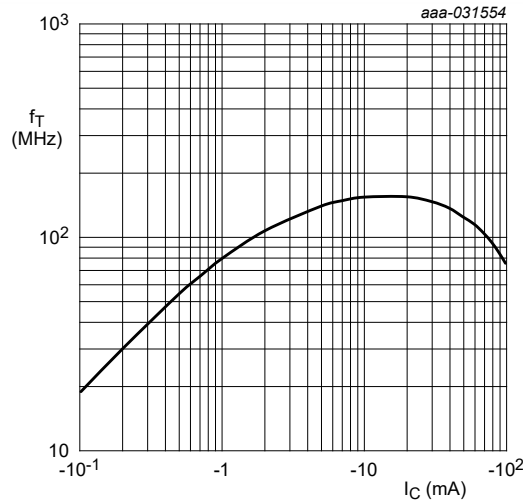
**Fig. 20. NHDTA114YU: Collector-emitter saturation voltage as a function of collector current; typical values**



$f = 1\text{ MHz}$

$T_{amb} = 25\text{ }^\circ\text{C}$

**Fig. 21. NHDTA114YU: Collector capacitance as a function of collector-base voltage; typical values**



$f = 100\text{ MHz}$

$V_{CE} = -5\text{ V}$

$T_{amb} = 25\text{ }^\circ\text{C}$

**Fig. 22. 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.

### Resistor calculation

- Calculation of bias resistor 1 (R1)

$$R1 = \frac{V(I12) - V(I11)}{I12 - I11}$$

- Calculation of bias resistor ratio (R2/R1)

$$\frac{R2}{R1} = \frac{V(I14) - V(I13)}{R1 \cdot (I14 - I13)} - 1$$

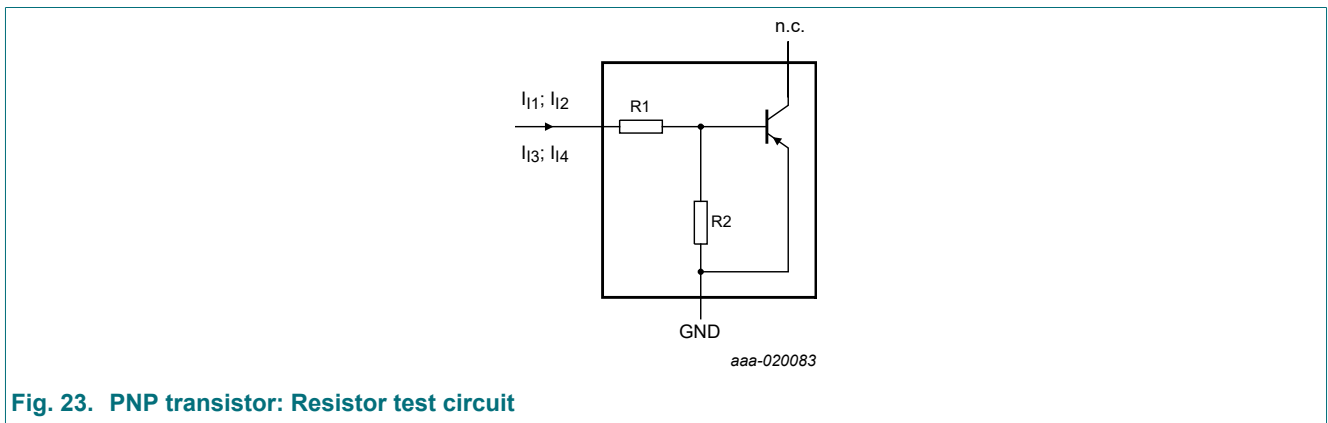


Fig. 23. PNP transistor: Resistor test circuit

### Resistor test conditions

Table 9. Resistor test conditions

Type number	R1 (kΩ)	R2 (kΩ)	Test conditions			
			I <sub>11</sub>	I <sub>12</sub>	I <sub>13</sub>	I <sub>14</sub>
NHDTA123JU	2.2	47	-1.6 mA	-2.4 mA	55 μA	105 μA
NHDTA143ZU	4.7	47	-1.2 mA	-1.8 mA	55 μA	105 μA
NHDTA114YU	10	47	-0.8 mA	-1.1 mA	55 μA	105 μA

## 12. Package outline

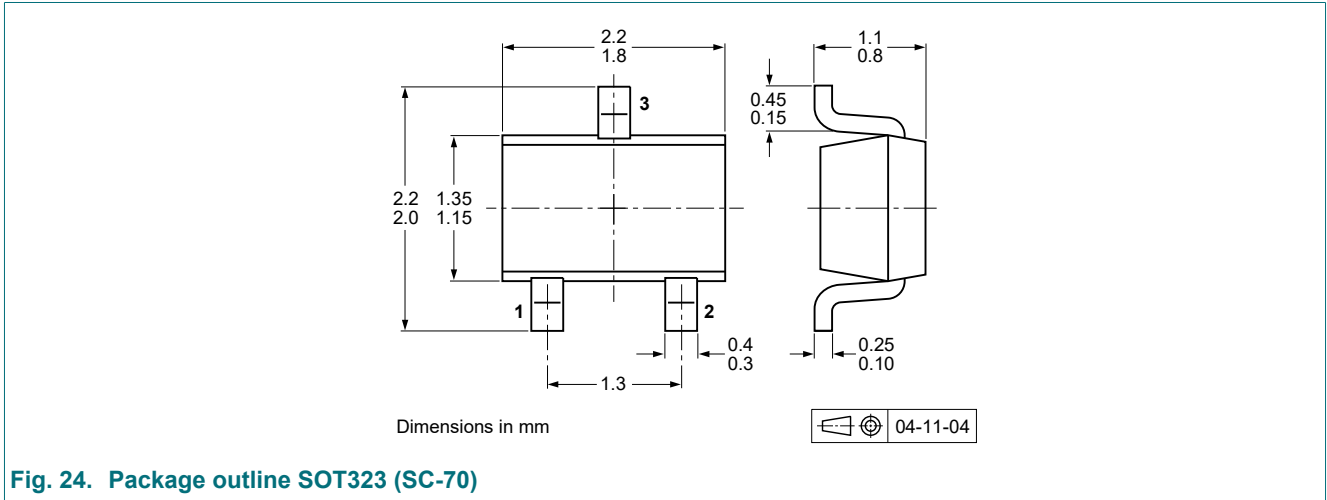


Fig. 24. Package outline SOT323 (SC-70)

### 13. Soldering

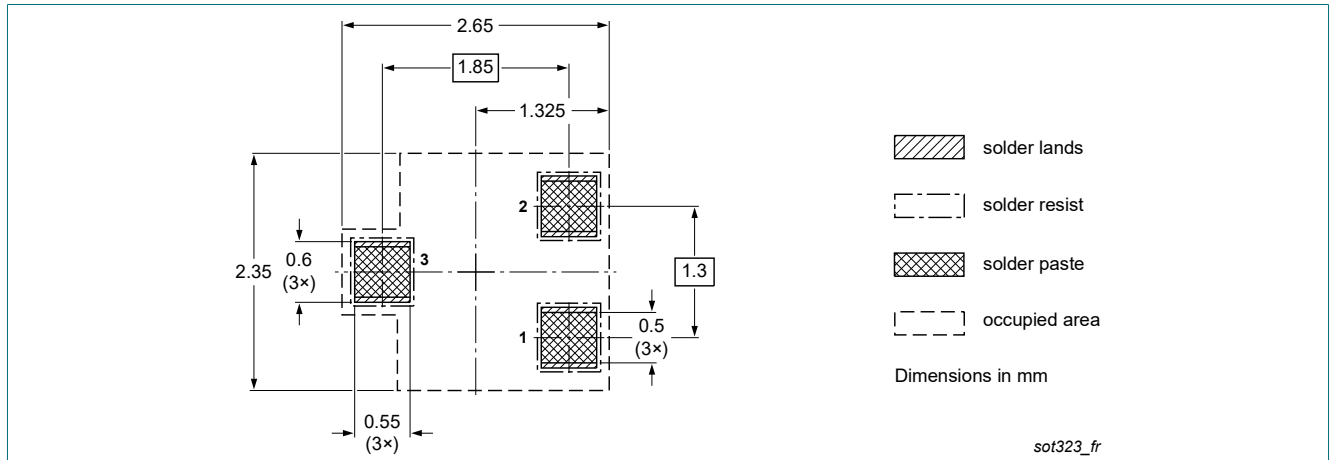


Fig. 25. Reflow soldering footprint for SOT323 (SC-70)

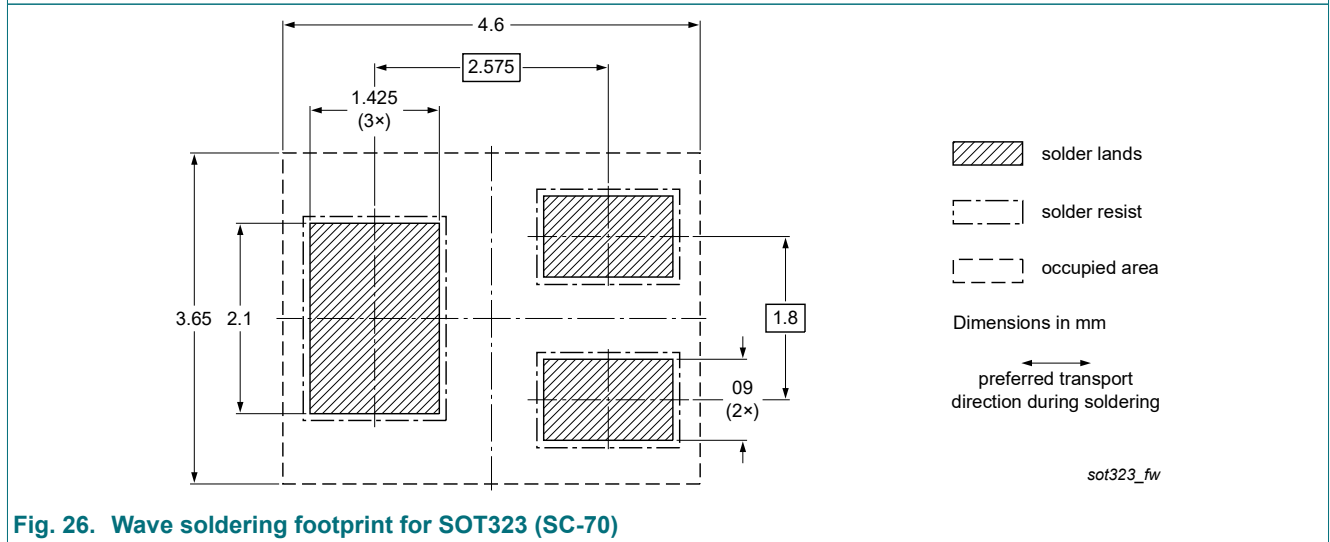


Fig. 26. Wave soldering footprint for SOT323 (SC-70)

## 14. Revision history

Table 10. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
NHDTA123JU_143ZU_114YU_SER v.1	20200716	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.

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