



NHDTC144EU-Q

80 V, 100 mA NPN resistor-equipped transistor

9 August 2023

Product data sheet

1. General description

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

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
- Qualified according to AEC-Q101 and recommended for use in automotive applications

3. Applications

- Digital applications
- Cost saving alternative for BC846 series in digital applications
- Controlling IC inputs
- Switching loads

4. Quick reference data

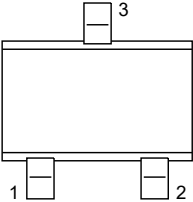
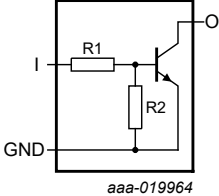
Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{CEO}	collector-emitter voltage	open base		-	-	80	V
I_O	output current			-	-	100	mA
R1	bias resistor 1 (input)	$T_{amb} = 25\text{ °C}$	[1]	33	47	61	k Ω
R2/R1	bias resistor ratio		[1]	0.8	1	1.2	

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

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	I	input (base)	 SC-70 (SOT323)	 aaa-019964
2	G	GND (emitter)		
3	O	output (collector)		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
NHDTC144EU-Q	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]
NHDTC144EU-Q	5S%

[1] % = placeholder for manufacturing site code

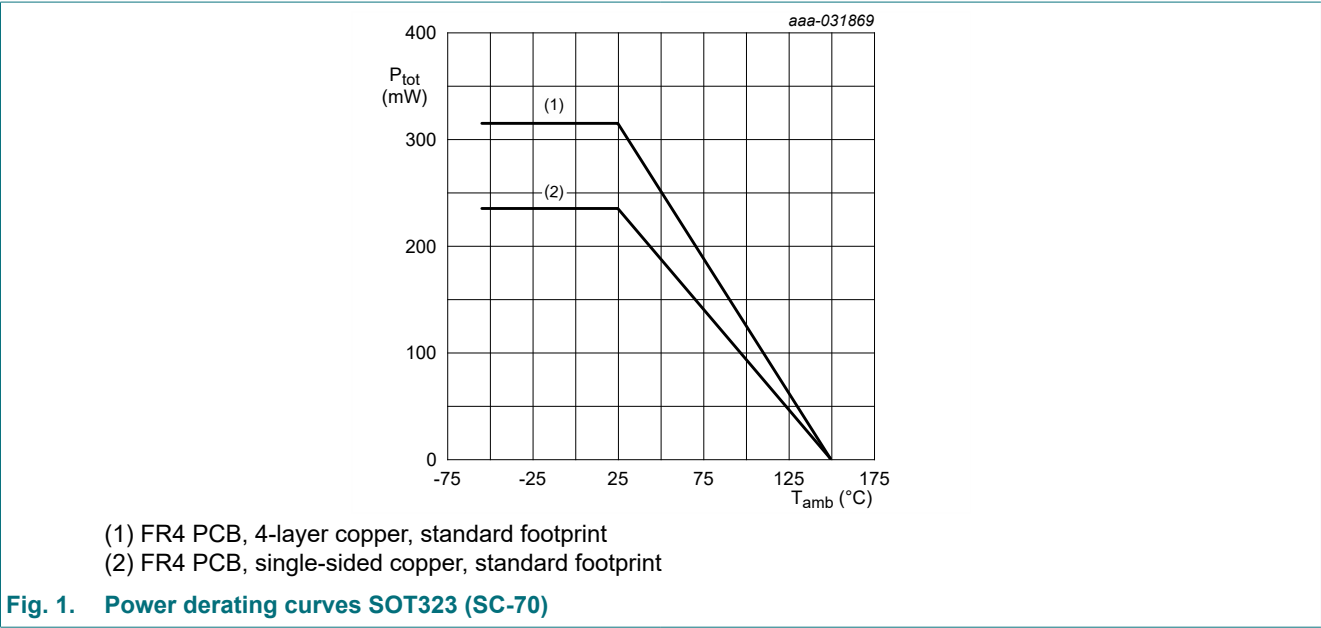
8. Limiting values

Table 5. Limiting values

Tamb = 25 °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		-	10	V
V _I	input voltage			-10	80	V
I _O	output current			-	100	mA
P _{tot}	total power dissipation	T _{amb} ≤ 25 °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 (PCB);4-layer copper, tin-plated and standard footprint.



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

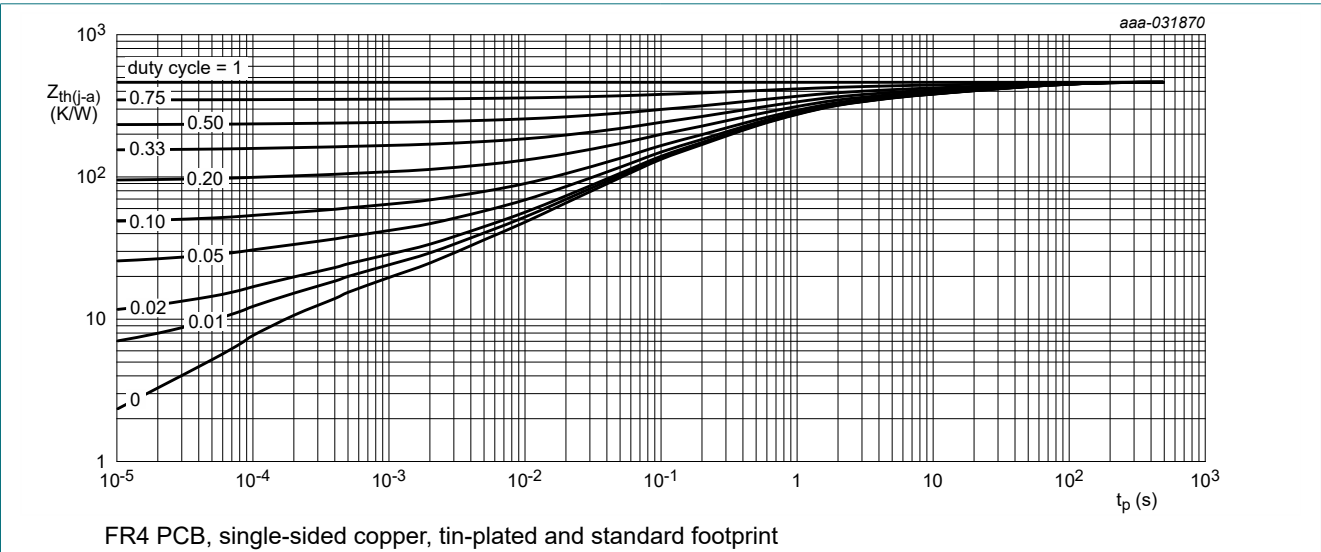


Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

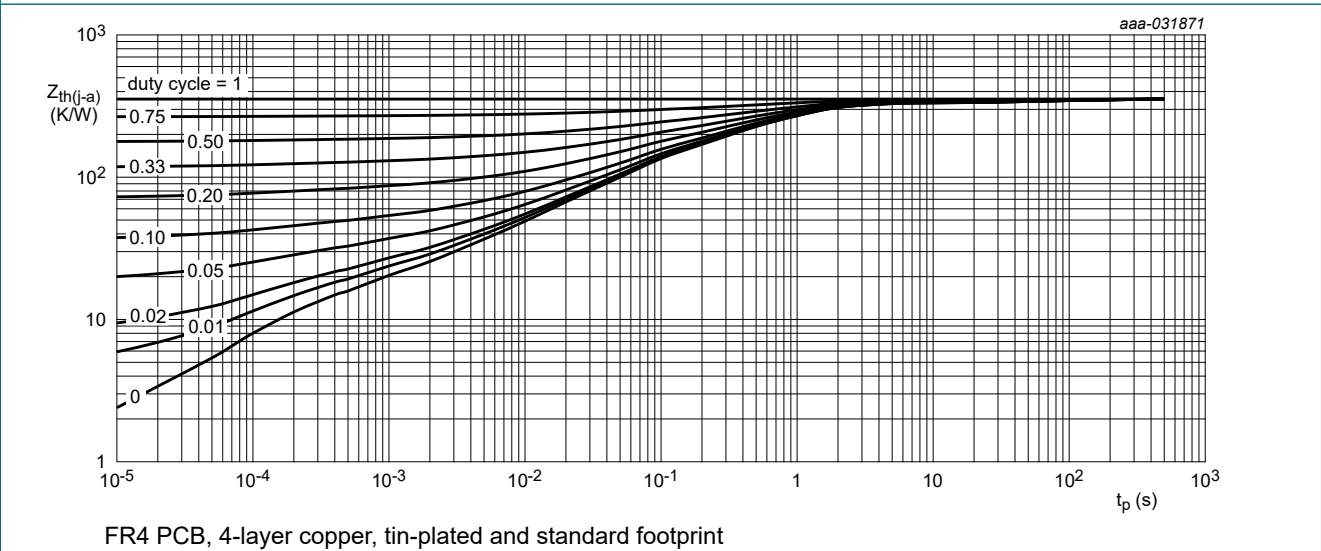


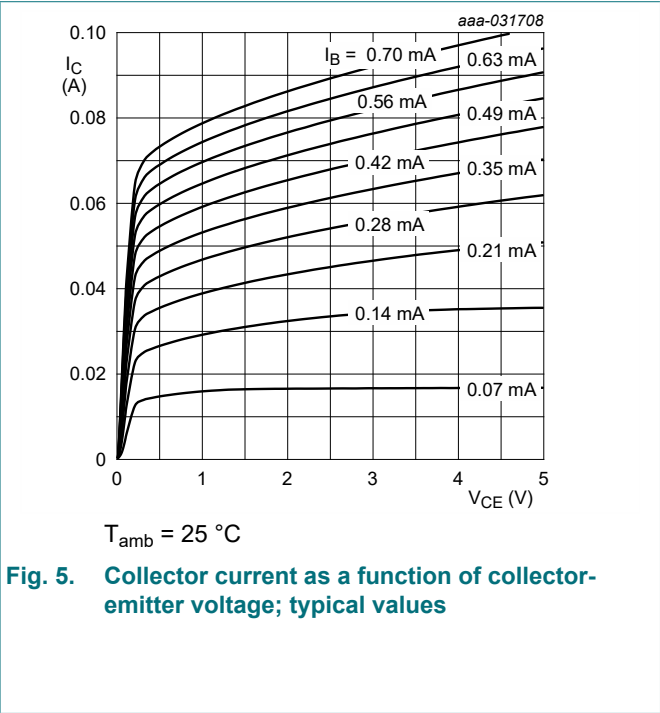
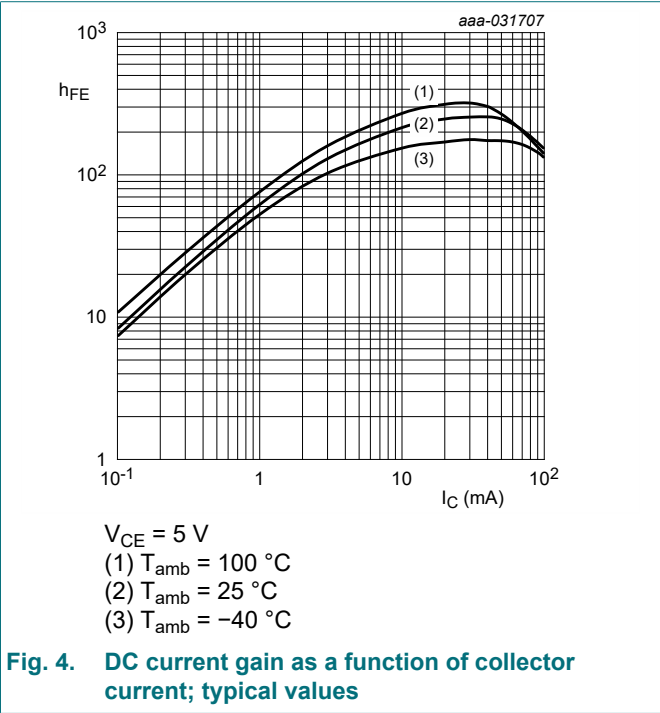
Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{(BR)CBO}$	collector-base breakdown voltage	$I_C = 100\text{ }\mu\text{A}$; $I_E = 0\text{ A}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$	80	-	-	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	$I_C = 2\text{ mA}$; $I_B = 0\text{ A}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$	80	-	-	V
I_{CBO}	collector-base cut-off current	$V_{CB} = 80\text{ V}$; $I_E = 0\text{ A}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$	-	-	100	nA
I_{CEO}	collector-emitter cut-off current	$V_{CE} = 60\text{ V}$; $I_B = 0\text{ A}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$	-	-	100	nA
		$V_{CE} = 60\text{ V}$; $I_B = 0\text{ A}$; $T_j = 150\text{ }^{\circ}\text{C}$	-	-	5	μA
I_{EBO}	emitter-base cut-off current	$V_{EB} = 7\text{ V}$; $I_C = 0\text{ A}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$	-	-	130	μA
h_{FE}	DC current gain	$V_{CE} = 5\text{ V}$; $I_C = 10\text{ mA}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$	100	-	-	
V_{CEsat}	collector-emitter saturation voltage	$I_C = 10\text{ mA}$; $I_B = 0.5\text{ mA}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$	-	-	100	mV
$V_{I(off)}$	off-state input voltage	$V_{CE} = 5\text{ V}$; $I_C = 100\text{ }\mu\text{A}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$	-	1.15	0.8	V
$V_{I(on)}$	on-state input voltage	$V_{CE} = 0.3\text{ V}$; $I_C = 10\text{ mA}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$	5	3.3	-	V
R1	bias resistor 1 (input)	$T_{amb} = 25\text{ }^{\circ}\text{C}$	[1]	33	47	61 k Ω
R2/R1	bias resistor ratio		[1]	0.8	1	1.2
C_c	collector capacitance	$V_{CB} = 10\text{ V}$; $I_E = 0\text{ A}$; $i_e = 0\text{ A}$; $f = 1\text{ MHz}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$	-	-	2.5	pF
f_T	transition frequency	$V_{CE} = 5\text{ V}$; $I_C = 10\text{ mA}$; $f = 100\text{ MHz}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$	[2]	-	170	MHz

[1] See section "Test information" for resistor calculation and test conditions
[2] Characteristics of built-in transistor



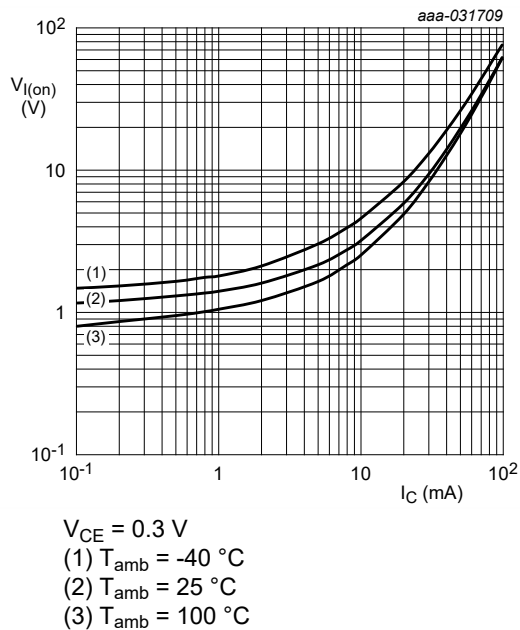


Fig. 6. On-state input voltage as a function of collector current; typical values

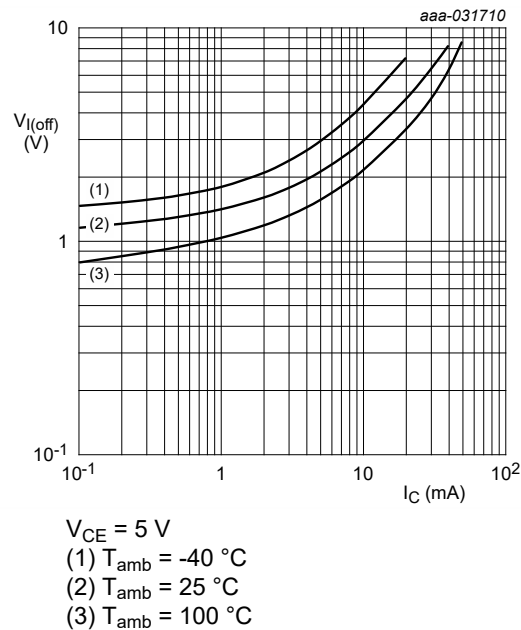


Fig. 7. Off-state input voltage as a function of collector current; typical values

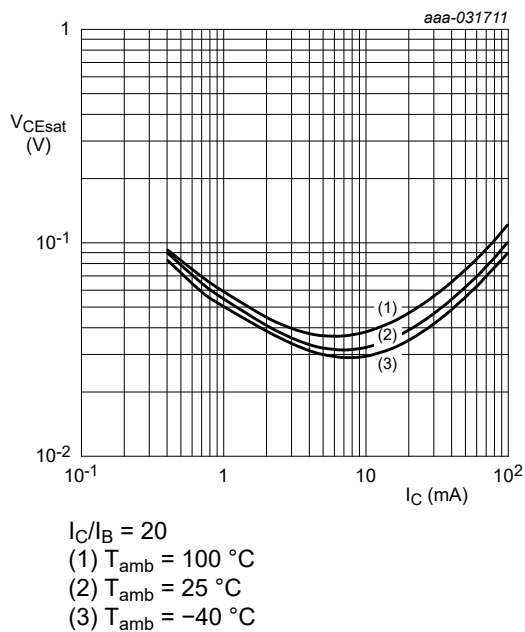


Fig. 8. Collector-emitter saturation voltage as a function of collector current; typical values

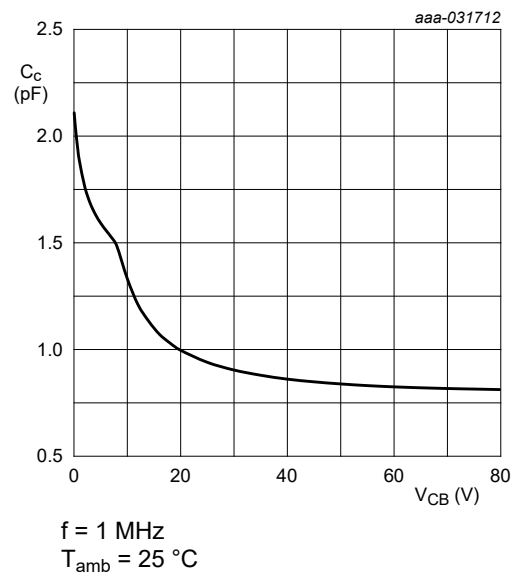
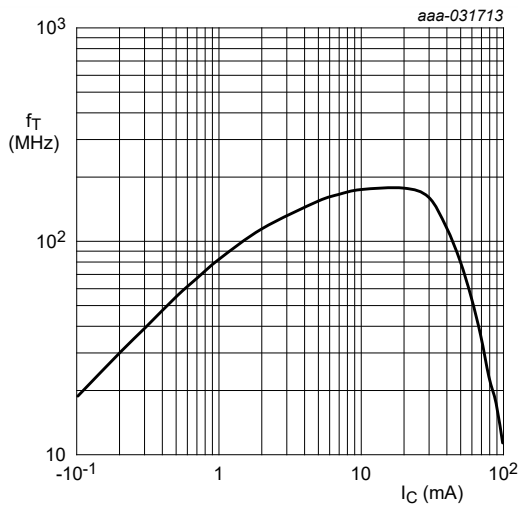


Fig. 9. Collector capacitance as a function of collector-base voltage; typical values



$f = 100\text{ MHz}$; $V_{CE} = 5\text{ V}$ $T_{amb} = 25\text{ }^{\circ}\text{C}$

Fig. 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.

Resistor calculation

- Calculation of bias resistor 1 (R1):

$$R_1 = \frac{V(I_2) - V(I_1)}{I_2 - I_1}$$

- Calculation of bias resistor ratio (R2/R1):

$$\frac{R_2}{R_1} = \frac{V(I_4) - V(I_3)}{R_1 \cdot (I_4 - I_3)} - 1$$

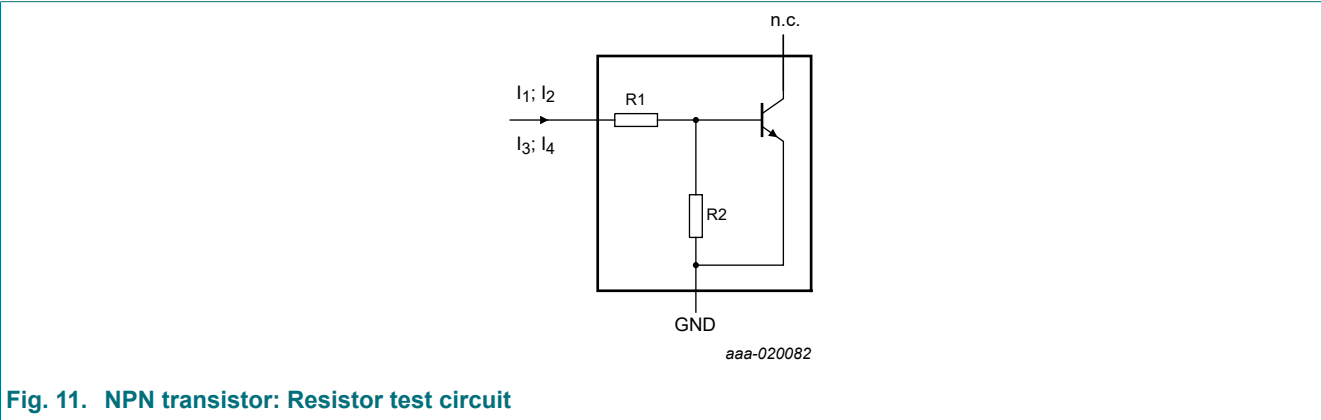


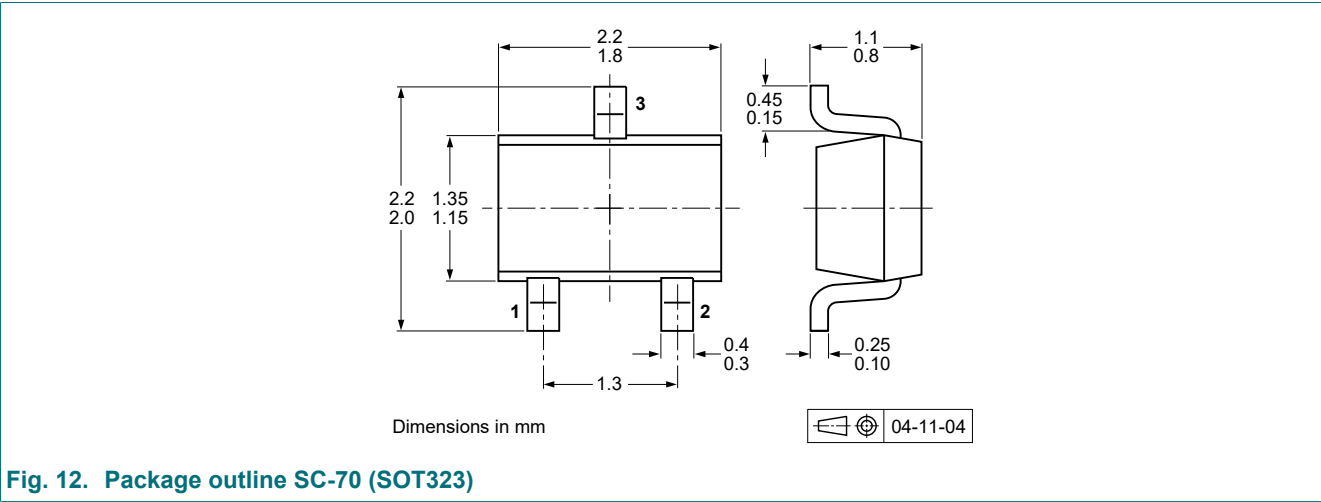
Fig. 11. NPN transistor: Resistor test circuit

Resistor test conditions

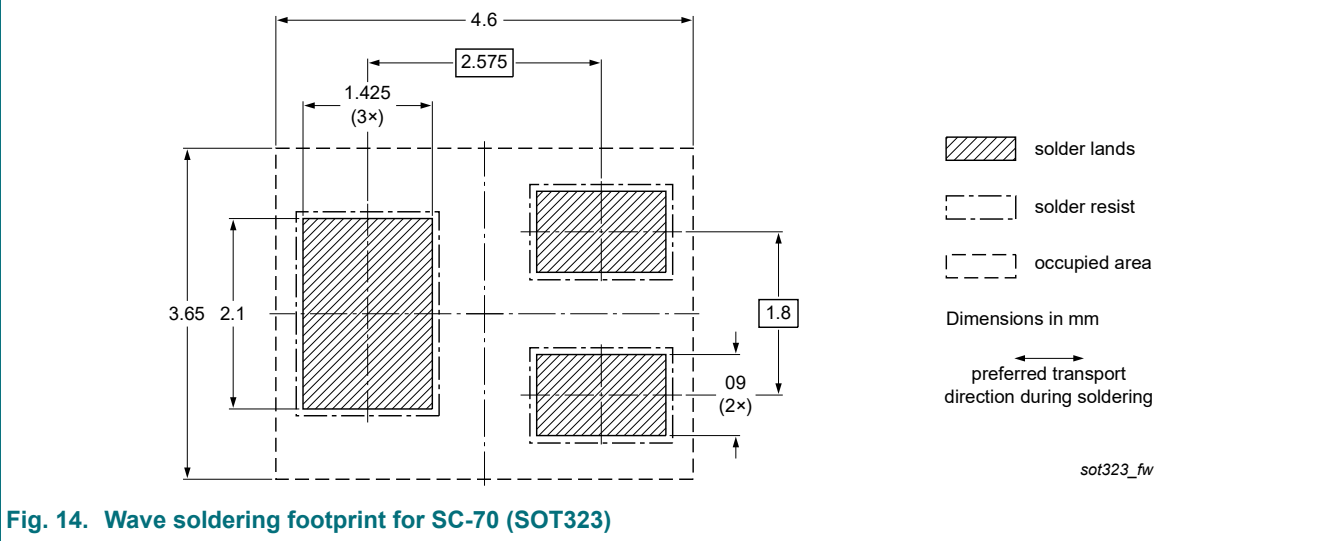
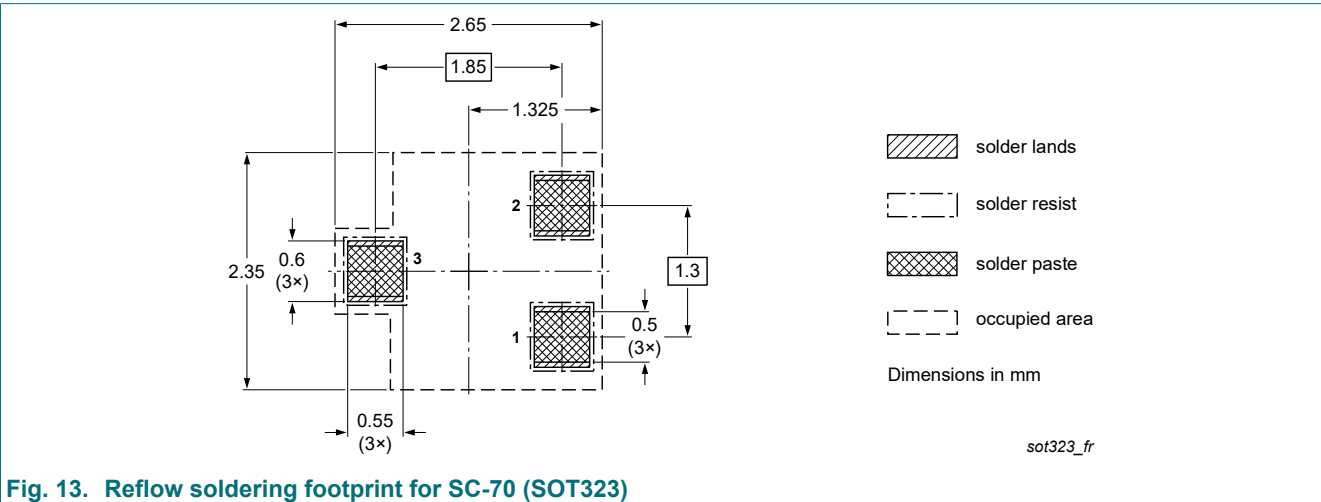
Table 8. Resistor test conditions

Type number	R1 (kΩ)	R2 (kΩ)	Test conditions			
			I ₁	I ₂	I ₃	I ₄
NHDTC144EU-Q	47	47	250 μA	350 μA	-55 μA	-105 μA

12. Package outline



13. Soldering



14. Revision history

Table 9. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
NHDTC144EU-Q v.1	20230809	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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