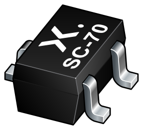

NHDTC144EU-Q

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 °C	[1]	33	47	61	kΩ
R2/R1	bias resistor ratio		[1]	0.8	1	1.2	

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

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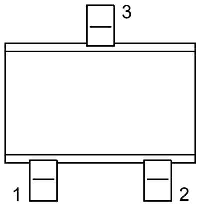
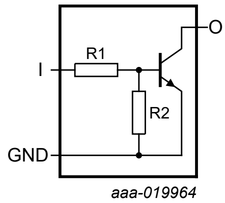
5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	I	input (base)	 SC-70 (SOT323)	
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

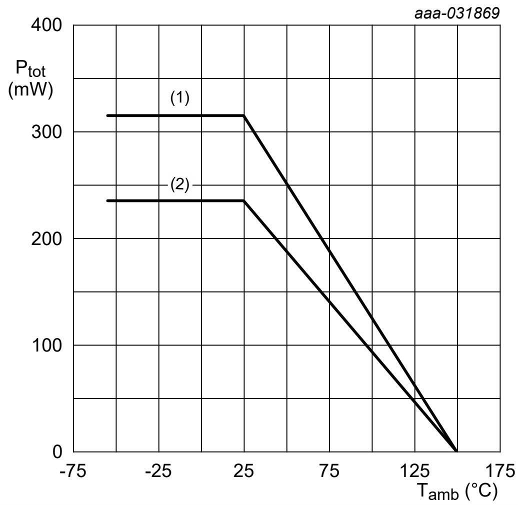
8. Limiting values

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	$T_{amb} \leq$ 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.



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

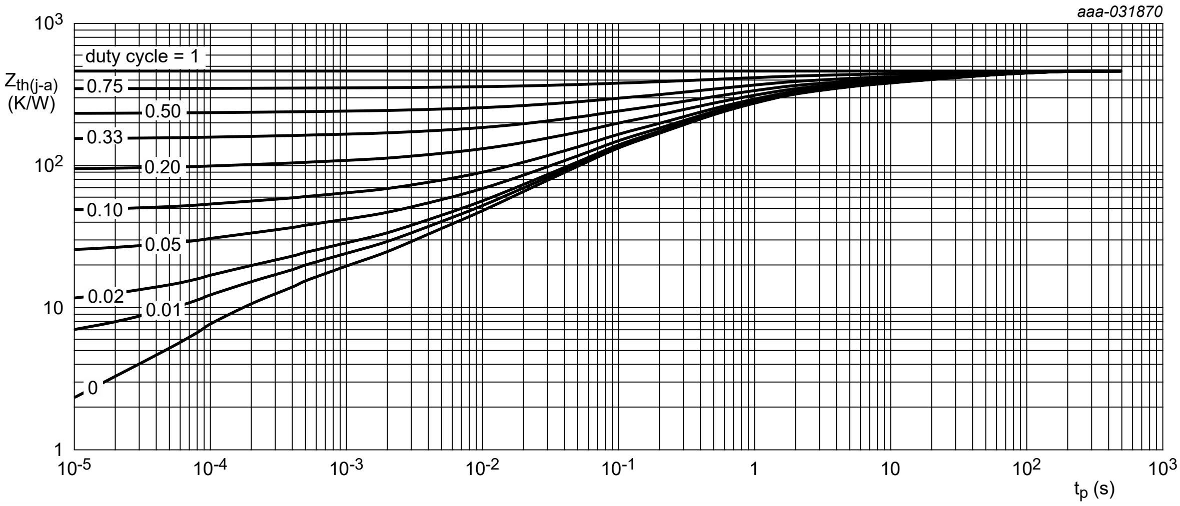
Fig. 1. Power derating curves SOT323 (SC-70)

9. Thermal characteristics

Table 6. Thermal characteristics

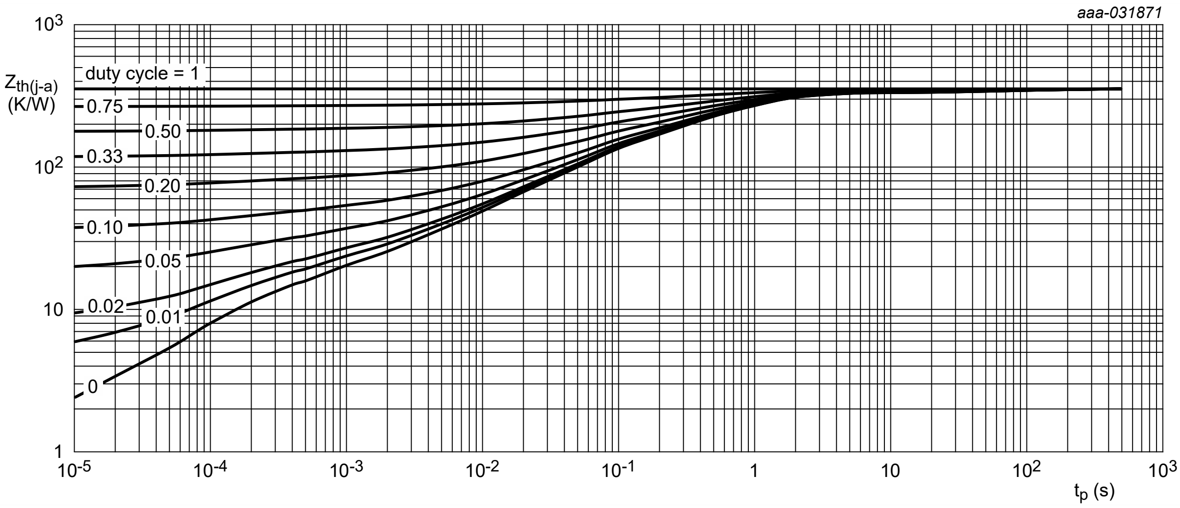
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	532	K/W
			[2]	-	-	397	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	-	150	K/W

[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.



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; typical values



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

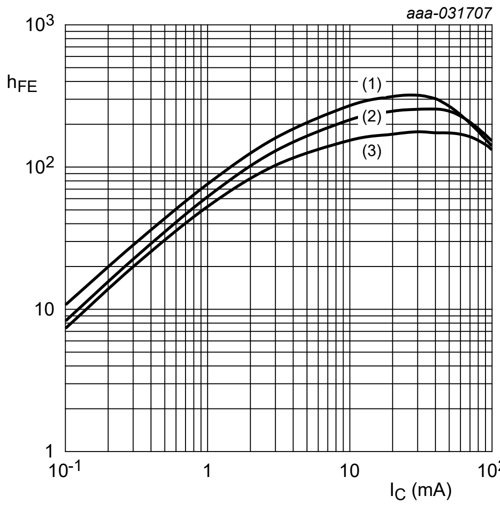
Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

10. Characteristics

Table 7. Characteristics

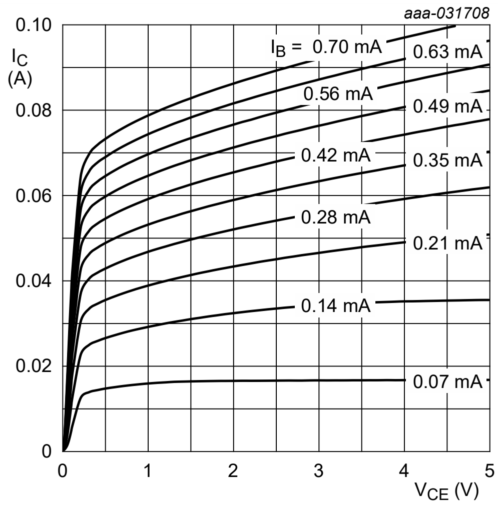
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 100 µA; I_E = 0 A; T_{amb} = 25 °C		80	-	-	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	I_C = 2 mA; I_B = 0 A; T_{amb} = 25 °C		80	-	-	V
I_{CBO}	collector-base cut-off current	V_{CB} = 80 V; I_E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

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



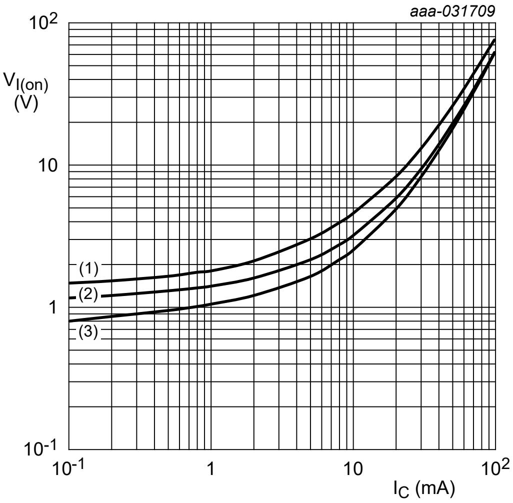
V_{CE} = 5 V
(1) T_{amb} = 100 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = −40 °C

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



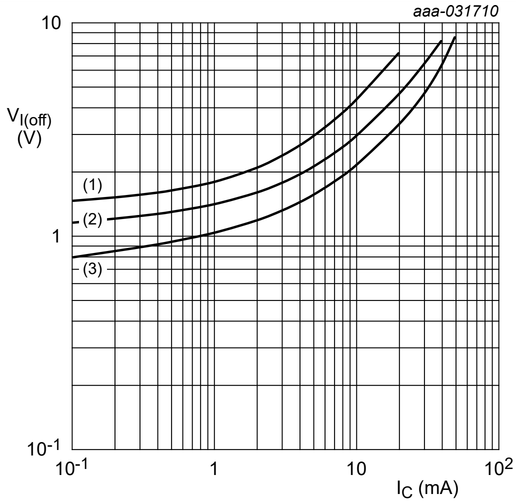
T_{amb} = 25 °C

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



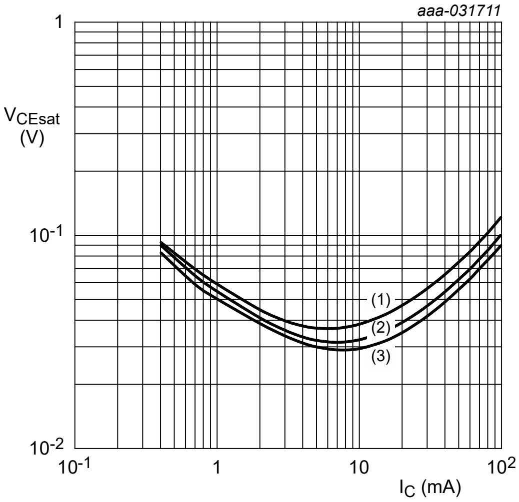
V_{CE} = 0.3 V
(1) T_{amb} = -40 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = 100 °C

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



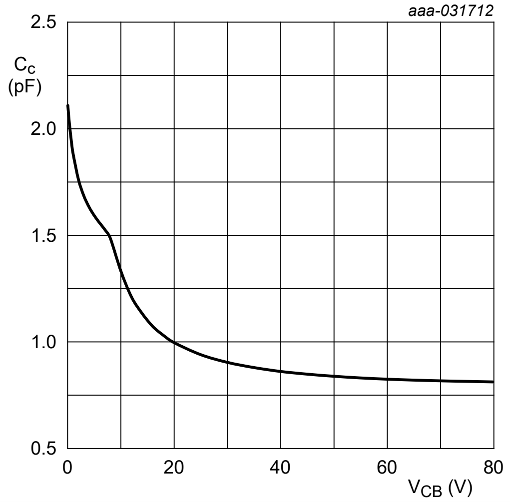
V_{CE} = 5 V
(1) T_{amb} = -40 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = 100 °C

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



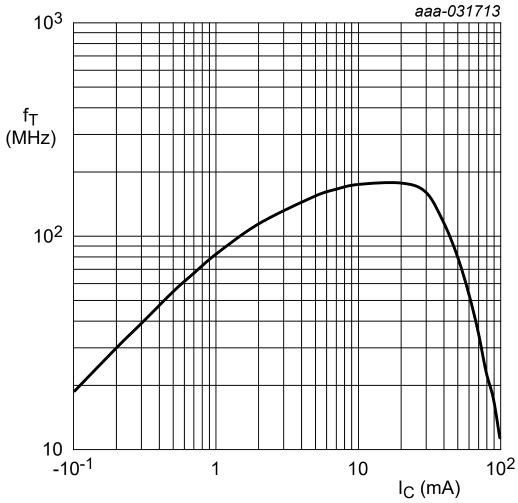
I_C/I_B = 20
(1) T_{amb} = 100 °C
(2) T_{amb} = 25 °C
(3) T_{amb} = −40 °C

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



f = 1 MHz
T_{amb} = 25 °C

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



f = 100 MHz; V_{CE} = 5 V T_{amb} = 25 °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):

$$\frac{R2}{R1} = \frac{V(I_4) - V(I_3)}{R1 \cdot (I_4 - I_3)} - 1$$

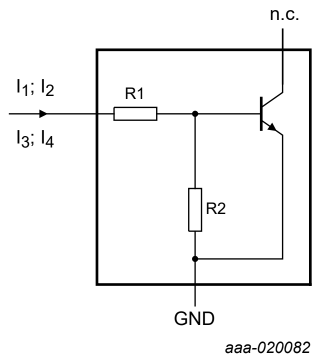


Fig. 11. NPN transistor: Resistor test circuit

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

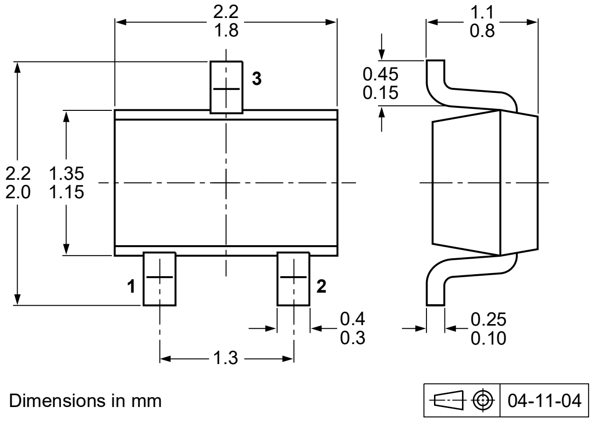


Fig. 12. Package outline SC-70 (SOT323)

13. Soldering

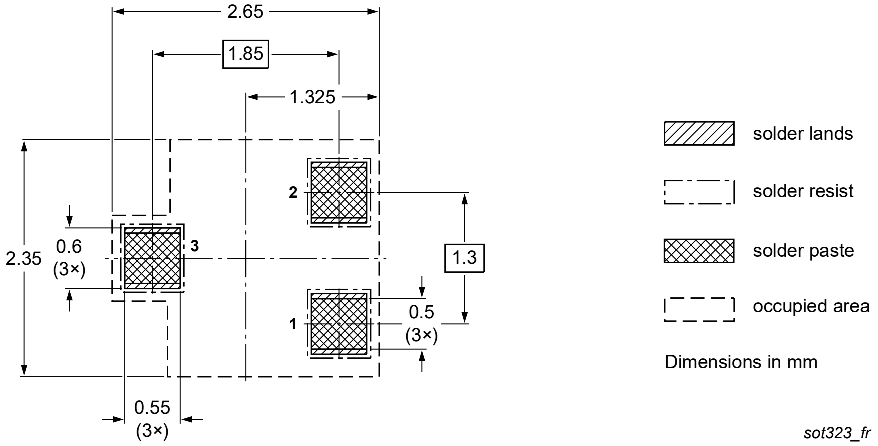


Fig. 13. Reflow soldering footprint for SC-70 (SOT323)

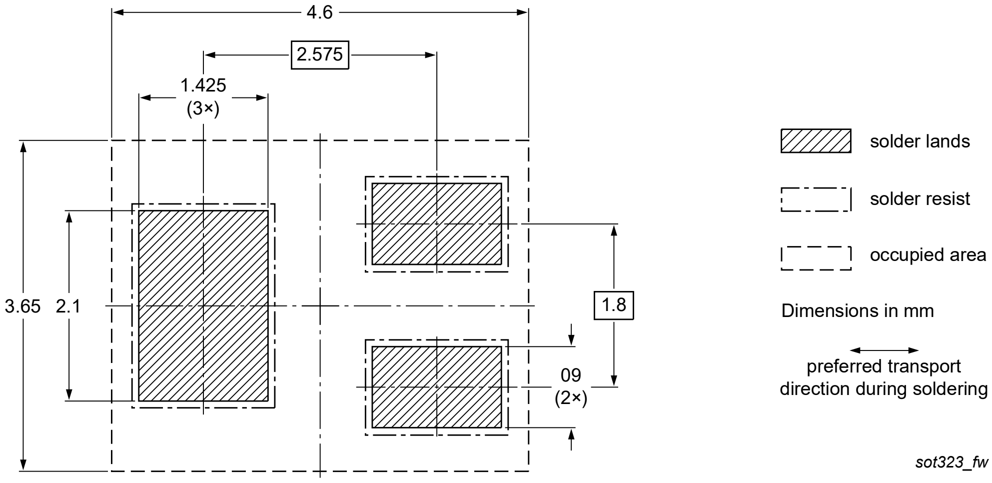


Fig. 14. Wave soldering footprint for SC-70 (SOT323)

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.

[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 https://www.nexperia.com.

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Date of release: 9 August 2023

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