

ANTREX Electronics

Electronic Components Sourcing Information

Product Reference Information

Part Number: NHDTA114ETR
Manufacturer: Nexperia USA Inc.
Package: TO-236-3, SC-59, SOT-23-3
Availability: Please confirm with sales

Product Page:

<https://antrexco.com/product/details/nexperia-usa-inc/nhdt114etr.html>

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Note:

This PDF includes an ANTREX product reference cover page.

The original manufacturer datasheet follows from the next page.



NHDTA114/124/144ET series

80 V, 100 mA PNP resistor-equipped transistors

Rev. 1 — 26 June 2020

Product data sheet

1. General description

PNP Resistor-Equipped Transistor (RET) family in a small SOT23 (TO-236AB) Surface-Mounted Device (SMD) plastic package.

Table 1. Product overview

Type number	R1	R2	Package		NPN complement:
	k Ω	k Ω	Nexperia	JEDEC	
NHDTA114ET	10	10	SOT23	TO-236AB	NHDTC114ET
NHDTA124ET	22	22			NHDTC124ET
NHDTA144ET	47	47			NHDTC144ET

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

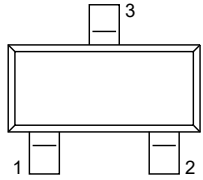
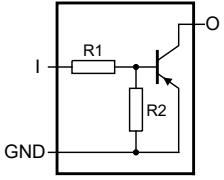
Table 2. Quick reference data

$T_{amb} = 25\text{ }^{\circ}\text{C}$ 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)		 aaa-019606
2	GND	GND (emitter)		
3	O	output (collector)		

6. Ordering information

Table 4. Ordering information

Type number	Package		
	Name	Description	Version
NHDTA114ET	TO-236AB	plastic surface-mounted package; 3 leads	SOT23
NHDTA124ET			
NHDTA144ET			

7. Marking

Table 5. Marking

Type number	Marking code [1]
NHDTA114ET	QA%
NHDTA124ET	QD%
NHDTA144ET	QF%

[1] % = placeholder for manufacturing site code

8. Limiting values

Table 6. Limiting values

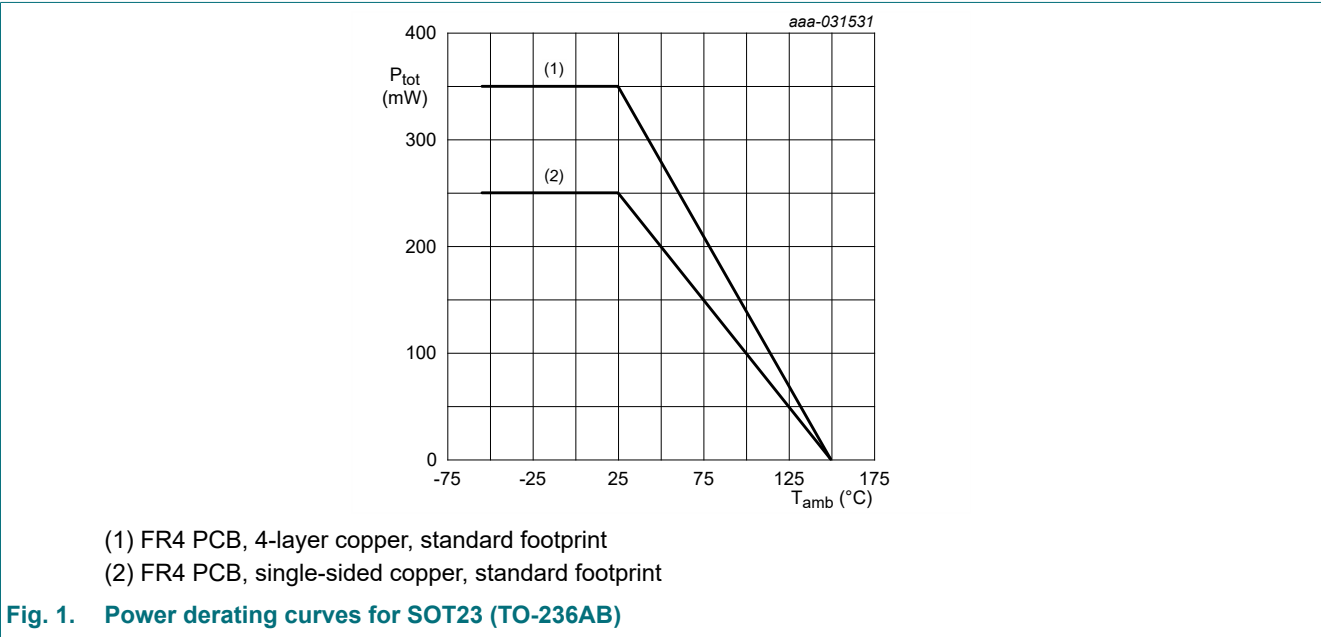
In accordance with the Absolute Maximum Rating System (IEC 60134).

$T_{amb} = 25\text{ °C}$ 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	-	-10	V	
V _I	input voltage					
	NHDTA114ET		-40	+10	V	
	NHDTA124ET		-60	+10	V	
	NHDTA144ET		-80	+10	V	
I _O	output current		-	-100	mA	
P _{tot}	total power dissipation	T _{amb} ≤ 25 °C	[1]	-	250	mW
			[2]	-	350	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.



9. Thermal characteristics

Table 7. Thermal characteristics

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

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	500	K/W
			[2]	-	-	357	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	-	130	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.

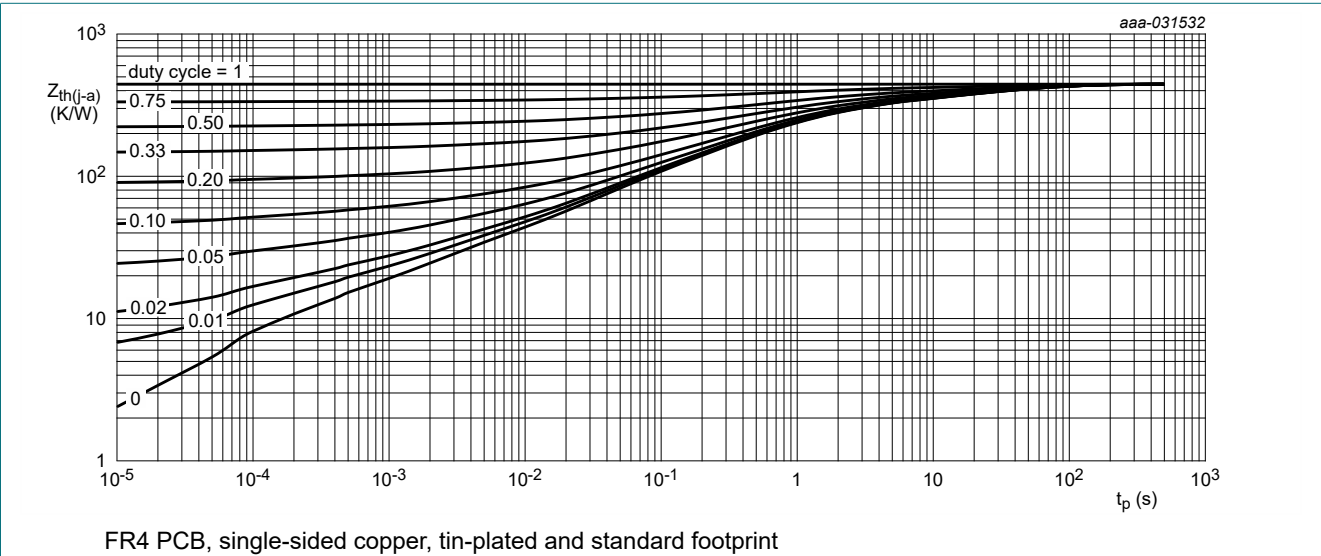


Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

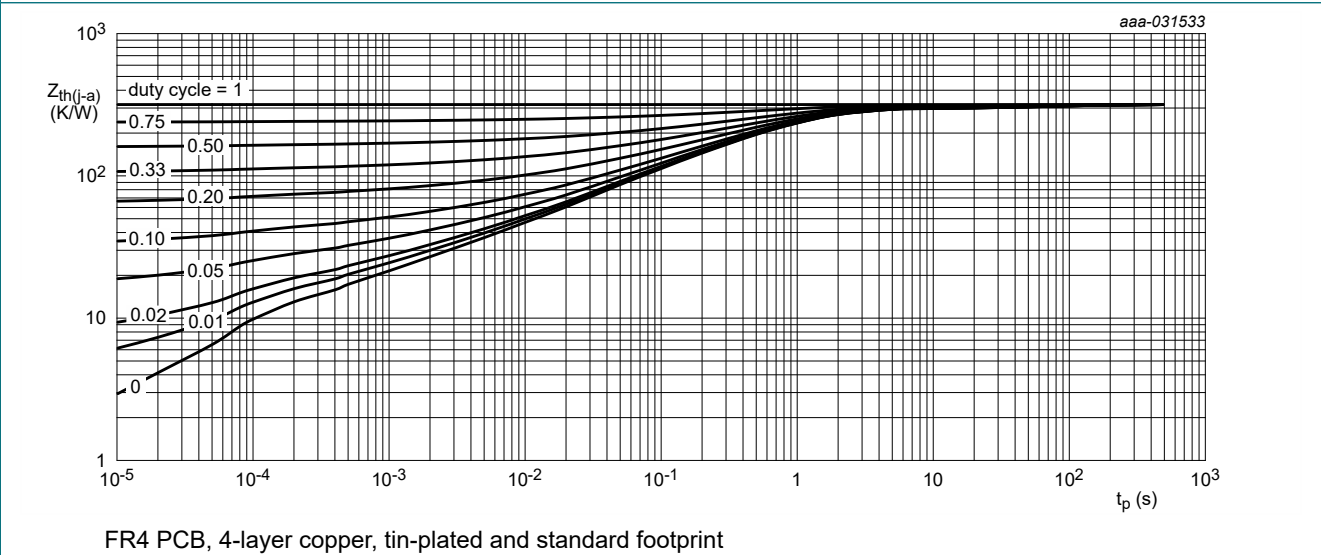


Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

10. Characteristics

Table 8. Characteristics

$T_{amb} = 25\text{ }^{\circ}\text{C}$ 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
		$V_{CE} = -60\text{ V}$; $I_B = 0\text{ A}$; $T_j = 150\text{ }^{\circ}\text{C}$	-	-	-5	μA
I_{EBO}	emitter-base cut-off current					
	NHDTA114ET	$V_{EB} = -7\text{ V}$; $I_C = 0\text{ A}$	-	-	-600	μA
	NHDTA124ET		-	-	-270	μA
	NHDTA144ET		-	-	-130	μA
h_{FE}	DC current gain					
	NHDTA114ET	$V_{CE} = -5\text{ V}$; $I_C = -10\text{ mA}$	50	-	-	
	NHDTA124ET		70	-	-	
	NHDTA144ET		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	$V_{CE} = -5\text{ V}$; $I_C = -100\text{ }\mu\text{A}$	-	-1.15	-0.8	V
$V_{I(on)}$	on-state input voltage					
	NHDTA114ET	$V_{CE} = -0.3\text{ V}$; $I_C = -10\text{ mA}$	-2.5	-1.8	-	V
	NHDTA124ET		-3	-2.3	-	V
	NHDTA144ET		-5	-3.3	-	V
R1	bias resistor 1 (input)		[1]			
	NHDTA114ET		7	10	13	k Ω
	NHDTA124ET		15.4	22	28.6	k Ω
	NHDTA144ET		33	47	61	k Ω
R2/R1	bias resistor ratio	[1]	0.8	1	1.2	
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	$V_{CB} = -10\text{ V}$; $I_E = I_C = 0\text{ A}$; $f = 1\text{ MHz}$	-	-	3	pF

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

[2] Characteristics of built-in transistor

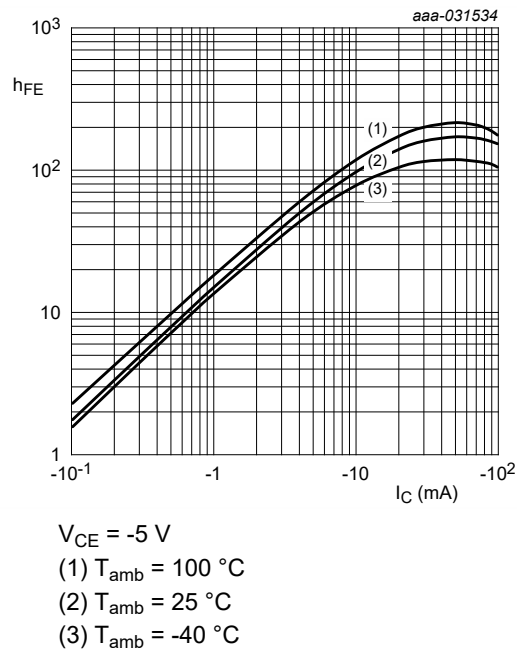


Fig. 4. NHDTA114ET: DC current gain as a function of collector current; typical values

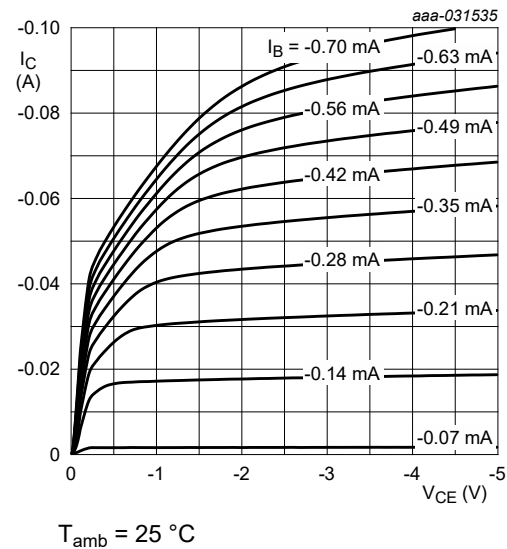


Fig. 5. NHDTA114ET: Collector current as a function of collector-emitter voltage; typical values

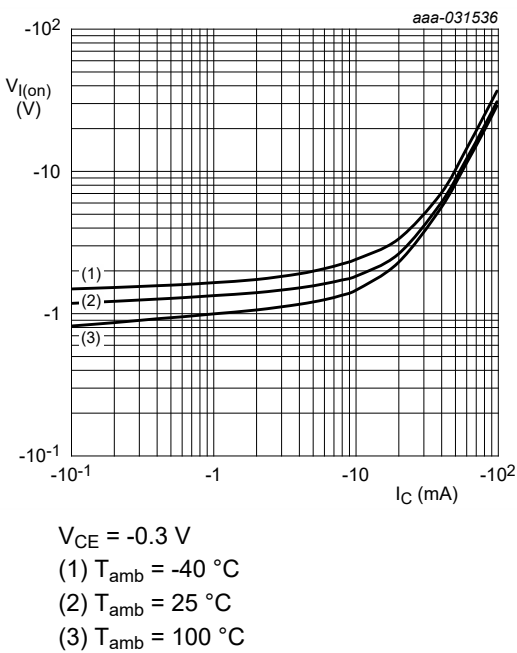


Fig. 6. NHDTA114ET: On-state input voltage as a function of collector current; typical values

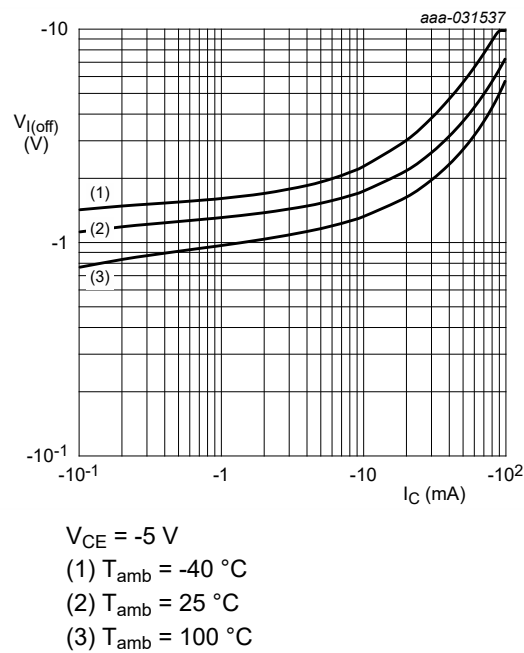
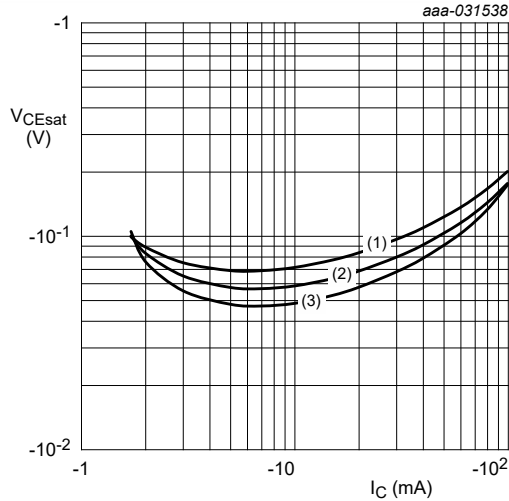


Fig. 7. NHDTA114ET: Off-state input voltage as a function of collector current; typical values



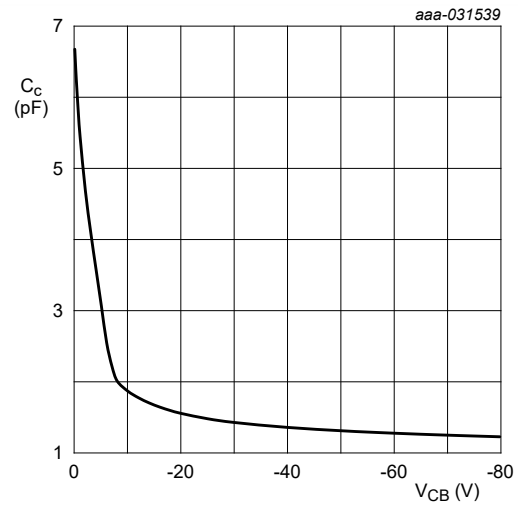
$$I_C/I_B = 20$$

(1) $T_{amb} = 100\text{ °C}$

(2) $T_{amb} = 25\text{ °C}$

(3) $T_{amb} = -40\text{ °C}$

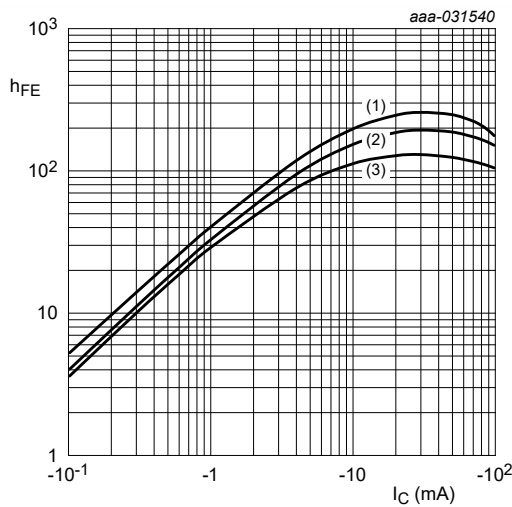
Fig. 8. NHDTA114ET: Collector-emitter saturation voltage as a function of collector current; typical values



$f = 1\text{ MHz}$

$T_{amb} = 25\text{ °C}$

Fig. 9. NHDTA114ET: Collector capacitance as a function of collector-base voltage; typical values



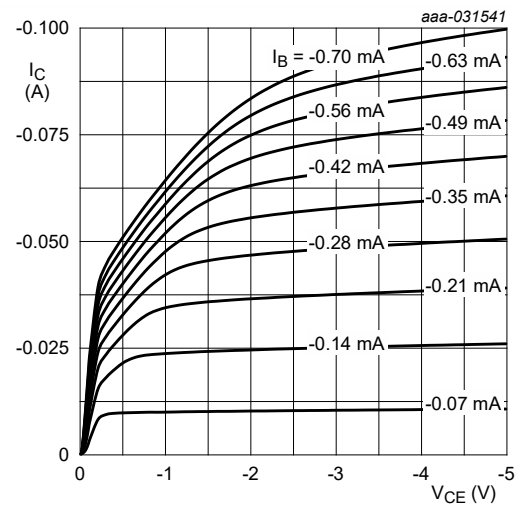
$$V_{CE} = -5\text{ V}$$

(1) $T_{amb} = 100\text{ °C}$

(2) $T_{amb} = 25\text{ °C}$

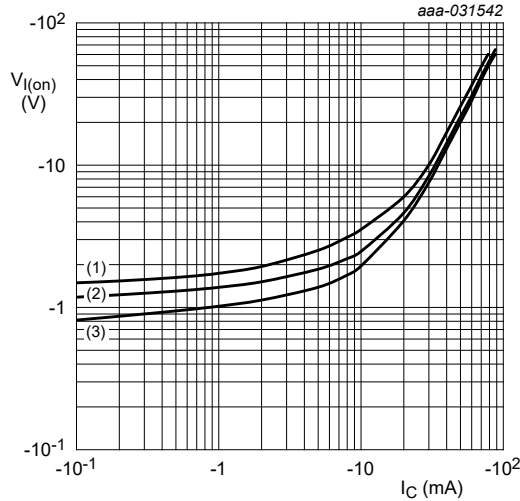
(3) $T_{amb} = -40\text{ °C}$

Fig. 10. NHDTA124ET: DC current gain as a function of collector current; typical values



$T_{amb} = 25\text{ °C}$

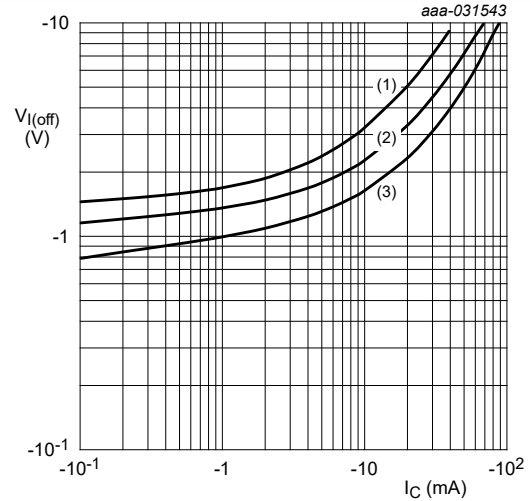
Fig. 11. NHDTA124ET: Collector current as a function of collector-emitter voltage; typical values



$V_{CE} = -0.3 \text{ V}$

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

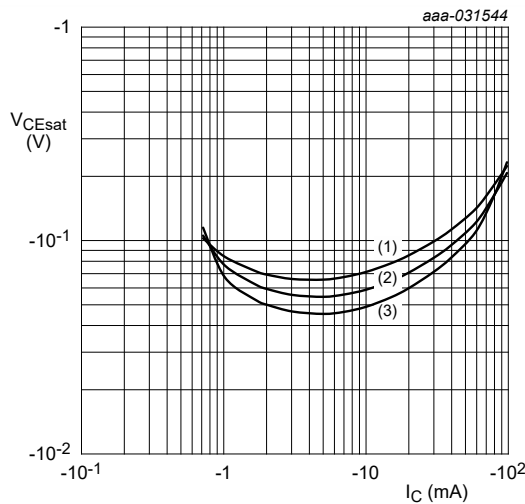
Fig. 12. NHDTA124ET: On-state input voltage as a function of collector current; typical values



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

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

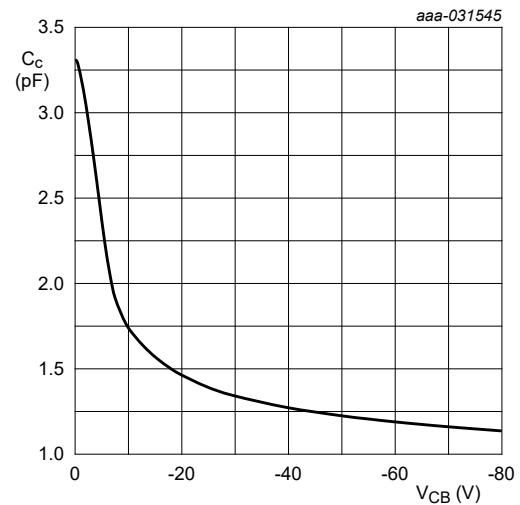
Fig. 13. NHDTA124ET: Off-state input voltage as a function of collector current; typical values



$I_C/I_B = 20$

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

Fig. 14. NHDTA124ET: Collector-emitter saturation voltage as a function of collector current; typical values



$f = 1 \text{ MHz}$

$T_{amb} = 25 \text{ °C}$

Fig. 15. NHDTA124ET: Collector capacitance as a function of collector-base voltage; typical values

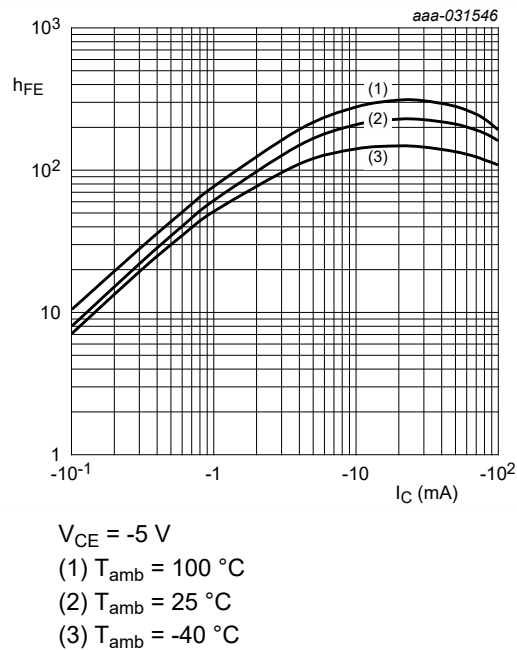


Fig. 16. NHDTA144ET: DC current gain as a function of collector current; typical values

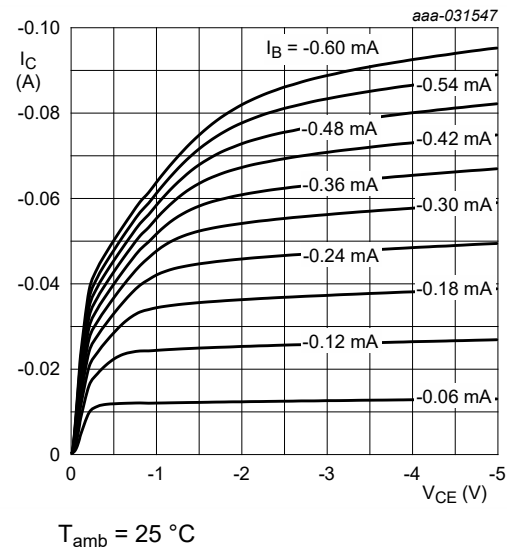


Fig. 17. NHDTA144ET: Collector current as a function of collector-emitter voltage; typical values

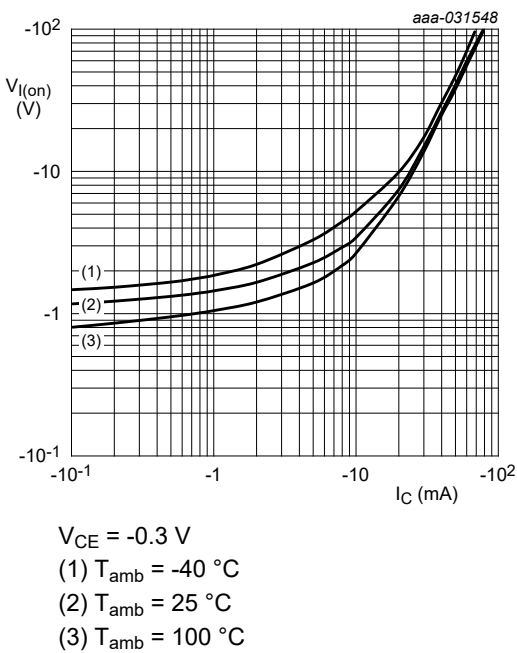


Fig. 18. NHDTA144ET: On-state input voltage as a function of collector current; typical values

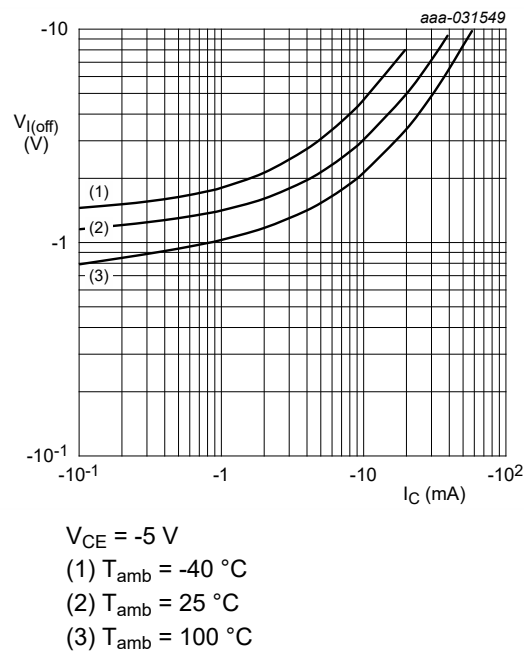


Fig. 19. NHDTA144ET: Off-state input voltage as a function of collector current; typical values

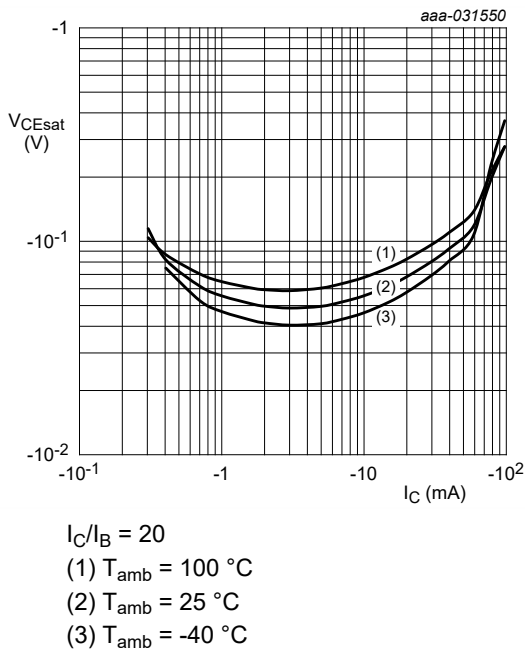


Fig. 20. NHDTA144ET: Collector-emitter saturation voltage as a function of collector current; typical values

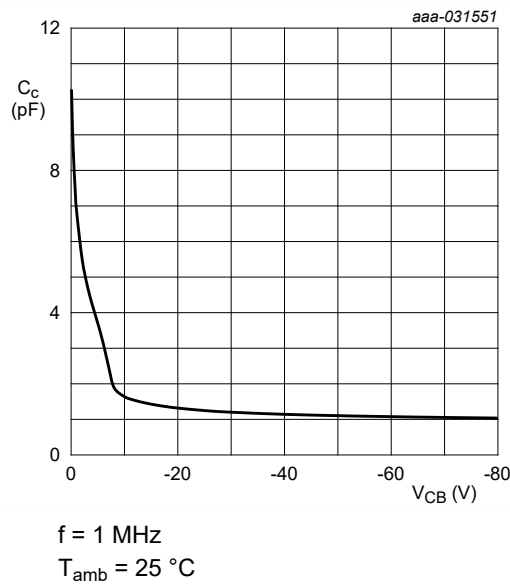


Fig. 21. NHDTA144ET: Collector capacitance as a function of collector-base voltage; typical values of built-in transistor

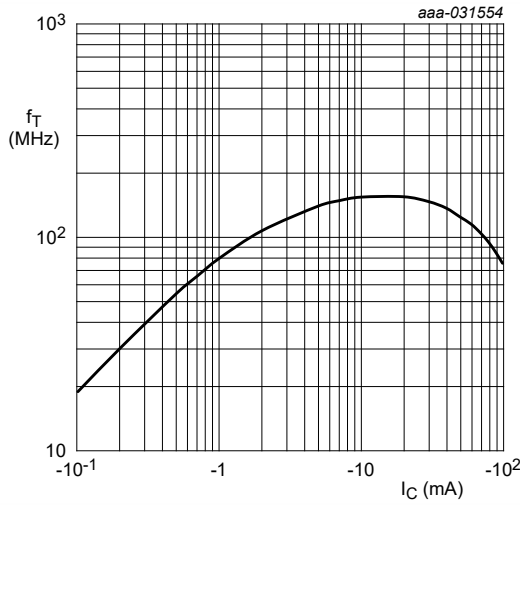


Fig. 22. Transition frequency as a function of collector current; typical values of built-in transistor

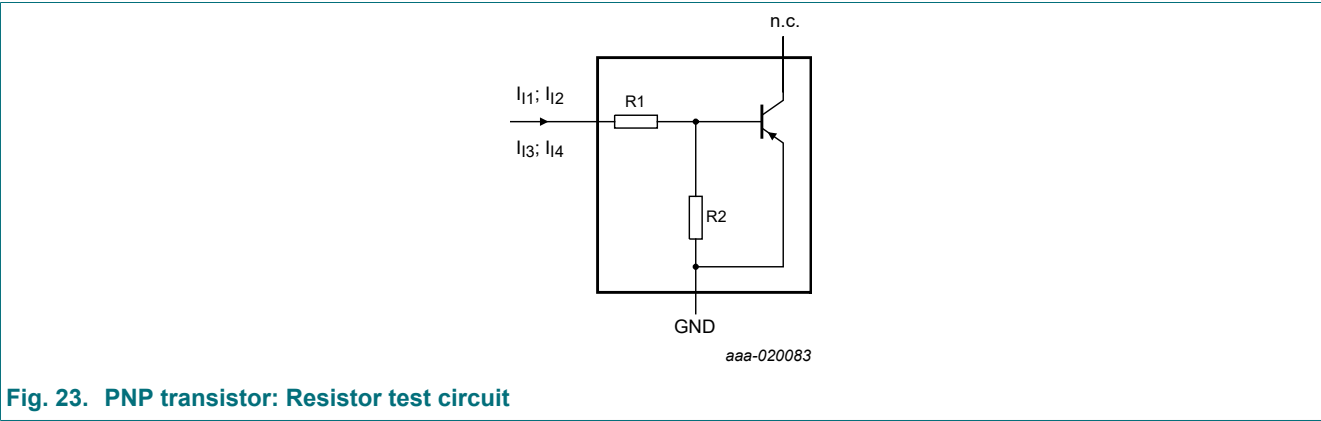
11. Test information

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



Resistor test conditions

Table 9. Resistor test conditions

Type number	R1 (kΩ)	R2 (kΩ)	Test conditions			
			I11	I12	I13	I14
NHDTA114ET	10	10	-800 μA	-1.1 mA	350 μA	450 μA
NHDTA124ET	22	22	-550 μA	-750 μA	150 μA	230 μA
NHDTA144ET	47	47	-250 μA	-350 μA	55 μA	105 μA

12. Package outline

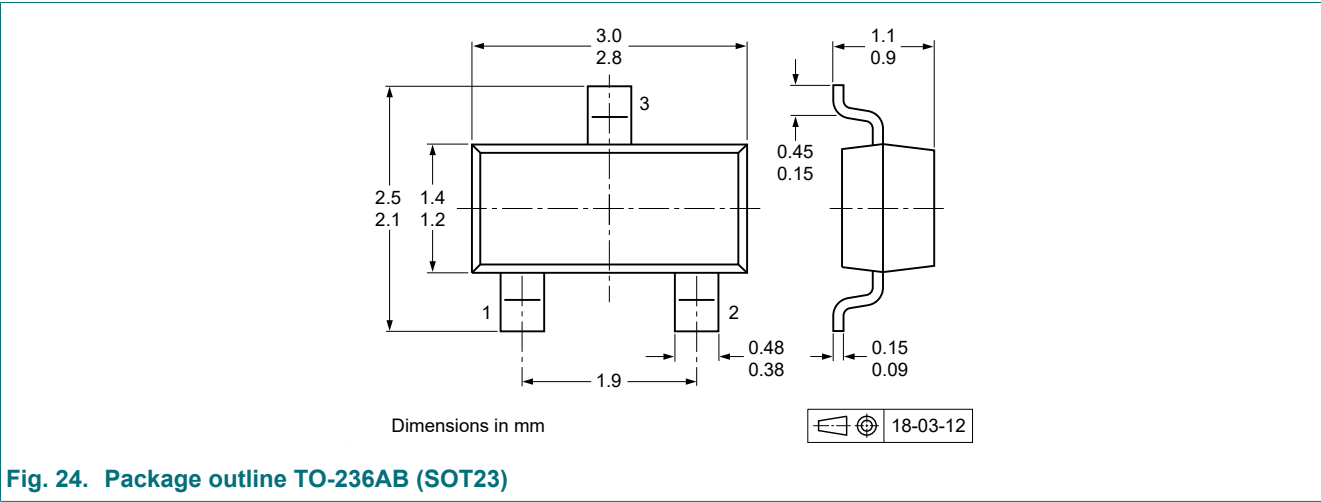


Fig. 24. Package outline TO-236AB (SOT23)

13. Soldering

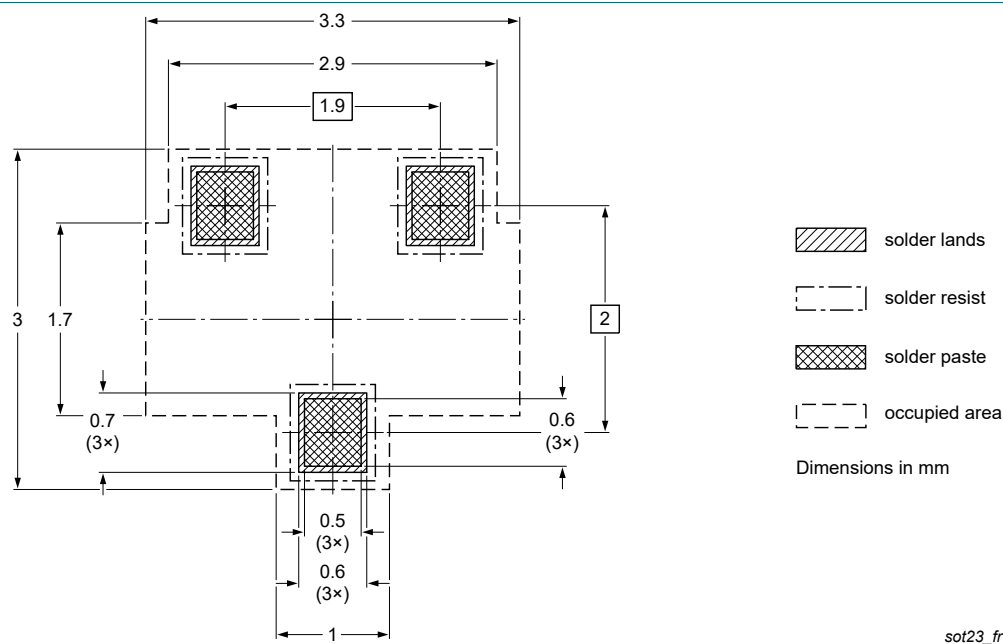


Fig. 25. Reflow soldering footprint TO-236AB (SOT23)

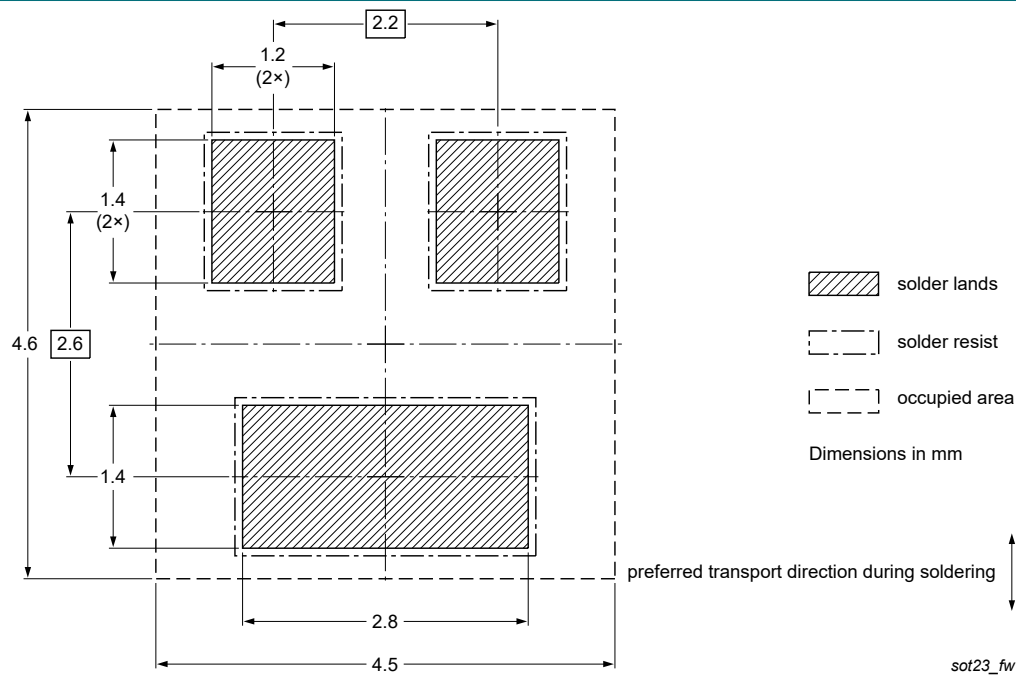


Fig. 26. Wave soldering footprint TO-236AB (SOT23)

14. Revision history

Table 10. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
NHDTA114_124_144ET_SER v.1	20200626	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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