



# NHUMB10/13/9-Q series

80 V, 100 mA PNP/PNP resistor-equipped double transistors

Rev. 1 — 9 October 2024

Product data sheet

## 1. General description

PNP/PNP Resistor-Equipped double Transistor (RET) family in a very small SOT363 (SC-88) Surface-Mounted Device (SMD) plastic package.

Table 1. Product overview

| Type number | R1         | R2         | Package  |       | NPN/NPN complement: | NPN/PNP complement: |
|-------------|------------|------------|----------|-------|---------------------|---------------------|
|             | k $\Omega$ | k $\Omega$ | Nexperia | JEITA |                     |                     |
| NHUMB10-Q   | 2.2        | 47         | SOT363   | SC-88 | NHUMH10-Q           | NHUMD10-Q           |
| NHUMB13-Q   | 4.7        | 47         |          |       | NHUMH13-Q           | NHUMD13-Q           |
| NHUMB9-Q    | 10         | 47         |          |       | NHUMH9-Q            | NHUMD9-Q            |

## 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 BC856 series in digital applications
- Controlling IC inputs
- Switching loads

## 4. Quick reference data

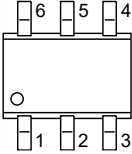
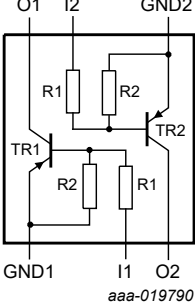
Table 2. Quick reference data

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

| Symbol                | Parameter                 | Conditions | Min | Typ | Max  | Unit |
|-----------------------|---------------------------|------------|-----|-----|------|------|
| <b>Per transistor</b> |                           |            |     |     |      |      |
| $V_{CEO}$             | 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   | GND1   | GND (emitter) TR1      |  |  |
| 2   | I1     | input (base) TR1       |                                                                                    |                                                                                     |
| 3   | O2     | output (collector) TR2 |                                                                                    |                                                                                     |
| 4   | GND2   | GND (emitter) TR2      |                                                                                    |                                                                                     |
| 5   | I2     | input (base) TR2       |                                                                                    |                                                                                     |
| 6   | O1     | output (collector) TR1 |                                                                                    |                                                                                     |

6. Ordering information

Table 4. Ordering information

| Type number               | Package |                                          |                        |
|---------------------------|---------|------------------------------------------|------------------------|
|                           | Name    | Description                              | Version                |
| <a href="#">NHUMB10-Q</a> | SC-88   | plastic surface-mounted package; 6 leads | <a href="#">SOT363</a> |
| <a href="#">NHUMB13-Q</a> |         |                                          |                        |
| <a href="#">NHUMB9-Q</a>  |         |                                          |                        |

7. Marking

Table 5. Marking

| Type number | Marking code [1] |
|-------------|------------------|
| NHUMB10-Q   | 6B%              |
| NHUMB13-Q   | 6D%              |
| NHUMB9-Q    | 6A%              |

[1] % = placeholder for manufacturing site code

8. Limiting values

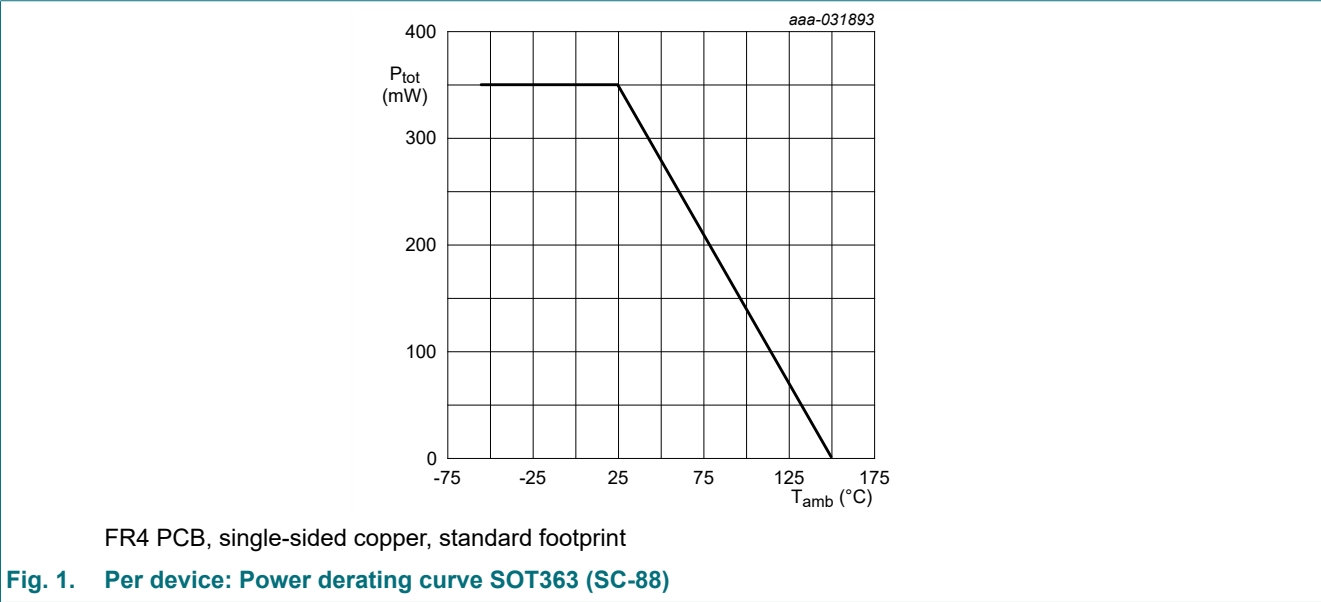
Table 6. Limiting values

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

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

| Symbol         | Parameter                 | Conditions                      | Min | Max  | Unit |
|----------------|---------------------------|---------------------------------|-----|------|------|
| Per transistor |                           |                                 |     |      |      |
| $V_{CBO}$      | 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             |                                 |     |      |      |
|                | NHUMB10-Q                 |                                 | -20 | +7   | V    |
|                | NHUMB13-Q                 |                                 | -30 | +7   | V    |
|                | NHUMB9-Q                  |                                 | -40 | +7   | V    |
| $I_O$          | output current            |                                 | -   | -100 | mA   |
| $P_{tot}$      | total power dissipation   | $T_{amb} \leq 25\text{ °C}$ [1] | -   | 235  | mW   |
| Per device     |                           |                                 |     |      |      |
| $P_{tot}$      | total power dissipation   | $T_{amb} \leq 25\text{ °C}$ [1] | -   | 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.

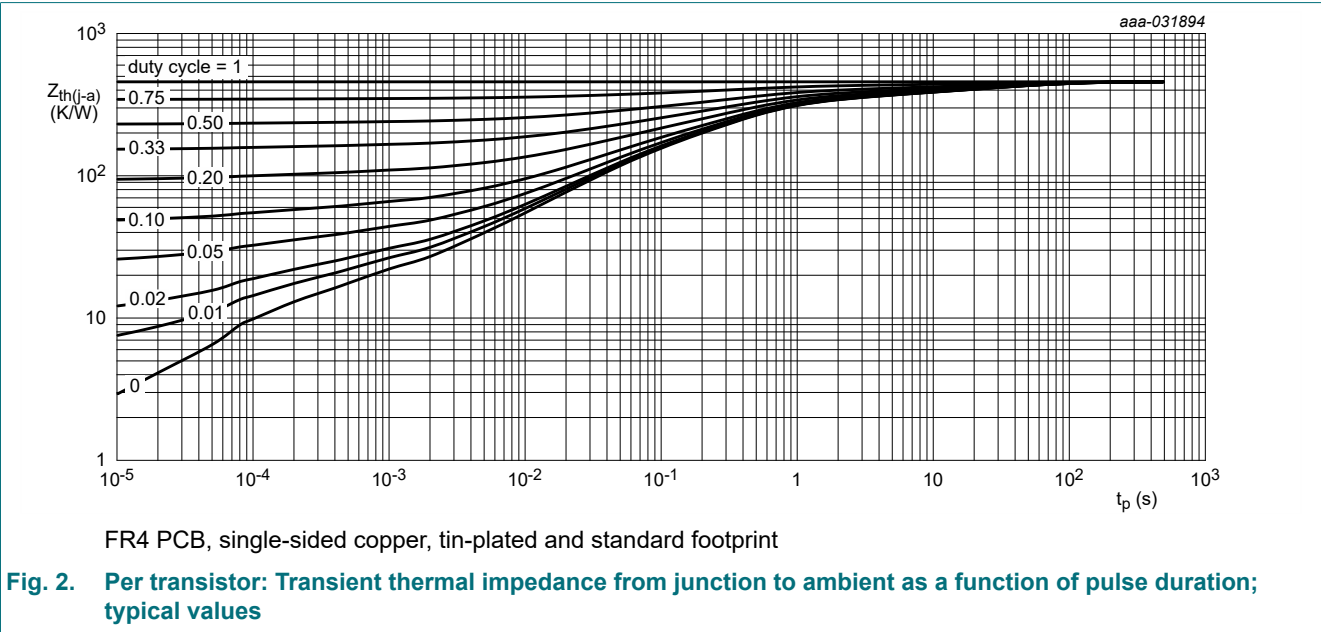


9. Thermal characteristics

Table 7. Thermal characteristics  
T\_amb = 25 °C unless otherwise specified.

| Symbol                | Parameter                                        | Conditions  |     | Min | Typ | Max | Unit |
|-----------------------|--------------------------------------------------|-------------|-----|-----|-----|-----|------|
| Per transistor        |                                                  |             |     |     |     |     |      |
| R <sub>th(j-a)</sub>  | thermal resistance from junction to ambient      | in free air | [1] | -   | -   | 532 | K/W  |
| R <sub>th(j-sp)</sub> | thermal resistance from junction to solder point |             |     | -   | -   | 150 | K/W  |
| Per device            |                                                  |             |     |     |     |     |      |
| R <sub>th(j-a)</sub>  | thermal resistance from junction to ambient      | in free air | [1] | -   | -   | 358 | K/W  |

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



10. Characteristics

Table 8. Characteristics  
*T<sub>amb</sub> = 25 °C unless otherwise specified.*

| Symbol               | Parameter                            | Conditions                                                                | Min  | Typ   | Max  | Unit |
|----------------------|--------------------------------------|---------------------------------------------------------------------------|------|-------|------|------|
| Per transistor       |                                      |                                                                           |      |       |      |      |
| V <sub>(BR)CBO</sub> | collector-base breakdown voltage     | I <sub>C</sub> = -100 μA; I <sub>E</sub> = 0 A                            | -80  | -     | -    | V    |
| V <sub>(BR)CEO</sub> | collector-emitter breakdown voltage  | I <sub>C</sub> = -2 mA; I <sub>B</sub> = 0 A                              | -80  | -     | -    | V    |
| I <sub>CBO</sub>     | collector-base cut-off current       | V <sub>CB</sub> = -80 V; I <sub>E</sub> = 0 A                             | -    | -     | -100 | nA   |
| I <sub>CEO</sub>     | collector-emitter cut-off current    | V <sub>CE</sub> = -60 V; I <sub>B</sub> = 0 A                             | -    | -     | -100 | nA   |
|                      |                                      | V <sub>CE</sub> = -60 V; I <sub>B</sub> = 0 A; T <sub>j</sub> = 150 °C    | -    | -     | -5   | μA   |
| I <sub>EBO</sub>     | emitter-base cut-off current         |                                                                           |      |       |      |      |
|                      | NHUMB10-Q                            | V <sub>EB</sub> = -7 V; I <sub>C</sub> = 0 A                              | -    | -     | -270 | μA   |
|                      | NHUMB13-Q                            |                                                                           | -    | -     | -260 | μA   |
|                      | NHUMB9-Q                             |                                                                           | -    | -     | -230 | μA   |
| h <sub>FE</sub>      | DC current gain                      | V <sub>CE</sub> = -5 V; I <sub>C</sub> = -10 mA                           | 100  | -     | -    |      |
| V <sub>CEsat</sub>   | collector-emitter saturation voltage | I <sub>C</sub> = -10 mA; I <sub>B</sub> = -0.5 mA                         | -    | -     | -100 | mV   |
| V <sub>I(off)</sub>  | off-state input voltage              |                                                                           |      |       |      |      |
|                      | NHUMB10-Q                            | V <sub>CE</sub> = -5 V ; I <sub>C</sub> = -100 μA                         | -    | -595  | -500 | mV   |
|                      | NHUMB13-Q                            |                                                                           |      | -625  | -500 | mV   |
|                      | NHUMB9-Q                             |                                                                           |      | -690  | -500 | mV   |
| V <sub>I(on)</sub>   | on-state input voltage               |                                                                           |      |       |      |      |
|                      | NHUMB10-Q                            | V <sub>CE</sub> = -0.3 V ; I <sub>C</sub> = -10 mA                        | -1.2 | -0.81 | -    | V    |
|                      | NHUMB13-Q                            |                                                                           | -1.4 | -0.95 | -    | V    |
|                      | NHUMB9-Q                             |                                                                           | -1.6 | -1.22 | -    | V    |
| R1                   | bias resistor 1 (input)              |                                                                           | [1]  |       |      |      |
|                      | NHUMB10-Q                            |                                                                           | 1.54 | 2.2   | 2.86 | kΩ   |
|                      | NHUMB13-Q                            |                                                                           | 3.3  | 4.7   | 6.1  | kΩ   |
|                      | NHUMB9-Q                             |                                                                           | 7    | 10    | 13   | kΩ   |
| R2/R1                | bias resistor ratio                  |                                                                           | [1]  |       |      |      |
|                      | NHUMB10-Q                            |                                                                           | 17   | 21    | 26   |      |
|                      | NHUMB13-Q                            |                                                                           | 8    | 10    | 12   |      |
|                      | NHUMB9-Q                             |                                                                           | 3.7  | 4.7   | 5.7  |      |
| f <sub>T</sub>       | transition frequency                 | V <sub>CE</sub> = -5 V; I <sub>C</sub> = -10 mA; f = 100 MHz              | [2]  |       | 150  | MHz  |
| C <sub>c</sub>       | collector capacitance                | V <sub>CB</sub> = -10 V; I <sub>E</sub> = i <sub>e</sub> = 0 A; f = 1 MHz | -    | -     | 3    | pF   |

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

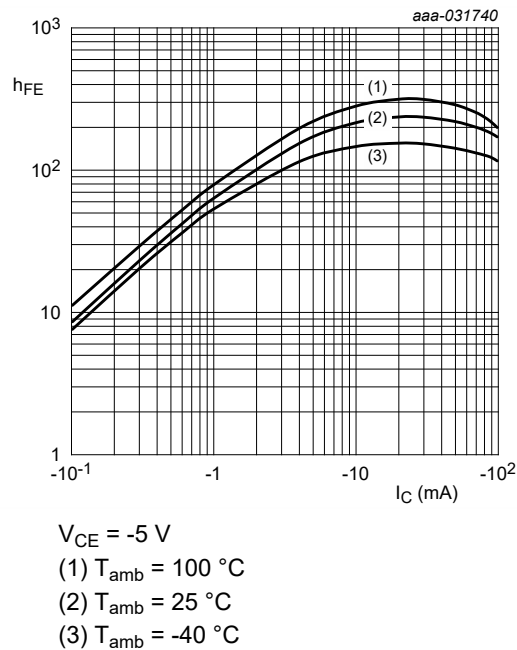


Fig. 3. NHUMB10-Q: DC current gain as a function of collector current; typical values

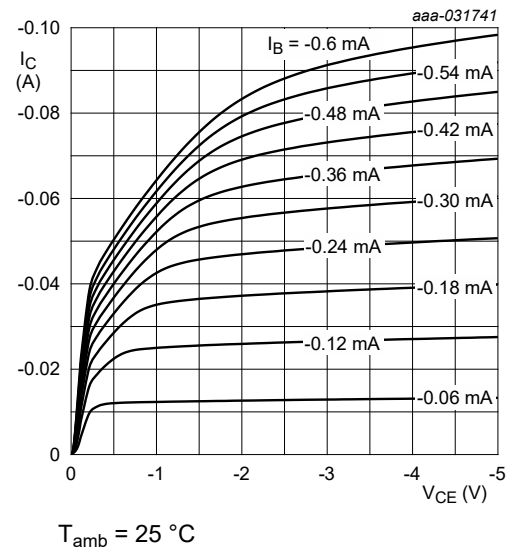


Fig. 4. NHUMB10-Q: Collector current as a function of collector-emitter voltage; typical values

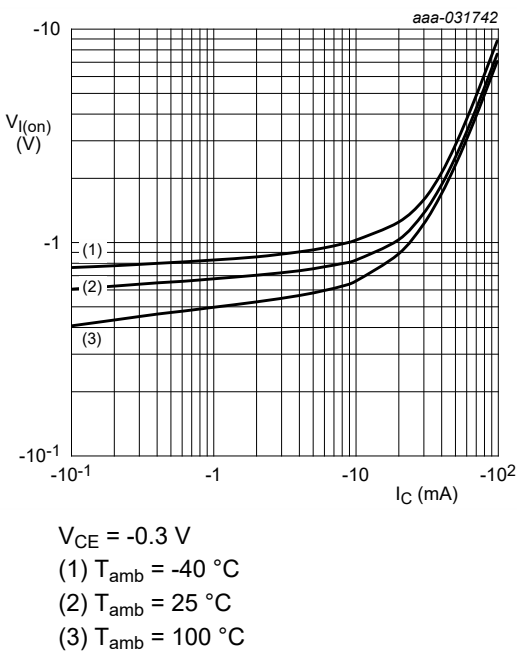


Fig. 5. NHUMB10-Q: On-state input voltage as a function of collector current; typical values

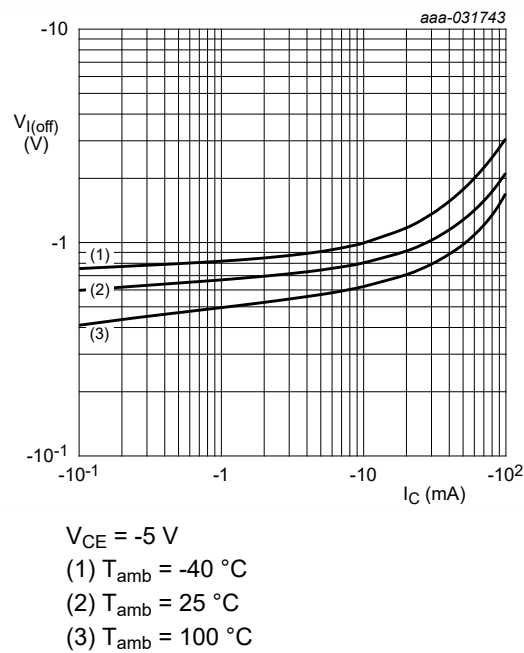


Fig. 6. NHUMB10-Q: Off-state input voltage as a function of collector current; typical values

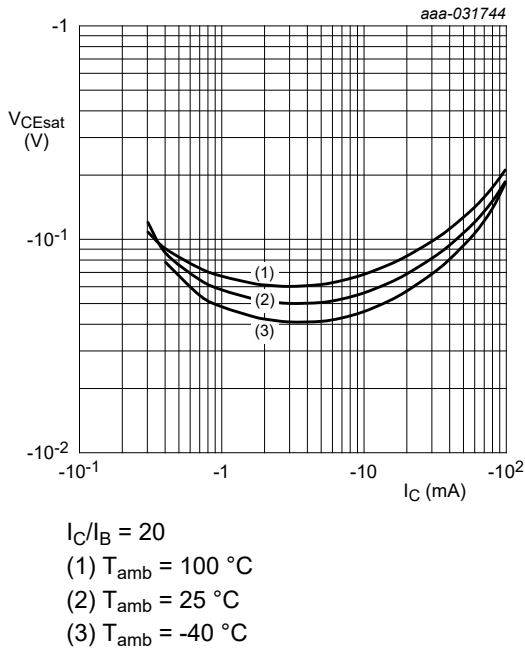


Fig. 7. NHUMB10-Q: Collector-emitter saturation voltage as a function of collector current; typical values

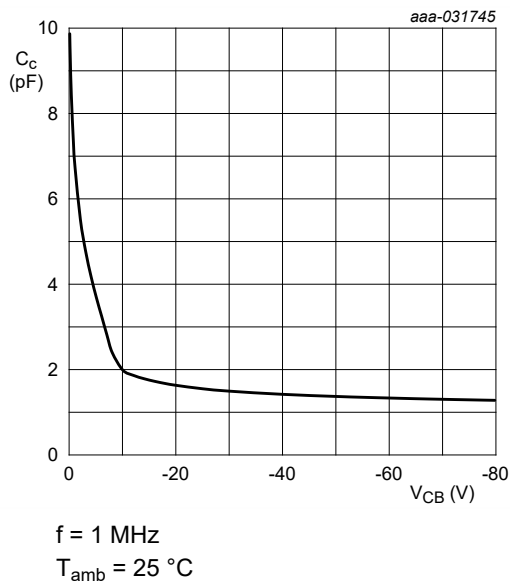


Fig. 8. NHUMB10-Q: Collector capacitance as a function of collector-base voltage; typical values

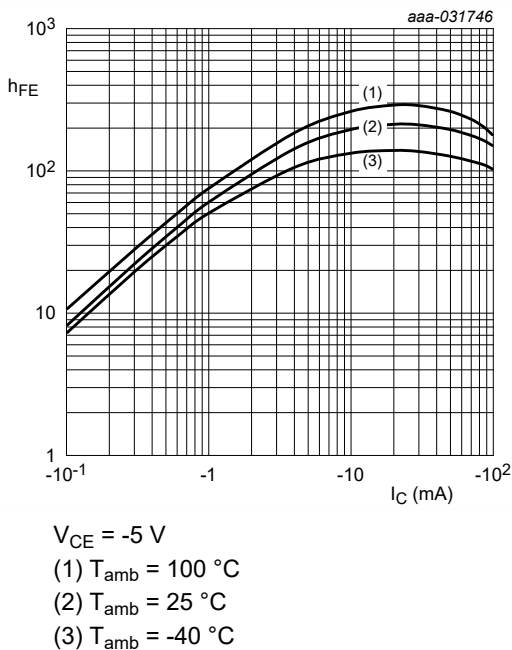


Fig. 9. NHUMB13-Q: DC current gain as a function of collector current; typical values

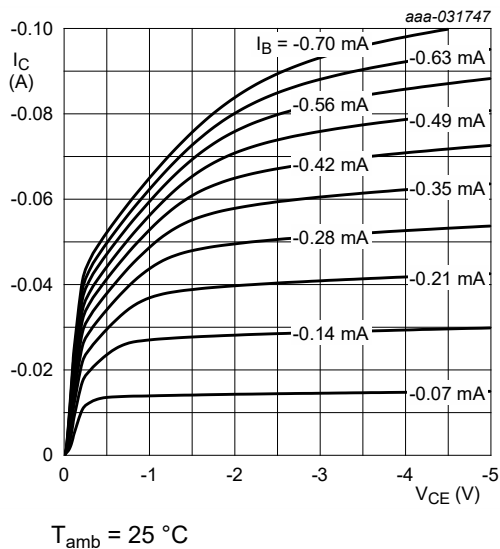


Fig. 10. NHUMB13-Q: Collector current as a function of collector-emitter voltage; typical values

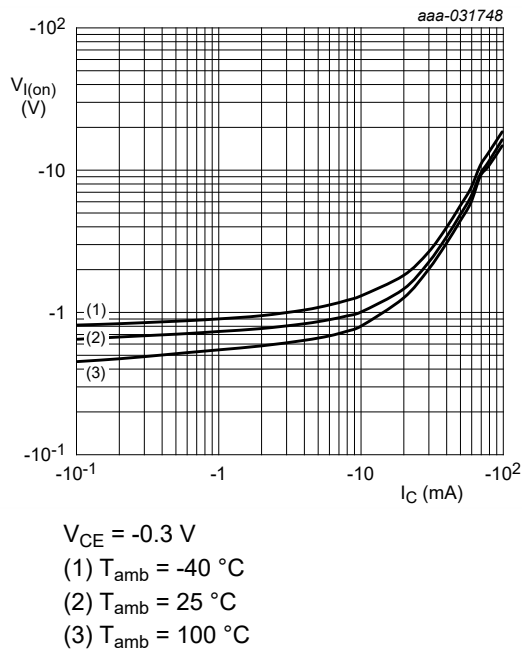


Fig. 11. NHUMB13-Q: On-state input voltage as a function of collector current; typical values

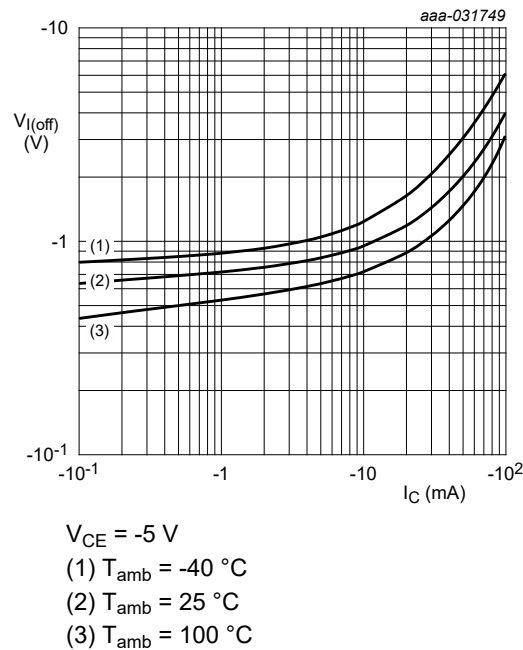


Fig. 12. NHUMB13-Q: Off-state input voltage as a function of collector current; typical values

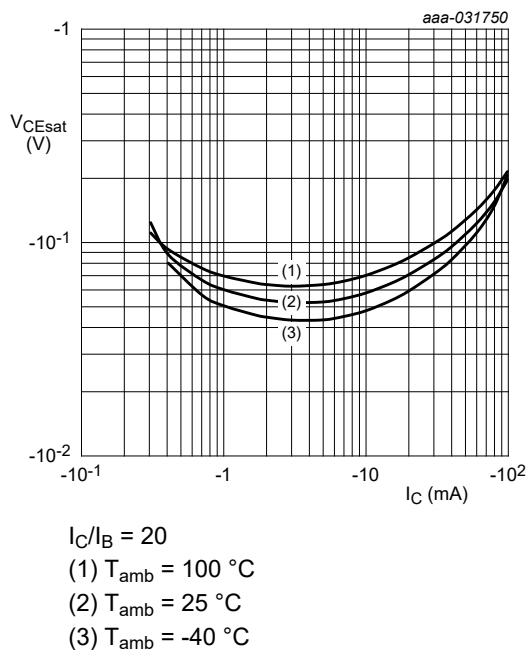


Fig. 13. NHUMB13-Q: Collector-emitter saturation voltage as a function of collector current; typical values

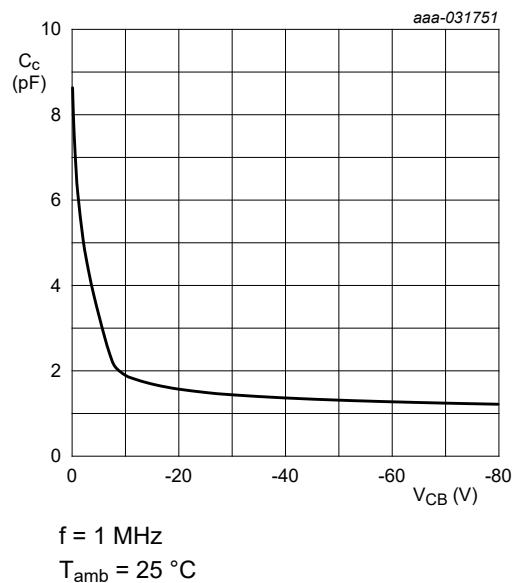


Fig. 14. NHUMB13-Q: Collector capacitance as a function of collector-base voltage; typical values



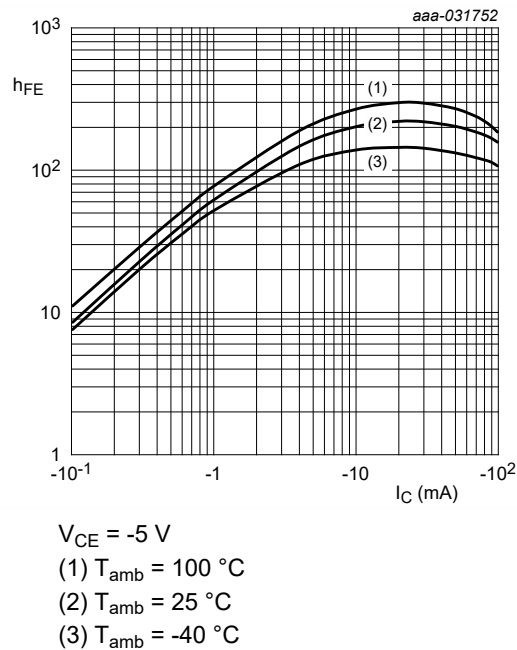


Fig. 15. NHUMB9-Q: DC current gain as a function of collector current; typical values

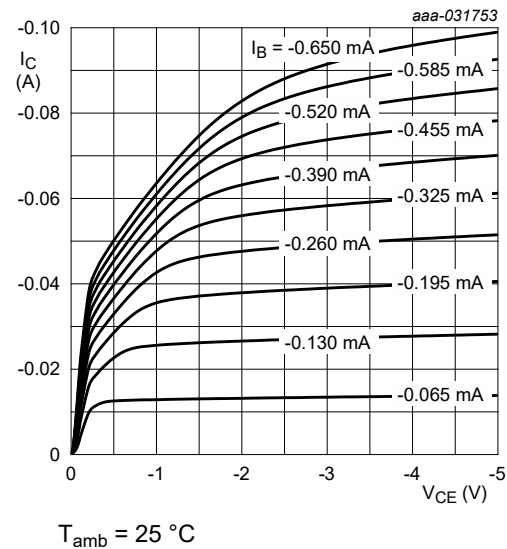


Fig. 16. NHUMB9-Q: Collector current as a function of collector-emitter voltage; typical values

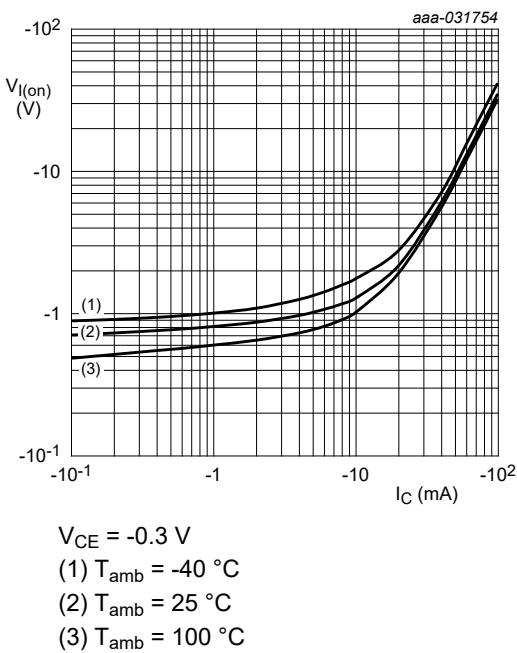


Fig. 17. NHUMB9-Q: On-state input voltage as a function of collector current; typical values

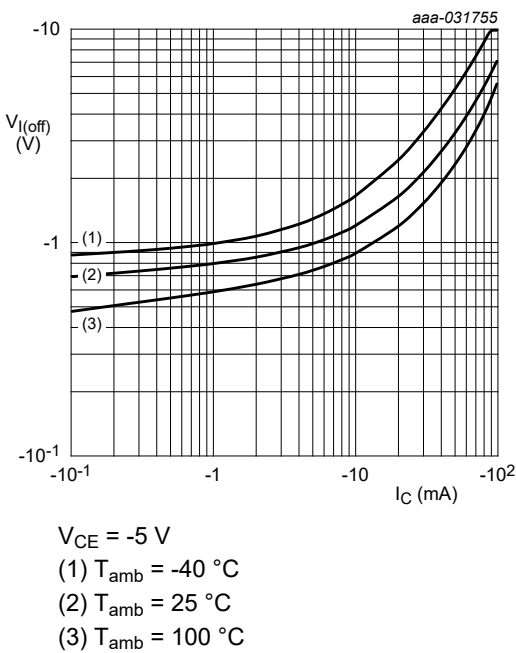


Fig. 18. NHUMB9-Q: Off-state input voltage as a function of collector current; typical values

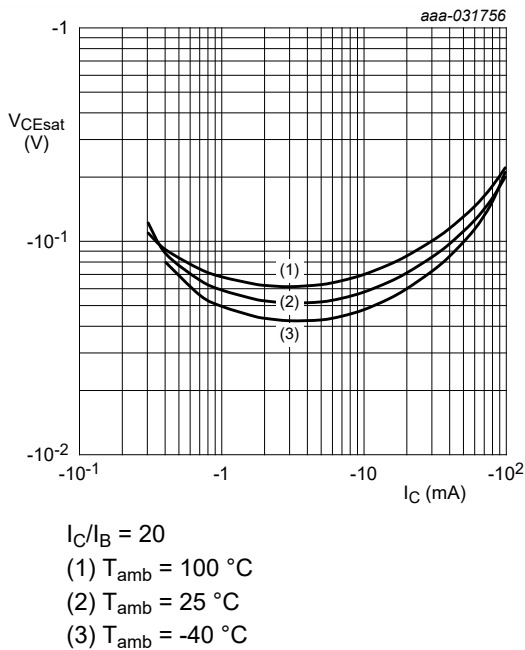


Fig. 19. NHUMB9-Q: Collector-emitter saturation voltage as a function of collector current; typical values

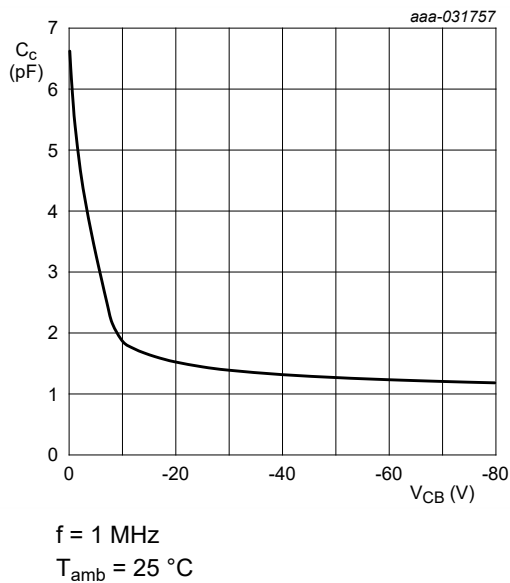


Fig. 20. NHUMB9-Q: Collector capacitance as a function of collector-base voltage; typical values

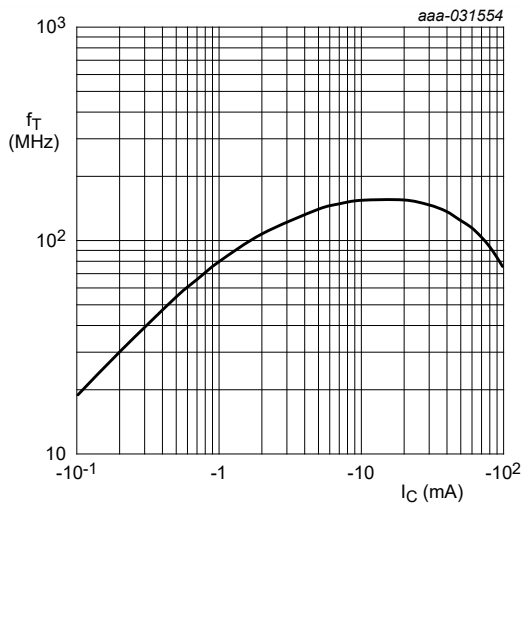


Fig. 21. Transition frequency as a function of collector current; typical values of built-in transistor

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)
$$R_I = \frac{V(I_2) - V(I_I)}{I_2 - I_I}$$
- Calculation of bias resistor ratio (R2/R1)
$$\frac{R2}{R1} = \frac{V(I_4) - V(I_3)}{R1 \cdot (I_4 - I_3)} - 1$$

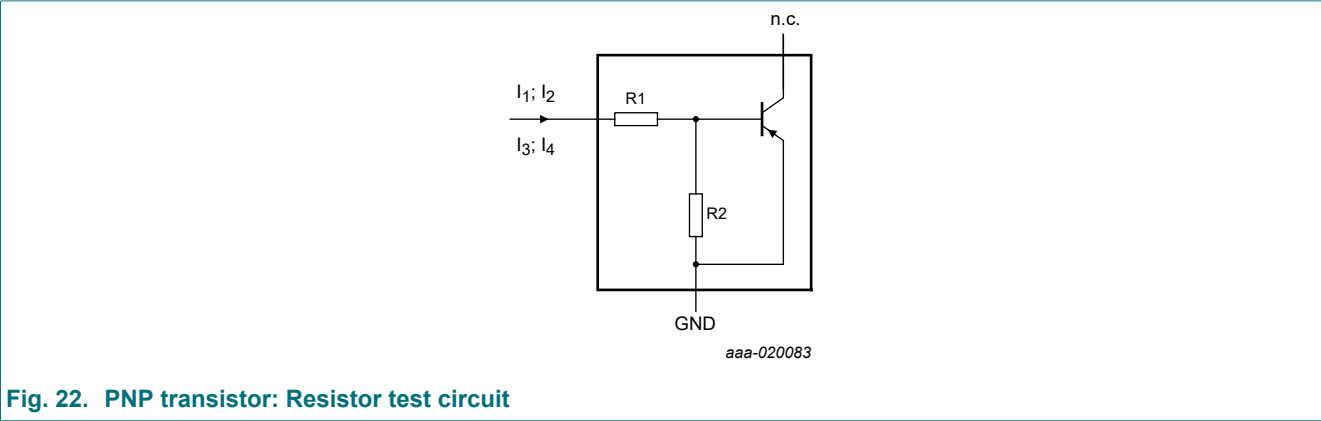


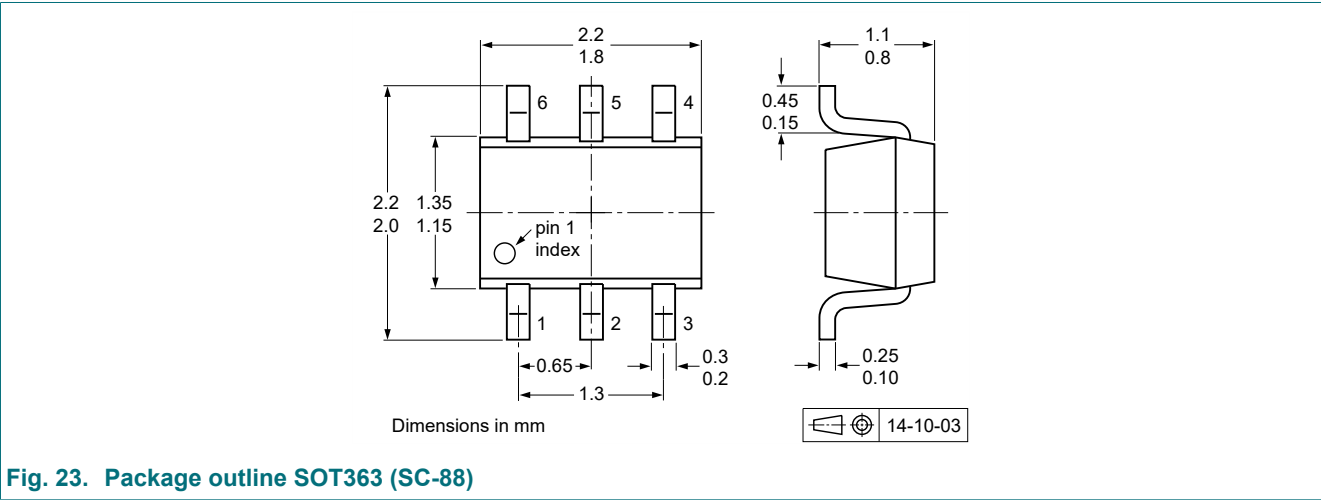
Fig. 22. PNP transistor: Resistor test circuit

Resistor test conditions

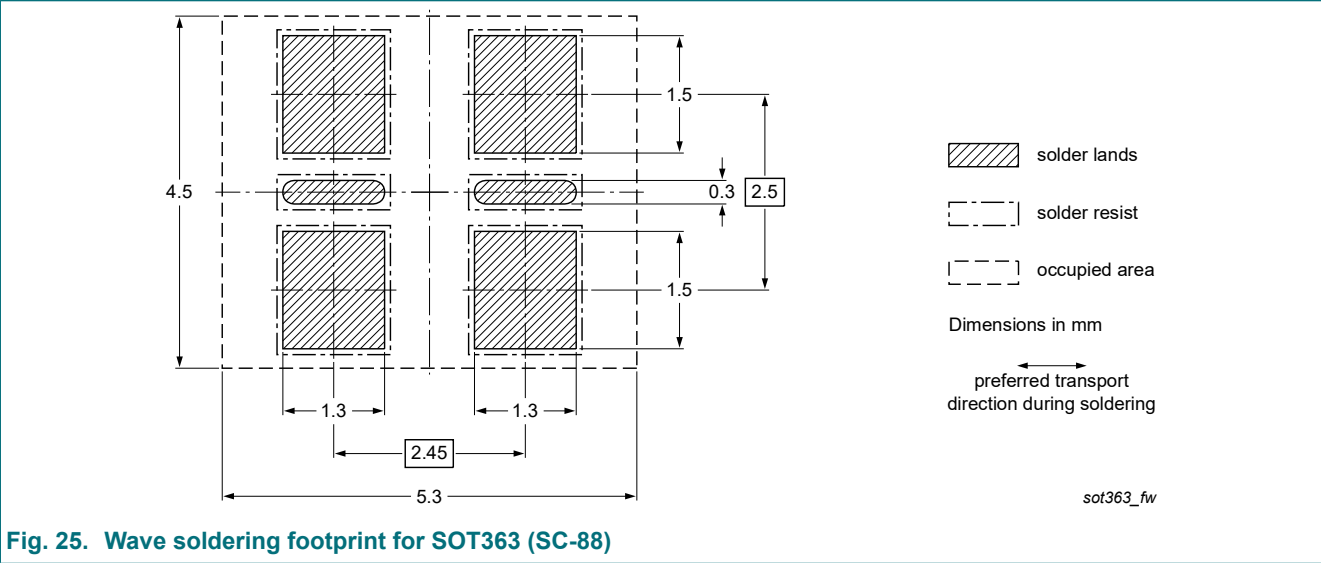
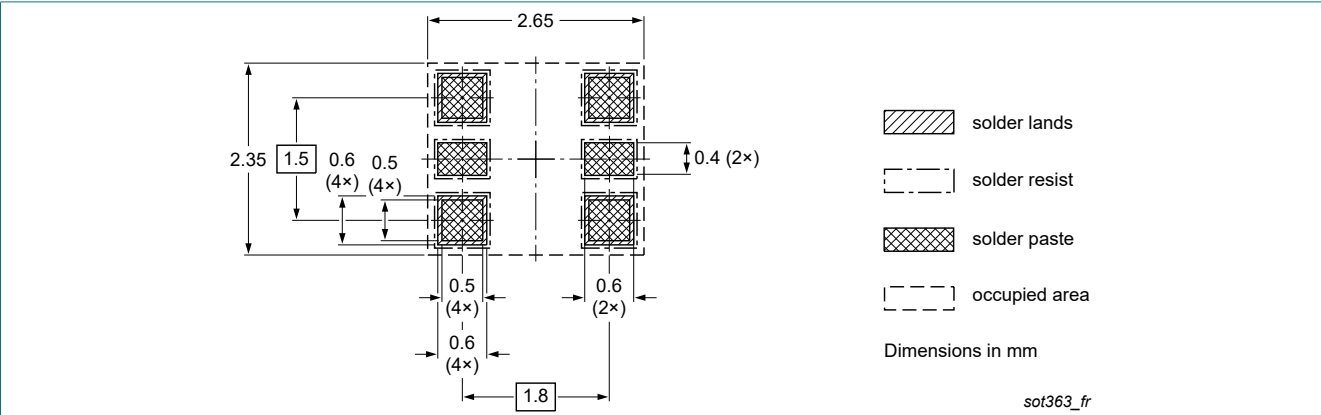
Table 9. Resistor test conditions

| Type number    | R1 (kΩ) | R2 (kΩ) | Test conditions |                |                |                |
|----------------|---------|---------|-----------------|----------------|----------------|----------------|
|                |         |         | I <sub>1</sub>  | I <sub>2</sub> | I <sub>3</sub> | I <sub>4</sub> |
| Per transistor |         |         |                 |                |                |                |
| NHUMB10-Q      | 2.2     | 47      | -1.6 mA         | -2.4 mA        | 55 μA          | 105 μA         |
| NHUMB13-Q      | 4.7     | 47      | -1.2 mA         | -1.8 mA        | 55 μA          | 105 μA         |
| NHUMB9-Q       | 10      | 47      | -0.8 mA         | -1.1 mA        | 55 μA          | 105 μA         |

12. Package outline



13. Soldering



14. Revision history

Table 10. Revision history

| Data sheet ID          | Release date | Data sheet status  | Change notice | Supersedes |
|------------------------|--------------|--------------------|---------------|------------|
| NHUMB10_13_9-Q_SER v.1 | 20241009     | 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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For more information, please visit: <http://www.nexperia.com>

For sales office addresses, please send an email to: [salesaddresses@nexperia.com](mailto:salesaddresses@nexperia.com)

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