

BC846BPN

65 V, 100 mA NPN/PNP general-purpose transistor

Rev. 01 — 17 July 2009

Product data sheet

1. Product profile

1.1 General description

NPN/PNP general-purpose transistor pair in a very small Surface-Mounted Device (SMD) plastic package.

Table 1. Product overview

| Type number | Package | | NPN/NPN complement | PNP/PNP complement |
|-------------|---------|-------|--------------------|--------------------|
| | NXP | JEITA | | |
| BC846BPN | SOT363 | SC-88 | BC846BS | BC856BS |

1.2 Features

- Low collector capacitance
- Low collector-emitter saturation voltage
- Closely matched current gain
- Reduces number of components and board space
- No mutual interference between the transistors
- AEC-Q101 qualified

1.3 Applications

- General-purpose switching and amplification

1.4 Quick reference data

Table 2. Quick reference data

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--|---------------------------|-----------------------------------|-----|-----|-----|------|
| Per transistor; for the PNP transistor with negative polarity | | | | | | |
| V_{CEO} | collector-emitter voltage | open base | - | - | 65 | V |
| I_C | collector current | | - | - | 100 | mA |
| TR1 (NPN) | | | | | | |
| h_{FE} | DC current gain | $V_{CE} = 5$ V; $I_C = 2$ mA | 200 | 300 | 450 | |
| TR2 (PNP) | | | | | | |
| h_{FE} | DC current gain | $V_{CE} = -5$ V; $I_C = -2$ mA | 200 | 290 | 450 | |

2. Pinning information

Table 3. Pinning

| Pin | Description | Simplified outline | Graphic symbol |
|-----|---------------|--------------------|----------------|
| 1 | emitter TR1 | | |
| 2 | base TR1 | | |
| 3 | collector TR2 | | |
| 4 | emitter TR2 | | |
| 5 | base TR2 | | |
| 6 | collector TR1 | | |

sym019

3. Ordering information

Table 4. Ordering information

| Type number | Package | | | Version |
|-------------|---------|--|--|---------|
| | Name | Description | | |
| BC846BPN | SC-88 | plastic surface-mounted package; 6 leads | | SOT363 |

4. Marking

Table 5. Marking codes

| Type number | Marking code ^[1] |
|-------------|-----------------------------|
| BC846BPN | PJ* |

[1] * = -: made in Hong Kong
 * = p: made in Hong Kong
 * = t: made in Malaysia
 * = W: made in China

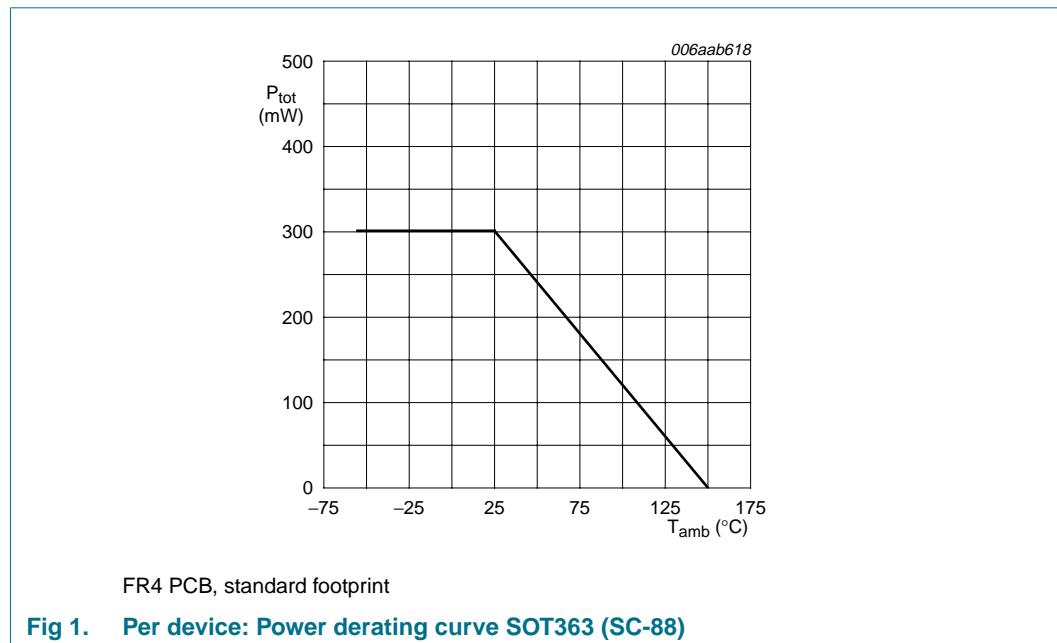
5. Limiting values

Table 6. Limiting values

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

| Symbol | Parameter | Conditions | Min | Max | Unit | |
|--|---------------------------|----------------------------------|-----|------|------|----|
| Per transistor; for the PNP transistor with negative polarity | | | | | | |
| V_{CBO} | collector-base voltage | open emitter | - | 80 | V | |
| V_{CEO} | collector-emitter voltage | open base | - | 65 | V | |
| V_{EBO} | emitter-base voltage | open collector | - | 6 | V | |
| I_C | collector current | | - | 100 | mA | |
| I_{CM} | peak collector current | single pulse; $t_p \leq 1$ ms | - | 200 | mA | |
| I_{BM} | peak base current | single pulse; $t_p \leq 1$ ms | - | 200 | mA | |
| P_{tot} | total power dissipation | $T_{amb} \leq 25$ °C | [1] | - | 200 | mW |
| Per device | | | | | | |
| P_{tot} | total power dissipation | $T_{amb} \leq 25$ °C | [1] | - | 300 | 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.

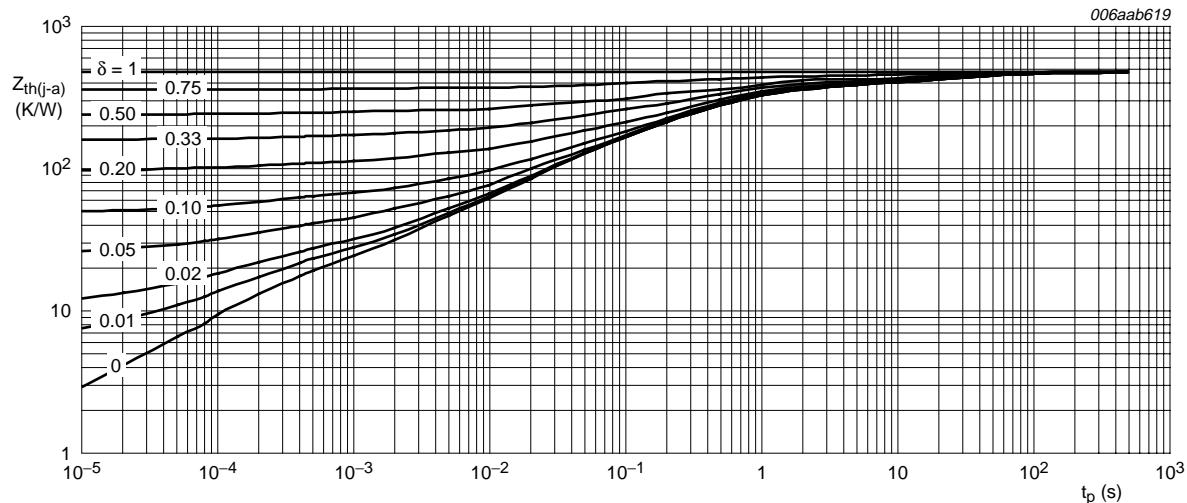


6. Thermal characteristics

Table 7. Thermal characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-----------------------|--|-------------|-----|-----|-----|------|
| Per transistor | | | | | | |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | [1] | - | - | K/W |
| $R_{th(j-sp)}$ | thermal resistance from junction to solder point | | - | - | 230 | K/W |
| Per device | | | | | | |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | [1] | - | - | K/W |

[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.



FR4 PCB, standard footprint

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

7. Characteristics

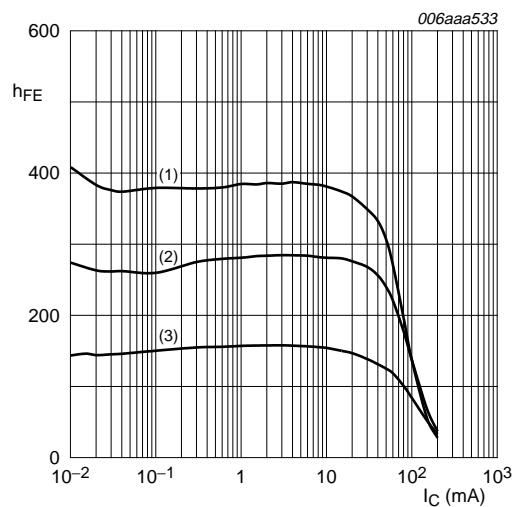
Table 8. Characteristics

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

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|------------------|--------------------------------------|---|-----|------|------|------|
| TR1 (NPN) | | | | | | |
| I_{CBO} | collector-base cut-off current | $V_{CB} = 50\text{ V}; I_E = 0\text{ A}$ $V_{CB} = 30\text{ V}; I_E = 0\text{ A}; T_j = 150^\circ\text{C}$ | - | - | 15 | nA |
| I_{EBO} | emitter-base cut-off current | $V_{EB} = 6\text{ V}; I_C = 0\text{ A}$ | - | - | 100 | nA |
| h_{FE} | DC current gain | $V_{CE} = 5\text{ V}$ $I_C = 10\text{ }\mu\text{A}$ $I_C = 2\text{ mA}$ | 200 | 300 | 450 | |
| V_{CEsat} | collector-emitter saturation voltage | $I_C = 10\text{ mA}; I_B = 0.5\text{ mA}$ $I_C = 100\text{ mA}; I_B = 5\text{ mA}$ | - | 55 | 100 | mV |
| V_{BEsat} | base-emitter saturation voltage | $I_C = 10\text{ mA}; I_B = 0.5\text{ mA}$ $I_C = 100\text{ mA}; I_B = 5\text{ mA}$ | - | 755 | 850 | mV |
| V_{BE} | base-emitter voltage | $V_{CE} = 5\text{ V}$ $I_C = 2\text{ mA}$ $I_C = 10\text{ mA}$ | 580 | 650 | 700 | mV |
| C_c | collector capacitance | $V_{CB} = 10\text{ V}; I_E = i_e = 0\text{ A}; f = 1\text{ MHz}$ | - | 1.9 | - | pF |
| C_e | emitter capacitance | $V_{EB} = 0.5\text{ V}; I_C = i_c = 0\text{ A}; f = 1\text{ MHz}$ | - | 11 | - | pF |
| f_T | transition frequency | $V_{CE} = 5\text{ V}; I_C = 10\text{ mA}; f = 100\text{ MHz}$ | 100 | - | - | MHz |
| NF | noise figure | $V_{CE} = 5\text{ V}; I_C = 0.2\text{ mA}; R_S = 2\text{ k}\Omega; f = 10\text{ Hz to } 15.7\text{ kHz}$ $V_{CE} = 5\text{ V}; I_C = 0.2\text{ mA}; R_S = 2\text{ k}\Omega; f = 1\text{ kHz}; B = 200\text{ Hz}$ | - | 1.9 | - | dB |
| TR2 (PNP) | | | | | | |
| I_{CBO} | collector-base cut-off current | $V_{CB} = -50\text{ V}; I_E = 0\text{ A}$ $V_{CB} = -30\text{ V}; I_E = 0\text{ A}; T_j = 150^\circ\text{C}$ | - | - | -15 | nA |
| I_{EBO} | emitter-base cut-off current | $V_{EB} = -6\text{ V}; I_C = 0\text{ A}$ | - | - | -100 | nA |
| h_{FE} | DC current gain | $V_{CE} = -5\text{ V}$ $I_C = -10\text{ }\mu\text{A}$ $I_C = -2\text{ mA}$ | 200 | 270 | 450 | |
| V_{CEsat} | collector-emitter saturation voltage | $I_C = -10\text{ mA}; I_B = -0.5\text{ mA}$ $I_C = -100\text{ mA}; I_B = -5\text{ mA}$ | - | -55 | -100 | mV |
| | | | - | -200 | -300 | mV |

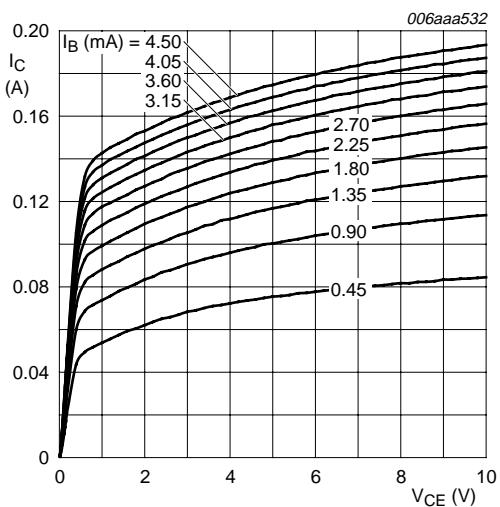
Table 8. Characteristics ...continued
 $T_{amb} = 25^\circ\text{C}$ unless otherwise specified.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------|---------------------------------|---|------|------|------|------|
| V_{BEsat} | base-emitter saturation voltage | $I_C = -10 \text{ mA}; I_B = -0.5 \text{ mA}$ | - | -755 | -850 | mV |
| | | $I_C = -100 \text{ mA}; I_B = -5 \text{ mA}$ | - | -900 | - | mV |
| V_{BE} | base-emitter voltage | $V_{CE} = -5 \text{ V}$ | -600 | -650 | -750 | mV |
| | | $I_C = -2 \text{ mA}$ | - | - | -820 | mV |
| | | $I_C = -10 \text{ mA}$ | - | - | - | mV |
| C_C | collector capacitance | $V_{CB} = -10 \text{ V}; I_E = i_e = 0 \text{ A}; f = 1 \text{ MHz}$ | - | 2.3 | - | pF |
| C_e | emitter capacitance | $V_{EB} = -0.5 \text{ V}; I_C = i_c = 0 \text{ A}; f = 1 \text{ MHz}$ | - | 10 | - | pF |
| f_T | transition frequency | $V_{CE} = -5 \text{ V}; I_C = -10 \text{ mA}; f = 100 \text{ MHz}$ | 100 | - | - | MHz |
| NF | noise figure | $V_{CE} = -5 \text{ V}; I_C = -0.2 \text{ mA}; R_S = 2 \text{ k}\Omega; f = 10 \text{ Hz to } 15.7 \text{ kHz}$ | - | 1.6 | - | dB |
| | | $V_{CE} = -5 \text{ V}; I_C = -0.2 \text{ mA}; R_S = 2 \text{ k}\Omega; f = 1 \text{ kHz}; B = 200 \text{ Hz}$ | - | 2.9 | - | dB |



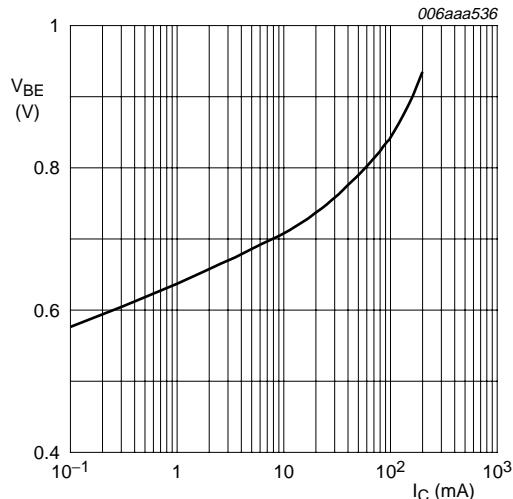
$V_{CE} = 5 \text{ V}$
(1) $T_{amb} = 100^\circ\text{C}$
(2) $T_{amb} = 25^\circ\text{C}$
(3) $T_{amb} = -55^\circ\text{C}$

Fig 3. TR1 (NPN): DC current gain as a function of collector current; typical values



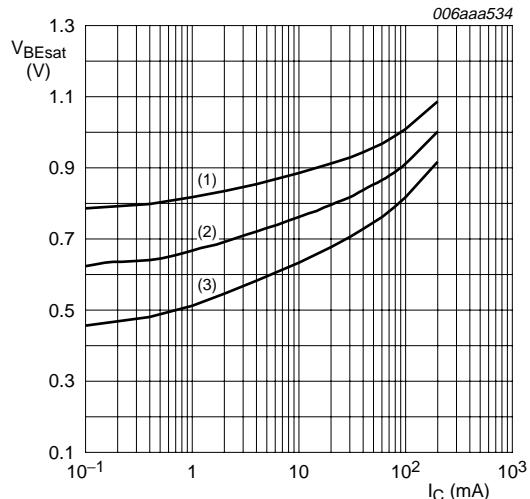
$T_{amb} = 25^\circ\text{C}$

Fig 4. TR1 (NPN): Collector current as a function of collector-emitter voltage; typical values



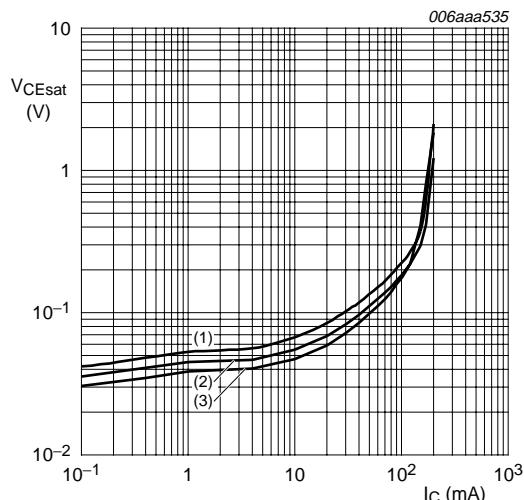
$V_{CE} = 5$ V; $T_{amb} = 25$ °C

Fig 5. TR1 (NPN): Base-emitter voltage as a function of collector current; typical values



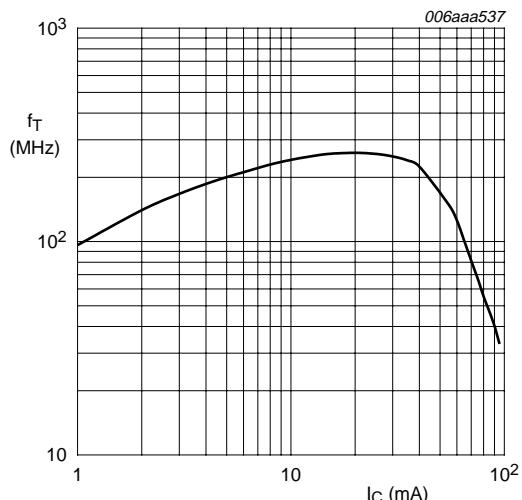
$I_C/I_B = 20$
 (1) $T_{amb} = -55$ °C
 (2) $T_{amb} = 25$ °C
 (3) $T_{amb} = 100$ °C

Fig 6. TR1 (NPN): Base-emitter saturation voltage as a function of collector current; typical values



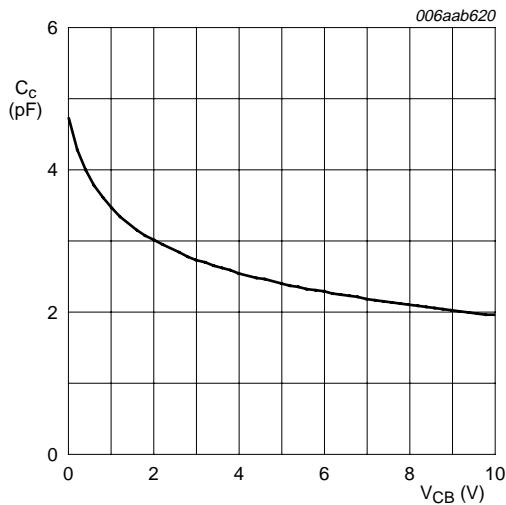
$I_C/I_B = 20$
 (1) $T_{amb} = 100$ °C
 (2) $T_{amb} = 25$ °C
 (3) $T_{amb} = -55$ °C

Fig 7. TR1 (NPN): Collector-emitter saturation voltage as a function of collector current; typical values



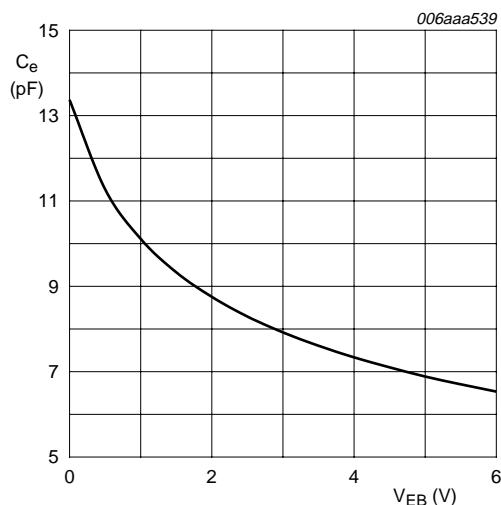
$V_{CE} = 5$ V; $T_{amb} = 25$ °C

Fig 8. TR1 (NPN): Transition frequency as a function of collector current; typical values



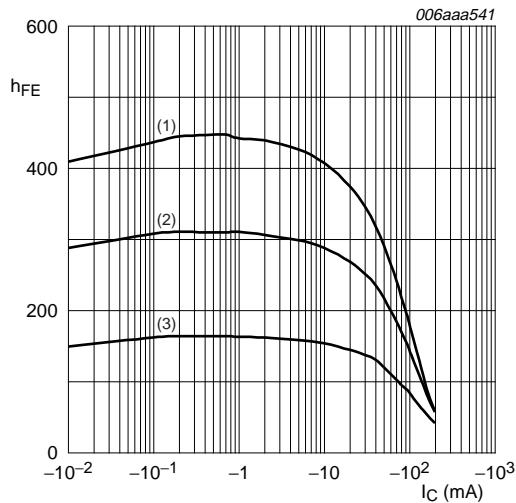
$f = 1$ MHz; $T_{amb} = 25$ °C

Fig 9. TR1 (NPN): Collector capacitance as a function of collector-base voltage; typical values



$f = 1$ MHz; $T_{amb} = 25$ °C

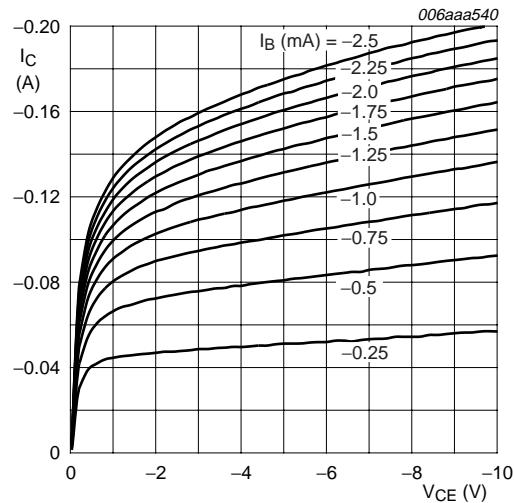
Fig 10. TR1 (NPN): Emitter capacitance as a function of emitter-base voltage; typical values



$V_{CE} = -5$ V

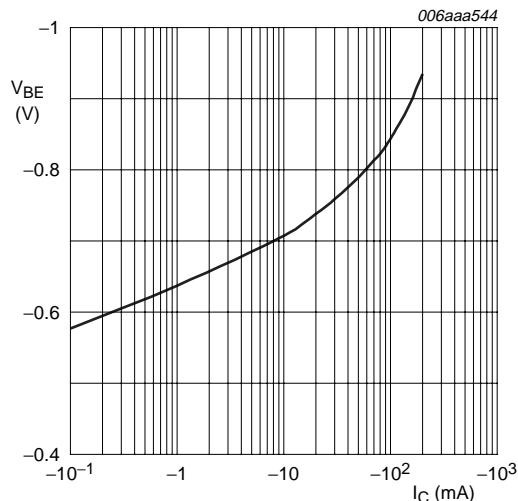
- (1) $T_{amb} = 100$ °C
- (2) $T_{amb} = 25$ °C
- (3) $T_{amb} = -55$ °C

Fig 11. TR2 (PNP): DC current gain as a function of collector current; typical values



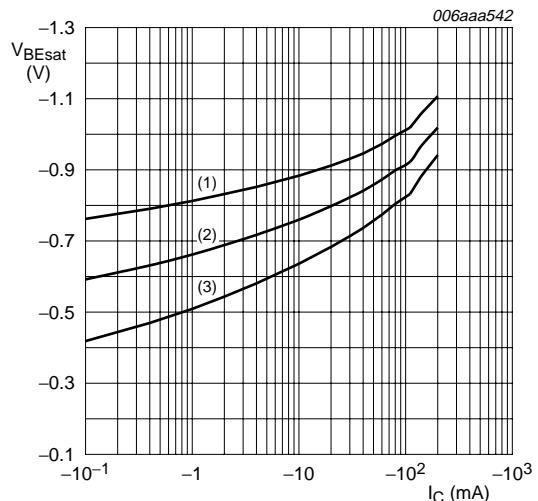
$T_{amb} = 25$ °C

Fig 12. TR2 (PNP): Collector current as a function of collector-emitter voltage; typical values



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

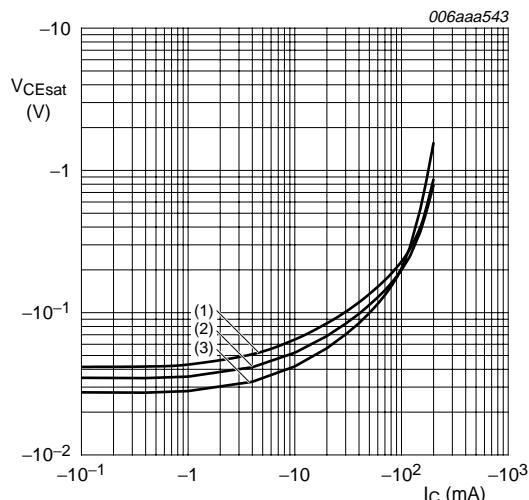
Fig 13. TR2 (PNP): Base-emitter voltage as a function of collector current; typical values



$I_c/I_b = 20$

- (1) $T_{amb} = -55 \text{ }^{\circ}\text{C}$
- (2) $T_{amb} = 25 \text{ }^{\circ}\text{C}$
- (3) $T_{amb} = 100 \text{ }^{\circ}\text{C}$

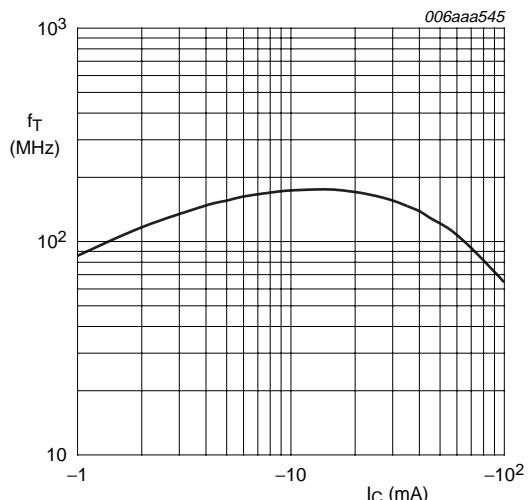
Fig 14. TR2 (PNP): Base-emitter saturation voltage as a function of collector current; typical values



$I_c/I_b = 20$

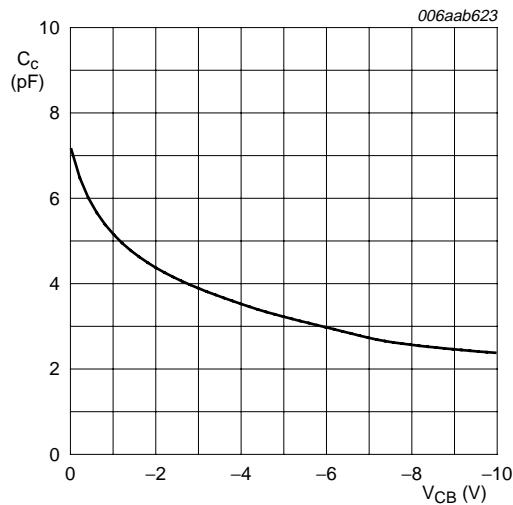
- (1) $T_{amb} = 100 \text{ }^{\circ}\text{C}$
- (2) $T_{amb} = 25 \text{ }^{\circ}\text{C}$
- (3) $T_{amb} = -55 \text{ }^{\circ}\text{C}$

Fig 15. TR2 (PNP): Collector-emitter saturation voltage as a function of collector current; typical values



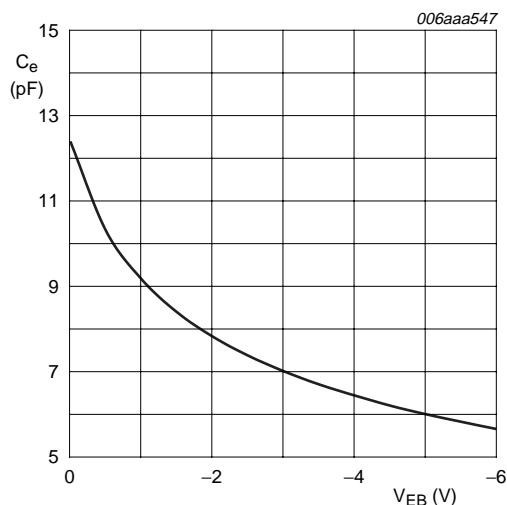
$V_{CE} = -5 \text{ V}; T_{amb} = 25 \text{ }^{\circ}\text{C}$

Fig 16. TR2 (PNP): Transition frequency as a function of collector current; typical values



$f = 1$ MHz; $T_{amb} = 25$ °C

Fig 17. TR2 (PNP): Collector capacitance as a function of collector-base voltage; typical values



$f = 1$ MHz; $T_{amb} = 25$ °C

Fig 18. TR2 (PNP): Emitter capacitance as a function of emitter-base voltage; typical values

8. Test information

8.1 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.

9. Package outline

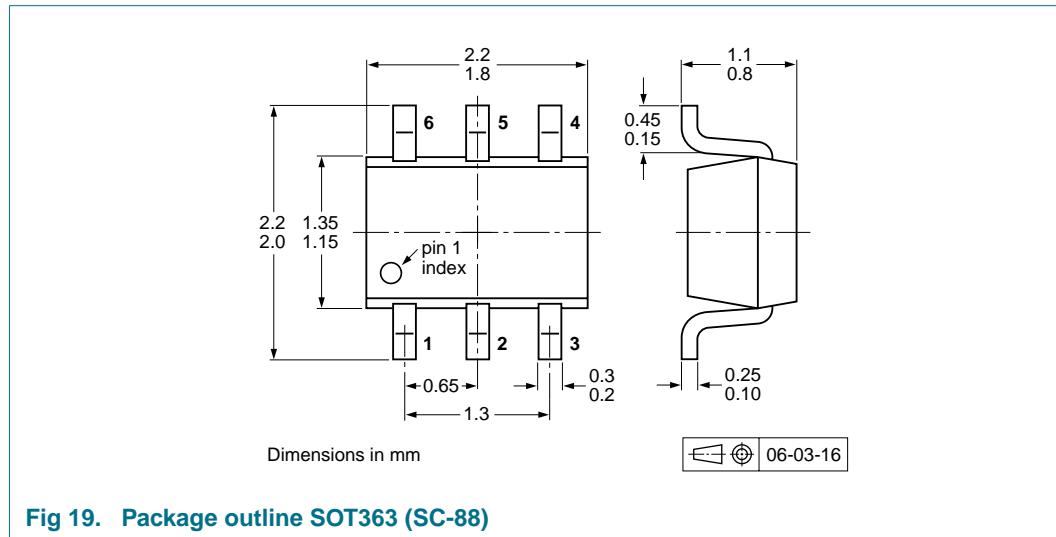


Fig 19. Package outline SOT363 (SC-88)

10. Packing information

Table 9. Packing methods

The indicated -xxx are the last three digits of the 12NC ordering code.^[1]

| Type number | Package | Description | Packing quantity | |
|-------------|---------|------------------------------------|------------------|-----------|
| | | | 3000 | |
| BC846BPN | SOT363 | 4 mm pitch, 8 mm tape and reel; T1 | [2] | -115 -135 |
| | | 4 mm pitch, 8 mm tape and reel; T2 | [3] | -125 -165 |

[1] For further information and the availability of packing methods, see [Section 14](#).

[2] T1: normal taping

[3] T2: reverse taping

11. Soldering

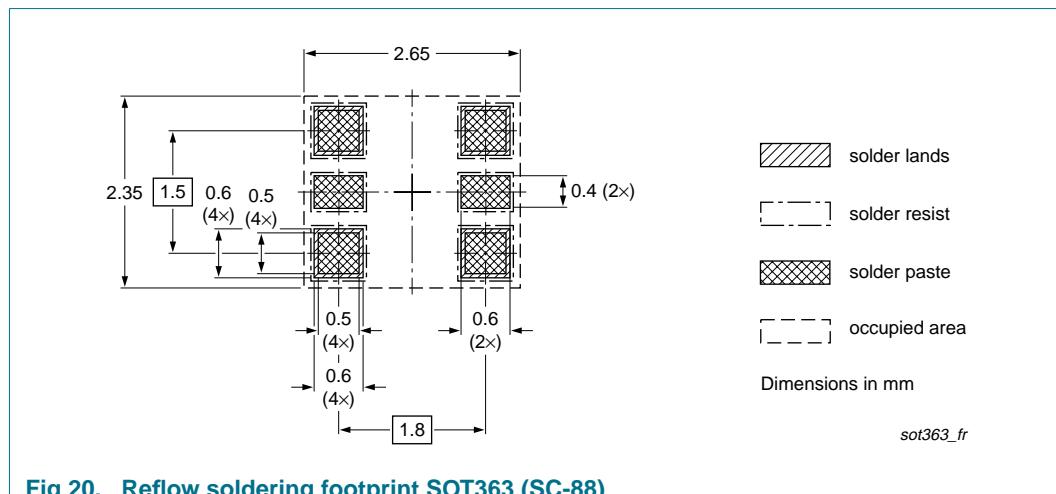


Fig 20. Reflow soldering footprint SOT363 (SC-88)

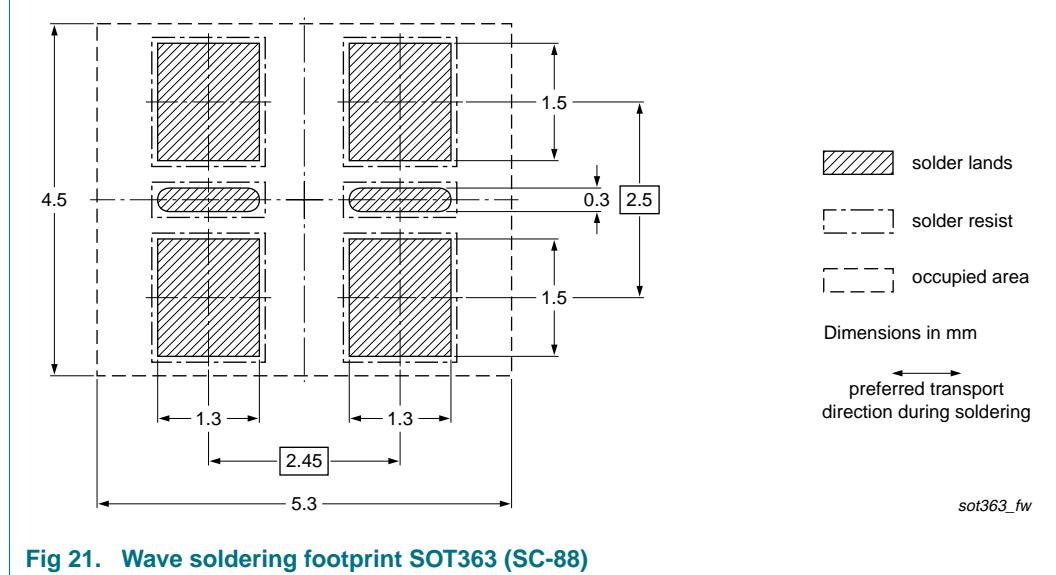


Fig 21. Wave soldering footprint SOT363 (SC-88)

12. Revision history

Table 10. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|-------------|--------------|--------------------|---------------|------------|
| BC846BPN_1 | 20090717 | Product data sheet | - | - |

13. Legal information

13.1 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 URL <http://www.nxp.com>.

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14. Contact information

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For sales office addresses, please send an email to: salesaddresses@nxp.com

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