



# BCM847QAS

45 V, 100 mA NPN/NPN matched double transistors

24 April 2018

Product data sheet

## 1. General description

NPN/NPN matched double transistors in an ultra small DFN1010B-6 (SOT1216) leadless Surface-Mounted Device (SMD) plastic package.

PNP/PNP complement: BCM857QAS

## 2. Features and benefits

- Reduces component count
- Reduces pick and place costs
- Low package height of 0.37 mm
- Current gain matching
- Base-emitter voltage matching
- Application-optimized pinout
- AEC-Q101 qualified

## 3. Applications

- Current mirror
- Differential amplifier

## 4. Quick reference data

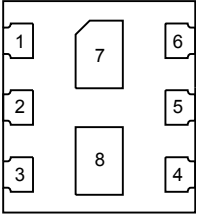
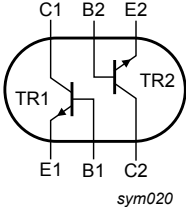
Table 1. Quick reference data

| Symbol                | Parameter                     | Conditions                                      | Min  | Typ | Max  | Unit |
|-----------------------|-------------------------------|-------------------------------------------------|------|-----|------|------|
| <b>Per transistor</b> |                               |                                                 |      |     |      |      |
| $V_{CE0}$             | collector-emitter voltage     | open base                                       | -    | -   | 45   | V    |
| $I_C$                 | collector current             |                                                 | -    | -   | 100  | mA   |
| $I_{CM}$              | peak collector current        | $t_p \leq 1$ ms; single pulse                   | -    | -   | 200  | mA   |
| $h_{FE}$              | DC current gain               | $V_{CE} = 5$ V; $I_C = 2$ mA; $T_{amb} = 25$ °C | 200  | 290 | 450  |      |
| <b>Per device</b>     |                               |                                                 |      |     |      |      |
| $h_{FE1}/h_{FE2}$     | DC current gain matching      | $V_{CE} = 5$ V; $I_C = 2$ mA; $T_{amb} = 25$ °C | 0.95 | 1   | 1.05 |      |
| $V_{BE1}-V_{BE2}$     | base-emitter voltage matching |                                                 | [1]  | -   | 2    | mV   |

[1] The smaller of the two values is subtracted from the larger value.

5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description   | Simplified outline                                                                                                                     | Graphic symbol                                                                                    |
|-----|--------|---------------|----------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| 1   | E1     | emitter TR1   |  <p>Transparent top view<br/>DFN1010B-6 (SOT1216)</p> |  <p>sym020</p> |
| 2   | B1     | base TR1      |                                                                                                                                        |                                                                                                   |
| 3   | C2     | collector TR2 |                                                                                                                                        |                                                                                                   |
| 4   | E2     | emitter TR2   |                                                                                                                                        |                                                                                                   |
| 5   | B2     | base TR2      |                                                                                                                                        |                                                                                                   |
| 6   | C1     | collector TR1 |                                                                                                                                        |                                                                                                   |
| 7   | C1     | collector TR1 |                                                                                                                                        |                                                                                                   |
| 8   | C2     | collector TR2 |                                                                                                                                        |                                                                                                   |

6. Ordering information

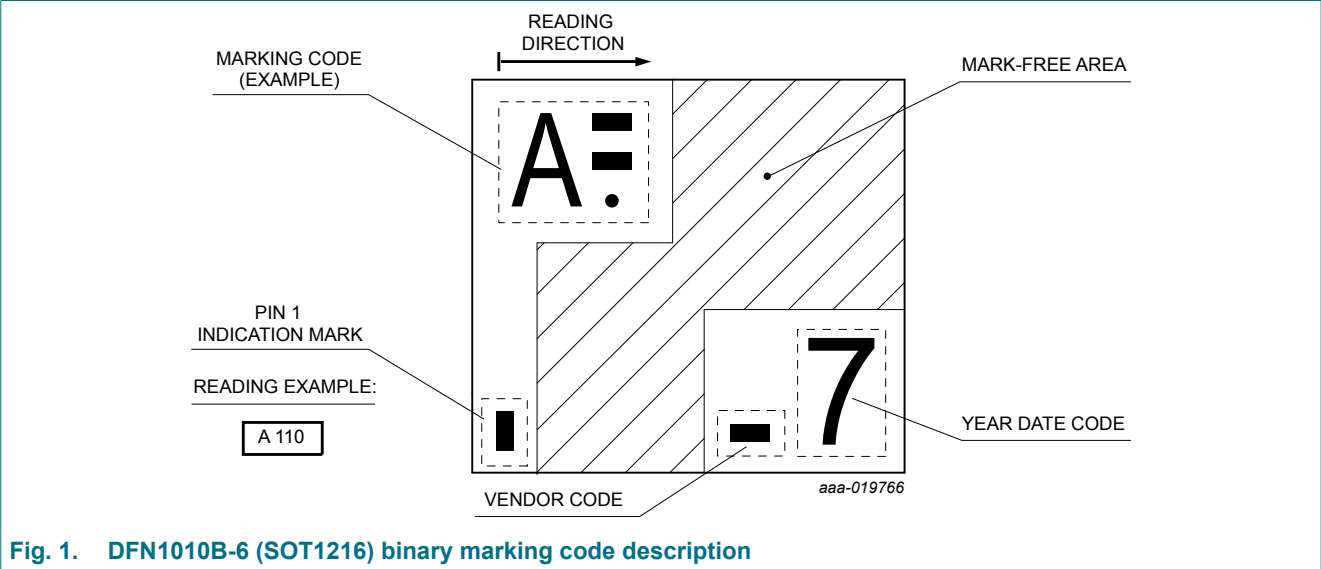
Table 3. Ordering information

| Type number | Package    |                                                                                              |         |
|-------------|------------|----------------------------------------------------------------------------------------------|---------|
|             | Name       | Description                                                                                  | Version |
| BCM847QAS   | DFN1010B-6 | DFN1010B-6: plastic thermal enhanced ultra thin small outline package; no leads; 6 terminals | SOT1216 |

7. Marking

Table 4. Marking codes

| Type number | Marking code |
|-------------|--------------|
| BCM847QAS   | C 010        |

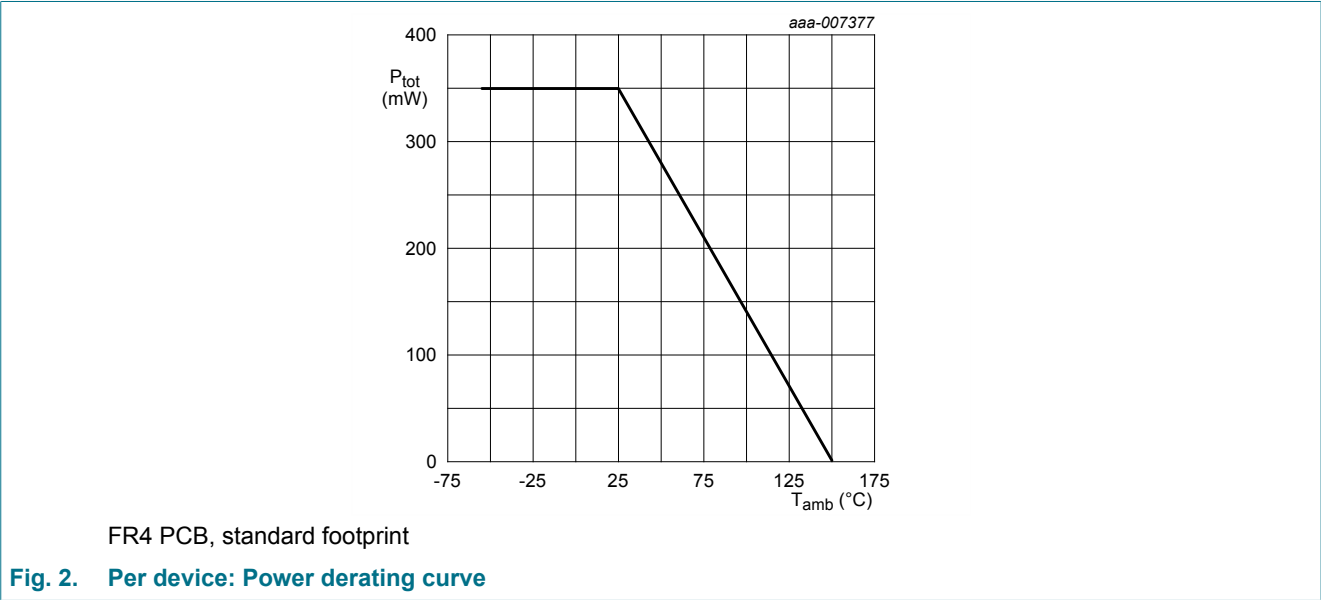


8. Limiting values

Table 5. Limiting values  
In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol           | Parameter                 | Conditions                          |     | Min | Max | Unit |
|------------------|---------------------------|-------------------------------------|-----|-----|-----|------|
| Per transistor   |                           |                                     |     |     |     |      |
| V <sub>CBO</sub> | collector-base voltage    | open emitter                        |     | -   | 50  | V    |
| V <sub>CEO</sub> | collector-emitter voltage | open base                           |     | -   | 45  | V    |
| V <sub>EBO</sub> | emitter-base voltage      | open collector                      |     | -   | 6   | V    |
| I <sub>C</sub>   | collector current         |                                     |     | -   | 100 | mA   |
| I <sub>CM</sub>  | peak collector current    | t <sub>p</sub> ≤ 1 ms; single pulse |     | -   | 200 | mA   |
| I <sub>BM</sub>  | peak base current         |                                     |     | -   | 100 | mA   |
| P <sub>tot</sub> | total power dissipation   | T <sub>amb</sub> ≤ 25 °C            | [1] | -   | 230 | mW   |
| Per device       |                           |                                     |     |     |     |      |
| P <sub>tot</sub> | total power dissipation   | T <sub>amb</sub> ≤ 25 °C            | [1] | -   | 350 | mW   |
| T <sub>j</sub>   | junction temperature      |                                     |     | -   | 150 | °C   |
| T <sub>amb</sub> | ambient temperature       |                                     |     | -55 | 150 | °C   |
| T <sub>stg</sub> | 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 6. 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] | -   | -   | 544 | K/W  |
| Per device     |                                             |             |     |     |     |     |      |
| $R_{th(j-a)}$  | thermal resistance from junction to ambient | in free air | [1] | -   | -   | 358 | K/W  |

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

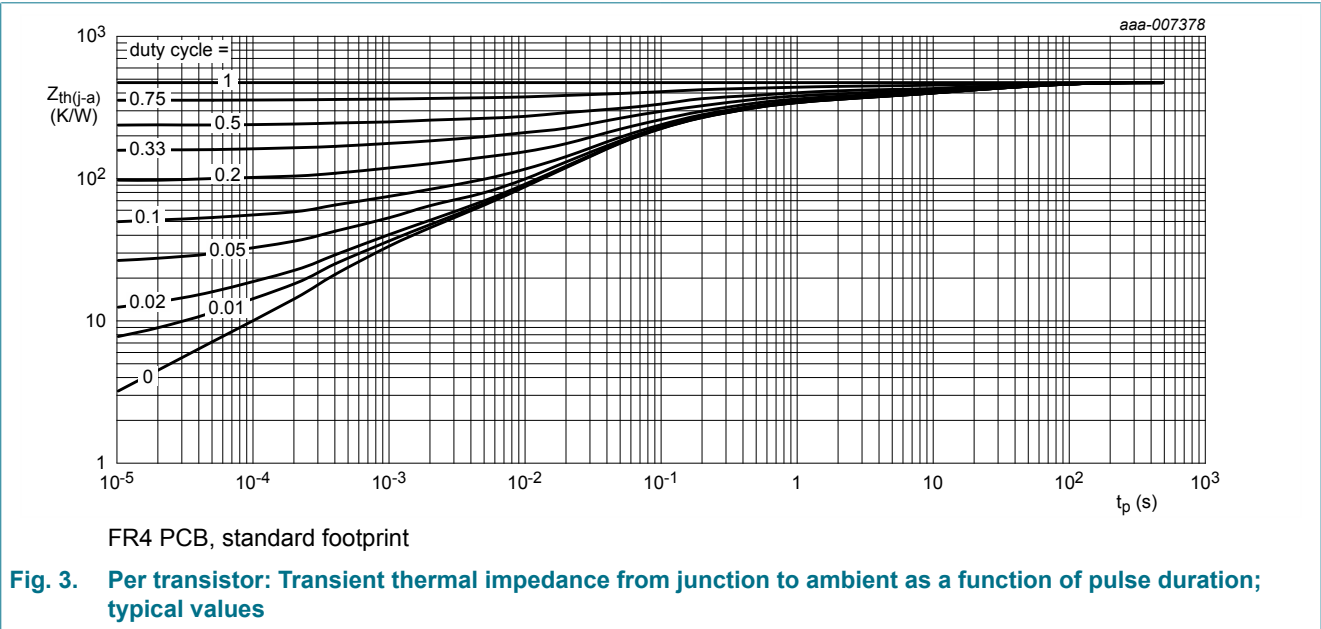


Fig. 3. Per transistor: Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

## 10. Characteristics

Table 7. Characteristics

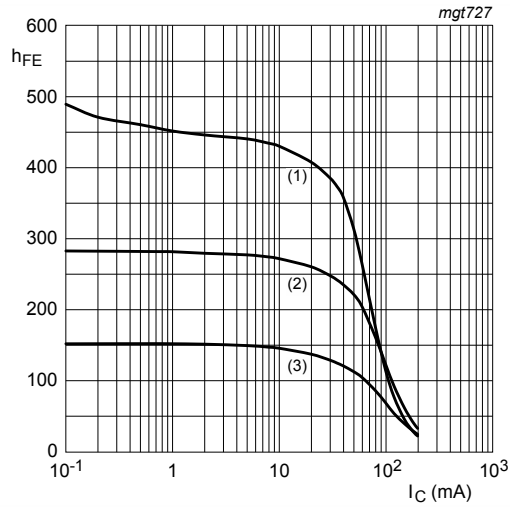
| Symbol                | Parameter                            | Conditions                                                                                                                         |     | Min  | Typ | Max  | Unit          |
|-----------------------|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|-----|------|-----|------|---------------|
| <b>Per transistor</b> |                                      |                                                                                                                                    |     |      |     |      |               |
| $V_{(BR)CBO}$         | collector-base breakdown voltage     | $I_C = 100\ \mu\text{A}$ ; $I_E = 0\ \text{A}$                                                                                     |     | 50   | -   | -    | V             |
| $V_{(BR)CEO}$         | collector-emitter breakdown voltage  | $I_C = 2\ \text{mA}$ ; $I_B = 0\ \text{A}$                                                                                         |     | 45   | -   | -    | V             |
| $V_{(BR)EBO}$         | emitter-base breakdown voltage       | $I_C = 0\ \text{A}$ ; $I_E = 100\ \mu\text{A}$                                                                                     |     | 6    | -   | -    | V             |
| $I_{CBO}$             | collector-base cut-off current       | $V_{CB} = 30\ \text{V}$ ; $I_E = 0\ \text{A}$ ; $T_{\text{amb}} = 25\ ^\circ\text{C}$                                              |     | -    | -   | 15   | nA            |
|                       |                                      | $V_{CB} = 30\ \text{V}$ ; $I_E = 0\ \text{A}$ ; $T_J = 150\ ^\circ\text{C}$                                                        |     | -    | -   | 5    | $\mu\text{A}$ |
| $I_{EBO}$             | emitter-base cut-off current         | $V_{EB} = 5\ \text{V}$ ; $I_C = 0\ \text{A}$ ; $T_{\text{amb}} = 25\ ^\circ\text{C}$                                               |     | -    | -   | 100  | nA            |
| $h_{FE}$              | DC current gain                      | $V_{CE} = 5\ \text{V}$ ; $I_C = 10\ \mu\text{A}$ ; $T_{\text{amb}} = 25\ ^\circ\text{C}$                                           |     | -    | 250 | -    |               |
|                       |                                      | $V_{CE} = 5\ \text{V}$ ; $I_C = 2\ \text{mA}$ ; $T_{\text{amb}} = 25\ ^\circ\text{C}$                                              |     | 200  | 290 | 450  |               |
| $V_{CEsat}$           | collector-emitter saturation voltage | $I_C = 10\ \text{mA}$ ; $I_B = 0.5\ \text{mA}$ ; $T_{\text{amb}} = 25\ ^\circ\text{C}$                                             |     | -    | -   | 200  | mV            |
|                       |                                      | $I_C = 100\ \text{mA}$ ; $I_B = 5\ \text{mA}$ ; $T_{\text{amb}} = 25\ ^\circ\text{C}$                                              | [1] | -    | -   | 400  | mV            |
| $V_{BEsat}$           | base-emitter saturation voltage      | $I_C = 10\ \text{mA}$ ; $I_B = 0.5\ \text{mA}$ ; $T_{\text{amb}} = 25\ ^\circ\text{C}$                                             | [2] | -    | 760 | -    | mV            |
|                       |                                      | $I_C = 100\ \text{mA}$ ; $I_B = 5\ \text{mA}$ ; $T_{\text{amb}} = 25\ ^\circ\text{C}$                                              | [2] | -    | 900 | -    | mV            |
| $V_{BE}$              | base-emitter voltage                 | $V_{CE} = 5\ \text{V}$ ; $I_C = 2\ \text{mA}$ ; $T_{\text{amb}} = 25\ ^\circ\text{C}$                                              | [3] | 600  | 660 | 725  | mV            |
|                       |                                      | $V_{CE} = 5\ \text{V}$ ; $I_C = 10\ \text{mA}$ ; $T_{\text{amb}} = 25\ ^\circ\text{C}$                                             | [3] | -    | 710 | 820  | mV            |
| $C_c$                 | collector capacitance                | $V_{CB} = 10\ \text{V}$ ; $I_E = 0\ \text{A}$ ; $i_e = 0\ \text{A}$ ; $f = 1\ \text{MHz}$ ; $T_{\text{amb}} = 25\ ^\circ\text{C}$  |     | -    | -   | 4    | pF            |
| $C_e$                 | emitter capacitance                  | $V_{EB} = 0.5\ \text{V}$ ; $I_C = 0\ \text{A}$ ; $i_c = 0\ \text{A}$ ; $f = 1\ \text{MHz}$ ; $T_{\text{amb}} = 25\ ^\circ\text{C}$ |     | -    | 11  | -    | pF            |
| $f_T$                 | transition frequency                 | $V_{CE} = 5\ \text{V}$ ; $I_C = 10\ \text{mA}$ ; $f = 100\ \text{MHz}$ ; $T_{\text{amb}} = 25\ ^\circ\text{C}$                     |     | 100  | -   | -    | MHz           |
| <b>Per device</b>     |                                      |                                                                                                                                    |     |      |     |      |               |
| $h_{FE1}/h_{FE2}$     | DC current gain matching             | $V_{CE} = 5\ \text{V}$ ; $I_C = 2\ \text{mA}$ ; $T_{\text{amb}} = 25\ ^\circ\text{C}$                                              |     | 0.95 | 1   | 1.05 |               |
| $V_{BE1}-V_{BE2}$     | base-emitter voltage matching        |                                                                                                                                    | [4] | -    | -   | 2    | mV            |

[1] Pulse test:  $t_p \leq 300\ \mu\text{s}$ ;  $\delta \leq 0.02$

[2]  $V_{BEsat}$  decreases by about  $1.7\ \text{mV/K}$  with increasing temperature.

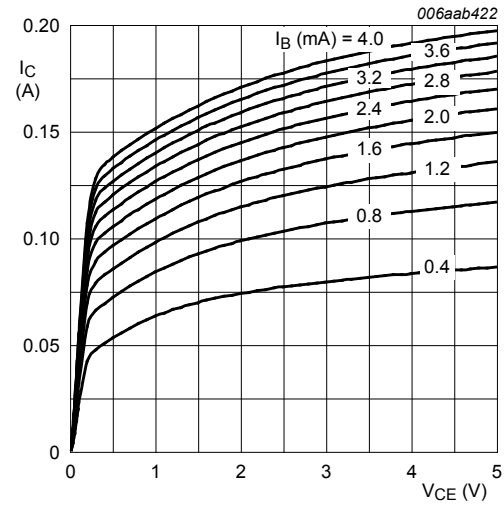
[3]  $V_{BE}$  decreases by about  $2\ \text{mV/K}$  with increasing temperature.

[4] The smaller of the two values is subtracted from the larger value.



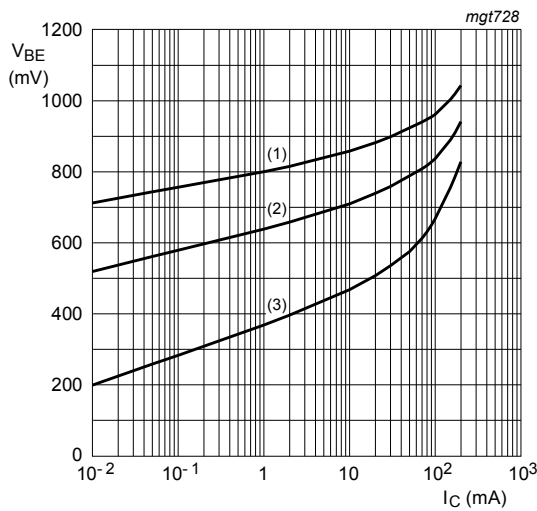
$V_{CE} = 5\text{ V}$   
 (1)  $T_{amb} = 150^\circ\text{C}$   
 (2)  $T_{amb} = 25^\circ\text{C}$   
 (3)  $T_{amb} = -55^\circ\text{C}$

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



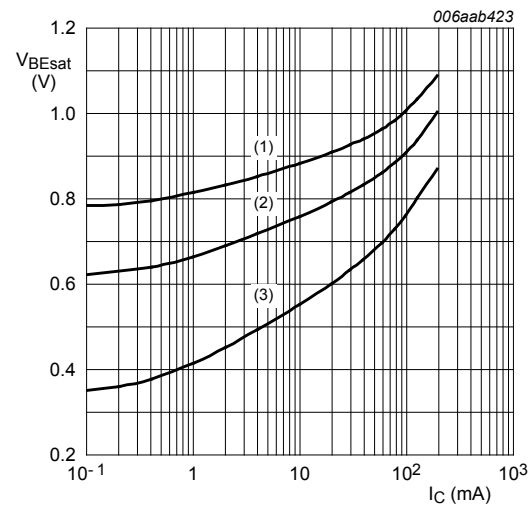
$T_{amb} = 25^\circ\text{C}$

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



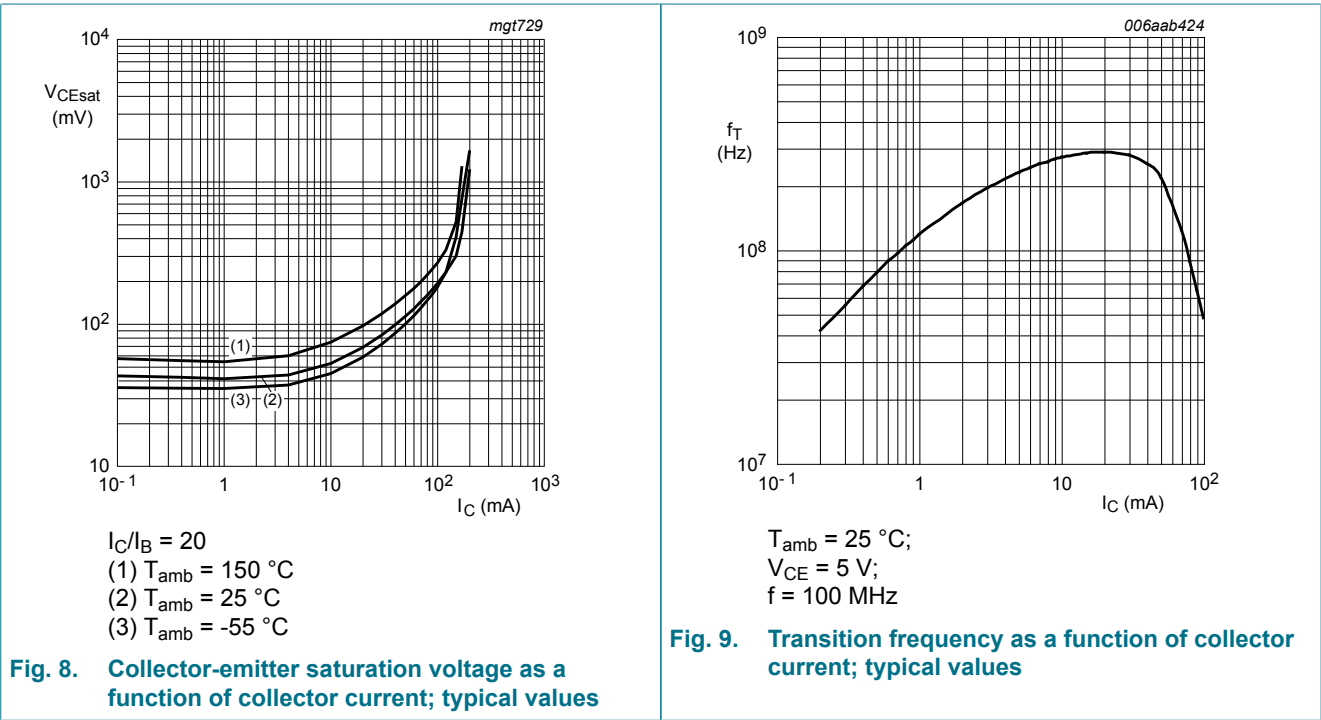
$V_{CE} = 5\text{ V}$   
 (1)  $T_{amb} = -55^\circ\text{C}$   
 (2)  $T_{amb} = 25^\circ\text{C}$   
 (3)  $T_{amb} = 150^\circ\text{C}$

**Fig. 6. Base-emitter voltage as a function of collector current; typical values**



$I_C/I_B = 20$   
 (1)  $T_{amb} = -55^\circ\text{C}$   
 (2)  $T_{amb} = 25^\circ\text{C}$   
 (3)  $T_{amb} = 150^\circ\text{C}$

**Fig. 7. Base-emitter saturation voltage as a function of collector current; typical values**

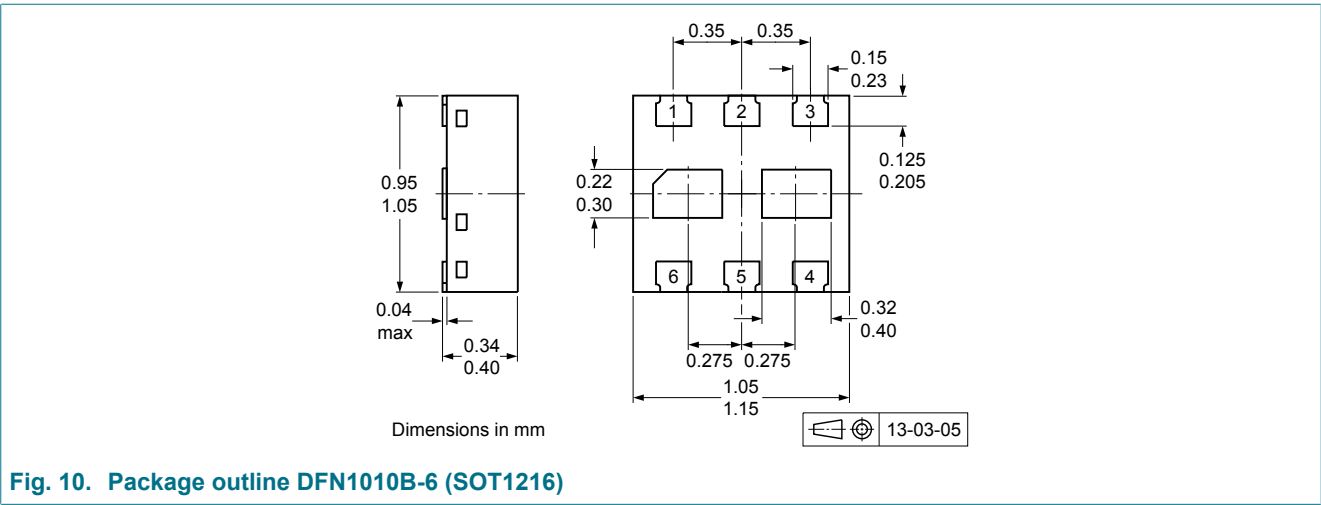


11. Test information

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.

12. Package outline







14. Revision history

Table 8. Revision history

| Data sheet ID | Release date | Data sheet status  | Change notice | Supersedes |
|---------------|--------------|--------------------|---------------|------------|
| BCM847QAS v.1 | 20180424     | 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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- [2] The term 'short data sheet' is explained in section "Definitions".
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