



# PBSS4130PANP

30 V, 1 A NPN/PNP low  $V_{CEsat}$  (BISS) transistor

12 December 2012

Product data sheet

## 1. General description

NPN/PNP low  $V_{CEsat}$  Breakthrough In Small Signal (BISS) transistor in a leadless medium power DFN2020-6 (SOT1118) Surface-Mounted Device (SMD) plastic package.

NPN/NPN complement: PBSS4130PAN. PNP/PNP complement: PBSS5130PAP.

## 2. Features and benefits

- Very low collector-emitter saturation voltage  $V_{CEsat}$
- High collector current capability  $I_C$  and  $I_{CM}$
- High collector current gain  $h_{FE}$  at high  $I_C$
- Reduced Printed-Circuit Board (PCB) requirements
- High efficiency due to less heat generation
- AEC-Q101 qualified

## 3. Applications

- Load switch
- Battery-driven devices
- Power management
- Charging circuits
- Power switches (e.g. motors, fans)

## 4. Quick reference data

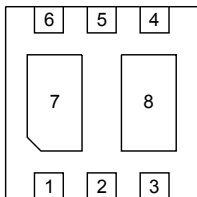
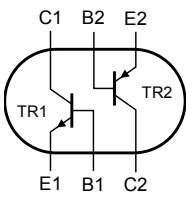
Table 1. Quick reference data

| Symbol                                                               | Parameter                               | Conditions                                                                                            | Min | Typ | Max | Unit       |
|----------------------------------------------------------------------|-----------------------------------------|-------------------------------------------------------------------------------------------------------|-----|-----|-----|------------|
| <b>Per transistor; for the PNP transistor with negative polarity</b> |                                         |                                                                                                       |     |     |     |            |
| $V_{CEO}$                                                            | collector-emitter voltage               | open base                                                                                             | -   | -   | 30  | V          |
| $I_C$                                                                | collector current                       |                                                                                                       | -   | -   | 1   | A          |
| $I_{CM}$                                                             | peak collector current                  | single pulse; $t_p \leq 1$ ms                                                                         | -   | -   | 2   | A          |
| <b>TR1 (NPN)</b>                                                     |                                         |                                                                                                       |     |     |     |            |
| $R_{CEsat}$                                                          | collector-emitter saturation resistance | $I_C = 1$ A; $I_B = 0.1$ A; pulsed; $t_p \leq 300$ $\mu$ s;<br>$\delta \leq 0.02$ ; $T_{amb} = 25$ °C | -   | -   | 190 | m $\Omega$ |

| Symbol           | Parameter                               | Conditions                                                                                                                                             | Min | Typ | Max | Unit       |
|------------------|-----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|-----|------------|
| <b>TR2 (PNP)</b> |                                         |                                                                                                                                                        |     |     |     |            |
| $R_{CEsat}$      | collector-emitter saturation resistance | $I_C = -1\text{ A}$ ; $I_B = -0.1\text{ A}$ ; pulsed;<br>$t_p \leq 300\text{ }\mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{amb} = 25\text{ }^\circ\text{C}$ | -   | -   | 250 | m $\Omega$ |

## 5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description   | Simplified outline                                                                                                                           | Graphic symbol                                                                                    |
|-----|--------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| 1   | E1     | emitter TR1   |  <p>Transparent top view<br/><b>DFN2020-6 (SOT1118)</b></p> |  <p>sym139</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 |
| PBSS4130PANP | DFN2020-6 | plastic thermal enhanced ultra thin small outline package; no leads; 6 terminals; body 2 x 2 x 0.65 mm | SOT1118 |

## 7. Marking

Table 4. Marking codes

| Type number  | Marking code |
|--------------|--------------|
| PBSS4130PANP | 2F           |

## 8. Limiting values

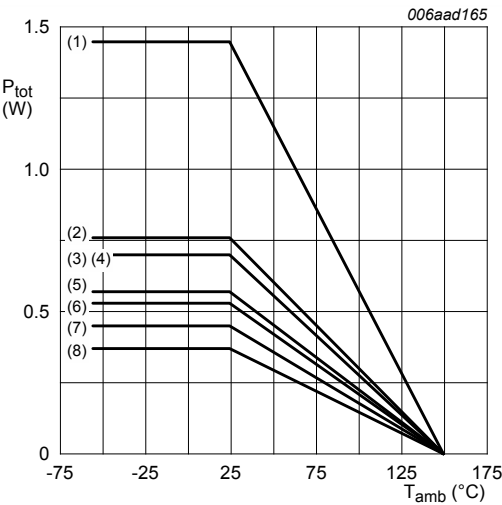
Table 5. Limiting values

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

| Symbol                                                               | Parameter                 | Conditions   | Min | Max | Unit |
|----------------------------------------------------------------------|---------------------------|--------------|-----|-----|------|
| <b>Per transistor; for the PNP transistor with negative polarity</b> |                           |              |     |     |      |
| $V_{CBO}$                                                            | collector-base voltage    | open emitter | -   | 30  | V    |
| $V_{CEO}$                                                            | collector-emitter voltage | open base    | -   | 30  | V    |

| Symbol           | Parameter               | Conditions                          |     | Min | Max  | Unit |
|------------------|-------------------------|-------------------------------------|-----|-----|------|------|
| V <sub>EBO</sub> | emitter-base voltage    | open collector                      |     | -   | 7    | V    |
| I <sub>C</sub>   | collector current       |                                     |     | -   | 1    | A    |
| I <sub>CM</sub>  | peak collector current  | single pulse; t <sub>p</sub> ≤ 1 ms |     | -   | 2    | A    |
| I <sub>B</sub>   | base current            |                                     |     | -   | 0.3  | A    |
| I <sub>BM</sub>  | peak base current       | single pulse; t <sub>p</sub> ≤ 1 ms |     | -   | 1    | A    |
| P <sub>tot</sub> | total power dissipation | T <sub>amb</sub> ≤ 25 °C            | [1] | -   | 370  | mW   |
|                  |                         |                                     | [2] | -   | 570  | mW   |
|                  |                         |                                     | [3] | -   | 530  | mW   |
|                  |                         |                                     | [4] | -   | 700  | mW   |
|                  |                         |                                     | [5] | -   | 450  | mW   |
|                  |                         |                                     | [6] | -   | 760  | mW   |
|                  |                         |                                     | [7] | -   | 700  | mW   |
|                  |                         |                                     | [8] | -   | 1450 | mW   |
| Per device       |                         |                                     |     |     |      |      |
| P <sub>tot</sub> | total power dissipation | T <sub>amb</sub> ≤ 25 °C            | [1] | -   | 510  | mW   |
|                  |                         |                                     | [2] | -   | 780  | mW   |
|                  |                         |                                     | [3] | -   | 730  | mW   |
|                  |                         |                                     | [4] | -   | 960  | mW   |
|                  |                         |                                     | [5] | -   | 620  | mW   |
|                  |                         |                                     | [6] | -   | 1040 | mW   |
|                  |                         |                                     | [7] | -   | 960  | mW   |
|                  |                         |                                     | [8] | -   | 2000 | 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 35 µm copper strip line, tin-plated and standard footprint.
- [2] Device mounted on an FR4 PCB, single-sided 35 µm copper strip line, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.
- [3] Device mounted on 4-layer PCB 35 µm copper strip line, tin-plated and standard footprint.
- [4] Device mounted on 4-layer PCB 35 µm copper strip line, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.
- [5] Device mounted on an FR4 PCB, single-sided 70 µm copper strip line, tin-plated and standard footprint.
- [6] Device mounted on an FR4 PCB, single-sided 70 µm copper strip line, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.
- [7] Device mounted on 4-layer PCB 70 µm copper strip line, tin-plated and standard footprint.
- [8] Device mounted on 4-layer PCB 70 µm copper strip line, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.



- (1) 4-layer PCB 70 μm, mounting pad for collector 1 cm<sup>2</sup>
- (2) FR4 PCB 70 μm, mounting pad for collector 1 cm<sup>2</sup>
- (3) 4-layer PCB 70 μm, standard footprint
- (4) 4-layer PCB 35 μm, mounting pad for collector 1 cm<sup>2</sup>
- (5) FR4 PCB 35 μm, mounting pad for collector 1 cm<sup>2</sup>
- (6) 4-layer PCB 35 μm, standard footprint
- (7) FR4 PCB 70 μm, standard footprint
- (8) FR4 PCB 35 μm, standard footprint

Fig. 1. Per transistor: power derating curves

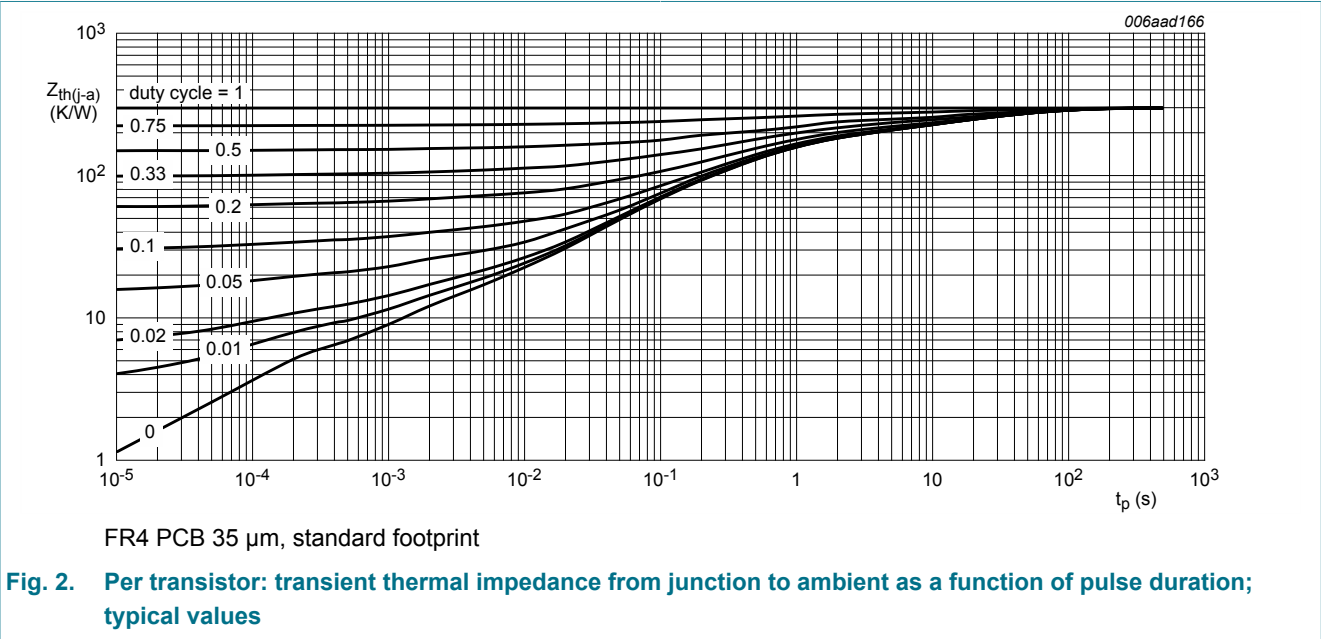
9. Thermal characteristics

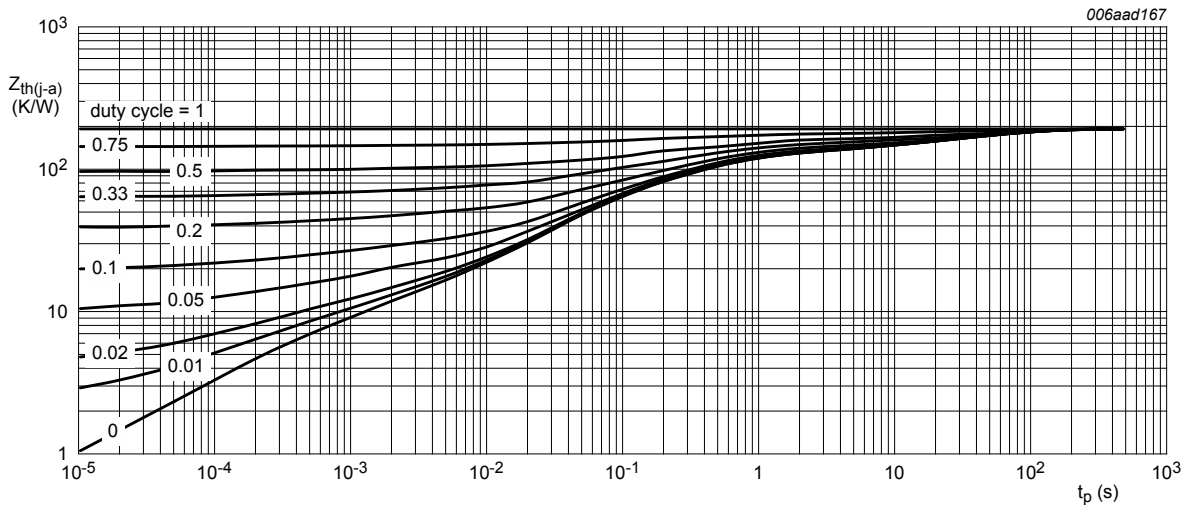
Table 6. Thermal characteristics

| 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] | -   | -   | 338 | K/W  |
|                       |                                                  |             | [2] | -   | -   | 219 | K/W  |
|                       |                                                  |             | [3] | -   | -   | 236 | K/W  |
|                       |                                                  |             | [4] | -   | -   | 179 | K/W  |
|                       |                                                  |             | [5] | -   | -   | 278 | K/W  |
|                       |                                                  |             | [6] | -   | -   | 164 | K/W  |
|                       |                                                  |             | [7] | -   | -   | 179 | K/W  |
|                       |                                                  |             | [8] | -   | -   | 86  | K/W  |
| R <sub>th(j-sp)</sub> | thermal resistance from junction to solder point |             |     | -   | -   | 30  | K/W  |

| Symbol               | Parameter                                   | Conditions  |     | Min | Typ | Max | Unit |
|----------------------|---------------------------------------------|-------------|-----|-----|-----|-----|------|
| Per device           |                                             |             |     |     |     |     |      |
| R <sub>th(j-a)</sub> | thermal resistance from junction to ambient | in free air | [1] | -   | -   | 245 | K/W  |
|                      |                                             |             | [2] | -   | -   | 160 | K/W  |
|                      |                                             |             | [3] | -   | -   | 171 | K/W  |
|                      |                                             |             | [4] | -   | -   | 130 | K/W  |
|                      |                                             |             | [5] | -   | -   | 202 | K/W  |
|                      |                                             |             | [6] | -   | -   | 120 | K/W  |
|                      |                                             |             | [7] | -   | -   | 130 | K/W  |
|                      |                                             |             | [8] | -   | -   | 63  | K/W  |

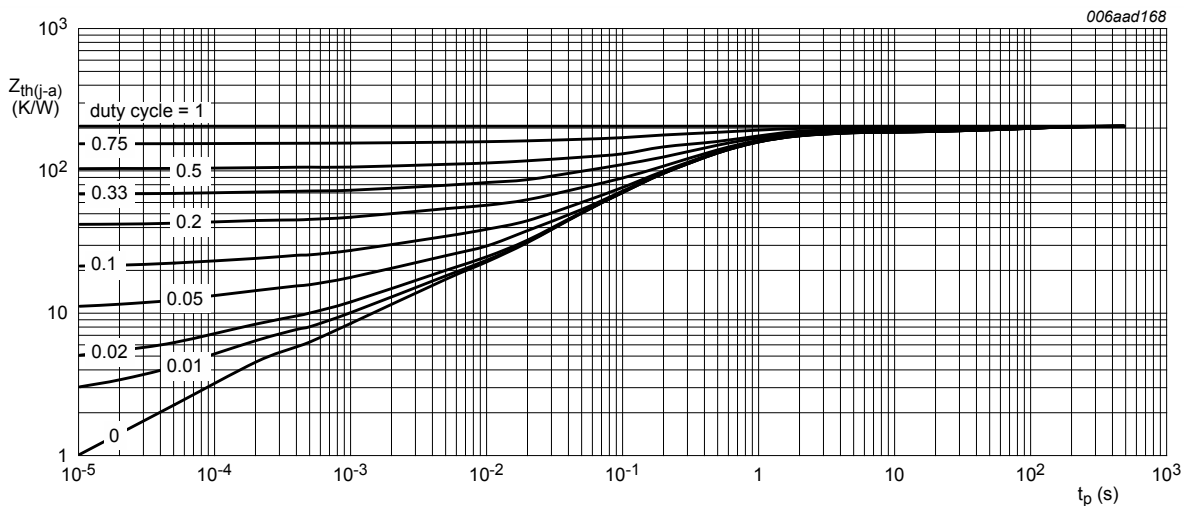
- [1] Device mounted on an FR4 PCB, single-sided 35 µm copper strip line, tin-plated and standard footprint.
- [2] Device mounted on an FR4 PCB, single-sided 35 µm copper strip line, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.
- [3] Device mounted on 4-layer PCB 35 µm copper strip line, tin-plated and standard footprint.
- [4] Device mounted on 4-layer PCB 35 µm copper strip line, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.
- [5] Device mounted on an FR4 PCB, single-sided 70 µm copper strip line, tin-plated and standard footprint.
- [6] Device mounted on an FR4 PCB, single-sided 70 µm copper strip line, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.
- [7] Device mounted on 4-layer PCB 70 µm copper strip line, tin-plated and standard footprint.
- [8] Device mounted on 4-layer PCB 70 µm copper strip line, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.





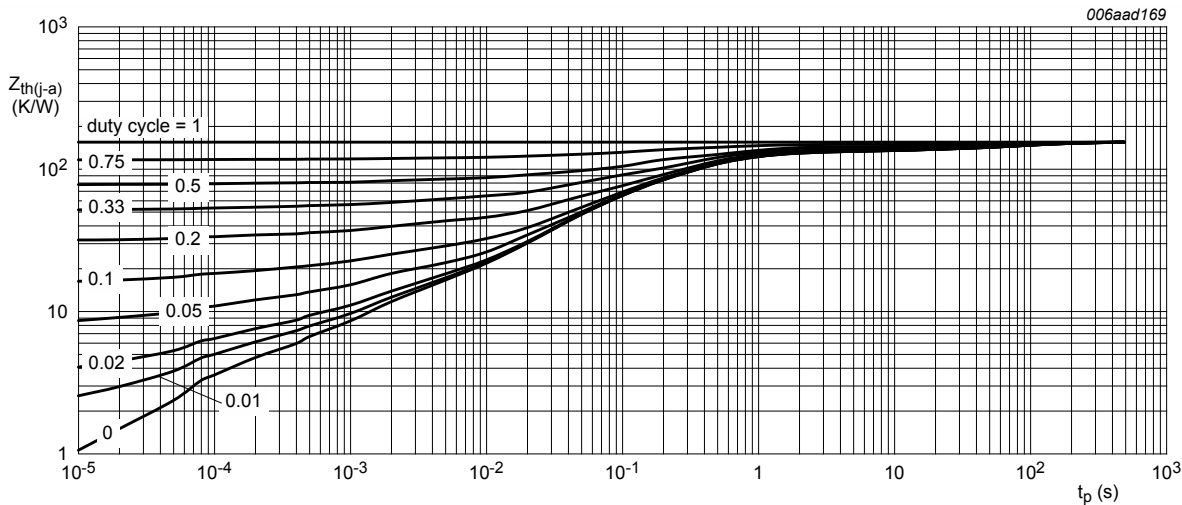
FR4 PCB 35  $\mu$ m, mounting pad for collector 1 cm<sup>2</sup>

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



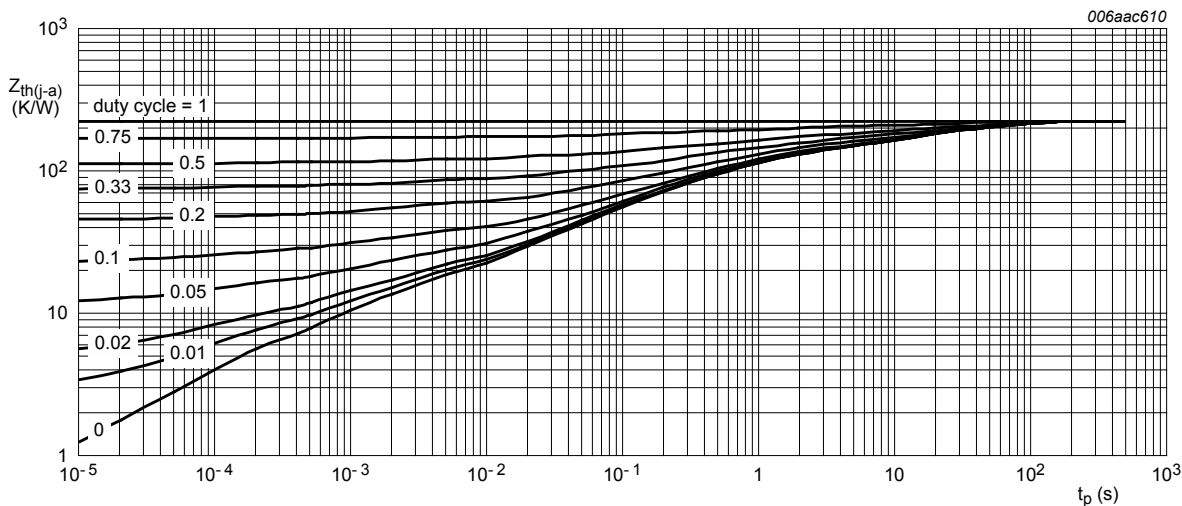
4-layer PCB 35  $\mu$ m, standard footprint

Fig. 4. Per transistor: transient thermal impedance from junction to ambient as a function of pulse duration; typical values



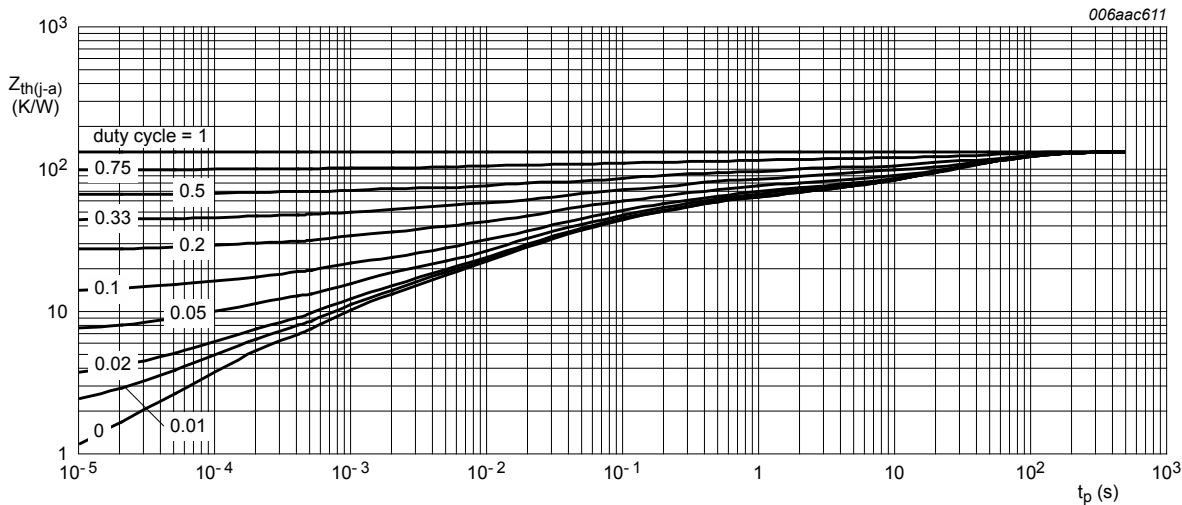
4-layer PCB 35  $\mu\text{m}$ , mounting pad for collector 1  $\text{cm}^2$

Fig. 5. Per transistor: transient thermal impedance from junction to ambient as a function of pulse duration; typical values



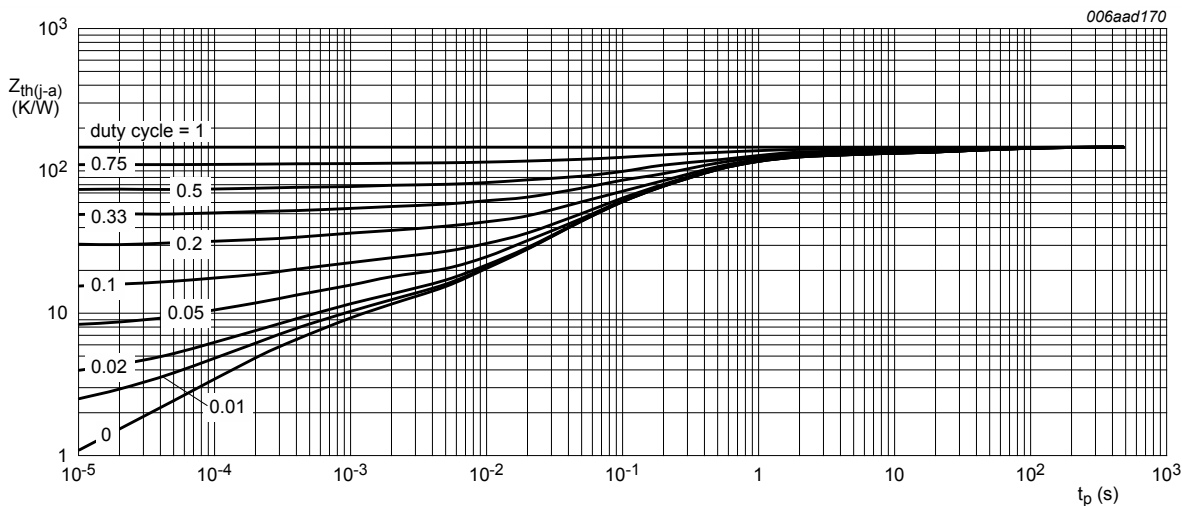
FR4 PCB 70  $\mu\text{m}$ , standard footprint

Fig. 6. Per transistor: transient thermal impedance from junction to ambient as a function of pulse duration; typical values



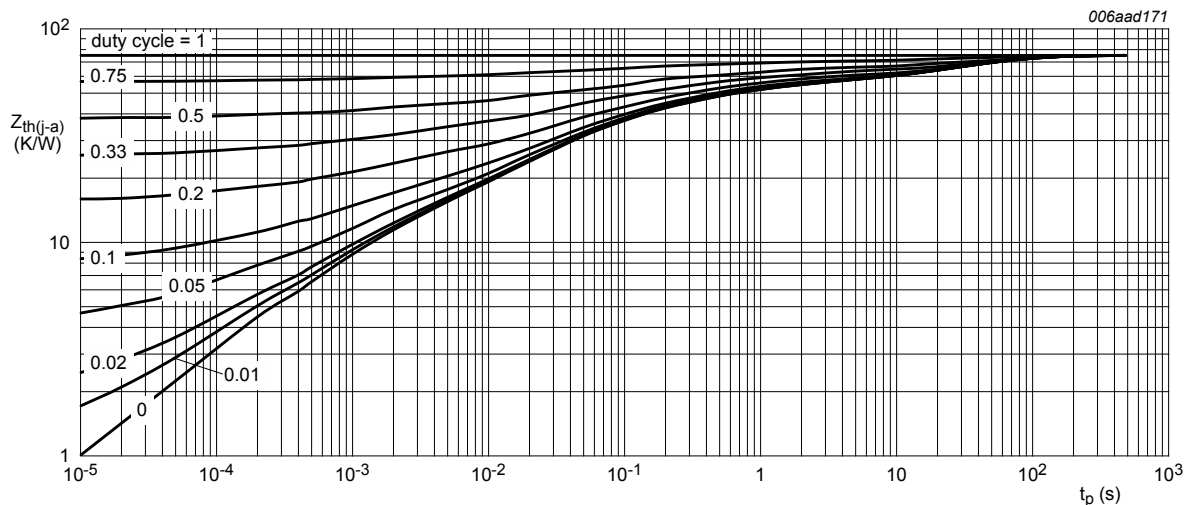
FR4 PCB 70  $\mu$ m, mounting pad for collector 1 cm<sup>2</sup>

Fig. 7. Per transistor: transient thermal impedance from junction to ambient as a function of pulse duration; typical values



4-layer PCB 70  $\mu$ m, standard footprint

Fig. 8. Per transistor: transient thermal impedance from junction to ambient as a function of pulse duration; typical values



4-layer PCB 70  $\mu\text{m}$ , mounting pad for collector 1  $\text{cm}^2$

**Fig. 9.** Per transistor: transient thermal impedance from junction to ambient as a function of pulse duration; typical values

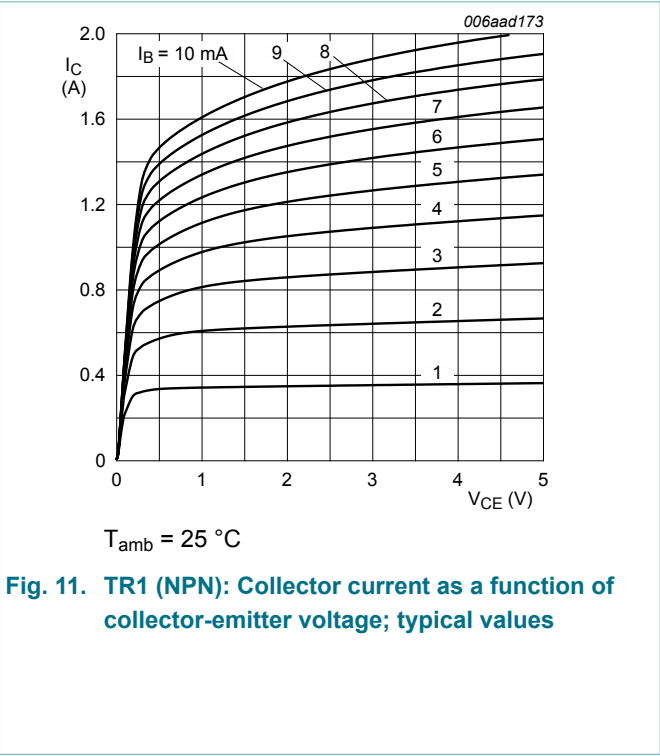
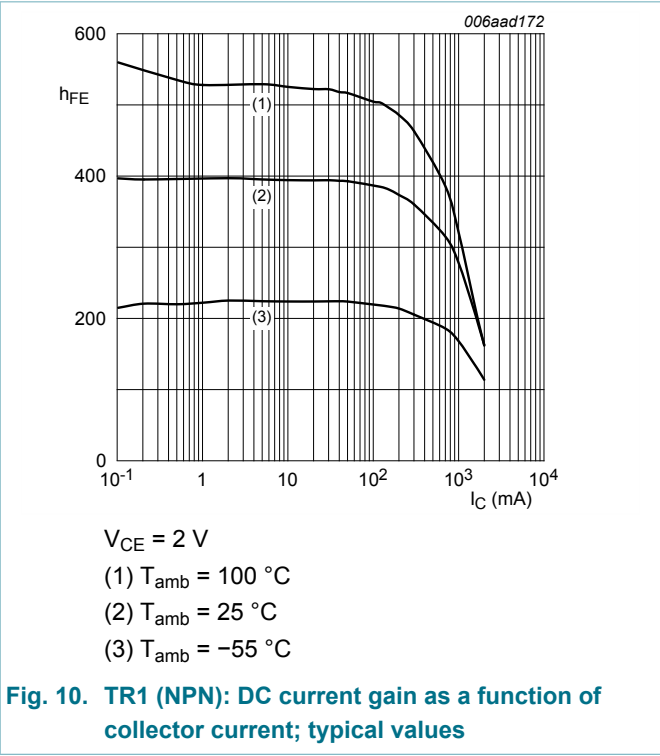
## 10. Characteristics

**Table 7.** Characteristics

| Symbol             | Parameter                               | Conditions                                                                                                                                                                              | Min | Typ | Max | Unit          |
|--------------------|-----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|-----|---------------|
| <b>TR1 (NPN)</b>   |                                         |                                                                                                                                                                                         |     |     |     |               |
| $I_{\text{CBO}}$   | collector-base cut-off current          | $V_{\text{CB}} = 24 \text{ V}; I_{\text{E}} = 0 \text{ A}; T_{\text{amb}} = 25 \text{ }^{\circ}\text{C}$                                                                                | -   | -   | 100 | nA            |
|                    |                                         | $V_{\text{CB}} = 24 \text{ V}; I_{\text{E}} = 0 \text{ A}; T_{\text{j}} = 150 \text{ }^{\circ}\text{C}$                                                                                 | -   | -   | 50  | $\mu\text{A}$ |
| $I_{\text{EBO}}$   | emitter-base cut-off current            | $V_{\text{EB}} = 5 \text{ V}; I_{\text{C}} = 0 \text{ A}; T_{\text{amb}} = 25 \text{ }^{\circ}\text{C}$                                                                                 | -   | -   | 100 | nA            |
| $h_{\text{FE}}$    | DC current gain                         | $V_{\text{CE}} = 2 \text{ V}; I_{\text{C}} = 100 \text{ mA}; \text{pulsed}; t_{\text{p}} \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{\text{amb}} = 25 \text{ }^{\circ}\text{C}$ | 240 | 370 | -   |               |
|                    |                                         | $V_{\text{CE}} = 2 \text{ V}; I_{\text{C}} = 500 \text{ mA}; \text{pulsed}; t_{\text{p}} \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{\text{amb}} = 25 \text{ }^{\circ}\text{C}$ | 210 | 320 | -   |               |
|                    |                                         | $V_{\text{CE}} = 2 \text{ V}; I_{\text{C}} = 1 \text{ A}; \text{pulsed}; t_{\text{p}} \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{\text{amb}} = 25 \text{ }^{\circ}\text{C}$    | 180 | 270 | -   |               |
| $V_{\text{CEsat}}$ | collector-emitter saturation voltage    | $I_{\text{C}} = 500 \text{ mA}; I_{\text{B}} = 50 \text{ mA}; T_{\text{amb}} = 25 \text{ }^{\circ}\text{C}$                                                                             | -   | 75  | 100 | mV            |
|                    |                                         | $I_{\text{C}} = 1 \text{ A}; I_{\text{B}} = 50 \text{ mA}; \text{pulsed}; t_{\text{p}} \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{\text{amb}} = 25 \text{ }^{\circ}\text{C}$   | -   | 155 | 200 | mV            |
|                    |                                         | $I_{\text{C}} = 1 \text{ A}; I_{\text{B}} = 100 \text{ mA}; \text{pulsed}; t_{\text{p}} \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{\text{amb}} = 25 \text{ }^{\circ}\text{C}$  | -   | 150 | 190 | mV            |
| $R_{\text{CEsat}}$ | collector-emitter saturation resistance | $I_{\text{C}} = 1 \text{ A}; I_{\text{B}} = 0.1 \text{ A}; \text{pulsed}; t_{\text{p}} \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02; T_{\text{amb}} = 25 \text{ }^{\circ}\text{C}$   | -   | -   | 190 | m $\Omega$    |

| Symbol             | Parameter                               | Conditions                                                                                                                        |  | Min | Typ  | Max  | Unit |
|--------------------|-----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|--|-----|------|------|------|
| V <sub>BEsat</sub> | base-emitter saturation voltage         | I <sub>C</sub> = 500 mA; I <sub>B</sub> = 50 mA; T <sub>amb</sub> = 25 °C                                                         |  | -   | -    | 1    | V    |
|                    |                                         | I <sub>C</sub> = 1 A; I <sub>B</sub> = 50 mA; pulsed;<br>t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C              |  | -   | -    | 1.1  | V    |
|                    |                                         | I <sub>C</sub> = 1 A; I <sub>B</sub> = 100 mA; pulsed;<br>t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C             |  | -   | -    | 1.1  | V    |
| V <sub>BEon</sub>  | base-emitter turn-on voltage            | V <sub>CE</sub> = 2 V; I <sub>C</sub> = 0.5 A; pulsed;<br>t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C             |  | -   | -    | 0.9  | V    |
| t <sub>d</sub>     | delay time                              | V <sub>CC</sub> = 10 V; I <sub>C</sub> = 0.5 A; I <sub>Bon</sub> = 25 mA;<br>I <sub>Boff</sub> = -25 mA; T <sub>amb</sub> = 25 °C |  | -   | 15   | -    | ns   |
| t <sub>r</sub>     | rise time                               |                                                                                                                                   |  | -   | 30   | -    | ns   |
| t <sub>on</sub>    | turn-on time                            |                                                                                                                                   |  | -   | 45   | -    | ns   |
| t <sub>s</sub>     | storage time                            |                                                                                                                                   |  | -   | 310  | -    | ns   |
| t <sub>f</sub>     | fall time                               |                                                                                                                                   |  | -   | 55   | -    | ns   |
| t <sub>off</sub>   | turn-off time                           |                                                                                                                                   |  | -   | 365  | -    | ns   |
| f <sub>T</sub>     | transition frequency                    | V <sub>CE</sub> = 10 V; I <sub>C</sub> = 50 mA; f = 100 MHz;<br>T <sub>amb</sub> = 25 °C                                          |  | 90  | 165  | -    | MHz  |
| C <sub>c</sub>     | collector capacitance                   | V <sub>CB</sub> = 10 V; I <sub>E</sub> = 0 A; i <sub>e</sub> = 0 A;<br>f = 1 MHz; T <sub>amb</sub> = 25 °C                        |  | -   | 7.5  | 10   | pF   |
| <b>TR2 (PNP)</b>   |                                         |                                                                                                                                   |  |     |      |      |      |
| I <sub>CBO</sub>   | collector-base cut-off current          | V <sub>CB</sub> = -24 V; I <sub>E</sub> = 0 A                                                                                     |  | -   | -    | -100 | nA   |
|                    |                                         | V <sub>CB</sub> = -24 V; I <sub>E</sub> = 0 A; T <sub>j</sub> = 150 °C                                                            |  | -   | -    | -50  | μA   |
| I <sub>EBO</sub>   | emitter-base cut-off current            | V <sub>EB</sub> = -5 V; I <sub>C</sub> = 0 A                                                                                      |  | -   | -    | -100 | nA   |
| h <sub>FE</sub>    | DC current gain                         | V <sub>CE</sub> = -2 V; I <sub>C</sub> = -100 mA; pulsed;<br>t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C          |  | 250 | 350  | -    |      |
|                    |                                         | V <sub>CE</sub> = -2 V; I <sub>C</sub> = -500 mA; pulsed;<br>t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C          |  | 170 | 250  | -    |      |
|                    |                                         | V <sub>CE</sub> = -2 V; I <sub>C</sub> = -1 A; pulsed;<br>t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C             |  | 120 | 175  | -    |      |
| V <sub>CEsat</sub> | collector-emitter saturation voltage    | I <sub>C</sub> = -500 mA; I <sub>B</sub> = -50 mA; pulsed;<br>t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C         |  | -   | -85  | -140 | mV   |
|                    |                                         | I <sub>C</sub> = -1 A; I <sub>B</sub> = -50 mA; pulsed;<br>t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C            |  | -   | -175 | -280 | mV   |
|                    |                                         | I <sub>C</sub> = -1 A; I <sub>B</sub> = -100 mA; pulsed;<br>t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C           |  | -   | -160 | -250 | mV   |
| R <sub>CEsat</sub> | collector-emitter saturation resistance | I <sub>C</sub> = -1 A; I <sub>B</sub> = -0.1 A; pulsed;<br>t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C            |  | -   | -    | 250  | mΩ   |
| V <sub>BEsat</sub> | base-emitter saturation voltage         | I <sub>C</sub> = -500 mA; I <sub>B</sub> = -50 mA; pulsed;<br>t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C         |  | -   | -    | -1   | V    |

| Symbol            | Parameter                    | Conditions                                                                                                                                                                    | Min | Typ | Max  | Unit |
|-------------------|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|------|------|
|                   |                              | $I_C = -1\text{ A}$ ; $I_B = -50\text{ mA}$ ; pulsed;<br>$t_p \leq 300\text{ }\mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{\text{amb}} = 25\text{ }^\circ\text{C}$                 | -   | -   | -1   | V    |
|                   |                              | $I_C = -1\text{ A}$ ; $I_B = -100\text{ mA}$ ; pulsed;<br>$t_p \leq 300\text{ }\mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{\text{amb}} = 25\text{ }^\circ\text{C}$                | -   | -   | -1.1 | V    |
| $V_{\text{BEon}}$ | base-emitter turn-on voltage | $V_{\text{CE}} = -2\text{ V}$ ; $I_C = -0.5\text{ A}$ ; pulsed;<br>$t_p \leq 300\text{ }\mu\text{s}$ ; $\delta \leq 0.02$ ; $T_{\text{amb}} = 25\text{ }^\circ\text{C}$       | -   | -   | -0.9 | V    |
| $t_d$             | delay time                   | $V_{\text{CC}} = -10\text{ V}$ ; $I_C = -0.5\text{ A}$ ; $I_{\text{Bon}} = -25\text{ mA}$ ;<br>$I_{\text{Boff}} = 25\text{ mA}$ ; $T_{\text{amb}} = 25\text{ }^\circ\text{C}$ | -   | 15  | -    | ns   |
| $t_r$             | rise time                    |                                                                                                                                                                               | -   | 35  | -    | ns   |
| $t_{\text{on}}$   | turn-on time                 |                                                                                                                                                                               | -   | 50  | -    | ns   |
| $t_s$             | storage time                 |                                                                                                                                                                               | -   | 105 | -    | ns   |
| $t_f$             | fall time                    |                                                                                                                                                                               | -   | 35  | -    | ns   |
| $t_{\text{off}}$  | turn-off time                |                                                                                                                                                                               | -   | 140 | -    | ns   |
| $f_T$             | transition frequency         | $V_{\text{CE}} = -10\text{ V}$ ; $I_C = -50\text{ mA}$ ; $f = 100\text{ MHz}$ ;<br>$T_{\text{amb}} = 25\text{ }^\circ\text{C}$                                                | 65  | 125 | -    | MHz  |
| $C_c$             | collector capacitance        | $V_{\text{CB}} = -10\text{ V}$ ; $I_E = 0\text{ A}$ ; $i_e = 0\text{ A}$ ;<br>$f = 1\text{ MHz}$ ; $T_{\text{amb}} = 25\text{ }^\circ\text{C}$                                | -   | 13  | 17   | pF   |



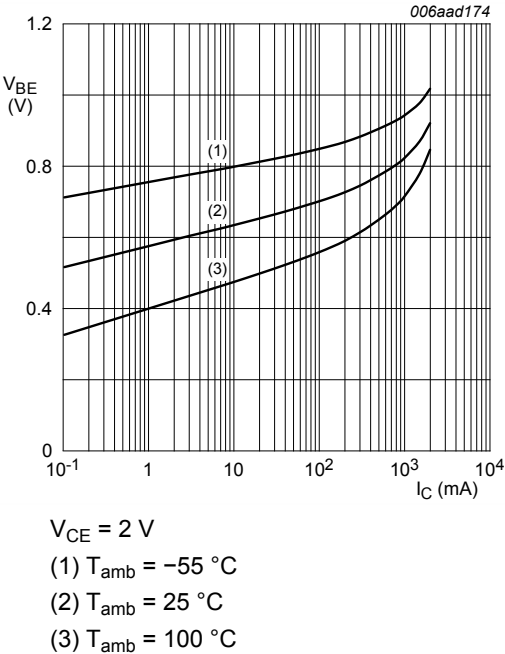


Fig. 12. TR1 (NPN): Base-emitter voltage as a function of collector current; typical values

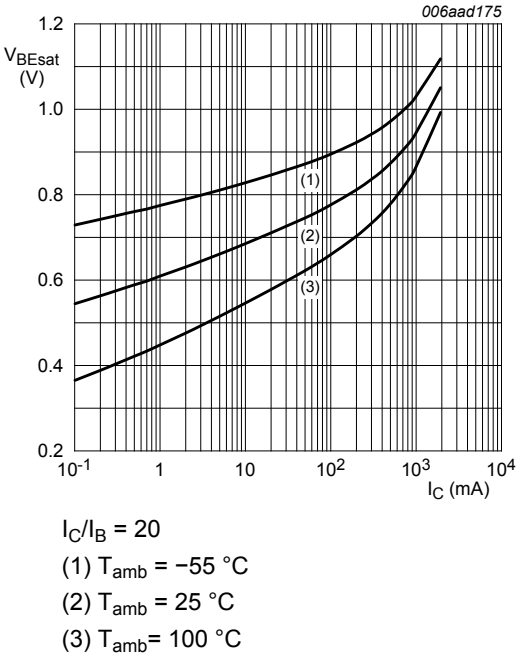


Fig. 13. TR1 (NPN): Base-emitter saturation voltage as a function of collector current; typical values

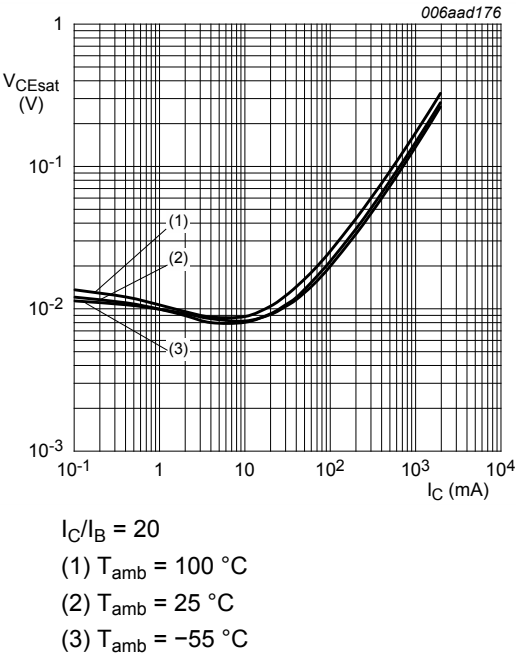


Fig. 14. TR1 (NPN): Collector-emitter saturation voltage as a function of collector current; typical values

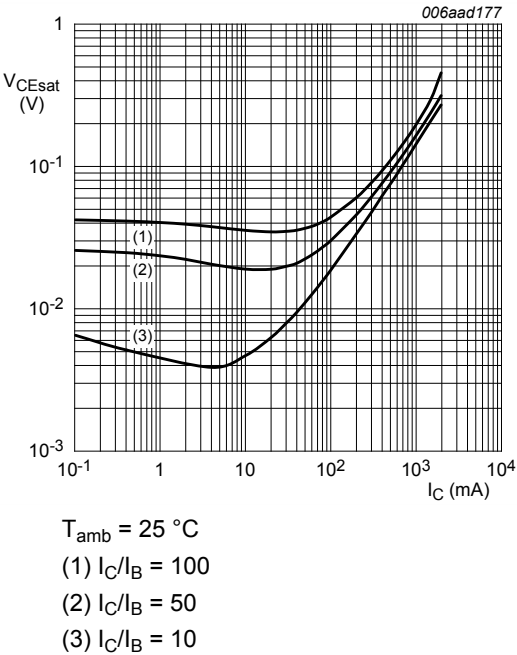


Fig. 15. TR1 (NPN): Collector-emitter saturation voltage as a function of collector current; typical values

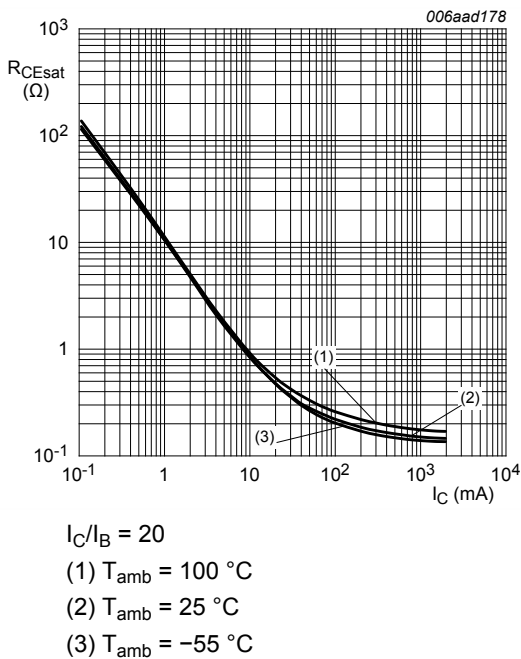


Fig. 16. TR1 (NPN): Collector-emitter saturation resistance as a function of collector current; typical values

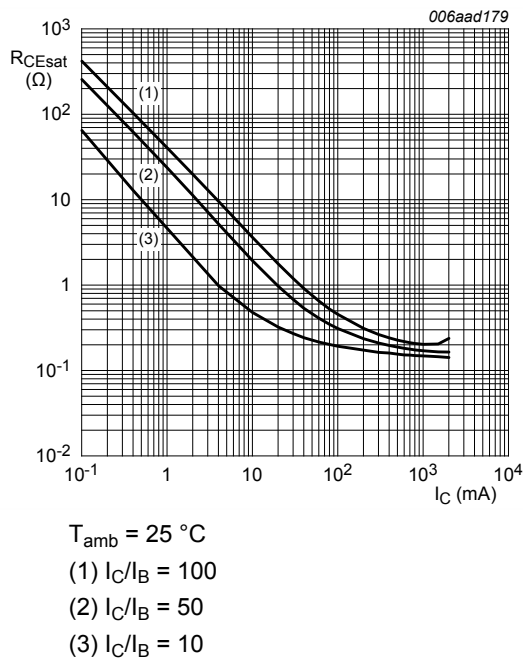


Fig. 17. TR1 (NPN): Collector-emitter saturation resistance as a function of collector current; typical values

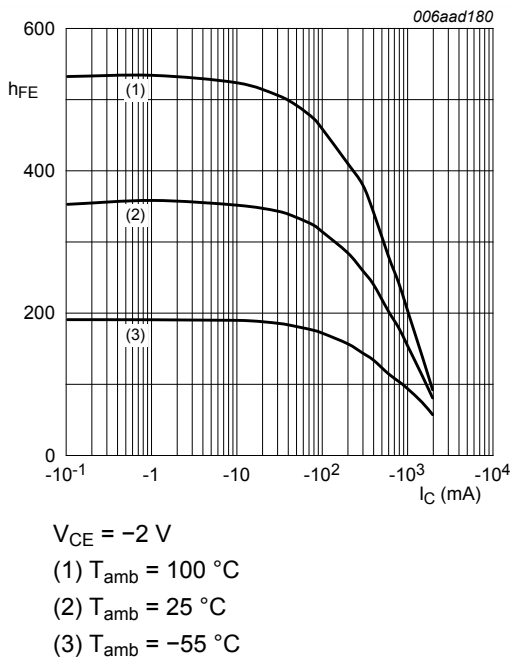


Fig. 18. TR2 (PNP): DC current gain as a function of collector current; typical values

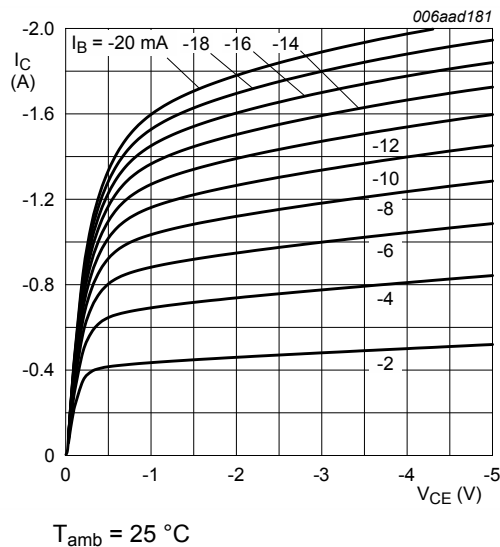


Fig. 19. TR2 (PNP): Collector current as a function of collector-emitter voltage; typical values

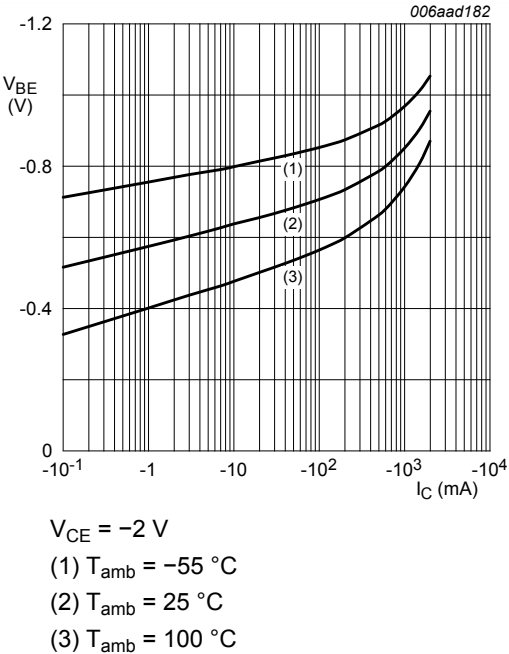


Fig. 20. TR2 (PNP): Base-emitter voltage as a function of collector current; typical values

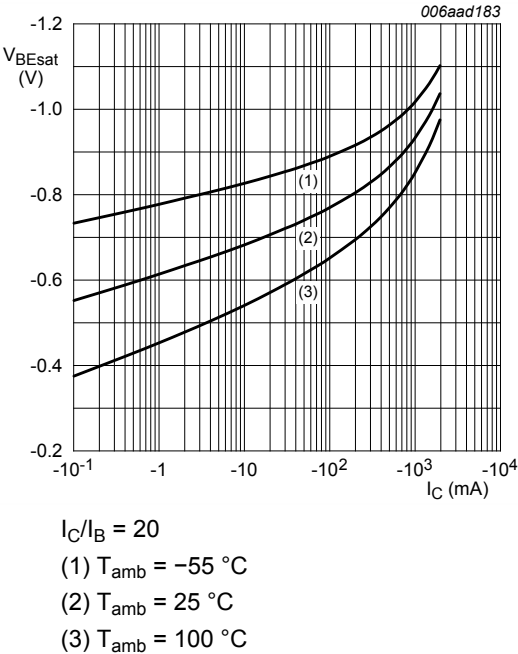


Fig. 21. TR2 (PNP): Base-emitter saturation voltage as a function of collector current; typical values

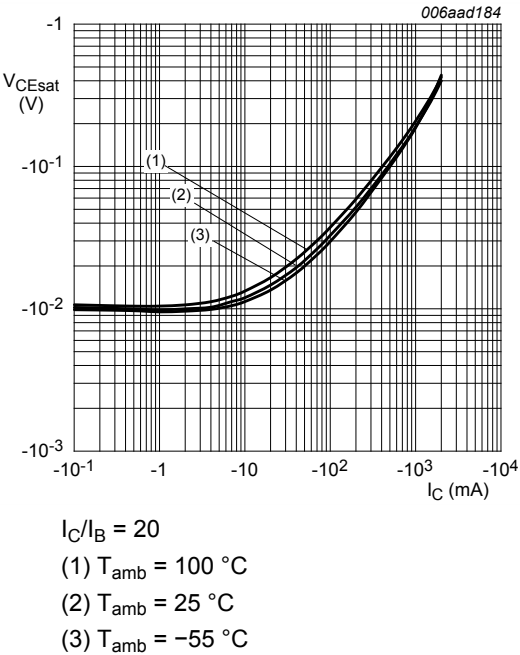


Fig. 22. TR2 (PNP): Collector-emitter saturation voltage as a function of collector current; typical values

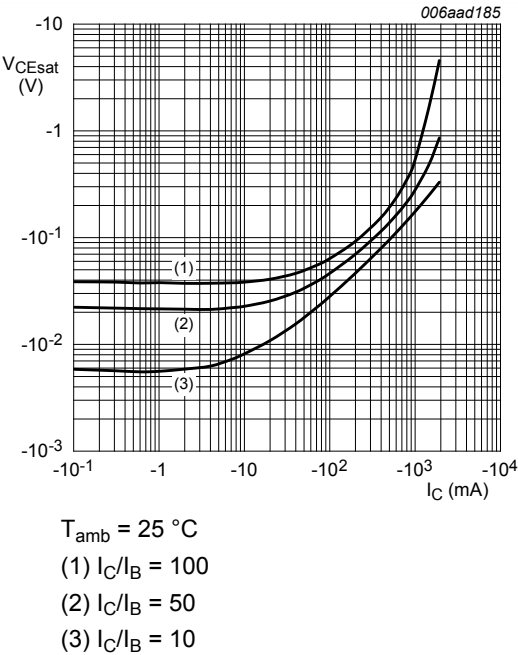
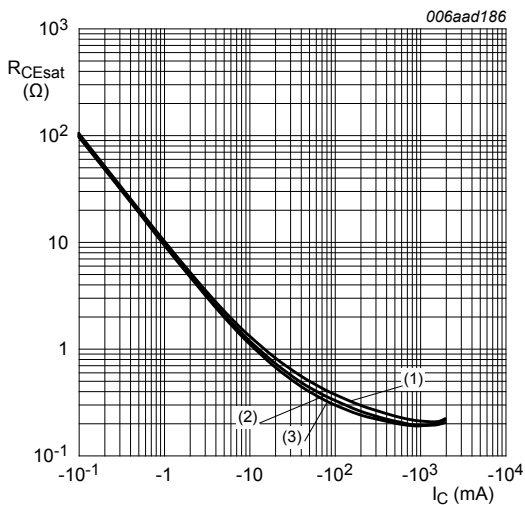
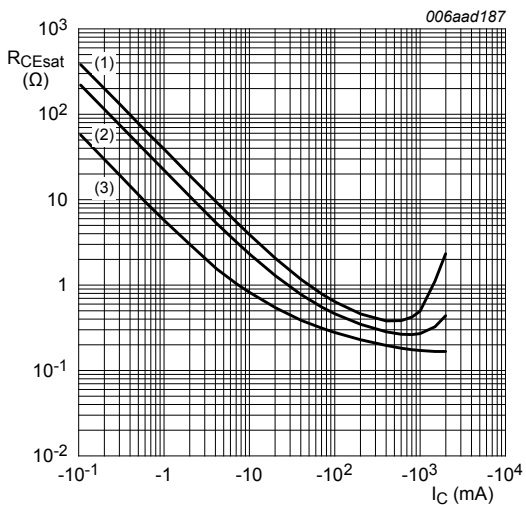


Fig. 23. TR2 (PNP): Collector-emitter saturation voltage as a function of collector current; typical values



$I_C/I_B = 20$   
(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. 24. TR2 (PNP): Collector-emitter saturation resistance as a function of collector current; typical values



$T_{amb} = 25\text{ }^{\circ}\text{C}$   
(1)  $I_C/I_B = 100$   
(2)  $I_C/I_B = 50$   
(3)  $I_C/I_B = 10$

Fig. 25. TR2 (PNP): Collector-emitter saturation resistance as a function of collector current; typical values

11. Test information

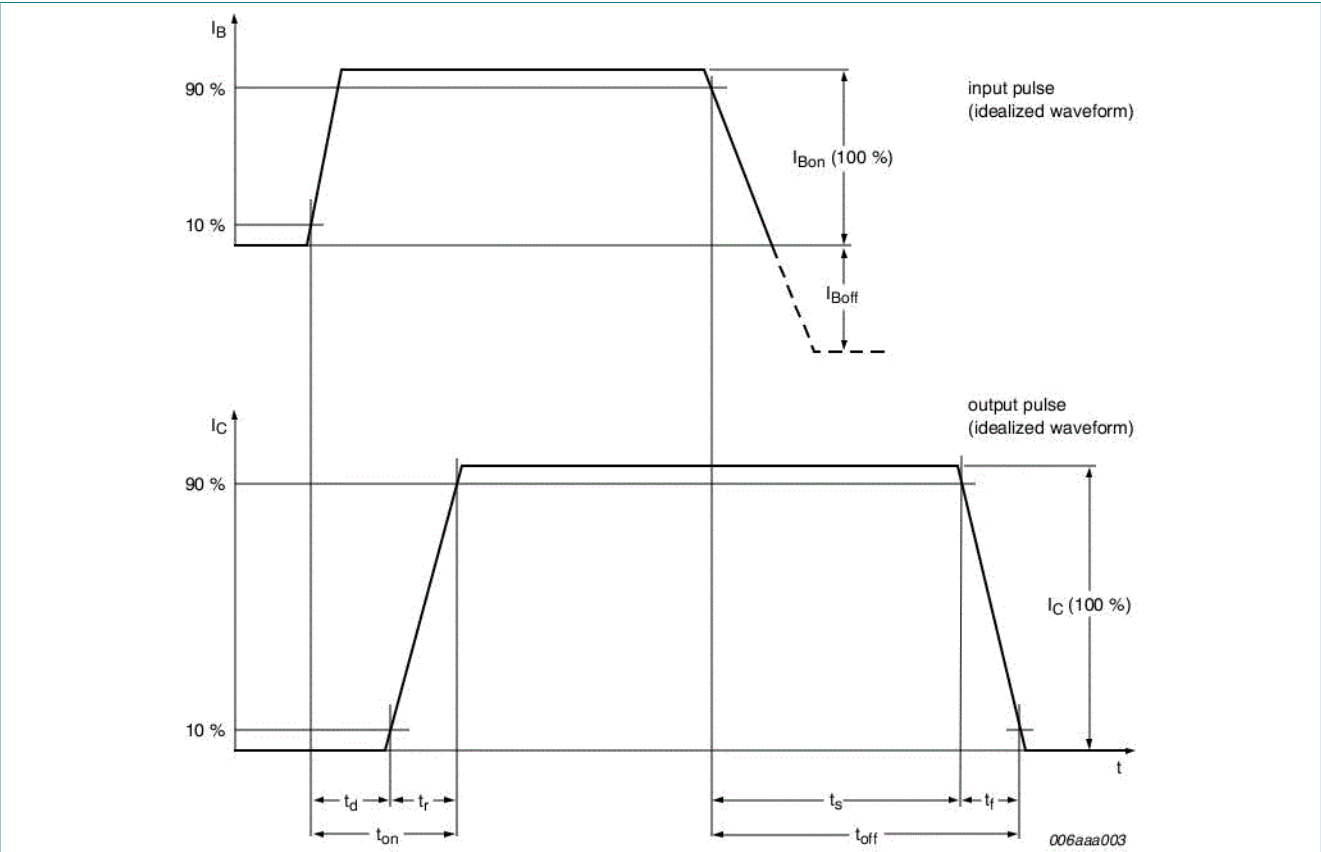


Fig. 26. TR1 (NPN): BISS transistor switching time definition

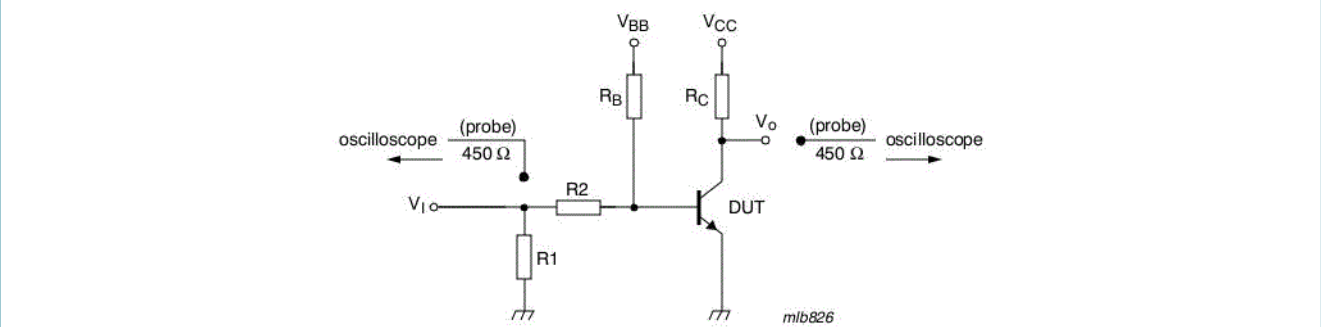


Fig. 27. TR1 (NPN): Test circuit for switching times

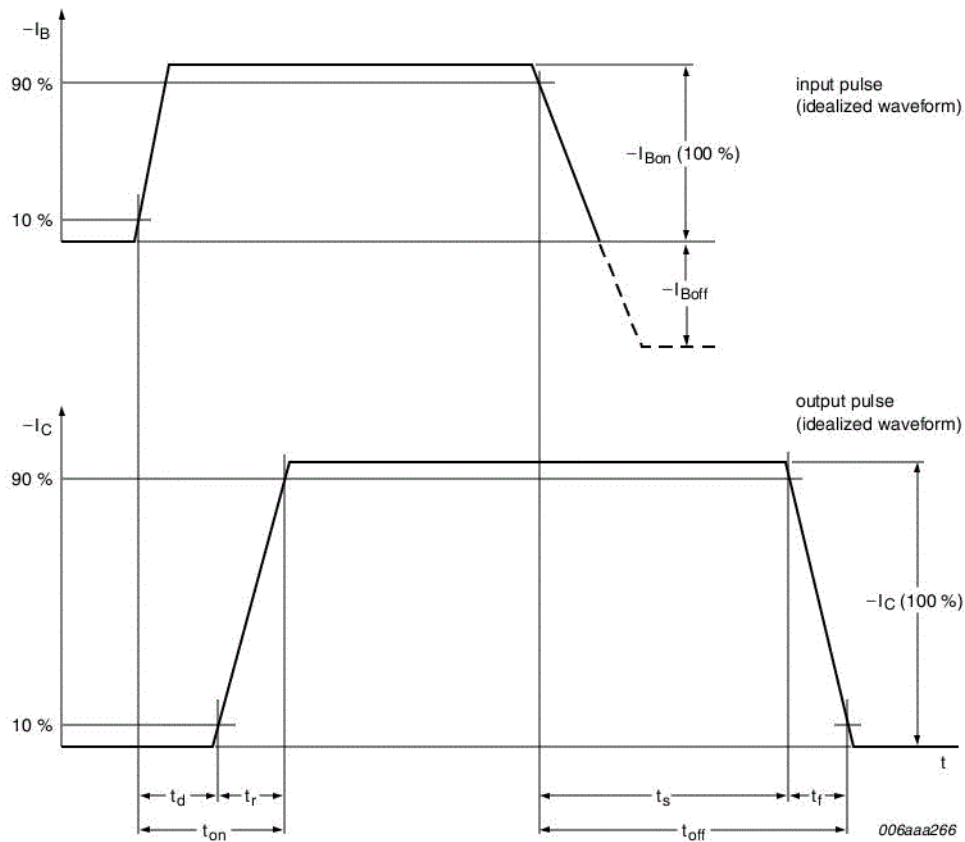


Fig. 28. TR2 (PNP): BISS transistor switching time definition

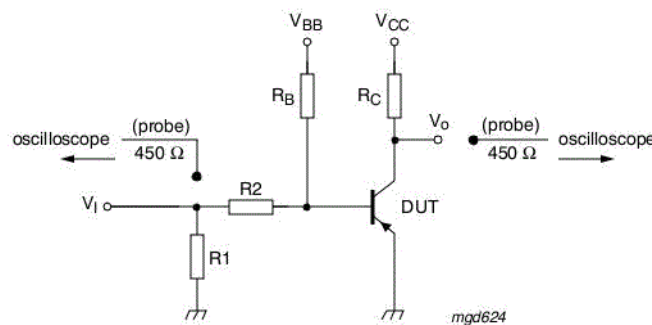
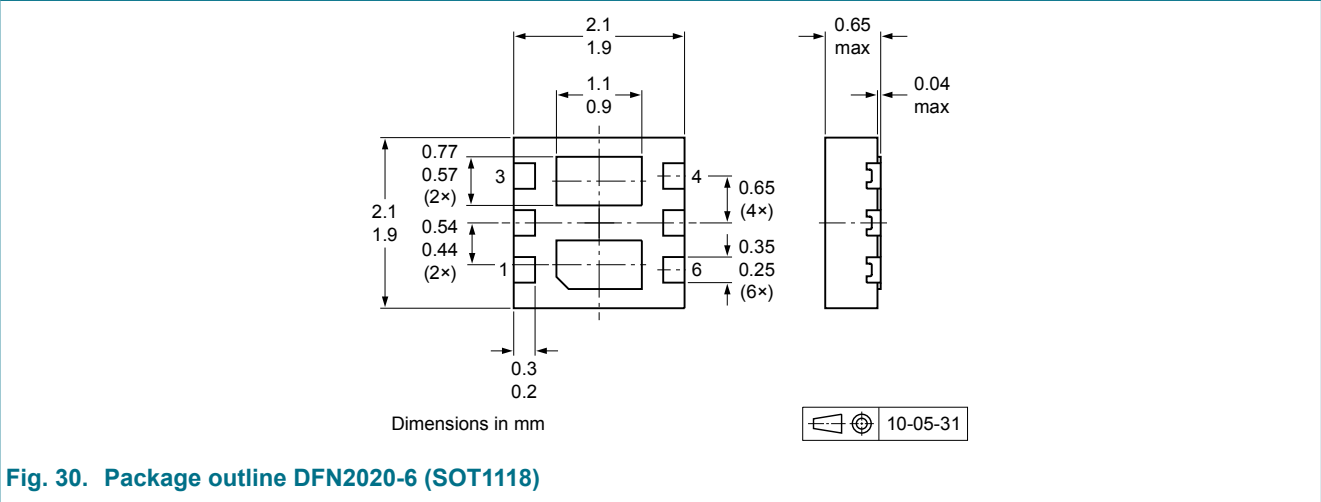


Fig. 29. TR2 (PNP): Test circuit for switching times

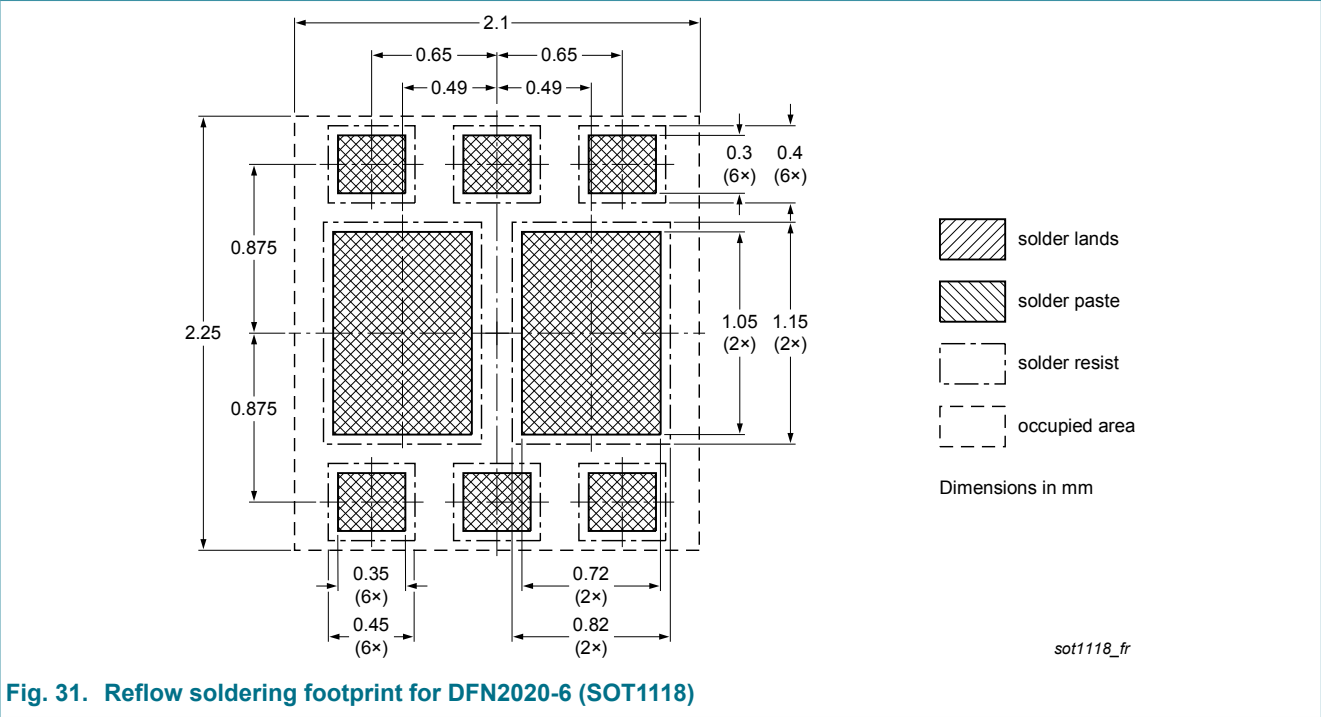
## 11.1 Quality information

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.

12. Package outline



13. Soldering



14. Revision history

| Table 8. Revision history |              |                    |               |            |
|---------------------------|--------------|--------------------|---------------|------------|
| Data sheet ID             | Release date | Data sheet status  | Change notice | Supersedes |
| PBSS4130PANP v.1          | 20121212     | Product data sheet | -             | -          |

## 15. Legal information

### 15.1 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".
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