



PMBT2222; PMBT2222A

NPN switching transistors

Rev. 6 — 12 November 2010

Product data sheet

1. Product profile

1.1 General description

NPN switching transistors in a small SOT23 (TO-236AB) Surface-Mounted Device (SMD) plastic package.

Table 1. Product overview

| Type number | Package | | PNP complement |
|-------------|----------|----------|----------------|
| | Nexperia | JEDEC | |
| PMBT2222 | SOT23 | TO-236AB | PMBT2907 |
| PMBT2222A | | | PMBT2907A |

1.2 Features and benefits

- High current (max. 600 mA)
- Low voltage (max. 40 V)

1.3 Applications

- Switching and linear amplification

1.4 Quick reference data

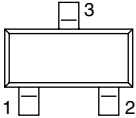
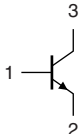
Table 2. Quick reference data

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-----------|---------------------------|--------------------------------------------------|---------|-----|-----|------|
| V_{CE0} | collector-emitter voltage | open base | | | | |
| | PMBT2222 | | - | - | 30 | V |
| | PMBT2222A | | - | - | 40 | V |
| I_C | collector current | | - | - | 600 | mA |
| h_{FE} | DC current gain | $V_{CE} = 10\text{ V};$ $I_C = 150\text{ mA}$ | [1] 100 | - | 300 | |
| | PMBT2222 | $V_{CE} = 10\text{ V};$ $I_C = 500\text{ mA}$ | [1] 30 | - | - | |
| | PMBT2222A | $V_{CE} = 10\text{ V};$ $I_C = 500\text{ mA}$ | [1] 40 | - | - | |

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

2. Pinning information

Table 3. Pinning

| Pin | Description | Simplified outline | Graphic symbol |
|-----|-------------|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| 1 | base |  |  sym021 |
| 2 | emitter | | |
| 3 | collector | | |

3. Ordering information

Table 4. Ordering information

| Type number | Package | | |
|-------------|---------|------------------------------------------|---------|
| | Name | Description | Version |
| PMBT2222 | - | plastic surface-mounted package; 3 leads | SOT23 |
| PMBT2222A | | | |

4. Marking

Table 5. Marking codes

| Type number | Marking code ^[1] |
|-------------|-----------------------------|
| PMBT2222 | *1B |
| PMBT2222A | *1P |

[1] * = placeholder for manufacturing site code

5. Limiting values

Table 6. Limiting values

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

| Symbol | Parameter | Conditions | Min | Max | Unit |
|------------------|---------------------------|--------------------------|-------|------|------|
| V _{CBO} | collector-base voltage | open emitter | | | |
| | PMBT2222 | | - | 60 | V |
| | PMBT2222A | | - | 75 | V |
| V _{CEO} | collector-emitter voltage | open base | | | |
| | PMBT2222 | | - | 30 | V |
| | PMBT2222A | | - | 40 | V |
| V _{EBO} | emitter-base voltage | open collector | | | |
| | PMBT2222 | | - | 5 | V |
| | PMBT2222A | | - | 6 | V |
| I _C | collector current | | - | 600 | mA |
| I _{CM} | peak collector current | | - | 800 | mA |
| I _{BM} | peak base current | | - | 200 | mA |
| P _{tot} | total power dissipation | T _{amb} ≤ 25 °C | [1] - | 250 | mW |
| T _j | junction temperature | | - | 150 | °C |
| T _{amb} | ambient temperature | | -65 | +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 |
|----------------------|---------------------------------------------|-------------|-------|-----|-----|------|
| R _{th(j-a)} | thermal resistance from junction to ambient | in free air | [1] - | - | 500 | K/W |

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

7. Characteristics

Table 8. Characteristics
 $T_j = 25\text{ °C}$ unless otherwise specified.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit | | |
|--------------------------------------|--------------------------------|-----------------------------------------|---------------------------------------------------------------------|-------------------------------------------|-----|------|---------------|--|
| I_{CBO} | collector-base cut-off current | PMBT2222 | $V_{CB} = 50\text{ V}; I_E = 0\text{ A}$ | - | - | 10 | nA | |
| | | | $V_{CB} = 50\text{ V}; I_E = 0\text{ A}; T_j = 125\text{ °C}$ | - | - | 10 | μA | |
| | collector-base cut-off current | PMBT2222A | $V_{CB} = 60\text{ V}; I_E = 0\text{ A}$ | - | - | 10 | nA | |
| | | | $V_{CB} = 60\text{ V}; I_E = 0\text{ A}; T_j = 125\text{ °C}$ | - | - | 10 | μA | |
| I_{EBO} | emitter-base cut-off current | $V_{EB} = 5\text{ V}; I_C = 0\text{ A}$ | - | - | 10 | nA | | |
| h_{FE} | DC current gain | | $V_{CE} = 10\text{ V}; I_C = 0.1\text{ mA}$ | 35 | | | | |
| | | | $V_{CE} = 10\text{ V}; I_C = 1\text{ mA}$ | 50 | - | - | | |
| | | | $V_{CE} = 10\text{ V}; I_C = 10\text{ mA}$ | 75 | - | - | | |
| | | | $V_{CE} = 10\text{ V}; I_C = 10\text{ mA}; T_{amb} = -55\text{ °C}$ | 35 | - | - | | |
| | | | $V_{CE} = 10\text{ V}; I_C = 150\text{ mA}$ | [1] 100 | - | 300 | | |
| | | | $V_{CE} = 1\text{ V}; I_C = 150\text{ mA}$ | [1] 50 | - | - | | |
| | DC current gain | | $V_{CE} = 10\text{ V}; I_C = 500\text{ mA}$ | [1] | | | | |
| | | | | | | | | |
| | V_{CEsat} | collector-emitter saturation voltage | | $I_C = 150\text{ mA}; I_B = 15\text{ mA}$ | [1] | | | |
| | | | | | | | | |
| | | PMBT2222 | | - | - | 400 | mV | |
| | | PMBT2222A | | - | - | 300 | mV | |
| collector-emitter saturation voltage | | | $I_C = 500\text{ mA}; I_B = 50\text{ mA}$ | [1] | | | | |
| | | | | | | | | |
| | PMBT2222 | | - | - | 1.6 | V | | |
| | PMBT2222A | | - | - | 1 | V | | |

Table 8. Characteristics ...continued
 $T_j = 25\text{ °C}$ unless otherwise specified.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------|---------------------------------|--------------------------------------------------------------------------------------------------------------|-----|-----|-----|------|
| V_{BEsat} | base-emitter saturation voltage | $I_C = 150\text{ mA};$ $I_B = 15\text{ mA}$ | [1] | | | |
| | | | | | | |
| | | PMBT2222 | - | - | 1.3 | V |
| | | PMBT2222A | 0.6 | - | 1.2 | V |
| | base-emitter saturation voltage | $I_C = 500\text{ mA};$ $I_B = 50\text{ mA}$ | [1] | | | |
| | | | | | | |
| | PMBT2222 | - | - | 2.6 | V | |
| | PMBT2222A | - | - | 2 | V | |
| C_c | collector capacitance | $V_{CB} = 10\text{ V};$ $I_E = i_e = 0\text{ A};$ $f = 1\text{ MHz}$ | - | - | 8 | pF |
| C_e | emitter capacitance | $V_{EB} = 500\text{ mV};$ $I_C = i_c = 0\text{ A};$ $f = 1\text{ MHz}$ | | | | |
| | | | | | | |
| | | | | | | |
| | PMBT2222 | - | - | 30 | pF | |
| | PMBT2222A | - | - | 25 | pF | |
| f_T | transition frequency | $V_{CE} = 20\text{ V};$ $I_C = 20\text{ mA};$ $f = 100\text{ MHz}$ | | | | |
| | | | | | | |
| | | | | | | |
| | PMBT2222 | 250 | - | - | MHz | |
| | PMBT2222A | 300 | - | - | MHz | |
| NF | noise figure | $V_{CE} = 5\text{ V};$ $I_C = 100\text{ }\mu\text{A};$ $R_S = 1\text{ k}\Omega;$ $f = 1\text{ kHz}$ | - | - | 4 | dB |
| t_d | delay time | $V_{CC} = 10\text{ V};$ | - | - | 15 | ns |
| t_r | rise time | $I_C = 150\text{ mA};$ | - | - | 20 | ns |
| t_{on} | turn-on time | $I_{Bon} = 15\text{ mA};$ | - | - | 35 | ns |
| t_s | storage time | $I_{Boff} = -15\text{ mA}$ | - | - | 200 | ns |
| t_f | fall time | | - | - | 60 | ns |
| t_{off} | turn-off time | | - | - | 250 | ns |

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

8. Test information

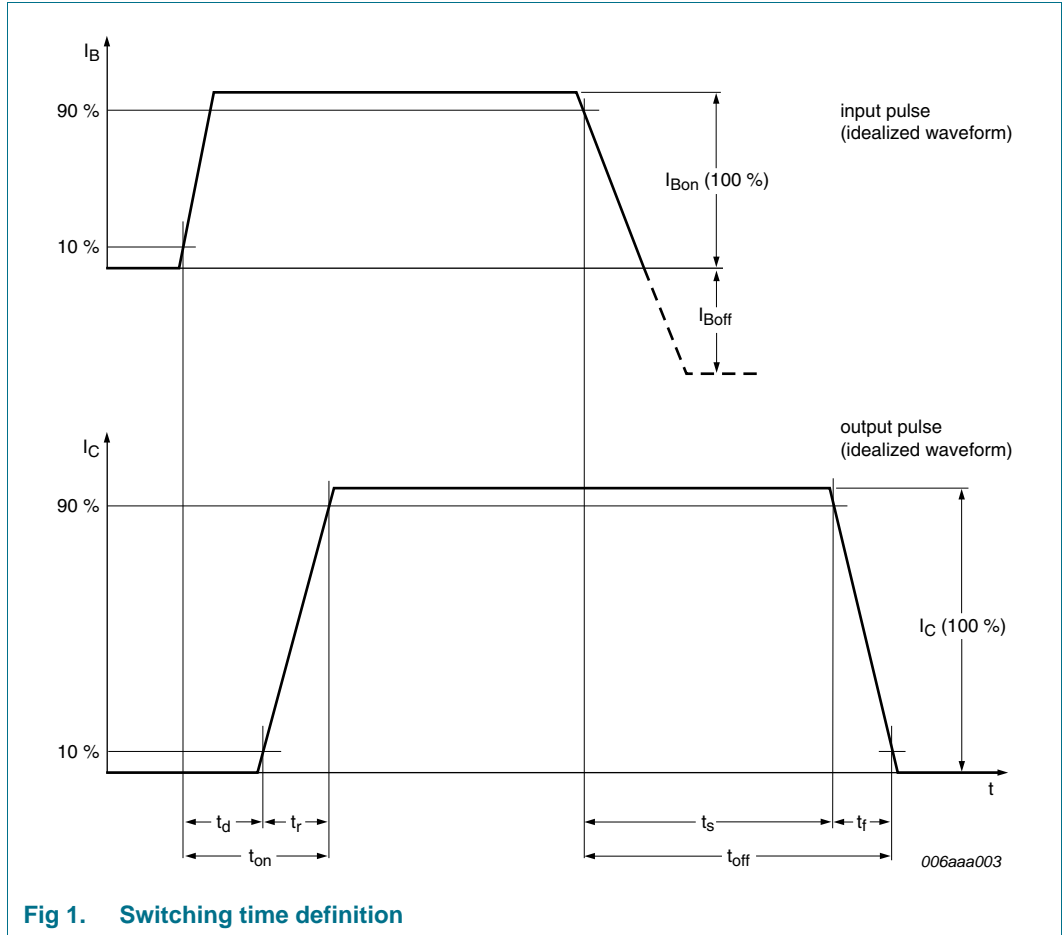


Fig 1. Switching time definition

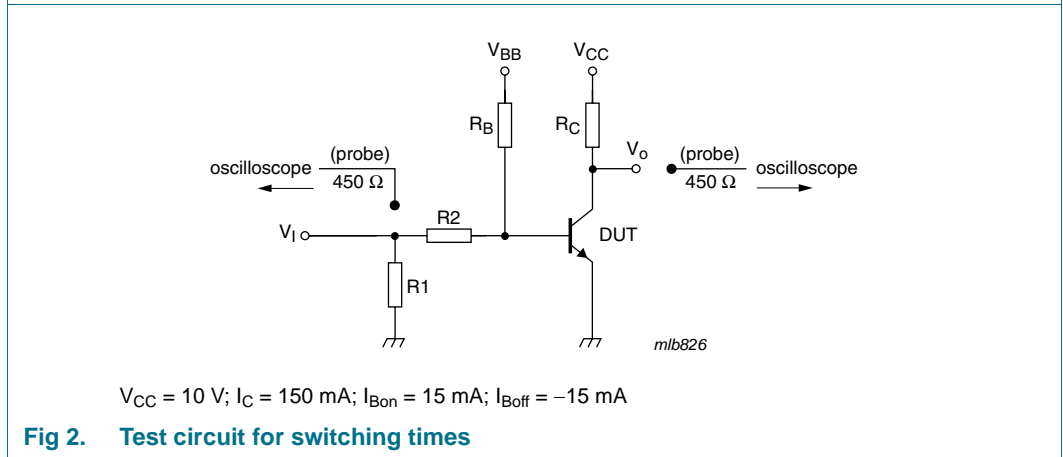
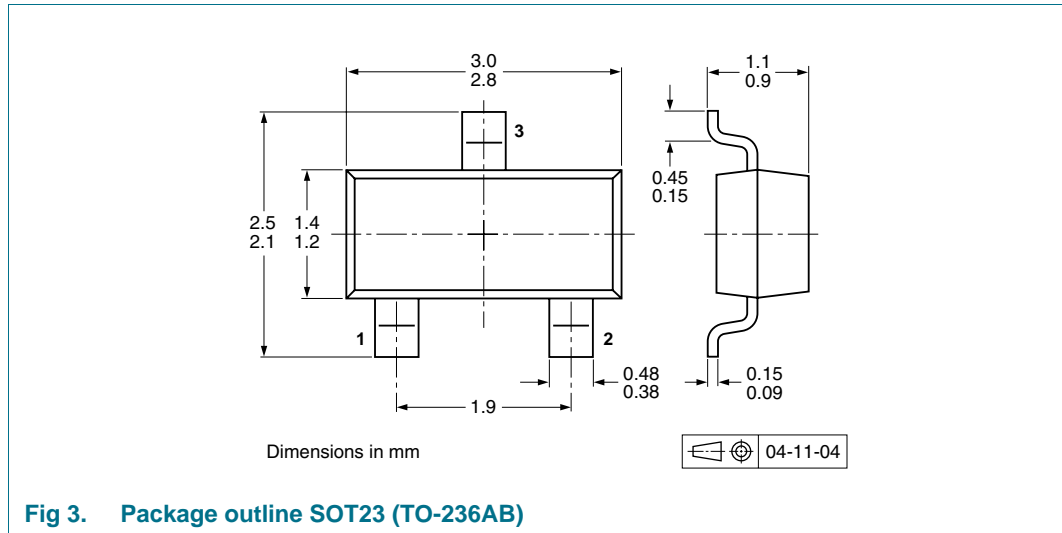


Fig 2. Test circuit for switching times

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



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 | 10000 |
| PMBT2222 | SOT23 | 4 mm pitch, 8 mm tape and reel | -215 | -235 |
| PMBT2222A | | | | |

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

11. Soldering

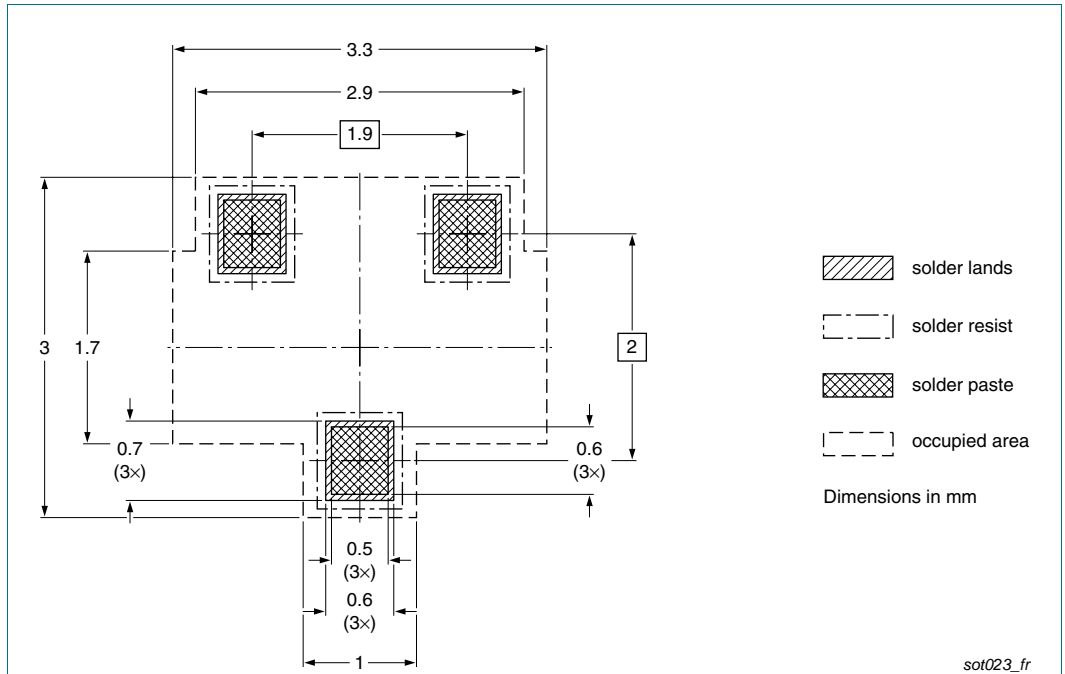


Fig 4. Reflow soldering footprint SOT23 (TO-236AB)

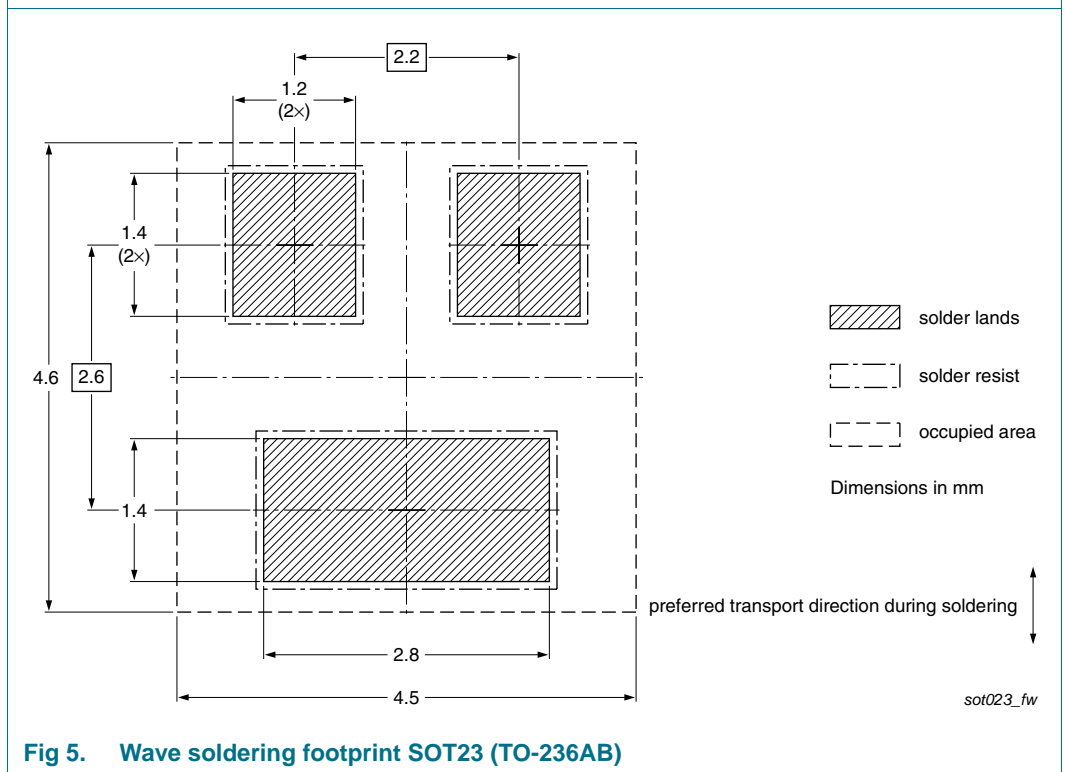


Fig 5. Wave soldering footprint SOT23 (TO-236AB)

12. Revision history

Table 10. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---------------|------------------|
| PMBT2222_PMBT2222A v.6 | 20101112 | Product data sheet | - | PMBT2222_2222A_5 |
| Modifications: | <ul style="list-style-type: none"> • Section 4 “Marking”: updated • Figure 1 “Switching time definition”: added • Section 8 “Test information”: updated • Section 10 “Packing information”: added • Section 11 “Soldering”: added • Section 13 “Legal information”: updated | | | |
| PMBT2222_2222A_5 | 20040122 | Product specification | - | PMBT2222_2222A_4 |
| PMBT2222_2222A_4 | 19990427 | Product specification | - | PMBT2222_3 |
| PMBT2222_3 | 19970909 | Product specification | - | - |

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".

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