# 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 |
|---|---|---|---|
| | **NXP** | **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
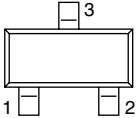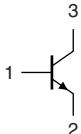
**Table 2.    Quick reference data**

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $V_{CEO}$ | 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 V; $I_C$ = 150 mA | [1] | 100 | - | 300 | |
| | PMBT2222 | $V_{CE}$ = 10 V; $I_C$ = 500 mA | [1] | 30 | - | - | |
| | PMBT2222A | $V_{CE}$ = 10 V; $I_C$ = 500 mA | [1] | 40 | - | - | |

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

## 2. Pinning information

**Table 3.    Pinning**

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

sym021

## 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

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## 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 | $T_{amb} \leq 25$ °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.

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## 7. Characteristics

**Table 8.    Characteristics**

*$T_j = 25 \ ^\circ C$ unless otherwise specified.*

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $I_{CBO}$ | collector-base cut-off current | | | | | |
| | PMBT2222 | $V_{CB} = 50$ V; $I_E = 0$ A | - | - | 10 | nA |
| | | $V_{CB} = 50$ V; $I_E = 0$ A; $T_j = 125$ °C | - | - | 10 | μA |
| | collector-base cut-off current | | | | | |
| | PMBT2222A | $V_{CB} = 60$ V; $I_E = 0$ A | - | - | 10 | nA |
| | | $V_{CB} = 60$ V; $I_E = 0$ A; $T_j = 125$ °C | - | - | 10 | μA |
| $I_{EBO}$ | emitter-base cut-off current | $V_{EB} = 5$ V; $I_C = 0$ A | - | - | 10 | nA |
| $h_{FE}$ | DC current gain | $V_{CE} = 10$ V; $I_C = 0.1$ mA | 35 | | | |
| | | $V_{CE} = 10$ V; $I_C = 1$ mA | 50 | - | - | |
| | | $V_{CE} = 10$ V; $I_C = 10$ mA | 75 | - | - | |
| | | $V_{CE} = 10$ V; $I_C = 10$ mA; $T_{amb} = -55$ °C | 35 | - | - | |
| | | $V_{CE} = 10$ V; $I_C = 150$ mA | [1] 100 | - | 300 | |
| | | $V_{CE} = 1$ V; $I_C = 150$ mA | [1] 50 | - | - | |
| | DC current gain | $V_{CE} = 10$ V; $I_C = 500$ mA | [1] | | | |
| | PMBT2222 | | 30 | - | - | |
| | PMBT2222A | | 40 | - | - | |
| $V_{CEsat}$ | collector-emitter saturation voltage | $I_C = 150$ mA; $I_B = 15$ mA | [1] | | | |
| | PMBT2222 | | - | - | 400 | mV |
| | PMBT2222A | | - | - | 300 | mV |
| | collector-emitter saturation voltage | $I_C = 500$ mA; $I_B = 50$ mA | [1] | | | |
| | PMBT2222 | | - | - | 1.6 | V |
| | PMBT2222A | | - | - | 1 | V |

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**Table 8.** **Characteristics** *…continued*

*$T_j = 25$ °C unless otherwise specified.*

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

[1] Pulse test: $t_p \leq 300$ μs; $\delta \leq 0.02$.

## 8. Test information



**Fig 1.    Switching time definition**
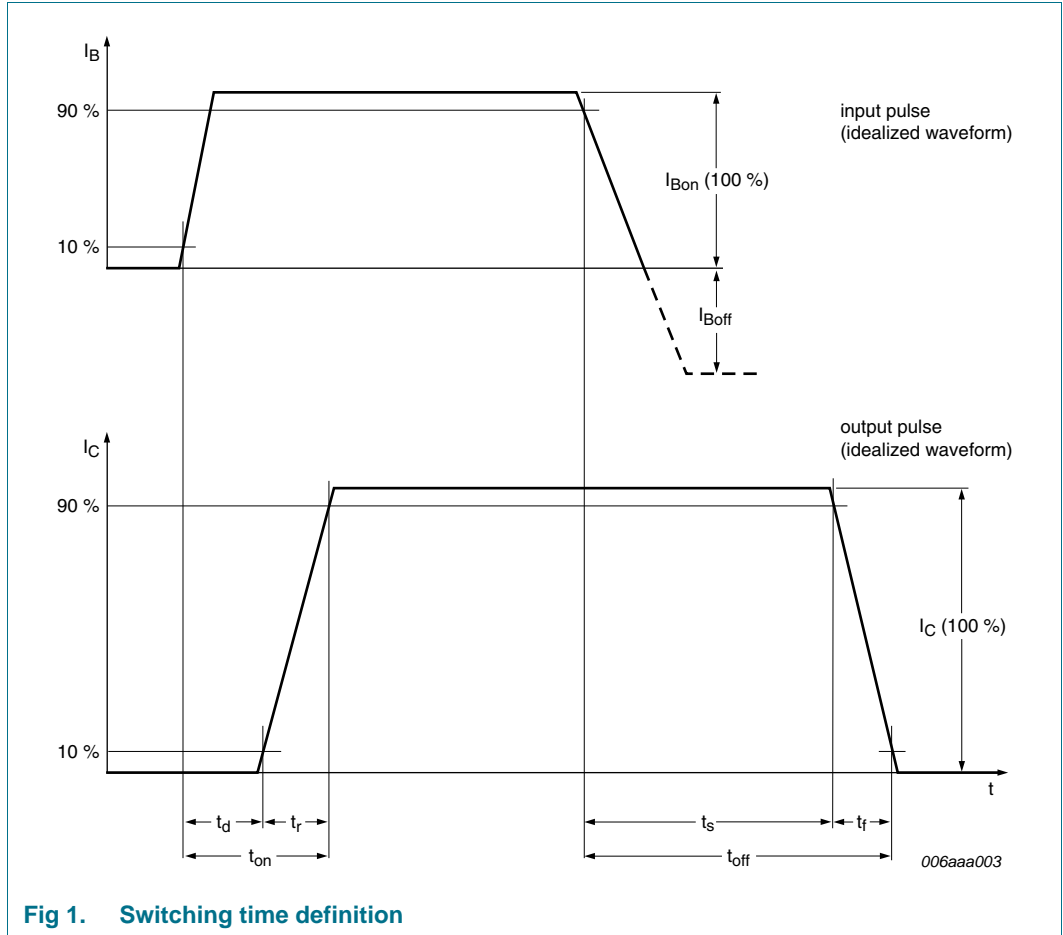


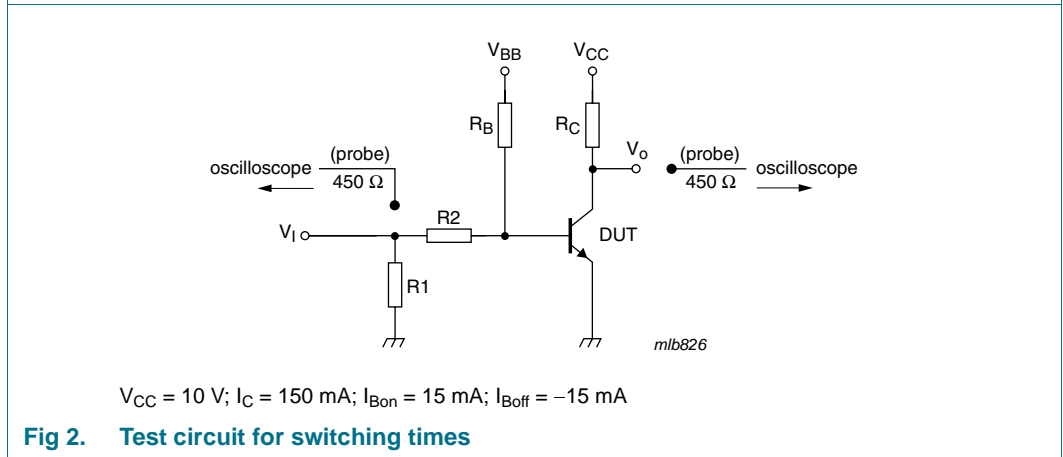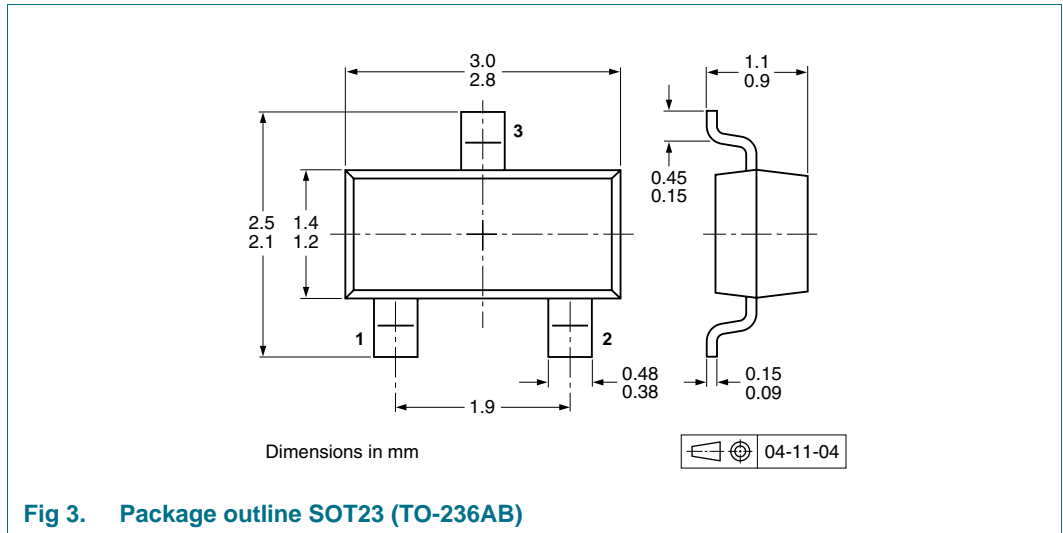$V_{CC}$ = 10 V; $I_C$ = 150 mA; $I_{Bon}$ = 15 mA; $I_{Boff}$ = −15 mA

**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.

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## 9. Package outline



Dimensions in mm

04-11-04

**Fig 3.    Package outline SOT23 (TO-236AB)**

## 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
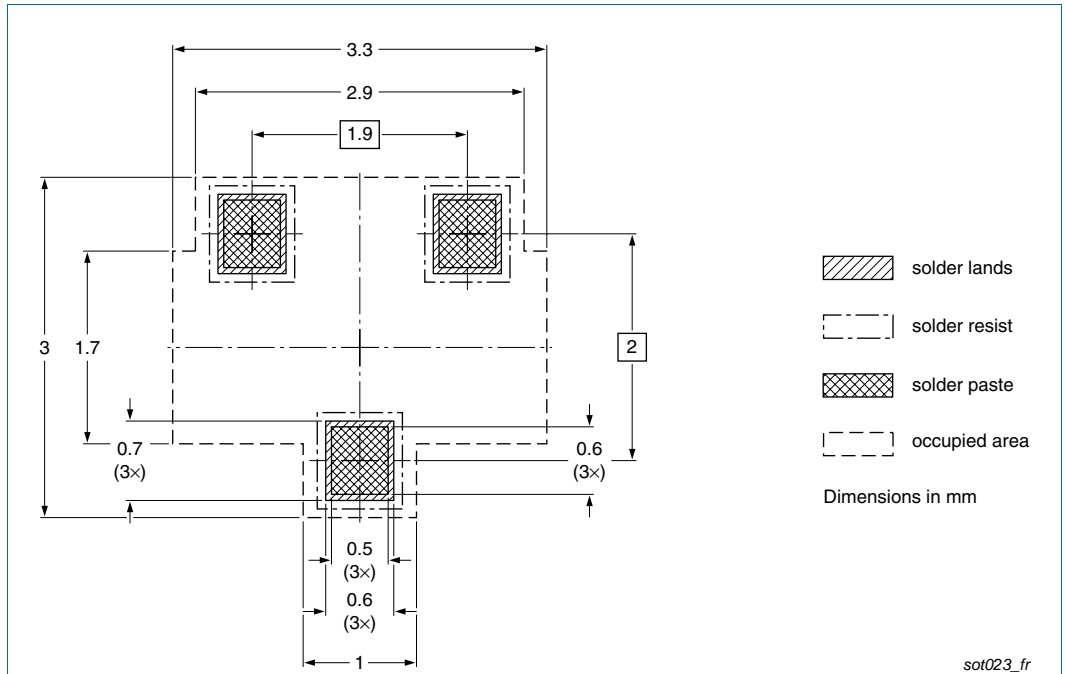


**Fig 4.    Reflow soldering footprint SOT23 (TO-236AB)**
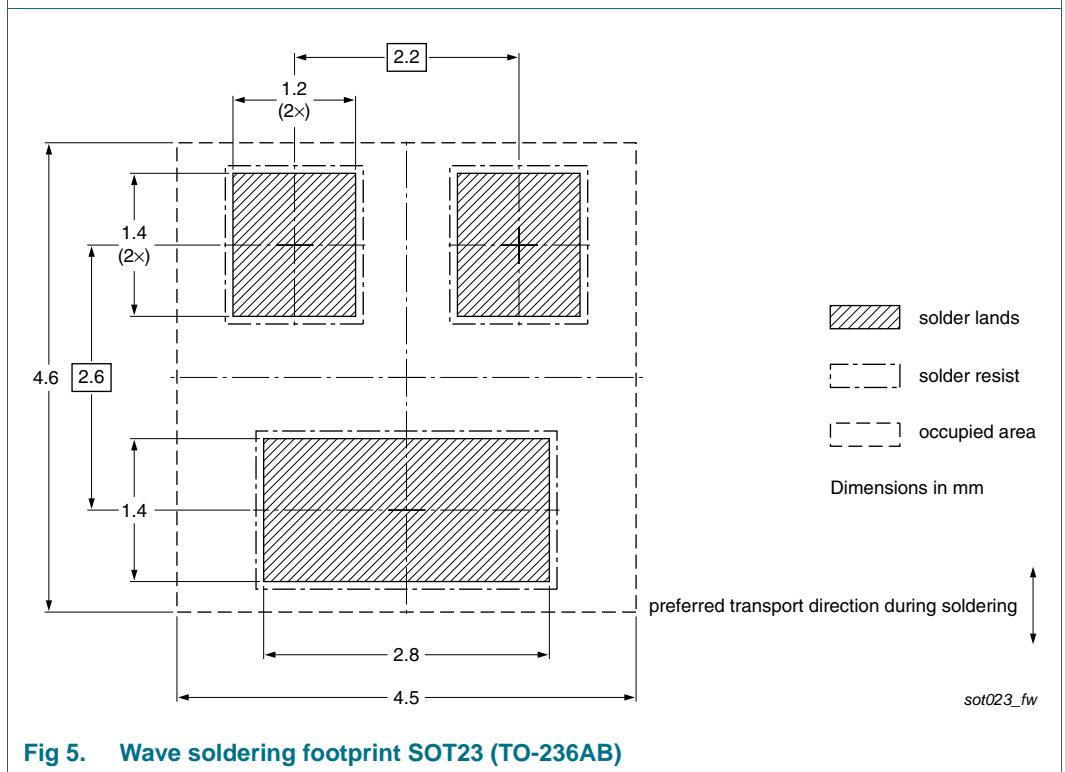


**Fig 5.    Wave soldering footprint SOT23 (TO-236AB)**

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## 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><li>Section 4 "Marking": updated</li><li>Figure 1 "Switching time definition": added</li><li>Section 8 "Test information": updated</li><li>Section 10 "Packing information": added</li><li>Section 11 "Soldering": added</li><li>Section 13 "Legal information": updated</li></ul> | | | |
| PMBT2222_2222A_5 | 20040122 | Product specification | - | PMBT2222_2222A_4 |
| PMBT2222_2222A_4 | 19990427 | Product specification | - | PMBT2222_3 |
| PMBT2222_3 | 19970909 | Product specification | - | - |

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| 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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