1. General description

NPN high-voltage low $V_{CE\text{sat}}$ transistor in a SOT23 small Surface-Mounted Device (SMD) plastic package.

2. Features and benefits

- High voltage
- Low collector-emitter saturation voltage $V_{CE\text{sat}}$
- High collector current capability $I_C$ and $I_{CM}$
- High collector current gain ($h_{FE}$) at high $I_C$
- Qualified according to AEC-Q101 and recommended for use in automotive applications

3. Applications

- Electronic ballasts
- LED driver for LED chain module
- LCD backlighting
- Automotive motor management
- Flyback converters
- Hook switch for wired telecom
- Switch Mode Power Supply (SMPS)

4. Quick reference data

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter Description</th>
<th>Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{CE\text{SM}}$</td>
<td>collector-emitter peak voltage</td>
<td>$V_{BE} = 0$ V</td>
<td></td>
<td></td>
<td>500</td>
<td>V</td>
</tr>
<tr>
<td>$V_{CEO}$</td>
<td>collector-emitter voltage</td>
<td>open base</td>
<td></td>
<td></td>
<td>500</td>
<td>V</td>
</tr>
<tr>
<td>$I_C$</td>
<td>collector current</td>
<td></td>
<td>-</td>
<td>-</td>
<td>0.15</td>
<td>A</td>
</tr>
<tr>
<td>$h_{FE}$</td>
<td>DC current gain</td>
<td>$V_{CE} = 10$ V; $I_C = 30$ mA; $T_{\text{amb}} = 25$ °C</td>
<td>50</td>
<td>100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5. Pinning information

Table 2. Pinning information

<table>
<thead>
<tr>
<th>Pin</th>
<th>Symbol</th>
<th>Description</th>
<th>Simplified outline</th>
<th>Graphic symbol</th>
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<tbody>
<tr>
<td>1</td>
<td>B</td>
<td>base</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>E</td>
<td>emitter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>C</td>
<td>collector</td>
<td></td>
<td></td>
</tr>
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</table>

6. Ordering information

Table 3. Ordering information

<table>
<thead>
<tr>
<th>Type number</th>
<th>Package</th>
<th>Name</th>
<th>Description</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>PMBTA45-Q</td>
<td>SOT23</td>
<td>plastic, surface-mounted package; 3 terminals; 1.9 mm pitch; 2.9 mm x 1.3 mm x 1 mm body</td>
<td>SOT23</td>
<td></td>
</tr>
</tbody>
</table>

7. Marking

Table 4. Marking codes

<table>
<thead>
<tr>
<th>Type number</th>
<th>Marking code[1]</th>
</tr>
</thead>
<tbody>
<tr>
<td>PMBTA45-Q</td>
<td>LK%</td>
</tr>
</tbody>
</table>

[1] % = placeholder for manufacturing site code

8. Limiting values

Table 5. Limiting values

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

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{CBO}$</td>
<td>collector-base voltage</td>
<td>open emitter</td>
<td>-</td>
<td>500</td>
<td>V</td>
</tr>
<tr>
<td>$V_{CEO}$</td>
<td>collector-emitter voltage</td>
<td>open base</td>
<td>-</td>
<td>500</td>
<td>V</td>
</tr>
<tr>
<td>$V_{CESM}$</td>
<td>collector-emitter peak voltage</td>
<td>$V_{BE} = 0$ V</td>
<td>-</td>
<td>500</td>
<td>V</td>
</tr>
<tr>
<td>$V_{EBO}$</td>
<td>emitter-base voltage</td>
<td>open collector</td>
<td>-</td>
<td>6</td>
<td>V</td>
</tr>
<tr>
<td>$I_C$</td>
<td>collector current</td>
<td></td>
<td>-</td>
<td>0.15</td>
<td>A</td>
</tr>
<tr>
<td>$I_{CM}$</td>
<td>peak collector current</td>
<td>single pulse; $t_p \leq 1$ ms</td>
<td>-</td>
<td>0.5</td>
<td>A</td>
</tr>
<tr>
<td>$I_{BM}$</td>
<td>peak base current</td>
<td></td>
<td>-</td>
<td>200</td>
<td>mA</td>
</tr>
<tr>
<td>$P_{tot}$</td>
<td>total power dissipation</td>
<td>$T_{amb} \leq 25$ °C</td>
<td>[1]</td>
<td>300</td>
<td>mW</td>
</tr>
<tr>
<td>$T_j$</td>
<td>junction temperature</td>
<td></td>
<td>-</td>
<td>150</td>
<td>°C</td>
</tr>
<tr>
<td>$T_{amb}$</td>
<td>ambient temperature</td>
<td></td>
<td>-55</td>
<td>150</td>
<td>°C</td>
</tr>
<tr>
<td>$T_{stg}$</td>
<td>storage temperature</td>
<td></td>
<td>-65</td>
<td>150</td>
<td>°C</td>
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</tbody>
</table>

9. Thermal characteristics

Table 6. Thermal characteristics

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min (K/W)</th>
<th>Typ (K/W)</th>
<th>Max (K/W)</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_{th(j-a)}$</td>
<td>thermal resistance from junction to ambient in free air</td>
<td>[1]</td>
<td>-</td>
<td>-</td>
<td>417</td>
<td>K/W</td>
</tr>
<tr>
<td>$R_{th(j-sp)}$</td>
<td>thermal resistance from junction to solder point</td>
<td>-</td>
<td>-</td>
<td>70</td>
<td>K/W</td>
<td></td>
</tr>
</tbody>
</table>


FR4 PCB, standard footprint

Fig. 1. Power derating curve

Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values
## 10. Characteristics

Table 7. Characteristics

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>I_{CBO}</td>
<td>collector-base cut-off current</td>
<td>$V_{CB} = 360 \text{ V}$; $I_E = 0 \text{ A}$; $T_{amb} = 25 \degree \text{ C}$</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td>nA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{CB} = 360 \text{ V}$; $I_E = 0 \text{ A}$; $T_J = 150 \degree \text{ C}$</td>
<td>-</td>
<td>-</td>
<td>10</td>
<td>\mu A</td>
</tr>
<tr>
<td>I_{EBO}</td>
<td>emitter-base cut-off current</td>
<td>$V_{EB} = 5 \text{ V}$; $I_C = 0 \text{ A}$; $T_{amb} = 25 \degree \text{ C}$</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td>nA</td>
</tr>
<tr>
<td>I_{CES}</td>
<td>collector-emitter cut-off current</td>
<td>$V_{CE} = 360 \text{ V}$; $V_{BE} = 0 \text{ V}$; $T_{amb} = 25 \degree \text{ C}$</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td>nA</td>
</tr>
<tr>
<td>hFE</td>
<td>DC current gain</td>
<td>$V_{CE} = 10 \text{ V}$; $I_C = 30 \text{ mA}$; $T_{amb} = 25 \degree \text{ C}$</td>
<td>50</td>
<td>100</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{CE} = 10 \text{ V}$; $I_C = 50 \text{ mA}$; pulsed; $t_p \leq 300 \mu \text{s}$; $\delta \leq 0.02$; $T_{amb} = 25 \degree \text{ C}$</td>
<td>50</td>
<td>100</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>V_{CES}</td>
<td>collector-emitter saturation voltage</td>
<td>$I_C = 20 \text{ mA}$; $I_B = 2 \text{ mA}$; $T_{amb} = 25 \degree \text{ C}$</td>
<td>-</td>
<td>60</td>
<td>75</td>
<td>mV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_C = 50 \text{ mA}$; $I_B = 6 \text{ mA}$; pulsed; $t_p \leq 300 \mu \text{s}$; $\delta \leq 0.02$; $T_{amb} = 25 \degree \text{ C}$</td>
<td>-</td>
<td>65</td>
<td>90</td>
<td>mV</td>
</tr>
<tr>
<td>V_{BE}</td>
<td>base-emitter saturation voltage</td>
<td>$I_C = 50 \text{ mA}$; $I_B = 5 \text{ mA}$; pulsed; $t_p \leq 300 \mu \text{s}$; $\delta \leq 0.02$; $T_{amb} = 25 \degree \text{ C}$</td>
<td>-</td>
<td>0.75</td>
<td>0.9</td>
<td>V</td>
</tr>
<tr>
<td>t_d</td>
<td>delay time</td>
<td>$V_{CC} = 20 \text{ V}$; $I_C = 0.05 \text{ A}$; $I_{Bon} = 5 \text{ mA}$; $I_{Boff} = -10 \text{ mA}$; $T_{amb} = 25 \degree \text{ C}$</td>
<td>-</td>
<td>80</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td>t_r</td>
<td>rise time</td>
<td>$V_{CC} = 20 \text{ V}$; $I_C = 0.05 \text{ A}$; $I_{Bon} = 5 \text{ mA}$; $I_{Boff} = -10 \text{ mA}$; $T_{amb} = 25 \degree \text{ C}$</td>
<td>-</td>
<td>2700</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td>t_on</td>
<td>turn-on time</td>
<td>$V_{CC} = 20 \text{ V}$; $I_C = 0.05 \text{ A}$; $I_{Bon} = 5 \text{ mA}$; $I_{Boff} = -10 \text{ mA}$; $T_{amb} = 25 \degree \text{ C}$</td>
<td>-</td>
<td>2780</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td>t_s</td>
<td>storage time</td>
<td>$V_{CC} = 20 \text{ V}$; $I_C = 0.05 \text{ A}$; $I_{Bon} = 5 \text{ mA}$; $I_{Boff} = -10 \text{ mA}$; $T_{amb} = 25 \degree \text{ C}$</td>
<td>-</td>
<td>3400</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td>t_f</td>
<td>fall time</td>
<td>$V_{CC} = 20 \text{ V}$; $I_C = 0.05 \text{ A}$; $I_{Bon} = 5 \text{ mA}$; $I_{Boff} = -10 \text{ mA}$; $T_{amb} = 25 \degree \text{ C}$</td>
<td>-</td>
<td>800</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td>t_{off}</td>
<td>turn-off time</td>
<td>$V_{CE} = 10 \text{ V}$; $I_C = 10 \text{ mA}$; $f = 100 \text{ MHz}$; $T_{amb} = 25 \degree \text{ C}$</td>
<td>-</td>
<td>4200</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td>f_T</td>
<td>transition frequency</td>
<td>$V_{CE} = 10 \text{ V}$; $I_C = 10 \text{ mA}$; $f = 1 \text{ MHz}$; $T_{amb} = 25 \degree \text{ C}$</td>
<td>-</td>
<td>35</td>
<td>-</td>
<td>MHz</td>
</tr>
<tr>
<td>C_c</td>
<td>collector capacitance</td>
<td>$V_{CB} = 20 \text{ V}$; $I_E = 0 \text{ A}$; $I_P = 0 \text{ A}$; $I_J = 1 \text{ MHz}$; $T_{amb} = 25 \degree \text{ C}$</td>
<td>-</td>
<td>4</td>
<td>-</td>
<td>pF</td>
</tr>
<tr>
<td>C_e</td>
<td>emitter capacitance</td>
<td>$V_{EB} = 0.5 \text{ V}$; $I_C = 0 \text{ A}$; $I_E = 0 \text{ A}$; $f = 1 \text{ MHz}$; $T_{amb} = 25 \degree \text{ C}$</td>
<td>-</td>
<td>200</td>
<td>-</td>
<td>pF</td>
</tr>
</tbody>
</table>
Nexperia

500 V, 150 mA NPN high-voltage low VCEsat transistor

Fig. 3. DC current gain as a function of collector current; typical values

\[ V_{CE} = 10 \text{ V} \]

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

Fig. 4. Collector current as a function of collector-emitter voltage; typical values

\[ T_{amb} = 25 \degree \text{C} \]

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

\[ V_{CE} = 10 \text{ V} \]

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

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

\[ I_{C}/I_{B} = 5 \]

(1) \( T_{amb} = -55 \degree \text{C} \)
(2) \( T_{amb} = 25 \degree \text{C} \)
(3) \( T_{amb} = 100 \degree \text{C} \)
**Nexperia**

**PMBTA45-Q**

500 V, 150 mA NPN high-voltage low VCEsat transistor

---

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

\[
\begin{align*}
I_C/I_B &= 5 \\
(1) &\quad T_{\text{amb}} = 100 °C \\
(2) &\quad T_{\text{amb}} = 25 °C \\
(3) &\quad T_{\text{amb}} = -55 °C
\end{align*}
\]

**Fig. 8.** Collector-emitter saturation voltage as a function of collector current; typical values

\[
\begin{align*}
T_{\text{amb}} &= 25 °C \\
(1) &\quad I_C/I_B = 20 \\
(2) &\quad I_C/I_B = 10 \\
(3) &\quad I_C/I_B = 5
\end{align*}
\]

**Fig. 9.** Collector-emitter saturation resistance as a function of collector current; typical values

\[
\begin{align*}
I_C/I_B &= 5 \\
(1) &\quad T_{\text{amb}} = 100 °C \\
(2) &\quad T_{\text{amb}} = 25 °C \\
(3) &\quad T_{\text{amb}} = -55 °C
\end{align*}
\]

**Fig. 10.** Collector-emitter saturation resistance as a function of collector current; typical values

\[
\begin{align*}
T_{\text{amb}} &= 25 °C \\
(1) &\quad I_C/I_B = 20 \\
(2) &\quad I_C/I_B = 10 \\
(3) &\quad I_C/I_B = 5
\end{align*}
\]
11. Test information

![Test circuit for switching times](image)

**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

![Package outline SOT23](image)
13. Soldering

Fig. 13. Reflow soldering footprint for SOT23

Fig. 14. Wave soldering footprint for SOT23
# 14. Revision history

Table 8. Revision history

<table>
<thead>
<tr>
<th>Data sheet ID</th>
<th>Release date</th>
<th>Data sheet status</th>
<th>Change notice</th>
<th>Supersedes</th>
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<tbody>
<tr>
<td>PMBTA45-Q v.1</td>
<td>20230720</td>
<td>Product data sheet</td>
<td>-</td>
<td>-</td>
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</tbody>
</table>
15. Legal information

Data sheet status

<table>
<thead>
<tr>
<th></th>
<th></th>
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<tbody>
<tr>
<td>Objective [short] data sheet</td>
<td>Development</td>
<td>This document contains data from the objective specification for product development.</td>
</tr>
<tr>
<td>Preliminary [short] data sheet</td>
<td>Qualification</td>
<td>This document contains data from the preliminary specification.</td>
</tr>
<tr>
<td>Product [short] data sheet</td>
<td>Production</td>
<td>This document contains the product specification.</td>
</tr>
</tbody>
</table>

[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 https://www.nexperia.com.

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For more information, please visit: http://www.nexperia.com
For sales office addresses, please send an email to: salesaddresses@nexperia.com
Date of release: 20 July 2023

Product data sheet 20 July 2023