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Team Nexperia
1. Product profile

1.1 General description

NPN Resistor-Equipped Transistor (RET) in a leadless ultra small DFN1006B-3 (SOT883B) Surface-Mounted Device (SMD) plastic package.

PNP complement: PDTA123EMB.

1.2 Features and benefits

- 100 mA output current capability
- Reduces component count
- Built-in bias resistors
- Reduces pick and place costs
- Simplifies circuit design
- AEC-Q101 qualified
- Leadless ultra small SMD plastic package
- Low package height of 0.37 mm

1.3 Applications

- Low-current peripheral driver
- Control of IC inputs
- Replaces general-purpose transistors in digital applications
- Mobile applications

1.4 Quick reference data

Table 1. Quick reference data

<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>VCEO</td>
<td>collector-emitter voltage</td>
<td>open base</td>
<td>-</td>
<td>-</td>
<td>50</td>
<td>V</td>
</tr>
<tr>
<td>I0</td>
<td>output current</td>
<td></td>
<td>-</td>
<td>-</td>
<td>100</td>
<td>mA</td>
</tr>
<tr>
<td>R1</td>
<td>bias resistor 1 (input)</td>
<td>T_{amb} = 25 °C</td>
<td>1.54</td>
<td>2.2</td>
<td>2.86</td>
<td>kΩ</td>
</tr>
<tr>
<td>R2/R1</td>
<td>bias resistor ratio</td>
<td></td>
<td>0.8</td>
<td>1</td>
<td>1.2</td>
<td></td>
</tr>
</tbody>
</table>
2. 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>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I</td>
<td>input (base)</td>
<td><img src="sym007" alt="Transparent top view" /></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>G</td>
<td>GND (emitter)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>O</td>
<td>output (collector)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SOT883B (DFN1006B-3)

3. Ordering information

Table 3. Ordering information

<table>
<thead>
<tr>
<th>Type number</th>
<th>Package Name</th>
<th>Description</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>PDTC123EMB</td>
<td>DFN1006B-3</td>
<td>Leadless ultra small plastic package; 3 solder lands; body 1.0 x 0.6 x 0.37 mm</td>
<td>SOT883B</td>
</tr>
</tbody>
</table>

4. Marking

Table 4. Marking codes

<table>
<thead>
<tr>
<th>Type number</th>
<th>Marking code</th>
</tr>
</thead>
<tbody>
<tr>
<td>PDTC123EMB</td>
<td>0011 0011</td>
</tr>
</tbody>
</table>

Fig 1. DFN1006B-3 (SOT883B) binary marking code description
5. 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>50</td>
<td>V</td>
</tr>
<tr>
<td>$V_{CEO}$</td>
<td>collector-emitter voltage</td>
<td>open base</td>
<td>-</td>
<td>50</td>
<td>V</td>
</tr>
<tr>
<td>$V_{EBO}$</td>
<td>emitter-base voltage</td>
<td>open collector</td>
<td>-</td>
<td>10</td>
<td>V</td>
</tr>
<tr>
<td>$V_I$</td>
<td>input voltage</td>
<td>positive</td>
<td>-</td>
<td>12</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>negative</td>
<td>-</td>
<td>-10</td>
<td>V</td>
</tr>
<tr>
<td>$I_O$</td>
<td>output current</td>
<td>-</td>
<td>100</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td>$I_{CM}$</td>
<td>peak collector current</td>
<td>pulsed; $t_p \leq 1$ ms</td>
<td>-</td>
<td>100</td>
<td>mA</td>
</tr>
<tr>
<td>$P_{tot}$</td>
<td>total power dissipation</td>
<td>$T_{amb} \leq 25$ °C</td>
<td>-</td>
<td>250</td>
<td>mW</td>
</tr>
<tr>
<td>$T_j$</td>
<td>junction temperature</td>
<td>-</td>
<td>150</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>$T_{amb}$</td>
<td>ambient temperature</td>
<td>-65</td>
<td>150</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>$T_{stg}$</td>
<td>storage temperature</td>
<td>-65</td>
<td>150</td>
<td>°C</td>
<td></td>
</tr>
</tbody>
</table>

[2] Reflow soldering is the only recommended soldering method.

---

![Power derating curve for DFN1006B-3 (SOT883B)](image_url)

FR4 PCB, standard footprint

Fig 2. Power derating curve for DFN1006B-3 (SOT883B)
6. Thermal characteristics

Table 6. Thermal 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>$R_{th(j-a)}$</td>
<td>thermal resistance</td>
<td>in free air</td>
<td></td>
<td></td>
<td>500</td>
<td>K/W</td>
</tr>
<tr>
<td></td>
<td>from junction to ambient</td>
<td></td>
<td>[1]</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


[2] Reflow soldering is the only recommended soldering method.

Fig 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values.
7. 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} = 50) V; (I_E = 0) A; (T_{amb} = 25) °C</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td>nA</td>
</tr>
<tr>
<td>(I_{CEO})</td>
<td>collector-emitter cut-off current</td>
<td>(V_{CE} = 30) V; (I_B = 0) A; (T_{amb} = 25) °C</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>µA</td>
</tr>
<tr>
<td>(I_{EBO})</td>
<td>emitter-base cut-off current</td>
<td>(V_{EB} = 5) V; (I_C = 0) A; (T_{amb} = 25) °C</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>mA</td>
</tr>
<tr>
<td>(h_{FE})</td>
<td>DC current gain</td>
<td>(V_{CE} = 5) V; (I_C = 10) mA; (T_{amb} = 25) °C</td>
<td>30</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>(V_{CEsat})</td>
<td>collector-emitter saturation voltage</td>
<td>(I_C = 10) mA; (I_B = 0.5) mA; (T_{amb} = 25) °C</td>
<td>-</td>
<td>-</td>
<td>150</td>
<td>mV</td>
</tr>
<tr>
<td>(V_{I(off)})</td>
<td>off-state input voltage</td>
<td>(V_{CE} = 5) V; (I_C = 1) mA; (T_{amb} = 25) °C</td>
<td>-</td>
<td>1.2</td>
<td>0.5</td>
<td>V</td>
</tr>
<tr>
<td>(V_{I(on)})</td>
<td>on-state input voltage</td>
<td>(V_{CE} = 0.3) V; (I_C = 20) mA; (T_{amb} = 25) °C</td>
<td>2</td>
<td>1.6</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>R1</td>
<td>bias resistor 1 (input)</td>
<td>(T_{amb} = 25) °C</td>
<td>1.54</td>
<td>2.2</td>
<td>2.86</td>
<td>kΩ</td>
</tr>
<tr>
<td>R2/R1</td>
<td>bias resistor ratio</td>
<td></td>
<td>0.8</td>
<td>1</td>
<td>1.2</td>
<td></td>
</tr>
<tr>
<td>(C_C)</td>
<td>collector capacitance</td>
<td>(V_{CB} = 10) V; (I_E = 0) A; (I_E = 0) A; (f = 1) MHz, (T_{amb} = 25) °C</td>
<td>-</td>
<td>-</td>
<td>2.5</td>
<td>pF</td>
</tr>
<tr>
<td>(f_T)</td>
<td>transition frequency</td>
<td>(V_{CE} = 5) V; (I_C = 10) mA; (f = 100) MHz, (T_{amb} = 25) °C</td>
<td>[1]</td>
<td>-</td>
<td>230</td>
<td>MHz</td>
</tr>
</tbody>
</table>


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

Fig 5. Collector-emitter saturation voltage as a function of collector current; typical values
NPN resistor-equipped transistor; $R_1 = 2.2 \, \Omega$, $R_2 = 2.2 \, \Omega$

**Fig 6.** On-state input voltage as a function of collector current; typical values

- $V_{CE} = 0.3 \, V$
  - (1) $T_{amb} = -40 \, ^\circ C$
  - (2) $T_{amb} = 25 \, ^\circ C$
  - (3) $T_{amb} = 100 \, ^\circ C$

**Fig 7.** Off-state input voltage as a function of collector current; typical values

- $V_{CE} = 5 \, V$
  - (1) $T_{amb} = -40 \, ^\circ C$
  - (2) $T_{amb} = 25 \, ^\circ C$
  - (3) $T_{amb} = 100 \, ^\circ C$

**Fig 8.** Collector capacitance as a function of collector-base voltage; typical values of built-in transistor

- $f = 1 \, MHz$; $T_{amb} = 25 \, ^\circ C$

**Fig 9.** Transition frequency as a function of collector current; typical values of built-in transistor

- $V_{CE} = 5 \, V$; $T_{amb} = 25 \, ^\circ C$
8. Test information

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

Fig 10. Package outline SOT883B (DFN1006B-3)
10. Soldering

Fig 11. Reflow soldering footprint for SOT883B (DFN1006B-3)
11. Revision history

Table 8. Revision history

<table>
<thead>
<tr>
<th>Document 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>PDTC123EMB v.1</td>
<td>20120403</td>
<td>Product data sheet</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
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12. Legal information

12.1 Data sheet status

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<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.
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