1. **General description**

PNP medium power transistor series encapsulated in an ultra thin DFN2020D-3 (SOT1061D) leadless small Surface-Mounted Device (SMD) plastic package with medium power capability and visible and solderable side pads.

2. **Features and benefits**

- High collector current capability \( I_C \) and \( I_{CM} \)
- Reduced Printed-Circuit Board (PCB) area requirements
- Exposed heat sink for excellent thermal and electrical conductivity
- Two current gain selections
- Leadless very small SMD plastic package with medium power capability
- Suitable for Automatic Optical Inspection (AOI) of solder joint
- Qualified according to AEC-Q101 and recommended for use in automotive applications

3. **Applications**

- Linear voltage regulators
- Battery driven devices
- MOSFET drivers
- High-side switches
- Power management
- Amplifiers

4. **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>( V_{CEO} )</td>
<td>collector-emitter voltage</td>
<td>open base</td>
<td>-</td>
<td>-</td>
<td>-80</td>
<td>V</td>
</tr>
<tr>
<td>( I_C )</td>
<td>collector current</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-1</td>
<td>A</td>
</tr>
<tr>
<td>( I_{CM} )</td>
<td>peak collector current</td>
<td>single pulse; ( t_p \leq 1 \text{ ms} )</td>
<td>-</td>
<td>-</td>
<td>-2</td>
<td>A</td>
</tr>
<tr>
<td>( h_{FE} )</td>
<td>DC current gain</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BC53PAS-Q</td>
<td></td>
<td>( V_{CE} = -2 \text{ V}; I_C = -150 \text{ mA}; T_{amb} = 25 \text{ °C} )</td>
<td>[1]</td>
<td>63</td>
<td>-</td>
<td>250</td>
</tr>
<tr>
<td>BC53-10PAS-Q</td>
<td></td>
<td></td>
<td></td>
<td>63</td>
<td>-</td>
<td>160</td>
</tr>
<tr>
<td>BC53-16PAS-Q</td>
<td></td>
<td></td>
<td></td>
<td>100</td>
<td>-</td>
<td>250</td>
</tr>
</tbody>
</table>

[1] pulsed; \( t_p \leq 300 \text{ µs}; \delta \leq 0.02 \)
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>
</tr>
</thead>
<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>Transparent top view</td>
<td>sym013</td>
</tr>
</tbody>
</table>

DFN2020D-3 (SOT1061D)

6. Ordering information

Table 3. Ordering information

<table>
<thead>
<tr>
<th>Package</th>
<th>Type number</th>
<th>Name</th>
<th>Description</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>DFN2020D-3</td>
<td>BC53PAS-Q</td>
<td>plastic, leadless thermal enhanced ultra thin small outline package with side-wettable flanks (SWF); no leads; 3 terminals; 1.3 mm pitch; 2 mm x 2 mm x 0.65 mm body</td>
<td>SOT1061D</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BC53-10PAS-Q</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BC53-16PAS-Q</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7. Marking

Table 4. Marking codes

<table>
<thead>
<tr>
<th>Type number</th>
<th>Marking code</th>
</tr>
</thead>
<tbody>
<tr>
<td>BC53PAS-Q</td>
<td>CA</td>
</tr>
<tr>
<td>BC53-10PAS-Q</td>
<td>CB</td>
</tr>
<tr>
<td>BC53-16PAS-Q</td>
<td>CC</td>
</tr>
</tbody>
</table>
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>-100</td>
<td>V</td>
</tr>
<tr>
<td>V_{CEO}</td>
<td>collector-emitter voltage</td>
<td>open base</td>
<td>-</td>
<td>-80</td>
<td>V</td>
</tr>
<tr>
<td>V_{EBO}</td>
<td>emitter-base voltage</td>
<td>open collector</td>
<td>-</td>
<td>-5</td>
<td>V</td>
</tr>
<tr>
<td>I_C</td>
<td>collector current</td>
<td></td>
<td>-</td>
<td>-1</td>
<td>A</td>
</tr>
<tr>
<td>I_{CM}</td>
<td>peak collector current</td>
<td>single pulse; t_p ≤ 1 ms</td>
<td>-</td>
<td>-2</td>
<td>A</td>
</tr>
<tr>
<td>I_B</td>
<td>base current</td>
<td></td>
<td>-</td>
<td>-0.3</td>
<td>A</td>
</tr>
<tr>
<td>P_{tot}</td>
<td>total power dissipation</td>
<td>T_{amb} ≤ 25 °C</td>
<td>[1]</td>
<td>0.42</td>
<td>W</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[2]</td>
<td>0.81</td>
<td>W</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[3]</td>
<td>0.83</td>
<td>W</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[4]</td>
<td>1.1</td>
<td>W</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[5]</td>
<td>1.65</td>
<td>W</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>
</tr>
</tbody>
</table>

[3] Device mounted on an FR4 PCB, single-sided copper, tin-plated and mounting pad for collector 1 cm\(^2\).
[4] Device mounted on an FR4 PCB, single-sided copper, tin-plated and mounting pad for collector 6 cm\(^2\).
[5] Device mounted on an FR4 PCB, 4-layer copper, tin-plated and mounting pad for collector 1 cm\(^2\).

Fig. 1. Power derating curves

(1) FR4 PCB, 4-layer copper, mounting pad for collector 1 cm\(^2\)
(2) FR4 PCB, single-sided copper, mounting pad for collector 6 cm\(^2\)
(3) FR4 PCB, single-sided copper, mounting pad for collector 1 cm\(^2\)
(4) FR4 PCB, 4-layer copper, standard footprint
(5) FR4 PCB, single-sided copper, standard footprint
9. Thermal characteristics

Table 6. Thermal characteristics

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</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 from junction to ambient</td>
<td>in free air</td>
<td></td>
<td>[1]</td>
<td>-</td>
<td>-</td>
<td>298  K/W</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>[2]</td>
<td>-</td>
<td>-</td>
<td>154  K/W</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>[3]</td>
<td>-</td>
<td>-</td>
<td>151  K/W</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>[4]</td>
<td>-</td>
<td>-</td>
<td>114  K/W</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>[5]</td>
<td>-</td>
<td>-</td>
<td>76   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>-</td>
<td>-</td>
<td>20</td>
<td>K/W</td>
</tr>
</tbody>
</table>

[5] Device mounted on an FR4 PCB, 4-layer copper, tin-plated and mounting pad for collector 1 cm$^2$.

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

Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values
Nexperia

BC53xPAS-Q series

80 V, 1 A PNP medium power transistors

FR4 PCB, single-sided copper, mounting pad for collector 1 cm²

Fig. 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

FR4 PCB, single-sided copper, mounting pad for collector 6 cm²

Fig. 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

FR4 PCB, 4-layer copper, mounting pad for collector 1 cm²

Fig. 6. 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 (emitter open)</td>
<td>$V_{CB} = -30 , \text{V}; , I_E = 0 , \text{A}; , T_{amb} = 25 , ^\circ\text{C}$</td>
<td>-</td>
<td>-</td>
<td>-100</td>
<td>nA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{CB} = -30 , \text{V}; , I_E = 0 , \text{A}; , T_{amb} = 150 , ^\circ\text{C}$</td>
<td>-</td>
<td>-</td>
<td>-10</td>
<td>µA</td>
</tr>
<tr>
<td>$I_{EBO}$</td>
<td>emitter-base cut-off current (collector open)</td>
<td>$V_{EB} = -5 , \text{V}; , I_C = 0 , \text{A}; , T_{amb} = 25 , ^\circ\text{C}$</td>
<td>-</td>
<td>-</td>
<td>-100</td>
<td>nA</td>
</tr>
</tbody>
</table>

$h_{FE}$

DC current gain

- $BC53PAS-Q$  
  $V_{CE} = -2 \, \text{V}; \, I_C = -5 \, \text{mA}; \, T_{amb} = 25 \, ^\circ\text{C}$
  63 - -

- $BC53-10PAS-Q$  
  $V_{CE} = -2 \, \text{V}; \, I_C = -150 \, \text{mA}; \, T_{amb} = 25 \, ^\circ\text{C}$
  1 [1] 63 - 250

- $BC53-16PAS-Q$  
  $V_{CE} = -2 \, \text{V}; \, I_C = -500 \, \text{mA}; \, T_{amb} = 25 \, ^\circ\text{C}$
  1 [1] 40 - -

$V_{CEsat}$

Collector-emitter saturation voltage

- $I_C = -500 \, \text{mA}; \, I_S = -50 \, \text{mA}; \, T_{amb} = 25 \, ^\circ\text{C}$
  1 [1] - - -500 mV

$V_{BE}$

Base-emitter voltage

- $V_{CE} = -2 \, \text{V}; \, I_C = -500 \, \text{mA}; \, T_{amb} = 25 \, ^\circ\text{C}$
  1 [1] - - -1 V

$C_C$

Collector capacitance

- $V_{CB} = -10 \, \text{V}; \, I_E = 0 \, \text{A}; \, f = 1 \, \text{MHz}; \, T_{amb} = 25 \, ^\circ\text{C}$
  - 15 - pF

$f_T$

Transition frequency

- $V_{CE} = -5 \, \text{V}; \, I_C = -50 \, \text{mA}; \, f = 100 \, \text{MHz}; \, T_{amb} = 25 \, ^\circ\text{C}$
  - 145 - MHz

[1] pulsed; $t_p \leq 300 \, \mu\text{s}; \, \delta \leq 0.02$

Fig. 7. DC current gain as a function of collector current; typical values

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

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11. Test information

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

Fig. 9. Base-emitter voltage as a function of collector current; typical values

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

Fig. 11. Package outline DFN2020D-3 (SOT1061D)
13. Soldering

Fig. 12. Reflow soldering footprint for DFN2020D-3 (SOT1061D)
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>
</tr>
</thead>
<tbody>
<tr>
<td>BC53XPAS-Q_SER v.1</td>
<td>20221017</td>
<td>Product data sheet</td>
<td>-</td>
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</table>

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Data sheet status

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

[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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