1. General description

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

Table 1. Product overview

<table>
<thead>
<tr>
<th>Type number</th>
<th>Package</th>
<th>NPN complement:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nexperia</td>
<td>JEDEC</td>
</tr>
<tr>
<td>BC816-16H-Q</td>
<td>SOT23</td>
<td>TO-236AB</td>
</tr>
<tr>
<td>BC816-25H-Q</td>
<td>SOT23</td>
<td>TO-236AB</td>
</tr>
</tbody>
</table>

2. Features and benefits

- High current
- High voltage
- Two current gain selections
- High-temperature applications up to 175 °C
- Qualified according to AEC-Q101 and recommended for use in automotive applications

3. Applications

- General-purpose switching and amplification
- 48 V automotive board net

4. Quick reference data

Table 2. 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&lt;sub&gt;CEO&lt;/sub&gt;</td>
<td>collector-emitter voltage</td>
<td>open base; T&lt;sub&gt;amb&lt;/sub&gt; = 25 °C</td>
<td>-</td>
<td>-</td>
<td>80</td>
<td>V</td>
</tr>
<tr>
<td>I&lt;sub&gt;C&lt;/sub&gt;</td>
<td>collector current</td>
<td>T&lt;sub&gt;amb&lt;/sub&gt; = 25 °C</td>
<td>-</td>
<td>-</td>
<td>500</td>
<td>mA</td>
</tr>
<tr>
<td>I&lt;sub&gt;CM&lt;/sub&gt;</td>
<td>peak collector current</td>
<td>single pulse; t&lt;sub&gt;p&lt;/sub&gt; ≤ 1 ms; T&lt;sub&gt;amb&lt;/sub&gt; = 25 °C</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>A</td>
</tr>
<tr>
<td>h&lt;sub&gt;FE&lt;/sub&gt;</td>
<td>DC current gain</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BC816-16H-Q</td>
<td>V&lt;sub&gt;CE&lt;/sub&gt; = 1 V; I&lt;sub&gt;C&lt;/sub&gt; = 100 mA T&lt;sub&gt;amb&lt;/sub&gt; = 25 °C</td>
<td>[1]</td>
<td>100</td>
<td>-</td>
<td>250</td>
<td></td>
</tr>
<tr>
<td>BC816-25H-Q</td>
<td>V&lt;sub&gt;CE&lt;/sub&gt; = 1 V; I&lt;sub&gt;C&lt;/sub&gt; = 100 mA T&lt;sub&gt;amb&lt;/sub&gt; = 25 °C</td>
<td>[1]</td>
<td>160</td>
<td>-</td>
<td>400</td>
<td></td>
</tr>
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</table>

[1] pulsed; t<sub>p</sub> ≤ 300 μs; δ ≤ 0.02
5. Pinning information

Table 3. Pinning

<table>
<thead>
<tr>
<th>Pin</th>
<th>Symbol</th>
<th>Description</th>
<th>Simplified outline</th>
<th>Graphic symbol</th>
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<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>SOT23</td>
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6. Ordering information

Table 4. 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>BC816H-Q</td>
<td>SOT23</td>
<td>plastic, surface-mounted package; 3 leads</td>
<td>SOT23</td>
<td></td>
</tr>
<tr>
<td>BC816-25H-Q</td>
<td>SOT23</td>
<td>plastic, surface-mounted package; 3 leads</td>
<td>SOT23</td>
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7. Marking

Table 5. Marking

<table>
<thead>
<tr>
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<th>Marking code [1]</th>
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<tr>
<td>BC816-16H-Q</td>
<td>QQ%</td>
</tr>
<tr>
<td>BC816-25H-Q</td>
<td>QR%</td>
</tr>
</tbody>
</table>

[1] % = placeholder for manufacturing site code
8. Limiting values

Table 6. 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; ( T_{\text{amb}} = 25 \degree \text{C} )</td>
<td>-</td>
<td>80</td>
<td>V</td>
</tr>
<tr>
<td>V_{CEO}</td>
<td>collector-emitter voltage</td>
<td>open base; ( T_{\text{amb}} = 25 \degree \text{C} )</td>
<td>-</td>
<td>80</td>
<td>V</td>
</tr>
<tr>
<td>V_{EBO}</td>
<td>emitter-base voltage</td>
<td>open collector; ( T_{\text{amb}} = 25 \degree \text{C} )</td>
<td>-</td>
<td>7</td>
<td>V</td>
</tr>
<tr>
<td>I_{C}</td>
<td>collector current</td>
<td>( T_{\text{amb}} = 25 \degree \text{C} )</td>
<td>-</td>
<td>500</td>
<td>mA</td>
</tr>
<tr>
<td>I_{CM}</td>
<td>peak collector current</td>
<td>single pulse; ( t_{p} \leq 1 \text{ ms}; T_{\text{amb}} = 25 \degree \text{C} )</td>
<td>-</td>
<td>1</td>
<td>A</td>
</tr>
<tr>
<td>I_{BM}</td>
<td>peak base current</td>
<td>single pulse; ( t_{p} \leq 1 \text{ ms}; T_{\text{amb}} = 25 \degree \text{C} )</td>
<td>-</td>
<td>200</td>
<td>mA</td>
</tr>
<tr>
<td>P_{tot}</td>
<td>total power dissipation</td>
<td>( T_{\text{amb}} \leq 25 \degree \text{C} )</td>
<td>[1]</td>
<td>300</td>
<td>mW</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[2]</td>
<td>415</td>
<td>mW</td>
</tr>
</tbody>
</table>

<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>T_{j}</td>
<td>junction temperature</td>
<td>-</td>
<td>175</td>
<td>175</td>
<td>°C</td>
</tr>
<tr>
<td>T_{amb}</td>
<td>ambient temperature</td>
<td>-55</td>
<td>175</td>
<td>175</td>
<td>°C</td>
</tr>
<tr>
<td>T_{stg}</td>
<td>storage temperature</td>
<td>-65</td>
<td>175</td>
<td>175</td>
<td>°C</td>
</tr>
</tbody>
</table>

[1] Device mounted on an FR4 Printed-Circuit-Board (PCB); single-sided copper; tin-plated and standard footprint.
[2] Device mounted on an FR4 PCB; single-sided copper; tin-plated; mounting pad for collector 1 cm².

![Power derating curves for SOT23](aaa-030916)

(1) FR4 PCB; 1 cm² mounting pad for collector
(2) FR4 PCB; standard footprint

Fig. 1. Power derating curves for SOT23
9. Thermal characteristics

Table 7. 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 from junction to ambient</td>
<td>in free air; $T_{amb} = 25 , ^\circ C$</td>
<td></td>
<td></td>
<td>500</td>
<td>K/W</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[1] Device mounted on an FR4 PCB; single-sided copper; tin-plated and standard footprint.</td>
<td></td>
<td></td>
<td>363</td>
<td>K/W</td>
</tr>
</tbody>
</table>

[2] Device mounted on an FR4 PCB; single-sided copper; tin-plated; 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
## 10. Characteristics

Table 8. 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>$V_{(BR)CBO}$</td>
<td>collector-base break-down voltage</td>
<td>$I_C = 100 \mu A; I_E = 0 A; T_{amb} = 25 , ^\circ C$</td>
<td>80</td>
<td>-</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>$V_{(BR)CEO}$</td>
<td>collector-emitter break-down voltage</td>
<td>$I_C = 2 mA; I_E = 0 A; T_{amb} = 25 , ^\circ C$</td>
<td>80</td>
<td>-</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>$V_{(BR)EBO}$</td>
<td>emitter-base break-down voltage</td>
<td>$I_E = 100 \mu A; I_C = 0 A; T_{amb} = 25 , ^\circ C$</td>
<td>7</td>
<td>-</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>$I_{CBO}$</td>
<td>collector-base cut-off current</td>
<td>$V_{CB} = 64 , V; I_E = 0 A; T_{amb} = 25 , ^\circ C$</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td>nA</td>
</tr>
<tr>
<td>$I_{EBO}$</td>
<td>emitter-base cut-off current</td>
<td>$V_{EB} = 5.6 , V; I_C = 0 A; T_{amb} = 25 , ^\circ C$</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td>nA</td>
</tr>
<tr>
<td>$h_{FE}$</td>
<td>DC current gain</td>
<td>$V_{CE} = 1 , V; I_C = 100 , mA; T_{amb} = 25 , ^\circ C$</td>
<td>[1]</td>
<td>100</td>
<td>250</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BC816-16H-Q</td>
<td>$V_{CE} = 2 , V; I_C = 500 , mA; T_{amb} = 25 , ^\circ C$</td>
<td>[1]</td>
<td>30</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BC816-25H-Q</td>
<td>$V_{CE} = 5 , V; I_C = 50 , mA; f = 100 , MHz; T_{amb} = 25 , ^\circ C$</td>
<td>100</td>
<td>-</td>
<td>-</td>
<td>MHz</td>
</tr>
<tr>
<td>$V_{CESat}$</td>
<td>collector-emitter saturation voltage</td>
<td>$I_C = 100 , mA; I_B = 10 , mA; T_{amb} = 25 , ^\circ C$</td>
<td>[1]</td>
<td>-</td>
<td>150</td>
<td>mV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_C = 500 , mA; I_B = 50 , mA; T_{amb} = 25 , ^\circ C$</td>
<td>[1]</td>
<td>-</td>
<td>400</td>
<td>mV</td>
</tr>
<tr>
<td>$V_{BE}$</td>
<td>base-emitter voltage</td>
<td>$V_{CE} = 1 , V; I_C = 500 , mA; T_{amb} = 25 , ^\circ C$</td>
<td>[1]</td>
<td>-</td>
<td>1.2</td>
<td>V</td>
</tr>
<tr>
<td>$f_T$</td>
<td>transition frequency</td>
<td>$V_{CE} = 5 , V; I_C = 50 , mA; f = 100 , MHz; T_{amb} = 25 , ^\circ C$</td>
<td>100</td>
<td>-</td>
<td>-</td>
<td>MHz</td>
</tr>
<tr>
<td>$C_c$</td>
<td>collector capacitance</td>
<td>$V_{CB} = 10 , V; I_E = I_c = 0 A; f = 1 , MHz; T_{amb} = 25 , ^\circ C$</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>pF</td>
</tr>
<tr>
<td>$C_e$</td>
<td>emitter capacitance</td>
<td>$V_{EB} = 0.5 , V; I_C = I_e = 0 A; f = 1 , MHz; T_{amb} = 25 , ^\circ C$</td>
<td>-</td>
<td>42</td>
<td>-</td>
<td>pF</td>
</tr>
</tbody>
</table>

[1] pulsed; $t_p \leq 300 \, \mu s; \delta \leq 0.02$
**BC816H-Q series**

80 V, 500 mA NPN general-purpose transistors

---

**Fig. 4.** BC816-16H-Q: DC current gain as a function of collector current; typical values

- **V\(_{CE}\) = 1 V**
  - (1) \(T_{\text{amb}} = 175^\circ C\)
  - (2) \(T_{\text{amb}} = 150^\circ C\)
  - (3) \(T_{\text{amb}} = 125^\circ C\)
  - (4) \(T_{\text{amb}} = 100^\circ C\)
  - (5) \(T_{\text{amb}} = 85^\circ C\)
  - (6) \(T_{\text{amb}} = 25^\circ C\)
  - (7) \(T_{\text{amb}} = -40^\circ C\)
  - (8) \(T_{\text{amb}} = -55^\circ C\)

**Fig. 5.** BC816-16H-Q: DC current gain as a function of collector current; typical values

- **T\(_{\text{amb}}\) = 25 \(^\circ C\)**
  - (1) \(V_{CE} = 5 V\)
  - (2) \(V_{CE} = 2 V\)
  - (3) \(V_{CE} = 1 V\)

**Fig. 6.** BC816-16H-Q: Base-emitter voltage as a function of collector current; typical values

- **V\(_{CE}\) = 5 V**
  - (1) \(T_{\text{amb}} = -55^\circ C\)
  - (2) \(T_{\text{amb}} = -40^\circ C\)
  - (3) \(T_{\text{amb}} = 25^\circ C\)
  - (4) \(T_{\text{amb}} = 85^\circ C\)
  - (5) \(T_{\text{amb}} = 100^\circ C\)
  - (6) \(T_{\text{amb}} = 125^\circ C\)
  - (7) \(T_{\text{amb}} = 150^\circ C\)
  - (8) \(T_{\text{amb}} = 175^\circ C\)

**Fig. 7.** BC816-16H-Q: Base-emitter voltage as a function of collector current; typical values

- **T\(_{\text{amb}}\) = 25 \(^\circ C\)**
  - (1) \(V_{CE} = 1 V\)
  - (2) \(V_{CE} = 2 V\)
  - (3) \(V_{CE} = 5 V\)
Fig. 8. BC816-16H-Q: Base-emitter saturation voltage as a function of collector current; typical values

IC/IB = 10
(1) $T_{\text{amb}} = -55 \, ^\circ\text{C}$
(2) $T_{\text{amb}} = -40 \, ^\circ\text{C}$
(3) $T_{\text{amb}} = 25 \, ^\circ\text{C}$
(4) $T_{\text{amb}} = 100 \, ^\circ\text{C}$
(5) $T_{\text{amb}} = 150 \, ^\circ\text{C}$
(6) $T_{\text{amb}} = 175 \, ^\circ\text{C}$

Fig. 9. BC816-16H-Q: Base-emitter saturation voltage as a function of collector current; typical values

$T_{\text{amb}} = 25 \, ^\circ\text{C}$
(1) IC/IB = 10
(2) IC/IB = 20
(3) IC/IB = 50
(4) IC/IB = 100

Fig. 10. BC816-16H-Q: Collector-emitter saturation voltage as a function of collector current; typical values

IC/IB = 20
(1) $T_{\text{amb}} = 100 \, ^\circ\text{C}$
(2) $T_{\text{amb}} = 25 \, ^\circ\text{C}$
(3) $T_{\text{amb}} = -40 \, ^\circ\text{C}$

Fig. 11. BC816-16H-Q: Collector-emitter saturation voltage as a function of collector current; typical values

$T_{\text{amb}} = 25 \, ^\circ\text{C}$
(1) IC/IB = 100
(2) IC/IB = 50
(3) IC/IB = 20
(4) IC/IB = 10
80 V, 500 mA NPN general-purpose transistors

**Fig. 12.** BC816-16H-Q: Collector current as a function of collector-emitter voltage; typical values

**Fig. 13.** BC816-16H-Q: Transition frequency as a function of collector current; typical values

**Fig. 14.** BC816-16H-Q: Collector capacitance as a function of collector-base voltage; typical values

**Fig. 15.** BC816-16H-Q: Emitter capacitance as a function of emitter-base voltage; typical values
**Fig. 16. BC816-25H-Q: DC current gain as a function of collector current; typical values**

- $V_{CE} = 1\, \text{V}$
- $T_{\text{amb}} = 175\, ^\circ\text{C}$
- $T_{\text{amb}} = 150\, ^\circ\text{C}$
- $T_{\text{amb}} = 125\, ^\circ\text{C}$
- $T_{\text{amb}} = 100\, ^\circ\text{C}$
- $T_{\text{amb}} = 85\, ^\circ\text{C}$
- $T_{\text{amb}} = 25\, ^\circ\text{C}$
- $T_{\text{amb}} = -40\, ^\circ\text{C}$
- $T_{\text{amb}} = -55\, ^\circ\text{C}$

**Fig. 17. BC816-25H-Q: DC current gain as a function of collector current; typical values**

- $T_{\text{amb}} = 25\, ^\circ\text{C}$
- $V_{CE} = 5\, \text{V}$
- $V_{CE} = 2\, \text{V}$
- $V_{CE} = 1\, \text{V}$

**Fig. 18. BC816-25H-Q: Base-emitter voltage as a function of collector current; typical values**

- $V_{CE} = 5\, \text{V}$
- $T_{\text{amb}} = -55\, ^\circ\text{C}$
- $T_{\text{amb}} = -40\, ^\circ\text{C}$
- $T_{\text{amb}} = 25\, ^\circ\text{C}$
- $T_{\text{amb}} = 85\, ^\circ\text{C}$
- $T_{\text{amb}} = 100\, ^\circ\text{C}$
- $T_{\text{amb}} = 125\, ^\circ\text{C}$
- $T_{\text{amb}} = 150\, ^\circ\text{C}$
- $T_{\text{amb}} = 175\, ^\circ\text{C}$

**Fig. 19. BC816-25H-Q: Base-emitter voltage as a function of collector current; typical values**

- $T_{\text{amb}} = 25\, ^\circ\text{C}$
- $V_{CE} = 1\, \text{V}$
- $V_{CE} = 2\, \text{V}$
- $V_{CE} = 5\, \text{V}$
Fig. 20. BC816-25H-Q: Base-emitter saturation voltage as a function of collector current; typical values

Fig. 21. BC816-25H-Q: Base-emitter saturation voltage as a function of collector current; typical values

Fig. 22. BC816-25H-Q: Collector-emitter saturation voltage as a function of collector current; typical values

Fig. 23. BC816-25H-Q: Collector-emitter saturation voltage as a function of collector current; typical values
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. 28. Package outline SOT23
13. Soldering

Fig. 29. Reflow soldering footprint for SOT23

Fig. 30. Wave soldering footprint for SOT23
14. Revision history

Table 9. 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>BC816H-Q_SER v.1</td>
<td>20231114</td>
<td>Product data sheet</td>
<td>-</td>
<td>-</td>
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</tbody>
</table>
15. Legal information

Data sheet status

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<tr>
<th>Document status</th>
<th>Product status</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
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<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>

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