1. General description

NPN general-purpose transistor in an ultra small DFN1412D-3 (SOT8009) leadless Surface-Mounted Device (SMD) plastic package with side-wettable flanks.

<table>
<thead>
<tr>
<th>Type number</th>
<th>Package</th>
<th>JEDEC</th>
<th>Version</th>
<th>PNP complement</th>
</tr>
</thead>
<tbody>
<tr>
<td>BC817-16QC</td>
<td>DFN1412D-3</td>
<td>MO-340CA</td>
<td>SOT8009</td>
<td>BC807-16QC</td>
</tr>
<tr>
<td>BC817-25QC</td>
<td></td>
<td></td>
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<td>BC807-25QC</td>
</tr>
<tr>
<td>BC817-40QC</td>
<td></td>
<td></td>
<td></td>
<td>BC807-40QC</td>
</tr>
</tbody>
</table>

2. Features and benefits

- High power dissipation capability
- High current
- Three current gain selections
- Suitable for Automatic Optical Inspection (AOI) of solder joint
- Smaller footprint compared to conventional leaded SMD packages
- Low package height of 0.5 mm
- AEC-Q101 qualified

3. Applications

- General-purpose switching and amplification
- Space restricted applications

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; ( T_{amb} = 25 , ^\circ C )</td>
<td>-</td>
<td>-</td>
<td>45</td>
<td>V</td>
</tr>
<tr>
<td>I_C</td>
<td>collector current</td>
<td>( T_{amb} = 25 , ^\circ C )</td>
<td>-</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 , ms ); ( T_{amb} = 25 , ^\circ C )</td>
<td>-</td>
<td>-</td>
<td>1</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>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type number</th>
<th>Conditions</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BC817-16QC</td>
<td>( V_{CE} = 1 , V ); ( I_C = 100 , mA ); ( T_{amb} = 25 , ^\circ C )</td>
<td>250</td>
</tr>
<tr>
<td>BC817-25QC</td>
<td>[1] ( V_{CE} = 1 , V ); ( I_C = 100 , mA ); ( T_{amb} = 25 , ^\circ C )</td>
<td>400</td>
</tr>
<tr>
<td>BC817-40QC</td>
<td>[1] ( V_{CE} = 1 , V ); ( I_C = 100 , mA ); ( T_{amb} = 25 , ^\circ C )</td>
<td>600</td>
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</table>

[1] pulsed; \( t_p \leq 300 \, \mu s \); \( \delta \leq 0.02 \)
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></td>
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</table>

6. Ordering information

Table 4. Ordering information

<table>
<thead>
<tr>
<th>Type number</th>
<th>Package Name</th>
<th>Description</th>
<th>Version</th>
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</thead>
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<tr>
<td>BC817-16QC</td>
<td>DFN1412D-3</td>
<td>DFN1412D-3: plastic thermal enhanced ultra thin small outline package; no leads; 3 terminals; body: 1.4 x 1.2 x 0.5 mm</td>
<td>SOT8009 (MO-340CA)</td>
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<tr>
<td>BC817-25QC</td>
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<td>BC817-40QC</td>
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7. Marking

Table 5. Marking

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<tr>
<td>BC817-25QC</td>
<td>9N</td>
</tr>
<tr>
<td>BC817-40QC</td>
<td>9P</td>
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8. Limiting values

Table 6. Limiting values
In accordance with the Absolute Maximum Rating System (IEC 60134).

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<th>Conditions</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
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</thead>
<tbody>
<tr>
<td>V&lt;sub&gt;CBO&lt;/sub&gt;</td>
<td>collector-base voltage</td>
<td>open emitter; T&lt;sub&gt;amb&lt;/sub&gt; = 25 °C</td>
<td>-</td>
<td>50</td>
<td>V</td>
</tr>
<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>45</td>
<td>V</td>
</tr>
<tr>
<td>V&lt;sub&gt;EBO&lt;/sub&gt;</td>
<td>emitter-base voltage</td>
<td>open collector; T&lt;sub&gt;amb&lt;/sub&gt; = 25 °C</td>
<td>-</td>
<td>5</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>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>1</td>
<td>A</td>
</tr>
<tr>
<td>I&lt;sub&gt;BM&lt;/sub&gt;</td>
<td>peak base 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>200</td>
<td>mA</td>
</tr>
<tr>
<td>P&lt;sub&gt;tot&lt;/sub&gt;</td>
<td>total power dissipation</td>
<td>T&lt;sub&gt;amb&lt;/sub&gt; = 25 °C [1]</td>
<td>-</td>
<td>380</td>
<td>mW</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[2]</td>
<td>480</td>
<td>mW</td>
</tr>
<tr>
<td>T&lt;sub&gt;j&lt;/sub&gt;</td>
<td>junction temperature</td>
<td>-</td>
<td>150</td>
<td></td>
<td>°C</td>
</tr>
<tr>
<td>T&lt;sub&gt;amb&lt;/sub&gt;</td>
<td>ambient temperature</td>
<td>-55</td>
<td>150</td>
<td></td>
<td>°C</td>
</tr>
<tr>
<td>T&lt;sub&gt;stg&lt;/sub&gt;</td>
<td>storage temperature</td>
<td>-65</td>
<td>150</td>
<td></td>
<td>°C</td>
</tr>
</tbody>
</table>


Fig. 1. Power derating curves for SOT8009

(1) FR4 PCB; single-sided 70 μm copper, tin-plated and standard footprint
(2) FR4 PCB; single-sided 35 μm copper, tin-plated and standard footprint
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>[1] -</td>
<td>-</td>
<td>329</td>
<td>K/W</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[2] -</td>
<td>-</td>
<td>261</td>
<td>K/W</td>
</tr>
</tbody>
</table>


FR4 PCB, single-sided 35μm copper, tin-plated and standard footprint

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

FR4 PCB, single-sided 70μm copper, tin-plated and standard footprint

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 breakdown voltage</td>
<td>$I_C = 100 \mu A; I_E = 0 A; T_{amb} = 25 ^\circ C$</td>
<td>50</td>
<td>-</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>$V_{(BR)CEO}$</td>
<td>collector-emitter breakdown voltage</td>
<td>$I_C = 10 mA; I_E = 0 A; T_{amb} = 25 ^\circ C$</td>
<td>45</td>
<td>-</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>$V_{(BR)EBO}$</td>
<td>emitter-base breakdown voltage</td>
<td>$I_E = 100 \mu A; I_C = 0 A; T_{amb} = 25 ^\circ C$</td>
<td>5</td>
<td>-</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>$I_{CBO}$</td>
<td>collector-base cut-off current</td>
<td>$V_{CB} = 20 V; I_E = 0 A; T_{amb} = 25 ^\circ C$</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td>nA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{CB} = 20 V; I_E = 0 A; T_j = 150 ^\circ C$</td>
<td>-</td>
<td>-</td>
<td>5</td>
<td>µA</td>
</tr>
<tr>
<td>$I_{EBO}$</td>
<td>emitter-base cut-off current</td>
<td>$V_{EB} = 5 V; I_C = 0 A; T_{amb} = 25 ^\circ C$</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td>nA</td>
</tr>
<tr>
<td>$h_{FE}$</td>
<td>DC current gain</td>
<td>$V_{CE} = 1 V; I_C = 100 mA; T_{amb} = 25 ^\circ C$ [1]</td>
<td>100</td>
<td>-</td>
<td>250</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{CE} = 1 V; I_C = 100 mA; T_{amb} = 25 ^\circ C$ [1]</td>
<td>160</td>
<td>-</td>
<td>400</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{CE} = 1 V; I_C = 100 mA; T_{amb} = 25 ^\circ C$ [1]</td>
<td>250</td>
<td>-</td>
<td>600</td>
<td></td>
</tr>
<tr>
<td>$V_{CEsat}$</td>
<td>collector-emitter saturation voltage</td>
<td>$I_C = 500 mA; I_B = 50 mA; T_{amb} = 25 ^\circ C$</td>
<td>[1]</td>
<td>-</td>
<td>700</td>
<td>mV</td>
</tr>
<tr>
<td>$V_{BE}$</td>
<td>base-emitter voltage</td>
<td>$V_{CE} = 1 V; I_C = 500 mA; T_{amb} = 25 ^\circ C$ [1]</td>
<td>-</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 = 10 mA; f = 100 MHz; $</td>
<td>100</td>
<td>-</td>
<td>-</td>
<td>MHz</td>
</tr>
<tr>
<td>$C_c$</td>
<td>collector capacitance</td>
<td>$V_{CB} = 10 V; I_E = I_a = 0 A; f = 1 MHz; $</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>pF</td>
</tr>
</tbody>
</table>

[1] pulsed; $t_p \leq 300 \mu s; \delta \leq 0.02$
Fig. 4. BC817-16QC: DC current gain as a function of collector current; typical values

\[ V_{CE} = 1 \text{ V} \]

1. \( T_{\text{amb}} = 150 \degree \text{C} \)
2. \( T_{\text{amb}} = 25 \degree \text{C} \)
3. \( T_{\text{amb}} = -55 \degree \text{C} \)

Fig. 5. BC817-16QC: Collector current as a function of collector-emitter voltage; typical values

\[ V_{CE} = 1 \text{ V} \]

1. \( T_{\text{amb}} = 150 \degree \text{C} \)
2. \( T_{\text{amb}} = 25 \degree \text{C} \)
3. \( T_{\text{amb}} = -55 \degree \text{C} \)

IC/IB = 10

1. \( I_B = 16.0 \text{ mA} \)
2. \( I_B = 14.4 \text{ mA} \)
3. \( I_B = 12.8 \text{ mA} \)
4. \( I_B = 11.2 \text{ mA} \)
5. \( I_B = 9.6 \text{ mA} \)
6. \( I_B = 8.0 \text{ mA} \)
7. \( I_B = 6.4 \text{ mA} \)
8. \( I_B = 4.8 \text{ mA} \)
9. \( I_B = 3.2 \text{ mA} \)
10. \( I_B = 1.6 \text{ mA} \)

Fig. 6. BC817-16QC: Base-emitter saturation voltage as a function of collector current; typical values

IC/IB = 10

1. \( I_B = 16.0 \text{ mA} \)
2. \( I_B = 14.4 \text{ mA} \)
3. \( I_B = 12.8 \text{ mA} \)
4. \( I_B = 11.2 \text{ mA} \)
5. \( I_B = 9.6 \text{ mA} \)
6. \( I_B = 8.0 \text{ mA} \)
7. \( I_B = 6.4 \text{ mA} \)
8. \( I_B = 4.8 \text{ mA} \)
9. \( I_B = 3.2 \text{ mA} \)
10. \( I_B = 1.6 \text{ mA} \)

Fig. 7. BC817-16QC: Collector-emitter saturation voltage as a function of collector current; typical values
Fig. 8. BC817-25QC: DC current gain as a function of collector current; typical values

\[ h_{FE} = 1 \text{ V} \]

1. \( T_{\text{amb}} = 150 \degree \text{C} \)
2. \( T_{\text{amb}} = 25 \degree \text{C} \)
3. \( T_{\text{amb}} = -55 \degree \text{C} \)

Fig. 9. BC817-25QC: Collector current as a function of collector-emitter voltage; typical values

\[ I_C (\text{mA}) \]

1. \( I_B = 13.0 \text{ mA} \)
2. \( I_B = 11.7 \text{ mA} \)
3. \( I_B = 10.4 \text{ mA} \)
4. \( I_B = 9.1 \text{ mA} \)
5. \( I_B = 7.8 \text{ mA} \)
6. \( I_B = 6.5 \text{ mA} \)
7. \( I_B = 5.2 \text{ mA} \)
8. \( I_B = 3.9 \text{ mA} \)
9. \( I_B = 2.6 \text{ mA} \)
10. \( I_B = 1.3 \text{ mA} \)

Fig. 10. BC817-25QC: Base-emitter saturation voltage as a function of collector current; typical values

\[ V_{\text{BE sat}} (\text{V}) \]

1. \( I_C = 10 \text{ mA} \)
2. \( I_C = 25 \text{ mA} \)
3. \( I_C = 50 \text{ mA} \)

Fig. 11. BC817-25QC: Collector-emitter saturation voltage as a function of collector current; typical values

\[ V_{\text{CE sat}} (\text{V}) \]

1. \( I_C = 10 \text{ mA} \)
2. \( I_C = 25 \text{ mA} \)
3. \( I_C = 50 \text{ mA} \)
Nexperia

BC817QC series

45 V, 500 mA NPN general-purpose transistors

---

Fig. 12. BC817-40QC: DC current gain as a function of collector current; typical values

\[ V_{CE} = 1 \text{ V} \]

(1) \( T_{amb} = 150 \degree \text{C} \)
(2) \( T_{amb} = 25 \degree \text{C} \)
(3) \( T_{amb} = -55 \degree \text{C} \)

---

Fig. 13. BC817-40QC: Transition frequency as a function of collector current; typical values

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

(1) \( I_B = 12.0 \text{ mA} \)
(2) \( I_B = 10.8 \text{ mA} \)
(3) \( I_B = 9.6 \text{ mA} \)
(4) \( I_B = 8.4 \text{ mA} \)
(5) \( I_B = 7.2 \text{ mA} \)
(6) \( I_B = 6.0 \text{ mA} \)
(7) \( I_B = 4.8 \text{ mA} \)
(8) \( I_B = 3.6 \text{ mA} \)
(9) \( I_B = 2.4 \text{ mA} \)
(10) \( I_B = 1.2 \text{ mA} \)

---

Fig. 14. BC817-40QC: Base-emitter saturation voltage as a function of collector current; typical values

\[ I_C/I_B = 10 \]

(1) \( T_{amb} = -55 \degree \text{C} \)
(2) \( T_{amb} = 25 \degree \text{C} \)
(3) \( T_{amb} = 150 \degree \text{C} \)

---

Fig. 15. BC817-40QC: Collector-emitter saturation voltage as a function of collector current; typical values

\[ I_C/I_B = 10 \]

(1) \( T_{amb} = 150 \degree \text{C} \)
(2) \( T_{amb} = 25 \degree \text{C} \)
(3) \( T_{amb} = -55 \degree \text{C} \)

---
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

DFN1412D-3: plastic, leadless extremely thin small outline package with side-wettable flanks (SWF);
3 terminals; 0.8 mm pitch; 1.4 mm x 1.2 mm x 0.48 mm body

Dimensions (mm are the original dimensions)

<table>
<thead>
<tr>
<th>Unit</th>
<th>A</th>
<th>A₁</th>
<th>b</th>
<th>D</th>
<th>D₁</th>
<th>E</th>
<th>E₁</th>
<th>e₁</th>
<th>e₂</th>
<th>G</th>
<th>K</th>
<th>L</th>
<th>T</th>
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<th>v</th>
<th>w</th>
<th>y</th>
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<tbody>
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</tr>
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<td>min</td>
<td>0.44</td>
<td>0.22</td>
<td>1.17</td>
<td>1.07</td>
<td>0.47</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note:
1. Side Wettable Flank, protrusion max. 0.02 mm.
2. Visible depend upon used manufacturing technology.
Dimension A and T are including plating thickness.

Fig. 16. Package outline SOT8009 (DFN1412D-3)
13. Soldering

Fig. 17. Reflow soldering footprint for SOT8009 (DFN1412D-3)
## 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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<td>20201028</td>
<td>Product data sheet</td>
<td>-</td>
<td>BC817QC_SER v.1</td>
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<td>• Thermal</td>
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<tr>
<td>characteristics:</td>
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</tr>
<tr>
<td>R_{th(j-sp)}</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BC817QC_SER v.1</td>
<td>20200512</td>
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15. Legal information

Data sheet status

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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.

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