



# PBHV8515QA

150 V, 500 mA NPN high-voltage low V<sub>CEsat</sub> (BISS) transistor  
19 November 2015

Product data sheet

## 1. General description

NPN high-voltage low V<sub>CEsat</sub> Breakthrough In Small Signal (BISS) transistor in a leadless ultra small DFN1010D-3 (SOT1215) Surface-Mounted Device (SMD) plastic package with visible and solderable side pads.

PNP complement: PBHV9515QA.

## 2. Features and benefits

- High voltage
- Low collector-emitter saturation voltage V<sub>CEsat</sub>
- High collector current capability I<sub>C</sub> and I<sub>CM</sub>
- High collector current gain (h<sub>FE</sub>) at high I<sub>C</sub>
- Low package height of 0.37 mm
- AEC-Q101 qualified
- Suitable for Automatic Optical Inspection (AOI) of solder joint

## 3. Applications

- LED driver for LED chain module
- High Intensity Discharge (HID) front lighting
- Automotive motor management
- Switch Mode Power Supply (SMPS)

## 4. Quick reference data

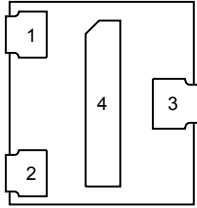
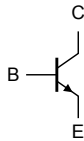
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V <sub>CEO</sub>	collector-emitter voltage	open base	-	-	150	V
I <sub>C</sub>	collector current		-	-	500	mA
h <sub>FE</sub>	DC current gain	V <sub>CE</sub> = 10 V; I <sub>C</sub> = 100 mA; pulsed; t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C	100	215	-	



### 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	B	base	 <p>Transparent top view DFN1010D-3 (SOT1215)</p>	 <p>sym123</p>
2	E	emitter		
3	C	collector		
4	C	collector		

### 6. Ordering information

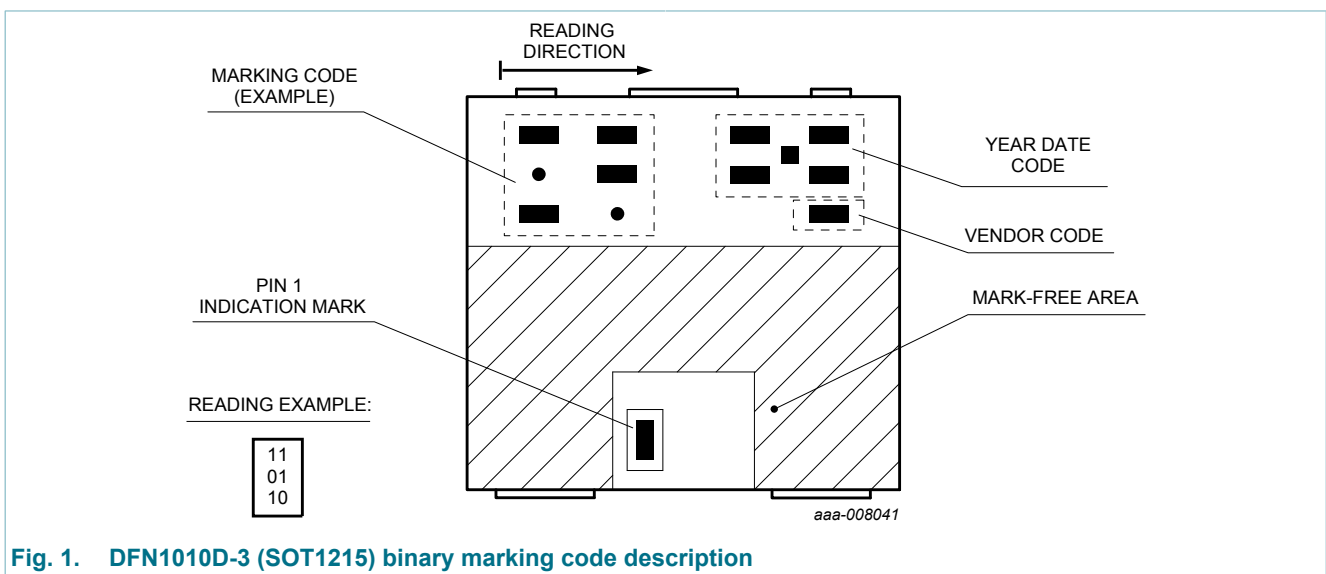
Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PBHV8515QA	DFN1010D-3	DFN1010D-3: plastic thermal enhanced ultra thin small outline package; no leads; 3 terminals; body 1.1 x 1.0 x 0.37 mm	SOT1215

### 7. Marking

Table 4. Marking codes

Type number	Marking code
PBHV8515QA	00 00 11



## 8. Limiting values

**Table 5. Limiting values**

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

Symbol	Parameter	Conditions		Min	Max	Unit
V <sub>CBO</sub>	collector-base voltage	open emitter		-	150	V
V <sub>CEO</sub>	collector-emitter voltage	open base		-	150	V
V <sub>EBO</sub>	emitter-base voltage	open collector		-	6	V
I <sub>C</sub>	collector current			-	500	mA
I <sub>CM</sub>	peak collector current	single pulse; t <sub>p</sub> ≤ 1 ms		-	1	A
I <sub>BM</sub>	peak base current			-	200	mA
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> ≤ 25 °C	[1]	-	325	mW
			[2]	-	600	mW
			[3]	-	740	mW
			[4]	-	540	mW
			[5]	-	1	W
T <sub>j</sub>	junction temperature			-	150	°C
T <sub>amb</sub>	ambient temperature			-55	150	°C
T <sub>stg</sub>	storage temperature			-65	150	°C

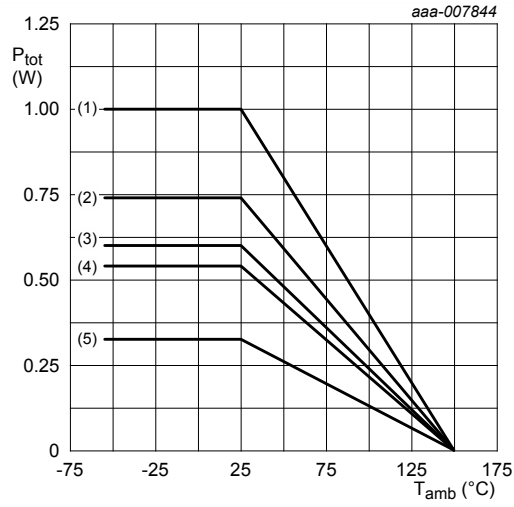
[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.

[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.

[3] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm<sup>2</sup>.

[4] Device mounted on an FR4 PCB, 4-layer copper, tin-plated and standard footprint.

[5] Device mounted on an FR4 PCB, 4-layer copper, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.



- (1) FR4 PCB, 4-layer copper, 1 cm<sup>2</sup>
- (2) FR4 PCB, single-sided copper, 6 cm<sup>2</sup>
- (3) FR4 PCB, single-sided copper, 1 cm<sup>2</sup>
- (4) FR4 PCB, 4-layer copper, standard footprint
- (5) FR4 PCB, single-sided copper, standard footprint

Fig. 2. Power derating curves

### 9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
R <sub>th(j-a)</sub>	thermal resistance from junction to ambient	in free air	[1]	-	-	385	K/W
			[2]	-	-	209	K/W
			[3]	-	-	169	K/W
			[4]	-	-	232	K/W
			[5]	-	-	125	K/W

- [1] Device mounted on an FR4 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 cm<sup>2</sup>.
- [3] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 6 cm<sup>2</sup>.
- [4] Device mounted on an FR4 PCB, 4-layer copper, tin-plated and standard footprint.
- [5] Device mounted on an FR4 PCB, 4-layer copper, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.

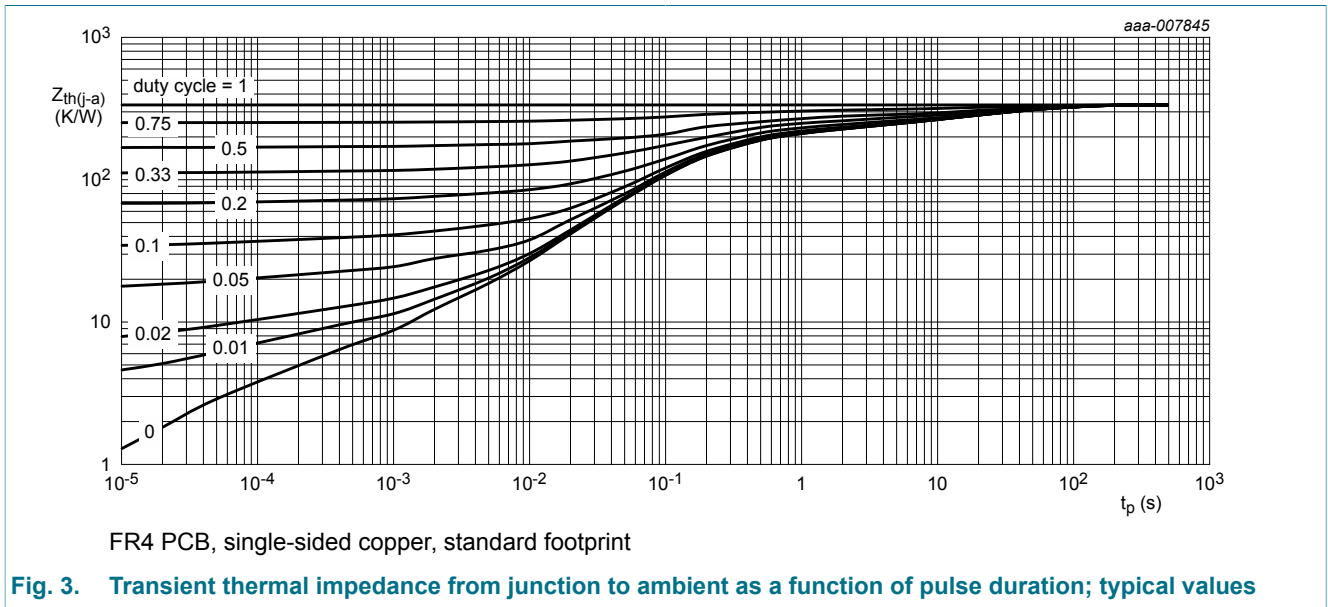
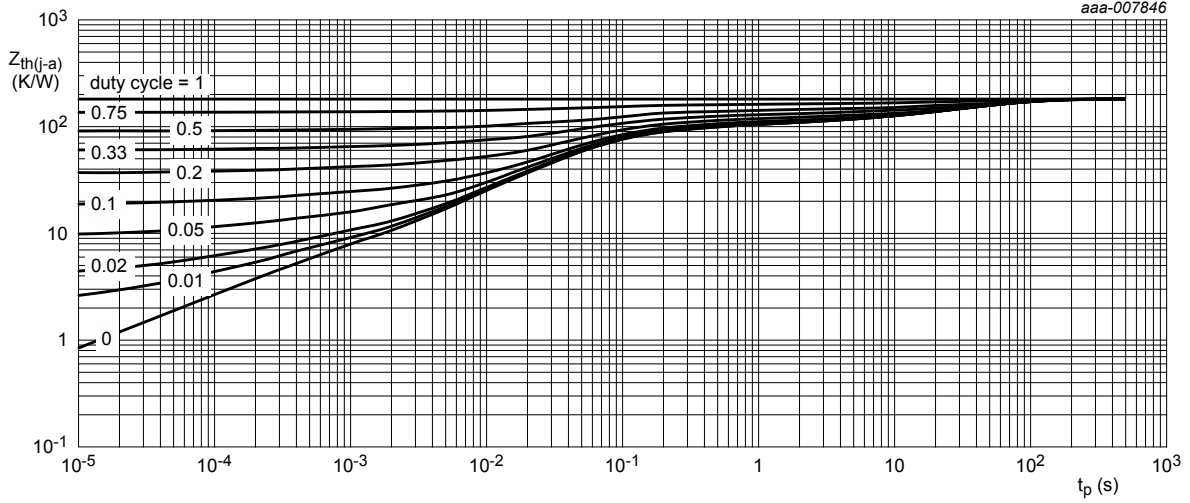
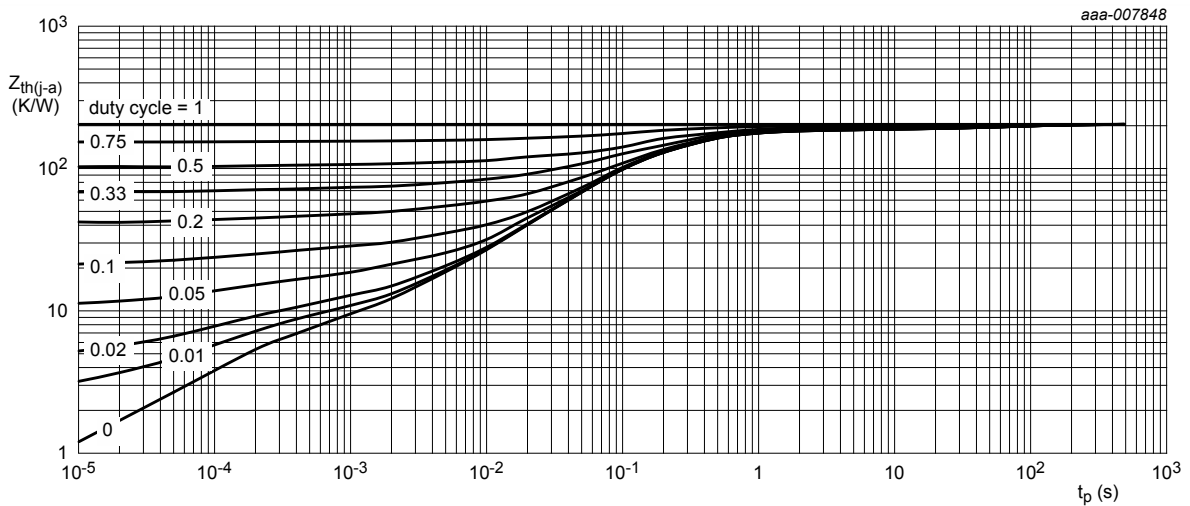


Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



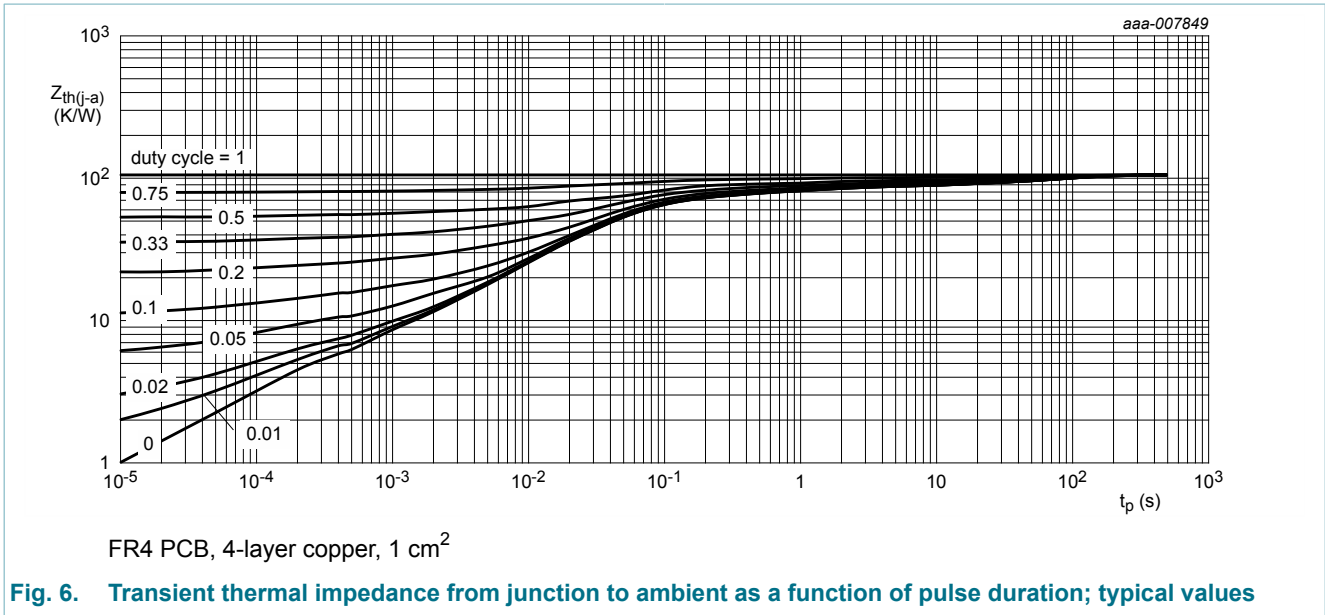
FR4 PCB, single-sided copper, 1 cm<sup>2</sup>

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



FR4 PCB, 4-layer copper, standard footprint

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



## 10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I <sub>CBO</sub>	collector-base cut-off current	V <sub>CB</sub> = 120 V; I <sub>E</sub> = 0 A; T <sub>amb</sub> = 25 °C	-	-	100	nA
		V <sub>CB</sub> = 120 V; I <sub>E</sub> = 0 A; T <sub>j</sub> = 150 °C	-	-	10	μA
I <sub>CES</sub>	collector-emitter cut-off current	V <sub>CE</sub> = 120 V; V <sub>BE</sub> = 0 V; T <sub>amb</sub> = 25 °C	-	-	100	nA
I <sub>EBO</sub>	emitter-base cut-off current	V <sub>EB</sub> = 5 V; I <sub>C</sub> = 0 A; T <sub>amb</sub> = 25 °C	-	-	100	nA
h <sub>FE</sub>	DC current gain	V <sub>CE</sub> = 10 V; I <sub>C</sub> = 50 mA; pulsed; t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C	100	215	-	
		V <sub>CE</sub> = 10 V; I <sub>C</sub> = 100 mA; pulsed; t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C	100	215	-	
		V <sub>CE</sub> = 10 V; I <sub>C</sub> = 200 mA; pulsed; t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C	100	200	-	
		V <sub>CE</sub> = 10 V; I <sub>C</sub> = 500 mA; pulsed; t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C	35	60	-	
V <sub>CEsat</sub>	collector-emitter saturation voltage	I <sub>C</sub> = 50 mA; I <sub>B</sub> = 5 mA; T <sub>amb</sub> = 25 °C	-	30	60	mV
		I <sub>C</sub> = 100 mA; I <sub>B</sub> = 10 mA; pulsed; t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C	-	45	80	mV
		I <sub>C</sub> = 100 mA; I <sub>B</sub> = 20 mA; pulsed; t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C	-	35	70	mV
		I <sub>C</sub> = 200 mA; I <sub>B</sub> = 40 mA; pulsed; t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C	-	60	100	mV
		I <sub>C</sub> = 500 mA; I <sub>B</sub> = 100 mA; pulsed; t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C	-	120	200	mV
V <sub>BEsat</sub>	base-emitter saturation voltage	t <sub>p</sub> ≤ 300 μs; δ ≤ 0.02; T <sub>amb</sub> = 25 °C	-	0.95	1.2	V
t <sub>d</sub>	delay time	V <sub>CC</sub> = 10 V; I <sub>C</sub> = 100 mA; I <sub>Bon</sub> = 20 mA; I <sub>Boff</sub> = -20 mA; T <sub>amb</sub> = 25 °C	-	15	-	ns
t <sub>r</sub>	rise time		-	155	-	ns
t <sub>on</sub>	turn-on time		-	170	-	ns
t <sub>s</sub>	storage time		-	650	-	ns
t <sub>f</sub>	fall time		-	170	-	ns
t <sub>off</sub>	turn-off time		-	820	-	ns
f <sub>T</sub>	transition frequency		V <sub>CE</sub> = 10 V; I <sub>C</sub> = 10 mA; f = 100 MHz; T <sub>amb</sub> = 25 °C	-	75	-
C <sub>c</sub>	collector capacitance	V <sub>CB</sub> = 20 V; I <sub>E</sub> = 0 A; i <sub>e</sub> = 0 A; f = 1 MHz; T <sub>amb</sub> = 25 °C	-	2.4	-	pF



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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
C <sub>e</sub>	emitter capacitance	V <sub>EB</sub> = 0.5 V; I <sub>C</sub> = 0 A; i <sub>c</sub> = 0 A; f = 1 MHz; T <sub>amb</sub> = 25 °C	-	125	-	pF

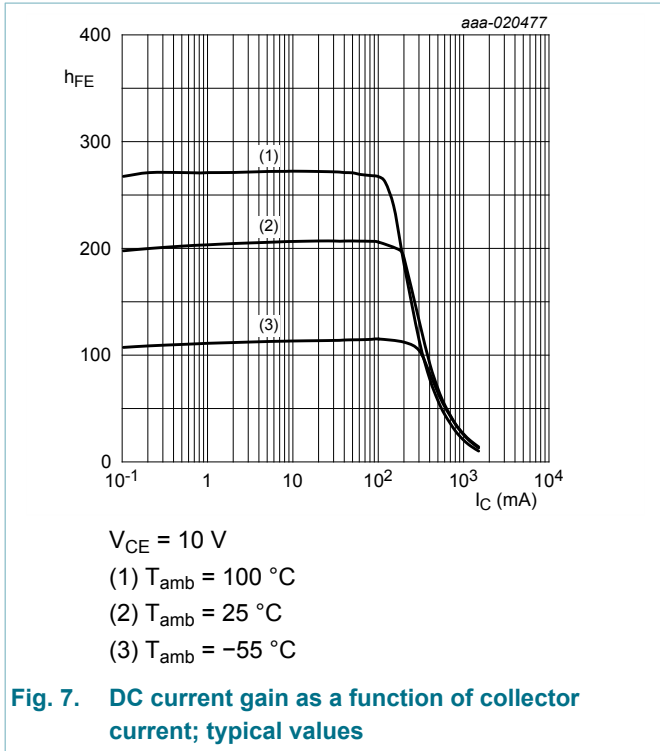


Fig. 7. DC current gain as a function of collector current; typical values

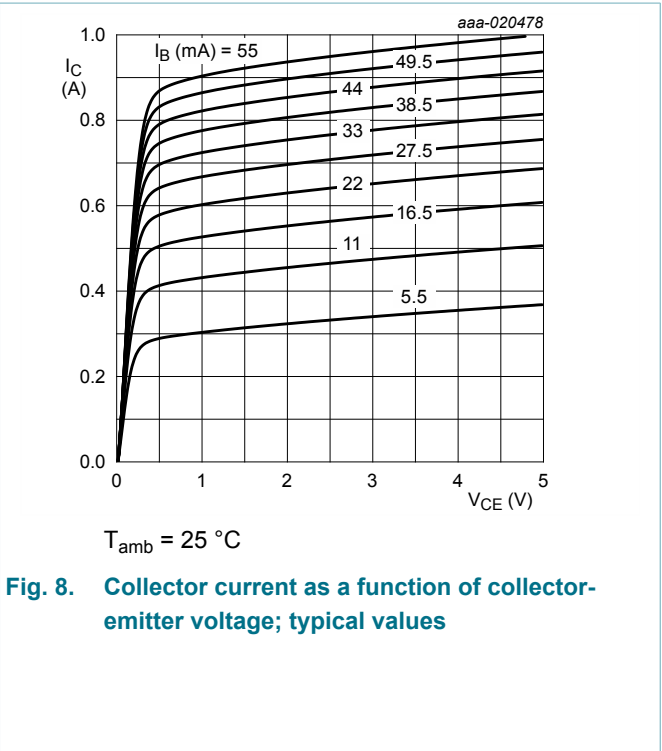


Fig. 8. Collector current as a function of collector-emitter voltage; typical values

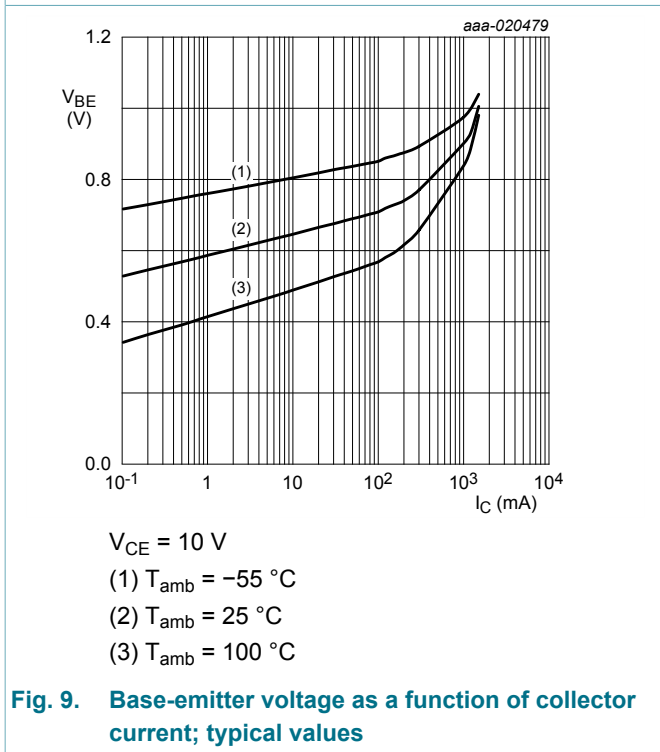


Fig. 9. Base-emitter voltage as a function of collector current; typical values

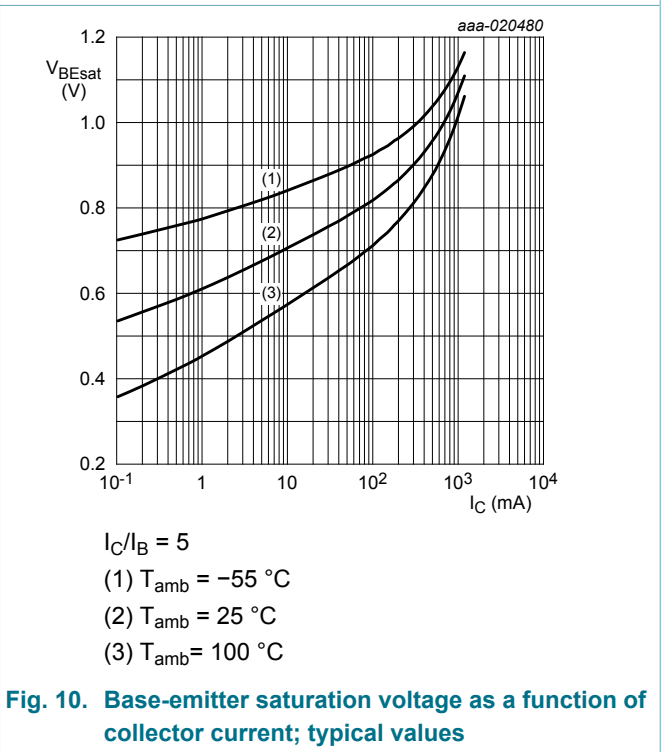
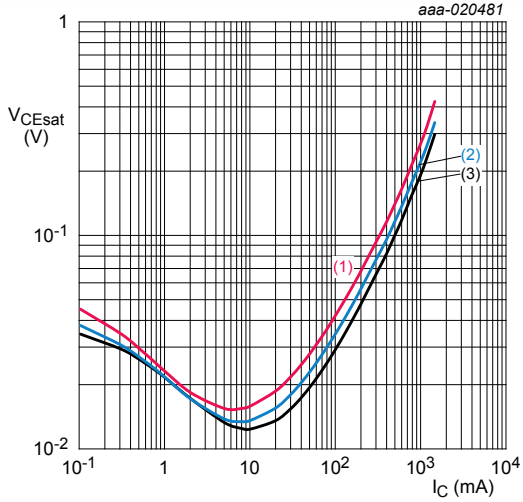
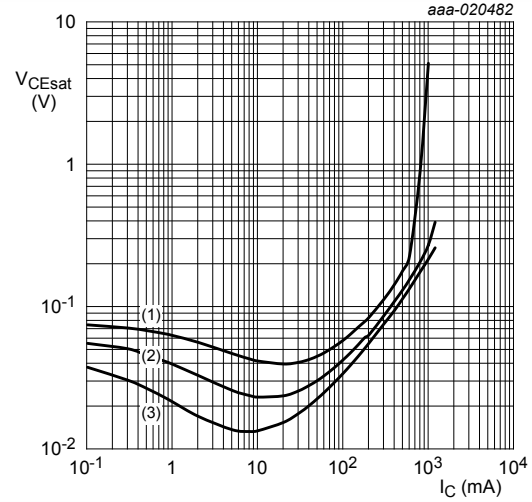


Fig. 10. Base-emitter saturation voltage as a function of collector current; typical values



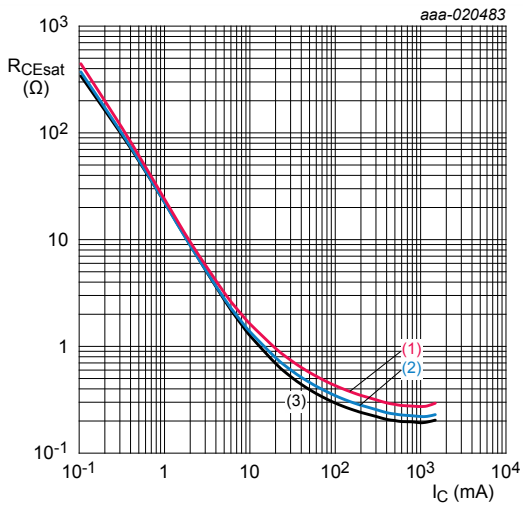
$I_C/I_B = 5$   
 (1)  $T_{amb} = 100^\circ\text{C}$   
 (2)  $T_{amb} = 25^\circ\text{C}$   
 (3)  $T_{amb} = -55^\circ\text{C}$

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



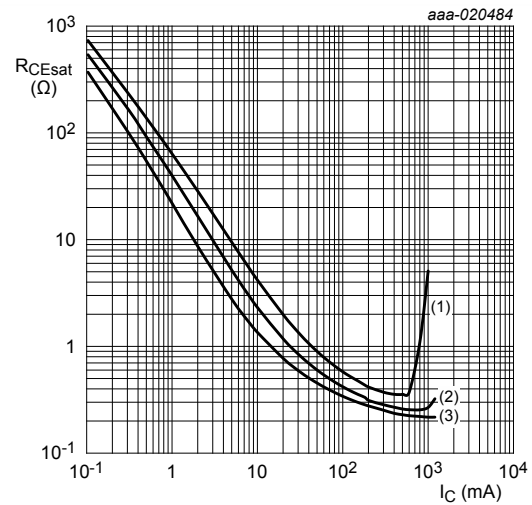
$T_{amb} = 25^\circ\text{C}$   
 (1)  $I_C/I_B = 20$   
 (2)  $I_C/I_B = 10$   
 (3)  $I_C/I_B = 5$

Fig. 12. Collector-emitter saturation voltage as a function of collector current; typical values



$I_C/I_B = 5$   
 (1)  $T_{amb} = 100^\circ\text{C}$   
 (2)  $T_{amb} = 25^\circ\text{C}$   
 (3)  $T_{amb} = -55^\circ\text{C}$

Fig. 13. Collector-emitter saturation resistance as a function of collector current; typical values



$T_{amb} = 25^\circ\text{C}$   
 (1)  $I_C/I_B = 20$   
 (2)  $I_C/I_B = 10$   
 (3)  $I_C/I_B = 5$

Fig. 14. Collector-emitter saturation resistance as a function of collector current; typical values

### 11. Test information

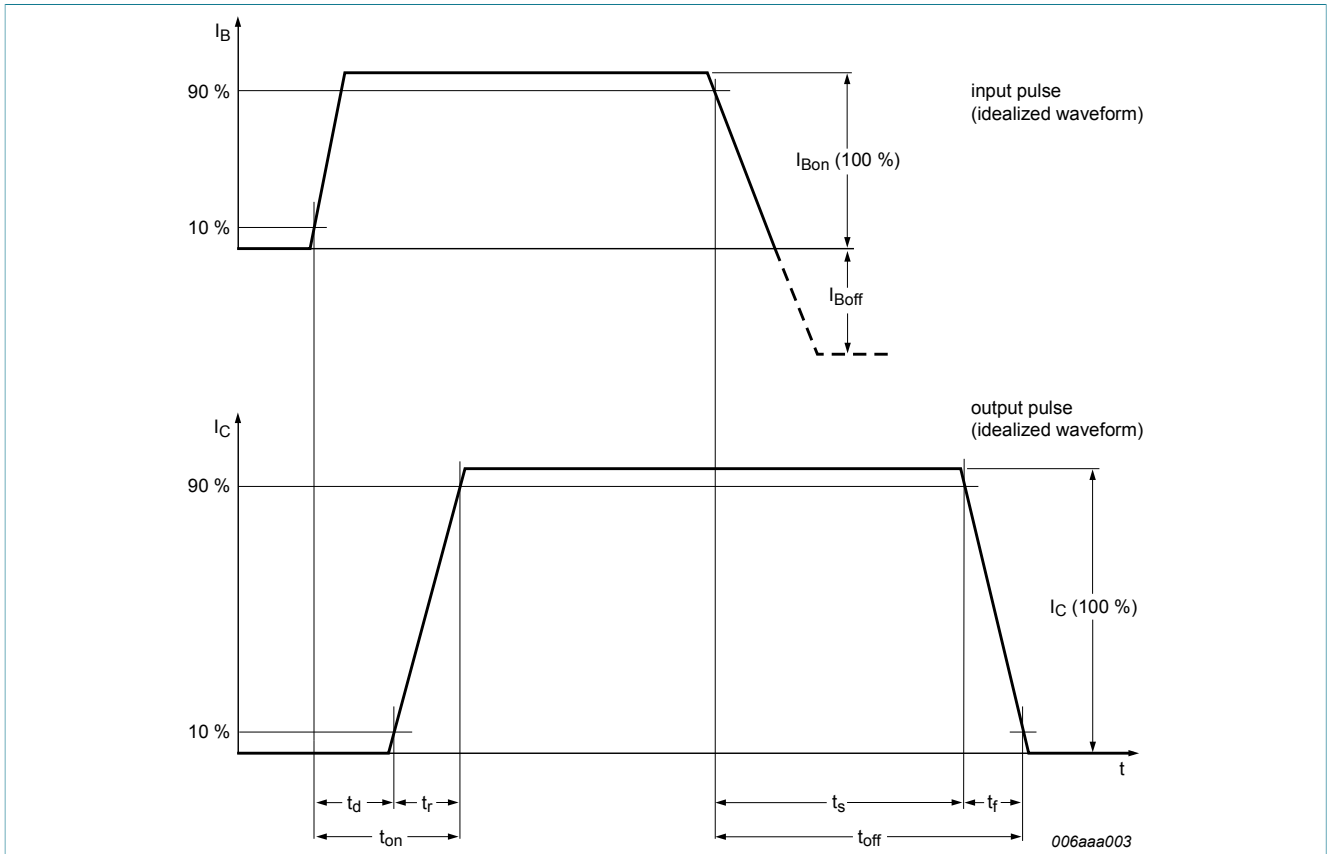


Fig. 15. BISS transistor switching time definition

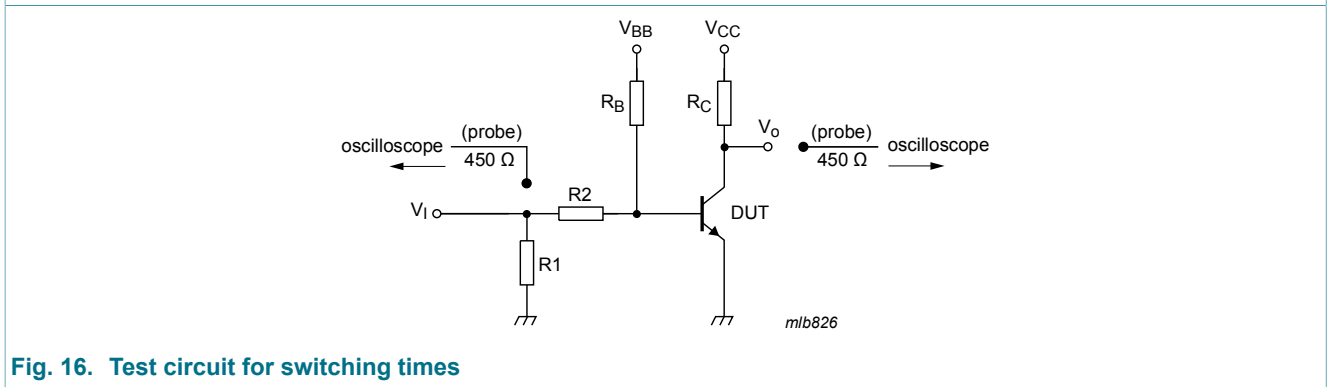


Fig. 16. Test circuit for switching times

#### 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

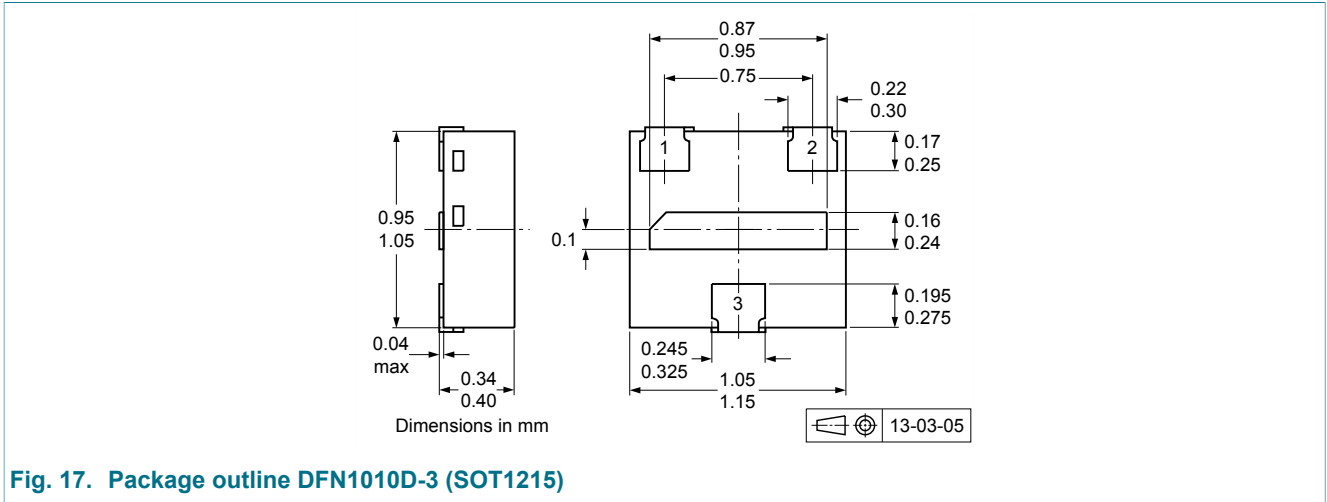


Fig. 17. Package outline DFN1010D-3 (SOT1215)

### 13. Soldering

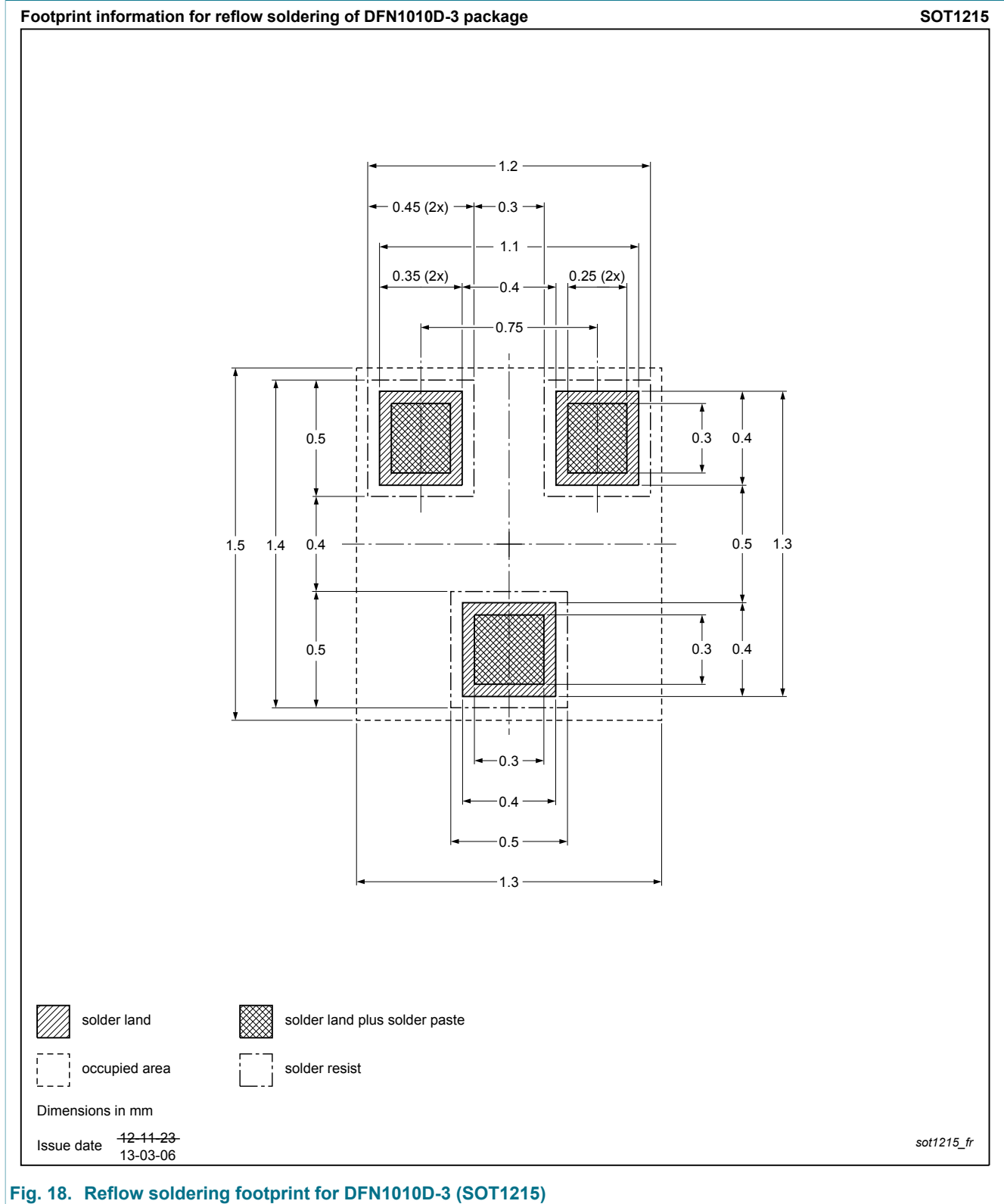


Fig. 18. Reflow soldering footprint for DFN1010D-3 (SOT1215)

## 14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PBHV8515QA v.1	20151119	Product data sheet	-	-

## 15. Legal information

### 15.1 Data sheet status

Document status [1][2]	Product status [3]	Definition
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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- [2] The term 'short data sheet' is explained in section "Definitions".
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