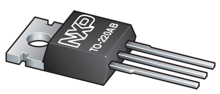


BUJ303A

NPN power transistor

Rev. 05 — 3 May 2011 Product data sheet

1. Product profile

1.1 General description

High voltage, high speed planar passivated NPN power switching transistor in a SOT78 (TO-220AB) plastic package.

1.2 Features and benefits

- Fast switching
- Low thermal resistance
- Very high voltage capability
- Very low switching and conduction losses

1.3 Applications

- DC-to-DC converters
- High frequency electronic lighting ballasts
- Inverters
- Motor control systems

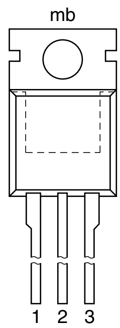
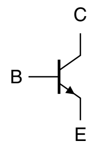
1.4 Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_C	collector current	see Figure 1; see Figure 2; see Figure 4	-	-	5	A
P_{tot}	total power dissipation	$T_{mb} \leq 25$ °C; see Figure 3	-	-	100	W
V_{CESM}	collector-emitter peak voltage	$V_{BE} = 0$ V	-	-	1000	V
Static characteristics						
h_{FE}	DC current gain	$I_C = 5$ mA; $V_{CE} = 5$ V; $T_{mb} = 25$ °C; see Figure 11	10	22	35	
		$I_C = 500$ mA; $V_{CE} = 5$ V; $T_{mb} = 25$ °C; see Figure 11	14	25	35	

2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	B	base	 SOT78 (TO-220AB)	 sym123
2	C	collector		
3	E	emitter		
mb	C	mounting base; connected to collector		

3. Ordering information

Table 3. Ordering information

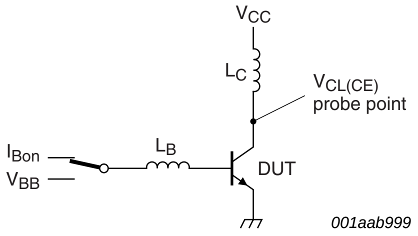
Type number	Package		
	Name	Description	Version
BUJ303A	TO-220AB	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB	SOT78

4. Limiting values

Table 4. Limiting values

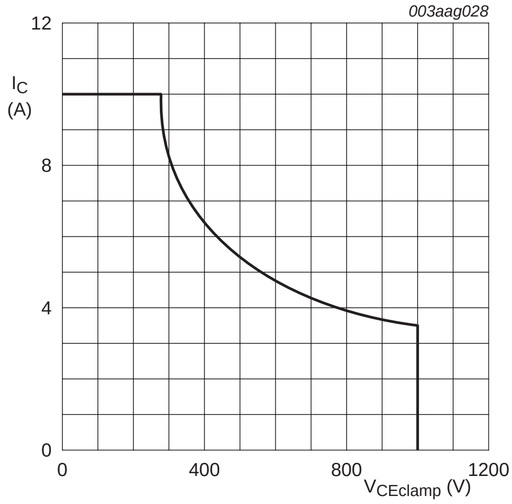
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CESM}	collector-emitter peak voltage	V_{BE} = 0 V	-	1000	V
V_{CEO}	collector-emitter voltage	I_B = 0 A	-	500	V
I_C	collector current	see Figure 1; see Figure 2; see Figure 4	-	5	A
I_{CM}	peak collector current		-	10	A
I_B	base current		-	2	A
I_{BM}	peak base current		-	4	A
P_{tot}	total power dissipation	T_{mb} ≤ 25 °C; see Figure 3	-	100	W
T_{stg}	storage temperature		-65	150	°C
T_j	junction temperature		-	150	°C



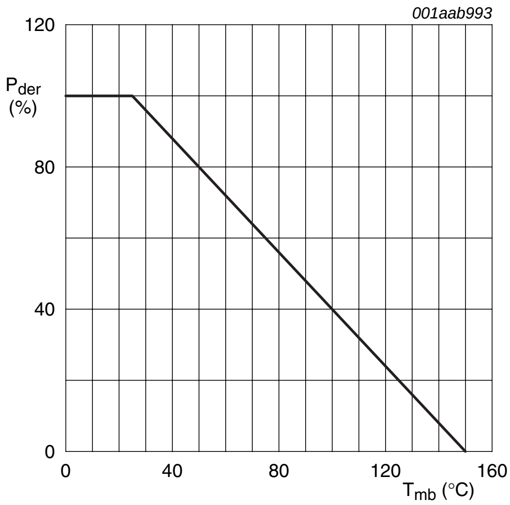
$$V_{CL(CE)} \leq 1000\ V; V_{CC} = 150\ V; V_{BB} = -5\ V;$$
$$L_B = 1\ \mu H; L_C = 200\ \mu H$$

Fig 1. Test circuit for reverse bias safe operating area



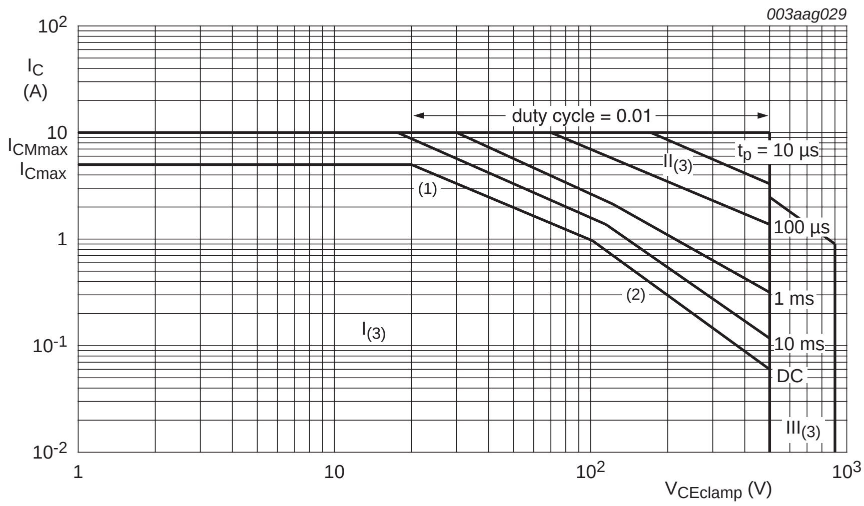
$$T_j \leq T_{j(max)}$$

Fig 2. Reverse bias safe operating area



$$P_{der} = \frac{P_{tot}}{P_{tot(25°C)}} \times 100\,\%$$

Fig 3. Normalized total power dissipation as a function of mounting base temperature



(1) P_{tot} maximum and P_{tot} peak maximum lines.

(2) Second breakdown limits.

(3) I = Region of permissible DC operation.

II = Extension for repetitive pulse operation.

III = Extension during turn-on in single transistor converters provided that $R_{BE} \leq 100\ \Omega$ and $t_p \leq 0.6$ μs.

Fig 4. Forward bias safe operating area for $T_{mb} \leq 25$ °C

5. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	see Figure 5	-	-	1.25	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	-	60	-	K/W

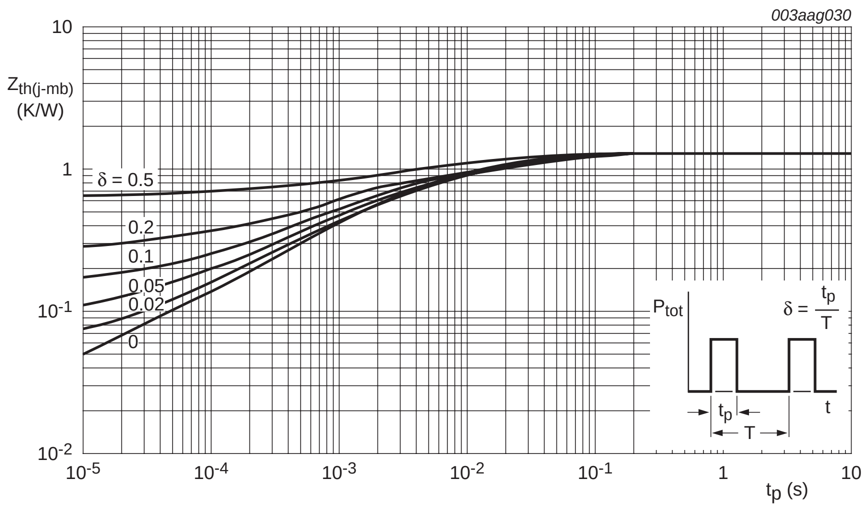


Fig 5. Transient thermal impedance from junction to mounting base as a function of pulse width

6. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics							
I_{CES}	collector-emitter cut-off current	V_{BE} = 0 V; V_{CE} = 1000 V; T_{mb} = 25 °C	[1]	-	-	1	mA
		V_{BE} = 0 V; V_{CE} = 1000 V; T_j = 125 °C	[1]	-	-	2	mA
I_{CBO}	collector-base cut-off current	V_{CB} = 1000 V; I_E = 0 A; T_{mb} = 25 °C	[1]	-	-	1	mA
I_{CEO}	collector-emitter cut-off current	V_{CE} = 500 V; I_B = 0 A; T_{mb} = 25 °C	[1]	-	-	0.1	mA
I_{EBO}	emitter-base cut-off current	V_{EB} = 9 V; I_C = 0 A; T_{mb} = 25 °C		-	-	0.1	mA
V_{CEOsus}	collector-emitter sustaining voltage	I_B = 0 A; I_C = 100 mA; L_C = 25 mH; T_{mb} = 25 °C; see Figure 6; see Figure 7		500	-	-	V
V_{CEsat}	collector-emitter saturation voltage	I_C = 3 A; I_B = 0.6 A; T_{mb} = 25 °C; see Figure 8; see Figure 9		-	0.25	1.5	V
V_{BEsat}	base-emitter saturation voltage	I_C = 3 A; I_B = 0.6 A; T_{mb} = 25 °C; see Figure 10		-	0.97	1.3	V
h_{FE}	DC current gain	I_C = 5 mA; V_{CE} = 5 V; T_{mb} = 25 °C; see Figure 11		10	22	35	
		I_C = 500 mA; V_{CE} = 5 V; T_{mb} = 25 °C; see Figure 11		14	25	35	
h_{FEsat}	DC saturation current gain	I_C = 2.5 A; V_{CE} = 5 V; T_{mb} = 25 °C; see Figure 11		10	13.5	17	
		I_C = 3 A; V_{CE} = 5 V; T_{mb} = 25 °C; see Figure 11		-	12	-	
Dynamic characteristics							
t_{on}	turn-on time	I_C = 2.5 A; I_{Bon} = 0.5 A; I_{Boff} = -0.5 A; R_L = 75 Ω; V_{BB} = -4 V; T_{mb} = 25 °C; resistive load; see Figure 12; see Figure 13		-	0.5	0.7	µs
t_s	storage time			-	3.3	4	µs
		I_C = 2.5 A; I_{Bon} = 0.5 A; V_{BB} = -5 V; L_B = 1 µH; T_{mb} = 25 °C; inductive load; see Figure 14; see Figure 15		-	1.4	1.6	µs
		I_C = 2.5 A; I_{Bon} = 0.5 A; V_{BB} = -5 V; L_B = 1 µH; T_j = 100 °C; inductive load; see Figure 14; see Figure 15		-	1.7	1.9	µs
t_f	fall time	I_C = 2.5 A; I_{Bon} = 0.5 A; I_{Boff} = -0.5 A; R_L = 75 Ω; V_{BB} = -4 V; T_{mb} = 25 °C; resistive load; see Figure 12; see Figure 13		-	0.33	0.45	µs
		I_C = 2.5 A; I_{Bon} = 0.5 A; V_{BB} = -5 V; L_B = 1 µH; T_{mb} = 25 °C; inductive load; see Figure 14; see Figure 15		-	145	160	ns
		I_C = 2.5 A; I_{Bon} = 0.5 A; V_{BB} = -5 V; L_B = 1 µH; T_j = 100 °C; inductive load; see Figure 14; see Figure 15		-	160	200	ns

[1] Measured with half-sine wave voltage (curve tracer).

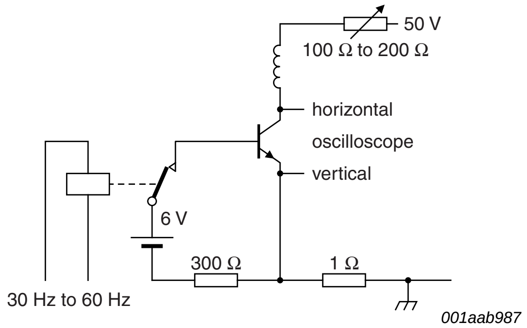


Fig 6. Test circuit for collector-emitter sustaining voltage

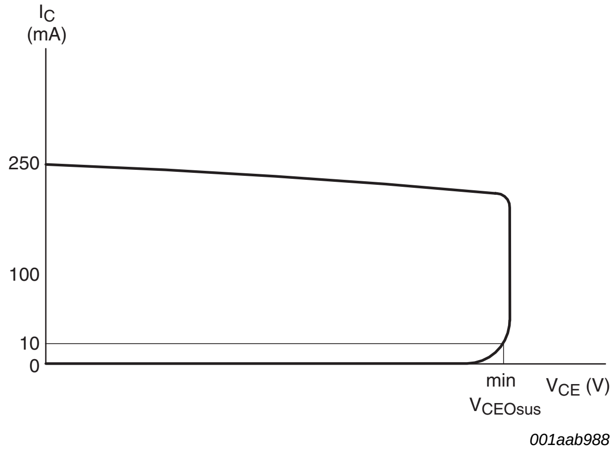


Fig 7. Oscilloscope display for collector-emitter sustaining voltage test waveform

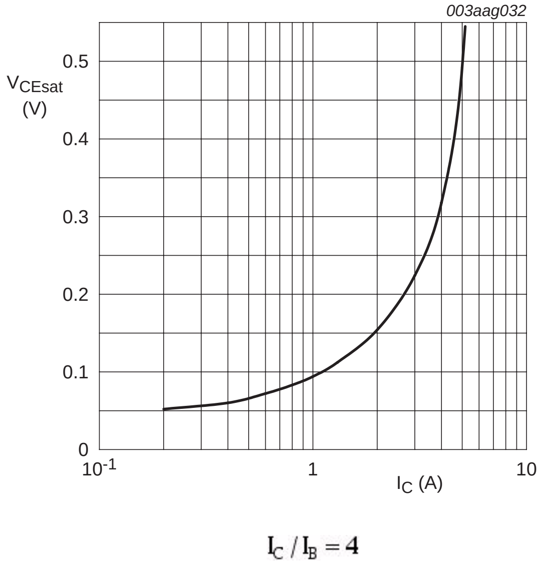


Fig 8. Collector-emitter saturation voltage as a function of collector current; typical values

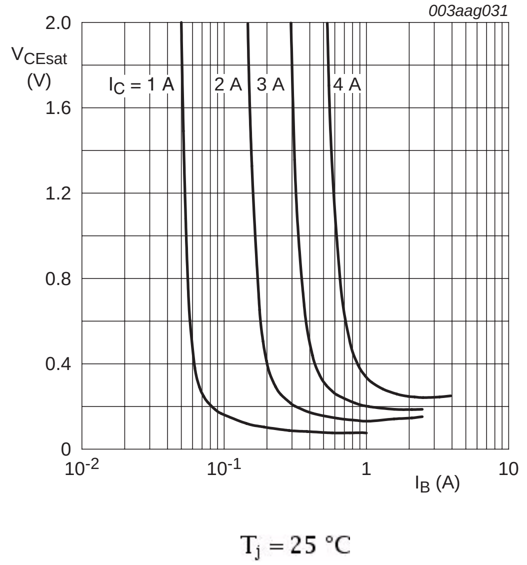
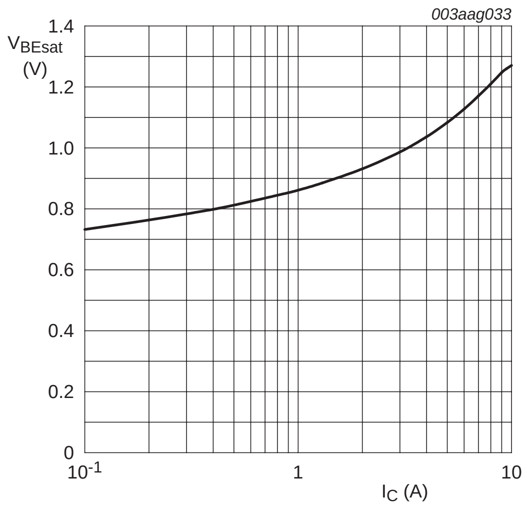
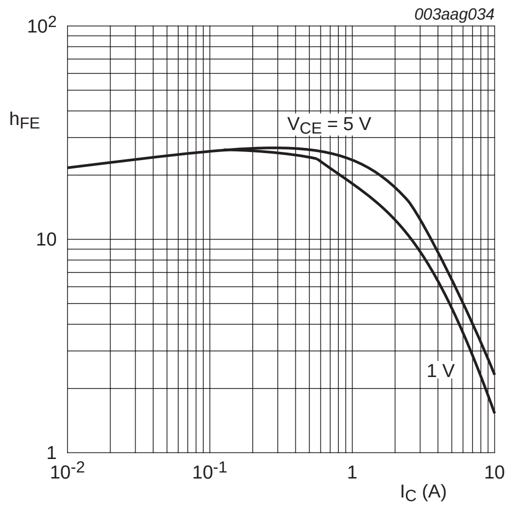


Fig 9. Collector-emitter saturation voltage as a function of base current; typical values



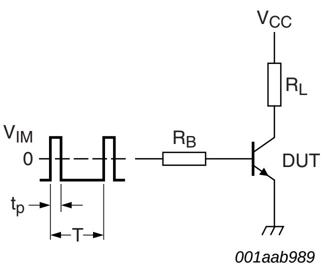
$I_C / I_B = 4$

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



$T_j = 25$ °C

Fig 11. DC current gain as a function of collector current; typical values



$V_{IM} = -6$ to $+8$ V; $V_{CC} = 250$ V; $t_p = 20$ µs; $\delta = \frac{t_p}{T} = 0.01$

R_B and R_L calculated from I_{Con} and I_{Bon} requirements.

Fig 12. Test circuit for resistive load switching

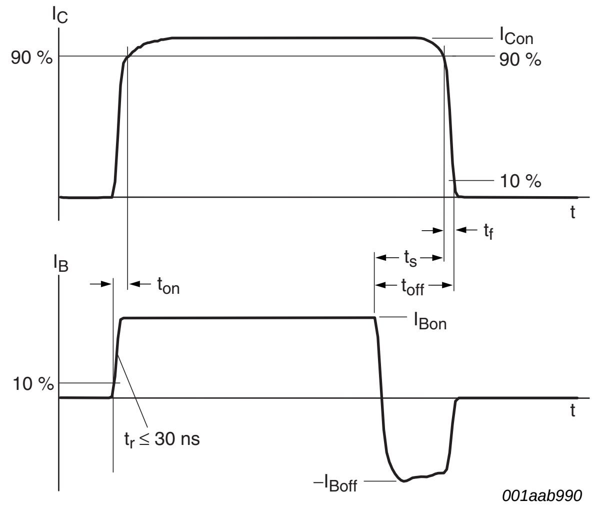
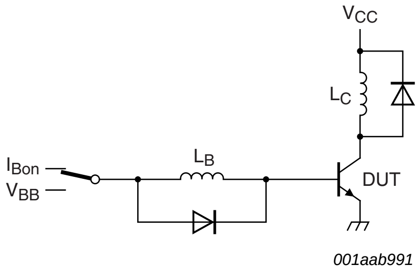


Fig 13. Switching times waveforms for resistive load



$V_{CC} = 300\ V;\ V_{BB} = -5\ V;\ L_C = 200\ \mu H;\ L_B = 1\ \mu H$

Fig 14. Test circuit for inductive load switching

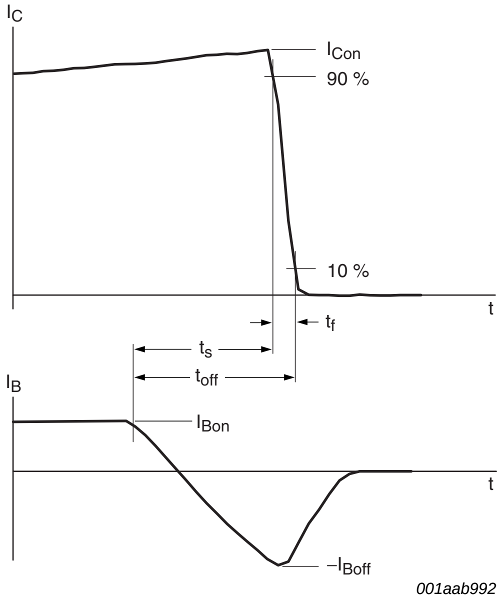
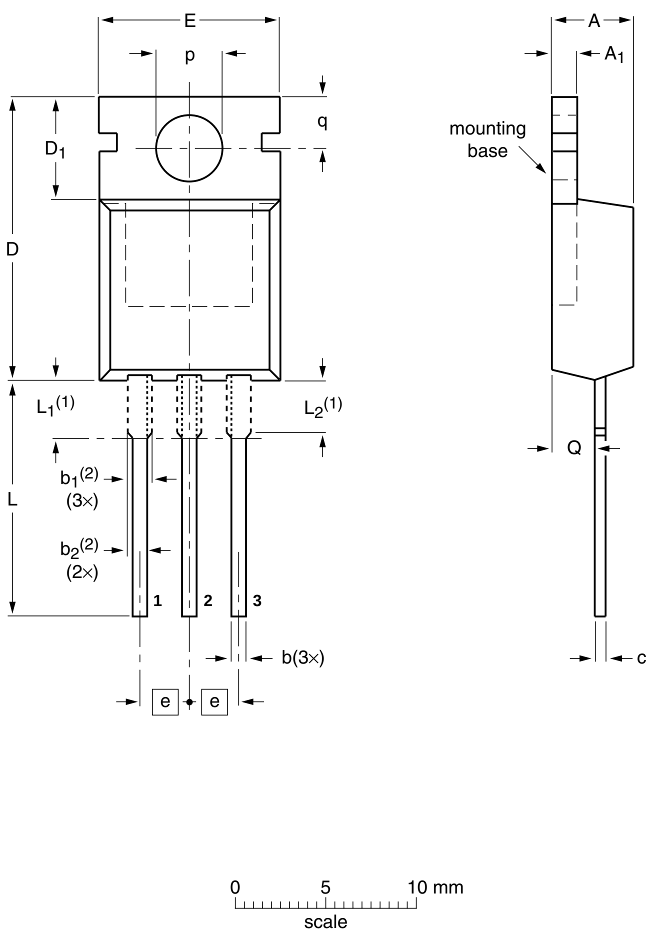


Fig 15. Switching times waveforms for inductive load

7. Package outline

Plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB **SOT78**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1	b	b_1(2)	b_2(2)	c	D	D_1	E	e	L	L_1(1)	L_2(1) max.	p	q	Q
mm	4.7 4.1	1.40 1.25	0.9 0.6	1.6 1.0	1.3 1.0	0.7 0.4	16.0 15.2	6.6 5.9	10.3 9.7	2.54	15.0 12.8	3.30 2.79	3.0	3.8 3.5	3.0 2.7	2.6 2.2

Notes

1. Lead shoulder designs may vary.
2. Dimension includes excess dambar.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT78		3-lead TO-220AB	SC-46			~~08-04-23~~ 08-06-13

Fig 16. Package outline SOT78 (TO-220AB)

8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BUJ303A v.5	20110503	Product data sheet	-	BUJ303A v.4
Modifications:	• Various changes to content.			
BUJ303A v.4	20110414	Product data sheet	-	BUJ303A v.3

9. Legal information

9.1 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.

[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 URL http://www.nxp.com.

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11. Contents

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