1.4 Quick reference data

Table 2. Quick reference data

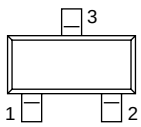
T_{amb} = 25 °C unless otherwise specified.

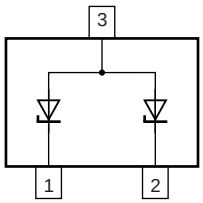
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Per diode						
V_{RWM}	reverse standoff voltage					
	MMBZ12VAL MMBZ12VAL/DG		-	-	8.5	V
	MMBZ15VAL MMBZ15VAL/DG		-	-	12	V
	MMBZ18VAL MMBZ18VAL/DG		-	-	14.5	V
	MMBZ20VAL MMBZ20VAL/DG		-	-	17	V
	MMBZ27VAL MMBZ27VAL/DG		-	-	22	V
	MMBZ33VAL MMBZ33VAL/DG		-	-	26	V
C_d	diode capacitance	f = 1 MHz; V_R = 0 V				
	MMBZ12VAL MMBZ12VAL/DG		-	110	140	pF
	MMBZ15VAL MMBZ15VAL/DG		-	85	105	pF
	MMBZ18VAL MMBZ18VAL/DG		-	70	90	pF
	MMBZ20VAL MMBZ20VAL/DG		-	65	80	pF
	MMBZ27VAL MMBZ27VAL/DG		-	48	60	pF
	MMBZ33VAL MMBZ33VAL/DG		-	45	55	pF

2. Pinning information

Table 3. Pinning

Pin	Description	Simplified outline	Graphic symbol
1	cathode (diode 1)		
2	cathode (diode 2)		
3	common anode		





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3. Ordering information

Table 4. Ordering information

Type number	Package		
	Name	Description	Version
MMBZ12VAL	-	plastic surface-mounted package; 3 leads	SOT23
MMBZ15VAL			
MMBZ18VAL			
MMBZ20VAL			
MMBZ27VAL			
MMBZ33VAL			
MMBZ12VAL/DG	-	plastic surface-mounted package; 3 leads	SOT23
MMBZ15VAL/DG			
MMBZ18VAL/DG			
MMBZ20VAL/DG			
MMBZ27VAL/DG			
MMBZ33VAL/DG			

4. Marking

Table 5. Marking codes

Type number	Marking code[1]	Type number	Marking code[1]
MMBZ12VAL	*H1	MMBZ12VAL/DG	TH*
MMBZ15VAL	*H2	MMBZ15VAL/DG	TK*
MMBZ18VAL	*H3	MMBZ18VAL/DG	TM*
MMBZ20VAL	*H4	MMBZ20VAL/DG	TP*
MMBZ27VAL	*H5	MMBZ27VAL/DG	TR*
MMBZ33VAL	*H6	MMBZ33VAL/DG	TT*

[1] * = -: made in Hong Kong
* = p: made in Hong Kong
* = t: made in Malaysia
* = W: made in China

5. Limiting values

Table 6. Limiting values

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

Symbol	Parameter	Conditions		Min	Max	Unit
Per diode						
P_{PPM}	rated peak pulse power	t_p = 10/1000 µs	[1][2]	-	40	W
I_{PPM}	rated peak pulse current	t_p = 10/1000 µs	[1][2]			
	MMBZ12VAL MMBZ12VAL/DG			-	2.35	A
	MMBZ15VAL MMBZ15VAL/DG			-	1.9	A
	MMBZ18VAL MMBZ18VAL/DG			-	1.6	A
	MMBZ20VAL MMBZ20VAL/DG			-	1.4	A
	MMBZ27VAL MMBZ27VAL/DG			-	1	A
	MMBZ33VAL MMBZ33VAL/DG			-	0.87	A
Per device						
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	[3]	-	265	mW
			[4]	-	360	mW
T_j	junction temperature			-	150	°C
T_{amb}	ambient temperature			–55	+150	°C
T_{stg}	storage temperature			–65	+150	°C

[1] In accordance with IEC 61643-321 (10/1000 µs current waveform).

[2] Measured from pin 1 or 2 to pin 3.

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

[4] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for cathode 1 cm^2.

Table 7. ESD maximum ratings

T_{amb} = 25 °C unless otherwise specified.

Symbol	Parameter	Conditions		Min	Max	Unit
Per diode						
V_{ESD}	electrostatic discharge voltage		[1][2]			
		IEC 61000-4-2 (contact discharge)		-	30	kV
		machine model		-	2	kV

[1] Device stressed with ten non-repetitive ESD pulses.

[2] Measured from pin 1 or 2 to pin 3.

Table 8. ESD standards compliance

Standard	Conditions
Per diode	
IEC 61000-4-2; level 4 (ESD)	> 15 kV (air); > 8 kV (contact)
MIL-STD-883; class 3 (human body model)	> 8 kV

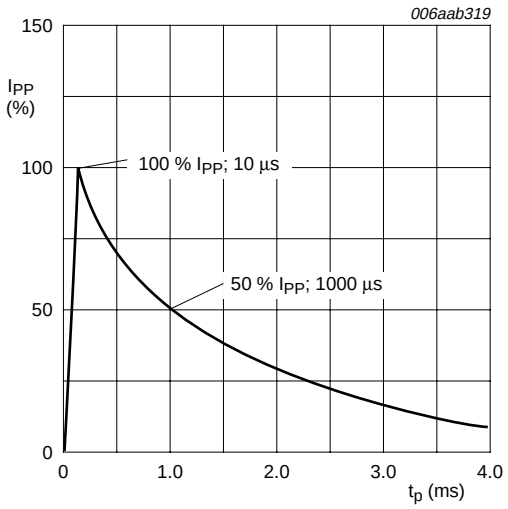


Fig 1. 10/1000 µs pulse waveform according to IEC 61643-321

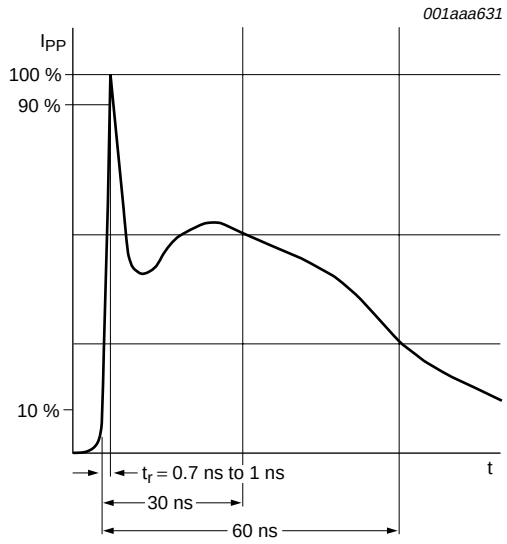


Fig 2. ESD pulse waveform according to IEC 61000-4-2

6. Thermal characteristics

Table 9. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Per device							
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	460	K/W
			[2]	-	-	340	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point		[3]	-	-	50	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 cathode 1 cm^2.

[3] Measured from pin 1 or 2 to pin 3.

7. Characteristics

Table 10. Characteristics

T_{amb} = 25 °C unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Per diode						
V_F	forward voltage	I_F = 10 mA	-	-	0.9	V
V_{RWM}	reverse standoff voltage					
	MMBZ12VAL MMBZ12VAL/DG		-	-	8.5	V
	MMBZ15VAL MMBZ15VAL/DG		-	-	12	V
	MMBZ18VAL MMBZ18VAL/DG		-	-	14.5	V
	MMBZ20VAL MMBZ20VAL/DG		-	-	17	V
	MMBZ27VAL MMBZ27VAL/DG		-	-	22	V
	MMBZ33VAL MMBZ33VAL/DG		-	-	26	V
I_{RM}	reverse leakage current					
	MMBZ12VAL MMBZ12VAL/DG	V_{RWM} = 8.5 V	-	0.1	5	nA
	MMBZ15VAL MMBZ15VAL/DG	V_{RWM} = 12 V	-	0.1	5	nA
	MMBZ18VAL MMBZ18VAL/DG	V_{RWM} = 14.5 V	-	0.1	5	nA
	MMBZ20VAL MMBZ20VAL/DG	V_{RWM} = 17 V	-	0.1	5	nA
	MMBZ27VAL MMBZ27VAL/DG	V_{RWM} = 22 V	-	0.1	5	nA
	MMBZ33VAL MMBZ33VAL/DG	V_{RWM} = 26 V	-	0.1	5	nA
V_{BR}	breakdown voltage	I_R = 1 mA				
	MMBZ12VAL MMBZ12VAL/DG		11.4	12	12.6	V
	MMBZ15VAL MMBZ15VAL/DG		14.25	15	15.75	V
	MMBZ18VAL MMBZ18VAL/DG		17.1	18	18.9	V
	MMBZ20VAL MMBZ20VAL/DG		19	20	21	V
	MMBZ27VAL MMBZ27VAL/DG		25.65	27	28.35	V
	MMBZ33VAL MMBZ33VAL/DG		31.35	33	34.65	V

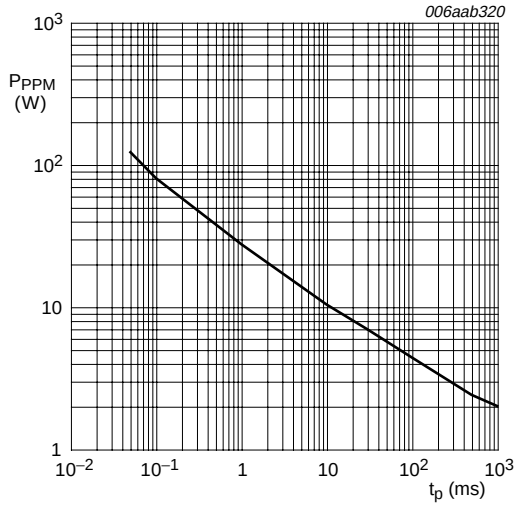
Table 10. Characteristics *...continued*

T_{amb} = 25 °C unless otherwise specified.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
C_d	diode capacitance	f = 1 MHz; V_R = 0 V					
	MMBZ12VAL MMBZ12VAL/DG			-	110	140	pF
	MMBZ15VAL MMBZ15VAL/DG			-	85	105	pF
	MMBZ18VAL MMBZ18VAL/DG			-	70	90	pF
	MMBZ20VAL MMBZ20VAL/DG			-	65	80	pF
	MMBZ27VAL MMBZ27VAL/DG			-	48	60	pF
	MMBZ33VAL MMBZ33VAL/DG			-	45	55	pF
V_{CL}	clamping voltage		[1][2]				
	MMBZ12VAL MMBZ12VAL/DG	I_{PPM} = 2.35 A		-	-	17	V
	MMBZ15VAL MMBZ15VAL/DG	I_{PPM} = 1.9 A		-	-	21	V
	MMBZ18VAL MMBZ18VAL/DG	I_{PPM} = 1.6 A		-	-	25	V
	MMBZ20VAL MMBZ20VAL/DG	I_{PPM} = 1.4 A		-	-	28	V
	MMBZ27VAL MMBZ27VAL/DG	I_{PPM} = 1 A		-	-	40	V
	MMBZ33VAL MMBZ33VAL/DG	I_{PPM} = 0.87 A		-	-	46	V
S_Z	temperature coefficient	I_Z = 1 mA					
	MMBZ12VAL MMBZ12VAL/DG			-	8.2	-	mV/K
	MMBZ15VAL MMBZ15VAL/DG			-	11	-	mV/K
	MMBZ18VAL MMBZ18VAL/DG			-	14	-	mV/K
	MMBZ20VAL MMBZ20VAL/DG			-	15.8	-	mV/K
	MMBZ27VAL MMBZ27VAL/DG			-	23	-	mV/K
	MMBZ33VAL MMBZ33VAL/DG			-	29.8	-	mV/K

[1] In accordance with IEC 61643-321(10/1000 µs current waveform).

[2] Measured from pin 1 or 2 to pin 3.



MMBZ27VAL: unidirectional and bidirectional

T_{amb} = 25 °C

Fig 3. Rated peak pulse power as a function of exponential pulse duration (rectangular waveform); typical values

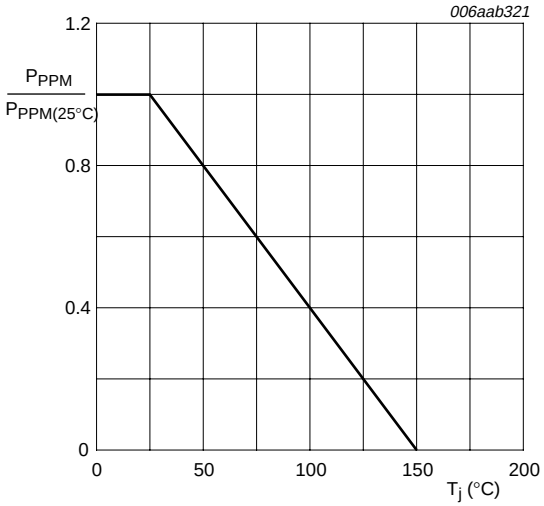
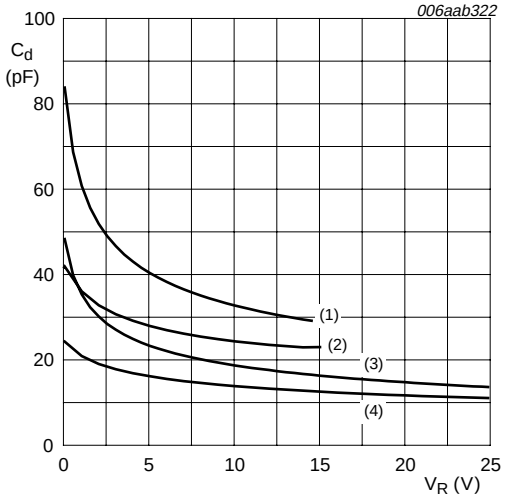


Fig 4. Relative variation of rated peak pulse power as a function of junction temperature; typical values



f = 1 MHz; T_{amb} = 25 °C

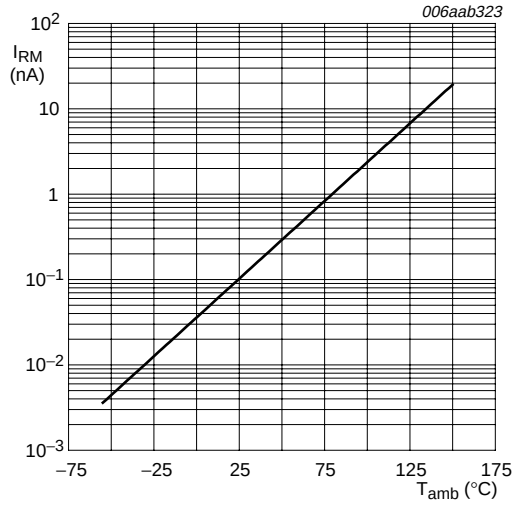
(1) MMBZ15VAL: unidirectional

(2) MMBZ15VAL: bidirectional

(3) MMBZ27VAL: unidirectional

(4) MMBZ27VAL: bidirectional

Fig 5. Diode capacitance as a function of reverse voltage; typical values



MMBZ27VAL: V_{RWM} = 22 V

Fig 6. Reverse leakage current as a function of ambient temperature; typical values

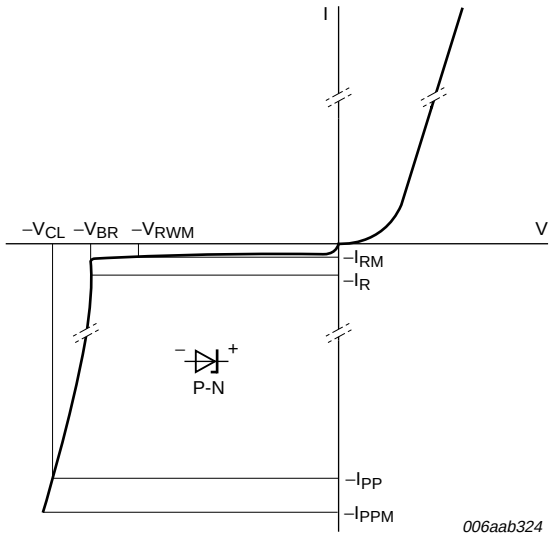


Fig 7. V-I characteristics for a unidirectional ESD protection diode

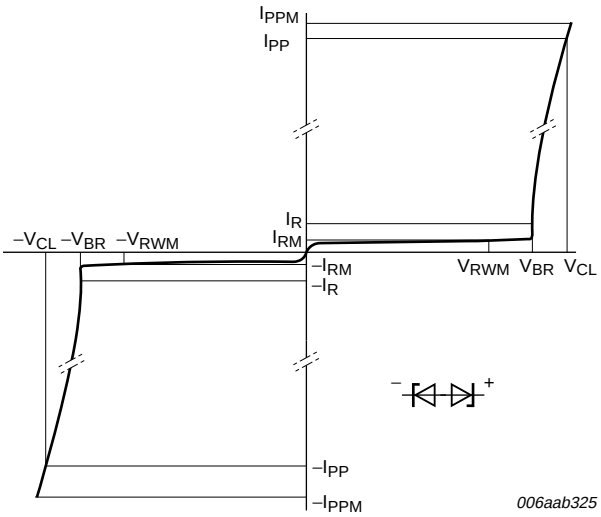


Fig 8. V-I characteristics for a bidirectional ESD protection diode

8. Application information

The MMBZxVAL series is designed for the protection of up to two unidirectional data or signal lines from the damage caused by ESD and surge pulses. The devices may be used on lines where the signal polarities are either positive or negative with respect to ground. The devices provide a surge capability of 40 W per line for a 10/1000 µs waveform.

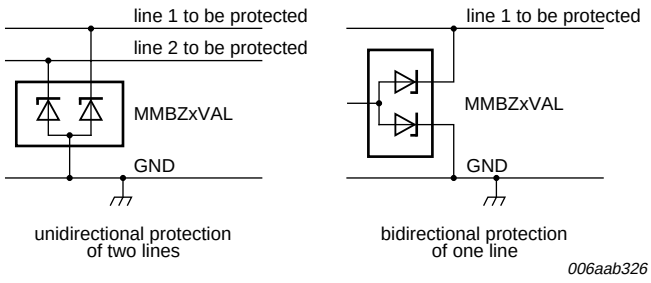


Fig 9. Typical application: ESD and transient voltage protection of data lines

Circuit board layout and protection device placement

Circuit board layout is critical for the suppression of ESD, Electrical Fast Transient (EFT) and surge transients. The following guidelines are recommended:

1. Place the devices as close to the input terminal or connector as possible.
2. The path length between the device and the protected line should be minimized.
3. Keep parallel signal paths to a minimum.
4. Avoid running protected conductors in parallel with unprotected conductors.
5. Minimize all Printed-Circuit Board (PCB) conductive loops including power and ground loops.
6. Minimize the length of the transient return path to ground.
7. Avoid using shared transient return paths to a common ground point.
8. Ground planes should be used whenever possible. For multilayer PCBs, use ground vias.

9. Test information

9.1 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.

10. Package outline

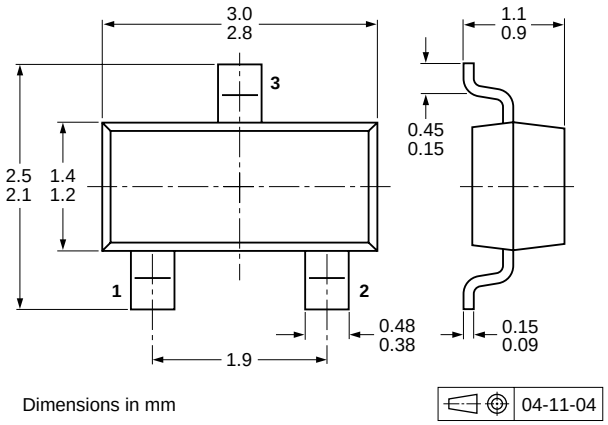


Fig 10. Package outline SOT23 (TO-236AB)

11. Packing information

Table 11. Packing methods

The indicated -xxx are the last three digits of the 12NC ordering code.[1]

Type number	Package	Description	Packing quantity	
			3000	10000
MMBZ12VAL	SOT23	4 mm pitch, 8 mm tape and reel	-215	-235
MMBZ15VAL				
MMBZ18VAL				
MMBZ20VAL				
MMBZ27VAL				
MMBZ33VAL				
MMBZ12VAL/DG	SOT23	4 mm pitch, 8 mm tape and reel	-215	-235
MMBZ15VAL/DG				
MMBZ18VAL/DG				
MMBZ20VAL/DG				
MMBZ27VAL/DG				
MMBZ33VAL/DG				

[1] For further information and the availability of packing methods, see Section 15.

12. Soldering

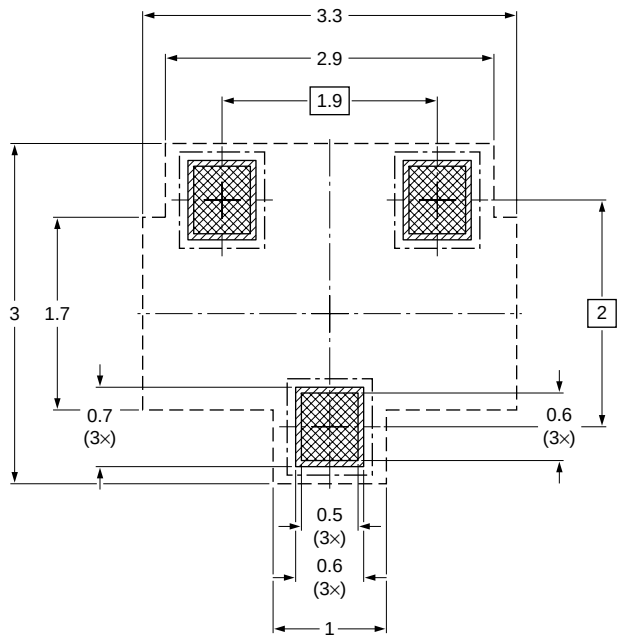


Fig 11. Reflow soldering footprint SOT23 (TO-236AB)

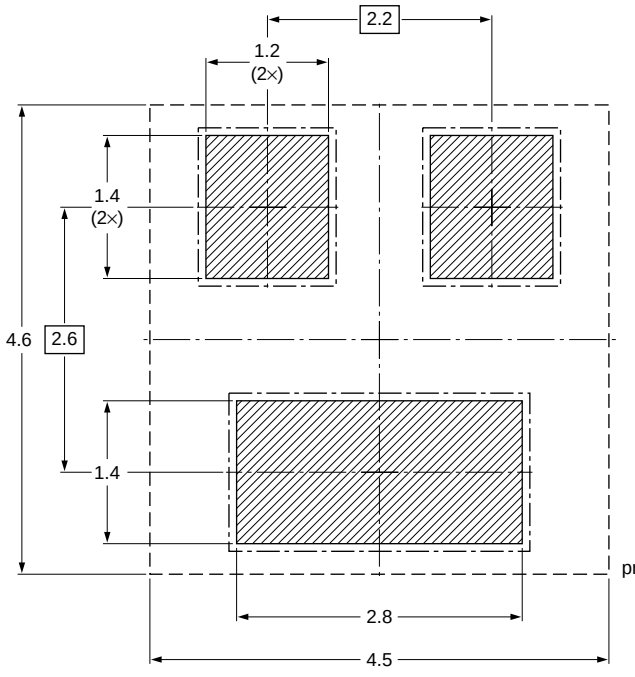


Fig 12. Wave soldering footprint SOT23 (TO-236AB)

13. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
MMBZXVAL_SER_1	20080901	Product data sheet	-	-

14. Legal information

14.1 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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16. Contents

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