MMBZ16VAL

High surge current unidirectional double ESD protection diodes

6 November 2017 **Product data sheet**

1. General description

Unidirectional double ElectroStatic Discharge (ESD) protection diodes in a common anode configuration, encapsulated in a SOT23 (TO-236AB) small Surface-Mounted Device (SMD) plastic package. The device is designed for ESD and transient overvoltage protection of up to two signal lines.

2. Features and benefits

- Unidirectional protection of two lines
- Reverse standoff voltage: V_{RWM} = 13 V
- Average measured surge robustness: I_{PPM} = 14 A (8/20 µs) / I_{PPM} = 2.54 A (10/1000 µs)
- Typical reverse leakage current: I_{RM} = 0.1 nA
- AEC-Q101 qualified

3. Applications

- Automotive in-vehicle networks protection
- Industrial application
- Power management

4. Quick reference data

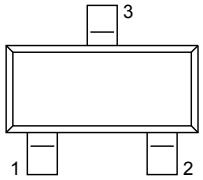
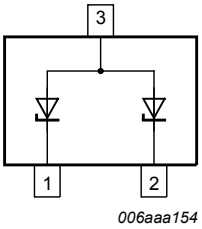
Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{RWM}	reverse standoff voltage	T_j = 25 °C		-	-	13	V
I_{PPM}	rated peak pulse current	t_p = 10/1000 µs	[1] [2]	-	-	1.9	A
V_{CL}	clamping voltage	I_{PP} = 1.7 A; t_p = 10/1000 µs; T_j = 25 °C	[1] [2]	-	19.5	23	V

[1] According to IEC 61643-321.
[2] Measured from pin 1 or 2 to pin 3.

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	K1	cathode	 TO-236AB (SOT23)	 006aaa154
2	K2	cathode		
3	A	common anode		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
MMBZ16VAL	TO-236AB	plastic, surface-mounted package; 3 terminals; 1.9 mm pitch; 2.9 mm x 1.3 mm x 1 mm body	SOT23

7. Marking

Table 4. Marking codes

Type number	Marking code[1]
MMBZ16VAL	%H7

[1] % = placeholder for manufacturing site code

8. Limiting values

Table 5. Limiting values

In accordance with the Aboluste Maximum Rating System (IEC 60134)

Symbol	Parameter	Conditions		Min	Max	Unit
P_{PPM}	rated peak pulse power	t_p = 8/20 µs	[1] [2]	-	300	W
		t_p = 10/1000 µs	[3] [2]	-	45	W
I_{PPM}	rated peak pulse current	t_p = 8/20 µs	[1] [2]	-	11	A
		t_p = 10/1000 µs	[3] [2]	-	1.9	A
T_j	junction temperature			-	150	°C
T_{amb}	ambient temperature			-55	150	°C
T_{stg}	storage temperature			-65	150	°C
ESD maximum ratings						
V_{ESD}	electrostatic discharge voltage	IEC 61000-4-2; contact discharge	[4] [2]	-	30	kV
		IEC 61000-4-2; air discharge	[4] [2]	-	30	kV

[1] According to IEC 61000-4-5.
[2] Measured from pin 1 or 2 to pin 3.
[3] According to IEC 61643-321.
[4] Device stressed with ten non-repetitive ESD pulses.

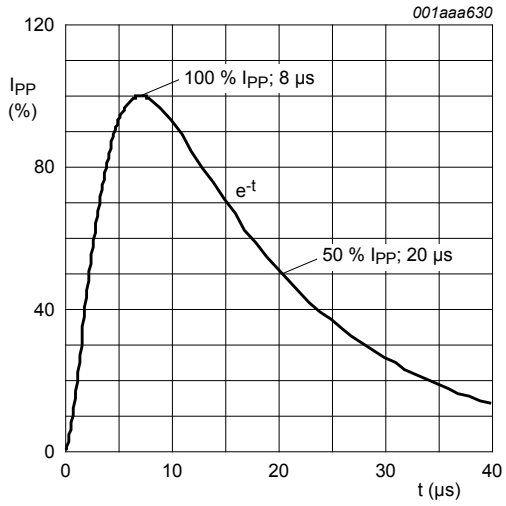


Fig. 1. 8/20 µs pulse waveform according to IEC 61000-4-5

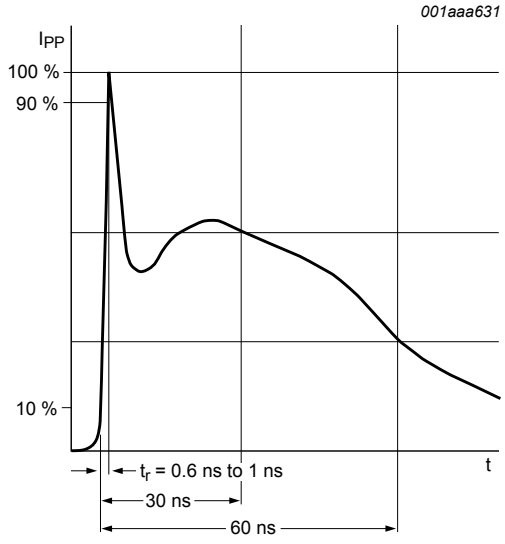


Fig. 2. ESD pulse waveform according to IEC 61000-4-2

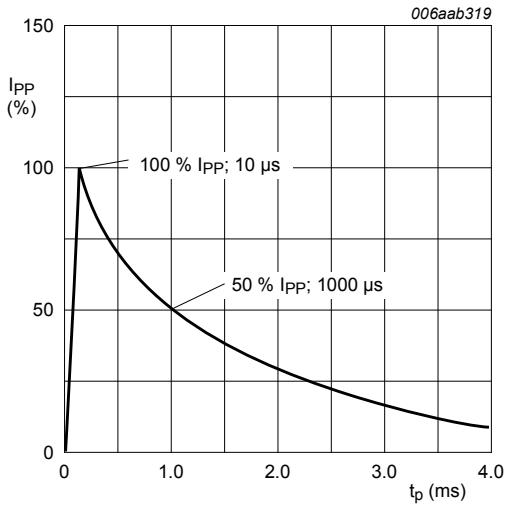


Fig. 3. 10/1000 µs pulse waveform according to IEC 61643-321

9. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{RWM}	reverse standoff voltage	T_j = 25 °C		-	-	13	V
V_{BR}	breakdown voltage	I_R = 1 mA; T_j = 25 °C	[1]	15.2	16	16.8	V
I_{RM}	reverse leakage current	V_{RWM} = 13 V; T_j = 25 °C	[1]	-	0.1	5	nA
C_d	diode capacitance	f = 1 MHz; V_R = 0 V; T_j = 25 °C	[1]	-	76	95	pF
V_{CL}	clamping voltage	I_{PP} = 11 A; t_p = 8/20 µs; T_j = 25 °C	[2] [1]	-	23	28	V
		I_{PP} = 1.7 A; t_p = 10/1000 µs; T_j = 25 °C	[3] [1]	-	19.5	23	V

[1] Measured from pin 1 or 2 to pin 3.
[2] According to IEC 61000-4-5.
[3] According to IEC 61643-321.

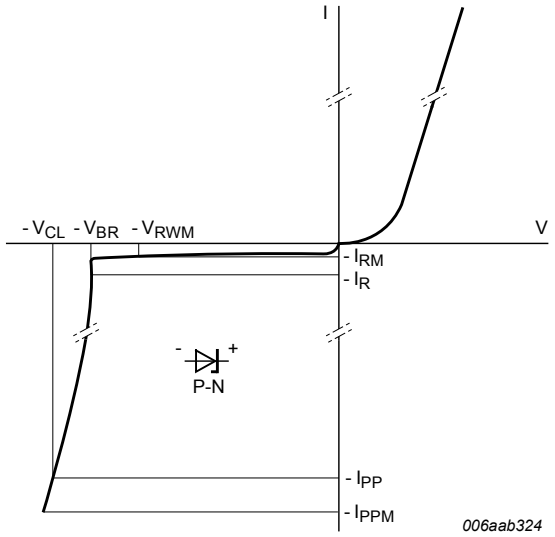


Fig. 4. V-I characteristics for a unidirectional TVS protection diode

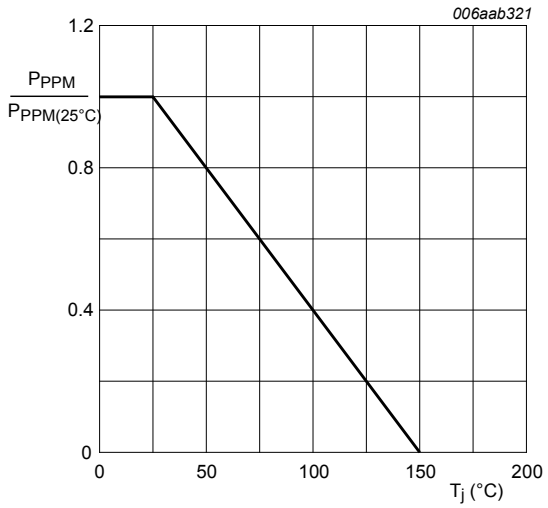


Fig. 5. Relative variation of rated peak pulse power as a function of junction temperature; typical values

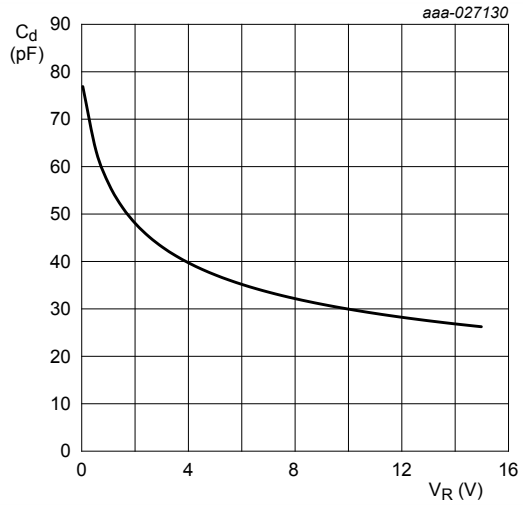


Fig. 6. Diode capacitance as a function of reverse voltage; typical values

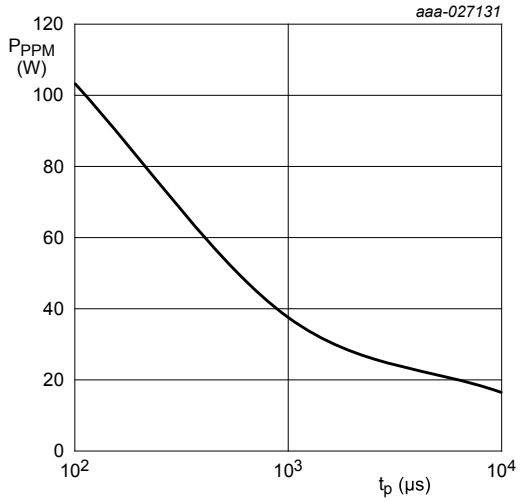
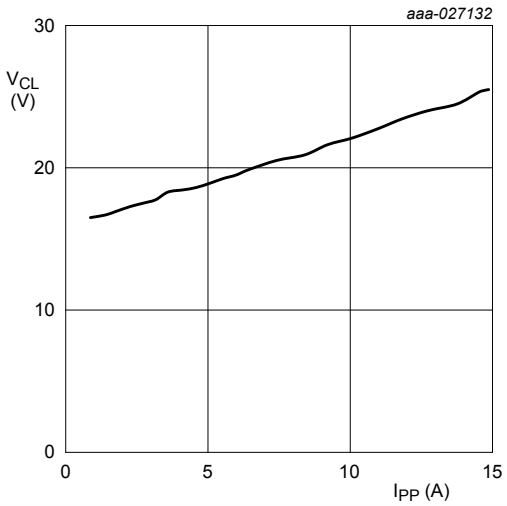
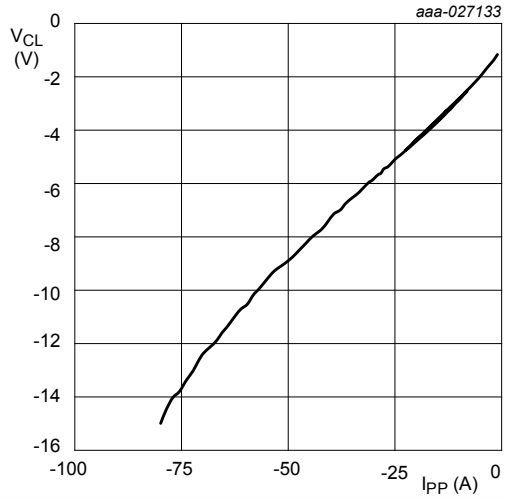


Fig. 7. Rated peak pulse power as a function of a pulse duration; typical values



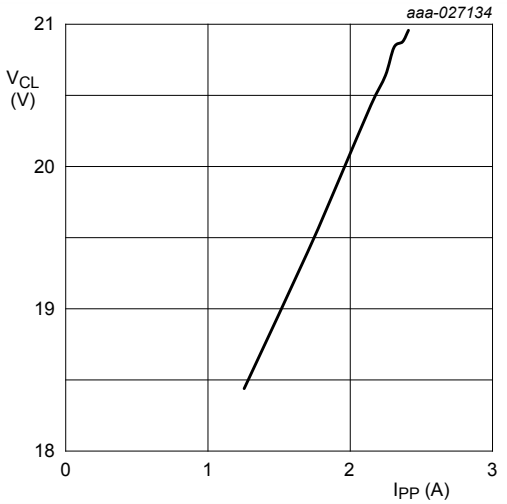
t_p = 8/20 µs; according to IEC 61000-4-5

Fig. 8. Positive clamping voltage (8/20 µs pulse); typical values



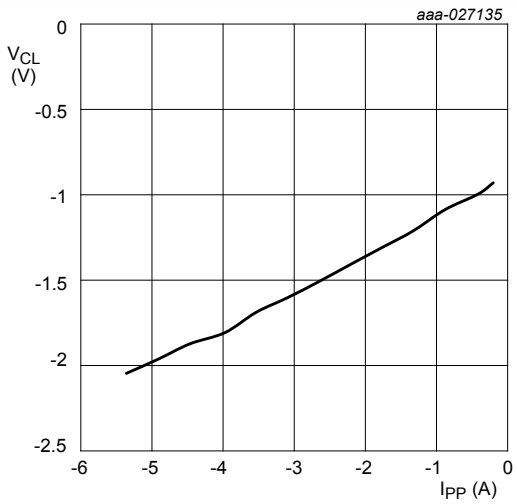
t_p = 8/20 µs; according to IEC 61000-4-5

Fig. 9. Negative clamping voltage (8/20 µs pulse); typical values



t_p = 10/1000 µs; according to IEC 61643-321

Fig. 10. Positive clamping voltage (10/1000 µs pulse); typical values



t_p = 10/1000 µs; according to IEC 61643-321

Fig. 11. Negative clamping voltage (10/1000 µs pulse); typical values

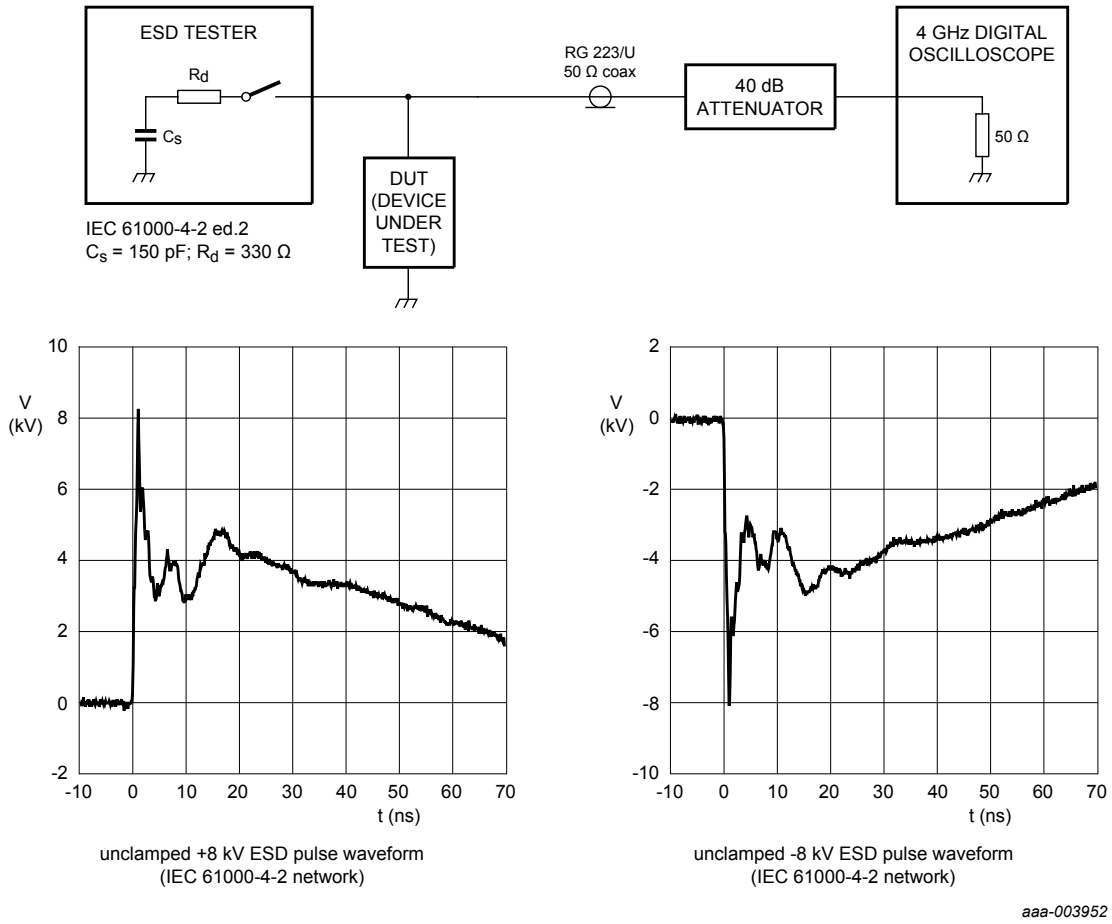


Fig. 12. ESD clamping test setup and waveforms

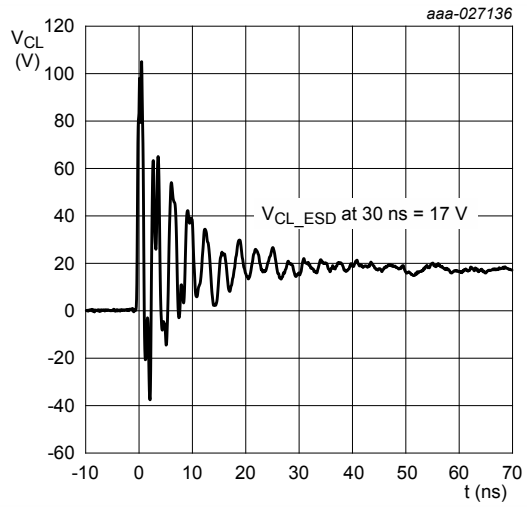


Fig. 13. Clamped +8 kV pulse waveform (IEC61000-4-2 network)

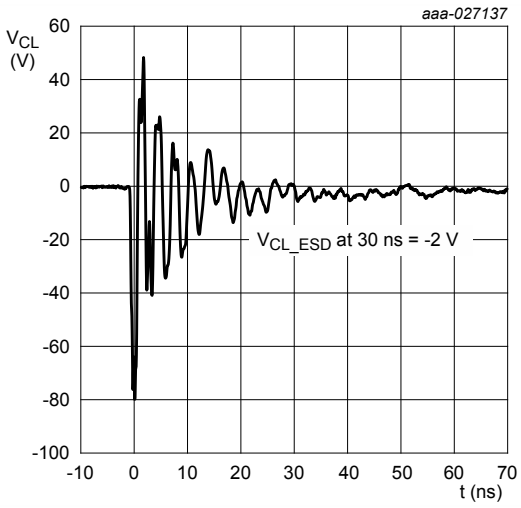


Fig. 14. Clamped -8 kV pulse waveform (IEC61000-4-2 network)

10. Application information

The device is designed for the protection of one bidirectional or 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 for the unidirectional configuration or both positive and negative for the bidirectional configuration.

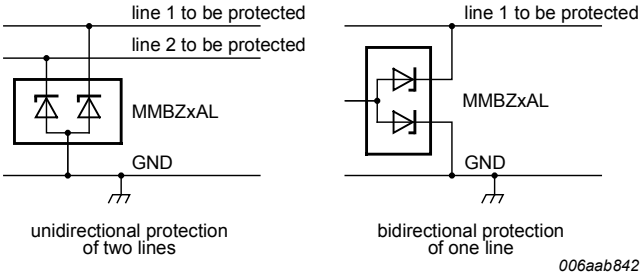


Fig. 15. Application diagram

11. Package outline

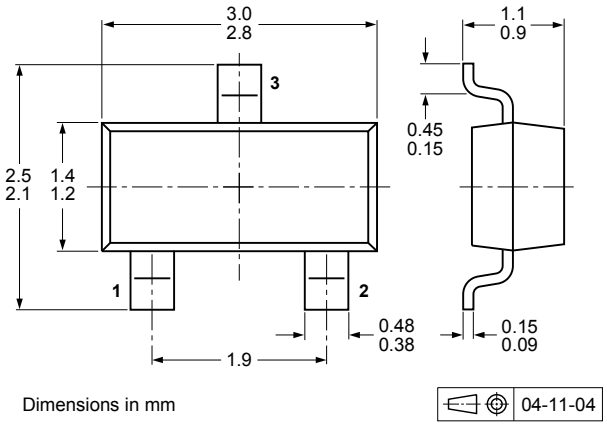


Fig. 16. Package outline TO-236AB (SOT23)

12. Soldering

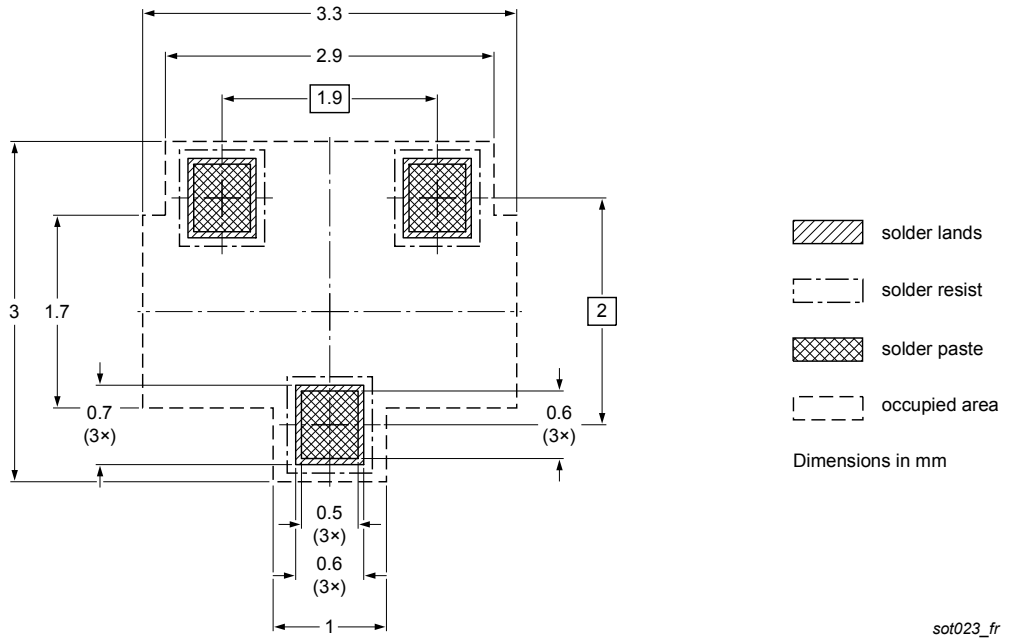


Fig. 17. Reflow soldering footprint for TO-236AB (SOT23)

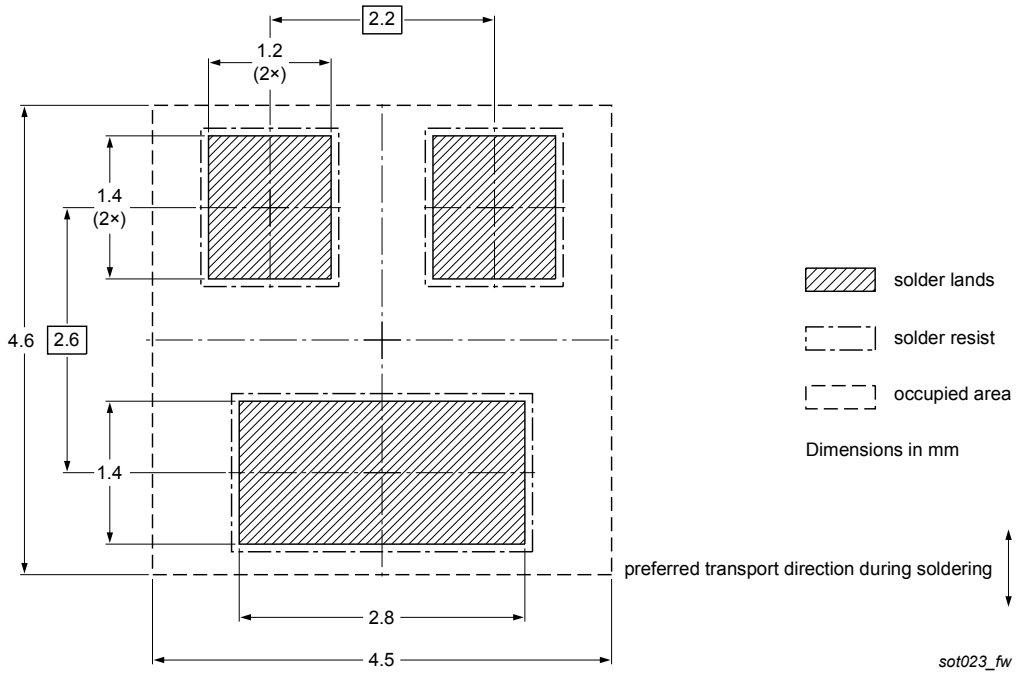


Fig. 18. Wave soldering footprint for TO-236AB (SOT23)

13. Revision history

Table 7. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
MMBZ16VAL v.1	20171106	Product data sheet	-	-

14. Legal information

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".
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15. Contents

1. General description....1
2. Features and benefits....1
3. Applications....1
4. Quick reference data....1
5. Pinning information....2
6. Ordering information....2
7. Marking....2
8. Limiting values....3
9. Characteristics....4
10. Application information....8
11. Package outline....8
12. Soldering....9
13. Revision history....10
14. Legal information....11

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