MMBZ15VDL

Double ESD protection diode for transient overvoltage suppression

11 April 2023 Product data sheet

1. General description

Unidirectional double ElectroStatic Discharge (ESD) protection diode in a common cathode 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 ESD protection of two lines
- Bidirectional ESD protection of one line
- Low diode capacitance: $C_d \leq 105$ pF
- Rated peak pulse power: $P_{PPM} \leq 40$ W
- Ultra low leakage current: $I_{RM} \leq 5$ nA
- ESD protection up to 30 kV (contact discharge)
- IEC 61000-4-2; level 4 (ESD)
- IEC 61643-321

3. Applications

- Computers and peripherals
- Audio and video equipment
- Cellular handsets and accessories
- Portable electronics

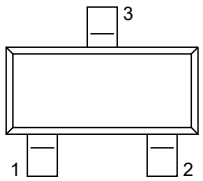
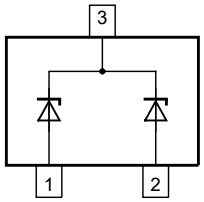
4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{RWM}	reverse standoff voltage	T_{amb} = 25 °C		-	-	12.8	V
C_d	diode capacitance	f = 1 MHz; V_R = 0 V; T_{amb} = 25 °C		-	85	105	pF

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	A1	anode (diode 1)	 SOT23	 006aaa150
2	A2	anode (diode 2)		
3	CC	common cathode		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
MMBZ15VDL	SOT23	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]
MMBZ15VDL	%MB

[1] % = placeholder for manufacturing site code

8. Limiting values

Table 5. Limiting values

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

Symbol	Parameter	Conditions		Min	Max	Unit
P_{PPM}	rated peak pulse power	t_p = 10/1000 µs	[1] [2]	-	40	W
I_{PPM}	rated peak pulse current		[1] [2]	-	1.9	A
P_{tot}	total power dissipation	$T_{amb} \leq$ 25 °C	[3]	-	350	mW
			[4]	-	440	mW
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; T_{amb} = 25 °C	[5] [2]	-	30	kV
		IEC 61000-4-2; air discharge		-	15	kV
		machine model; T_{amb} = 25 °C	[5] [2]	-	2	kV
		MIL-STD-883; human body model (HBM)		-	8	kV

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

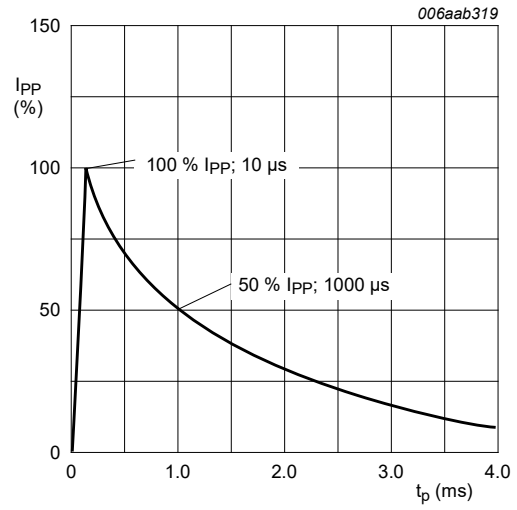


Fig. 1. 10/1000 µs pulse waveform according to IEC 61643-321

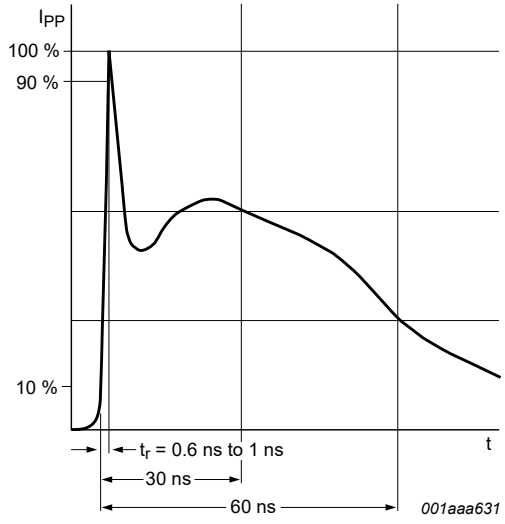


Fig. 2. ESD pulse waveform according to IEC 61000-4-2

9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient		[1]	-	-	350	K/W
			[2]	-	-	280	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point		[3]	-	-	60	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] Soldering point at pin 3.

10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_F	forward voltage	I_F = 10 mA; T_{amb} = 25 °C		-	-	0.9	V
V_{RWM}	reverse standoff voltage	T_{amb} = 25 °C		-	-	12.8	V
V_{BR}	breakdown voltage	I_R = 1 mA; T_{amb} = 25 °C		14.3	15	15.8	V
I_{RM}	reverse leakage current	V_{RWM} = 12.8 V; T_{amb} = 25 °C		-	0.1	5	nA
C_d	diode capacitance	f = 1 MHz; V_R = 0 V; T_{amb} = 25 °C		-	85	105	pF
V_{CL}	clamping voltage	I_{PPM} = 1.9 A; t_p = 10/1000 µs; T_{amb} = 25 °C	[1] [2]	-	-	21.2	V
S_Z	temperature coefficient	I_Z = 1 mA; T_{amb} = 25 °C		-	11	-	mV/K

[1] In accordance with IEC 61643-321 (10/1000 µs current waveform).
[2] Measured from pin 1 or 2 to pin 3.

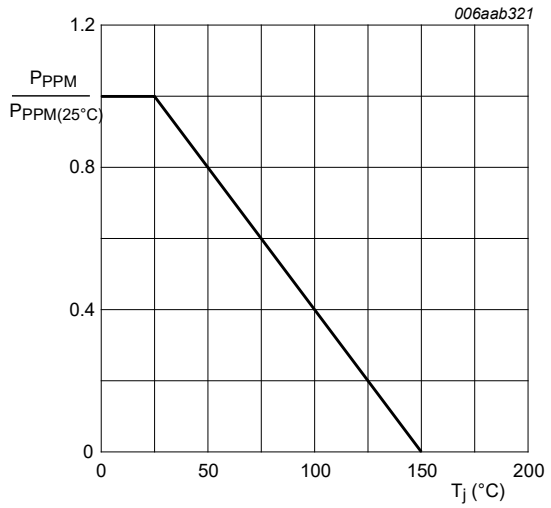
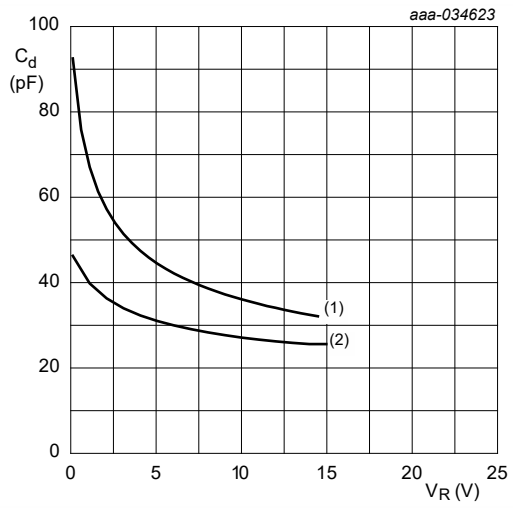


Fig. 3. Relative variation of rated peak pulse power as a function of junction temperature; typical values



f = 1 MHz; T_{amb} = 25 °C
(1) unidirectional
(2) bidirectional

Fig. 4. Diode capacitance as a function of reverse voltage; typical values

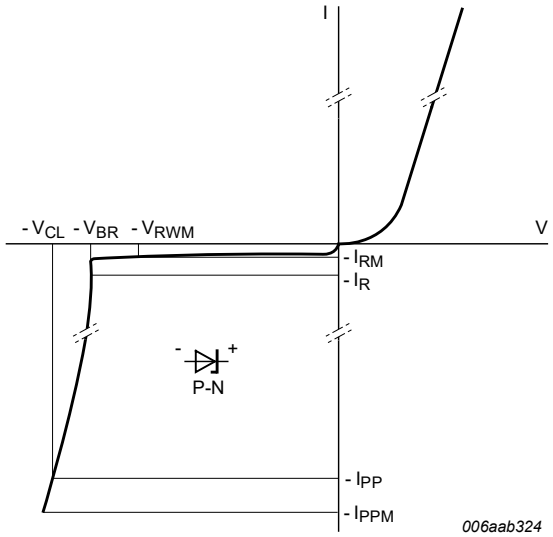


Fig. 5. V-I characteristics for a unidirectional ESD protection diode

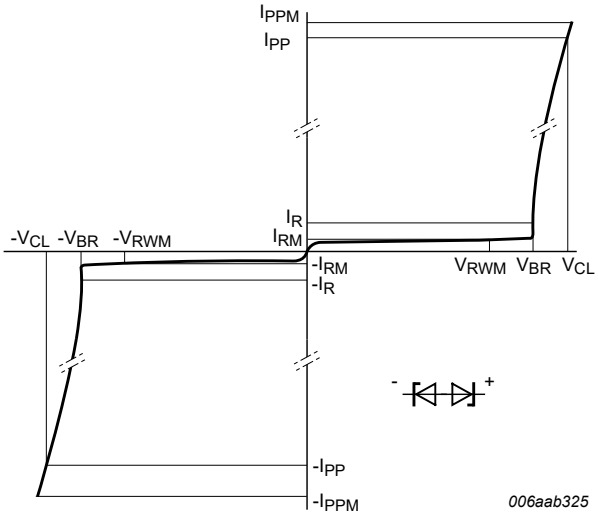


Fig. 6. V-I characteristics for a bidirectional ESD protection diode

11. Application information

The device is designed for the protection of up to two unidirectional data lines from the damage caused by ESD and surge pulses. The device may be used on lines where the signal polarities are either positive or negative with respect to ground.

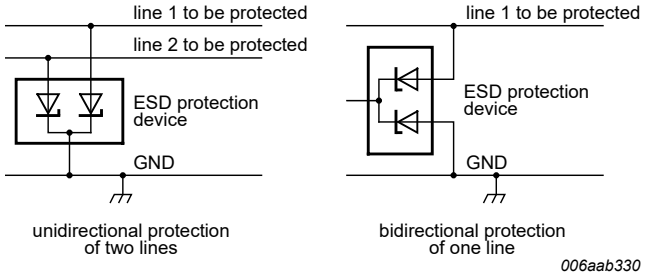


Fig. 7. Typical application: ESD and transient voltage protection of data lines

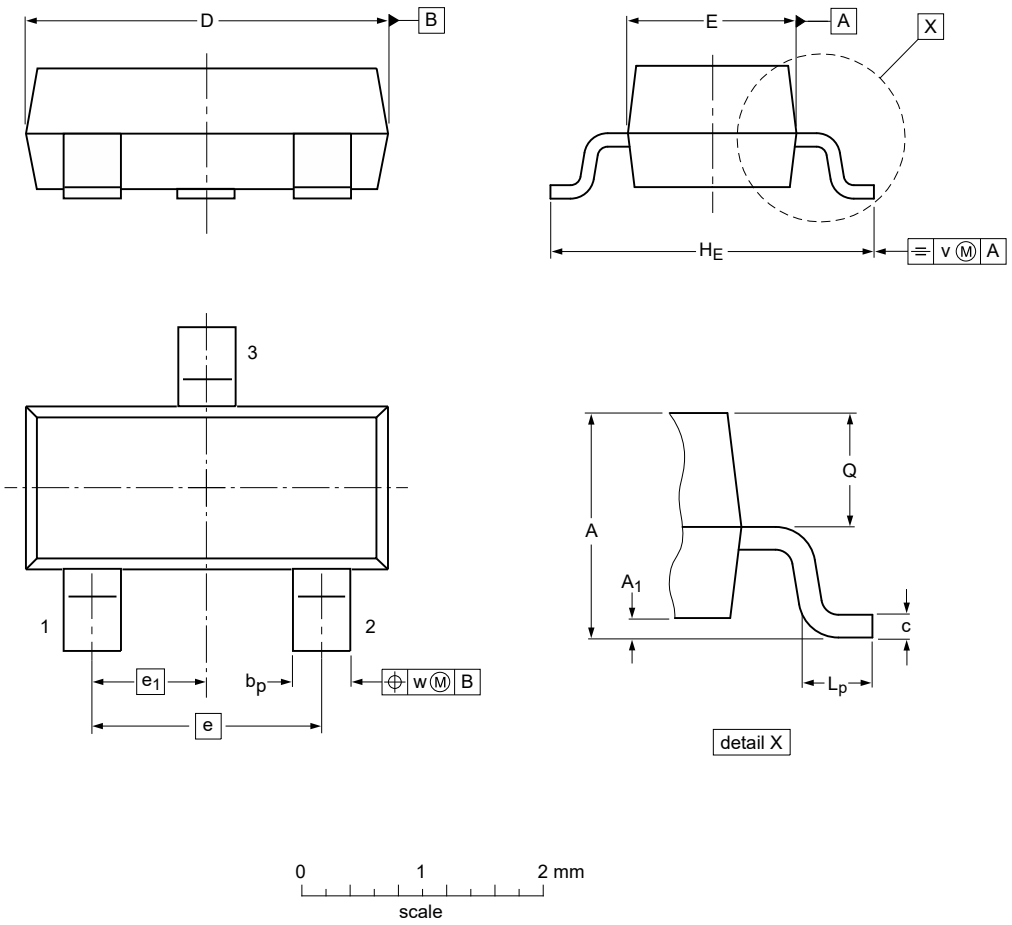
Circuit board layout and protection device placement

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 device as close to the input terminal or connector as possible.
2. Minimize the path length between the device and the protected line.
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. Use ground planes whenever possible. For multilayer PCBs, use ground vias.

12. Package outline

Plastic surface-mounted package; 3 leads **SOT23**



Dimensions (mm are the original dimensions)

Unit		A	A_1	b_p	c	D	E	e	e_1	H_E	L_p	Q	v	w
mm	max	1.1	0.1	0.48	0.15	3.0	1.4	1.9	0.95	2.5	0.45	0.55	0.2	0.1
	nom													
	min	0.9		0.38	0.09	2.8	1.2			2.1	0.15	0.45		

sot023_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT23		TO-236AB				~~14-06-19~~ 14-09-22

Fig. 8. Package outline SOT23

13. Soldering

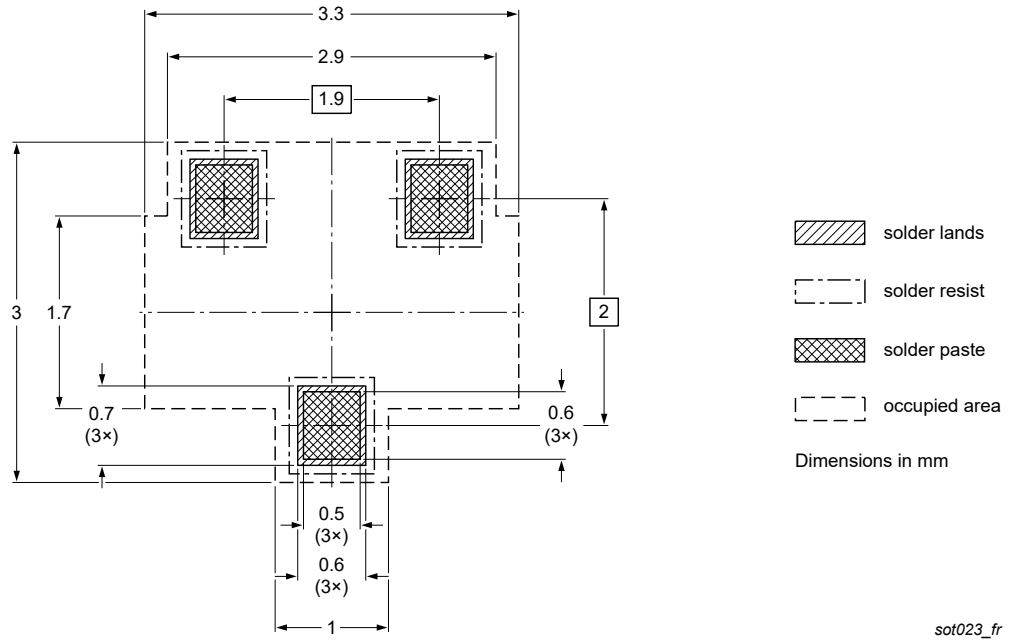


Fig. 9. Reflow soldering footprint for SOT23

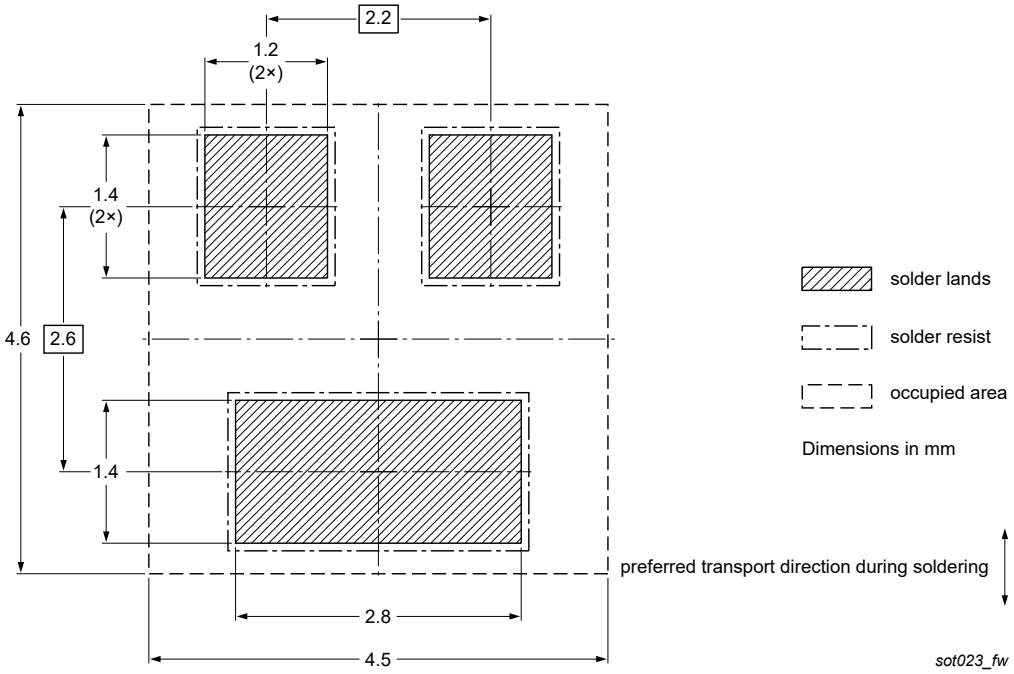


Fig. 10. Wave soldering footprint for SOT23

14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
MMBZ15VDL v.2	20230411	Product data sheet	-	MMBZXVCL_MMBZXVDL_SER_1
Modifications:	• Family data sheet reduced to single type data sheet. • Product changed to non-automotive qualification. Please refer to nexperia.com for automotive (-Q) product alternative(s).			
MMBZXVCL_MMBZXVDL_SER_1	20080903	Product data sheet	-	-

15. 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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