MMBZ5V6AT-Q

Low capacitance unidirectional double ESD protection diode

1 November 2023 Product data sheet

1. General description

Unidirectional double ElectroStatic Discharge (ESD) protection diode 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 ESD protection of two lines
- Bidirectional ESD protection of one line
- Reverse stand-off voltage: V_{RWM} = 3 V
- Low clamping voltage: V_{CL} = 13 V typ. at I_{PP} = 18 A
- ESD protection up to 30 kV (IEC 61000-4-2)
- Ultra low leakage current: I_{RM} < 200 nA
- Qualified according to AEC-Q101 and recommended for use in automotive applications

3. Applications

- Computers and peripherals
- Audio and video equipment
- Cellular handsets and accessories
- Automotive electronic control units
- 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		-	-	3	V
I_{PPM}	rated peak pulse current	t_p = 8/20 µs	[1]	-	-	18	A
C_d	diode capacitance	f = 1 MHz; V_R = 0 V; T_{amb} = 25 °C		-	200	240	pF

[1] Device stressed with 8/20 µs exponential decay waveform according to IEC 61000-4-5.

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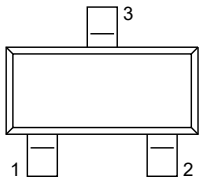
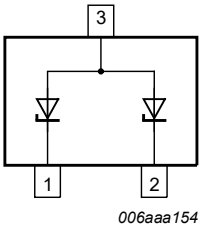
5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	K1	cathode (diode 1)	 SOT23	 006aaa154
2	K2	cathode (diode 2)		
3	CA	common anode		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
MMBZ5V6AT-Q	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]
MMBZ5V6AT-Q	%Q4

[1] % = placeholder for manufacturing site code

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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 = 10/1000 µs	[1]	-	41	W
I_{PPM}	rated peak pulse current	t_p = 8/20 µs	[2]	-	18	A
		t_p = 10/1000 µs	[1]	-	4.5	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	[3]	-	30	kV
		IEC 61000-4-2; air discharge	[3]	-	30	kV

[1] In accordance with IEC 61643-321 (10/1000 µs current waveform).
[2] Device stressed with 8/20 µs exponential decay waveform according to IEC 61000-4-5.
[3] Device stressed with ten non-repetitive ESD pulses.

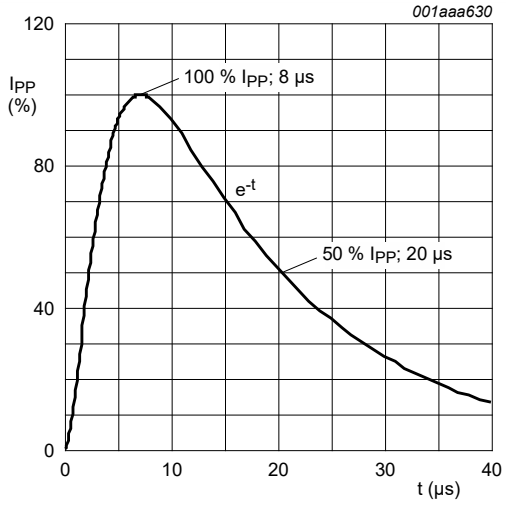

Fig. 1. 8/20 µs pulse waveform according to IEC 61000-4-5

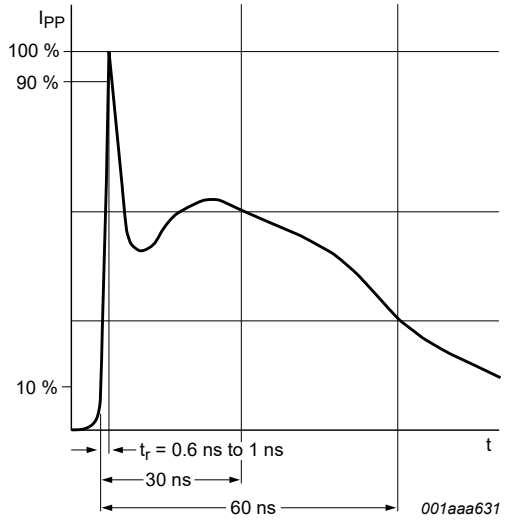

Fig. 2. ESD pulse waveform according to IEC 61000-4-2

9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	417	-	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point		[2]	-	100	-	K/W

[1] Device mounted on an FR4PCB, single-sided copper, tin-plated and standard footprint.
[2] Soldering points at pin 1 and 2.

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10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_F	forward voltage	I_F = 1 mA; T_{amb} = 25 °C		-	0.7	-	V
V_{RWM}	reverse standoff voltage	T_{amb} = 25 °C		-	-	3	V
V_{BR}	breakdown voltage	I_R = 1 mA; T_{amb} = 25 °C		5.1	5.6	6.1	V
I_{RM}	reverse leakage current	V_{RWM} = 3 V; T_{amb} = 25 °C		-	200	500	nA
C_d	diode capacitance	f = 1 MHz; V_R = 0 V; T_{amb} = 25 °C		-	200	240	pF
V_{CL}	clamping voltage	I_{PPM} = 18 A; t_p = 8/20 µs; T_{amb} = 25 °C	[1]	-	13	-	V
S_Z	temperature coefficient	I_Z = 1 mA		-	0.52	-	mV/K

[1] Device stressed with 8/20 µs exponential decay waveform according to IEC 61000-4-5.

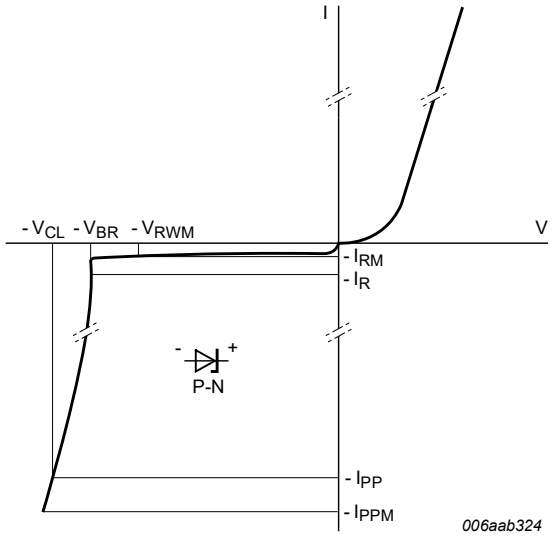
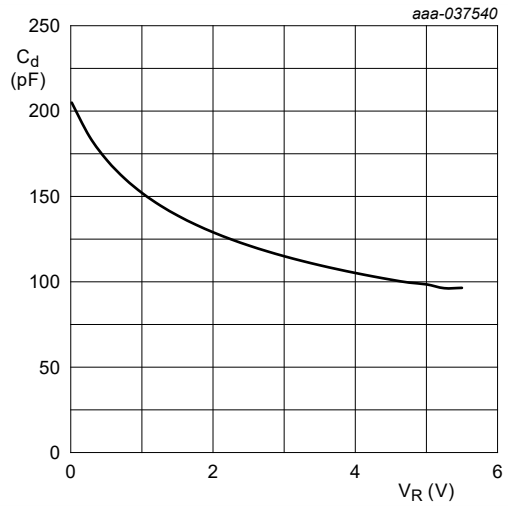
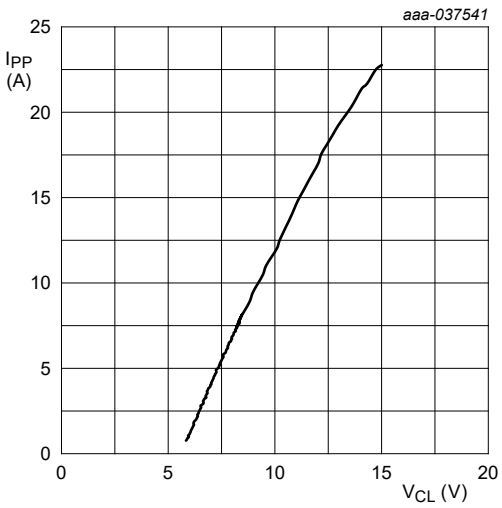


Fig. 3. V-I characteristics for a unidirectional ESD protection diode



f = 1 MHz; T_{amb} = 25 °C

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



f = 1 MHz; T_{amb} = 25 °C

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

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11. Application information

The device is designed for the protection of two lines from the damage caused by ESD and surge pulses.

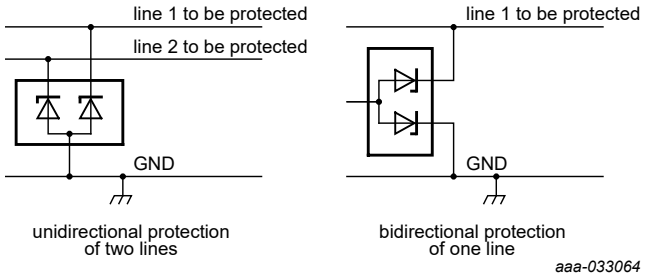

Fig. 6. Typical application

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. Test information

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.

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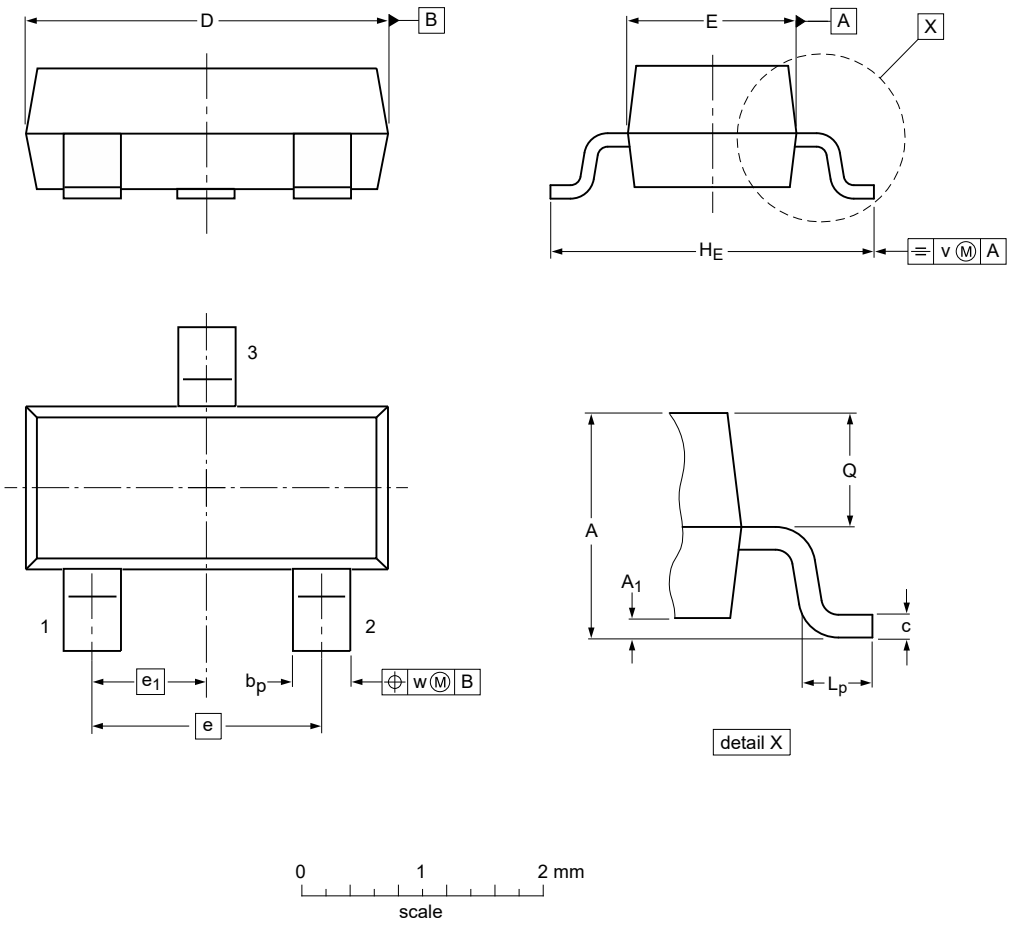
13. Package outline

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			2.5	0.45	0.55		
	nom							1.9	0.95				0.2	0.1
	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. 7. Package outline SOT23

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14. Soldering

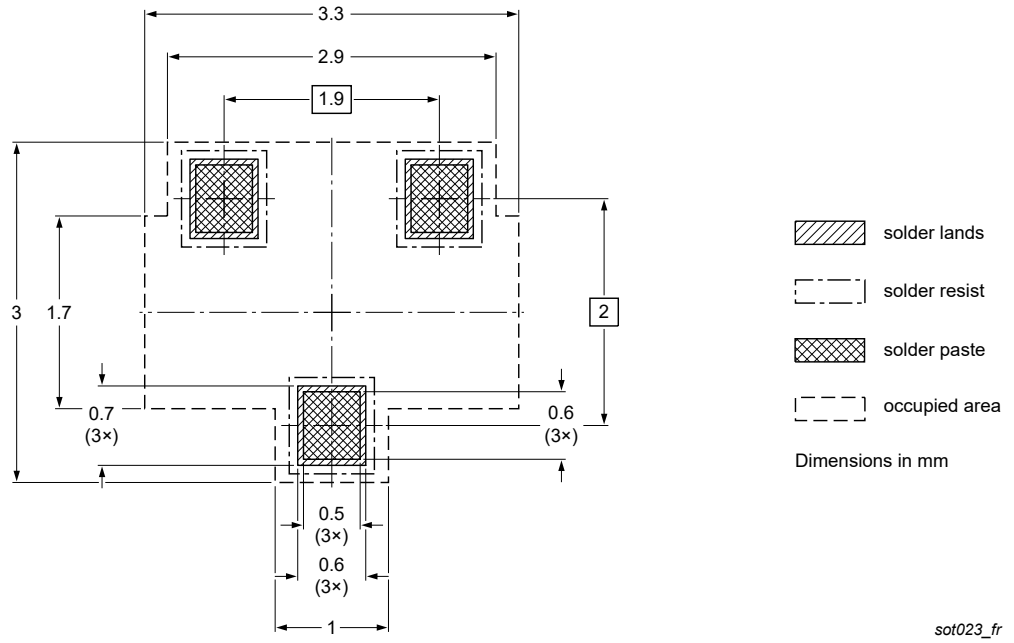

Fig. 8. Reflow soldering footprint for SOT23

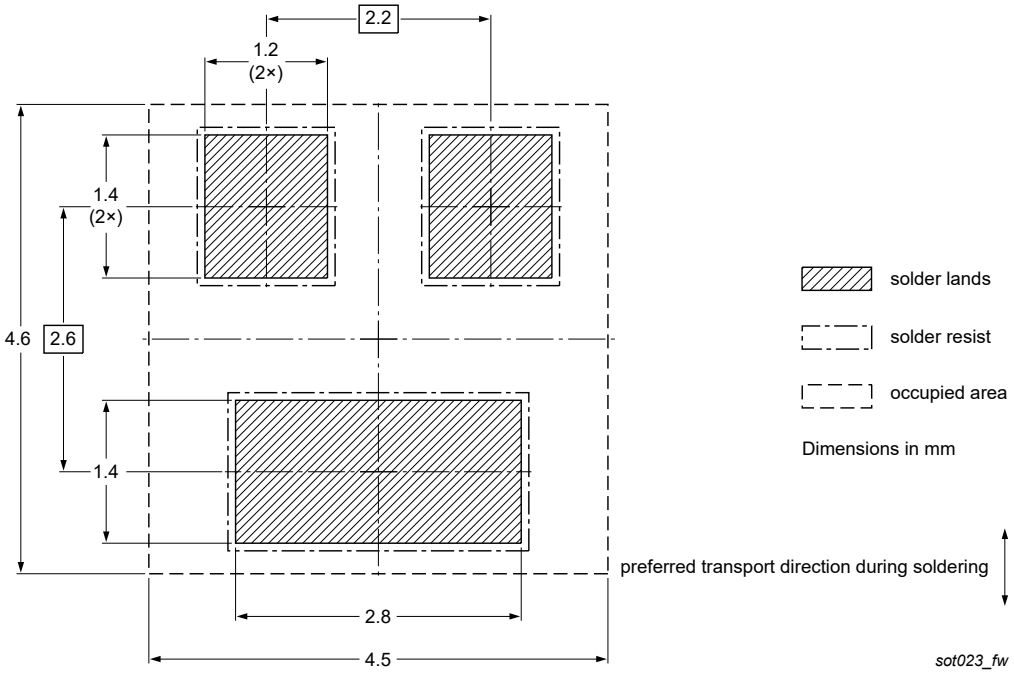

Fig. 9. Wave soldering footprint for SOT23

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15. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
MMBZ5V6AT-Q v.1	20231101	Product data sheet	-	-

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16. 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".
[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 https://www.nexperia.com.

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