



MMBZ33VST-Q

Low capacitance bidirectional single ESD protection diode

19 July 2024

Product data sheet

1. General description

Bidirectional single line ElectroStatic Discharge (ESD) protection diode encapsulated in a SOT23 (TO-236AB) small Surface-Mounted Device (SMD) plastic package. The device is designed for ESD and transient overvoltage protection of one signal line.

2. Features and benefits

- Reverse stand-off voltage: $V_{RWM} = 27\text{ V}$
- Low clamping voltage: $V_{CL} = 36\text{ V}$ at $I_{PP} = 3.5\text{ A}$
- ESD protection up to 30 kV (IEC 61000-4-2)
- ESD protection up to 30 kV (ISO 10605)
- Low capacitance: $C_d = 15.6\text{ pF}$
- Ultra low leakage current: $I_{RM} = 1\text{ nA}$ (typ.)
- AEC-Q101 qualified

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	$T_{amb} = 25\text{ °C}$		-	-	27	V
I_{PPM}	rated peak pulse current	$t_p = 8/20\text{ }\mu\text{s}$	[1] [2]	-	-	3.5	A
V_{CL}	clamping voltage	$I_{PPM} = 3.5\text{ A}$; $t_p = 8/20\text{ }\mu\text{s}$; $T_{amb} = 25\text{ °C}$	[2] [3]	-	36	43	V

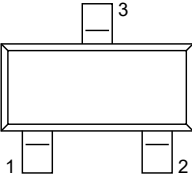
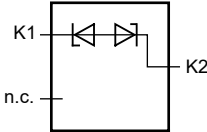
[1] According to IEC 61000-4-5

[2] Measured from pin 1 to pin 3

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

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	K1	cathode (diode 1)	 SOT23	 aaa-039857
2	n.c.	not connected		
3	K2	cathode (diode 2)		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
MMBZ33VST-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]
MMBZ33VST-Q	J1%

[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
I _{PPM}	rated peak pulse current	t _p = 8/20 μs	[1] [2]	-	3.5	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)	[2] [3]	-	30	kV
		ISO10605; contact discharge; C = 330 pF, R = 330 Ω	[2] [3]	-	30	kV
		ISO10605; contact discharge; C = 150 pF, R = 330Ω	[2] [3]	-	30	kV

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

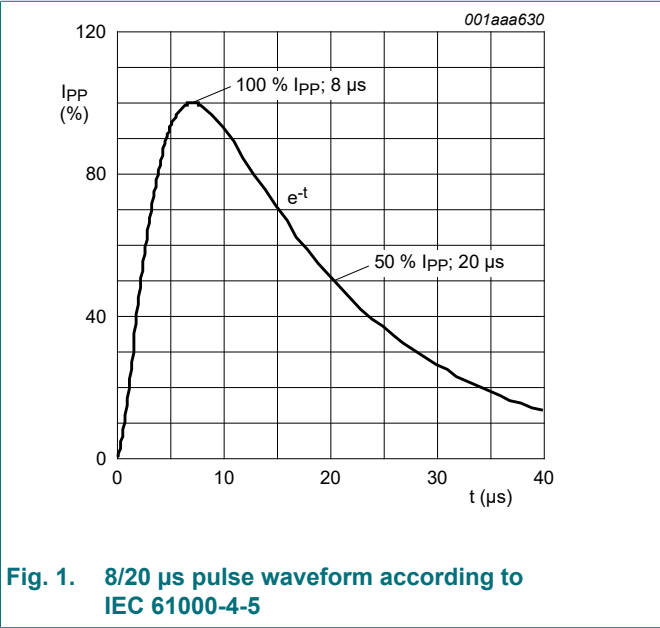


Fig. 1. 8/20 μs pulse waveform according to IEC 61000-4-5

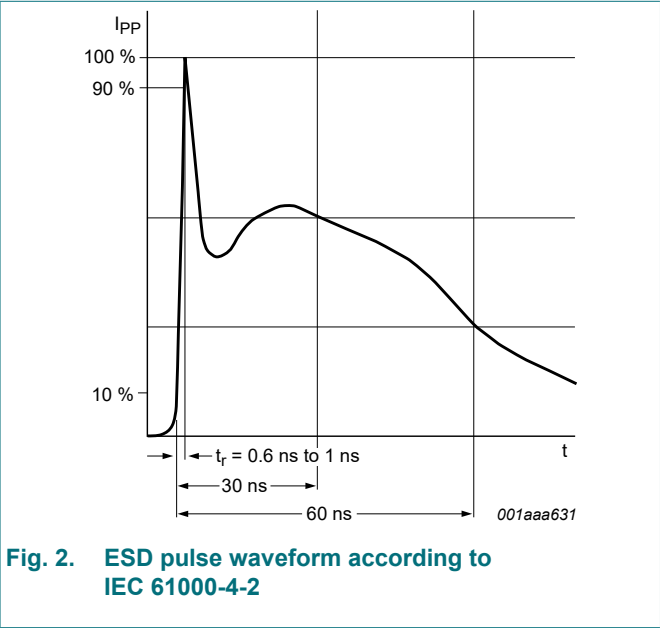


Fig. 2. ESD pulse waveform according to IEC 61000-4-2

9. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V _{RWM}	reverse standoff voltage	T _{amb} = 25 °C		-	-	27	V
V _{BR}	breakdown voltage	I _R = 10 mA; T _{amb} = 25 °C	[1]	28	33	38	V
I _{RM}	reverse leakage current	V _{RWM} = 27 V; T _{amb} = 25 °C	[1]	-	1	50	nA
C _d	diode capacitance	f = 1 MHz; V _R = 0 V; T _{amb} = 25 °C	[1]	-	13	15.6	pF
V _{CL}	clamping voltage	I _{PPM} = 3.5 A; t _p = 8/20 μs; T _{amb} = 25 °C	[1] [2]	-	36	43	V
		I _{PP} = 16 A; t _p = 100 ns; T _{amb} = 25 °C	[1] [3]	-	35	-	V

[1] Measured from pin 1 to pin 3

[2] Device stressed with 8/20 μ s exponential decay waveform according to IEC 61000-4-5

[3] Non-repetitive current pulse, Transmission Line Pulse (TLP); square pulse; ANSI / ESD STM5.5.1-2008

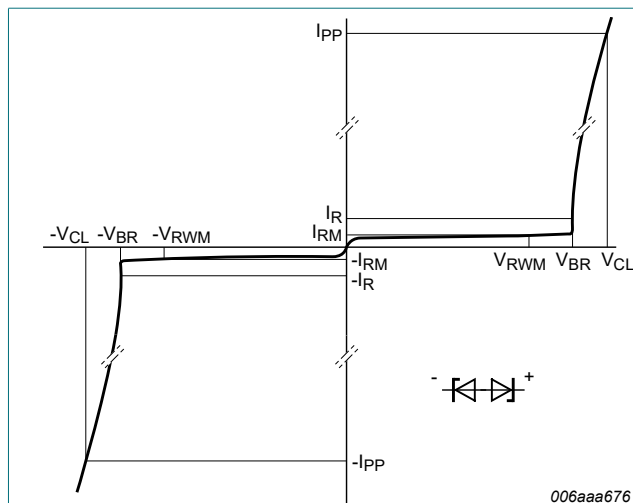


Fig. 3. V-I characteristics for a bidirectional ESD protection diode

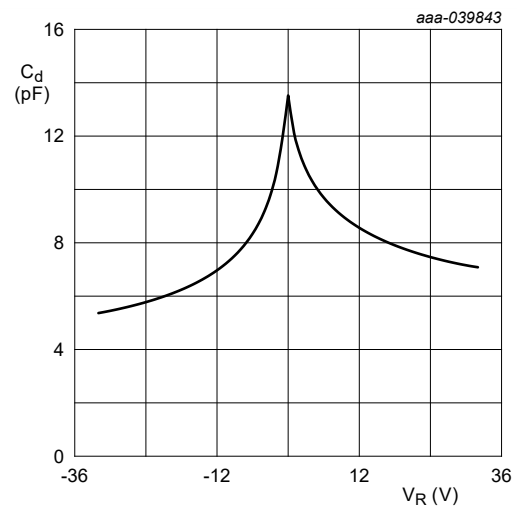
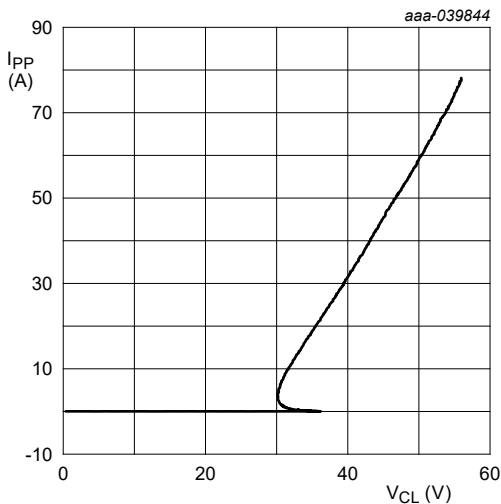
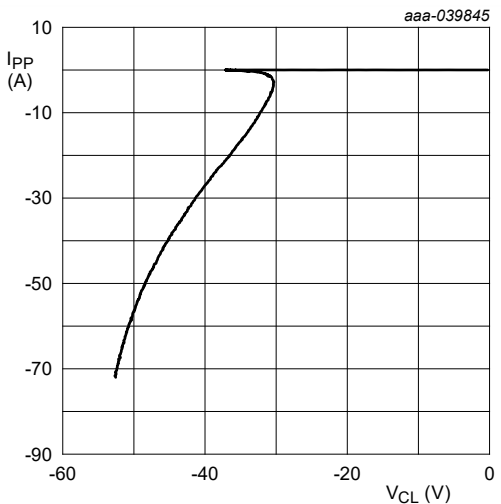


Fig. 4. Diode capacitance as a function of reverse voltage; typical values



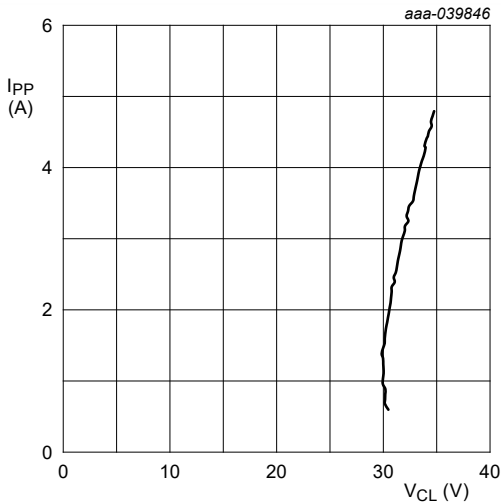
Transmission Line Pulse (TLP);
 $t_p = 100\text{ ns}$; $t_r = 1\text{ ns}$

Fig. 5. Dynamic resistance with positive clamping; typical values



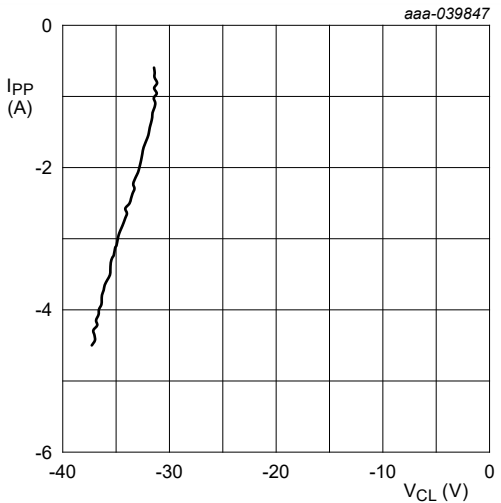
Transmission Line Pulse (TLP);
 $t_p = 100\text{ ns}$; $t_r = 1\text{ ns}$

Fig. 6. Dynamic resistance with negative clamping; typical values



IEC 61000-4-5; $t_p = 8/20\text{ }\mu\text{s}$; positive pulse

Fig. 7. Dynamic resistance with positive clamping; typical values



IEC 61000-4-5; $t_p = 8/20\text{ }\mu\text{s}$; negative pulse

Fig. 8. Dynamic resistance with negative clamping; typical values

10. Application information

The device is designed for the protection of one data line from surge pulses and ESD damage.

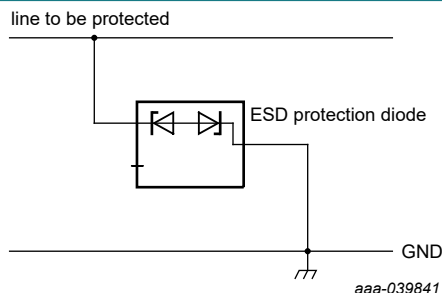


Fig. 9. Application diagram

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.

11. 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.

12. Package outline

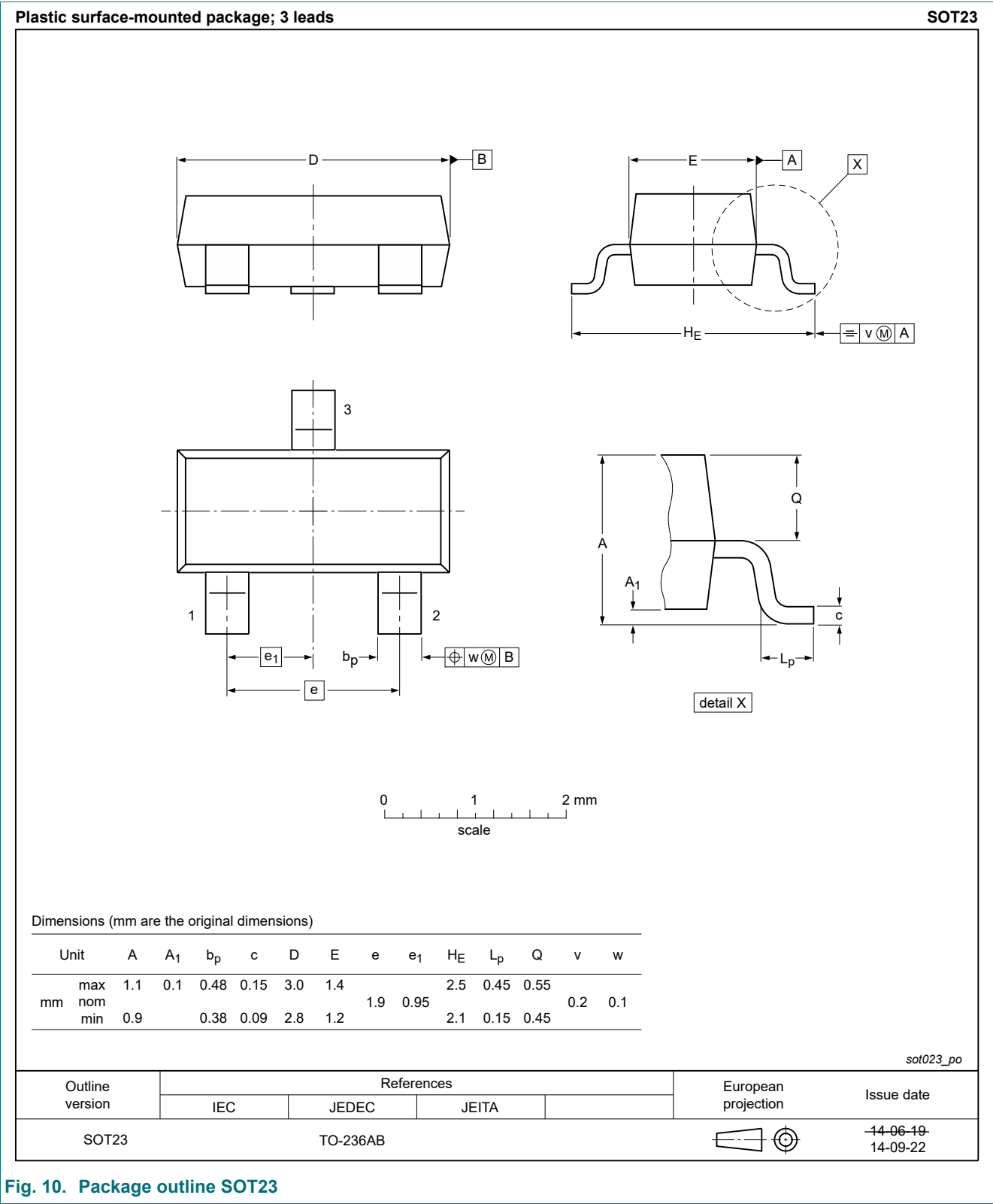


Fig. 10. Package outline SOT23

13. Soldering



Fig. 11. Reflow soldering footprint for SOT23

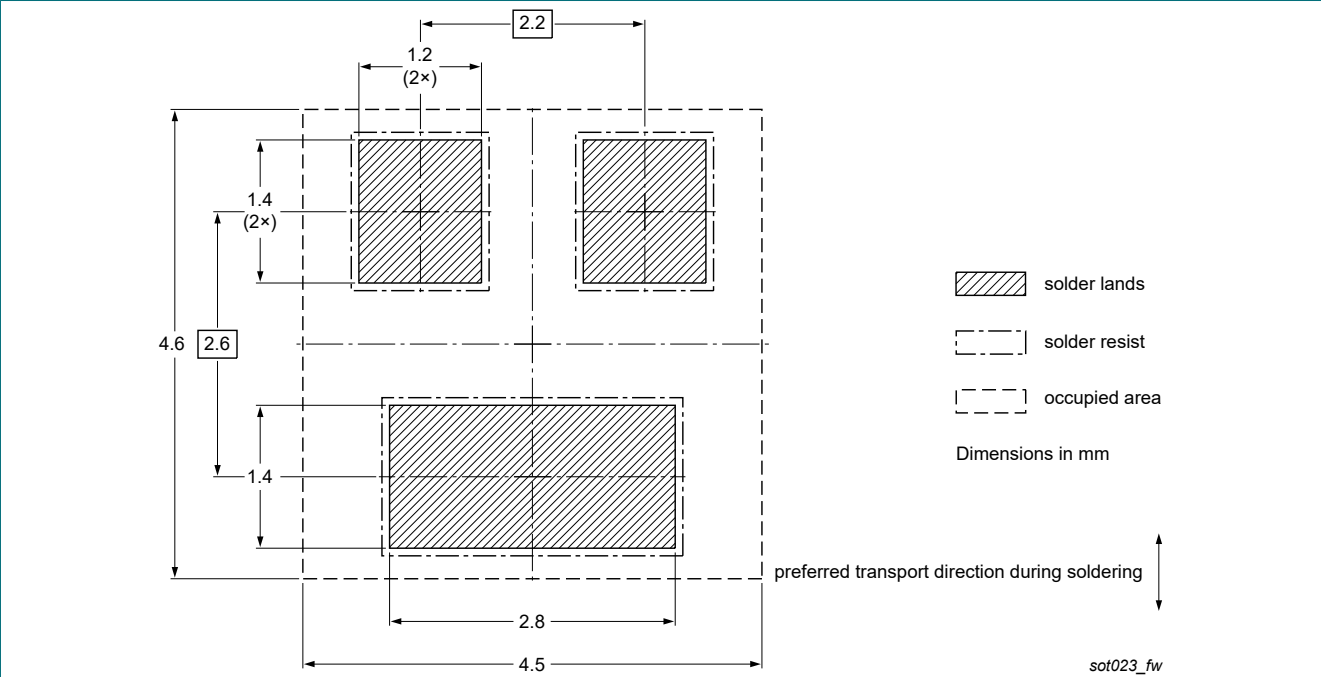


Fig. 12. Wave soldering footprint for SOT23

14. Revision history

Table 7. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
MMBZ33VST-Q v.1	20240719	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.

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