

## General Description

The AOZ7203AV is a Zero Bridge Loss AlphaZBL™ Controller that controls the two external N-channel MOSFETs to replace two low-side diodes when used in AC/DC diode-bridge application. The AOZ7203AV can help the power supply to reduce power consumption and heat dissipation, and can make it easier to reach the titanium level efficiency and shorten engineering development time.

In diode-bridge application, the AOZ7203AV senses the AC input voltage and reduces the forward conduction loss to the minimum value. The AOZ7203AV is self-powered from the AC line without the need of an extra voltage supply.

The AOZ7203AV is available in a SO8 package.

## Features

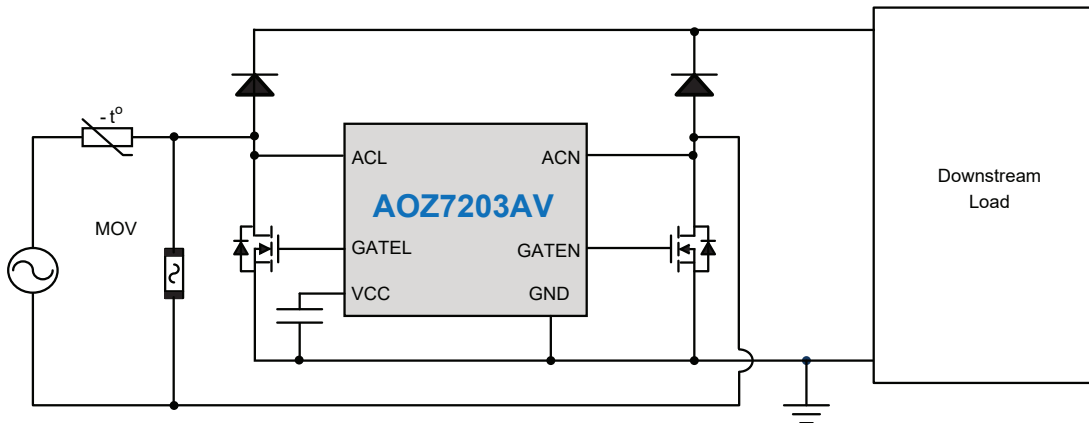
- Replaces two low side diodes in the bridge rectifier
- Increases efficiency and reduces power consumption
- Self-powered in AC system
- Integrated X-capacitor discharge
- Low IC power consumption
- 1x2 drivers compact design
- Very low external part counts
- Avoid gate signal of two low side MOSFET overlapped

## Applications

- High-end adaptors
- Desktops
- Game consoles
- Servers
- Telecom power supplies



## Typical Application



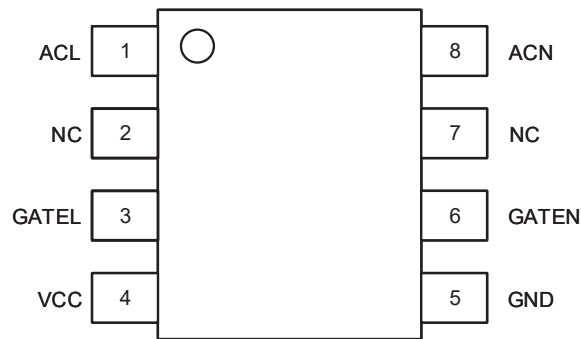
## Ordering Information

Part Number	Ambient Temperature Range	Package	Environmental
AOZ7203AV	-40°C to +125°C	SO8	Green Product



AOS products are offered in packages with Pb-free plating and compliant to RoHS standards. Please visit [www.aosmd.com/media/AOSGreenPolicy.pdf](http://www.aosmd.com/media/AOSGreenPolicy.pdf) for additional information.

## Pin Configuration



**SO8**  
**(Top View)**

## Pin Description

Pin Number	Pin Name	Pin Function
1	ACL	AC Input L; don't apply a DC voltage between the ACL and ACN pins.
2	NC	No Connection.
3	GATEL	Gate Driver for Low Side.
4	VCC	Power Source for Controller.
5	GND	Ground.
6	GATEN	Gate Driver for Low Side N.
7	NC	No Connection.
8	ACN	AC Input N; don't apply a DC voltage between the ACL and ACN pins.

## Absolute Maximum Ratings

Exceeding the Absolute Maximum ratings may damage the device.

Parameter	Rating
VCC to GND	-0.3V to +24V
ACL, ACN to GND, DC	-1V to 600V
ACL, ACN to GND, Negative Transient <sup>(1)</sup>	-5V
GATEL, GATEN to GND	-0.3V to (VCC + 0.3V)
Storage Temperature (T <sub>S</sub> )	-40°C to +150°C
ESD Rating, human body model <sup>(2)</sup> – ACL, ACN	1kV
ESD Rating, human body model – GATEL, GATEN, VCC	2kV
ESD Rating, charge device model	1kV

### Notes:

1. Peak voltages can be applied for 10 minutes over a lifetime.
2. Devices are inherently ESD sensitive, handling precaution are required. Human body model rating: 1.5kΩ in series with 100pF.

## Electrical Characteristics

T<sub>A</sub> = 25°C, VCC = 17V, VGND = 0V, unless otherwise specified.

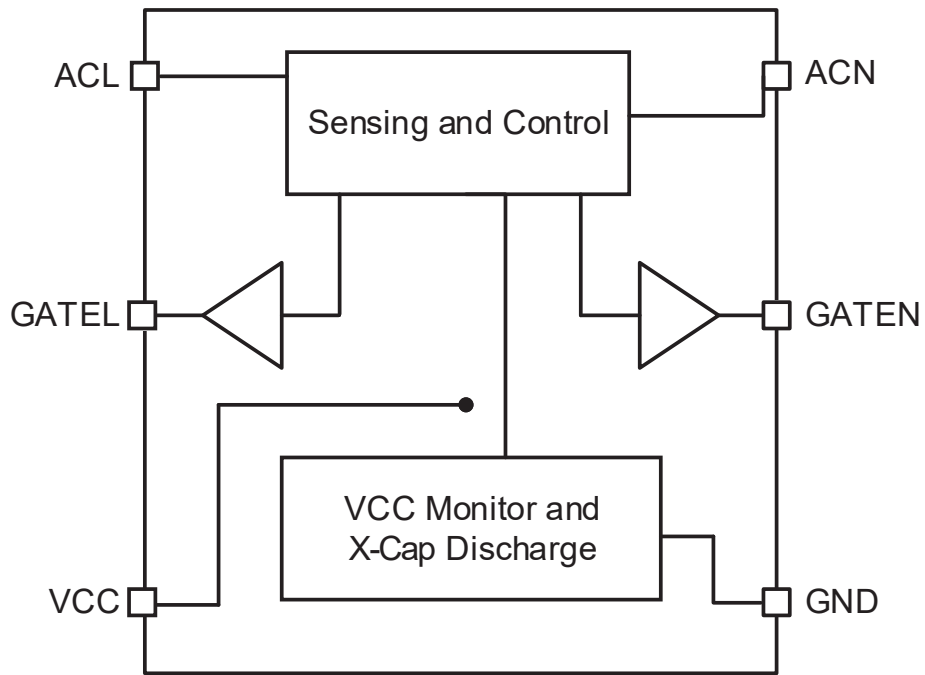
Symbol	Parameter	Conditions	Min	Typ	Max	Units
V <sub>RRM</sub>	Repetitive Peak Reverse Voltage	I <sub>ACL/N</sub> = 250μA	600			V
V <sub>CC_UP</sub>	V <sub>CC</sub> UVLO Rising	V <sub>CC</sub> rising	15.5	16.5	17.5	V
V <sub>CC_UVLO</sub>	V <sub>CC</sub> UVLO Falling	V <sub>CC</sub> falling	11	12.5	14	V
I <sub>Charge</sub>	ACL, ACN Charging for Vcc	V <sub>ACL/N</sub> – V <sub>CC</sub> = 13V	2	2.8		mA
I <sub>off</sub>	ACL, ACN Non-charging	V <sub>ACL/N</sub> = 600V		1	2	μA
I <sub>x-dis</sub>	X-discharge Current	V <sub>ACL/N</sub> – V <sub>CC</sub> = 13V	2	3		mA
T <sub>x-delay</sub>	X-discharge Delay Time	V <sub>ACL/N</sub> rising	80	120	160	ms
I <sub>OP</sub>	Vcc Operation Current at On-state	V <sub>ACL/N</sub> = 0V, V <sub>ACL/N</sub> = 7V		35	45	μA
V <sub>ACL/N_ON</sub>	Switch Turn-on Threshold	V <sub>ACN/L</sub> = 0V, V <sub>ACL/N</sub> rising		5		V
V <sub>ACL/N_OFF</sub>	Switch Turn-off Threshold	V <sub>ACN/L</sub> = 0V, V <sub>ACL/N</sub> falling		0.75		V
T <sub>d_on</sub>	Turn-on Delay Time	V <sub>ACN/L</sub> = 0V, V <sub>ACL/N</sub> rising		4	5	μs
T <sub>d_off</sub>	Turn-off Delay Time	V <sub>ACN/L</sub> = 0V, V <sub>ACL/N</sub> falling		0.1	0.2	μs
T <sub>pp</sub>	ACL, ACN Propagation Delay Time	GATEL, GATEN swap states	15	45	65	μs
I <sub>GATEL/N_source</sub>	Gate Pull-high Current	V <sub>cc</sub> = 16V V <sub>GATEL/N</sub> = 10V	125	200	295	mA
I <sub>GATEL/N_sink</sub>	Gate Pull-low Current	V <sub>cc</sub> = 16V V <sub>GATEL/N</sub> = 6V	300	380	430	mA
R <sub>GATEL/N_source</sub>	Gate Pull-high Resistance		15	20	25	Ω
R <sub>GATEL/N_sink</sub>	Gate Pull-low Resistance		4	7	10	Ω

## Recommended Operating Conditions

The device is not guaranteed to operate beyond the Maximum Recommended Operating Conditions.

Parameter	Rating
ACL, ACN to GND, DC	440V
Junction Temperature (T <sub>J</sub> )	-40°C to +125°C
Package Thermal Resistance SO8 (Θ <sub>JA</sub> )	115°C/W

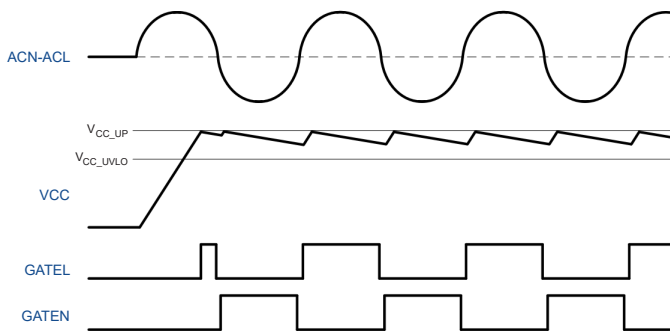
## Functional Block Diagram



## Detailed Description

The AOZ7203AV with a low-voltage capacitor can drive the two external N-MOSFETs to replace two low-side diodes in the traditional bridge rectifier application.

In normal operation, after  $V_{CC}$  is charged to UVLO rising level  $V_{CC\_UP}$ , AOZ7203AV senses the voltages of input pins ACL and ACN to determine when to turn high one of the gates GATEL and GATEN. When the ACL voltage approaches zero and the ACN voltage rises above the switch turn-on threshold  $V_{ACL/N\_ON}$  (5V typical), the GATEL is turned high and the N-MOSFET driven by GATEL is on. When this half AC cycle comes near the end, the ACN voltage falls below the switch turn-off threshold  $V_{ACL/N\_OFF}$  (0.75V typical) and the GATEL is turned low. Thus the conduction loss in this half AC cycle is reduced. On the next half AC cycle, the N-MOSFET driven by GATEN is controlled in the similar way to reduce the conduction loss.

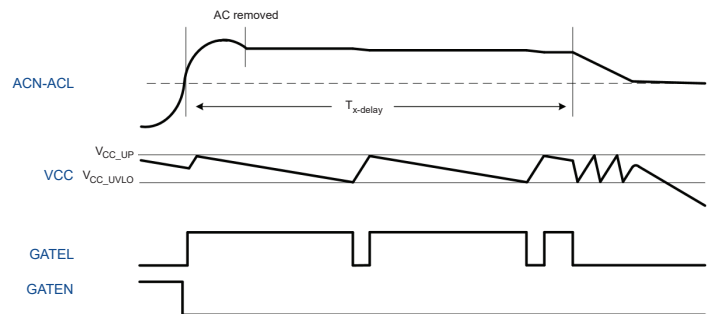


**Figure 1. Startup and Normal Operation**

When the AC input voltage is connected, the VCC capacitor is first charged to UVLO rising level  $V_{CC\_UP}$  via the ACL or ACN pin. During normal operation, VCC capacitor is also charged when the voltage of ACL or ACN rises from zero to the level a little bit above the VCC voltage. The power

consumption during charging is thus minimized to about 1mW to 2mW for AC input with typical line frequency, and the VCC voltage is thus kept above the UVLO falling level  $V_{CC\_UVLO}$  if VCC capacitor is large enough. The value of VCC capacitor is recommended not smaller than  $1\mu\text{F}/25\text{V}$  for typical application.

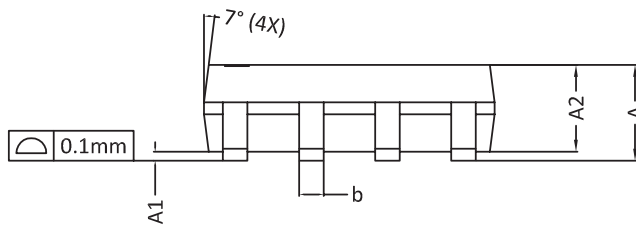
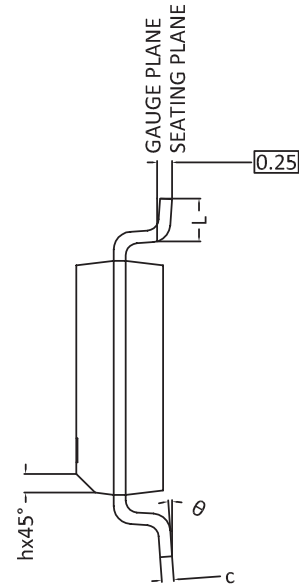
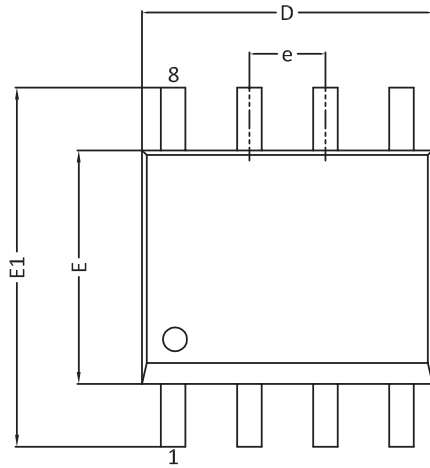
When the AC input voltage is removed, after about the X-discharge delay time  $T_{x\text{-delay}}$ , the AOZ7203AV enters X-cap discharge mode. The X-discharge current  $I_{x\text{-dis}}$  is pulled via the ACL or ACN pin to discharge the X capacitors. The GATEL and GATEN are kept low in this mode. If the AC input voltage comes back, the AOZ7203AV detects the voltage change on the ACL and ACN pin and leaves the X-cap discharge mode. The VCC voltage is then recharged and the AOZ7203 operates normally again.



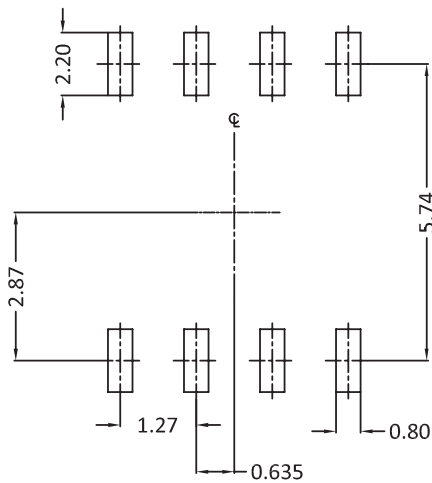
**Figure 2. X-discharge Waveform**

**Note that AOZ7203AV does not support DC input applications.** When the input voltage between ACL and ACN is a DC, after about the X-discharge delay time  $T_{x\text{-delay}}$ , the AOZ7203AV also enters X-cap discharge mode. Then AOZ7203AV keeps pulling the current  $I_{x\text{-dis}}$  via the ACL or ACN pin and driving GATEL and GATEN low. So there is no benefit of power loss reduction.

**Package Dimensions, SO8**



**RECOMMENDED LAND PATTERN**



SYMBOLS	DIMENSION IN MM			DIMENSION IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	1.35	1.65	1.75	0.053	0.065	0.069
A1	0.10	0.15	0.25	0.004	0.006	0.010
A2	1.25	1.50	1.65	0.049	0.059	0.065
b	0.31	0.41	0.51	0.012	0.016	0.020
c	0.17	0.20	0.25	0.007	0.008	0.010
D	4.80	4.90	5.00	0.189	0.193	0.197
E	3.80	3.90	4.00	0.150	0.154	0.157
E1	5.80	6.00	6.20	0.228	0.236	0.244
e	1.27 BSC			0.050 BSC		
h	0.25	0.30	0.50	0.010	0.012	0.020
L	0.40	0.69	1.27	0.016	0.027	0.050
θ	0°	4°	8°	0°	4°	8°

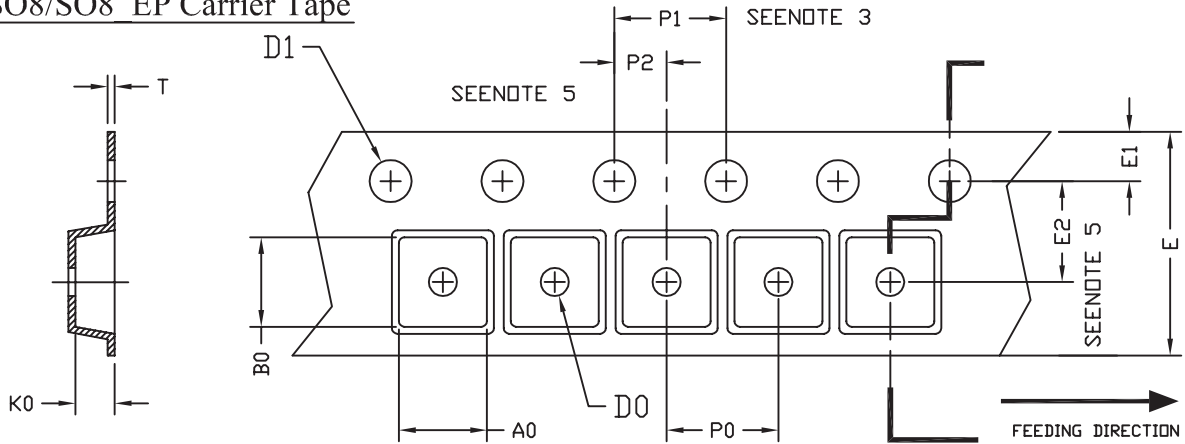
UNIT: mm

**NOTE**

1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. DIMENSIONS ARE INCLUSIVE OF PLATING.
3. PACKAGE BODY SIZES EXCLUDE MOLD FLASH AND GATE BURRS.  
MOLD FLASH AT THE NON-LEAD SIDES SHOULD BE LESS THAN 6 MILS EACH.
4. DIMENSION L IS MEASURED IN GAUGE PLANE.
5. CONTROLLING DIMENSION IS MILLIMETER.  
CONVERTED INCH DIMENSIONS ARE NOT NECESSARILY EXACT.

**Tape and Reel Dimensions, SO8**

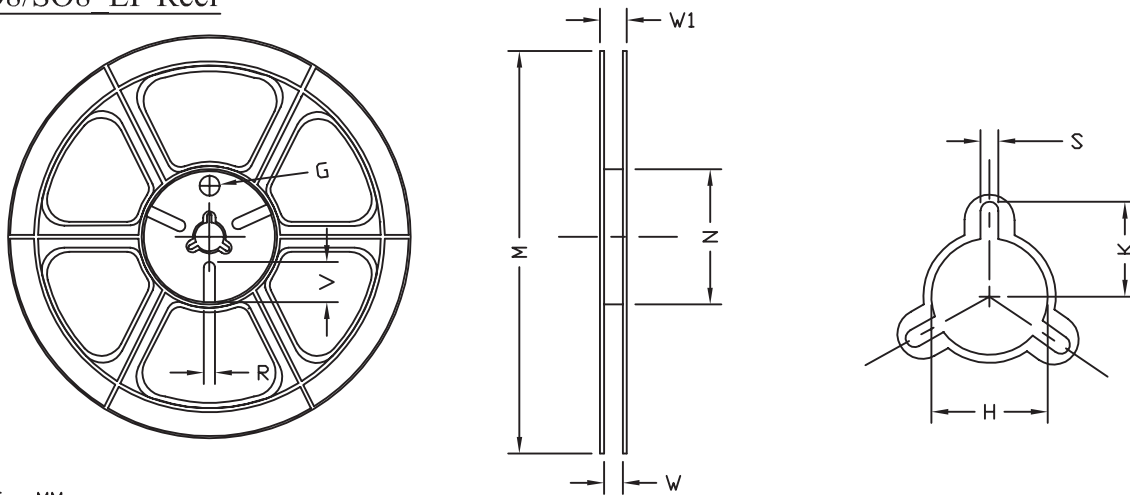
**SO7/SO8/SO8 EP Carrier Tape**



UNIT: MM

PACKAGE	A0	B0	K0	D0	D1	E	E1	E2	P0	P1	P2	T
SO7/SO-8 (12 mm)	6.40 ±0.10	5.20 ±0.10	2.10 ±0.10	1.60 ±0.10	1.50 +0.10	12.00 ±0.30	1.75 ±0.10	5.50 ±0.05	8.00 ±0.10	4.00 ±0.10	2.00 ±0.05	0.25 ±0.05

**SO7/SO8/SO8 EP Reel**



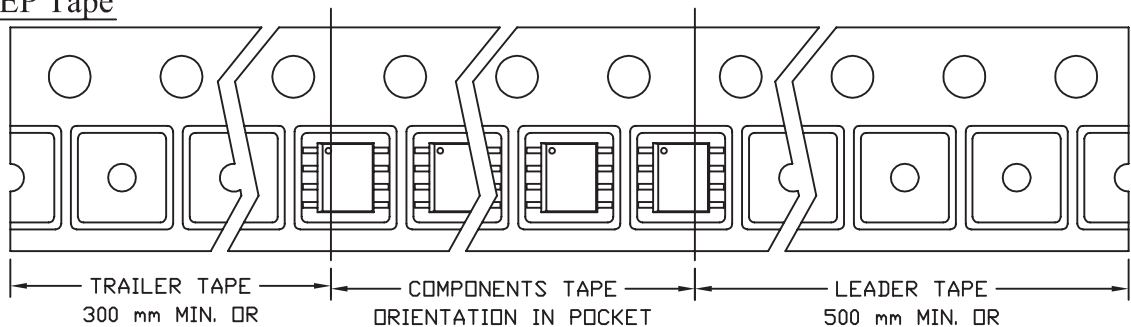
UNIT: MM

TAPE SIZE	REEL SIZE	M	N	W	W1	H	K	S	G	R	V
12 mm	ø330	ø330.00 ±0.50	ø97.00 ±0.10	13.00 ±0.30	17.40 ±1.00	ø13.00 +0.50 -0.20	10.60	2.00 ±0.50	---	---	---

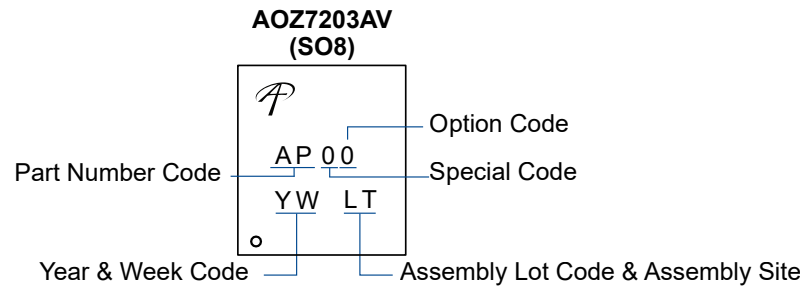
**SO7/SO8/SO8 EP Tape**

Leader / Trailer  
& Orientation

Unit Per Reel:  
3000pcs



## Part Marking



Part Number	Description	Code
AOZ7203AV	Green Product	AP00

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- A critical component in any component of a life support device, or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.