ACE717C

High Efficiency 1.2MHz 24V Step-up DC/DC Converter

Description

The ACE717C is a constant frequency, current mode step-up converter intended for small, low power applications. The ACE717C switches at 1.2MHz and allows the use of tiny, low cost capacitors and inductors 2mm or less in height. Internal soft-start results in small inrush current and extends battery life. The ACE717C includes under-voltage lockout, current limiting, and thermal overload protection to prevent damage in the event of an output overload.

ACE717C is available in SOT23-6 package that is PB free.

Features

- 2V to 24V Input Voltage
- Up to 24 Output Voltage
- Integrated 80mΩ Power MOSFET
- 1.2MHz Fixed Switching Frequency
- Internal 2A Switch Current Limit
- Internal Compensation
- Thermal Shutdown
- Output Adjustable from 0.6V
- Available in SOT23-6 Package

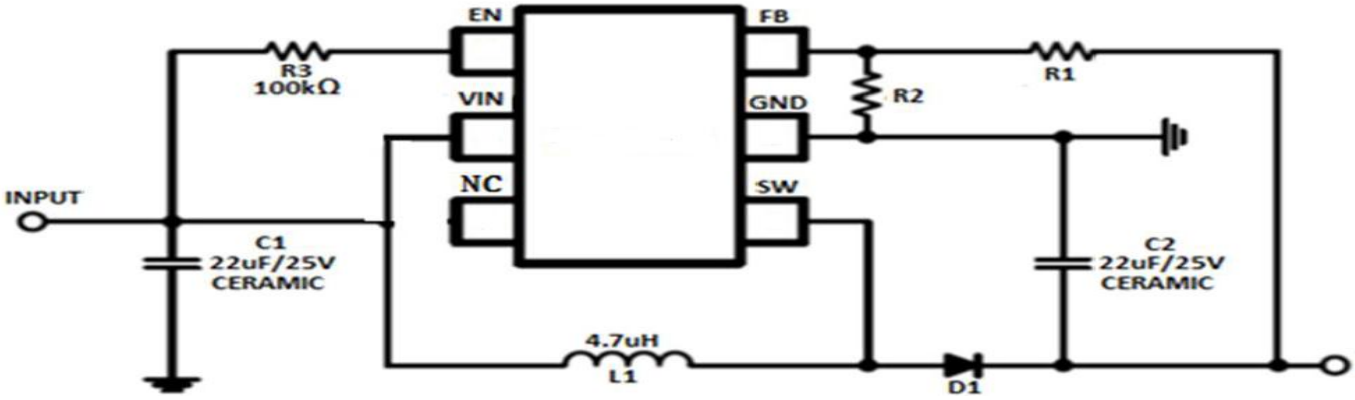
Application

- ABS Set-Top Boxed
- DVB-S/S2

Absolute Maximum Ratings

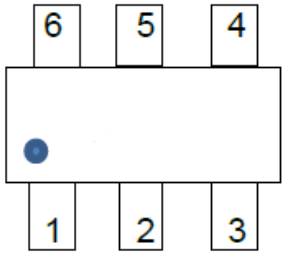
Parameter		Max
IN, EN Pin Voltage		-0.3V to 24V
SW Pin Voltage		-0.3V to 24V
All Other Pin Voltage		-0.3V to 6V
Junction Temperature (T_J)		150°C
Ambient Temperature (T_A)		-40°C to 85°C
Power Dissipation	SOT23-6	600mW
Thermal Resistance (θ_{JA})		250°C /W
Thermal Resistance (θ_{JC})		130°C /W
Storage Temperature (Ts)		-65°C to 150°C
Lead Temperature & Time		260°C, 10Sec

Typical Application



Packaging Type

SOT-23-6A/ SOT-23-6B



Pin No.		Symbol	Description
SOT-23-6A	SOT-23-6B		
1	1	SW	Power Switch Output. SW is the drain of the internal MOSFET switch. Connect the power inductor and output rectifier to SW. SW can swing between GND and 24V.
2	2	GND	Ground.
3	3	FB	Feedback Input. The FB voltage is 0.25V. Connect a resistor divider to FB.
4	4	EN	Regulator On/Off Control Input. A high input at EN turns on the converter, and a low input turns it off. When not used, connect EN to the input supply for automatic startup.
5	6	VIN	Power Supply. Must be locally bypassed.
6	5	NC	No Connection

Ordering Information

ACE717CXX + H

- Halogen - free
- Pb - free
- GMA：SOT-23-6A
- GMB：SOT-23-6B

Recommended Work Conditions

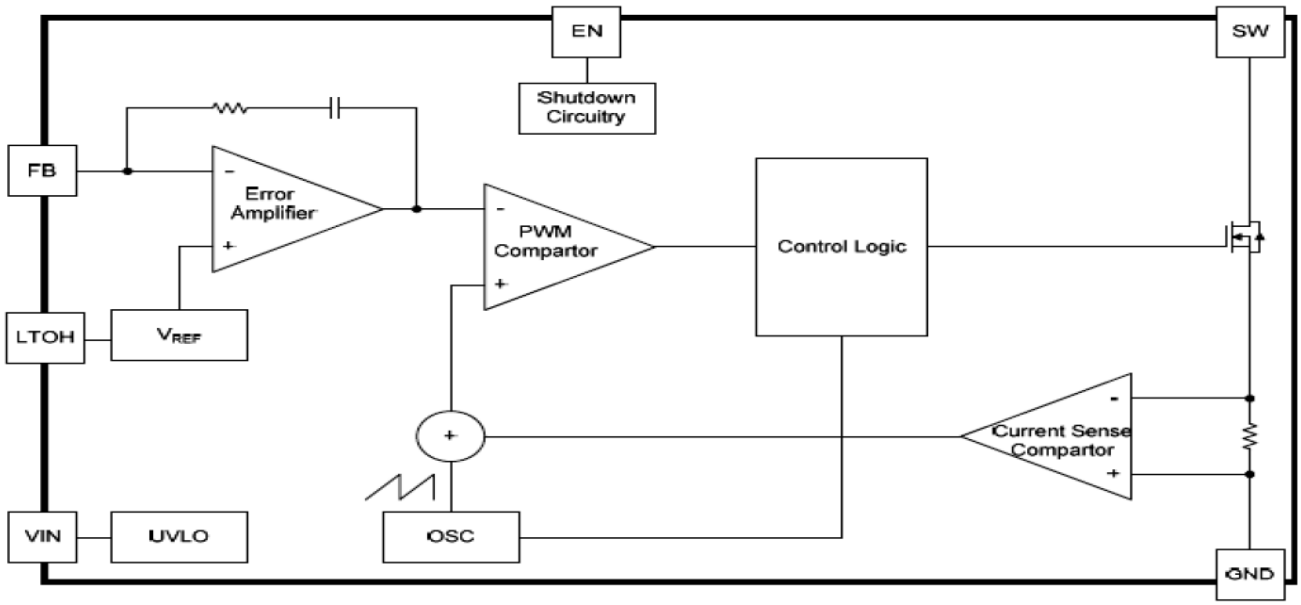
Parameter	Value
Input Voltage Range	2V to 24V
Output Voltage Range	VIN to 24V
Operating Junction Temperature(Tj)	-40°C –125°C

Electrical Characteristics

(Ta=25℃, unless otherwise noted)

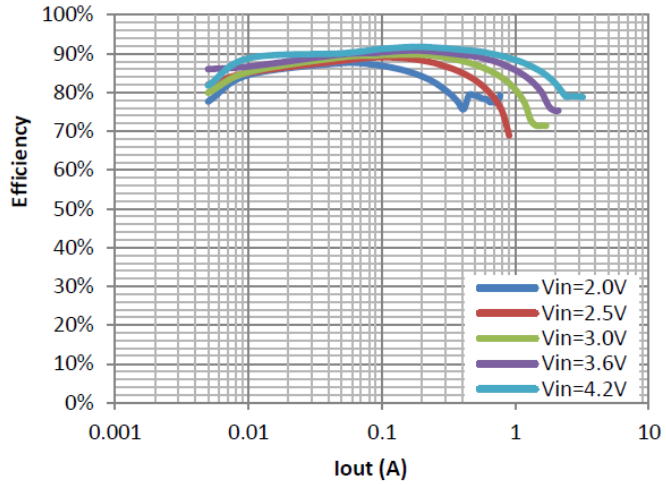
Parameter	Symbol	Conditions	Min	Typ	Max	Units
V_{IN}	Operating Input Voltage		2		24	V
V_{FB}	Feedback Voltage		588	600	612	mV
I_{FB}	FB input Bias Current	V_{FB}=0.6V	-50	-10		nA
	SW Leakage	V_{SW}=20V			1	uA
I_Q	Quiescent Current	V_{FB}=0.5V, Switch		0.2	0.4	mA
		V_{EN}=0V		0.1	1	uA
F_{SW}	Oscillator Frequency	V_{FB}=0.75V		1.2		MHz
D_{MAX}	Maximum Duty Cycle	V_{FB}=0.7V		90		%
V_{EN}	EN Threshold			1		V
	SW On-Resistance			80	150	mΩ
I_{LIMIT}	Current Limit	V_{IN}=5V, Duty Cycle = 50%		2		A
	Thermal Shutdown			160		°C

Block Diagram

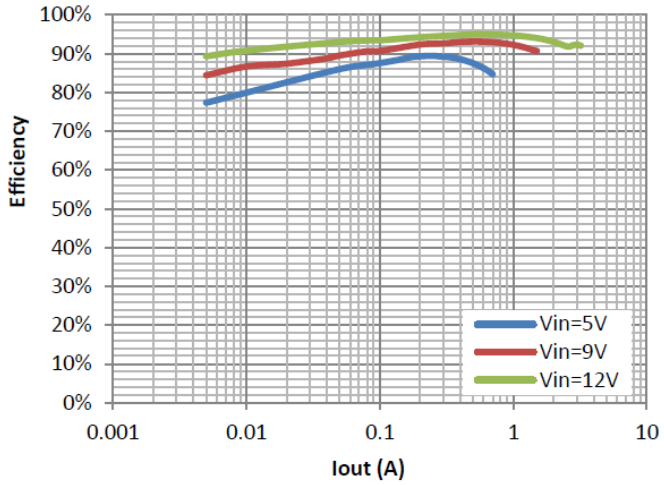


Typical Performance Characteristics

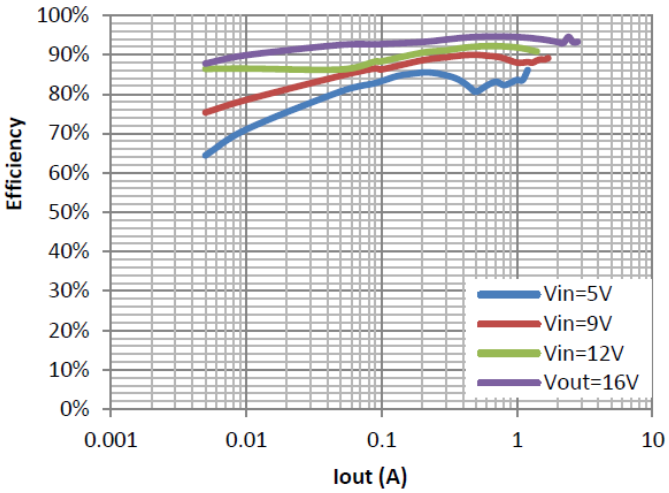
Efficiency vs. Output Current (Vout=5V)



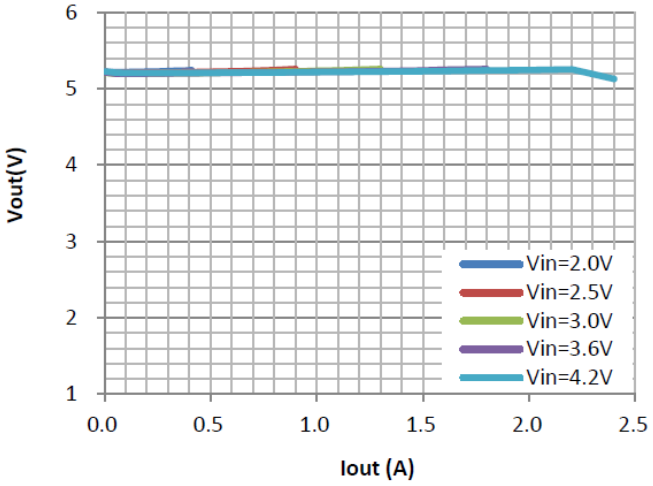
Efficiency vs. Output Current (Vout=14V)



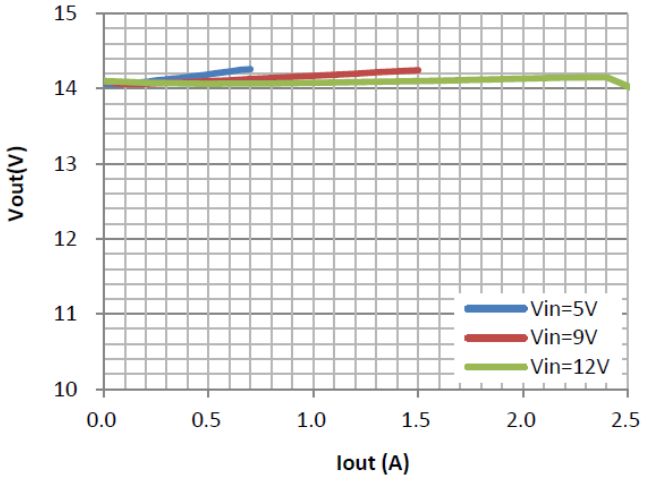
Efficiency vs. Output Current (Vout=19V)



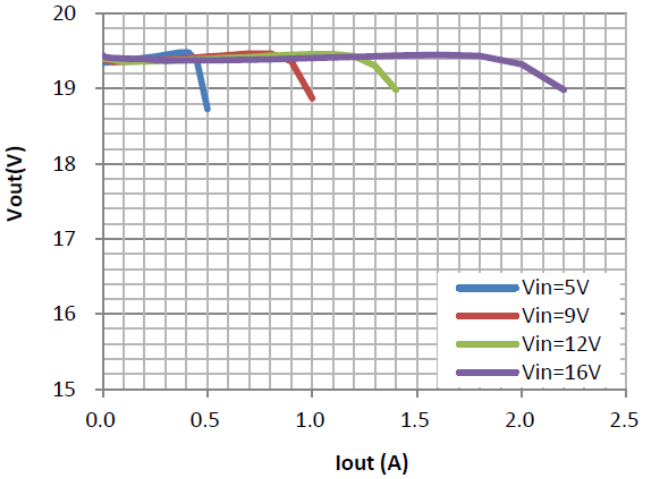
Load Regulation (Vout=5V)

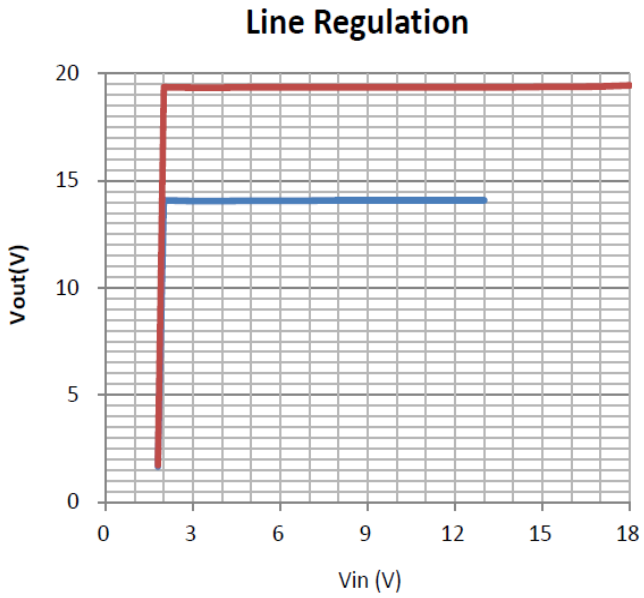


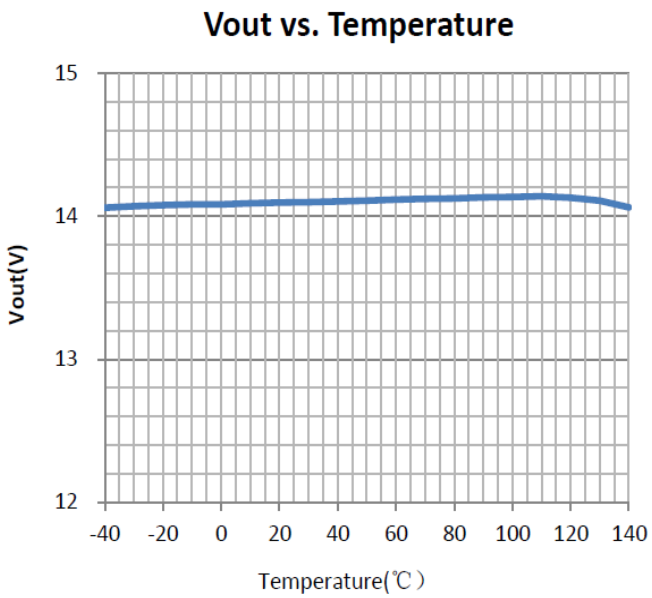
Load Regulation (Vout=14V)



Load Regulation (Vout=19V)







Detailed Description

The ACE717C uses a fixed frequency, peak current mode boost regulator architecture to regulate voltage at the feedback pin. The operation of the ACE717C can be understood by referring to the block diagram of Figure 3. At the start of each oscillator cycle the MOSFET is turned on through the control circuitry. To prevent sub-harmonic oscillations at duty cycles greater than 50 percent, a stabilizing ramp is added to the output of the current sense amplifier and the result is fed into the negative input of the PWM comparator. When this voltage equals The output voltage of the error amplifier the power MOSFET is turned off. The voltage at the output of the error amplifier is an amplified version of the difference between the 0.6V band gap reference voltage and the feedback voltage. In this way the peak current level keeps the output in regulation. If the feedback voltage starts to drop, the output of the error amplifier increases. These results in more current to flow through the power MOSFET, thus increasing the power delivered to the output. The ACE717C has internal soft start to limit the amount of input current at startup and to also limit the amount of overshoot on the output.

Application Information

Setting the Output Voltage

The internal reference VREF is 0.6V (Typical).The output voltage is divided by a resistor divider, R1 and R2 to the FB pin. The output voltage is given by

$$V_{OUT} = V_{REF} \times \left(\frac{1 + R_1}{R_2}\right)$$

Inductor Selection

The recommended values of inductor are 4.7 to 22μH. Small size and better efficiency are the major concerns for portable device, such as ACE717C used for mobile phone. The inductor should have low core loss at 1.2MHz and low DCR for better efficiency. To avoid inductor saturation current rating should be considered.

Capacitor Selection

Input and output ceramic capacitors of 22μF are recommended for ACE717C applications. For better voltage filtering, ceramic capacitors with low ESR are recommended. X5R and X7R types are suitable because of their wider voltage and temperature ranges.

Diode Selection

Schottky diode is a good choice for ACE717C because of its low forward voltage drop and fast reverses recovery. Using Schottky diode can get better efficiency. The high speed rectification is also a good characteristic of Schottky diode for high switching frequency. Current rating of the diode must meet the root mean square of the peak current and output average current multiplication as following:

$$I_D(RMS) \approx \sqrt{I_{OUT} \times I_{PEAK}}$$

The diode' s reverse breakdown voltage should be larger than the output voltage.

Layout Consideration

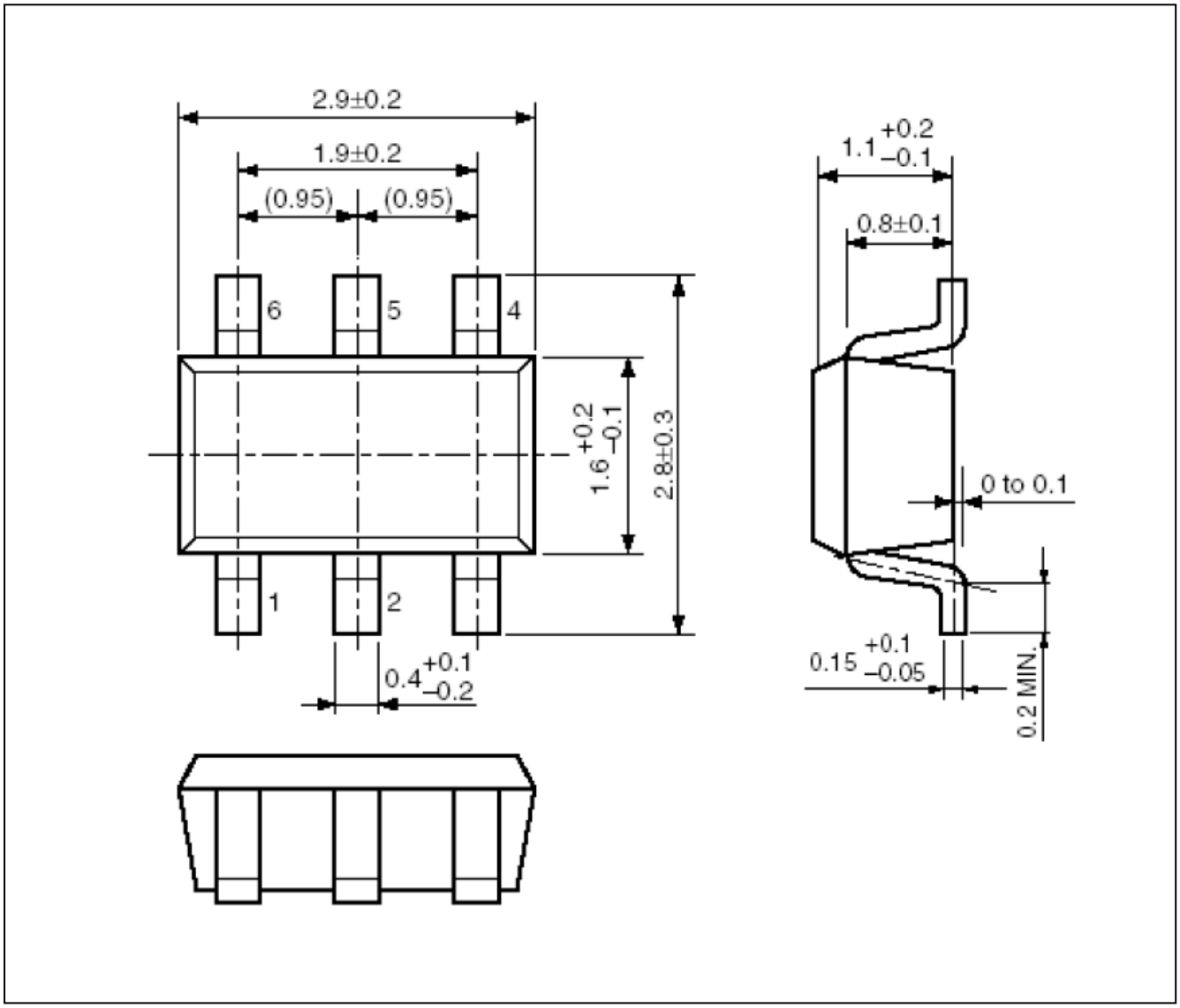
When laying out the printed circuit board, the following checking should be used to ensure proper operation of the ACE717C .

Check the following in your layout:

1. The power traces, consisting of the GND trace, the SW trace and the VIN, trace should be kept short, direct and wide.
2. Does the (+) plates of Cin connect to Vin as closely as possible. This capacitor provides the AC current to the internal power MOSFETs.
3. Keep the switching node SW away from the sensitive VOUT node.
4. Keep the (-) plates of Cin and Cout as close as possible

Packing Information

SOT-23-6



Notes

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2. A critical component is 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.