

# LM741

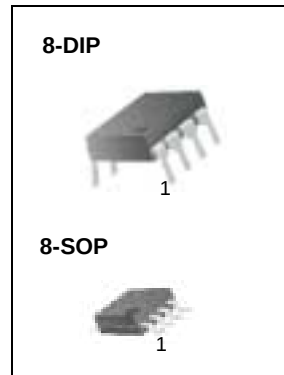
## Single Operational Amplifier

### Features

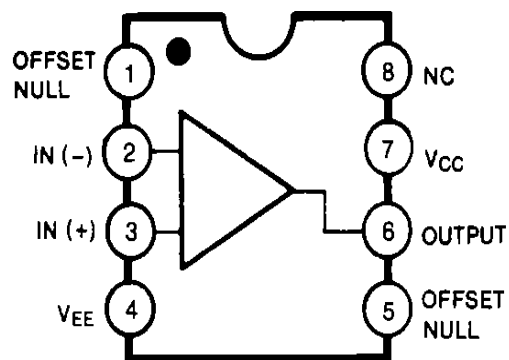
- Short circuit protection
- Excellent temperature stability
- Internal frequency compensation
- High Input voltage range
- Null of offset

### Description

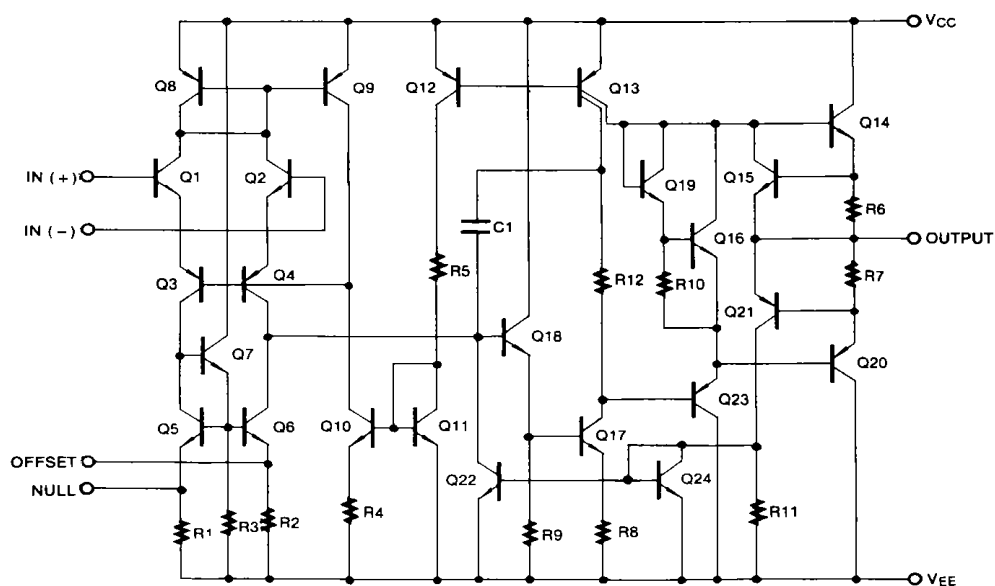
The LM741 series are general purpose operational amplifiers. It is intended for a wide range of analog applications. The high gain and wide range of operating voltage provide superior performance in integrator, summing amplifier, and general feedback applications.



### Internal Block Diagram



## Schematic Diagram



## Absolute Maximum Ratings ( $T_A = 25^\circ\text{C}$ )

| Parameter                                       | Symbol        | Value                  | Unit             |
|-------------------------------------------------|---------------|------------------------|------------------|
| Supply Voltage                                  | $V_{CC}$      | $\pm 18$               | V                |
| Differential Input Voltage                      | $V_{I(DIFF)}$ | 30                     | V                |
| Input Voltage                                   | $V_I$         | $\pm 15$               | V                |
| Output Short Circuit Duration                   | -             | Indefinite             | -                |
| Power Dissipation                               | $P_D$         | 500                    | mW               |
| Operating Temperature Range<br>LM741C<br>LM741I | $T_{OPR}$     | 0 ~ + 70<br>-40 ~ + 85 | $^\circ\text{C}$ |
| Storage Temperature Range                       | $T_{STG}$     | -65 ~ + 150            | $^\circ\text{C}$ |

## Electrical Characteristics

( $V_{CC} = 15V$ ,  $V_{EE} = -15V$ ,  $T_A = 25^\circ C$ , unless otherwise specified)

| Parameter                             |           | Symbol       | Conditions                                                            | LM741C/LM741I |          |      | Unit       |
|---------------------------------------|-----------|--------------|-----------------------------------------------------------------------|---------------|----------|------|------------|
|                                       |           |              |                                                                       | Min.          | Typ.     | Max. |            |
| Input Offset Voltage                  |           | $V_{IO}$     | $R_S \leq 10K\Omega$                                                  | -             | 2.0      | 6.0  | mV         |
|                                       |           |              | $R_S \leq 50\Omega$                                                   | -             | -        | -    |            |
| Input Offset Voltage Adjustment Range |           | $V_{IO(R)}$  | $V_{CC} = \pm 20V$                                                    | -             | $\pm 15$ | -    | mV         |
| Input Offset Current                  |           | $I_{IO}$     | -                                                                     | -             | 20       | 200  | nA         |
| Input Bias Current                    |           | $I_{BIAS}$   | -                                                                     | -             | 80       | 500  | nA         |
| Input Resistance (Note1)              |           | $R_I$        | $V_{CC} = \pm 20V$                                                    | 0.3           | 2.0      | -    | $M\Omega$  |
| Input Voltage Range                   |           | $V_I(R)$     | -                                                                     | $\pm 12$      | $\pm 13$ | -    | V          |
| Large Signal Voltage Gain             |           | $G_V$        | $R_L \geq 2K\Omega$<br>$V_{CC} = \pm 20V$ ,<br>$V_{O(P-P)} = \pm 15V$ | -             | -        | -    | V/mV       |
|                                       |           |              | $V_{CC} = \pm 15V$ ,<br>$V_{O(P-P)} = \pm 10V$                        | 20            | 200      | -    |            |
| Output Short Circuit Current          |           | $I_{SC}$     | -                                                                     | -             | 25       | -    | mA         |
| Output Voltage Swing                  |           | $V_{O(P-P)}$ | $V_{CC} = \pm 20V$<br>$R_L \geq 10K\Omega$                            | -             | -        | -    | V          |
|                                       |           |              | $R_L \geq 2K\Omega$                                                   | -             | -        | -    |            |
|                                       |           |              | $V_{CC} = \pm 15V$<br>$R_L \geq 10K\Omega$                            | $\pm 12$      | $\pm 14$ | -    |            |
|                                       |           |              | $R_L \geq 2K\Omega$                                                   | $\pm 10$      | $\pm 13$ | -    |            |
| Common Mode Rejection Ratio           |           | CMRR         | $R_S \leq 10K\Omega$ , $V_{CM} = \pm 12V$                             | 70            | 90       | -    | dB         |
|                                       |           |              | $R_S \leq 50\Omega$ , $V_{CM} = \pm 12V$                              | -             | -        | -    |            |
| Power Supply Rejection Ratio          |           | PSRR         | $V_{CC} = \pm 15V$ to $V_{CC} = \pm 15V$<br>$R_S \leq 50\Omega$       | -             | -        | -    | dB         |
|                                       |           |              | $V_{CC} = \pm 15V$ to $V_{CC} = \pm 15V$<br>$R_S \leq 10K\Omega$      | 77            | 96       | -    |            |
| Transient Response                    | Rise Time | $T_R$        | Unity Gain                                                            | -             | 0.3      | -    | $\mu s$    |
|                                       | Overshoot | OS           |                                                                       | -             | 10       | -    | %          |
| Bandwidth                             |           | BW           | -                                                                     | -             | -        | -    | MHz        |
| Slew Rate                             |           | SR           | Unity Gain                                                            | -             | 0.5      | -    | V/ $\mu s$ |
| Supply Current                        |           | $I_{CC}$     | $R_L = \infty\Omega$                                                  | -             | 1.5      | 2.8  | mA         |
| Power Consumption                     |           | $P_C$        | $V_{CC} = \pm 20V$                                                    | -             | -        | -    | mW         |
|                                       |           |              | $V_{CC} = \pm 15V$                                                    | -             | 50       | 85   |            |

Note:

1. Guaranteed by design.

## Electrical Characteristics

( $0^{\circ}\text{C} \leq T_A \leq 70^{\circ}\text{C}$   $V_{CC} = \pm 15\text{V}$ , unless otherwise specified)

The following specification apply over the range of  $0^{\circ}\text{C} \leq T_A \leq +70^{\circ}\text{C}$  for the LM741C; and the  $-40^{\circ}\text{C} \leq T_A \leq +85^{\circ}\text{C}$  for the LM741I

| Parameter                    | Symbol                   | Conditions                                              | LM741C/LM741I                                                |          |          | Unit                           |
|------------------------------|--------------------------|---------------------------------------------------------|--------------------------------------------------------------|----------|----------|--------------------------------|
|                              |                          |                                                         | Min.                                                         | Typ.     | Max.     |                                |
| Input Offset Voltage         | $V_{IO}$                 | $R_S \leq 50\Omega$                                     | -                                                            | -        | -        | mV                             |
|                              |                          | $R_S \leq 10\text{K}\Omega$                             | -                                                            | -        | 7.5      |                                |
| Input Offset Voltage Drift   | $\Delta V_{IO}/\Delta T$ | -                                                       | -                                                            | -        | -        | $\mu\text{V}/^{\circ}\text{C}$ |
| Input Offset Current         | $I_{IO}$                 | -                                                       | -                                                            | -        | 300      | nA                             |
| Input Offset Current Drift   | $\Delta I_{IO}/\Delta T$ | -                                                       | -                                                            | -        | -        | $\text{nA}/^{\circ}\text{C}$   |
| Input Bias Current           | $I_{BIAS}$               | -                                                       | -                                                            | -        | 0.8      | $\mu\text{A}$                  |
| Input Resistance (Note1)     | $R_I$                    | $V_{CC} = \pm 20\text{V}$                               | -                                                            | -        | -        | $\text{M}\Omega$               |
| Input Voltage Range          | $V_{I(R)}$               | -                                                       | $\pm 12$                                                     | $\pm 13$ | -        | V                              |
| Output Voltage Swing         | $V_{O(P-P)}$             | $V_{CC} = \pm 20\text{V}$                               | $R_S \geq 10\text{K}\Omega$                                  | -        | -        | V                              |
|                              |                          |                                                         | $R_S \geq 2\text{K}\Omega$                                   | -        | -        |                                |
|                              |                          | $V_{CC} = \pm 15\text{V}$                               | $R_S \geq 10\text{K}\Omega$                                  | $\pm 12$ | $\pm 14$ |                                |
|                              |                          |                                                         | $R_S \geq 2\text{K}\Omega$                                   | $\pm 10$ | $\pm 13$ |                                |
| Output Short Circuit Current | $I_{SC}$                 | -                                                       | 10                                                           | -        | 40       | mA                             |
| Common Mode Rejection Ratio  | CMRR                     | $R_S \leq 10\text{K}\Omega$ , $V_{CM} = \pm 12\text{V}$ | 70                                                           | 90       | -        | dB                             |
|                              |                          | $R_S \leq 50\Omega$ , $V_{CM} = \pm 12\text{V}$         | -                                                            | -        | -        |                                |
| Power Supply Rejection Ratio | PSRR                     | $V_{CC} = \pm 20\text{V}$<br>to $\pm 5\text{V}$         | $R_S \leq 50\Omega$                                          | -        | -        | dB                             |
|                              |                          |                                                         | $R_S \leq 10\text{K}\Omega$                                  | 77       | 96       |                                |
| Large Signal Voltage Gain    | $G_V$                    | $R_S \geq 2\text{K}\Omega$                              | $V_{CC} = \pm 20\text{V}$ ,<br>$V_{O(P-P)} = \pm 15\text{V}$ | -        | -        | V/mV                           |
|                              |                          |                                                         | $V_{CC} = \pm 15\text{V}$ ,<br>$V_{O(P-P)} = \pm 10\text{V}$ | 15       | -        |                                |
|                              |                          |                                                         | $V_{CC} = \pm 15\text{V}$ ,<br>$V_{O(P-P)} = \pm 2\text{V}$  | -        | -        |                                |

Note :

1. Guaranteed by design.

## Typical Performance Characteristics

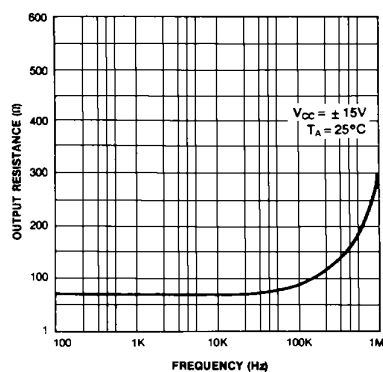


Figure 1. Output Resistance vs Frequency

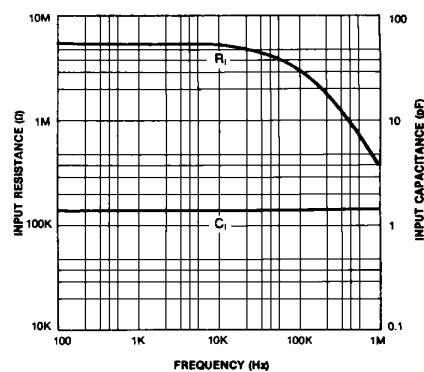


Figure 2. Input Resistance and Input Capacitance vs Frequency

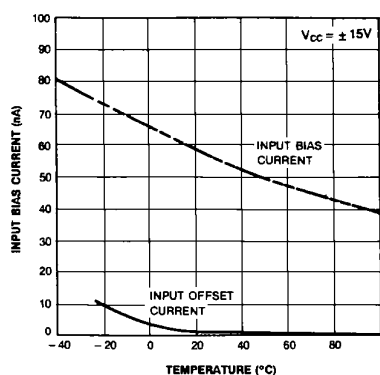


Figure 3. Input Bias Current vs Ambient Temperature

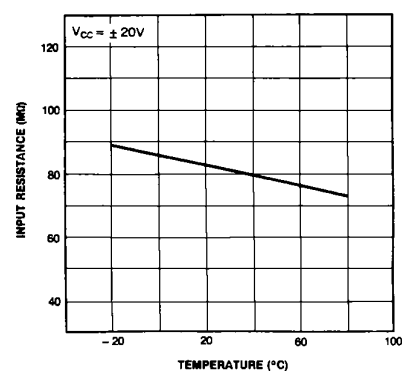


Figure 4. Power Consumption vs Ambient Temperature

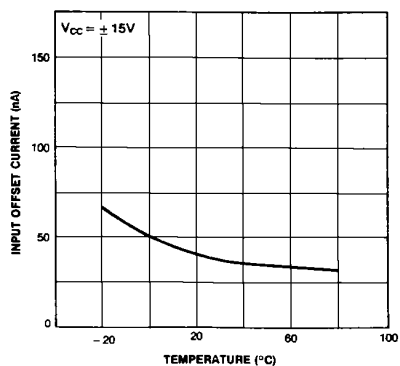


Figure 5. Input Offset Current vs Ambient Temperature

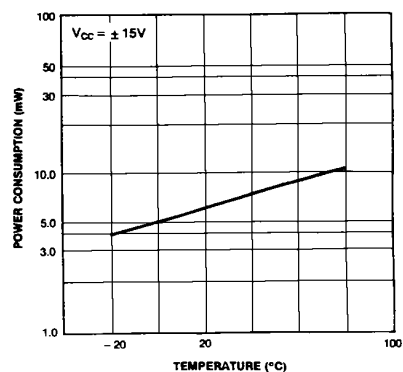


Figure 6. Input Resistance vs Ambient Temperature

## Typical Performance Characteristics (continued)

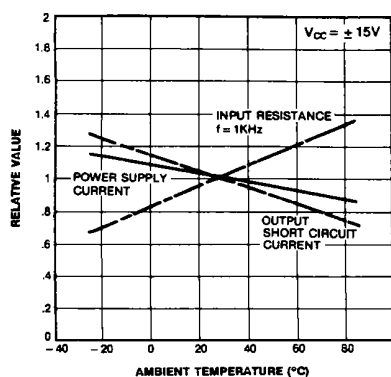


Figure 7. Normalized DC Parameters vs Ambient Temperature

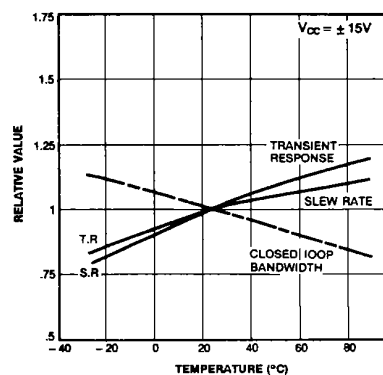


Figure 8. Frequency Characteristics vs Ambient Temperature

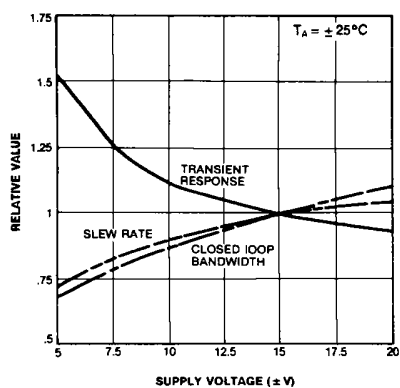


Figure 9. Frequency Characteristics vs Supply Voltage

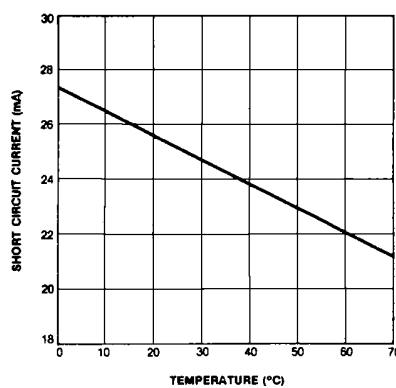


Figure 10. Output Short Circuit Current vs Ambient Temperature

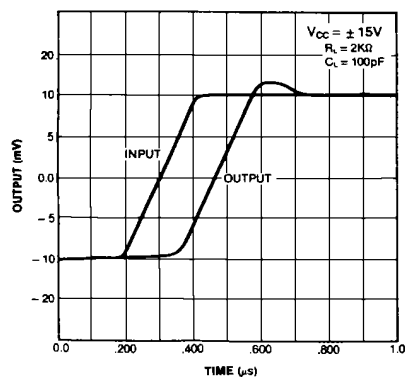


Figure 11. Transient Response

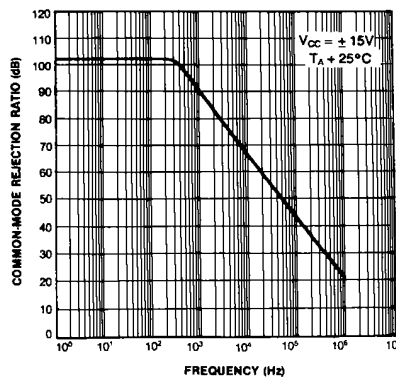


Figure 12. Common-Mode Rejection Ratio vs Frequency

## Typical Performance Characteristics (continued)

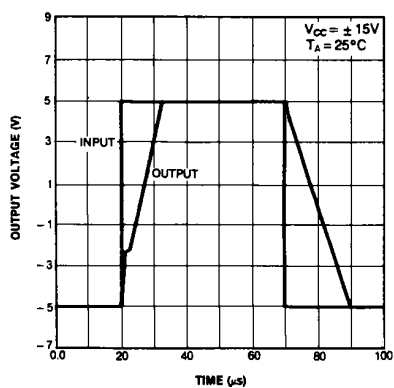


Figure 13. Voltage Follower Large Signal Pulse Response

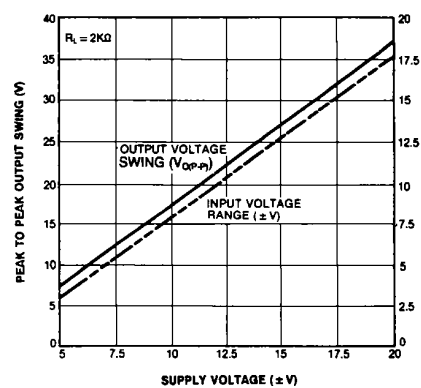
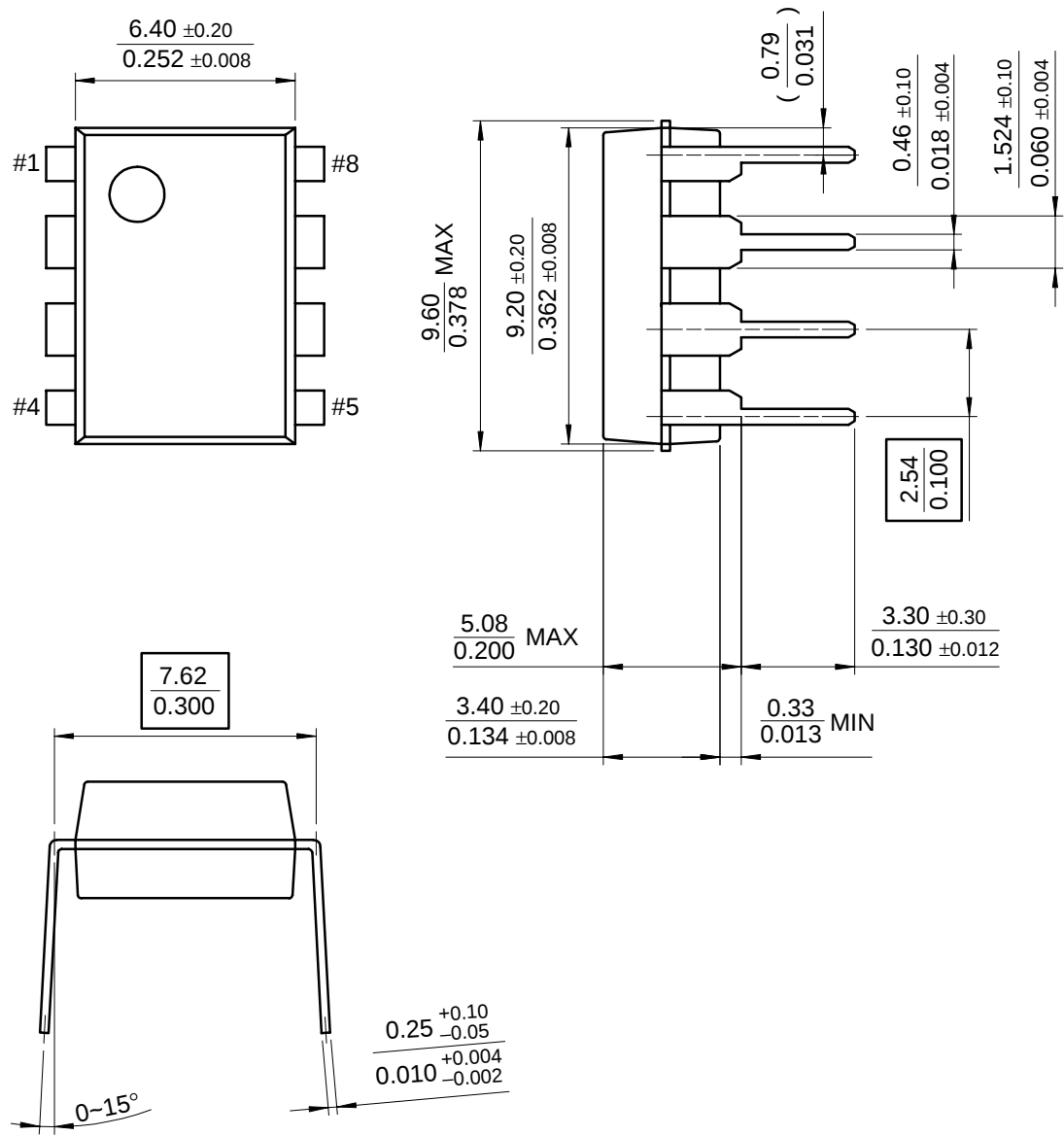


Figure 14. Output Swing and Input Range vs Supply Voltage

Mechanical Dimensions

Package

8-DIP





## Ordering Information

| Product Number | Package | Operating Temperature |
|----------------|---------|-----------------------|
| LM741CN        | 8-DIP   | 0 ~ + 70°C            |
| LM741CM        | 8-SOP   |                       |
| LM741IN        | 8-DIP   | -40 ~ + 85°C          |

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2. 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.