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FAIRCHILD SEMICONDUCTOR®

July 1999
Revised February 2005

74VCX132
Low Voltage Quad 2-Input NAND Gate with Schmitt Trigger Inputs and 3.6V Tolerant Inputs and Outputs

General Description

The VCX132 contains four 2-input NAND gates with Schmitt Trigger Inputs. The pin configuration and function are the same as the VCX00 except the inputs have hysteresis between the positive-going and negative-going input thresholds. This hysteresis is useful for transforming slowly switching input signals into sharply defined, jitter-free output signals. This product should be used where noise margin greater than that of conventional gates is required.

The VCX132 is designed for low voltage (1.4V to 3.6V) V_{CC} applications with I/O compatibility up to 3.6V.

This product is fabricated with an advanced CMOS technology to achieve high-speed operation while maintaining low CMOS power dissipation.

Features

- 1.4V to 3.6V V_{CC} supply operation
- 3.6V tolerant inputs and outputs
- t_{PD}
  3.3 ns max for 3.0V to 3.6V V_{CC}
- Power-off high impedance inputs and outputs
- Static Drive (I_{OH}/I_{OL})
  ±24 mA @ 3.0V V_{CC}
- Uses patented Quiet Series™ noise/EMI reduction circuitry
- Latchup performance exceeds JEDEC 78 conditions
- ESD performance:
  Human body model > 2000V
  Machine model > 250V
- Leadless Pb-Free DQFN package

Ordering Code:

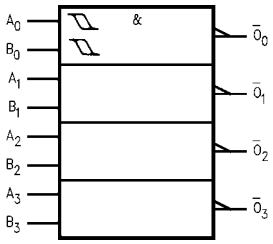
Order Number	Package Number	Package Description
74VCX132M	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
74VCX132BQX (Note 1)	MLP014A	Pb-Free 14-Terminal Depopulated Quad Very-Thin Flat Pack No Leads (DQFN), JEDEC MO-241, 2.5 x 3.0mm
74VCX132MTC	MTC14	14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide

Devices also available in Tape and Reel. Specify by appending suffix letter "X" to the ordering code.
Pb-Free package per JEDEC J-STD-020B.

Note 1: DQFN package available in Tape and Reel only.

Quiet Series™ is a trademark of Fairchild Semiconductor Corporation.

Logic Diagram

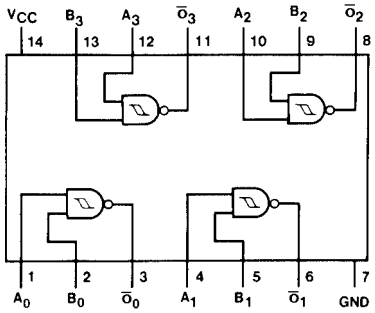


Pin Descriptions

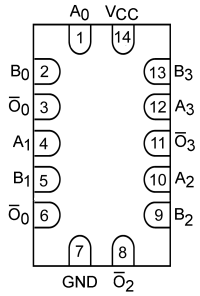
Pin Name	Description
A_n, B_n	Inputs
$\overline{O}_n$	Outputs

Connection Diagrams

Pin Assignments for SOIC and TSSOP



Pad Assignments for DQFN



(Top View)

Absolute Maximum Ratings(Note 2)

Supply Voltage (V_{CC})	−0.5V to +4.6V
DC Input Voltage (V_I)	−0.5V to 4.6V
DC Output Voltage (V_O)	
HIGH or LOW State (Note 3)	−0.5V to V_{CC} + 0.5V
V_{CC} = 0V	−0.5V to +4.6V
DC Input Diode Current (I_{IK})	
V_I < 0V	−50 mA
DC Output Diode Current (I_{OK})	
V_O < 0V	−50 mA
V_O > V_{CC}	+50 mA
DC Output Source/Sink Current	
(I_{OH}/I_{OL})	±50 mA
DC V_{CC} or Ground Current per	
Supply Pin (I_{CC} or Ground)	±100 mA
Storage Temperature (T_{STG})	−65°C to +150°C

Recommended Operating Conditions (Note 4)

Power Supply	
Operating	1.4V to 3.6V
Input Voltage	−0.3V to 3.6V
Output Voltage (V_O)	
HIGH or LOW State	0V to V_{CC}
Output Current in I_{OH}/I_{OL}	
V_{CC} = 3.0V to 3.6V	±24 mA
V_{CC} = 2.3V to 2.7V	±18 mA
V_{CC} = 1.65V to 2.3V	±6 mA
V_{CC} = 1.4V to 1.6V	±2 mA
Free Air Operating Temperature (T_A)	−40°C to +85°C

Note 2: The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

Note 3: I_O Absolute Maximum Rating must be observed.

Note 4: Floating or unused inputs must be held HIGH or LOW.

DC Electrical Characteristics

Symbol	Parameter	Conditions	V_{CC} (V)	Min	Max	Units
V_{t+}	HIGH Level Input Voltage		3.6		2.2	
			3.0		2.0	
			2.3		1.6	V
			1.6		1.2	
			1.4		1.2	
V_{t-}	LOW Level Input Voltage		3.6	0.8		
			3.0	0.7		
			2.3	0.5		V
			1.6	0.2		
			1.4	0.2		
V_H	Input Hysteresis		3.6	0.3	1.2	
			3.0	0.3	1.2	
			2.3	0.3	1.0	V
			1.6	0.15	0.9	
			1.4	0.15	0.9	
V_{OH}	HIGH Level Output Voltage	I_{OH} = −100 μA	2.7 - 3.6	V_{CC} - 0.2		
		I_{OH}= −12 mA	2.7	2.2		
		I_{OH} = −18 mA	3.0	2.4		
		I_{OH} = −24mA	3.0	2.2		
		I_{OH} = −100 μA	2.3 - 2.7	V_{CC} - 0.2		
		I_{OH} = −6 mA	2.3	2.0		V
		I_{OH} = −12 mA	2.3	1.8		
		I_{OH} = −18 mA	2.3	1.7		
		I_{OH} = −100 μA	1.65 - 2.3	V_{CC} - 0.2		
		I_{OH} = − 6 mA	1.65	1.25		
		I_{OH} = −100μA	1.4 - 1.6	V_{CC} - 0.2		
		I_{OH} = −2 mA	1.4	1.05		

DC Electrical Characteristics (Continued)

Symbol	Parameter	Conditions	V_{CC} (V)	Min	Max	Units
V_{OL}	LOW Level Output Voltage	I_{OL} = 100 μA	2.7 - 3.6		0.2	V
		I_{OL} = 12 μA	2.7		0.4	
		I_{OL} = 18 mA	3.0		0.4	
		I_{OL} = 24 mA	3.0		0.55	
		I_{OL} = 100 μA	2.3 - 2.7		0.2	
		I_{OL} = 12 mA	2.3		0.4	
		I_{OL} = 18 mA	2.3		0.6	
		I_{OL} = 100 μA	1.65 - 2.3		0.2	
		I_{OL} = 6 mA	1.65		0.3	
		I_{OL} = 100 μA	1.4 - 1.6		0.2	
		I_{OL} = 2 mA	1.4		0.35	
I_I	Input Leakage Current	0 ≤ V_I ≤ 3.6V	1.4 - 3.6		±5.0	μA
I_{OZ}	3-STATE Output Leakage	0 ≤ V_O ≤ 3.6V V_I = V_{IH} or V_{IL}	1.4 - 3.6		±10.0	μA
I_{OFF}	Power Off Leakage Current	0 ≤ (V_I, V_O) ≤ 3.6V	0		10.0	μA
I_{CC}	Quiescent Supply Current	V_I = V_{CC} or GND	1.4 - 3.6		20.0	μA
		V_{CC} ≤ V_I ≤ 3.6V	1.4 - 3.6		±20.0	
ΔI_{CC}	Increase in I_{CC} per Input	V_{IH} = V_{CC} - 0.6V	2.7 - 3.6		750	μA

AC Electrical Characteristics (Note 5)

Symbol	Parameter	Conditions	V_{CC} (V)	T_A = −40°C to +85°C		Units	Figure Number
				Min	Max		
t_{PHL} t_{PLH}	Propagation Delay	C_L = 30 pF, R_L = 500Ω	3.3 ± 0.3	0.6	3.3	ns	Figures 1, 2
			2.5 ± 0.2	0.8	4.1		
			1.8 ± 0.15	1.0	8.2		
		C_L = 15 pF, R_L = 2kΩ	1.5 ± 0.1	1.0	16.4		Figures 3, 4
t_{OSHL} t_{OSLH}	Output-to-Output Skew (Note 6)	C_L = 30 pF, R_L = 500Ω	3.3 ± 0.3		0.5	ns	
			2.5 ± 0.2		0.5		
			1.8 ± 0.15		0.75		
		C_L = 15 pF, R_L = 2kΩ	1.5 ± 0.1		1.5		

Note 5: For C_L = 50 pF, add approximately 300 ps to the AC maximum specification.

Note 6: Skew is defined as the absolute value of the difference between the actual propagation delay for any two separate outputs of the same device. The specification applies to any outputs switching in the same direction, either HIGH-to-LOW (t_{OSHL}) or LOW-to-HIGH (t_{OSLH}).

Dynamic Switching Characteristics

Symbol	Parameter	Conditions	V_{CC} (V)	T_A = +25°C Typical	Units
V_{OLP}	Quiet Output Dynamic Peak V_{OL}	C_L = 30 pF, V_{IH} = V_{CC}, V_{IL} = 0V	1.8	0.25	V
			2.5	0.6	
			3.3	0.8	
V_{OLV}	Quiet Output Dynamic Valley V_{OL}	C_L = 30 pF, V_{IH} = V_{CC}, V_{IL} = 0V	1.8	−0.25	V
			2.5	−0.6	
			3.3	−0.8	
V_{OHV}	Quiet Output Dynamic Valley V_{OH}	C_L = 30 pF, V_{IH} = V_{CC}, V_{IL} = 0V	1.8	1.5	V
			2.5	1.9	
			3.3	2.2	

Capacitance

Symbol	Parameter	Conditions	T_A = +25°C Typical	Units
C_{IN}	Input Capacitance	V_I = 0V or V_{CC}, V_{CC} = 1.8V, 2.5V or 3.3V	6.0	pF
C_{OUT}	Output Capacitance	V_I = 0V or V_{CC}, V_{CC} = 1.8V, 2.5V or 3.3V	7.0	pF
C_{PD}	Power Dissipation Capacitance	V_I = 0V or V_{CC}, f = 10MHz, V_{CC} = 1.8V, 2.5V or 3.3V	20.0	pF

AC Loading and Waveforms (V_{CC} 3.3V ± 0.3V to 1.8V ± 0.15V)

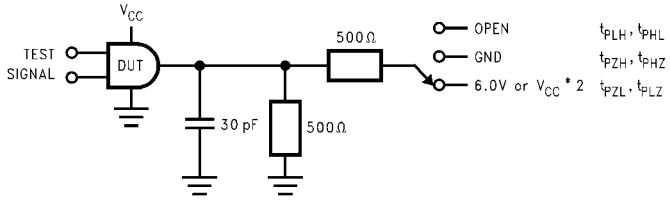


FIGURE 1. AC Test Circuit

TEST	SWITCH
t_{PLH}, t_{PHL}	Open

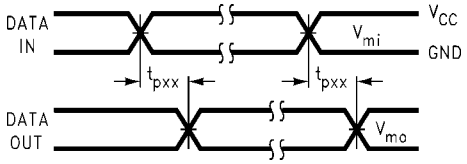
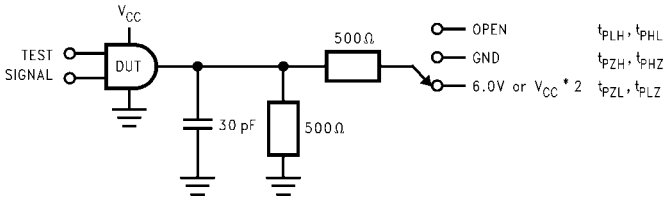


FIGURE 2. Waveform for Inverting and Non-inverting Functions

Symbol	V_{CC}		
	3.3V ± 0.3V	2.5V ± 0.2V	1.8V ± 0.15V
V_{mi}	1.5V	V_{CC}/2	V_{CC}/2
V_{mo}	1.5V	V_{CC}/2	V_{CC}/2

AC Loading and Waveforms (V_{CC} 1.5V ± 0.1V)



TEST	SWITCH
t_{PLH}, t_{PHL}	Open
t_{PZL}, t_{PLZ}	V_{CC} x 2 at V_{CC} = 1.5V ± 0.1V
t_{PZH}, t_{PHZ}	GND

FIGURE 3. AC Test Circuit

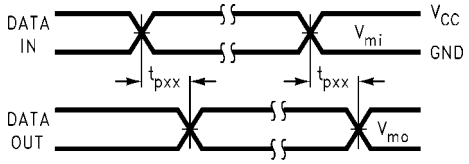


FIGURE 4. Waveform for Inverting and Non-inverting Functions

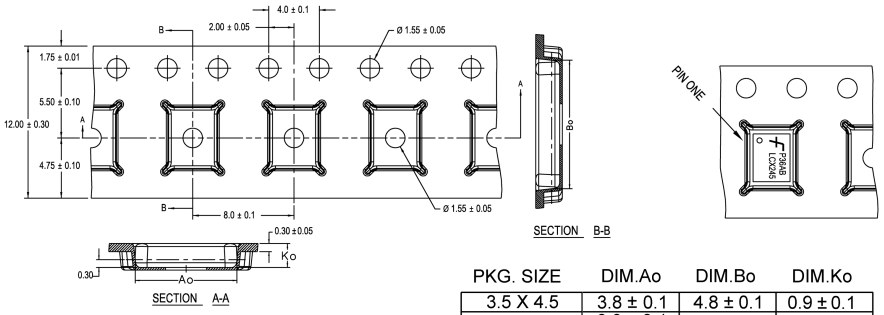
Symbol	V_{CC}
	1.5V ± 0.1V
V_{mi}	V_{CC}/2
V_{mo}	V_{CC}/2

Tape and Reel Specification

Tape Format for DQFN

Package Designator	Tape Section	Number Cavities	Cavity Status	Cover Tape Status
BQX	Leader (Start End)	125 (typ)	Empty	Sealed
	Carrier	2500/3000	Filled	Sealed
	Trailer (Hub End)	75 (typ)	Empty	Sealed

TAPE DIMENSIONS inches (millimeters)



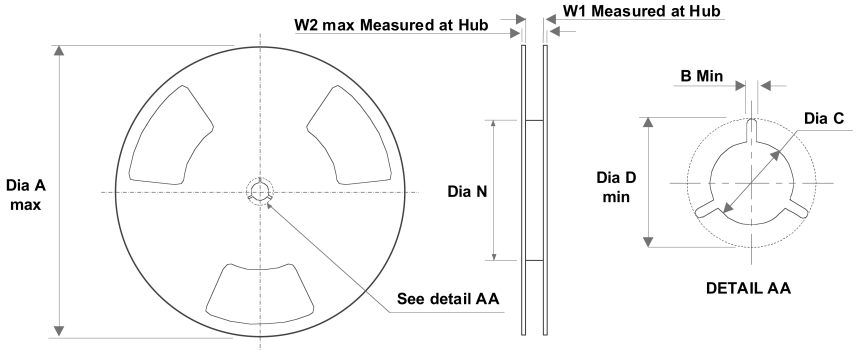
PKG. SIZE	DIM.Ao	DIM.Bo	DIM.Ko
3.5 X 4.5	3.8 ± 0.1	4.8 ± 0.1	0.9 ± 0.1
3.0 X 3.0	3.3 ± 0.1	3.3 ± 0.1	0.9 ± 0.1
2.5 X 4.5	2.8 ± 0.1	4.8 ± 0.1	0.9 ± 0.1
2.5 X 3.5	2.8 ± 0.1	3.8 ± 0.1	0.9 ± 0.1
2.5 X 3.0	2.8 ± 0.1	3.3 ± 0.1	0.9 ± 0.1
2.5 X 2.5	2.8 ± 0.1	2.8 ± 0.1	0.9 ± 0.1

DIMENSIONS ARE IN MILLIMETERS

NOTES: unless otherwise specified

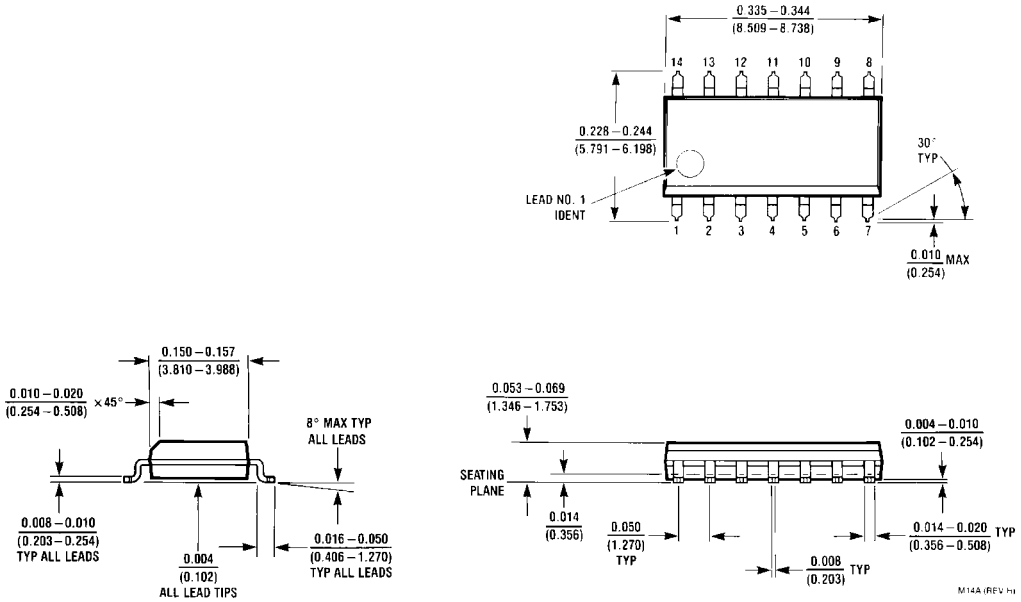
1. Cummulative pitch for feeding holes and cavities (chip pockets) not to exceed 0.008[0.20] over 10 pitch span.
2. Smallest allowable bending radius.
3. Thru hole inside cavity is centered within cavity.
4. Tolerance is ±0.002[0.05] for these dimensions on all 12mm tapes.
5. Ao and Bo measured on a plane 0.120[0.30] above the bottom of the pocket.
6. Ko measured from a plane on the inside bottom of the pocket to the top surface of the carrier.
7. Pocket position relative to sprocket hole measured as true position of pocket. Not pocket hole.
8. Controlling dimension is millimeter. Diemension in inches rounded.

REEL DIMENSIONS inches (millimeters)



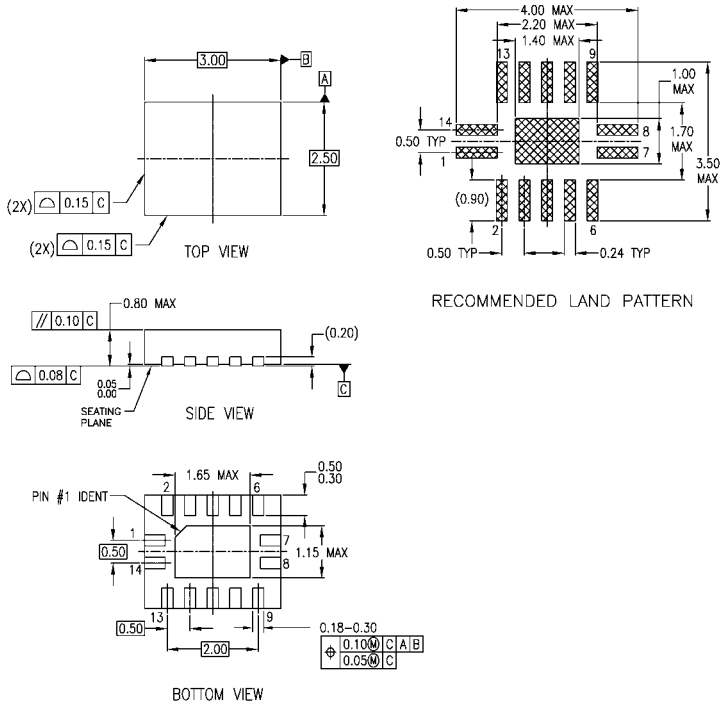
Tape Size	A	B	C	D	N	W1	W2
12 mm	13.0 (330)	0.059 (1.50)	0.512 (13.00)	0.795 (20.20)	7.008 (178)	0.488 (12.4)	0.724 (18.4)

Physical Dimensions inches (millimeters) unless otherwise noted



14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
Package Number M14A

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



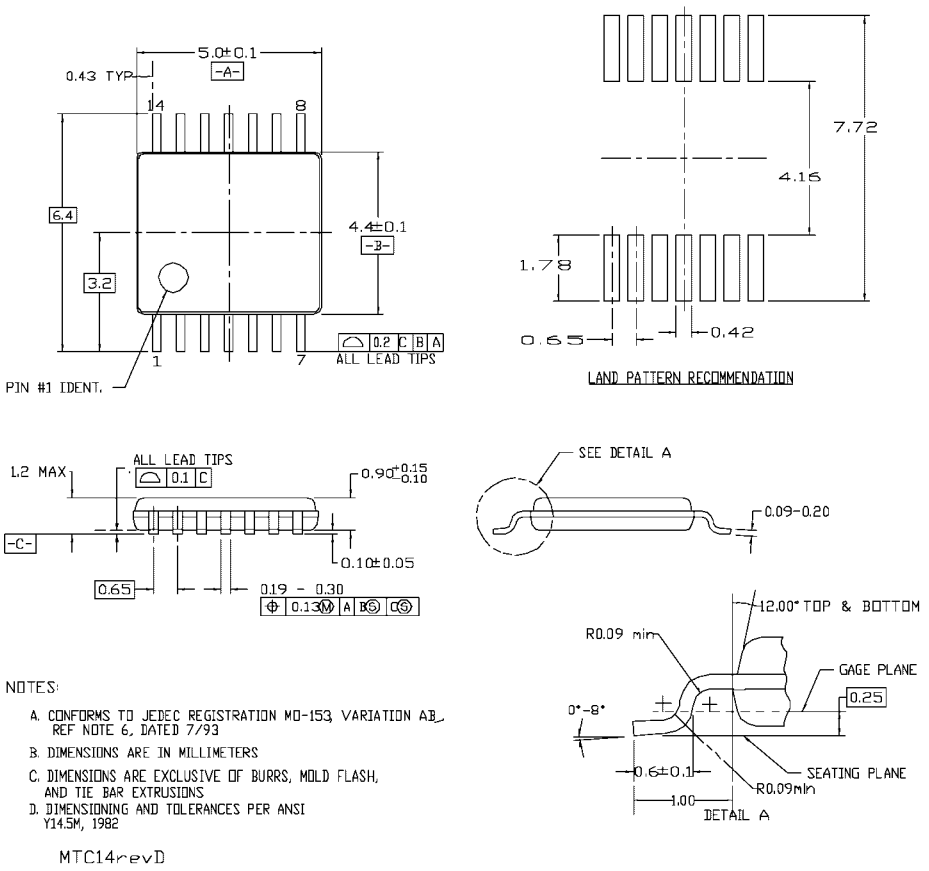
NOTES:

A. CONFORMS TO JEDEC REGISTRATION MO–241, VARIATION AA
B. DIMENSIONS ARE IN MILLIMETERS.
C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994

MLP014ArevA

Pb-Free 14-Terminal Depopulated Quad Very-Thin Flat Pack No Leads (DQFN), JEDEC MO-241, 2.5 x 3.0mm
Package Number MLP014A

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
Package Number MTC14

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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.

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