

Miniature Surface-Mount DAA for Audio or Data Transfer

Description

The XE0402LCC supplies a complete telephone line interface or DAA (Data Access Arrangement) in a miniature, surface-mount module. It offers an alternative to a discrete DAA for a multitude of voice, audio, DTMF, fax and data communications uses. The XE0402LCC replaces more than 25 discrete components with a single, fully-assembled and fully-tested unit.

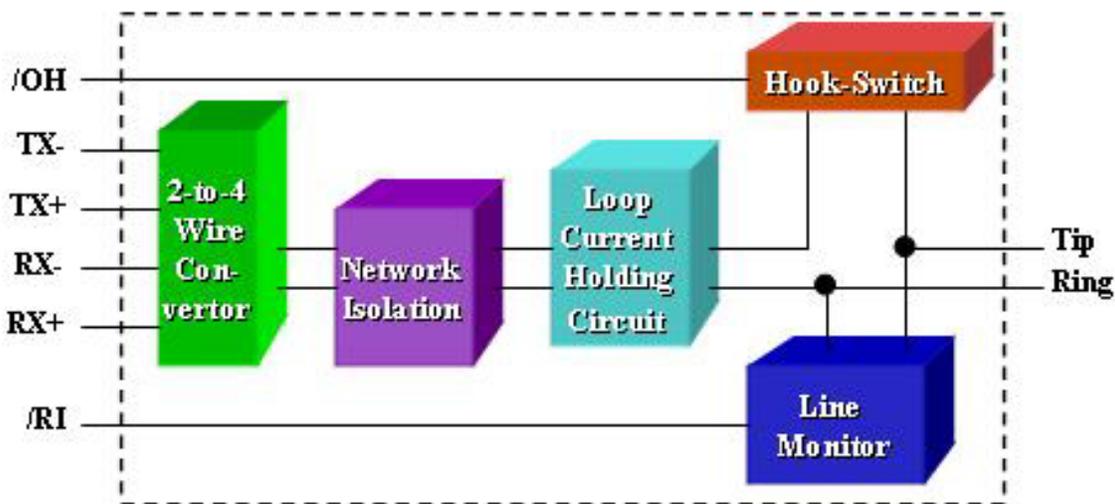
The XE0402LCC does not sacrifice performance for small size and surface-mount convenience. The wide bandwidth, low distortion design provides sufficient bandwidth for 56K bps analog modem communications.

Like all Xecom DAA modules the XE0402LCC is a complete telephone interface. It includes a 2-4 wire converter, loop current holding circuit, hook switch and ring indicator. It also passes Caller ID signals. The XE0402LCC complies with TIA-968-A (FCC Part 68) rules for direct connection to the telephone line.

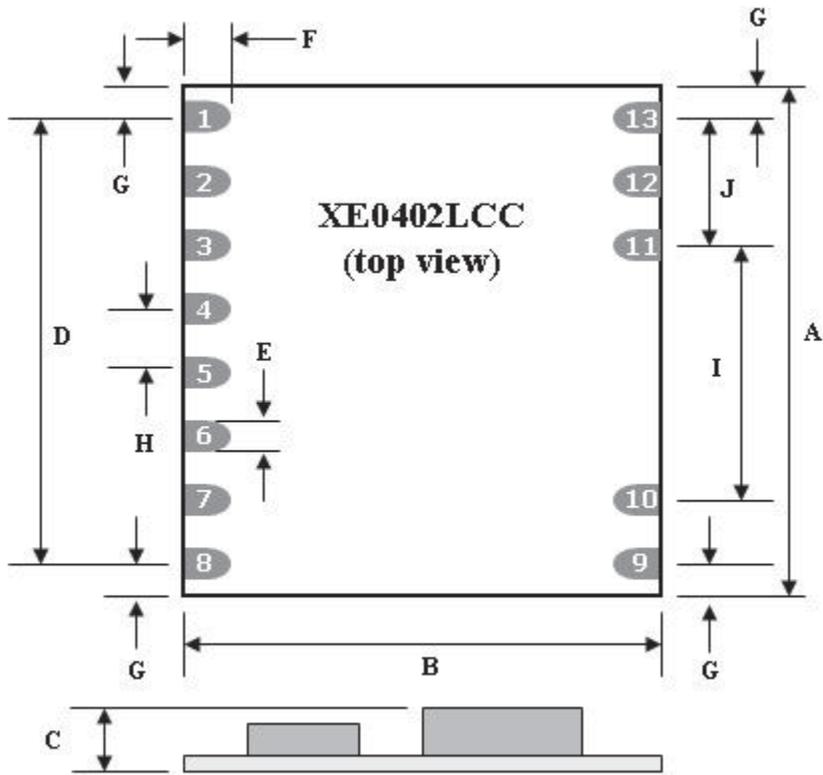
Features

- Low-profile, surface-mount package: 0.80 inches by 0.78 inches by 0.13 inches
- RoHS Compliant
- Meets line interface requirements for reliable V.90 and V.92 communications
- Typical Second Harmonic Distortion of -80 dB
- TIA-968-A Compliant
- Integrated 2-to-4 wire converter provides 40 dB Transhybrid Loss
- Supports detection of incoming Caller ID signals
- Integrated Ring Detection
- Low power operation: Just 10 millamps from a single + 3.3 Volt Power Supply
- Solid-State Hook switch Control

XE0402LCC BLOCK DIAGRAM

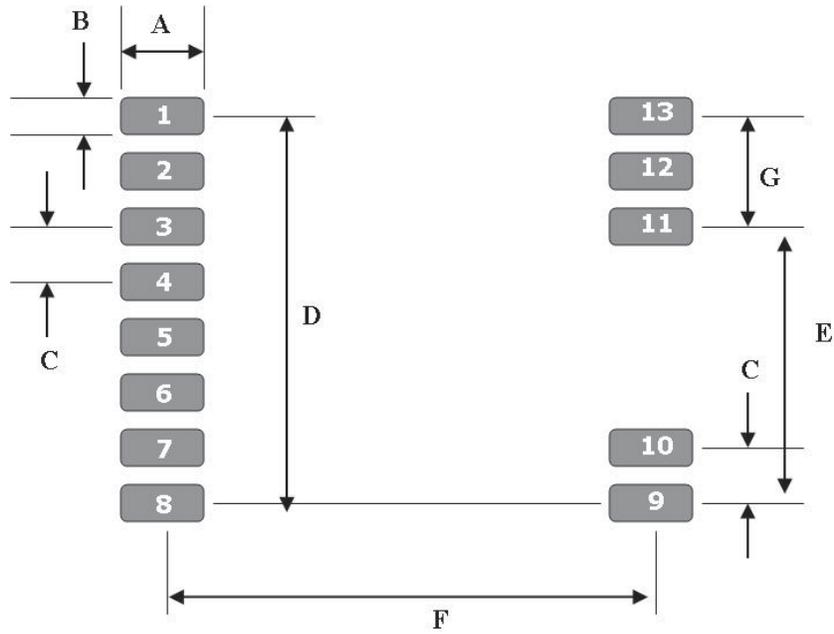


XE0402LCC Mechanical Specifications



| DIM | INCHES | MM | DESCRIPTION |
|-----|--------|-------|---|
| A | 0.800 | 20.32 | Product Length |
| B | 0.780 | 19.81 | Product Width |
| C | 0.132 | 3.35 | Product Thickness at tallest component |
| D | 0.700 | 17.78 | Pin Row length from center of Pin 1 to center of Pin 8 |
| E | 0.045 | 1.14 | Width of solder pad |
| F | 0.075 | 1.90 | Length of solder pad |
| G | 0.050 | 1.27 | Distance from center of last pin of pin row to product edge |
| H | 0.100 | 2.54 | Center to center distance between adjacent Pins |
| I | 0.400 | 10.16 | Distance from center of Pin 10 to center of Pin 11 |
| J | 0.200 | 5.08 | Distance from center of Pin 11 to center of Pin 13 |

XE0402LCC PCB Layout Recommendations

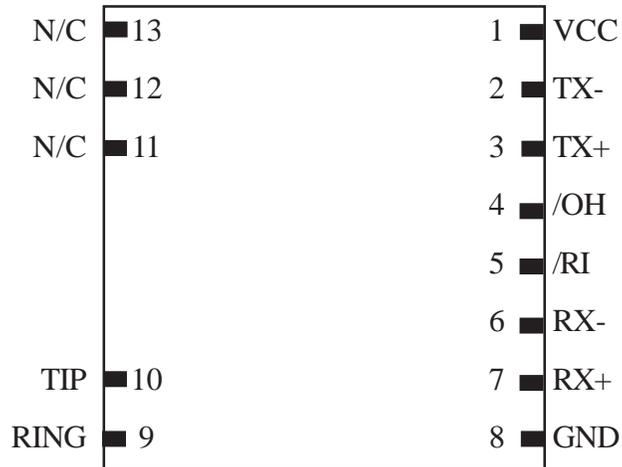


| Dimension | Typical (inches) | Description |
|-----------|------------------|--|
| A | 0.125 | Pad Length |
| B | 0.055 | Pad Width |
| C | 0.100 | Adjacent Pad Spacing center to center |
| D | 0.700 | Spacing center of Pin 1 to center of Pin8 |
| E | 0.400 | Spacing center of Pin 11 to center of Pin 12 |
| F | 0.730 | Row-to-Row Spacing Center to Center |
| G | 0.200 | Center of pin 12 to Center of Pin 14 |

Note: No Components or traces should be placed under the DAA module.

XE0402LCC Pin Configuration

(Bottom View)



XE0402LCC Pin Descriptions

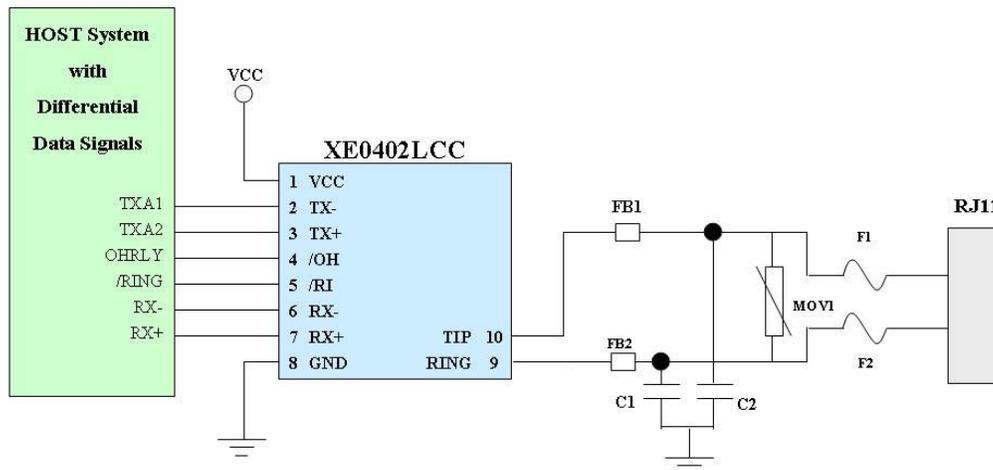
| Pin | Name | Description |
|-----|------|-------------|
|-----|------|-------------|

| | | |
|---|-----|---|
| 1 | VCC | +3.3 or 5 Volt power source for the XE0402LCC. |
| 2 | TX- | TX- is the negative half of the differential transmit data input to the XE0402LCC from the host system. If the host system uses a single ended transmit data output, that output should be connected to TX-. |
| 3 | TX+ | TX+ is the positive half of the differential transmit data input to the XE0402LCC from the host system. If the host system uses a single ended transmit data output, TX+ should be grounded. |
| 4 | /OH | Switch-hook control to the modem. /OH is an active low input. Activating /OH closes the switch-hook causing the XE0402LCC to seize the telephone line. The telephone line connection drops when /OH is deactivated. The host can pulse /OH to simulate rotary dialing. The pulse rate in the US is ten pulses per second. Each digit is dialed as a series of pulses created by closure of the hook-switch, one pulse for the digit one to ten pulses for the digit zero. The pulses must be asymmetrical so that the hook-switch is closed for thirty-one milliseconds and open for sixty-nine milliseconds. An inter-digit delay of at least one hundred milliseconds is required. |
| 5 | /RI | Ring Indicate output from the module. /RI provides a low going, Ring frequency, pulse output. The XE0402LCC recognizes ring voltages of twenty-eight to one hundred fifty volts RMS in the frequency range of sixteen to sixty-eight Hertz. |
| 6 | RX- | RX- is the negative half of the differential received data output from the XE0402LCC. If the host system uses a single ended received data input, RX- should remain open. |
| 7 | RX+ | RX+ is the positive half of the differential received data output from the to the host system. If the host system uses a single ended received data input, that input should be connected to RX+. |
| 8 | GND | Ground connection to the XE0402LCC. This signal provides the reference for the /OH input and /RI output. This pin should be connected to the systems digital ground. |

XE0402LCC Pin Descriptions

| Pin | Name | Description |
|-------|------|--|
| 9 | Ring | Ring is one half of the two-wire telephone line connection (RJ11 Pin 4). FCC Part 68 Rules require a 1500 volt isolation barrier between the telephone line and all other circuits. This isolation must be preserved throughout the system. Xecom recommends 0.100 inch spacing between traces connected to Ring and all other conductors to preserve this isolation |
| 10 | Tip | Tip is one half of the two-wire telephone line connection (RJ11 Pin 3). The telephone company places a DC "Battery" voltage across Tip and Ring on all public switched telephone lines. The XE0402LCC accepts this line battery voltage without regard to its polarity. |
| 11-13 | N/C | No Connection; These pads are provided for mechanical stability only. |

Typical Connections Diagram for North America and Japan



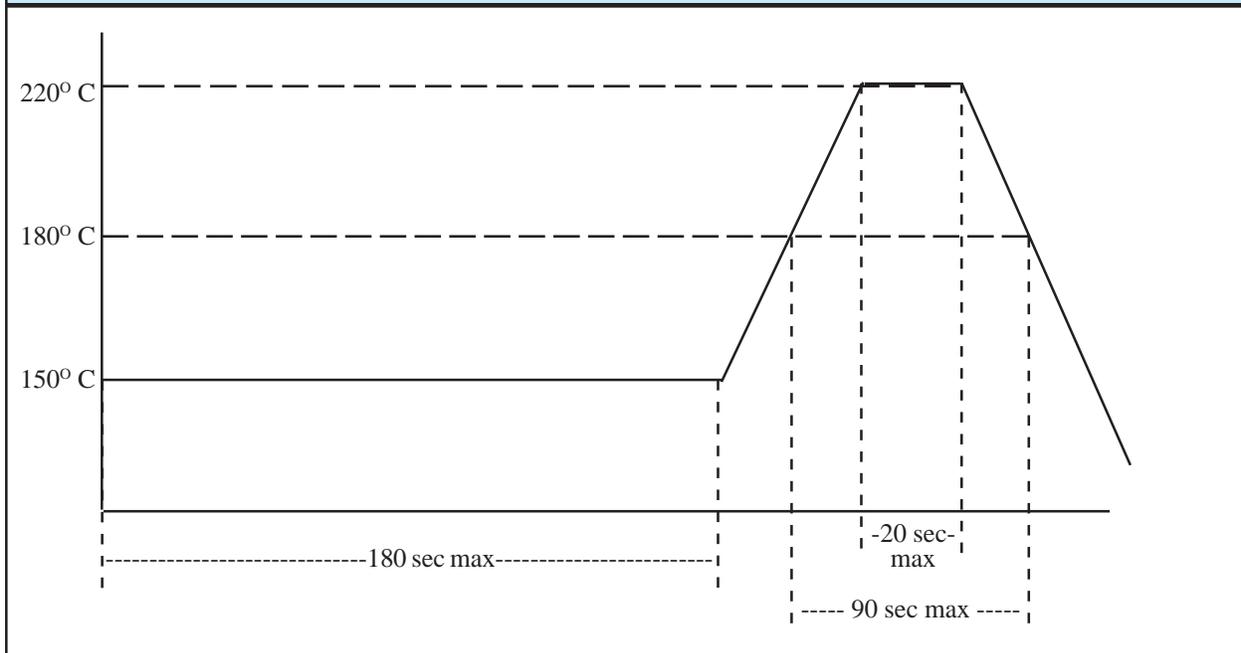
| Component | Description |
|-----------|--|
| C1, C2 | Capacitors, C1 and C2, may be required for EMI filtering in your system. Without these components you may experience unintended radiation when the telephone cable is attached. To maintain required isolation C1 and C2 are high-voltage capacitors. We recommend the Novocap ES2211N681K502NXTM. This 680 pF, 5000 volt capacitor will direct the high frequency harmonics to the system ground. |
| FB1, FB2 | FB1 and FB2 are ferrite beads which may be required for EMI filtering to prevent unintended radiation when the telephone cable is attached to your system. Xecom recommends the TDK ACB2012L-120 which provides more than 100 ohms impedance at frequencies above 100 MHz. |
| MOV1 | MOV1 protects against damage from lightening strikes on the telephone lines. Xecom recommends the World Products WPCDS-275E Thyristor to provide this protection. |
| F1, F2 | F1 and F2 prevent damage to the system when a power line crosses with the telephone line. Xecom recommends the Littlefuse 0461 1.25 for this function. |

XE0402LCC Soldering Instructions

Because of its Hybrid construction, the XE0402LCC is subject to damage if overexposed to heat during solder reflow operations. Following the soldering instructions below will ensure that the process of soldering the module to the board does not damage the DAA.

| | |
|--------------------------------------|-------------|
| Maximum Temperature | 220° C |
| Maximum Time at 220° C | 20 Seconds |
| Maximum Time above Eutectic (180° C) | 90 Seconds |
| Maximum Preheat Dwell Time | 180 Seconds |

Maximum Recommended Solder Temperature Profile



Notes:

Xecom's XE0402LCC DAA modules should be exposed to no more than one reflow cycle.

XE0402LCC Applications Notes

Dialing:

The public switched telephone network permits tone and rotary (pulse) dialing. The XE0402LCC supports both types. Tone dialing requires an external signal source to generate the dialing tones. The /OH line on the XE0402LCC may be pulsed to create pulse dialing.

Pulse Dialing: The XE0402LCC generates dialing pulses through momentary closures of the switch-hook. Each digit is represented as a series of pulses, one pulse for a one to ten pulses for a zero. The pulse rate in North America is ten pulses per second. The dialing pulses are asymmetrical. The correct duty cycle in North America is 31 milliseconds on and 69 milliseconds off. An inter-digit delay of at least one hundred milliseconds separates the digits.

Tone Dialing: To permit tone dialing the XE0402LCC seizes the line, /OH active. For each digit a unique DTMF, Dual Tone Multiple Frequency, tone pair is applied to TX+ and TX-. The higher frequency tone is always larger than the lower frequency one. Transmit the tones for a minimum of 70 milliseconds, and leave a minimum of 70 milliseconds between digits.

The following chart shows the DTMF signal frequencies for each digit.

| <u>Digit</u> | <u>Lower Tone</u> | <u>Upper Tone</u> |
|--------------|-------------------|-------------------|
| 1 | 697 | 1209 |
| 2 | 697 | 1336 |
| 3 | 697 | 1477 |
| 4 | 770 | 1209 |
| 5 | 770 | 1336 |
| 6 | 770 | 1477 |
| 7 | 852 | 1209 |
| 8 | 852 | 1336 |
| 9 | 852 | 1477 |
| 0 | 941 | 1336 |
| * | 941 | 1209 |
| # | 941 | 1477 |

Signal Levels:

In the US TIA-968A sets the allowable signal level for all signals placed on the telephone line other than live voice. Signal levels are measured in dBm. Zero dBm is 1 milliwatt through a 600 ohm load. In the US the maximum magnitude is -9 dBm. Other countries have similar regulations.

Distortion:

Distortion is the most common measure of the quality of the signal path provided by the DAA. The primary sources of this distortion is the line current holding circuit, although board layout and other factors can introduce distortion.

Distortion varies with frequency. The voice band of the telephone line is limited to less than 4000 Hz. High speed modems such as 33.6K bps and 56K bps require virtually all of this bandwidth for signal transmission. Even if the distortion through a device is good in the center portion of the spectrum, signal quality is compromised if distortion greatly increases at the outer limits of the voice band. The XE0402LCC provides a low distortion signal path across the entire voice band.

Caller ID Reporting:

The telephone network normally sends the Caller ID signal between the first and second ring signals. The XE0402LCC passes the Caller ID signal through to the host through the RX+ and RX- pins. Caller ID pass-through can only be used when the XE0402LCC is in the On-hook state, /OH high.

Electrical Specifications

| Parameter | Conditions | Min | Typ | Max | Units |
|--|--|----------|-----|------|------------|
| Power Supply Voltage | | 3.0 | | 5.50 | Volts |
| Power Supply Current | Off-hook | | 10 | | mA |
| | On-hook | | 0.5 | | mA |
| Transhybrid Loss | 600 Ohm Impedance, 300-3400 Hz | 36 | 40 | | dB |
| Transmit Insertion loss | 600 Ohm Impedance, 300-3400 Hz | -0.2 | 0 | 0.2 | dB |
| Receive Insertion loss | 600 Ohm Impedance, 3000-3400 Hz | -0.2 | 0 | 0.2 | dB |
| Line Impedance | Off-hook | | 600 | | Ω |
| Second Harmonic Distortion | 600 Ohm Impedance, 200 to 4000 Hz | | -80 | | dB |
| Ring Detect Sensitivity | Min. AC voltage between Tip & Ring Type B ringer | 28 | | 150 | Vrms |
| Ring Frequencies Detected | | 15 | | 68 | Hz |
| RI Output Voltage | Ring present, Active low | | | 0.4 | Volts |
| | No Ring signal , Active High | VCC - .4 | | | Volts |
| Hook-Switch Control Voltage (active low) | ON: (off-hook) | | 0.2 | 0.5 | Volts |
| | OFF: (on-hook) | 2.0 | 3.0 | | Volts |
| Hook-Switch Control | ON: (on-hook) | 0.8 | | 2.0 | Volts |
| Hook-Switch Control Current | Low: (off-hook) | | | -120 | μ A |
| | High: (on-hook) | -120 | | | μ A |
| Loop Current | Off-Hook current draw from Telephone Line | 10 | | 100 | mA |
| DC On-Hook Impedance | Hook-switch Open | 10 | | | M Ω |

XE0402LCC ABSOLUTE MAXIMUM RATINGS

| | |
|---|-------------------|
| Storage Temperature | -40° C to +125° C |
| Operating Temperature Range * | 0° C to +85° C |
| * The XE0402LCC can be ordered with an Operating Temperature of -40° C to +85° C at extra cost. Order Model Number XE0402LCC-ITR | |

XE0402LCC FCC Part 68 Information

When developing a product to be connected to the telephone line, it is necessary to use a circuit known as a Data Access Arrangement (DAA) approved by the appropriate governmental agency. In the US this agency is the Federal Communications Commission (FCC), while in Canada it is Industry Canada (IC). These agencies test and approve the product to ensure that it meets their specifications, thereby protecting the telephone system from damage and protecting the user from high voltage transients (such as lightning strikes) which may come down the telephone line.

The XE0402LCC has been designed to meet all TIA-968-A requirements for hazardous voltage, line impedance and leakage current. If the system transmits data, synthesized voice, or DTMF tones on the telephone line, the user must certify that the signals transmitted meet basic requirements for maximum transmission levels, out of band energy and billing delay. Full details may be obtained from the FCC under Part 68 of the FCC Rules and Regulations, or in Title 47 of the Code of Federal Regulations, however the basic requirements are as follows:

1. Maximum Transmit Level

For the normal “permissive” (standard) telephone line, equipment which transmits data (such as a modem) must not exceed a transmission level of -9 dBm.

2. Out of Band Energy

Data equipment must not transmit “out of band” energy on the telephone line which exceeds the following limits:

| Frequency | | Range | Max. Power |
|------------------|----|--------------|-------------------|
| 3995 Hz | to | 4005 Hz | -27 dBm |
| 4005 Hz | to | 12 kHz | -20 dBm |
| 12 kHz | to | 90 kHz | -55 dBm |
| 90 kHz | to | 270 kHz | -55 dBm |
| 270 kHz | to | 6 MHz | -15 dBm |

3. DTMF Transmission Level

If the system is capable of DTMF dialing, the maximum DTMF transmission level must be less than 0 dBm averaged over a 3 second interval.

4. Billing Delay

A delay of 2 seconds or greater is required after the time the XE0402LCC is taken “off hook” and before any information is transmitted. This is required to ensure that billing information may be exchanged between telephone company central offices without interference.

The user of the XE0402LCC must certify that the final system meets the requirements of TIA-968-A which include the criteria above as well as the high voltage protection provided by the XE0402LCC. This is generally accomplished through an independent testing lab which tests the System and submits the proper paperwork. Since the XE0402LCC already complies with FCC Part 68 rules, this should be a relatively simple process.

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A **Critical Component** is any component of a life support device or system whose failure to perform can be reasonably expected to cause failure of the life support device or system, or to affect its safety or effectiveness.

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Xecom Incorporated
374 Turquoise Street, Milpitas, CA 95035
Ph:408-942-2200 Fax:408-942-1346
Email: info@xecom.com
Web Site: <http://www.xecom.com>