

SIP DAA Provides 3750 Volt Isolation Barrier

Description

Xecom's XE1030 is a complete DAA in a compact Single-in-Line package. It provides an ideal telephone interface for modem, audio and DTMF signaling applications.

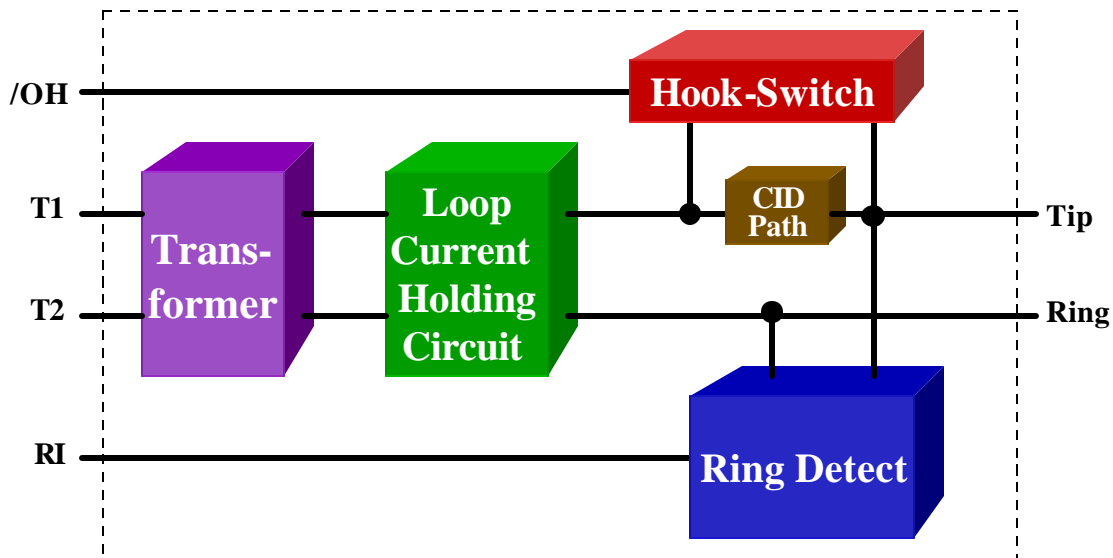
The XE1030 also provides a 3750 volt isolation barrier making it ideal for safety critical applications. Typical DAA circuits provide the minimum 1500 Volt DC isolation required by FCC part 68 rules. Xecom designed the XE1030 to meet more stringent requirements.

The XE1030 provides all of the circuits required to connect equipment to the public telephone network. these include a solid-state hook switch to control the connection to the telephone line, a fully isolated Ring Detect circuit, isolation transformer and loop current holding circuit. The XE1030 even includes a circuit to allow Caller ID signals to be passed along the signal path without any control lines or switching requirements. The XE1030 is complete and ready for service as Xecom ships it.

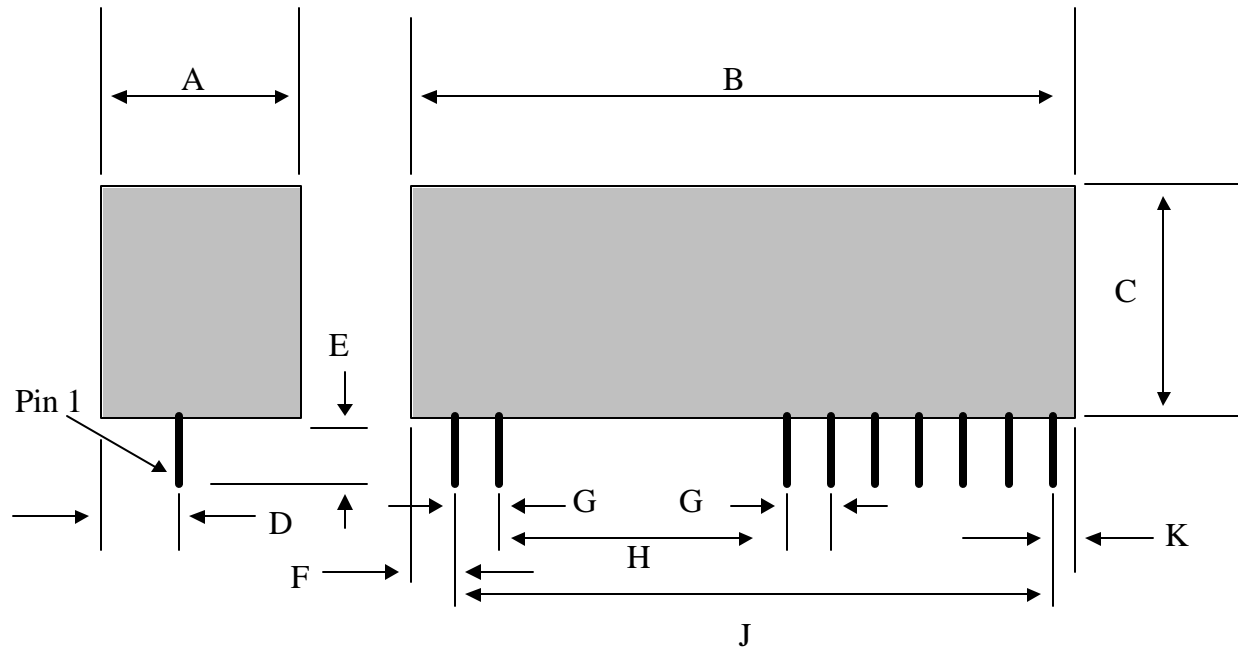
Features

- * Small Single In-Line Package: 1.6" by 0.5" by 0.45"
- * 3750 Volt DC Isolation barrier between the telephone line and all other points.
- * FCC Part 68 Compliant;
- * UL Recognized
- * Integrated Low-Distortion Telephone Line Transformer
- * Ring Detection, active high and active low options available;
- * Operates on a Single +5 Volt Power Supply;
- * Solid-State Hookswitch Control, active high and active low options available;
- * Caller ID Pass-through included;
- * Extended Temperature Ranges available;

XE1030 BLOCK DIAGRAM



XE1030 Mechanical Specifications



Dim	Description	Inches		Millimeters	
		Min	Max	Min	Max
A	Module Width	0.420	0.460	10.80	11.56
B	Module Length	1.590	1.630	40.39	41.40
C	Module Height	0.490	0.530	12.45	13.46
D	Pin Row to Edge	0.100	0.140	2.54	3.56
E	Pin Length	0.120	0.140	3.05	3.56
F	Pin 1 to Edge	0.150	0.170	3.81	4.32
G	Pin to Pin	0.040	0.060	1.02	1.52
H	Pin 2 to Pin 3	1.070	1.080	27.18	27.43
J	Pin Row Length	1.410	1.440	35.81	36.58
K	Pin 9 to Edge	0.015	0.035	0.38	0.89

All Pins are 0.018 inches square; Tin Plated.

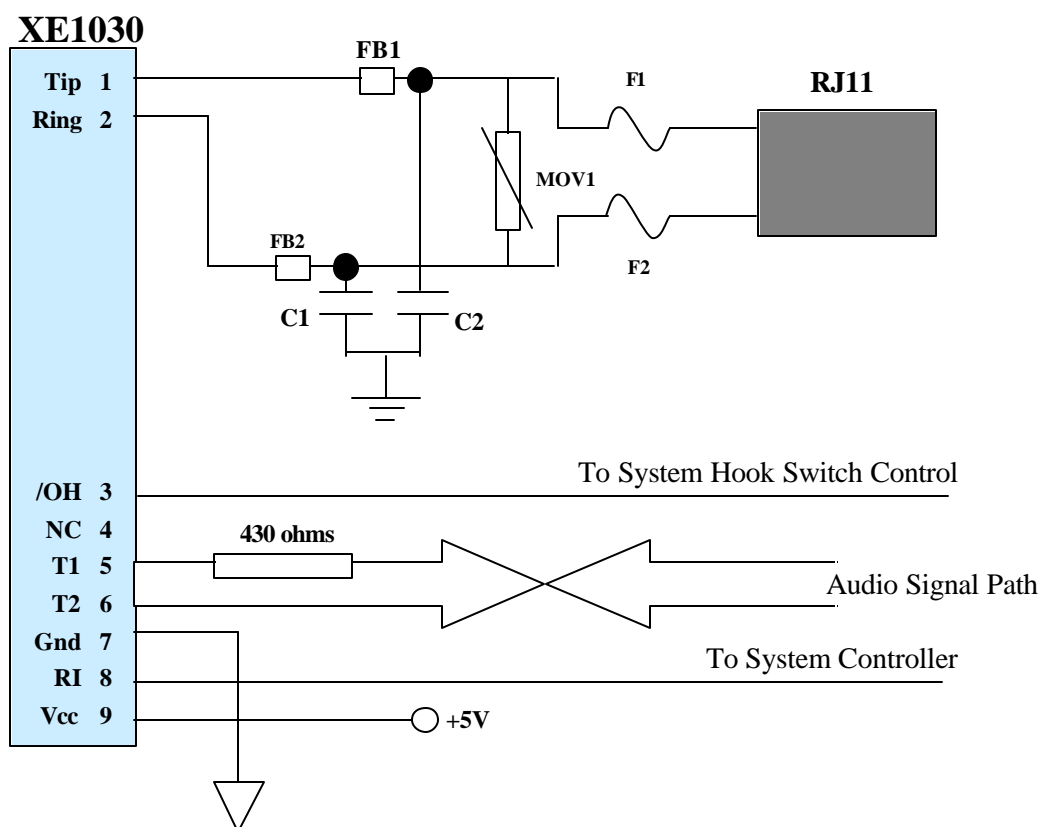
XE1030 Pin Descriptions



XE1030 Pin Configuration

<u>Pin</u>	<u>Name</u>	<u>Description</u>	<u>Pin</u>	<u>Name</u>	<u>Description</u>
1	Ring	Ring is one wire of the two-wire telephone line connection (RJ11 Pin 4). The XE1030 provides a 3750 volt isolation barrier between the telephone line and all other circuits. FCC Part 68 rules require a 1500 Volt isolation barrier to be preserved throughout the system. Xecom recommends 0.100 inch spacing between traces connected to Ring and all other conductors to preserve this isolation.	4	N/C	No Connection
2	Tip	Tip is one wire 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 XE1030 accept this line battery voltage without regard to its polarity.	5	T1	T1 in conjunction with T2 provides the differential input/output for the analog signal. T1 connects directly to the secondary side of the line transformer embedded into the XE1030. To match the impedance of the DAA to the 600 ohm telephone line, a 430 ohm resistor is required on T1 or T2.
3	/OH	Switch-hook control to the modem. /OH is an active low input. Activating OH closes the switch-hook causing the XE1030 to seize the local telephone line. The telephone line connection is dropped when /OH is deactivated. Rotary dialing can be simulated by pulsing /OH. The required 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.	6	T2	T2 in conjunction with T1 provides the differential input/output for the analog signal. T2 connects directly to the secondary side of the line transformer embedded into the XE1030. To match the impedance of the DAA to the 600 ohm telephone line, a 430 ohm resistor is required on T1 or T2.
			7	GND	Ground connection to the XE1030 This signal provides the reference for the OH output and RI input. This pin should be connected to the systems digital ground.
			8	RI	Ring Indicate in an active high output from the modem. RI provides a square wave representation of the Ring signal present across Tip and Ring. This permits intelligent monitoring of the incoming ring. The XE1030 recognizes ring voltages of thirty-eight to one hundred fifty volts RMS in the frequency range of sixteen to sixty-eight Hertz.
			9	VCC	+5 Volt power source for the XE1030 VCC powers the RI and OH control lines.

Typical Connections Diagram for North America and Japan



Recommended Parts

<u>Designation</u>	<u>Description</u>
C1, C2	470 pFd, 3000 Volts; These capacitors may be required for EMI filtering to prevent unintended radiation when the telephone cable is attached to your system. These capacitors must be rated at a minimum of 1500 volts to maintain the isolation required by FCC Part 68 Rules, but 3000 volts is recommended to maintain the isolation barrier provided by the XE1030.
FB1, FB2	All equipment with a system clock of 9 KHz or greater is required to comply with EMI regulations. FB1 and FB2 are ferrite beads which may be required 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 lightning strikes on the telephone lines. Xecom recommends the Teccor P3100BA Sidactor 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 Raychem TR600-150 for this function. The TR600-150 is a PTC devices which automatically resets after use.

Electrical Specifications (Vcc=+5v ±10%, Ta=0 to 70 deg C)

Parameter	Conditions	Min	Typ	Max	Units
Power Supply Current	Off-hook		10	15	mA
	On-hook		0.5		mA
Transmit Insertion loss	600 Ohm Impedance, 1800 Hz		2.0	4.0	dB
Receive Insertion loss	600 Ohm Impedance, 1800 Hz		2.0	4.0	dB
Line Matching Impedance (RT)	Input to T1 and T2		430		ohms
Line Impedance	RT equals 430 ohms		600		ohms
Ring Detect Sensitivity	Min. AC voltage between Tip & Ring Type B ringer	38		150	Vrms
Ring Frequencies Detected		16		68	Hz
RI Output Voltage	Ring signal present, Active low		4.2		Volts
Hook-Switch Control Voltage	ON: (off-hook)		0.2	0.5	Volts
	OFF: (on-hook)	2.0	3.0		Volts
Hook-Switch Control Current	ON: (off-hook)		5	10	milliamps
	OFF: (on-hook)			5	microamps
Loop Current	Off-Hook Loop Current	10		120	mA
DC On-Hook Impedance	Hookswitch Open	10			MOhms

XE1030 ABSOLUTE MAXIMUM RATINGS

Storage Temperature	-25° C to +85° C
Operating Temperature Range *	0° C to +70° C
* The XE1030 can be ordered with an Operating Temperature of -40° C to +85° C at extra cost. Order Model Number XE1030-ITR	

XE1030 Applications Notes

Dialing:

The public switched telephone network permits tone and rotary (pulse) dialing. The XE1030 supports both types. Tone dialing requires an external signal source to generate the dialing tones. Rotary dialing is accomplished by pulsing the OH line on the XE1030.

Pulse Dialing: The XE1030 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 varies from ten pulses per second in North America to 20 pulses per second in Europe. The dialing pulses are asymmetrical. To achieve the correct duty cycle consult with the local country regulations. An inter-digit delay of at least one hundred milliseconds separates the digits.

Tone Dialing: To permit tone dialing the XE1030 seizes the line, OH active. For each digit a unique DTMF, Dual Tone Multiple Frequency, tone pair is placed across T1 and T2. 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 correct 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:

FCC Part 68 Rules set the maximum allowable signal level in the US for all signals placed on the telephone line other than live voice. Other countries have similar regulations. Signal levels are measured in dBm. Zero dBm is 1 milliwatt through a 600 ohm load. In the USA the limit for most signals is -9 dBm.

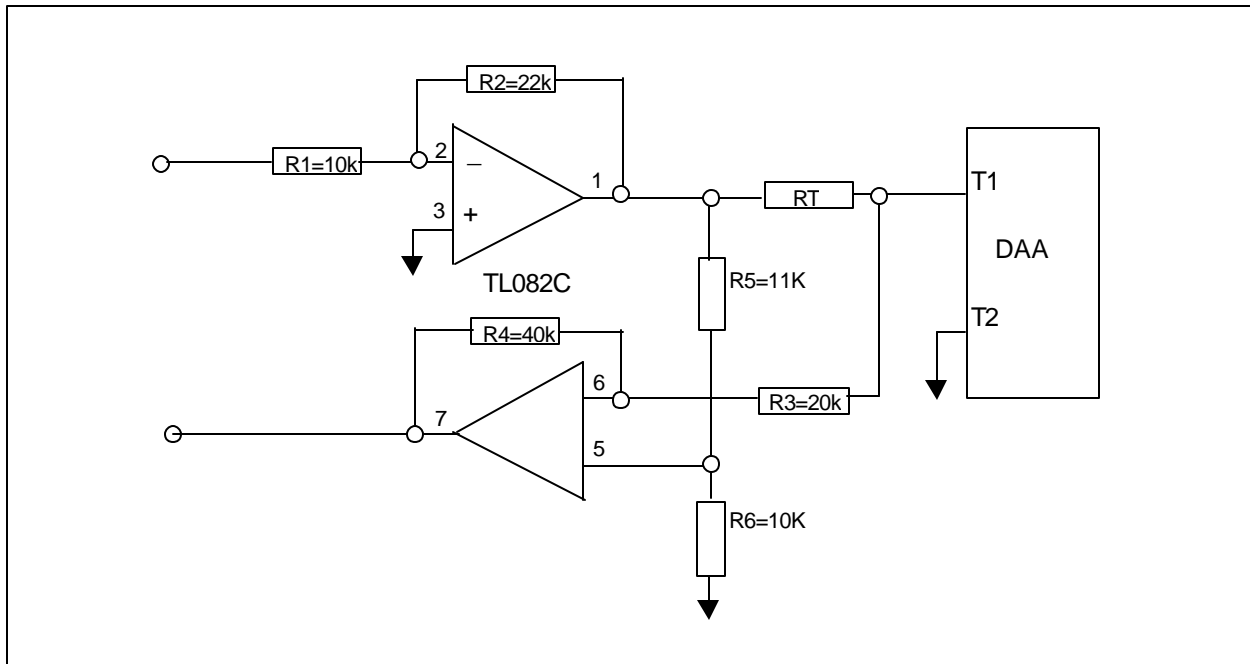
Insertion Loss: There is some loss of signal power as the information signal passes through the XE1030. This "insertion" loss should be taken into account when placing signals across T1 and T2 for transmission. The typical insertion loss of the XE1030 is 2 dB.

XE1030 Applications Notes

2/4 Wire Conversion:

Full Duplex communications over a two-wire telephone line requires that transmit and receive signals share the available bandwidth. The two-to-four wire convertor separates these signals at the host interface. Most modem analog front end chips incorporate an internal 2/4 wire convertor making it unnecessary to provide one in the DAA.

If you are using the XE1030 for an application other than a modem, or your modem analog front end does not provide the 2/4 wire convertor, you will need to provide a discrete 2/4 wire convertor. The schematic below illustrates a simple 2/4 wire convertor circuit



2/4 Wire Convertor

The level of separation provided by the 2/4 wire convertor is measured by its Transhybrid Loss. The Transhybrid Loss shows how much the 2/4 wire convertor attenuates the transmit signal on the received data line. The circuit above provides a typical Transhybrid Loss of 20 dB.

The Transhybrid Loss will vary with the quality of the impedance match to the telephone line. Even when the recommended value for the impedance matching resistor, R6, is used variations from line to line alter the impedance match. The value of R3 can be changed to improve the Transhybrid Loss.

The 2/4 wire convertor also amplifies the transmit and receive signals to compensate for the insertion loss of the DAA. This circuit provides 6 dB gain of both the transmit and receive signals. The values of R1 and R2 set the transmit gain. The values of R4 and R5 set the receive gain.

XE1030 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 XE1030 has been designed to meet all FCC Part 68 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 FCC 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 XE1030 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 XE1030 must certify to the FCC that the final system meets the requirements of Part 68 which include the criteria above as well as the high voltage protection provided by the XE1030. This is generally accomplished through an independent testing lab which tests the System and submits the proper paperwork to the FCC for approval. Since the XE1030 already complies with FCC Part 68 rules, this is a relatively simple process.

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