

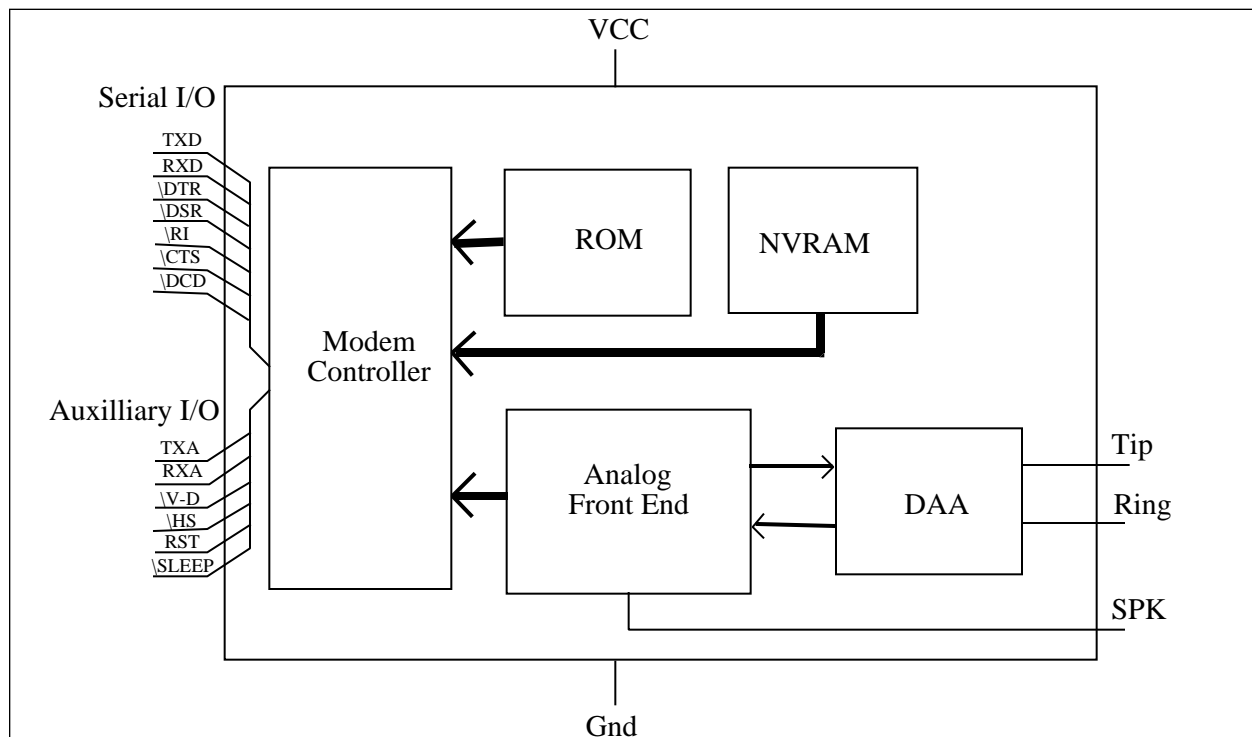
**Miniature 2400 bps Modem Module****Description**

Xecom's XE2486 is a miniature, low cost 2400 bit per second modem. It provides a complete modem, including necessary memory and the DAA in a package just 1.0 inch by 1.25 inches. User transferable FCC Part 68 registration is included.

The XE2486 was specifically designed to provide OEM system designers with a quick, easy and low-cost way to integrate a 2400 bits per second modem. Industry standard "AT" commands provide modem control and configuration. The XE2486 interfaces with the system host through a TTL level, serial interface.

**Features**

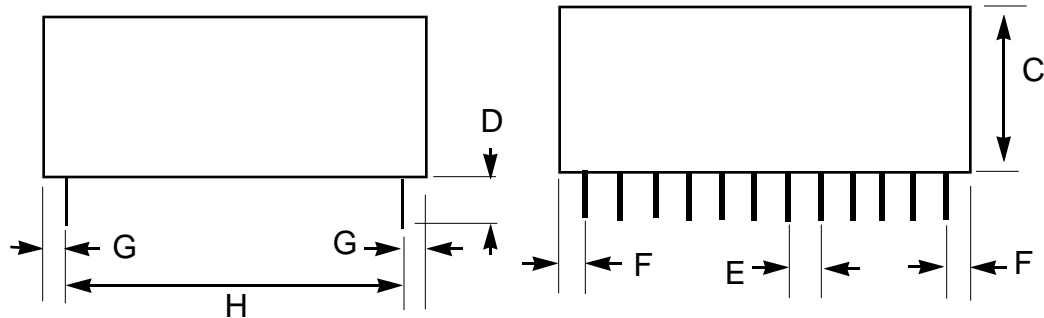
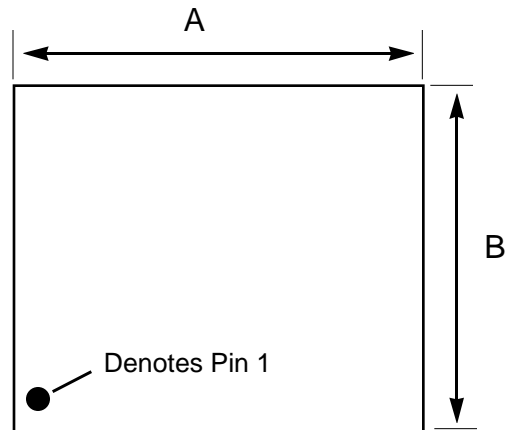
- Supported Protocols: V.22bis, V.22, V.21, Bell 212A and 103
- "AT" commands for modem control and configuration.
- Small Size: 1.25 inches long, 1.0 inches wide, 0.50 inches high.
- NVRAM stores commonly dialed numbers and custom modem configurations
- Single +5V supply
- Low power CMOS:  
Operating: 200 mW (Typ.)  
Sleep mode: 50 mW (Typ.)

**Block Diagram**

## XE2486 Mechanical Specifications

PIN	INCHES		METRIC(MM)	
	MIN	MAX	MIN	MAX
A	1.240	1.260	31.50	32.00
B	0.990	1.010	25.15	25.65
C	0.490	0.510	12.45	12.95
D	0.120	0.140	3.05	3.56
E	0.090	0.110	2.29	2.79
F	0.060	0.080	1.52	2.03
G	0.090	0.110	2.29	2.79
H	0.790	0.810	20.07	20.57

Pins = 0.010 by 0.020 inches



## Pin Configuration and Descriptions

PIN	NAME	DESCRIPTION
1	Ring	Ring provides half the two-wire connection to the telephone network, RJ-11 Pin 4. A 1500 volt barrier isolates Ring from all other circuits. This isolation must be preserved throughout the system. The battery voltage on Ring may be positive or negative with respect to Tip.
2	Tip	Tip provides half the two-wire connection to the telephone network, RJ-11 Pin 3. A 1500 volt barrier isolates Tip from all other circuits. This isolation must be preserved throughout the system. The battery voltage on Tip may be positive or negative with respect to Ring.
3,4	N/A	Not used; Do not connect any circuitry to these Pins.

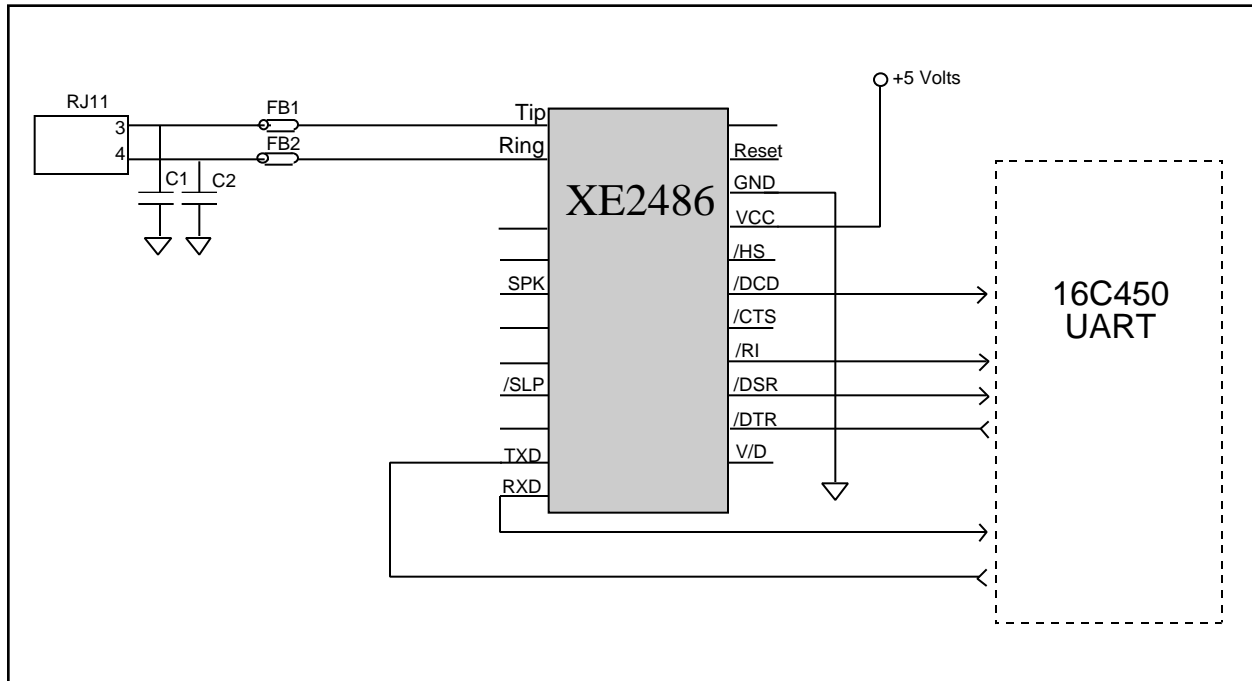
**XE2486**

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## Pin Descriptions continued

PIN	NAME	DESCRIPTION
5	SPK	SPK provides the audio output to a speaker. Speaker output is controlled by the ATL and ATM commands. The input impedance to the speaker driver must be greater than 300 ohms.
6, 7	N/C	No Connection
8	/SLP	This active low output indicates when the modem is in the sleep mode.
9	N/C	No Connection
10	TXD	TXD provides serial data input from the host. A logic high represents a "Mark" and a low represents a "Space".
11	RXD	RXD provides serial data output to the host. A logic high represents a "Mark" and a low represents a "Space".
12	/V-D	The Voice-Data output can be used to drive an external relay for switching between the modem and handset connected to the same telephone line.
13	/DTR	Data Terminal Ready is an active low input to the modem. The AT&D command sets the function of DTR.
14	/DSR	Data Set Ready is an active low output from the modem. Its operation is determined by the AT&S command.
15	/RI	Ring Indicator is an active low output which marks the presence of a ring on the line.
16	/CTS	Clear to Send is not used on the XE2486; it will remain low at all times.
17	/DCD	Data Carrier Detect goes low to indicate receipt of a valid incoming carrier. The AT&C1 command enables the carrier detect function.
18	/HS	This active low output indicates when the XE2486 has made a 2400 bps connection.
19	VCC	VCC provides the +5 volt power required by the modem.
20	Gnd	Ground provides the common reference for the XE2486.
21	RST	This active high input cause a hardware reset in the XE2486. The reset pulse must be held high for at least 10 milliseconds to correctly reset the modem.
22	N/C	No Connection

## XE2486 Typical Connection Diagram



Note: RJ11 Pin assignments reference a 6-pin connector. Tip and Ring are the center pins of all RJ11 jacks.

### Recommended Parts

Reference Designation	Description	Recommended Part Number
L1, L2	Ferrite Beads	TDK CB30-1812
C1, C2	Capacitors	Sprague 30GAT47, 470 pfd, 3000 Volts
J1	RJ11 Jack	Stewart SS6446NF

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## AT Commands

### Modes of Operation

The XE2486 "AT" commands provide two operational modes in the XE2486; Command Mode and Data Mode.

**Data Mode:** The XE2486 enters data mode after it establishes a modem link and issues a "CONNECT" result code. In Data Mode the modem transmits all signals on Transmit Data (TXD) to the remote modem and puts data from the remote modem onto Received Data (RXD). When the modem exits data mode, it issues a "NO CARRIER" result code.

**Command Mode:** The XE2486 enters command mode on power-up, reset, a lost connection, or escape code receipt. In command mode the modem accepts commands from the host on transmit data. The modem returns appropriate responses on received data.

### Command Line Format

Command lines issued to the modem follow a strict format. The AT prefix begins each command. The command buffer stores the command line which is executed upon receipt of a carriage return. Until executed, the command line can be edited with a backspace.

**Command Prefix** - Each command begins with the AT prefix. The "A" and "T" may be both upper case or both lower case but cannot be of different cases. The prefix identifies the speed and parity of the host. The modem measures the width of incoming bits to determine speed and compares parity bits of the two characters to determine parity.

**Command Line** - A command line may include a series of commands. The modem executes such commands in the sequence they appear. A carriage return terminates the command line and executes the commands. Register S3 allows selection of another character to terminate the command line.

**Command Buffer** - The command buffer holds a maximum of 40 characters, including the AT prefix. Space inserted into the command line do not fill space in the command buffer. Attempting to load a longer command line causes the modem to issue an "ERROR" result code and the commands are not executed.

**Command Line Editing** - A backspace can be used to edit the command line before execution. The backspace erases the previous character in the command line. Register S5 allows selection of a character other than a backspace to edit the command line.

**Re-Execute Last Command** - An "A/" causes the modem to re-execute the last command line. This command which does not require the "AT" prefix.

**Omitted Parameters** - Most commands include a parameter which determines how the functions will be set. When this parameter is omitted from the command string, it is assumed to be a 0.

**Escape Characters** - A 3-character escape sequence switches the modem from data to command mode while remaining on line. The escape character, Register S2, must be entered 3 times in succession within a 1 second guard time to execute the escape. The default escape sequence is "+++."

**Result Codes** - The modem issues a result code after each action. Result codes may be provided as full words, numeric codes or may be disabled all together. Each result code ends with a carriage return when numeric result codes are chosen. When full word result codes are chosen, a Line Feed and Carriage Return precede and follow each result code.

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## AT Command List

An asterisk indicates the factory default

### A - Answer Command -

### Bn - Select Communications Standard

- n=0 Selects CCITT standards
- n=1 Selects Bell standards\*

### D - Dial Command -

- P = Pulse dial
- T = Tone dial
- R = Connect as an answering modem
- W = Wait for dial tone
- , = Pause for the duration of S8
- @ = Wait for silence
- ! = Switch hook flash
- ; = Return to the command state

### En - Command Echo

- n=0 Do not echo commands
- n=1 Enable command echo\*

### Hn - Switch Hook Control -

- n=0 Switch hook relay closes\*
- n=1 The switch hook relay opens

### In - Modem Identification

### Ln - Speaker Volume -

- n=0 Low speaker volume
- n=1 Low speaker volume
- n=2 Moderate speaker volume\*
- n=3 High speaker volume

### Mn - Speaker Activity -

- n=0 Speaker off
- n=1 Speaker on until carrier received\*
- n=2 Speaker remains on
- n=3 Speaker on after dialing until carrier is detected.

### On - On Line

- n=0 Return On Line with no retrain\*
- n=1 Initiate retrain while returning On line.

### Qn - Responses

- n=0 Send responses \*
- n=1 No Responses

### Sr? - Interrogate Register -

### Sr=n - Set Register Value -

### Vn - Result Codes -

- n=0 Numeric Result Codes
- n=1 English Word Result Codes\*

### Xn - Result Code Set -

- n=0 Responses 0-4\*
- n=1 Responses 0-5 & 10
- n=2 Responses 0-6 & 10
- n=3 Responses 0-5, 7 & 10
- n=4 Responses 0-7 & 10

### Z - Reset -

### &Cn - DCD Operation

- n=0 DCD is forced active\*
- n=1 DCD indicates a valid carrier signal

### &Dn - DTR

- n=0 DTR is ignored by the modem\*
- n=2 Modem disconnects if the host revokes DTR.
- n=3 The modem performs a soft reset when DTR is revoked.

### &F - Revert to Factory Defaults

### &Ln - Line Type

- n=0 Modem operates on dial-up lines\*
- n=1 Modem operates on leased lines

### &Qn - Communications Format

- n=0 Sets the modem for normal, unbuffered operation.

### &Tn - Test Modes

- n=0 Exit test mode
- n=1 Local analog loopback
- n=3 Initiate local digital loopback
- n=4 Respond to remote loop request\*
- n=5 Deny remote loop request
- n=6 Initiate a Remote Digital loopback
- n=7 Remote digital loopback w self-test
- n=8 Local analog loopback w self-test

### &V - View Active Profile -

### &Wn - Store Profile -

- n=0 Stores the current configuration in memory location 0.
- n=1 Stores the current configuration in memory location 1.

### &Yn - Recall Profile

- n=0 Use memory location 0.
- n=1 Use memory location 1.

### &Zn=X- Store Number

## S-Register Summary

REG.	RANGE/UNITS	DESCRIPTION	DEFAULT
S0	0-255/rings	Number of rings to answer on	000
S1	0-255/rings	Count number of incoming rings	000
S2	0-127/ASCII	Escape character	043
S3	0-127/ASCII	Carriage return character	013
S4	0-127/ASCII	Line feed character	010
S5	0-32,127/ASCII	Backspace character	008
S6	2-255/sec	Dial tone wait time	002
S7	1-60/sec	Wait time for remote carrier	030
S8	0-255/sec	Comma pause time	002
S9	1-255/0.1 sec	Carrier detect response time	006
S10	1-255/0.1 sec	Delay from loss of carrier to hang up	014
S14	Bit Mapped	E,Q,V,T,P,D,A,R accept/ignore	170
S16	Bit Mapped	Modem loopback tests	000
S18	0-255/sec	Modem test timer	000
S21	Bit Mapped	J, &R, &D, &C, &S, Y	000
S22	Bit Mapped	L, M, X, &P, &T4, &T5, DTE speed and parity	118
S23	Bit Mapped	&T4,&T5, DTE speed, parity	007
S27	Bit Mapped	&Q, &L, &X, B commands	064

## Result Code Summary

DIGIT	CODE	WORD CODE MEANING
0	OK	Successfully executed command line
1	CONNECT	300 bps connection established
2	RING	Ring signal detected
3	NO CARRIER	Carrier not detected within Register S7 detect time
4	ErroR	Error found in command line; returns to command line
5	Connect 1200	1200 bps connection established
6	No dial tone	No dial tone detected within 5 Sec. after going off-hook
7	Busy	Busy signal detected after automatically dialing a call
8	No answer	Five seconds of silence was not detected when using the @ command in the Dial command line
10	Connect 2400	Connection established at 2400 bps

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## Electrical Specifications

Absolute Maximum Ratings*	
SUPPLY VOLTAGE - Vcc	+6.5 Volts
DC INPUT VOLTAGE	-0.6 Volts to +6.5 Volts
STORAGE TEMPERATURE RANGE	-25° C TO +100° C
LEAD TEMPERATURE (Soldering, 2 sec per wave)	260° C
OPERATING TEMPERATURE RANGE	0 TO 70° C

\*Exceeding these values may result in permanent damage to the device.

## Telephone Interface Specifications

PARAMETER	MIN	TYP	MAX	UNIT
Telephone Line Impedance Match		600		ohms
Ring Detect Sensitivity (on hook, Type B ringer)	38			Vrms
Telephone Loop Current	20		100	mA

## Power Supply Characteristics (TA = 0 - 70°C, Vcc = 5v ±5%)

Symbol	Parameter	Min	Typ	Max	Units	Comments
Vcc	Supply Voltage	4.75	5.0	5.25	V	
Icc	Vcc Supply Current		40		mA	All outputs Disconnected
Iccpd	Power Down Current		10		mA	

**Power Management:** The XE2486 has an integrated, advanced power management capability. If no activity is detected on the RXD, DTR, or RI lines the modem will automatically go into a smart power down mode. In this mode power consumption is typically less than 50 milliwatts.



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## FCC Instructions

This product complies with Part 68 of the FCC Rules. With each device shipped, there is a label which contains, among other information, the FCC Registration Number and Ringer Equivalence Number (REN) for this product. You must, upon request, provide this information to your telephone company.

The mounting of this device in the final assembly must be made in such a manner as to preserve the high voltage protection between the TIP/RING and the rest of the system. Typically, this may be accomplished by maintaining a minimum spacing .100 mils between the TIP/RING Traces to the RJ-11C Jack and low voltage portion of the system. No additional circuitry may be attached between TIP/RING and the telephone line connection, unless specifically allowed in the rules.

The REN helps determine the number of devices you may connect to a telephone line and still have all of these devices ring when the number is called. In most, but not all areas, the sum of the RENs of all devices connected to one line should not exceed five (5.0). To be certain of the number of devices you may connect to the line, as determined by the REN, you should contact the local telephone company to determine the maximum REN for your calling area.

If your system causes harm to the telephone network, the telephone company may discontinue service temporarily. If possible, they will notify you in advance. If advance notification is not practical, you will be notified as soon as possible.

Your telephone company may make changes in its facilities, equipment, operations or procedures that could affect proper functioning of your equipment. If they do, you will be notified in advance to give you an opportunity to maintain uninterrupted telephone service.

If you experience trouble with this device, please contact XECOM at (408) 945-6640 for information on obtaining service or repairs. The telephone company may ask you to disconnect this device from the network until the problem has been corrected or until you are sure that the device is not malfunctioning.

The device may not be used on coin service lines provided by the telephone company (this does not apply to private coin telephone applications which use standard telephone lines). Connection to party lines is subject to state tariffs.

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## Terms of Sale

Devices sold by XECOM are covered by the warranty provisions appearing in its Terms of Sale only. XECOM makes no warranty, express, statutory, implied, or by description regarding the information set forth herein, or regarding the freedom of the described devices from patent infringement. XECOM makes no warranty of merchantability or fitness for any purposes. XECOM reserves the right to discontinue production and change specifications and prices at any time and without notice. This product is intended for use in normal commercial applications. Applications requiring extended temperature range, unusual environmental requirements, or high reliability applications, such as military, medical life-support or life-sustaining equipment, are specifically not recommended without additional processing and authorization by XECOM for such application.

Xecom assumes no responsibility for the use of any circuitry other than circuitry embodied in a Xecom product. No other circuits, patents, or licenses are implied.

## Life Support Policy

Xecom's products are not authorized for use as Critical Components in Life Support Devices or Systems.

**Life Support Devices or Systems** are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform, when properly used in accordance with instructions provided in the labeling, can be reasonably expected to result in significant injury to the user.

**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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The logo for Xecom, featuring the word "xecom" in a bold, lowercase, sans-serif font. The letters are white and set against a solid black rectangular background.

**Xecom Incorporated**  
374 Turquoise Street, Milpitas, CA 95035  
Ph:408-945-6640 Fax:408-942-1346 E-Mail: info@xecom.com