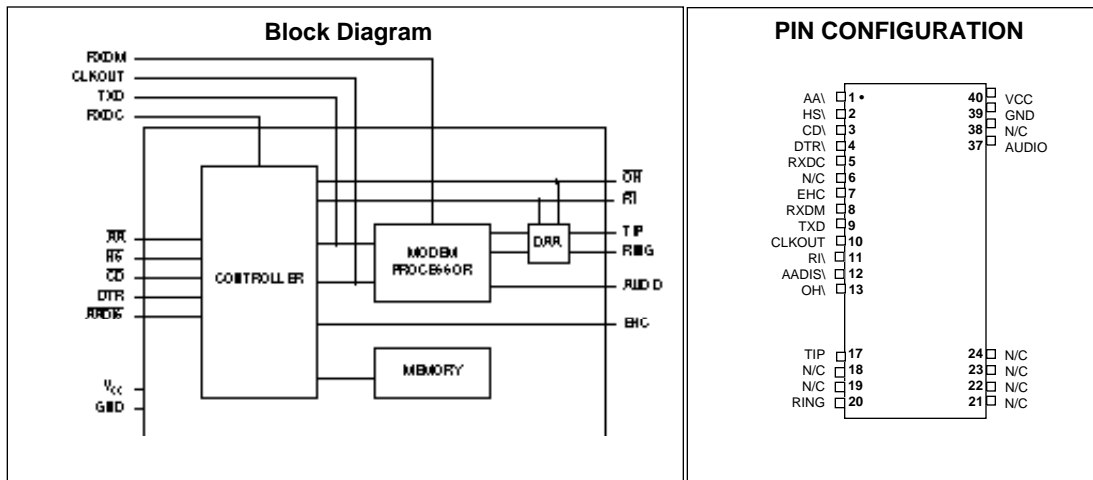## 1200bps Component Modem

Description

The XE1214B5 is a complete, self contained 1200/300 bps modem in small, component form. It contains all circuitry necessary for a complete modem, including an internal, FCC Registered, Data Access Arrangement (DAA) for direct connection to the telephone line, and a serial TTL interface. With the addition of line driver and receiver ICs (such as the MC1488 and MC1489), this serial interface may be easily converted to a full RS232C serial interface.

The XE1214B5 uses the industry standard "AT" commands. This allows the XE1214B5 to operate with most communications software. It supports full duplex, 1200/300 bps, data transfer with either Bell 212A/103 or CCITT V.22/V.21 modulation. The XE1214B5 includes the capability to monitor call progressand generate DTMF and guard tones required for CCITT V.22/V.21 communication. It operates in the asynchronous mode and provides analog loopback, digital loopback and remote digital loopback functions for testing purposes.

Features

- Small Size -2.28" x 1.0" x 0.5"
- FCC Part 68 Registered
- Fully Bell 212A/103 and CCITT V.22/V.21 Compatible
- Complete Industry Standard "AT" Command Set
- TTL Serial Interface
- Call Progress Monitoring
- DTMF and Pulse Dialing
- Software Controlled Audio Output
- UL Recognized Component
- CSA Recognized Component
- +5 Volt Power Only

Block Diagram

PIN CONFIGURATION

Pin Descriptions

PIN	NAME	I/O	DESCRIPTION
1	AA	O	AA goes low when the XE1214B5 is set in the auto-answer mode, either by switch input AA DIS (pin 12) or register S0. If the XE1214B5 is not set to automatically answer (pin 12 held low, or S0 = 0), AAI follows the incoming ring signal, going low for the 4 sec interval between rings. For display purposes, this output may be used to drive an external LED through a 330 ohm resistor.
2	\HS	O	This output, when low, indicates that the modem is in the high speed (1200 bps) mode. When high, it indicates that the modem is in the low speed (300 bps) mode. For display purposes, this output may be used to drive an external LED through a 330 ohm resistor.
3	\CD	O	\CD indicates detection of a remote modem by going low. If the connection is broken, or never established| \CD remains high. For display purposes, this output may drive an external LED through a 330 ohm resistor.
4	\DTR	I	A low on \DTRallows the XE1214B5toll execute data call commands. If this input is driven high during a data call, the XE1214B5 terminate the data call, hang up the phone line and return to the command state.
5	RXDC	O	The XE1214B5 internal controller (see block diagram) uses RXDC to transfer serial data in an asynchronous start/stop format at the data rate selected by the terminal. This data is either the echo of commands received from the terminal, or result codes generated by the controller during processing of commands. It is normally high, and should be "AND"ed with RXDM (pin 8) to form the received data to the terminal.
6	N/C	---	No Connection.
7	EHC	O	External Handset Control, when activated by the H1 Command, is used to control an additional relay to allow an independent handset to be connected to the telephone line. During data transmission, when the relay in the internal DAA is closed (off-hook), this output is low. When the internal relay is open (on-hook), this output is high,and may be used to control an external relay to connect a telephone handset to the line.
8	RXDM	O	The internal modem processor of the XE1214B5B5 (see block diagram) demodulates the received carrier and outputs data on this pin. A logic low level is "space" and a logic high is "mark". This output is normally high, and should be "AND"ed with RXDC (pin 5) to form the received data signal to the terminal.

Pin Descriptions

PIN	NAME	I/O	DESCRIPTION
9	TXD	I	This is the input for data to be transmitted. The internal controller of the XE1214B5 receives command data from the terminal on this input while the internal modem processor receives data from the terminal on this input for modulation. A logic low is "space" and a logic high is "mark".
10	CLKOUT	O	The buffered internal clock signal is output on this pin. Its frequency is 7.3728 MHz and it can drive one LS TTL load.
11	\RI	O	Ring Indicator. A low level on this status line indicates the ring portion of the ring cycle. This line is normally used for test/status purposes only.
12	\AADIS	I	When this input is held low, the XE1214B5 will not answer incoming calls. When held high or left open, the XE1214B5 will automatically answer incoming calls on the first ring. This function may also be enabled/disabled by writing to the S0 register.
13	\OH	O	Off Hook status monitor. This status line allows the user to monitor the status of the hookswitch relay in the internal DAA (see block diagram). When the signal on OH is low, the internal relay is closed and the XE1214B5 is connected to the phone line. During rotary dialing, this pin is pulsed at a rate of 10 pps with appropriate Make/Break ratio depending on the 212A or V.22 mode selected.
14-16	N/C	---	No connection.
17,20	TIP-RING	---	These pins are for the TIP and RING connections to the telephone line from the internal DAA. In order to preserve the high voltage isolation provided by the DAA, traces from these pins to the RJ11C Jack should have a minimum spacing of 150 mils between them and any other traces on the PC board.
18,19	N/C	---	No connection.
21-24	N/C	---	No connection.
37	AUDIO	O	The output of the internal hybrid 2-4 wire converter is brought out on this pin through an internally programmable attenuator. The attenuation level may be set by the ATL command.
38	N/C	---	No connection.
39	GND	---	Ground (0 volts).
40	VCC	---	Positive supply voltage (+5 volts).

S-Register Description

Register	Range/Units	Default	Description
S0	0-255/rings	1	Number of rings before the XE1214B5 answers the call. With S0=0, the XE1214B5 does not answer the call. With S0=5, the XE1214B5 answers the call on the fifth ring.
S1	0-255/rings	0	Number of rings detected. S1 is cleared if no ring occurs within 8 seconds. S1 operates only if S0 is not zero.
S2	0-127/ASCII	43	ASCII value for the escape code. Values greater than 127 are not accepted, but do disable escape code operation.
S3	0-127/ASCII	13	ASCII value for carriage return. The character in S3 is used for both the command line and the result code terminators.
S4	0-127/ASCII	10	ASCII value for line feed. The XE1214B5 sends a line feed after it sends a carriage return only when English word result codes have been selected (V1). If a line feed is not needed, it can be set to a null. But this function cannot be disabled.
S5	0-32, 127/ASCII	8	ASCII value for backspace. This character is both the backspace key and the character echoed to move the cursor back one position. The values between 33 and 126, the range of printable ASCII characters are not accepted.
S6	2-255/sec.	2	Waiting time before dialing when X0, X1 or X3 is enabled. Values greater than 2 seconds may be necessary if trouble is encountered getting dial tones.
S7	1-255/sec.	30	The time the XE1214B5 waits for carrier signal detection from remote modem before hanging up. If the XE1214B5 does not detect a carrier signal within that time, it hangs up and a NO CARRIER result code is displayed. If it does, a CONNECT result code (or (CONNECT 1200 when X1, X2, X3 or X4 is enabled) is displayed and the XE1214B5 goes on line. Also used to control time-out of W command.
S8	0-255/sec.	2	Pause time for each comma. The comma is used during dialing when it is necessary to dial out of a PBX and wait for a second dial tone. Two seconds is usually enough, however the default may be changed or multiple commas may be used for longer time delays.
S9	1-255/0.1 sec.	6	The time required for the carrier signal from a remote modem must be present for the XE1214B5 to recognize it as a carrier and signal a carrier detection. This feature prevents the XE1214B5 from mistaking a carrier signal for a ring or busy signal. The Units are in tenths of seconds.
S10	1-255/0.1 sec.	14	The time between the loss of carrier from a remote modem and hangup. With S10 equal to 255, XE1214B5 acts as if carrier is always present. If S10 is smaller than S9, XE1214B5 disconnects for short loss of carrier. This is because S10 will time out before the carrier detect response time expires. The Units are in tenths of seconds.

Register	Range/Units	Default	Description
S11	50-255/msec.	75	Duration and spacing of touch-tones. Note that pulse dialing is fixed at 10 pulses per second.
S12	20-255/0.02 sec	50	The time delay required both before and after entering the escape command (+ + +). The Units are in 20 millisecond intervals.
S13	bit mapped	—	XE1214B5 status register (see Note 1) bit 0 - undefined (Note 2) bit 1 - undefined bit 2 - 0 parity disabled 1 parity enabled bit 3 - 0 odd parity 1 even parity bit 4 - 0 seven data bits 1 eight data bits bit 5 - undefined bit 6 - 1 buffer overflow flag (causes ERROR result code to be sent) bit 7 - 0 8th data bit set to space (if bit 4 + 1) 1 8th data bit set to mark (if bit 4 = 1)
S14	bit mapped	170	XE1214B5 option register bit 0 - 1 auto answer enabled bit 1 - 0 local echo disabled 1 local echo enabled bit 2 - 0 result code enabled 1 result code disabled bit 3 - 0 result codes sent as digits 1 result codes sent as words bit 4 - 0 enable command recognition 1 disable command recognition bit 5 - 0 67/33% make/break ratio 1 61/39% make/break ratio bit 6 - 0 CCITT V.22/V.21 1 Bell 212A/103 bit 7 - 0 long space disconnect disabled 1 long space disconnect enabled
S15	bit mapped		XE1214B5 flag register bit 0 - same as setting of bit 4 bit 1 - same as setting of bit 5 bit 2 - 0 answer mode 1 originate mode bit 3 - 0 half duplex 1 full duplex bit 4 bit 5 0 0 undefined 1 0 110 bps 0 1 300 bps 1 1 1200 bps bit 6 - 0 no connection 1 connection established bit 7 - undefined
S16	0,1,4		This register is used to test analog loopback, digital loopback and remote digital loopback.

Offline Analog Loopback

Before entering offline analog loopback, the telephone line must be disconnected. Normal line signals may disrupt modem performance during the analog loopback test. The test is started by entering the following commands: Answer Mode - ATS16 = 1A
                                                                        Originate Mode - ATS16 - 1O

With both commands, a CONNECT result code is displayed and subsequent characters typed on the keyboard are displayed on the screen. The test may be ended by the escape command. S16 may be reset to zero by the H command.

Online Analog Loopback

This test is useful in the event that the XE1214B5 is on line with a remote modem and is receiving many errors. The test is started by entering the command: ATS16 = 1O

The O command puts the XE1214B5 back on line. All characters entered on the keyboard should be transmitted to the remote modem and displayed on the screen. If the information is correctly displayed, then XE1214B5 is working properly and the problem is either in the phone line or with the remote modem. To finish the test and return on line in the normal mode enter the command: ATS16 = 0O

Digital Loopback

This test causes the modem to resend each received character. It is used for testing a remote modem. The modems must be connected before the test. The test is started with the commands: ATS16 = 4O

All the characters entered by the remote modem are looped back to its screen through the XE1214B5 and are not displayed on the local screen.

Remote Digital Loopback

This test enables the remote modem to loop received data back to the transmitting modem. It is useful when meaningless data is received from the remote modem or vice versa. To execute the test, the remote modem must be capable of operating in remote digital loopback. The test is started by the command: ATO2

To exit this test and go back on line enter the command: ATO1

Audio Output Stage

A programmable attenuator that can drive a load impedance of 50K is provided to allow monitoring of the telephone line signal through an external speaker. Four levels of signal (high, medium, low and off) are provided through the L and M commands as well as the capability to automatically turn the signal off when a data connection is established. The output of the attenuator is available on the Audio Output (pin 12) and may be used with an external audio amplifier (such as an LM386) to drive a low impedance speaker. The output can directly drive a high impedance transducer, however the output may be low.

AT Data Commands

AT   Command line prefix; Must preceed all of the commands, except for the A/ command.
A   Answer incoming call immediately.
A/   Re-execute last command line, don't precede this command with AT or press <Enter> at the end of the command line
B   Uses Bell or CCITT z answer tone at 1200 bps
C   Modem carrier signal on
Dn   Dial telephone number n; you can also include the following Dial string modifiers:
      P   Pulse dialing
      R   Originate call in answer mode
      T   Touch-Tone dial
      ;   Return to Command Mode after dialing
      ,   Pause (default 2 seconds; see register S8)
      !   0.5-second hookflash
      /   Wait for 1/8 second
      @   Wait for silence (default 5 seconds)
      W   Wait for dial tone (default 30 secs; see register S7)
E   Command echo
F   Full or half Duplex
H   switch hook control
I   Product code
L   Speaker volume
M   Speakercontrol
O   Return to on-line mode
Q   Result codes (default)
Sr?   Read and display value of register r
Sr=n   Set register r value to n
V   Full Word or numeric result codes
X4   Response set,
Y   Long space disconnect disabled
Z   Resets modem and sets modem to factory default states

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

Note: When the XE1214B5 detects ringing on the telephone line, it sends a Ring result code. However, the XE1214B5 will answer call only if it is in auto-answer mode (ATSO>0) or is given an ATA.

Typical Connection Diagram
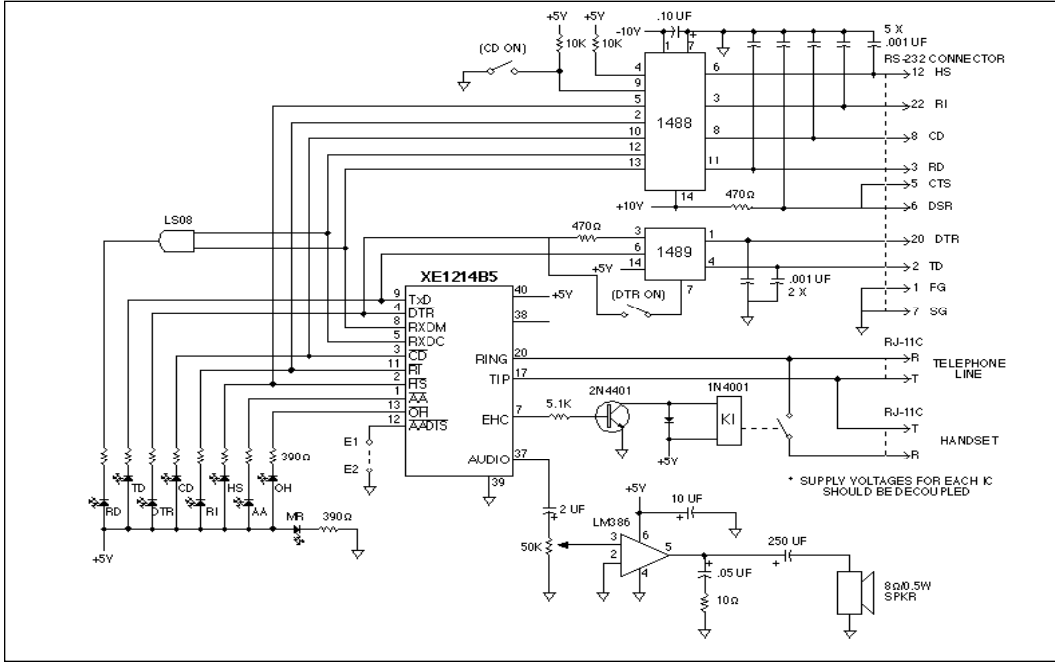
Mechanical Specifications

DIM	INCHES		METRIC(MM)	
	MIN	MAX	MIN	MAX
A	2.255	2.305	57.2	58.6
B	0.985	1.015	25.0	25.8
C	0.490	0.510	12.4	13.0
D	0.890	0.910	22.6	23.1
E	1.890	1.910	48.0	48.5
F	0.125	0.200	3.1	5.1
G	0.040	0.060	1.0	1.5
H	0.180	0.200	4.5	5.1
J	0.090	0.110	2.3	2.8

Denotes Pin 1
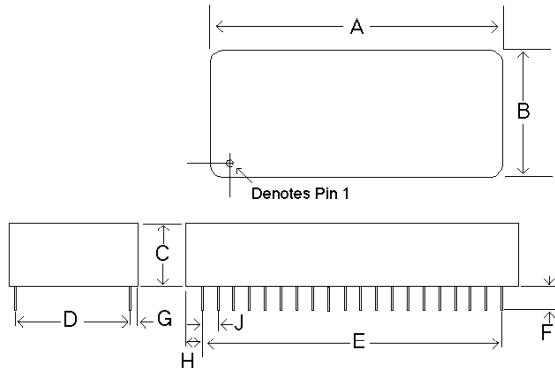
Electrical Specifications

ABSOLUTE MAXIMUM RATINGS*	
SUPPLY VOLTAGE - Vcc	+6 Volts
DC INPUT VOLTAGE	-0.6 Volts to (Vcc +0.6 Volts)
STORAGE TEMPERATURE RANGE	-25° C TO +85° C
LEAD TEMPERATURE(Soldering, 2 seconds per wave)	260° C
OPERATING TEMPERATURE RANGE	0 TO 70° C
*Exceeding these values may result in permanent damage to the device.	

D.C. Electrical Specifications

(TA = 0 - 70°C, Vcc = 5v ±10%)

Description	Parameter	Min	Typ	Max	Units
Power Supply Voltage	Vcc	4.5	5.0	5.5	Volts
Power Supply Current	Icc (on-hook)		28.0	50.0	mA
	Icc (off-hook)		68.0	100.0	mA
High Level Input Voltage	Vih	2.0			Volts
Low Level Input Voltage	Vil			0.8	Volts
High Level Output Voltage	Voh	3.5			Volts
Low Level Output Voltage	Vol			0.4	Volts
Leakage Current				± 1.0	uA

Telephone Line Interface Specification

Description	Min	Typ	Max	Units
Telephone Line Impedance Match		600		Ohms
Ring Detect Sensitivity (on hook, Type B Ringer)	38			Vrms
DC Telephone Line Current	0	20	100	milliamps

Transmitter Specifications

Description	Parameter	Min	Typ	Max	Units
Input Character Length	Start Bit=Data Bit + Stop Bit		10		bits
Character Bit Rate		1170	1200	1212	bps
Carrier Output Level			-10	-9	dBm
DTMF Row Output Level			-6		dBm
DTMF Column Output Level			-4		dBm
1800 Hz Guard Tone			-16		dBm

Receiver Specifications

Description	Min	Typ	Max	Units
Received Signal Range	-45		0	dBm
Character Bit Rate	1170	1200	1224	dps
Carrier Detect Level	-48		-43	dBm
Carrier Detect Hysteresis	2			
Carrier Detect Delay	10	20	30	msec
Carrier Detect Hold	15	20	24	msec

FCC Instructions

This product complies with part 68 of the FCC Rules and Regulations. 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 Connection 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 is useful to determine the quantity 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 you 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.

FCC Registration Number DWEUSA-65595-MD-E
Ringer Equivalence 0.9B

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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.