Consumer Microcircuits Limited
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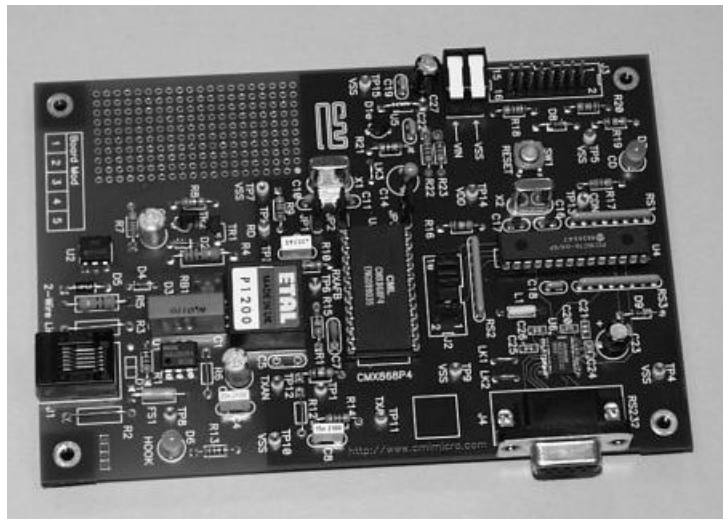
EV8680
Evaluation Kit
User Manual

1.0   Features

- **CMX868 Product Evaluation**

- **Fully Isolated 2-Wire Line Interface**

- **Modem Calling/Answering Demonstrations**

- **'AT' Command Compatible Firmware**

- **Opto Isolated Ring Detect Circuitry and OptoMOS Hook Relay**

- **Single Power Supply Operation with On-Board Regulator**

- **PC Controlled via Terminal Emulator**

- **DIP or SOIC Product Evaluation**

- **User's Prototyping Area**

- **On-Board PIC Programming**

- **Socketed Space for Optional Telco-Specific Components**

- **Socketed Components and Links for Circuit Adjustment**

1.1   Brief Description

The EV8680 Evaluation Kit comprises a single board containing a CMX868 V.22 bis Modem IC, line interface components and a PIC µC with serial communications port for interfacing to a PC. AT Commands are used to control the evaluation board via standard terminal emulators.

The board is powered from a single 8 - 14V dc power supply; an on-board regulator and two discrete components set V_{DD} to provide 2.7 Volt or 5.0 Volt operation. LEDs indicate carrier detect and hook relay status. The CMX868 may be driven from an external clock, or from the on-board crystal oscillator.

Removal of jumpers allows the user to measure device current and also to disconnect the 'C-BUS' control lines from the on-board µC to allow control from an external system. Important signals can be monitored via test points and header pins.

The evaluation board has a 2-wire line interface to provide line matching and dc isolation. This 2-wire interface is connected to the line using an OptoMOS relay.

The CMX868 and µC are fitted in DIL sockets for easy replacement. Where components are telco-specific (line impedance, line protection, etc.) space is provided for the user to add appropriate components.

CONTENTS

Note: This product is in development: Changes and additions will be made to this specification. Items marked TBD or left blank will be included in later issues.

Information in this data sheet should not be relied upon for final product design.
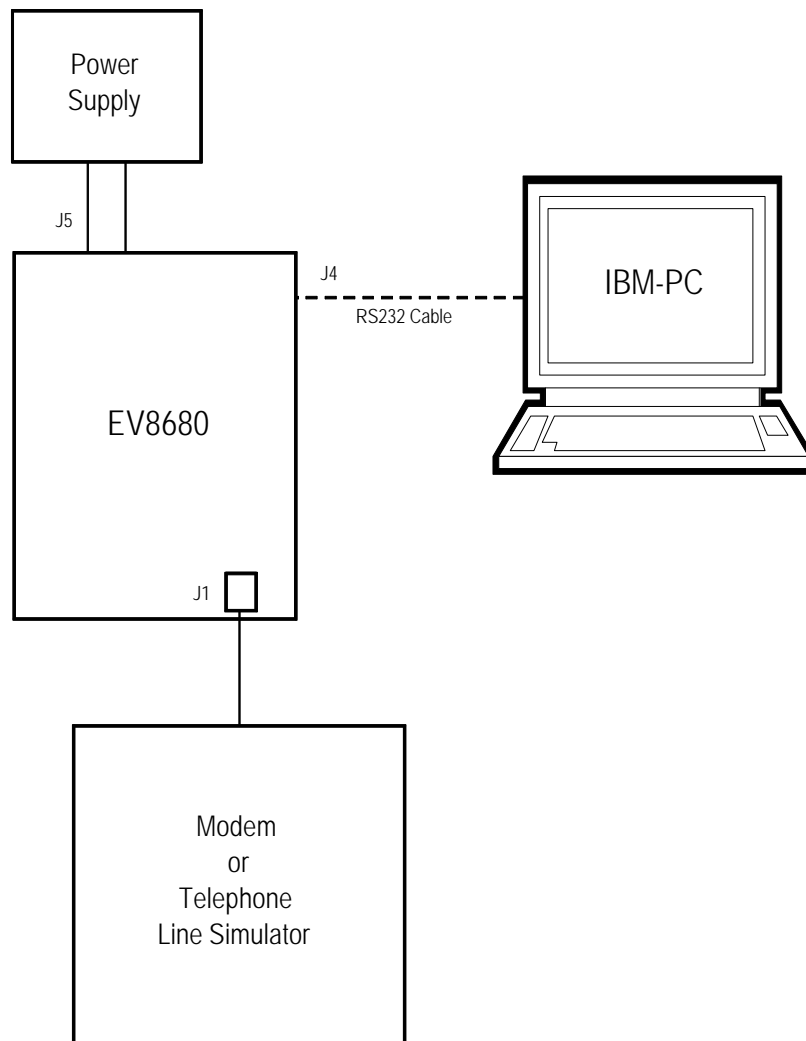
Figure 1 Block Diagram

1.2   Preliminary Information

1.2.1   Laboratory Equipment

The following laboratory equipment is needed to use this evaluation kit:

1.2.1.1 8 - 14V dc Power Supply

1.2.1.2 An IBM compatible PC; 66MHz '486 or better, running Microsoft Windows™ 95/NT. The PIC programming software supplied (PICPROGB.EXE) runs most efficiently under DOS and cannot be used with Windows NT.

1.2.2   Handling Precautions

Like most evaluation kits, this product is designed for use in laboratory environments. The following practices will help ensure its proper operation.

1.2.2.1 Static Protection

This product uses low power CMOS circuits which can be damaged by electrostatic discharge. Partially damaged circuits can function erroneously, leading to misleading results. Observe ESD precautions at all times when handling this product.

1.2.2.2 Contents - Unpacking

Please ensure that you have received all of the items on the separate information sheet (EK8680) and notify CML within 7 working days if the delivery is incomplete.

1.2.3   Approvals

This product is not approved for direct or indirect connection to any public telecommunication system. Users are advised to observe local statutory requirements which may apply to this product.

1.3   Quick Start

This section provides instructions for users who wish to experiment immediately with the evaluation kit. A fuller description of the kit and its use appears later in this document.

1.3.1   Setting-Up

THE EV8680 COMES PRE-CONFIGURED WITH A CMX868 DIP DEVICE FOR OPERATION AT 5.0 VOLTS.   THE IDC HEADER, J2, HAS ALL 5 JUMPERS INSERTED TO PROVIDE 'C-BUS' CONTROL FROM THE ON-BOARD PIC.

An RJ11 (US style) phone jack, J1, is provided for 2-wire line connection. Power is connected via the two-way socket, J5.

Attach the 9-way RS232 cable between connector J4 and the serial port of the PC. Connect an external modem/line simulator to the evaluation kit using a suitable RJ11 telephone cable (not supplied).

1.3.2   Adjustments

The line matching components can be adjusted, as required (refer to CMX868 data sheet and ETAL transformer recommendations). Telco-specific components may be added, as required.

1.3.3   Operation

The EV8680 Evaluation board allows the user to perform calling, answering and simple data transfer with a suitable simulator or external third party modem (not supplied). The board also allows the user to attach laboratory test equipment to perform simple CMX868 device evaluation tests i.e. current measurement, tone generation and detection.

The board is controlled by the AT command set described in Section 1.6.3, by running a terminal emulator program on the host PC. A suitable emulator is the 'Hyper Terminal' program which operates under Windows 95/NT systems. The EV8680 AT command set consists of Basic, Extended and CML Specific commands.

The board has two modes of operation:

AT Command Mode
In this mode the command processor firmware is constantly checking to see if the user has typed a valid AT command. When a valid command is received the firmware will execute that command. While the firmware is operating in this mode, the user can instruct it to manually answer a call, originate a call, go on/off hook, read/write to S-registers, issue CML specific AT commands, and perform any number of other AT command functions.

The board always starts in AT Command mode after power is applied and board initialisation is complete.

The CML specific AT commands allow the user to directly control the CMX868 device for evaluation purposes. Note, customer modified CMX868 device registers will be overwritten when Dial and Answer AT commands are executed.

The Dial and Answer commands will execute the relevant DTMF transmit, call progress tone detection and negotiation (handshaking) firmware routines before a connection to a remote modem/simulator can be established. Negotiation may be aborted by pushing any key.

Note, if the S0 register is modified to a non-zero value during this operating mode, the CMX868 status register will be polled every 20ms to check for ring detect status. If valid ringing is detected the EV8680 Evaluation board will automatically answer a call after n ring cycles. Where n is equivalent to the contents of the S0 register.

Data Transfer Mode

After gaining a connection (i.e. successful negotiation) with a remote modem the board will be operating in data transfer mode. In this mode the board will transmit all the data it receives from the RS232 computer terminal to the remote modem via the 2-wire line. Likewise any data received from the remote modem via the 2-wire line will be sent to RS232 computer terminal.

Whilst operating in this mode the data stream from the RS232 computer terminal is monitored for the escape code sequence (+++). If this sequence is encountered during data transfer the firmware will revert to on-line AT command mode. Whilst in on-line AT command mode the board to remote modem connection may be aborted by typing ATH0 (instructs modem to go on-hook). Alternatively the user can enter relevant AT commands or return to data transfer mode by using the ATO command.

The modem line speed is much lower than the speed of the RS232 interface (RS232 is running at 19200bps) and the EV8680 firmware only provides a small amount of data buffering. Therefore to prevent the data buffer from overflowing the data flow between the µC and RS232 is controlled by the RTS/CTS (Request/Clear to Send) hardware handshake lines.

The CMX868 settings used during negotiation and data transfer will be based on the contents of the S-registers when the call was originated or answered. The S-registers are described in Section 1.6.3. Certain S-register settings (relevant to the CMX868 configuration), modified during on-line AT command mode, will only take effect when a new call is originated or answered. For example, new CMX868 Tx gain settings (S25 register) modified in on-line AT command mode will be ignored until the next call.

1.4   Signal Lists

CONNECTOR PINOUT				
Connector Ref.	Connector Pin No.	Signal Name	Signal Type	Description
J1	1, 2	-	-	No connection needed
	3	A	BI	Bidirectional 2-wire line (A=TIP)
	4	B	BI	Bidirectional 2-wire line (B=RING)
	5, 6	-	-	No connection needed
J2	1	PICCSN	Output	PIC16LC76 RC2 pin
	2	CSN	Input	CSN 'C-BUS' Chip Select
	3	PICCDATA	Output	PIC16LC76 RC5 pin
	4	CDATA	Input	CDATA 'C-BUS' Command Data
	5	PICSCLK	Output	PIC16LC76 RC3 pin
	6	SCLK	Input	SCLK 'C-BUS' Serial Clock
	7	PICRDATA	Input	PIC16LC76 RC4 pin
	8	RDATA	Output	RDATA 'C-BUS' Reply Data
	9	PICIRQN	Input	PIC16LC76 RB0 pin
	10	IRQN	Output	CMX868 IRQN output, pin 23. Pull up resistor R16 is included on board
J3	1	V_{DD}	Power	V_{DD} connection
	2	V_{DD}	Power	V_{DD} connection
	3	MODEA	-	MODEA programming pin
	4	MODEB	-	MODEB programming pin
	5	V_{SS}	Power	V_{SS} connection
	6	V_{SS}	Power	V_{SS} connection
	7	TEST0	Output	Reserved for future use
	8	TEST1	Output	Reserved for future use
	9	TEST2	Output	Reserved for future use
	10	TEST3	Output	Reserved for future use
	11	V_{DDADJ}	-	V_{DDADJ} adjustment connection
	12	V_{SS}	Power	V_{SS} connection
	13	V_{SS}	Power	V_{SS} connection
	14	RESET	Input	PIC16LC76 Reset
	15	V_{PP}	Input	V_{PP} programming voltage for PIC16LC76
	16	V_{IN}	Power	V_{IN} connection

CONNECTOR PINOUT				
Connector Ref.	Connector Pin No.	Signal Name	Signal Type	Description
J4	1	DCD	Output	Connection to PC DCD
	2	TXD	Output	Connection to PC RXD
	3	RXD	Input	Connection to PC TXD
	4	DTR	Input	Connection to PC DTR
	5	Vss	Power	Connection to PC 0V common
	6	DSR	Output	Connection to PC DSR
	7	RTS	Input	Connection to PC RTS
	8	CTS	Output	Connection to PC CTS
	9	RI	Output	Connection to PC RI
J5	1	VIN	Power	+ve power from external power supply
	2	Vss	Power	0V power from external power supply

TEST POINTS		
Test Point Ref.	Default Measurement	Description
TP1	-	Modem line signal after transformer, T1
TP2	-	CMX868 RD, pin 5
TP3	-	CMX868 RT, pin 6
TP4	0V	Vss connection
TP5	0V	Vss connection
TP6	-	CMX868 RXAFB, pin 9
TP7	0V	Vss connection
TP8	-	CMX868 RLYDRV, pin 3
TP9	0V	Vss connection
TP10	0V	Vss connection
TP11	-	CMX868 TXA, pin 15
TP12	-	CMX868 TXAN, pin 14
TP13	HI	Modem CDN
TP14	5V	VDD connection
TP15	0V	Vss connection

LINKS			
Link Ref.	**Positions**	**Default Position**	**Description**
LK1	Open/Closed	Closed	MAX3237CAI /EN connection to V_{SS}
LK2	Open/Closed	Closed	MAX3237CAI /SHDN connection to V_{DD}
LK3	Open/Closed	Closed	On-board regulator (U5) output connection to V_{DD}

JUMPERS			
Jumper Ref.	**Positions**	**Default Position**	**Description**
JP1	1 - 2	S/C	Disconnect when supplying external clock to CMX868 via pin 2
JP2	1 - 2	S/C	Disconnect when supplying external clock to CMX868 via JP1 pin 2
JP3	1 - 2	S/C	Disconnect to measure I_{DD} of CMX868
JP4	J2:1 - J2:2	S/C	Disconnect when supplying external CSN to CMX868
JP5	J2:3 - J2:4	S/C	Disconnect when supplying external CDATA to CMX868
JP6	J2:5 - J2:6	S/C	Disconnect when supplying external SCLK to CMX868
JP7	J2:7 - J2:8	S/C	Disconnect when supplying external RDATA to CMX868
JP8	J2:9 - J2:10	S/C	Disconnect when supplying external IRQN to CMX868

Notes: BI = Bidirectional
S/C = Short Circuit

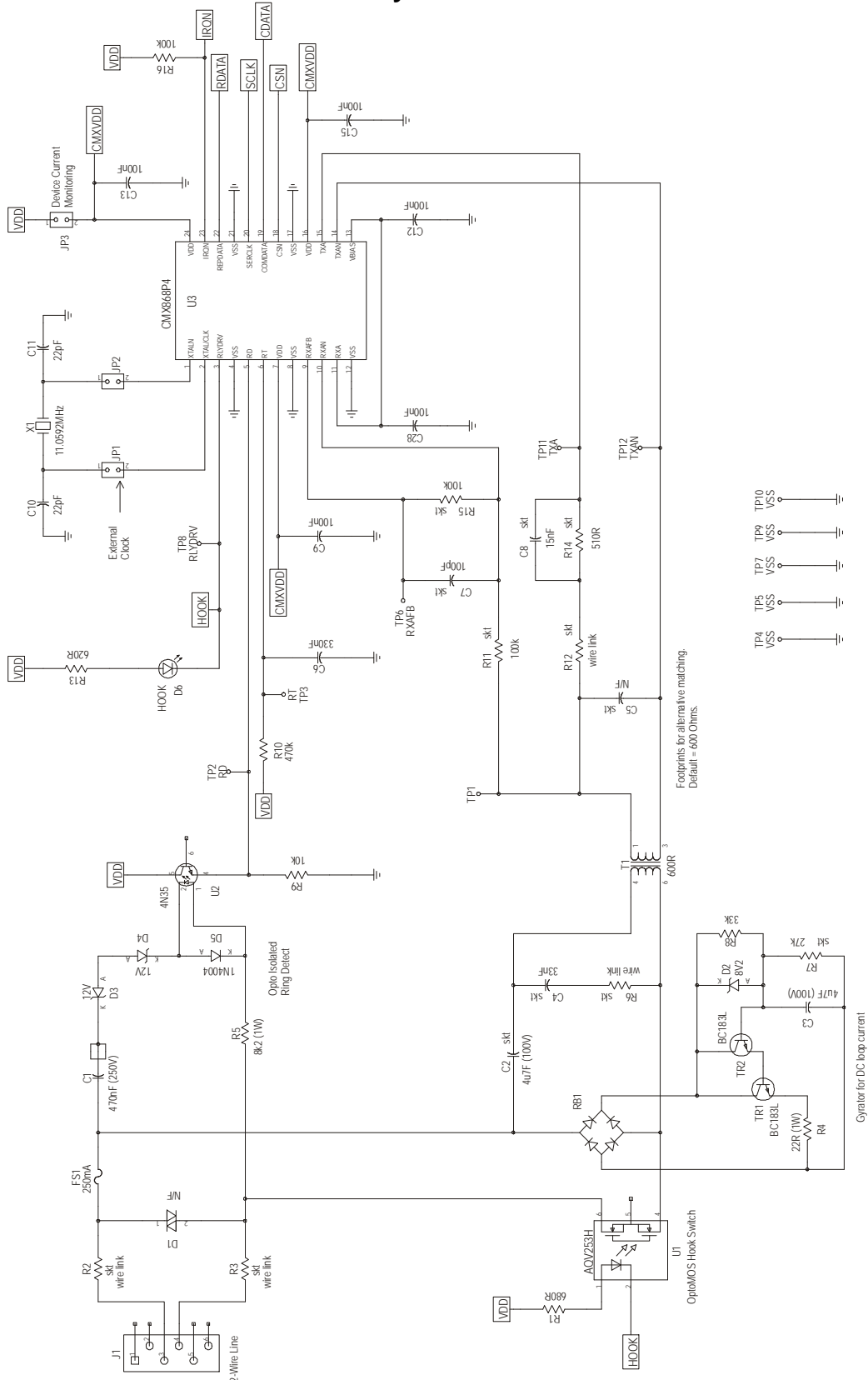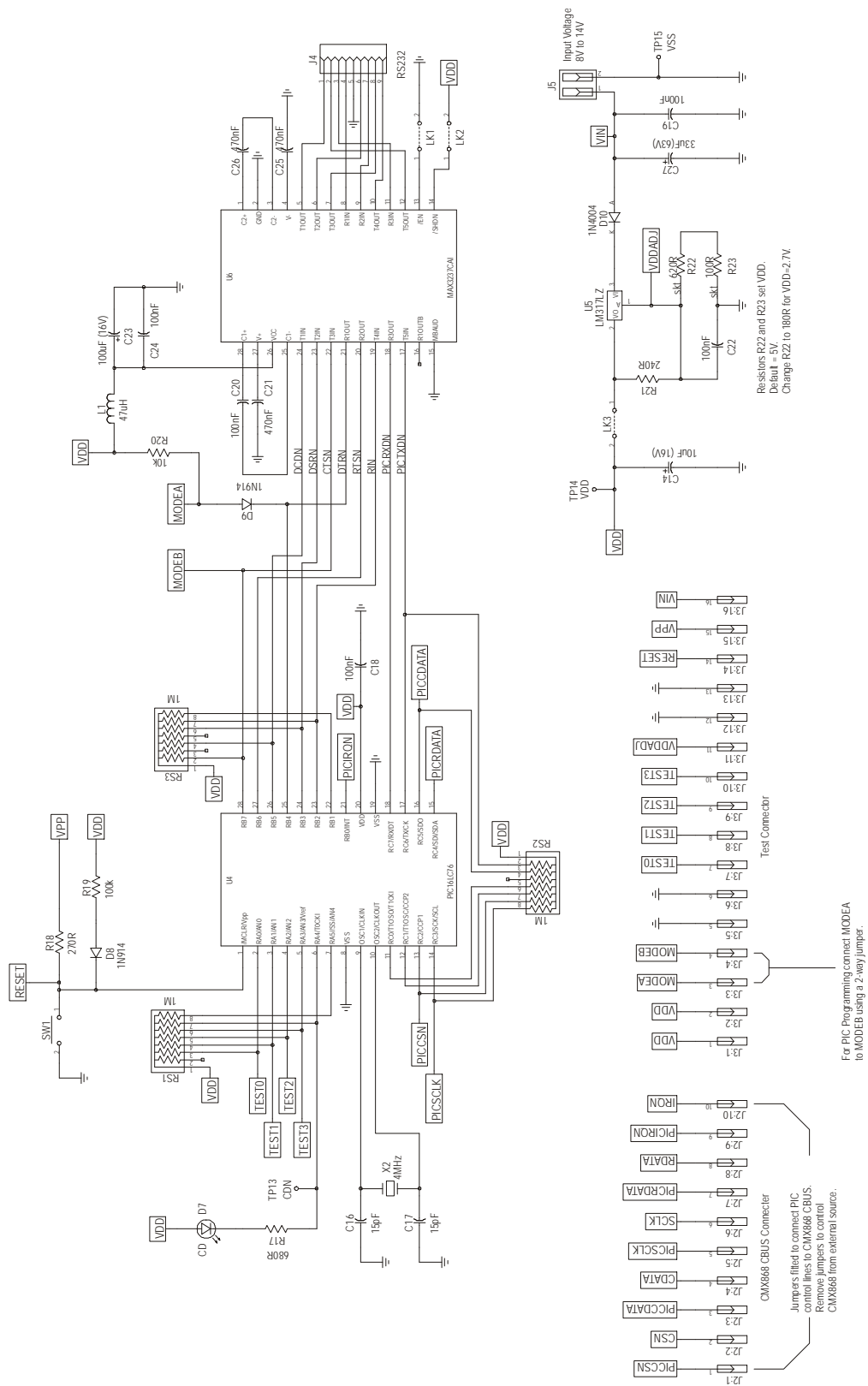## 1.5   Circuit Schematics and Board Layout

Figure 2 Modem Section

Figure 3 Control Section

Figure 4 Evaluation Board Layout

1.6   Detailed Description

1.6.1   Hardware Description

1.6.1.1 Operating Voltage

The operating voltage (VDD) is set to 5.0V. This may be altered by changing components R22 and R23 which are socketed. To select 2.7 Volts set R22 = 180Ω and R23 = 100Ω. The formula for calculating the values of R22 and R23 is as follows:

$$R22 + R23 = \frac{240\ (VDD - 1.25)}{1.25}$$

Where 240 is the value of R21 in ohms and VDD is the required supply voltage.

1.6.1.2 IDD Measurement

The evaluation device IDD may be measured by removing jumper JP3 and replacing it with a multimeter.

1.6.1.3 Clock/Oscillator

The CMX868 may use either an external clock or its own crystal oscillator. An 11.0592MHz crystal is provided on-board for the latter method. Two jumpers JP1 and JP2, which are normally fitted, select the crystal oscillator. An external clock may be supplied to JP1 pin 2 once the jumpers have been removed.

The PIC μC is provided with an on-board 4MHz crystal, X2. Note that PICs programmed by CML are only configured for use with the on-board 4MHz crystal.

1.6.1.4 Line Interface

The majority of the line interface components are fitted in sockets for adjustment purposes. These values should be calculated based on the operating voltage and line conditions, see the CMX868 data sheet and ETAL transformer recommendations for more information. The 2-wire ac line impedance matching is provided by components C2, C4, R6, T1, C5, C8, R12 and R14 which are factory fitted to suit a 600Ω line.

A gyrator circuit is provided to allow the evaluation kit to be used with a line simulator. This circuit will draw dc loop current in the off-hook state. The current drawn may be altered by adjusting the value of R7. Note, the gyrator is designed to function with a dc current limited line.

1.6.1.5 Ring Detection

Ring Detection is provided by an opto-isolated circuit formed by components C1, D3 - D5, R5, R9 and U2. The response time is set by components R10 and C6. See CMX868 data sheet for further details.

1.6.1.6 Line Protection

Line protection is provided by R2 (47Ω), R3 (47Ω), and D1 (Phillips BR211 series 140V). These components are not fitted, but suitable values for UK applications are suggested in brackets. Wire links which bypass R2 and R3 will need to be removed if these resistors are fitted.

1.6.2 Adjustments and Controls

Various line interface components around the evaluation devices are socketed to allow for user adjustments. Discrete component sockets are also provided for Telco-specific components.

1.6.3 Firmware Description

The PIC16LC76-04/SP (OTP) µC fitted on the EV8680 evaluation kit has been programmed by CML before shipment with the latest version of firmware. Please read the separate information sheet (EK8680) and check the CML web site for firmware status. The latest source code and programming file (EF8680xx.HEX, where xx represents the version number) can be downloaded from the CML web site.

The serial communications firmware supplied in the PIC µC assumes the following configuration; 8 data bits, no parity, 1 stop bit and 19,200 baud with hardware flow control.

The firmware routine run at start-up and reset performs the following important tasks:

> Peripheral Interrupt Initialisation
> µC ports and I/O direction initialisation
> Serial Communication Interface (SCI) initialisation
> Serial Peripheral Interface (SPI) initialisation
> Loads factory profile 0
> Resets CMX868 evaluation device.

The message EF8680 Vx.x, will be displayed in the terminal emulator window when these tasks have been completed.

The EV8680 evaluation board will send an error message ('Invalid CMX868 Rev') to the PC if an old CMX868 device revision is detected. The latest EV8680 firmware is only designed to work with the latest CMX868 device.

Note, the CMX868 device is always reset and powered up at the beginning of the negotiation or BERT routines.

The firmware only supports DTMF dialling.

AT command echoing is an option available in the firmware and involves echoing the received characters sent by the PC. The firmware also provides the option of sending result codes to the PC. These responses can be in either an alpha or numeric form.

The AT command set for the EV8680 Evaluation kit is tabulated below. These commands can be entered on a PC running Windows terminal emulator software, such as the 'Hyper Terminal' program supplied with Windows 95/NT systems.

The 'Hyper Terminal' Send Text File facility is useful for data transfer i.e. when the EV8680 has established a connection with a remote modem. This terminal emulator facility can also be used for sending AT command scripts to the EV8680. These scripts should consist of a single line multiple AT command, for example.

ATH1@RE0=4929@RE6?@RE1=4567<*CR*>

Note, some of the commands listed may not be implemented in early versions of EV8680 firmware. Please read the separate information sheet (EK8680) and check the CML web site for firmware status.

Basic EV8680 AT Commands

Command	*Description*

A   **Answer Command**
The modem will go off-hook and attempt to establish a connection with a remote modem.

Syntax: **ATA**<*CR*>

A/   **Re-Execute Previous Command Line**
Re-executes the last issued command line. This command does not require the AT prefix or a carriage return.

Syntax: **A/**

Bn   **Select Communications Standard**
Selects the communications standard specified by the parameter n.

Syntax: **ATBn**<*CR*>

Modifier Usage
n=0 Selects ITU-T V.22bis at 2400bps QAM (default).
n=1 Selects ITU-T V.22 at 1200bps DPSK.
n=2 Selects ITU-T V.23 with Tx 75bps and Rx 1200bps FSK.
n=3 Selects ITU-T V.23 with Tx 1200bps and Rx 75bps FSK.
n=4 Selects ITU-T V.22 at 600bps DPSK.
n=5 Selects ITU-T V.21 at 300bps FSK.
n=6 Selects Bell 212A at 1200bps DPSK.
n=7 Selects Bell 202 with Tx 150bps and Rx 1200bps FSK.
n=8 Selects Bell 202 with Tx 1200bps and Rx 150bps FSK.
n=9 Selects Bell 103 at 300bps FSK.

Dn   **Dial Command**
This command directs the modem to go off-hook, dials according to the string entered and attempts to establish a connection with a remote modem. The n represents an ASCII string composed of dial digits and dial modifiers and must not exceed the 15 character buffer limit. The DTMF tone dialling digits include 0 through 9, A, B, C, D, and the symbols # and *.

For example: **ATD9,01621875500**<*CR*>

Modifier Usage
n=L   Re-dial last number.
n=,   Delay dial sequence (pause setting contained in S-Register S8).

En   Echo Command Characters

Syntax: **ATEn**<*CR*>

Modifier Usage
n=0 Disables the echoing of commands to the screen.
n=1 Enables echoing of commands to the screen (default**)**.

Hn   Switch Hook Control

Syntax: **ATHn**<*CR*>

Modifier Usage
n=0 Instructs the modem to go on-hook (disconnect).
n=1 Instructs the modem to go off-hook.

In   Identification
Requests the modem to return its product identification information.

Syntax: **ATIn**<*CR*>

Modifier Usage
n=0 Displays the firmware name and version number.
n=1 Displays Product Name.
n=2 Displays CML UK sales information.
n=3 Displays South East Asia sales information.
n=4 Displays NAFTA sales information.

Nn   Modulation Fallback Option

Syntax: **ATNn**<*CR*>

Modifier Usage
n=0 When originating or answering, modem negotiates only at the specified communications standard (default).
n=1 When originating or answering, falls back from V.22bis to V.22 as required.

O   Return to Data Transfer Mode
Used during on-line AT command mode, this command allows the user to return to data transfer mode. Note, this command does not initiate any retrain sequence.

Syntax: **ATO**<*CR*>

Qn   Enable/Disable Modem Responses

Syntax: **ATQn**<*CR*>

Modifier Usage
n=0 Enables result codes to be issued to the screen (default).
n=1 Disables result codes to be issued to the screen.

Sn?   **S-Register Read**
Command for displaying the contents of an S-Register (See S-Register Table).

Syntax: **ATSn?**<*CR*>

where **n** is the S-Register to be interrogated (decimal).
Value returned is either in decimal (default) or hex format depending on the setting
of Bit 4 in the S14 register.

Sn=x   **S-Register Write**
Command for writing to an S-Register (See S-Register Table).

Syntax: **ATSn=x**<*CR*>

where **n** is the S-Register (decimal) and **x** is the value to be written (decimal, 0-
255).

Vn   **Result Code Format**

Syntax: **ATVn**<*CR*>

Modifier Usage
n=0 Instructs the modem to display result codes as numbers.
n=1 Instructs the modem to display result codes as words (default).

Xn   **Calling Characteristics**
Determines which set of responses and calling characteristics are used.

Syntax: **ATXn**<*CR*>

Modifier Usage
n=0 The modem will ignore dial tones and busy tones. Dial tone wait time is zero,
and blind dialling is enabled. The modem returns a CONNECT result code when a
connection is established.
n=1 The modem will ignore dial tones and busy tones. Dial tone wait time is zero,
and blind dialling is enabled. The modem returns a CONNECT xxxx result code
when a connection is established, where xxxx is the Tx/Rx line speed (default).
n=2 The modem will ignore busy tones, but waits for a dial tone before dialling. If a
dial tone is not detected within 5 seconds, a NO DIAL TONE result code is
returned. The modem returns a CONNECT xxxx result code when a connection is
established, where xxxx is the Tx/Rx line speed.
n=3 The modem will ignore dial tones. If a busy tone is detected, a BUSY result
code is returned. Blind dialling is enabled. The modem returns a CONNECT xxxx
result code when a connection is established, where xxxx is the Tx/Rx line speed.
n=4 If a dial tone is not detected within 5 seconds, a NO DIAL TONE result code is
returned. If a busy tone is detected, a BUSY result code is returned. The modem
returns a CONNECT xxxx result code when a connection is established, where
xxxx is the Tx/Rx line speed.

Zn   **Modem Reset**
Instructs the modem to reset the evaluation device and then reload the factory S-Register settings (See S-Register Table).

Syntax: **ATZn**<*CR*>

Modifier Usage
n=0 Reset CMX868 device and restore factory profile 0.
n=1 Reset CMX868 device and restore factory profile 1.

Extended EV8680 AT Commands

Command   *Description*
&Fn   **Recall Factory Defaults**
Instructs the modem to reload the factory S-Register settings (See S-Register Table).

Syntax: **AT&Fn**<*CR*>

Modifier Usage
n=0 Recalls factory profile 0.
n=1 Recalls factory profile 1.

&Gn   **Guard Tone Select**
Selects the Guard tone to be transmitted with highband QAM or DPSK.

Syntax: **AT&Gn**<*CR*>

Modifier Usage
n=0 Disable guard tone (default).
n=1 Enable 550Hz guard tone.
n=2 Enable 1800Hz guard tone.

CML Specific EV8680 AT Commands

Command   *Description*

@Fn   **Test Functions**

Syntax: **AT@Fn**<*CR*>

Modifier Usage
n=0 Reserved.
n=1 Reserved.
n=2 Delay 100ms.
n=3 Delay 1s.
n=4 Initiate BERT as Rx End.
n=5 Initiate BERT as Rx End**.**
n=6 CMX868 Status Register Monitor Function 1. Continuously reads and displays the contents of the Status register. The update rate is based on the S19 register setting. The function may be aborted by pushing any key.
n=7 CMX868 Status Register Monitor Function 2. Reads and displays the contents of the Status register when an interrupt occurs. Error message returned after 30 seconds if IRQN does not go low. User must enable IRQN output and set the appropriate IRQ Mask bit before executing this test command.
n=8 Reserved.
n=9 Reserved.

@RR   **CMX868 Device Reset**
Sends the General Reset Command to the CMX868 device.

Syntax: **AT@RR**<*CR*>

@Rn?   **CMX868 Register Read**
Command for displaying the contents of a CMX868 device register

Syntax: **AT@Rn?**<*CR*>

where **n** is a valid CMX868 register address (hexadecimal).
Value returned is either in decimal (default) or hex format depending on the setting of Bit 4 in the S14 register.

@Rn=x   **CMX868 Register Write**
Command for writing to a CMX868 device register.

Syntax: **AT@Rn=x**<*CR*>

where **n** is a valid CMX868 register address (hexadecimal) and **x** is the value to be written (decimal).   8-bit register values should be between 0-255, whilst 16-bit register values should be between 0-65535.

S-Registers

The following table gives a brief description of the available S-registers and their functions. Register range, units and factory profiles are also listed.

	S-Register			Factory Profiles	
Reg	**Range**	**Units**	**Description**	**'0'** (Default at Power up)	**'1'**
S0	0-255	Rings	**Automatic answer** - Number of rings until automatic answer. If the register is zero the modem will not automatically answer.	0	5
S1	0-255	Rings	**Count incoming rings** - This register is read only and contains the number of rings detected by the modem.	0	0
S2	0-127	ASCII Decimal	**Escape character value** - This register defines an ASCII decimal value of the escape character. The default setting is an ASCII + and the escape sequence is +++. A value over 127 disables the escape sequence.	43	43
S3	0-127	ASCII Decimal	**Carriage return character** - Contains the ASCII decimal value of the character recognised as the command line terminator. This character will also be sent at the end of result codes.	13	13
S4	0-127	ASCII Decimal	**Line feed character** - Contains the ASCII decimal value of the character recognised by the modem as the line feed. The modem sends the line feed character after a carriage return only when word responses are sent.	10	10
S5	0-127	ASCII Decimal	**Backspace character** - Contains the ASCII decimal value of the character recognised as a backspace.	8	8
S6	2-255	s	**Wait time for blind dialling -** Sets the length of time to pause after the modem goes off the hook before the modem dials the first digit of the telephone number.	2	2
S7	1-255	s	**Wait for carrier after dial** - Sets the length of time the modem waits for a carrier before returning on-hook.	50	50
S8	0-255	s	**Pause Time for Comma Dial Modifier** - Specifies the number of seconds to pause for each comma (,) encountered in a dial string.	2	2

S-Register				Factory Profiles	
Reg	Range	Units	Description	'0'	'1'
S9	1-255	100ms	**Reserved**	6	6
S10	1-255	100ms	**Lost carrier to hang up delay** - Sets the length of time that the modem waits before hanging up after the loss of a carrier. This allows the modem to distinguish between disturbances that momentarily break the connection and the remote modem hanging up.	7	7
S11	5-255	10ms	**DTMF tone duration** - Defines the duration of DTMF tones for tone dialling. The length of pause between each DTMF tone is the same as this duration time.	10	20
S12	0-255	50ms	**Escape code guard time** - Specifies the minimum time before entry of the escape sequence. This value also dictates the acceptable entry speed (inter-character time) for each escape character.	20	20
S13	0-255	Decimal	**Reserved**	0	0
S14	0-255	Decimal	**General options** - provides the following functions: Bit 0 - Reserved Bit 1 - Echo command character, 0 Disables echoing (ATE0), 1 Enables echoing (ATE1) Bit 2 - Result code display, 0 Send responses (ATQ0), 1 Do not send responses (ATQ1) Bit 3 - Word or number responses, 0 Send number responses (ATV0), 1 Send word responses (ATV1) Bit 4 - Output format when reading CMX868 registers or S-registers, 0 Decimal, 1 Hex Bit 5, 6 – Reserved Bit 7 - Answer/originate operation, 0 Answer (ATA), 1 Originate (ATD)	138	128
S15	0-255	Decimal	**Reserved**	0	0
S16	0-255	Decimal	**Reserved**	0	0
S17	0-255	Decimal	**Reserved**	0	0
S18	0-255	s	**General Purpose Timer** - Used for various firmware functions.	30	30
S19	0-255	10ms	**General Purpose Timer** – Used for various firmware functions	2	2

S-Register				Factory Profiles	
Reg	**Range**	**Units**	**Description**	**'0'**	**'1'**
S20	0-255	Decimal	**Reserved**	0	0
S21	0-255	Decimal	**BERT options** - Provides the following functions: Bit 0 - BERT End, 0 Rx Board (AT@F4), 1 Tx Board (AT@F5) Bit 1 - BERT Operating Band (ignored for V23/Bell202 BERT operation), 0 Low, 1 High Bit 2, 3, 4, 5 - Reserved Bit 6,7 - BERT Scrambler/Descrambler, 11 Enabled (64 ones detect circuit enabled), 10 Enabled (64 ones detect circuit disabled), 00 Disabled	193	193
S22	0-255	Decimal	**Bit Mapped register** - Provides the following functions: Bit 0, 1, 2, 3, 4 - Reserved Bit 5, 6, 7 - Calling Characteristics, 000 (ATX0), 100 (ATX1), 101 (ATX2), 110 (ATX3), 111 (ATX4)	0	0
S23	0-255	Decimal	**Bit Mapped register** - Provides the following functions: Bit 0, 1, 2, 3, 4, 5 - Reserved Bit 6, 7 - Guard Tones (DPSK/QAM high band operation only), 00 None (AT&G0), 11 550Hz (AT&G1), 10 1800Hz (AT&G2)	0	0
S24	0-255	Decimal	**Bit Mapped register** - Provides the following functions: Bit 0 - CMX868 Xtal Freq, 0 12.2880MHz, 1 11.0592MHz Bit 1 - CMX868 Tx and Rx Fixed Compromise Equalisers (used during negotiation and data transfer), 0 Enable, 1 Disable Bit 2 - CMX868 Auto Equaliser (DPSK operating modes, always enabled during V22bis QAM operation), 0 Disable, 1 Enable Bit 3, 4, 5, 6, 7 – Reserved	1	3

Reg	Range	Units	Description	'0'	'1'
S25	0-255	Decimal	**Bit Mapped register** - Provides the following functions: Bit 0, 1, 2 - CMX868 Tx Gain (used during negotiation, data transfer and BERT), 111 0dB, 110 -1.5dB, 101 -3.0dB, 100 -4.5dB, 011 -6dB, 010 -7.5dB, 001 -9.0dB, 000 -10.5dB Bit 3, 4, 5 - CMX868 Tx Data/Stop bits (used during data transfer), 111 8/2 bits, 110 8/1 bits, 101 7/2 bits, 100 7/1 bits, 011 6/2 bits, 010 6/1 bits, 001 5/2 bits, 000 5/1 bits Bit 6, 7 - CMX868 Tx Start-stop mode (used during data transfer), 00 Odd parity, 01 Even parity, 10 No parity	176	176
S26	0-255	Decimal	**Bit Mapped register** - Provides the following functions: Bit 0, 1, 2 - CMX868 Rx Gain (used during negotiation, data transfer and BERT), 111 0dB, 110 -1.5dB, 101 -3.0dB, 100 -4.5dB, 011 -6dB, 010 -7.5dB, 001 -9.0dB, 000 -10.5dB Bit 3, 4, 5 - CMX868 Rx Data and Parity bits (used during data transfer), 111 8 data + parity, 110 8 data, 101 7 data + parity, 100 7 data, 011 6 data + parity, 010 6 data, 001 5 data + parity, 000 5 data Bit 6, 7 - CMX868 Rx USART (used during data transfer), 00 2.3% overspeed, 01 1% overspeed, 10 No overspeed	48	176
S27	0-255	Decimal	**Bit Mapped register** - Provides the following functions: Bit 0, 1, 2, 3 - Reserved. Bit 4, 5, 6, 7 - Communication Standard, 0000 (ATB0), 0001 (ATB1), 0010 (ATB2), 0011 (ATB3), 0100 (ATB4), 0101 (ATB5), 0110 (ATB6), 0111 (ATB7), 1000 (ATB8), 1001 (ATB9)	0	0
S28	0-255	Decimal	**Reserved**	0	0
S29	0-255	Decimal	**Reserved**	0	0

Modem Result Codes

Numeric Response (Decimal)	Alpha Response
00	OK
01	CONNECT
02	RING
03	NO CARRIER
04	ERROR
05	NO DIAL TONE
06	BUSY
07	CONNECT 2400
08	CONNECT 1200
09	CONNECT 600
10	CONNECT 300
11	CONNECT 1200/75
12	CONNECT 75/1200
13	CONNECT 1200/150
14	CONNECT 150/1200
15	NYI

AT Command Summary

1) The maximum command length is 48 characters, excluding the AT prefix and carriage return.
2) A user defined escape sequence (usually +++) is required to revert the modem from on-line (data transfer mode) to the command mode, to allow the user to issue AT commands to the PIC.
3) Every command except for A/ and the escape sequence must begin with the AT prefix and be entered by pressing a carriage return.
4) When the default command echoing and word result codes are enabled the firmware will send a LF character directly after a CR character to ensure the terminal emulator display is legible.
5) Commands which are not fully implemented will return the result code 'NYI' (Not Yet Implemented).
6) Do not send AT commands to the Evaluation Kit until the previous result code (if enabled) has been received.

1.6.4   Software Description

1.6.4.1 In-Circuit Programming of PIC16LC76

TO ENTER PROGRAMMING MODE
a) Remove power from board.
b) Insert a blank PIC16LC76-04/SP (OTP) μC device into the U4 IC socket.
c) Using a 2-way jumper connect MODEA (J3:3) to MODEB (J3:4).
d) Re-apply power to board. (V_{DD} = 5.0V).
e) Connect the programming voltage (12.5V to 13.5V) power supply between V_{PP}, J3:15 (+ve) and V_{SS} (-ve).
f) Ensure the PIC μC programming utility **PICPROGB.EXE** is loaded into the PC under DOS and the PC is connected to the evaluation kit.
g) Reset the EV8680 board by momentarily pressing switch SW1.

USING THE SOFTWARE - **PICPROGB**
This is supplied on disk as a self-documented executable file **PICPROGB.EXE** for a PC running DOS (either directly or as a DOS window in Windows 3.11 or '95). It is not recommended for use on Windows NT systems. Please note that this programming software does not meet the Arizona Microchip Technology verification requirements for a "production quality" programmer. Also, it does not support the programming of ID.

The user interface consists of two windows. The top window contains the operating instructions and status information. The bottom window contains prompting and progress information plus user input. When the top window first appears the user will be prompted to enter the number of the serial communications port to which the EV8680 board is connected, and then, which device is to be programmed. For the EV8680 board select option 2, PIC16C77. Once the user has entered this information, the following commands may be selected:

> **Press F   to load file**
>
> **Press C   to configure device.**
>
> **Press B   to check target device is blank.**
>
> **Press P   to program target device.**
>
> **Press V   to verify target device.**
>
> **Press R   to read target device.**
>
> **Press A   to view contents of program data array.**
>
> **Press Esc to return to DOS.**

A new function from the above table can be selected whenever the **>ok** prompt appears in the bottom window.

Notes:
a) Programming files must be in the Intel hex format **(.HEX)** in order to be usable by this programming software.

b) The PIC μC supplied has a Configuration Word which is preset **3FB1H**. This selects the crystal oscillator, disables the watch dog timer, enables the power up timer and disables code protection. The programming software currently defaults to **3FB1H.** Consult Arizona Microchip Technology for more information on the Configuration Word.

c) The "blank check" command **(B)** only looks at the first location. A programmed device will always have data in this location as it is the program start address.

d) For each of the commands **B, P, R** and **V** the user will be prompted to manually reset the target μC, by pressing the RESET switch (SW1) on the EV8680 Evaluation Board. This is because PIC programming always starts from location **0000** and the program counter can only be incremented.

e) Pressing **A** will display the program data in the bottom window, formatted in pages of 48 consecutive locations. Use the **<PageUp>** and **<PageDown>** keys to scroll through the data. Pressing **<Esc>** will return the user to the **>ok** prompt.

f) Programming a blank PIC16LC76 using the PICPROGB software takes approximately 2 minutes.

g) Customers are advised to use PIC16C76JW μC devices (not supplied) for further PIC firmware development, however, these devices are not guaranteed for low volt operation. Customers re-programming this development PIC must erase the existing program by placing the device in a UV-Eraser for approximately 15 minutes.

TO LEAVE PROGRAMMING MODE
a) Remove power from board (including the programming voltage, V$_{PP}$).
b) Remove 2-way jumper connecting MODEA to MODEB.
c) Power up board as described in previous sections for normal operation.

1.6.4.2 Terminal Emulator

Users will need to run a suitable terminal emulator on their PC in order to communicate with the PIC μC on the Evaluation Kit. 'Hyper Terminal', which is supplied with the Windows 95/NT installations, is suitable for this purpose.

Hyper Terminal Setup
Emulation VT100
ASCII Character set
ASCII Receiving: Wrap lines that exceed terminal width.
COM Port Settings:

Bits per second	19,200
Data bits	8
Parity	None
Stop bits	1
Flow Control	Hardware

### 1.6.5   Additional Information

1.6.5.1 AT Command Text Files

To allow evaluation tests to be quickly and easily repeated it may be useful to create text files containing single line multiple AT commands. Commands can be transferred to the PIC μC via the 'Hyper Terminal' send text file facility. Note, multiple text files may be required to perform a test if any command lines exceed 48 characters.
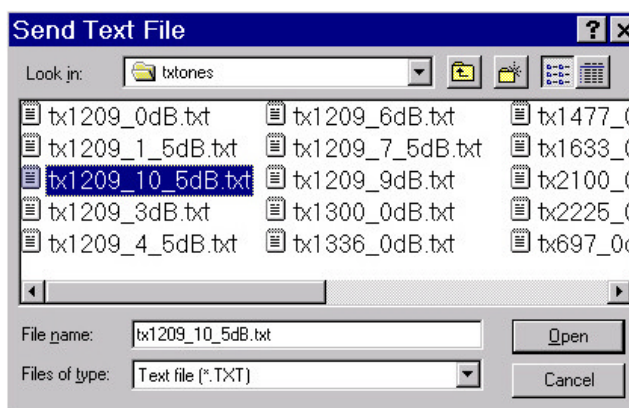
1.6.5.2 Sending Text Files using 'Hyper Terminal'

The following is a description of how to send text files to the EV8680 using 'Hyper Terminal'.

a) Select the Transfer menu
b) Select Send Text File
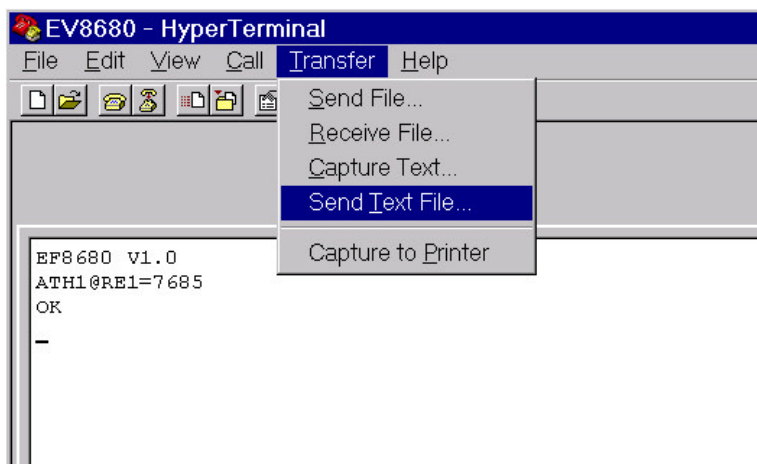
c) Select the required file from the Send Text File window

1.6.5.3 Negotiation and Data Transfer

Modem negotiation (handshaking) may be aborted by pushing any key prior to entering data transfer mode.

During data transfer mode the user can revert to on-line AT command mode by typing the escape code sequence (+++). The escape code guard time (based on S12) must have expired to successfully access this mode. Whilst in on-line AT command mode the board to remote modem connection may be aborted by typing ATH0 (instructs modem to go on-hook). Alternatively the user can enter relevant AT commands or return to data transfer mode by using the ATO command.

The firmware only supports asynchronous data transfer.

Receiver USART overspeed settings specified in S-Register, S26, only apply to DPSK/QAM operating modes.

Transmitter Guard Tone settings specified in S-Register, S23, only apply to DPSK/QAM answering modes.

If the carrier is lost (during data transfer) or negotiation is aborted by the user, the firmware will send the General Reset Command to the CMX868 evaluation device. This action will cause the EV8680 evaluation board to hang up and powersave the CMX868 device.

The data transfer firmware does not contain any retrain code. This process is sometimes performed by modems when signal distortion or line noise is detected which may threaten data integrity.

The receive auto equaliser function can be enabled via the S24 register. This S24 register setting only applies to DPSK modes of operation. The CMX868 firmware for V22bis always enables the receive auto equaliser half way through the negotiation phase.

1.6.5.4 Example AT Commands for Hayes Optima 336 Modem (not supplied) Setup

V.22bis Protocol - AT&FB30X1Q0E1V1L0N0W2S37=6S95=42

V.22 Protocol - AT&FB0X1Q0E1V1L0N0W2S37=5S95=42

1.6.6   Example EV8680 Modem Tests

1.6.6.1 Set up EV8680 to Automatically Answer a V.22 Call from a Remote Modem

1. Select V.22 communication standard (default is V.22 bis).
        Command : **ATB1**<*CR*>

2. Select the required Guard Tone setting using the AT&Gn command (default is none).

3. Enable/Disable Fixed Compromise Equalisers by writing to S-Register, S24 (default is enabled).

4. Configure CMX868 Transmitter by writing to S-Register, S25.

5. Configure CMX868 Receiver by writing to S-Register, S26.

6. Set Automatic Answer S-Register (S0) to 5 rings.
        Command : **ATS0=5**<*CR*>

The EV8680 will attempt to establish a V.22 connection when 5 rings (BT or Bell) have been successfully detected. The CONNECT 1200 result code will be returned to the PC if a V.22 connection is successfully established. The NO CARRIER result code will be returned to the PC if the EV8680 fails to establish a V.22 connection within the time specified in S-Register, S18.

1.6.6.2 Set up EV8680 to Manually Answer V.23 Call from a Remote Modem

1. Select V.23 communication standard (default is V.22 bis).
   Command : **ATB2**<*CR*>

2. Enable/Disable Fixed Compromise Equalisers by writing to S-Register, S24 (default is enabled).

3. Configure CMX868 Transmitter by writing to S-Register, S25

4. Configure CMX868 Receiver by writing to S-Register, S26.

5. Manually Answer V.23 Call.
   Command : **ATA**<*CR*>

The EV8680 will attempt to establish a V.23 connection. The CONNECT 1200/75 result code will be returned to the PC if a V.23 connection is successfully established. The NO CARRIER result code will be returned to the PC if the EV8680 fails to establish a V.23 connection within the time specified in S-Register, S18.

1.6.6.3 Set up EV8680 to Originate V.22 bis Call to a Remote Modem

Configure EV8680 to dial out using a blind dialling method with DTMF tone duration of 150ms.

1. Select V.22 bis communication standard (default is V.22 bis).
   Command : **ATB0**<*CR*>

2. Set calling characteristic to blind dial, ignoring dial and busy tones (default is ATX1).
   Command : **ATX1**<*CR*>

3. Set Wait Time for Blind dialling S-Register (S6) to 5 seconds.
   Command : **ATS6=5**<*CR*>

4. Set DTMF Tone Duration S-Register (S11) to 150ms.
   Command : **ATS11=15**<*CR*>

5. Enable/Disable Fixed Compromise Equalisers by writing to S-Register, S24 (default is enabled).

6. Configure CMX868 Transmitter by writing to S-Register, S25.

7. Configure CMX868 Receiver by writing to S-Register, S26.

8. DTMF Dial.
   Command : **ATD0165447887**<*CR*>

The EV8680 will go off-hook and blind dial after 5 seconds. After dialling the EV8680 will attempt to establish a V.22 bis connection. The CONNECT 2400 result code will be returned to the PC if a V.22 bis connection is successfully established. The NO CARRIER result code will be returned to the PC if the EV8680 fails to establish a V.22 bis connection within the time specified in S-Register, S7.

1.6.7   Example EV8680 Device Evaluation Tests

The following information shows example text files (not supplied) that can be created by the user for EV8680 Evaluation Mode Tests.

Description :   Instructs EV8680 to reset and powerup the CMX868 evaluation device.
Command :   **AT@RE0=4480@F2@RE0=4352**<*CR*>
@RE0=4480 :   Load 1180 Hex into CMX868 General Control Register ($E0)
@F2 :   100ms Delay
@RE0=4352 :   Load 1100 Hex into CMX868 General Control Register ($E0)

General Control Register ($E0) = 1180 Hex

B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0
			11.0592 Xtal	No LB	Equ Enable	On Hook	Powered Up	Reset	IRQN O/P Disabled	No IRQ Mask					

General Control Register ($E0) = 1100 Hex

B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
			11.0592 Xtal	No LB	Equ Enable	On Hook	Powered Up	Norm	IRQN O/P Disabled	No IRQ Mask					

The following information shows example AT commands for simple EV8680 Evaluation Board Tests. All tests assume the CMX868 is powered up, as shown above.

Test 1

Description :   Instructs EV8680 to go off-hook and transmit a 1209Hz tone (Tx Gain = 0dB).
Command :   **ATH1@RE1=7685**<*CR*>
H1 :   Take EV8680 Off-Hook
@RE1=7685 :   Load 1E05 Hex into CMX868 Tx Mode Register ($E1)

Tx Mode Register ($E1) = 1E05 Hex

B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
0	0	0	1	1	1	1	0	0	0	0	0	0	1	0	1
Tx Mode = DTMF/Tones				Tx Level = 0dB			Unused				Tx 1209Hz Fixed Tone				

Test 2

Description :   Instructs EV8680 to go off-hook and transmit a 1209Hz tone (Tx Gain = -10.5dB).
Command :   **ATH1@RE1=4101**<*CR*>
H1 :   Take EV8680 Off-Hook
@RE1=4101 :   Load 1005 Hex into CMX868 Tx Mode Register ($E1)

Tx Mode Register ($E1) = 1005 Hex

B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1
Tx Mode = DTMF/Tones				Tx Level = -10.5dB			Unused				Tx 1209Hz Fixed Tone				

Test 3

Description :   Instructs EV8680 to go off-hook and transmit a 2100Hz tone (Tx Gain = 0dB).
Command :   **ATH1@RE1=7690**<*CR*>
H1 :   Take EV8680 Off-Hook
@RE1=7690 :   Load 1E0A Hex into CMX868 Tx Mode Register ($E1)

Tx Mode Register ($E1) = 1E0A Hex

B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
0	0	0	1	1	1	1	0	0	0	0	0	1	0	1	0
Tx Mode = DTMF/Tones				Tx Level = 0dB			Unused				Tx 2100Hz Fixed Tone				

Test 4

Description : Instructs EV8680 to go off-hook and transmit V.23 continuous 1s at 75bps.
Command : **ATH1@RE1=19995**<*CR*>
             H1 : Take EV8680 Off-Hook
    @RE1=19995 : Load 4E1B Hex into CMX868 Tx Mode Register ($E1)

Tx Mode Register ($E1) = 4E1B Hex

B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
0	1	0	0	1	1	1	0	0	0	0	1	1	0	1	1
Tx Mode = V.23 FSK 75 bps				Tx Level = 0dB			No Guard Tone		Scrambler Disabled		Sync Mode		Tx Cont 1's		

Test 5

Description : Instructs EV8680 to go off-hook and transmit two DTMF digits ('A' then 'B' with 100ms duration/separation).
Command : **ATH1@RE1=7709@F2@RE1=7680@F2@RE1=7710@F2@RE1=7680**<*CR*>
             H1 : Take EV8680 Off-Hook
             @F2 : 100ms Delay
    @RE1=7709 : Load 1E1D Hex into CMX868 Tx Mode Register ($E1)
    @RE1=7680 : Load 1E00 Hex into CMX868 Tx Mode Register ($E1)
    @RE1=7710 : Load 1E1E Hex into CMX868 Tx Mode Register ($E1)

Tx Mode Register ($E1) = 1E1D Hex

B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
0	0	0	1	1	1	1	0	0	0	0	1	1	1	0	1
Tx Mode = DTMF/Tones				Tx Level = 0dB			Unused				Tx DTMF 'A'				

Tx Mode Register ($E1) = 1E00 Hex

B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0
Tx Mode = DTMF/Tones				Tx Level = 0dB			Unused				Tx No Tone				

Tx Mode Register ($E1) = 1E1E Hex

B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
0	0	0	1	1	1	1	0	0	0	0	1	1	1	1	0
Tx Mode = DTMF/Tones				Tx Level = 0dB			Unused				Tx DTMF 'B'				

Test 6

Description : Set up CMX868 for receiving DTMF, then wait for five DTMF digits.
Command : **AT@RE0=5953@RE2=7681@RE6?@F7@F7@F7@F7@F7**<*CR*>
    @RE0=5953 : Load 1741 Hex into CMX868 General Control Register ($E0)
    @RE2=7681 : Load 1E01 Hex into CMX868 Rx Mode Register ($E2)
        @RE6? : Read and display contents of CMX868 Status Register ($E6)
          @F7 : Wait until IRQN output goes low then read and display contents of CMX868 Status Register ($E6)

General Control Register ($E0) = 1741 Hex

B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
0	0	0	1	0	1	1	1	0	1	0	0	0	0	0	1
			11.0592 Xtal	No LB	Equ Disable	Off Hook	Powered Up	Norm	IRQN O/P Enabled	DTMF Detect IRQ Mask					

Rx Mode Register ($E2) = 1E01 Hex

B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	1
Rx Mode = DTMF/Tones				Rx Level = 0dB			Detect DTMF								

1.6.8 BER Measurement

To allow the user to perform a Bit Error Rate Test (BERT) on the CMX868, the EF8680 firmware contains a BERT routine. This facility is enabled using the test functions AT@F4 (Rx End) or AT@F5 (Tx End). Before selecting these functions the user must select the required protocol via the ATBn command. Various bit mapped S-registers must also be modified to select the CMX868 configuration used during the BERT.

The BERT routines have been designed for use with two EV8680 kits and a BER Datatester unit (compatible with the EV8680 BER test pin timings, see below). The firmware only allows the user to set up a single EV8680 board as the Tx or Rx end. The second EV8680 evaluation board(not supplied) could be replaced with an alternative system (designed for use with the BER Datatester unit).

The EV8680 BERT is performed in synchronous mode and uses simple negotiation before data is clocked in and out of the BER Datatester unit.

Hardware Setup
This function enables connection to BER Testers as follows:

TEST3 (J3 Pin 10) from BER Tester Tx Data O/P
TEST2 (J3 Pin 9) to BER Tester Tx Data Clock I/P
TEST1 (J3 Pin 8) to BER Tester Rx Data I/P
TEST0 (J3 Pin 7) to BER Tester Rx Data Clock I/P

The tester must be able to operate from an external clock. The timings of the clock provided from the Evaluation board μC are as follows:
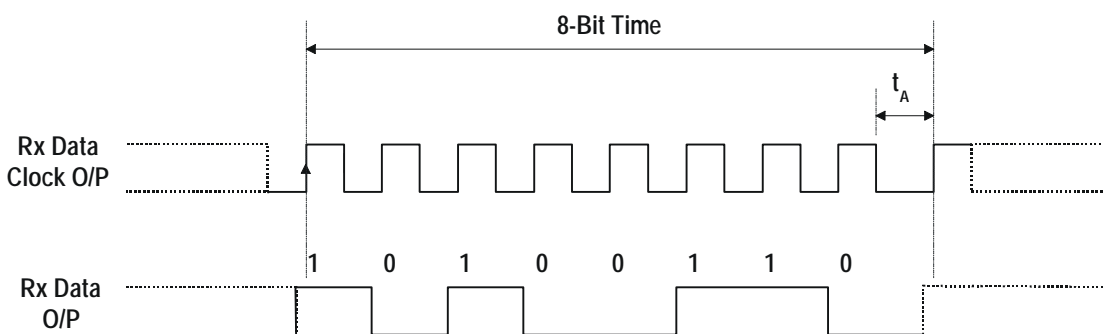
Figure 5 Evaluation Board μC Rx Timing

The μC modifies the state of the Rx data output before taking the Rx clock pin high. Therefore, Rx data is assumed to be clocked into the BER Datatester on the rising edge of Rx clock.
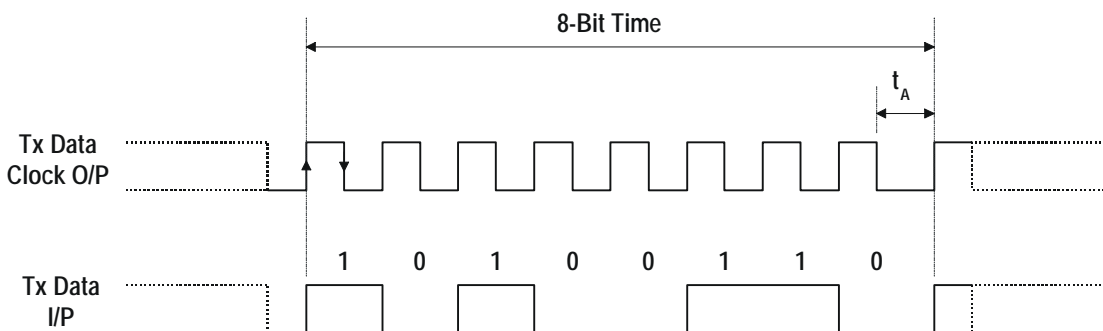

Figure 6 Evaluation Board μC Tx Timing

Tx data is assumed to be clocked out of the BER Datatester on the rising edge of the Tx clock. This data is sampled by the µC on the falling edge of the Tx clock.

The time t_A varies as the clocks are adjusted to fit the exact byte periods of the evaluation devices.

Example BERT AT Command Setup

Ensure the BER Datatester is running (awaiting the external clocks supplied from the EV8680 boards) and then start the Rx end board followed by the Tx end. The following sections show the required setup for each end.

EV8680 Rx End Board Setup

1. Select V.22 communication standard (default is V.22 bis).
   Command : **ATB1**<*CR*>

2. Enable/Disable Fixed Compromise and Auto Equalisers by writing to S-Register, S24.

3. Select the Operating Band and Enable/Disable the Descrambler by writing to S-Register S21.

4. Configure CMX868 Tx Gain by writing to S-Register, S25.

5. Configure CMX868 Rx Gain by writing to S-Register, S26.

6. Instruct the board to start the BERT routine as the Rx end.
   Command : **AT&F4**<*CR*>

EV8680 Tx End Board Setup

1. Select V.22 communication standard (default is V.22 bis).
   Command : **ATB1**<*CR*>

2. Enable/Disable Fixed Compromise Equaliser by writing to S-Register, S24.

3. Select the Operating Band and Enable/Disable the Scrambler by writing to S-Register S21.

4. Configure CMX868 Tx Gain by writing to S-Register, S25.

5. Configure CMX868 Rx Gain by writing to S-Register, S26.

6. Instruct the board to start the BERT routine as the Tx end.
   Command : **AT&F5**<*CR*>

1.6.9   Trouble Shooting

Some terminal emulators have been found not to support full hardware flow control when transferring text files. This could result in data loss when using this facility. If this problem is experienced users should try using a different terminal emulator

To ensure successful negotiation and data transfer between the EV8680 and third party modems, users should ensure their third party modem is configured to the correct protocol (see third party AT command documentation).

Note, any sudden loss of the 2-wire line during data transfer will result in loss of carrier and therefore the evaluation board will hang up and display the NO CARRIER message. However, due to the lost carrier to hang up delay (S10), a short burst of corrupt characters (noise generated) will be observed on the Hyper Terminal window before the NO CARRIER message is displayed. These corrupt noise generated characters can sometimes match control characters and therefore modify Hyper Terminal's behaviour. The user is advised to restart Hyper Terminal if this problem is encountered.

1.7   Performance Specification

1.7.1   Electrical Performance

1.7.1.1 Absolute Maximum Ratings
Exceeding these maximum ratings can result in damage to the Evaluation Kit.

	Min.	Max.	Units
Supply (V_{IN} - V_{SS})	-0.3	40.0	V
Supply (V_{DD} - V_{SS})	-0.3	7.0	V
Voltage on any connector pin to V_{SS}	-0.3	V_{DD} + 0.3	V
Current into or out of V_{IN} and V_{SS} pins	0	+1.5	A
Current into or out of any other connector pin	-20	+20	mA
Storage Temperature	-10	+70	°C
Operating Temperature	+10	+35	°C

1.7.1.2 Operating Limits
Correct operation of the Evaluation Kit outside these limits is not implied. To operate the Evaluation Kit with V_{DD} = 5.5V the user should modify resistors R13 and R17 to prevent damage to the LEDs, D6 and D7.

	Notes	Min.	Max.	Units
Supply (V_{IN} - V_{SS})		8.0	14.0	V
Supply (V_{DD} - V_{SS})		2.7	5.0	V
Operating Temperature		+10	+35	°C

1.7.1.3 Operating Characteristics
For the following conditions unless otherwise specified:

      Evaluation Device Xtal Frequency = 11.0592MHz or 12.288MHz ±0.01% (100ppm)
      V_{DD} = 2.7V or 5.0V, Tamb = +25°C.

	Notes	Min.	Typ.	Max.	Units
DC Parameters					
I_{DD} (evaluation board - idle)	1		30.0	-	mA
AC Parameters					
Xtal/Clock Input					
'High' pulse width	2	30	-	-	ns
'Low' pulse width	2	30	-	-	ns

Notes: 1.   Hook relay and CD LEDs off.
           2.   Timing for an external input to the evaluation device CLOCK/XTAL pin.