CH1792 - V.32/9600 bps
CH1793 - V.32 bis/14,400 bps
FAX/Modem Module

Technology patent pending

INTRODUCTION

The CH1792 and CH1793 are very small, high speed modem and FAX modules. They provide simplicity and short time to market to the designer who wants to integrate a FAX/modem into an OEM product. These modules require very little space, less than 5 square inches. The CH1792 and CH1793 have two interfaces, a CCITT V.24, TTL level serial interface and a two wire Tip and Ring signal which goes directly to an RJ-11 jack for the telephone connection. Both the modem and the FAX components can be controlled with industry standard AT commands and are therefore compatible with off-the-shelf communications software.

The CH1792 modem supports asynchronous operation at 9600 bps, 4800 bps, 2400 bps, 1200 bps and 300 bps per CCITT V.32, V.22 bis, V.22, and V.21 and Bell 212A and 103 standards. The CH1793 modem is similar to the CH1792 with the addition of 14,400 bps and 12,000 bps communication per CCITT V.32 bis. Both modules support FAX operation at 9600, 7200, 4800, 2400 and 300 bps per CCITT V.29, V.27 ter, V.21, T.3, T.4 and T.30 standards. The FAX meets EIA/TIA 578 Class 1 specification.

The internal telephone line interface, also called Data Access Arrangement (DAA), is FCC Part 68 approved. This approval is automatically transferred to the user, eliminating the need for costly and timely registration procedures. The module is also Canadian DOC approvable and can be approved in other countries that require 1500 VDC isolation.

The CH1792/CH1793 is powered with a single +5V supply and is pin similar to the CH1782 which allows for easy upgrades. An automatic Power Down mode reduces current draw.

GENERAL DESCRIPTION

Figure 1 is a functional block drawing of the CH1792/CH1793. The CH1792 and CH1793 are highly integrated, full function FAX/modems, each comprised of a modulator/demodulator, controller, send/receive FAX generator, and an FCC Part 68 approved telephone interface, also called a Data Access Arrangement (DAA).

Modulator/Demodulator and Controller

This function block is comprised of a monolithic modem integrated circuit, with built-in facilities to accommodate "AT" command control and resident interfaces for general communication and routing to the DAA.

Fax Generator

The FAX portion of the CH1792/CH1793 meets EIA/TIA 578 Class 1 specification. As such the FAX generator accepts

FEATURES:

- Supports Modem Standards CCITT V.32 bis (CH1793), V.32, V.22 bis, V.22, Bell 212, V.21, and Bell 103.
- Supports FAX Standards CCITT V.29, V.27 ter, V.21, T.3, T.4, T.30, and EIA/TIA 578 Class 1
- FCC Part 68 approved and DOC approvable
- Asynchronous operation
- MNP 5, V.42 & V.42 bis error correction and data compression
- AT Command Structure with extensions
- EEPROM for storage of parameters and telephone numbers
- Single +5 volt operation
- Reduced power standby mode
- Automatic adaptive and fixed compromise equalization
- Test modes and diagnostics
- Size 4.00" x 1.13" x 0.50"
- Pin compatible with CH1782

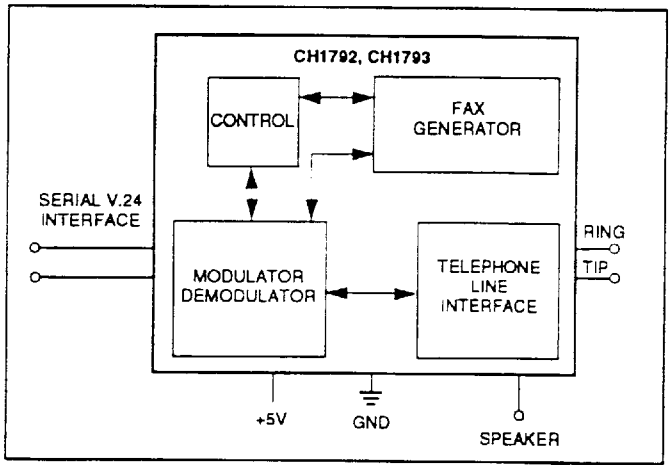

Figure 1. CH1792/CH1793 Functional Block Diagram

from the terminal data that conforms to either CCITT T.3 or T.4 standards and is processed according to CCITT T.30 standards.

DAA

The CH1792/CH1793 is designed to meet North American telephone standards as set by FCC Part 68 and Canada's DOC. The telephone line interface is designed to meet 1500 VDC isolation, among other parameters. As such it will meet U.S. and Canadian requirements and other international specifications that stipulate that level of isolation. The CH1792 and CH1793 are FCC Part 68 approved and are accompanied by

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Table 1. CH1792/CH1793 Pin Descriptions

PIN	NAME	I/O	FUNCTION
1	$\overline{RTS}$	I	**REQUEST TO SEND**, input. A LOW on this input is used to condition the CH1792/CH1793 for data. The $\overline{RTS}$ is the input half of the DCE/DTE hardware flow control.
2	GND	I/O	**GROUND.** Signal and power.
3	-	-	Reserved. Leave this pin unconnected.
4	V_{CC}	I	**POWER SUPPLY.** +5 Volts ±10%.
5	RXD	O	**RECEIVE DATA, DIGITAL**, Output. Serial receive data. MARK or binary 1 condition is indicated by a TTL HIGH.
6	$\overline{DTR}$	I	**DATA TERMINAL READY,** Input. Active LOW. Switching OFF $\overline{DTR}$ can force the FAX/ modem to either return to command state, disconnect phone call, or reset. The default is to ignore $\overline{DTR}$.
7	$\overline{DSR}$	O	**DATA SET READY**, Output. A LOW indicates the CH1792/ CH1793 is Off-Hook.
8	$\overline{DCD}$	O	**DATA CARRIER DETECT**, Output. When asserted LOW, the receive data carrier is present.
9	TIP	I/O	**TIP.** Directly connects to the telephone line's TIP lead through a user supplied RJ-11C jack.
10	RING	I/O	**RING.** Directly connects to the telephone line's Ring lead through a user supplied RJ-11C jack.
11	$\overline{RI}$	O	**RING INDICATION**, Output. A LOW indicates that the local telephone line is ringing. This signal follows the envelope of the ringing signal (typically: 2 seconds LOW, 4 seconds HIGH).
12	-	-	Reserved. Leave this pin unconnected.
13	$\overline{CTS}$	O	**CLEAR TO SEND**,Output. When LOW the modem has set up the data call and is ready to transmit data. The $\overline{CTS}$ is the output half of the DCE/DTE hardware flow control.
14	RST	I	**RESET**, Input. Active HIGH. This input may be asserted HIGH for at least 10 ms to reset the FAX/modem. RST is then returned LOW for normal operation.
15	ID	-	**IDENTIFIER** pin. On the CH1782, this pin is used for $\overline{HS}$ and upon power-up, defaults to LOW. On the CH1792/CH1793, this pin is left unconnected. User can detect whether current flows into this pin to determine if CH1782 is installed.
16	TXD	I	**TRANSMIT DATA DIGITAL**, Input. Serial transmit data. Mark or binary 1 condition is transmitted when a TTL HIGH is asserted.
17-19	-	-	Reserved. Leave these pins unconnected.
20	SPK	O	**SPEAKER**, Output. Audio output for speaker interface. See speaker control diagram.
21	-	-	Reserved. Leave this pin unconnected.

Note: Various "AT" commands can alter the function and meaning of the following signals: $\overline{RTS}$, $\overline{DTR}$, $\overline{DCD}$, $\overline{CTS}$, and SPK.

an FCC label with the registration number and ringer equivalent number (REN). This label should be prominently displayed on the final product. As with most countries, Canada requires submission of the end product containing the CH1792 or CH1793 to the Department of Communications for approval. This can be done by submitting the design to a test house or consultant. Contact Cermetek for assistance.

OPERATION AND USE

"AT" Command Set

A 40 character command line is provided. The command line starts with AT and may contain standard or enhanced commands. The commands are compatible with EIA document TR302.2/88-08006.

Serial Host Interface

The serial interface is V.24 (EIA-232-D) compatible interface. See Pin Description, Table 1.

Speaker Interface

An interface to an externally supplied speaker circuit is provided. The speaker can be used to monitor call progress. The "AT Ln" (n = 0 to 3) command can be used to adjust the volume in suitable steps. See Figure 3.

Power Down Mode

To reduce the modem power consumption, the CH1792/CH1793 includes a power down, or standby mode. The CH1792/CH1793 enters standby mode whenever TXD has been inactive for 10 to 15 seconds. (Note: The modem never enters power down mode while in data mode.) The modem returns to full operation whenever a ring signal occurs or the host sends a command to the modem along TXD.

Data Encoding

The data encoding conforms to CCITT Recommendations V.32 bis (14,400 bps - CH1793 only), V.32 (9600 bps), V.22 bis (2400 bps), V.22 (International 1200 bps), V.21 (Int'l 300 bps), Bell 212A (North American 1200 bps) or Bell 103 (N.A. 300 bps) for modem communications. For facsimile (FAX) transmission, the data encoding conforms to CCITT Recommendation V.29 (9600 bps and 7200 bps), V.27 ter (4800 bps and 2400 bps) and V.21 (300 bps). The CH1792 and CH1793 meet EIA/TIA 578 specifications for Class 1 FAX. In FAX mode, the CH1792/CH1793 will accept data formatted according to either CCITT Recommendation T.4 (Group 3) or T.3 (Group 2) and processed according to CCITT Recommendation T.30.

Line Equalization

Transmitter and receiver digital filters compensate for delay and amplitude distortion during operation on nominal phone lines. In addition, automatic adaptive equalization in the receiver minimizes the effects of intersymbol interference.

Transmission Speed

The transmission rate of the host computer must be 300, 1200, 2400, 4800, 9600 or 14,400 bps (19,200 bps for FAX). Data transmission speed can be increased by implementing MNP5 or V.42 bis. The FAX/modem will connect at the selected speed or will fall back to the speed set by the remote FAX/modem. When the FAX/modem answers a call, it selects a carrier tone to identify the data speed at which it is set. The originating FAX/modem responds with either a matching speed tone or a slower speed tone.

Speed and Parity Selection

Before a call, the FAX/modem adjusts to the host speed and parity via a host-initiated training sequence. The FAX/modem matches the host's speed and parity when it returns status messages to the host. This is also the data speed that the FAX/modem will use when attempting to make connection with another FAX/modem. When the DCE communicates with the CH1792/CH1793, each byte of data must be ten bits including Start, Stop, Data and Parity bits. During a data connection, the modem passes parity through without interpretation or alteration.

Power Supply

The modem module is a complex sub-system that may be treated as any other component. Special attention should be paid to the power supply connections. The modem decodes analog signals from the telephone line that are in the millivolt range and even though the modem is designed to withstand significant induced power supply noise, there is a limit. Steps must be taken to guarantee that power supply noise on all supply lines including ground does not exceed 50 mV peak to peak. If necessary, this should include the use of dedicated power and ground planes. Failure to provide such operating conditions could cause the modem to malfunction.

The CH1792/CH1793 requires a single +5V ± 10% supply. It is recommended that by-pass capacitors be placed on the power supply line as close to the modem's supply input as practical. It is recommended that a 100µF Electrolytic capacitor in parallel with a 0.01µF Electrolytic capacitor be used.

FAX/MODEM CONTROL

The CH1792/CH1793 FAX/modem may be controlled by sending serial ASCII command sequences. The commands are sent to the FAX/modem serially on TXD. After execution of the command, the modem returns a serial status message on RXD, to indicate the completion status of the command. Contact Cermetek to obtain a detailed description of the AT commands for the CH1792/CH1793.

Training the Modem

The CH1792/CH1793 must be trained to match the host's speed and parity so that it is able to recognize serial asynchronous commands sent to it by the host UART. The host must retrain the modem each time a reset signal is applied on RST or after a RESET serial command. The CH1792 CH1793 is trained by sending it the following three character sequence:

AT[CR]

where: **A** and **T** may be upper case or lower case
[CR] represents carriage return

The FAX/modem will respond with either one of the following status messages, depending on whether it is optioned for abbreviated or English status messages.

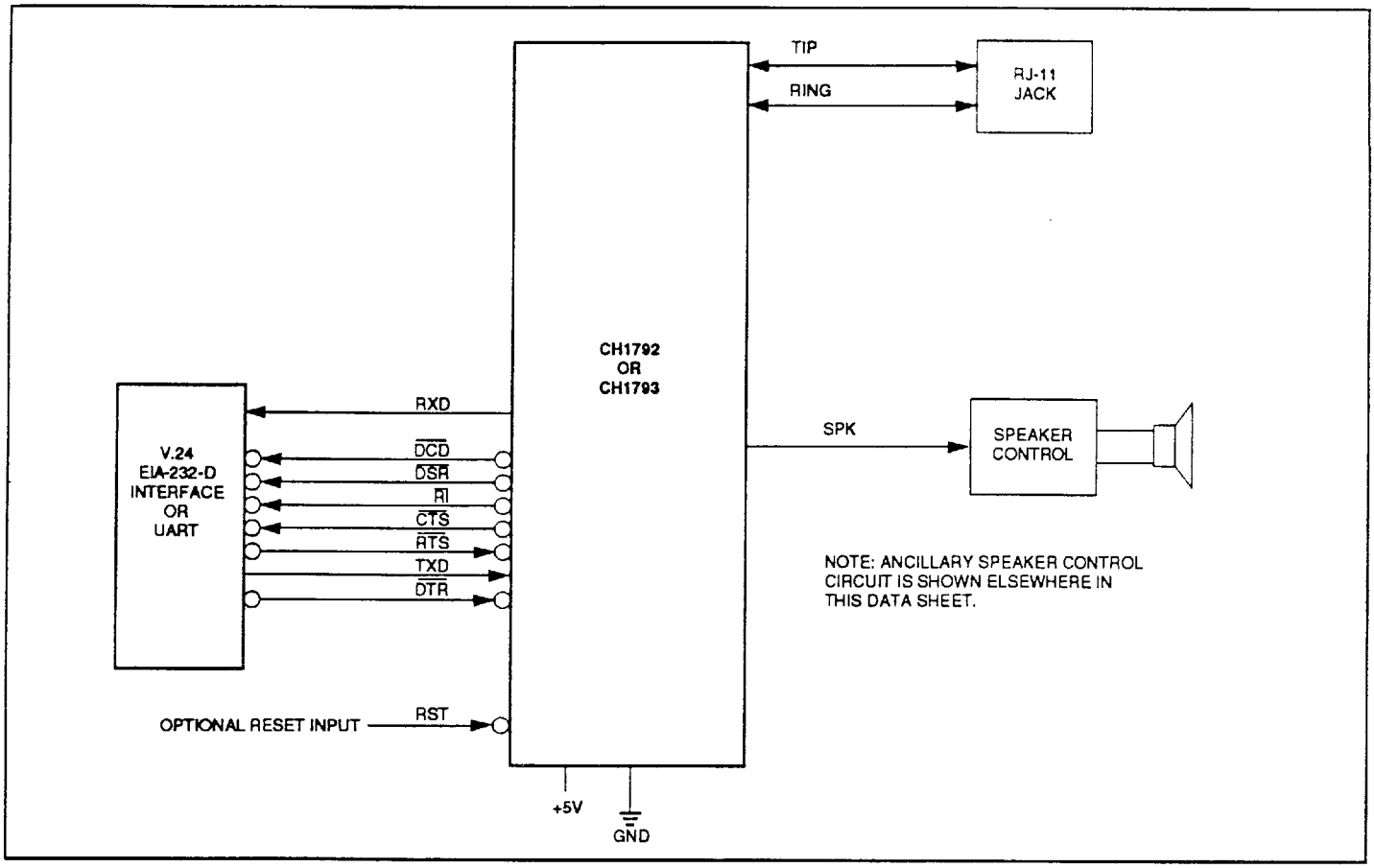


Figure 2. CH1792/CH1793 Application Design

0[CR] (abbreviated form)
[CR][LF][OK][CR][LF] (English form)
where: **[CR]** represents carriage return (ASCII 13)
[LF] represents line feed (ASCII 10)

The CH1792/CH1793 may be retrained any time while it is idle.

Another attention sequence "A/" is much like the "AT" sequence except it repeats the previously entered command specified with an "AT" prefix. No carriage return is needed.

The Command Format

Typical commands consist of three elements, the attention sequence, the commands themselves, and a terminating carriage return.

AT(commands)[CR]
where: **[CR]** represents carriage return (ASCII 13)

When entering commands to the CH1792/CH1793 the backspace character - control-H (ASCII 8) - can be used to edit mistakes. "AT" and "A/" may not be edited however. Multiple commands may be placed in the command line. A command line may be as long as 40 characters, excluding AT. The command below instructs the modem to configure itself to not echo characters in the command mode (E0) and then go to answer mode.
ATE0A[CR]

AT Command Data Rate

With the serial interface, the rate is speed sensed for parity and format.

AT Command Set

The commands are divided into five types: Basic Commands, Dial Modifiers, Ampersand Command, Error Correction Commands, and FAX commands. These commands are listed in Table 2. The supporting S registers are listed in Table 3.

The Status Messages

The FAX/modem responds with a Status Message (or Result Codes) after each command has been executed. This status message may either be a single or double digit followed by a carriage return or it may be a carriage return, line feed, message in English, carriage return, and line feed. The digits and English messages are listed along with their meanings in Table 4.

The basic status code subsets are enabled with the Xn command, where n = 0,1,2,3, or 4. The following are the results codes subsets for the five Xn commands.

X0 - Result Codes 0,1,2,3,4
X1 - All Result Codes except 6,7
X2 - All Result Codes except 7
X3 - All Result Codes except 6
X4 - All Result Codes (factory default)

Modem States

The modem can be in either a command mode or a data mode. When the modem is idle, it is in the command mode. When a data call is in progress it is in the data mode. The modem does not recognize commands when in the data mode. To recognize commands, the computer must send an "escape sequence" to the modem that forces it out of the data mode and into the command mode.

The escape sequence consists of a "guard time" (a period where no characters are sent to the modem) followed by 3 escape characters followed by a "guard time" again. At power-up, the guard time is set to 1 second minimum and the escape character is set at "+". These two parameters can be modified via registers S2 and S12.

The modem will stay off-hook with its carrier on after the escape sequence is received. It returns an OK status message when it is ready to accept commands. You may re-enter the data mode by issuing the ONLINE command:

ATO[CR]

"AT" COMMAND APPLICATIONS

Dial a Number "D"

The Dial Command takes the form Dn, where n is a string of characters. In the simplest form, n will be only the digits of the phone number to be dialed.

Example: Dial number.

Enter: AT D1234567 [CR]

In response to this command, the modem dials the telephone number "123-4567" and then waits for carrier from a distant modem. If no carrier is detected within a given time (the default time is 50 seconds), the modem automatically releases the line and sends a NO CARRIER result code. If carrier is detected, the modem gives a CONNECT result code and goes on-line, permitting communication with the distant modem.

The Dial Command may also be issued without a telephone number. ATD [CR] causes the modem to pick up the telephone line and wait for a carrier without dialing a number.

Touch Tone and Pulse Dialing "T" and "P"

The FAX/modem can use DTMF (touch-tones) or dial pulses when dialing a telephone number. If the dial command does not specify which type to use, the modem defaults to the type last specified. The power-on default value is P.

Example: Pulse dial 9, pause, touch-tone dial number.

Enter: AT DP9, T1234567

Pause ","

When placing a call from an office with a telephone connected to a PBX, it may be necessary to dial an access code (usually the digit 9) to get an outside line. Inserting a comma in the telephone number commands the FAX/modem to pause for a specific length of time. The factory default pause time is 2 seconds.

Example: Dial 9, pause, dial number.

Enter: AT DT9, 1234567 [CR]

Multiple commas may be used for a greater delay time.

Originate a Call in Answer Mode "R"

The D command forces the modem into originate mode. To call an originate-only modem, dial the number and set the modem to answer mode via the R (reverse originate). Enter the R command at the end of the telephone number.

Example: Dial number in answer mode.

Enter: AT D1234567R [CR]

Redial Last Number "A/"

Use A/, the repeat command, to redial the last telephone number dialed when a busy signal is received.

Return to Command State ";"

The modem can be forced to reenter the command state after dialing (without hanging up) by ending the dial command with a semicolon. This is useful when using the modem as an auto dialer.

Example: Touch-tone dial 9, pause, dial number, return for command.

Enter: AT DT9, 1234567; [CR]

Result: OK

Automatic Answering

The S0 register controls the number of rings that must occur before the modem answers a call. The register may range in value from 0-255.

S0 = 0 DO NOT ANSWER TELEPHONE
S0 = 1 ANSWER ON RING 1
S0 = 2 ANSWER ON RING 2
S0 = 3 ANSWER ON RING 3

S0 = 255 ANSWER ON RING 255

When S0 is set to 0, the modem will not auto-answer.

Example: Assign the value "6" to S0 to set the modem to answer on the sixth ring.

Enter: AT S0 = 6 [CR]

Result: OK

Table 2.
CH1792/CH1793 "AT" Command Set Summary

Basic Commands	Function (Default)
AT	Attention Code
A/	Repeat Last Command
A	Answer Command
Bn	Communication Standard (n=1)
D	Dial Command
En	Off-Line Echo Command (n=1)
Hn	Switch Hook Control
Ln	Speaker Volume (n=2)
Mn	Speaker Control (n=1)
On	Go On-Line Command
P	Pulse Dial
Qn	Result Code Display (n=0)
Sn	Select S Register
Sn=x	Write x to S Register
Sn?	Read S Register
T	Touch-Tone Dial
Vn	Result Code Form (n=1)
Wn	Select Extended Result Codes (n=2)
Xn	Select Basic Result Codes (n=4)
Yn	Long Space Disconnect (n=0)
Zn	Reset and Recall User Profile
+++	Escape Code Sequence
?	Read Last S Register

Dial Modifiers	Function
P	Pulse Dial
R	Originate Call in Answer Mode
T	Touch-Tone Dial
W	Wait for Dial Tone
;	Return to Command Mode
@	Wait for Quiet Answer
!	Flash Hook
,	Pause
0-9,#,*, A,B,C,D	Dial Digits or Characters

Ampersand Commands	Function (Default)
&Cn	DCD Output Control (n=0)
&Dn	DTR Input Response Control (n=0)
&Fn	Recall Factory Settings
&Gn	Guard Tone Control (n=0)
&Mn	Asynchronous Mode (n=0)
&Pn	Dial Pulse Ratio (n=0)

Ampersand Commands	Function (Default)
&Qn	Communications Mode (n=0)
&Rn	CTS/RTS Control (n=0)
&Sn	DSR Output Control (n=0)
&Tn	Diagnostics Command (n=4)
&V	View Configuration & Profiles
&Wn	Save Active Configuration
&Yn	Recall User Profile (n=0)
&Zn=x	Store Phone Number x

Error Correction Commands	Function (Default)
\An	Maximum Block Size (n=3)
\Bn	Send Break (n=0)
\Cn	Set Autoreliable Buffer (n=0)
\Gn	Modem Port Flow Control (n=0)
\Hn	HP ENQ/ACK Protocol (n=0)
\Jn	Serial Port Data Rate Adjust (n=1)
\Kn	Break Control (n=5)
\Nn	Error Correction Operating Control (n=0)
\Qn	Serial Port Flow Control (n=0)
\Tn	Set Inactivity Timer (n=0)
\Vn	Extended Result Code Form (n=0)
\Xn	XON/XOFF Pass-Through Control (n=0)
\Z	Switch to Normal Mode
%An	Set Auto-Reliable Fallback Character (n=0)
%Bn	Modem Port Data Rate (n=9600 CH1792, n=14400 CH1793)
%Cn	Data Compression Control (n=0)
%En	Auto-Retrain (n=1)
%Mn	Minimum Modem Port Rate (n=300)

FAX Commands	Function
+FCLASS?	Service Class Indication
+FCLASS=?	Service Class Capabilities
+FCLASS=1	Service Class 1 Selection
+FRH=m	Receive HDLC Data with m Carrier
+FRM=m	Receive FAX Data with m Carrier
+FRS=n	Receive Silence
+FTH=m	Transmit HDLC Data with m Carrier
+FTM=m	Transmit FAX Data with m Carrier
+FTS=n	Transmit Silence

Note: The default settings indicated above are the "Factory" defaults and are accessed by the command AT&F0. Upon power-up the CH1792/CH1793 recalls the configuration stored in memory as determined by the user. Refer to the &Wn and &Yn commands. Contact Cermetek to obtain a detailed description of the AT commands for the CH1792/CH1793.

Table 3.
CH1792/CH1793 S Register Summary

Register	Function (Default)
S0	Ring to Auto-Answer On (x=0)
S1	Ring Count (x=0)
S2	Escape Code Character (x=43)
S3	Carriage Return Character (x=13)
S4	Line Feed Character (x=10)
S5	Backspace Character (x=8)
S6	Wait Before Dialing (x=2)
S7	Wait For Carrier (x=50)
S8	Pause Time For Comma Dial Modifier (x=2)
S9	Carrier Recovery Time (x=6)
S10	Lost Carrier Hang-Up Delay (x=14)
S11	DTMF Dialing Speed (x=95)
S12	Guard Time (x=50)
S14	Bit Mapped Options (x=10 or 0AH)
S16	Bit Mapped Options (x=0)
S18	Modem Test Timer (x=0)
S19	AutoSync Protocol Support Mode (x=26)
S20	AutoSync Sync/Address Character (x=32)
S21	Bit Mapped Options (x=0)
S22	Bit Mapped Options (x=118 or 76H)
S23	Bit Mapped Options (x=31 or 1FH)
S25	Detect DTR Change (x=5)
S26	RTS to CTS Delay Interval (x=1)
S27	Bit Mapped Options (x=64 or 40H)
S30	Inactivity Timer Value (x=0)
S37	Desired DCE speed (x=0)

INTERFACES

In addition to the power supply (+5 VDC and Ground), the CH1792/CH1793 has a TTL level serial interface, a two-wire phone line interface, and a few other optional connections.

Connecting to the Host UART

Since a modem communicates data serially and most host products handle data in a parallel format, a UART is needed to make parallel-to-serial and serial-to-parallel translations.

The Serial Interface Lines

The module supports a full RS-232C/V.24 serial interface. Signal levels are TTL rather than RS-232C level compatible, which allows you to directly connect the modem to your host's UART without level translating circuitry. A complete description of each signal can be found under Pin Description, Table 1.

Two of these lines must be utilized for proper modem operation; TXD and RXD. The modem is controlled by sending it serial commands over TXD and can be monitored by serial status messages returned on RXD. All other serial interface lines may be utilized for the convenience of your application but are not required by the modem. Unused outputs (from-modem) should be left unconnected. Unused inputs should be tied to the proper logic level.

Phone Line Connection Guidelines

1) The mounting of the CH1792/CH1793 in the final assembly must be made so that it is isolated from exposure to any hazardous voltages within the assembly. Adequate separation and restraint of cables and cords must be provided.
2) The circuitry from the CH1792/CH1793 to the telephone line interface must be provided in wiring that carries no other circuitry than that specifically allowed in the FCC Part 68 Rules (such as A and A1 leads).
3) Connection to the phone line should be made through an RJ-11C jack.
4) Traces from the modem's RING and TIP pins to the RJ-11C jack must exceed 0.1 inch spacing to one another and 0.2 inch spacing to all other traces. The traces should have a nominal width of 0.020 inches or greater.
5) The RING and TIP traces should be as short as possible and oriented to prevent coupling other high speed or high frequency signals onto the host circuit card.
6) No additional circuitry other than that shown in Figure 4 may be connected between the modem module and the RJ-11C jack.
7) The supplied FCC registration label must be applied visibly on the outside of the host product.
8) The host product's User Manual must provide the user with instructions for connection and use as recommended in the FCC Registration section of this data sheet.

Optional Connections

1) Reset (RST), Input: When this input is toggled HIGH then LOW, the FAX/modem will re-initialize itself and return all options to the pre-programed default settings.
2) Speaker (SPK), Output: This output allows aural monitoring of the phone call progression. Apply this output to an amplifier and speaker. See Figure 3. This speaker output can be controlled via the AT commands

Mounting the Modem

The modem contains static sensitive devices and should only be handled by personnel and in areas that are properly protected against static discharge.

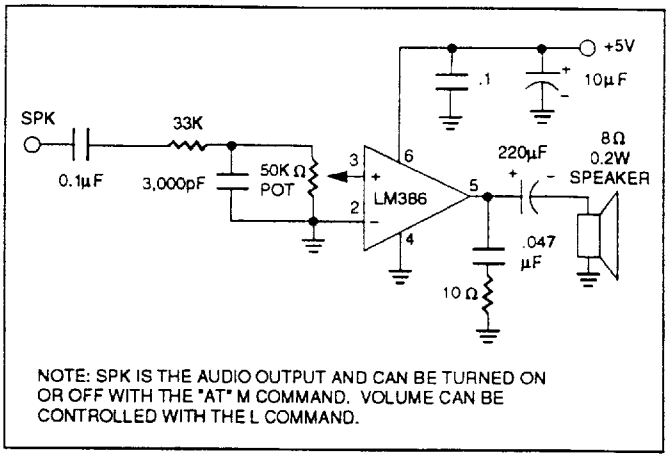


**Figure 3. Speaker Control Circuit-
Optional to Allow for Call Progress Monitoring**

Table 4.
Result Codes

Code	Verbose	Meaning
0	OK	Command Executed
1	CONNECT	Data Connection Established
2	RING	Incoming Call Detected
3	NO CARRIER	Carrier Not Detected or Lost
4	ERROR	Invalid Command, Checksum, or Command String
5	CONNECT 1200	Data Connection at 1200 BPS
6	NO DIALTONE	No Dial Tone Detected
7	BUSY	Busy Signal Detected
8	NO ANSWER	No Silence Detected After @ Dial Modifier
10	CONNECT 2400	Data Connection at 2400 BPS
11	CONNECT 4800	Data Connection at 4800 BPS
12	CONNECT 9600	Data Connection at 9600 BPS
14	CONNECT 19200	Data Connection at 19200 BPS
15	CONNECT 38400	Data Connection at 38400 BPS
16	CONNECT 1200/75	Data Connection at 1200 BPS TX / 75 BPS RX
17	CONNECT 75/1200	Data Connection at 75 BPS TX / 1200 BPS RX
20	CONNECT/REL	Error Protected Connection at 300 BPS
22	CONNECT 1200/REL	Error Protected Connection at 1200 BPS
23	CONNECT 2400/REL	Error Protected Connection at 2400 BPS
24	CONNECT 4800/REL	Error Protected Connection at 4800 BPS
26	CONNECT 9600/REL	Error Protected Connection at 9600 BPS
27	CONNECT 19200/REL	Error Protected Connection at 19200 BPS
28	CONNECT 38400/REL	Error Protected Connection at 38400 BPS
34	CONNECT 7200	Data Connection at 7200 BPS
35	CONNECT 12000	Data Connection at 12000 BPS
36	CONNECT 14400	Data Connection at 14400 BPS
37	CONNECT 7200/REL	Error Protected Connection at 7200 BPS
38	CONNECT 12000/REL	Error Protected Connection at 12000 BPS
39	CONNECT 14400/REL	Error Protected Connection at 14400 BPS
40	CARRIER 300	Carrier Detected at 300 BPS
44	CARRIER 1200/75	V.23 Carrier Detected 1200 BPS TX / 75 BPS RX
45	CARRIER 75/1200	V.23 Carrier Detected 75 BPS TX / 1200 BPS RX
46	CARRIER 1200	Carrier Detected at 1200 BPS
47	CARRIER 2400	Carrier Detected at 2400 BPS
48	CARRIER 4800	Carrier Detected at 4800 BPS
49	CARRIER 7200	Carrier Detected at 7200 BPS
50	CARRIER 9600	Carrier Detected at 9600 BPS
51	CARRIER 12000	Carrier Detected at 12000 BPS
52	CARRIER 14400	Carrier Detected at 14400 BPS
66	COMPRESSION:CLASS5	MNP Compression Negotiated
67	COMPRESSION:V42BIS	V.42 bis Compression Negotiated
69	COMPRESSION:NONE	No Compression Negotiated
70	PROTOCOL:NON E	Asynchronous Mode
77	PROTOCOL:LAP-M	V.42 LAPM
80	PROTOCOL:ALT	Alternate Protocol (MNP Compatible)

There are two popular mounting techniques that are recommended for physically connecting the modem to your circuit card; 1) sockets, and 2) direct soldering. Each approach has its own set of benefits and challenges.

The direct soldering approach solders the modem directly into the host circuit card. This approach provides the most sound mechanical mounting and also the best electrical connection. However, it does present a couple of challenges.

If the modem is wave soldered on a circuit card, flux and other corrosive chemicals can be left on the modem's components. Care should be taken during the freon rinse cycle to fully wash any chemical residue away. Ideally, the modem should be soldered in by hand after the rest of the card is wave soldered to minimize this problem. Also, soldering can present a sizable challenge if the modem ever needs to be removed from the card.

If the direct soldering approach is selected, it is recommended that 0.040 inch diameter plated through holes be used with 0.060 inch minimum diameter pads.

The socketing approach to mounting eliminates cleaning and desoldering concerns. When a socket is used, it must make a solid connection to all modem pins. Failure to do so will cause unreliable modem operation. Also, steps should be taken to assure that the module remains tightly seated in the socket after the host product is shipped.

If you decide to select the socket approach, make sure that the socket is designed to accept square 0.025 inch pins. Single-in-line sockets may be purchased from manufacturers such as SAMTEC, Amp, or Robinson Nugent.

FCC REGISTRATION

The CH1792/CH1793 is registered with the FCC (Federal Communications Commission) under Part 68. To maintain the validity of the registration, you must serve notice to the end user of the product that contains the modem of several restrictions the FCC places on the modem and its use. The following notice is recommended and should be included in the host product's USER MANUAL. Also, the FCC requires that Cermetek make all repairs to the modem. If repair is necessary after the modem is installed in your product and has been delivered to your customer, the modem must be returned to you where it can be removed from the host product and then forwarded to Cermetek for repair.

FOR YOUR USER'S MANUAL

The Part 68 rules require the following or the equivalent information be provided to the end user of equipment containing a DAA:

FCC Notice to the Users

1. UPON REQUEST ONLY, you must provide the following data to your telephone utility company (telco):
   a) Notice of intention to install or permanently remove an FCC Part 68 registered device or system, and the *FCC Registration Number.
   b) *The Ringer Equivalence Number (REN) (see device label). Note that if several devices are connected to the same line, the REN's must not add up to more than 5.0 (A or B). This REN figure is important to your telco.
   c) *The (USOC) jack type to be provided by the telco. Typically this will be RJ-11C/W for single lines.

   *The *-flagged items above are noted on the equipment's FCC compliance label.
2. This device may not be used on telco-operated coin phone lines. Party lines and privately owned coin-phones are subject to local State regulatory policies, and possible additional State special requirements.
3. The telco has the right to make changes to their network which may affect the operation of your equipment, provided you are given adequate advance written notice to permit correct operation.
4. In case of operational problems, disconnect your unit by removing the modular plug from the telco jack. If your regular phone (or other device or system) still works properly, your (product name) has a problem and must remain disconnected and (officially) serviced or returned for repairs. If upon the above disconnection your regular service still has problems, notify your telco that they may have a problem. Request prompt service at no cost to you the user. If a problem is found in premises wiring not telco-installed, you are subject to a service charge. If a fault is in telco installed wiring, you may be subject to a service call charge.
5. Unless otherwise noted in the User's Manual (eg: fuses, etc.), user may not under any circumstances (in or out of warranty) attempt any service, adjustments or repairs on this unit. It must be returned to the factory or authorized U.S. service agency for all such work. Locations (or phone numbers) of factory or authorized U.S. service points are listed in this user' manual.
6. Special FCC rules apply to equipment connected behind a PBX or KTS.

DIAGNOSTIC TESTS

The CH1792/CH1793 supports the following tests to help diagnose the source of data communications problems that may be encountered.

Analog Loop Test

In an analog loop test, transmitted characters are looped back to the sending terminal or computer. This allows verification of the modem's analog circuits. These circuits modulate and demodulate the host's data. Since the modem uses different circuits to originate and answer calls, it is important to test both answer and originate modes.

An analog loop self test can also be performed. In a self test the modem automatically generates characters back as before. In addition, the modem transmits a character stream and compares it with the received character stream for accuracy. This is a more rigorous test than is possible with the basic analog loop set-up.

Digital Loop Test

In a digital loop test, data that is received from the remote modem is looped back or re-sent to the remote modem. This test is performed after a data connection has been established and after the local modem is enabled to enter this

test mode. To go back on line and return to the data mode, type ATO.

If the remote terminal or computer is having trouble exchanging data with the local host, the problem is usually related to either a poor modem-to-modem connection or incompatible communication settings (parity, data bits, etc.) If a digital loop test is performed and the remote modem receives exactly what is sent, then the data exchange difficulties are probably due to incompatible communication settings.

Remote Digital Loop Test

Once a connection has been established, this command makes it possible for a local operator to put the remote modem into Digital Loop. When this is done, characters sent to the remote modem are looped back to the local modem.

DEFAULT STATUS, PERFORMANCE AND SPECS

Primary Default Configuration Profile
14,400 bps (CH1793) or 9600 bps (CH1792)
Bell 212A operation at 1200 bps
Even parity
Auto answer disabled
Command echo ON
All result codes enabled - except \REL codes
Wait for dial tone before dialing - 2 seconds
Dials with touch-tone
Detects busy signal
Full word result codes
Pulse dial make/break ratio = 39/61
Test timer set to 0 seconds
Inactivity timer set to 0 minutes
CTS always active
DSR always active
DCD always active
RTS to CTS delay - .01 seconds
Modem ignores DTR
Long space disconnect disabled
Speaker enabled but off when receiving carrier
Speaker volume set to medium
Local modem will grant RDL request from remote modem
Guard tones disabled
Minimum DTR pulse width = .01 seconds
Ring count - 00
Escape code character = 43
Carriage return character = 13
Line feed character = 10
Back space character = 08
Duration of wait for dial tone = 02 seconds
Duration of wait for carrier after dialing = 50 seconds
Carrier detect response time = 0.6 seconds
Escape code guard time = 1 second
Length of pause after comma = 2.0 seconds
Lost carrier to hang up delay = 1.4 seconds
DTMF interdigit delay = .095 seconds
AutoSync address character = 32
Minimum DTR pulse = 0.5 seconds
RTS to CTS delay interval = .01 seconds
Connection attempted at last AT speed
Auto-retrain enabled
Error correction mode is inactive
Data compression disabled
Error correction maximum block size is 256 characters
Autoreliable fallback character = 00
Transmit break length is 0.3 seconds
Autoreliable buffer disabled
Serial port flow control disabled
Modem port flow control disabled
XON/XOFF characters processed without pass-through
HP ENQ/ACK protocol disabled
Serial port data rate adjust is enabled
All breaks are transmitted in sequence with data
NOTE: Upon power-up modem will recall user profile 0 which may override the above Factory Defaults

Secondary Factory Default Configuration Profile
Same as above except:
Autoreliable mode active (LAPM with fallback to MNP)
\REL extended codes enabled
Modem port flow control enabled
Bidirectional XON/XOFF flow control enabled
Serial port data rate adjust disabled
Switches to normal upon receipt of autoreliable character

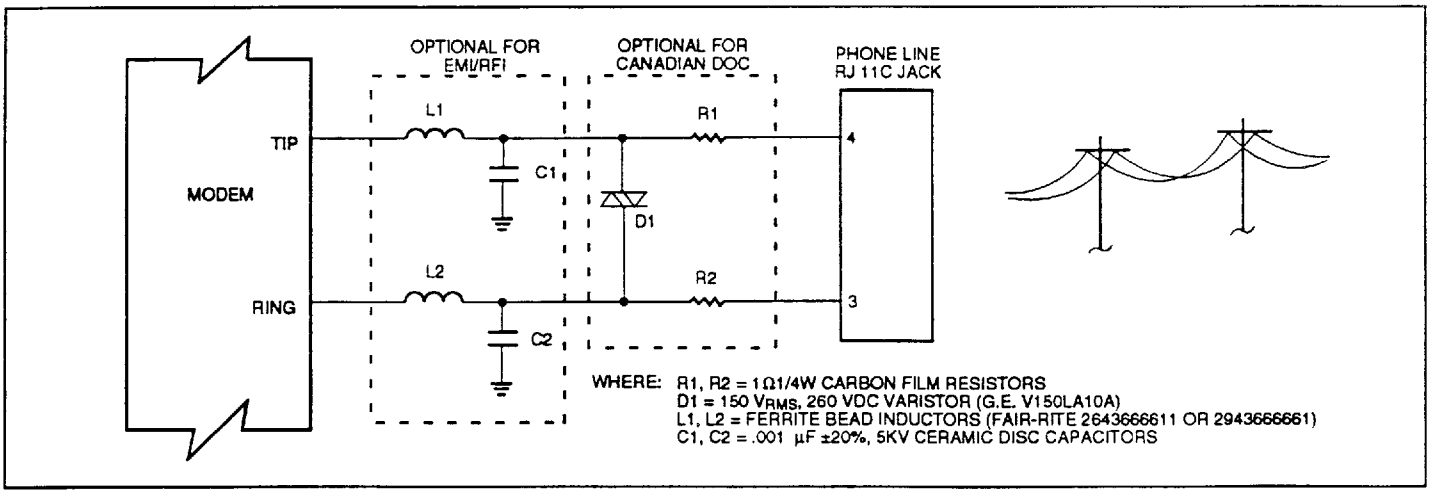


Figure 4. Optional Phone Line Interface

Table 5.
CH1792/CH1793 System Data Mode Compatibility Specifications

Parameter	Specification	
Asynchronous	14,400, 9600, 4800, 2400, 1200 bps, character asynchronous. 0 - 300 bps asynchronous	
Asynchronous Speed Range	+2.3% - 2.5%, extended range option of CCITT standards in character asynchronous mode	
Asynchronous Format	10 bits, including start, stop, parity	
Telephone Line Interface	Two wire full duplex over public switched network. On-chip hybrid and billing delay timers	
Modulation	V.32 bis TCM, V. 32 TCM & QAM at 2400 baud. V.22 bis QAM at 600 baud. V.22 and 212A DPSK at 600 baud. V.21 and 103, binary phase coherent FSK	
Output Spectral Shaping	Square root of 75% raised cosine, TCM/QAM/PSK	
Transmit Carrier Frequencies		
V.32 bis, V.32	Originate/Answer	1800Hz ±.01%
V.22 bis, V.22, 212A	Originate	1200 Hz ±.01%
	Answer	2400 Hz ±.01%
V.21 at 300 bps	Originate `space'	1180 Hz ±.01%
	Originate `mark'	980 Hz ±.01%
	Answer `space'	1850 Hz ±.01%
	Answer `mark'	1650 Hz ±.01%
Bell 103 mode	Originate `space'	1070 Hz ±.01%
	Originate `mark'	1270 Hz ±.01%
	Answer `space'	2020 Hz ±.01%
	Answer `mark'	2225 Hz ±.01%

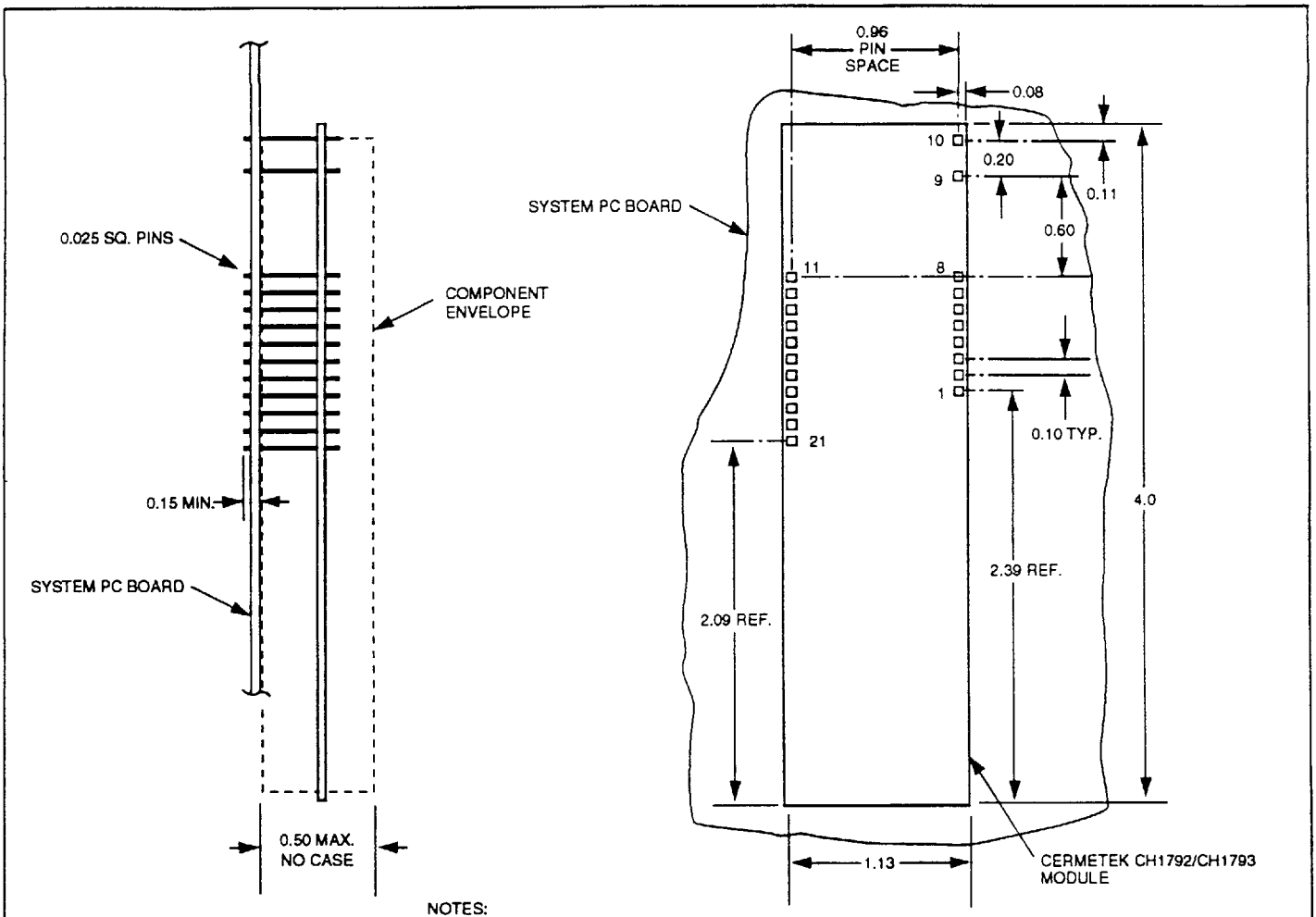
Parameter	Specification	
Receive Carrier Frequencies V.22 bis, V.22, 212A	Originate	2400 Hz ± 7 Hz
	Answer	1200 Hz ± 7 Hz
V.21	Originate `space'	1850 Hz ± 12 Hz
	Originate `mark'	1650 Hz ± 12 Hz
	Answer `space'	1180 Hz ± 12 Hz
	Answer `mark'	980 Hz ± 12 Hz
Bell 103	Originate `space'	2020 Hz ± 12 Hz
	Originate `mark'	2225 Hz ± 12 Hz
	Answer `space'	1070 Hz ± 12 Hz
	Answer `mark'	1270 Hz ± 12 Hz
Receiver Sensitivity	OFF to ON threshold - 45 dBm ON to OFF threshold - 48 dBm	
Line Equalization	Fixed compromise equalization, transmit. Adaptive equalizer for TCM/PSK/QAM, receive.	
Diagnostics Available	Local analog loopback. Local digital loopback Remote digital loopback Request remote digital loopback Local interface loopback modem with self test.	
Self Test Pattern Generator	Alternate `ones' and `zeros' and error detector, to be used along with most loopbacks. A number indicating the bit errors detected is sent to DTE.	
Call Progress Tones Detected:	With speaker or quiet screen messages (no dial tone, busy, ringback, modem answer tone and voice.)	
Computer Interface:	IBM PC/XT/AT bus compatible with an INS8250 UART as a serial controller.	

Table 6
CH1792/CH1793 Electrical Specifications
T_A = 0°C to 50°C. V_{CC} = +5V ±10%

Parameter	Description	Min.	Typ.	Max.	Unit
V_{CC}	Positive Supply Voltage	4.5	5.0	5.5	V
I_{CC} Off Hook	Nominal Operating Current @ V_{CC} = 5.5V when modem is Off Hook		135	200	mA
I_{CCPD}	Power Down Current @ V_{CC}= 5.5V		76	90	mA
V_{IH}	High Level Input Voltage	2			V
V_{IL}	Low Level Input Voltage			0.8	V
VT+	Positive Hysteresis Threshold for RESET pin		2.5		V
VT-	Negative hysteresis Threshold for RESET pin		0.5		V
V_{OH}	High Level Output (I_{OH} = 0.5 mA)	2.4			V
V_{OL}	Low Level Output (I_{OL} = 1.6 mA)			0.6	V

Table 7
Other Performance Specifications

Parameter	Min.	Typ.	Max.	Units	Comments
Tone 2nd Harmonic Distortion			-35	dB	HYB enabled into 600
DTMF Tone Duration	50		255	ms	
Default Duration		70		ms	
Pulse Dialing Rate		10		pps	
Pulse Dialing Make/Break		39/61			US
Pulse Interdigit Interval		785		ms	
Billing Delay Interval			2.1	sec	
Guard Tone Frequency Amplitude Frequency Amplitude		550 -6 1800 -9		Hz dB Hz dB	referenced to High channel transmit
High Channel Transmit Amplitude		-1		dB	referenced to Low channel, Guard Tone enabled
Guard Tone 2nd Harmonic Distortion		-40		dB	
Tone Detection Passband Frequency		480		Hz	3 dB Point
Tone Detection OFF to ON Threshold	-43			dBm	Into 600
Tone Detection ON to OFF threshold			-48	dBm	Into 600
Dial Tone Detect Duration	3.0			sec	



NOTES:
1. ALL DIMENSIONS IN INCHES
2. NOMINAL TOLERANCE ±0.01 INCHES
3. FCC LABEL PROVIDED TO USER

PACKAGE CONNECTION TABLE			
PIN NO.	FUNCTION	PIN NO.	FUNCTION
1	$\overline{RTS}$	12	RESERVED
2	GND	13	$\overline{CTS}$
3	RESERVED	14	RST
4	VCC	15	ID
5	RXD	16	TXD
6	$\overline{DTR}$	17	RESERVED
7	$\overline{DSR}$	18	RESERVED
8	$\overline{DCD}$	19	RESERVED
9	TIP	20	SPK
10	RING	21	RESERVED
11	$\overline{RI}$		

Figure 6. CH1792/1793 Physical Dimensions and Pin Configuration

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