CH1840
FCC Registered Data Access Arrangement (DAA) Module

INTRODUCTION

The CH1840 is an ultra small, low profile Data Access Arrangement (DAA). Its modular construction and single +5 Volt D.C. power requirement simplify your development process. Specifically designed for both voice and data, this allows direct connection of these circuits to the telephone lines. The CH1840 has FCC Part 68 registration that can be transferred to your product. Simply attach the included registration sticker to the outside of your product. This eliminates the costs and delays associated with Part 68 testing and registration.

The CH1840 has also been designed to meet the requirements of Industry Canada (IC). However, it is necessary to register your product with the Industry Canada (IC) before use in Canada.

The CH1840 requires only 1.5 square inches of circuit board space and presents a profile of only 0.35 inches in height. This DAA can either be mounted directly on a printed circuit board or socketed. Connection is made through 0.025-inch square pins on 0.10-inch centers. The telephone line connection is made through a user supplied RJ-11 jack. The CH1840 is recommended for data applications while the CH1840D is recommended for voice applications.

The CH1840/D DAA is designed for use with a variety of voice circuitry and LSI modem/fax chip sets. This device is ideal for fax and modem applications up through V.32bis. The CH1840 is pin compatible with the CH1837A.

FEATURES

- Works with all modem chip sets.
- Available in 0 dB and –9 dB insertion losses.
- Available in extended temperature operation, -40C to +85C.
- Complete DAA function.
- Voice and data.
- FCC Part 68 registered.
- Registration conveyed to user.
- Hook switch control.
- Ring detection.
- Single +5V operation.
- Pulse dial capability.
- CH1840B

FUNCTIONAL DESCRIPTION

The operation of the CH1840 can be broken down into the functional blocks shown in Figure 1.

1) Phone line control
2) Billing delay
3) Ring detection
4) Signal Path
5) 2- to 4-wire converter

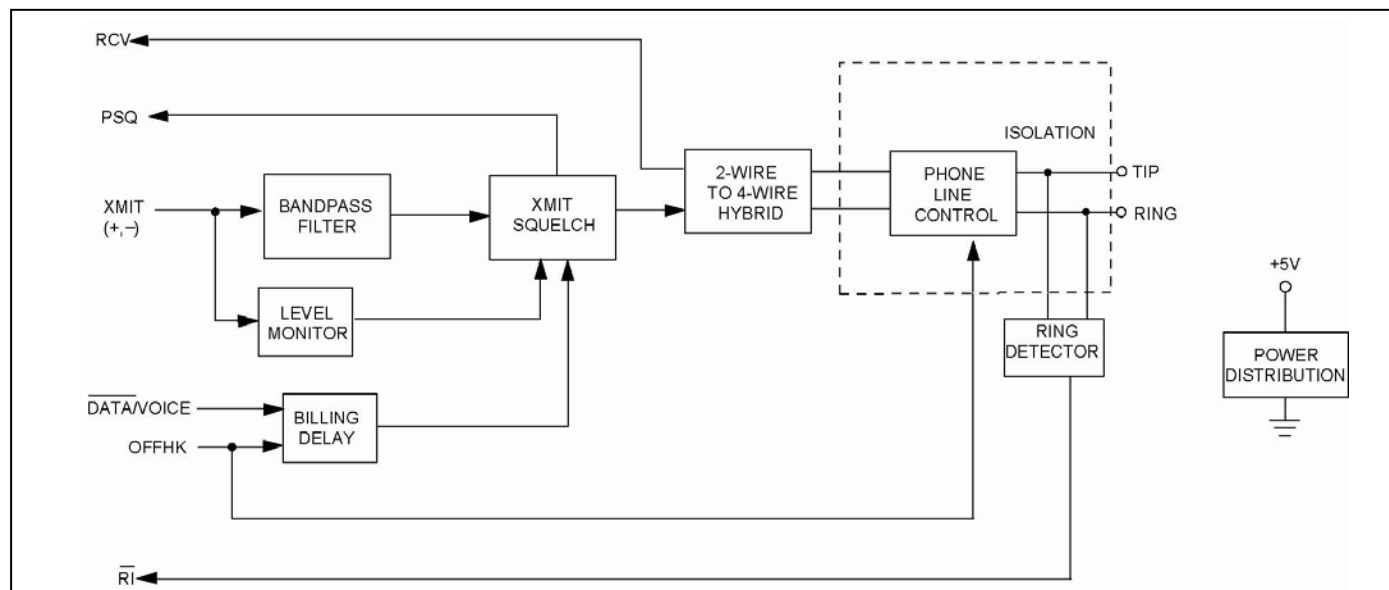Control inputs and status outputs for the CH1840 are compatible with 5 Volt CMOS. See the Electrical Specifications.

Figure 1.   CH1840 DAA Functional Block Diagram.

Phone Line Control. In the Public Switched Telephone Network (PSTN), the wires from a telephone to the phone company's central office (CO) are referred to as the local loop.

2-Wire To 4-Wire Hybrid Converter. This block has two functions:

Drawing current from the local loop signals the central office that the telephone is Off Hook, that is, either answering a call or preparing to place a call. In the CH1840, this function is controlled by the OFFHK signal. When this input is LOW, the CH1840 is On-Hook, indicating to the central office that it is not using the line. CH1840 can pulse dial by togging the OFFHK input

For data calls, FCC Part 68 rules require silence on the phone line for at least 2 seconds after the call has been completed to allow central office to exchange billing information. The CH1840 assures conformance to this requirement by stating a two-second timer on the LOW to HIGHT transition to OFFHK and squelching transmitted signals until the time expires. The CH1840 defeats this function when Voice Mode is selected on the Data/Voice pin.

RING DETECTION
The central office signals an incoming call by placing a ring signal on the local loop. The CH1840 monitors the loop for this signal. The Ring Indication output, RI, is normally HIGH. When ringing appears, RI is set LOW during the typically 2 second ring period and is restored to HIGH for the typically 4 seconds between rings. The ring detection circuit is designed to prevent false indications due to noise or pulse dialing on the line.

The RI output of the CH1840 is diode protected so that an external pull-up resister(R> 100Kohm) to +5V may be utilized to activate the ring detection circuit when the DAA is not connected to power. This can be handy with designs in which power consumption is of concern. When circuited in this manner, there is virtually no current draw until a ring signal is present. See Figure 3.

TRANSMIT SIGNAL
The outgoing analog signal to be transmitted through the phone line should be applied to the XMIT pin (with respect to GND

The CH1840 attenuates the transmit signal by 9.5, dB (0dB for the D option applied to XMIT will comply with the FCC Part 68 requirement for data signals of -9dBm across Tip and Ring. In all cases in the data mode, the CH1840 prevents the signal level from being greater than -9dBm at Tip and Ring.
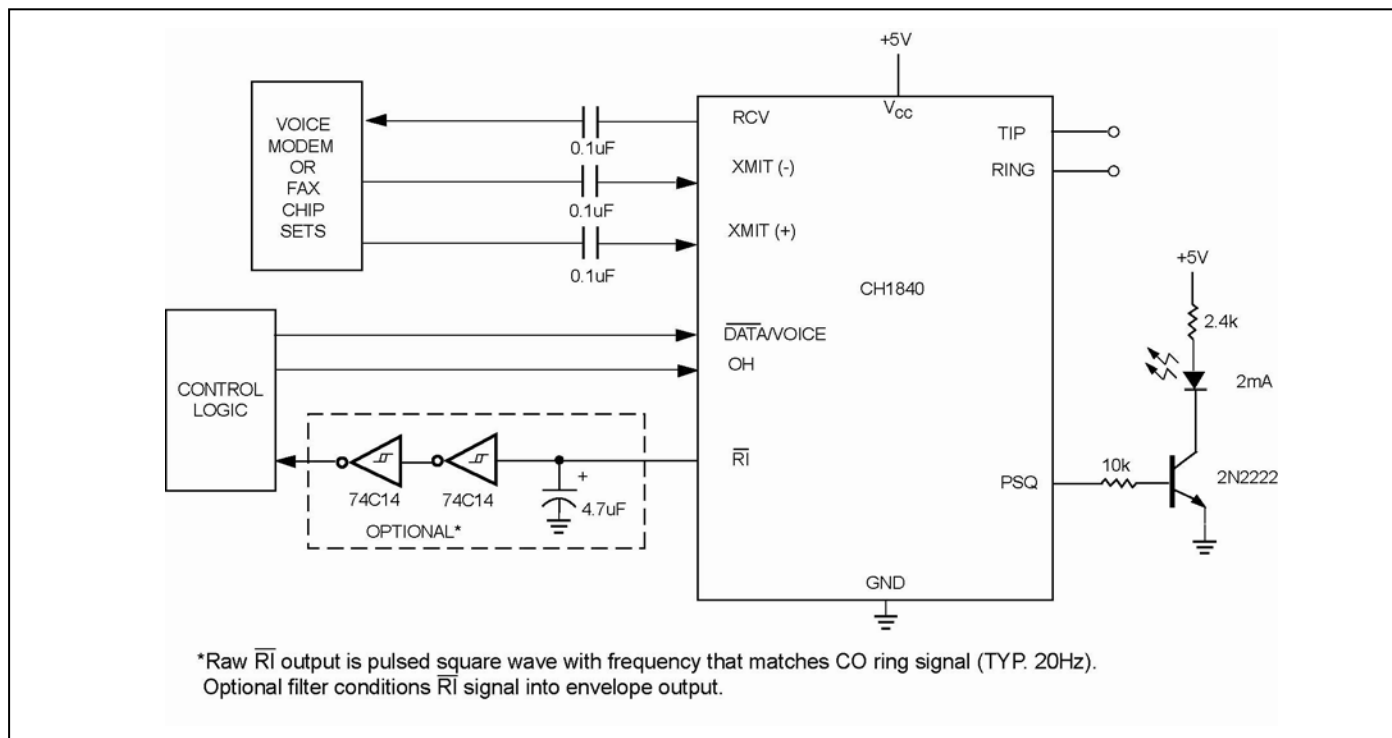

*Raw RI output is pulsed square wave with frequency that matches CO ring signal (TYP. 20Hz).
Optional filter conditions RI signal into envelope output.

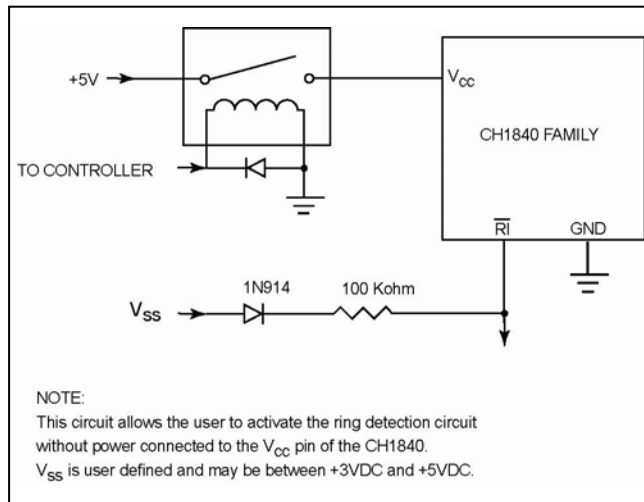**Figure 2.**   **Typical CH1840 Application.**

Figure 3. Low Power Ring Detection

For live voice or DTMF, when the CH1840 family products are in voice mode, the output can be 0 dBm. Hence, by applying a 0dBm signal to the CH1840D and a +9.5 dBm signal to the CH1840, it will achieve the maximum signal output.

CH1840 Family	Normal Insertion Loss
CH1840	-9.5 dB
CH1840D	0 dB

The D designation refers to differential input between the XMIT (+) and (-) pins. This is required and is a convenient input for certain types of modem ship sets.

RECEIVE SIGNAL

Receive Signal is presented at RCV with respect to GND and must be AC coupled to your receive input. The CH1840 does not add any gain to the receive signal. Receive signals can vary from a maximum strength of 9dBm to below –50 dBm for data mode and up to 0 dBm strength when DTMF and live voice are being received.

EXCESSIVE SIGNAL DETECT

FCC Part 68 rules limit the average power of data signals transmitted to the phone line. To meet this requirement, the CH1840 monitors the transmit audio signal at XMIT. If the signal level exceeds 0 dBm. The output PSQ is normally LOW. It is set HIGH when excessive Power is detected and returns LOW when the transmitted signal is unsquelched.

The squelch feature is defeated when Voice Mode is selected on the Data/Voice pin. The PSQ output always becomes inactive when the CH1840 is in Voice Mode. Note: When transmitting recorded or synthesized voice, the
signal must be treated as Data per FCC; thus Data Mode must be selected on the Data/Voice pin.

2-WIRE TO 4-WIRE CONVERTER

This block has two functions: (1) it applies the XMIT signal to the phone line, (2) it subtracts this signal from the total signal on the phone to produce the received signal. The accuracy of this subtraction process depends on how closely the impedance of the phone line matches 600 ohms. Generally, a small amount of the XMIT signal will appear at RCV. The ratio of the XMIT signal applied to the signal returned is called trans-hybrid rejection. The CH1840 has a high trans-hybrid loss, which is at least 18dB rejection from 300 Hz to 4 KHz bandwidth.

VOICE SIGNALS

Voice signals are much more complex in nature than data signals. A voice signal is comprised of numerous frequencies combined at varying intensities. Whereas a data signal is comprised of no more than a few discreet frequencies. This difference dictates that voice signals receive more attention before connecting to the telephone lines.

The FCC restricts voice and data signals to between 300 Hz and 3300Hz. This is because the Telephone Company uses frequencies below 300 Hz for low-speed tele type and frequencies above 3300 Hz for internal signaling and multiplexing.

Data signals easily meet the FCC requirements without additional filtering. However, bandpass filters are essential for voice communication.

A bandpass filter is utilized on the transmit line. This filter ensures that the signal meets FCC requirements. It also shapes the signal to minimize the phone line distortion.

Table 1.Pin descriptions

Pin	Name	I/O	Function
1	TIP	I/O	**TIP**. Direct connection to the telephone line through a standard jack.
2	RING	I/O	**RING**. Direct connection to the telephone line through a standard jack.
3	N/C	-	**Not Used**. Please leave unconnected
4	OFFHK	I	**OFF HOOK**, Input. When set LOW, the CH1840 is placed On-Hook. When set HIGH, the CH1840 is placed Off-Hook to answer or place a call. This input can also be used for pulse dialing.
5	RI	O	**RING INDICATION**, Output. RI is driven LOW during the typically 2 second ring period and HIGH during the typically 4 seconds between rings. RI is otherwise HIGH. NOTE: RI pulses square wave along with ring signal frequency. The square wave can be suppressed to produce an envelope of the AC ring with the application circuit shown in Figure 2.
6	D/V	I	**DATA/VOICE SELECT**, Input. When driven LOW or left unconnected, Data Mode is selected and the Billing Delay and Power Squelch are enabled. When driven HIGH, Voice Mode is selected and the Billing Delay and Power Squelch are disabled.
7	PSQ	O	**POWER SQUELCH**, Output. PSQ indicates the status of the signal limiting squelch circuit. When PSQ is HIGH, the transmit path is squelched. PSQ is also active when On-Hook and in Data Mode.
8	RCV	O	**RECEIVE**, Output. RCV is the audio signal received from the phone line. This output is symmetrical with respect to +2.5V. AC coupling is recommended for most designs.
9	XMIT(-)	I	Input must be used with pin 11 in differential mode only. When not used, please leave unconnected.
10	VCC	I	+5V Power Supply, Input.
11	XMIT(+)	I	**TRANSMIT**, Input. Analog signal input. Audio data and voice signals presented here will be monitored for excessive power, filtered through a bandpass, and applied to the phone line unless squelched. One input pin of two when used in differential mode with pin 9.
12	GND	I	**SIGNAL AND POWER COMMON GROUND**, Input.

SAMPLE APPLICATION
Figure 2 illustrates a typical application of the CH1840. When transmitting data the controller must assert the D/V pin low to provide the two second billing delay required by the FCC. When transmitting voice signals, the controller shoud drive the D/V̄ pin high. This disavles the billing delay, and power squelch

One of the requirements of an FCC approved DAA is that the signal transmitted to Tip and Ring does not exceed –9.0 dBm. The CH1840 incorporates an automatic squelch

CH1840-D: 0 dB XMIT ATTENUATION
The D option has 0.0 dB insertion loss (typical) with respect to a differential input between XMIT (-) and XMIT (+). This allows the maximum signal strength of –9dBm to be input while maintaining FCC compliance. To use the CH1840-D as single end input device, ground the XMIT (-) pin through a 0.1uF capacitor.

MOUNTING THE DAA
The DAA can be soldered directly to the host circuit card or installed in sockets. To avoid the problems of contamination, hand soldering is preferred to wave soldering. When hand cleaning use only deionized water; when wave soldering use washless flux.

DESIGN CONSIDERATIONS
The CH1840 DAA includes circuits that couple the modem signals to the phone line and provides FCC required isolation and protection. The FCC registration process by the host product can be minimized provided that the following guidelines are followed.

1. The mounting of the DAA 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. Connection to the phone line should be made through a standard FCC approved RJ-11C jack or equivalent.

3. Circuit board traces from the DAA's TIP and RING pins must exceed 0.1 inch spacing from all other traces or other conducting material. The purpose for this pacing is to maintain 1000 VAC isolation between the phone line and the other traces. Traces should have a nominal width of 0.020 inches or greater.

4. TIP and RING traces should be as short as possible and should be oriented to prevent direct or induced coupling with other signals on the host circuit card.

5. The DAA Module is a sensitive subsystem that should be treated as any other integrated component. Pay special attention to the power supply to the DAA. The device handles signals in the millivolt range. Even though it is designed to handle noise in the power supply, steps should be taken to assure the noise level does not exceed 50mV peak-peak.

6. For data calls, Part 68 rules require silence on the phone line for at least 2 seconds after a data call has been completed to allow central offices to exchange billing information and specifies the transmit level must not exceed -9dBm. The FCC rules also require that for voice calls the final system meet the requirements of Part 68 for Out-of Band Energy, and DTMF Transmit Levels. Because the CH1840 already meets FCC requirements for Part 68 registration for High Voltage isolation and Surge Protection, the certification of the product is normally a simple process that often can be completed directly with the FCC. If desired, independent testing labs are available that can test the system and submit the required paperwork to the FCC for approval. Cermetek can assist with the registration.

MOUNTING THE CH1840
The CH1840 can be soldered directly to the host circuit card or installed in sockets. Direct soldering provides the most sound connection. To avoid the problems of flux contamination, hand soldering is preferred to wave soldering. Many socket manufacturers offer socket strips that accept the 0.025 inch square pins on 0.10 inch centers. When using sockets mechanical restraint of the CH1840 should be provided to keep it seated during shipment. Plastic cable wraps are secure yet easily removed.

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

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

If the DAA module is wave soldered on a circuit card, please use washless flux or hand solder. This part is not hermetically sealed. Water or chemical intrusion into the case can cause malfunction and void the warranty.

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 RENs 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 telco. Typically this will be RJ-11C/W for single lines.

*The *-flagged items above are noted on the equipments 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 cases 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's manual.

6) Special FCC rules apply to equipment connected behind PBX or KTS.

7) Changes in Attestation Procedure for Plugs and Jacks; (Name of Applicant) attests that the network interface plugs or jacks used on this equipment comply with and will continue to comply with the mechanical requirements specified in Part 68. Subpart F. Specifically the dimensions, tolerances and metallic plating requirements. The compliance of these connectors will be assured by purchase specifications and incoming inspections. Documentation of such specifications and/or inspections will be provided the FCC within 30 days of their request for same.
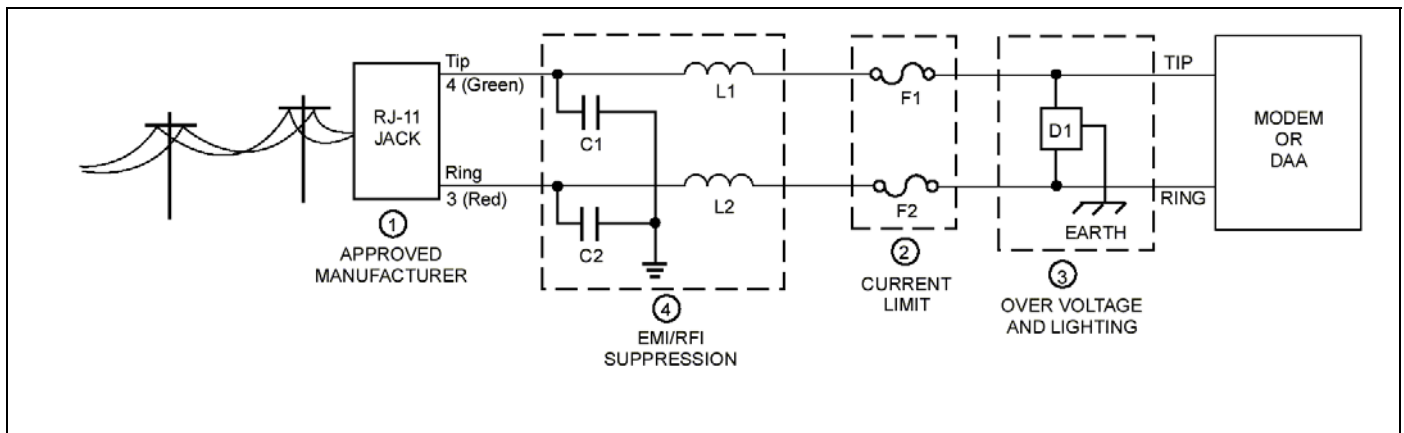
Figure 4   Telephone Line Interface.

1. RJ-11 Jacks must be provided by one of the vendors on the list. Refer to Application Note #130, Summary of Recommended Suppliers.

2. **Current Line Device: F1 and F2 – 1.25amp.**
   A. UL 1459 must use a current limit device. A Poly Fuse is recommended as this device resets automatically after each power surge.

   B. Resistors (10ohm carbon film or SMD 1/8W minimum) may be used for non UL applications.

3. **Over Voltage and Lightning Protection.**
   A. DOC (Canada) may require external current limiting devices. Use 1ohm resistors (carbon film or SMD parts 1/8W minimum) in each lead (TIP and RING). You may substitute fuses or the Poly Fuse described in Section 2.

   B. For lightning prone areas where there are more than 2 storms per year, provide an earth ground connection and use a three terminal sidactor or similar device that provides metallic and longitudinal protection. This must also include the current protection in Section 2.

4. **EMI/RFI Suppression.**
   The capacitor/ inductor network should be located as close to the RJ-11 Jack as possible with an excellent ground path to the chassis. Capacitors C1 and C2 should not exceed $0.005\mu F$. They must have a rating of 1.5KV and typically have a value of $0.001\mu F \pm 20\%$. Inductors L1 and L2 are ferrite cylinders and provide attenuation to high frequencies from system level components external to the CH1840. The required values must be empirically determined for each product design

Table 2.   CH1840 DAA Electrical Specifications.
T_A=0°C to 55°C unless otherwise specified
Extended Temperature (ET) versions available for T_A=-40°C to +85°C

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Logic						
Input HIGH	V_{IH}		2.4			V
Input LOW	V_{IL}				0.4	V
Input Leakage HIGH	I_{IH}				500	μA
Input Leakage LOW	I_{IL}				-500	μA
Output HIGH	V_{OH}	IOH=0.2mA	3.0			V
Output LOW	V_{OL}	IOL=2.0mA			0.4	V
Telephone Line Interface AC Impedance	Z_{LINE}			600		Ohms
Isolation Protection		Conforms to FCC Part 68 hazardous voltage and leakage	1K			V_{RMS}
Surge Protection		Conforms to FCC Part 68 for surge	800			V_{Peak}
Transmit Level	V_{TRX}	Measured at XMIT, 1800Hz				
		CH1840			0.774	V_{RMS}
		(Voice Mode) CH1840D			0.251	V_{RMS}
Transmission Insertion Loss	G_{TRX}	1800Hz, 600 Ohms, 35mA loop current				
		CH1840	9.5	10	10.5	dB
		(Voice Mode) CH1840D	-9.5	0.0	0.5	dB
Receive Insertion Gain	G_{RCV}	1800Hz, 600 Ohms, 35mA loop current	-0.5	0	+0.5	dB
Trans-Hybrid Loss	G_{TH}	600 Ohms+3& between TIP & RING 600HZ to 4000Hz	18	23		dB
On-Hook Impedance	Z_{ONHK}	OFFHK = 0 volts	10	20		Mohm
Loop Current	ILOOP	OFFHK = 5 volts	20		80	mA
Receive Output Impedance	ZRNC	Measured at RCV			50	Ohms
Transmit Input Impedance	Z_{TRX}	Measured at XMIT @ 1800Hz	50	100		kOhm
FCC Registration Number		Supplied on unit label				
Ringer Equivalence	REN	Supplied on unit label		0.2A		REN
TIMERS						
Ring Detection Delay	T_{RGD}	Ringing at 40Hz, 45 V_{RMS}		200	360	ms
Billing Delay Timer	T_{BD}		20	2.5	30	sec
Hook Switch		Drive capable of sourcing current	1			mA
Power Supply Current		V_{CC}=+5VDC±5%, Off-Hook		6	10	mA
		V_{CC}=+5VDC±5%, On-Hook		3	6	mA

Model Numbers

Cermetek offers several variants of the CH1840. Table 5 below lists the available CH1840 models.

Table 3: CH1724 Model Numbers

| Model	Summary of Features
CH1840	FCC Registered DAA; 9.5 dB Transmit Insertion Loss; Operating Temperature 0°C to 70°C
CH1840D	FCC Registered DAA; 0 dB Transmit Insertion Loss; Operating Temperature 0°C to 70°C
CH1840R	FCC Registered DAA; 9.5 dB Transmit Insertion Loss; Operating Temperature 0°C to 70°C; RoHS Compliant
CH1840RD	FCC Registered DAA; 0 dB Transmit Insertion Loss; Operating Temperature 0°C to 70°C; RoHS Compliant
CH1840 ET	FCC Registered DAA; 9.5 dB Transmit Insertion Loss; Operating Temperature -40°C to 85°C
CH1840B ET	FCC Registered DAA; 9.5 dB Transmit Insertion Loss; Operating Temperature -40°C to 85°C; Customer Specific Modification to Calibrate Receive Output Level
CH1840D ET	FCC Registered DAA; 0 dB Transmit Insertion Loss; Operating Temperature -40°C to 85°C
CH1840R ET	FCC Registered DAA; 9.5 dB Transmit Insertion Loss; Operating Temperature -40°C to 85°C; RoHS Compliant
CH1840RD ET	FCC Registered DAA; 0 dB Transmit Insertion Loss; Operating Temperature -40°C to 85°C; RoHS Compliant
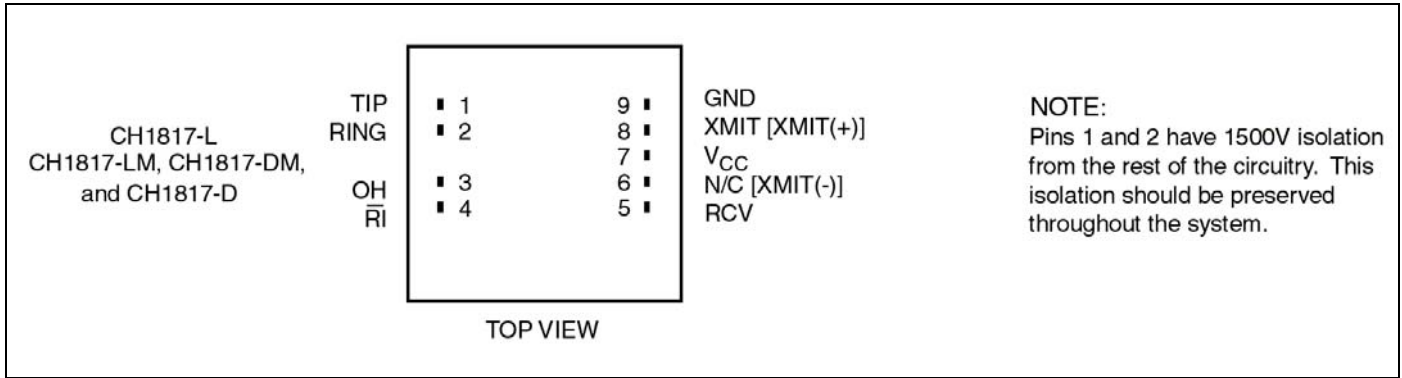
Figure 6.   Pin Connections.
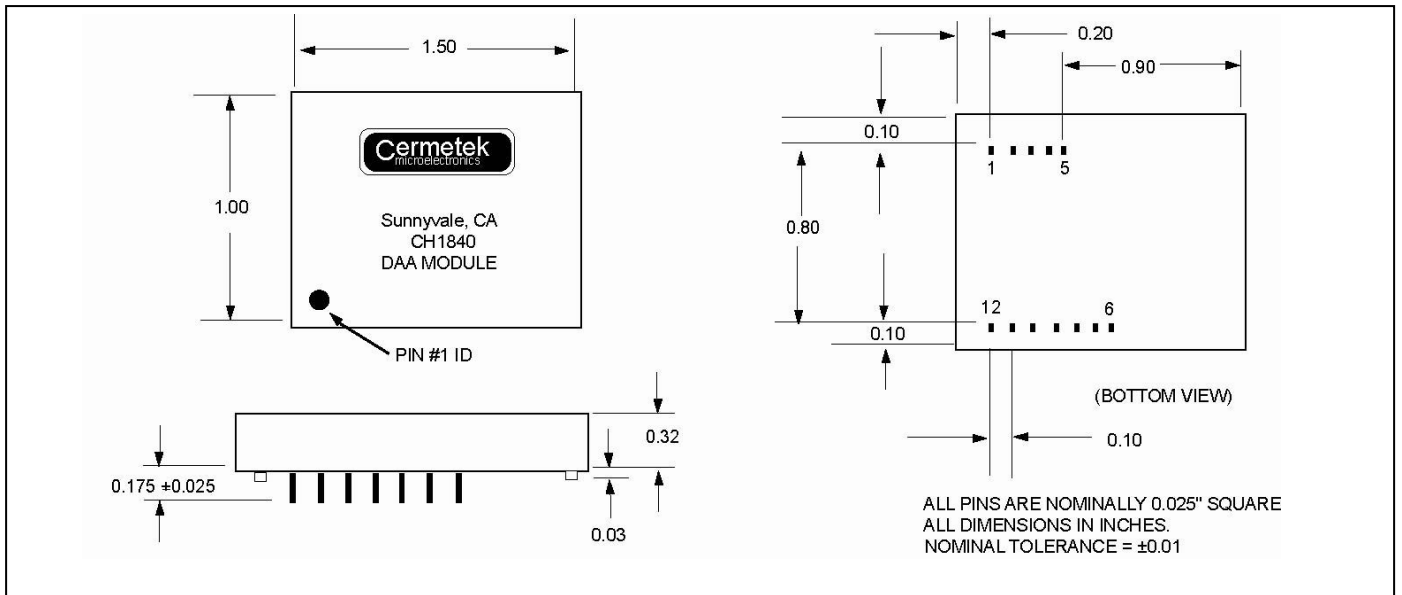
Figure 7.   Mechanical Specifications.

Cermetek reserves the right to make changes in specifications at any time and without notice. The information furnished by Cermetek in this publication is believed to be accurate and reliable. However, Cermetek assumes no responsibility for its use, or for any infringements of patents or other rights of third parties resulting from its use. No license is granted under any patents or patent rights of Cermetek.

Cermetek provides the user with a FCC (USA) and IC (Canada) Approved or device. However, Cermetek does not have influence over nor knowledge of the specific user application environment. Therefore, for FCC and IC Approved or Approvable devices, the user assumes all risk for maintaining compliance to registration.

Printed in U.S.A