CH1840
FCC Registered Data Access Arrangement (DAA) Module

INTRODUCTION

The CH1840 is an ultra small, low profile Data Access Arrangement (DAA). Designed for both voice and data, the CH1840 allows direct connection of your product to telephone lines. The CH1840 includes FCC Part 68 registration that is transferrable to your product. The transferrable registration eliminates the costs and delays of Part 68 testing and registration of your equipment. The FCC registration, modular construction, and single +5 Volt D.C. power requirement simplify your product development.

The CH1840 also meets Industry Canada (IC) requirements. However, you must register your product with Industry Canada before it can be used there.

The small size of the CH1840 maximizes design flexibility. CH1840 requires only 1.5 square inches of circuit board space and stands just 0.35 inches high. It can be mounted directly on your printed circuit board or socketed. The CH1840 uses 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 DAA works with a variety of voice circuits and with fax and modem chip sets up through V.32bis (19,200 bps). The CH1840 is pin compatible with the Cermetek CH1837A.

Control inputs and status outputs for the CH1840 are compatible with 5 Volt CMOS. See the Electrical Specifications on Page 8.

FEATURES

- Compatible with modem chip sets and discrete analog circuits
- Available varieties provide a range of insertion losses; CH1840D 0dB, CH1840DM -6.5dB and CH1840 –9dB.
- Available for extended temperature operation, -40C to +85C (CH1840 ET)
- Available RoHS compliant versions
- Complete DAA function
- For Voice and Data Applications
- FCC Part 68 Registration Conveyed to User
- Hook Switch Control.
- Ring Detection.
- Single +5V Operation.
- Pulse Dial Capability.

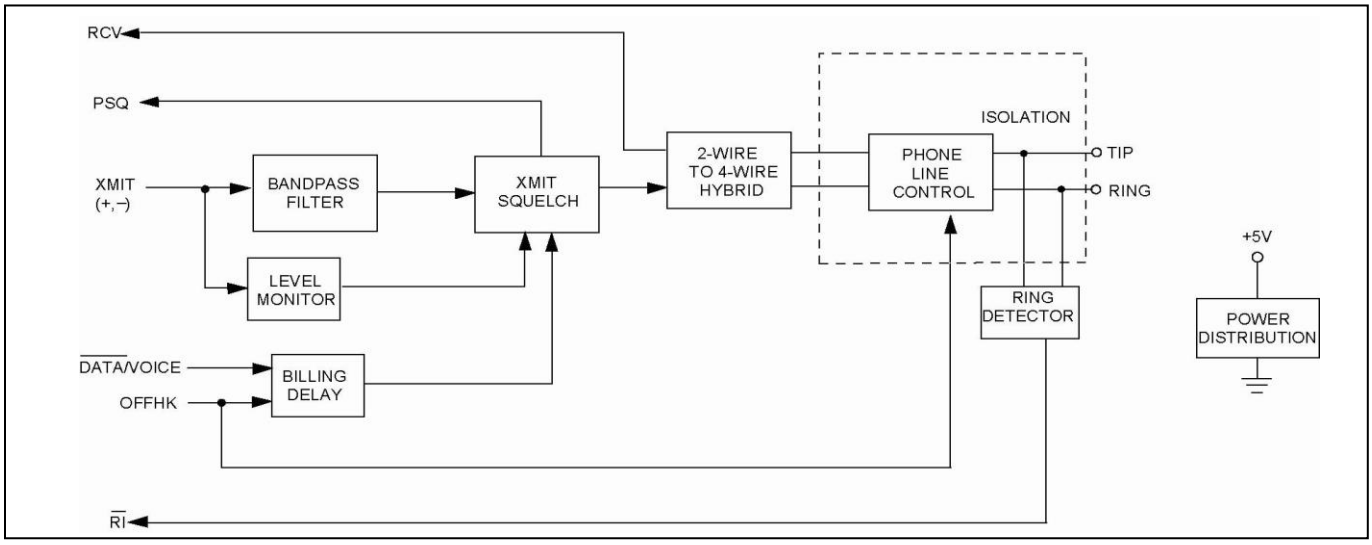

Figure 1: CH1840 DAA Functional Block Diagram

FUNCTIONAL DESCRIPTION

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

- Phone Line Control
- Billing Delay
- Ring Detector
- Level Monitor and XMIT Squelch
- 2-Wire to 4-Wire Hybrid
- Bandpass Filter

PHONE LINE CONTROL

In the Public Switched Telephone Network (PSTN), the wires from a telephone to the telephone central office (CO) are referred to as the local loop. The "Hook Switch" at the heart of the Phone Line Control circuitry makes the electrical connection between the CH1840 and the local loop. The OFFHK input to the CH1840 controls the Hook Switch. A HIGH on OFFHK connects the CH1840 to the local loop; a LOW on OFFHK opens the Hook Switch disconnecting the circuit from the local loop, "hanging up the phone." Pulse dialing can be executed by toggling OFFHK at the appropriate rate.

BILLING DELAY

FCC Part 68 rules require data calls to maintain 2 seconds of silence on the phone line after completion of a call. This pause allows the central offices to exchange billing information. The CH1840 assures conformance to this Billing Delay by employing a two-second timer on a LOW to HIGH transition of OFFHK and blocking transmitted signals until the timer expires. The CH1840 defeats this function when Voice Mode is selected on the Data/Voice (D/V) pin.

RING DETECTOR

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. The CH1840 presents a square wave on RI at the ring signal frequency while the ring signal is active, typically 2 seconds. RI then returns HIGH between rings, typically 4 seconds. The ring detection circuit prevents false indications due to noise or dialing pulses on the line.

The CH1840 RI output is diode protected. Installation of an external pull-up resister greater than 100 KOhms allows activation of the ring detection circuit when no power is applied to the CH1840. This circuit virtually eliminates current draw with no ring signal present, saving power without missing a call See Figure 2.

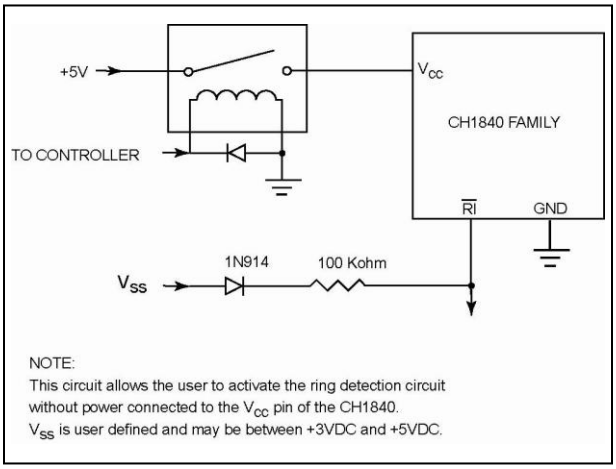

Figure 2: Low Power Ring Detection

LEVEL MONITOR AND XMIT SQUELCH

The outgoing analog signal to be transmitted through the phone line should be applied to the XMIT(+) pin (with respect to GND) or between the XMIT(+) and XMIT(-) on the CH1840D or CH1840DM.

FCC Part 68 rules limit the signal power placed on the telephone line. When transferring data, the signal can be no greater than -9 dBm across Tip and Ring. The CH1840 squelches any data signal greater than -9 dBm to prevent a violation. The CH1840 monitors the transmitted data signal at XMIT. If the signal level would cause a violation of FCC rules, the CH1840 sets the normally LOW PSQ output HIGH and squelches the transmit signal. PSQ returns to a LOW when the transmit signal level drops below the FCC threshold.

The squelch feature is disabled when Voice Mode is selected by setting the Data/Voice pin (D/V) HIGH. PSQ remains 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, D/V LOW, must be selected on the Data/Voice pin.

CH1840 Model	Normal Insertion Loss
CH1840	-9.5 dB
CH1840DM	-6.5 dB
CH1840D	0 dB

Table 1: Insertion Loss by Model

Use Table 1 to select the CH1840 version with the correct signal attenuation for your equipment's output signal level.

2-WIRE TO 4-WIRE HYBIRD

This block has two functions: (1) it applies the XMIT signal to the phone line, and (2) it subtracts this signal from the total combined signal on the line to reveal the received signal.

The signal received off of the telephone line is presented at RCV with respect to GND. This signal must be AC coupled to you system's receive input. The received signal typically has a very low amplitude. The CH1840 does not amplify the receive signal. Receive signals can be as low as –50 dBm.

To extract a usable received signal the 2-wire to 4-wire hybrid subtracts the outgoing transmit signal from combined signal on the telephone line. The accuracy of this subtraction process depends on how precisely the impedance of the phone line matches 600 ohms. A small remnant of the XMIT signal will appear on RCV. Trans-hybrid loss shows the level of the transmit signal remnant relative to the original transmit signal. The CH1840 typically provides a high trans-hybrid loss of at least 18 dB from 300 Hz to 4 KHz bandwidth.

Bandpass Filter

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 2: Pin Descriptions

Pin	Name	I/O	Function
1	TIP	I/O	**TIP**: One half (together with RING) of the direct connection to the telephone line through a standard jack.
2	RING	I/O	**RING**: One half (together with TIP) of the 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 toggled to pulse the hook-switch relay for pulse dialing.
5	RI	O	**RING INDICATION**, Output: RI is driven LOW during the typically 2 second ring period and returns 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 3.
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.
9	XMIT(-)	I	**TRANSMIT**, Analog Signal Input: Used with pin 11 only in differential input mode for the applied audio or data signals. When differential input mode is not used, please leave unconnected.
10	VCC	I	+5V Power Supply, Input
11	XMIT(+)	I	**TRANSMIT**, 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. Used with XMIT(-), Pin 9, in differential mode.
12	GND	I	**SIGNAL AND POWER COMMON GROUND**, Input

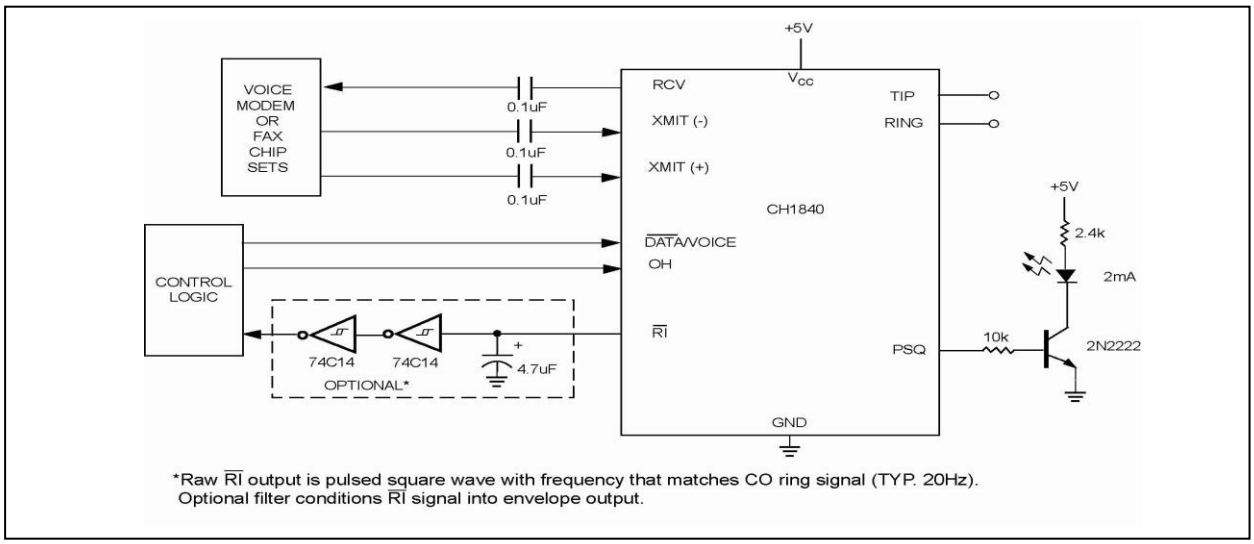

Figure 3: Typical CH1840 Application.

SAMPLE APPLICATION

Figure 3 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 should drive the D/V pin HIGH. This disables the billing delay, and transmit signal squelch.

FCC rules require an approved DAA to limit the data signal at Tip and Ring to no more than -9.0 dBm. The CH1840 employs the Transmit Squelch feature to insure compliance with this rule.

CH1840: -9 dB XMIT ATTENUATION

The CH1840 has -9 dB insertion loss with respect to the input at XMIT(+). This allows the maximum input signal strength of 0 dBm while maintaining FCC compliance. Ground the XMIT(-) pin through a 0.1uF capacitor when connecting the CH1840.

CH1840D: 0 dB XMIT ATTENUATION

The CH1840D has 0.0 dB insertion loss with respect to a differential input between XMIT(-) and XMIT(+). This allows the maximum input signal strength of –9dBm while maintaining FCC compliance. To use the CH1840D as single end *in*put device, ground the XMIT(-) pin through a 0.1uF capacitor.

CH1840DM: -6.5 dB XMIT ATTENUATION

The CH1840DM has 6.5 dB insertion loss with respect to a differential input between XMIT(-) and XMIT(+). This allows the maximum signal strength of –2.5dBm to be input while maintaining FCC compliance. To use the CH1840DM 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 a socket. To avoid contamination problems hand soldering is recommended. When hand-cleaning, use only deionized water; when wave soldering, use a no-wash flux.

DESIGN CONSIDERATIONS

The CH1840 couples modem signals to the phone line and provides isolation and protection. To utilize the CH1840 transferrable FCC registration for the host product, your design must follow the guidelines below.

1. Mount the DAA module on the circuit board so that it is isolated from any hazardous voltages within the assembly through adequate trace separation and restraint of cables and cords.

2. Use an FCC approved RJ-11C jack for the telephone line connection.

3. Circuit board traces from the CH1840 TIP and RING pins to the RJ-11C jack must be more than 0.1 inch from all other traces or conducting materials. This spacing insures maintenance of 1000 VAC isolation between the phone line and all other traces. Traces should have a nominal width of 0.020 inches or greater.

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

5. The CH1840 should be treated as a sensitive integrated component. Pay special attention to the power supply. The CH1840 handles signals in the millivolt range. Even though it is designed to handle some power supply noise, the noise level should not exceed 50mV peak-peak.

6. Part 68 rules require a minimum of 2 seconds of silence on the phone line after a data call has been completed. This quiet period allows the central offices to exchange billing information. FCC rules also specify a transmit level no greater than -9dBm. The FCC rules also regulate Out-of-Band Energy, and DTMF Transmit Levels. The CH1840 already meets FCC requirements for Part 68 registration for High Voltage isolation and Surge Protection.

MOUNTING THE CH1840

The CH1840 can be soldered directly to the host circuit card or installed in sockets. Direct soldering provides the most reliable connection. To avoid flux contamination, hand soldering is recommended. This part is not hermetically sealed; water or chemical intrusion into the case can cause malfunction and void the warranty.

Many socket manufacturers offer socket strips that accept the 0.025 inch square pins on 0.10 inch centers used by the CH1840. When using sockets mechanical restraint of the CH1840 should be provided to maintain seating during shipment. Plastic cable wraps are secure yet easily removed.

The CH1840 module contains static sensitive devices and should be handled by personnel and in areas that are properly protected against static discharge.

FCC REGISTRATION INFORMATION

- FCC Registration Number: B46-USA-68641-DP-E
- Ringer Equivalence (REN): 0.2A

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 the CH1840:

FCC NOTICE TO THE USERS

These paragraphs below must be included on the Equipment's external label

1) UPON REQUEST ONLY, you must provide the following data to your telephone service provider (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). 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.

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) If telephone line problems occur, remove the modular plug from the telco jack to disconnect your unit. If other equipment on the line works after disconnecting your product, your product has a problem and must remain disconnected until repaired. If telephone line problems persist after your equipment is disconnected, there may be a telephone system problem. Notify your Telco to request service of your line.

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.*

1) *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.*

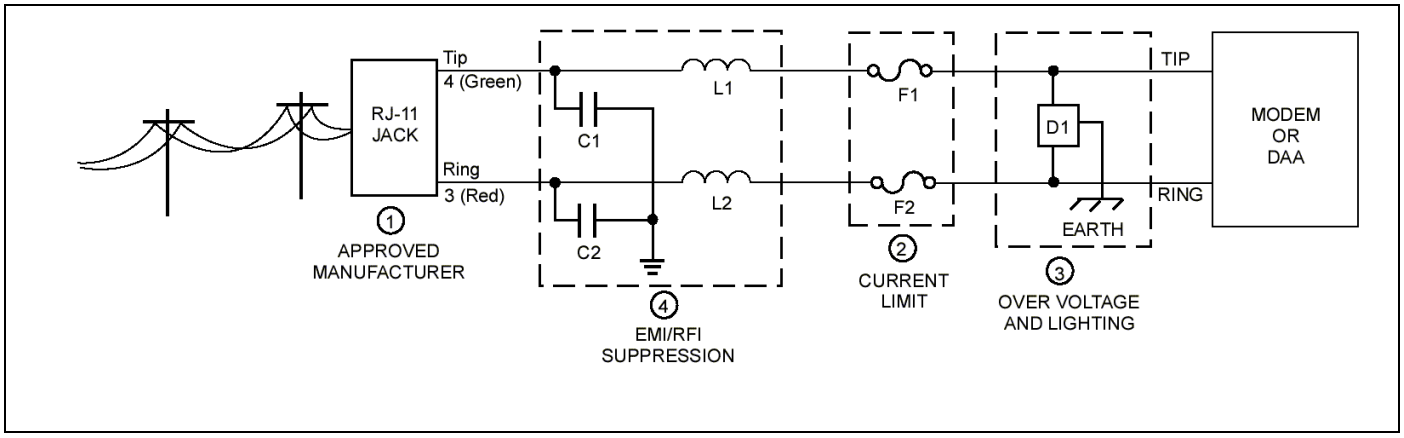

Figure 4: Telephone Line Interface.

1. RJ-11 Jacks

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 60950 must use a current limit device. A Poly Fuse is recommended as this device resets automatically after each power surge.

B. Resistors (10 ohm 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 1 ohm 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 provide an earth ground connection and use a three-terminal Sidactor or similar device to provide metallic and longitudinal protection. This must also include the current protection in Section 2.

4. **EMI/RFI Suppression.**

A 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 0.005μF. They must have a rating of 1.5KV and typically have a value of 0.001μF ± 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 3: 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
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				
		(Data Mode)			0.774	V_{RMS}
		(Voice Mode)			0.251	V_{RMS}
Transmit Insertion Loss	G_{TRX}	1800Hz, 600 Ohms, 35mA loop current				
		CH1840	9.5	10	10.5	dB
		CH1840D (Voice Mode)	-0.5	0.0	0.5	dB
		CH1840DM (Voice Mode)	6.0	6.5	7.0	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
RCV Output Impedance	ZRNC	Measured at RCV			50	Ohms
XMIT 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
Ring Detection Delay	T_{RGD}	Ringing at 40Hz, 45 V_{RMS}		200	360	msec
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 4 below lists the available CH1840 models.

Table 4: CH1840 Model Numbers

Model	Summary of Features
CH1840	FCC Registered DAA; 9.5 dB Transmit Insertion Loss; Operating Temperature 0°C to 70°C
CH1840 ET	FCC Registered DAA; 9.5 dB Transmit Insertion Loss; Operating Temperature -40°C to 85°C
CH1840R	FCC Registered DAA; 9.5 dB Transmit Insertion Loss; Operating Temperature 0°C to 70°C; RoHS Compliant
CH1840R ET	FCC Registered DAA; 9.5 dB Transmit Insertion Loss; Operating Temperature -40°C to 85°C; RoHS Compliant
CH1840D	FCC Registered DAA; 0 dB Transmit Insertion Loss; Operating Temperature 0°C to 70°C
CH1840D ET	FCC Registered DAA; 0 dB Transmit Insertion Loss; Operating Temperature -40°C to 85°C
CH1840RD	FCC Registered DAA; 0 dB Transmit Insertion Loss; Operating Temperature 0°C to 70°C; RoHS Compliant
CH1840RD ET	FCC Registered DAA; 0 dB Transmit Insertion Loss; Operating Temperature -40°C to 85°C; RoHS Compliant
CH184DM	FCC Registered DAA; 6.5 dB Transmit Insertion Loss; Operating Temperature 0°C to 70°C
CH184DM ET	FCC Registered DAA; 6.5 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

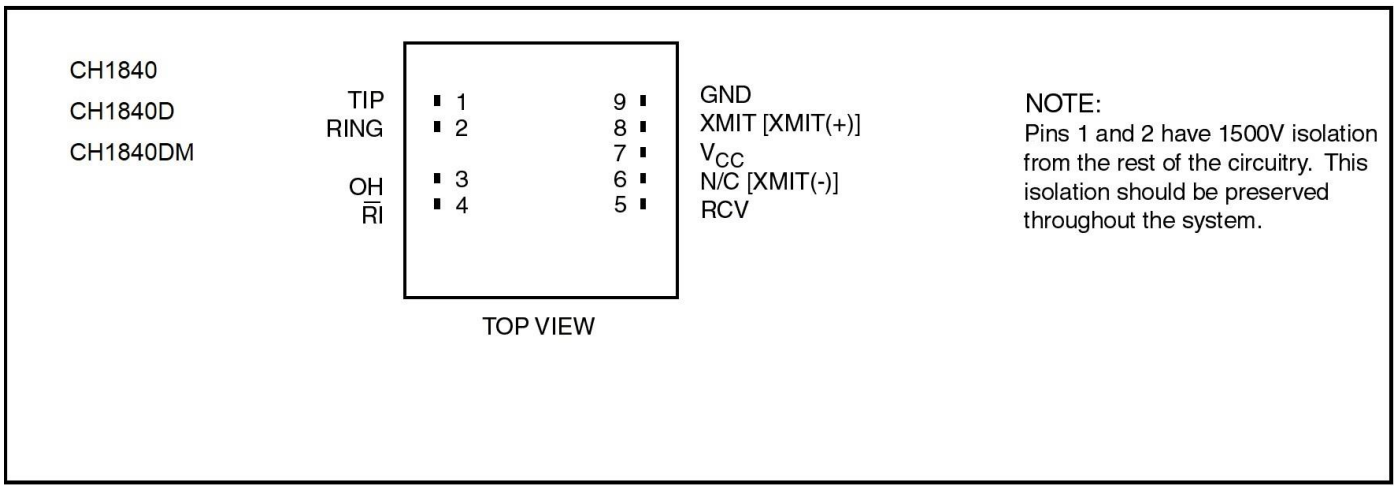

Figure 6: Pin Connections.

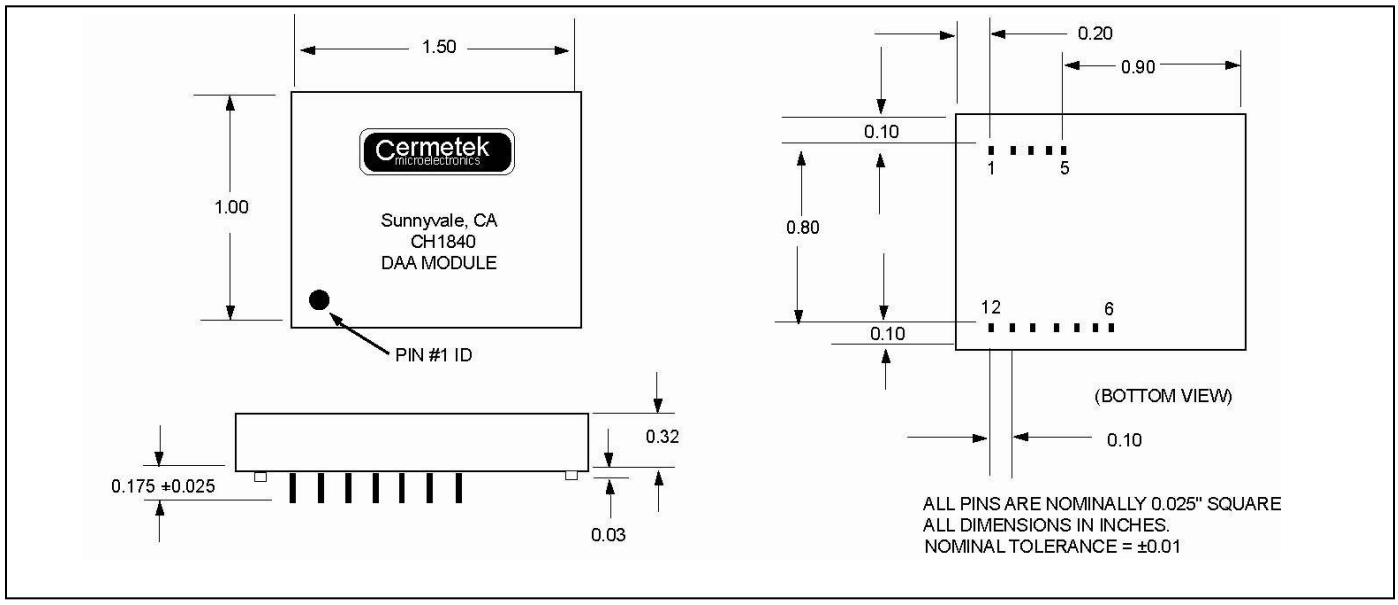

Figure 7: Mechanical Specifications

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