CH1837/8
Data Access Arrangement Modules
V.34bis Family of High Speed DAA Modules

INTRODUCTION
The Cermetek CH1837/8 Family of Data Access Arrangement (DAAs) products are designed to meet the performance requirements of 33.6Kbps modems, such as V.34bis, for embedded applications. CH1837/8 meets or exceeds the requirements for V.34 and can be used in lower speed applications as well. The isolation voltage and surge protection meets, as a minimum, the UL 1459 requirements. Further, the CH1837/8 has been tested to meet FCC Part 68 and is Canadian DOT CSA CS-03 Part I approvable.

The CH1837/8 is compatible with all popular V.34bis modem/fax chip sets. Application examples are included in this datasheet. The CH1837/8 family offers a Quick-to-Market DAA solution for high performance modem designs.

FEATURES
- Low Profile
- Complete DAA function
- Compatible with most popular V.34bis modem chip sets
- Ring detection circuitry included
- Built-in 2-wire to 4-wire conversion circuitry
- All CH1837/8 Products UL 1459 Compliant
- 1000 VAC RMS Isolation
- 1500V peak surge protection
- +5V low power operation
- Caller ID (CH1837C/ CH1838C)
- Compatible with V.34bis, V.32bis, V.32, V.22bis, and V.22
- FCC Part 68 (USA) and DOT CSA CS-03 Part I (Canada) Approvable
- Extended Temperature Available.

DESCRIPTION OF FUNCTIONAL BLOCKS AND DISCUSSION OF BASIC OPERATIONS
Figure 1 contains a functional block drawing of the CH1837/8 family of DAA products. Each CH1837/8 product consists of:
1. Isolation barrier
2. Off-Hook Switch/Ring Detect
3. PSTN Line Surge and High Voltage Protection circuit

Additionally, the 2-to-4 Wire Conversion circuit is present in all CH1837 products.

Ring Detection. To announce an incoming call, the telephone company's central office (CO) applies an AC ringing signal to the PSTN line. The DAA is designed to detect this signal. The CH1837/8 sets the RI pin Low during the second ring period and restores it to High for the period between subsequent rings. While the AC ring signal is present on tip and ring, the RI output is pulsed at the same frequency as the incoming AC ringing signal, thereby creating a square wave output, typically at 20 Hz. Figure 2 shows additional filtering which may be employed to provide an envelope indication of the ring signal's presence. The ring detection circuit in the CH1837/8 family is designed to deter false indications caused by pulse dialing or noise on the PSTN line.

The RI output of the all CH1837/8 products is diode protected thereby allowing an external pull-up resistor (R>100k ohms) to +5V to be utilized to activate the ring detection circuit when the DAA is not connected to power. This can be handy for 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. Refer to Figure 5.

RI Output:	Opto coupler, 30KW pull-up Active low Square wave 15-68 Hz (Tip. 20Hz)
Sensitivity:	38 Vrms across Tip & Ring

Hook Switch Control. The OFFHK input is used to toggle the CH1837/8 DAA from Off-Hook to On-Hook and back to Off-Hook.

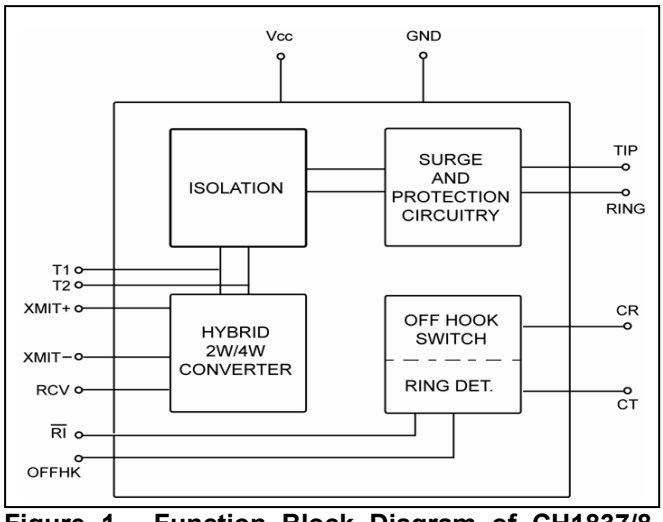

Figure 1. Function Block Diagram of CH1837/8 DAA Family.

When the OFFHK input is low, the DAA is On-Hook. On-Hook indicates to the CO that the DAA is ready to receive calls. When OFFHK input is high, the DAA is Off-Hook. The Off-Hook state allows the CO supplied PSTN loop current to flow thereby indicating to the CO that the DAA is either answering a call or preparing to place a call.

OFFHK Input: Active High OFFHK Active Current: 5 mA

2-Wire to 4-Wire Hybrid Converter. This circuit block performs two functions:

1. It applies the XMIT signal to the PSTN line and
2. It subtracts the XMIT signal from the total signal present on the PSTN line thereby deriving the RCV signal.

The accuracy of the RCV signal derivation depends on how closely the impedance of the PSTN line matches an ideal 600 Ohms. Generally, a small amount of the XMIT signal will appear at RCV due to the non-ideal nature of the PSTN line impedance. The ratio of the applied XMIT signal to the received XMIT signal is called Trans-Hybrid Rejection, or Trans-Hybrid Loss.

PSTN Line Isolation and Surge/Peak Voltage Protection. The Public Switched Telephone Network (PSTN) line isolation barrier circuitry provides isolation and the required surge and high voltage protection. This circuitry effectively isolates the user's equipment from both the PSTN line and the CO. All CH1837/8 products are designed to meet both FCC Part 68 (USA) and DOT CSA CS-03 Part I (Canada) isolation and surge requirements. Among the more critical parameters, the PSTN isolation barrier will provide at least 1000VAC RMS isolation and 1500V peak surge protection.

TRANSMIT SIGNALS

All outgoing signals are presented to the XMIT(-) pin with respect to GND for single ended operation or between XMIT(-) and XMIT(+) for differential operation.

For single-ended operation, the outgoing analog signal is applied to the XMIT(-) pin with respect to GND. This signal must be AC coupled using a 0.1uF capacitor as shown in Figure 2. In single ended operation, the XMIT(+) pin must be connected to GND through a 0.1uF capacitor.

For differential operation, the outgoing analog signal is applied across pins XMIT(+) and XMIT(-). This signal must be AC coupled through a 0.1uF capacitor present on both the XMIT(-) and XMIT(+) pins as shown in Figure 2.

The CH1837/8 family of DAAs does not attenuate the transmit signal. Therefore, a transmit signal of –9 dBm applied to XMIT will comply with the FCC Part 68 requirement for data signals across Tip and Ring.

Attenuation	0.0 dB
Input impedance	150KΩ
Typical input signal	0dBm or 0.775 V_{rms} with the Signal referenced to GND and AC coupled

RECEIVE SIGNALS

The incoming analog signal appears across TIP and RING. The CH1837/8 derives the incoming signal and presents it at RCV with respect to GND. The user must AC couple RCV through a 0.1uF capacitor as indicated in Figure 2.

The CH1837/8 does not gain the receive signal. Receive signals can vary from a maximum strength of -9dBm to below -50dBm.

Attenuation	0.0 dB
Input impedance	150KΩ
Typical input signal	0dBm or 0.775 Vrms with the Signal referenced to GND and AC coupled

CH1838. The CH1838 products do not contain the 2-to-4 wire converter circuit. The CH1838 is intended for those applications where the 2-to-4 wire conversion is performed by the modem chip set.

Pins RCV and XMIT(+) are replaced by pins T1 (Pin 8) and T2 (Pin 5). T1 and T2 are connected directly to the internal isolation barrier circuitry. Figure 3 shows a typical application using a V.34 modem chip set with built-in 2-to-4 wire conversion. Use PSTN line interface as shown in Figure 5. Other application notes for specific chip sets are available from Cermetek.

CH1837C/CH1838C. The CH1837C and the CH1838C contain two additional pins. These pins are CR and CT. By connecting CR and CT through separate capacitors and switches/relays to TIP and RING (respectively), the Caller ID signal can be presented at RCV (See Figure 2).

UL RECOGNITION

To further protect the end product containing the CH1837/8 from field failure due to large transients present on poor quality lines and to maintain U.L. recognition, an additional level of transient protection is required. Refer to Figure 5 for mandatory additional protection circuitry.

DESIGN CONSIDERATIONS

The CH1837/8 DAA includes circuitry that couple the modem signals to the PSTN line and provide the FCC required voltage isolation and surge protection. Cermetek offers the following end product design guidelines as suggestions only. These guidelines are intended to facilitate the usage of Cermetek DAA modules and to assist the user with FCC certification of their end product.

1. Mount the DAA in the final assembly 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. Connect to the PSTN line through a standard FCC approved RJ-11C jack or equivalent. For RJ-11, use the two center pins.

3. All PCB traces from the CH1837/8 TIP, RING, CR, and CT pins must be at least 0.1 inch spacing from all other traces or other conducting material. The purpose for this spacing is to maintain 1500 VAC isolation between the incoming PSTN line and the other traces. PSTN related PCB Traces should have a width of 0.020 inches or greater.

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

5. The CH1837/8 processes signals in the millivolt range. Even though the CH1837/8 is designed to handle noise in the power supply, steps should be taken to assure that the noise level does not exceed 50 mV peak-to-peak. Particular attention should be paid to both the power supply and the ground line PCB traces.

6. For data calls, FCC Part 68 rules require silence on the PSTN line for at least 2 seconds after a data call has been completed to allow central offices to exchange billing information. Further, Part 68 specifies that the transmit level must not exceed -9dBm.

7. For voice calls, the FCC rules require that the end product must meet the requirements of Part 68 for Out-of-Band Energy, and DTMF Transmit Levels.

HANDLING AND ASSEMBLY RECOMMENDATIONS

The CH1837/8 DAA Module contains static-sensitive components and should only be handled by personnel and in areas that are properly protected against static discharge. Industry standard ESD and EOS procedures and precautions should be observed when handling CH1837/8 products.

MOUNTING THE DAA

There are two mounting techniques that are recommended for physically connecting the CH1837/8 DAA to a PCB:

1. Direct soldering.
2. Sockets.

Direct Soldering. The CH1837/8 DAA products may be wave soldered onto a circuit card. All CH1837/8 products are hermetically sealed and will not be harmed by industry standard wave soldering processes.

To avoid the problems of flux contamination, hand soldering is preferred to wave soldering. When cleaning, use only deionized water.

Socketing. The socketing approach to mounting eliminates cleaning and desoldering concerns. When the socket is used, it must make a solid connection to all pins. Failure to do so will cause unreliable or intermittent operation.

When using sockets, steps should be taken to assure that the DAA module remains tightly seated in the socket after the end product is shipped. It is recommended that some type of mechanical restraint be provided to keep the CH1837/8 seated to avoid any possibility that the CH1837/8 works loose due to exposure to vibration and/or shock during shipment.

Recommended sockets are AMP series 535541 or 87334; Berg series 76308; 65780, 66954; or Robinson Nugent series SB5, or any 0.025” square strip socket.

FCC (USA) AND DOT (CANADA) REGISTRATION

FCC Part 68 or DOT CS-03 registration of the end product containing the CH1837A/8A DAA is normally quite simple. The process involves testing the end system for compliance and submitting the test data to the FCC or DOT for review.

Typically, independent approved testing labs are contracted to perform the required tests on the end product and to submit the required paperwork to the FCC or DOT. If desired, Cermetek can assist with the Registration activity. See Application Note # 130, Summary of Recommended Suppliers. The user is assigned the registration and assumes all risk for registration compliance.

Table 1. CH1837/8 Pin Descriptions.

Pin #	I/O	CH1837 7/C	CH1838/8C	Function
1	I/O	TIP	TIP	Direct PSTN line connection.
2	I/O	RING	RING	Direct PSTN line connection.
3	I	OFFHK	OFFHK	Used to toggle CH1837/8 product between On-Hook and Off-Hook. When set LOW, CH1837/8 is placed On-Hook. When set HIGH, CH1837/8 is placed Off-Hook to answer or place a call. See Note 1.
4	O	RI	RI	Indicates the presence of a ring signal between TIP and RING pins. RI output is a square wave coincident with the incoming AC ring signal. The RI square wave output can be conditioned to produce an envelope of the incoming AC ring signal by using the circuit in Figure 2.
5	O	RCV	----	Audio output signal with respect to GND. AC couple RCV through 0.1uF capacitor to eliminate any DC offset. CH1837 products only.
5	I/O	-----	T1	Direct connection to isolation barrier. CH1838 products only.
6	I	XMIT(-)	N/C	Audio input signal for CH1837 products when used in differential mode only. Connect to GND through 0.1uF capacitor when CH1837Xused in single ended input via Pin 8. No Connect for CH1838X products.
7	I	V_{CC}	V_{CC}	+5V±5%.
8	I	XMIT(+)	----	Audio input signal. AC couple through 0.1uF capacitor. For CH1837X products, can be used in differential mode with XMIT(-) or in single ended mode with respect to GND. For CH1838, operation in single ended mode only with respect to GND.
8	I	----	T2	Direct connection to isolation barrier. CH1838 product only.
9	I	GND	GND	Ground.
10	I	CR	CR	Caller ID connection to RING input pin. CR should be connected through a switch/relay and a 0.47uF 100V capacitor to the RING pin. Refer to the circuit in Figure 2. When both the CR switch/relay and the CT switch/relay are closed, the CH1837C/8C will AC terminate the incoming PSTN line and present the caller ID signal on RCV. CR pin is only present on CH1837C/8C product.
11	I	CT	CT	Caller ID connection to TIP input pin. CT should be connected through a switch/relay and a 0.47uF 100V capacitor to the TIP pin. Refer to the circuit in Figure 2. When both the CT switch/relay and the CR switch/relay are closed, the CH1837C/8C will AC terminate the incoming PSTN line and present the caller ID signal on RCV. CR pin is only present on CH1837C/8C product.

Notes:
1. When answering incoming calls in response to a ring indication on RI, internal degradation may occur if OFFHK is set HIGH before RI returns to its HIGH state.

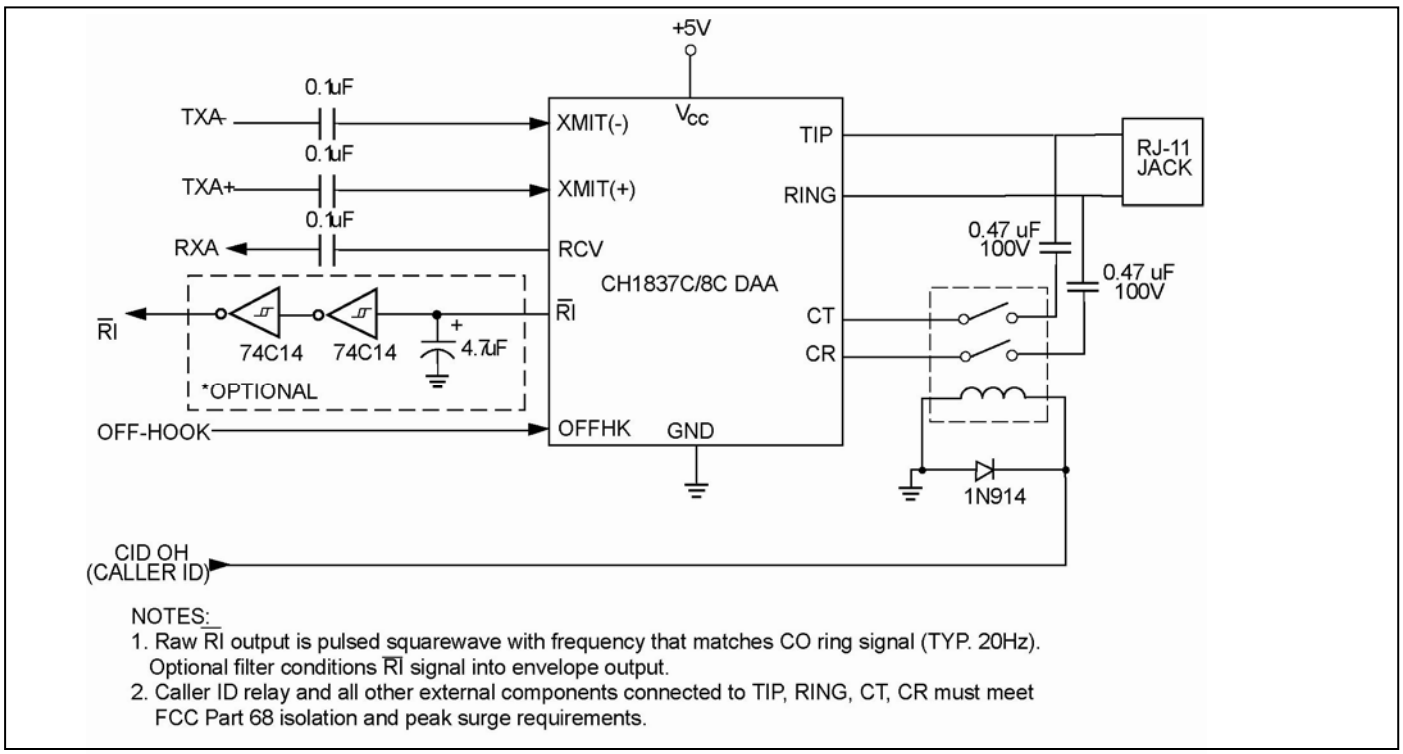

Figure 2. Typical Application.

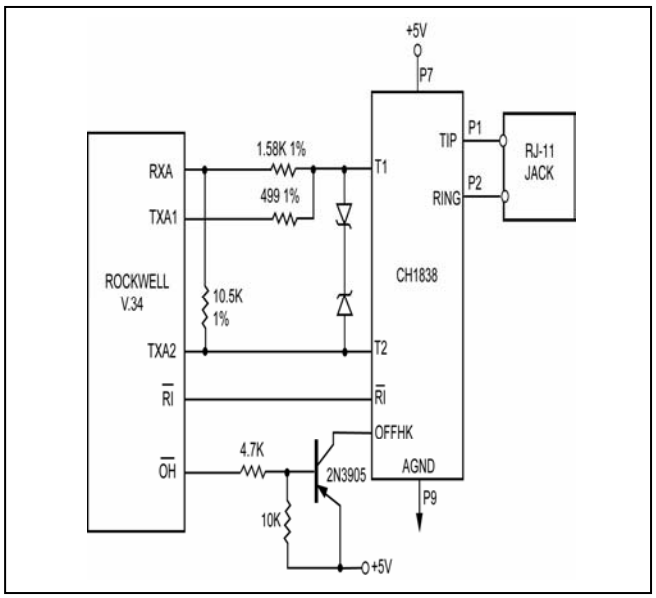

Figure 3. CH1838 Typical Connection to Modem.

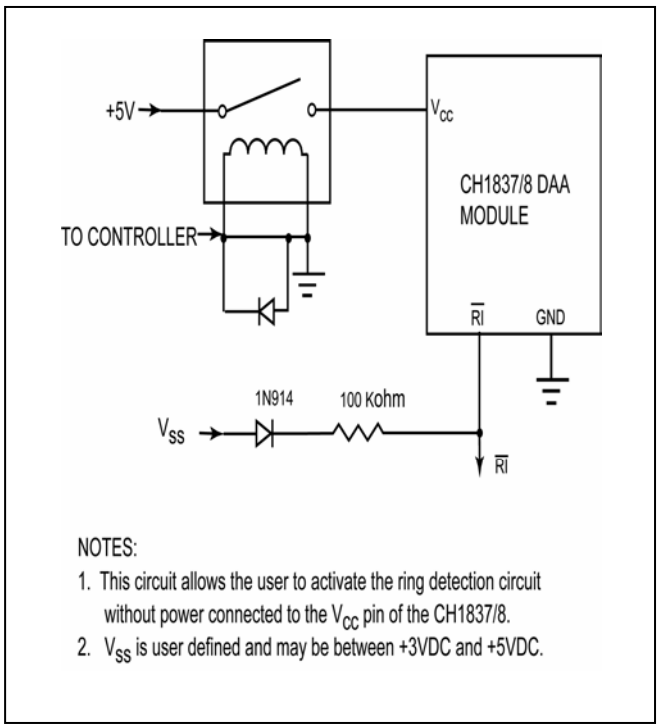

Figure 4. Low Power Ring Detection Circuit.

Table 2. CH1837A/8A Electrical Specifications.

Parameter	Conditions	Min.	Typ.	Max.	Units
Logic					
Input HIGH		2.4			V
Input LOW				0.4	V
Input Leakage HIGH				500	μA
Input Leakage LOW				-500	μA
Output HIGH	IOH=0.05mA	3.0			V
Output LOW	IOL=2.0mA			0.4	V
Isolation Protection Between TIP and RING	All CH1837/8 Products	100			VAC RMS
Surge Protection Between TIP and RING	All CH1837/8 Products	1500			V_{Peak}
Transmission Insertion Loss	Attenuation between the transmitter input PSTN line at 1.8kHz with 600ohms termination (flat from 300-4kHz)	-0.8	0	+0.8	dB
Frequency Response (Ref=1800Hz Transit)	200-4kHz	-0.3		+0.3	dBm
Distortion Noise-Transmit	-10dBm transmit power (600Hz)			-82	dBm
Receive Gain	Gain between PSTN line and receive output at 1800Hz with 600 ohm resistive termination (flat from 300-4kHz)	-0.5	0	+0.5	dB
Receive Frequency Response (Ref = 1800Hz Receive)	200-4kHz	-0.3		+0.3	dBm
Receive $2^{nd}/3^{rd}/4^{th}$ Harmonic Distortion	-10dB at TIP and RING			-82	dBm
Noise-Receive	400Hz-4kHz		-82		dBm
PSTN Line Input Impedance	At 1800Hz	550	600	650	Ohm
On-Hook Impedance		10	20		mOhms
Loop Current	48VDC from TIP to RING. Not applicable to CH1837LL.	20		100	mA
Longitudinal Balance FCC Part 68.310 and DOT	OH=0 (On-Hook) OH=1 (Off-Hook)	66 66			dBm dbm
Return Loss (Zref=600ohm, 2.16μF)	1kHz	25			dBm
Trans-Hybrid Loss	Attenuation between the transmitter input and receiver output at 1kHz with 600ohm complex termination	22	25		dB
Transmit Input Impedance	At 1800Hz	120	150	200	kOhm
Receive Output Impedance	At 1800Hz		10	100	Ohms
Ring Select Sensitivity	AC voltage between TIP and RING	38			V_{rms}
Hook Switch Control Current	Drive capable of sourcing current	4			mA
Weight			20		gm
Supply Current	V_{CC}=+5VDC±5%, Off-Hook V_{CC}=+5VDC±5%, On-Hook		 5	8	mA mA
Ringer Equivalence	Type A		0.2A		REN

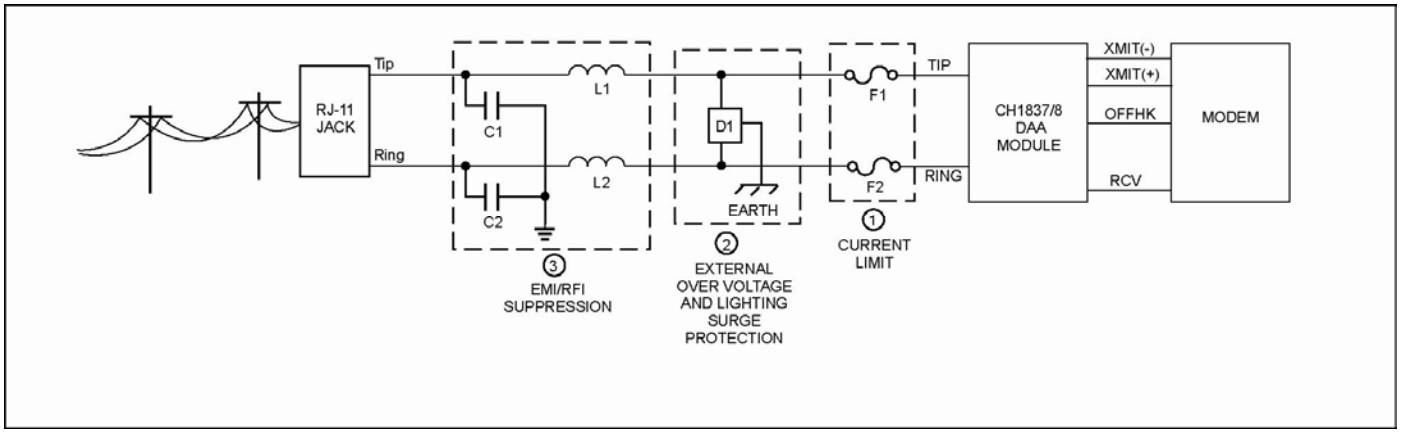

Figure 5. PSTN Line Interface.

1. Currently Limiting PSTN Protection Line Device.

Currently limiting devices are mandatory to meet UL safety standards. For FCC Part 68 approval, the current limiting components identified as F1 and F2 in dashed Box #1 must also survive FCC Part 68 surge testing. Refer to Cermetek Application Note #126, Supplemental PSTN Line Protection, for more details. Refer to Application Note # 130, Summary of Recommend Suppliers, for a list of suppliers and associated part numbers.

A. A Polyfuse (rated at 0.15 amps) is preferred because it resets automatically upon removal of the current flow. Non-resettable devices are also acceptable. Refer to Application Note #130 for a complete list of recommended vendors and associated part numbers.

B. Resistors (10Ω carbon film or 1/8 watt minimum) may be used in Canada, as Canada has no requirements that PSTN equipment be operational after a Type B surge test.

C. Although CSA CS-03 Part 1 (Canada) follows the requirements of FCC Part 68 (USA), Cermetek recommends contacting DOT (Canada) and/or a certified independent lab to verify compliance. For Canada, use either 10Ω resistors (carbon film or SMD parts 1/8 watt minimum) as described in paragraph B above.

2. Over Voltage and Lightning Protection.

A. The required UL60950 and FCC Part 68 surge protection (identified as D1 in dashed Box 2) must be supplied externally. The purchaser must include some form of surge protection as described herein to obtain FCC Part 68 approval and to maintain UL60950/3rd edition listing.

B. In most environments, 2 terminal surge suppressors are adequate. For severe environments, use an external 3 terminal device (as indicated in Figure 5) with an earth ground.

3. EMI/RFI Suppression.

Additional suppression, if required, may be added as described below in Sections 3A-3B without adversely affecting FCC Part 68 approval or UL60950 listing.

A. To provide adequate EMI/RFI suppression, the capacitor/inductor network contained in dashed Box #3 should be located as close to the RJ11 Jack as possible. Further, this network should be provided with an excellent ground path to the chassis.

B. Capacitors C1 and C2 should not exceed 0.005μf. They must have a rating of 1.5KV and typically are 0.001μf ± 20%. Inductors L1 and L2 may be either individual inductors or a dual inductor. Refer to Application Note #130 for a complete list of recommended vendors and associated part numbers. For UL applications, choose capacitors and inductors that are UL60950 listed. The actual values of the components used may vary depending on the end product design.

Table 3. Summary CH1837/8 Family of Products.

Model	Summary of Features	Operating Temperature
CH1837	33.6kbps DAA, 2-to-4 Wire Conversion, FCC Part 68 and UL 1459 compliant	0° C to +70°C
CH1837C	33.6kbps DAA, 2-to-4 Wire Conversion, Caller ID, FCC Part 68 and UL 1459 Compliant	0° C to +70°C
CH1837C ET	33.6kbps DAA, 2-to-4 Wire Conversion, Caller ID, FCC Part 68 and UL 1459 Compliant	-40° C to +85°C
CH1838	33.6kbps DAA, FCC Part 68 and UL 1459 Compliant	0° C to +70°C
CH1838C	33.6kbps DAA, Caller ID, FCC Part 68 and UL 1459 Compliant	0° C to +70°C
CH1838C ET	33.6kbps DAA, Caller ID, FCC Part 68 and UL 1459 Compliant	-40° C to +85°C

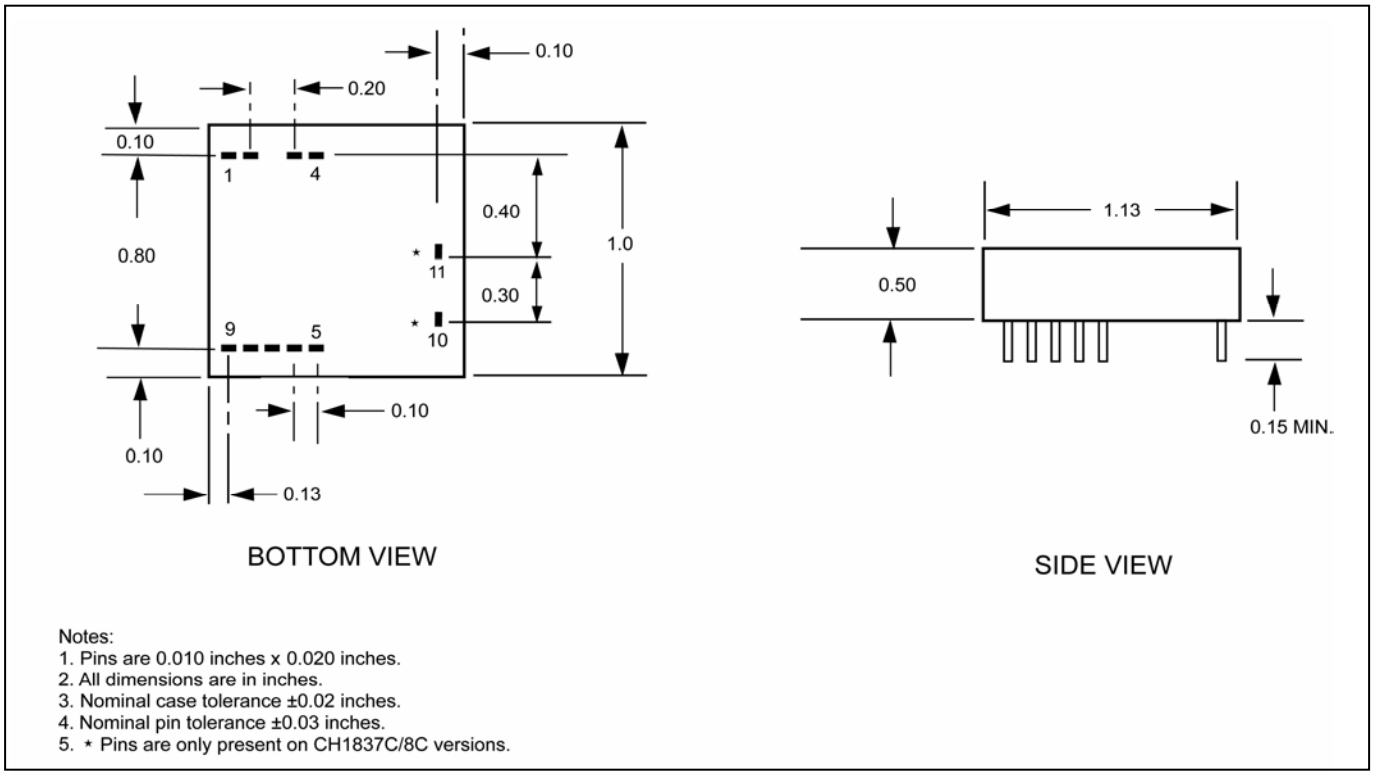

Figure 6. Physical Dimensions

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

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