

CH1847/D Data Access Arrangement Module

V.34bis High Speed DAA Module with Output Squelch

INTRODUCTION

The Cermetek CH1847/D Data Access Arrangement (DAA) product family is an FCC Approved DAA. The user does not need to register this DAA when properly designed in. Registration is conveyed to the user. A FCC label is provided with each unit for monitoring on the outside of the users product. The device is designed to meet the performance requirements of 33.6Kbps modems, such as V.34bis, for embedded applications. The CH1847/D 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, meet UL60950 Revision 1 (USA) and CSA C22.2 950 (Canada) requirements. Further, the CH1847/D is FCC Part 68 (TIA/EIA/IS-968) and Industry Canada (IC) CS-03 Part I approved.

The CH1847/D is compatible with all popular V.32bis FAX chip sets. Application examples are included in this datasheet. The CH1847/D offers a Quick-to-Market DAA solution with its conveyed FCC Part 68 approval.

The CH1847/D is exceptionally well suited for voice-over-data (VoIP) and other internet-based telephony and data communication applications and is pin compatible with the CH1840 product family.

FEATURES

- Low Profile.
- Complete DAA function.
- Ring detection circuitry included.
- Caller ID (CID) circuitry included.
- Compatible with most popular V.34bis modem chip sets.
- Available in 0dbm and -9dbm versions.
- Extended temperature operation: -40°C to +85°C.
- Built-in 2-wire to 4-wire conversion circuitry.
- UL60950 Revision 1 Listed and CSA C22.2 950 Compliant. See UL File E104957.
- 1500 VAC RMS Isolation.
- 2122V peak surge protection.
- +5V low power operation.
- Differential transmission, VoIP applications.
- Compatible with V.34bis, V.32bis, V.32, V.22bis, and V.22.
- FCC Part 68 Registration #: US:B46MMO1BCH1847.
- IC CS-03 Part I Ref #: IC:176A-CH1847.

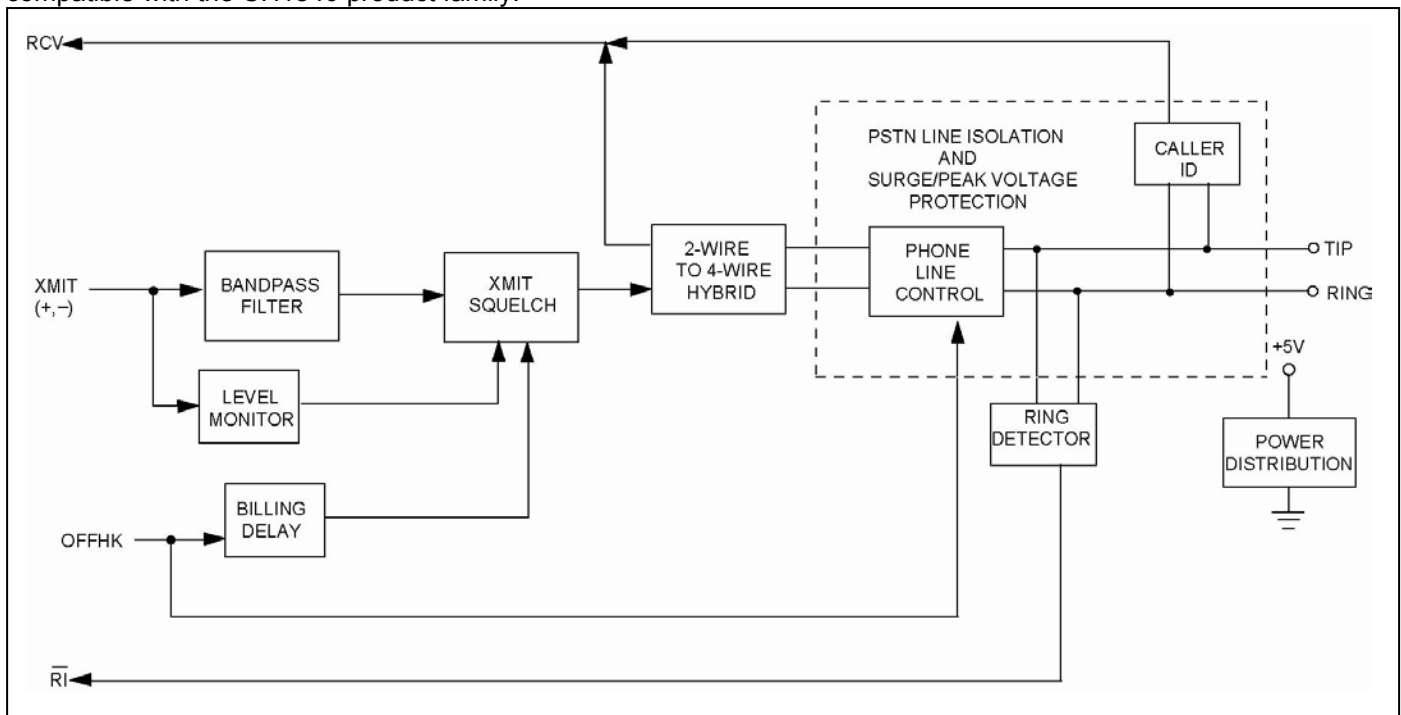


Figure 1. CH1847/D Functional Block Diagram.

DESCRIPTION OF FUNCTIONAL BLOCKS AND DISCUSSION OF BASIC OPERATIONS

Figure 1 contains a functional block drawing of the CH1847/D. Each CH1847/D product consists of:

1. Isolation Barrier.
2. Ring Detection.
3. Phone Line Control/Off-Hook Switch.
4. PSTN Line Surge and High Voltage Protection circuitry.
5. 2-to-4 Wire Conversion circuit.
6. Caller ID (CID).
7. XMIT Squelch.

Ring Detection. To announce an incoming call, the telephone company's central office (CO) applies an AC ringing signal to the PSTN line. The CH1847/D is designed to detect this signal. The CH1847/D uses the AC ring signal to produce a square wave pulse train output at the CH1847/D RI pin. This pulse train is the same frequency as the incoming AC ring signal and is typically 20 Hz. Figure 3 shows external filtering which may be employed to provide an envelope indication of the ring signal using the CH1847/D RI output. The ring detection circuit in the CH1847/D family is designed to deter false indications caused by pulse dialing or noise on the PSTN line.

Additionally, the $\bar{R}I$ output of the CH1847/D 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 CH1847/D 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 3.

RI Output:	Opt coupler, 30K Ω pull-up, Active LOW
	Square wave 15-68HZ (TIP, 20Hz)
Sensitivity:	38Vrms across TIP and RING

Phone Line Control/Hook Switch. The OFFHK input is used to toggle the CH1847/D from On-Hook to Off-Hook and back to On-Hook. When the OFFHK input is TTL Low, the CH1847/D is On-Hook. The On-Hook state indicates to the CO that the CH1847/D is ready to receive calls.

When the OFFHK input is TTL High, the CH1847/D is Off-Hook. The Off-Hook state indicates to the CO that the CH1847/D is either answering a call or preparing to place a call.

OFFHK Input:	Active HIGH
OFFHK active Current:	5mA

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.

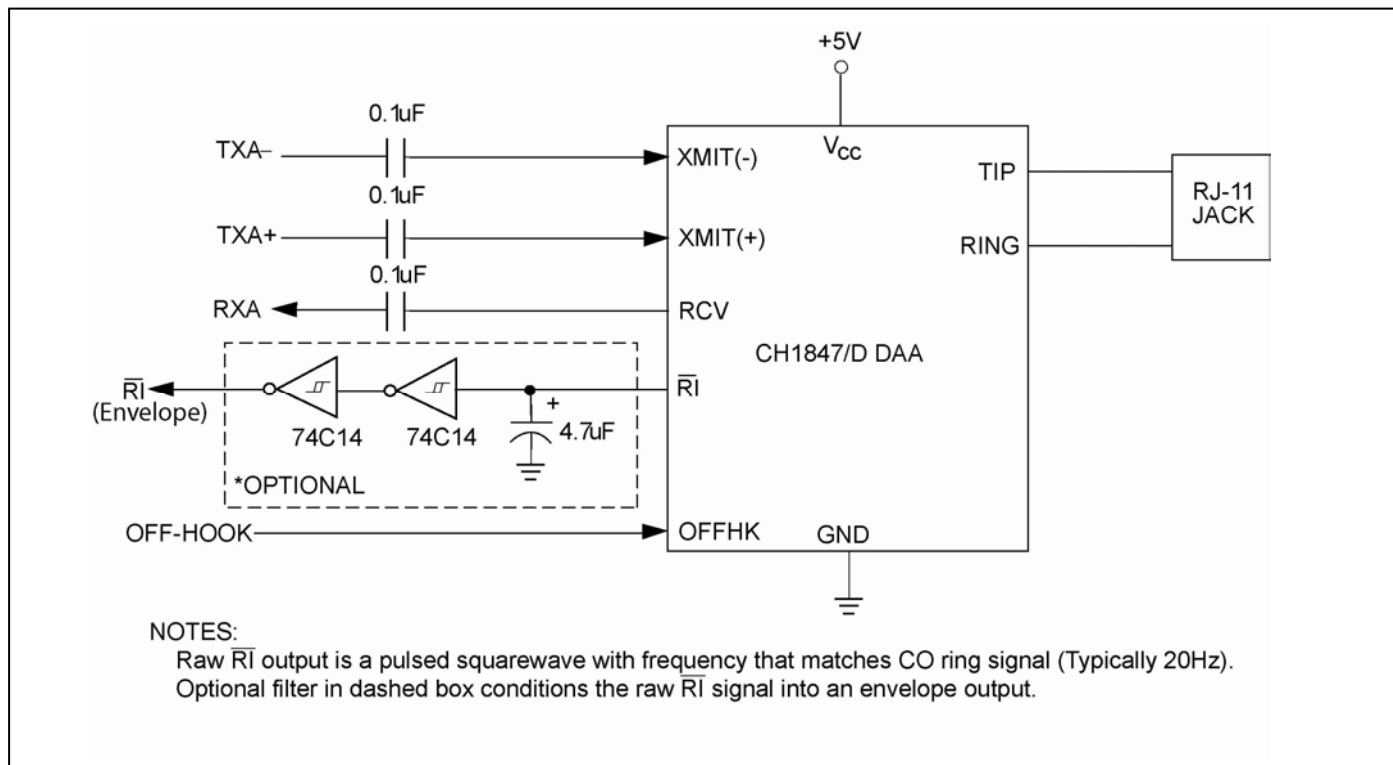


Figure 2. Typical Application.

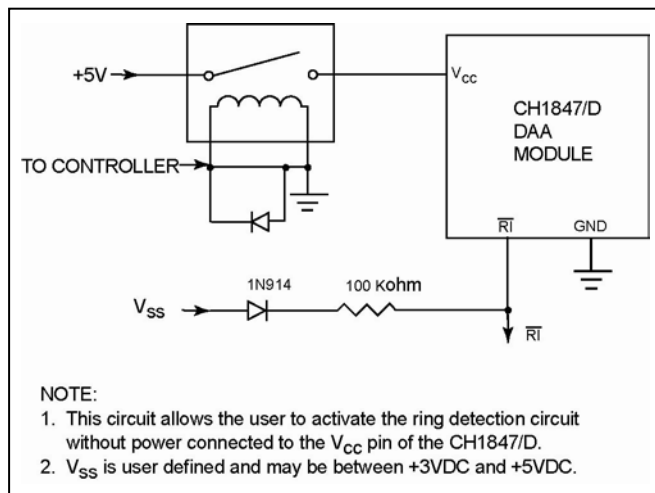


Figure 3. Low Power Ring Detection Circuit.

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.

Isolation Barrier/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. The CH1847/D has been designed to meet both FCC Part 68 (USA) and Industry Canada CSA CS-03 Part I (Canada) isolation and surge requirements when circuited as indicated in Figure 5. Among the more critical parameters, the PSTN isolation barrier will provide at least 1500VAC RMS isolation and 2122V peak surge protection. The CH1847/D is also UL60950 Revision 1 listed and meets CSA C22-950 test conditions when connected as indicated in Figure 5.

Caller ID (CID). The CID circuit maintains the required Isolation Barrier, PSTN Line Isolation and Surge/Peak Voltage Protection while providing the encoded CID signal to the user via the RCV pin.

TRANSMIT SIGNALS

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

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 0.1µF capacitor as shown in Figure 2. In single ended signal operation,

the XMIT(+) pin must be connected to GND through a 0.1µF capacitor.

CH1847. The CH1847 attenuates the transmit signal by 9dBm before it applies the signal across TIP and RING. Therefore, a transmit signal of 0dBm applied between XMIT(-) and XMIT(+) will comply with the FCC Part 68 TIP and RING maximum data output requirement of -9dBm.

CH1847D. The CH1847D does not attenuate the transmit signal before it applies the signal across TIP and RING. Therefore, a transmit signal of -9dBm applied between XMIT(-) and XMIT(+) will comply with the FCC Part 68 TIP and RING maximum data output requirement of -9dBm.

RECEIVE SIGNALS

The incoming analog signal appears across TIP and RING. The CH1847/D does not amplify the receive signal. Receive signals can vary from a maximum strength of -9dBm to below -50dBm for data and from 0dBm to below -50dBm for incoming DTMF tones and voice.

RCV. The CH1847/D derives the incoming signal and presents it at RCV with respect to GND. The user must AC couple RCV through a 0.1µF capacitor as indicated in Figure 3.

Attenuation:	0.0dBm
Input Impedance:	150KΩ
Typical Input Signal:	0dBm or 0.775Vrms with the Signal referenced to GND and AC coupled

CALLER ID

The CH1847/D will detect Caller ID (i.e., CID) information. CID data, when supplied by the local telephone service provider, is present between the first and second incoming ring signals.

Setup. CID does not require additional external circuitry to access the encoded CID data but it does require external circuitry to process the encoded signal.

Operation. The CID signal is always provided by the CH1847/D when supplied by the PSTN. The encoded CID data will appear on RCV relative to GND. The user must decode the data. Refer to Application Note # 176, Caller ID Feature for CH1847/D DAA, for details concerning CID signal decoding.

UL RECOGNITION

To further protect the end product containing the CH1847/D from field failures caused by large transients present on poor quality PSTN lines and to maintain UL recognition, an additional level of external transient protection is required. Refer to Figure 5 for mandatory additional protection circuitry.

DESIGN CONSIDERATIONS

The CH1847/D DAA includes circuitry that couples the modem signals to the PSTN line and provides the FCC required voltage isolation and surge protection when circuited per Figure 5 herein. 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 CH1847/D TIP and RING 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 VC 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 CH1847/D processes signals in the millivolt range. Even though the CH1847/D 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 CH1847/D 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 CH1847/D products.

MOUNTING THE DAA

There are two mounting techniques recommended for physically connecting the CH1847/D DAA to a PCB:

1. Direct soldering.
2. Sockets.

Direct Soldering. The CH1847/D may be wave soldered onto a circuit card. All CH1847/D 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 demonized 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 CH1847/D seated to avoid any possibility that the CH1847/D works loose during shipment. See Application Note # 130, [Summary of Recommended Suppliers](#) for a list of recommended socket manufacturers.

FCC (USA) AND IC (INDUSTRY CANADA) REGISTRATION

The CH1847/D has been approved by the FCC (USA) and the IC (Industry Canada). The user is assigned the registration upon purchase of the CH1847/D. However, because Cermetek does not have influence over nor knowledge of the specific user application environment, the user assumes all risk for maintaining compliance to registration for FCC and IC Approved or Approvable end products.

The PSTN interface connectivity requirements specified in Figure 5 should be adequate to maintain FCC and IC Approval for most applications, but, as applications vary, the user is encouraged to submit the end product or system to a reputable independent test facility for evaluation and approval verification. The

test/evaluation process involves testing the end system and reviewing the resultant data.

MAINTAINING FCC REGISTRATION

All CH1847 products are registered with the FCC (Federal Communications Commission) under Part 68 and IC (Industry Canada) CS-03 Part I. To maintain the validity of the registration, the end product manufacturer must serve notice to the end user of its products of several restrictions the FCC places on the DAA and its use.

In addition to restriction notification, the FCC requires that Cermetek make all repairs to all products in the CH1847 family. If repairs are necessary after installation of the CH1847 in the end product and the end product has been delivered to the end user, the end product must be returned to the end product supplier where the CH1847 can be removed and then forward to Cermetek for repair. The following notice is recommended and should be included in the end product's user manual.

FOR YOUR USER'S MANUAL

The FCC Part 68 rules require the following (or equivalent) be provided to the end user of equipment containing a DAA.

Type of Service. The (insert end product name) is designed to be used on standard device telephone lines. It connects to the telephone line by means of a standard jack called the USOC RJ-11C (or USOC RJ45S). Connection to telephone-company-provided coin service (central office implemented systems) is prohibited. Connection to party lines service is subject to state tariffs.

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, sub-part F, specifically the dimensions, tolerances and metallic plating requirements. The compliance of these connectors will be assured by purchase specifications and incoming inspection. Documentation of such specifications and/ or inspections will be provided to the FCC within 30 days of their request for the same.

Telephone Company Procedures. The goal of the telephone company is to provide you with the best service it can. In order to do this, it may occasionally be necessary for them to make changes in their equipment, operations or procedures. If these changes might affect your service or the operation of your equipment, the telephone company will give you notice, in writing, to allow you to make any changes necessary to maintain uninterrupted service.

In certain circumstances, it may be necessary for the telephone company to request information from you concerning the equipment which you have connected to your telephone line. Upon request of the telephone company, provide the FCC registration number and the ringer equivalence number (REN); both of these items are listed on the equipment label. The sum of all of the REN's on your telephone lines should be less than five in order to assure proper service from the telephone company. In some cases, a sum of five may not be useable on given line. Consult your telephone provider.

If Problems Arise. If any of your telephone equipment is not operating properly, you should immediately remove it from your telephone line, as it may cause harm to the telephone network. If the telephone company notes a problem, they may temporarily discontinue service. When practical, they will notify you in advance of this disconnection. If advance notice is not feasible, you will be notified as soon as possible.

When you are notified, you will be given the opportunity to correct the problem and informed of your right to file a complaint with the FCC. Contact your local telephone service provider if you have any questions about your phone line.

In the event repairs are ever needed on the (insert your product name), they should be performed by (insert your company name) or an authorized representative of (insert your company name). For information contact: (insert your company address).

Table 1. CH1847/D Pin Descriptions.

PIN	I/O	CH1847/D	FUNCTION
1	I/O	TIP	TIP. Direct PSTN line connection.
2	I/O	RING	RING. Direct PSTN line connection.
3	---	N/C	No Pin. Pin location 3 does not contain a pin. This pin location is left blank to provide maximum voltage isolation between TIP/RING and the rest of the CH1847/D pins.
4	I	OFFHK	OFF-HOOK. Used to toggle CH1847/D product between On-Hook and Off-Hook. When set LOW, CH1847/D is On-Hook. When set HIGH, CH1847/D is set Off-Hook to answer or place a call. See Note 1.
5	O	$\overline{\text{RI}}$	RING INDICATION. Indicates the presence of a ring signal between TIP and RING pins. $\overline{\text{RI}}$ output is a square wave coincident with the incoming AC ring signal. The $\overline{\text{RI}}$ square wave output can be conditioned to produce an envelope of the incoming AC ring signal by using the circuit in Figure 4.
6	O	RCV	RECEIVE. Audio output signal with respect to GND. AC couple RCV through 0.1 μ F capacitor to eliminate any DC offset.
7	I	XMIT(-)	TRANSMIT(-). Audio input signal. AC couple through 0.1 μ F capacitor. The CH1847/D can be used in differential mode with respect to XMIT(+), or in single ended mode with respect to GND.
8	I	V _{CC}	POWER SUPPLY. +5V \pm 5%. Supply line noise should be less than 50mV peak to peak.
9	I	XMIT(+)	TRANSMIT(+). Audio input signal for CH1847/D when used in differential mode only. Connect to GND through 0.1 μ F capacity when CH1847/D used in single ended input via XMIT(-).
10	I	GND	GROUND. Supply line noise should be less than 50mV peak to peak.
<p>Note: When answering incoming calls in response to a ring indication on $\overline{\text{RI}}$, internal component degradation may result if OFFHK is set HIGH before $\overline{\text{RI}}$ returns to its HIGH state.</p>			

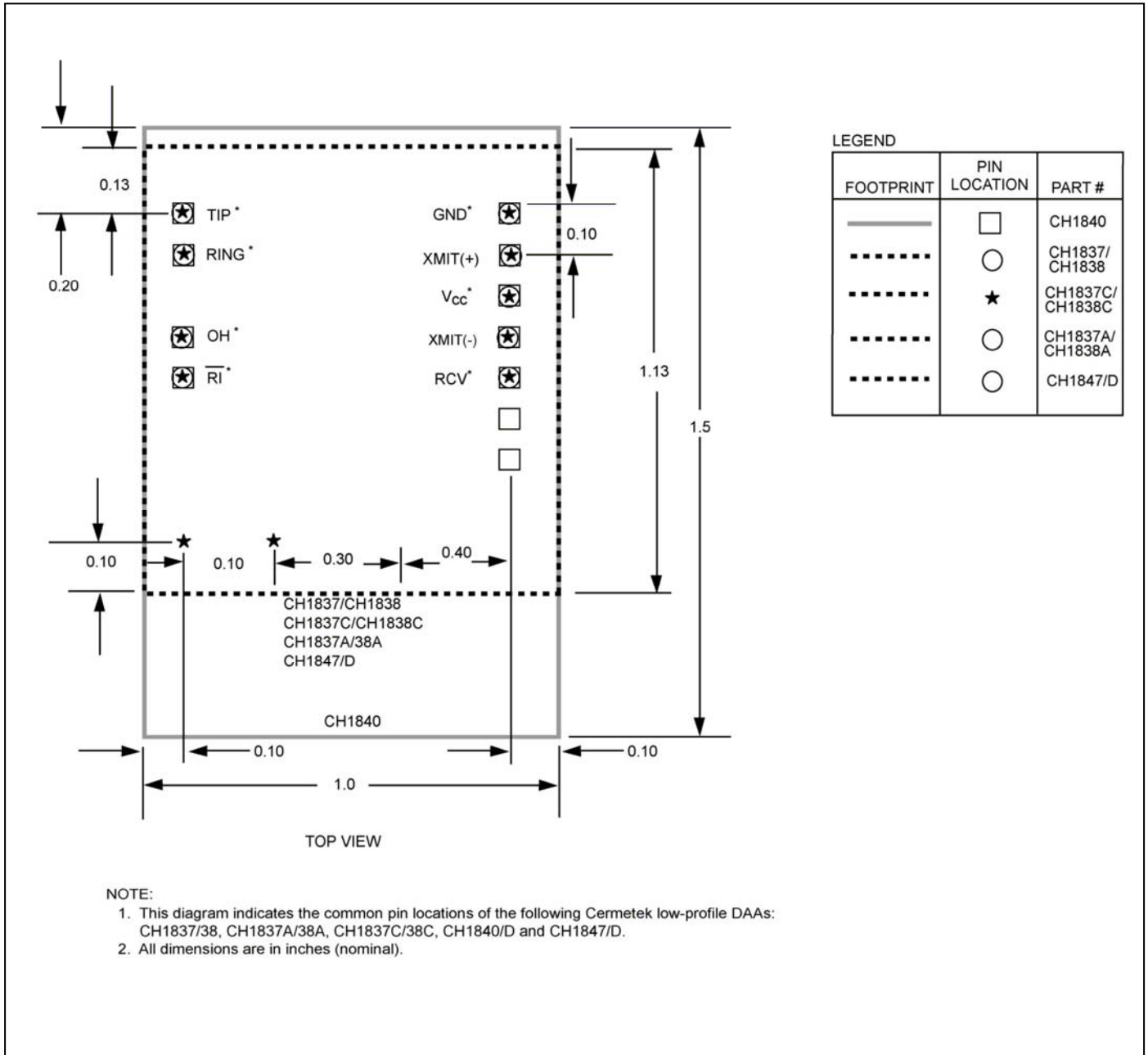


Figure 4. Pin and Configuration Comparison Summary for CH1837, CH1837A, CH1840 and CH1847 Product Families.

Table 2. CH1847/D Electrical Specifications.

Page 1 of 2

 $T_A = 0^\circ\text{C}$ to 55°C unless otherwise specified

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	$I_{OH}=0.05\text{mA}$	3.0			V
Output LOW	$I_{OL}=2.0\text{mA}$			0.4	V
Isolation Protection					
Between TIP and RING	CH1847/D	1500			VAC RMS
Surge Protection					
Between TIP and RING	CH1847/D	2212			V_{Peak}
Transmission Insertion Loss	1800Hz, 600ohms, 35mA loop current				
	CH1847	9.5	10	10.5	dB
	CH1847D	-0.5	0.0	0.5	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

Table 2. CH1847/D Electrical Specifications.**Page 2 of 2** $T_A = 0^\circ\text{C}$ to 55°C unless otherwise specified

Parameter	Conditions	Min.	Typ.	Max.	Units
Receive 2nd/3rd/4th 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			20		mOhms
Loop Current	48VDC from TIP to RING.	20		100	mA
Longitudinal Balance	OH=0 (On-Hook)	66			dBm
	OH=1 (Off-Hook)	66			dbm
Return Loss (Zref=600ohm, 2.16 μ F)	1kHz	25			dBm
Trans-Hybrid Loss	Attenuation between the transmitter input and receiver output at 1kHz with 600ohm complex termination	22	30		dB
Transmit Input Impedance	Measured at XMIT @ 1800Hz	120	150	200	kOhm
Receive Output Impedance	Measured at RCV @ 1800Hz		10	100	Ohms
Ring Select Sensitivity	AC voltage between TIP and RING	38			Vrms
Hook Switch Control Current	Drive capable of sourcing current	4			mA
Supply Current	VCC=+5VDC \pm 5%, Off-Hook			8	mA
	VCC=+5VDC \pm 5%, On-Hook		5		mA
Ringer Equivalence	Type A		0.2A		REN
Caller ID	Single Level		-0		dB

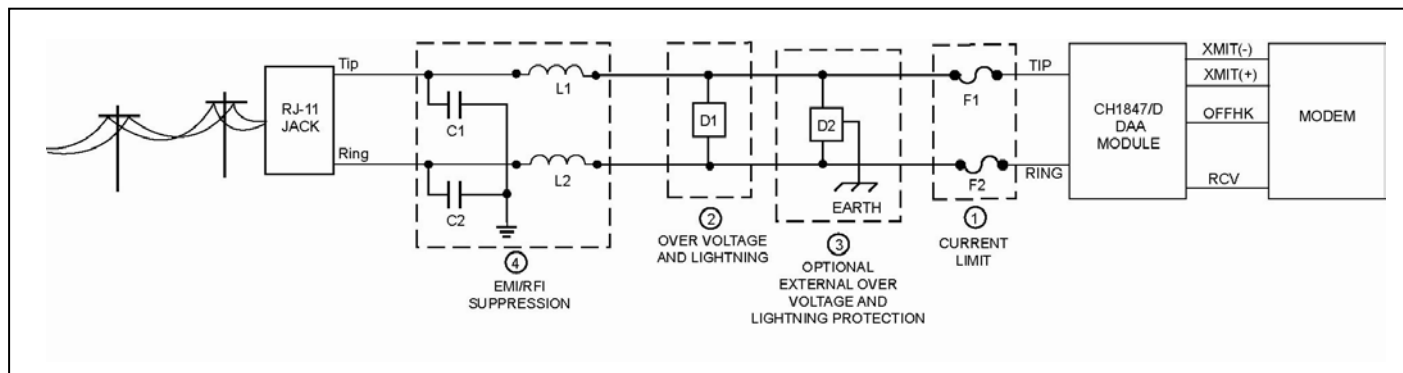


Figure 5. PSTN Line Interface.

1. Current Limiting PSTN Protection Line Device.

Current limiting devices are mandatory to meet UL safety standards. 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 Recommended Suppliers, for a list of suppliers and associated part numbers.

A resettable/repairable fuse (rated at 0.15 amps) is preferred because it resets automatically upon removal of the current flow. Non-resettable devices are also acceptable. Although CS-03 Part I (Canada) follows the requirements of FCC Part 68 (USA), Cermetek recommends contacting a certified independent lab to verify compliance in the specific application.

2. Over Voltage and Lightning Protection.

The purchaser must include some form of surge protection as described herein to maintain FCC Part 68 and CS-03 part I approval. This protection MUST be provided by external circuitry. Refer to Application Note #130 for a list of recommended suppliers.

As a minimum, the surge protection identified as D1 in dashed Box 2 must be provided.

3. Optional External Over Voltage and Lightning Protection.

In most environments, the two terminal surge suppressor described above (and indicated as D1 in dashed Box 2) is adequate. For severe environments, use a three terminal device with an earth ground as is shown in dashed Box 3 in place of the two terminal device in dashed Box 2.

IMPORTANT NOTE

Do NOT use both D1 and D2 in the external protection circuitry. Use either D1 (recommended for typical applications) or D2 (recommended for severe applications).

4. EMI/RFI Suppression.

Suppression of emitted EMI/RFI is recommended and is typically required to obtain FCC part 15 A and/or B approval. EMI/RFI suppression circuitry is also used to suppress reception of externally generated EMI/RFI signals, such as strong radio signals which are known to adversely affect modem operation, should the end product containing the CH1847/D be located near a source of such signals. Typical EMI/RFI suppression circuitry may be added as described below:

- A. To provide adequate EMI/RFI suppression, the capacitor/inductor network contained in dashed Box 4 should be located as close to the RJ-11C 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 UL 60950 Revision 1 listed. The actual values of the components used may vary depending on the end product design and the nature of the EMI/ RFI. Consult an FCC part 15 consultant if required.

Table 3. Summary CH1847/D Family Product Features.

Model	Summary of Features	Operating Temperature
CH1847	33.6kbps DAA, -9dbm Output Attenuation, FCC Part 68 Approved (USA), Industry Canada (IC) CS-03 Part I Approved, UL60950 Revision 1 Listed (USA) and CSA C22.2 950 (Canada) compliant.	0°C to +70°C
CH1847 ET	33.6kbps DAA, -9dbm Output Attenuation, FCC Part 68 Approved (USA), Industry Canada (IC) CS-03 Part I Approved, UL60950 Revision 1 Listed (USA) and CSA C22.2 950 (Canada) compliant.	-40°C to +85°C
CH1847D	33.6kbps DAA, 0dbm Output Attenuation, FCC Part 68 Approved (USA), Industry Canada (IC) CS-03 Part I Approved, UL60950 Revision 1 Listed (USA) and CSA C22.2 950 (Canada) compliant.	0°C to +70°C
CH1847D ET	33.6kbps DAA, 0dbm Output Attenuation, FCC Part 68 Approved (USA), Industry Canada (IC) CS-03 Part I Approved, UL60950 Revision 1 Listed (USA) and CSA C22.2 950 (Canada) compliant.	-40°C to +85°C

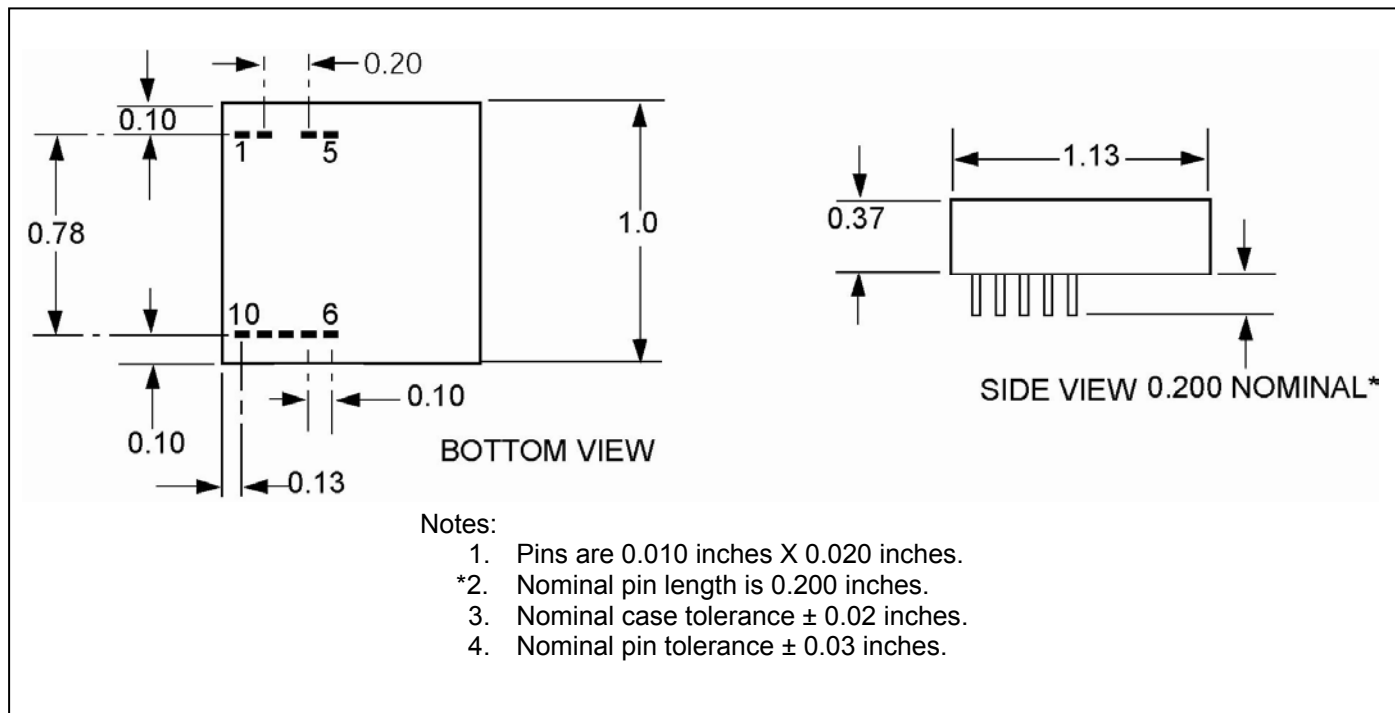


Figure 6. CH1847/D Physical Dimensions.

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.

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