CH1817 Family of Low Profile Data Access Arrangement Modules

Technology patent pending.

INTRODUCTION

The Cermetek CH1817 Family of Low Profile Data Access Arrangement (DAA) Modules connect directly to the telephone line and to your voice or data circuit. These devices have been tested to meet or exceed FCC Part 68 requirements and are Canadian DOC approvable, therefore speeding up the user approval process. They are also recognized by Underwriters Laboratories for meeting UL 1459 Specifications, thus making these components adaptable to any application.

These modules are ultra small (1.0" x 1.0" x 0.35"), and thus, easy to integrate into space-sensitive designs, including laptop and hand-held computer based products. These devices can be socketed or mounted directly on a Printed Circuit Board (PCB). The telephone line connection is made through Tip and Ring to an RJ-11 jack or equivalent.

The CH1817 Family is designed to be used with a variety of LSI FAX/modem chip sets. These devices are ideal for data throughput up through 14,400 bps/V.32 bis, providing superior performance in a very small package.

FUNCTIONAL DESCRIPTION

Ring Detection

To announce an incoming call, the telephone company's central office (CO) applies an AC ringing signal to the phone line. The DAA is designed to detect this signal. The $\overline{RI}$ is set Low during the typically 2 second ring period and is restored to High for the typically 4 seconds between rings. During the active state, the $\overline{RI}$ output is pulsed at the same frequency as the AC signal, typically 20 Hz. Figure 2 shows additional filtering which may be used to provide an envelope indication of the ring signal's presence. The ring detection circuit is designed to deter false indications due to pulse dialing or noise on the line.

The $\overline{RI}$ output of the CH1817-L,-C,-D, and -LM is diode protected so that an external pull-up resistor (R>100KΩ) to +5V may be utilized to activate the ring detection circuit when the DAA is not connected to power. This can be handy in 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.

$\overline{RI}$, Output:	Opto-coupler, 30KΩ pull-up Active low Square wave 15-68 Hz (Typ. 20 Hz) Sensitivity: 38 Vrms across Tip & Ring

FEATURES

- Low Profile
- Complete DAA function
- Ring detection
- Ultra small size 1.0" × 1.0" × 0.35"
- Built-in 2-wire to 4-wire conversion
- Lightweight
- Creates more board space
- +5V operation
- 1500 Volt isolation
- 800 Volt surge protection
- V.32 bis/14,400 bps applications
- UL 1459 recognized, file #E104957
- CH1817-ET: -40° to 85°C operation
- CH1817-L: Low power consumption and Common mode noise rejection filter
- CH1817-C: Caller ID
- CH1817-LM: Reduced transmit attenuation
- CH1817-D: Differential transmission input and 0 dBm transmission insertion loss.

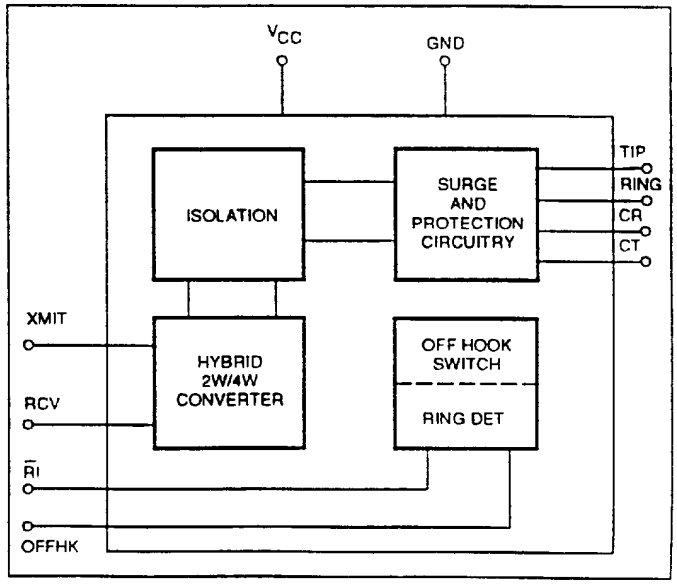


Figure 1. CH1817 DAA Functional Block Diagram

Cermetek Microelectronics / 1308 Borregas Avenue / Sunnyvale, CA 94089 / 408-752-5000 / Fax: 408-752-5004

Hook Switch Control

The OFFHK input is used to take the CH1817 DAA Off-Hook. When the input is low, the DAA is On-Hook which indicates to the CO that it is ready to receive calls. When OFFHK is high, the DAA allows the CO supplied loop current to flow, indicating either it is answering a call or preparing to place a call.

OFFHK, Input: **Active high**
OFFHK active current: 4 mA

Transmit Signal

The outgoing analog signal to be transmitted through the phone line should be applied to the XMIT pin (with respect to GND) and must be AC coupled as shown in Figure 2. For the CH1817-D a XMIT(+) and XMIT(–) pin designation provides a differential input. The CH1817-L attenuates the transmit signal by 9.5 dB (6.5 dB for the -LM option, 0 dB for the -D option). Therefore, a transmit signal of 0 dBm for the -L option (-3 dB for -LM, -9.5 dB for -D) applied to XMIT will comply with the FCC Part 68 requirement for data signals of -9 dBm across Tip and Ring. (Note: The FCC does not currently maintain specific signal strength requirements for voice signals or DTMF dialing signals. DTMF dialing signals have a "recommended" strength of -2 dBm.)

XMIT, Input: **Attenuation: 9.5 dB for CH1817-L**
(6.5 dB for CH1817-LM, 0 dB for CH1817-D)
Input impedance: 150KΩ
Typ. input signal: 0 dBm, or 0.775 Vrms (-L)
(-3 dBm for CH1817-LM,
-9.5 dBm for CH1817-D)
Signal referenced to GND
AC coupling required

Receive Signal

The incoming analog signal appearing between Tip and Ring is presented at RCV with respect to GND and must be AC coupled to your receive input. The CH1817 does not add any gain to the receive signal. Receive signals can vary from a maximum strength of -9dBm to below -50dBm.

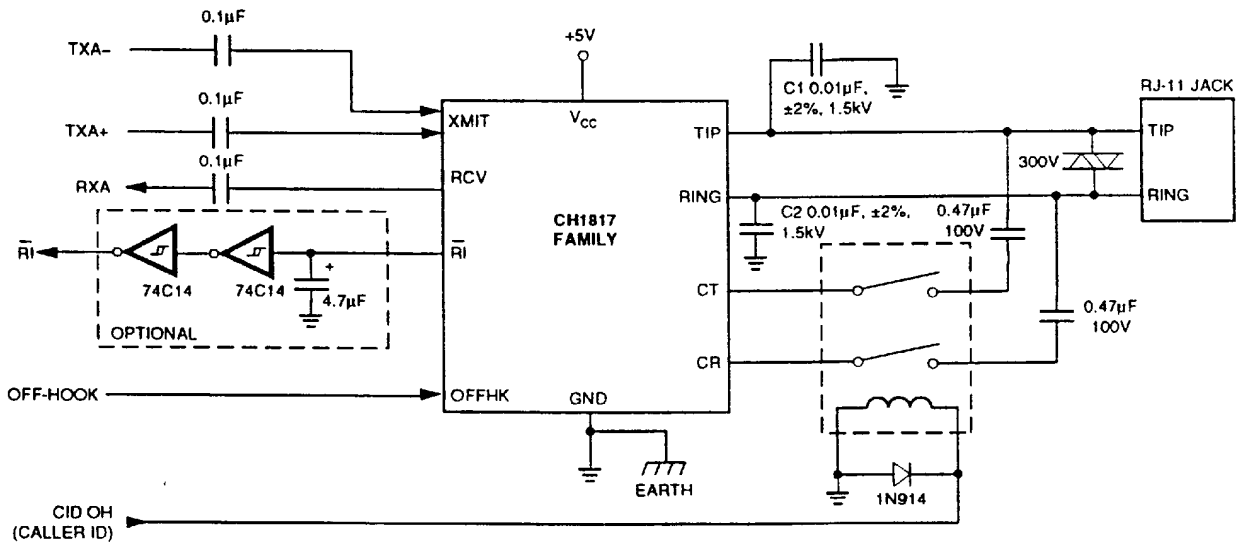
RCV, Output: **Gain: 0 dB**
Output impedance: 100Ω
Typ. output signal: -9 dBm to -50 dBm,
or 0.27 Vrms to 2.5 mVrms
Signal referenced to GND
AC coupling required

2-Wire to 4-Wire Hybrid Converter

This block has two functions: 1) It applies the XMIT signal to the phone line and 2) It subtracts this signal from the total signal on the phone line to derive the RCV signal. The accuracy of this derivation 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 applied XMIT signal to the received XMIT signal is called Trans-Hybrid Rejection, or Trans-Hybrid Loss. On a 600Ω phone line, the CH1817 DAA's have very high trans-hybrid rejection, typically 23 dB.

CH1817-L, LM, D, C: Low Power

The L Family is a Low Power version of the CH1817 DAA. When Off-Hook, this DAA draws only 4 mA through V_{CC}. When On-Hook, the L Family can be configured so that the



NOTES.
1. Raw $\overline{RI}$ output is pulsed square wave with frequency that matches CO ring signal (TYP. 20Hz). Optional filter conditions $\overline{RI}$ signal into envelope output
2. CT and CR are applicable to CH1817-C only.
3. Caller ID relay must meet FCC Part 68 isolation requirements. Tip, Ring, CT, and CR must be isolated from all other circuitry by 1500 V peak
4. 300V VARISTOR (TECCOR,-P3100BA70) across Tip and Ring
5. C1 and C2 are recommended for installations that may have 60 Hz noise on the phone line (CH1817 and CH1817-M only).
6. Earth ground connection is not required when CH1817 is powered by battery or for CH1817-L or CH1817-C (see CH1817-L and CH1817-C sections)
7. See Figure 3 for additional telephone interface options.

Figure 2. Typical Application

Table 1. CH1817 Pin Descriptions

NAME	I/O	FUNCTION
TIP	I/O	Direct telephone line connection.
RING	I/O	Direct telephone line connection.
OFFHK	I	When set LOW, the CH1817 is placed On-Hook. When set HIGH, the CH1817 is placed Off-Hook to answer or place a call. This input can also be used for pulse dialing. NOTE: When answering incoming calls in response to a ring indication on $\overline{RI}$, internal relay contact degradation may occur if OFFHK is set HIGH before $\overline{RI}$ returns to its HIGH state.
$\overline{RI}$	O	It is asserted LOW by producing a square wave in coincidence with the AC Ring signal during the typically 2 second ON telephone ringing cycle and is asserted high during the 4 second idle period between rings. The square wave can be suppressed to produce an envelope of the AC ring with the application circuit shown in Figure 2.
CR	I	Caller ID telephone connection. This should be connected to a switch, or relay, a 0.47µF, 100V capacitor, and finally to Ring. When this switch is closed, along with the switch on CT, the CH1817-C will AC terminate the telephone line and present the Caller ID signal at RCV.
CT	I	Caller ID telephone connection. This should be connected to a switch, or relay, a 0.47µF, 100V capacitor, and finally to Tip. When this switch is closed, along with the switch on CR, the CH1817-C will AC terminate the telephone line and present the Caller ID signal at RCV.
RCV	O	This provides the signal or audio output with respect to ground and must be AC coupled with a 0.1µF capacitor to eliminate DC offset.
N/C	-	No user connection on this pin. Please leave unconnected.
VCC	I	+5 Volts ±5%.
XMIT(+)	I	Input an AC coupled audio signal with respect to ground. (XMIT(–) for the CH1817-D only.
XMIT(–)	I	Input an AC coupled audio signal with respect to GND, CH1817-D only. On all others No Connect.
GND	I	Ground - must be tied to signal and earth ground close to the CH1817. NOTE: The CH1817-L, -LM, -D and -C do not require an earth ground connection. See CH1817-L and CH1817-C Sections.

Ring Detection circuit can be activated by a pull-up resistor on $\overline{RI}$ while V_{CC} has been disconnected from the power supply, thus making the On-Hook power consumption virtually zero (See Figure 4).

CH1817-C: Caller ID

The CH1817-C offers the same features as the CH1817-L with the following additional attribute: Caller ID. There are two pins more on the CH1817-C than the other members of the CH1817 Family. These are CR and CT. By connecting these pins through capacitors and switches to Tip and Ring, the Caller ID signal, which is generated between the first and second rings, can be presented at the RCV output pin. See Figure 2.

CH1817-LM: Reduced XMIT Attenuation

The "-LM" option provides less transmit attenuation (Typ. 6.5 dB) from XMIT to Tip and Ring than the standard CH1817 (Typ. 9.5 dB). This option will be very useful for modem and FAX designs that have a TXA output of -3 dBm and also designs that utilize only +5 VDC and Ground. The former because FCC requires data signals on Tip and Ring not to exceed -9 dBm. The latter because only a very efficient op-amp powered by only +5 VDC can provide a signal at 0 dBm which is required for the standard CH1817.

CH1817-D: 0 dB XMIT Attenuation

The "-D" option has typically 0.0 dB insertion loss with respect to a differential input XMIT(–) to XMIT(+) allowing for -9 dBm signal inputs to be FCC compliant. To use the CH1817-D as a single end input device, ground the XMIT (–) pin through a 0.1 µF capacitor.

Mounting the DAA

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

DESIGN CONSIDERATIONS

The CH1817 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.

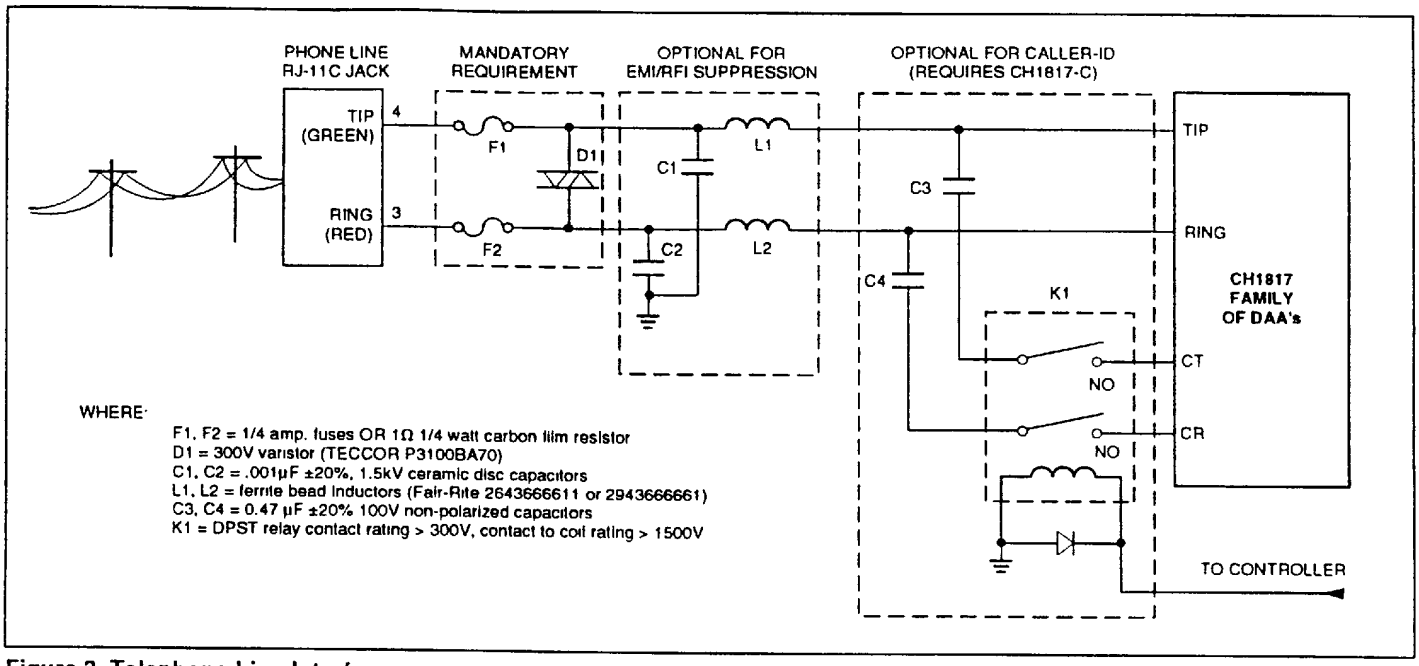


Figure 3. Telephone Line Interface

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, RING, CR, and CT pins must exceed 0.1 inch spacing from all other traces or other conducting material. The purpose for this spacing is to maintain 1500 VDC isolation between the phone line and the other traces. Traces should have a nominal width of 0.020 inches or greater. Contact Cermetek for a suggested layout drawing that can be implemented in your design, especially useful for CH1817-C designs.

4) RING and TIP 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 50 mV peak-to-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 CH1817 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.

7) The CH1817 DAA as is meets or exceeds the hazardous voltage, surge and leakage requirements of the FCC. For applications that connect to Canadian phone lines, governed by the DOC (Department of Communications) and to further protect the CH1817 from field failure on excessively poor quality lines and to maintain U.L. recognition, a higher level of transient protection is required, thereby making mandatory the circuit consisting of two fuses and one varistor as shown in Figure 3. Adding these three devices will not affect FCC registration.

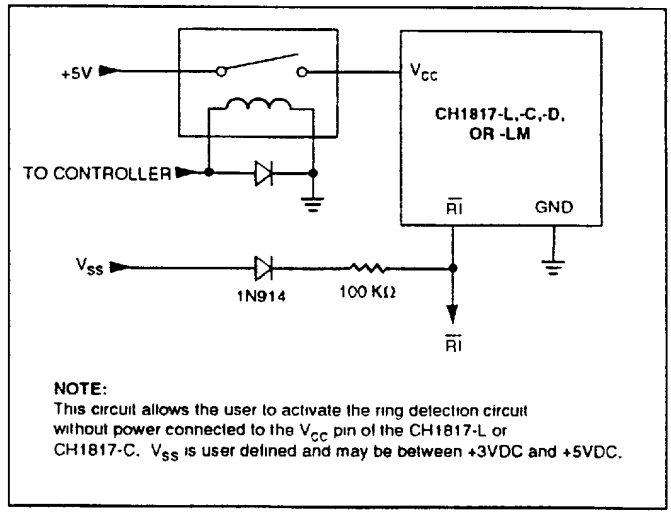


Figure 4. Low Power Ring Detection (CH1817-L, -C, -D, -LM Only)

Components L1, L2, C1, C2 are optional and serve two purposes. First, they restrict high frequency signals from reaching the phone line and thereby add EMI protection. Second, they protect against externally generated RFI from degrading the modem's ability to operate on proper carrier signals. Adding these devices will not affect FCC, DOC, or U.L. registration.

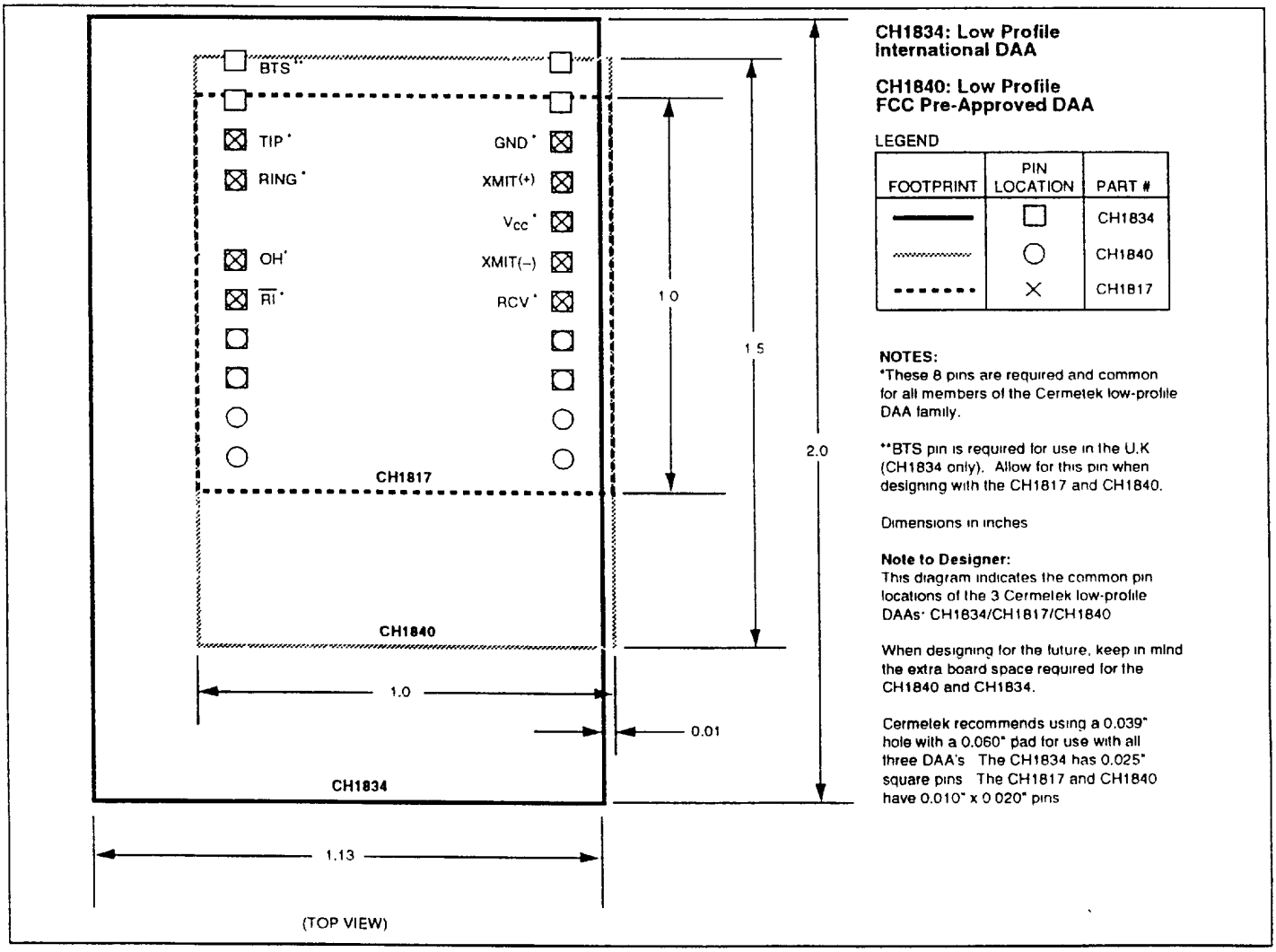


Figure 5. CH1817/CH1834/CH1840 Footprint Compatibility

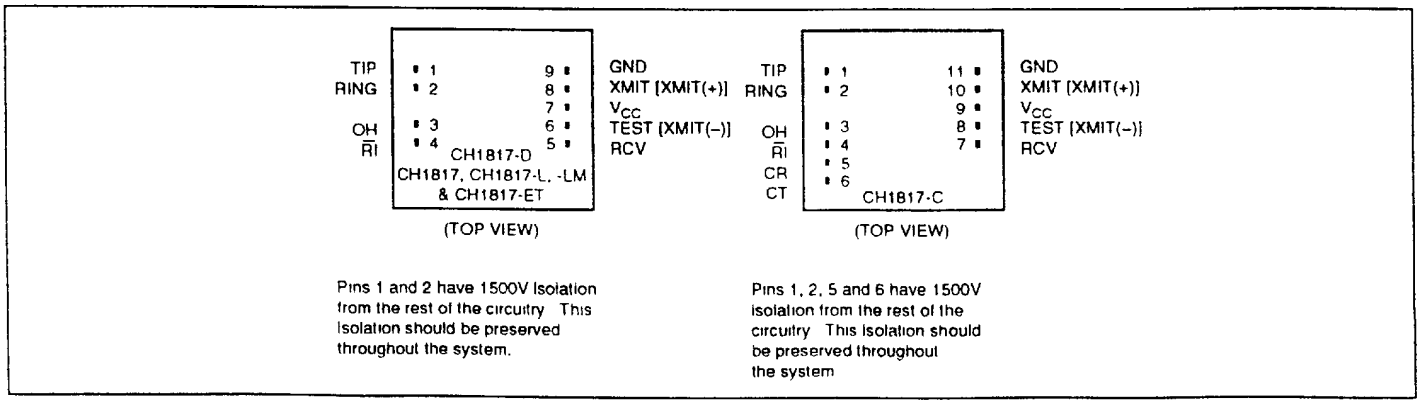
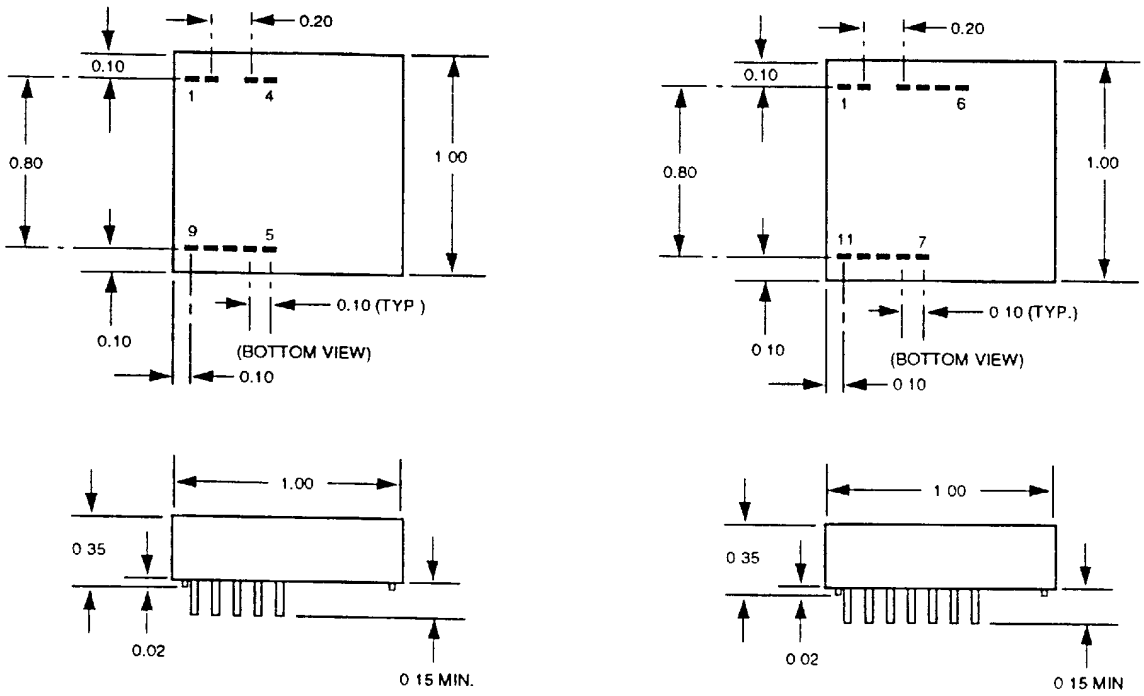


Figure 6. Pin Connections

Table 2.
CH1817 DAA Electrical Specifications
V_{CC} = +5 VDC ±5%, T_A = 0° to 55° C
Order CH1817ET for operating temperature T_A = -40° to +85° C

Parameter	Conditions	Min.	Typ.	Max.	Units
Supply Current	Off Hook,		4	6	mA
	On Hook		0.6	1.5	mA
Transmission Insertion Loss	Attenuation between transmit input and telephone line at 1800 Hz with 600 Ohm termination (CH1817-L and -C)	9.0	9.5	10.0	dB
	CH1817-LM	6.0	6.5	7.0	dB
	CH1817-D with respect to XMIT(–) and XMIT(+)	-0.5	0.0	0.5	dB
Receive Gain	Gain between telephone line and receive output at 1800 Hz with 600 Ohm termination	-0.5	0.0	0.5	dB
Telephone Line Input Impedance	at 1800 Hz	550	600	650	Ohm
Trans-Hybrid Loss	Attenuation between the transmitter input and receiver output at 1800 Hz with 600 Ohm termination	18	23		dB
Transmit Input Impedance	at 1800 Hz	120	150	200	kOhm
Receive Output Impedance	at 1800 Hz		100	1000	Ohm
Ring Detect Sensitivity	AC voltage between Tip and Ring	38			V_{rms}
Ringer Equivalency Number (REN)	Type "A"		0.2		A
Hook Switch Control Current			4		mA
Loop Current		20		80	mA
Weight			10		gm



Notes:
1. Pins are 0.010 inches × 0.020 inches
2. All dimensions are in inches
3. Nominal tolerance ±0.01 inch

Figure 7. Mechanical Specifications

1308 BORREGAS AVENUE • SUNNYVALE, CALIFORNIA 94089 • TEL: (408) 752-5000 FAX (408) 752-5004