PRELIMINARY

CH1835 High Performance V.34/V.FAST Family of Low Profile Data Access Arrangement Modules

Technology patented.

INTRODUCTION

The Cermetek CH1835 Family of Data Access Arrangements (DAAs) are designed to meet the performance requirements of 28.8K bps modems, such as V.34 and V.FAST for embedded applications. The CH1835 uses a patented solid state isolation technology requiring no external transformer. Because the CH1835 meets or exceeds the requirements for V.34, it can be used in lower speed applications as well. The isolation voltage and surge protection meet the North American requirements. The device has been tested to meet FCC Part 68 requirements and is Canadian DOC approvable. The device is compliant with domestic safety agency requirements.

The CH1835 is compatible with all popular V.34/V.FAST modem/fax chip sets. Application examples are included in the data sheet, and additional application assistance is available from Cermetek. The CH1835 is ideal for free-standing or embedded modem designs where small size, lightweight, low power and low cost are required. This includes computer and industrial OEM applications. The CH1835 is a "Quick-to-Market" DAA solution to high performance modem designs. For lower performance, V.32bis and below, the CH1817 and CH1840 are pin compatible DAA families, as well as the CH1827 PCMCIA DAA. Contact Cermetek for technical details.

The CH1835 is the progenitor of a family of more integrated devices due in early 1995 that will be smaller is size, though pin compatible. Further size and cost reduction is made possible by the solid state isolation approach.

FEATURES

- Low Profile
- Complete DAA function
- Compatible with popular V.34/V.FAST modem chip sets
- Operates on low telephone line voltage
- Ring detection
- Built-in 2-wire to 4-wire conversion
- Lightweight
- Multimedia compatible
- +5V operation, Low power
- 1500 Volt isolation
- Differential transmission option
- Compatible with V.34, V.FAST, V.32bis, V.32 and V.TURBO
- FCC Part 68 and DOC compliant

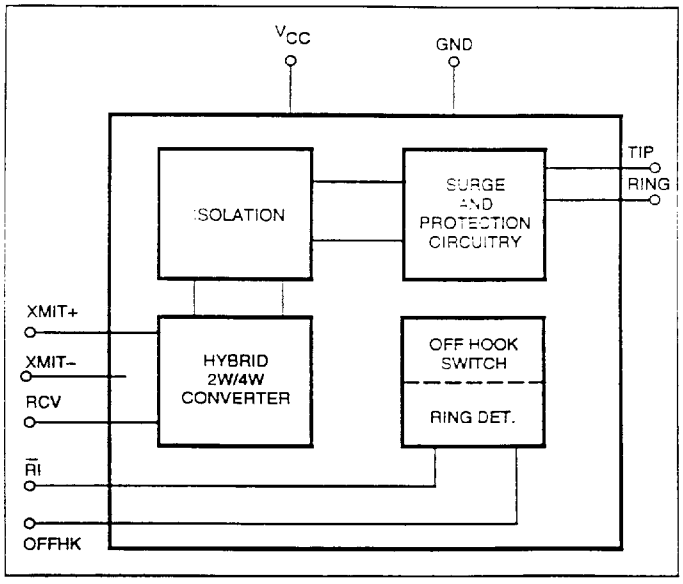

Figure 1. CH1835 DAA Functional Block Diagram

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 the 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 CH1835 Family 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.

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

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Hook Switch Control

The OFFHK input is used to take the CH1835 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 CH1835 in differential mode a XMIT(+) and XMIT(–) pin designation provides a differential input. The CH1835 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 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 0 to -2 dBm.)

XMIT, Input: **Attenuation: 0.0 dB for CH1835**
Input impedance: 150 KΩ
Typical input signal: 0 dBm, or 0.775 Vrms
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 CH1835 does not add any gain to the receive signal. Receive signals can vary from a maximum strength of -9 dBm to below -50 dBm.

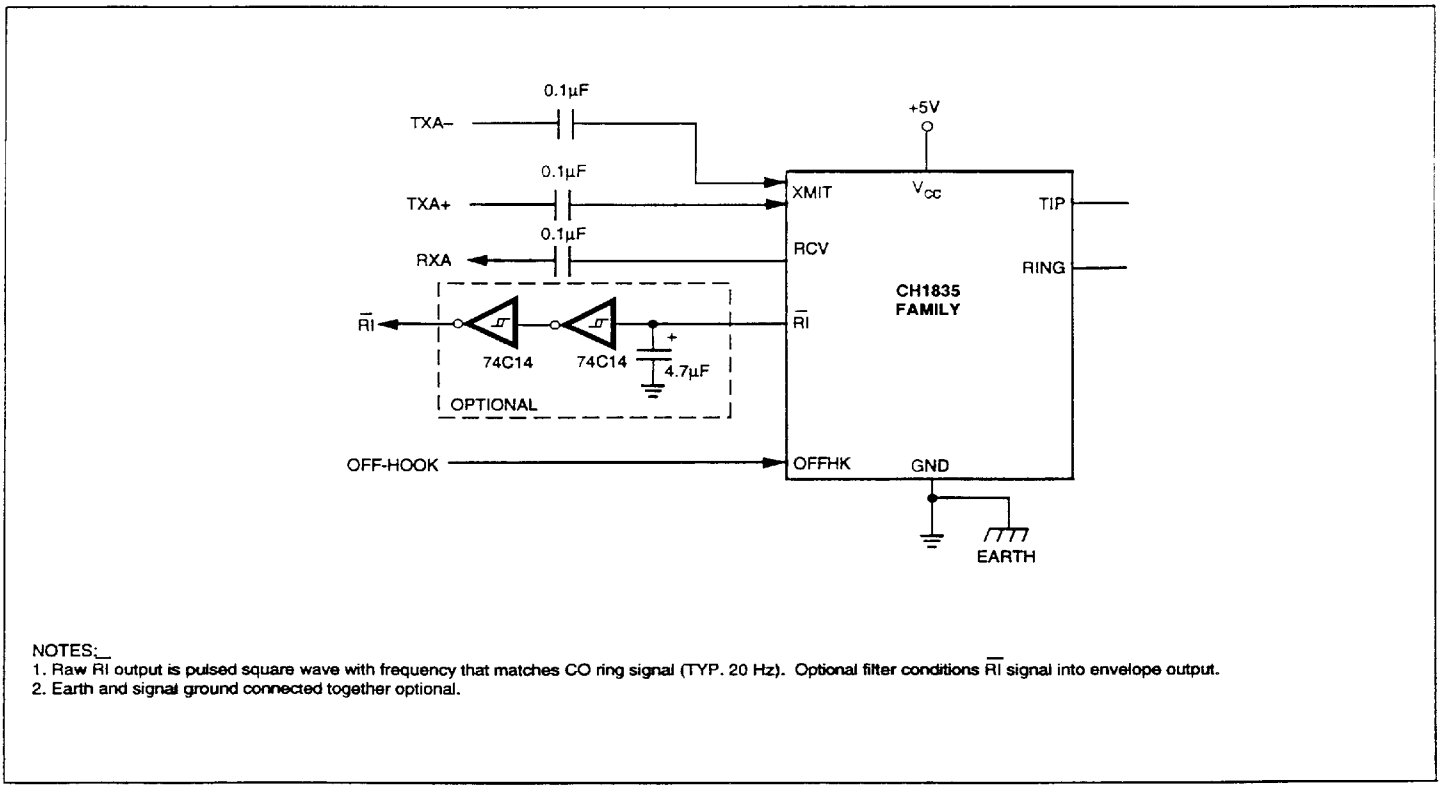
RCV, Output: **Gain: 0 dB**
Output impedance: 100 Ω
Typ. output signal: -9 dBm to -50 dBm, or 0.27 Vrms to 2.5 mVrms
Signal referenced to GND
AC coupling required

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.

CH1835: Low Power

When On-Hook the CH1835 can be configured so that the Ring Detection circuit can be activated by a pull-up resistor on RI while V_{CC} has been disconnected from the power supply, thus making the On-Hook power consumption virtually zero. (See Figure 4.)



NOTES:
1. Raw RI output is pulsed square wave with frequency that matches CO ring signal (TYP. 20 Hz). Optional filter conditions RI signal into envelope output.
2. Earth and signal ground connected together optional.

Figure 2. Typical Application

Table 1. CH1835 Pin Descriptions

NAME	I/O	PIN #	FUNCTION
TIP	I/O	1	Direct telephone line connection.
RING	I/O	2	Direct telephone line connection.
OFFHK	I	3	When set LOW, the CH1835 is placed On-Hook. When set HIGH, the CH1835 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 degradation may occur if OFFHK is set HIGH before $\overline{RI}$ returns to its HIGH state.
$\overline{RI}$	O	4	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.
RCV	O	5	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.
VCC	I	7	+5 Volts ±5%.
XMIT(+)	I	8	Input an AC coupled audio signal with respect to ground when not in differential mode. [XMIT(+) for the differential versions only.]
XMIT(–)	I	6	Input an AC coupled audio signal for the differential versions only. Otherwise No Connect when not in differential mode. (This pin can be connected to ground through a 0.1 µF capacitor to provide single ended input via Pin 8.)
GND	I	9	Ground

DESIGN CONSIDERATIONS

The CH1835 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. For RJ-11 use two center pins.

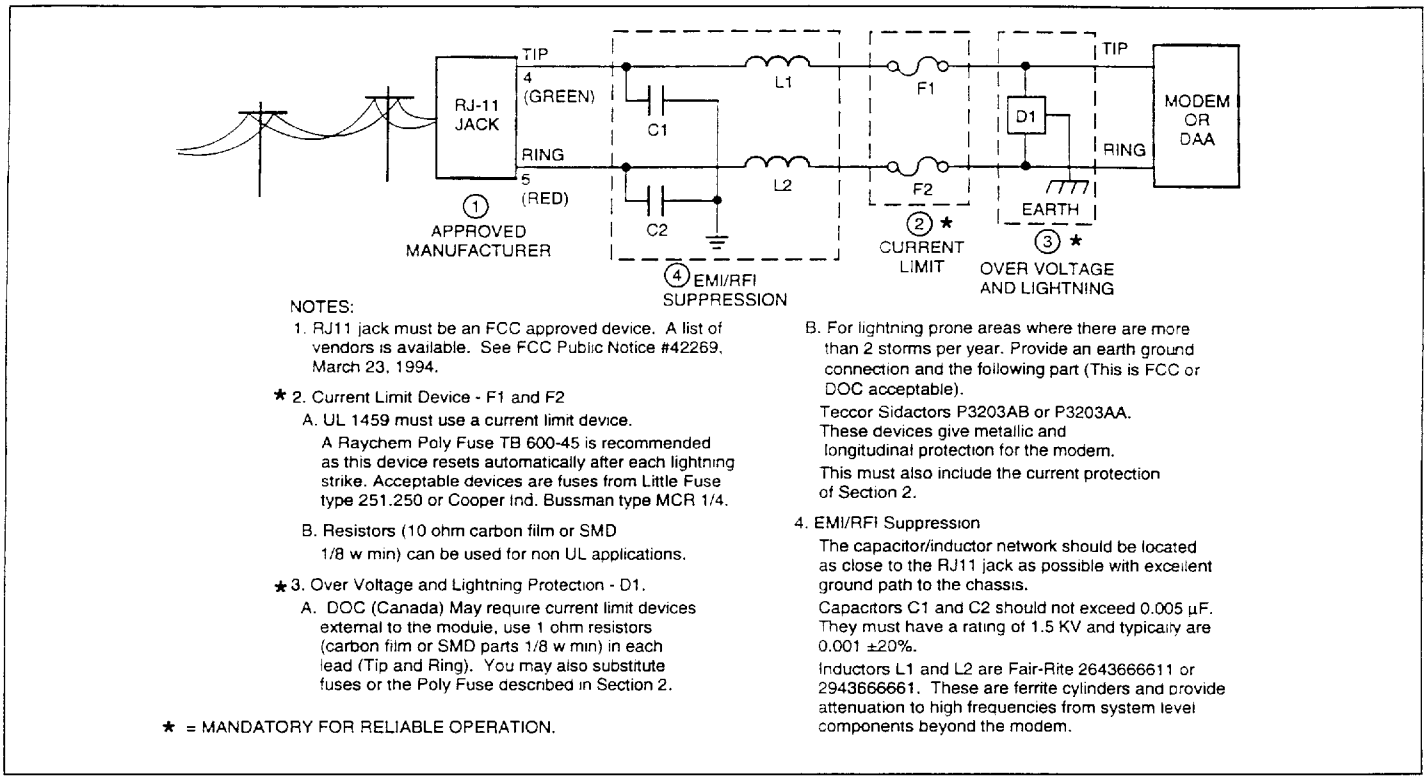
3) Circuit board traces from the DAA's TIP and RING pins must exceed 0.1 inch spacing from all other traces or other conducting material. The purpose for this spacing is to maintain 1500 VDC isolation between the phone line and the other traces. Traces should have a nominal width of 0.020 inches or greater.

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 -9 dBm. 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 CH1835 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 CH1835 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 CH1835 from field failure on excessively poor quality lines, as well as 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.



NOTES:

1. RJ11 jack must be an FCC approved device. A list of vendors is available. See FCC Public Notice #42269, March 23, 1994.

★ 2. Current Limit Device - F1 and F2

A. UL 1459 must use a current limit device.
A Raychem Poly Fuse TB 600-45 is recommended as this device resets automatically after each lightning strike. Acceptable devices are fuses from Little Fuse type 251.250 or Cooper Ind. Bussman type MCR 1/4.

B. Resistors (10 ohm carbon film or SMD 1/8 w min) can be used for non UL applications.

★ 3. Over Voltage and Lightning Protection - D1.

A. DOC (Canada) May require current limit devices external to the module, use 1 ohm resistors (carbon film or SMD parts 1/8 w min) in each lead (Tip and Ring). You may also 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 the following part (This is FCC or DOC acceptable).
Teccor Sidactors P3203AB or P3203AA.
These devices give metallic and longitudinal protection for the modem.
This must also include the current protection of Section 2.

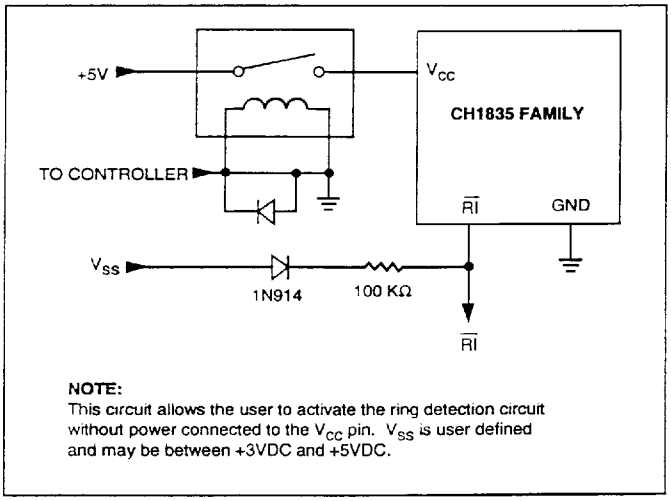
4. EMI/RFI Suppression
The capacitor/inductor network should be located as close to the RJ11 jack as possible with excellent ground path to the chassis.
Capacitors C1 and C2 should not exceed 0.005 µF. They must have a rating of 1.5 KV and typically are 0.001 ±20%.
Inductors L1 and L2 are Fair-Rite 2643666611 or 2943666661. These are ferrite cylinders and provide attenuation to high frequencies from system level components beyond the modem.

★ = MANDATORY FOR RELIABLE OPERATION.

Figure 3. Telephone Line Interface

Mounting the DAA

The CH1835 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. When using sockets, mechanical restraint of the CH1835 should be provided to keep the component seated through vibration and shock. 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.



NOTE:
This circuit allows the user to activate the ring detection circuit without power connected to the V_{CC} pin. V_{SS} is user defined and may be between +3VDC and +5VDC.

Figure 4. Low Power Ring Detection

Table 2. CH1835 DAA Electrical Specifications

V_{CC} = +5 VDC ±5%, T_A = 0° to 55° C

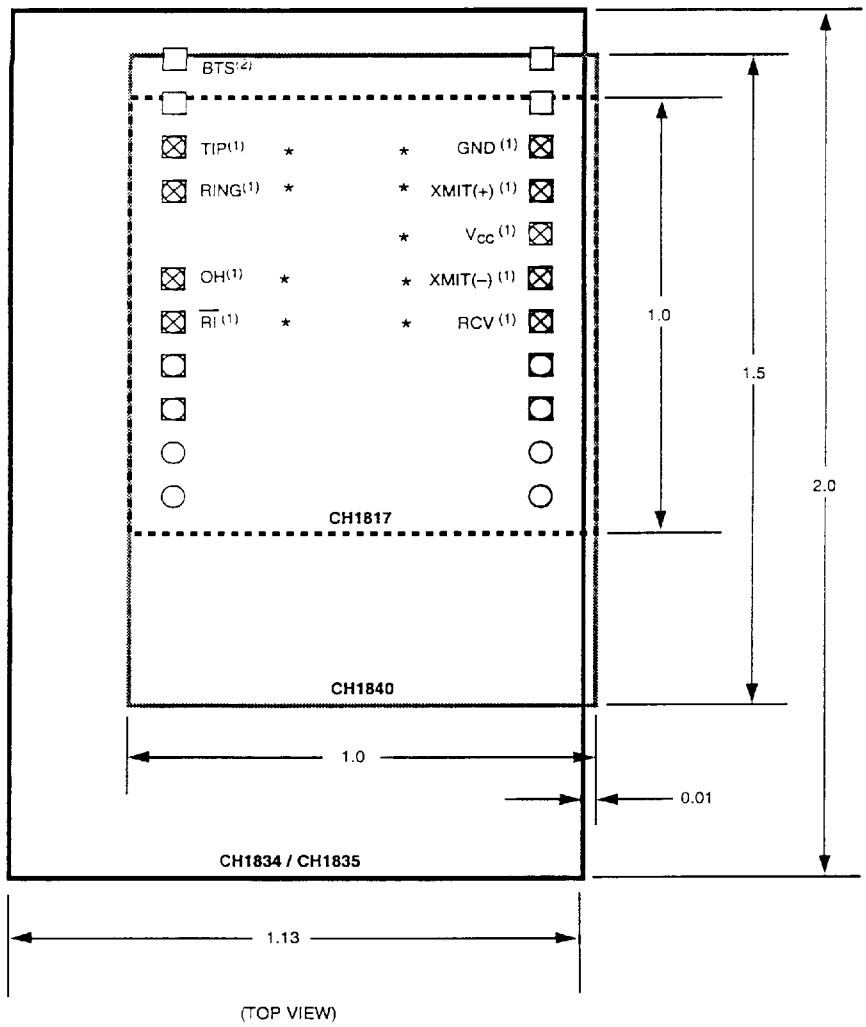
Parameter	Conditions	Min.	Typ.	Max.	Units
Logic					
Input HIGH		2.4			V
Input LOW				0.4	V
Input Leakage HIGH				500	µA
Input Leakage LOW				–500	µA
Output HIGH	I_{OH} = 0.05 mA	3.0			V
Output LOW	I_{OL} = 2.0 mA			0.4	V
Isolation Protection	Between Tip, Ring and all other pins	1500			Vdc
Surge Protection	Between Tip, Ring and all other pins	2500			Vpeak

(Table continues)

Table 2. CH1835 DAA Electrical Specifications (continued)

V_{CC} = +5 VDC ±5%. T_A = 0° to 55° C

Parameter	Conditions	Min.	Typ.	Max.	Units
Transmission Insertion Loss	Attenuation between the transmitter input and telephone line at 1800 Hz, with 600 Ω resistive termination (flat from 300–4000 Hz)	-0.5	0	+0.5	dB
Frequency Response (Ref = 1800 Hz Transmit)	200 Hz – 4 K Hz	-0.2		+0.2	dBm
Group Delay Transmit 2nd/3rd/4th harmonic	200 Hz – 4 K Hz –9 dBm transmit power		20		µs
Distortion Noise-Transmit	–3 dBm transmit power 400 Hz to 4 K Hz		-89		dBm
Receive Gain	Gain between telephone line and receive output at 1800 Hz with 600 Ω resistive termination (flat from 300 – 4000 Hz)	–0.5	0	+0.5	dB
Receive Freq. Response (Ref = 1800 Hz Receive)	200 Hz – 4K Hz	-0.2		+0.2	dBm
Group Delay - Receive	200 Hz – 4K Hz		20		µs
Receive 2nd/3rd/4th harmonic distortion	–9 dB at Tip and Ring		-89		dBm
Noise - Receive	400 Hz – 4 K Hz		-90		dBm
Tel. Line Input Impedance	at 1800 Hz	550	600	650	Ohm
On-Hook Impedance		10	20		M Ohm
Loop Current	48 Volts from Tip to Ring Off-Hook	20		120	mA
Tip/Ring DC Voltage	Loop Current 20 mA (Complies with Bell & DOC low voltage recommendations)	4		6	V
AC Input Impedance	200 Hz – 4 K Hz	550	600	650	Ohm
Longitudinal Balance FCC Part 68.310 and DOC	Oh = 0 (On hook) Oh = 1 (Off hook)	60 66			dBm dBm
Return Loss (Zref = 600 Ω +2.6 MF)	200 Hz – 4 K Hz	25			dBm
On-Hook DC Impedance	0 – 100 V 100 – 200 V	10 30			M Ohm K Ohm
On-Hook AC Impedance	15.3 – 68 Hz 40 Vrms – 150 Vrms on 52 Vdc or 105 Vdc	20		40	K Ohm
Off-Hook Current	OFFHK = 5 volts		0.5	1.0	mA
Trans-Hybrid Loss	Attenuation between the transmitter input and receiver output at 1K Hz, with 600 Ω resistive termination	22	35		dB
CMRR (Common Mode Nose Rejection)		100			dBm
Transmit Input Impedance	at 1800 Hz	120	150	200	k Ohm
Receive Output Impedance	at 1800 Hz		10	100	Ohm
Ring Detect Sensitivity	AC voltage between Tip and Ring	38			Vrms
Hook Switch Control Current	Driver capable of sourcing	4			mA
Weight			40		gm
Supply Current	V_{CC} = +5 Vdc ±5%, Off Hook V_{CC} = +5 Vdc ±5%, On Hook		25 0.6	1.5	mA mA



LEGEND

FOOTPRINT	PIN LOCATION	PART #
———	□	CH1834
———	*	CH1835
———	○	CH1840
- - - - - -	×	CH1817

NOTES:
1. These 8 pins are required and common for all members of the Cermetek low-profile DAA family.

2. BTS pin is required for use in the U.K. (CH1834 only). Allow for this pin when designing with the CH1817 and CH1840.

3. Dimensions in inches.

Note to Designer:
This diagram indicates the common pin locations of 4 Cermetek low-profile DAAs: CH1834, CH1817, CH1840, CH1835.

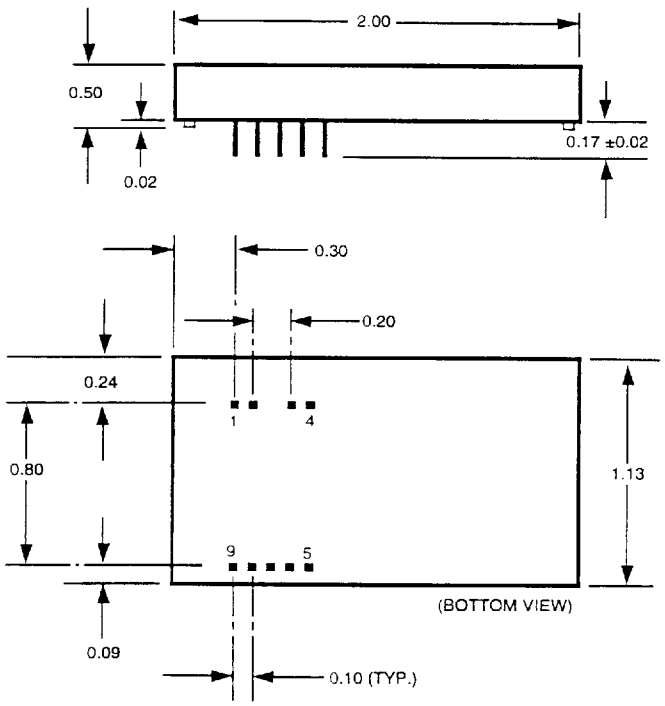
When designing for the future, keep in mind the extra board space required for the CH1840, CH1834, and CH1835.

Cermetek recommends using a 0.039" hole with a 0.060" pad for use with all four DAAs. The CH1834 and CH1835 have 0.025" square pins. The CH1817 and CH1840 have 0.010" x 0.020" pins.

Figure 5. CH1834/CH1835/CH1817/CH1840 Footprint Compatibility

Applications Support

Cermetek Microelectronics offers applications support in the use of all its products. If you desire further information, including application diagrams showing the CH1835 with AT&T and Rockwell V.FAST chip sets, please call Cermetek at 408-752-5000, ext. 19.



PIN ASSIGNMENT

PIN	FUNCTION	PIN	FUNCTION
1	TIP	5	RCV
2	RING	6	XMIT (–)
	(NO PIN)	7	V_{CC}
3	OFFHK	8	XMIT (+)
4	RI	9	GND

NOTES:
1. ALL PINS ARE 0.025 INCH SQUARE
2. ALL DIMENSIONS IN INCHES
3. NOMINAL TOLERANCE ±0.01 INCH

Figure 6. Mechanical Specifications and Pin Assignments

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