Cermetek Microelectronics, Inc.

CH1837/CH1838 High Performance V.34/V.FAST Family of High Speed Data Access Arrangement Modules

INTRODUCTION

The Cermetek CH1837/CH1838 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. Because the CH1837/1838 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 CH1837/1838 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 CH1837/1838 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 CH1837/1838 is a "Quick-to-Market" DAA solution to high performance modem designs. For lower performance, V.32bis and below, the CH1835, CH1817, and CH1840 are pin compatible DAA families, as well as the CH1827 PCMCIA DAA. Contact Cermetek for technical details.

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 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 CH1837/1838 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.

$\overline{RI}$ 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
- Compatible with popular V.34/V.FAST modem chip sets
- Ring detection
- Built-in 2-wire to 4-wire conversion (CH1837)
- Multimedia compatible
- +5V operation, Low power
- 1500 Volt isolation
- Caller ID (CH1837/CH1838C)
- Differential transmission (CH1837)
- Compatible with V.34, V.FAST, V.32bis, V.32 V.TURBO, V.22bis ,and V.22
- FCC Part 68 and DOC compliant

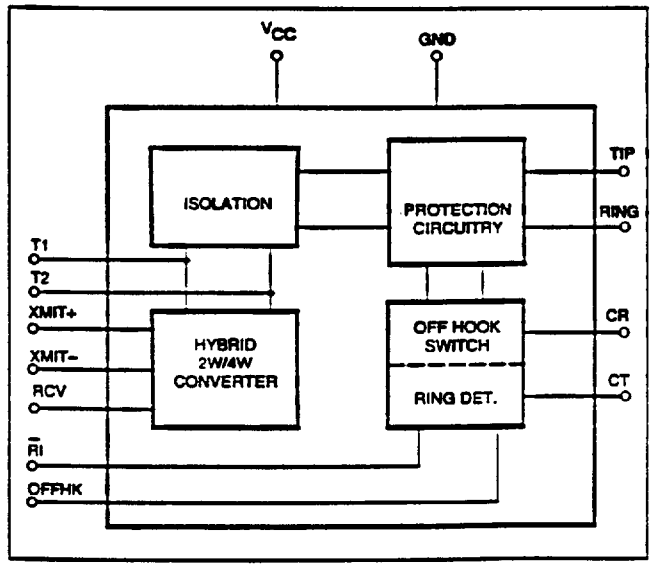

Figure 1. CH1837/CH1838 DAA Functional Block Diagram

Hook Switch Control

The OFFHK input is used to take the CH1837/CH1838 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

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Transmit Signal (CH1837)

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. The XMIT(+) pin must be connected to GND via a 0.1 µF capacitor for proper single-ended input operation. For the CH1837 in differential mode use pins XMIT(+) and XMIT(-). The CH1837 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 CH1837
Input impedance: 150KΩ
Typical input signal: 0dBm or 0.775Vrms
Signal referenced to GND
AC coupling required

Receive Signal (CH1837)

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 CH1837 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: 100Ω
Typical output signal: -9dBm to -50dBm, or 0.27Vrms to 2.5 mVrms
Signal referenced to GND
AC coupling required

CH1837 (With 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 received XMIT signal to the applied XMIT signal is called Trans-Hybrid Rejection, or Trans-Hybrid Loss.

CH1838 (Without 2-Wire to 4-Wire Converter)

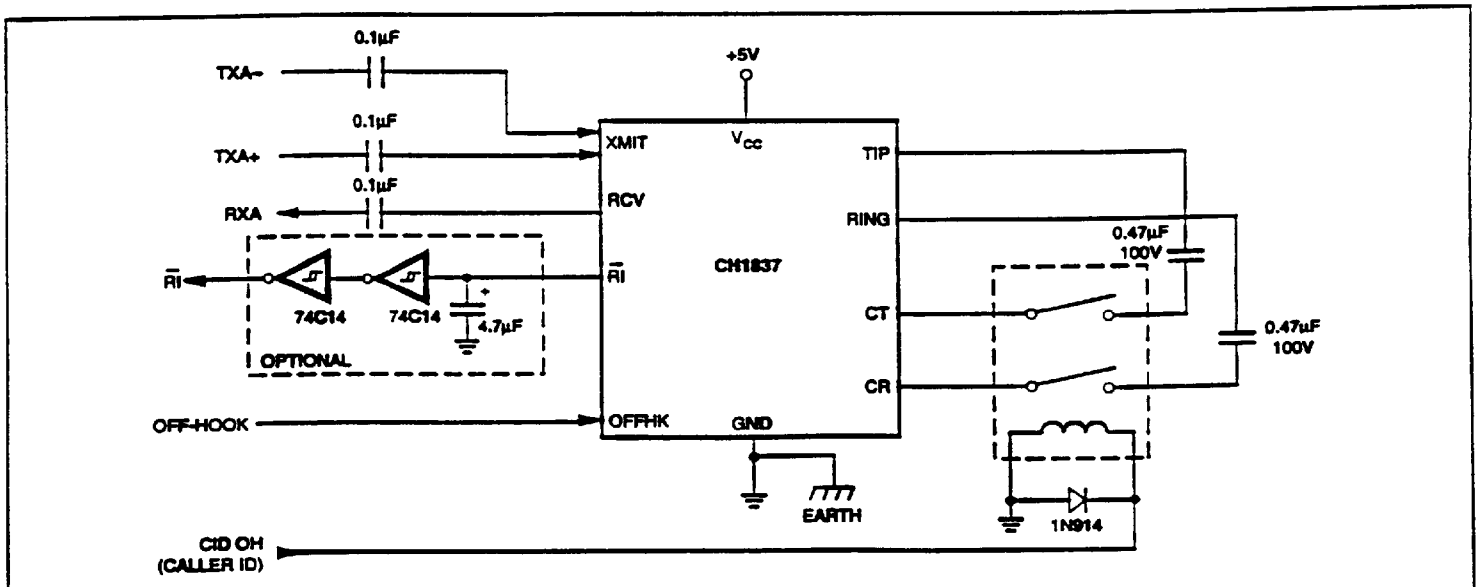
The T1 (Pin 8) and T2 (Pin 5) leads connect to the internal transformer secondary pins. They provide isolation from the telephone line and give access to those applications not requiring a 2-/4-wire converter. Figure 4 shows a typical application using a V.34 modem chip set with built-in 2-/4-wire conversion. The telephone interface is the same and is shown in Figure 3. Other application notes for specific chip sets are available from Cermetek.

CH1837/CH1838: Low Power

When On-Hook the CH1837/CH1838 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 5.)

CH1837C/CH1838C: Caller ID

With the CH1837C and the CH1838C, there are two pins more than the other members of the CH1837/CH1838 Family. These pins 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.)



NOTES:
1. Raw $\overline{RI}$ output is pulsed square wave with frequency that matches CO ring signal (TYP. 20 Hz). Optional filter conditions $\overline{RI}$ signal into envelope output.
2. CT and CR are applicable to CH1837C/CH1838C.
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. Earth and signal ground connected together optional.

Figure 2. Typical Application

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Table 1. CH1837/CH1838 Pin Descriptions

CH1837	CH1838	I/O	PIN #	FUNCTION
TIP	TIP	I/O	1	Direct telephone line connection.
RING	RING	I/O	2	Direct telephone line connection.
OFFHK	OFFHK	I	3	When set LOW, the CH1837/CH1838 is placed On-Hook. When set HIGH, the CH1837/CH1838 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.
$\overline{RI}$	$\overline{RI}$	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.
—	T1	I/O	5	Transformer connection to secondary side inside the CH1838.
XMIT(–)	NC	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.)
V_{CC}	V_{CC}	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.]
—	T2	I/O	8	Transformer connection to secondary side inside the CH1838.
GND	GND	I	9	Ground
CR	CR	I	10	Caller ID telephone connection. This should be connected to a switch, or relay, a 0.47 µF, 100V capacitor, and finally to Ring. When this switch is closed, along with the switch on CT, the CH1837C/CH1838C will AC terminate the telephone line and present the Caller ID signal at RCV.
CT	CT	I	11	Caller ID telephone connection. This should be connected to a switch, or relay, a 0.47 µF, 100V capacitor, and finally to Tip. When this switch is closed, along with the switch on CR, the CH1837C/CH1838C will AC terminate the telephone line and present the Caller ID signal at RCV.

DESIGN CONSIDERATIONS

The CH1837/CH1838 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.

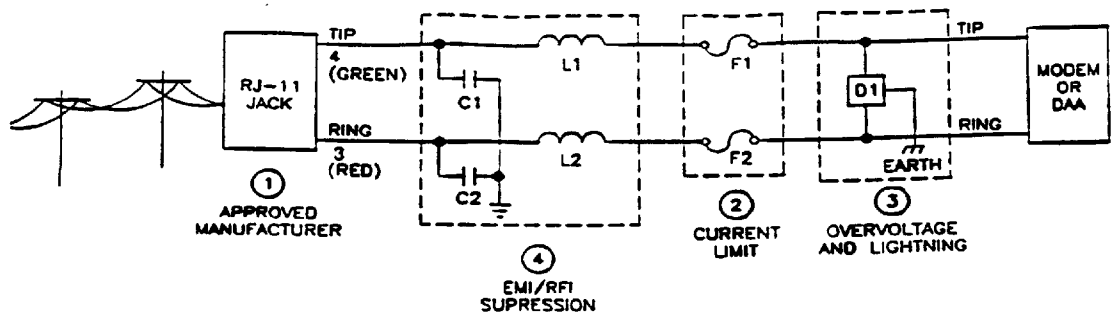
1) The mounting of the DAA in the final assembly must be made so that it is isolated from exposure to any hazardous voltages within the assembly. Adequate separation and restraint of cables and cords must be provided.

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



1) Manufacturers list - see FCC Public Notice #42269, dated 3/23/94. RJ11 Jacks must be provided by one of the vendors on this list.

*2) Current Line Device: F1 and F2 - 1.25 amp

A. UL 1459 must use a current limit device. A Raychem Poly Fuse TR 600-150 is recommended as this device resets automatically after each power cross. Acceptable devices are fuses from Little Fuse, type 25101.5 or Cooper Ind. Bussman, type MCR 1½.

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

A. DOC (Canada) May require current limit devices external to the module. Use 1ohm resistors (carbon film or SMD parts 1/8 w min) in each lead (Tip and Ring). You may also substitute fuses or the PolyFuse 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 P3100BA70. 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 .005 mF. They must have a rating of 1.5 KV and typically are on .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

• Mandatory for reliable operation.

Figure 3. Telephone Line Interfaces

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 CH1837/CH1838 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 CH1837/CH1838 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 CH1837/CH1838 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.

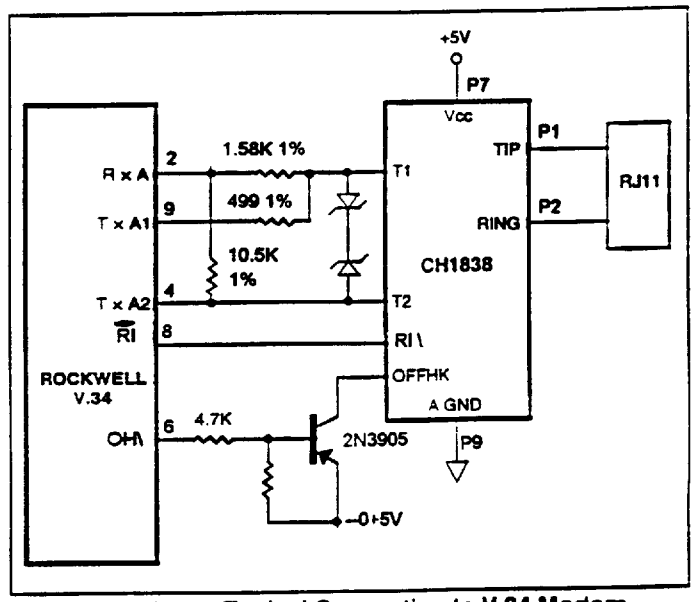


Figure 4. CH1838 Typical Connection to V.34 Modem Chip Set or Socket Modem

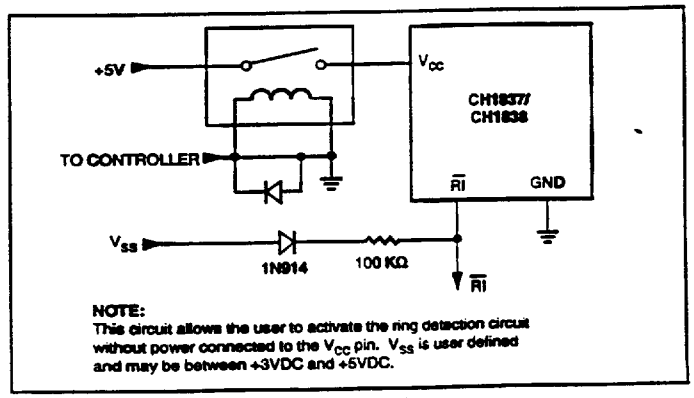


Figure 5. Low Power Ring Detection

Table 2. CH1837 DAA Electrical Specifications

V_{CC} = +5 VDC ± 5%. T_A = -20° to + 70° C

Parameter	Conditions	Min.	Typ.	Max.	Units
Logic Input HIGH Input LOW Input Leakage HIGH Input Leakage LOW Output HIGH Output LOW	 I_{OH} = 0.05 mA I_{OL} = 2.0 mA	 2.4 3.0 	 	 0.4 500 -500 0.4	 V V µA µA V V
Isolation Protection	Between Tip, Ring and all other pins	1500			Vdc
Surge Protection	Between Tip, Ring and all other pins	2500			Vpeak
Transmission Insertion Loss	Attenuation between the transmitter input and telephone line at 1800 Hz, with 600 Ω resistive termination (flat from 300-4000 Hz)	-0.8	0	+0.8	dB
Frequency Response (Ref = 1800 Hz Transmit)	200 Hz - 4 K Hz	-0.3		+0.3	dBm
Distortion Noise-Transmit	-10 dBm transmit power (600 Hz)			-82	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	-0.3		+0.3	dBm
Receive 2nd/3rd/4th harmonic distortion	-10 dB at Tip and Ring			-82	dBm
Noise - Receive	400 Hz - 4 K Hz		-82		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		100	mA
Longitudinal Balance FCC Part 68.310 and DOC	OH = 0 (On hook) OH = 1 (Off hook)	66 66			dBm dBm
Return Loss (Zref=600Ω, 2.16µfd)	1 K Hz	25			dBm
Trans-Hybrid Loss	Attenuation between the transmitter input and receiver output at 1K Hz, with 600 Ω complex termination	22	25		dB
Transmit Input Impedance	at 1800 Hz	120	150	200	kOhm
Receive Output Impedance	at 1800 Hz		10	100	Ohm
Ring Detect Sensitivity	AC voltage between Tip and Ring	38			Vms
Hook Switch Control Current	Driver capable of sourcing	4			mA
Weight			20		gm
Supply Current	V_{CC} = +5 Vdc ± 5%, Off Hook V_{CC} = +5 Vdc ± 5%, On Hook		 5	8	mA mA
Ringer Equivalence	Type A		0.2		REN

Table 3. CH1838 DAA Electrical Specifications

V_{CC} = +5 VDC ± 5%. T_A = -20° to +70° 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
Transmission Insertion Loss	Attenuation between the transmitter input and telephone line at 1800 Hz, with 600 Ω resistive termination (flat from 300-4000 Hz)	1.2	1.4	1.6	dB
Frequency Response (Ref = 1800 Hz Transmit)	200 Hz - 4 K Hz	-0.3		+0.3	dBm
Distortion Noise-Transmit	-10 dBm transmit power (600 Hz)			-82	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	-0.3		+0.3	dBm
Receive 2nd/3rd/4th harmonic distortion	-10 dB at Tip and Ring			-82	dBm
Noise - Receive	400 Hz - 4Hz		-85		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		100	mA
Longitudinal Balance FCC Part 68.310 and DOC	OH = 0 (On hook) OH = 1 (Off hook)	66 66			dBm dBm
Return Loss (Zref=600Ω, 2.16µfd)	1 K Hz	25			dBm
Ring Detect Sensitivity	AC voltage between Tip and Ring	38			Vms
Hook Switch Control Current	Driver capable of sourcing	4			mA
Weight			20		gm
Supply Current	V_{CC} = +5 Vdc ± 5%, Off Hook V_{CC} = +5 Vdc ± 5%, On Hook		<1	4	mA mA
Ringer Equivalence	Type A		0.2		REN

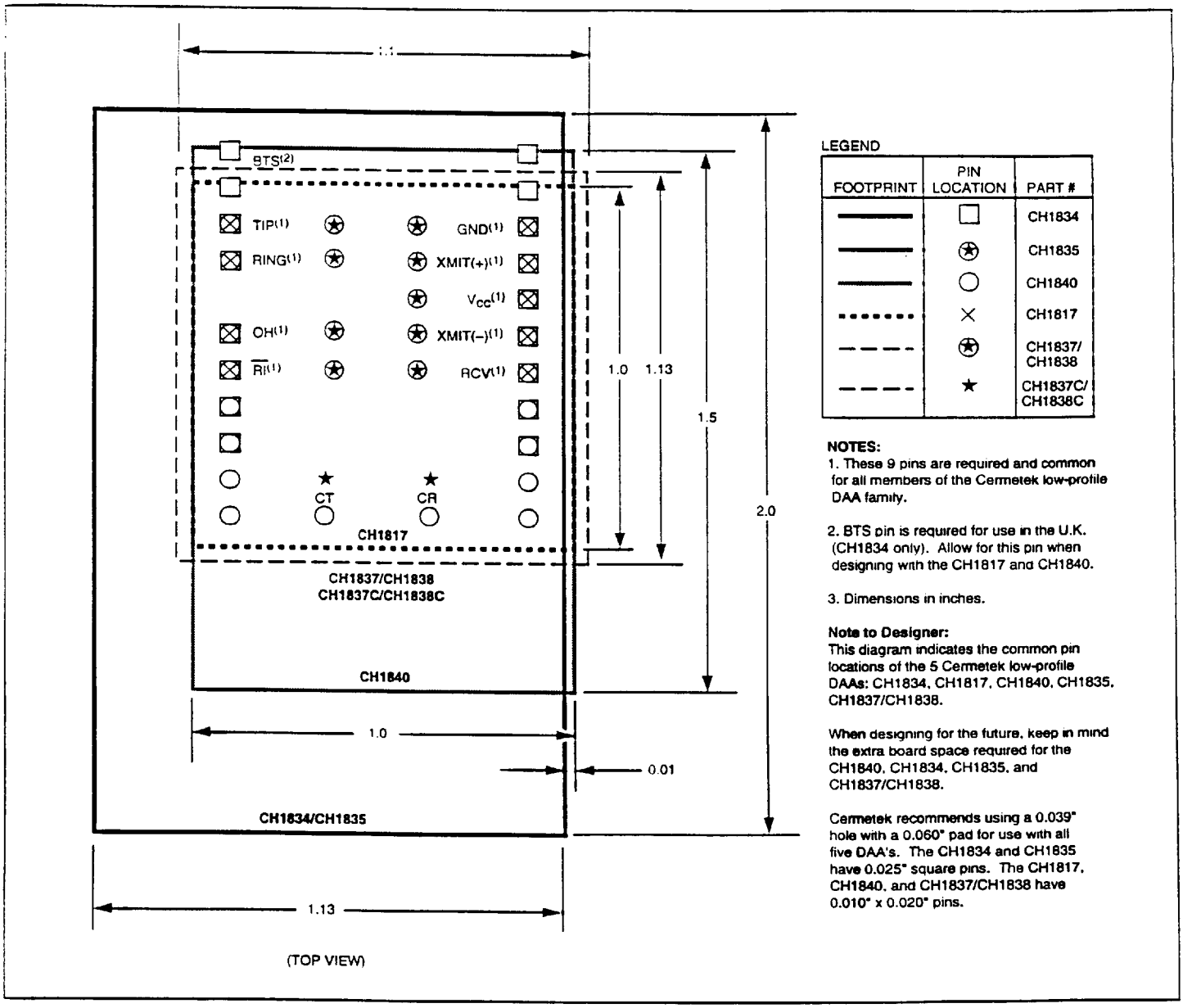


Figure 6. CH1837/1838, CH1834/CH1835, CH1817, CH1840 Footprint Compatibility

Mounting the DAA

The CH1837/CH1838 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 CH1837/CH1838 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.

Applications Support

Cermetek Microelectronics offers applications support in the use of all its products. If you desire further information, including application diagrams showing the CH1837/CH1838 with AT&T and Rockwell V.FAST chip sets, please call Cermetek at 408-752-5000, ext. 19.

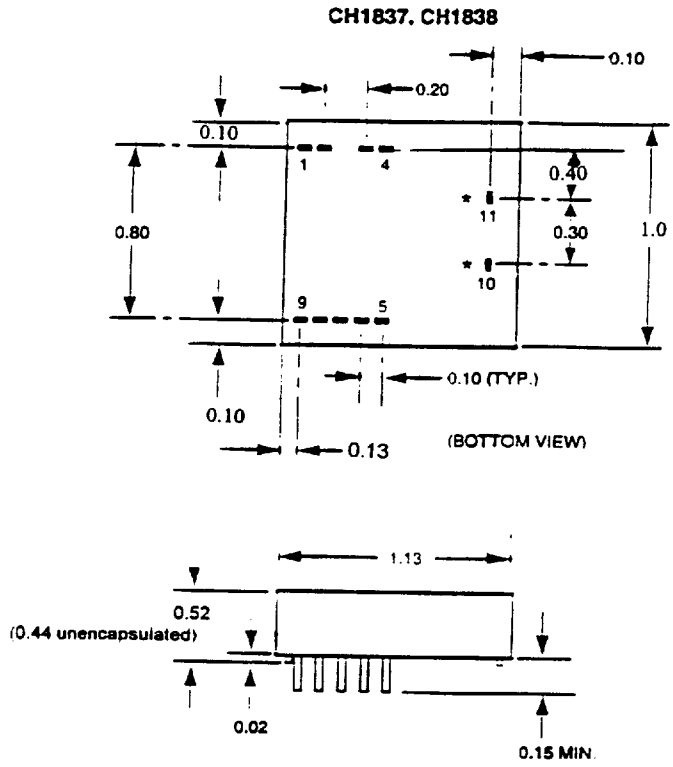


Figure 7. Mechanical Specifications

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