



## CH1808 Telephone Line Status Detector

### INTRODUCTION

The CH1808 Telephone Line Status Detector can detect severed lines, off-hook status, remote disconnect, and incoming call ringing. The device is ideal for security systems, alarm systems, or critical instrumentation products where it is essential that the status of the telephone line be monitored. Because the detector accesses the public switched telephone lines, it must be FCC Part 68 approved. This approval is provided with conveyed registration. A sticker is supplied for mounting on the user equipment to indicate compliance with FCC Part 68 requirements.

The CH1808 operates on a single 5V supply and is housed in a single in-line package. 1.4" long and 0.45" high requiring minimal PCB area. It employs three logic outputs: Local Loop Monitor (LLM), Ring Indication ( $\overline{\text{RI}}$ ), and Off-Hook Detect ( $\overline{\text{OHD}}$ ). The LLM output becomes active when the CH1808 detects a loss of voltage resulting from a cut line or when another device goes off-hook on the same line. The  $\overline{\text{RI}}$  becomes active when the telephone company Central Office (CO) applies a ringing signal to the telephone line. The  $\overline{\text{OHD}}$  becomes active when current on the line is detected caused by the handset removal from the cradle of a telephone set that is connected to the Tip and Ring Out port. The  $\overline{\text{OHD}}$  can also be used to detect a remote line disconnect.

### PRINCIPLES OF OPERATION

The operation of the CH1808 can be characterized by the following functional blocks:

Local loop voltage loss detect  
Ring detect  
Off-hook/current detect

Figure 1 shows these blocks and their input and output functions. In the Public Switched Telephone Network (PSTN), the wires from a telephone set to the CO are referred to as the local loop. This loop is connected to the CH1808 via the Telco port TIP and RING pins. Drawing current from the local loop signals to the CO that the telephone is off-hook. This occurs either when answering a call or when placing a call.

### LOCAL LOOP VOLTAGE LOSS DETECTION

The CH1808 detects a cut line or another device off-hook on the local loop by the reduction of the line voltage between TIP and RING terminals. This voltage is always present whether the telephone line is in use or idle. The line voltage must be at least 18 V to indicate the presence of the line. All North American PSTN lines and most "wet" active lease lines can use the Local Loop Voltage Loss Detect function. "Dry" leased lines may not be used with the CH1808 because there is no voltage present. When the line drops below 18 V due to a cut line or other device that is off-hook on the local loop, the LLM output is driven high.

### FEATURES

- FCC Part 68 approved
- Used on public switched telephone lines and "wet" leased lines.
- Detects off-hook on the local loop
- Detects automatic off-hook for separate telsets
- Detects a severed telephone cable; does not require polling
- Detects incoming ringing
- Optionally configured for remote off-hook detection
- Requires minimum PCB area by using single in-line package (SIP)
- Operates at low power and uses a single +5 V supply

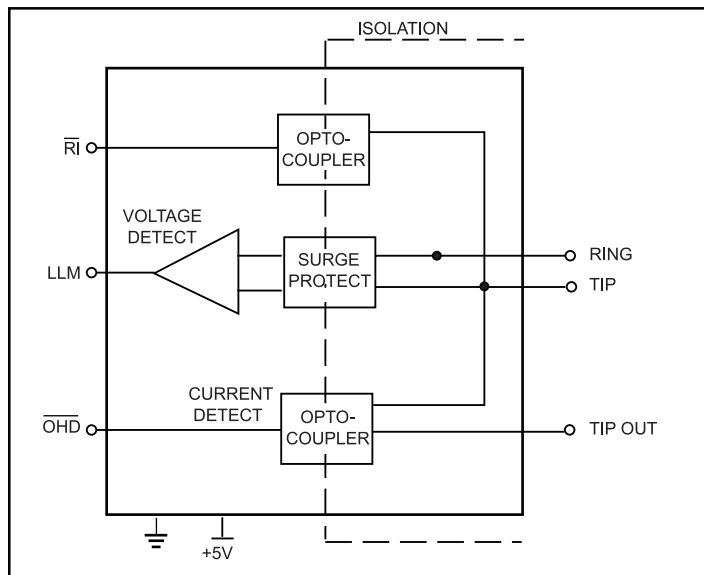


Figure 1. CH1808 Block Diagram

The LLM output has 45 k $\Omega$  pull-up resistance to +5 V and 2.2  $\mu\text{F}$  capacitance to ground. This is provided to filter out zero crossing pulses that can occur during ringing. The residence source of output drive current might not be sufficient for some applications. In these cases, it is permissible to add a lower value resistor (not less than 1 k $\Omega$ ) in parallel between the output and the +5 V pin, if the zero crossing pulses are not objectionable. If more drive current is needed while retaining zero cross filtering, an external capacitor must be added to keep the RC time constant, the same or higher.

When using this Local Loop Monitoring circuit, external leakage and capacitance on the Tip and Ring input must be minimized. Differential leakage to Tip and Ring in excess of 0.1  $\mu\text{A}$  can appear like a CO battery voltage to the monitor circuit.

This could result in the monitor circuit failing to detect a cut line. Similarly, capacitance on the Tip and Ring in excess of 0.1  $\mu\text{F}$  could delay a cut line detection for tens of seconds. Potential sources of capacitance include devices that share the local loop such as modems and extension telephones.

## RING DETECTION

The CO signals an incoming call by placing a ring signal on the local loop. The CH1808 monitors the loop for this signal. The Ring Indication output  $\overline{\text{RI}}$  is normally HIGH. When ringing appears, the  $\overline{\text{RI}}$  output follows the ringing cycle. It is set LOW during the typical 2-second ring period and is restored to HIGH for the typical 4 seconds between rings.

False ring indication may occur during the pulse dialing on the same line. Therefore, the Ring Indication Signal should be ignored whenever any device is off-hook and especially when pulse dialing.

## OFF HOOK/CURRENT DETECTION

The CH1808 supports a telephone connection via the Tip Out and Ring port. The CH1808 will provide a logic compatible indication to the host when attached telephone is taken off hook. The Off-Hook Detect,  $\overline{\text{OHD}}$ , output will be active LOW any time the handset is removed from the telephone cradle. Because pulse dialing is achieved by repeatedly switching the telset on and off-hook, the  $\overline{\text{OHD}}$  will mirror this pulse by switching LOW and HIGH at a typical rate of 10 pulses per second.

## NOISE SUPPRESSION

The CH1808 interfaces a telephone line and as such is subject to transients produced by electrical discharge and ring voltage transition, which could cause momentary false status change detections. While some suppression is built in and is adequate for most applications, additional external capacitance on the outputs may be desirable. The capacitance value that may have to be added to each output should be determined by appropriate analysis and testing for each particular application. It is suggested that the outputs be level detected as opposed to edge detected to indicate line status. This will minimize the possibility of false indications on excessively noisy lines.

## APPLICATIONS

The following are some typical applications for the CH1808.

### OFF-HOOK DETECT

In Telset 2 on the Tip Out port is off-hook, the  $\overline{\text{OHD}}$  is driven LOW as shown in Figure 2. This activates a relay disconnecting Telset 1 from the Telco Tip line.

### RING DETECTION

The  $\overline{\text{RI}}$  output is in raw form from an opto-isolator. The circuitry shown in Figure 3 converts this raw output to a clean logic output. The 4.7 mF capacitor suppresses the  $\overline{\text{RI}}$  return to HIGH during zero-crossing of the ring pulse and holds  $\overline{\text{RI}}$  around 0.2 V. The comparator circuit maintains a steady output when  $\overline{\text{RI}}$  is active. The comparator circuit may be substituted with a NAND gate.

The  $\overline{\text{RI}}$  output from the CH1808 can be applied directly to a micro-processor input port and the signal debouncing can be done in software. The pulse frequency during ringing is twice that of the signal from the CO. The CO signal is usually 20 Hz but older CO systems may provide signals that range from 15.3 to 68 Hz.

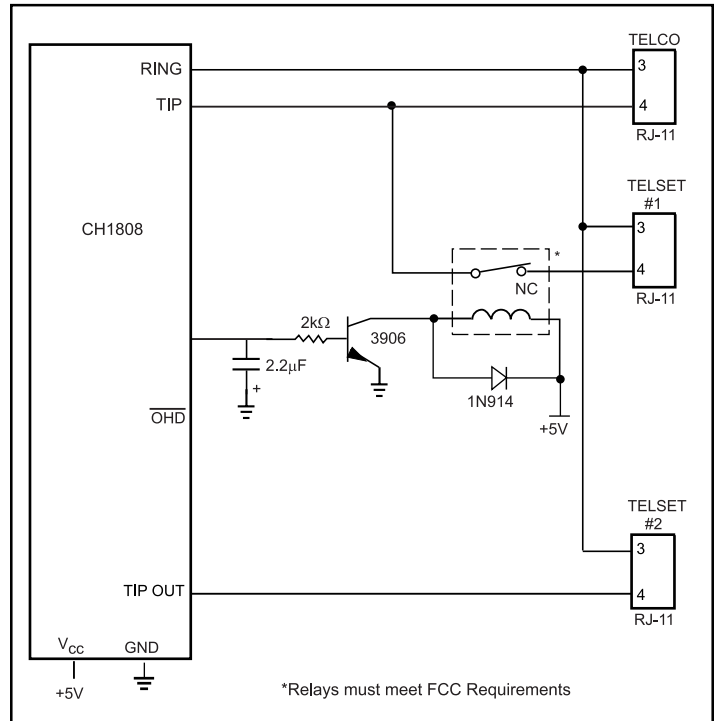


Figure 2. Dual Telset Control

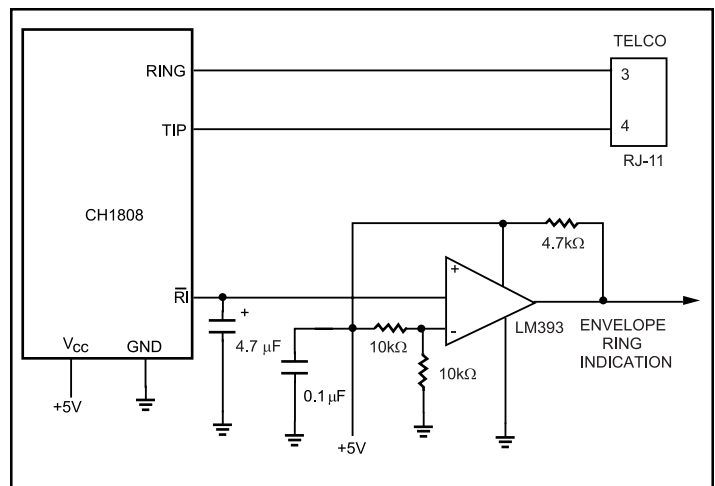


Figure 3. Ring Indicator Envelope Filter

### REMOTE DISCONNECT DETECT

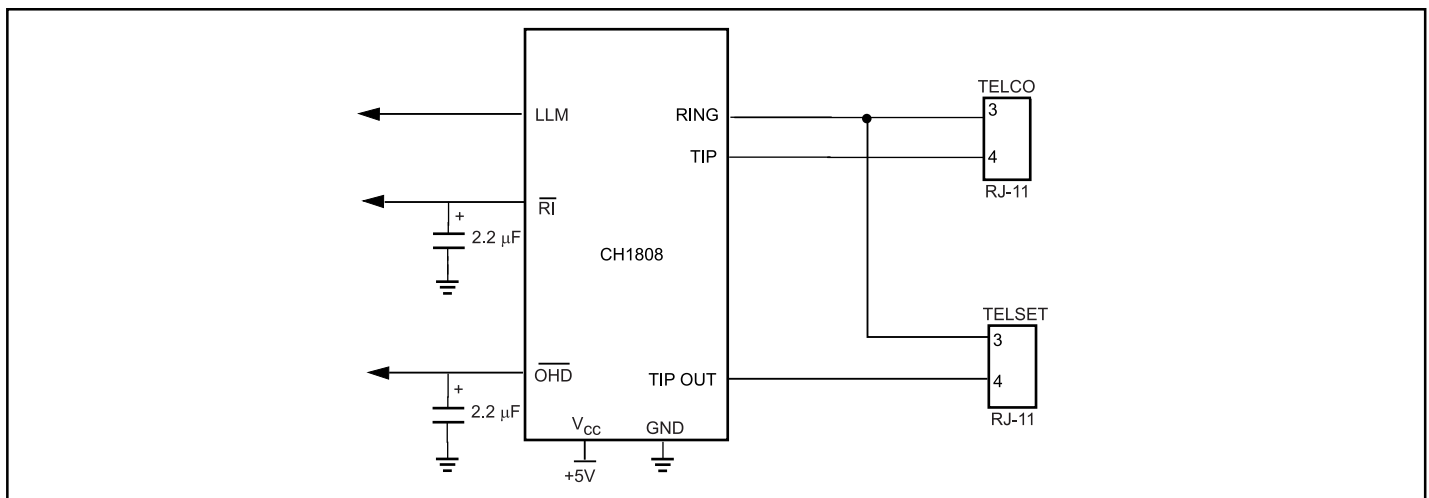
The Off-Hook Detect circuit can be utilized to signal when the remote party has disconnected the call. To use the CH1808 in this mode, connect the local telset or data device to Ring and Tip Out as shown in Figure 4.

During a telephone call, the  $\overline{\text{OHD}}$  pin is driven LOW. Once the telephone system detects a remote disconnect, a signal is sent to the local loop. This usually occurs about 10 to 12 seconds after the remote party has hung up. This issues a break in the local loop current for 800 to 1,000 ms. The  $\overline{\text{OHD}}$  output, detecting the loss of current, is driven HIGH during this break.

## DESIGN CONSIDERATIONS FOR FCC CONFORMANCE

### 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



**Figure 4. Remote Telset Disconnect Detect**

comply with the mechanical requirements specified in Part 68. Subpart 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 the FCC within 30 days of their request for same.

The CH1808 includes interface circuits that couple it to the telephone line and provide FCC required isolation and protection. The following guidelines should be followed to maintain FCC compliance:

- 1) CH1808 must be mounted away from hazardous voltages.
- 2) Connecting the CH1808 to telephone lines should be made through a standard RJ-11 jack or other approved connector device.
- 3) Circuit board traces to the CH1808 Tip, Ring, and Tip Out pins must exceed 0.10 inch spacing from all other traces. Tip, Ring, and Tip Out traces should have a nominal width of 0.020 inches.
- 4) Tip, Ring, and Tip Out traces should be as short as possible to prevent coupling from other signals. Mount the CH1808 close to the telephone line connection.
- 5) No additional circuitry should be connected between the CH1808 and the telephone line's RJ-11C jack except as shown in Figure 4.
- 6) The FCC registration label included must be affixed to the outside of the host product.
- 7) In your user manual, the following information should be provided.

**Type of Service:** The (insert your 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 USOC RJ-11C or (USOC RJ45S). Connection to the telephone company provided coin service (CO implemented systems) is prohibited.

Connection to party line service is subject to state tariffs.

**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 affect your service or the operation of your equipment, the telephone company will give you written notice to allow you to make any changes necessary to maintain uninterrupted services.

If you have any questions about your telephone line, such as how many pieces of equipment you can connect to it, the telephone company will provide this information upon request.

In certain circumstances, it may be necessary for the telephone company to request information from you concerning the equipment you have connected to your telephone.

Upon request by the telephone company, provide the FCC registration number and the ringer equivalence number (REN) of the equipment connected that is connected to your line; both of these items are listed on the equipment label. The sum of all the RENs 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 usable on a given line.

**If Problems Arise:** If any of your telephone equipment is not operating properly, you should immediately remove it from your telephone line because 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.

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**  
**CH1808 Pin Descriptions**

Pin	Name	I/O	Function
1	RING	I/O	Telco/Telset Port. Direct connection to the Ring lead of a telset and the Ring lead of the telephone line through a standard jack. PSTN or two-wire "wet" leased line connection.
2	TIP	I/O	Telco Port. Direct connection to the TIP lead of the telephone line through a standard jack. PSTN or two-wire "wet" leased line connection.
3	TIP OUT	I/O	Telset Port. Direct connection to the TIP lead of a telset.
4	$\overline{\text{OHD}}$	O	Off-Hook Detect Output. Active LOW when telset device is connected to Tip Out and Ring. When telephone handset is removed from cradle, $\overline{\text{OHD}}$ is driven LOW. Once active, $\overline{\text{OHD}}$ will momentarily be driven HIGH after a remote disconnect.
5, 9, 10	GND	I	Ground. Signal and power common ground. Pins 5, 9, and 10 are internally connected.
6	$\overline{\text{RI}}$	O	Ring Indication Output. Active LOW. $\overline{\text{RI}}$ is driven LOW during the typical 2-second ring period and HIGH during the typical 4 seconds between rings. $\overline{\text{RI}}$ is otherwise HIGH.
7	$V_{CC}$	I	+5V: Positive Supply Input. This supply is +5.0 VDC $\pm$ 10%
8	LLM	O	Local Loop Monitor Output. Active HIGH. LLM is driven HIGH when the local loop is severed or when another device on the local loop is off-hook.

**Table 2**  
**CH1808 Electrical Specifications**

$V_{CC} = +5V \pm 10\%$   
 $T_A = 0^\circ \text{ to } 55^\circ\text{C}$  UNLESS OTHERWISE SPECIFIED

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
LOGIC Output high Output low	$V_{OH}$ $V_{OL}$	$I_{OH} = 40\text{mA}$ $I_{OL} = 1.0\text{mA}$	2.4		0.4	V V
TELEPHONE LINE INTERFACE						
Line Resistance	$R_L$	Tip to Ring	7			M ohms
Input Resistance	$R_i$	Tip or Ring to any other pin	30		1500	M ohms
Surge Protection		Conforms to all FCC Part 68 surge, hazardous voltage, and leakage requirements				V
LLM Threshold Voltage	$V_{LLM}$	Voltage across Tip and Ring,	16	18	20	V
LLM Detection Time	$I_D$	$C_X = 0.001 \mu\text{F}$ (Tip or Ring to GND) $V_{CX} = 50\text{V}$ (Tip to Ring)		1		sec
OHD Threshold Current	$I_D$	Current from Tip to Tip Out		5	10	mA
Loop Current	$I_{LOOP}$	Current from Tip to Tip Out	2		100	mA
Ring Detect Threshold		15.3 to 68 Hz	20		130	V <sub>rms</sub>
Leakage Current	$I_L$	Leakage to Tip to Ring	40		0.1	mA
POWER Current	$I_{CC}$	Supply Voltage = +5V		2	5	mA

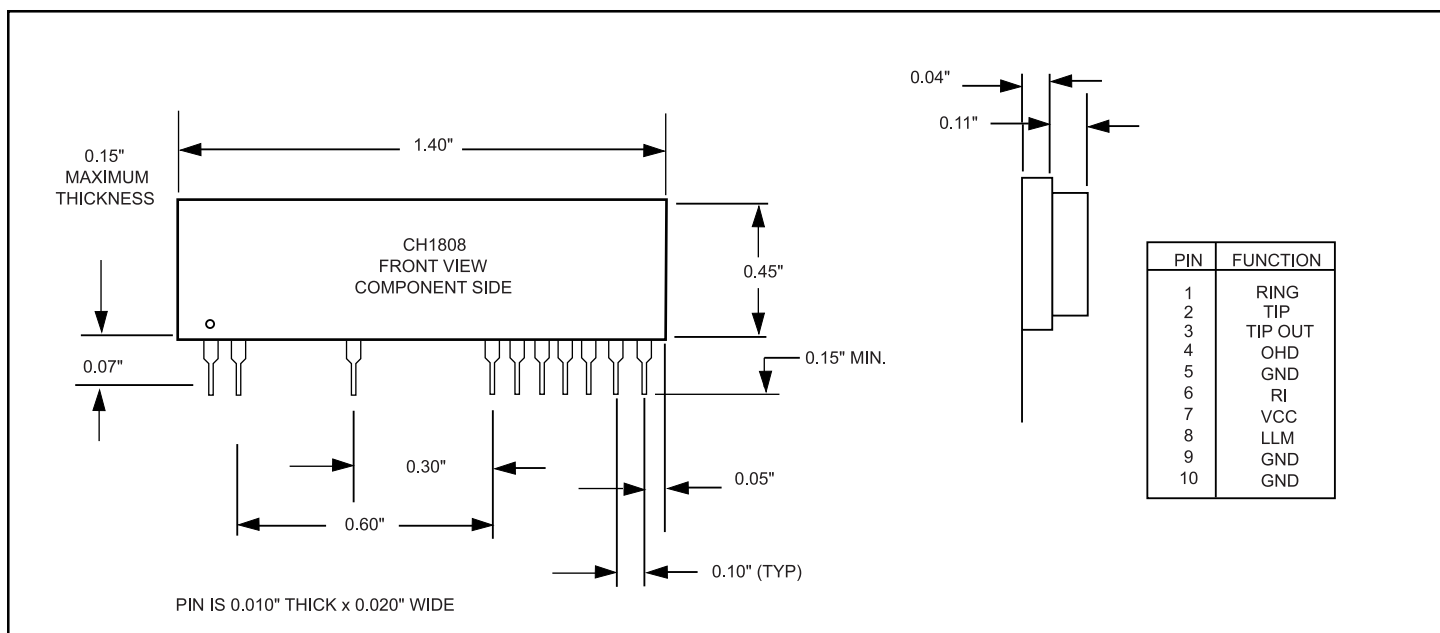


Figure 5. CH1808 Physical Dimensions and Pin Functions



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