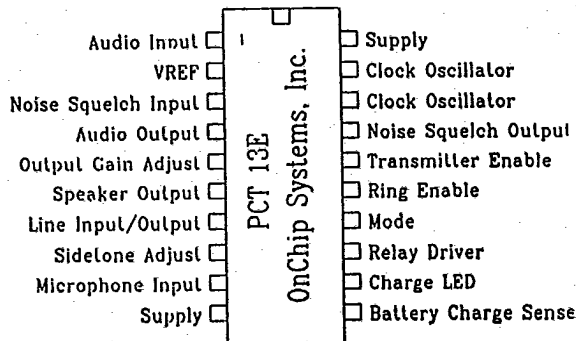


**PCT 13 / PCT 13E****PRODUCT HIGHLIGHTS**

- Complete audio processing and tone signalling on a single chip.
- Few external components
- Low pin count and small size: 18 (PCT 13) or 20 (PCT 13E) pin plastic DIP or SOIC package.
- No trimming required.
- Three different pilot tone frequencies available
- Pilot delay timer accommodates hook signalling.
- Page and intercom functions.
- Ring tone generation.
- Noise squelch (PCT 13E)
- Low cost.

Ordering Information:

- PCT 13P 18 pin plastic DIP
- PCT 13S 18 pin plastic Small Outline (SOIC)
- PCT 13EP 20 pin plastic DIP
- PCT 13ES 20 pin plastic Small Outline (SOIC)

Cordless Telephone Base Subsystem**Description**

The PCT 13 and PCT 13E Cordless Telephone Base Subsystem ICs perform all the audio processing and tone signalling functions required of the base unit in a cordless telephone system. Included on-chip are a preamp for the FM demodulated audio, an output line driver to the telephone line, a hybrid/preamp for amplifying the telephone incoming signal while suppressing the outgoing signal, and a microphone preamplifier and separate audio output to a speaker amplifier for providing the intercom function. In addition, a pilot tone detector and security delay timer enables the line connect relay driver in the presence of a pilot

tone, a page tone detector allows signalling of the base by the handset for intercom operation, a ring tone oscillator generates the traditional warble tone for transmission to handset upon ring detection, and a battery charge sense current detects when the handset is in or out of the base cradle. Finally, on-chip logic with inputs from the detection circuits enables the necessary functions and directs the signals to the necessary points for proper operation.

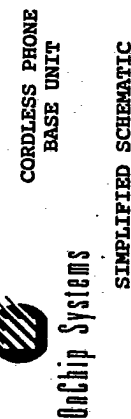
Use of switched capacitor techniques and crystal controlled divider chains for the detection filters and tone generators not only eliminates many external components, but provides

extremely high frequency accuracy without the need for any external circuit trimming. In addition to all the above functions, the PCT13E includes a noise detection circuit, providing noise squelch of the demodulated audio output and possible channel scan control in the absence of a FM carrier.

Able to operate from a single 8V to 10V supply and requiring few external components, the PCT 13 and PCT 13E facilitate implementing low cost cordless telephone base units with just the addition of a standard IF/FM demodulator IC and simple RF receiver and transmitter circuitry

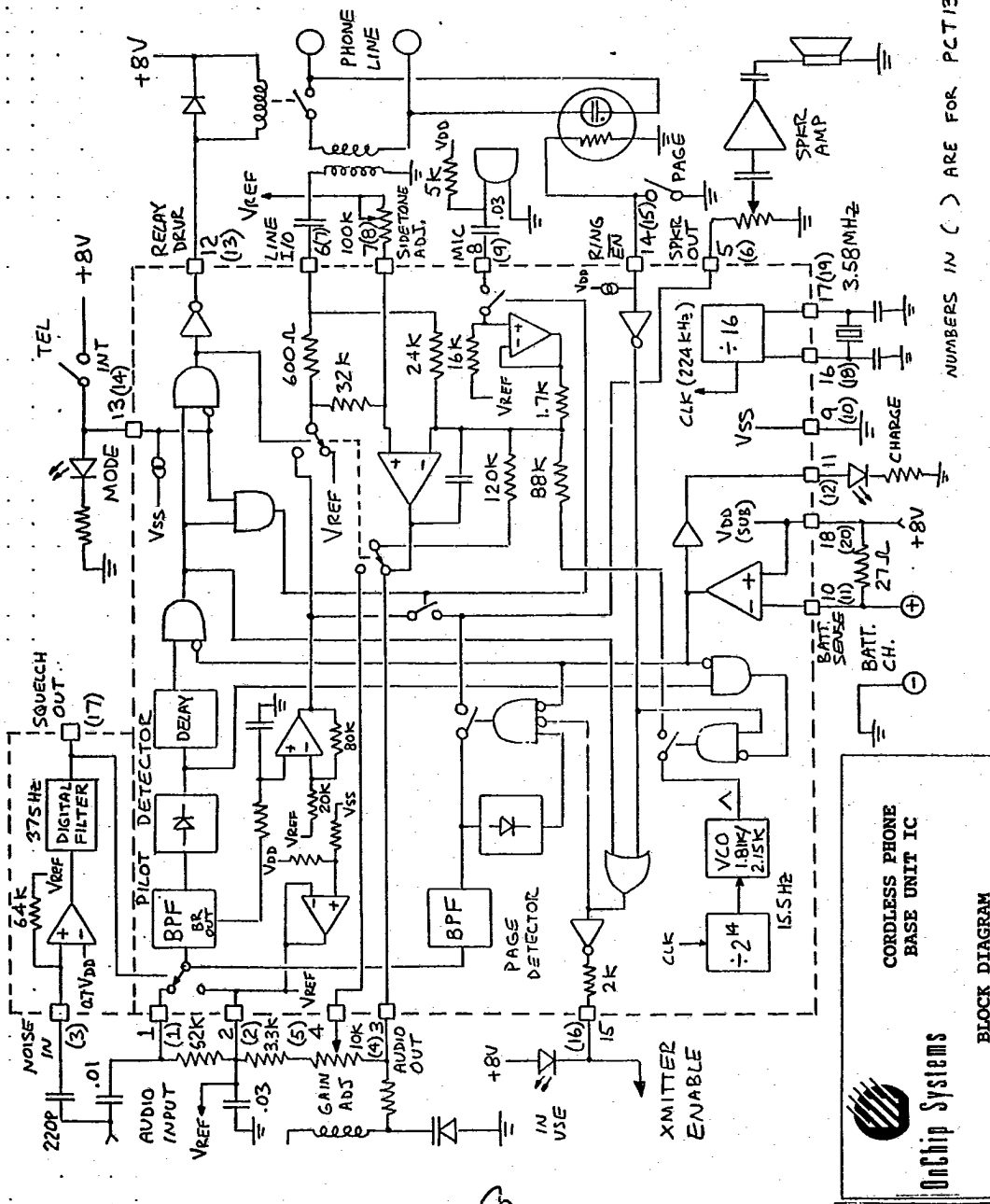
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PRELIMINARY

CORDLESS PHONE BASE UNIT
SIMPLIFIED SCHEMATIC



caps in () can be used for higher system gain

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NUMBERS IN () ARE FOR PCT13E

CORDLESS PHONE
BASE UNIT IC

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BLOCK DIAGRAM

Functional Description Base Unit IC (18 pin and 20 pin versions)**Audio Input Pin: (pin 1, both versions)**

Accepts band limited audio output from FM demodulator (1VPP nominal) and routes it to two circuits. One is a 2nd order universal filter with separate bandpass and bandreject outputs centered at either 4.0, 5.1, or 5.9KHZ selectable by metal mask option. The bandpass output is followed by a rectifier, threshold comparator and delay circuit to detect the presence of the pilot signal. The bandreject output (audio input less pilot signal) is filtered by a low pass filter with cutoff at nominally 3 KHz, and routed to the hybrid amplifier and Line Output pin if the pilot tone is present, the Mode pin is "low" or open, and the handset is not in the cradle. If these same conditions exist except the Mode pin is "high" instead of "low" or "open", then the bandreject filter output is routed to the Speaker Output pin instead.

The other circuit which processes the audio input signal is the page detector, comprised of a 2nd order bandpass filter with center frequency at 870Hz and followed by a rectifier and threshold comparator to detect the presence of the page tone. If detected, the bandpass filter output is connected to the Speaker output pin unless the pilot is present or the Ring Enable pin is "low" or the handset unit is in the cradle.

The input must be biased through a resistor from the VREF pin, which sets the input impedance.

Speaker Output Pin: (pin 5, version 18; pin 6, version 20)

Either the filtered audio input or the page tone (see above) is routed to this pin so that it may be applied to an external power amplifier IC to drive the intercom speaker. A volume adjust trim pot may be required. Passband gain from audio input to this output is nominally 4 for voice input, but only 2 for the page tone when present.

Line Input/Output pin: (pin 6, version 18; pin 7, version 20)

This pin is connected to the telephone line isolation transformer (usually through a coupling capacitor) allowing the filtered audio output to drive the phone line and allowing any incoming signal from the phone line to be received into the hybrid amplifier. Note that the signal flow to and from the phone line requires the relay connecting the transformer secondary to the phone line to be energized.

Unloaded passband gain from the audio input is nominally 4.4. Output impedance is 600 ohm nominal. Input gain from this pin to the Audio Output pin is nominally 5 with Gain Adjust pin shorted to the Audio Output pin. A level adjustment trim pot may be required at the Audio Input pin to adjust the telephone line output level to phone company specifications.

Relay Driver pin: (pin 12, version 18; pin 13, version 20)

Energizes the relay which connects the transformer output to the phone line when the pilot tone is present, the Mode pin is "low" or "open", and the handset is not in-cradle. Maximum output pull down drive is 20MA @ 1V.

Since in addition to initiating input/output audio signal flow, the relay is also used for control signaling to the phone company such as pulse dialing and call waiting, the pilot tone detector delay circuit mentioned above has been designed to allow these functions as well as provide the required security. If the pilot tone has been absent for more than 1 second, the pilot tone must be present for a full 1 second without any interruption of more than 5ms for the pilot detector to give a true detection and enable all functions, including the relay, which depend upon the pilot tone's presence. Once the detector has reached this point, and only then, may the pilot tone momentarily drop out and then reappear to de-energize and re-energize the relay with only 10ms

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delay instead of the initial 1 second delay, provided the drop-out period does not exceed 1 second. If the drop-out period does exceed 1 second, then the pilot tone detection delay will revert back to the initial 1 second.

Sidetone Adjust pin: (pin 7, version 18; pin 8, version 20)

A variable resistance from 0 to 100k ohms is connected from this pin to the VREF pin to allow adjustment for maximum cancellation in the hybrid amplifier of any audio input appearing at the Audio Output pin (i.e. sidetone). The maximum amount of attenuation possible is dependent on the makeup of the complex impedance presented to the Line pin by the phone line.

Microphone Input pin: (pin 8, version 18; pin 9, version 20)

When the pilot tone is present, the Mode pin is "high", and the handset is not in-cradle, this input is connected to a higher gain input on the hybrid amplifier for amplifying the microphone signal. Gain from this input to the Audio output pin is 90 nominal, and input impedance is 16K nominal. Since this pin is internally biased at VREF, a coupling capacitor will normally be required. A series trim pot may also be necessary to adjust the intercom loudness to the desired levels.

Audio Output pin: (pin 3, version 18; pin 4, version 20)

Output of hybrid amplifier/microphone preamplifier used to drive the varactor diode and modulate the FM oscillator. This signal is band limited by an internal low pass filter with cutoff frequency at 4.5KHz nominal and 6dB/octave rolloff. The DC output level of VREF may be used to directly bias the varactor diode. Output impedance is less than 50 ohms. If more band limiting is required, the output should be passed through an external RC low pass and high pass filter. Additionally, a trim pot may be needed to adjust the final level applied to the varactor diode, to control FM deviation to FCC specifications.

Output Gain Adjust pin: (pin 4, version 18; pin 5, version 20)

This pin allows external gain adjustment of the hybrid amplifier and hence amplification of the incoming phone line signal, without affecting the low output impedance of the Audio Output pin. Gain is adjusted by applying a portion of the Audio Output signal back to this pin through a resistor attenuator (usually a potentiometer in series with a fixed resistor) between the Audio Output pin and VREF pin; the amount of gain increase is inversely proportional to the amount of attenuation. This gain adjustment capability is disabled in the intercom mode (i.e. when the audio input is routed to the speaker output and the microphone is connected to the hybrid amplifier) so that it affects only the gain from the phone line and not the microphone gain.

Transmitter Enable pin: (pin 15, version 18; pin 16, version 20)

Active low 2K ohm pull down to ground used for enabling power to the external FM transmission circuitry and "In Use" LED (by driving the base of a PNP transistor, for example). This output is enabled whenever the pilot tone is present and the handset is not in-cradle, or whenever the Ring Enable pin is brought low.

Ring Enable pin: (pin 14, version 18; pin 15, version 20)

Whenever this input is brought low by either the "Page" button or the phone line ring detection photocell, the Transmitter Enable pin is pulled low and the ring tone oscillator is activated, provided there is no pilot tone or the handset is not in-cradle. The activated ring tone oscillator generates a tone alternating between 1.81KHz and 2.15KHz at a 15HZ rate which appears at the Audio Output pin.

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Battery Charge Sense pin: (pin 10, version 18; pin 11, version 20)

Normally connected to the positive battery charging pin, this pin senses a voltage drop below the VDD supply of more than 230MV. Whenever this 230MV threshold is exceeded, i.e. whenever the handset is in the cradle, the page detector is disabled, the Charge LED pin is brought "high", and the pilot tone detector is disabled, causing any of the above mentioned functions which depend on the presence of the pilot tone to also be disabled.

Charge LED pin: (pin 11, version 18; pin 12, version 20)

Active high capable of sourcing 20MA @ 1.6V used to drive the "Charge" LED, activated whenever the battery charge sense threshold is exceeded.

Mode pin: (pin 13, version 18; pin 14, version 20)

Controls whether the chip functions in the telephone mode (pin "open" or "low") or in the intercom mode (pin pulled "high").

Clock Oscillator pins: (pins 16 & 17, ver 18; pins 18 & 19, ver 20) A standard 3.58MHZ clock crystal connected between these pins generates the necessary internal clock signals which determine the filter and tone oscillator frequencies.

VREF pin: (pin 2, both versions)

An internally generated and buffered reference voltage, nominally 1/2 VDD, is brought out at this pin and should be bypassed with a .005 to .05uF capacitor.

Supply pins: (pins 9 & 18, version 18; pins 10 & 20, version 20)

The chip operates from a single supply of 7-10V. Current drain is mA.

Noise Squelch Input pin: (pin 3, version 20 only)

A signal applied to this pin with amplitude greater than 3 V.P.P. and frequency higher than 375 Hz will cause the Audio Input pin to disconnect from all the internal circuitry. Normally connected to the FM demodulator output through a high pass 10K-20KHZ filter, this pin provides internal noise squelch whenever the carrier is absent, thereby preventing potential false triggering from random noise. Input impedance is nominally 64K internally biased at VREF.

Should the FM receiver already include the audio noise squelch function, then pin 3 may be left open, or version 18 used instead.

Noise Squelch Output pin: (pin 17, version 20 only)

Provides an active high output whenever the Audio Input pin is in the squelched condition (see above). This pin may be used to indicate presence of carrier (e.g. a nearby cordless phone using the same channel) or to allow for automatic channel scan.

Specifications - Base Unit

VDD = 8V

| | Min. | Typical | Max. | Unit |
|-------------------------------|---------|---------|---------|--------|
| Audio Input | | | | |
| Impedance | 108 | --- | --- | ohm |
| Signal Level | --- | --- | 1.6 | V.P.P. |
| Common Mode Range | VREF-.1 | --- | VREF+.1 | V |
| Pilot Detect Filter | | | | |
| Center Frequency | 4.0 | 5.1 | 5.9 | KHz |
| Tolerance | -3 | --- | +3 | % |
| Bandwidth | --- | +100 | --- | Hz |
| DetectionThreshold | --- | 0.16 | --- | V.P.P. |
| DetectionHysteresis | --- | 0.06 | --- | V.P.P. |
| Detect Delay | --- | 1.05 | --- | S |
| Undetect Delay | --- | 30 | --- | mS |
| Detect Delay Reset Time | --- | 1.05 | --- | S |
| Pilot Rejection Filter | | | | |
| Cutoff Frequency | 2.7 | --- | 3.3 | KHz |
| Notch Depth | -40 | -50 | --- | dB |
| Page Detection Filter | | | | |
| Center Frequency | --- | 875 | --- | Hz |
| Tolerance | -3 | --- | +3 | % |
| Bandwidth | --- | +46 | --- | Hz |
| DetectionThreshold | --- | 1.05 | --- | V.P.P. |
| DetectionHysteresis | --- | .48 | --- | V.P.P. |
| Response Time | --- | 100 | --- | mS |

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| | Min. | Typical | Max. | Unit |
|-----------------------------------|------|---------|------|---------|
| Speaker Output | | | | |
| Impedance, Page Det. Mode | --- | 1700 | --- | ohm |
| Intercom Mode | --- | 100 | --- | ohm |
| Min. Load, Page Det. Mode | 10K | --- | --- | ohm |
| Intercom mode | 500 | --- | --- | ohm |
| Peak Gain from Audio Input | | | | |
| Page Det. Mode | --- | 1.8 | --- | |
| Intercom Mode | --- | 4.4 | --- | |
| Max. Signal Level | --- | --- | 5.5 | V.P.P. |
| Line Output | | | | |
| Impedance | 450 | 600 | 800 | ohm |
| Gain from Audio Input1 | --- | 2.2 | --- | |
| Max. Signal Level1 | --- | --- | 2.5 | V.P.P. |
| THD1 | --- | 0.8 | --- | % |
| Noise, 1.300-3KHz | --- | 4 | --- | mVRMS |
| Line Input | | | | |
| Impedance | 450 | 600 | 800 | ohm |
| Signal Level | --- | --- | 1.2 | V.P.P. |
| Microphone Input | | | | |
| Impedance | --- | 16K | --- | ohm |
| Signal Level | --- | --- | 75 | mV.P.P. |
| Audio Output | | | | |
| Impedance | --- | 5 | --- | ohm |
| Min. Load | 5K | --- | --- | ohm |
| Max. Signal Level | --- | --- | 5.5 | V.P.P. |

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| | Min. | Typical | Max. | Unit |
|---------------------------------|------|----------|------|--------|
| Gain from Line input2 | --- | 4.8 | --- | --- |
| Gain from Mic. input | --- | 90 | --- | --- |
| Bandwidth | 3.0 | 4.5 | 6.0 | KHz |
| THD, Line input | --- | 0.5 | --- | % |
| THD, Mic input | --- | 1.0 | --- | % |
| Noise, 300-3KHz | --- | 3 | --- | mVRMS |
| Audio Input Rejection3 | --- | 6 | --- | dB |
| Ring Tone Oscillator | | | | |
| Frequency A | --- | 1.81 | --- | KHz |
| Frequency B | --- | 2.15 | --- | KHz |
| Switch Rate | --- | 15.5 | --- | Hz |
| Waveform | --- | Triangle | --- | |
| Frequency Tolerance | --- | - XTAL | --- | |
| Output Level | --- | 5.6 | --- | V.P.P. |
| Relay Driver (Open Drain) | | | | |
| Full-Down Drive @ 1V | --- | 20 | --- | mA |
| Charge LED Driver | | | | |
| Pull-up Resistance | --- | 200 | --- | ohm |
| Source Drive @ 1.6V | --- | 20 | --- | mA |
| Transmitter Enable (Open Drain) | | | | |
| Pull-down Resistance | --- | 2.0K | --- | ohm |
| Ring Enable Input | | | | |
| Internal Pull-up | --- | 20 | --- | uA |
| Low Threshold | --- | 4 | --- | V |

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| | Min. | Typical | Max. | Unit |
|---|------|---------|------|------|
| Mode Input | | | | |
| Internal Pull-down | --- | 40 | --- | uA |
| High Threshold | --- | 4 | --- | V |
| Battery Charge Sense Input | | | | |
| Bias Current | --- | 16 | --- | uA |
| Threshold re VDD | --- | -230 | --- | mV |
| Reference Output | | | | |
| Voltage | --- | 4.1 | --- | V |
| Impedance | --- | 400 | --- | ohm |
| Current Drive | --- | --- | 4 | mA |
| Supply | | | | |
| Voltage Range | 6 | --- | 10 | V |
| Current Drain | --- | 6.0 | 8 | mA |
| Noise Squelch Input (version 20 only) | | | | |
| Impedance | 48K | 64K | 80K | ohm |
| Detect Threshold re VREF | +1.4 | +1.5 | +1.6 | V |
| Threshold Crossing Rate | | | | |
| For Detection | 375 | --- | --- | Hz |
| Detection Response Time | --- | --- | 5.5 | mS |
| Noise Squelch Output (version 20 only) | | | | |
| Pull-down Resistance | --- | 800 | --- | ohm |
| Pull-up Resistance | --- | 1200 | --- | ohm |
| Note 1. 600 ohm load. | | | | |
| Note 2. Pins 3 & 4 shorted. | | | | |
| Note 3. Sidetone adjust set for maximum rejection at 1KHz | | | | |

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Base Unit Truth Table

| INPUTS | | | | | | OUTPUTS/FUNCTIONS | | | | | | | | OPERATION | | |
|-------------|-----------------------|---|----------------------|----------------|------------|-------------------|----------|-----------|-----------------|-------------|-------|-----------------|------------|-----------|-------------|-------------------------|
| Noise Input | Pilot Tone @ Audio In | | Page Tone @ Audio In | Charge Current | Mode Input | Ring Enable | Line I/O | Audio Out | Gain Adjustment | Speaker Out | Relay | Transmit Enable | Charge LED | Mode LED | Squelch Out | |
| - | - | - | - | X | X | H | - | (T) | - | - | H | H | * | * | L | No Pilot & No Page |
| - | - | S | X | - | X | X | * | * | * | * | * | L | L/OFF | * | L | Enable Transmitter |
| - | - | S | X | - | L | X | A | T | E | - | L | L | L/OFF | L/OFF | L | Telephone Mode |
| - | - | S | X | - | H | X | - | M/(T) | - | A | H | L | L/OFF | H/ON | L | Intercom mode |
| X | X | X | X | X | X | L | * | * | * | * | * | L | * | * | * | Enable Transmitter |
| - | - | X | X | X | X | L | - | R/(T) | - | - | H | L | * | * | L | Ring H/S |
| X | X | X | S | X | X | H | - | (T) | - | - | H | H | H/ON | * | * | In Cradle |
| X | X | X | S | X | X | L | - | R/(T) | - | - | H | H | H/ON | * | * | Ring H/S while in cradl |
| - | - | S | - | X | H | - | - | (T) | - | P | H | H | L/OFF | * | L | Page Base |
| S | X | X | X | X | X | H | - | (T) | - | - | H | H | * | * | H | Noise Squelch |
| S | X | X | X | X | X | L | - | R/(T) | - | - | H | L | * | * | H | Ring H/S while Squelche |

Key: S Signal Present
 - Signal Not Present/Function Not Enabled
 L Low Logic Level
 H High Logic Level
 X Don't Care
 * Depends on Don't Care Inputs
 E Function Enabled
 A Signal Applied to Audio Input
 M Signal Applied to Microphone Input
 T Signal Applied to Line I/O
 P Page Tone
 R Ring Tone

Note: (T) means that, in actual application, relay will prevent phone line signal from appearing at Line I/O pin and, therefore, also at Audio Out pin.

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