WAN_0134

WM9712 Jack Plug Auto-detection, Hookswitch Detection and Microphone Headset Detection

INTRODUCTION

This application note describes two operations associated with using headsets. The first is the facility to automatically switch between a mono ear speaker and stereo headphones for use in a Smartphone, PDA etc. The second operation is a method which can be used to detect if stereo headphones have been attached or if a mono headset with microphone has been attached.

JACK INSERTION AUTO-SWITCHING

There is a specific auto-switching jack insertion mode which is controlled by the WM9712 device. This is specifically to switch from using a mono output on OUT3 to using Headphones (on jack insertion) and vice versa (on jack removal). Figure 1 below details the setup of ear speaker and jack for headphones. When the headphone connector is inserted the Ear speaker is disabled as OUT3 is powered down.

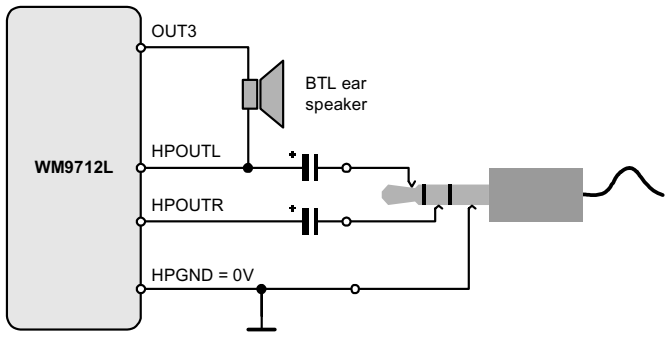

Figure 1 Combined Headset / BTL Ear Speaker

GPIO1 (pin44) is required to be toggled by jack insertion. Therefore a logic signal must be connected from the Jack Socket to indicate an insertion. A potential circuit for this purpose is detailed below in **Figure 2**.

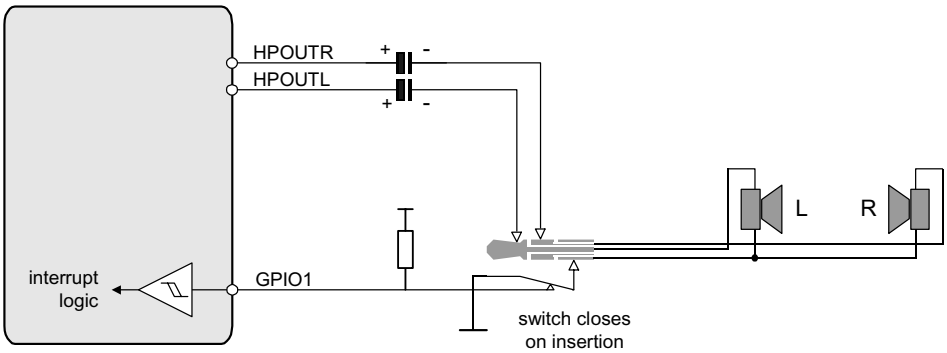

Figure 2 GPIO Jack Insertion Detection Circuit

Auto-detection is setup by setting register bit 58h bit 12 JIEN to "1".

When the jack plug is not inserted:

1. GPIO is HIGH
2. The OUT3 state is set by the register settings of 24h and 26h
3. HPOUTL volume is set by register 16h HPOUTR volume is set by 04h

When the jack plug is inserted:

1. GPIO is LOW
2. The OUT3 state is disabled
3. HPOUTL and HPOUTR volume is set by register 04h

No CPU access is required for these setups, the operation is controlled by the WM9712 (Note that JIEN must be set to enable this feature). See the latest datasheet for further details.

Alternatively, the switch can be controlled by the software driver. When the GPIO is used in this way for Jack insertion detection, it creates an interrupt (IRQ), which will be dealt with by the controller (the controller must be setup to receive these interrupts).

To read the status of the GPIO's or change the settings PR4 must be set to 0.

Steps required for jack insertion are as listed below:

1. Jack inserted.
2. GPIO generates interrupt for logic level change
3. Interrupt sent to CPU via AC Link
4. CPU reads GPIO register to see what caused interrupt
5. CPU runs appropriate software routine to setup the device for jack insertion.
6. Jack removed.
7. GPIO generates interrupt for logic level change
8. Interrupt sent to CPU via AC Link
9. CPU reads GPIO register to see what caused interrupt
10. CPU runs appropriate software routine to setup the device for jack removal.

HOOKSWITCH DETECTION

The circuit diagram displayed in Figure 3 shows how to detect when the “hookswitch” of a phone headset is pressed (pressing the hookswitch is equivalent to lifting the receiver in a stationary telephone).

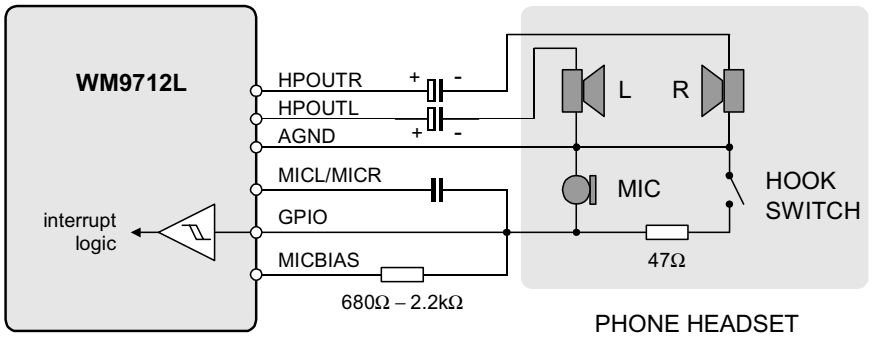

Figure 3 Hookswitch Detection Circuit

The circuit uses a GPIO pin as a sense input. However, in this case the voltage level seen at the GPIO can vary depending on the microphone impedance and the bias resistor connected to MICBIAS. This can be difficult to setup correctly as the GPIO inputs are setup for CMOS input levels.

Therefore, to operate correctly the impedance of the microphone and the resistor in the MICBIAS path must be such that the potential at the GPIO pin is above 0.7×DBVDD when the hookswitch is open, and below 0.3×DBVDD when it is closed.

This arrangement will not work for all types of microphones.

Alternatively, if available, either of the comparator COMP1 or COMP2 inputs can be used instead of the standard GPIO. This allows the switching threshold to be set manually or to AVDD/2. So instead of connecting the Mic Input to a GPIO pin, the connection would be made to COMP1 or COMP2. The threshold for switching can be set to AVDD/2 or to a level connected to the AUX4 pin. With this arrangement virtually any microphone can be selected and setup for hookswitch detection. An example setup is displayed in Figure 4.

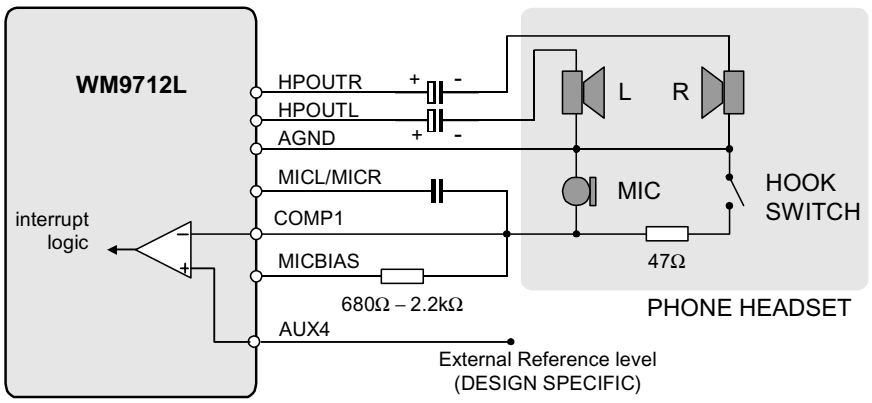

Figure 4 Possible Hookswitch Detection Circuit Using Internal Comparator

MICROPHONE HEADSET DETECTION

The WM9712 does not have the same auto-detect functionality as the WM9705 (refer to WM9705 datasheet for further details), however, it is possible to devise a circuit for this purpose using the same principals as the WM9705 circuit.

Shown in Figure 5 is a potential circuit which can be used for headphone/headset detect on the WM9712. This is based on the principal that headphone resistance is generally low (16 to 32Ω) and mic resistance is high (approximately >1k).

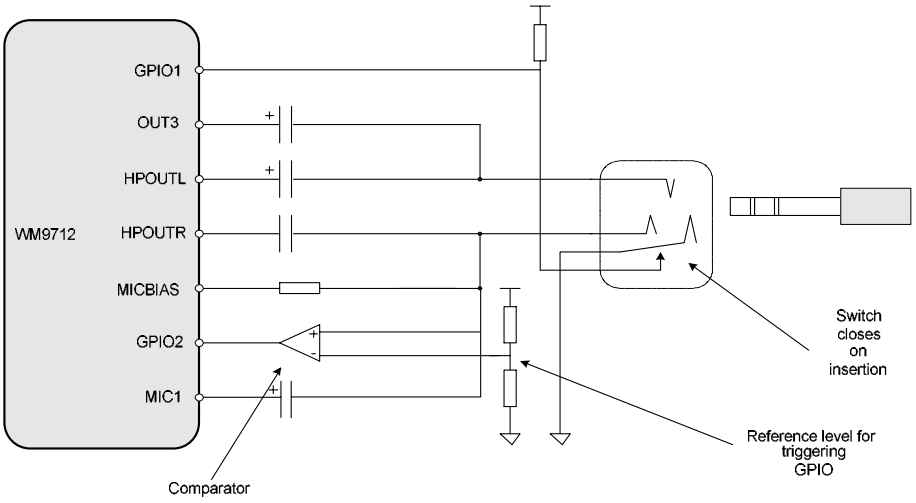

Figure 5 Possible Stereo Headphone/Microphone Headset Detection Circuit

To understand how the circuit displayed in Figure 5 operates we need to consider what happens when a stereo headphone jack is inserted or when a mono headset with microphone is inserted

STEREO HEADPHONE JACK INSERTED

When inserted, GPIO1 goes from HIGH to LOW indicating a jack insertion. The MICBIAS source is then presented across the Micbias resistor and the headphone impedance to ground. The level presented to the positive input of the comparator is the potential divide of these two resistances. For example:

Comparator_+I/P = MICBIAS_VOLTS * [HP_RES / (HP_RES + MICBIAS_RES)]

Say, MICBIAS = 3V

HP_RES = 32Ω

MICBIAS = 680Ω

Then, Comparator_+I/P = 3 * [32 / (32 + 680)] = 0.135V

MONO HEADSET WITH MICROPHONE INSERTED

When inserted, GPIO1 goes from HIGH to LOW indicating a jack insertion. The MICBIAS source is then presented across the Micbias resistor and the microphone impedance to ground (this assumes the microphone connection is to the tip of the jack plug). The level presented to the positive input of the comparator is the potential divide of these two resistances. For example:

Comparator_+I/P = MICBIAS_VOLTS * [MIC_RES / (MIC_RES + MICBIAS_RES)]

Say, MICBIAS = 3V

HP_RES = 1KΩ

MICBIAS = 680Ω

Then, Comparator_+I/P = 3 * [1000 / (1000 + 680)] = 1.785V

With the examples given above for Stereo Headphones and Mono Headset with Microphone the Comparator's negative input still needs to be considered. This level should be set approximately mid-way between the levels presented to the positive input of the comparator for the two different jack insertions.

For the examples given the negative input to the comparator should be set to approximately 0.96V. This means that for the example Stereo Headphone the Comparator Output will present a LOW to the GPIO and the Mono Headset with Microphone will present a HIGH to the GPIO. This allows the two types of insertions to be detected individually.

The sequence to use the attached circuit in terms of software driver control is as follows:

1. No connection to socket
2. Micbias, HPOUT and OUT3 disabled
3. Mic internal paths muted.
4. Headset/headphone connected
5. GPIO detects jack insertion
6. Set Micbias enabled
7. GPIO2 detects headphone or mic using comparator with threshold set by resistor divide
8. Enable HPOUT if headphones connected, enable mic and OUT3 if Headset connected
9. Headset/Headphone removed
10. GPIO detects jack removal
11. Set Micbias, HPOUT and OUT3 disabled

Potential setup problems are caused as there is such variance in headphone and microphone designs, the selection of resistors for biasing and reference setting will be application specific. The setup relies on the comparator differentiating between the impedance of the headphone and mic using Micbias as the current source (alternatively instead of using an external comparator, if COMP1 or COMP2 are not being used either can be connected instead). This setup may not be applicable to all requirements and may cause a "pop" on jack insertion. Please also note that in the circuit diagram the decoupling capacitor which connects HPOUTR to the socket tip and mic bias is non-polarised. This is required for when the DC offset at the socket side increases above VMID and biases the capacitor in the opposite direction.

SUMMARY

This document describes how to setup the WM9712 for auto-switching between ear speaker and stereo headphones and a potential circuit for detecting if a Microphone headset or Stereo headphones have been connected. The detection of microphones or headphones is based on monitoring the resistance connected and requires a DC level to be monitored. The side effects are that non-polarised capacitors are required and there will be a "Pop" on the output.

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