

**QV30 RS232 playback module for ISD33000-4000 series ChipCorders®****Features:**

- delivered with 4 minute ISD4003-04
- up to 240 messages
- four addressing modes
- low power dissipation: <2mA at 5V, less than 1uA in power down mode
- single 5V supply (3V is generated on-board)
- separate amplifier power control and busy functions
- digitally controlled analog volume control (64 levels)
- 1W amplifier on-board
- built-in sequential record mode for initial ChipCorder® setup
- automatic sensing of number of phrases when used with our recording software
- free recording software from our website
- QV430P PC interface hardware available, or build your own from our schematics
- for use with simple RXD/TXD RS232 controls

General description:

The QV306m1 module provides a simple method of adding voice and sound to your system. It comprises a controller based on a Microchip PIC processor, an ISD4003-04 ChipCorder® analog recording chips with four minutes capacity at 4kHz bandwidth, a digital potentiometer for volume control, and a 1W audio amplifier. It is controlled with a simple two-wire RS232 connection (the return path is optional). Baud rate is selectable.

By taking advantage of the ChipCorder's® cueing mode, the QV306 can manage up to 240 separate messages without explicit reference to physical addresses. Three phrase selection modes are provided and are selected via a mode setting command. The addressing mode can be changed at any time.

A single n,8,1 byte transfer selects one of 240 messages (subject to the constraints explained later in this document). A code of 0fxh is interpreted as a mode- or volume- set command. A byte in the range 0-239 selects a single message in direct addressing mode, or determines the upper bound of a linear sequence or random selection. Upon power up or after a recording, the system will automatically detect the number of messages and define its own maximum upper bound.

By default, the QV306 is powered from start-up until the sleep mode bit is set with a set mode command. The mute/power pin can be used to switch power to an external amplifier. RESET_ or a dummy RS232 command wakes the QV306 from sleep mode.

The QV430P and QV300s2 programming tools create properly formatted ISD ChipCorders®. They are also available in software and schematic form free from <www.quadravox.com>. If required, the Quadravox QV401P gang programmer can be used to mass produce formatted ChipCorder® devices.

In order to make the module as small as possible, the RS232 level conversion, audio connectors, power jack and 5V regulator are on a separate PCB, the QV430P. The QV430P makes it convenient to use our free QV300S2 programming software, but it not required for operation.

QV306m1 pinout and control lines:

Control lines	pin	level	Function
RXD (5V)	1	--	RS232 receive line
TXD (5V)	2	--	RS232 transmit line
BUSY_	3	low	indicates system is busy (same signal as RECLED_)
BR1	4	--	msb of baud rate selection; must be +5V or GND
BR0	5	--	lsb of baud rate selection; must be +5V or GND
RECLED_	6	low	can be used to sink current for record LED. The external system must provide the current-limiting resistor.
+5V	7	+5	system power
GND	8	0	system ground
ANA_IN	9	--	line level analog input for recording
	10	--	N.C.
GND	11	0	system ground
	12	--	N.C.
AUX	13	--	direct ChipCorder output
RESET_	14	low	system reset
SP-	15	--	speaker output; bridge tied load
SP+	16	--	speaker output; bridge tied load

Baud rate selection:

BR1	BR0	Rate
0	0	2400b
0	1	4800b
1	0	9600b
1	1	19200b

Commands:

Value	Record mode?	Action
0-239	No	Play phrase <value> according to mode settings
240-255	No	Set mode: see mode table for functions
1	Yes	Start recording individual phrase
0	Yes	Stop recording individual phrase

Set mode functions:

Value (hex)	Function
0f0h	set play mode to direct addressing
0f1h	set play mode to linear sequence
0f3h	set play mode to random sequence
0f4h	record mode; subsequent 1 and 0 commands start and stop recording
0f6h	stop play
0f8h	sleep
0f9h	open string
0fah	close string
0fbh	play string
0fch	set volume with next byte transmitted. Only values 0-63 are valid
0fdh	software reset
0feh	return version byte (00ch)
0ffh	return type byte (036h)

Setting the addressing mode:

The QV306m1 offers three modes of playback addressing for individual phrases. The modes are selected using the two low-order bits of the set mode command. Bit 0 selects direct or sequential addressing. In direct addressing (bit 0 = 0), the value transferred in the command byte is used to select the phrase of the same number. If a value exceeding the maximum number of recorded phrases is sent, the last phrase in the memory will be played. If bit 0 is set to one, the phrase played will lie within the bounds of zero and the number transferred in the command byte. If bit 1 of the mode value is 0, the phrases in this range will be played in sequence, rolling back to zero after the top phrase (the one corresponding to the command byte) has been played. If bit 1 is 1, a randomly-selected one of the same range will be played.

The mode can be changed at any time, so system operation can combine the different addressing options. For example, to have ten phrases triggered by specific events and a different set of ten randomly selected by a fifth event, do the following:

- Record the phrases in order with the ten randomly selected ones as the first ten in the list.
- To randomly select one of the bottom group, first issue a set mode command specifying "random sequence" (0f3h). Repeatedly sending a command byte of "9" will produce a random selection of phrases 0-9.
- To select one of the fixed phrases, issue a set mode command for "direct" (0f0h), then send the number of the phrase to be played.
- If you desire that the phrases in the first group be played in sequence, issue a set mode "linear sequence" (0f1h) instead of 0f3h.

Recording messages:

The primary function of the QV306m4 is to manage message playback. The recording function is intended to be used only to set up the system initially. Messages must be recorded in the order they are to be selected, that is, from number 0 to n, and must all be recorded in the same session. Resetting record mode places a very short file on the ChipCorder to serve as the "last" marker. Quadravox provides the QV300S2 software and optional QV430P hardware to perform this operation, but it is simple enough to be easily integrated into your application.

To record a new set of messages:

- issue a set mode "record" command (0f4h)
- send a command byte of "1" (01h) and at the same time start applying the analog signal to be recorded to the analog-in+ pin of module. The recording level may have to be adjusted to achieve the best overall recording quality, as explained in ISD's documentation.
- When the analog segment is complete, send a command byte of "0" to stop the recording and place an EOM marker in the ChipCorder.
- When all phrases have been recorded, issue a set mode command of 0f0h.(or 0f1h or 0f3h for different playback modes).

Playing messages:

To play a message, first ensure that the mode (as explained as above) matches your intentions. Then, issue a single byte in a contiguous range from 0 to the number of recorded messages – 1 (maximum 239). When the phrase has completed, a byte with the number of the phrase spoken will be returned.

Message play can be stopped by issuing a stop command (0f6h). There is no return code for a stop command. Be aware that the ISD ChipCorder may require up to 50ms to effect the stop after it is received. Commands sent during this time may fail to execute properly.

The BUSY_ line can also be used to determine when the message is complete.

String play:

In some cases it is desirable to set up a long string of words or phrases to be played as one utterance. This simplifies message management and allows the segments to be closer together as the amplifier does not need to be powered down between phrases. To use the string mode, open a new string by sending the command 0f9h. Send up to 32 phrase numbers. The phrases will not be spoken in this process. Send the close string command, 0fah. Until you change the string by reopening it, the stored sequence can be played by issuing the play string command, 0fbh. Individual words are still accessible in the usual way- playing them does not affect the stored string.

Power management:

The QV306m1 sends a power up command to the ChipCorder on startup. The QV306 and the ChipCorder will remain powered up until a set mode "sleep" command is issued. The amplifier will be muted except during playback. This muting is essential to cover address scan noise. The system can be awakened by use of the RESET_ pin or by sending a dummy RS232 command. Due to the wakeup time of the processor, the dummy command will not be interpreted.

Applications:

The QV306m1 is intended for message playback applications where the user requires the large capacity of ISD's serial interface ChipCorders®, but does not want to develop custom microprocessor algorithms to manage the devices.

The QV306m1 can also be used in conjunction with a host microprocessor in lieu of developing custom real-time code on the host platform. When used in cueing mode, the ISD chips in this series require either constant polling or an interrupt driven service routine for advancing to the proper address. If used in address mode, they require that the microprocessor maintain an address table with entries for each of the independently accessed phrases. The QV306m1 can offload these functions as well as system power management from the main processor.

Limitations:

The QV306m1 is limited to 240 phrase selections.

The minimum allowable phrase length is 200ms, which in practical terms means that the minimum valid phrase length is more than a single segment for most ISD part types. This restriction is due to the necessity of using a particularly short phrase as an end-of-project marker.

The QV306m1 uses ISD's cueing mode for message management. Playback starting delay depends on both the position of the data in the chip and the number of messages in the project. Although the cueing mode scan runs 1600 times faster than normal chip speed, this still can amount to 150ms for a four-minute chip. To this is added the overhead of restarting the scan after each message is located. This delay complicates use of the 306 for phrase concatenation, but with care in the data preparation, some limited use is possible. Place all the frequently concatenated sounds (e.g. numbers) at the beginning of the list, followed by ending phrase segments, and finally by beginning phrase sections. This will optimize the allocation of the unavoidable delays

Simple development platform:

The QV300S2 software and QV430P programming hardware provide a low-cost method of programming the 306m1 modules. The QV300S2 software is available free from the Quadravox website. The software makes use of your PC's sound card and serial port to control the QV306m1, which in turn invokes a cueing-mode record routine. The connections are as follows:

Serial port pins:

Ground (DB9 pin 5) connects to system ground.

TXD (DB9 pin 2) connects via the MAX232 level converter to QV306 RXD.

RXD (DB9 pin 3) connects via the MAX232 level converter to QV306 TXD.

Sound card line out, left channel, is capacitively coupled to one of the analog-in pins of the ISD chip. The QV300s2 software outputs a stereo signal, so channel definition is not a factor. The QV430P rev 1 board uses a fixed 9600B transfer rate.

Electrical Characteristics:**Absolute Maximum Ratings:**

Stresses above these limits may cause permanent damage to the PIC16C505 controller device. This is a stress rating only and functional operation of the device at those or any other conditions above those indicated in the operation listings of this specification is not implied. Exposure to maximum rating conditions for extended periods may effect device reliability.

Ambient temperature under bias	-40°C to +125°C
Storage temperature	-65°C to +150°C
Voltage on VDD with respect to Vss	0 to +7 V
Voltage on all other pins with respect to Vss	-0.6 v to (VDD + 0.6V)
Total power dissipation	700 mW
Maximum current out of Vss pin	150 mA
Maximum current into VDD pin	125 mA
Input clamp current, I _{IK} (V _I < 0 or V _I > VDD)	+/- 20 mA
Output clamp current, I _{OK} (V _O < 0 or V _O > VDD)	+/- 20 mA
Maximum output current sunk by any output pin	25 mA
Maximum output current sourced by any input pin	25 mA

DC Characteristics: standard operating temperature $0^{\circ}\text{C} \leq T_A \leq +70^{\circ}\text{C}$

Power supply pins:

Symbol	Description	Min	Typ ⁽¹⁾	Max	Units	Conditions
VDD	Supply voltage	3.5		5.5	V	
VPOR	VDD start voltage to ensure power-on reset	--	Vss	--	V	See section on power-on reset for details
SVDD	VDD rise rate to ensure power-on reset	0.05	--	--	V	See section on power-on reset for details
IDD	Supply current⁽²⁾	--	1.8	2.4	mA	VDD = 5.0V
IPD	Power down current	--	4	12	μA	VDD = 3.5V
VIL	Input low voltage RXD, BR0-1-	Vss	--	0.5	V	
VIH	Input high voltage RXD, BR0-1	2.0	--	VDD	V	$4.5 \leq V_{DD} \leq 5.5\text{V}$
IIL	Input leakage current⁽²⁾ RXD, BR0-1	--	--	+/- 1	μA	$V_{SS} \leq V_{PIN} \leq V_{DD}$
VOL	Output low voltage RECLEd_, TXD	--	--	0.6	V	IOL=8.5mA, IDD=4.5V
VOH	Output high voltage RECLEd_, TXD	VDD-0.7	--	--	V	
CIO	Capacitive loading specs on output pins	--	--	50	pF	

Note 1: Data in the typical ("typ") column is based on characterization results at 25°C. This data is for design guidance only and is not tested.

2: Negative current is defined as coming out of the pin

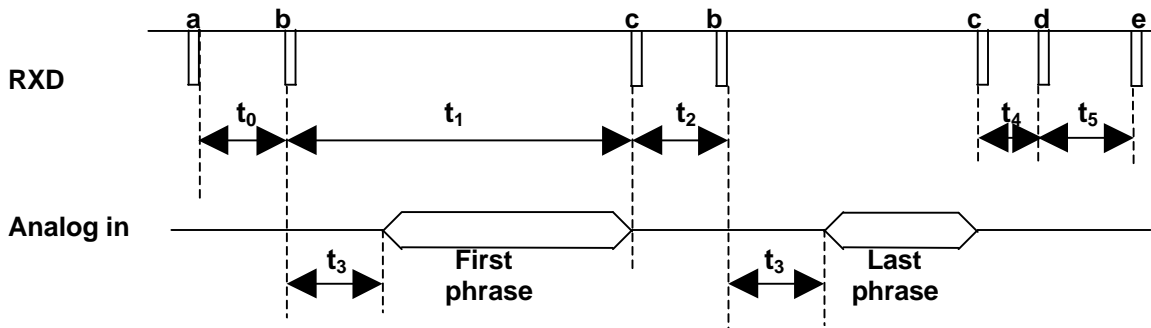
AC Characteristics: standard operating temperature $0^{\circ}\text{C} \leq T_A \leq +70^{\circ}\text{C}$

Symbol	Description	Min	Typ ⁽¹⁾	Max	Units	Conditions
TioR	Pin output rise time	--	10	25 ⁽²⁾	ns	
TioF	Pin output fall time	--	10	25 ⁽²⁾	ns	

Note 1: Data in the typical ("typ") column is based on characterization results at 5V, 25°C. These parameters are for design guidance only and are not tested.

2: These parameters are design targets and are not tested. No Characterization data available.

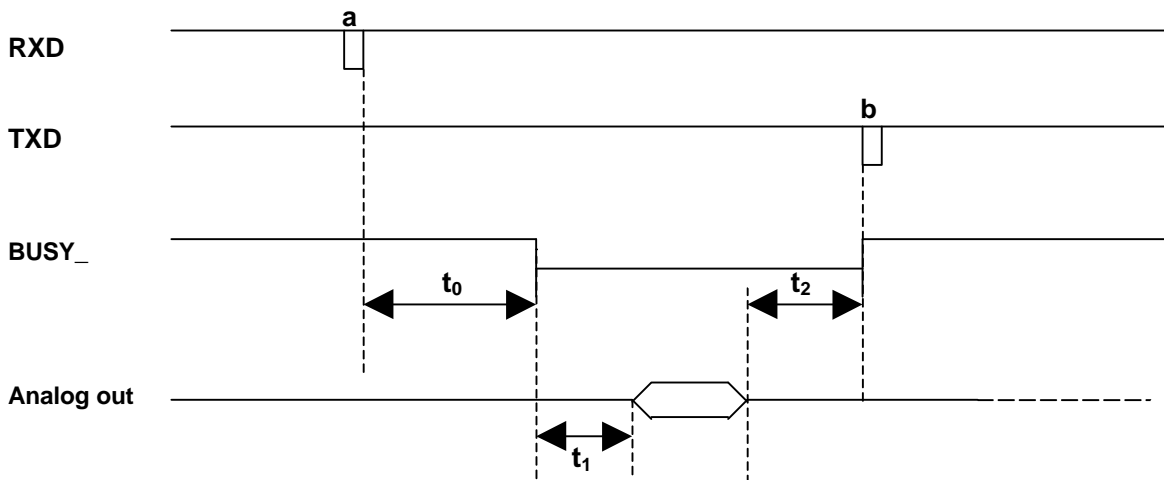
Record timing:



Timing values:

Symbol	event	min	typ	max	unit
t ₀	record mode start to first recording start	200			ms
t ₁	recording length	200		chip-400	ms
t ₂	spacing between subsequent recordings	50			ms
t ₃	start recording to analog in	15			ms
t ₄	end of last recording to end of recording mode	50			ms
t ₅	end of recording mode to next command	500			ms
a	set recording mode (F4h)				
b	start recording command (01h)				
c	stop recording command (00h)				
d	clear recording mode (F0h)				
e	any other command				

Play Timing:

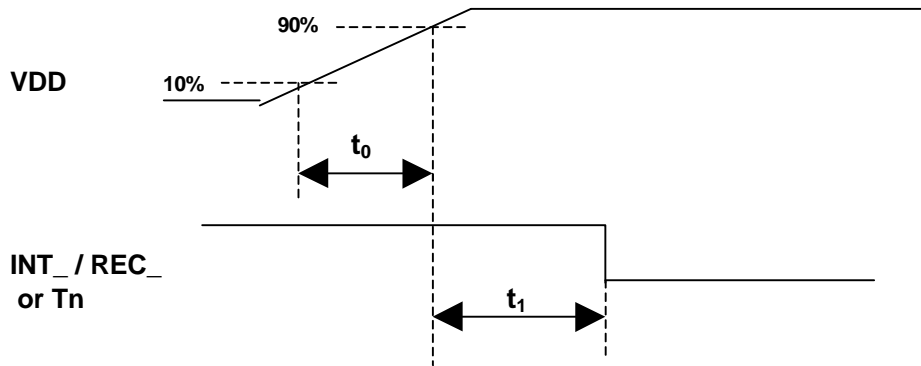


Timing values:

Symbol	event	min	typ	max	unit
t0	play command to BUSY_ active		10		us
t1	BUSY_ active to audio output		15	*	ms
t2	end of sound to BUSY_ inactive		1		ms
a	play command (00h – Efh)				
b	“done” response from QV306m4 (word value)				

*Note: the delay depends on the position of the data in the ISD chip and the number of messages in the project. For the ISD4003-04 and 20 messages, the maximum possible delay is approximately 150ms.

Power up timing:



Timing values:

Symbol	Event	min	typ	max	unit
t0	Vcc rise time			9	ms
t1	Delay to first command	500			ms

Online Support:

Quadravox maintains the latest specifications, schematic diagrams, and support software in the support section of our website, www.quadravox.com/support.htm.

For questions not answered there or for other inquiries, please write us at support@quadravox.com, or call 1-972-669-4002.

Revision 1.2, January 5, 2003.