

2108 Rx SERIAL RECEIVER

A 200 Mhz SERIAL LOGIC ANALYZER • • • •

2108 RX RECEIVER

1.0 INTRODUCTION

The 2108RX was developed to receive and record serial data at frequencies to 200 MHz. The architecture of the 2108RX is best described as a 200 MHz logic analyzer dedicated to serial applications.

A total of 8 megabits of data can be recorded (actually, there are two 8 megabit memories, one storing "GOOD 1" data and the other storing "GOOD 0" data). Alternately, the 2108 can operate in a continuous recording mode where 4 megabits are actively recorded while the previous 4 megabits of recorded data are transferred to a mass storage media. Seamless recording is achieved between the two banks of memory.

2.0 TRIGGERING

The 2108RX incorporates a special purpose TRIGGER SEQUENCER which allows a multitude of trigger combinations. Fig 1 depicts the soft panel which allows the set-up for the TRIGGER SEQUENCE. The TRIGGER SEQUENCE consists of two basic elements: the TRIGGER REGISTERS and the TRIGGER SEQUENCER.

2.1 TRIGGER REGISTERS

As shown in Fig 1, there are 16 thirty-two bit TRIGGER REGISTERS, nomenclated TRIGGER 1 through TRIGGER 16 (alternately, these may be software configured to 8 sixty-four bit trigger registers). The user can program up to 16 different trigger patterns, each pattern being from 1 bit to 32 bits. Any bit within a trigger pattern may be masked off.

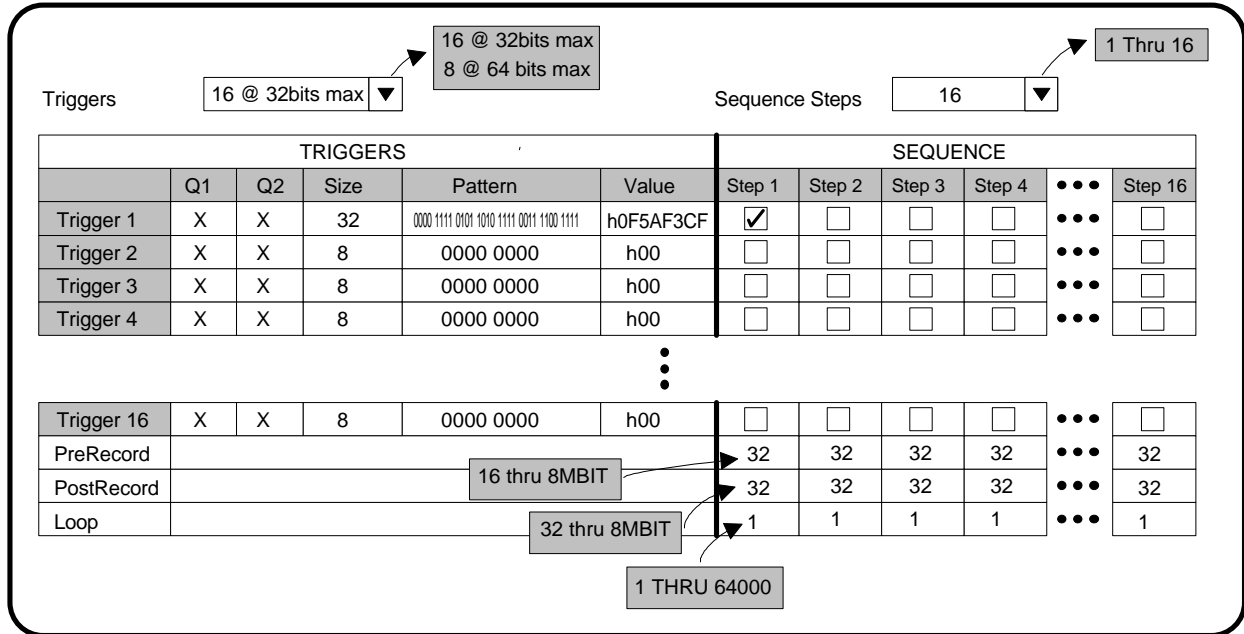


Fig. 1

Once started, the 2108RX is constantly recording data while searching for a trigger pattern. Once triggered, a fixed number of bits prior to the trigger is saved plus a fixed number of bits after the trigger. These bits are referred to as the PRE RECORD data and the POST RECORD data. Fig 1 depicts the

minimum and maximum values for the pre and post data. Note the total of all recorded data is 8 mega-bits.

In addition to the trigger pattern, two QUALIFIER signals may also be added to the trigger equation (reference section 2.6). After the trigger registers are defined, the sequence of the trigger search is entered. This may be best described with a set of examples.

2.2 TRIGGER EXAMPLE #1: Trigger and Record

Fig 2 depicts a typical serial data stream.

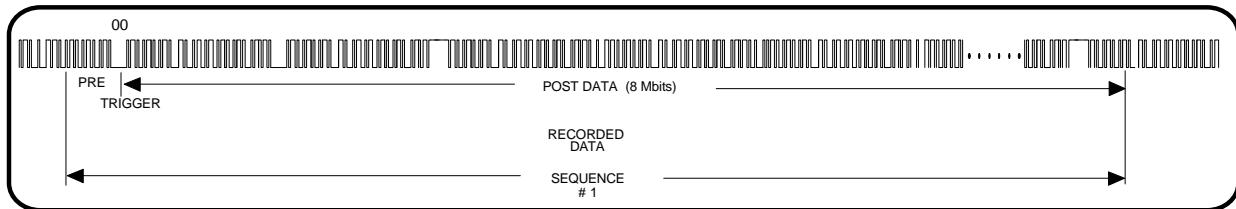


Fig. 2

Assume it is desired to trigger on the first occurrence of the serial hexadecimal character h00. To achieve this, TRIGGER REGISTER 1 would be set to h00, Fig 3. A sequence of 1 STEP would be entered. STEP 1, TRIGGER 1 would then be enabled (shown with a check mark). The PRE RECORD length is set to 64 bits; the POST RECORD bit length is set to 8,000,000 bits with a LOOP count of 1. Once the serial data value of h00 is detected, the 2108RX will save the previous 64 data bits prior to the trigger and then record an additional 8 megabits of data after the trigger, Fig 2.

Triggers 16 @ 32bits max ▼ Sequence Steps 1 ▼

TRIGGERS						SEQUENCE						
	Q1	Q2	Size	Pattern	Value	Step 1	Step 2	Step 3	Step 4	...	Step 16	
Trigger 1	X	X	8	0000 0000	h00	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	•••	<input type="checkbox"/>	
Trigger 2						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	•••	<input type="checkbox"/>	
Trigger 3						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	•••	<input type="checkbox"/>	
Trigger 4						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	•••	<input type="checkbox"/>	
⋮												
Trigger 16						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	•••	<input type="checkbox"/>	
PreRecord						64						•••
PostRecord						8MegBit						•••
Loop						1						•••

Fig. 3

2.3 TRIGGER EXAMPLE #2: Search for a Sequence of Data Values

The following example, although it may have no practical value, should provide the reader with a further understanding of the trigger capability of the 2108RX.

Assume it is desired to record the data surrounding a sequential set of characters. In particular, assume we first want to record 64 bits (32 PRE DATA bits and 32 POST DATA bits) when the hex character h00 is detected. We then want to wait for the hex character h11, then h22 and so forth.

Fig 4 depicts the serial data train and the desired recorded data. Fig 5 depicts the TRIGGER SE-

QUENCE. STEP 1 would be enabled to search for the hex characters h00 with the LOOP set to the value 1. After the trigger occurs, the sequencer would go to STEP 2, which in turn is enabled to search for the value h11. The process will continue until STEP 16 is executed.

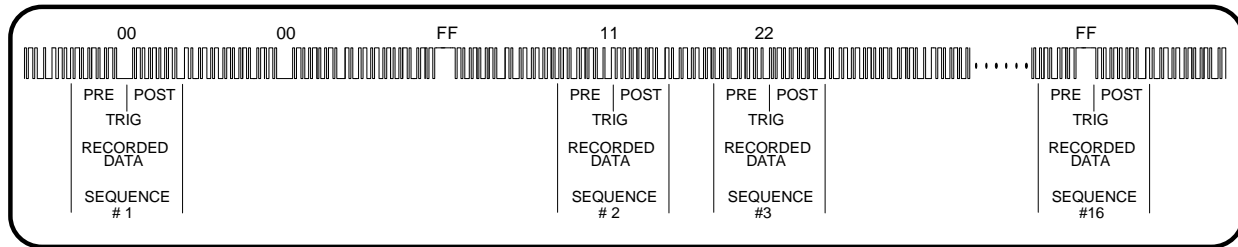


Fig. 4

Triggers Sequence Steps

TRIGGERS						SEQUENCE					
	Q1	Q2	Size	Pattern	Value	Step 1	Step 2	Step 3	Step 4	...	Step 16
Trigger 1	X	X	8	0000 0000	h00	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...	<input type="checkbox"/>
Trigger 2	X	X	8	0001 0001	h11	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...	<input type="checkbox"/>
Trigger 3	X	X	8	0010 0010	h22	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	...	<input type="checkbox"/>
Trigger 4	X	X	8	0011 0011	h33	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	...	<input type="checkbox"/>
⋮											
Trigger 16	X	X	8	1111 1111	hFF	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...	<input checked="" type="checkbox"/>
PreRecord						32	32	32	32	...	32
PostRecord						32	32	32	32	...	32
Loop						1	1	1	1	...	1

Fig. 5

2.4 TRIGGER EXAMPLE #3: Search for Multiple Data Values

Note the recorded results, Fig 6, if TRIGGER 1 is also enabled in STEP 2 of the SEQUENCER. At STEP 2, the SEQUENCER will now search for the character occurrence of either h00 or h11, Fig 7.

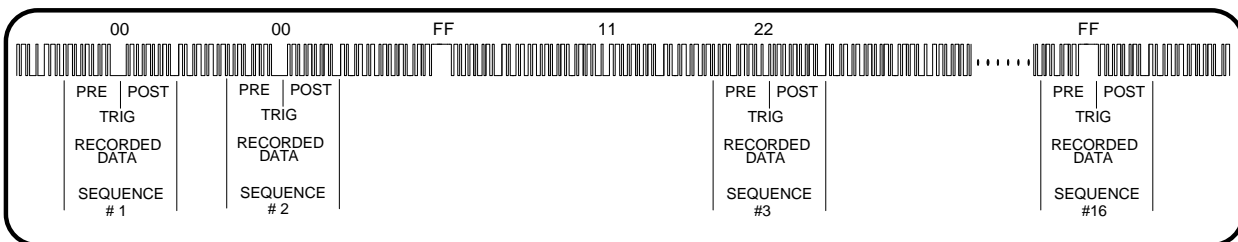


Fig. 6

Triggers: 16 @ 32bits max Sequence Steps: 16

TRIGGERS						SEQUENCE					
	Q1	Q2	Size	Pattern	Value	Step 1	Step 2	Step 3	Step 4	...	Step 16
Trigger 1	X	X	8	0000 0000	h00	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...	<input type="checkbox"/>
Trigger 2	X	X	8	0001 0001	h11	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...	<input type="checkbox"/>
Trigger 3	X	X	8	0010 0010	h22	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	...	<input type="checkbox"/>
Trigger 4	X	X	8	0011 0011	h33	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	...	<input type="checkbox"/>
⋮											
Trigger 16	X	X	8	1111 1111	hFF	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...	<input checked="" type="checkbox"/>
PreRecord						32	32	32	32	...	32
PostRecord						32	32	32	32	...	32
Loop						1	1	1	1	...	1

Fig. 7

If two or more triggers are enabled in a particular step, the 2108RX will search and trigger if any of the trigger values are detected. Fig 8 and fig 9 depict the recorded data and SEQUENCE set up menu when all the triggers are enabled. For STEP 1 note the LOOP count is set to 16 (reference Section 2.5).

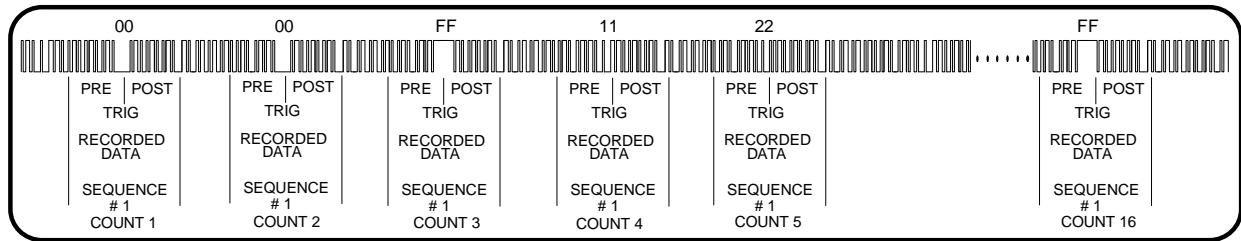


Fig. 8

Triggers: 16 @ 32bits max Sequence Steps: 1

TRIGGERS						SEQUENCE					
	Q1	Q2	Size	Pattern	Value	Step 1	Step 2	Step 3	Step 4	...	Step 16
Trigger 1	X	X	8	0000 0000	h00	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...	<input type="checkbox"/>
Trigger 2	X	X	8	0001 0001	h11	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...	<input type="checkbox"/>
Trigger 3	X	X	8	0010 0010	h22	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...	<input type="checkbox"/>
Trigger 4	X	X	8	0011 0011	h33	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...	<input type="checkbox"/>
⋮											
Trigger 16	X	X	8	1111 1111	hFF	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...	<input type="checkbox"/>
PreRecord						32				...	
PostRecord						32				...	
Loop						16				...	

Fig. 9

2.5 TRIGGER EXAMPLE #4: Record a Multiple Number of Words

Each SEQUENCE step incorporates a LOOP count value. This enables the recording of multiple words, each with a common or unique trigger value. Assume the code h00 precedes each data word to be captured and we want to trigger and record 1000 data words. Fig 10 and Fig 11 depict this scenario.

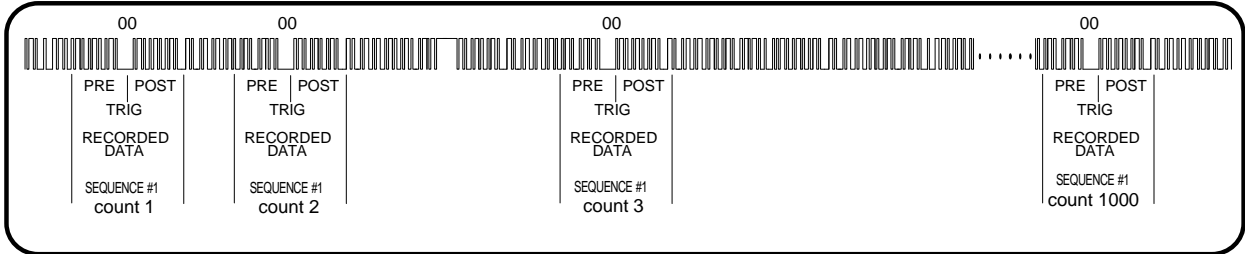


Fig. 10

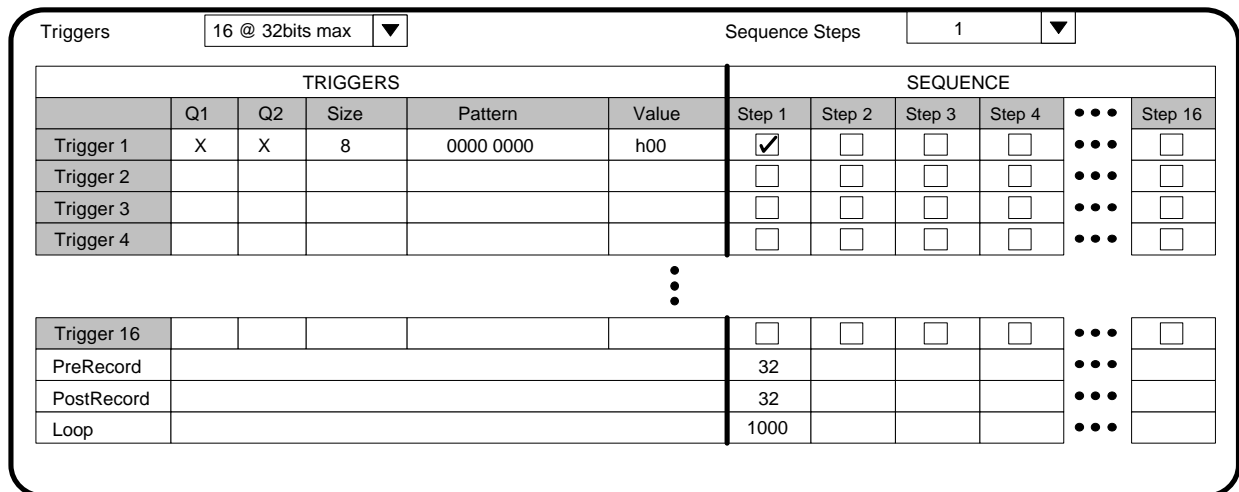


Fig. 11

2.6 TRIGGER EXAMPLE #5: Trigger on Qualifier

In addition to the 16 trigger registers, there are two QUALIFIER signals. These two signals can be logically combined with the trigger registers to form a more complex trigger event.

Assume an interface uses a separate signal, a DATA ENABLE signal, to indicate that the serial data is valid. Fig 12 and Fig 13 depict the recorded data and SEQUENCE set up to record 1000 words, one for each time the DATA ENABLE goes true (Active Low).

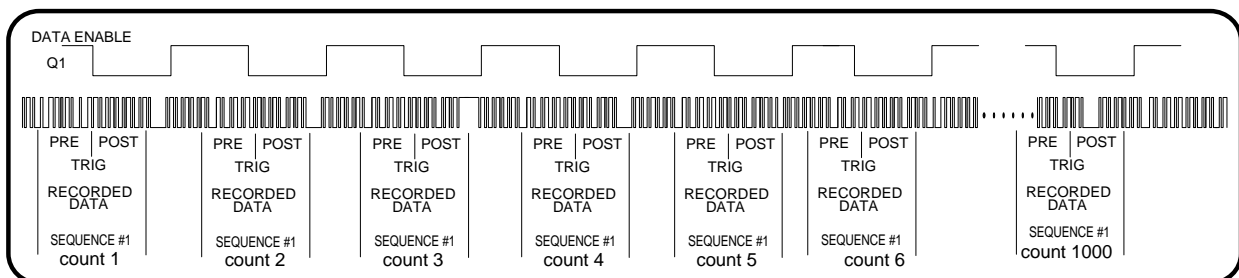


Fig. 12

Triggers 16 @ 32bits max ▼ Sequence Steps 1 ▼

TRIGGERS						SEQUENCE					
	Q1	Q2	Size	Pattern	Value	Step 1	Step 2	Step 3	Step 4	•••	Step 16
Trigger 1	0	X	8	XXXX XXXX	hXX	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	•••	<input type="checkbox"/>
Trigger 2						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	•••	<input type="checkbox"/>
Trigger 3						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	•••	<input type="checkbox"/>
Trigger 4						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	•••	<input type="checkbox"/>
⋮											
Trigger 16						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	•••	<input type="checkbox"/>
PreRecord						32				•••	
PostRecord						32				•••	
Loop						1000				•••	

Fig. 13

The QUALIFIERS can also be logically combined with the trigger registers. Fig 14 and Fig 15 depict the recording of data when the QUALIFIER 1 is true and the data value of hFF is detected. After this occurrence, STEP 2 will record 1000 data words only when DATA ENABLE is true.

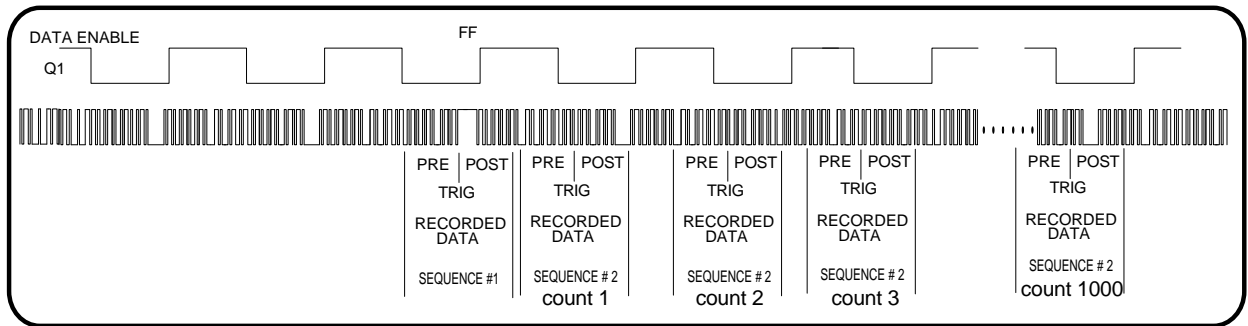


Fig. 14

Triggers 16 @ 32bits max ▼ Sequence Steps 2 ▼

TRIGGERS						SEQUENCE					
	Q1	Q2	Size	Pattern	Value	Step 1	Step 2	Step 3	Step 4	•••	Step 16
Trigger 1	0	X	8	1111 1111	hFF	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	•••	<input type="checkbox"/>
Trigger 2	0	X	8	XXXX XXXX	hXX	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	•••	<input type="checkbox"/>
Trigger 3						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	•••	<input type="checkbox"/>
Trigger 4						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	•••	<input type="checkbox"/>
⋮											
Trigger 16						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	•••	<input type="checkbox"/>
PreRecord						32	32			•••	
PostRecord						32	32			•••	
Loop						1	1000			•••	

Fig. 15

2.7 TRIGGER EXAMPLE: Trigger on Waveform

Each data bit of a serial bus consists of a particular bit format; AMI, BiPhase, NRZ, etc. Once the 2108RX knows the bit format, the 2108RX compensates for the format such that the user enters his trigger data in a user orientated format.

Many serial interfaces use illegal data formats for the purpose of syncing the transmitter with the receiver. The 1553 interface is an example of this. A legal Manchester code does not allow for three consecutive 1/2 bit times of ones followed by three consecutive 1/2 bit times of zeros. The 1553 takes advantage of this by using this illegal code to indicate that data following the illegal code is valid data. It is therefore imperative that the 2108RX TRIGGER logic have the ability to TRIGGER on valid data streams as well as invalid data streams.

The TRIGGER on WAVEFORM function accomplishes this function. In addition to the TRIGGER and QUALIFIER data, the user may enter a WAVEFORM in the TRIGGER "equation". The WAVEFORM is always entered in 1/2 bit times. Fig 16 and Fig 17 depict the trigger set up for a waveform combined with a data value.

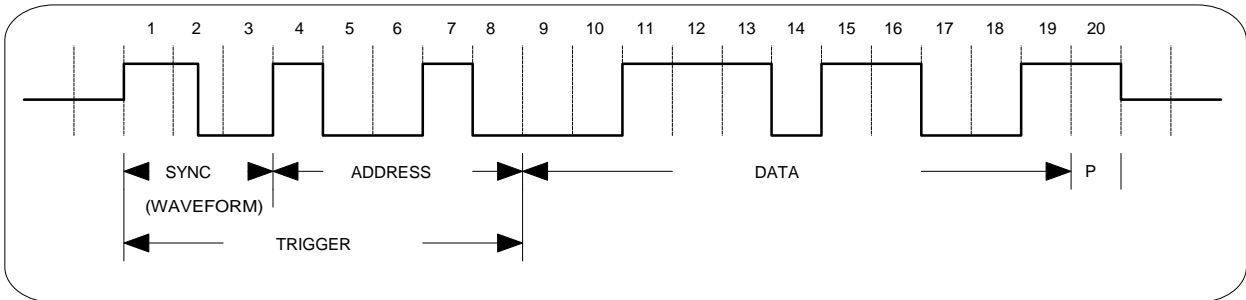


Fig. 16

Triggers: 16 @ 32bits max

Sequence Steps: 1

	TRIGGERS						SEQUENCE					
	Q1	Q2	Size	Waveform	Pattern	Value	Step 1	Step 2	Step 3	Step 4	...	Step 16
Trigger 1	X	X	5		XXX0 1001	h09	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...	<input type="checkbox"/>
Trigger 2							<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...	<input type="checkbox"/>
Trigger 3							<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...	<input type="checkbox"/>
Trigger 4							<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...	<input type="checkbox"/>
⋮												
Trigger 16							<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	...	<input type="checkbox"/>
PreRecord							16				...	
PostRecord							32				...	
Loop							1				...	

Fig. 17

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INSTRUMENTS

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