

PRECISION VERY LONG TIME PULSE

October 1991

The LS7210 can be used to generate extremely long, very precise delay times with the use of the RDD 104 and its crystal oscillator. **Figure 1** shows the use of two RDD 104's and the LS7210 to generate a 1.12 second positive pulse every 24 hours. The first RDD 104 operates with a 3.67065 crystal and provides a 10,000 to 1 clock division most of the time. The second RDD 104 provides a 1,000 to 1 clock division most of the time. The frequency output of the second RDD 104 is normally .367065Hz. This is applied to the LS7210 clock input. With all the weighting factor inputs of the LS7210 tied to a logic zero, the output of the LS7210, which is in the Dual Delay Mode, will be negative for 23 hours, 59 minutes and 58.88 seconds. When the output switches to a logic 1, the LS7210 is re-triggered and only the LSB+2 weighting factor input becomes tied to a logic zero. The first RDD 104 is placed into a Divide by 100 Mode and the second RDD 104 is placed into a divide by 10 Mode. The input clock to the LS7210 becomes 3.67KHz. With the new weighting factor and the higher speed, the output will remain a logic 1 for only 1.12 seconds. When the output switches to a logic 0, the cycle is repeated. The output waveform is shown in **Figure 1**.

A circuit used to generate a programmable long time precision pulse train generator using only the LS7210 is shown in **Figure 2**. Again, the LS7210 is placed in the Dual Delay Mode. Calibration of the circuit to achieve a 30 minute LSB weight when the output is a logic zero and a 1 minute LSB weight when the output is a logic one, is as follows: Ground the base of transistor T1 and calibrate the oscillator for a frequency of .57Hz by adjusting the 5Mohm potentiometer. Then remove the ground and adjust the 100Kohm potentiometer for a frequency of 17.1Hz. The DIP switches DS1 and DS2 provide for programming the output logic one and logic zero times as binary

multiples of the LSB weight. The binary weighting factors are shown on DS1 and DS2 of **Figure 2**. For example, if a 5 minute logic one and a 12 hour logic zero are desired, close switches 1 and 4 on DS1 and close switches 8 and 16 on DS2. The resulting pulse train is shown in **Figure 2**.

Figure 3 shows a method for extending the time delay out of the LS7210 for up to one year and even longer. For 1 year timing, a 3Mohm resistor and a 300uF capacitor could be used with the LS7210 internal oscillator generating a .001Hz frequency. Using the equation for delay from the LS7210 Data Sheet, the delay calculates out to be approximately one year. However, if the 300uF capacitor is leaky, the frequency would be unpredictable. A much better solution utilizes an unsymmetrical oscillator stage to produce a low duty cycle charge for the RC network used with the LS7210 internal oscillator. As can be seen from the figure, the capacitor C is being charged for time "T" and remains uncharged for time $(R_2/R_1+1)T$ of every oscillation cycle. If R remains a 3Mohm resistor, the 300uF capacitor can be reduced by a factor of (R_2/R_1+1) . For example, in **Figure 3**, if $R_2 = 4.7\text{Mohms}$ and $R_1 = 47\text{Kohm}$, then the 300uF capacitor can be reduced to approximately 3uF, thereby eliminating any unpredictability due to leakage. The frequency of the unsymmetrical oscillator is immaterial. The C1 capacitor shown in the Schmitt trigger oscillator can have a value which is conveniently chosen.

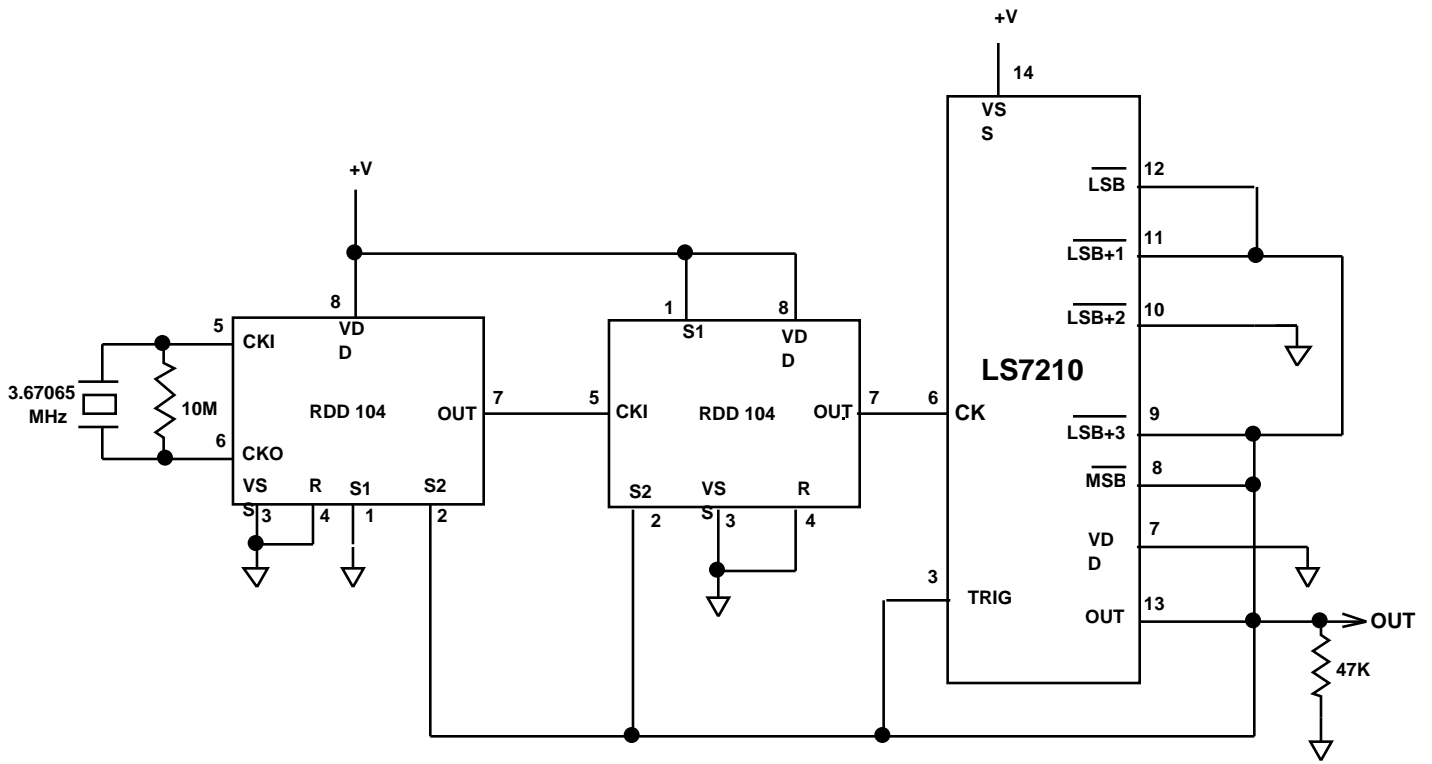
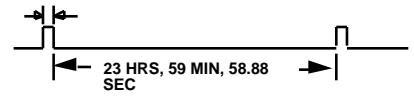
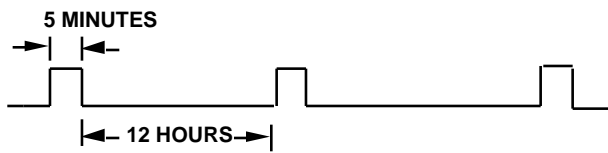
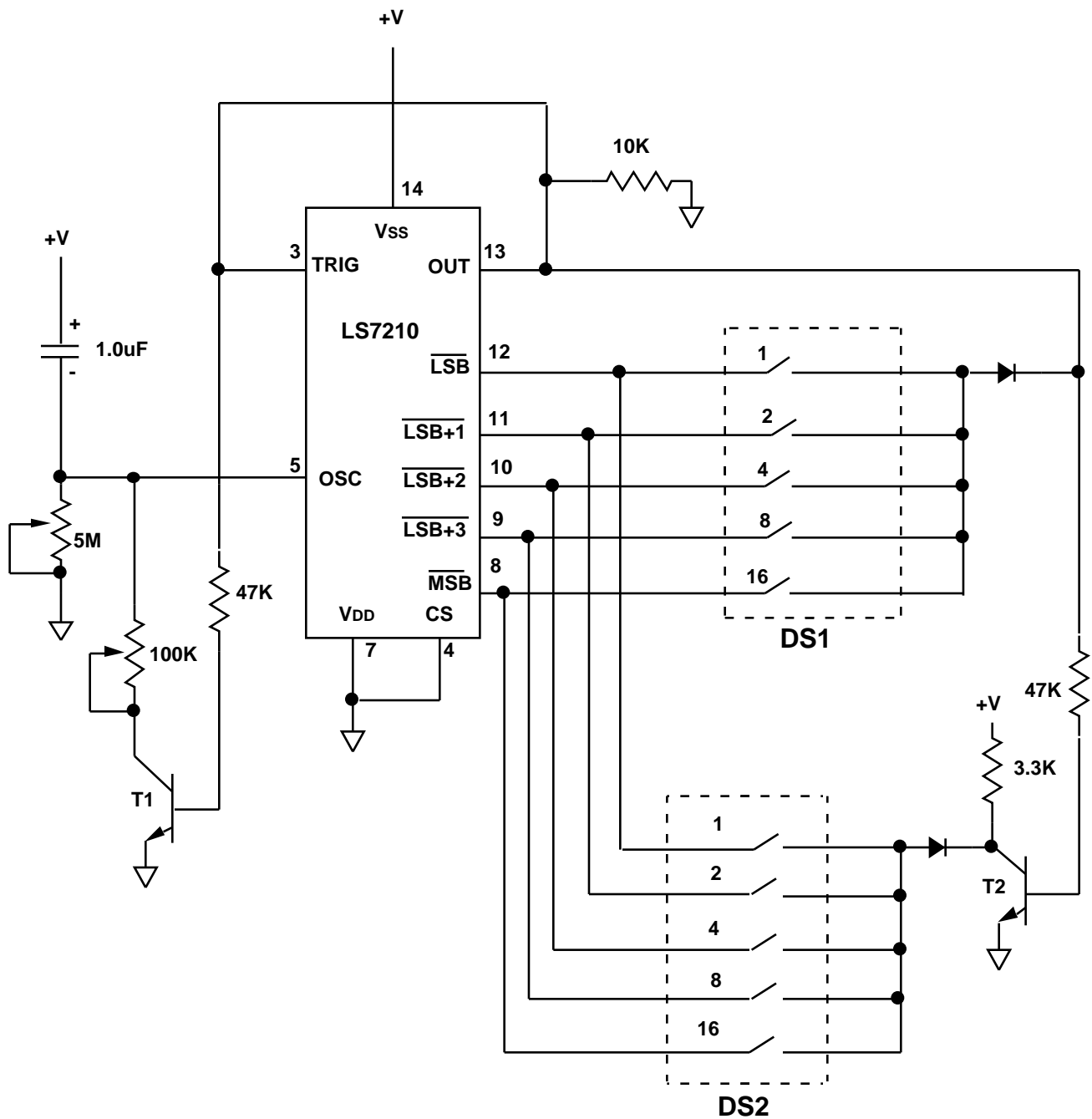


FIGURE 1. PRECISION LONG TIME DELAY GENERATOR

1.12 SECONDS

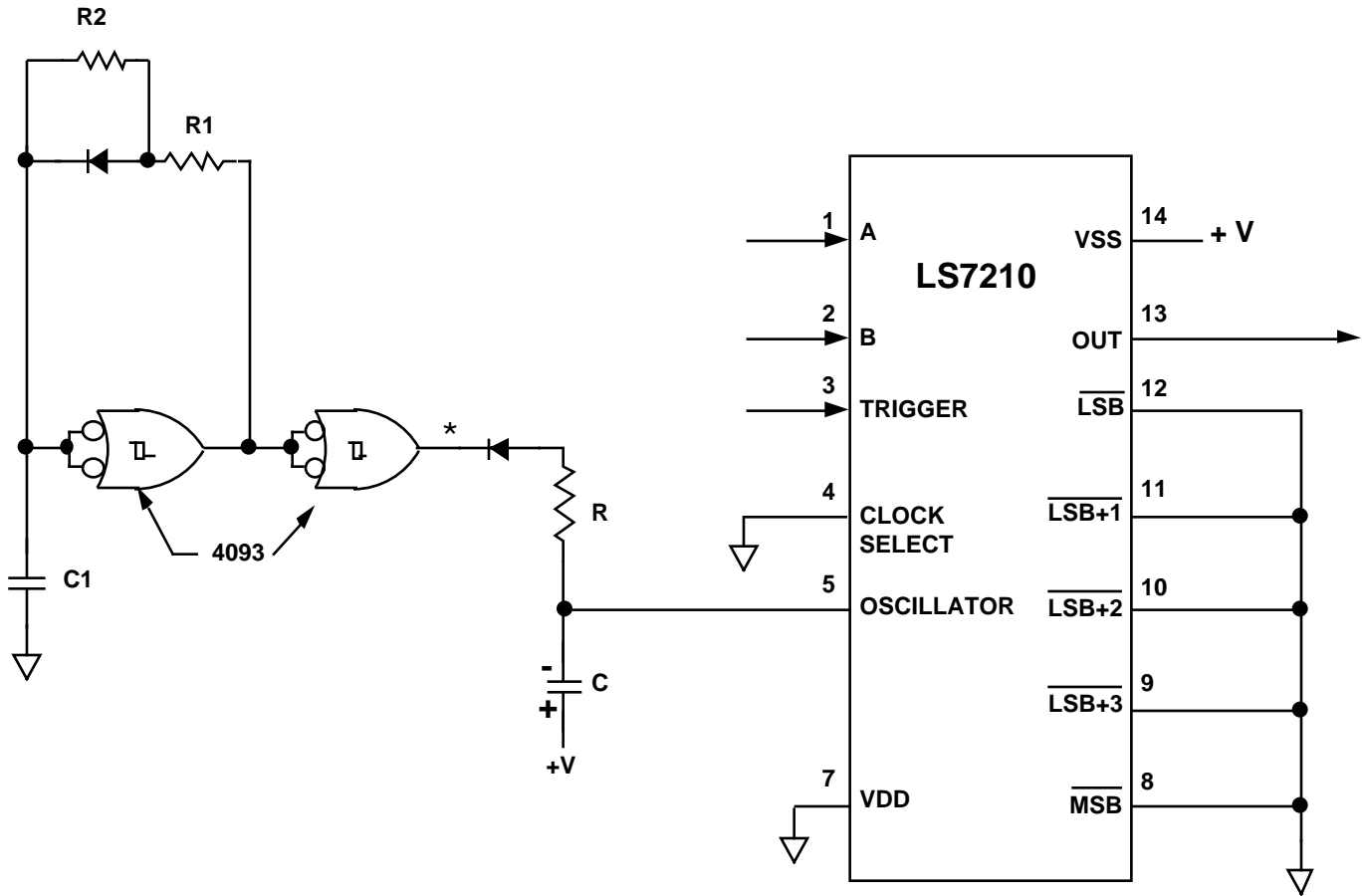


LS7210 OUTPUT WAVEFORM (PIN 13)



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FIGURE 2.
PROGRAMMABLE LONG TIME PRECISION PULSE GENERATOR



* WAVEFORM AT THIS NODE:

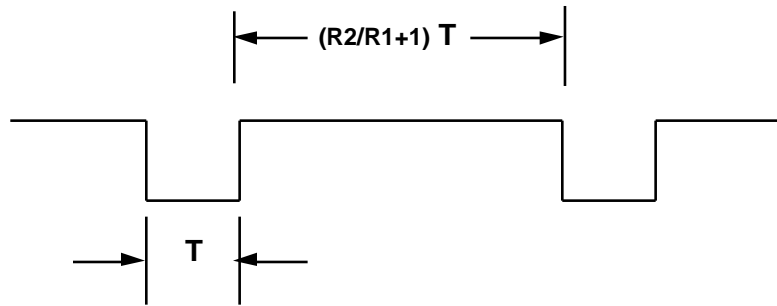


FIGURE 3. EXTREMELY LONG TIME DELAY GENERATOR