

# APPLICATION NOTE

**AN171**  
NE558 applications

1988 Dec

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## INTRODUCTION

The 558 is a monolithic Quad Timer designed to be used in the timing range from a few microseconds to a few hours. Four entirely independent timing functions can be achieved using a timing resistor and capacitor for each section. Two sections of the quad may be interconnected for astable operation. All four sections may be used together, in tandem, for sequential timing applications up to several hours. No coupling capacitors are required when connecting the output of one timer section to the input of the next.

## FEATURES

- 100mA output current per section
- Edge-triggered (no coupling capacitor)
- Output independent of trigger conditions
- Wide supply voltage range 4.5V to 16V
- Timer intervals from microseconds to hours
- Time period equals RC

## CIRCUIT OPERATIONS

In the one-shot mode of operation, it is necessary to supply a minimum of two external components (the resistor and capacitor) for timing. The time period is equal to the product of R and C. An output load must be present to complete the circuit due to the output structure of the 558.

For astable operation, it is desirable to cross-couple two devices from the 558 Quad. The outputs are direct-coupled to the opposite trigger input. The duty cycle can be set by the ratio of  $R_1C_1$  to  $R_2C_2$ , from close to zero to almost 100%. An astable circuit using one timer is shown in Figure 5b.

## OUTPUT STRUCTURE 558

The 558 structure is open-collector which requires a pull-up resistor to  $V_{CC}$  and is capable of sinking 100mA per unit, but not to exceed the power dissipation and junction temperature rating of the die and package. The output is normally low and is switched high when triggered.

## RESET

A reset function has been made available to reset all sections simultaneously to an output low state. During reset the trigger is

disabled. After reset is finished, the trigger voltage must be taken high and then low to implement triggering.

The reset voltage must be brought below 0.8V to insure reset.

## THE CONTROL VOLTAGE

The control voltage is also made available on the 558 timer. This allows the threshold

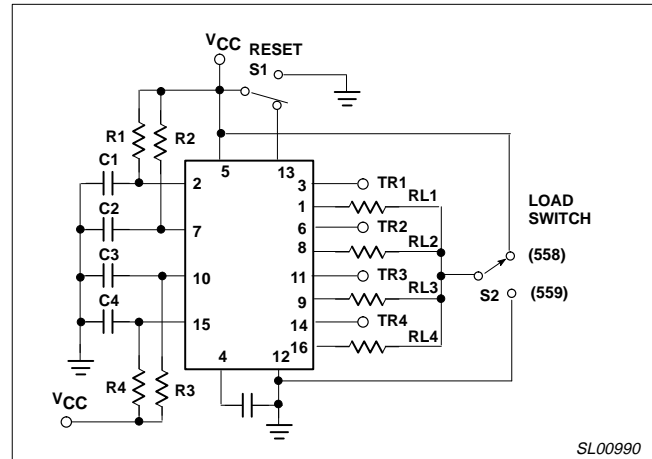


Figure 1. 558 Test Circuit

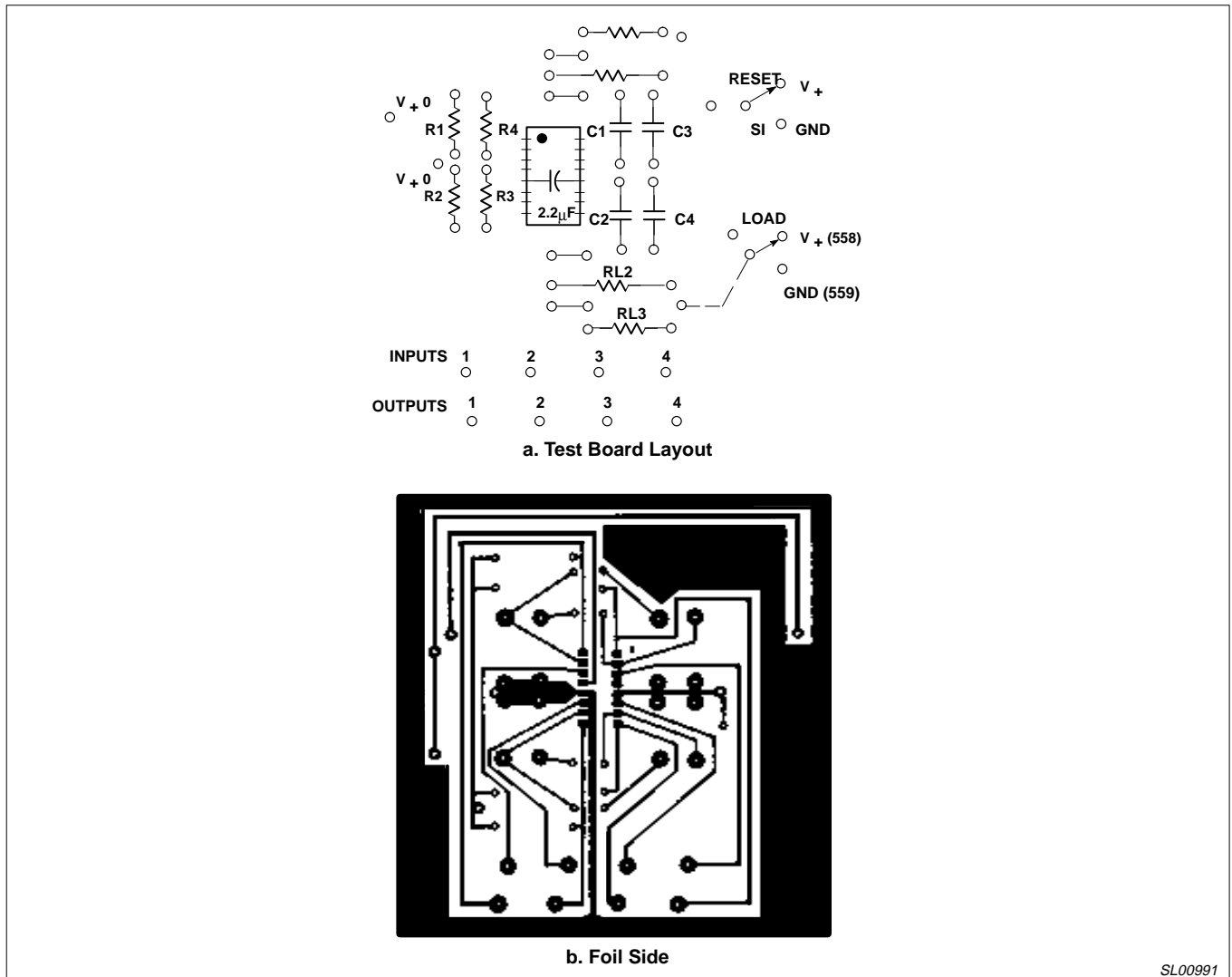
voltage to be modulated, therefore controlling the output pulse width and duty cycle with an external control voltage. The range of this control voltage is from about 0.5V to  $V_{CC}$  minus 1V. This will give a cycle time variation of about 50:1. In a sequential timer with voltage-controlled cycle time, the timing periods remain proportional over the adjustment range.

## TEST BOARD FOR 558

The circuit layout can be used to test and characterize the 558 timer.  $S_2$  is used to connect the loads to either  $V_{CC}$  or ground. The main precaution, in layout of the 558 circuit, is the path of the discharge current from the timing capacitor to ground (Pin 12). The path must be direct to Pin 12 and not on the ground bus. This is to prevent voltage spikes on the ground bus return due to current switching transient. It is also wise to use good power supply bypassing when large currents are being switched.

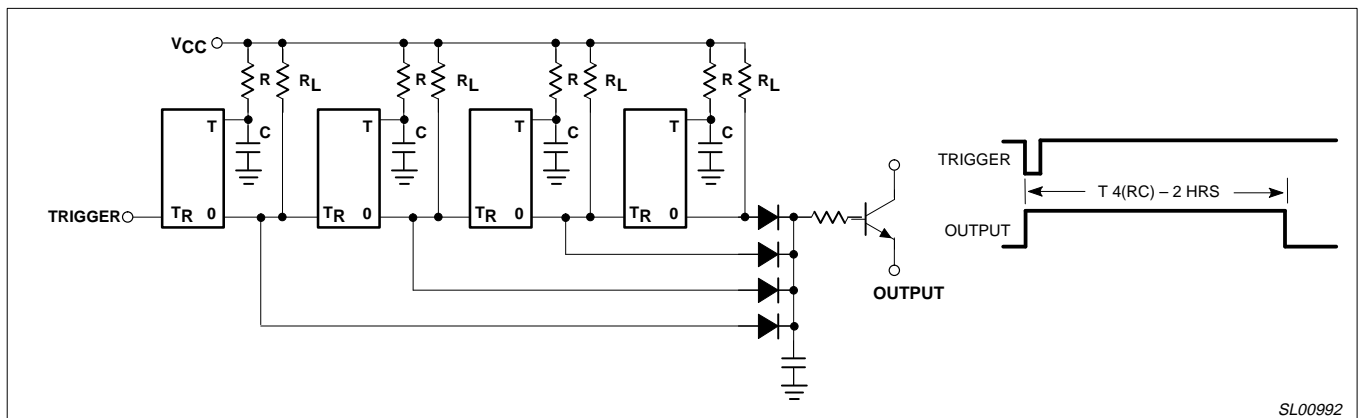
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Figure 2.



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Figure 3. 558 Two-Hour Timer

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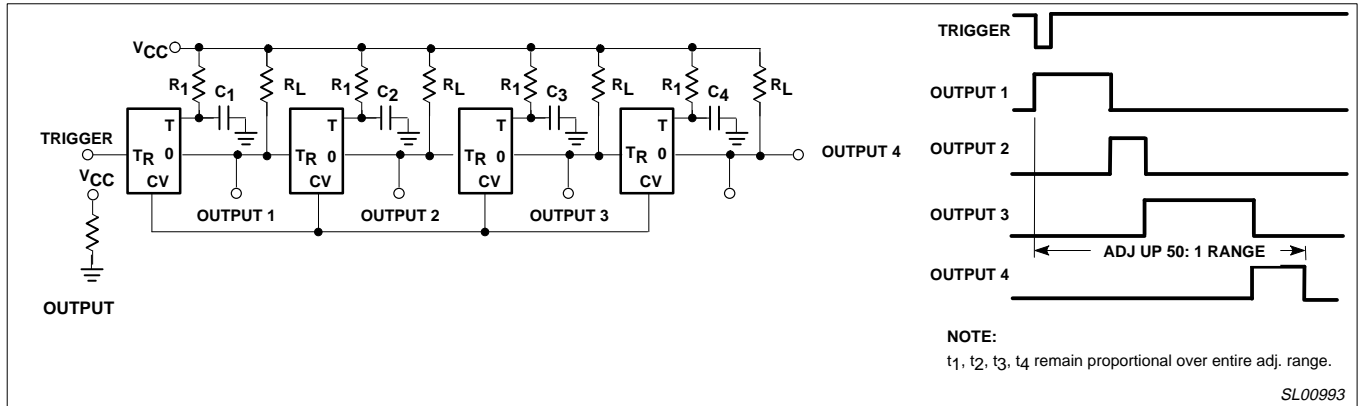


Figure 4. 558 Sequential Timer With Voltage-Controlled Cycle Time (50:1 Range)

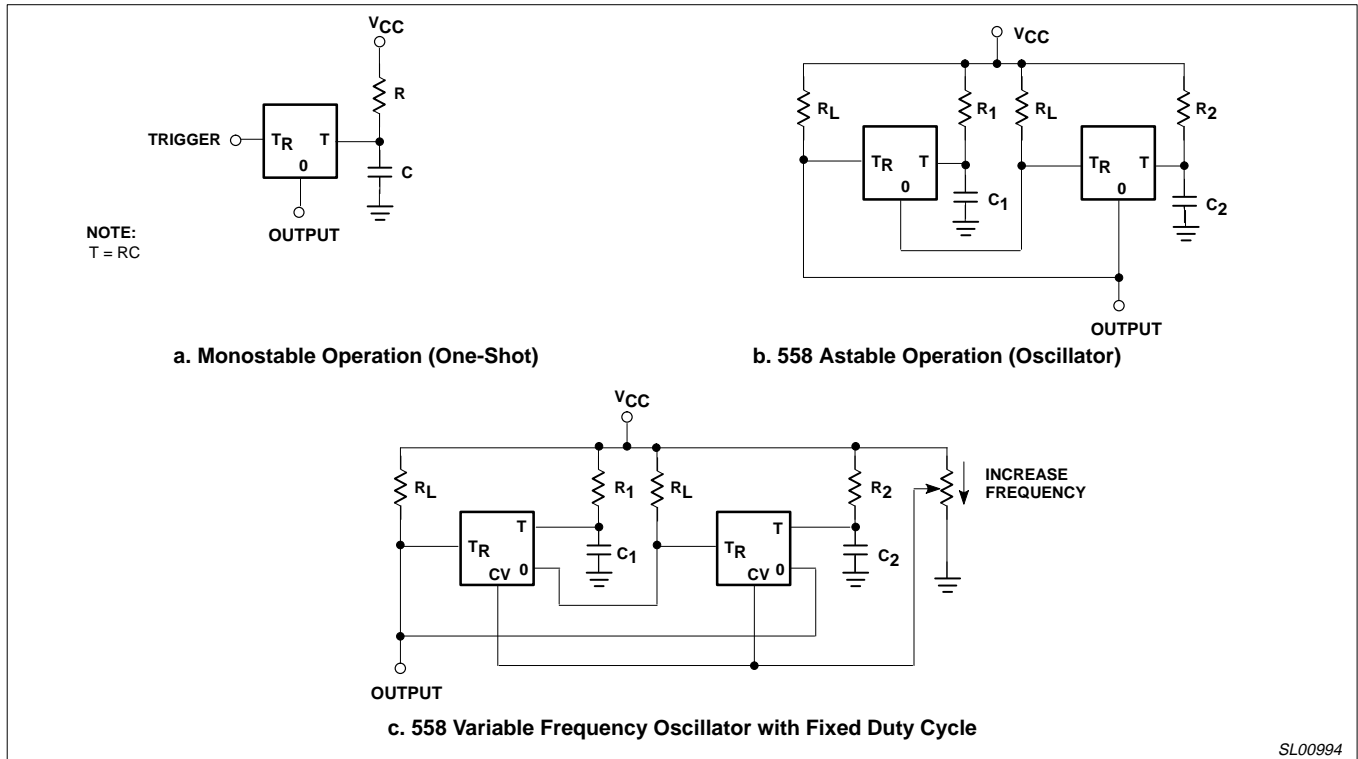


Figure 5.

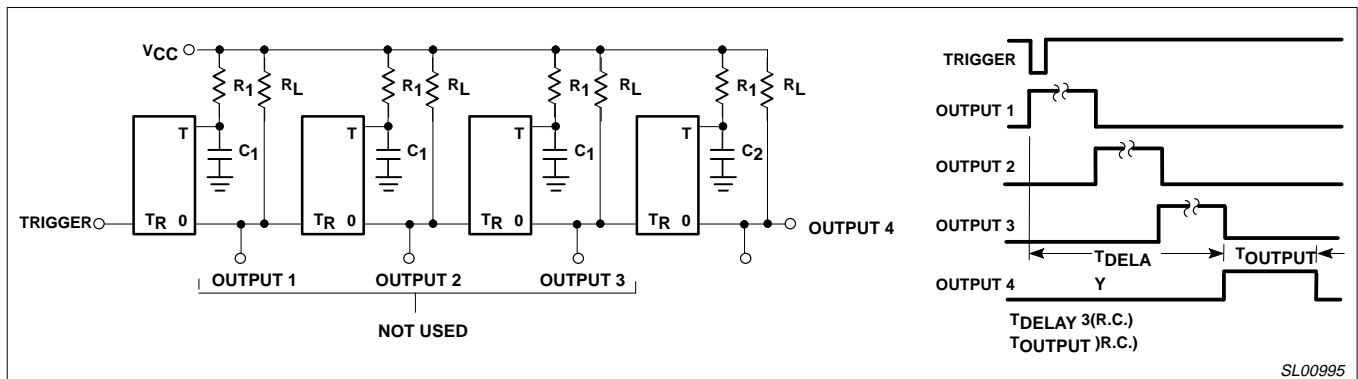
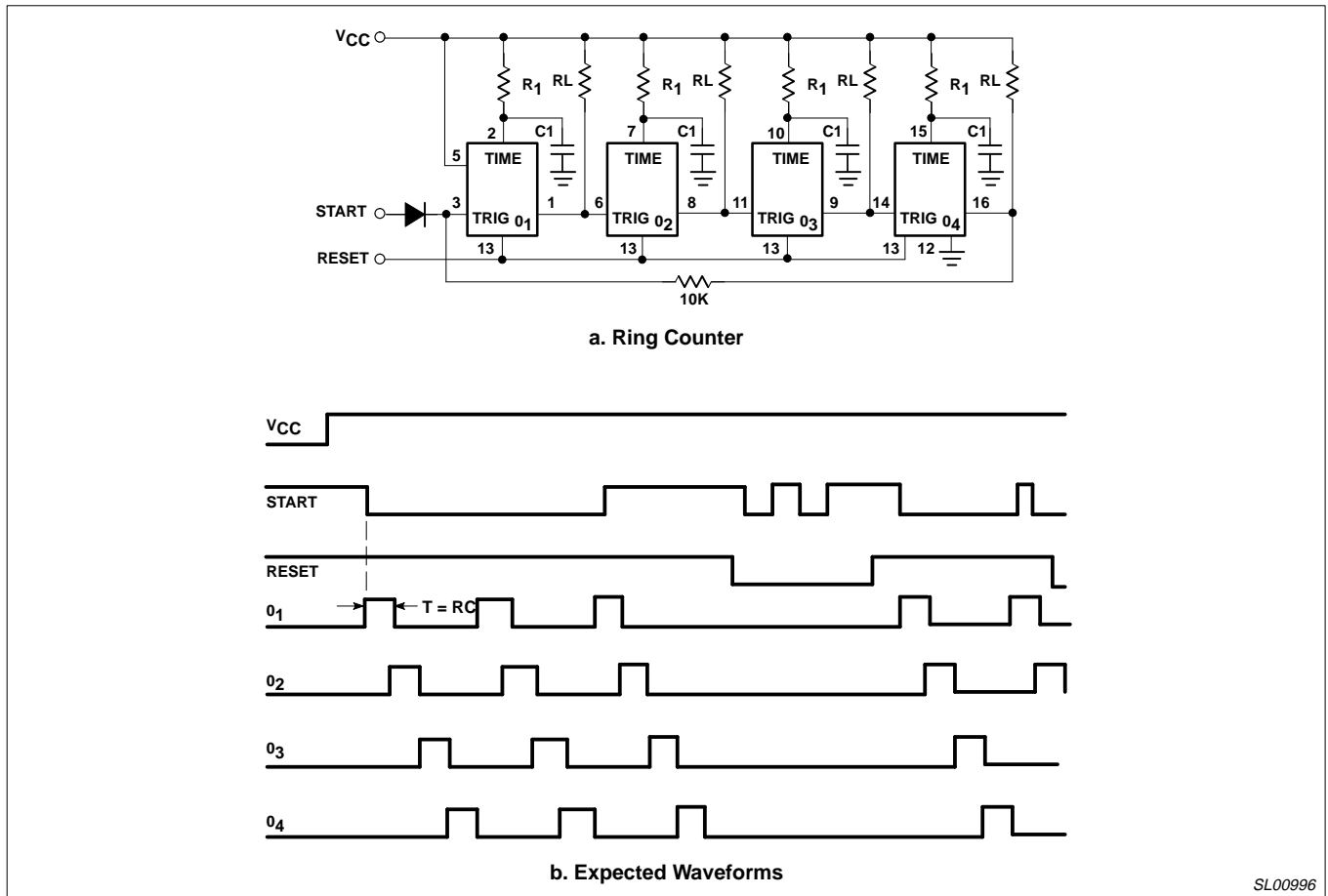


Figure 6. 558 Long Time Delay

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Figure 7.

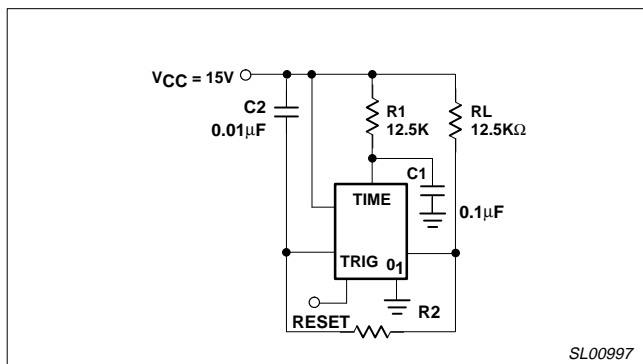


Figure 8. NE558 400Hz Square Wave Oscillator

A single section of the quad time may be used as a non-precision oscillator. The values given are for oscillation at about 400Hz.  $T_1 \approx R_1 C_1$  and  $T_2 \approx 2.25 R_2 C_2$  for  $V_{CC}$  of 15V. The frequency of oscillation is subject to the changes in  $V_{CC}$ .

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