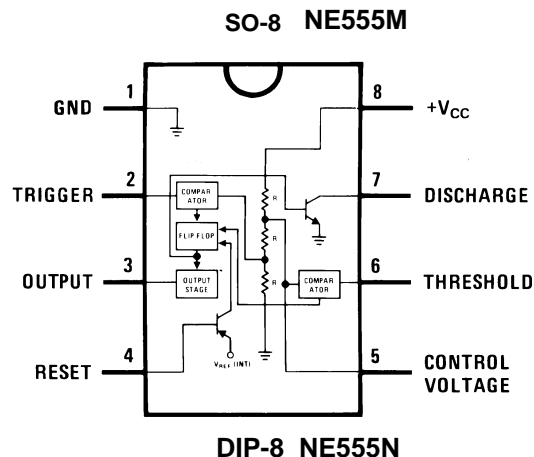




# Precision Timer

NE555

## Connection Diagram



## FUNCTION TABLE

RESET	TRIGGER VOLTAGE	THRESHOLD VOLTAGE	OUTPUT	DISCHARGE SWITCH
Low	Irrelevant	Irrelevant	Low	On
High	$<1/3V_{DD}$	High	High	Off
High	$>1/3V_{DD}$	$>2/3V_{DD}$	Low	On
High	$>1/3V_{DD}$	$<2/3V_{DD}$	As previously established	

## General Description

The NE555 is a highly stable device for generating accurate time delays or oscillation. Additional terminals are provided for triggering or resetting if desired. In the time delay mode of operation, the time is precisely controlled by one external resistor and capacitor. For astable operation as an oscillator, the free running frequency and duty cycle are accurately controlled with two external resistors and one capacitor. The circuit may be triggered and reset on falling waveforms, and the output circuit can source or sink up to 200mA or drive TTL circuits.

## Features

- Direct replacement for SE555/NE555
- Timing from microseconds through hours
- Operates in both astable and monostable modes
- Adjustable duty cycle
- Output can source or sink 200 mA
- Output and supply TTL compatible
- Normally on and normally off output

## Applications

- Precision timing
- Pulse generation
- Sequential timing
- Time delay generation
- Pulse width modulation
- Pulse position modulation
- Linear ramp generator

**ELECTRICAL CHARACTERISTICS**(T<sub>A</sub> = 25°C, V<sub>CC</sub> = +5V to +15V, unless otherwise specified)

Parameter	Conditions	Limits			Units
		Min	Typ	Max	
Supply Voltage		4.5		16	V
Supply Current	V <sub>CC</sub> = 5V, R <sub>L</sub> = ∞ OUTPUT LOW		3	6	mA
Note 4	V <sub>CC</sub> = 15V, R <sub>L</sub> = ∞ OUTPUT LOW		10	15	
	V <sub>CC</sub> =5V, No load OUTPUT HIGH		2	5	
Timing Error, Monostable	R <sub>A</sub> = 1k to 100kΩ, C = 0.1μF, (Note 5)				% ppm/°C
Initial Accuracy			1	3	
Drift with Temperature			50		% %/V
Accuracy over Temperature			1.5		
Drift with Supply			0.1	0.5	
Timing Error, Astable	R <sub>A</sub> , R <sub>B</sub> = 1k to 100kΩ, C = 0.1μF, (Note 5)				% ppm/°C
Initial Accuracy			2.25		
Drift with Temperature			150		% %/V
Accuracy over Temperature			3.0		
Drift with Supply			0.30		
Threshold Voltage			0.667		x V <sub>CC</sub>
Trigger Voltage	V <sub>CC</sub> = 15V	4.5	5	5.6	V
	V <sub>CC</sub> = 5V	1.1	1.67	2.2	V
Trigger Current	Trigger at 0V		0.5	2	uA
Reset Voltage		0.3	0.7	1	V
Reset Current	Reset at V <sub>CC</sub>		0.1	0.4	mA
Threshold Current	(Note 6)		30	250	nA
Control Voltage Level	V <sub>CC</sub> = 15V	9	10	11	V
	V <sub>CC</sub> = 5V	2.6	3.33	4	
Pin 7 Leakage Output High			20	100	nA
Pin 7 Sat (Note 7)					
Output Low	V <sub>CC</sub> = 15V, I <sub>7</sub> = 15mA		180		mV
Output Low	V <sub>CC</sub> = 4.5V, I <sub>7</sub> = 4.5mA		80	200	mV

## Electrical Characteristics (Notes 1, 2) (Continued)

( $T_A = 25^\circ\text{C}$ ,  $V_{CC} = +5\text{V}$  to  $+15\text{V}$ , unless otherwise specified)

Parameter	Conditions	Limits			Units
		Min	Typ	Max	
Output Voltage Drop (Low)	V <sub>CC</sub> = 15V				
	I <sub>SINK</sub> = 10mA		0.1	0.25	V
	I <sub>SINK</sub> = 50mA		0.4	0.75	V
	I <sub>SINK</sub> = 100mA		2	2.5	V
	I <sub>SINK</sub> = 200mA		2.5		V
	V <sub>CC</sub> = 5V				
	I <sub>SINK</sub> = 8mA		0.15	0.4	V
	I <sub>SINK</sub> = 5mA		0.1	0.35	V
Output Voltage Drop (High)	I <sub>SOURCE</sub> = 200mA, V <sub>CC</sub> = 15V		12.5		V
	I <sub>SOURCE</sub> = 100mA, V <sub>CC</sub> = 15V	12.75	13.3		V
	V <sub>CC</sub> = 5V	2.75	3.3		V
Rise Time of Output			100	300	ns
Fall Time of Output			100	300	ns

**Note 1:** All voltages are measured with respect to the ground pin, unless otherwise specified.

**Note 2:** Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is functional, but do not guarantee specific performance limits. Electrical Characteristics state DC and AC electrical specifications under particular test conditions which guarantee specific performance limits. This assumes that the device is within the Operating Ratings. Specifications are not guaranteed for parameters where no limit is given, however, the typical value is a good indication of device performance.

**Note 3:** For operating at elevated temperatures the device must be derated above  $25^\circ\text{C}$  based on a  $+150^\circ\text{C}$  maximum junction temperature and a thermal resistance  $170^\circ\text{C/W}$  (S0-8), junction to ambient.

**Note 4:** Supply current when output high typically 9mA and MAX. is 13mA at  $V_{CC}=15\text{V}$ .

**Note 5:** Tested at  $V_{CC} = 5\text{V}$  and  $V_{CC} = 15\text{V}$ .

**Note 6:** This will determine the maximum value of  $R_A + R_B$  for 15V operation. The maximum total ( $R_A + R_B$ ) is  $20\text{M}\Omega$ .

**Note 7:** No protection against excessive pin 7 current is necessary providing the package dissipation rating will not be exceeded.

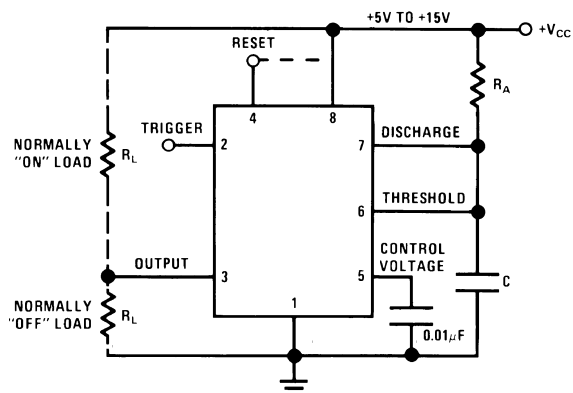
## RECOMMENDED OPERATING

	MIN	MAX.	UNIT
Supply voltage , $V_{CC}$	4.5	16	V
Input voltage (control,reset,threshold, and trigger )		$V_{CC}$	
Output current		$\pm 200$	mA
Operating free-air temperature, $T_A$	0	70	$^\circ\text{C}$

## Applications Information

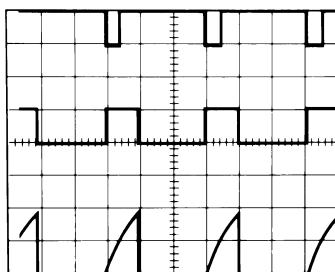
### MONOSTABLE OPERATION

In this mode of operation, the timer functions as a one-shot (*Figure 1*). The external capacitor is initially held discharged by a transistor inside the timer. Upon application of a negative trigger pulse of less than  $1/3 V_{CC}$  to pin 2, the flip-flop is set which both releases the short circuit across the capacitor and drives the output high.



**FIGURE 1. Monostable**

The voltage across the capacitor then increases exponentially for a period of  $t = 1.1 R_A C$ , at the end of which time the voltage equals  $2/3 V_{CC}$ . The comparator then resets the flip-flop which in turn discharges the capacitor and drives the output to its low state. *Figure 2* shows the waveforms generated in this mode of operation. Since the charge and the threshold level of the comparator are both directly proportional to supply voltage, the timing interval is independent of supply.



$V_{CC} = 5V$   
 $TIME = 0.1 ms/DIV.$   
 $R_A = 9.1k\Omega$   
 $C = 0.01\mu F$

Top Trace: Input 5V/Div.  
 Middle Trace: Output 5V/Div.  
 Bottom Trace: Capacitor Voltage 2V/Div.

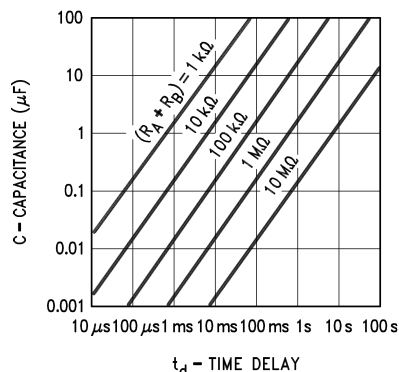
**FIGURE 2. Monostable Waveforms**

During the timing cycle when the output is high, the further application of a trigger pulse will not effect the circuit so long as the trigger input is returned high at least  $10\mu s$  before the end of the timing interval. However the circuit can be reset during this time by the application of a negative pulse to the reset terminal (pin 4). The output will then remain in the low state until a trigger pulse is again applied.

When the reset function is not in use, it is recommended that it be connected to  $V_{CC}$  to avoid any possibility of false triggering.

*Figure 3* is a nomograph for easy determination of  $R$ ,  $C$  values for various time delays.

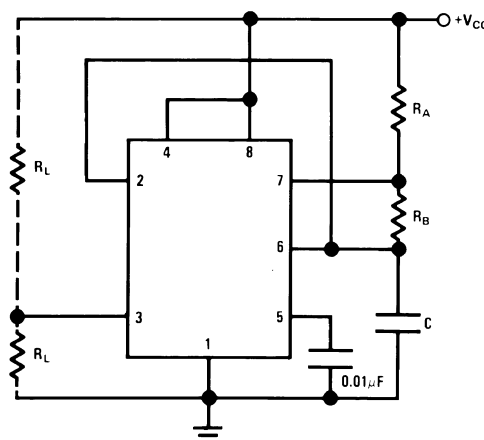
**NOTE:** In monostable operation, the trigger should be driven high before the end of timing cycle.



**FIGURE 3. Time Delay**

### ASTABLE OPERATION

If the circuit is connected as shown in *Figure 4* (pins 2 and 6 connected) it will trigger itself and free run as a multivibrator. The external capacitor charges through  $R_A + R_B$  and discharges through  $R_B$ . Thus the duty cycle may be precisely set by the ratio of these two resistors.

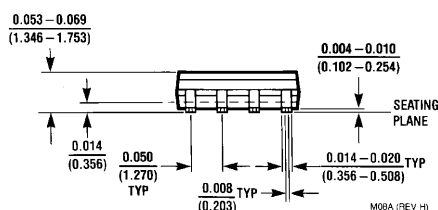
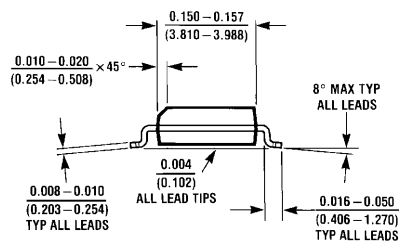
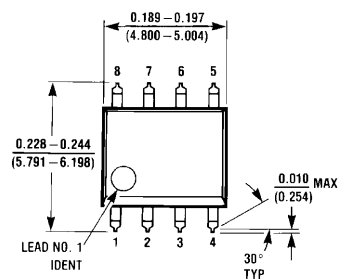


**FIGURE 4. Astable**

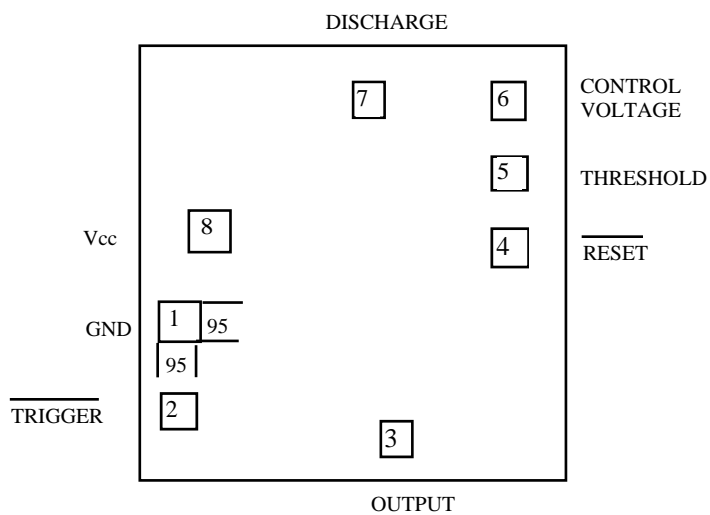
In this mode of operation, the capacitor charges and discharges between  $1/3 V_{CC}$  and  $2/3 V_{CC}$ . As in the triggered mode, the charge and discharge times, and therefore the frequency are independent of the supply voltage.

**Physical Dimensions** inches (millimeters) unless otherwise noted

## NE555M



## Pad locatin



Pad N	Pad Name	Coordinates mkm	
		X	Y
1	GND	95	313
2	TRIGGER	115	126
3	OUTPUT	590	126
4	RESET	810	451
5	THRESHOLD	810	635
6	CONTROL VOLTAGE	780	829
7	DISCHARGE	420	893
8	Vcc	125	492