

## Timers and signal generators

Order code	Manufacturer code	Description
82-0344	NE556N	NE556 DUAL TIMER

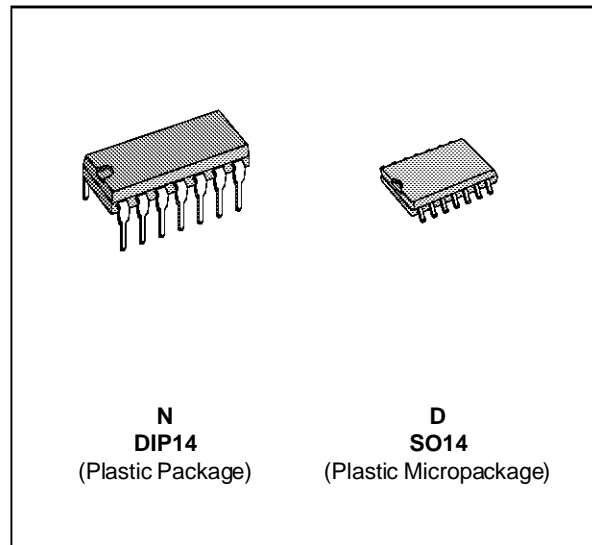
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**GENERAL PURPOSE DUAL BIPOLAR TIMERS**

- LOW TURN OFF TIME
- MAXIMUM OPERATING FREQUENCY GREATER THAN 500kHz
- TIMING FROM MICROSECONDS TO HOURS
- OPERATES IN BOTH ASTABLE AND MONOSTABLE MODES
- HIGH OUTPUT CURRENT CAN SOURCE OR SINK 200mA
- ADJUSTABLE DUTY CYCLE
- TTL COMPATIBLE
- TEMPERATURE STABILITY OF 0.005% PER °C

**DESCRIPTION**

The NE556 dual monolithic timing circuit is a highly stable controller capable of producing accurate time delays or oscillation. In the time delay mode of operation, the time is precisely controlled by one external resistor and capacitor. For a stable operation as an oscillator, the free running frequency and the duty cycle are both accurately controlled with two external resistors and one capacitor. The circuit may be triggered and reset on falling waveforms, and the output structure can source or sink up to 200mA.

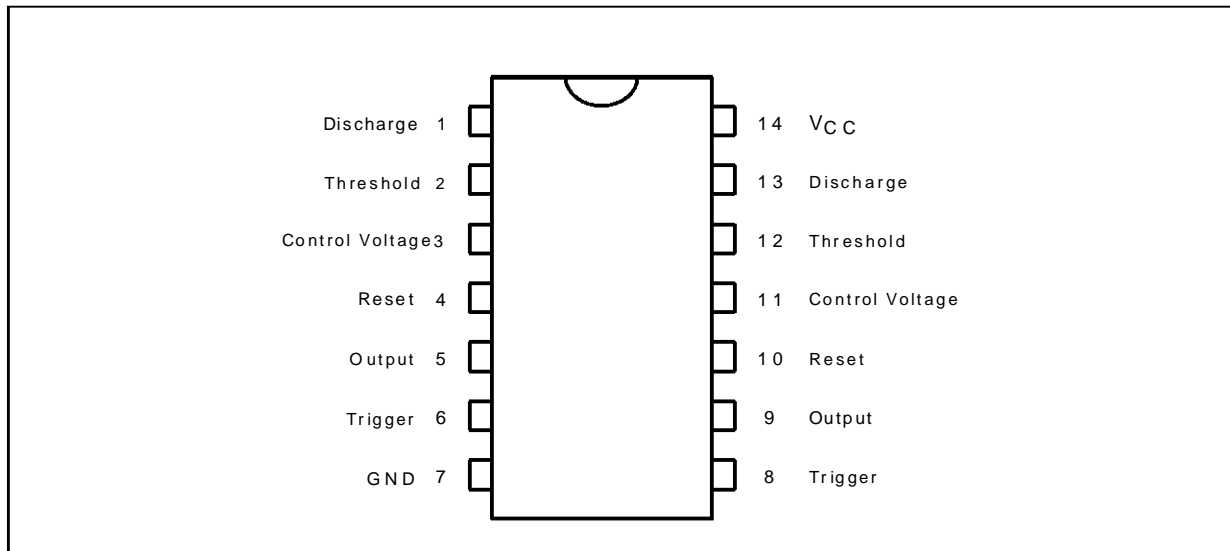


**ORDER CODES**

Part Number	Temperature Range	Package	
		N	D
NE556	0°C, 70°C	•	•
SA556	-40°C, 105°C	•	•
SE556	-55°C, 125°C	•	•

556-01.TBL

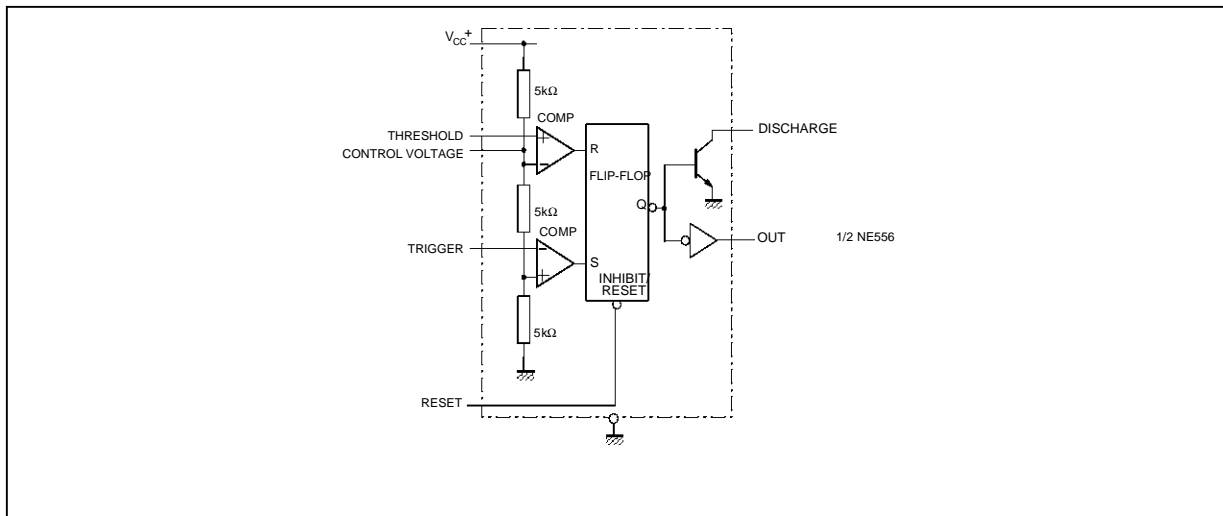
**PIN CONNECTIONS (top view)**



556-01.EPS

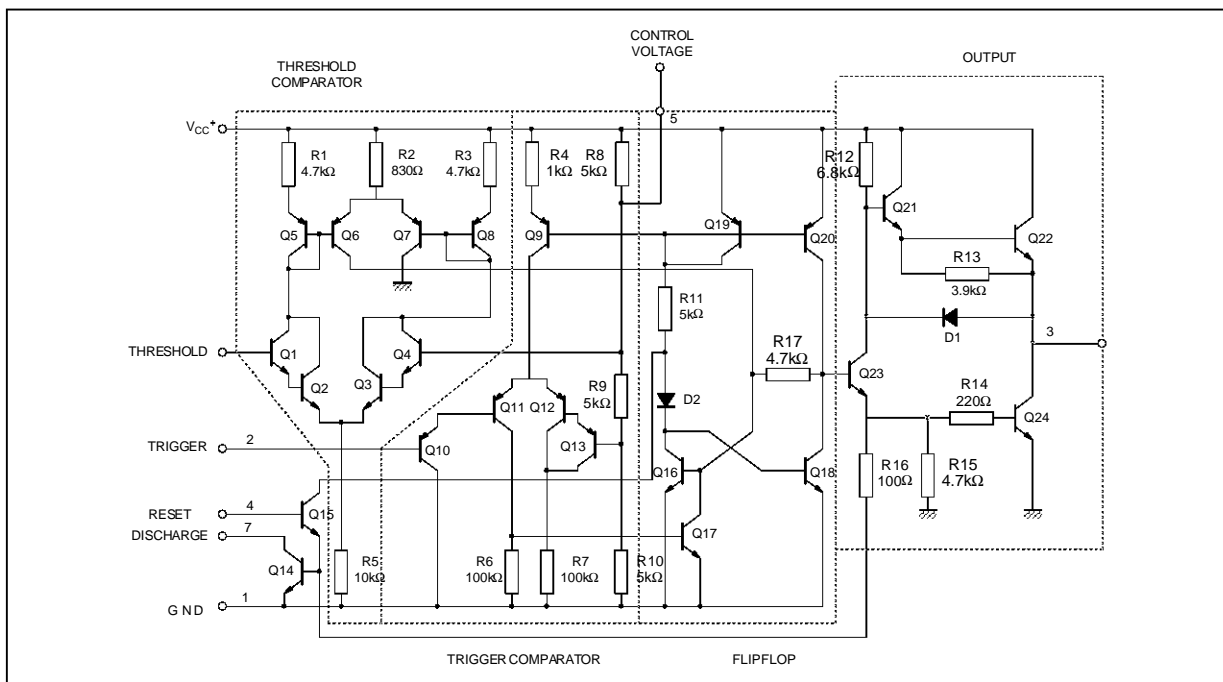
# NE556/SA556/SE556

## BLOCK DIAGRAM



556-02.EPS

## SCHEMATIC DIAGRAM



556-03.EPS

## ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V <sub>CC</sub>	Supply Voltage	for SE556 18 for NE556 16	V
T <sub>oper</sub>	Operating Free Air Temperature Range	for NE556 0 to 70 for SA556 -40 to 105 for SE556 -55 to 125	°C
T <sub>j</sub>	Junction Temperature	150	°C

556-02.TBL

## OPERATING CONDITIONS

Symbol	Parameter	SE556	NE556 - SA556	Unit
$V_{CC}$	Supply Voltage	4.5 to 18	4.5 to 16	V
$V_{th}$ , $V_{trig}$ , $V_{cl}$ , $V_{reset}$	Maximum Input Voltage	$V_{CC}$	$V_{CC}$	V

556-03.TBL

## ELECTRICAL CHARACTERISTICS

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

Symbol	Parameter	SE556			NE556 - SA556			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
$I_{CC}$	Supply Current ( $R_L = \infty$ ) - (note 1) - (2 timers)							mA
	Low State $V_{CC} = +5\text{V}$		6	10		6	12	
	High State $V_{CC} = +5\text{V}$		20	24		20	30	
	Timing Error (monostable) ( $R_A = 2\text{k}$ to $100\text{k}\Omega$ , $C = 0.1\mu\text{F}$ )							% ppm/ $^{\circ}\text{C}$ %/V
	Initial Accuracy - (note 2)		0.5	2		1	3	
	Drift with Temperature		30	100		50		
	Drift with Supply Voltage		0.05	0.2		0.1	0.5	
	Timing Error (astable) ( $R_A, R_B = 1\text{k}\Omega$ to $100\text{k}\Omega$ , $C = 0.1\mu\text{F}$ , $V_{CC} = +15\text{V}$ )							% ppm/ $^{\circ}\text{C}$ %/V
	Initial Accuracy - (note 2)		1.5			2.25		
	Drift with Temperature		90			150		
	Drift with Supply Voltage		0.15			0.3		
$V_{CL}$	Control Voltage level							V
	$V_{CC} = +15\text{V}$	9.6	10	10.4	9	10	11	
	$V_{CC} = +5\text{V}$	2.9	3.33	3.8	2.6	3.33	4	
$V_{th}$	Threshold Voltage							V
	$V_{CC} = +15\text{V}$	9.4	10	10.6	8.8	10	11.2	
	$V_{CC} = +5\text{V}$	2.7	3.33	4	2.4	3.33	4.2	
$I_{th}$	Threshold Current - (note 3)		0.1	0.25		0.1	0.25	$\mu\text{A}$
$V_{trig}$	Trigger Voltage							V
	$V_{CC} = +15\text{V}$	4.8	5	5.2	4.5	5	5.6	
	$V_{CC} = +5\text{V}$	1.45	1.67	1.9	1.1	1.67	2.2	
$I_{trig}$	Trigger Current ( $V_{trig} = 0\text{V}$ )		0.5	0.9		0.5	2.0	$\mu\text{A}$
$V_{reset}$	Reset Voltage - (note 4)	0.4	0.7	1	0.4	0.7	1	V
$I_{reset}$	Reset Current							mA
	$V_{reset} = +0.4\text{V}$		0.1	0.4		0.1	0.4	
	$V_{reset} = 0\text{V}$		0.4	1		0.4	1.5	
$V_{OL}$	Low Level Output Voltage							V
	$V_{CC} = +15\text{V}$ , $I_{O(sink)} = 10\text{mA}$		0.1	0.15		0.1	0.25	
	$I_{O(sink)} = 50\text{mA}$		0.4	0.5		0.4	0.75	
	$I_{O(sink)} = 100\text{mA}$		2	2.2		2	2.5	
	$I_{O(sink)} = 200\text{mA}$		2.5			2.5		
	$V_{CC} = +5\text{V}$ , $I_{O(sink)} = 8\text{mA}$		0.1	0.25		0.3	0.4	
	$I_{O(sink)} = 5\text{mA}$		0.05	0.2		0.25	0.35	
$V_{OH}$	High Level Output Voltage							V
	$V_{CC} = +15\text{V}$ , $I_{O(source)} = 200\text{mA}$	13	12.5		12.75	12.5		
	$I_{O(source)} = 100\text{mA}$	3	3.3		2.75	3.3		

556-4.TBL

- Notes :
1. Supply current when output is high is typically 1mA less.
  2. Tested at  $V_{CC} = +5\text{V}$  and  $V_{CC} = +15\text{V}$ .
  3. This will determine the maximum value of  $R_A + R_B$  for +15V operation the max total is  $R = 20\text{M}\Omega$  and for 5V operation, the max total  $R = 3.5\text{M}\Omega$ .
  4. Specified with trigger input high.

ELECTRICAL CHARACTERISTICS (continued)

Symbol	Parameter	SE556			NE556 - SA556			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
$I_{dis(off)}$	Discharge Pin Leakage Current (output high) ( $V_{dis} = 10V$ )		20	100		20	100	nA
$V_{dis(sat)}$	Discharge pin Saturation Voltage (output low) - (note 5) $V_{CC} = +15V, I_{dis} = 15mA$ $V_{CC} = +5V, I_{dis} = 4.5mA$		180 80	480 200		180 80	480 200	mV
$t_r$ $t_f$	Output Rise Time Output Fall Time		100 100	200 200		100 100	300 300	ns
$t_{off}$	Turn off Time - (note 6) ( $V_{reset} = V_{CC}$ )		0.5			0.5		$\mu s$

- Notes :
- No protection against excessive Pin 7 current is necessary, providing the package dissipation rating will not be exceeded.
  - Time measured from a positive going input pulse from 0 to  $0.8x V_{CC}$  into the threshold to the drop from high to low of the output trigger is tied to threshold.

Figure 1 : Minimum Pulse Width Required for Trigering

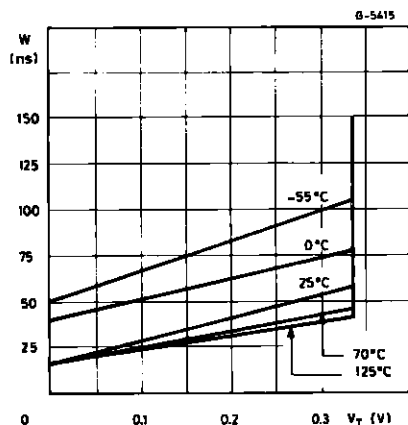


Figure 2 : Supply Current versus Supply Voltage

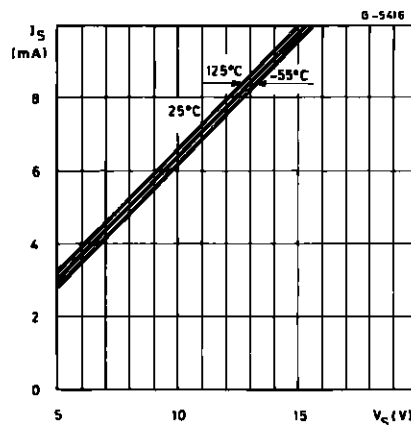


Figure 3 : Delay Time versus Temperature

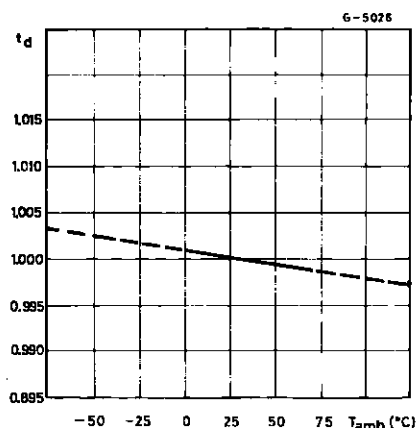


Figure 4 : Low Output Voltage versus Output Sink Current

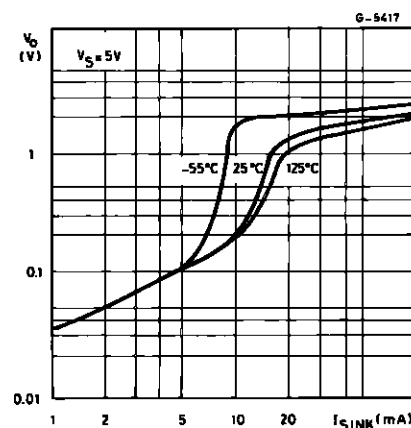
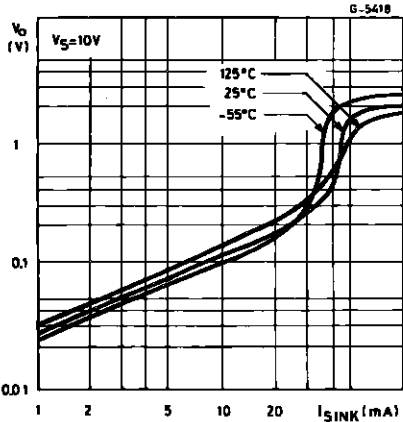
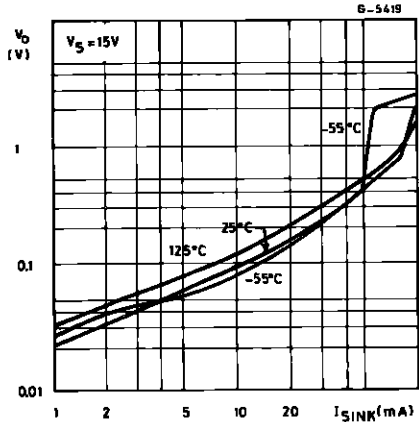


Figure 5 : Low Output Voltage versus Output Sink Current



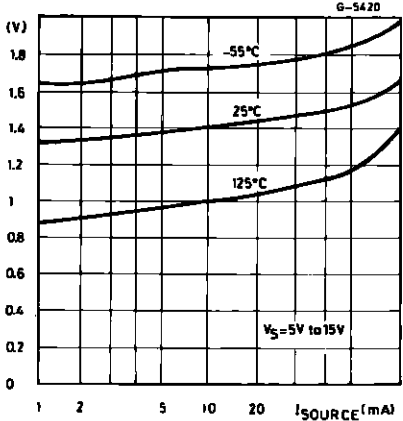
556-08.EPS

Figure 6 : Low Output Voltage versus Output Sink Current



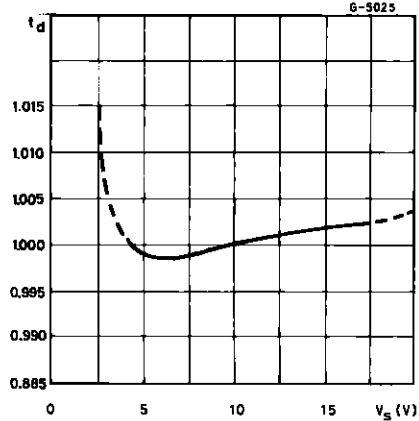
556-09.EPS

Figure 7 : High Output Voltage Drop versus Output



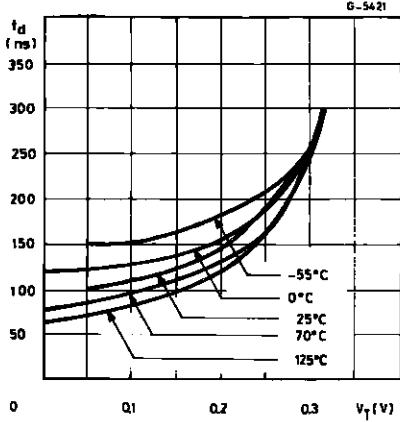
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Figure 8 : Delay Time versus Supply Voltage



556-11.EPS

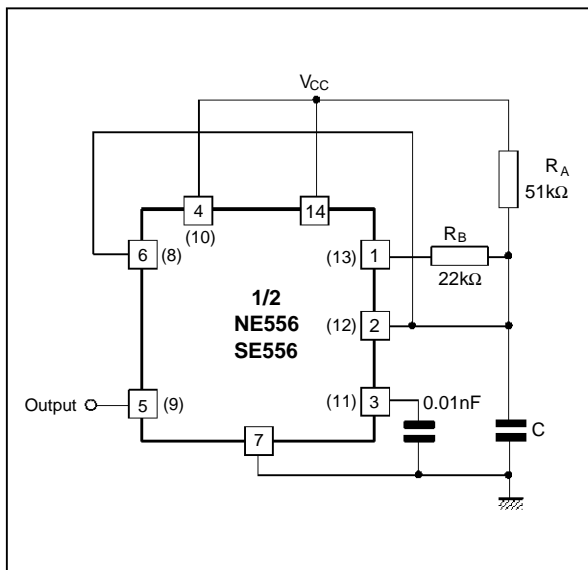
Figure 9 : Propagation Delay versus Voltage Level of Trigger Value



556-12.EPS

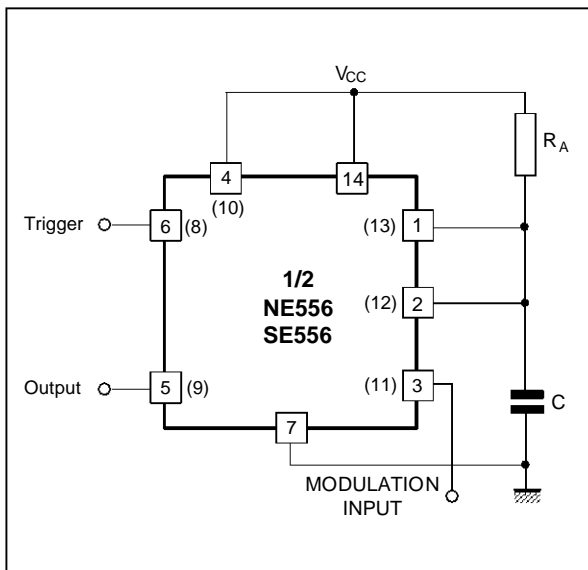
TYPICAL APPLICATION

50 % DUTY CYCLE OSCILLATOR



556-13.EPS

PULSE WIDTH MODULATOR

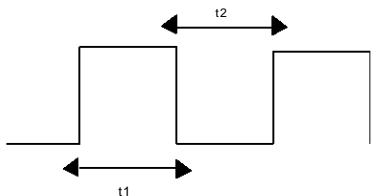


556-14.EPS

$$t_1 = 0.693 R_A \cdot C$$

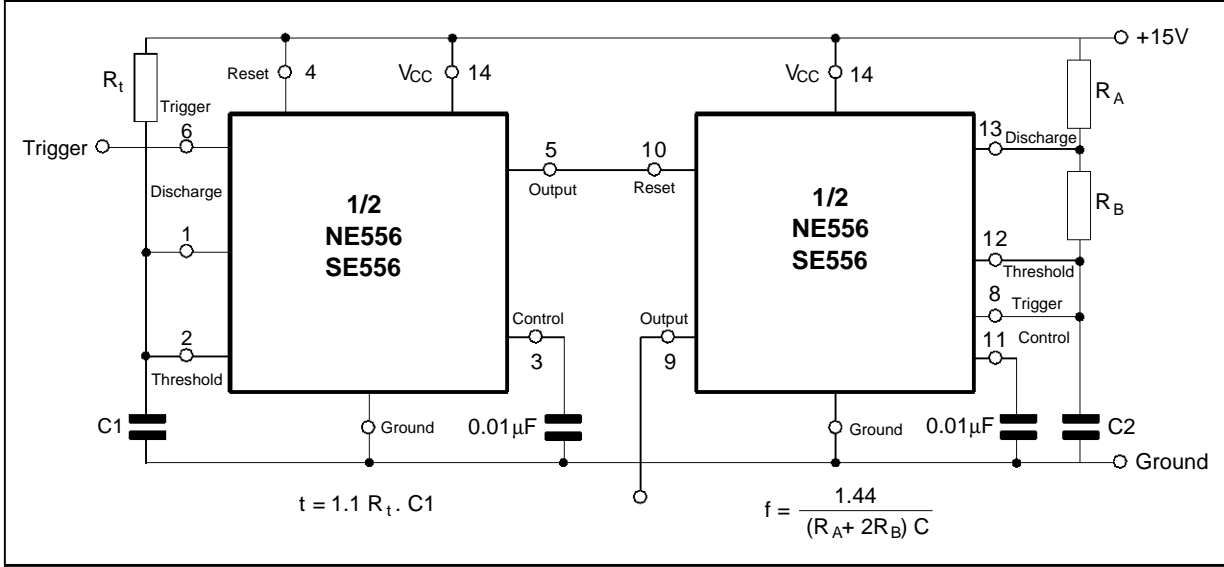
$$t_2 = [(R_A R_B) / (R_A + R_B)] \cdot C \cdot \ln \left[ \frac{R_B \pm 2R_A}{2R_B \pm R_A} \right]$$

$$f = \frac{1}{t_1 + t_2} \quad R_B < \frac{1}{2} R_A \quad t_i$$



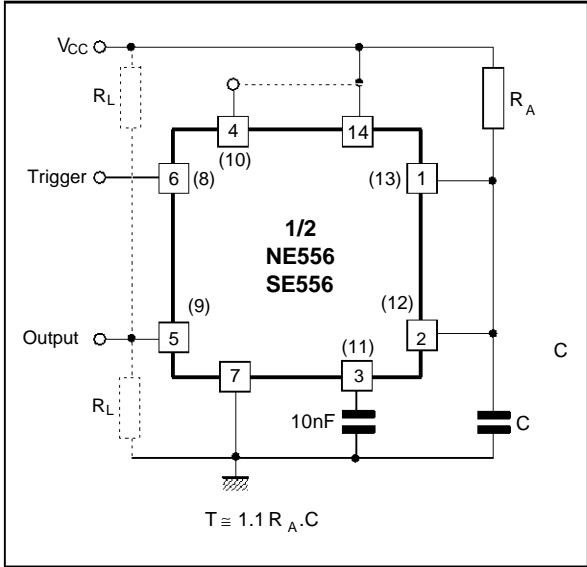
**TONE BURST GENERATOR**

For a tone burst generator the first timer is used as a monostable and determines the tone duration when triggered by a positive pulse at pin 6. The second timer is enabled by the high output of the monostable. It is connected as an astable and determines the frequency of the tone.



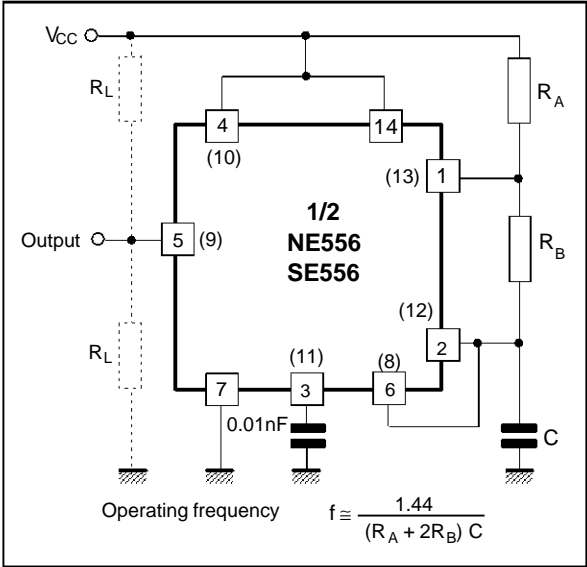
556-16.EPS

**MONOSTABLE OPERATION**



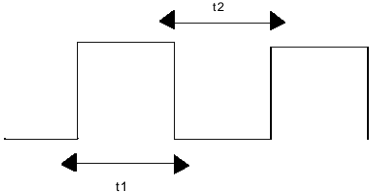
556-16.EPS

**ASTABLE OPERATION**

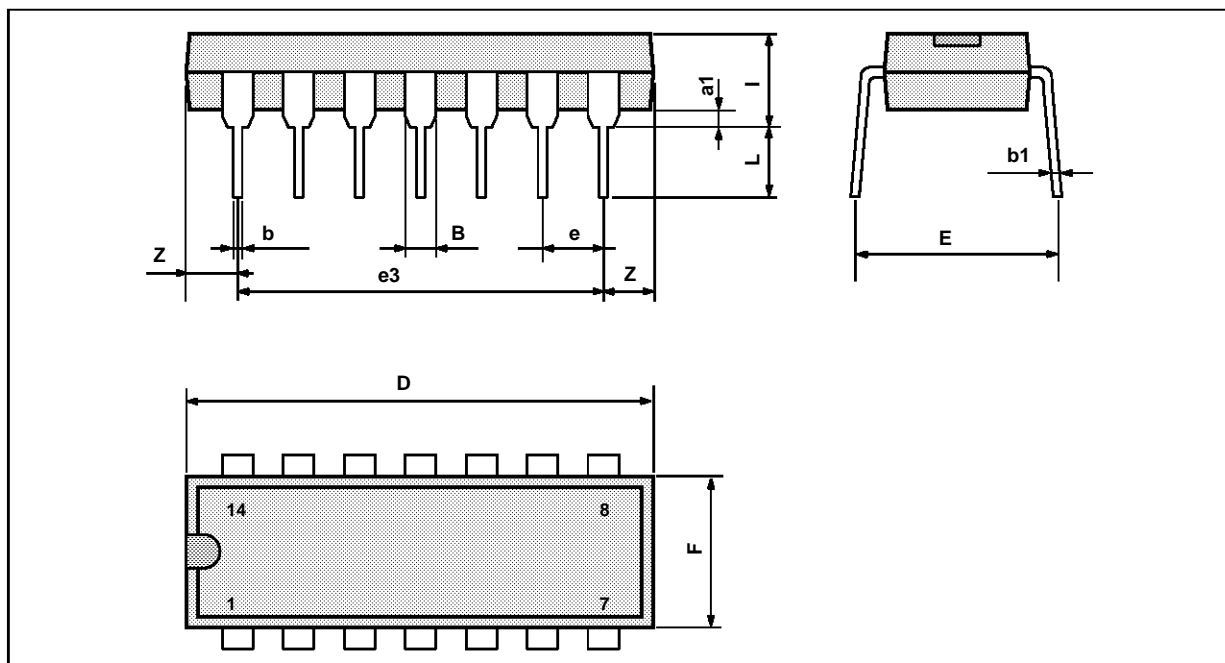


556-17.EPS

$t_1 = 0.693 (R_A + R_B) C$  Output High  
 $t_2 = 0.693 R_B C$  Output low



**PACKAGE MECHANICAL DATA**  
14 PINS - PLASTIC DIP OR CERDIP

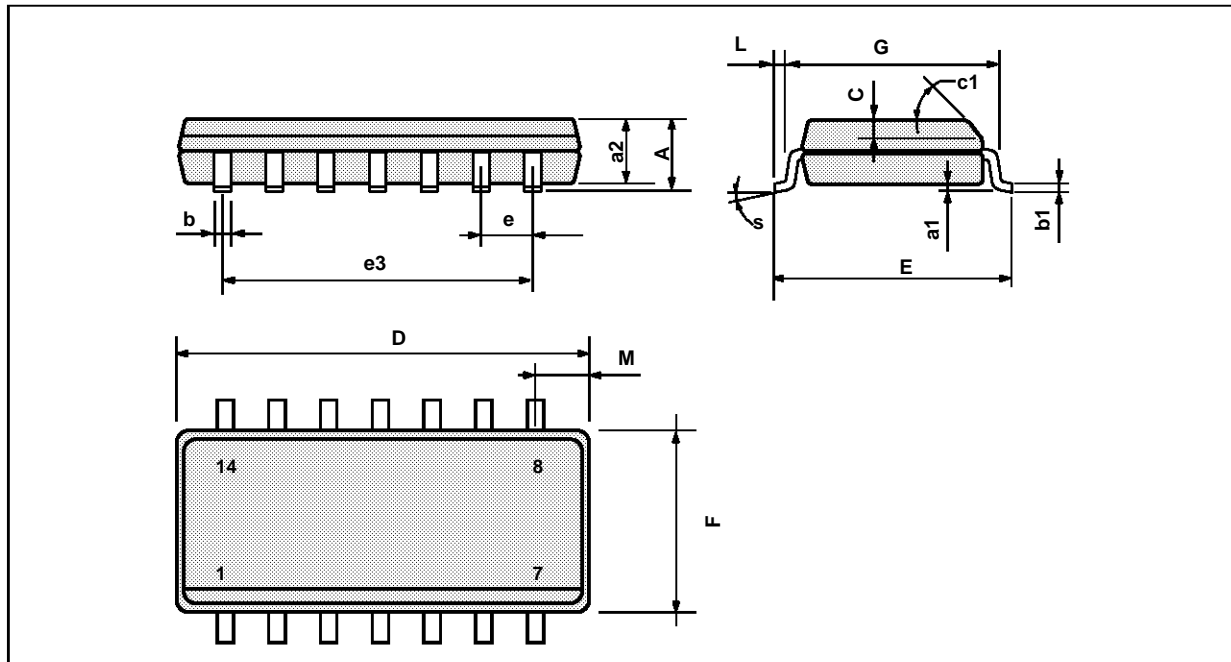


PM-DIP14.EPS

Dimensions	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
a1	0.51			0.020		
B	1.39		1.65	0.055		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		15.24			0.600	
F			7.1			0.280
i			5.1			0.201
L		3.3			0.130	
Z	1.27		2.54	0.050		0.100

DIP14.TBL

**PACKAGE MECHANICAL DATA**  
14 PINS - PLASTIC MICROPACKAGE (SO)



PM-S014.EPS

Dimensions	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.75			0.069
a1	0.1		0.2	0.004		0.008
a2			1.6			0.063
b	0.35		0.46	0.014		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.020	
c1	45° (typ.)					
D	8.55		8.75	0.336		0.334
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		7.62			0.300	
F	3.8		4.0	0.150		0.157
G	4.6		5.3	0.181		0.208
L	0.5		1.27	0.020		0.050
M			0.68			0.027
S	8° (max.)					

SO14.TBL

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