NE556
SA556 - SE556

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
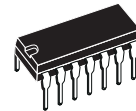- ■ TEMPERATURE STABILITY OF 0.005% PER°C

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.

N
DIP14
(Plastic Package)

D
SO14
(Plastic Micropackage)

PIN CONNECTIONS (top view)

Pin			Pin
Discharge	1	14	VCC
Threshold	2	13	Discharge
Control Voltage	3	12	Threshold
Reset	4	11	Control Voltage
Output	5	10	Reset
Trigger	6	9	Output
GND	7	8	Trigger

ORDER CODE

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

N = Dual in Line Package (DIP)
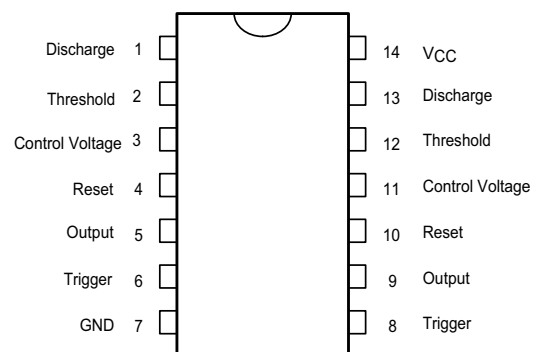**D =** Small Outline Package (SO) - also available in Tape & Reel (DT)

BLOCK DIAGRAM
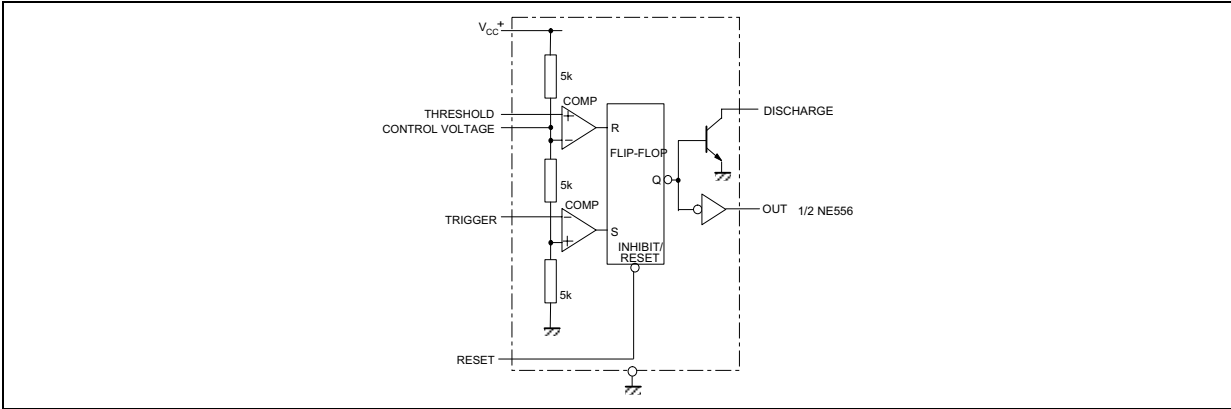
SCHEMATIC DIAGRAM
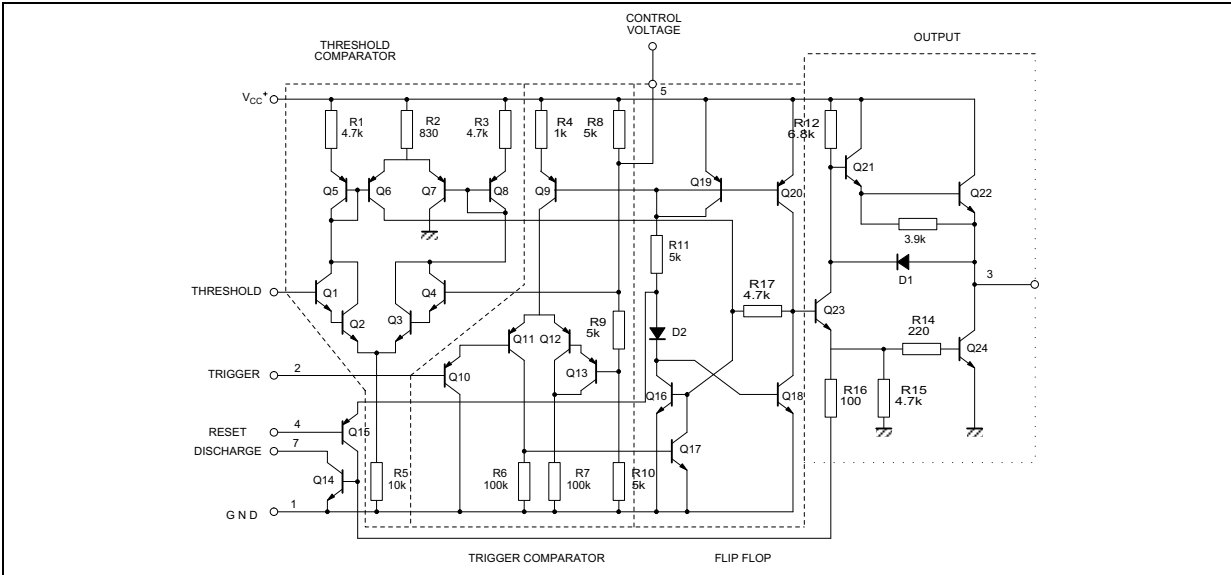
ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	18	V
T_j	Junction Temperature	150	°C
T_{stg}	Storage Temperature Range	-65 to 150	°C

OPERATING CONDITIONS

Symbol	Parameter		Value	Unit
V_{CC}	Supply Voltage	NE556	4.5 to 16	V
		SA556	4.5 to 16	
		SE556	4.5 to 18	
V_{th}, V_{trig}, V_{cl}, V_{reset}	Maximum Input Voltage		V_{CC}	V
T_{oper}	Operating Free Air Temperature Range			°C
	for NE556		0 to 70	
	for SA556		-40 to 105	
	for SE556		-55 to 125	

ELECTRICAL CHARACTERISTICS T_{amb} = +25°C, V_{CC} = +5V to +15V (unless otherwise specified)

| Symbol	Parameter	SE556			NE556 - SA556			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
I_{CC}	Supply Current (RL ∞) - note [1] (2 timers) Low Stage V_{CC} = +5V V_{CC} = +15V High State V_{CC} = +5V		6 20 4	10 24		6 20 4	12 30	mA
	Timing Error (monostable) (R_A = 2k to 100kΩ, C = 0.1µF) Initial Accuracy - note [2] Drift with Temperature Drift with Supply Voltage		0.5 30 0.05	2 100 0.2		1 50 0.1	3 0.5	% ppm/°C %/V
	Timing Error (astable) (R_A, R_B = 1kΩ to 100kΩ, C = 0.1µF, V_{CC} = +15V) Initial Accuracy - see note 2 Drift with Temperature Drift with Supply Voltage		1.5 90 0.15			2.25 150 0.3		% ppm/°C %/V
V_{CL}	Control Voltage Level V_{CC} = +15V V_{CC} = +5V	9.6 2.9	10 3.33	10.4 3.8	9 2.6	10 3.33	11 4	V
V_{th}	Threshold Voltage V_{CC} = +15V V_{CC} = +5V	9.4 2.7	10 3.33	10.6 4	8.8 2.4	10 3.33	11.2 4.2	V
I_{th}	Threshold Current - note [3]		0.1	0.25		0.1	0.25	µA
V_{trig}	Trigger Voltage V_{CC} = +15V V_{CC} = +5V	4.8 1.45	5 1.67	5.2 1.9	4.5 1.1	5 1.67	5.6 2.2	V
I_{trig}	Trigger Current (V_{trig} = 0V)		0.5	0.9		0.5	2.0	µA
V_{reset}	Reset Voltage [4]	0.4	0.7	1	0.4	0.7	1	V
I_{reset}	Reset Current V_{reset} = +0.4V V_{reset} = 0V		0.1 0.4	0.4 1		0.1 0.4	0.4 1.5	mA
V_{OL}	Low Level Output Voltage V_{CC} = +15V $I_{O(sink)}$ = 10mA $I_{O(sink)}$ = 50mA $I_{O(sink)}$ = 100mA $I_{O(sink)}$ = 200mA V_{CC} = +5V $I_{O(sink)}$ = 8mA $I_{O(sink)}$ = 5mA		0.1 0.4 2 2.5 0.1 0.05	0.15 0.5 2.2 0.25 0.2		0.1 0.4 2 2.5 0.3 0.25	0.25 0.75 2.5 0.4 0.35	V
V_{OH}	High Level Output Voltage V_{CC} = +15V $I_{O(sink)}$ = 200mA $I_{O(sink)}$ = 100mA V_{CC} = +5V $I_{O(sink)}$ = 100mA	13 3	12.5 13.3 3.3		12.75 2.75	12.5 13.3 3.3		V
$I_{dis(off)}$	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
toff	Turn off Time - note [6] (V_{reset} = V_{CC})		0.5			0.5		µs

1. Supply current when output is high is typically 1mA less.

2. Tested at V_{CC} = +5V and V_{CC} = +15V

3. This will determine the maximum value of R_A + R_B for +15V operation the max total is R = 20MΩ and for 5V operation the max total R = 3.5MΩ

4. Specified with trigger input high

5. No protection against excessive pin 7 current is necessary, providing the package dissipation rating will not be exceeded

6. Time measured from a positive going input pulse from 0 to 0.8x Vcc into the threshold to the drop from high to low of the output trigger is tied to threshold.
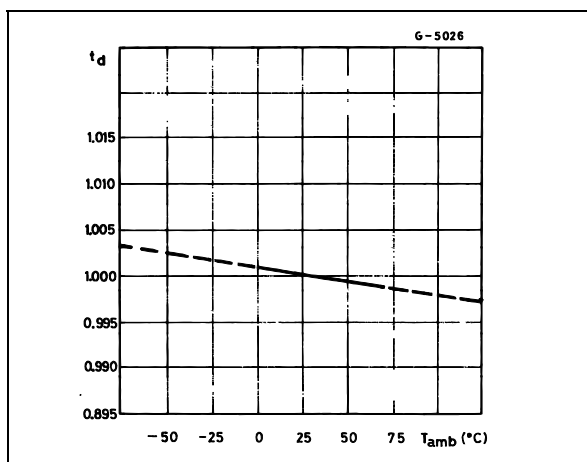
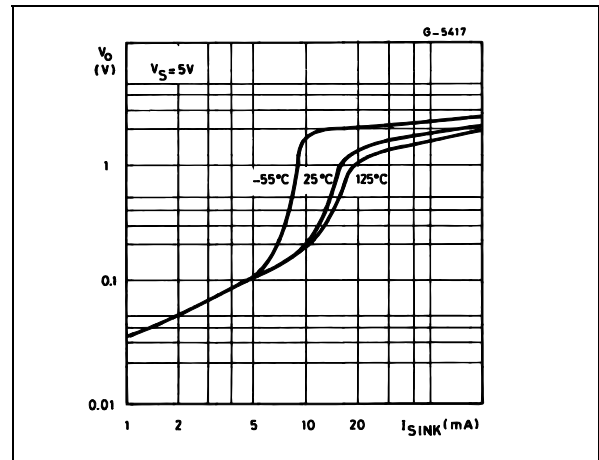**Figure 1 :** Minimum Pulse Width Required for Triggering
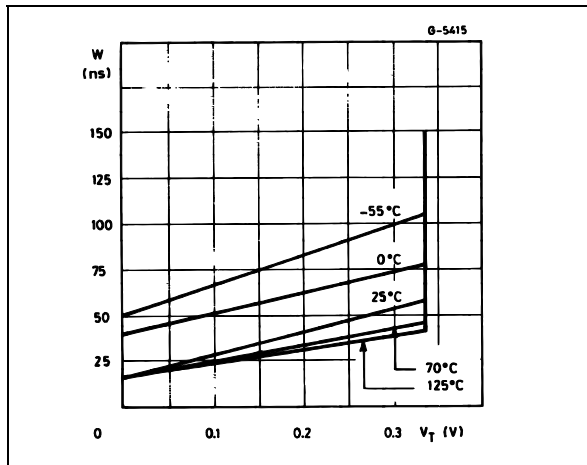
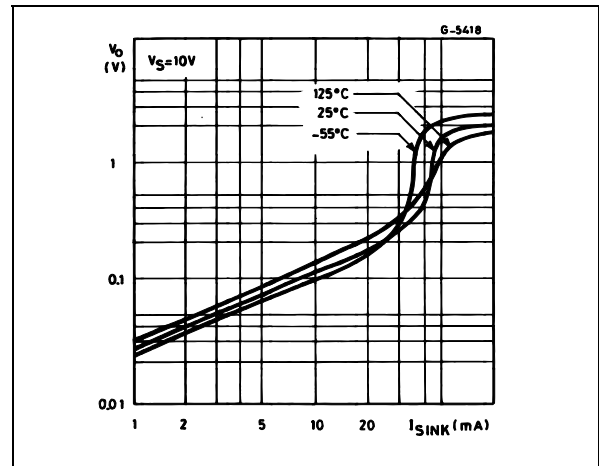**Figure 2 :** Supply Current versus Supply Voltage
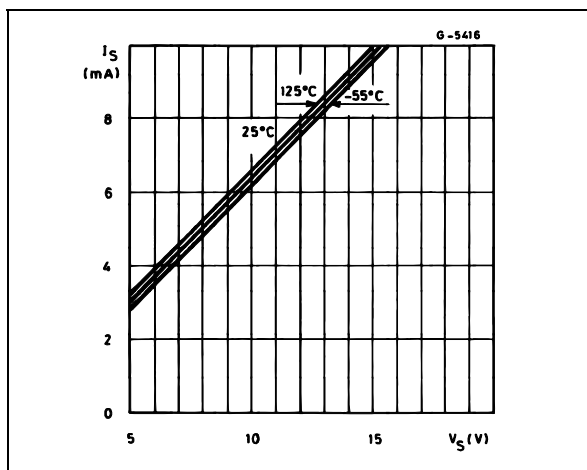
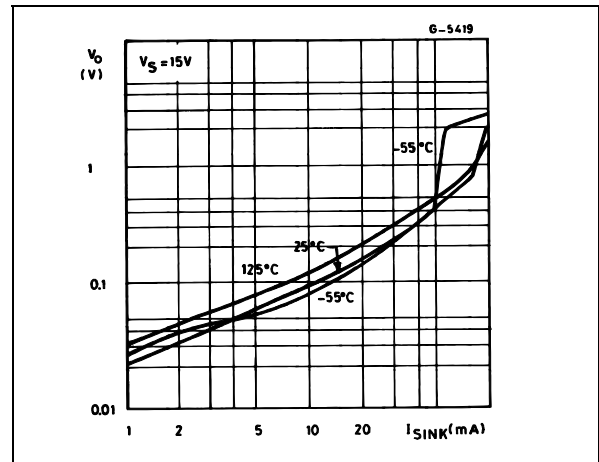
Figure 3 : Delay Time versus Temperature

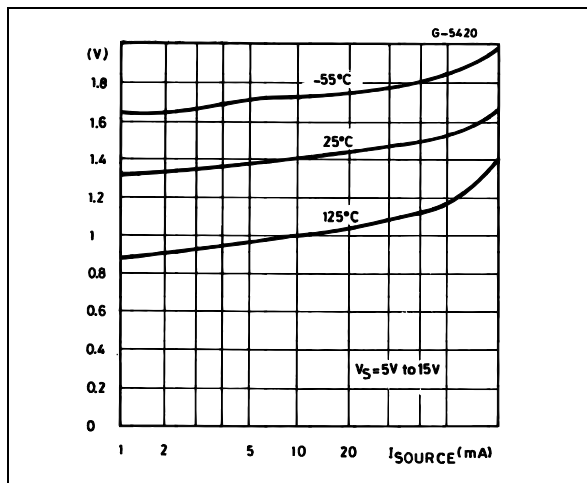**Figure 4 :** Low Output Voltage versus Output Sink Current

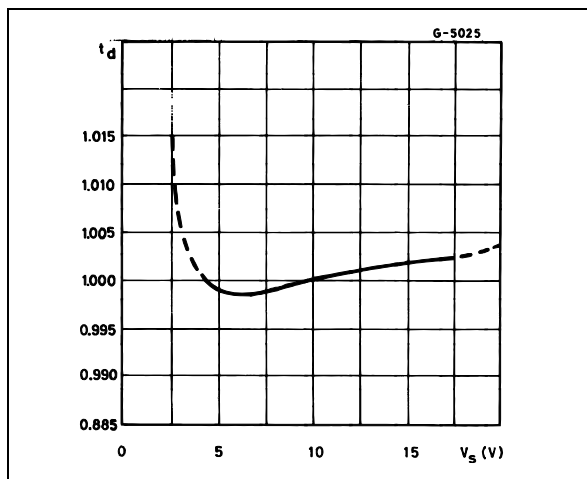**Figure 5 :** Low Output Voltage versus Output Sink Current

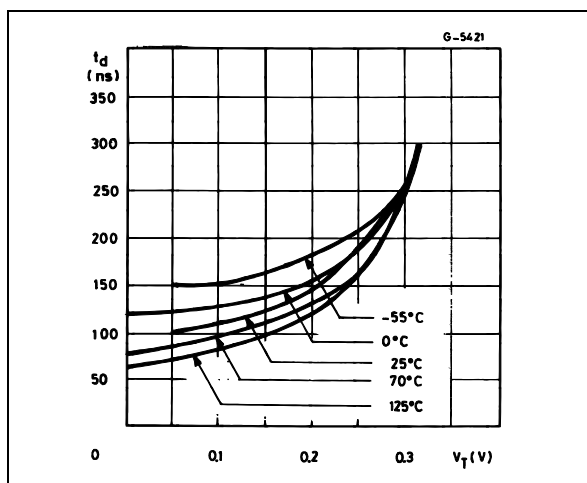**Figure 6 :** Low Output Voltage versus Output Sink Current

Figure 7 : High Output Voltage Drop versus Output

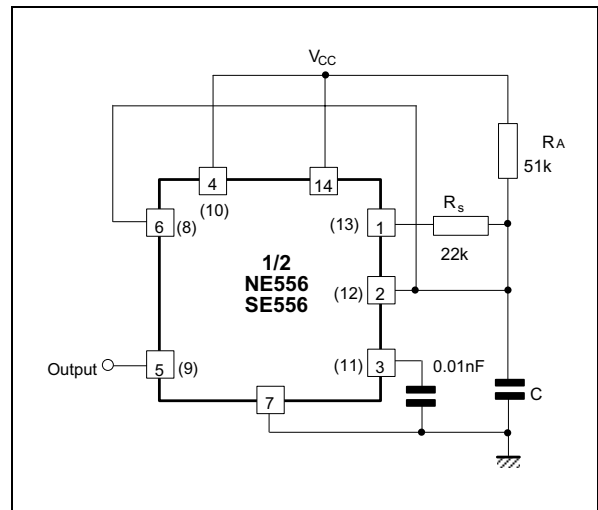
Figure 8 : Delay Time versus Supply Voltage

Figure 9 : Propagation Delay versus Voltage Level of Trigger Value
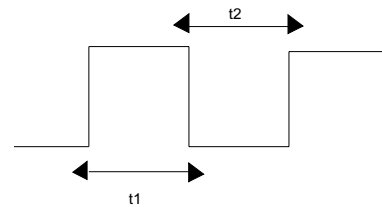

TYPICAL APPLICATION

50% DUTY CYCLE OSCILLATOR
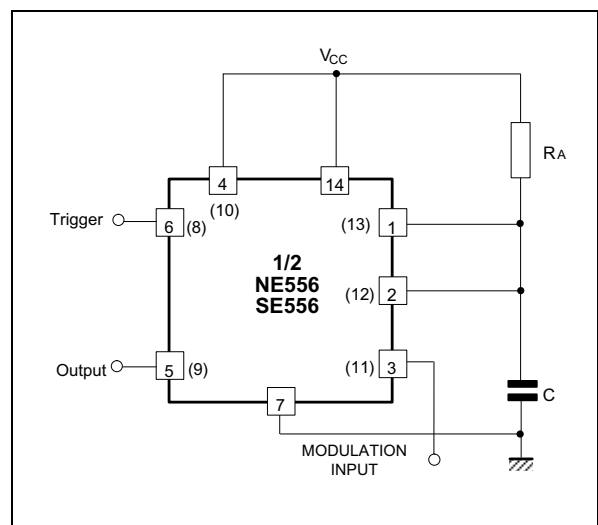

$t_1 = 0.693 \, R_A . C$

$$t2 = [(RARB)/(RA+RB)]CLn \left[\frac{RB - 2RA}{2RB - RA} \right]$$

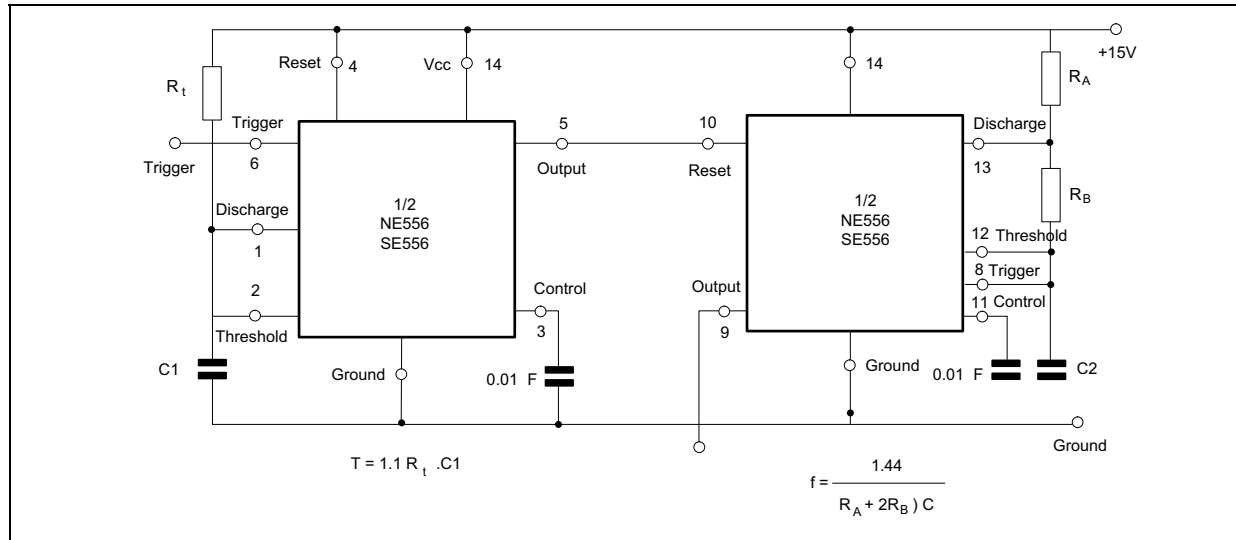$$f = \frac{t1}{t1 + t2} \quad RB < \frac{1}{2} \, RA \; ti$$
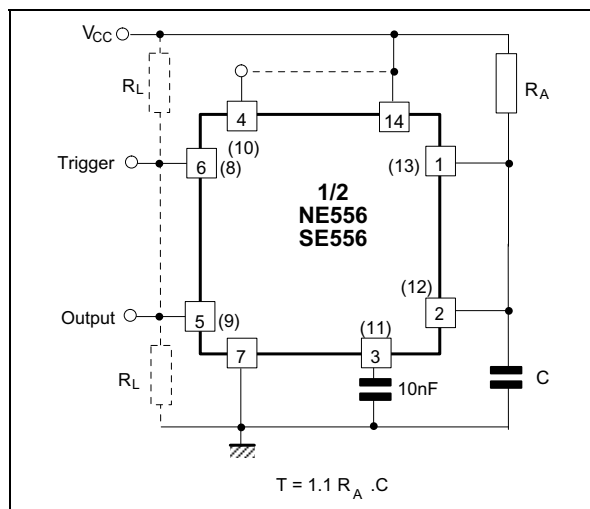

PULSE WIDTH MODULATOR
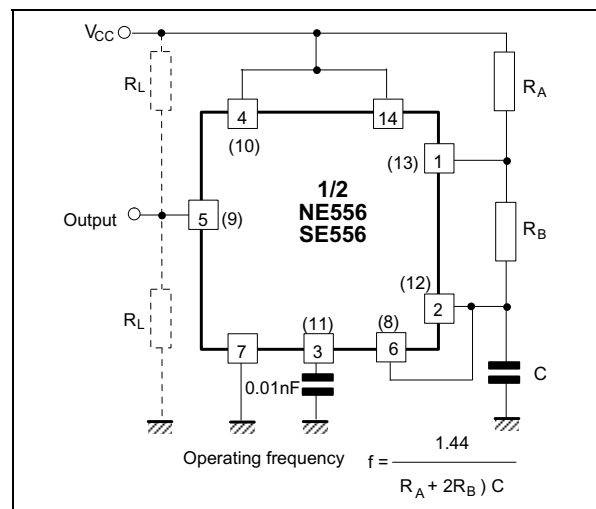
TONE BURST GENERATOR

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 or the monostable. It is connected as an astable and determines the frequency of the tone.

$$T = 1.1 R_t \cdot C1$$

$$f = \frac{1.44}{(R_A + 2R_B) \, C}$$

MONOSTABLE OPERATION

$$T = 1.1 R_A \cdot C$$

ASTABLE OPERATION

Operating frequency $\quad f = \dfrac{1.44}{(R_A + 2R_B) \, C}$

$t_1 = 0.693 \, (R_A + R_B) \, C$ Output High
$t_2 = 0.693 \, R_B C$ Output Low

PACKAGE MECHANICAL DATA
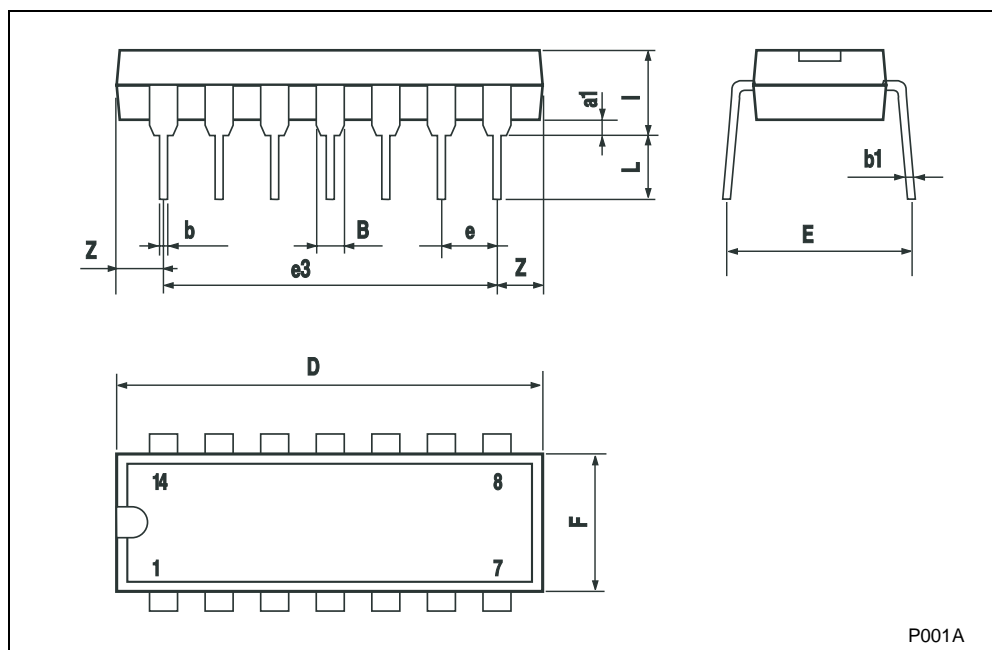
<table>
<tr><td rowspan="2">DIM.</td><td colspan="3">mm.</td><td colspan="3">inch</td></tr>
<tr><td>MIN.</td><td>TYP</td><td>MAX.</td><td>MIN.</td><td>TYP.</td><td>MAX.</td></tr>
<tr><td>a1</td><td>0.51</td><td></td><td></td><td>0.020</td><td></td><td></td></tr>
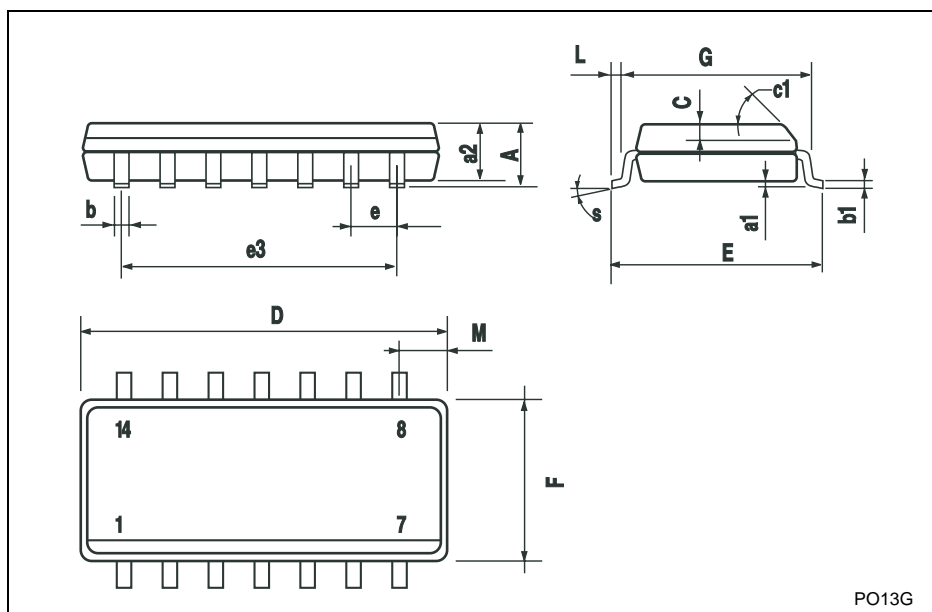<tr><td>B</td><td>1.39</td><td></td><td>1.65</td><td>0.055</td><td></td><td>0.065</td></tr>
<tr><td>b</td><td></td><td>0.5</td><td></td><td></td><td>0.020</td><td></td></tr>
<tr><td>b1</td><td></td><td>0.25</td><td></td><td></td><td>0.010</td><td></td></tr>
<tr><td>D</td><td></td><td></td><td>20</td><td></td><td></td><td>0.787</td></tr>
<tr><td>E</td><td></td><td>8.5</td><td></td><td></td><td>0.335</td><td></td></tr>
<tr><td>e</td><td></td><td>2.54</td><td></td><td></td><td>0.100</td><td></td></tr>
<tr><td>e3</td><td></td><td>15.24</td><td></td><td></td><td>0.600</td><td></td></tr>
<tr><td>F</td><td></td><td></td><td>7.1</td><td></td><td></td><td>0.280</td></tr>
<tr><td>I</td><td></td><td></td><td>5.1</td><td></td><td></td><td>0.201</td></tr>
<tr><td>L</td><td></td><td>3.3</td><td></td><td></td><td>0.130</td><td></td></tr>
<tr><td>Z</td><td>1.27</td><td></td><td>2.54</td><td>0.050</td><td></td><td>0.100</td></tr>
</table>
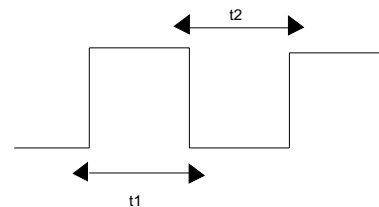
Plastic DIP-14 MECHANICAL DATA

P001A

PACKAGE MECHANICAL DATA

	SO-14 MECHANICAL DATA					

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			1.75			0.068
a1	0.1		0.2	0.003		0.007
a2			1.65			0.064
b	0.35		0.46	0.013		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.019	
c1	45° (typ.)					
D	8.55		8.75	0.336		0.344
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		7.62			0.300	
F	3.8		4.0	0.149		0.157
G	4.6		5.3	0.181		0.208
L	0.5		1.27	0.019		0.050
M			0.68			0.026
S	8° (max.)					

PO13G