

# KA555/I

# SINGLE TIMER

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The KA555/I is a highly stable controller capable of producing accurate timing pulses. With monostable operation, the time delay is controlled by one external resistor and one capacitor. With astable operation, the frequency and duty cycle are accurately controlled with two external resistors and one capacitor.

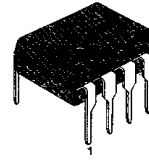
## FEATURES

- High Current Drive Capability (= 200mA)
- Adjustable Duty Cycle
- Temperature Stability of 0.005%/°C
- Timing From  $\mu$  Sec To Hours
- Turn Off Time Less Than  $2\mu$  Sec

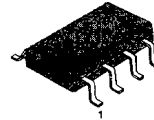
## APPLICATIONS

- Precision Timing
- Pulse Generation
- Time Delay Generation
- Sequential Timing

8 DIP



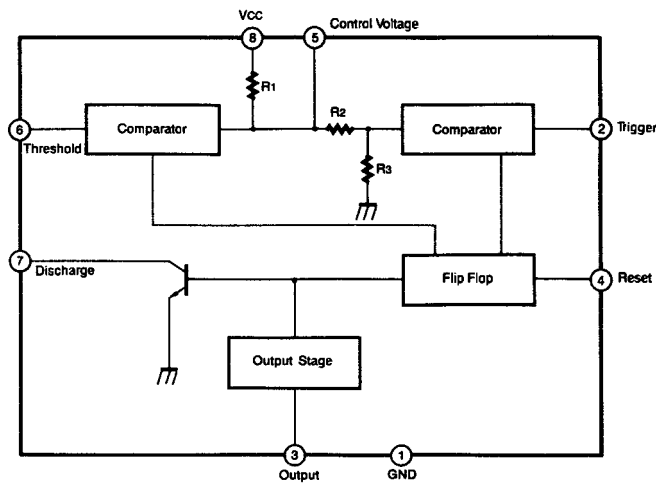
8 SOP



## ORDERING INFORMATION

Device	Package	Operating Temperature
KA555	8 DIP	0 ~ +70°C
KA555D	8 SOP	
KA555I	8 DIP	-40 ~ +85°C
KA555ID	8 SOP	

## BLOCK DIAGRAM



**ABSOLUTE MAXIMUM RATINGS** ( $T_A = 25^\circ\text{C}$ )

Characteristic	Symbol	Value	Unit
Supply Voltage	$V_{CC}$	16	V
Lead Temperature (soldering 10sec)	$T_{LEAD}$	300	$^\circ\text{C}$
Power Dissipation	$P_D$	600	mW
Operating Temperature Range KA555 KA555I	$T_{OPR}$	0 ~ +70 -40 ~ +85	$^\circ\text{C}$
Storage Temperature Range	$T_{STG}$	-65 ~ +150	$^\circ\text{C}$

**ELECTRICAL CHARACTERISTICS**( $T_A = 25^\circ\text{C}$ ,  $V_{CC} = 5 \sim 15\text{V}$ , unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Supply Voltage	$V_{CC}$		4.5		16	V
Supply Current	$I_{CC}$	$V_{CC} = 5\text{V}$ , $R_L = \infty$		3	6	mA
* $I_1$ (low stable)		$V_{CC} = 15\text{V}$ , $R_L = \infty$		7.5	15	mA
* Timing Error (Monostable) <sup>2</sup> Initial Accuracy Drift with Temperature Drift with Supply Voltage	ACCUR $\Delta t/\Delta T$ $\Delta t/\Delta V_{CC}$	$R_A = 1\text{K}\Omega$ to 100K $\Omega$ $C = 0.1\mu\text{F}$		1.0 50 0.1	3.0  0.5	% ppm/ $^\circ\text{C}$ %/V
* Timing Error (astable) <sup>2</sup> Initial Accuracy Drift with Temperature Drift with Supply Voltage	ACCUR $\Delta t/\Delta T$ $\Delta t/\Delta V_{CC}$	$R_A = 1\text{K}\Omega$ to 100K $\Omega$ $C = 0.1\mu\text{F}$		2.25 150 0.3		% ppm/ $^\circ\text{C}$ %/V
Control Voltage	$V_C$	$V_{CC} = 15\text{V}$	9.0	10.0	11.0	V
		$V_{CC} = 5\text{V}$	2.6	3.33	4.0	V
Threshold Voltage	$V_{TH}$	$V_{CC} = 15\text{V}$		10.0		V
		$V_{CC} = 5\text{V}$			3.33	
* <sup>3</sup> Threshold Current	$I_{TH}$			0.1	0.25	$\mu\text{A}$
Trigger Voltage	$V_{TR}$	$V_{CC} = 5\text{V}$	1.1	1.67	2.2	V
Trigger Voltage	$V_{TR}$	$V_{CC} = 15\text{V}$	4.5	5	5.6	V
Trigger Current	$I_{TR}$	$V_{TR} = 0\text{V}$		0.01	2.0	$\mu\text{A}$
Reset Voltage	$V_{RST}$		0.4	0.7	1.0	V
Reset Current	$I_{RST}$			0.1	0.4	mA

**ELECTRICAL CHARACTERISTICS**

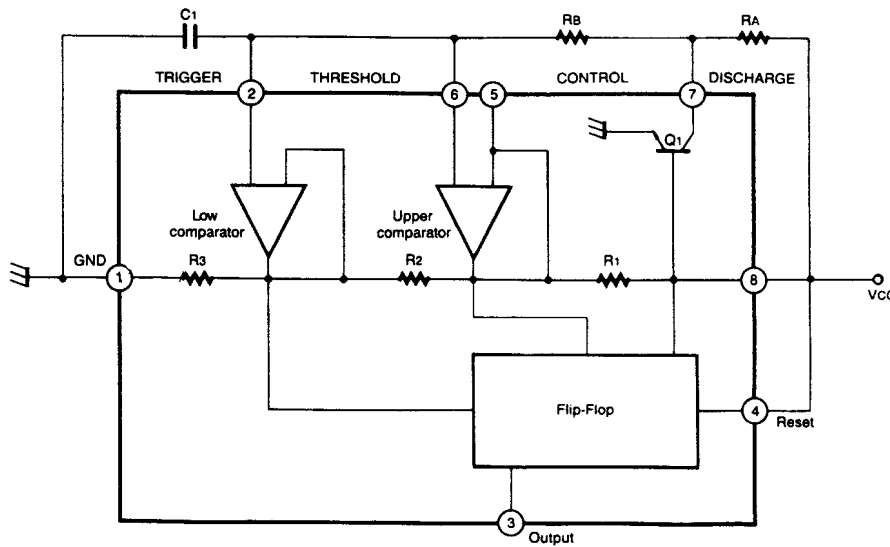
( $T_A = 25^\circ\text{C}$ ,  $V_{CC} = 5 \sim 15\text{V}$ , unless otherwise specified)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Low Output Voltage	$V_{OL}$	$V_{CC} = 15\text{V}$ $I_{SINK} = 10\text{mA}$		0.06	0.25	V
		$I_{SINK} = 50\text{mA}$		0.3	0.75	V
		$V_{CC} = 5\text{V}$ $I_{SINK} = 5\text{mA}$		0.05	0.35	V
High Output Voltage	$V_{OH}$	$V_{CC} = 15\text{V}$ $I_{SOURCE} = 200\text{mA}$		12.5		V
		$I_{SOURCE} = 100\text{mA}$	12.75	13.3		V
		$V_{CC} = 5\text{V}$ $I_{SOURCE} = 100\text{mA}$	2.75	3.3		V
Rise Time of Output	$t_R$			100		nsec
Fall Time of Output	$t_F$			100		nsec
Discharge Leakage Current	$I_{LKG}$			20	100	nA

Notes:

1. Supply current when output is high is typically 1mA less at  $V_{CC} = 5\text{V}$
2. Tested at  $V_{CC} = 5.0\text{V}$  and  $V_{CC} = 15\text{V}$
3. This will determine maximum value of  $R_A + R_B$  for 15V operation, the max. total  $R = 20\text{M}\Omega$ , and for 5V operation the max. total  $R = 6.7\text{M}\Omega$

**APPLICATION CIRCUIT**



**APPLICATION NOTE**

The application circuit shows astable mode.

Pin 6 (threshold) is tied to Pin 2 (trigger) and Pin 4 (reset) is tied to  $V_{CC}$  (Pin 8).

The external capacitor  $C_1$  of Pin 6 and Pin 2 charges through  $R_A$ ,  $R_B$  and discharges through  $R_B$  only.

In the internal circuit of the KA555 one input of the upper comparator is the  $2/3 V_{CC}$  ( \*  $R_1 = R_2 = R_3$ , another input if it is connected Pin 6.

As soon as charging  $C_1$  is higher than  $2/3 V_{CC}$ , discharge transistor  $Q_1$  turns on and  $C_1$  discharges to collector of transistor  $Q_1$ .

Therefore, the flip-flop circuit is reset and output is low.

One input of lower comparator is the  $1/3 V_{CC}$ , discharge transistor  $Q_1$  turn off and  $C_1$  charges through  $R_A$  and  $R_B$ .

Therefore, the flip-flop circuit is set and output is high.

So to say, when  $C_1$  charges through  $R_A$  and  $R_1$  output is high and when  $C_1$  discharges through  $R_B$  output is low.

The charge time (output is high)  $T_1$  is  $0.693 (R_A + R_B) C_1$  and the discharge time (output is low)  $T_2$  is  $0.693 (R_B C_1)$ .

$$\left( \ln \frac{V_{CC} - 1/3 V_{CC}}{V_{CC} - 2/3 V_{CC}} \right) 0.693$$

Thus the total period time  $T$  is given by

$$T = T_1 + T_2 = 0.693 (R_A + 2R_B) C_1$$

Then the frequency of astable mode is given by

$$f = \frac{1}{T} = \frac{1.44}{(R_A + 2R_B) C_1}$$

The duty cycle is given by

$$D.C = \frac{T_2}{T} = \frac{R_B}{R_A + 2R_B}$$

If you make use of the KA556 you can make two astable modes.

**Astable Operation**

The KA555 can free run as a multivibrator by triggering itself; refer to Fig.2. The output can swing from  $V_{DD}$  to GND and have 50% duty cycle square wave. Less than 1% frequency deviation can be observed, over a voltage range of 2 to 5V.  $f=1/1.4RC$

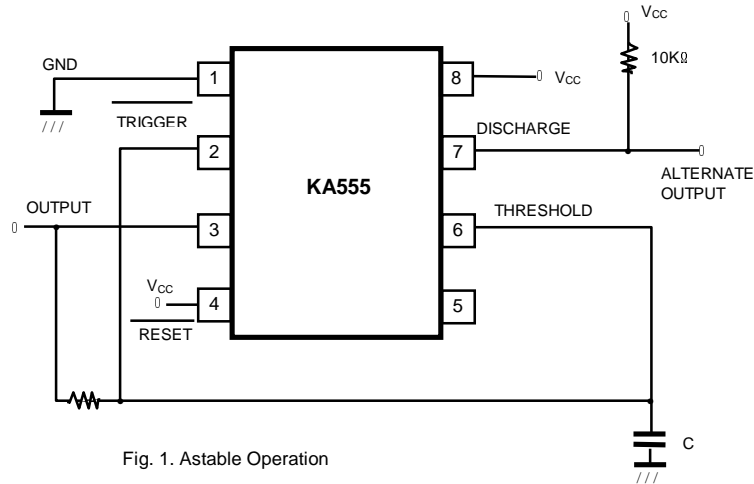


Fig. 1. Astable Operation

**Monostable Operation**

The KA555 can be used as a one-shot, i.e. monostable multivibrator. Initially, because the inside discharge transistor is on state, external timing capacitor is held to GND potential. Upon application of a negative TRIGGER pulse pin 2, the internal discharge transistor is off state and the voltage across the capacitor increases with time constant  $T = R_A C$  and OUTPUT goes to high state. When the voltage across the capacitor equals  $2/3V_{CC}$  the inner comparator is reset by THRESHOLD input and the discharge transistor goes to on state, which in turn discharges the capacitor rapidly and drives the OUTPUT to its low state.

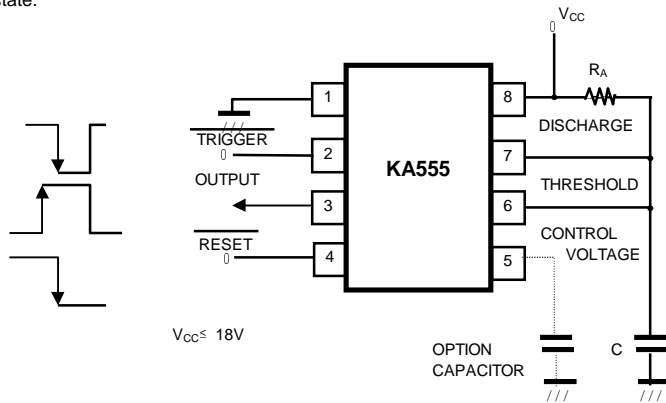


Fig. 2. Monostable Operation