Am555

Precision Timer

Distinctive Characteristics

- Timing from microseconds through hours
- 200mA output sink current
- Variable duty cycle
- TTL output compatibility
- Temperature stability of 0.005%/°C
- 100% reliability assurance testing in compliance with MIL-STD-883

FUNCTIONAL DESCRIPTION

The Am555 is a highly stable timing device used to provide accurate time delays or to build precision oscillators. When the device is used as a monostable, the time is precisely controlled using one external resistor and one external capacitor. When the device is used as a precision oscillator, the frequency and duty cycle are controlled by two external resistors and one external capacitor.

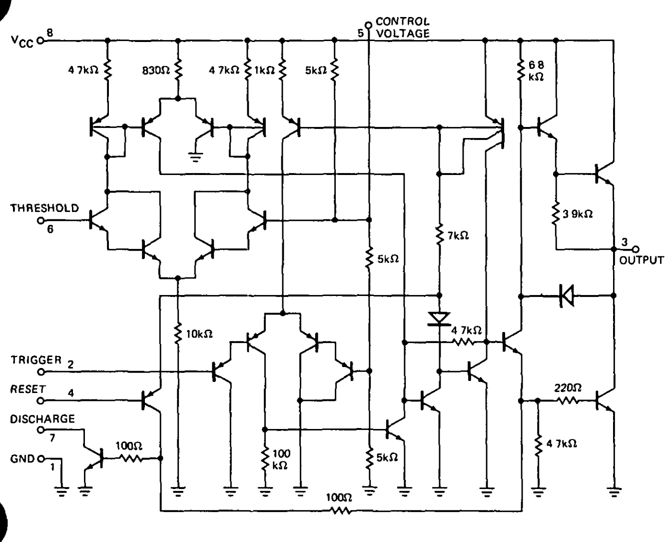
For monostable operation, a HIGH-to-LOW transition is applied to the trigger input. The device is triggered when the input trigger voltage reaches 1/3 V_{CC}.

Once the circuit is triggered, it will remain in the triggered state until the set time has elapsed, even if it is triggered again. The output pulse width is equal to 1.1 $R_A C$.

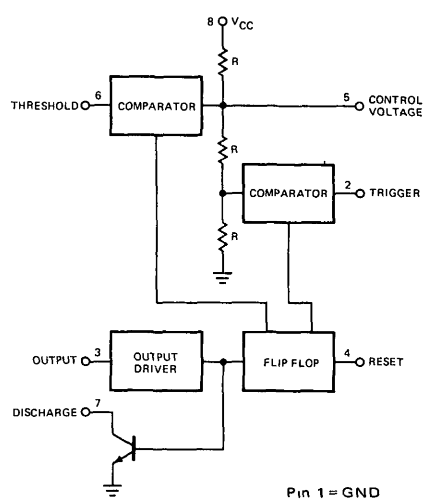
For continuous oscillation, two external resistors are used such that the external capacitor charges and discharges between 1/3 V_{CC} and 2/3 V_{CC}. The charge time is given by $t_{charge} = 0.693\ (R_A + R_B)C$ while the discharge time is $t_{discharge} = 0.693\ R_B C$.

The device also features a direct reset that overrides all other inputs. When the reset is LOW the output is LOW regardless of the other inputs.

SCHEMATIC DIAGRAM



LOGIC SYMBOL



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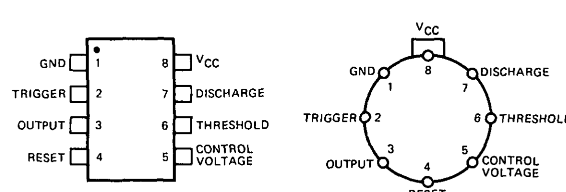
ORDERING INFORMATION

Package Type	Temperature Range	Order Number
Mini-DIP	0°C to +70°C	NE555V
TO-5	0°C to +70°C	NE555T
Dice	0°C to +70°C	AM555XC
TO-5	–55°C to +125°C	SE555T
Dice	–55°C to +125°C	AM555XM

CONNECTION DIAGRAMS



Note Pin 1 is marked for orientation

MAXIMUM RATING (Above which the useful life may be impaired)

Storage Temperature	−65°C to +150°C
Temperature (Ambient) Under Bias	
Military Grade	−55°C to +125°C
Commercial Grade	0°C to +70°C
Supply Voltage to Ground Potential	+18V
Power Dissipation	600mW
Lead Temperature (Soldering 60 seconds)	+300°C

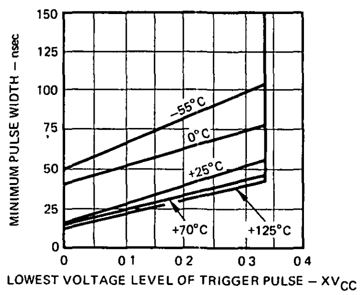
ELECTRICAL CHARACTERISTICS (T_A = 25°C V_{CC} = +5V to +15V Unless Otherwise Noted)

Parameter	Test Conditions	Military Min	Military Typ	Military Max	Commercial Min	Commercial Typ	Commercial Max	Units
Supply Voltage		4 5		18	4 5		16	V
Supply Current (LOW State)	V_{CC} = 5V R_L = ∞		3	5		3	6	mA
	V_{CC} = 15V R_L = ∞ (Note 1)		10	12		10	15	
Threshold Voltage			2/3			2/3		XV_{CC}
Trigger Voltage	V_{CC} = 15V	4 8	5	5 2		5		V
	V_{CC} = 5V	1 45	1 67	1 9		1 67		
Trigger Current			0 5			0 5		μA
Reset Voltage		0 4	0 7	1 0	0 4	0 7	1 0	V
Reset Current			0 1			0 1		mA
Threshold Current	(Note 3)		0 1	25		0 1	25	μA
Control Voltage Level	V_{CC} = 15V	9 6	10	10 4	9 0	10	11	V
	V_{CC} = 5V	2 9	3 33	3 8	2 6	3 33	4	
Output Voltage (LOW)	V_{CC} = 15V, I_{SINK} = 10mA		0 1	0 15		0 1	25	V
	V_{CC} = 15V, I_{SINK} = 50mA		0 4	0 5		0 4	75	
	V_{CC} = 15V, I_{SINK} = 100mA		2 0	2 2		2 0	2 5	
	V_{CC} = 15V, I_{SINK} = 200mA		2 5			2 5		
	V_{CC} = 5V, I_{SINK} = 8mA		0 1	0 25				V
	V_{CC} = 5V, I_{SINK} = 5mA					25	35	
Output Voltage (HIGH)	V_{CC} = 15V, I_{SOURCE} = −200mA		12 5			12 5		V
	V_{CC} = 15V, I_{SOURCE} = − 100mA	13 0	13 3		12 75	13 3		V
	V_{CC} = 5V, I_{SOURCE} = − 100mA	3 0	3 3		2 75	3 3		
Timing Error (Monostable)								
Initial Accuracy	R_A = 1kΩ to 100kΩ, C = 0 1μF (Note 2)		0 5	2		1		%
Drift with Temp			30	100		50		ppm/°C
Drift with Sup Volt			0 05	0 2		0 1		%/Volt
Rise Time of Output			100			100		nsec
Fall Time of Output			100			100		

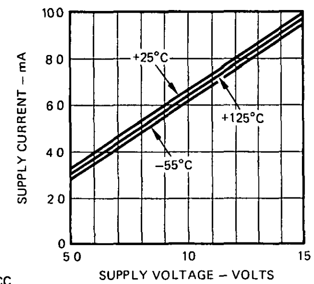
Notes 1 Supply current when output HIGH typically 1mA less
2 Tested at V_{CC} = 5V and V_{CC} = 15V
3 Determines the maximum value of $R_A + R_B$ For 15V operation the max total R = 20mΩ

TYPICAL CHARACTERISTICS

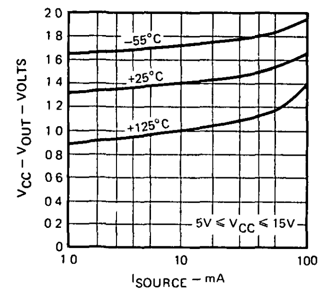
Minimum Pulse Width Required for Triggering



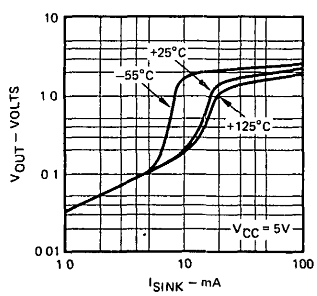
Supply Current Versus Supply Voltage



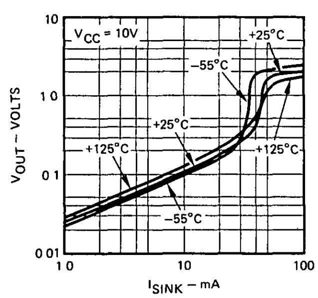
High Output Voltage Versus Output Source Current



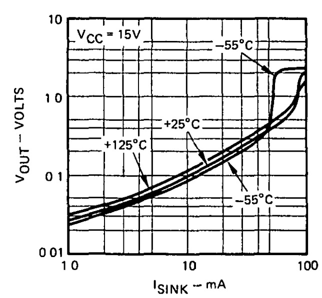
Low Output Voltage Versus Output Sink Current



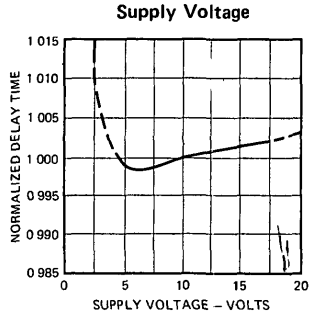
Low Output Voltage Versus Output Sink Current



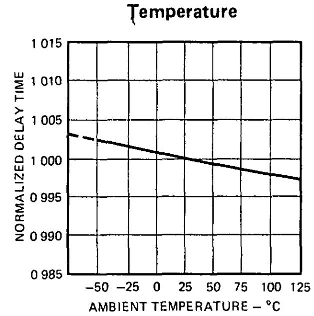
Low Output Voltage Versus Output Sink Current



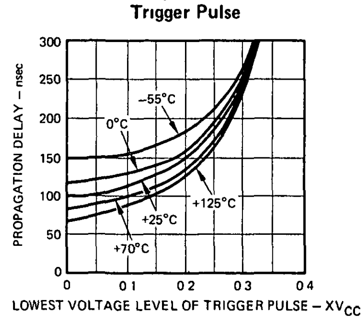
Delay Time Versus Supply Voltage



Delay Time Versus Temperature



Propagation Delay Versus Voltage Level of Trigger Pulse



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APPLICATIONS

MONOSTABLE OPERATION

When the timer is operated as a monostable multivibrator, one external capacitor, C, and one external resistor, R_A, are used as shown in Figure 1. When the trigger input is reduced below 1/3 V_{CC}, the timer internal flip-flop is set. This releases the short circuit across the external capacitor and the Q output goes HIGH. The voltage across the capacitor begins to rise exponentially with the time constant R_AC. When the capacitor voltage reaches 2/3 V_{CC}, the internal comparator resets the flip-flop and the external capacitor, C, is rapidly discharged provided the trigger voltage is returned above 1/3 V_{CC}. The output is now in LOW state and a new timing cycle may be initiated. The time that the output is in the HIGH state is given by 1.1 R_AC or can be taken directly from Figure 2. Both the charge rate and internal threshold are directly proportional to the V_{CC} supply voltage. Thus, the timer output pulse width is independent of the power supply voltage. If a LOW is applied to the reset input, the output is forced LOW and the external capacitor discharged regardless of the other inputs.

ASTABLE OPERATION

When the timer is operated in the astable mode, two external resistors, R_A and R_B, and one external capacitor, C, are used as shown in Figure 3. With this connection scheme, the external capacitor, C, charges and discharges between 1/3 V_{CC} and 2/3 V_{CC}. The charge time (output HIGH) is

$$t_{AB} = 0.693\,(R_A + R_B)\,C$$

The discharge time (output LOW) is

$$t_B = 0.693\,R_BC$$

The total period for one cycle of output HIGH and output LOW is

$$T = t_{AB} + t_B = 0.693\,(R_A + 2R_B)\,C$$

The frequency for this period, T, is

$$f = \frac{1}{T} = \frac{1}{0.693\,(R_A + 2R_B)\,C}$$

The astable free running frequency can also be found from the graph shown in Figure 4. The duty cycle, time the output is LOW divided by the period, is given by

$$D = \frac{t_B}{t_{AB} + t_B} = \frac{R_B}{R_A + 2R_B}$$

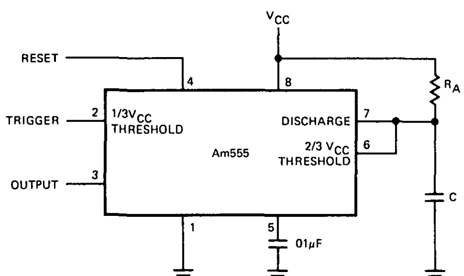


Fig. 1. Monostable Operation of the Am555.

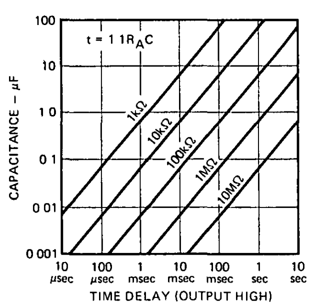


Fig. 2. Monostable Pulse Width.

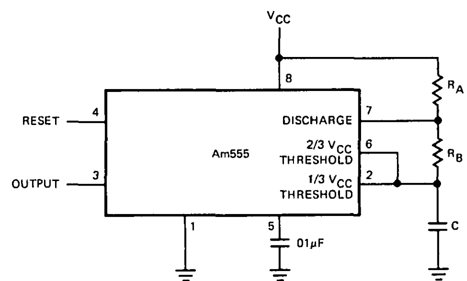


Fig. 3. Astable Operation of the Am555.

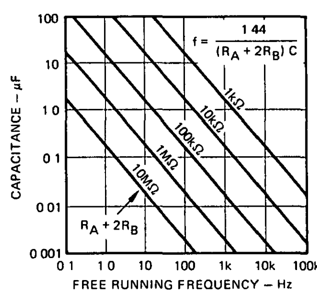
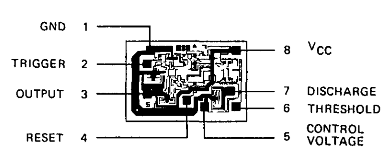


Fig. 4. Astable Free Running Frequency.

Metallization and Pad Layout



DIE SIZE 0.040" X 0.060"