INTERSIL

555
Precision Timer

FEATURES

- **Timing from microseconds through hours**
- **Operates in both astable and monostable modes**
- **Adjustable duty cycle**
- **High current output can source or sink 200mA**
- **Output can drive TTL**
- **Temperature stability of 0.005%/° C**

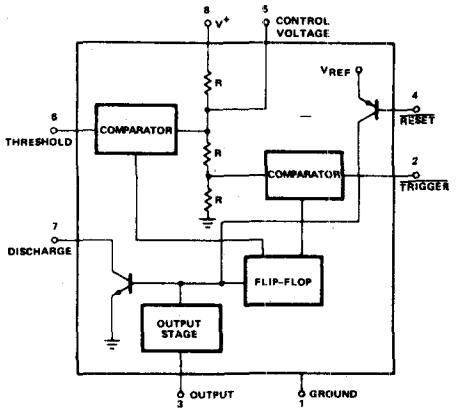
APPLICATIONS

- **Precision Timing**
- **Pulse Generation**
- **Sequential Timing**
- **Time Delay Generation**
- **Pulse Width Modulation**
- **Pulse Position Modulation**
- **Missing Pulse Detector**

GENERAL DESCRIPTION

The NE/SE 555 monolithic timing circuit is a highly stable controller capable of producing 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 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 large currents or drive TTL circuits.

BLOCK DIAGRAM



ORDERING INFORMATION

NE555/D	0° C to +70° C	Dice
NE555F		14 pin CERDIP
NE555N		8 pin plastic DIP
NE555T		TO-99 can
SE555/D	-55° C to +125° C	Dice
SE555F*		14 pin CERDIP
SE555T*		TO-99 can

*Add /883B to order number if 883B processing is desired.

PIN CONFIGURATIONS

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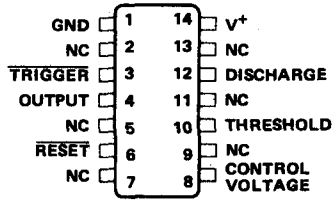

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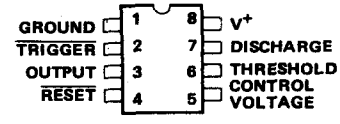

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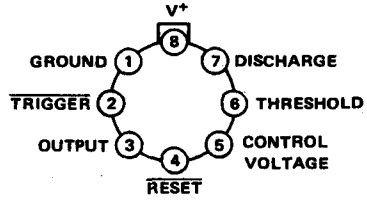

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ABSOLUTE MAXIMUM RATINGS

Supply Voltage ..... +18V
Power Dissipation 600mW
Operating Temperature Range
NE555 ..... 0°C to +70°C
SE555 ..... 55°C to +125°C
Storage Temperature Range ..... 65°C to +150°C
Lead Temperature (Soldering, 10 seconds) ..... +300°C

ELECTRICAL CHARACTERISTICS

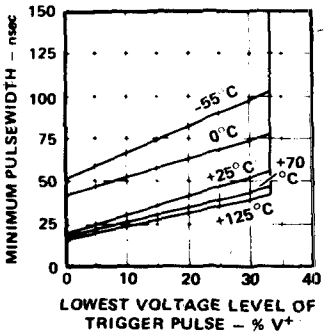
TEST CONDITIONS: $T_A = 25°C$, $V^+ = +5V$ to +15 unless otherwise specified.

PARAMETER	TEST CONDITIONS	SE555			NE555			UNITS
		MIN	TYP	MAX	MIN	TYP	MAX	
Supply Voltage		4.5		18	4.5		16	V
Supply Current	$V^+ = 5V$ $R_L = \infty$		3	5		3	6	mA
	$V^+ = 15V$ $R_L = \infty$		10	12		10	15	
	Low State, Note 1							
Timing Error	R_A, R_B = 1kΩ to 100kΩ							
Initial Accuracy	C = 0.1μF Note 2		0.5	2		1		%
Drift with Temperature			30	100		50		ppm/°C
Drift with Supply Voltage			0.005	0.02		0.01		%/Volt
Threshold Voltage			2/3			2/3		X Vcc
Trigger Voltage	$V^+ = 15V$	4.8	5	5.2		5		V
	$V^+ = 5V$	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	$V^+ = 15V$	9.6	10	10.4	9.0	10	11	V
	$V^+ = 5V$	2.9	3.33	3.8	2.6	3.33	4	
Output Voltage Drop (low)	$V^+ = 15V$							
	I_{SINK} = 10mA		0.1	0.15		0.1	.25	
	I_{SINK} = 50mA		0.4	0.5		0.4	.75	
	I_{SINK} = 100mA		2.0	2.2		2.0	2.5	
	I_{SINK} = 200mA		2.5			2.5		
	$V^+ = 5V$							
	I_{SINK} = 8mA		0.1	0.25				
	I_{SINK} = 5mA					.25	.35	
Output Voltage Drop (high)	I_{SOURCE} = 200mA		12.5			12.5		
	$V^+ = 15V$							
	I_{SOURCE} = 100mA							
	$V^+ = 15V$	13.0	13.3		12.75	13.3		
	$V^+ = 5V$	3.0	3.3		2.75	3.3		
Rise Time of Output			100			100		nsec
Fall Time of Output			100			100		

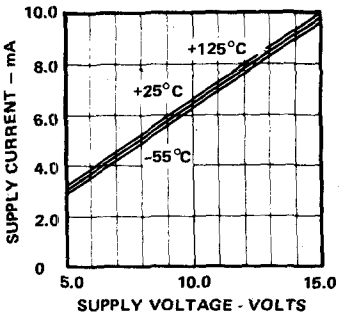
NOTE 1: Supply Current when output high typically 1mA less.
NOTE 2: Tested at $V^+ = 5V$ and $V^+ = 15V$.
NOTE 3: This will determine the maximum value of $R_A + R_B$ for 15V operation. The maximum total R = 20 MΩ.

TYPICAL CHARACTERISTICS

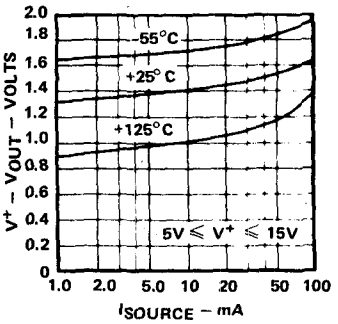
MINIMUM PULSE WIDTH REQUIRED FOR TRIGGERING



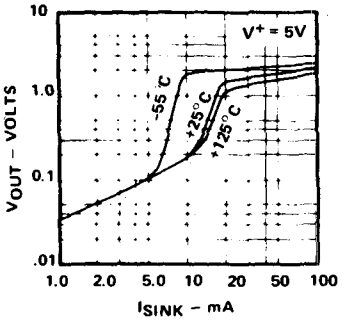
SUPPLY CURRENT vs. SUPPLY VOLTAGE



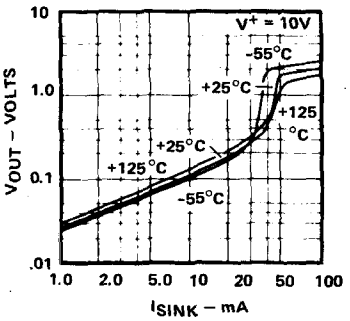
HIGH OUTPUT VOLTAGE vs. OUTPUT SOURCE CURRENT



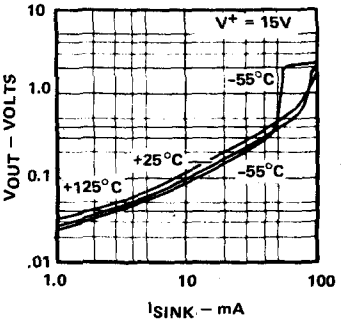
LOW OUTPUT VOLTAGE vs. OUTPUT SINK CURRENT



LOW OUTPUT VOLTAGE vs. OUTPUT SINK CURRENT



LOW OUTPUT VOLTAGE vs. OUTPUT SINK CURRENT



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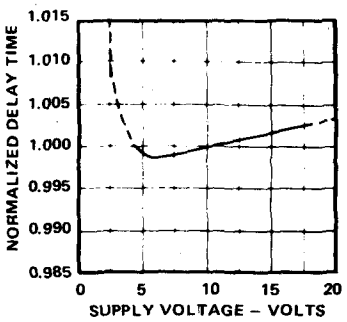
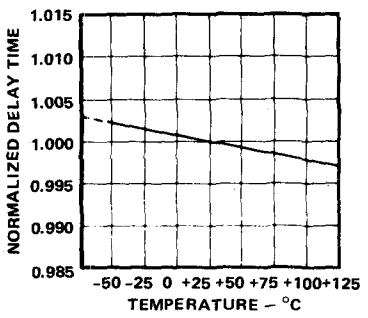
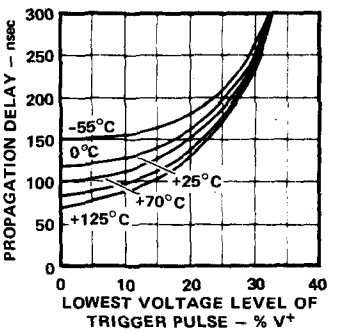
DELAY TIME vs. SUPPLY VOLTAGE



DELAY TIME vs. TEMPERATURE

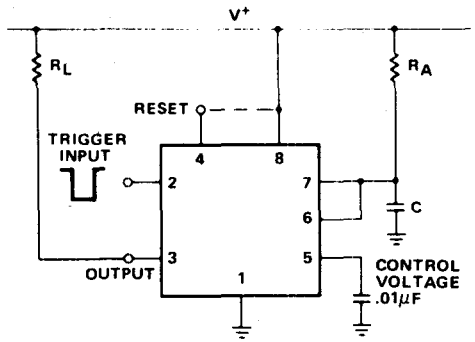


PROPAGATION DELAY vs. VOLTAGE LEVEL OF TRIGGER PULSE

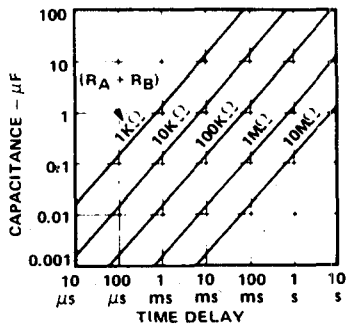


APPLICATION INFORMATION

MONOSTABLE OPERATION

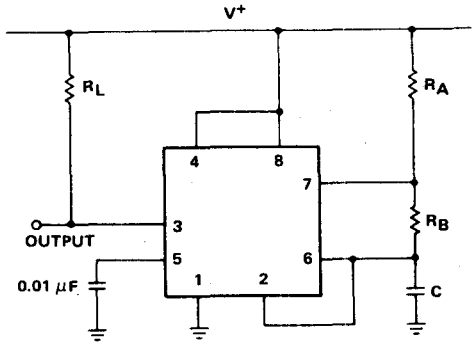


TIME DELAY vs. R_A, R_B AND C

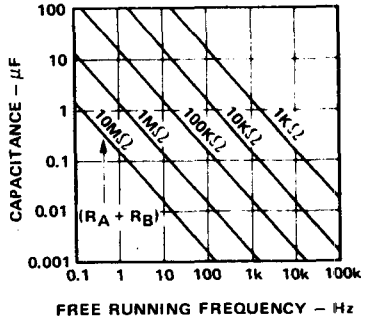


In this mode of operation, the timer functions as a one-shot. Initially the external capacitor (C) is held discharged by a transistor inside the timer. Upon application of a negative trigger pulse to pin 2, a flip-flop is set which releases the short circuit across the external capacitor and drives the output high. The voltage across the capacitor increases exponentially with the time constant $\tau = R_A C$. When the voltage across the capacitor equals 2/3 V^+, the comparator resets the flip-flop, which in turn discharges the capacitor rapidly and drives the output to its low state.

ASTABLE OPERATION



FREE RUNNING FREQUENCY vs. R_A, R_B AND C



The circuit can also be connected to trigger itself and free run as a multivibrator. The external capacitor charges through R_A and R_B and discharges through R_B only. Thus the duty cycle may be precisely set by the ratio of these two resistors. In this mode of operation, the capacitor charges and discharges between 1/3 V^+ and 2/3 V^+. As in the triggered mode, the charge and discharge times, and therefore the frequency are independent of the supply voltage.

The frequency of oscillation is given by: $f = \frac{1}{t} = \frac{1.46}{R_A + 2R_B C}$