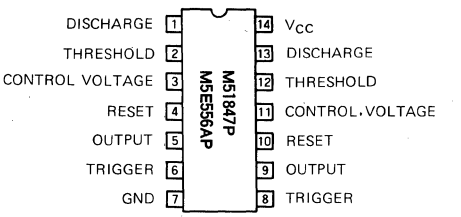
M51847P/M5E556AP

DUAL TIMER

DESCRIPTION

The M51847P / M5E556AP monolithic timing circuits are highly stable controllers capable of producing accurate time delays, or oscillation. Additional terminals are provided for triggering or resetting if desired. In the time delay mode, the time is precisely controlled by one external resistor and capacitor. For a stable operation as an oscillator, both the free running frequency and the duty cycle are accurately controlled by two external resistors and capacitor. In this operation, the maximum frequency is 100kHz. The circuit will trigger and reset on falling waveforms. The reset voltage is about 1.4V and is compatible with TTL level. The output structure can source or sink up to 100mA or drive TTL circuits.

PIN CONFIGURATION (TOP VIEW)

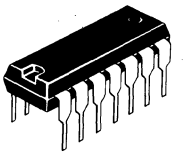


Outline 14P4

NC: NO CONNECTION

FEATURES

- Timing from microseconds through minutes
- Operates in both astable and monostable modes
- Adjustable duty cycle
- High current output can source or sink 100mA
- Maximum frequency is 100kHz (guarantee)
- Reset voltage is about 1.4V for TTL level
- Built in power on reset
- Interchangeable with the signetics NE556 in pin configuration and characteristics



14-pin plastic DIL package

APPLICATIONS

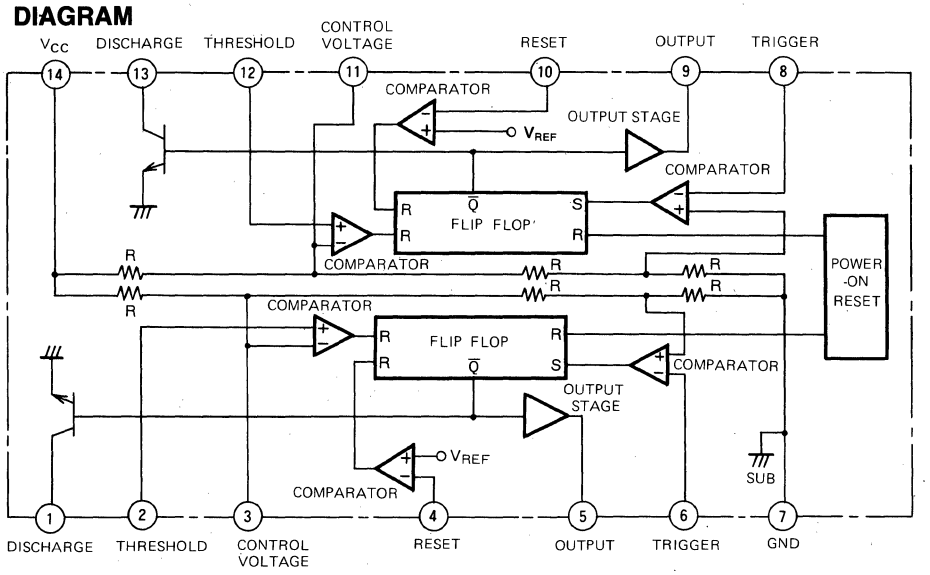
- Precision timing
- Pulse generation
- Sequential timing
- Time delay generation
- Pulse width modulation
- Pulse position modulation
- Missing pulse detector

RECOMMENDED OPERATING CONDITIONS

Supply voltage ..... 4 ~ 17V

Rated supply voltage 6V, 12V

BLOCK DIAGRAM



MITSUBISHI ELECTRIC

ABSOLUTE MAXIMUM RATINGS (T_a=25℃, unless otherwise noted)

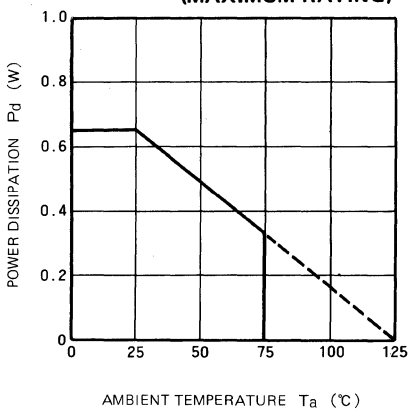
Symbol	Parameter	Conditions	Limits	Unit
V_{CC}	Supply voltage		18	V
I_O	Output current		100	mA
P_d	Power dissipation		650	mW
T_{opr}	Operating ambient temperature		−20 ~ +75	℃
T_{stg}	Storage temperature		−40 ~ +125	℃

ELECTRICAL CHARACTERISTICS (T_a=25℃, unless otherwise noted)

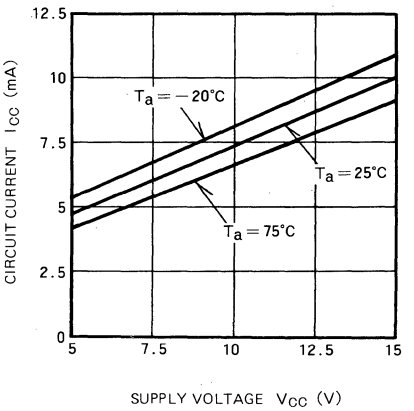
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
V_{CC}	Supply voltage		4		17	V
I_{CC}	Circuit current	V_{CC}=5V, No load		5	9	mA
		V_{CC}=15V, No load		10	19	mA
V_{CNT}	Control voltage	V_{CC}=5V	2.6	3.3	4	V
		V_{CC}=15V	9	10	11	V
V_{TH}	Threshold voltage			$\frac{2}{3}V_{CC}$		V
I_{TH}	Threshold current			0.03	0.2	μA
V_T	Trigger voltage			$\frac{1}{3}V_{CC}$		V
I_T	Trigger current			0.05	0.4	μA
V_R	Reset voltage		1.0	1.4	2.0	V
I_R	Reset current			0.05	0.2	μA
V_{OL}	Low output voltage	V_{CC}=5V, I_{sink}=5mA		0.05	0.2	V
		V_{CC}=15V, I_{sink}=10mA		0.05	0.2	V
		V_{CC}=15V, I_{sink}=50mA		0.2	0.5	V
		V_{CC}=15V, I_{sink}=100mA		1.0	2.0	V
V_{OH}	High output voltage	V_{CC}=5V, I_{source}=100mA	2.8	3.3		V
		V_{CC}=15V, I_{source}=100mA	12.8	13.3		V
fmax	Maximum frequency	R_a=R_b=2kΩ, C_a=200pF	100			kHz

TYPICAL CHARACTERISTICS

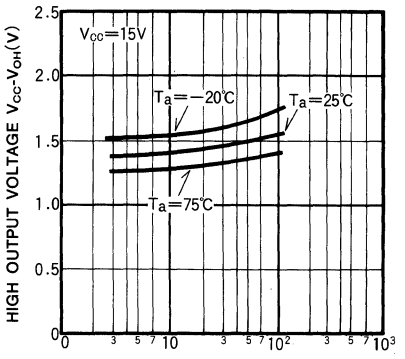
THERMAL DERATING (MAXIMUM RATING)



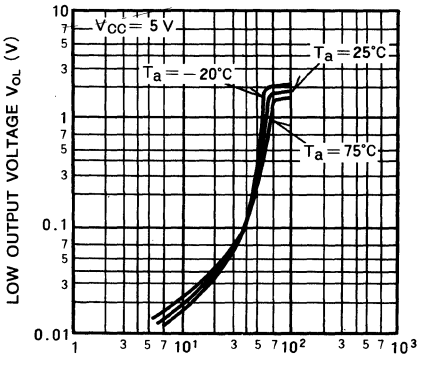
SUPPLY VOLTAGE VS CIRCUIT CURRENT



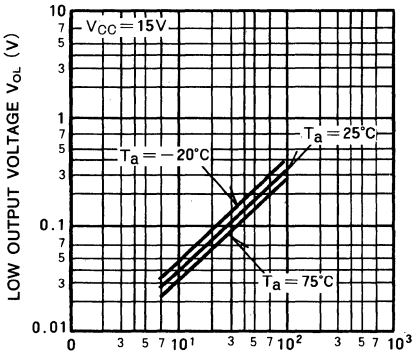
HIGH OUTPUT VOLTAGE VS OUTPUT SOURCE CURRENT



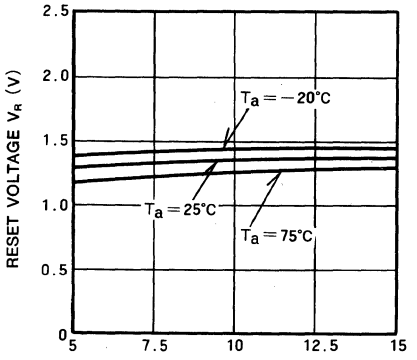
LOW OUTPUT VOLTAGE VS OUTPUT SINK CURRENT



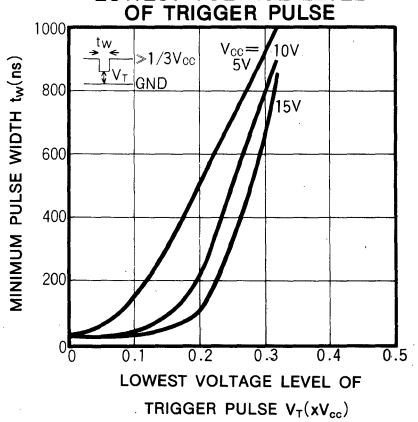
LOW OUTPUT VOLTAGE VS OUTPUT SINK CURRENT



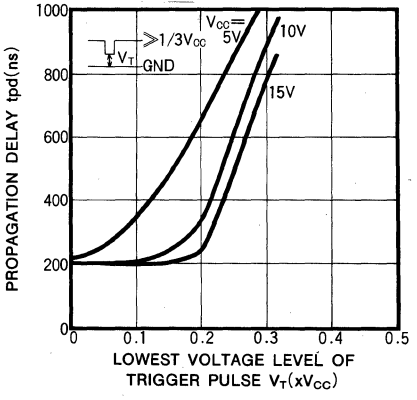
SUPPLY VOLTAGE VS RESET VOLTAGE



MINIMUM PULSE WIDTH VS LOWEST VOLTAGE LEVEL OF TRIGGER PULSE



PROPAGATION DELAY VS LOWEST VOLTAGE OF TRIGGER



APPLICATIONS

Monostable operation

In this mode operation, timer functions an one-shot. The external capacitor is initially held discharged by a transistor internal to the timer.

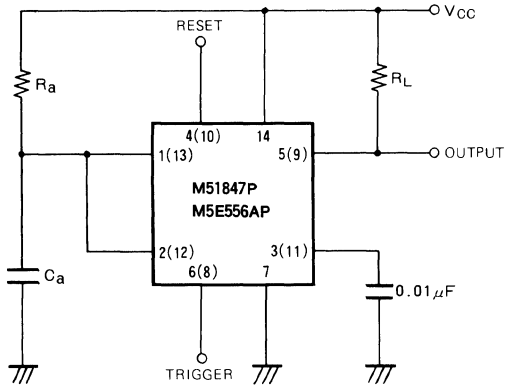
Applying a negative trigger pulse to Pin ⑥ (Pin ⑧) sets the flip-flop, driving the output high and releasing the short-circuit across the external capacitor. The voltage across the capacitor increases with the time constant $\tau = R_a \cdot C_a$ to 2/3 V_{CC}, where the comparator resets the flip-flop and discharges the external capacitor.

The output is now in the low state. The circuit triggering takes place when the negative going trigger pulse reaches 1/3 V_{CC} and circuit stays in the output high state until the set time elapses. The time the output remains in the high state is 1.1 Ra·Ca and can be determined by the graph.

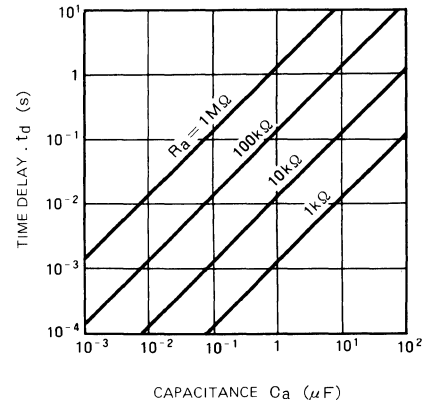
A negative pulse applied to Pin ④ (Pin ⑩) during the timing cycle over again beginning on the positive going edge of the reset pulse. If reset function is not used, Pin ④ (Pin ⑩) should be connected to V_{CC} to avoid false resetting. The delay time is given by:

$t_d = 1.1\ Ra \cdot Ca$

Monostable multivibrator



TIME DELAY VS Ra, Ca



Astable operation

With the circuit connected as shown and it will trigger itself and free run as a multivibrator. The external capacitor charges through R_a and R_b and discharges through Rb only.

Through the duty cycle is set by the ratio of these two resistors, and the capacitor charges and discharges between 1/3 V_{CC} and 2/3 V_{CC}.

Charge and discharge times, and therefore frequency, are independent of supply voltage. The free running frequency versus R_a, R_b and C_a is shown in the graph. The charge time (output high) is given by:

$t_1 = 0.693\ (R_a + R_b) \cdot C_a$

and discharge time (output low) by:

$t_2 = 0.693\ R_b \cdot C_a$

Through the free running frequency is given by:

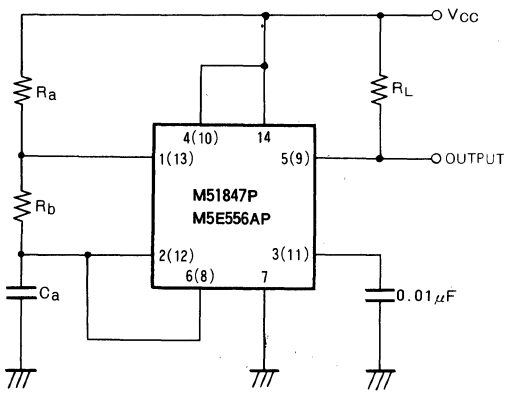
$f = 1/(t_1 + t_2)$

$= 1.44/\{(R_a + 2R_b) \cdot C_a\}$

and the duty cycle by:

$D = R_b/(R_a + 2R_b)$

Astable multivibrator



FREE RUNNING FREQUENCY VS Ra, Rb and Ca