

3V LOW POWER SINGLE TIMERS

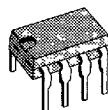
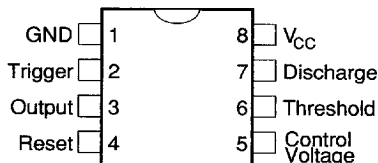
- DEDICATED TO 3.3V OR BATTERY SUPPLY
(Specified at 3V and 5V plus 1.5V for A version)
- VERY LOW POWER CONSUMPTION :
90 μ A at $V_{CC} = 3V$
- WIDE SINGLE SUPPLY RANGE :
+1.5V to +16V
- HIGH OUTPUT CURRENT CAPABILITY
- SUPPLY CURRENT SPIKES REDUCED
DURING OUTPUT TRANSITIONS
- HIGH INPUT IMPEDANCE : $10^{12} \Omega$
- PIN-TO-PIN AND FUNCTIONALLY COMPAT-
IBLE WITH BIPOLAR NE555 AND CMOS
TS555
- OUTPUT COMPATIBLE WITH TTL, CMOS
AND LOGIC MOS

DESCRIPTION

The TS3V555 with its low consumption (90 μ A at $V_{CC} = 3V$) is a single CMOS timer dedicated to 3.3V or battery supply (specified at 3V and 5V plus 1.5V for A version) offering also a high frequency ($f_{(max)}$) 2MHz at $V_{CC} = 3V$ and 2.7 MHz at $V_{CC} = 5V$. Thus, either in monostable or astable mode, timing remains very accurate.

Timing capacitors can also be minimized due to high input impedance ($10^{12} \Omega$).

PIN CONNECTIONS (top view)



N
DIP8
(Plastic Package)



D
SO8
(Plastic Micropackage)

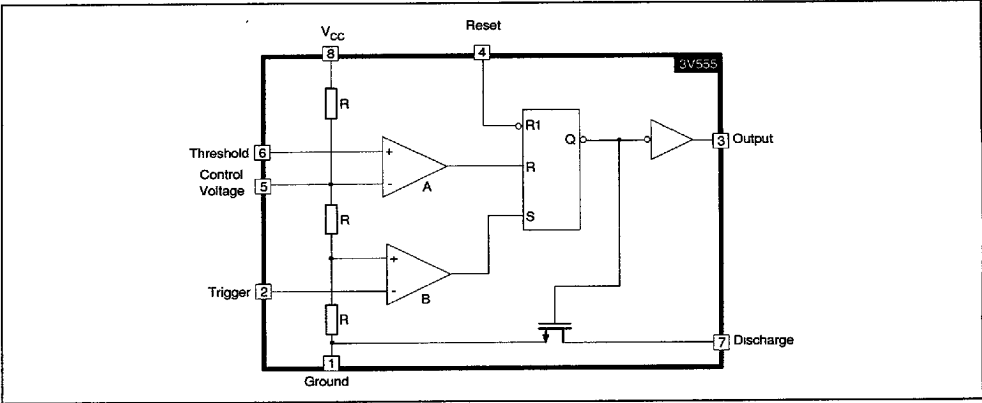
ORDER CODES

Part Number	Temperature Range	Package	
		N	D
TS3V555I, AI	-40, +125°C	●	●

3V555-01 TEL

3V555-01 EPS

BLOCK DIAGRAM



FUNCTION TABLE

RESET	TRIGGER	THRESHOLD	OUTPUT
Low	x	x	Low
High	Low	x	High
High	High	High	Low
High	High	Low	Previous State

LOW ↔ Level Voltage ≤ Min voltage specified
HIGH ↔ Level Voltage ≥ Max voltage specified
X ↔ Irrelevant

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{cc}	Supply Voltage	+18	V
T _j	Junction Temperature	+150	°C

THERMAL CHARACTERISTICS

Symbol	Parameter	Value	Unit
T _{oper}	Operating Temperature Range TS3V555I, AI	-40 to +125	°C
T _{stg}	Storage Temperature Range	-65 to +150	°C

OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
V _{cc}	Supply Voltage	+1.5 to +16	V

ELECTRICAL CHARACTERISTICS

$V_{CC} = +3V$, $T_{amb} = +25^{\circ}C$, Reset to V_{CC} (unless otherwise specified)

STATIC

Symbol	Parameter	TS3V555I, AI			Unit
		Min.	Typ.	Max.	
I_{CC}	Supply Current - (no load, High and Low States) $T_{amb} = +25^{\circ}C$ $T_{min} \leq T_{amb} \leq T_{max}$		90	230 230	μA
V_{CL}	Control Voltage $T_{amb} = +25^{\circ}C$ $T_{min} \leq T_{amb} \leq T_{max}$	1.8 1.7	2	2.2 2.3	V
V_{DIS}	Discharge Saturation Voltage ($I_{DIS} = 1mA$) $T_{amb} = +25^{\circ}C$ $T_{min} \leq T_{amb} \leq T_{max}$		0.05 -	0.2 0.25	V
V_{OL}	Low Level Output Voltage ($I_{SINK} = 1mA$) $T_{amb} = +25^{\circ}C$ $T_{min} \leq T_{amb} \leq T_{max}$		0.1	0.3 0.35	V
V_{OH}	High Level Output Voltage ($I_{SOURCE} = -0.3mA$) $T_{amb} = +25^{\circ}C$ $T_{min} \leq T_{amb} \leq T_{max}$	2.5 2.5	2.9		V
V_{TRIG}	Trigger Voltage $T_{amb} = +25^{\circ}C$ $T_{min} \leq T_{amb} \leq T_{max}$	0.9 0.8	1	1.1 1.2	V
I_{TRIG}	Trigger Current		10		μA
I_{TH}	Threshold Current		10		μA
V_{RESET}	Reset Voltage $T_{amb} = +25^{\circ}C$ $T_{min} \leq T_{amb} \leq T_{max}$	0.4 0.3	1.1	1.5 2.0	V
I_{RESET}	Reset Current		10		μA
I_{DIS}	Discharge Pin Leakage Current		1	100	nA

3V555-06 TEL

DYNAMIC

Symbol	Parameter	TS3V555I, AI			Unit
		Min.	Typ.	Max.	
	Timing Accuracy (Monostable) $R = 10k\Omega$, $C = 0.1\mu F$ - (note 1)		1		%
	Timing Shift with supply voltage variations (Monostable) $R = 10k\Omega$, $C = 0.1\mu F$, $V_{CC} = +3V \pm 0.3V$ - (note 1)		0.5		%/V
	Timing Shift with temperature - (note 1) $T_{min} \leq T_{amb} \leq T_{max}$		75		ppm/ $^{\circ}C$
f_{max}	Maximum astable frequency - (note 2) $R_A = 470\Omega$, $R_B = 200\Omega$, $C = 200pF$		2		MHz
	Astable frequency accuracy - (note 2) $R_A = R_B = 1k\Omega$ to $100k\Omega$, $C = 0.1\mu F$		5		%
	Timing Shift with supply voltage variations (Astable mode) - (note 2) $R_A = R_B = 10k\Omega$, $C = 0.1\mu F$, $V_{CC} = +3$ to $+5V$		0.5		%/V
t_r	Output Rise Time ($C_{LOAD} = 10pF$)		25		ns
t_f	Output Fall Time ($C_{LOAD} = 10pF$)		20		ns
t_{PD}	Trigger Propagation Delay		100		ns
t_{RPW}	Minimum Reset Pulse Width ($V_{TRIG} = +3V$)		350		ns

Note : 1. See Figure 2
2. See Figure 4

3V555-07 TEL

ELECTRICAL CHARACTERISTICS

VCC = +5V , Tamb = +25°C , Reset to VCC (unless otherwise specified)

STATIC

Symbol	Parameter	TS3V555I,AI			Unit
		Min.	Typ.	Max.	
ICC	Supply Current - (no load, High and Low States) Tamb = +25°C Tmin. ≤ Tamb ≤ Tmax.		110	250 250	µA
VCL	Control Voltage Tamb = +25°C Tmin. ≤ Tamb ≤ Tmax.	2.9 2.8	3.3	3.8 3.9	V
VDIS	Discharge Saturation Voltage (IDIS = 10mA) Tamb = +25°C Tmin. ≤ Tamb ≤ Tmax.		0.2	0.3 0.35	V
VOL	Low Level Output Voltage (ISINK = 8mA) Tamb = +25°C Tmin. ≤ Tamb ≤ Tmax.		0.3	0.6 0.8	V
VOH	High Level Output Voltage (ISOURCE = -2mA) Tamb = +25°C Tmin. ≤ Tamb ≤ Tmax.	4.4 4.4	4.6		V
VTRIG	Trigger Voltage Tamb = +25°C Tmin. ≤ Tamb ≤ Tmax.	1.36 1.26	1.67	1.96 2.06	V
ITRIG	Trigger Current		10		pA
ITH	Threshold Current		10		pA
VRESET	Reset Voltage Tamb = +25°C Tmin. ≤ Tamb ≤ Tmax.	0.4 0.3	1.1	1.5 2.0	V
IRESET	Reset Current		10		pA
IDIS	Discharge Pin Leakage Current		1	100	nA

DYNAMIC

Symbol	Parameter	TS3V555I,AI			Unit
		Min.	Typ.	Max.	
	Timing Accuracy (Monostable) - (note1) R = 10kΩ , C = 0.1µF - (note 1)		2		%
	Timing Shift with supply voltage variations (Monostable) - (note1) R = 10kΩ , C = 0.1µF, VCC = +5V +/-1V		0.38		%/V
	Timing Shift with temperature - (note1) Tmin. ≤ Tamb ≤ Tmax.		75		ppm/°C
fmax	Maximum astable frequency - (note 2) RA = 470Ω , RB = 200Ω, C = 200pF		2.7		MHz
	Astable frequency accuracy - (note 2) RA = RB = 1kΩ to 100kΩ, C = 0.1µF		3		%
	Timing Shift with supply voltage variations (Astable mode) - (note 2) RA = RB = 10kΩ, C = 0.1µF, VCC = +5V to+12V		0.1		%/V
tr	Output Rise Time (CLOAD = 10pF)		25		ns
tf	Output Fall Time (CLOAD = 10pF)		20		ns
tPD	Trigger Propagation Delay		100		ns
tRPW	Minimum Reset Pulse Width (VTRIG = +5V)		350		ns

Note : 1. See Figure 2
2. See Figure 4

ELECTRICAL CHARACTERISTICS**TS3V555AI only**

$V_{CC} = +1.5V$, $T_{amb} = +25^{\circ}C$, Reset to V_{CC} (unless otherwise specified)

STATIC

Symbol	Parameter	TS3V555AI			Unit
		Min.	Typ.	Max.	
I_{CC}	Supply Current - (no load, High and Low States) $T_{amb} = +25^{\circ}C$		50	150	μA
V_{CL}	Control Voltage $T_{amb} = +25^{\circ}C$	0.8	1.0	1.2	V
V_{DIS}	Discharge Saturation Voltage ($I_{DIS} = 1mA$) $T_{amb} = +25^{\circ}C$		75	150	mV
V_{OL}	Low Level Output Voltage ($I_{SINK} = 1mA$) $T_{amb} = +25^{\circ}C$		0.2	0.4	V
V_{OH}	High Level Output Voltage ($I_{SOURCE} = -0.25mA$) $T_{amb} = +25^{\circ}C$	1.0	1.25		V
V_{TRIG}	Trigger Voltage $T_{amb} = +25^{\circ}C$	0.4	0.5	0.6	V
I_{TRIG}	Trigger Current		10		pA
I_{TH}	Threshold Current		10		pA
V_{RESET}	Reset Voltage $T_{amb} = +25^{\circ}C$	0.4	1.1	1.4	V
I_{RESET}	Reset Current		10		pA

3V555-10 TEL

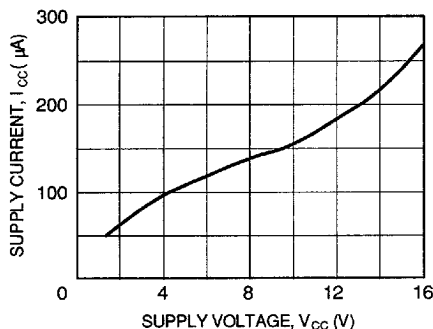
DYNAMIC

Symbol	Parameter	TS3V555AI			Unit
		Min.	Typ.	Max.	
	Timing Accuracy (Monostable) $R = 10k\Omega$, $C = 0.1\mu F$ - (note 1)		4		%

3V555-11 TEL

Note : 1. See Figure 2

TYPICAL CHARACTERISTICS

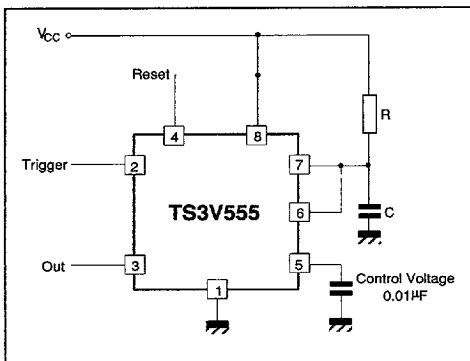
Figure 1 : Supply Current (each timer) versus supply voltage.

3V555-03 EPS

APPLICATION INFORMATION

MONOSTABLE OPERATION

In the monostable mode, the timer functions as a one-shot. Referring to figure 2 the external capacitor is initially held discharged by a transistor inside the timer.

Figure 2

3V555-04 EPS

The circuit triggers on a negative-going input signal when the level reaches $1/3 V_{CC}$. Once triggered, the circuit remains in this state until the set time has elapsed, even if it is triggered again during this interval. The duration of the output HIGH state is given by $t = 1.1 R \times C$.

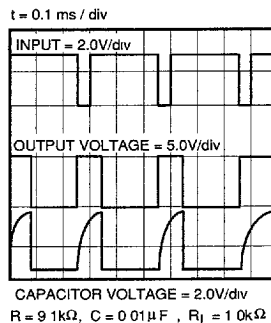
Notice that since the charge rate and the threshold level of the comparator are both directly proportional to supply voltage, the timing interval is independent of supply. Applying a negative pulse simultaneously to the Reset terminal (pin 4) and the Trigger terminal (pin 2) during the timing cycle discharges the external capacitor and causes the cycle to start over. The timing cycle now starts on the positive edge of the reset pulse. During the time the reset pulse is applied, the output is driven to its LOW state.

When a negative trigger pulse is applied to pin 2, the flip-flop is set, releasing the short circuit across the external capacitor and driving the output HIGH. The voltage across the capacitor increases exponentially with the time constant $\tau = R \times C$.

When the voltage across the capacitor equals $2/3 V_{CC}$, the comparator resets the flip-flop which then discharges the capacitor rapidly and drives the output to its LOW state.

Figure 3 shows the actual waveforms generated in this mode of operation.

When Reset is not used, it should be tied high to avoid any possible or false triggering.

Figure 3

3V555-05 EPS

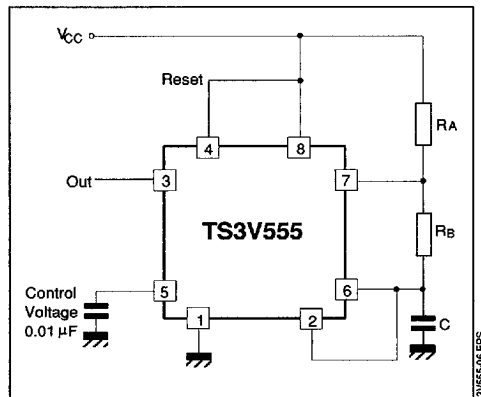
ASTABLE OPERATION

When the circuit is connected as shown in figure 4 (pin 2 and 6 connected) it triggers itself and free runs 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 the astable mode of operation, C charges and discharges between $1/3 V_{CC}$ and $2/3 V_{CC}$. As in the triggered mode, the charge and discharge times and therefore frequency, are independent of the supply voltage.

Figure 5 shows actual waveforms generated in this mode of operation.

Figure 4



3V555-06 EPS

The charge time (output HIGH) is given by :

$$t_1 = 0.693 (R_A + R_B) C$$

and the discharge time (output LOW) by :

$$t_2 = 0.693 (R_B) C$$

Thus the total period T is given by :

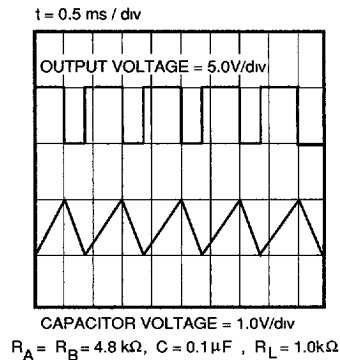
$$T = t_1 + t_2 = 0.693 (R_A + 2R_B) C$$

The frequency of oscillation is then :

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

The duty cycle is given by : $D = \frac{R_B}{R_A + 2R_B}$

Figure 5



3V555-07 EPS