

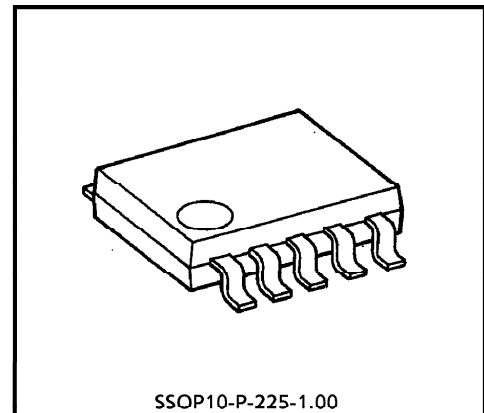
TOSHIBA Bi-CMOS INTEGRATED CIRCUIT SILICON MONOLITHIC

TB1004AF

CR TIMER

FEATURES

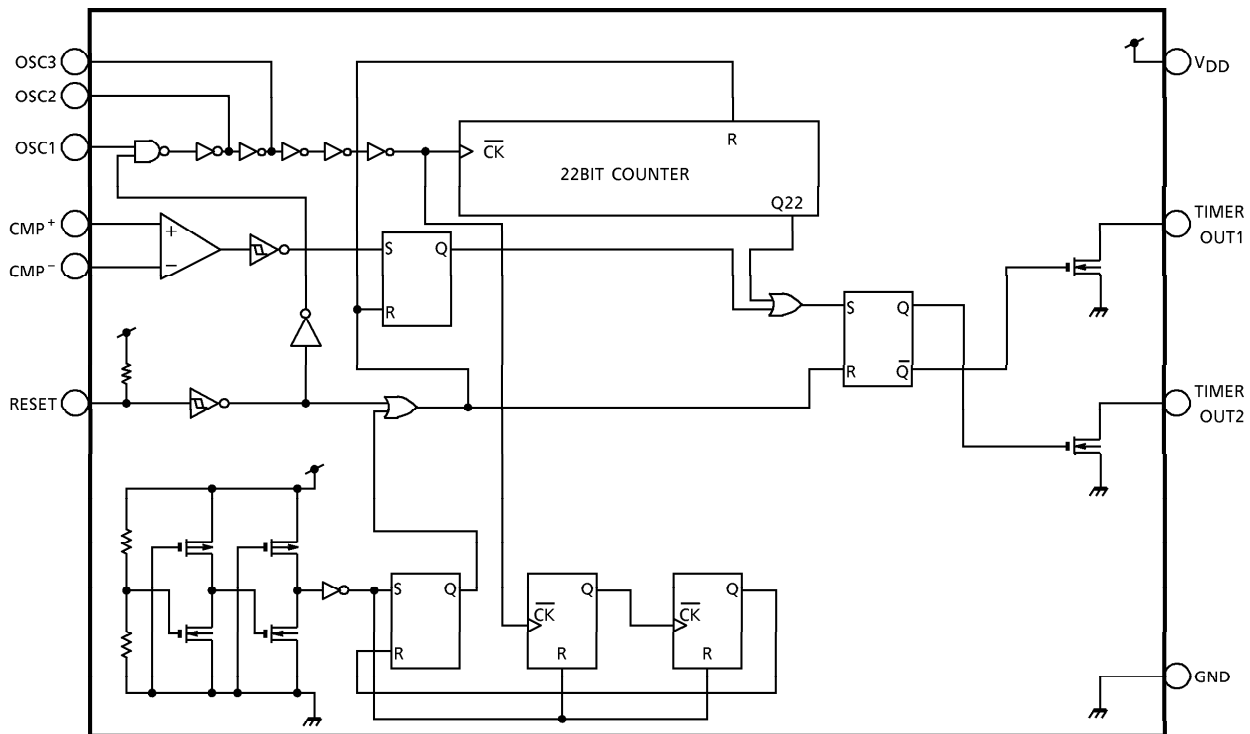
- MOS IC with 22-stage binary counter.
- Built-in initialize circuit.
- Built-in voltage detection comparator.
- Wide range timer setting.
- Low power dissipation current.
- Suitable for Ni-cd battery charger.



SSOP10-P-225-1.00

Weight : 0.1g (Typ.)

BLOCK DIAGRAM



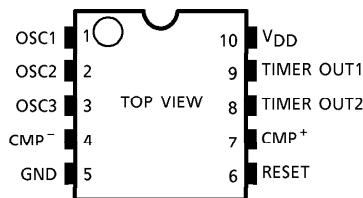
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FUNCTION DESCRIPTION ON EACH TERMINAL

PIN No.	SYMBOL	FUNCTION
1	OSC1	Oscillation input terminal
2	OSC2	Oscillation input terminal
3	OSC3	Oscillation input terminal
4	CMP ⁻	Comparator minus (-) side input terminal "L" : Timer mode, "H" : Timer over voltage detection mode
5	GND	GND
6	RESET	Reset terminal (H→L : inside reset)
7	CMP ⁺	Comparator plus (+) side input terminal "H" : Timer mode, "L" : Timer over voltage detection mode
8	TIMER OUT2	Timer output terminal 2 ($\overline{\text{TIMER OUT1}}$) (N-ch open drain, sink max. 5mA)
9	TIMER OUT1	Timer output terminal 1 (N-ch open drain, sink max. 5mA)
10	V _{DD}	Power supply voltage

PIN CONNECTION



TRUTH TABLE

MODE	INPUT			OUTPUT
	RESET	CMP ⁺	CMP ⁻	
1	L	(*)	(*)	L
2	H	H	L	Timer mode
3	H	L	H	Timer over voltage detecting mode

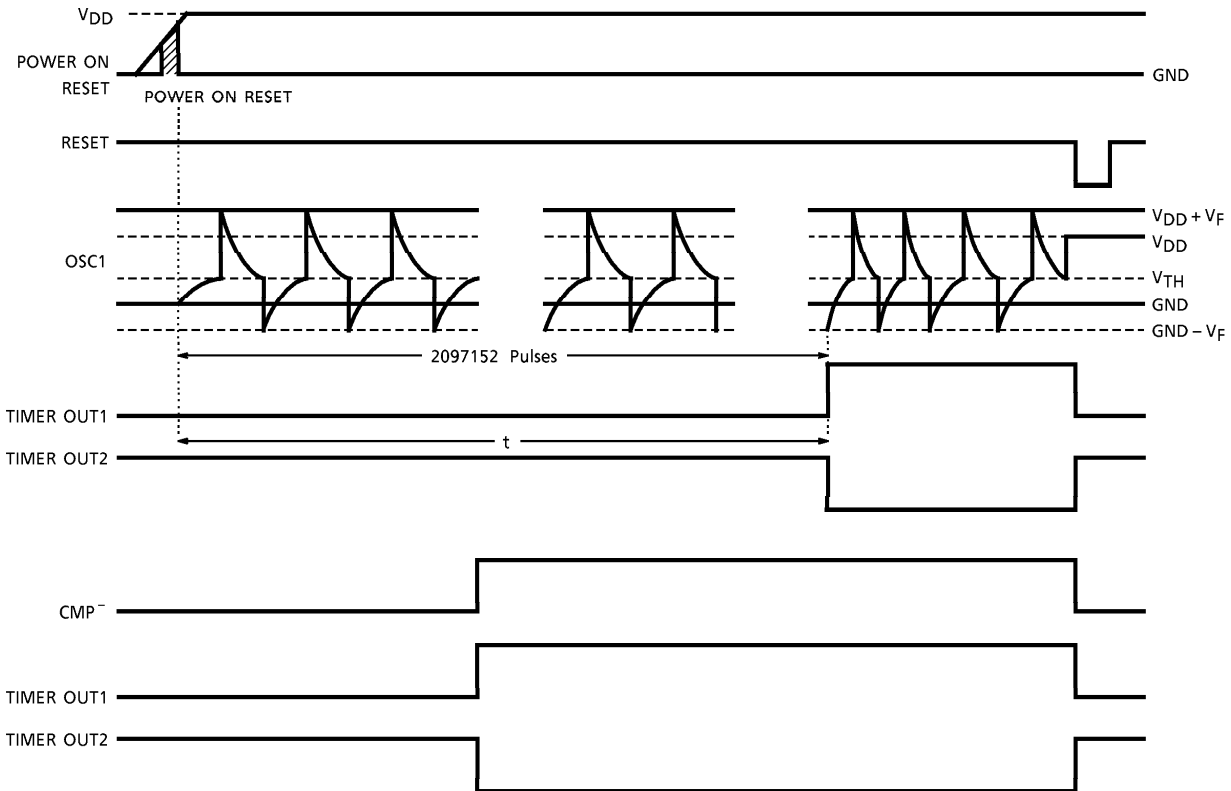
(*) : H or L

Turning the power supply on, "Power on Reset" is operated and output level is "L".

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TIMING CHART



MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage	V _{DD}	-0.3 ~ 7.0	V
Power Dissipation	P _D	250 ~ 300	mW
Operating Temperature	T _{opr}	-20 ~ 75	°C
Storage Temperature	T _{stg}	-55 ~ 125	°C
Electrostatic Discharge	ESD (*)	±200	V
Latch Up Current	I _L	±10	mA

(*) : C = 200pF, R = 0Ω, one time discharge

ELECTRICAL CHARACTERISTICS (Unless otherwise specified, $V_{DD} = 5.0V$, $T_a = 25 \pm 1.5^\circ C$)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Operating Voltage	V_{opr}	—		4.0	5.0	6.0	V	
Oscillation Frequency Characteristic	Δf_{OSC1}	—	1H $C = 4700pF$ $R = 254.9k\Omega$, $V_{DD} = 4\sim 6V$ ($f = 582.5Hz$)	- 15	—	15	%	
	Δf_{OSC2}	—	60s $C = 1000pF$ $R = 17.2k\Omega$, $V_{DD} = 4\sim 6V$ ($f = 34.9Hz$)	- 20	—	20		
8H $C = 0.01\mu F$ $R = 996.7k\Omega$, $V_{DD} = 4\sim 6V$ ($f = 72.8Hz$)			—					
Power Dissipation Current	1	I_{QD}	—	CR OSC. stopping (at reset) $V_{DD} = 6V$	—	—	130	μA
	2	I_{DD}	—	CR OSC. operating	—	—	700	

DC CHARACTERISTICS

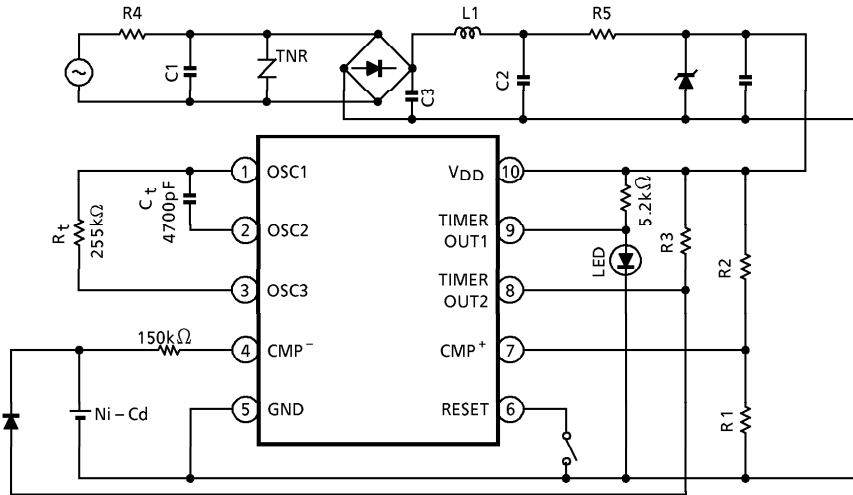
1. Oscillation Input							
OSC1 Leak Current	$I_{IH\ OSC}$	—	$V_{IN} = 5.0V$	- 1.0	—	1.0	μA
OSC1 Leak Current	$I_{IL\ OSC}$	—	$V_{IN} = 0V$	- 1.0	—	1.0	μA
2. CMP Terminal							
CMP Offset Voltage	V_{off}	—	$V_{DD} = 5V$	- 30	—	30	mV
Offset Supply Voltage Change	ΔV_{off}	—	$V_{DD} = 4 \sim 6V$	- 10	—	10	mV
CMP ⁺ , CMP ⁻ , Leak Current	$I_{IH\ CMP^{+,-}}$ $I_{IL\ CMP^{+,-}}$	—	$V_{IN} = 5.0V$	- 1.0	—	1.0	μA
			$V_{IN} = 0V$	- 1.0	—	1.0	
Input Dynamic Range		—		0	—	V_{DD} - 2.5	V
3. Reset Terminal							
Leak Current	I_{IHR}	—	$V_{IN} = 5.0V$	- 1.0	—	1.0	μA
Input Pull Up Resistance	R3	—		490	700	910	k Ω
4. Timer Out Terminal							
Timer Out1, 2 Sink Current	I_{TS}	—	$V_{OL} = 0.3V$	—	—	5	mA
Timer Out Offleak Current	$I_{TSLH1, 2}$	—	$V_{IN} = 0 \sim 5.0V$	- 1.0	—	1.0	μA

FUNCTION CHARACTERISTICS

Timer Precision	$\Delta T1$	—	$C = 4700pF$, $R = 254.9k\Omega$ $V_{DD} = 4 \sim 6V$ (1H)	- 15		15	%
	$\Delta T2$	—	$C = 1000pF$, $R = 17.2k\Omega$ $V_{DD} = 4 \sim 6V$ (60s)	- 20		20	
$C = 0.01\mu F$, $R = 966.7k\Omega$ $V_{DD} = 4 \sim 6V$ (8H)							

APPLICATION CIRCUIT (Example)

1 hour setting



- Timer setting time -

$$T = 2^{21} \cdot C_t \cdot R_t \cdot \ln \left\{ \frac{V_{DD}^2 - V_f^2}{V_{TH} (V_{DD} - V_{TH})} \right\}$$

T : Timer setting time (s)

C_t (F)

R_t (Ω)

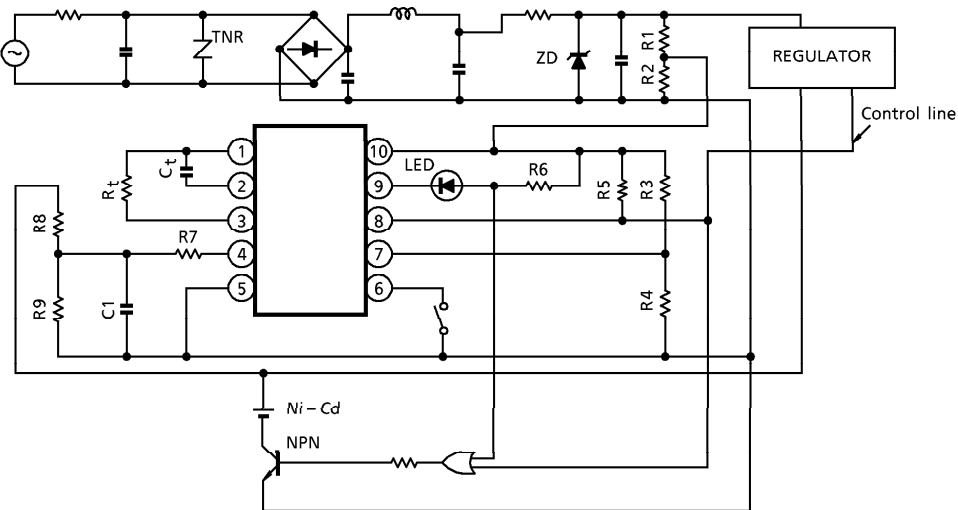
V_{TH} = 1.95 (V) : Voltage of OSC. first stage circuit

V_f = 0.7 (V) : Voltage of input protection diode (1pin)

(*) Recommendation of timer setting

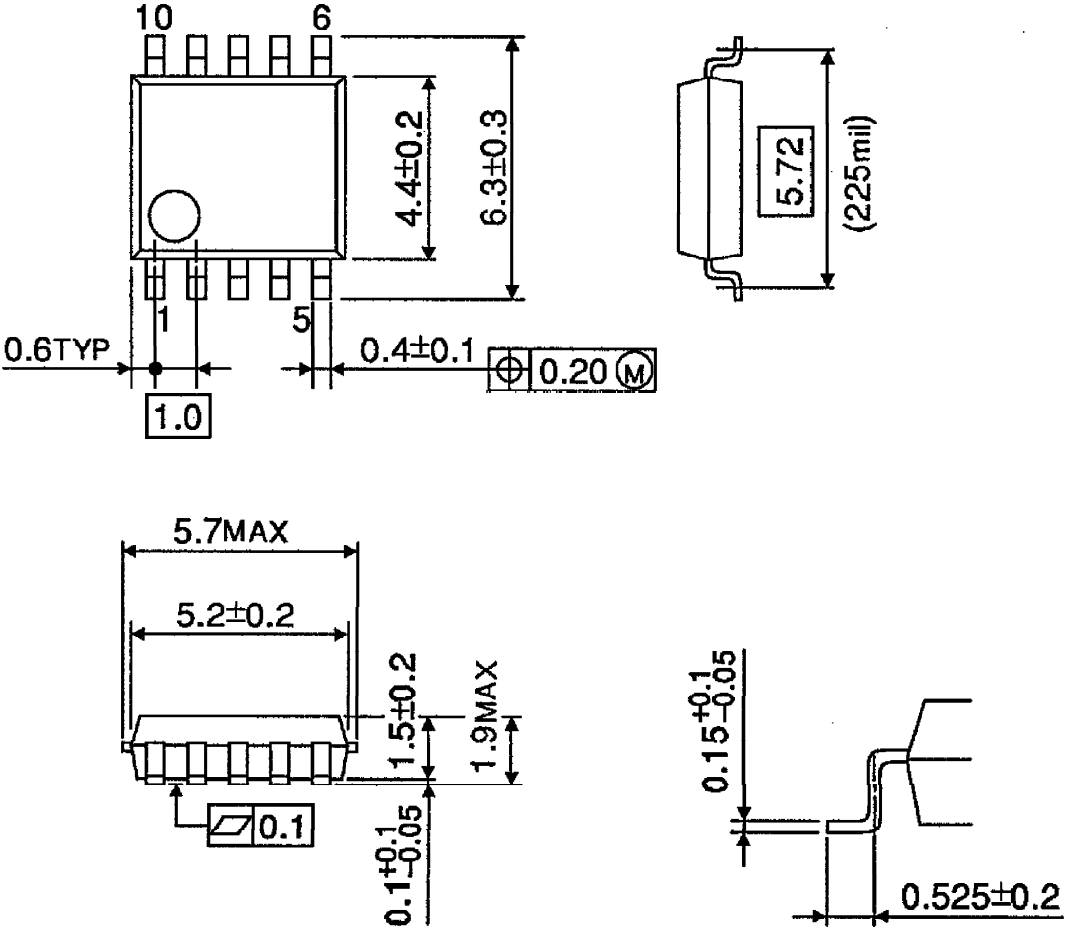
TIMER SET UP	R _t	C _t
About 60s	17.2kΩ	1000pF
About 1H	254.9kΩ	4700pF
About 8H	966.7kΩ	0.01μF

APPLICATION CIRCUIT (Example)



OUTLINE DRAWING
SSOP10-P-225-1.00

Unit : mm



Weight : 0.1g (Typ.)