

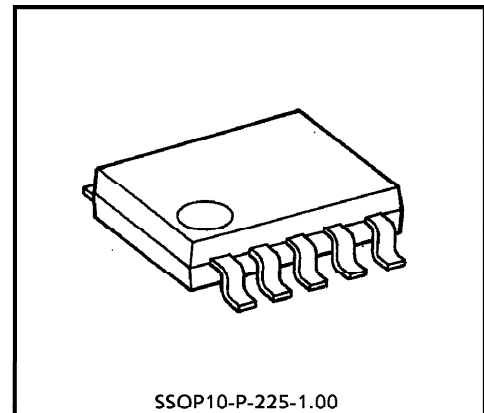
TOSHIBA Bi-CMOS INTEGRATED CIRCUIT SILICON MONOLITHIC

# TB1004AF

## CR TIMER

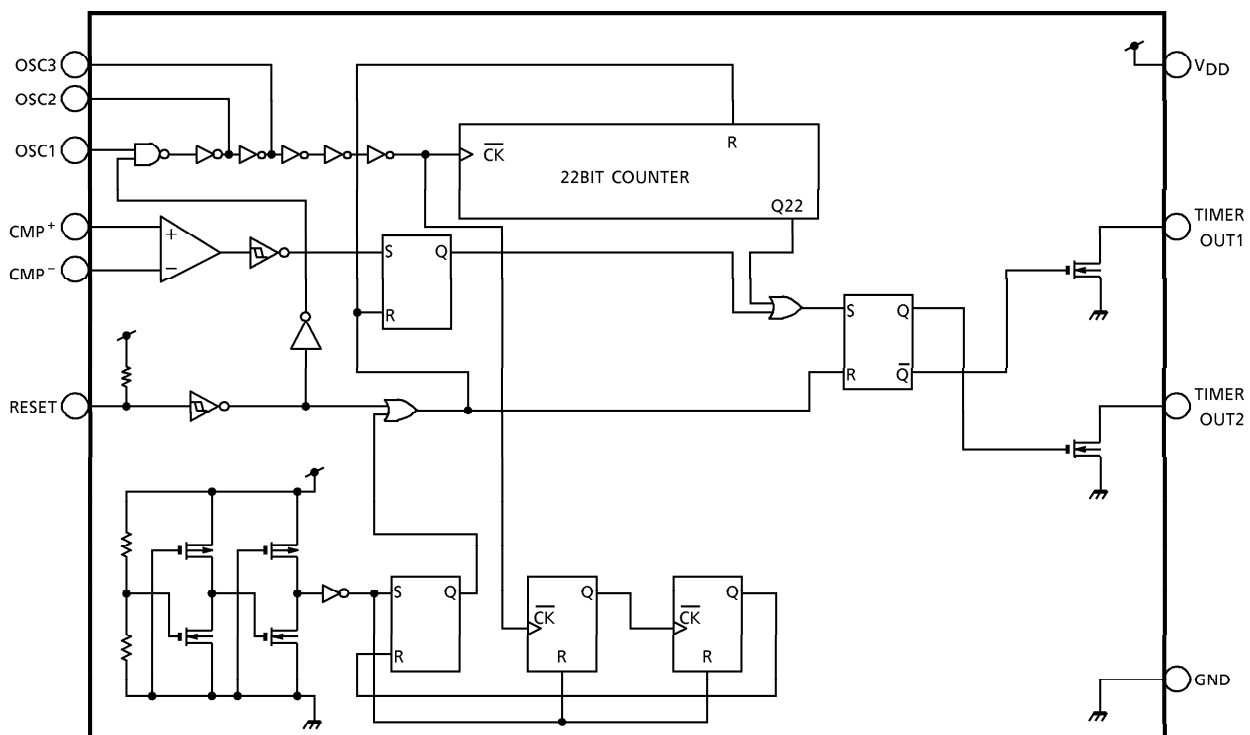
### FEATURES

- 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.



Weight : 0.1g (Typ.)

### BLOCK DIAGRAM



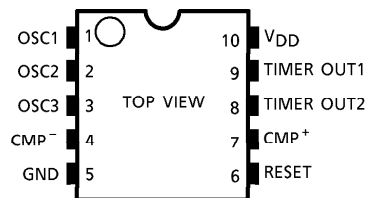
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**FUNCTION DESCRIPTION ON EACH TERMINAL**

PIN No.	SYMBOL	FUNCTION
1	OSC1	Oscillation input terminal
2	OSC2	Oscillation input terminal
3	OSC3	Oscillation input terminal
4	CMP <sup>-</sup>	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 <sup>+</sup>	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 <sub>DD</sub>	Power supply voltage

**PIN CONNECTION**



**TRUTH TABLE**

MODE	INPUT			OUTPUT
	RESET	CMP <sup>+</sup>	CMP <sup>-</sup>	
1	L	(*)	(*)	L
2	H	H	L	Timer mode
3	H	L	H	Timer over voltage detecting mode

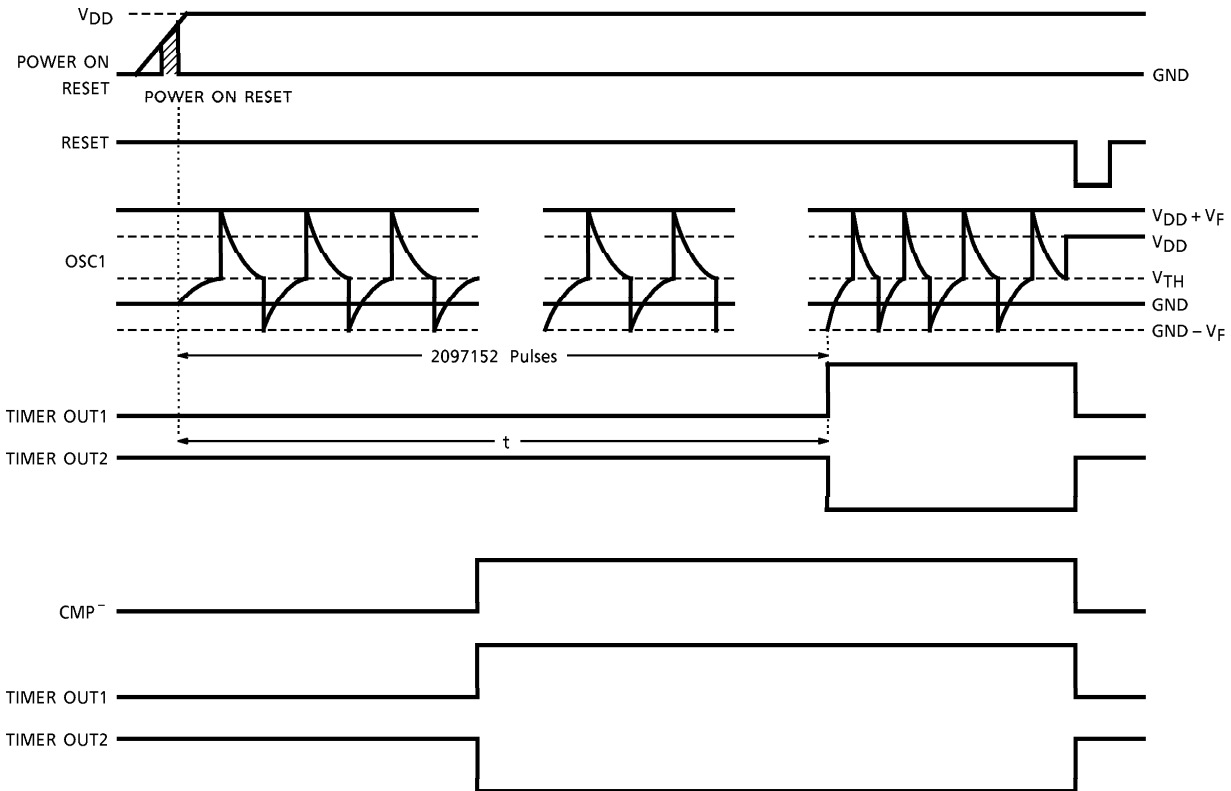
(\*) : H or L

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 <sub>DD</sub>	-0.3 ~ 7.0	V
Power Dissipation	P <sub>D</sub>	250 ~ 300	mW
Operating Temperature	T <sub>opr</sub>	-20 ~ 75	°C
Storage Temperature	T <sub>stg</sub>	-55 ~ 125	°C
Electrostatic Discharge	ESD (*)	±200	V
Latch Up Current	I <sub>L</sub>	±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	$\Delta f_{OSC1}$	—	1H $C = 4700pF$ $R = 254.9k\Omega$ , $V_{DD} = 4\sim 6V$ ( $f = 582.5Hz$ )	- 15	—	15	%	
	$\Delta f_{OSC2}$	—	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	$\mu A$
	2	$I_{DD}$	—	CR OSC. operating	—	—	700	

**DC CHARACTERISTICS**

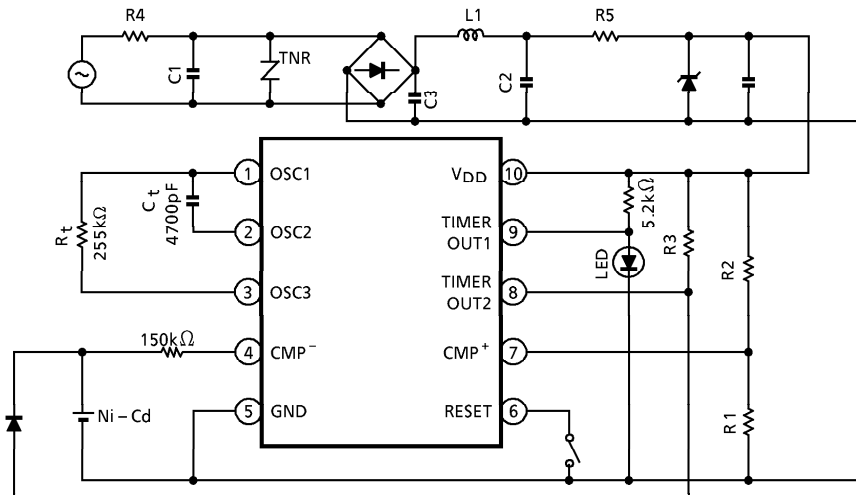
<b>1. Oscillation Input</b>							
OSC1 Leak Current	$I_{IH\ OSC}$	—	$V_{IN} = 5.0V$	- 1.0	—	1.0	$\mu A$
OSC1 Leak Current	$I_{IL\ OSC}$	—	$V_{IN} = 0V$	- 1.0	—	1.0	$\mu A$
<b>2. CMP Terminal</b>							
CMP Offset Voltage	$V_{off}$	—	$V_{DD} = 5V$	- 30	—	30	mV
Offset Supply Voltage Change	$\Delta V_{off}$	—	$V_{DD} = 4 \sim 6V$	- 10	—	10	mV
CMP <sup>+</sup> , CMP <sup>-</sup> , Leak Current	$I_{IH\ CMP^{+,-}}$ $I_{IL\ CMP^{+,-}}$	—	$V_{IN} = 5.0V$	- 1.0	—	1.0	$\mu A$
			$V_{IN} = 0V$	- 1.0	—	1.0	
Input Dynamic Range		—		0	—	$V_{DD}$ - 2.5	V
<b>3. Reset Terminal</b>							
Leak Current	$I_{IHR}$	—	$V_{IN} = 5.0V$	- 1.0	—	1.0	$\mu A$
Input Pull Up Resistance	R3	—		490	700	910	k $\Omega$
<b>4. Timer Out Terminal</b>							
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	$\mu A$

**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<sub>t</sub> (F)

R<sub>t</sub> (Ω)

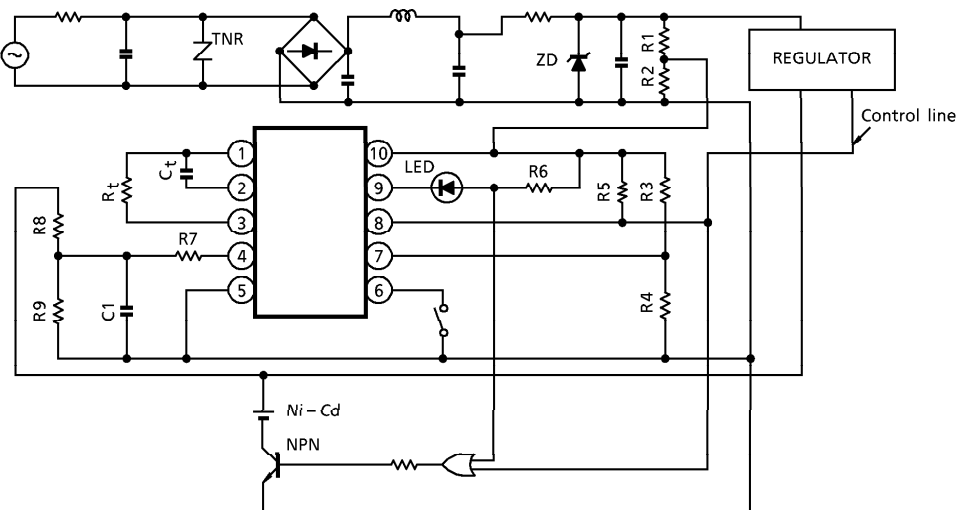
V<sub>TH</sub> = 1.95 (V) : Voltage of OSC. first stage circuit

V<sub>f</sub> = 0.7 (V) : Voltage of input protection diode (1pin)

(\*) Recommendation of timer setting

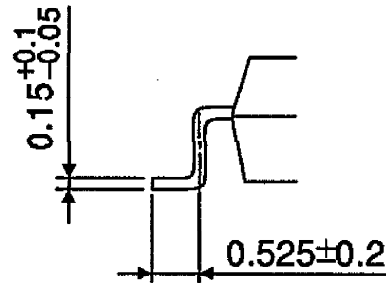
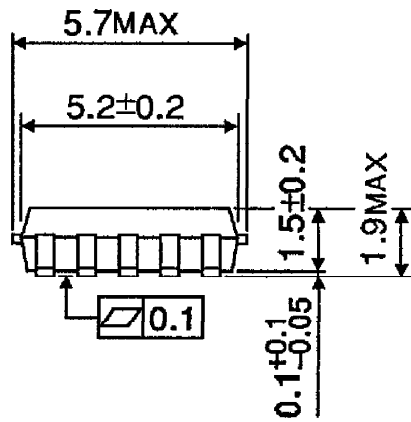
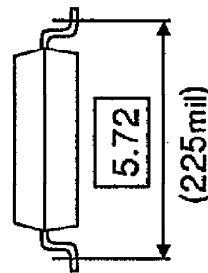
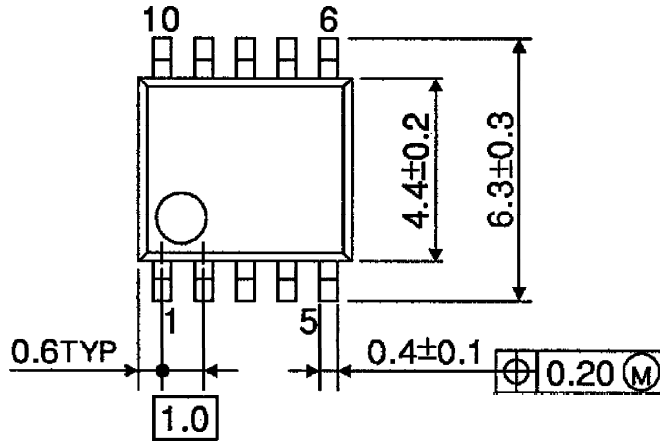
TIMER SET UP	R <sub>t</sub>	C <sub>t</sub>
About 60s	17.2kΩ	1000pF
About 1H	254.9kΩ	4700pF
About 8H	966.7kΩ	0.01μF

APPLICATION CIRCUIT (Example)



OUTLINE DRAWING  
SSOP10-P-225-1.00

Unit : mm



Weight : 0.1g (Typ.)