

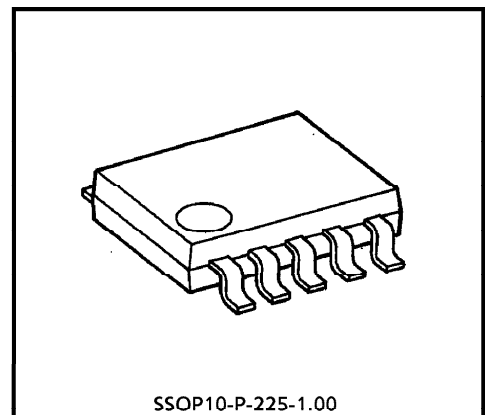
TOSHIBA Bi-CMOS INTEGRATED CIRCUIT SILICON MONOLITHIC

# TB1010F

## CR TIMER

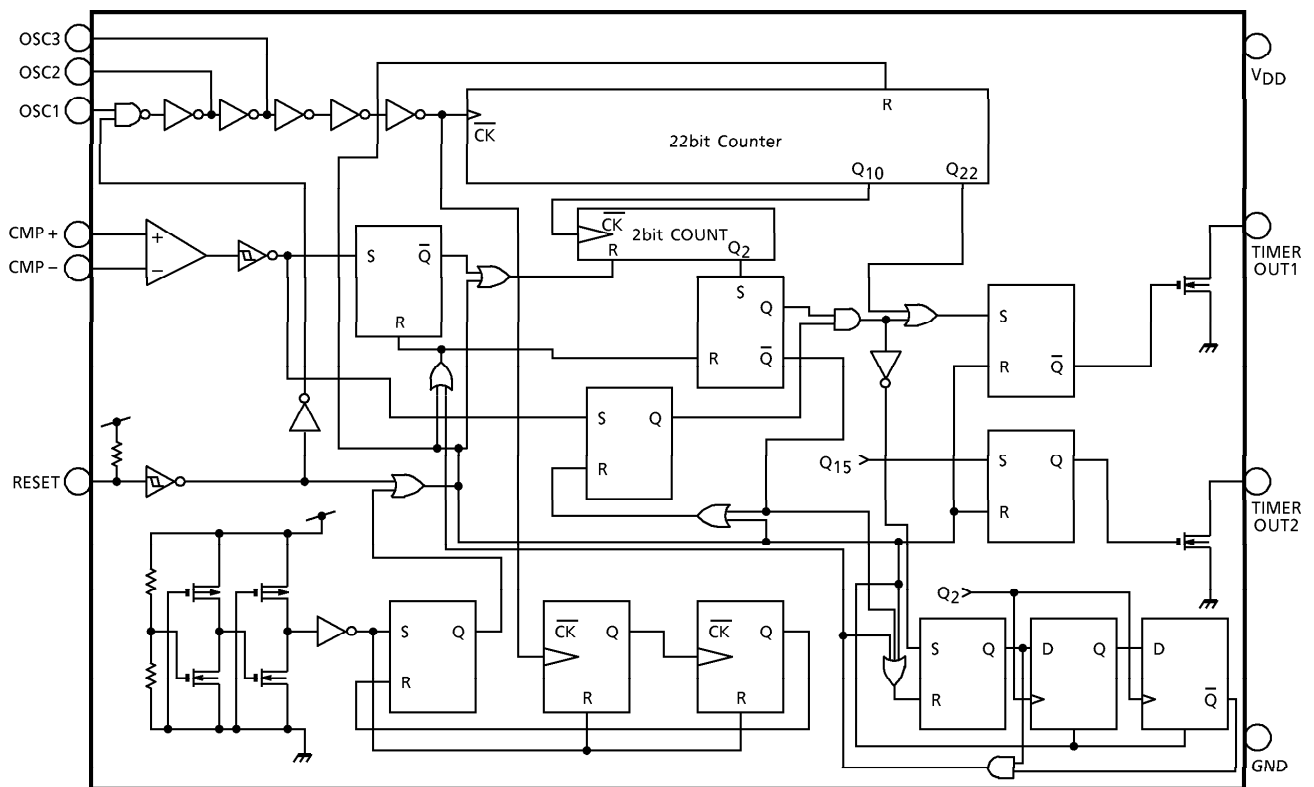
### FEATURES

- 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



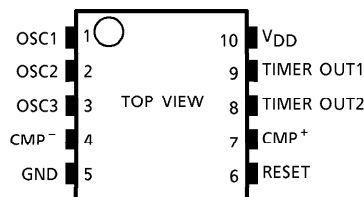
961001EBA2

● TOSHIBA is continually working to improve the quality and the reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to observe standards of safety, and to avoid situations in which a malfunction or failure of a TOSHIBA product could cause loss of human life, bodily injury or damage to property. In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent products specifications. Also, please keep in mind the precautions and conditions set forth in the TOSHIBA Semiconductor Reliability Handbook.

**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 stop
5	GND	GND
6	RESET	Reset terminal (H→L : inside reset)
7	CMP <sup>+</sup>	Comparator plus (+) side input terminal Comparator reference voltage setting terminal
8	TIMER OUT2	Timer output terminal 2 (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

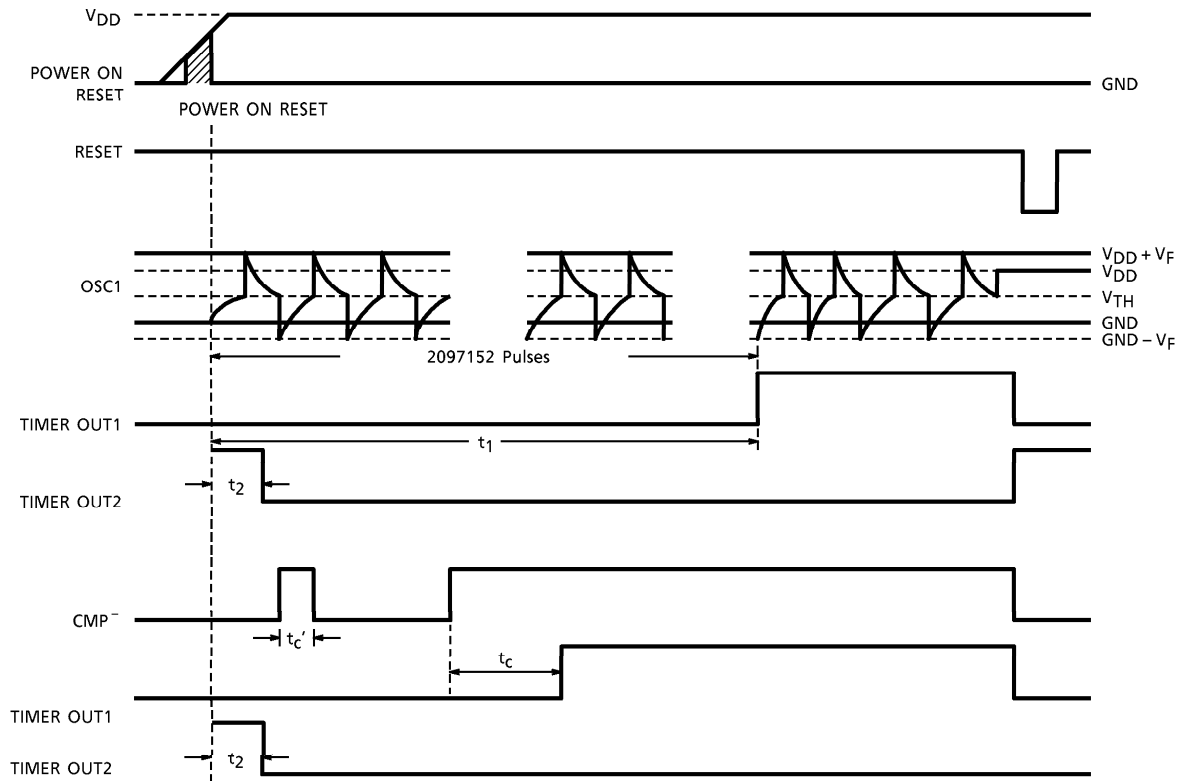
(\*) : H or L

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

961001EBA2'

- The products described in this document are subject to foreign exchange and foreign trade control laws.
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA CORPORATION for any infringements of intellectual property or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any intellectual property or other rights of TOSHIBA CORPORATION or others.
- The information contained herein is subject to change without notice.

**TIMING CHART**



(\*) :  $t_{c'} < t_c$  at CMP- input "H" Level cancelled

**MAXIMUM RATINGS (Ta = 25°C)**

CHARACTERISTIC	SYMBOL	RATING	UNIT
Power 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, Ta = 25 ± 1.5°C, V<sub>DD</sub> = 5.0V)

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Voltage	V <sub>opr</sub>	—	—	4.0	5.0	6.0	V
Oscillation Frequency Characteristic	Δf <sub>OSC1</sub>	—	1H C = 4700pF, R = 254.9kΩ, V <sub>DD</sub> = 5V (f = 582.5Hz)	—	—	10	%
	Δf <sub>OSC2</sub>	—	60s C = 1000pF, R = 17.2kΩ, V <sub>DD</sub> = 5V (f = 34.9kHz) 8H C = 0.01μF, R = 996.7kΩ, V <sub>DD</sub> = 5V (f = 72.8Hz)	—	—	15	
Power Dissipation Current	1	I <sub>QD</sub>	—	—	—	130	μA
	2	I <sub>DD</sub>	—	—	—	700	
Power on Reset Release Voltage	V <sub>thH</sub>	—	V <sub>DD</sub> rise time	1.4	2.5	3.5	V
	V <sub>thL</sub>	—	40μs/V	1.4	2.5	3.5	

**DC CHARACTERISTICS**

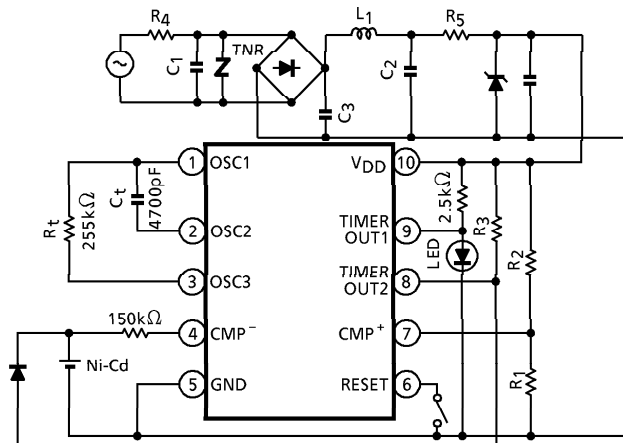
<b>1. Oscillation Input</b>							
OSC1 Leak Current	I <sub>IH OSC</sub>	—	V <sub>IN</sub> = 5.0V	- 1.0	—	1.0	μA
OSC1 Leak Current	I <sub>IL OSC</sub>	—	V <sub>IN</sub> = 0V	- 1.0	—	1.0	μA
<b>2. CMP+, CMP- Terminal</b>							
CMP Offset Voltage	V <sub>off</sub>	—	V <sub>DD</sub> = 5V	- 30	—	30	mV
Offset Supply Voltage Change	ΔV <sub>off</sub>	—	V <sub>DD</sub> = 4~6V	- 10	—	10	mV
CMP+, CMP- Leak Current	I <sub>IH CMP+, -</sub>	—	V <sub>IN</sub> = 5.0V	- 1.0	—	1.0	μA
	I <sub>IL CMP+, -</sub>	—	V <sub>IN</sub> = 0V	- 1.0	—	1.0	
Input Dynamic Range	—	—	—	0	—	V <sub>DD</sub> -2.5	V
<b>3. Reset Terminal</b>							
Leak Current	I <sub>IHR</sub>	—	V <sub>IN</sub> = 5.0V	- 1.0	—	1.0	μA
Input Pull Up Resistance	R <sub>3</sub>	—	—	490	700	910	kΩ
<b>4. Timer Out Terminal</b>							
Timer Out1, 2 Sink Current	I <sub>TS</sub>	—	V <sub>OL</sub> = 0.3V	—	—	5	mA
Timer Out Offleak Current	I <sub>TLH1, 2</sub>	—	V <sub>IN</sub> = 0~5.0V	- 1.0	—	1.0	μA

FUNCTION CHARACTERISTICS

CHARACTERISTICS	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Timer Precision (TIMER OUT1)	$\Delta T_1$	—	C = 4700pF, R = 254.9k $\Omega$ , V <sub>DD</sub> = 5V (1H setting)	—	—	10	%
	$\Delta T_2$	—	C = 1000pF, R = 17.2k $\Omega$ , V <sub>DD</sub> = 5V (60s setting) C = 0.01 $\mu$ F, R = 966.7k $\Omega$ , V <sub>DD</sub> = 5V (8H setting)	—	—	15	
CMP Detecting Timer Precision	t <sub>c</sub>	—	C = 4700pF, R = 254.9k $\Omega$ , V <sub>DD</sub> = 5V (1H)	- 50	3.5s	50	%
Timer2 Precision (TIMER OUT2)	$\Delta T_3$	—	C = 4700pF, R = 254.9k $\Omega$ , V <sub>DD</sub> = 5V (1H setting)	- 10	28.12	10	%

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) : Capacitor

R<sub>t</sub> (Ω) : Resistance

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

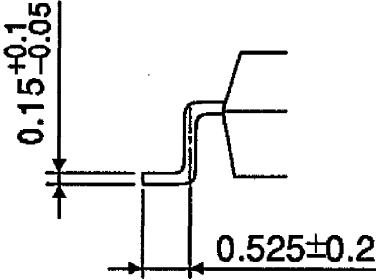
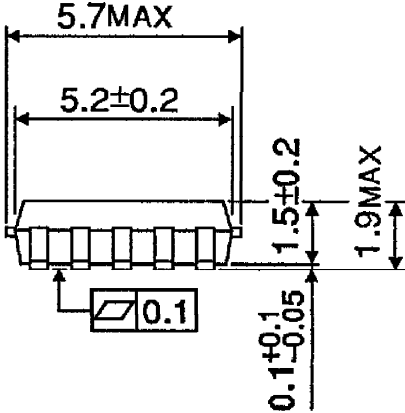
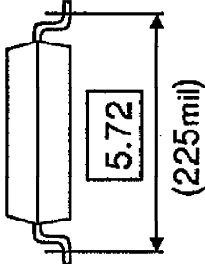
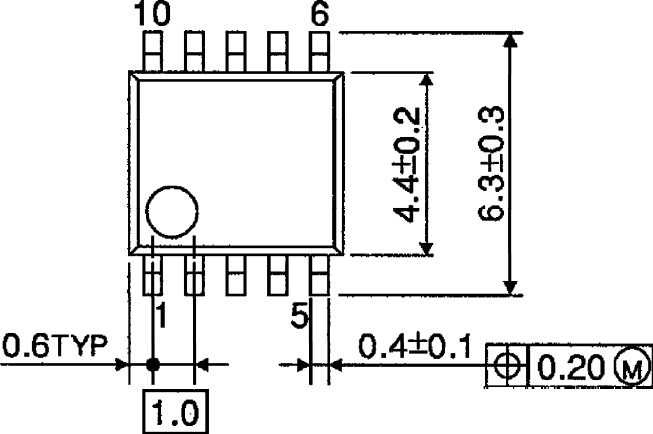
V<sub>f</sub> = 0.7 (V) : Voltage of input protection diode (1Pin)

(\*) Recommendation of timer setting

TIMER SET UP	R <sub>t</sub>	C <sub>t</sub>
About 60s	17.2k $\Omega$	1000pF
About 1Hour	254.9k $\Omega$	4700pF
About 8Hour	966.7k $\Omega$	0.01 $\mu$ F

OUTLINE DRAWING  
SSOP10-P-225-1.00

Unit : mm



Weight : 0.1g (Typ.)