

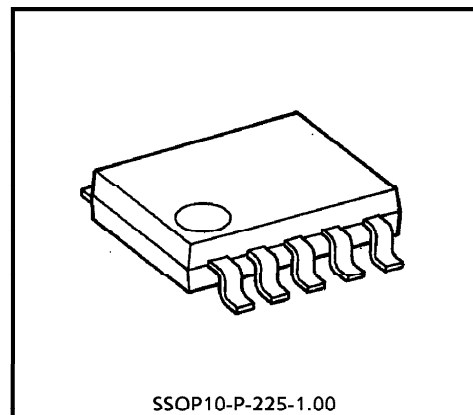
TOSHIBA Bi-CMOS INTEGRATED CIRCUIT SILICON MONOLITHIC

# TB1010F

## CR TIMER

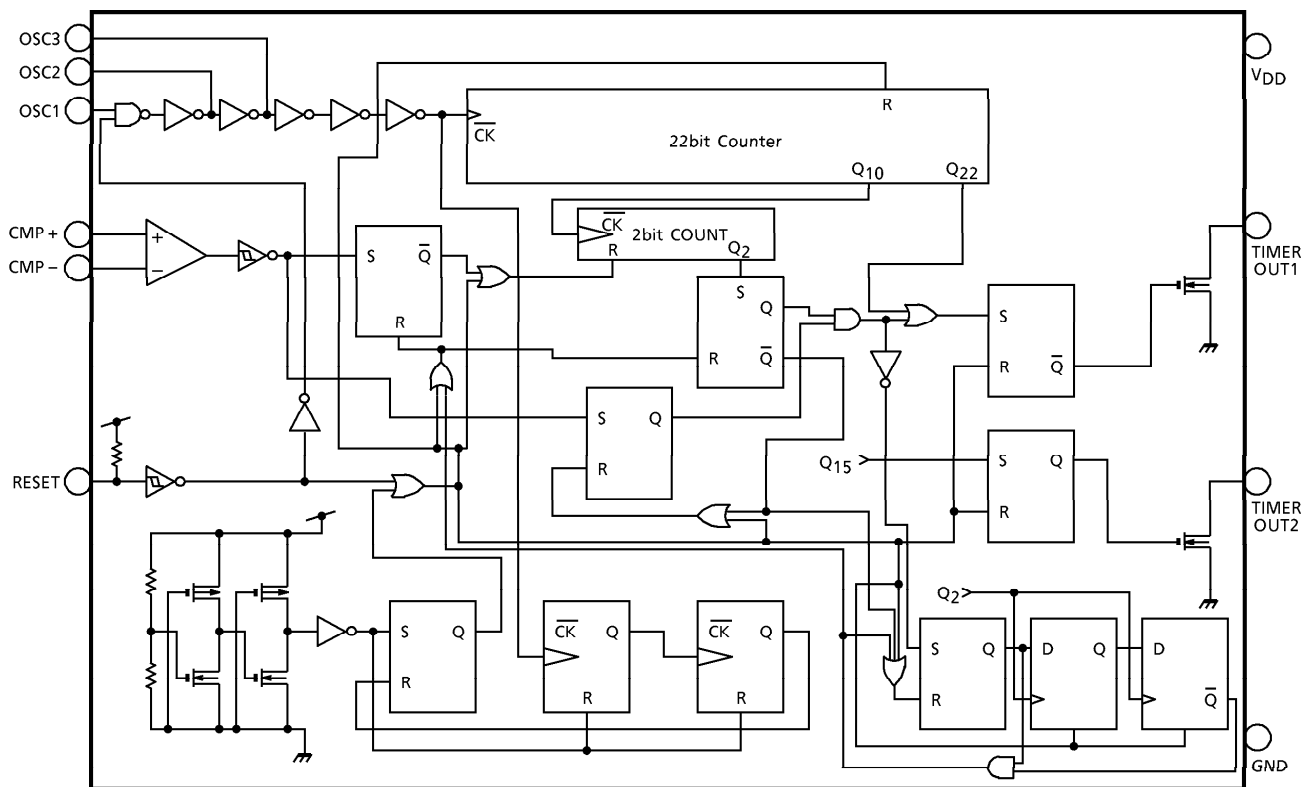
### FEATURES

- 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



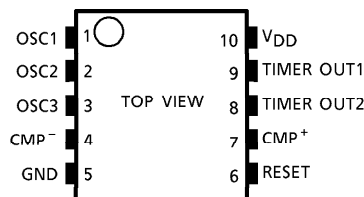
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**FUNCTION DESCRIPTION ON EACH TERMINAL**

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 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**

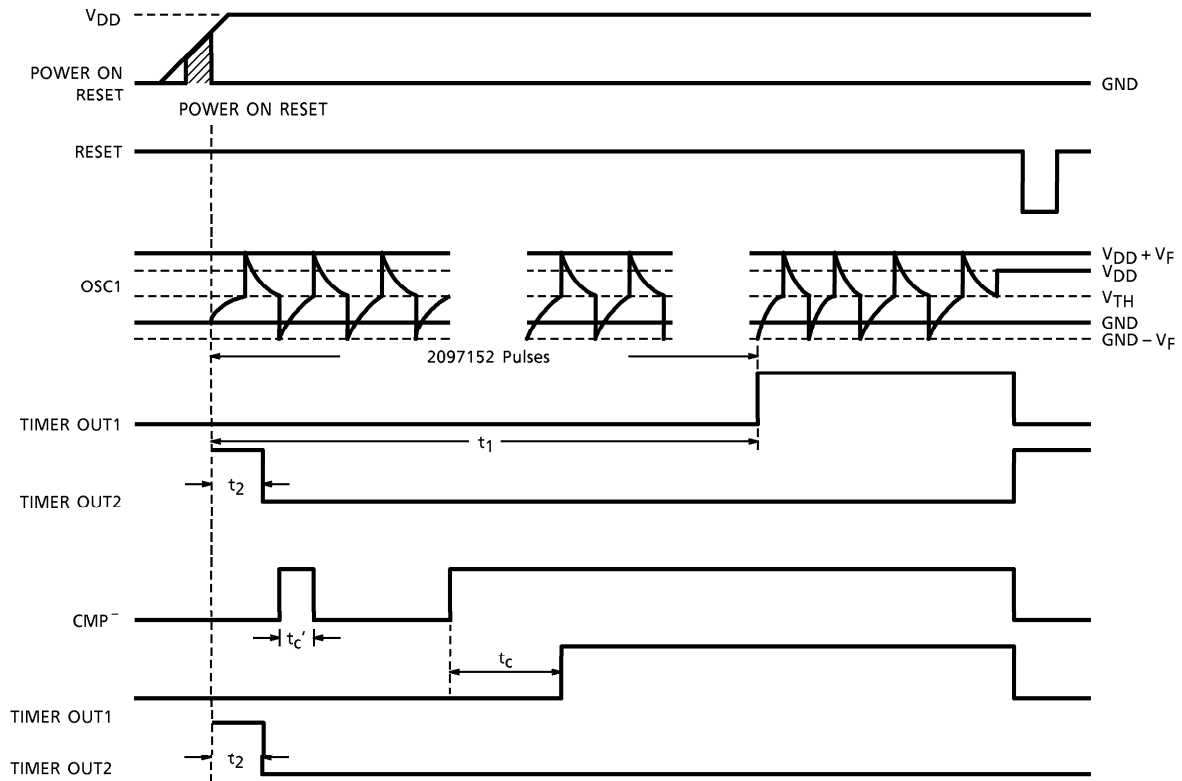
MODE	INPUT			OUTPUT
	RESET	CMP <sup>+</sup>	CMP <sup>-</sup>	
1	L	(*)	(*)	L
2	H	H	L	Timer mode
3	H	L	H	Timer over-voltage detecting mode

(\*) : H or L

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

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TIMING CHART



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

MAXIMUM RATINGS (Ta = 25°C)

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

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	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**

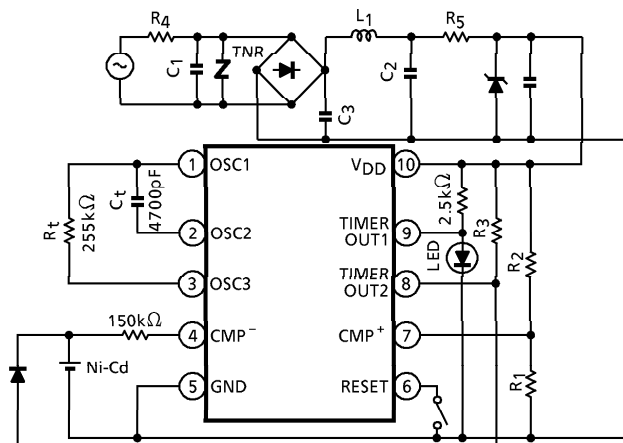
<b>1. Oscillation Input</b>							
OSC1 Leak Current	I <sub>IH OSC</sub>	—	V <sub>IN</sub> = 5.0V	- 1.0	—	1.0	μA
OSC1 Leak Current	I <sub>IL OSC</sub>	—	V <sub>IN</sub> = 0V	- 1.0	—	1.0	μA
<b>2. CMP+, CMP- Terminal</b>							
CMP Offset Voltage	V <sub>off</sub>	—	V <sub>DD</sub> = 5V	- 30	—	30	mV
Offset 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

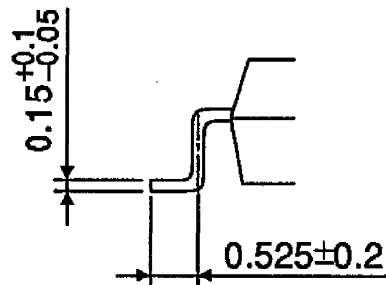
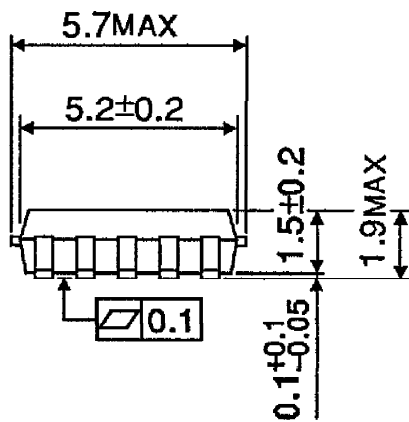
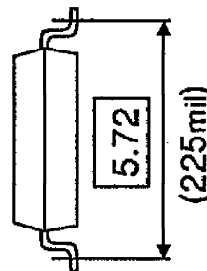
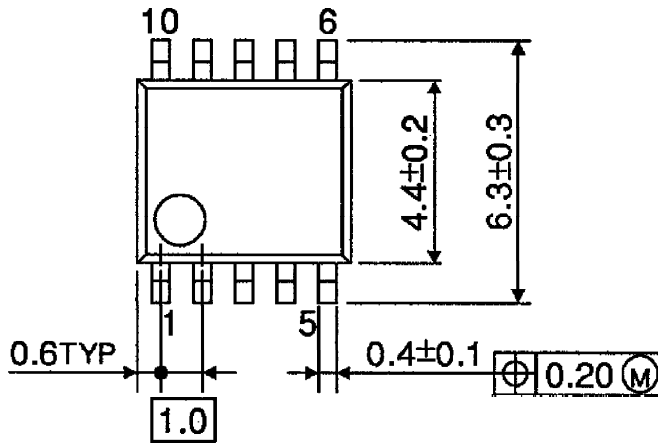
V<sub>f</sub> = 0.7 (V) : Voltage of input protection diode (1Pin)

(\*) 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.)