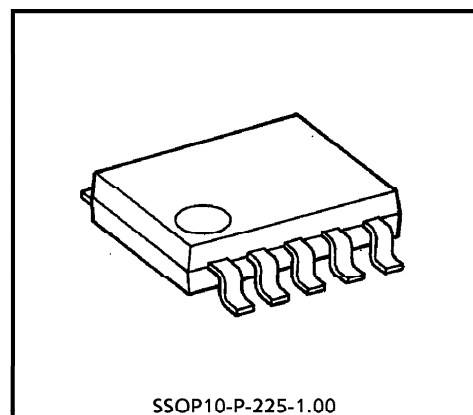


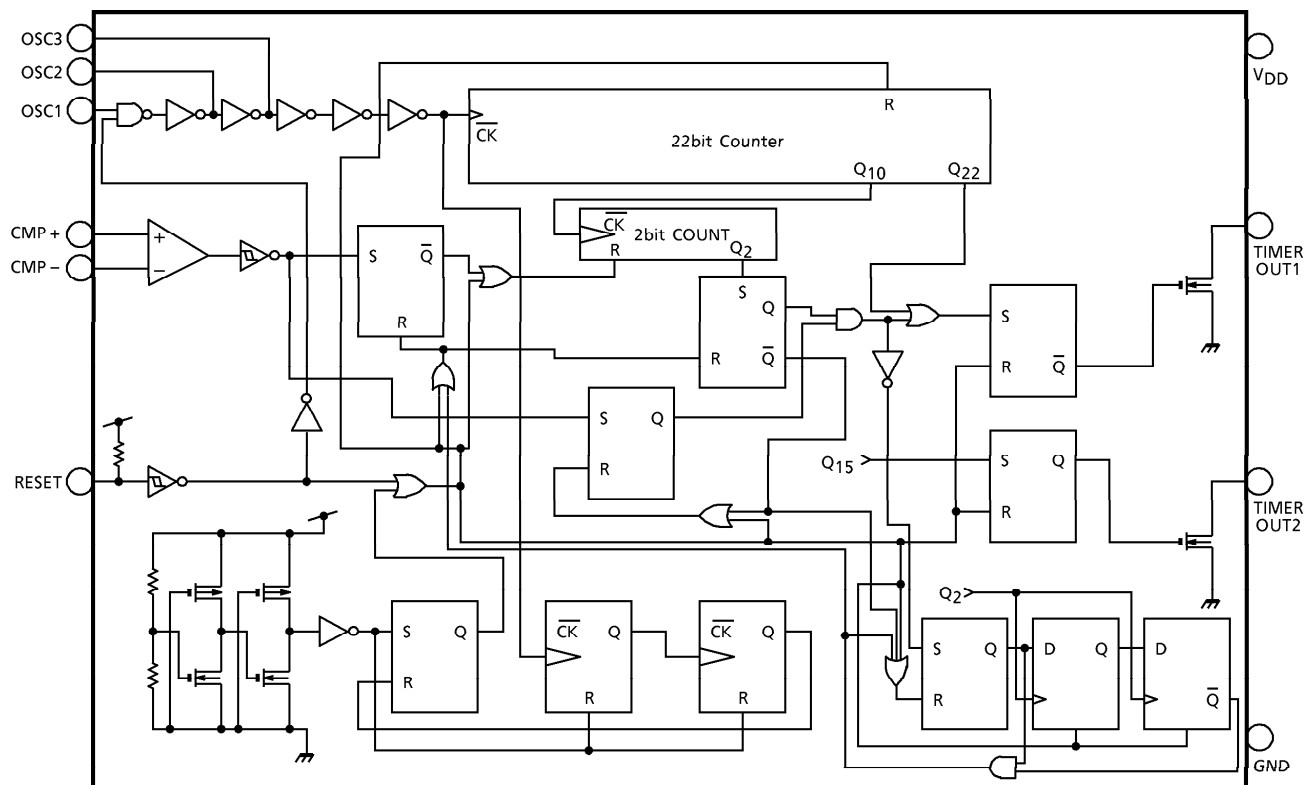
TOSHIBA Bi-CMOS INTEGRATED CIRCUIT SILICON MONOLITHIC

T B 1 0 1 0 F**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

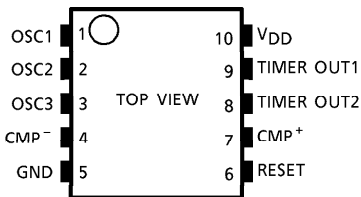
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FUNCTION DESCRIPTION ON EACH TERMINAL

PIN No.	SYMBOL	FUNCTION
1	OSC1	Oscillation input terminal
2	OSC2	Oscillation input terminal
3	OSC3	Oscillation input terminal
4	CMP ⁻	Comparator minus (-) side input terminal "L" : Timer mode, "H" : Timer stop
5	GND	GND
6	RESET	Reset terminal (H→L : inside reset)
7	CMP ⁺	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 _{DD}	Power supply voltage

PIN CONNECTION



TRUTH TABLE

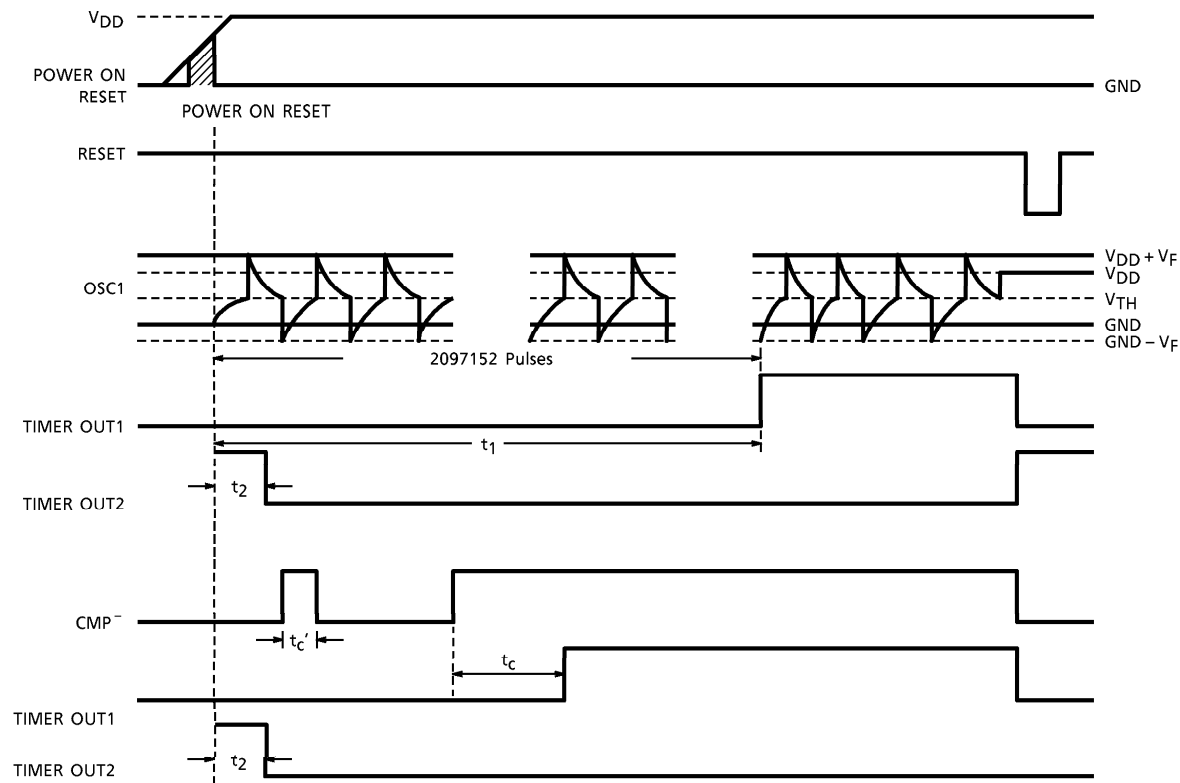
MODE	INPUT			OUTPUT
	RESET	CMP ⁺	CMP ⁻	
1	L	(*)	(*)	L
2	H	H	L	Timer mode
3	H	L	H	Timer over-voltage detecting mode

(*) : H or L
Turning the power supply on, "Power on Reset" is operated and output level is "L".

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TIMING CHART



(*) : $t_c' < t_c$ 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, $T_a = 25 \pm 1.5^\circ\text{C}$, $V_{DD} = 5.0\text{V}$)

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Voltage	V_{opr}	—	—	4.0	5.0	6.0	V
Oscillation Frequency Characteristic	Δf_{OSC1}	—	1H $C = 4700\text{pF}$, $R = 254.9\text{k}\Omega$, $V_{DD} = 5\text{V}$ ($f = 582.5\text{Hz}$)	—	—	10	%
	Δf_{OSC2}	—	60s $C = 1000\text{pF}$, $R = 17.2\text{k}\Omega$, $V_{DD} = 5\text{V}$ ($f = 34.9\text{kHz}$) 8H $C = 0.01\mu\text{F}$, $R = 996.7\text{k}\Omega$, $V_{DD} = 5\text{V}$ ($f = 72.8\text{Hz}$)	—	—	15	
Power Dissipation Current	1	I_{QD}	—	—	—	130	μA
	2	I_{DD}	—	—	—	700	
Power on Reset Release Voltage	V_{thH}	—	V_{DD} rise time	1.4	2.5	3.5	V
	V_{thL}	—	$40\mu\text{s} / \text{V}$	1.4	2.5	3.5	

DC CHARACTERISTICS

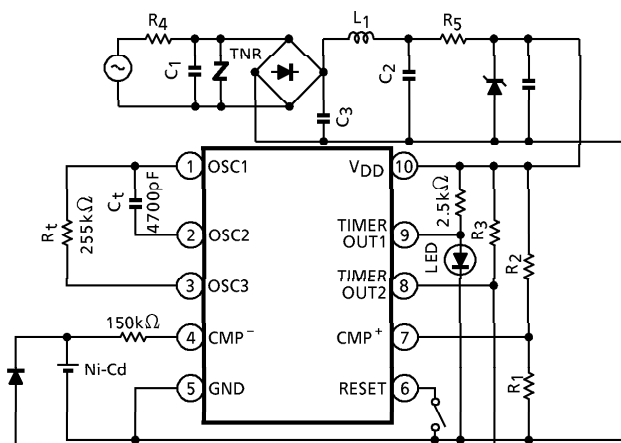
1. Oscillation Input							
OSC1 Leak Current	$I_{IH\ OSC}$	—	$V_{IN} = 5.0\text{V}$	- 1.0	—	1.0	μA
OSC1 Leak Current	$I_{IL\ OSC}$	—	$V_{IN} = 0\text{V}$	- 1.0	—	1.0	μA
2. CMP ⁺ , CMP ⁻ Terminal							
CMP Offset Voltage	V_{off}	—	$V_{DD} = 5\text{V}$	- 30	—	30	mV
Offset Supply Voltage Change	ΔV_{off}	—	$V_{DD} = 4 \sim 6\text{V}$	- 10	—	10	mV
CMP ⁺ , CMP ⁻ Leak Current	$I_{IH\ CMP^+, -}$	—	$V_{IN} = 5.0\text{V}$	- 1.0	—	1.0	μA
	$I_{IL\ CMP^+, -}$	—	$V_{IN} = 0\text{V}$	- 1.0	—	1.0	
Input Dynamic Range	—	—	—	0	—	$V_{DD} - 2.5$	V
3. Reset Terminal							
Leak Current	I_{IHR}	—	$V_{IN} = 5.0\text{V}$	- 1.0	—	1.0	μA
Input Pull Up Resistance	R_3	—	—	490	700	910	$\text{k}\Omega$
4. Timer Out Terminal							
Timer Out1, 2 Sink Current	I_{TS}	—	$V_{OL} = 0.3\text{V}$	—	—	5	mA
Timer Out Offleak Current	$I_{TLH1, 2}$	—	$V_{IN} = 0 \sim 5.0\text{V}$	- 1.0	—	1.0	μA

FUNCTION CHARACTERISTICS

CHARACTERISTICS	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Timer Precision (TIMER OUT1)	ΔT_1	—	C = 4700pF, R = 254.9k Ω , V _{DD} = 5V (1H setting)	—	—	10	%
	ΔT_2	—	C = 1000pF, R = 17.2k Ω , V _{DD} = 5V (60s setting)	—	—	15	
			C = 0.01 μ F, R = 966.7k Ω , V _{DD} = 5V (8H setting)		—		
CMP Detecting Timer Precision	t _c	—	C = 4700pF, R = 254.9k Ω , V _{DD} = 5V (1H)	– 50	3.5s	50	%
Timer2 Precision (TIMER OUT2)	ΔT_3	—	C = 4700pF, R = 254.9k Ω , V _{DD} = 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_f (F) : Capacitor

 R_t (Ω) : Resistance

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

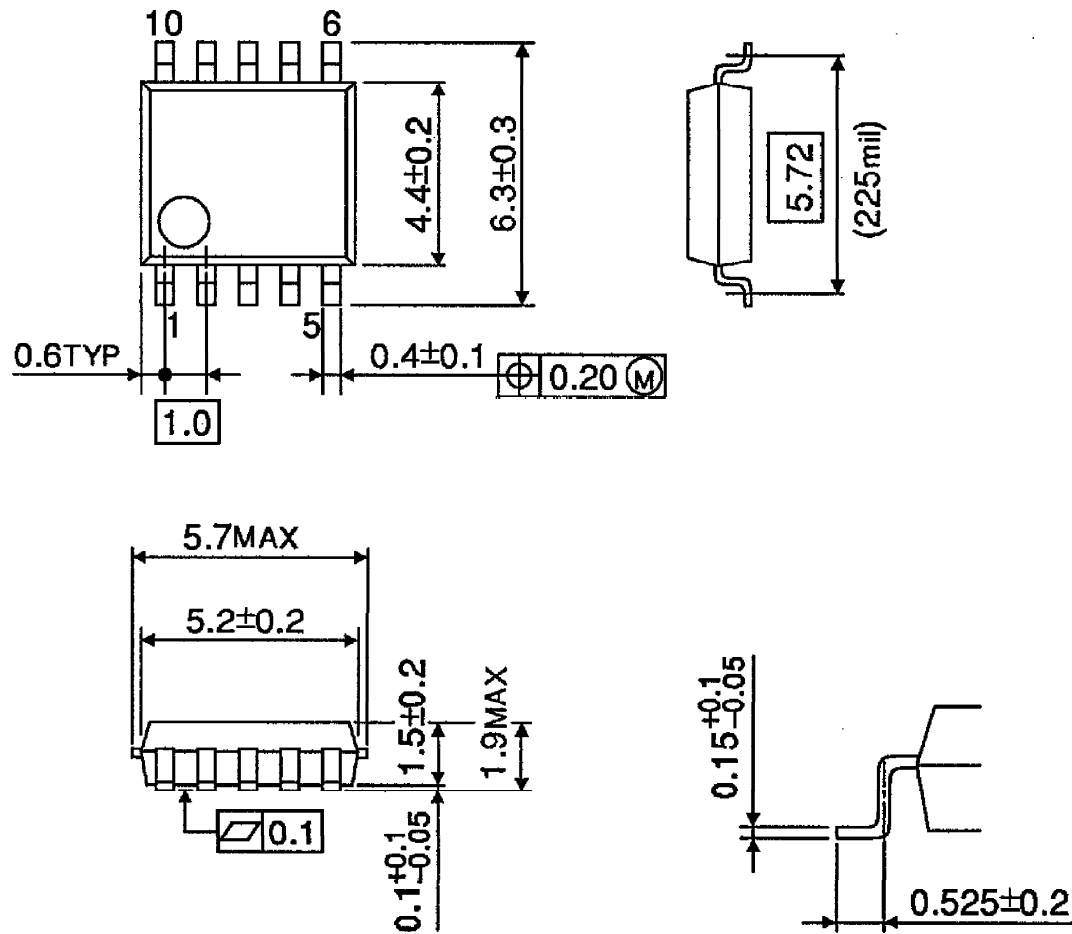
$V_f = 0.7$ (V) : Voltage of input protection diode (1Pin)

(*) Recommendation of timer setting

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

OUTLINE DRAWING
SSOP10-P-225-1.00

Unit : mm



Weight : 0.1g (Typ.)