

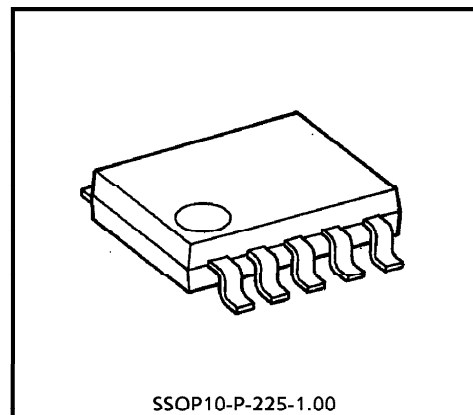
TOSHIBA Bi-CMOS INTEGRATED CIRCUIT SILICON MONOLITHIC

T B 1 0 2 2 F

CR TIMER

FEATURES

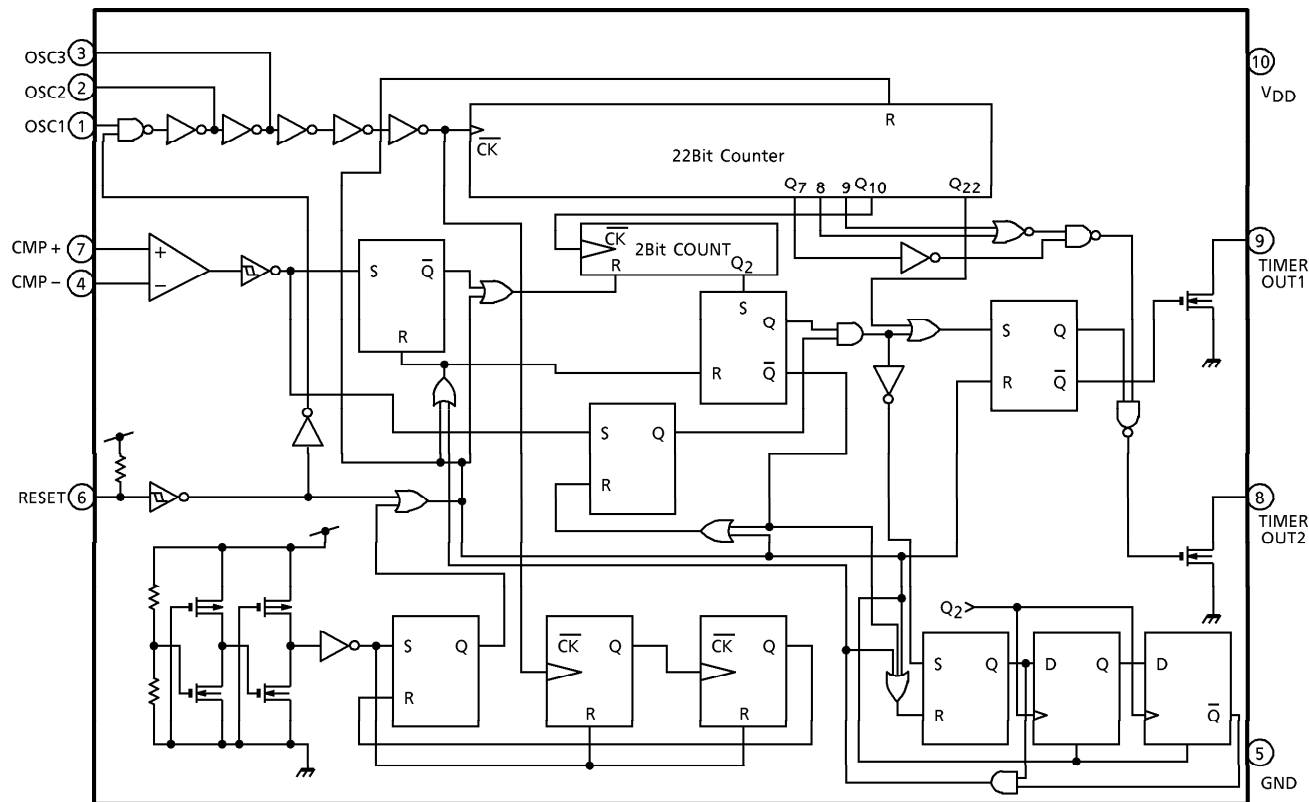
- MOS IC with 22-stage binary counter.
- Built-in initialize circuit.
- Built-in voltage detection comparator.
- Wide range timer setting.
- Low power dissipation current.
- Suitable for Ni-cd battery charger.



SSOP10-P-225-1.00

Weight : 0.1g (Typ.)

BLOCK DIAGRAM



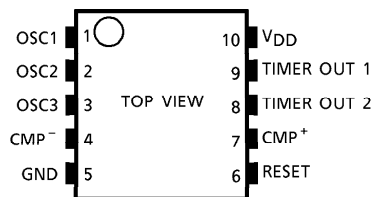
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FUNCTION DESCRIPTION ON EACH TERMINAL

PIN No.	SYMBOL	FUNCTION
1	OSC1	Oscillation input terminal 1
2	OSC2	Oscillation input terminal 2
3	OSC3	Oscillation input terminal 3
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 (N-ch open drain, sink max. 5mA)
9	TIMER OUT1	Timer output terminal 1 (N-ch open drain, sink max. 5mA)
10	V _{DD}	System power supply

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

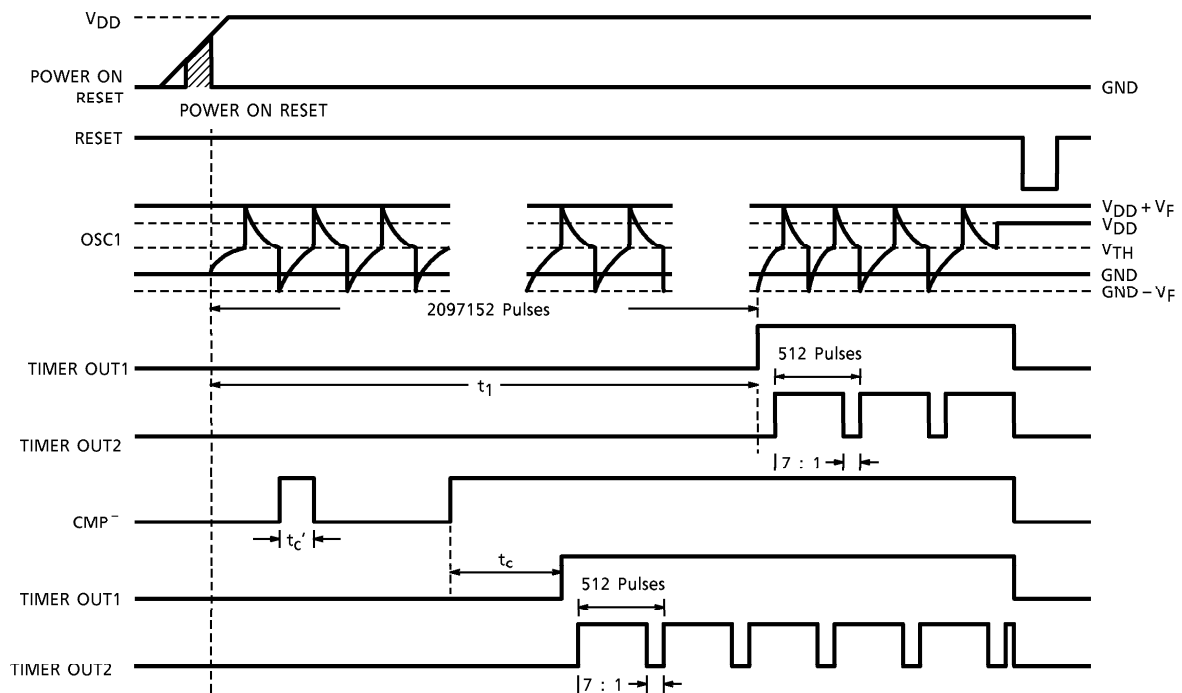
(*) : H or L

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	—	± 10	mA

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

ELECTRICAL CHARACTERISTICS (Unless otherwise specified, Ta = 25 ± 1.5°C, V_{DD} = 5.0V)

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 = 4700pF, R = 254.9kΩ, V _{DD} = 5V (f = 582.5Hz)	—	—	10	%
			60s C = 1000pF, R = 17.2kΩ, V _{DD} = 5V (f = 34.9kHz)	—	—	15	
			8H C = 0.01μF, R = 996.7kΩ, V _{DD} = 5V (f = 72.8Hz)	—	—		

CHARACTERISTIC		SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Power Dissipation Current	1	I _{QD}	—	CR OSC. stopping (at reset) V _{DD} = 6V	—	—	130	μA
	2	I _{DD}	—	CR OSC. operating (at 60s setting)	—	—	700	
Power on Reset Release Voltage		V _{thH}	—	V _{DD} rise time	1.4	2.5	3.5	V
		V _{thL}	—	40μs/V	1.4	2.5	3.5	

DC CHARACTERISTICS

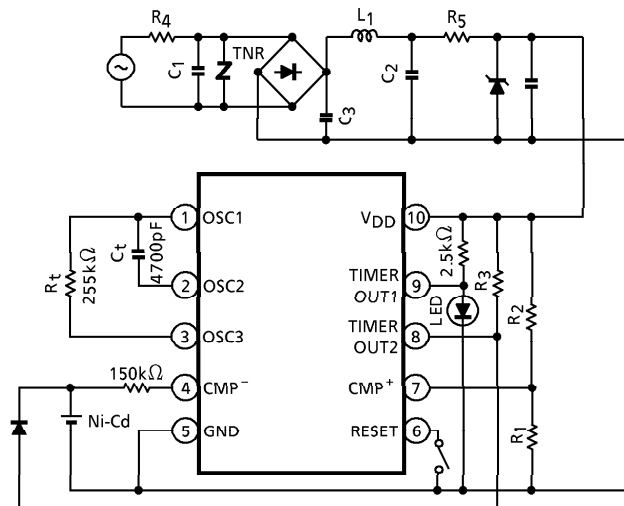
1. Oscillation Input								
OSC1 Leak Current	I _{IH OSC}	—	V _{IN} = 5.0V	- 1.0	—	1.0	μA	
OSC1 Leak Current	I _{IL OSC}	—	V _{IN} = 0V	- 1.0	—	1.0	μA	
2. CMP Terminal								
CMP Offset Voltage	V _{off}	—	V _{DD} = 5V	- 30	—	30	mV	
Offset Supply Voltage Change	ΔV _{off}	—	V _{DD} = 4~6V	- 10	—	10	mV	
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	R ₃	—	—	490	700	910	kΩ	
4. Timer OUT1, 2 Terminal								
Timer Out1, 2 Sink Current	I _{TS}	—	V _{OL} = 0.3V	—	—	5	mA	
Timer Out Offleak Current	I _{TLH1, 2}	—	V _{IN} = 0~5.0V	- 1.0	—	1.0	μA	

FUNCTION CHARACTERISTICS

Timer 1 Precision (TIMER OUT1)	ΔT ₁	—	C = 4700pF, R = 254.9kΩ, V _{DD} = 5V (1H)	—	—	10	%
	ΔT ₂	—	C = 1000pF, R = 17.2kΩ, V _{DD} = 5V (60s)	—	—	15	
C = 0.01μF, R = 966.7kΩ, V _{DD} = 5V (8H)							
CMP Detecting Timer Precision	t _c	—	C = 4700pF, R = 254.9kΩ, V _{DD} = 5V (1H) Typ. = 3.5s	- 50	—	50	%
Timer 2 Precision (TIMER OUT2)	Duty	—	C = 4700pF, R = 254.9kΩ, V _{DD} = 5V (1H)	0.85	1 : 7	1.15	—
	Frequency			: 7.15		: 6.85	
				0.967	1.137	1.308	Hz

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

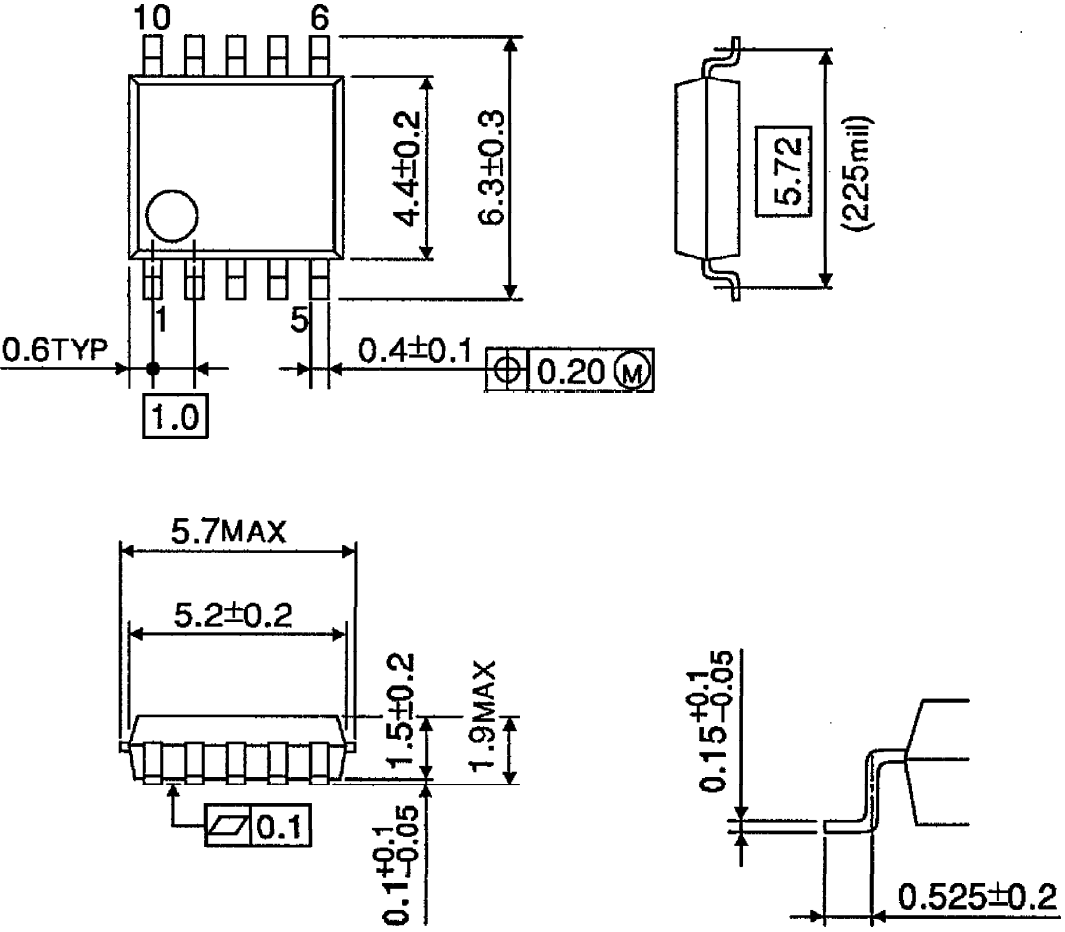
$V_f = 0.7$ (V) : Voltage of input protection diode (1Pin)

(*) Recommendation of timer setting

TIMER SET UP	R_t	C_t
About 60s	17.2k Ω	1000pF
About 1Hour	254.9k Ω	4700pF
About 8Hour	966.7k Ω	0.01 μ F

OUTLINE DRAWING
SSOP10-P-225-1.00

Unit : mm



Weight : 0.1g (Typ.)