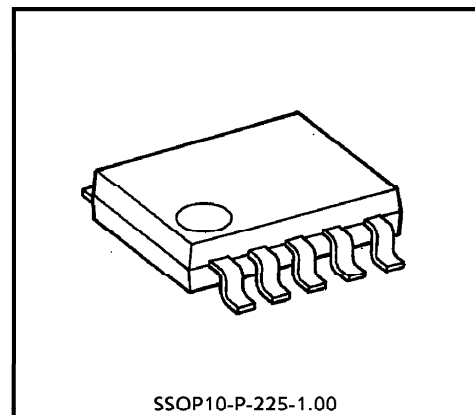


TB1022F

CR TIMER

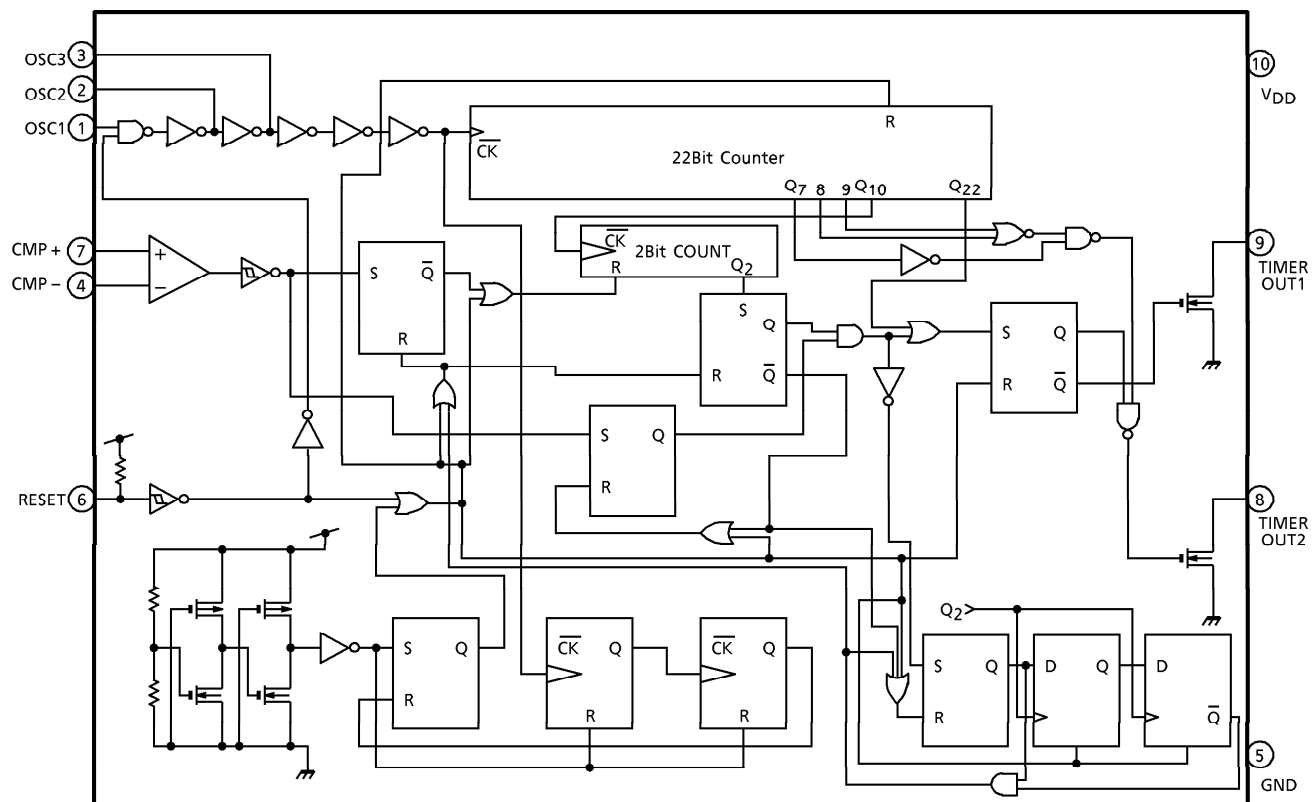
FEATURES

- 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



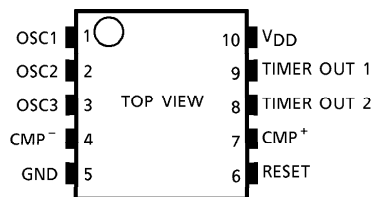
961001EBA2

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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 |

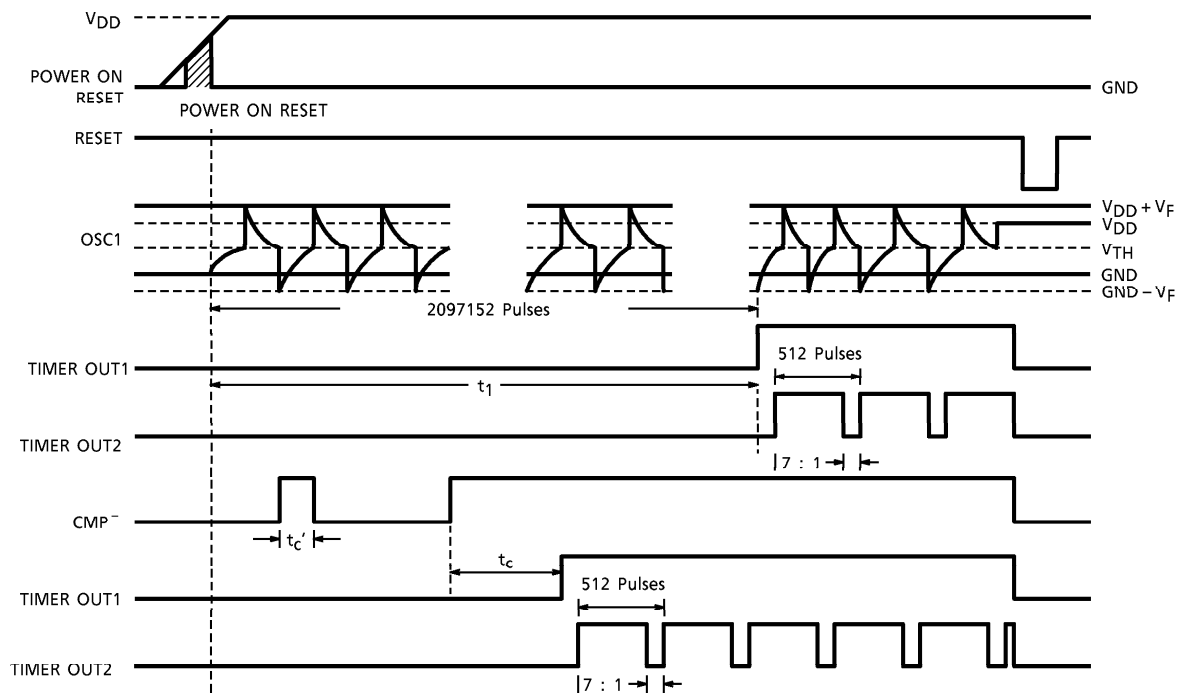
(*) : H or L

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

961001EBA2'

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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) | — | — | 15 | |

| 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

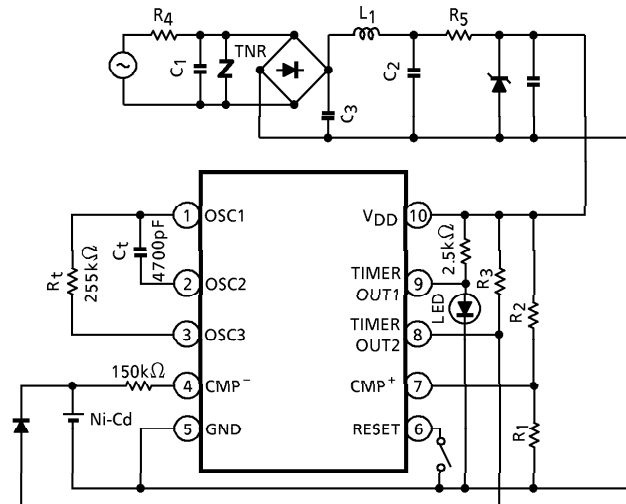
| | | | | | | | | |
|--|--|---|--------------------------|-------|-----|--------------------------|----|--|
| 1. Oscillation Input | | | | | | | | |
| OSC1 Leak Current | I _{IH OSC} | — | V _{IN} = 5.0V | - 1.0 | — | 1.0 | μA | |
| OSC1 Leak Current | I _{IL OSC} | — | V _{IN} = 0V | - 1.0 | — | 1.0 | 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 : 7.15 | 1 : 7 | 1.15 : 6.85 | — |
| | Frequency | | | 0.967 | | 1.137 | |

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

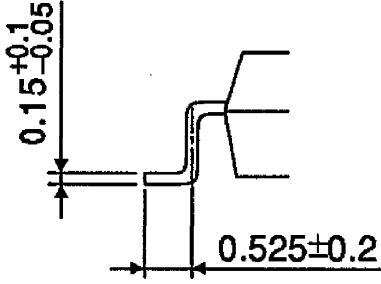
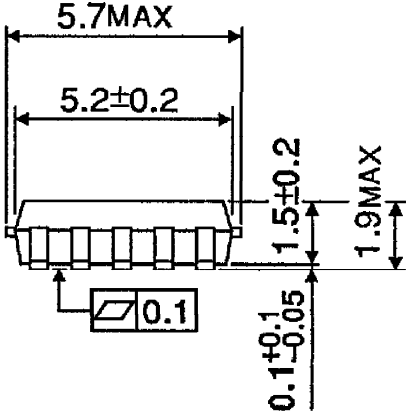
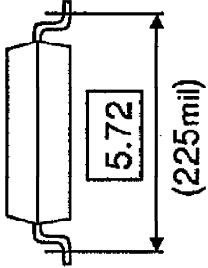
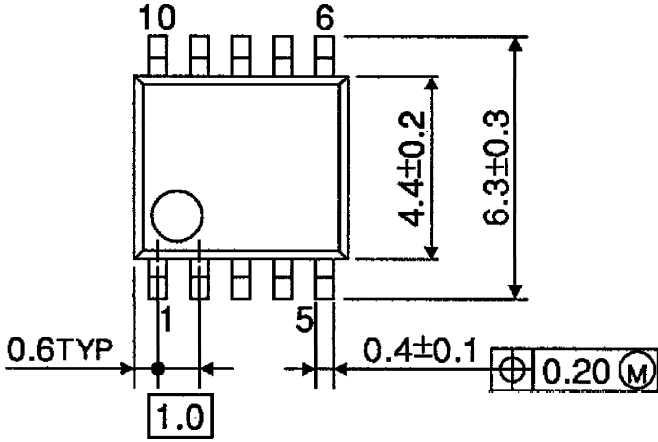
$V_f = 0.7$ (V) : Voltage of input protection diode (1Pin)

(*) 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.)