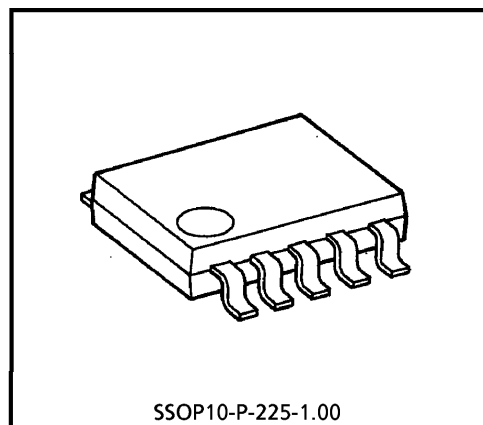


# TB1022F

## CR TIMER

### FEATURES

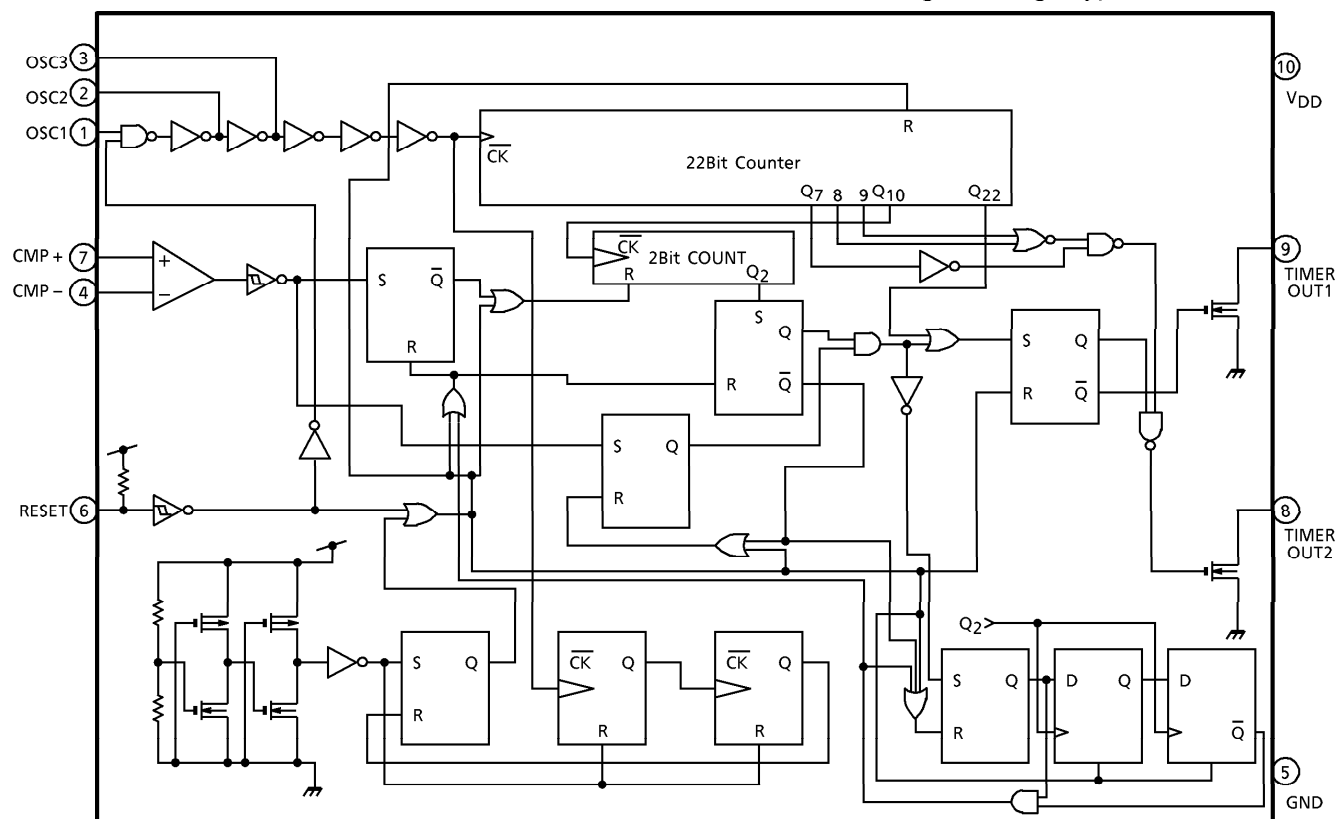
- MOS IC with 22-stage binary counter.
- Built-in initialize circuit.
- Built-in voltage detection comparator.
- Wide range timer setting.
- Low power dissipation current.
- Suitable for Ni-cd battery charger.



SSOP10-P-225-1.00

### BLOCK DIAGRAM

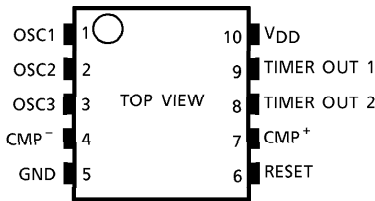
Weight : 0.1g (Typ.)



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 <sup>-</sup> | Comparator minus ( - ) side input terminal<br>"L" : Timer mode, "H" : Timer over voltage detection mode |
| 5       | GND              | GND                                                                                                     |
| 6       | RESET            | Reset terminal (H→L : inside reset)                                                                     |
| 7       | CMP <sup>+</sup> | Comparator plus ( + ) side input terminal<br>"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 <sub>DD</sub>  | System power supply                                                                                     |

PIN CONNECTION

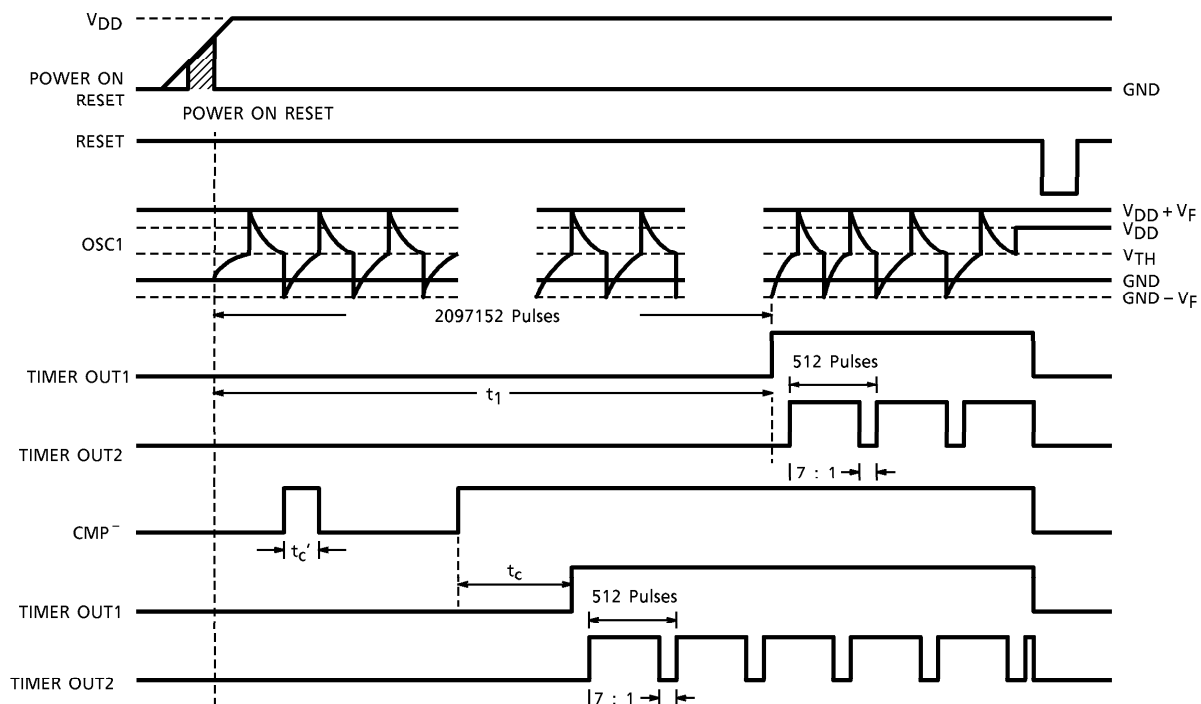


TRUTH TABLE

| 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".

## 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        | —                | ± 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-<br>CUIT | TEST CONDITION                                                    | MIN. | TYP. | MAX. | UNIT |
|-----------------------------------------|--------------------|-------------------|-------------------------------------------------------------------|------|------|------|------|
| Operating Voltage                       | V <sub>opr</sub>   | —                 | —                                                                 | 4.0  | 5.0  | 6.0  | V    |
| Oscillation Frequency<br>Characteristic | Δf <sub>osc1</sub> | —                 | 1H C = 4700pF, R = 254.9kΩ,<br>V <sub>DD</sub> = 5V (f = 582.5Hz) | —    | —    | 10   | %    |
|                                         | Δf <sub>osc2</sub> | —                 | 60s C = 1000pF, R = 17.2kΩ,<br>V <sub>DD</sub> = 5V (f = 34.9kHz) | —    | —    | 15   |      |
|                                         |                    |                   | 8H C = 0.01μF, R = 996.7kΩ,<br>V <sub>DD</sub> = 5V (f = 72.8Hz)  |      | —    |      |      |

| CHARACTERISTIC                 |   | SYMBOL           | TEST CIRCUIT | TEST CONDITION                                      | MIN. | TYP. | MAX. | UNIT    |
|--------------------------------|---|------------------|--------------|-----------------------------------------------------|------|------|------|---------|
| Power Dissipation Current      | 1 | I <sub>QD</sub>  | —            | CR OSC. stopping (at reset)<br>V <sub>DD</sub> = 6V | —    | —    | 130  | $\mu$ A |
|                                | 2 | I <sub>DD</sub>  | —            | CR OSC. operating<br>(at 60s setting)               | —    | —    | 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> | —            | 40 $\mu$ s / V                                      | 1.4  | 2.5  | 3.5  |         |

## DC CHARACTERISTICS

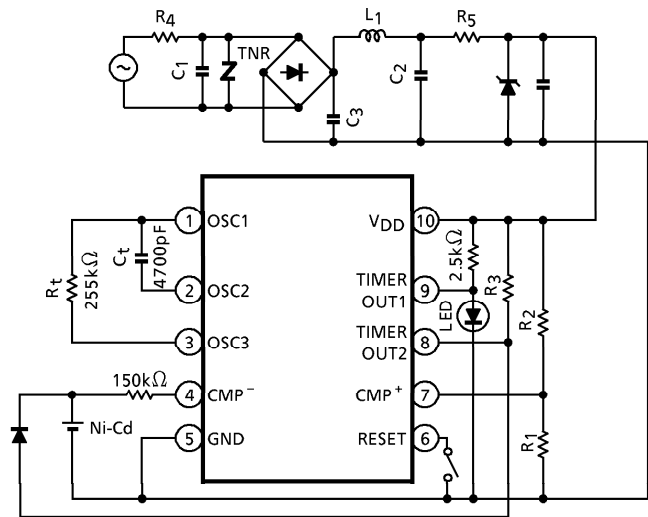
|                                                  |                                    |   |                          |       |     |                       |    |
|--------------------------------------------------|------------------------------------|---|--------------------------|-------|-----|-----------------------|----|
| 1. Oscillation Input                             |                                    |   |                          |       |     |                       |    |
| 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 |
| 2. CMP Terminal                                  |                                    |   |                          |       |     |                       |    |
| 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 <sup>+</sup> , CMP <sup>-</sup> Leak Current | I <sub>IH CMP<sup>+</sup>, -</sub> | — | V <sub>IN</sub> = 5.0V   | – 1.0 | —   | 1.0                   | μA |
|                                                  | I <sub>IL CMP<sup>+</sup>, -</sub> |   | V <sub>IN</sub> = 0V     | – 1.0 | —   | 1.0                   |    |
| Input Dynamic Range                              | —                                  | — | —                        | 0     | —   | V <sub>DD</sub> – 2.5 | V  |
| 3. Reset Terminal                                |                                    |   |                          |       |     |                       |    |
| 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 |
| 4. Timer OUT1, 2 Terminal                        |                                    |   |                          |       |     |                       |    |
| 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

|                                   |                |   |                                                                            |                |       |                |    |
|-----------------------------------|----------------|---|----------------------------------------------------------------------------|----------------|-------|----------------|----|
| Timer 1 Precision<br>(TIMER OUT1) | $\Delta T_1$   | — | C = 4700pF, R = 254.9k $\Omega$ ,<br>V <sub>DD</sub> = 5V (1H)             | —              | —     | 10             | %  |
|                                   | $\Delta T_2$   | — | C = 1000pF, R = 17.2k $\Omega$ ,<br>V <sub>DD</sub> = 5V (60s)             | —              | —     | 15             |    |
|                                   |                |   | C = 0.01 $\mu$ F, R = 966.7k $\Omega$ ,<br>V <sub>DD</sub> = 5V (8H)       |                | —     |                |    |
| CMP Detecting Timer Precision     | t <sub>c</sub> | — | C = 4700pF, R = 254.9k $\Omega$ ,<br>V <sub>DD</sub> = 5V (1H) Typ. = 3.5s | – 50           | —     | 50             | %  |
| Timer 2 Precision<br>(TIMER OUT2) | Duty           | — | C = 4700pF, R = 254.9k $\Omega$ ,<br>V <sub>DD</sub> = 5V (1H)             | 0.85<br>: 7.15 | 1 : 7 | 1.15<br>: 6.85 | —  |
|                                   | Frequency      |   |                                                                            | 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<sub>t</sub> (F)

R<sub>t</sub> (Ω)

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

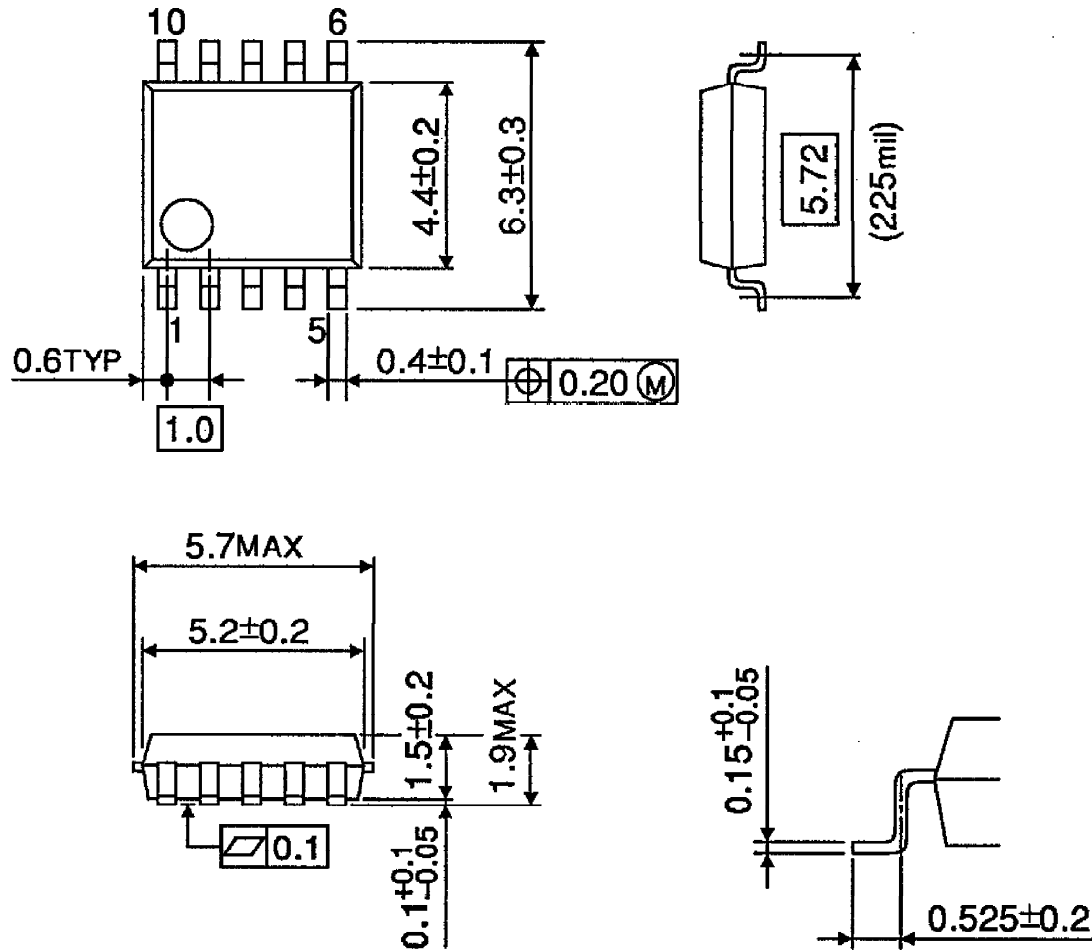
V<sub>f</sub> = 0.7 (V) : Voltage of input protection diode (1Pin)

(\*) Recommendation of timer setting

| TIMER SET UP | R <sub>t</sub> | C <sub>t</sub> |
|--------------|----------------|----------------|
| About 60s    | 17.2kΩ         | 1000pF         |
| About 1Hour  | 254.9kΩ        | 4700pF         |
| About 8Hour  | 966.7kΩ        | 0.01μF         |

PACKAGE DIMENSIONS  
SSOP10-P-225-1.00

Unit : mm



Weight : 0.1g (Typ.)

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000707EBA

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