APN 鉛フリー基準「８７Ｓ７０１９５Ｙー ＡＢ」に適合
APN Pb-free soldering parts design standards conform with "87S 70195Y-AB"

# 納　入　仕　様　書
## ＳＰＥＣＩＦＩＣＡＴＩＯＮ

## ALPINE ELECTRONICS(CHINA)CO.,LTD

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Total number of pages.　29P

# ALPINE ELECTRONICS(CHINA)CO.,LTD

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## SPECIFICATIONS

**ALPINE P/N :**    **51-29314Z01-A**

**PRODUCT NO :**    **X1B000271A00200**

**MODEL :**    **RA8900CE**

**Country of origin : Malaysia**

**SPEC. No. :**    **Q14-055-0B**

**DATE:**    **May. 30. 2014**

### SEIKO EPSON CORPORATION

**8548 Naka-minowa**
**Minowa-machi Kamiina-gun**
**Nagano-ken**
**399-4696 Japan**

**CHECKED** _T. Kuwahara_ / TD Production Engineering Department Manager
Takuo Kuwahara

**CHECKED** _S. Takemura_ / TD Production Engineering Department Staff
Satoru Takemura

**CHECKED** _Y. Hiraizumi_ / TD·CS Quality Assurance Department Manager
Yasushi Hiraizumi

**PREPARED** _T. Kurumizawa_ / TD·CS Quality Assurance Department Senior Staff
Takashi kurumizawa

# Update History

| Date | Page | Item | Current | Update |
|------|------|------|---------|--------|
|      |      |      |         |        |

# Contents

# SPECIFICATION

## 1. Application

1)This document is applicable to the real time clock module RA8900CE that are delivered
to ALPINE ELECTRONICS(CHINA)CO.,LTD from Seiko Epson Corp.

2)RoHS compliant
RA8900CE contains lead in high melting type solder which is exempted in RoHS directive.

3)This Product supplied (and any technical information furnished, if any) by Seiko Epson Corporation shall not be used for the development and manufacture of weapon of mass destruction or for other military purposes. Making available such products and technology to any third party who may use such products or technologies for the said purposes are also prohibited.

4)This product listed here is designed as components or parts for electronics equipment in general consumer use. We do not expect that any of these products would be incorporated or otherwise used as a component or part forthe equipment, which requires an systems, and medical equipment, the functional purpose of which is to keep extra high reliability, such as satellite, rocket and other space life.

This RA8900CE is authorized for Audio equipment for automobile only.

## 2. Model

The model is RA8900CE.

## 3. Packing

It is subject to the packing standard of Seiko Epson Corp.

## 4. Warranty

Defective parts which are originated by us are replaced free of charge in case defects are found within 12 Months after delivery.
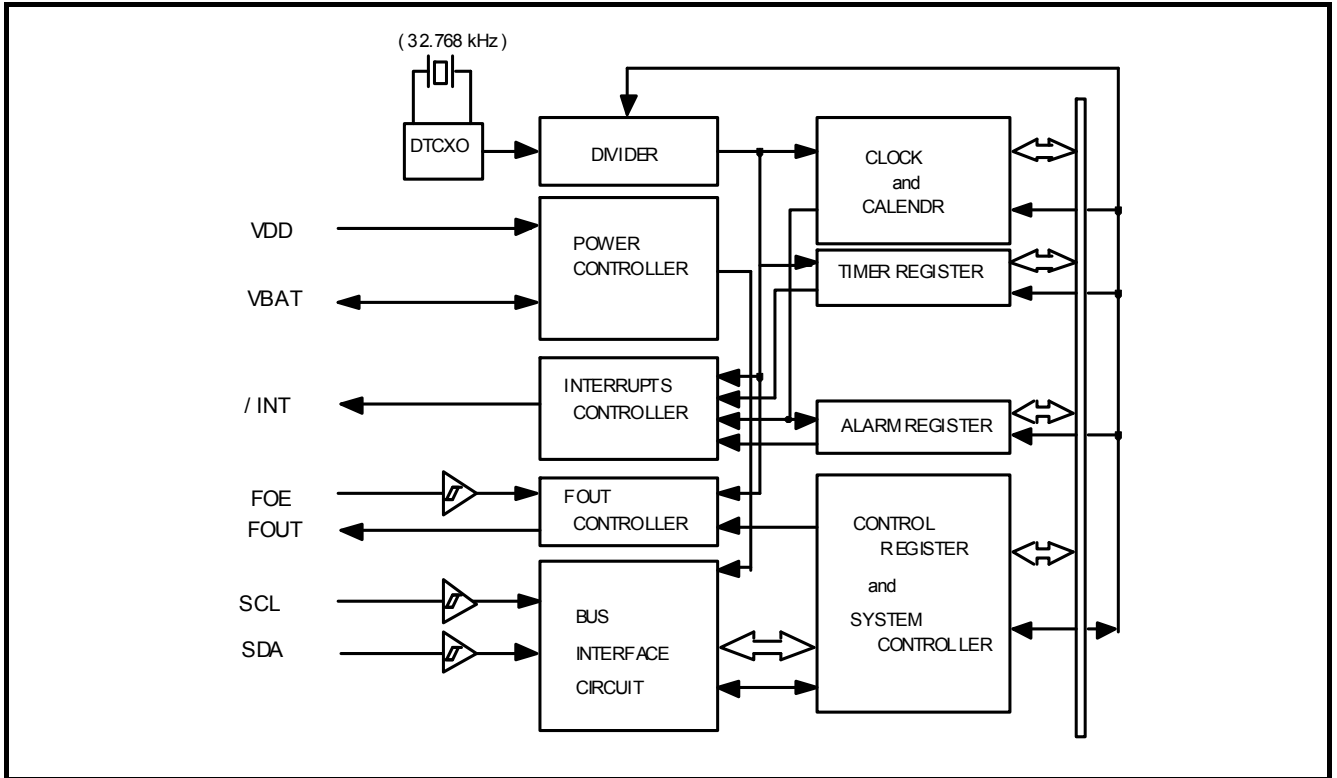
## 5. Amendment and abolishment

Amendment and/or abolishment of this specification are subject to the agreement of both parties.

## 6. Original Production Country / Total Quality Assurance

| Country | Product Factory Name | Total Quality Assurance |
|---------|----------------------|-------------------------|
| Malaysia | EPMY | EPMY |

# 1. Block Diagram



# 2. Description of Registers

## 2.1. Write / Read and Bank Select

Address 00h to 0Fh : Basic time and calendar register … Compatible with RA8803.

Address 10h to 1Fh : Extension register

## 2.2. Register table (Basic time and calendar register)

| Address | Function | bit 7 | bit 6 | bit 5 | bit 4 | bit 3 | bit 2 | bit 1 | bit 0 | Read | Write |
|---------|----------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|
| 00 | SEC | ○ | 40 | 20 | 10 | 8 | 4 | 2 | 1 | P | P |
| 01 | MIN | ○ | 40 | 20 | 10 | 8 | 4 | 2 | 1 | P | P |
| 02 | HOUR | ○ | ○ | 20 | 10 | 8 | 4 | 2 | 1 | P | P |
| 03 | WEEK | ○ | 6 | 5 | 4 | 3 | 2 | 1 | 0 | P | P |
| 04 | DAY | ○ | ○ | 20 | 10 | 8 | 4 | 2 | 1 | P | P |
| 05 | MONTH | ○ | ○ | ○ | 10 | 8 | 4 | 2 | 1 | P | P |
| 06 | YEAR | 80 | 40 | 20 | 10 | 8 | 4 | 2 | 1 | P | P |
| 07 | RAM | • | • | • | • | • | • | • | • | P | P |
| 08 | MIN Alarm | AE | 40 | 20 | 10 | 8 | 4 | 2 | 1 | P | P |
| 09 | HOUR Alarm | AE | • | 20 | 10 | 8 | 4 | 2 | 1 | P | P |
| 0A | WEEK Alarm | AE | 6 | 5 | 4 | 3 | 2 | 1 | 0 | P | P |
| 0A | DAY Alarm | AE | • | 20 | 10 | 8 | 4 | 2 | 1 | P | P |
| 0B | Timer Counter 0 | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 | P | P |
| 0C | Timer Counter 1 | • | • | • | • | 2048 | 1024 | 512 | 256 | P | P |
| 0D | Extension Register | TEST | WADA | USEL | TE | FSEL1 | FSEL0 | TSEL1 | TSEL0 | P | P |
| 0E | Flag Register | ○ | ○ | UF | TF | AF | ○ | VLF | VDET | P | P |
| 0F | Control Register | CSEL1 | CSEL0 | UIE | TIE | AIE | ○ | ○ | RESET | P | P |

P : Possible , I : Impossible

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## 2.3. Register table (Extension register)

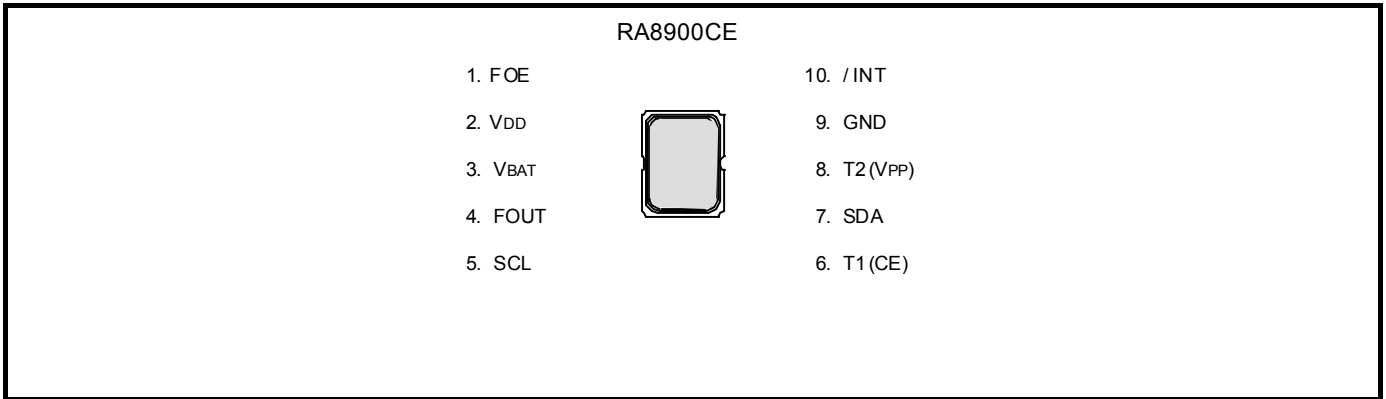| Address | Function | bit 7 | bit 6 | bit 5 | bit 4 | bit 3 | bit 2 | bit 1 | bit 0 | Read | Write |
|---------|----------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|
| 10 | SEC | ○ | 40 | 20 | 10 | 8 | 4 | 2 | 1 | P | P |
| 11 | MIN | ○ | 40 | 20 | 10 | 8 | 4 | 2 | 1 | P | P |
| 12 | HOUR | ○ | ○ | 20 | 10 | 8 | 4 | 2 | 1 | P | P |
| 13 | WEEK | ○ | 6 | 5 | 4 | 3 | 2 | 1 | 0 | P | P |
| 14 | DAY | ○ | ○ | 20 | 10 | 8 | 4 | 2 | 1 | P | P |
| 15 | MONTH | ○ | ○ | ○ | 10 | 8 | 4 | 2 | 1 | P | P |
| 16 | YEAR | 80 | 40 | 20 | 10 | 8 | 4 | 2 | 1 | P | P |
| 17 | TEMP | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 | P | I |
| 18 | Backup Function | ○ | ○ | ○ | ○ | VDET OFF | SWOFF | BKSMP1 | BKSMP0 | P | P |
| 19 | Not use | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | P | I |
| 1A | Not use | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | P | I |
| 1B | Timer Counter 0 | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 | P | P |
| 1C | Timer Counter 1 | • | • | • | • | 2048 | 1024 | 512 | 256 | P | P |
| 1D | Extension Register | TEST | WADA | USEL | TE | FSEL1 | FSEL0 | TSEL1 | TSEL0 | P | P |
| 1E | Flag Register | ○ | ○ | UF | TF | AF | ○ | VLF | VDET | P | P |
| 1F | Control Register | CSEL1 | CSEL0 | UIE | TIE | AIE | ○ | ○ | RESET | P | P |

P : Possible , I : Impossible

Note   When after the initial power-up (from 0 V) or when the result of read out the VLF bit is "1" , initialize all registers, before using the module.
Be sure to avoid entering incorrect date and time data, as clock operations are not guaranteed when the data or time data is incorrect.

∗1)   During the initial power-up, the TEST bit is reset to "0"  and the VLF bit is set to "1".
∗ At this point, all other register values are undefined, so be sure to perform a reset before using the module.

∗2)   Only a "0" can be written to the UF, TF, AF, VLF, or VDET bit.

∗3)   Any bit marked with "○" should be used with a value of "0" after initialization.

∗4)   Any bit marked with "•"  is a RAM bit that can be used to read or write any data.

∗5)   The TEST bit is used by the manufacturer for testing. Be sure to set "0" for this bit when writing.

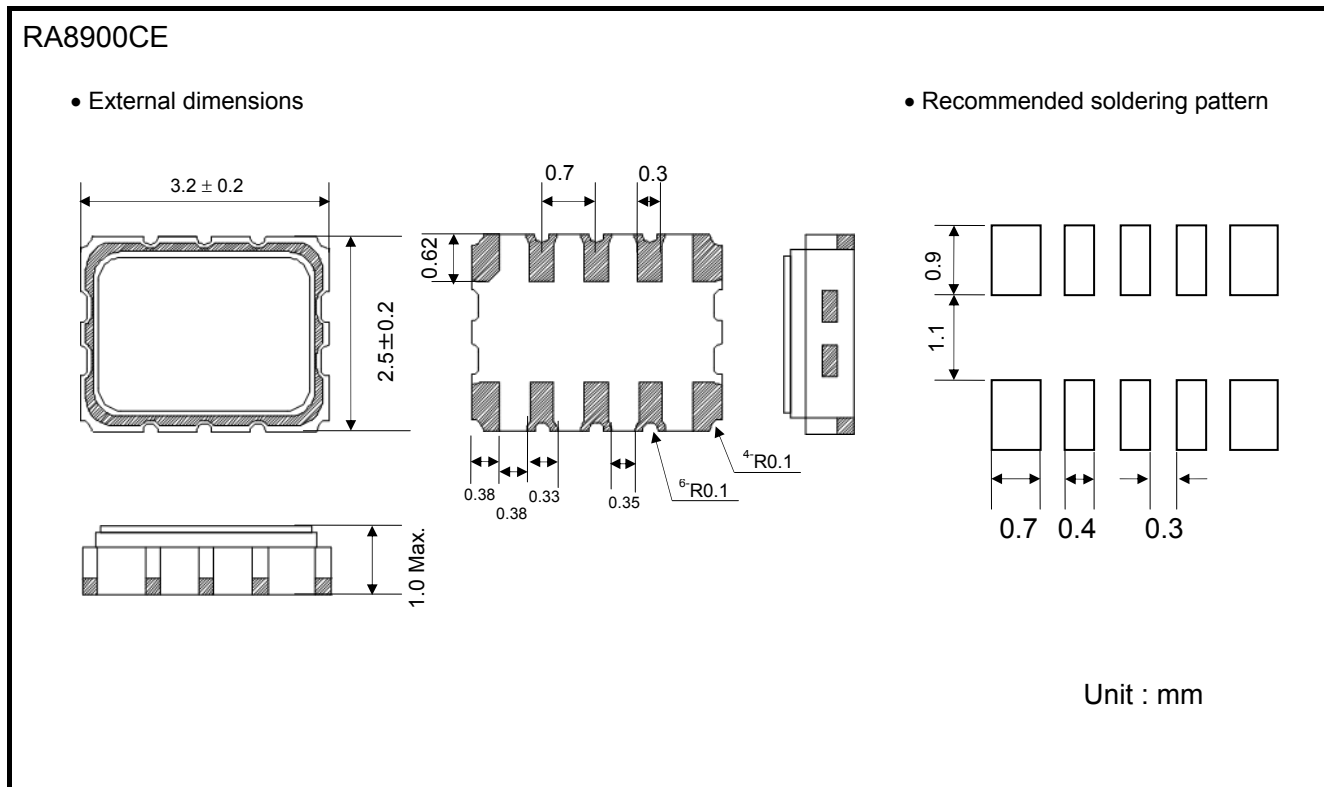# 3. Terminal description

## 3.1. Terminal connections

RA8900CE

| 1. FOE | 10. / INT |
|---|---|
| 2. V$_{DD}$ | 9. GND |
| 3. V$_{BAT}$ | 8. T2 (V$_{PP}$) |
| 4. FOUT | 7. SDA |
| 5. SCL | 6. T1 (CE) |

## 3.2. Pin Functions

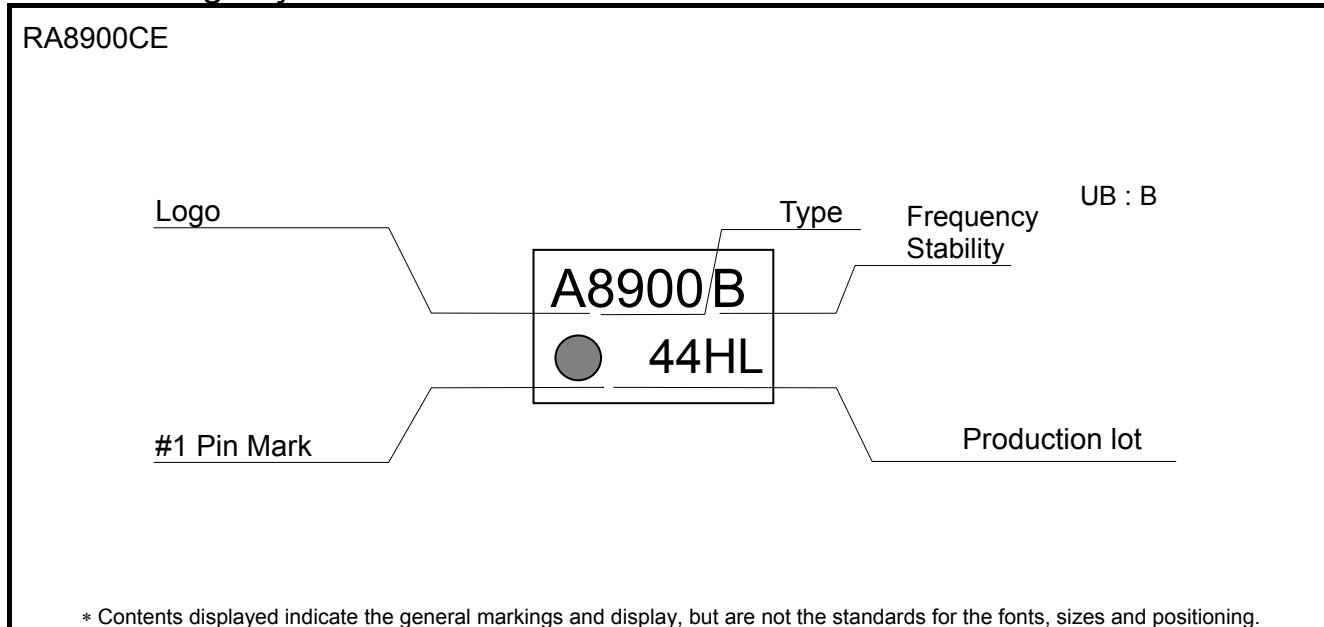| Signal name | I/O | Function |
|---|---|---|
| SDA | I/O | This pin's signal is used for input and output of address, data, and ACK bits, synchronized with the serial clock used for I$^2$C communications.<br>Since the SDA pin is an N-ch open drain pin during output, be sure to connect a suitable pull-up resistance relative to the signal line capacity. |
| SCL | Input | This is the serial clock input pin for I$^2$C Bus communications. |
| FOUT | Output | This is the C-MOS output pin with output control provided via the FOE pin.<br>When FOE = "H" (high level), this pin outputs a 32.768 kHz signal.<br>When output is stopped, the FOUT pin = "Hi-Z" ( high impedance ). |
| FOE | Input | This is an input pin used to control the output mode of the FOUT pin.<br>When this pin's level is high, the FOUT pin is in output mode. When it is low, output via the FOUT pin is stopped. |
| / INT | Output | This pins is used to output alarm signals, timer signals, time update signals, and other signals. This pin is an open drain pin. |
| V$_{BAT}$ | – | This is a power supply pin for backup battery.<br>This is a pin to connect a large-capacity capacitor, a secondary battery.<br>When the battery switchover function does not need, VBAT must be connected to VDD. |
| V$_{DD}$ | – | This pin is connected to a positive power supply. |
| GND | – | This pin is connected to a ground. |
| TEST | Input | Use by the manufacture for testing. ( Do not connect externally.) |
| T1 (CE) | Input | Use by the manufacture for testing. ( Do not connect externally.) |
| T2 (V$_{PP}$) | – | Use by the manufacture for testing. ( Do not connect externally.) |
| N.C. | – | This pin is not connected to the internal IC.<br>Leave N.C. pins open or connect them to GND or V$_{DD}$. |

Note: Be sure to connect a bypass capacitor rated at least 0.1 µF between V$_{DD}$ and GND.

# 4. External Dimensions / Marking Layout

## 4.1 External Dimensions

RA8900CE

• External dimensions

• Recommended soldering pattern

3.2 ± 0.2

2.5 ± 0.2

0.7    0.3

0.62

0.38    0.33    0.35
0.38

4-R0.1
6-R0.1

1.0 Max.

0.9

1.1

0.7  0.4    0.3

Unit : mm

## 4.2 Marking Layout

RA8900CE

Logo

Type

Frequency
Stability

UB : B

A8900B

44HL

#1 Pin Mark

Production lot

∗ Contents displayed indicate the general markings and display, but are not the standards for the fonts, sizes and positioning.

## 5. Absolute Maximum Ratings
<div align="right">GND = 0 V</div>

| Item | Symbol | Condition | Rating | Unit |
|---|---|---|---|---|
| Supply voltage (1) | $V_{DD}$ | Between $V_{DD}$ and GND | $-0.3$ to $+6.5$ | V |
| Supply voltage (2) | $V_{BAT}$ | Between $V_{BAT}$ and GND | $-0.3$ to $+6.5$ | V |
| Input voltage | $V_{IN2}$ | FOE,SCL,SDA pins | GND$-0.3$ to $+6.5$ | V |
| Output voltage (1) | $V_{OUT1}$ | FOUT pin | GND$-0.3$ to $V_{DD}+0.3$ | V |
| Output voltage (2) | $V_{OUT2}$ | SDA and /INT pins | GND$-0.3$ to $+6.5$ | V |
| Storage temperature | $T_{STG}$ | When stored separately, without packaging | $-55$ to $+125$ | °C |

## 6. Recommended Operating Conditions
<div align="right">GND = 0 V</div>

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Operating supply voltage (1) | $V_{ACC}$ | Between $V_{DD}$ and GND ($V_{DD} = V_{BAT}$ ) | 1.6 | 3.0 | 5.5 | V |
| Operating supply voltage (2) | $V_{ACCSW}$ | Between $V_{DD}$ and GND | 2.5 | 3.0 | 5.5 | V |
| Backup power supply voltage | $V_{BAT}$ | Between $V_{BAT}$ and GND | 1.6 | 3.0 | 5.5 | V |
| Temp. compensation voltage | $V_{TEM}$ | Temperature compensation voltage | 2.0 | 3.0 | 5.5 | V |
| Clock supply voltage | $V_{CLK}$ | – | 1.6 | 3.0 | 5.5 | V |
| Operating temperature | $T_{OPR}$ | No condensation | $-40$ | $+25$ | $+85$ | °C |

## 7. Frequency Characteristics
<div align="right">GND = 0 V</div>

| Item | Symbol | Condition | | Rating | Unit |
|---|---|---|---|---|---|
| Frequency stability | $\Delta f / f$ | U B | Ta= 0 to +50 °C, $V_{DD}$=3.0 V<br>Ta=$-40$ to +85 °C, $V_{DD}$=3.0 V | $\pm 3.8$ [*1]<br>$\pm 5.0$ [*2] | $\times 10^{-6}$ |
| Frequency/voltage characteristics | f / V | Ta= +25 °C, $V_{DD}$=2.2 V to 5.5 V | | $\pm 1.0$ Max. | $\times 10^{-6}$ /V |
| Oscillation start time | $t_{STA}$ | Ta= +25 °C, $V_{DD}$=1.6 V | | 1.0 Max. | s |
| | | Ta=$-40$ to +85 °C, $V_{DD}$=1.6 V to 5.5 V | | 3.0 Max. | |
| Aging | fa | Ta= +25 °C, $V_{DD}$=3.0 V, first year | | $\pm 3$ Max. | $\times 10^{-6}$ / year |
| Temperature Sensor Accuracy | Temp | VDD=3.0 V | | $\pm 5.0$ Max. (TBD) | °C |

[*1] Equivalent to 10 seconds of month deviation.　　[*2] Equivalent to 13 seconds of month deviation.

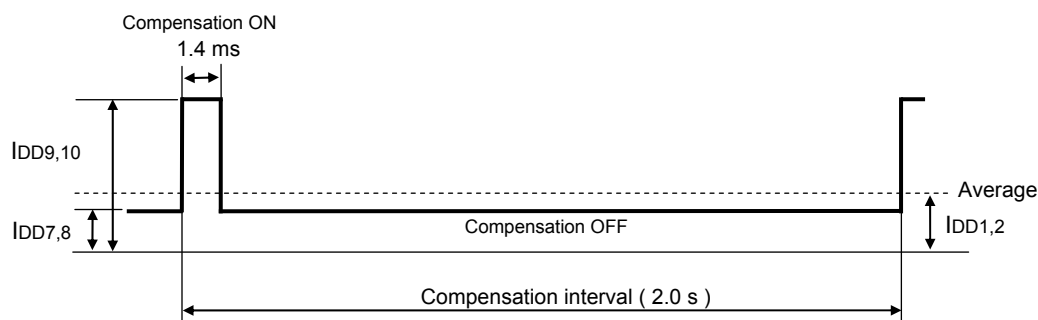# 8. Electrical Characteristics

## 8.1. DC Characteristics

*Unless otherwise specified, GND = 0 V, $V_{DD}$ = 1.6 V to 5.5 V, Ta = −40 °C to +85 °C

| Item | Symbol | Condition | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| Current consumption (1) | $I_{DD1}$ | $f_{SCL}$ = 0 Hz, / INT = $V_{DD}$ FOE = GND | $V_{DD}$ = 5 V | | 0.75 | 3.4 | μA |
| Current consumption (2) | $I_{DD2}$ | FOUT : output OFF ( High Z ) Compensation interval 2.0 s | $V_{DD}$ = 3 V | | 0.75 | 2.1 | |
| Current consumption (3) | $I_{DD3}$ | $f_{SCL}$ = 0 Hz, / INT = $V_{DD}$ FOE = $V_{DD}$ | $V_{DD}$ = 5 V | | 2.0 | 7.5 | μA |
| Current consumption (4) | $I_{DD4}$ | FOUT :32.768 kHz, CL =0pF Compensation interval 2.0 s | $V_{DD}$ = 3 V | | 1.5 | 5.0 | |
| Current consumption (5) | $I_{DD5}$ | $f_{SCL}$ = 0 Hz, / INT = $V_{DD}$ FOE = $V_{DD}$ | $V_{DD}$ = 5 V | | 7.0 | 20.0 | μA |
| Current consumption (6) | $I_{DD6}$ | FOUT :32.768 kHz, CL =30pF Compensation interval 2.0 s | $V_{DD}$ = 3 V | | 4.5 | 12.0 | |
| Current consumption (7) | $I_{DD7}$ | $f_{SCL}$ = 0 Hz, / INT = $V_{DD}$ FOE = GND | $V_{DD}$ = 5 V | | 0.7 | 2.95 | μA |
| Current consumption (8) | $I_{DD8}$ | FOUT : output OFF ( High Z ) Compensation OFF | $V_{DD}$ = 3 V | | 0.7 | 1.85 | |
| Current consumption (9) | $I_{DD9}$ | $f_{SCL}$ = 0 Hz, / INT = $V_{DD}$ FOE = GND | $V_{DD}$ = 5 V | | 120 | 900 | μA |
| Current consumption (10) | $I_{DD10}$ | FOUT : output OFF ( High Z ) Compensation ON ( peak ) | $V_{DD}$ = 3 V | | 115 | 350 | |
| High-level input voltage | $V_{IH}$ | CE, DI, CLK, FOE pins | | $0.8 \times V_{DD}$ | | 5.5 | V |
| Low-level input voltage | $V_{IL}$ | CE, DI, CLK, FOE pins | | GND − 0.3 | | $0.2 \times V_{DD}$ | V |
| High-level output voltage | $V_{OH1}$ | FOUT pin | $V_{DD}$=5 V, $I_{OH}$=−1 mA | 4.5 | | 5.0 | V |
| | $V_{OH2}$ | | $V_{DD}$=3 V, $I_{OH}$=−1 mA | 2.2 | | 3.0 | |
| | $V_{OH3}$ | | $V_{DD}$=3 V, $I_{OH}$=−100 μA | 2.9 | | 3.0 | |
| Low-level output voltage | $V_{OL1}$ | FOUT pin | $V_{DD}$=5 V, $I_{OL}$=1 mA | GND | | GND+0.5 | V |
| | $V_{OL2}$ | | $V_{DD}$=3 V, $I_{OL}$=1 mA | GND | | GND+0.8 | |
| | $V_{OL3}$ | | $V_{DD}$=3 V, $I_{OL}$=100 μA | GND | | GND+0.1 | |
| | $V_{OL4}$ | / INT pin | $V_{DD}$=5 V, $I_{OL}$=1 mA | GND | | GND+0.25 | V |
| | $V_{OL5}$ | | $V_{DD}$=3 V, $I_{OL}$=1 mA | GND | | GND+0.4 | |
| | $V_{OL6}$ | SDA pin | $V_{DD} \geq$2 V, $I_{OL}$=3 mA | GND | | GND+0.4 | V |
| Input leakage current | $I_{LK}$ | FOE, SCL, SDA pins , $V_{IN}$ = $V_{DD}$ or GND | | −0.5 | | 0.5 | μA |
| Output leakage current | $I_{OZ}$ | / INT, SDA, FOUT pins, $V_{OUT}$ = $V_{DD}$ or GND | | −0.5 | | 0.5 | μA |

• Temperature compensation and consumption current



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## 8.2. AC Characteristics

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| SCL clock frequency | $f_{SCL}$ | | | | 400 | kHz |
| Start condition setup time | $t_{SU;STA}$ | | 0.6 | | | μs |
| Start condition hold time | $t_{HD;STA}$ | | 0.6 | | | μs |
| Data setup time | $t_{SU;DAT}$ | | 100 | | | ns |
| Data hold time | $t_{HD;DAT}$ | | 0 | | 900 | ns |
| Stop condition setup time | $t_{SU;STO}$ | | 0.6 | | | μs |
| Bus idle time between start condition and stop condition | $t_{BUF}$ | | 1.3 | | | μs |
| Time when SCL = "L" | $t_{LOW}$ | | 1.3 | | | μs |
| Time when SCL = "H" | $t_{HIGH}$ | | 0.6 | | | μs |
| Rise time for SCL and SDA | $t_r$ | | | | 0.3 | μs |
| Fall time for SCL and SDA | $t_f$ | | | | 0.3 | μs |
| Allowable spike time on bus | $t_{SP}$ | | | | 50 | ns |
| FOUT duty | $t_W /t$ | 50% of $V_{DD}$ level | 40 | 50 | 60 | % |

Timing chart
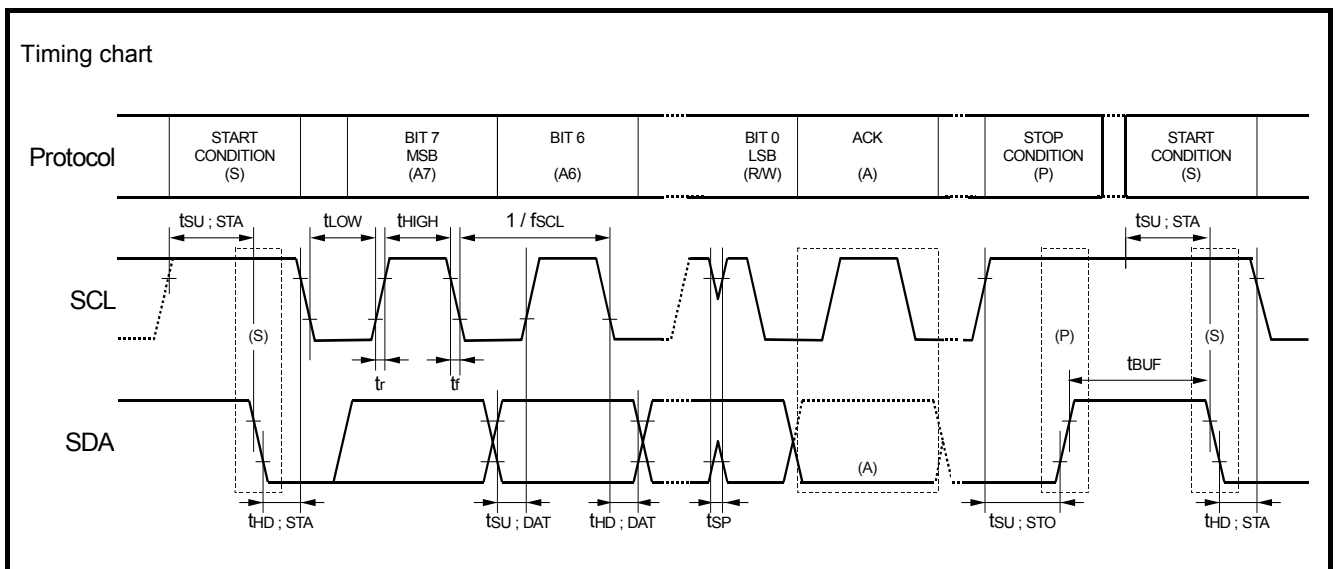


Caution:  When accessing this device, all communication from transmitting the start condition to transmitting the stop condition after access **should be completed within 0.95 seconds**.
If such communication requires **0.95 seconds** or longer, the I²C bus interface is reset by the internal bus timeout function.

## 8.3. Connection with Typical Microcontroller



Note : It uses the secondary battery or a lithium battery.
For detailed value on the resistance, please consult a battery maker.
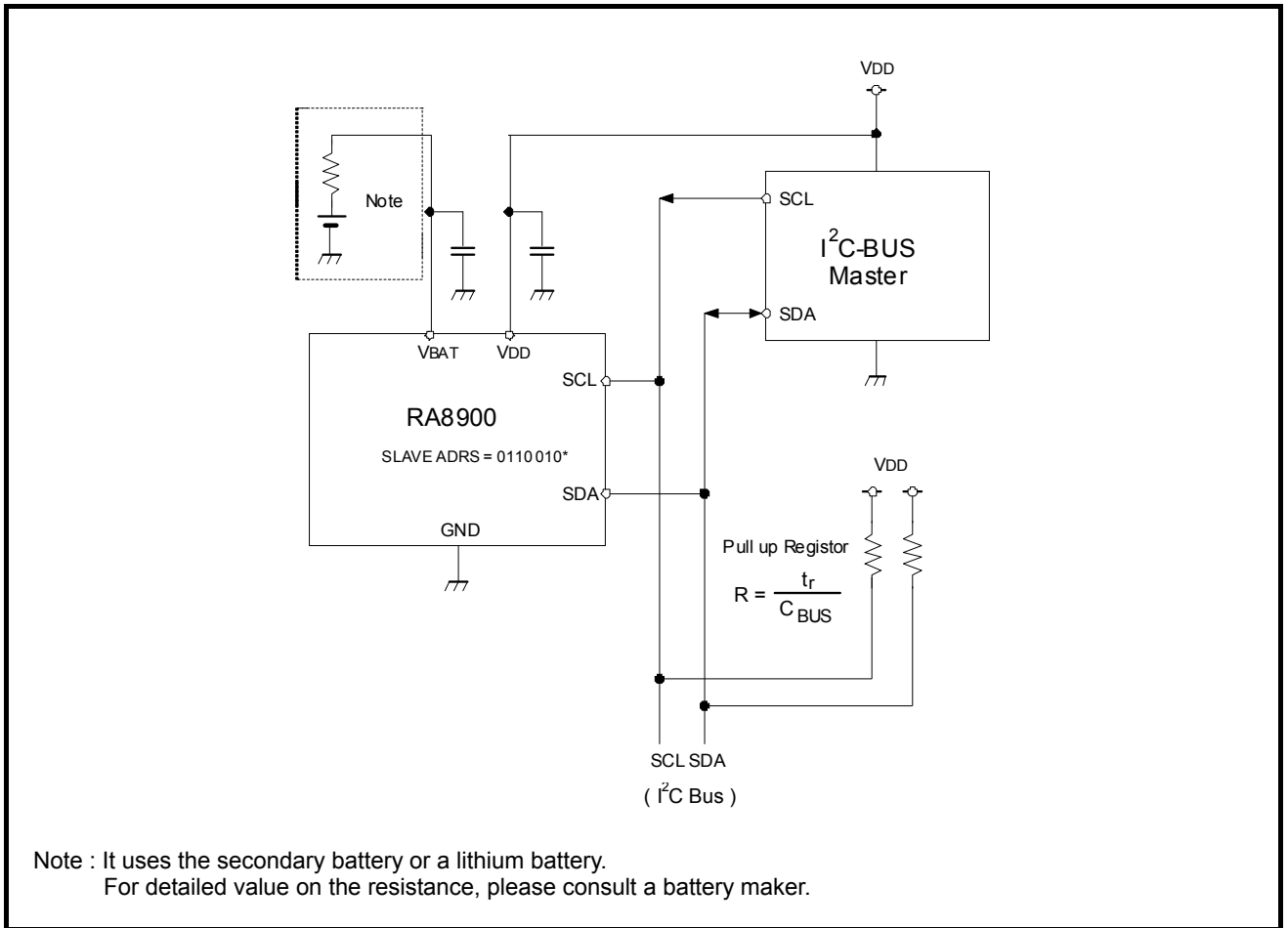
## 8.4. When used as a clock source (32 kHz-TCXO)
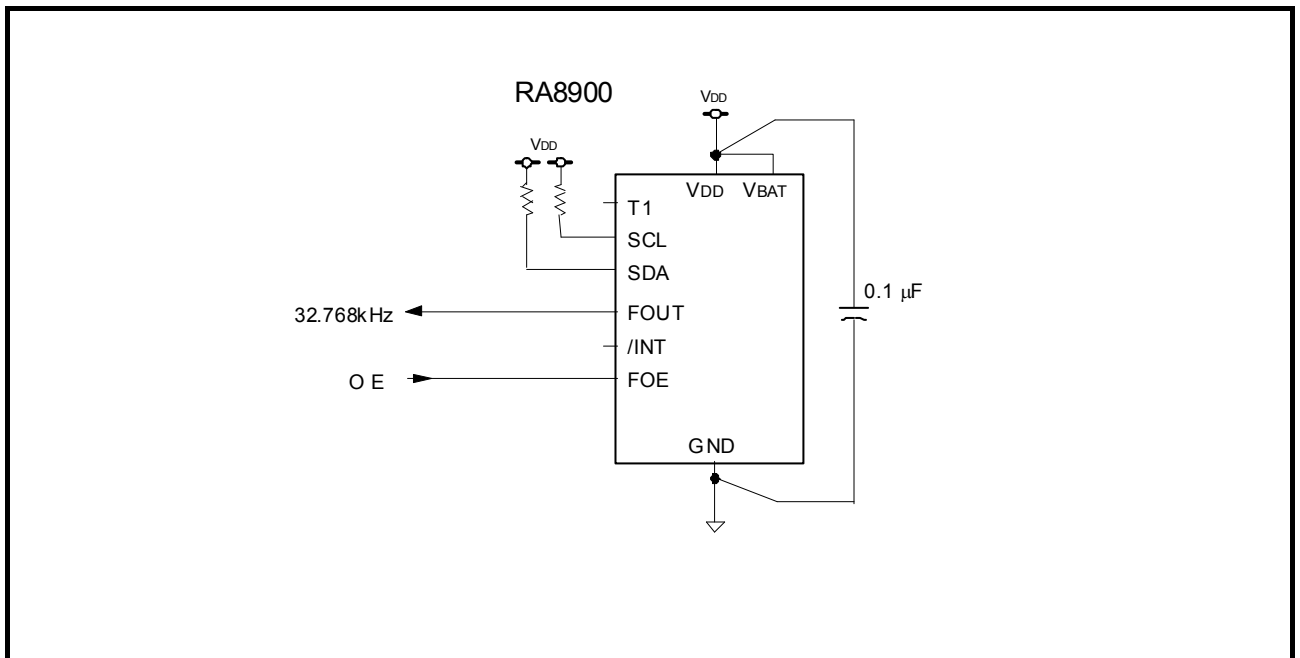
# 9. Environmental and mechanical characteristics

(The company evaluation condition　We evaluate it by the following examination item and examination condition.)

| No. | Item | Value *1 | | Test Conditions |
|---|---|---|---|---|
| | | $\Delta f / f$ [ $1 \times 10^{-6}$ ] *2 | Electrical characteristics | |
| 1 | High temperature storage | *3 　± 50 | | +125 °C × 1 000 h |
| 2 | Low temperature storage | *3 　± 10 | | -55 °C × 1 000 h |
| 3 | High temperature bias | *3 　± 20 | | +85 °C × 5.5 V × 1 000 h |
| 4 | Low temperature bias | *3 　± 10 | | -40 °C × 5.5 V × 1 000 h |
| 5 | Temperature humidity bias | *3 　± 20 | | +85 °C × 85 %RH × 5.5 V × 1 000 h |
| 6 | Temperature cycle | *3 　± 10 | | -40 °C ⇔ +85 °C<br>30 min at each temp. 1000 cycles |
| 7 | Resistance to soldering heat | ± 8 | *4 Satisfy item 7,8 after test | IPC/JEDEC J-STD-020D.1 Reflow (3 times) |
| 8 | Drop | ± 5 | | Free drop from 750 mm height on a hard wooden board for 3 times (Board is thickness more than 30 mm) |
| 9 | Vibration | ± 5 | | 10 Hz to 55 Hz amplitude 0.75 mm<br>55 Hz to 500 Hz　acceleration 98 m/s$^2$<br>10 Hz → 500 Hz → 10 Hz 15min./cycle<br>6 h (2 hours , 3 directions) |
| 10 | Solderability | Termination must be 95 % covered with fresh solder | | Dip termination into solder bath at +235 °C ± 5 °C for 5 s (Using Rosin Flux) |

< Notes >
*1 Each test done independently.
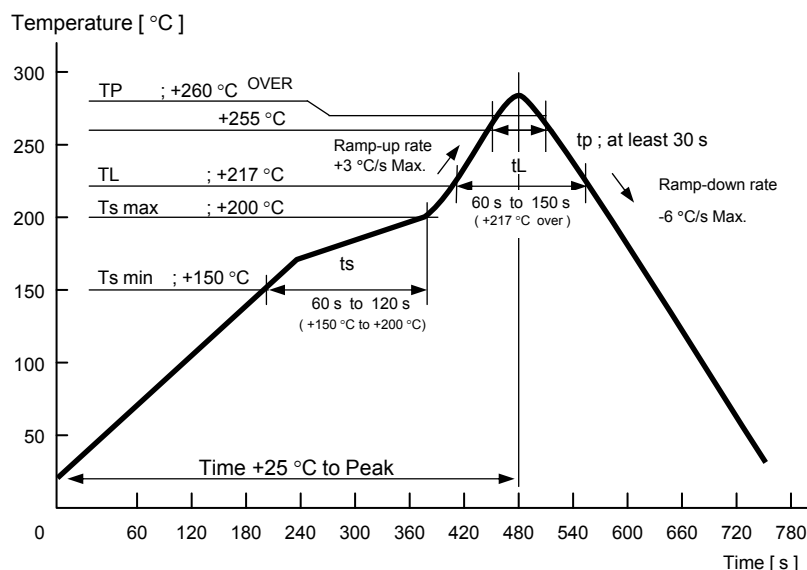*2 Measuring 2 h to 24 h later leaving in room temperature after each test.
*3 Pre conditionings
　　1. +125 °C × 24 h to +85 °C × 85 % × 168 h ± 1 h→ reflow 3 times
　　2. Initial value shall be after 24 h at room temperature.
*4 7. Frequency Characteristics (but excludes frequency tolerance and aging.)
　　8. Electrical characteristics

♦ Reflow condition (follow to IPC / JEDEC J-STD-020D.1)

# 10. How to use

## 10.1 Reading/Writing Data via the I$^2$C Bus Interface

### Overview of I$^2$C-BUS

**10.1.1**

The I$^2$C bus supports bi-directional communications via two signal lines: the SDA (data) line and SCL (clock) line. A combination of these two signals is used to transmit and receive communication start/stop signals, data transfer signals, acknowledge signals, and so on.

**10.1.2**

Both the SCL and SDA signals are held at high level whenever communications are not being performed.
The starting and stopping of communications is controlled at the rising edge or falling edge of SDA while SCL is at high level.

**10.1.3**

During data transfers, data changes that occur on the SDA line are performed while the SCL line is at low level, and on the receiving side the data is output while the SCL line is at high level.
The I$^2$C bus device does not include a chip select pin such as is found in ordinary logic devices. Instead of using a chip select pin, slave addresses are allocated to each device and the receiving device responds to communications only when its slave address matches the slave address in the received data. In either case, the data is transferred via the SCL line at a rate of one bit per clock pulse.
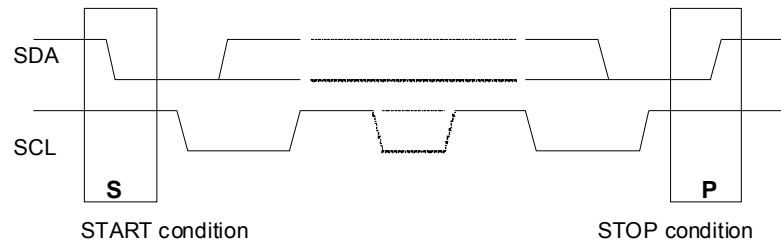


**10.1.4. Slave address**

The I$^2$C bus device does not include a chip select pin such as is found in ordinary logic devices. Instead of using a chip select pin, slave addresses are allocated to each device.
All communications begin with transmitting the [START condition] + [slave address (+ R/W specification)]. The receiving device responds to this communication only when the specified slave address it has received matches its own slave address.

Slave addresses have a fixed length of 7 bits. This RTC's slave address is **[0110 010∗]**.
An R/W bit ("∗" above) is added to each 7-bit slave address during 8-bit transfers.

|  | Transfer data | Slave address | | | | | | | R/W bit |
|---|---|---|---|---|---|---|---|---|---|
|  |  | bit 7 | bit 6 | bit 5 | bit 4 | bit 3 | bit 2 | bit 1 | bit 0 |
| Read | **65 h** | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 (= Read) |
| Write | **64 h** | | | | | | | | 0 (= Write) |

## 10.2 Backup and Recovery

\* tR1 is restrictions to validate power-on reset. When cannot keep this standard, power-on reset does not work normally. It is necessary to initial setting by the software command.

Repeated ON/OFF of the power supply in short term, the power-on reset becomes unstable.
After power-OFF, keep a state of VDD=GND more than 60 seconds to validate power-on reset.
When it is impossible, please perform initial setting by the software command.



\*1:VDD Voltage detection
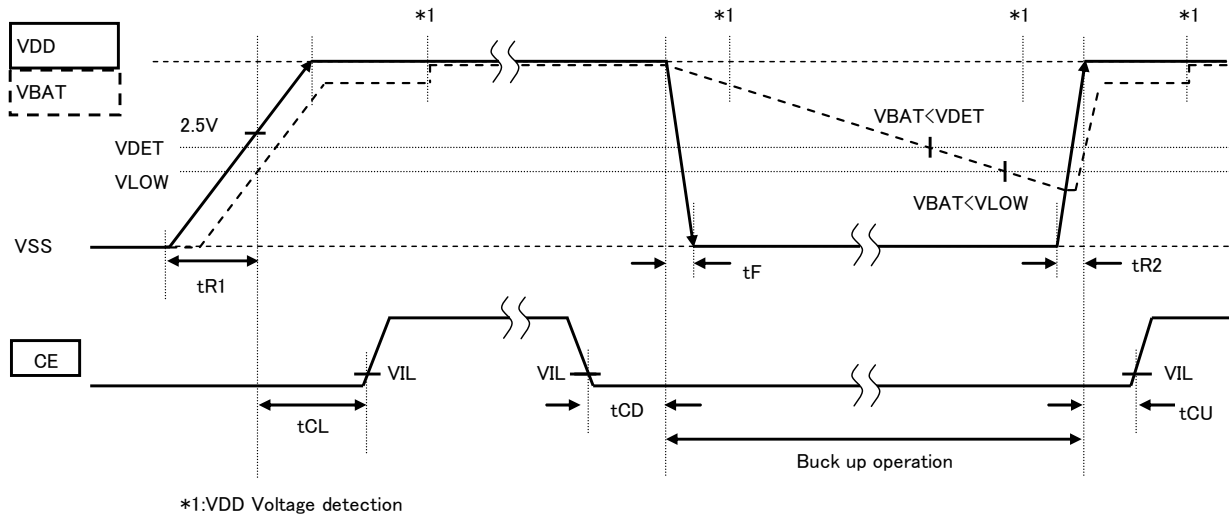
| Item | Symbol | Condition | Min. | Typ. | Max. | Unit. |
|---|---|---|---|---|---|---|
| Detection voltage (1) | VDET | - | 1.9 | 1.95 | 2.0 | V |
| Detection voltage (2) | VLOW | - | 1.2 | - | 1.6 | V |
| Detection voltage (3) | VDET3 | - | | 2.4 | | V |
| Power supply rise time1 | tR1 | VDD=VSS to 2.5V | 1 | - | 10 | ms / V |
| Access wait time (Initial power on) | tCL | After VDD=2.5V | 30 | - | - | ms |
| Chip disable wait time | tCD | After stop condition | 0 | - | - | μs / V |
| Power supply fall time | tF | VDD=2.5V to VSS | 2 | - | - | μs / V |
| Power supply rise time2 | tR2 | VDD=VSS to 2.5V | 15 | - | - | μs / V |
| Access wait time ( Normal power on) | tCU | After VDD=2.5V | 0 | - | - | μs |

# 11. Application notes

## 1) Notes on handling

This module uses a C-MOS IC to realize low power consumption.    Carefully note the following cautions when handling.

### (1) Static electricity

While this module has built-in circuitry designed to protect it against electrostatic discharge, the chip could still be damaged by a large discharge of static electricity. Containers used for packing and transport should be constructed of conductive materials. In addition, only soldering irons, measurement circuits, and other such devices which do not leak high voltage should be used with this module, which should also be grounded when such devices are being used.

### (2) Noise

If a signal with excessive external noise is applied to the power supply or input pins, the device may malfunction or "latch up." In order to ensure stable operation, connect a filter capacitor (preferably ceramic) of greater that 0.1 μF as close as possible to the power supply pins (between VDD and GNDs). Also, avoid placing any device that generates high level of electronic noise near this module.

* Do not connect signal lines to the shaded area in the figure shown in Fig. 1 and, if possible, embed this area in a GND land.

### (3) Voltage levels of input pins

When the input pins are at the mid-level, this will cause increased current consumption and a reduced noise margin, and can impair the functioning of the device. Therefore, try as much as possible to apply the voltage level close to VDD or GND.

### (4) Handling of unused pins

Since the input impedance of the input pins is extremely high, operating the device with these pins in the open circuit state can lead to unstable voltage level and malfunctions due to noise. Therefore, pull-up or pull-down resistors should be provided for all unused input pins.

## 2) Notes on packaging

### (1) Soldering heat resistance.

If the temperature within the package exceeds +260 °C, the characteristics of the crystal oscillator will be degraded and it may be damaged. The reflow conditions within our reflow profile is recommended. Therefore, always check the mounting temperature and time before mounting this device. Also, check again if the mounting conditions are later changed.

* See Fig. 2 profile for our evaluation of Soldering heat resistance for reference.

### (2) Mounting equipment

While this module can be used with general-purpose mounting equipment, the internal crystal oscillator may be damaged in some circumstances, depending on the equipment and conditions. Therefore, be sure to check this. In addition, if the mounting conditions are later changed, the same check should be performed again.

### (3) Ultrasonic cleaning

Depending on the usage conditions, there is a possibility that the crystal oscillator will be damaged by resonance during ultrasonic cleaning. Since the conditions under which ultrasonic cleaning is carried out (the type of cleaner, power level, time, state of the inside of the cleaning vessel, etc.) vary widely, this device is not warranted against damage during ultrasonic cleaning.

### (4) Mounting orientation

This device can be damaged if it is mounted in the wrong orientation. Always confirm the orientation of the device before mounting.

### (5) Leakage between pins

Leakage between pins may occur if the power is turned on while the device has condensation or dirt on it. Make sure the device is dry and clean before supplying power to it.



Fig. 1 : Reference profile for our evaluation of Soldering heat resistance.
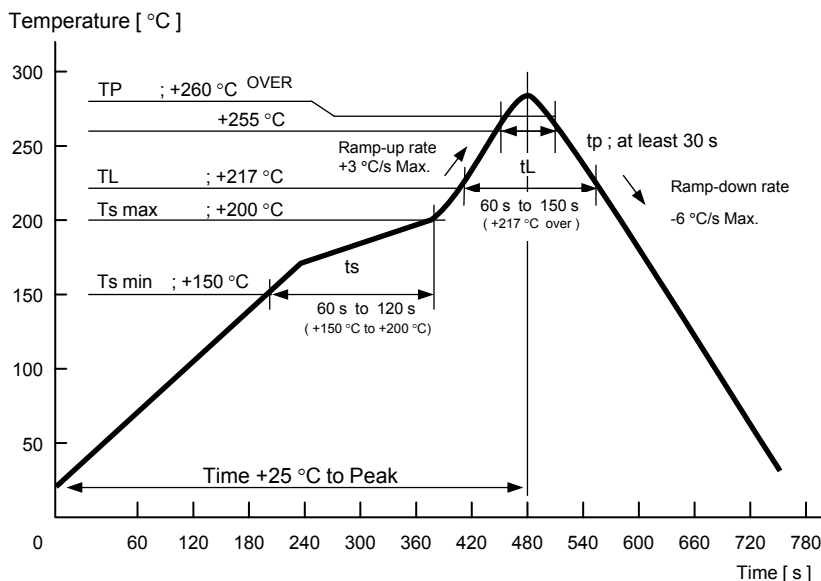
### ALPINEの要求する半田付け関連の耐熱条件への見解
### Alpine's requirement of heatproof condition for soldering

Ver. 3.03

この部材の半田付け関連の耐熱条件を、当てはまる項目のMarkを塗りつぶすことで報告致します。
Report the condition of heatproof for soldering of this part by marking the appropriate
issue written below.


Rank C：ALPINE要求条件以外の管理基準について
　　　　要求条件以外のプロファイルの提示が必要な場合については、生産現場で管理できる記載内容で
　　　　指定の項目に、提示されているページを記載致します。
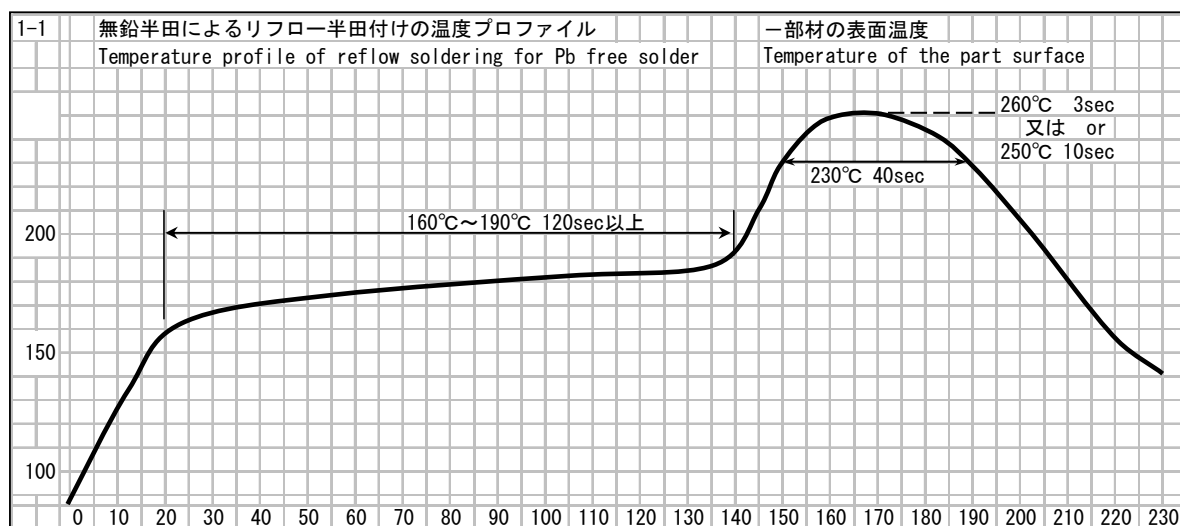Rank C：Standard control for other condition. (Other than Alpine's requirement)
　　　　If it is necessary to hand in the profile other than Alpine's requirement, note the
　　　　page no. for the specified issue. It needs to be possible to control at manufacturing scene.
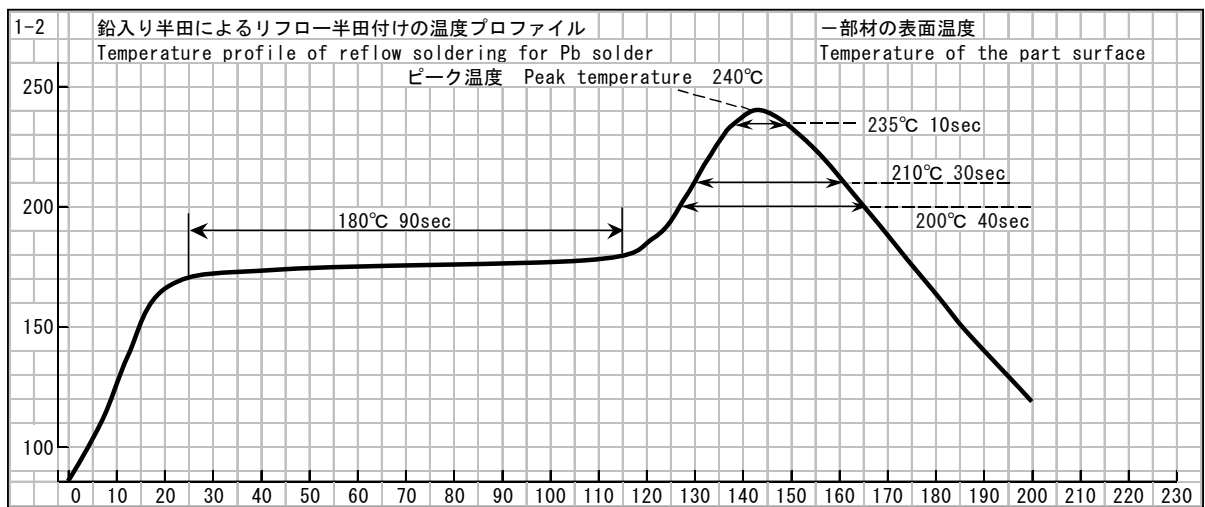

1-1 無鉛半田によるリフロー半田付けの温度条件
　　Temperature profile of reflow soldering for Pb free solder
　　要求された温度プロファイルで半田付けすることに関し、この部材は、
　　Mark the appropriate condition for this part

| Mark | Rank | 保証内容 Assurance condition | |
|------|------|------------------------------|---|
| ◯ | PA 2 | 2回のリフローによる加熱に耐えることが保証できます<br>Assures enduring 2 times reflow heat | なお、ピーク温度は、<br>Temperature peak is |
| | PA 1 | 2回のリフローによる加熱に耐える実力があります<br>Has ability of enduring 2 times reflow heat | 260 ℃ |
| | PB 2 | 1回のリフローによる加熱に耐えることが保証できます<br>Assures enduring 1 time reflow heat | |
| | PB 1 | 1回のリフローによる加熱に耐える実力があります<br>Has ability of enduring 1 time reflow heat | となります |
| | PC | 指定のプロファイルであれば保証可能です<br>Possible to assure under specified profile | プロファイルはP.　に提示してあります<br>Profile is written in page |
| | PN | リフローに対応する品種ではありません<br>This part is not reflow part | |



1-1 無鉛半田によるリフロー半田付けの温度プロファイル　　　　ー部材の表面温度
Temperature profile of reflow soldering for Pb free solder　　Temperature of the part surface

260℃　3sec
又は　or
250℃　10sec
230℃　40sec
160℃～190℃　120sec以上

1-2 鉛入り半田によるリフロー半田付けの温度条件
Temperature profile of reflow soldering for Pb solder
要求された温度プロファイルで半田付けすることに関し、この部材は、
Mark the appropriate condition for this part

| Mark | Rank | 保証内容 Assurance condition | |
|---|---|---|---|
| ◯ | RA 2 | 2回のリフローによる加熱に耐えることが保証できます<br>Assures enduring 2 times reflow heat | |
| | RA 1 | 2回のリフローによる加熱に耐える実力があります<br>Has ability of enduring 2 times reflow heat | |
| | RB 2 | 1回のリフローによる加熱に耐えることが保証できます<br>Assures enduring 1 time reflow heat | |
| | RB 1 | 1回のリフローによる加熱に耐える実力があります<br>Has ability of enduring 1 time reflow heat | |
| | RC | 指定のプロファイル以下であれば保証可能です<br>Possible to assure under specified profile | プロファイルはP　に提示してあります<br>Profile is written in page |
| | RN | リフローに対応する品種ではありません<br>This part is not reflow part | |



1-2　鉛入り半田によるリフロー半田付けの温度プロファイル　　　一部材の表面温度
Temperature profile of reflow soldering for Pb solder　　Temperature of the part surface
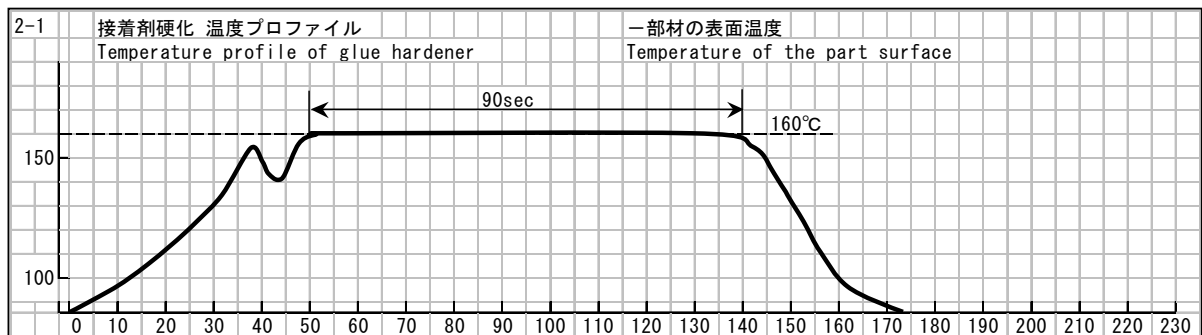ピーク温度　Peak temperature　240℃
235℃ 10sec
210℃ 30sec
200℃ 40sec
180℃ 90sec

2-1 接着剤硬化の温度条件(RD／AX部品は、この条件を満足しなければならない)
Temperature profile of glue hardener (RD/AX parts must satisfy this condition)
要求された温度プロファイルに関し、この部材は、
Mark the appropriate condition for this part

| Mark | Rank | 保証内容 Assurance condition | |
|---|---|---|---|
| ◯ | HA 2 | 要求された条件の加熱に耐えることが保証できます<br>Assures enduring required heat profile | |
| | HA 1 | 要求された条件の加熱に耐える実力があります<br>Has ability of enduring required heat profile | |
| | HC | 指定のプロファイル以下であれば保証可能です<br>Possible to assure under specified profile | プロファイルはP　に提示してあります<br>Profile is written in page |
| | | | |



2-1　接着剤硬化 温度プロファイル　　　一部材の表面温度
Temperature profile of glue hardener　　Temperature of the part surface
90sec
160℃

3-1 フロー半田付けの温度条件
　　Temperature profile of flow soldering
　　要求された温度プロファイルで半田付けすることに関し、この部材は、
　　Mark the appropriate condition for this part

| Mark | Rank | 保証内容 Assurance condition | |
|---|---|---|---|
| | FA 2 | フローによる加熱に耐えることが保証できます<br>Assures enduring heat by flow | |
| | FA 1 | フローによる加熱に耐える実力があります<br>Has ability of enduring heat by flow | |
| | FC | 指定のプロファイル以下であれば保証可能です<br>Possible to assure under specified profile | プロファイルはP　に提示してあります<br>Profile is written in page |
| ◯ | FN | フローに対応する品種ではありません<br>This part is not flow part | |



3-1　フロー半田付け 温度プロファイル
Temperature profile of flow soldering
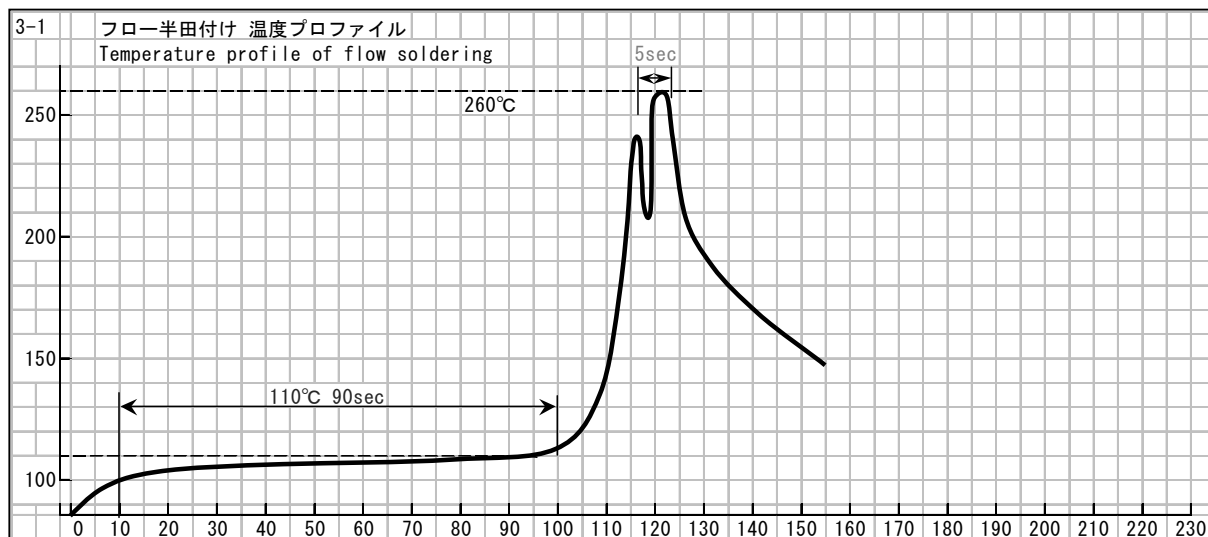
4-1 半田こてによる半田付け温度条件
　　Temperature profile of soldering with soldering iron
　　要求された温度条件で半田付けすることに関し、この部材は、
　　半田付け部分の加熱条件で表現すると
　　Mark the appropriate condition for this part
　　Express the heat condition of soldering point

| Mark | Rank | 保証内容 Assurance condition | |
|---|---|---|---|
| | MA | Max 380℃ × 3Secを保証できます<br>Assure Max 380℃ × 3Sec | |
| ◯ | MB 2 | Max 350℃ × 3Secを保証できます<br>Assure Max 350℃ × 3Sec | |
| | MB 1 | Max 300℃ × 3Secを保証できます<br>Assure Max 300℃ × 3Sec | |
| | MC | 指定の条件であれば保証可能です<br>Possible to assure under specified profile | Max　　℃ × Sec<br><br>注意点としては、<br>Caution |
| | MN | NG | |

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# TAPING SPECIFICATION

## Ⅰ. Application

This standard will apply to　3.2×2.5　Ceramic package.
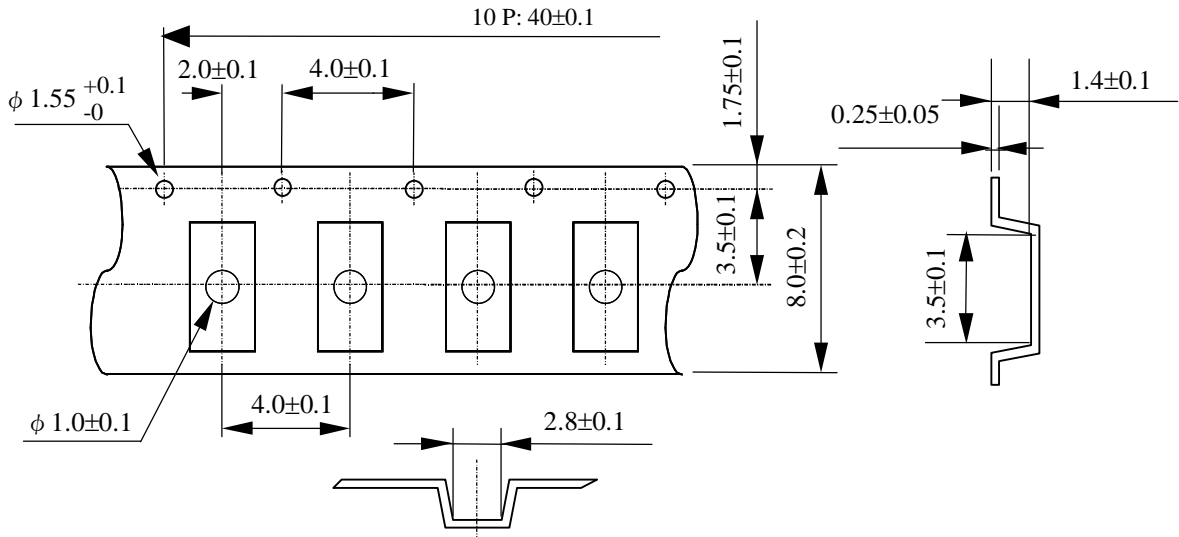Spec：CE package

## Ⅱ. Contents

〔1〕 Taping specification
Subject to 「EIA-481」 and 「IEC-60286」

(1) Tape dimensions

Material of the carrier tape : ＰＳ
Material of the top tape : PET+PE
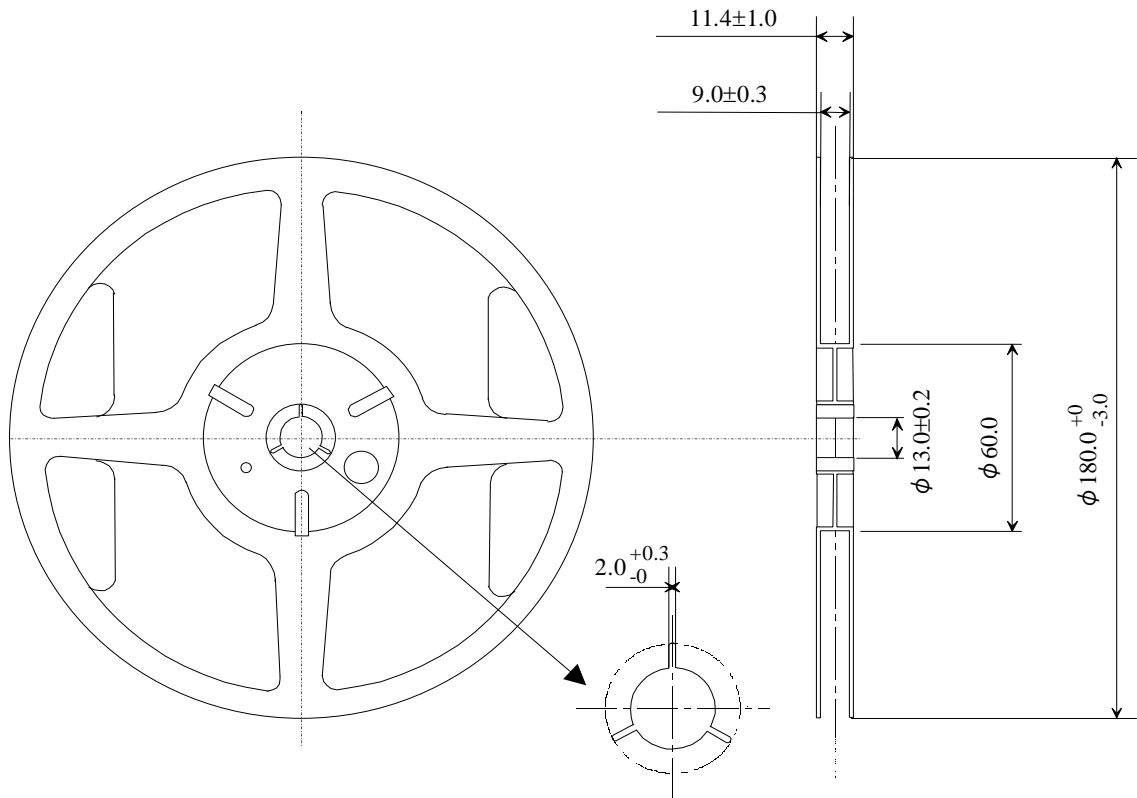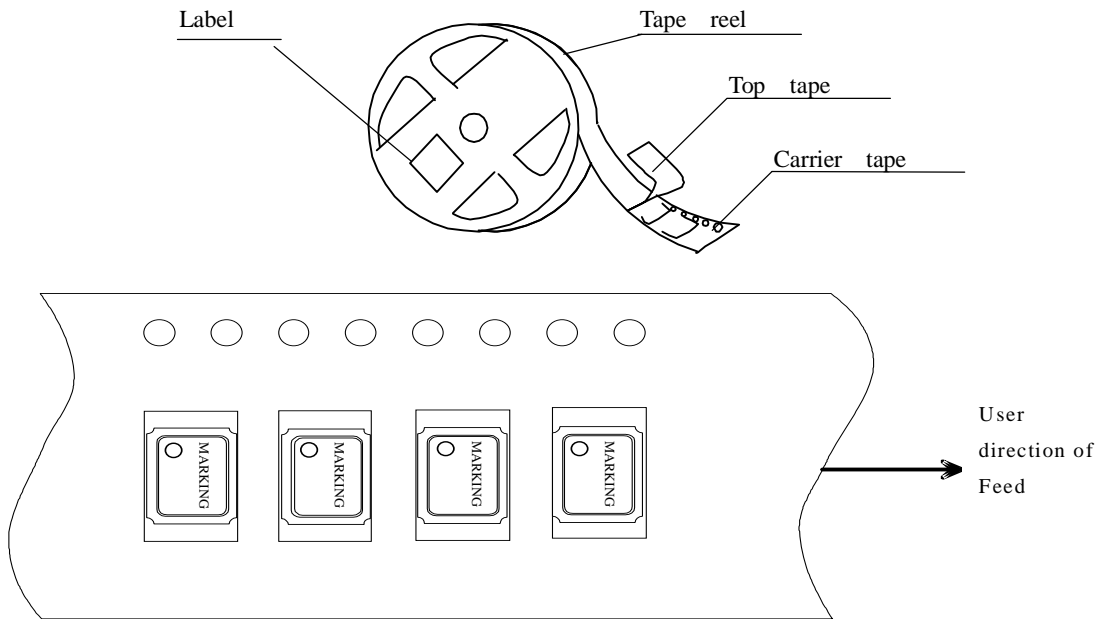
10 P: 40±0.1

2.0±0.1  4.0±0.1

$\phi$ 1.55 $^{+0.1}_{-0}$

1.75±0.1

1.4±0.1

0.25±0.05

3.5±0.1

8.0±0.2

3.5±0.1

$\phi$ 1.0±0.1

4.0±0.1

2.8±0.1

Unit : mm

(2) Reel dimensions

Material of the reel : Conductive polystyrene

11.4±1.0

9.0±0.3

$\phi$ 13.0±0.2

$\phi$ 60.0

$\phi$ 180.0 $^{+0}_{-3.0}$

2.0 $^{+0.3}_{-0}$

P. 1

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(3) Packing

①Tape & reel

Label

Tape reel

Top tape

Carrier tape

MARKING MARKING MARKING MARKING

User direction of Feed

②Start & end point

End

Start

Empty pocket
Reel side

User direction of feed
tape trailer side

Empty pocket

Top tape
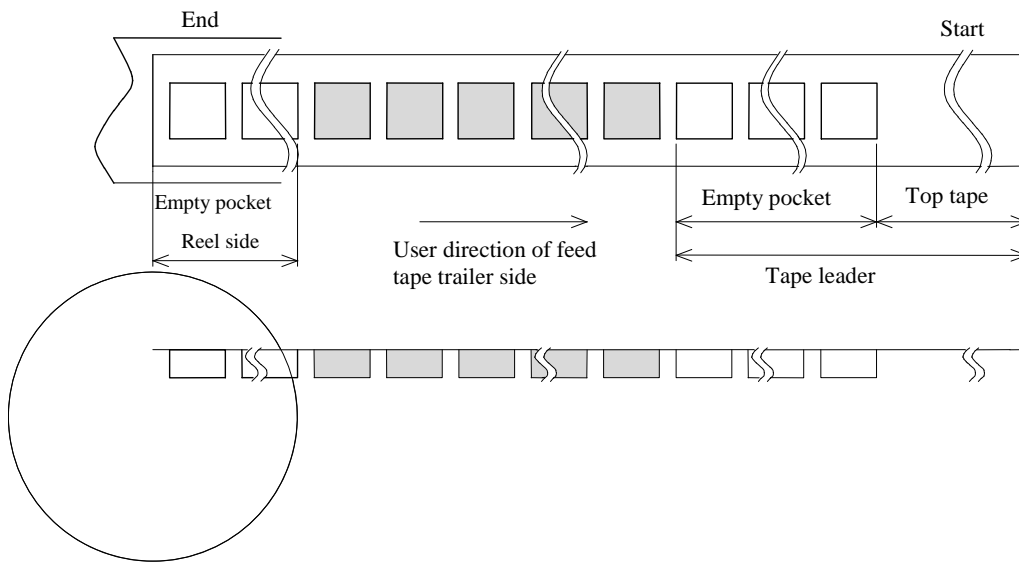
Tape leader

| | Item | Empty space |
|---|---|---|
| Tape leader | Top tape | Min. 1 000 mm |
| | Carrier tape | Min. 160 mm |
| Tape trailer | Top tape | Min. 0 mm |
| | Carrier tape | Min. 160 mm |

〔2〕 Inner carton

a) Packing to antistatic bag

Sealing

Antistatic Bag

Desiccant

Label
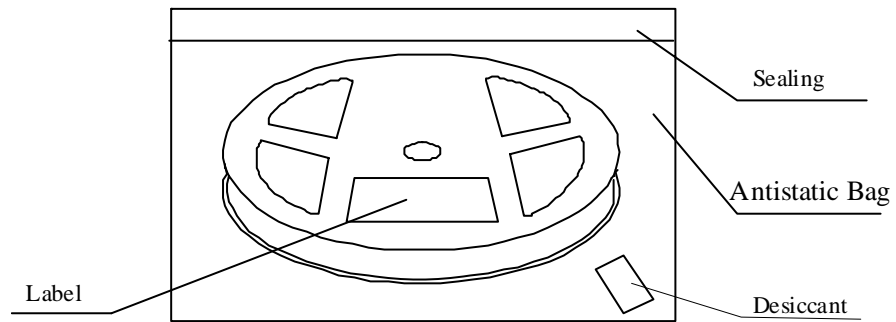
b) Packing to inner carton

Label

〔3〕 Shipping carton

Taping

Label
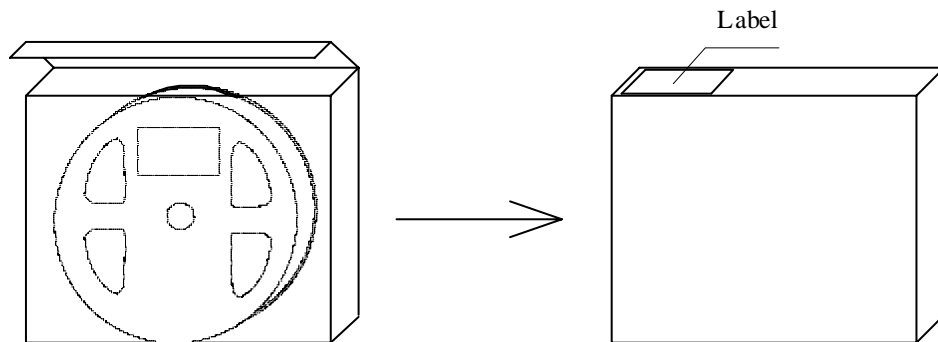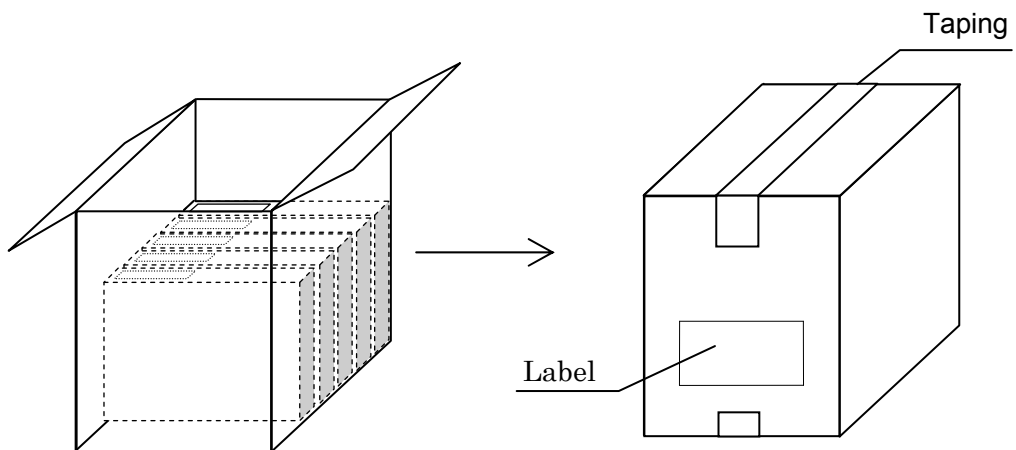
〔4〕 Marking

(1) Reel marking
・Reel marking shall consist of :

1) Parts name
2) Quantity
3) Manufacturing date or symbol
4) Manufacturer's date or symbol
5) Others (if necessary)

(2) Inner carton marking
・Same as reel marking.

(3) Shipping carton marking
・Shipping carton marking shall consist of :

1) Parts name
2) Quantity

〔5〕 Quantity
・Max :2,000 pcs./reel

〔6〕 Storage environment
(1) Before open the packing, we recommend to keep less than +30 °C and 85 %RH of Humidity, and to use it less than 6 months after delivery.
(2) We recommend to open Package in immediately before use.
After open Package, We recommend to keeps less than 6 month. No need dry air before soldering work if it is less than temperature +30 °C, 85 humidity %RH.
(3) Not to expose the sun.
(4) Not to storage with some erosive chemicals.
(5) Nothing is allowed to put on the reel or carton to prevent mechanical damage.

〔7〕 Handling
・To handle with care to prevent the damage of tape, reel and products.

## Structure diagram

### Structure diagram RA8900CE
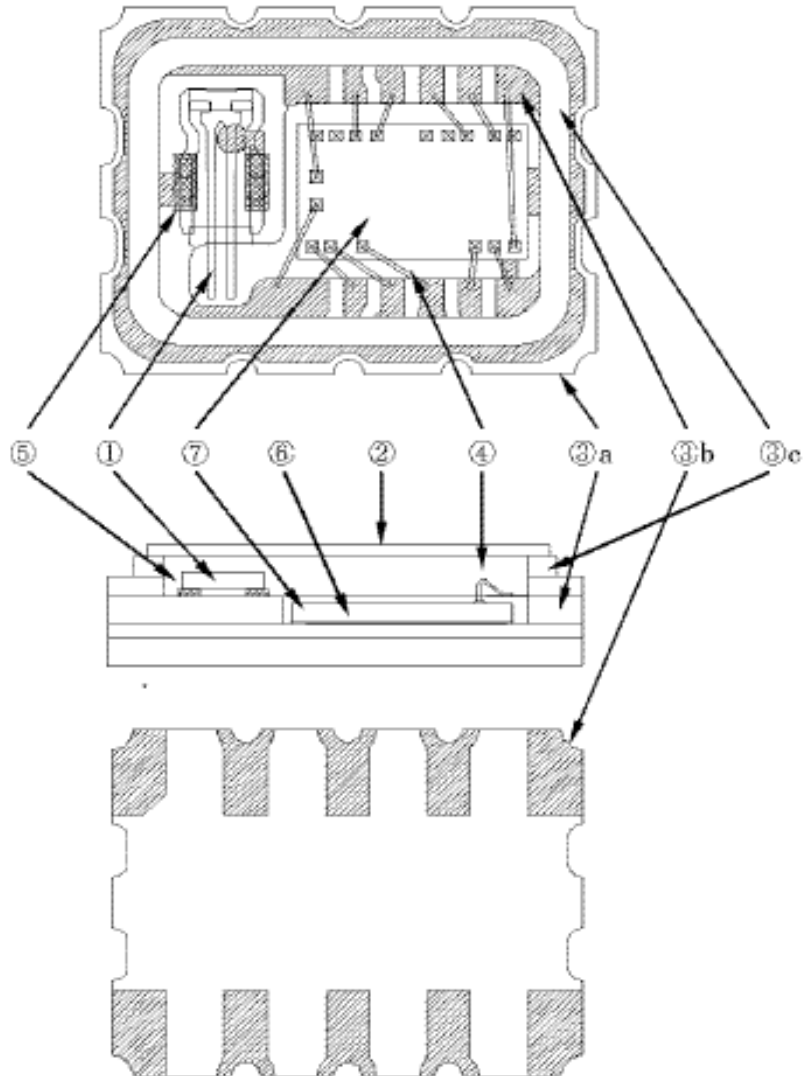


| LIST | | | |
|---|---|---|---|
| **No.** | **Site No.** | **Measurement site** | **Material** |
| ① | 1-1 | Crystal Chip(Blank) | Quartz |
| | 1-2 | Crystal Chip(Under Electrode) | Cr |
| | 1-3 | Crystal Chip(Electrode) | Au |
| ② | 2-1 | Lid(Alloy) | Highly alloy |
| | 2-2 | Lid(Ni Pating) | Ni |
| ③a | 3-1 | Base(Ceramic) | Ceramic |
| ③b | 3-2 | Base(Metalize) | Other nonferrous metals |
| ③b | 3-3 | Base(Brazing Mateial) | Other special metals |
| ③c | 3-4 | Base(Seal Ring) | Highly alloy |
| ③b | 3-5 | Base(Ni Plating) | Ni |
| ③b | 3-6 | Base(Au Plating) | Au |
| ④ | 4-1 | Bonding Wire | Au |
| ⑤ | 5-1 | Adhesive for Crystal Chip | Ag Paste |
| ⑥ | 6-1 | Adhesive for IC Chip | Ag Paste |
| ⑦ | 7-1 | IC Chip(Terminal Plating) | Silicon |

## Reliability test data

RELIABILITY TEST DATA
### Product Name : RA8900CE

The Company evaluation condition

We evaluate environmental and mechanical characteristics by the following test condition .  **No. F-R-1305-00-001EES**

| No. | ITEM | TEST CONDITIONS | $\Delta f/f$ *2 $[1 \times 10^{-6}]$ | Electrical characteristics | TEST Qty [ n ] | FAIL Qty [ n ] |
|---|---|---|---|---|---|---|
| | | | VALUE *1 | | | |
| 1 | High temperature storage | +125 °C × 1 000 h | *3 ± 50 | | 22 | 0 |
| 2 | Low temperature storage | -55 °C × 1 000 h | *3 ± 10 | | 22 | 0 |
| 3 | High temperature bias | +85 °C × 5.5 V × 1 000 h | *3 ± 20 | | 22 | 0 |
| 4 | Low temperature bias | -40 °C × 5.5 V × 1 000 h | *3 ± 10 | | 22 | 0 |
| 5 | Temperature humidity bias | +85 °C × 85 %RH × 5.5 V × 1 000 h | *3 ± 20 | Satisfy specification after test | 22 | 0 |
| 6 | Temperature cycle | -55 °C ⇔ +125 °C 30 min at each temp. 100 cycles | *3 ± 10 | | 22 | 0 |
| 7 | Resistance to soldering heat | For convention reflow soldering furnace (3 times) Follow JEDEC J-STD-020D.1 | ± 8 | | 22 | 0 |
| 8 | Shock | Free drop from 750 mm height on a hard wooden board for 3 times (Board is thickness more than 30 mm) | ± 5 | | 22 | 0 |
| 9 | Vibration | 10 Hz to 55 Hz amplitude 0.75 mm 55 Hz to 500 Hz acceleration 98 m/s² 10 Hz → 500 Hz → 10 Hz 15 min/cycle 6 h (2 h × 3 directions) | ± 5 | | 22 | 0 |
| 10 | Solderability | Dip termination into solder bath at +235 °C ± 5 °C for 5 s (Using Rosin Flux) | Termination must be 95 % covered with fresh solder | | 11 | 0 |

Notes
*1 Each test done independently.
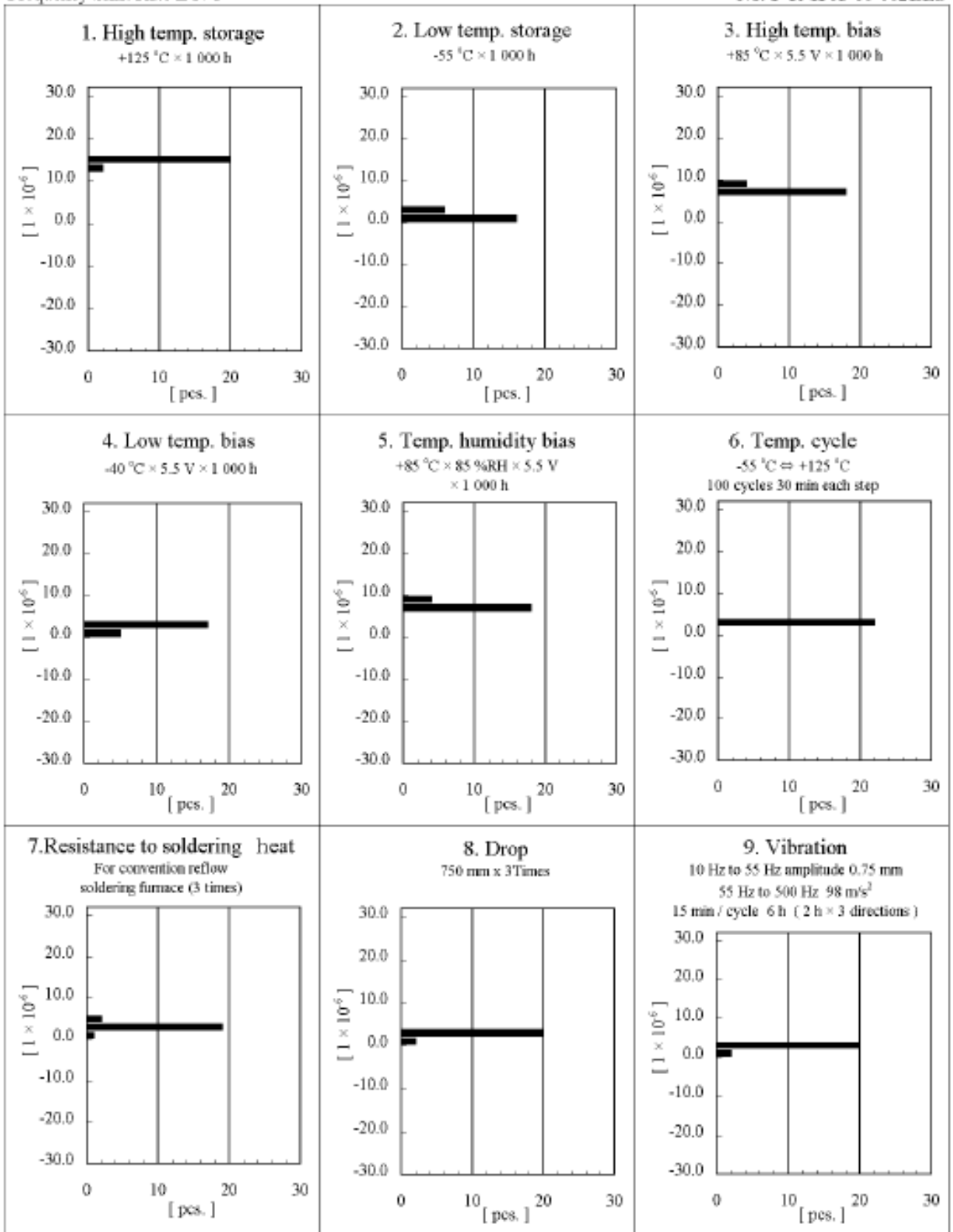*2 Measuring 2 h to 24 h later leaving in room temperature after each test.
*3 Pre-conditions (Dry +125°Cx24h→ high temp & humidity +85°Cx85%RHx168h→Reflow 3times) should be
   performed before each tests. Pre conditionings Initial value shall be after 24 h at room temperature.

Qualification Data

**Product Name** : **RA8900CE**

Frequency Shift Rate Δ f / f

### 1. High temp. storage
+125 °C × 1 000 h



### 2. Low temp. storage
-55 °C × 1 000 h



### 3. High temp. bias
+85 °C × 5.5 V × 1 000 h



### 4. Low temp. bias
-40 °C × 5.5 V × 1 000 h



### 5. Temp. humidity bias
+85 °C × 85 %RH × 5.5 V × 1 000 h



### 6. Temp. cycle
-55 °C ⇔ +125 °C
100 cycles 30 min each step



### 7. Resistance to soldering heat
For convention reflow soldering furnace (3 times)



### 8. Drop
750 mm x 3Times



### 9. Vibration
10 Hz to 55 Hz amplitude 0.75 mm
55 Hz to 500 Hz 98 m/s²
15 min / cycle 6 h ( 2 h × 3 directions )



**Qualification Data**

# Reliability test data Failure rate

## ATTN : ALPINE ELECTRONICS(CHINA)CO.,LTD.Dalian R&D Center

### Failure rate

The parts failure rate for real time clock module are following.

Failure rate can be calculated with high temperature test result of +125 °C.

The calculate procedure of Failure rate is as follows.

RA8900CE showed no failure during our with high temperature test result of +125 °C.

$$\text{Failure rate} = \frac{0.917}{2.2 \times 10^4 \times 578.72}$$

$$= 72.0 \text{ FIT}$$

Total operating time ; $2.2 \times 10^4$

Acceleration factor ; 578.72

Reliability level ; 60 %(at +25 °C)

# Reel marking label

## Reel marking lable

### Example of label

| RIAL TIME CLOCK MODULE | | |
|---|---|---|
| P/N 12345678901234567890 | P/O 12345678901234567890 | |
| RA8900CE　UB | | LF |
| LOT NO. Q123456789-001 | Q'TY | 2,000 pcs |
| WEEK CODE: / 44HL | X1B000271A00200　09 | 2014.05.30 |
| SEIKO EPSON CORP | MADE IN: MALAYSIA | |

| ① | | |
|---|---|---|
| ② | | ③ |
| ④ | | |
| ⑤ | | ⑥ |
| ⑦ | | ⑧ |
| ⑨ | ⑩ | |

| | Item | Contents | | | |
|---|---|---|---|---|---|
| ① | PRODUCT NAME | Crystal unit | — | QUARTZ CRYSTAL | |
| | | Crystal oscillator | — | CRYSTAL OSCILLATOR | |
| | | Real time clock module | — | RIAL TIME CLOCK MODULE | |
| ② | P/N | Customer Part Number | | | |
| ③ | P/O | Purchase Order Nubmer | | | |
| ④ | TYPE、FREQENCY、SPEC | Seko Epson Products Name, Frequency, Spec. | | | LF(Lead free) |
| ⑤ | LOT NO. | Sipping Lot Number | | | |
| ⑥ | QUANTITY | Quantity | | | |
| ⑦ | WEEK CODE | Week Code Oldest/Newest | | | |
| ⑧ | HIM CODE、PACK、ShipDate | Seiko Epson Parts Number, Packing Code, Ship Date | | | |
| ⑨ | Shpper Name | | | | |
| ⑩ | Coutry of Origin | | | | |