

## Reset Timer IC for Mobile Equipment

NO.EA-418-180810

### OVERVIEW

The R3201L is a reset timer IC for mobile equipment featuring a shipping mode. This device can detect an external adaptor by the TAIN input signal.

### KEY BENEFITS

- Setting shipping mode provides to improve the battery's consumption at shipping a terminal equipment.
- Despite its extensive functions, achieve 0.35  $\mu$ A low supply current.

### KEY SPECIFICATIONS

- Operating Voltage Range (Max. Rating): 2.2 V to 5.5 V (12.0V)
- Supply Current (at Standby / Shipping mode): Typ.0.35  $\mu$ A
- Operating Temperature Range: -40°C to 85°C
- Reset Request Time: Refer to *Optional Function* for details.
- Reset Request Time Accuracy:  $\pm 10\%$
- Reset Time: Typ.0.4s
- Reset Time Accuracy:  $\pm 10\%$
- Shipping Mode Entry Delay Time (Input pin: OFF): Typ.15 s
- Shipping Mode Entry Command (Input pin: OFF): 5 cycles
- Shipping Mode Exit Delay Time (Input pin: RST0): Typ.2 s
- Output Type (Output pin: SRO, nSRO, DCHGx): Nch. Open Drain and CMOS

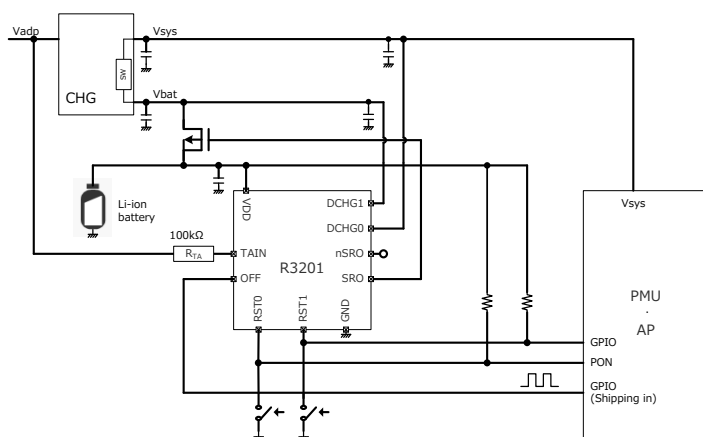
### OPTIONAL FUNCTION

| Product Name    | Package      |
|-----------------|--------------|
| R3201Lxxx * -E2 | QFN014018-10 |

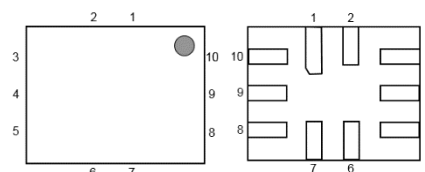
xxx: Specify a delay time for reset signal.

| xxx | Reset Request Time |
|-----|--------------------|
| 001 | 8 s                |
| 002 | 10 s               |
| 003 | 12 s               |
| 004 | 16 s               |

### TYPICAL APPLICATIONS



### PACKAGE



**QFN014018-10**

1.40mm x 1.80 mm,  
t = 0.4 mm (Max.)

### APPLICATIONS

- Battery-powered mobile equipments
- Audio, Home-use electrical medical, and Image processing devices
- Mobile phone, Smartphone, and Wearable devices
- Portable games

# R3201L

NO.EA-418-180810

## SELECTION GUIDE

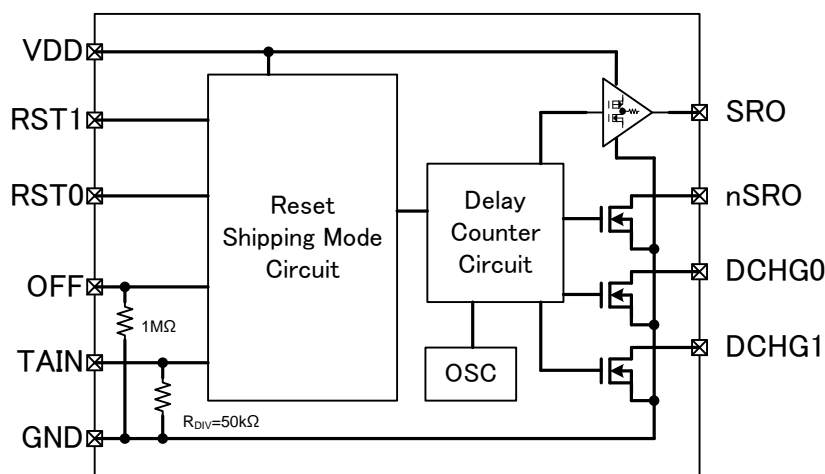
| Product Name  | Package      | Quantity per Reel | Pb Free | Halogen Free |
|---------------|--------------|-------------------|---------|--------------|
| R3201Lxxx*-E2 | QFN014018-10 | 5,000 pcs         | Yes     | Yes          |

xxx : Reset request time

- 001: 8 s
- 002: 10 s
- 003: 12 s
- 004: 16 s

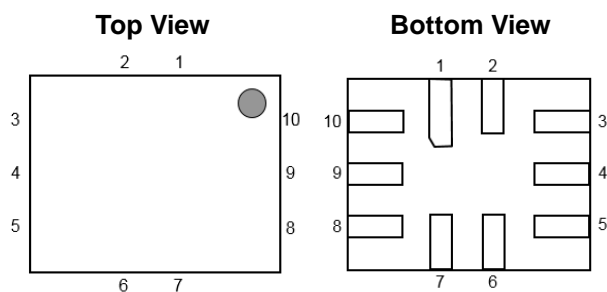
\* : Output Type  
A: Nch Open-drain

## BLOCK DIAGRAM



R3201L00xA Block Diagram

## PIN DESCRIPTIONS



**R3201L (QFN014018-10) Pin Configuration**

### R3201L Pin Descriptions

| Pin No. | Symbol | Description  |
|---------|--------|--|
| 1       | DCHG1  | Discharge output pin 1 (Nch. open-drain output) <sup>(1)</sup> |
| 2       | TAIN   | Adaptor insert detection pin                                   |
| 3       | VDD    | Power supply input pin   |
| 4       | RST0   | Reset request input pin 0, Active-low                          |
| 5       | RST1   | Reset request input pin 1 , Active-low                         |
| 6       | OFF    | Shipping mode enter command input pin <sup>(2)</sup>           |
| 7       | GND    | Ground pin   |
| 8       | SRO    | CMOS output pin, Active-high                                   |
| 9       | nSRO   | Nch open drain output pin, Active-low <sup>(3)</sup>           |
| 10      | DCHG0  | Discharge output pin 0 (Nch. open-drain output) <sup>(1)</sup> |

<sup>(1)</sup> The DCHG0 and DCHG1 pins must be connected to GND or left floating if it is not used.

<sup>(2)</sup> The OFF pin must be connected to GND if it is not used (shipping mode is not used).

<sup>(3)</sup> The nSRO pin must be connected to GND or left floating if it is not used.

## ABSOLUTE MAXIMUM RATINGS

### Absolute Maximum Ratings

| Symbol             | Item  | Rating                           | Unit |
|--------------------|---|----------------------------------|------|
| V <sub>DD</sub>    | Supply Voltage  | GND -0.3 to 12                   | V    |
| V <sub>RST0</sub>  | RST0 Pin Input Voltage (Input Pin-0)  | GND -0.3 to 12                   | V    |
| V <sub>RST1</sub>  | RST1 Pin Input Voltage (Input Pin-1)  | GND -0.3 to 12                   | V    |
| V <sub>SRO</sub>   | SRO Pin Output Voltage (Reset Signal Output Pin-0)                                  | GND -0.3 to V <sub>DD</sub> +0.3 | V    |
| V <sub>nSRO</sub>  | nSRO Pin Output Voltage (Reset Signal Output Pin-1)                                 | GND -0.3 to 6                    | V    |
| V <sub>TAIN</sub>  | TAIN Pin Input Voltage <sup>(1)</sup>   | GND -0.3 to 12                   | V    |
| V <sub>OFF</sub>   | OFF Pin Input Voltage   | GND -0.3 to 6                    | V    |
| V <sub>DCHG0</sub> | DCHG0 Pin Output Voltage  | GND -0.3 to 12                   | V    |
| V <sub>DCHG1</sub> | DCHG1 Pin Output Voltage  | GND -0.3 to 12                   | V    |
| P <sub>D</sub>     | Power Dissipation <sup>(2)</sup><br>(QFN014018-10, EDEC STD.51-7 Test Land Pattern) | 625                              | mW   |
| T <sub>j</sub>     | Junction Temperature Range  | -40 to 125                       | °C   |
| T <sub>stg</sub>   | Storage Temperature Range   | -55 to 125                       | °C   |

### ABSOLUTE MAXIMUM RATINGS

Electronic and mechanical stress momentarily exceeded absolute maximum ratings may cause the permanent damages and may degrade the life time and safety for both device and system using the device in the field. The functional operation at or over these absolute maximum ratings are not assured.

## RECOMMENDED OPERATING CONDITIONS

### Recommended Operating Conditions

| Symbol          | Item                        | Rating     | Unit |
|-----------------|-----------------------------|------------|------|
| V <sub>DD</sub> | Supply Voltage              | 2.2 to 5.5 | V    |
| T <sub>a</sub>  | Operating Temperature Range | -40 to 85  | °C   |

### RECOMMENDED OPERATING CONDITIONS

All of electronic equipment should be designed that the mounted semiconductor devices operate within the recommended operating conditions. The semiconductor devices cannot operate normally over the recommended operating conditions, even if when they are used over such conditions by momentary electronic noise or surge. And the semiconductor devices may receive serious damage when they continue to operate over the recommended operating conditions. The device electrical characteristics up to 125°C are evaluated at preproduction.

<sup>(1)</sup> Refer to *TAIN Test Circuit* information.

<sup>(2)</sup> Refer to *POWER DISSIPATION* for detailed information.

## ELECTRICAL CHARACTERISTICS

The specifications surrounded by   are guaranteed by design engineering at  $-40^{\circ}\text{C} \leq T_a \leq 85^{\circ}\text{C}$ .

### R3201L Electrical Characteristics

( $T_a = 25^{\circ}\text{C}$ )

| Symbol    | Item  | Conditions  | Min.   | Typ. | Max.  | Unit          |
|-----------|---|---|--|------|---|---------------|
| $I_{SS1}$ | Supply current 1 <sup>(1)</sup>                 | $V_{DD} = 4.0\text{ V}$ (at standby)                                    |  | 0.35 | <span style="border: 1px solid black; padding: 0 2px;">1.0</span> | $\mu\text{A}$ |
| $I_{SS2}$ | Supply current 2 <sup>(2)</sup>                 | $V_{DD} = 4.0\text{ V}$ (at active reset counter & reset signal output) |  | 3    | <span style="border: 1px solid black; padding: 0 2px;">10</span>  | $\mu\text{A}$ |
| $I_{SS3}$ | Supply current 3 <sup>(3)</sup>                 | $V_{DD} = 4.0\text{ V}$ (at active after reset signal output)           |  | 0.4  | <span style="border: 1px solid black; padding: 0 2px;">1.7</span> | $\mu\text{A}$ |
| $V_{IL1}$ | RST0/RST1 input voltage, low                    |   |  |      | <span style="border: 1px solid black; padding: 0 2px;">0.3</span> | V             |
| $V_{IH1}$ | RST0/RST1 input voltage, high                   |   | <span style="border: 1px solid black; padding: 0 2px;">1.15</span> |      | $V_{DD}$  | V             |
| $V_{IL2}$ | OFF input voltage, low                          |   |  |      | <span style="border: 1px solid black; padding: 0 2px;">0.4</span> | V             |
| $V_{IH2}$ | OFF input voltage, high                         |   | <span style="border: 1px solid black; padding: 0 2px;">1.0</span>  |      | <span style="border: 1px solid black; padding: 0 2px;">5.5</span> | V             |
| $I_{IIL}$ | OFF (pull-down pin) input leakage current, low  | $V_I = 0\text{ V}$  | <span style="border: 1px solid black; padding: 0 2px;">-0.1</span> |      | <span style="border: 1px solid black; padding: 0 2px;">0.1</span> | $\mu\text{A}$ |
| $I_{IIH}$ | OFF (pull-down pin) input leakage current, high | $V_{DD} = 5.5\text{ V}$ , $V_I = V_{DD}$                                |  | 5.5  |   | $\mu\text{A}$ |
| $T_{DEB}$ | Debounce time of RST0/RST1                      |   |  | 10   |   | msec          |

### ■ RESET Operation

|             |   |  |  |     |  |               |
|-------------|---|--|--|-----|--|---------------|
| $T_R$       | Reset request time                                      | R3201L001                                    | <span style="border: 1px solid black; padding: 0 2px;">7.2</span>  | 8   | <span style="border: 1px solid black; padding: 0 2px;">8.8</span>  | sec           |
|             |   | R3201L002                                    | <span style="border: 1px solid black; padding: 0 2px;">9</span>    | 10  | <span style="border: 1px solid black; padding: 0 2px;">11</span>   |               |
|             |   | R3201L003                                    | <span style="border: 1px solid black; padding: 0 2px;">10.8</span> | 12  | <span style="border: 1px solid black; padding: 0 2px;">13.2</span> |               |
|             |   | R3201L004                                    | <span style="border: 1px solid black; padding: 0 2px;">14.4</span> | 16  | <span style="border: 1px solid black; padding: 0 2px;">17.6</span> |               |
| $T_D$       | Reset time  |  | <span style="border: 1px solid black; padding: 0 2px;">0.36</span> | 0.4 | <span style="border: 1px solid black; padding: 0 2px;">0.44</span> | sec           |
| $T_0$       | SRO output pin slew rate time (rising and falling time) | $V_{DD} = 4\text{ V}$ , $Q_g = 20\text{ nC}$ | <span style="border: 1px solid black; padding: 0 2px;">1</span>    | 2   | <span style="border: 1px solid black; padding: 0 2px;">3</span>    | msec          |
| $T_{DD}$    | Discharge active of DCHG0/1 delay time                  |  | <span style="border: 1px solid black; padding: 0 2px;">3</span>    | 4   | <span style="border: 1px solid black; padding: 0 2px;">5</span>    | msec          |
| $I_D$       | Discharge current of DCHG0/1                            | $V_{DD} = V_{DCHG0,1} = 4\text{ V}$          |  | 50  |  | mA            |
| $V_{OL}$    | nSRO output voltage, low                                | $I_{OL} = 2\text{ mA}$                       |  |     | <span style="border: 1px solid black; padding: 0 2px;">0.3</span>  | V             |
| $I_{LEAKO}$ | nSRO output leakage current                             | $V_{DD} = 5.5\text{ V}$                      |  |     | <span style="border: 1px solid black; padding: 0 2px;">0.1</span>  | $\mu\text{A}$ |

<sup>(1)</sup> Supply current when the device is active and waiting for the reset input.

<sup>(2)</sup> Supply current when the RST0 and RST1 input pins are low and the timer operation is running.

<sup>(3)</sup> Supply current after the automatic cancellation of reset signal following the completion of timer operation and the output of rest signal.

## R3201L

NO.EA-418-180810

The specifications surrounded by   are guaranteed by design engineering at  $-40^{\circ}\text{C} \leq T_a \leq 85^{\circ}\text{C}$ .

### R3201L Electrical Characteristics (Continued)

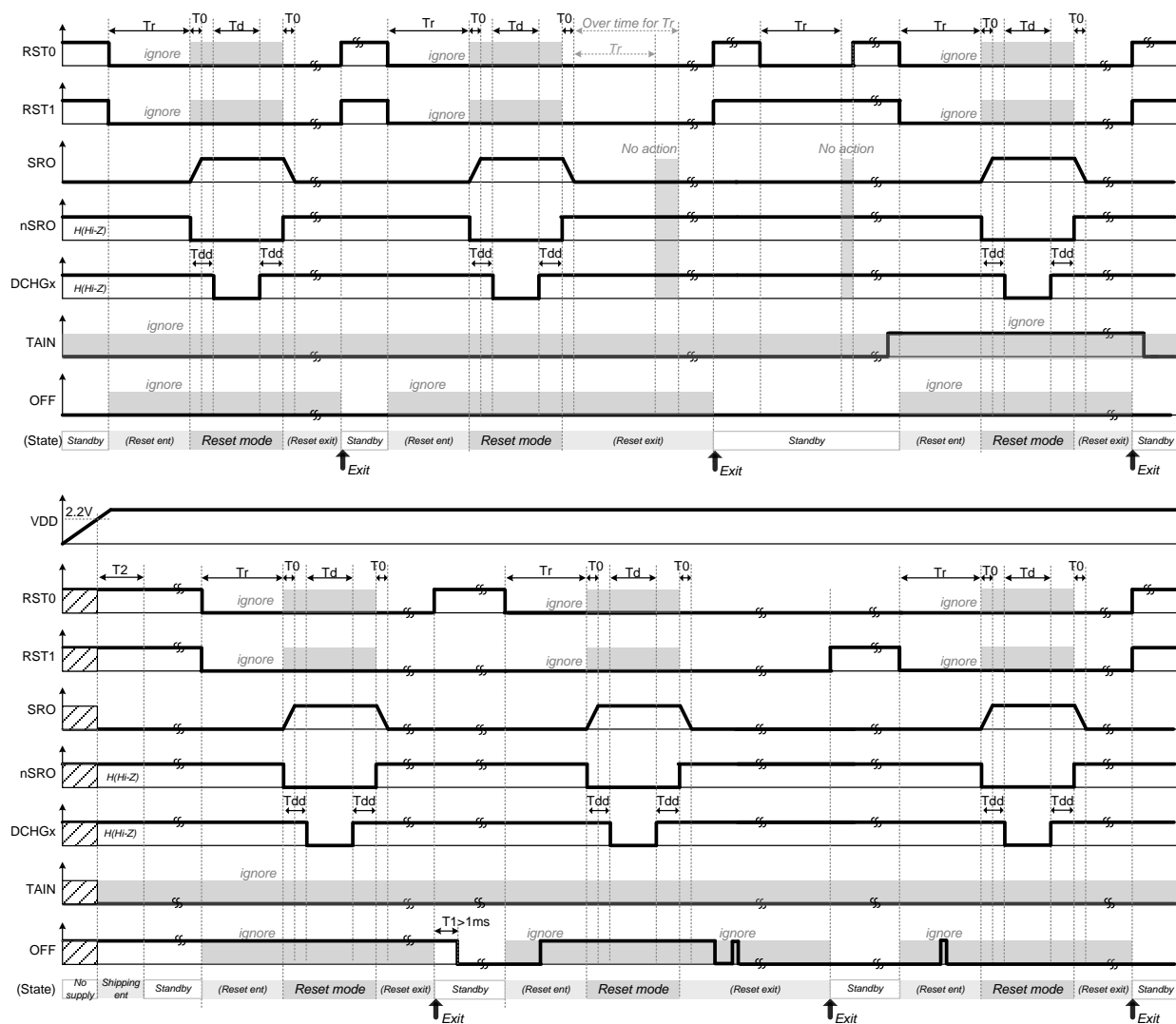
( $T_a = 25^{\circ}\text{C}$ )

| Symbol                           | Item  | Conditions  | Min.  | Typ. | Max.  | Unit          |
|----------------------------------|---|---|---|------|---|---------------|
| <b>■ TAIN Detect Operation</b>   |   |   |   |      |   |               |
| $V_{TA\_DET}$                    | Input detection voltage for $R_{TA}$          | $R_{TA} = 100\text{k}\Omega$ , $R_{DIV} = 50\text{k}\Omega$ | <span style="border: 1px solid black; padding: 0 2px;">2</span>   |      | <span style="border: 1px solid black; padding: 0 2px;">4.4</span> | V             |
| $V_{TA\_RELEASE}$                | Input release voltage for $R_{TA}$            | $R_{TA} = 100\text{k}\Omega$ , $R_{DIV} = 50\text{k}\Omega$ | <span style="border: 1px solid black; padding: 0 2px;">1</span>   |      | <span style="border: 1px solid black; padding: 0 2px;">3.4</span> | V             |
| $V_{TA\_HYS}$                    | Input hysteresis voltage for $R_{TA}$         | $R_{TA} = 100\text{k}\Omega$ , $R_{DIV} = 50\text{k}\Omega$ | <span style="border: 1px solid black; padding: 0 2px;">0.8</span> |      |   | V             |
| $T_{TA}$                         | TAIN input detection delay Time               |   | <span style="border: 1px solid black; padding: 0 2px;">20</span>  | 50   | <span style="border: 1px solid black; padding: 0 2px;">100</span> | ms            |
| <b>■ Shipping Mode Operation</b> |   |   |   |      |   |               |
| $T_S$                            | Shipping mode entry delay time                |   | <span style="border: 1px solid black; padding: 0 2px;">12</span>  | 15   | <span style="border: 1px solid black; padding: 0 2px;">18</span>  | sec           |
| $N_{OFF}$                        | Shipping mode entry command                   |   |   | 5    |   | Cycle         |
| $T_1$                            | HIGH and LOW hold time of OFF-pin input pulse |   | <span style="border: 1px solid black; padding: 0 2px;">1</span>   | 2    |   | msec          |
| $T_2$                            | Entry limited time at shipping mode           | Total 5 pulses Time of OFF-pin input pulse                  |   |      | <span style="border: 1px solid black; padding: 0 2px;">100</span> | msec          |
| $T_3$                            | Shipping mode exit delay time                 |   | <span style="border: 1px solid black; padding: 0 2px;">1.6</span> | 2    | <span style="border: 1px solid black; padding: 0 2px;">2.4</span> | sec           |
| $I_{OFF}$                        | Supply current at shipping mode               | $V_{DD} = 4.0\text{ V}$                                     |   | 0.35 | <span style="border: 1px solid black; padding: 0 2px;">1.0</span> | $\mu\text{A}$ |

All test items listed under *ELECTRICAL CHARACTERISTICS* are done under the pulse load condition ( $T_j \approx T_a = 25^{\circ}\text{C}$ ) except Supply Current 2.

## THEORY OF OPERATION

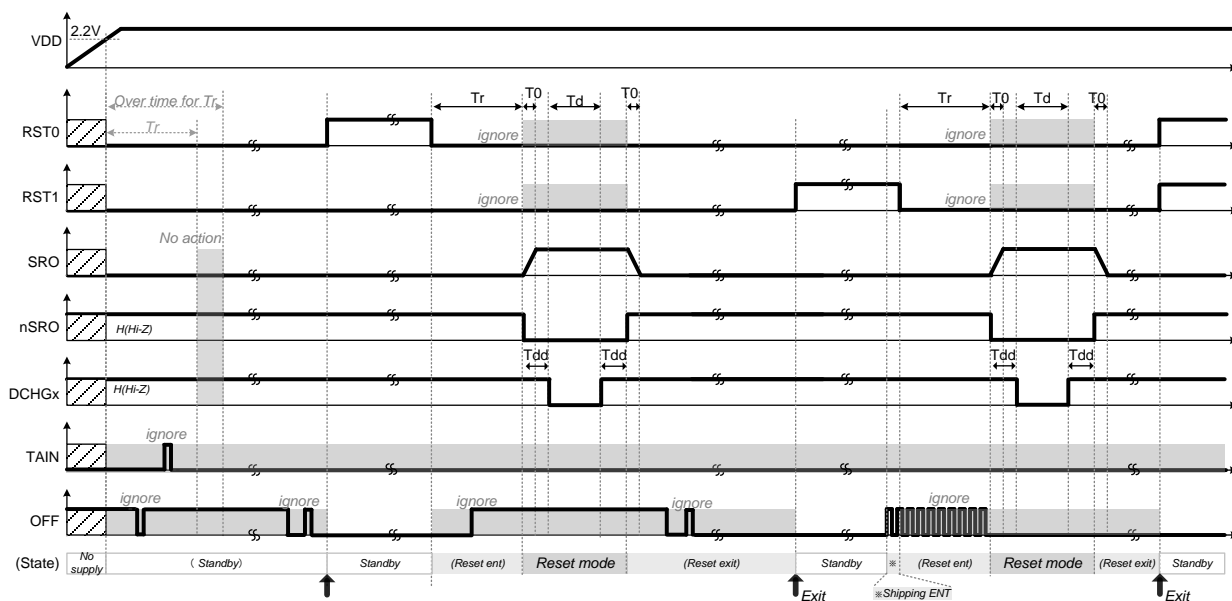
### Reset Operation-1



**Reset Timing Chart 1**

1. When both active-low input pins (RST0 and RST1) become Low level, Reset operation starts.
2. After the period of  $T_r$  time, R3201L enters into Reset mode.
3. If RST0 or RST1 becomes High level before Reset mode, reset operation will be cancelled.
4. Once the R3201L finishes the Reset mode, it keep same state (Reset exit state) as long as both RST0 and RST1 remain Low level.
5. In order to move to Standby, High level input is needed to RST0 or RST1.
6. The debounce time of RST0 and RST1 (L→H, H→L) is 10 [msec].

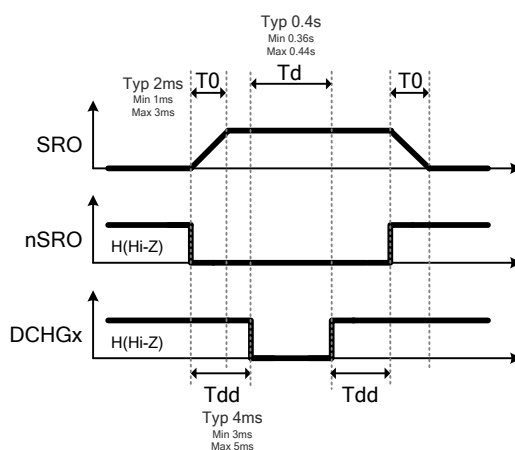
## Reset Operation-2



Reset Timing Chart 2

## SRO/ nSRO/ DCHGx Operation

SRO slew rate time, nSRO and Discharge ON/OFF timing (DCHGx) follow;



$Q_g = 20 \text{ nC}$  (external P-MOSFET @SRO pin control)

$$T_0 [\text{s}] = (Q_g / V_{DD}) \times (132\text{k}\Omega) \times 3 \quad \text{※}132\text{k}\Omega \cdots \text{IC internal resistance}$$

## SRO/ nSRO/ DCHGx Timing



The diagram illustrates the timing and state transitions for the 74VHC163 4-bit counter. The signals shown are RST0, RST1, SRO, nSRO, DCHGx, TAIN, and OFF. The state transitions are indicated by the (State) signal at the bottom.

**Timing Parameters:**

- $T_0$ : Delay from SRO to nSRO.
- $T_1$ : Delay from OFF to TAIN.
- $T_2$ : Delay from OFF to TAIN.
- $T_s$ : Setup time for TAIN.
- $T_{ta}$ : Turn-around time for TAIN.
- $T_3$ : Delay from OFF to TAIN.
- $T_r$ : Delay from OFF to TAIN.

**State Transitions:**

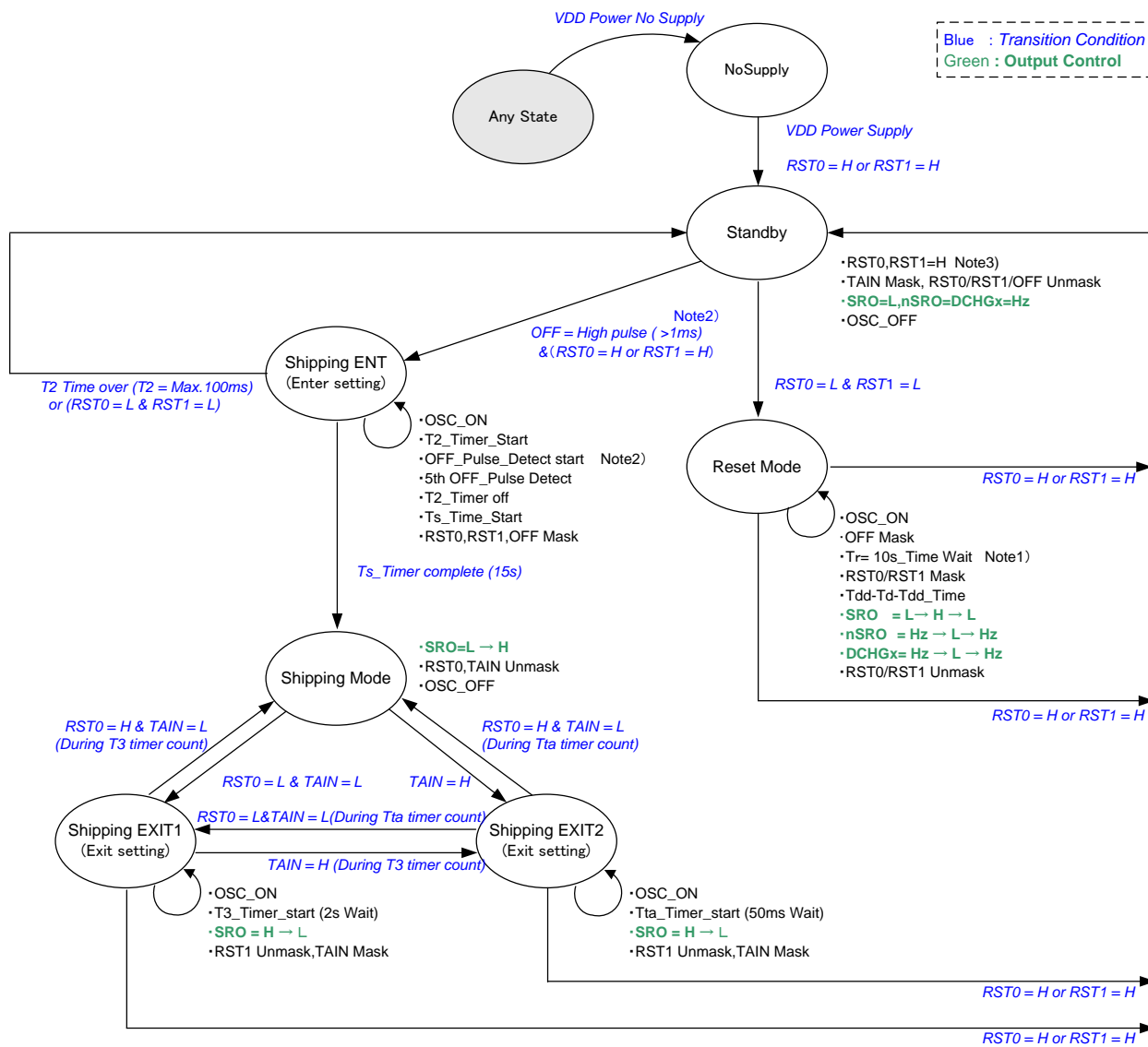
- Standby
- Shipping ENT
- Shipping Mode
- Shipping EXIT1
- Shipping EXIT2
- Standby

**Annotations:**

- ignore
- No action
- Exit
- to Shipping EXIT2 via Shipping Mode

1. If High Pulse to OFF-pin is input, when RST0 or RST1 input pins are High level, Shipping ENT starts.
2. During the period of T2 time, if both of RST0 and RST1 input pins become Low level, Shipping ENT stops, and Reset operation starts.
3. When the 5<sup>th</sup> Pulse input of OFF-pin (N<sub>OFF</sub>) is NOT inputted until T2 time, R3201L is NOT moved to the shipping mode by lack of the shipping mode setting request.
4. The setting condition priority of the shipping mode exit is higher TAIN detection (R<sub>TA</sub> input > min 4V) than RST0=L during T3 time.
5. The debounce time of RST0 and RST1 (L→H, H→L) is 10 [msec].

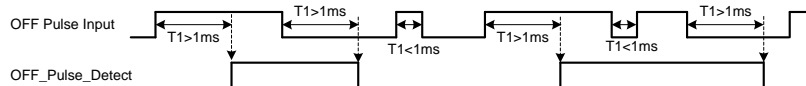
## State Diagram



Note1) 8s, 10s, 12s, 16s code selectable option

Note2) OFF input pin supports debounce function. The initial value in the debounce circuit is "OFF=L" at Power ON.

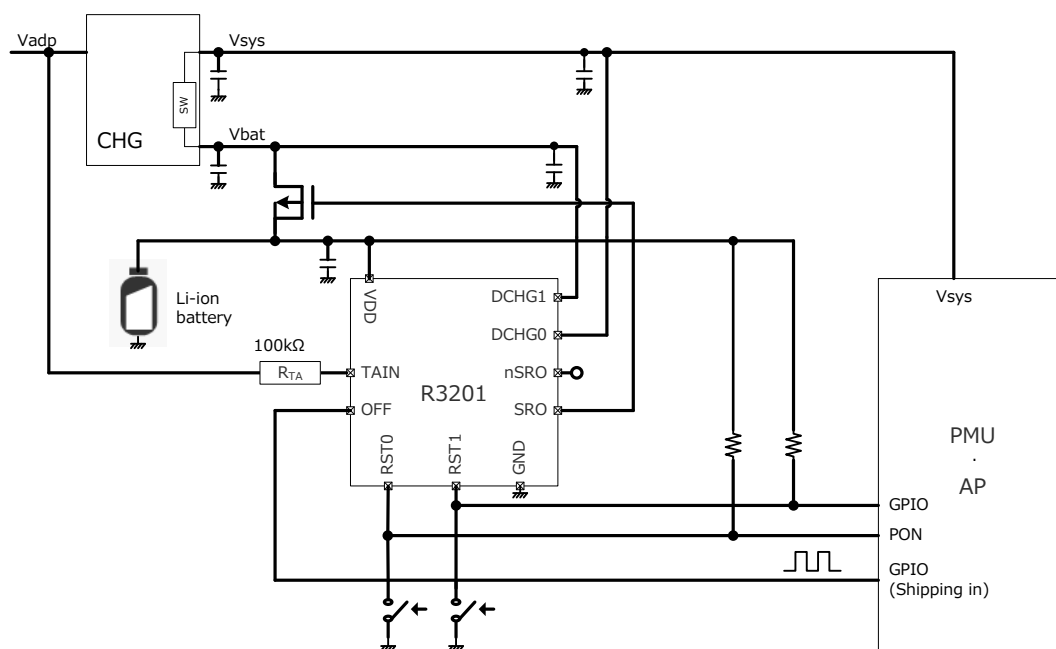
Input pulse width of OFF pin must be at least T1 time (min.1ms). If the pulse width is shorter than T1 time, R3201x may not be able to recognize pulse input. When the 5th Pulse input of OFF-pin is not inputted by T2 time, R3201x is not moved to the shipping mode by lack of the shipping mode setting request.



Note3) RST0/RST1 input pins support debounce function. Debounce circuit for RST0/RST1 is reset on transition to Standby state (except from Shipping ENT state). Initial values of debounce circuit are "H".

## APPLICATION INFORMATION

### Typical Application Circuit

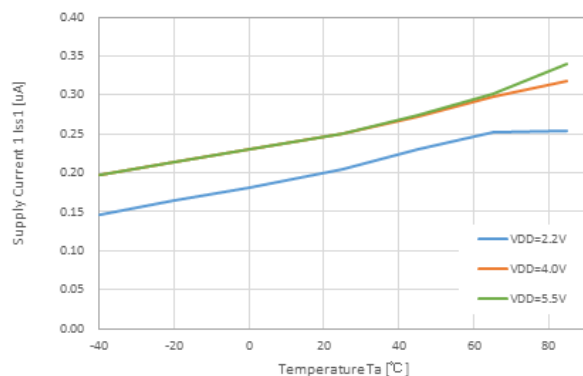


R3201L Typical Application Circuit

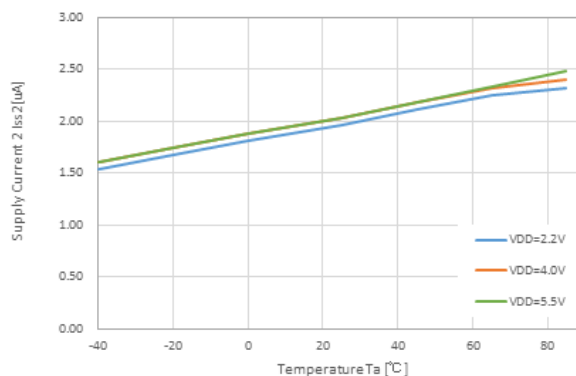
## TYPICAL CHARACTERISTICS

Note: Typical Characteristics are intended to be used as reference data, they are not guaranteed.

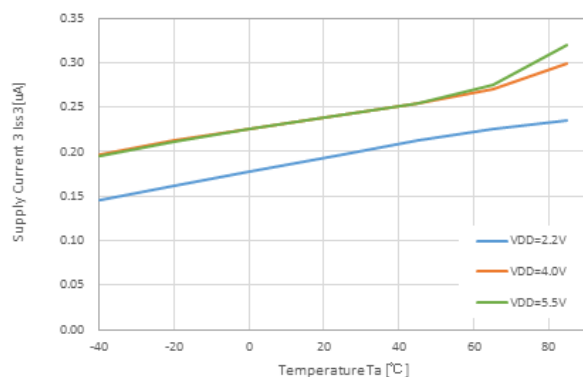
1) Supply Current 1  
R3201Lxxx



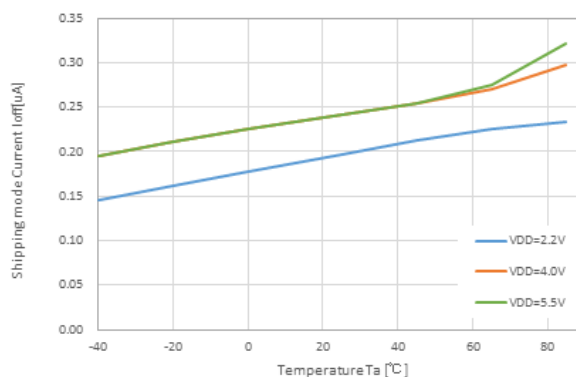
2) Supply Current 2  
R3201Lxxx



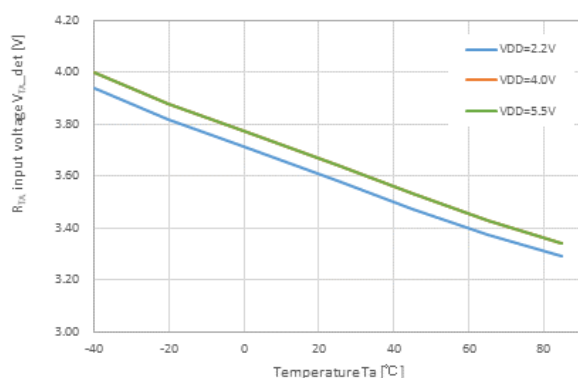
3) Supply Current 3  
R3201Lxxx



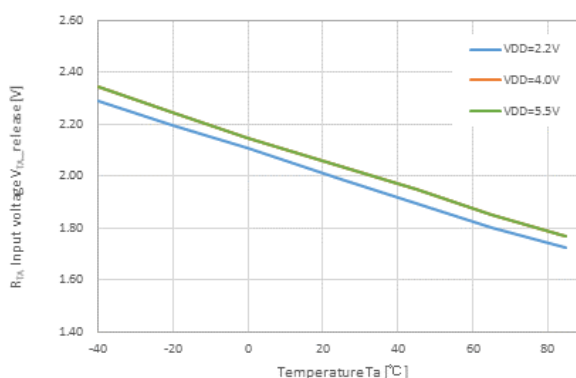
4) Supply Current at Shipping Mode  
R3201Lxxx



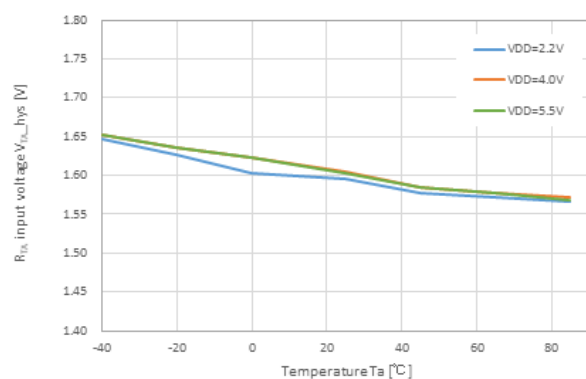
5)  $R_{TA}$  Input Detection Voltage  
R3201Lxxx



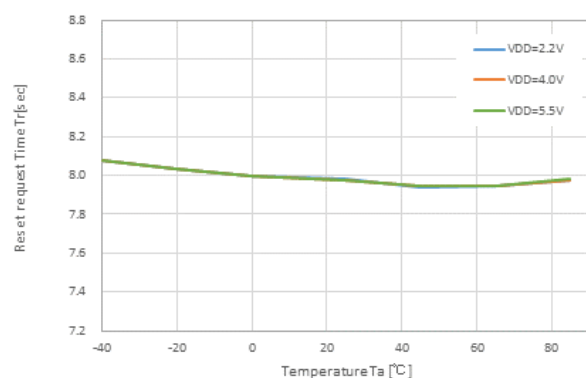
6)  $R_{TA}$  Input Release Voltage  
R3201Lxxx



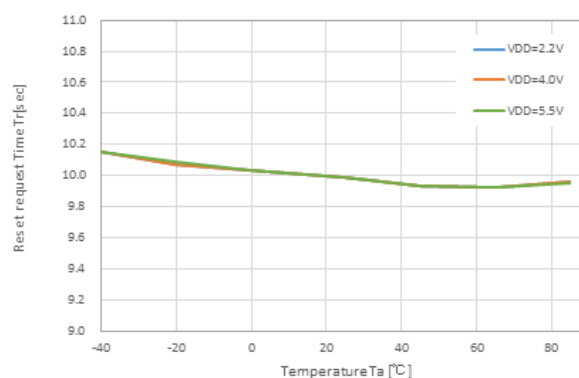
## 7) $R_{TA}$ Input Hysteresis Voltage R3201Lxxx



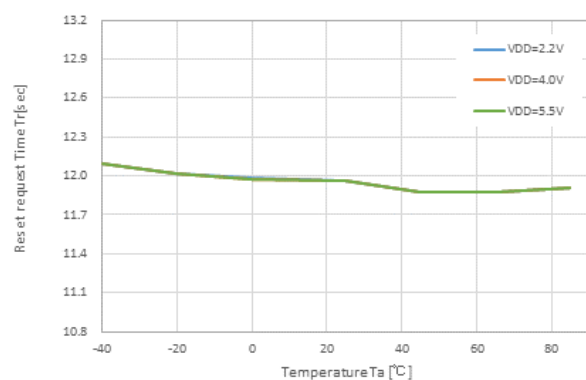
## 8) Reset Request Time R3201Lxx1(8s)



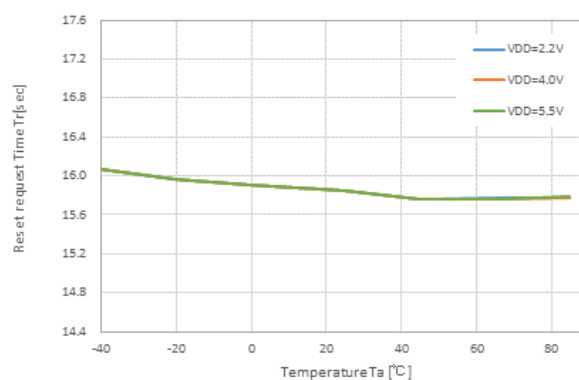
## R3201Lxx2(10s)



## R3201Lxx3(12s)



## R3201Lxx4(16s)



The power dissipation of the package is dependent on PCB material, layout, and environmental conditions. The following measurement conditions are based on JEDEC STD. 51-7.

Measurement Conditions

| Item             | Measurement Conditions   |
|------------------|--|
| Environment      | Mounting on Board (Wind Velocity = 0 m/s)  |
| Board Material   | Glass Cloth Epoxy Plastic (Four-Layer Board)   |
| Board Dimensions | 76.2 mm × 114.3 mm × 0.8 mm  |
| Copper Ratio     | Outer Layer (First Layer): Less than 95% of 50 mm Square<br>Inner Layers (Second and Third Layers): Approx. 100% of 50 mm Square<br>Outer Layer (Fourth Layer): Approx. 100% of 50 mm Square |
| Through-holes    | φ 0.3 mm × 36 pcs  |

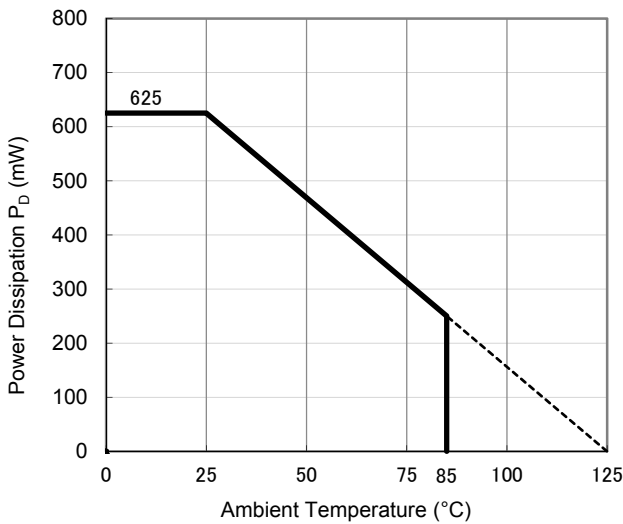
Measurement Result

(Ta = 25°C, Tjmax = 125°C)

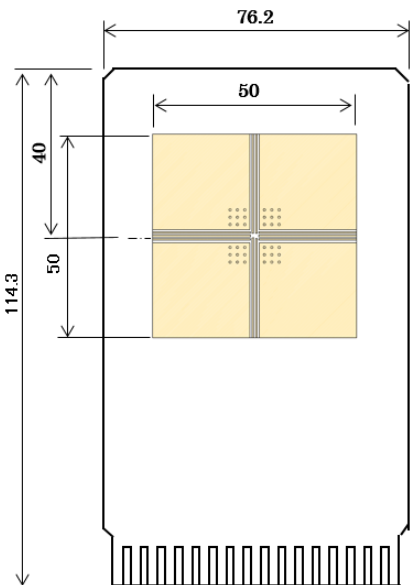
| Item                                     | Measurement Result |
|--|--------------------|
| Power Dissipation                        | 625 mW             |
| Thermal Resistance (θja)                 | θja = 160°C/W      |
| Thermal Characterization Parameter (ψjt) | ψjt = 76°C/W       |

θja: Junction-to-Ambient Thermal Resistance

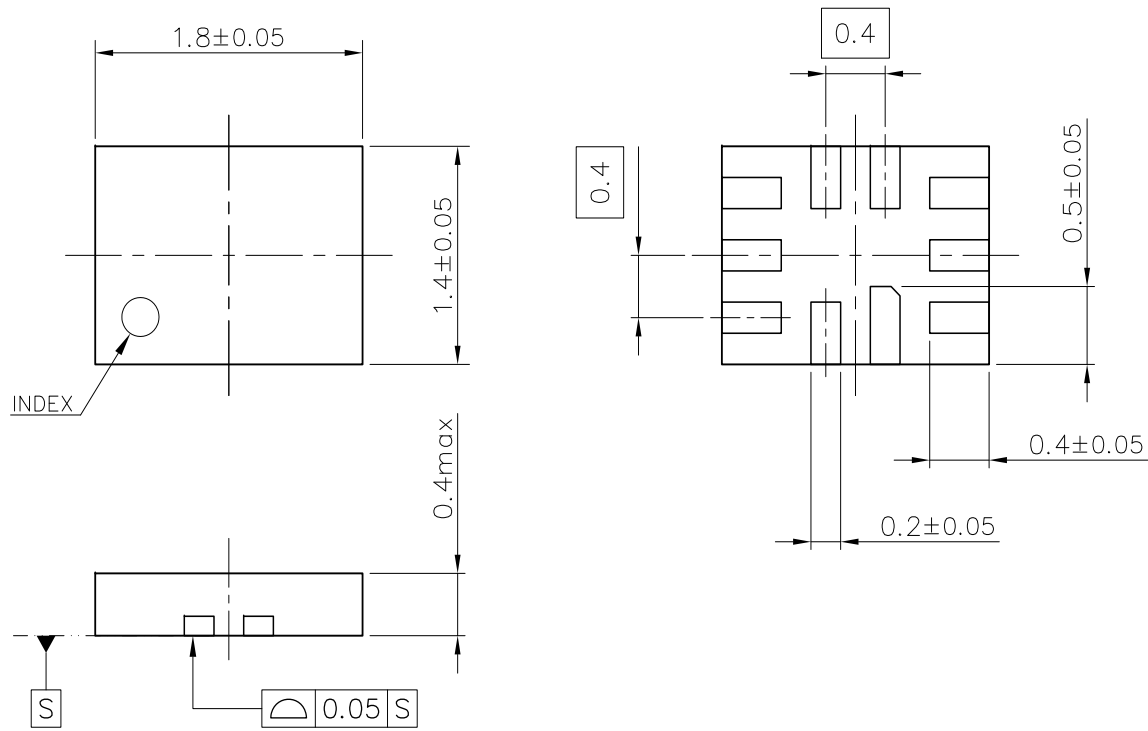
ψjt: Junction-to-Top Thermal Characterization Parameter



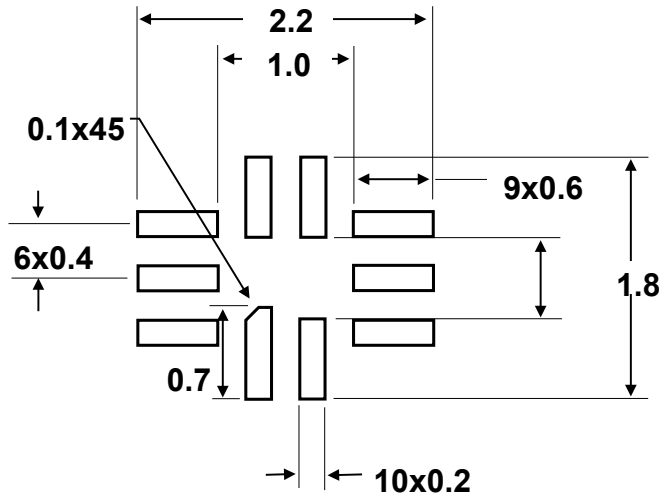
Power Dissipation vs. Ambient Temperature



Measurement Board Pattern



QFN014018-10 Package Dimensions (Unit: mm)



QFN014018-10 Recommended Land Pattern (Unit: mm)



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