2-WIRE CMOS SERIAL E^{2}PROM S-24C01C/02C

The S-24C01C/02C is a 2-wire, low current consumption and wide range operation serial E^{2}PROM. The S-24C01C/02C has the capacity of 1 K-bit and 2 K-bit, and the organization is 128 words × 8-bit, 256 words × 8-bit, respectively. Page write and sequential read are available.

■ Features

- Operating voltage range Read: 1.6 V to 5.5 V
  Write: 1.7 V to 5.5 V
- Operation frequency 400 kHz (V_{CC} = 1.6 V to 5.5 V)
- Noise filtering Schmitt trigger and noise filter on input pins (SCL, SDA)
- Page write: 16 bytes / page
- Sequential read
- Write disable function when power supply voltage is low
- Endurance: 10^6cycles / word*1 (at +25°C)
  ***1.** For each address (Word: 8-bit)
- Data retention: 100 years (at +25°C)
- Memory capacitance S-24C01C: 1 Kbit
  S-24C02C: 2 Kbit
- Write protect: 100%
- Lead-free product

■ Packages

Package name	Drawing code			
	Package	Tape	Reel	Land
8-Pin SOP (JEDEC)	FJ008-Z	FJ008-Z	FJ008-Z	–
8-Pin TSSOP	FT008-Z	FT008-Z	FT008-Z	–
SNT-8A	PH008-A	PH008-A	PH008-A	PH008-A
TMSOP-8	FM008-A	FM008-A	FM008-A	–

Caution This product is intended to use in general electronic devices such as consumer electronics, office equipment, and communications devices. Before using the product in medical equipment or automobile equipment including car audio, keyless entry and engine control unit, contact to SII is indispensable.

■ Pin Configurations

8-Pin SOP (JEDEC)
Top view

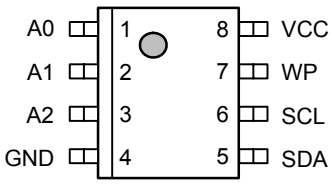


Figure 1

S-24C01CI-J8T1U
S-24C02CI-J8T1U

Table 1

Pin No.	Symbol	Description
1	A0*1	Slave address input
2	A1*1	Slave address input
3	A2*1	Slave address input
4	GND	Ground
5	SDA*1	Serial data I/O
6	SCL*1	Serial clock input
7	WP*1	Write protection input Connected to V_{CC}: Protection valid Connected to GND: Protection invalid
8	VCC	Power supply

***1.** All input pins have the CMOS structure. Do not set the input pins in high impedance during operation.

Remark See Dimensions for details of the package drawings.

8-Pin TSSOP
Top view

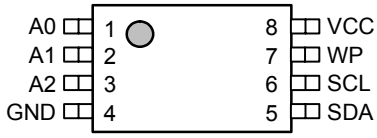


Figure 2

S-24C01CI-T8T1U
S-24C02CI-T8T1U

Table 2

Pin No.	Symbol	Description
1	A0*1	Slave address input
2	A1*1	Slave address input
3	A2*1	Slave address input
4	GND	Ground
5	SDA*1	Serial data I/O
6	SCL*1	Serial clock input
7	WP*1	Write protection input Connected to V_{CC}: Protection valid Connected to GND: Protection invalid
8	VCC	Power supply

***1.** All input pins have the CMOS structure. Do not set the input pins in high impedance during operation.

Remark See Dimensions for details of the package drawings.

SNT-8A
Top view

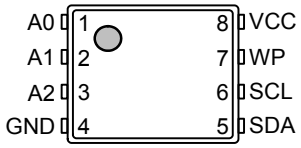


Figure 3

S-24C01CI-I8T1U
S-24C02CI-I8T1U

Table 3

Pin No.	Symbol	Description
1	A0*1	Slave address input
2	A1*1	Slave address input
3	A2*1	Slave address input
4	GND	Ground
5	SDA*1	Serial data I/O
6	SCL*1	Serial clock input
7	WP*1	Write protection input Connected to V_{CC}: Protection valid Connected to GND: Protection invalid
8	VCC	Power supply

***1.** All input pins have the CMOS structure. Do not set the input pins in high impedance during operation.

Remark See Dimensions for details of the package drawings.

TMSOP-8
Top view

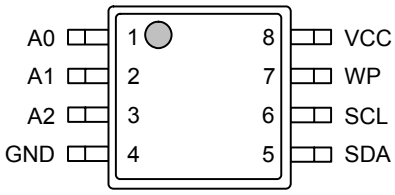


Figure 4

S-24C01CI-K8T3U
S-24C02CI-K8T3U

Table 4

Pin No.	Symbol	Description
1	A0*1	Slave address input
2	A1*1	Slave address input
3	A2*1	Slave address input
4	GND	Ground
5	SDA*1	Serial data I/O
6	SCL*1	Serial clock input
7	WP*1	Write protection input Connected to V_{CC}: Protection valid Connected to GND: Protection invalid
8	VCC	Power supply

***1.** All input pins have the CMOS structure. Do not set the input pins in high impedance during operation.

Remark See Dimensions for details of the package drawings.

■ Block Diagram

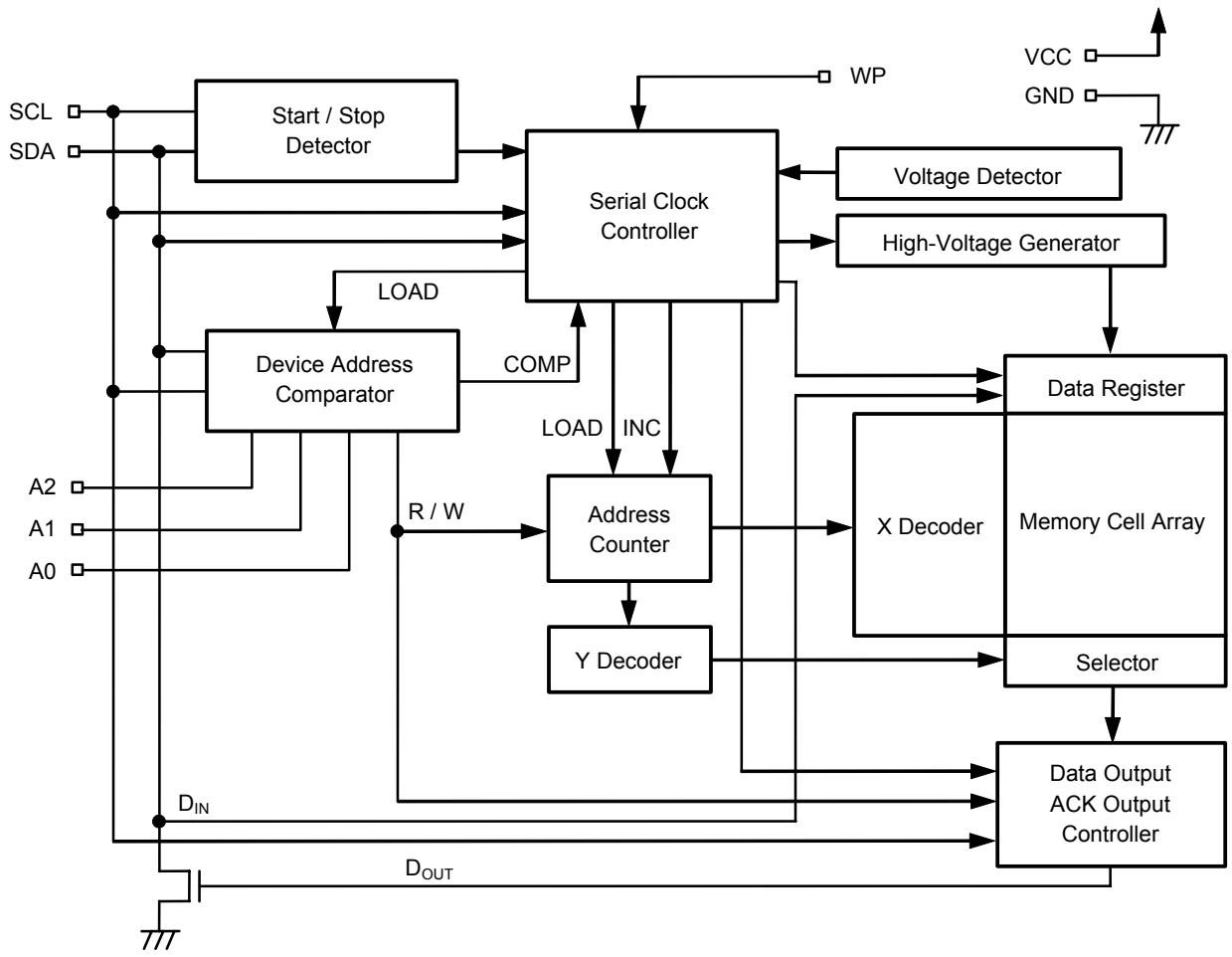


Figure 5

■ Absolute Maximum Ratings

Table 5

Item	Symbol	Absolute Maximum Ratings	Unit
Power supply voltage	V_{CC}	−0.3 to +6.5	V
Input voltage	V_{IN}	−0.3 to +6.5	V
Output voltage	V_{OUT}	−0.3 to +6.5	V
Operation ambient temperature	T_{opr}	−40 to +85	°C
Storage temperature	T_{stg}	−65 to +150	°C

Caution The absolute maximum ratings are rated values exceeding which the product could suffer physical damage. These values must therefore not be exceeded under any conditions.

■ Recommended Operating Conditions

Table 6

Item	Symbol	Condition	Min.	Max.	Unit
Power supply voltage	V_{CC}	Read Operation	1.6	5.5	V
		Write Operation	1.7	5.5	V
High level input voltage	V_{IH}	V_{CC} = 1.6 V to 5.5 V	0.7 × V_{CC}	5.5	V
Low level input voltage	V_{IL}	V_{CC} = 1.6 V to 5.5 V	−0.3	0.3 × V_{CC}	V

■ Pin Capacitance

Table 7

(Ta = +25°C, f = 1.0 MHz, V_{CC} = 5 V)

Item	Symbol	Condition	Min.	Max.	Unit
Input capacitance	C_{IN}	V_{IN} = 0 V (SCL, A0, A1, A2, WP)	–	10	pF
I/O capacitance	$C_{I/O}$	$V_{I/O}$ = 0 V (SDA)	–	10	pF

■ Endurance

Table 8

Item	Symbol	Operation Ambient Temperature	Min.	Max.	Unit
Endurance	N_W	+25°C	10^6	–	cycles / word*1

***1.** For each address (Word: 8 bits)

■ Data Retention

Table 9

Item	Symbol	Operation Ambient Temperature	Min.	Max.	Unit
Data retention	–	+25°C	100	–	year

■ DC Electrical Characteristics

Table 10

Item	Symbol	Condition	V_{CC} = 1.6 V to 5.5 V f = 400 kHz		Unit
			Min.	Max.	
Current consumption (READ)	I_{CC1}	–	–	0.8	mA

Table 11

Item	Symbol	Condition	V_{CC} = 1.7 V to 5.5 V f = 400 kHz		Unit
			Min.	Max.	
Current consumption (WRITE)	I_{CC2}	–	–	4.0	mA

Table 12

Item	Symbol	Condition	V_{CC} = 2.5 V to 5.5 V		V_{CC} = 1.8 V to 5.5 V		V_{CC} = 1.6 V to 1.8 V		Unit
			Min.	Max.	Min.	Max.	Min.	Max.	
Standby current consumption	I_{SB}	V_{IN} = V_{CC} or GND	–	3.5	–	3.5	–	2.0	μA
Input leakage current	I_{LI}	SCL, SDA, A0, A1, A2 V_{IN} = GND to V_{CC}	–	1.0	–	1.0	–	1.0	μA
Output leakage current	I_{LO}	SDA V_{OUT} = GND to V_{CC}	–	1.0	–	1.0	–	1.0	μA
Input current 1	I_{IL}	WP $V_{IN} < 0.3 \times V_{CC}$	–	50.0	–	50.0	–	50.0	μA
Input current 2	I_{IH}	WP $V_{IN} > 0.7 \times V_{CC}$	–	2.0	–	2.0	–	2.0	μA
Input Impedance 1	Z_{IL}	WP $V_{IN} = 0.3 \times V_{CC}$	30	–	30	–	30	–	kΩ
Input Impedance 2	Z_{IH}	WP $V_{IN} = 0.7 \times V_{CC}$	500	–	500	–	500	–	kΩ
Low level output voltage	V_{OL}	I_{OL} = 3.2 mA	–	0.4	–	–	–	–	V
		I_{OL} = 1.5 mA	–	0.3	–	0.3	–	0.3	V
		I_{OL} = 0.7 mA	–	0.2	–	0.2	–	0.2	V

■ AC Electrical Characteristics

Table 13 Measurement Conditions

Input pulse voltage	$0.2 \times V_{CC}$ to $0.8 \times V_{CC}$
Input pulse rising / falling time	20 ns or less
Output reference voltage	$0.3 \times V_{CC}$ to $0.7 \times V_{CC}$
Output load	100 pF

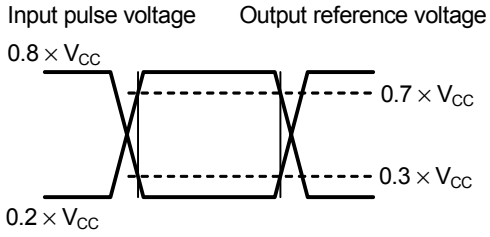


Figure 6 Input / Output Waveform during AC Measurement

Table 14

Item	Symbol	V_{CC} = 1.6 V to 5.5 V		Unit
		Min.	Max.	
SCL clock frequency	f_{SCL}	0	400	kHz
SCL clock time "L"	t_{LOW}	1.3	–	µs
SCL clock time "H"	t_{HIGH}	0.6	–	µs
SDA output delay time	t_{AA}	0.1	0.9	µs
SDA output hold time	t_{DH}	50	–	ns
Start condition setup time	$t_{SU.STA}$	0.6	–	µs
Start condition hold time	$t_{HD.STA}$	0.6	–	µs
Data input setup time	$t_{SU.DAT}$	100	–	ns
Data input hold time	$t_{HD.DAT}$	0	–	ns
Stop condition setup time	$t_{SU.STO}$	0.6	–	µs
SCL, SDA rising time	t_R	–	0.3	µs
SCL, SDA falling time	t_F	–	0.3	µs
WP setup time	t_{WS1}	0	–	µs
WP hold time	t_{WH1}	0	–	µs
WP release setup time	t_{WS2}	0	–	µs
WP release hold time	t_{WH2}	0	–	µs
Bus release time	t_{BUF}	1.3	–	µs
Noise suppression time	t_I	–	50	ns

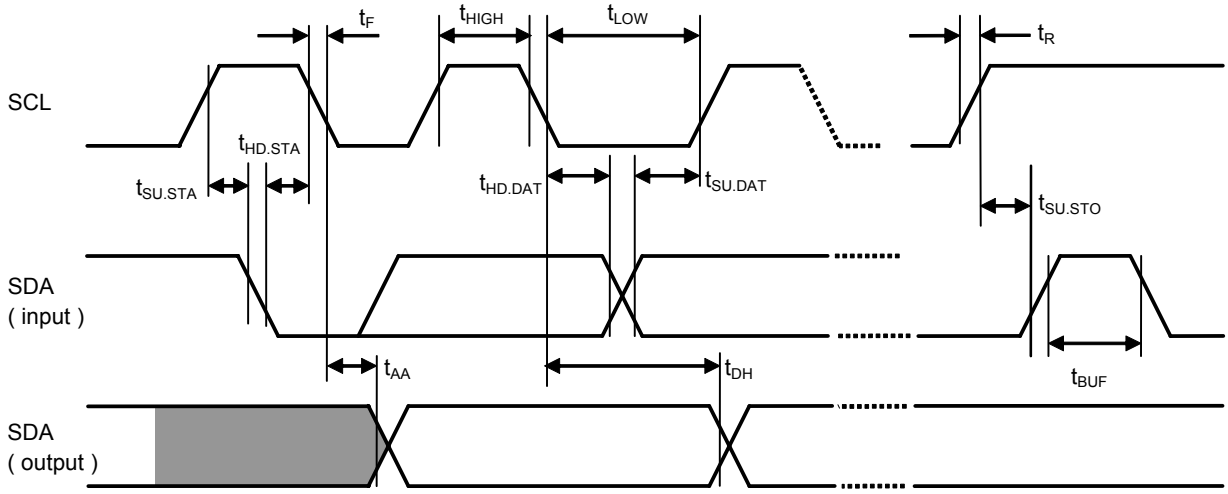


Figure 7 Bus Timing

Table 15

Item	Symbol	V_{CC} = 1.7 V to 5.5 V		Unit
		Min.	Max.	
Write time	t_{WR}	–	5.0	ms

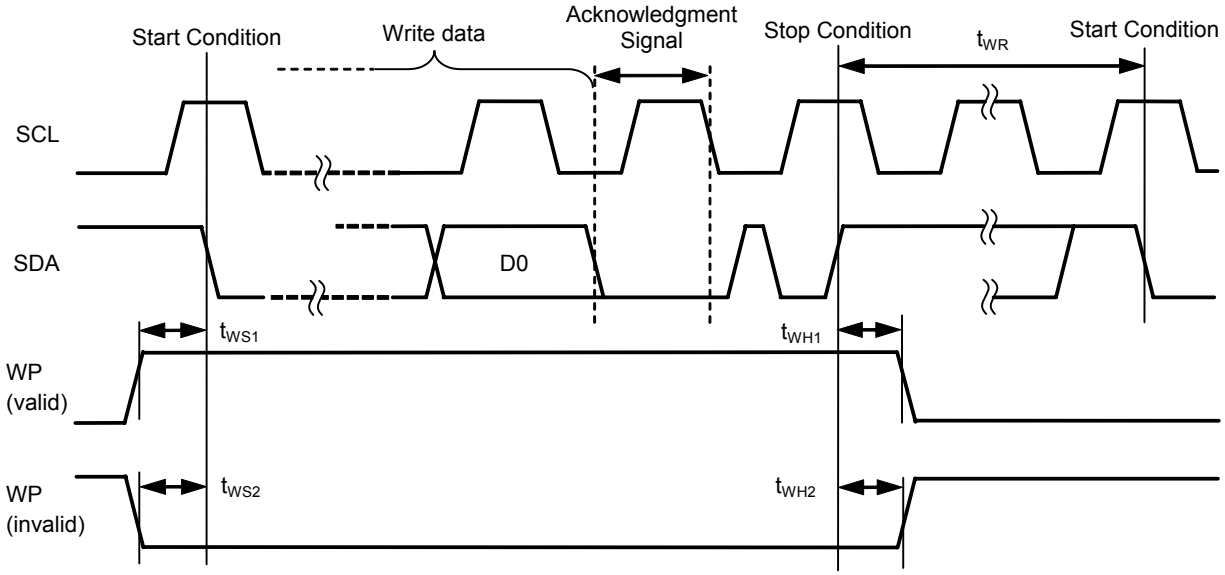


Figure 8 Write Cycle Timing

■ Pin Functions

1. A0, A1 and A2 (Slave Address Input) Pins

In the S-24C01C/02C, to set the slave address, connect each pin of A0, A1, A2 to GND or V_{CC}. Therefore the users can set 8 types of slave address by a combination of A0, A1, A2 pins.

Comparing the slave address transmitted from the master device and one that you set, makes possible to select the S-24C01C/02C from other devices connected onto the bus.
Be sure to connect to fix the address input pin to GND or V_{CC}.

2. SDA (Serial Data Input / Output) Pin

The SDA pin is used for the bi-directional transmission of serial data. This pin is a signal input pin, and an Nch open drain output pin.
In use, generally, connect the SDA line to any other device which has the open-drain or open-collector output with Wired-OR connection by pulling up to V_{CC} by a resistor (**Figure 9** shows the relation with an output load.).

3. SCL (Serial Clock Input) Pin

The SCL pin is used for the serial clock input. Since the signals are processed at a rising or falling edge of the SCL clock, pay attention to the rising and falling time and comply with the specification.

4. WP (Write Protection Input) Pin

The write protection is enabled by connecting the WP pin to V_{CC}. When not using the write protection, connect this pin to GND or set in high impedance.

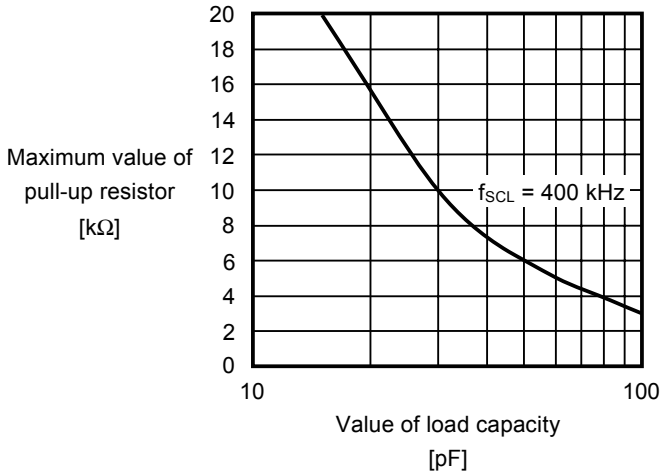


Figure 9 Output Load

■ Operation

1. Start Condition

Start is identified by a high to low transition of the SDA line while the SCL line is stable at high.
Every operation begins from a start condition.

2. Stop Condition

Stop is identified by a low to high transition of the SDA line while the SCL line is stable at high.
When a device receives a stop condition during a read sequence, the read operation is interrupted, and the device enters standby mode.
When a device receives a stop condition during a write sequence, the reception of the write data is halted, and the E^{2}PROM initiates a write cycle.

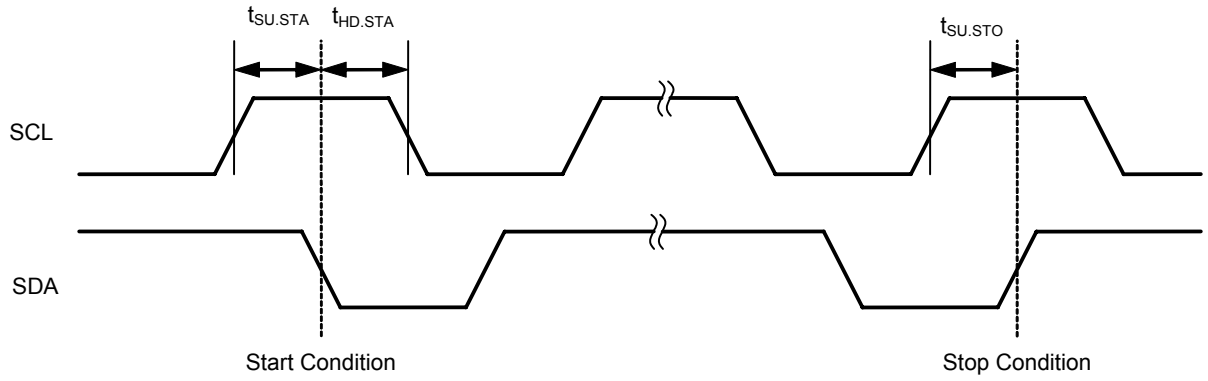


Figure 10 Start / Stop Conditions

3. Data Transmission

Changing the SDA line while the SCL line is low, data is transmitted.
Changing the SDA line while the SCL line is high, a start or stop condition is recognized.

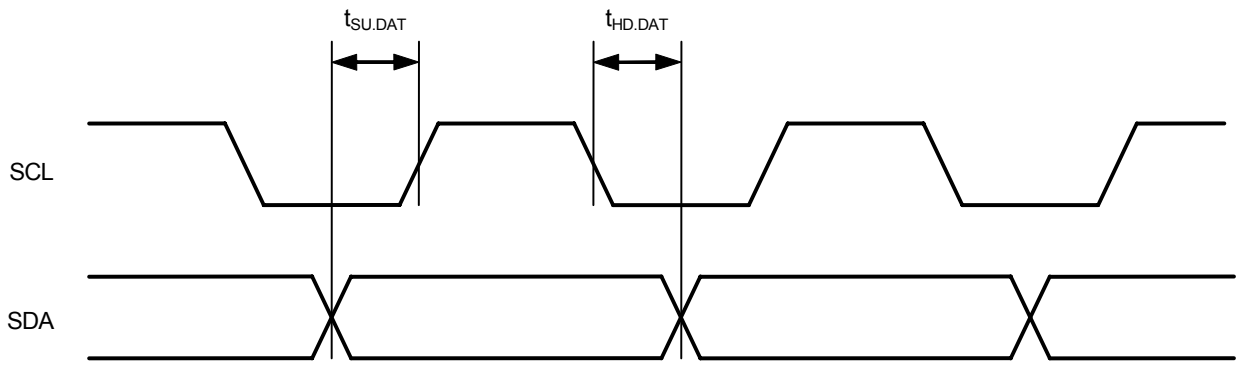


Figure 11 Data Transmission Timing

4. Acknowledge

The unit of data transmission is 8 bits. During the 9th clock cycle period the receiver on the bus pulls down the SDA line to acknowledge the receipt of the 8-bit data.
When an internal write cycle is in progress, the device does not generate an acknowledge.

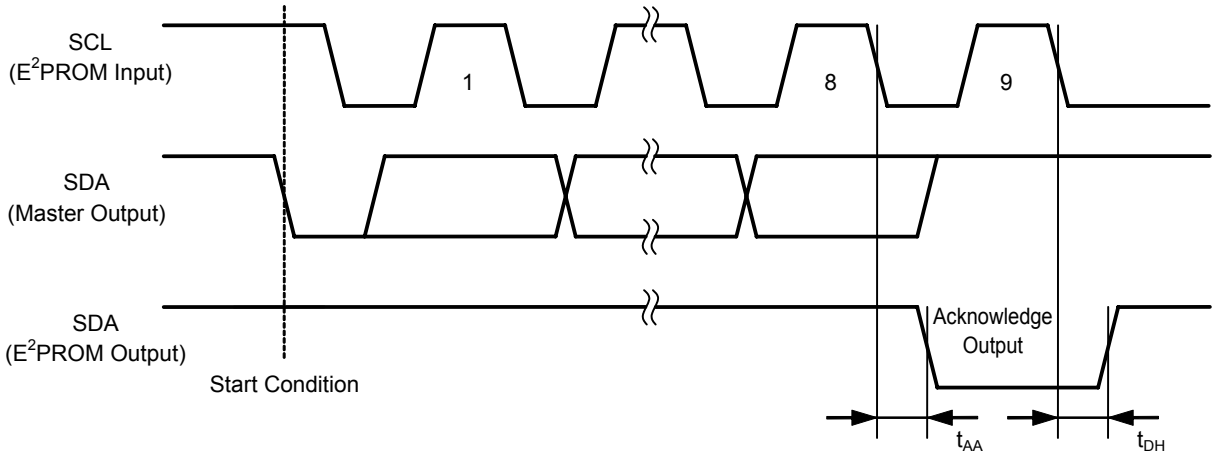


Figure 12 Acknowledge Output Timing

5. Device Addressing

To start communication, the master device on the system generates a start condition to the bus line. Next, the master device sends 7-bit device address and a 1-bit read / write instruction code on to the SDA bus.
The higher 4 bits of the device address are the “Device Code”, and are fixed to “1010”.

In the S-24C01C/02C, successive 3 bits are the “Slave Address”. These 3 bits are used to identify a device on the system bus and are compared with the predetermined value which is defined by the address input pins (A2, A1, A0). When the comparison result matches, the slave device responds with an acknowledge during the 9th clock cycle.

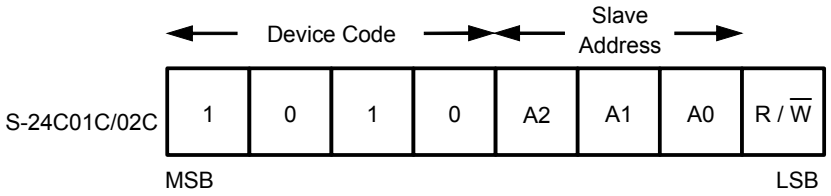
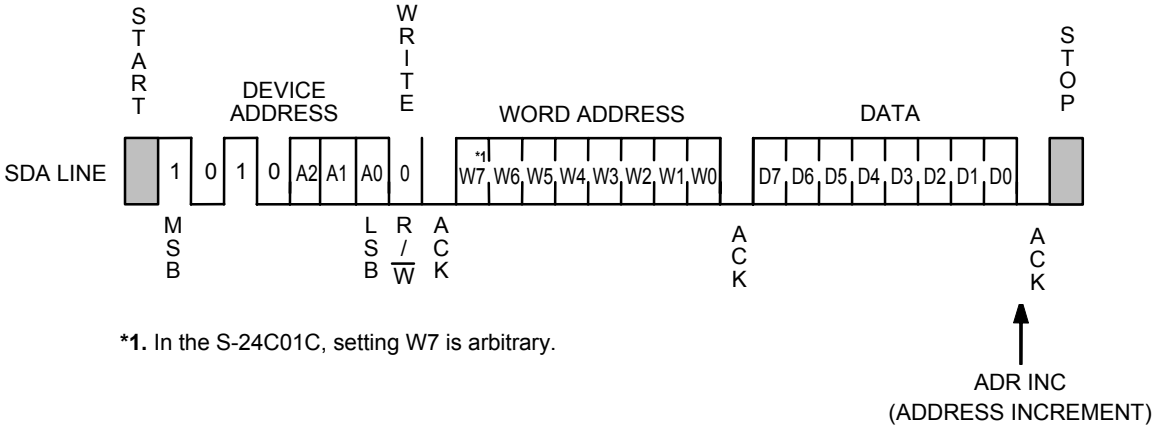


Figure 13 Device Address

6. Write

6. 1 Byte Write

When the master sends a 7-bit device address and a 1-bit read / write instruction code set to “0”, following a start condition, the E^{2}PROM acknowledges it. The E^{2}PROM then receives an 8-bit word address and responds with an acknowledge. After the E^{2}PROM receives 8-bit write data and responds with an acknowledge, it receives a stop condition and that initiates the write cycle at the addressed memory.
During the write cycle all operations are forbidden and no acknowledge is generated.

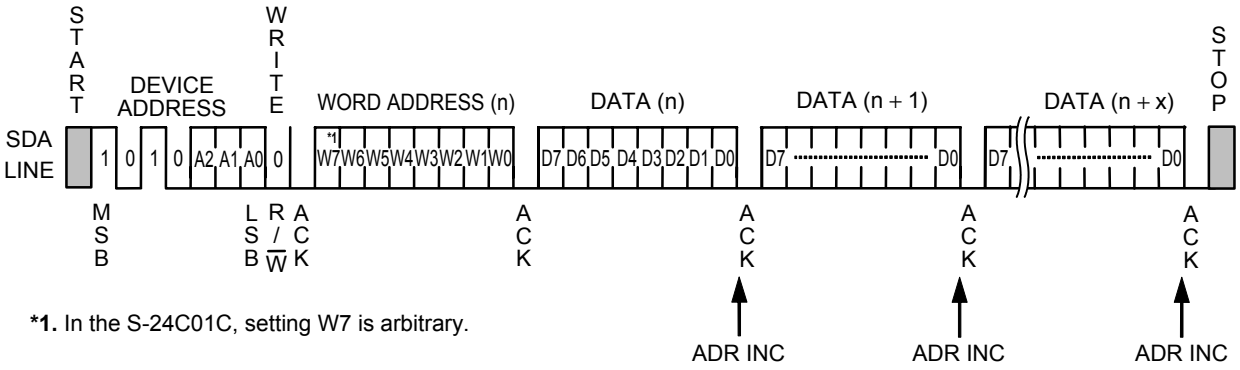


***1.** In the S-24C01C, setting W7 is arbitrary.

Figure 14 Byte Write

6. 2 Page Write

The page write mode allows up to 16 bytes to be written in a single write operation in the S-24C01C/02C.
Its basic process to transmit data is as same as byte write, but it operates page write by sequentially receiving 8-bit write data as much data as the page size has.
When the E^{2}PROM receives a 7-bit device address and a 1-bit read / write instruction code set to "0", following a start condition, it generates an acknowledge. Then the E^{2}PROM receives an 8-bit word address, and responds with an acknowledge. After the E^{2}PROM receives 8-bit write data and responds with an acknowledge, it receives 8-bit write data corresponding to the next word address, and generates an acknowledge. The E^{2}PROM repeats reception of 8-bit write data and generation of acknowledge in succession. The E^{2}PROM can receive as many write data as the maximum page size.
Receiving a stop condition initiates a write cycle of the area starting from the designated memory address and having the page size equal to the received write data.



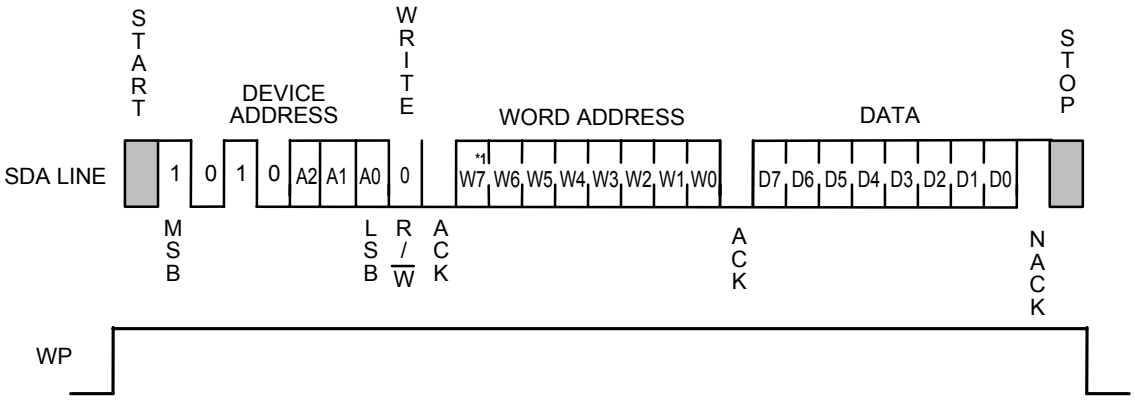
***1.** In the S-24C01C, setting W7 is arbitrary.

Figure 15 Page Write

In the S-24C01C/02C, the lower 4 bits of the word address are automatically incremented every time when the E^{2}PROM receives 8-bit write data. If the size of the write data exceeds 16 bytes, the upper 4 bits of the word address remain unchanged, and the lower 4 bits are rolled over and the last 16-byte data that the S-24C01C/02C received will be overwritten.

6. 3 Write Protection

Write protection is available in the S-24C01C/02C. When the WP pin is connected to the V_{CC}, write operation to memory area is forbidden at all.
When the WP pin is connected to GND or set in high impedance, the write protection is invalid, and write operation in all memory area is available.
Fix the level of the WP pin from start condition in the write operation (byte write, page write) until stop condition. If the WP pin changes during this time, the address data being written at this time is not guaranteed. Regarding the timing of write protection, refer to **Figure 8**.
In not using the write protection, connect the WP pin to GND or set it open. The write protection is valid in the range of operation power supply voltage.
As seen in **Figure 16** when the write protection is valid, the S-24C01C/02C does not generate an acknowledgment signal after data input.



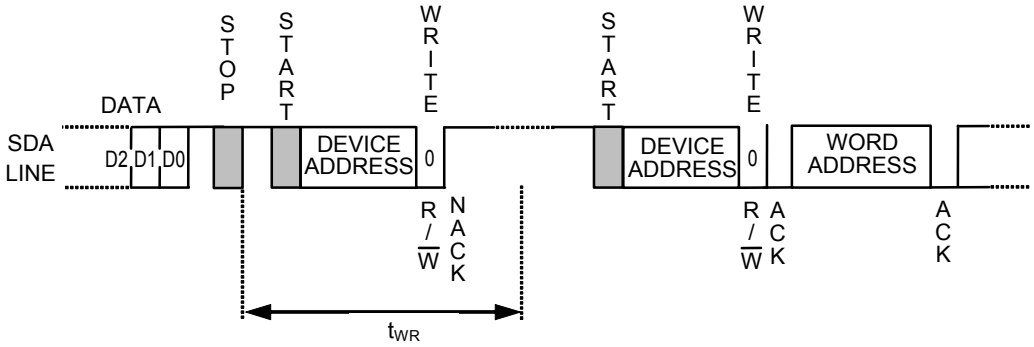
***1.** In the S-24C01C, setting W7 is arbitrary.

Figure 16 Write Protection

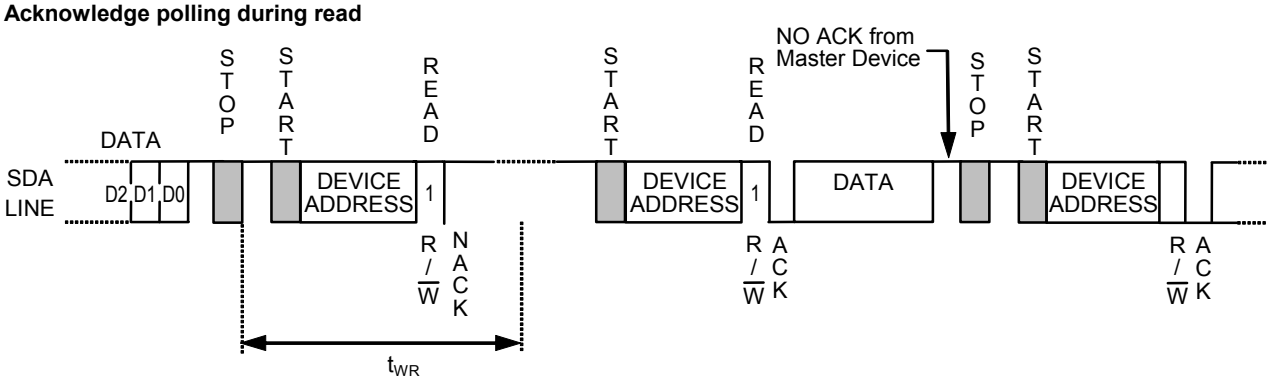
6. 4 Acknowledge Polling

Acknowledge polling is used to know the completion of the write cycle in the E^{2}PROM.
After the E^{2}PROM receives a stop condition and once starts the write cycle, all operations are forbidden and no response is made to the signal transmitted by the master device.
Accordingly the master device can recognize the completion of the write cycle in the E^{2}PROM by detecting a response from the slave device after transmitting the start condition, the device address and the read / write instruction code to the E^{2}PROM, namely to the slave devices.
That is, if the E^{2}PROM does not generate an acknowledge, the write cycle is in progress and if the E^{2}PROM generates an acknowledge, the write cycle has been completed.
It is recommended to use the read instruction "1" as the read / write instruction code transmitted by the master device.

Acknowledge polling during write



Acknowledge polling during read



Remark Users are able to input word address and data after ACK output in acknowledge polling during write.
Users are able to read data after ACK output in acknowledge polling during read. However, after that users input the write instruction, a start condition may not be input during data output. Input a stop condition and the next instruction after data output and ACK output.

Figure 17 Usage Example of Acknowledge Polling

7. Read

7. 1 Current Address Read

Either in writing or in reading the E^{2}PROM holds the last accessed memory address. The memory address is maintained as long as the power voltage is higher than the current address hold voltage V_{AH}.
The master device can read the data at the memory address of the current address pointer without assigning the word address as a result, when it recognizes the position of the address pointer in the E^{2}PROM. This is called "Current Address Read".
In the following the address counter in the E^{2}PROM is assumed to be "n".
When the E^{2}PROM receives a 7-bit device address and a 1-bit read / write instruction code set to "1" following a start condition, it responds with an acknowledge.
Next an 8-bit data at the address "n" is sent from the E^{2}PROM synchronous to the SCL clock. The address counter is incremented at the falling edge of the SCL clock for the 8th bit data, and the content of the address counter becomes n+1.
The master device outputs stop condition not an acknowledge, the reading of E^{2}PROM is ended.

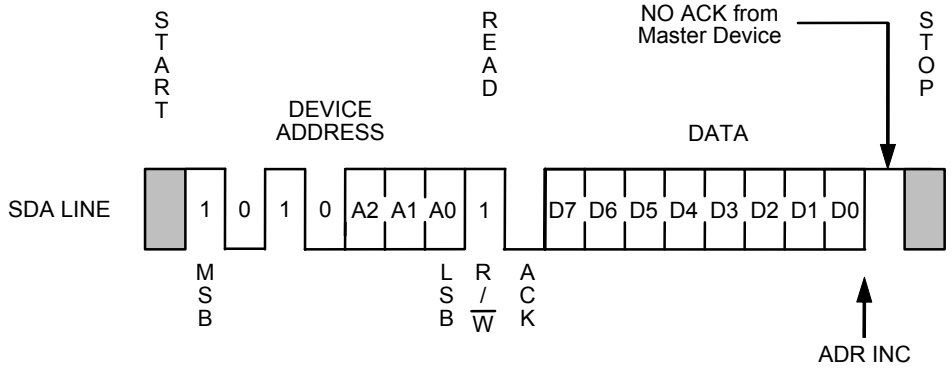


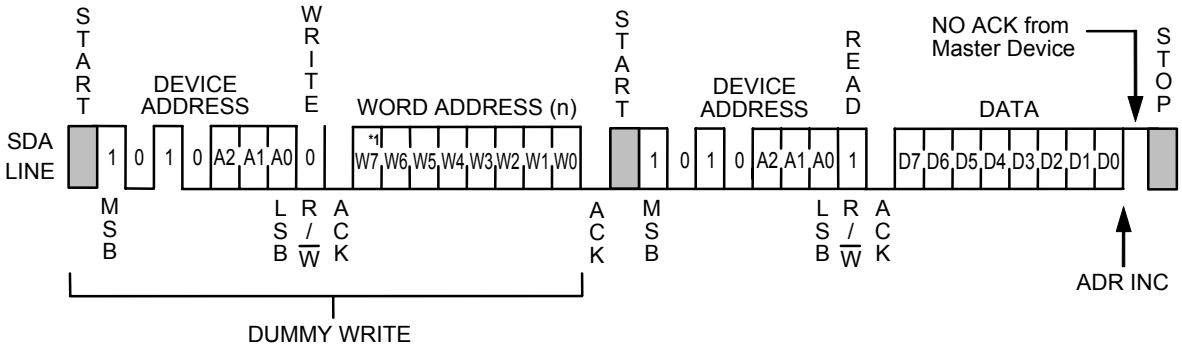
Figure 18 Current Address Read

Attention should be paid to the following point on the recognition of the address pointer in the E^{2}PROM.
In the read operation the memory address counter in the E^{2}PROM is automatically incremented at every falling edge of the SCL clock for the 8th bit of the output data. In the write operation, on the other hand, the upper bits of the memory address (the upper bits of the word address and page address)*1 are left unchanged and are not incremented at the falling edge of the SCL clock for the 8th bit of the received data.

*1. In the S-24C01C/02C, the upper 4 bits of the word address

7. 2 Random Read

Random read is used to read the data at an arbitrary memory address.
A dummy write is performed to load the memory address into the address counter.
When the E^{2}PROM receives a 7-bit device address and a 1-bit read / write instruction code set to “0” following a start condition, it responds with an acknowledge. The E^{2}PROM then receives an 8-bit word address and responds with an acknowledge. The memory address is loaded to the address counter in the E^{2}PROM by these operations. Reception of write data does not follow in a dummy write whereas reception of write data follows in byte write and in page write.
Since the memory address is loaded into the memory address counter by dummy write, the master device can read the data starting from the arbitrary memory address by transmitting a new start condition and performing the same operation in the current address read.
That is, when the E^{2}PROM receives a 7-bit device address and a 1-bit read / write instruction code set to “1”, following a start condition signal, it responds with an acknowledge. Next, 8-bit data is transmitted from the E^{2}PROM in synchronous to the SCL clock. The master device outputs stop condition not an acknowledge, the reading of E^{2}PROM is ended.



***1.** In the S-24C01C, setting W7 is arbitrary.

Figure 19 Random Read

7. 3 Sequential Read

When the E²PROM receives a 7-bit device address and a 1-bit read / write instruction code set to "1" following a start condition both in current address read and random read, it responds with an acknowledge.
An 8-bit data is then sent from the E²PROM synchronous to the SCL clock and the address counter is automatically incremented at the falling edge of the SCL clock for the 8th bit data.
When the master device responds with an acknowledge, the data at the next memory address is transmitted. Response with an acknowledge by the master device has the memory address counter in the E²PROM incremented and makes it possible to read data in succession. This is called "Sequential Read".
The master device outputs stop condition not an acknowledge, the reading of E²PROM is ended.
Data can be read in succession in the sequential read mode. When the memory address counter reaches the last word address, it rolls over to the first word address.

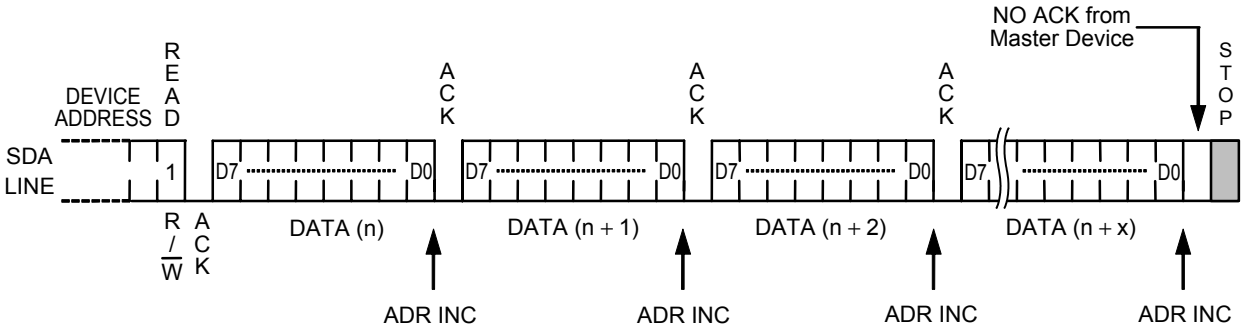


Figure 20 Sequential Read

8. Address Increment Timing

The timing for the automatic address increment is the falling edge of the SCL clock for the 8th bit of the read data in read operation and the falling edge of the SCL clock for the 8th bit of the received data in write operation.

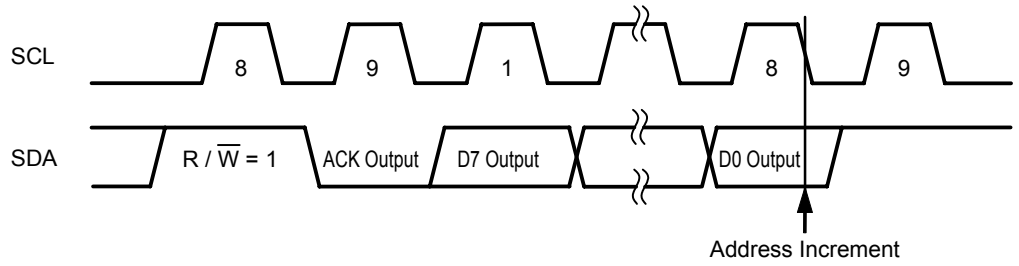


Figure 21 Address Increment Timing in Reading

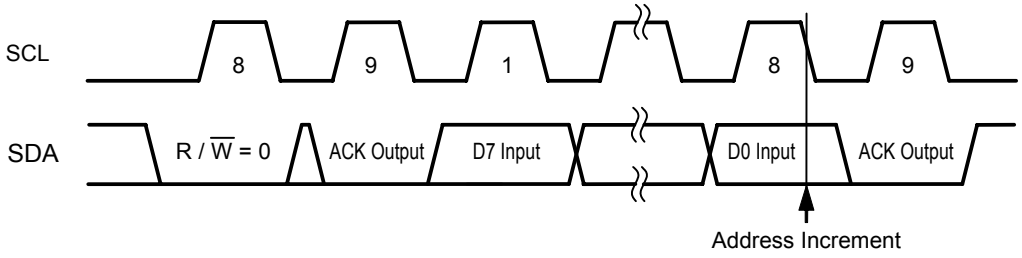


Figure 22 Address Increment Timing in Writing

■ Write Inhibition Function at Low Power Voltage

The S-24C01C/02C has a built-in detection circuit which operates with the low power supply voltage, cancels Write when the power supply voltage drops and power-on. Its detection and release voltages are 1.20 V typ. (Refer to **Figure 23**).
The S-24C01C/02C cancels Write by detecting a low power supply voltage when it receives a stop condition.
In the data trasmission and the Write operation, data in the address written during the low power supply voltage is not assurable.

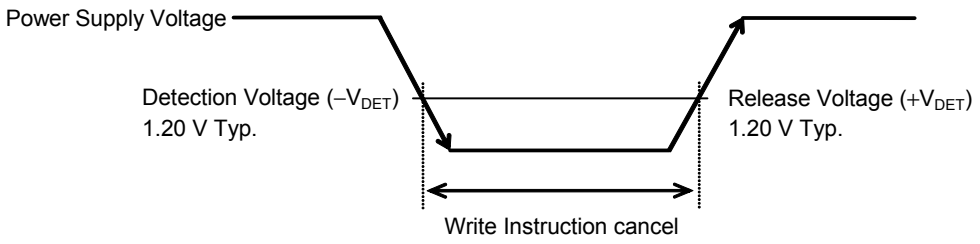


Figure 23 Operation at Low Power Voltage

■ Using S-24C01C/02C

1. Adding a pull-up resistor to SDA I/O pin and SCL input pin

In consideration of I^{2}C-bus protocol function, the SDA I/O pins should be connected with a pull-up resistor. The S-24C01C/02C cannot transmit normally without using a pull-up resistor.

In case that the SCL input pin of the S-24C01C/02C is connected to the Nch open drain output pin of the master device, connect the SCL pin with a pull-up resistor. As well, in case the SCL input pin of the E^{2}PROM is connected to the tri-state output pin of the master device, connect the SCL pin with a pull-up resistor in order not to set it in high impedance. This prevents the S-24C01C/02C from error caused by an uncertain output (high impedance) from the tri-state pin when resetting the master device during the voltage drop.

2. Equivalent circuit of I/O pin

Each pin (SCL, SDA, A0, A1, A2) of the S-24C01C/02C does not have a built-in pull-down or pull-up resistor. The WP pin includes a pull-down resistor. The SDA line has an open-drain output. The followings are equivalent circuits of the pins.

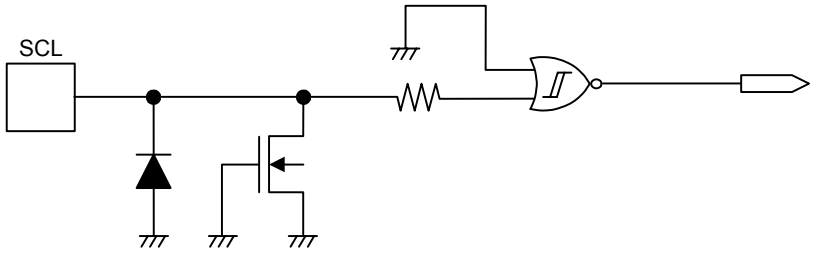


Figure 24 SCL Pin

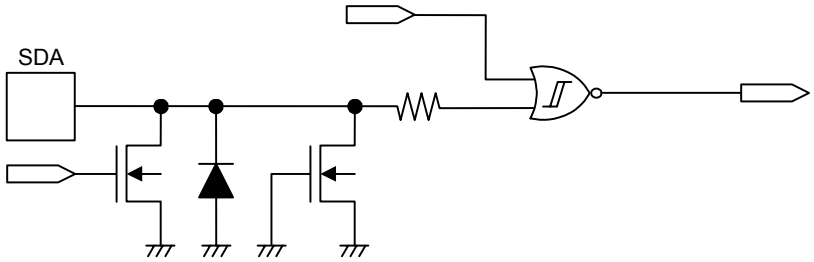


Figure 25 SDA Pin

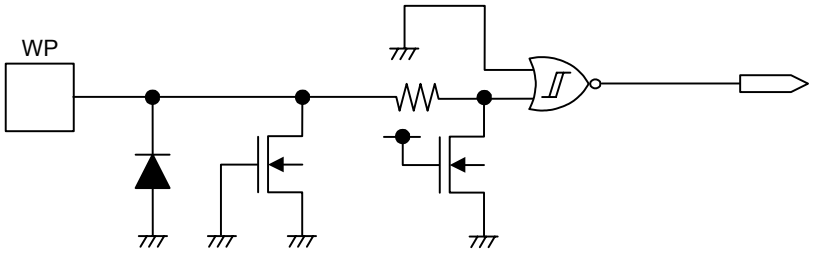


Figure 26 WP Pin

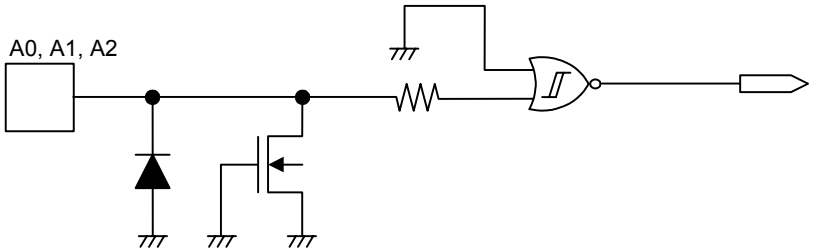


Figure 27 A0, A1, A2 Pins

3. Phase adjustment during S-24C01C/02C access

The S-24C01C/02C does not have a pin to reset (the internal circuit). The users cannot forcibly reset it externally. If the communication to the S-24C01C/02C interrupted, the users need to handle it as you do for software.
In the S-24C01C/02C, users are able to reset the internal circuit by inputting a start condition and a stop condition.
Although the reset signal is input to the master device, the S-24C01C/02C's internal circuit does not go in reset, but it does by inputting a stop condition to the S-24C01C/02C. The S-24C01C/02C keeps the same status thus cannot do the next operation. Especially, this case corresponds to that only the master device is reset when the power supply voltage drops.
If the power supply voltage restored in this status, input the instruction after resetting (adjusting the phase with the master device) the S-24C01C/02C. How to reset is shown below.

[How to reset S-24C01C/02C]

The S-24C01C/02C is able to be reset by a start and stop instructions. When the S-24C01C/02C is reading data "0" or is outputting the acknowledgment signal, outputs "0" to the SDA line. In this status, the master device cannot output an instruction to the SDA line. In this case, terminate the acknowledgment output operation or the Read operation, and then input a start instruction. **Figure 28** shows this procedure.
First, input a start condition. Then transmit 9 clocks (dummy clock) of SCL. During this time, the master device sets the SDA line to "H". By this operation, the S-24C01C/02C interrupts the acknowledgment output operation or data output, so input a start condition*1. When a start condition is input, the S-24C01C/02C is reset. To make doubly sure, input the stop condition to the S-24C01C/02C. The normal operation is then possible.

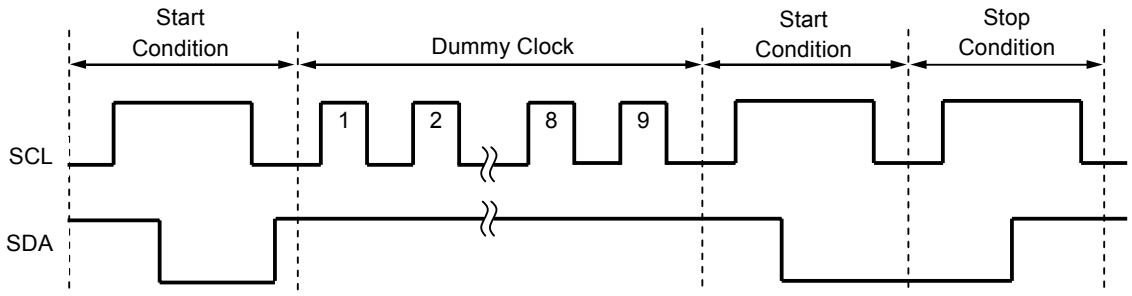


Figure 28 Resetting S-24C01C/02C

***1.** After 9 clocks (dummy clock), if the SCL clock continues to being output without inputting a start condition, S-24C01C/02C may go in the write operation when it receives a stop condition. To prevent this, input a start condition after 9 clocks (dummy clock).

Remark Regarding this reset procedure with dummy clock, it is recommended to perform at the system initialization after applying the power supply voltage.

4. Acknowledge check

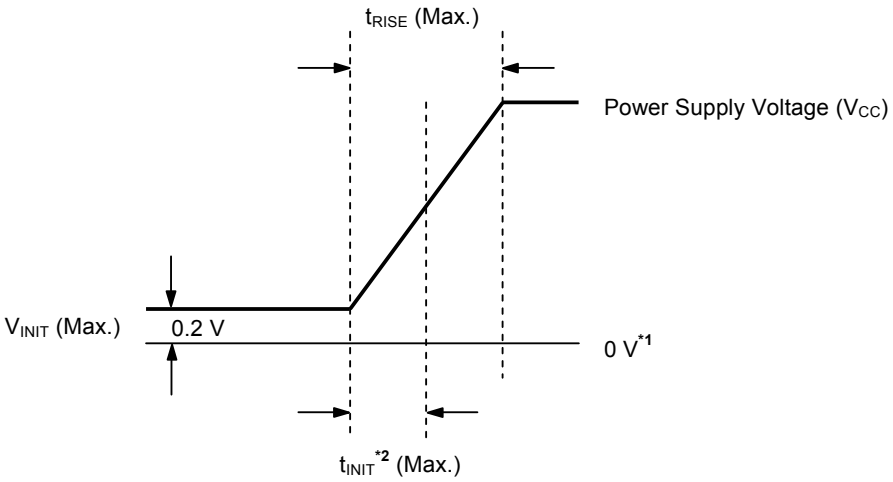
The I^{2}C-bus protocol includes an acknowledge check function as a handshake function to prevent a communication error. This function allows detection of a communication failure during data communication between the master device and S-24C01C/02C. This function is effective to prevent malfunction, so it is recommended to perform an acknowledge check with the master device.

5. Built-in power-on-clear circuit

The S-24C01C/02C has a built-in power-on-clear circuit that initializes itself at the same time during power-on. Unsuccessful initialization may cause a malfunction. To operate the power-on-clear circuit normally, the following conditions must be satisfied to raise the power supply voltage.

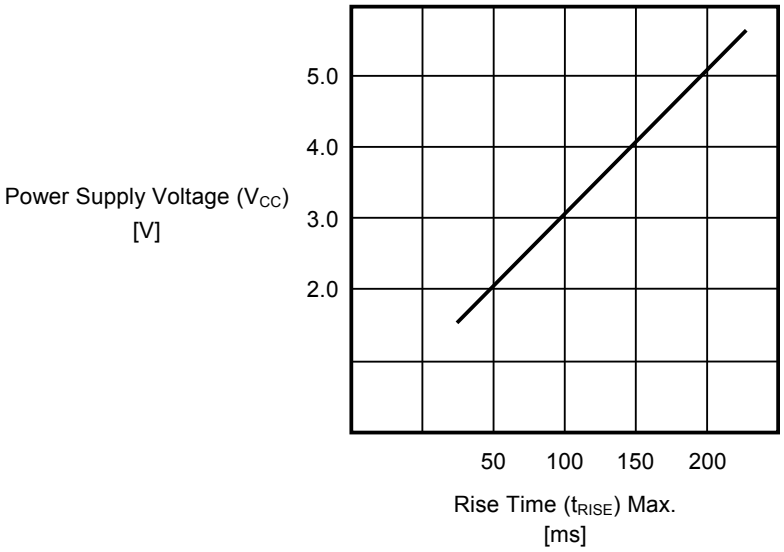
5. 1 Raising power supply voltage

Shown in **Figure 29**, raise the power supply voltage from 0.2 V max., within the time defined as t_{RISE} which is the time required to reach the power supply voltage to be set.
For example, if the power supply voltage is 5.0 V, t_{RISE} = 200 ms seen in **Figure 30**. The power supply voltage must be raised within 200 ms.



***1.** 0 V means there is no difference in potential between the VCC pin and the GND pin of the S-24C01C/02C.
***2.** t_{INIT} is the time required to initialize the S-24C01C/02C. No instructions are accepted during this time.

Figure 29 Raising Power Supply Voltage



For example: If the supply voltage = 5.0 V, raise the power supply voltage to 5.0 V within 200 ms.

Figure 30 Rise Time of Power Supply Voltage

When initialization is successfully completed by the power-on-clear circuit, the S-24C01C/02C enters the standby status.
If the power-on-clear circuit does not operate;
The S-24C01C/02C has not completed initialization, an instruction previously input is still valid or an instruction may be inappropriately recognized. In this case, S-24C01C/02C may perform the Write operation.
The voltage drops due to power off while the S-24C01C/02C is being accessed. Even if the master device is reset due to the low power voltage, the S-24C01C/02C may malfunction unless the power-on-clear operation conditions of S-24C01C/02C are satisfied.

When not using this rise time seen in **Figure 30**, adjust the phase (reset) to reset the internal circuit in the S-24C01C/02C normally.

5. 2 Initialization time

The S-24C01C/02C initializes at the same time when the power supply voltage is raised. Input instructions to the S-24C01C/02C after initialization. S-24C01C/02C does not accept any instruction during initialization.
Figure 31 shows the initialization time of the S-24C01C/02C.

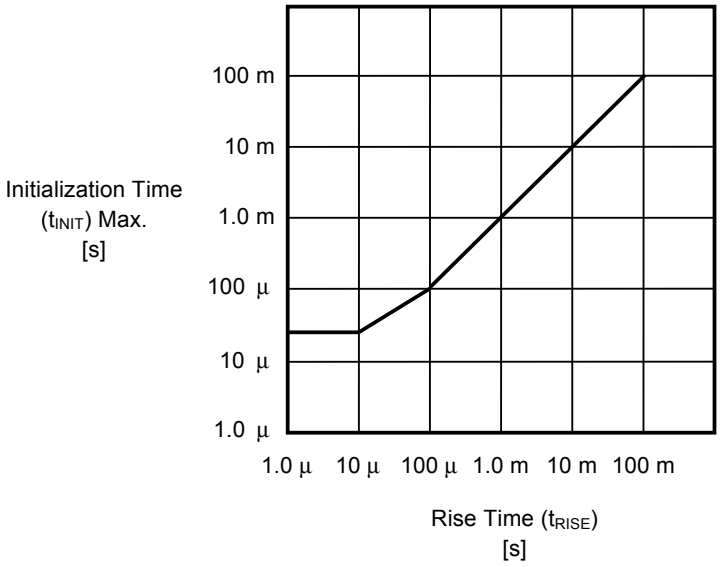


Figure 31 Initialization Time of S-24C01C/02C

6. Data hold time ($t_{HD.DAT}$ = 0 ns)

If SCL and SDA of the S-24C01C/02C are changed at the same time, it is necessary to prevent a start / stop condition from being mistakenly recognized due to the effect of noise.
The S-24C01C/02C may error if it does not recognize a start / stop condition correctly during transmission.
In the S-24C01C/02C, it is recommended to set the delay time of 0.3 µs minimum from a falling edge of SCL for the SDA.
This is to prevent S-24C01C/02C from going in a start / stop condition due to the time lag caused by the load of the bus line.

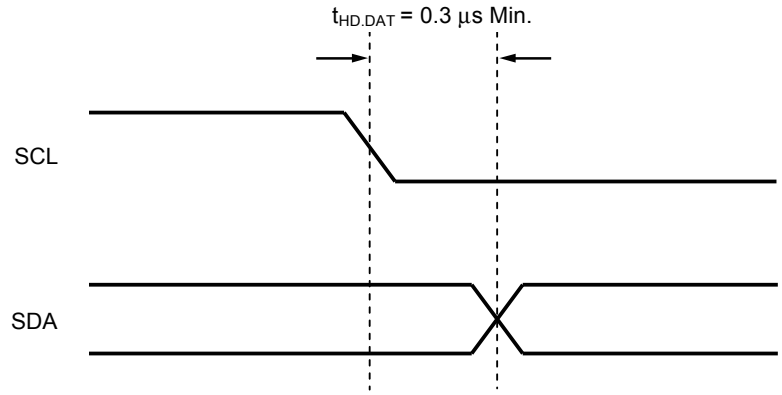


Figure 32 S-24C01C/02C Data Hold Time

7. SDA pin and SCL pin noise suppression time

The S-24C01C/02C includes a built-in low-pass filter at the SDA and SCL pins to suppress noise. This means that if the power supply voltage is 5.0 V, noise with a pulse width of 160 ns or less can be suppressed.
For details of the assurable value, refer to noise suppression time (t_I) in **Table 14**.

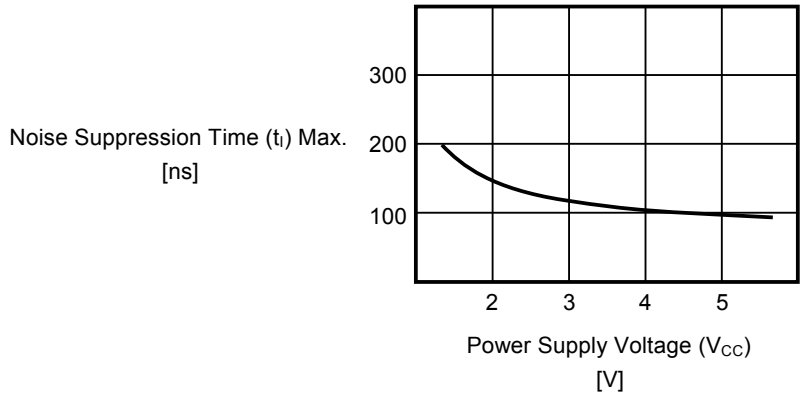
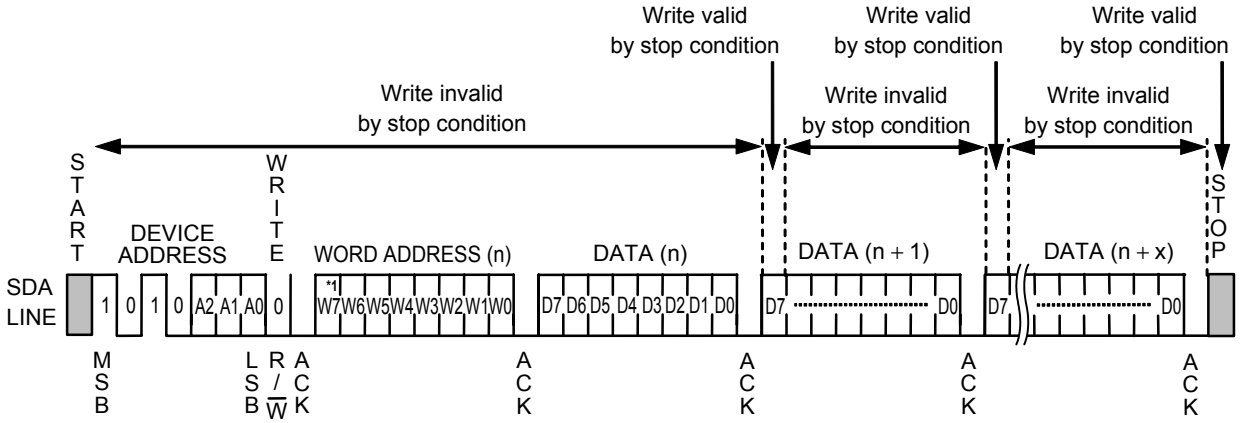


Figure 33 Noise Suppression Time for SDA and SCL Pins

8. Operation when input stop condition during input write data

The S-24C01C/02C does the write operation only when it receives data of 1 byte or more and receives a stop condition immediately after ACK output.
Refer to **Figure 34** regarding details.



***1.** In the S-24C01C, setting W7 is arbitrary.

Figure 34 Write Operation by Inputting Stop Condition during Write

9. Command cancel by start condition

By a start condition, users are able to cancel command which is being input. However, adjust the phase while the S-24C01C/02C is outputting "L" because users are not able to input a start condition. When users cancel the command, there may be a case that the address will not be identified. Use random read for the read operation, not current address read.

10. Precaution for use

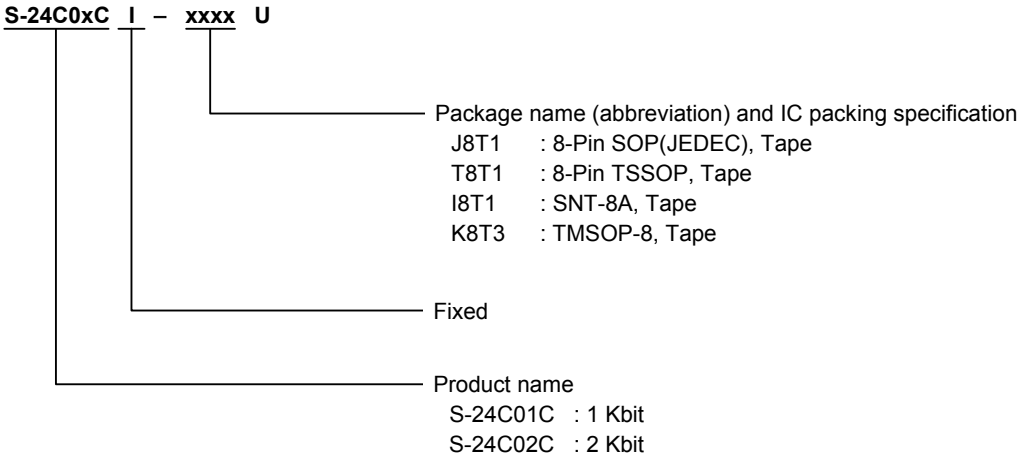
- Absolute maximum ratings: Do not operate these ICs in excess of the absolute maximum ratings (as listed on the data sheet). Exceeding the supply voltage rating can cause latch-up.

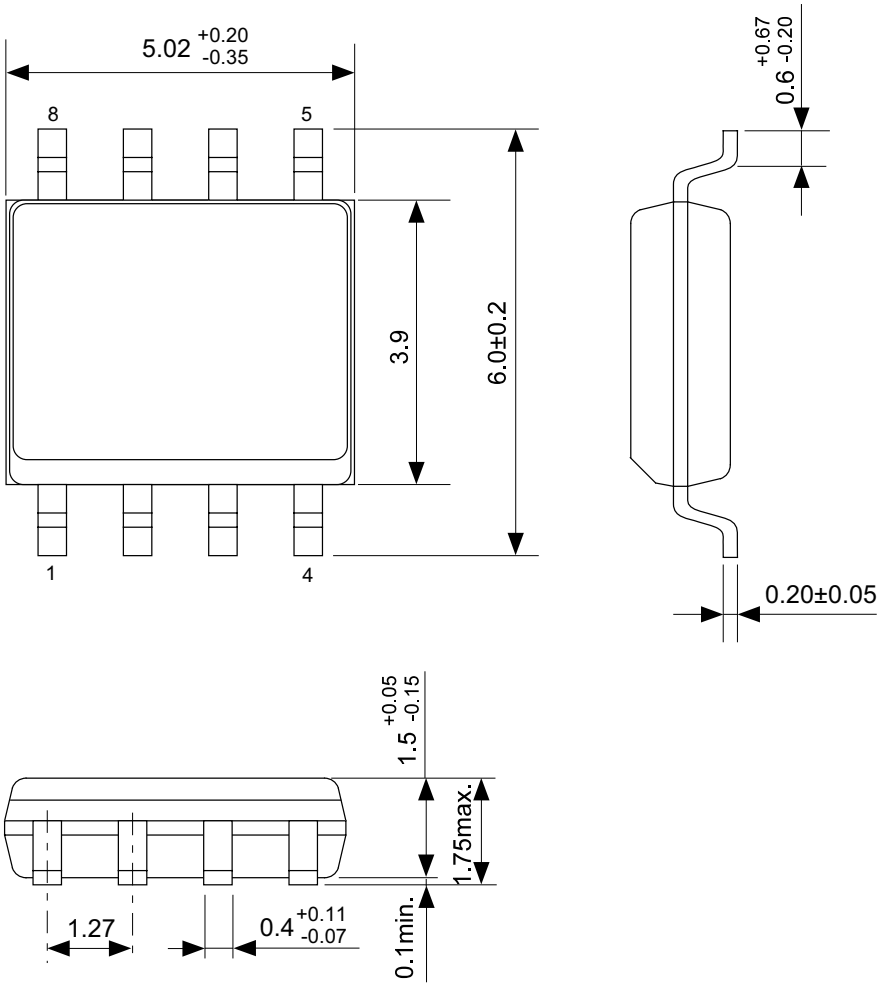
- Operations with moisture on the S-24C01C/02C pins may occur malfunction by short-circuit between pins. Especially, in occasions like picking the S-24C01C/02C up from low temperature tank during the evaluation. Be sure that not remain frost on the S-24C01C/02C pin to prevent malfunction by short-circuit.
  Also attention should be paid in using on environment, which is easy to dew for the same reason.

■ Precautions

- Do not apply an electrostatic discharge to this IC that exceeds the performance ratings of the built-in electrostatic protection circuit.
- SII claims no responsibility for any and all disputes arising out of or in connection with any infringement of the products including this IC upon patents owned by a third party.

■ Product Name Structure





No. FJ008-Z-P-SD-1.0

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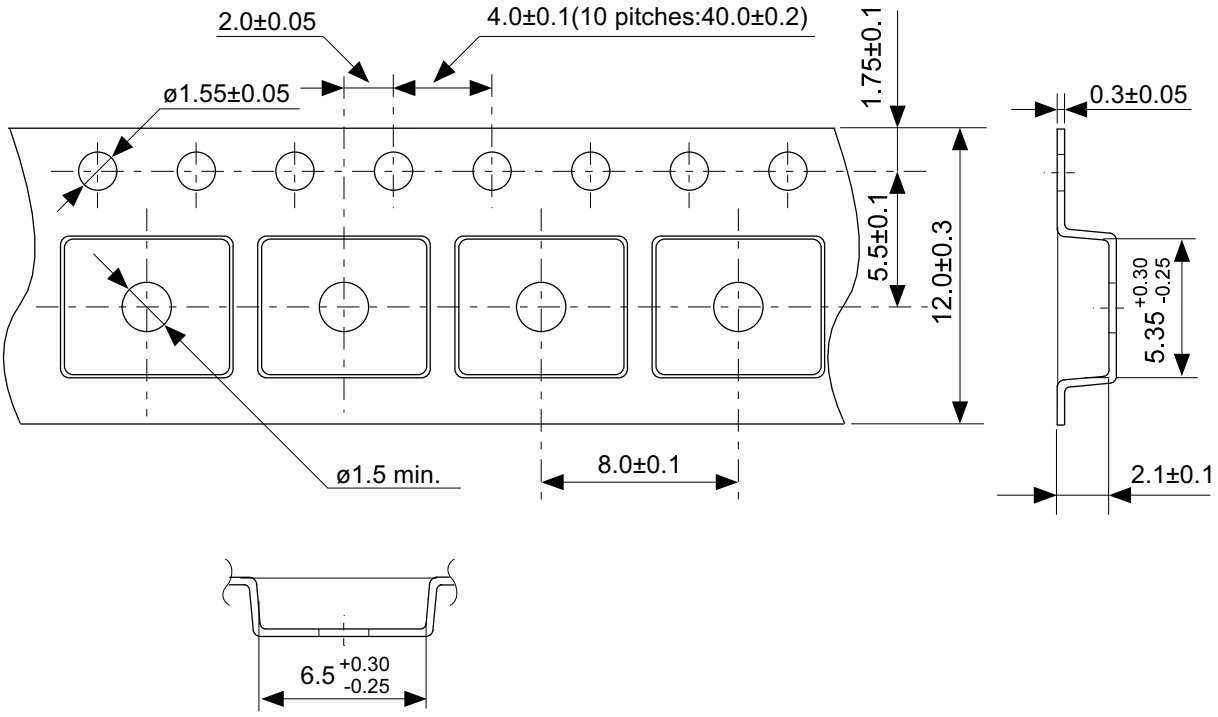
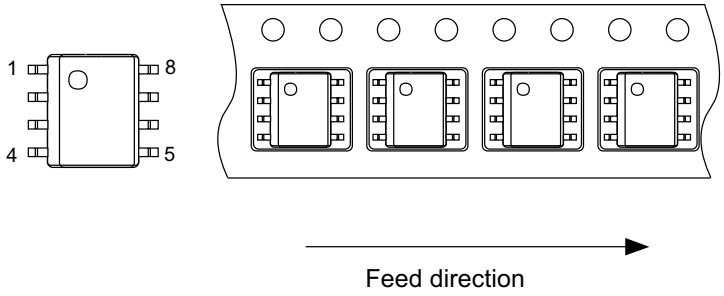
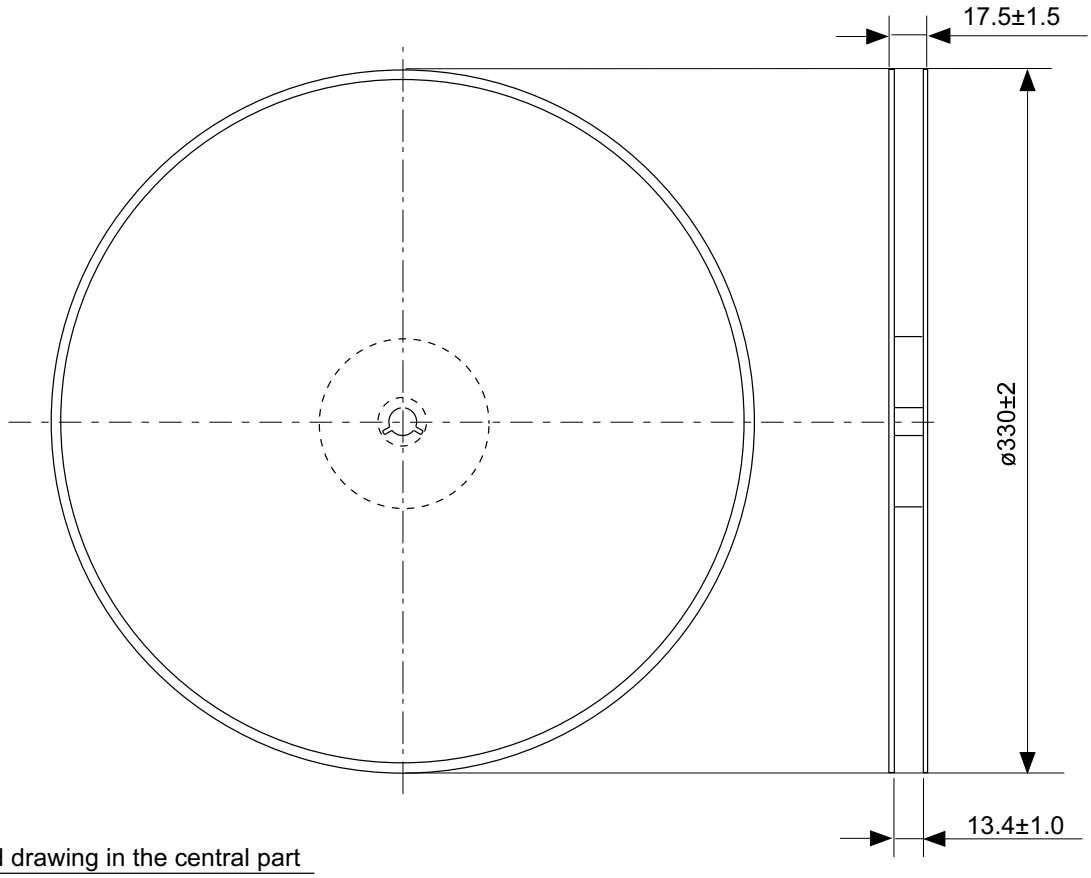
No.	FJ008-Z-P-SD-1.0
SCALE	
UNIT	mm
Seiko Instruments Inc.	



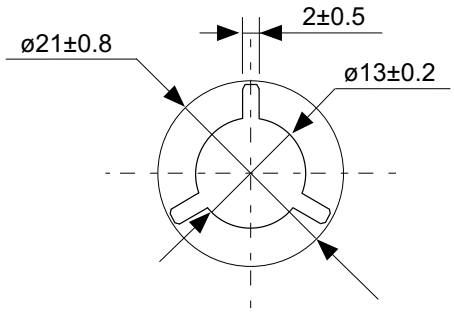


No. FJ008-Z-C-SD-1.0

TITLE	SOP8J-Z-Carrier Tape
No.	FJ008-Z-C-SD-1.0
SCALE	
UNIT	mm
Seiko Instruments Inc.	



Enlarged drawing in the central part



No. FJ008-Z-R-SD-1.0

TITLE	SOP8J-Z-Reel		
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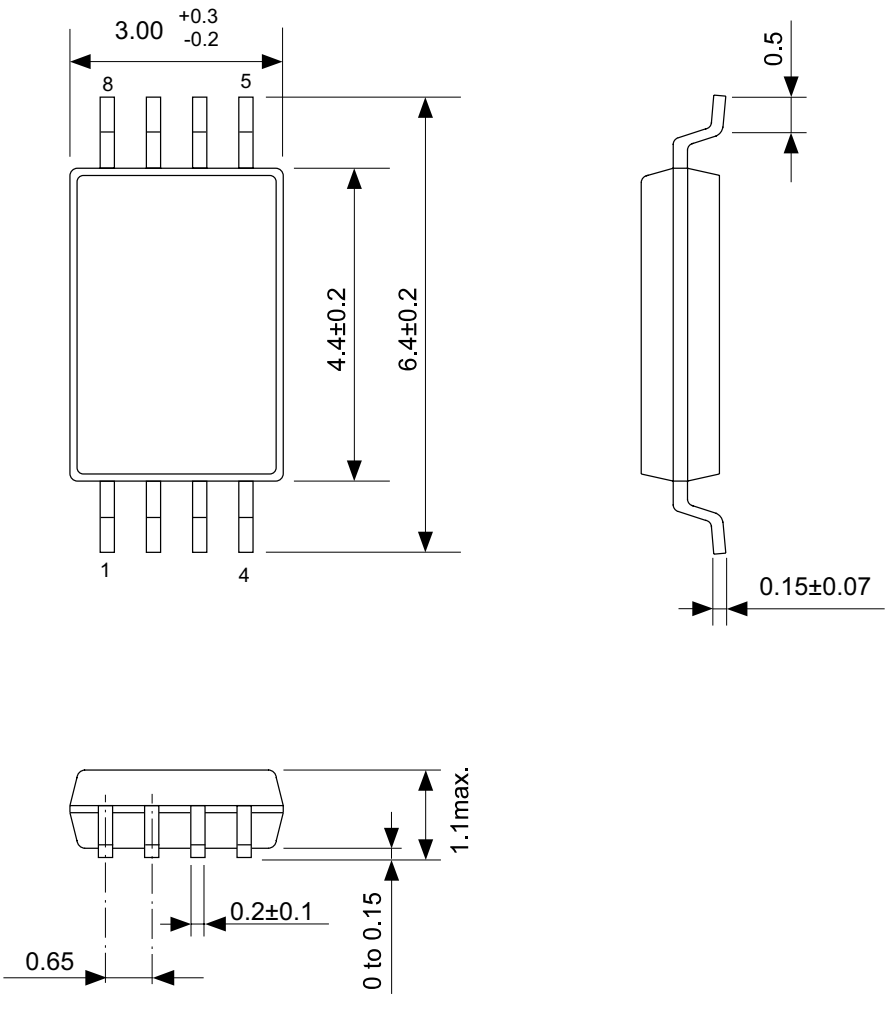
UNIT	mm		
Seiko Instruments Inc.			



No. FT008-Z-P-SD-1.0

TITLE	TSSOP8-Z-PKG Dimensions
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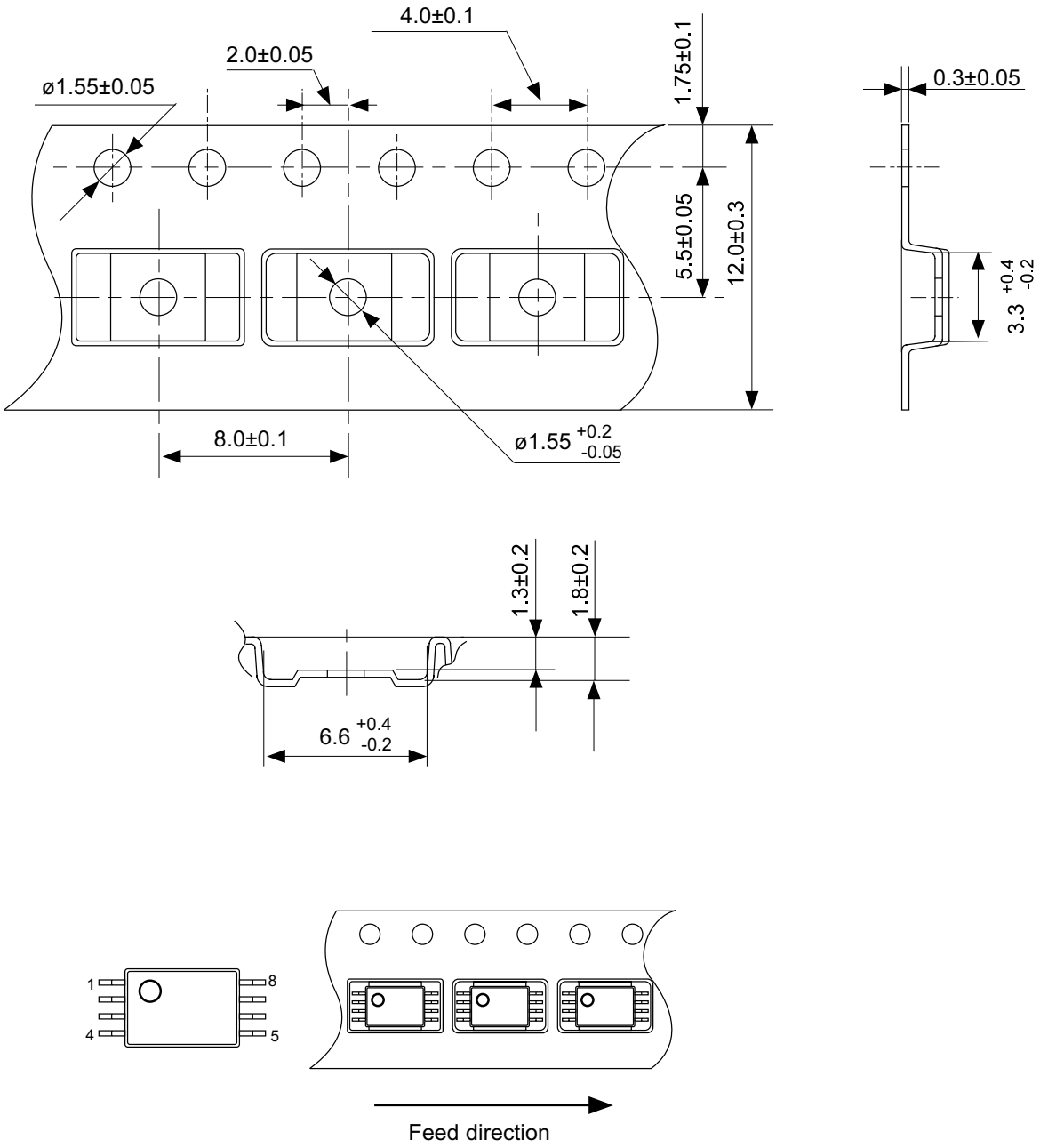
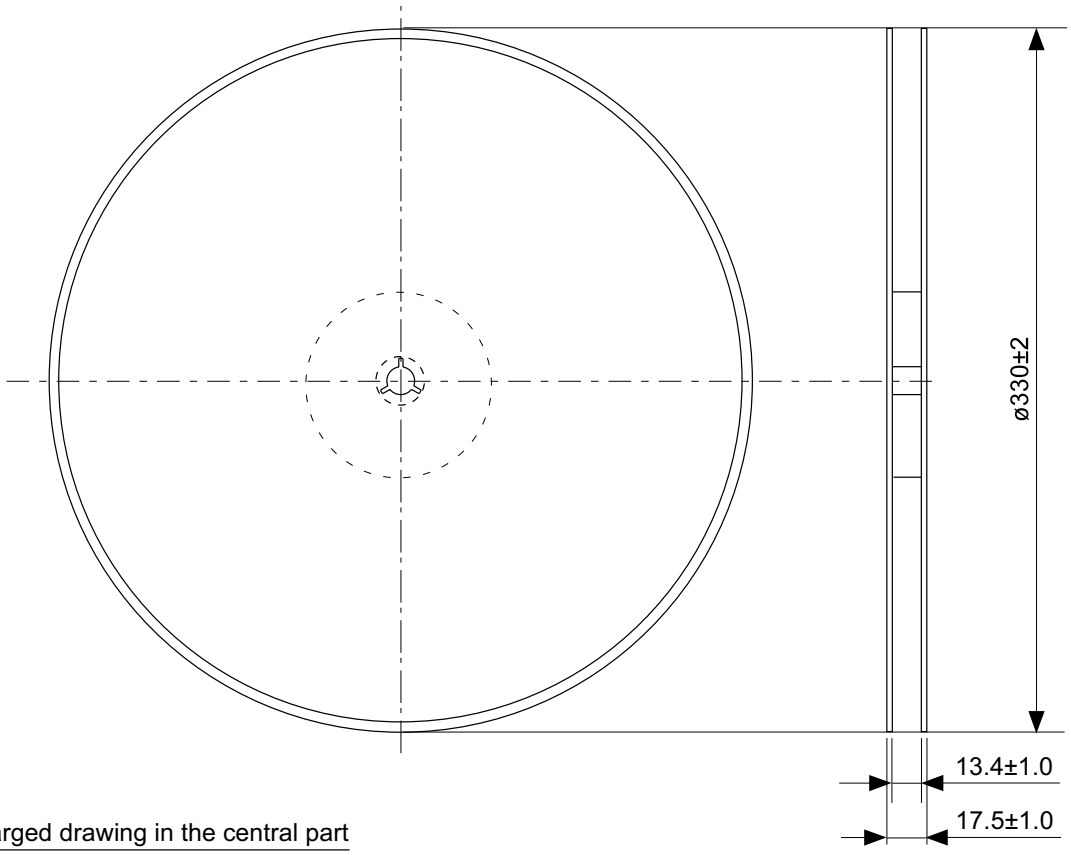
SCALE	
UNIT	mm
Seiko Instruments Inc.	

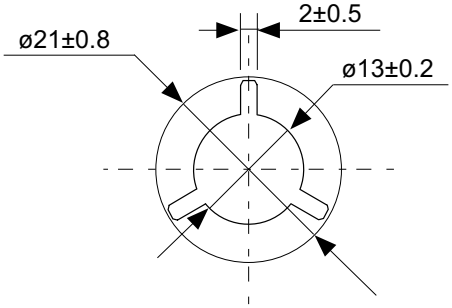


No. FT008-Z-C-SD-1.0

TITLE	TSSOP8-Z-Carrier Tape
No.	FT008-Z-C-SD-1.0
SCALE	
UNIT	mm
Seiko Instruments Inc.	



Enlarged drawing in the central part



No. FT008-Z-R-SD-1.0

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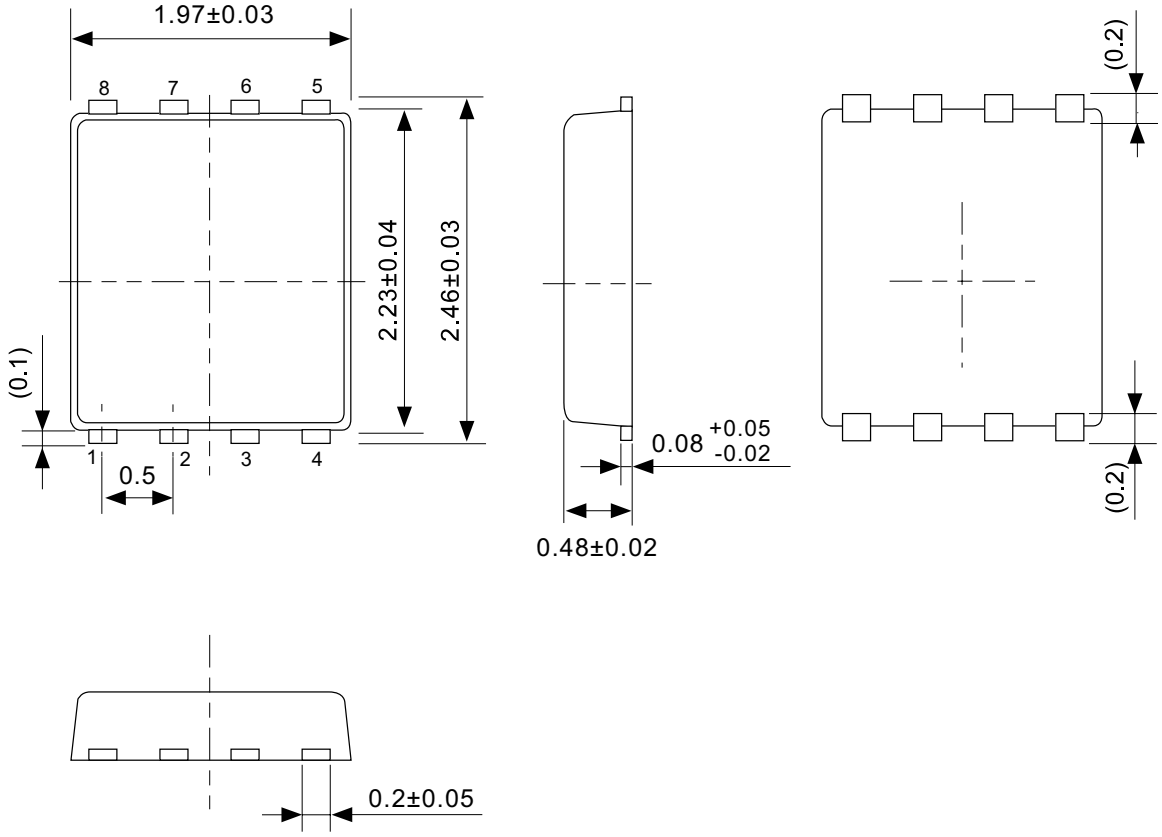
UNIT	mm		
Seiko Instruments Inc.			



No. PH008-A-P-SD-2.0

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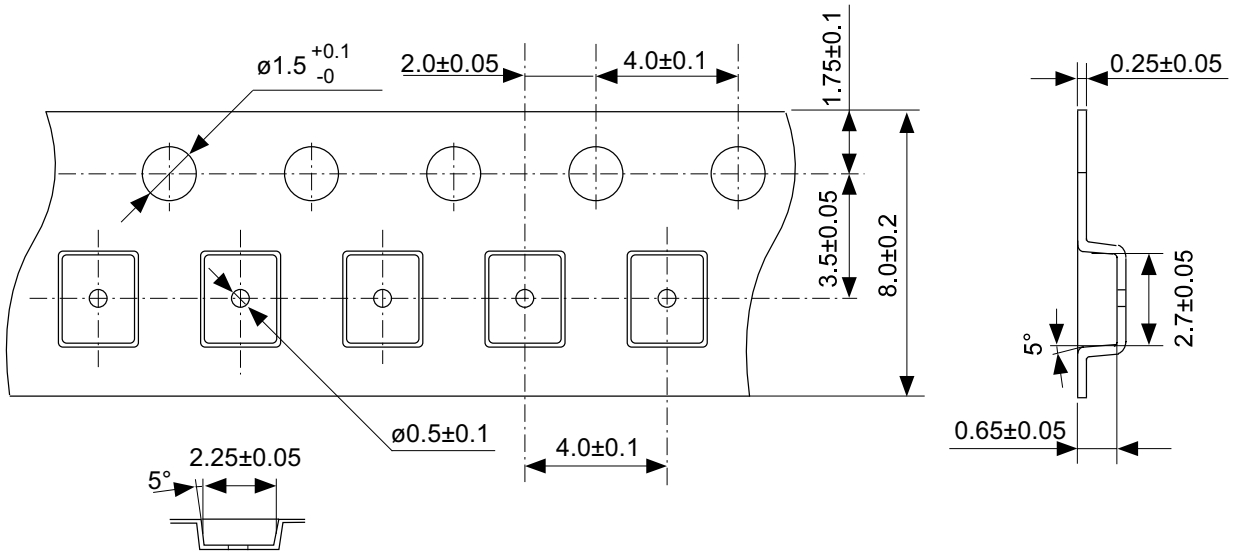
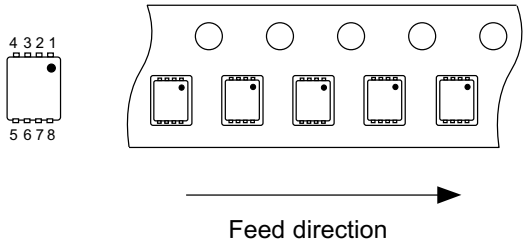
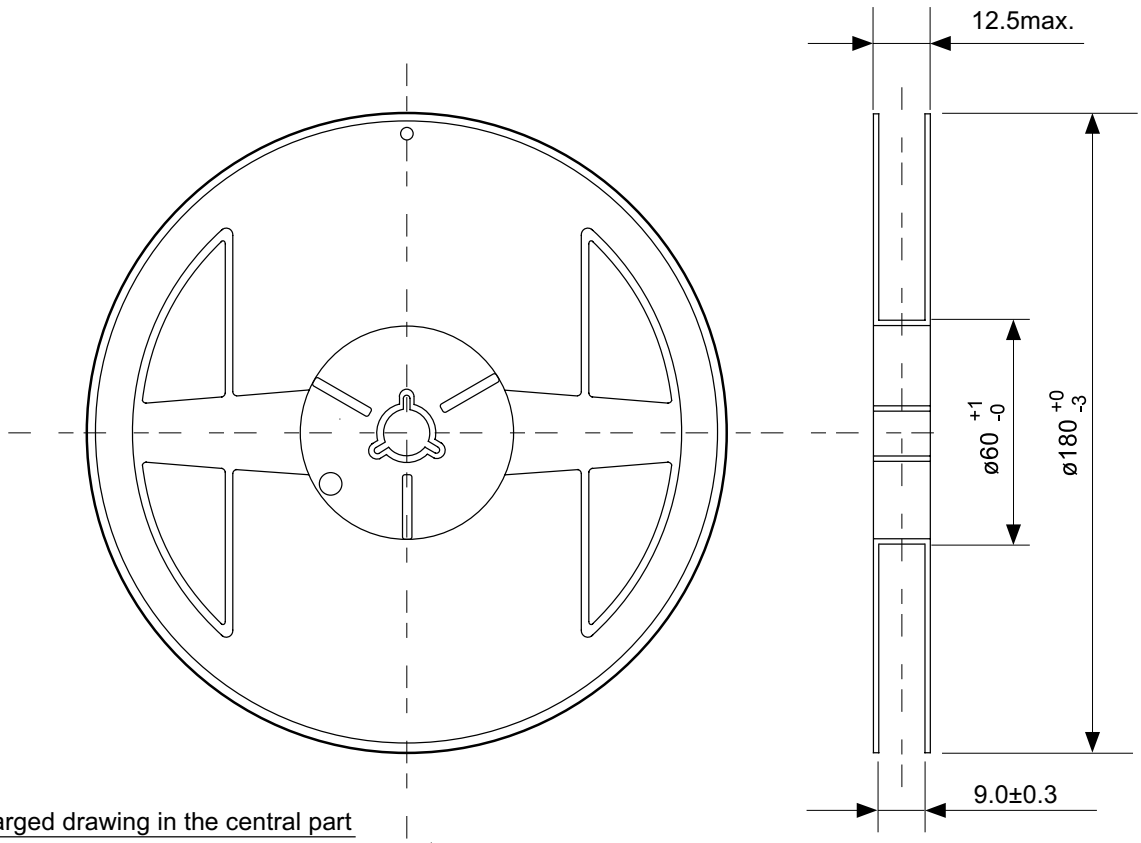
UNIT	mm
Seiko Instruments Inc.	



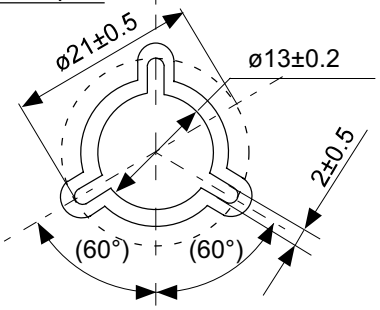


No. PH008-A-C-SD-1.0

TITLE	SNT-8A-A-Carrier Tape
No.	PH008-A-C-SD-1.0
SCALE	
UNIT	mm
Seiko Instruments Inc.	

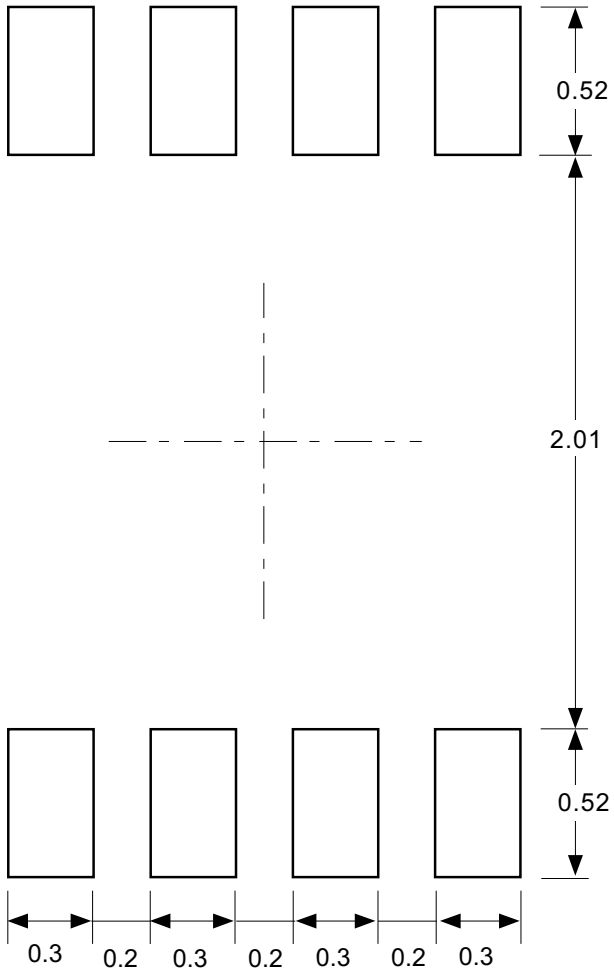


Enlarged drawing in the central part



No. PH008-A-R-SD-1.0

TITLE	SNT-8A-A-Reel		
No.	PH008-A-R-SD-1.0		
SCALE		QTY.	5,000
UNIT	mm		
Seiko Instruments Inc.			

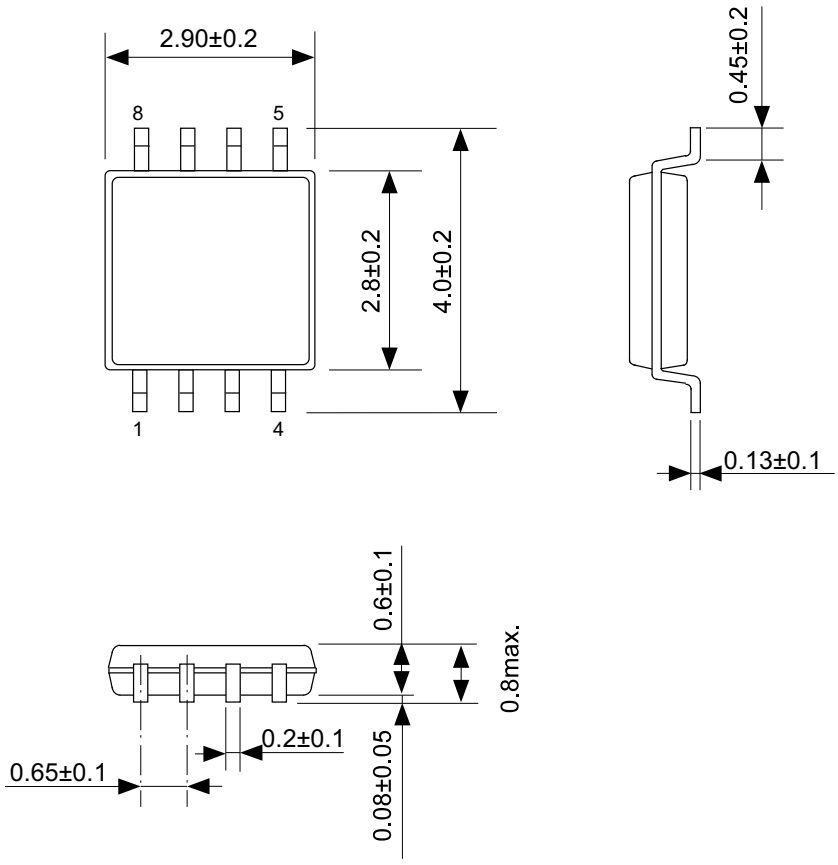


Caution Making the wire pattern under the package is possible. However, note that the package may be upraised due to the thickness made by the silk screen printing and of a solder resist on the pattern because this package does not have the standoff.

注意 パッケージ下への配線パターン形成は可能ですが、本パッケージはスタンドオフが無いので、パターン上のレジスト厚み、シルク印刷の厚みによってパッケージが持ち上がることがありますのでご配慮ください。

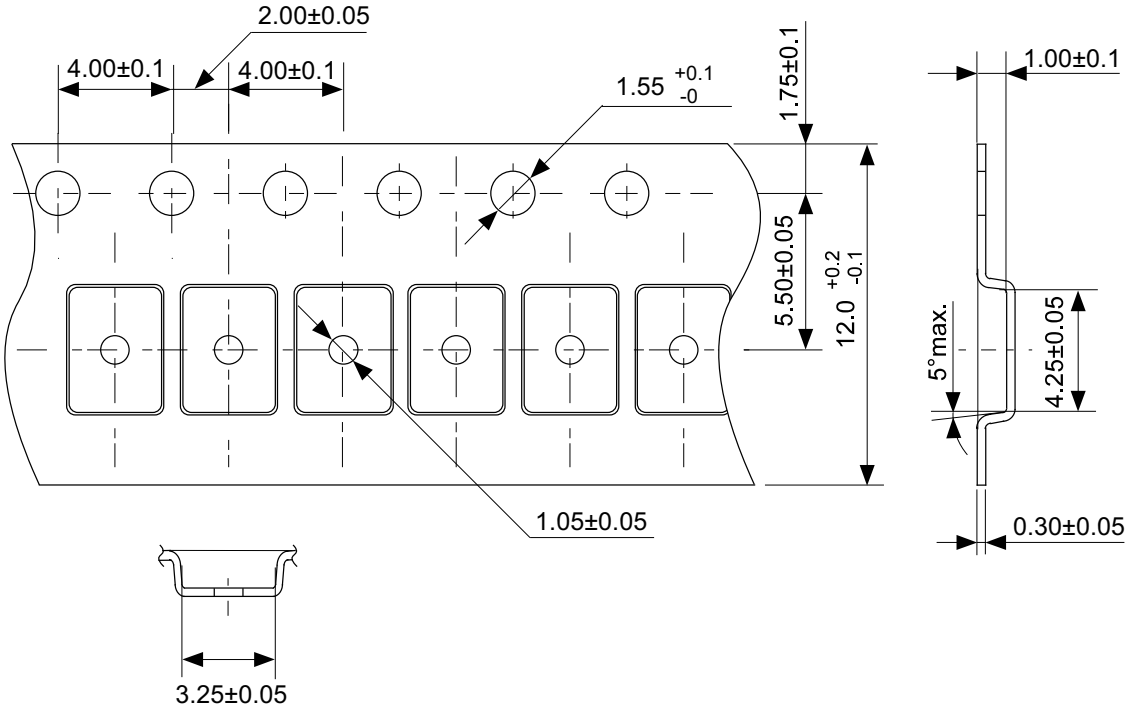
No. PH008-A-L-SD-3.0

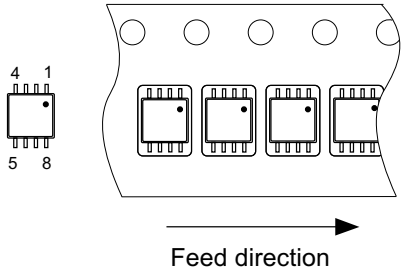
TITLE	SNT-8A-A-Land Recommendation
No.	PH008-A-L-SD-3.0
SCALE	
UNIT	mm
Seiko Instruments Inc.	



No. FM008-A-P-SD-1.0

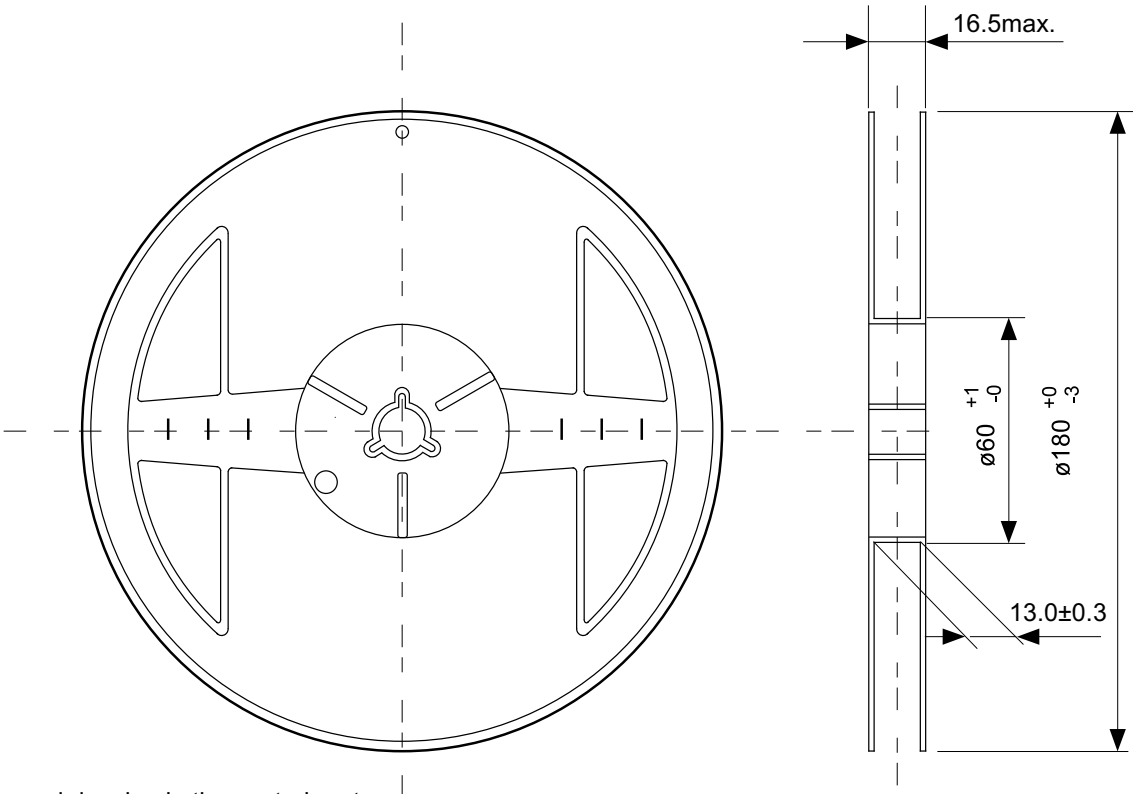
TITLE	TMSOP8-A-PKG Dimensions
No.	FM008-A-P-SD-1.0
SCALE	
UNIT	mm
Seiko Instruments Inc.	



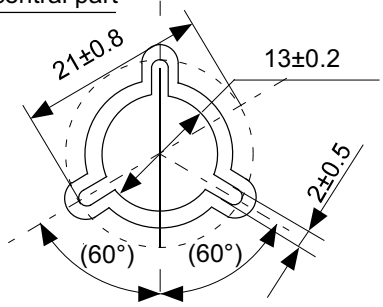


No. FM008-A-C-SD-1.0

TITLE	TMSOP8-A-Carrier Tape
No.	FM008-A-C-SD-1.0
SCALE	
UNIT	mm
Seiko Instruments Inc.	



Enlarged drawing in the central part



No. FM008-A-R-SD-1.0

TITLE	TMSOP8-A-Reel		
No.	FM008-A-R-SD-1.0		
SCALE		QTY.	4,000
UNIT	mm		
Seiko Instruments Inc.			

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