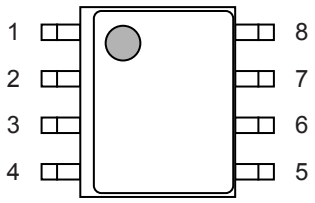
The S-24C512C is a 2-wire, low current consumption and wide range operation serial E^2PROM. The S-24C512C has the capacity of 512 K-bit, and the organization is 65536 words 8-bit. Page write and sequential read are available.

Operating voltage range	Read:	1.6 V to 5.5 V
	Write:	1.7 V to 5.5 V
Page write:	128 bytes / page	
Sequential read		
Operation frequency:	1.0 MHz (V_{CC} = 2.5 V to 5.5 V)	
	400 kHz (V_{CC} = 1.6 V to 2.5 V)	
Write time:	5.0 ms max.	
Noise suppression:	Schmitt trigger and noise filter on input pins (SCL, SDA)	
Write protect function during the low power supply voltage		
Endurance:	10^6 cycles / unit (Ta =	

8-Pin SOP (JEDEC)
Top view

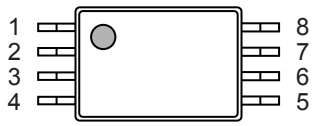


S-24C512CI-J8T1U4

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

Do not use it in high impedance.

8-Pin TSSOP
Top view



S-24C512CI-T8T1U4

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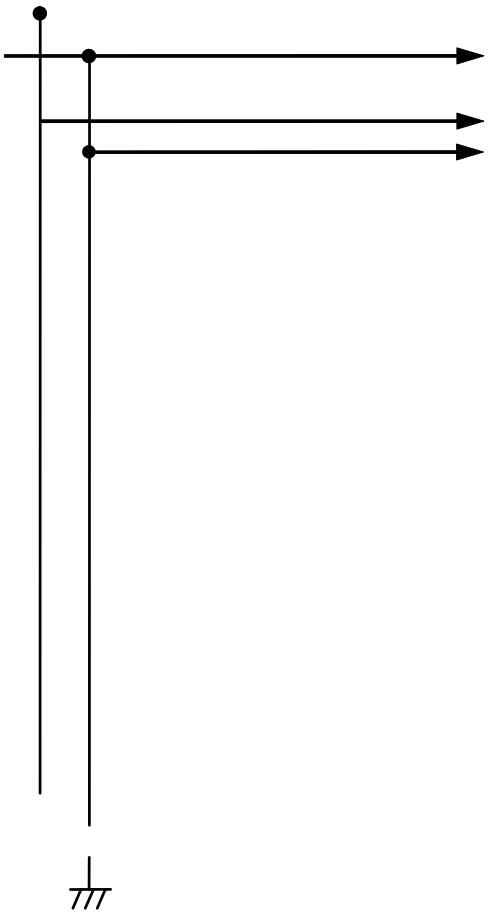
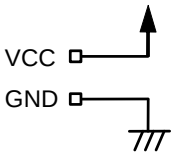
Do not use it in high impedance.

Refer to the “ ” for the details.




VCC
GND

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

Item	Symbol	Condition	Ta = 40°C to 85°C		Unit
			Min.	Max.	
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} = 1.8 V to 5.5 V	0.7 V_{CC}	5.5	V
		V_{CC} = 1.6 V to 1.8 V	0.8 V_{CC}	5.5	V
Low level input voltage	V_{IL}	V_{CC} = 1.8 V to 5.5 V	0.3	0.3 V_{CC}	V
		V_{CC} = 1.6 V to 1.8 V	0.3	0.2 V_{CC}	V

(Ta = 25°C, f = 1.0 MHz, V_{CC} = 5.0 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

Item	Symbol	Operation Ambient Temperature	Min.	Max.	Unit
Endurance	N_W	Ta = 25°C	10^6		cycles / unit

For each unit (unit: the 4 bytes with the same address of W15 to W2)

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

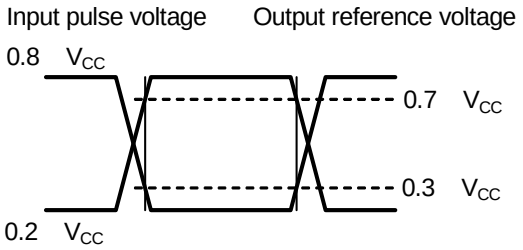
Item	Symbol	Condition	Ta = 40°C to 85°C				Unit
			V_{CC} = 2.5 V to 5.5 V f_{SCL} = 1.0 MHz		V_{CC} = 1.6 V to 2.5 V f_{SCL} = 400 kHz		
			Min.	Max.	Min.	Max.	
Current consumption (READ)	I_{CC1}			2.0		1.5	mA

Item	Symbol	Condition	Ta = 40°C to 85°C				Unit
			V_{CC} = 2.5 V to 5.5 V f_{SCL} = 1.0 MHz		V_{CC} = 1.7 V to 2.5 V f_{SCL} = 400 kHz		
			Min.	Max.	Min.	Max.	
Current consumption (WRITE)	I_{CC2}			4.0		4.0	mA

VIN Item	Symbol	Condition	Ta = 40°C to 85°C				Unit
			V_{CC} = 2.5 V to 5.5 V		V_{CC} = 1.6 V to 2.5 V		
			Min.	Max.	Min.	Max.	
Standby current consumption	I_{SB}	V_{IN} = V_{CC} or GND		8.0		4.0	A
nput leakage current 1	I_{LI1}	SCL, SDA, V_{IN} = GND to V_{CC}		1.0		1.0	A

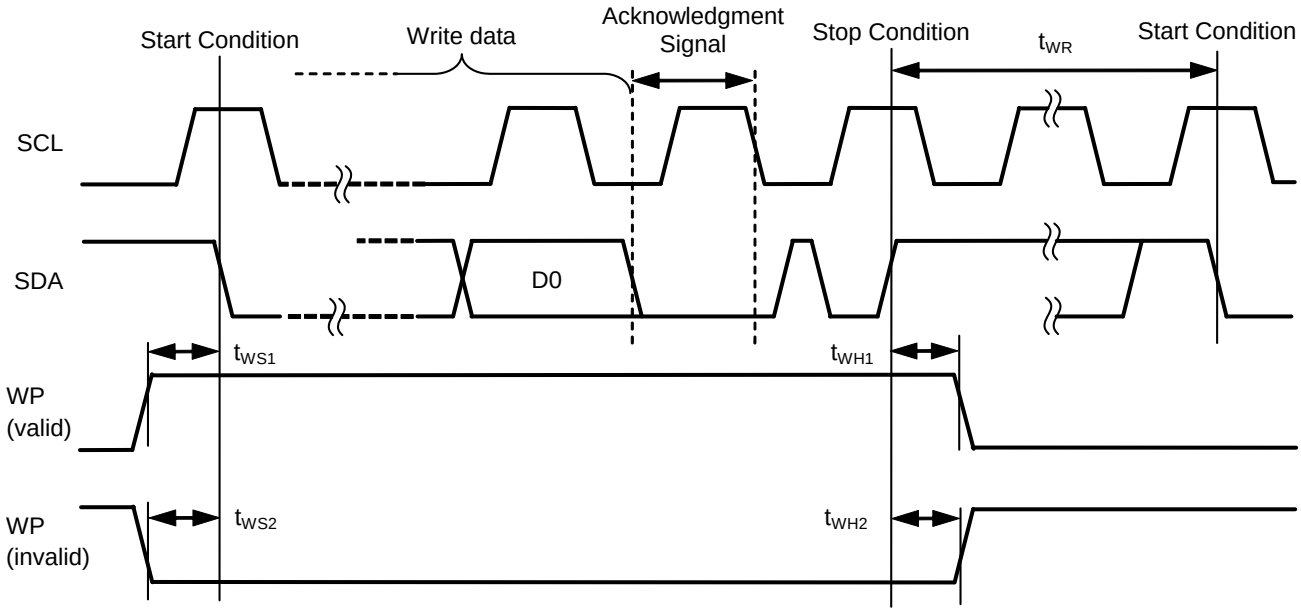
Input leakage current 2 I

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



Item	Symbol	Ta = 40°C to 85°C				Unit
		V_{CC} = 2.5 V to 5.5 V		V_{CC} = 1.6 V to 2.5 V		
		Min.	Max.	Min.	Max.	
SCL clock frequency	f_{SCL}	0	1000	0	400	kHz
SCL clock time “L”	t_{LOW}	0.4		1.3		s
SCL clock time “H”	t_{HIGH}	0.3		0.6		s

Item	Symbol	Ta = 40°C to 85°C V_{CC} = 1.7 V to 5.5 V		Unit
		Min.	Max.	
Write time	t_{WR}		5.0	ms



In the S-24C512C, 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-24C512C from other devices connected onto the bus.
Each A0, A1 and A2 pin has a pull-down resistor. In open, these pins have the status when they are connected to GND.

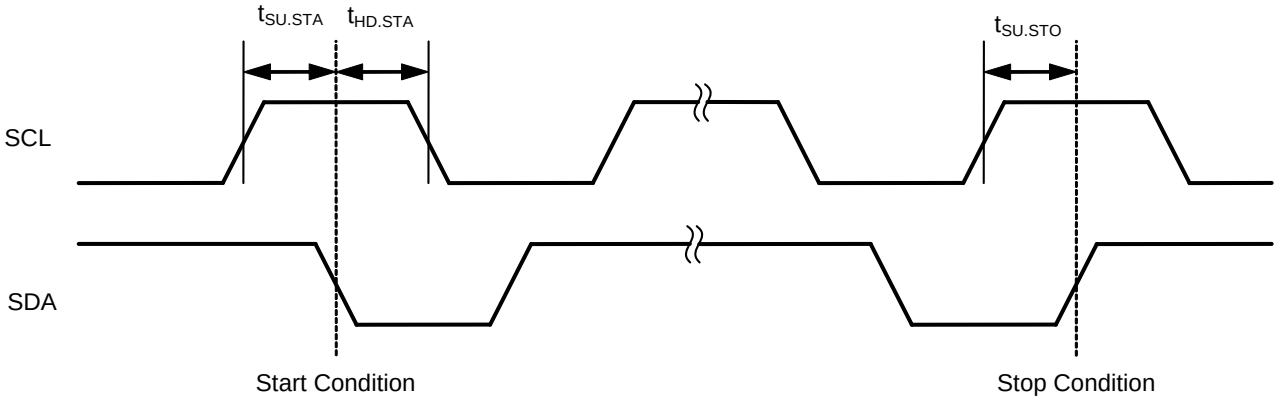
The SDA pin is used for the bi-directional transmission of serial data. This pin is a signal input pin, and an Nch open drain output pin.
In use, generally, connect the SDA line to any other device which has the open-drain or open-collector output with Wired-OR connection by pulling up to V_{CC} by a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

The SCL pin is used for the serial clock input. Since

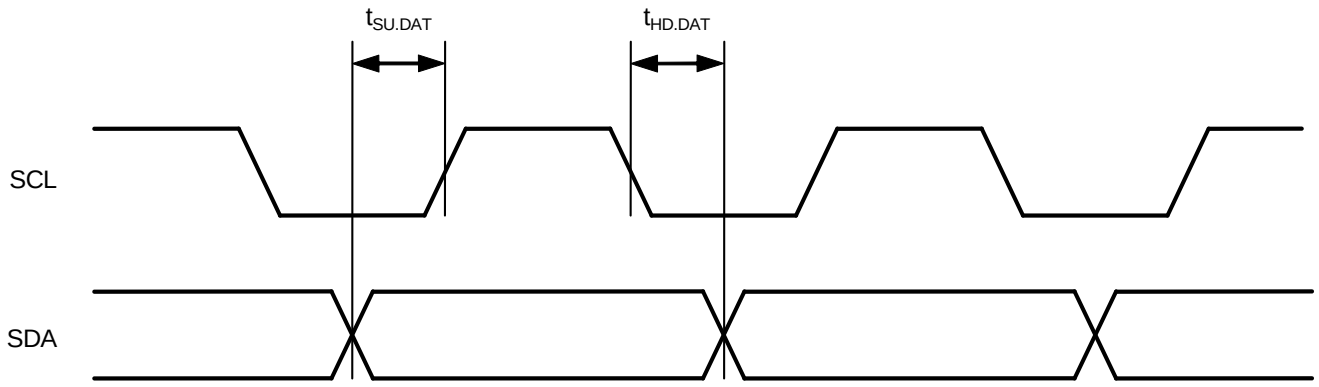
S-24C512C Series adds 6 ECC bits for error correction to each 4 bytes with the same address of W15 to W2. The ECC function can make correction and output correct data even if wrong data of 1 bit is in the 4 bytes when reading.
In addition, the S-24C512C Series rewrites the 4 bytes used as the rewriting minimum unit and 6 ECC bits if only 1 byte data is input.
Therefore, it is recommended to rewrite data of each 4 bytes with the same address of W15 to W2 in order to get the maximum endurance in the application in which the data is rewrote frequently.

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.

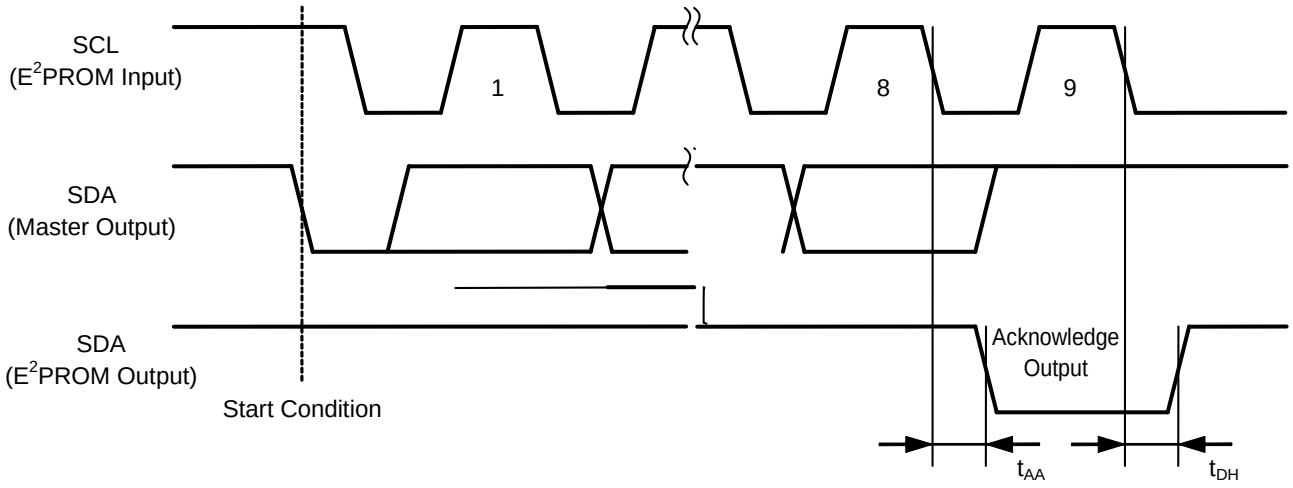
Stop is identified by a low to high transition of the SDA line while the SCL line is stable at high.
When a device receives a stop condition during a read sequence, the read operation is interrupted, and the device enters standby mode.
When a device receives a stop condition during a write sequence, the reception of the write data is halted, and the S-24C512C initiates a write cycle.



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.

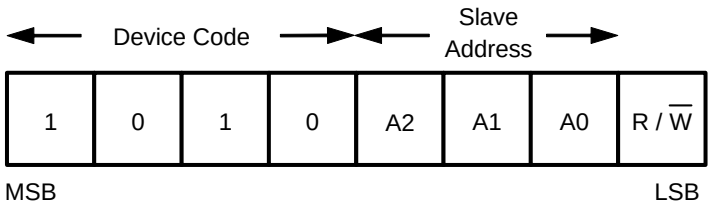


The unit of data transmission is 8 bits. During the 9th clock cycle period the receiver on the bus pulls down the SDA line to acknowledge the receipt of the 8-bit data.
When an internal write cycle is in progress, the S-24C512C does not generate an acknowledge.

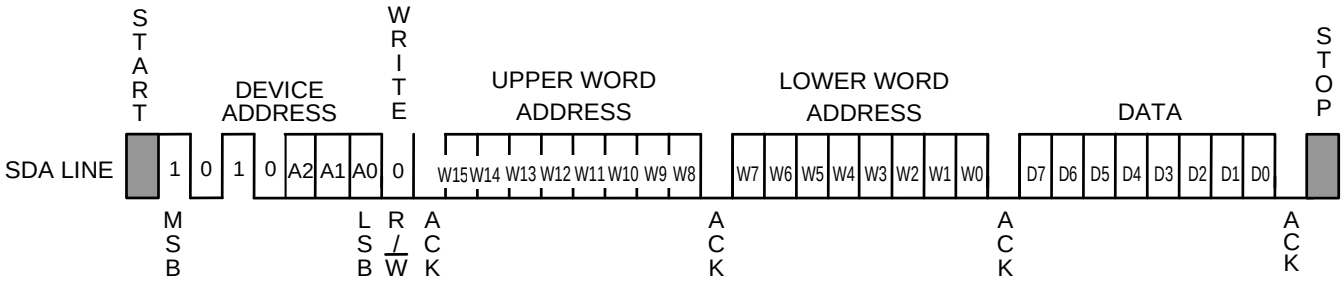


To start communication, the master device on the system generates a start condition to the bus line. Next, the master device sends 7-bit device address and a 1-bit read / write instruction code on to the SDA bus.
The upper 4 bits of the device address are the “Device Code”, and are fixed to “1010”.

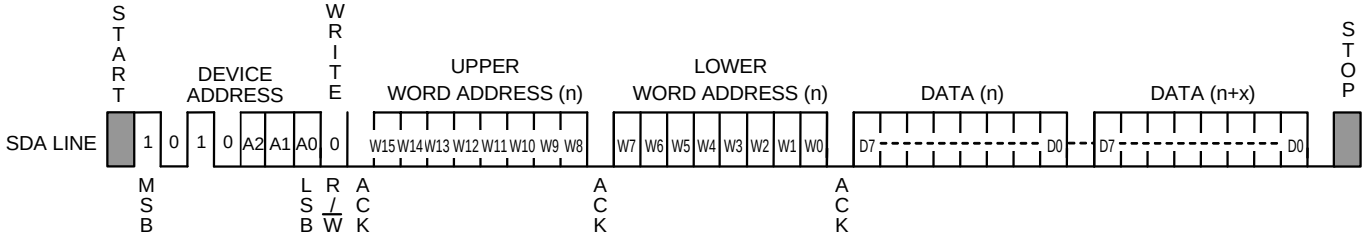
In the S-24C512C, successive 3 bits are the “Slave Address”. These 3 bits are used to identify a device on the system bus and is compared with the predetermined value which is defined by the address input pins (A2, A1, A0). When the comparison result matches, the slave device responds with an acknowlede during the 9th clock cycle.



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 S-24C512C acknowledges it. The S-24C512C then receives a upper 8-bit word address and responds with an acknowledge. And the S-24C512C receives a lower 8-bit word address and responds with an acknowledge. After the S-24C512C 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.

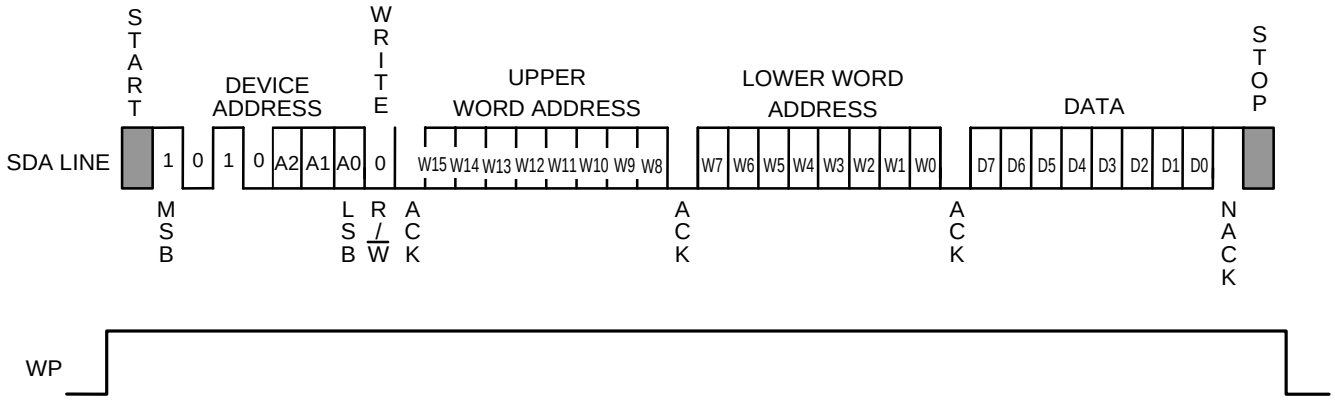


The page write mode allows up to 128 bytes to be written in a single write operation in the S-24C512C.
Its basic process to transmit data is as same as byte write, but it operates page write by sequentially receiving 8-bit write data as much data as the page size has.
When the S-24C512C receives a 7-bit device address and a 1-bit read / write instruction code set to “0”, following a start condition, it generates an acknowledge. And the S-24C512C receives a upper 8-bit word address, and responds with an acknowledge. Then the S-24C512C receives a lower 8-bit word address, and responds with an acknowledge. After the S-24C512C 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 S-24C512C repeats reception of 8-bit write data and generation of acknowledge in succession. The S-24C512C 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.

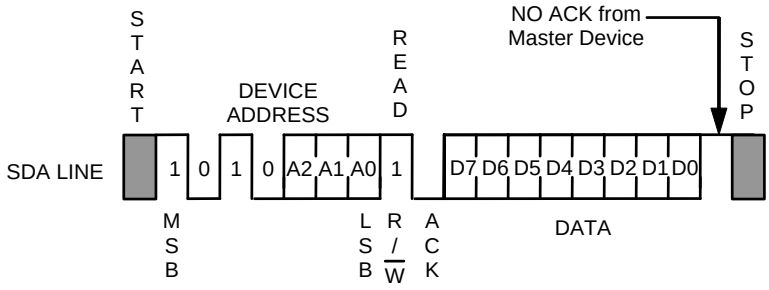


In the S-24C512C, the lower 7 bits of the word address are automatically incremented every time when the S-24C512C receives 8-bit write data. If the size of the write data exceeds 128 bytes, the upper 9 bits of the word address remain unchanged, and the lower 7 bits are rolled over and the last 128-byte data that the S-24C512C received will be overwritten.

Write protect is available in the S-24C512C. When the WP pin is connected to the V_{CC}, write operation to memory area is inhibited.
When the WP pin is connected to GND or set in open, the write protect 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 protect, refer to .
In not using the write protect, connect the WP pin to GND or set it open. The write protect is valid in the range of operation power supply voltage.
As seen in when the write protect is valid, the S-24C512C does not generate an acknowledgment signal after data input.



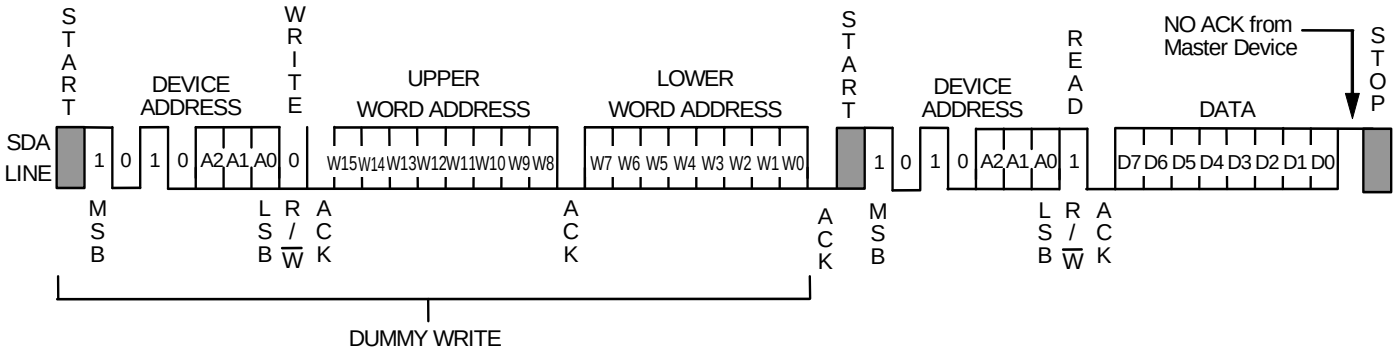
Either in writing or in reading the S-24C512C holds the last accessed memory address. The memory address is maintained as long as the power voltage does not decrease less than the operating voltage.
The master device can read the data at the memory address of the current address pointer without assigning the word address as a result, when it recognizes the position of the address pointer in the S-24C512C. This is called “Current Address Read”.
In the following the address counter in the S-24C512C is assumed to be “n”.
When the S-24C512C 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 S-24C512C synchronous to the SCL clock. The address counter is incremented and the content of the address counter becomes n 1.
The master device outputs stop condition not an acknowledge, the reading of S-24C512C is ended.



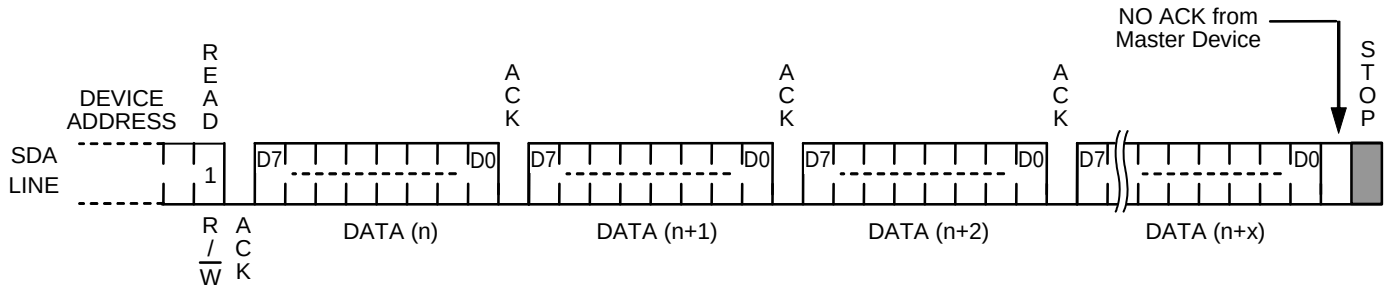
Attention should be paid to the following point on the recognition of the address pointer in the S-24C512C.
In Read, the memory address counter in the S-24C512C is automatically incremented after output of the 8th bit of the data. In Write, on the other hand, the upper bits of the memory address (the upper bits of the word address) are left unchanged and are not incremented.

The upper 9 bits of the word address

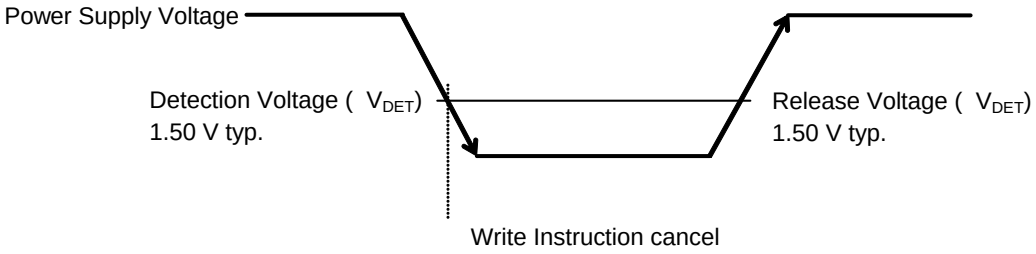
Random read is used to read the data at an arbitrary memory address.
A dummy write is performed to load the memory address into the address counter.
When the S-24C512C receives a 7-bit device address and a 1-bit read / write instruction code set to “0” following a start condition, it responds with an acknowledge.
The S-24C512C then receives a upper 8-bit word address and responds with an acknowledge. And the S-24C512C receives a lower 8-bit word address and responds with an acknowledge. The memory address is loaded to the address counter in the S-24C512C 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 S-24C512C 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 S-24C512C in synchronous to the SCL clock. The master device outputs stop condition not an acknowledge, the reading of S-24C512C is ended.

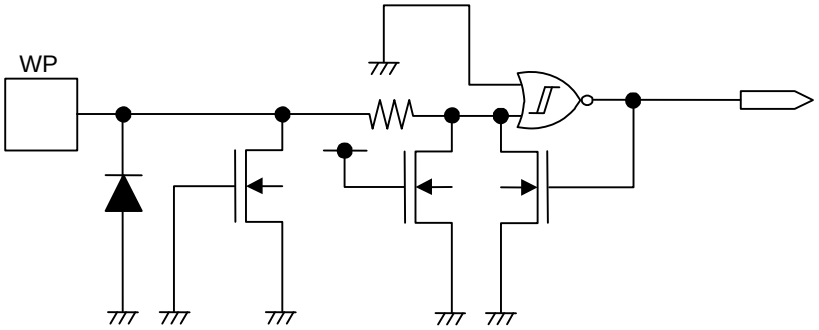


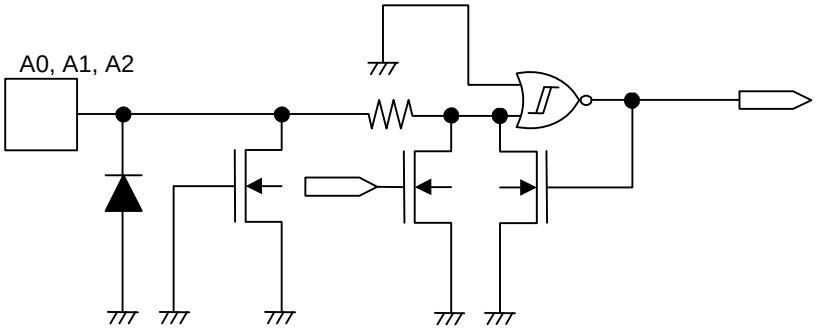
When the S-24C512C receives a 7-bit device address and a 1-bit read / write instruction code set to “1” following a start condition both in current address read and random read, it responds with an acknowledge.
When an 8-bit data is output from the S-24C512C synchronous to the SCL clock, the address counter is automatically incremented.
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 S-24C512C 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 S-24C512C 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.



The S-24C512C 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 1.50 V typ. (Refer to).
The S-24C512C 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.

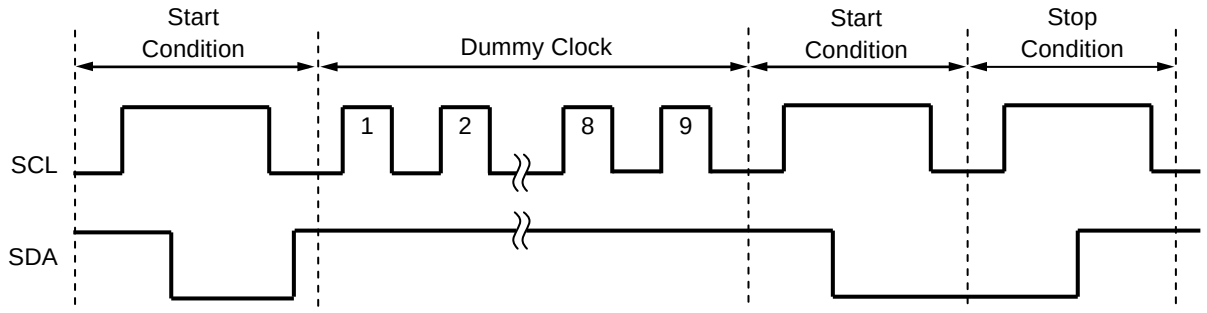



WP


A0, A1, A2

The S-24C512C does not have a pin to reset (the internal circuit). The users cannot forcibly reset it externally. If the communication to the S-24C512C interrupted, the users need to handle it as you do for software.
In the S-24C512C, 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-24C512C's internal circuit does not go in reset, but it does by inputting a stop condition to the S-24C512C. The S-24C512C 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-24C512C. How to reset is shown below.

The S-24C512C is able to be reset by a start and stop instructions. When the S-24C512C 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. 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-24C512C interrupts the acknowledgment output operation or data output, so input a start condition . When a start condition is input, the S-24C512C is reset. To make doubly sure, input the stop condition to the S-24C512C. The normal operation is then possible.



After 9 clocks (dummy clock), if the SCL clock continues to being output without inputting a start condition, S-24C512C may go in the write operation when it receives a stop condition. To prevent this, input a start condition after 9 clocks (dummy clock).

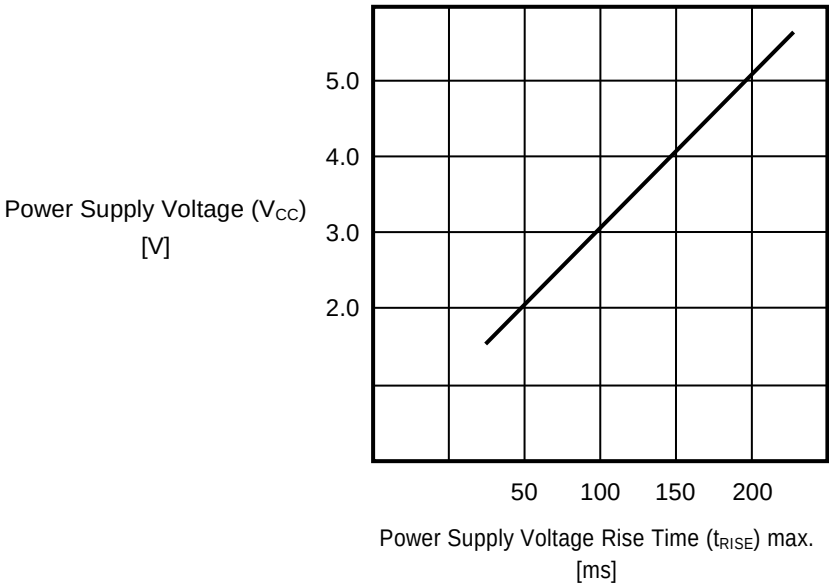
Regarding this reset procedure with dummy clock, it is recommended to perform at the system initialization after applying the power supply voltage.

The I^2C-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-24C512C. This function is effective to prevent malfunction, so it is recommended to perform an acknowledge check with the master device.

The S-24C512C 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.

Shown in , 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 . The power supply voltage must be raised within 200 ms.

V_{INIT} 0.2 V



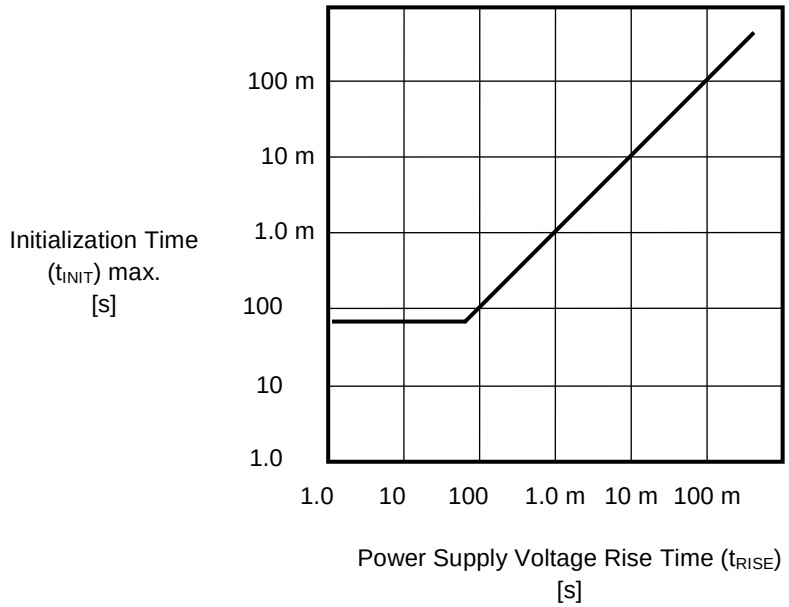
For example: If the power supply voltage = 5.0 V, raise the power supply voltage to 5.0 V within 200 ms.

When initialization is successfully completed by the power-on-clear circuit, the S-24C512C enters the standby status.
If the power-on-clear circuit does not operate;
The S-24C512C has not completed initialization, an instruction previously input is still valid or an instruction may be inappropriately recognized. In this case, S-24C512C may perform the Write operation.
The voltage drops due to power off while the S-24C512C is being accessed. Even if the master device is reset due to the low power voltage, the S-24C512C may malfunction unless the power-on-clear operation conditions of S-24C512C are satisfied.

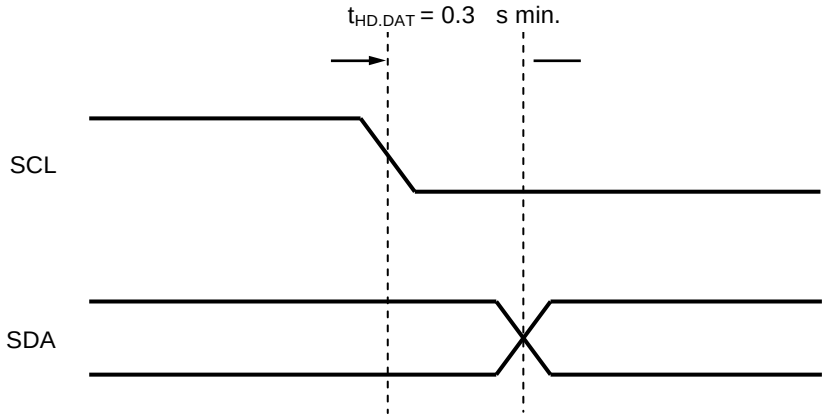
When not keeping to the power supply voltage rise time seen in , adjust the phase (reset) to reset the internal circuit in the S-24C512C normally.

The S-24C512C initializes at the same time when the power supply voltage is raised. Input instructions to the S-24C512C after initialization. S-24C512C does not accept any instruction during initialization.

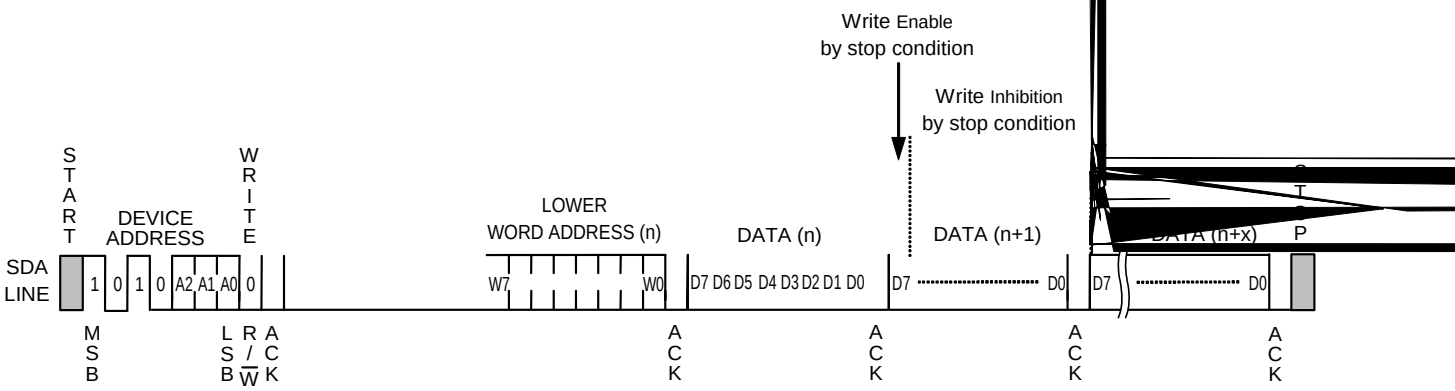
shows the initialization time of the S-24C512C.



If SCL and SDA of the S-24C512C 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-24C512C may error if it does not recognize a start / stop condition correctly during transmission.
It is recommended to set the delay time of 0.3 s minimum from a falling edge of SCL for the SDA.
This is to prevent S-24C512C from going in a start / stop condition due to the time lag caused by the load of the bus line.



The S-24C512C 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 regarding details.



Set a by-pass capacitor of about 0.1 F between the VCC and GND pin for stabilization.

Do not apply an electrostatic discharge to this IC that exceeds the performance ratings of the built-in electrostatic protection circuit.

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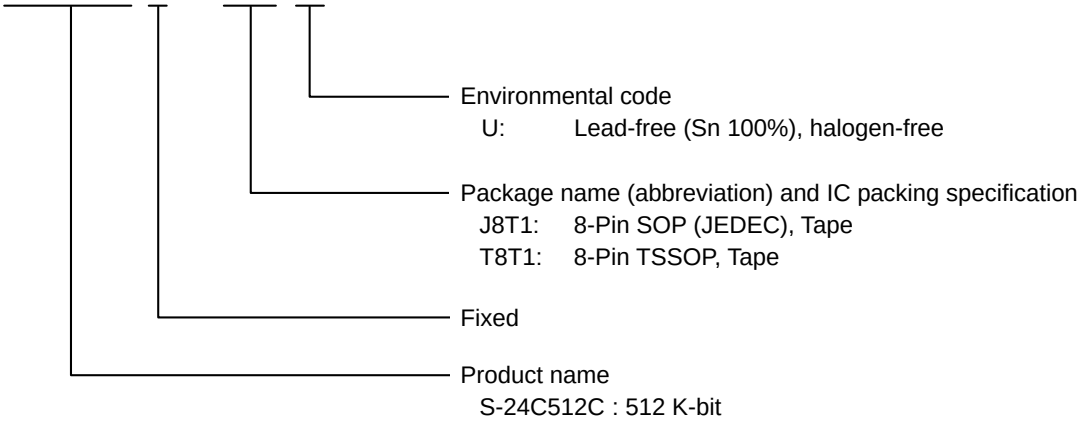
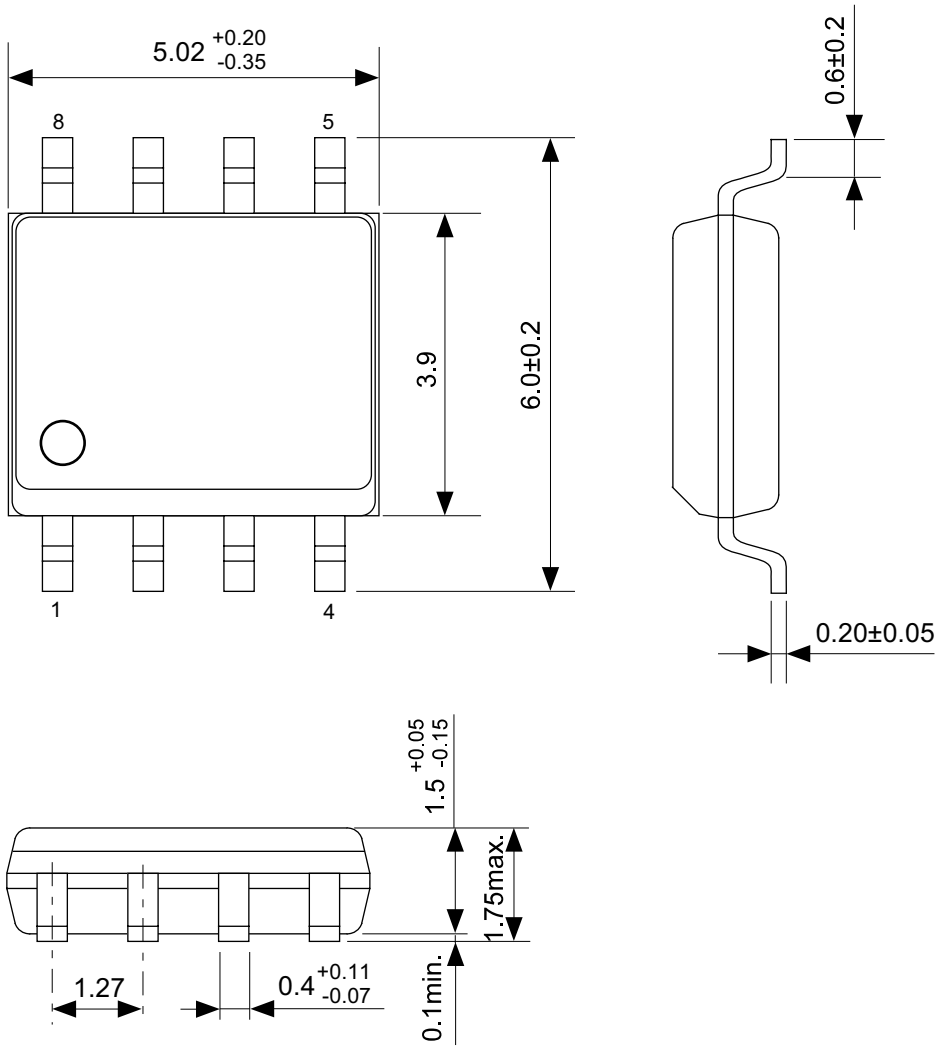
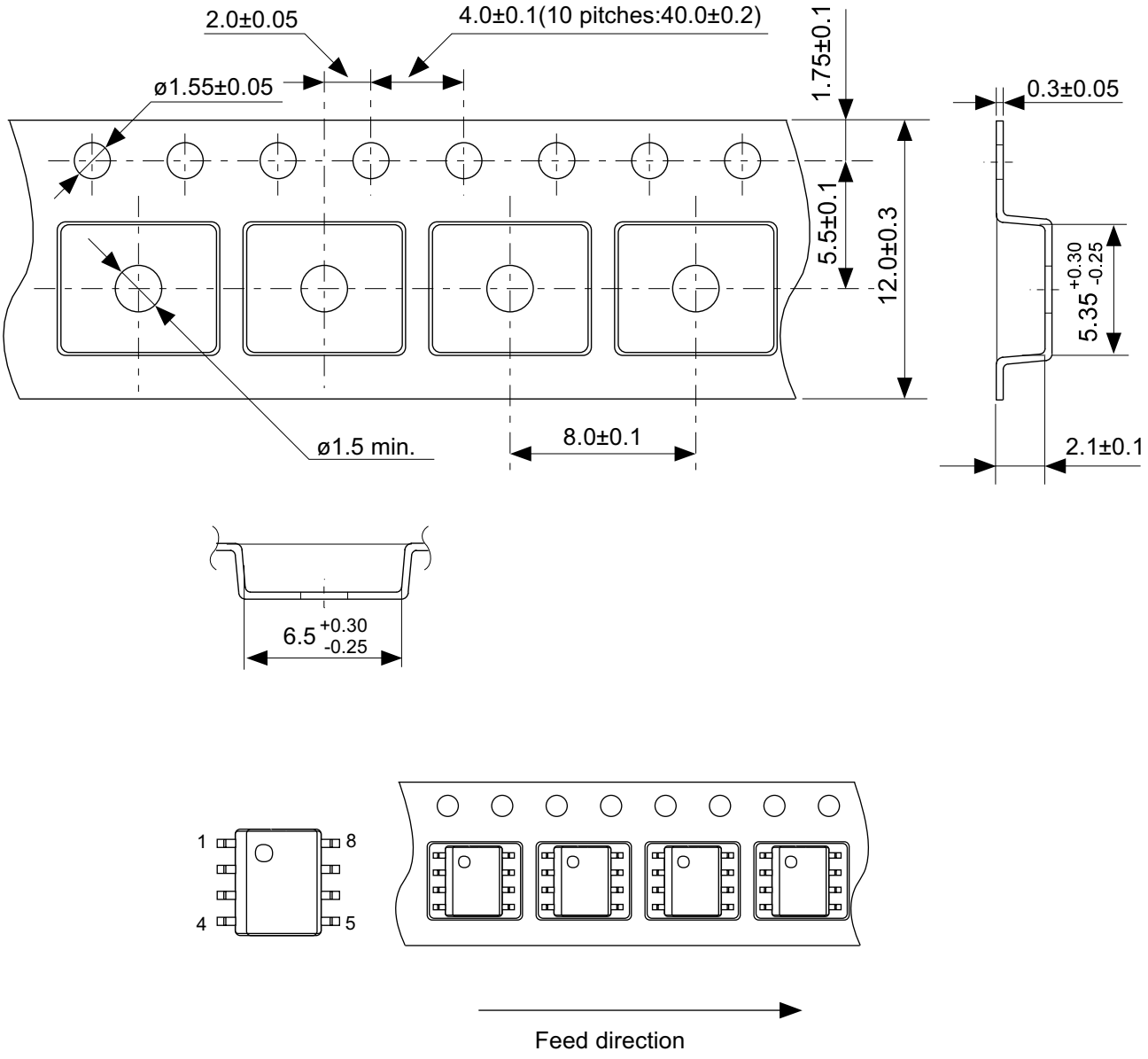


Package name	Drawing code		
	Package	Tape	Reel
8-Pin SOP (JEDEC)	FJ008-Z-P-SD	FJ008-Z-C-SD	FJ008-Z-R-SD
8-Pin TSSOP	FT008-Z-P-SD	FT008-Z-C-SD	FT008-Z-R-SD



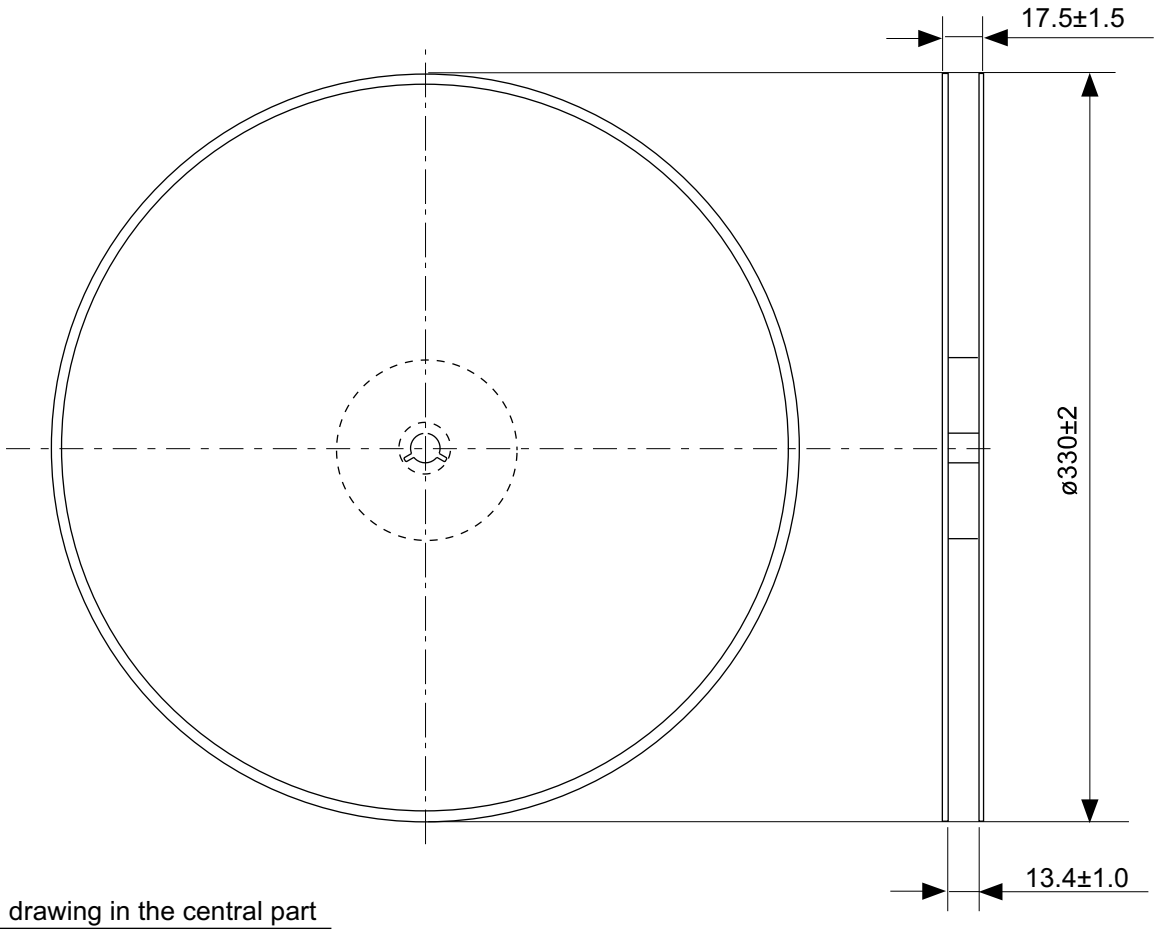
No. FJ008-Z-P-SD-2.1

TITLE	SOP8J-Z-PKG Dimensions
No.	FJ008-Z-P-SD-2.1
ANGLE	
UNIT	mm
ABLIC Inc.	

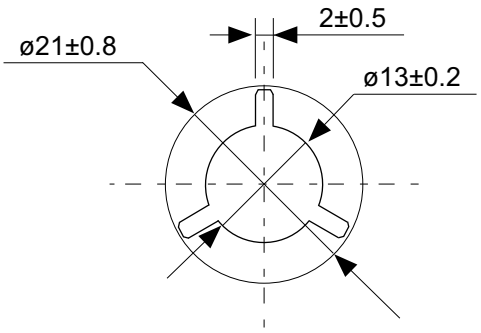


No. FJ008-Z-C-SD-1.0

TITLE	SOP8J-Z-Carrier Tape
No.	FJ008-Z-C-SD-1.0
ANGLE	
UNIT	mm
	ABLIC Inc.

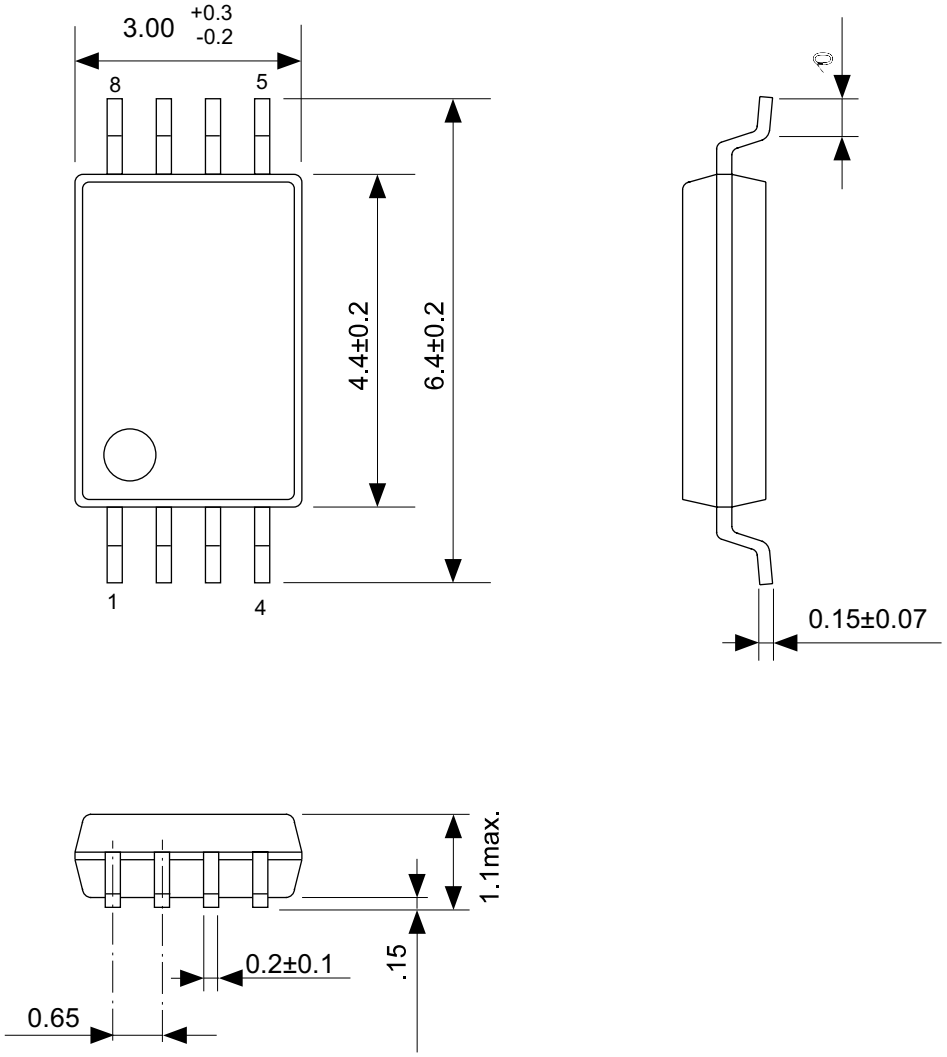


Enlarged drawing in the central part



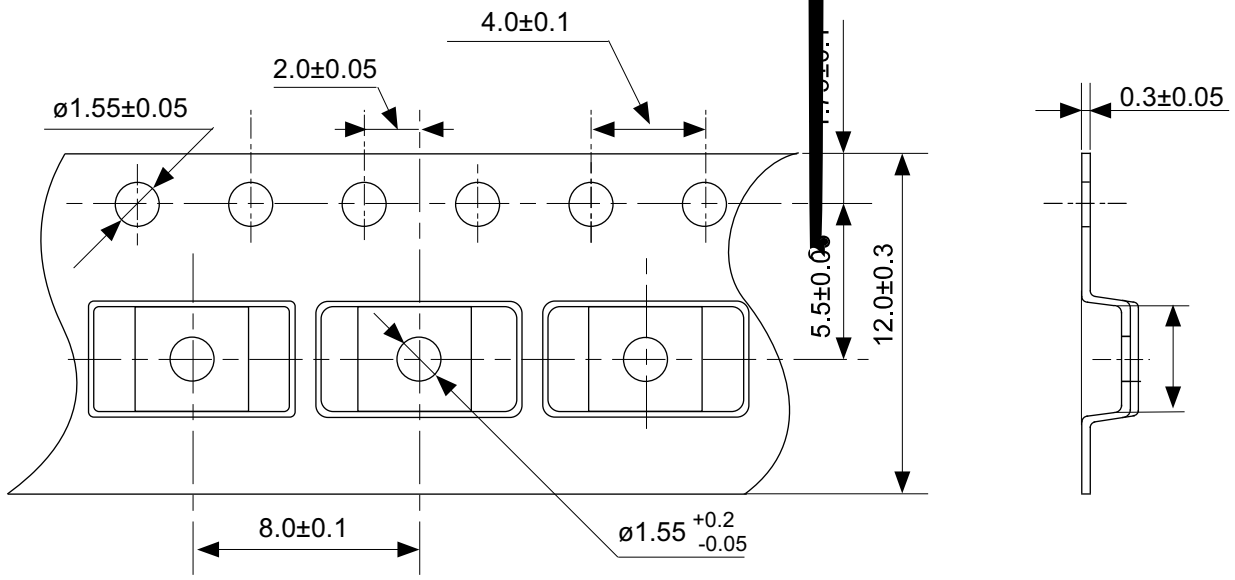
No. FJ008-Z-R-SD-1.0

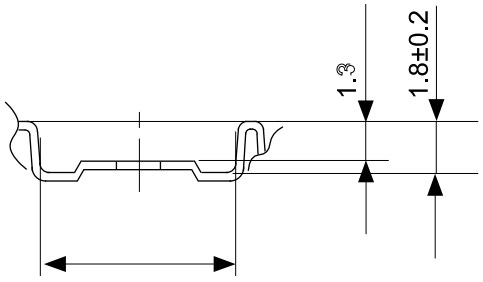
TITLE	SOP8J-Z-Reel		
No.	FJ008-Z-R-SD-1.0		
ANGLE		QTY.	4,000
UNIT	mm		
ABLIC Inc.			

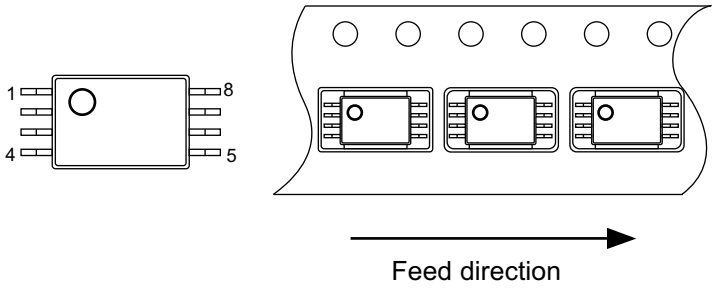


No. FT008-Z-P-SD-1.2

TITLE	TSSOP8-Z-PKG Dimensions
No.	FT008-Z-P-SD-1.2
ANGLE	
UNIT	mm
ABLIC Inc.	

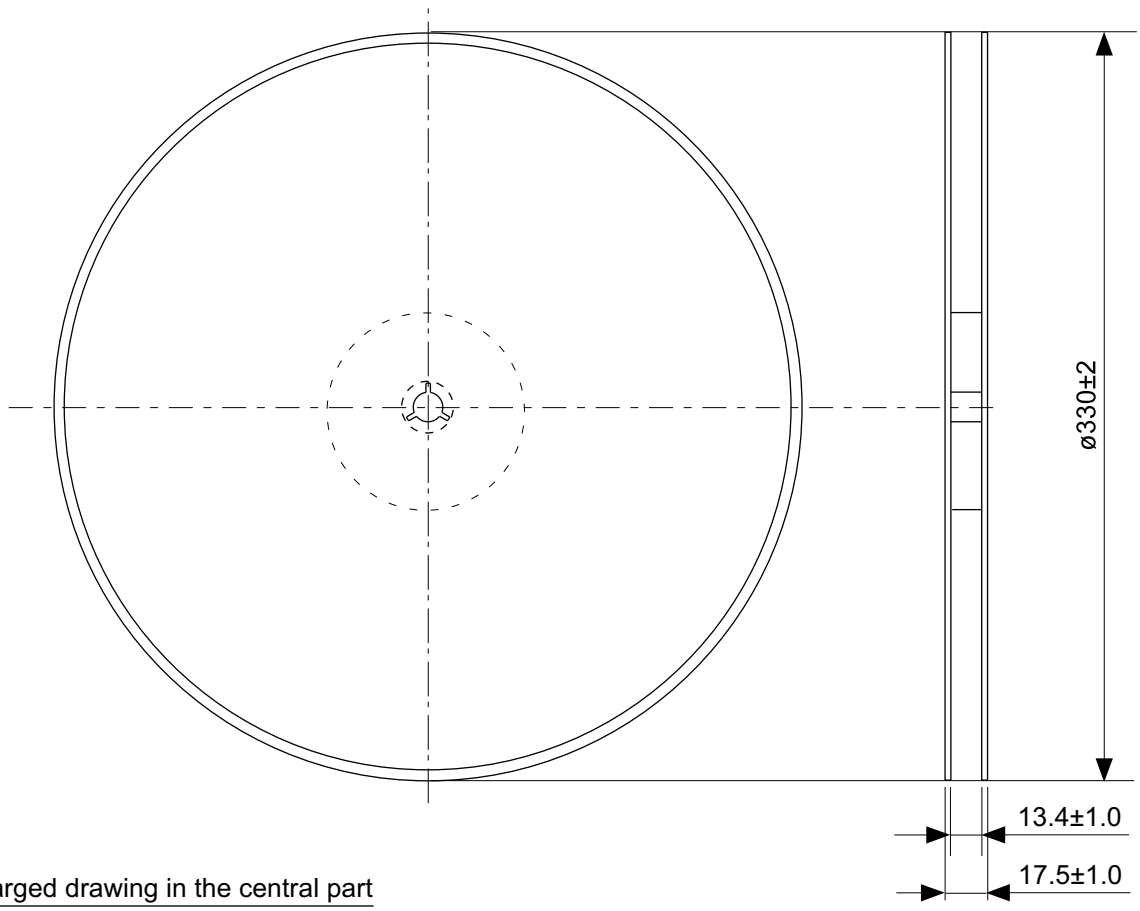




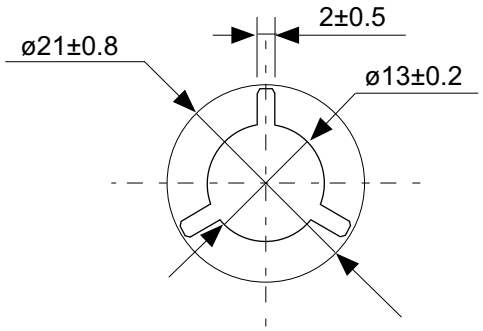


No. FT008-Z-C-SD-1.0

TITLE	TSSOP8-Z-Carrier Tape
No.	FT008-Z-C-SD-1.0
ANGLE	
UNIT	
ABLIC Inc.	



Enlarged drawing in the central part



No. FT008-Z-R-SD-1.0

TITLE	TSSOP8-Z-Reel		
No.	FT008-Z-R-SD-1.0		
ANGLE		QTY.	4,000
UNIT	mm		
ABLIC Inc.			

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