

HIGH-ACCURACY DIGITAL TEMPERATURE SENSOR WITH THERMOSTAT FUNCTION

The S-5852A Series is a high-accuracy digital temperature sensor with thermostat function, which operates in 1.7 V to 3.6 V voltage ranges. The S-5852A Series interfaces with exteriors via I²C-bus and operates at 1.0 MHz maximum. The temperature detection signal is output by using the thermostat function which can be set by the I²C-bus. Moreover, a substantial reduction in current consumption may be achieved by using the shutdown mode which can be set by the I²C-bus.

The operation of the S-5852A Series is explained in the user's manual. Contact our sales representatives for more information.

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, it is imperative to contact our sales representatives.

■ Features

- Temperature accuracy, high-accuracy temperature range*1: $\pm 0.5^{\circ}\text{C}$ typ. / $\pm 1.0^{\circ}\text{C}$ max. ($T_a = 0^{\circ}\text{C}$ to $+65^{\circ}\text{C}$)
 $\pm 0.5^{\circ}\text{C}$ typ. / $\pm 1.0^{\circ}\text{C}$ max. ($T_a = +75^{\circ}\text{C}$ to $+95^{\circ}\text{C}$)
- Temperature resolution: 0.5°C, 0.25°C, 0.125°C, 0.0625°C
(Selectable by the resolution register)
- Temperature sample rate: 7 samples / s min.
- Hysteresis width: No hysteresis, 1.5°C, 3.0°C, 6.0°C
(Selectable by the configuration register)
- Current consumption:
 - Shutdown mode at serial bus non-active: $I_{DD3} = 0.3\ \mu\text{A}$ typ., $I_{DD3} = 3.0\ \mu\text{A}$ max.
 - Active mode at serial bus non-active: $I_{DD1} = 40.0\ \mu\text{A}$ typ., $I_{DD1} = 100.0\ \mu\text{A}$ max.
- Operation voltage range: 1.7 V to 3.6 V
- Operation frequency: 1.0 MHz max. ($V_{DD} = 2.2\ \text{V}$ to $3.6\ \text{V}$)
400 kHz max. ($V_{DD} = 1.7\ \text{V}$ to $3.6\ \text{V}$)
- Thermostat function: Dual trip mode, single trip mode
(Selectable by the configuration register)
- Noise suppression: Schmitt trigger and noise filter on input pins (SCL, SDA)
- Operation temperature range: $T_a = -40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$
- Lead-free (Sn 100%), halogen-free

*1. The option of the high-accuracy temperature range can be selected.

■ Applications

- Solid state drive
- Hard disk drive
- Notebook PC, tablet PC
- Refrigerator
- Air conditioning system

■ Package

- HSNT-8(2030)

■ **Block Diagram**

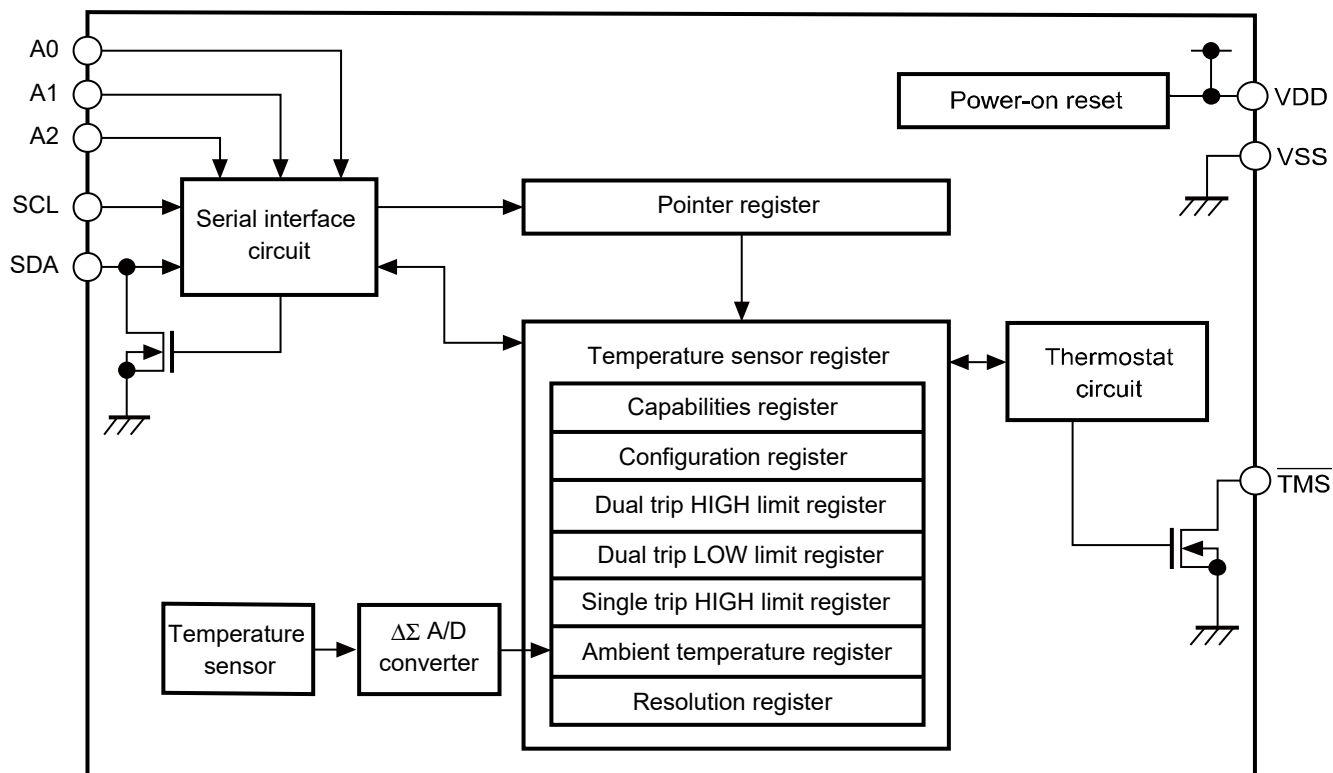
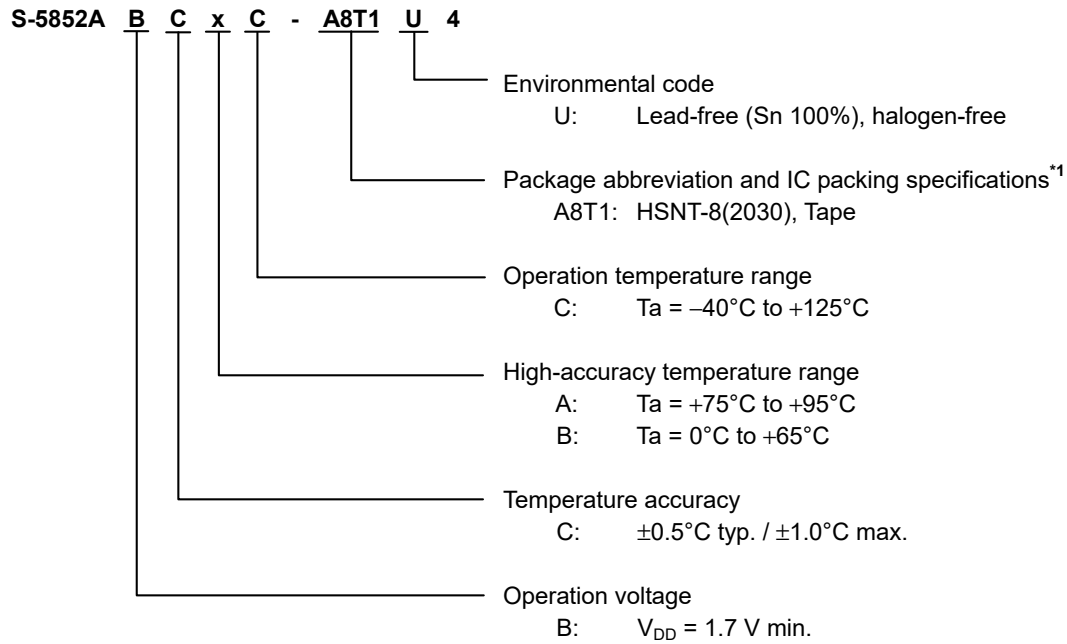


Figure 1

■ Product Name Structure

1. Product name



*1. Refer to the tape drawing.

2. Package

Table 1 Package Drawing Codes

Package Name	Dimension	Tape	Reel	Land
HSNT-8(2030)	PP008-A-P-SD	PP008-A-C-SD	PP008-A-R-SD	PP008-A-L-SD

3. Product name list

Table 2

Product Name	Operation Voltage	Temperature Accuracy	High-accuracy Temperature Range	Operation Temperature Range
S-5852ABCAC-A8T1U4	1.7 V min.	±0.5°C typ. / ±1.0°C max.	Ta = +75°C to +95°C	Ta = -40°C to +125°C
S-5852ABCBC-A8T1U4	1.7 V min.	±0.5°C typ. / ±1.0°C max.	Ta = 0°C to +65°C	Ta = -40°C to +125°C

Pin Configuration

1. HSNT-8(2030)

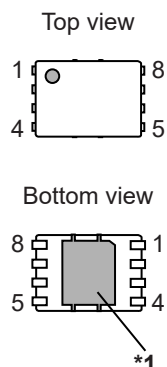


Table 3

Pin No.	Symbol	Description
1	A0	Slave address input pin
2	A1	Slave address input pin
3	A2	Slave address input pin
4	VSS	GND pin
5	SDA* ²	Serial data I/O pin
6	SCL* ²	Serial clock input pin
7	TMS	Temperature switch output (Thermostat output) pin
8	VDD	Power supply pin

Figure 2

- *1. Connect the heat sink of backside at shadowed area to the board, and set electric potential open or GND. However, do not use it as the function of electrode.
- *2. Do not use it in "High-Z".

■ Absolute Maximum Ratings

Table 4

Item	Symbol	Absolute Maximum Rating	Unit
Power supply voltage	V _{DD}	−0.3 to +4.3	V
Input voltage (SCL, A0, A1, A2)	V _{IN}	−0.3 to +4.3	V
I/O voltage (SDA)	V _{IO}	−0.3 to +4.3	V
Output voltage (TMS)	V _{OUT}	−0.3 to +4.3	V
Operation ambient temperature	T _{opr}	−40 to +125	°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 Operation Conditions

Table 5

Item	Symbol	Min.	Max.	Unit
Power supply voltage	V _{DD}	1.7	3.6	V
Operation ambient temperature	T _{opr}	−40	+125	°C
High level input voltage	V _{IH}	0.7 × V _{DD}	3.6	V
Low level input voltage	V _{IL}	−0.3	0.3 × V _{DD}	V

■ Pin Capacitance

Table 6

(Ta = +25°C, f_{SCL} = 1.0 MHz, V_{DD} = 2.5 V)

Item	Symbol	Condition	Min.	Max.	Unit
Input capacitance	C _{IN}	V _{IN} = 0 V (SCL, A0, A1, A2)	—	6	pF
I/O capacitance	C _{I/O}	V _{I/O} = 0 V (SDA)	—	8	pF
Output capacitance	C _{OUT}	V _{OUT} = 0 V (TMS)	—	8	pF

■ DC Electrical Characteristics

Table 7

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Current consumption at active mode	I _{DD1}	Active mode at serial bus non-active	–	40.0	100.0	μA
	I _{DD2}	Active mode at serial bus active	–	–	400.0	μA
Current consumption at shutdown mode	I _{DD3}	Shutdown mode at serial bus non-active	–	0.3	3.0	μA
	I _{DD4}	Shutdown mode at serial bus active	–	–	400.0	μA

Table 8

Item	Symbol	Condition	Min.	Max.	Unit
Input leakage current	I _{LI}	SCL, SDA V _{IN} = V _{SS} to V _{DD}	–	1.0	μA
Output leakage current	I _{LO}	SDA, TMS V _{OUT} = V _{SS} to V _{DD}	–	1.0	μA
Input current 1	I _{IL}	A0, A1, A2 V _{IN} < 0.3 × V _{DD}	–	50.0	μA
Input current 2	I _{IH}	A0, A1, A2 V _{IN} > 0.7 × V _{DD}	–	2.0	μA
Input impedance 1	Z _{IL}	A0, A1, A2 V _{IN} = 0.3 × V _{DD}	30	–	kΩ
Input impedance 2	Z _{IH}	A0, A1, A2 V _{IN} = 0.7 × V _{DD}	800	–	kΩ
Low level output voltage	V _{OL}	SDA, TMS I _{OL} = 3.0 mA	–	0.4	V
Low level output current 1	I _{OL1}	SDA, TMS V _{OL} = 0.4 V, 2.2 V ≤ V _{DD} ≤ 3.6 V	20	–	mA
Low level output current 2	I _{OL2}	SDA, TMS V _{OL} = 0.6 V, 1.7 V ≤ V _{DD} ≤ 2.2 V	6	–	mA

AC Electrical Characteristics

Table 9 Measurement Conditions

Input pulse voltage	$0.2 \times V_{DD}$ to $0.8 \times V_{DD}$
Input pulse rising / falling time	20 ns or less
Output reference voltage	$0.3 \times V_{DD}$ to $0.7 \times V_{DD}$
Output load	100 pF + 1 kΩ pull-up resistance

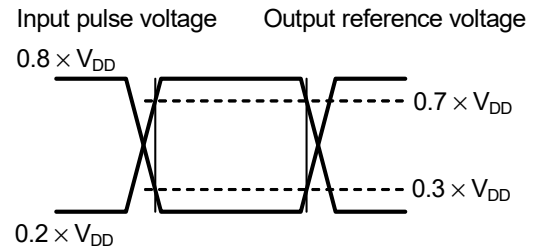


Figure 3 Input / Output Waveform during AC Measurement

Table 10

Item	Symbol	$V_{DD} = 1.7 \text{ V to } 3.6 \text{ V}$		$V_{DD} = 2.2 \text{ V to } 3.6 \text{ V}$		Unit
		Min.	Max.	Min.	Max.	
SCL clock frequency	f_{SCL}	0	400	0	1000	kHz
SCL clock time "L"	t_{LOW}	1.3	—	0.5	—	μs
SCL clock time "H"	t_{HIGH}	0.6	—	0.26	—	μs
SDA output delay time	t_{AA}	0.1	0.9	0.1	0.45	μs
SDA output hold time	t_{DH}	50	—	50	—	ns
SCL, SDA rising time	t_R	0.02	0.3	—	0.12	μs
SCL, SDA falling time	t_F	0.02	0.3	—	0.12	μs
Data input setup time	$t_{SU.DAT}$	100	—	50	—	ns
Data input hold time	$t_{HD.DAT}$	0	—	0	—	ns
Start condition setup time	$t_{SU.STA}$	0.6	—	0.26	—	μs
Start condition hold time	$t_{HD.STA}$	0.6	—	0.26	—	μs
Stop condition setup time	$t_{SU.STO}$	0.6	—	0.26	—	μs
Bus release time	t_{BUF}	1.3	—	0.5	—	μs
Noise suppression time	t_i	—	50	—	50	ns

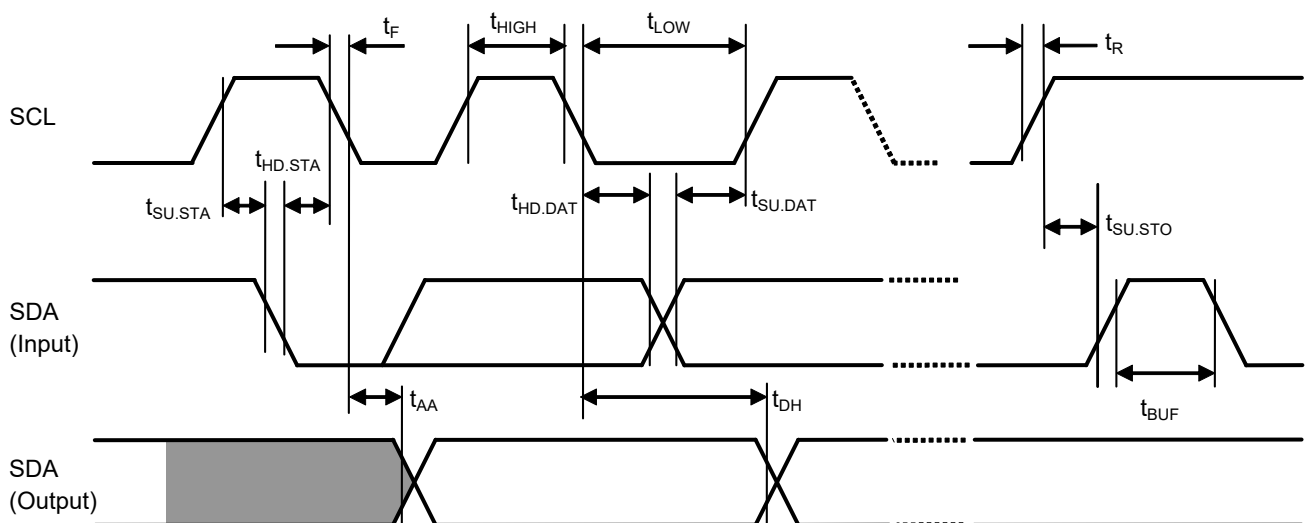


Figure 4 Bus Timing

■ Temperature Characteristics

Table 11

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Temperature accuracy*1	T _{ACC1}	Ta = 0°C to +65°C	–	±0.5	±1.0	°C
	T _{ACC2}	Ta = –40°C to +125°C	–	–	±3.0	°C
Temperature resolution	T _{RES}	Default value	–	0.25	–	°C
Temperature conversion time	t _{CONV1}	TRES[1:0] = "00" setting LSB = 0.5°C	–	–	35	ms
	t _{CONV2}	TRES[1:0] = "01" setting LSB = 0.25°C	–	–	70	ms
	t _{CONV3}	TRES[1:0] = "10" setting LSB = 0.125°C	–	–	140	ms
	t _{CONV4}	TRES[1:0] = "11" setting LSB = 0.0625°C	–	–	140	ms

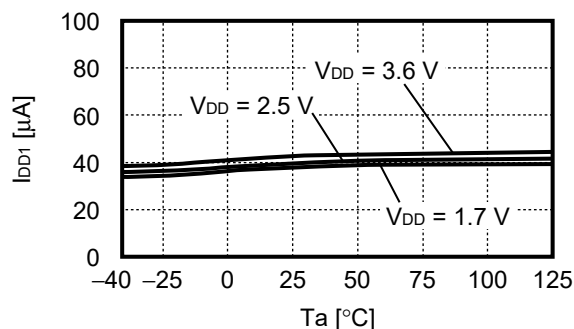
*1. TRES[1:0] = "11" setting

■ Precautions

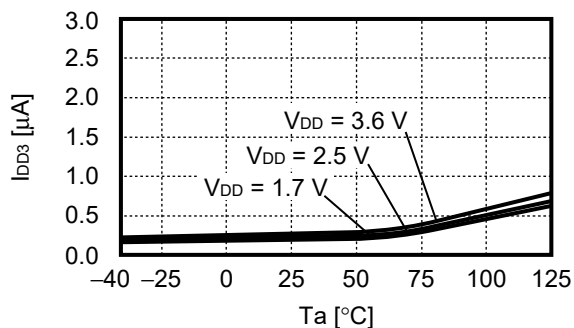
- Do not operate these ICs in excess of the absolute maximum ratings. Attention should be paid to the power supply voltage, especially. The surge voltage which exceeds the absolute maximum ratings can cause latch-up and malfunction. Perform operations after confirming the detailed operation condition in the datasheet.
- Operations with moisture on this IC's pins may occur malfunction by short-circuit between pins. Especially, in occasions like picking this IC up from low temperature tank during the evaluation. Be sure that there is no frost on this IC's pins to prevent malfunction by short-circuit.
Also attention should be paid in using on environment, which is easy to dew for the same reason.
- Do not apply an electrostatic discharge to this IC that exceeds the performance ratings of the built-in electrostatic protection circuit.
- ABLIC Inc. 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.

■ Characteristics (Typical Data)

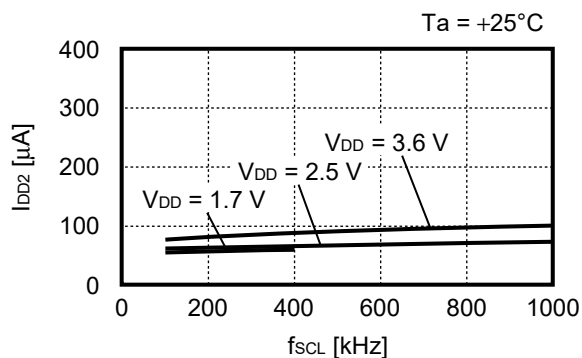
1. Current consumption at active mode (I_{DD1}) vs. Temperature (T_a)



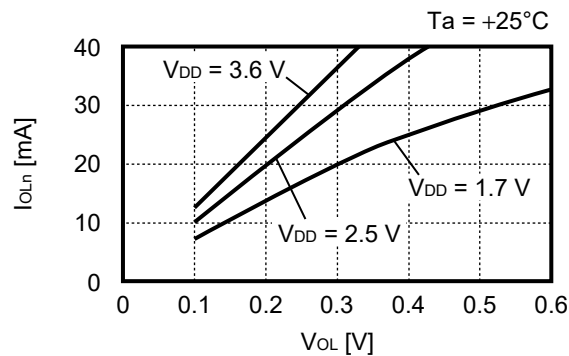
2. Current consumption at shutdown mode (I_{DD3}) vs. Temperature (T_a)



3. Current consumption at active mode (I_{DD2}) vs. SCL clock frequency (f_{SCL})

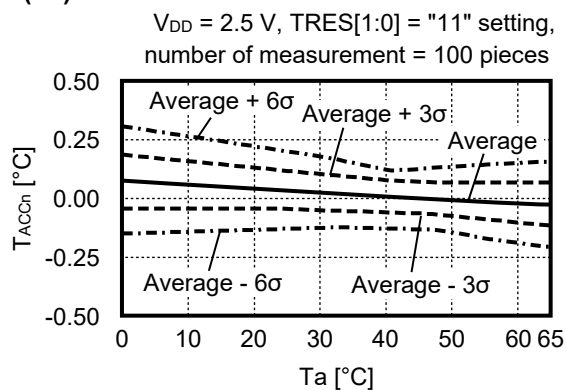
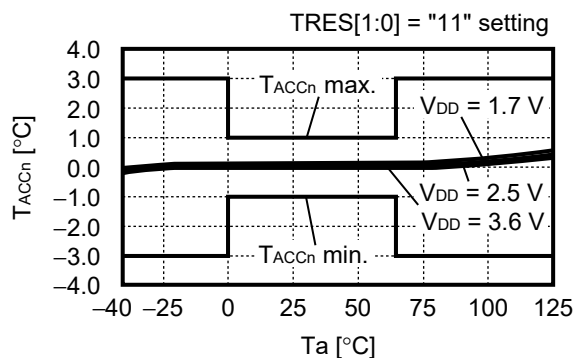


4. Low level output current (I_{OLn}) vs. Low level output voltage (V_{OL})



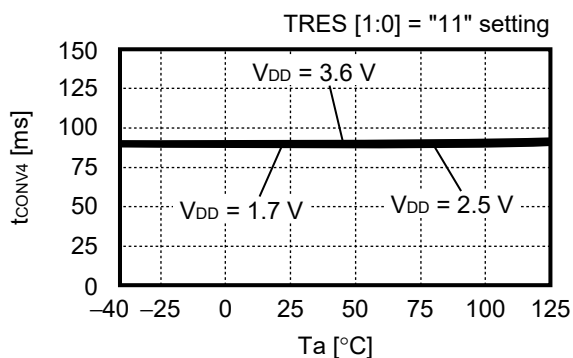
Remark $n = 1, 2$

5. Temperature accuracy (T_{ACCn}) vs. Temperature (T_a)



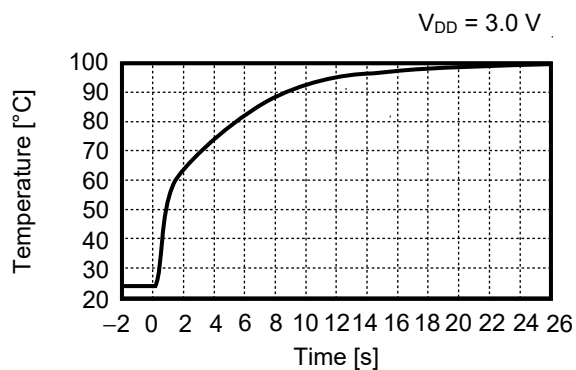
Remark $n = 1, 2$

6. Temperature conversion time (t_{CONV4}) vs. Temperature (T_a)

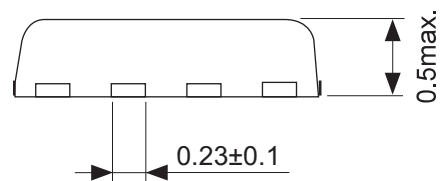
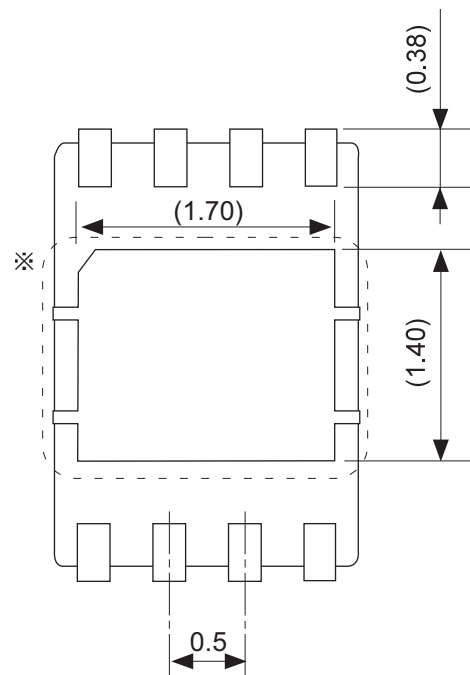
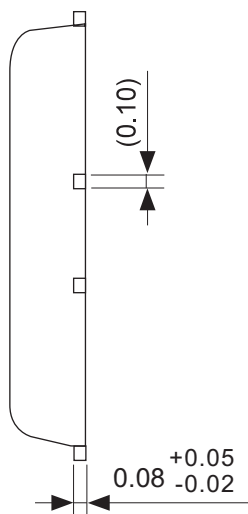
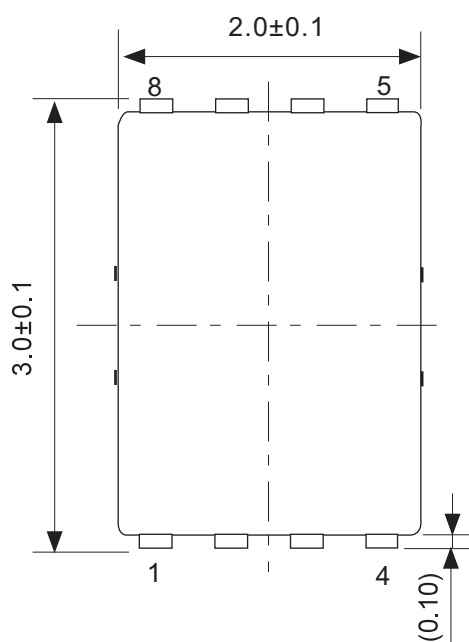


7. Thermal response time (Temperature vs. Time)

When HSNT-8(2030) mounted on the evaluation board is put into the liquid of +100°C from the air of +25°C.



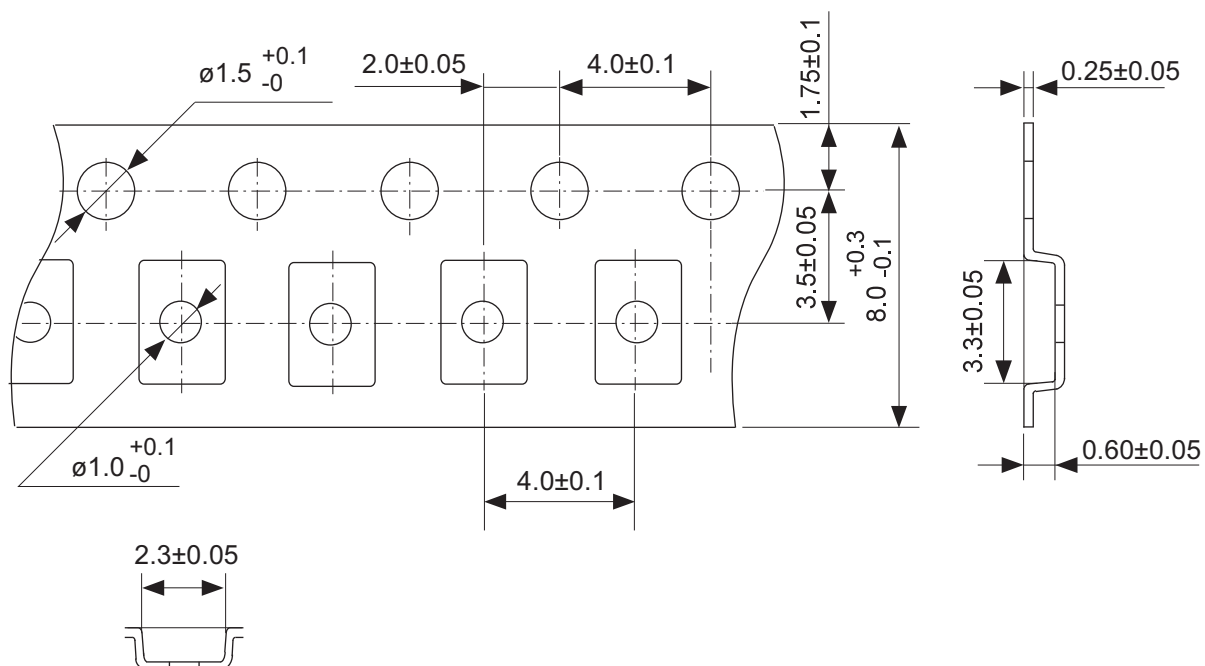
Remark Evaluation board
Dimensions: 22 mm × 21 mm
Thickness: 1.6 mm



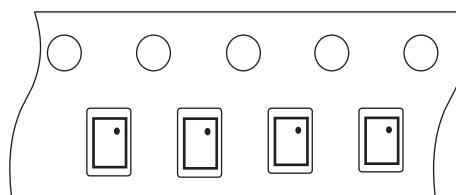
※ The heat sink of back side has different electric potential depending on the product.
 Confirm specifications of each product.
 Do not use it as the function of electrode.

No. PP008-A-P-SD-2.0

TITLE	HSNT-8-A-PKG Dimensions
No.	PP008-A-P-SD-2.0
ANGLE	
UNIT	mm
ABLIC Inc.	



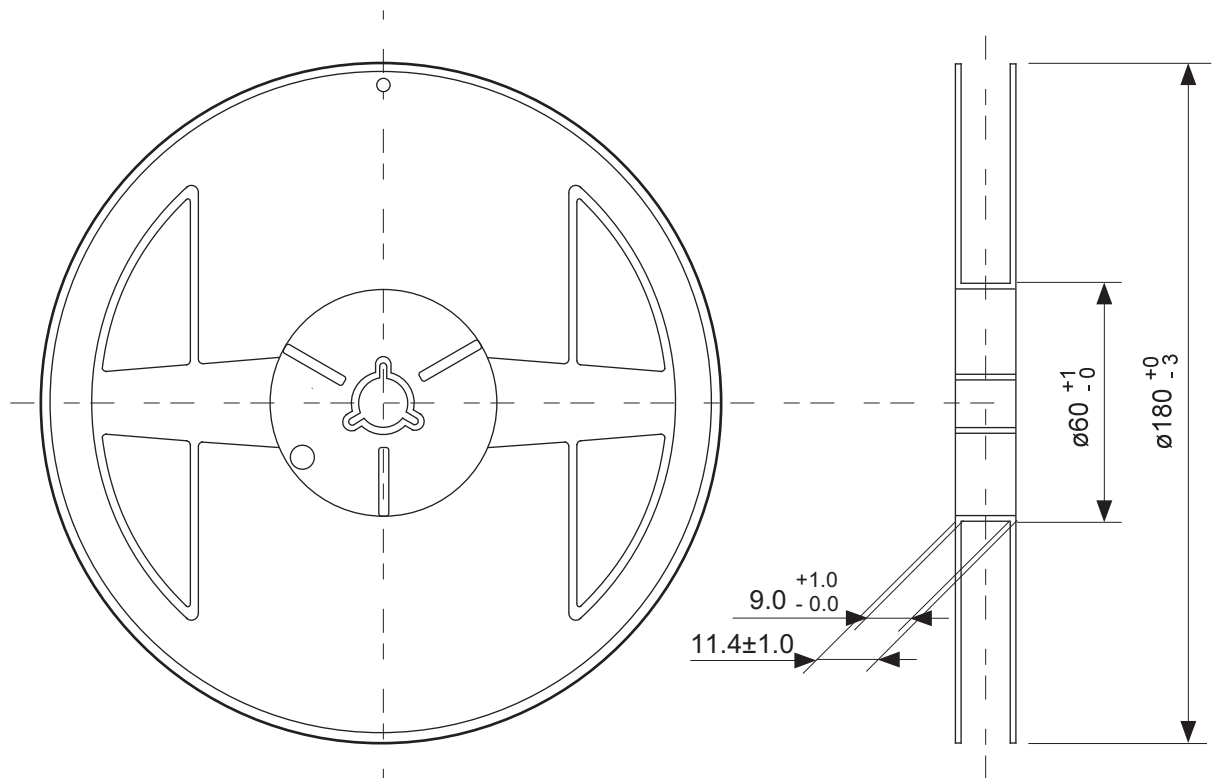
4 3 2 1
5 6 7 8



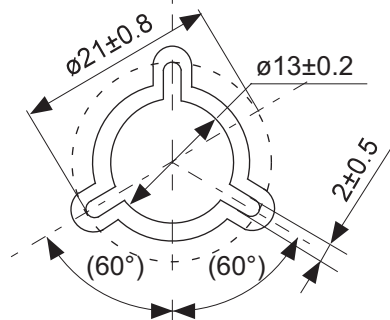
Feed direction

No. PP008-A-C-SD-1.0

TITLE	HSNT-8-A-Carrier Tape
No.	PP008-A-C-SD-1.0
ANGLE	
UNIT	mm
ABLIC Inc.	

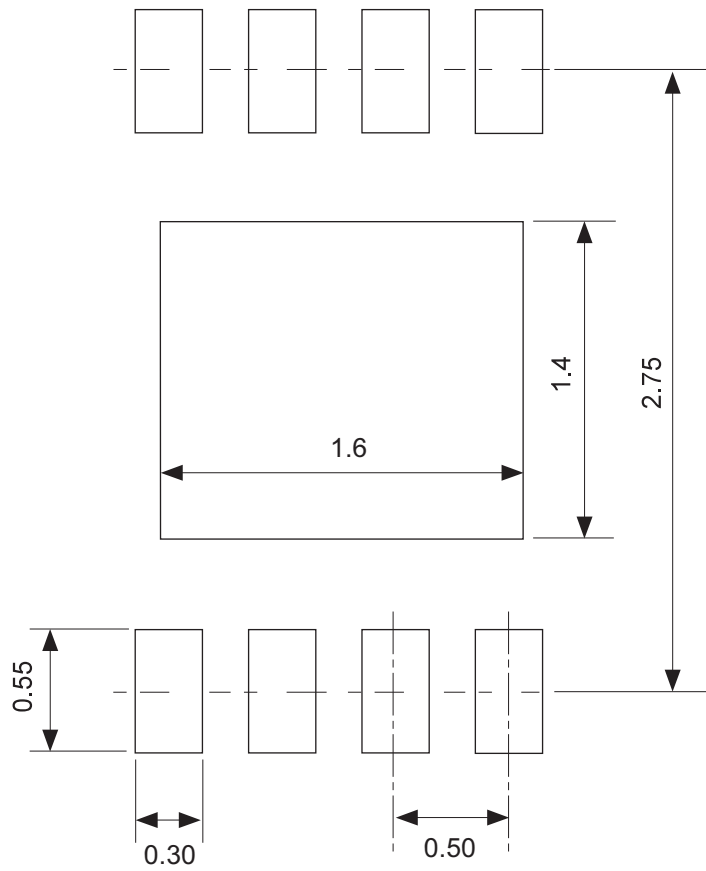


Enlarged drawing in the central part



No. PP008-A-R-SD-2.0

TITLE	HSNT-8-A-Reel		
No.	PP008-A-R-SD-2.0		
ANGLE		QTY.	5,000
UNIT	mm		
ABLIC Inc.			



No. PP008-A-L-SD-1.0

TITLE	HSNT-8-A -Land Recommendation
No.	PP008-A-L-SD-1.0
ANGLE	
UNIT	mm
ABLIC Inc.	

Disclaimers (Handling Precautions)

1. All the information described herein (product data, specifications, figures, tables, programs, algorithms and application circuit examples, etc.) is current as of publishing date of this document and is subject to change without notice.
2. The circuit examples and the usages described herein are for reference only, and do not guarantee the success of any specific mass-production design.
ABLIC Inc. is not liable for any losses, damages, claims or demands caused by the reasons other than the products described herein (hereinafter "the products") or infringement of third-party intellectual property right and any other right due to the use of the information described herein.
3. ABLIC Inc. is not liable for any losses, damages, claims or demands caused by the incorrect information described herein.
4. Be careful to use the products within their ranges described herein. Pay special attention for use to the absolute maximum ratings, operation voltage range and electrical characteristics, etc.
ABLIC Inc. is not liable for any losses, damages, claims or demands caused by failures and / or accidents, etc. due to the use of the products outside their specified ranges.
5. Before using the products, confirm their applications, and the laws and regulations of the region or country where they are used and verify suitability, safety and other factors for the intended use.
6. When exporting the products, comply with the Foreign Exchange and Foreign Trade Act and all other export-related laws, and follow the required procedures.
7. The products are strictly prohibited from using, providing or exporting for the purposes of the development of weapons of mass destruction or military use. ABLIC Inc. is not liable for any losses, damages, claims or demands caused by any provision or export to the person or entity who intends to develop, manufacture, use or store nuclear, biological or chemical weapons or missiles, or use any other military purposes.
8. The products are not designed to be used as part of any device or equipment that may affect the human body, human life, or assets (such as medical equipment, disaster prevention systems, security systems, combustion control systems, infrastructure control systems, vehicle equipment, traffic systems, in-vehicle equipment, aviation equipment, aerospace equipment, and nuclear-related equipment), excluding when specified for in-vehicle use or other uses by ABLIC, Inc. Do not apply the products to the above listed devices and equipments.
ABLIC Inc. is not liable for any losses, damages, claims or demands caused by unauthorized or unspecified use of the products.
9. In general, semiconductor products may fail or malfunction with some probability. The user of the products should therefore take responsibility to give thorough consideration to safety design including redundancy, fire spread prevention measures, and malfunction prevention to prevent accidents causing injury or death, fires and social damage, etc. that may ensue from the products' failure or malfunction.
The entire system in which the products are used must be sufficiently evaluated and judged whether the products are allowed to apply for the system on customer's own responsibility.
10. The products are not designed to be radiation-proof. The necessary radiation measures should be taken in the product design by the customer depending on the intended use.
11. The products do not affect human health under normal use. However, they contain chemical substances and heavy metals and should therefore not be put in the mouth. The fracture surfaces of wafers and chips may be sharp. Be careful when handling these with the bare hands to prevent injuries, etc.
12. When disposing of the products, comply with the laws and ordinances of the country or region where they are used.
13. The information described herein contains copyright information and know-how of ABLIC Inc. The information described herein does not convey any license under any intellectual property rights or any other rights belonging to ABLIC Inc. or a third party. Reproduction or copying of the information from this document or any part of this document described herein for the purpose of disclosing it to a third-party is strictly prohibited without the express permission of ABLIC Inc.
14. For more details on the information described herein or any other questions, please contact ABLIC Inc.'s sales representative.
15. This Disclaimers have been delivered in a text using the Japanese language, which text, despite any translations into the English language and the Chinese language, shall be controlling.

2.4-2019.07