S-5852A Series

HIGH-ACCURACY DIGITAL TEMPERATURE SENSOR WITH THERMOSTAT FUNCTION

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Rev.1.3_00

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: ±0.5°C typ. / ±1.0°C max. (Ta = 0°C to +65°C)
  ±0.5°C typ. / ±1.0°C max. (Ta = +75°C to +95°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 µA typ., I_{DD3} = 3.0 µA max.
  Active mode at serial bus non-active: I_{DD1} = 40.0 µA typ., I_{DD1} = 100.0 µA max.
- Operation voltage range: 1.7 V to 3.6 V
- Operation frequency: 1.0 MHz max. (V_{DD} = 2.2 V to 3.6 V)
  400 kHz max. (V_{DD} = 1.7 V to 3.6 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: Ta = –40°C to +125°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)

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■ Block Diagram

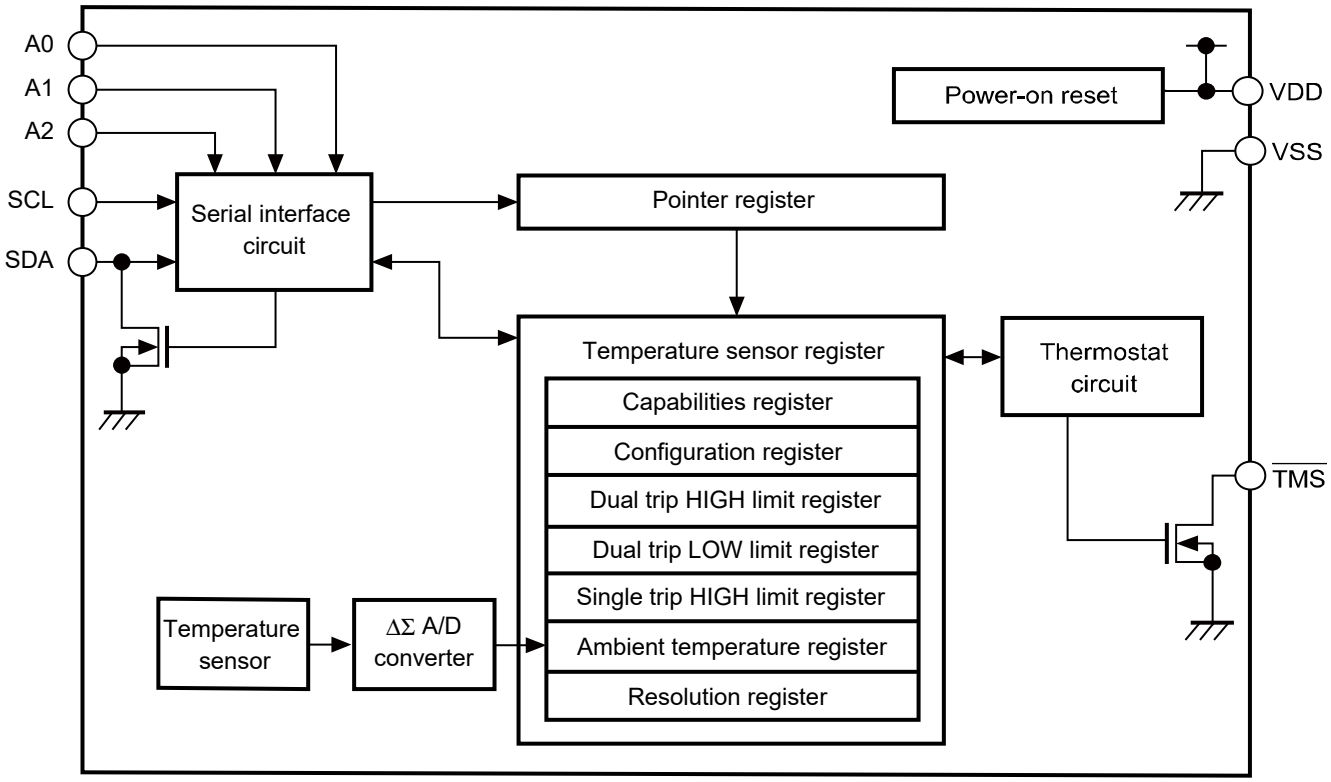
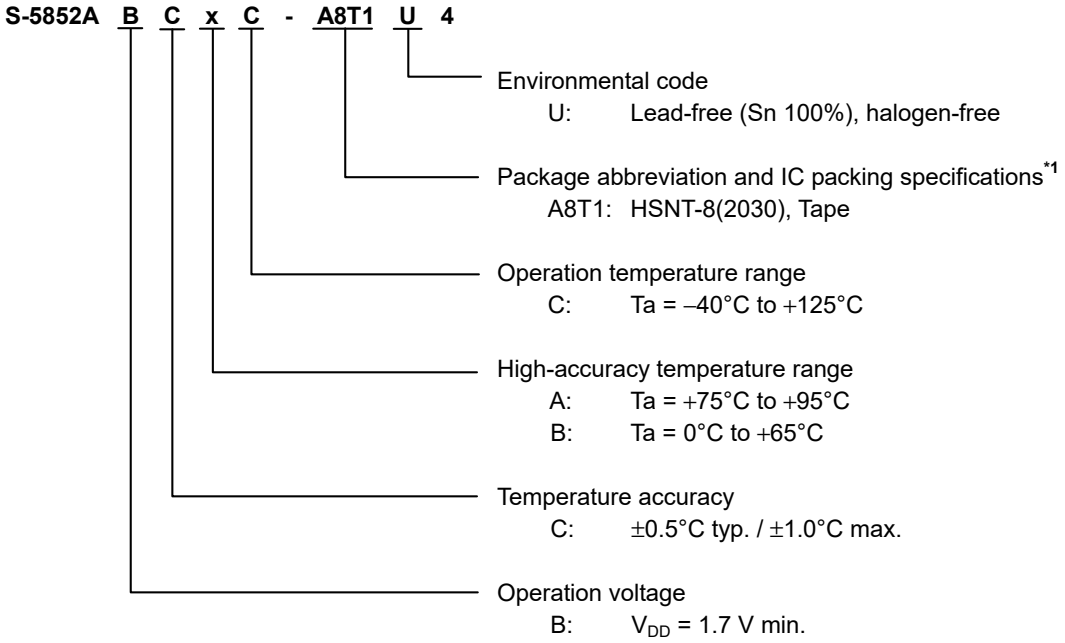


Figure 1

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■ 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

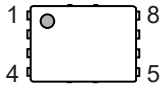
Product Name	Operation Voltage	Temperature Accuracy	High-accuracy Temperature Range	Operation Temperature Range
S-5852ABCAC-A8T1U4	1.7 V min.	±0.5°C typ. / ±1.0°C max.	Ta = +75°C to +95°C	Ta = –40°C to +125°C
S-5852ABCBC-A8T1U4	1.7 V min.	±0.5°C typ. / ±1.0°C max.	Ta = 0°C to +65°C	Ta = –40°C to +125°C

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■ Pin Configuration

1. HSNT-8(2030)

Top view



Bottom view

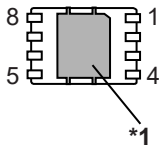


Figure 2

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	$\overline{\text{TMS}}$	Temperature switch output (Thermostat output) pin
8	VDD	Power supply pin

***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".

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■ 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 ($\overline{TMS}$)	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}	$0.7 \times V_{DD}$	3.6	V
Low level input voltage	V_{IL}	–0.3	$0.3 \times V_{DD}$	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 ($\overline{TMS}$)	–	8	pF

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■ 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, $\overline{TMS}$ $V_{OUT} = V_{SS}$ to V_{DD}	–	1.0	μA
Input current 1	I_{IL}	A0, A1, A2 $V_{IN} < 0.3 \times V_{DD}$	–	50.0	μA
Input current 2	I_{IH}	A0, A1, A2 $V_{IN} > 0.7 \times V_{DD}$	–	2.0	μA
Input impedance 1	Z_{IL}	A0, A1, A2 $V_{IN} = 0.3 \times V_{DD}$	30	–	kΩ
Input impedance 2	Z_{IH}	A0, A1, A2 $V_{IN} = 0.7 \times V_{DD}$	800	–	kΩ
Low level output voltage	V_{OL}	SDA, $\overline{TMS}$ $I_{OL} = 3.0$ mA	–	0.4	V
Low level output current 1	I_{OL1}	SDA, $\overline{TMS}$ $V_{OL} = 0.4$ V, 2.2 V $\leq V_{DD} \leq 3.6$ V	20	–	mA
Low level output current 2	I_{OL2}	SDA, $\overline{TMS}$ $V_{OL} = 0.6$ V, 1.7 V $\leq V_{DD} \leq 2.2$ V	6	–	mA

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■ 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 reisitance

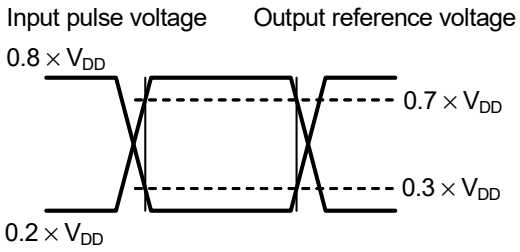


Figure 3 Input / Output Waveform during AC Measurement

Table 10

Item	Symbol	V_{DD} = 1.7 V to 3.6 V		V_{DD} = 2.2 V to 3.6 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

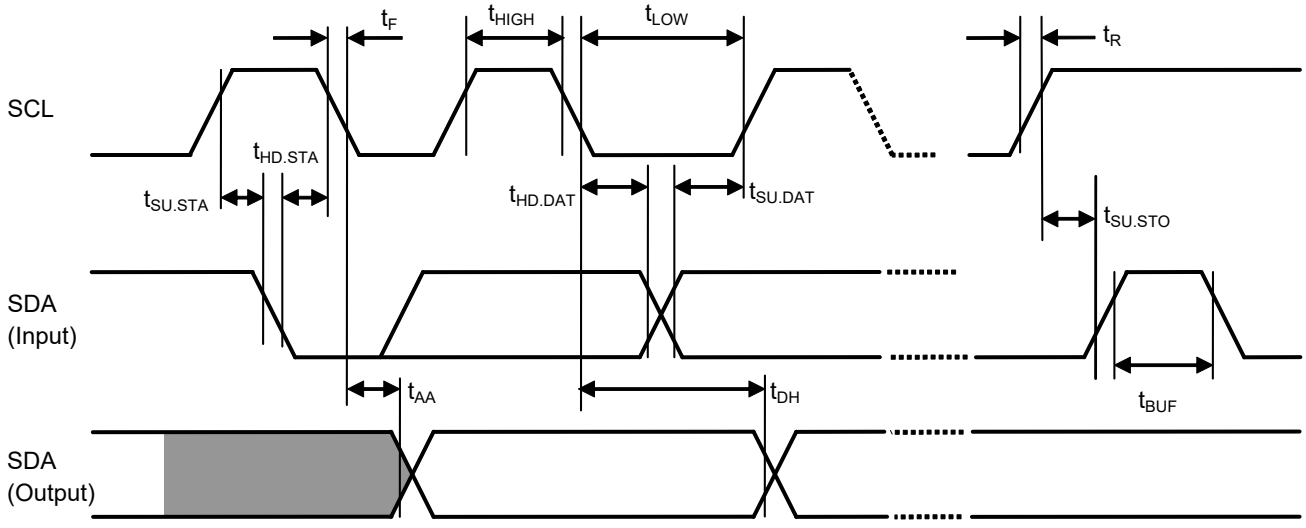


Figure 4 Bus Timing

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■ 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

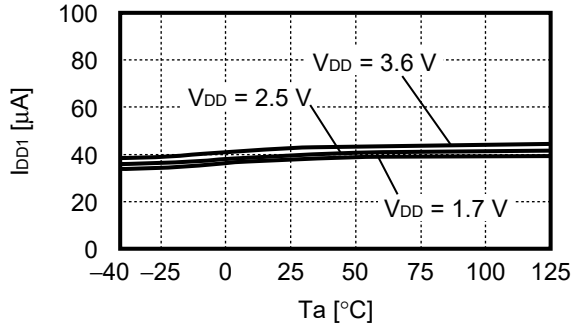
■ Precautions

- 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.

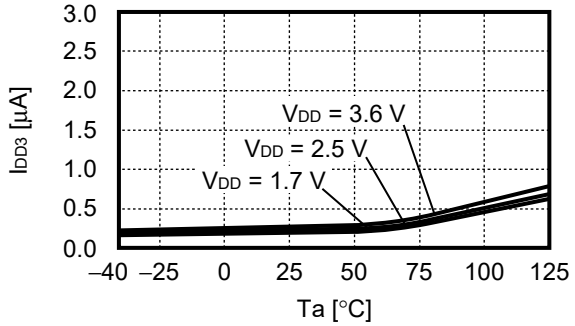
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■ Characteristics (Typical Data)

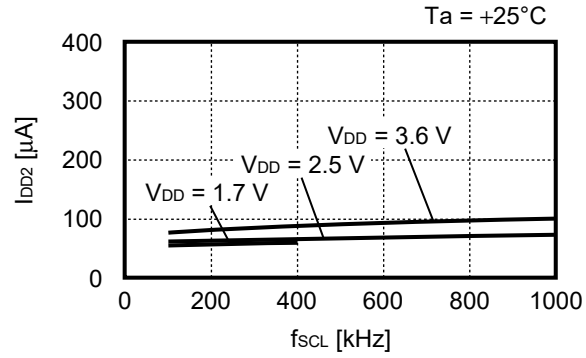
1. Current consumption at active mode (I_{DD1}) vs. Temperature (Ta)



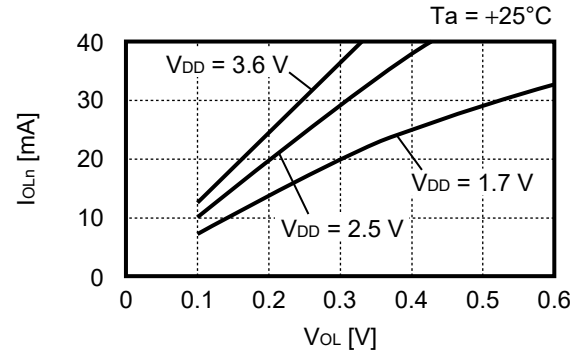
2. Current consumption at shutdown mode (I_{DD3}) vs. Temperature (Ta)



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



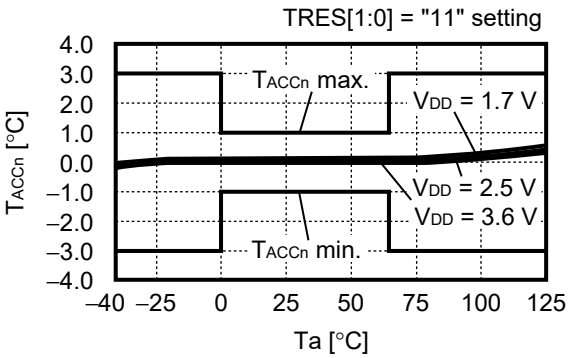
4. Low level output current (I_{OLn}) vs. Low level output voltage (V_{OL})

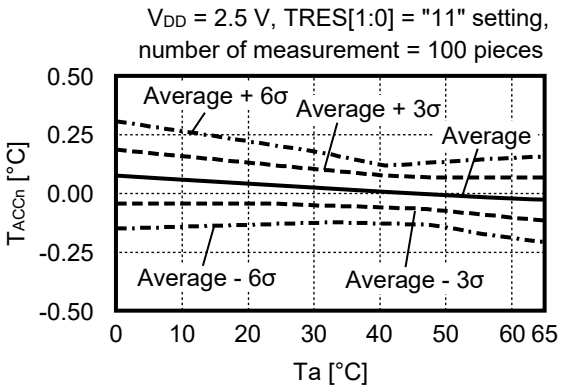


Remark n = 1, 2

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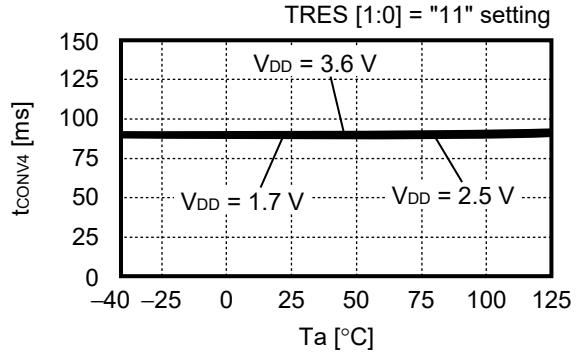
5. Temperature accuracy (T_{ACCn}) vs. Temperature (Ta)





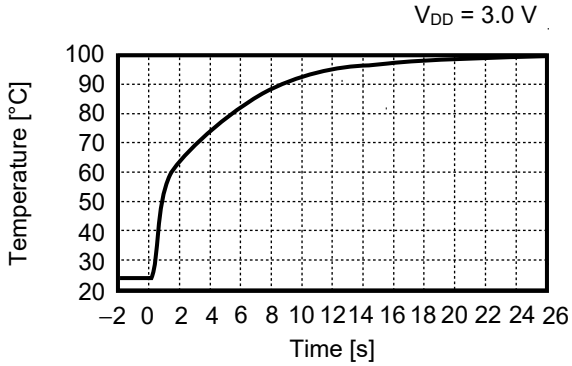
Remark n = 1, 2

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



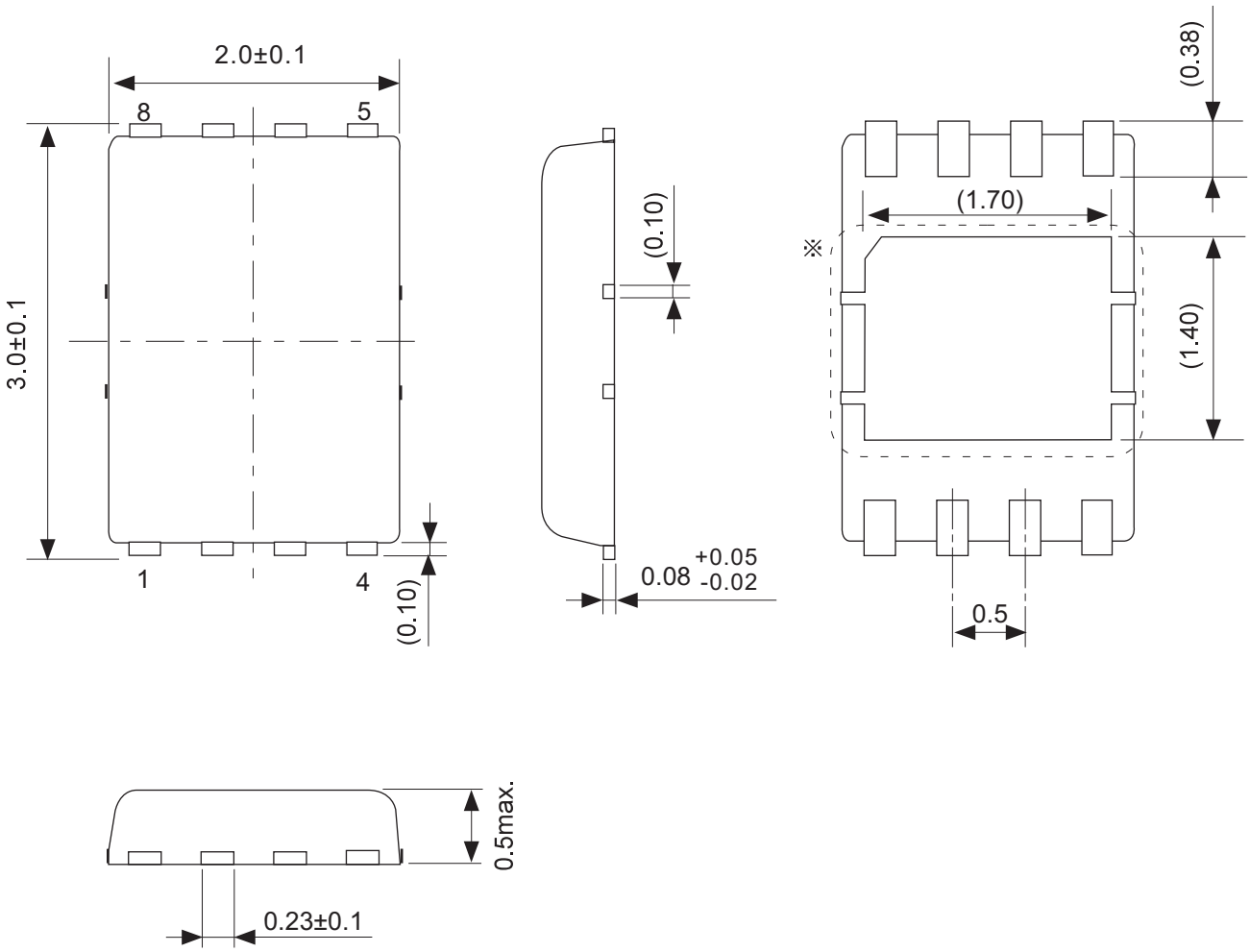
7. Thermal response time (Temperature vs. Time)

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

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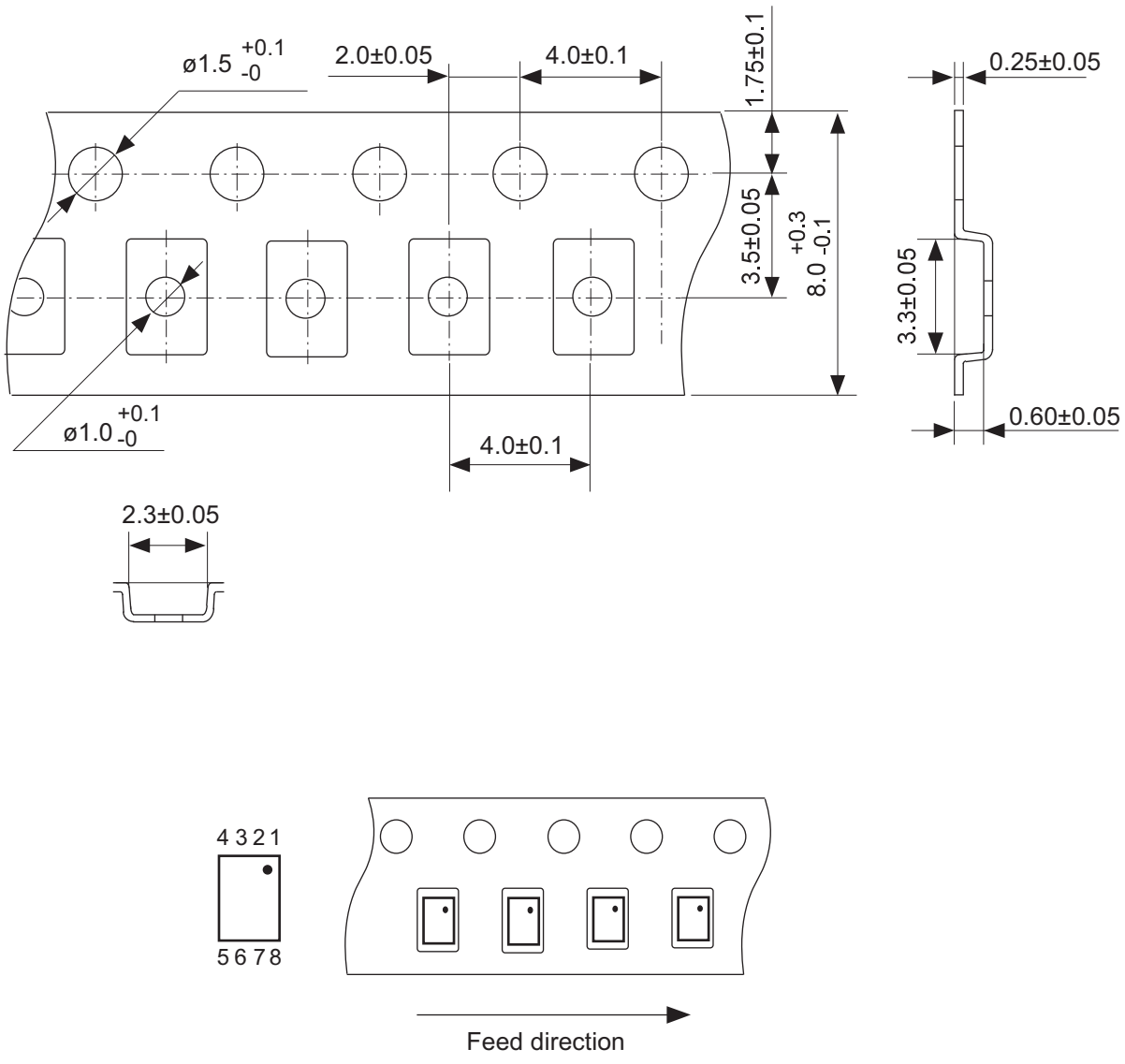


※ The heat sink of back side has different electric potential depending on the product.
Confirm specifications of each product.
Do not use it as the function of electrode.

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.	

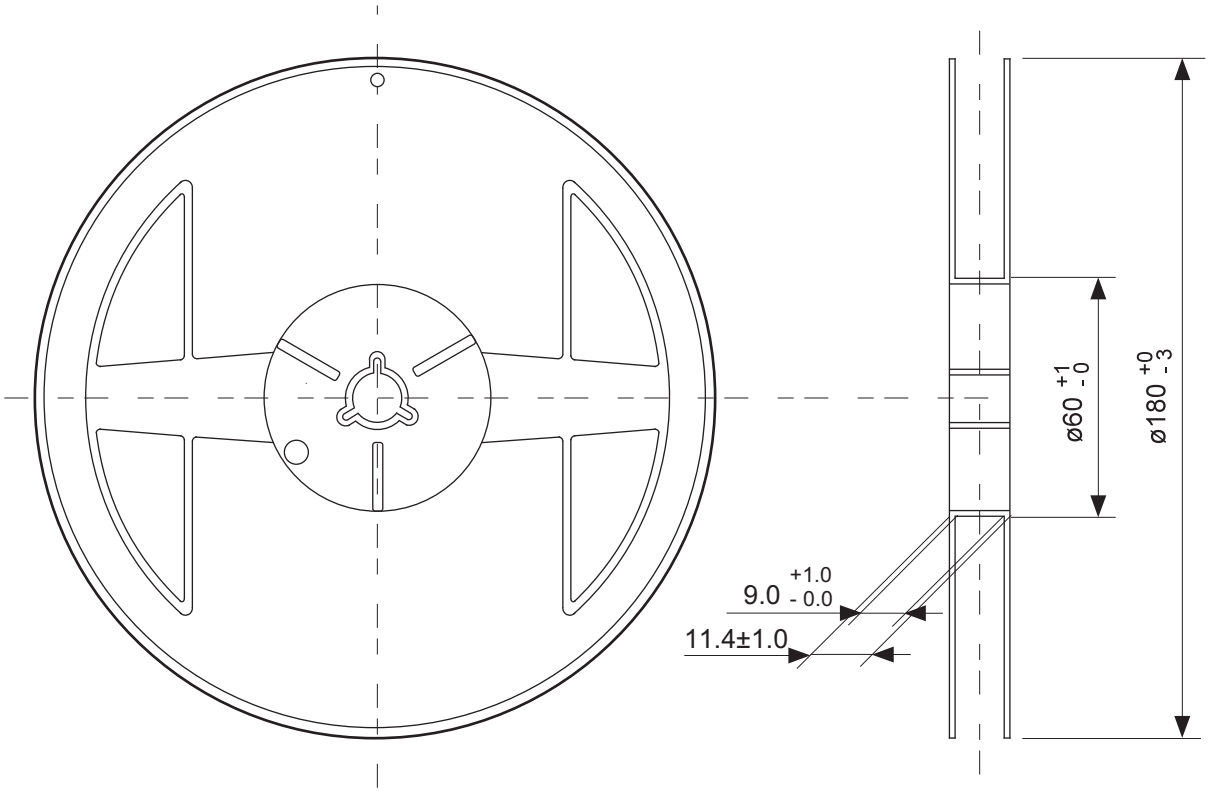
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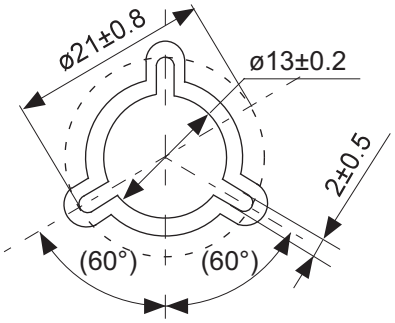
No. PP008-A-C-SD-1.0

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

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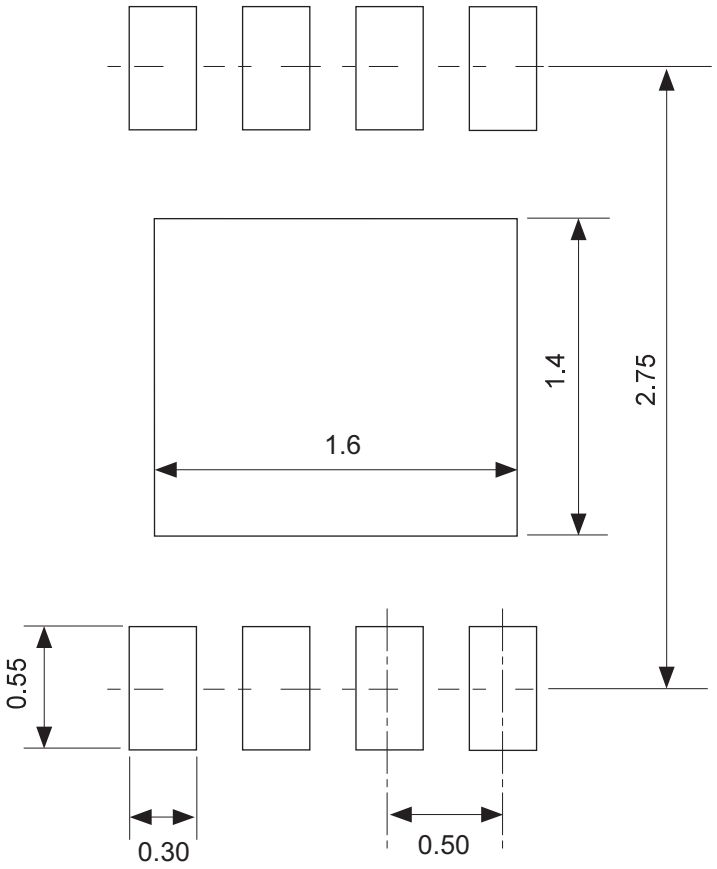
Enlarged drawing in the central part



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.			

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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.	

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