S-89230/89240 Series

MINI ANALOG SERIES
CMOS COMPARATOR

The mini-analog series is a group of ICs that incorporate a general purpose analog circuit in a small package.
The S-89230/89240 Series is a CMOS type comparator works on a lower voltage and lower current consumption. These features make this product the ideal solution for small battery-powered portable equipment.
This product is a dual comparator (with 2 circuits).

■ Features

- Lower operating voltage than the conventional general-purpose: V_{DD} = 1.8 V to 5.5 V
- Low current consumption (per circuit): I_{DD} = 23 μA Typ. (S-89230 Series)
  I_{DD} = 5 μA Typ. (S-89240 Series)
- Low input offset voltage: 4.0 mV Max.
- Output full swing
- A dual comparator (with 2 circuits)
- Lead-free, Sn 100%, halogen-free*1

***1.** Refer to "■ **Product Name Structure**" for details.

■ Applications

- Mobile phones
- Notebook PCs
- Digital cameras
- Digital video cameras

■ Packages

- SNT-8A
- TMSOP-8

■ Block Diagram

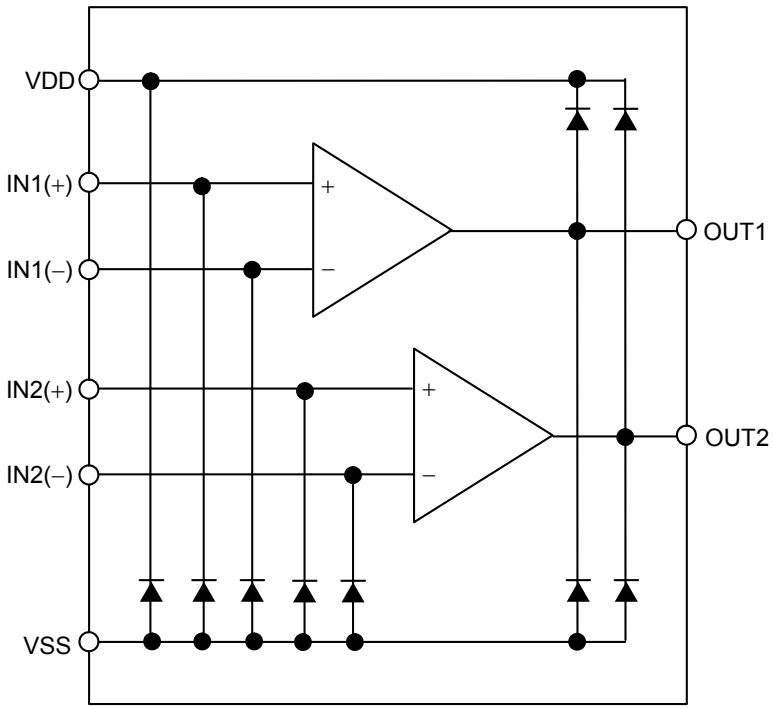
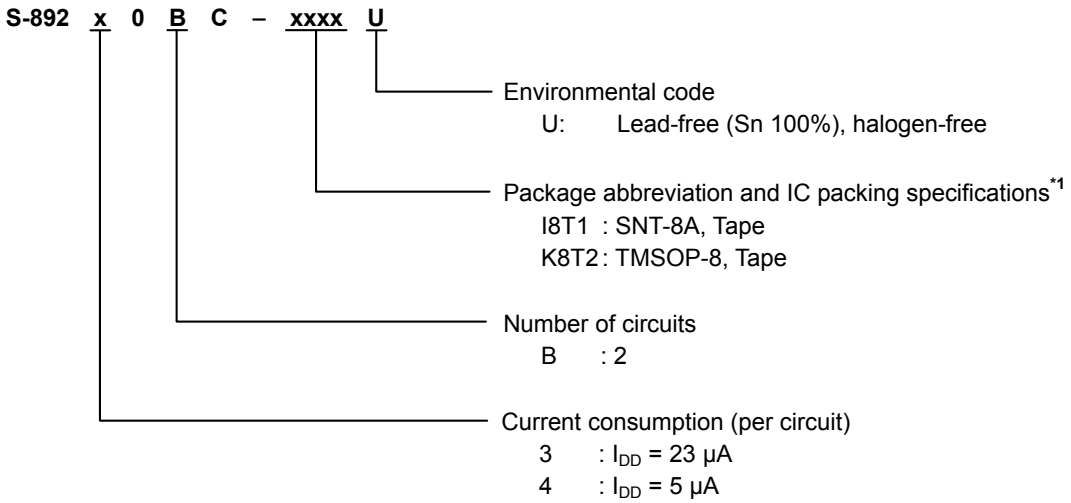


Figure 1

■ Product Name Structure

Users can select the product type and package for the S-89230/89240 Series. Refer to "**1. Product name**" regarding the contents of product name, "**2. Package**" regarding the package drawings and "**3. Product name list**" regarding the product type.

1. Product name



***1.** Refer to the tape specifications.

2. Package

Package Name	Drawing Code			
	Package	Tape	Reel	Land
SNT-8A	PH008-A-P-SD	PH008-A-C-SD	PH008-A-R-SD	PH008-A-L-SD
TMSOP-8	FM008-A-P-SD	FM008-A-C-SD	FM008-A-R-SD	–

3. Product name list

Table 1

Product name	Current consumption (per circuit)	Rise propagation delay time*1	Fall propagation delay time*1	Number of circuits	Package
S-89230BC-I8T1U	23 µA	26 µs	4 µs	2 circuits	SNT-8A
S-89230BC-K8T2U	23 µA	26 µs	4 µs	2 circuits	TMSOP-8
S-89240BC-I8T1U	5 µA	100 µs	18 µs	2 circuits	SNT-8A
S-89240BC-K8T2U	5 µA	100 µs	18 µs	2 circuits	TMSOP-8

***1.** The value when V_{DD} = 3.0 V

Remark Please select products of environmental code = U for Sn 100%, halogen-free products.

■ Pin Configurations

SNT-8A
Top view

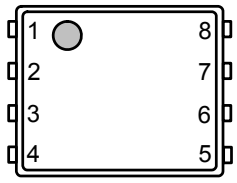


Figure 2

Table 2

Pin No.	Symbol	Description
1	OUT1	Output pin 1
2	IN1(−)	Inverted input pin 1
3	IN1(+)	Non-inverted input pin 1
4	VSS	GND pin
5	IN2(+)	Non-inverted input pin 2
6	IN2(−)	Inverted input pin 2
7	OUT2	Output pin 2
8	VDD	Positive power supply pin

TMSOP-8
Top view

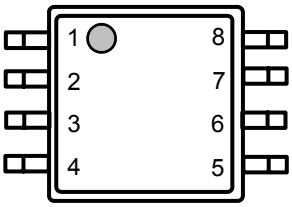


Figure 3

Table 3

Pin No.	Symbol	Description
1	OUT1	Output pin 1
2	IN1(−)	Inverted input pin 1
3	IN1(+)	Non-inverted input pin 1
4	VSS	GND pin
5	IN2(+)	Non-inverted input pin 2
6	IN2(−)	Inverted input pin 2
7	OUT2	Output pin 2
8	VDD	Positive power supply pin

■ Absolute Maximum Ratings

Table 4

(Ta =+25°C unless otherwise specified)

Parameter		Symbol	Absolute maximum ratings	Unit
Power supply voltage		V_{DD}	V_{SS}−0.3 to V_{SS}+7.0	V
Input voltage		V_{IN}	V_{SS}−0.3 to V_{SS}+7.0	V
Output voltage		V_{OUT}	V_{SS}−0.3 to V_{DD}+0.3	V
Differential input voltage		V_{IND}	±7.0	V
Output pin current		I_{SINK}	20	mA
Power dissipation	SNT-8A	P_D	450[*1]	mW
	TMSOP-8		650[*1]	mW
Operating ambient temperature		T_{opr}	−40 to +85	°C
Storage temperature		T_{stg}	−55 to +125	°C

***1.** When mounted on board

[Mounted board]

(1) Board size: 114.3 mm × 76.2 mm × t1.6 mm

(2) Board name: JEDEC STANDARD51-7

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.

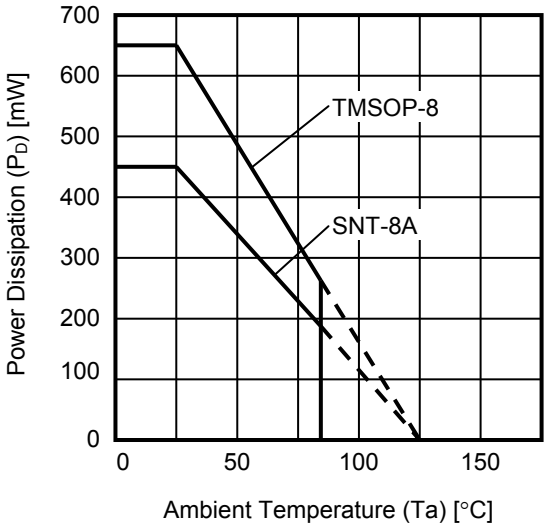


Figure 4 Power Dissipation of Package (When Mounted on Board)

■ Electrical Characteristics

Table 5

(Ta = +25°C unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	Test Circuit
Range of operating power supply voltage	V_{DD}	–	1.8	–	5.5	V	–

1. V_{DD} = 5.0 V

Table 6

DC Electrical Characteristics (V_{DD} = 5.0 V) (Ta = +25°C unless otherwise specified)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit	Test Circuit
Current consumption (per circuit)	I_{DD}	S-89230 Series		–	23	40	μA	5
		S-89240 Series		–	5	9	μA	5
Input offset voltage drift	V_{IO}	–		–4	±3	+4	mV	1
Input offset voltage	$\frac{\Delta V_{IO}}{\Delta Ta}$	Ta = –40°C to +85°C		–	±10	–	μV/°C	1
Input offset current	I_{IO}	–		–	1	–	pA	–
Input bias current	I_{BIAS}	–		–	1	–	pA	–
Common-mode input voltage range	V_{CMR}	–		0	–	4.3	V	2
Maximum output swing voltage	V_{OH}	R_L = 1.0 MΩ		4.9	–	–	V	3
	V_{OL}	R_L = 1.0 MΩ		–	–	0.01	V	4
Common-mode input signal rejection ratio	CMRR	–		60	70	–	dB	2
Power supply voltage rejection ratio	PSRR	–		60	70	–	dB	1
Source current	I_{SOURCE}	V_{OUT} = 0 V	S-89230 Series	120	–	–	μA	6
			S-89240 Series	25	–	–	μA	6
Sink current	I_{SINK}	V_{OUT} = 0.5 V	S-89230 Series	5	–	–	mA	7
			S-89240 Series	3.5	–	–	mA	7

Table 7

AC Electrical Characteristics (V_{DD} = 5.0 V) (Ta = +25°C unless otherwise specified)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Rise propagation delay time	t_{PLH}	Overdrive = 100 mV C_L = 15 pF (Refer to **Figure 12**)	S-89230 Series	–	26	–	μs
			S-89240 Series	–	100	–	μs
Fall propagation delay time	t_{PHL}		S-89230 Series	–	5	–	μs
			S-89240 Series	–	22	–	μs
Rise response time	t_{TLH}		S-89230 Series	–	3	–	μs
			S-89240 Series	–	15	–	μs
Fall response time	t_{THL}		S-89230 Series	–	3	–	μs
			S-89240 Series	–	15	–	μs

2. V_{DD} = 3.0 V

Table 8

DC Electrical Characteristics (V_{DD} = 3.0 V) (Ta = +25°C unless otherwise specified)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit	Test Circuit
Current consumption (per circuit)	I_{DD}	S-89230 Series		–	23	40	μA	5
		S-89240 Series		–	5	9	μA	5
Input offset voltage drift	V_{IO}	–		−4	±3	+4	mV	1
Input offset voltage	$\frac{\Delta V_{IO}}{\Delta Ta}$	Ta = −40°C to +85°C		–	±10	–	μV/°C	1
Input offset current	I_{IO}	–		–	1	–	pA	–
Input bias current	I_{BIAS}	–		–	1	–	pA	–
Common-mode input voltage range	V_{CMR}	–		0	–	2.3	V	2
Maximum output swing voltage	V_{OH}	R_L = 1.0 MΩ		2.9	–	–	V	3
	V_{OL}	R_L = 1.0 MΩ		–	–	0.01	V	4
Common-mode input signal rejection ratio	CMRR	–		60	70	–	dB	2
Power supply voltage rejection ratio	PSRR	–		60	70	–	dB	1
Source current	I_{SOURCE}	V_{OUT} = 0 V	S-89230 Series	120	–	–	μA	6
			S-89240 Series	25	–	–	μA	6
Sink current	I_{SINK}	V_{OUT} = 0.5 V	S-89230 Series	5	–	–	mA	7
			S-89240 Series	3.5	–	–	mA	7

Table 9

AC Electrical Characteristics (V_{DD} = 3.0 V) (Ta = +25°C unless otherwise specified)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Rise propagation delay time	t_{PLH}	Overdrive = 100 mV C_L = 15 pF (Refer to **Figure 12**)	S-89230 Series	–	26	–	μs
			S-89240 Series	–	100	–	μs
Fall propagation delay time	t_{PHL}		S-89230 Series	–	4	–	μs
			S-89240 Series	–	18	–	μs
Rise response time	t_{TLH}		S-89230 Series	–	2	–	μs
			S-89240 Series	–	10	–	μs
Fall response time	t_{THL}		S-89230 Series	–	2	–	μs
			S-89240 Series	–	10	–	μs

3. V_{DD} = 1.8 V

Table 10

DC Electrical Characteristics (V_{DD} = 1.8 V) (Ta = +25°C unless otherwise specified)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit	Test Circuit
Current consumption (per circuit)	I_{DD}	S-89230 Series		–	23	40	μA	5
		S-89240 Series		–	5	9	μA	5
Input offset voltage drift	V_{IO}	–		−4	±3	+4	mV	1
Input offset voltage	$\frac{\Delta V_{IO}}{\Delta Ta}$	Ta = −40°C to +85°C		–	±10	–	μV/°C	1
Input offset current	I_{IO}	–		–	1	–	pA	–
Input bias current	I_{BIAS}	–		–	1	–	pA	–
Common-mode input voltage range	V_{CMR}	–		0	–	1.1	V	2
Maximum output swing voltage	V_{OH}	R_L = 1.0 MΩ		1.7	–	–	V	3
	V_{OL}	R_L = 1.0 MΩ		–	–	0.01	V	4
Common-mode input signal rejection ratio	CMRR	–		60	70	–	dB	2
Power supply voltage rejection ratio	PSRR	–		60	70	–	dB	1
Source current	I_{SOURCE}	V_{OUT} = 0 V	S-89230 Series	100	–	–	μA	6
			S-89240 Series	20	–	–	μA	6
Sink current	I_{SINK}	V_{OUT} = 0.5 V	S-89230 Series	5	–	–	mA	7
			S-89240 Series	3.5	–	–	mA	7

Table 11

AC Electrical Characteristics (V_{DD} = 1.8 V) (Ta = +25°C unless otherwise specified)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Rise propagation delay time	t_{PLH}	Overdrive = 100 mV C_L = 15 pF (Refer to **Figure 12**)	S-89230 Series	–	18	–	μs
			S-89240 Series	–	87	–	μs
Fall propagation delay time	t_{PHL}		S-89230 Series	–	3.5	–	μs
			S-89240 Series	–	15	–	μs
Rise response time	t_{TLH}		S-89230 Series	–	1.2	–	μs
			S-89240 Series	–	6	–	μs
Fall response time	t_{THL}		S-89230 Series	–	1.2	–	μs
			S-89240 Series	–	6	–	μs

■ Test Circuit (Per Circuit)

1. Power supply voltage rejection ratio, input offset voltage

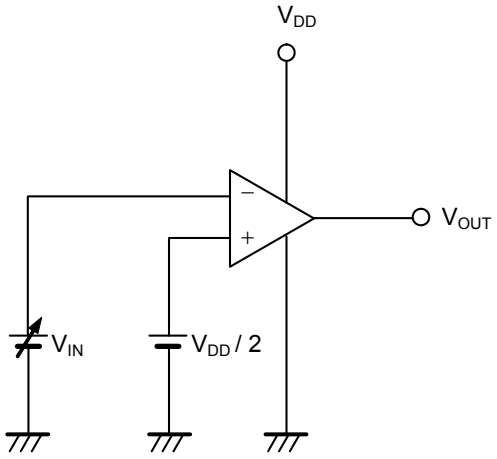


Figure 5

- **Power supply voltage rejection ratio (PSRR)**
  Input offset voltage (V_{IO})

  The input offset voltage (V_{IO}) is defined as V_{IN} − V_{DD} / 2 when V_{OUT} is changed by changing V_{IN} to V_{DD} / 2 level. The power supply voltage rejection ratio (PSRR) can be calculated by following expression, with the value of V_{IO} measured at each V_{DD}.

  Measurement conditions:
  When V_{DD} = 1.8 V: $V_{DD} = V_{DD1}$, $V_{IO} = V_{IO1}$
  When V_{DD} = 5.0 V: $V_{DD} = V_{DD2}$, $V_{IO} = V_{IO2}$

$$PSRR = 20 \log \left(\left| \frac{V_{DD1} - V_{DD2}}{V_{IO1} - V_{IO2}} \right| \right)$$

2. Common-mode input signal rejection ratio, common-mode input voltage range

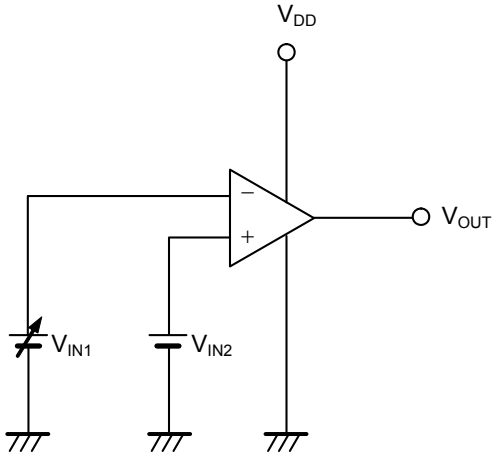


Figure 6

- **Common-mode input signal rejection ratio (CMRR)**
  The common-mode input signal rejection ratio (CMRR) can be calculated by the following expression, with the offset voltage (V_{IO}) set as V_{IN1} − V_{IN2} after V_{OUT} is changed by changing V_{IN1}.

  Measurement conditions:
  When $V_{IN2} = V_{CMR\ Max.}$: $V_{IN2} = V_{INH}$, $V_{IO} = V_{IO1}$
  When $V_{IN2} = V_{DD}/2$: $V_{IN2} = V_{INL}$, $V_{IO} = V_{IO2}$

$$CMRR = 20 \log \left(\left| \frac{V_{INH} - V_{INL}}{V_{IO1} - V_{IO2}} \right| \right)$$

- **Common-mode input voltage range (V_{CMR})**
  Varying V_{IN2}, the range of V_{IN2} that satisfies the common-mode input signal rejection ratio (CMRR) is the common-mode input voltage range (V_{CMR}).

3. Maximum output swing voltage (V_{OH})

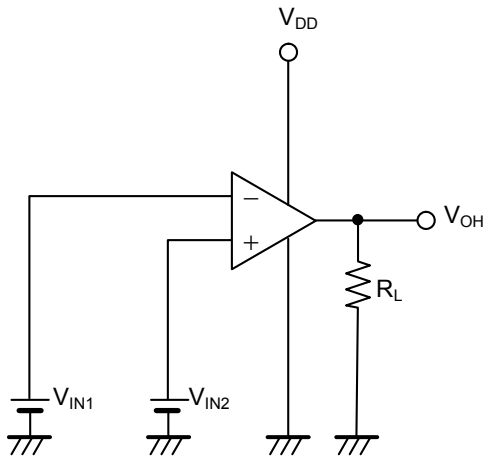


Figure 7

- **Maximum output swing voltage (V_{OH})**

Test conditions:

$V_{IN1} = \frac{V_{DD}}{2} - 0.1$ V

$V_{IN2} = \frac{V_{DD}}{2} + 0.1$ V

R_L = 1 MΩ

4. Maximum output swing voltage (V_{OL})

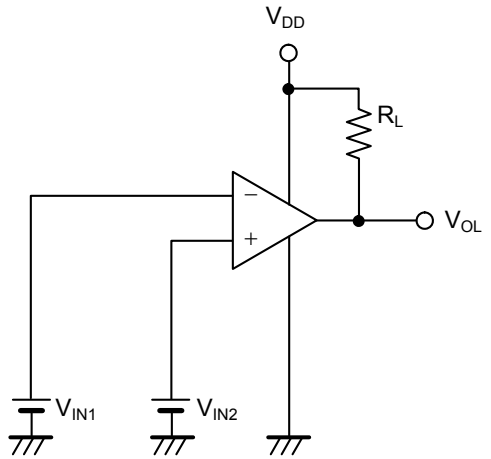


Figure 8

- **Maximum output swing voltage (V_{OL})**

Test conditions:

$V_{IN1} = \frac{V_{DD}}{2} + 0.1$ V

$V_{IN2} = \frac{V_{DD}}{2} - 0.1$ V

R_L = 1 MΩ

5. Current consumption

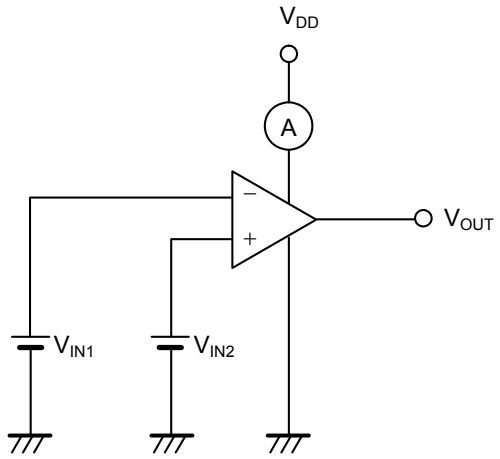


Figure 9

- **Current consumption (I_{DD})**

Test conditions:
$V_{IN} = V_{SS}$
$V_{IN} = V_{CMR\ Max.}$

6. Source current

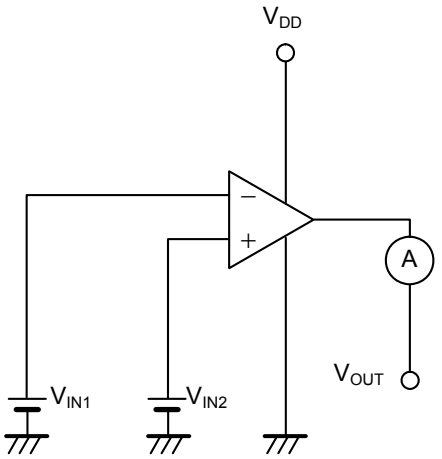


Figure 10

- **Source current (I_{SOURCE})**

Test conditions:
V_{OUT} = 0 V
$V_{IN1} = \frac{V_{DD}}{2} - 0.5\,V$
$V_{IN2} = \frac{V_{DD}}{2} + 0.5\ V$

7. Sink current

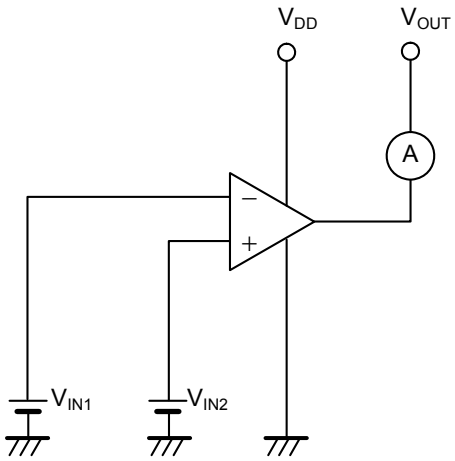


Figure 11

- **Sink current (I_{SINK})**

Test conditions:
V_{OUT} = 0.5 V
$V_{IN1} = \frac{V_{DD}}{2} + 0.5\ V$
$V_{IN2} = \frac{V_{DD}}{2} - 0.5\ V$

8. Propagation time, response time

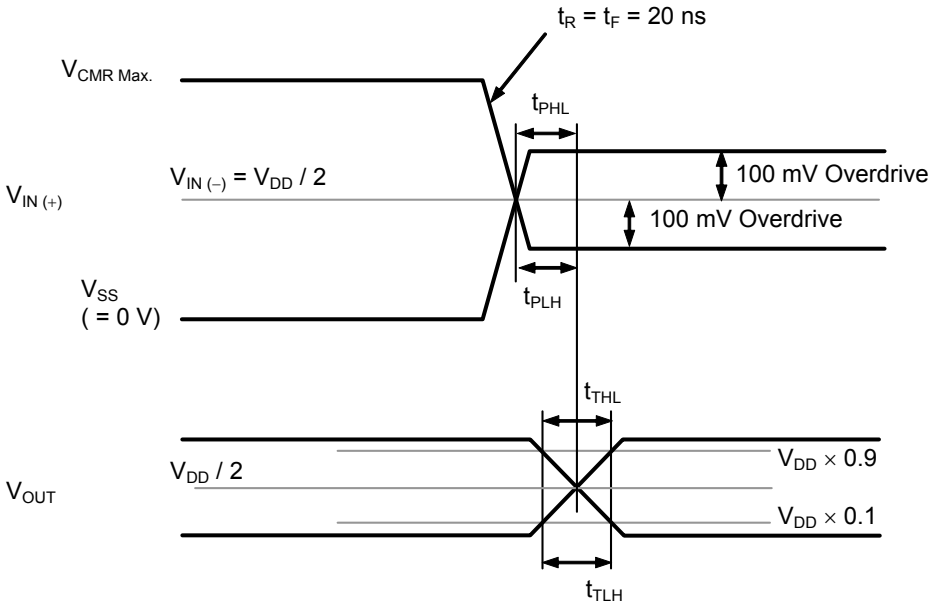


Figure 12

■ Precautions

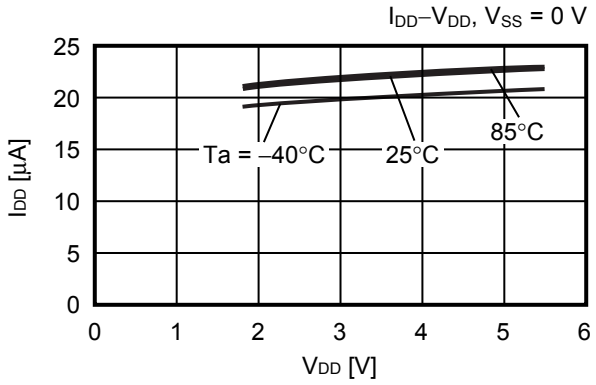
- Do not apply an electrostatic discharge to this IC that exceeds performance ratings of the built-in electrostatic protection circuit.

- ABLIC Inc. claims no responsibility for any disputes arising out of or in connection with any infringement by products including this IC of patents owned by a third party.

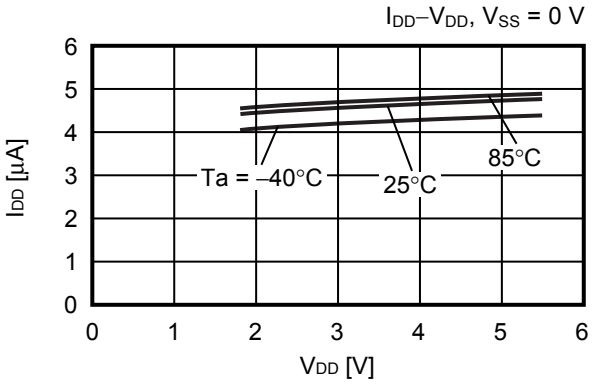
■ Characteristics (Typical Data)

1. Current consumption (per circuit, I_{DD}) vs. Power supply voltage (V_{DD})

(1) S-89230 Series



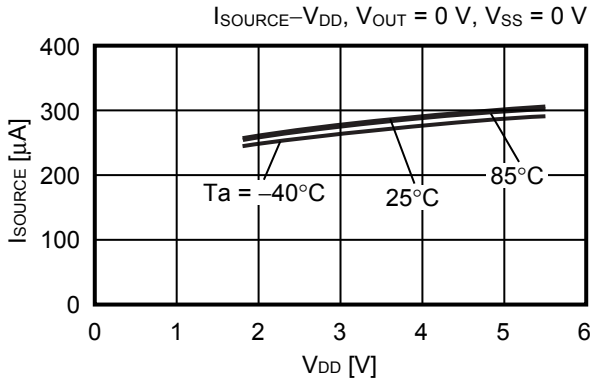
(2) S-89240 Series



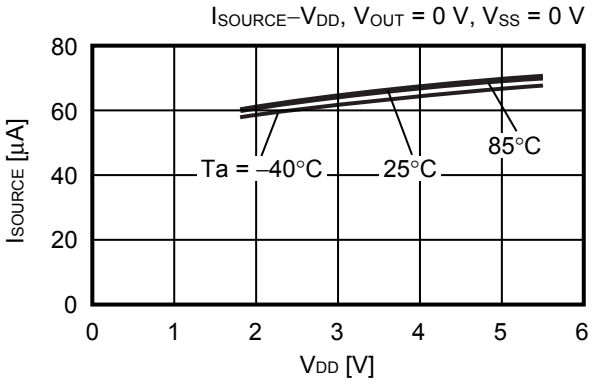
2. Output current characteristics

2. 1 Source current (I_{SOURCE}) vs. Power supply voltage (V_{DD})

(1) S-89230 Series

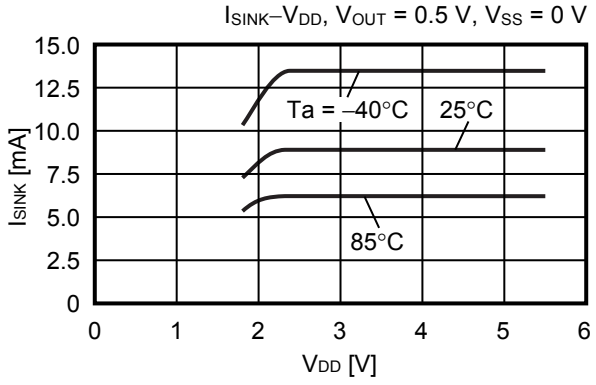


(2) S-89240 Series

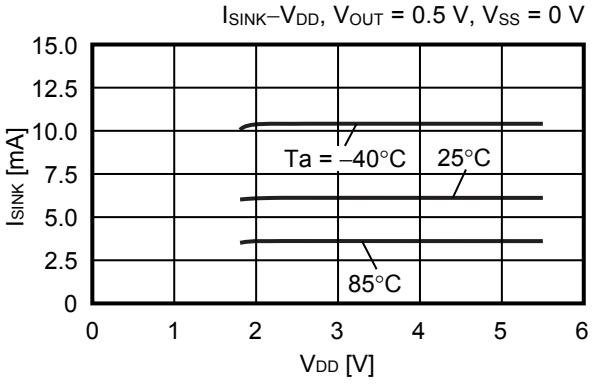


2. 2 Sink current (I_{SINK}) vs. Power supply voltage (V_{DD})

(1) S-89230 Series



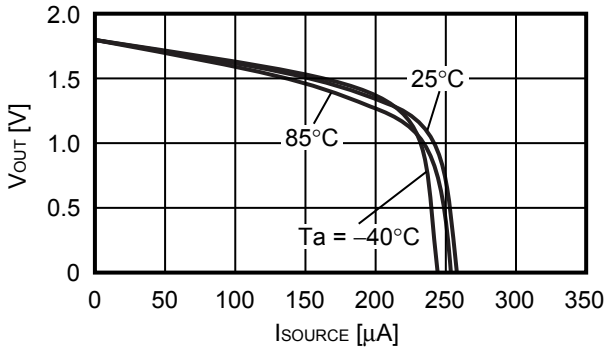
(2) S-89240 Series



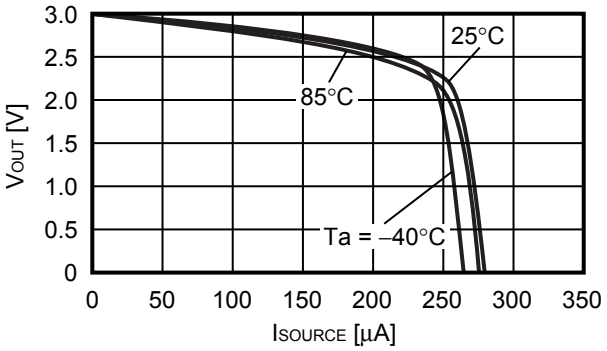
2. 3 Output voltage (V_{OUT}) vs. Source current (I_{SOURCE})

(1) S-89230 Series

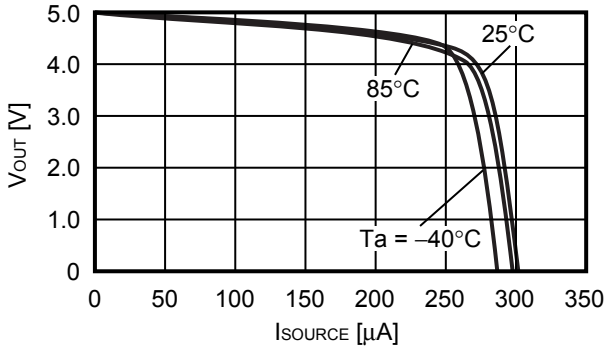
V_{OUT}–I_{SOURCE}, V_{DD} = 1.8 V, V_{SS} = 0 V



V_{OUT}–I_{SOURCE}, V_{DD} = 3.0 V, V_{SS} = 0 V

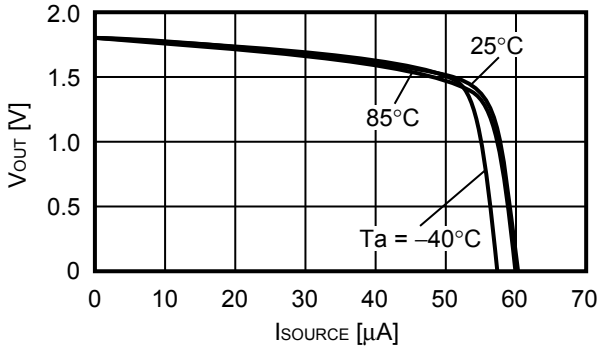


V_{OUT}–I_{SOURCE}, V_{DD} = 5.0 V, V_{SS} = 0 V

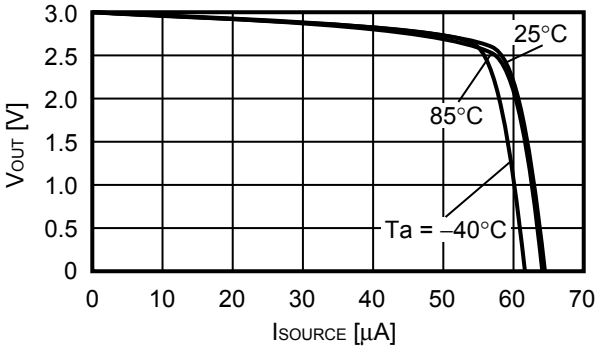


(2) S-89240 Series

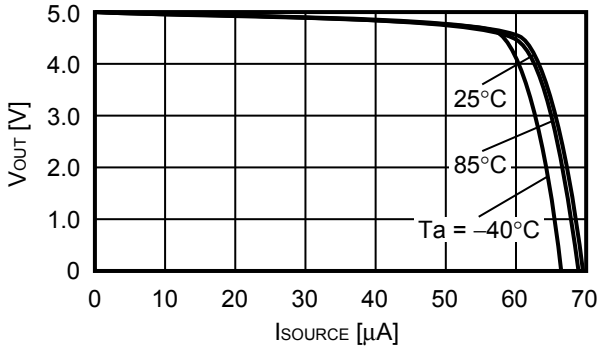
V_{OUT}–I_{SOURCE}, V_{DD} = 1.8 V, V_{SS} = 0 V



V_{OUT}–I_{SOURCE}, V_{DD} = 3.0 V, V_{SS} = 0 V

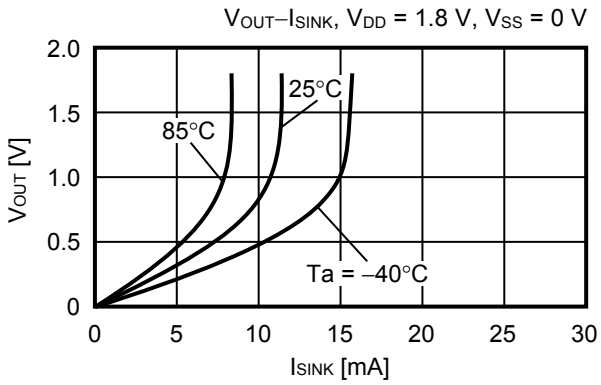


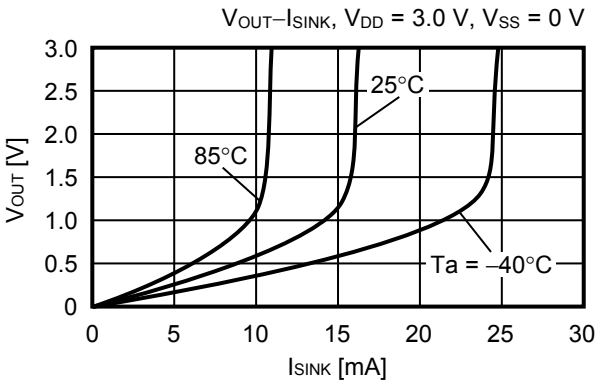
V_{OUT}–I_{SOURCE}, V_{DD} = 5.0 V, V_{SS} = 0 V

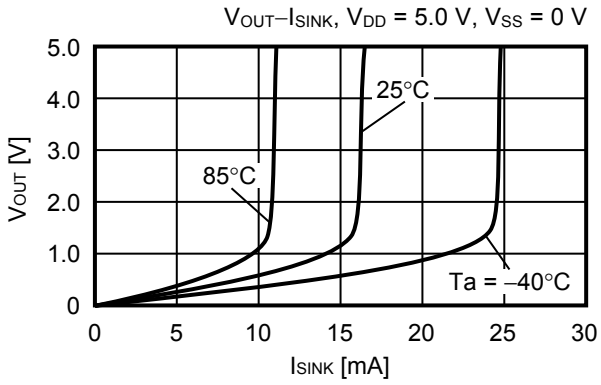


2. 4 Output voltage (V_{OUT}) vs. Sink current (I_{SINK})

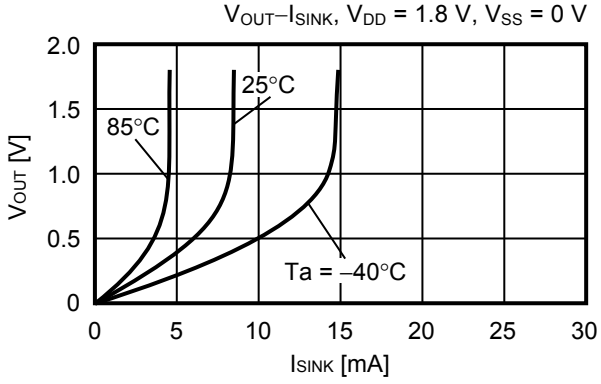
(1) S-89230 Series

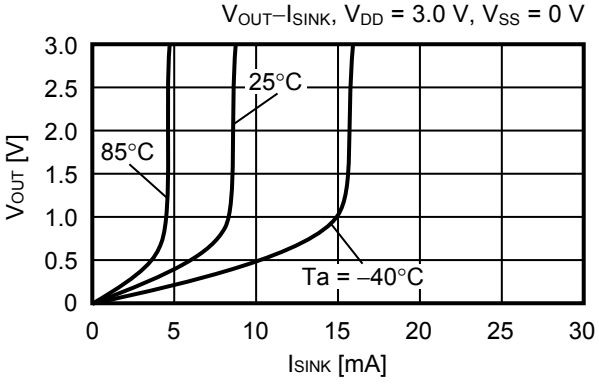


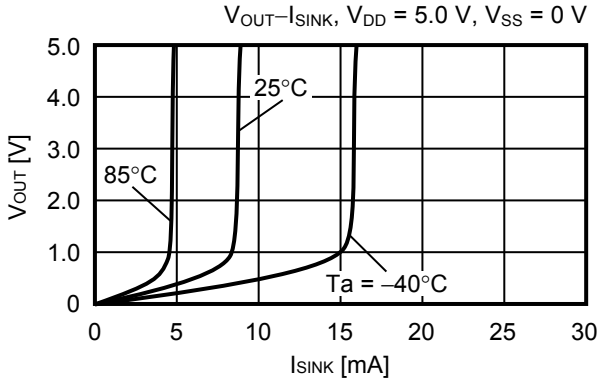


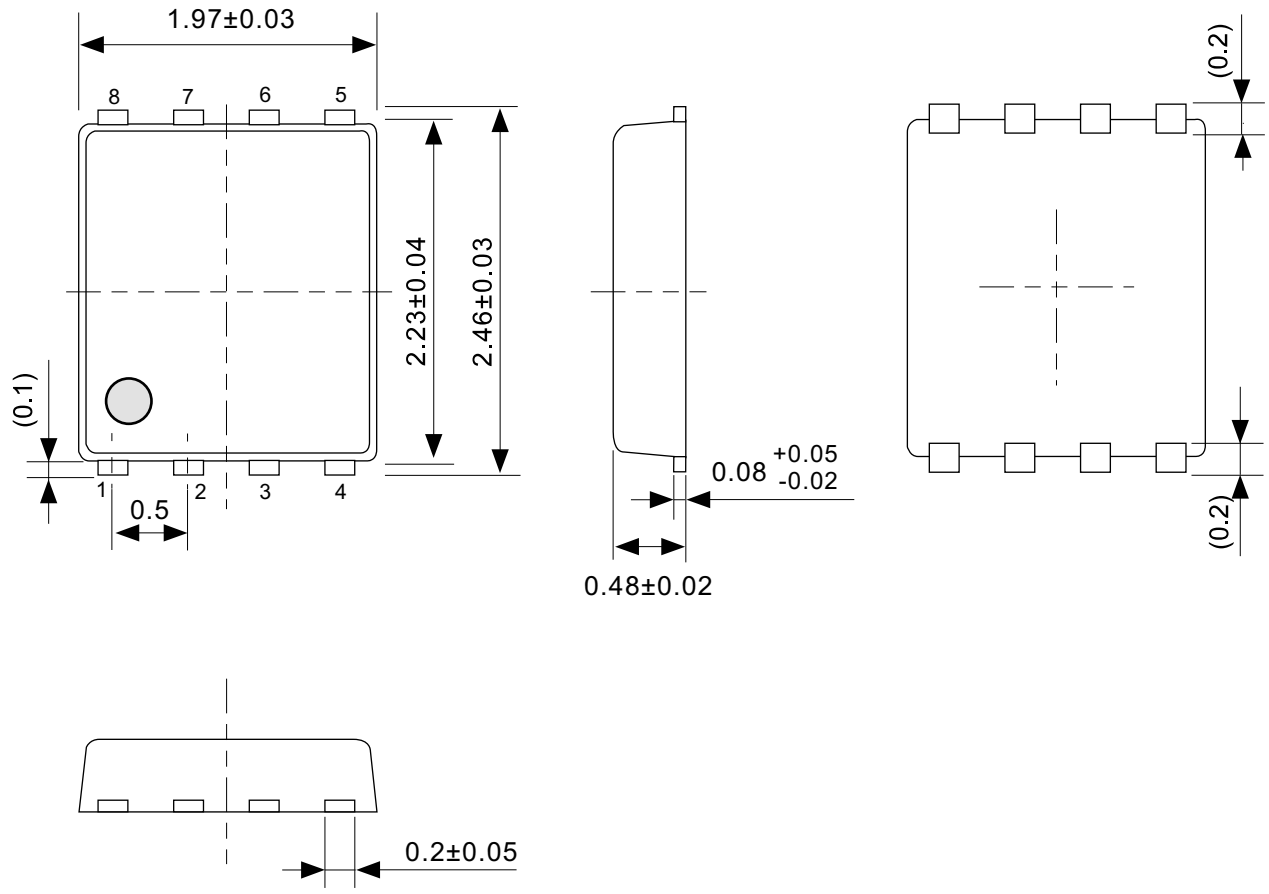


(2) S-89240 Series



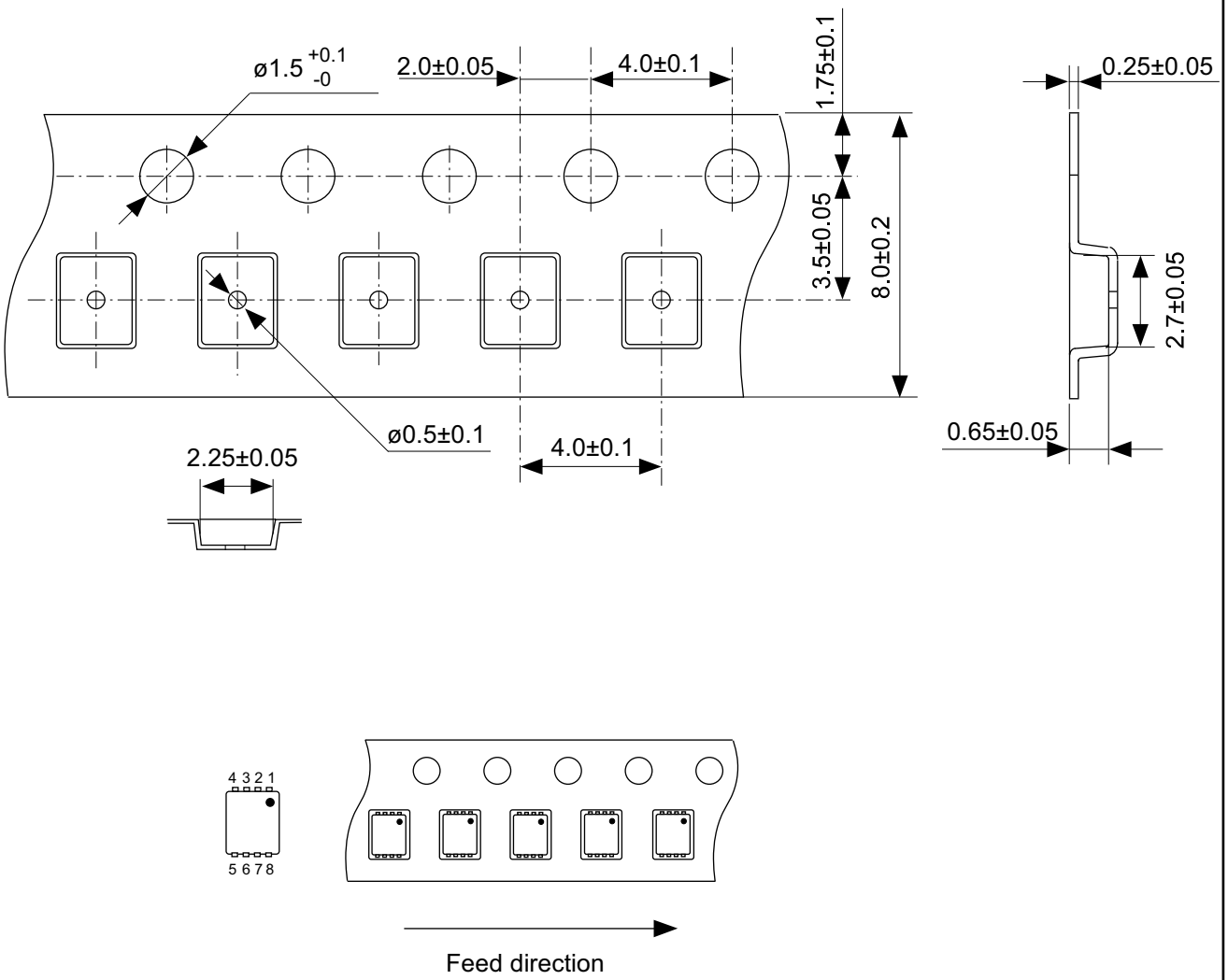






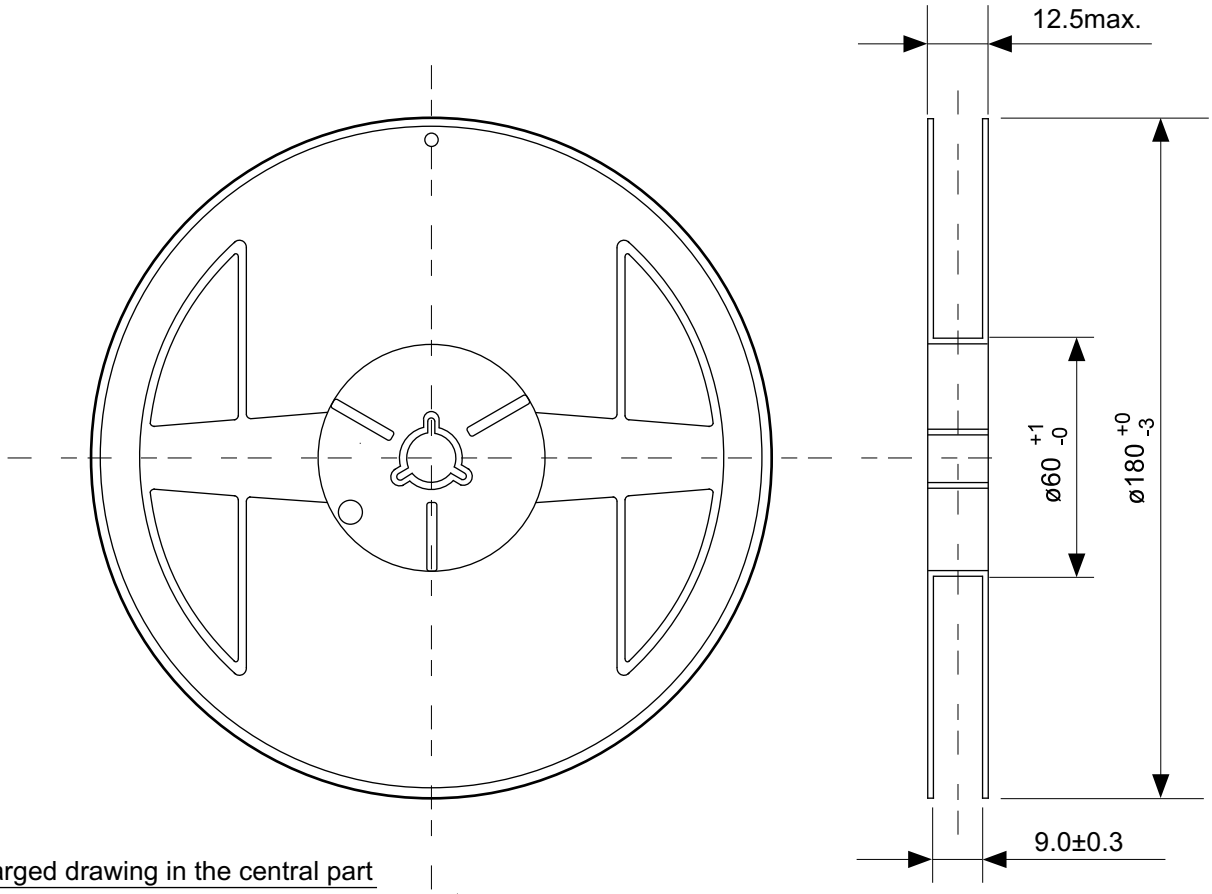
No. PH008-A-P-SD-2.1

TITLE	SNT-8A-A-PKG Dimensions
No.	PH008-A-P-SD-2.1
ANGLE	
UNIT	mm
ABLIC Inc.	

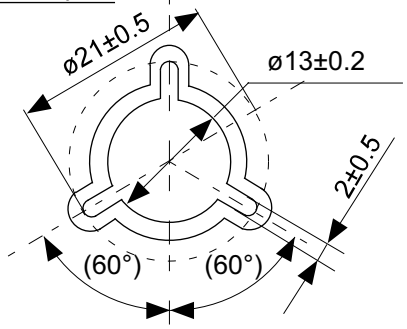


No. PH008-A-C-SD-2.0

TITLE	SNT-8A-A-Carrier Tape
No.	PH008-A-C-SD-2.0
ANGLE	
UNIT	mm
ABLIC Inc.	

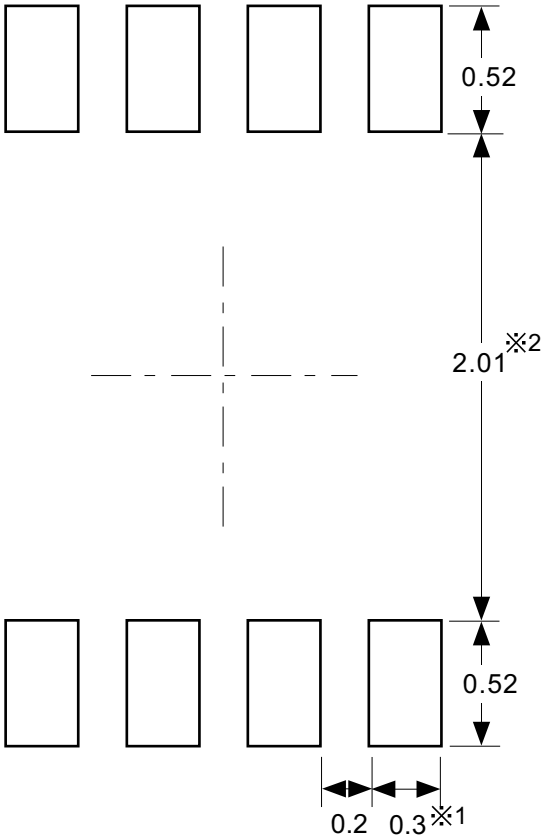


Enlarged drawing in the central part



No. PH008-A-R-SD-1.0

TITLE	SNT-8A-A-Reel		
No.	PH008-A-R-SD-1.0		
ANGLE		QTY.	5,000
UNIT	mm		
ABLIC Inc.			



※1. ランドパターンの幅に注意してください (0.25 mm min. / 0.30 mm typ.)。
※2. パッケージ中央にランドパターンを広げないでください (1.96 mm ~ 2.06 mm)。

注意 1. パッケージのモールド樹脂下にシルク印刷やハンダ印刷などしないでください。
2. パッケージ下の配線上のソルダーレジストなどの厚みをランドパターン表面から0.03 mm 以下にしてください。
3. マスク開口サイズと開口位置はランドパターンと合わせてください。
4. 詳細は〝SNTパッケージ活用の手引き〟を参照してください。

※1. Pay attention to the land pattern width (0.25 mm min. / 0.30 mm typ.).
※2. Do not widen the land pattern to the center of the package (1.96 mm to 2.06mm).

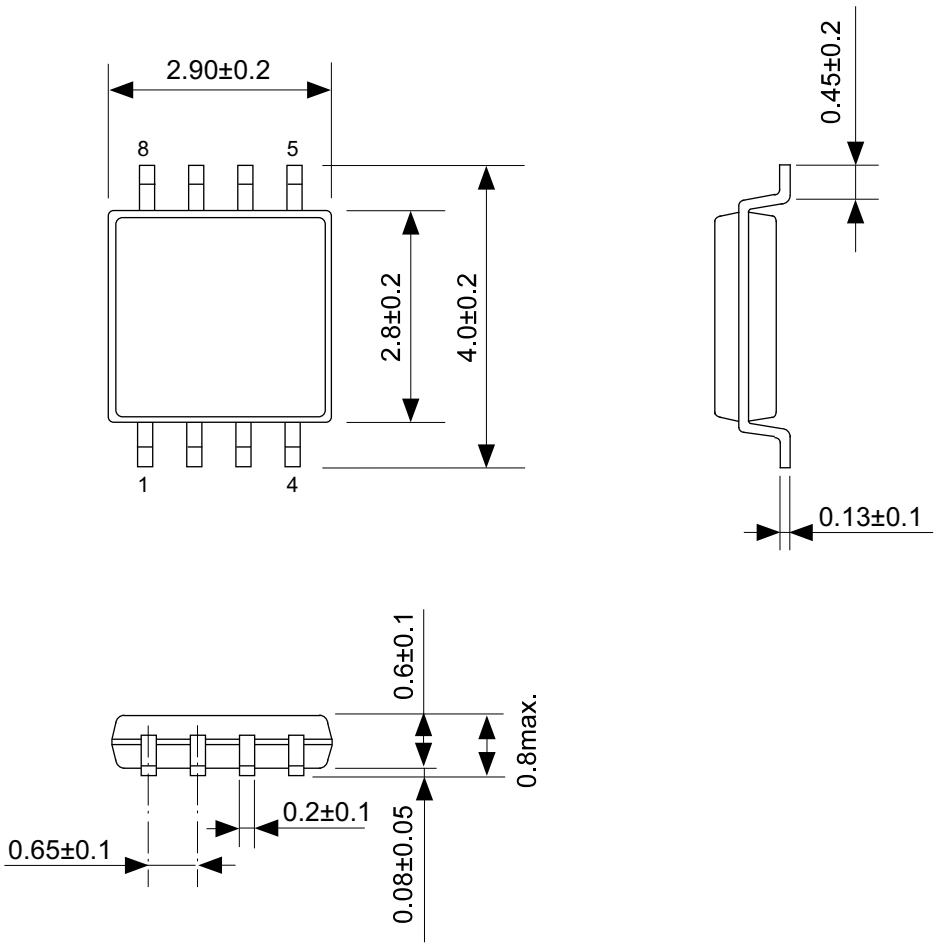
Caution 1. Do not do silkscreen printing and solder printing under the mold resin of the package.
2. The thickness of the solder resist on the wire pattern under the package should be 0.03 mm or less from the land pattern surface.
3. Match the mask aperture size and aperture position with the land pattern.
4. Refer to "SNT Package User's Guide" for details.

※1. 请注意焊盘模式的宽度 (0.25 mm min. / 0.30 mm typ.)。
※2. 请勿向封装中间扩展焊盘模式 (1.96 mm ~ 2.06 mm)。

注意 1. 请勿在树脂型封装的下面印刷丝网、焊锡。
2. 在封装下、布线上的阻焊膜厚度 (从焊盘模式表面起) 请控制在 0.03 mm 以下。
3. 钢网的开口尺寸和开口位置请与焊盘模式对齐。
4. 详细内容请参阅 "SNT 封装的应用指南"。

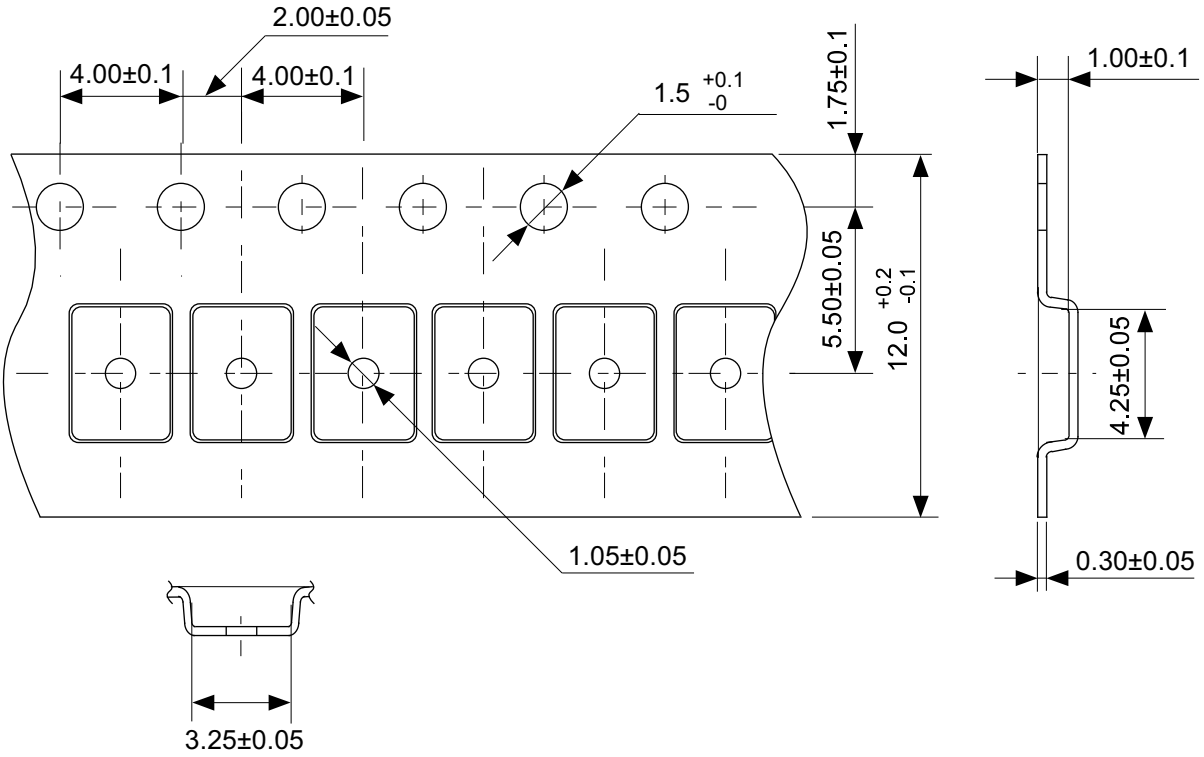
No. PH008-A-L-SD-4.1

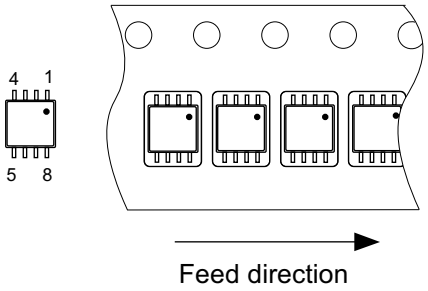
TITLE	SNT-8A-A -Land Recommendation
No.	PH008-A-L-SD-4.1
ANGLE	
UNIT	mm
ABLIC Inc.	



No. FM008-A-P-SD-1.2

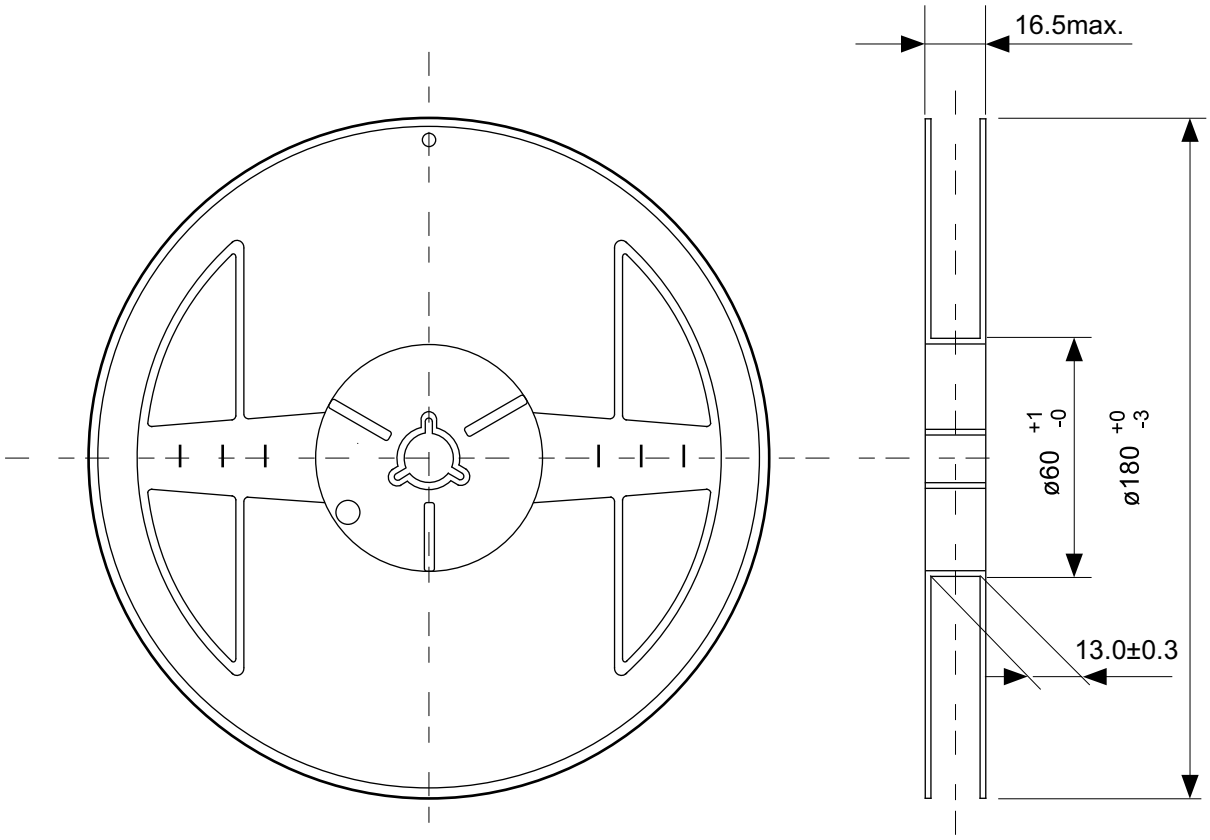
TITLE	TMSOP8-A-PKG Dimensions
No.	FM008-A-P-SD-1.2
ANGLE	
UNIT	mm
ABLIC Inc.	



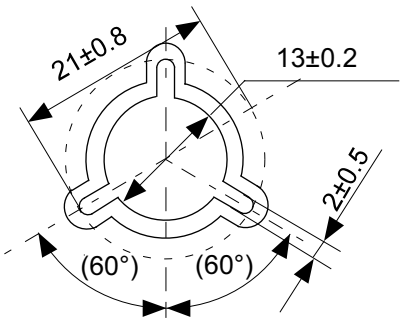


No. FM008-A-C-SD-2.0

TITLE	TMSOP8-A-Carrier Tape
No.	FM008-A-C-SD-2.0
ANGLE	
UNIT	mm
ABLIC 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		
ANGLE		QTY.	4,000
UNIT	mm		
ABLIC Inc.			

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