S-89210/89220 Series

MINI ANALOG SERIES
CMOS COMPARATOR

www.sii-ic.com

Rev.4.0_00

The mini-analog series is a group of ICs that incorporate a general purpose analog circuit in a small package.
The S-89210/89220 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 single comparator (with 1 circuit).

■ Features

- Lower operating voltage than the conventional general-purpose: V_{DD} = 1.8 V to 5.5 V
- Low current consumption: I_{DD} = 50 μA Typ. (S-89210 Series), I_{DD} = 10 μA Typ. (S-89220 Series)
- Low input offset voltage: 4.0 mV Max.
- Lead-free, halogen-free*1

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

■ Application

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

■ Package

- SC-88A

■ Block Diagram

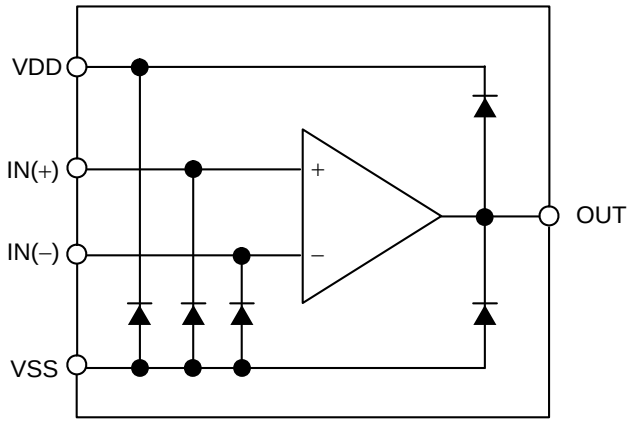
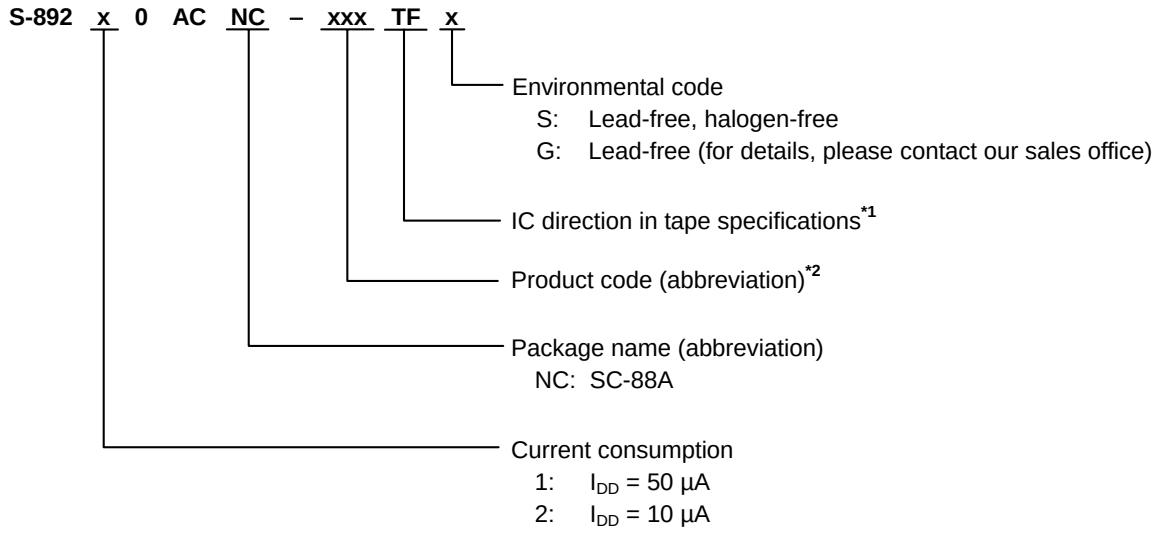


Figure 1

■ Product Name Structure

Users can select the product type for the S-89210/89220 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.** Refer to "**3. Product name list**".

2. Package

Package Name	Drawing Code		
	Package	Tape	Reel
SC-88A	NP005-B-P-SD	NP005-B-C-SD	NP005-B-R-SD

3. Product name list

Table 1

Product name	Current consumption	Rise propagation delay time*1	Fall propagation delay time*1
S-89210ACNC-1C0TFz	50 µA	30 µs	6 µs
S-89220ACNC-1C1TFz	10 µA	150 µs	30 µs

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

Remark z: G or S

■ Pin Configuration

SC-88A
Top view

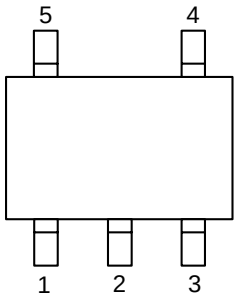


Figure 2

Table 2

Pin No.	Symbol	Description
1	IN(+)	Non-inverted input pin
2	VSS	GND pin
3	IN(–)	Inverted input pin
4	OUT	Output pin
5	VDD	Positive power supply pin

■ Absolute Maximum Ratings

Table 3

(Ta = +25°C unless otherwise specified)

Parameter	Symbol	Absolute Maximum Ratings	Unit
Power supply voltage	V_{DD}	V_{SS} − 0.3 to V_{SS} + 10.0	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}	13	mA
Power dissipation	P_D	200 (When not mounted on board)	mW
		350[*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.

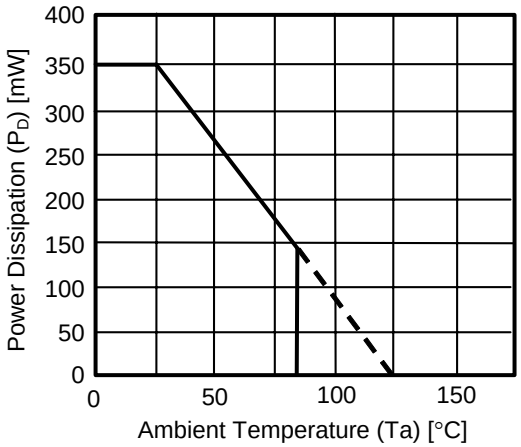


Figure 3 Power Dissipation of Package (When Mounted on Board)

■ Electrical Characteristics

Table 4

(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 5

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

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit	Test Circuit
Current consumption	I_{DD}	S-89210 Series		–	50	120	μA	5
		S-89220 Series		–	10	30	μA	5
Input offset voltage	V_{IO}	–		–4	±3	+4	mV	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}	I_{OH} = 20 μA		4.7	–	–	V	3
	V_{OL}	I_{OL} = 20 μA		–	–	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-89210 Series	120	–	–	μA	6
			S-89220 Series	25	–	–	μA	6
Sink current	I_{SINK}	V_{OUT} = 0.5 V		9	–	–	mA	7

Table 6

AC Electrical Characteristic (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 11**)	S-89210 Series	–	45	–	μs
			S-89220 Series	–	230	–	μs
Fall propagation delay time	t_{PHL}		S-89210 Series	–	9	–	μs
			S-89220 Series	–	45	–	μs
Rise response time	t_{TLH}		S-89210 Series	–	3	–	μs
			S-89220 Series	–	15	–	μs
Fall response time	t_{THL}		S-89210 Series	–	3	–	μs
			S-89220 Series	–	15		μs

2. V_{DD} = 3.0 V

Table 7

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

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit	Test Circuit
Current consumption	I_{DD}	S-89210 Series		–	50	120	μA	5
		S-89220 Series		–	10	30	μA	5
Input offset voltage	V_{IO}	–		−4	±3	+4	mV	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}	I_{OH} = 20 μA		2.7	–	–	V	3
	V_{OL}	I_{OL} = 20 μA		–	–	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-89210 Series	120	–	–	μA	6
			S-89220 Series	25	–	–	μA	6
Sink current	I_{SINK}	V_{OUT} = 0.5 V		8	–	–	mA	7

Table 8

AC Electrical Characteristic (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 11**)	S-89210 Series	–	30	–	μs
			S-89220 Series	–	150	–	μs
Fall propagation delay time	t_{PHL}		S-89210 Series	–	6	–	μs
			S-89220 Series	–	30	–	μs
Rise response time	t_{TLH}		S-89210 Series	–	2	–	μs
			S-89220 Series	–	10	–	μs
Fall response time	t_{THL}		S-89210 Series	–	2	–	μs
			S-89220 Series	–	10	–	μs

3. V_{DD} = 1.8 V

Table 9

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

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit	Test Circuit
Current consumption	I_{DD}	S-89210 Series		–	50	120	μA	5
		S-89220 Series		–	10	30	μA	5
Input offset voltage	V_{IO}	–		−4	±3	+4	mV	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}	I_{OH} = 20 μA		1.5	–	–	V	3
	V_{OL}	I_{OL} = 20 μA		–	–	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-89210 Series	100	–	–	μA	6
			S-89220 Series	20	–	–	μA	6
Sink current	I_{SINK}	V_{OUT} = 0.5 V		5	–	–	mA	7

Table 10

AC Electrical Characteristic (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 11**)	S-89210 Series	–	20	–	μs
			S-89220 Series	–	100	–	μs
Fall propagation delay time	t_{PHL}		S-89210 Series	–	5	–	μs
			S-89220 Series	–	25	–	μs
Rise response time	t_{TLH}		S-89210 Series	–	1.2	–	μs
			S-89220 Series	–	6	–	μs
Fall response time	t_{THL}		S-89210 Series	–	1.2	–	μs
			S-89220 Series	–	6	–	μs

■ Test Circuit

1. Power supply voltage rejection ratio, input offset voltage

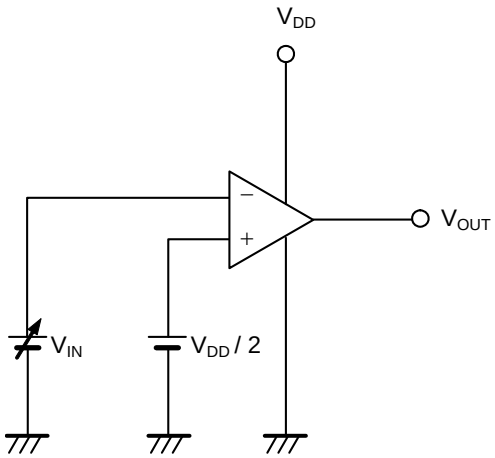


Figure 4

- **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}.

  Test 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

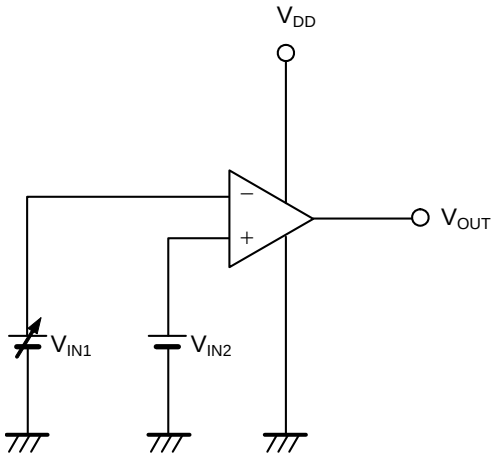


Figure 5

- **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}.

  Test 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})

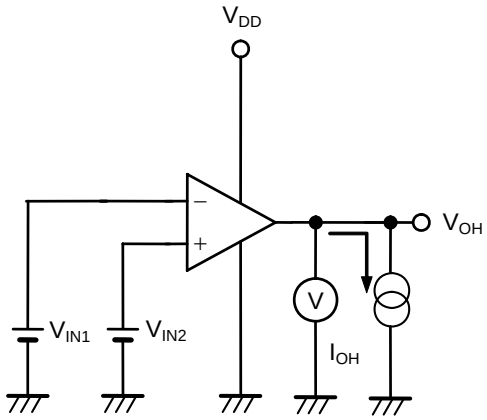


Figure 6

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

  Test conditions:

  $V_{IN1} = \frac{V_{DD}}{2} - 0.5$ V

  $V_{IN2} = \frac{V_{DD}}{2} + 0.5$ V

  $I_{OH} = 20$ μA

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

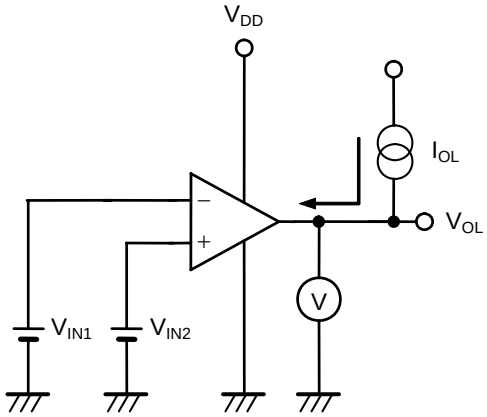


Figure 7

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

  Test conditions:

  $V_{IN1} = \frac{V_{DD}}{2} + 0.5$ V

  $V_{IN2} = \frac{V_{DD}}{2} - 0.5$ V

  $I_{OL} = 20$ μA

5. Current consumption

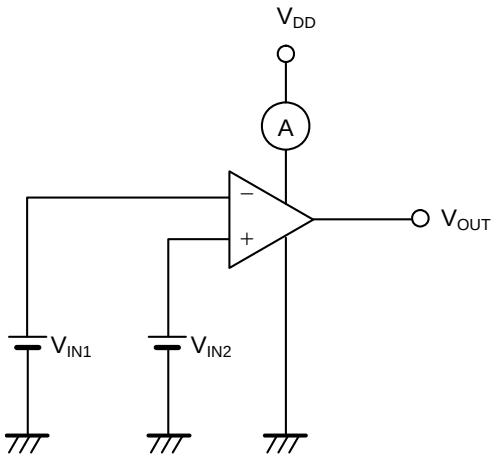


Figure 8

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

  Test conditions:
  $V_{IN1} = V_{SS}$
  $V_{IN2} = V_{CMR\ Max.}$

6. Source current

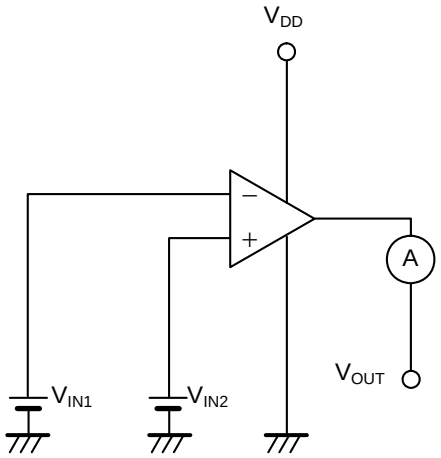


Figure 9

- **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

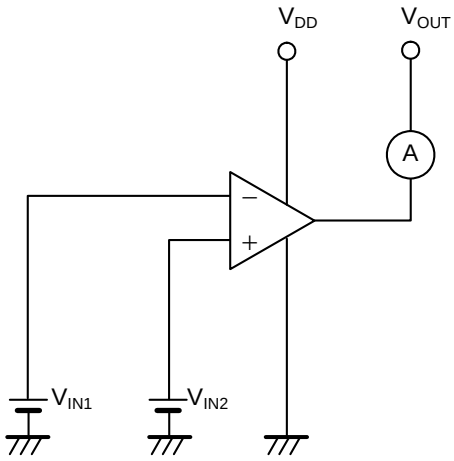


Figure 10

- **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

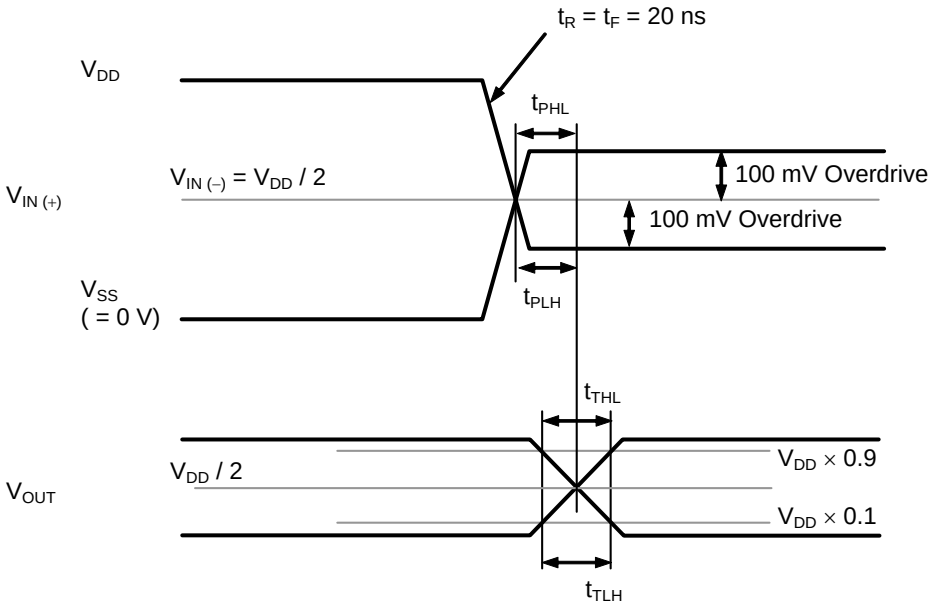


Figure 11

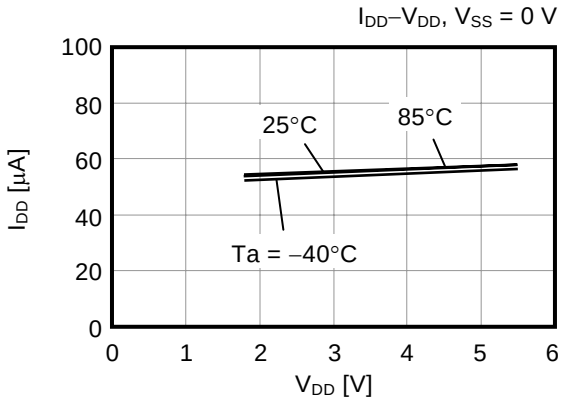
■ Precautions

- Do not apply an electrostatic discharge to this IC that exceeds performance ratings of the built-in electrostatic protection circuit.
- SII 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.
- Use this IC with the output pin current 13 mA or less.

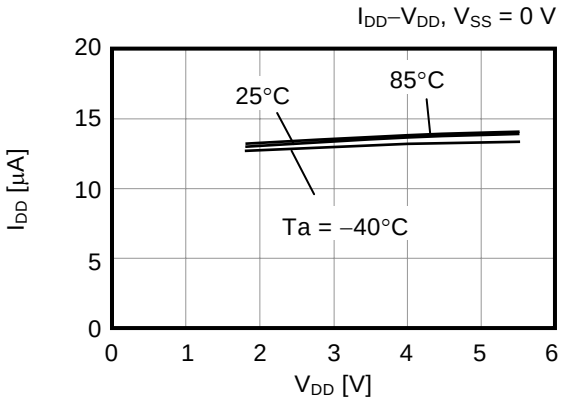
■ Characteristics (Typical Data)

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

(1) S-89210 Series



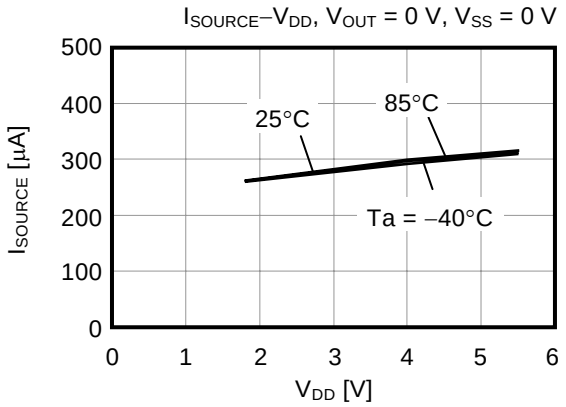
(2) S-89220 Series



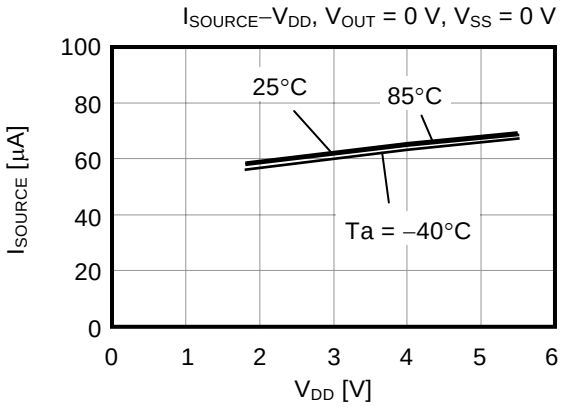
2. Output current characteristics

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

(1) S-89210 Series

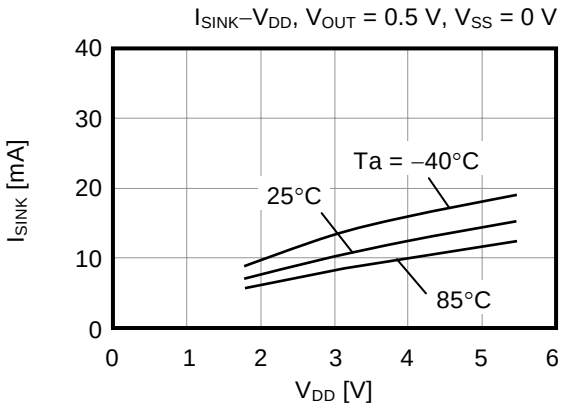


(2) S-89220 Series

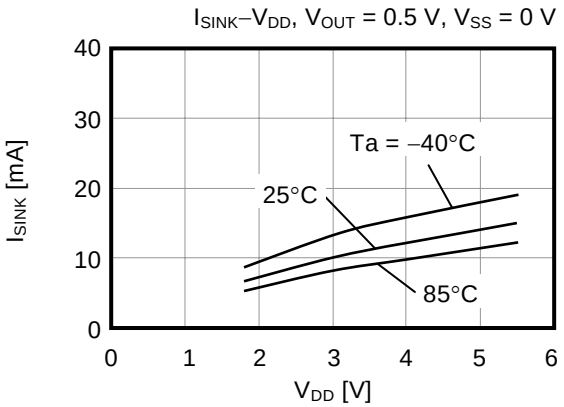


2. 2 Sink current (I_{SINK}) vs. Power supply voltage (V_{DD})

(1) S-89210 Series



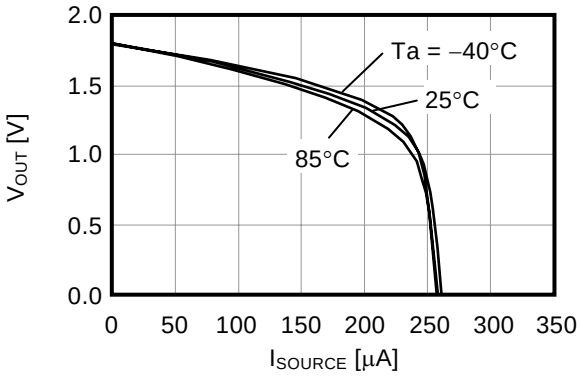
(2) S-89220 Series



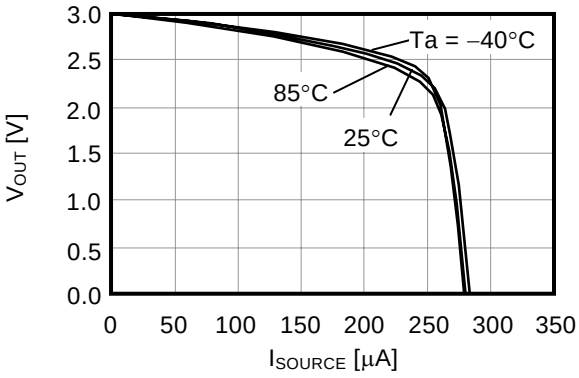
2. 3 Output voltage (V_{OUT}) vs. Source current (I_{SOURCE})

(1) S-89210 Series

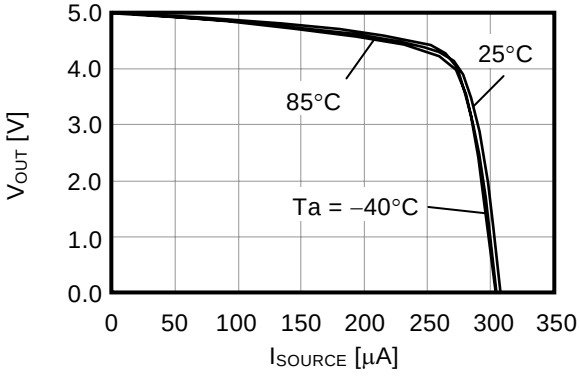
V_{OUT}–I_{SOURCE}, V_{DD} = 1.8 V, V_{SS} = 0 V



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

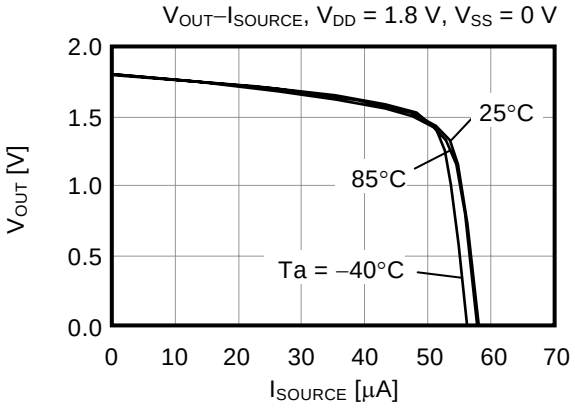


V_{OUT}–I_{SOURCE}, V_{DD} = 5.0 V, V_{SS} = 0 V

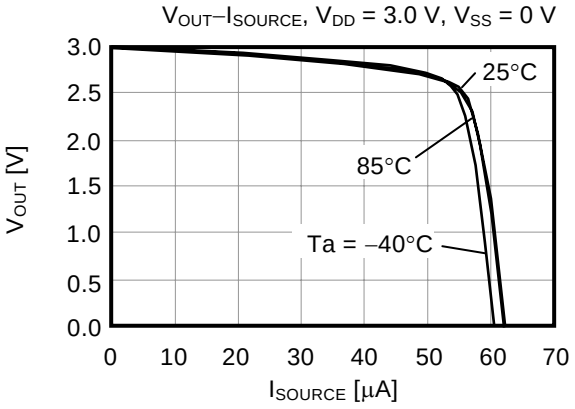


(2) S-89220 Series

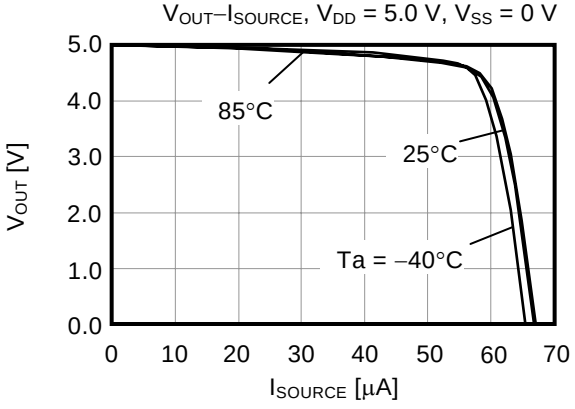
V_{OUT}–I_{SOURCE}, V_{DD} = 1.8 V, V_{SS} = 0 V



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



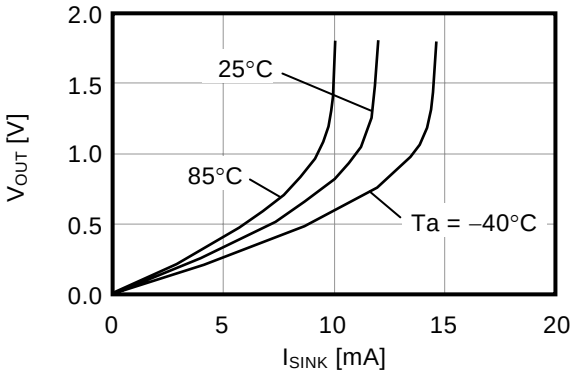
V_{OUT}–I_{SOURCE}, V_{DD} = 5.0 V, V_{SS} = 0 V



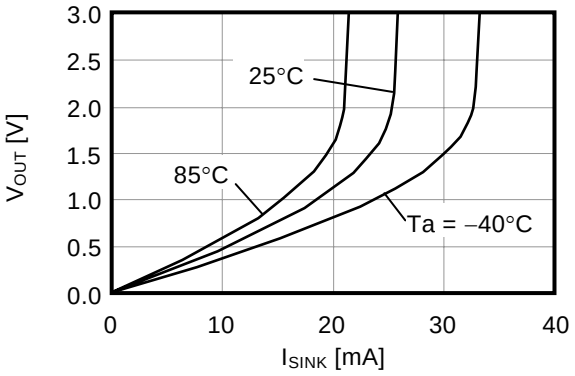
2. 4 Output voltage (V_{OUT}) vs. Sink current (I_{SINK})

(1) S-89210 Series

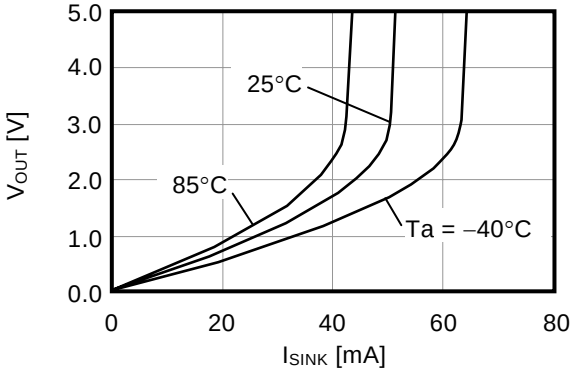
V_{OUT}–I_{SINK}, V_{DD} = 1.8 V, V_{SS} = 0 V



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

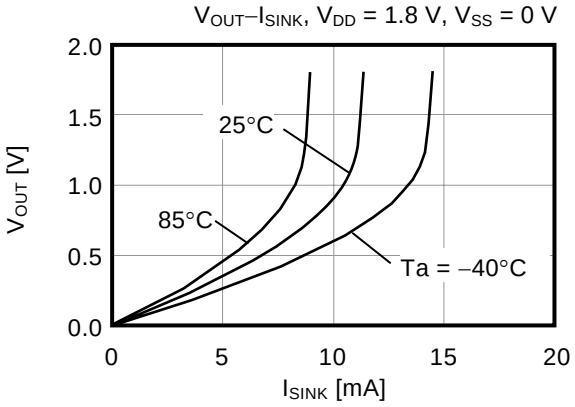


V_{OUT}–I_{SINK}, V_{DD} = 5.0 V, V_{SS} = 0 V

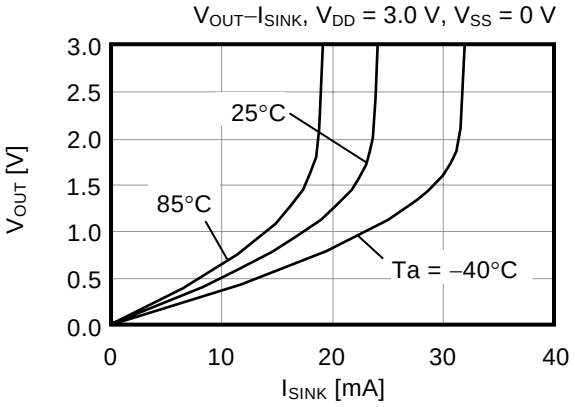


(2) S-89220 Series

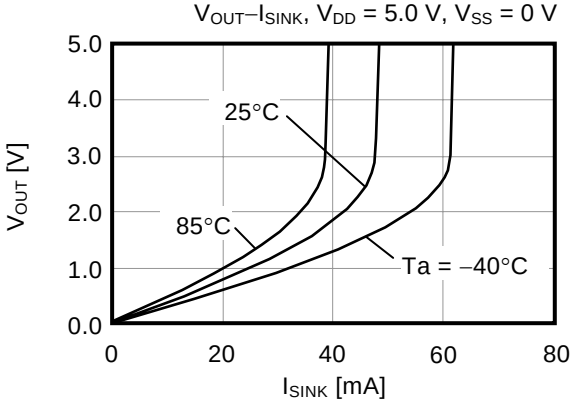
V_{OUT}–I_{SINK}, V_{DD} = 1.8 V, V_{SS} = 0 V

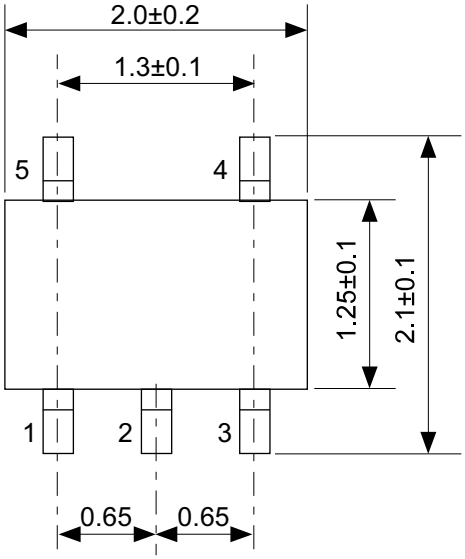


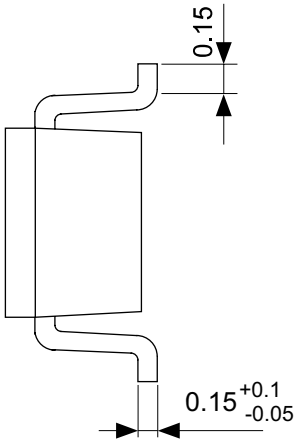
V_{OUT}–I_{SINK}, V_{DD} = 3.0 V, V_{SS} = 0 V

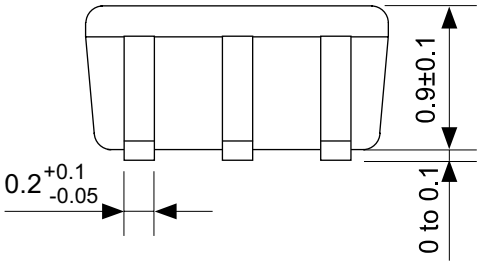


V_{OUT}–I_{SINK}, V_{DD} = 5.0 V, V_{SS} = 0 V



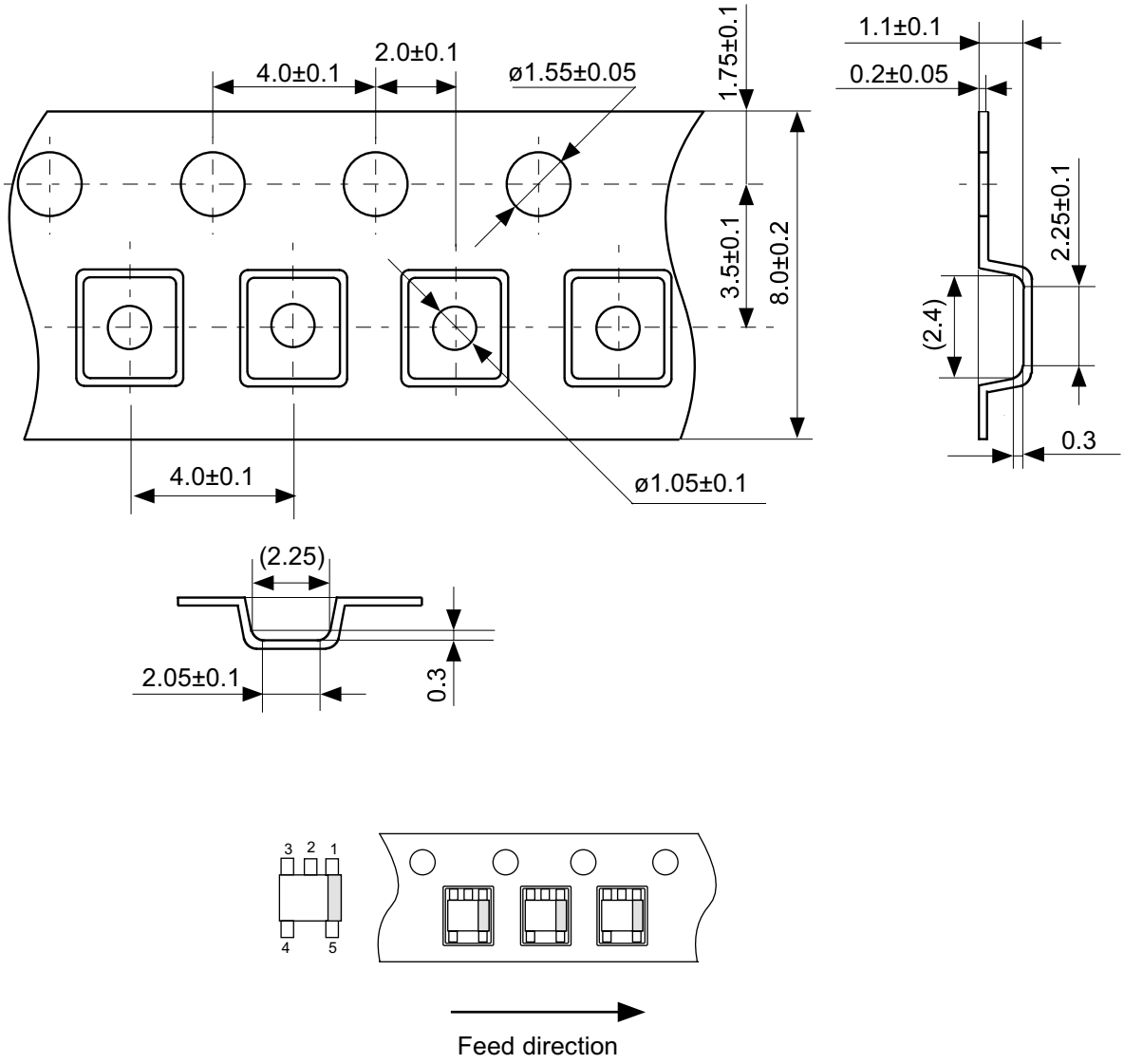






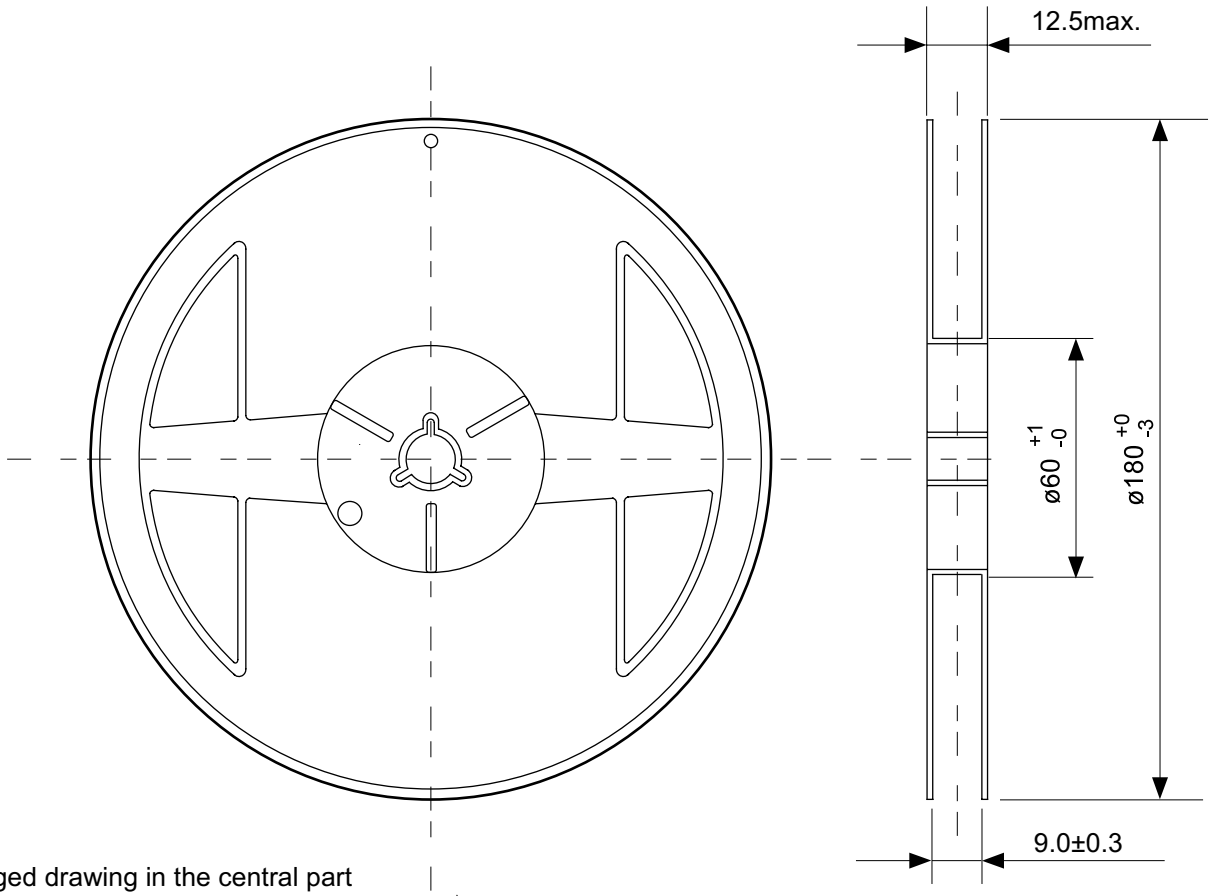
No. NP005-B-P-SD-1.1

TITLE	SC88A-B-PKG Dimensions
No.	NP005-B-P-SD-1.1
SCALE	
UNIT	mm
Seiko Instruments Inc.	

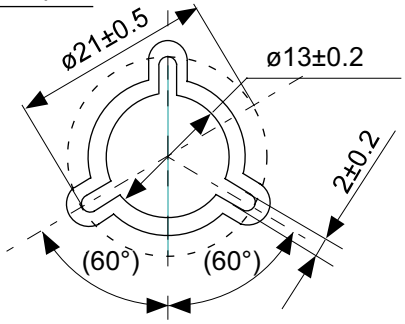


No. NP005-B-C-SD-2.0

TITLE	SC88A-B-Carrier Tape
No.	NP005-B-C-SD-2.0
SCALE	
UNIT	mm
Seiko Instruments Inc.	



Enlarged drawing in the central part



No. NP005-B-R-SD-2.1

TITLE	SC88A-B-Reel		
No.	NP005-B-R-SD-2.1		
SCALE		QTY.	3000
UNIT	mm		
Seiko Instruments Inc.			

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