

The mini-analog series is a group of ICs that incorporate a general purpose analog circuit in a small package.

The S-89210A/89220A is a CMOS type comparator that has a phase compensation circuit, and that can be driven at a lower voltage with lower current consumption than existing bipolar comparators. These features make this product the ideal solution for small battery-powered portable equipment. The S-89210A/89220A is a single comparator.



- Lower operating voltage than the conventional general-purpose comparators: $V_{DD} = 1.8$ to 5.5 V
- Low current consumption: $I_{DD} = 50$ μ A (S-89210A)
 $I_{DD} = 10$ μ A (S-89220A)
- Low input offset voltage: 4.0 mV (max.)
- Lead-free products



- Cellular phones
- PDAs
- Notebook PCs
- Digital cameras
- Digital video cameras

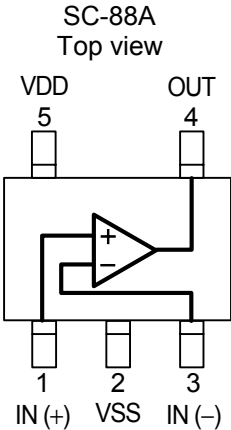


Package Name	Drawing Code		
	Package	Tape	Reel
SC-88A	NP005-B	NP005-B	NP005-B

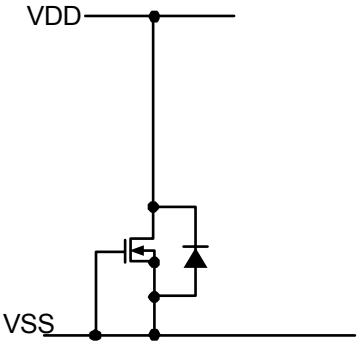
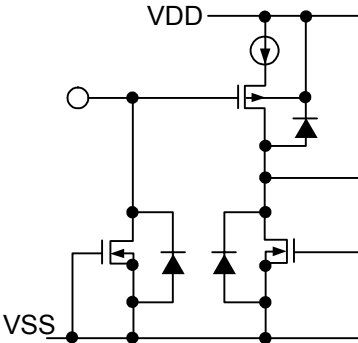
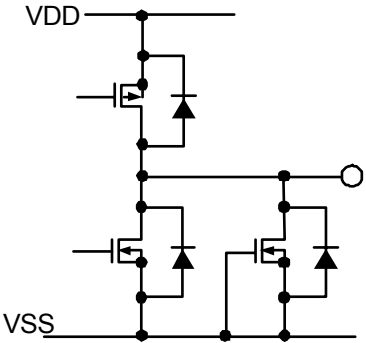


Current consumption	SC-88A
$I_{DD} = 50$ μ A	S-89210ACNC-1C0TFG
$I_{DD} = 10$ μ A	S-89220ACNC-1C1TFG

Delivery form : Taping only



Pin No.	Symbol	Description	Internal Equivalent Circuit
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	





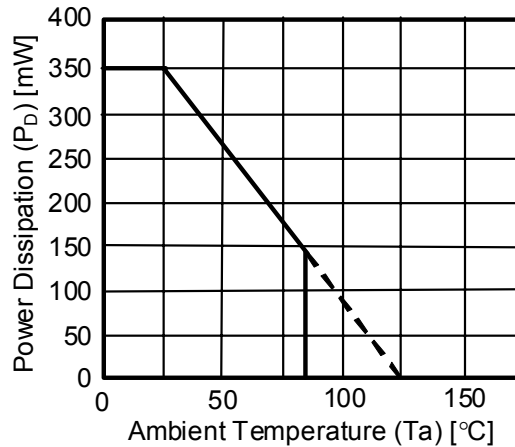
Parameter	Symbol	Ratings	Unit
Power supply voltage	V_{DD}	$V_{SS}-0.3$ to $V_{SS}+10.0$	V
Input voltage	V_{IN}	$V_{SS}-0.3$ to $V_{SS}+7.0$ (7.0 max.)	V
Output voltage	V_{OUT}	$V_{SS}-0.3$ to $V_{DD}+0.3$ (7.0 max.)	V
Differential input voltage	V_{IND}	± 7.0	V
Power dissipation	P_D	200 (When not mounted on board)	mW
		350	mW
Operating temperature range	T_{opr}	-40 to +85	°C
Storage temperature range	T_{stg}	-55 to +125	°C

When mounted on board

[Mounted board]

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

(2) Board name : JEDEC STANDARD51-7



Parameter	Symbol	Range	Unit
Operating power supply voltage range	V_{DD}	1.8 to 5.5	V

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DC Characteristics ($V_{DD} = 5.0 \text{ V}$)

(Ta = 25°C unless otherwise specified)

Parameter	Symbol	Measurement Conditions	Min.	Typ.	Max.	Unit	Measurement Circuit
Current consumption	I_{DD}	S-89210A	—	50	120	μA	
		S-89220A	—	10	30	μA	
Input offset voltage	V_{IO}	—	-4	± 3	+4	mV	
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	
Maximum output swing voltage	V_{OH} V_{OL}	$I_{OH} = 20 \mu\text{A}$ $I_{OL} = 20 \mu\text{A}$	4.7	—	— 0.01	V	
Common-mode input signal rejection ratio	CMRR	—	60	70	—	dB	
Power supply voltage rejection ratio	PSRR	—	60	70	—	dB	
Source current	I_{SOURCE}	S-89210A	$V_{OH} = 0 \text{ V}$	120	—	—	μA
		S-89220A		25	—	—	
Sink current	I_{SINK}	$V_{OL} = 0.5 \text{ V}$	9	—	—	mA	

AC Characteristics ($V_{DD} = 5.0 \text{ V}$)

(Ta = 25°C unless otherwise specified)

Parameter	Symbol	Measurement conditions	Min.	Typ.	Max.	Unit	
Rise propagation delay time	t_{PLH}	S-89210A	Overdrive = 100 mV $C_L = 15 \text{ pF}$ (Refer to)	—	45	—	μs
		S-89220A		—	230	—	
Fall propagation delay time	t_{PHL}	S-89210A		—	9	—	
		S-89220A		—	45	—	
Rise response time	t_{TLH}	S-89210A		—	3	—	
		S-89220A		—	15	—	
Fall response time	t_{THL}	S-89210A	—	3	—		
		S-89220A	—	15	—		

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DC Characteristics ($V_{DD} = 3.0\text{ V}$)

(Ta = 25°C unless otherwise specified)

Parameter	Symbol	Measurement Conditions	Min.	Typ.	Max.	Unit	Measurement Circuit
Current consumption	I_{DD}	S-89210A	—	50	120	μA	
		S-89220A	—	10	30	μA	
Input offset voltage	V_{IO}	—	-4	± 3	+4	mV	
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	
Maximum output swing voltage	V_{OH}	$I_{OH} = 20\ \mu\text{A}$	2.7	—	—	V	
	V_{OL}	$I_{OL} = 20\ \mu\text{A}$	—	—	0.01	V	
Common-mode input signal rejection ratio	CMRR	—	60	70	—	dB	
Power supply voltage rejection ratio	PSRR	—	60	70	—	dB	
Source current	I_{SOURCE}	S-89210A	$V_{OH} = 0\text{ V}$	120	—	—	μA
	I_{SOURCE}	S-89220A		25	—	—	
Sink current	I_{SINK}	$V_{OL} = 0.5\text{ V}$	8	—	—	mA	

AC Characteristics ($V_{DD} = 3.0\text{ V}$)

(Ta = 25°C unless otherwise specified)

Parameter	Symbol	Measurement conditions	Min.	Typ.	Max.	Unit	
Rise propagation delay time	t_{PLH}	S-89210A	Overdrive = 100 mV $C_L = 15\text{ pF}$ (Refer to)	—	30	—	μs
		S-89220A		—	150	—	
Fall propagation delay time	t_{PHL}	S-89210A		—	6	—	
		S-89220A		—	30	—	
Rise response time	t_{TLH}	S-89210A		—	2	—	
		S-89220A		—	10	—	
Fall response time	t_{THL}	S-89210A		—	2	—	
		S-89220A		—	10	—	

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DC Characteristics ($V_{DD} = 1.8\text{ V}$)

(Ta = 25°C unless otherwise specified)

Parameter	Symbol	Measurement Conditions	Min.	Typ.	Max.	Unit	Measurement Circuit
Current consumption	I_{DD}	S-89210A	—	50	120	μA	
		S-89220A	—	10	30	μA	
Input offset voltage	V_{IO}	—	-4	± 3	+4	mV	
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	
Maximum output swing voltage	V_{OH}	$I_{OH} = 20\ \mu\text{A}$	1.5	—	—	V	
	V_{OL}	$I_{OL} = 20\ \mu\text{A}$	—	—	0.01	V	
Common-mode input signal rejection ratio	CMRR	—	60	70	—	dB	
Power supply voltage rejection ratio	PSRR	—	60	70	—	dB	
Source current	I_{SOURCE}	S-89210A	$V_{OH} = 0\text{ V}$	100	—	—	μA
	I_{SOURCE}	S-89220A		20	—	—	
Sink current	I_{SINK}	$V_{OL} = 0.5\text{ V}$	5	—	—	mA	

AC Characteristics ($V_{DD} = 1.8\text{ V}$)

(Ta = 25°C unless otherwise specified)

Parameter	Symbol	Measurement conditions	Min.	Typ.	Max.	Unit	
Rise propagation delay time	t_{PLH}	S-89210A	Overdrive = 100 mV $C_L = 15\text{ pF}$ (Refer to)	—	20	—	μs
		S-89220A		—	100	—	
Fall propagation delay time	t_{PHL}	S-89210A		—	5	—	
		S-89220A		—	25	—	
Rise response time	t_{TLH}	S-89210A		—	1.2	—	
		S-89220A		—	6	—	
Fall response time	t_{THL}	S-89210A		—	1.2	—	
		S-89220A		—	6	—	

■ Measurement Circuit

1. Power supply voltage rejection ratio, input offset voltage

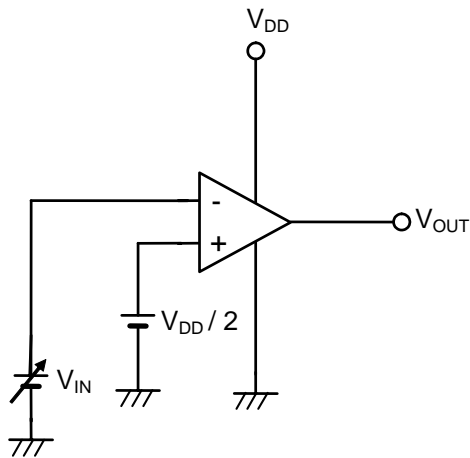


Figure 6

- **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 $V_{DD} = 1.8\text{ V}$: $V_{DD} = V_{DD1}$, $V_{IO} = V_{IO1}$

When $V_{DD} = 5.0\text{ V}$: $V_{DD} = V_{DD2}$, $V_{IO} = V_{IO2}$

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

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

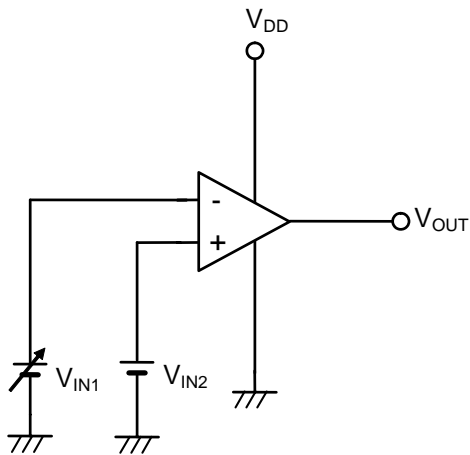


Figure 7

- **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} minus V_{IN2} after V_{OUT} is changed by changing V_{IN1} .

Measurement conditions:

When $V_{IN2} = V_{CMR} (\text{max.})$: $V_{IN2} = V_{INH}$, $V_{IO} = V_{IO1}$

When $V_{IN2} = V_{DD}/2$: $V_{IN2} = V_{INL}$, $V_{IO} = V_{IO2}$

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

- **Common-mode input voltage range (V_{CMR})**

The common-mode input voltage range is the range of V_{IN2} in which V_{OUT} satisfies the common-mode input signal rejection ratio specifications.

3. Maximum output swing voltage

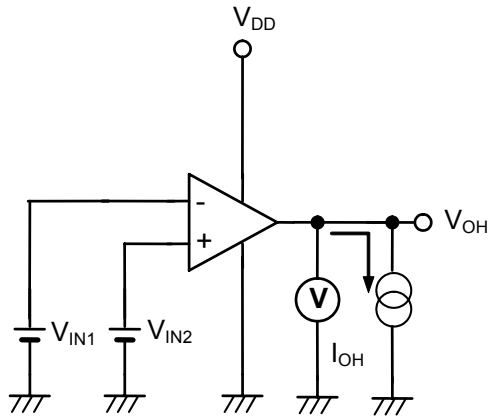


Figure 8

• Maximum output swing voltage (V_{OH})

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

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

$$I_{OH} = 20 \mu A$$

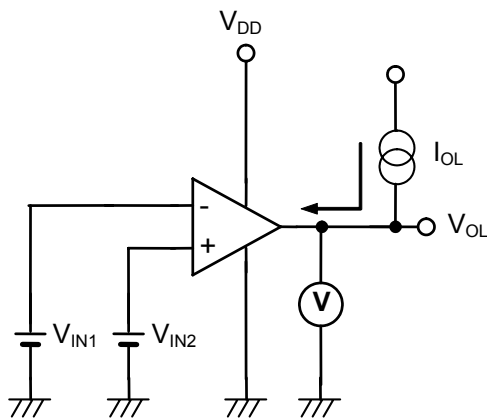


Figure 9

• Maximum output swing voltage (V_{OL})

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

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

$$I_{OL} = 20 \mu A$$

4. Current consumption

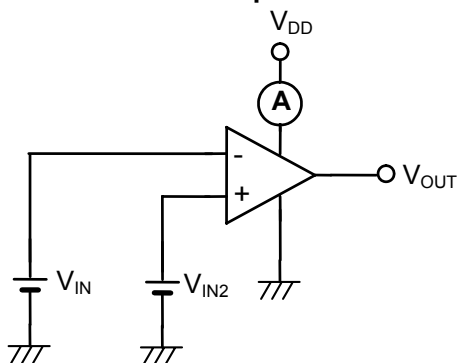


Figure 10

• Current consumption (I_{DD})

Measurement conditions: $V_{IN1} = V_{SS}$
 $V_{IN2} = V_{DD}$

5. Source current

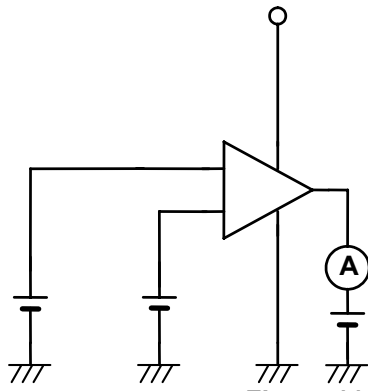


Figure 11

• Source current (I_{SOURCE})

= --- -

= --- +

6. Sink current

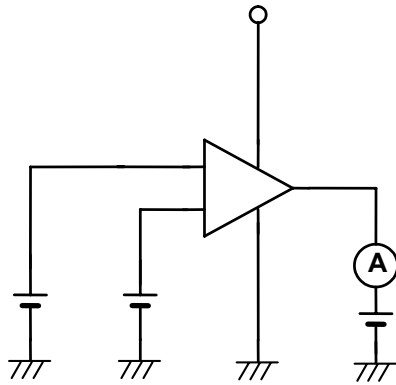


Figure 12

• Sink current (I_{SINK})

= --- +

= --- -

7. Propagation delay time / response time

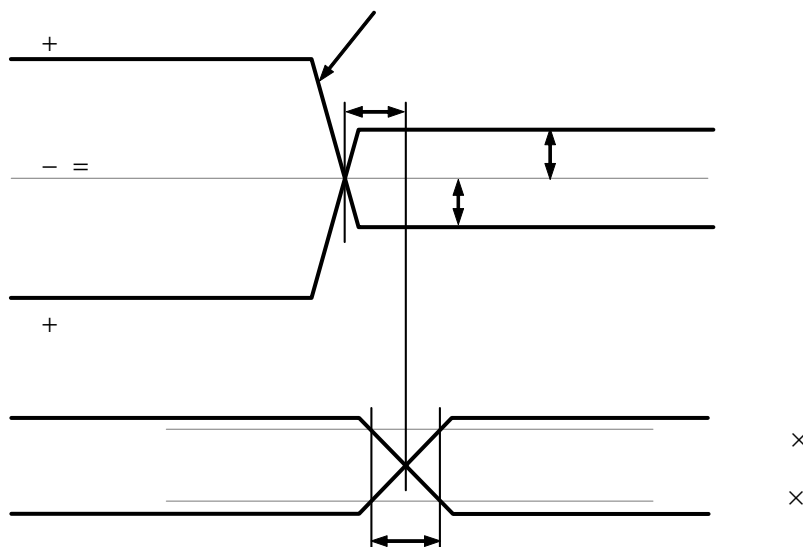
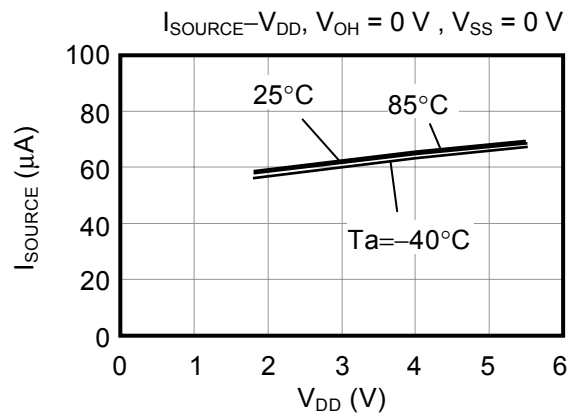
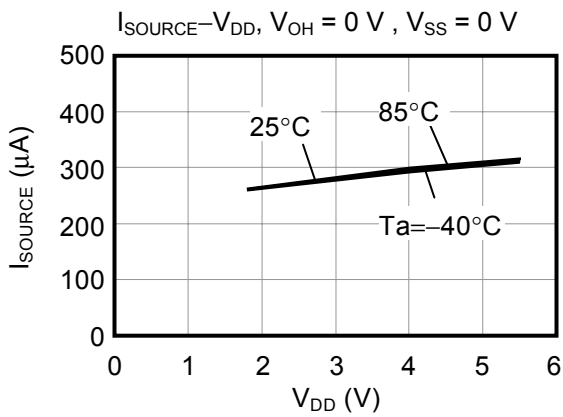
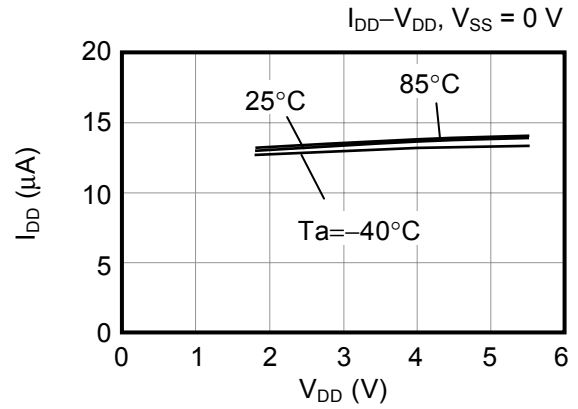
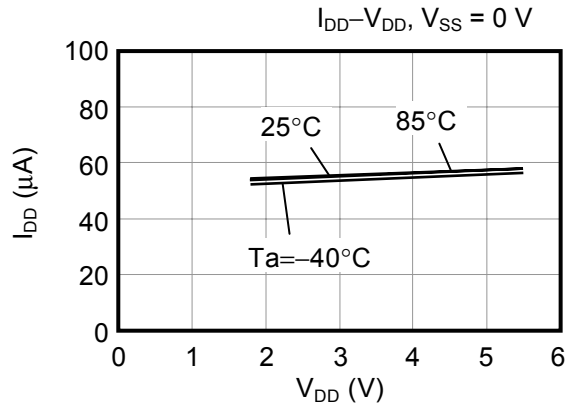
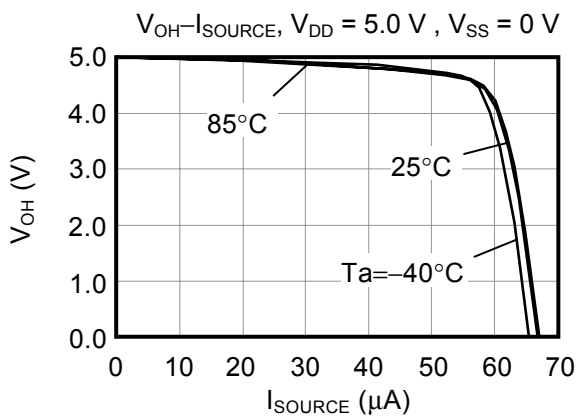
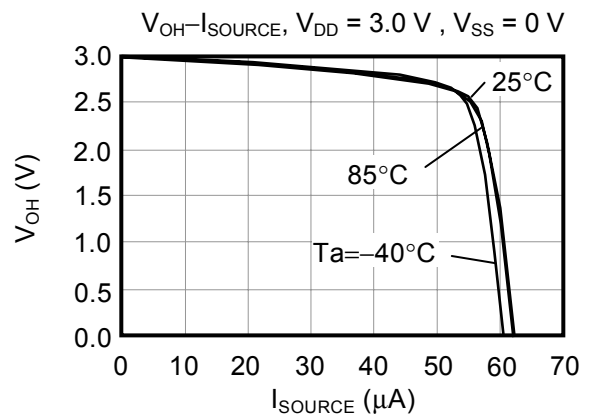
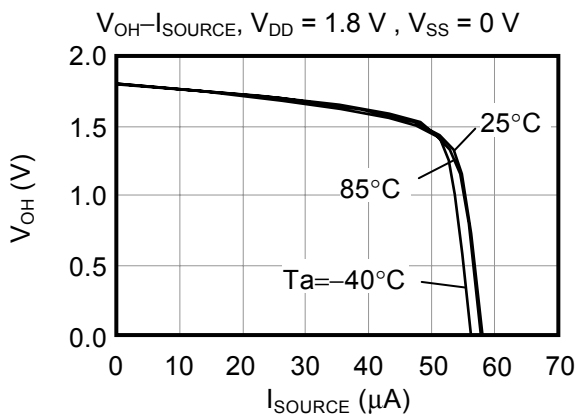
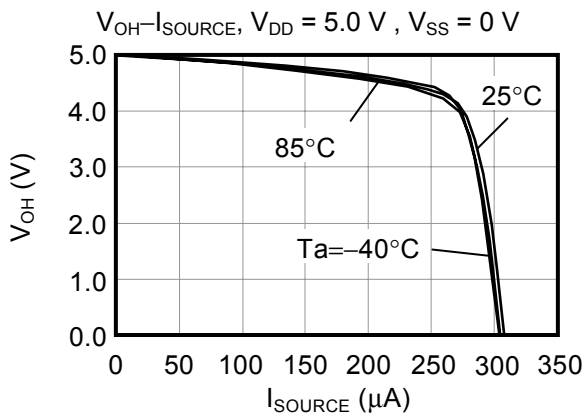
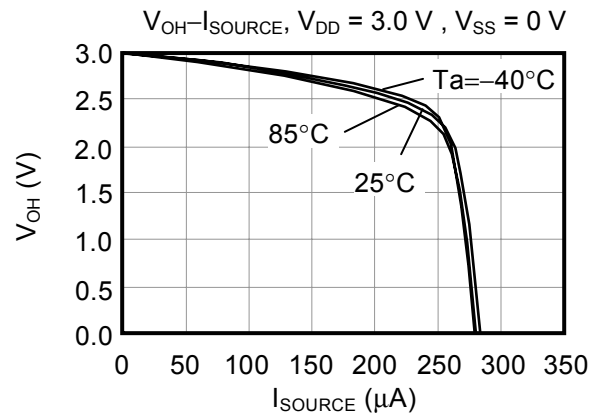
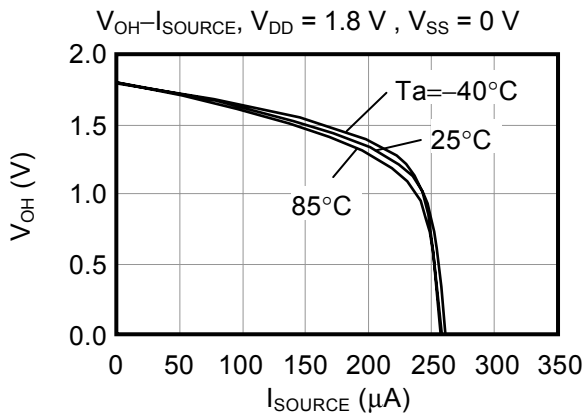


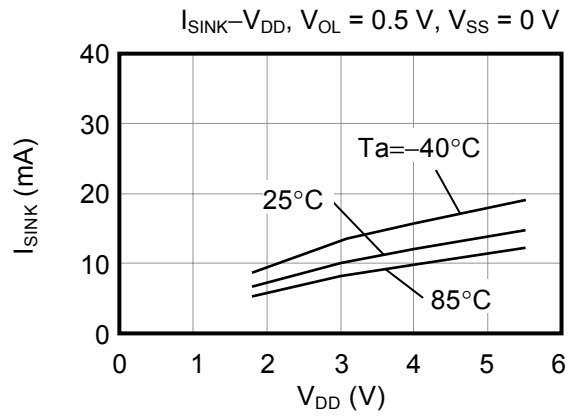
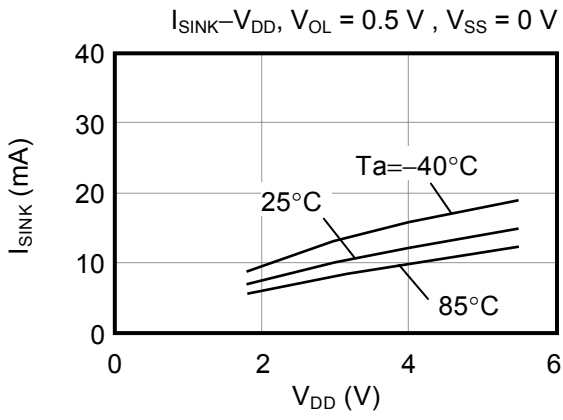
Figure 13

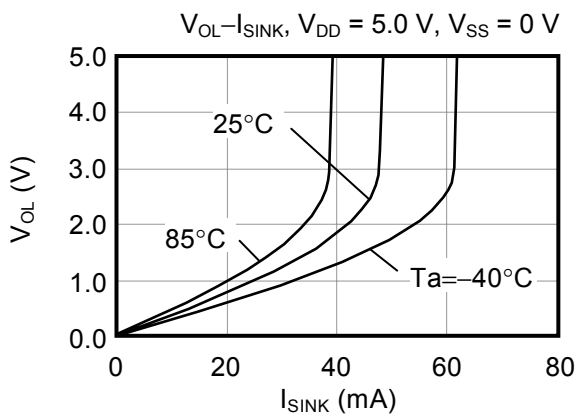
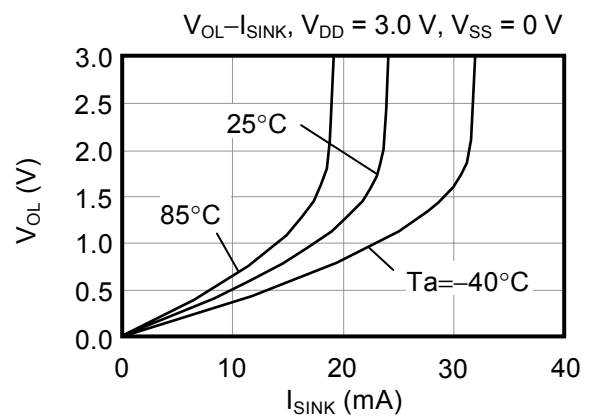
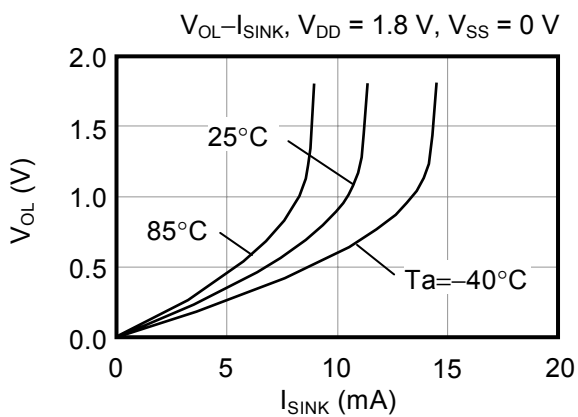
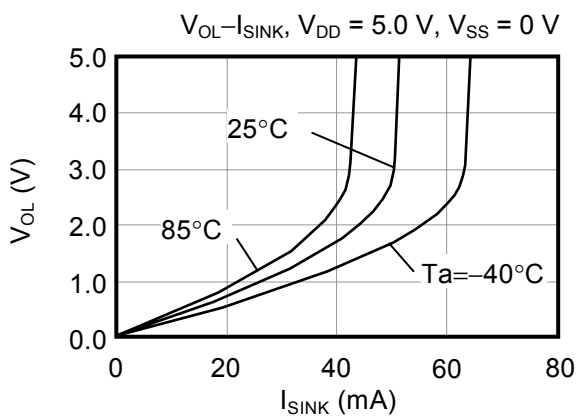
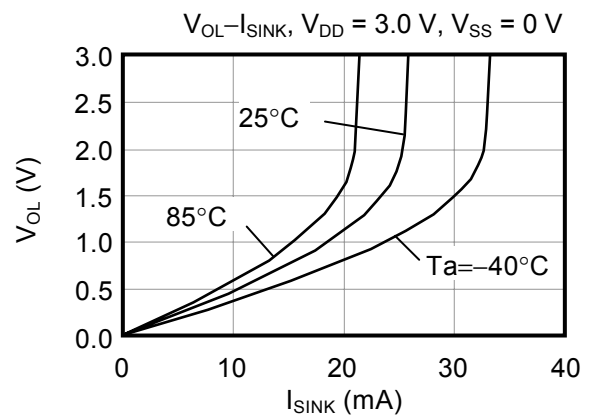
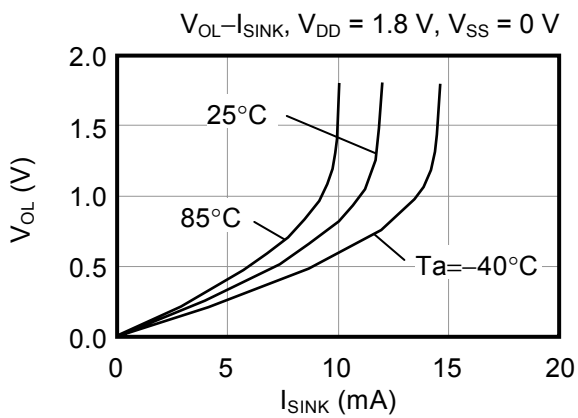


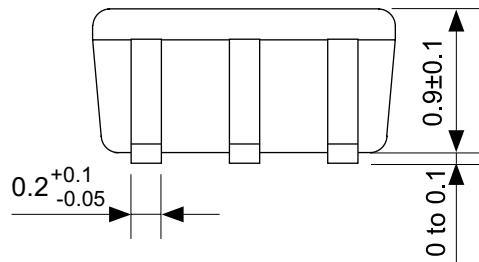
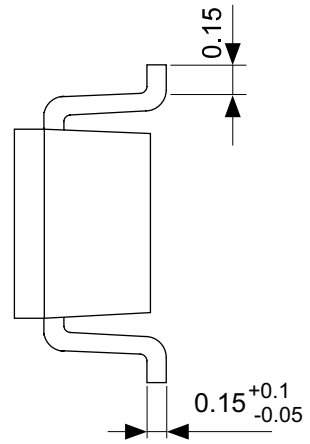
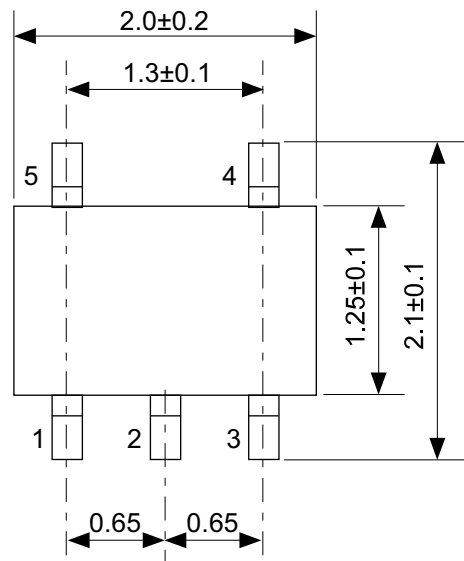
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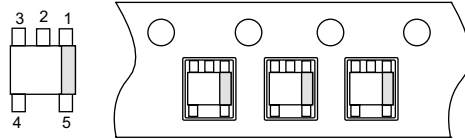
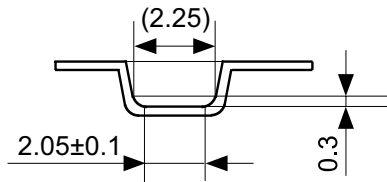
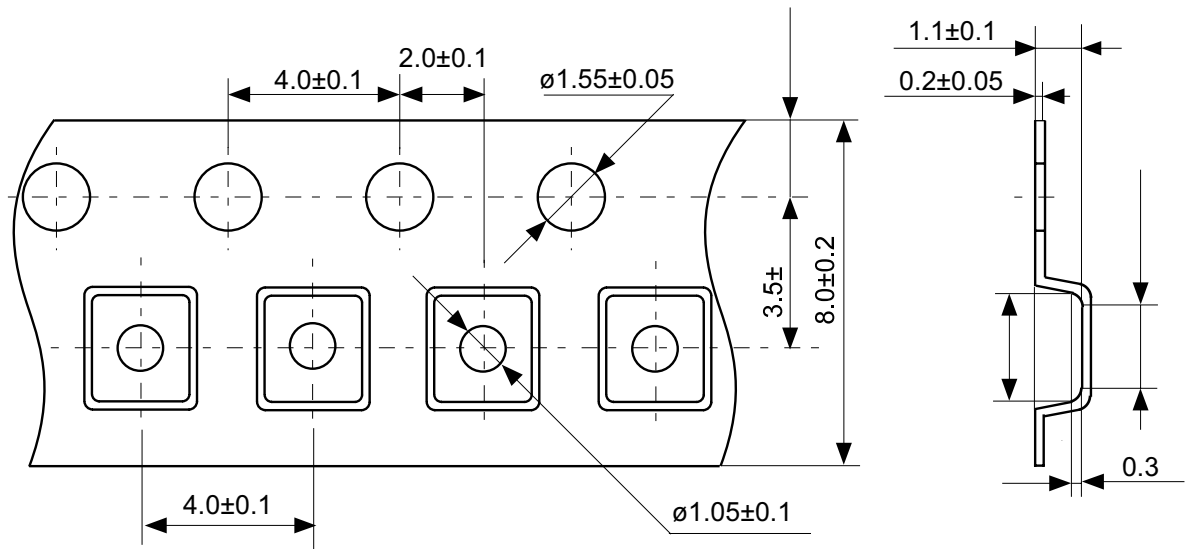






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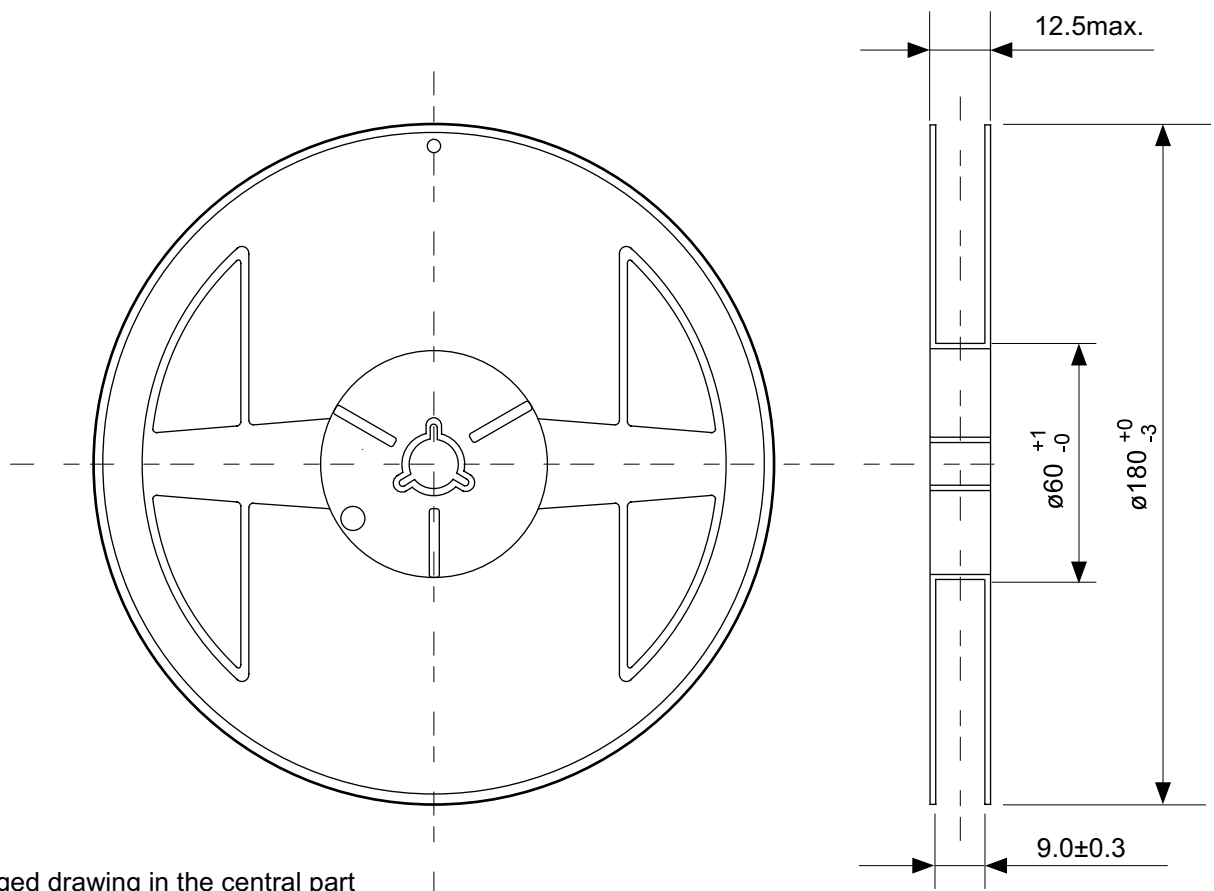
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Seiko Instruments Inc.	



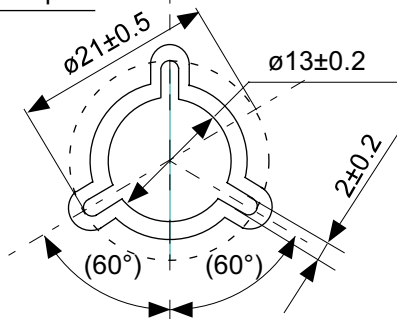
Feed direction

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		TY.	3000
UNIT	mm		
Seiko Instruments Inc.			

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