

MINI ANALOG SERIES
CMOS SINGLE COMPARATOR
S-892xxA Series

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

The S-892xxA Series is a CMOS type single comparator 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.

■ Features

- CMOS single comparator
- Low operating voltage: $V_{DD} = 1.8$ to 5.5 V
- Low current consumption: $I_{DD} = 50$ μ A (S-89210ACNC)
 $I_{DD} = 10$ μ A (S-89220ACNC)
- Low input offset voltage (4.0 mV max.)
- Small package (SC-88A: 2.0 mm $\times$ 2.1 mm)

■ Application

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

■ Package

SC-88A (PKG drawing code: NP005-B)

■ Selection Guide
Table 1

Current consumption	Product Name
$I_{DD} = 50$ μ A	S-89210ACNC-1C0-TF
$I_{DD} = 10$ μ A	S-89220ACNC-1C1-TF

■ Absolute Maximum Ratings
Table 2

Parameter	Symbol	Ratings	Unit
Power supply voltage	$V_{DD} - V_{SS}$	10.0	V
Input voltage	V_{IN}	V_{SS} to V_{DD} (7.0 max.)	V
Output voltage	V_{OUT}	V_{SS} to V_{DD} (7.0 max.)	V
Differential input voltage	V_{IND}	± 7.0	V
Power dissipation	P_D	200	mW
Operating temperature range	T_{opr}	-40 to +85	$^{\circ}$ C
Storage temperature range	T_{stg}	-55 to +125	$^{\circ}$ 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.

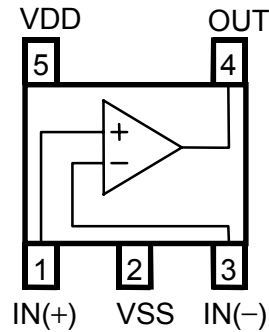
■ Recommended Operating Power Supply Voltage Range

Table 3

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

■ Pin Configuration

5-Pin SC-88A Top View



(S-89210ACNC, S-89220ACNC)

Table 4

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

Figure 1

[Internal equivalent circuits]

<1> Output pin

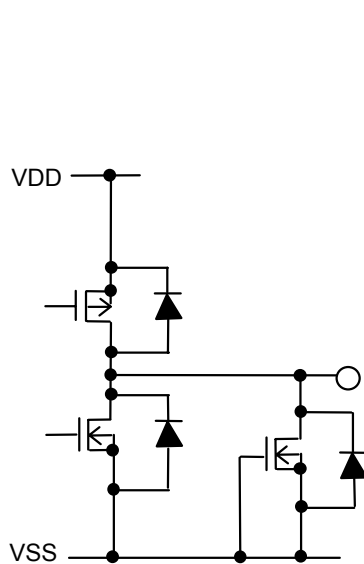


Figure 2

<2> Input pin

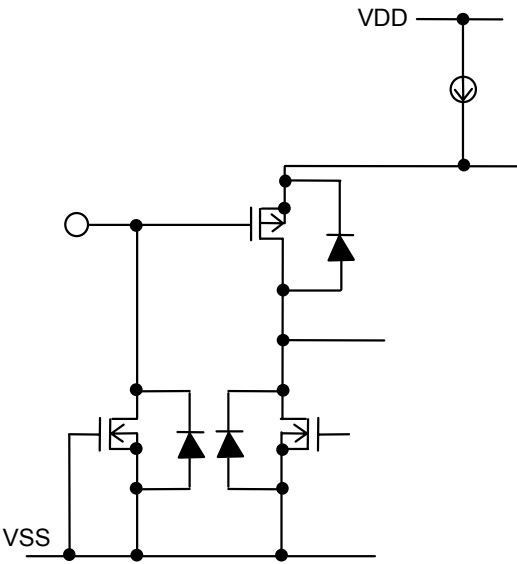


Figure 3

<3> VDD pin

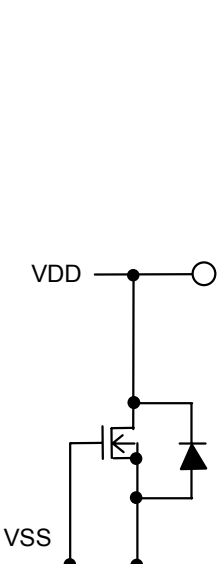


Figure 4

■ Electrical Characteristics

1. $V_{DD} = 5.0 \text{ V}$

DC Characteristics ($V_{DD} = 5.0 \text{ V}$)**Table 5**

(Ta = 25°C unless otherwise specified)

Parameter	Model No.	Symbol	Measurement conditions	Min.	Typ.	Max.	Unit	Measurement circuit
Input offset voltage	—	V_{IO}	—	—	± 3	± 4	mV	Figure 5
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}	$I_{OH} = 20 \mu\text{A}$	4.7	—	—	V	Figure 7
	—	V_{OL}	$I_{OL} = 20 \mu\text{A}$	—	—	0.01	V	Figure 8
Common-mode input signal rejection ratio	—	CMRR	—	60	70	—	dB	Figure 6
Power supply voltage rejection ratio	—	PSRR	—	60	70	—	dB	Figure 5
Supply current	S-89210A	I_{DD}	—	—	50	120	μA	Figure 9
	S-89220A	I_{DD}	—	—	10	30	μA	Figure 9
Source current	S-89210A	I_{SOURCE}	$V_{OH} = 0 \text{ V}$	120	—	—	μA	Figure 10
	S-89220A	I_{SOURCE}	$V_{OH} = 0 \text{ V}$	25	—	—	μA	Figure 10
Sink current	—	I_{SINK}	$V_{OL} = 0.5 \text{ V}$	9	—	—	mA	Figure 11

AC Characteristics ($V_{DD} = 5.0 \text{ V}$)**Table 6**

(Ta = 25°C unless otherwise specified)

Parameter	Model No.	Symbol	Measurement conditions	Min.	Typ.	Max.	Unit
Rise propagation delay time	S-89210A	t_{PLH}	Overdrive = 100 mV $C_L = 15 \text{ pF}$ (Refer to Figure 12.)	—	45	—	μs
	S-89220A	t_{PLH}		—	230	—	μs
Fall propagation delay time	S-89210A	t_{PHL}		—	9	—	μs
	S-89220A	t_{PHL}		—	45	—	μs
Rise response time	S-89210A	t_{TLH}		—	3	—	μs
	S-89220A	t_{TLH}		—	15	—	μs
Fall response time	S-89210A	t_{THL}		—	3	—	μs
	S-89220A	t_{THL}		—	15	—	μs

2. $V_{DD} = 3.0\text{ V}$

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

Table 7

($T_a = 25^\circ\text{C}$ unless otherwise specified)

Parameter	Model No.	Symbol	Measurement conditions	Min.	Typ.	Max.	Unit	Measurement circuit
Input offset voltage	—	V_{IO}	—	—	± 3	± 4	mV	Figure 5
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}	$I_{OH} = 20\text{ }\mu\text{A}$	2.7	—	—	V	Figure 7
	—	V_{OL}	$I_{OL} = 20\text{ }\mu\text{A}$	—	—	0.01	V	Figure 8
Common-mode input signal rejection ratio	—	CMRR	—	60	70	—	dB	Figure 6
Power supply voltage rejection ratio	—	PSRR	—	60	70	—	dB	Figure 5
Supply current	S-89210A	I_{DD}	—	—	50	120	μA	Figure 9
	S-89220A	I_{DD}	—	—	10	30	μA	Figure 9
Source current	S-89210A	I_{SOURCE}	$V_{OH} = 0\text{ V}$	120	—	—	μA	Figure 10
	S-89220A	I_{SOURCE}	$V_{OH} = 0\text{ V}$	25	—	—	μA	Figure 10
Sink current	—	I_{SINK}	$V_{OL} = 0.5\text{ V}$	8	—	—	mA	Figure 11

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

Table 8

($T_a = 25^\circ\text{C}$ unless otherwise specified)

Parameter	Model No.	Symbol	Measurement conditions	Min.	Typ.	Max.	Unit
Rise propagation delay time	S-89210A	t_{PLH}	Overdrive = 100 mV $C_L = 15\text{ pF}$ (Refer to Figure 12.)	—	30	—	μs
	S-89220A	t_{PLH}		—	150	—	μs
Fall propagation delay time	S-89210A	t_{PHL}		—	6	—	μs
	S-89220A	t_{PHL}		—	30	—	μs
Rise response time	S-89210A	t_{TLH}		—	2	—	μs
	S-89220A	t_{TLH}		—	10	—	μs
Fall response time	S-89210A	t_{THL}		—	2	—	μs
	S-89220A	t_{THL}		—	10	—	μs

3. $V_{DD} = 1.8\text{ V}$ DC Characteristics ($V_{DD} = 1.8\text{ V}$)**Table 9**

(Ta = 25°C unless otherwise specified)

Parameter	Model No.	Symbol	Measurement conditions	Min.	Typ.	Max.	Unit	Measurement circuit
Input offset voltage	—	V_{IO}	—	—	± 3	± 4	mV	Figure 5
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}	$I_{OH} = 20\text{ }\mu\text{A}$	1.5	—	—	V	Figure 7
	—	V_{OL}	$I_{OL} = 20\text{ }\mu\text{A}$	—	—	0.01	V	Figure 8
Common-mode input signal rejection ratio	—	CMRR	—	60	70	—	dB	Figure 6
Power supply voltage rejection ratio	—	PSRR	—	60	70	—	dB	Figure 5
Supply current	S-89210A	I_{DD}	—	—	50	120	μA	Figure 9
	S-89220A	I_{DD}	—	—	10	30	μA	Figure 9
Source current	S-89210A	I_{SOURCE}	$V_{OH} = 0\text{ V}$	100	—	—	μA	Figure 10
	S-89220A	I_{SOURCE}	$V_{OH} = 0\text{ V}$	20	—	—	μA	Figure 10
Sink current	—	I_{SINK}	$V_{OL} = 0.5\text{ V}$	5	—	—	mA	Figure 11

AC Characteristics ($V_{DD} = 1.8\text{ V}$)**Table 10**

(Ta = 25°C unless otherwise specified)

Parameter	Model No.	Symbol	Measurement conditions	Min.	Typ.	Max.	Unit
Rise propagation delay time	S-89210A	t_{PLH}	Overdrive = 100 mV $C_L = 15\text{ pF}$ (Refer to Figure 12.)	—	20	—	μs
	S-89220A	t_{PLH}		—	100	—	μs
Fall propagation delay time	S-89210A	t_{PHL}		—	5	—	μs
	S-89220A	t_{PHL}		—	25	—	μs
Rise response time	S-89210A	t_{TLH}		—	1.2	—	μs
	S-89220A	t_{TLH}		—	6	—	μs
Fall response time	S-89210A	t_{THL}		—	1.2	—	μs
	S-89220A	t_{THL}		—	6	—	μs

■ Measurement Circuits

1. Power supply voltage rejection ratio, input offset voltage

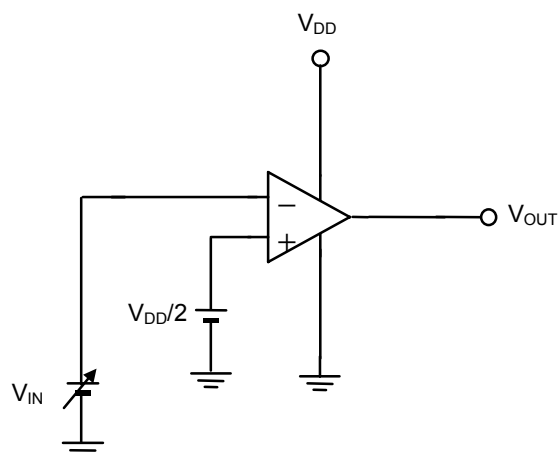


Figure 5

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

The input offset voltage (V_{IO}) is defined as V_{IN} 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 $V_{DD} = 5.0\text{ V}$: $V_{DD} = V_{DD2}$, $V_{IO} = V_{IO2}$

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

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

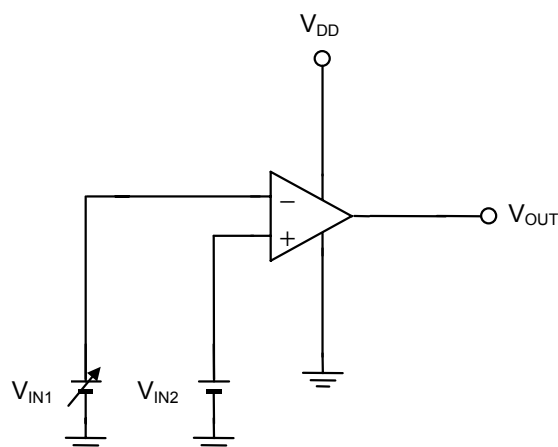


Figure 6

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

Measurement conditions:

$V_{DD} = 3.0\text{ V}$

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

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

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

- 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.

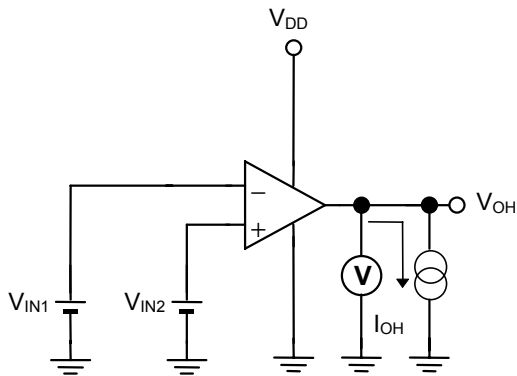
3. Maximum output swing voltage (V_{OH})

Figure 7

- Maximum output swing voltage (V_{OH})

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

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

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

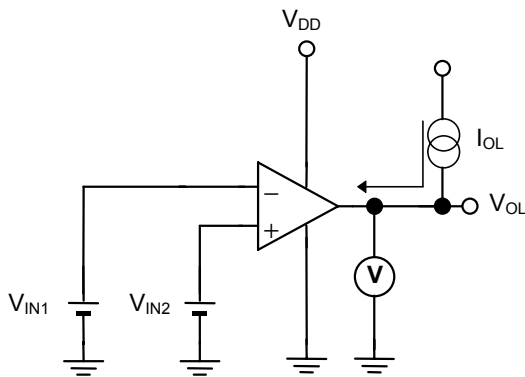
4. Maximum output swing voltage (V_{OL})

Figure 8

- Maximum output swing voltage (V_{OL})

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

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

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

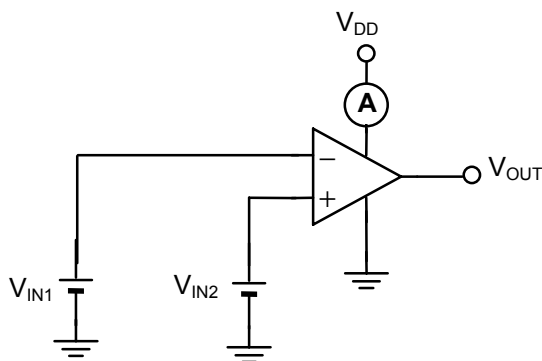
5. Supply current (I_{DD})

Figure 9

- Supply current (I_{DD})

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

$$V_{IN2} = V_{DD}$$

6. Source current (I_{SOURCE})

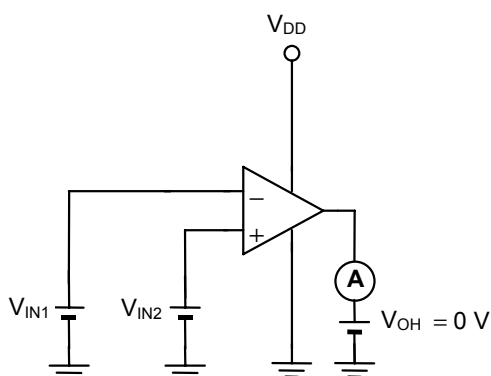


Figure 10

- Source current (I_{SOURCE})

Measurement conditions: $V_{\text{IN}1} = \frac{V_{\text{DD}}}{2} - 0.5 \text{ V}$

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

7. Sink current (I_{SINK})

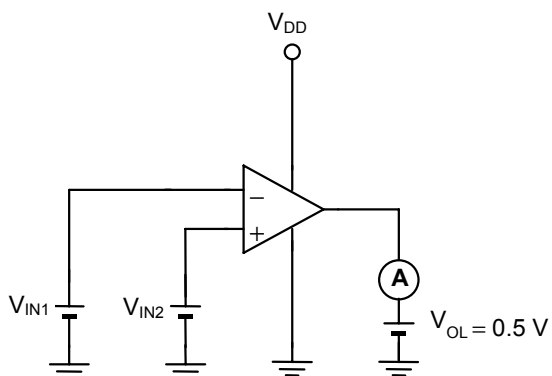


Figure 11

- Sink current (I_{SINK})

Measurement conditions: $V_{\text{IN}1} = \frac{V_{\text{DD}}}{2} + 0.5 \text{ V}$

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

8. Propagation delay time/transient response time

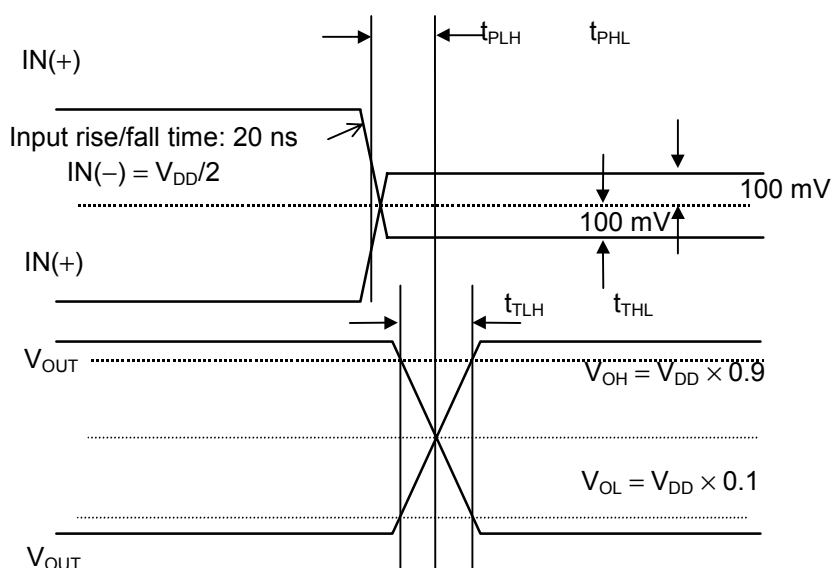


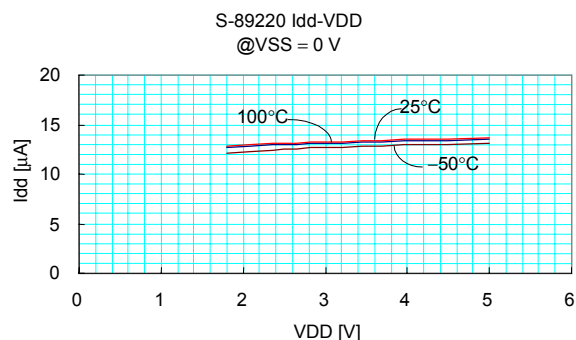
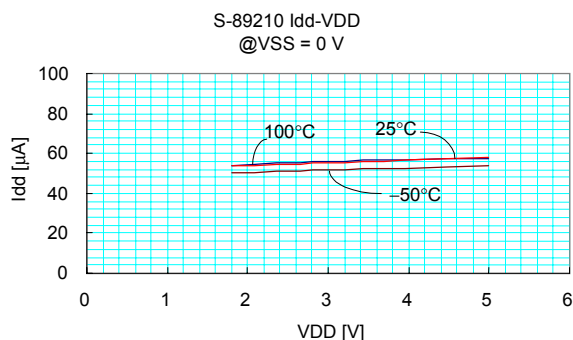
Figure 12

■ Precaution

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

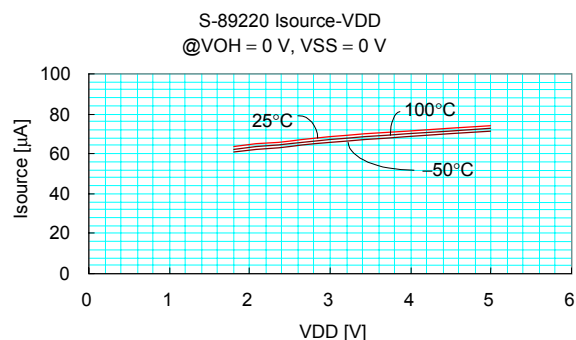
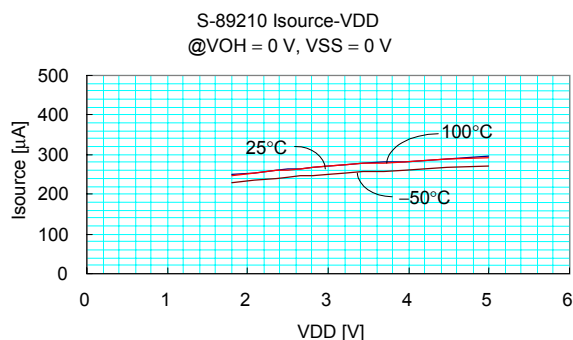
■ Comparator Characteristics (All Data Indicates Typical Values for One Circuit)

1. Current consumption vs. Power supply voltage

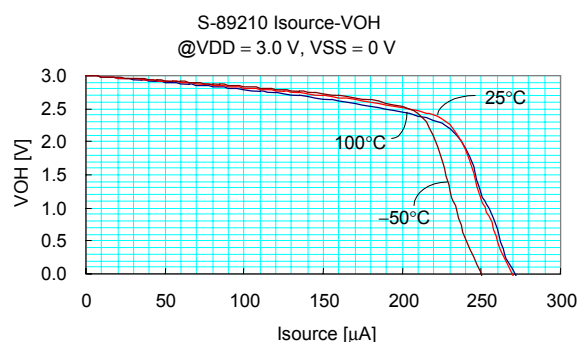
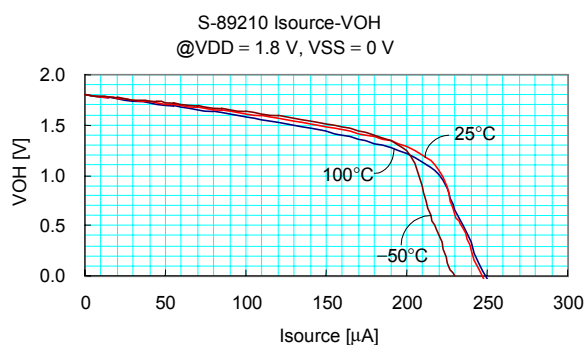


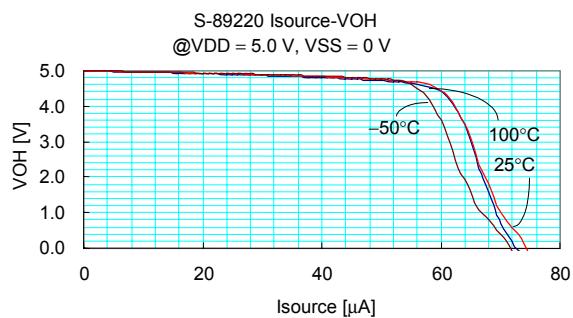
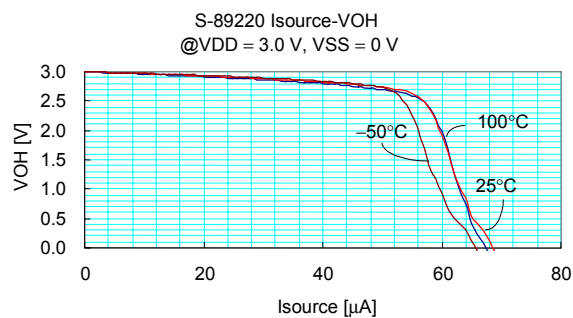
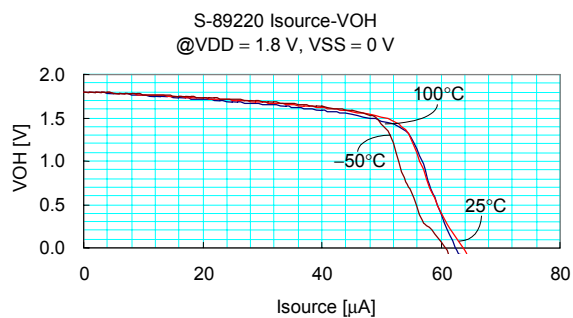
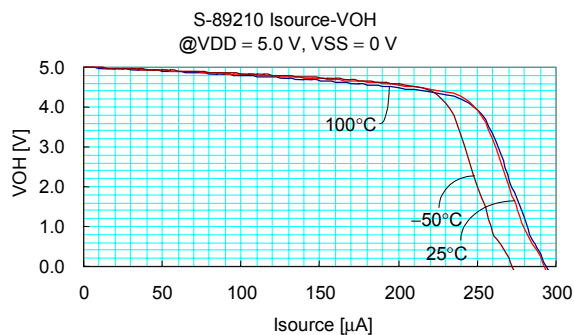
2. Output current

2-1. I_{SOURCE} vs. Power supply voltage

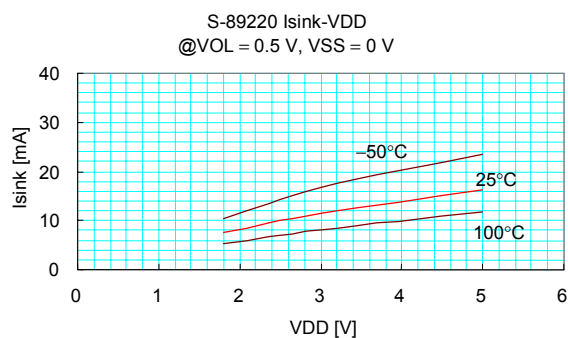
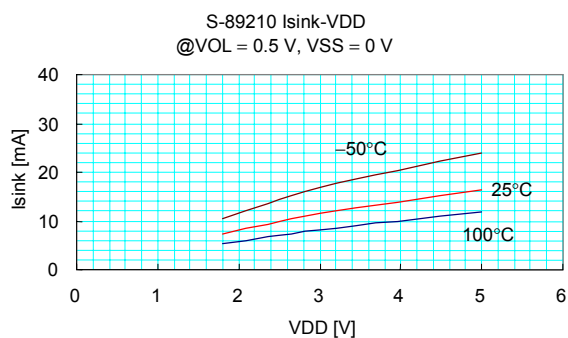


2-2. Output voltage (V_{OH}) vs. I_{SOURCE}

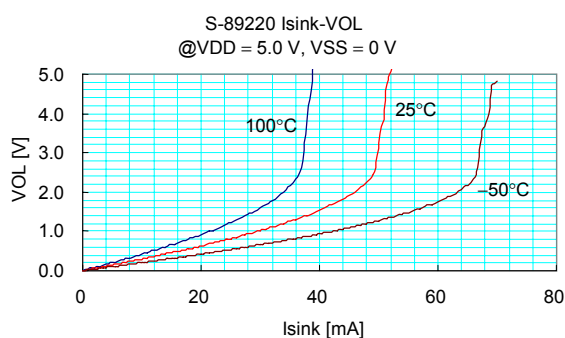
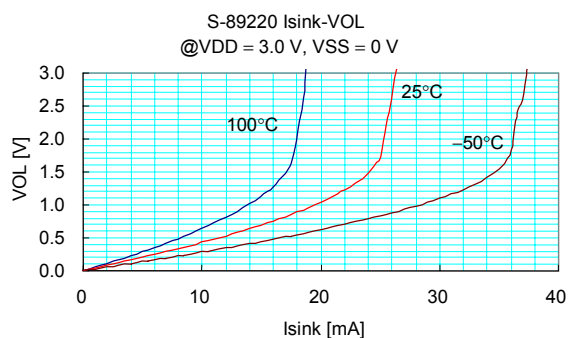
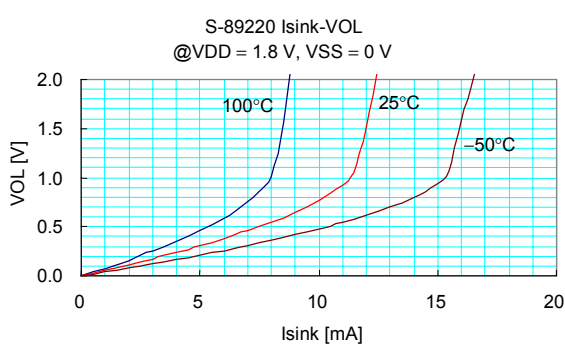
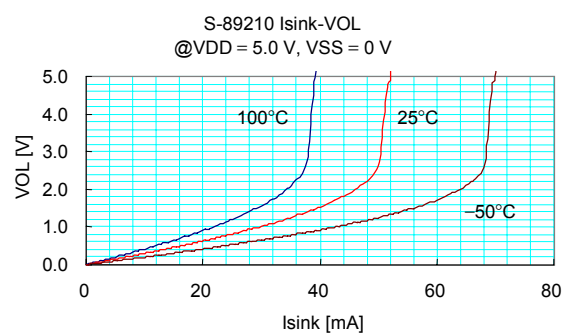
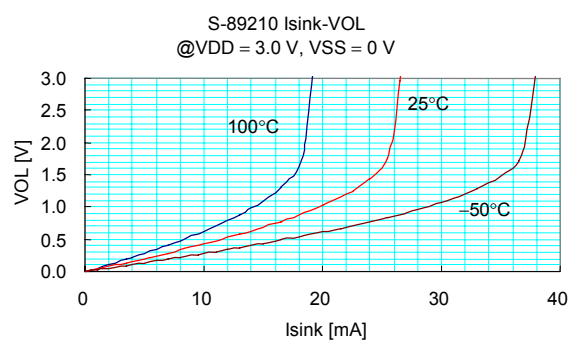
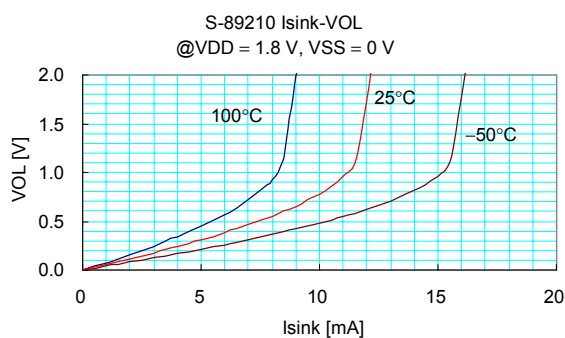




2-3. I_{SINK} vs. Power supply voltage



2-4. I_{SINK} vs. Output voltage (V_{OL})

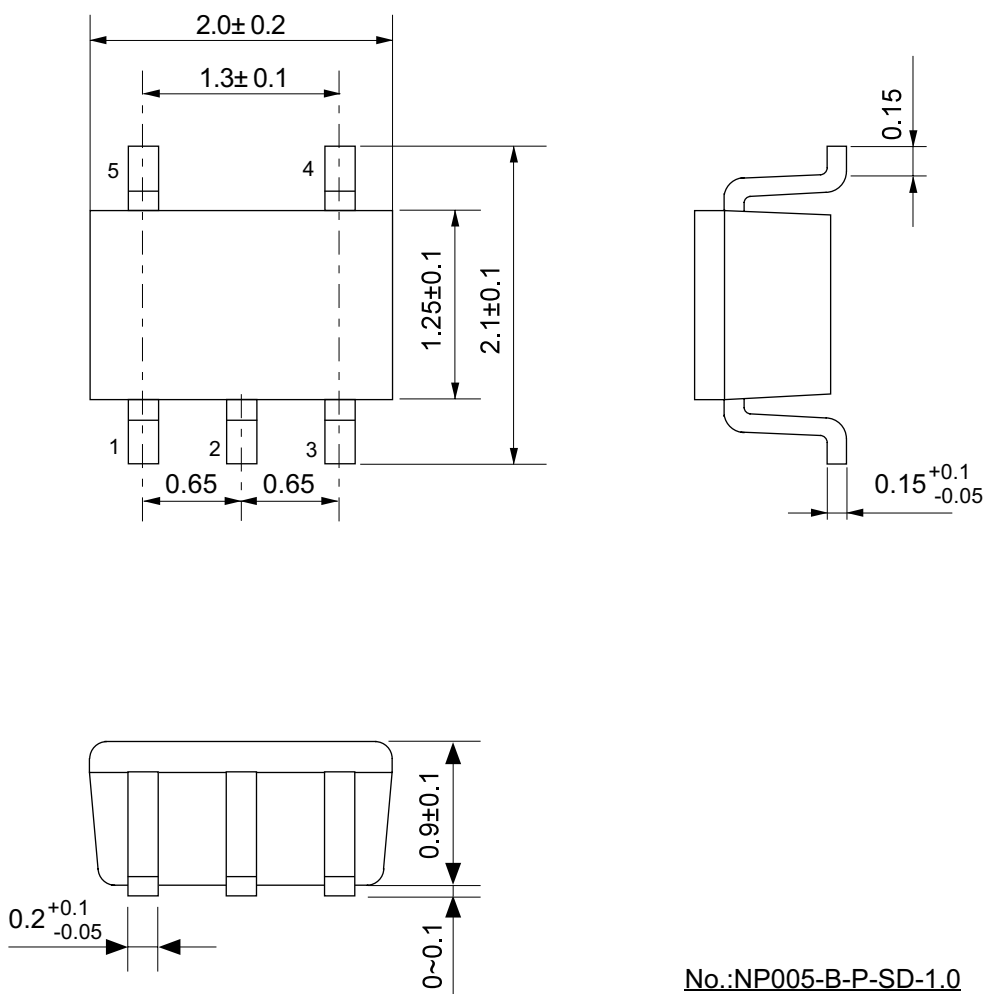


■ SC-88A

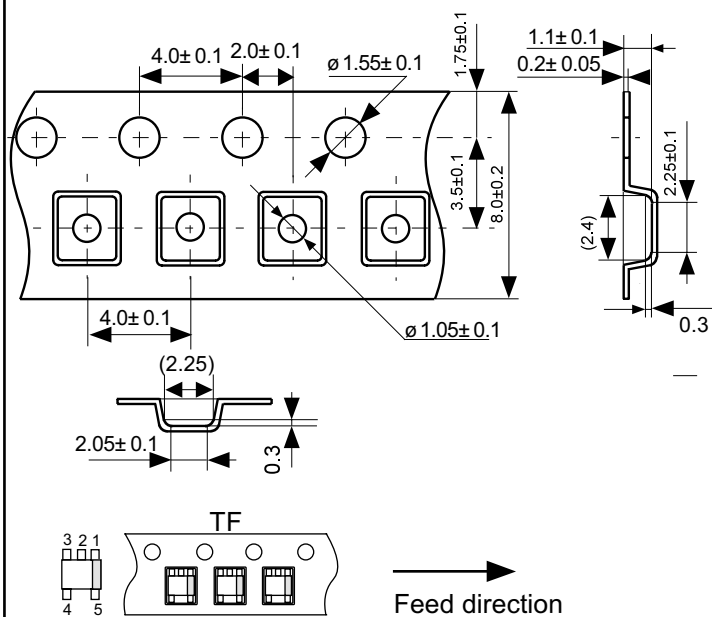
NP005-B Rev.1.1 020517

● Dimensions

Unit: mm

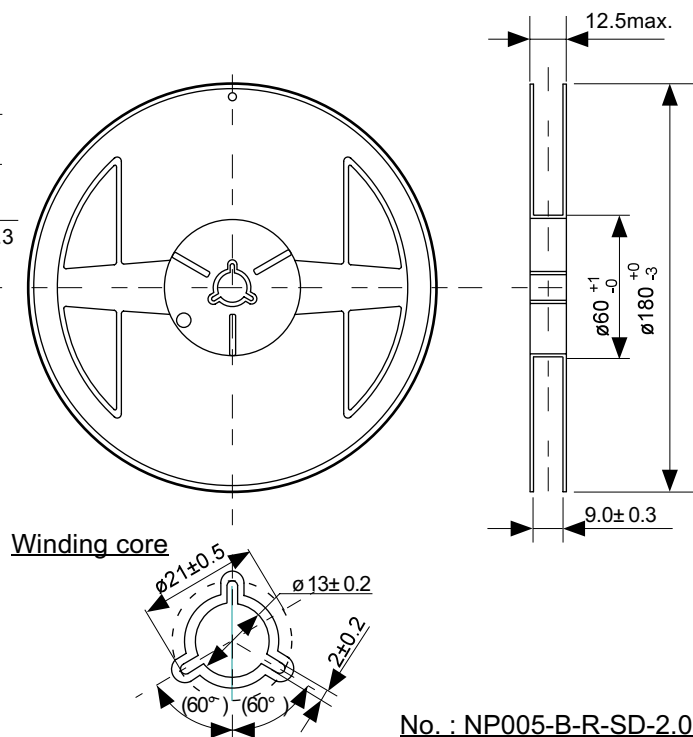


●Taping Specifications



●Reel Specifications

3000 pcs/reel



No. : NP005-B-C-SD-1.0

No. : NP005-B-R-SD-2.0

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