

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:
 $V_{DD} = 1.8\text{ V to }5.5\text{ V}$
- Low current consumption:
 $I_{DD} = 50\ \mu\text{A Typ. (S-89210 Series)}$
 $I_{DD} = 10\ \mu\text{A Typ. (S-89220 Series)}$
- 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

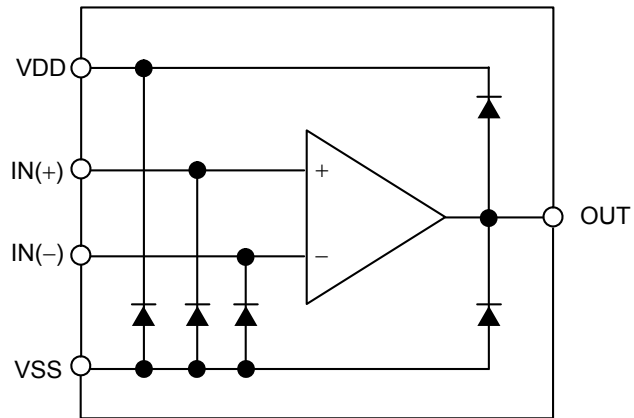
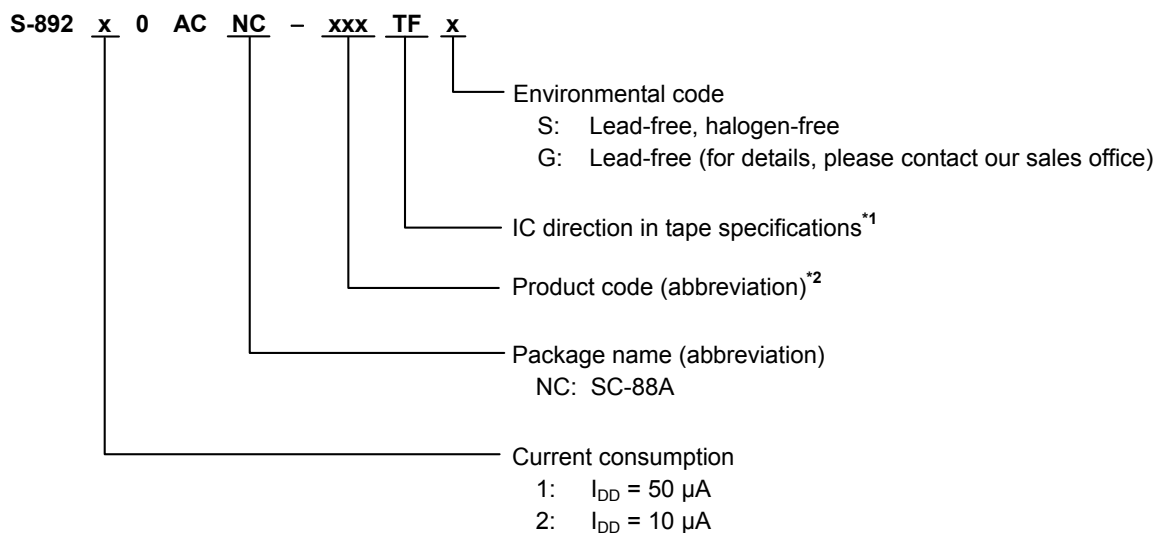


Figure 1

■ 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

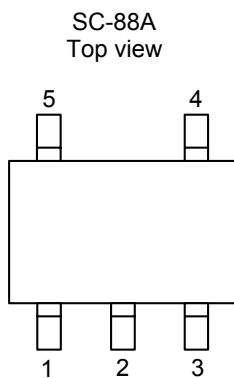


Figure 2

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 × 1.6 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.

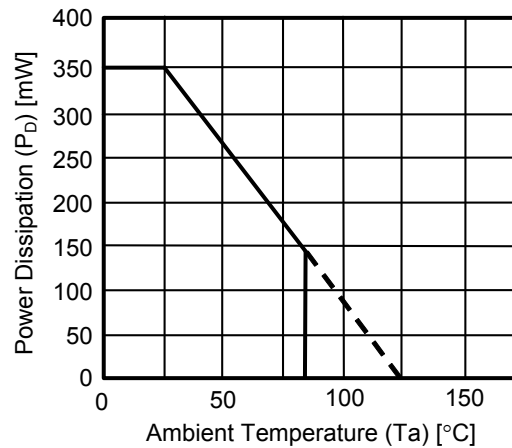


Figure 3 Power Dissipation of Package (When Mounted on Board)

■ **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. $V_{DD} = 3.0\text{ V}$

Table 7

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

($T_a = +25^\circ\text{C}$ 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}	$I_{OH} = 20\ \mu\text{A}$	2.7	–	–	V	3	
	V_{OL}	$I_{OL} = 20\ \mu\text{A}$	–	–	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}	$V_{OUT} = 0\text{ V}$	S-89210 Series	120	–	–	μA	6
			S-89220 Series	25	–	–	μA	6
Sink current	I_{SINK}	$V_{OUT} = 0.5\text{ V}$	8	–	–	mA	7	

Table 8

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

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

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
Rise propagation delay time	t_{PLH}	Overdrive = 100 mV $C_L = 15\text{ pF}$ (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. $V_{DD} = 1.8\text{ V}$

Table 9

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

($T_a = +25^\circ\text{C}$ 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}	$I_{OH} = 20\ \mu\text{A}$	1.5	–	–	V	3	
	V_{OL}	$I_{OL} = 20\ \mu\text{A}$	–	–	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}	$V_{OUT} = 0\text{ V}$	S-89210 Series	100	–	–	μA	6
			S-89220 Series	20	–	–	μA	6
Sink current	I_{SINK}	$V_{OUT} = 0.5\text{ V}$	5	–	–	mA	7	

Table 10

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

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

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
Rise propagation delay time	t_{PLH}	Overdrive = 100 mV $C_L = 15\text{ pF}$ (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

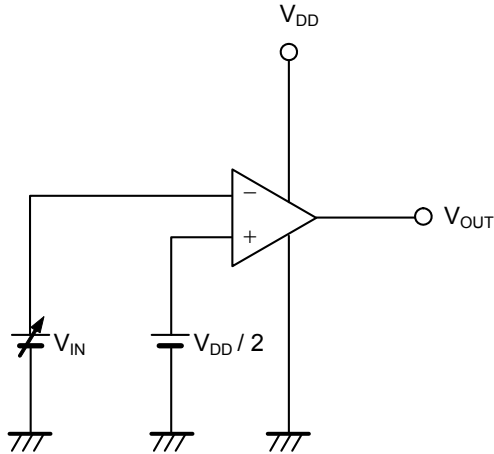


Figure 4

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

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

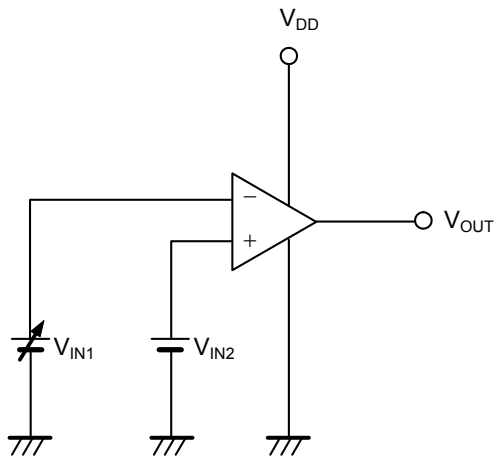


Figure 5

- **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 $V_{IN2} = V_{CMR\text{ Max.}}$: $V_{IN2} = V_{INH}$, $V_{IO} = V_{IO1}$

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})**

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})

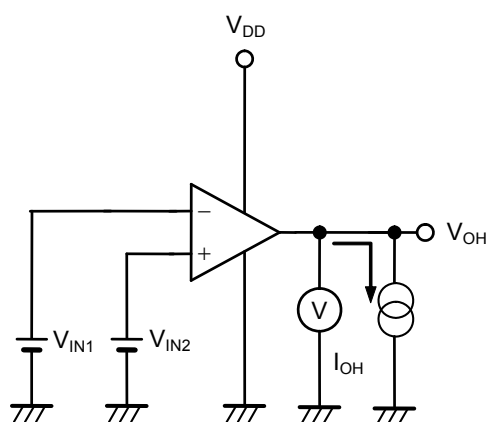


Figure 6

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

Test conditions:

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

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

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

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

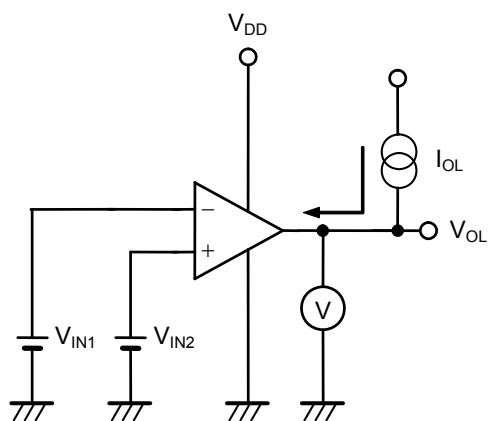


Figure 7

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

Test 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. Current consumption

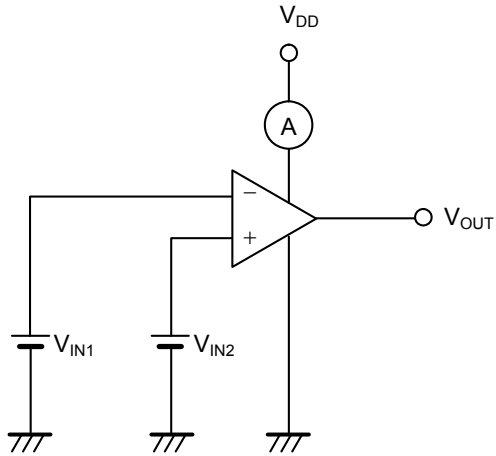


Figure 8

• Current consumption (I_{DD})

Test conditions:

$$V_{IN1} = V_{SS}$$

$$V_{IN2} = V_{CMR \text{ Max.}}$$

6. Source current

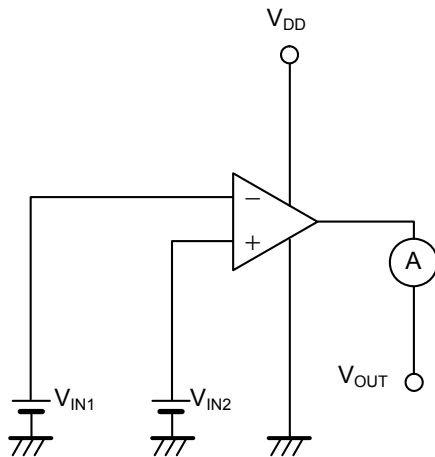


Figure 9

• Source current (I_{SOURCE})

Test conditions:

$$V_{OUT} = 0 \text{ V}$$

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

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

7. Sink current

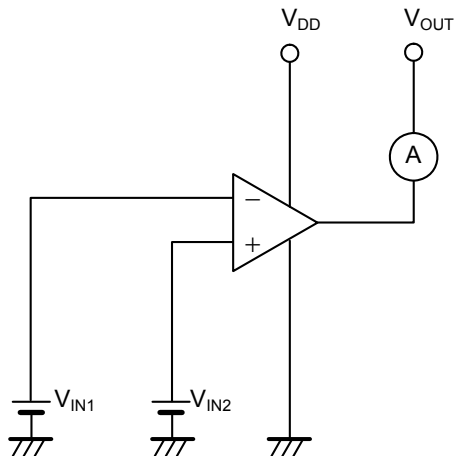


Figure 10

• Sink current (I_{SINK})

Test conditions:

$$V_{OUT} = 0.5 \text{ V}$$

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

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

8. Propagation time, response time

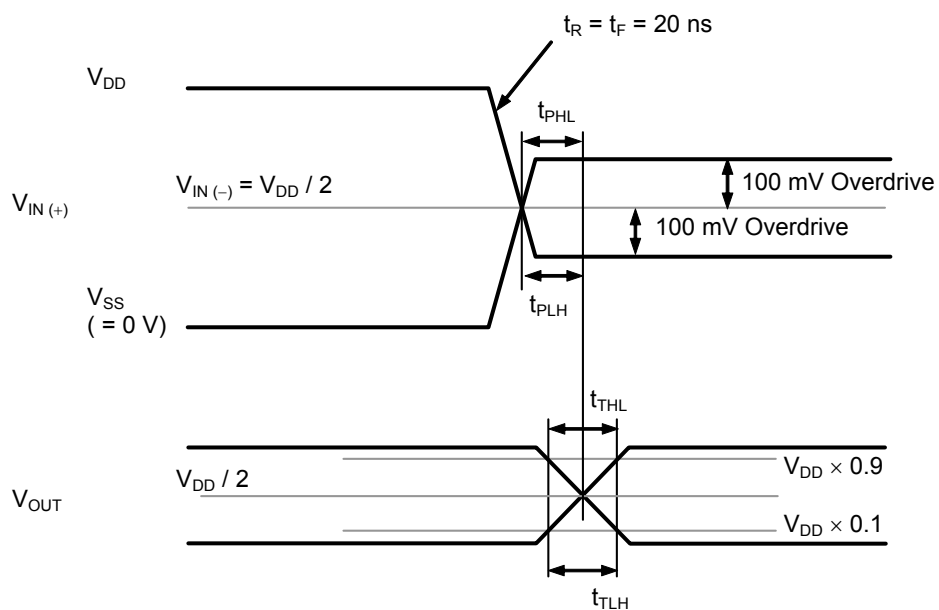


Figure 11

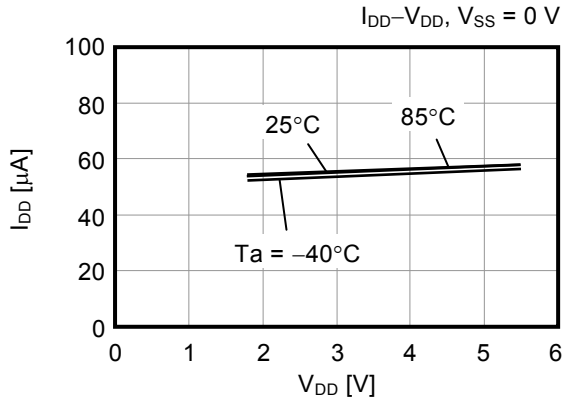
■ Precautions

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

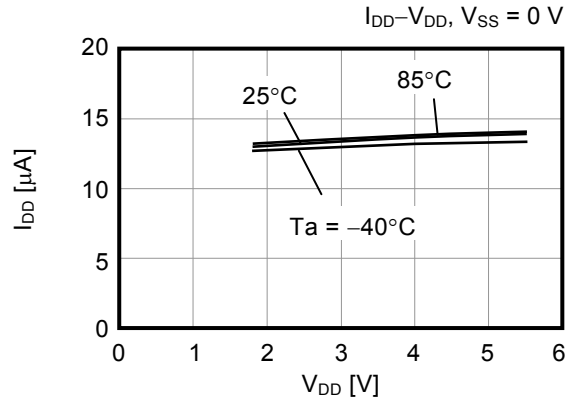
■ **Characteristics (Typical Data)**

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

(1) S-89210 Series



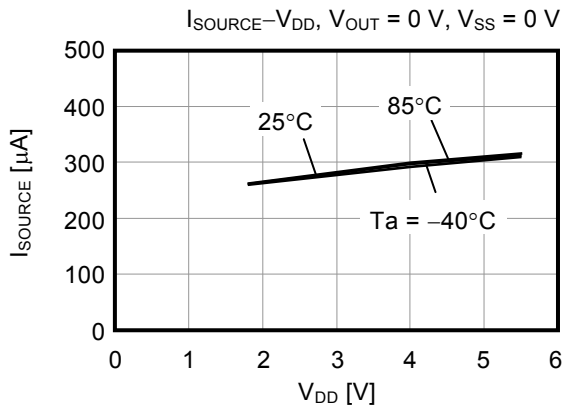
(2) S-89220 Series



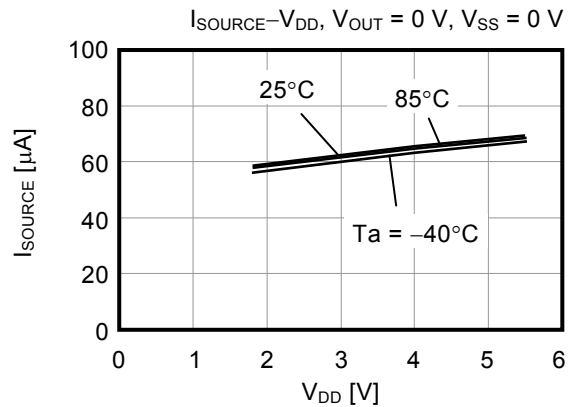
2. Output current characteristics

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

(1) S-89210 Series

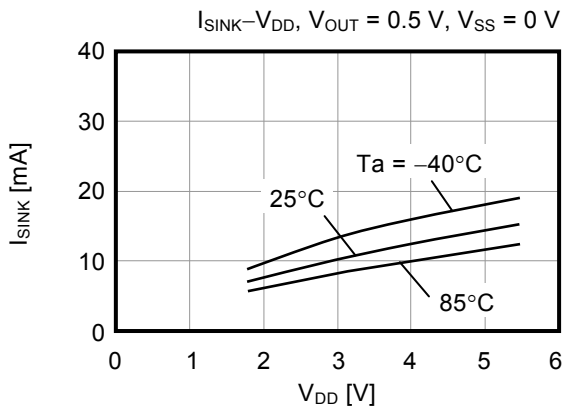


(2) S-89220 Series

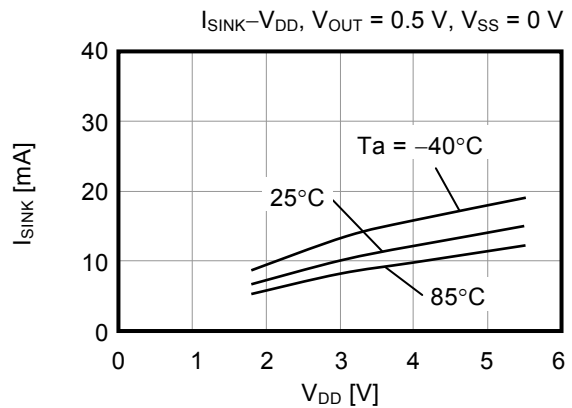


2.2 Sink current (I_{SINK}) vs. Power supply voltage (V_{DD})

(1) S-89210 Series

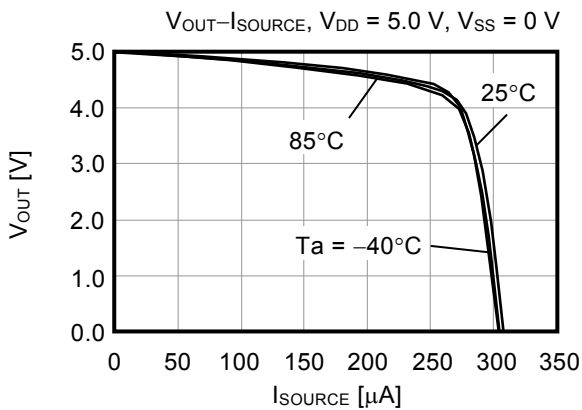
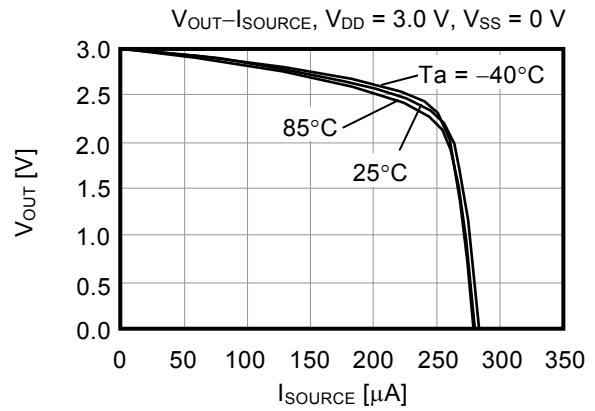
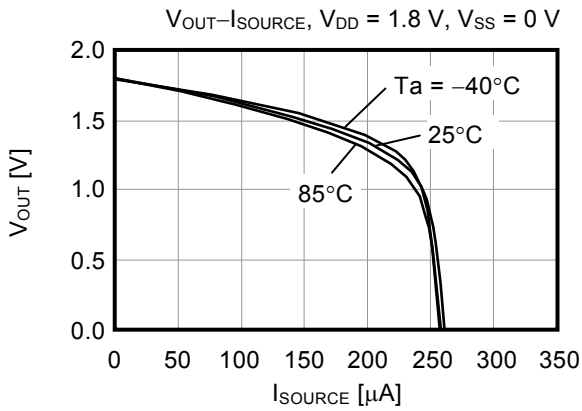


(2) S-89220 Series

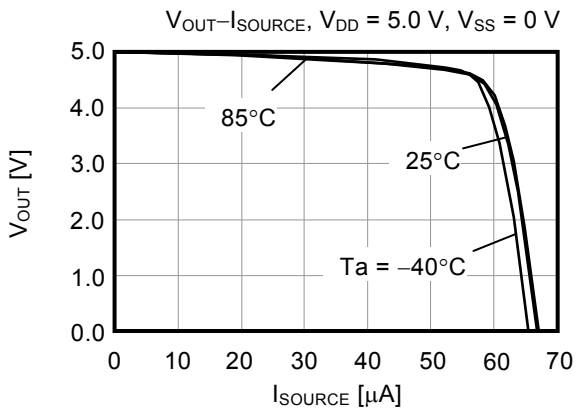
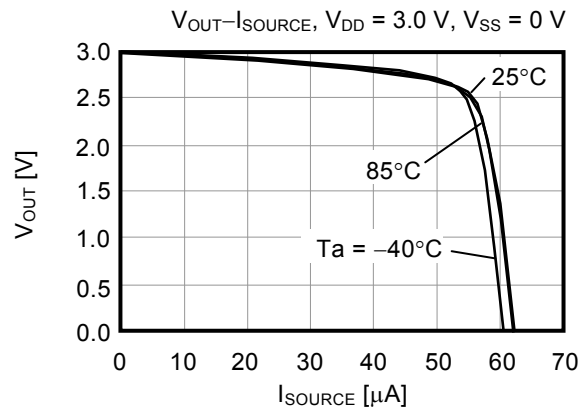
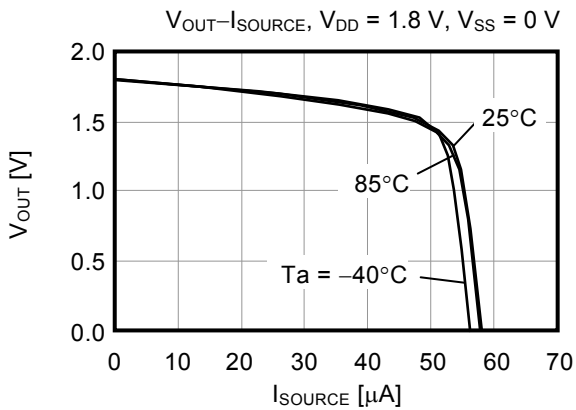


2.3 Output voltage (V_{OUT}) vs. Source current (I_{SOURCE})

(1) S-89210 Series

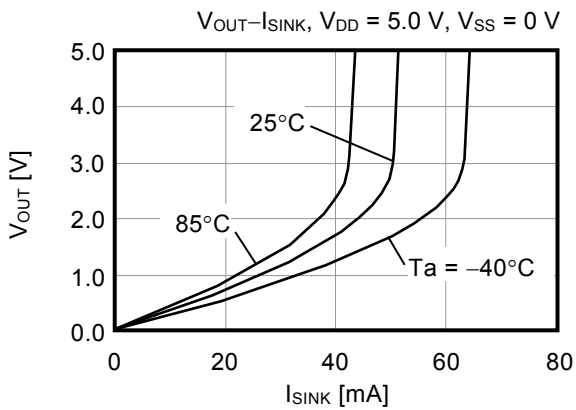
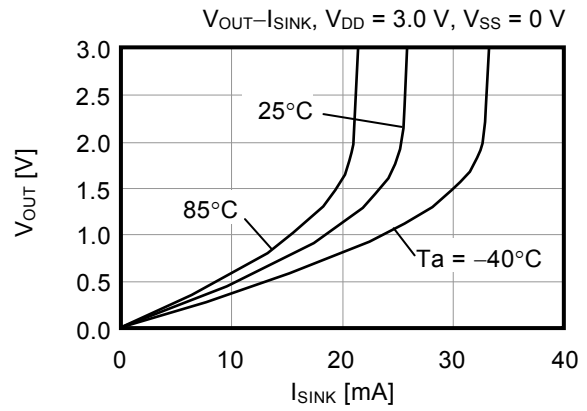
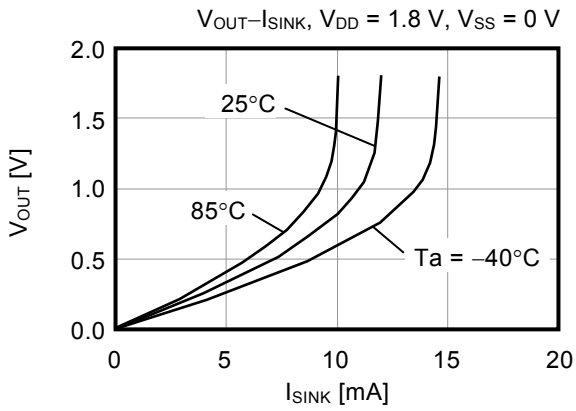


(2) S-89220 Series

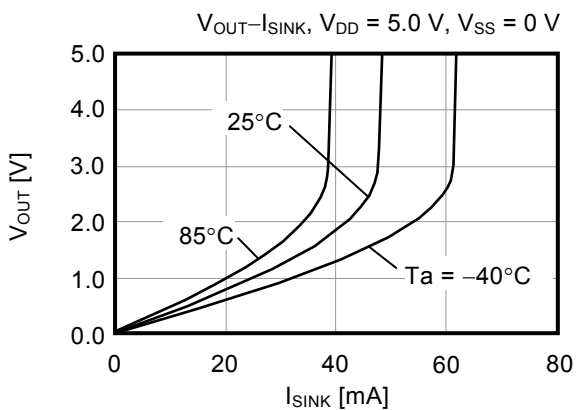
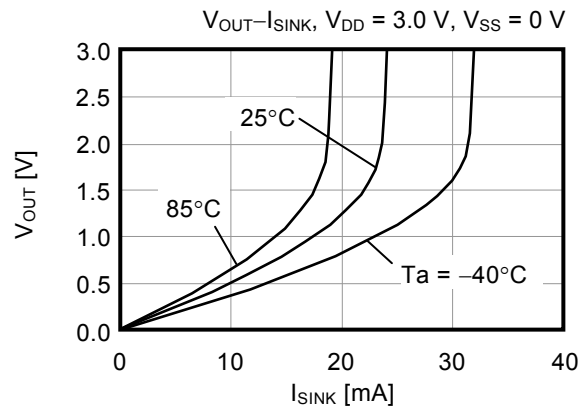
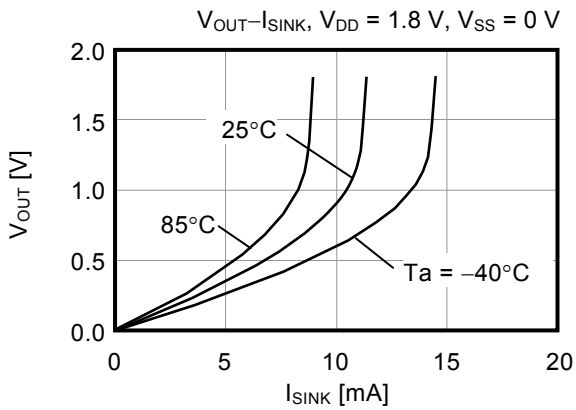


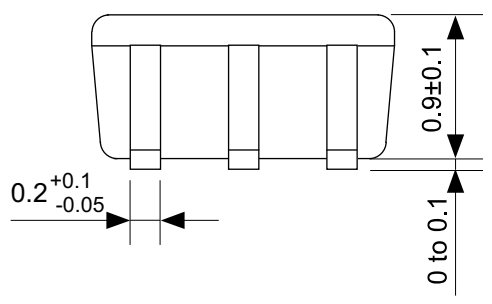
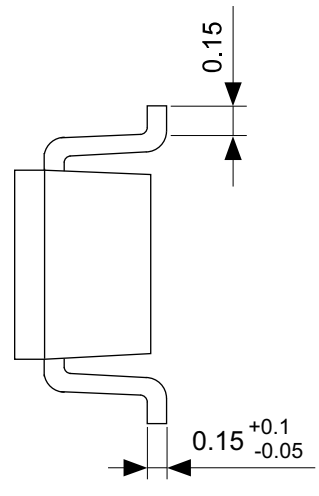
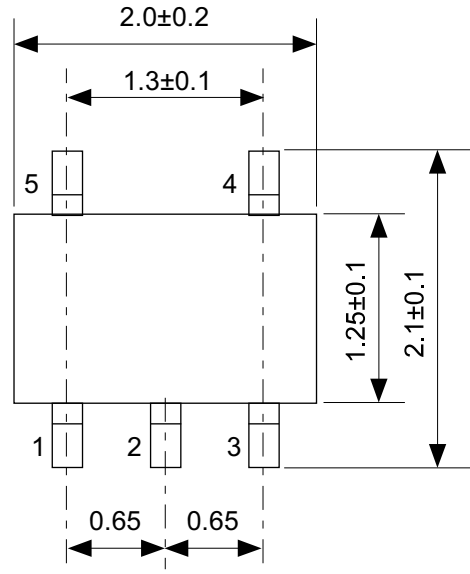
2.4 Output voltage (V_{OUT}) vs. Sink current (I_{SINK})

(1) S-89210 Series



(2) S-89220 Series

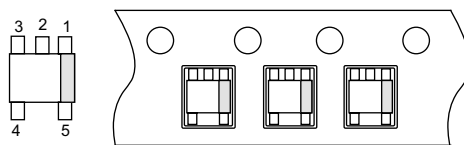
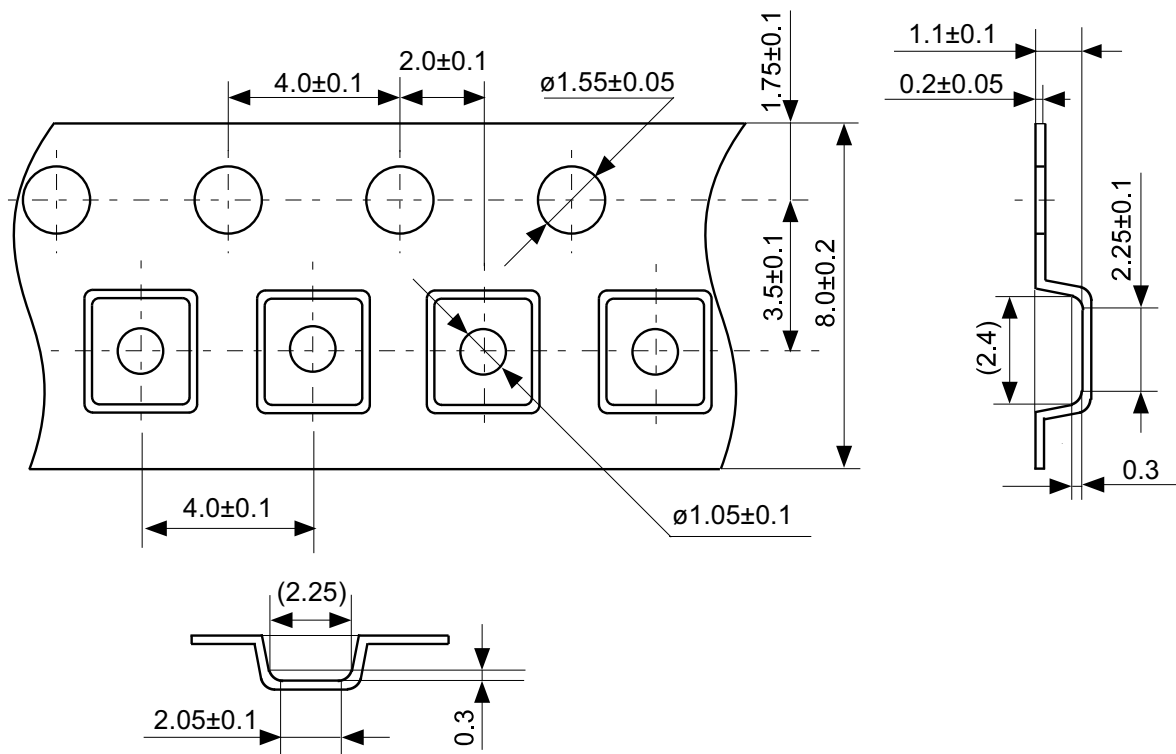




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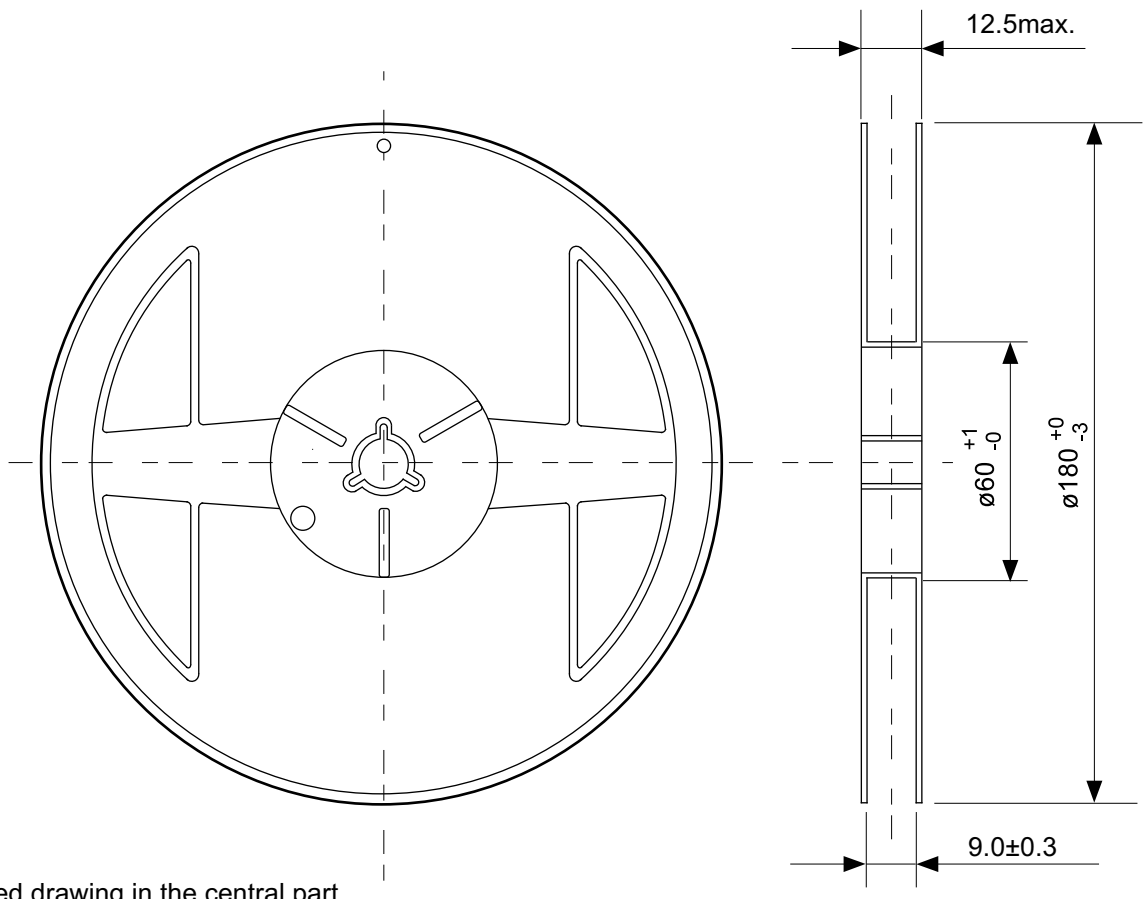
TITLE	SC88A-B-PKG Dimensions
No.	NP005-B-P-SD-1.2
ANGLE	
UNIT	mm

ABLIC Inc.

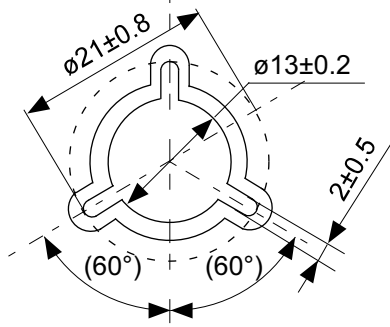


No. NP005-B-C-SD-2.0

TITLE	SC88A-B-Carrier Tape
No.	NP005-B-C-SD-2.0
ANGLE	
UNIT	mm
ABLIC 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		
ANGLE		QTY.	3,000
UNIT	mm		
ABLIC Inc.			

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5. When using the products, confirm their applications, and the laws and regulations of the region or country where they are used and verify suitability, safety and other factors for the intended use.
6. When exporting the products, comply with the Foreign Exchange and Foreign Trade Act and all other export-related laws, and follow the required procedures.
7. The products must not be used or provided (exported) for the purposes of the development of weapons of mass destruction or military use. ABLIC Inc. is not responsible for any provision (export) to those whose purpose is to develop, manufacture, use or store nuclear, biological or chemical weapons, missiles, or other military use.
8. The products are not designed to be used as part of any device or equipment that may affect the human body, human life, or assets (such as medical equipment, disaster prevention systems, security systems, combustion control systems, infrastructure control systems, vehicle equipment, traffic systems, in-vehicle equipment, aviation equipment, aerospace equipment, and nuclear-related equipment), excluding when specified for in-vehicle use or other uses. Do not apply the products to the above listed devices and equipments without prior written permission by ABLIC Inc. Especially, the products cannot be used for life support devices, devices implanted in the human body and devices that directly affect human life, etc.
Prior consultation with our sales office is required when considering the above uses.
ABLIC Inc. is not responsible for damages caused by unauthorized or unspecified use of our products.
9. Semiconductor products may fail or malfunction with some probability.
The user of the products should therefore take responsibility to give thorough consideration to safety design including redundancy, fire spread prevention measures, and malfunction prevention to prevent accidents causing injury or death, fires and social damage, etc. that may ensue from the products' failure or malfunction.
The entire system must be sufficiently evaluated and applied on customer's own responsibility.
10. The products are not designed to be radiation-proof. The necessary radiation measures should be taken in the product design by the customer depending on the intended use.
11. The products do not affect human health under normal use. However, they contain chemical substances and heavy metals and should therefore not be put in the mouth. The fracture surfaces of wafers and chips may be sharp. Be careful when handling these with the bare hands to prevent injuries, etc.
12. When disposing of the products, comply with the laws and ordinances of the country or region where they are used.
13. The information described herein contains copyright information and know-how of ABLIC Inc.
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14. For more details on the information described herein, contact our sales office.

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