Hall Effect Latch

BD54132G-LBZ

General Description

This product is a rank product for the industrial equipment market. This is the best product for use in these applications.

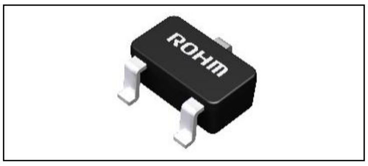
BD54132G-LBZ is latch type Hall IC with wide VDD voltage range and wide operation temperature range. This IC can detect magnetic flux density with superior sensitivity stability by using the chopper stabilized way.
This IC has reverse supply voltage protection and output over current protection features built-in.

Key Specifications

■ VDD Voltage Range:	2.5 V to 38 V
■ Operate Point:	2.7 mT (Typ)
■ Release Point:	-2.7 mT (Typ)
■ Magnetic Signal Input Frequency:	20 kHz (Max)
■ Supply Current:	1.3 mA (Typ)
■ Output Type:	Nch Open Drain
■ Operating Temperature Range:	-40 °C to +150 °C

Package

Package	W (Typ) x D (Typ) x H (Max)
SSOP3A	2.92 mm x 2.4 mm x 1.12 mm



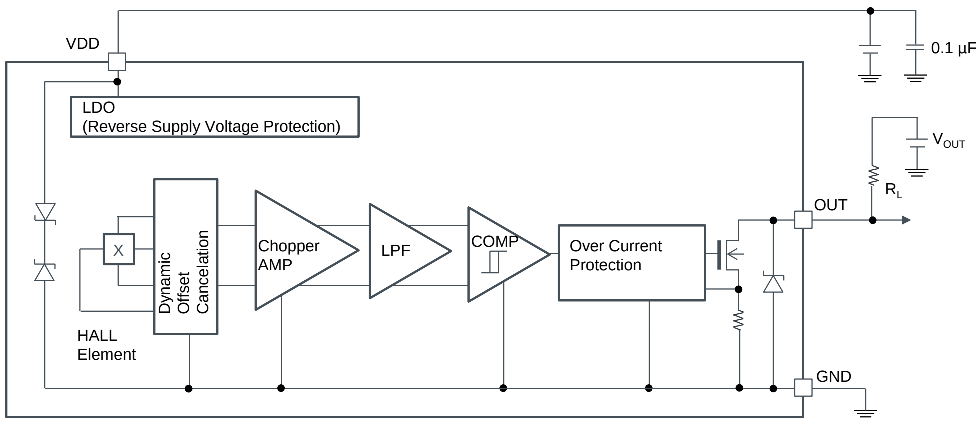
Features

- Latch Type
- Nch Open Drain
- Output Over Current Protection
- Reverse Supply Voltage Protection

Applications

- Industrial Equipment, Rotation Detection, Position Sensing

Typical Application Circuit, Block Diagram



Adjust the bypass capacitor value as necessary, according to power supply noise conditions, etc.

R_L = 1 kΩ (V_{OUT} = 12 V)

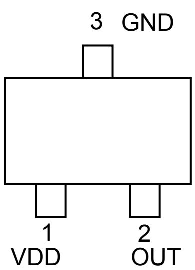
Pin Descriptions

Pin No.	Pin Name	Function
1	VDD	Power Supply(Note 1)
2	OUT	Output
3	GND	Ground

(Note 1) Dispose a bypass capacitor between VDD and GND.

Pin Configurations

TOP VIEW



○Product structure : Silicon integrated circuit ○This product has no designed protection against radioactive rays

Contents

Absolute Maximum Ratings (Ta = 25 °C)

Parameter	Symbol	Rating	Unit
Power Supply Voltage	V_{DD}	-36 to +42	V
Output Voltage	V_{OUT}	-0.3 to +42	V
Continuous Output Current	I_{OUT}	25	mA
Storage Temperature Range	Tstg	-55 to +150	°C
Maximum Junction Temperature	Tjmax	150	°C

Caution 1: *Operating the IC over the absolute maximum ratings may damage the IC. The damage can either be a short circuit between pins or an open circuit between pins and the internal circuitry. Therefore, it is important to consider circuit protection measures, such as adding a fuse, in case the IC is operated over the absolute maximum ratings.*
Caution 2: *Should by any chance the maximum junction temperature rating be exceeded the rise in temperature of the chip may result in deterioration of the properties of the chip. In case of exceeding this absolute maximum rating, design a PCB with thermal resistance taken into consideration by increasing board size and copper area so as not to exceed the maximum junction temperature rating.*

Thermal Resistance*(Note 2)*

Parameter	Symbol	Thermal Resistance (Typ)		Unit
		1s*(Note 4)*	2s2p*(Note 5)*	
SSOP3A				
Junction to Ambient	θ_{JA}	465.9	265.1	°C/W
Junction to Top Characterization Parameter*(Note 3)*	Ψ_{JT}	48	52	°C/W

(Note 2) Based on JESD51-2A (Still-Air).
(Note 3) The thermal characterization parameter to report the difference between junction temperature and the temperature at the top center of the outside surface of the component package.
(Note 4) Using a PCB board based on JESD51-3.
(Note 5) Using a PCB board based on JESD51-7.

Layer Number of Measurement Board	Material	Board Size
Single	FR-4	114.3 mm x 76.2 mm x 1.57 mmt

Top	
Copper Pattern	Thickness
Footprints and Traces	70 μm

Layer Number of Measurement Board	Material	Board Size
4 Layers	FR-4	114.3 mm x 76.2 mm x 1.6 mmt

Top		2 Internal Layers		Bottom	
Copper Pattern	Thickness	Copper Pattern	Thickness	Copper Pattern	Thickness
Footprints and Traces	70 μm	74.2 mm x 74.2 mm	35 μm	74.2 mm x 74.2 mm	70 μm

Recommended Operating Conditions

Parameter	Symbol	Min	Typ	Max	Unit
Power Supply Voltage	V_{DD}	2.5	12	38	V
Operating Temperature	Topr	-40	+25	+150	°C

Magnetic Characteristics (Unless otherwise specified V_{DD} = 12.0 V Ta = 25 °C)

Parameter	Symbol	Min	Typ	Max	Unit	Comment
Operate Point	B_{OP}	1.0	2.7	4.4	mT	-
Release Point	B_{RP}	-4.4	-2.7	-1.0	mT	-
Hysteresis	B_{HYS}	-	5.4	-	mT	-

(Note) Polarity of Magnetic flux density is defined as positive when south pole side of magnet approaches top surface of the device.

Electrical Characteristics (Unless otherwise specified V_{DD} = 12.0 V Ta = 25 °C)

Parameter	Symbol	Min	Typ	Max	Unit	Comment
Power ON Time	t_{PON}	-	-	25	μs	-
Output Leakage Current	I_{LEAK}	-	-	10	μA	-
Output Low Voltage	V_{OL}	-	-	0.5	V	I_{OUT} = +20 mA
Output Current Limitation	I_{LIMIT}	30	55	120	mA	-
Output Rise Time	tr	-	-	2	μs	V_{OUT} = 12 V R_L = 1 kΩ C_L = 20 pF
Output Fall Time	tf	-	-	2	μs	
Supply Current	I_{DD}	-	1.3	1.8	mA	-

Typical Performance Curves

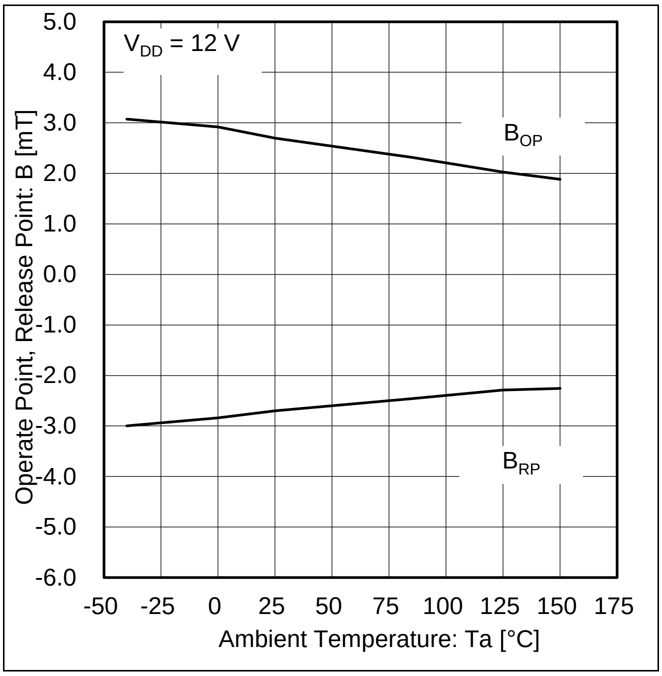


Figure 1. Operate Point, Release Point vs Ambient Temperature

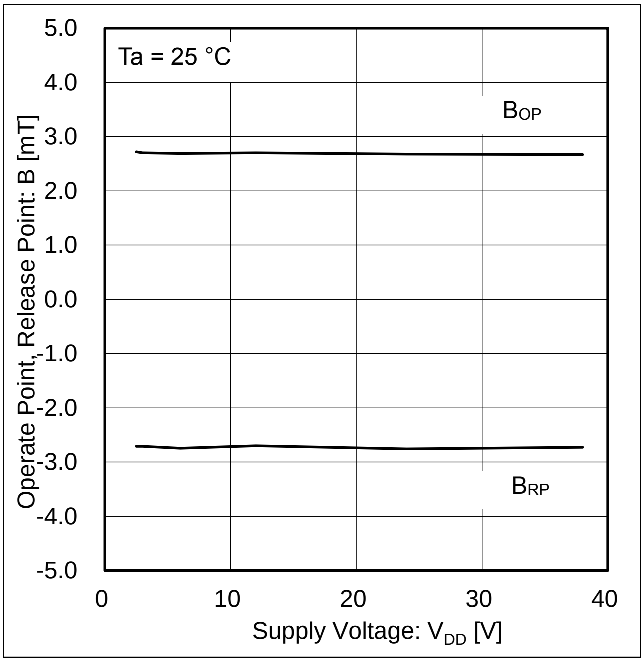


Figure 2. Operate Point, Release Point vs Supply Voltage

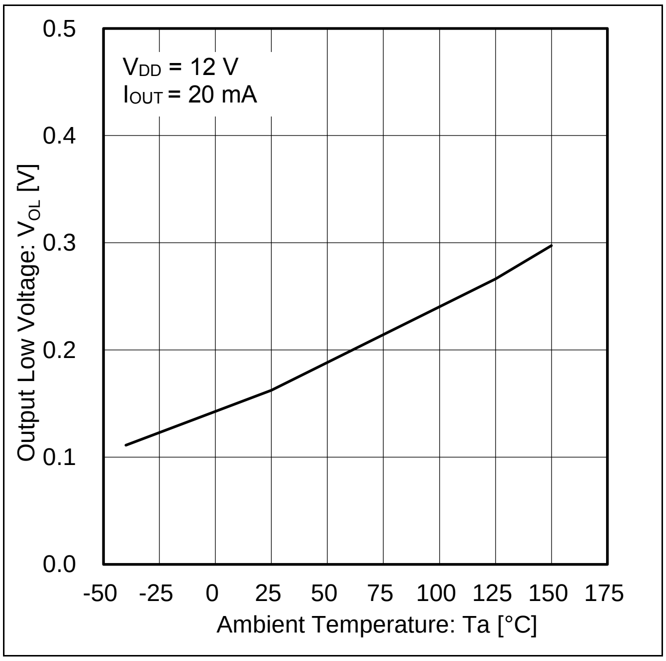


Figure 3. Output Low Voltage vs Ambient Temperature

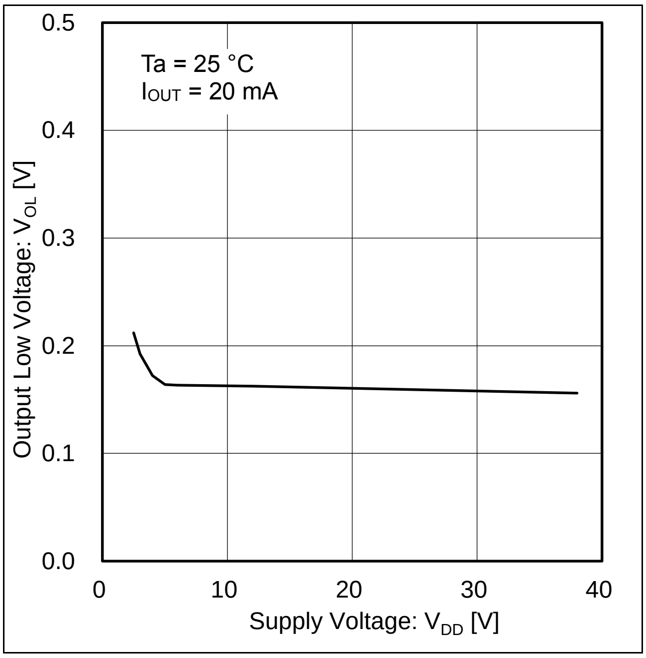


Figure 4. Output Low Voltage vs Supply Voltage

Typical Performance Curves - continued

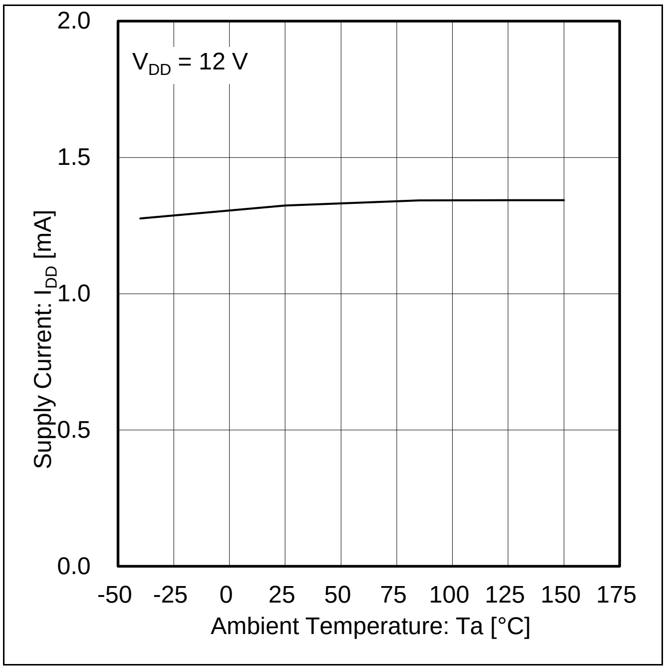


Figure 5. Supply Current vs Ambient Temperature

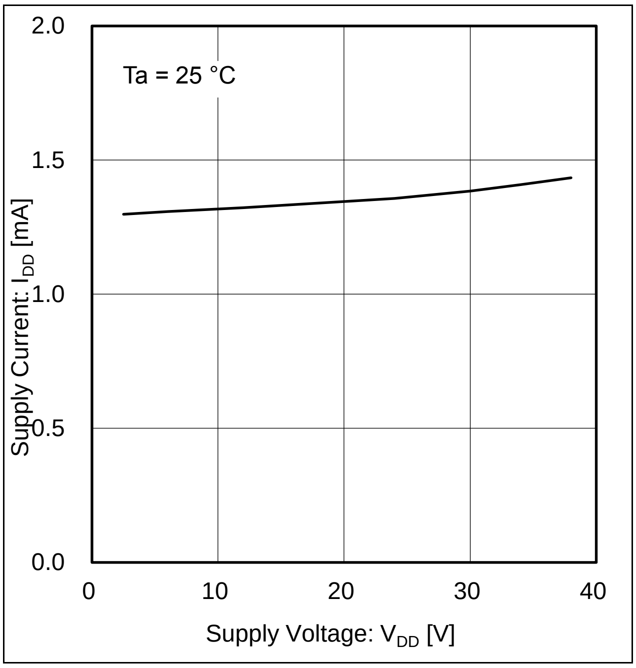


Figure 6. Supply Current vs Supply Voltage

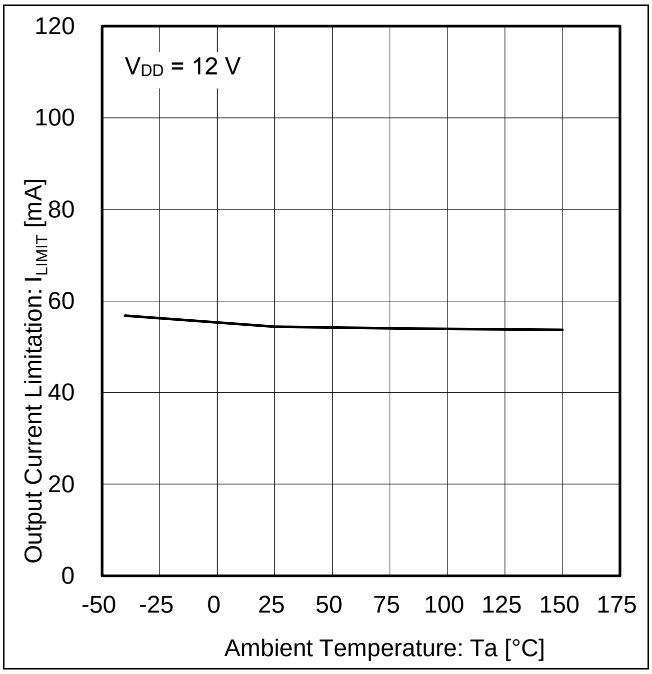


Figure 7. Output Current Limitation vs Ambient Temperature

Description of Operations

(Offset Cancellation)

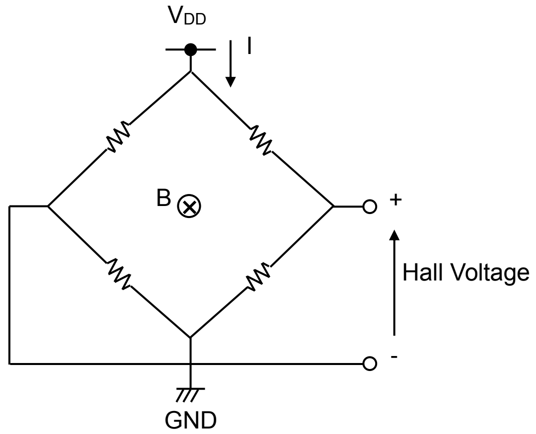


Figure 8. Equivalent Circuit of Hall Elements

The Hall elements are shown with an equivalent Wheatstone (resistor) bridge circuit. Offset voltage may be generated by a differential in this bridge resistance, or can arise from changes of resistance due to package or bonding stress. A dynamic offset cancellation circuit is employed to cancel this offset voltage.
When the Hall elements are connected as shown in Figure 8 and a magnetic field is applied perpendicular to the Hall elements, a voltage is generated at the mid-points of the bridge. This is known as Hall voltage.
Dynamic offset cancellation switches the wiring to redirect the current flow to a 90° angle from its original path, and thereby cancels the offset voltage of Hall elements.
Only the magnetic signal is maintained in the sample/hold circuit process and then released.

(Magnetic Field Direction Definition)

Polarity of Magnetic flux density is defined as positive when south pole side of magnet approaches top surface of the device.

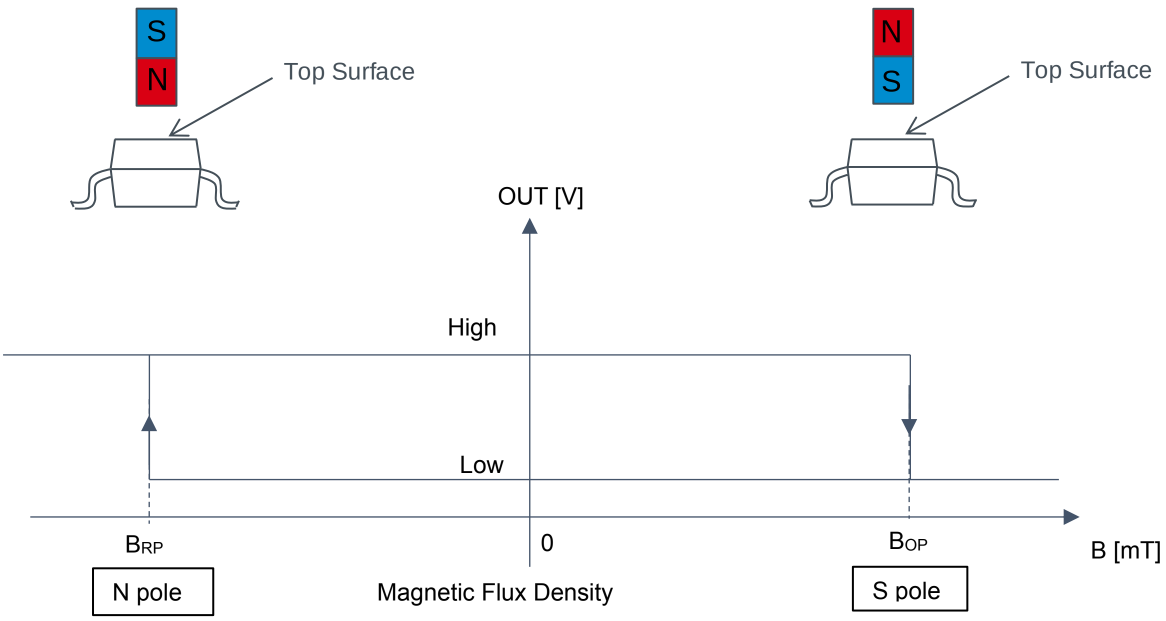


Figure 9. Magnetic Field Detection

OUT changes to low at S pole magnetic field. OUT changes to high at N pole magnetic field.

Operation at Power ON

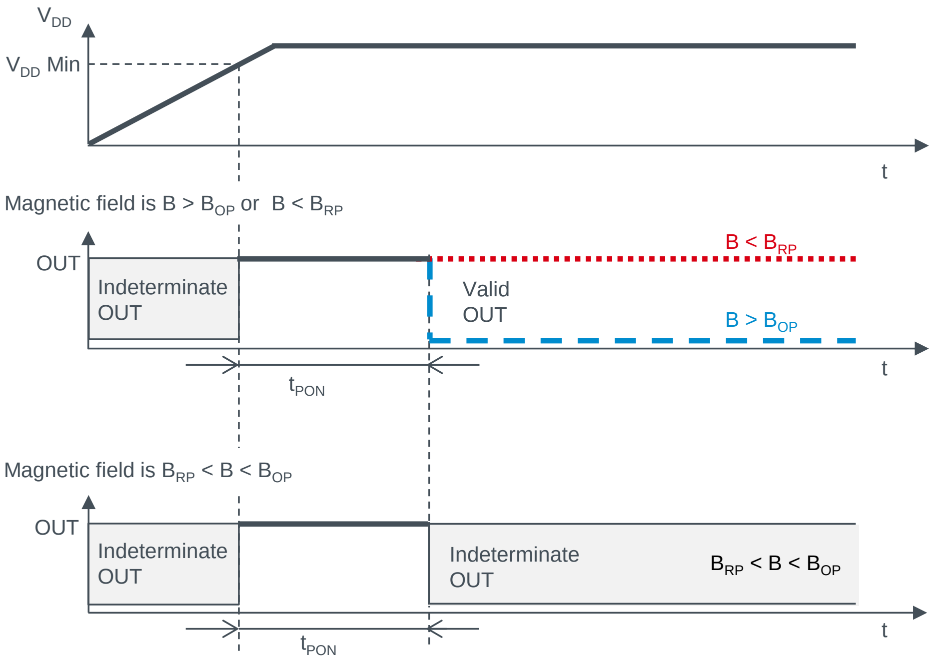


Figure 10. Operation at Power ON

After applying V_{DD} and t_{PON} has elapsed, OUT is valid.
During the power-up sequence, OUT is High (Hi-Z).
When t_{PON} has elapsed, if the magnetic field is $B > B_{OP}$ or $B < B_{RP}$, OUT is defined,
and if it's $B_{RP} < B < B_{OP}$, OUT is indeterminate and can either be High (Hi-Z) or Low.

Magnet Selection

Neodymium and ferrite are major permanent magnets. Neodymium generally offers greater magnetic power per volume than ferrite, thereby enabling miniaturization of magnet. The larger neodymium magnet is, the stronger magnetic flux density is. And the farther detection distance is, the weaker it is. Therefore, the proper size and detection distance of the magnet should be determined according to the operate point of Hall IC. To increase the magnet's detection distance, the magnet which is thicker or larger sectional area is used.

Position of the Hall Element

(Reference)

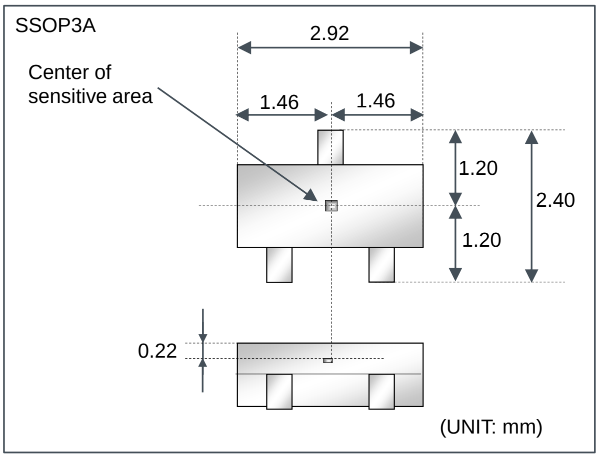


Figure 11. Position of the Hall Element

Output Equivalence Circuit

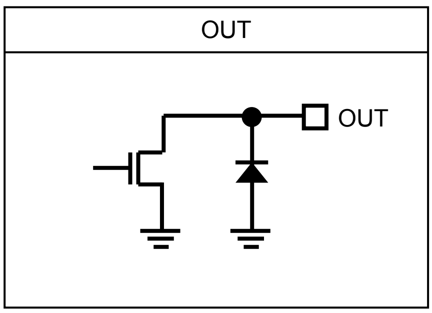


Figure 12. Output Equivalence Circuit

Operational Notes

1. **Reverse Connection of Power Supply**
This IC has a built-in reverse supply voltage protection circuit that prevents damage to the IC. Do not use in a situation that exceeds the absolute maximum ratings of built-in reverse supply voltage protection circuit.

2. **Power Supply Lines**
Design the PCB layout pattern to provide low impedance supply lines. Furthermore, connect a capacitor to ground at all power supply pins. Consider the effect of temperature and aging on the capacitance value when using electrolytic capacitors.

3. **Ground Voltage**
Except for pins built-in reverse protection, ensure that no pins are at a voltage below that of the ground pin at any time, even during transient condition.

4. **Ground Wiring Pattern**
When using both small-signal and large-current ground traces, the two ground traces should be routed separately but connected to a single ground at the reference point of the application board to avoid fluctuations in the small-signal ground caused by large currents. Also ensure that the ground traces of external components do not cause variations on the ground voltage. The ground lines must be as short and thick as possible to reduce line impedance.

5. **Recommended Operating Conditions**
The function and operation of the IC are guaranteed within the range specified by the recommended operating conditions. The characteristic values are guaranteed only under the conditions of each item specified by the electrical characteristics.

6. **Inrush Current**
When power is first supplied to the IC, it is possible that the internal logic may be unstable and inrush current may flow instantaneously due to the internal powering sequence and delays, especially if the IC has more than one power supply. Therefore, give special consideration to power coupling capacitance, power wiring, width of ground wiring, and routing of connections.

7. **Testing on Application Boards**
When testing the IC on an application board, connecting a capacitor directly to a low-impedance output pin may subject the IC to stress. Always discharge capacitors completely after each process or step. The IC's power supply should always be turned off completely before connecting or removing it from the test setup during the inspection process. To prevent damage from static discharge, ground the IC during assembly and use similar precautions during transport and storage.

Operational Notes – continued

8. Inter-pin Short and Mounting Errors
Ensure that the direction and position are correct when mounting the IC on the PCB. Incorrect mounting may result in damaging the IC. Avoid nearby pins being shorted to each other especially to ground, power supply and output pin. Inter-pin shorts could be due to many reasons such as metal particles, water droplets (in very humid environment) and unintentional solder bridge deposited in between pins during assembly to name a few.

9. Unused Input Pins
Input pins of an IC are often connected to the gate of a MOS transistor. The gate has extremely high impedance and extremely low capacitance. If left unconnected, the electric field from the outside can easily charge it. The small charge acquired in this way is enough to produce a significant effect on the conduction through the transistor and cause unexpected operation of the IC. So unless otherwise specified, unused input pins should be connected to the power supply or ground line.

10. Regarding the Input Pin of the IC
This monolithic IC contains P+ isolation and P substrate layers between adjacent elements in order to keep them isolated. P-N junctions are formed at the intersection of the P layers with the N layers of other elements, creating a parasitic diode or transistor. For example (refer to figure below):

When GND > Pin A and GND > Pin B, the P-N junction operates as a parasitic diode.
When GND > Pin B, the P-N junction operates as a parasitic transistor.

Parasitic diodes inevitably occur in the structure of the IC. The operation of parasitic diodes can result in mutual interference among circuits, operational faults, or physical damage. Therefore, conditions that cause these diodes to operate, such as applying a voltage lower than the GND voltage to an input pin (and thus to the P substrate) should be avoided.

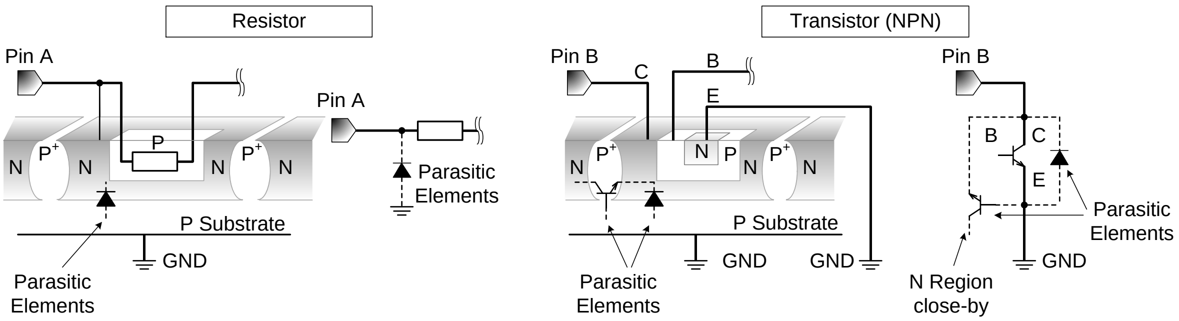
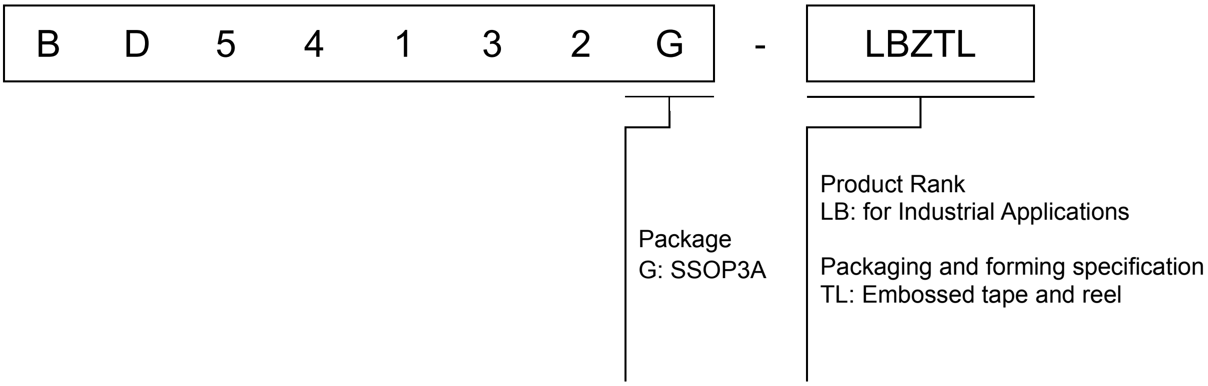


Figure 13. Example of Monolithic IC Structure

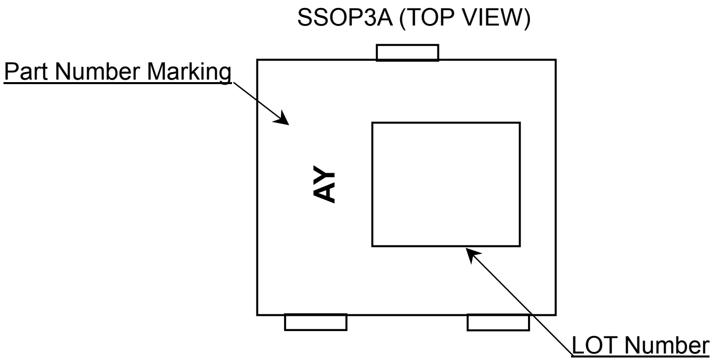
11. Ceramic Capacitor
When using a ceramic capacitor, determine a capacitance value considering the change of capacitance with temperature and the decrease in nominal capacitance due to DC bias and others.

12. Over Current Protection Circuit (OCP)
This IC incorporates an integrated overcurrent protection circuit that is activated when the load is shorted. This protection circuit is effective in preventing damage due to sudden and unexpected incidents. However, the IC should not be used in applications characterized by continuous operation or transitioning of the protection circuit.

Ordering Information

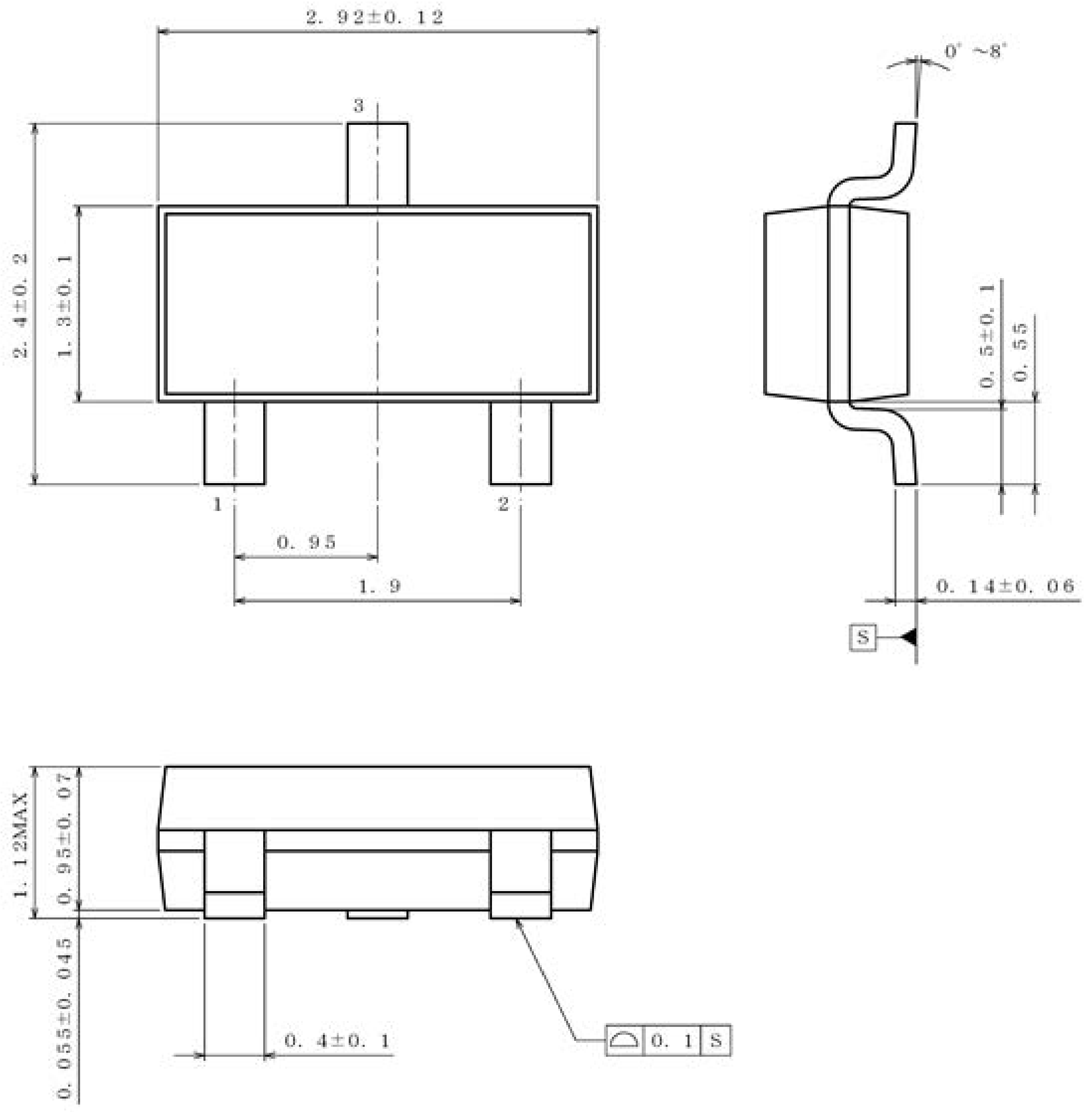


Marking Diagram



Physical Dimension and Packing Information

Package Name	SSOP3A



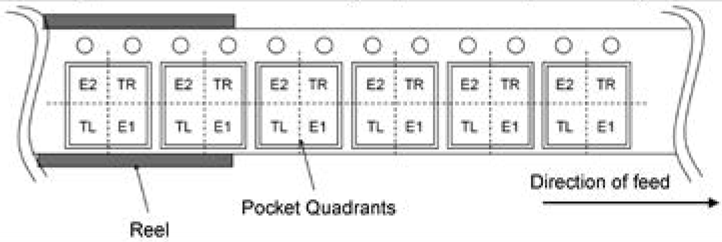
(UNIT : mm)

PKG : SSOP3A

Drawing No. EX001−0112

< Tape and Reel Information >

Tape	Embossed carrier tape
Quantity	3000pcs
Direction of feed	TL The direction is the pin 1 of product is at the lower left when you hold reel on the left hand and you pull out the tape on the right hand



Revision History

Date	Revision	Changes
31.Mar.2023	001	New Release

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1. If you intend to use our Products in devices requiring extremely high reliability (such as medical equipment (Note 1), aircraft/spacecraft, nuclear power controllers, etc.) and whose malfunction or failure may cause loss of human life, bodily injury or serious damage to property ("Specific Applications"), please consult with the ROHM sales representative in advance. Unless otherwise agreed in writing by ROHM in advance, ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of any ROHM's Products for Specific Applications.

(Note1) Medical Equipment Classification of the Specific Applications

JAPAN	USA	EU	CHINA
CLASSⅢ	CLASSⅢ	CLASSⅡb	CLASSⅢ
CLASSⅣ		CLASSⅢ	

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   [b] Installation of redundant circuits to reduce the impact of single or multiple circuit failure

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   [a] Use of our Products in any types of liquid, including water, oils, chemicals, and organic solvents
   [b] Use of our Products outdoors or in places where the Products are exposed to direct sunlight or dust
   [c] Use of our Products in places where the Products are exposed to sea wind or corrosive gases, including Cl_2, H_2S, NH_3, SO_2, and NO_2
   [d] Use of our Products in places where the Products are exposed to static electricity or electromagnetic waves
   [e] Use of our Products in proximity to heat-producing components, plastic cords, or other flammable items
   [f] Sealing or coating our Products with resin or other coating materials
   [g] Use of our Products without cleaning residue of flux (Exclude cases where no-clean type fluxes is used. However, recommend sufficiently about the residue.); or Washing our Products by using water or water-soluble cleaning agents for cleaning residue after soldering
   [h] Use of the Products in places subject to dew condensation

4. The Products are not subject to radiation-proof design.

5. Please verify and confirm characteristics of the final or mounted products in using the Products.

6. In particular, if a transient load (a large amount of load applied in a short period of time, such as pulse, is applied, confirmation of performance characteristics after on-board mounting is strongly recommended. Avoid applying power exceeding normal rated power; exceeding the power rating under steady-state loading condition may negatively affect product performance and reliability.

7. De-rate Power Dissipation depending on ambient temperature. When used in sealed area, confirm that it is the use in the range that does not exceed the maximum junction temperature.

8. Confirm that operation temperature is within the specified range described in the product specification.

9. ROHM shall not be in any way responsible or liable for failure induced under deviant condition from what is defined in this document.

Precaution for Mounting / Circuit board design

1. When a highly active halogenous (chlorine, bromine, etc.) flux is used, the residue of flux may negatively affect product performance and reliability.

2. In principle, the reflow soldering method must be used on a surface-mount products, the flow soldering method must be used on a through hole mount products. If the flow soldering method is preferred on a surface-mount products, please consult with the ROHM representative in advance.

For details, please refer to ROHM Mounting specification

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1. If change is made to the constant of an external circuit, please allow a sufficient margin considering variations of the characteristics of the Products and external components, including transient characteristics, as well as static characteristics.

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This Product is electrostatic sensitive product, which may be damaged due to electrostatic discharge. Please take proper caution in your manufacturing process and storage so that voltage exceeding the Products maximum rating will not be applied to Products. Please take special care under dry condition (e.g. Grounding of human body / equipment / solder iron, isolation from charged objects, setting of Ionizer, friction prevention and temperature / humidity control).

Precaution for Storage / Transportation

1. Product performance and soldered connections may deteriorate if the Products are stored in the places where:
   [a] the Products are exposed to sea winds or corrosive gases, including Cl_2, H_2S, NH_3, SO_2, and NO_2
   [b] the temperature or humidity exceeds those recommended by ROHM
   [c] the Products are exposed to direct sunshine or condensation
   [d] the Products are exposed to high Electrostatic

2. Even under ROHM recommended storage condition, solderability of products out of recommended storage time period may be degraded. It is strongly recommended to confirm solderability before using Products of which storage time is exceeding the recommended storage time period.

3. Store / transport cartons in the correct direction, which is indicated on a carton with a symbol. Otherwise bent leads may occur due to excessive stress applied when dropping of a carton.

4. Use Products within the specified time after opening a humidity barrier bag. Baking is required before using Products of which storage time is exceeding the recommended storage time period.

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