AK8779B
Hall Effect IC for Pulse Encoders

1. General Description

The AK8779B is a Hall effect latch which detects both “vertical” and “horizontal” (perpendicular and parallel to the marked side of the package) magnetic fields at the same time. The OUTA and OUTB outputs are switched according to the vertical and horizontal magnetic fields applied to the device. The AK8779B is for use in the incremental pulse encoders or rotational detection systems.

2. Features

☐	Supply Voltage:	3.8 to 24V
☐	Operation Temperature:	−40 to 150ºC
☐	Sensitivity (Vertical):	±2.0mT(Typ.), ±4.0mT(Max.)
☐	Sensitivity (Horizontal):	±2.0mT(Typ.), ±4.0mT(Max.)
☐	Two Outputs:	OUTA (vertical magnetic field detection) OUTB (horizontal magnetic field detection)
☐	Package:	6-pin SOP Type (RoHS Compliant, Halogen free)

3. Table of Contents

4. Block Diagram and Functions

4.1. Block Diagram

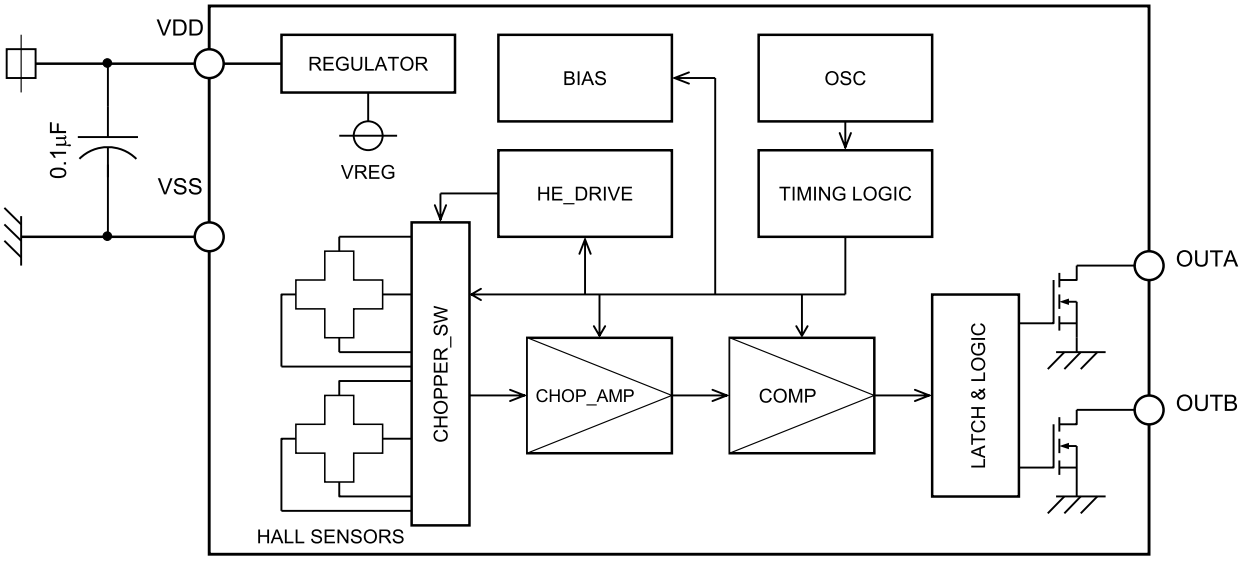


Figure 1. AK8779B Block Diagram

4.2. Functions

Table 1. Circuit configuration

Block Name	Function
REGULATOR	Generate internal operating voltage.
HALL SENSORS	Two Hall elements fabricated by CMOS process.
CHOPPER_SW	Hall sensor drive switch. Perform chopping in order to cancel the offset of Hall sensor.
CHOP_AMP	Amplify two Hall sensor output voltages with summation and subtraction circuit.
COMP	Hysteresis comparator.
BIAS	Generate bias current to internal circuits.
HE_DRIVE	Generate bias current for Hall sensors.
OSC	Generate operational clock.
TIMING LOGIC	Generate timing signal for internal circuits.
LATCH & LOGIC	Logical circuits and open drain driver.

5. Pin Configurations and Functions

5.1. Pin Configurations

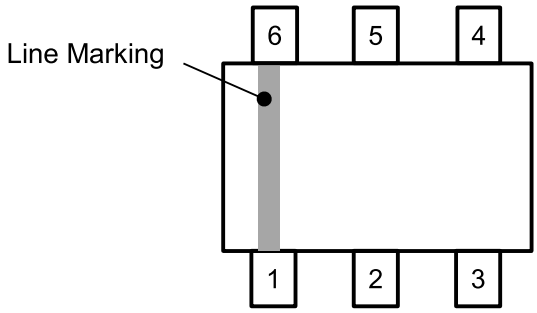


Figure 2. Pin Layout

5.2. Functions

Table 2. Description of pin name and function

Pin No.	Pin Name	I/O	Function	Description
1	OUTB	O	Output pin (relating to the horizontal magnetic field)	Open Drain
2	TAB	-	(TAB pin)	(* 1)
3	OUTA	O	Output pin (relating to the vertical magnetic field)	Open Drain
4	VDD	-	Power Supply pin	
5	TAB	-	(TAB pin)	(* 1)
6	VSS	-	Ground pin (GND)	

* 1. The TAB pin should be connected to the VSS pin.

6. Absolute Maximum Ratings

Table 3. Absolute maximum ratings

Parameter	Symbol	Min.	Max.	Unit	Description
Supply Voltage	V_{DD}	−0.3	32	V	VSS = 0V
Output Voltage	V_{OUT}	−0.3	32	V	OUTA pin, OUTB pin VSS = 0V
Output Current	I_{SINK}		20	mA	OUTA pin, OUTB pin
Storage Temperature	T_{STG}	−55	150	ºC	

Operation at or beyond these limits may result in permanent damage to the device. Normal operation is not guaranteed at these extremes.

7. Recommended Operating Conditions

Table 4. Recommended operating conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit
Supply Voltage	V_{DD}	3.8	12	24	V
Output Current	I_{SINK}			15	mA
Operation Temperature	Ta	–40		150	ºC

8. Electrical Characteristics

Table 5. Electrical characteristics at V_{DD} = 3.8 to 24V, Ta = –40 to 150ºC

Parameter	Symbol	Min.	Typ.	Max.	Unit	Description
Current Consumption	I_{DD}	1.7	3.5	6.2	mA	V_{DD} = 3.8 to 24V
Current Consumption (2)	I_{DD2}	1.7	3.5	6.0	mA	V_{DD} = 3.8 to 18V
Output Saturation Voltage	V_{SAT}			0.4	V	OUTA pin, OUTB pin, I_{SINK} = 15mA
Output Leak Current	I_{LEAK}			10	µA	OUTA, OUTB pin = V_{DD}
Output Refresh Period	Tp	5.0	8.3	16.7	µs	

9. Magnetic Characteristics

Table 6. Magnetic characteristics at V_{DD} = 3.8 to 24V, Ta = –40 to 150ºC

Parameter	Symbol	Min.	Typ.	Max.	Unit	Description
Operate point of vertical magnetic field	BopV	0.5	2.0	4.0	mT	(* 2)
Release point of vertical magnetic field	BrpV	–4.0	–2.0	–0.5	mT	(* 2)
Operate point of horizontal magnetic field	BopH	0.5	2.0	4.0	mT	(* 3)
Release point of horizontal magnetic field	BrpH	–4.0	–2.0	–0.5	mT	(* 3)
Hysteresis	BhV, BhH	2.0	4.0	6.4	mT	(* 2, * 3, * 4)
Magnetic offset	BoffV, BoffH	–1.1	0.0	+1.1	mT	(* 2, * 3, * 5)

* 2. Horizontal magnetic flux density is zero.
* 3. Vertical magnetic flux density is zero
* 4. Bh = Bop – Brp
* 5. Boff = (Bop + Brp) / 2

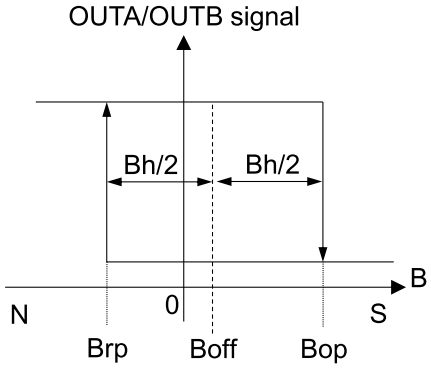


Figure 3. Definition of Bh and Boff

10. Operating Characteristics

10.1. Definition of Vertical Magnetic Field

The OUTA signal switches 'L' (ON) when the magnetic field perpendicular to the marking side of the package exceeds BopV. When the magnetic field is reduced below BrpV, the OUTA goes 'H' (OFF). Otherwise; that is, in case of the magnetic field strength is greater than BrpV and smaller than BopV; OUTA keeps its status.

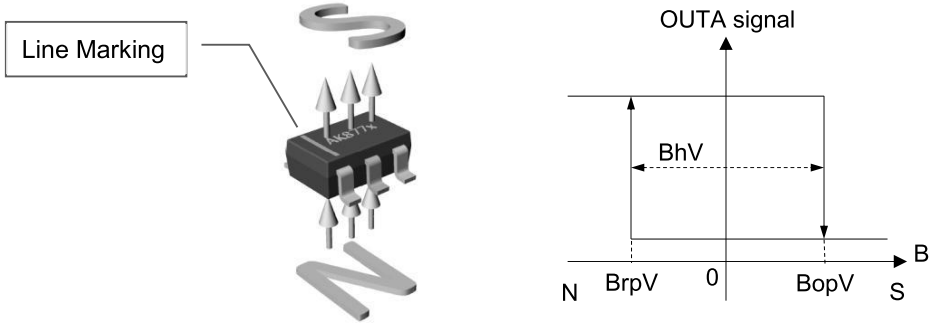


Figure 4. Switching behavior of OUTA signal when vertical magnetic field is applied

10.2. Definition of Horizontal Magnetic Field

The OUTB signal switches 'L' (ON) when the magnetic field parallel to the marking side of the package exceeds BopH. When the magnetic field is reduced below BrpH, the OUTB goes 'H' (OFF). Otherwise; that is, in case of the magnetic field strength is greater than BrpH and smaller than BopH; OUTB keeps its status.

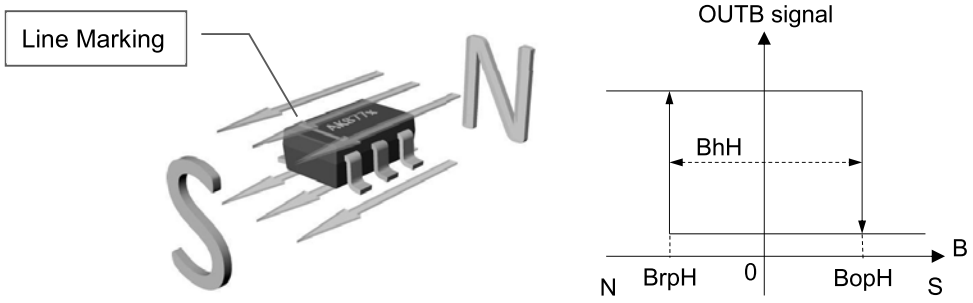


Figure 5. Switching behavior of the OUTB signal when horizontal magnetic field is applied

10.3. Behaviors of OUTA and OUTB Signals when a Rotating Magnetic Field Is Applied on The AK8779B

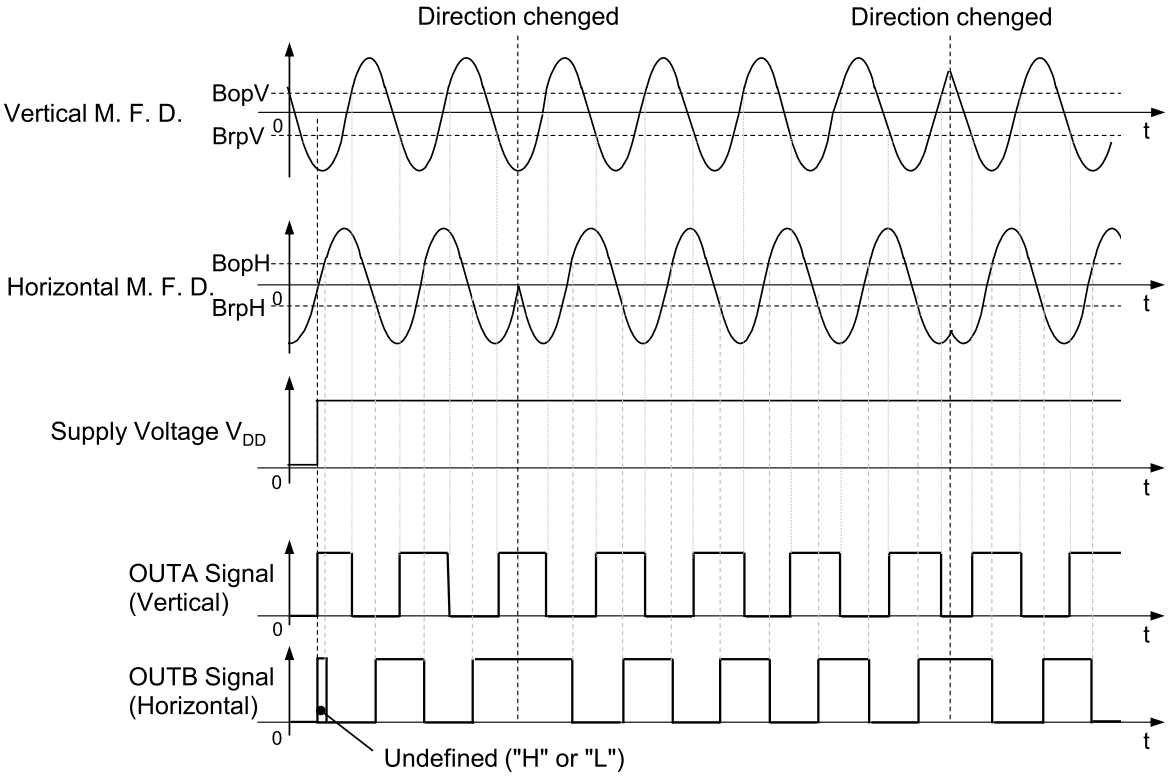


Figure 6. Behaviors of OUTA and OUTB Signals with Rotating Magnetic Field

* M.F.D. = Magnetic Flux Density
* The indeterminate output state appears only in the powering up of this device.

11. Functional Timing

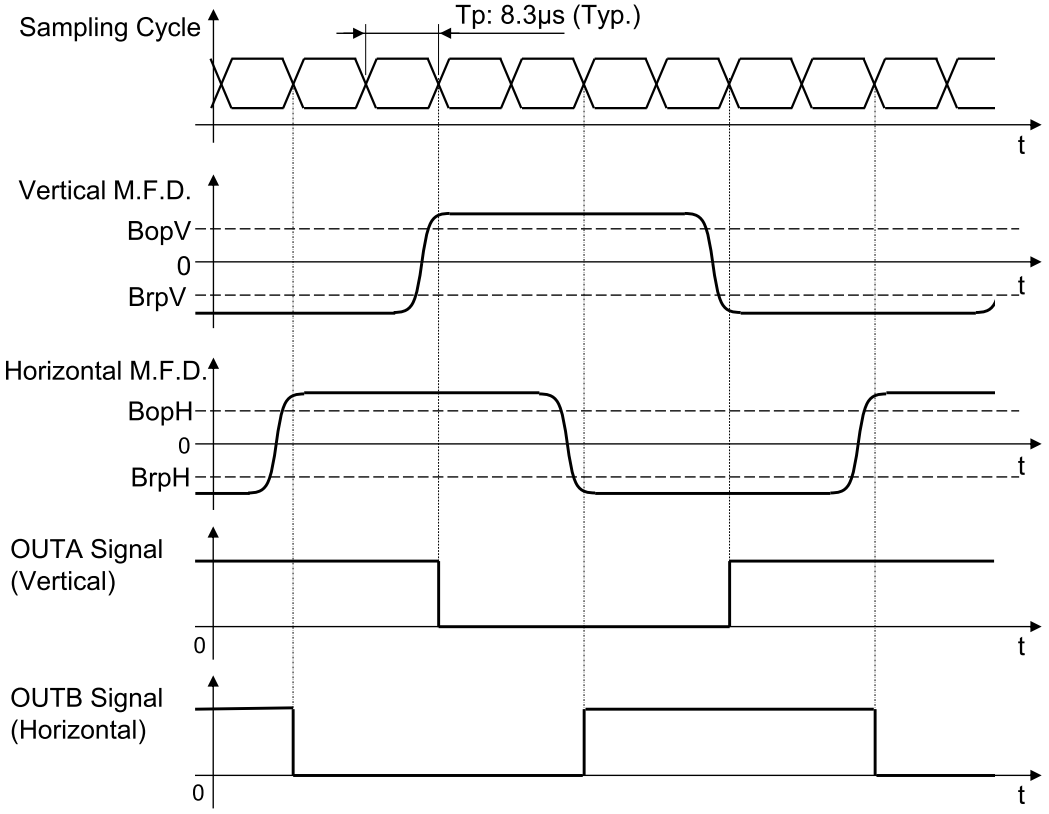


Figure 7. Output Signal Timing Diagram

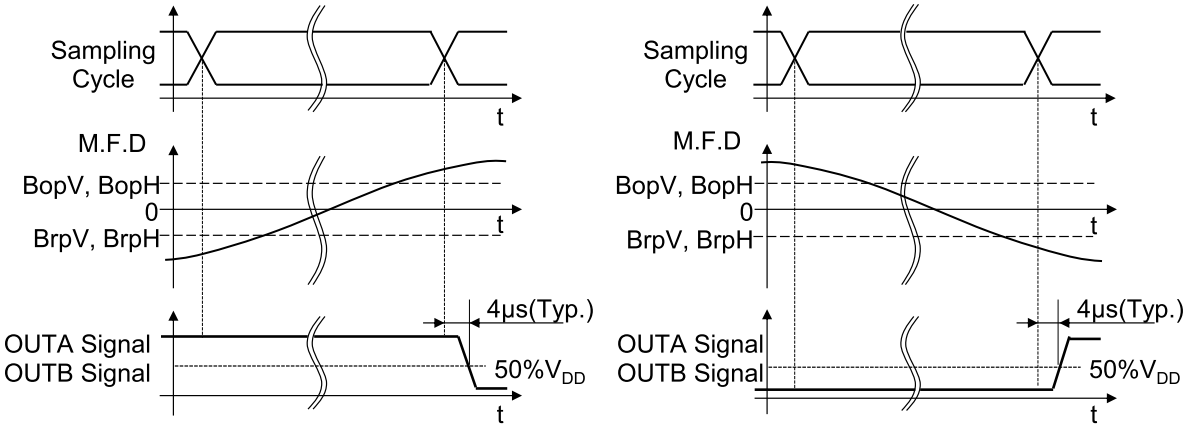


Figure 8. Output Signal Timing Diagram (in detail)

* M.F.D. = Magnetic Flux Density
* V_{DD} = 12V, R_L = 10kΩ, C_L = 20pF

12. Recommended External Circuit

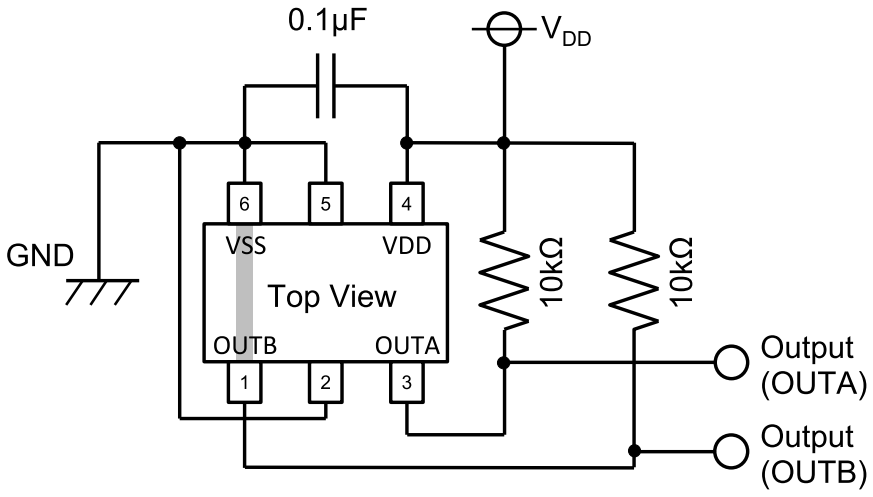


Figure 9. Recommended External Circuit

13. Typical Characteristics Data (for reference)

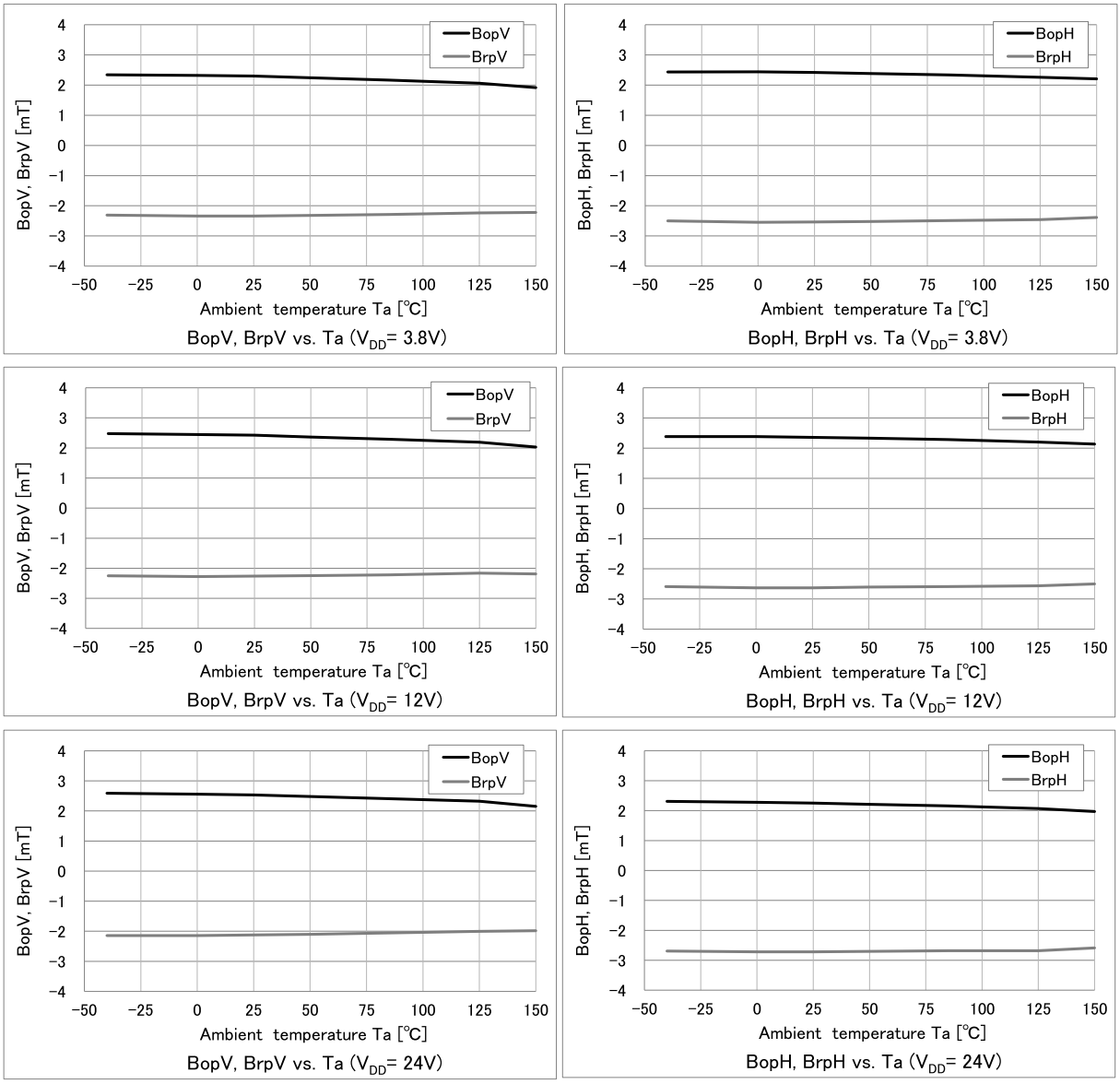


Figure 10. Temperature Dependence of Bop, Brp

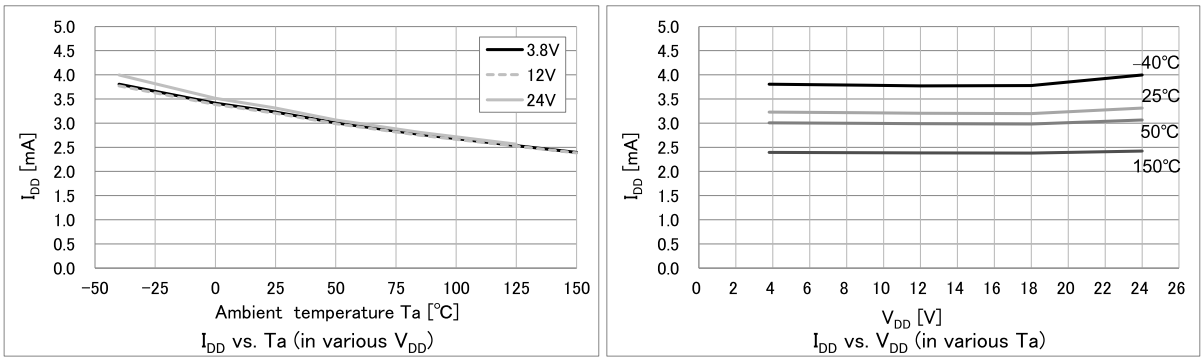


Figure 11. Temperature Dependence of Current Consumption

14. Package

14.1. Outline Dimensions

6-pin SOP (Unit: mm)

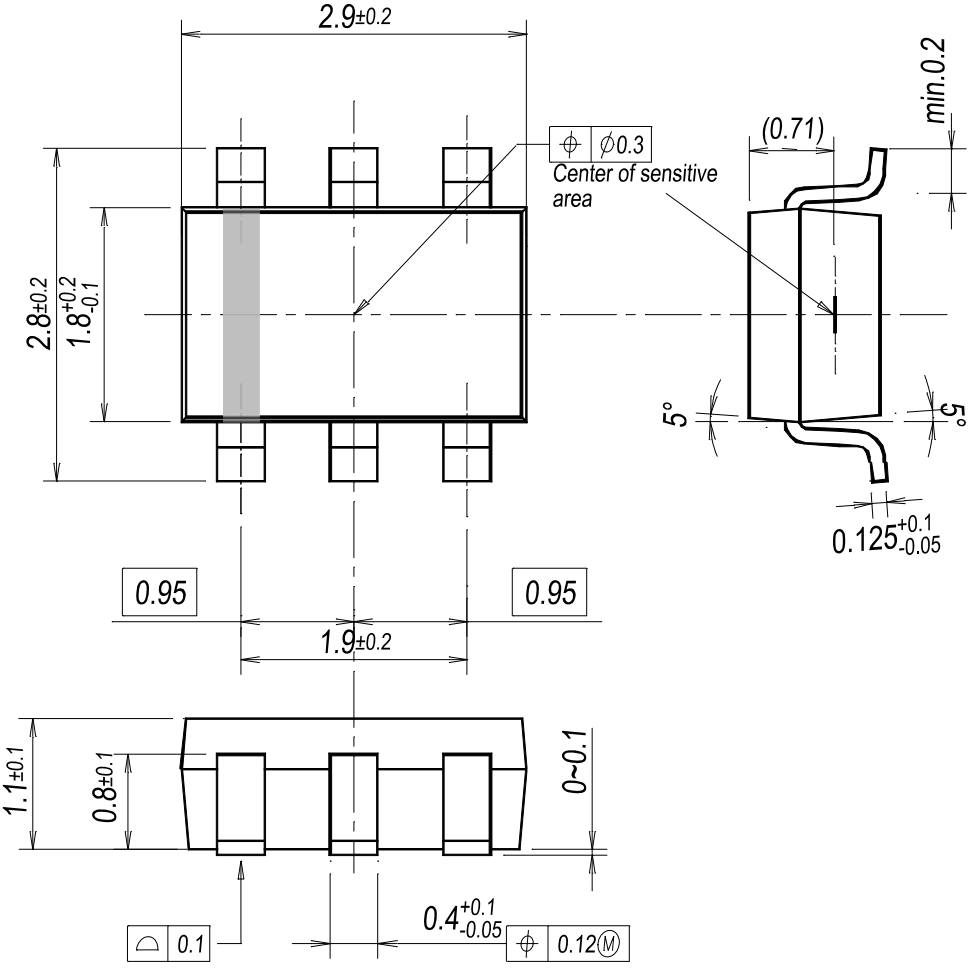


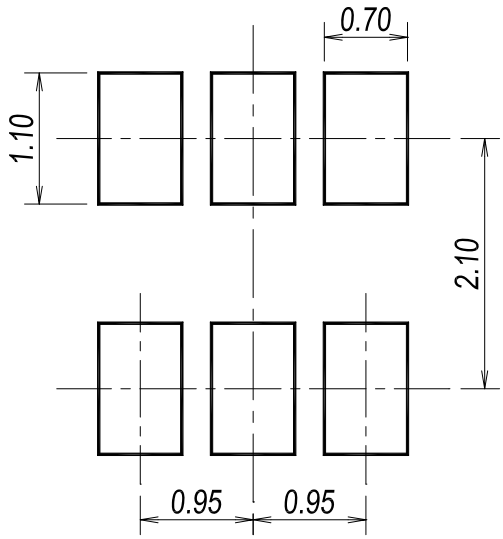
Figure 12. Outline Dimensions

* The center of the sensitive are is located within a φ0.3mm circle.
* Lead flatness: The standoff differences among terminals are Max. 0.1mm.
* The sensor part is located at 0.71mm (Typ.) deep from the marked surface.

14.2. Material of Terminals

Material:	Cu alloy
Plating:	Sn 100%
Thickness:	10μm (Typ.)

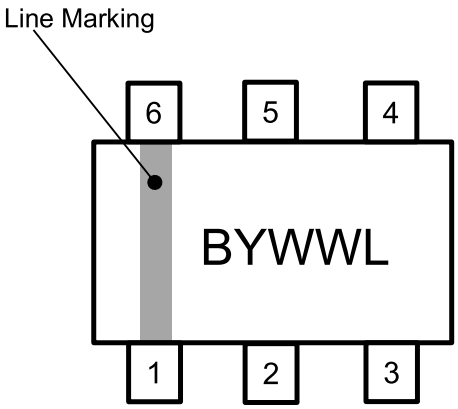
14.3. Land Pattern



Unit: mm

Figure 13. Land Pattern

14.4. Marking



Marking is performed by laser.

Product name	B(AK8779B)
Date code	YWWL
	Y: Manufactured Year
	WW: Manufactured Week
	L: Lot Number

Figure 14. Marking

IMPORTANT NOTICE

0. Asahi Kasei Microdevices Corporation (“AKM”) reserves the right to make changes to the information contained in this document without notice. When you consider any use or application of AKM product stipulated in this document (“Product”), please make inquiries the sales office of AKM or authorized distributors as to current status of the Products.
1. All information included in this document are provided only to illustrate the operation and application examples of AKM Products. AKM neither makes warranties or representations with respect to the accuracy or completeness of the information contained in this document nor grants any license to any intellectual property rights or any other rights of AKM or any third party with respect to the information in this document. You are fully responsible for use of such information contained in this document in your product design or applications. AKM ASSUMES NO LIABILITY FOR ANY LOSSES INCURRED BY YOU OR THIRD PARTIES ARISING FROM THE USE OF SUCH INFORMATION IN YOUR PRODUCT DESIGN OR APPLICATIONS.
2. The Product is neither intended nor warranted for use in equipment or systems that require extraordinarily high levels of quality and/or reliability and/or a malfunction or failure of which may cause loss of human life, bodily injury, serious property damage or serious public impact, including but not limited to, equipment used in nuclear facilities, equipment used in the aerospace industry, medical equipment, equipment used for automobiles, trains, ships and other transportation, traffic signaling equipment, equipment used to control combustions or explosions, safety devices, elevators and escalators, devices related to electric power, and equipment used in finance-related fields. Do not use Product for the above use unless specifically agreed by AKM in writing.
3. Though AKM works continually to improve the Product’s quality and reliability, you are responsible for complying with safety standards and for providing adequate designs and safeguards for your hardware, software and systems which minimize risk and avoid situations in which a malfunction or failure of the Product could cause loss of human life, bodily injury or damage to property, including data loss or corruption.
4. Do not use or otherwise make available the Product or related technology or any information contained in this document for any military purposes, including without limitation, for the design, development, use, stockpiling or manufacturing of nuclear, chemical, or biological weapons or missile technology products (mass destruction weapons). When exporting the Products or related technology or any information contained in this document, you should comply with the applicable export control laws and regulations and follow the procedures required by such laws and regulations. The Products and related technology may not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations.
5. Please contact AKM sales representative for details as to environmental matters such as the RoHS compatibility of the Product. Please use the Product in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. AKM assumes no liability for damages or losses occurring as a result of noncompliance with applicable laws and regulations.
6. Resale of the Product with provisions different from the statement and/or technical features set forth in this document shall immediately void any warranty granted by AKM for the Product and shall not create or extend in any manner whatsoever, any liability of AKM.
7. This document may not be reproduced or duplicated, in any form, in whole or in part, without prior written consent of AKM.