



AK8781

Hall Effect Latch

1. General Description

The AK8781 is an ultra small package Hall effect latch which is suitable for small brushless DC motors. Its fast response time is useful for high performance precision motors and actuators.

2. Features

- Product type : Bipolar latch
- Operating point : 1.9mT (typ.)
- Operating logic : $V_{OUT} = \text{Low}$ at north pole detection
- Operating temperature : $-40 \sim +125^{\circ}\text{C}$
- Supply voltage : 2.5 ~ 5.5V
- Output type : CMOS output
- Package : Ultra small WL-CSP 0.76 x 0.76 x t0.38mm
- Other : Chopper stabilization, Power down function

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4. Block Diagram and Functions

4.1. Block Diagram

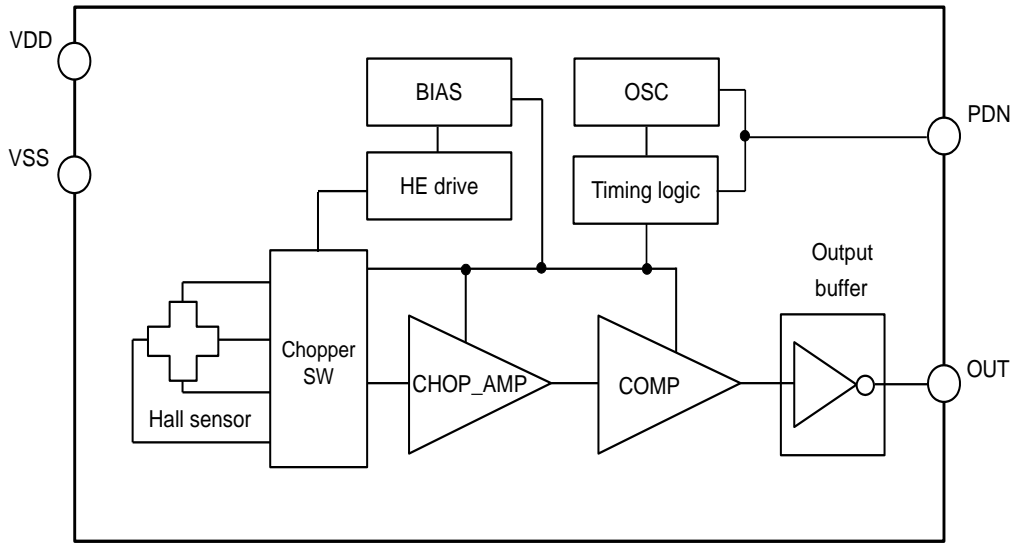


Figure 1. Block diagram

4.2. Functions

Table 1. Circuit configuration

Block	Function
Hall sensor	Hall element fabricated by CMOS process.
Chopper SW	Performs chopping in order to cancel the offset voltage of Hall sensor.
CHOP_AMP	Amplifies Hall output voltage.
COMP	Hysteresis comparator.
Output buffer	CMOS output. During the power down mode, output is latched in its previous state.
BIAS	Generates bias current to other circuits.
HE drive	Generates bias current to Hall element.
OSC	Generates operating clock.
Timing logic	Generates timing signal for Chopper SW, CHOP_AMP and COMP.

5. Pin Configurations and Functions

5.1. Pin Configurations

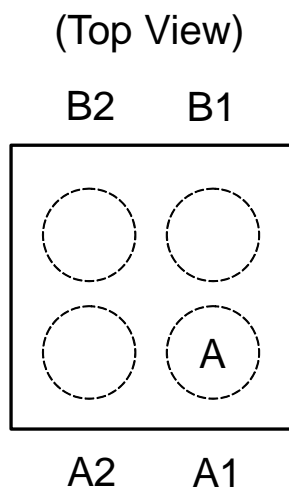


Figure 2. Pin Layout

Note)The package marking “A” indicates product identification and pin A1 indicator.

5.2. Functions

Table 2. Description of pin name and function

No	Pin name	I/O	Function	Note
A1	VDD	-	Power supply pin	
A2	PDN	I	Power down pin High: Device active Low: Device power down	CMOS input. This pin has to be tied to VDD pin when power down function is not used. It is internally pulled down with 180kΩ(Typ.).
B1	VSS	-	Ground pin	
B2	OUT	O	Output pin	CMOS output.

6. Absolute Maximum Ratings

Table 3. Absolute maximum ratings

Parameter	Symbol	Min.	Max.	Unit	Note
Supply voltage	V_{DD}	-0.3	+6.5	V	
Output current	I_{OUT}	-0.5	+0.5	mA	OUT pin
Input voltage	V_{IN}	-0.3	$V_{DD}+0.3^*$	V	PDN pin
Storage temperature	T_{STG}	-55	+125	°C	

*)Less than +6.5V.

Note)Stress beyond these listed values may cause permanent damage to the device.

7. Recommended Operating Conditions

Table 4. Recommended operating conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit
Supply voltage	V_{DD}	2.5	3.0	5.5	V
Operating temperature	T_a	-40		+125	°C

8. Electrical Characteristics

Table 5. Electrical Characteristics (Ta=25°C, V_{DD}=3.0V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Current consumption 1*	I _{DD1}			1	μA	PDN=0V (at Power down)
Current consumption 2*	I _{DD2}		2.5	6	mA	PDN=V _{DD} (at Active)
PDN input current	I _{IN}	10	17	27	μA	PDN=V _{DD} (at Active)
PDN input High voltage	V _{IH}	2.1			V	0.7V _{DD} (Min.)
PDN input Low voltage	V _{IL}			0.3	V	
High level output voltage	V _{OH}	2.6			V	I _{OUT} =-0.5mA V _{DD} -0.4V(Min.)
Low level output voltage	V _{OL}			0.4	V	I _{OUT} =+0.5mA
PDN mode transition time 1	T _{PD1}			50	μs	Active→Power down
PDN mode transition time 2	T _{PD2}			50	μs	Power down→Active
Output refresh period	T _P	2	4	9	μs	

*)I_{OUT}=0mA

9. Magnetic Characteristics(1)

Table 6. Magnetic characteristics (Ta=25°C, V_{DD}=3.0V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Operating point	Bop	0.5	1.9	4.0	mT	
Releasing point	Brp	-4.0	-1.9	-0.5	mT	
Hysteresis	Bh	1.0	3.8		mT	

10. Magnetic Characteristics(2)

Table 7. Magnetic characteristics (Ta=-40~+85°C, V_{DD}=2.5~5.5V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Operating point	Bop	0.4	1.9	4.3	mT	
Releasing point	Brp	-4.3	-1.9	-0.4	mT	
Hysteresis	Bh	0.8	3.8		mT	

Note) The specifications in Table 7 are design targets.

Table 8. Magnetic characteristics (Ta=-40~+125°C, V_{DD}=2.5~5.5V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Operating point	Bop	0.2	1.9	4.8	mT	
Releasing point	Brp	-4.8	-1.9	-0.2	mT	
Hysteresis	Bh	0.4	3.8		mT	

Note) The specifications in Table 8 are design targets.

11. Operational Characteristics

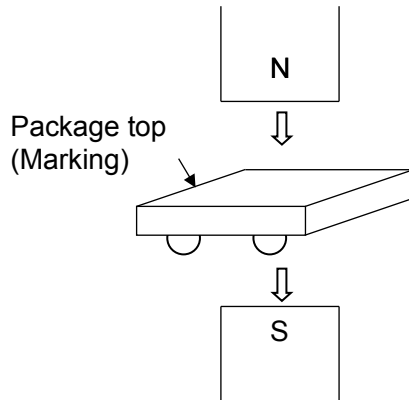


Figure 3. Definition of sensitivity direction

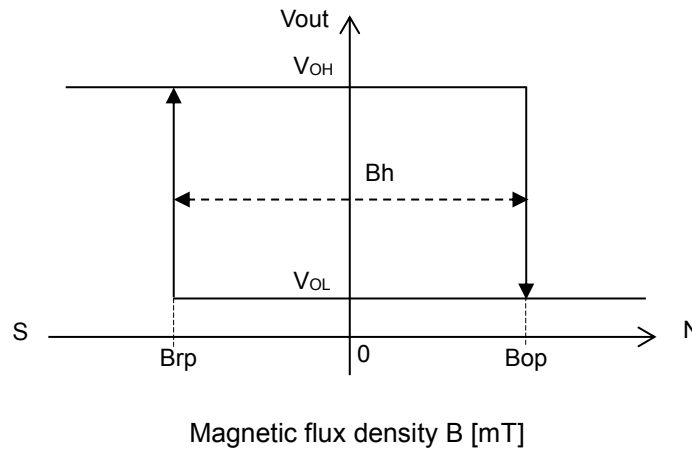


Figure 4. Output switching characteristics

Note) Positive polarity magnetic flux is defined as the magnetic flux from north pole which is facing the marking face of the package.

The output voltage switches Low when north pole is placed on the marking surface and the magnetic flux density B exceeds Bop. On the other hand , the output voltage switches High when south pole is placed on the marking surface and the magnetic flux density B reduces below Brp.

12. Functional Timing

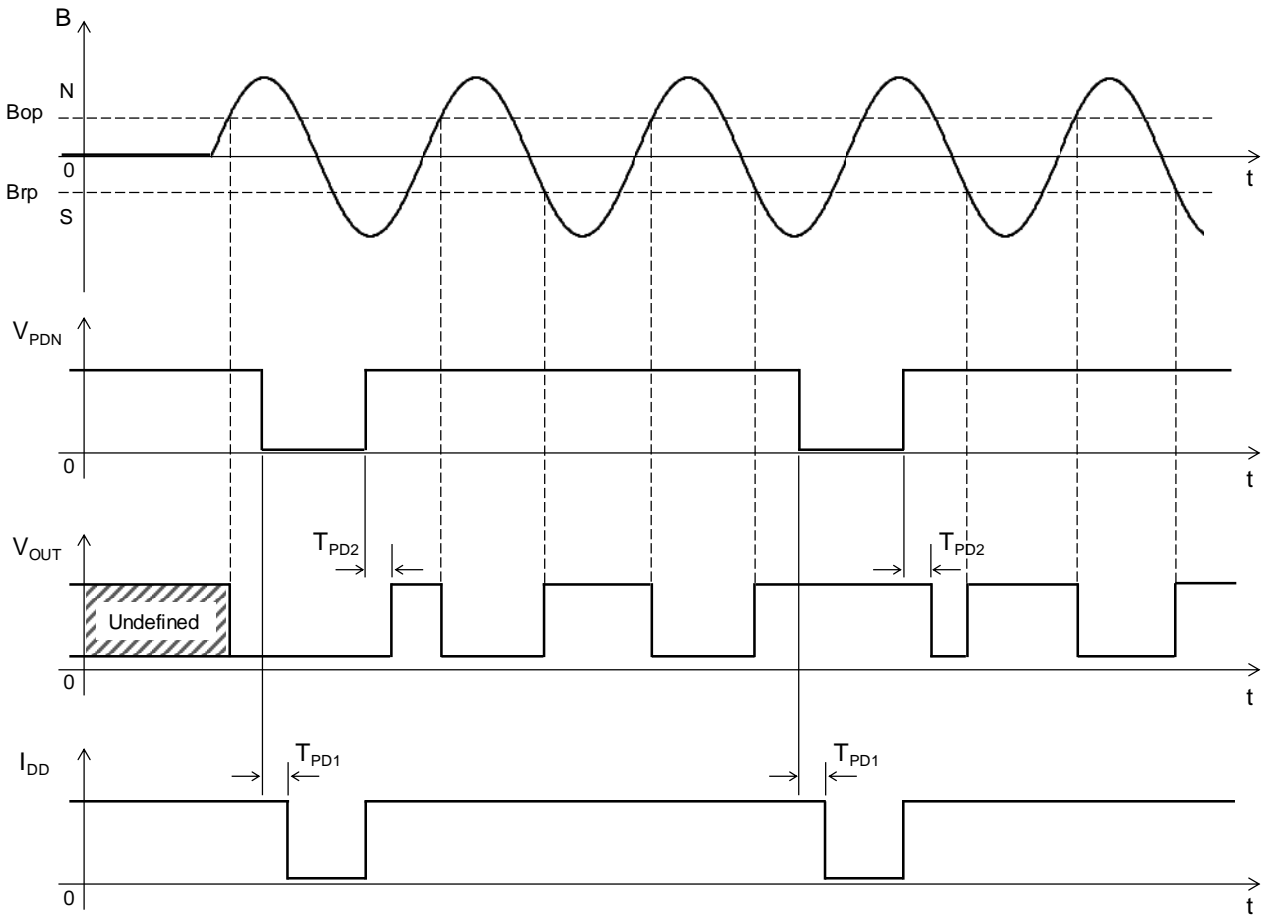


Figure 5. Functional timing chart

- Note1) During power down, output is latched in its previous state.
- Note2) The output settling time from the PDN pin operation is same as T_{PD2} on condition that V_{DD} exceeds 2.5V.
- Note3) The PDN pin has to be tied to the VDD pin when the power down function is not to be used.
- Note4) In case of the power down function is used, the PDN pin should be kept Low until the VDD reaches 2.5V for proper operation.

13. Typical Characteristic Data (for reference)

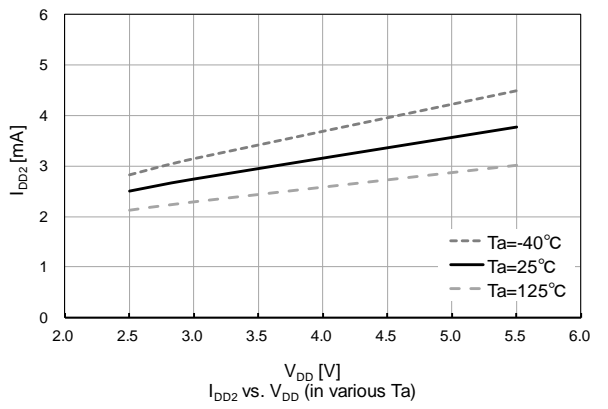
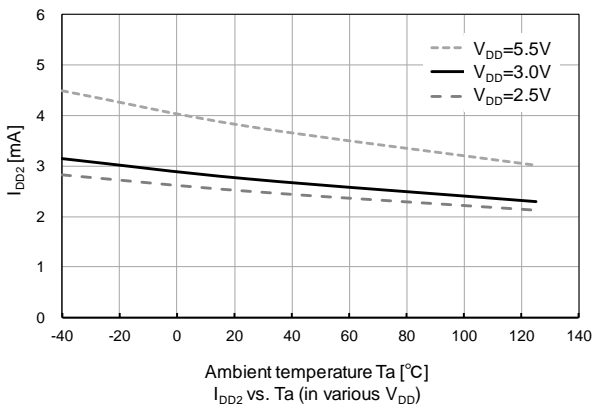
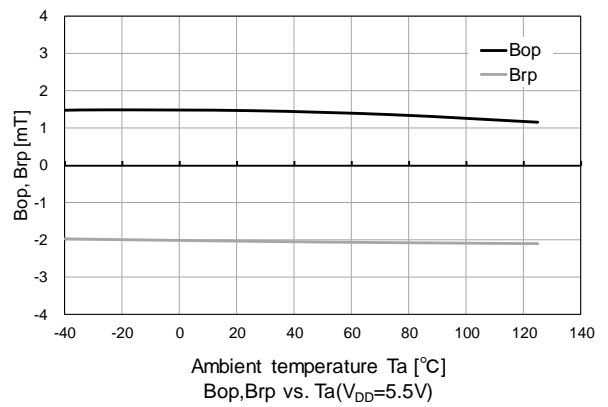
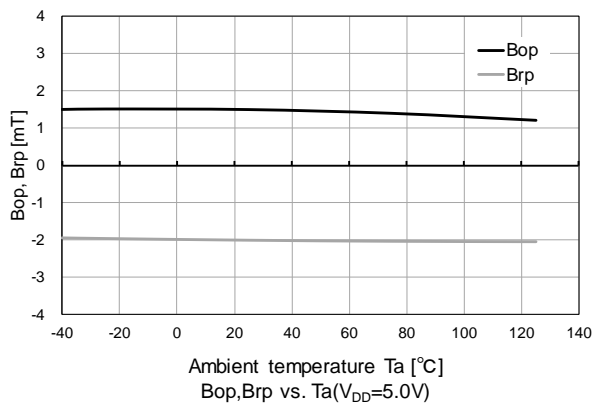
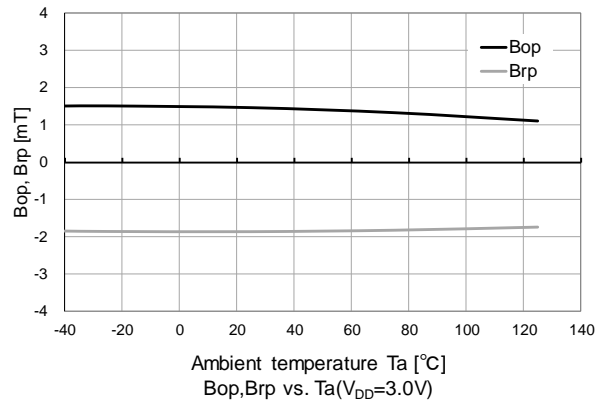
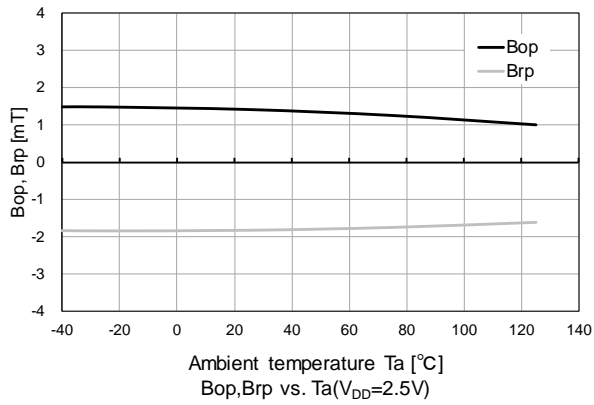


Figure 6. Temperature dependence of Bop, Brp and current consumption

14. Recommended External Circuits

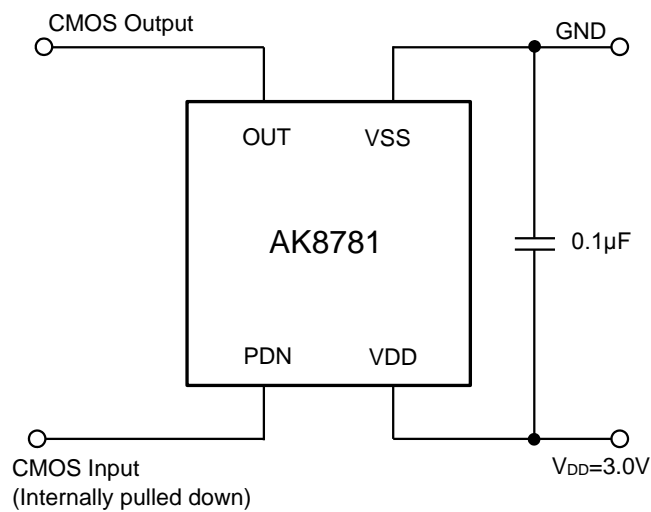


Figure 7. Recommended external circuit

15. Package

15.1. Outline Dimensions

Unit : mm

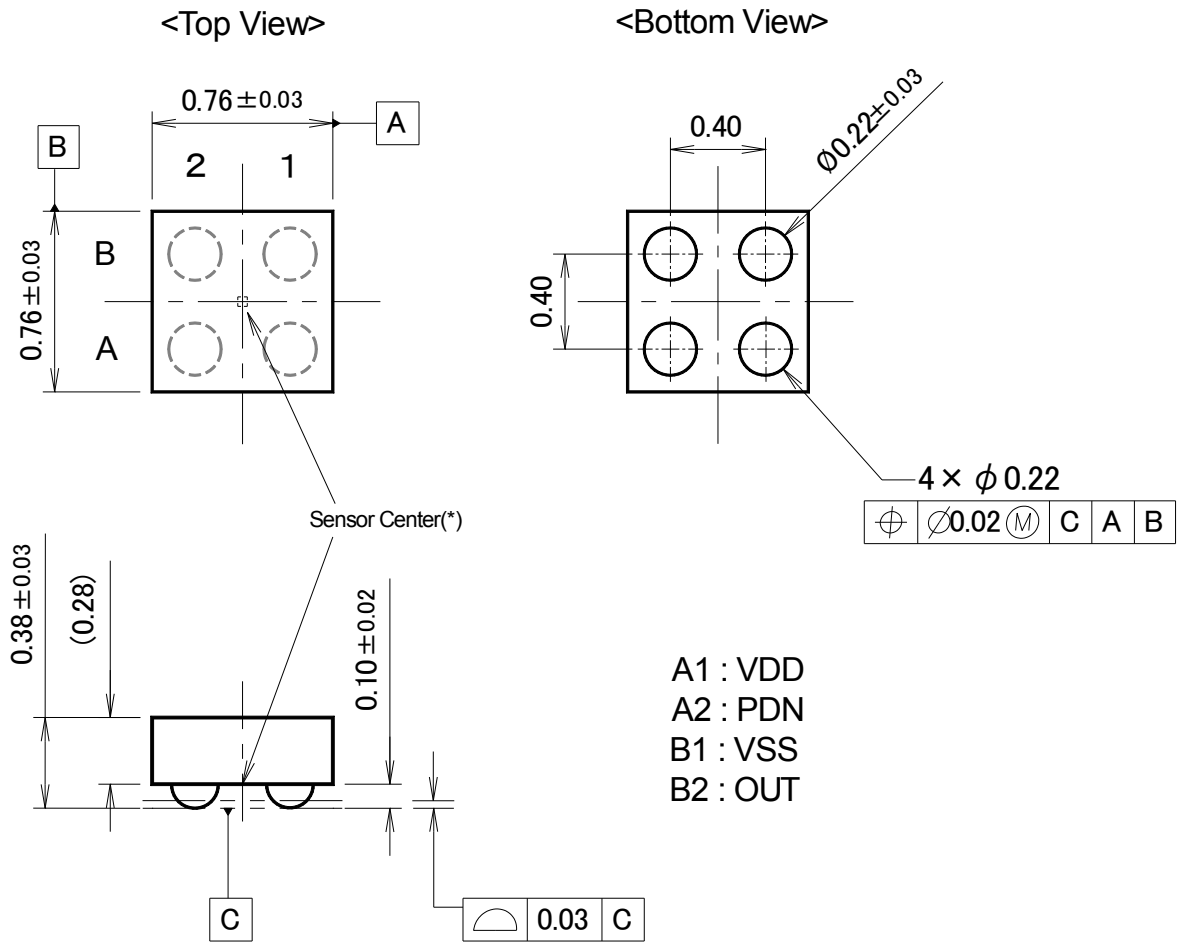


Figure 8. Package dimensions

*) Sensitive area position referenced to the center of package within □0.05mm square.
Material of terminals :SAC405

15.2. Pad Dimensions

Unit:mm

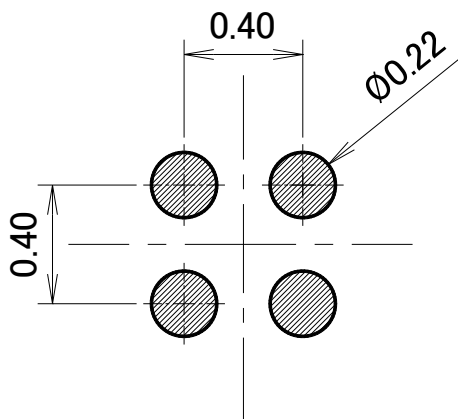
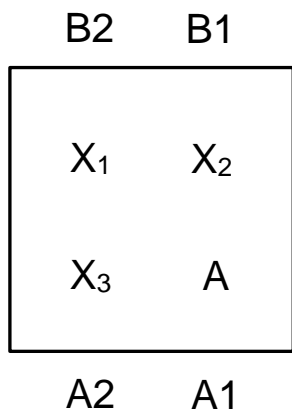


Figure 9.Land Pattern (for reference)

15.3. Marking



Marking is performed by laser

Product identification : A (=AK8781)
and pin A1 indicator

Date code : X₁ Last one digit of manufactured year
: X₂ Lot
: X₃ Lot

Figure 10. Marking

16. Revision History

Date (Y/M/D)	Revision	Reason	Page	Contents
19/2/18	00	FirstEdition		

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