AK2970

Zero Drift Operational Amplifier

1. General Description

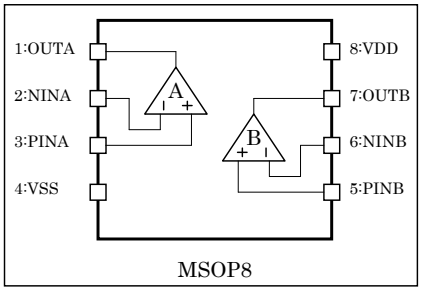
AK2970 is the dual channel CMOS operational amplifires which is available to output with very low input offset voltage (± 5μV@10V) and near zero input offset dirft.
It's operated with very small current consumptions, 2mA typ. (VDD:10V), which is available to operate full swing signals in output. AK2970 is appropriate to Sensor Pre Amp. applications.

2. Features

☐ Wide Supply Operation Range: 4.5V ~ 13.2V (±2.25V ~ ±6.6V)
☐ Very Low Input Offset Voltage : ± 5μV max. (@VDD:10V)
☐ Near Zero Dirft over time and temperature : ± 20nV/°C max. (@VDD:10V)
☐ Input Voltage Range : VSS – VDD
☐ Full Swing Outputs to 10kΩ Load
☐ Power Supply Current : 2mA typ. (@VDD: 10V, No Load)
☐ Gain Bandwidth : 4MHz typ.
☐ Slew Rate : 4V/μsec typ.
☐ Operationg Temperature Range : –40 ~ 125°C
☐ Package : MSOP8

Part Name	Channel Nummber	Package
AK2970H	2	MSOP8

3. Block Diagram



(AK2970)

4. Pin Configurations and Functions

Pin number	Pin Name	I/O : Note 1	Function
1	OUTA	AO	Amplifier A Output
2	NINA	AI	Amplifier A Inverted Input
3	PINA	AI	Amplifier A No Inverted Input
4	VSS	PWR	Power Supply Ground
5	PINB	AI	Amplifier B No Inverted Input
6	NINB	AI	Amplifier B Inverted Input
7	OUTB	AO	Amplifier B Output
8	VDD	PWR	Positive Power Supply

Note 1.
PWR : Power Supply
AI : Analog Input
AO : Analog Output

5. Absolute Maximum Ratings

(VSS = 0V : Note 2)

Parameter	Symbol	Min	Max	Units
Supply Voltage	VDD	−0.3	14	V
Input Voltage	V_{TD}	−0.3	VDD + 0.3	V
Input Current	I_{IN}	−10	+10	mA
Storage Temperature Range	T_{stg}	−55	150	°C

Note 2. All voltage with respect to ground
Note 3. Operational at or beyond these limits may result in permanent damage to the device. Normal operation is not guaranteed at these extremes.

6. Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Units	Conditions
Operationg Temperature Range	T_a	−40		125	°C	
Supply Voltage	VDD	4.5		13.2	V	

7. Electrical Characteristics

☐ DC Characteristics (typical condition is VDD=10V,Ta=25°C)

VDD:10V, Vcm=VDD/2, Ta:-40 to 125°C, unless otherwise noted

Parameter	Symbol	Conditions	min	Typ	Max	Units
Input Voltage Offset	VIO	Ta=25°C,inverting-amp, gain@60dB		±1	±5	μV
		VDD:10V,all temperature range, inverting-amp, gain@60dB			±5	μV
		VDD≥5V,All temperature Inverting amp@60dB			±10	μV
		VDD≥4.5V,All temperature Inverting amp@60dB			±20	μV
Input Voltage Offset Drift	VIOD	Inverting amp@60dB		±5	±20	nV/℃
		VDD≥6V Inverting-amp@60dB			±40	nV/℃
		VDD≥5V Inverting-amp@60dB			±50	nV/℃
		Vdd≥4.5V, Inverting-amp@60dB			±70	nV/℃
Input Bias Current	IS	Ta=25°C (@1/2*VDD) Rf=510kΩ : Note 4		±50		pA
Input Common Mode Range	VICM		VSS		VDD	V
Output Voltage Swing	VOM	RL≥10kΩ (@1/2*VDD)	0.1		VDD-0.1	V
CMRR	CMR	@Common mode rage	110	130		dB
		VDD≥5V @ Common mode rage	105			dB
		VDD≥4.5V @ Common mode rage	85			dB
		VDD≥4.5V @(VSS~[VDD-0.1])	100			dB
PSRR	SVR	VDD:4.5V ~ 13.2V	110	130		dB
Large Signal Voltage Gain	Av	RL≥10kΩ (@1/2*VDD) @Max. output range	110	130		dB
Short Circuit Current	IOS	Short Vout and VDD or VSS, by voltage follower		±50		mA
		Short Vout and VDD or VSS, by voltage follower VDD:13.2V			±180	mA
Output Current	IOS	Vcm:VSS@out [VSS+1V] Vcm:VDD@out [VDD-1V]		±15		mA
		VDD:4.5V	±5			mA
Power Supply Current	Idd	VDD:10V :Note 5		1.0	1.8	mA/ch
		VDD:4.5 ~ 13.2V :Note 5		1.0	2.5	mA/ch

Note 4. It is defined by "offset voltage (Voff)" of transformer impedance amplifier. When beedback resister is Rf. Input bias current is expressed by a following formula. Is= Voff/Rf
When using it as transformer impedance amplifier, "VCOM=VDD/2" are recommended.

Note 5. It does not contain output drive current.

■ Analog AC Characteristics (typ. value condition : VDD=10V, Ta=25°C)

VDD=10V、Vcm=VDD/2、Ta:-40~125°C , unless otherwise noted

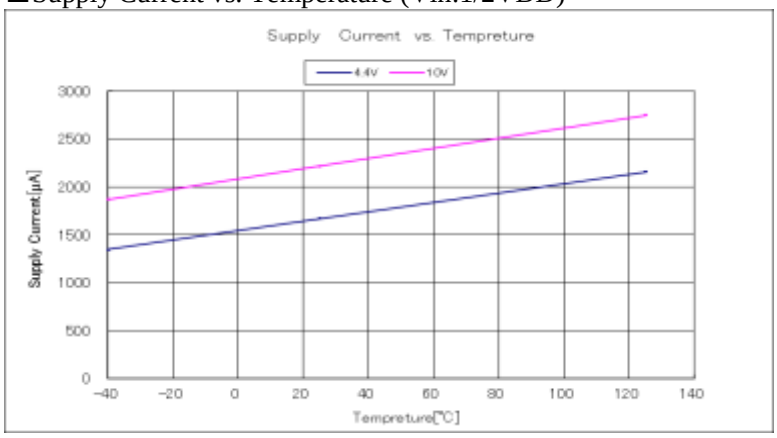
項　　目		記号	条件	min	Typ	max	単位
Gain Banb Width		GB	Inverting-amp@60dB Load cap.= 20pF		4		MHz
			VDD:13.2V			6.5	MHz
			VDD:4.5V	3			MHz
Slew rate		SR	|Av|=1, Load cap.=20pF, 10%⇔90%		4		V/μs
			VDD:13.2V			10	V/μs
			VDD:4.5V	1.7			V/μs
Voltage Noise Density		VNI	@1kHz		50		nVrms/√Hz
			0.1~10Hz :Note 6		0.8		μVpp
			0.1~1Hz :Note 6		0.3		μVpp
Overload Recovery Time		TOR	Av:-50 times, Load capacitance: 20pF, 200mV input, VDD:10V, ±10% attainment time of the last value		10		μsec
Input Capacitance	Differential	CIND			1.5		pF
	Common Mode	CINC			5		pF
Maximum Capacitance Loads		CL				150	pF

Note 6. It was converted from noise density.

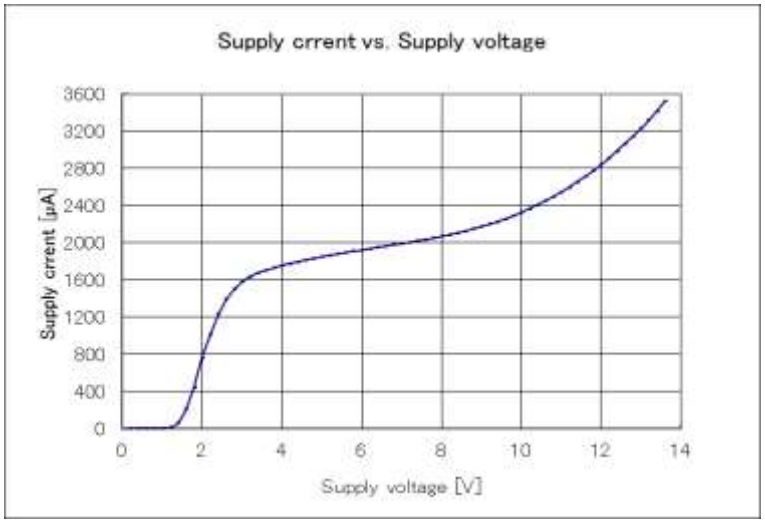
<Reference information>
- When output load=150pF , phase margin = 70deg typ.
- Chopper clock frequency : 10kHz typ.

8. Typical Operating Characteristics (Reference)

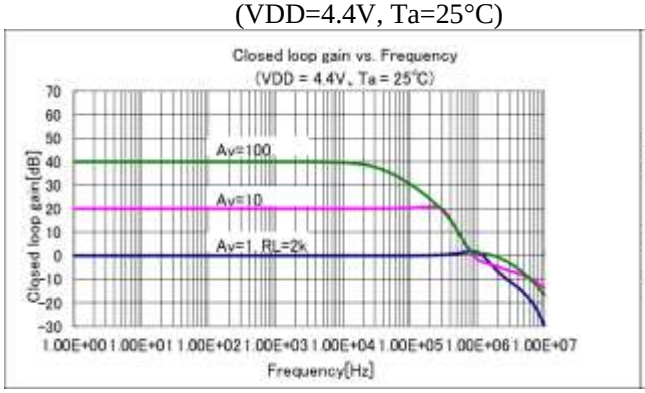
■Supply Current vs. Temperature (Vin:1/2VDD)



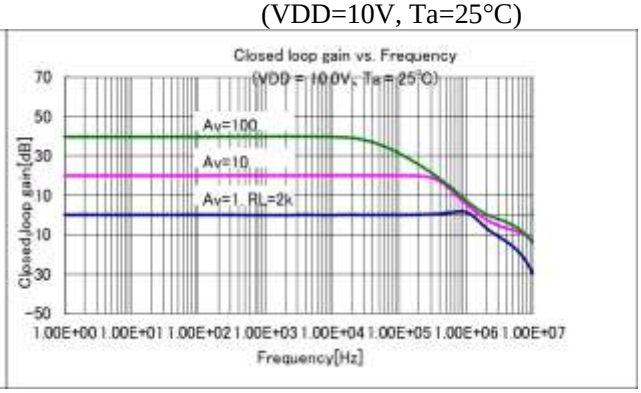
■Supply Current vs. VDD (Vin:1/2VDD)



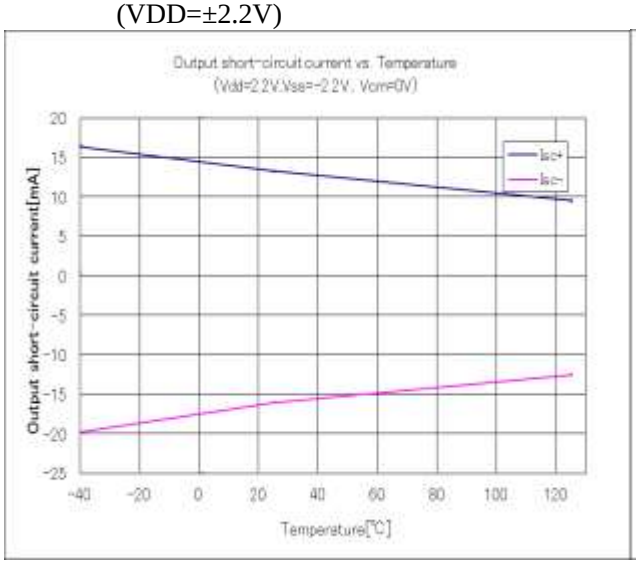
■Closed loop gain vs. frequency
(VDD=4.4V, Ta=25°C)



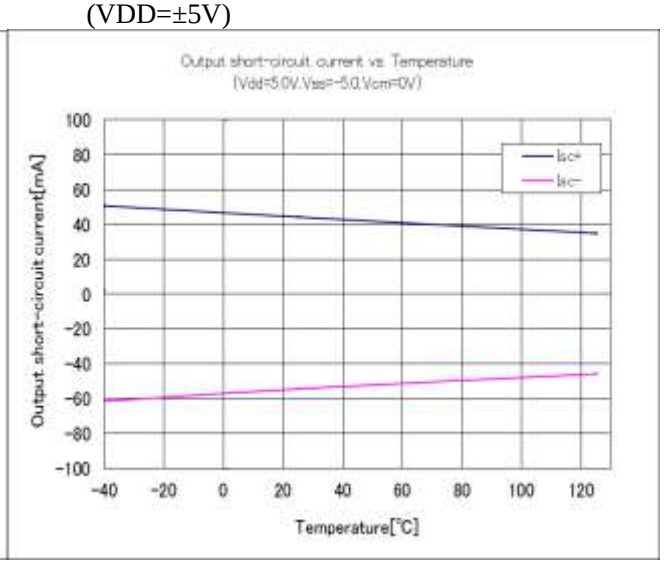
■Closed loop gain vs. frequency
(VDD=10V, Ta=25°C)



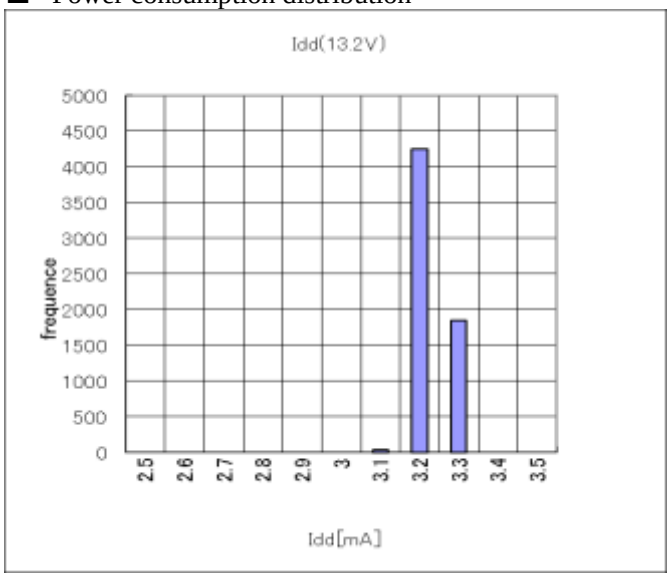
■ Short circuit current vs. Temperature (VDD=±2.2V)



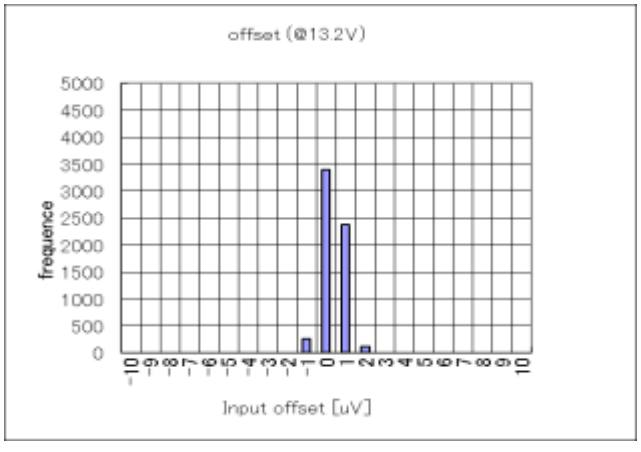
■ Short circuit current vs. Temperature (VDD=±5V)



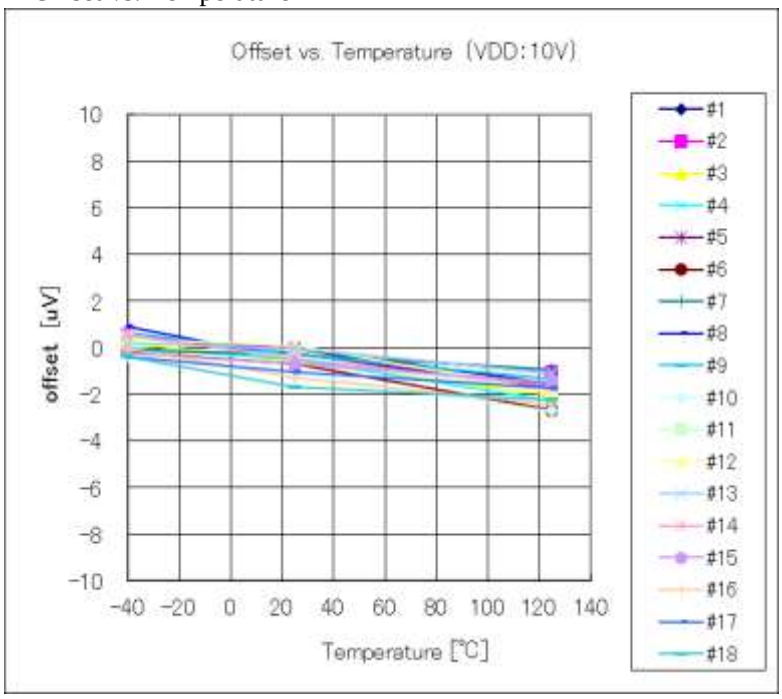
■ Power consumption distribution



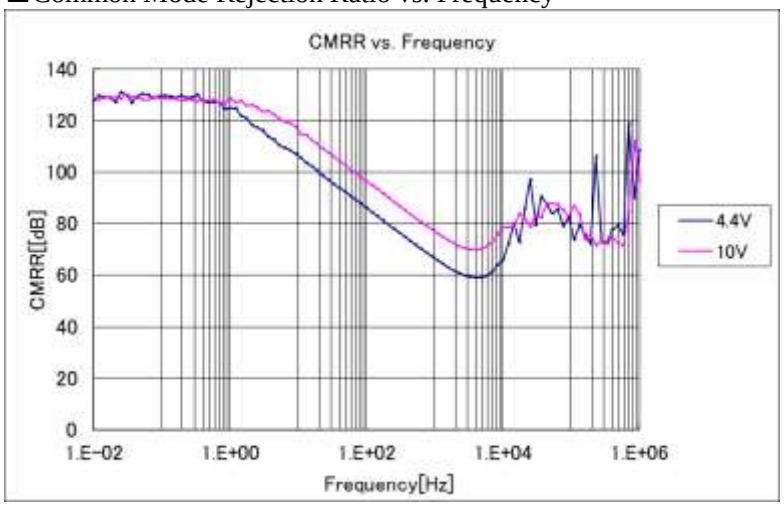
■ Offset distribution



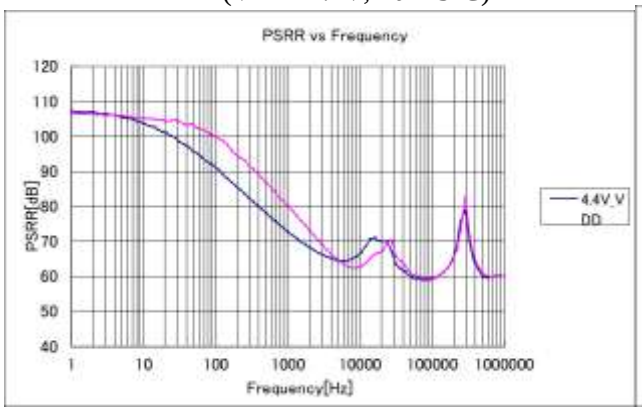
■Offset vs. Temperature



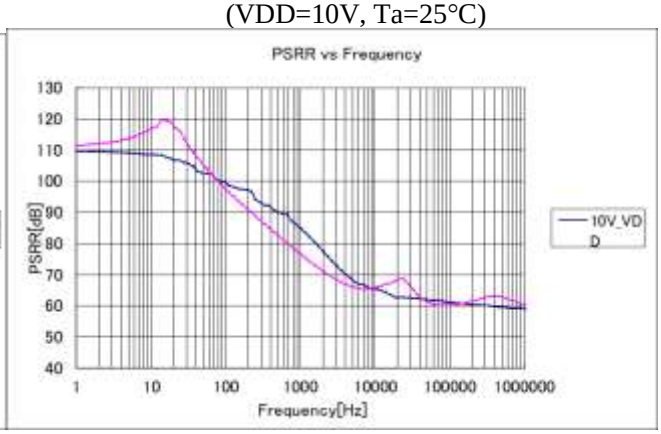
■Common Mode Rejection Ratio vs. Frequency



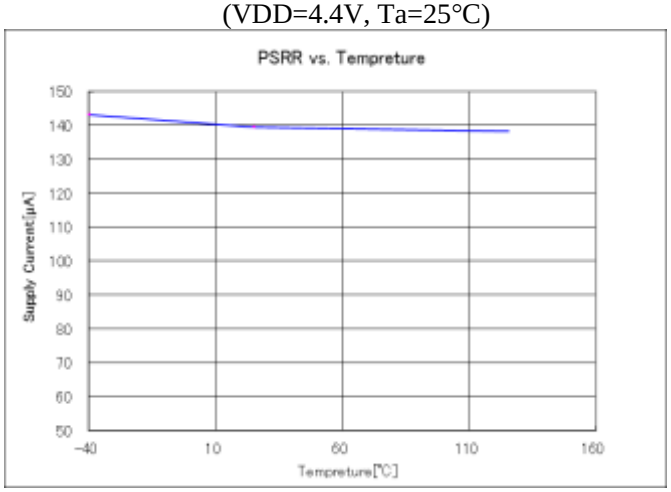
■ Power Supply Rejection Ratio vs. Frequency
(VDD=4.4V, Ta=25°C)



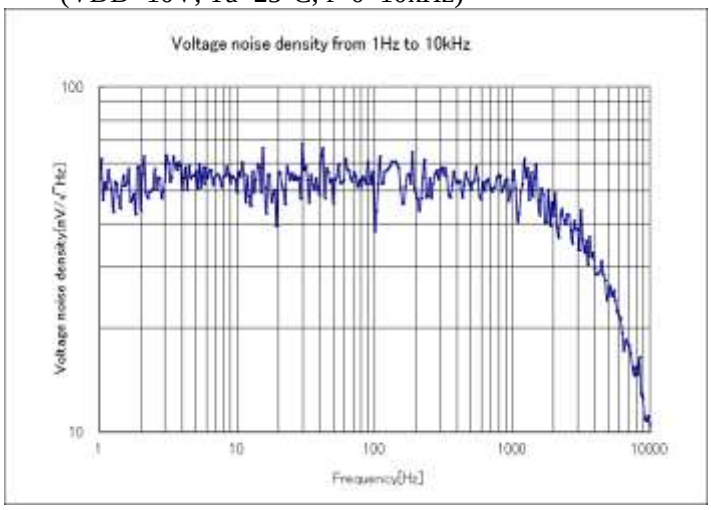
■ Power Supply Rejection Ratio vs. Frequency
(VDD=10V, Ta=25°C)



■ Power Supply Rejection Ratio vs. Temperature
(VDD=4.4V, Ta=25°C)



■ Voltage noise density
(VDD=10V, Ta=25°C, f=0~10kHz)

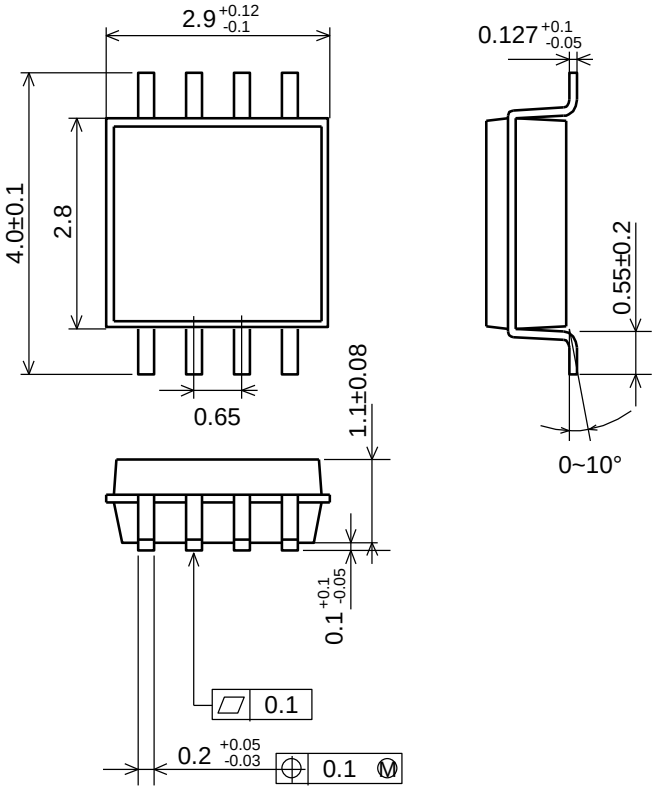


9. Package

9.1. Outline Dimensions

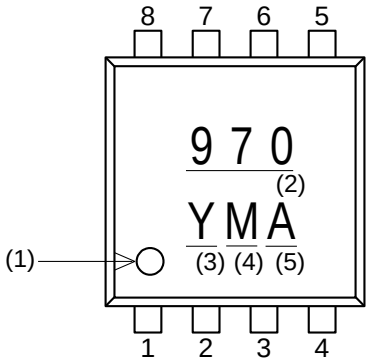
(unit : mm)

MSOP8



9.2.Marking

MSOP8



(1) 1 pin indicator
(2) Part number (AK2970 : 970)
(3) Date code (Year)
(4) Date code (Month)
(5) In-house control code

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