AK2975

Precision High Speed Low Noise Operational Amplifier

1. Genaral Description

AK2975 is the dual channel Precision CMOS operational amplifiers which is available to output with low Input Offset Voltage (±200μV typ.) , High Band Width and Low Noise.
AK2975 is appropriated to Sensor Pre Amp. Applications.

2. Feartures

AK2975 is the dual channel Precision CMOS operational amplifiers which is available to output with low Input Offset Voltage (±200μV typ.) , High Band Width and Low Noise.
AK2975 is appropriated to Sensor Pre Amp. Applications.

- Single Supply Operation Range : 2.7V ~ 5.5V
- Low Input Offset Voltage : ±200μV typ.
  - Offset Drift : ±1μ V/°C typ.
  - Input Voltage Noise : 10nVrms/$\sqrt{\mathrm{Hz}}$ Typ. (@ 1kHz)
  - Input Common Mode Range : VSS to VDD
  - Output Voltage Range : [VSS+0.03] to [VDD-0.03]V @ (RL:10kΩ)
- Power Supply Current : 4mA/ch. typ. (VDD: 5V, No Load)
- Gain Bandwidth : 50MHz typ.
- Slew Rate : 20V/μsec typ.
- Operating Temperature Range : −40 ~ 125°C
- Package : MSOP8

Part Name	Channel Number	Package
AK2975H	2	MSOP8

3. Table of Contents

4. Pin Location

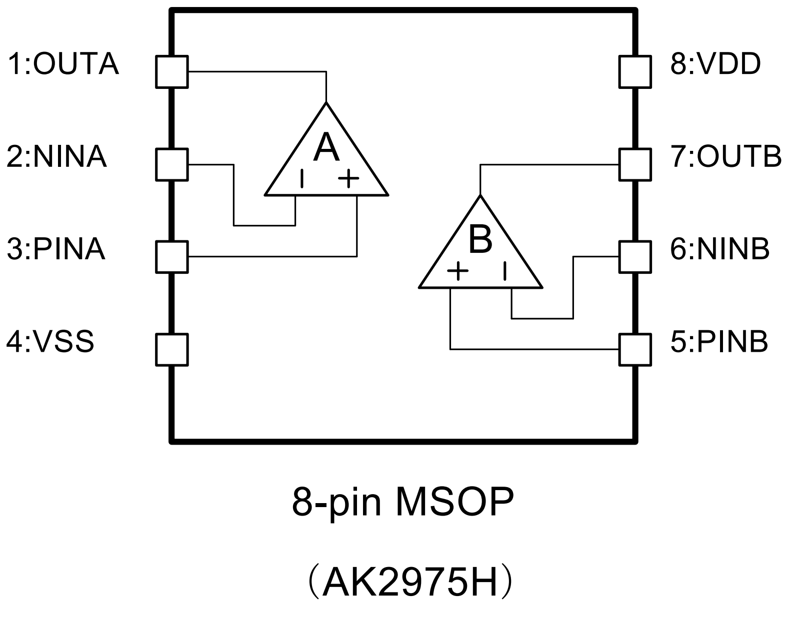


Figure 4.1 AK2975 Pin Location

5. Pin Function Descriptions

Pin number	Name	I/O (* 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

6. Absolute Maximum Ratings

VSS=0V (* 2)

Parameter	Symbol	Min	Max	Units
Supply Voltage	VDD	−0.3	6.5	V
Input Voltage	V_{TD}	−0.3	VDD + 0.3	V
Input Current	I_{IN}	−10	+10	mA
Storage Temperature Range	T_{stg}	−65	150	°C

Note
* 2. All voltage with respect to ground

[WARNING] Operational 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

VSS=0V (* 2)

Parameter	Symbol	Min.	Typ.	Max.	Units	Conditions
Operationg Temperature Range	T_a	−40		125	°C	
Ground level (* 2)	VSS	0	0	0	V	
Supply Voltage	VDD	2.7		5.5	V	

[WARNING] We asuumes no responsibility for the usage beyond the conditions in this datasheet.

8. Electrical Characteristics

☐ DC Characteristics (typical condition is VDD= 5V, V_{CM}= VDD/2 (* 3), Ta= 25ºC)

VDD= 5.0V, VCM= VDD/2, VSS= 0V, Ta= −40~125°C, unless otherwise noted

Parameter	Min.	Typ.	Max.	Units	Conditions
Input Voltage Offset :V_{IO}		± 200	±1000	μV	VCM = VDD/2 (* 3)
Input Voltage Offset Drift :V_{IOD}		± 1	±3.5	μV/°C	(* 4)
Input Bias Current :I_S		± 1	± 200	pA	
Input Common Mode Range :V_{ICM}	VSS		VDD	V	
Output Voltage Swing :V_{OM}	0.03		VDD−0.03	V	RL≥10kΩ
Common Mode Rejection Ratio:CMR	60	90		dB	(* 5)
Power Supply Rejection Ratio :SVR	80	100		dB	(* 6)
Large Signal Voltage Gain :A_V	95	115		dB	RL≥10kΩ connected to VDD/2 (* 7)
Output Short Current :I_{OS}		± 450		mA	
Output Current :I_O		± 350.		mA	
Power Supply Current :Idd		4	5	mA/ch.	VDD:5V (* 8)

Notes

* 3. V_{CM} means the common voltage of an input pin (PIN/NIN).

* 4. V_{IOD} = [(high temperature side WST(**)) –(low temperature side WST(**))]/[125°C－(－40°C)）]
  ** WST is MIN. or MAX. value of V_{IO}.
  ex.) If high temperature side is MAX. and low temperature side is MIN. the V_{IOD} polarity is positive. And if high temperature side is MIN. and low temperature side is MAX. the V_{IOD} polarity is negative.

* 5. CMRR = 20 x Log[(VDD-VSS) / (α)]
  ‘(α) is a Max. value among [(Offset at input = VDD)-(Offset at Input = VSS)] and
  [(Offset at input = VDD)-(Offset at input = VDD/2)] and
  [(Offset at input = VDD/2)-(Offset at input = VSS)].

* 6. PSRR = 20 x Log[(Max. supply voltage – Min. supply voltage) / (Offset at Max. supply voltage – Offset at Min. supply voltage)]

* 7. A_V = 20×LOG [((VDD-0.2)－(VSS+0.2)) /
  ((Offset at output= VDD－0.2) － (Offset at output = VSS+0.2)）]

* 8. It contains consumption of one OPAmp circuit. It doesn't include an output drive current.

☐ AC Characteristics

VDD= 5.0V, V_{CM}= VDD/2, VSS= 0V, Ta= –40~125°C, unless otherwise noted

Parameter		Min.	Typ.	Max.	Units	Conditions
Gain Bandwidth (GBW)			50		MHz	Ta=25°C
Slew Rate			20		V/µs	Ta=25°C
Input Voltage Noise			10		nVrms /$\sqrt{\mathrm{Hz}}$	@1kHz :IIN1
			5		nVrms /$\sqrt{\mathrm{Hz}}$	@10kHz :IIN2
THD+N			0.0003		%	Input:1kHz, 1Vrms, Av:1V/V, VDD=5.0V, BW:20Hz ~ 20kHz Ta=25°C
Overload Recovery Time :T_{OR}			160		nsec	AV= –10 times, Input swing:300mV (±2.5V) @90% (* 9)
Input capacitance	Differencial		8		pF	
	Common		7		pF	
Maximum Capacitance Loads :C_L				1000	pF	If the 10Ω resistor is connected in series to the output.

Note

* 9. The definition of “Overload Recovery Time” is following.

- Positive side overload recovery time (Time until it returns to VDD/2 from VDD saturation)

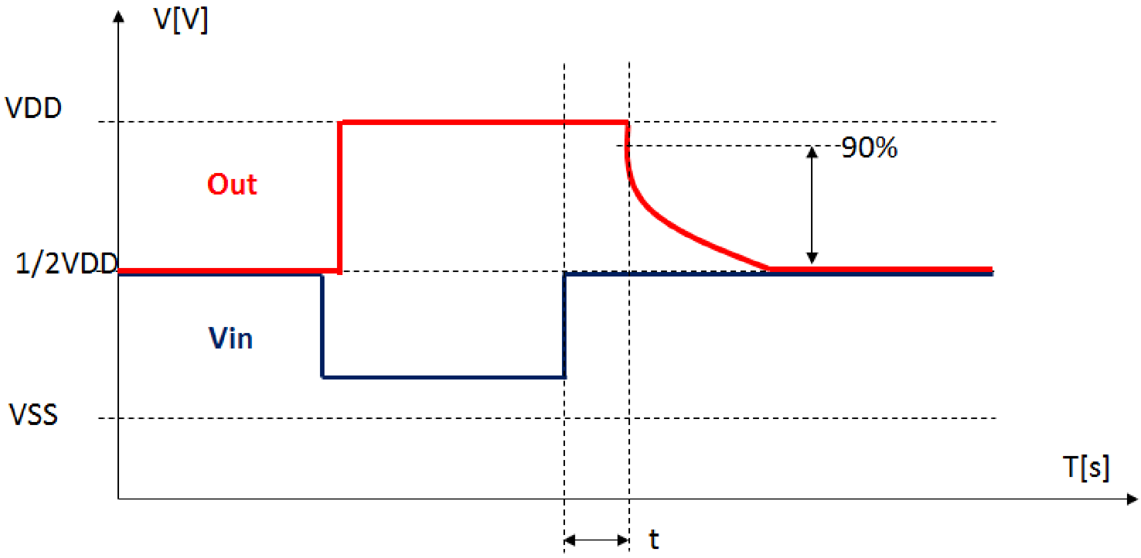


Figure 8.1 Positive side overload recovery time

- Negative side overload recovery time (Time until it returns to VDD/2 from VSS saturation)

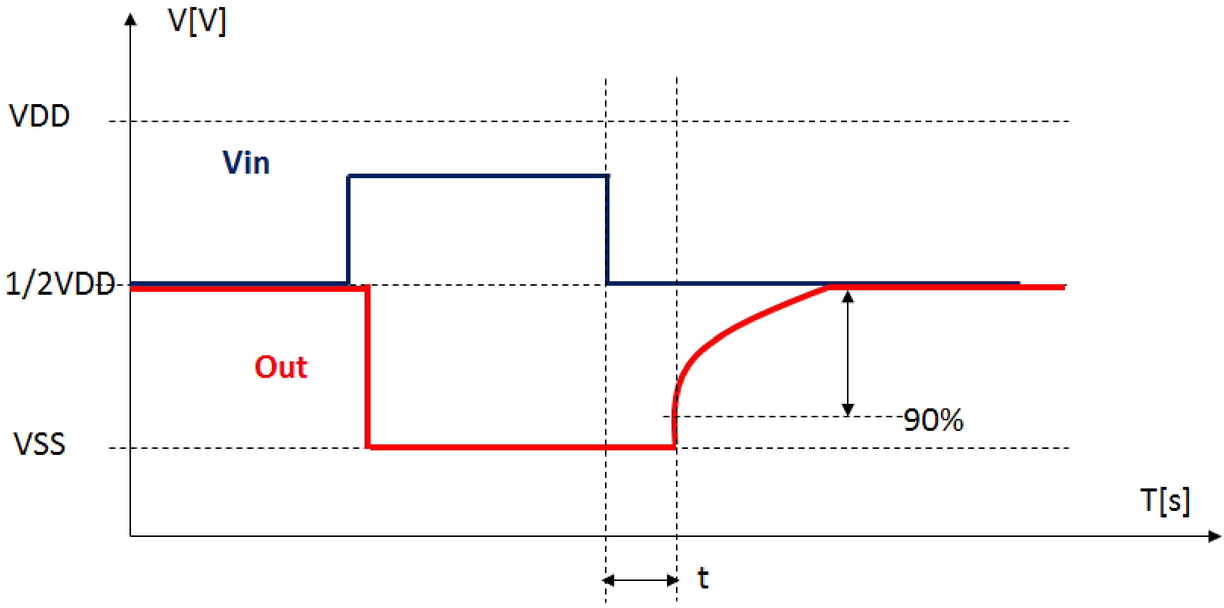


Figure 8.2 Negative side overload recovery time

Note
* 10. Notes for a board design
AK2975 is high-bandwidth amplifier. Therefore if large impedance and inductance are included to a power supply line, the characteristic may get worse. Please place the decoupling capacitor of "0.1µF and 10µF" of a low loss near the power supply pin ,between each power supply terminal and a ground.

9. Typical Operating Characteristics (for reference)

VDD:5.0V, Ta:25°C, CL=0pF unless otherwise noted

9.1 Current consumption – Operating temperature characteristics (Vin/Vout: VDD/2)

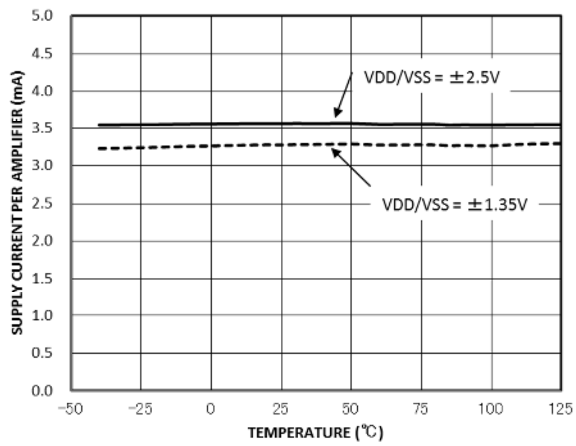


Figure 9.1 Current consumption vs. Operating temperature

[9. Typical Operating Characteristics (for reference) continuation]

9.2 Current consumption – Supply voltage characteristics (Vin/Vout: VDD/2)

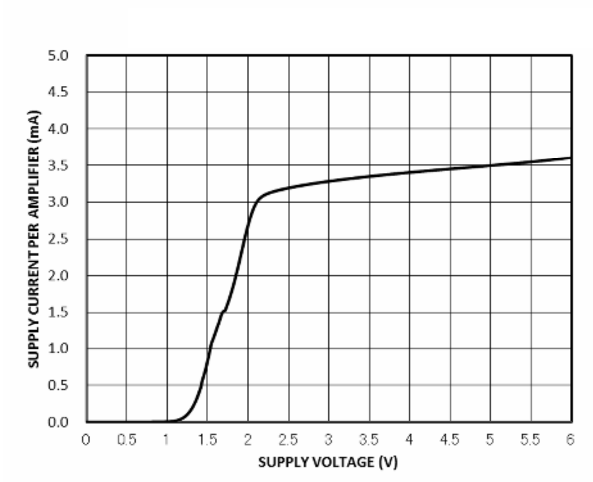


Figure 9.2 Current consumption vs. Supply voltage

9.3 Input offset – Temperature characteristics (Vin/Vout: VDD/2)

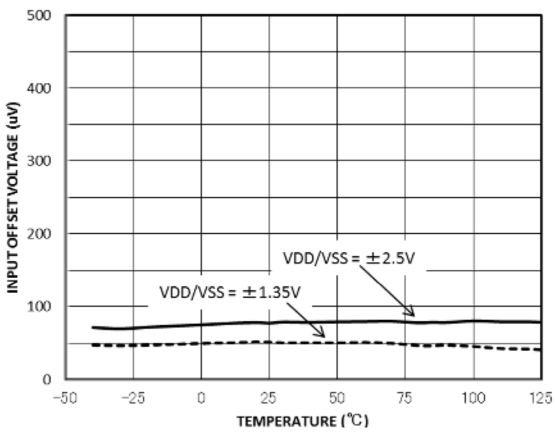


Figure 9.3 Input offset vs. Temperature

[9. Typical Operating Characteristics (for reference) continuation]

9.4 Distribution of Input offset drift (VDD:5V,Vin/Vout: VDD/2,Ta:-40 to 125ºC)

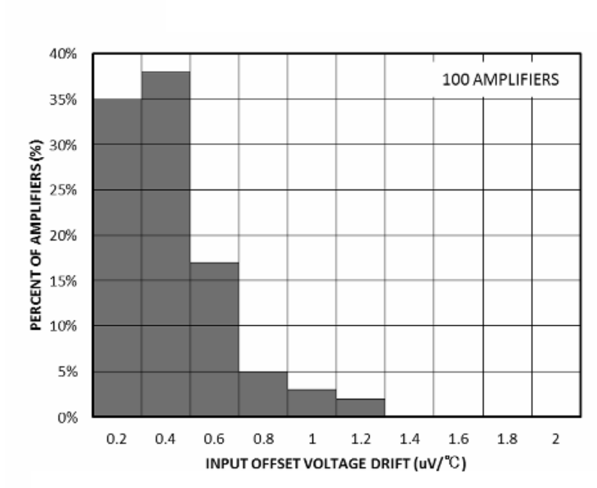


Figure 9.4 Input offset drift distribution

9.5 Distribution of Input offset (VDD:5V,Vin/Vout: VDD/2,Ta:-40 to 125ºC)

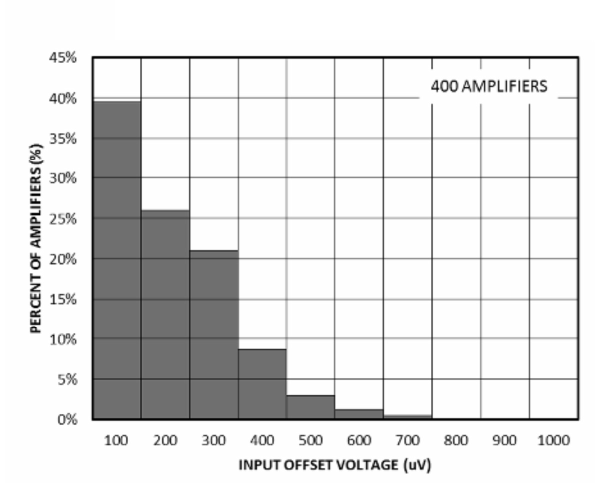


Figure 9.5 Input offset distribution

9.6 Input Bias current – Temperature characteristics

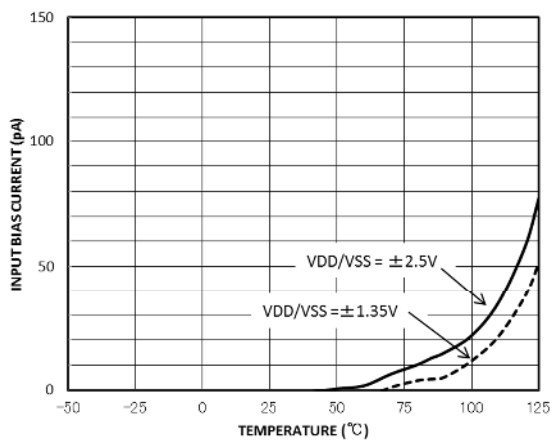


Figure 9.6 Input Bias current vs. Temperature

[9. Typical Operating Characteristics (for reference) continuation]

9.7 Output Voltage - Load current characteristics

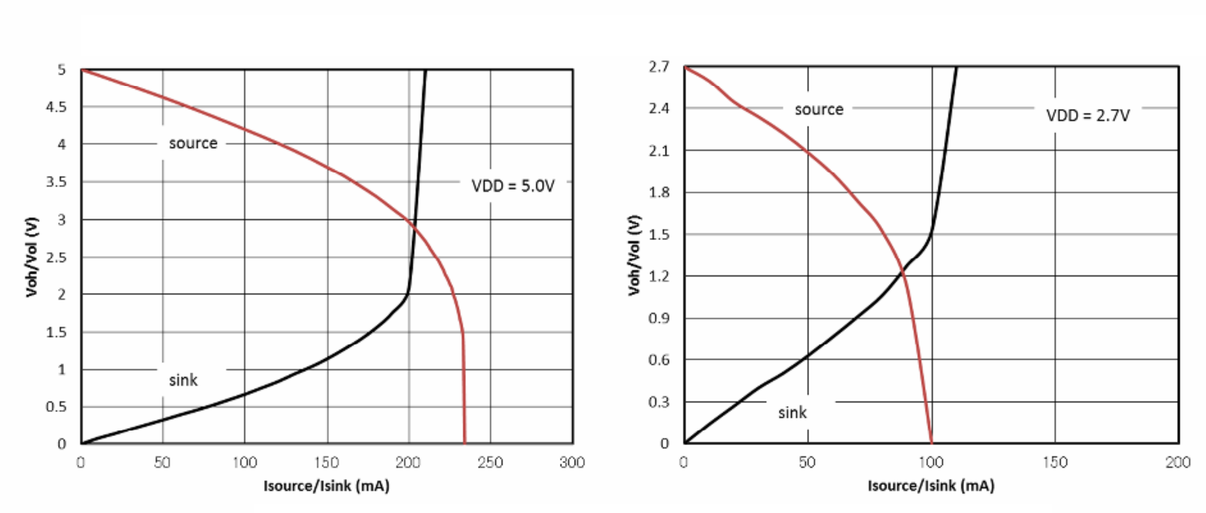


Figure 9.7 Output Volatge vs. Load current

9.8 Short circuit current – Supply Voltage characteristics

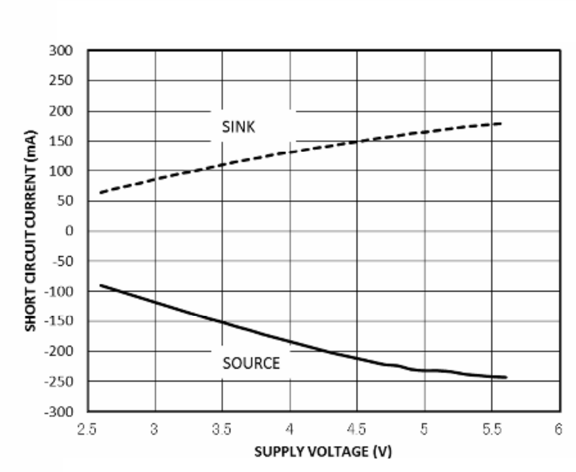


Figure 9.8 Short curcuit current vs. Supply voltage

9.9 Short circuit current – Temperature characteristics

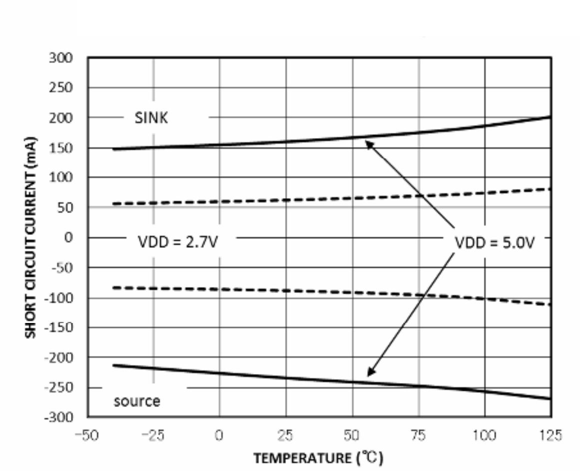
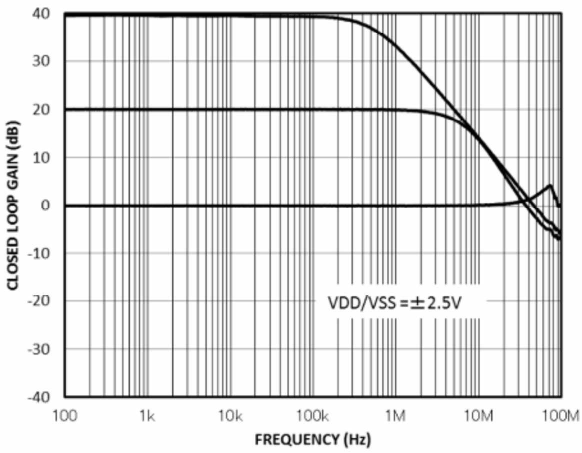


Figure 9.9 Short curcuit current vs. Temperature

[9. Typical Operating Characteristics (for reference) continuation]

9.10 Closed loop gain – Frequency characteristics



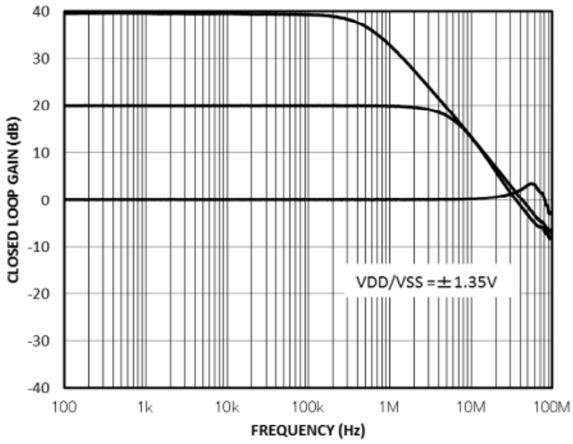
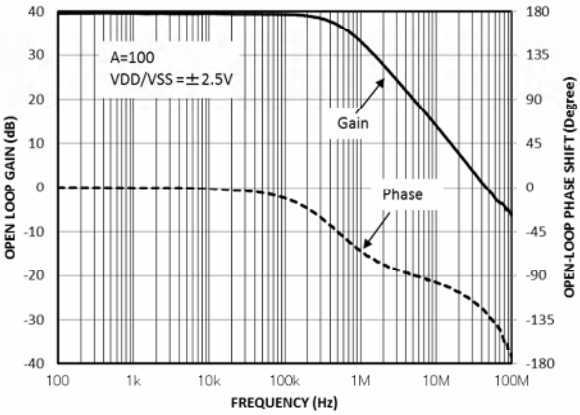


Figure 9.10 Closed loop gain vs. Frequency

9.11 Open loop gain – Frequency characteristics



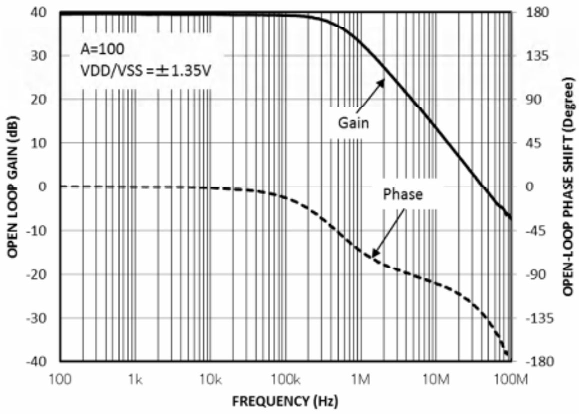
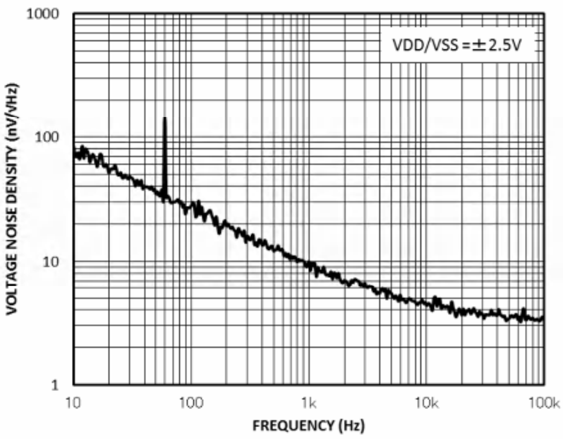


Figure 9.11 Open loop gain vs. Frequency

9.12 Input voltage noise – Frequency characteristics



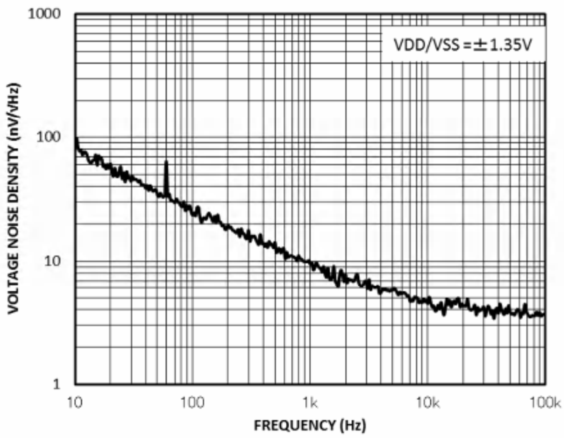
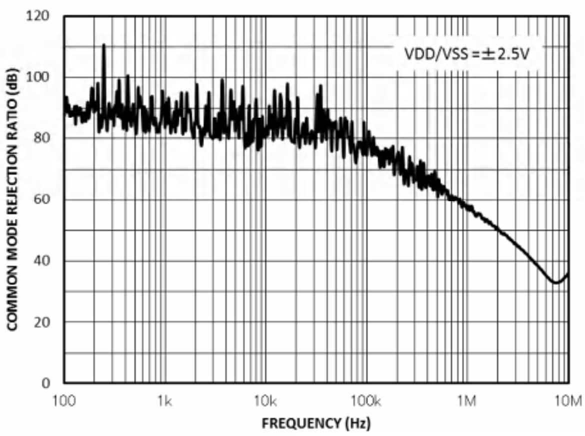


Figure 9.12 Input voltage noise vs. Frequency

[9. Typical Operating Characteristics (for reference) continuation]

9.13 CMRR – Frequency characteristics



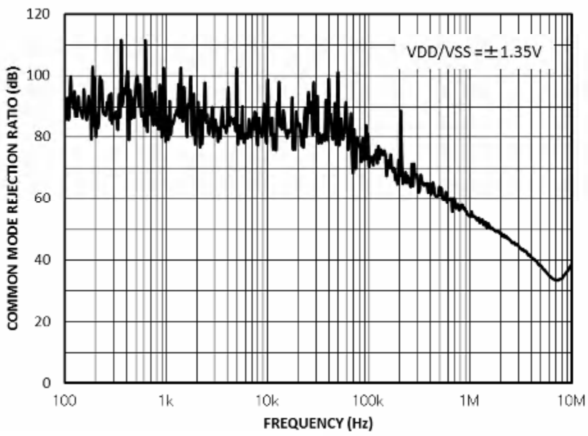
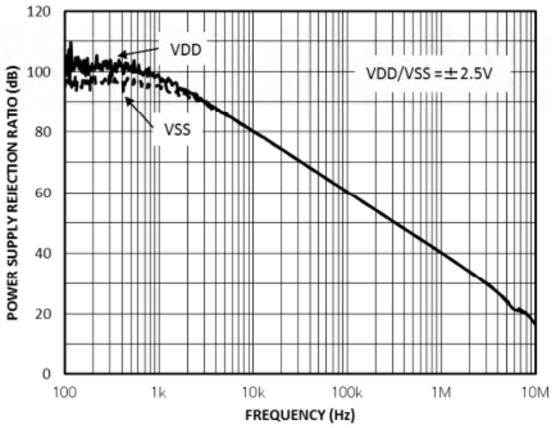


Figure 9.13 CMRR vs. Frequency

9.14 PSRR – Frequency characteristics



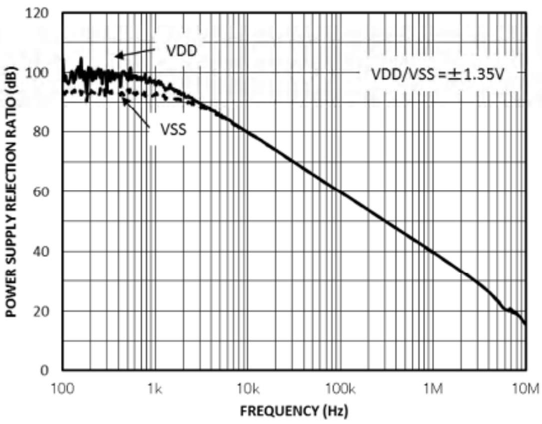


Figure 9.14 PSRR vs. Frequency

9.15 Output Impedance – Frequency characteristics

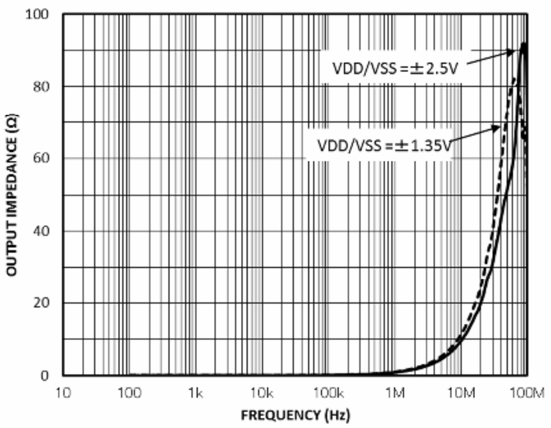


Figure 9.15 Output Impedance vs. Frequency

[9. Typical Operating Characteristics (for reference) continuation]

9.16 Maximum output swing – Frequency characteristics

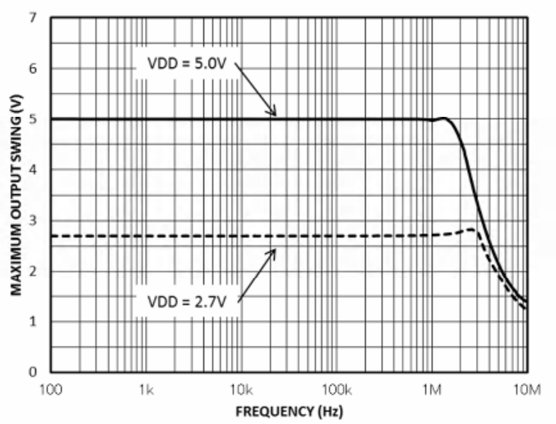


Figure 9.16 Maximum output swing vs. Frequency

9.17 THD +Noise – Output amplitude

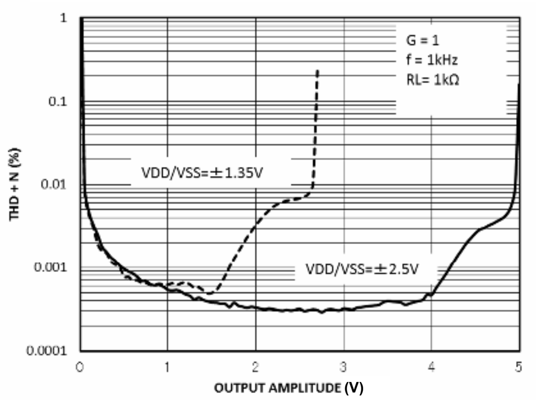


Figure 9.17 THD +Noise vs. Output swing

9.18 THD +Noise – Frequency characteristics

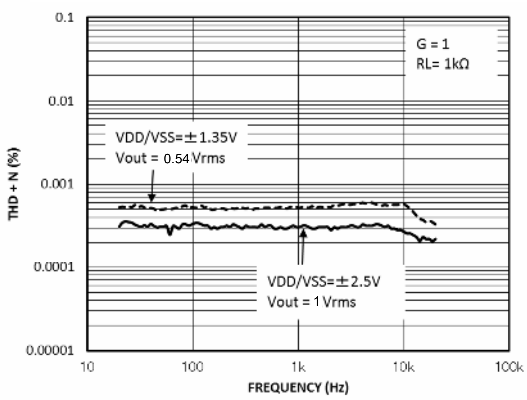


Figure 9.18 THD +Noise vs. Frequency

[9. Typical Operating Characteristics (for reference) continuation]

9.19 Small signal step response (C_L:0pF)

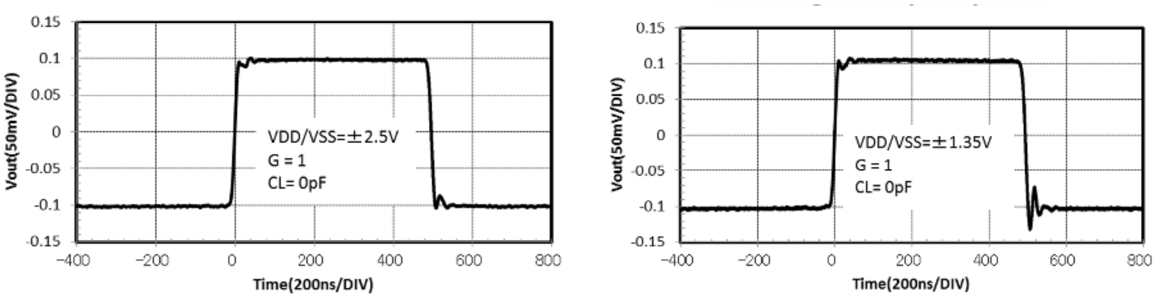


Figure 9.19 Small signal step response

9.20 Large signal step response (C_L:0pF)

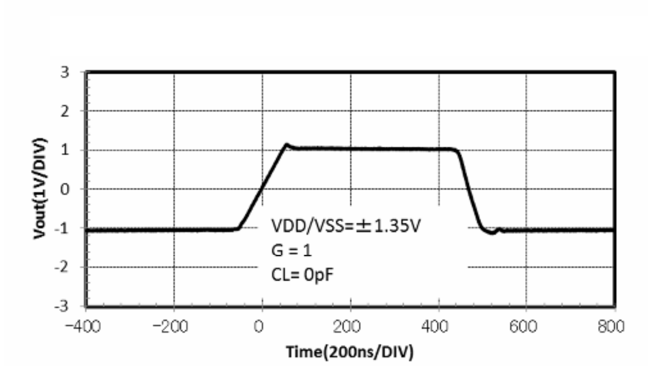


Figure 9.19 Large signal step response

9.21 Small output swing – Frequency characteristics (C_L:1000pF,R_L:10Ω)

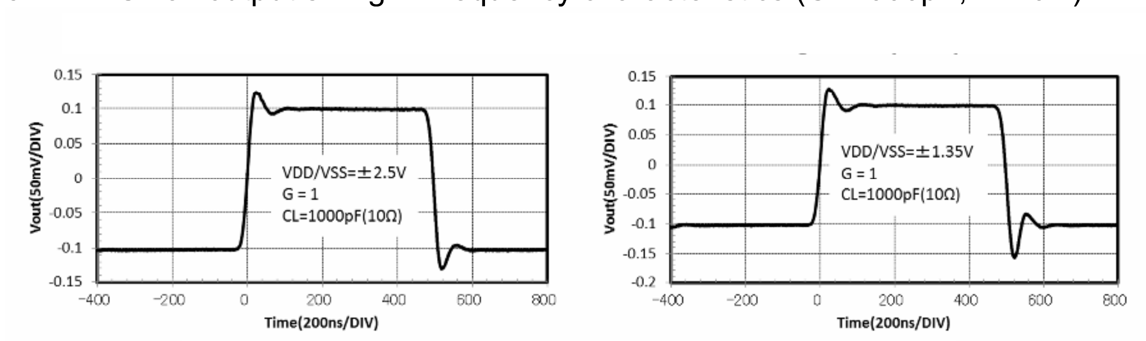


Figure 9.21 Small signal step response

9.22 Large signal step response (C_L:1000pF,R_L:10Ω)

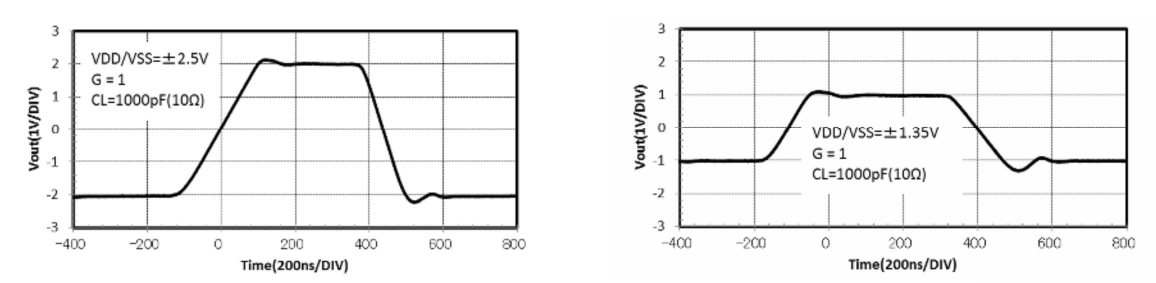


Figure 9.22 Large signal step response

[9. Typical Operating Characteristics (for reference) continuation]

9.23 Over load recovery time

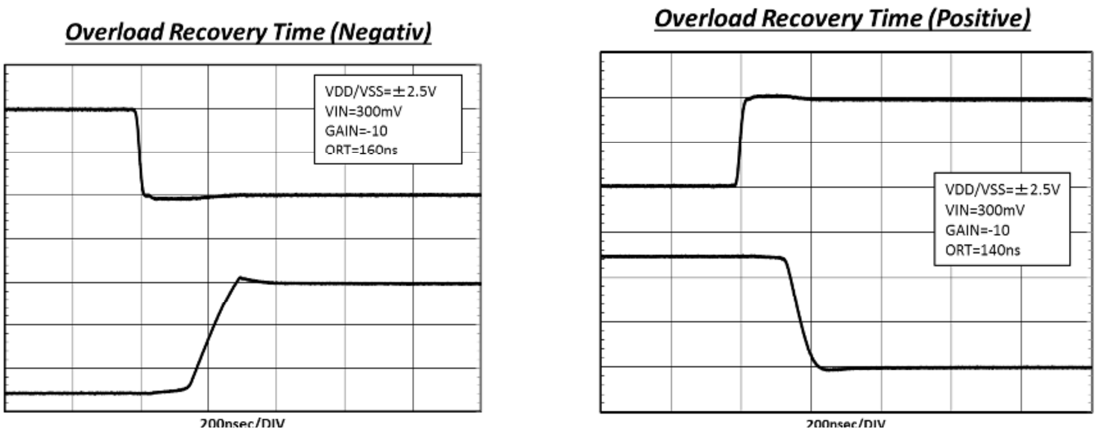
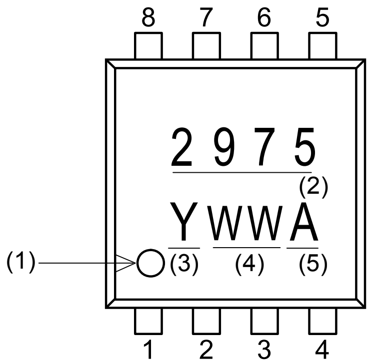


Figure 9.23 Overload recovery time

10. Package

10.1 Marking

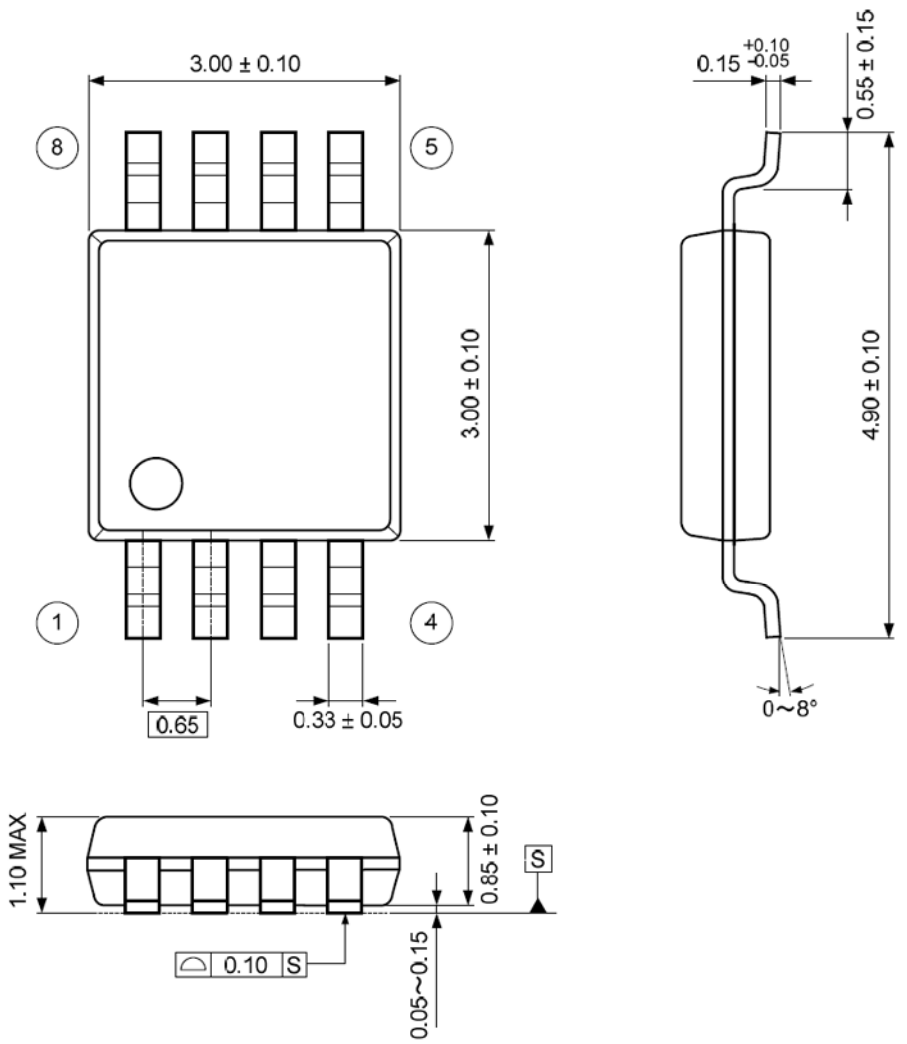
- MSOP8



(1) 1 pin
(2) Part No.（AK2975:2975）
(3) Date code (Year)
(4) Date code (Week)
(5) In-house control code

10.2 Outline Dimensions

- MSOP8 Package Outline (UNIT: mm)



11. Ordering Guide

AK2975H	–40 ~ 125ºC	8-pin MSOP

IMPORTANT NOTICE