

## DUAL OPERATIONAL AMPLIFIER WITH SWITCH

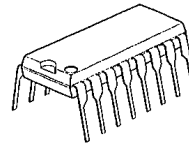
### GENERAL DESCRIPTION

The NJM2123 is a operational amplifier with analog switch (2 circuit of 2-input/1-output). It is applicable to the audio part for Video (VTR, LD...) and the Car-stereo.

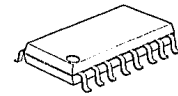
The NJM2123 has the same electrical characteristic of the NJM2112, and is low saturation output type.

The mode of switch is improved from the current control type (NJM2120: 1 circuit of 2-input/1-output) to the voltage control type. So, it is easy to use.

### PACKAGE OUTLINE



NJM2123D



NJM2123M



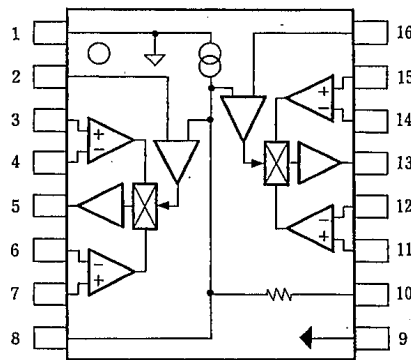
NJM2123V

### FEATURES

- Single Supply
- Operating Voltage (+4V ~ +20V)
- Slew Rate (3V/μs typ.)
- Analog Switch Function
- Wide Unity Gain Bandwidth (10MHz typ.)
- Package Outline DIP16, DMP16, SSOP16
- Bipolar Technology

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### PIN CONFIGURATION

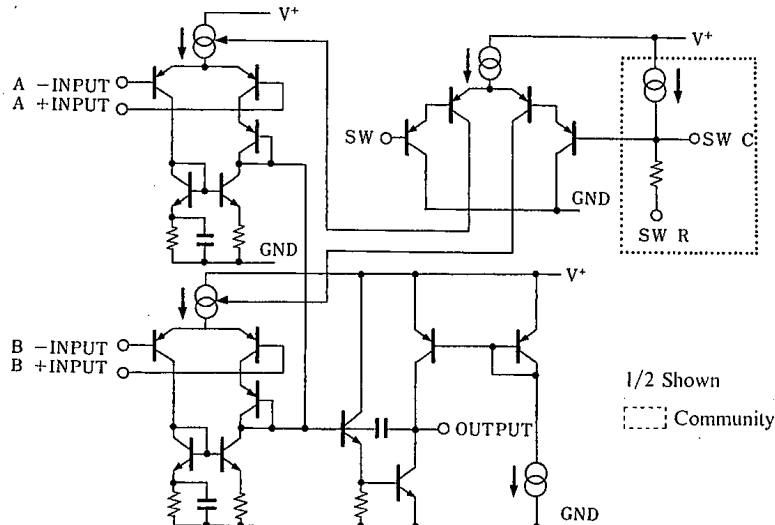


NJM2123D  
NJM2123M  
NJM2123V

#### PIN FUNCTION

- |                   |                  |
|-------------------|------------------|
| 1. V <sup>+</sup> | 9. GND           |
| 2. SW1            | 10. SW R         |
| 3. IN1 A +INPUT   | 11. IN2 B +INPUT |
| 4. IN1 A -INPUT   | 12. IN2 B -INPUT |
| 5. OUT1           | 13. OUT2         |
| 6. IN1 B -INPUT   | 14. IN2 A -INPUT |
| 7. IN1 B +INPUT   | 15. IN2 A +INPUT |
| 8. SW C           | 16. SW2          |

### EQUIVALENT CIRCUIT



1/2 Shown  
Community

■ ABSOLUTE MAXIMUM RATINGS

(Ta=25°C)

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V <sup>+</sup>	20(±10)	V
Differential Input Voltage	V <sub>ID</sub>	±14	V
Input Voltage	V <sub>IC</sub>	20(±10) note: Less than V <sup>+</sup> (note)	V
Control Voltage	V <sub>CTR</sub>	20(±10) note: Less than V <sup>+</sup>	V
Power Dissipation	P <sub>b</sub>	(DIP8) 700	mW
		(DMP8) 300	mW
		(SSOP8) 300	mW
Operating Temperature Range	T <sub>opr</sub>	-30~+85	°C
Storage Temperature Range	T <sub>stg</sub>	-40~+125	°C

■ ELECTRICAL CHARACTERISTICS

(V<sup>+</sup>=5V, Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Current	I <sub>CC</sub>	V <sub>IN</sub> =2.5, R <sub>L</sub> =∞	—	6.0	8.0	mA
Input Offset Voltage	V <sub>IO</sub>	R <sub>S</sub> ≤ 10kΩ	—	1.0	6.0	mV
Input Offset Current	I <sub>IO</sub>		—	10	200	nA
Input Bias Current	I <sub>B</sub>		—	100	300	nA
Large Signal Voltage Gain	A <sub>v</sub>	R <sub>I</sub> ≥ 10kΩ	60	80	—	dB
Maximum Output Voltage Swing 1	V <sub>OM1</sub>	V <sup>+</sup> /V <sup>-</sup> =±2.5V, R <sub>L</sub> ≥ 2kΩ	±2.0	±2.2	—	V
Maximum Output Voltage Swing 2	V <sub>OM2</sub>	V <sup>+</sup> /V <sup>-</sup> =2.5V, R <sub>L</sub> 10kΩ	±2.3	±2.4	—	V
Input Common Mode Voltage Range	V <sub>ICM</sub>		1.5	—	4.0	V
Common Mode Rejection Ratio	CMR		60	74	—	dB
Supply Voltage Rejection Ratio	SVR		60	80	—	dB
Slew Rate	SR	A <sub>v</sub> =1, V <sub>IN</sub> =2V~3V	—	3	—	V/μs
Gain Bandwidth Product	GB		—	10	—	MHz
Crosstalk	CT	f=1kHz	—	90	—	dB
Channel Separation	CS	f=1kHz	—	120	—	dB
Switch Threshold Voltage	V <sub>th</sub>	internal V <sub>th</sub>	2.0	2.5	3.0	V

(note 1) Applied circuit voltage gain is desired to be operated of 3 dB to 30 dB.

(note 2) Special care being required for input common mode voltage range and the oscillation due to the capacitive load when operating on voltage follower.

(note 3) "Crosstalk" is defined about leak of signal on the same circuit.

(note 4) "Channel Separation" is defined about leak of signal between 2 circuits.

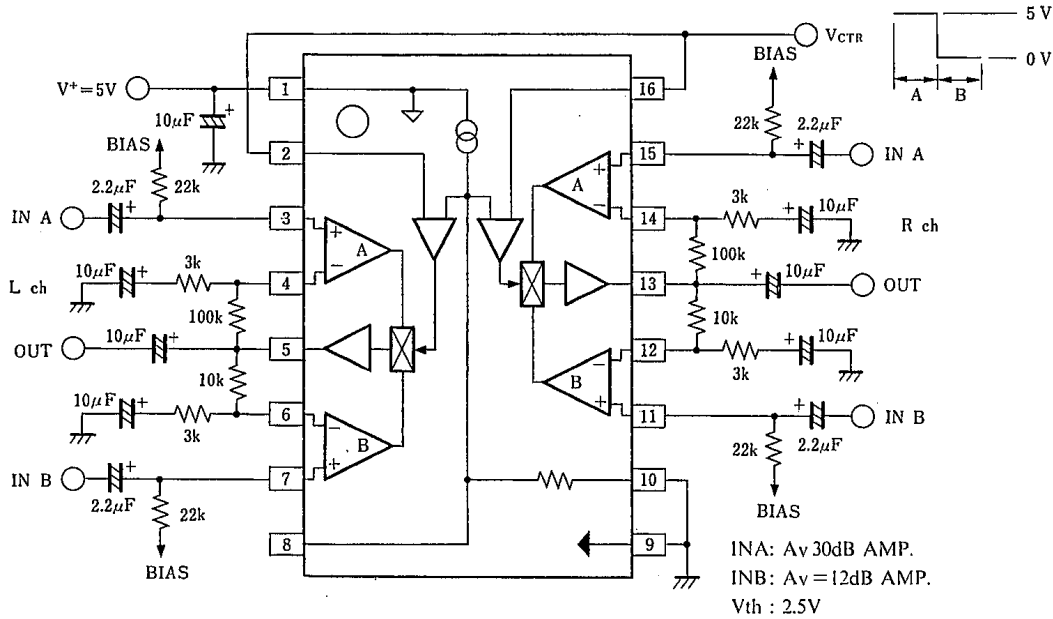
(note 5) V<sub>th</sub> is possible to adjust by external parts.

(note 6) Voltage for V<sup>-</sup>-PIN has to be supplied earlier than V<sup>+</sup>-PIN in case of two supply voltage.

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## ■ TYPICAL CHARACTERISTICS

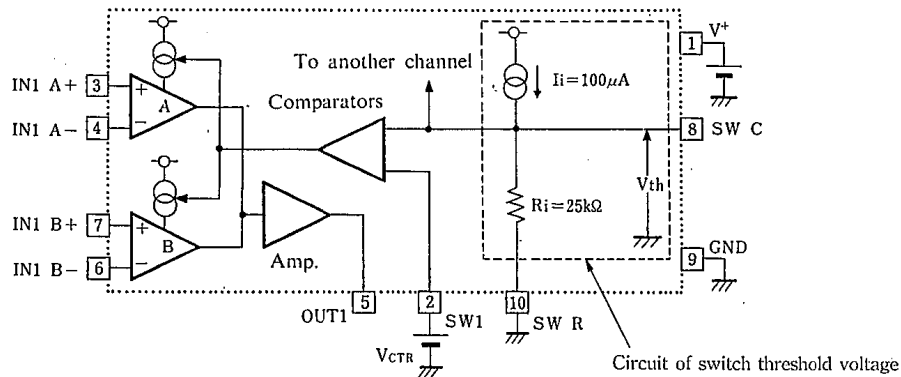
In case of single supply voltage ( $v^+=5V$ )



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## ■ SWITCHING MECHANISM

- in case of single supply voltage



The switch circuit of NJM2123 consist of comparators for switch and circuit for switch threshold voltage ( $V_{th}$ ) due to establish threshold of comparator.  $V_{th} = I_i \times R_i = 2.5V$  in case of above Figure.

Comparator selects INPUT (A or B) by compare of control voltage ( $V_{CTR}$ ) and threshold voltage ( $V_{th}$ ) and control of operating current of Amp (INPUT).

INPUT A is selected in case of  $V_{CTR} > V_{th}$  and INPUT B is selected in case of  $V_{CTR} < V_{th}$ .

$V_{CTR}$  can not be used between  $V_{th} \pm 0.1V$  in order that signal of both INPUT A and INPUT B are mixed in case that  $V_{CTR}$  is near  $V_{th}$ .

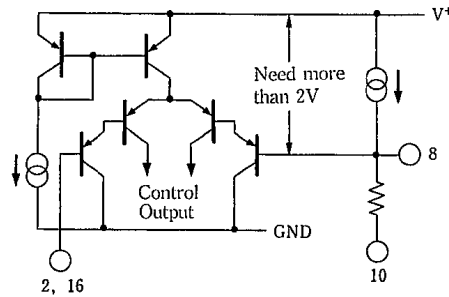
■ ABOUT ADJUSTMENT OF V<sub>th</sub>

The switch threshold voltage (V<sub>th</sub>) is possible to adjust by external parts to SW C/SW R. It needs to be satisfy with condition of  $V_{th} \leq V^+ - 2V$ .

This reason is caused by equivalent circuit of comparator for switch.

The V<sub>th</sub> has to adjust in case that supply voltage is less than 5V ( $\pm 2.5V$ ).

Adjustment method is as following.

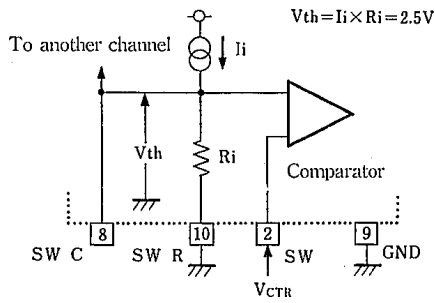


■ ADJUSTMENT OF V<sub>th</sub>

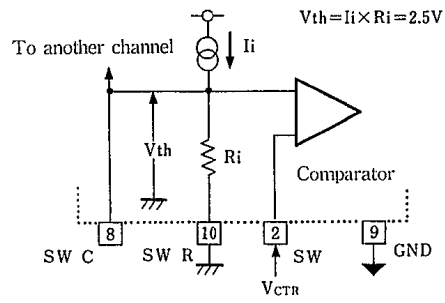
In case of  $I_i = 100\mu A$ ,  $R_i = 25k\Omega$ ,  $R_e$  (External Resistor)

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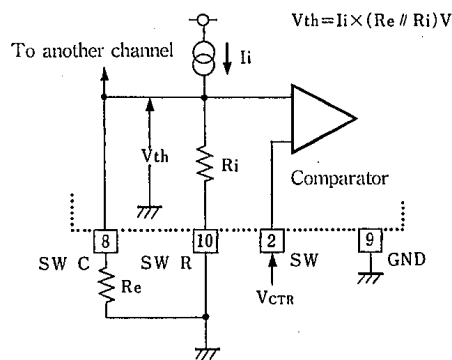
• Internal V<sub>th</sub> (Single supply)



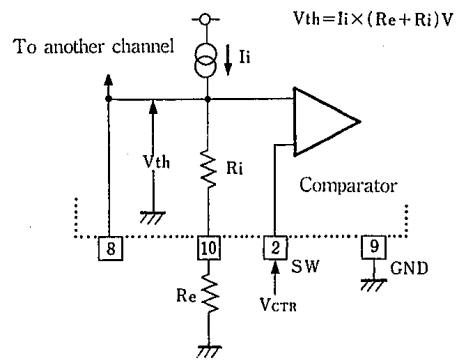
• Internal V<sub>th</sub> (Two supply)



• V<sub>th</sub>, 2.5V (Single supply)

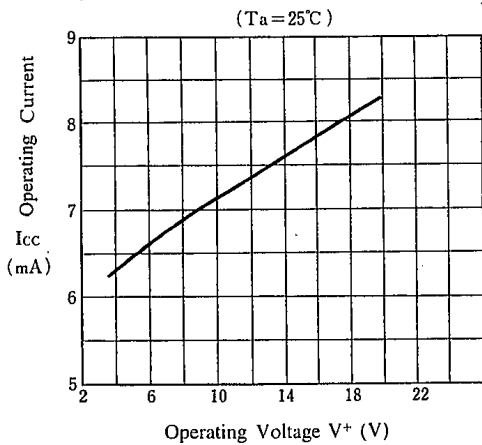


• V<sub>th</sub> > 2.5V (Single Supply)

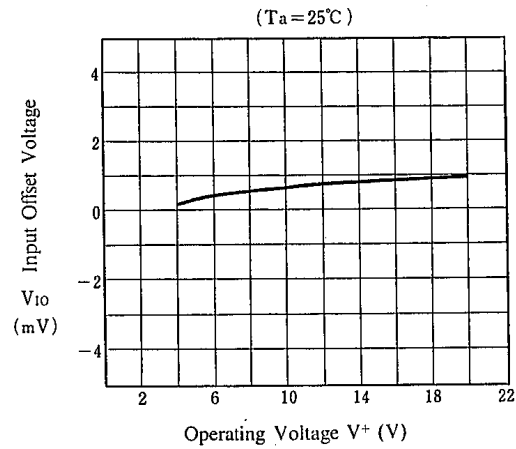


## ■ TYPICAL CHARACTERISTICS

### Operating Current vs. Operating Voltage

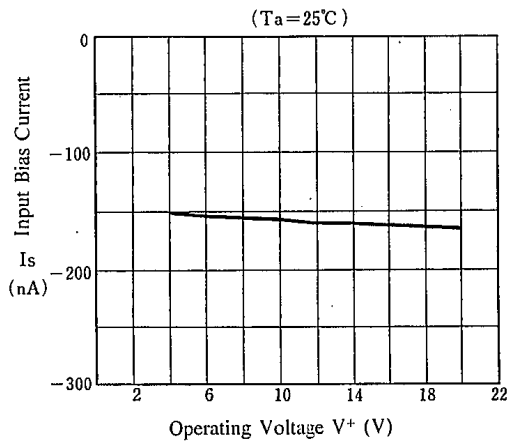


### Input Offset Voltage vs. Operating Voltage

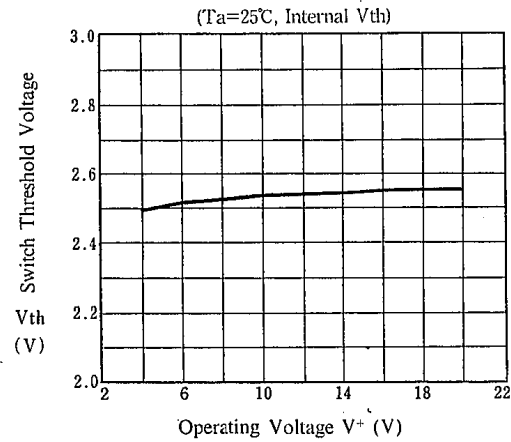


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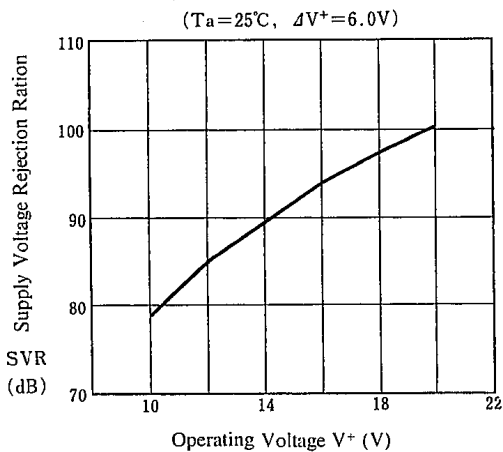
### Input Bias Current vs. Operating Voltage



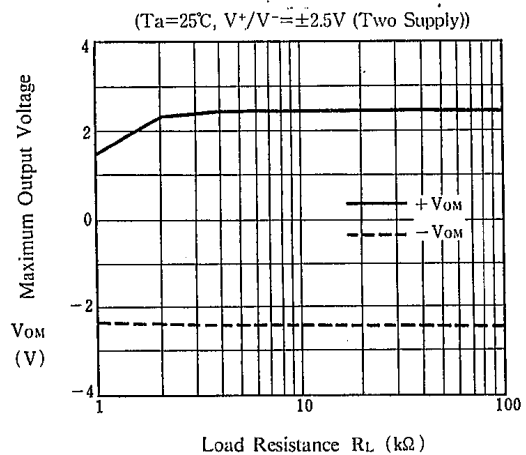
### Switch Threshold Voltage vs. Operating Voltage



### Supply Voltage Rejection Ratio vs. Operating Voltage



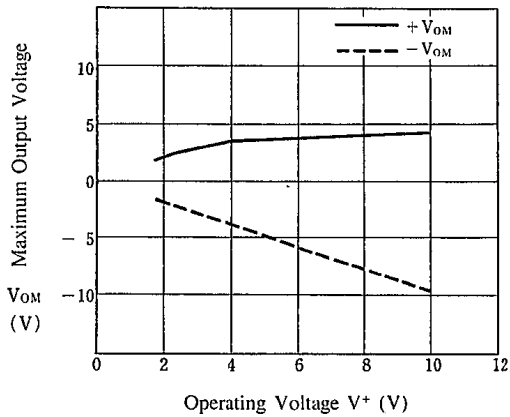
### Maximum Output Voltage vs. Load Resistance



■ TYPICAL CHARACTERISTICS

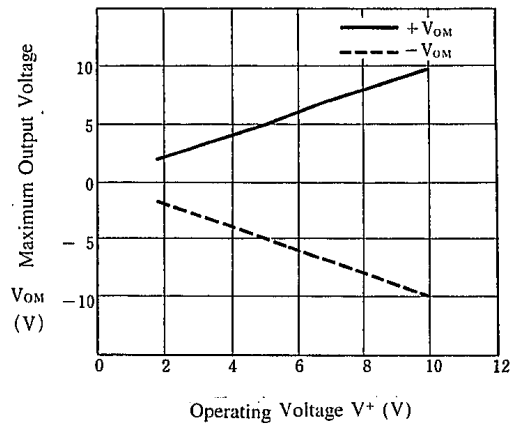
Maximum Output Voltage vs. Operating Voltage

( $T_a=25^\circ\text{C}$ ,  $R_L=2\text{ k}\Omega$ )



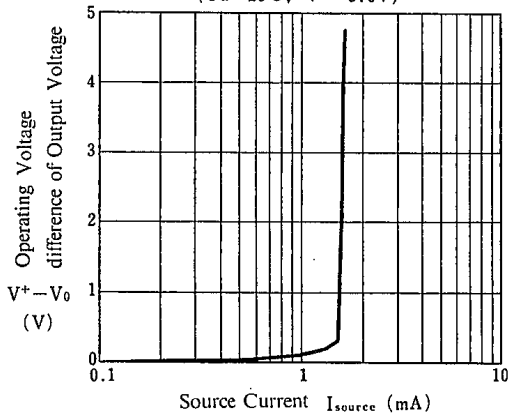
Maximum Output Voltage vs. Operating Voltage

( $T_a=25^\circ\text{C}$ ,  $R_L=10\text{ k}\Omega$ )

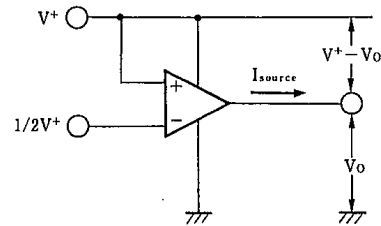


Output Source Current

( $T_a=25^\circ\text{C}$ ,  $V^+=5.0\text{ V}$ )

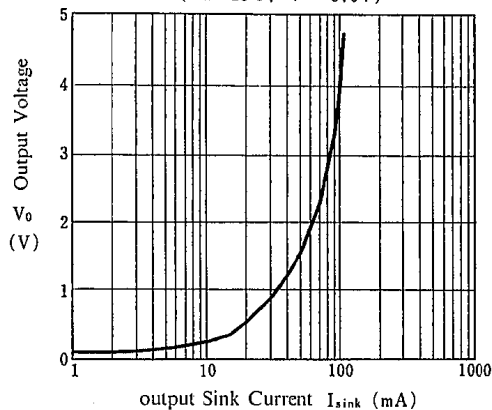


Test Circuit (Output Source Current)

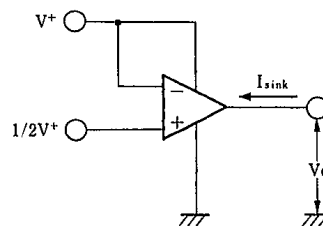


Output Voltage vs. Output Sink Current

( $T_a=25^\circ\text{C}$ ,  $V^+=5.0\text{ V}$ )

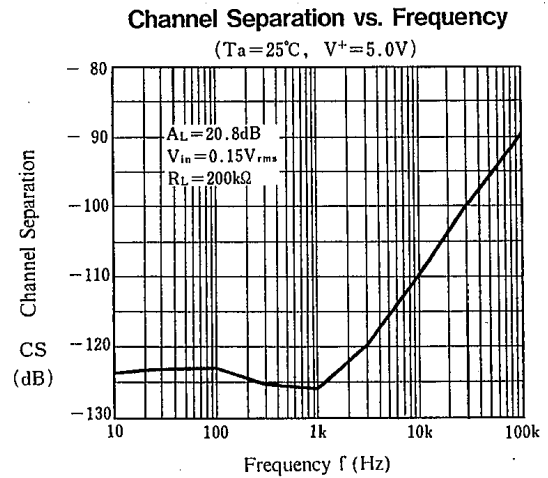
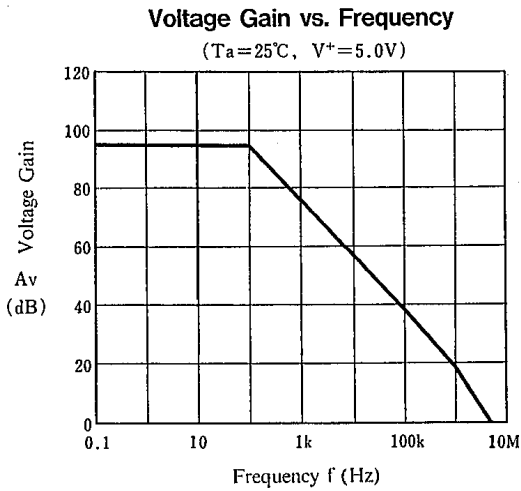


Test Circuit (Output Sink Current)

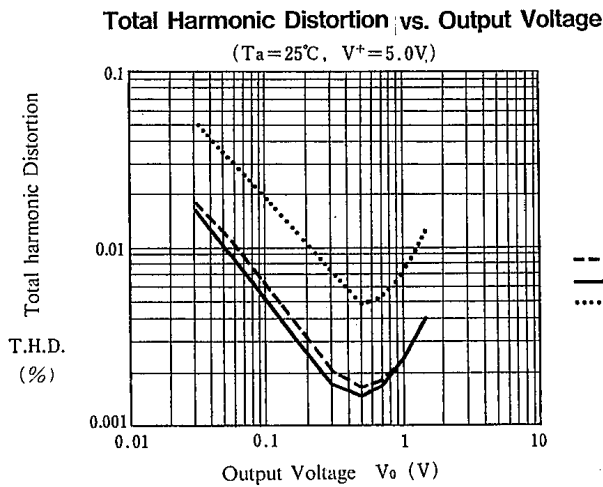


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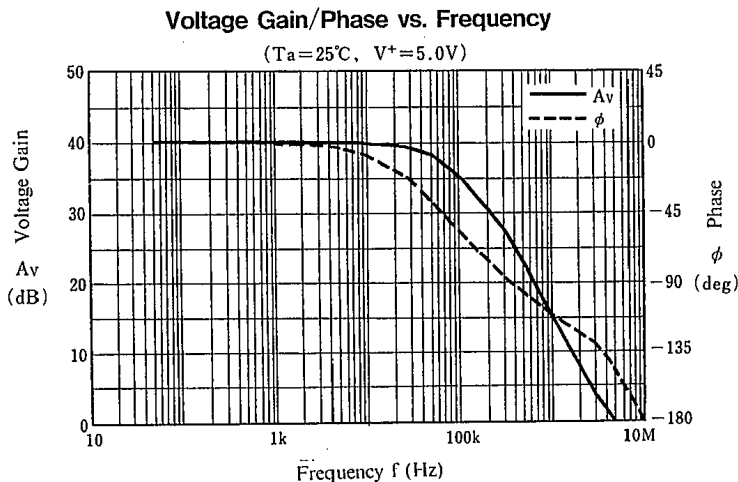
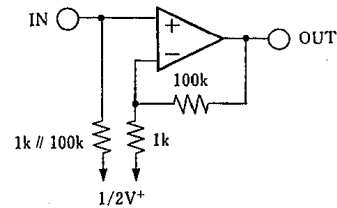
## TYPICAL CHARACTERISTICS



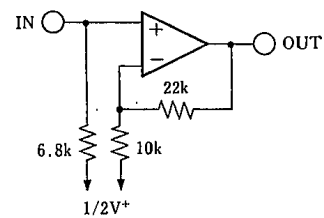
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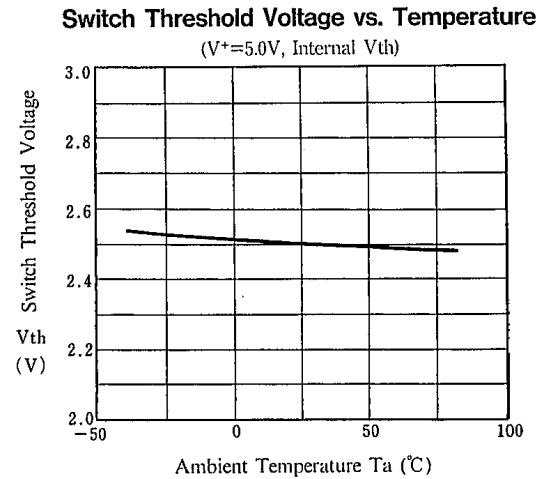
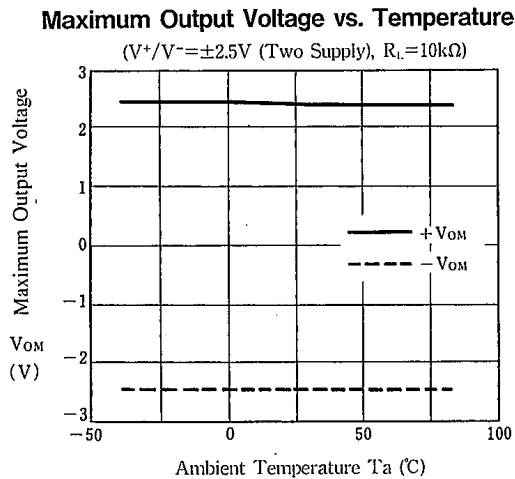
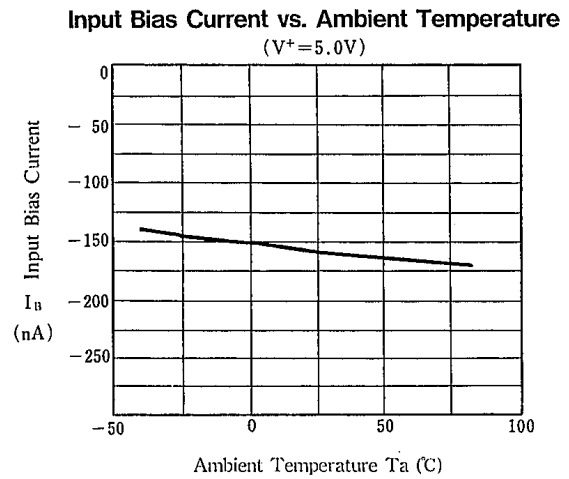
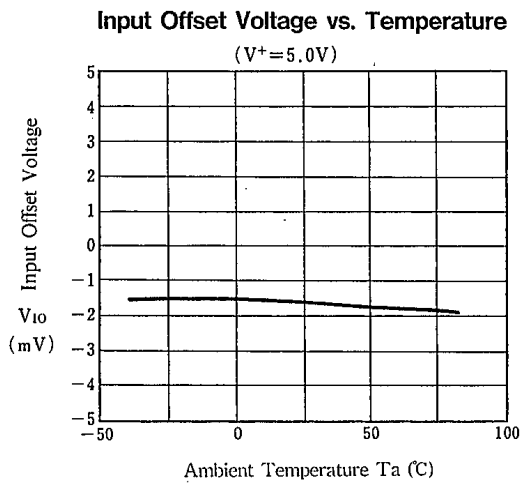
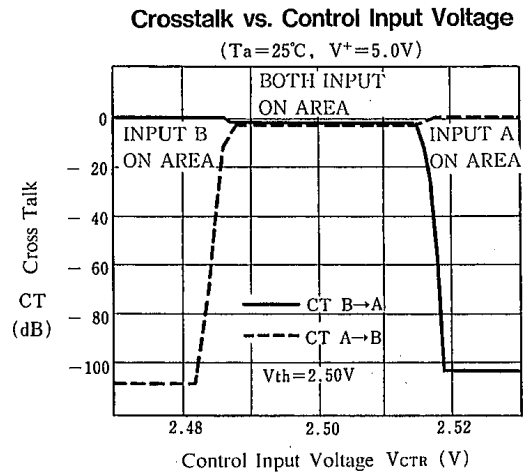
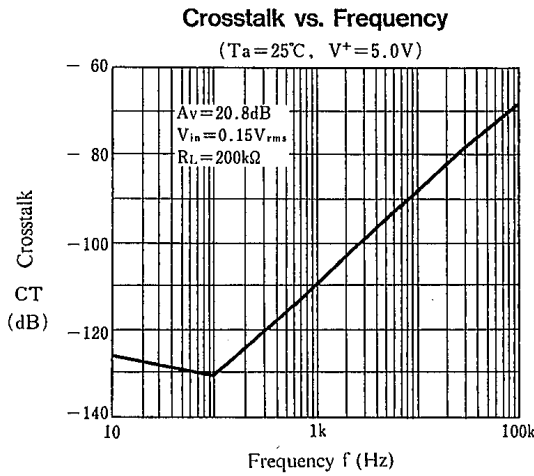
Test Circuit (Voltage Gain/Phase)



Test Circuit (THD)



■ TYPICAL CHARACTERISTICS



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## MEMO

**[CAUTION]**

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