

**SANYO**

No.3191A

**LA6358N,6358NS****High-Performance  
Dual Operational Amplifiers****Overview**

The LA6358N is an IC integrating two high-performance operational amplifiers in a single package. This operational amplifier contains an internal phase compensator and is designed to operate from a single power supply over a wide range of voltages. As with conventional general-purpose operational amplifiers, operation from dual power supplies is also possible and power dissipation is very low. This IC can be used widely in commercial and industrial applications including various transducer amplifiers and DC amplifiers.

**Features**

- Eliminates need for phase compensation
- Wide range of operating supply voltage : 3.0 to 30.0V (single power supply)  
 $\pm 1.5$  to  $\pm 15.0$ V (dual power supply)
- Input voltage swingable down to nearly ground level and output voltage range  $V_{OUT}$  of 0 to  $V_{CC} - 1.5$ V
- Low current dissipation :  $I_{CC} = 0.5$ mA typ/ $V_{CC} = +5$ V,  $R_L = \infty$

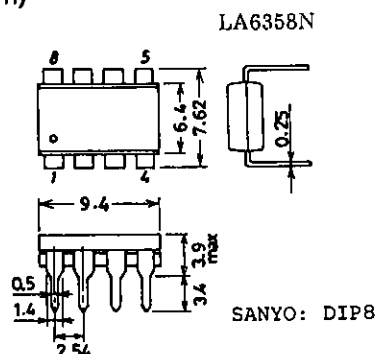
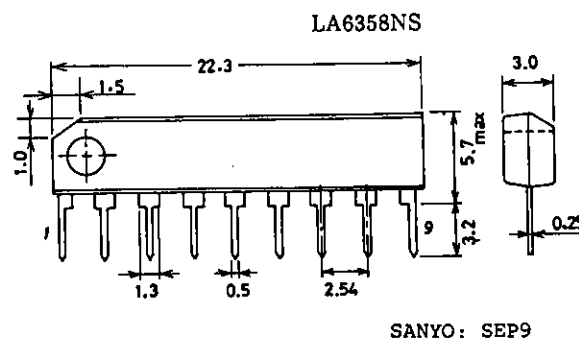
**Maximum Ratings at  $T_a = 25^\circ\text{C}$** 

			unit
Maximum Supply Voltage	$V_{CC}$	32	V
Differential Input Voltage	$V_{ID}$	32	V
Maximum Input Voltage	$V_{IN\ max}$	-0.3 to +32	V
Allowable Power Dissipation	$P_d\ max$ $T_a \leq 25^\circ\text{C}$	570	mW
Operating Temperature	$T_{opr}$	-30 to +85	$^\circ\text{C}$
Storage Temperature	$T_{stg}$	-55 to +125	$^\circ\text{C}$

**Operating Characteristics at  $T_a = 25^\circ\text{C}$ ,  $V_{CC} = +5$ V**

			Test Circuit	min	typ	max	unit
Input Offset Voltage	$V_{IO}$		1		$\pm 2$	$\pm 7$	mV
Input Offset Current	$I_{IO}$	$I_{IN(+)} / I_{IN(-)}$	2		$\pm 5$	$\pm 50$	nA
Input Bias Current	$I_B$	$I_{IN(+)} / I_{IN(-)}$	3		45	250	nA
Common-Mode Input Voltage Range	$V_{ICM}$		4	0	$V_{CC} - 1.5$		V

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**Package Dimensions 3001B-D8IC**  
(unit : mm)**Package Dimensions 3017B-S9IC**  
(unit : mm)

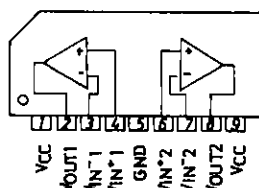
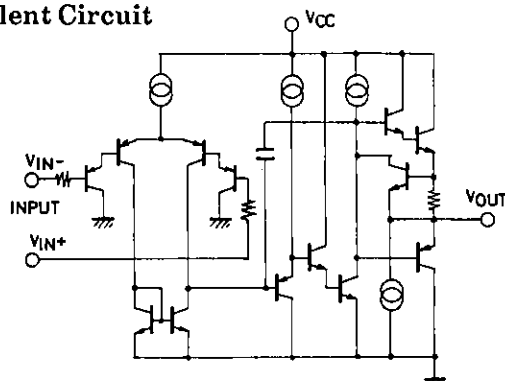
**SANYO Electric Co., Ltd. Semiconductor Business Headquarters**  
TOKYO OFFICE Tokyo Bldg., 1-10, 1 Chome, Ueno, Taito-ku, TOKYO, 110 JAPAN

1100YT/8029TA, TS №3191-1/4

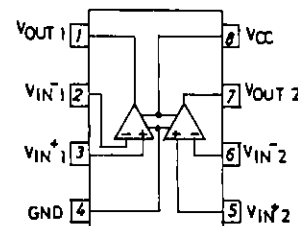
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		Test Circuit	min	typ	max	unit
Common-Mode Rejection Ratio	CMR	4	65	80		dB
Large Signal Voltage Gain	V <sub>G</sub>	5	25	100		V/mV
Output Voltage Range	V <sub>OUT</sub>		0	V <sub>CC</sub> -1.5		V
Power Supply Rejection Ratio	SVR	6	65	100		dB
Channel Separation		7		120		dB
Current Dissipation	I <sub>CC</sub>	8		0.5	1.2	mA
Output Current (Source)	I <sub>O source</sub>	9	20	40		mA
Output Current (Sink)	I <sub>O sink</sub>	10	10	20		mA

## Equivalent Circuit

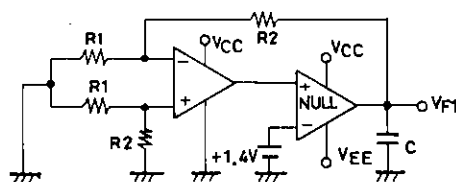


LA6358NS

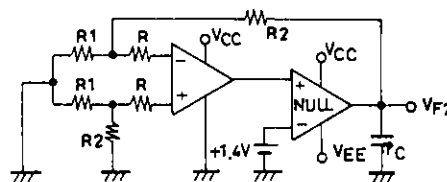


LA6358N

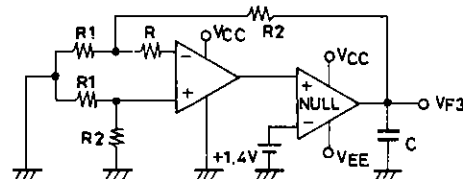
## Test Circuits

1. Input Offset Voltage V<sub>IO</sub>

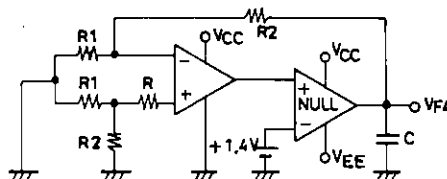
$$V_{IO} = \frac{VF1}{1 + R2/R1}$$

2. Input Offset Current I<sub>IO</sub>

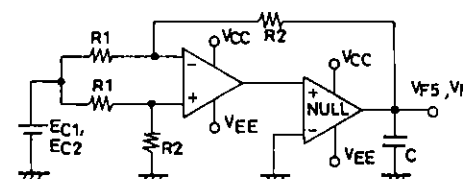
$$I_{IO} = \frac{VF2 - VF1}{R(1 + R2/R1)}$$

3. Input Bias Current I<sub>B</sub>

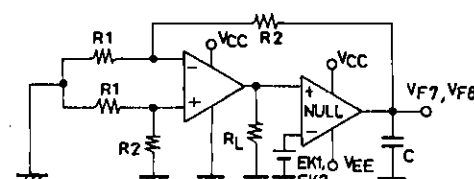
$$I_B = \frac{VF4 - VF3}{2R(1 + R2/R1)}$$



## 4. Common-mode Rejection Ratio CMR

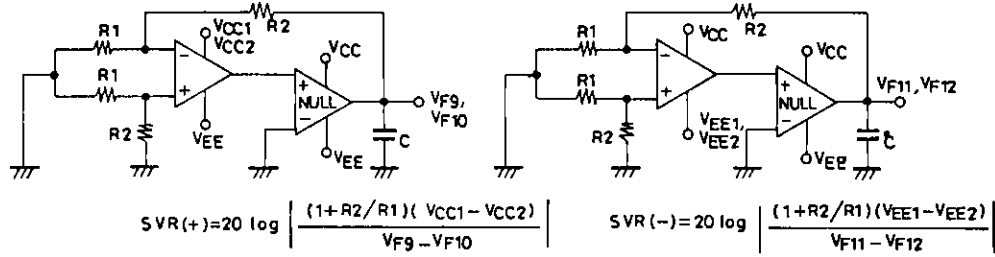
Common-mode Input Voltage Range V<sub>ICM</sub>

$$CMR = 20 \log \left| \frac{(EC1 - EC2)(1 + R2/R1)}{VF5 - VF6} \right|$$

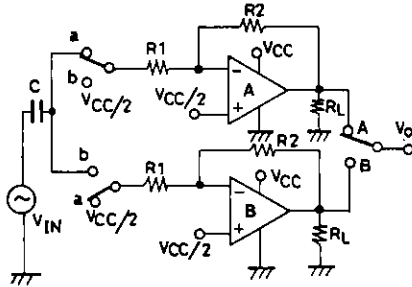
5. Voltage Gain V<sub>G</sub>

$$V_G = \frac{(EK1 - EK2)(1 + R2/R1)}{VF8 - VF7}$$

## 6. Supply Voltage Rejection SVR



## 7. Channel Separation CS



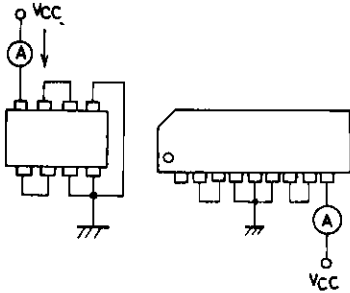
SW : a

$$CS(A \rightarrow B) + 20 \log \frac{R_2 V_{OA}}{R_1 V_{OB}}$$

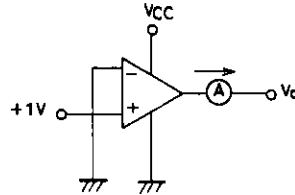
SW : b

$$CS(B \rightarrow A) + 20 \log \frac{R_2 V_{OB}}{R_1 V_{OA}}$$

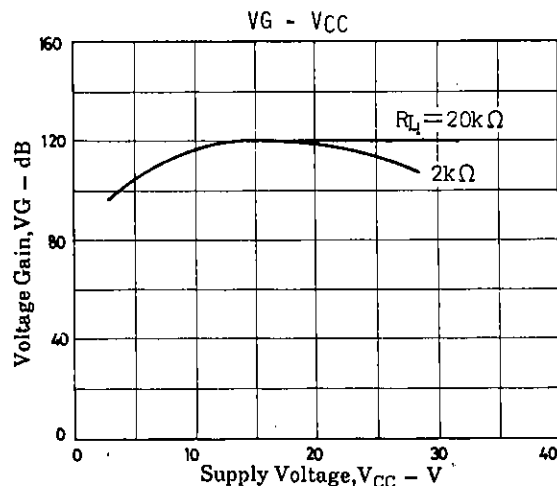
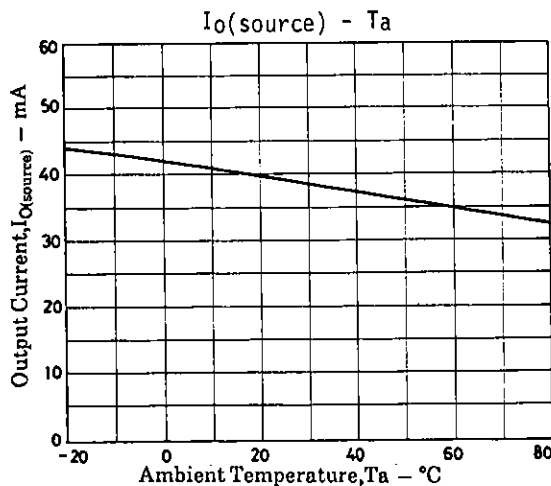
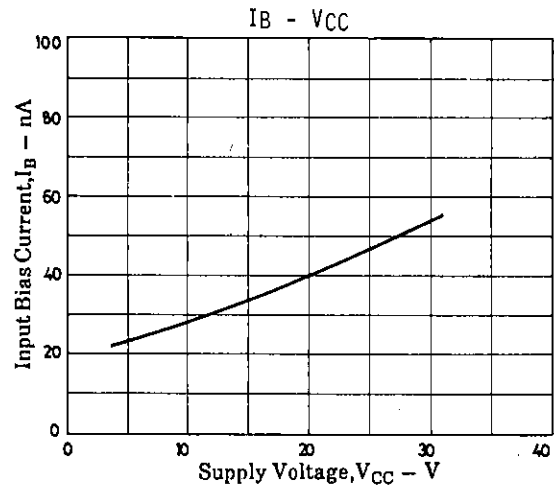
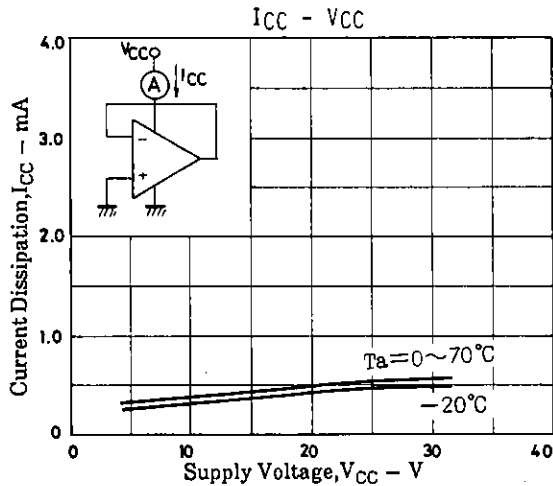
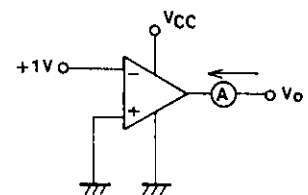
## 8. Current Dissipation ICC

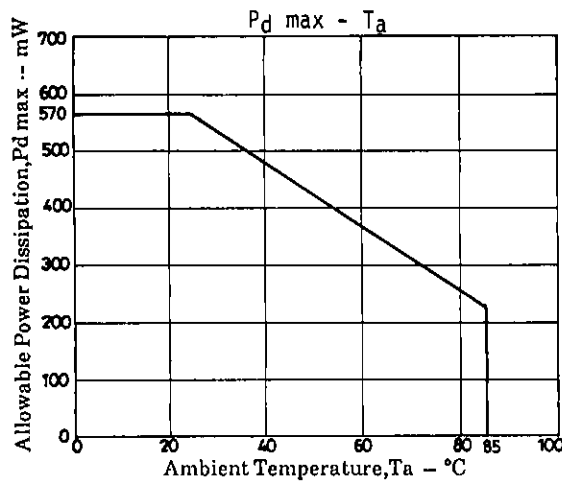
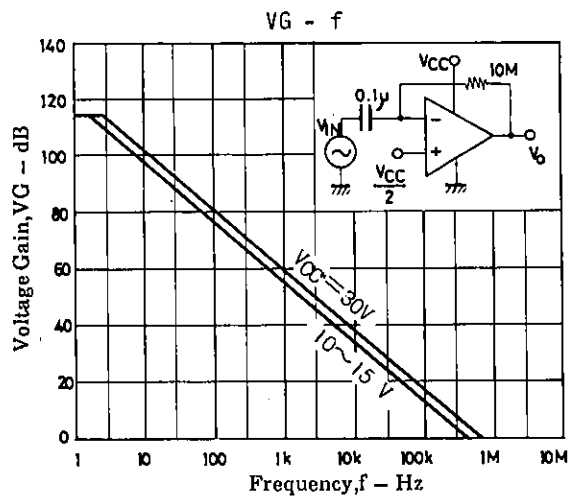
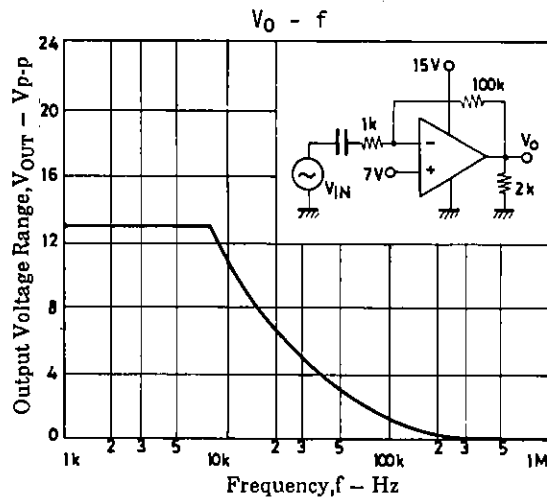


## 9. Output Current IO source



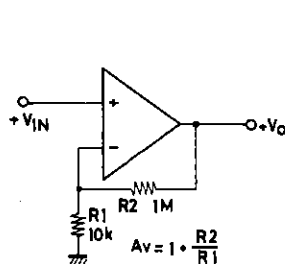
## 10. Output Current IO sink



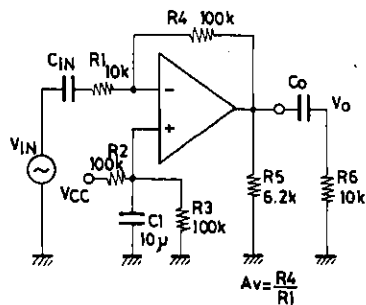


### Sample Application Circuits

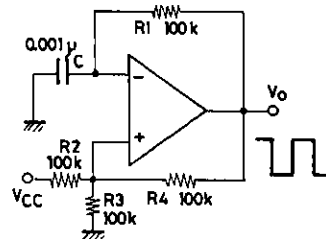
Noninverting DC amplifier



Inverting AC amplifier



Rectangular wave oscillator



Unit (resistance:  $\Omega$  capacitance: F)

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**SANYO**

No.3192

**LA6358NM****High-Performance  
Dual Operational Amplifier****Overview**

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**Features**

- Eliminates need for phase compensation
- Wide range of operating supply voltage : 3.0 to 30.0V (single power supply)  
±1.5 to ±15.0V (dual power supply)
- Input voltage swingable down to nearly ground level and output voltage range  $V_{OUT}$  of 0 to  $V_{CC} - 1.5V$
- Low current dissipation :  $I_{CC} = 0.5mA$  typ/ $V_{CC} = +5V, R_L = \infty$
- Miniflat package permitting the LA6358NM-applied sets to be made small

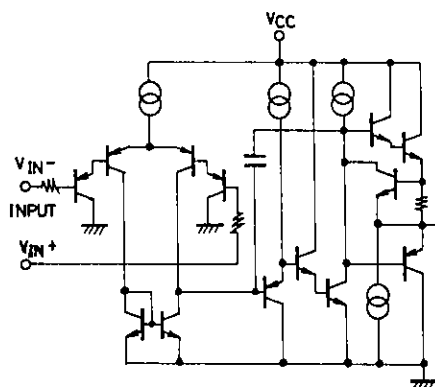
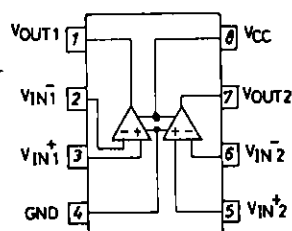
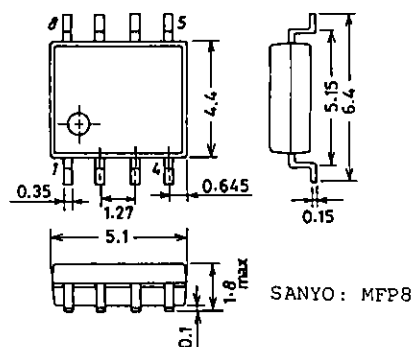
**Maximum Ratings at  $T_a = 25^\circ C$** 

			unit
Maximum Supply Voltage	$V_{CC}$	32	V
Differential Input Voltage	$V_{ID}$	32	V
Maximum Input Voltage	$V_{IN\ max}$	-0.3 to +32	V
Allowable Power Dissipation	$P_d\ max$	300	mW
Operating Temperature	$T_{opr}$	-30 to +85	$^\circ C$
Storage Temperature	$T_{stg}$	-55 to +125	$^\circ C$

**Operating Characteristics at  $T_a = 25^\circ C, V_{CC} = +5V$** 

			Test	min	typ	max	unit
Input Offset Voltage	$V_{IO}$		Circuit 1		±2	±7	mV
Input Offset Current	$I_{IO}$	$I_{IN(+)} / I_{IN(-)}$	2		±5	±50	nA
Input Bias Current	$I_B$	$I_{IN(+)} / I_{IN(-)}$	3		45	250	nA
Common-mode	$V_{ICM}$		4	0	$V_{CC} - 1.5$		V
Input Voltage Range							

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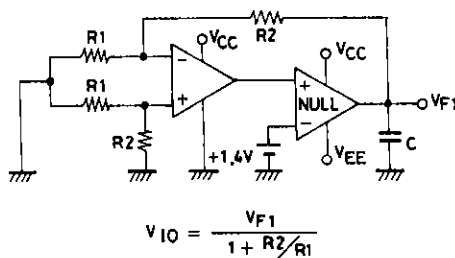
**Equivalent Circuit (1 unit)****Pin Assignment****Package Dimensions 3032B-M8IC  
(unit : mm)**

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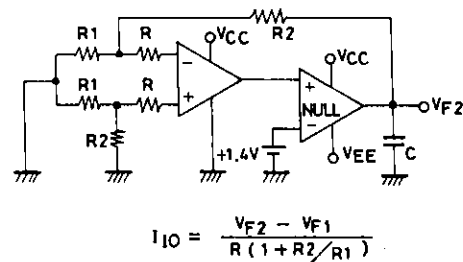
			Test Circuit	min	typ	max	unit
Common-mode Rejection Ratio	CMR		4	65	80		dB
Large Signal Voltage Gain	V <sub>G</sub>	V <sub>CC</sub> = 15V, R <sub>L</sub> ≥ 2kΩ	5	25	100		V/mV
Output Voltage Range	V <sub>OUT</sub>			0	V <sub>CC</sub> - 1.5		V
Power Supply Rejection Ratio	SVR		6	65	100		dB
Channel Separation		f = 1k to 20kHz	7		120		dB
Current Dissipation	I <sub>CC</sub>		8		0.5	1.2	mA
Output Current (Source)	I <sub>O source</sub>	V <sub>IN+</sub> = 1V, V <sub>IN-</sub> = 0V	9	20	40		mA
Output Current (Sink)	I <sub>O sink</sub>	V <sub>IN+</sub> = 0V, V <sub>IN-</sub> = 1V	10	10	20		mA

### Test Circuits

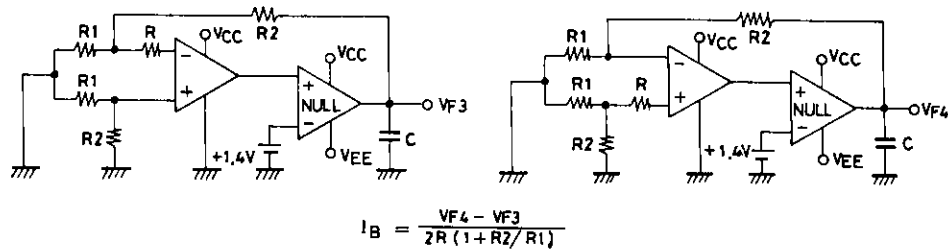
#### 1. Input Offset Voltage V<sub>IO</sub>



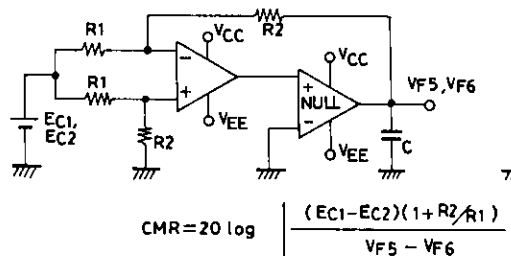
#### 2. Input Offset Current I<sub>IO</sub>



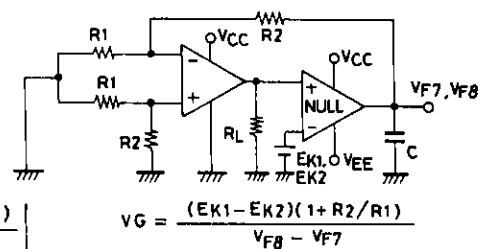
#### 3. Input Bias Current I<sub>B</sub>



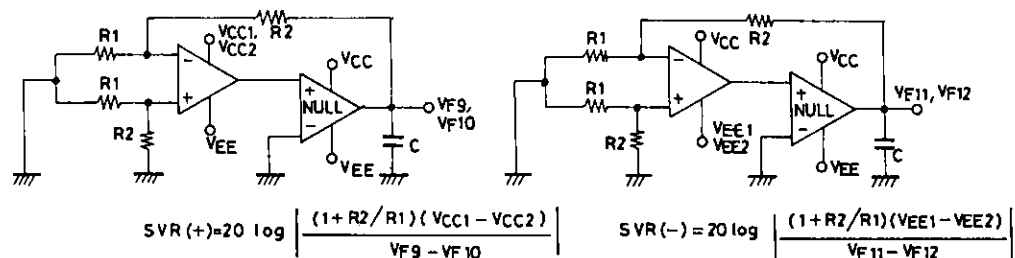
#### 4. Common-mode Rejection Ratio CMR Common-mode Input Voltage Range V<sub>ICM</sub>



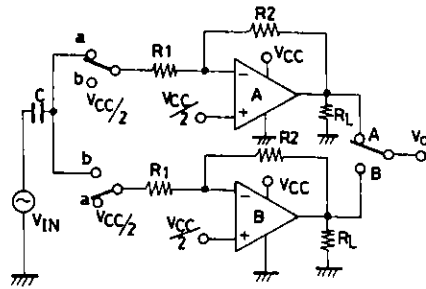
#### 5. Voltage Gain V<sub>G</sub>



#### 6. Supply Voltage Rejection SVR



7. Channel Separation CS



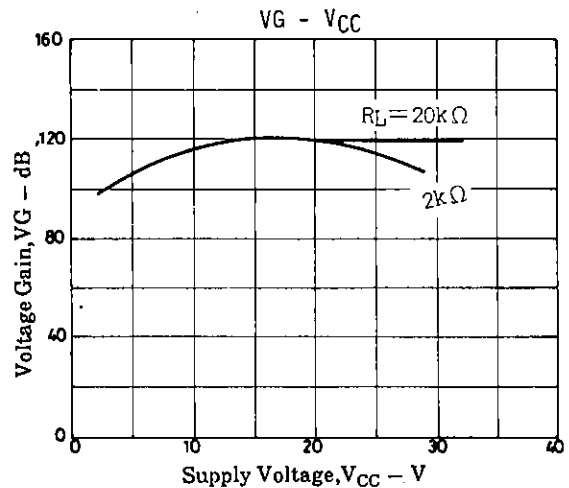
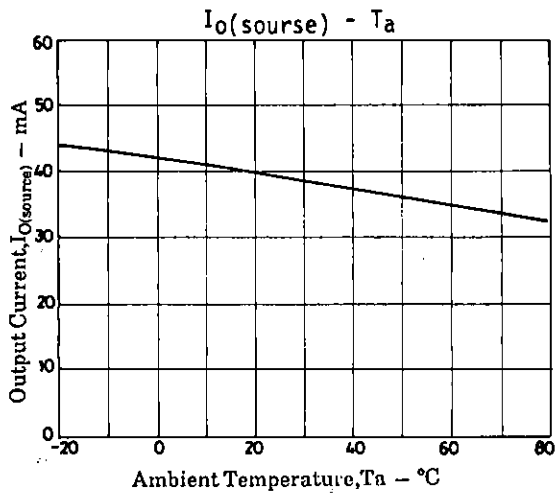
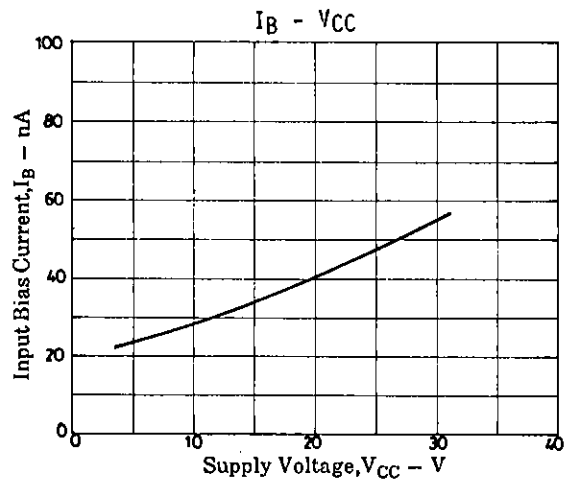
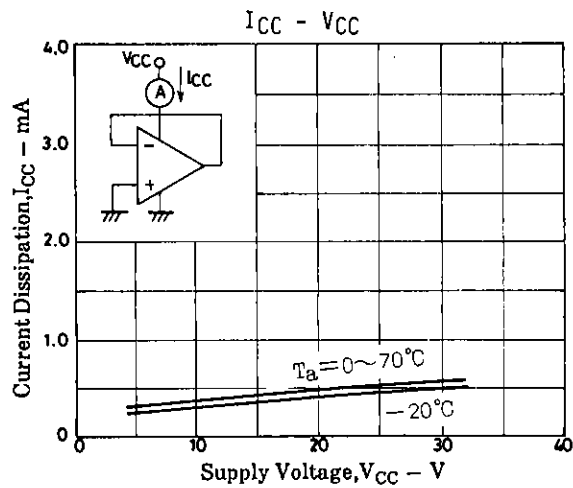
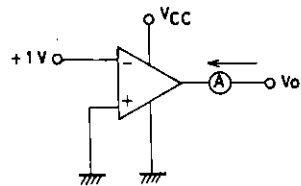
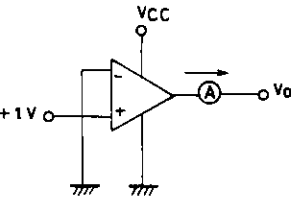
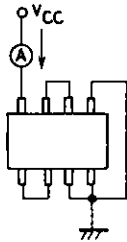
SW : a

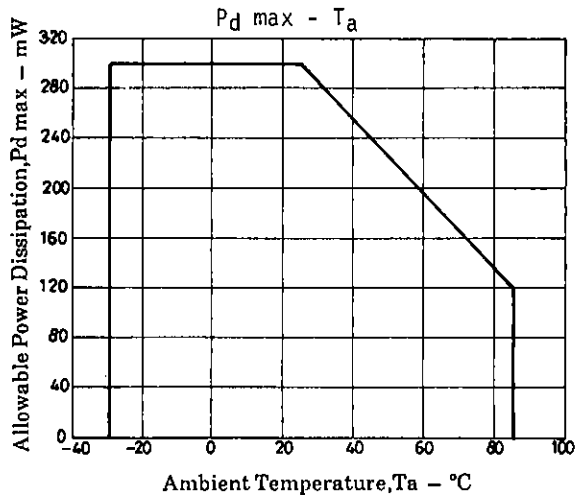
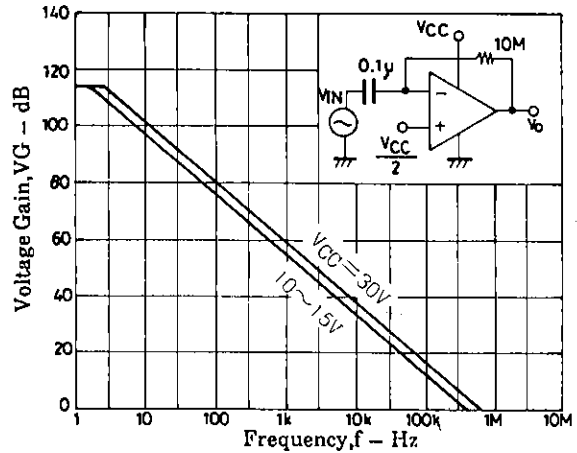
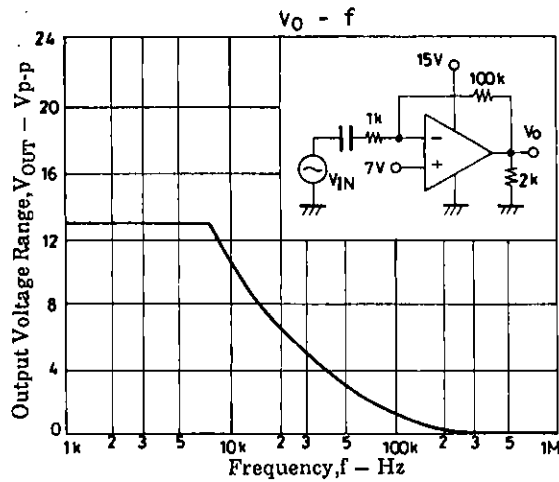
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SW : b

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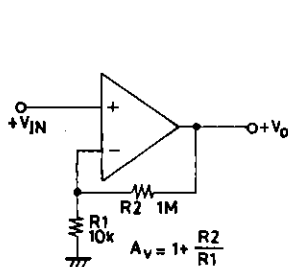
8. Current Dissipation  $I_{CC}$



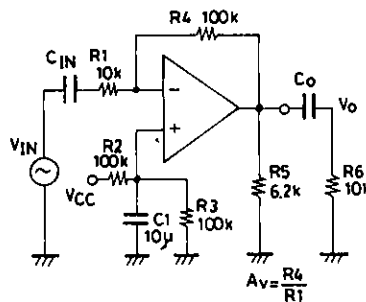


## Sample Application Circuits

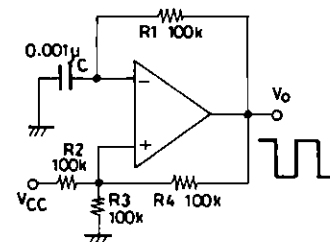
### Noninverting DC amplifier



### Inverting AC amplifier



### Rectangular wave oscillator



Unit (resistance:  $\Omega$ , capacitance: F)

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 $\pm 1.5$  to  $\pm 15.0$ V (dual power supply)
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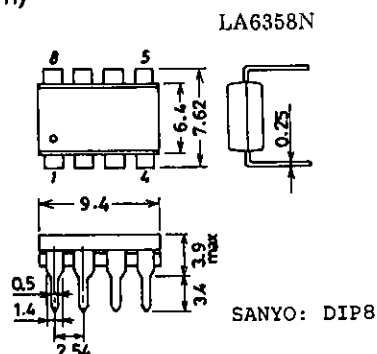
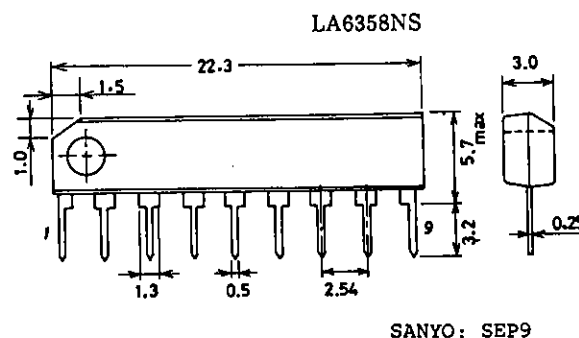
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Maximum Input Voltage	$V_{IN\text{ max}}$	-0.3 to +32	V
Allowable Power Dissipation	$P_d\text{ max}$ $T_a \leq 25^\circ\text{C}$	570	mW
Operating Temperature	$T_{opr}$	-30 to +85	$^\circ\text{C}$
Storage Temperature	$T_{stg}$	-55 to +125	$^\circ\text{C}$

**Operating Characteristics at  $T_a = 25^\circ\text{C}, V_{CC} = +5\text{V}$** 

			Test Circuit	min	typ	max	unit
Input Offset Voltage	$V_{IO}$		1		$\pm 2$	$\pm 7$	mV
Input Offset Current	$I_{IO}$	$I_{IN(+)} / I_{IN(-)}$	2		$\pm 5$	$\pm 50$	nA
Input Bias Current	$I_B$	$I_{IN(+)} / I_{IN(-)}$	3		45	250	nA
Common-Mode Input Voltage Range	$V_{ICM}$		4	0	$V_{CC} - 1.5$		V

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**Package Dimensions 3001B-D8IC**  
(unit : mm)**Package Dimensions 3017B-S9IC**  
(unit : mm)

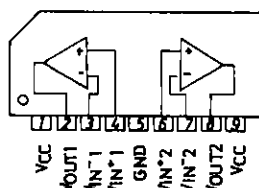
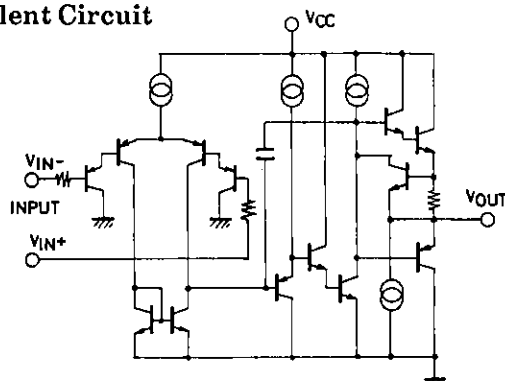
**SANYO Electric Co., Ltd. Semiconductor Business Headquarters**  
TOKYO OFFICE Tokyo Bldg., 1-10, 1 Chome, Ueno, Taito-ku, TOKYO, 110 JAPAN

1100YT/8029TA, TS №3191-1/4

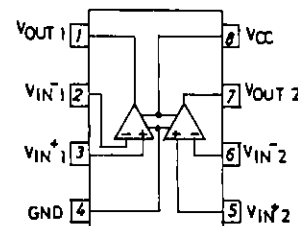
Continued from preceding page.

		Test Circuit	min	typ	max	unit
Common-Mode Rejection Ratio	CMR	4	65	80		dB
Large Signal Voltage Gain	V <sub>G</sub>	5	25	100		V/mV
Output Voltage Range	V <sub>OUT</sub>		0	V <sub>CC</sub> -1.5		V
Power Supply Rejection Ratio	SVR	6	65	100		dB
Channel Separation		7		120		dB
Current Dissipation	I <sub>CC</sub>	8		0.5	1.2	mA
Output Current (Source)	I <sub>O source</sub>	9	20	40		mA
Output Current (Sink)	I <sub>O sink</sub>	10	10	20		mA

## Equivalent Circuit

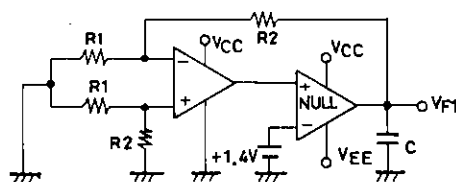


LA6358NS

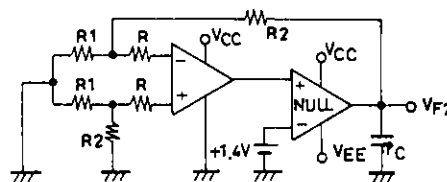


LA6358N

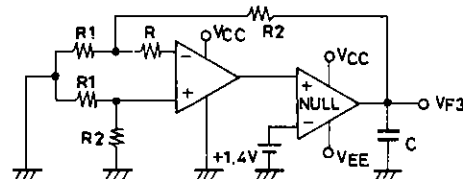
## Test Circuits

1. Input Offset Voltage V<sub>IO</sub>

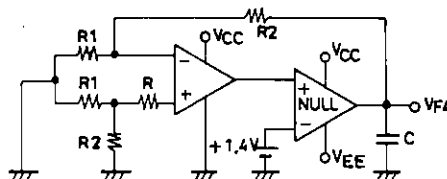
$$V_{IO} = \frac{VF1}{1 + R2/R1}$$

2. Input Offset Current I<sub>IO</sub>

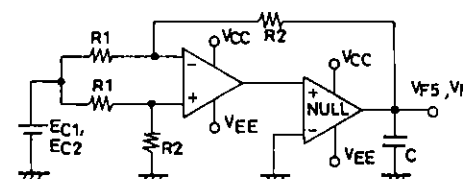
$$I_{IO} = \frac{VF2 - VF1}{R(1 + R2/R1)}$$

3. Input Bias Current I<sub>B</sub>

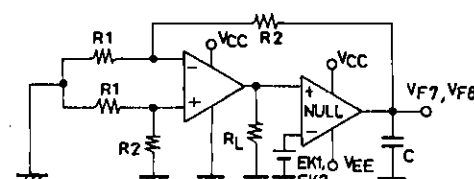
$$I_B = \frac{VF4 - VF3}{2R(1 + R2/R1)}$$



## 4. Common-mode Rejection Ratio CMR

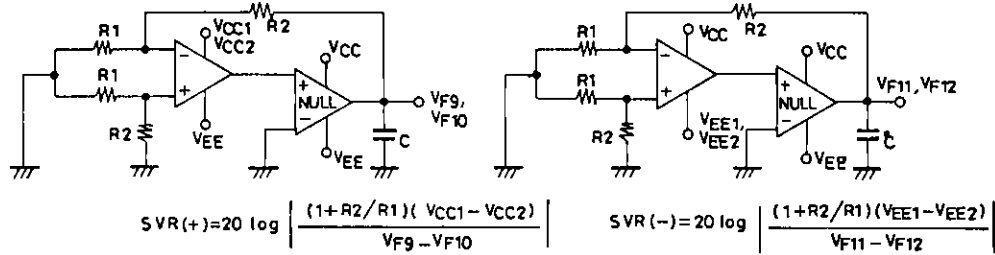
Common-mode Input Voltage Range V<sub>ICM</sub>

$$CMR = 20 \log \left| \frac{(EC1 - EC2)(1 + R2/R1)}{VF5 - VF6} \right|$$

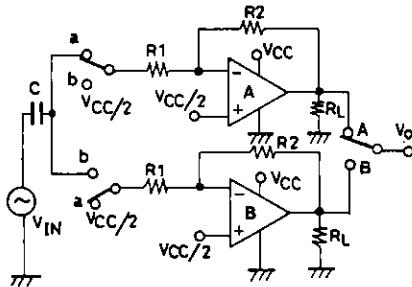
5. Voltage Gain V<sub>G</sub>

$$V_G = \frac{(EK1 - EK2)(1 + R2/R1)}{VF8 - VF7}$$

## 6. Supply Voltage Rejection SVR



## 7. Channel Separation CS



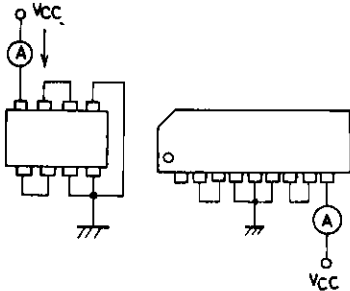
SW : a

$$CS(A \rightarrow B) + 20 \log \frac{R_2 V_{OA}}{R_1 V_{OB}}$$

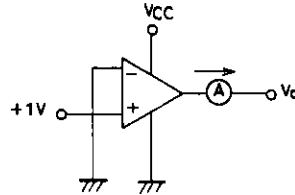
SW : b

$$CS(B \rightarrow A) + 20 \log \frac{R_2 V_{OB}}{R_1 V_{OA}}$$

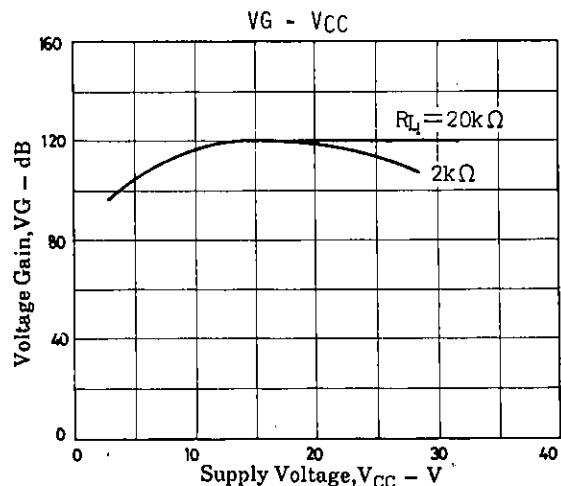
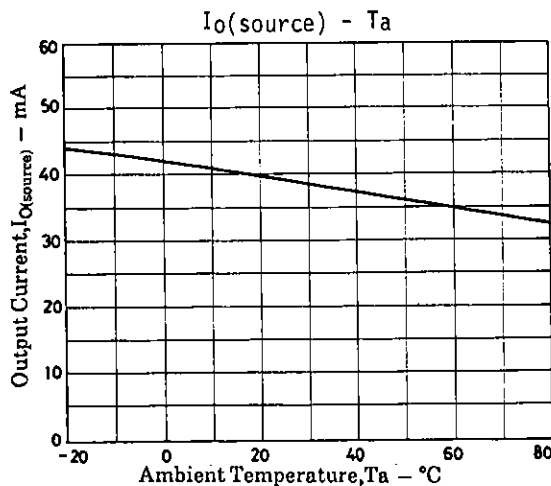
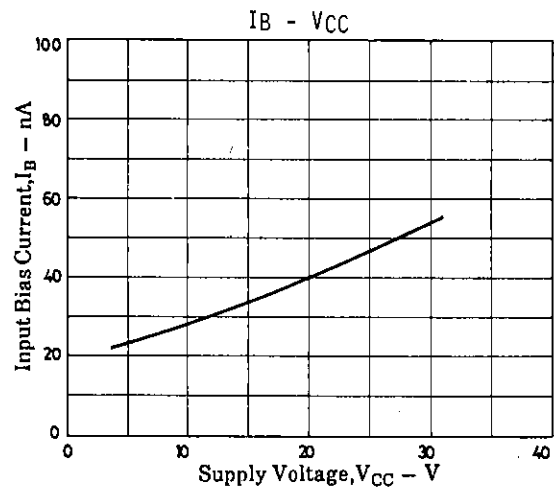
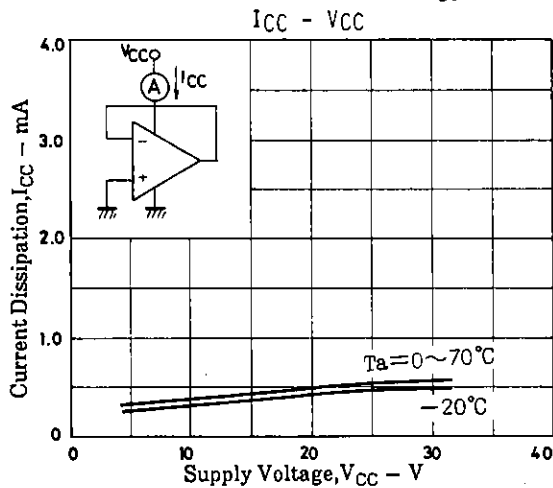
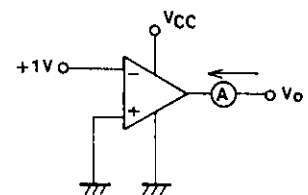
## 8. Current Dissipation ICC

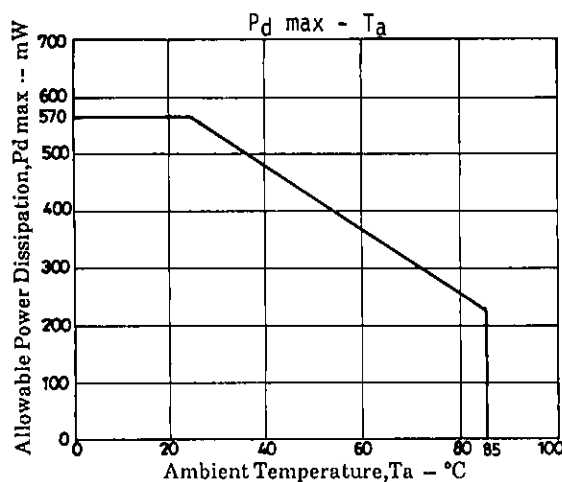
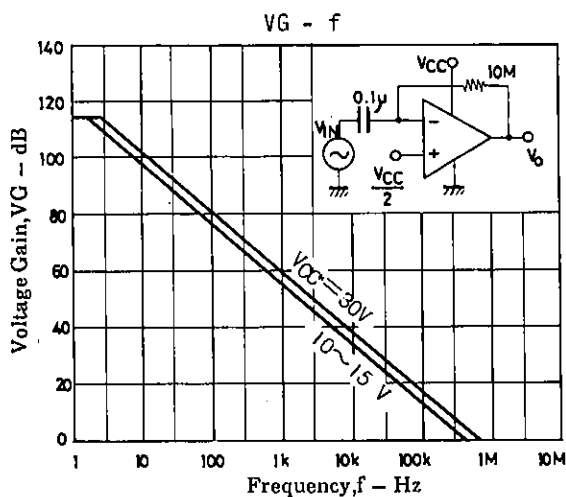
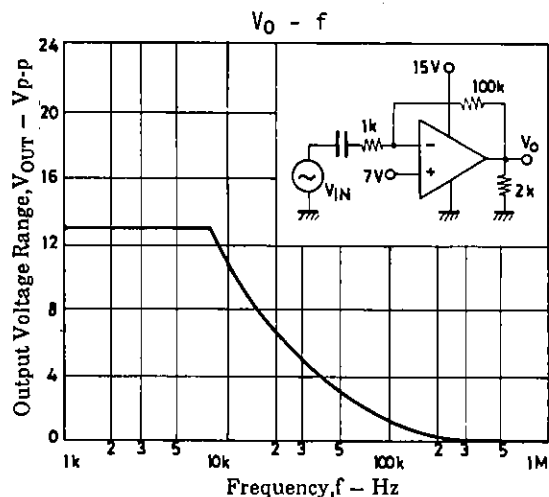


## 9. Output Current IO source



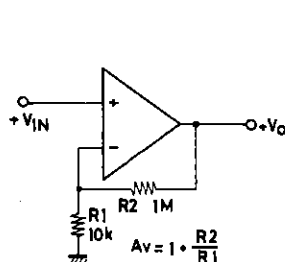
## 10. Output Current IO sink



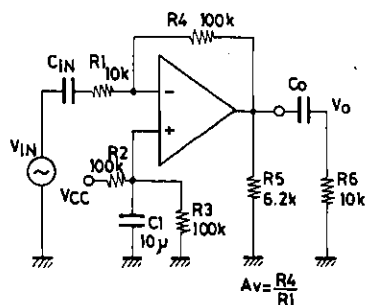


### Sample Application Circuits

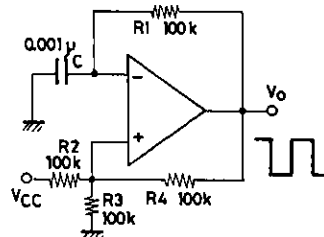
Noninverting DC amplifier



Inverting AC amplifier



Rectangular wave oscillator



Unit (resistance:  $\Omega$  capacitance: F)

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