SGS

LS 101
LS 201
LS 301

LINEAR INTEGRATED CIRCUITS

HIGH PERFORMANCE OPERATIONAL AMPLIFIERS

- GUARANTED DRIFT CHARACTERISTICS
- SLEW RATE OF 10V/µs AS A SUMMING AMPLIFIER
- UNITY GAIN PHASE COMPENSATION WITH A SINGLE 30 pF CAPACITOR
- 3 mV MAX OFFSET VOLTAGE OVER TEMPERATURE RANGE
- 100 nA MAX INPUT BIAS CURRENT OVER TEMPERATURE RANGE

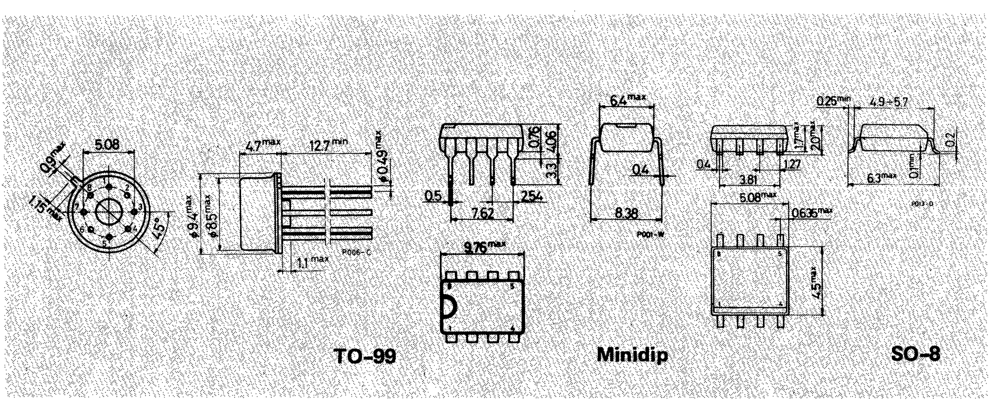
The LS 101 series consists of high performance operational amplifiers, intended for a wide range of analog applications, where tailoring of frequency characteristics is desirable. The LS 101 series is short circuit protected and has the same pin configuration as the LS 141 and LS 148. Absence of latch-up and high common mode voltage range make the LS 101 series ideal for use as voltage followers. In addition, the LS 101 series provides better accuracy and lower noise in high impedance circuitry: the low input current also makes it particularly well suited for long interval integrators, timers, sample and hold circuits and low frequency generators. The LS 101 series is also available with hermetic gold chip (8000 series), particularly suitable for professional and telecom applications, wherever very high MTBF are required.

ABSOLUTE MAXIMUM RATINGS		TO-99	Minidip	µpackage
V_s	Supply voltage for **LS 101/101A/201/201A**		± 22 V	
	for **LS 301A**		± 18 V	
V_i (1)	Input voltage		± 15 V	
ΔV_i	Differential input voltage		± 30 V	
T_{op}	Operating temperature for **LS 101/LS 101A**		-55 to 125 °C	
	for **LS 201A**		-25 to 85 °C	
	for **LS 201/LS 301A**		0 to 70 °C	
	Output short circuit duration (2)		indefinite	
P_{tot}	Power dissipation at T_{amb} = 70 °C	520 mW	665 mW	400 mW
T_{stg}	Storage temperature	-65 to 150 °C	-55 to 150 °C	-55 to 150 °C

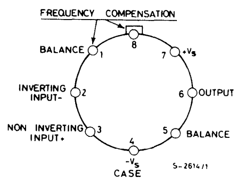
(1) For supply voltage less than ± 15V, input voltage is equal to the supply voltage.
(2) The short circuit duration is limited by thermal dissipation.

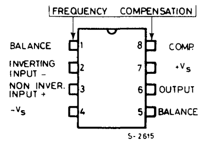
MECHANICAL DATA

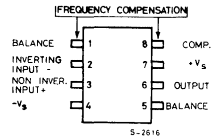
Dimensions in mm



CONNECTION DIAGRAMS AND ORDERING NUMBERS
(top views)

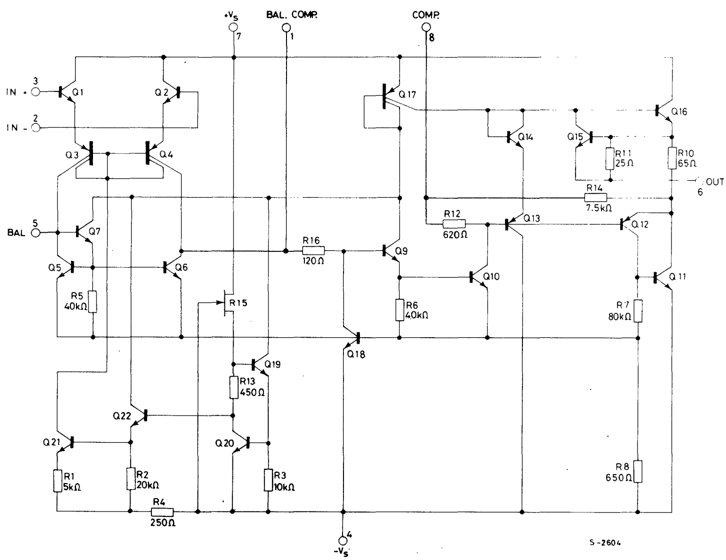






Type	TO-99	Minidip	SO-8
LS 101	LS 101T	–	–
LS 101A	LS 101AT	–	–
LS 201	LS 201T	LS 201B	LS 201M
LS 201A	LS 201AT	–	–
LS 301A	LS 301AT	LS 301AB	LS 301AM
LS 8101	–	–	LS 8101M
LS 8101A	–	–	LS 8101AM
LS 8201	–	–	LS 8201M
LS 8201A	–	–	LS 8201AM
LS 8301A	–	–	LS 8301AM

SCHEMATIC DIAGRAM



THERMAL DATA

			TO-99	Minidip	SO-8
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	155 °C/W	120 °C/W	200* °C/W

* Measured with the device mounted on a ceramic substrate (25x16x0.6 mm)

ELECTRICAL CHARACTERISTICS* for LS 101 and LS 201

Parameter		Test conditions	LS 101			LS 201			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
V_{os}	Input offset voltage	$R_g \leq 10\ k\Omega$ $R_g \leq 10\ k\Omega$ $T_{amb} = 25°C$		 1	6 5		 2	10 7.5	mV mV
$\frac{\Delta V_{os}}{\Delta T}$	Average temperat. coefficient of input offset voltage	$R_g \leq 10\ k\Omega$ $R_g \leq 50\Omega$		6 3			10 6		µV/°C µV/°C
I_{os}	Input offset current	$T_{amb} = 25°C$ $T_{amb} = T_{max}$ $T_{amb} = T_{min}$		40 10 100	200 200 500		100 50 150	500 400 750	nA nA nA
I_b	Input bias current	 $T_{amb} = 25°C$		 0.12	1.5 0.5		 0.25	2 1.5	µA µA
R_i	Input resistance	$T_{amb} = 25°C$	0.3	0.8		0.1	0.4		MΩ
V_i	Input voltage range	$V_s = \pm 15V$	± 12			± 12			V
G_v	Large signal voltage gain	$V_s = \pm 15V$ $V_o = \pm 10V$ $R_L \geq 2\ k\Omega$	88			83			dB
		$V_s = \pm 15V$ $V_o = \pm 10V$ $R_L \geq 2\ k\Omega$ $T_{amb} = 25°C$	94	104		86	103		dB
CMR	Common mode rejection	$R_g \leq 10\ k\Omega$	70	90		65	90		dB
SVR	Supply voltage rejection	$R_g \leq 10\ k\Omega$	70	90		70	90		dB
V_o	Output voltage swing	$V_s = \pm 15V$ $R_L = 10\ k\Omega$ $R_L = 2\ k\Omega$	 ± 12 ± 10	 ± 14 ± 13		 ± 12 ± 10	 ± 14 ± 13		 V V
I_s	Supply current	$V_s \pm 20V$		1.8	3		1.8	3	mA

* These specifications, unless otherwise specified, apply for $C_1 = 30$ pF, $V_s = \pm 5$ to $\pm 20V$ and $T_{amb} = -55$ to 125 °C (LS 101/LS 101A), $T_{amb} = -25$ to 85 °C (LS 201A) and $T_{amb} = 0$ to 70 °C (LS 201); $V_s = \pm 5$ to $\pm 15V$ and $T_{amb} = 0$ to 70 °C (LS 301A).

ELECTRICAL CHARACTERISTICS* for LS 101A, LS 201A and LS 301A

Parameter		Test conditions	LS 101A/LS 201A			LS 301A			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
V_{os}	Input offset voltage	$R_g \leq 10\ k\Omega$ $R_g \leq 10\ k\Omega$ $T_{amb} = 25°C$		 0.7	3 2		 2	10 7.5	mV mV
$\frac{\Delta V_{os}}{\Delta T}$	Average temperat. coefficient of input offset voltage	$R_g \leq 10\ k\Omega$		3	15		6	30	μV/°C
I_{os}	Input offset current	$T_{amb} = 25°C$		 1.5	20 10		 3	70 50	nA nA
$\frac{\Delta I_{os}}{\Delta T}$	Average temperat. coefficient of input offset current	$T_{amb} = 25°C$ to T_{max} $T_{amb} = T_{min}$ to $25°C$		0.01 0.02	0.1 0.2		0.01 0.02	0.3 0.6	nA/°C nA/°C
I_b	Input bias current	 $T_{amb} = 25°C$		 30	0.1 75		 70	0.3 250	μA nA
R_i	Input resistance	$T_{amb} = 25°C$	1.5	4		0.5	2		MΩ
V_i	Input voltage range	$V_s = \pm 20V$ $V_s = \pm 15V$	± 15 			 ±12			V V
G_v	Large signal voltage gain	$V_s = \pm 15V$ $V_o = \pm 10V$ $R_L \geq 2\ k\Omega$	 88			 83			 dB
		$V_s = \pm 15V$ $V_o = \pm 10V$ $R_L \geq 2\ k\Omega$ $T_{amb} = 25°C$	 94	 104		 86	 104		 dB
CMR	Common mode rejection	$R_g \leq 10\ k\Omega$	80	96		70	90		dB
SVR	Supply voltage rejection	$R_g \leq 10\ k\Omega$	80	96		70	96		dB
V_o	Output voltage swing	$V_s = \pm 15V$ $R_L = 10\ k\Omega$ $R_L = 2\ k\Omega$	 ± 12 ± 10	 ± 14 ± 13		 ± 12 ± 10	 ± 14 ± 13		 V V
I_s	Supply current	$V_s = \pm 20V$ $T_{amb} = T_{max}$		1.2	2.5				mA
		$T_{amb} = 25°C$ $V_s = \pm 20V$ $V_s = \pm 15V$		 1.8 	 3 		 1.8	 3	 mA mA

* These specifications, unless otherwise specified, apply for $C_1 = 30\ pF$, $V_s = \pm 5$ to $\pm 20V$ and $T_{amb} = -55$ to 125 °C (LS 101/LS 101A), $T_{amb} = -25$ to 85 °C (LS 201A) and $T_{amb} = 0$ to 70 °C (LS 201); $V_s = \pm 5$ to $\pm 15V$ and $T_{amb} = 0$ to 70 °C (LS 301A).

Guaranteed characteristics (LS 101/LS 201)

Fig. 1 - Input voltage range vs. supply voltage

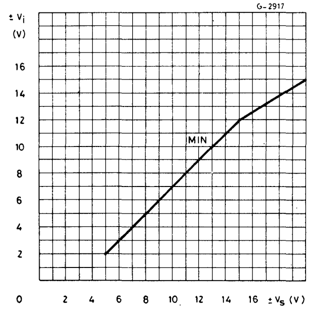


Fig. 2 - Output voltage swing vs. supply voltage

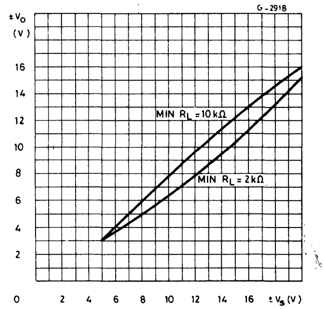
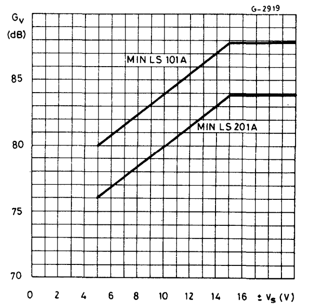


Fig. 3 -- Voltage gain vs. supply voltage



Guaranteed characteristics (LS 101A/LS 201A)

Fig. 4 - Input voltage range vs. supply voltage

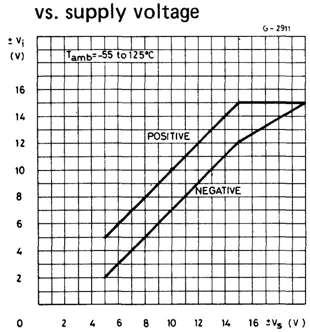


Fig. 5 - Output voltage swing vs. supply voltage

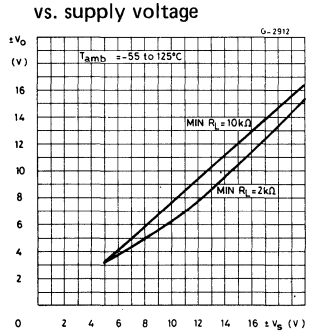
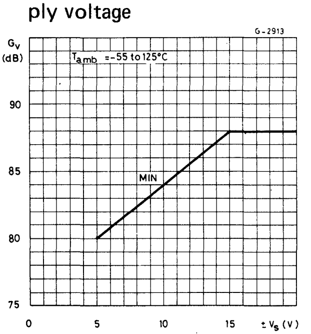


Fig. 6 - Voltage gain vs. supply voltage



Guaranteed characteristics (LS 301A)

Fig. 7 - Input voltage range vs. supply voltage

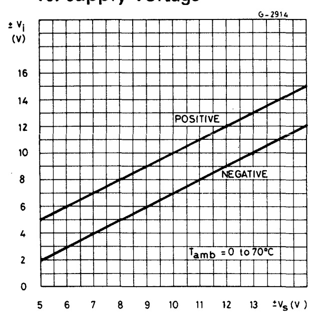


Fig. 8 - Output voltage swing vs. supply voltage

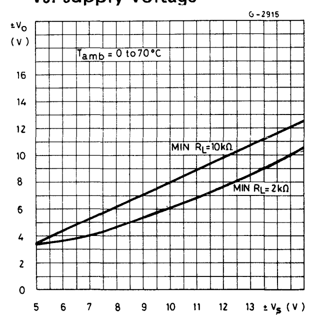


Fig. 9 - Voltage gain vs. supply voltage

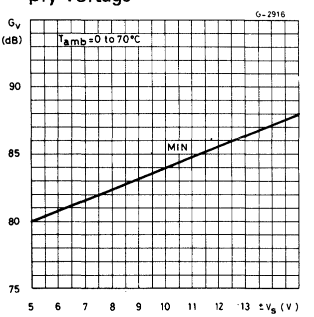


Fig. 10 - Input bias current vs. ambient temperature (for LS 101A/201A/301A)

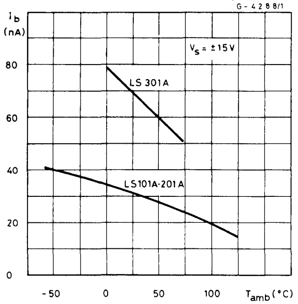


Fig. 11 - Input offset current vs. ambient temperature (for LS 101A/201A/301A)

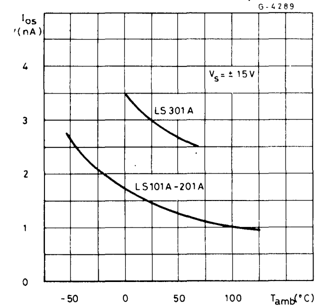


Fig. 12 - Input bias current vs. ambient temperature (for LS 101/201)

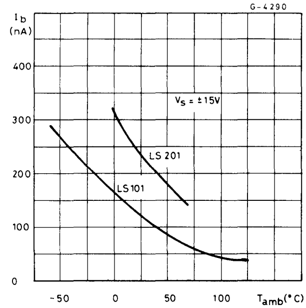


Fig. 13 - Input offset current vs. ambient temperature (for LS 101/201)

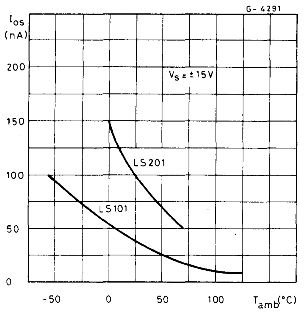


Fig. 14 - Supply current vs. supply voltage

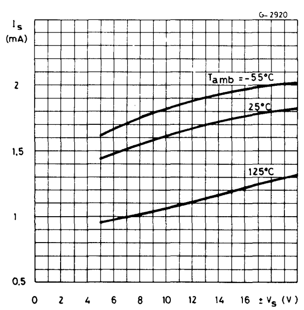


Fig. 15 - Voltage gain vs. supply voltage

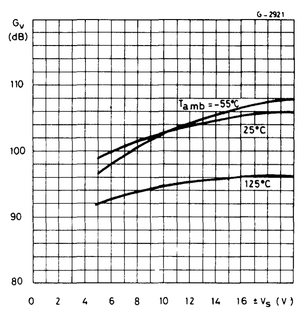


Fig. 16 - Output voltage swing vs. output current

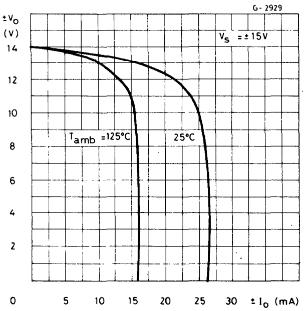


Fig. 17 - Input noise voltage vs. frequency

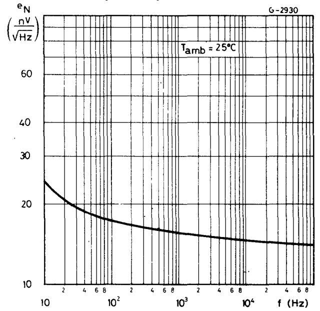
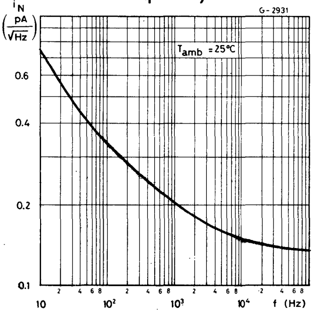


Fig. 18 - Input noise current vs. frequency



LS101 LS201 LS301

OPERATIONAL AMPLIFIER COMPENSATION

SINGLE POLE

Fig. 19

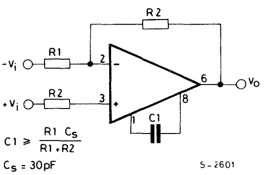


Fig. 20 - Open loop frequency response

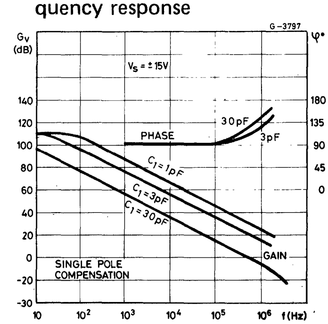
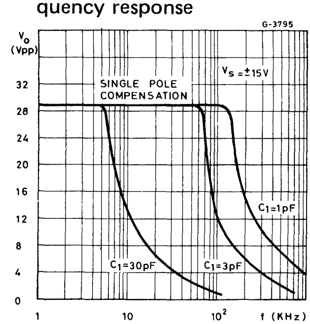


Fig. 21 - Large signal frequency response



TWO POLE

Fig. 22

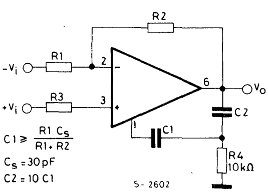


Fig. 23 - Open loop frequency response

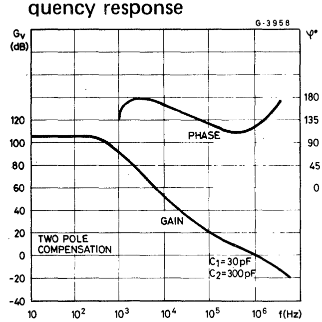
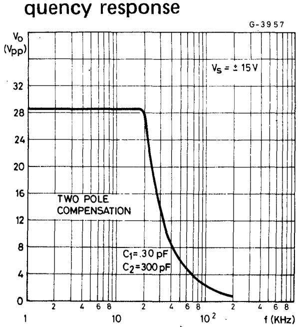


Fig. 24 - Large signal frequency response



FEED FORWARD

Fig. 25

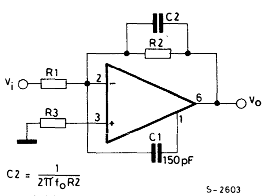


Fig. 26 - Open loop frequency response

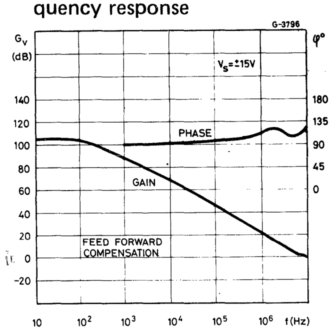


Fig. 27 - Large signal frequency response

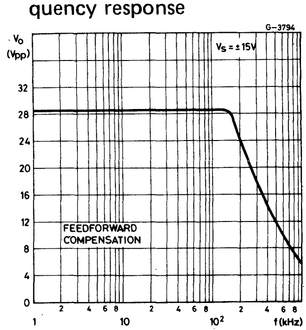


Fig. 28 - Single pole compensation pulse response

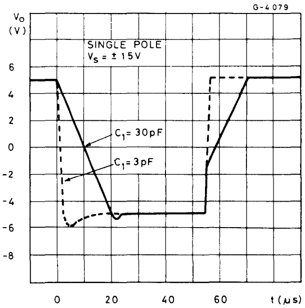


Fig. 29 - Two pole compensation pulse response

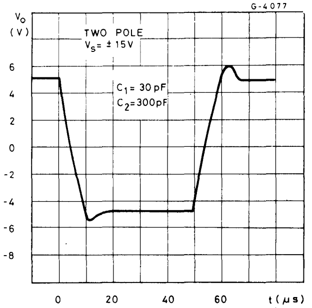
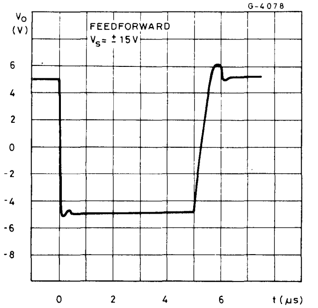


Fig. 30 - Feed forward pulse response



TYPICAL APPLICATIONS

Fig. 31 - Inverting amplifier with balancing circuit

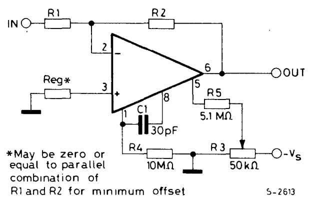


Fig. 32 - Integrator with bias current compensation

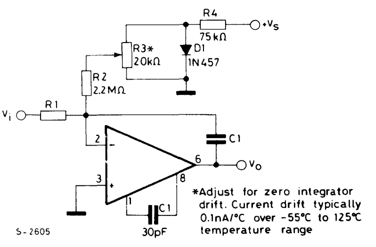


Fig. 33 - Standard compensation and offset balancing circuit

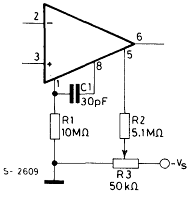
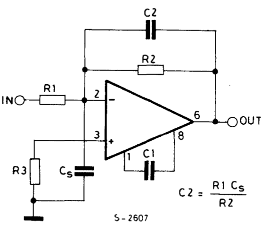


Fig. 34 - Compensation for stray input capacitances or large feedback resistor



TYPICAL APPLICATIONS (continued)

Fig. 35 - Protecting against gross fault conditions

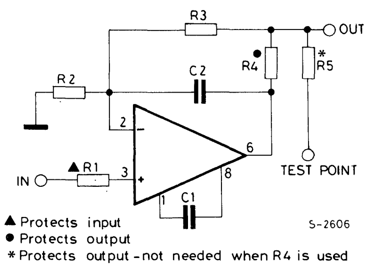


Fig. 36 - Bilateral current source

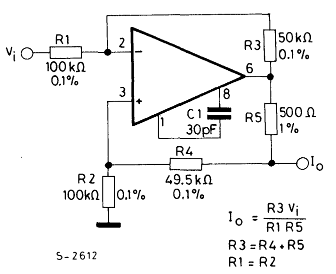


Fig. 37 - Power operational amplifier ($G_v = 40$ dB)