



# SANYO Semiconductors DATA SHEET

## LA6510 — Monolithic Linear IC Dual Power Operational Amplifier

### Overview

The LA6510 is a dual power operational amplifier IC capable of delivering larger output currents than conventional operational amplifiers.

The LA6510 features an on-chip current limiter and provides high voltage gain and a high common-mode rejection ratio. The LA6510 is an ideal choice for power applications such as DC servos, capstan drivers, actuator drivers, programmable power supplies and high-quality audio amplifiers.

### Functions

- High output current ( $I_O \text{ max} = 1.0\text{A}$ )
- High gain
- Equipped with current limiter pin
- Supports single power source operation

### Specifications

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

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	$V_{CC} / V_{EE} \text{ max}$		$\pm 18$	V
Differential input voltage	$V_{ID}$		30	V
Common mode input voltage	$V_{ICOM}$		$\pm 15$	V
Maximum output current	$I_O \text{ max}$		1.0	A
Allowable power dissipation	$P_d \text{ max}$		2.5	W
Operating temperature	$T_{opr}$		-40 to +85	$^\circ\text{C}$
Storage temperature	$T_{stg}$		-55 to +150	$^\circ\text{C}$

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**SANYO Semiconductor Co., Ltd.**

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# LA6510

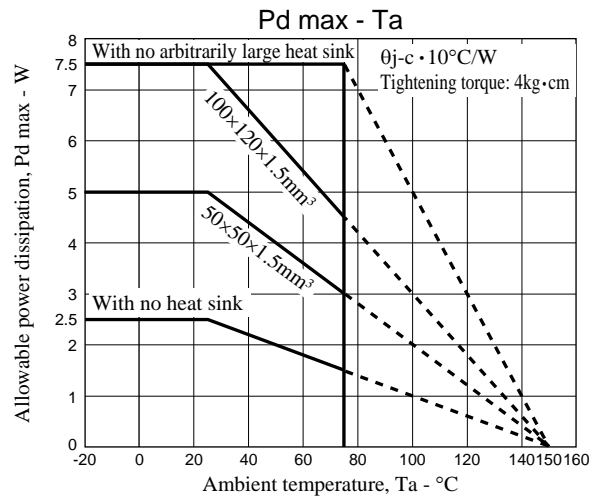
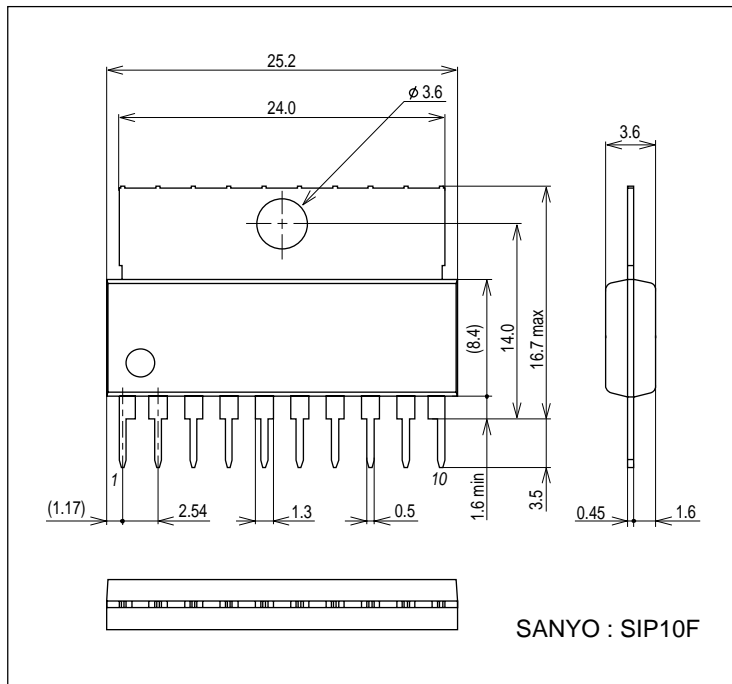
Electrical Characteristics at  $T_a = 25^\circ\text{C}$ ,  $V_{CC} / V_{EE} = \pm 15\text{V}$

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
No-load current drain	$I_{CCO}$			12	20	mA
Input offset voltage	$V_{IO}$	$R_S \leq 10\text{k}\Omega$		2	6	mV
Input offset current	$I_{IO}$			10	200	nA
Input bias current	$I_B$			100	700	nA
Common-mode input voltage range	$V_{ICM}$		-15		+13	V
Common-mode signal rejection ratio	$C_{MR}$		70	80		dB
Output voltage	$V_O$	$R_L = 33\Omega$	$\pm 12$	$\pm 13$		V
Voltage gain	$V_{GO}$			100		dB
Slew rate	SR	$G_V = 0$ , $R_L = 33\Omega$ , $R = 2.2\Omega$ , $C = 0.1\mu\text{F}$		0.15		V/ $\mu\text{s}$
Equivalent input noise voltage	$V_{NI}$	$R_g = 1\text{k}\Omega$ , DIN AUDIO		2		$\mu\text{V}$
Supply voltage rejection ratio	SVR			30	150	$\mu\text{V/V}$
Limiting current	$I_{SC}$	$R_{sc} = 2.2\Omega$		0.35		A

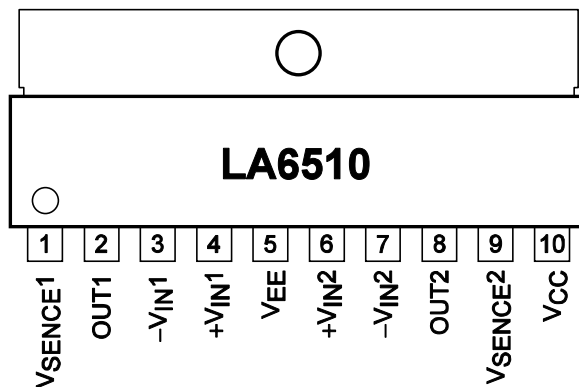
## Package Dimensions

unit : mm (typ)

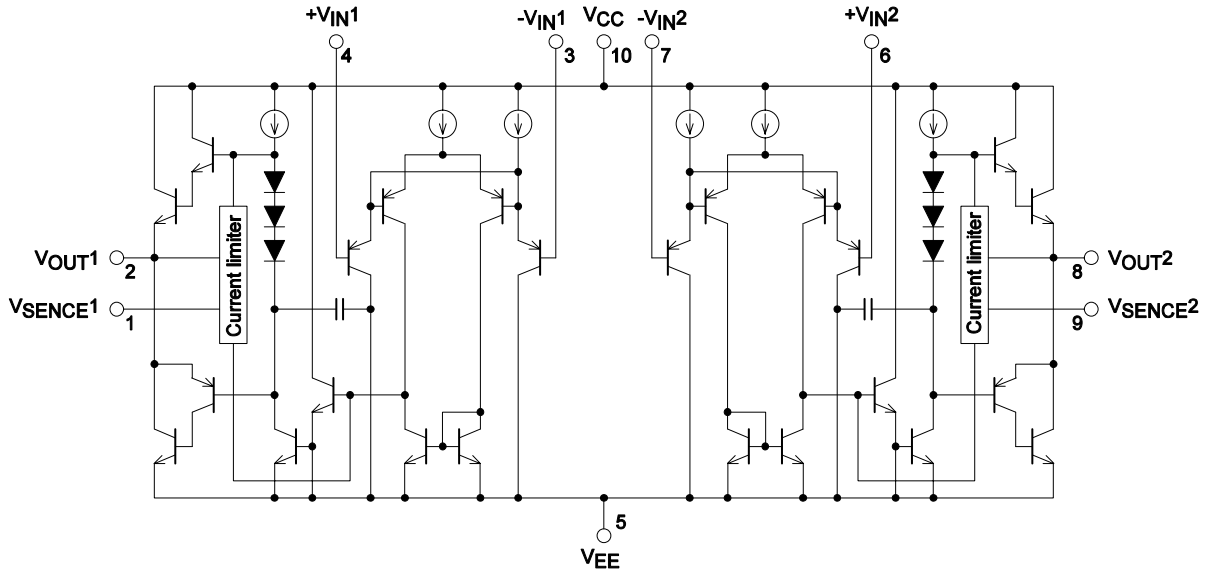
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## Pin Assignment

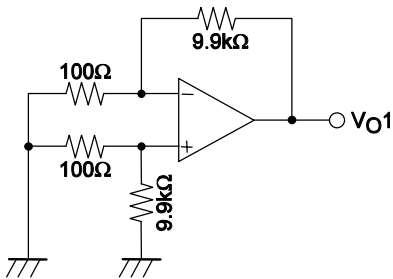


Equivalent Circuit



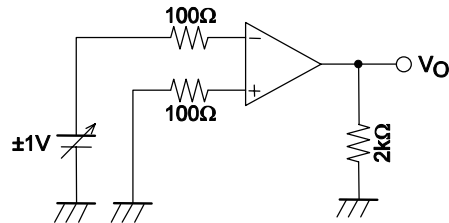
Test Circuits

- 1. Input offset voltage [ $V_{IO}$ ]  
Supply voltage rejection ratio [SVR]



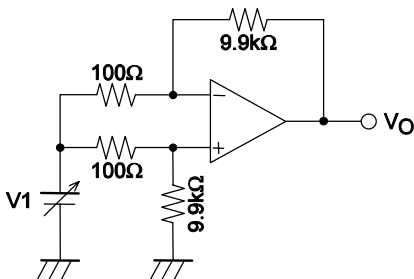
$V_{IO} \quad V_{CC} / V_{EE} = \pm 15V$   
 $SVR \quad \begin{cases} V_{CC} = 15V, 5V \\ V_{EE} = -5V, -15V \end{cases}$

- 2. Output voltage [ $V_O$ ]



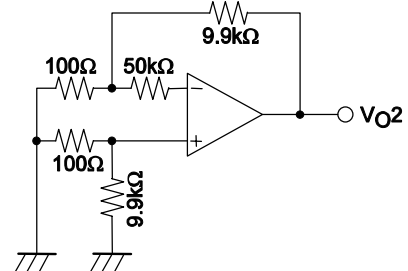
$V_{IO} = V_{O1} / 100$   
 $SVR(+)$   
 $SVR(-) = \left| \frac{\Delta V_{O1}}{100 \times 10V} \right|$

- 3. Common-mode signal rejection ratio [CMR]  
Common-mode input voltage range [ $V_{ICM}$ ]



$CMR \quad V_1 = \pm 7.5V$   
 $CMR = 20 \log \frac{15 \times 100}{|\Delta V_{O1}|}$

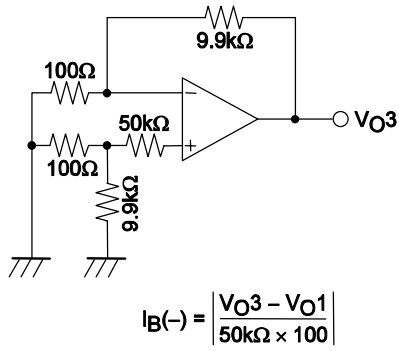
- 4. Input bias current [ $I_{B(+)}$ ]



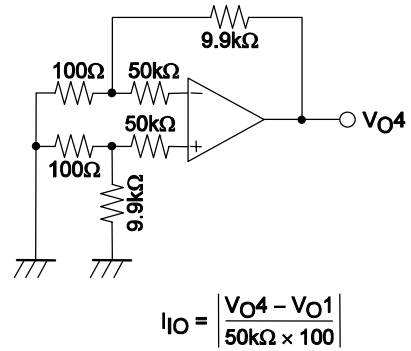
$I_{B(+)} = \frac{V_{O2} - V_{O1}}{50k\Omega \times 100}$

# LA6510

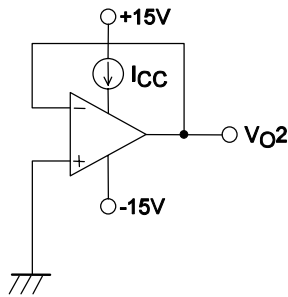
5. Input bias current [ $I_{B(-)}$ ]



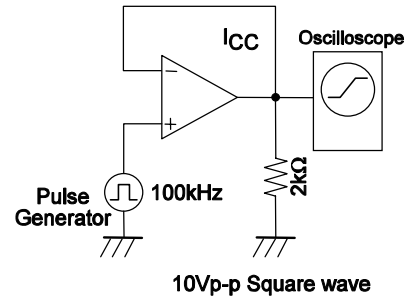
6. Input offset current [ $I_{IO}$ ]



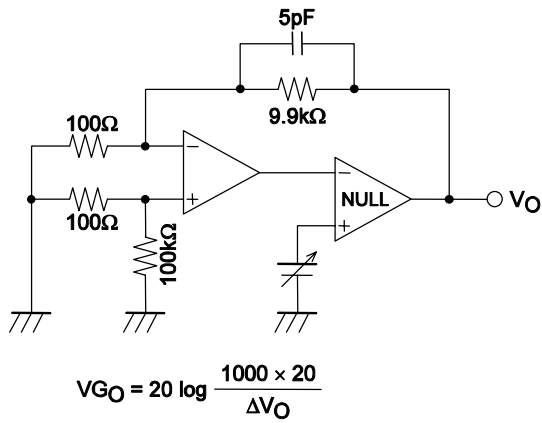
7. Current drain [ $I_{CC}$ ]



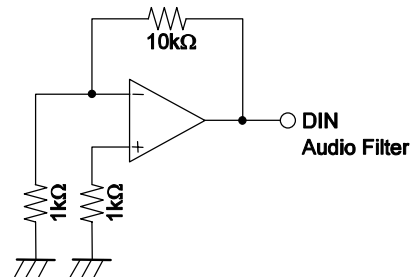
8. Slew rate [SR]



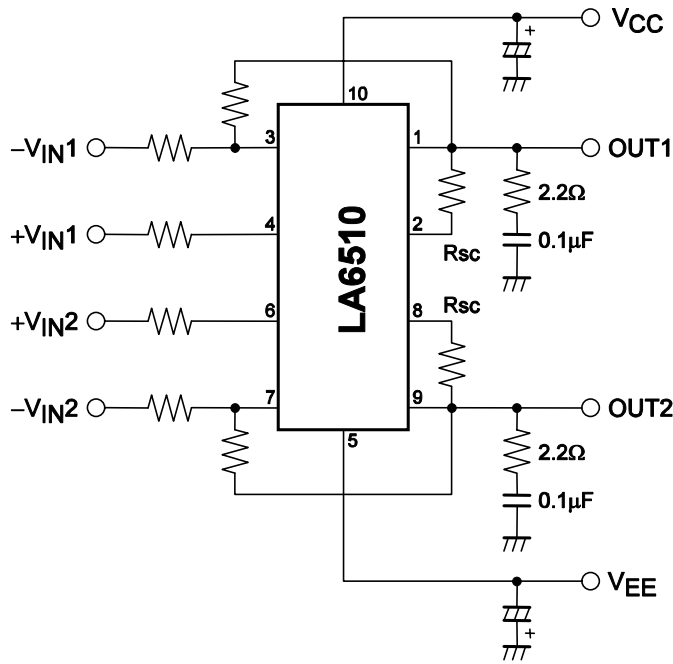
9. Voltage gain [ $V_{G0}$ ]



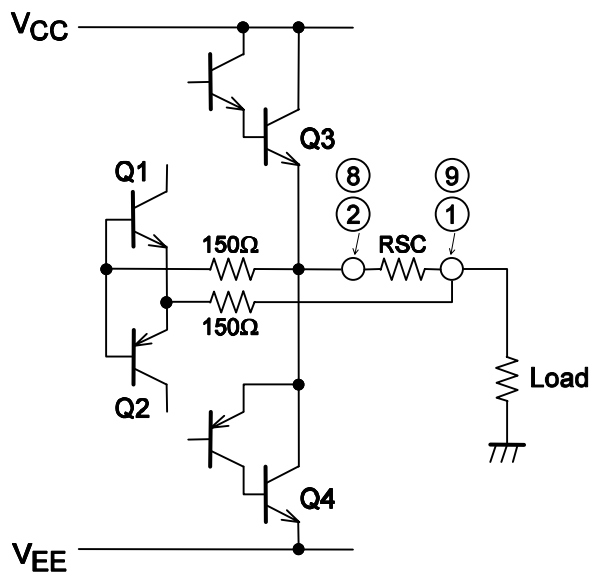
10. Equivalent input noise voltage [ $V_{NI}$ ]



Application Circuit Examples



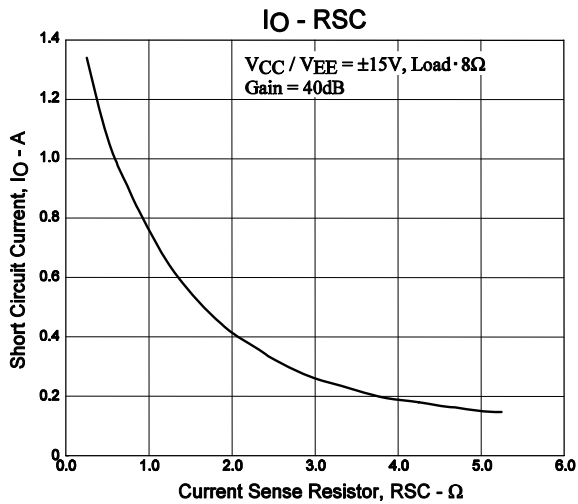
Current Limiter Circuit and Output Stage



In source mode, when Q3 turns on and current flows into the load resistor, a voltage difference occurs across RSC, turning on Q1 and activating the current limiter.

In sink mode, Q4 turns on to develop a voltage difference of the polarity opposite to that in the source mode across RSC, thus turning on Q2 and activating the limiter.

A RSC can be used to set the maximum output current, but the maximum output current will vary slightly depending on the  $V_{BE}$  temperature characteristics of the transistor.



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