LOW POWER QUAD OPERATIONAL AMPLIFIER

| 14 DIP | Unit: mm |

The DBL324 consists of four independent high gain, internally frequency compensated operational amplifiers designed to operate from a single supply over a wide range of voltage.

FEATURES

- O Input common mode voltage range includes ground
- O Internally frequency compensated for unity gain
- O Large DC voltage gain : 100dB
- O Wide bandwidth for unity gain : 1MHz
- O Very low power consumption
- O Wide supply voltage range :
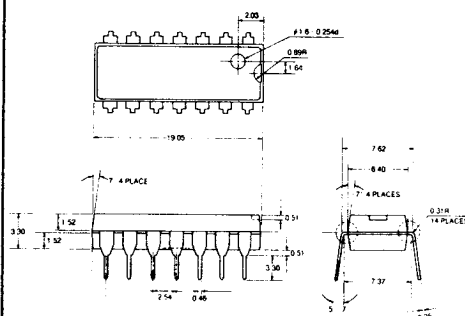   - Single : 3V~30V
    - Dual : ±1.5V~±15V

APPLICATIONS

- O Transducer amplifiers
- O DC gain blocks
- O Conventional operational amplifiers

MAXIMUM RATINGS

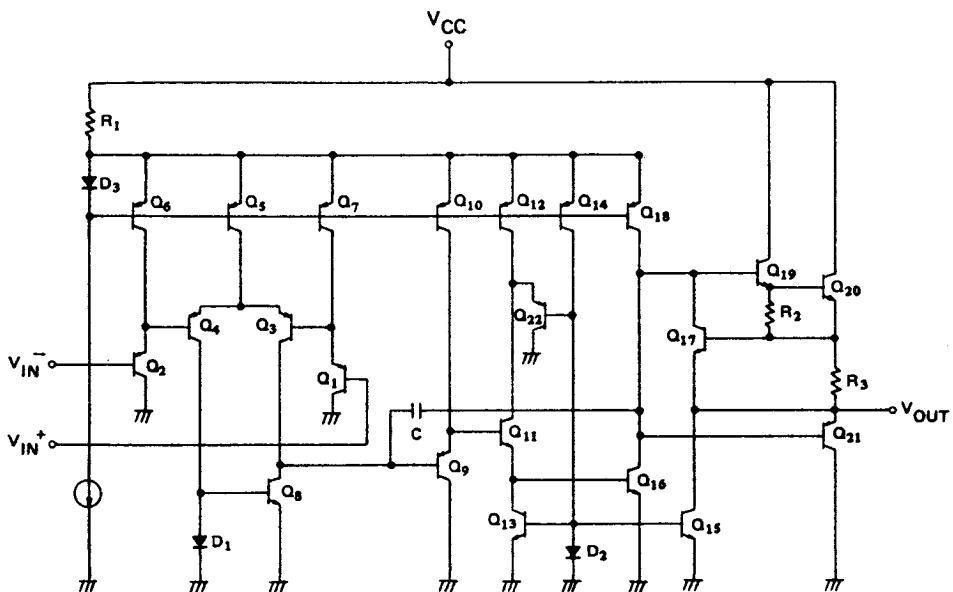| Characteristic	Symbol	Rating	Unit
Supply Voltage	V_{CC}	32 or ± 16	V
Differential Input Voltage	V_{IND}	32	V
Input Voltage	V_{IN}	0.3~+32	V
Power Dissipation	P_D	570	mW
Operating Temperature	T_{opr}	0~+70	°C
Storage Temperature	T_{stg}	−55~+150	°C

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□ BLOCK DIAGRAM
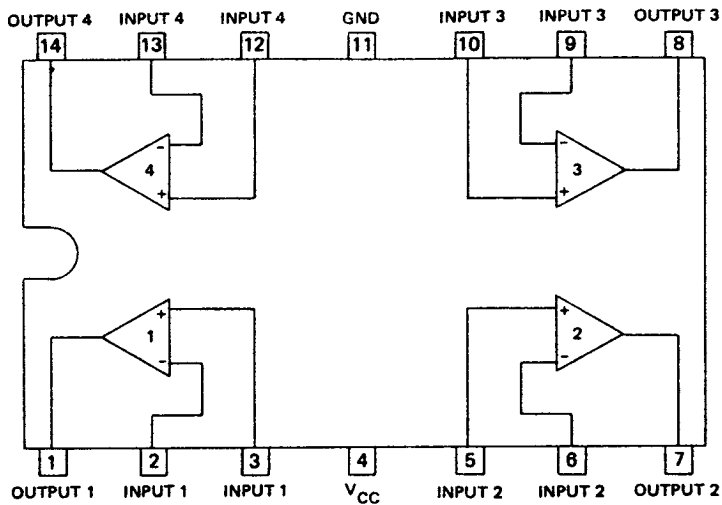
□ EQUIVALENT CIRCUIT(One section)
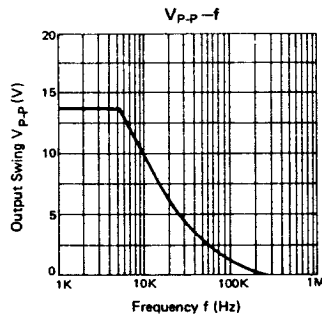
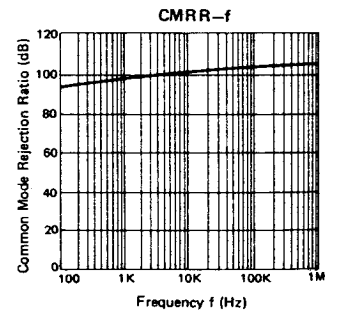# DBL 324

☐ ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, $V_{CC} = 5V$ and $0°C \leq Ta \leq 70°C$)

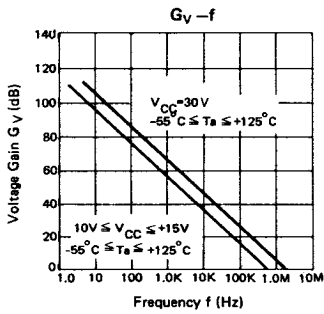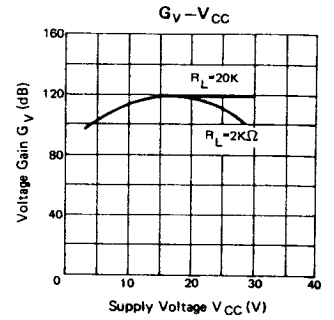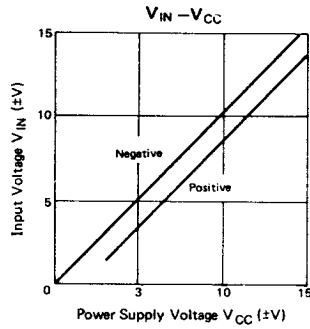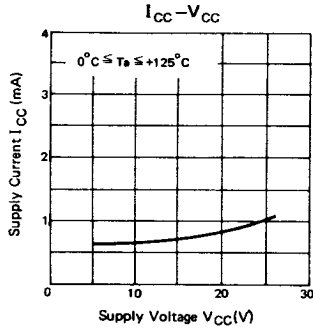| Characteristic	Symbol	Test Condition		Min.	Typ.	Max.	Unit
Input Offset Voltage	V_{IOS}	$V_{OUT} = 1.4V$, $5V \leq V_{CC} \leq 30V$	$Ta = 25°C$	—	±2	±7	mV
		$Rg = 0\,\Omega$, $0V \leq V_{IC} \leq V_{CC} - 1.5V$		—	—	±9	mV
Input Offset Voltage Drift	$\triangle V_{IOS}/\triangle T$	$Rg = 0\,\Omega$		—	7	—	$\mu V/°C$
Input Offset Current	I_{IOS}	—	$Ta = 25°C$	—	±5	±50	nA
				—	—	±150	nA
Input Offset Current Drift	$\triangle I_{IOS}/\triangle T$	—		—	10	—	$pA/°C$
Input Bias Current	I_{IB}	—	$Ta = 25°C$	—	45	250	nA
				—	40	500	nA
Input Common Mode Voltage Range	V_{ICR}	$V_{CC} = 30V$	$Ta = 25°C$	0	—	$V_{CC}-1.5$	V
				0	—	$V_{CC}-2$	V
Supply Current	I_{CC}	$V_{CC} = 30V$, $R_L = \infty$		—	1.5	3	mA
		$V_{CC} = 5V$, $R_L = \infty$		—	0.7	1.2	mA
Large Signal Volage Gain	G_V	$V_{CC} = 15V$, $R_L \geq 2K\,\Omega$	$Ta = 25°C$	25	100	—	V/mV
				15	—	—	V/mV
Output Voltage Swing	V_{OH}	$V_{CC} = 30V$	$R_L = 2K\,\Omega$	27	28	—	V
			$R_L \geq 10K\,\Omega$	27	28	—	V
	V_{OL}	$V_{CC} = 5V$, $R_L \leq 10K\,\Omega$		—	5	20	mV
Common Mode Rejection Ratio	CMRR	$Ta = 25°C$		65	70	—	dB
Power Supply Rejection Ratio	PSRR	$Ta = 25°C$		65	100	—	dB
Output Short Circuit Current to Ground	I_{OS}	$Ta = 25°C$		—	40	60	mA
Differential Input Voltage	V_{IND}	—		—	—	32	V
Output Source Current	I_{O}·	$V_{CC} = 15V$, $V_{IN·} = 1V$, $V_{IN^-} = 0V$	$Ta = 25°C$	20	40	—	mA
				10	20	—	mA
Output Sink Current	I_{O^-}	$V_{CC} = 15V$, $V_{IN·} = 0V$, $V_{IN^-} = 1V$	$Ta = 25°C$	10	20	—	mA
				5	8	—	mA
		$V_{OUT} = 200mV$, $Ta = 25°C$, $V_{IN·} = 0V$, $V_{IN^-} = 1V$		12	50	—	μA

* V_{IC} : Input Common Mode Voltage

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☐ TYPICAL PERFORMANCE CHARACTERISTICS

$I_{CC} - V_{CC}$

$0°C \leq T_a \leq +125°C$

Supply Current I_{CC} (mA)

Supply Voltage V_{CC} (V)

$V_{IN} - V_{CC}$

Negative

Positive

Input Voltage V_{IN} (±V)

Power Supply Voltage V_{CC} (±V)

$G_V - V_{CC}$

$R_L = 20K$

$R_L = 2K\Omega$

Voltage Gain G_V (dB)

Supply Voltage V_{CC} (V)

$G_V - f$

$V_{CC} = 30V$
$-55°C \leq T_a \leq +125°C$

$10V \leq V_{CC} \leq +15V$
$-55°C \leq T_a \leq +125°C$

Voltage Gain G_V (dB)

Frequency f (Hz)

$V_{OUT} - t$

$T_a = +25°C$
$V_{CC} = 30V$

Input

Output

Output Voltage V_{OUT} (mV)

Time t (μS)

$CMRR - f$

Common Mode Rejection Ratio (dB)

Frequency f (Hz)

$V_{OUT} - I_O^+$

$T_a = 25°C$

Output Voltage Referenced to V_{CC} V_{OUT} (V)

Output Source Current I_O^+ (mA)

$V_{P-P} - f$

Output Swing V_{P-P} (V)

Frequency f (Hz)

$I_{OUT} - T_a$

Output Current I_{OUT} (mA)

Temperature Ta (°C)

☐ APPLICATION INFORMATION

The DBL324 operates with only a single power supply voltage, has true-differential inputs and remains in the linear mode with an input common mode voltage of 0 V. This amplifier works over a wide range of power supply voltage with little change in performance characteristics. At 25°C amplifier operation is possible down to a minimum supply voltage of 2.3V.

Large differential input voltage can be easily accommodated and, as input differential voltage protection diodes are not used, no large input currents result from large differential input voltage. The differential input voltage may be larger than V_{CC} without damage. Protection should be provided to prevent the input voltages from going negative more than $-0.3V$. An input clamp diode with a resistor to the IC input terminal can be used.

To reduce the power supply current drain, the amplifier has a class A output stage for small signal level which converts to class B in a large signal mode. This allows the amplifiers to both source and sink large output currents. Therefore both NPN and PNP external current boost transistors can be used to extend the power capability of the basic amplifiers. The output voltage needs to raise approximately 1 diode drop above ground to bias the on-chip vertical PNP transistor for output current sinking applications.

Output short circuits either to ground or to the positive power supply should be of short time duration. Units can be destroyed, not as a result of the short circuit current causing metal fusing, but rather due to the large increase in IC chip dissipation which will cause eventual faiure due to excessive junction temperatures. Putting direct shortcircuits on more than one amplifier at a time, the total IC power dissipation will increase to destructive levels, if not properly protected with external dissipation limiting resistors in series with the output leads of the amplifiers.

☐ APPLICATION CIRCUITS
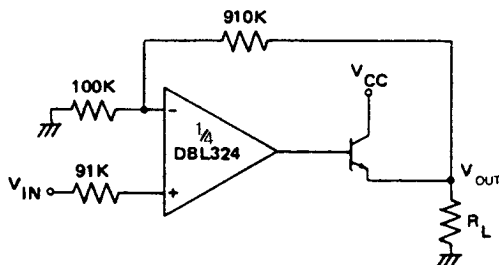(Single supply circuits, $V_{CC} = 5V$)

1. DC Summing Amplifer
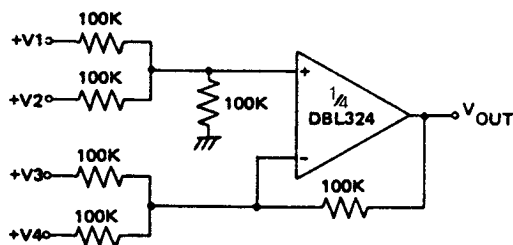
2. **Power Amplifier**

$V_{OUT} = V1 + V2 - V3 - V4$

$(V1 + V2) \geqq (V3 + V4)$ to keep $V_{OUT} > 0V$
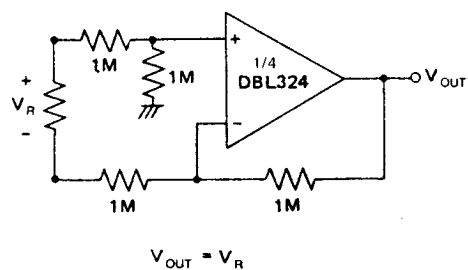
$V_{OUT} = 0V$ for $V_{IN} = 0V$

$G_V = 10dB$

☐ APPLICATION CIRCUIT (continued)

7. Fixed Current Sources

$$I_2 = (\frac{R_1}{R_2}) I_1$$
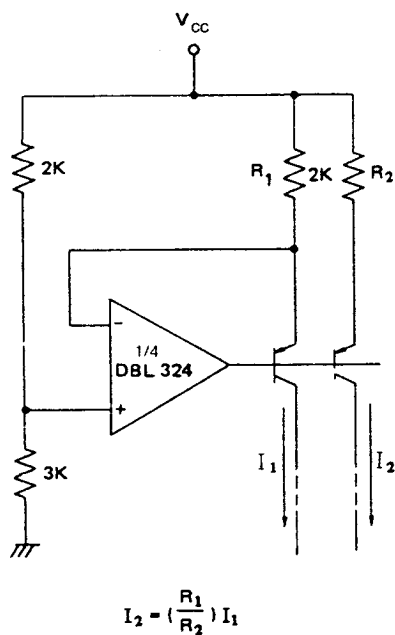
8. Ground Referencing a Differential input Signal

$$V_{OUT} = V_R$$

9. Pluse Generator

C=0.01μF