

## QUADRUPLE OPERATIONAL AMPLIFIERS

- LOW SUPPLY CURRENT: 0.53mA/AMPLIFIER
- CLASS AB OUTPUT STAGE: NO CROSS OVER DISTORTION
- PIN COMPATIBLE WITH LM124
- LOW INPUT OFFSET VOLTAGE: 1mV
- LOW INPUT OFFSET CURRENT: 2nA
- LOW INPUT BIAS CURRENT: 30nA
- GAIN BANDWIDTH PRODUCT: 1.3MHz
- HIGH DEGREE OF ISOLATION BETWEEN AMPLIFIERS: 120dB
- OVERLOAD PROTECTION FOR INPUTS AND OUTPUTS

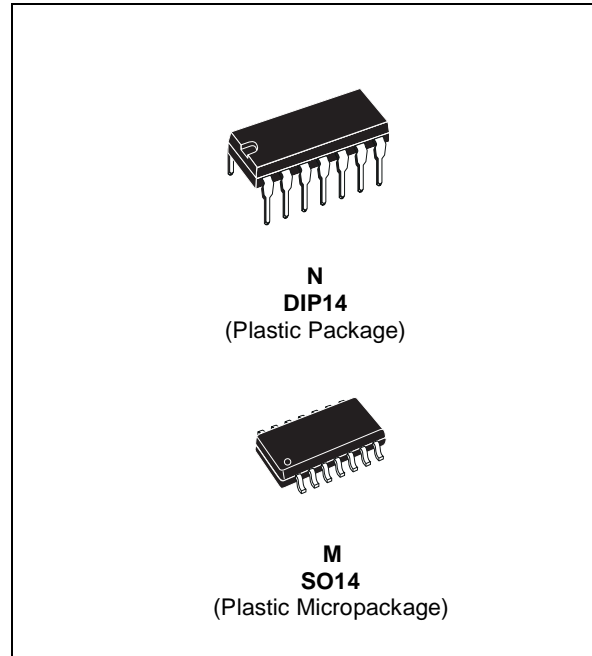
### DESCRIPTION

The LM148 consists of four independent, high gain internally compensated, low power operational amplifiers which have been designed to provide functional characteristics identical to those of the familiar UA741 operational amplifier. In addition the total supply current for all four amplifiers is compatible to the supply current of a single UA741 type op amp. Other features include input offset current and input bias current which are much less than those of a standard UA741. Also, excellent isolation between amplifiers has been achieved by independently biasing each amplifier and using layout techniques which minimize thermal coupling.

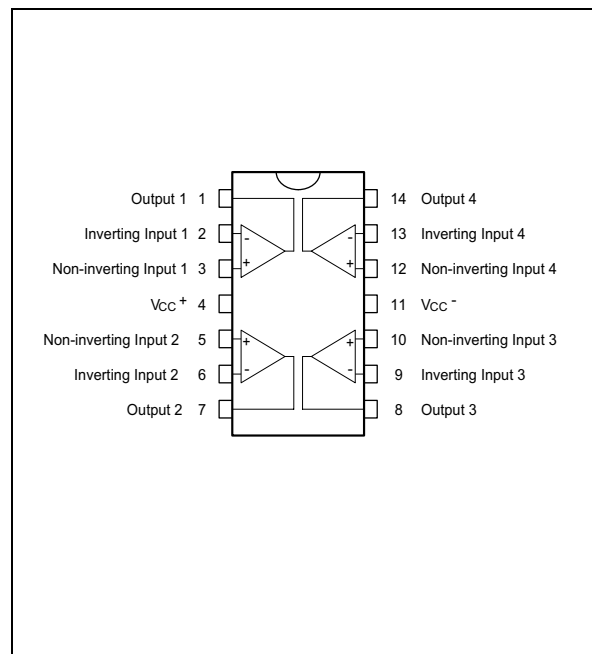
### ORDER CODE

Part Number	Temperature Range	Package	
		N	M
LM148	-55°C, +125°C	•	•
LM248	-40°C, +105°C	•	•
LM348	0°C, +70°C	•	•
<b>Example : LM348D</b>			

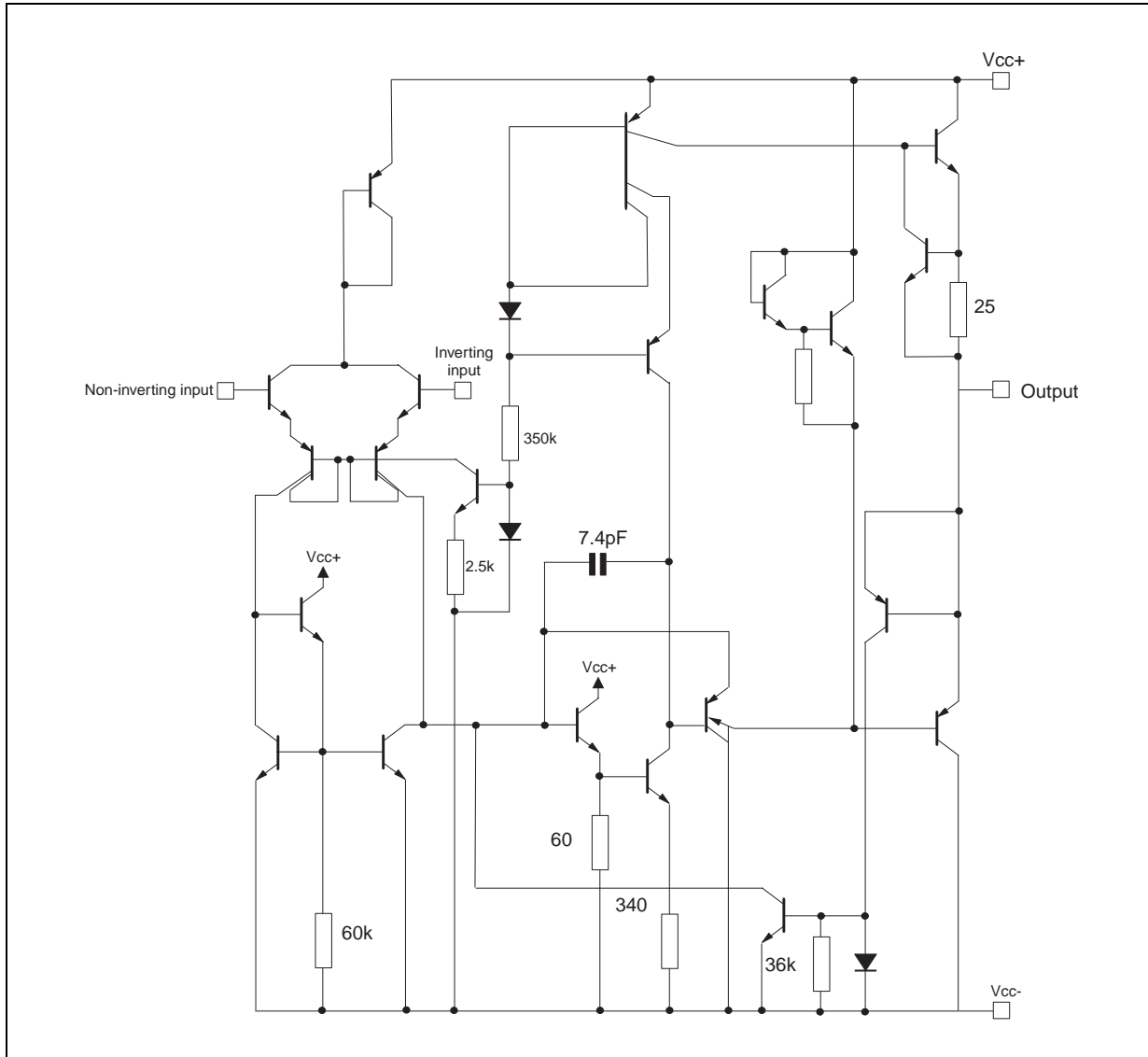
**N** = Dual in Line Package (DIP)  
**M** = Small Outline Package (SO) - also available in Tape & Reel (DT)



### PIN CONNECTIONS (top view)



## SCHEMATIC DIAGRAM



## ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	LM148	LM248	LM348	Unit
$V_{CC}$	Supply voltage	±22			V
$V_i$	Input Voltage <sup>1)</sup>	±22			V
$V_{id}$	Differential Input Voltage	±44			V
	Output Short-circuit Duration <sup>2)</sup>	Infinite			
$P_{tot}$	Power Dissipation	500			mW
$T_{oper}$	Operating Free-air Temperature Range	-55 to +125	-40 to +105	0 to +70	°C
$T_{stg}$	Storage Temperature Range	-65 to +150			°C

1. For supply voltage less than maximum value, the absolute maximum input voltage is equal to the supply voltage.

2. Any of the amplifier outputs can be shorted to ground indefinitely; however more than one should not be simultaneously shorted as the maximum junction will be exceeded.

## ELECTRICAL CHARACTERISTICS

$V_{CC} = \pm 15V$ ,  $T_{amb} = 25^{\circ}C$  (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit
$V_{io}$	Input Offset Voltage ( $R_s \leq 10k\Omega$ ) $T_{amb} = 25^{\circ}C$ $T_{min} \leq T_{amb} \leq T_{max}$		1	5 6	mV
$I_{io}$	Input Offset Current $T_{amb} = 25^{\circ}C$ $T_{min} \leq T_{amb} \leq T_{max}$		2	25 75	nA
$I_{ib}$	Input Bias Current $T_{amb} = 25^{\circ}C$ $T_{min} \leq T_{amb} \leq T_{max}$		30	100 300	nA
$A_{vd}$	Large Signal Voltage Gain ( $V_o = \pm 10V$ , $R_L = 2k\Omega$ ) $T_{amb} = 25^{\circ}C$ $T_{min} \leq T_{amb} \leq T_{max}$	50 25	160		V/mV
SVR	Supply Voltage Rejection Ratio ( $R_s \leq 10k\Omega$ ) $T_{amb} = 25^{\circ}C$ $T_{min} \leq T_{amb} \leq T_{max}$	77 77	100		dB
$I_{cc}$	Supply Current, all Amp, no load $T_{amb} = 25^{\circ}C$ $T_{min} \leq T_{amb} \leq T_{max}$		2.1	3.6 4.8	mA
$V_{icm}$	Input Common Mode Voltage Range $T_{amb} = 25^{\circ}C$ $T_{min} \leq T_{amb} \leq T_{max}$	$\pm 12$ $\pm 12$			
CMR	Common Mode Rejection Ratio ( $R_s \leq 10k\Omega$ ) $T_{amb} = 25^{\circ}C$ $T_{min} \leq T_{amb} \leq T_{max}$	70 70	110		dB
$I_{os}$	Output Short-circuit Current $T_{amb} = 25^{\circ}C$	10	25	35	mA
$\pm V_{opp}$	Output Voltage Swing $T_{amb} = 25^{\circ}C$ $T_{min} \leq T_{amb} \leq T_{max}$				V
SR	Slew Rate ( $V_I = \pm 10V$ , $R_L = 10k\Omega$ , $C_L = 100pF$ , unity Gain)	0.25	0.5		V/ $\mu s$
$t_r$	Rsie Time ( $V_I = \pm 10V$ , $R_L = 10k\Omega$ , $C_L = 100pF$ , unity Gain)		0.3		$\mu s$
$K_{OV}$	Overshoot ( $V_I = \pm 10V$ , $R_L = 10k\Omega$ , $C_L = 100pF$ , unity Gain)		5		%
$R_I$	Input Resistance	0.8	2.5		M $\Omega$
GBP	Gain Bandwith Product ( $V_I = 10 mV$ , $R_L = 10k\Omega$ , $C_L = 100pF$ $f = 100kHz$ )	0.7	1.3		MHz
THD	Total Harmonic Distortion ( $f = 1kHz$ , $A_v = 20dB$ , $R_L = 10k\Omega$ $C_L = 100pF$ , $V_o = 2V_{pp}$ )		0.08		%
$e_n$	Equivalent Input Noise Voltage ( $f = 1kHz$ , $R_s = 100\Omega$ )		40		$\frac{nV}{\sqrt{Hz}}$
$V_{o1}/V_{o2}$	Channel Separation		120		dB

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