

THOMSON SEMICONDUCTORS

LM148/248/348
LM149/249/349

DIFFERENTIAL INPUT QUAD OP-AMPS

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 comparable to the supply current of a single UA741 type op amp. Other features include input offset currents 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.

The LM149 series has the same features as the LM148 plus a gain bandwidth product of 4 MHz at a gain of 5 or greater.

The LM148 can be used anywhere multiple UA741 type amplifiers are being used and in applications where amplifier matching or high packing density is required.

- Low supply current : 0.6 mA/amplifier.
- Class AB output stage : no crossover distortion.
- Pin compatible with LM124.
- Low input offset voltage : 1 mV.
- Low input offset current : 4 nA.
- Low input bias current : 30 nA.
- Gain bandwidth product : 1 MHz.
- High degree of isolation between amplifiers : 120 dB.
- Overload protection for inputs and outputs.

ORDERING INFORMATION

Hi-Rel versions available - See chapter 14

PART NUMBER	TEMPERATURE RANGE	PACKAGE			
		DP	DG	GC	FP
LM148	-55°C to +125°C		•	•	
LM248	-25°C to +85°C	•		•	
LM348	0°C to 70°C	•	•		•
LM149	-55°C to +125°C		•	•	
LM249	-25°C to +85°C	•		•	
LM349	0°C to +70°C	•	•		•

Examples : LM148DG, LM349FP

DIFFERENTIAL INPUT QUAD OPERATIONAL AMPLIFIERS

CASES

CB-2
(TO-116)



DP SUFFIX
PLASTIC PACKAGE
DG SUFFIX
CERDIP PACKAGE

CB-511



FP SUFFIX
PLASTIC MICROPACKAGE

CB-705

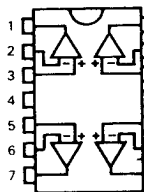


GC SUFFIX
TRICECOP (LCC)

PIN ASSIGNMENTS

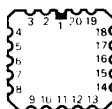
(Top views)

CB-2 CB-511



- 1 - Output 1
- 2 - Inverting input 1
- 3 - Non-inverting input 1
- 4 - V_{CC}
- 5 - Non-inverting input 2
- 6 - Inverting input 2
- 7 - Output 2
- 8 - Output 3
- 9 - Inverting input 3
- 10 - Non-inverting input 3
- 11 - V_{CC}
- 12 - Non-inverting input 4
- 13 - Inverting input 4
- 14 - Output 4

CB-705



- 1 - NC
- 2 - Output 1
- 3 - Inverting input 1
- 4 - Non-inverting input 1
- 5 - NC
- 6 - V_{CC}
- 7 - NC
- 8 - Non-inverting input 2
- 9 - Inverting input 2
- 10 - Output 2
- 11 - NC
- 12 - Output 3
- 13 - Inverting input 3
- 14 - Non-inverting input 3
- 15 - NC
- 16 - V_{CC}
- 17 - NC
- 18 - Non-inverting input 4
- 19 - Inverting input 4
- 20 - Output 4

THOMSON SEMICONDUCTORS

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THOMSON
COMPONENTS

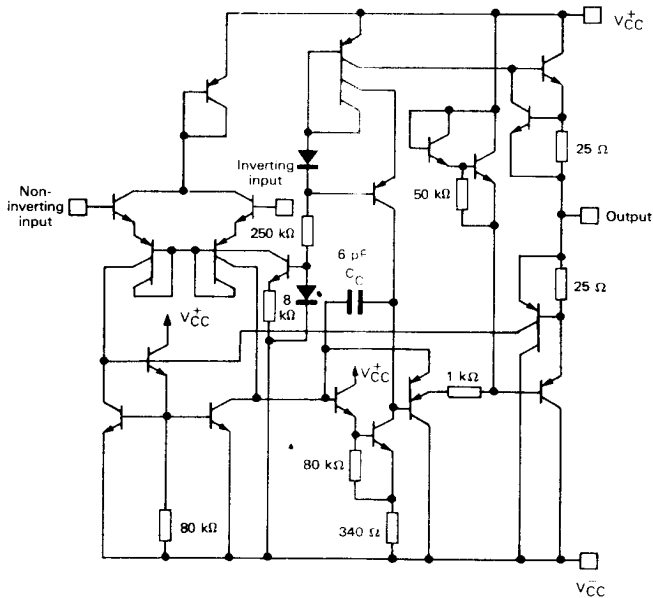
MAXIMUM RATINGS

Rating	Symbol	LM148, LM149	LM248, LM249	LM348, LM349	Unit
Supply voltage	V_{CC}	± 22	± 18	± 18	V
Differential input voltage	V_{ID}	± 44	± 36	± 36	V
Input voltage	V_I	± 22	± 18	± 18	V
Power dissipation (Note 1)	P_{tot}	500	500	500	mW
Output short-circuit duration (Note 2)		indefinite	Indefinite	Indefinite	—
Operating free-air temperature range	T_{oper}	-55 to +125	-25 to +85	0 to +70	$^{\circ}C$
Storage temperature range	T_{stg}	65 to +150	-55 to -150	-55 to +150	$^{\circ}C$

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

Note 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 temperature will be exceeded.

SCHEMATIC DIAGRAM



CASE	Outputs	Inverting inputs	Non-inverting inputs	V_{CC}^+	V_{CC}^-	N.C.
CB-2, CB-511	1, 7, 8, 14	2, 6, 9, 13	3, 5, 10, 12	4	11	—
CB-705	1, 2, 12, 20	3, 9, 13, 19	4, 8, 14, 18	6	16	*

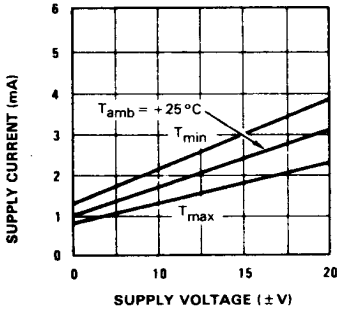
* CB-705 : Other pins are not connected

ELECTRICAL CHARACTERISTICSLM148/LM149 : $-55^{\circ}\text{C} \leq T_{\text{amb}} \leq +125^{\circ}\text{C}$, $V_{\text{CC}} = \pm 15\text{ V}$ LM348/LM349 : $0^{\circ}\text{C} \leq T_{\text{amb}} \leq +70^{\circ}\text{C}$, $V_{\text{CC}} = \pm 15\text{ V}$ LM248/LM249 : $-25^{\circ}\text{C} \leq T_{\text{amb}} \leq +85^{\circ}\text{C}$, $V_{\text{CC}} = \pm 15\text{ V}$

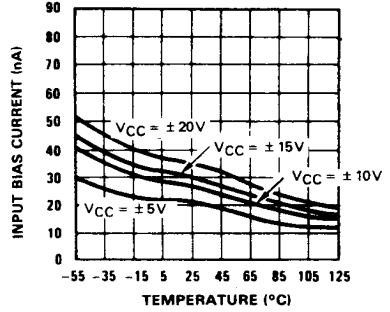
(Unless otherwise specified)

Characteristic	Symbol	LM148 - LM149			LM248 - LM249 LM348 - LM349			Unit
		Min	Typ	Max	Min	Typ	Max	
Input offset voltage ($R_S \leq 10\text{ k}\Omega$) $T_{\text{amb}} = +25^{\circ}\text{C}$ $T_{\text{min}} \leq T_{\text{amb}} \leq T_{\text{max}}$	V_{IO}	—	1	5 6	—	1	6 7.5	mV
Input offset current $T_{\text{amb}} = +25^{\circ}\text{C}$ $T_{\text{min}} \leq T_{\text{amb}} \leq T_{\text{max}}$	I_{IO}	—	4	25 75	—	4	50 100	nA
Input bias current $T_{\text{amb}} = +25^{\circ}\text{C}$ $T_{\text{min}} \leq T_{\text{amb}} \leq T_{\text{max}}$	I_{IB}	—	30	100 325	—	30	200 400	nA
Large signal voltage gain ($V_O = \pm 10\text{ V}$, $R_L \geq 2\text{ k}\Omega$) $T_{\text{amb}} = +25^{\circ}\text{C}$ $T_{\text{min}} \leq T_{\text{amb}} \leq T_{\text{max}}$	A_{VD}	50 25	160	—	25 15	160	—	V/mW
Supply current (4 amplifiers) - ($T_{\text{amb}} = +25^{\circ}\text{C}$)	I_{CC}	—	2.4	3.6	—	2.4	4.5	mA
Input voltage range	V_{I}	± 12	—	—	± 12	—	—	V
Short-circuit output current	I_{OS}	—	25	—	—	25	—	mA
Supply voltage rejection ratio ($R_S \leq 10\text{ k}\Omega$)	SVR	77	96	—	77	96	—	dB
Common-mode rejection ratio ($R_S \leq 10\text{ k}\Omega$)	CMR	70	90	—	70	90	—	dB
Input resistance ($T_{\text{amb}} = +25^{\circ}\text{C}$)	R_{I}	0.8	2.5	—	0.8	2.5	—	M Ω
Output voltage swing $R_L = 2\text{ k}\Omega$ $R_L = 10\text{ k}\Omega$	V_{OPP}	± 10 ± 12	± 12 ± 13	—	± 10 ± 12	± 12 ± 13	—	V
Slew rate ($T_{\text{amb}} = +25^{\circ}\text{C}$) $A_V = 1$ $A_V = 5$	S_{VO}	— —	0.5 2	—	—	0.5 2	—	V/ μs
Channel separation (1 Hz $\leq f \leq 20\text{ kHz}$, $T_{\text{amb}} = +25^{\circ}\text{C}$)	$V_{\text{O1}}/V_{\text{O2}}$	—	-120	—	—	-120	—	dB
Gain-bandwidth product ($T_{\text{amb}} = +25^{\circ}\text{C}$) $A_V = 1$ $A_V = 5$	GBP	—	1 4	—	—	1 4	—	MHz
Phase margin ($T_{\text{amb}} = +25^{\circ}\text{C}$) $A_V = 1$ $A_V = 5$	φ_{M}	—	60 60	—	—	60 60	—	Degrees

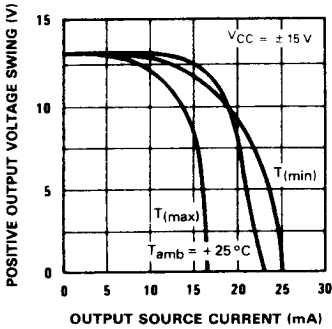
SUPPLY CURRENT



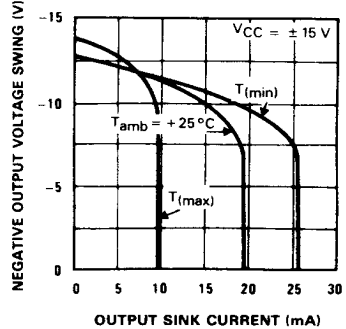
INPUT BIAS CURRENT



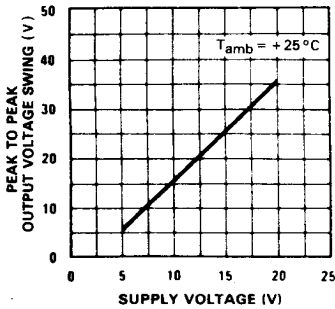
POSITIVE CURRENT LIMIT



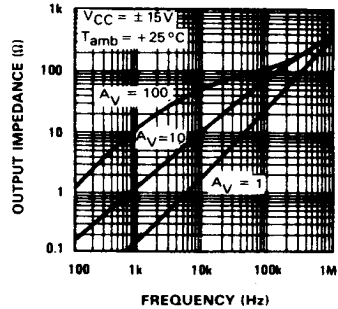
NEGATIVE CURRENT LIMIT



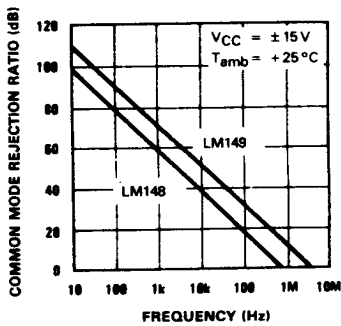
OUTPUT VOLTAGE SWING



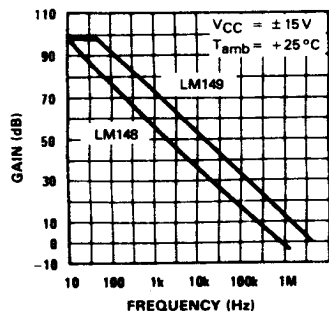
OUTPUT IMPEDANCE



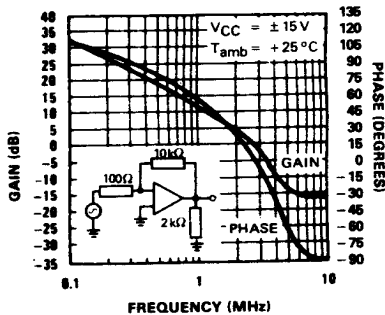
COMMON-MODE REJECTION RATIO



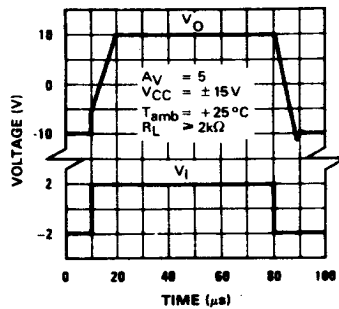
OPEN LOOP FREQUENCY RESPONSE



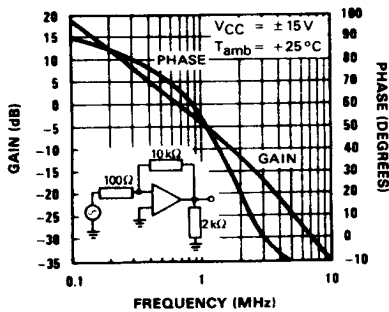
BODE PLOT (LM149)



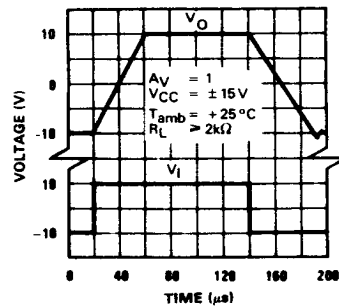
LARGE SIGNAL PULSE RESPONSE (LM149)



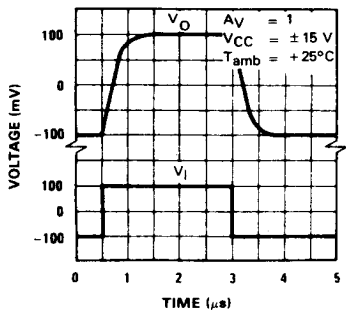
BODE PLOT (LM148)



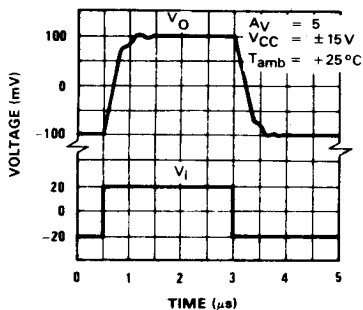
LARGE SIGNAL PULSE RESPONSE (LM148)



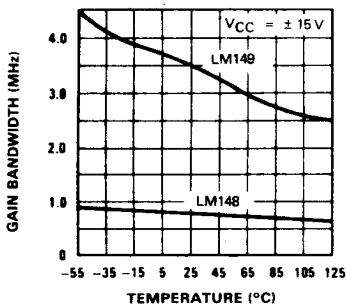
SMALL SIGNAL PULSE RESPONSE (LM148)



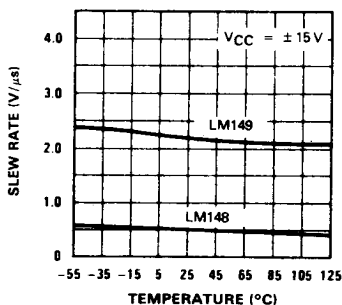
SMALL SIGNAL PULSE RESPONSE (LM149)



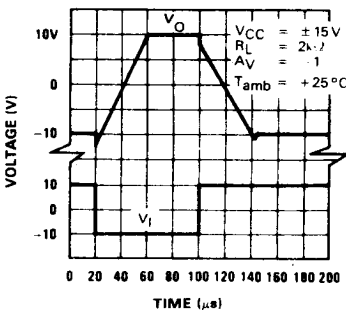
GAIN BANDWIDTH



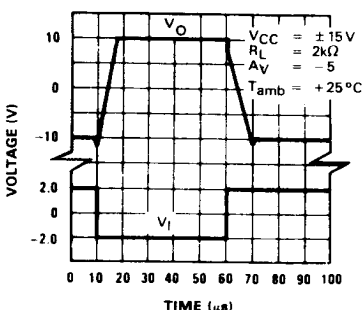
SLEW RATE



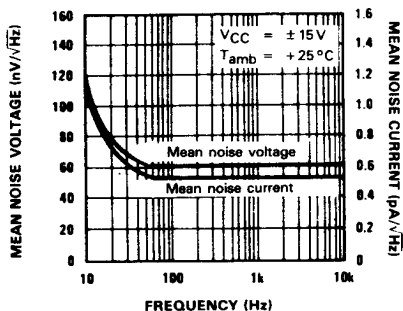
INVERTING LARGE SIGNAL PULSE RESPONSE (LM148)



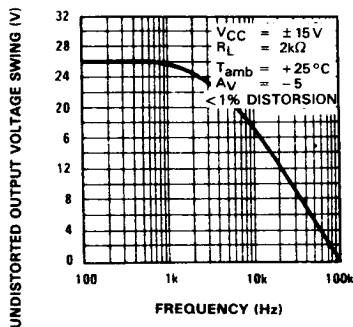
INVERTING LARGE SIGNAL PULSE RESPONSE (LM149)



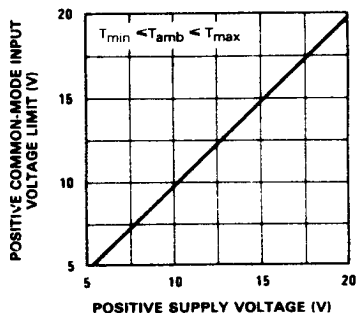
INPUT NOISE VOLTAGE AND NOISE CURRENT



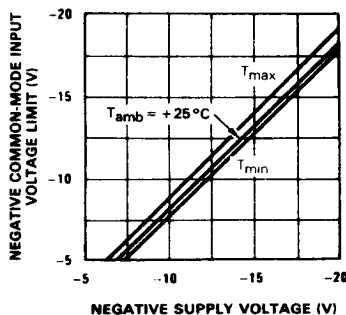
UNDISTORTED OUTPUT VOLTAGE SWING



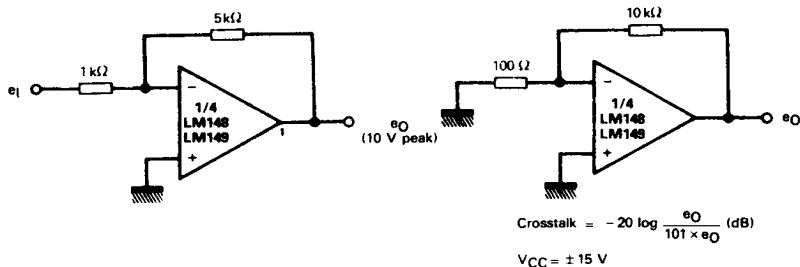
POSITIVE COMMON-MODE INPUT VOLTAGE LIMIT

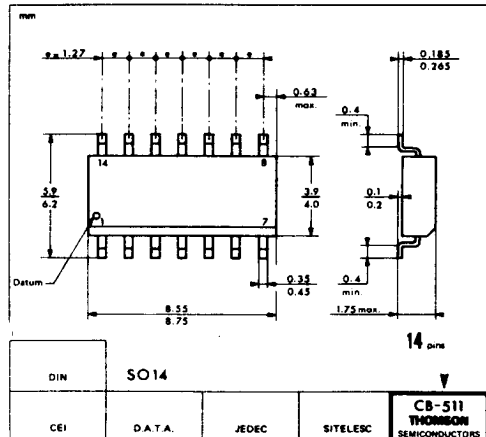
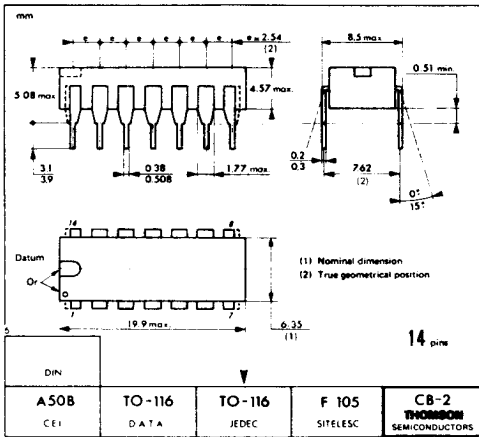


NEGATIVE COMMON-MODE INPUT VOLTAGE LIMIT



TEST CIRCUITS

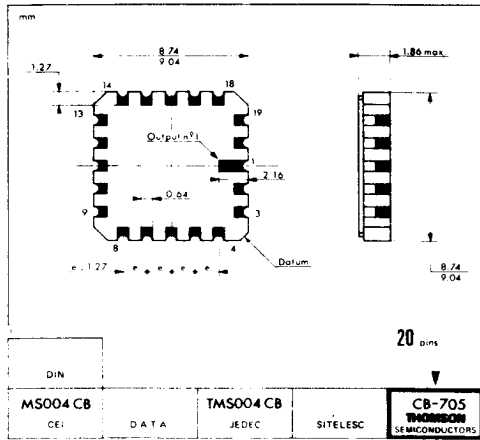




CB-2
(TO-116)
DP SUFFIX
PLASTIC PACKAGE
DG SUFFIX
CERDIP PACKAGE



CB-511
FP SUFFIX
PLASTIC MICROPACKAGE



CB-705
GC SUFFIX
TRICOP (LCC)

These specifications are subject to change without notice.
Please inquire with our sales offices about the availability of the different packages.