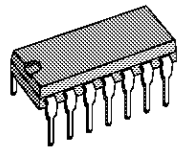
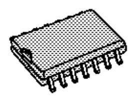
LM148
LM248 - LM348

FOUR UA741
QUAD BIPOLAR 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



N
DIP14
(Plastic Package)



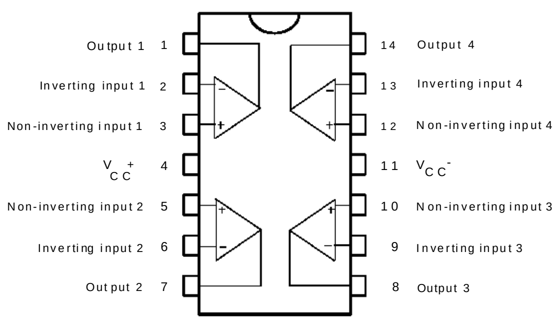
D
SO14
(Plastic Micropackage)

ORDER CODES

Part Number	Temperature Range	Package N	Package D
LM148	–55°C, +125°C	•	•
LM248	–40°C, +105°C	•	•
LM348	0°C, +70°C	•	•
Example : LM348D			

148-01.TBL

PIN CONNECTIONS (top view)



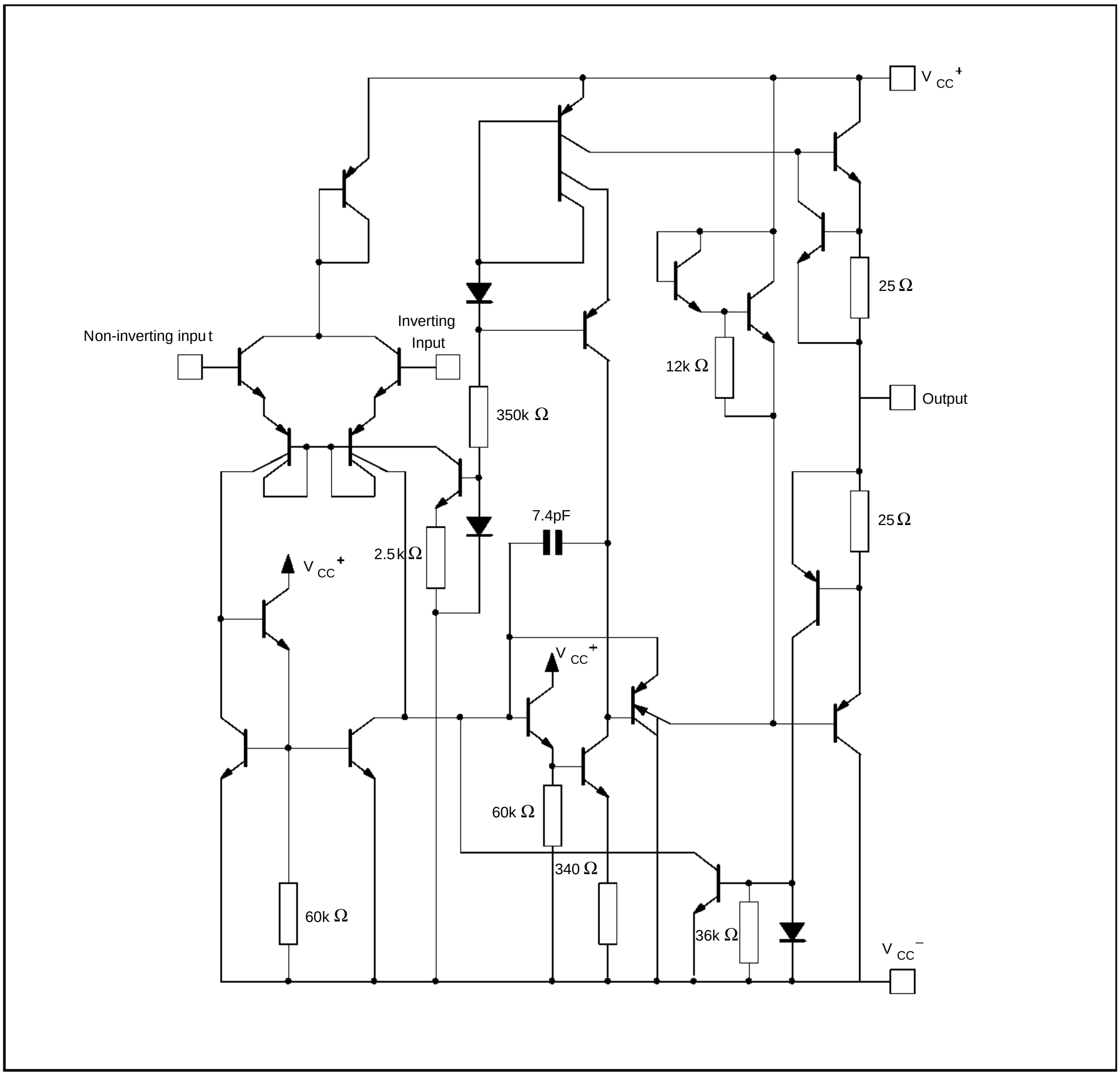
148-01.EPS

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 comparable 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.

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.

SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

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

148-02.TBL

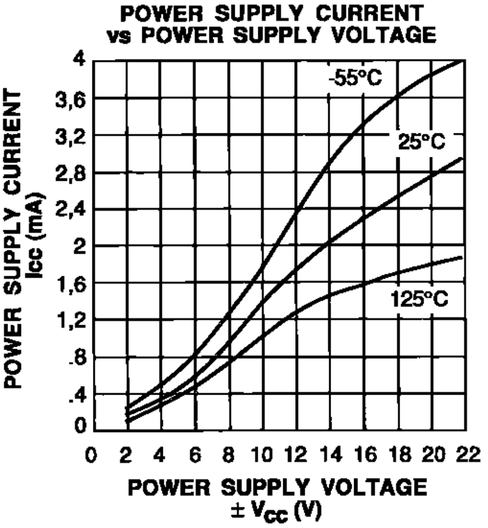
Notes : 1. For supply voltage less than maximum value, the absolute maximum input voltage is equal to the supply voltage.
2. Any of the amplifier outputs can be shorted to ground indefinitely ; however, more than one should not be simultaneously shorted as the maximum junction temperature will be exceeded.

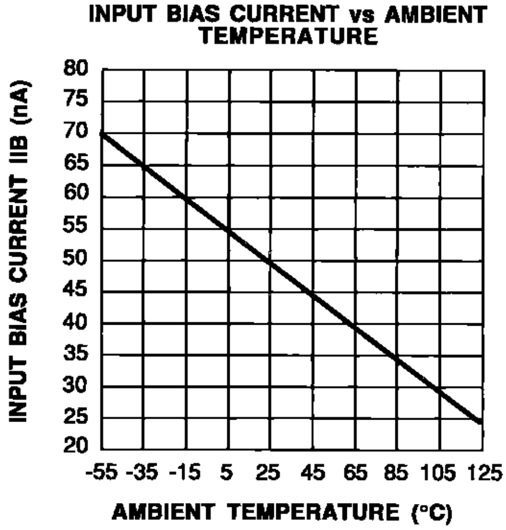
ELECTRICAL CHARACTERISTICS

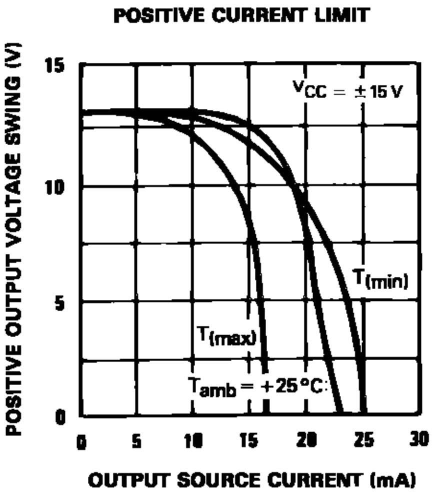
$V_{CC} = \pm 15V$, $T_{amb} = 25^oC$ (unless otherwise specified)

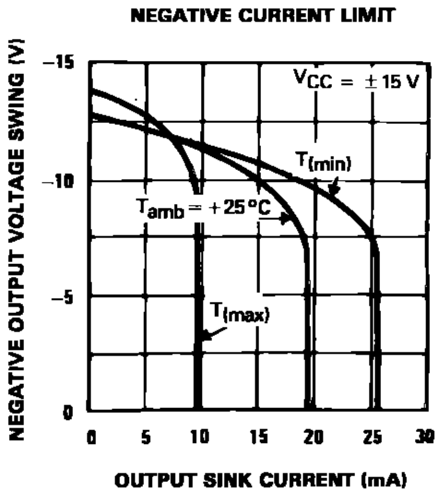
Symbol	Parameter	LM148 - LM248 - LM348			Unit
		Min.	Typ.	Max.	
V_{io}	Input Offset Voltage ($R_S \leq 10k\Omega$) $T_{amb} = 25^oC$ $T_{min.} \leq T_{amb} \leq T_{max.}$		 1	 5 6	mV
I_{io}	Input Offset Current $T_{amb} = 25^oC$ $T_{min.} \leq T_{amb} \leq T_{max.}$		 2	 25 75	nA
I_{ib}	Input Bias Current $T_{amb} = 25^oC$ $T_{min.} \leq T_{amb} \leq T_{max.}$		 30	 100 300	nA
A_{vd}	Large Signal Voltage Gain ($V_o = \pm 10V$, $R_L = 2k\Omega$) $T_{amb} = 25^oC$ $T_{min.} \leq T_{amb} \leq T_{max.}$	 50 25	 160		V/mV
SVR	Supply Voltage Rejection Ratio ($R_S \leq 10k\Omega$) $T_{amb} = 25^oC$ $T_{min.} \leq T_{amb} \leq T_{max.}$	 77 77	 100		dB
I_{CC}	Supply Current, all Amp, no Load $T_{amb} = 25^oC$ $T_{min.} \leq T_{amb} \leq T_{max.}$		 2.1	 3.6 4.8	mA
V_{icm}	Input Common Mode Voltage Range $T_{amb} = 25^oC$ $T_{min.} \leq T_{amb} \leq T_{max.}$	 ±12 ±12			V
CMR	Common Mode Rejection Ratio ($R_S \leq 10k\Omega$) $T_{amb} = 25^oC$ $T_{min.} \leq T_{amb} \leq T_{max.}$	 70 70	 110		dB
I_{OS}	Output Short-circuit Current $T_{amb} = 25^oC$	 10	 25	 35	mA
$\pm V_{opp}$	Output Voltage Swing $T_{amb} = 25^oC$ $R_L = 10k\Omega$ $R_L = 2k\Omega$ $T_{min.} \leq T_{amb} \leq T_{max.}$ $R_L = 10k\Omega$ $R_L = 2k\Omega$	 12 10 12 10	 13 12		V
SR	Slew Rate ($V_I = \pm 10V$, $R_L = 10k\Omega$, $C_L = 100pF$, $T_{amb} = 25^oC$, unity Gain)	 0.25	 0.5		V/µs
t_r	Rise Time ($V_I = \pm 10V$, $R_L = 10k\Omega$, $C_L = 100pF$, $T_{amb} = 25^oC$, unity Gain)		 0.3		µs
K_{OV}	Overshoot ($V_I = \pm 10V$, $R_L = 10k\Omega$, $C_L = 100pF$, $T_{amb} = 25^oC$, unity Gain)		 5		%
R_I	Input Resistance	0.8	2.5		MΩ
GBP	Gain Bandwidth Product ($V_I = 10$ mV, $R_L = 10k\Omega$, $C_L = 100pF$, f = 100kHz, $T_{amb} = 25^oC$)	 0.7	 1.3		MHz
THD	Total Harmonic Distortion (f = 1kHz, $A_v = 20dB$, $R_L = 10k\Omega$, $C_L = 100pF$, $T_{amb} = 25^oC$, $v_o = 2V_{pp}$)		 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

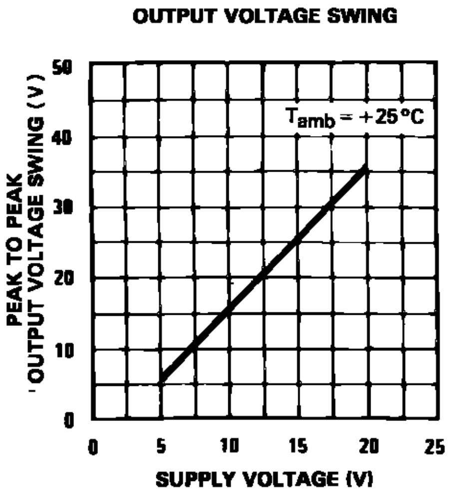
148-03.TBL

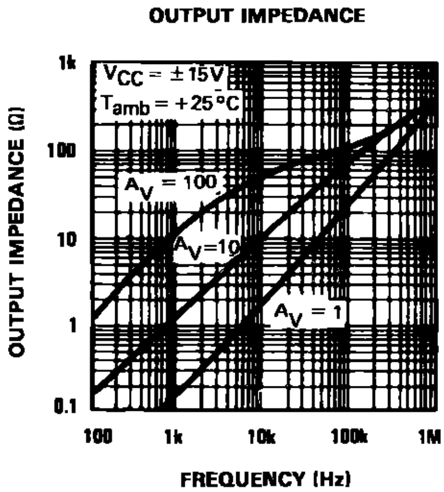

POWER SUPPLY CURRENT
vs POWER SUPPLY VOLTAGE
POWER SUPPLY CURRENT
Icc (mA)
-55°C
25°C
125°C
POWER SUPPLY VOLTAGE
± Vcc (V)
148-03.EPS


INPUT BIAS CURRENT vs AMBIENT
TEMPERATURE
INPUT BIAS CURRENT IIB (nA)
AMBIENT TEMPERATURE (°C)
148-04.EPS

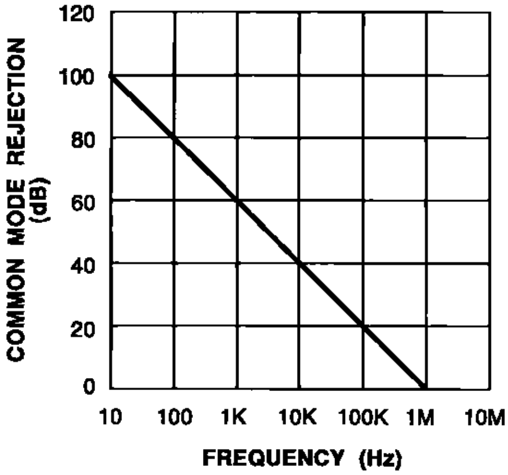

POSITIVE CURRENT LIMIT
POSITIVE OUTPUT VOLTAGE SWING (V)
VCC = ±15 V
T(min)
T(max)
Tamb = +25°C
OUTPUT SOURCE CURRENT (mA)
148-05.EPS


NEGATIVE CURRENT LIMIT
NEGATIVE OUTPUT VOLTAGE SWING (V)
VCC = ±15 V
T(min)
Tamb = +25°C
T(max)
OUTPUT SINK CURRENT (mA)
148-06.EPS


OUTPUT VOLTAGE SWING
PEAK TO PEAK
OUTPUT VOLTAGE SWING (V)
Tamb = +25°C
SUPPLY VOLTAGE (V)
148-07.EPS

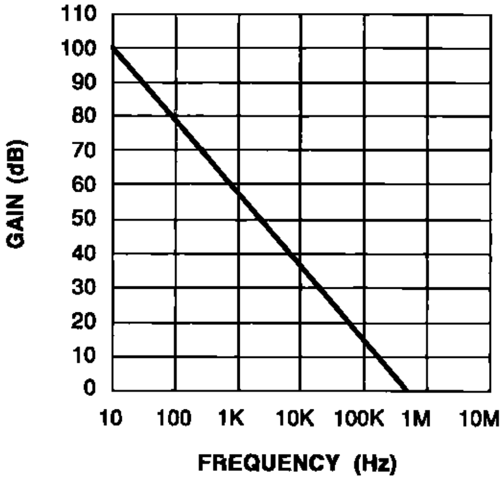

OUTPUT IMPEDANCE
OUTPUT IMPEDANCE (Ω)
VCC = ±15V
Tamb = +25°C
AV = 100
AV=10
AV = 1
FREQUENCY (Hz)
148-08.EPS

COMMON MODE REJECTION RATIO vs FREQUENCY



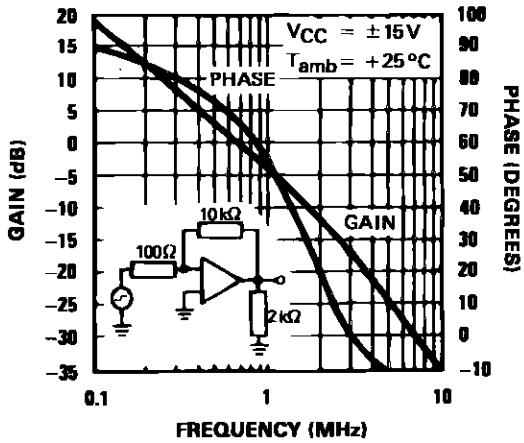
148-09.EPS

OPEN LOOP FREQUENCY RESPONSE



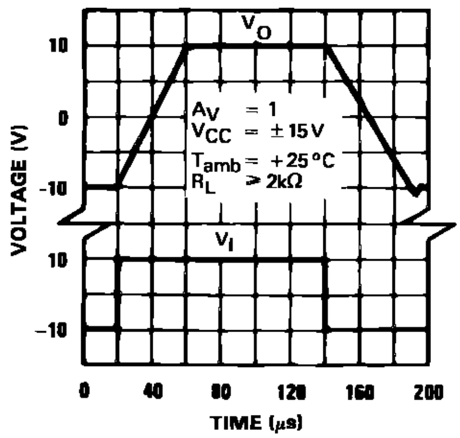
148-10.EPS

BODE PLOT (LM148)



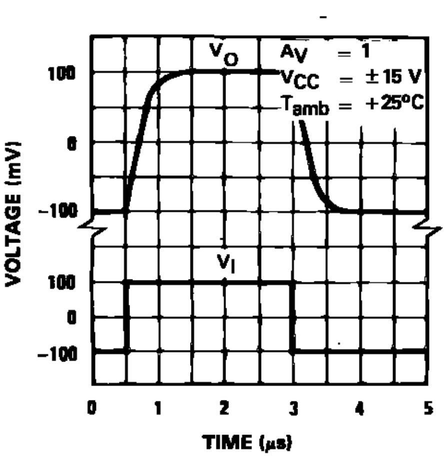
148-11.EPS

LARGE SIGNAL PULSE RESPONSE (LM148)



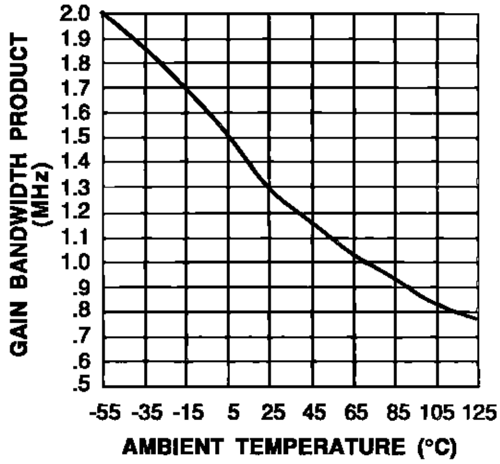
148-12.EPS

SMALL SIGNAL PULSE RESPONSE (LM148)

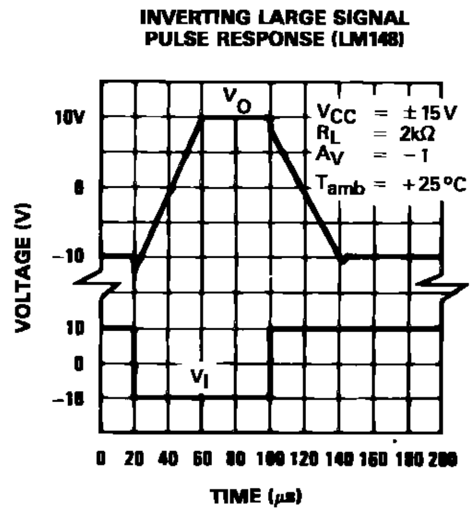


148-13.EPS

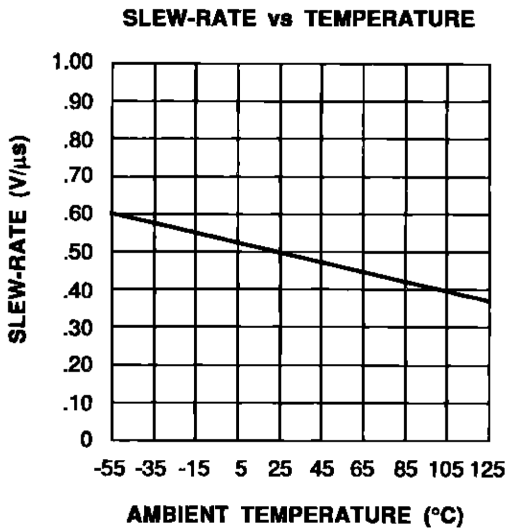
GAIN BANDWIDTH PRODUCT vs AMBIENT TEMPERATURE



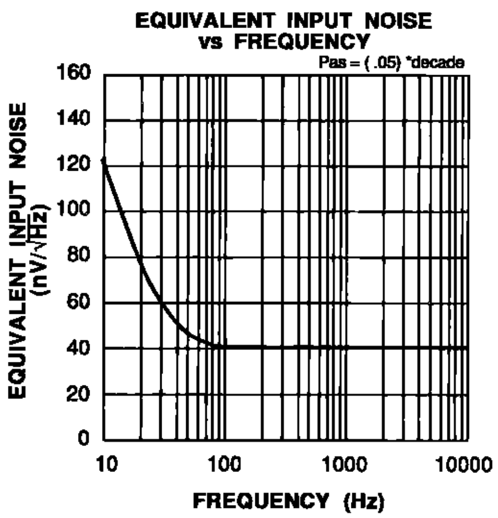
148-14.EPS



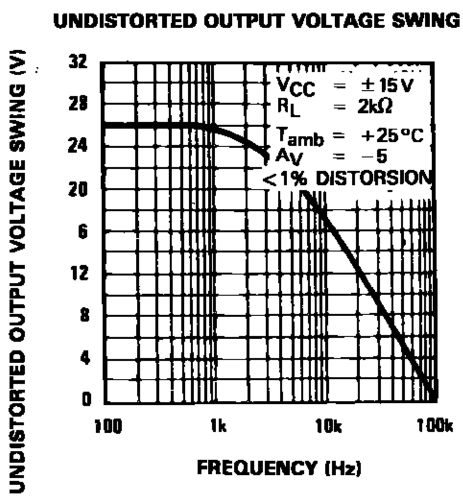
148-15.EPS



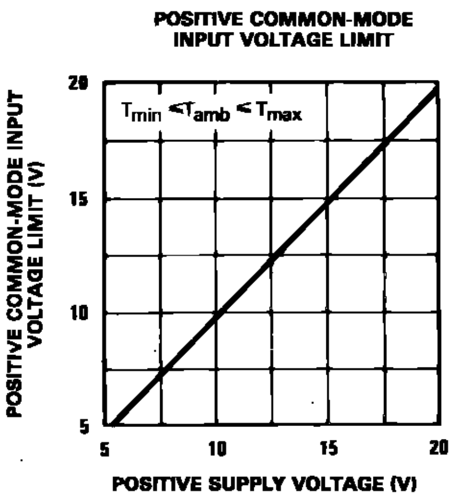
148-16.EPS



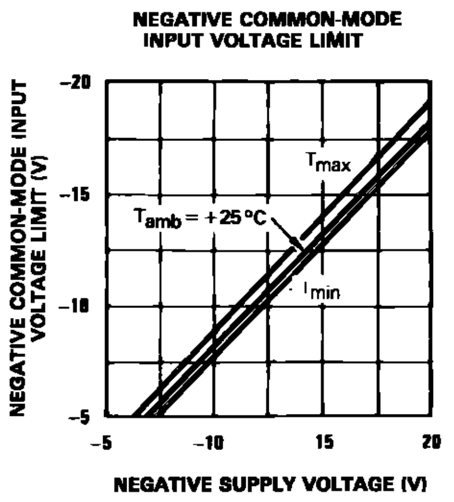
148-17.EPS



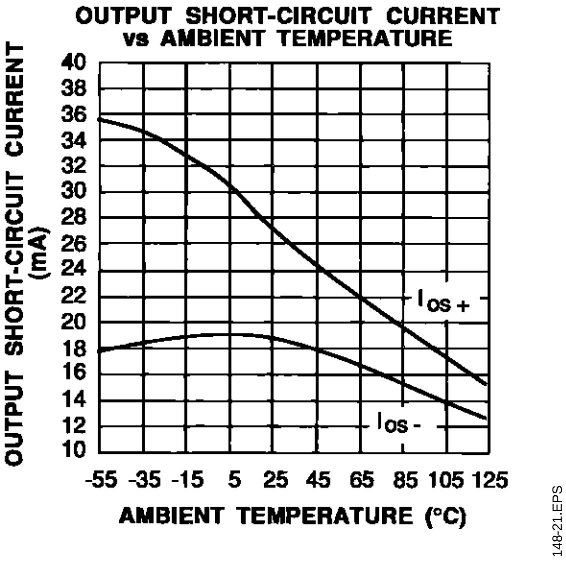
148-18.EPS

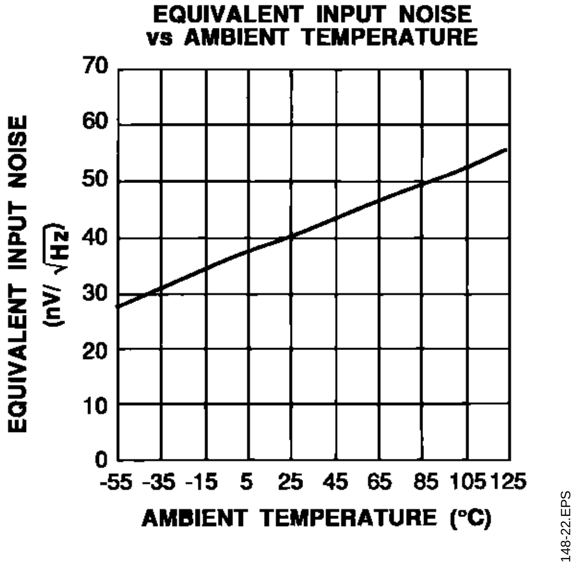


148-19.EPS

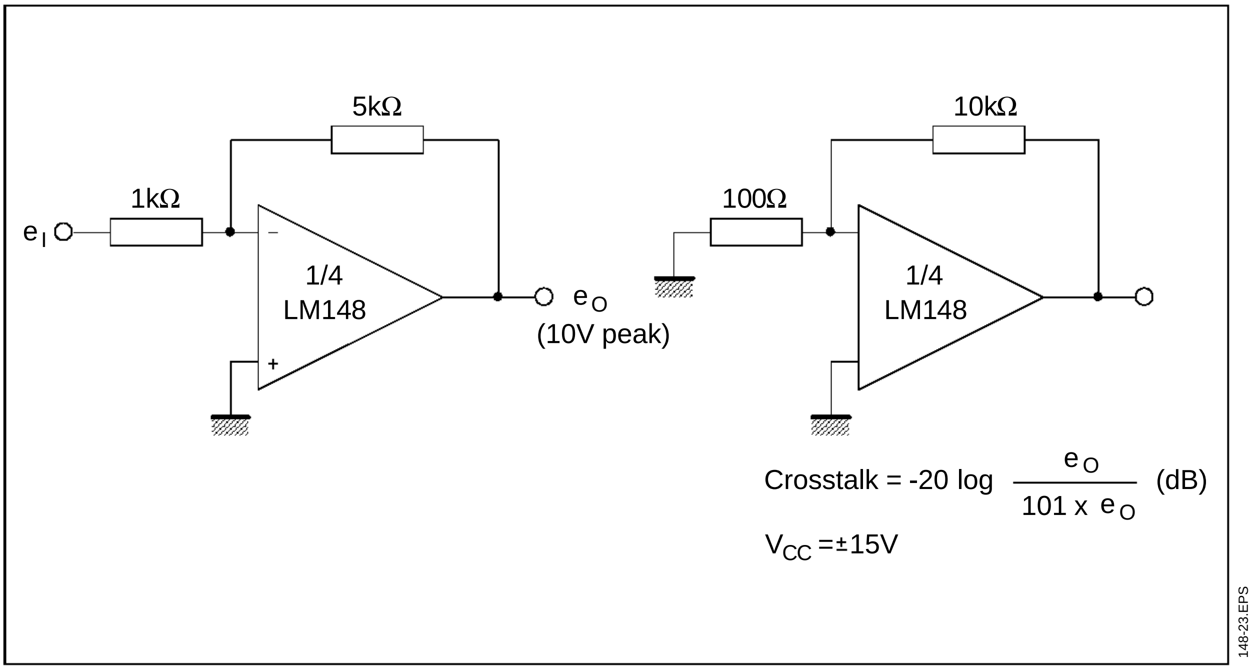


148-20.EPS



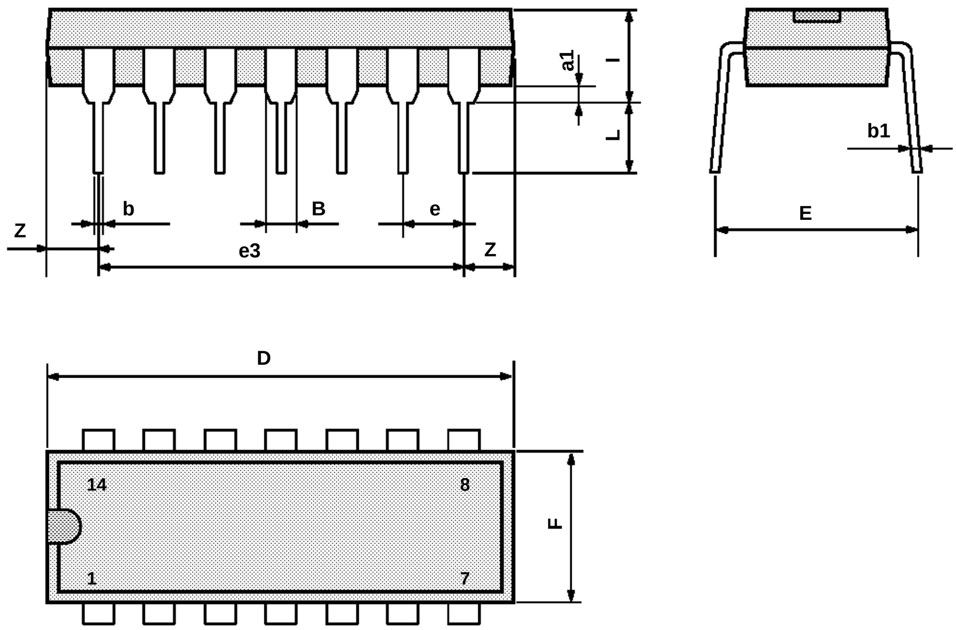


TEST CIRCUITS



PACKAGE MECHANICAL DATA

14 PINS - PLASTIC DIP OR CERDIP

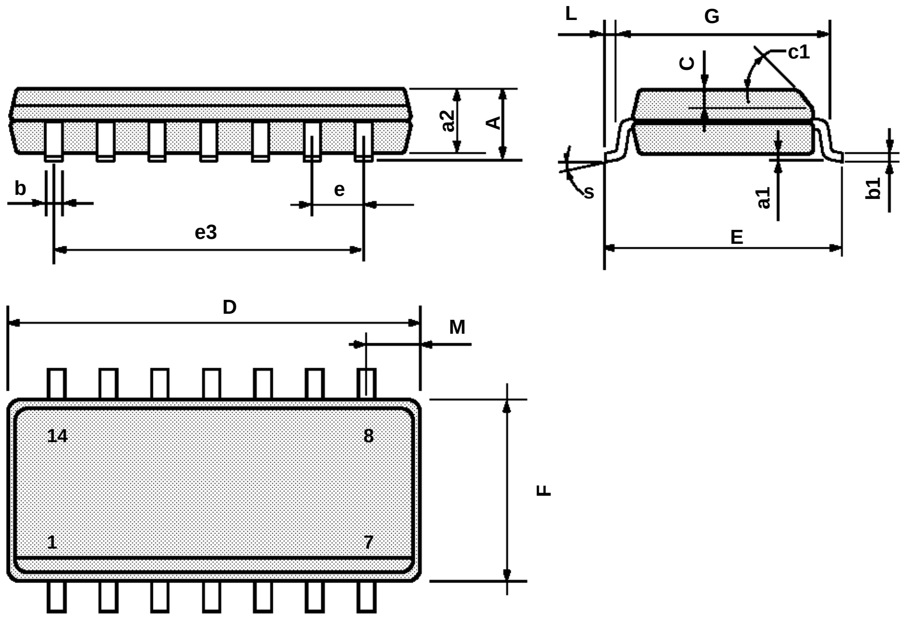


Dimensions	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
a1	0.51			0.020		
B	1.39		1.65	0.055		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		15.24			0.600	
F			7.1			0.280
i			5.1			0.201
L		3.3			0.130	
Z	1.27		2.54	0.050		0.100

DIP14.TBL

PACKAGE MECHANICAL DATA

14 PINS - PLASTIC MICROPACKAGE (SO)



PM-SO14.EPS

Dimensions	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.75			0.069
a1	0.1		0.2	0.004		0.008
a2			1.6			0.063
b	0.35		0.46	0.014		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.020	
c1	45^o (typ.)					
D	8.55		8.75	0.336		0.334
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		7.62			0.300	
F	3.8		4.0	0.150		0.157
G	4.6		5.3	0.181		0.208
L	0.5		1.27	0.020		0.050
M			0.68			0.027
S	8^o (max.)					

SO14.TBL

ORDER CODE :