

# uA748C, uA748M GENERAL-PURPOSE OPERATIONAL AMPLIFIERS

SLOS095 – D921, DECEMBER 1970 – REVISED OCTOBER 1990

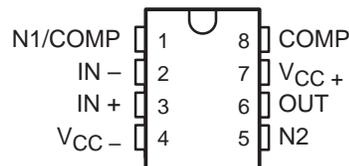
- Frequency and Transient Response Characteristics Adjustable
- Short-Circuit Protection
- Offset-Voltage Null Capability
- Wide Common-Mode and Differential Voltage Ranges
- Low Power Consumption
- No Latch-Up
- Same Pin Assignments as uA709

## description

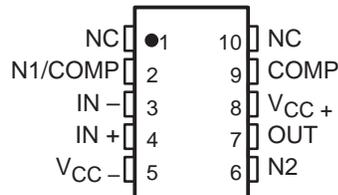
The uA748 is a general-purpose operational amplifier that offers the same advantages and attractive features as the uA741 except for internal compensation. External compensation can be as simple as a 30-pF capacitor for unity-gain conditions and, when the closed-loop gain is greater than one, can be changed to obtain wider bandwidth or higher slew rate. This circuit features high gain, large differential and common-mode input voltage range, and output short-circuit protection. Input offset-voltage adjustment can be provided by connecting a variable resistor between the offset null pins as shown in Figure 12.

The uA748C is characterized for operation from 0°C to 70°C; the uA748M is characterized for operation over the full military temperature range of –55°C to 125°C.

uA748C . . . D OR P PACKAGE  
uA748M . . . JG PACKAGE  
(TOP VIEW)

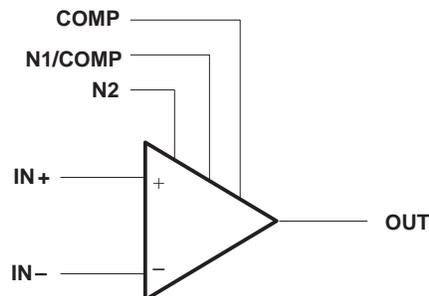


uA748M . . . U FLAT PACKAGE  
(TOP VIEW)



NC – No internal connection

## symbol



## AVAILABLE OPTIONS

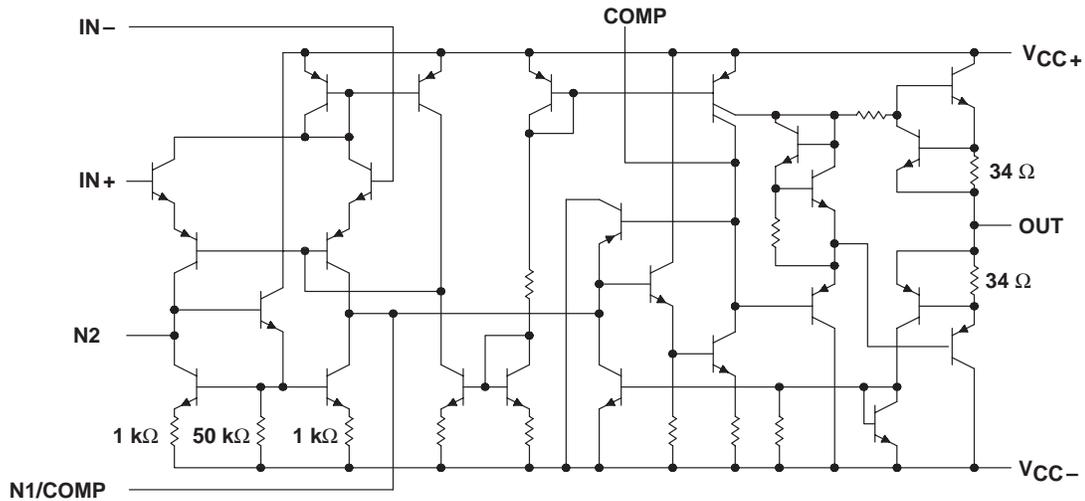
T <sub>A</sub>	V <sub>IO</sub> max AT 25°C	PACKAGE			
		8-PIN			10-PIN
		SMALL OUTLINE (D)	CERAMIC DIP (JG)	PLASTIC DIP (P)	FLAT PACK (U)
0°C to 70°C	6 mV	uA748CD	—	uA748CP	—
–55°C to 125°C	5 mV	—	uA748MJG	—	uA747MU

The D package is available taped and reeled. Add the suffix R to the device type, (e.g., uA748CDR).

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## schematic



Resistor values shown are nominal.

## absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

	uA748C	uA748M	UNIT
Supply voltage, $V_{CC+}$ (see Note 1)	18	22	V
Supply voltage, $V_{CC-}$ (see Note 1)	-18	-22	V
Differential input voltage (see Note 2)	$\pm 30$	$\pm 30$	V
Input voltage (either input, see Notes 1 and 3)	$\pm 15$	$\pm 15$	V
Voltage range between either offset null terminal (N1/N2) and $V_{CC-}$	-0.5 to 2	-0.5	V
Duration of output short circuit (see Note 4)	unlimited	unlimited	
Continuous total power dissipation	See Dissipation Rating Table		
Operating free-air temperature range	0 to 70	-55 to 125	$^{\circ}\text{C}$
Storage temperature range	-65 to 150	-65 to 150	$^{\circ}\text{C}$
Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds	JG or U package		300
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	D or P package		260

NOTES: 1. All voltage values, unless otherwise noted, are with respect to the midpoint between  $V_{CC+}$  and  $V_{CC-}$ .

2. Differential voltages are at the noninverting input terminal with respect to the inverting input terminal.

3. The magnitude of the input voltage must never exceed the magnitude of the supply voltage or 15V, whichever is less.

4. The output may be shorted to ground or either power supply. For the uA748M only, the unlimited duration of the short circuit applies at (or below) 125 $^{\circ}\text{C}$  case temperature or 75 $^{\circ}\text{C}$  free-air temperature

DISSIPATION RATING TABLE

PACKAGE	$T_A \leq 25^{\circ}\text{C}$ POWER RATING	DERATING FACTOR	DERATE ABOVE $T_A$	$T_A = 70^{\circ}\text{C}$ POWER RATING	$T_A = 125^{\circ}\text{C}$ POWER RATING
D	500 mW	5.8 mW/ $^{\circ}\text{C}$	64 $^{\circ}\text{C}$	464 mW	N/A
JG	500 mW	8.4 mW/ $^{\circ}\text{C}$	90 $^{\circ}\text{C}$	500 mW	210 mW
P	500 mW	N/A	N/A	500 mW	N/A
U	500 mW	5.4 mW/ $^{\circ}\text{C}$	57 $^{\circ}\text{C}$	432 mW	135 mW

**uA748C, uA748M**  
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**electrical characteristics at specified free-air temperature,  $V_{CC} \pm = \pm 15\text{ V}$ ,  $C_C = 30\text{ pF}$**

PARAMETER	TEST CONDITIONST	uA748C			uA748M			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
$V_{IO}$ Input offset voltage	$V_O = 0$	25°C	1	6	1	5	mV	
		Full range		7.5		6		
$I_{IO}$ Input offset current	$V_O = 0$	25°C	20	200	20	200	nA	
		Full range		300		500		
$I_{IB}$ Input bias current	$V_O = 0$	25°C	80	500	80	500	nA	
		Full range		800		1500		
$V_{ICR}$ Common-mode input voltage range		25°C	±12	±13	±12	±13	V	
		Full range	±12		±12			
$V_{O(PP)}$ Maximum peak output voltage swing	$R_L = 10\text{ k}\Omega$	25°C	±12	±14	±12	±14	V	
	$R_L \geq 10\text{ k}\Omega$	Full range	±12		±12			
	$R_L = 2\text{ k}\Omega$	25°C	±10	±13	±10	±13		
	$R_L \geq 2\text{ k}\Omega$	Full range	±10		±10			
$A_{VD}$ Large-signal differential voltage amplification	$R_L \geq 2\text{ k}\Omega$ , $V_O = \pm 10\text{ V}$	25°C	20	200	50	200	V/mV	
		Full range	15		25			
$r_i$ Input resistance		25°C	0.3	2	0.3	2	MΩ	
$r_o$ Output resistance	$V_O = 0$ , See Note 5	25°C		75		75	Ω	
$C_i$ Input capacitance		25°C		1.4		1.4	pF	
CMRR Common-mode rejection ratio	$V_{IC} = V_{ICRmin}$ , $V_O = 0$	25°C	70	90	70	90	dB	
		Full range	70		70			
$k_{SVS}$ Supply-voltage sensitivity ( $\Delta V_{IO} / \Delta V_{CC}$ )	$V_{CC} = \pm 9\text{ V}$ to $\pm 15\text{ V}$ , $V_O = 0$	25°C	30	150	30	150	μV/V	
		Full range		150		150		
$I_{OS}$ Short-circuit output current		25°C	±25	±40	±25	±40	mA	
$I_{CC}$ Supply current	No load, $V_O = 0$	25°C	1.7	2.8	1.7	2.8	mA	
		Full range		3.3		3.3		
$P_D$ Power dissipation (each amplifier)	No load, $V_O = 0$	25°C	50	85	50	85	mW	
		Full range		100		100		

† All characteristics are measured under open-loop conditions with zero common-mode input voltage unless otherwise specified. Full range for uA748C is 0°C to 70°C and for uA748M is –55°C to 125°C.

NOTE 5: This typical value applies only at frequencies above a few hundred hertz because of the effects of drift and thermal feedback.

**operating characteristics,  $V_{CC} \pm = \pm 15\text{ V}$ ,  $T_A = 25^\circ\text{C}$**

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_r$ Rise time	$V_I = 20\text{ mV}$ , $R_L = 2\text{ k}\Omega$ , $C_L = 100\text{ pF}$ , $C_C = 30\text{ pF}$ , See Figure 1		0.3		μs
		Overshoot factor	5%		
SR Slew rate at unity gain	$V_I = 10\text{ V}$ , $R_L = 2\text{ k}\Omega$ , $C_L = 100\text{ pF}$ , $C_C = 30\text{ pF}$ , See Figure 1		0.5		V/μs



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## PARAMETER MEASUREMENT INFORMATION

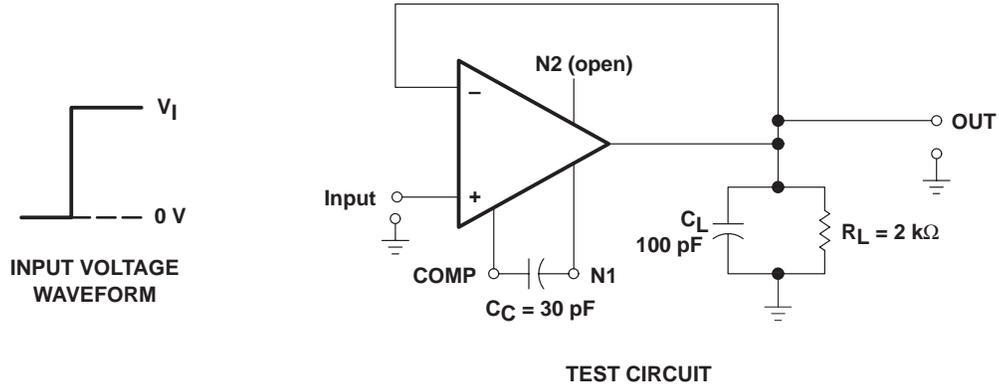


Figure 1. Rise Time, Overshoot, and Slew Rate

## TYPICAL CHARACTERISTICS†

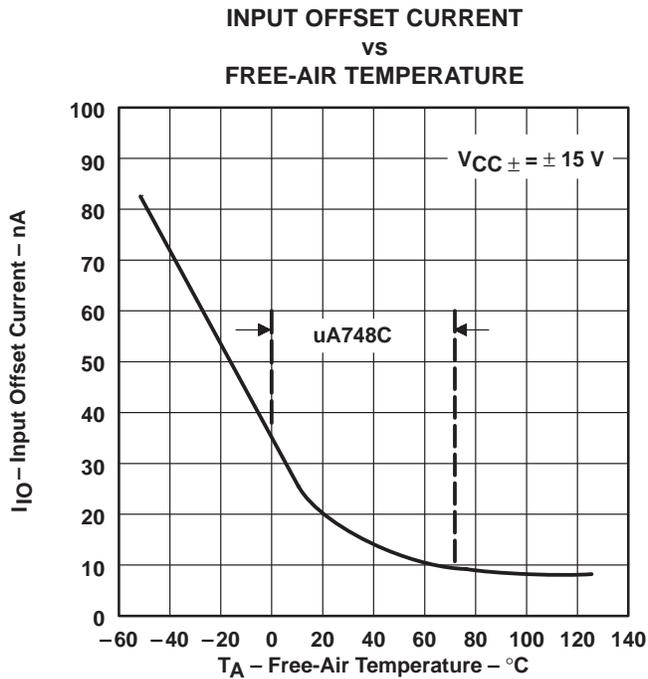


Figure 2

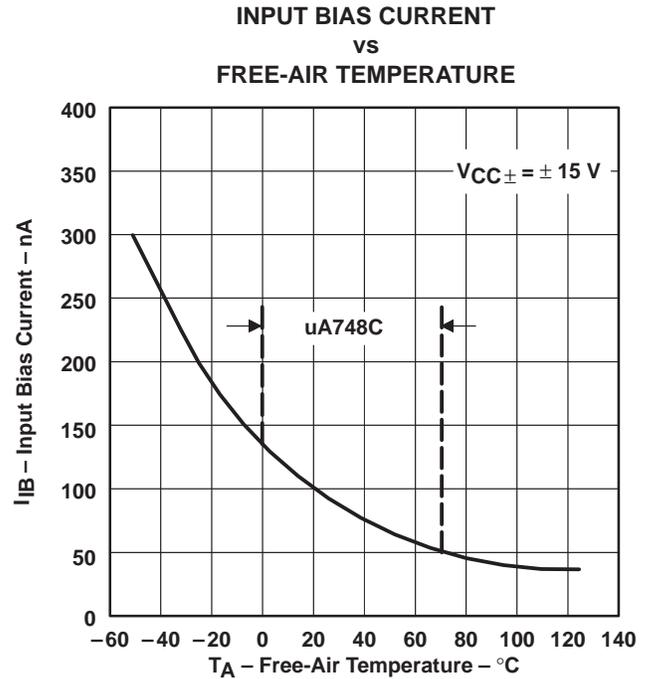


Figure 3

† Data at high and low temperatures are applicable only within the rated operating free-air temperature range of the particular devices.

TYPICAL CHARACTERISTICS

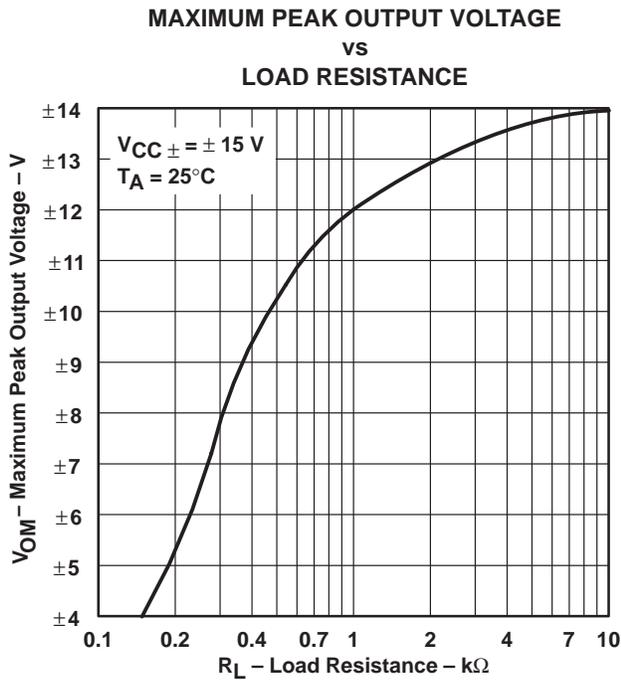


Figure 4

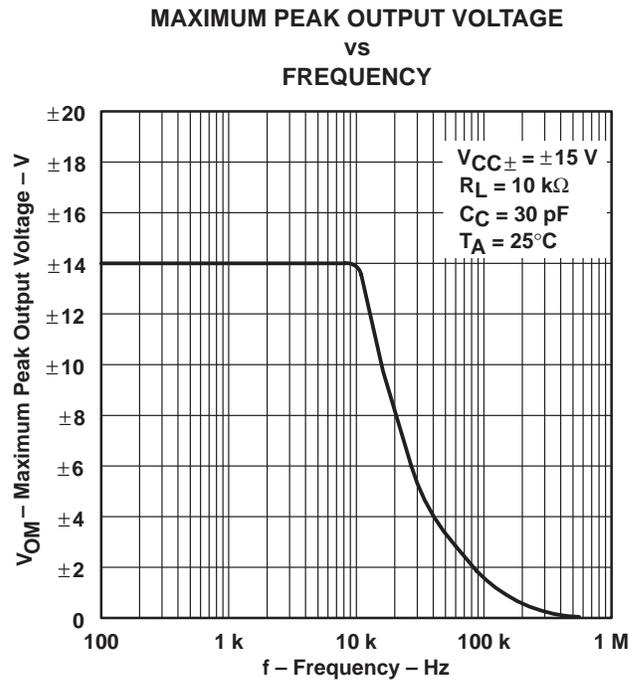


Figure 5

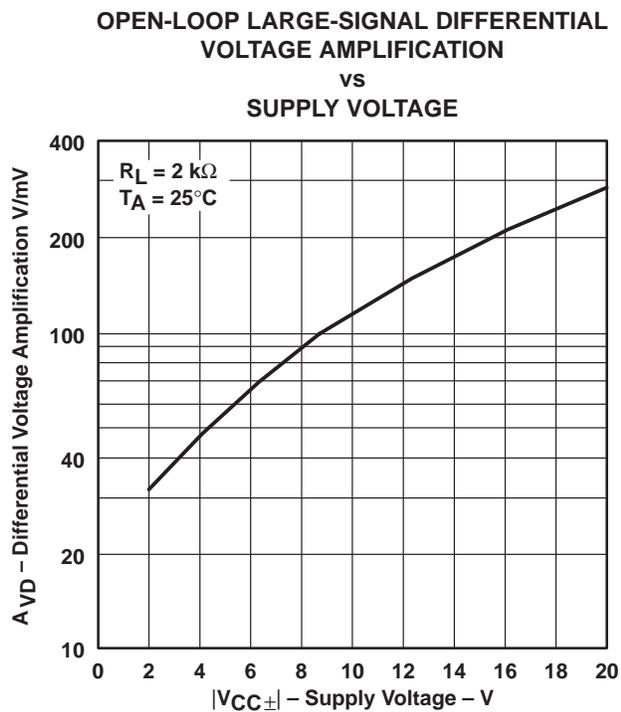


Figure 6

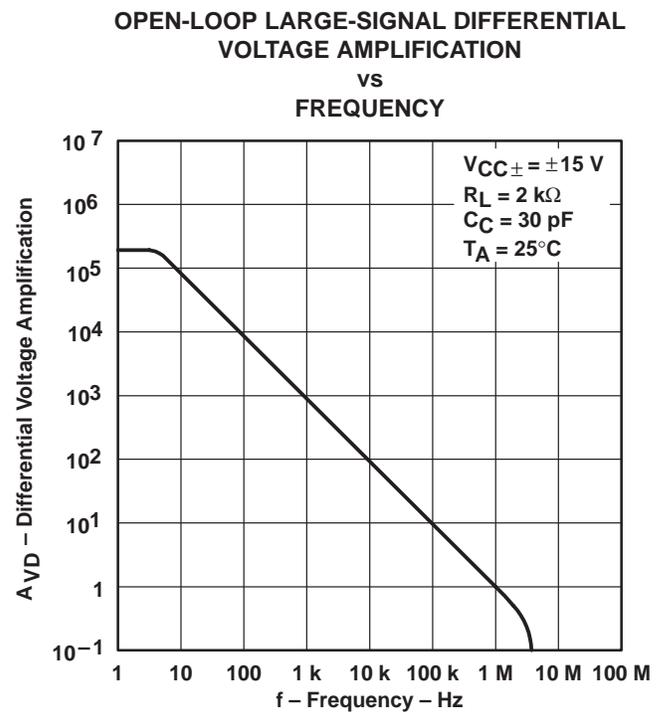


Figure 7

# uA748C, uA748M GENERAL-PURPOSE OPERATIONAL AMPLIFIERS

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## TYPICAL CHARACTERISTICS

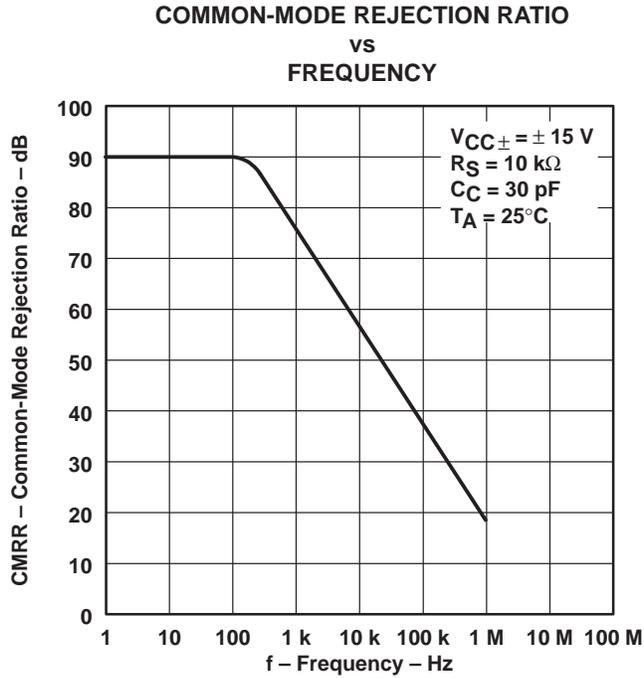


Figure 8

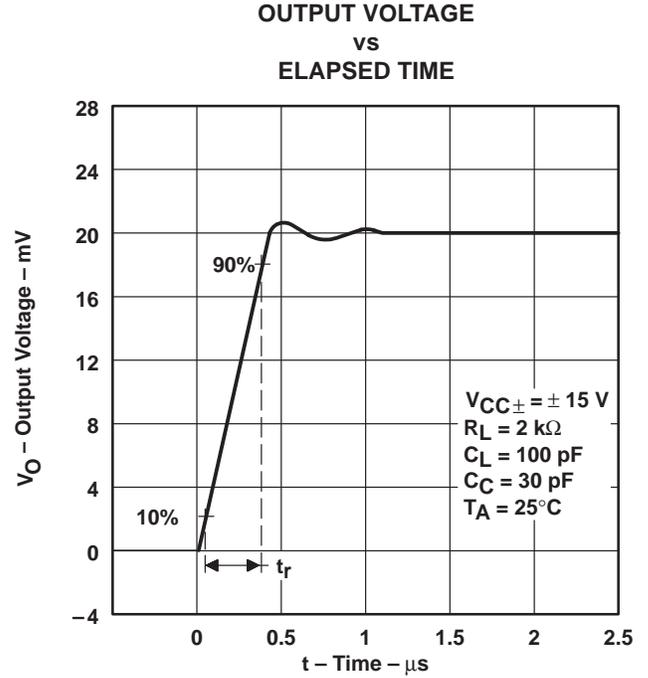


Figure 9

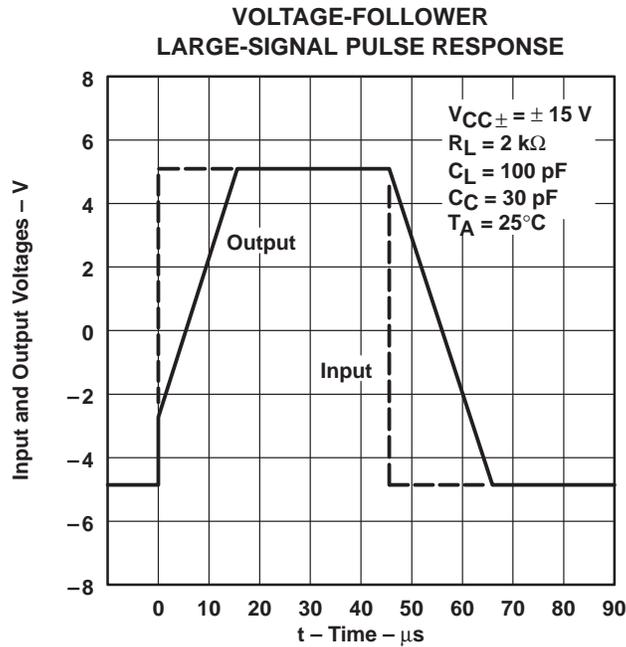


Figure 10

TYPICAL APPLICATION DATA

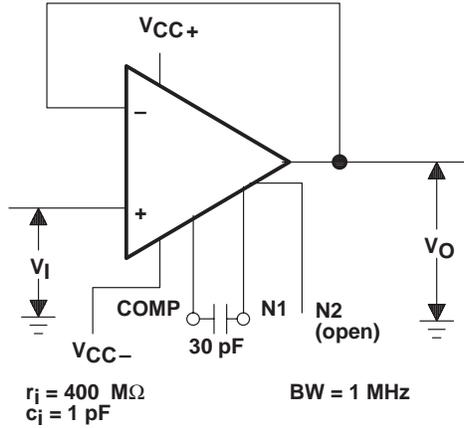
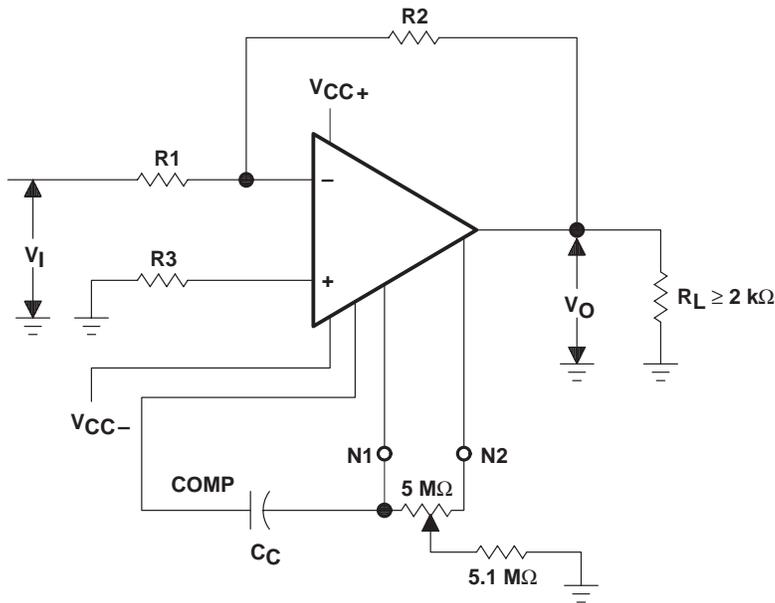


Figure 11. Unity-Gain Voltage Follower



$$\frac{V_O}{V_I} = -\frac{R_2}{R_1}$$

$$C_C \geq \frac{R_1 \cdot 30 \text{ pF}}{R_1 + R_2}$$

$$R_3 = \frac{R_1 \cdot R_2}{R_1 + R_2}$$

Figure 12. Inverting Circuit With Adjustable Gain Compensation and Offset Adjustment

**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
UA748CD	OBSOLETE	SOIC	D	8		TBD	Call TI	Call TI
UA748CDR	OBSOLETE	SOIC	D	8		TBD	Call TI	Call TI
UA748CDR	OBSOLETE	SOIC	D	8		TBD	Call TI	Call TI
UA748CP	OBSOLETE	PDIP	P	8		TBD	Call TI	Call TI
UA748CP	OBSOLETE	PDIP	P	8		TBD	Call TI	Call TI

<sup>(1)</sup> The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS) or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

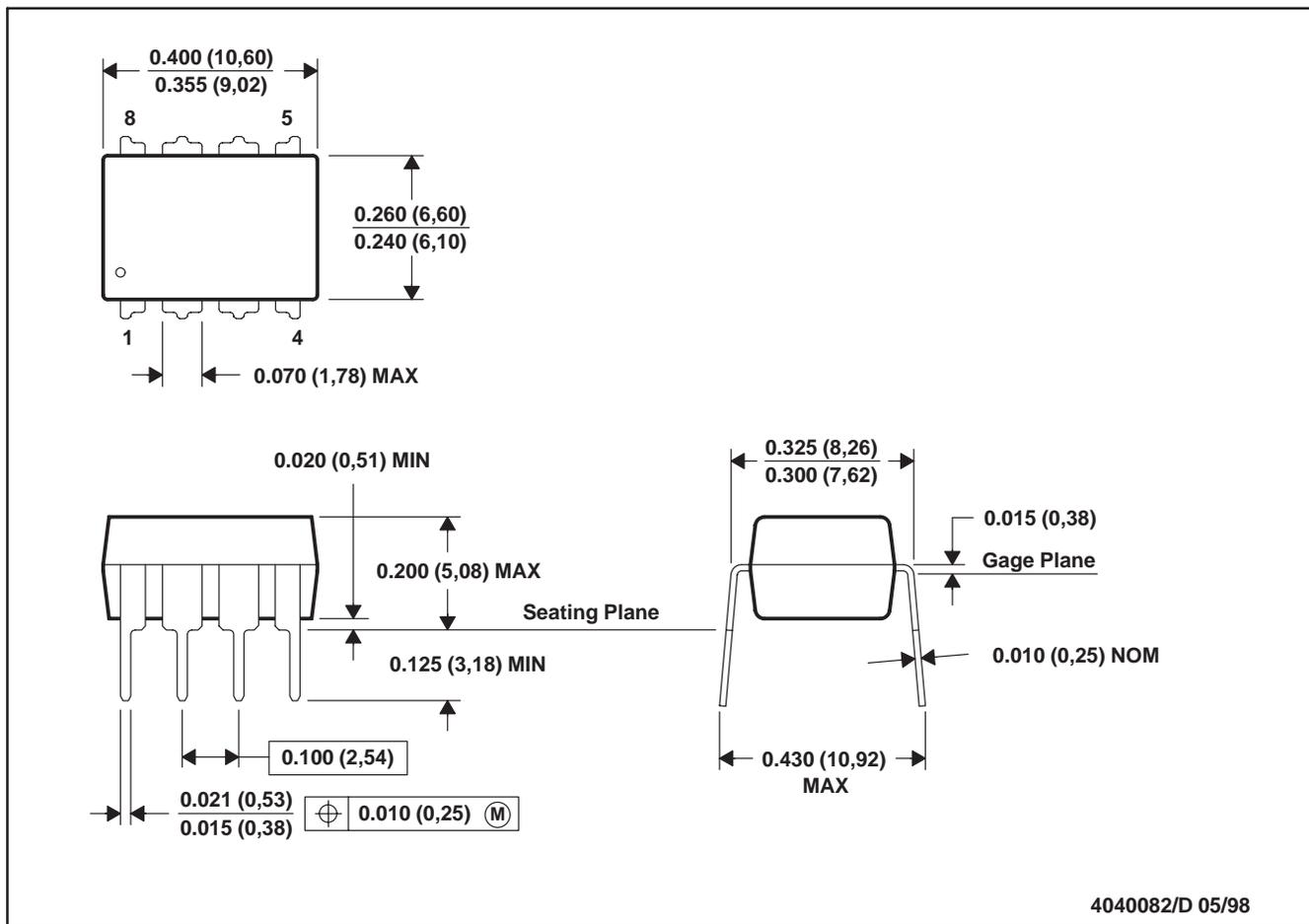
<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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PLASTIC DUAL-IN-LINE



- NOTES: A. All linear dimensions are in inches (millimeters).  
 B. This drawing is subject to change without notice.  
 C. Falls within JEDEC MS-001

For the latest package information, go to [http://www.ti.com/sc/docs/package/pkg\\_info.htm](http://www.ti.com/sc/docs/package/pkg_info.htm)





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