SLOS009A - D971, FEBRUARY 1971 - REVISED OCTOBER 1990

- No Frequency Compensation Required
- Low Power Consumption
- Short-Circuit Protection
- Offset-Voltage Null Capability
- Wide Common-Mode and Differential Voltage Ranges
- No Latch-Up
- Designed to Be Interchangeable With Fairchild μA747C and μA747M

#### description

The uA747 is a dual general-purpose operational amplifier featuring offset-voltage null capability. Each half is electrically similar to uA741.

The high common-mode input voltage range and the absence of latch-up make this amplifier ideal for voltage-follower applications. The device is short-circuit protected and the internal frequency compensation ensures stability without external components. A low-value potentiometer may be connected between the offset null inputs to null out the offset voltage as shown in Figure 2.

The uA747C is characterized for operation from  $0^{\circ}$ C to  $70^{\circ}$ C; the uA747M is characterized for operation over the full military temperature range of  $-55^{\circ}$ C to  $125^{\circ}$ C.

#### symbol (each amplifier)





NC - No internal connection

 $^{+}$  The two positive supply terminals (1 V<sub>CC +</sub> and 2 V<sub>CC +</sub>) are connected together internally.

				PACKAGE		
	Via Max		20-PIN			
TA	AT 25°C	SMALL OUTLINE (D)	CERAMIC DIP (J)	PLASTIC DIP (N)	FLAT PACK (W)	CHIP CARRIER (FK)
0°C to 70°C	6 mV	uA747CD	_	uA747CN	_	_
–55°C to 125°C	5 mV	_	uA747MJ	_	uA747MW	uA747MFK

AVAILABLE OPTIONS

The D package is available taped and reeled. Add the suffix R to the device type, (i.e., uA747CDR).

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.



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#### schematic (each amplifier)



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

		uA747C	uA747M	UNIT		
Supply voltage, V <sub>CC+</sub> (see Note 1)		18	22	V		
Supply voltage, V <sub>CC</sub> (see Note 1)		-18 -22				
Differential input voltage (see Note 2)		±30	±30	V		
Input voltage any input (see Notes 1 and 3)		±15	±15	V		
Voltage between any offset null terminal (N1/N2) and V <sub>CC</sub> -	±0.5	±0.5	V			
Duration of output short circuit (see Note 4)	unlimited	unlimited				
Continuous total dissipation	See Dissipation Rating Table					
Operating free-air temperature range		0 to 70	-55 to 125	°C		
Storage temperature range		-65 to 150	-65 to 150	°C		
Case temperature for 60 seconds	FK package		260	°C		
Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds	J or W package		300	°C		
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	D or N package	260		°C		

NOTES: 1. All voltage values, unless otherwise noted, are with respect to the midpoint between V<sub>CC +</sub> and V<sub>CC -</sub>.

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 15 V, whichever is less.

4. The output may be shorted to ground or either power supply. For the uA747M only, the unlimited duration of the short circuit applies at (or below) 125°C case temperature or 75°C free-air temperature.

DISSIPATION RATING TABLE											
PACKAGE	T <sub>A</sub> ≤ 25°C POWER RATING	DERATING FACTOR	DERATE ABOVE T <sub>A</sub>	T <sub>A</sub> = 70°C POWER RATING	T <sub>A</sub> = 125°C POWER RATING						
D	800 mW	7.6 mW/°C	45°C	608 mW	_						
FK	800 mW	11.0 mW/°C	77°C	800 mW	275 mW						
J	800 mW	11.0 mW/°C	77°C	800 mW	275 mW						
Ν	800 mW	9.2 mW/°C	63°C	736 mW	—						
W	800 mW	8.0 mW/°C	50°C	640 mW	200 mW						



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			_ +	ι	IA747C		uA747M				
	PARAMETER	TEST CONDITIONST	TA+	MIN	TYP	MAX	MIN	TYP	MAX	UNIT	
Vie	Input offect veltage	$V_{\rm C} = 0$	25°C		1	6		1	5	m\/	
۷IO	input onset voltage	vO = 0	Full range			7.5			6	mv	
$\Delta V$ IO(adj)	Offset voltage adjust range		25°C		±15			±15		mV	
lia	Input offect current		25°C		20	200		20	200	20	
NO	input onset current		Full range			300			500	IIA	
lin	Input biog current		25°C		80	500		80	500	24	
чВ	Input bias current		Full range			800			1500	ПА	
Vion	Common-mode		25°C	±12	±13		±12	±13		V	
VICR	input voltage range		Full range	±12			±12			v	
V <sub>O(PP)</sub>		RL= 10 kΩ	25°C	24	28		24	28			
	Maximum peak-to-peak	$R_L \ge 10 \ k\Omega$	Full range	24			24			V	
	output voltage swing	$R_L=2 k\Omega$	25°C	20	26		20	26			
		$R_L \ge 2 k\Omega$	Full range	20			20				
•	Large-signal differential	$R_L \ge 2 k\Omega$ ,	25°C	25	200		50	200		\//m\/	
AVD	voltage amplification	$V_{O} = \pm 10 V$	Full range	15			25			v/mv	
r <sub>i</sub>	Input resistance		25°C	0.3	2		0.3*	2		MΩ	
r <sub>o</sub>	Output resistance	See Note 5	25°C		75			75		Ω	
Ci	Input capacitance		25°C		1.4			1.4		pF	
Common-mode			25°C	70	90		70	90		dD	
CIVIKK	rejection ratio	VIC = VICR	Full range	70			70			uБ	
	Supply-voltage		25°C		30	150		30	150		
k <sub>SVS</sub>	sensitivity	$V_{CC} = \pm 9$ V to $\pm 15$ V	Full range			150	-		150	μV/V	
	$(\Delta \Lambda^{\rm IO} / \Delta \Lambda^{\rm CC})$		· · ·····g·			150			150		
IOS	Short-circuit output current		25°C		±25	±40		±25	±40	mA	
100	Supply current	Noload	25°C		1.7	2.8		1.7	2.8	m۵	
	(each amplifier)		Full range			3.3			3.3		
Pp	Power dissipation	No load Vo - 0	25°C		50	85		50	85	m\//	
U U	(each amplifier)		Full range			100			100	IIIVV	
$V_{01}/V_{02}$	Channel separation		25°C		120			120	0	dB	

### electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15 V$

<sup>†</sup> All characteristics are measured under open-loop conditions with zero common-mode input voltage unless otherwise specified.

 $\ddagger$  Full range for uA747C is 0°C to 70°C and for uA747M is –55°C to 125°C.

\*On products compliant to MIL-STD-883, Class B, this parameter is not production tested.

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<sub>CC $\pm$ </sub> = $\pm$ 15 V, T<sub>A</sub> = 25°C

	PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
tr	Rise time	$1/2 = 20 \text{ m}/2$ By $= 2 k_0$ Cy $= 100 \text{ pc}$ See Figure 1		0.3		μs
	Overshoot factor	$v_1 = 20111v$ , $R_1 = 2 R_{22}$ , $C_2 = 100 pr$ , see rigule 1		5%		
SR	Slew rate at unity gain	$V_I = 10 \text{ mV}, R_L = 2 \text{ k}\Omega, C_L = 100 \text{ pF}, \text{ See Figure 1}$		0.5		V/µs



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### PARAMETER MEASUREMENT INFORMATION



Figure 1. Rise Time, Overshoot, and Slew Rate



Figure 2. Input Offset Voltage Null Circuit



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



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#### **TYPICAL CHARACTERISTICS**

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#### **TYPICAL CHARACTERISTICS**





### PACKAGING INFORMATION

Orderable Device	Status	Package Type	Package	Pins	Package	Eco Plan	Lead finish/	MSL Peak Temp	Op Temp (°C)	Device Marking	Samples
	(1)		Drawing		Qty	(2)	Ball material	(3)		(4/5)	
							(6)				
UA747CN	ACTIVE	PDIP	Ν	14	25	RoHS & Green	NIPDAU	N / A for Pkg Type	0 to 70	UA747CN	Samples
UA747CNE4	LIFEBUY	PDIP	N	14	25	RoHS & Green	NIPDAU	N / A for Pkg Type	0 to 70	UA747CN	
UA747CNE4	LIFEBUY	PDIP	Ν	14	25	RoHS & Green	NIPDAU	N / A for Pkg Type	0 to 70	UA747CN	

<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> RoHS: TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

Green: TI defines "Green" to mean the content of Chlorine (CI) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

<sup>(4)</sup> There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

<sup>(6)</sup> Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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# PACKAGE OPTION ADDENDUM

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### TUBE



#### \*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	Τ (μm)	B (mm)
UA747CN	N	PDIP	14	25	506	13.97	11230	4.32
UA747CNE4	N	PDIP	14	25	506	13.97	11230	4.32

# N (R-PDIP-T\*\*)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



NOTES:

- A. All linear dimensions are in inches (millimeters).B. This drawing is subject to change without notice.
- Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
- $\triangle$  The 20 pin end lead shoulder width is a vendor option, either half or full width.



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