

November 1994

LM747 Dual Operational Amplifier

General Description

The LM747 is a general purpose dual operational amplifier. The two amplifiers share a common bias network and power supply leads. Otherwise, their operation is completely independent.

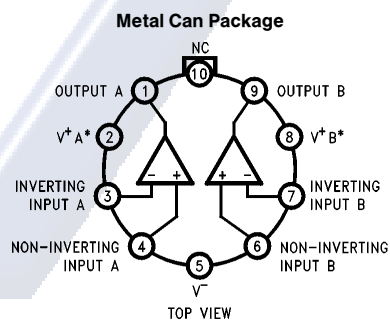
Additional features of the LM747 are: no latch-up when input common mode range is exceeded, freedom from oscillations, and package flexibility.

The LM747C/LM747E is identical to the LM747/LM747A except that the LM747C/LM747E has its specifications guaranteed over the temperature range from 0°C to +70°C instead of -55°C to +125°C.

Features

- No frequency compensation required
- Short-circuit protection
- Wide common-mode and differential voltage ranges
- Low power consumption
- No latch-up
- Balanced offset null

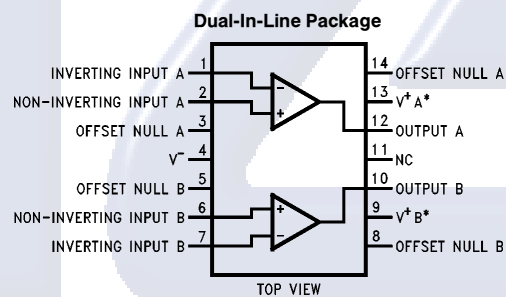
Connection Diagrams



TL/H/11479-4

Order Number LM747H
See NS Package Number H10C

*V⁺A and V⁺B are internally connected.



TL/H/11479-5

Order Number LM747CN or LM747EN
See NS Package Number N14A

Absolute Maximum Ratings

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage	
LM747/LM747A	±22V
LM747C/LM747E	±18V
Power Dissipation (Note 1)	800 mW
Differential Input Voltage	±30V

Input Voltage (Note 2)	±15V
Output Short-Circuit Duration	Indefinite
Operating Temperature Range	
LM747/LM747A	−55°C to +125°C
LM747C/LM747E	0°C to +70°C
Storage Temperature Range	−65°C to +150°C
Lead Temperature (Soldering, 10 sec.)	300°C

Electrical Characteristics (Note 3)

Parameter	Conditions	LM747A/LM747E			LM747			LM747C			Units
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
Input Offset Voltage	$T_A = 25^\circ\text{C}$ $R_S \leq 10\text{ k}\Omega$ $R_S \leq 50\Omega$		0.8	3.0	1.0	5.0		2.0	6.0		mV
	$R_S \leq 50\Omega$ $R_S \leq 10\text{ k}\Omega$			4.0		6.0			7.5		mV
Average Input Offset Voltage Drift				15							$\mu\text{V}/^\circ\text{C}$
Input Offset Voltage Adjustment Range	$T_A = 25^\circ\text{C}$, $V_S = \pm 20\text{V}$	±10			±15			±15			mV
Input Offset Current	$T_A = 25^\circ\text{C}$		3.0	30	20	200		20	200		nA
				70	85	500			300		
Average Input Offset Current Drift				0.5							nA/ $^\circ\text{C}$
Input Bias Current	$T_A = 25^\circ\text{C}$		30	80	80	500		80	500		nA
	$T_{\text{AMIN}} \leq T_A \leq T_{\text{AMAX}}$			0.210		1.5			0.8		μA
Input Resistance	$T_A = 25^\circ\text{C}$, $V_S = \pm 20\text{V}$	1.0	6.0		0.3	2.0		0.3	2.0		M Ω
	$V_S = \pm 20\text{V}$	0.5									
Input Voltage Range	$T_A = 25^\circ\text{C}$							±12	±13		V
		±12	±13		±12	±13					
Large Signal Voltage Gain	$T_A = 25^\circ\text{C}$, $R_L \geq 2\text{ k}\Omega$ $V_S = \pm 20\text{V}$, $V_O = \pm 15\text{V}$	50									V/mV
	$V_S = \pm 15\text{V}$, $V_O = \pm 10\text{V}$ $R_L \geq 2\text{ k}\Omega$				50	200		20	200		V/mV
	$V_S = \pm 20\text{V}$, $V_O = \pm 15\text{V}$	32									V/mV
	$V_S = \pm 15\text{V}$, $V_O = \pm 10\text{V}$				25			15			V/mV
	$V_S = \pm 5\text{V}$, $V_O = \pm 2\text{V}$	10									V/mV
Output Voltage Swing	$V_S = \pm 20\text{V}$ $R_L \geq 10\text{ k}\Omega$ $R_L \geq 2\text{ k}\Omega$	±16									V
	$V_S = \pm 15\text{V}$ $R_L \geq 10\text{ k}\Omega$ $R_L \geq 2\text{ k}\Omega$				±12	±14		±12	±14		V
Output Short Circuit Current	$T_A = 25^\circ\text{C}$	10	25	35	25			25			mA
		10		40							
Common-Mode Rejection Ratio	$R_S \leq 10\text{ k}\Omega$, $V_{\text{CM}} = \pm 12\text{V}$				70	90		70	90		dB
	$R_S \leq 50\text{ k}\Omega$, $V_{\text{CM}} = \pm 12\text{V}$	80	95								

Electrical Characteristics (Note 3) (Continued)

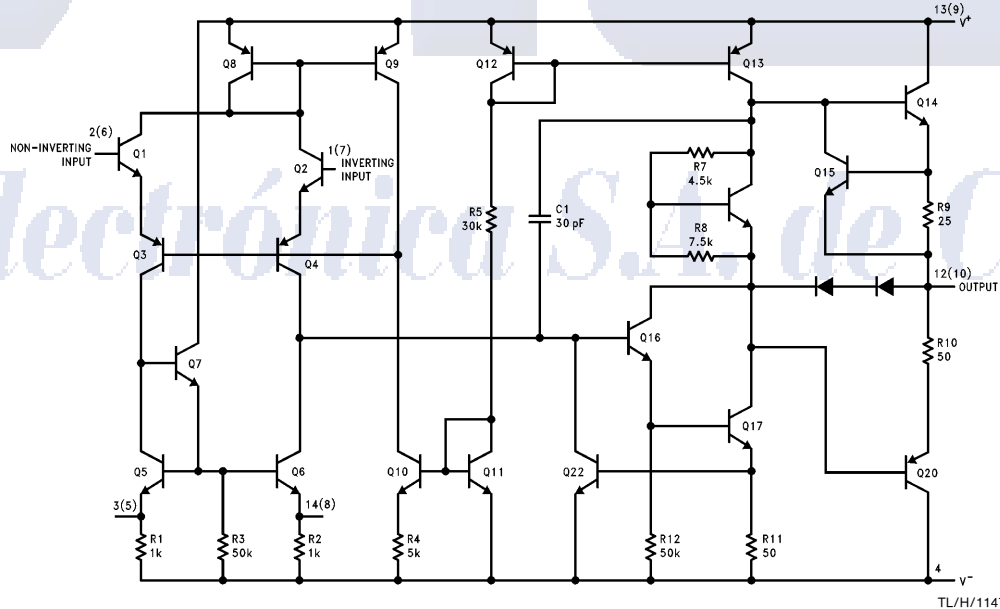
Parameter	Conditions	LM747A/LM747E			LM747			LM747C			Units
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
Supply Voltage Rejection Ratio	$V_S = \pm 20V$ to $V_S = \pm 5V$ $R_S \leq 50\Omega$ $R_S \leq 10 k\Omega$	86	96		77	96		77	96		dB
Transient Response	$T_A = 25^\circ C$, Unity Gain		0.25	0.8		0.3			0.3		μs
Rise Time			6.0	20		5			5		%
Overshoot											
Bandwidth (Note 4)	$T_A = 25^\circ C$	0.437	1.5								MHz
Slew Rate	$T_A = 25^\circ C$, Unity Gain	0.3	0.7		0.5			0.5			V/ μs
Supply Current/Amp	$T_A = 25^\circ C$			2.5	1.7	2.8		1.7	2.8		mA
Power Consumption/Amp	$T_A = 25^\circ C$ $V_S = \pm 20V$ $V_S = \pm 15V$		80	150		50	85		50	85	mW
LM747A	$V_S = \pm 20V$ $T_A = T_{AMIN}$ $T_A = T_{AMAX}$			165 135							mW
LM747E	$V_S = \pm 20V$ $T_A = T_{AMIN}$ $T_A = T_{AMAX}$			150 150 150							mW
LM747	$V_S = \pm 15V$ $T_A = T_{AMIN}$ $T_A = T_{AMAX}$				60 45	100 75					mW

Note 1: The maximum junction temperature of the LM747C/LM747E is $100^\circ C$. For operating at elevated temperatures, devices in the TO-5 package must be derated based on a thermal resistance of $150^\circ C/W$, junction to ambient, or $45^\circ C/W$, junction to case. The thermal resistance of the dual-in-line package is $100^\circ C/W$, junction to ambient.

Note 2: For supply voltages less than $\pm 15V$, the absolute maximum input voltage is equal to the supply voltage.

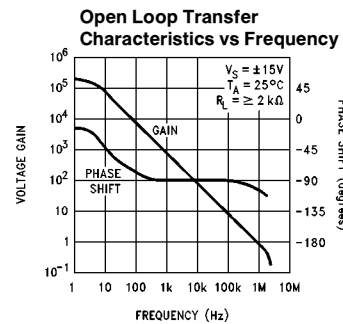
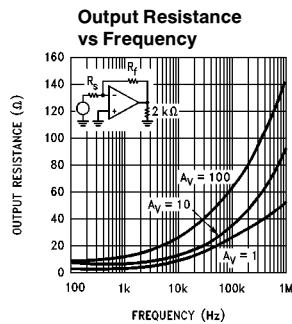
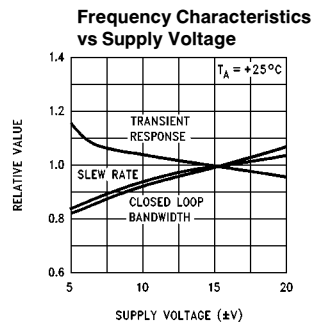
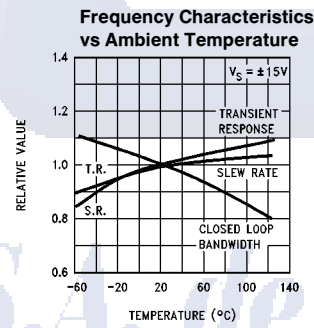
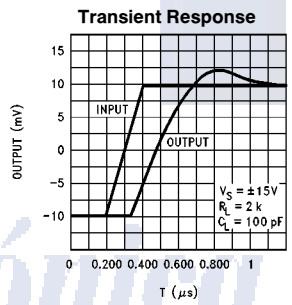
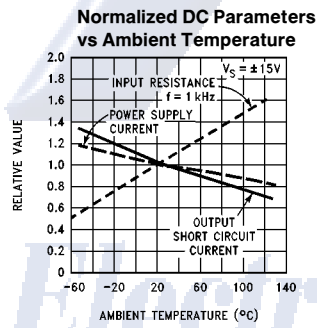
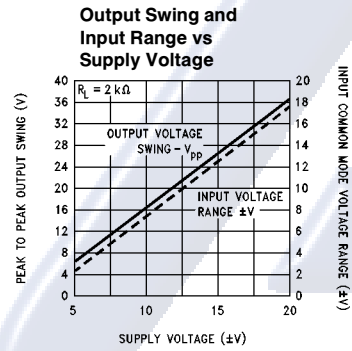
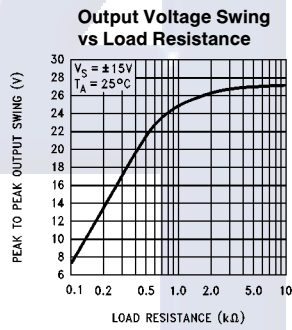
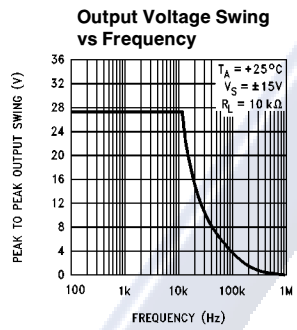
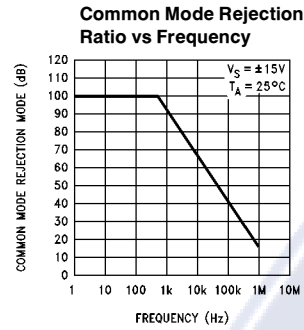
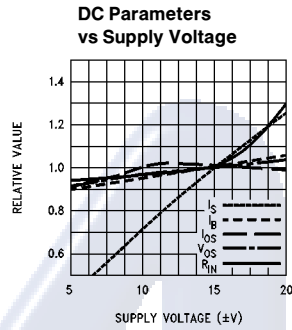
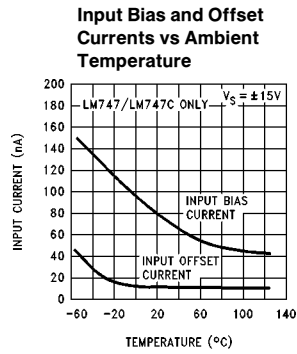
Note 3: These specifications apply for $\pm 5V \leq V_S \leq \pm 20V$ and $-55^\circ C \leq T_A \leq 125^\circ C$ for the LM747A and $0^\circ C \leq T_A \leq 70^\circ C$ for the LM747E unless otherwise specified. The LM747 and LM747C are specified for $V_S = \pm 15V$ and $-55^\circ C \leq T_A \leq 125^\circ C$ and $0^\circ C \leq T_A \leq 70^\circ C$, respectively, unless otherwise specified.

Note 4: Calculated value from: $0.35/\text{Rise Time } (\mu s)$.

Schematic Diagram (Each Amplifier)

Note: Numbers in parentheses are pin numbers for amplifier B. DIP only.

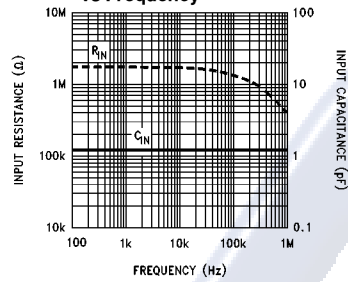
Typical Performance Characteristics



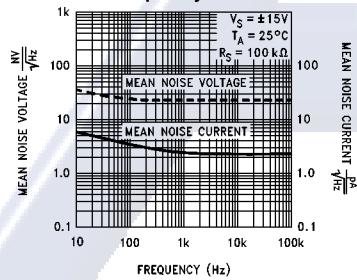
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Typical Performance Characteristics (Continued)

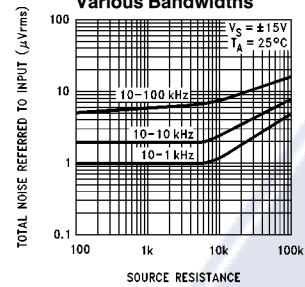
**Input Resistance and
Input Capacitance
vs Frequency**



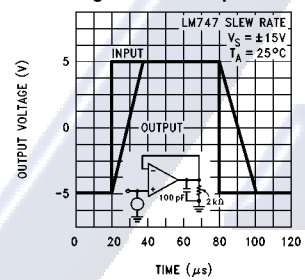
**Input Noise Voltage
and Current
vs Frequency**



**Broadband Noise for
Various Bandwidths**



**Voltage Follower Large
Signal Pulse Response**

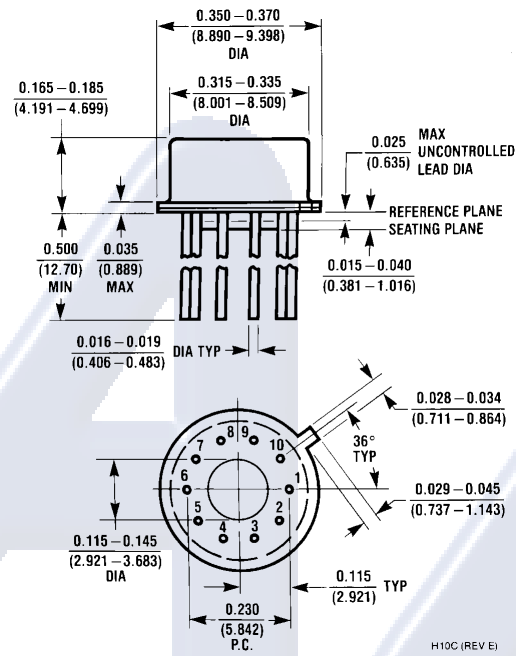


TL/H/11479-3

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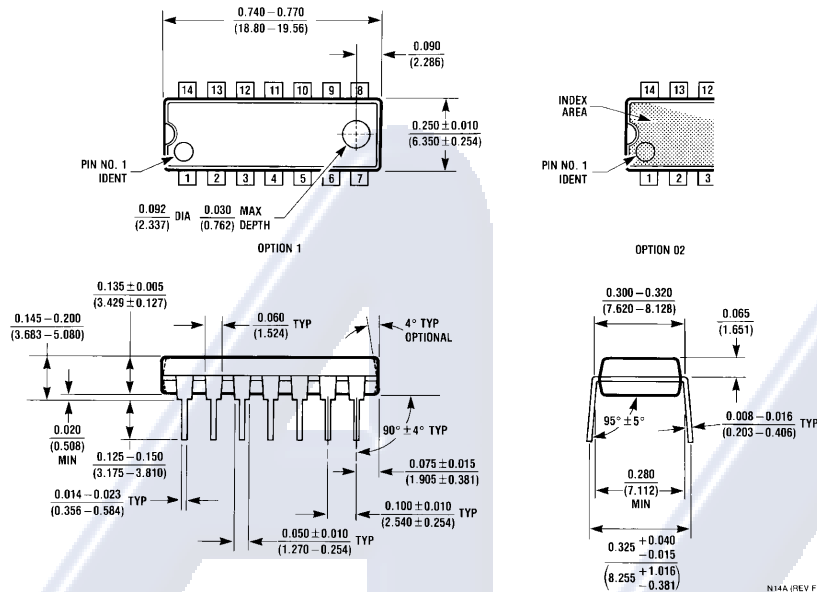
Physical Dimensions inches (millimeters)



Metal Can Package (H)
Order Number LM747H
NS Package Number H10C

LM747 Dual Operational Amplifier

Physical Dimensions inches (millimeters) (Continued)



Dual-In-Line Package (N)
Order Number LM747CN or LM747EN
NS Package Number N14A

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