National Semiconductor

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.

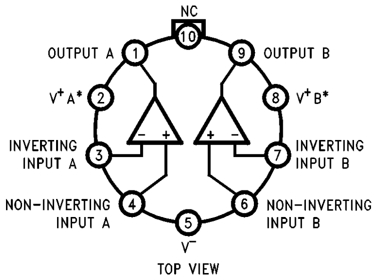
The LM747C/LM747E is identical to the LM747/LM747A except that the LM747C/LM747E has its specifications guaranteed over the temperature range from 0°C to +70°C instead of −55°C to +125°C.

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

Metal Can Package



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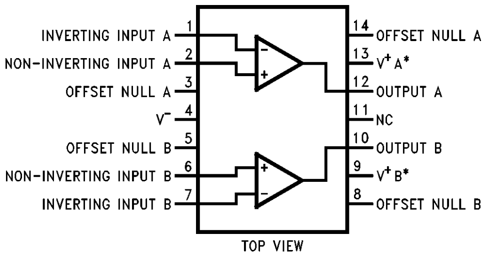
Order Number LM747H
See NS Package Number H10C

Dual-In-Line Package



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Order Number LM747CN or LM747EN
See NS Package Number N14A

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

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°C $R_S \leq$ 10 kΩ $R_S \leq$ 50Ω		 0.8	 3.0		 1.0	 5.0		 2.0	 6.0	mV
	$R_S \leq$ 50Ω $R_S \leq$ 10 kΩ			4.0			 6.0			 7.5	mV
Average Input Offset Voltage Drift				15							μV/°C
Input Offset Voltage Adjustment Range	T_A = 25°C, V_S = ±20V	±10				±15			±15		mV
Input Offset Current	T_A = 25°C		3.0	30		20	200		20	200	nA
				70		85	500			300	
Average Input Offset Current Drift				0.5							nA/°C
Input Bias Current	T_A = 25°C $T_{AMIN} \leq T_A \leq T_{AMAX}$		30	80 0.210		80	500 1.5		80	500 0.8	nA μA
Input Resistance	T_A = 25°C, V_S = ±20V	1.0	6.0		0.3	2.0		0.3	2.0		MΩ
	V_S = ±20V	0.5									
Input Voltage Range	T_A = 25°C							±12	±13		V
		±12	±13		±12	±13					
Large Signal Voltage Gain	T_A = 25°C, $R_L \geq$ 2 kΩ V_S = ±20V, V_O = ±15V	 50									V/mV
	V_S = ±15V, V_O = ±10V $R_L \geq$ 2 kΩ				50	200		20	200		V/mV
	V_S = ±20V, V_O = ±15V	32									V/mV
	V_S = ±15V, V_O = ±10V				25			15			V/mV
	V_S = ±5V, V_O = ±2V	10									V/mV
Output Voltage Swing	V_S = ±20V $R_L \geq$ 10 kΩ $R_L \geq$ 2 kΩ	 ±16 ±15									V
	V_S = ±15V $R_L \geq$ 10 kΩ $R_L \geq$ 2 kΩ				 ±12 ±10	 ±14 ±13		 ±12 ±10	 ±14 ±13		V
Output Short Circuit Current	T_A = 25°C	10 10	25	35 40		25			25		mA
Common-Mode Rejection Ratio	$R_S \leq$ 10 kΩ, V_{CM} = ±12V				70	90		70	90		dB
	$R_S \leq$ 50 kΩ, V_{CM} = ±12V	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 $V_S = \pm 5V$										dB
	$R_S \leq 50\Omega$	86	96								
	$R_S \leq 10\ k\Omega$				77	96		77	96		
Transient Response	$T_A = 25°C$, Unity Gain										
Rise Time			0.25	0.8		0.3			0.3		µs
Overshoot			6.0	20		5			5		%
Bandwidth (Note 4)	$T_A = 25°C$	0.437	1.5								MHz
Slew Rate	$T_A = 25°C$, Unity Gain	0.3	0.7			0.5			0.5		V/µs
Supply Current/Amp	$T_A = 25°C$			2.5		1.7	2.8		1.7	2.8	mA
Power Consumption/Amp	$T_A = 25°C$										mW
	$V_S = \pm 20V$		80	150							
	$V_S = \pm 15V$					50	85		50	85	
LM747A	$V_S = \pm 20V$										mW
	$T_A = T_{AMIN}$			165							
	$T_A = T_{AMAX}$			135							
LM747E	$V_S = \pm 20V$			150							mW
	$T_A = T_{AMIN}$			150							
	$T_A = T_{AMAX}$			150							
LM747	$V_S = \pm 15V$										mW
	$T_A = T_{AMIN}$					60	100				
	$T_A = T_{AMAX}$					45	75				

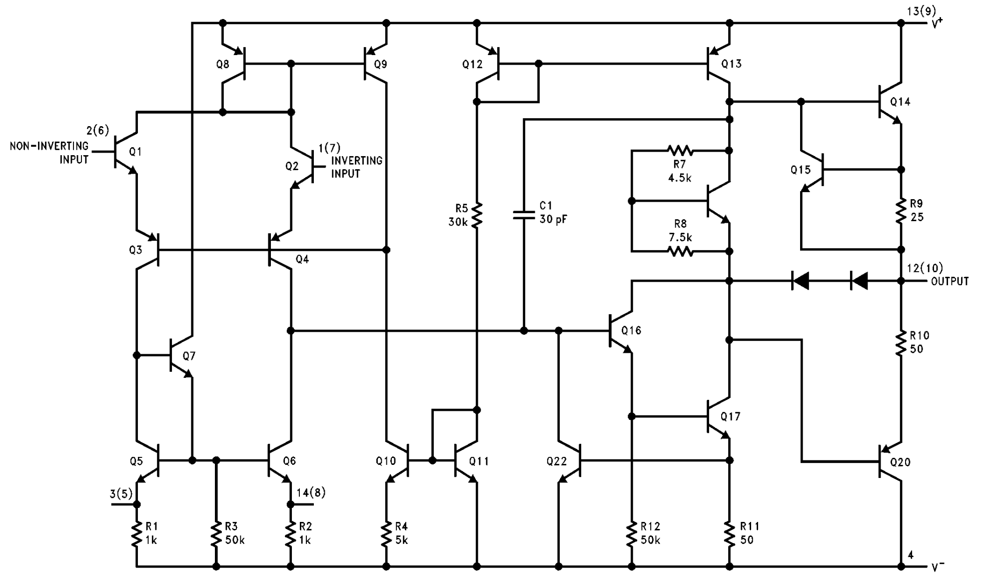
Note 1: The maximum junction temperature of the LM747C/LM747E is 100°C. For operating at elevated temperatures, devies in the TO-5 package must be derated based on a thermal resistance of 150°C/W, junction to ambient, or 45°C/W, junction to case. The thermal resistance of the dual-in-line package is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

Note 2: For supply voltages less than ±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 $-55°C \leq T_A \leq 125°C$ for the LM747A and $0°C \leq T_A \leq 70°C$ for the LM747E unless otherwise specified. The LM747 and LM747C are specified for $V_S = \pm 15V$ and $-55°C \leq T_A \leq 125°C$ and $0°C \leq T_A \leq 70°C$, respectively, unless otherwise specified.

Note 4: Calculated value from: 0.35/Rise Time (µs).

Schematic Diagram (Each Amplifier)



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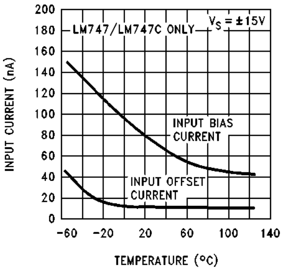
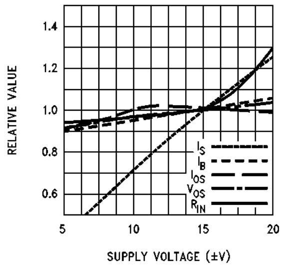
Note: Numbers in parentheses are pin numbers for amplifier B. DIP only.

Typical Performance Characteristics

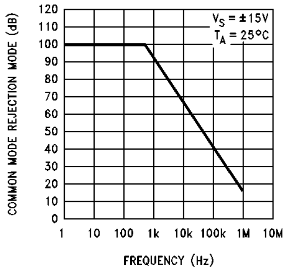
Input Bias and Offset Currents vs Ambient Temperature



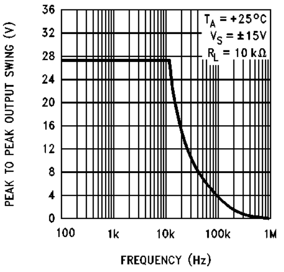
DC Parameters vs Supply Voltage



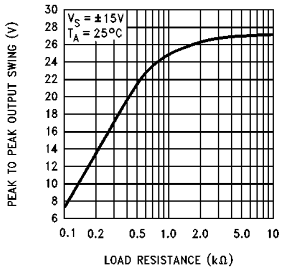
Common Mode Rejection Ratio vs Frequency



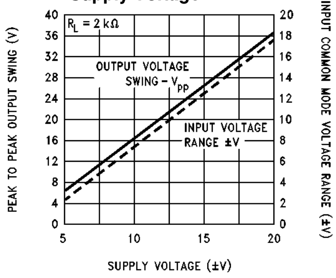
Output Voltage Swing vs Frequency



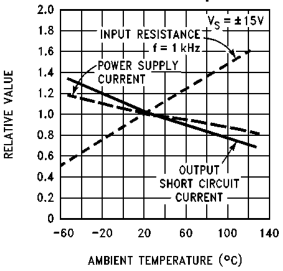
Output Voltage Swing vs Load Resistance



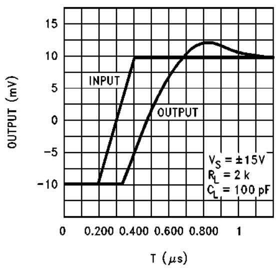
Output Swing and Input Range vs Supply Voltage



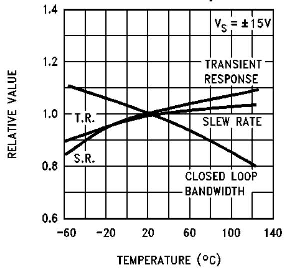
Normalized DC Parameters vs Ambient Temperature



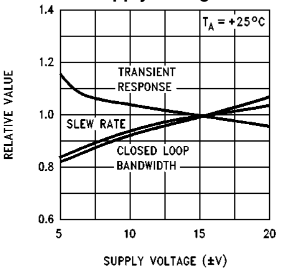
Transient Response



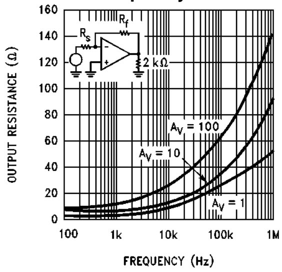
Frequency Characteristics vs Ambient Temperature



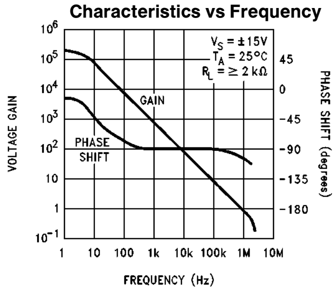
Frequency Characteristics vs Supply Voltage



Output Resistance vs Frequency



Open Loop Transfer Characteristics vs Frequency



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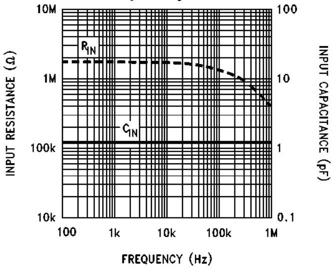
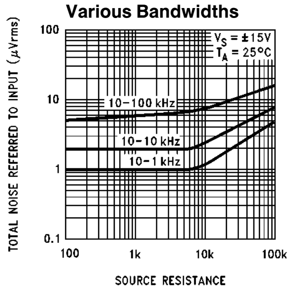
Typical Performance Characteristics (Continued)

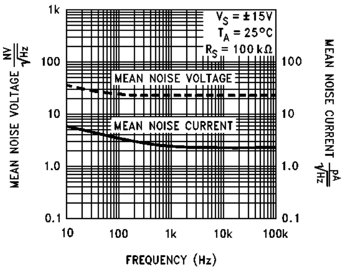
Input Resistance and Input Capacitance vs Frequency



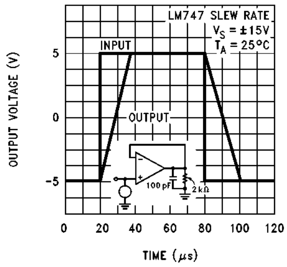
Broadband Noise for Various Bandwidths



Input Noise Voltage and Current vs Frequency



Voltage Follower Large Signal Pulse Response



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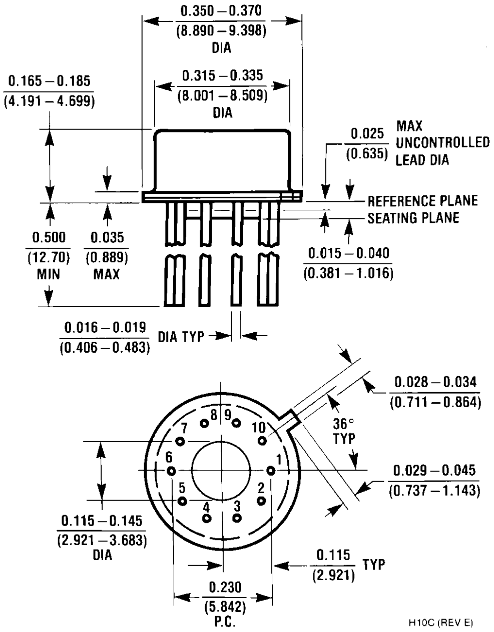
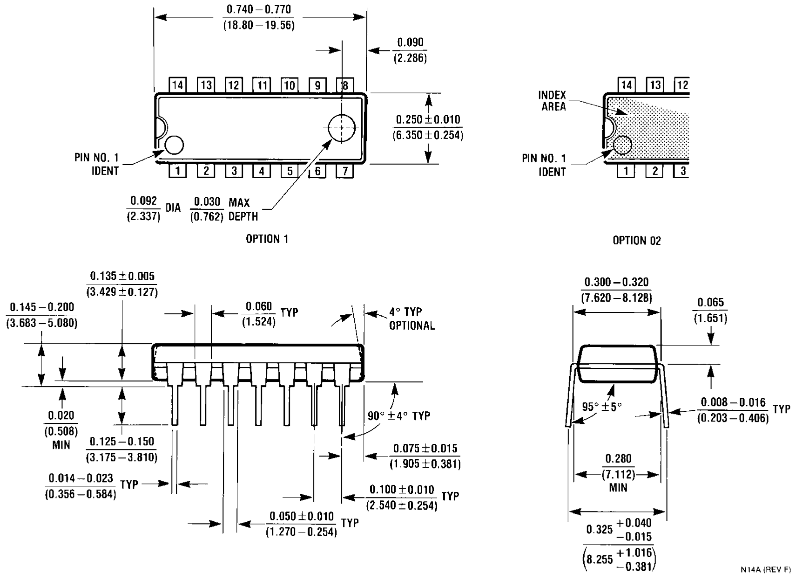
Physical Dimensions inches (millimeters)



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

Physical Dimensions inches (millimeters) (Continued)



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

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