# LM747

***LM747 Dual Operational Amplifier***


Literature Number: SNOS661

National Semiconductor

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# 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.

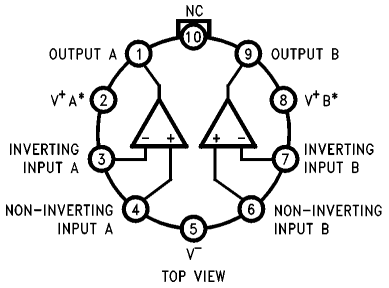
The LM747C/LM747E is identical to the LM747/LM747A except that the LM747C/LM747E has its specifications guaranteed over the temperature range from 0°C to +70°C instead of −55°C to +125°C.

## 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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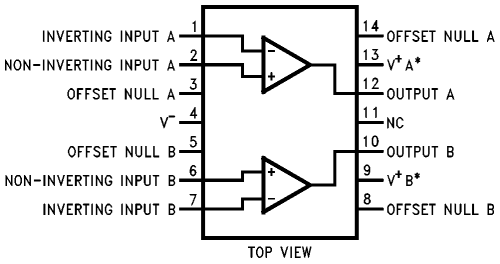
**Order Number LM747H**
**See NS Package Number H10C**

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

**Dual-In-Line Package**

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**Order Number LM747CN or LM747EN**
**See NS Package Number N14A**

RRD-B30M115/Printed in U. S. A.

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

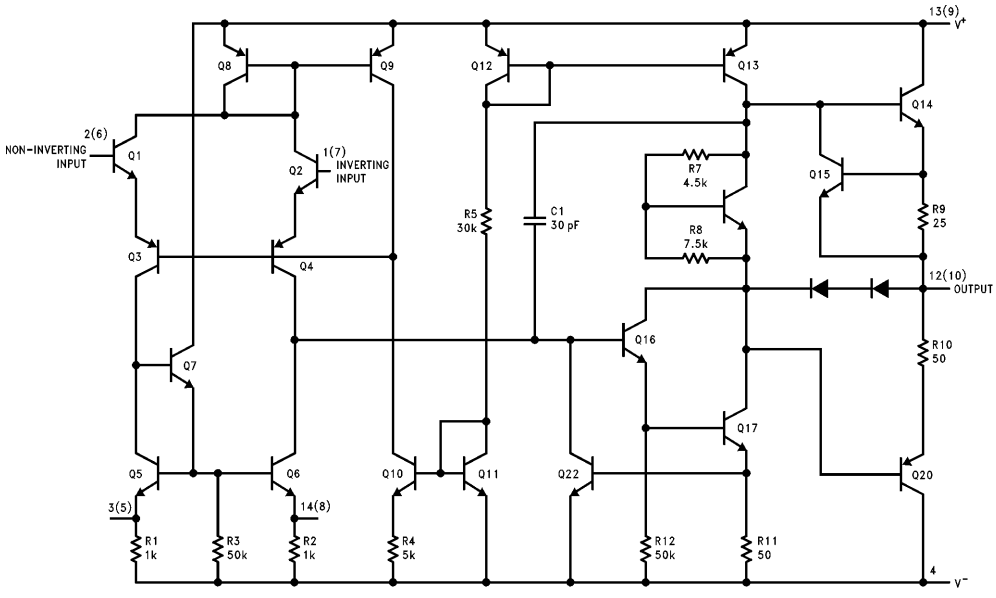
**Note 1:** The maximum junction temperature of the LM747C/LM747E is 100°C. For operating at elevated temperatures, devies in the TO-5 package must be derated based on a thermal resistance of 150°C/W, junction to ambient, or 45°C/W, junction to case. The thermal resistance of the dual-in-line package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

**Note 2:** For supply voltages less than $\pm 15V$, 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 $-55°C \leq T_A \leq 125°C$ 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 ($\mu s$).

## Schematic Diagram (Each Amplifier)

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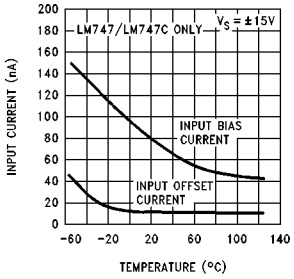
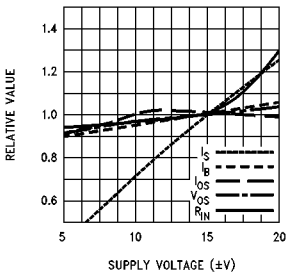
**Note:** Numbers in parentheses are pin numbers for amplifier B. DIP only.

## Typical Performance Characteristics

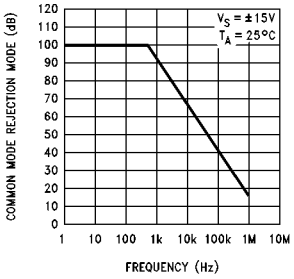
**Input Bias and Offset Currents vs Ambient Temperature**



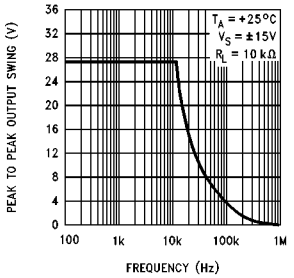

**DC Parameters vs Supply Voltage**



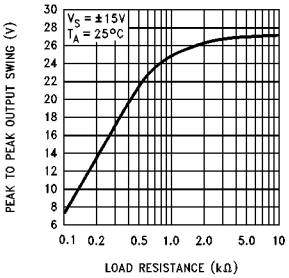

**Common Mode Rejection Ratio vs Frequency**



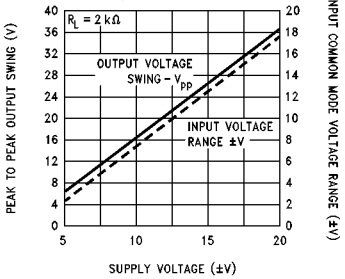

**Output Voltage Swing vs Frequency**



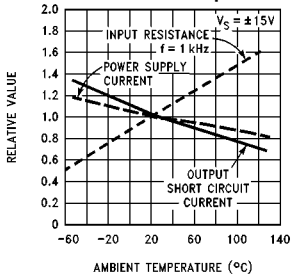

**Output Voltage Swing vs Load Resistance**



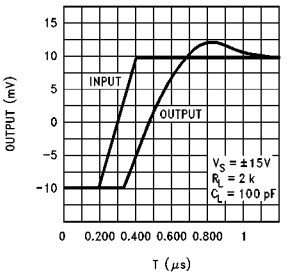

**Output Swing and Input Range vs Supply Voltage**



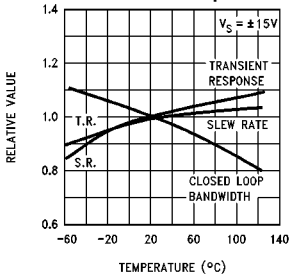

**Normalized DC Parameters vs Ambient Temperature**



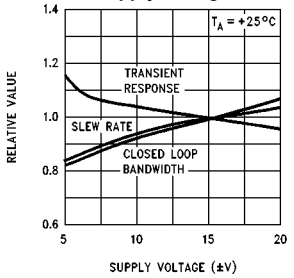

**Transient Response**



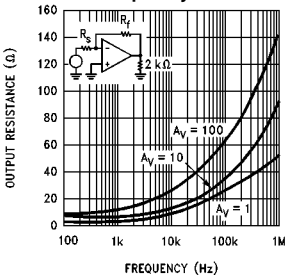

**Frequency Characteristics vs Ambient Temperature**



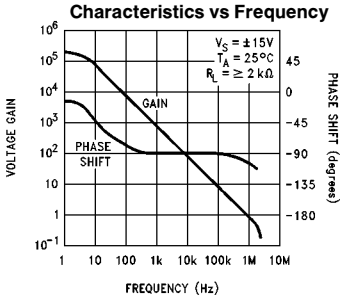

**Frequency Characteristics vs Supply Voltage**




**Output Resistance vs Frequency**




**Open Loop Transfer Characteristics vs Frequency**

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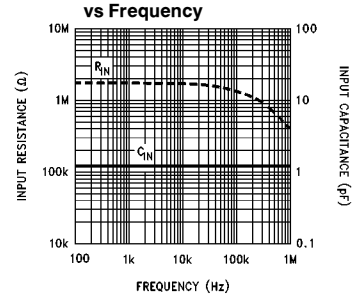
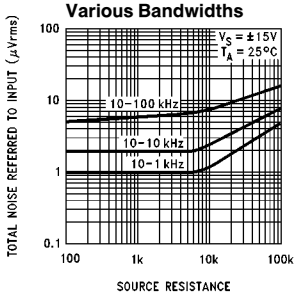
## Typical Performance Characteristics (Continued)

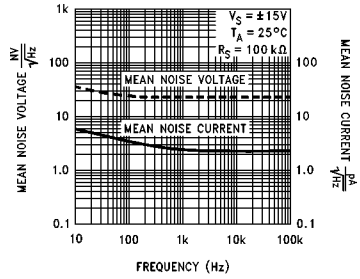
**Input Resistance and Input Capacitance vs Frequency**



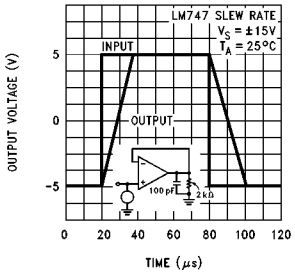

**Broadband Noise for Various Bandwidths**




**Input Noise Voltage and Current vs Frequency**




**Voltage Follower Large Signal Pulse Response**

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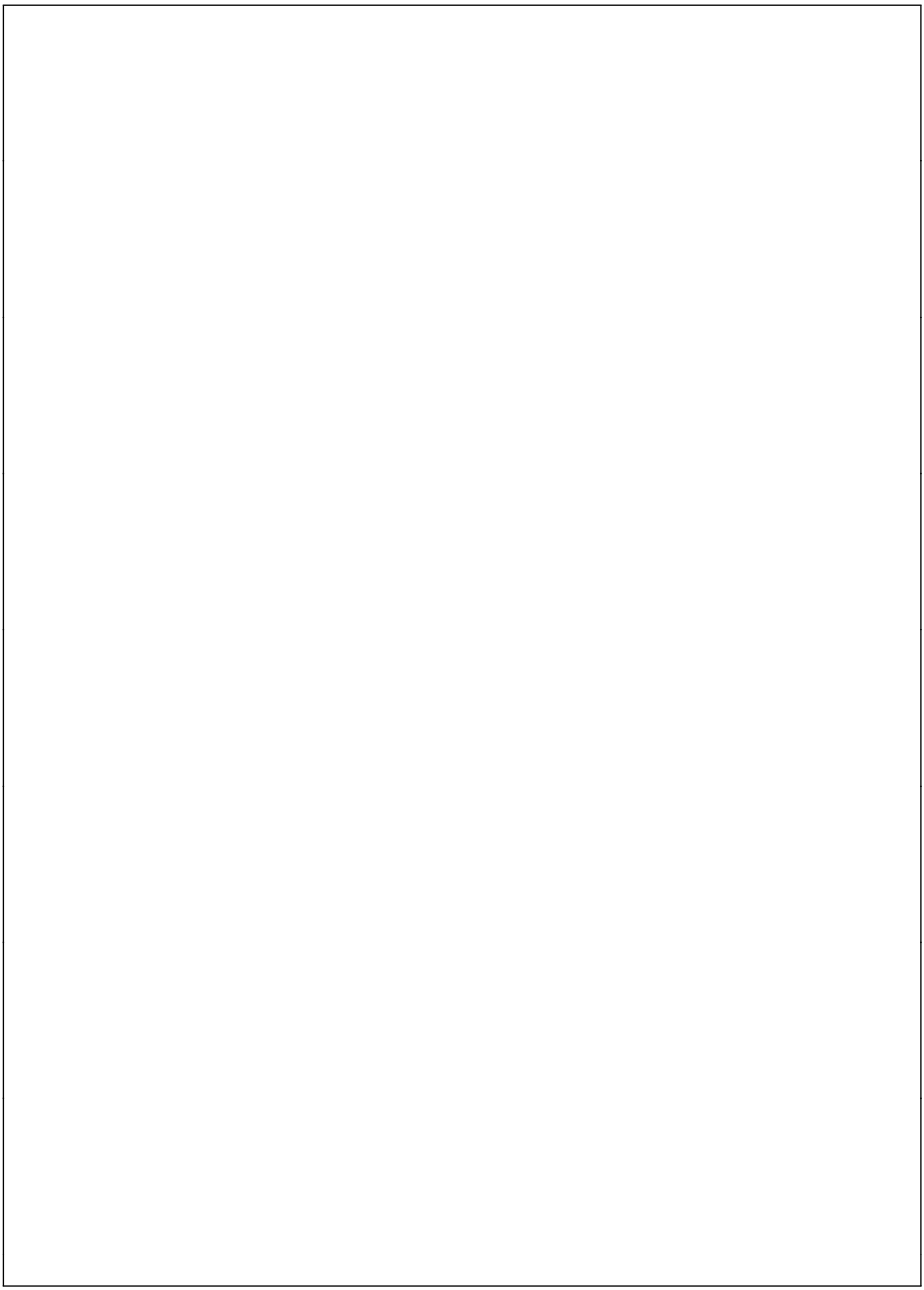
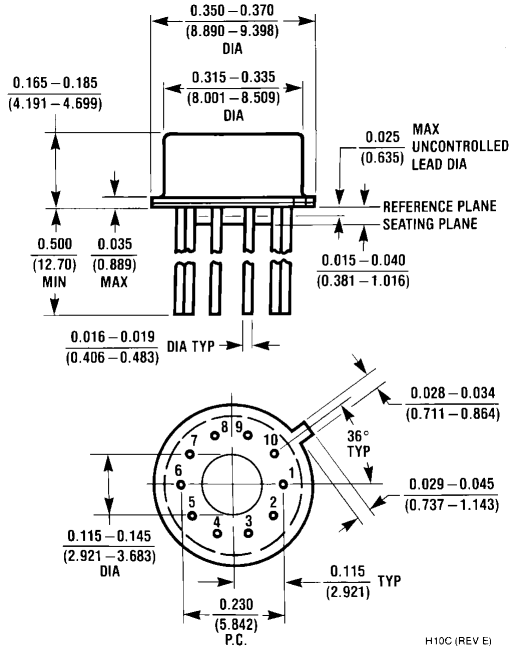
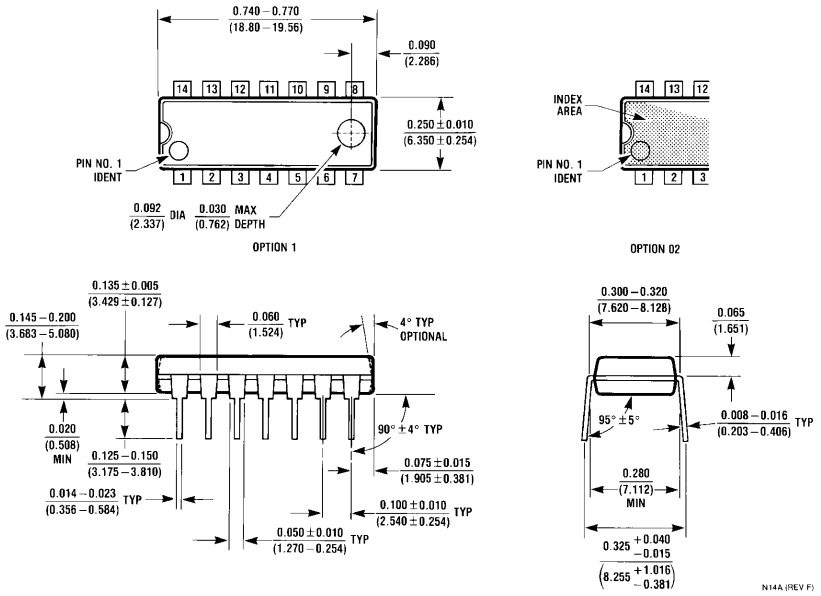


## Physical Dimensions inches (millimeters)




**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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