

# SN54S124, SN74S124 DUAL VOLTAGE-CONTROLLED OSCILLATORS

SDLS201A – DECEMBER 1983 – REVISED APRIL 2004

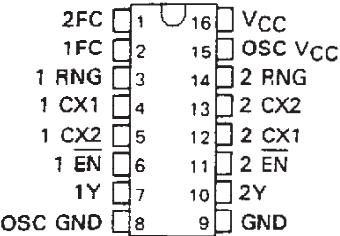
- Two independent VCOs in a 16-Pin Package
- Output Frequency Set by Single External Component:  
Capacitor for Fixed- or Variable-Frequency Operation
- Separate Supply Voltage Pins for Isolation of Frequency Control Inputs and Oscillators from Output Circuitry
- Highly Stable Operation over Specified Temperature and/or Supply Voltage Ranges
- Typical  $f_{max}$  ..... 85 MHz  
Typical Power Dissipation ..... 525 mW
- Frequency Spectrum ... 1 Hz to 60 MHz

## description

The 'S124 features two independent voltage-controlled oscillators (VCO) in a single monolithic chip. The output frequency of each VCO is established by an external capacitor in combination with two voltage-sensitive inputs, one for frequency range and one for frequency control. These inputs can be used to vary the output frequency as shown under typical characteristics. These highly stable oscillators can be set to operate at any frequency typically between 0.12 hertz and 85 megahertz.<sup>1</sup>

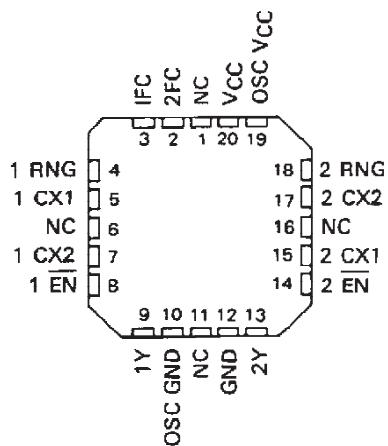
SN54S124 ... J OR W PACKAGE  
SN74S124 ... D OR N PACKAGE

(TOP VIEW)



SN54S124 ... FK PACKAGE

(TOP VIEW)



NC – No internal connection

While the enable input is low, the output is enabled.  
While the enable input is high, the output is high.

These devices can operate from a single 5-volt supply. However, one set of supply-voltage and ground pins (V<sub>CC</sub> and GND) is provided for the enable, synchronization-gating, and output sections, and a separate set (OSC V<sub>CC</sub> and OSC GND) is provided for the oscillator and associated frequency-control circuits so that effective isolation can be accomplished in the system.

The enable input of these devices starts or stops the output pulses when it is low or high, respectively. The internal oscillator of the 'S124 is started and stopped by the enable input. The enable input is one standard load; it and the buffered output operate at standard Schottky-clamped TTL levels.

The pulse synchronization-gating section ensures that the first output pulse is neither clipped nor extended. Duty cycle of the square-wave output is fixed at approximately 50 percent.

The SN54S124 is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ ; the SN74S124 is characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .



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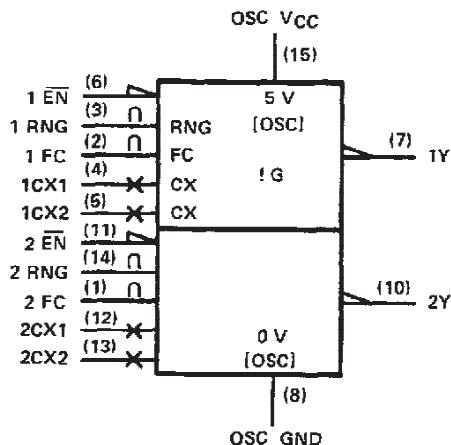


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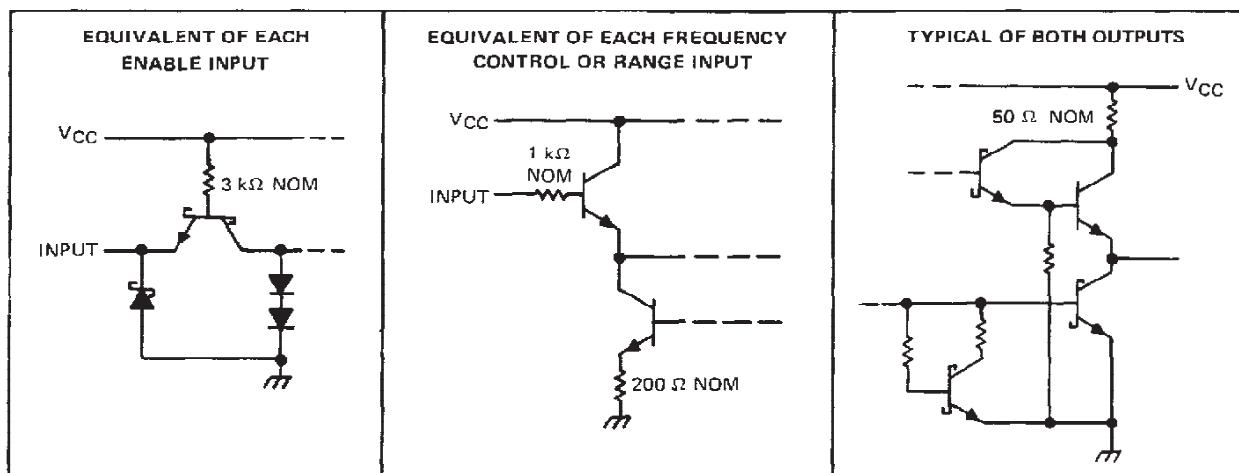
## logic symbol<sup>†</sup>



<sup>†</sup>This symbol is in accordance with ANSI/IEEE Std 91-1984  
and IEC Publication 817-12.

Pin numbers shown are for D, J, N, and W packages.

## schematics of inputs and outputs



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

Supply voltage, V <sub>CC</sub> (See Notes 1 and 2)	7 V
Input voltage	5.5 V
Operating free-air temperature range: SN54S124	-55°C to 125°C
SN74S124	0°C to 70°C
Storage temperature range	-65°C to 150°C

NOTES: 1. Voltage values are with respect to the appropriate ground terminal.

2. Throughout this data sheet, the symbol V<sub>CC</sub> is used for the voltage applied to both the V<sub>CC</sub> and GND terminals, unless otherwise noted.

# SN54S124, SN74S124 DUAL VOLTAGE-CONTROLLED OSCILLATORS

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## recommended operating conditions

	SN54S124			SN74S124			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, $V_{CC}$ (see Note 1)	4.5	5	5.5	4.75	5	5.25	V
Input voltage at frequency control or range input, $V_I$ (freq) or $V_I$ (rng)	1	5	1	5			V
High-level output current, $I_{OH}$			-1			-1	mA
Low-level output current, $I_{OL}$			20			20	mA
Output frequency (enabled), $f_o$	1		1				Hz
			60			60	MHz
Operating free-air temperature, $T_A$	-55	125	0	70			°C

## electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS <sup>†</sup>		MIN	TYP <sup>‡</sup>	MAX	UNIT
$V_{IH}$ High-level input voltage at enable			2			V
$V_{IL}$ Low-level input voltage at enable					0.8	V
$V_{IK}$ Input clamp voltage at enable	$V_{CC} = \text{MIN}$ , $I_I = -18 \text{ mA}$				-1.2	V
$V_{OH}$ High-level output voltage	$V_{CC} = \text{MIN}$ , $V_{IH} = 2 \text{ V}$ , $I_{OH} = -1 \text{ mA}$	SN54S'	2.5	3.4		V
		SN74S'	2.7	3.4		
$V_{OL}$ Low-level output voltage	$V_{CC} = \text{MIN}$ , $V_{IL} = 0.8 \text{ V}$ , $I_{OL} = 20 \text{ mA}$				0.5	V
$I_I$ Input current	Freq control or range	$V_{CC} = \text{MAX}$	$V_I = 5 \text{ V}$	10	50	$\mu\text{A}$
			$V_I = 1 \text{ V}$	1	15	
$I_I$ Input current at maximum input voltage	Enable	$V_{CC} = \text{MAX}$ , $V_I = 5.5 \text{ V}$		1	mA	
$I_{IH}$ High-level input current	Enable	$V_{CC} = \text{MAX}$ , $V_I = 2.7 \text{ V}$		50	$\mu\text{A}$	
$I_{IL}$ Low-level input current	Enable	$V_{CC} = \text{MAX}$ , $V_I = 0.5 \text{ V}$		-2	mA	
$I_{OS}$ Short-circuit output current <sup>§</sup>		$V_{CC} = \text{MAX}$	-40	-100	mA	
$I_{CC}$ Supply current, total into $V_{CC}$ and $\ominus V_{CC}$	$V_{CC} = \text{MAX}$ , See Note 3		105	150		
	$V_{CC} = \text{MAX}$ , $T_A = 125^\circ\text{C}$ , See Note 3	W package only			110	mA

<sup>†</sup>For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

<sup>‡</sup>All typical values are at  $V_{CC} = 5 \text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

<sup>§</sup>Not more than one output should be shorted at a time and duration of the short-circuit should not exceed one second.

NOTE 3:  $I_{CC}$  is measured with the outputs disabled and open.

## switching characteristics, $V_{CC} = 5 \text{ V}$ , $R_L = 280 \Omega$ , $C_L = 15 \text{ pF}$ , $T_A = 25^\circ\text{C}$ (see note 4)

PARAMETER	TEST CONDITIONS		MIN	TYP	MAX	UNIT
$f_o$ Output frequency	$C_{ext} = 2 \text{ pF}$	$V_{I(freq)} = 4 \text{ V}$ , $V_{I(rng)} = 1 \text{ V}$	60	85		MHz
		$V_{I(freq)} = 1 \text{ V}$ , $V_{I(rng)} = 5 \text{ V}$	25	40		
Output duty cycle	$C_{ext} = 8.3 \text{ pF}$ to $500 \mu\text{F}$		50%			
$t_{PHL}$ Propagation delay time, high-to-low-level output from enable	$f_o = 1 \text{ Hz}$ to $20 \text{ MHz}$		$\frac{1.4}{f_o(\text{Hz})}$			s
	$f_o > 20 \text{ MHz}$		70			ns

NOTE 4: Load circuits and voltage waveforms are shown in Section 1.

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## TYPICAL CHARACTERISTICS

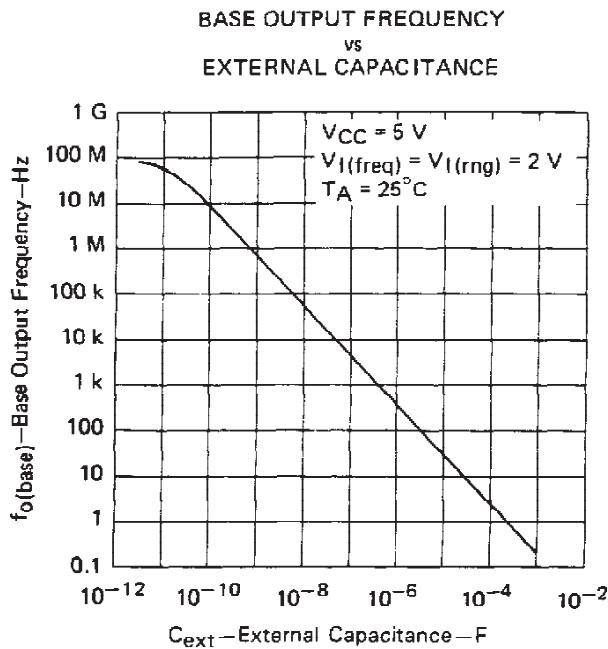


FIGURE 1

NOTE:  $f_o = f_n \times f_o(\text{base})$

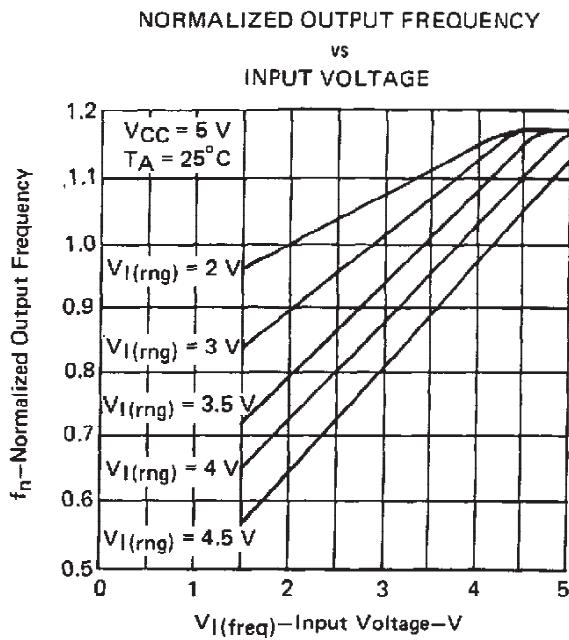


FIGURE 2

**PACKAGING INFORMATION**

Orderable part number	Status (1)	Material type (2)	Package   Pins	Package qty   Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
<a href="#">SN54S124J</a>	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SN54S124J
SN54S124J.A	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SN54S124J
<a href="#">SN74S124D</a>	Active	Production	SOIC (D)   16	40   TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	S124
SN74S124D.A	Active	Production	SOIC (D)   16	40   TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	S124
<a href="#">SN74S124N</a>	Active	Production	PDIP (N)   16	25   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74S124N
SN74S124N.A	Active	Production	PDIP (N)   16	25   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74S124N
SN74S124NE4	Active	Production	PDIP (N)   16	25   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74S124N
<a href="#">SNJ54S124J</a>	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SNJ54S124J
SNJ54S124J.A	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SNJ54S124J

<sup>(1)</sup> **Status:** For more details on status, see our [product life cycle](#).

<sup>(2)</sup> **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

<sup>(3)</sup> **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

<sup>(4)</sup> **Lead finish/Ball material:** Parts 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.

<sup>(5)</sup> **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

<sup>(6)</sup> **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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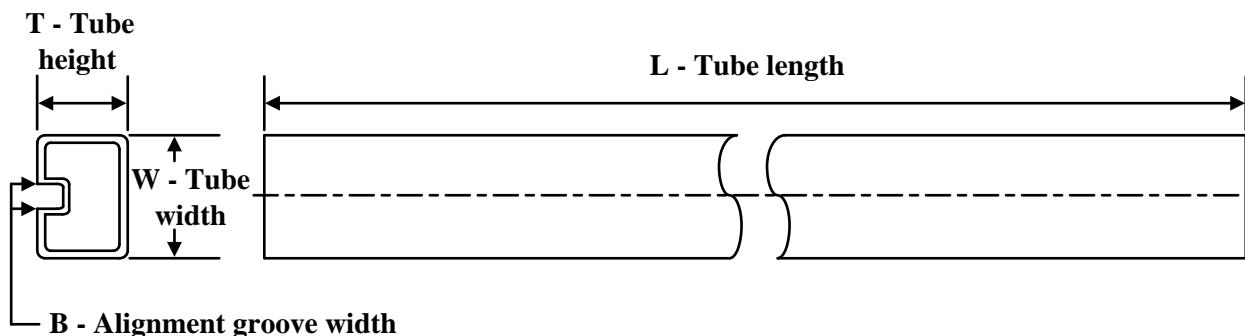
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**OTHER QUALIFIED VERSIONS OF SN54S124, SN74S124 :**

- Catalog : [SN74S124](#)
- Military : [SN54S124](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications

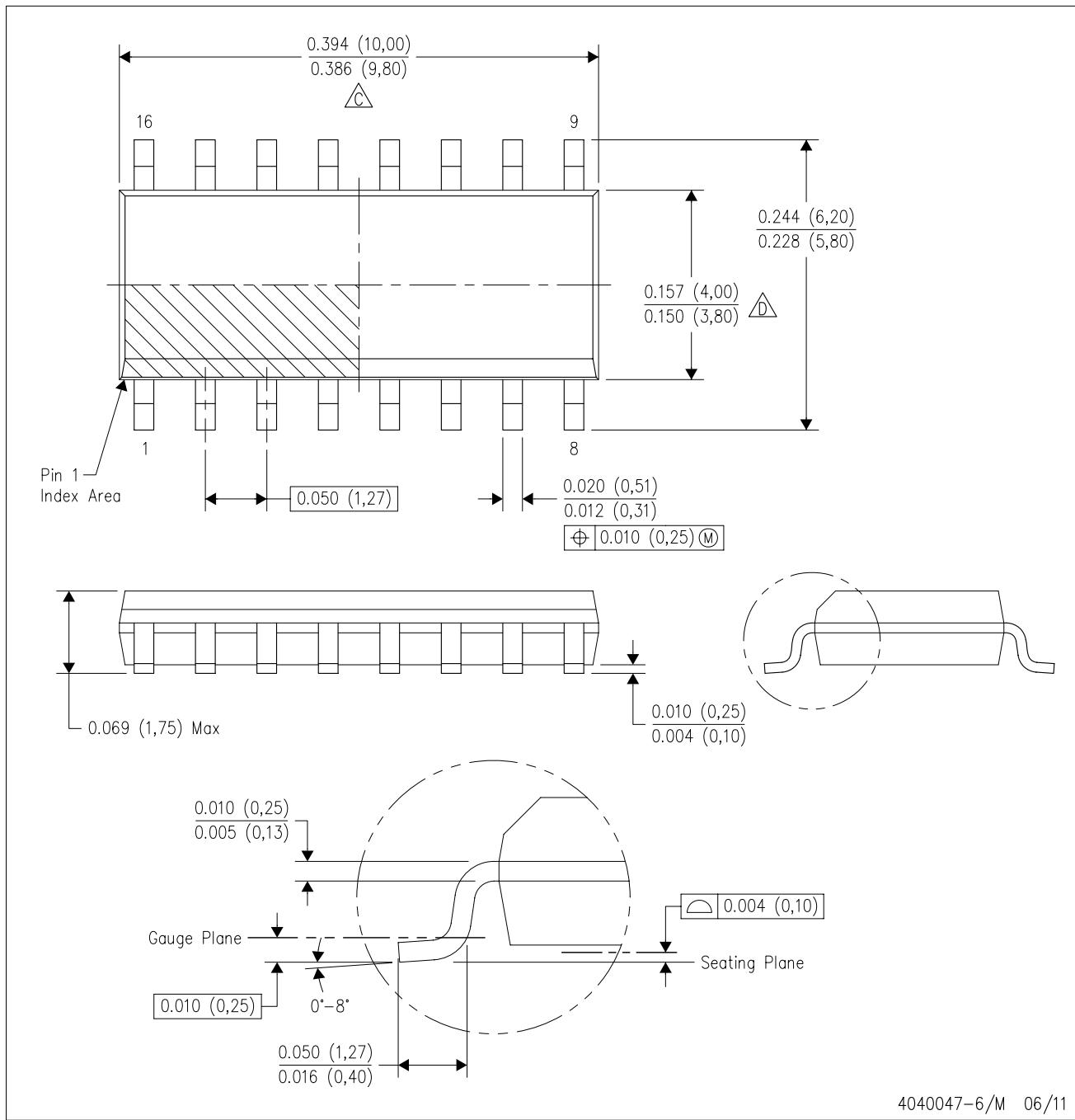
**TUBE**


\*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
SN74S124D	D	SOIC	16	40	507	8	3940	4.32
SN74S124D.A	D	SOIC	16	40	507	8	3940	4.32
SN74S124N	N	PDIP	16	25	506	13.97	11230	4.32
SN74S124N	N	PDIP	16	25	506	13.97	11230	4.32
SN74S124N.A	N	PDIP	16	25	506	13.97	11230	4.32
SN74S124N.A	N	PDIP	16	25	506	13.97	11230	4.32
SN74S124NE4	N	PDIP	16	25	506	13.97	11230	4.32
SN74S124NE4	N	PDIP	16	25	506	13.97	11230	4.32

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



NOTES: A. All linear dimensions are in inches (millimeters).

B. This drawing is subject to change without notice.

C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.

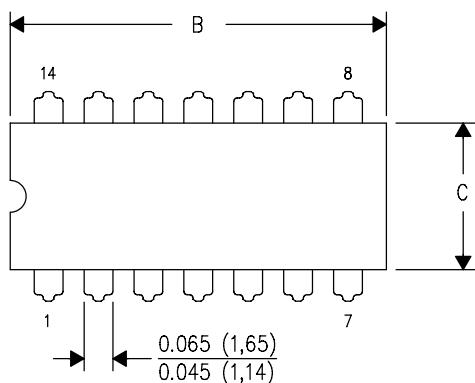
D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.

E. Reference JEDEC MS-012 variation AC.

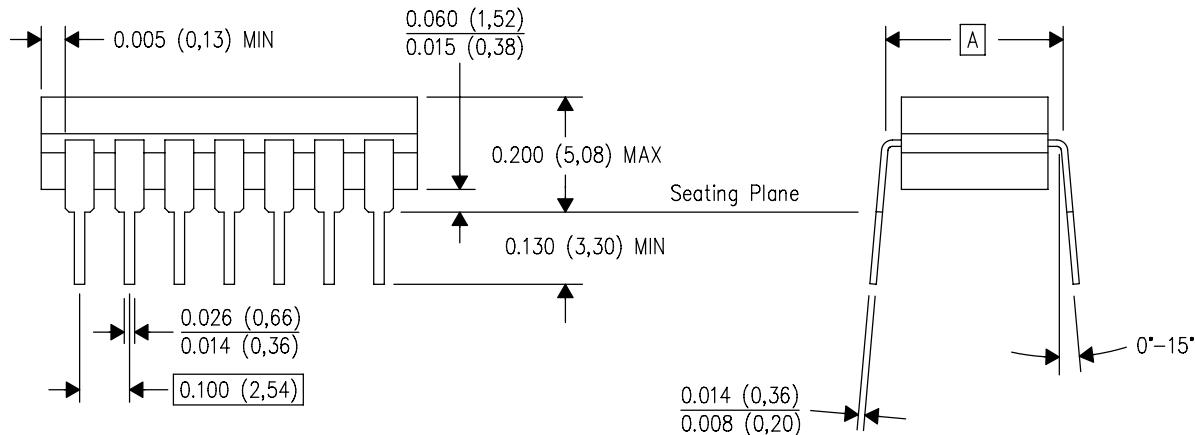
J (R-GDIP-T\*\*)

14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



PINS ** DIM	14	16	18	20
A	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC
B MAX	0.785 (19,94)	.840 (21,34)	0.960 (24,38)	1.060 (26,92)
B MIN	—	—	—	—
C MAX	0.300 (7,62)	0.300 (7,62)	0.310 (7,87)	0.300 (7,62)
C MIN	0.245 (6,22)	0.245 (6,22)	0.220 (5,59)	0.245 (6,22)



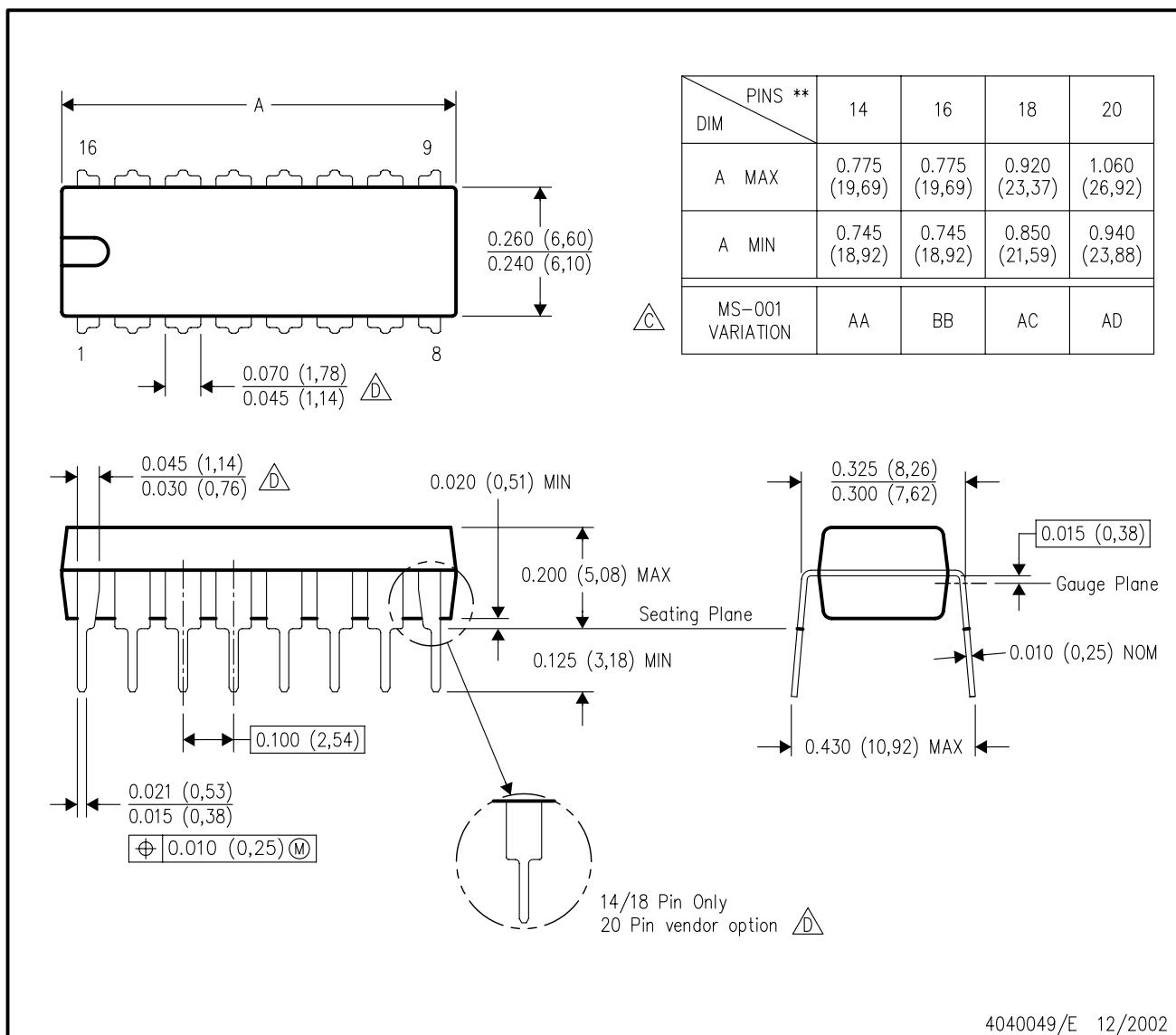
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NOTES: A. All linear dimensions are in inches (millimeters).  
B. This drawing is subject to change without notice.  
C. This package is hermetically sealed with a ceramic lid using glass frit.  
D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.  
E. Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

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

16 PINS SHOWN

## PLASTIC DUAL-IN-LINE PACKAGE



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).

△ The 20 pin end lead shoulder width is a vendor option, either half or full width.

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