

# SN54121, SN74121

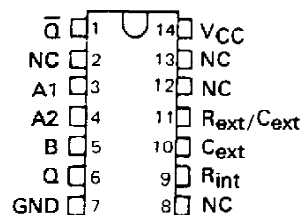
## MONOSTABLE MULTIVIBRATORS

### WITH SCHMITT-TRIGGER INPUTS

MAY 1983 — REVISED MARCH 1988

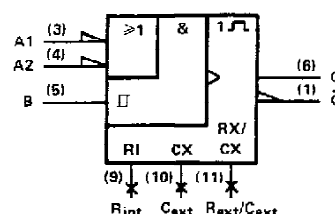
- Programmable Output Pulse Width  
With  $R_{int}$  . . . 35 ns Typ  
With  $R_{ext}/C_{ext}$  . . . 40 ns to 28 Seconds
- Internal Compensation for Virtual Temperature Independence
- Jitter-Free Operation up to 90% Duty Cycle
- Inhibit Capability

SN54121 . . . J OR W PACKAGE  
SN74121 . . . N PACKAGE  
(TOP VIEW)



NC - No internal connection.

logic symbol†



†This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

FUNCTION TABLE

INPUTS			OUTPUTS	
A1	A2	B	Q	$\bar{Q}$
L	X	H	L	H
X	L	H	L†	H†
X	X	L	L†	H†
H	H	X	L†	H†
H	↓	H	□	□
↓	H	H	□	□
↓	↓	H	□	□
L	X	↑	□	□
X	L	↑	□	□

For explanation of function table symbols, see page

† These lines of the function table assume that the indicated steady-state conditions at the A and B inputs have been setup long enough to complete any pulse started before the setup.

## description

These multivibrators feature dual negative-transition-triggered inputs and a single positive-transition-triggered input which can be used as an inhibit input. Complementary output pulses are provided.

Pulse triggering occurs at a particular voltage level and is not directly related to the transition time of the input pulse. Schmitt-trigger input circuitry (TTL hysteresis) for the B input allows jitter-free triggering from inputs with transition rates as slow as 1 volt/second, providing the circuit with an excellent noise immunity of typically 1.2 volts. A high immunity to  $V_{CC}$  noise of typically 1.5 volts is also provided by internal latching circuitry.

Once fired, the outputs are independent of further transitions of the inputs and are a function only of the timing components. Input pulses may be of any duration relative to the output pulse. Output pulse length may be varied from 40 nanoseconds to 28 seconds by choosing appropriate timing components. With no external timing components (i.e.,  $R_{int}$  connected to  $V_{CC}$ ,  $C_{ext}$  and  $R_{ext}/C_{ext}$  open), an output pulse of typically 30 or 35 nanoseconds is achieved which may be used as a d-c triggered reset signal. Output rise and fall times are TTL compatible and independent of pulse length.

Pulse width stability is achieved through internal compensation and is virtually independent of  $V_{CC}$  and temperature. In most applications, pulse stability will only be limited by the accuracy of external timing components.

Jitter-free operation is maintained over the full temperature and  $V_{CC}$  ranges for more than six decades of timing capacitance (10 pF to 10  $\mu$ F) and more than one decade of timing resistance (2 k $\Omega$  to 30 k $\Omega$  for the SN54121 and 2 k $\Omega$  to 40 k $\Omega$  for the SN74121). Throughout these ranges, pulse width is defined by the relationship  $t_{w(out)} = C_{ext}R_{Tln2} \approx 0.7 C_{ext}R_T$ . In circuits where pulse cutoff is not critical, timing capacitance up to 1000  $\mu$ F and timing resistance as low as 1.4 k $\Omega$  may be used. Also, the range of jitter-free output pulse widths is extended if  $V_{CC}$  is held to 5 volts and free-air temperature is 25°C. Duty cycles as high as 90% are achieved when using maximum recommended  $R_T$ . Higher duty cycles are available if a certain amount of pulse-width jitter is allowed.

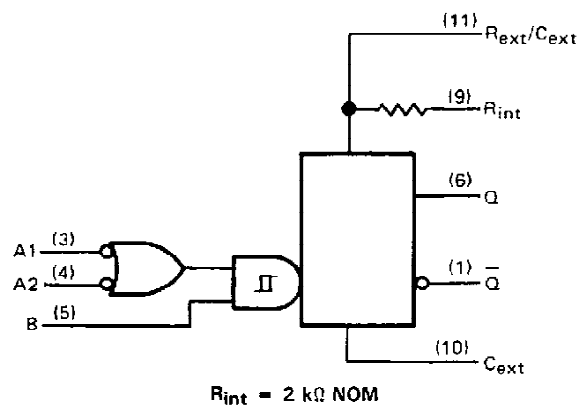
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# **SN54121, SN74121** **MONOSTABLE MULTIVIBRATORS** **WITH SCHMITT-TRIGGER INPUTS**

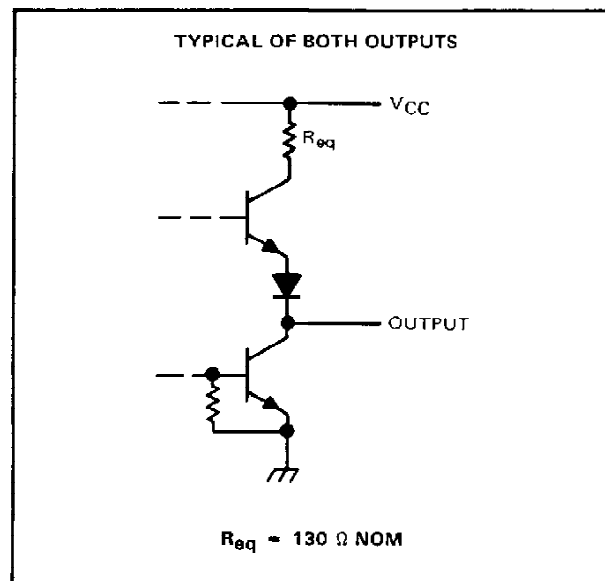
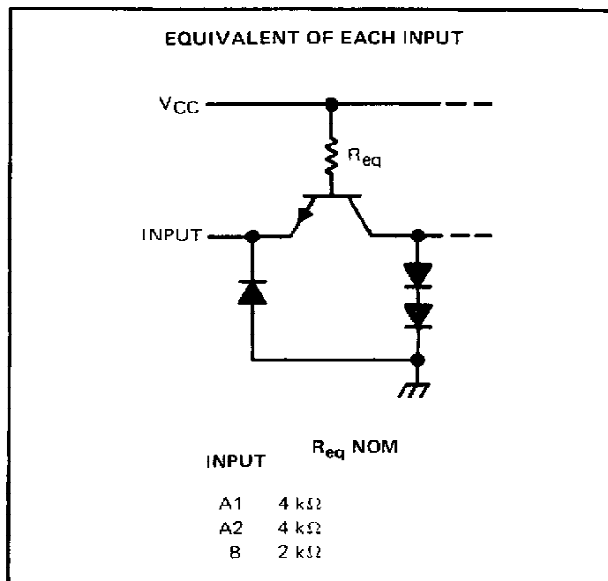
logic diagram (positive logic)



Pin numbers shown on logic notation are for J or N packages.

- NOTES: 1. An external capacitor may be connected between  $C_{ext}$  (positive) and  $R_{ext}/C_{ext}$ .  
 2. To use the internal timing resistor, connect  $R_{int}$  to  $V_{CC}$ . For improved pulse width accuracy and repeatability, connect an external resistor between  $R_{ext}/C_{ext}$  and  $V_{CC}$  with  $R_{int}$  open-circuited.

schematics of inputs and outputs



# **SN54121, SN74121** **MONOSTABLE MULTIVIBRATORS** **WITH SCHMITT-TRIGGER INPUTS**

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

Supply voltage, $V_{CC}$ (see Note 3)	7 V
Input voltage	5.5 V
Operating free-air temperature range: SN54121	– 55 °C to 125 °C
SN74121	0 °C to 70 °C
Storage temperature range	– 65 °C to 150 °C

NOTE 3: Voltage values are with respect to network ground terminal.

## **recommended operating conditions**

			MIN	NOM	MAX	UNIT
$V_{CC}$	Supply voltage	54 Family	4.5	5	5.5	V
		74 Family	4.75	5	5.25	
$I_{OH}$	High-level output current				– 0.4	mA
$I_{OL}$	Low-level output current				16	mA
$dv/dt$	Rate of rise or fall of input pulse	Schmitt input, B	1			V/s
		Logic inputs, A1, A2	1			V/ $\mu$ s
$t_{w(in)}$	Input pulse width		50			ns
$R_{ext}$	External timing capacitance	54 Family	1.4		30	k $\Omega$
		74 Family	1.4		40	
$C_{ext}$	External timing capacitance		0		1000	$\mu$ F
	Duty cycle	$R_T = 2 \text{ k}\Omega$			67	%
		$R_T = \text{MAX } R_{ext}$			90	
$T_A$	Operating free-air temperature	54 Family	– 55		125	°C
		74 Family	0		70	



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# SN54121, SN74121

## MONOSTABLE MULTIVIBRATORS

### WITH SCHMITT-TRIGGER INPUTS

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

PARAMETER	TEST CONDITIONS†	MIN	TYP‡	MAX	UNIT
$V_{IH}$ High-level input voltage at B input	$V_{CC} = \text{MIN}$	2			V
$V_{IL}$ Low-level input voltage at A input	$V_{CC} = \text{MIN}$			0.8	V
$V_{T+}$ Positive-going threshold voltage at B input	$V_{CC} = \text{MIN}$		1.55	2	V
$V_{T-}$ Negative-going threshold voltage at B input	$V_{CC} = \text{MIN}$	0.8	1.35		V
$V_{IK}$ Input clamp voltage	$V_{CC} = \text{MIN}$ , $I_I = -12 \text{ mA}$			-1.5	V
$I_{OH}$ High-level output voltage	$V_{CC} = \text{MIN}$ , $I_{OH} = \text{MAX}$	2.4	3.4		V
$V_{OL}$ Low-level output voltage	$V_{CC} = \text{MIN}$ , $I_{OL} = \text{MAX}$		0.2	0.4	V
$I_I$ Input current at maximum input voltage	$V_{CC} = \text{MAX}$ , $V_I = 5.5 \text{ V}$			1	mA
$I_{IH}$ High-level input current	$V_{CC} = \text{MAX}$ , $V_I = 2.4 \text{ V}$	A1 or A2		40	$\mu\text{A}$
		B		80	
$I_{IL}$ Low-level input current	$V_{CC} = \text{MAX}$ , $V_I = 0.4 \text{ V}$	A1 or A2		-1.6	mA
		B		-3.2	
$I_{OS}$ Short-circuit output current‡	$V_{CC} = \text{MAX}$	54 Family		-20	mA
		74 Family		-18	
$I_{CC}$ Supply current	$V_{CC} = \text{MAX}$	Quiescent		13	mA
		Triggered		23	

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

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

†Not more than one output should be shorted at a time.

switching characteristics,  $V_{CC} = 5 \text{ V}$ ,  $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS			MIN	TYP	MAX	UNIT
t <sub>PLH</sub>	Propagation delay time, low-to-high-level Q output from either A input	C <sub>L</sub> = 15 pF, R <sub>L</sub> = 400 Ω, See Note 4	C <sub>ext</sub> = 80 pF, R <sub>int</sub> to V <sub>CC</sub>		45	70	ns	
t <sub>PLH</sub>	Propagation delay time, low-to-high-level Q output from B input				35	55	ns	
t <sub>PHL</sub>	Propagation delay time, high-to-low level Q̄ output from either A input				50	80	ns	
t <sub>PHL</sub>	Propagation delay time, high-to-low level Q̄ output from B input				40	65	ns	
t <sub>w(out)</sub>	Pulse width obtained using internal timing resistor		C <sub>ext</sub> = 80 pF, R <sub>int</sub> to V <sub>CC</sub>	70	110	150	ns	
t <sub>w(out)</sub>	Pulse width obtained with zero timing capacitance		C <sub>ext</sub> = 0, R <sub>int</sub> to V <sub>CC</sub>		30	50	ns	
t <sub>w(out)</sub>	Pulse width obtained using external timing resistor		C <sub>ext</sub> = 100 pF, R <sub>T</sub> = 10 kΩ	600	700	800	ns	
			C <sub>ext</sub> = 1 μF, R <sub>T</sub> = 10 kΩ	6	7	8	ms	

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

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## TYPICAL CHARACTERISTICS†

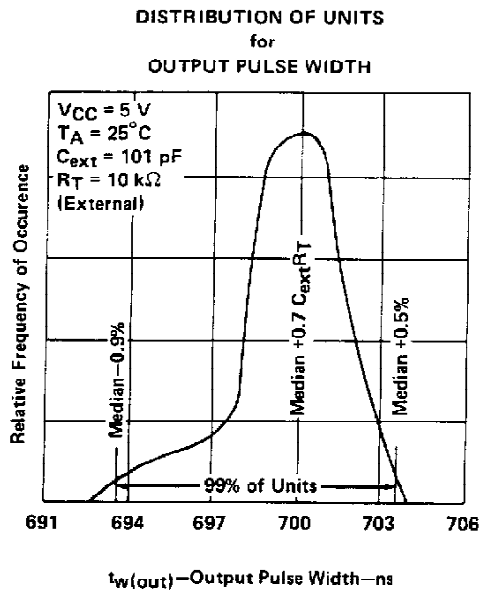


FIGURE 1

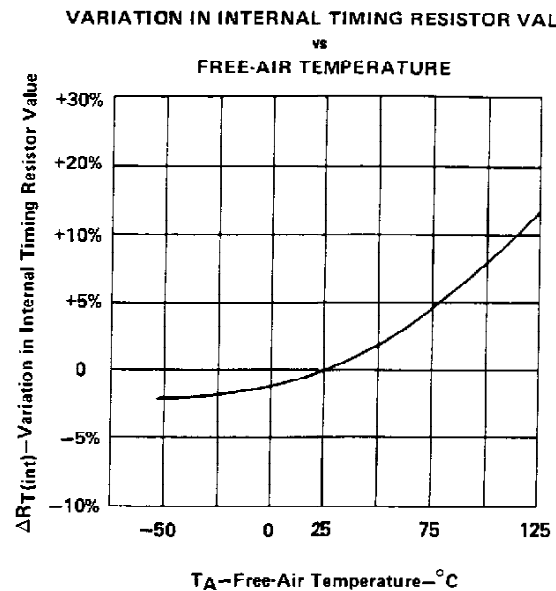


FIGURE 2

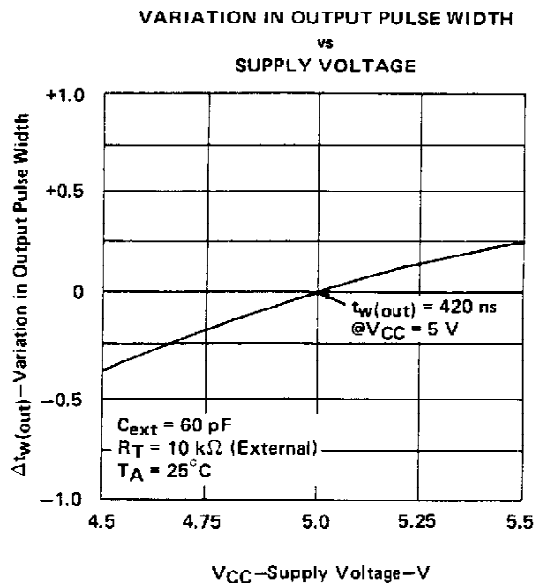


FIGURE 3

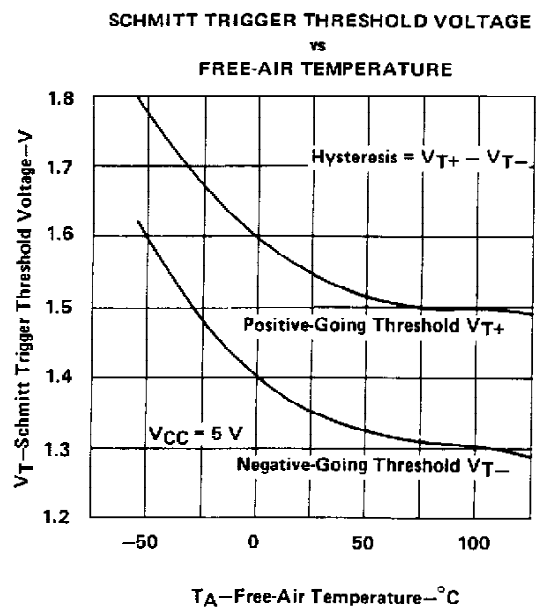


FIGURE 4

†Data for temperatures below  $0^\circ\text{C}$  and above  $70^\circ\text{C}$  are applicable for SN54121.

# SN54121, SN74121 MONOSTABLE MULTIVIBRATORS WITH SCHMITT-TRIGGER INPUTS

## TYPICAL CHARACTERISTICS† (continued)

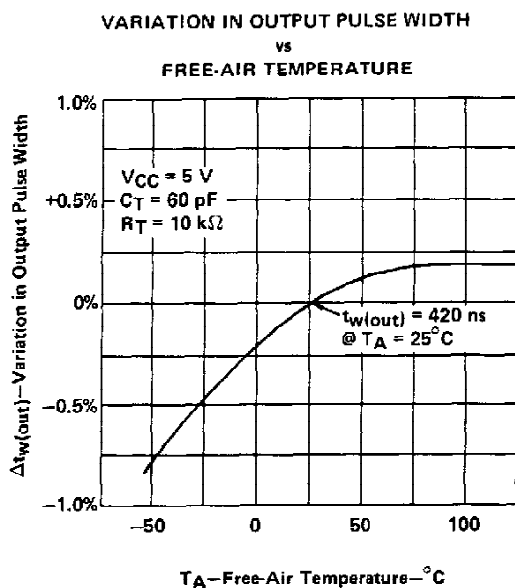


FIGURE 5

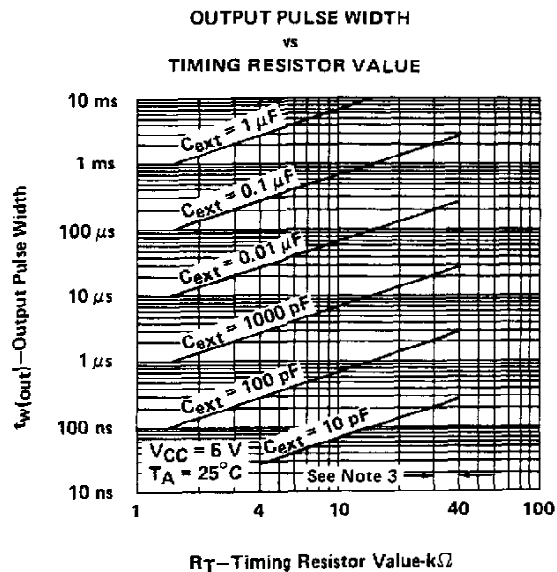


FIGURE 6

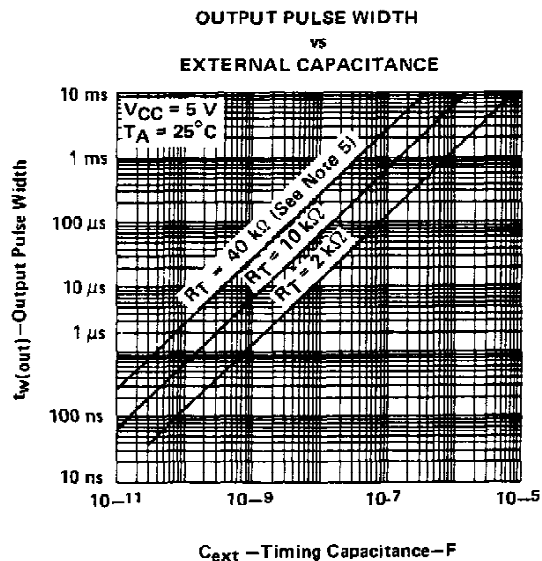


FIGURE 7

NOTE 5: These values of resistance exceed the maximum recommended use over the full temperature range of the SN54121.  
†Data for temperatures below  $0^\circ\text{C}$  and above  $70^\circ\text{C}$  are applicable for SN54121.

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**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
5962-9755301QCA	ACTIVE	CDIP	J	14	1	TBD	Call TI	Level-NC-NC-NC
5962-9755301QDA	ACTIVE	CFP	W	14	1	TBD	Call TI	Level-NC-NC-NC
SN54121J	ACTIVE	CDIP	J	14	1	TBD	Call TI	Level-NC-NC-NC
SN74121D	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74121DE4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74121DR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74121DRE4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74121N	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
SN74121N3	OBSOLETE	PDIP	N	14		TBD	Call TI	Call TI
SN74121NE4	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
SN74121NSR	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74121NSRE4	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SNJ54121J	ACTIVE	CDIP	J	14	1	TBD	Call TI	Level-NC-NC-NC
SNJ54121W	ACTIVE	CFP	W	14	1	TBD	Call TI	Level-NC-NC-NC
SNJ54121WA	ACTIVE	CFP	WA	14	1	TBD	Call TI	Level-NC-NC-NC

<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> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS) or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

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**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

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

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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)

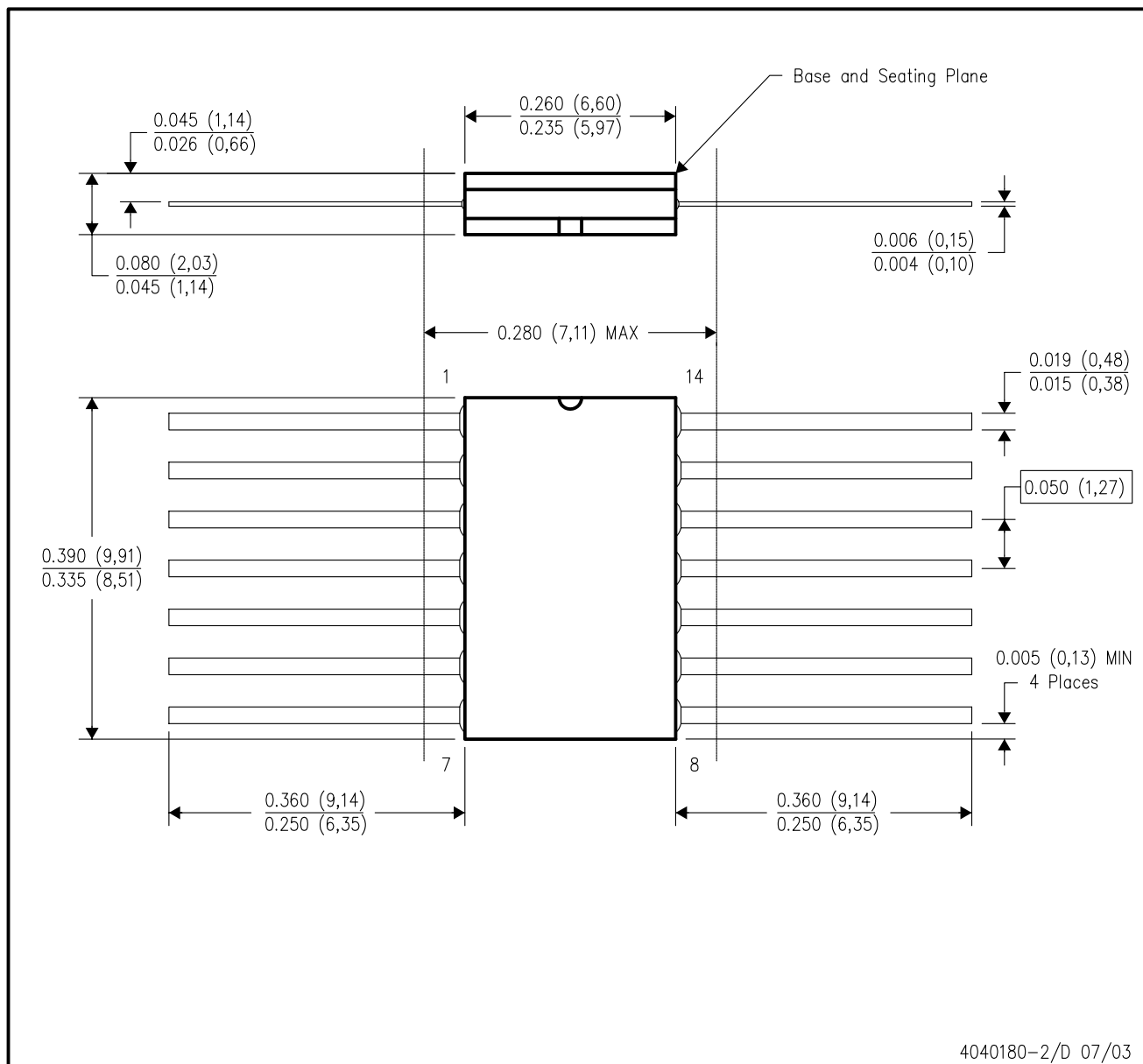


4040083/F 03/03

- 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.

W (R-GDFP-F14)

CERAMIC DUAL FLATPACK

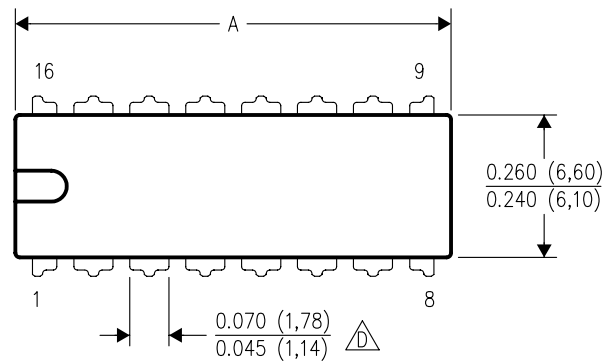


- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - This package can be hermetically sealed with a ceramic lid using glass frit.
  - Index point is provided on cap for terminal identification only.
  - Falls within MIL STD 1835 GDFP1-F14 and JEDEC MO-092AB

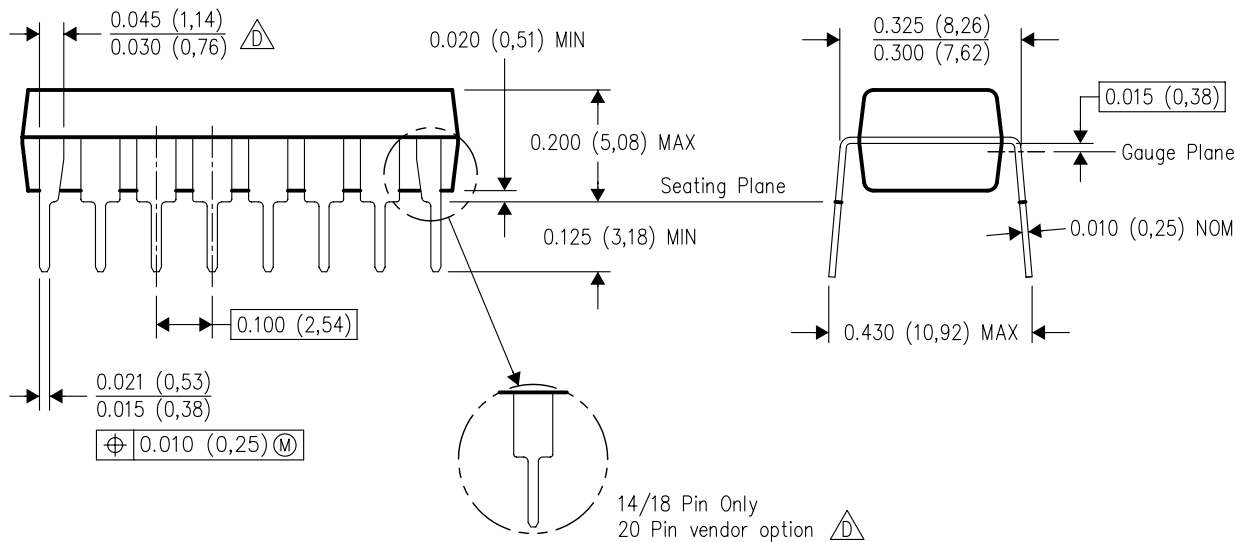
N (R-PDIP-T\*\*)

16 PINS SHOWN

# PLASTIC DUAL-IN-LINE PACKAGE



DIM \ PINS **	14	16	18	20
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	1.060 (26,92)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)
MS-001 VARIATION	AA	BB	AC	AD



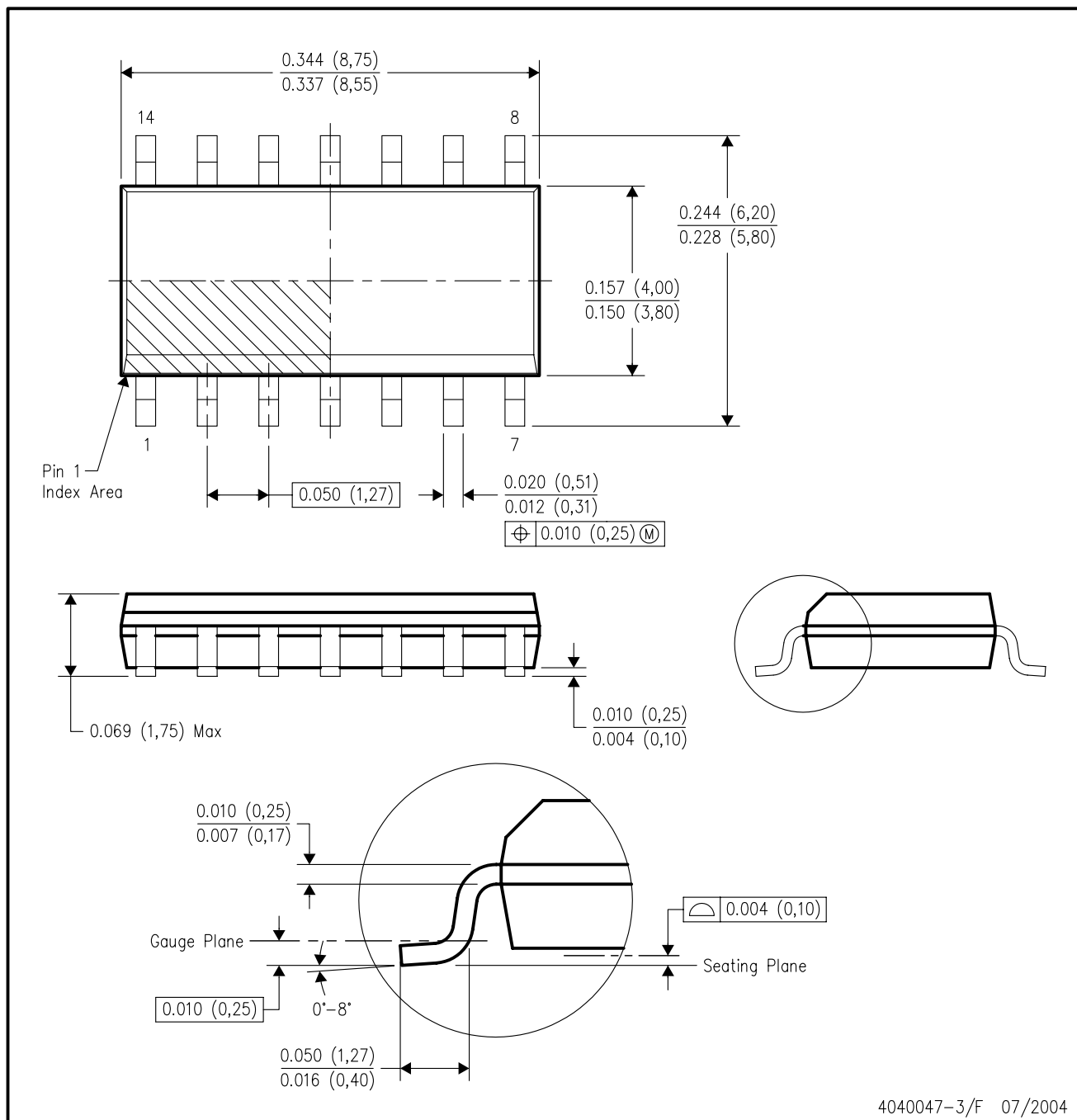
4040049/E 12/2002

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.

## D (R-PDSO-G14)

## PLASTIC SMALL-OUTLINE PACKAGE



4040047-3/F 07/2004

## NOTES:

- All linear dimensions are in inches (millimeters).
- This drawing is subject to change without notice.
- Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
- Falls within JEDEC MS-012 variation AB.

# MECHANICAL DATA

NS (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



DIM \ PINS **	14	16	20	24
A MAX	10,50	10,50	12,90	15,30
A MIN	9,90	9,90	12,30	14,70

4040062/C 03/03

- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

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Data Converters	<a href="http://dataconverter.ti.com">dataconverter.ti.com</a>	Automotive	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>	Broadband	<a href="http://www.ti.com/broadband">www.ti.com/broadband</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>	Digital Control	<a href="http://www.ti.com/digitalcontrol">www.ti.com/digitalcontrol</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>	Military	<a href="http://www.ti.com/military">www.ti.com/military</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>	Optical Networking	<a href="http://www.ti.com/opticalnetwork">www.ti.com/opticalnetwork</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>	Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
		Telephony	<a href="http://www.ti.com/telephony">www.ti.com/telephony</a>
		Video & Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>
		Wireless	<a href="http://www.ti.com/wireless">www.ti.com/wireless</a>

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