

# CD40105B Types

## CMOS FIFO Register

4 Bits X 16 Words

High-Voltage Types (20-Volt Rating)

■ CD40105B is a low-power first-in-first-out (FIFO) "elastic" storage register that can store 16 4-bit words. It is capable of handling input and output data at different shifting rates. This feature makes it particularly useful as a buffer between asynchronous systems.

Each word position in the register is clocked by a control flip-flop, which stores a marker bit. A "1" signifies that the position's data is filled and a "0" denotes a vacancy in that position. The control flip-flop detects the state of the preceding flip-flop and communicates its own status to the succeeding flip-flop. When a control flip-flop is in the "0" state and sees a "1" in the preceding flip-flop, it generates a clock pulse that transfers data from the preceding four data latches into its own four data latches and resets the preceding flip-flop to "0". The first and last control flip-flops have buffered outputs. Since all empty locations "bubble" automatically to the input end, and all valid data ripple through to the output end, the status of the first control flip-flop (DATA-IN READY) indicates if the FIFO is full, and the status of the last flip-flop (DATA-OUT READY) indicates if the FIFO contains data. As the earliest data are removed from the bottom of the data stack (the output end), all data entered later will automatically propagate (ripple) toward the output.

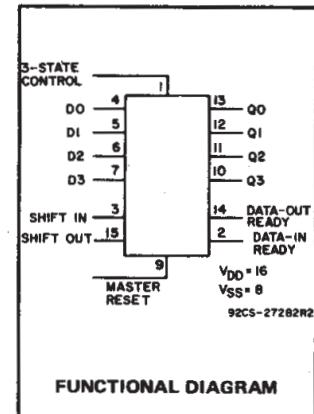
**Loading Data** — Data can be entered whenever the DATA-IN READY (DIR) flag is high, by a low to high transition on the SHIFT-IN (SI) input. This input must go low momentarily before the next word is accepted by the FIFO. The DIR flag will go low momentarily, until the data have been trans-

### Features:

- Independent asynchronous inputs and outputs
- 3-state outputs
- Status indicators on input and output
- Standardized, symmetrical output characteristics
- 100% tested for quiescent current at 20 V
- 5-V, 10-V, and 15-V parametric ratings
- Maximum input current of 1  $\mu$ A at 18 V over full package-temperature range; 100 nA at 18 V and 25°C
- Noise margin (over full package-temperature range): 1 V at  $V_{DD} = 5$  V  
2 V at  $V_{DD} = 10$  V  
2.5 V at  $V_{DD} = 15$  V
- Meets all requirements of JEDEC Tentative Standard No. 13B, "Standard Specifications for Description of 'B' Series CMOS Devices"

ferred to the second location. The flag will remain low when all 16-word locations are filled with valid data, and further pulses on the SI input will be ignored until DIR goes high.

**Unloading Data** — As soon as the first word has rippled to the output, DATA-OUT READY (DOR) goes high, and data can be removed by a falling edge on the SO input. This falling edge causes the DOR signal to go low while the word on the output is dumped and the next word moves to the output. As long as valid data are available in the FIFO, the DOR signal will go high again signifying that the next word is ready at the output. When the FIFO is empty, DOR will remain low, and any further commands will be ignored until a "1" marker ripples down to the last control register,



FUNCTIONAL DIAGRAM

### Applications:

- Bit rate smoothing
- CPU/terminal buffering
- Data communications
- Peripheral buffering
- Line printer input buffers
- Auto dialers
- CRT buffer memories
- Radar data acquisition

when DOR goes high. Unloading of data is inhibited while the 3-state control input is high. The 3-state control signal should not be shifted from high to low (data outputs turned on) while the SHIFT-OUT is at logic 0. This level change would cause the first word to be shifted out (unloaded) immediately and the data to be lost.

**Cascading** — The CD40105B can be cascaded to form longer registers simply by connecting the DIR to SO and DOR to SI. In the cascaded mode, a MASTER RESET pulse must be applied after the supply voltage is turned on. For words wider than 4 bits, the DIR and the DOR outputs must be gated together with AND gates. Their outputs drive the SI and SO inputs in parallel, if expanding is done in both directions (see Figs. 3 and 15).

**3-State Outputs** — In order to facilitate data busing, 3-state outputs are provided on the data output lines, while the load condition of the register can be detected by the state of the DOR output.

**Master Reset** — A high on the MASTER RESET (MR) sets all the control logic marker bits to "0". DOR goes low and DIR goes high. The contents of the data register are not changed, only declared invalid, and will be superseded when the first word is loaded. The shift-in must be low during Master Reset. The CD40105B types are supplied in 16-lead hermetic dual-in-line ceramic packages (D and F suffixes), 16-lead dual-in-line plastic packages (E suffix), and in chip form (H suffix).

### MAXIMUM RATINGS, Absolute-Maximum Values:

#### DC SUPPLY-VOLTAGE RANGE, ( $V_{DD}$ )

Voltages referenced to  $V_{SS}$  Terminal) ..... -0.5V to +20V

#### INPUT VOLTAGE RANGE, ALL INPUTS

..... -0.5V to  $V_{DD}$  +0.5V

#### DC INPUT CURRENT, ANY ONE INPUT

.....  $\pm 10$ mA

#### POWER DISSIPATION PER PACKAGE ( $P_D$ ):

For  $T_A = -55^\circ\text{C}$  to  $+100^\circ\text{C}$  ..... 500mW

For  $T_A = +100^\circ\text{C}$  to  $+125^\circ\text{C}$  ..... Derate Linearity at 12mW/ $^\circ\text{C}$  to 200mW

#### DEVICE DISSIPATION PER OUTPUT TRANSISTOR

FOR  $T_A = \text{FULL PACKAGE-TEMPERATURE RANGE (All Package Types)}$  ..... 100mW

OPERATING-TEMPERATURE RANGE ( $T_A$ ) ..... -55°C to +125°C

STORAGE TEMPERATURE RANGE ( $T_{stg}$ ) ..... -65°C to +150°C

#### LEAD TEMPERATURE (DURING SOLDERING):

At distance  $1/16 \pm 1/32$  inch (1.59  $\pm$  0.79mm) from case for 10s max ..... +265°C

## CD40105B Types

### RECOMMENDED OPERATING CONDITIONS at 25°C, Except as Noted

For maximum reliability, nominal operating conditions should be selected so that operation is always within the following ranges:

CHARACTERISTIC	V <sub>DD</sub> (V)	LIMITS		UNITS
		Min.	Max.	
Supply-Voltage Range (For T <sub>A</sub> = Full Package - Temperature Range)	3	18	—	V
Shift-In or Shift-Out Rate	5	—	1.5	MHz
	10	—	3	
	15	—	4	
Shift-In Pulse Width (Pin 3)	5	200	—	ns
	10	80	—	
	15	60	—	
Shift-Out Pulse Width (Pin 15)	5	180	—	ns
	10	75	—	
	15	55	—	
Shift-In or Shift-Out Rise Time	5	—	15	μs
	10	—	15	
	15	—	15	
Shift-In Fall Time	5	—	15	μs
	10	—	15	
	15	—	15	
Shift-Out Fall Time	5	—	15	μs
	10	—	5	
	15	—	5	
Data Hold Time	5	350	—	ns
	10	150	—	
	15	120	—	
Master Reset Pulse Width	5	220	—	ns
	10	90	—	
	15	60	—	

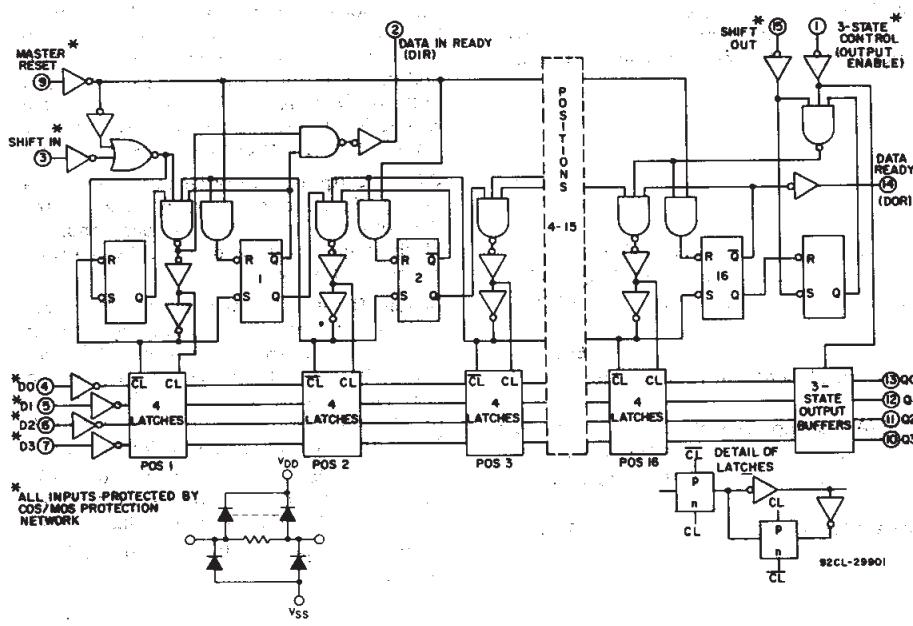


Fig. 1 – Logic diagram for the CD40105B.

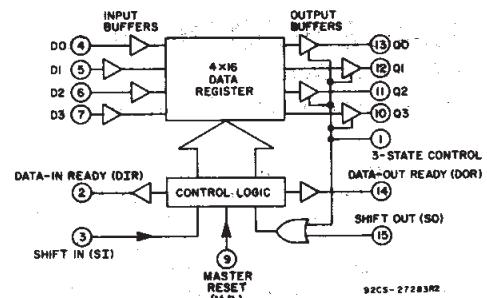
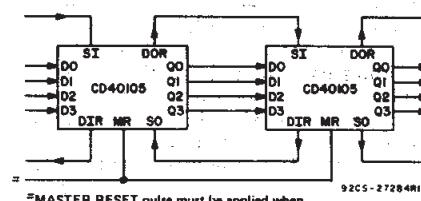


Fig. 2 – CD40105B functional block diagram.



MASTER RESET pulse must be applied when cascading by 16 N-bits.

Fig. 3 – Expansion, 4-bits wide-by-16 N-bits long.

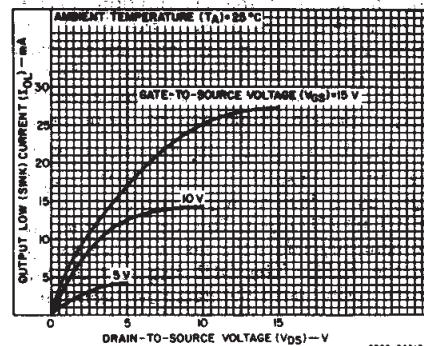


Fig. 4 – Typical output low (sink) current characteristics.

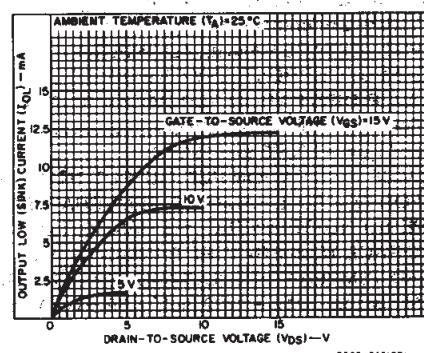


Fig. 5 – Minimum output low (sink) current characteristics.

## CD40105B Types

### STATIC ELECTRICAL CHARACTERISTICS

CHARAC- TERISTIC	CONDITIONS			LIMITS AT INDICATED TEMPERATURES (°C)						U N I T S		
	$V_O$ (V)	$V_{IN}$ (V)	$V_{DD}$ (V)	-55		-40		+85				
				Min.	Typ.	Max.	Min.	Typ.	Max.			
Quiescent Device Current, $I_{DD}$ Max.	—	0.5	5	5	5	150	150	—	0.04	5	μA	
	—	0.10	10	10	10	300	300	—	0.04	10		
	—	0.15	15	20	20	600	600	—	0.04	20		
	—	0.20	20	100	100	3000	3000	—	0.08	100		
Output Low (Sink) Current $I_{OL}$ Min.	0.4	0.5	5	0.64	0.61	0.42	0.36	0.51	1	—	mA	
	0.5	0.10	10	1.6	1.5	1.1	0.9	1.3	2.6	—		
	1.5	0.15	15	4.2	4	2.8	2.4	3.4	6.8	—		
Output High (Source) Current, $I_{OH}$ Min.	4.6	0.5	5	-0.64	-0.61	-0.42	-0.36	-0.51	-1	—	mA	
	2.5	0.5	5	-2	-1.8	-1.3	-1.15	-1.6	-3.2	—		
	9.5	0.10	10	-1.6	-1.5	-1.1	-0.9	-1.3	-2.6	—		
	13.5	0.15	15	-4.2	-4	-2.8	-2.4	-3.4	-6.8	—		
Output Voltage: Low-Level, $V_{OL}$ Max.	—	0.5	5	0.05			—	0	0.05	V		
	—	0.10	10	0.05			—	0	0.05			
	—	0.15	15	0.05			—	0	0.05			
Output Voltage: High-Level, $V_{OH}$ Min.	—	0.5	5	4.95			4.95	5	—	V		
	—	0.10	10	9.95			9.95	10	—			
	—	0.15	15	14.95			14.95	15	—			
Input Low Voltage $V_{IL}$ Max.	0.5,4.5	—	5	1.5			—	—	1.5	V		
	1.9	—	10	3			—	—	3			
	1.5,13.5	—	15	4			—	—	4			
Input High Voltage, $V_{IH}$ Min.	0.5,4.5	—	5	3.5			3.5	—	—	V		
	1.9	—	10	7			7	—	—			
	1.5,13.5	—	15	11			11	—	—			
Input Current $I_{IN}$ Max.	—	0.18	18	$\pm 0.1$	$\pm 0.1$	$\pm 1$	$\pm 1$	—	$\pm 10^{-5}$	$\pm 0.1$	μA	
3-State Output Leakage Current $I_{OUT}$ Max.	0.18	0.18	18	$\pm 0.4$	$\pm 0.4$	$\pm 12$	$\pm 12$	—	$\pm 10^{-4}$	$\pm 0.4$	μA	

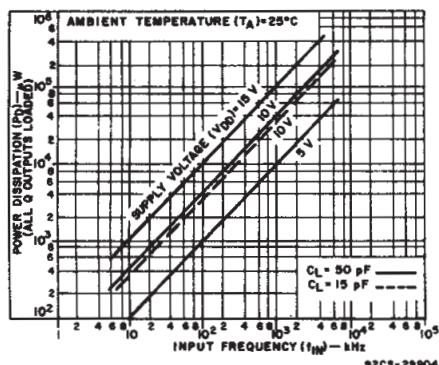


Fig. 9 – Typical dynamic power dissipation as a function of frequency.

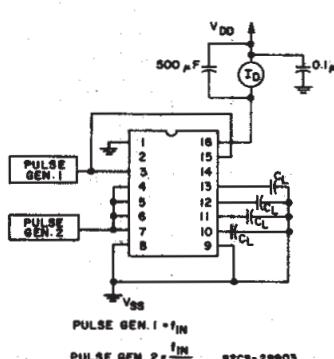


Fig. 10 – Dynamic power dissipation test circuit.

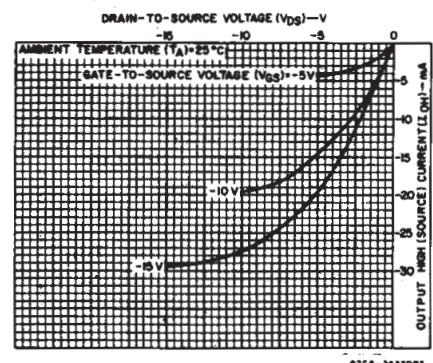


Fig. 6 – Typical output high (source) current characteristics.

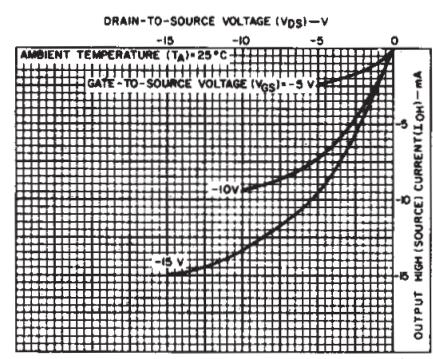


Fig. 7 – Minimum output high (source) current characteristics.

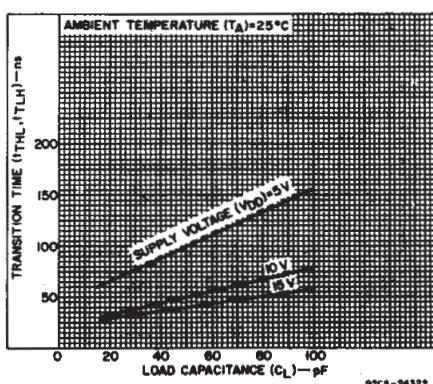


Fig. 8 – Typical transition time as a function of load capacitance.

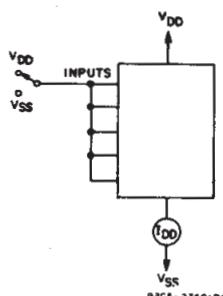


Fig. 11 – Quiescent-device-current test circuit.

## CD40105B Types

DYNAMIC ELECTRICAL CHARACTERISTICS at  $T_A = 25^\circ\text{C}$ ;  
 Input  $t_r, t_f = 20 \text{ ns}$ ,  $C_L = 50 \text{ pF}$ ,  $R_L = 200 \text{ k}\Omega$

CHARACTERISTIC	TEST CONDITIONS	LIMITS			UNITS	
		$V_{DD}$ (V)	Min.	Typ.		
Propagation Delay Time: Shift-Out or Reset to Data-Out Ready, $t_{PHL}$		5 10 15	— — —	185 90 65	370 180 130	ns
Shift-In to Data-In Ready, $t_{PHL}$		5 10 15	— — —	160 65 45	320 130 90	ns
Shift-Out to $Q_n$ Out, $t_{PHL}, t_{PLH}$		5 10 15	— — —	210 100 70	420 205 150	ns
3-State Control to Data Out Note 1 $t_{PZH}, t_{PZL}$		5 10 15	— — —	140 60 40	280 120 80	ns
	$t_{PHZ}, t_{PLZ}$	5 10 15	— — —	100 50 40	200 100 80	ns
Ripple-Through Delay Input to Output, $t_{PLH}$		5 10 15	— — —	2 1 0.7	4 2 1.4	$\mu\text{s}$
Transition Time, $t_{THL}, t_{TLH}$		5 10 15	— — —	100 50 40	200 100 80	ns
Maximum Shift-In or Shift-Out Rate, $f_I$		5 10 15	1.5 3 4	3 6 8	— — —	MHz
Minimum Shift-In Pulse Width, (Pin 3) $t_W$		5 10 15	— — —	100 40 30	200 80 60	ns
Minimum Shift-Out Pulse Width, (Pin 15) $t_{WL}$		5 10 15	— — —	90 35 25	180 75 55	ns
Maximum Shift-In or Shift-Out Rise Time, $t_r$		5 10 15	— — —	— — —	15 15 15	$\mu\text{s}$
Maximum Shift-In Fall Time, $t_f$		5 10 15	— — —	— — —	15 15 15	$\mu\text{s}$
Maximum Shift-Out Fall Time, $t_f$		5 10 15	— — —	— — —	15 5 5	$\mu\text{s}$
Minimum Data Setup Time, $t_{SU}$		5 10 15	— — —	— — —	0 0 0	ns
Minimum Data Hold Time, $t_H$		5 10 15	— — —	175 75 60	350 150 120	ns
Data-In Ready Pulse Width, $t_{WL}$ (Pin 2)		5 10 15	— — —	260 100 70	520 200 140	ns
Data-Out Ready Pulse Width, $t_{WL}$ (Pin 14)		5 10 15	— — —	220 90 65	440 180 130	ns
Minimum Master Reset Pulse Width, $t_{WH}$		5 10 15	— — —	100 45 30	200 90 60	ns
Input Capacitance $C_{IN}$	(Any Input)	—	—	5	7.5	pF

Note 1: The Output Enable Line (Pin 1) should be low for limits specified.

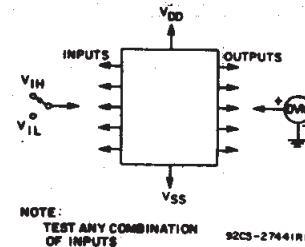


Fig. 12 – Input-voltage test circuit.

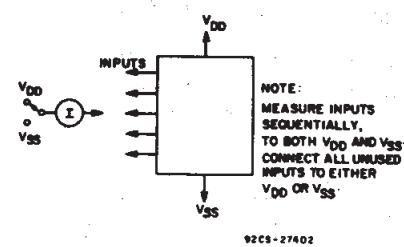
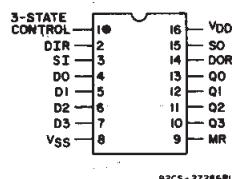


Fig. 13 – Input current test circuit.



### TERMINAL ASSIGNMENT

## CD40105B Types

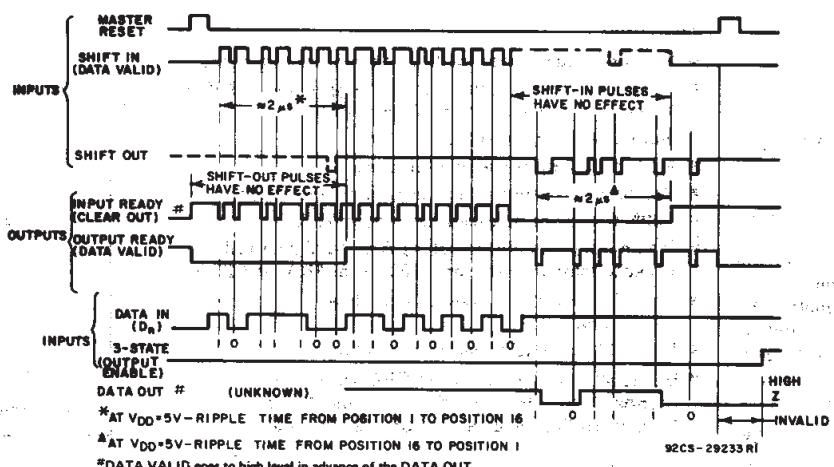
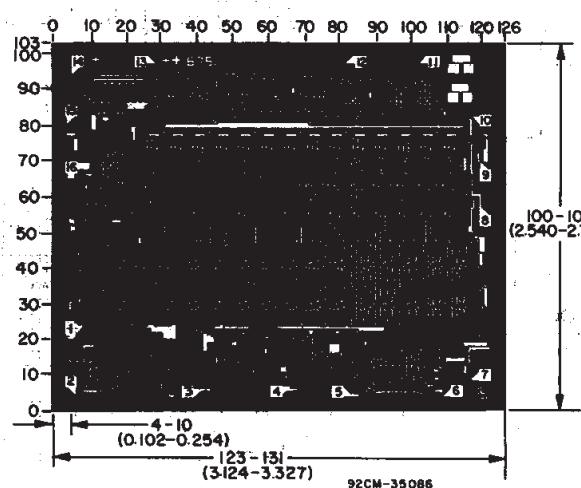
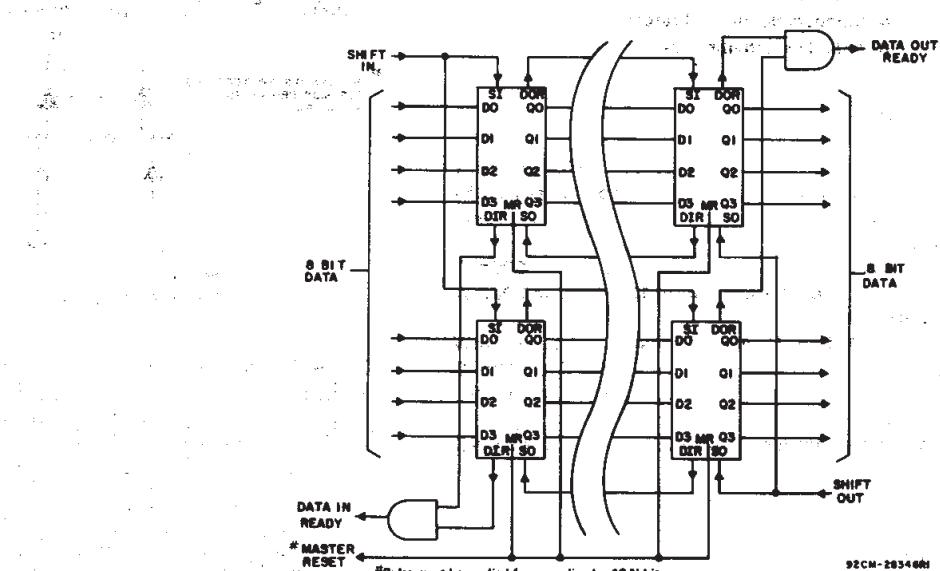


Fig. 14 - Timing diagram for the CD40105B.



Dimensions in parentheses are in millimeters and are derived from the basic inch dimensions as indicated. Grid graduations are in mils ( $10^{-3}$  inch).

Dimension and pad layout for CD40105B.

**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)
<b>CD40105BE</b>	Active	Production	PDIP (N)   16	25   TUBE	Yes	NIPDAU	N/A for Pkg Type	-55 to 125	CD40105BE
CD40105BE.A	Active	Production	PDIP (N)   16	25   TUBE	Yes	NIPDAU	N/A for Pkg Type	-55 to 125	CD40105BE
<b>CD40105BF</b>	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	CD40105BF
CD40105BF.A	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	CD40105BF
<b>CD40105BF3A</b>	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	CD40105BF3A
CD40105BF3A.A	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	CD40105BF3A

<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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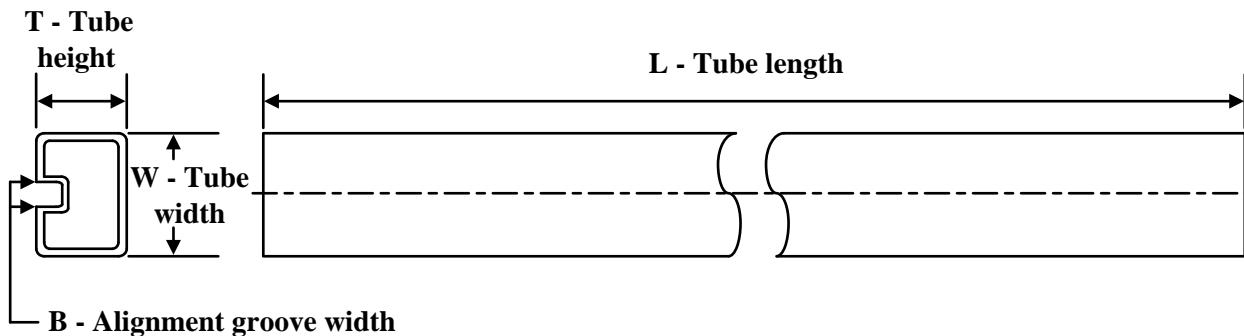
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**OTHER QUALIFIED VERSIONS OF CD40105B, CD40105B-MIL :**

- Catalog : [CD40105B](#)
- Military : [CD40105B-MIL](#)

**NOTE: Qualified Version Definitions:**

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

**TUBE**


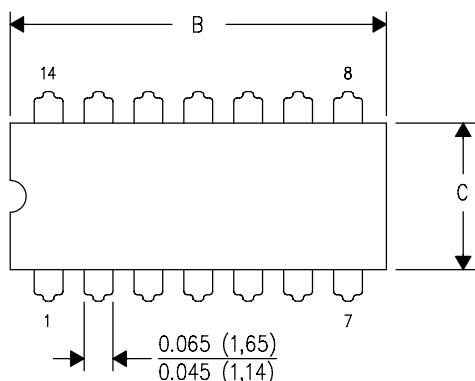
\*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T ( $\mu$ m)	B (mm)
CD40105BE	N	PDIP	16	25	506	13.97	11230	4.32
CD40105BE	N	PDIP	16	25	506	13.97	11230	4.32
CD40105BE.A	N	PDIP	16	25	506	13.97	11230	4.32
CD40105BE.A	N	PDIP	16	25	506	13.97	11230	4.32

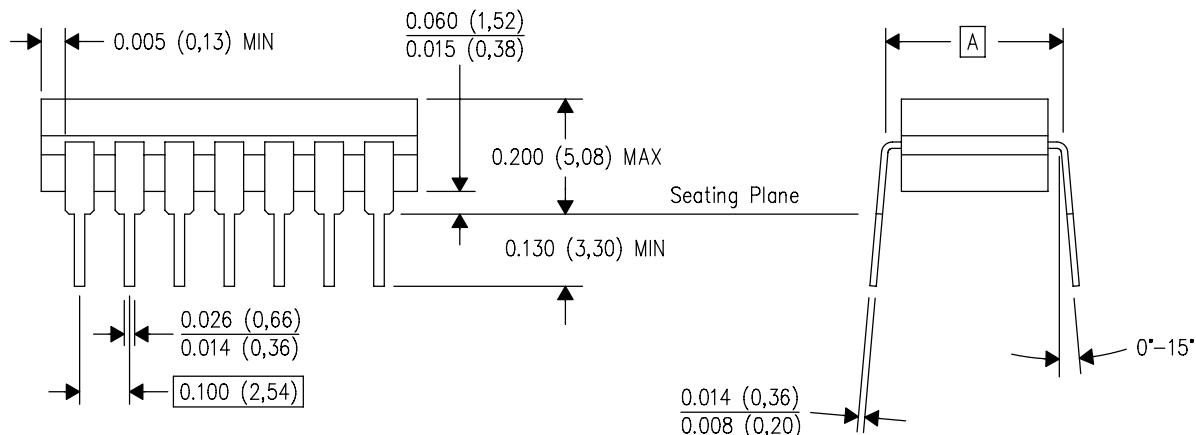
J (R-GDIP-T\*\*)

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)



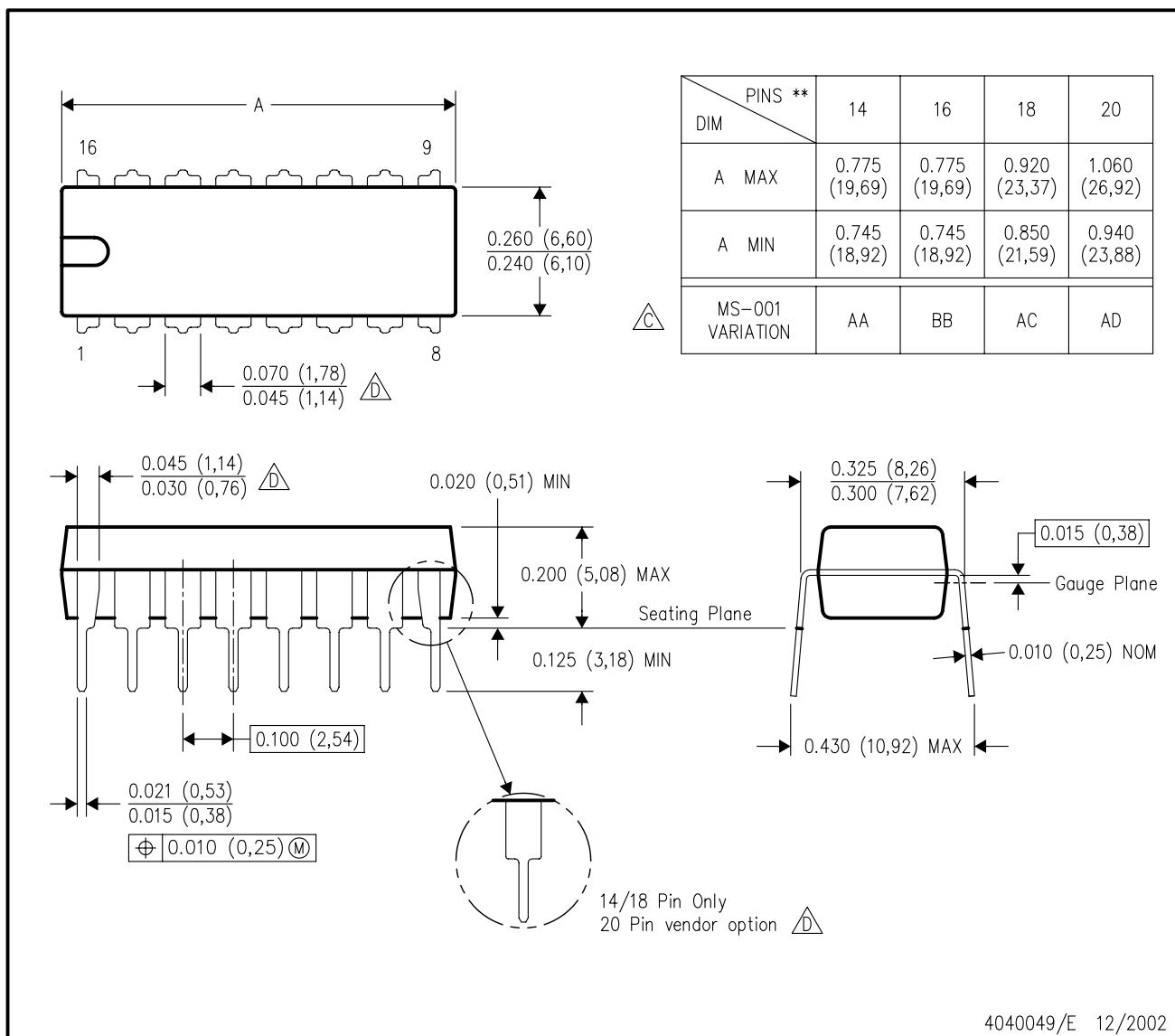
4040083/F 03/03

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.

## 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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