

SN54170, SN54LS170, SN74170, SN74LS170 4-BY-4 REGISTER FILES WITH OPEN-COLLECTOR OUTPUTS

SDLS065 – MARCH 1974 – REVISED MARCH 1988

- Separate Read/Write Addressing Permits Simultaneous Reading and Writing
- Fast Access Times . . . Typically 20 ns
- Organized as 4 Words of 4 Bits
- Expandable to 1024 Words of n-Bits
- For Use as:
Scratch-Pad Memory
Buffer Storage between Processors
Bit Storage in Fast Multiplication Designs
- Open-Collector Outputs with Low Maximum Off-State Current:
'170 . . . 30 μ A
'LS170 . . . 20 μ A
- SN54LS670 and SN74LS670 Are Similar But Have 3-State Outputs

description

The '170 and 'LS170 MSI 16-bit TTL register files incorporate the equivalent of 98 gates. The register file is organized as 4 words of 4 bits each and separate on-chip decoding is provided for addressing the four word locations to either write-in or retrieve data. This permits simultaneous writing into one location and reading from another word location.

Four data inputs are available which are used to supply the 4-bit word to be stored. Location of the word is determined by the write-address inputs A and B in conjunction with a write-enable signal. Data applied at the inputs should be in its true form. That is, if a high-level signal is desired from the output, a high level is applied at the data input for that particular bit location. The latch inputs are arranged so that new data will be accepted only if both internal address gate inputs are high. When this condition exists, data at the D input is transferred to the latch output. When the write-enable input, $\overline{G_W}$, is high, the data inputs are inhibited and their levels can cause no change in the information stored in the internal latches. When the read-enable input, $\overline{G_R}$, is high, the data outputs are inhibited and remain high.

The individual address lines permit direct acquisition of data stored in any four of the latches. Four individual decoding gates are used to complete the address for reading a word. When the read address is made in conjunction with the read-enable signal, the word appears at the four outputs.

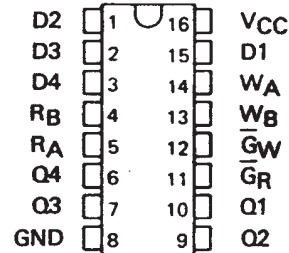
This arrangement—data-entry addressing separate from data-read addressing and individual sense line—eliminates recovery times, permits simultaneous reading and writing, and is limited in speed only by the write time (30 nanoseconds typical) and the read time (25 nanoseconds typical). The register file has a nondestructive readout in that data is not lost when addressed.

All '170 inputs and all inputs except the read enable and write enable of the 'LS170 are buffered to lower the drive requirements to one Series 54/74 or Series 54LS/74LS standard load, respectively. Input-clamping diodes minimize switching transients to simplify system design. High-speed, double-ended AND-OR-INVERT gates are employed for the read-address function and drive high-sink-current, open-collector outputs. Up to 256 of these outputs may be wire-AND connected for increasing the capacity up to 1024 words. Any number of these registers may be paralleled to provide n-bit word length.

The SN54170 and SN54LS170 are characterized for operation over the full military temperature range of -55°C to 125°C ; the SN74170 and SN74LS170 are characterized for operation from 0°C to 70°C .

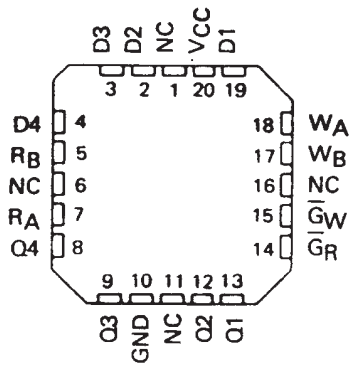
SN54170, SN54LS170 . . . J OR W PACKAGE
SN74170 . . . N PACKAGE
SN74LS170 . . . D OR N PACKAGE

(TOP VIEW)



SN54LS170 . . . FK PACKAGE

(TOP VIEW)



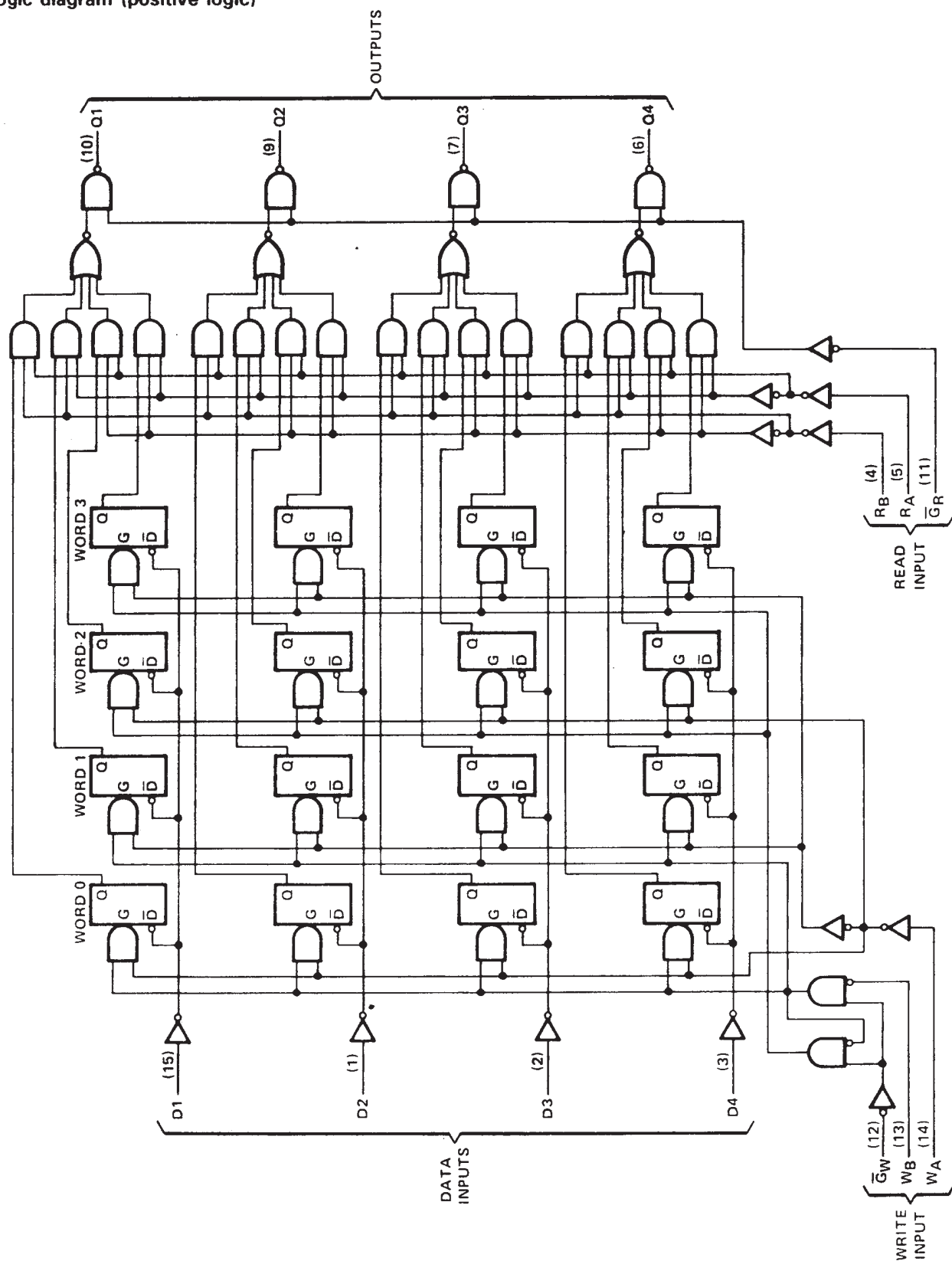
NC - No internal connection

SN54170, SN74170

4-BY-4 REGISTER FILES WITH OPEN-COLLECTOR OUTPUTS

SDLS065 – MARCH 1974 – REVISED MARCH 1988

logic diagram (positive logic)

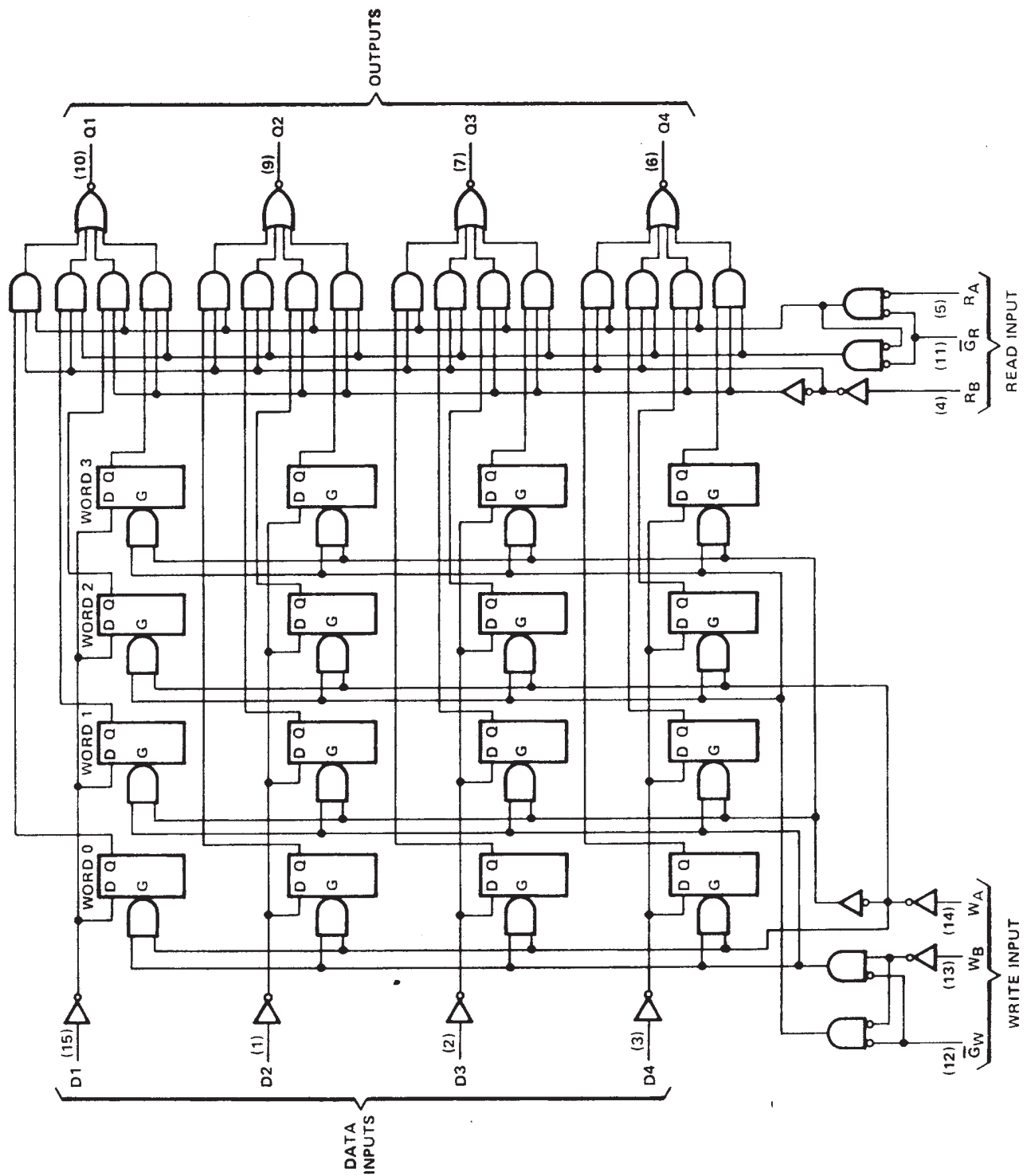


Pin numbers shown are for D, J, N, and W packages.

SN54LS170, SN74LS170 4-BY-4 REGISTER FILES WITH OPEN-COLLECTOR OUTPUTS

SDLS065 – MARCH 1974 – REVISED MARCH 1988

logic diagram (positive logic)



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

SN54170, SN54LS170, SN74170, SN74LS170

4-BY-4 REGISTER FILES WITH OPEN-COLLECTOR OUTPUTS

SDLS065 – MARCH 1974 – REVISED MARCH 1988

WRITE FUNCTION TABLE (SEE NOTES A, B, AND C)

WRITE INPUTS			WORD			
\overline{W}_B	\overline{W}_A	\overline{G}_W	0	1	2	3
L	L	L	$Q = D$	Q_0	Q_0	Q_0
L	H	L	Q_0	$Q = D$	Q_0	Q_0
H	L	L	Q_0	Q_0	$Q = D$	Q_0
H	H	L	Q_0	Q_0	Q_0	$Q = D$
X	X	H	Q_0	Q_0	Q_0	Q_0

READ FUNCTION TABLE (SEE NOTES A AND D)

READ INPUTS			OUTPUTS			
\overline{R}_B	\overline{R}_A	\overline{G}_R	Q1	Q2	Q3	Q4
L	L	L	W0B1	W0B2	W0B3	W0B4
L	H	L	W1B1	W1B2	W1B3	W1B4
H	L	L	W2B1	W2B2	W2B3	W2B4
H	H	L	W3B1	W3B2	W3B3	W3B4
X	X	H	H	H	H	H

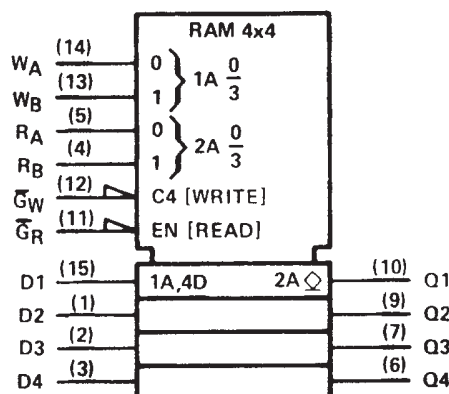
- NOTES: A. H = high level, L = low level, X = irrelevant.
 B. ($Q = D$) = The four selected internal flip-flop outputs will assume the states applied to the four external data inputs.
 C. Q_0 = the level of Q before the indicated input conditions were established.
 D. W0B1 = The first bit of word 0, etc.

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

Supply voltage, V_{CC} (see Note 1)	7 V
Input voltage: '170	5.5 V
'LS170	7 V
Off-state output voltage: '170	5.5 V
'LS170	7 V
Operating free-air temperature range: SN54170, SN54LS170 (see Note 2)	-55°C to 125°C
SN74170, SN74LS170	0°C to 70°C
Storage temperature range	-65°C to 150°C

- NOTES: 1. Voltage values are with respect to network ground terminal.
 2. An SN54170 in the W package operating at free-air temperatures above 105°C requires a heat sink that provides a thermal resistance from case to free-air, $R_{\theta CA}$, of not more than 38°C/W

logic symbols†



†This symbol is in accordance with ANSI/IEEE Std. 91-1984 and IEC Publication 617-12.
 Pin numbers shown are for D, J, N, and W packages.

SN54170, SN74170 4-BY-4 REGISTER FILES WITH OPEN-COLLECTOR OUTPUTS

SDLS065 – MARCH 1974 – REVISED MARCH 1988

recommended operating conditions

		SN54170			SN74170			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, V_{CC}		4.5	5	5.5	4.75	5	5.25	V
High-level output voltage, V_{OH}				5.5			5.5	V
Low-level output current, I_{OL}				16			16	mA
Width of write-enable or read-enable pulse, t_W		25			25			ns
Setup times, high- or low-level data (see Figure 2)	Data input with respect to write enable, $t_{su}(D)$	10			10			ns
	Write select with respect to write enable, $t_{su}(W)$	15			15			ns
Hold times, high- or low-level data (see Note 3 and Figure 2)	Data input with respect to write enable, $t_h(D)$	15			15			ns
	Write select with respect to write enable, $t_h(W)$	5			5			ns
Latch time for new data, t_{latch} (see Note 4)		25			25			ns
Operating free-air temperature range, T_A (see Note 2)		-55		125	0		70	°C

- NOTES: 2. An SN54170 in the W package operating at free-air temperatures above 105°C requires a heat sink that provides a thermal resistance from case to free-air, $R_{\theta CA}$, of not more than 38°C/W.
3. Write select setup time will protect the data written into the previous address. If protection of data in the previous address is not required, $t_{su}(W)$ can be ignored as any address selection sustained for the final 30 ns of the write-enable pulse and during $t_h(W)$ will result in data being written into that location. Depending on the duration of the input conditions, one or a number of previous addresses may have been written into.
4. Latch time is the time allowed for the internal output of the latch to assume the state of new data. See Figure 2. This is important only when attempting to read from a location immediately after that location has received new data.

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		2			V
V_{IL} Low-level input voltage				0.8	V
V_{IK} Input clamp voltage	$V_{CC} = \text{MIN}, I_I = -12 \text{ mA}$			-1.5	V
I_{OH} High-level output current	$V_{CC} = \text{MIN}, V_{OH} = 5.5 \text{ V}, V_{IH} = 2 \text{ V}, V_{IL} = 0.8 \text{ V}$			30	μA
V_{OL} Low-level output voltage	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = 0.8 \text{ V}, I_{OL} = 16 \text{ mA}$		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	$V_{CC} = \text{MAX}, V_I = 2.4 \text{ V}$			40	μA
I_{IL} Low-level input current	$V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$			-1.6	mA
I_{CC} Supply current	$V_{CC} = \text{MAX},$ SN54170		127§	140	mA
	See Note 5, SN74170		127§	150	

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

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

§Typical supply current shown is an average for 50% duty cycle.

NOTE 5: Maximum I_{CC} is guaranteed for the following worst-case conditions: 4.5 V is applied to all data inputs and both enable inputs, all address inputs are grounded, and all outputs are open.



SN54170, SN74170 4-BY-4 REGISTER FILES WITH OPEN-COLLECTOR OUTPUTS

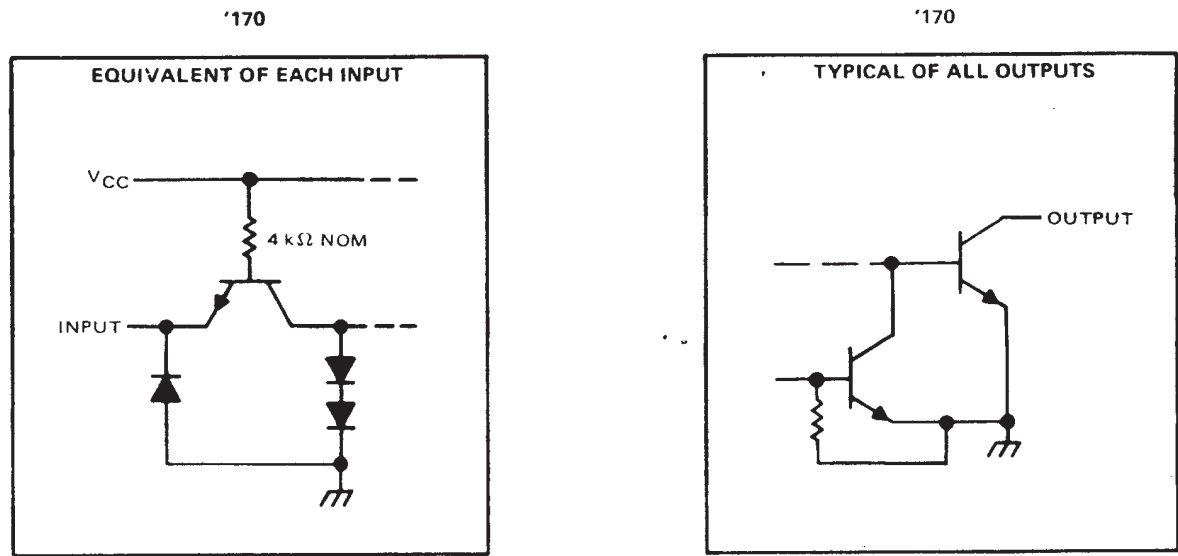
SDLS065 – MARCH 1974 – REVISED MARCH 1988

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

PARAMETER†	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
tPLH	Read enable	Any Q	CL = 15 pF, RL = 400 Ω, See Figures 1 and 2	10	15	ns	
tPHL				20	30		
tPLH	Read Select	Any Q		23	35	ns	
tPHL				30	40		
tPLH	Write enable	Any Q	CL = 15 pF, RL = 400 Ω, See Figures 1 and 3	25	40	ns	
tPHL				34	45		
tPLH	Data	Any Q		20	30	ns	
tPHL				30	45		

† t_{PLH} = propagation delay time, low-to-high-level output
 t_{PHL} = propagation delay time, high-to-low-level output

schematics of inputs and outputs



SN54LS170, SN74LS170

4-BY-4 REGISTER FILES WITH OPEN-COLLECTOR OUTPUTS

SDLS065 – MARCH 1974 – REVISED MARCH 1988

recommended operating conditions

		SN54LS170			SN74LS170			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, V_{CC}		4.5	5	5.5	4.75	5	5.25	V
High-level output voltage, V_{OH}				5.5			5.5	V
Low-level output current, I_{OL}				4			8	mA
Width of write-enable or read-enable pulse, t_w		25			25			ns
Setup times, high- or low-level data (see Figure 2)	Data input with respect to write enable, $t_{su}(D)$	10			10			ns
	Write select with respect to write enable, $t_{su}(W_L)$	15			15			ns
Hold times, high- or low-level data (see Note 3 and Figure 2)	Data input with respect to write enable, $t_h(D)$	15			15			ns
	Write select with respect to write enable, $t_h(W)$	5			5			ns
Latch time for new data, t_{latch} (see Note 4)		25			25			ns
Operating free-air temperature range, T_A		-55		125	0		70	°C

NOTES: 3. Write-select setup time will protect the data written into the previous address. If protection of data in the previous address is not required, $t_{su}(W)$ can be ignored as any address selection sustained for the final 30 ns of the write-enable pulse and during $t_h(W)$ will result in data being written into that location. Depending on the duration of the input conditions, one or a number of previous addresses may have been written into.

4. Latch time is the time allowed for the internal output of the latch to assume the state of new data. See Figure 2. This is important only when attempting to read from a location immediately after that location has received new data.

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

PARAMETER		TEST CONDITIONS†	SN54LS170			SN74LS170			UNIT
			MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V_{IH}	High-level input voltage		2			2			V
V_{IL}	Low-level input voltage				0.7			0.8	V
V_{IK}	Input clamp voltage	$V_{CC} = \text{MIN}, I_I = -18 \text{ mA}$			-1.5			-1.5	V
I_{OH}	High-level output current	$V_{CC} = \text{MIN}, V_{OH} = 5.5 \text{ V}, V_{IL} = V_{IL \text{ max}}, V_{IH} = 2 \text{ V}$			100			100	μA
V_{OL}	Low-level output voltage	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = V_{IL \text{ max}}, I_{OL} = 4 \text{ mA}$	0.25	0.4		0.25	0.4		V
		$I_{OL} = 8 \text{ mA}$				0.35	0.5		
I_I	Input current at maximum input voltage	Any D, R, or \overline{W}	$V_{CC} = \text{MAX}, V_I = 7 \text{ V}$						mA
		$\overline{G_R}$ or $\overline{G_W}$							
I_{IH}	High-level input current	Any D, R, or \overline{W}	$V_{CC} = \text{MAX}, V_I = 2.7 \text{ V}$						μA
		$\overline{G_R}$ or $\overline{G_W}$							
I_{IL}	Low-level input current	Any D, R, or \overline{W}	$V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$						mA
		$\overline{G_R}$ or $\overline{G_W}$							
I_{CC}	Supply current	$V_{CC} = \text{MAX},$ See Note 5	25	40		25	40		mA

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

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

NOTE 5: I_{CC} is measured under the following worst-case conditions: 4.5 V is applied to all data inputs and both enable inputs, all address inputs are ground, and all outputs are open.



SN54LS170, SN74LS170

4-BY-4 REGISTER FILES WITH OPEN-COLLECTOR OUTPUTS

SDLS065 – MARCH 1974 – REVISED MARCH 1988

recommended operating conditions

		SN54LS170			SN74LS170			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, V_{CC}		4.5	5	5.5	4.75	5	5.25	V
High-level output voltage, V_{OH}				5.5			5.5	V
Low-level output current, I_{OL}				4			8	mA
Width of write-enable or read-enable pulse, t_W		25			25			ns
Setup times, high- or low-level data (see Figure 2)	Data input with respect to write enable, $t_{su}(D)$	10			10			ns
	Write select with respect to write enable, $t_{su}(W_L)$	15			15			ns
Hold times, high- or low-level data (see Note 3 and Figure 2)	Data input with respect to write enable, $t_h(D)$	15			15			ns
	Write select with respect to write enable, $t_h(W)$	5			5			ns
Latch time for new data, t_{latch} (see Note 4)		25			25			ns
Operating free-air temperature range, T_A		–55		125	0		70	°C

NOTES: 3. Write-select setup time will protect the data written into the previous address. If protection of data in the previous address is not required, $t_{su}(W)$ can be ignored as any address selection sustained for the final 30 ns of the write-enable pulse and during $t_h(W)$ will result in data being written into that location. Depending on the duration of the input conditions, one or a number of previous addresses may have been written into.

4. Latch time is the time allowed for the internal output of the latch to assume the state of new data. See Figure 2. This is important only when attempting to read from a location immediately after that location has received new data.

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

PARAMETER		TEST CONDITIONS†	SN54LS170			SN74LS170			UNIT
			MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V_{IH}	High-level input voltage		2			2			V
V_{IL}	Low-level input voltage				0.7			0.8	V
V_{IK}	Input clamp voltage	$V_{CC} = \text{MIN}, I_I = -18 \text{ mA}$			–1.5			–1.5	V
I_{OH}	High-level output current	$V_{CC} = \text{MIN}, V_{OH} = 5.5 \text{ V}, V_{IL} = V_{IL \text{ max}}, V_{IH} = 2 \text{ V}$			100			100	μA
V_{OL}	Low-level output voltage	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = V_{IL \text{ max}}, I_{OL} = 4 \text{ mA}$	0.25	0.4		0.25	0.4		V
		$I_{OL} = 8 \text{ mA}$				0.35	0.5		
I_I	Input current at maximum input voltage	Any D, R, or W			0.1			0.1	mA
		$\overline{G_R}$ or $\overline{G_W}$			0.2			0.2	
I_{IH}	High-level input current	Any D, R, or W			20			20	μA
		$\overline{G_R}$ or $\overline{G_W}$			40			40	
I_{IL}	Low-level input current	Any D, R, or W			–0.4			–0.4	mA
		$\overline{G_R}$ or $\overline{G_W}$			–0.8			–0.8	
I_{CC}	Supply current	$V_{CC} = \text{MAX},$ See Note 5	25	40		25	40		mA

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

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

NOTE 5: I_{CC} is measured under the following worst-case conditions: 4.5 V is applied to all data inputs and both enable inputs, all address inputs are ground, and all outputs are open.



POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

SN54LS170, SN74LS170

4-BY-4 REGISTER FILES WITH OPEN-COLLECTOR OUTPUTS

SDLS065 – MARCH 1974 – REVISED MARCH 1988

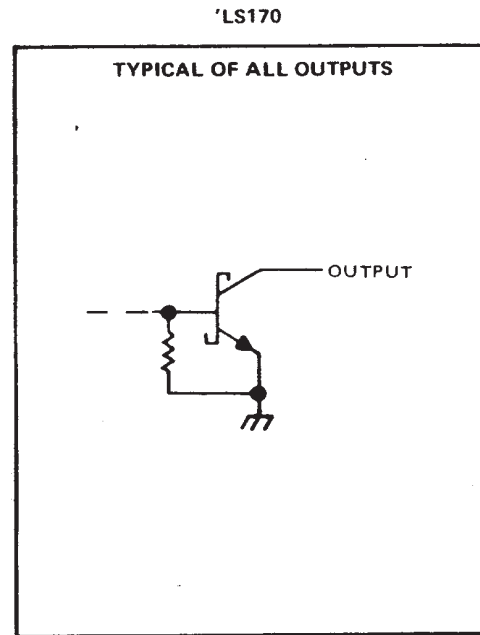
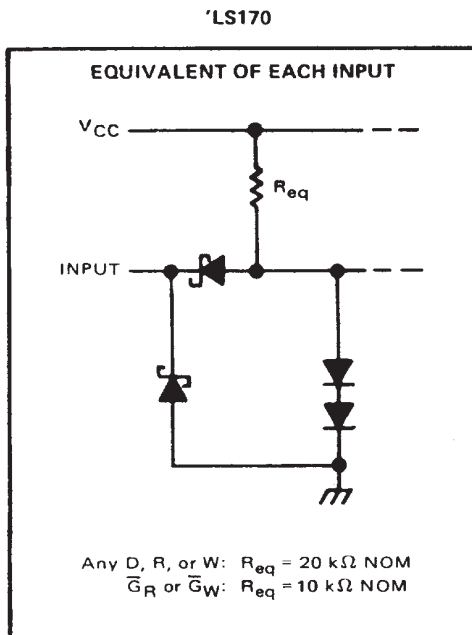
switching characteristics, $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER†	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
tPLH	Read enable	Any Q	CL = 15 pF, RL = 2 kΩ, See Figures 1 and 2	20	30	ns	
tPHL				20	30		
tPLH	Read select	Any Q		25	40	ns	
tPHL				24	40		
tPLH	Write enable	Any Q	CL = 15 pF, RL = 2 kΩ, See Figures 1 and 3	30	45	ns	
tPHL				26	40		
tPLH	Data	Any Q		30	45	ns	
tPHL				22	35		

† t_{PLH} = propagation delay time, low-to-high-level output

t_{PHL} = propagation delay time, high-to-low-level output

schematics of inputs and outputs



SN54170, SN54LS170, SN74170, SN74LS170

4-BY-4 REGISTER FILES WITH OPEN-COLLECTOR OUTPUTS

SDLS065 – MARCH 1974 – REVISED MARCH 1988

PARAMETER MEASUREMENT INFORMATION

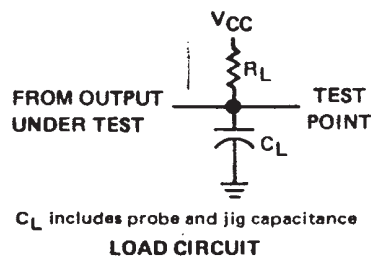


FIGURE 1

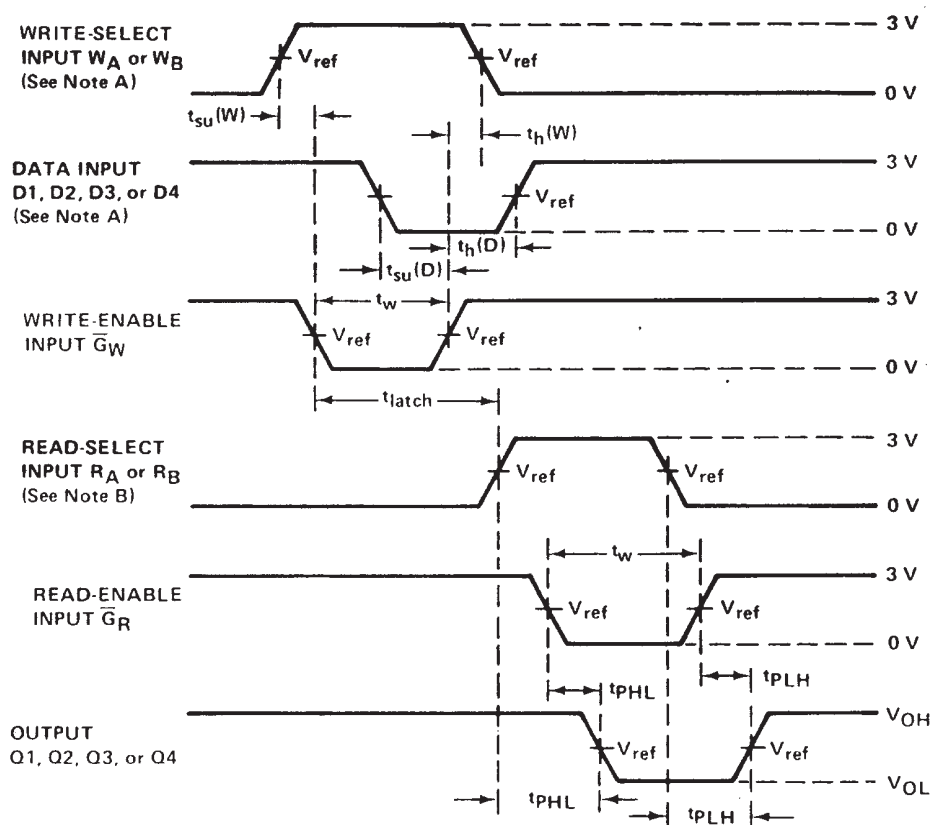


FIGURE 2

- NOTES:
- High-level input pulses at the select and data inputs are illustrated in Figure 2; however, times associated with low-level pulses are measured from the same reference points.
 - When measuring delay times from a read-select input, the read-enable input is low. When measuring delay times from the read-enable input, both read-select inputs have been established at steady states.
 - In Figure 3, each select address is tested. Prior to the start of each of the above tests, both write and read address inputs are stabilized with $W_A = R_A$ and $W_B = R_B$. During the test G_R is low.
 - Input waveforms are supplied by generators having the following characteristics: $PRR \leq 1$ MHz, $Z_{out} \approx 50 \Omega$, duty cycle $\leq 50\%$, $t_r \leq 10$ ns and $t_f \leq 10$ ns for '170, and $t_r \leq 15$ ns and $t_f \leq 6$ ns for 'LS170.
 - For '170, $V_{ref} = 1.5$ V; for 'LS170, $V_{ref} = 1.3$ V.

SN54170, SN54LS170, SN74170, SN74LS170 4-BY-4 REGISTER FILES WITH OPEN-COLLECTOR OUTPUTS

SDLS065 – MARCH 1974 – REVISED MARCH 1988

PARAMETER MEASUREMENT INFORMATION

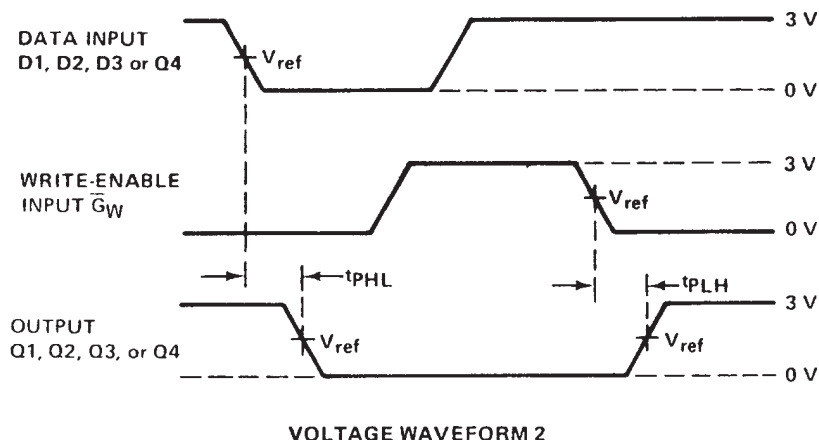
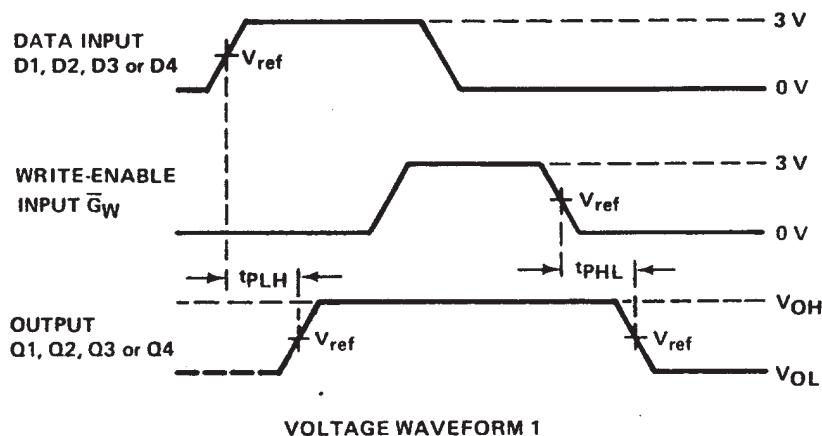


FIGURE 3

- NOTES: A. High-level input pulses at the select and data inputs are illustrated in Figure 2; however, times associated with low-level pulses are measured from the same reference points.
- B. When measuring delay times from a read-select input, the read-enable input is low. When measuring delay times from the read-enable input, both read-select inputs have been established at steady states.
- C. In Figure 3, each select address is tested. Prior to the start of each of the above tests, both write and read address inputs are stabilized with $W_A = R_A$ and $W_B = R_B$. During the test G_R is low.
- D. Input waveforms are supplied by generators having the following characteristics: $PRR \leq 1 \text{ MHz}$, $Z_{out} \approx 50 \Omega$, duty cycle $\leq 50\%$, $t_r \leq 10 \text{ ns}$ and $t_f \leq 10 \text{ ns}$ for '170, and $t_r \leq 15 \text{ ns}$ and $t_f \leq 6 \text{ ns}$ for 'LS170.
- E. For '170, $V_{ref} = 1.5 \text{ V}$; for 'LS170, $V_{ref} = 1.3 \text{ V}$.

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
8002501FA	OBSOLETE			16		TBD	Call TI	Call TI
SN54LS170J	OBSOLETE	CDIP	J	16		TBD	Call TI	Call TI
SN54LS170J	OBSOLETE	CDIP	J	16		TBD	Call TI	Call TI
SN74170N	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI
SN74170N	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI
SN74LS170D	OBSOLETE	SOIC	D	16		TBD	Call TI	Call TI
SN74LS170D	OBSOLETE	SOIC	D	16		TBD	Call TI	Call TI
SN74LS170N	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI
SN74LS170N	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI
SNJ54LS170J	OBSOLETE	CDIP	J	16		TBD	Call TI	Call TI
SNJ54LS170J	OBSOLETE	CDIP	J	16		TBD	Call TI	Call TI
SNJ54LS170W	OBSOLETE			16		TBD	Call TI	Call TI
SNJ54LS170W	OBSOLETE			16		TBD	Call TI	Call TI

⁽¹⁾ 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.

⁽²⁾ Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), 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.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

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)

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

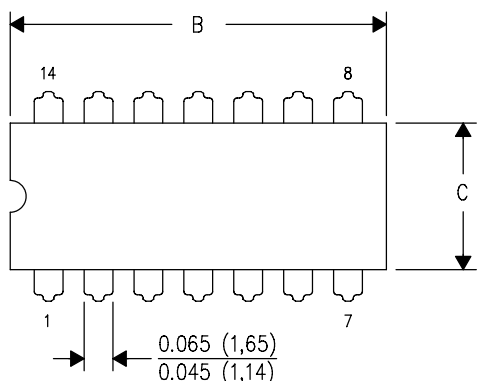
Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

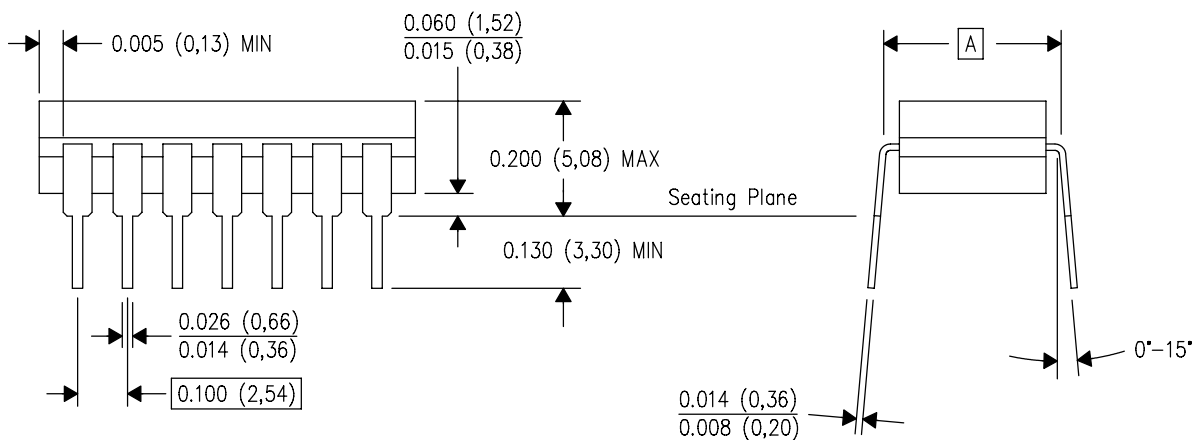
J (R-GDIP-T**)

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)

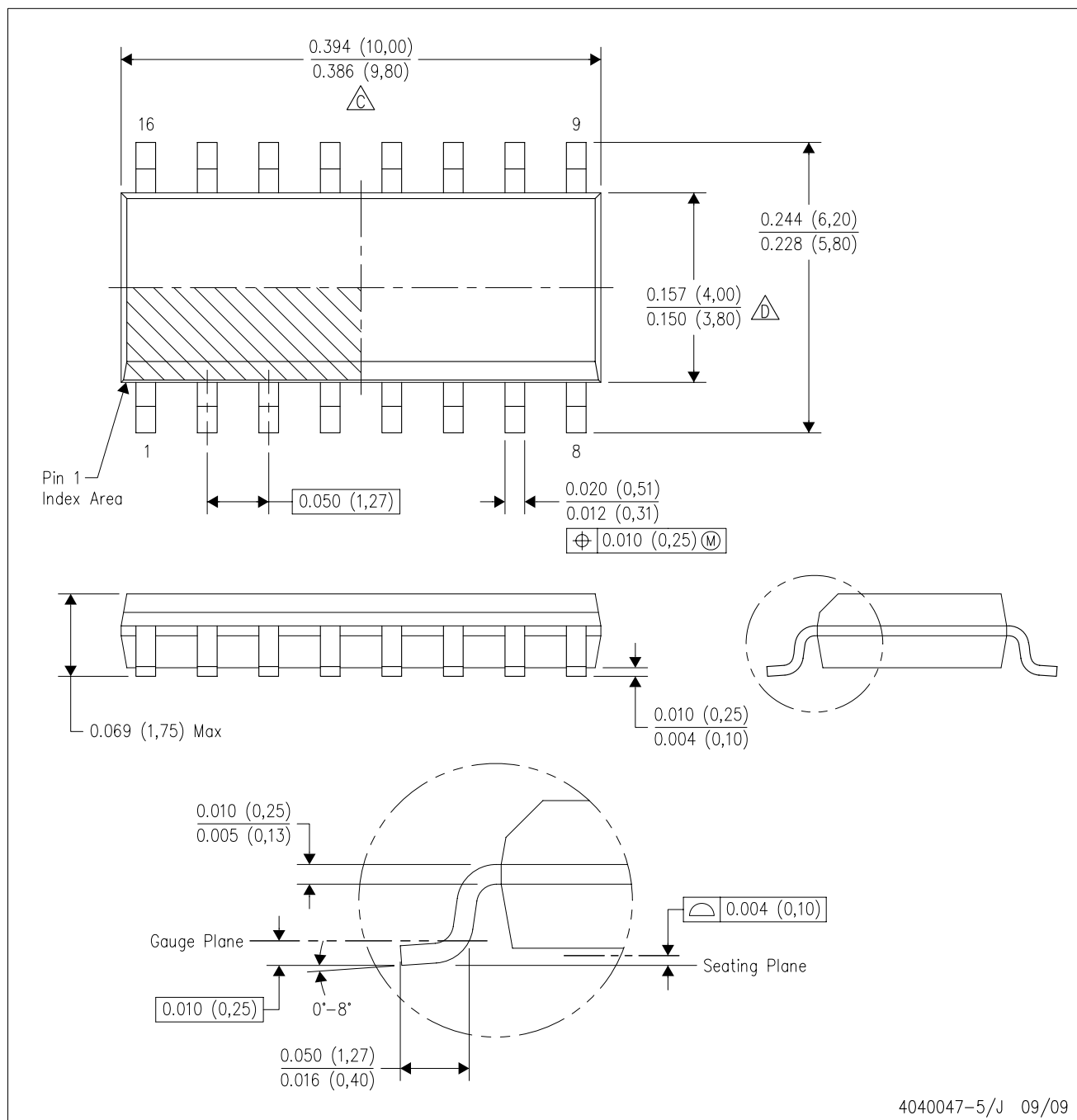


4040083/F 03/03

- 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.

D (R-PDSO-G16)

PLASTIC SMALL-OUTLINE PACKAGE



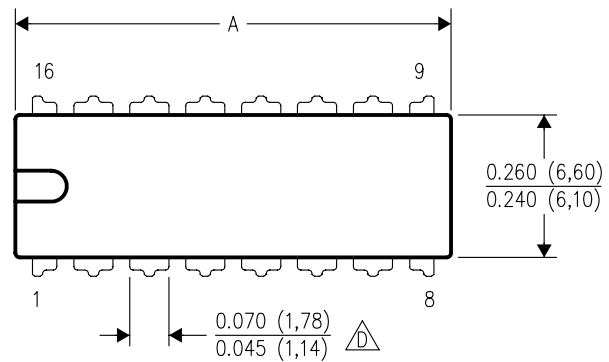
NOTES:

- 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 .006 (0,15) per end.
- D. Body width does not include interlead flash. Interlead flash shall not exceed .017 (0,43) per side.
- E. Reference JEDEC MS-012 variation AC.

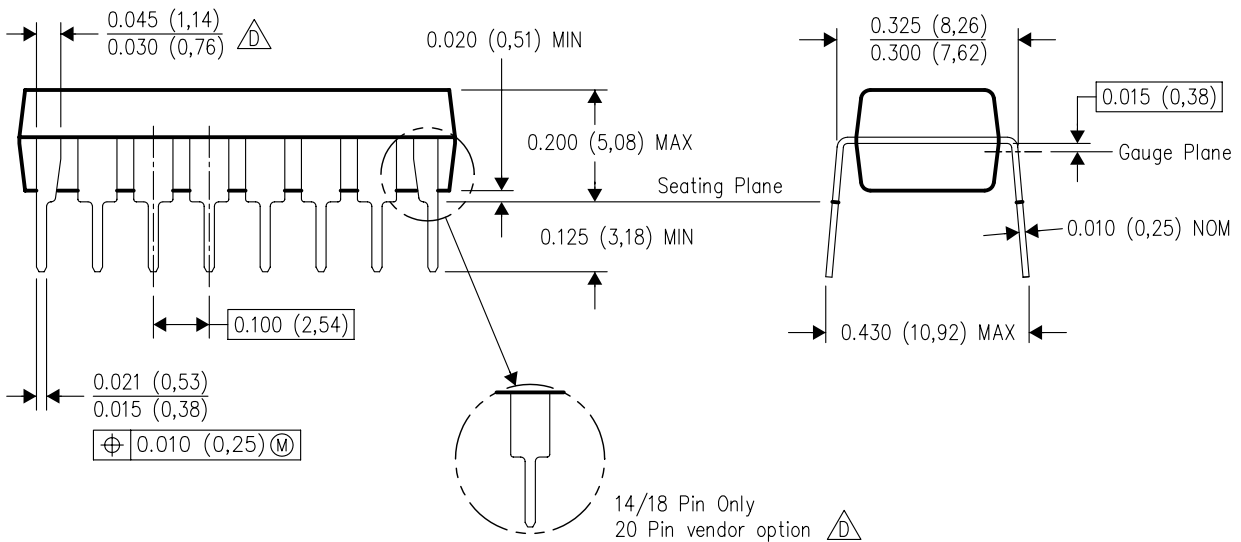
N (R-PDIP-T**)

16 PINS SHOWN

PLASTIC DUAL-IN-LINE PACKAGE



PINS **	14	16	18	20
DIM				
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



14/18 Pin Only
20 Pin vendor option

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.

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
8002501FA	OBSOLETE			16		TBD	Call TI	Call TI
SN54LS170J	OBSOLETE	CDIP	J	16		TBD	Call TI	Call TI
SN54LS170J	OBSOLETE	CDIP	J	16		TBD	Call TI	Call TI
SN74170N	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI
SN74170N	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI
SN74LS170D	OBSOLETE	SOIC	D	16		TBD	Call TI	Call TI
SN74LS170D	OBSOLETE	SOIC	D	16		TBD	Call TI	Call TI
SN74LS170N	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI
SN74LS170N	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI
SNJ54LS170J	OBSOLETE	CDIP	J	16		TBD	Call TI	Call TI
SNJ54LS170J	OBSOLETE	CDIP	J	16		TBD	Call TI	Call TI
SNJ54LS170W	OBSOLETE			16		TBD	Call TI	Call TI
SNJ54LS170W	OBSOLETE			16		TBD	Call TI	Call TI

⁽¹⁾ 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.

⁽²⁾ Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), 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.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

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)

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

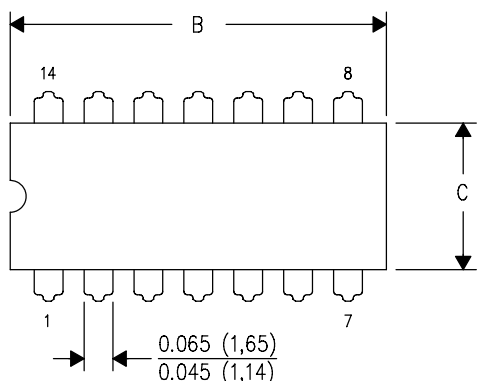
Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

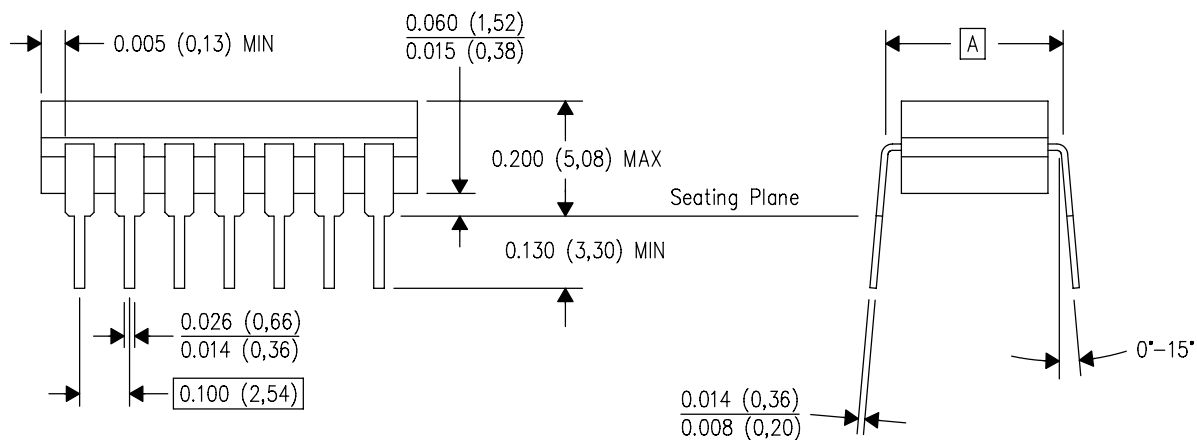
J (R-GDIP-T**)

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)

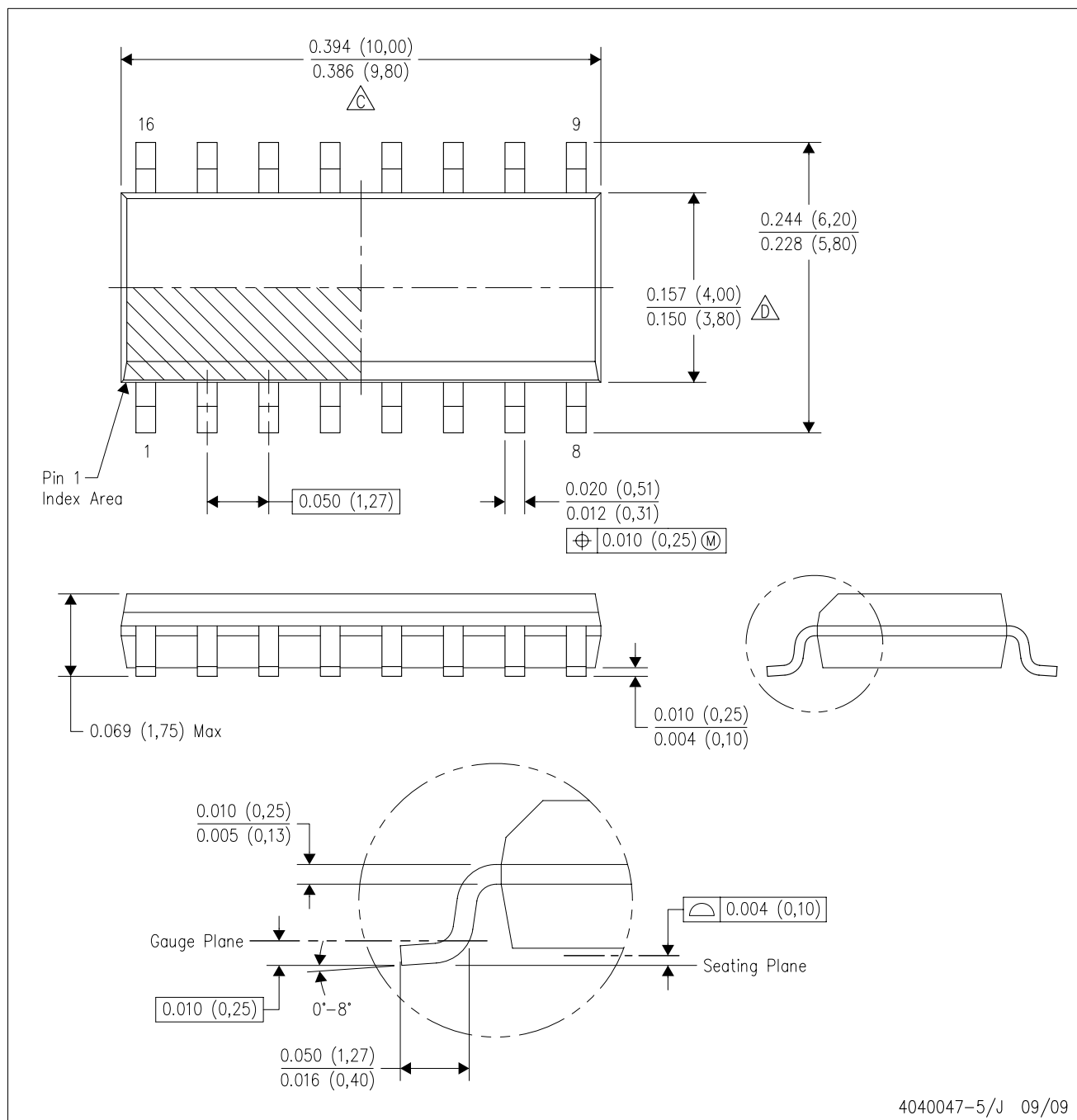


4040083/F 03/03

- 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.

D (R-PDSO-G16)

PLASTIC SMALL-OUTLINE PACKAGE



4040047-5/J 09/09

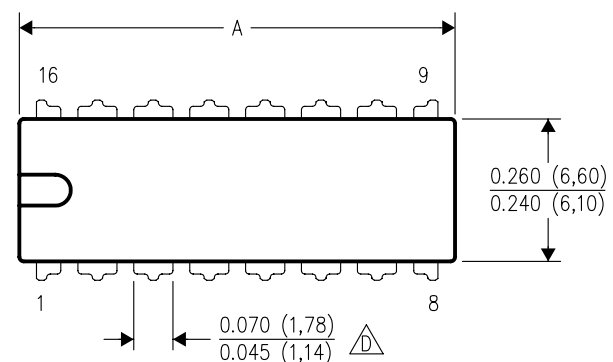
NOTES:

- 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 .006 (0,15) per end.
- D. Body width does not include interlead flash. Interlead flash shall not exceed .017 (0,43) per side.
- E. Reference JEDEC MS-012 variation AC.

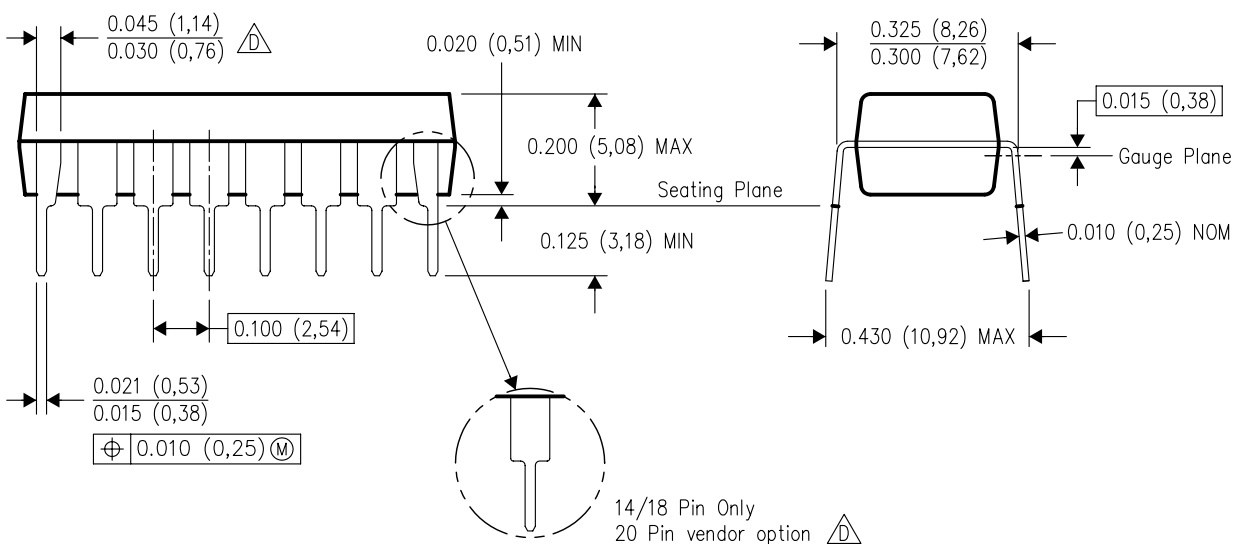
N (R-PDIP-T**)

16 PINS SHOWN

PLASTIC DUAL-IN-LINE PACKAGE





PINS ** DIM	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.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		Applications	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DLP® Products	www.dlp.com	Communications and Telecom	www.ti.com/communications
DSP	dsp.ti.com	Computers and Peripherals	www.ti.com/computers
Clocks and Timers	www.ti.com/clocks	Consumer Electronics	www.ti.com/consumer-apps
Interface	interface.ti.com	Energy	www.ti.com/energy
Logic	logic.ti.com	Industrial	www.ti.com/industrial
Power Mgmt	power.ti.com	Medical	www.ti.com/medical
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
RFID	www.ti-rfid.com	Space, Avionics & Defense	www.ti.com/space-avionics-defense
RF/IF and ZigBee® Solutions	www.ti.com/lprf	Video and Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless-apps