

- 3-State Outputs Interface Directly With System Bus
- Gated Output-Control Lines for Enabling or Disabling the Outputs
- Fully Independent Clock Virtually Eliminates Restrictions for Operating in One of Two Modes:
 - Parallel Load
 - Do Nothing (Hold)
- For Application as Bus Buffer Registers
- Package Options Include Plastic Small-Outline (D) Packages, Ceramic Flat (W) Packages, Ceramic Chip Carriers (FK), and Standard Plastic (N) and Ceramic (J) DIPs

TYPE	TYPICAL PROPAGATION DELAY TIME	MAXIMUM CLOCK FREQUENCY
'173	23 ns	35 MHz
'LS173A	18 ns	50 MHz

description

The '173 and 'LS173A 4-bit registers include D-type flip-flops featuring totem-pole 3-state outputs capable of driving highly capacitive or relatively low-impedance loads. The high-impedance third state and increased high-logic-level drive provide these flip-flops with the capability of being connected directly to and driving the bus lines in a bus-organized system without need for interface or pull-up components. Up to 128 of the SN74173 or SN74LS173A outputs can be connected to a common bus and still drive two Series 54/74 or 54LS/74LS TTL normalized loads, respectively. Similarly, up to 49 of the SN54173 or SN54LS173A outputs can be connected to a common bus and drive one additional Series 54/74 or 54LS/74LS TTL normalized load, respectively. To minimize the possibility that two outputs will attempt to take a common bus to opposite logic levels, the output control circuitry is designed so that the average output disable times are shorter than the average output enable times.

Gated enable inputs are provided on these devices for controlling the entry of data into the flip-flops. When both data-enable (\overline{G}_1 , \overline{G}_2) inputs are low, data at the D inputs are loaded into their respective flip-flops on the next positive transition of the buffered clock input. Gate output-control (M, N) inputs also are provided. When both are low, the normal logic states (high or low levels) of the four outputs are available for driving the loads or bus lines. The outputs are disabled independently from the level of the clock by a high logic level at either output-control input. The outputs then present a high impedance and neither load nor drive the bus line. Detailed operation is given in the function table.

The SN54173 and SN54LS173A are characterized for operation over the full military temperature range of -55°C to 125°C . The SN74173 and SN74LS173A are characterized for operation from 0°C to 70°C .



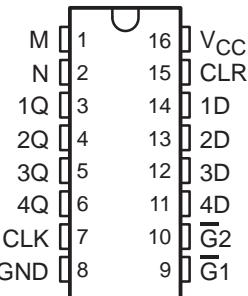
Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

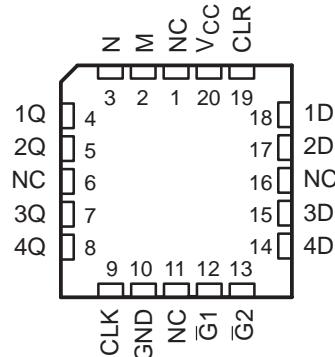


POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

SN54173, SN54LS173A . . . J OR W PACKAGE
 SN74173 . . . N PACKAGE
 SN74LS173A . . . D OR N PACKAGE
 (TOP VIEW)



SN54LS173A . . . FK PACKAGE
 (TOP VIEW)



NC – No internal connection

SN54173, SN54LS173A, SN74173, SN74LS173A

4-BIT D-TYPE REGISTERS

WITH 3-STATE OUTPUTS

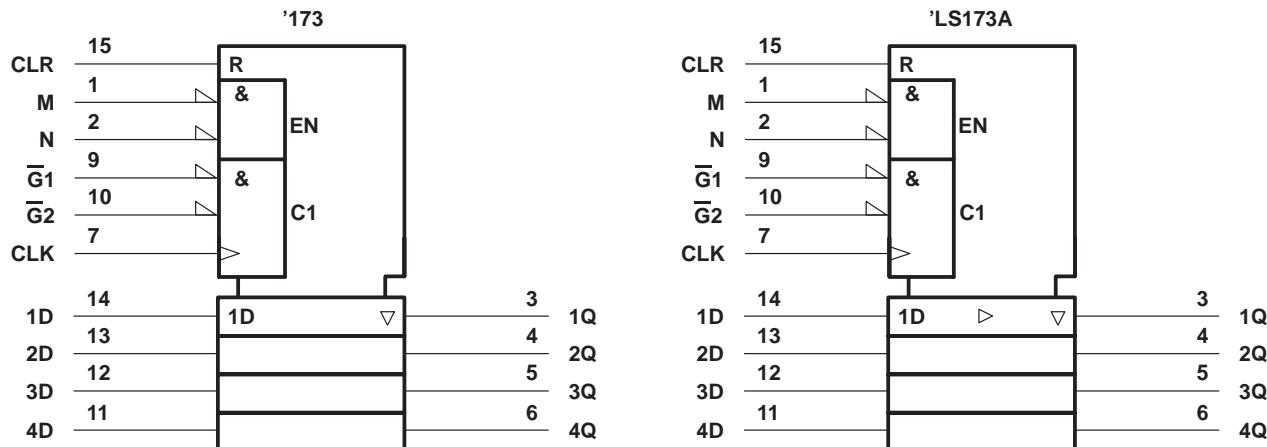
SDLS067A – OCTOBER 1976 – REVISED JUNE 1999

FUNCTION TABLE

		INPUTS			OUTPUT Q
CLR	CLK	DATA ENABLE		DATA D	
		\bar{G}_1	\bar{G}_2		
H	X	X	X	X	L
L	L	X	X	X	Q_0
L	↑	H	X	X	Q_0
L	↑	X	H	X	Q_0
L	↑	L	L	L	L
L	↑	L	L	H	H

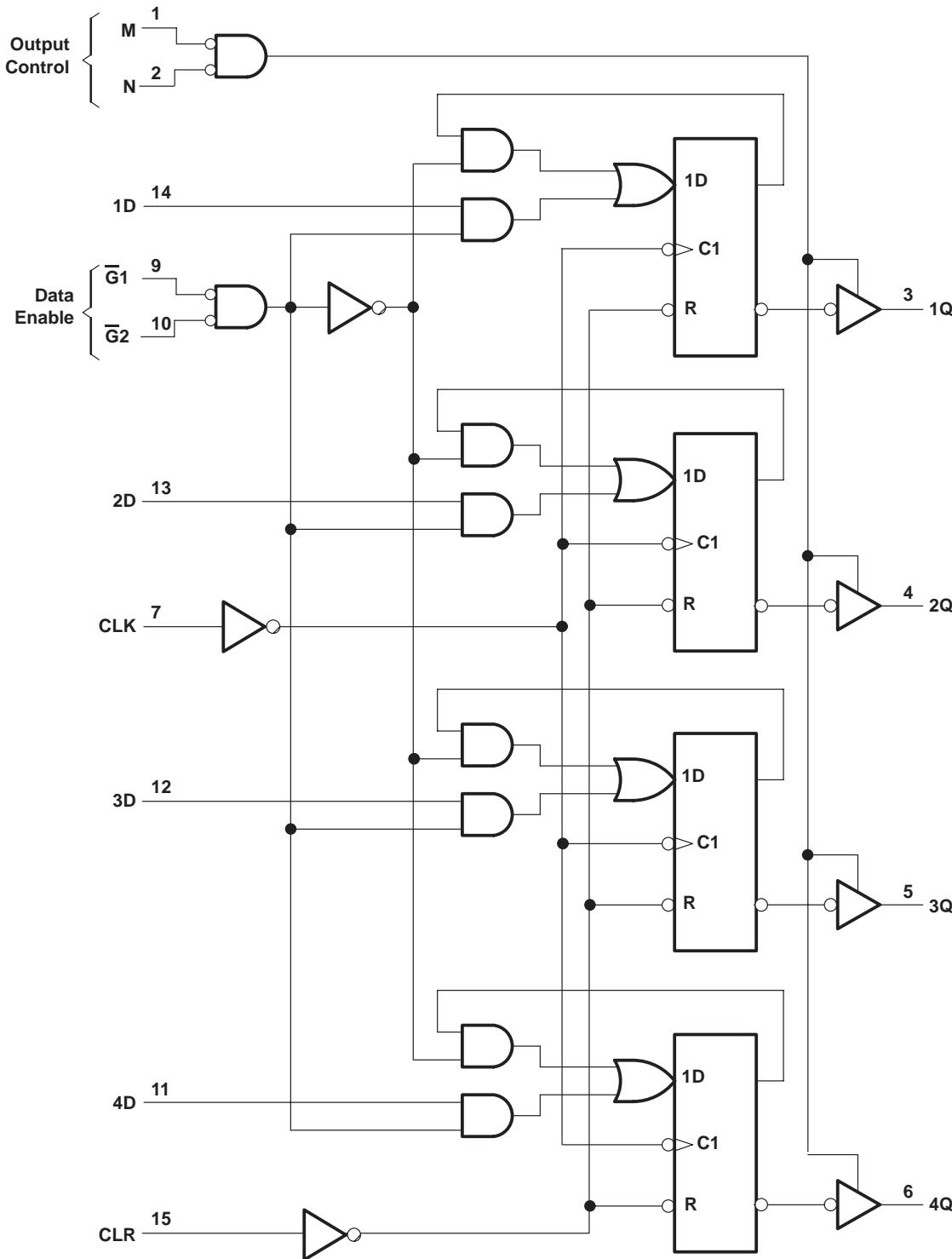
When either M or N (or both) is (are) high, the output is disabled to the high-impedance state; however, sequential operation of the flip-flops is not affected.

logic symbol†



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

logic diagram (positive logic)

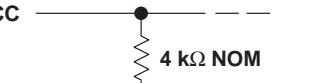
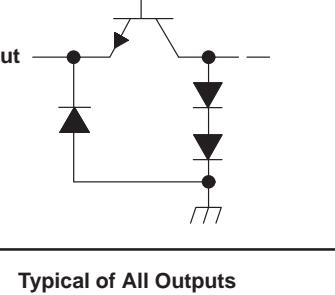
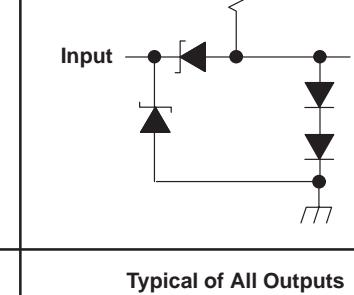


Pin numbers shown are for D, J, N, and W packages.

SN54173, SN54LS173A, SN74173, SN74LS173A 4-BIT D-TYPE REGISTERS WITH 3-STATE OUTPUTS

SDLS067A – OCTOBER 1976 – REVISED JUNE 1999

schematics of inputs and outputs

<p>Equivalent of Each Input</p> 	<p>Equivalent of Each Input</p> 
<p>Typical of All Outputs</p> 	<p>Typical of All Outputs</p> 

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

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

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

2. The package thermal impedance is calculated in accordance with JESD 51, except for through-hole packages, which use a trace length of zero.

SN54173, SN54LS173A, SN74173, SN74LS173A
4-BIT D-TYPE REGISTERS
WITH 3-STATE OUTPUTS

SDLS067A – OCTOBER 1976 – REVISED JUNE 1999

recommended operating conditions (see Note 3)

		SN54173			SN74173			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V _{CC}	Supply voltage	4.5	5	5.5	4.75	5	5.25	V
I _{OH}	High-level output current			-2			-5.2	mA
I _{OL}	Low-level output current			16			16	mA
T _A	Operating free-air temperature	-55		125	0		70	°C

NOTE 3: All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

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

PARAMETER	TEST CONDITIONS [†]	SN54173			SN74173			UNIT	
		MIN	TYP [‡]	MAX	MIN	TYP [‡]	MAX		
V _{IH}	High-level input voltage			2			2	V	
V _{IL}	Low-level input voltage			0.8			0.8	V	
V _{IK}	Input clamp voltage	V _{CC} = MIN, I _I = -12 mA			-1.5		-1.5	V	
V _{OH}	High-level output voltage	V _{CC} = MIN, V _{IH} = 2 V, I _{OH} = MAX		2.4			2.4	V	
V _{OL}	Low-level output voltage	V _{CC} = MIN, V _{IL} = 0.8 V, I _{OL} = 16 mA		0.4			0.4	V	
I _{O(off)}	Off-state (high-impedance state) output current	V _{CC} = MAX, V _{IH} = 2 V	V _O = 2.4 V	150			40	µA	
			V _O = 0.4 V	-150			-40		
I _I	Input current at maximum input voltage	V _{CC} = MAX, V _I = 5.5 V		1			1	mA	
I _{IH}	High-level input current	V _{CC} = MAX, V _I = 2.4 V		40			40	µA	
I _{IL}	Low-level input current	V _{CC} = MAX, V _I = 0.4 V		-1.6			-1.6	mA	
I _{OS}	Short-circuit output current [§]	V _{CC} = MAX		-30	-70	-30	-70	mA	
I _{CC}	Supply current	V _{CC} = MAX, See Note 4		50	72		50	72	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 V, T_A = 25°C.

[§] Not more than one output should be shorted at a time.

NOTE 4: I_{CC} is measured with all outputs open; CLR grounded, following momentary connection to 4.5 V, N, \bar{G}_1 , \bar{G}_2 , and all data inputs grounded; and CLK and M at 4.5 V.

timing requirements over recommended operating conditions (unless otherwise noted)

		SN54173		SN74173		UNIT
		MIN	MAX	MIN	MAX	
f _{clock}	Input clock frequency			25	25	MHz
t _w	Pulse duration	CLK or CLR		20	20	ns
t _{su}	Setup time	Data enable (\bar{G}_1 , \bar{G}_2)		17	17	ns
		Data		10	10	
		CLR (inactive state)		10	10	
t _h	Hold time	Data enable (\bar{G}_1 , \bar{G}_2)		2	2	ns
		Data		10	10	

SN54173, SN54LS173A, SN74173, SN74LS173A**4-BIT D-TYPE REGISTERS****WITH 3-STATE OUTPUTS**

SDLS067A – OCTOBER 1976 – REVISED JUNE 1999

switching characteristics, $V_{CC} = 5$ V, $T_A = 25^\circ\text{C}$, $R_L = 400 \Omega$ (see Figure 1)

PARAMETER	TEST CONDITIONS	SN54173			SN74173			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
f_{max}	$C_L = 50 \text{ pF}$	25	35		25	35		MHz
t_{PHL}		18	27		18	27		ns
t_{PLH}		28	43		28	43		ns
t_{PHL}		19	31		19	31		
t_{PZH}		7	16	30	7	16	30	ns
t_{PZL}		7	21	30	7	21	30	
t_{PHZ}	$C_L = 5 \text{ pF}$	3	5	14	3	5	14	ns
t_{PLZ}		3	11	20	3	11	20	

SN54173, SN54LS173A, SN74173, SN74LS173A
4-BIT D-TYPE REGISTERS
WITH 3-STATE OUTPUTS

SDLS067A – OCTOBER 1976 – REVISED JUNE 1999

recommended operating conditions

		SN54LS173A			SN74LS173A			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V _{CC}	Supply voltage	4.5	5	5.5	4.75	5	5.25	V
I _{OH}	High-level output current			-1			-2.6	mA
I _{OL}	Low-level output current			12			24	mA
T _A	Operating free-air temperature	-55		125	0		70	°C

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

PARAMETER	TEST CONDITIONS [†]	SN54LS173A			SN74LS173A			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} = MIN, I _I = -18 mA			-1.5		-1.5	V
V _{OH}	High-level output voltage	V _{CC} = MIN, V _{IH} = 2 V, V _{IL} = V _{IL} max, I _{OH} = MAX	2.4	3.4	2.4	3.1		V
V _{OL}	Low-level output voltage	V _{CC} = MIN, V _{IL} = 0.8 V, I _{OL} = 12 mA	0.25	0.4	0.25	0.4		V
I _{O(off)}	Off-state (high-impedance state) output current	V _{CC} = MAX, V _{IH} = 2 V	V _O = 2.7 V		20		20	V
			V _O = 0.4 V		-20		-20	
I _I	Input current at maximum input voltage	V _{CC} = MAX, V _I = 7 V		0.1			0.1	mA
I _{IH}	High-level input current	V _{CC} = MAX, V _I = 2.7 V		20			20	µA
I _{IL}	Low-level input current	V _{CC} = MAX, V _I = 0.4 V		-0.4			-0.4	mA
I _{OS}	Short-circuit output current [§]	V _{CC} = MAX	-30	-130	-30	-130		mA
I _{CC}	Supply current	V _{CC} = MAX, See Note 4	19	30	19	24		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 V, T_A = 25°C.

[§] Not more than one output should be shorted at a time.

NOTE 4: I_{CC} is measured with all outputs open; CLR grounded, following momentary connection to 4.5 V, N, \bar{G}_1 , \bar{G}_2 , and all data inputs grounded; and CLK and M at 4.5 V.

timing requirements over recommended operating conditions (unless otherwise noted)

		SN54LS173A		SN74LS173A		UNIT
		MIN	MAX	MIN	MAX	
f _{clock}	Input clock frequency			30	25	MHz
t _w	Pulse duration	CLK or CLR	25	25		ns
t _{su}	Setup time	Data enable (\bar{G}_1 , \bar{G}_2)	35	35		ns
		Data	17	17		
		CLR (inactive state)	10	10		
t _h	Hold time	Data enable (\bar{G}_1 , \bar{G}_2)	0	0		ns
		Data	3	3		

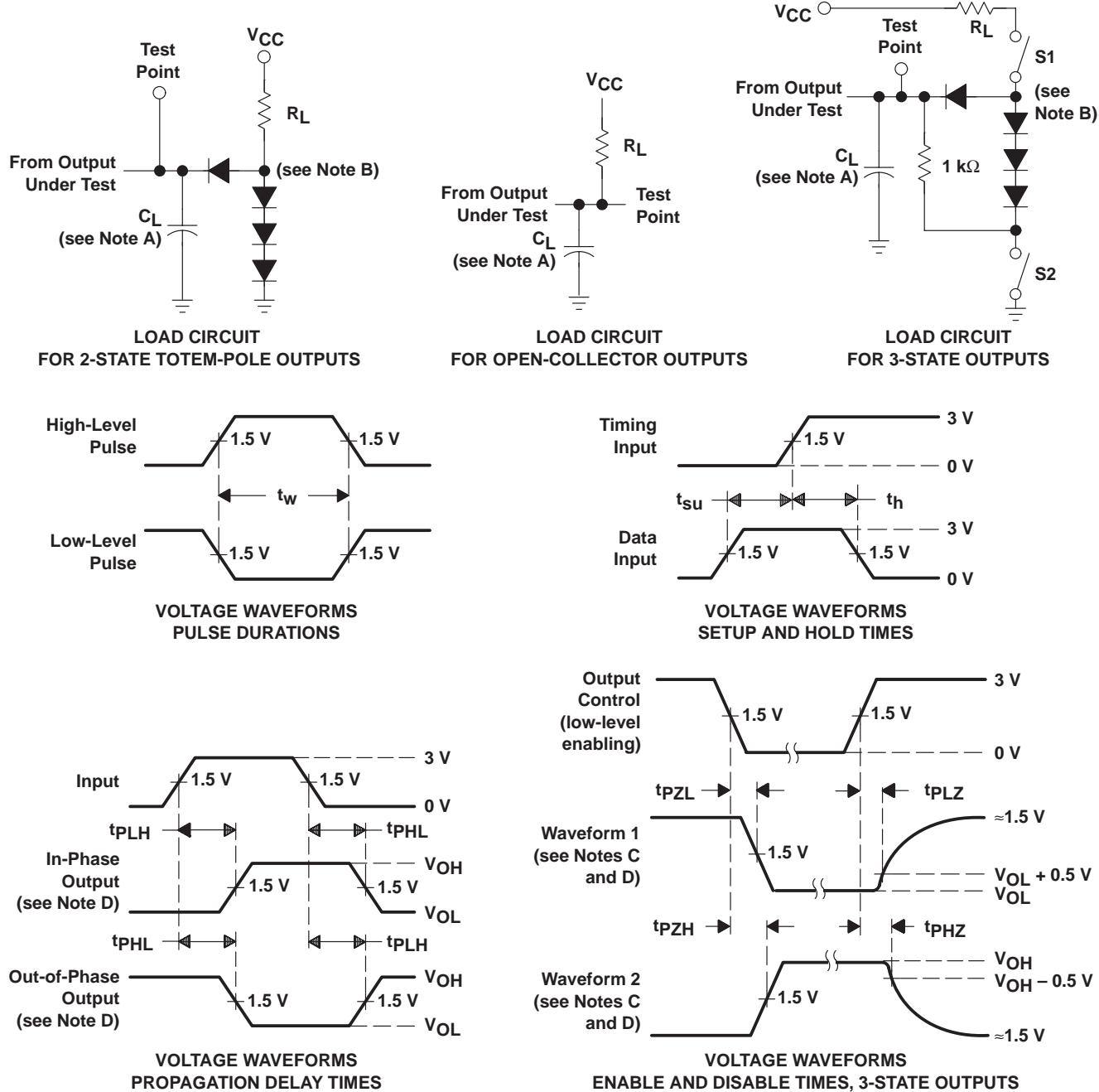
SN54173, SN54LS173A, SN74173, SN74LS173A**4-BIT D-TYPE REGISTERS****WITH 3-STATE OUTPUTS**

SDLS067A – OCTOBER 1976 – REVISED JUNE 1999

switching characteristics, $V_{CC} = 5$ V, $T_A = 25^\circ\text{C}$, $R_L = 667 \Omega$ (see Figure 2)

PARAMETER	TEST CONDITIONS	SN54LS173A			SN74LS173A			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
f_{max}	$C_L = 45 \text{ pF}$	30	50		30	50		MHz
t_{PHL}		26	35		26	35		ns
t_{PLH}		17	25		17	25		ns
t_{PHL}		22	30		22	30		
t_{PZH}		15	23		15	23		ns
t_{PZL}		18	27		18	27		
t_{PHZ}	$C_L = 5 \text{ pF}$	11	20		11	20		ns
t_{PLZ}		11	17		11	17		

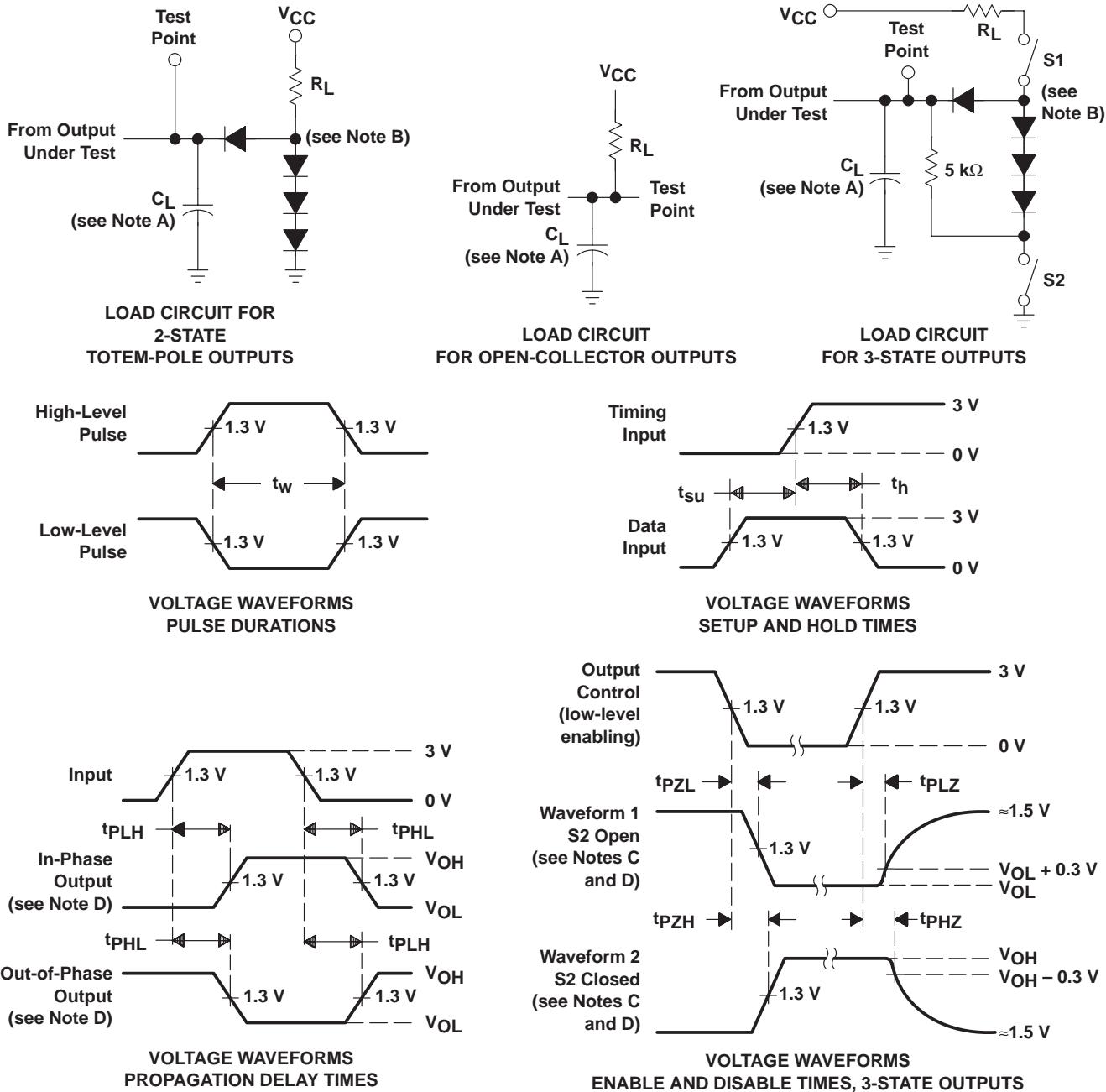
PARAMETER MEASUREMENT INFORMATION
 SERIES 54/74 AND 54S/74S DEVICES



NOTES:

- A. C_L includes probe and jig capacitance.
- B. All diodes are 1N3064 or equivalent.
- C. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
- D. S1 and S2 are closed for t_{PLH} , t_{PHL} , t_{PHZ} , and t_{PLZ} ; S1 is open and S2 is closed for t_{PZH} ; S1 is closed and S2 is open for t_{PLH} .
- E. All input pulses are supplied by generators having the following characteristics: $PRR \leq 1 \text{ MHz}$, $Z_O \approx 50 \Omega$, t_r and $t_f \leq 7 \text{ ns}$ for Series 54/74 devices and t_r and $t_f \leq 2.5 \text{ ns}$ for Series 54S/74S devices.
- F. The outputs are measured one at a time with one input transition per measurement.

Figure 1. Load Circuits and Voltage Waveforms

PARAMETER MEASUREMENT INFORMATION
SERIES 54LS/74LS DEVICES

NOTES:

- C_L includes probe and jig capacitance.
- All diodes are 1N3064 or equivalent.
- Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
- S1 and S2 are closed for t_{PLH} , t_{PHL} , t_{PHZ} , and t_{PLZ} ; S1 is open and S2 is closed for t_{PZH} ; S1 is closed and S2 is open for t_{PZL} .
- Phase relationships between inputs and outputs have been chosen arbitrarily for these examples.
- All input pulses are supplied by generators having the following characteristics: $PRR \leq 1 \text{ MHz}$, $Z_O \approx 50 \Omega$, $t_r \leq 15 \text{ ns}$, $t_f \leq 6 \text{ ns}$.
- The outputs are measured one at a time with one input transition per measurement.

Figure 2. Load Circuits and Voltage Waveforms

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 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.

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
Data Converters	dataconverter.ti.com
DSP	dsp.ti.com
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
Low Power Wireless	www.ti.com/lpw
	Audio www.ti.com/audio
	Automotive www.ti.com/automotive
	Broadband www.ti.com/broadband
	Digital Control www.ti.com/digitalcontrol
	Military www.ti.com/military
	Optical Networking www.ti.com/opticalnetwork
	Security www.ti.com/security
	Telephony www.ti.com/telephony
	Video & Imaging www.ti.com/video
	Wireless www.ti.com/wireless

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2007, Texas Instruments Incorporated

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
JM38510/36101B2A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
JM38510/36101BEA	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type
JM38510/36101BFA	ACTIVE	CFP	W	16	1	TBD	A42	N / A for Pkg Type
JM38510/36101SEA	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type
JM38510/36101SFA	ACTIVE	CFP	W	16	1	TBD	A42	N / A for Pkg Type
SN54173J	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type
SN54LS173AJ	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type
SN74173N	OBsolete	PDIP	N	16		TBD	Call TI	Call TI
SN74LS173AD	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS173ADE4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS173ADG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS173AN	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74LS173ANE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SNJ54173J	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type
SNJ54173W	OBsolete	CFP	W	16		TBD	Call TI	Call TI
SNJ54LS173AFK	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
SNJ54LS173AJ	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type
SNJ54LS173AW	ACTIVE	CFP	W	16	1	TBD	A42	N / A for Pkg Type

⁽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

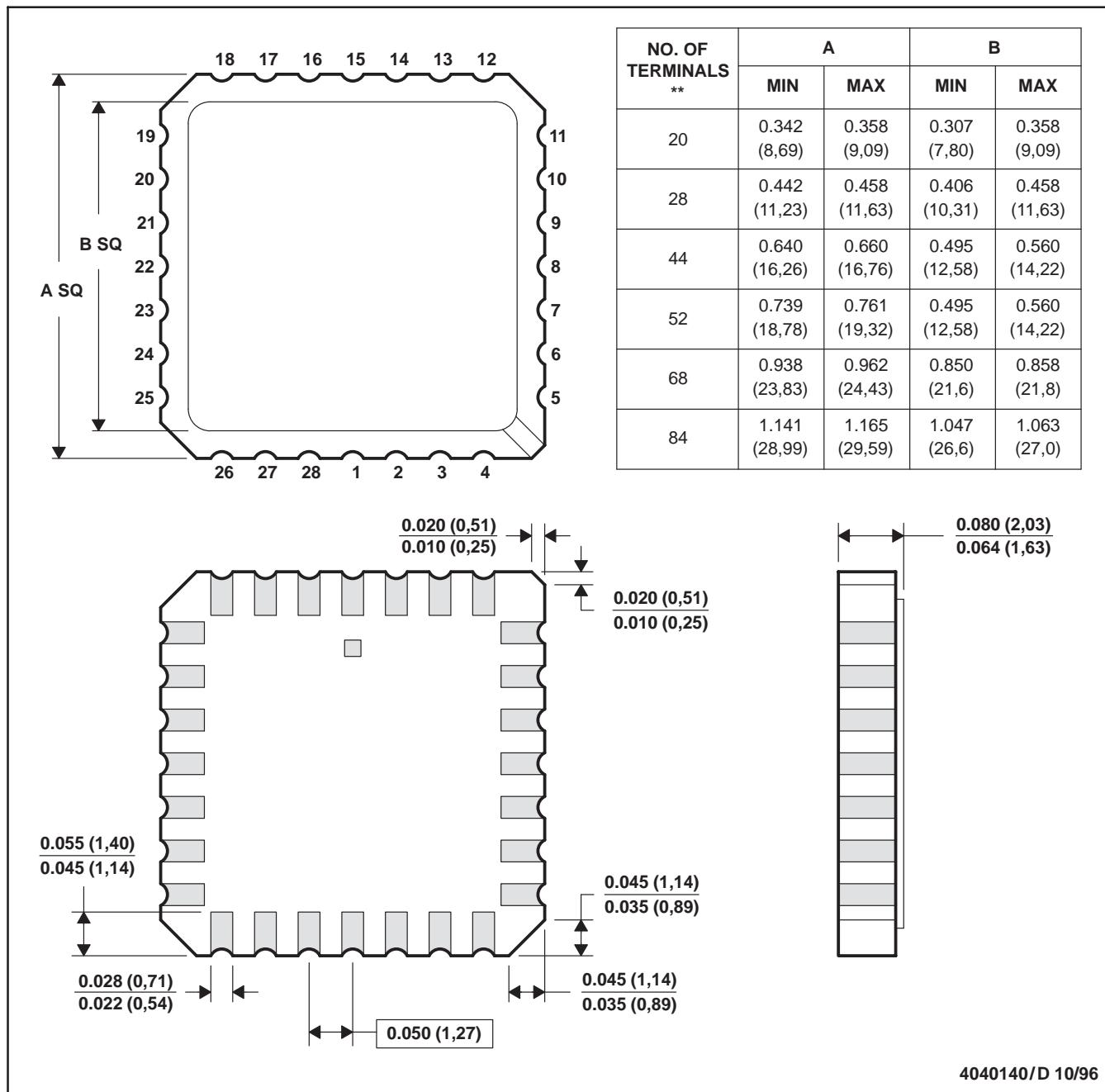
incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

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.

FK (S-CQCC-N**)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



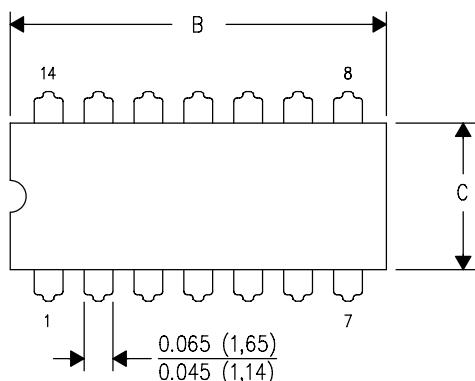
NOTES:

- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- C. This package can be hermetically sealed with a metal lid.
- D. The terminals are gold plated.
- E. Falls within JEDEC MS-004

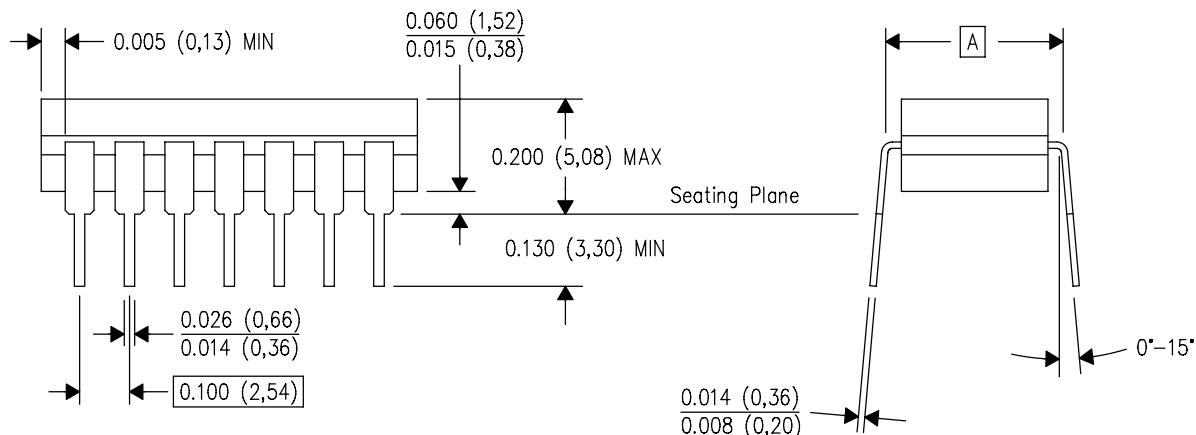
J (R-GDIP-T**)

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)

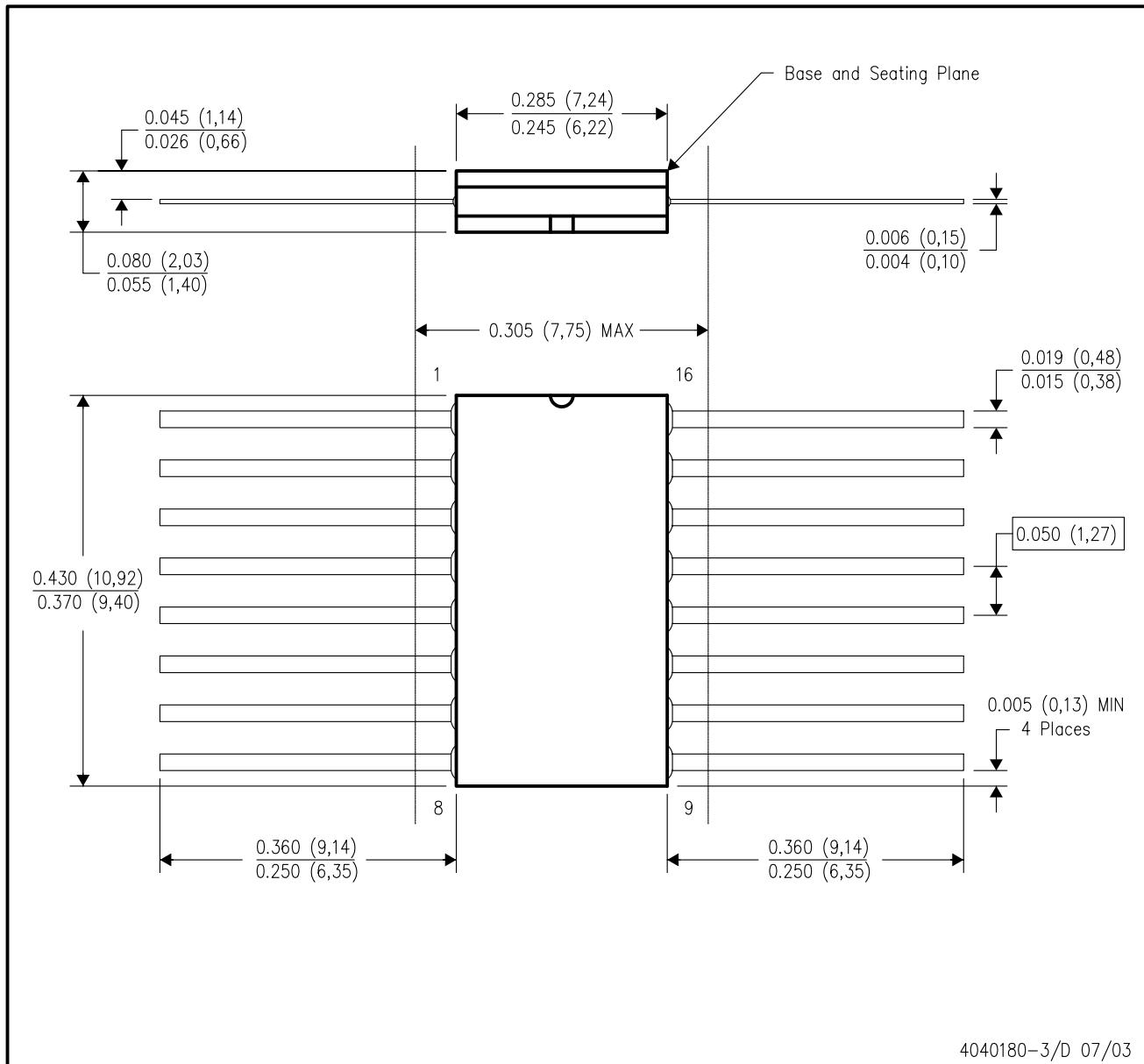


4040083/F 03/03

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-F16)

CERAMIC DUAL FLATPACK

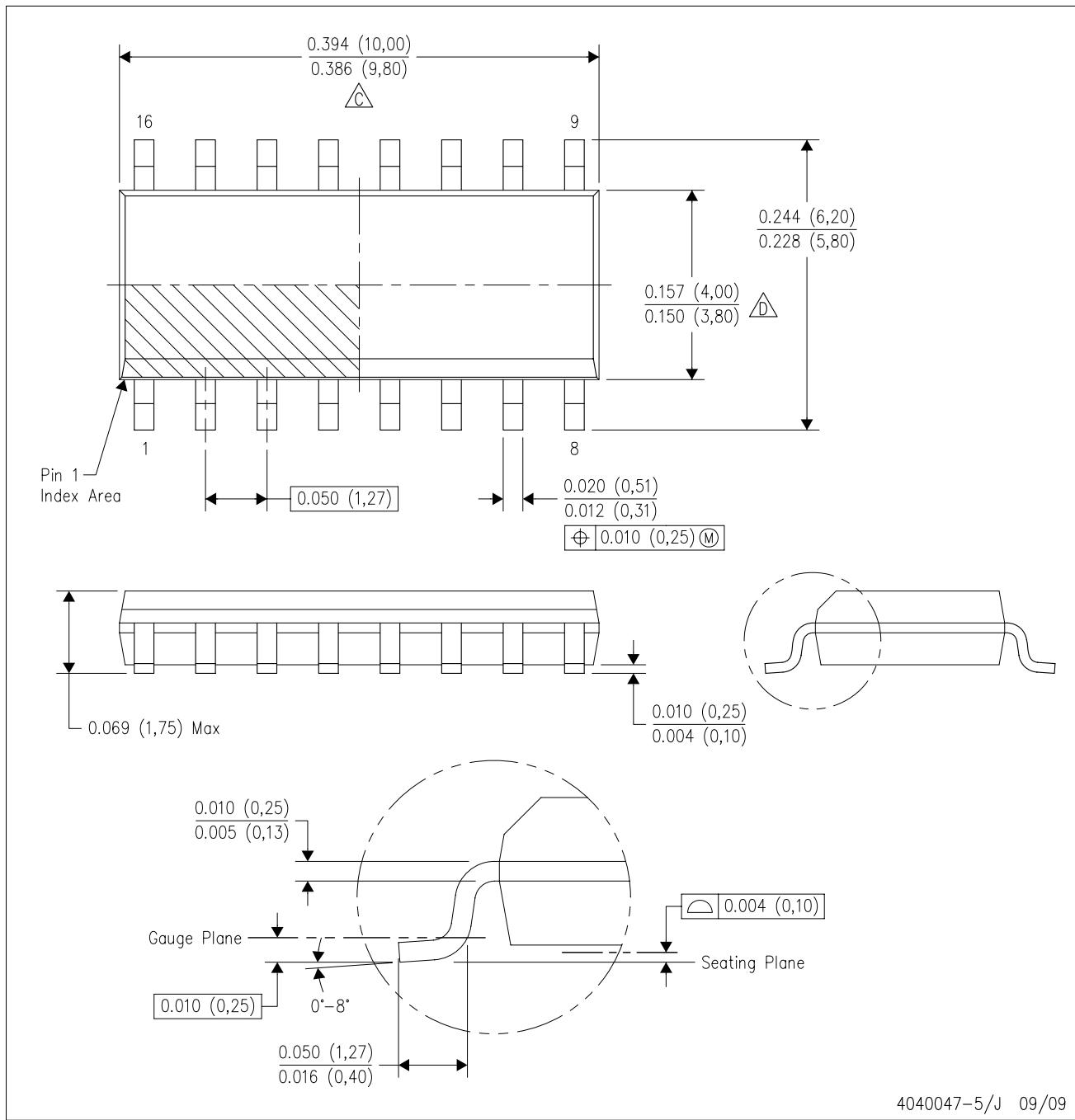


NOTES:

- 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-F16 and JEDEC MO-092AC

D (R-PDSO-G16)

PLASTIC SMALL-OUTLINE PACKAGE



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

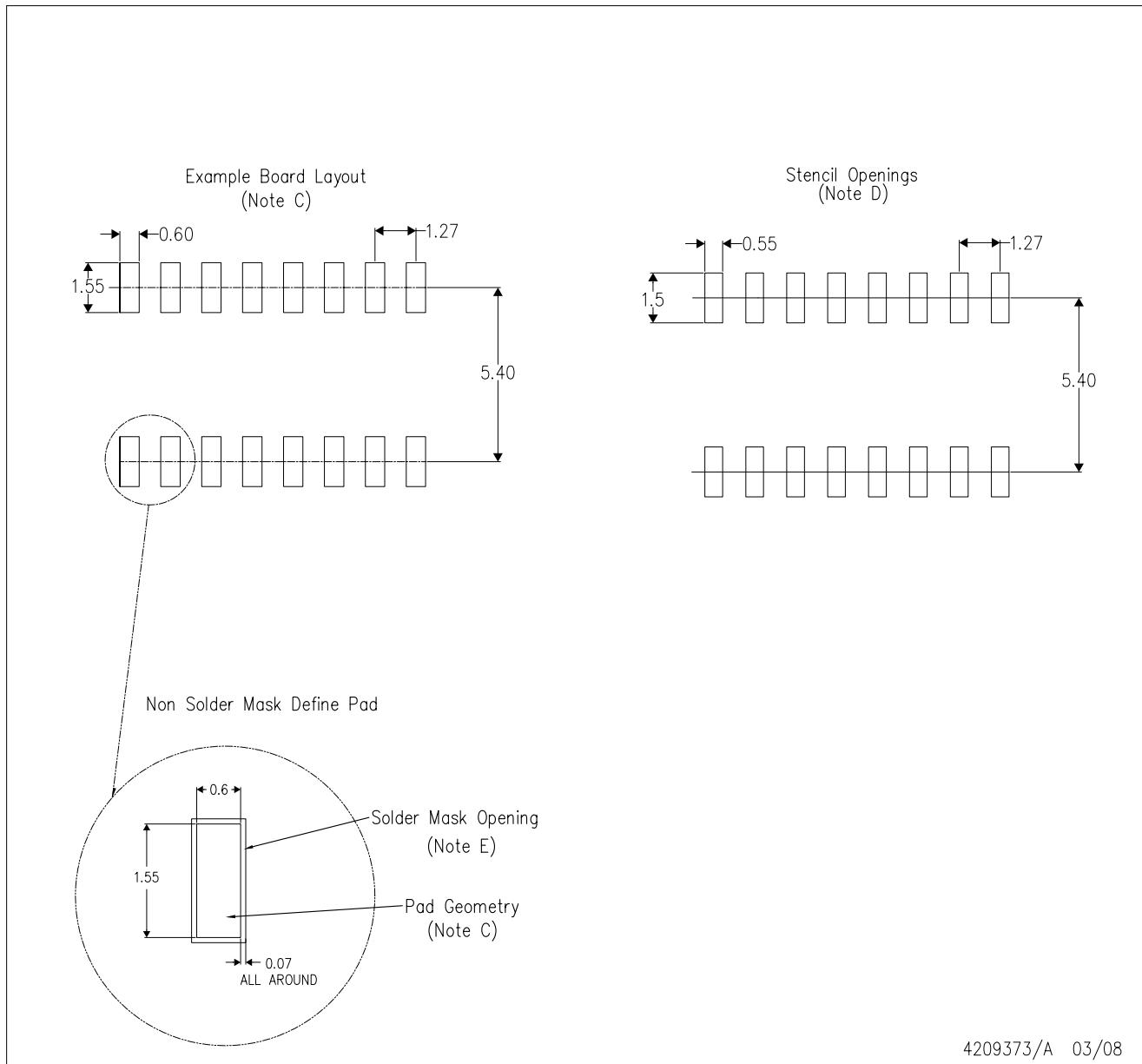
B. This drawing is subject to change without notice.

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.

D(R-PDSO-G16)



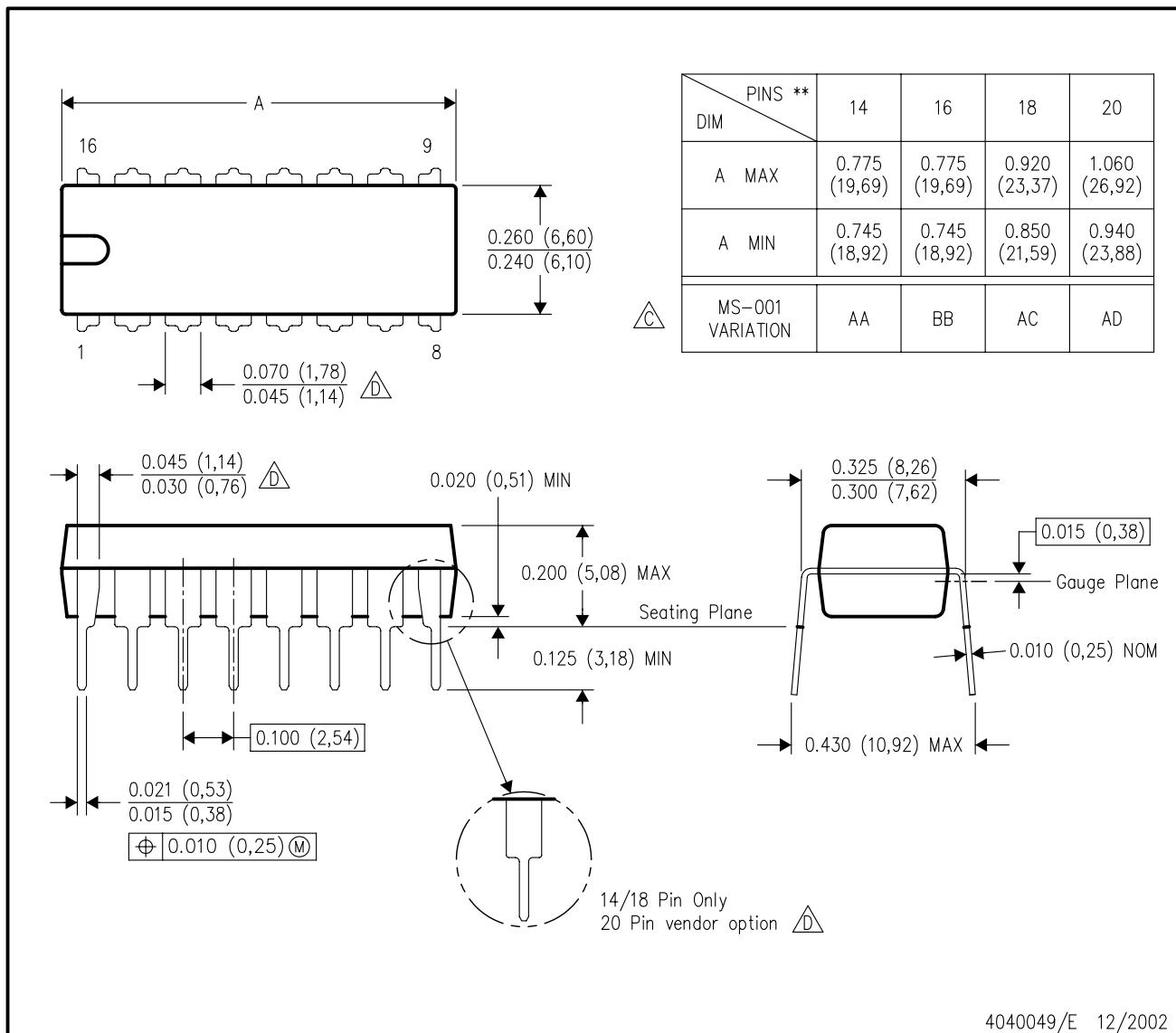
NOTES:

- All linear dimensions are in millimeters.
- This drawing is subject to change without notice.
- Refer to IPC7351 for alternate board design.
- Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525
- Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

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.

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