

# SN55138, SN75138 QUADRUPLE BUS TRANSCEIVERS

SLLS079B – SEPTEMBER 1973 – REVISED MAY 1995

- Single 5-V Supply
- High-Input-Impedance, High-Threshold Receivers
- Common Driver Strobe
- TTL-Compatible Driver and Strobe Inputs With Clamp Diodes
- High-Speed Operation
- 100-mA Open-Collector Driver Outputs
- Four Independent Channels
- TTL-Compatible Receiver Output

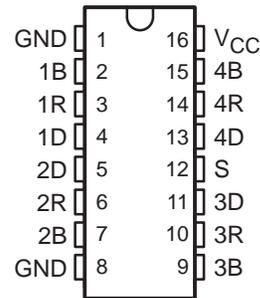
## description

The SN55138 and SN75138 quadruple bus transceivers are designed for two-way data communication over single-ended transmission lines. Each of the four identical channels consists of a driver with TTL inputs and a receiver with a TTL output. The driver open-collector output is designed to handle loads up to 100-mA open collector. The receiver input is internally connected to the driver output, and has a high impedance to minimize loading of the transmission line. Because of the high driver-output current and the high receiver-input impedance, a very large number (typically hundreds) of transceivers may be connected to a single data bus.

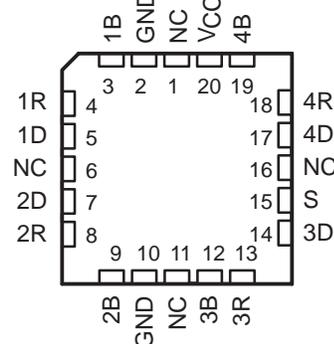
The receiver design also features a threshold of 2.3 V (typical), providing a wider noise margin than would be possible with a receiver having the usual TTL threshold. A strobe turns off all drivers (high impedance) but does not affect receiver operation. These circuits are designed for operation from a single 5-V supply and include a provision to minimize loading of the data bus when the power-supply voltage is zero.

The SN55138 is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN75138 is characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

SN55138 . . . J OR W PACKAGE  
SN75138 . . . D OR N PACKAGE  
(TOP VIEW)



SN55138 . . . FK PACKAGE  
(TOP VIEW)



NC – No internal connection



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.

 **TEXAS  
INSTRUMENTS**

POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

Copyright © 1995, Texas Instruments Incorporated

# SN55138, SN75138 QUADRUPLE BUS TRANSCEIVERS

SLLS079B – SEPTEMBER 1973 – REVISED MAY 1995

## Function Tables

### TRANSMITTING

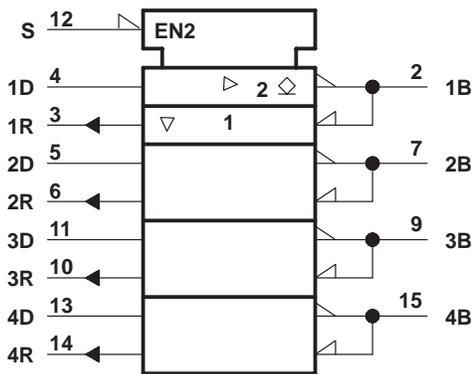
INPUTS		OUTPUTS	
S	D	B	R
L	H	L	H
L	L	H	L

### RECEIVING

INPUTS			OUTPUT
S	B	D	R
H	H	X	L
H	L	X	H

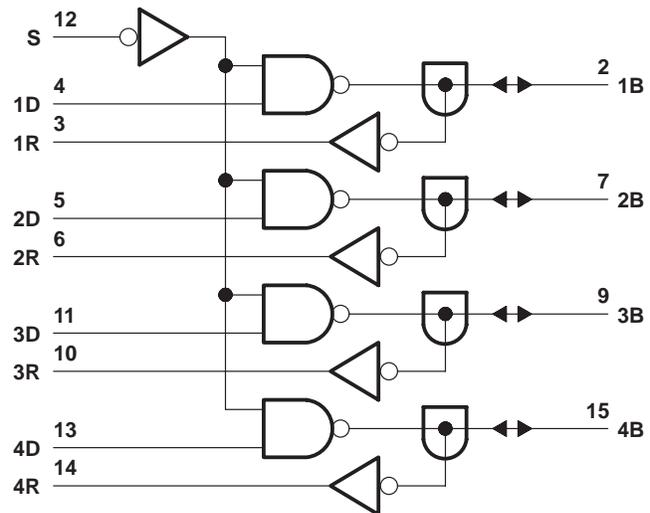
H = high level, L = low level, X = irrelevant

### logic symbol†

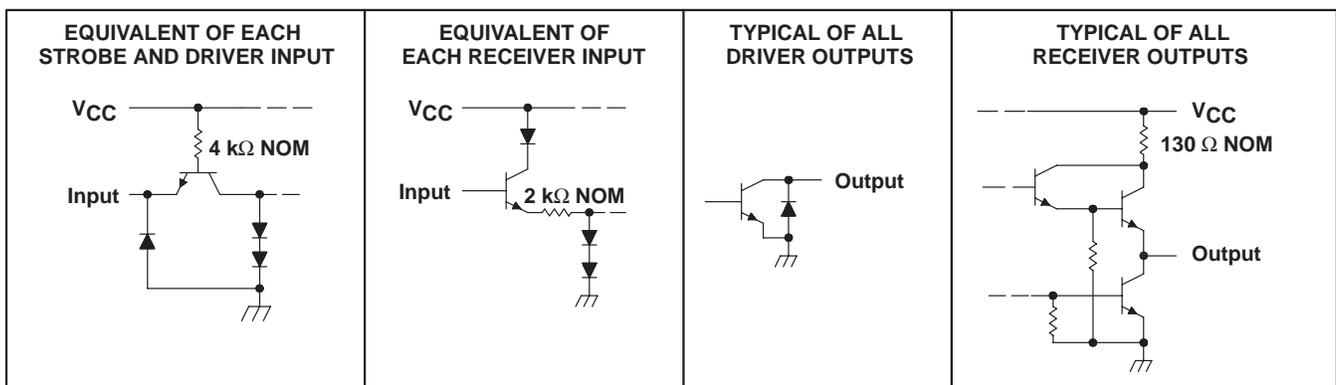


† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12. Pin numbers shown are for D, J, N, and W packages.

### logic diagram (positive logic)



### schematics of inputs and outputs



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

Supply voltage, $V_{CC}$ (see Note 1) .....	7 V
Input voltage, $V_I$ .....	5.5 V
Driver off-state output voltage .....	7 V
Low-level output current into the driver output .....	150 mA
Continuous total dissipation .....	See Dissipation Rating Table
Operating free-air temperature range, $T_A$ : SN55138 .....	–55°C to 125°C
SN75138 .....	0°C to 70°C
Storage temperature range, $T_{stg}$ .....	–65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds: D, N, or W package .....	260°C
Case temperature for 60 seconds, $T_C$ : FK package .....	260°C
Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds: J package .....	300°C

† 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.

NOTE 1: All voltage values are with respect to both ground terminals connected together.

**DISSIPATION RATING TABLE**

PACKAGE	$T_A \leq 25^\circ\text{C}$	DERATING FACTOR	$T_A = 70^\circ\text{C}$	$T_A = 125^\circ\text{C}$
	POWER RATING	ABOVE $T_A = 25^\circ\text{C}$	POWER RATING	POWER RATING
D	950 mW	7.6 mW/°C	608 mW	—
FK‡	1375 mW	11.0 mW/°C	880 mW	275 mW
J‡	1375 mW	11.0 mW/°C	880 mW	275 mW
N	1150 mW	9.2 mW/°C	736 mW	—
W	1000 mW	8.0 mW/°C	640 mW	200 mW

‡ In the FK and J packages, the SN55138 chip is alloy mounted.

**recommended operating conditions**

		SN55138			SN75138			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, $V_{CC}$		4.5		5.5	4.75	5	5.25	V
High-level input voltage, $V_{IH}$	Driver or strobe	2			2			V
	Receiver	3.2			2.9			
Low-level input voltage, $V_{IL}$	Driver or strobe			0.8			0.8	V
	Receiver			1.5			1.8	
High-level output current, $I_{OH}$	Receiver output			–400			–400	μA
Low-level output current, $I_{OL}$	Driver output			100			100	mA
	Receiver output			16			16	
Operating free-air temperature, $T_A$		–55		125	0		70	°C

# SN55138, SN75138 QUADRUPLE BUS TRANSCEIVERS

SLLS079B – SEPTEMBER 1973 – REVISED MAY 1995

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

PARAMETER			TEST CONDITIONS†		SN55138			SN75138			UNIT	
					MIN	TYP‡	MAX	MIN	TYP‡	MAX		
V <sub>IK</sub>	Input clamp voltage	Driver or strobe	V <sub>CC</sub> = MIN,	I <sub>I</sub> = -12 mA			-1.5			-1.5	V	
V <sub>OH</sub>	High-level output voltage	Receiver	V <sub>CC</sub> = MIN, V <sub>IL(R)</sub> = V <sub>IL</sub> max,	V <sub>IH(S)</sub> = 2 V, I <sub>OH</sub> = -400 μA	2.4	3.5		2.4	3.5		V	
V <sub>OL</sub>	Low-level output voltage	Driver	V <sub>CC</sub> = MIN, V <sub>IL(S)</sub> = 0.8 V,	V <sub>IH(D)</sub> = 2 V, I <sub>OL</sub> = 100 mA			0.45			0.45	V	
		Receiver	V <sub>CC</sub> = MIN, V <sub>IH(S)</sub> = 2 V,	V <sub>IH(R)</sub> = V <sub>IH</sub> min, I <sub>OL</sub> = 16 mA			0.4			0.4		
I <sub>I(max)</sub>	Input current at maximum input voltage	Driver or strobe	V <sub>CC</sub> = MAX,	V <sub>I</sub> = V <sub>CC</sub>			1			1	mA	
I <sub>IH</sub>	High-level input current	Driver or strobe	V <sub>CC</sub> = MAX,	V <sub>I</sub> = 2.4 V			40			40	μA	
		Receiver	V <sub>CC</sub> = 5 V, V <sub>I(S)</sub> = 2 V	V <sub>I(R)</sub> = 4.5 V,			25	300		25		300
I <sub>IL</sub>	Low-level input current	Driver or strobe	V <sub>CC</sub> = MAX,	V <sub>I</sub> = 0.4 V			-1	-1.6		-1	-1.6	mA
		Receiver	V <sub>CC</sub> = MAX, V <sub>I(S)</sub> = 2 V	V <sub>I(R)</sub> = 0.45 V,				-50			-50	μA
I <sub>I(off)</sub>	Input current with power off	Receiver	V <sub>CC</sub> = 0,	V <sub>I</sub> = 4.5 V			1.1	1.5		1.1	1.5	mA
I <sub>OS</sub>	Short-circuit output current§	Receiver	V <sub>CC</sub> = MAX				-20	-55		-18	-55	mA
I <sub>CC</sub>	Supply current	All driver outputs low	V <sub>CC</sub> = MAX, V <sub>I(S)</sub> = 0.8 V	V <sub>I(D)</sub> = 2 V,			50	65		50	65	mA
		All driver outputs high	V <sub>CC</sub> = MAX, V <sub>I(S)</sub> = 2 V, Receiver outputs open	V <sub>I(R)</sub> = 3.5 V,			42	55		42	55	

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions. Parenthetical letters D, R, and S used with V<sub>I</sub> refer to the driver input, receiver input, and strobe input, respectively.

‡ All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C.

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

## switching characteristics, V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C

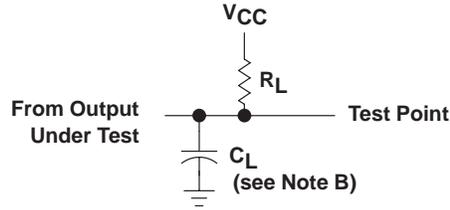
PARAMETER†	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS			MIN	TYP	MAX	UNIT
t <sub>PLH</sub>	Driver	Driver	C <sub>L</sub> = 50 pF, R <sub>L</sub> = 50 Ω,	See Figure 1		15	24	ns	
t <sub>PHL</sub>						14	24		
t <sub>PLH</sub>	Strobe	Driver					18	28	ns
t <sub>PHL</sub>						22	32		
t <sub>PLH</sub>	Receiver	Receiver	C <sub>L</sub> = 15 pF, R <sub>L</sub> = 400 Ω,	See Figure 2		7	15	ns	
t <sub>PHL</sub>						8	15		

† t<sub>PLH</sub> = propagation delay time, low- to high-level output

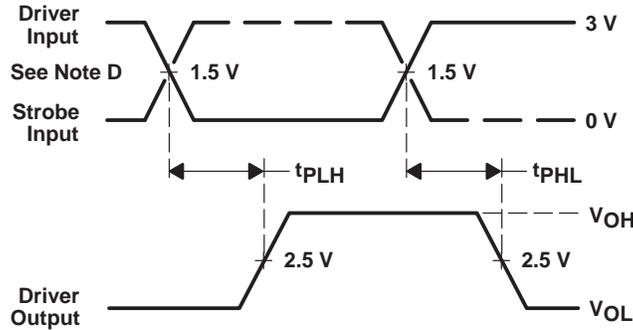
t<sub>PHL</sub> = propagation delay time, high- to low-level output



PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT



VOLTAGE WAVEFORMS

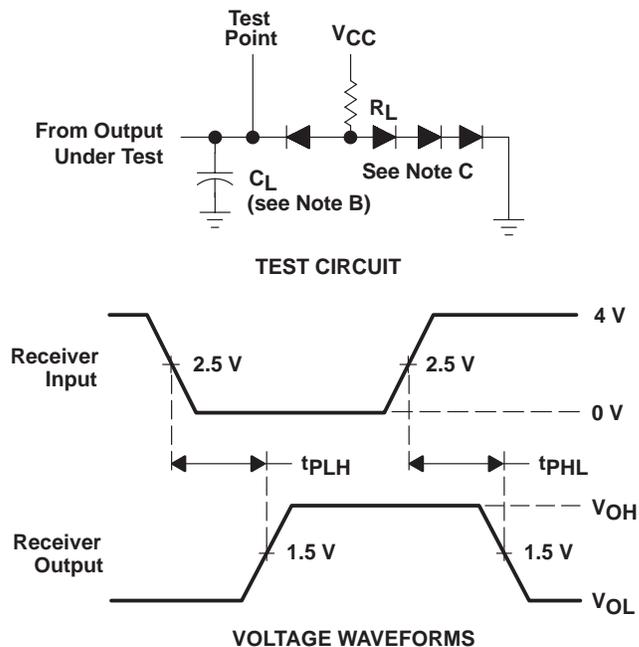
- NOTES: A. Input pulses are supplied by generators having the following characteristics:  $t_w = 100$  ns,  $PRR \leq 1$  MHz,  $t_r \leq 10$  ns,  $t_f \leq 10$  ns,  $Z_O \approx 50 \Omega$ .
- B.  $C_L$  includes probe and jig capacitance.
- C. All diodes are 1N916 or 1N3064.
- D. When testing driver input (solid line) strobe must be low; when testing strobe input (dashed line) driver input must be high.

Figure 1. Propagation Delay Times From Data and Strobe Inputs

# SN55138, SN75138 QUADRUPLE BUS TRANSCEIVERS

SLLS079B – SEPTEMBER 1973 – REVISED MAY 1995

## PARAMETER MEASUREMENT INFORMATION



- NOTES: A. Input pulses are supplied by generators having the following characteristics:  $t_W = 100$  ns,  $PRR \leq 1$  MHz,  $t_r \leq 10$  ns,  $t_f \leq 10$  ns,  $Z_O \approx 50 \Omega$ .
- B.  $C_L$  includes probe and jig capacitance.
- C. All diodes are 1N916 or 1N3064.
- D. When testing driver input (solid line) strobe must be low; when testing strobe input (dashed line) driver input must be high.

Figure 2. Propagation Delay Times From Receiver Input

TYPICAL CHARACTERISTICS†

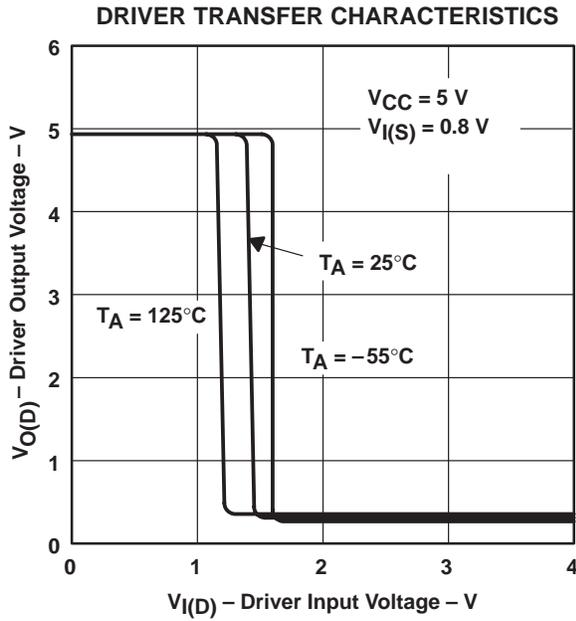


Figure 3

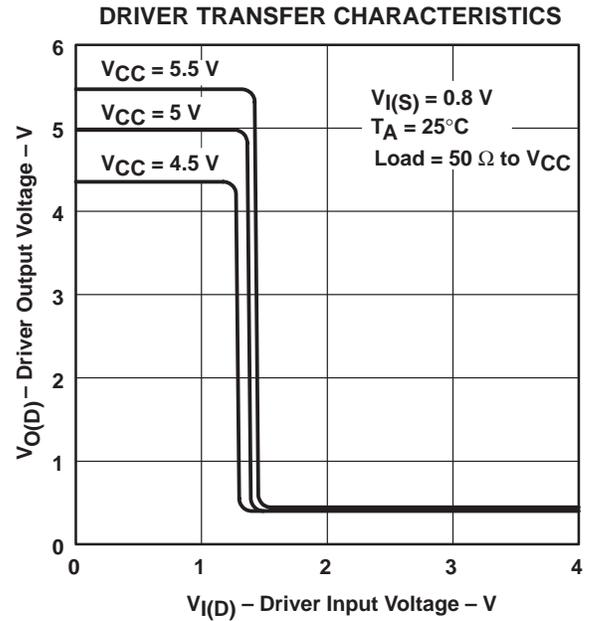


Figure 4

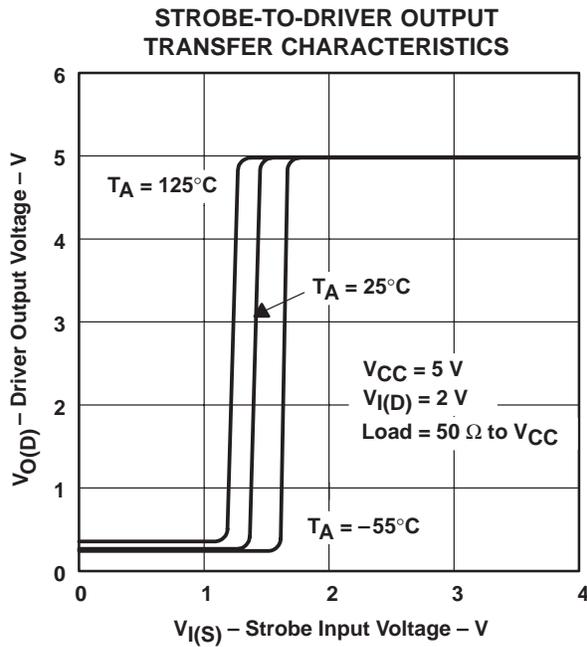


Figure 5

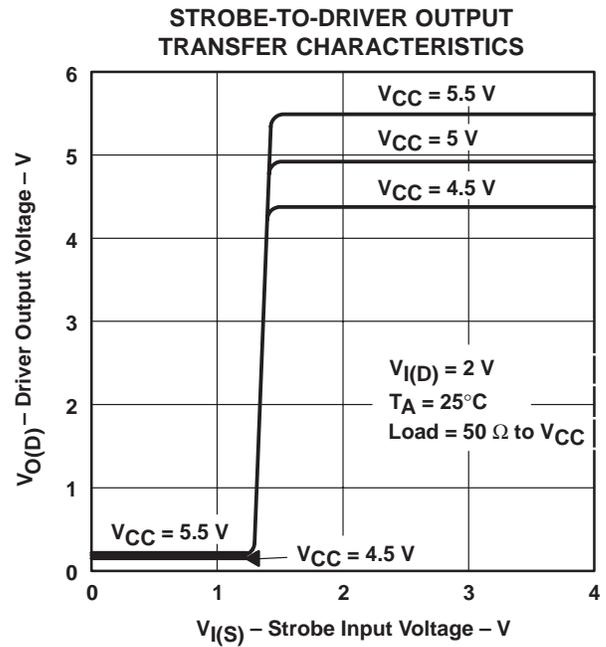


Figure 6

† Data for temperatures below  $0^\circ\text{C}$  and above  $70^\circ\text{C}$  is applicable to SN55138 circuits only.

# SN55138, SN75138 QUADRUPLE BUS TRANSCEIVERS

SLLS079B – SEPTEMBER 1973 – REVISED MAY 1995

## TYPICAL CHARACTERISTICS†

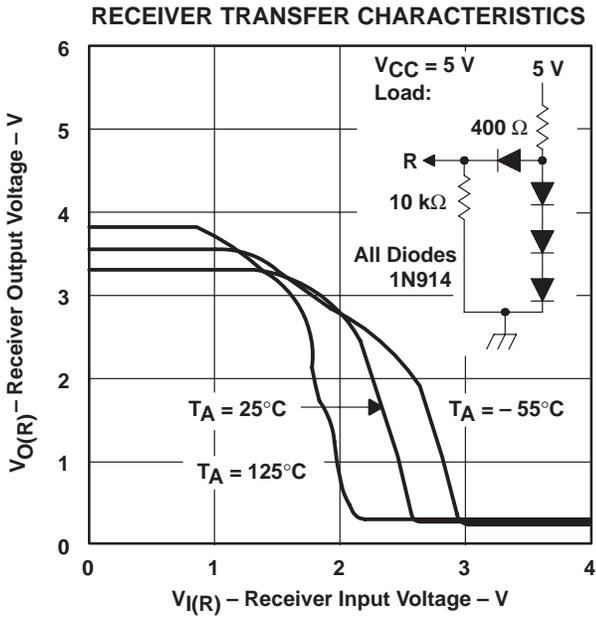


Figure 7

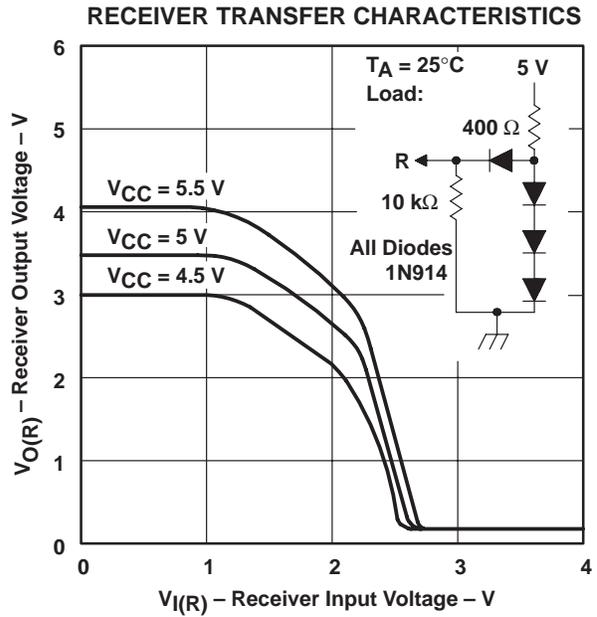


Figure 8

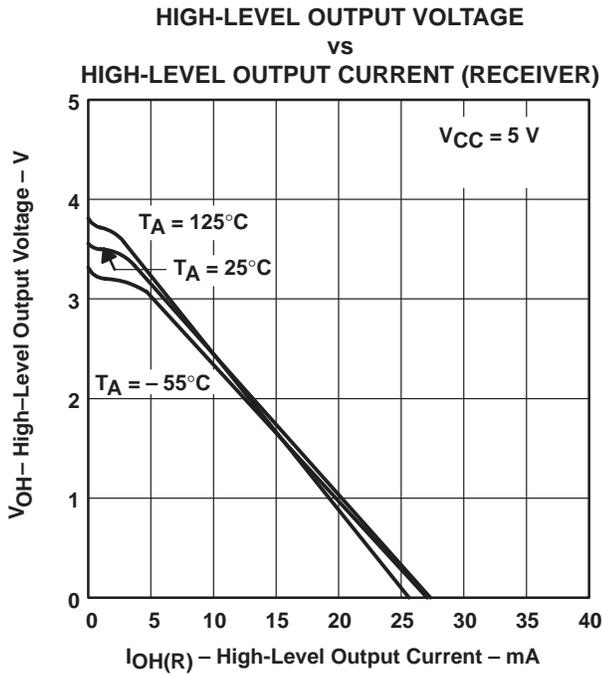


Figure 9

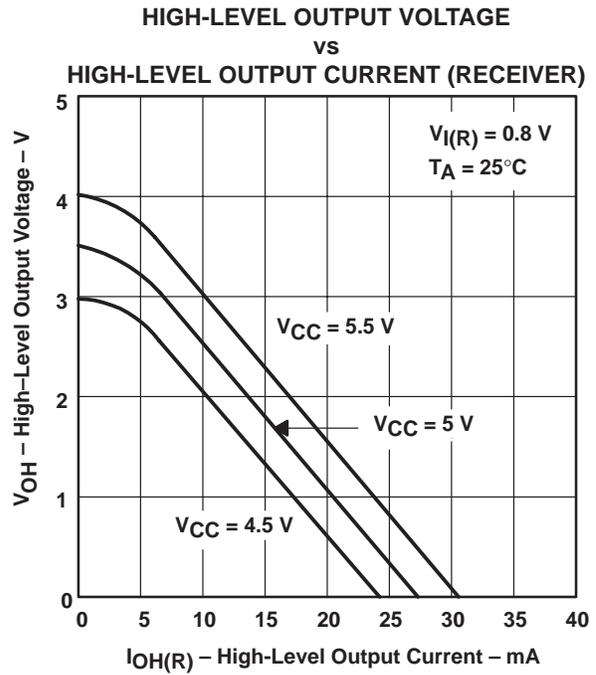


Figure 10

† Data for temperatures below 0°C and above 70°C is applicable to SN55138 circuits only.

TYPICAL CHARACTERISTICS†

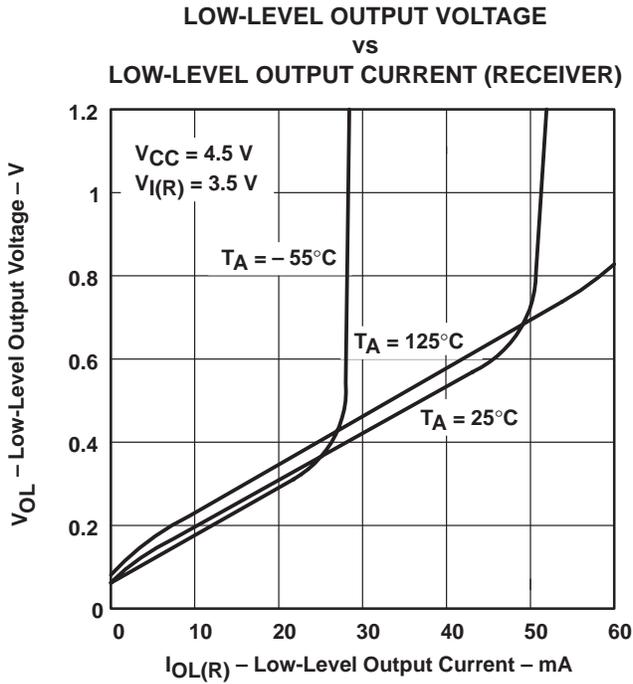


Figure 11

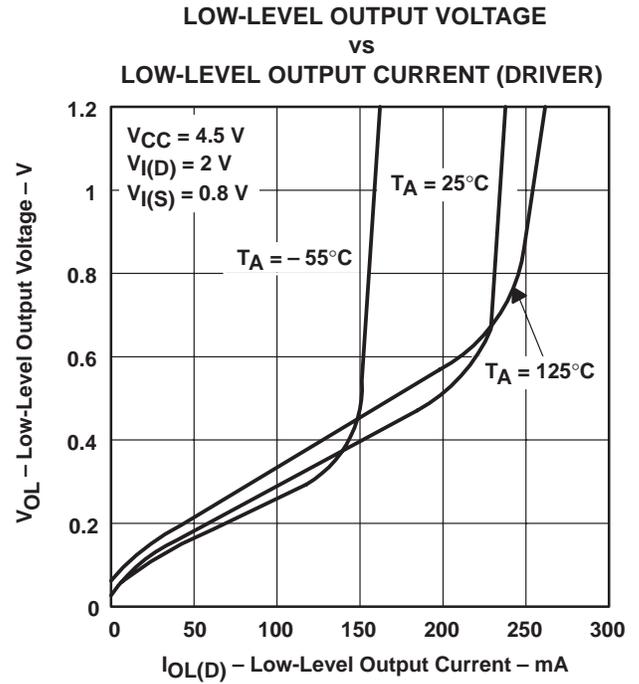


Figure 12

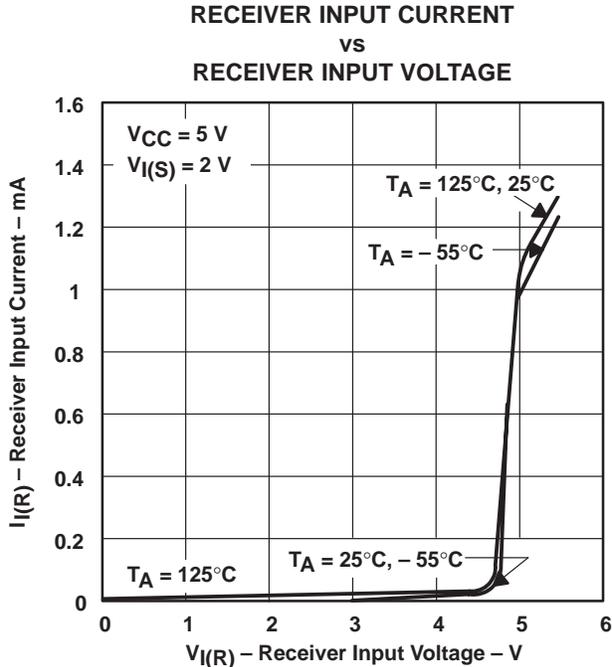


Figure 13

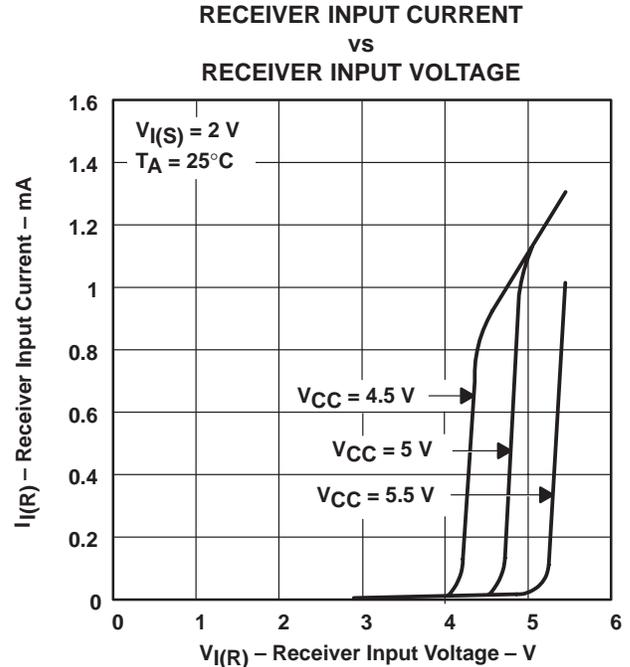


Figure 14

† Data for temperatures below 0°C and above 70°C is applicable to SN55138 circuits only.

TYPICAL CHARACTERISTICS†

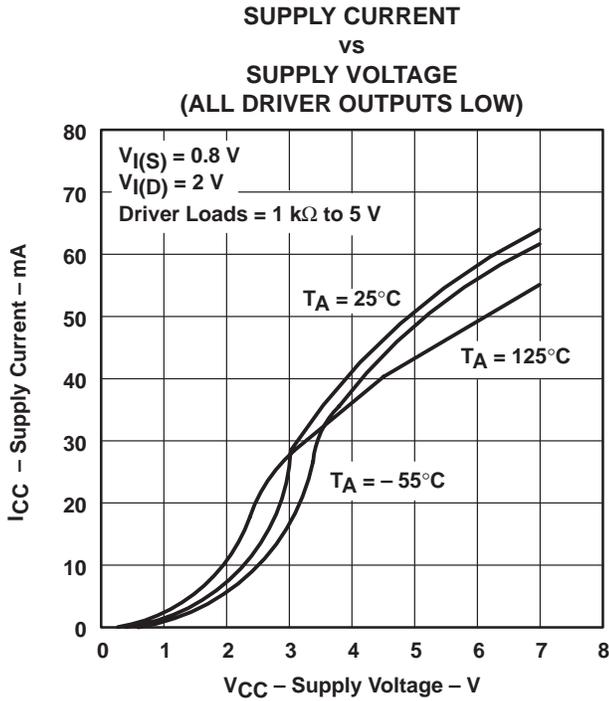


Figure 15

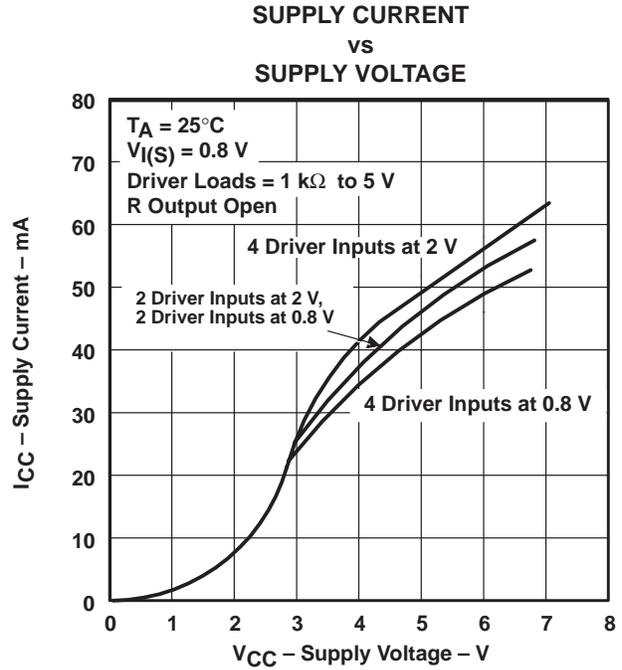


Figure 16

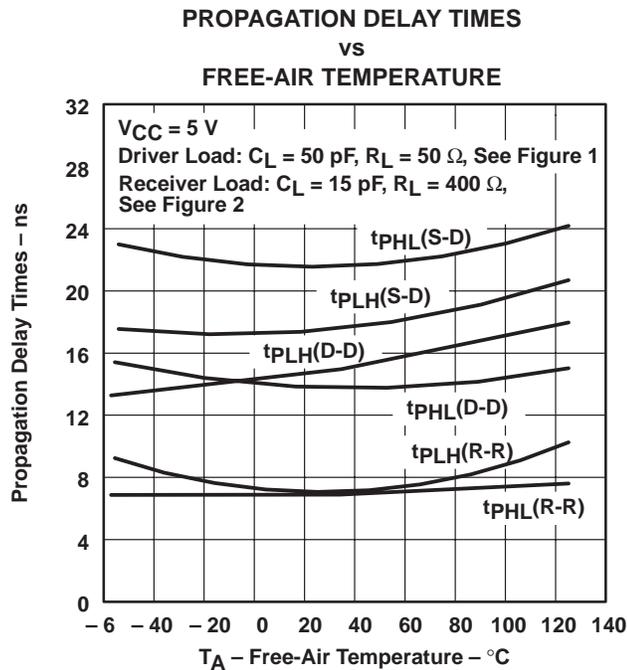


Figure 17

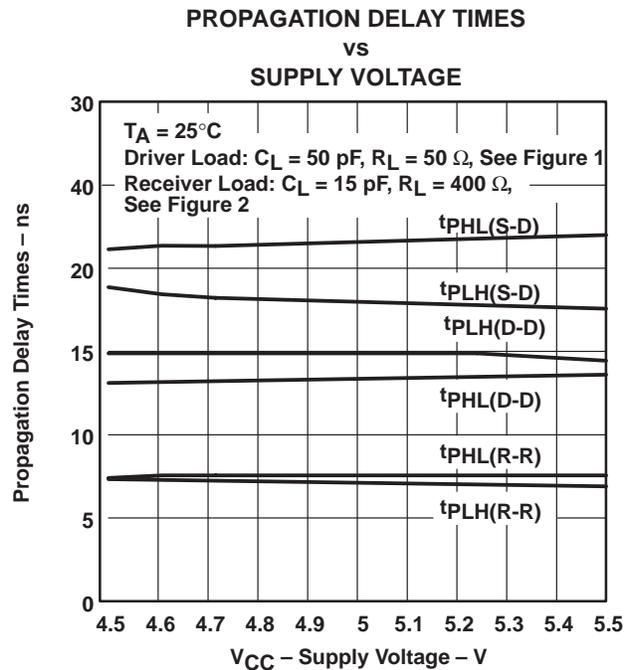
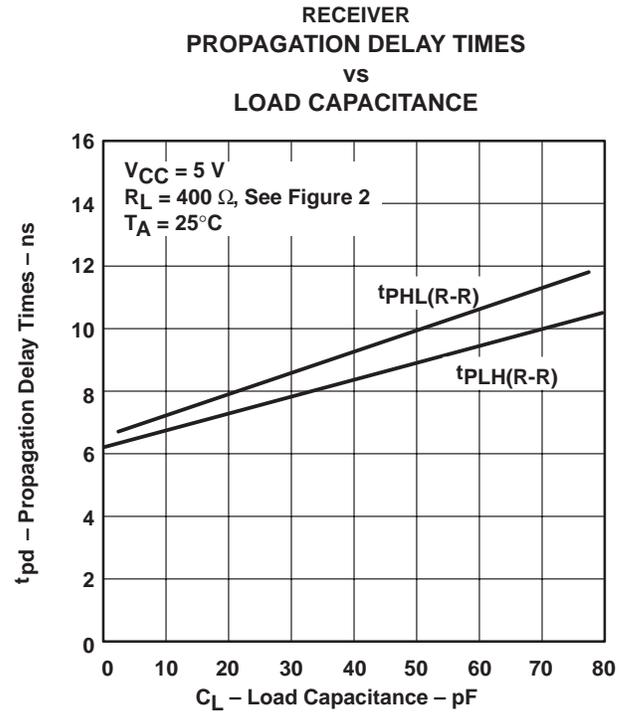
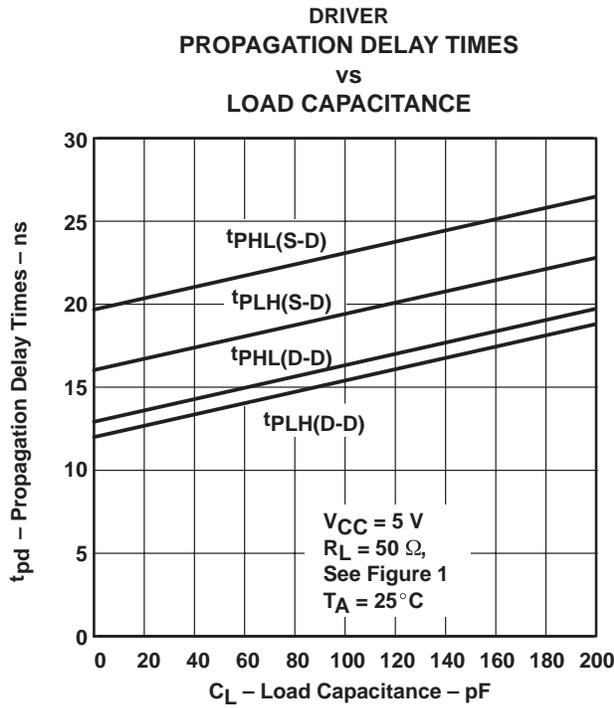


Figure 18

† Data for temperatures below 0°C and above 70°C is applicable to SN55138 circuits only.

TYPICAL CHARACTERISTICS



APPLICATION INFORMATION

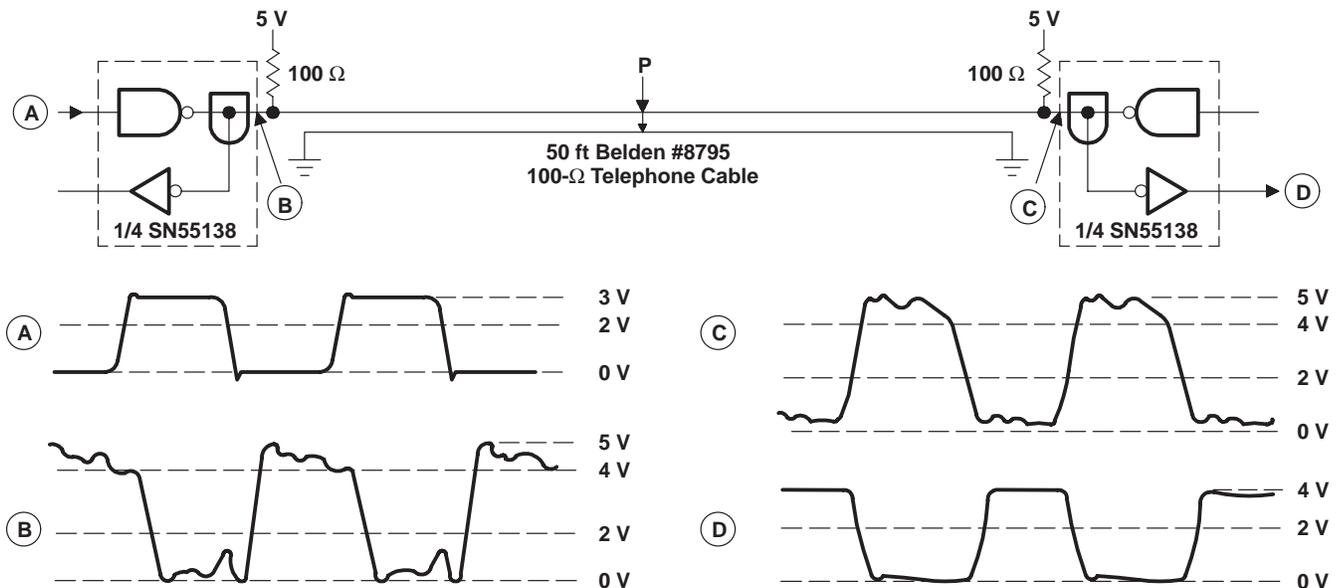
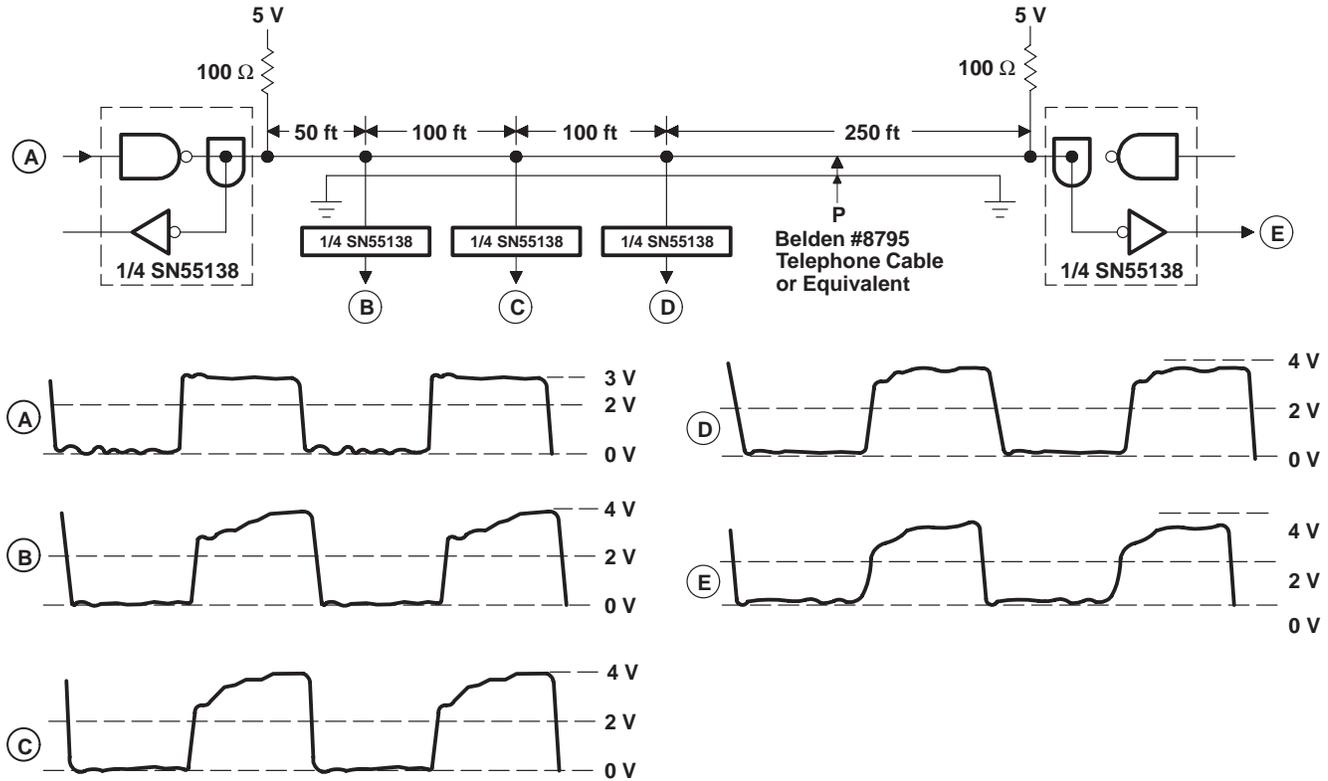


Figure 21. Point-to-Point Communication Over 50 Feet of Twisted Pair at 5 MHz

# SN55138, SN75138 QUADRUPLE BUS TRANSCEIVERS

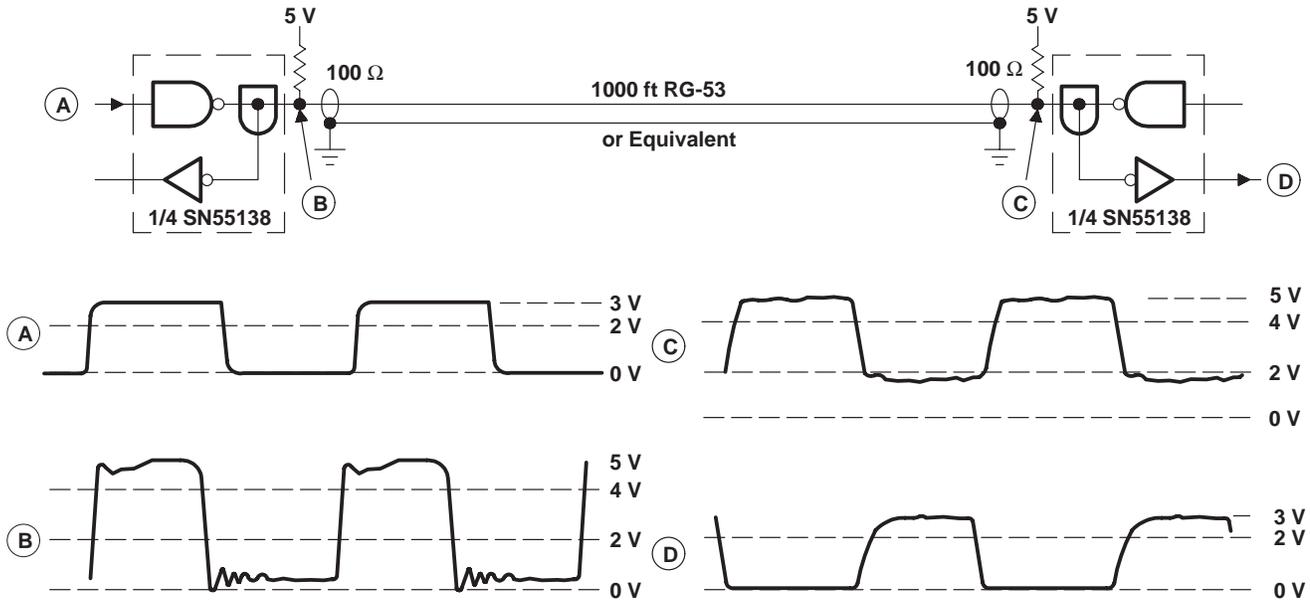
SLLS079B – SEPTEMBER 1973 – REVISED MAY 1995

## APPLICATION INFORMATION



TYPICAL VOLTAGE WAVEFORMS

Figure 22. Party-Line Communication on 500 Feet of Twisted Pair at 1 MHz



TYPICAL VOLTAGE WAVEFORMS

Figure 23. Point-to-Point Communication Over 1000 Feet of Coaxial Cable at 1 MHz

## 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

Amplifiers	<a href="http://amplifier.ti.com">amplifier.ti.com</a>
Data Converters	<a href="http://dataconverter.ti.com">dataconverter.ti.com</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>
Low Power Wireless	<a href="http://www.ti.com/lpw">www.ti.com/lpw</a>

### Applications

Audio	<a href="http://www.ti.com/audio">www.ti.com/audio</a>
Automotive	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
Broadband	<a href="http://www.ti.com/broadband">www.ti.com/broadband</a>
Digital Control	<a href="http://www.ti.com/digitalcontrol">www.ti.com/digitalcontrol</a>
Military	<a href="http://www.ti.com/military">www.ti.com/military</a>
Optical Networking	<a href="http://www.ti.com/opticalnetwork">www.ti.com/opticalnetwork</a>
Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
Telephony	<a href="http://www.ti.com/telephony">www.ti.com/telephony</a>
Video & Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>
Wireless	<a href="http://www.ti.com/wireless">www.ti.com/wireless</a>

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

**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
SN55138J	OBSOLETE	CDIP	J	16		TBD	Call TI	Call TI
SN75138D	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75138DE4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75138DG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75138DR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75138DRE4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75138DRG4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75138N	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN75138NE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN75138NSR	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75138NSRE4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75138NSRG4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SNJ55138FK	OBSOLETE	LCCC	FK	20		TBD	Call TI	Call TI
SNJ55138J	OBSOLETE	CDIP	J	16		TBD	Call TI	Call TI
SNJ55138W	OBSOLETE	CFP	W	16		TBD	Call TI	Call TI

<sup>(1)</sup> The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), 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)

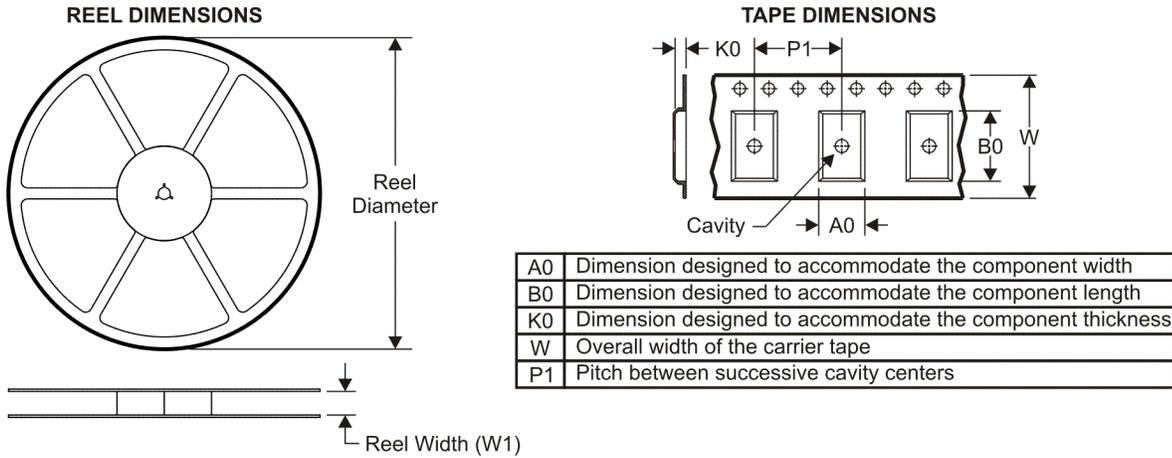
<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

**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

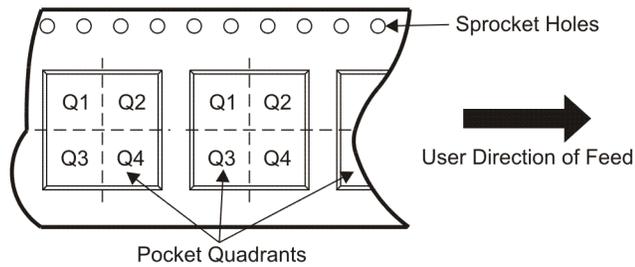
reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be 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.

**TAPE AND REEL INFORMATION**



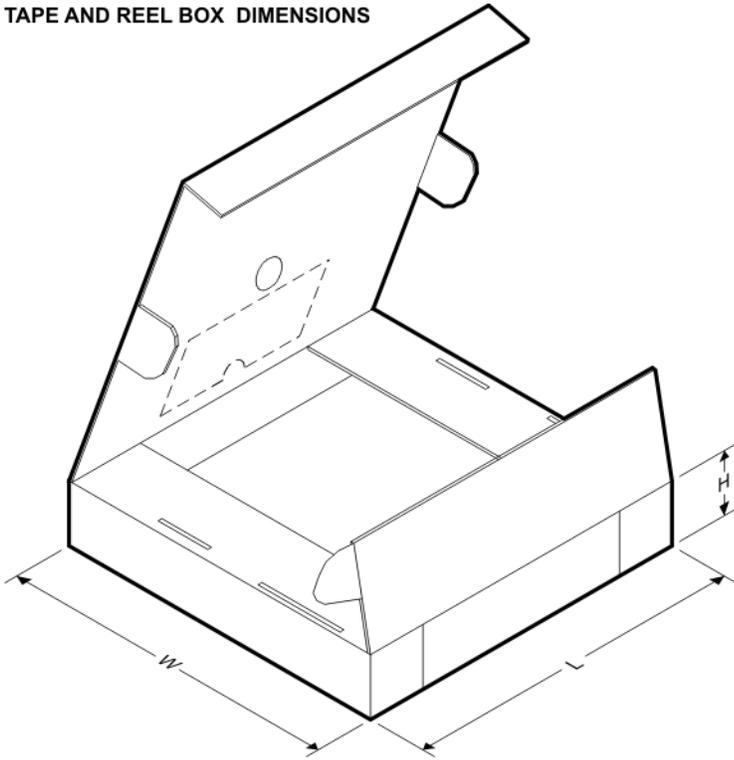
**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN75138DR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
SN75138NSR	SO	NS	16	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1

**TAPE AND REEL BOX DIMENSIONS**

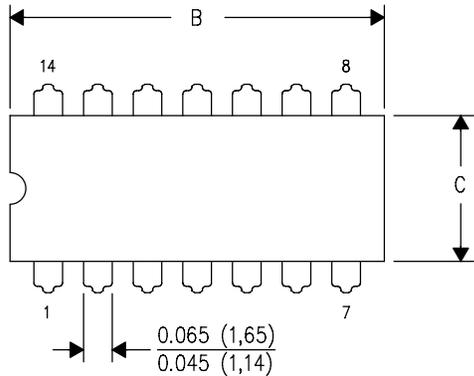


\*All dimensions are nominal

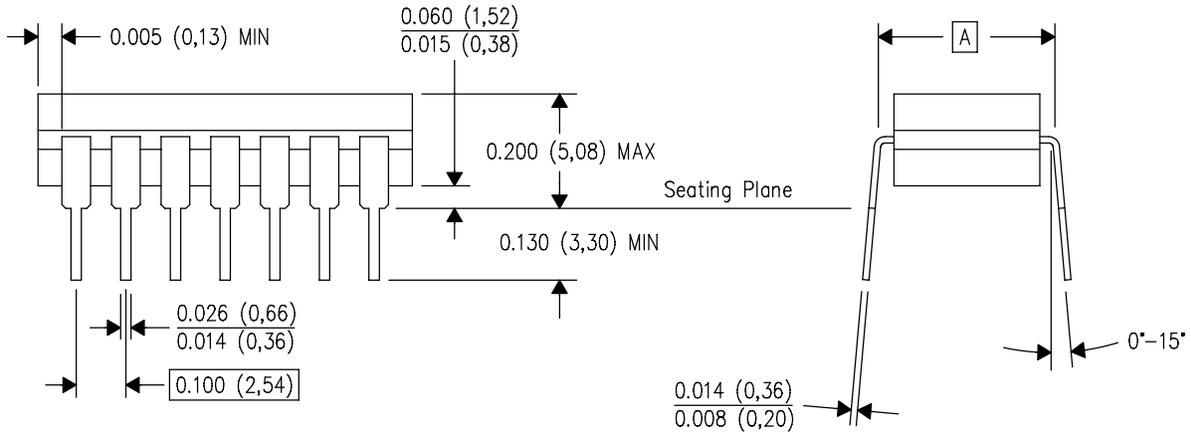
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN75138DR	SOIC	D	16	2500	342.9	345.9	28.6
SN75138NSR	SO	NS	16	2000	346.0	346.0	33.0

J (R-GDIP-T\*\*)  
14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



DIM \ PINS **	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

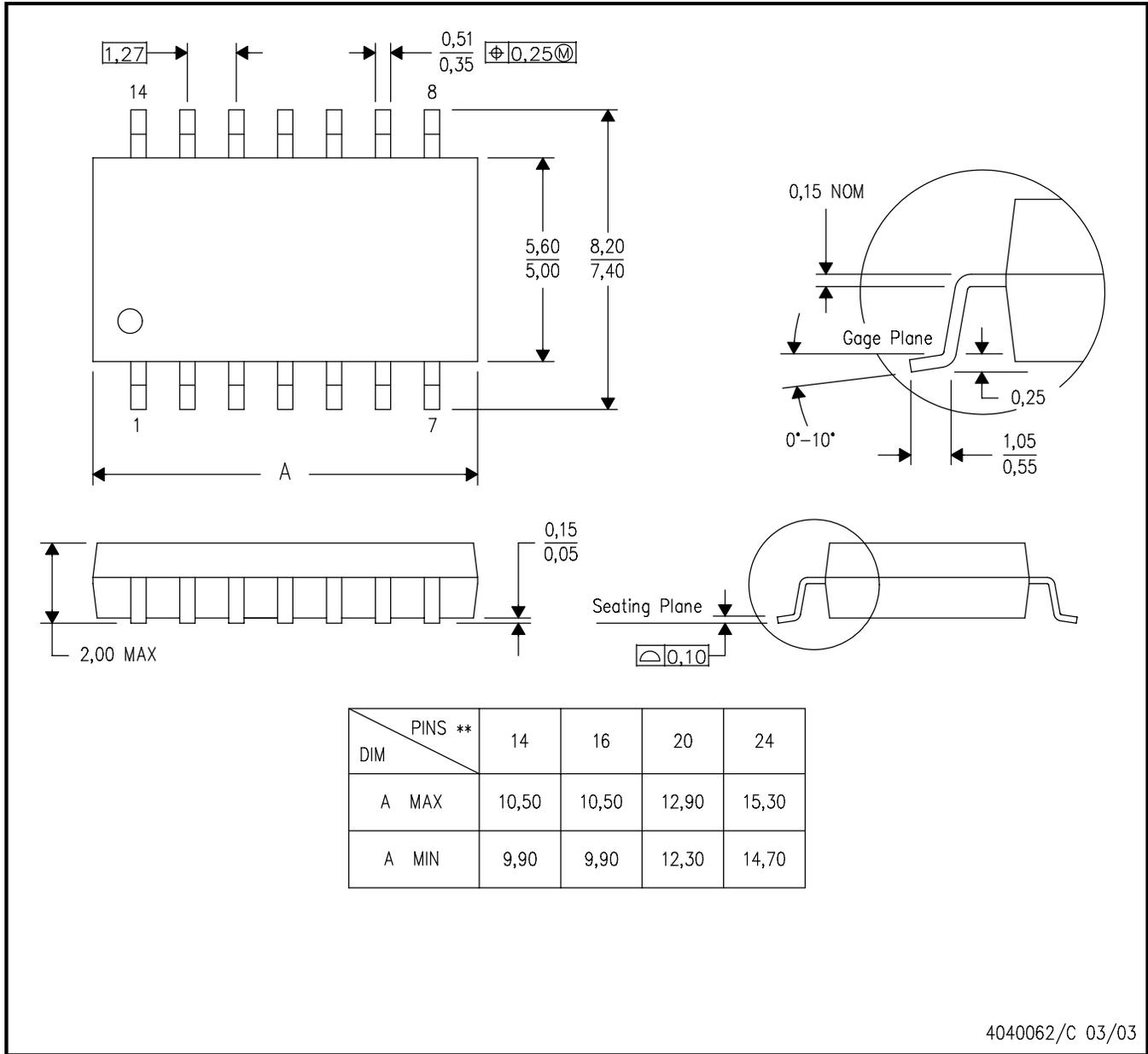
- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. This package is hermetically sealed with a ceramic lid using glass frit.
  - D. Index point is provided on cap for terminal identification only on press ceramic glass frit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

# MECHANICAL DATA

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

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN

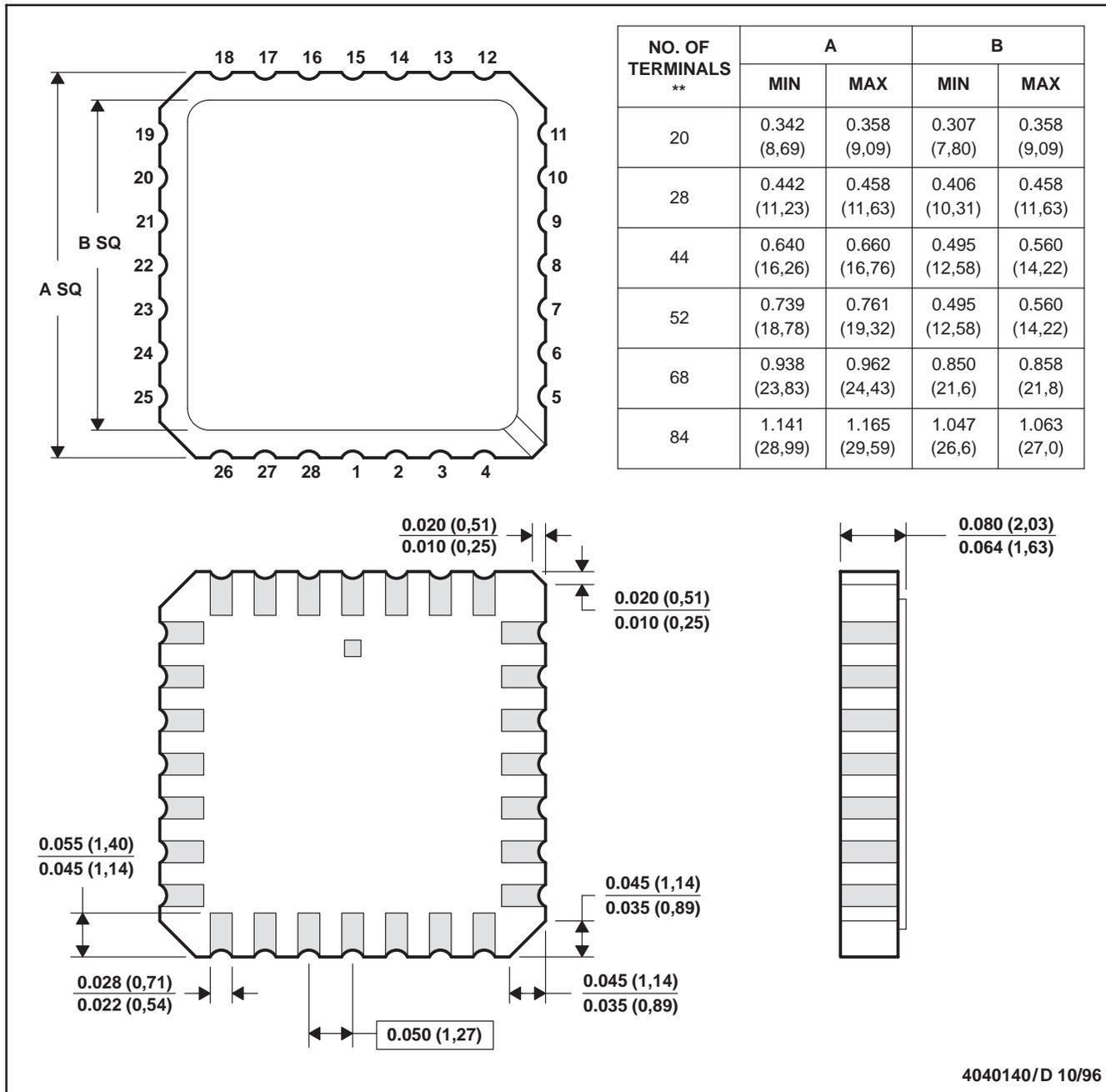


- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

FK (S-CQCC-N\*\*)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN

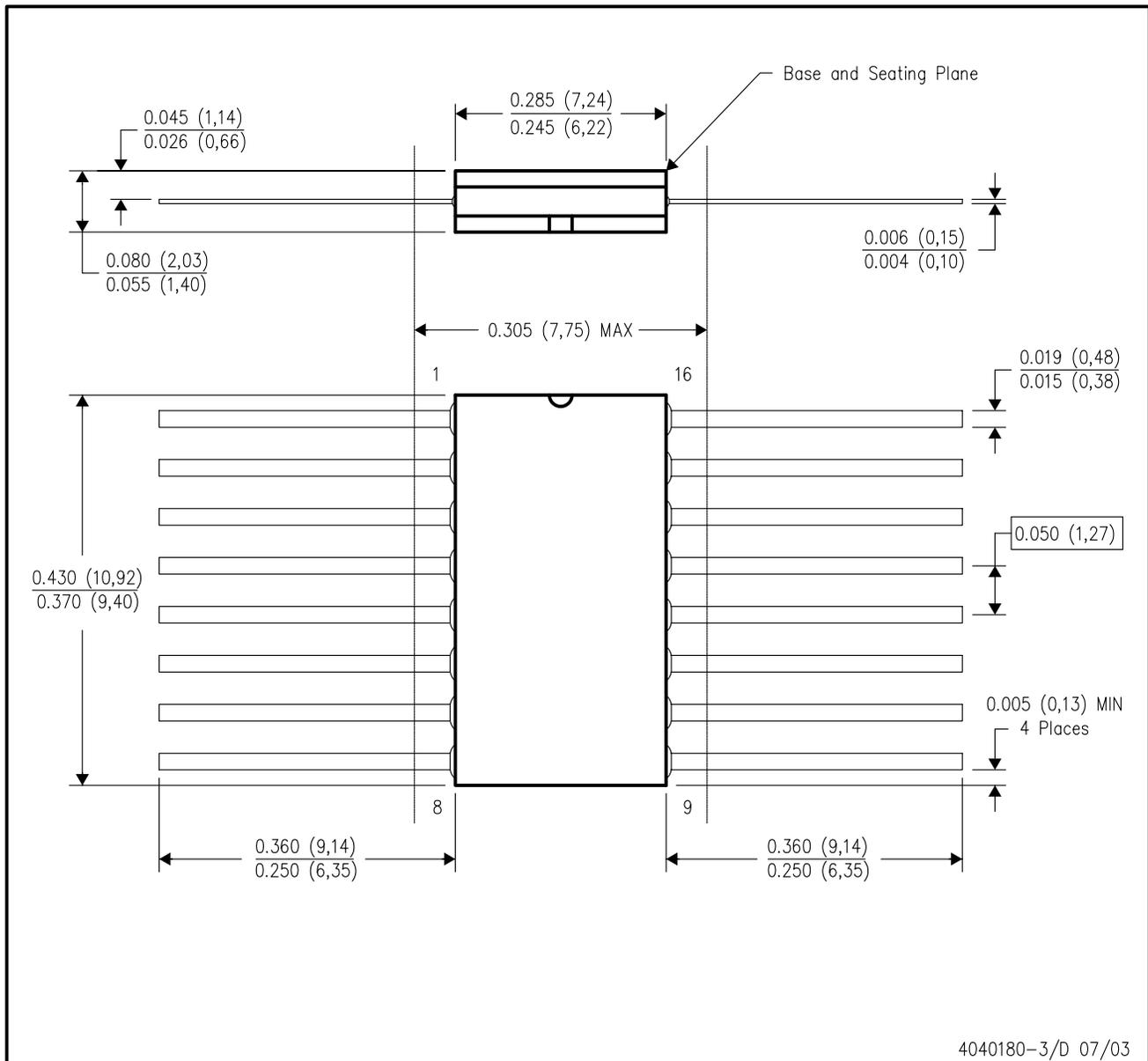


4040140/D 10/96

- 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

W (R-GDFP-F16)

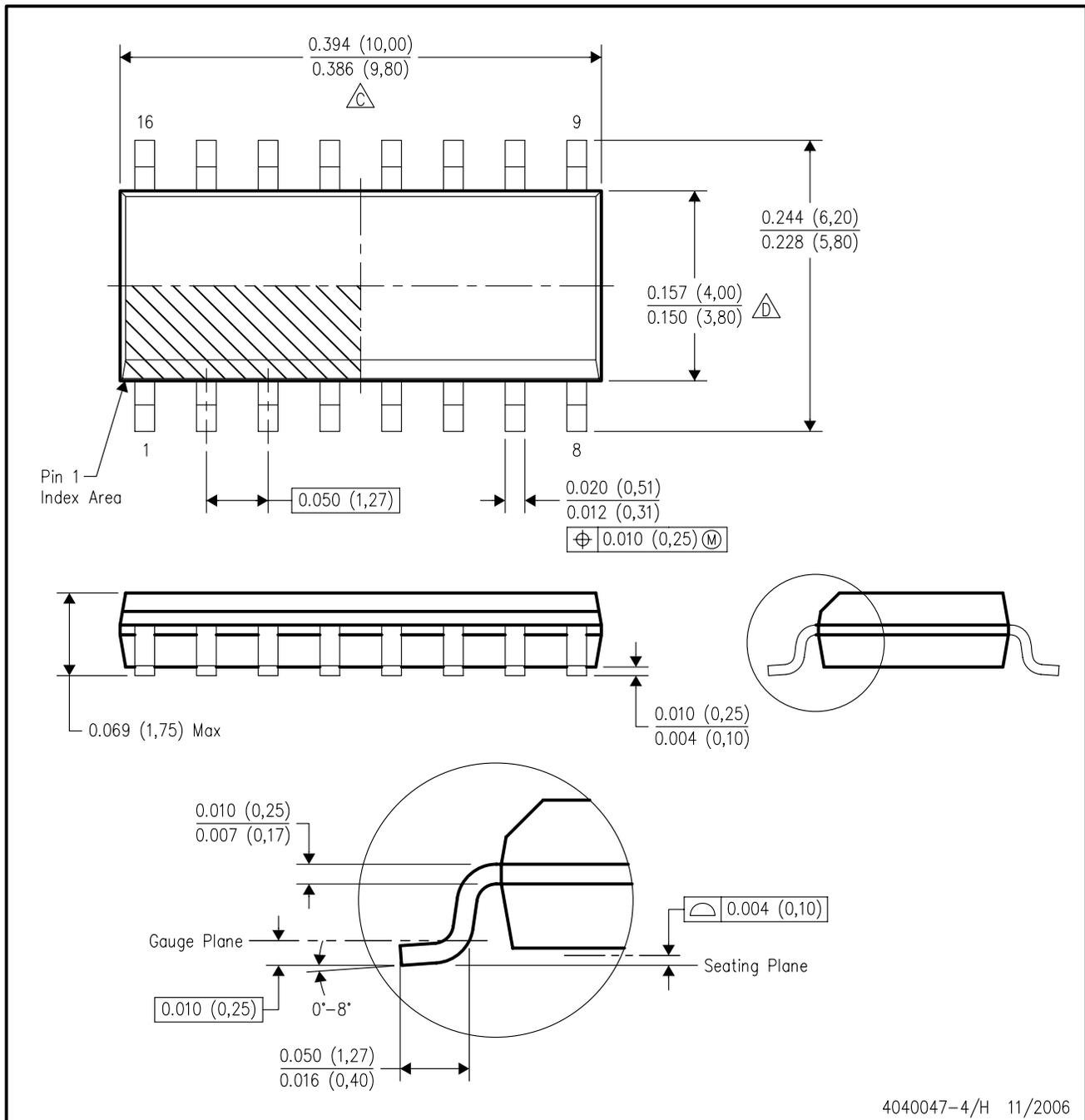
CERAMIC DUAL FLATPACK



- 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 ceramic lid using glass frit.
  - D. Index point is provided on cap for terminal identification only.
  - E. Falls within MIL STD 1835 GDFP1-F16 and JEDEC MO-092AC

D (R-PDSO-G16)

PLASTIC SMALL-OUTLINE PACKAGE

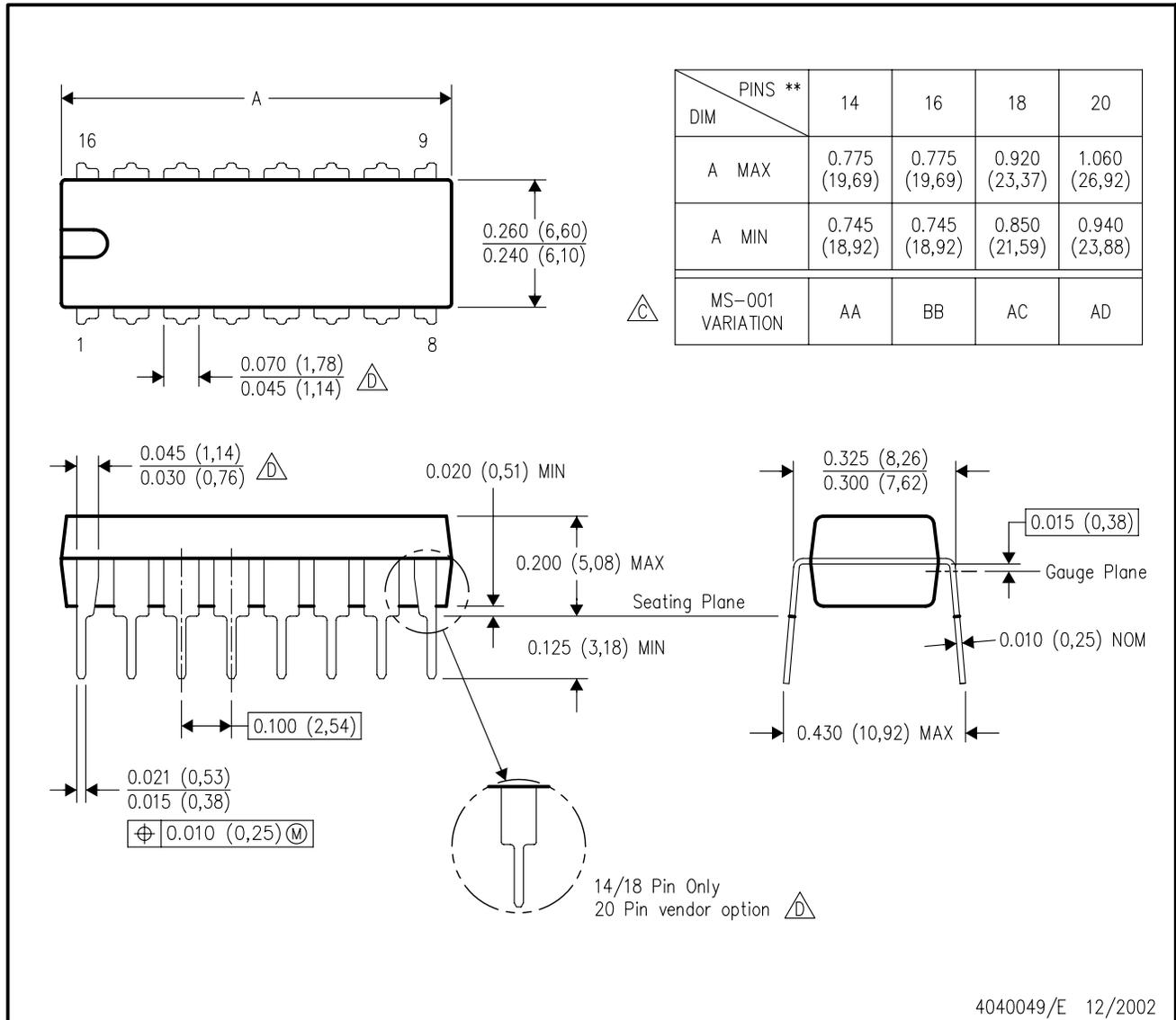


- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed .006 (0,15) per end.
  - D. Body width does not include interlead flash. Interlead flash shall not exceed .017 (0,43) per side.
  - E. Reference JEDEC MS-012 variation AC.

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

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



- 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

Amplifiers	<a href="http://amplifier.ti.com">amplifier.ti.com</a>
Data Converters	<a href="http://dataconverter.ti.com">dataconverter.ti.com</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>
RF/IF and ZigBee® Solutions	<a href="http://www.ti.com/lprf">www.ti.com/lprf</a>

### Applications

Audio	<a href="http://www.ti.com/audio">www.ti.com/audio</a>
Automotive	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
Broadband	<a href="http://www.ti.com/broadband">www.ti.com/broadband</a>
Digital Control	<a href="http://www.ti.com/digitalcontrol">www.ti.com/digitalcontrol</a>
Medical	<a href="http://www.ti.com/medical">www.ti.com/medical</a>
Military	<a href="http://www.ti.com/military">www.ti.com/military</a>
Optical Networking	<a href="http://www.ti.com/opticalnetwork">www.ti.com/opticalnetwork</a>
Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
Telephony	<a href="http://www.ti.com/telephony">www.ti.com/telephony</a>
Video & Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>
Wireless	<a href="http://www.ti.com/wireless">www.ti.com/wireless</a>

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
Copyright © 2008, Texas Instruments Incorporated