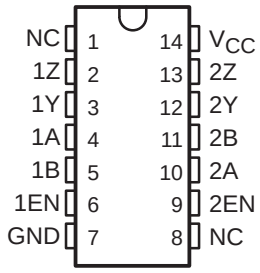
- **Meets or Exceeds the Requirements of ANSI EIA/TIA-422-B and ITU Recommendation V.11**
- **Single 5-V Supply**
- **Balanced Line Operation**
- **TTL Compatible**
- **High-Impedance Output State for Party-Line Applications**
- **High-Current Active-Pullup Outputs**
- **Short-Circuit Protection**
- **Dual Channels**
- **Clamp Diodes at Inputs**

D OR N PACKAGE
(TOP VIEW)



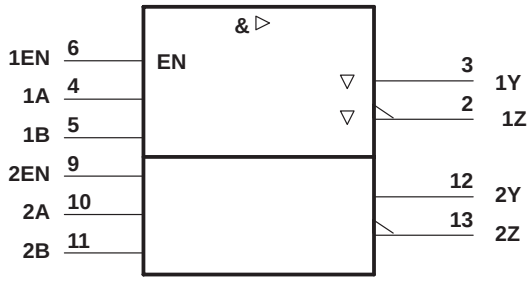
NC – No internal connection

description

The SN75159 dual differential line driver with 3-state outputs is designed to provide all the features of the SN75158 line driver with the added feature of driver output controls. There is an individual control for each driver. When the output control is low, the associated outputs are in a high-impedance state and the outputs can neither drive nor load the bus. This permits many devices to be connected together on the same transmission line for party-line applications.

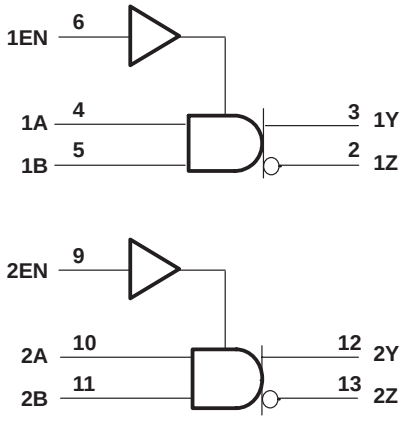
The SN75159 is characterized for operation from 0°C to 70°C.

logic symbol†

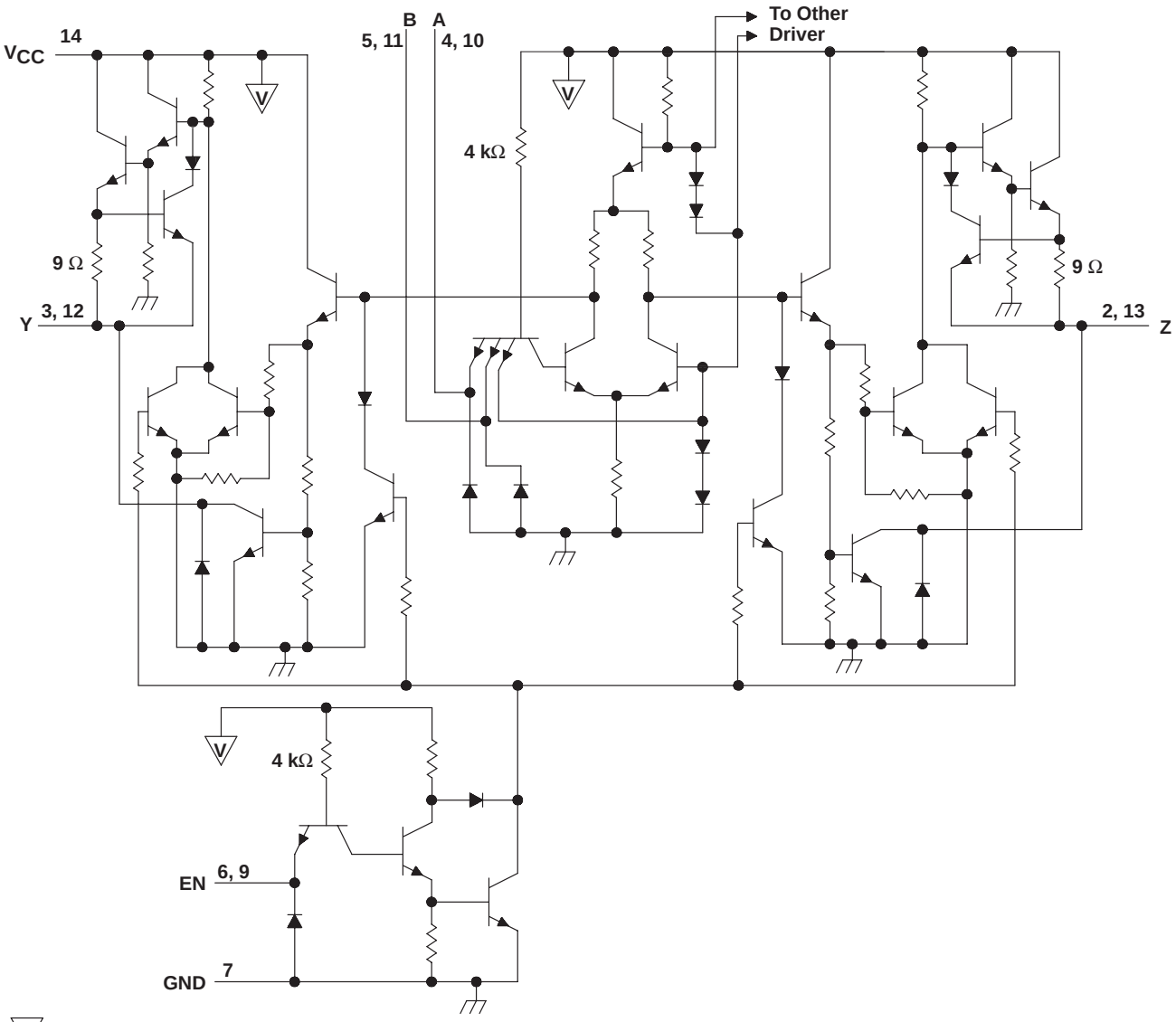


† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

logic diagram (positive logic)



schematic (each driver)



▽ . . . V_{CC} bus

Resistor values shown are nominal.

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

Supply voltage, V_{CC} (see Note 1) . . . . . 7 V
Input voltage, V_I . . . . . 5.5 V
Off-state voltage applied to open-collector outputs . . . . . 12 V
Continuous total dissipation . . . . . See Dissipation Rating Table
Operating free-air temperature range, T_A . . . . . 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 . . . . . 260°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 except differential output voltage V_{OD} are with respect to the network ground terminal. V_{OD} is at the Y output with respect to the Z output.

DISSIPATION RATING TABLE

PACKAGE	$T_A \le 25°C$ POWER RATING	DERATING FACTOR ABOVE $T_A = 25°C$	$T_A = 70°C$ POWER RATING
D	950 mW	7.6 mW/°C	608 mW
N	1150 mW	9.2 mW/°C	736 mW

recommended operating conditions

	MIN	NOM	MAX	UNIT
Supply voltage, V_{CC}	4.75	5	5.25	V
High-level input voltage, V_{IH}	2			V
Low-level input voltage, V_{IL}			0.8	V
High-level output voltage, I_{OH}			–40	mA
Low-level output current, I_{OL}			40	mA
Operating free-air temperature, T_A	0		70	°C

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

PARAMETER		TEST CONDITIONS			MIN	TYP†	MAX	UNIT
V_{IK}	Input clamp voltage	V_{CC} = 4.75 V,	I_I = –12 mA			–0.9	–1.5	V
V_{OH}	High-level output voltage	V_{CC} = 4.75 V, V_{IH} = 2 V,	V_{IL} = 0.8 V, I_{OH} = –40 mA		2.4	3		V
V_{OL}	Low-level output voltage	V_{CC} = 4.75 V, V_{IH} = 2 V,	V_{IL} = 0.8 V, I_{OL} = 40 mA			0.25	0.4	V
V_{OK}	Output clamp voltage	V_{CC} = 5.25 V,	I_O = –40 mA			–1.1	–1.5	V
V_O	Output voltage	V_{CC} = 4.75 V to 5.25 V,	I_O = 0		0		6	V
$\|V_{OD1}\|$	Differential output voltage	V_{CC} = 5.25 V,	I_O = 0			3.5	$2V_{OD2}$	V
$\|V_{OD2}\|$	Differential output voltage	V_{CC} = 4.75 V			2	3		V
$\Delta\|V_{OD}\|$	Change in magnitude of differential output voltage‡	V_{CC} = 4.75 V	R_L = 100 Ω, See Figure 1			±0.02	±0.4	V
V_{OC}	Common-mode output voltage§	V_{CC} = 5.25 V				1.8	3	V
		V_{CC} = 4.75 V				1.5	3	
$\Delta\|V_{OC}\|$	Change in magnitude of common-mode output voltage‡	V_{CC} = 4.75 V to 5.25 V				±0.01	±0.4	V
I_O	Output current with power off	V_{CC} = 0	V_O = 6 V			0.1	100	µA
			V_O = –0.25 V			–0.1	–100	
			V_O = –0.25 V to 6 V				±100	
I_{OZ}	Off-state (high-impedance state) output current	V_{CC} = 5.25 V, Output controls at 0.8 V	T_A = 25°C	V_O = 0 to V_{CC}			±10	µA
			T_A = 70°C	V_O = 0			–20	
				V_O = 0.4 V			±20	
				V_O = 2.4 V			±20	
				V_O = V_{CC}			20	
I_I	Input current at maximum input voltage	V_{CC} = 5.25 V,	V_I = 5.5 V				1	mA
I_{IH}	High-level input current	V_{CC} = 5.25 V,	V_I = 2.4 V				40	µA
I_{IL}	Low-level input current	V_{CC} = 5.25 V,	V_I = 0.4 V			–1	–1.6	mA
I_{OS}	Short-circuit output current¶	V_{CC} = 5.25 V			–40	–90	–150	mA
I_{CC}	Supply current (both drivers)	V_{CC} = 5.25 V, T_A = 25°C,	Inputs grounded, No load			47	65	mA

† All typical values are at V_{CC} = 5 V and T_A = 25°C except for V_{OC}, for which V_{CC} is as stated under test conditions.
‡ $\Delta|V_{OD}|$ and $\Delta|V_{OC}|$ are the changes in magnitudes of V_{OD} and V_{OC}, respectively, that occur when the input is changed from a high level to a low level.
§ In ANSI Standard EIA/TIA-422-B, V_{OC}, which is the average of the two output voltages with respect to GND, is called output offset voltage, V_{OS}.
¶ Only one output should be shorted at a time, and duration of the short circuit should not exceed one second.

switching characteristics over operating free-air temperature range, V_{CC} = 5 V

PARAMETER		TEST CONDITIONS	MIN	TYP†	MAX	UNIT
t_{PLH}	Propagation delay time, low-to-high-level output	C_L = 30 pF, R_L = 100 Ω, See Figure 2, Termination A		16	25	ns
t_{PHL}	Propagation delay time, high-to-low-level output			11	20	ns
t_{PLH}	Propagation delay time, low-to-high-level output	C_L = 15 pF, See Figure 2, Termination B		13	20	ns
t_{PHL}	Propagation delay time, high-to-low-level output			9	15	ns
t_{TLH}	Transition time, low-to-high-level output	C_L = 30 pF, R_L = 100 Ω, See Figure 2, Termination A		4	20	ns
t_{THL}	Transition time, high-to-low-level output			4	20	ns
t_{PZH}	Output enable time to high level	C_L = 30 pF, R_L = 180 Ω, See Figure 3		7	20	ns
t_{PZL}	Output enable time to low level	C_L = 30 pF, R_L = 250 Ω, See Figure 4		14	40	ns
t_{PHZ}	Output disable time from high level	C_L = 30 pF, R_L = 180 Ω, See Figure 3		10	30	ns
t_{PLZ}	Output disable time from low level	C_L = 30 pF, R_L = 250 Ω, See Figure 4		17	35	ns
	Overshoot factor	R_L = 100 Ω, See Figure 2, Termination C			10%	

† All typical values are at T_A = 25°C.

SYMBOL EQUIVALENTS

DATA-SHEET PARAMETER	EIA/TIA-422-B
V_O	V_{oa}, V_{ob}
$\|V_{OD1}\|$	V_o
$\|V_{OD2}\|$	V_t
$\Delta\|V_{OD}\|$	$\|\|V_t\| - \|\overline{V}_t\|\|$
V_{OC}	$\|V_{os}\|$
$\Delta\|V_{OC}\|$	$\|V_{os} - \overline{V}_{os}\|$
I_{OS}	$\|I_{sa}\|$, $\|I_{sb}\|$
I_O	$\|I_{xa}\|$, $\|I_{xb}\|$

PARAMETER MEASUREMENT INFORMATION

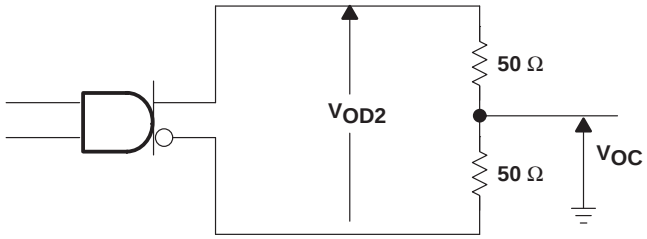
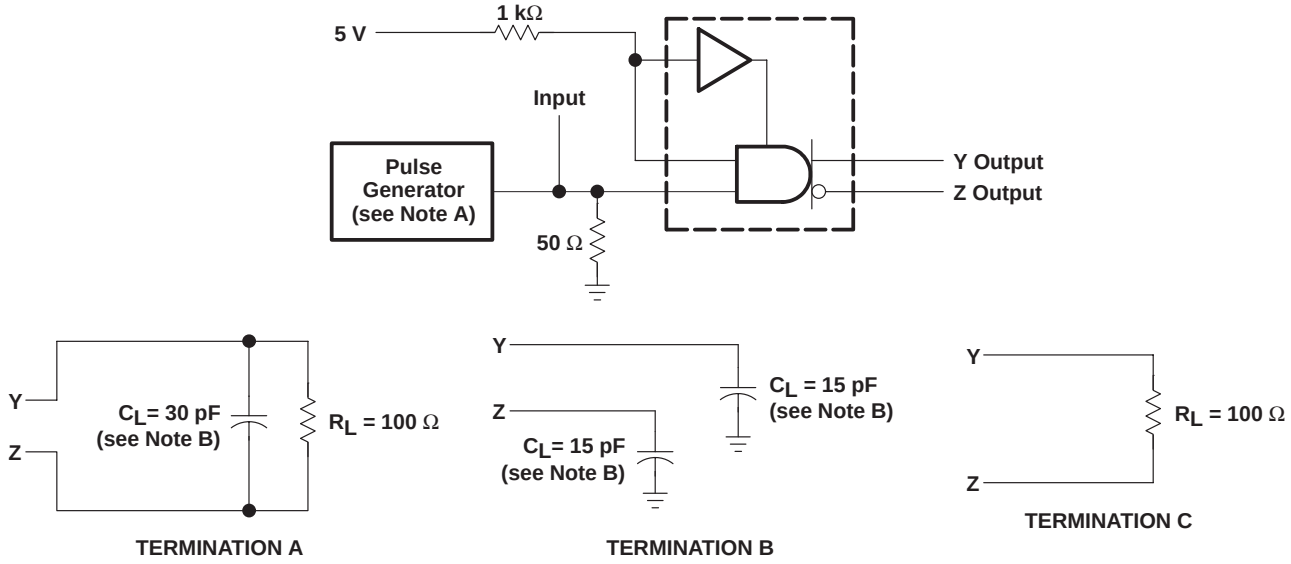
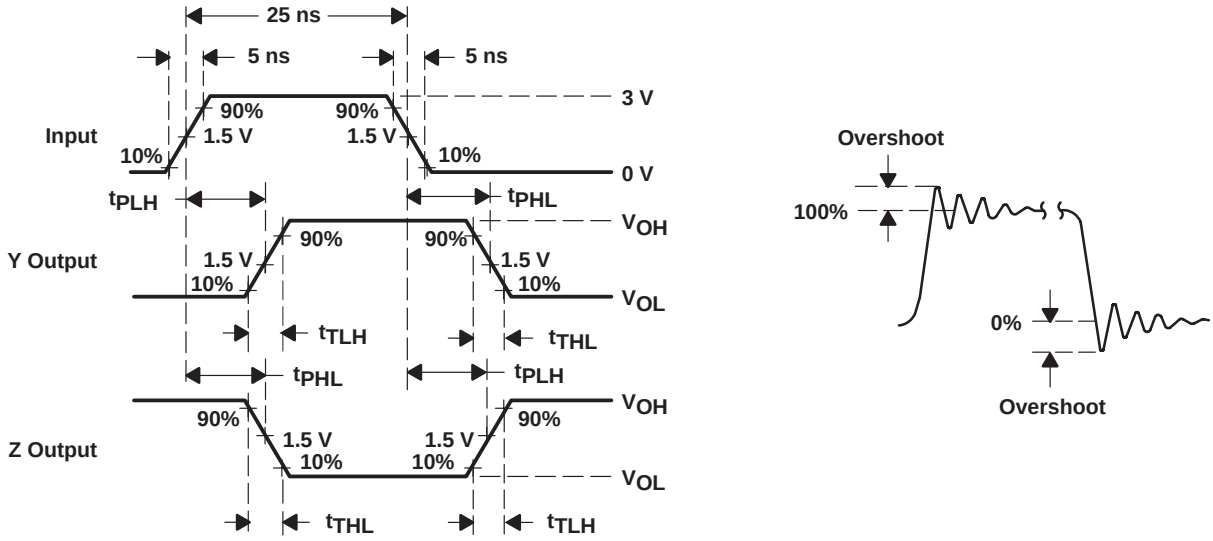


Figure 1. Differential and Common-Mode Output Voltages

PARAMETER MEASUREMENT INFORMATION



TEST CIRCUITS

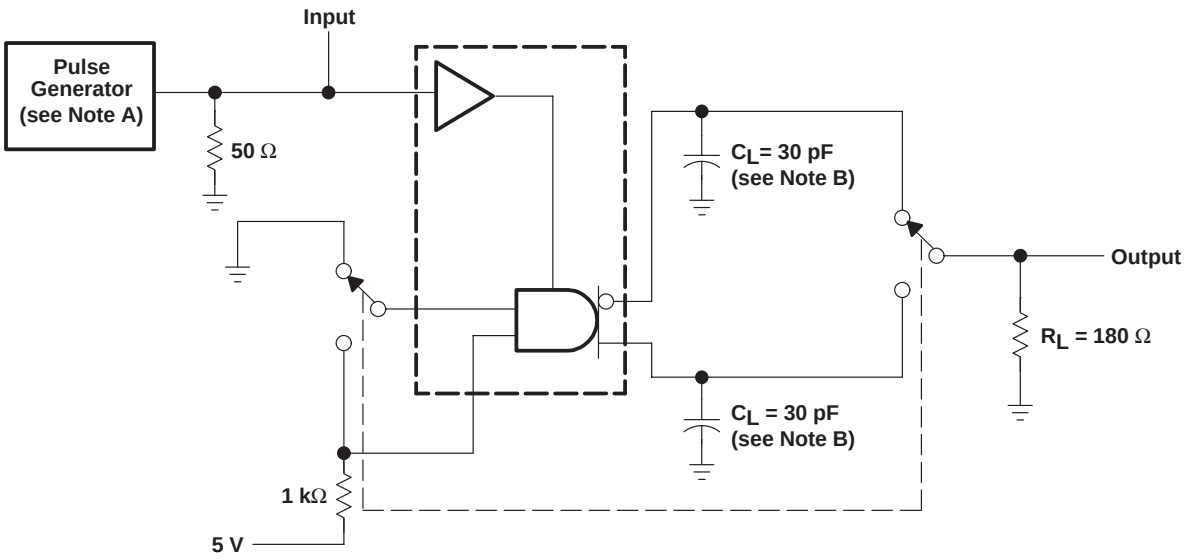


VOLTAGE WAVEFORMS

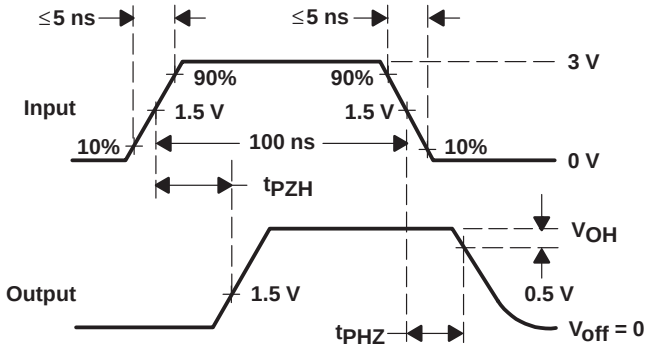
NOTES: A. The pulse generator has the following characteristics: Z_O = 50 Ω, PRR ≤ 10 MHz.
B. C_L includes probe and jig capacitance.

Figure 2. Test Circuits, Voltage Waveforms, and Overshoot Factor

PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT

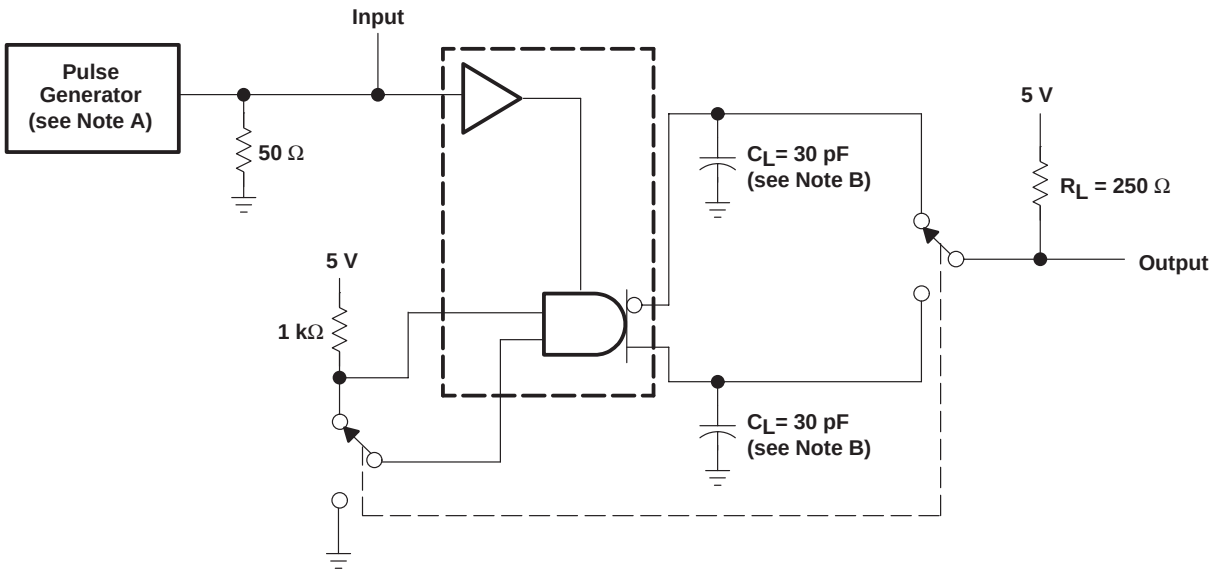


VOLTAGE WAVEFORMS

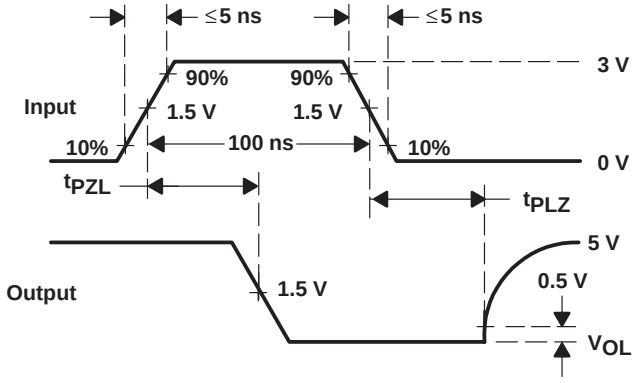
NOTES: A. The pulse generator has the following characteristics: Z_O = 50 Ω, PRR ≤ 500 kHz.
B. C_L includes probe and jig capacitance.

Figure 3. Test Circuit and Voltage Waveforms

PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT



VOLTAGE WAVEFORMS

NOTES: A. The pulse generator has the following characteristics: Z_O = 50 Ω, PRR ≤ 500 kHz.
B. C_L includes probe and jig capacitance.

Figure 4. Test Circuit and Voltage Waveform

TYPICAL CHARACTERISTICS

OUTPUT VOLTAGE vs DATA INPUT VOLTAGE

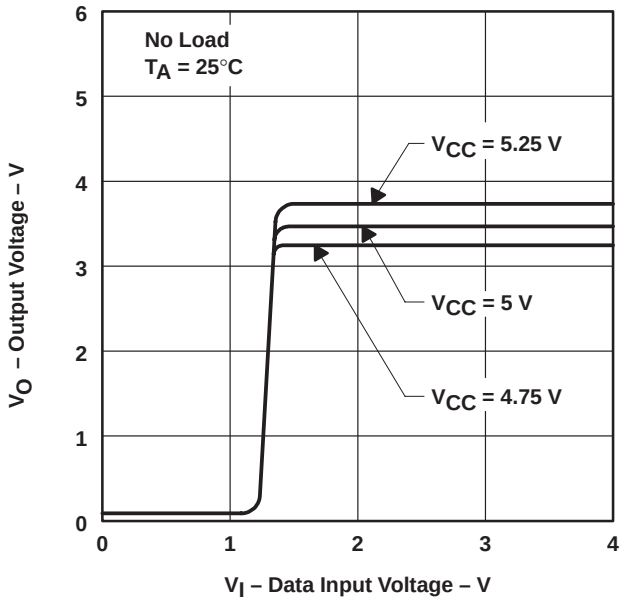


Figure 5

OUTPUT VOLTAGE vs DATA INPUT VOLTAGE

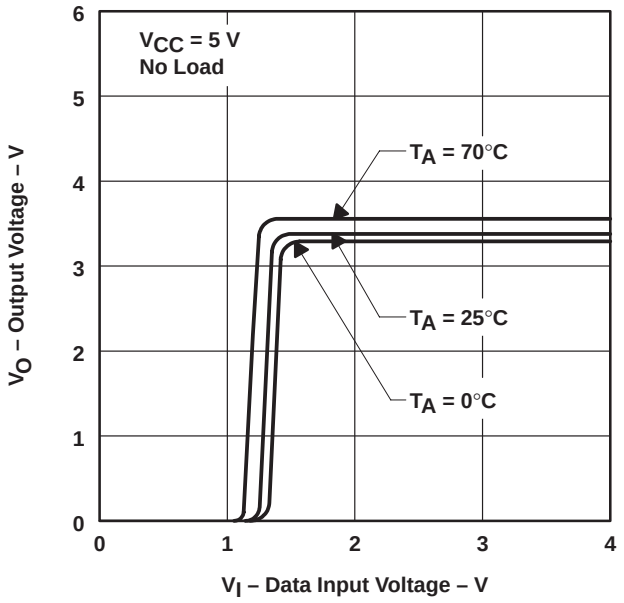


Figure 6

OUTPUT VOLTAGE vs FREE-AIR TEMPERATURE

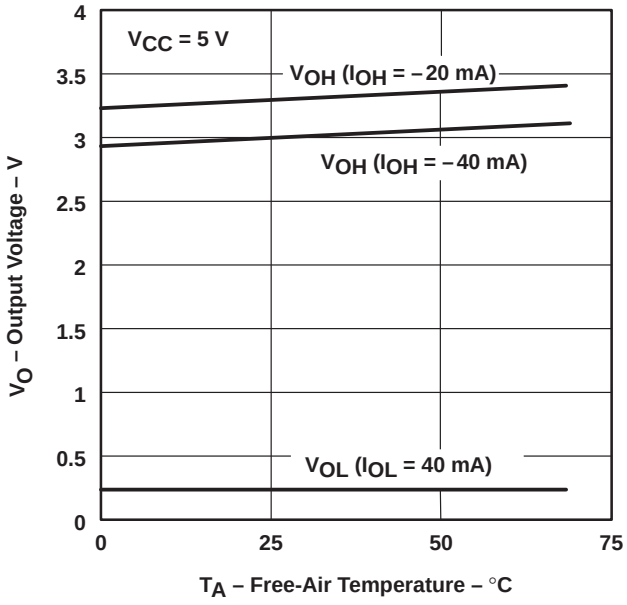


Figure 7

HIGH-LEVEL OUTPUT VOLTAGE vs HIGH-LEVEL OUTPUT CURRENT

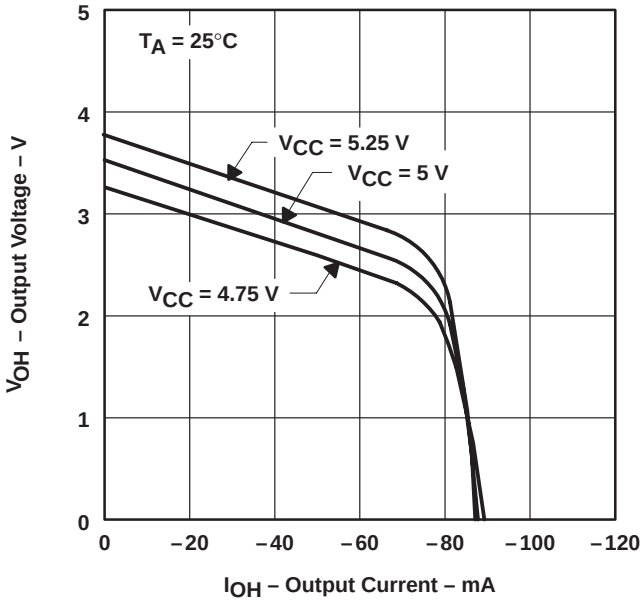


Figure 8

TYPICAL CHARACTERISTICS

LOW-LEVEL OUTPUT VOLTAGE
vs
LOW-LEVEL OUTPUT CURRENT

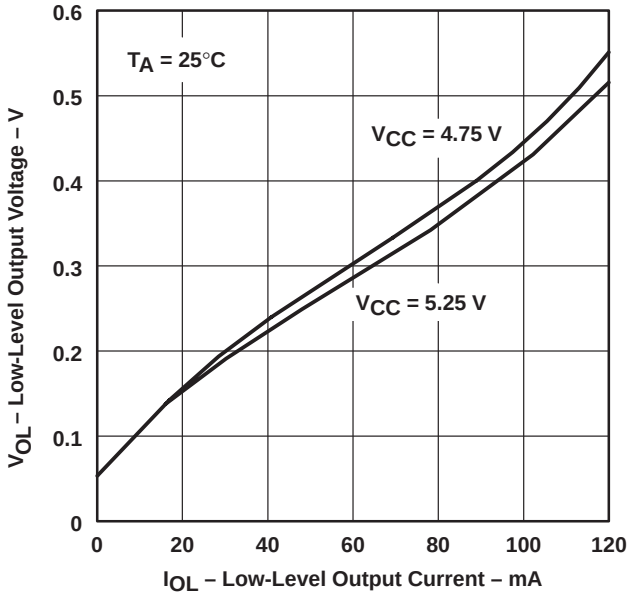


Figure 9

SUPPLY CURRENT
(BOTH DRIVERS)
vs
SUPPLY VOLTAGE

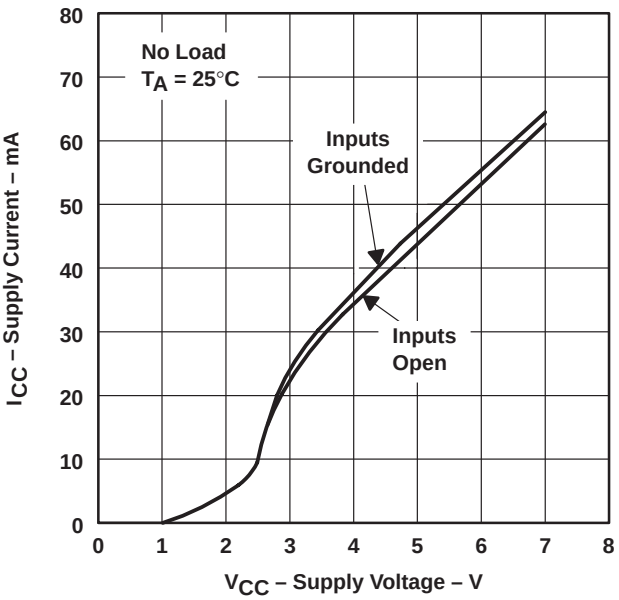


Figure 10

SUPPLY CURRENT
(BOTH DRIVERS)
vs
FREE-AIR TEMPERATURE

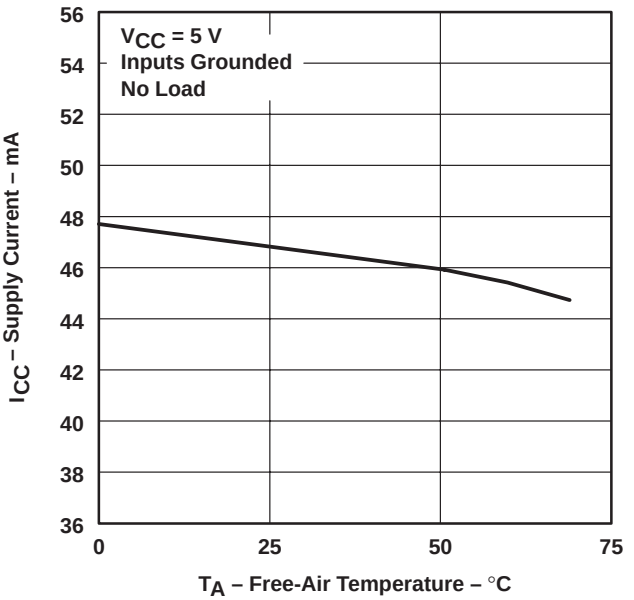


Figure 11

SUPPLY CURRENT
(BOTH DRIVERS)
vs
FREQUENCY

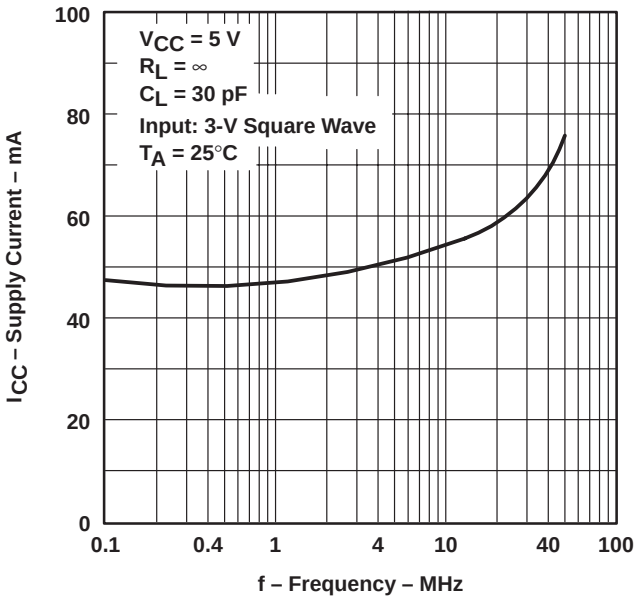


Figure 12

TYPICAL CHARACTERISTICS

**PROPAGATION DELAY TIME
FROM DATA INPUTS
vs
FREE-AIR TEMPERATURE**

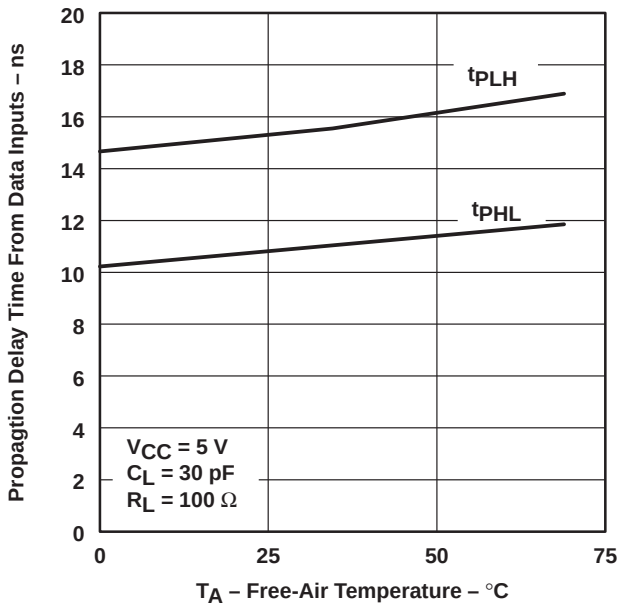


Figure 13

**OUTPUT ENABLE AND DISABLE TIME
vs
FREE-AIR TEMPERATURE**

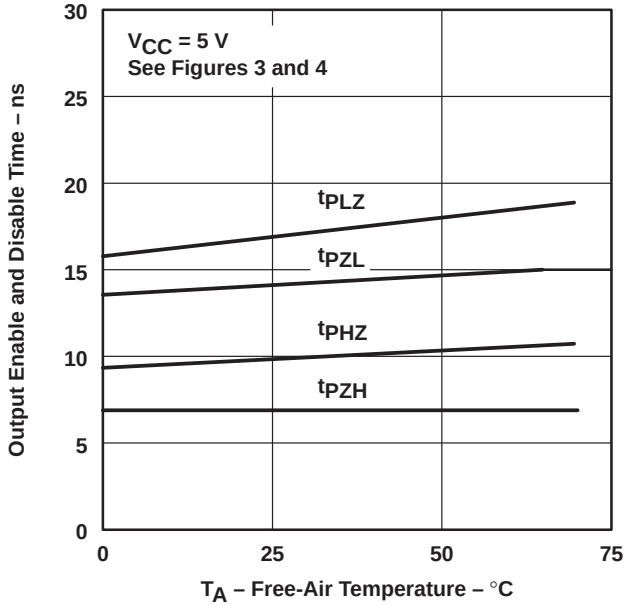


Figure 14

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)
SN75159D	ACTIVE	SOIC	D	14	50	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
SN75159DR	ACTIVE	SOIC	D	14	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
SN75159N	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
SN75159NSR	ACTIVE	SO	NS	14	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM

(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.

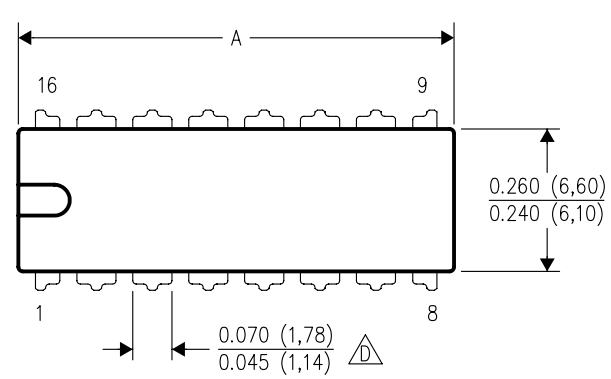
(2) Eco Plan - May not be currently available - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
None: Not yet available Lead (Pb-Free).
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are 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.
Green (RoHS & no Sb/Br): TI defines "Green" to mean "Pb-Free" and in addition, uses package materials that do not contain halogens, including bromine (Br) or antimony (Sb) above 0.1% of total product weight.

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

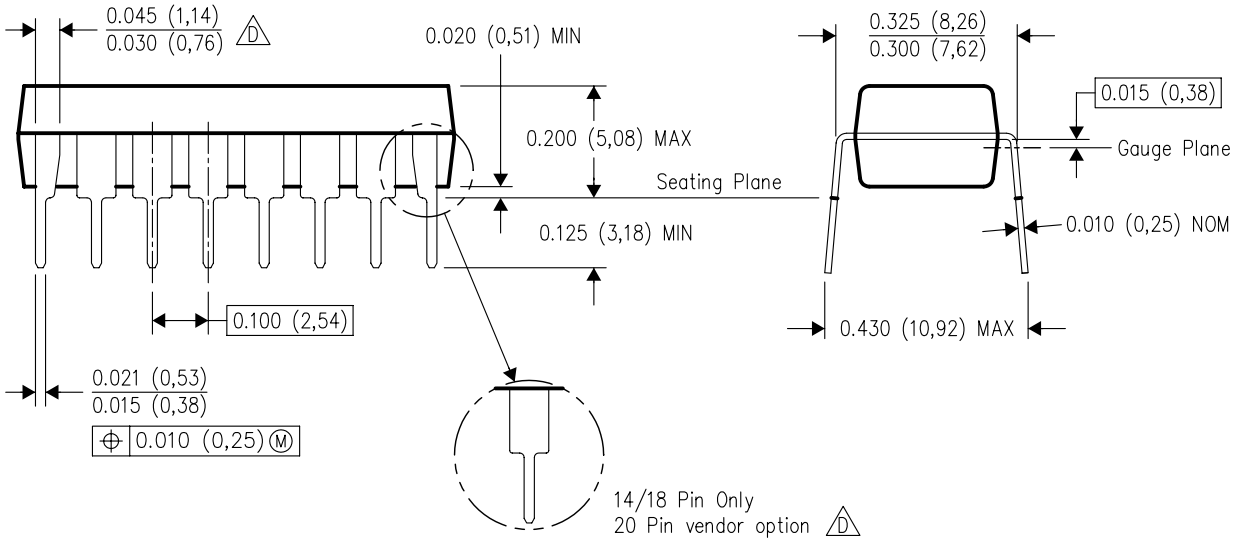
N (R–PDIP–T**)

PLASTIC DUAL–IN–LINE PACKAGE

16 PINS SHOWN



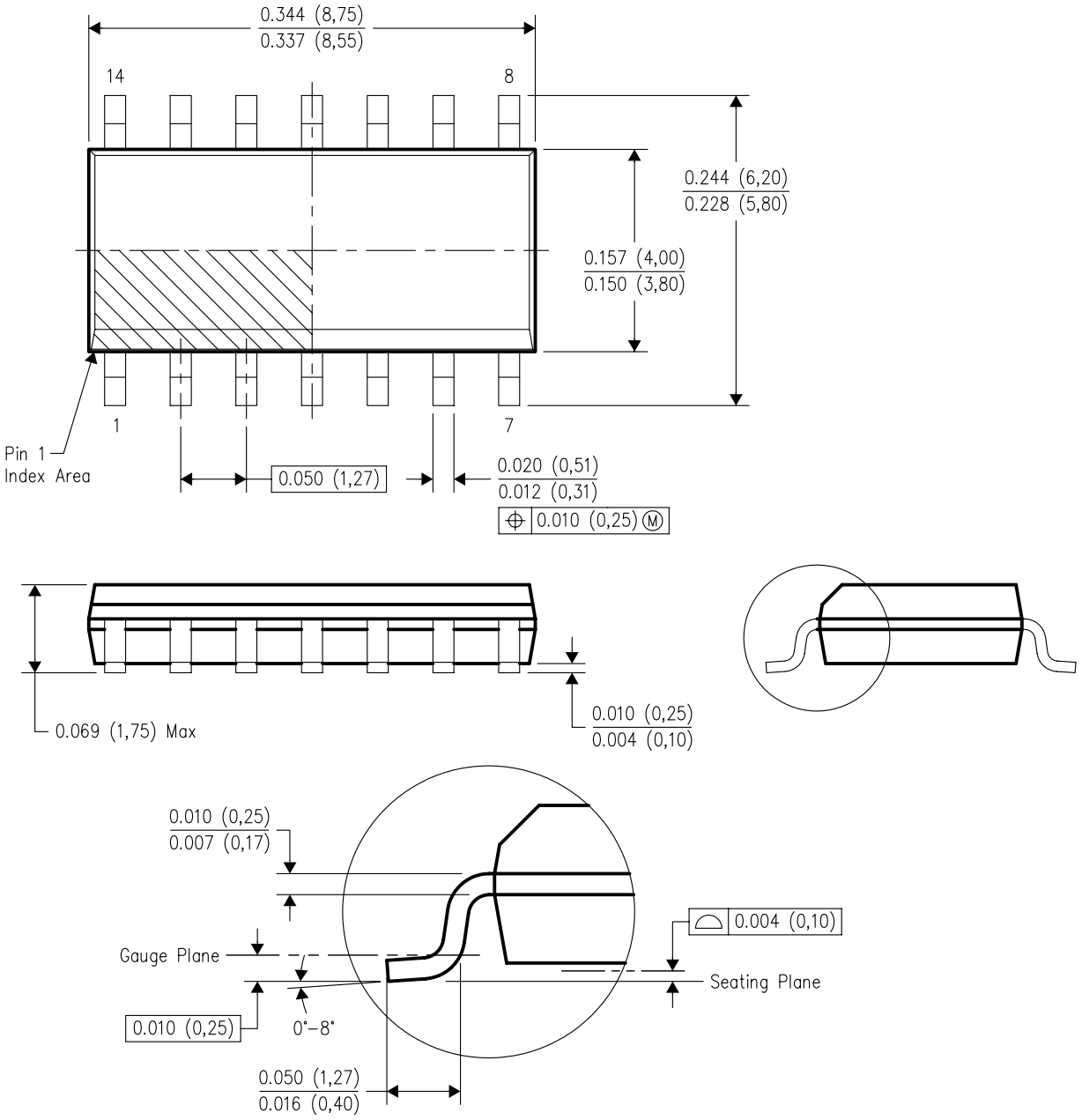
DIM \ PINS **	14	16	18	20
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	1.060 (26,92)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)
MS–001 VARIATION (C)	AA	BB	AC	AD



4040049/E 12/2002

NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS–001, except 18 and 20 pin minimum body length (Dim A).
D. The 20 pin end lead shoulder width is a vendor option, either half or full width.

D (R–PDSO–G14) PLASTIC SMALL–OUTLINE PACKAGE

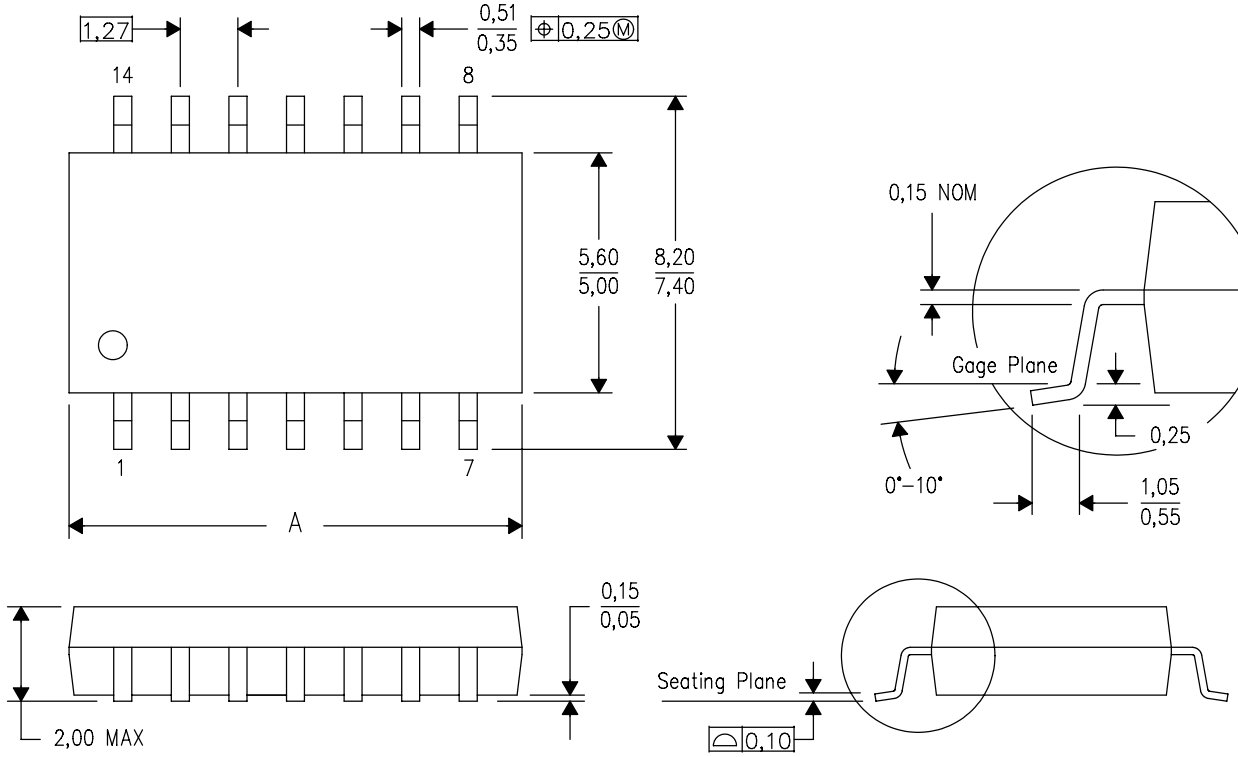


NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
D. Falls within JEDEC MS–012 variation AB.

MECHANICAL DATA

NS (R-PDSO-G)** **PLASTIC SMALL-OUTLINE PACKAGE**

14-PINS SHOWN



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

4040062/C 03/03

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

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Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
		Telephony	www.ti.com/telephony
		Video & Imaging	www.ti.com/video
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