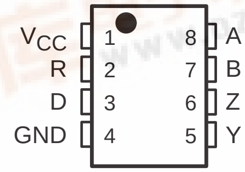
SN65LBC179A, SN75LBC179A
LOW-POWER DIFFERENTIAL LINE DRIVER AND RECEIVER PAIRS

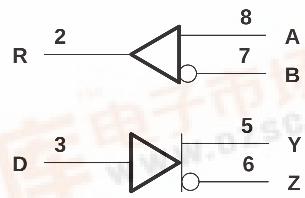
SLLS377A – MAY 2000 – REVISED JUNE 2000

- **High-Speed Low-Power LinBiCMOS™ Circuitry Designed for Signaling Rates† of 50 Mbps**
- **Bus-Pin ESD Protection Exceeds 12 kV HBM**
- **Very Low Disabled Supply-Current Requirements . . . 700 μA Max**
- **Common-Mode Voltage Range of –7 V to 12 V**
- **Low Supply Current . . . 15 mA Max**
- **Compatible With ANSI Standard TIA/EAI-485-A and ISO8482: 1987(E)**
- **Positive and Negative Output Current Limiting**
- **Driver Thermal Shutdown Protection**

SN65LBC179AD (Marked as BL179A)
SN65LBC179AP (Marked as 65LBC179A)
SN75LBC179AD (Marked as LB179A)
SN75LBC179AP (Marked as 75LBC179A)
(TOP VIEW)



logic diagram (positive logic)



description

The SN65LBC179A and SN75LBC179A differential driver and receiver pairs are monolithic integrated circuits designed for bidirectional data communication over long cables that take on the characteristics of transmission lines. They are balanced, or differential, voltage mode devices that are compatible with ANSI standard TIA/EIA-485-A and ISO 8482:1987(E). The A version offers improved switching performance over its predecessors without sacrificing significantly more power.

The SN65LBC179A and SN75LBC179A combine a differential line driver and differential input line receiver and operate from a single 5-V supply. The driver differential outputs and the receiver differential inputs are connected to separate terminals for full-duplex operation and are designed to present minimum loading to the bus when powered off (V_{CC} = 0). These parts feature a wide positive and negative common-mode voltage range making them suitable for point-to-point or multipoint data bus applications. The devices also provide positive- and negative-current limiting and thermal shutdown for protection from line fault conditions.

The SN65LBC179A is characterized over the industrial temperature range of –40°C to 85°C. The SN75LBC179A is characterized for operation over the commercial temperature range of 0°C to 70°C.

Function Tables

DRIVER

INPUT D	OUTPUTS Y	OUTPUTS Z
H	H	L
L	L	H
X	Z	Z
Open	H	L

RECEIVER

DIFFERENTIAL INPUTS A – B	OUTPUT R
$V_{ID} \geq 0.2$ V	H
-0.2 V $< V_{ID} < 0.2$ V	?
$V_{ID} \leq -0.2$ V	L
Open circuit	H

H = high level, L = low level, ? = indeterminate

† Signaling rate by TIA/EIA-485-A definition restrict transition times to 30% of the bit length, and much higher signaling rates may be achieved without this requirement as displayed in the *TYPICAL CHARACTERISTICS* of this device.

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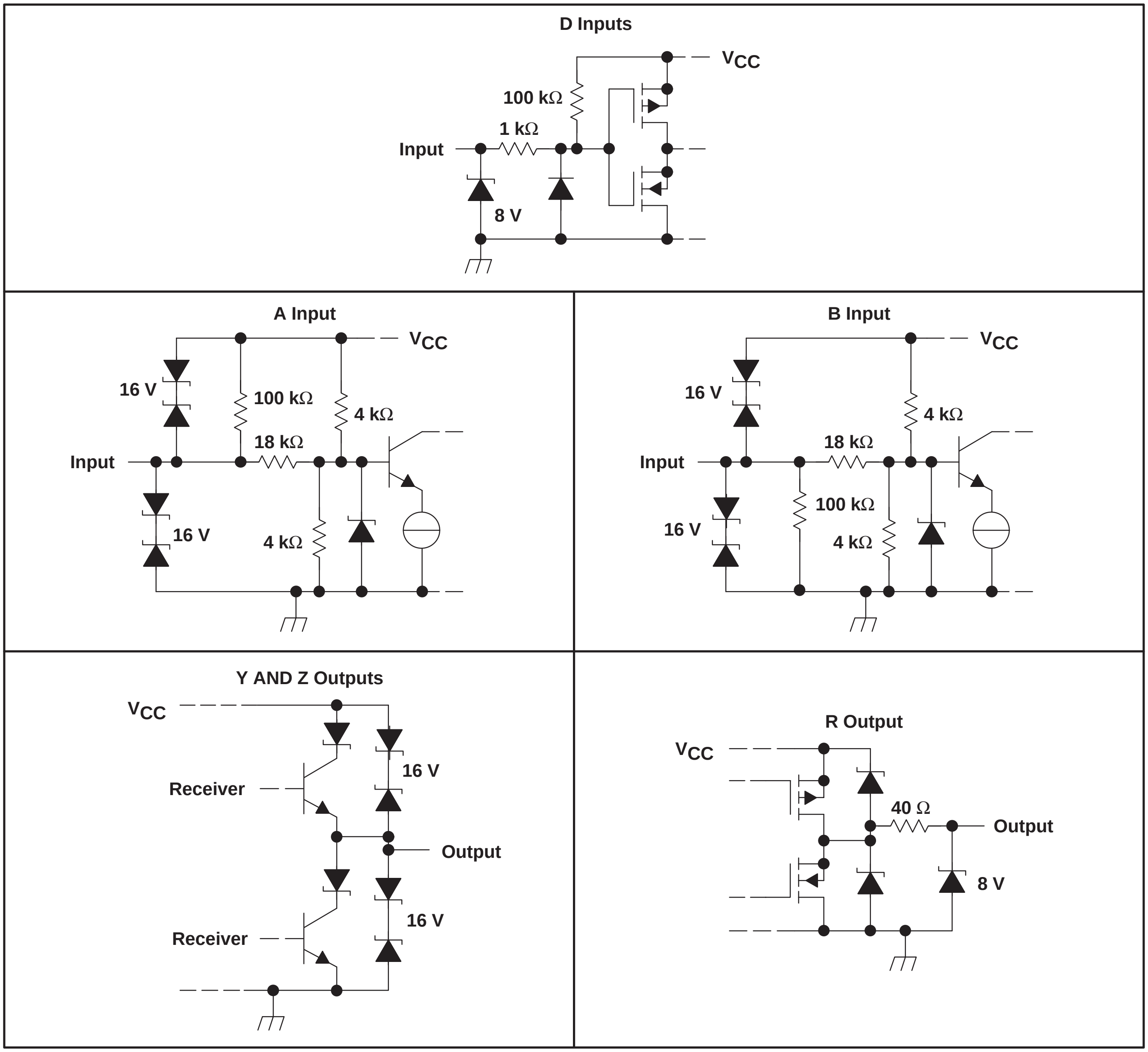
AVAILABLE OPTIONS

T_A	PACKAGE	
	SMALL OUTLINE (D)	PLASTIC DUAL-IN-LINE
0°C to 70°C	SN75LBC179AD	SN75LBC179AP
–40°C to 85°C	SN65LBC179AD	SN65LBC179AP

schematics of inputs and outputs



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

Supply voltage range, V_{CC} (see Note 2)		–0.3 V to 6 V
Voltage range at A, B, Y, or Z (see Note 1)		–10 V to 15 V
Voltage range at D or R (see Note 1)		–0.3 V to V_{CC} + 0.5 V
Electrostatic discharge:	Bus terminals and GND, Class 3, A: (see Note 2)	12 kV
	Bus terminals and GND, Class 3, B: (see Note 2)	400 V
	All terminals, Class 3, A:	4 kV
	All terminals, Class 3, B:	400 V
Continuous total power dissipation (see Note 2)		Internally limited
Total power dissipation		See Dissipation Rating Table
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.

NOTES: 1. All voltage values, except differential I/O bus voltages, are with respect to GND.
2. The maximum operating junction temperature is internally limited. Uses the dissipation rating table to operate below this temperature.

DISSIPATION RATING TABLE

PACKAGE	$T_A \leq 25°C$ POWER RATING	DERATING FACTOR‡ ABOVE $T_A = 25°C$	$T_A = 70°C$ POWER RATING	$T_A = 85°C$ POWER RATING
D	725 mW	5.8 mW/°C	464 mW	377 mW
P	1100 mW	8.08 mW/°C	640 mW	520 mW

‡ This is the inverse of the junction-to-ambient thermal resistance when board-mounted and with no air flow.

recommended operating conditions

		MIN	NOM	MAX	UNIT
Supply voltage, V_{CC}		4.75	5	5.25	V
High-level input voltage, V_{IH}	D	2			V
Low-level input voltage, V_{IL}	D			0.8	V
Differential input voltage, V_{ID} (see Note 3)		–12§		12	V
Voltage at any bus terminal (separately or common-mode), V_O, V_I, or V_{IC}	A, B, Y, or Z	–7		12	V
High-level output current, I_{OH}	Y or Z	–60			mA
	R	–8			
Low-level output current, I_{OL}	Y or Z			60	mA
	R			8	
Operating free-air temperature, T_A	SN65LBC179A	–40		85	°C
	SN75LBC179A	0		70	

§ The algebraic convention, in which the least positive (most negative) limit is designated as minimum, is used in this data sheet.

NOTE 3: Differential input/output bus voltage is measured at the noninverting terminal with respect to the inverting terminal.

driver electrical characteristics over recommended operating conditions (unless otherwise noted)

PARAMETER		TEST CONDITIONS		MIN	TYP†	MAX	UNIT
V_{IK}	Input clamp voltage	$I_I = -18$ mA		–1.5	–0.8		V
$\lvert V_{OD} \rvert$	Differential output voltage	$R_L = 54\ \Omega$, See Figure 1	SN65LBC179A	1	1.5	3	V
			SN75LBC179A	1.1	1.5	3	
		$R_L = 60\ \Omega$, See Figure 2	SN65LBC179A	1	1.5	3	
			SN75LBC179A	1.1	1.5	3	
$\Delta\lvert V_{OD} \rvert$	Change in magnitude of differential output voltage (see Note 4)	See Figures 1 and 2		–0.2		0.2	V
$V_{OC(SS)}$	Steady-state common-mode output voltage	See Figure 1		1.8	2.4	2.8	V
$\Delta V_{OC(SS)}$	Change in steady-state common-mode output voltage (see Note 4)			–0.1		0.1	V
I_O	Output current with power off	$V_{CC} = 0$,	$V_O = -7$ V to 12 V	–10	±1	10	µA
I_{IH}	High-level input current	$V_I = 2.V$		–100			µA
I_{IL}	Low-level input current	$V_I = 0.8$ V		–100			µA
I_{OS}	Short-circuit output current	$-7\text{ V} \le V_O \le 12$ V		–250	±70	250	mA
I_{CC}	Supply current	No load, $V_I = 0$ or V_{CC}			8.5	15	mA

† All typical values are at $V_{CC} = 5$ V, $T_A = 25°C$.

NOTE 4: $\Delta\lvert V_{OD}\rvert$ and $\Delta\lvert V_{OC}\rvert$ are the changes in the steady-state magnitude of V_{OD} and V_{OC}, respectively, that occur when the input is changed from a high level to a low level.

driver switching characteristics over recommended operating conditions (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{PLH}	Propagation delay time, low-to-high-level output	$R_L = 54\ \Omega$, $C_L = 10$ pF, See Figure 3	2	6	12	ns
t_{PHL}	Propagation delay time, high-to-low-level output		2	6	12	ns
$t_{sk(p)}$	Pulse skew ($\lvert t_{PHL} - t_{PLH}\rvert$)			0.3	1	ns
t_r	Differential output signal rise time		1.6	3.9	7.2	ns
t_f	Differential output signal fall time		1.6	3.9	7.2	ns

RECEIVER SECTION

receiver electrical characteristics over recommended operating conditions (unless otherwise noted)

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
V_{IT+}	Positive-going input threshold voltage	$I_O = -8$ mA				0.2	V
V_{IT-}	Negative-going input threshold voltage	$I_O = 8$ mA		–0.2			V
V_{hys}	Hysteresis voltage ($V_{IT+} - V_{IT-}$)	$I_O = 8$ mA			50		mV
V_{OH}	High-level output voltage	$V_{ID} = 200$ mV, $I_{OH} = -8$ mA, See Figure 1		4	4.9		V
V_{OL}	Low-level output voltage	$V_{ID} = -200$ mV, $I_{OL} = 8$ mA, See Figure 1			0.1	0.8	V
I_I	Bus input current	$V_{IH} = 12$ V, $V_{CC} = 5$ V	Other input at 0 V		0.4	1	mA
		$V_{IH} = 12$ V, $V_{CC} = 0$			0.5	1	
		$V_{IH} = -7$ V, $V_{CC} = 5$ V		–0.8	–0.4		
		$V_{IH} = -7$ V, $V_{CC} = 0$		–0.8	–0.3		

receiver switching characteristics over recommended operating conditions (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{PLH}	Propagation delay time, low-to-high-level output	$V_{ID} = -1.5$ V to 1.5 V, See Figure 4	7	13	20	ns
t_{PHL}	Propagation delay time, high-to-low-level output	$V_{ID} = -1.5$ V to 1.5 V, See Figure 4	7	13	20	ns
$t_{sk(p)}$	Pulse skew ($\lvert t_{PLH} - t_{PHL} \rvert$)	$V_{ID} = -1.5$ V to 1.5 V, See Figure 4		0.5	1.5	ns
t_r	Rise time, output	See Figure 4		2.1	3.3	ns
t_f	Fall time, output	See Figure 4		2.1	3.3	ns

PARAMETER MEASUREMENT INFORMATION

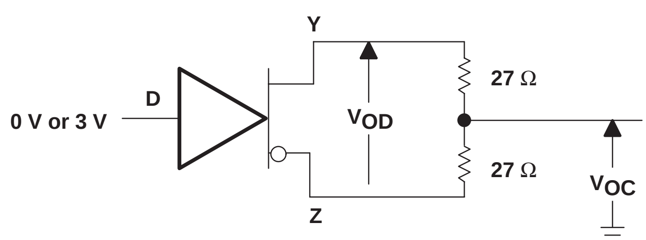


Figure 1. Driver V_{OD} and V_{OC}

PARAMETER MEASUREMENT INFORMATION

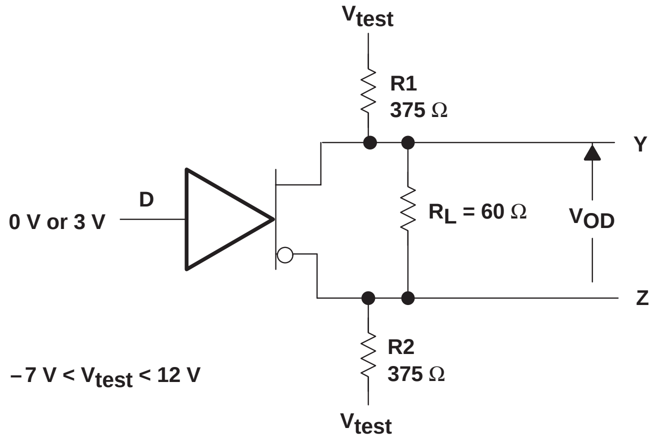
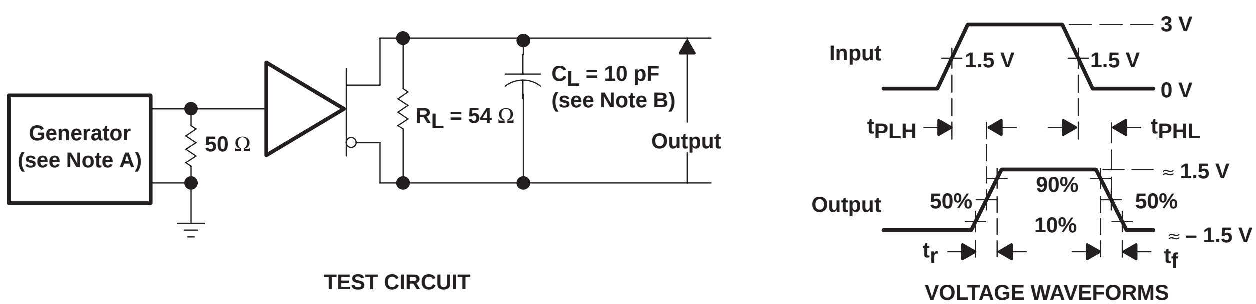


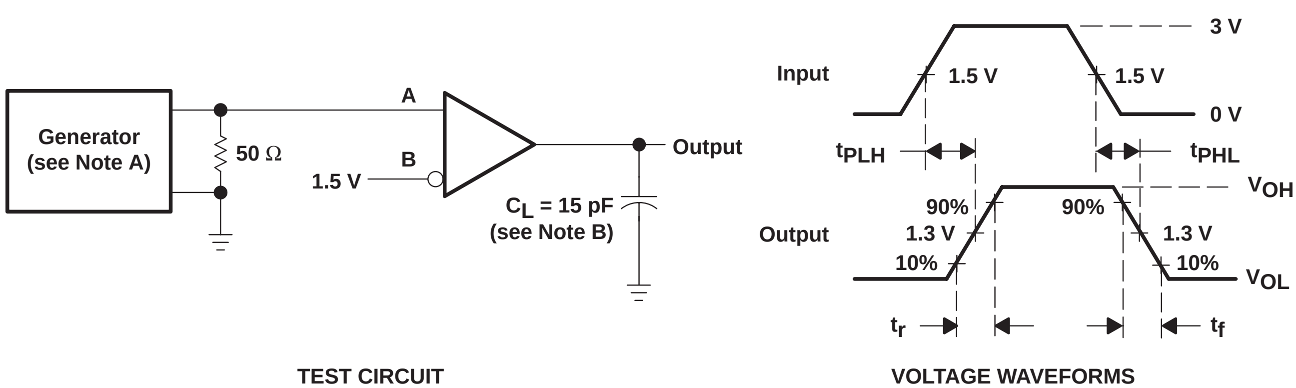
Figure 2. Driver $V_{OD(3)}$



NOTES: A. The input pulse is supplied by a generator having the following characteristics: PRR ≤ 1 MHz, 50% duty cycle, t_r ≤ 6 ns, t_f ≤ 6 ns, Z_O = 50 Ω.

B. C_L includes probe and jig capacitance.

Figure 3. Driver Test Circuits and Voltage Waveforms



NOTES: A. The input pulse is supplied by a generator having the following characteristics: PRR ≤ 1 MHz, 50% duty cycle, t_r ≤ 6 ns, t_f ≤ 6 ns, Z_O = 50 Ω.

B. C_L includes probe and jig capacitance.

Figure 4. Receiver Test Circuit and Voltage Waveforms

TYPICAL CHARACTERISTICS

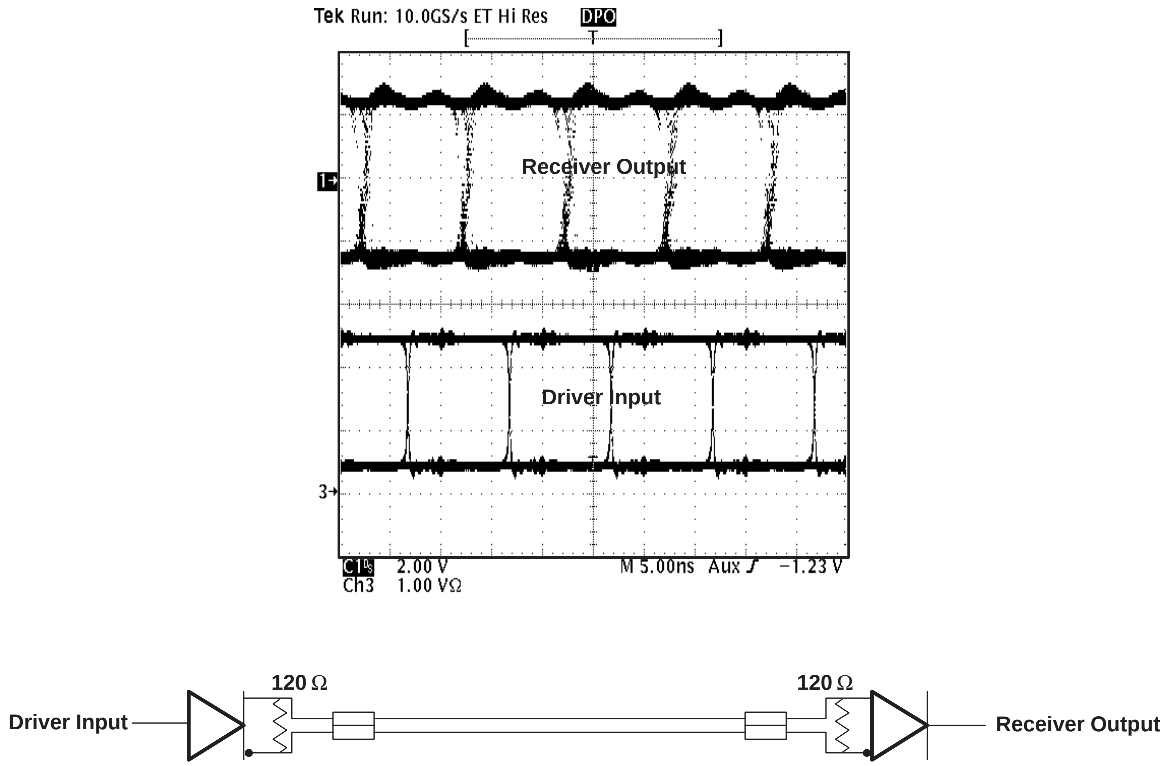


Figure 5. Typical Waveform of Non-Return-To-Zero (NRZ), Pseudorandom Binary Sequence (PRBS) Data at 100 Mbps Through 15m, of CAT 5 Unshielded Twisted Pair (UTP) Cable

TIA/EIA-485-A defines a maximum signaling rate as that in which the transition time of the voltage transition of a logic-state change remains less than or equal to 30% of the bit length. Transition times of greater length perform quite well even though they do not meet the standard by definition.

TYPICAL CHARACTERISTICS

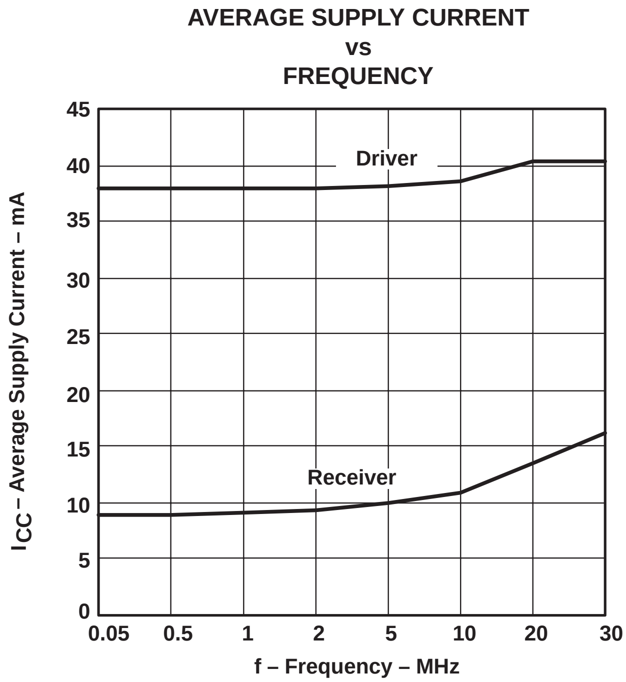


Figure 6

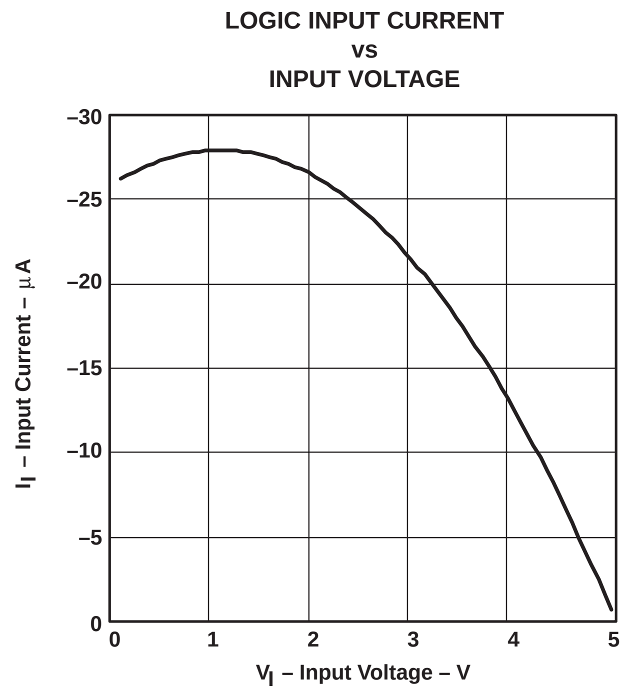


Figure 7

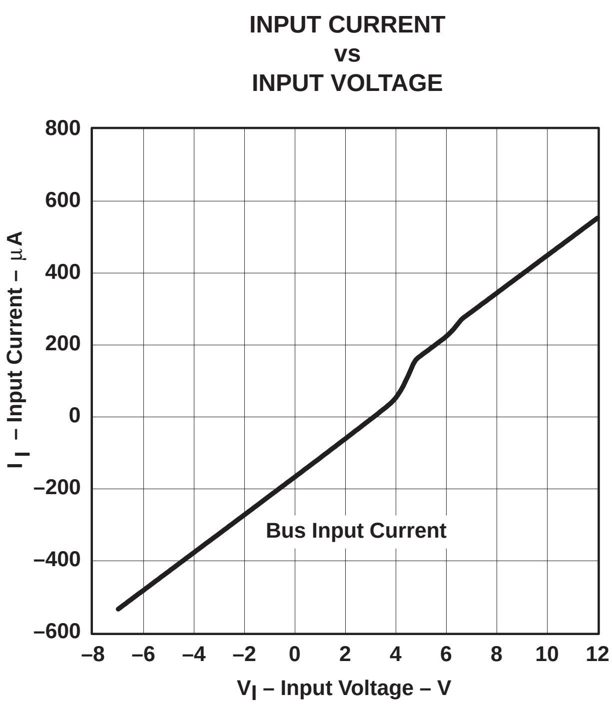


Figure 8

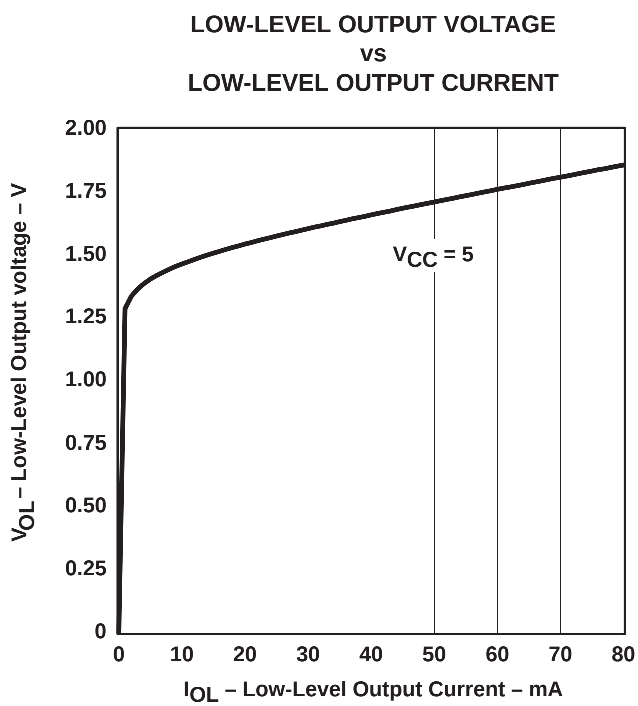


Figure 9

TYPICAL CHARACTERISTICS

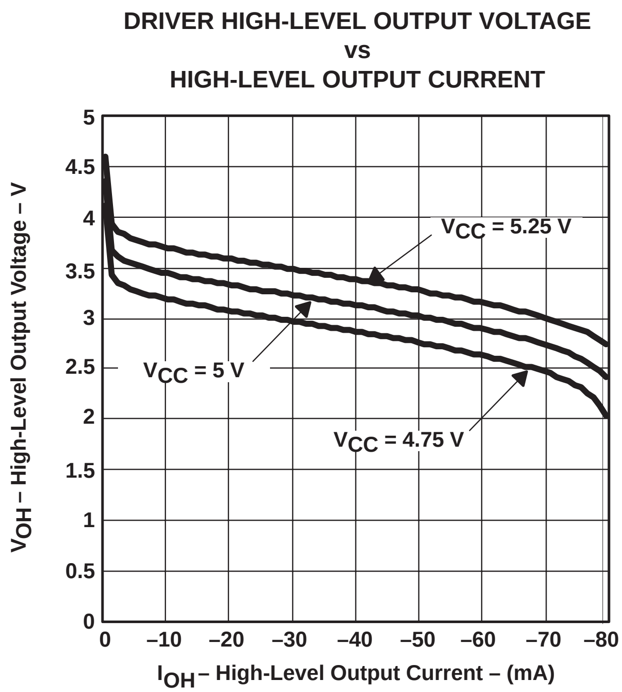


Figure 10

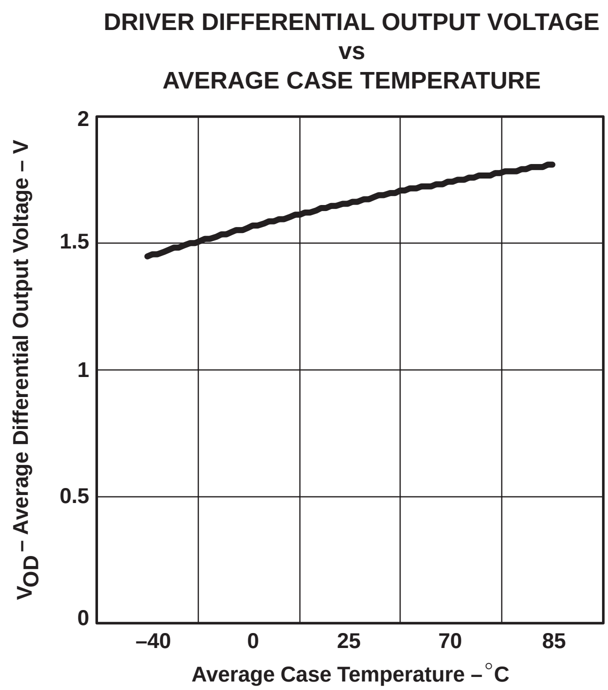


Figure 11

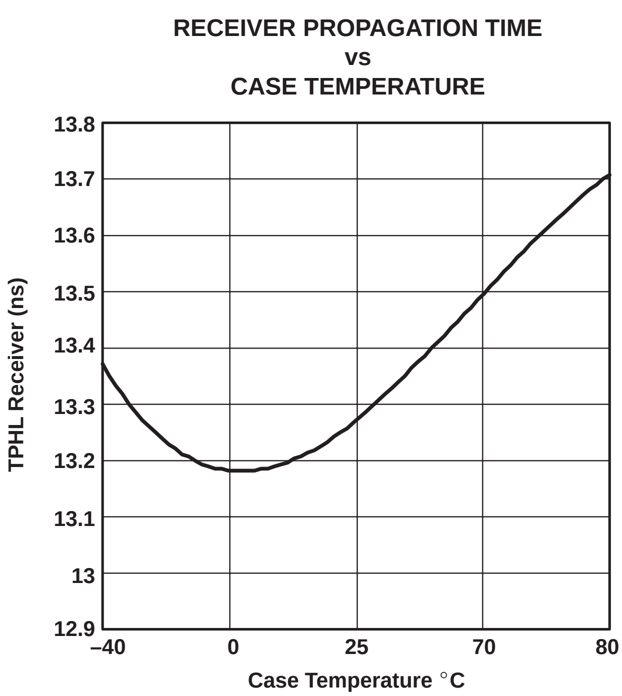


Figure 12

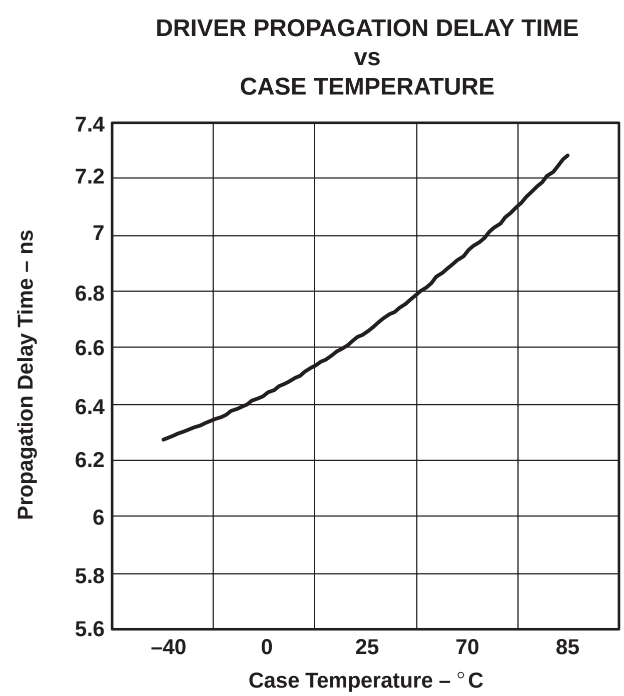


Figure 13

TYPICAL CHARACTERISTICS

DRIVER OUTPUT CURRENT
vs
SUPPLY VOLTAGE

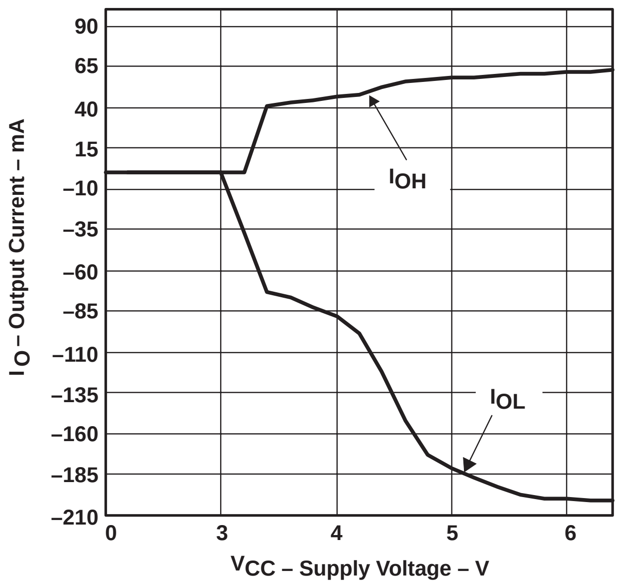
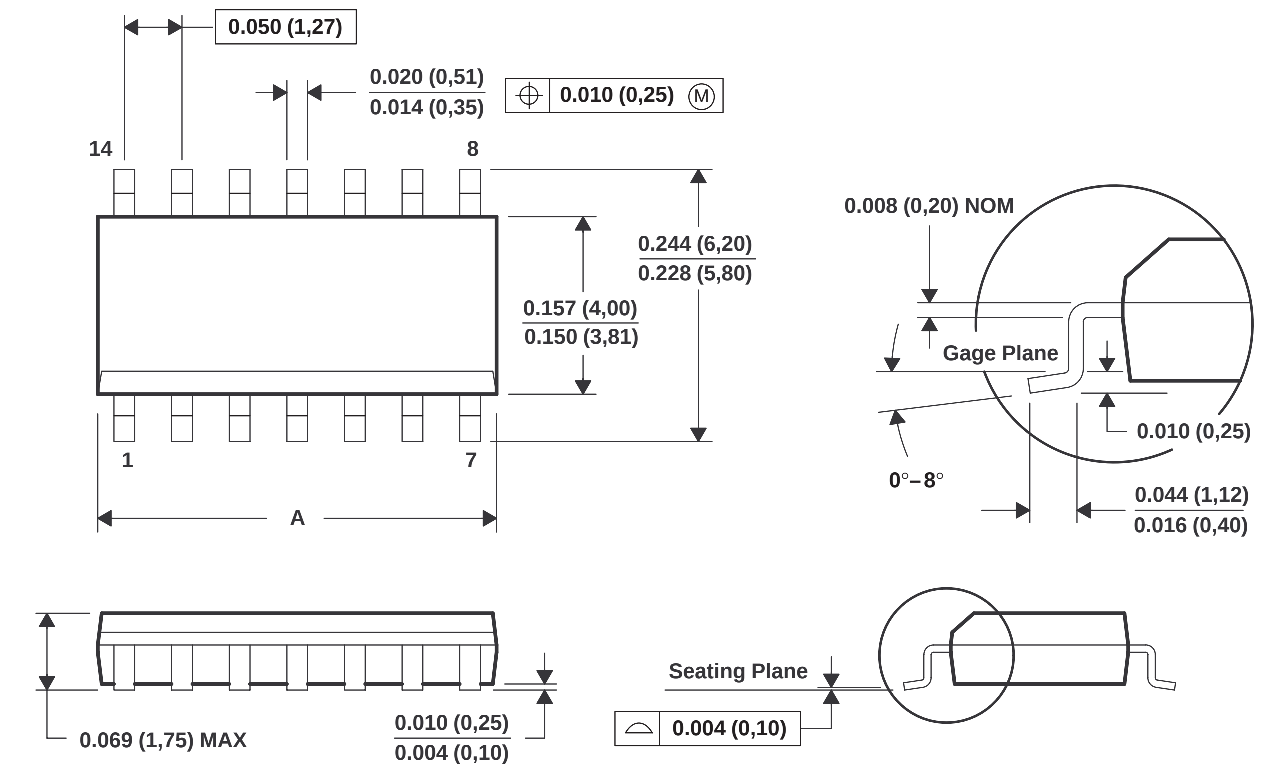


Figure 14

MECHANICAL INFORMATION

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

14 PINS SHOWN



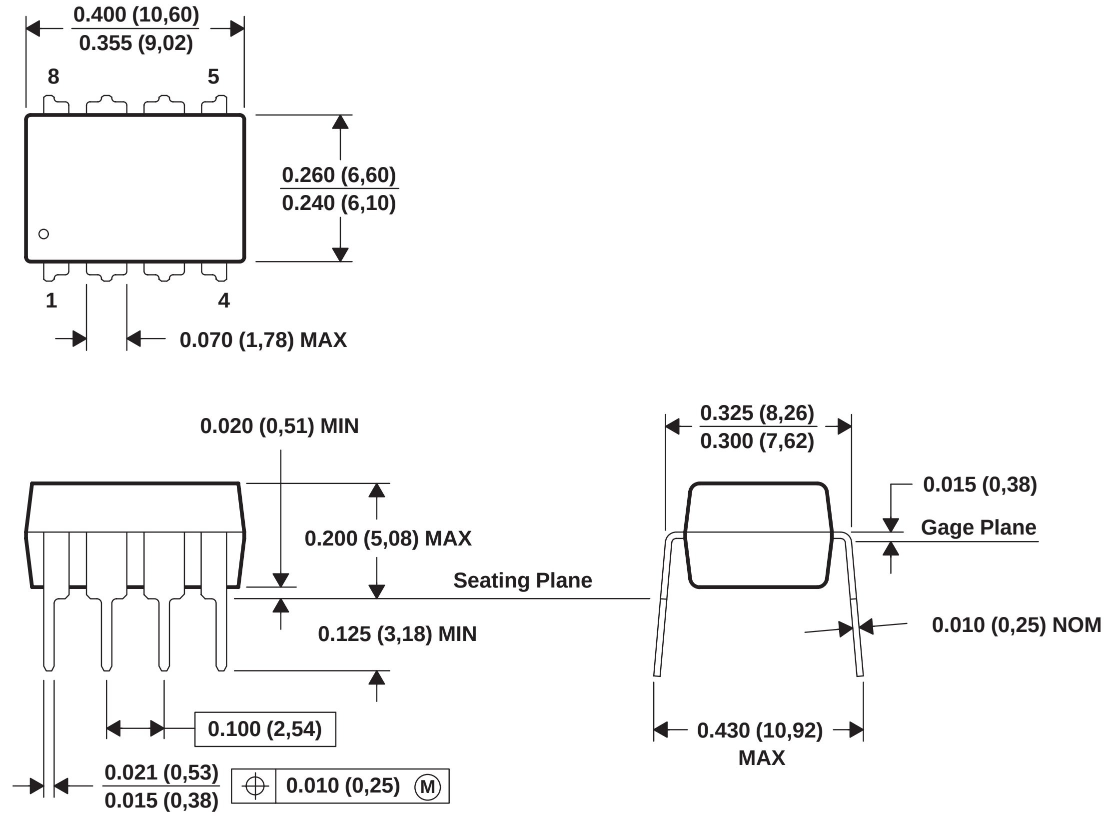
DIM \ PINS **	8	14	16
A MAX	0.197 (5,00)	0.344 (8,75)	0.394 (10,00)
A MIN	0.189 (4,80)	0.337 (8,55)	0.386 (9,80)

4040047/D 10/96

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

MECHANICAL INFORMATION

P (R-PDIP-T8) **PLASTIC DUAL-IN-LINE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS-001

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