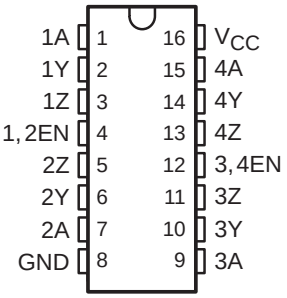
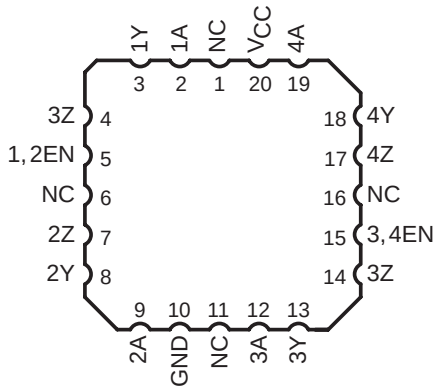
SN55LBC174
QUADRUPLE LOW-POWER DIFFERENTIAL LINE DRIVER

- **Meets EIA Standard RS-485**
- **Designed for High-Speed Multipoint Transmission on Long Bus Lines in Noisy Environments**
- **Supports Data Rates up to and Exceeding Ten Million Transfers Per Second**
- **Common-Mode Output Voltage Range of –7 V to 12 V**
- **Positive- and Negative-Current Limiting**
- **Low Power Consumption . . . 1.5 mA Max (Output Disabled)**

J OR W PACKAGE
(TOP VIEW)



FK PACKAGE
(TOP VIEW)



NC – No internal connection

description

The SN55LBC174 is composed of monolithic quadruple differential line drivers with 3-state outputs. This device is designed to meet the requirements of the Electronics Industry Association (EIA) Standard RS-485 and is optimized for balanced multipoint bus transmission at data rates up to and exceeding 10 million bits per second. Each driver features wide positive and negative common-mode output voltage ranges, current limiting, and thermal-shutdown protection making it suitable for party-line applications in noisy environments. This device is designed using LinBiCMOS™, facilitating ultra-low power consumption and inherent robustness.

The SN55LBC174 provides positive and negative-current limiting and thermal shutdown for protection from line fault conditions on the transmission bus line. This device offers optimum performance when used with the SN55LBC173 quadruple line receiver. The SN55LBC174 is available in the 16-pin CDIP package (J), the 16-pin CPAK (W), or the 20-pin LCCC package (FK).

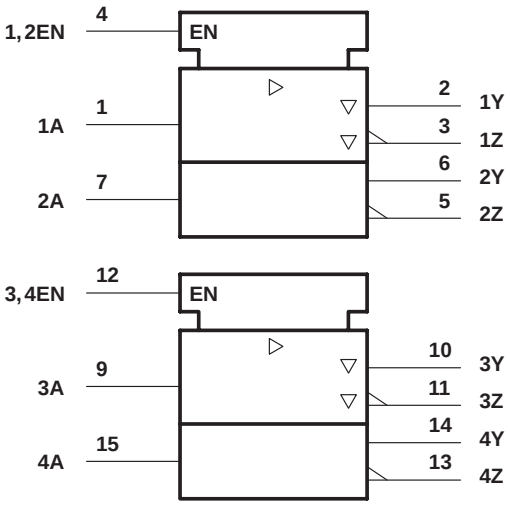
The SN55LBC174 is characterized for operation over the military temperature range of –55°C to 125°C.

FUNCTION TABLE
(each driver)

INPUT	ENABLE	OUTPUTS	
		Y	Z
H	H	H	L
L	H	L	H
X	L	Z	Z

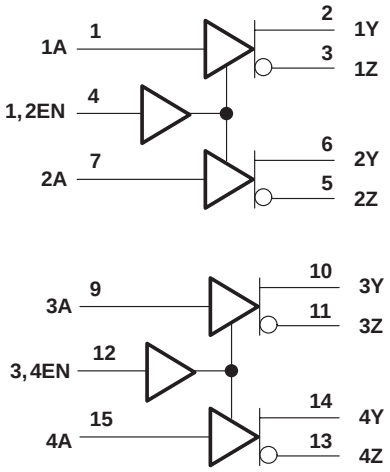
H = high level, L = low level, X = irrelevant,
Z = high impedance (off)

logic symbol†

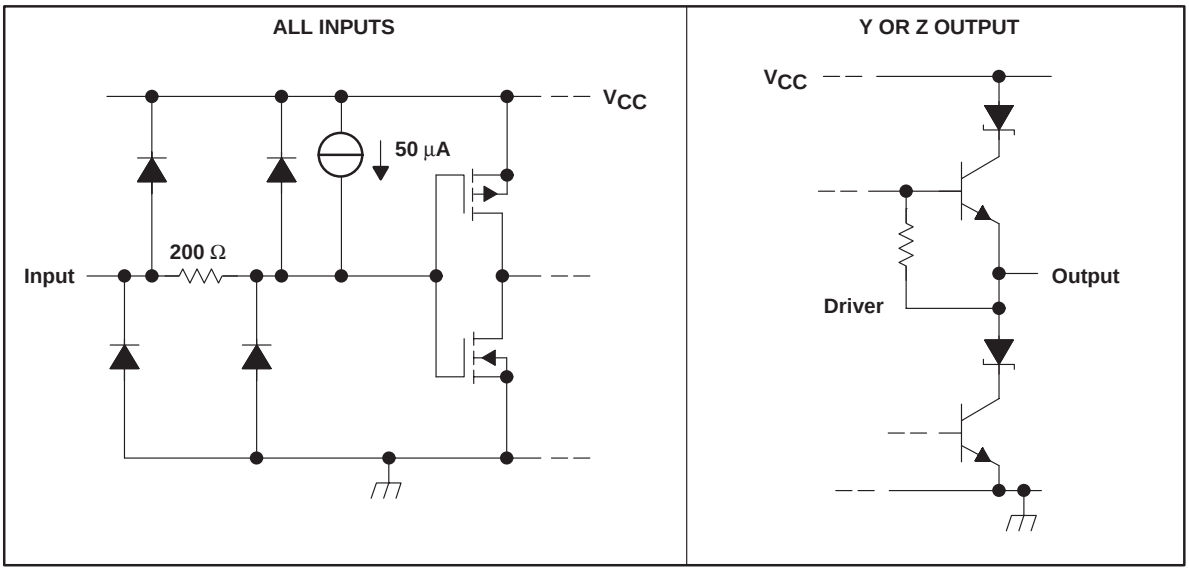


† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.
Pin numbers shown are for the J or W package.

logic diagram (positive logic)



schematic of inputs and outputs



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

Supply voltage range, V_{CC} (see Note 1) . . . . . –0.3 V to 7 V
Output voltage range, V_O . . . . . –10 V to 15 V
Input voltage range, V_I . . . . . –0.3 V to 7 V
Continuous power dissipation . . . . . internally limited‡
Operating free-air temperature range, T_A . . . . . –55°C to 125°C
Storage temperature range, T_{stg} . . . . . –65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds . . . . . –65°C to 150°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.
‡ The maximum operating junction temperature is internally limited. Use the dissipation rating table to operate below this temperature.
NOTE 1: All voltage values are with respect to GND.

DISSIPATION RATING TABLE

PACKAGE	$T_A \le 25°C$ POWER RATING	DERATING FACTOR ABOVE $T_A = 25°C$	$T_A = 125°C$ POWER RATING
FK	1375 mW	11.0 mW/°C	275 mW
J	1375 mW	11.0 mW/°C	275 mW
W	1000 mW	8.0 mW/°C	200 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
Voltage at any bus terminal (separately or common mode), V_O	Y or Z			12	V
				–7	
High-level output current, I_{OH}	Y or Z			–60	mA
Low-level output current, I_{OL}	Y or Z			60	mA
Operating free-air temperature, T_A		–55		125	°C

electrical characteristics over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)

PARAMETER		TEST CONDITIONS		MIN	TYP†	MAX	UNIT
V_{IK}	Input clamp voltage	I_I = –18 mA				–1.5	V
$\|V_{OD}\|$	Differential output voltage‡	R_L = 54 Ω, See Figure 1		1.1	1.8	5	V
		R_L = 60 Ω, See Figure 2		1.1	1.7	5	
$\Delta\|V_{OD}\|$	Change in magnitude of differential output voltage§	R_L = 54 Ω, See Figure 1				±0.2	V
V_{OC}	Common-mode output voltage					3 –1	V
$\Delta\|V_{OC}\|$	Change in magnitude of common-mode output voltage§					±0.2	V
I_O	Output current with power off	V_{CC} = 0, V_O = – 7 V to 12 V				±100	µA
I_{OZ}	High-impedance-state output current	V_O = – 7 V to 12 V				±100	µA
I_{IH}	High-level input current	V_I = 2.4 V				–100	µA
I_{IL}	Low-level input current	V_I = 0.4 V				–100	µA
I_{OS}	Short-circuit output current	V_O = –7 V to 12 V				±250	mA
I_{CC}	Supply current (all drivers)	No load	Outputs enabled			7	mA
			Outputs disabled			1.5	

† All typical values are at V_{CC} = 5 V and T_A = 25°C.
‡ The minimum V_{OD} specification does not fully comply with EIA Standard RS-485 at operating temperatures below 0°C. The lower output signal should be used to determine the maximum signal transmission distance.
§ $\Delta|V_{OD}|$ and $\Delta|V_{OC}|$ are the changes in magnitude of V_{OD} and V_{OC}, respectively, that occur when the input is changed from a high level to a low level.

switching characteristics, V_{CC} = 5 V

PARAMETER		TEST CONDITIONS	T_A	MIN	TYP	MAX	UNIT
$t_{d(OD)}$	Differential output delay time	R_L = 54 Ω, See Figure 3	25°C	2	11	20	ns
			–55°C to 125°C	2		40	
$t_{t(OD)}$	Differential output transition time	R_L = 54 Ω, See Figure 3	25°C	4	15	25	ns
			–55°C to 125°C	4		40	
t_{PZH}	Output enable time to high level	R_L = 110 Ω, See Figure 4	25°C			30	ns
			–55°C to 125°C			40	
t_{PZL}	Output enable time to low level	R_L = 110 Ω, See Figure 5	25°C			30	ns
			–55°C to 125°C			40	
t_{PHZ}	Output disable time from high level	R_L = 110 Ω, See Figure 4	25°C			50	ns
			–55°C to 125°C			90	
t_{PLZ}	Output disable time from low level	R_L = 110 Ω, See Figure 5	25°C			30	ns
			–55°C to 125°C			45	

PARAMETER MEASUREMENT INFORMATION

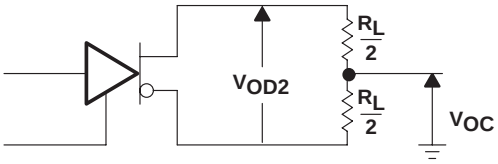


Figure 1. Differential and Common-Mode Output Voltages

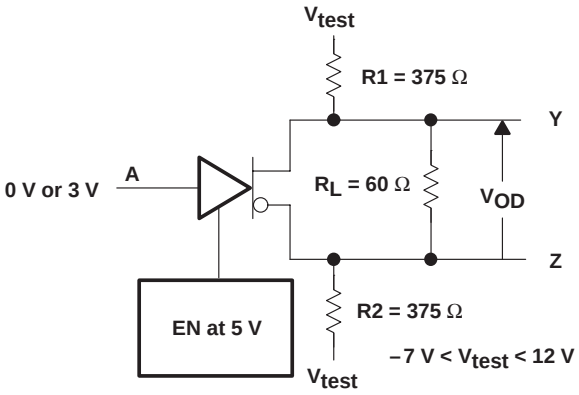
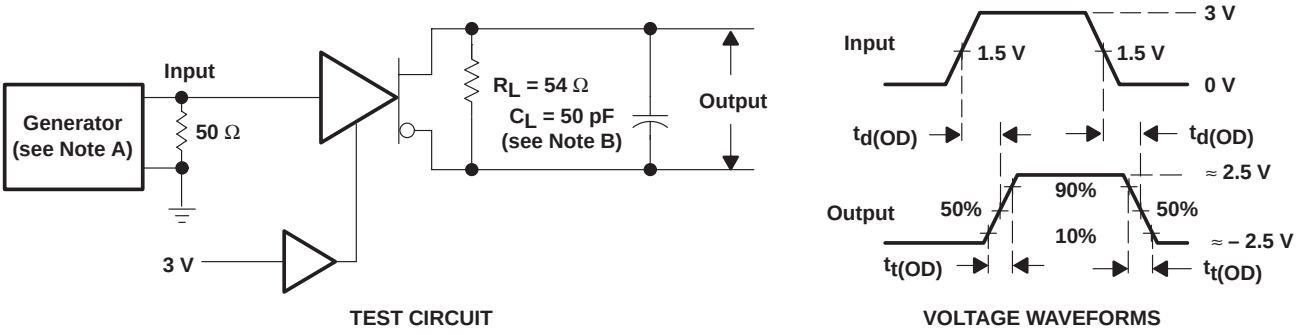


Figure 2. Driver V_{OD} Test Circuit

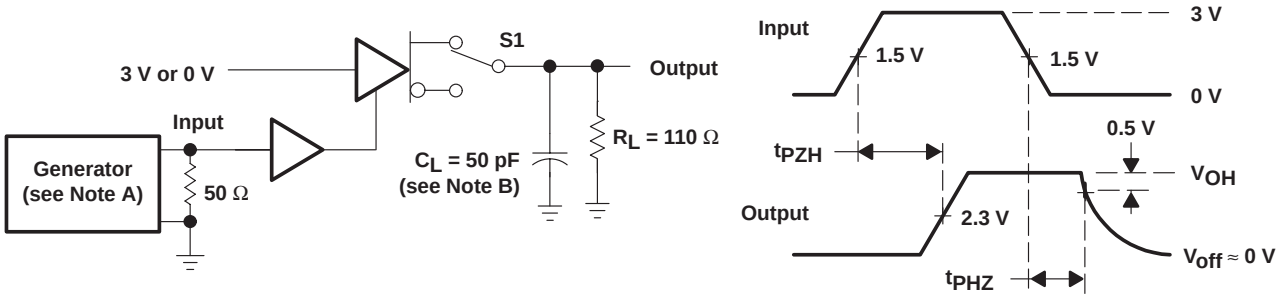


TEST CIRCUIT **VOLTAGE WAVEFORMS**

NOTES: A. The input pulse is supplied by a generator having the following characteristics: PRR ≤ 1 MHz, duty cycle ≤ 50%, t_r ≤ 5 ns, t_f ≤ 5 ns, Z_O = 50 Ω.
B. C_L includes probe and stray capacitance.

Figure 3. Driver Differential-Output Test Circuit Delay and Transition-Time Waveforms

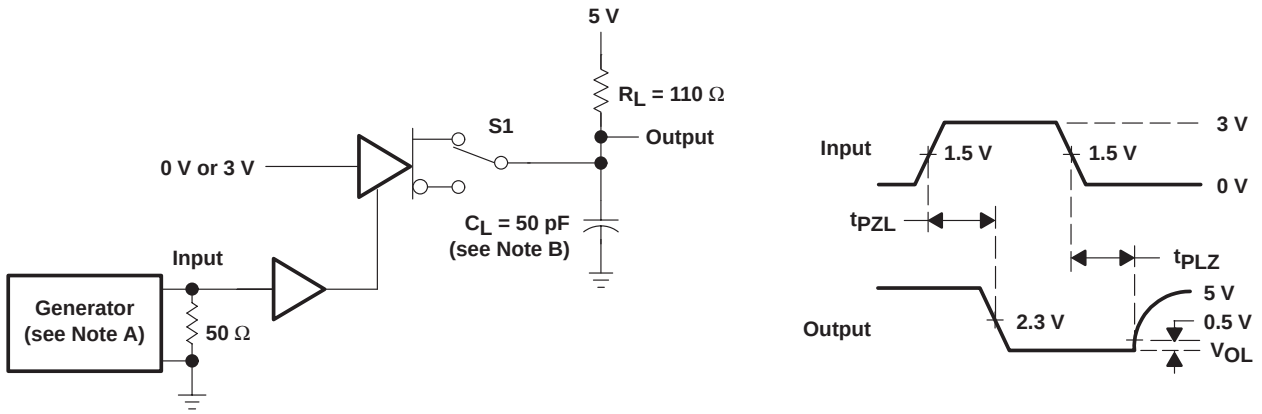
PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT VOLTAGE WAVEFORMS

NOTES: A. The input pulse is supplied by a generator having the following characteristics: PRR ≤ 1 MHz, duty cycle ≤ 50%, t_r ≤ 5 ns, t_f ≤ 5 ns, Z_O = 50 Ω.
B. C_L includes probe and stray capacitance.

Figure 4. t_{PZH} and t_{PHZ} Test Circuit and Waveforms



TEST CIRCUIT VOLTAGE WAVEFORMS

NOTES: A. The input pulse is supplied by a generator having the following characteristics: PRR ≤ 1 MHz, duty cycle ≤ 50%, t_r ≤ 5 ns, t_f ≤ 5 ns, Z_O = 50 Ω.
B. C_L includes probe and stray capacitance.

Figure 5. t_{PZL} and t_{PLZ} Test Circuit and Waveforms

TYPICAL CHARACTERISTICS

OUTPUT CURRENT vs OUTPUT VOLTAGE

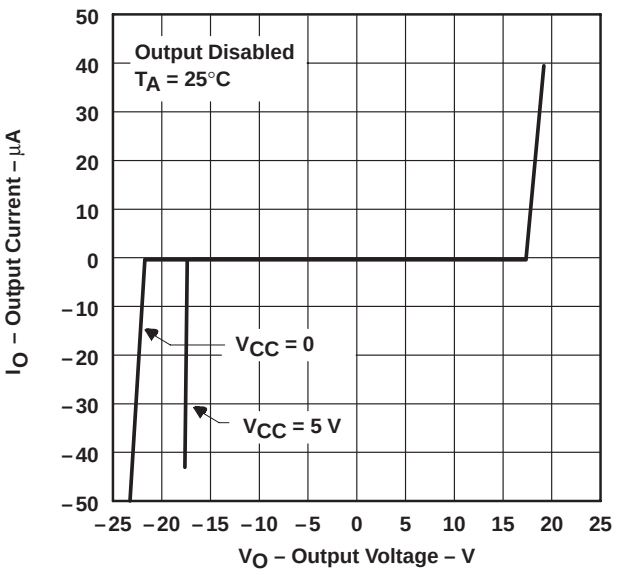


Figure 6

LOW-LEVEL OUTPUT VOLTAGE vs LOW-LEVEL OUTPUT CURRENT

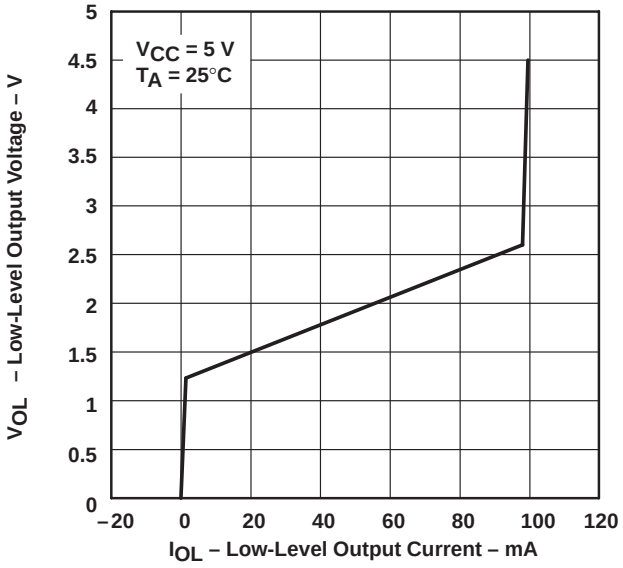


Figure 7

DIFFERENTIAL OUTPUT VOLTAGE vs FREE-AIR TEMPERATURE

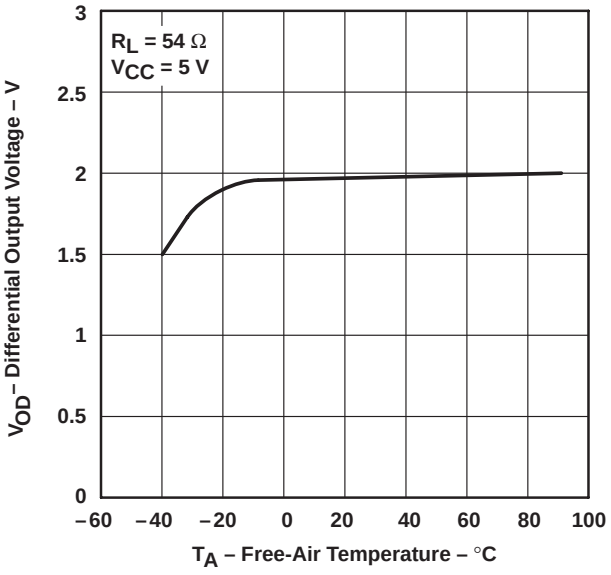


Figure 8

HIGH-LEVEL OUTPUT VOLTAGE vs HIGH-LEVEL OUTPUT CURRENT

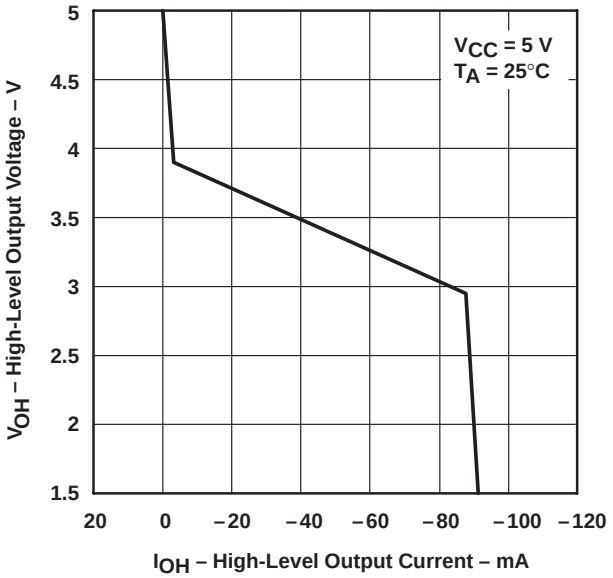


Figure 9

TYPICAL CHARACTERISTICS

DIFFERENTIAL OUTPUT VOLTAGE vs OUTPUT CURRENT

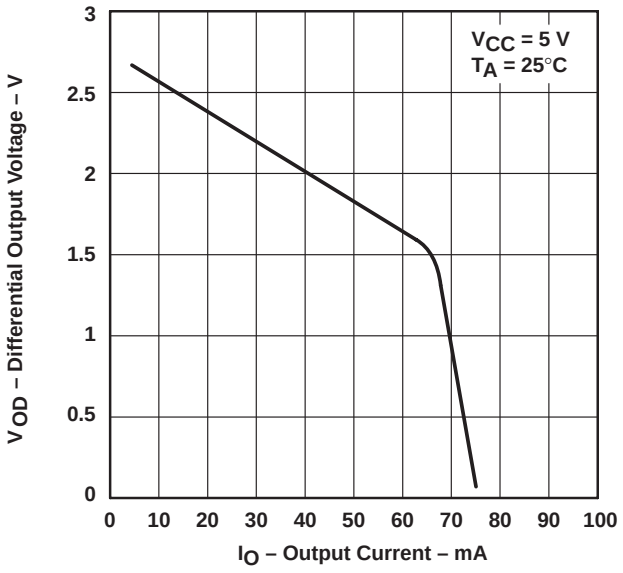


Figure 10

PROPAGATION DELAY TIME, DIFFERENTIAL OUTPUT vs FREE-AIR TEMPERATURE

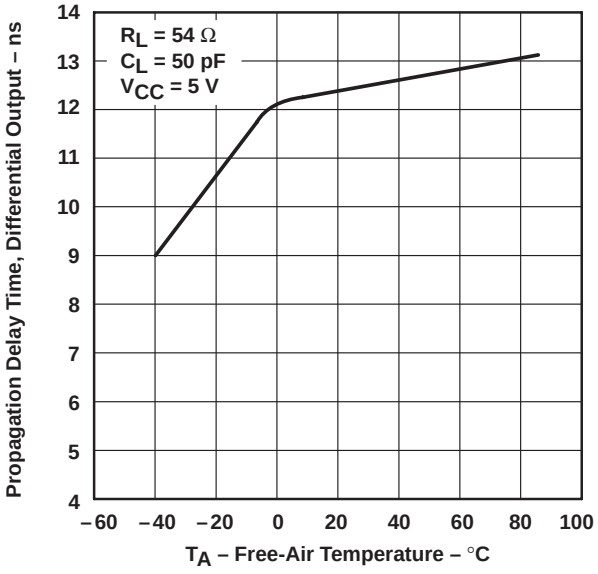


Figure 11

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