

SN55LBC172

QUADRUPLE LOW-POWER DIFFERENTIAL LINE DRIVER

SGLS084C – MARCH 1995 – REVISED JANUARY 2003

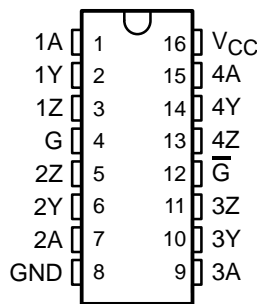
- Meets Standard EIA-485
- Designed for High-Speed Multipoint Transmission on Long Bus Lines in Noisy Environments
- Supports Data Rates up to and Exceeding Ten Million Transfers Per Second
- Common-Mode Output Voltage Range of -7 V to 12 V
- Positive- and Negative-Current Limiting
- Low Power Consumption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

description

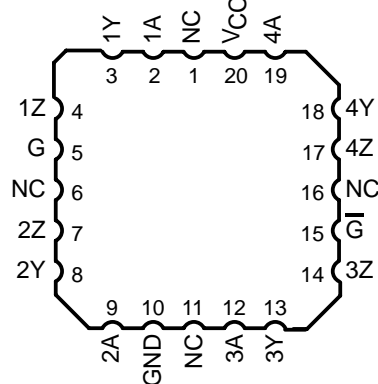
The SN55LBC172 is a monolithic quadruple differential line driver with 3-state outputs. This device is designed to meet the requirements of the Electronics Industry Association (EIA) standard RS-485. The SN55LBC172 is optimized for balanced multipoint bus transmission at data rates up to and exceeding 10 million bits per second. The driver features wide positive and negative common-mode output voltage ranges, current limiting, and thermal-shutdown circuitry, making it suitable for party-line applications in noisy environments. The device is designed using the LinBiCMOS™ process, facilitating ultralow power consumption and inherent robustness.

The SN55LBC172 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 SN55LBC173M quadruple line receiver.

**J OR W PACKAGE
(TOP VIEW)**



**FK PACKAGE
(TOP VIEW)**



NC – No internal connection

ORDERING INFORMATION‡

TA	PACKAGE§		ORDERABLE PART NUMBER	TOP-SIDE MARKING
-55°C to 125°C	LCCC – FK	Tube	SNJ55LBC172FK	SNJ55LBC172FK
	CDIP – J	Tube	SNJ55LBC172J	SNJ55LBC172J
	CFP – W	Tube	SNJ55LBC172W	SNJ55LBC172W

‡ Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.



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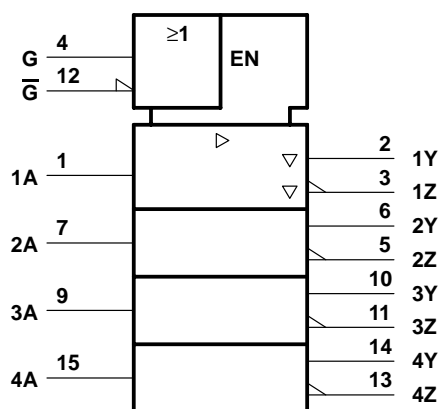
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FUNCTION TABLE
(each driver)

INPUT A	ENABLES		OUTPUTS	
	G	\bar{G}	Y	Z
H	H	X	H	L
L	H	X	L	H
H	X	L	H	L
L	X	L	L	H
X	L	H	Z	Z

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

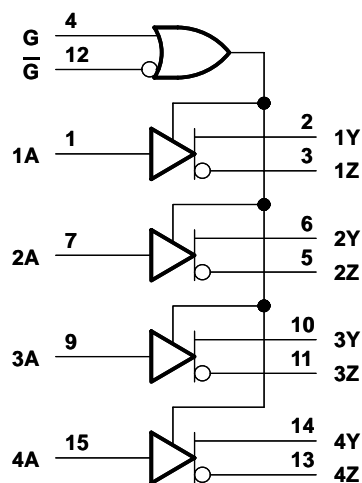
logic symbol†



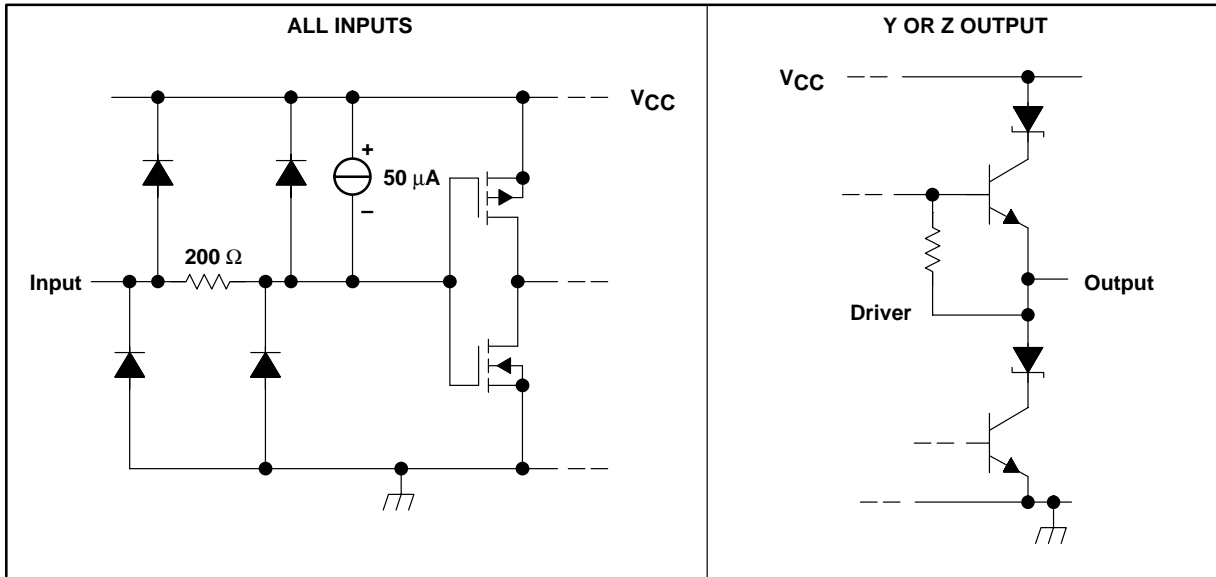
† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

Pin numbers shown are for the J or W package.

logic diagram (positive logic)



schematic diagrams of inputs and outputs



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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	$T_A \leq 25^\circ\text{C}$ POWER RATING	DERATING FACTOR ABOVE $T_A=125^\circ\text{C}$	$T_A = 125^\circ\text{C}$ 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
Output 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
Continuous total power dissipation	See Dissipation Rating Table			
Operating free-air temperature, T_A	-55		125	°C



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

† All typical values are at $V_{CC} = 5 \text{ V}$ and $T_A = 25^\circ\text{C}$.

‡ The minimum V_{OD} specification does not fully comply with EIA-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, $V_{CC} = 5 \text{ V}$

PARAMETER		TEST CONDITIONS	T_A	MIN	TYP	MAX	UNIT
$t_{d(OD)}$	Differential output delay time	$R_L = 54 \Omega$, See Figure 3	25°C	2	11	20	ns
			$-55^\circ\text{C to } 125^\circ\text{C}$		2		
$t_{t(OD)}$	Differential output transition time	$R_L = 54 \Omega$, See Figure 3	25°C	10	15	25	ns
			$-55^\circ\text{C to } 125^\circ\text{C}$		4		
t_{PZH}	Output enable time to high level	$R_L = 110 \Omega$, See Figure 4	25°C			30	ns
			$-55^\circ\text{C to } 125^\circ\text{C}$			40	
t_{PZL}	Output enable time to low level	$R_L = 110 \Omega$, See Figure 5	25°C			30	ns
			$-55^\circ\text{C to } 125^\circ\text{C}$			40	
t_{PHZ}	Output disable time from high level	$R_L = 110 \Omega$, See Figure 4	25°C			60	ns
			$-55^\circ\text{C to } 125^\circ\text{C}$			115	
t_{PLZ}	Output disable time from low level	$R_L = 110 \Omega$, See Figure 5	25°C			30	ns
			$-55^\circ\text{C to } 125^\circ\text{C}$			55	



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PARAMETER MEASUREMENT INFORMATION

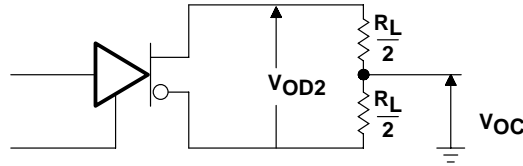


Figure 1. Differential and Common-Mode Output Voltages

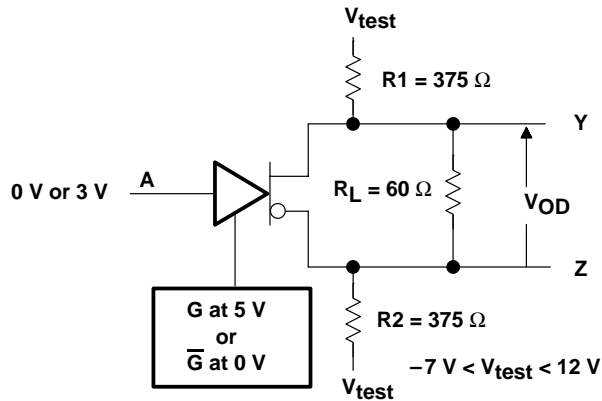
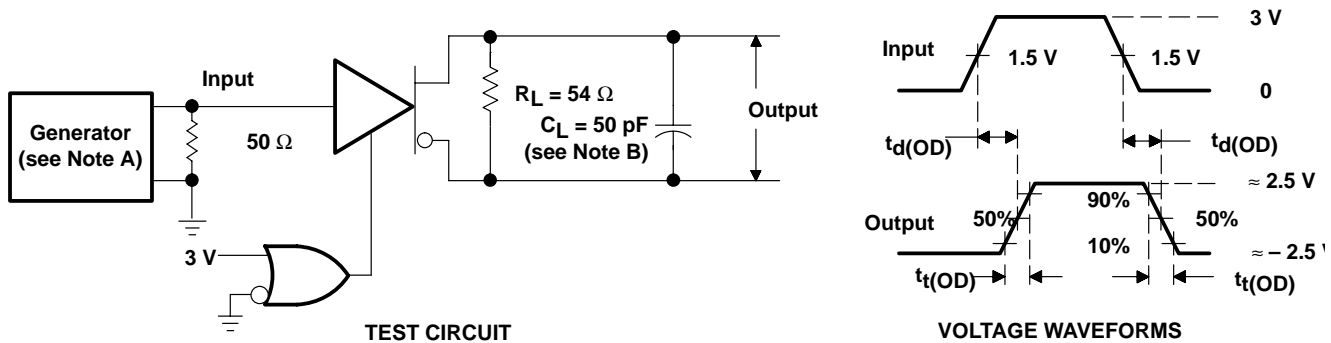


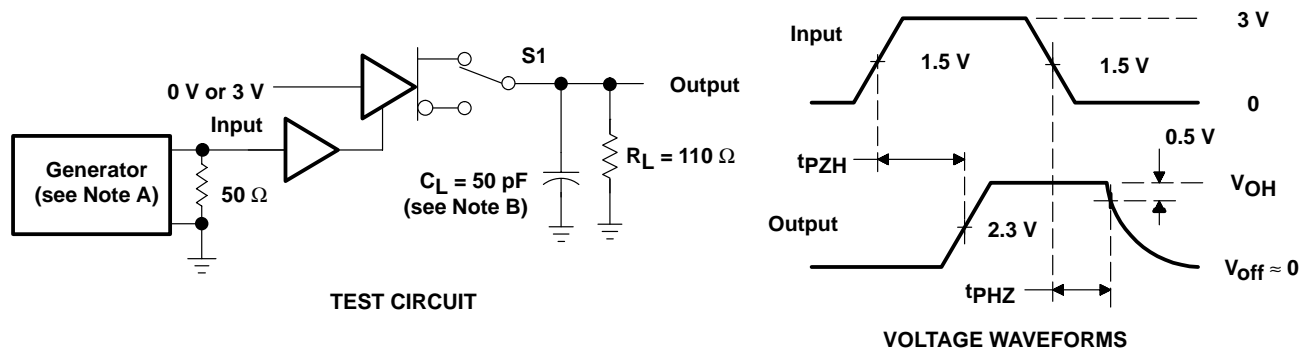
Figure 2. Driver V_{OD} Test Circuit



- NOTES: A. The input pulses are supplied by a generator having the following characteristics: $PRR \leq 1$ MHz, duty cycle $\leq 50\%$, $t_r \leq 5$ ns, $t_f \leq 5$ ns, $Z_O = 50 \Omega$.
- B. C_L includes probe and stray capacitance.

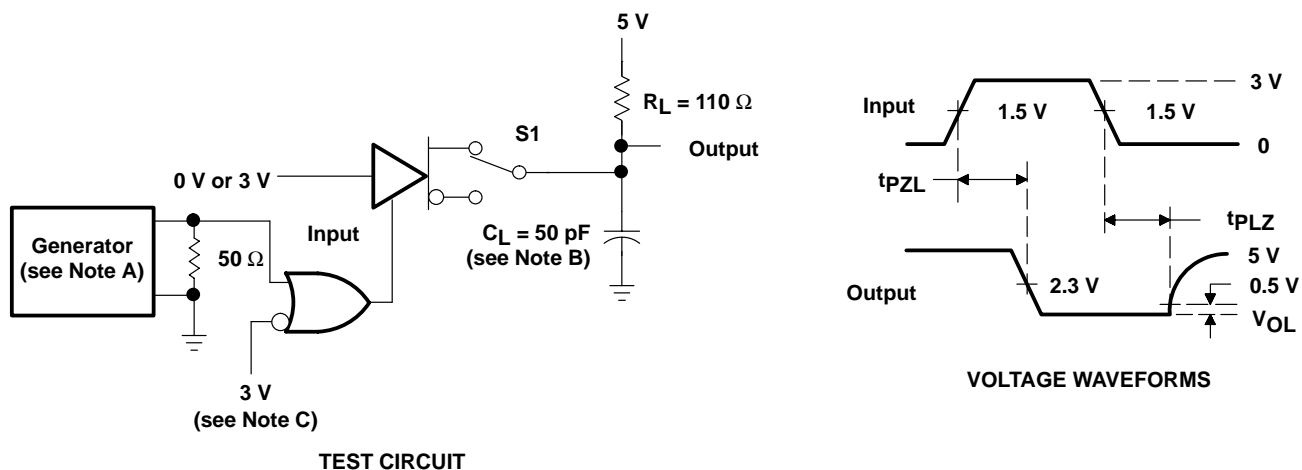
Figure 3. Driver Differential-Output Test Circuit and Delay and Transition-Time Waveforms

PARAMETER MEASUREMENT INFORMATION



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

Figure 4. t_{pZH} and t_{PHZ} Test Circuit and Voltage Waveforms



- NOTES: A. The input pulse is supplied by a generator having the following characteristics: PRR \leq 1 MHz, duty cycle \leq 50%, $t_r \leq$ 5 ns, $t_f \leq$ 5 ns, $Z_O = 50 \Omega$.
 B. C_L includes probe and stray capacitance.
 C. To test the active-low enable \overline{G} , ground G and apply an inverted waveform to \overline{G} .

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

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TYPICAL CHARACTERISTICS

OUTPUT CURRENT
vs
OUTPUT VOLTAGE

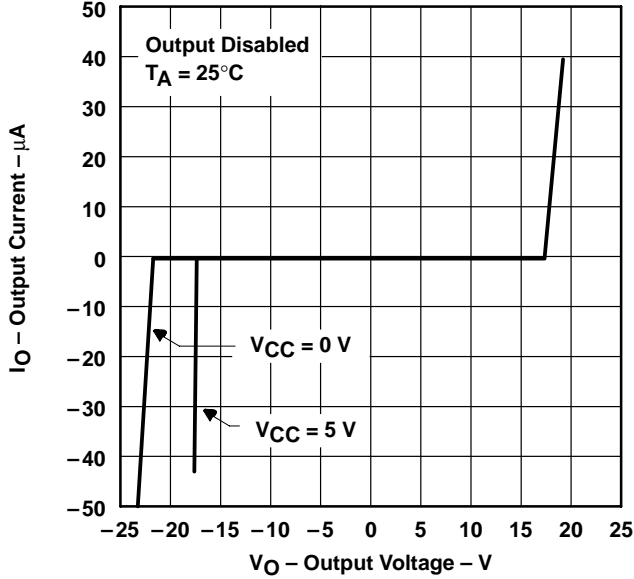


Figure 6

LOW-LEVEL OUTPUT VOLTAGE
vs
LOW-LEVEL OUTPUT CURRENT

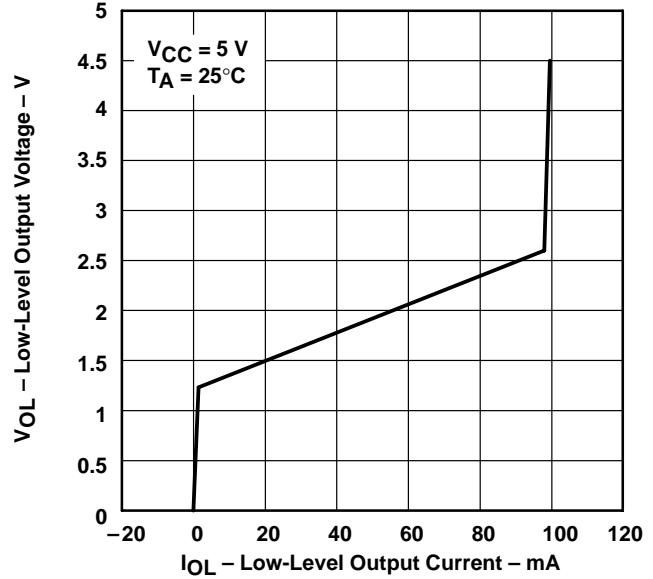


Figure 7

DRIVER
DIFFERENTIAL OUTPUT VOLTAGE
vs
FREE-AIR TEMPERATURE

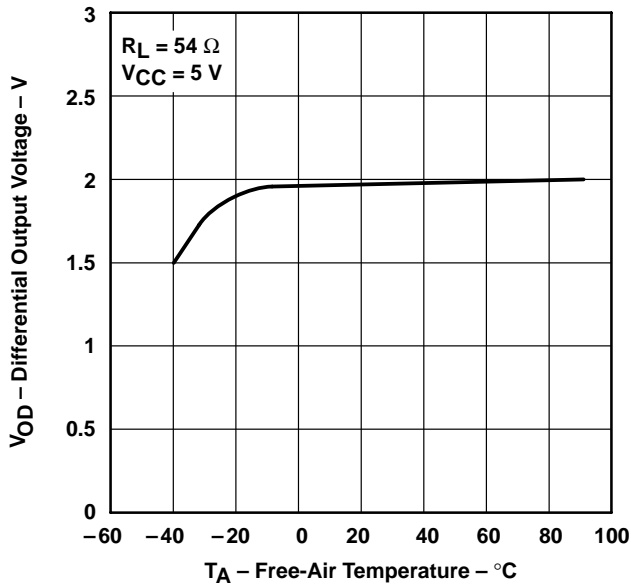


Figure 8

HIGH-LEVEL OUTPUT VOLTAGE
vs
HIGH-LEVEL OUTPUT CURRENT

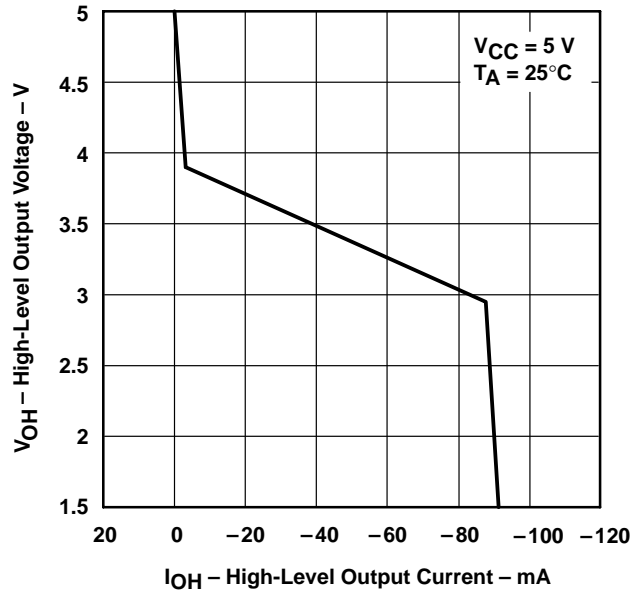


Figure 9



TYPICAL CHARACTERISTICS

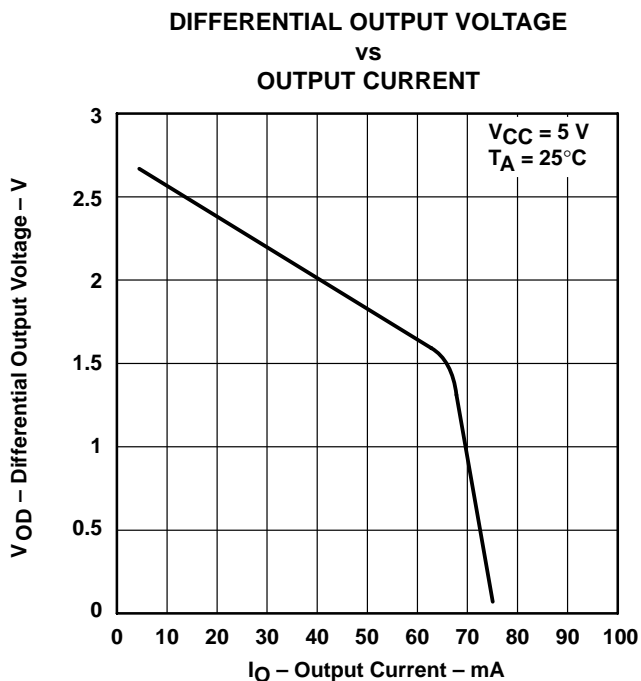


Figure 10

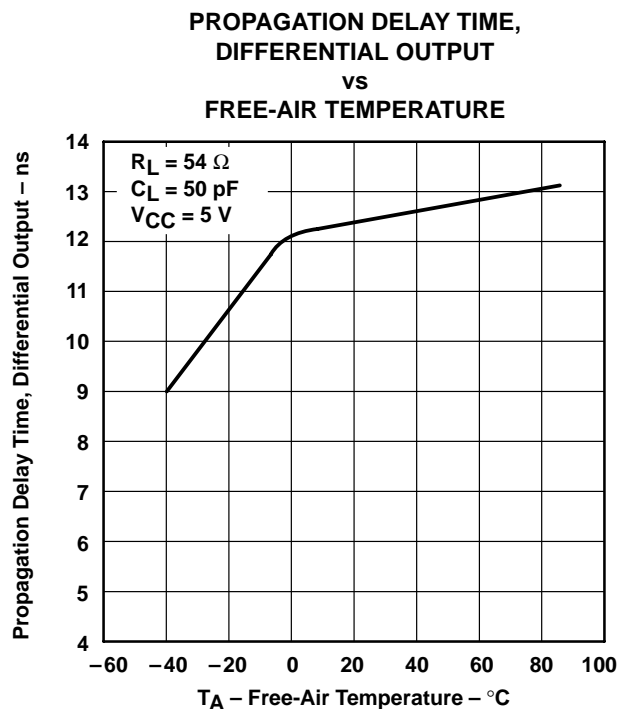


Figure 11

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/ Ball Finish	MSL Peak Temp ⁽³⁾	Samples (Requires Login)
5962-9076503Q2A	ACTIVE	LCCC	FK	20	1	TBD	Call TI	Call TI	
5962-9076503QEA	ACTIVE	CDIP	J	16	1	TBD	Call TI	Call TI	
5962-9076503QFA	ACTIVE	CFP	W	16	1	TBD	Call TI	Call TI	
SNJ55LBC172FK	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	
SNJ55LBC172J	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	
SNJ55LBC172W	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.

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OTHER QUALIFIED VERSIONS OF SN55LBC172 :

- Catalog: [SN75LBC172](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

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

W (R-GDFP-F16)

CERAMIC DUAL FLATPACK



- NOTES:
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 - 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

FK (S-CQCC-N**)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



NO. OF TERMINALS **	A		B	
	MIN	MAX	MIN	MAX
20	0.342 (8,69)	0.358 (9,09)	0.307 (7,80)	0.358 (9,09)
28	0.442 (11,23)	0.458 (11,63)	0.406 (10,31)	0.458 (11,63)
44	0.640 (16,26)	0.660 (16,76)	0.495 (12,58)	0.560 (14,22)
52	0.740 (18,78)	0.761 (19,32)	0.495 (12,58)	0.560 (14,22)
68	0.938 (23,83)	0.962 (24,43)	0.850 (21,6)	0.858 (21,8)
84	1.141 (28,99)	1.165 (29,59)	1.047 (26,6)	1.063 (27,0)



4040140/D 01/11

- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - This package can be hermetically sealed with a metal lid.
 - Falls within JEDEC MS-004

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