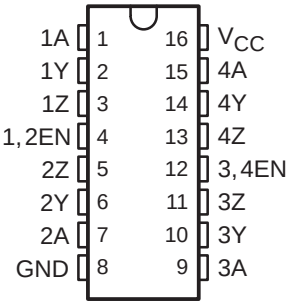
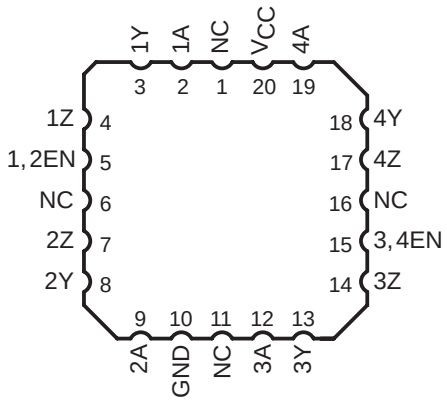
- **Meets EIA Standard RS-485**
- **Designed for High-Speed Multipoint Transmission on Long Bus Lines in Noisy Environments**
- **Supports Data Rates up to and Exceeding Ten Million Transfers Per Second**
- **Common-Mode Output Voltage Range of −7 V to 12 V**
- **Positive- and Negative-Current Limiting**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

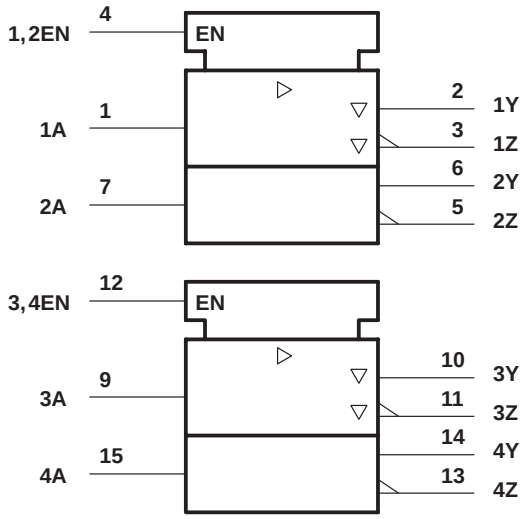
Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

LinBiCMOS is a trademark of Texas Instruments Incorporated.

**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.**

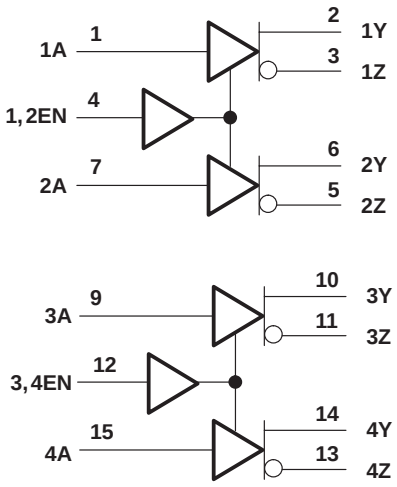
Copyright © 2004, Texas Instruments Incorporated
**On products compliant to MIL-PRF-38535, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.**

## logic symbol†

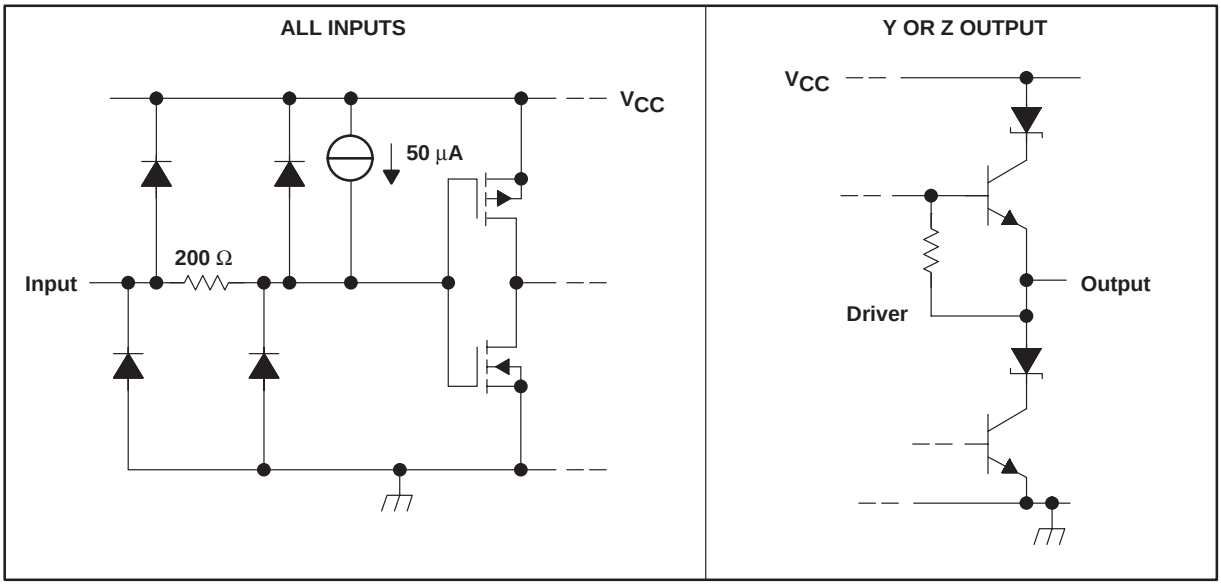



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC publication 617-12.
Pin numbers shown are for the J or W package.

## 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 mW/°C | 275 mW |
| J | 1375 mW | 11 mW/°C | 275 mW |
| W | 1000 mW | 8 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<br>−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

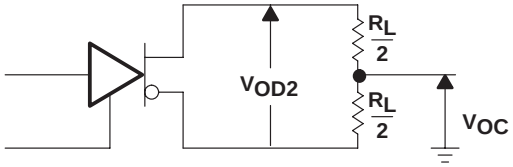



**Figure 1. Differential and Common-Mode Output Voltages**

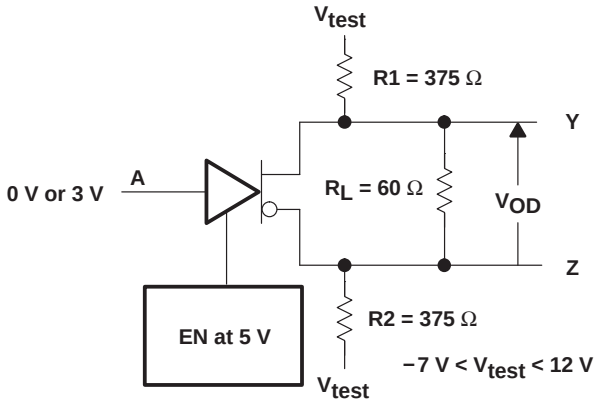
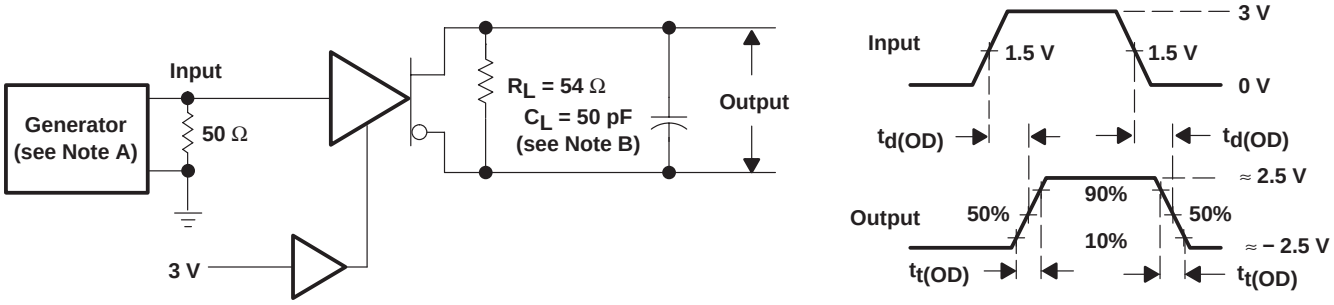



**Figure 2. Driver $V_{OD}$ Test Circuit**

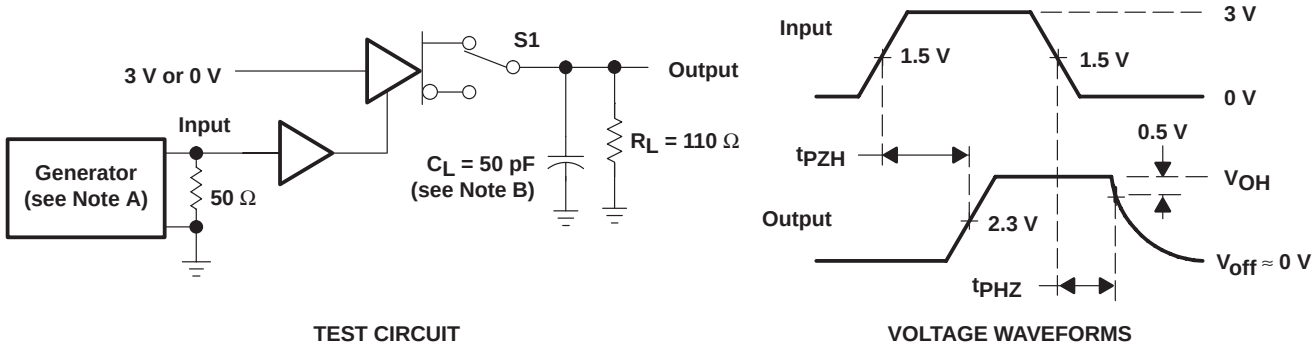



**TEST CIRCUIT** **VOLTAGE WAVEFORMS**

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**

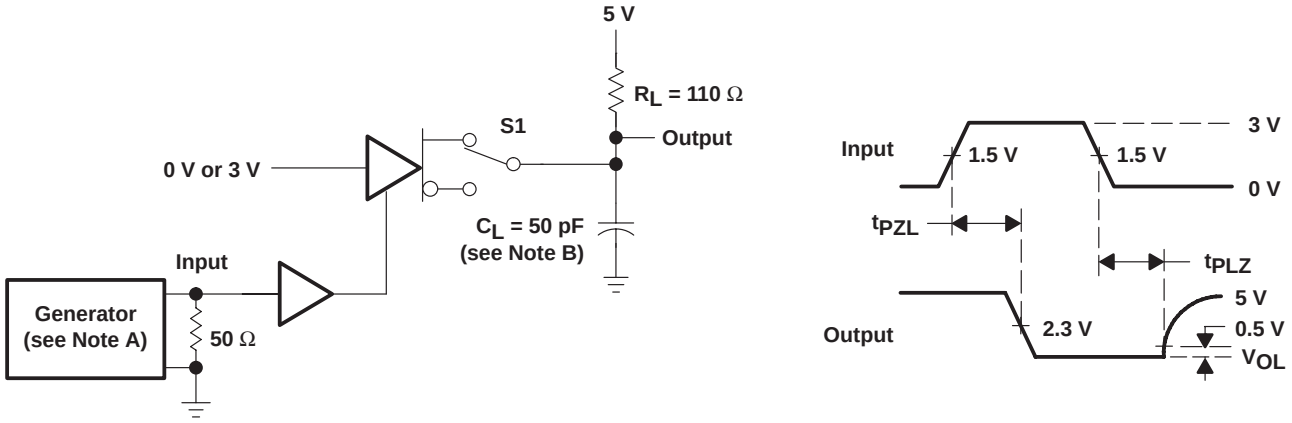
## PARAMETER MEASUREMENT INFORMATION




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**

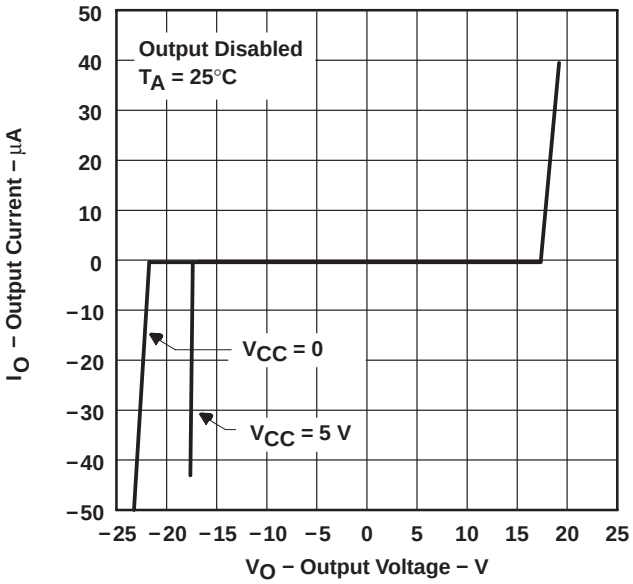



**Figure 6**

**LOW-LEVEL OUTPUT VOLTAGE vs LOW-LEVEL OUTPUT CURRENT**

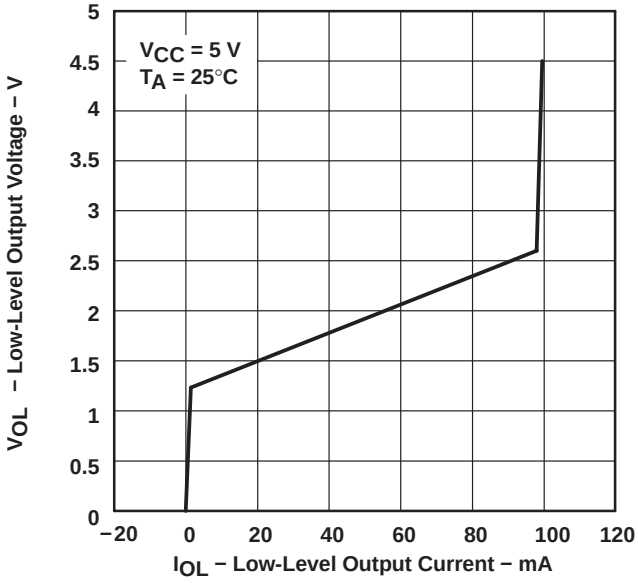



**Figure 7**

**DIFFERENTIAL OUTPUT VOLTAGE vs FREE-AIR TEMPERATURE**

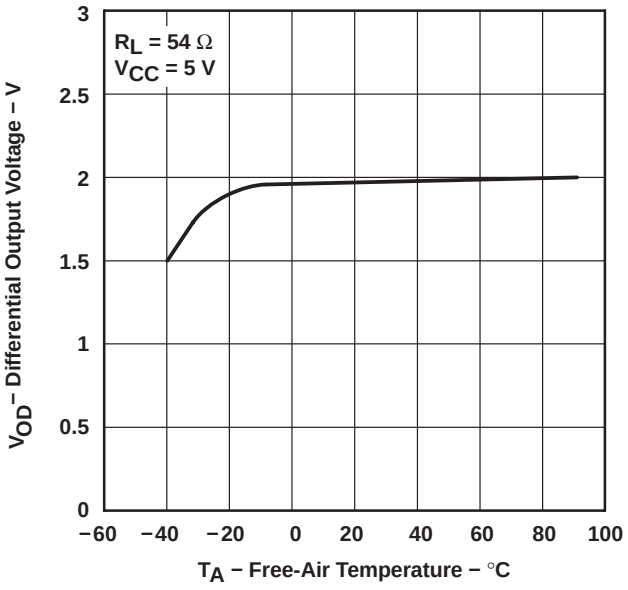



**Figure 8**

**HIGH-LEVEL OUTPUT VOLTAGE vs HIGH-LEVEL OUTPUT CURRENT**

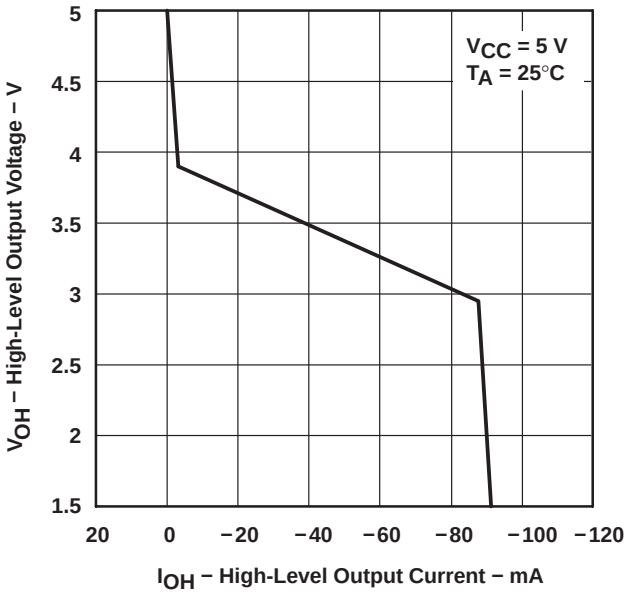



**Figure 9**

## TYPICAL CHARACTERISTICS

**DIFFERENTIAL OUTPUT VOLTAGE vs OUTPUT CURRENT**

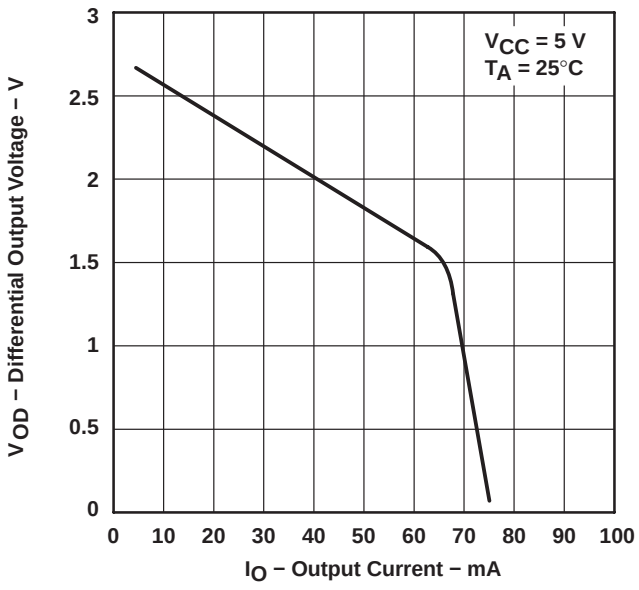



Figure 10

**PROPAGATION DELAY TIME, DIFFERENTIAL OUTPUT vs FREE-AIR TEMPERATURE**

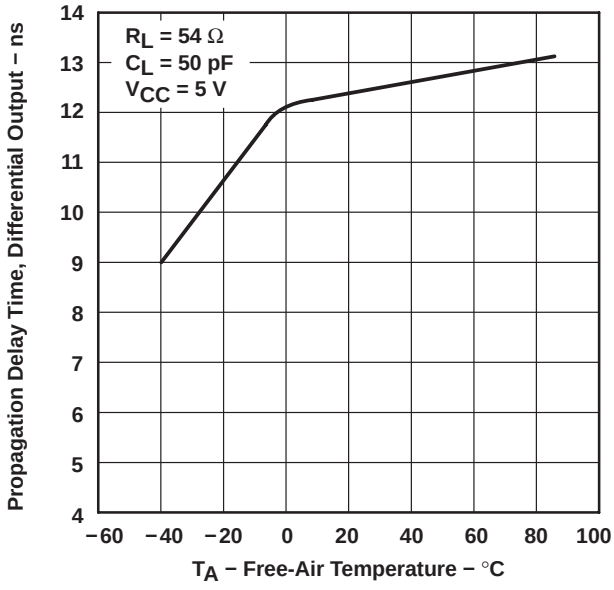



Figure 11

## PACKAGING INFORMATION

| Orderable part number | Status (1) | Material type (2) | Package \| Pins | Package qty \| Carrier | RoHS (3) | Lead finish/ Ball material (4) | MSL rating/ Peak reflow (5) | Op temp (°C) | Part marking (6) |
|---|---|---|---|---|---|---|---|---|---|
| 5962-9076504Q2A | Active | Production | LCCC (FK) \| 20 | 55 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-9076504Q2A SNJ55LBC174FK |
| 5962-9076504QEA | Active | Production | CDIP (J) \| 16 | 25 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-9076504QEA SNJ55LBC174J |
| 5962-9076504QFA | Active | Production | CFP (W) \| 16 | 25 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-9076504QFA SNJ55LBC174W |
| SN55LBC174J | Active | Production | CDIP (J) \| 16 | 25 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | SN55LBC174J |
| SN55LBC174J.A | Active | Production | CDIP (J) \| 16 | 25 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | SN55LBC174J |
| SNJ55LBC174FK | Active | Production | LCCC (FK) \| 20 | 55 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-9076504Q2A SNJ55LBC174FK |
| SNJ55LBC174FK.A | Active | Production | LCCC (FK) \| 20 | 55 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-9076504Q2A SNJ55LBC174FK |
| SNJ55LBC174J | Active | Production | CDIP (J) \| 16 | 25 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-9076504QEA SNJ55LBC174J |
| SNJ55LBC174J.A | Active | Production | CDIP (J) \| 16 | 25 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-9076504QEA SNJ55LBC174J |
| SNJ55LBC174W | Active | Production | CFP (W) \| 16 | 25 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-9076504QFA SNJ55LBC174W |
| SNJ55LBC174W.A | Active | Production | CFP (W) \| 16 | 25 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-9076504QFA SNJ55LBC174W |

(1) **Status:** For more details on status, see our product life cycle.

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the TI RoHS Statement for additional information and value definition.

(4) **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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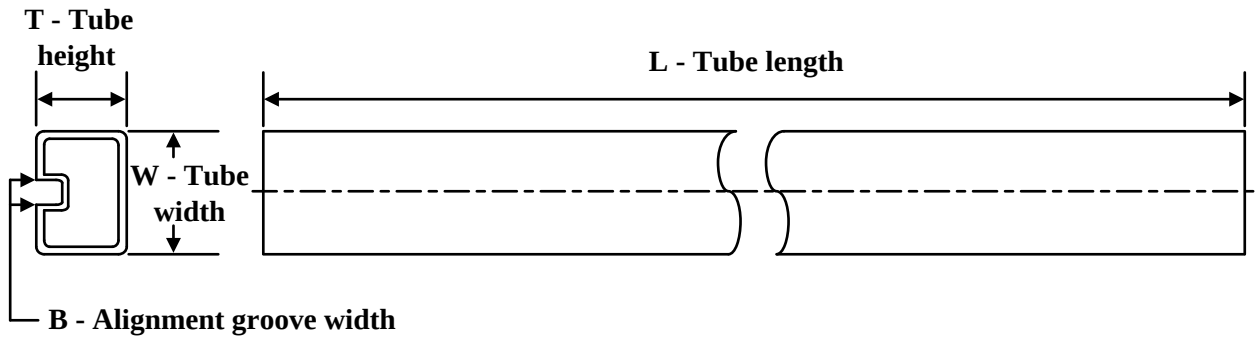
**OTHER QUALIFIED VERSIONS OF SN55LBC174 :**

- Catalog : SN75LBC174

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

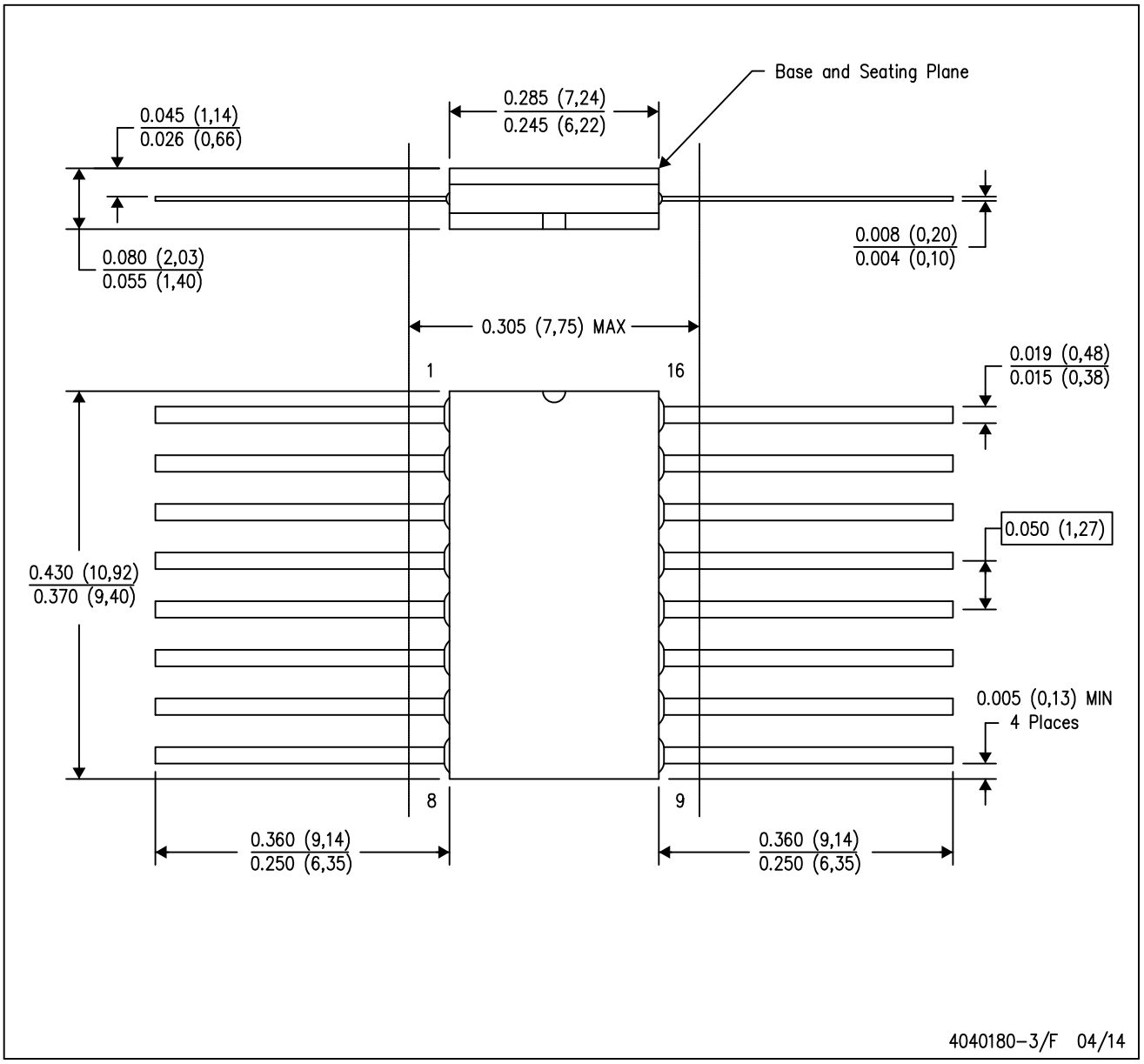
## TUBE




*All dimensions are nominal

| Device | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (µm) | B (mm) |
|---|---|---|---|---|---|---|---|---|
| 5962-9076504Q2A | FK | LCCC | 20 | 55 | 506.98 | 12.06 | 2030 | NA |
| 5962-9076504QFA | W | CFP | 16 | 25 | 506.98 | 26.16 | 6220 | NA |
| SNJ55LBC174FK | FK | LCCC | 20 | 55 | 506.98 | 12.06 | 2030 | NA |
| SNJ55LBC174FK.A | FK | LCCC | 20 | 55 | 506.98 | 12.06 | 2030 | NA |
| SNJ55LBC174W | W | CFP | 16 | 25 | 506.98 | 26.16 | 6220 | NA |
| SNJ55LBC174W.A | W | CFP | 16 | 25 | 506.98 | 26.16 | 6220 | NA |

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 GDFP2–F16

# GENERIC PACKAGE VIEW

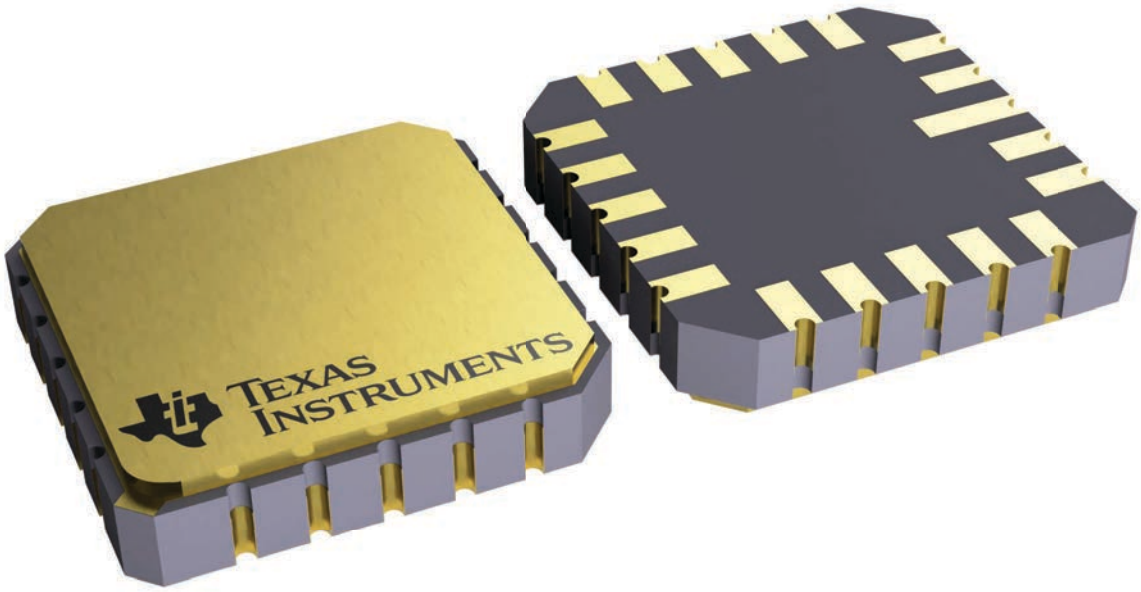
## FK 20

## LCCC - 2.03 mm max height

**8.89 x 8.89, 1.27 mm pitch**

LEADLESS CERAMIC CHIP CARRIER

This image is a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.

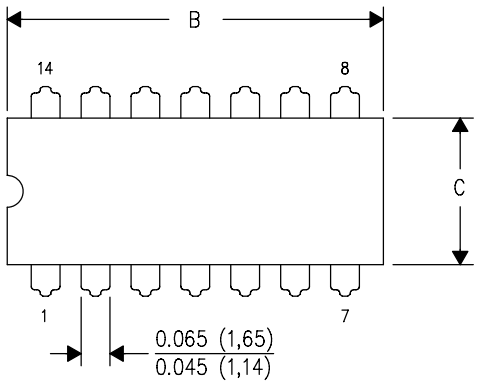



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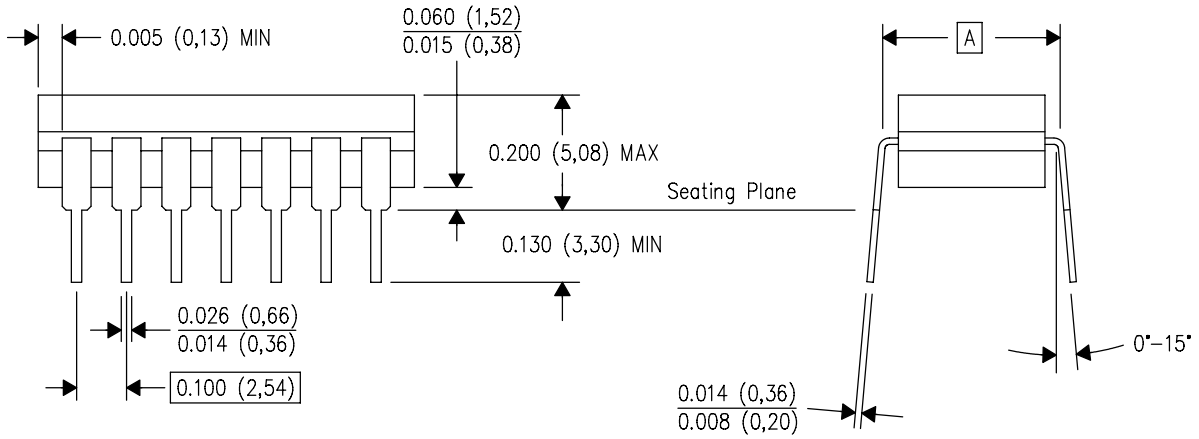
J (R–GDIP–T**)

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.

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Last updated 10/2025