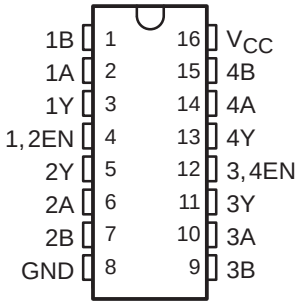
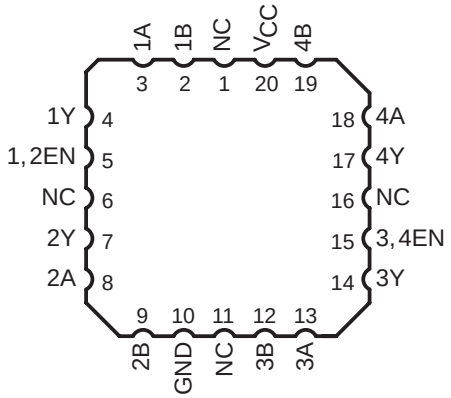
- **Meets EIA Standards RS-422-A, RS-423-A, RS-485, and CCITT V.11**
- **Designed to Operate With Pulse Durations as Short as 20 ns**
- **Designed for Multipoint Transmission on Long Bus Lines in Noisy Environments**
- **Input Sensitivity . . . ±200 mV**
- **Low-Power Consumption . . . 20 mA Max**
- **Open-Circuit Fail-Safe Design**
- **Common-Mode Input Voltage Range of –7 V to 12 V**

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




**FK PACKAGE**
**(TOP VIEW)**




NC – No internal connection

## description

The SN55LBC175 is a monolithic quadruple differential line receiver with 3-state outputs and is designed to meet the requirements of the EIA Standards RS-422-A, RS-423-A, RS-485, and CCITT V.11. This device is optimized for balanced multipoint bus transmission at data rates up to and exceeding 10 million bits per second. The receivers are enabled in pairs with an active-high enable input. Each differential receiver input features high impedance, hysteresis for increased noise immunity, and sensitivity of ±200 mV over a common-mode input voltage range of 12 V to –7 V. Fail-safe design ensures that if the inputs are open-circuited, the outputs are always high. This device is designed using the Texas Instruments proprietary LinBiCMOS™ technology allowing low power consumption, high switching speeds, and robustness.

This device offers optimum performance when used with the SN55LBC174 quadruple line driver. The SN55LBC175 is available in the 16-pin CDIP (J) package, a 16-pin CPAK (W) package, or a 20-pin LCCC (FK) package.

The SN55LBC175 is characterized over the military temperature range of –55°C to 125°C.

**FUNCTION TABLE**
**(each receiver)**

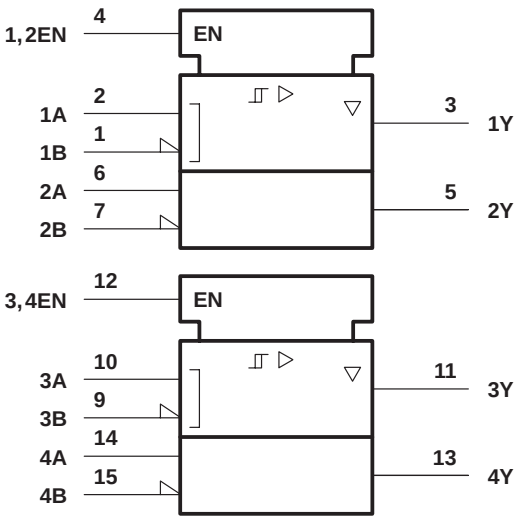
| DIFFERENTIAL INPUTS A – B | ENABLE | OUTPUT Y |
|---|---|---|
| $V_{ID} \geq 0.2$ V | H | H |
| $-0.2$ V $< V_{ID} < 0.2$ V | H | ? |
| $V_{ID} \leq -0.2$ V | H | L |
| X | L | Z |
| Open circuit | H | H |

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

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.

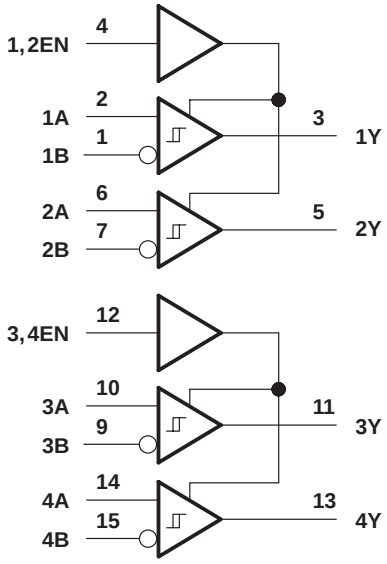
## logic symbol†



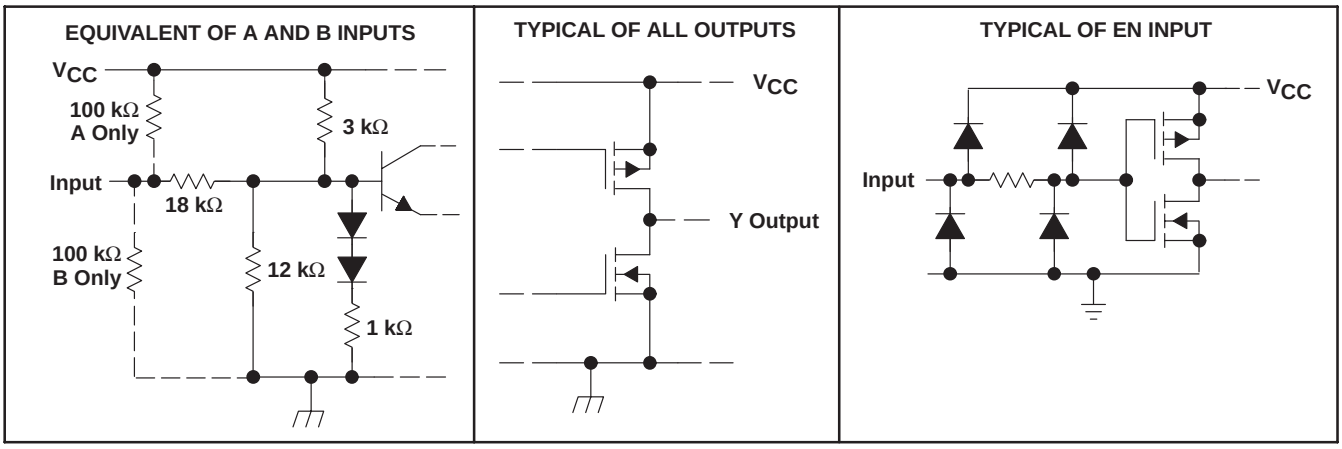

† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

Pin numbers shown are for the J or W package.

## logic diagram (positive logic)




## schematics of inputs and outputs



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

Supply voltage range, $V_{CC}$ (see Note 1) . . . . . –0.3 V to 7 V
Input voltage, A or B inputs, $V_I$ . . . . . ±25 V
Differential input voltage, $V_{ID}$ (see Note 2) . . . . . ±25 V
Data and control voltage range . . . . . –0.3 V to 7 V
Continuous total dissipation . . . . . See Dissipation Rating Table
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 . . . . . 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 are with respect to GND.
2. Differential input voltage is measured at the noninverting input with respect to the corresponding inverting input.

**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 |
| Common-mode input voltage, $V_{IC}$ | | –7 | | 12 | V |
| Differential input voltage, $V_{ID}$ | | | | ±6 | V |
| High-level input voltage, $V_{IH}$ | EN inputs | 2 | | | V |
| Low-level input voltage, $V_{IL}$ | EN inputs | | | 0.8 | V |
| High-level output current, $I_{OH}$ | | | | –8 | mA |
| Low-level output current, $I_{OL}$ | | | | 16 | 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)

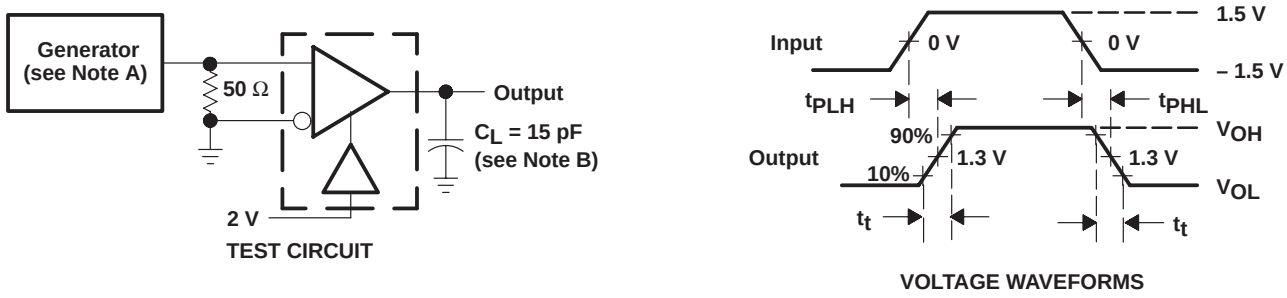
| PARAMETER | | | TEST CONDITIONS | | | MIN | TYP† | MAX | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| $V_{IT+}$ | Positive-going input threshold voltage | | $I_O$ = –8 mA | | | | | 0.2 | V |
| $V_{IT-}$ | Negative-going input threshold voltage | | $I_O$ = 8 mA | | | –0.2 | | | V |
| $V_{hys}$ | Hysteresis voltage ($V_{IT+} - V_{IT-}$) | | | | | | 45 | | mV |
| $V_{IK}$ | Enable input clamp voltage | | $I_I$ = –18 mA | | | | –0.9 | –1.5 | V |
| $V_{OH}$ | High-level output voltage | | $V_{ID}$ = 200 mV, | $I_{OH}$ = –8 mA | | 3.5 | 4.5 | | V |
| $V_{OL}$ | Low-level output voltage | | $V_{ID}$ = –200 mV, | $I_{OL}$ = 8 mA | | | 0.3 | 0.5 | V |
| | | | $V_{ID}$ = –200 mV, | $I_{OL}$ = 8 mA, | $T_A$ = 125°C | | | 0.7 | |
| $I_{OZ}$ | High-impedance-state output current | | $V_O$ = 0 V to $V_{CC}$ | | | | | ±20 | µA |
| $I_I$ | Bus input current | A or B inputs | $V_{IH}$ = 12 V, | $V_{CC}$ = 5 V, | Other inputs at 0 V | | 0.7 | 1 | mA |
| | | | $V_{IH}$ = 12 V, | $V_{CC}$ = 0 V, | Other inputs at 0 V | | 0.8 | 1 | |
| | | | $V_{IH}$ = –7 V, | $V_{CC}$ = 5 V, | Other inputs at 0 V | | –0.5 | –0.8 | |
| | | | $V_{IH}$ = –7 V, | $V_{CC}$ = 0 V, | Other inputs at 0 V | | –0.4 | –0.8 | |
| $I_{IH}$ | High-level enable input current | | $V_{IH}$ = 5 V | | | | | ±20 | µA |
| $I_{IL}$ | Low-level enable input current | | $V_{IL}$ = 0 V | | | | | –20 | µA |
| $I_{OS}$ | Short-circuit output current | | $V_O$ = 0 | | | | –80 | –120 | mA |
| $I_{CC}$ | Supply current | | Outputs enabled, | $I_O$ = 0, | $V_{ID}$ = 5 V | | 11 | 20 | mA |
| | | | Outputs disabled | | | | 0.9 | 1.4 | |

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

## switching characteristics, $V_{CC}$ = 5 V, $C_L$ = 15 pF

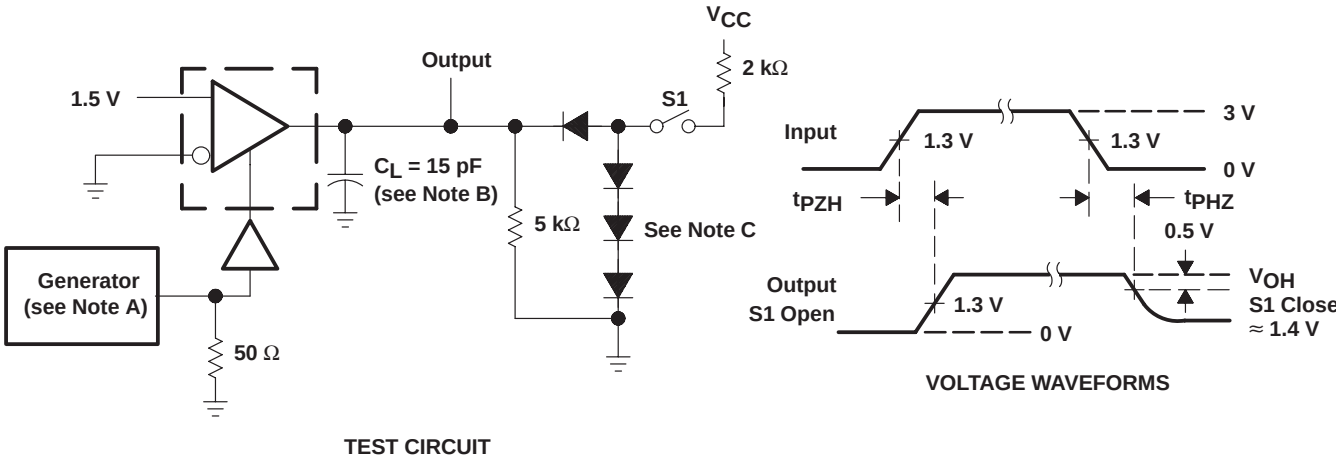
| PARAMETER | | TEST CONDITIONS | $T_A$ | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| $t_{PHL}$ | Propagation delay time, high- to low-level output | $V_{ID}$ = –1.5 V to 1.5 V, See Figure 1 | 25°C | 11 | 22 | 30 | ns |
| | | | –55°C to 125°C | | | 35 | |
| $t_{PLH}$ | Propagation delay time, low- to high-level output | $V_{ID}$ = –1.5 V to 1.5 V, See Figure 1 | 25°C | 11 | 22 | 30 | ns |
| | | | –55°C to 125°C | | | 35 | |
| $t_{PZH}$ | Output enable time to high level | See Figure 2 | 25°C | | 17 | 40 | ns |
| | | | –55°C to 125°C | | | 45 | |
| $t_{PZL}$ | Output enable time to low level | See Figure 3 | 25°C | | 18 | 30 | ns |
| | | | –55°C to 125°C | | | 35 | |
| $t_{PHZ}$ | Output disable time from high level | See Figure 2 | 25°C | | 30 | 40 | ns |
| | | | –55°C to 125°C | | | 55 | |
| $t_{PLZ}$ | Output disable time from low level | See Figure 3 | 25°C | | 23 | 30 | ns |
| | | | –55°C to 125°C | | | 45 | |
| $t_{sk(p)}$ | Pulse skew ($\lvert t_{PHL} - t_{PLH} \rvert$) | See Figure 1 | 25°C | | 4 | 6 | ns |
| | | | –55°C to 125°C | | | 7 | |
| $t_t$ | Transition time | See Figure 1 | 25°C | | 3 | 10 | ns |
| | | | –55°C to 125°C | | | 16 | |

## PARAMETER MEASUREMENT INFORMATION




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

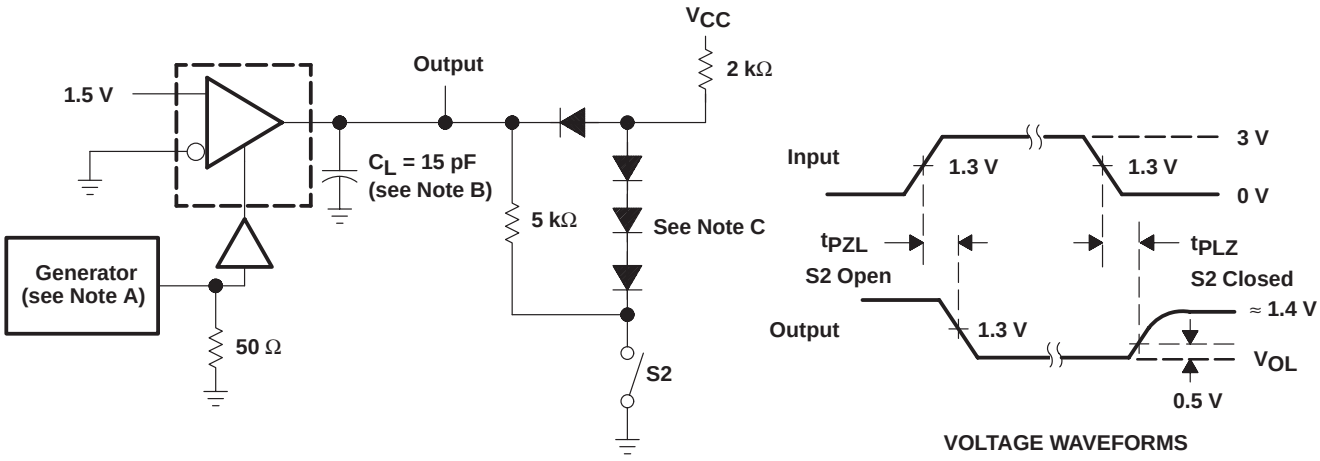
**Figure 1. $t_{PLH}$ and $t_{PHL}$ Test Circuit and Voltage Waveforms**




NOTES: A. The input pulse is supplied by a generator having the following characteristics: PRR = 1 MHz, duty cycle ≤ 50%, $t_r$ ≤ 6 ns, $t_f$ ≤ 6 ns, $Z_O$ = 50 Ω.
B. $C_L$ includes probe and jig capacitance.
C. All diodes are 1N916 or equivalent.

**Figure 2. $t_{PHZ}$ and $t_{PZH}$ Test Circuit and Voltage 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%, $t_r$ ≤ 6 ns, $t_f$ ≤ 6 ns, $Z_O$ = 50 Ω.
B. $C_L$ includes probe and jig capacitance.
C. All diodes are 1N916 or equivalent.

**Figure 3. $t_{PZL}$ and $t_{PLZ}$ Test Circuit and Voltage Waveforms**

## TYPICAL CHARACTERISTICS

**OUTPUT VOLTAGE vs DIFFERENTIAL INPUT VOLTAGE**

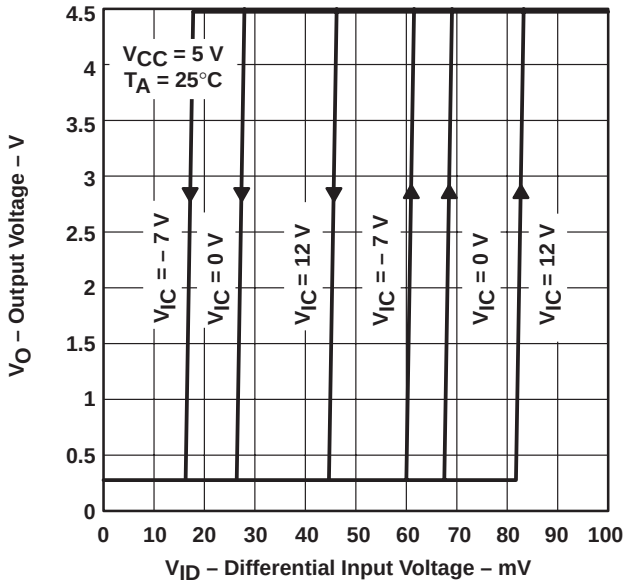



**Figure 4**

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

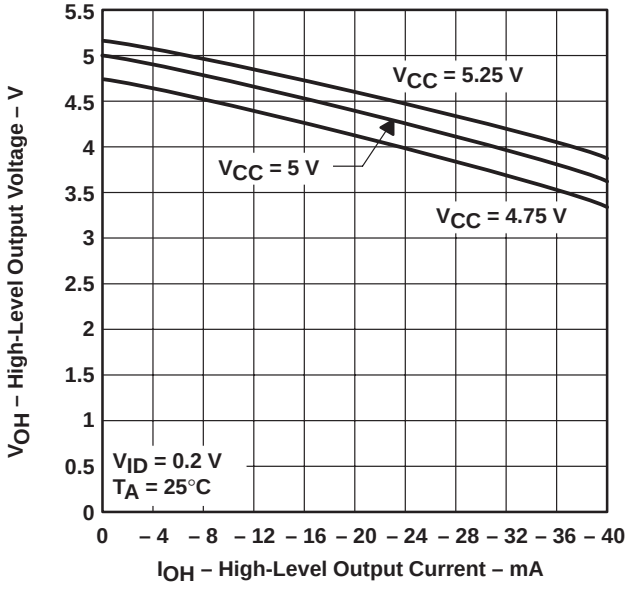



**Figure 5**

## TYPICAL CHARACTERISTICS

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

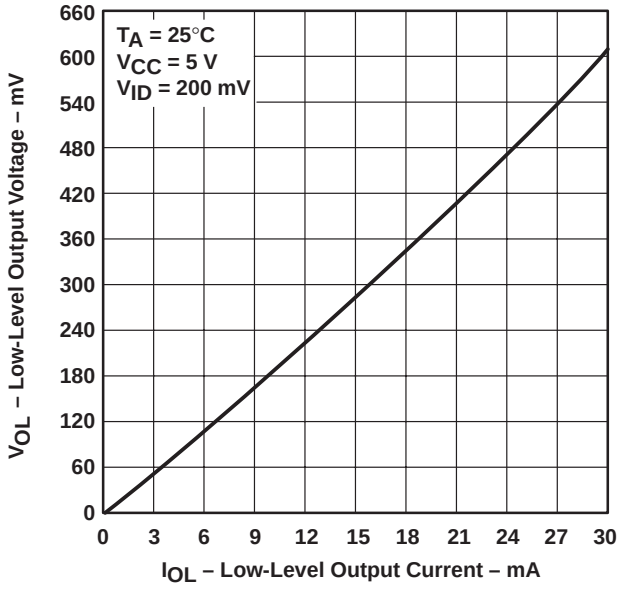



Figure 6

**AVERAGE SUPPLY CURRENT vs FREQUENCY**

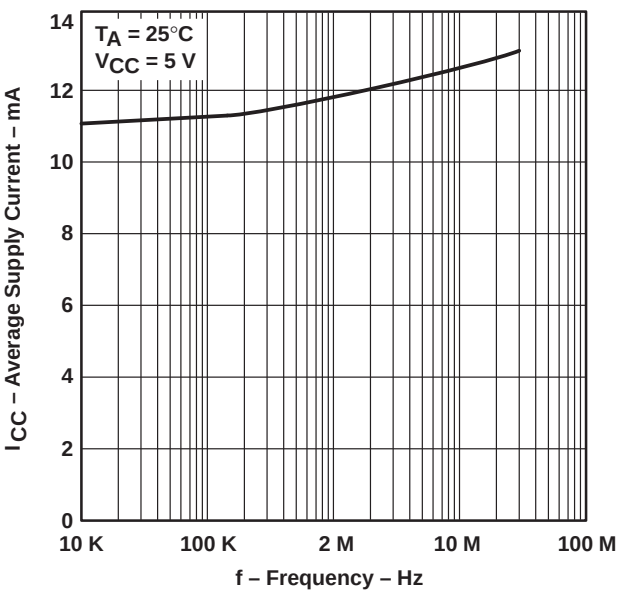



Figure 7

**BUS INPUT CURRENT vs INPUT VOLTAGE (COMPLEMENTARY INPUT AT 0 V)**

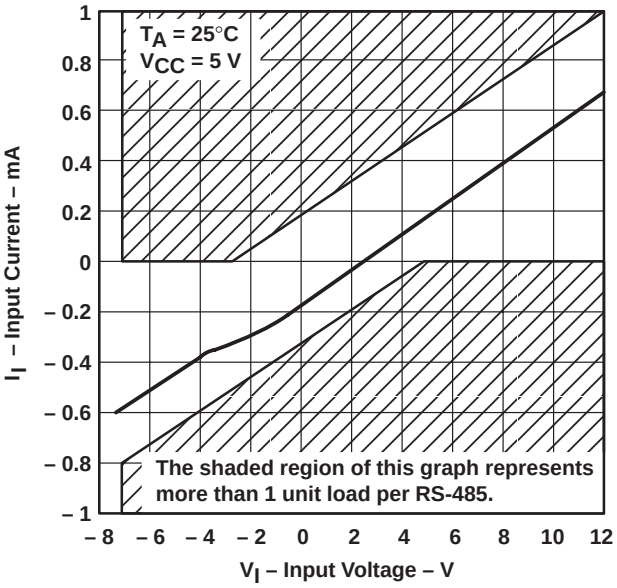



Figure 8

**PROPAGATION DELAY TIME vs FREE-AIR TEMPERATURE**

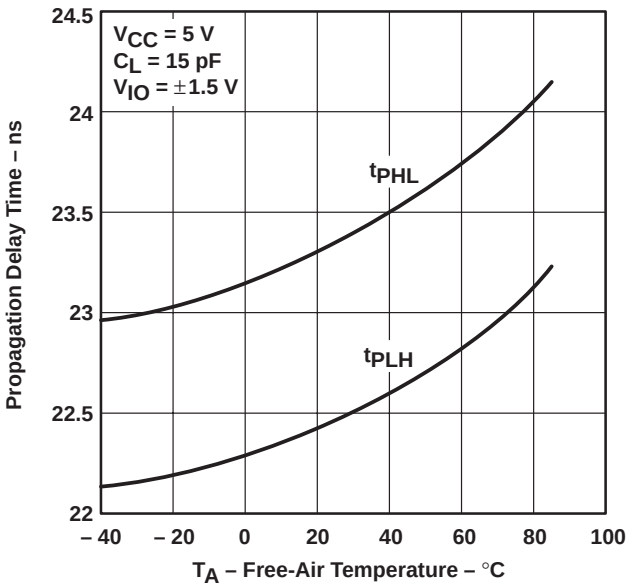



Figure 9

## PACKAGING INFORMATION

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead finish/ Ball material (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5962-9076603Q2A | ACTIVE | LCCC | FK | 20 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 5962-9076603Q2A SNJ55LBC175FK | Samples |
| 5962-9076603QEA | ACTIVE | CDIP | J | 16 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 5962-9076603QEA SNJ55LBC175J | Samples |
| 5962-9076603QFA | ACTIVE | CFP | W | 16 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 5962-9076603QFA SNJ55LBC175W | Samples |
| SN55LBC175J | ACTIVE | CDIP | J | 16 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | SN55LBC175J | Samples |
| SNJ55LBC175FK | ACTIVE | LCCC | FK | 20 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 5962-9076603Q2A SNJ55LBC175FK | Samples |
| SNJ55LBC175J | ACTIVE | CDIP | J | 16 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 5962-9076603QEA SNJ55LBC175J | Samples |
| SNJ55LBC175W | ACTIVE | CFP | W | 16 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 5962-9076603QFA SNJ55LBC175W | Samples |

(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) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".
**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.
**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices 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.



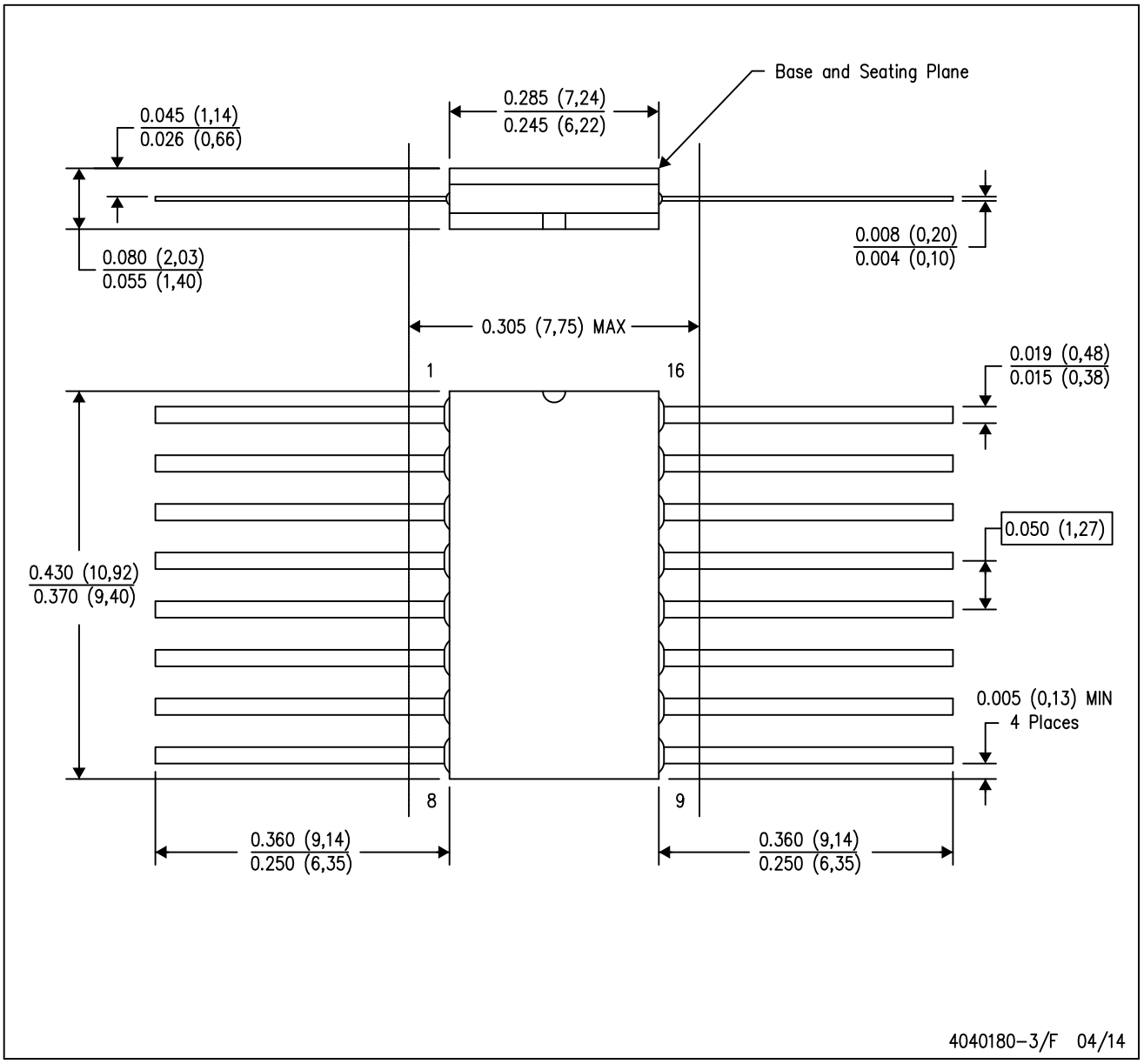
**OTHER QUALIFIED VERSIONS OF SN55LBC175 :**

- Catalog : SN75LBC175

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

W (R–GDFP–F16) CERAMIC DUAL FLATPACK

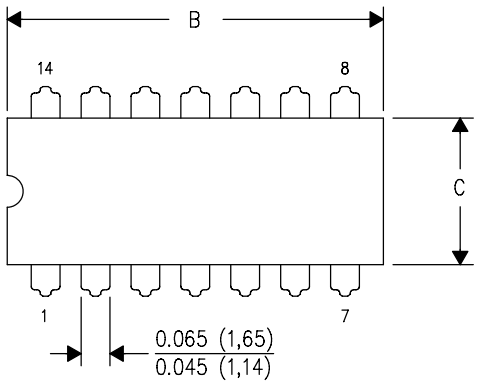



NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a ceramic lid using glass frit.
D. Index point is provided on cap for terminal identification only.
E. Falls within MIL STD 1835 GDFP2–F16

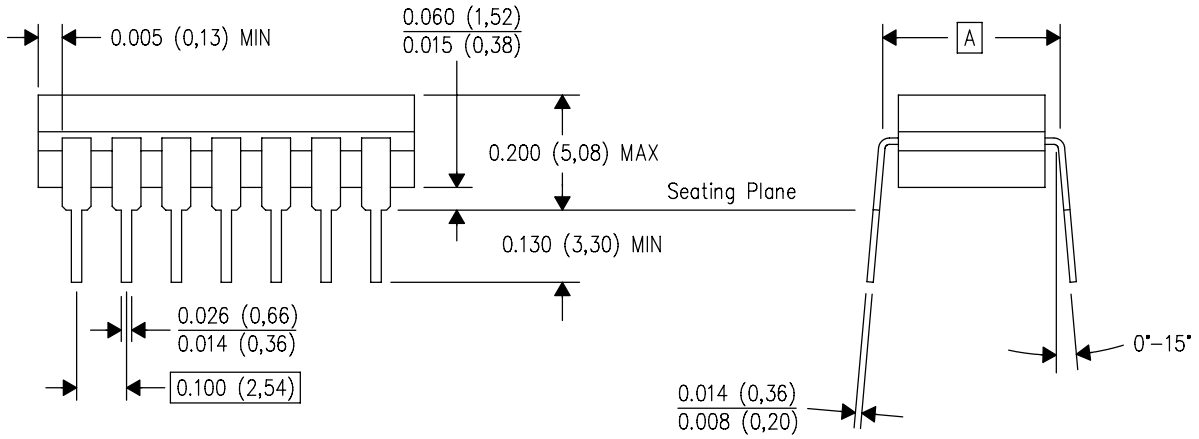
J (R–GDIP–T**)

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) |

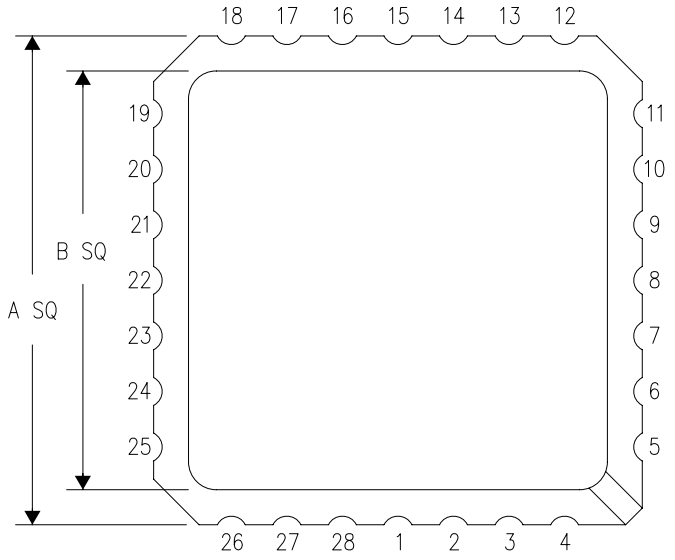



4040083/F 03/03

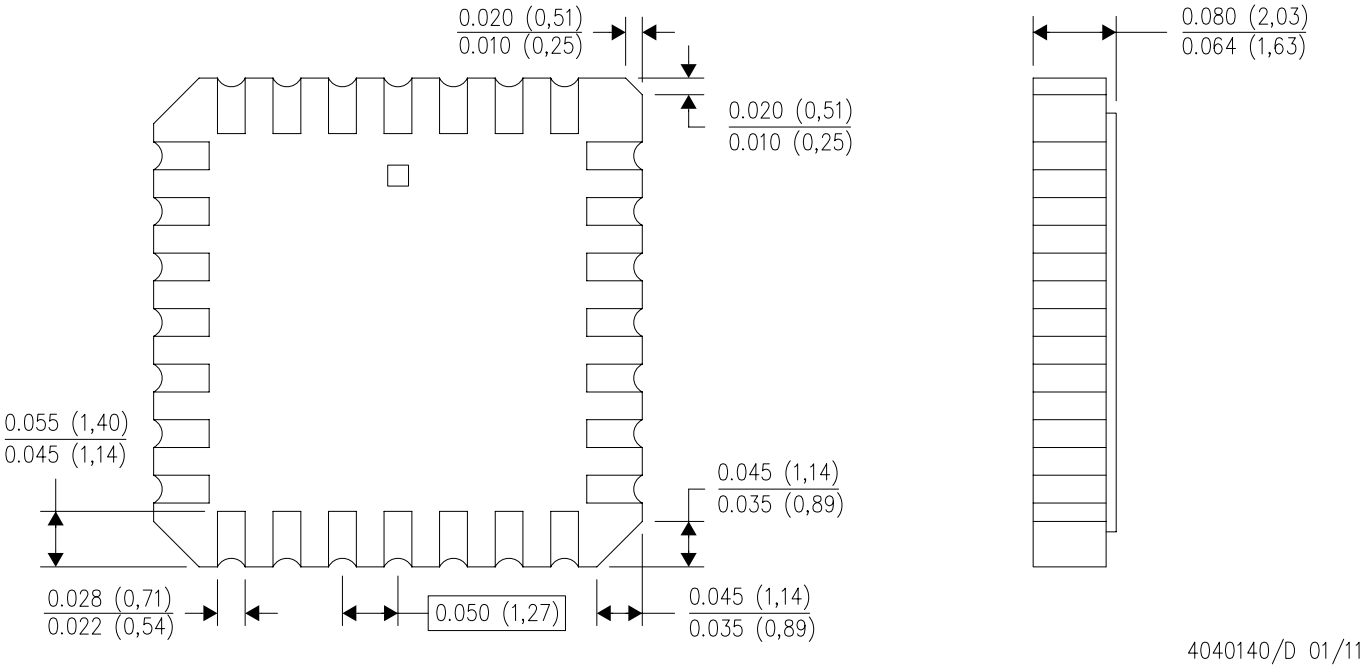
NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package is hermetically sealed with a ceramic lid using glass frit.
D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
E. Falls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

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:
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 metal lid.
D. Falls within JEDEC MS–004

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