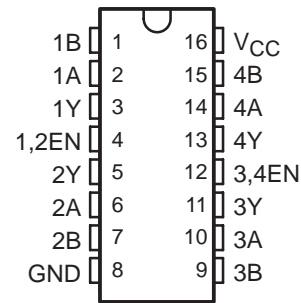


SN65LBC175, SN75LBC175 QUADRUPLE LOW-POWER DIFFERENTIAL LINE RECEIVERS

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- Meets or Exceeds the EIA Standards RS-422-A, RS-423-A, RS-485, and CCITT Recommendation 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
- Pin Compatible With SN75175 and LTC489

D, DW, OR N PACKAGE
(TOP VIEW)



description

The SN65LBC175 and SN75LBC175 are monolithic, quadruple, differential line receivers with 3-state outputs designed to meet the requirements of the EIA standards RS-422-A, RS-423-A, RS-485, and CCITT Recommendation V.11. The devices are 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. The fail-safe design ensures that when the inputs are open-circuited, the outputs are always high. Both devices are designed using the TI proprietary LinBiCMOS™ technology allowing low power consumption, high switching speeds, and robustness.

These devices offer optimum performance when used with the SN75LBC172 or SN75LBC174 quadruple line drivers. The SN65LBC175 is available in the 16-pin DIP (N), small-outline package (D), and the wide small-outline package (DW). The SN75LBC175 is available in the 16-pin DIP (N) and the small-outline package (D).

The SN65LBC175 is characterized over the industrial temperature range of -40°C to 85°C . The SN75LBC175 is characterized for operation over the commercial temperature range of 0°C to 70°C .

AVAILABLE OPTIONS

| PACKAGE | TEMPERATURE RANGE | |
|-----------|---|---|
| | 0°C to 70°C | -40°C to 85°C |
| SOIC | SN75LBC175D | SN65LBC175D |
| Wide SOIC | — | SN65LBC175DW |
| PDIP | SN75LBC175N | SN65LBC175N |



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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.



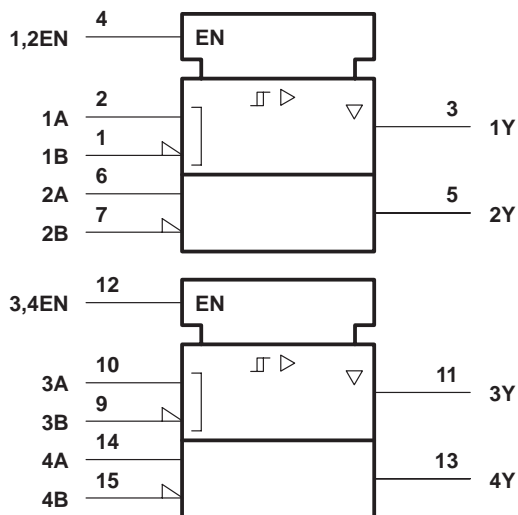
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SN65LBC175, SN75LBC175 QUADRUPLE LOW-POWER DIFFERENTIAL LINE RECEIVERS

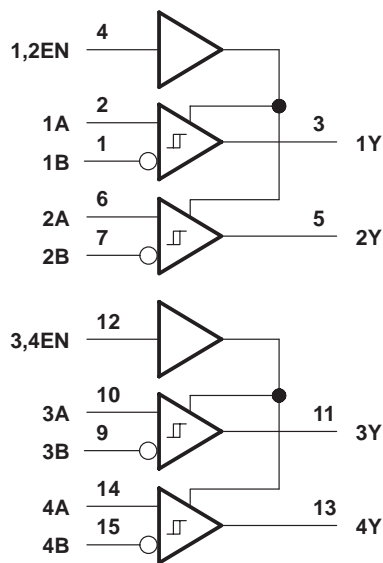
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logic symbol†



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

logic diagram (positive logic)

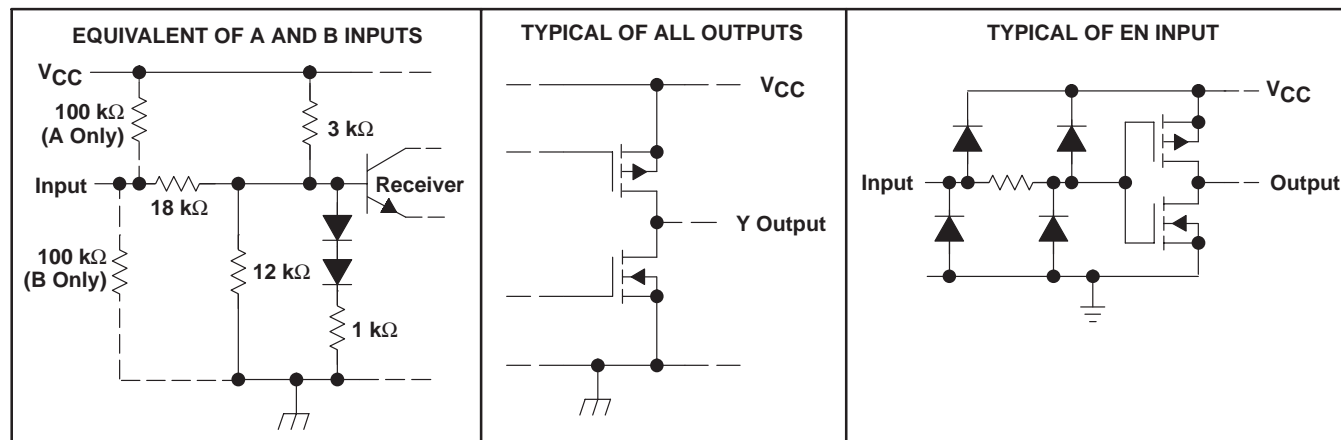


FUNCTION TABLE
(each receiver)

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

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

schematics of inputs and outputs



SN65LBC175, SN75LBC175 QUADRUPLE LOW-POWER DIFFERENTIAL LINE RECEIVERS

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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, V_I (A or B inputs) | ±25 V |
| Differential input voltage, V_{ID} (see Note 2) | ±25 V |
| Voltage range at Y, 1/2EN, 3/4EN | –0.3 V to $V_{CC} + 0.5$ V |
| Continuous total dissipation | See Dissipation Rating Table |
| Operating free-air temperature range, T_A : SN65LBC175 | –40°C to 85°C |
| SN75LBC175 | 0°C to 70°C |
| Storage temperature range, T_{stg} | –65°C to 150°C |
| Electrostatic Discharge (ESD): Human Body Model (HBM) | 1 kV |
| Machine Model (MM) | 200 V |
| Charged Device Model (CDM) | 1.5 kV |

† 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 | $T_A \leq 25^\circ\text{C}$ POWER RATING | DERATING FACTOR ABOVE $T_A = 25^\circ\text{C}$ | $T_A = 70^\circ\text{C}$ POWER RATING | $T_A = 85^\circ\text{C}$ POWER RATING |
|---------|---|---|--|--|
| D | 1100 mW | 8.7 mW/°C | 709 mW | 578 mW |
| DW | 1200 mW | 9.6 mW/°C | 770 mW | 625 mW |
| N | 1150 mW | 9.2 mW/°C | 736 mW | 598 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} | | | | 0.8 | V |
| High-level output current, I_{OH} | | | | –8 | mA |
| Low-level output current, I_{OL} | | | | 8 | mA |
| Operating free-air temperature, T_A | SN65LBC175 | –40 | | 85 | °C |
| | SN75LBC175 | 0 | | 70 | |



SN65LBC175, SN75LBC175 QUADRUPLE LOW-POWER DIFFERENTIAL LINE RECEIVERS

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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_{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 | |
| I_{OZ} | High-impedance-state output current | $V_O = 0$ V to V_{CC} | | | ± 20 | μ A | |
| 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 | μ A | |
| I_{IL} | Low-level enable input current | $V_{IL} = 0$ V | | | -20 | μ A | |
| 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 $T_A = 25^\circ\text{C}$.

switching characteristics, $V_{CC} = 5$ V, $C_L = 15$ pF, $T_A = 25^\circ\text{C}$

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



SN65LBC175, SN75LBC175 QUADRUPLE LOW-POWER DIFFERENTIAL LINE RECEIVERS

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PARAMETER MEASUREMENT INFORMATION

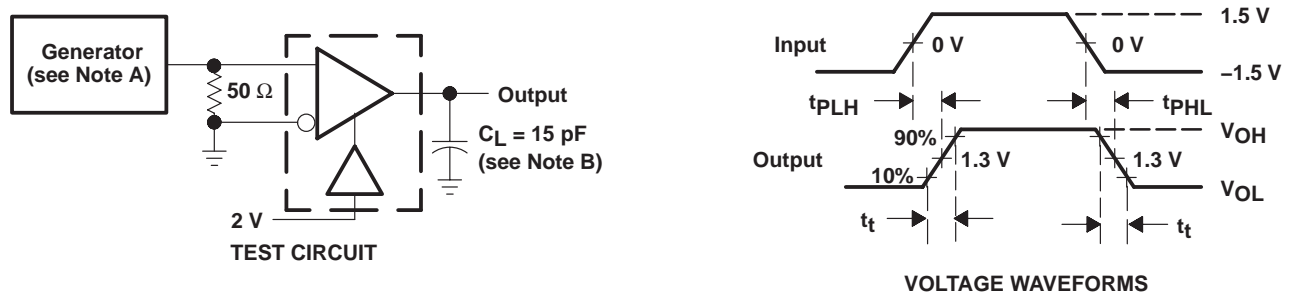
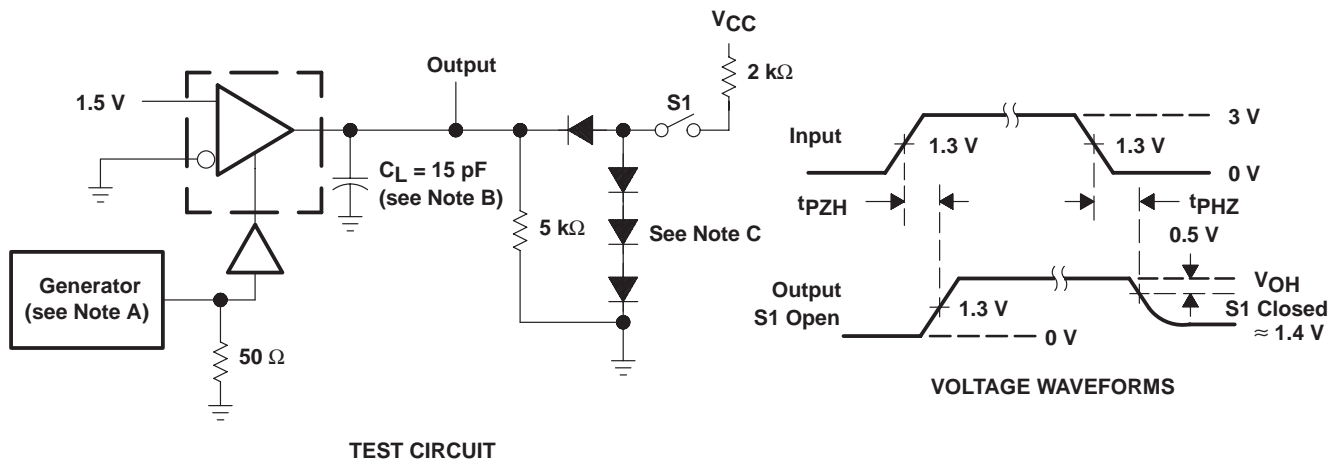


Figure 1. t_{pLH} and t_{pHL} Test Circuit and Voltage Waveforms



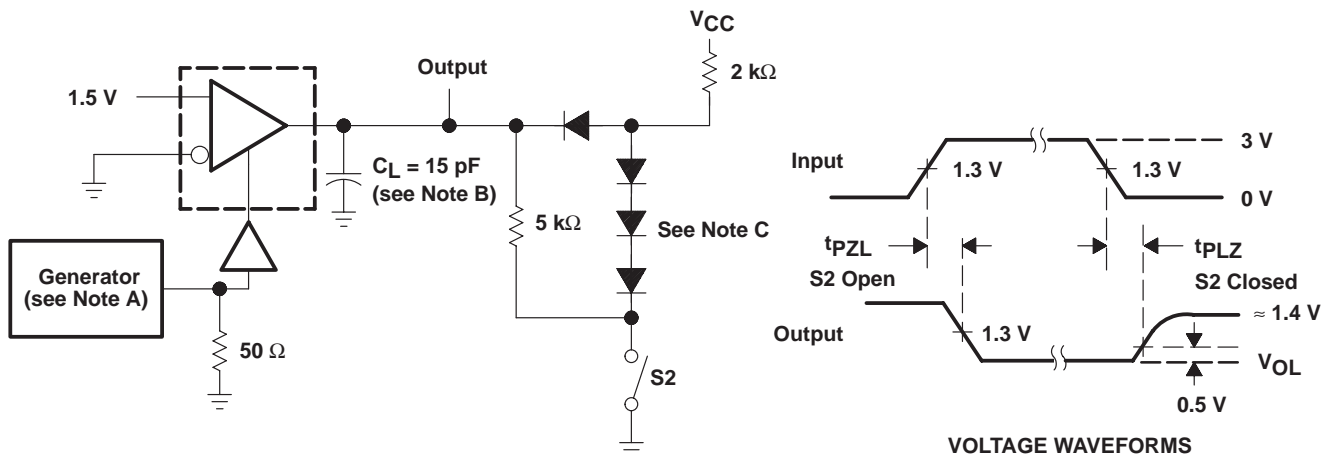
- NOTES: A. The input pulse is supplied by a generator having the following characteristics: PRR = 1 MHz, duty cycle = 50%, $t_r \leq 6$ ns, $t_f \leq 6$ ns, $Z_O = 50 \Omega$.
 B. C_L includes probe and jig capacitance.
 C. All diodes are 1N916 or equivalent.

Figure 2. t_{pHZ} and t_{pZH} Test Circuit and Voltage Waveforms

SN65LBC175, SN75LBC175 QUADRUPLE LOW-POWER DIFFERENTIAL LINE RECEIVERS

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PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT

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

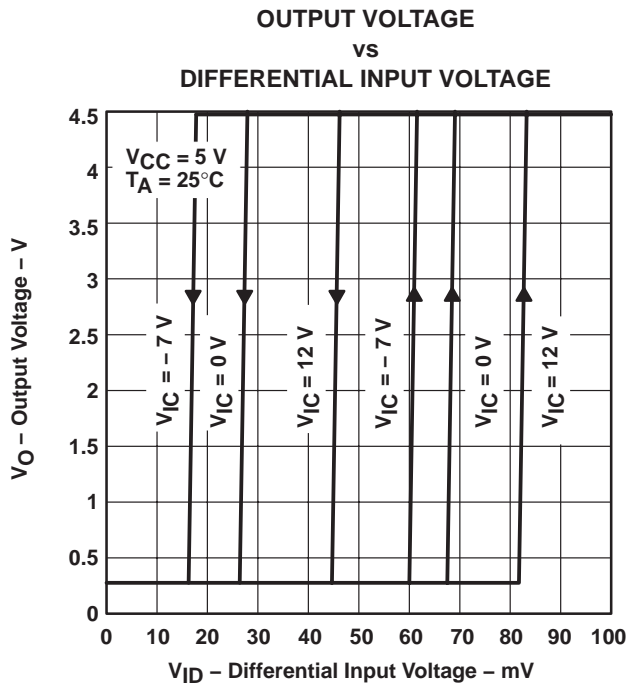


Figure 4

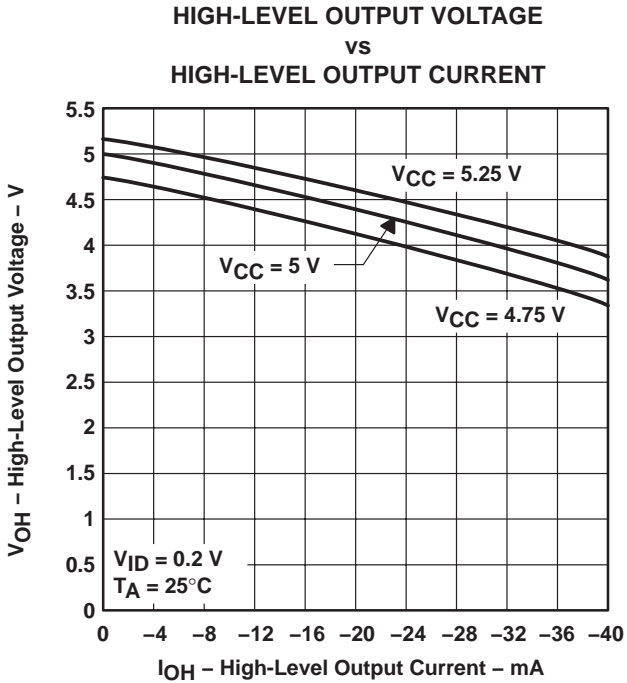


Figure 5

SN65LBC175, SN75LBC175 QUADRUPLE LOW-POWER DIFFERENTIAL LINE RECEIVERS

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TYPICAL CHARACTERISTICS

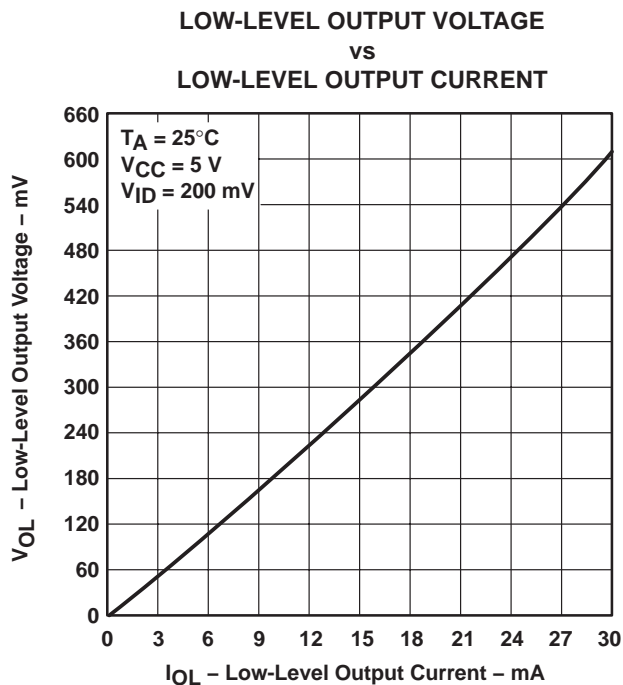


Figure 6

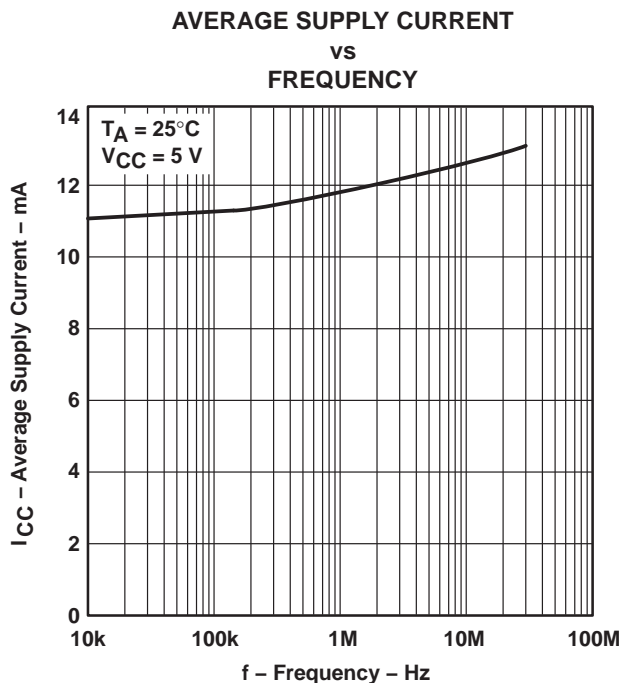


Figure 7

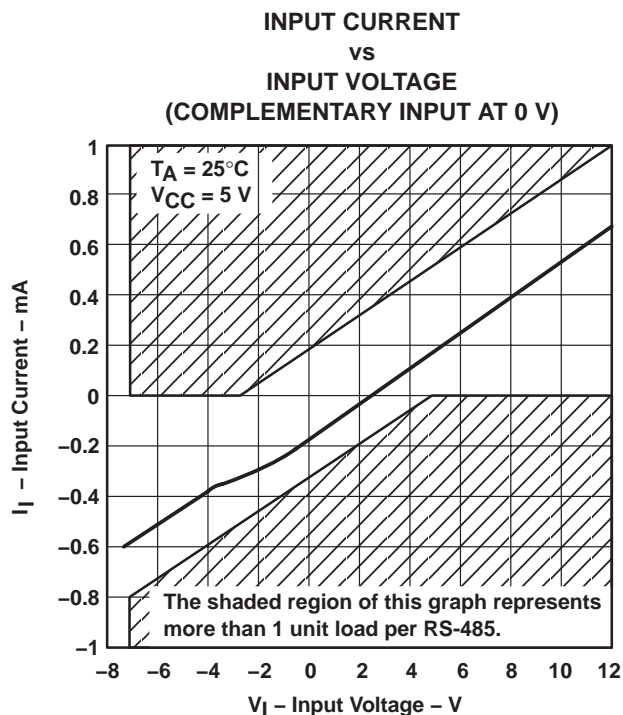


Figure 8

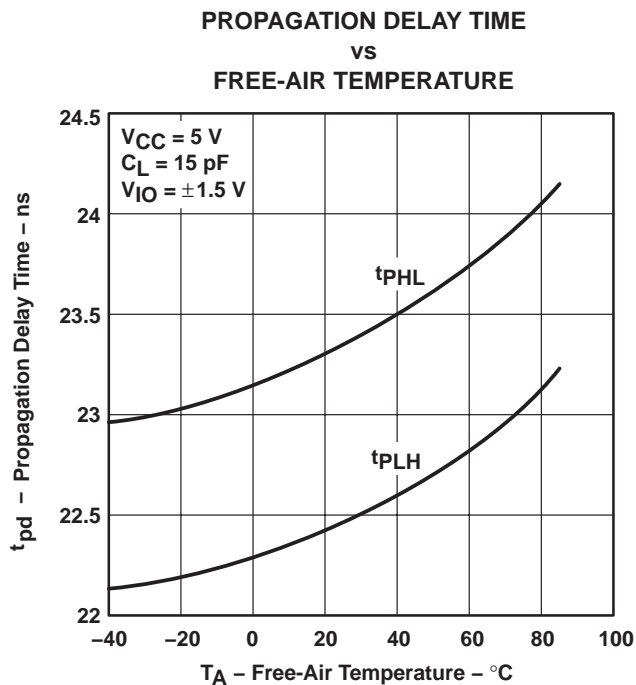


Figure 9

PACKAGING INFORMATION

| Orderable Device | Status ⁽¹⁾ | Package Type | Package Drawing | Pins | Package Qty | Eco Plan ⁽²⁾ | Lead/Ball Finish | MSL Peak Temp ⁽³⁾ |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| SN65LBC175D | ACTIVE | SOIC | D | 16 | 40 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN65LBC175DG4 | ACTIVE | SOIC | D | 16 | 40 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN65LBC175DR | ACTIVE | SOIC | D | 16 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN65LBC175DRG4 | ACTIVE | SOIC | D | 16 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN65LBC175DW | ACTIVE | SOIC | DW | 16 | 40 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN65LBC175DWG4 | ACTIVE | SOIC | DW | 16 | 40 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN65LBC175DWR | ACTIVE | SOIC | DW | 16 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN65LBC175DWRG4 | ACTIVE | SOIC | DW | 16 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN65LBC175N | ACTIVE | PDIP | N | 16 | 25 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| SN65LBC175NE4 | ACTIVE | PDIP | N | 16 | 25 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| SN75LBC175D | ACTIVE | SOIC | D | 16 | 40 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN75LBC175DG4 | ACTIVE | SOIC | D | 16 | 40 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN75LBC175DR | ACTIVE | SOIC | D | 16 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN75LBC175DRG4 | ACTIVE | SOIC | D | 16 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN75LBC175N | ACTIVE | PDIP | N | 16 | 25 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| SN75LBC175NE4 | ACTIVE | PDIP | N | 16 | 25 | Pb-Free (RoHS) | CU NIPDAU | 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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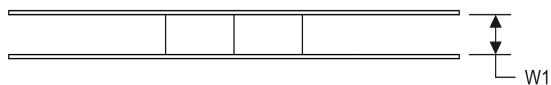
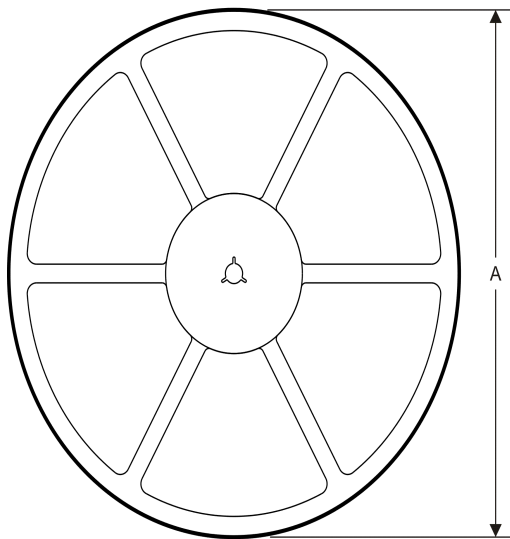
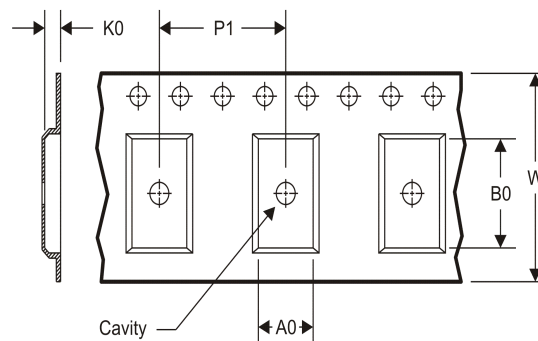
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OTHER QUALIFIED VERSIONS OF SN75LBC175 :

- Military: [SN55LBC175](#)

NOTE: Qualified Version Definitions:

- Military - QML certified for Military and Defense Applications

TAPE AND REEL INFORMATION
REEL DIMENSIONS

TAPE DIMENSIONS


| | |
|----|---|
| A0 | Dimension designed to accommodate the component width |
| B0 | Dimension designed to accommodate the component length |
| K0 | Dimension designed to accommodate the component thickness |
| W | Overall width of the carrier tape |
| P1 | Pitch between successive cavity centers |

TAPE AND REEL INFORMATION

*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|---------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN65LBC175DR | SOIC | D | 16 | 2500 | 330.0 | 16.4 | 6.5 | 10.3 | 2.1 | 8.0 | 16.0 | Q1 |
| SN65LBC175DR | SOIC | D | 16 | 2500 | 330.0 | 16.4 | 6.5 | 10.3 | 2.1 | 8.0 | 16.0 | Q1 |
| SN65LBC175DWR | SOIC | DW | 16 | 2000 | 330.0 | 16.4 | 10.75 | 10.7 | 2.7 | 12.0 | 16.0 | Q1 |
| SN75LBC175DR | SOIC | D | 16 | 2500 | 330.0 | 16.4 | 6.5 | 10.3 | 2.1 | 8.0 | 16.0 | Q1 |
| SN75LBC175DR | SOIC | D | 16 | 2500 | 330.0 | 16.4 | 6.5 | 10.3 | 2.1 | 8.0 | 16.0 | Q1 |

TAPE AND REEL BOX DIMENSIONS


*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|---------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN65LBC175DR | SOIC | D | 16 | 2500 | 333.2 | 345.9 | 28.6 |
| SN65LBC175DR | SOIC | D | 16 | 2500 | 367.0 | 367.0 | 38.0 |
| SN65LBC175DWR | SOIC | DW | 16 | 2000 | 367.0 | 367.0 | 38.0 |
| SN75LBC175DR | SOIC | D | 16 | 2500 | 333.2 | 345.9 | 28.6 |
| SN75LBC175DR | SOIC | D | 16 | 2500 | 367.0 | 367.0 | 38.0 |

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



4040047-6/M 06/11

- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 -  Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
 -  Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
 - E. Reference JEDEC MS-012 variation AC.

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Publication IPC-7351 is recommended for alternate designs.
 - Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
 - Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

DW (R-PDSO-G16)

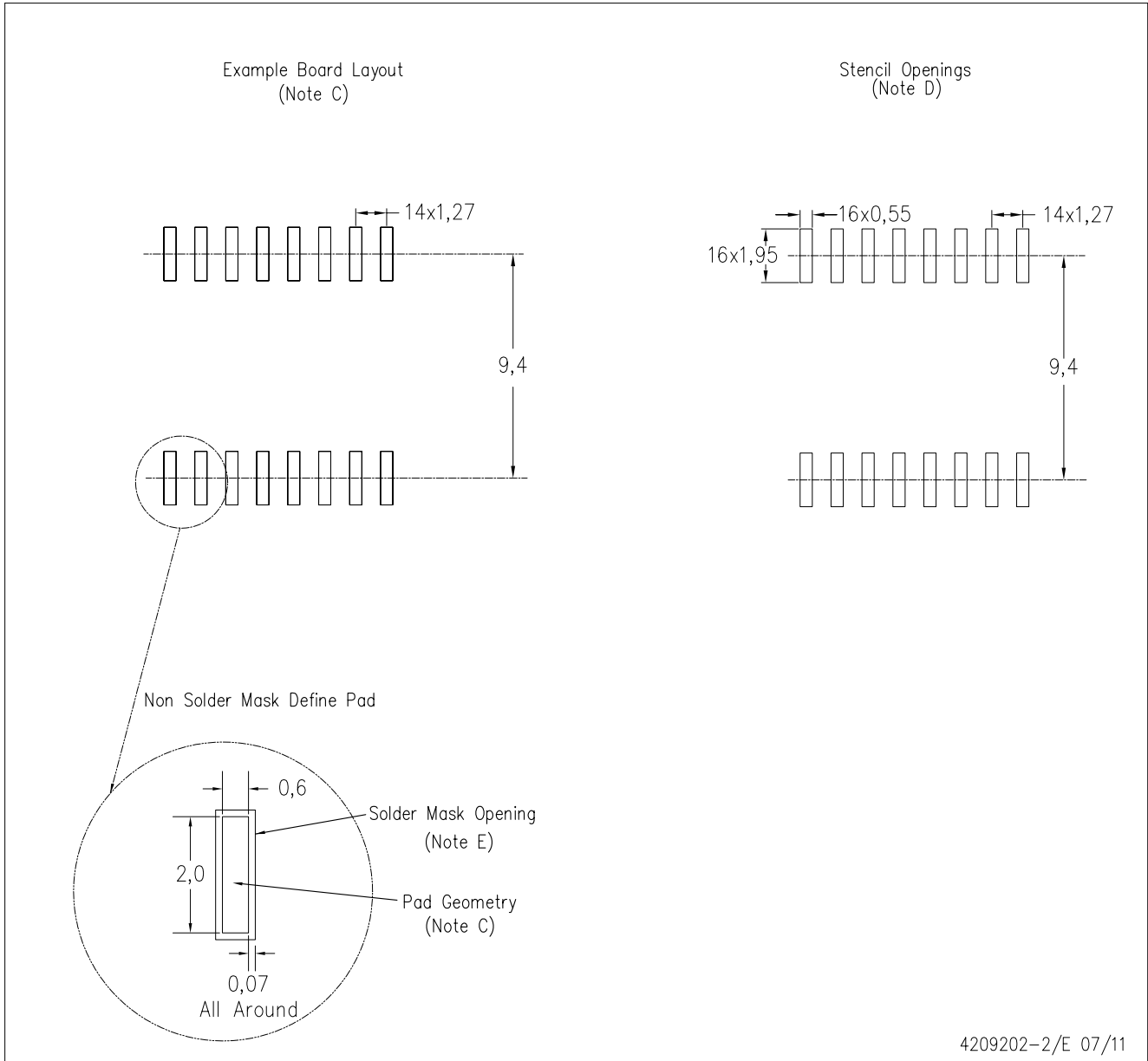
PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters). Dimensioning and tolerancing per ASME Y14.5M-1994.
 - 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-013 variation AA.

DW (R-PDSO-G16)

PLASTIC SMALL OUTLINE



4209202-2/E 07/11

- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Refer to IPC7351 for alternate board design.
 - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525
 - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

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