

The SN74LS16 is obsolete and is no longer supplied.

SN54LS06, SN74LS06, SN74LS16 HEX INVERTER BUFFERS/DRIVERS WITH OPEN-COLLECTOR HIGH-VOLTAGE OUTPUTS

SDLS020E – MAY 1990 – REVISED FEBRUARY 2004

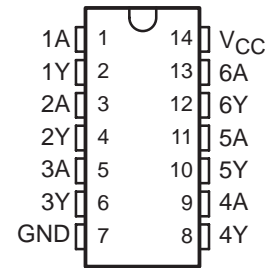
- Convert TTL Voltage Levels to MOS Levels
- High Sink-Current Capability
- Input Clamping Diodes Simplify System Design
- Open-Collector Driver for Indicator Lamps and Relays
- Inputs Fully Compatible With Most TTL Circuits

description/ordering information

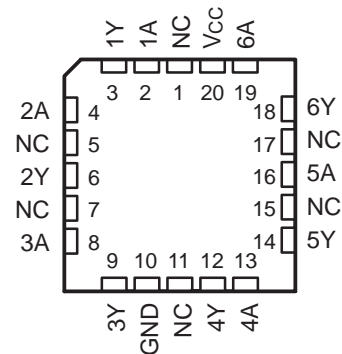
These hex inverter buffers/drivers feature high-voltage open-collector outputs to interface with high-level circuits (such as MOS), or for driving high-current loads, and also are characterized for use as inverter buffers for driving TTL inputs. The 'LS06 devices have a rated output voltage of 30 V, and the SN74LS16 has a rated output voltage of 15 V. The maximum sink current for the SN54LS06 is 30 mA, and for the SN74LS06 and SN74LS16 it is 40 mA.

These devices are compatible with most TTL families. Inputs are diode-clamped to minimize transmission effects, which simplifies design. Typical power dissipation is 175 mW, and average propagation delay time is 8 ns.

SN54LS06 . . . J PACKAGE
SN74LS06, SN74LS16 . . . D, DB, N, OR NS PACKAGE
(TOP VIEW)



SN54LS06 . . . FK PACKAGE
(TOP VIEW)



NC – No internal connection

ORDERING INFORMATION

| T _A | PACKAGE† | | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|----------------|---------------|---------------|-----------------------|------------------|
| 0°C to 70°C | PDIP – N | Tube | SN74LS06N | SN74LS06N |
| | SOIC – D | Tube | SN74LS06D | LS06 |
| | | Tape and reel | SN74LS06DR | |
| | SOP – NS | Tape and reel | SN74LS06NSR | 74LS06 |
| SSOP – DB | Tape and reel | SN74LS06DBR | LS06 | |
| –55°C to 125°C | CDIP – J | Tube | SN54LS06J | SN54LS06J |
| | | Tube | SNJ54LS06J | SNJ54LS06J |
| | LCCC – FK | Tube | SNJ54LS06FK | SNJ54LS06FK |

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



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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.

 **TEXAS
INSTRUMENTS**

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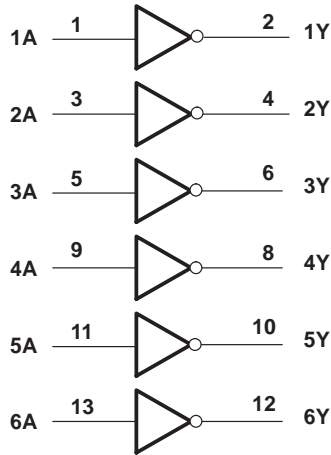
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On products compliant to MIL-PRF-38535, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

SN54LS06, SN74LS06, SN74LS16 HEX INVERTER BUFFERS/DRIVERS WITH OPEN-COLLECTOR HIGH-VOLTAGE OUTPUTS

SDLS020E – MAY 1990 – REVISED FEBRUARY 2004

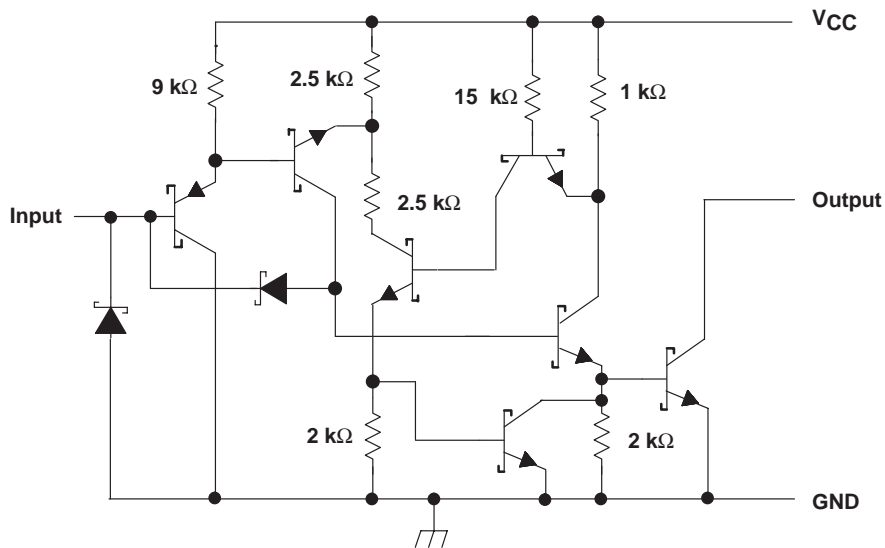
The SN74LS16 is obsolete
and is no longer supplied.

logic diagram (positive logic)



Pin numbers shown are for the D, DB, J, N, and NS packages.

schematic (each gate)



Resistor values shown are nominal.

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SN54LS06, SN74LS06, SN74LS16 HEX INVERTER BUFFERS/DRIVERS WITH OPEN-COLLECTOR HIGH-VOLTAGE OUTPUTS

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

| | |
|--|----------------|
| Supply voltage, V_{CC} | 7 V |
| Input voltage, V_I (see Note 1) | 7 V |
| Output voltage, V_O (see Notes 1 and 2): SN54LS06, SN74LS06 | 30 V |
| SN74LS16 | 15 V |
| Package thermal impedance, θ_{JA} (see Note 3): D package | 86°C/W |
| DB package | 96°C/W |
| N package | 80°C/W |
| NS package | 76°C/W |
| Storage temperature range, T_{stg} | -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.

- NOTES: 1. All voltage values are with respect to GND.
2. This is the maximum voltage that should be applied to any output when it is in the off state.
3. The package thermal impedance is calculated in accordance with JESD 51-7.

recommended operating conditions (see Note 4)

| | | SN54LS06 | | | SN74LS06 SN74LS16 | | | UNIT |
|----------|--------------------------------|----------|-----|-----|----------------------|-----|------|------|
| | | MIN | NOM | MAX | MIN | NOM | MAX | |
| V_{CC} | Supply voltage | 4.5 | 5 | 5.5 | 4.75 | 5 | 5.25 | V |
| V_{IH} | High-level input voltage | 2 | | | 2 | | | V |
| V_{IL} | Low-level input voltage | | | 0.8 | | | 0.8 | V |
| V_{OH} | High-level output voltage | 'LS06 | | | 30 | | | V |
| | | SN74LS16 | | | 15 | | | |
| I_{OL} | Low-level output current | | | 30 | | | 40 | mA |
| T_A | Operating free-air temperature | -55 | | 125 | 0 | | 70 | °C |

NOTE 4: All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

| PARAMETER | TEST CONDITIONS‡ | SN54LS06 | | | SN74LS06 SN74LS16 | | | UNIT | |
|-----------|--|-----------------------------------|------|------|----------------------|------|------|------|---|
| | | MIN | TYP§ | MAX | MIN | TYP§ | MAX | | |
| V_{IK} | $V_{CC} = \text{MIN}$, $I_I = -12 \text{ mA}$ | | | -1.5 | | | -1.5 | V | |
| I_{OH} | $V_{CC} = \text{MIN}$, $V_{IL} = 0.8 \text{ V}$ | 'LS06, $V_{OH} = 30 \text{ V}$ | | | 0.25 | | | mA | |
| | | SN74LS16, $V_{OH} = 15 \text{ V}$ | | | 0.25 | | | | |
| V_{OL} | $V_{CC} = \text{MIN}$, $V_{IH} = 2 \text{ V}$ | $I_{OL} = 16 \text{ mA}$ | | | 0.25 | 0.4 | 0.25 | 0.4 | V |
| | | $I_{OL} = 30 \text{ mA}$ | | | 0.7 | | | | |
| | | $I_{OL} = 40 \text{ mA}$ | | | 0.7 | | | | |
| I_I | $V_{CC} = \text{MAX}$, $V_I = 7 \text{ V}$ | | | 1 | | | 1 | mA | |
| I_{IH} | $V_{CC} = \text{MAX}$, $V_I = 2.4 \text{ V}$ | | | 20 | | | 20 | µA | |
| I_{IL} | $V_{CC} = \text{MAX}$, $V_I = 0.4 \text{ V}$ | | | -0.2 | | | -0.2 | mA | |
| I_{CCH} | $V_{CC} = \text{MAX}$ | | | 18 | | | 18 | mA | |
| I_{CCL} | $V_{CC} = \text{MAX}$ | | | 60 | | | 60 | mA | |

‡ For conditions shown as MIN or MAX, use the appropriate value specified under *recommended operating conditions*.

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



SN54LS06, SN74LS06, SN74LS16
HEX INVERTER BUFFERS/DRIVERS
WITH OPEN-COLLECTOR HIGH-VOLTAGE OUTPUTS

SDLS020E – MAY 1990 – REVISED FEBRUARY 2004

The SN74LS16 is obsolete
and is no longer supplied.

switching characteristics, $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$ (see Figure 1)

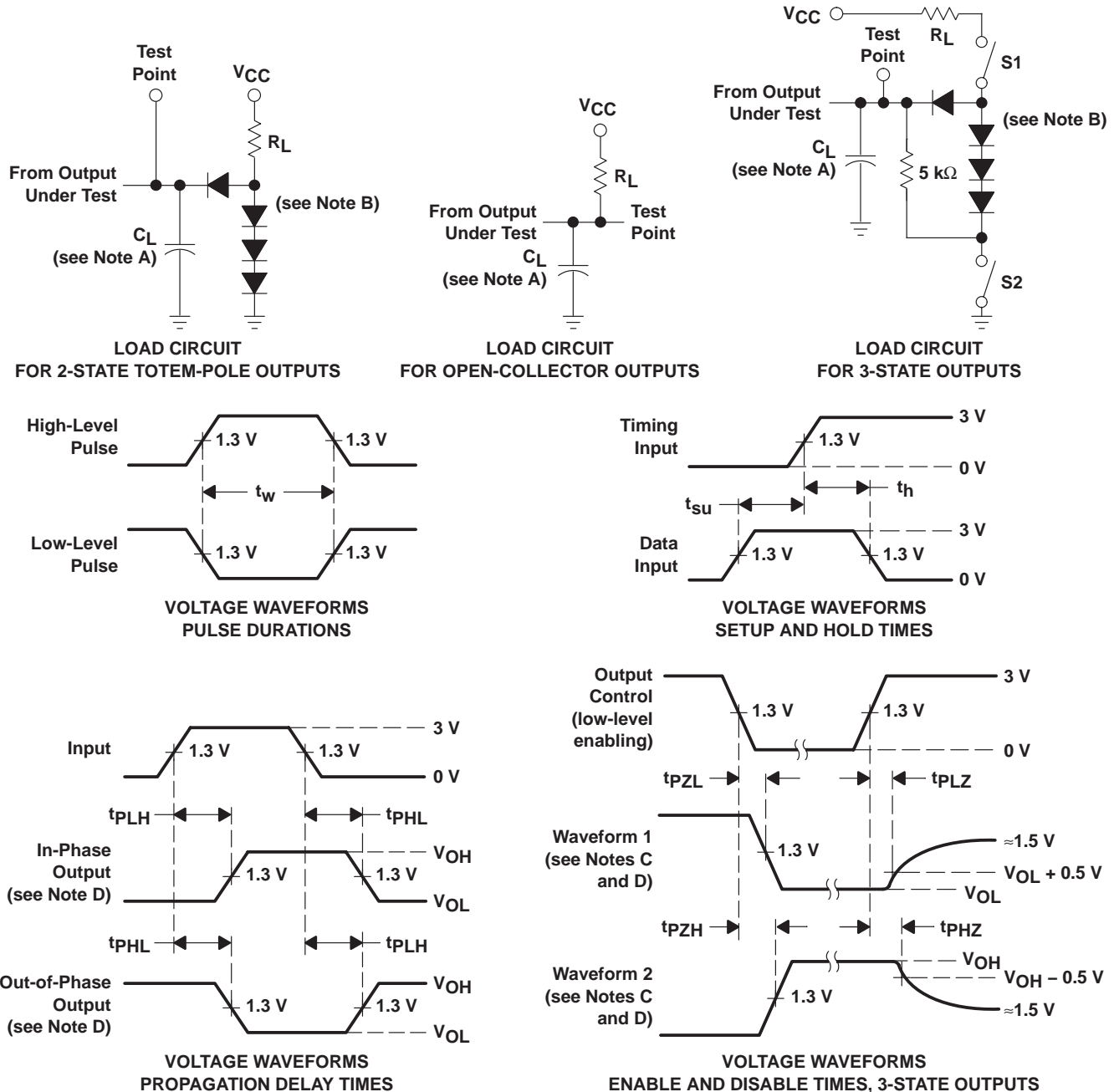
| PARAMETER | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS | MIN | MAX | UNIT |
|-----------|-----------------|----------------|--|-----|-----|------|
| t_{PLH} | A | Y | $R_L = 110\ \Omega$, $C_L = 15\ \text{pF}$ | 7 | 15 | ns |
| t_{PHL} | | | | 10 | 20 | |

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PARAMETER MEASUREMENT INFORMATION



- NOTES:
- A. C_L includes probe and jig capacitance.
 - B. All diodes are 1N3064 or equivalent.
 - C. Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.
 - D. S1 and S2 are closed for t_{PLH} , t_{PHL} , t_{PHZ} , and t_{PLZ} ; S1 is open and S2 is closed for t_{PZH} ; S1 is closed and S2 is open for t_{PZL} .
 - E. Phase relationships between inputs and outputs have been chosen arbitrarily for these examples.
 - F. All input pulses are supplied by generators having the following characteristics: PRR \leq 1 MHz, $Z_O \approx 50 \Omega$, $t_r \leq 1.5$ ns, $t_f \leq 2.6$ ns.
 - G. The outputs are measured one at a time, with one input transition per measurement.

Figure 1. Load Circuits and Voltage Waveforms

PACKAGING INFORMATION

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/Ball Finish (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|------------------|---------------|--------------|-----------------|------|-------------|-------------------------|-------------------------|----------------------|--------------|--------------------------------|-------------------------|
| 5962-9861701Q2A | ACTIVE | LCCC | FK | 20 | 1 | TBD | POST-PLATE | N / A for Pkg Type | -55 to 125 | 5962-9861701Q2A SNJ54LS06FK | Samples |
| 5962-9861701QCA | ACTIVE | CDIP | J | 14 | 1 | TBD | A42 | N / A for Pkg Type | -55 to 125 | 5962-9861701QCA SNJ54LS06J | Samples |
| SN54LS06J | ACTIVE | CDIP | J | 14 | 1 | TBD | A42 | N / A for Pkg Type | -55 to 125 | SN54LS06J | Samples |
| SN74LS06D | ACTIVE | SOIC | D | 14 | 50 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | LS06 | Samples |
| SN74LS06DBLE | OBSOLETE | SSOP | DB | 14 | | TBD | Call TI | Call TI | 0 to 70 | | |
| SN74LS06DBR | ACTIVE | SSOP | DB | 14 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | LS06 | Samples |
| SN74LS06DBRG4 | ACTIVE | SSOP | DB | 14 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | LS06 | Samples |
| SN74LS06DG4 | ACTIVE | SOIC | D | 14 | 50 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | LS06 | Samples |
| SN74LS06DR | ACTIVE | SOIC | D | 14 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | LS06 | Samples |
| SN74LS06DRE4 | ACTIVE | SOIC | D | 14 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | LS06 | Samples |
| SN74LS06N | ACTIVE | PDIP | N | 14 | 25 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | 0 to 70 | SN74LS06N | Samples |
| SN74LS06NE4 | ACTIVE | PDIP | N | 14 | 25 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | 0 to 70 | SN74LS06N | Samples |
| SN74LS06NSR | ACTIVE | SO | NS | 14 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | 74LS06 | Samples |
| SN74LS06NSRG4 | ACTIVE | SO | NS | 14 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | 74LS06 | Samples |
| SN74LS16D | OBSOLETE | SOIC | D | 14 | | TBD | Call TI | Call TI | 0 to 70 | | |
| SN74LS16DR | OBSOLETE | SOIC | D | 14 | | TBD | Call TI | Call TI | 0 to 70 | | |
| SN74LS16N | OBSOLETE | PDIP | N | 14 | | TBD | Call TI | Call TI | 0 to 70 | | |
| SNJ54LS06FK | ACTIVE | LCCC | FK | 20 | 1 | TBD | POST-PLATE | N / A for Pkg Type | -55 to 125 | 5962- | Samples |

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/Ball Finish (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|------------------|---------------|--------------|--------------------|------|----------------|-----------------|-------------------------|----------------------|--------------|-----------------------------------|----------------|
| | | | | | | | | | | 9861701Q2A SNJ54LS 06FK | |
| SNJ54LS06J | ACTIVE | CDIP | J | 14 | 1 | TBD | A42 | N / A for Pkg Type | -55 to 125 | 5962-9861701QC A SNJ54LS06J | 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.

OBSELETE: 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.

(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/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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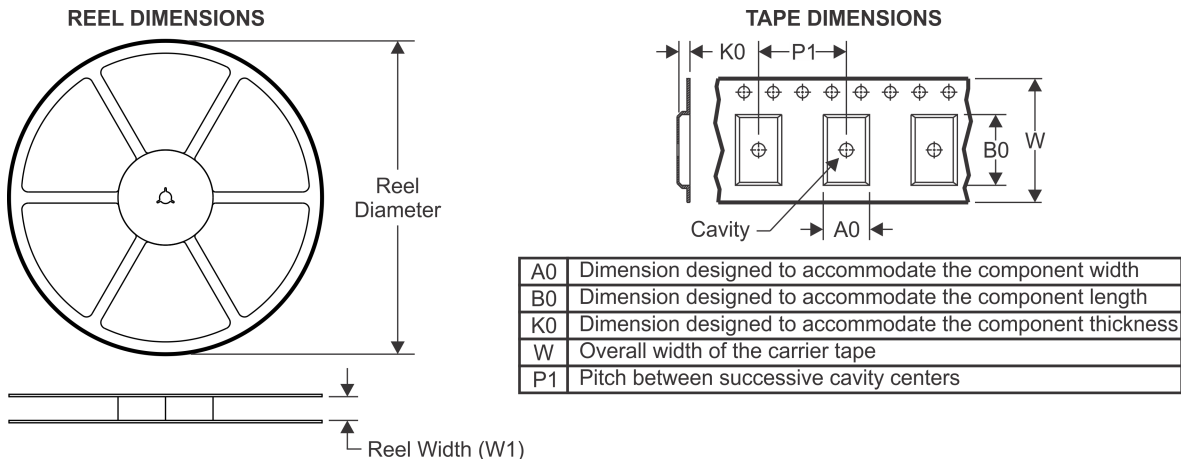
OTHER QUALIFIED VERSIONS OF SN54LS06, SN74LS06 :

- Catalog: [SN74LS06](#)
- Military: [SN54LS06](#)

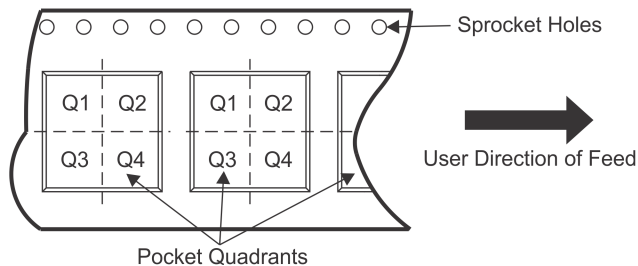
NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications

TAPE AND REEL INFORMATION



QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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 |
|-------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74LS06DBR | SSOP | DB | 14 | 2000 | 330.0 | 16.4 | 8.2 | 6.6 | 2.5 | 12.0 | 16.0 | Q1 |
| SN74LS06DR | SOIC | D | 14 | 2500 | 330.0 | 16.4 | 6.5 | 9.0 | 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) |
|-------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74LS06DBR | SSOP | DB | 14 | 2000 | 367.0 | 367.0 | 38.0 |
| SN74LS06DR | SOIC | D | 14 | 2500 | 367.0 | 367.0 | 38.0 |

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.

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

N (R-PDIP-T**)

PLASTIC DUAL-IN-LINE PACKAGE

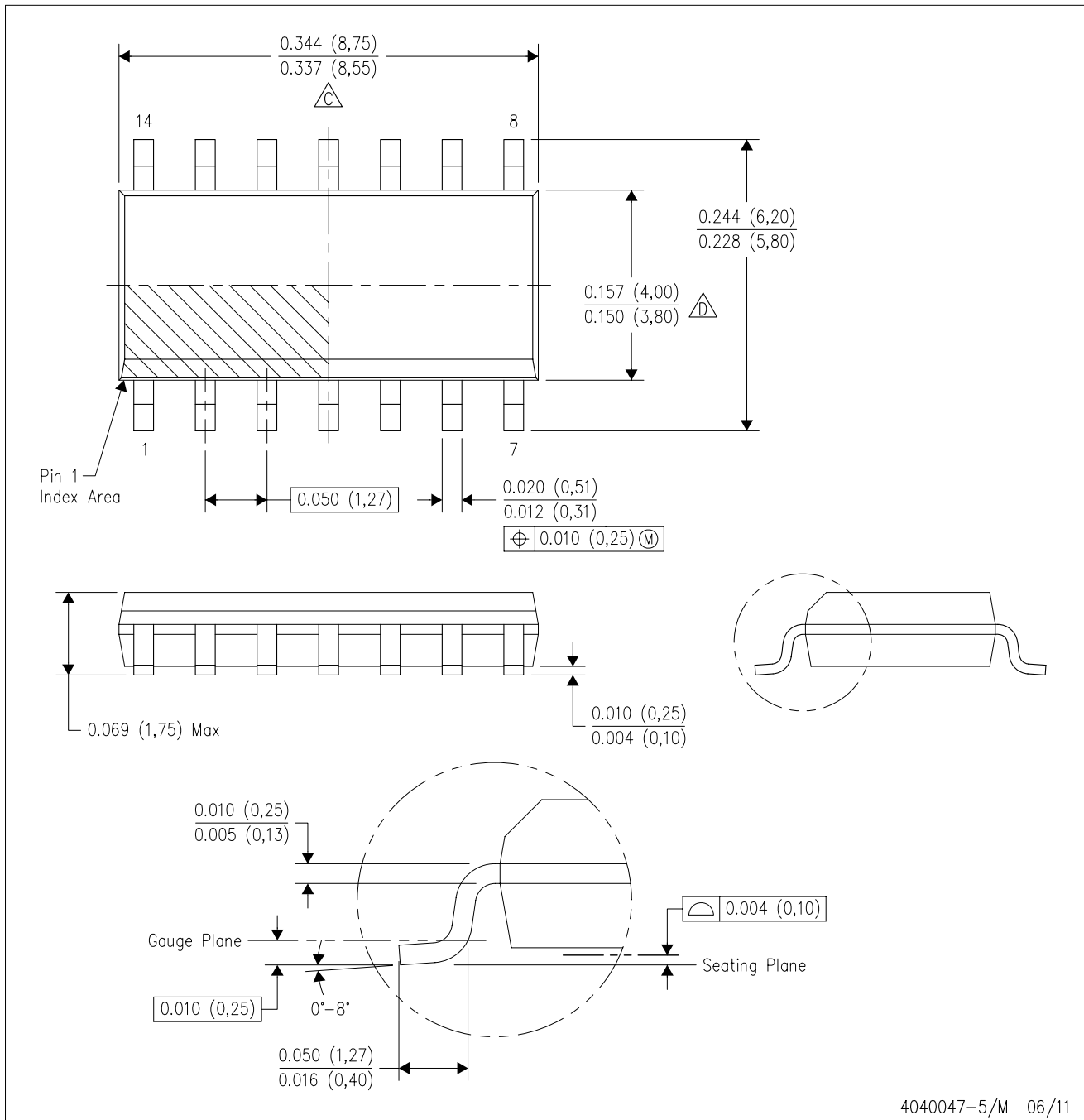
16 PINS SHOWN





- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
 - D The 20 pin end lead shoulder width is a vendor option, either half or full width.

D (R-PDSO-G14)

PLASTIC SMALL OUTLINE



4040047-5/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 AB.

D (R-PDSO-G14)

PLASTIC SMALL OUTLINE



4211283-3/E 08/12

- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Publication IPC-7351 is recommended for alternate designs.
 - 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 for other stencil recommendations.
 - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

MECHANICAL DATA

NS (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

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