

SN54AHCT158, SN74AHCT158 QUADRUPLE 2-LINE TO 1-LINE DATA SELECTORS/MUXES

SCLS348J – MAY 1996 – REVISED JULY 2003

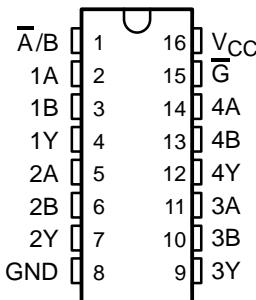
- Inputs Are TTL-Voltage Compatible
- Latch-Up Performance Exceeds 250 mA Per JESD 17
- ESD Protection Exceeds JESD 22
 - 2000-V Human-Body Model (A114-A)
 - 200-V Machine Model (A115-A)
 - 1000-V Charged-Device Model (C101)

description/ordering information

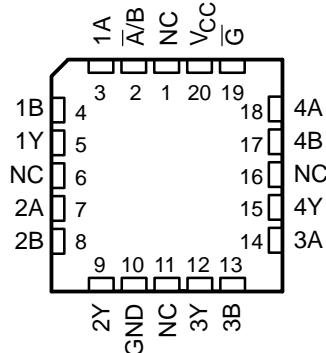
These quadruple 2-line to 1-line data selectors/multiplexers are designed for 4.5-V to 5.5-V V_{CC} operation.

The 'AHCT158 devices feature a common strobe (\bar{G}) input. When the strobe is high, all outputs are high. When the strobe is low, a 4-bit word is selected from one of two sources and is routed to the four outputs. The devices provide inverted data.

SN54AHCT158 . . . J OR W PACKAGE
SN74AHCT158 . . . D, DB, DGV, N, NS, OR PW PACKAGE
(TOP VIEW)



SN54AHCT158 . . . FK PACKAGE
(TOP VIEW)



NC – No internal connection

ORDERING INFORMATION

| TA | PACKAGE [†] | | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|----------------|----------------------|---------------|-----------------------|------------------|
| –40°C to 85°C | PDIP – N | Tube | SN74AHCT158N | SN74AHCT158N |
| | SOIC – D | Tube | SN74AHCT158D | AHCT158 |
| | | Tape and reel | SN74AHCT158DR | |
| | SOP – NS | Tape and reel | SN74AHCT158NSR | AHCT158 |
| | SSOP – DB | Tape and reel | SN74AHCT158DBR | HB158 |
| | TSSOP – PW | Tube | SN74AHCT158PW | HB158 |
| | | Tape and reel | SN74AHCT158PWR | |
| –55°C to 125°C | TVSOP – DGV | Tape and reel | SN74AHCT158DGVR | HB158 |
| | CDIP – J | Tube | SNJ54AHCT158J | SNJ54AHCT158J |
| | CFP – W | Tube | SNJ54AHCT158W | SNJ54AHCT158W |
| | LCCC – FK | Tube | SNJ54AHCT158K | SNJ54AHCT158FK |

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



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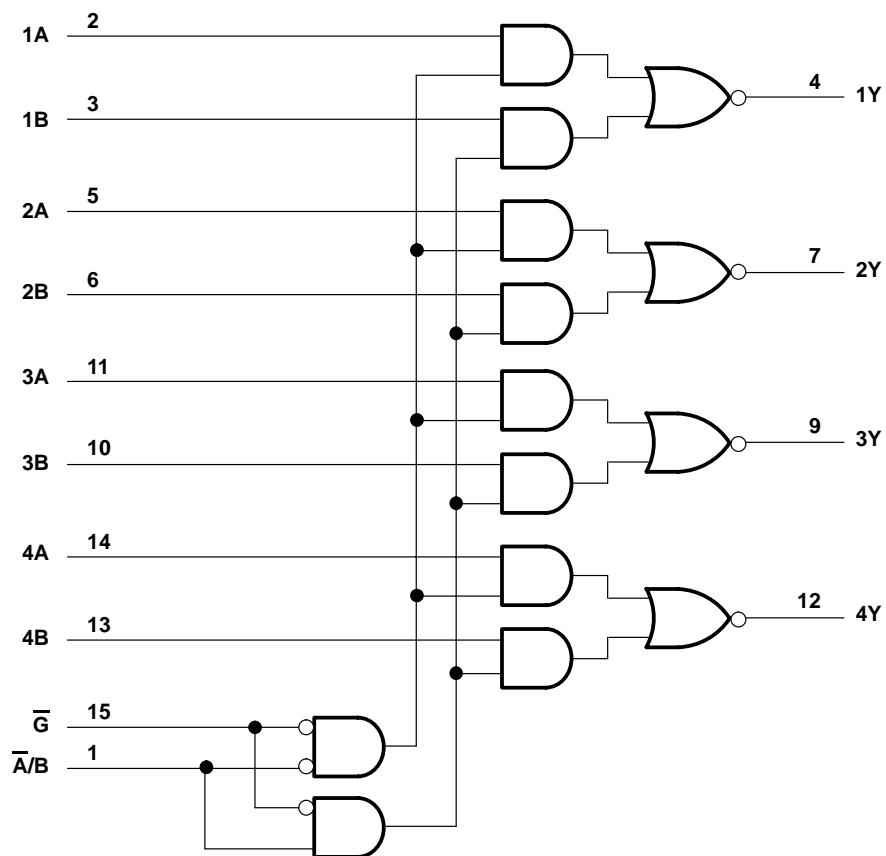
SN54AHCT158, SN74AHCT158 QUADRUPLE 2-LINE TO 1-LINE DATA SELECTORS/MULTIPLEXERS

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FUNCTION TABLE
(each data selector/multiplexer)

| INPUTS | | | | OUTPUT |
|-----------|-------------|---|---|--------|
| \bar{G} | \bar{A}/B | A | B | Y |
| H | X | X | X | H |
| L | L | L | X | H |
| L | L | H | X | L |
| L | H | X | L | H |
| L | H | X | H | L |

logic diagram (positive logic)



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

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

| | | |
|--|----------------------------|--|
| Supply voltage range, V_{CC} | –0.5 V to 7 V | |
| Input voltage range, V_I (see Note 1) | –0.5 V to 7 V | |
| Output voltage range, V_O (see Note 1) | –0.5 V to V_{CC} + 0.5 V | |
| Input clamp current, I_{IK} ($V_I < 0$) | –20 mA | |
| Output clamp current, I_{OK} ($V_O < 0$ or $V_O > V_{CC}$) | ±20 mA | |
| Continuous output current, I_O ($V_O = 0$ to V_{CC}) | ±25 mA | |
| Continuous current through V_{CC} or GND | ±50 mA | |
| Package thermal impedance, θ_{JA} (see Note 2): D package | 73°C/W | |
| DB package | 82°C/W | |
| DGV package | 120°C/W | |
| N package | 67°C/W | |
| NS package | 64°C/W | |
| PW package | 108°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. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
 2. The package thermal impedance is calculated in accordance with JESD 51-7.

recommended operating conditions (see Note 3)

| | | SN54AHCT158 | | SN74AHCT158 | | UNIT |
|---------------------|------------------------------------|-------------|----------|-------------|----------|------|
| | | MIN | MAX | MIN | MAX | |
| V_{CC} | Supply voltage | 4.5 | 5.5 | 4.5 | 5.5 | V |
| V_{IH} | High-level input voltage | 2 | | 2 | | V |
| V_{IL} | Low-level input voltage | | 0.8 | | 0.8 | V |
| V_I | Input voltage | 0 | 5.5 | 0 | 5.5 | V |
| V_O | Output voltage | 0 | V_{CC} | 0 | V_{CC} | V |
| I_{OH} | High-level output current | | –8 | | –8 | mA |
| I_{OL} | Low-level output current | | 8 | | 8 | mA |
| $\Delta t/\Delta v$ | Input transition rise or fall time | | 20 | | 20 | ns/V |
| T_A | Operating free-air temperature | –55 | 125 | –40 | 85 | °C |

NOTE 3: 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.

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

| PARAMETER | TEST CONDITIONS | V _{CC} | T _A = 25°C | | | SN54AHCT158 | | SN74AHCT158 | | UNIT |
|--------------------|---|-----------------|-----------------------|------|-----|-------------|-----|-------------|-----|------|
| | | | MIN | TYP | MAX | MIN | MAX | MIN | MAX | |
| V _{OH} | I _{OH} = -50 µA | 4.5 V | 4.4 | 4.5 | | 4.4 | | 4.4 | | V |
| | I _{OH} = -8 mA | | 3.94 | | | 3.8 | | 3.8 | | |
| V _{OL} | I _{OL} = 50 µA | 4.5 V | | 0.1 | | 0.1 | | 0.1 | | V |
| | I _{OL} = 8 mA | | | 0.36 | | 0.44 | | 0.44 | | |
| I _I | V _I = 5.5 V or GND | 0 V to 5.5 V | | ±0.1 | | ±1* | | ±1 | µA | |
| I _{CC} | V _I = V _{CC} or GND, I _O = 0 | 5.5 V | | 2 | | 20 | | 20 | µA | |
| ΔI _{CC} † | One input at 3.4 V, Other inputs at V _{CC} or GND | 5.5 V | | 1.35 | | 1.5 | | 1.5 | mA | |
| C _i | V _I = V _{CC} or GND | 5 V | 2 | 10 | | | | 10 | pF | |

* On products compliant to MIL-PRF-38535, this parameter is not production tested at V_{CC} = 0 V.

† This is the increase in supply current for each input at one of the specified TTL voltage levels rather than 0 V or V_{CC}.

switching characteristics over recommended operating free-air temperature range, V_{CC} = 5 V ± 0.5 V (unless otherwise noted) (see Figure 1)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | LOAD CAPACITANCE | T _A = 25°C | | | SN54AHCT158 | | SN74AHCT158 | | UNIT |
|------------------|--------------|-------------|------------------------|-----------------------|-------|-----|-------------|-------|-------------|-----|------|
| | | | | MIN | TYP | MAX | MIN | MAX | MIN | MAX | |
| t _{PLH} | A or B | Y | C _L = 15 pF | 4.1** | 6.4** | | 1** | 7.5** | 1 | 7.5 | ns |
| t _{PHL} | | | | 4.1** | 6.4** | | 1** | 7.5** | 1 | 7.5 | |
| t _{PLH} | A/B | Y | C _L = 15 pF | 5.3** | 8.1** | | 1** | 9.5** | 1 | 9.5 | ns |
| t _{PHL} | | | | 5.3** | 8.1** | | 1** | 9.5** | 1 | 9.5 | |
| t _{PLH} | G | Y | C _L = 15 pF | 5.6** | 8.6** | | 1** | 10** | 1 | 10 | ns |
| t _{PHL} | | | | 5.6** | 8.6** | | 1** | 10** | 1 | 10 | |
| t _{PLH} | A or B | Y | C _L = 50 pF | 5.6 | 8.7 | | 1 | 10.8 | 1 | 9.8 | ns |
| t _{PHL} | | | | 5.6 | 8.7 | | 1 | 10.8 | 1 | 9.8 | |
| t _{PLH} | A/B | Y | C _L = 50 pF | 6.8 | 10.4 | | 1 | 13.2 | 1 | 12 | ns |
| t _{PHL} | | | | 6.8 | 10.4 | | 1 | 13.2 | 1 | 12 | |
| t _{PLH} | G | Y | C _L = 50 pF | 7.1 | 11 | | 1 | 13.5 | 1 | 12 | ns |
| t _{PHL} | | | | 7.1 | 11 | | 1 | 13.5 | 1 | 12 | |

** On products compliant to MIL-PRF-38535, this parameter is not production tested.

noise characteristics V_{CC} = 5 V, C_L = 50 pF, T_A = 25°C (see Note 4)

| PARAMETER | SN74AHCT158 | | | UNIT |
|--|-------------|-----|------|------|
| | MIN | TYP | MAX | |
| V _{OL(P)} Quiet output, maximum dynamic V _{OL} | | | 0.8 | V |
| V _{OL(V)} Quiet output, minimum dynamic V _{OL} | | | -0.8 | V |
| V _{OH(V)} Quiet output, minimum dynamic V _{OH} | | | 4.8 | V |
| V _{IH(D)} High-level dynamic input voltage | | 2 | | V |
| V _{IL(D)} Low-level dynamic input voltage | | | 0.8 | V |

NOTE 4: Characteristics are for surface-mount packages only.

PRODUCT PREVIEW information concerns products in the formative or design phase of development. Characteristic data and other specifications are design goals. Texas Instruments reserves the right to change or discontinue these products without notice.

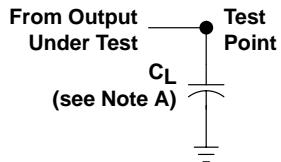


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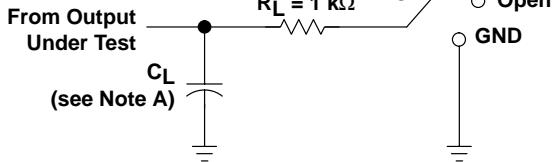
operating characteristics, $V_{CC} = 5$ V, $T_A = 25^\circ\text{C}$

| PARAMETER | | TEST CONDITIONS | TYP | UNIT |
|-----------------|-------------------------------|--------------------|-----|------|
| C _{pd} | Power dissipation capacitance | No load, f = 1 MHz | 11 | pF |

PARAMETER MEASUREMENT INFORMATION

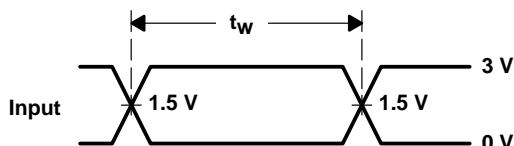


LOAD CIRCUIT FOR
TOTEM-POLE OUTPUTS

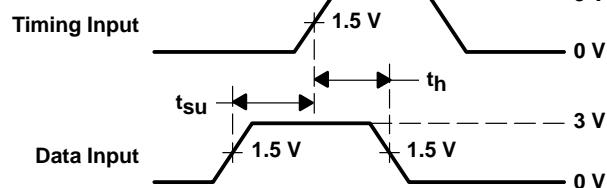


| TEST | S1 |
|------------------------------------|-----------------|
| t _{PLH} /t _{PHL} | Open |
| t _{PLZ} /t _{PZL} | V _{CC} |
| t _{PHZ} /t _{PZH} | GND |
| Open Drain | V _{CC} |

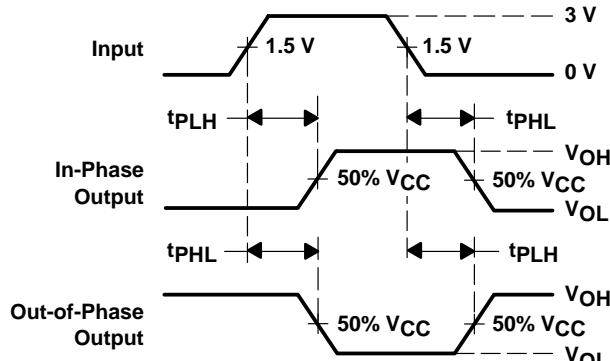
LOAD CIRCUIT FOR
3-STATE AND OPEN-DRAIN OUTPUTS



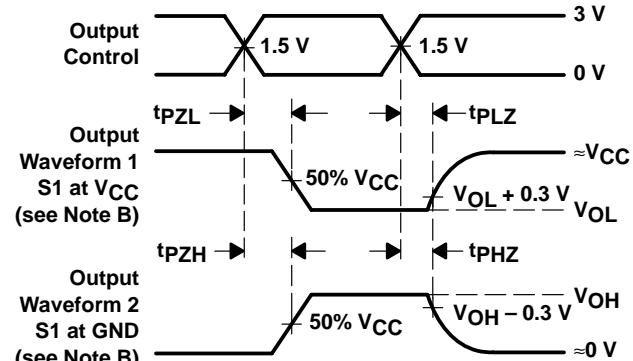
VOLTAGE WAVEFORMS
PULSE DURATION



VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES
INVERTING AND NONINVERTING OUTPUTS



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES
LOW- AND HIGH-LEVEL ENABLING

NOTES:

- C_L includes probe and jig capacitance.
- 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.
- All input pulses are supplied by generators having the following characteristics: PRR ≤ 1 MHz, $Z_O = 50 \Omega$, $t_f \leq 3$ ns, $t_r \leq 3$ ns.
- The outputs are measured one at a time with one input transition per measurement.
- All parameters and waveforms are not applicable to all devices.

Figure 1. Load Circuit and Voltage Waveforms

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PACKAGING INFORMATION

| Orderable Device | Status ⁽¹⁾ | Package Type | Package Drawing | Pins | Package Qty | Eco Plan ⁽²⁾ | Lead/Ball Finish | MSL Peak Temp ⁽³⁾ |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| SN74AHCT158D | ACTIVE | SOIC | D | 16 | 40 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74AHCT158DBLE | OBsolete | SSOP | DB | 16 | | TBD | Call TI | Call TI |
| SN74AHCT158DE4 | ACTIVE | SOIC | D | 16 | 40 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74AHCT158DG4 | ACTIVE | SOIC | D | 16 | 40 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74AHCT158NSR | ACTIVE | SO | NS | 16 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74AHCT158NSRE4 | ACTIVE | SO | NS | 16 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74AHCT158NSRG4 | ACTIVE | SO | NS | 16 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74AHCT158PW | ACTIVE | TSSOP | PW | 16 | 90 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74AHCT158PWE4 | ACTIVE | TSSOP | PW | 16 | 90 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74AHCT158PWG4 | ACTIVE | TSSOP | PW | 16 | 90 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74AHCT158PWLE | OBsolete | TSSOP | PW | 16 | | TBD | Call TI | Call TI |
| SN74AHCT158PWR | ACTIVE | TSSOP | PW | 16 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74AHCT158PWRE4 | ACTIVE | TSSOP | PW | 16 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74AHCT158PWRG4 | ACTIVE | TSSOP | PW | 16 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |

⁽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.

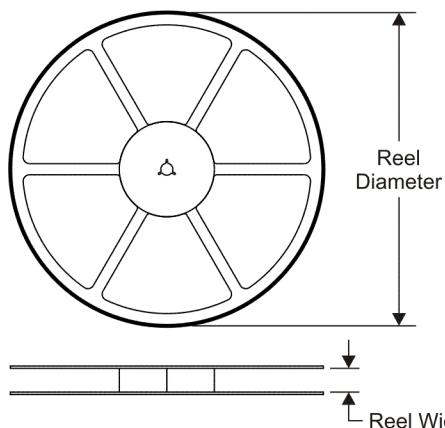
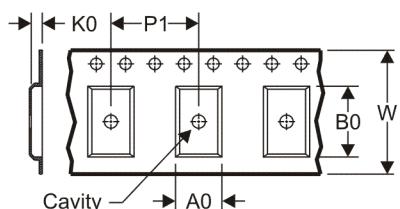
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

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

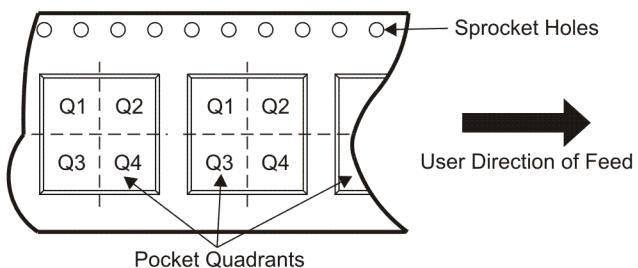
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TAPE AND REEL INFORMATION
REEL DIMENSIONS

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 |

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 |
|----------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74AHCT158NSR | SO | NS | 16 | 2000 | 330.0 | 16.4 | 8.2 | 10.5 | 2.5 | 12.0 | 16.0 | Q1 |
| SN74AHCT158PWR | TSSOP | PW | 16 | 2000 | 330.0 | 12.4 | 7.0 | 5.6 | 1.6 | 8.0 | 12.0 | Q1 |

TAPE AND REEL BOX DIMENSIONS

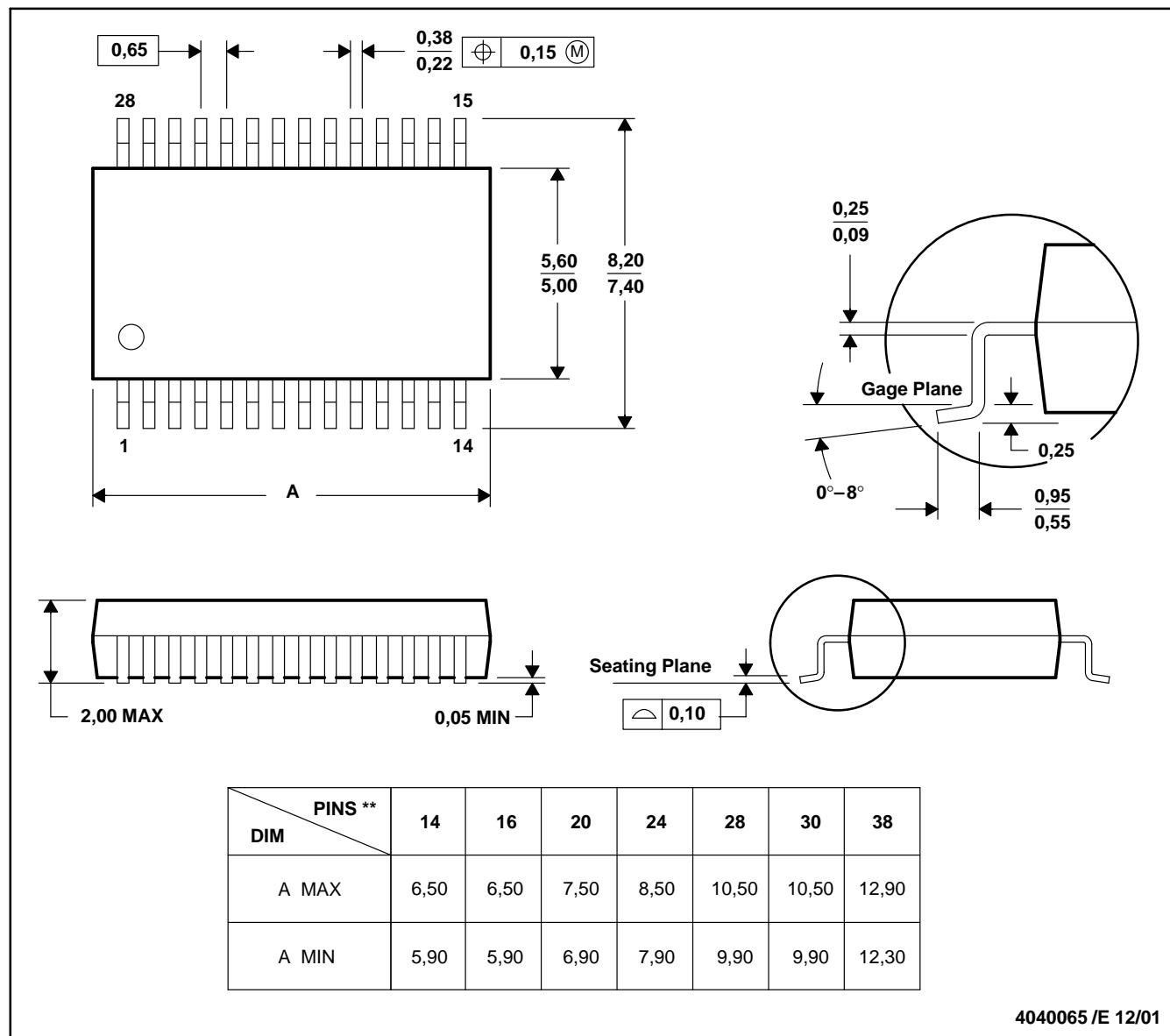

*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|----------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74AHCT158NSR | SO | NS | 16 | 2000 | 346.0 | 346.0 | 33.0 |
| SN74AHCT158PWR | TSSOP | PW | 16 | 2000 | 346.0 | 346.0 | 29.0 |

DB (R-PDSO-G**)

PLASTIC SMALL-OUTLINE

28 PINS SHOWN

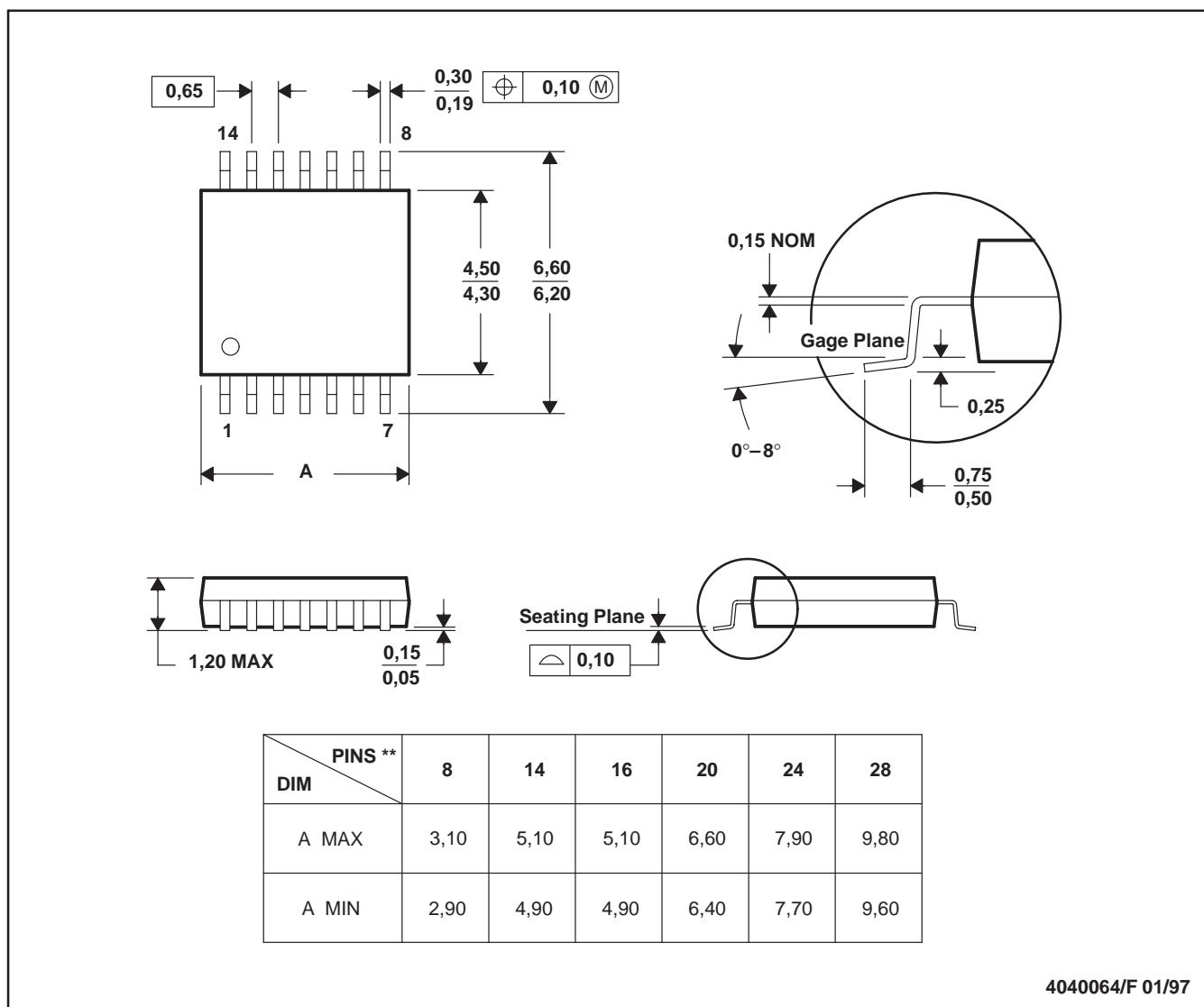


NOTES: A. All linear dimensions are in millimeters.
 B. This drawing is subject to change without notice.
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.
 D. Falls within JEDEC MO-150

PW (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



NOTES:

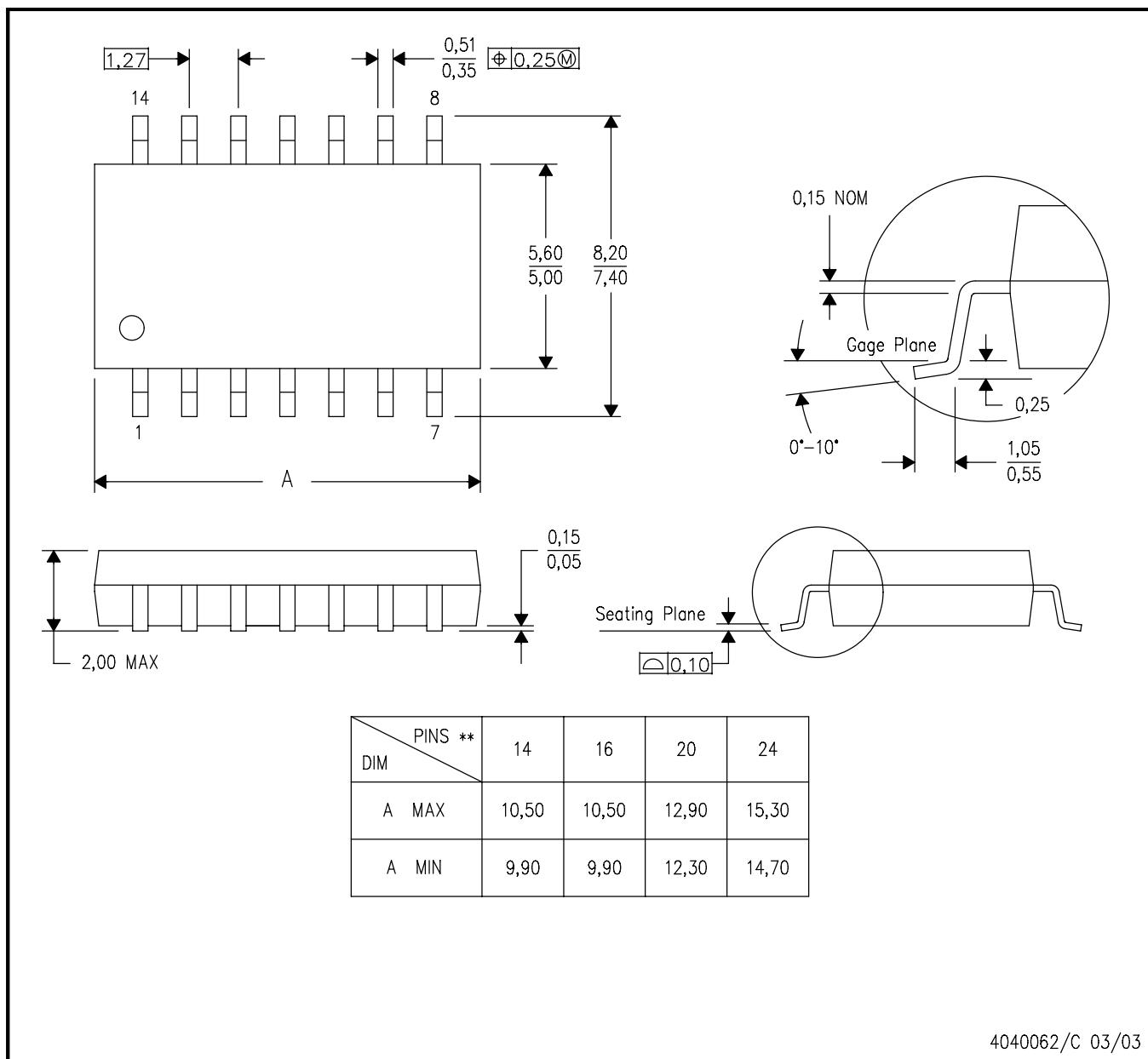
- All linear dimensions are in millimeters.
- This drawing is subject to change without notice.
- Body dimensions do not include mold flash or protrusion not to exceed 0,15.
- Falls within JEDEC MO-153

MECHANICAL DATA

NS (R-PDSO-G**)

14-PINS SHOWN

PLASTIC SMALL-OUTLINE PACKAGE

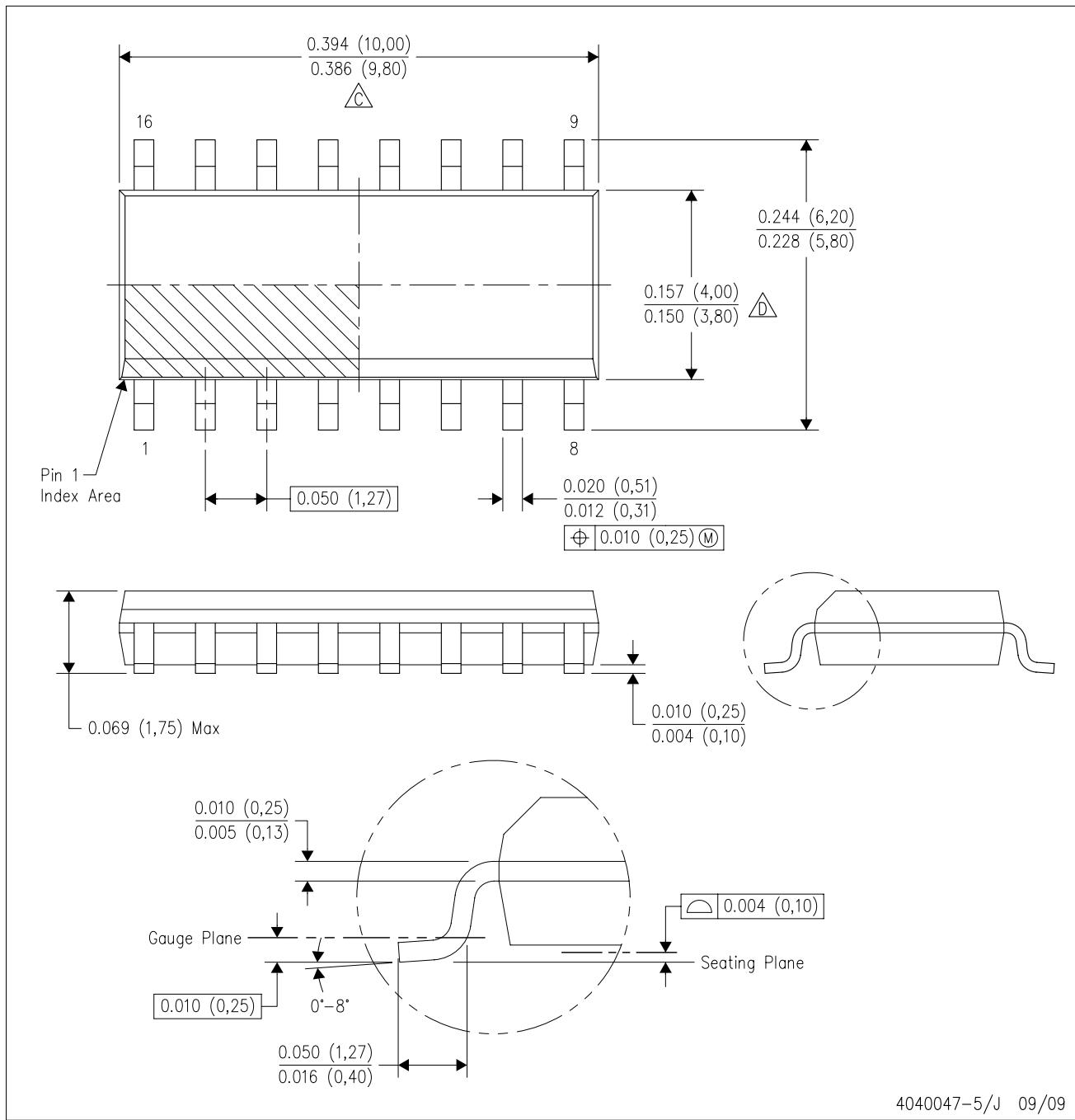


4040062/C 03/03

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.

D (R-PDSO-G16)

PLASTIC SMALL-OUTLINE PACKAGE



NOTES: A. All linear dimensions are in inches (millimeters).

B. This drawing is subject to change without notice.

△C Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed .006 (0,15) per end.

△D Body width does not include interlead flash. Interlead flash shall not exceed .017 (0,43) per side.

E. Reference JEDEC MS-012 variation AC.

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