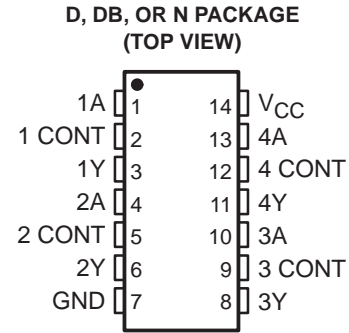


SN75C189, SN75C189A QUADRUPLE LOW-POWER LINE RECEIVERS

SLLS041G – OCTOBER 1988 – REVISED JANUARY 2000

- Meet or Exceed the Requirements of TIA/EIA-232-F and ITU Recommendation V.28
- Low Supply Current . . . 420 μ A Typ
- Preset On-Chip Input Noise Filter
- Built-in Input Hysteresis
- Response and Threshold Control Inputs
- Push-Pull Outputs
- Functionally Interchangeable and Pin-to-Pin Compatible With Texas Instruments SN75189/SN75189A and Motorola MC1489/MC1489A
- Package Options Include Plastic Small-Outline (D) and Shrink Small-Outline (DB) Packages, and Standard Plastic (N) DIP



description

The SN75C189 and SN75C189A are low-power, bipolar, quadruple line receivers that are used to interface data terminal equipment (DTE) with data circuit-terminating equipment (DCE). These devices have been designed to conform to TIA/EIA-232-F.

The SN75C189 has a 0.33-V typical hysteresis, compared with 0.97 V for the SN75C189A. Each receiver has provision for adjustment of the overall input threshold levels. This is achieved by choosing external series resistors and voltages to provide bias levels for the response-control pins. The output is in the high logic state if the input is open circuit or shorted to ground.

These devices have an on-chip filter that rejects input pulses of less than 1- μ s duration. An external capacitor can be connected from the control pins to ground to provide further input noise filtering for each receiver.

The SN75C189 and SN75C189A have been designed using low-power techniques in a bipolar technology. In most applications, these receivers interface to single inputs of peripheral devices such as UARTs, ACEs, or microprocessors. By using sampling, such peripheral devices usually are insensitive to the transition times of the input signals. If this is not the case, or for other uses, it is recommended that the SN75C189 and SN75C189A outputs be buffered by single Schmitt input gates or single gates of the HCMOS, ALS, or 74F logic families.

The SN75C189 and SN75C189A are characterized for operation from 0°C to 70°C.



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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**

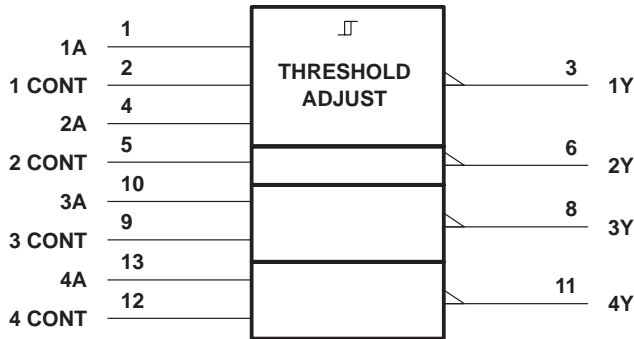
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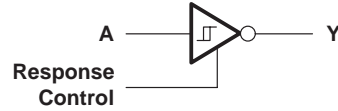
SN75C189, SN75C189A QUADRUPLE LOW-POWER LINE RECEIVERS

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logic symbol†

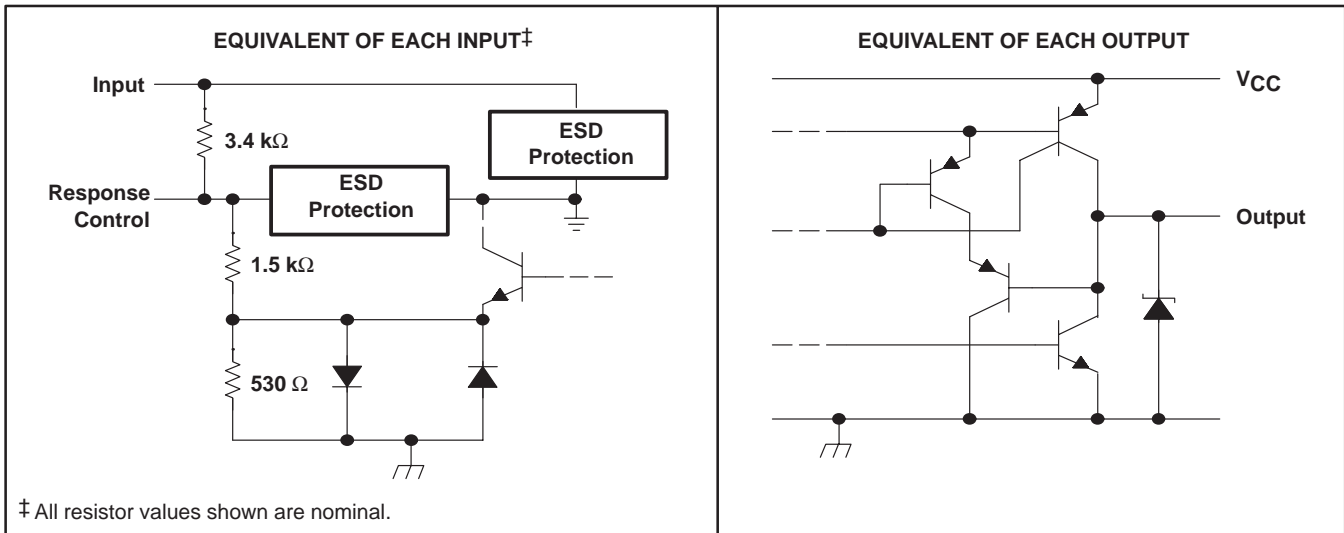


logic diagram (each receiver)



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

schematic of inputs and outputs



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

| | |
|--|----------------------------|
| Supply voltage, V_{CC} (see Note 1) | 7 V |
| Input voltage range, V_I | -30 V to 30 V |
| Output voltage range, V_O | -0.3 V to $V_{CC} + 0.3$ V |
| Package thermal impedance, θ_{JA} (see Note 2): | |
| D package | 86°C/W |
| DB package | 96°C/W |
| N package | 80°C/W |
| Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds | 260°C |
| 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 voltages are with respect to network GND.
2. The package thermal impedance is calculated in accordance with JESD 51.

SN75C189, SN75C189A QUADRUPLE LOW-POWER LINE RECEIVERS

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recommended operating conditions

| | MIN | NOM | MAX | UNIT |
|---|-----|-----|------|------|
| V _{CC} Supply voltage | 4.5 | 5 | 6 | V |
| V _I Input voltage (see Note 3) | -25 | | 25 | V |
| I _{OH} High-level output current | | | -3.2 | mA |
| I _{OL} Low-level output current | | | 3.2 | mA |
| Response-control current | | | ±1 | mA |
| T _A Operating free-air temperature | 0 | | 70 | °C |

NOTE 3: The algebraic convention, where the more positive (less negative) limit is designated as maximum, is used in this data sheet for logic levels only, e.g., if -10 V is a maximum, the typical value is a more negative voltage.

electrical characteristics over recommended free-air temperature range, V_{CC} = 5 V ±10% (unless otherwise noted) (see Note 4)

| PARAMETER | | TEST CONDITIONS | MIN | TYP† | MAX | UNIT |
|--|--|------------------------|-------|------|------|------|
| V _{IT+} Positive-going input threshold voltage | 'C189 | See Figure 1 | 1 | | 1.5 | V |
| | 'C189A | | 1.6 | | 2.25 | |
| V _{IT-} Negative-going input threshold voltage | 'C189 | See Figure 1 | 0.75 | | 1.25 | V |
| | 'C189A | | 0.75 | 1 | 1.25 | |
| V _{hys} Input hysteresis voltage (V _{IT+} - V _{IT-}) | 'C189 | See Figure 1 | 0.15 | 0.33 | | V |
| | 'C189A | | 0.65 | 0.97 | | |
| V _{OH} High-level output voltage | V _{CC} = 4.5 V to 6 V, V _I = 0.75 V, I _{OH} = -20 μA | | 3.5 | | | V |
| | V _{CC} = 4.5 V to 6 V, V _I = 0.75 V, I _{OH} = -3.2 mA | | 2.5 | | | |
| V _{OL} Low-level output voltage | V _{CC} = 4.5 V to 6 V, V _I = 3 V, I _{OL} = 3.2 mA | | | | 0.4 | V |
| I _{IH} High-level input current | See Figure 2 | V _I = 25 V | 3.6 | | 8.3 | mA |
| | | V _I = 3 V | 0.43 | | 1 | |
| I _{IL} Low-level input current | See Figure 2 | V _I = -25 V | -3.6 | | -8.3 | mA |
| | | V _I = -3 V | -0.43 | | -1 | |
| I _{OS} Short-circuit output current | See Figure 3 | | | | -35 | mA |
| I _{CC} Supply current | V _I = 5 V, See Figure 2 | No load, | | 420 | 700 | μA |

† All typical values are at T_A = 25°C.

NOTE 4: All characteristics are measured with response-control terminal open.

switching characteristics, V_{CC} = 5 V ±10%, T_A = 25°C

| PARAMETER | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|--|---|-----|-----|-----|------|
| t _{pLH} Propagation delay time, low- to high-level output | R _L = 5 kΩ, C _L = 50 pF, See Figure 4 | | | 6 | μs |
| t _{pHL} Propagation delay time, high- to low-level output | | | | 6 | μs |
| t _{TLH} Transition time, low- to high-level output‡ | | | | 500 | ns |
| t _{THL} Transition time, high- to low-level output‡ | | | | 300 | ns |
| t _{w(N)} Duration of longest pulse rejected as noise§ | | | 1 | | 6 |

‡ Measured between 10% and 90% points of output waveform

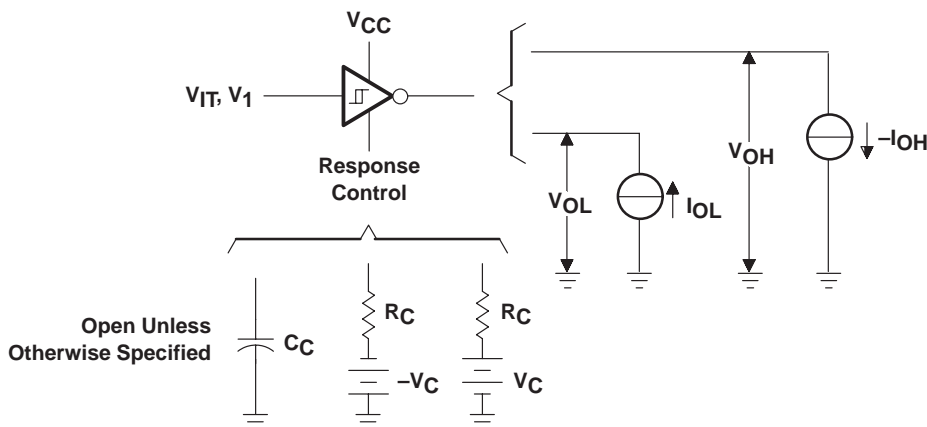
§ The receiver ignores any positive- or negative-going pulse that is less than the minimum value of t_{w(N)} and accepts any positive- or negative-going pulse greater than the maximum of t_{w(N)}.



SN75C189, SN75C189A QUADRUPLE LOW-POWER LINE RECEIVERS

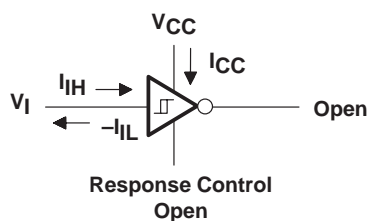
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PARAMETER MEASUREMENT INFORMATION



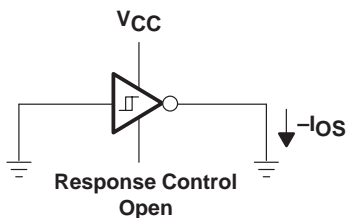
NOTE A: Arrows indicate actual direction of current flow. Current into a terminal is a positive value.

Figure 1. V_{T+} , V_{IT-} , V_{OH} , V_{OL}



NOTE A: Arrows indicate actual direction of current flow. Current into a terminal is a positive value.

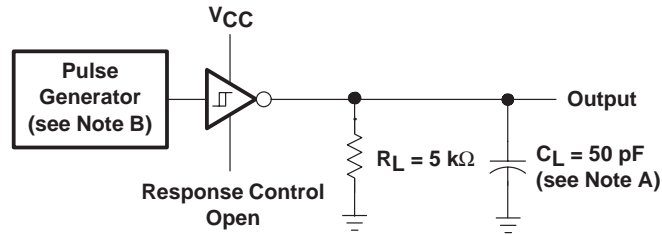
Figure 2. I_{IH} , I_{IL} , I_{CC}



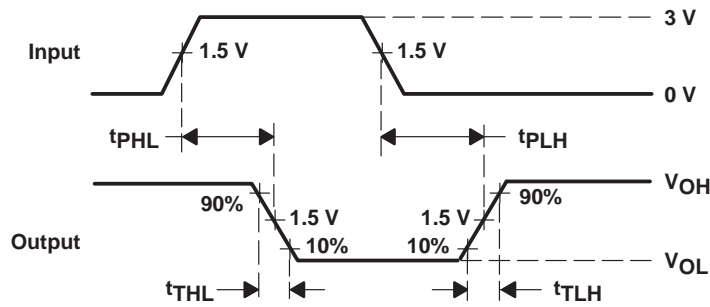
NOTE A: Arrows indicate actual direction of current flow. Current into a terminal is a positive value.

Figure 3. I_{OS}

PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT



VOLTAGE WAVEFORMS

- NOTES: A. C_L includes probe and jig capacitances.
 B. The pulse generator has the following characteristics: $Z_O = 50 \Omega$, $t_w = 25 \mu s$.

Figure 4. Test Circuit and Voltage Waveforms

SN75C189, SN75C189A QUADRUPLE LOW-POWER LINE RECEIVERS

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TYPICAL CHARACTERISTICS

SN75C189
INPUT THRESHOLD VOLTAGE (POSITIVE GOING)
vs
FREE-AIR TEMPERATURE

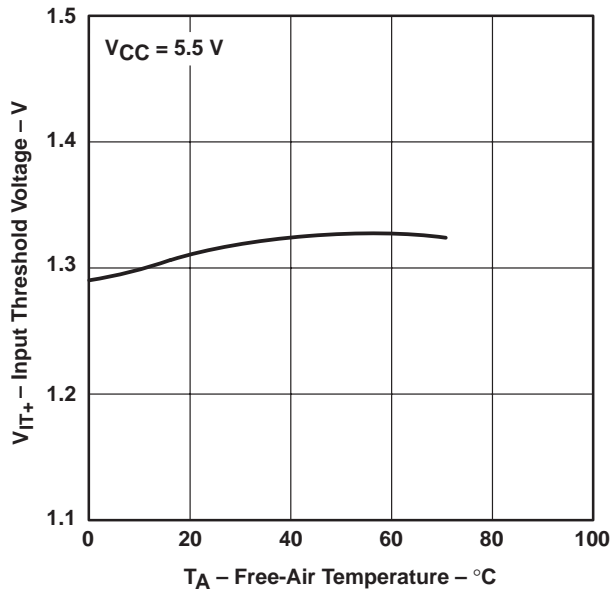


Figure 5

SN75C189A
INPUT THRESHOLD VOLTAGE (POSITIVE GOING)
vs
FREE-AIR TEMPERATURE

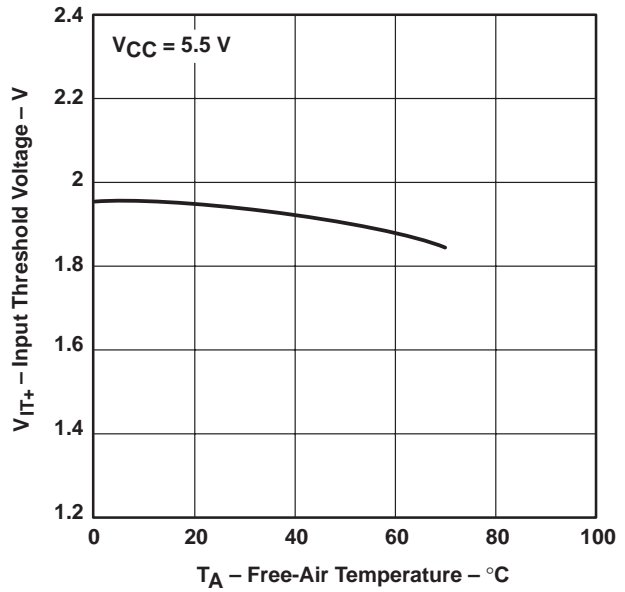


Figure 6

SN75C189
INPUT THRESHOLD VOLTAGE (NEGATIVE GOING)
vs
FREE-AIR TEMPERATURE

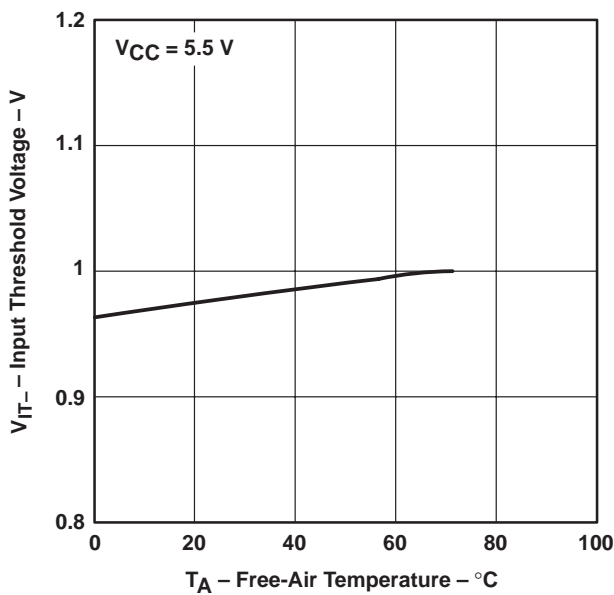


Figure 7

SN75C189A
INPUT THRESHOLD VOLTAGE (NEGATIVE GOING)
vs
FREE-AIR TEMPERATURE

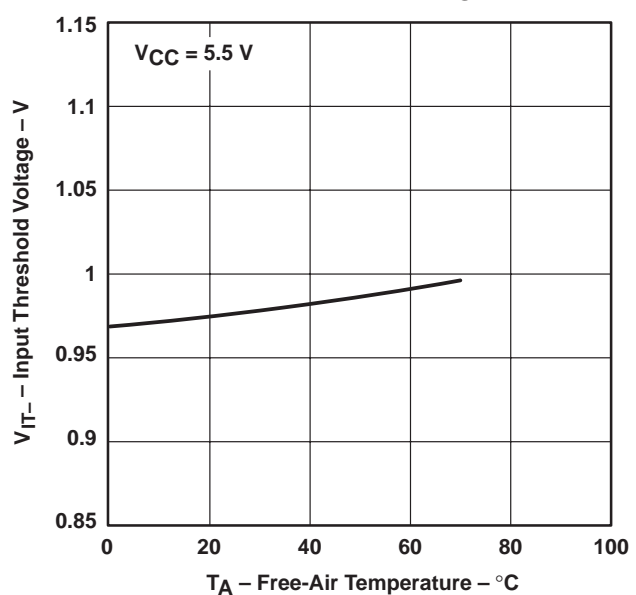
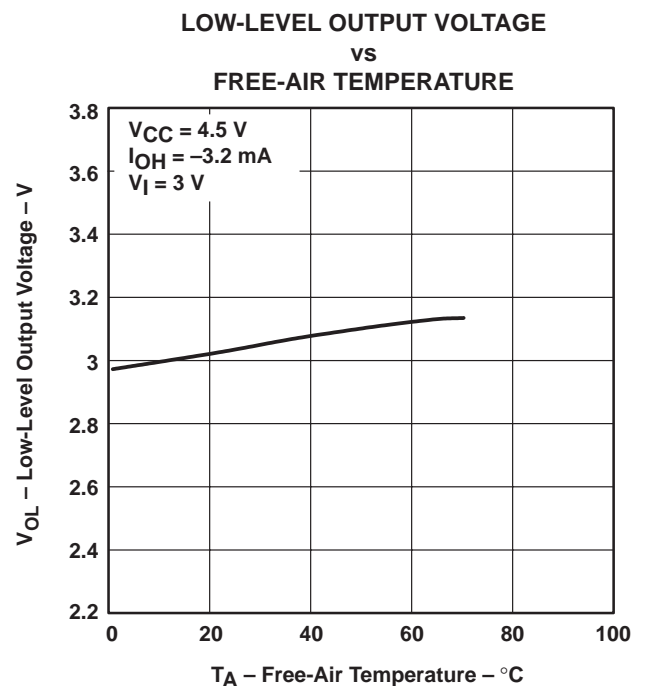
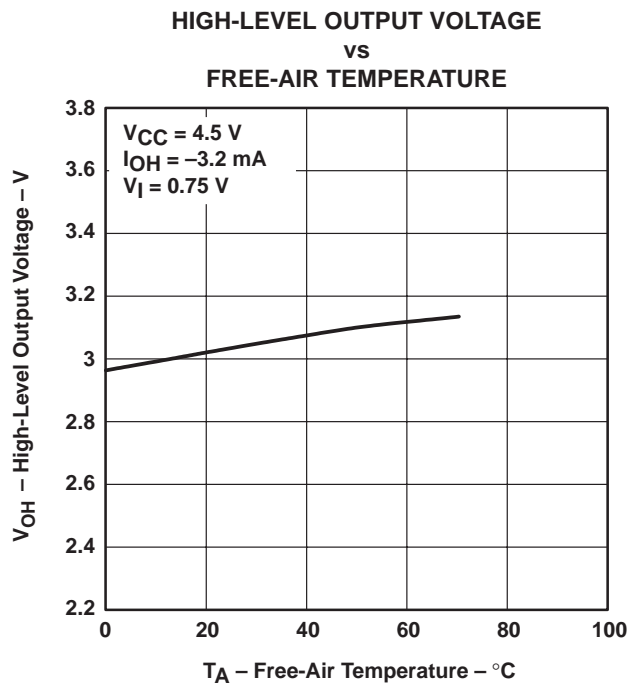
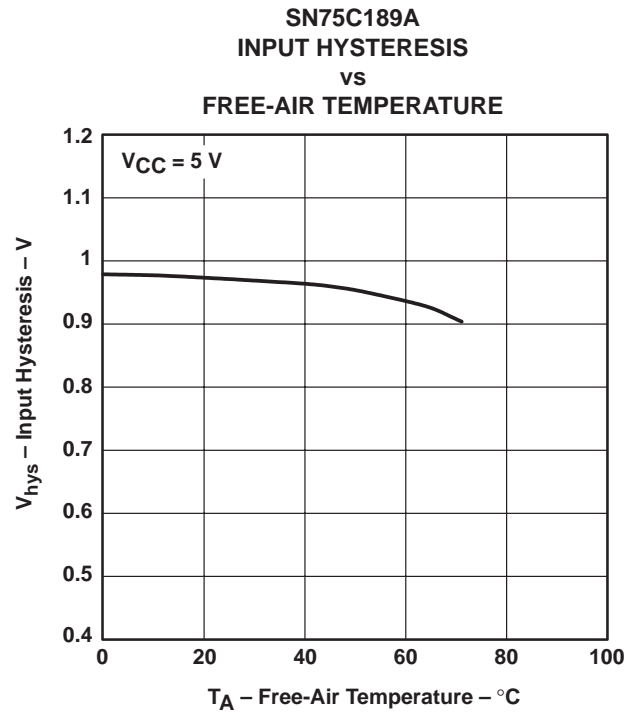
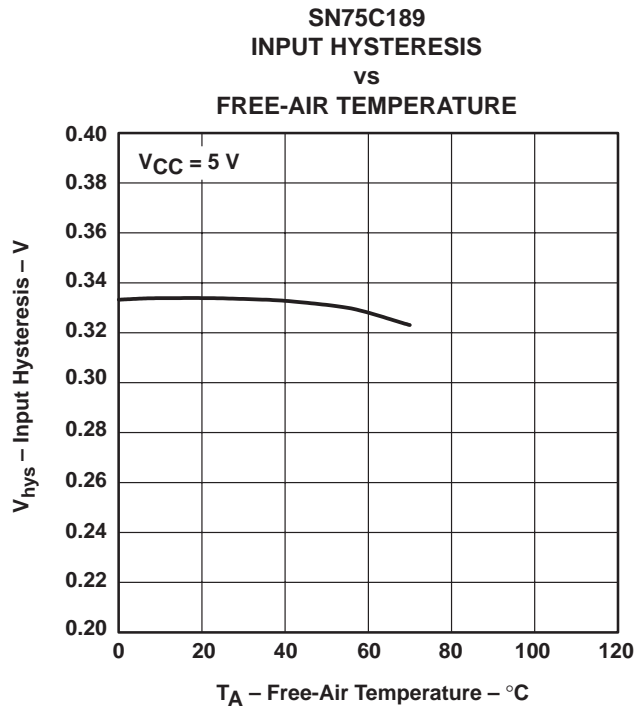


Figure 8



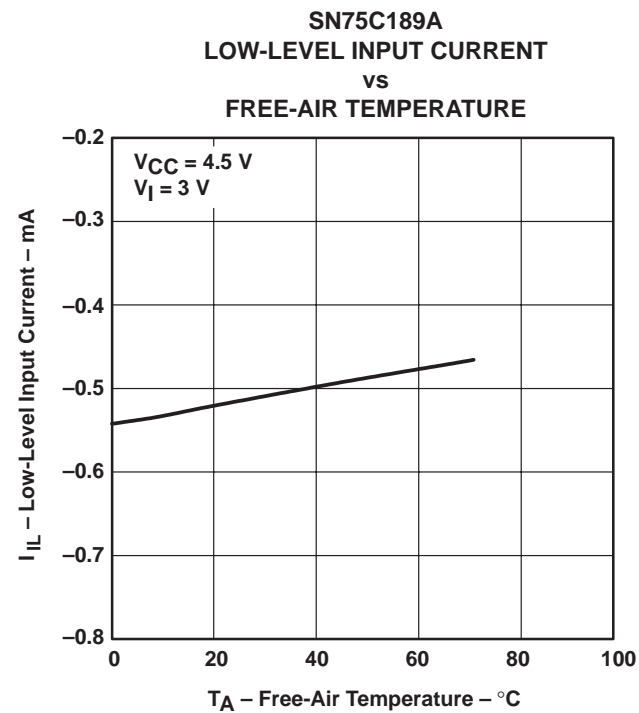
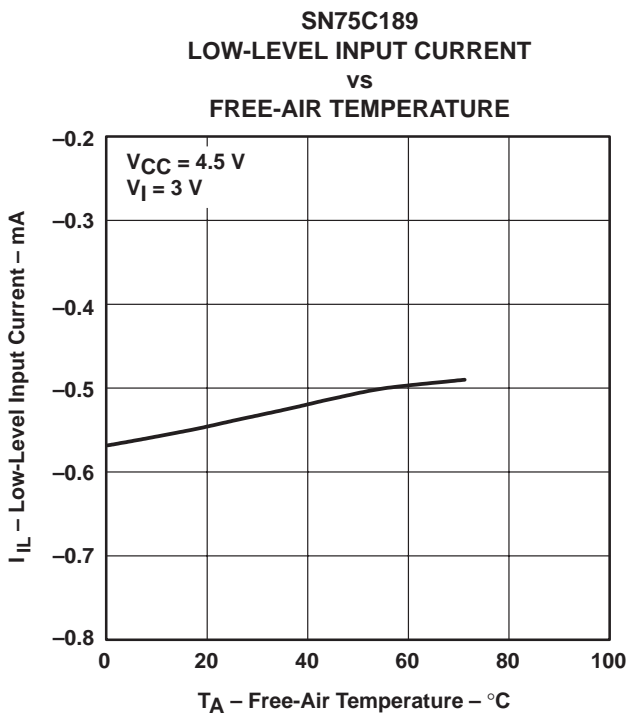
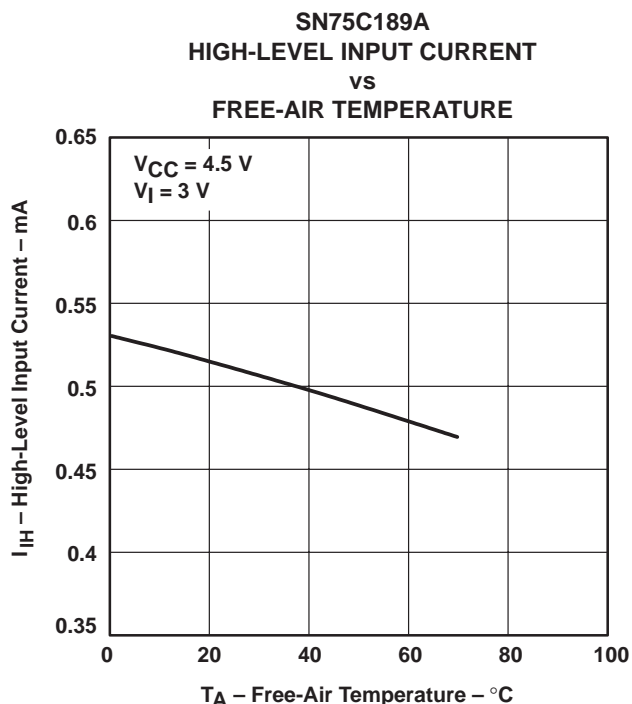
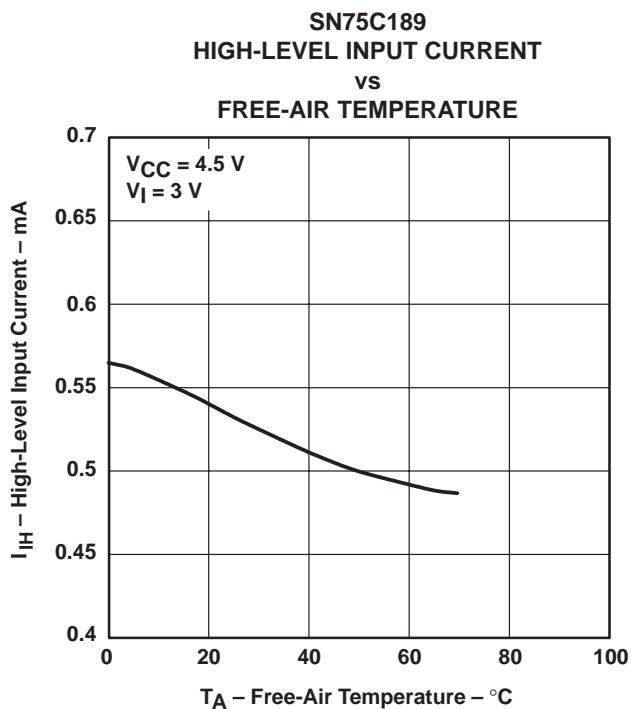
TYPICAL CHARACTERISTICS



SN75C189, SN75C189A QUADRUPLE LOW-POWER LINE RECEIVERS

SLLS041G – OCTOBER 1988 – REVISED JANUARY 2000

TYPICAL CHARACTERISTICS



TYPICAL CHARACTERISTICS

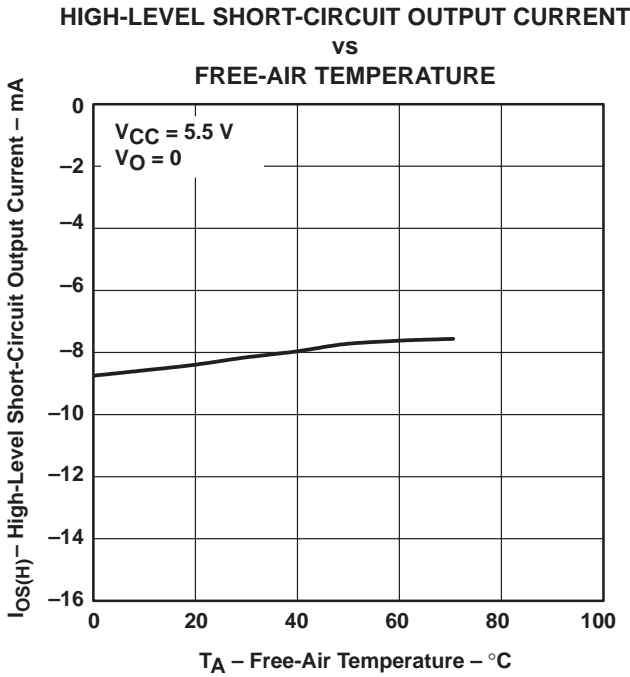


Figure 17

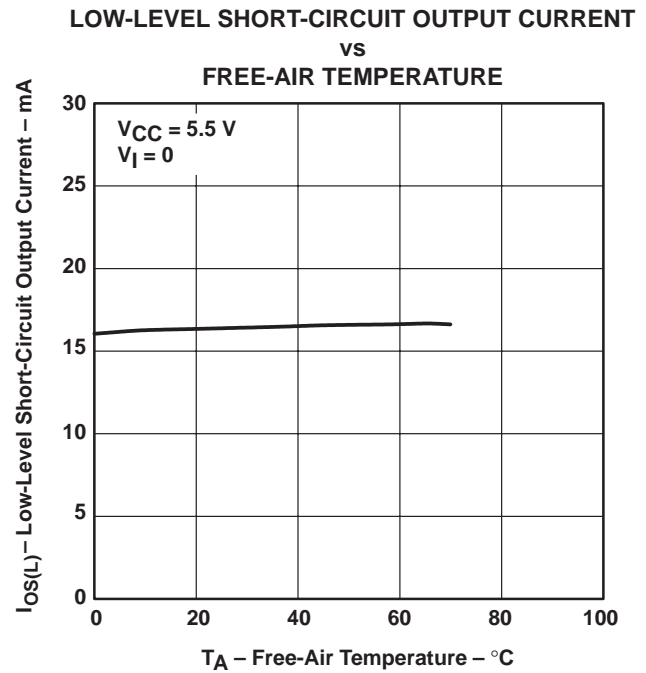


Figure 18

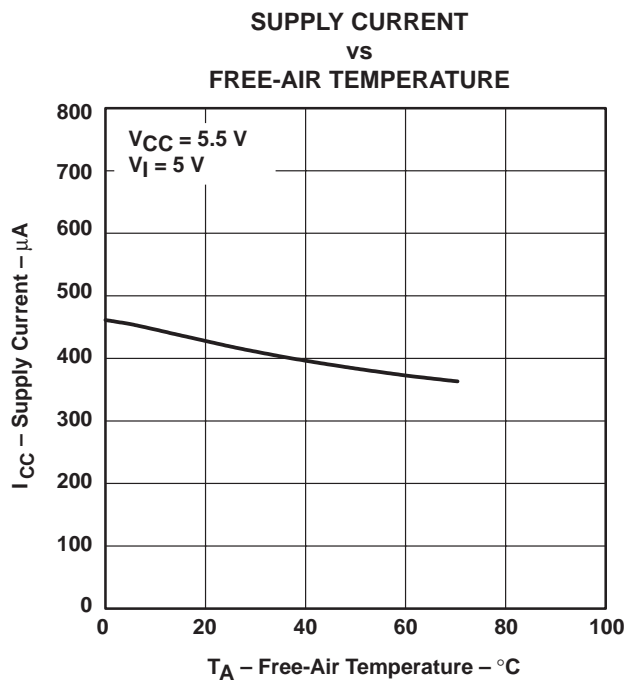


Figure 19

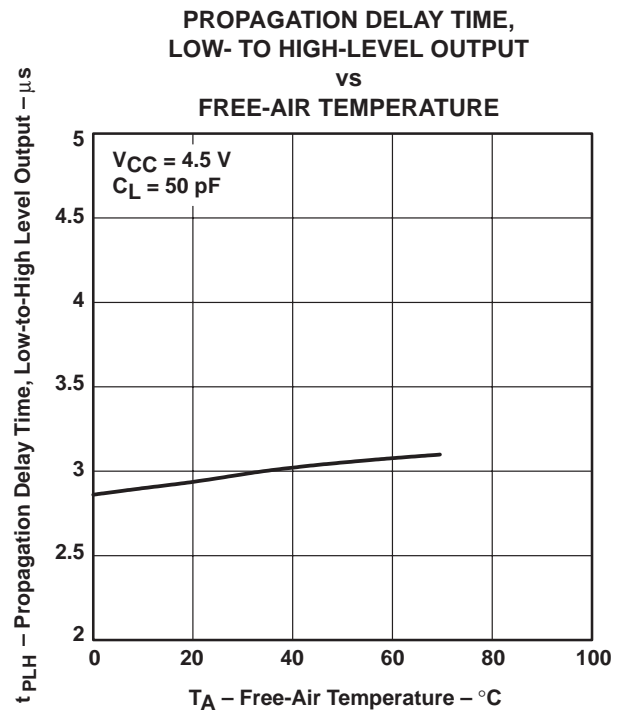


Figure 20

SN75C189, SN75C189A QUADRUPLE LOW-POWER LINE RECEIVERS

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TYPICAL CHARACTERISTICS

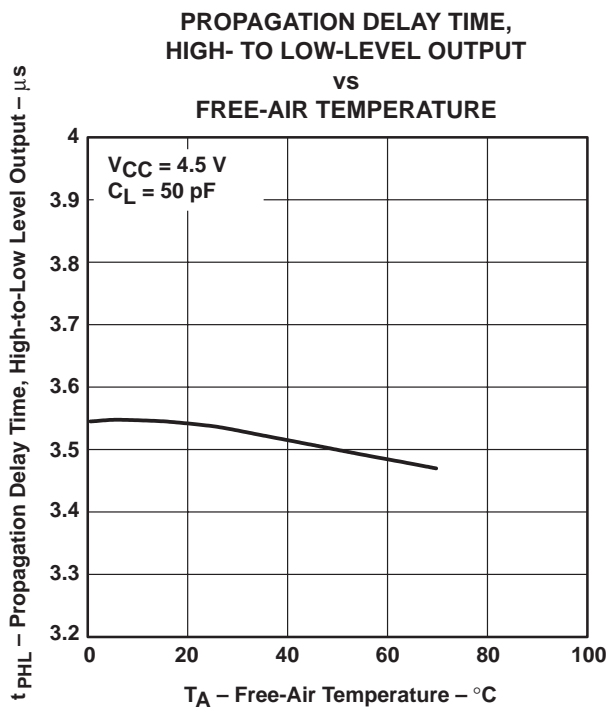


Figure 21

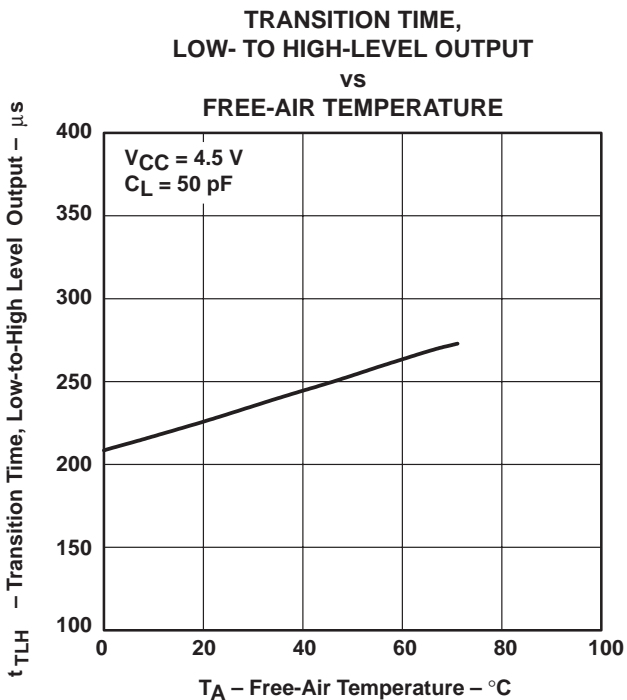


Figure 22

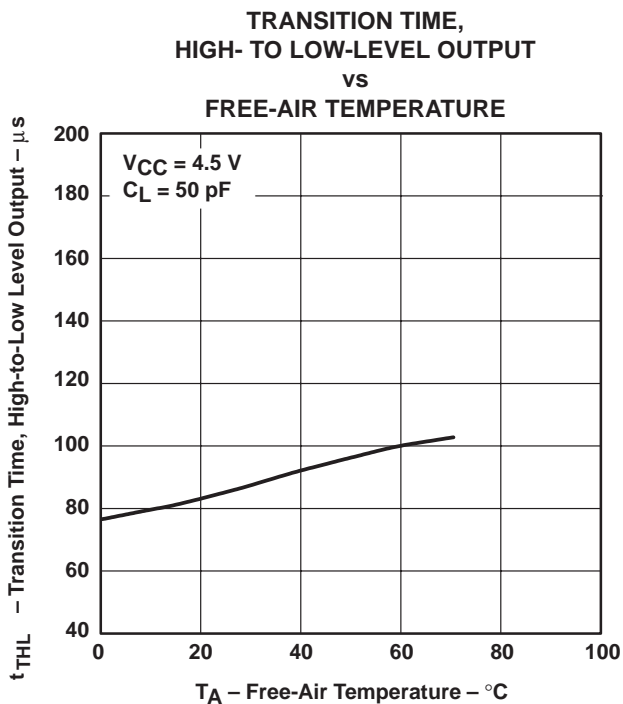


Figure 23



PACKAGING INFORMATION

| Orderable Device | Status ⁽¹⁾ | Package Type | Package Drawing | Pins | Package Qty | Eco Plan ⁽²⁾ | Lead/Ball Finish | MSL Peak Temp ⁽³⁾ |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|--|
| SN75C189AD | ACTIVE | SOIC | D | 14 | 50 | Pb-Free (RoHS) | CU NIPDAU | Level-2-250C-1 YEAR |
| SN75C189ADBLE | OBSOLETE | SSOP | DB | 14 | | None | Call TI | Call TI |
| SN75C189ADBR | ACTIVE | SSOP | DB | 14 | 2000 | Pb-Free (RoHS) | CU NIPDAU | Level-2-260C-1 YEAR/ Level-1-235C-UNLIM |
| SN75C189ADR | ACTIVE | SOIC | D | 14 | 2500 | Pb-Free (RoHS) | CU NIPDAU | Level-2-250C-1 YEAR |
| SN75C189AN | ACTIVE | PDIP | N | 14 | 25 | Pb-Free (RoHS) | CU NIPDAU | Level-NC-NC-NC |
| SN75C189ANSR | ACTIVE | SO | NS | 14 | 2000 | Pb-Free (RoHS) | CU NIPDAU | Level-2-260C-1 YEAR/ Level-1-235C-UNLIM |
| SN75C189D | ACTIVE | SOIC | D | 14 | 50 | Pb-Free (RoHS) | CU NIPDAU | Level-2-250C-1 YEAR |
| SN75C189DR | ACTIVE | SOIC | D | 14 | 2500 | Pb-Free (RoHS) | CU NIPDAU | Level-2-250C-1 YEAR |
| SN75C189N | ACTIVE | PDIP | N | 14 | 25 | Pb-Free (RoHS) | CU NIPDAU | Level-NC-NC-NC |
| SN75C189NSR | ACTIVE | SO | NS | 14 | 2000 | Pb-Free (RoHS) | CU NIPDAU | Level-2-260C-1 YEAR/ Level-1-235C-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 - May not be currently available - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

None: Not yet available Lead (Pb-Free).

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.

Green (RoHS & no Sb/Br): TI defines "Green" to mean "Pb-Free" and in addition, uses package materials that do not contain halogens, including bromine (Br) or antimony (Sb) above 0.1% of total product weight.

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

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N (R-PDIP-T**)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN

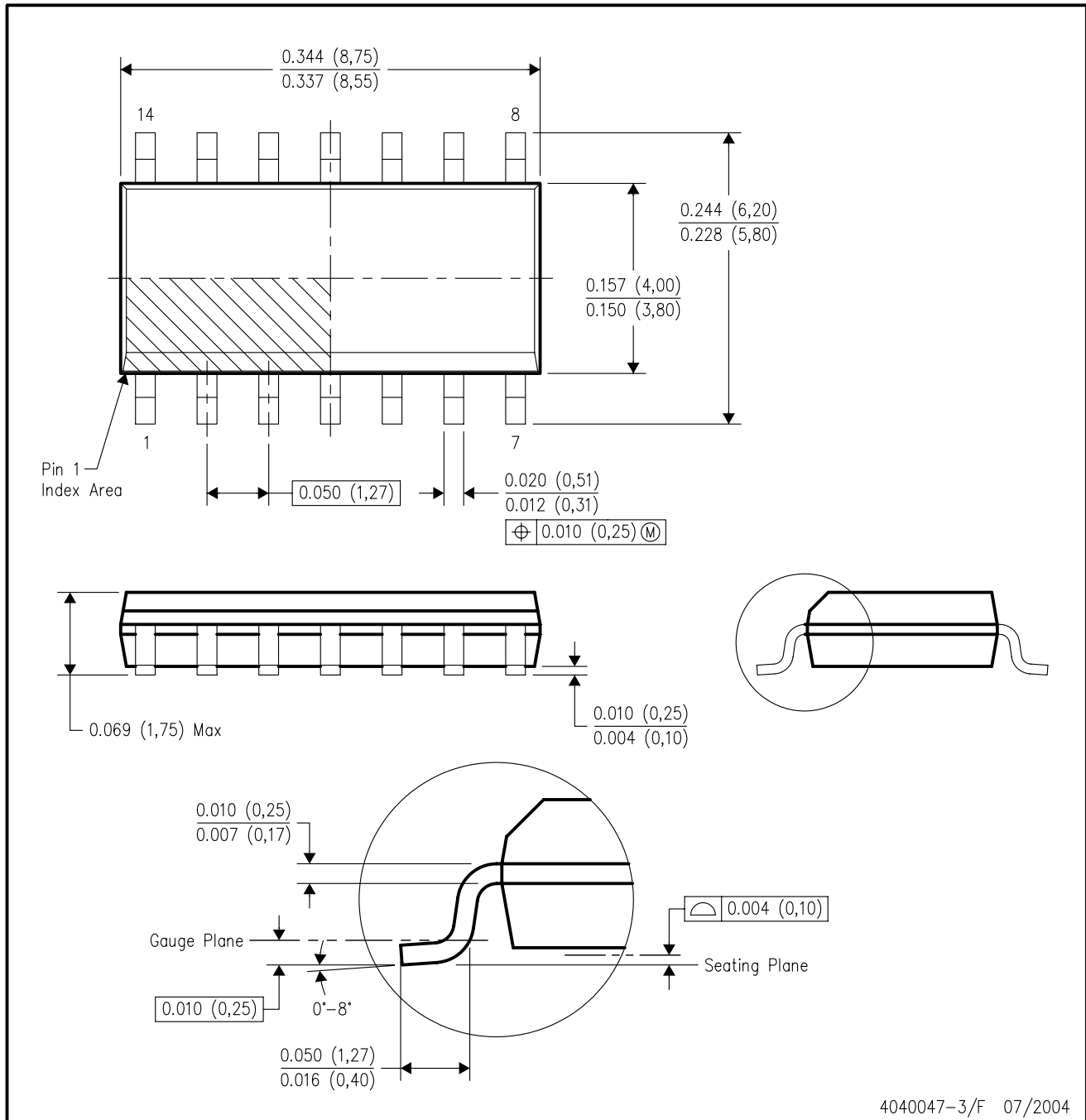


- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
 - D The 20 pin end lead shoulder width is a vendor option, either half or full width.

4040049/E 12/2002

D (R-PDSO-G14)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - 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-012 variation AB.

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.

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

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