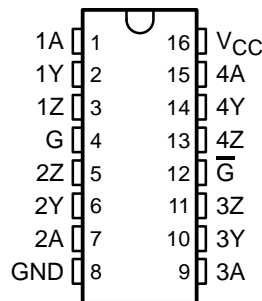


AM26LS31C, AM26LS31M QUADRUPLE DIFFERENTIAL LINE DRIVER

SLLS114H – JANUARY 1979 – REVISED JULY 2002

- Meets or Exceeds the Requirements of ANSI TIA/EIA-422-B and ITU Recommendation V.11
- Operates From a Single 5-V Supply
- TTL Compatible
- Complementary Outputs
- High Output Impedance in Power-Off Conditions
- Complementary Output-Enable Inputs

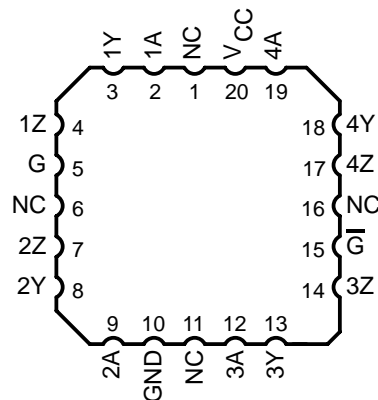
D, DB, N, NS, OR J PACKAGE
(TOP VIEW)



description/ordering information

The AM26LS31 is a quadruple complementary-output line driver designed to meet the requirements of ANSI TIA/EIA-422-B and ITU (formerly CCITT) Recommendation V.11. The 3-state outputs have high-current capability for driving balanced lines such as twisted-pair or parallel-wire transmission lines, and they are in the high-impedance state in the power-off condition. The enable function is common to all four drivers and offers the choice of an active-high or active-low enable (\overline{G} , \overline{G}) input. Low-power Schottky circuitry reduces power consumption without sacrificing speed.

FK PACKAGE
(TOP VIEW)



ORDERING INFORMATION

| T _A | PACKAGE† | | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|----------------|-----------|---------------|-----------------------|------------------|
| 0°C to 70°C | PDIP – N | Tube | AM26LS31CN | AM26LS31CN |
| | SOIC – D | Tube | AM26LS31CD | AM26LS31C |
| | | Tape and reel | AM26LS31CDR | |
| | SOP – NS | Tape and reel | AM26LS31CNSR | 26LS31 |
| | SSOP – DB | Tape and reel | AM26LS31CDBR | SA31C |
| –55°C to 125°C | CDIP – J | Tube | AM26LS31MJ | AM26LS31MJB |
| | LCCC – FK | Tube | AM26LS31MFK | AM26LS31MFKB |

† 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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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.

AM26LS31C, AM26LS31M QUADRUPLE DIFFERENTIAL LINE DRIVER

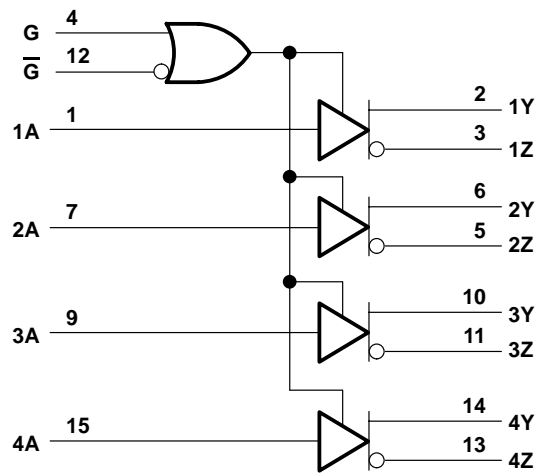
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FUNCTION TABLE
(each driver)

| INPUT A | ENABLES | | OUTPUTS | |
|------------|---------|----------------|---------|---|
| | G | \overline{G} | Y | Z |
| H | H | X | H | L |
| L | H | X | L | H |
| H | X | L | H | L |
| L | X | L | L | H |
| X | L | H | Z | Z |

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

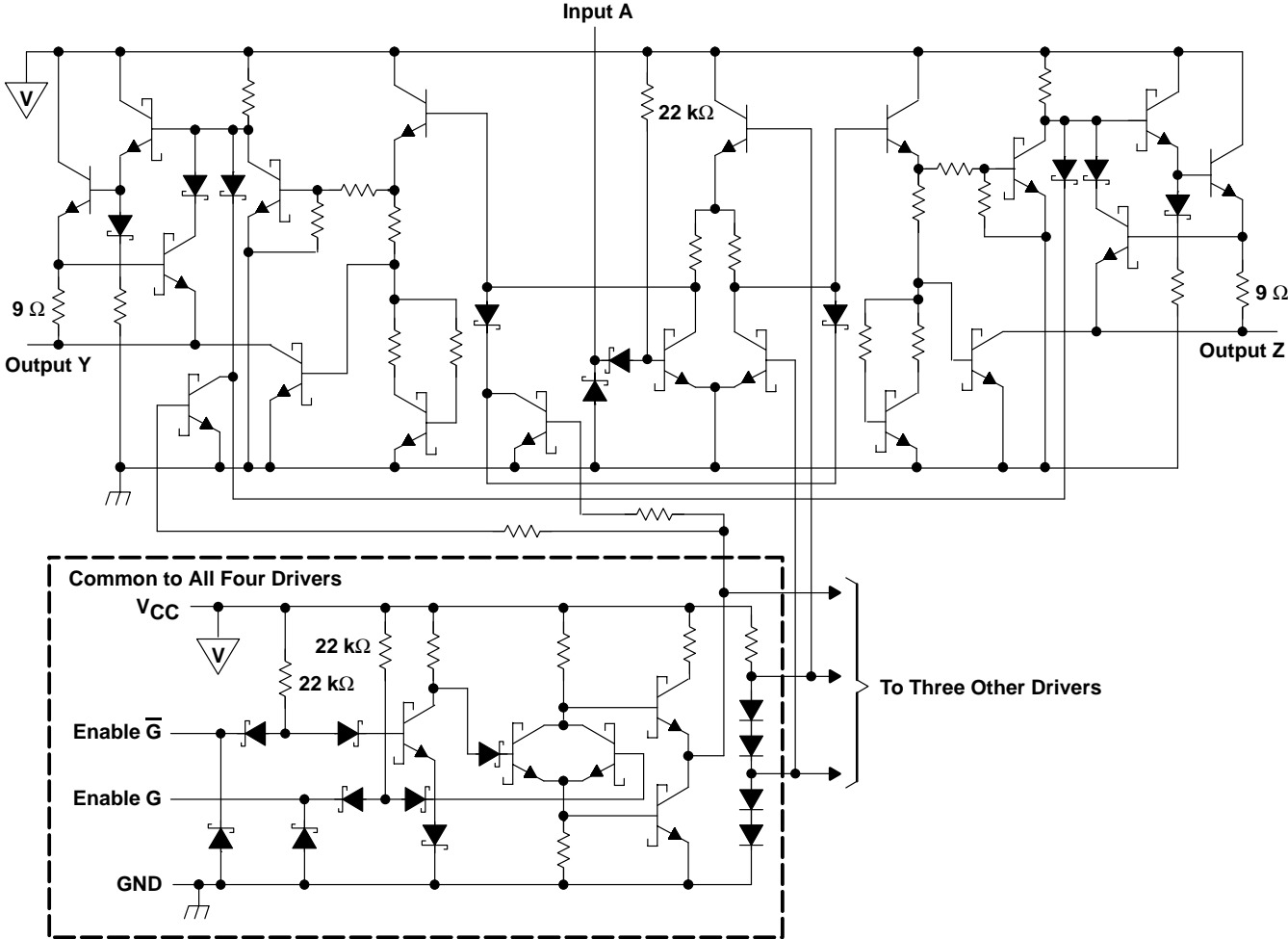
logic diagram (positive logic)



AM26LS31C, AM26LS31M QUADRUPLE DIFFERENTIAL LINE DRIVER

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schematic (each driver)



All resistor values are nominal.

AM26LS31C, AM26LS31M QUADRUPLE DIFFERENTIAL LINE DRIVER

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

| | |
|-------------------------------------------------------------------------|----------------|
| Supply voltage, V_{CC} (see Note 1) | 7 V |
| Input voltage, V_I | 7 V |
| Output off-state voltage | 5.5 V |
| Package thermal impedance, θ_{JA} (see Note 2): D package | 73°C/W |
| DB package | 82°C/W |
| N package | 67°C/W |
| NS package | 64°C/W |
| Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds | 260°C |
| Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds: J package | 300°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 voltage values, except differential output voltage V_{OD} , are with respect to network GND.
2. The package thermal impedance is calculated in accordance with JESD 51-7.

DISSIPATION RATING TABLE

| PACKAGE | $T_A \leq 25^\circ\text{C}$ POWER RATING | DERATING FACTOR ABOVE $T_A = 25^\circ\text{C}^\ddagger$ | $T_A = 70^\circ\text{C}$ POWER RATING | $T_A = 125^\circ\text{C}$ POWER RATING |
|---------|---------------------------------------------|------------------------------------------------------------|------------------------------------------|-------------------------------------------|
| FK | 1375 mW | 11.0 mW/°C | 880 mW | 275 mW |
| J | 1375 mW | 11.0 mW/°C | 880 mW | 275 mW |

‡ This is the inverse of the traditional junction-to-ambient thermal resistance ($R\theta_{JA}$). Thermal resistances are not production tested and the values given are for informational purposes only.

recommended operating conditions

| | | MIN | NOM | MAX | UNIT |
|--------------------------------------|-----------|------|-----|------|------|
| V_{CC} Supply voltage | AM26LS31C | 4.75 | 5 | 5.25 | V |
| | AM26LS31M | 4.5 | 5 | 5.5 | |
| V_{IH} High-level input voltage | | 2 | | | V |
| V_{IL} Low-level input voltage | | 0.8 | | | V |
| I_{OH} High-level output current | | -20 | | | mA |
| I_{OL} Low-level output current | | 20 | | | mA |
| T_A Operating free-air temperature | AM26LS31C | 0 | 70 | | °C |
| | AM26LS31M | -55 | 125 | | |



AM26LS31C, AM26LS31M QUADRUPLE DIFFERENTIAL LINE DRIVER

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

| PARAMETER | | TEST CONDITIONS | | MIN | TYP‡ | MAX | UNIT |
|-----------------|-------------------------------------------------|----------------------------------------------------|-------------------------|-----|------|-------|------|
| V _{IK} | Input clamp voltage | V _{CC} = MIN, | I _I = -18 mA | | | -1.5 | V |
| V _{OH} | High-level output voltage | V _{CC} = MIN, I _{OH} = -20 mA | T _A = -55°C | 2.4 | | | V |
| | | | All other temperatures | 2.5 | | | |
| V _{OL} | Low-level output voltage | V _{CC} = MIN, | I _{OL} = 20 mA | | | 0.5 | V |
| I _{OZ} | Off-state (high-impedance-state) output current | V _{CC} = MIN | V _O = 0.5 V | | | -20 | μA |
| | | | V _O = 2.5 V | | | 20 | |
| I _I | Input current at maximum input voltage | V _{CC} = MAX, | V _I = 7 V | | | 0.1 | mA |
| I _{IH} | High-level input current | V _{CC} = MAX, | V _I = 2.7 V | | | 20 | μA |
| I _{IL} | Low-level input current | V _{CC} = MAX, | V _I = 0.4 V | | | -0.36 | mA |
| I _{OS} | Short-circuit output current§ | V _{CC} = MAX | | -30 | | -150 | mA |
| I _{CC} | Supply current | V _{CC} = MAX, | All outputs disabled | | 32 | 80 | mA |

† For C suffix devices, V_{CC} MIN = 4.75 V and V_{CC} MAX = 5.25 V. For M suffix devices, V_{CC} MIN = 4.5 V and V_{CC} MAX = 5.5 V.

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

§ Not more than one output should be shorted at a time, and duration of the short circuit should not exceed one second.

switching characteristics, V_{CC} = 5 V, T_A = 25°C (see Figure 1)

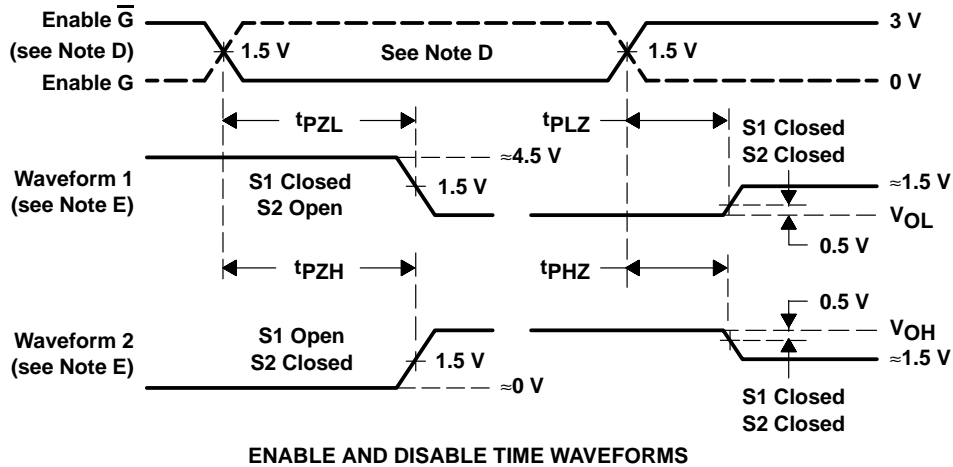
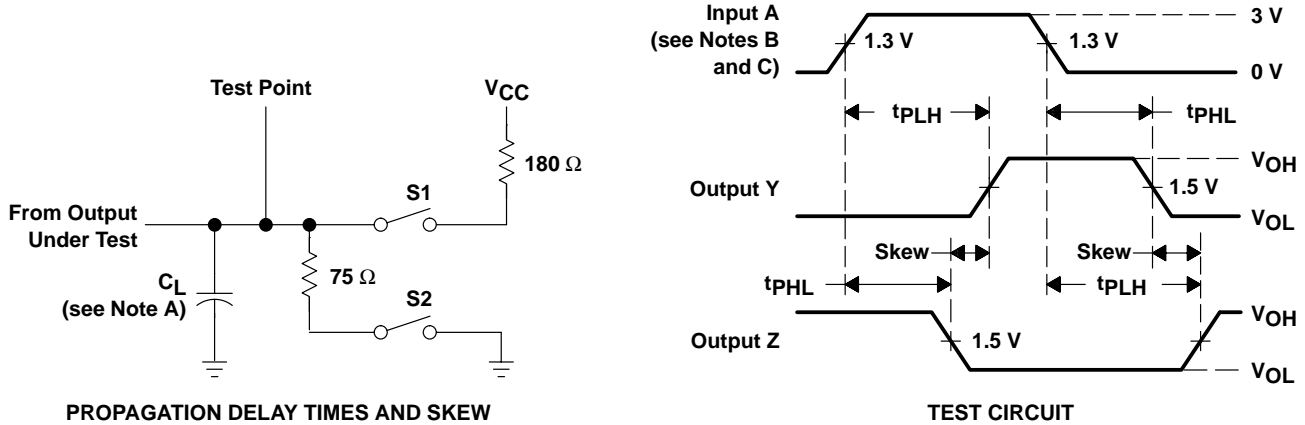
| PARAMETER | | TEST CONDITIONS | | MIN | TYP | MAX | UNIT |
|------------------|--------------------------------------------------|-------------------------|------------------------|-----|-----|-----|------|
| t _{PLH} | Propagation delay time, low-to-high-level output | C _L = 30 pF, | S1 and S2 open | | 14 | 20 | ns |
| t _{PHL} | Propagation delay time, high-to-low-level output | | | | 14 | 20 | |
| t _{PZH} | Output enable time to high level | C _L = 30 pF | R _L = 75 Ω | | 25 | 40 | ns |
| t _{PZL} | Output enable time to low level | | R _L = 180 Ω | | 37 | 45 | |
| t _{PHZ} | Output disable time from high level | C _L = 10 pF, | S1 and S2 closed | | 21 | 30 | ns |
| t _{PLZ} | Output disable time from low level | | | | 23 | 35 | |
| | Output-to-output skew | C _L = 30 pF, | S1 and S2 open | | 1 | 6 | ns |



AM26LS31C, AM26LS31M QUADRUPLE DIFFERENTIAL LINE DRIVER

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PARAMETER MEASUREMENT INFORMATION



- NOTES:
- A. C_L includes probe and jig capacitance.
 - B. All input pulses are supplied by generators having the following characteristics: $PRR \leq 1$ MHz, $Z_O \approx 50 \Omega$, $t_r \leq 15$ ns, $t_f \leq 6$ ns.
 - C. When measuring propagation delay times and skew, switches S1 and S2 are open.
 - D. Each enable is tested separately.
 - E. 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.

Figure 1. Test Circuit and Voltage Waveforms

TYPICAL CHARACTERISTICS

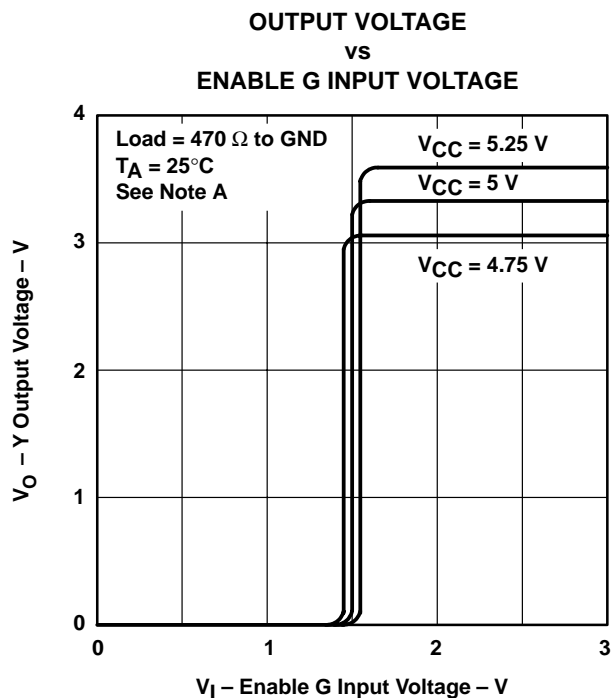


Figure 2

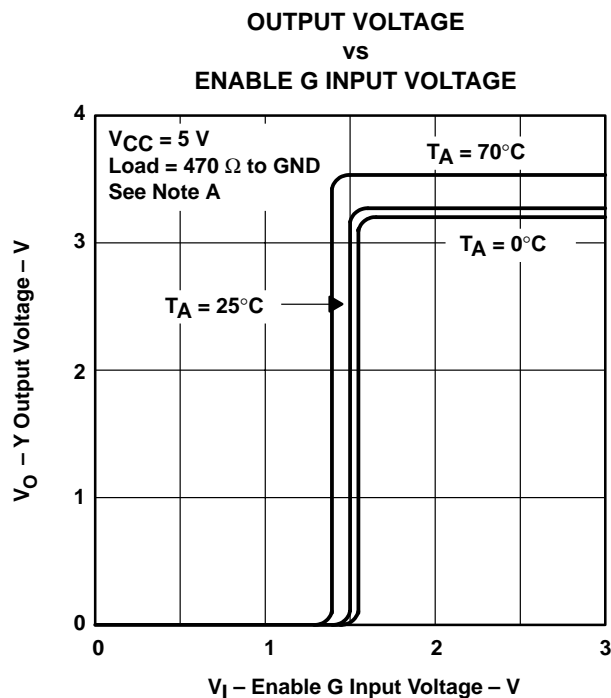


Figure 3

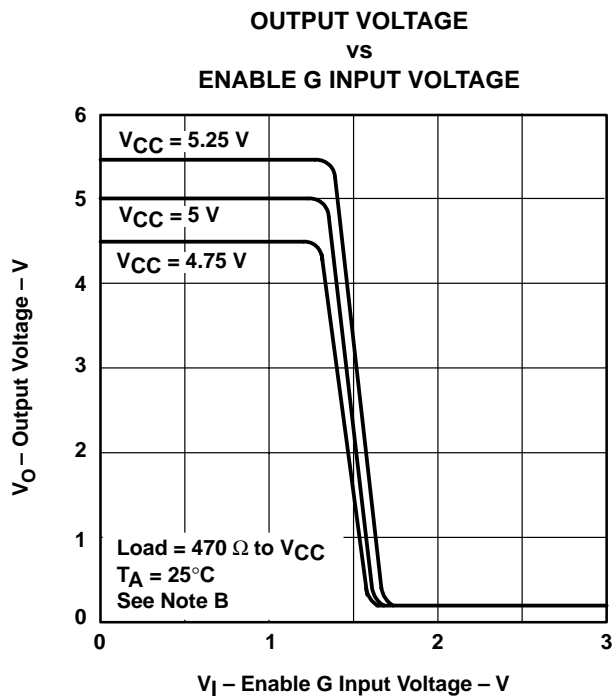


Figure 4

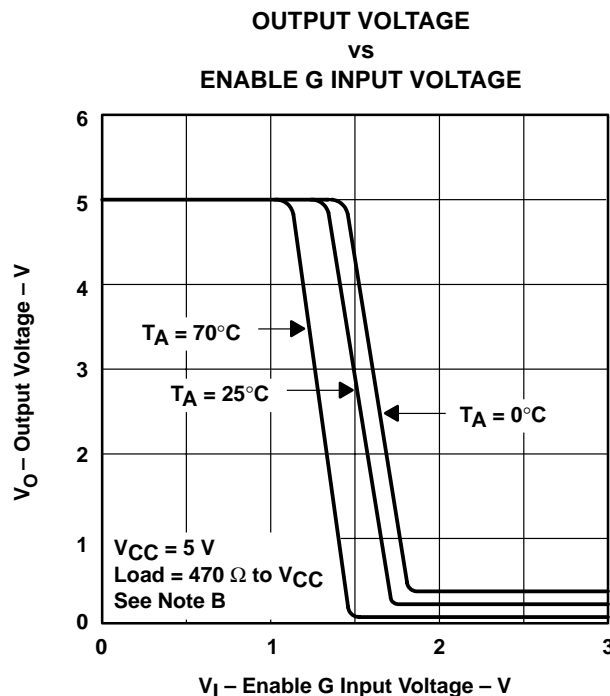


Figure 5

NOTES: A. The A input is connected to V_{CC} during testing of the Y outputs and to ground during testing of the Z outputs.
 B. The A input is connected to ground during testing of the Y outputs and to V_{CC} during testing of the Z outputs.

AM26LS31C, AM26LS31M QUADRUPLE DIFFERENTIAL LINE DRIVER

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TYPICAL CHARACTERISTICS

HIGH-LEVEL OUTPUT VOLTAGE
vs
FREE-AIR TEMPERATURE

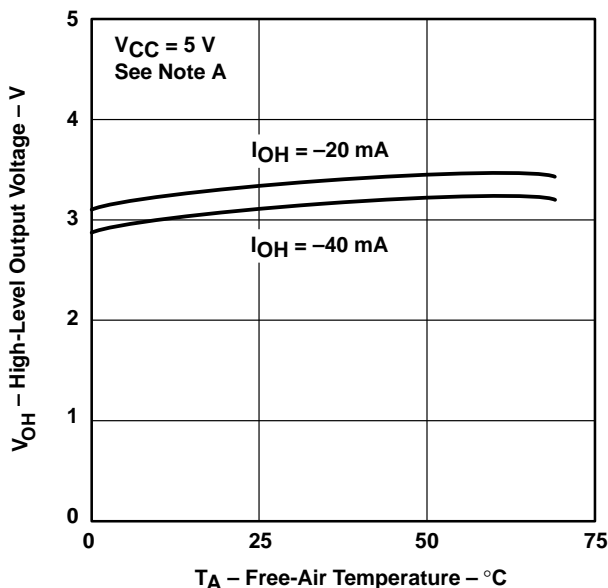


Figure 6

HIGH-LEVEL OUTPUT VOLTAGE
vs
HIGH-LEVEL OUTPUT CURRENT

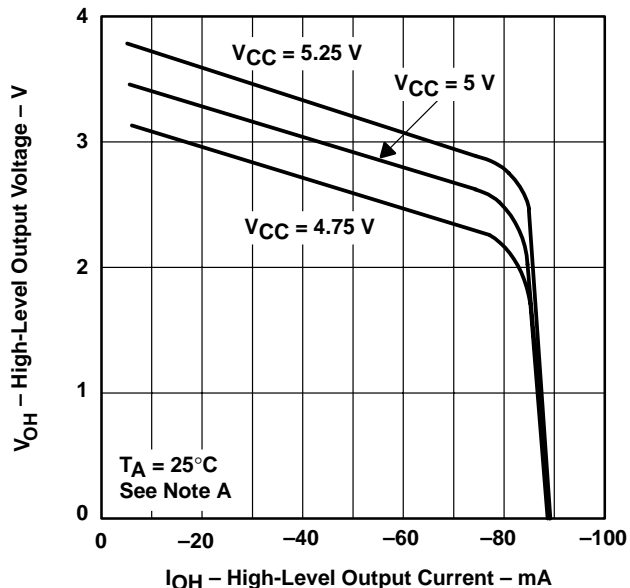


Figure 7

LOW-LEVEL OUTPUT VOLTAGE
vs
FREE-AIR TEMPERATURE

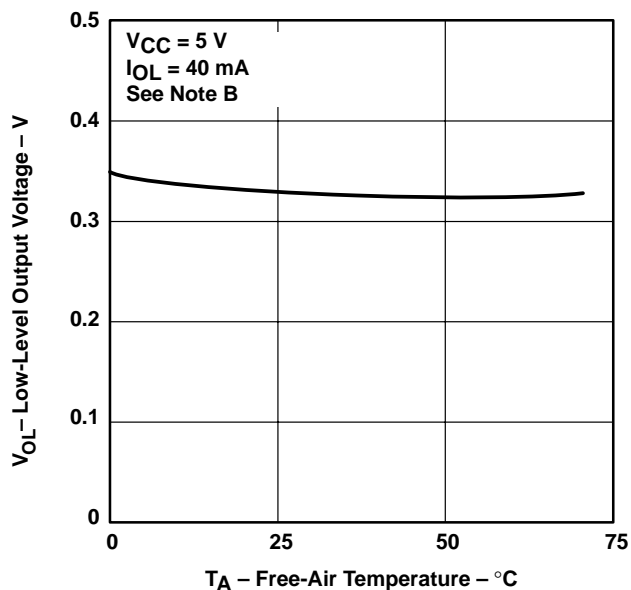


Figure 8

LOW-LEVEL OUTPUT VOLTAGE
vs
LOW-LEVEL OUTPUT CURRENT

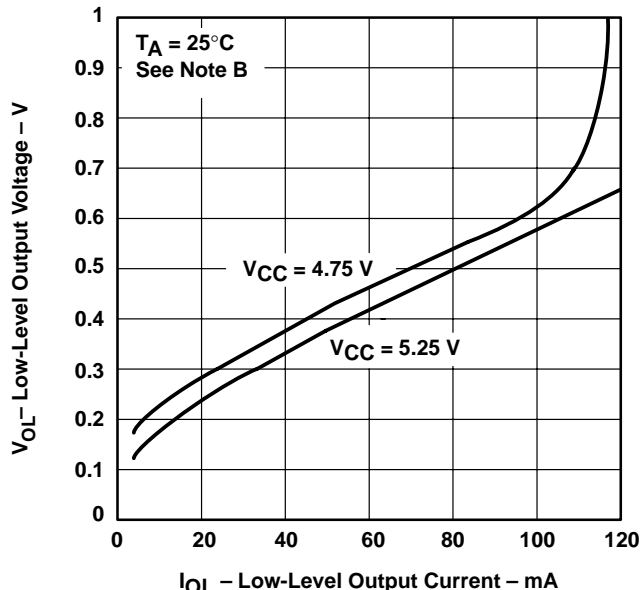
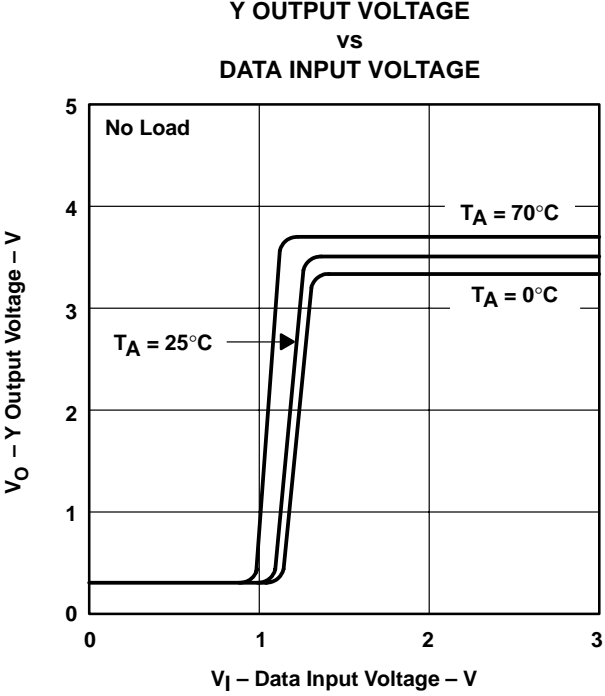
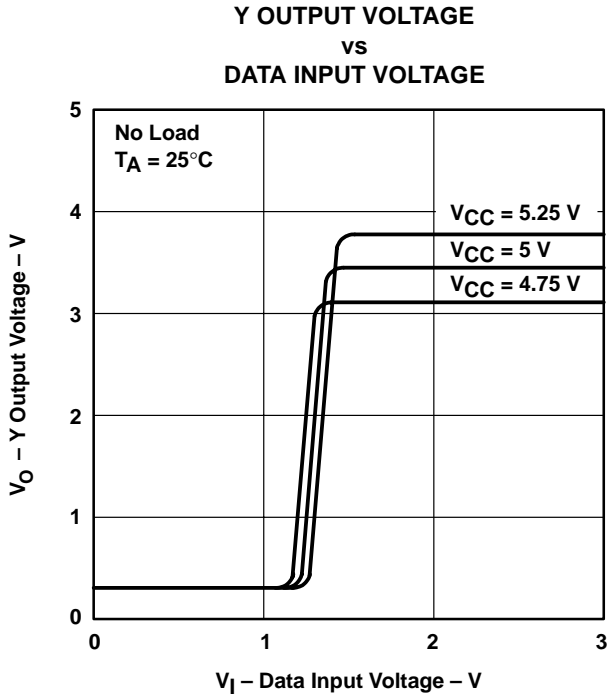


Figure 9

NOTES: A. The A input is connected to V_{CC} during testing of the Y outputs and to ground during testing of the Z outputs.
B. The A input is connected to ground during testing of the Y outputs and to V_{CC} during testing of the Z inputs.



TYPICAL CHARACTERISTICS



PACKAGING INFORMATION

| Orderable Device | Status ⁽¹⁾ | Package Type | Package Drawing | Pins | Package Qty | Eco Plan ⁽²⁾ | Lead/Ball Finish | MSL Peak Temp ⁽³⁾ |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|--------------------------------------------|
| AM26LS31CD | ACTIVE | SOIC | D | 16 | 40 | Pb-Free (RoHS) | CU NIPDAU | Level-2-260C-1 YEAR/ Level-1-235C-UNLIM |
| AM26LS31CDBR | ACTIVE | SSOP | DB | 16 | 2000 | Pb-Free (RoHS) | CU NIPDAU | Level-2-260C-1 YEAR/ Level-1-235C-UNLIM |
| AM26LS31CDR | ACTIVE | SOIC | D | 16 | 2500 | Pb-Free (RoHS) | CU NIPDAU | Level-2-260C-1 YEAR/ Level-1-235C-UNLIM |
| AM26LS31CN | ACTIVE | PDIP | N | 16 | 25 | Pb-Free (RoHS) | CU NIPDAU | Level-NC-NC-NC |
| AM26LS31CNSR | ACTIVE | SO | NS | 16 | 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.
 - $\triangle C$ Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
 - $\triangle D$ The 20 pin end lead shoulder width is a vendor option, either half or full width.

4040049/E 12/2002

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 dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
 - D. Falls within JEDEC MS-012 variation AC.

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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