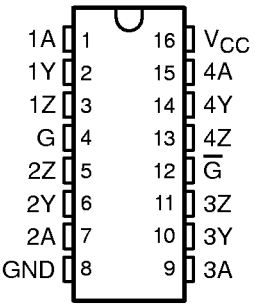
- **Meets or Exceeds the Requirements of ANSI Standard EIA/TIA-422-B and ITU Recommendation V.11**
- **Designed to Operate up to 20 Mbaud**
- **3-State TTL Compatible**
- **Single 5-V Supply Operation**
- **High Output Impedance in Power-Off Condition**
- **Complementary Output-Enable Inputs**
- **Improved Replacement for the AM26LS31**

**D OR N PACKAGE**
**(TOP VIEW)**




## description

The four differential line drivers are designed for data transmission over twisted-pair or parallel-wire transmission lines. They meet the requirements of ANSI Standard EIA/TIA-422-B and ITU Recommendations V.11 and are compatible with 3-state TTL circuits. Advanced low-power Schottky technology provides high speed without the usual power penalties. Standby supply current is typically only 26 mA, while typical propagation delay time is less than 10 ns.

High-impedance inputs maintain low input currents, less than 1 μA for a high level and less than 100 μA for a low level. Complementary output-enable inputs (G and $\overline{G}$) allow these devices to be enabled at either a high input level or low input level. The SN75ALS192 is capable of data rates in excess of 20 Mbit/s and is designed to operate with the SN75ALS193 quadruple line receiver.

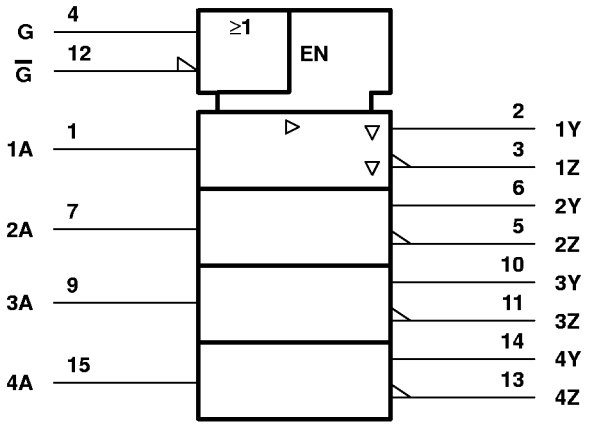
The SN75ALS192 is characterized for operation from 0°C to 70°C.

**FUNCTION TABLE**
**(each driver)**

| INPUT | ENABLES | | OUTPUTS | |
|---|---|---|---|---|
| A | 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 |

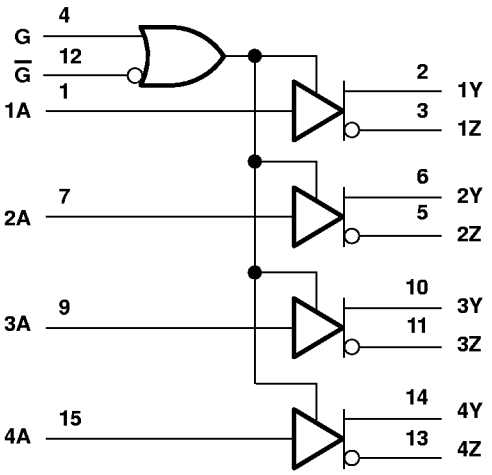
H = high level, L = low level, X = irrelevant,
Z = high impedance (off)

## logic symbol†

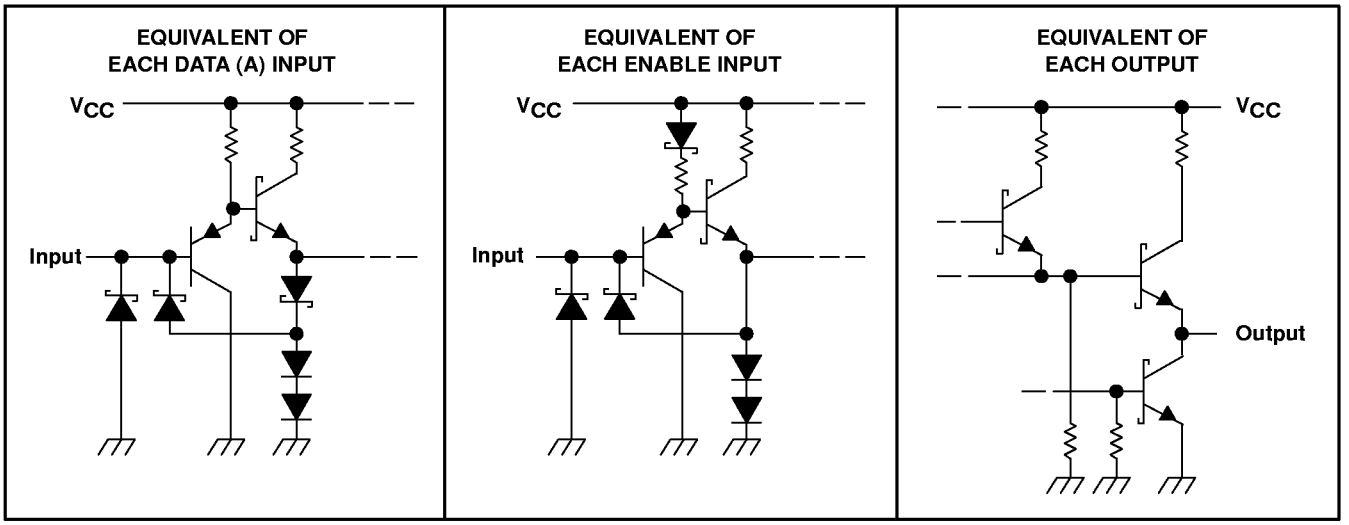



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

## logic diagram (positive logic)



## schematics 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, $V_I$ . . . . . 7 V
Off-state output voltage . . . . . 6 V
Continuous total dissipation . . . . . See Dissipation Rating Table
Storage temperature range, $T_{stg}$ . . . . . –65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds . . . . . 260°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.

NOTE 1: All voltage values except differential output voltage, $V_{OD}$, are with respect to network ground terminal.

**DISSIPATION RATING TABLE**

| PACKAGE | $T_A \le 25°C$ POWER RATING | DERATING FACTOR ABOVE $T_A = 25°C$ | $T_A = 70°C$ POWER RATING | $T_A = 125°C$ POWER RATING |
|---|---|---|---|---|
| D | 950 mW | 7.6 mW/°C | 608 mW | N/A |
| N | 1150 mW | 9.2 mW/°C | 736 mW | N/A |

## recommended operating conditions

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

## electrical characteristics over recommended 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 | 2.5 | | | V |
| $V_{OL}$ | Low-level output voltage | $V_{CC}$ = MIN, | $I_{OL}$ = 20 mA | | | 0.5 | V |
| $V_O$ | Output voltage | $V_{CC}$ = MAX, | $I_O$ = 0 | 0 | | 6 | V |
| $\|V_{OD1}\|$ | Differential output voltage | $V_{CC}$ = MIN, | $I_O$ = 0 | 1.5 | | 6 | V |
| $\|V_{OD2}\|$ | Differential output voltage | $R_L$ = 100 Ω, | See Figure 1 | 1/2 $V_{OD1}$ or 2§ | | | V |
| $\Delta\|V_{OD}\|$ | Change in magnitude of differential output voltage¶ | $R_L$ = 100 Ω, | See Figure 1 | | | ±0.2 | V |
| $V_{OC}$ | Common-mode output voltage# | $R_L$ = 100 Ω, | See Figure 1 | | | ±3 | V |
| $\Delta\|V_{OC}\|$ | Change in magnitude of common-mode output voltage¶ | $R_L$ = 100 Ω, | See Figure 1 | | | ±0.2 | V |
| $I_O$ | Output current with power off | $V_{CC}$ = 0 | $V_O$ = 6 V | | | 100 | µA |
| | | | $V_O$ = –0.25 V | | | –100 | |
| $I_{OZ}$ | Off-state (high-impedance state) output current | $V_{CC}$ = MAX | $V_O$ = 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 | | | 100 | µA |
| $I_{IH}$ | 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 | | | –200 | µA |
| $I_{OS}$ | Short-circuit output current‖ | $V_{CC}$ = MAX | | –30 | | –150 | mA |
| $I_{CC}$ | Supply current (all drivers) | $V_{CC}$ = MAX, | All outputs disabled | | 26 | 45 | 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 V and $T_A$ = 25°C.
§ The minimum $V_{OD2}$ with a 100-Ω load is either 1/2 $V_{OD1}$ or 2 V, whichever is greater.
¶ $|V_{OD}|$ and $|V_{OC}|$ are the changes in magnitude of $V_{OD}$ and $V_{OC}$, respectively, that occur when the input is changed from a high level to a low level.
# In ANSI Standard EIA/TIA-422-B, $V_{OC}$, which is the average of the two output voltages with respect to ground, is called output offset voltage, $V_{OS}$.
‖ 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 2)

| PARAMETER | | TEST CONDITIONS | | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| $t_{PLH}$ | Propagation delay time, low-to-high-level output | S1 and S2 open, | $C_L$ = 30 pF | | 6 | 13 | ns |
| $t_{PHL}$ | Propagation delay time, high-to-low-level output | S1 and S2 open, | $C_L$ = 30 pF | | 9 | 14 | ns |
| | Output-to-output skew | S1 and S2 open, | $C_L$ = 30 pF | | 3 | 6 | ns |
| $t_{PZH}$ | Output enable time to high level | S1 open and S2 closed | | | 11 | 15 | ns |
| $t_{PZL}$ | Output enable time to low level | S1 closed and S2 open | | | 16 | 20 | ns |
| $t_{PHZ}$ | Output disable time from high level | S1 open and S2 closed, | $C_L$ = 10 pF | | 8 | 15 | ns |
| $t_{PLZ}$ | Output disable time from low level | S1 and S2 closed, | $C_L$ = 10 pF | | 18 | 20 | ns |

## PARAMETER MEASUREMENT INFORMATION

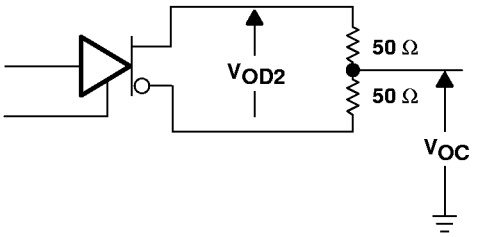
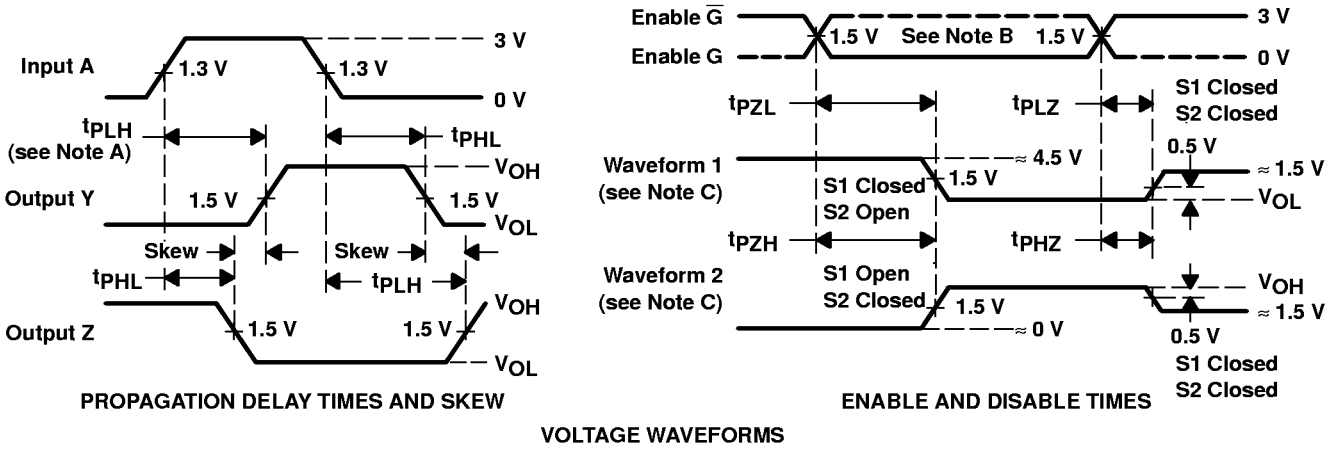
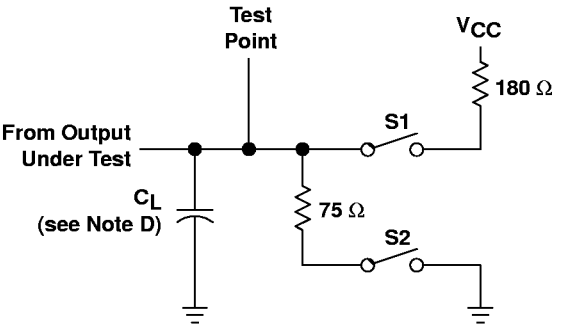



**Figure 1. Differential and Common-Mode Output Voltages**




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

**Figure 2. Test Circuit and Voltage Waveforms**

## TYPICAL CHARACTERISTICS†

Y OUTPUT VOLTAGE
vs
DATA INPUT VOLTAGE

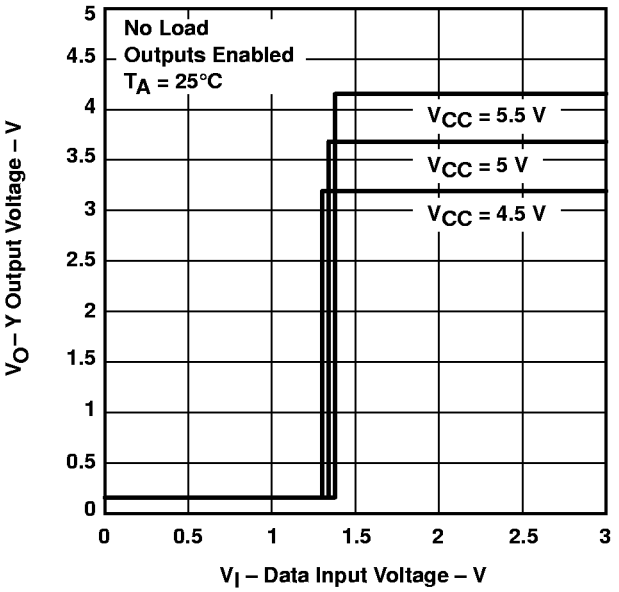



Figure 3

Y OUTPUT VOLTAGE
vs
DATA INPUT VOLTAGE

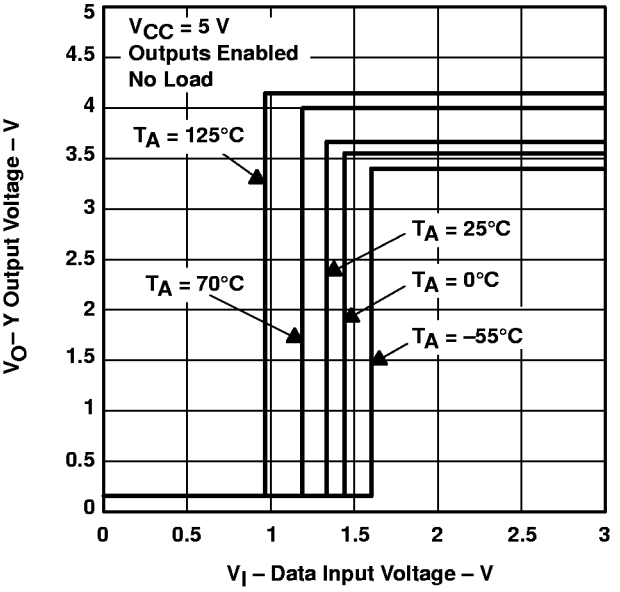
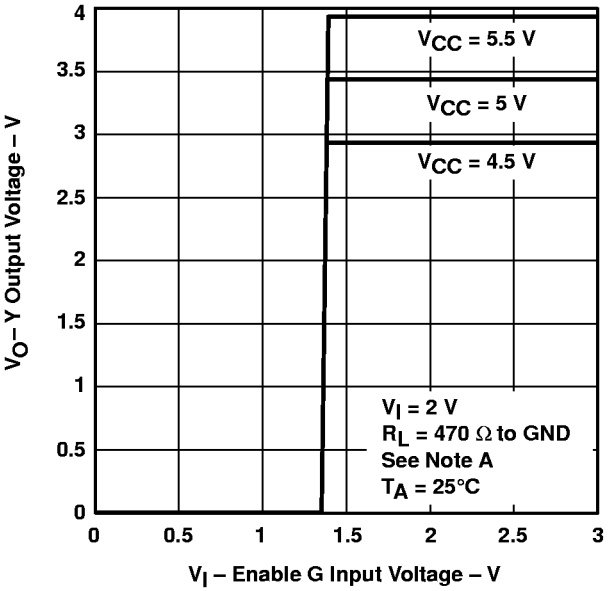



Figure 4

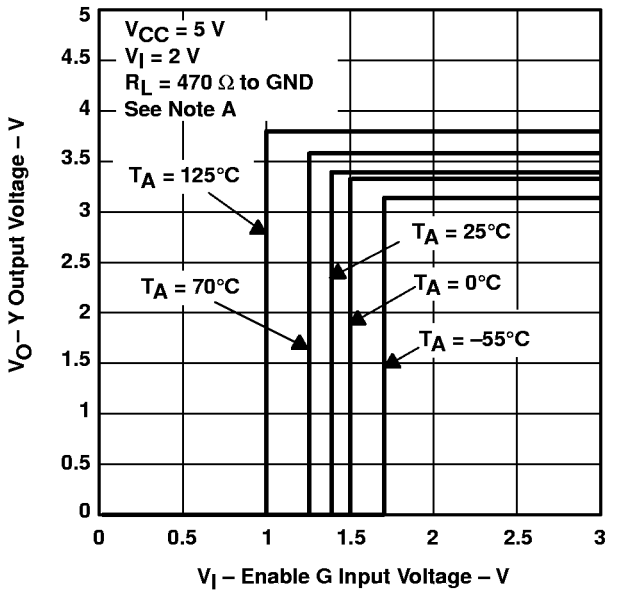
Y OUTPUT VOLTAGE
vs
ENABLE G INPUT VOLTAGE




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

Figure 5

Y OUTPUT VOLTAGE
vs
ENABLE G INPUT VOLTAGE



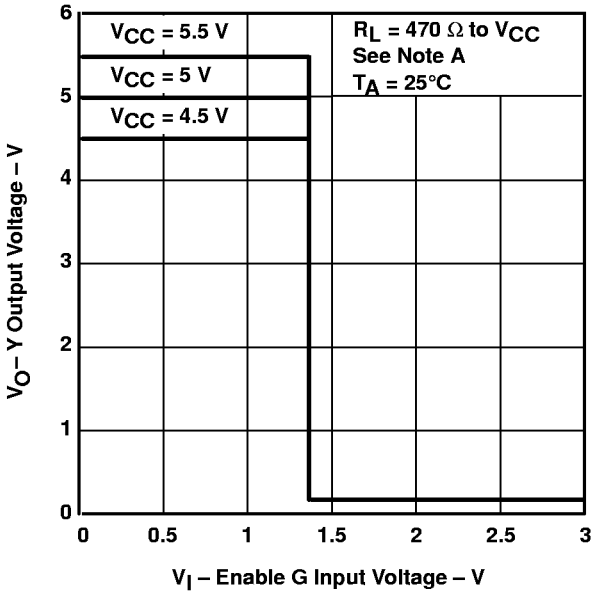

NOTE A: The A input is connected to $V_{CC}$ during the testing of the Y outputs and to ground during the testing of the Z outputs.

Figure 6

† Operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied.

## TYPICAL CHARACTERISTICS†

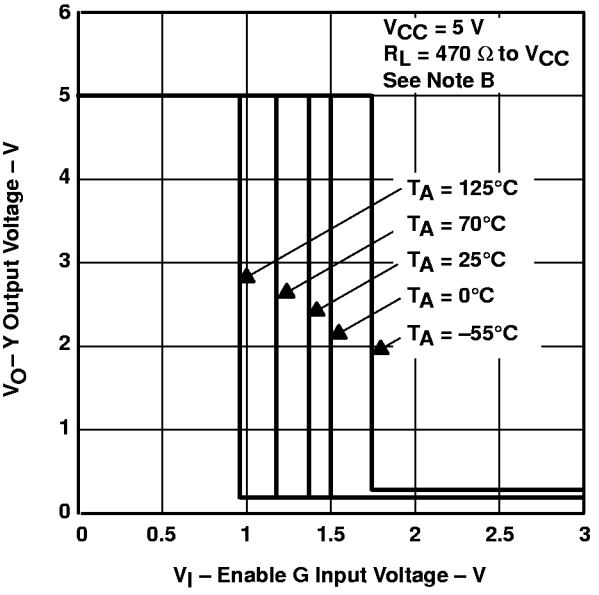
**Z OUTPUT VOLTAGE vs ENABLE G INPUT VOLTAGE**




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

**Figure 7**

**Z OUTPUT VOLTAGE vs ENABLE G INPUT VOLTAGE**



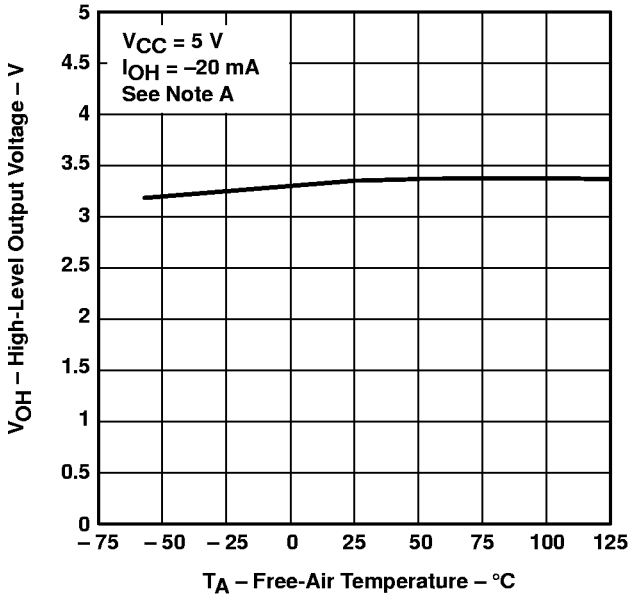

NOTE B: The A input is connected to GND during the testing of the Y outputs and to $V_{CC}$ during the testing of the Z outputs.

**Figure 8**

† Operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied.

## TYPICAL CHARACTERISTICS†

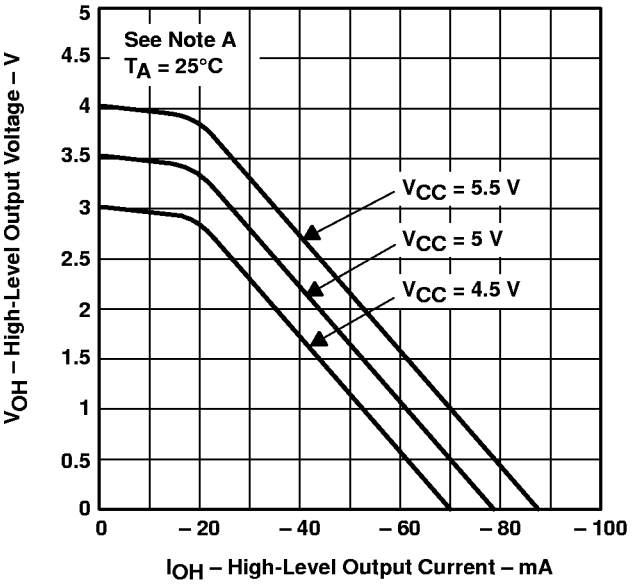
**HIGH-LEVEL OUTPUT VOLTAGE vs FREE-AIR TEMPERATURE**




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

**Figure 9**

**HIGH-LEVEL OUTPUT VOLTAGE vs OUTPUT CURRENT**



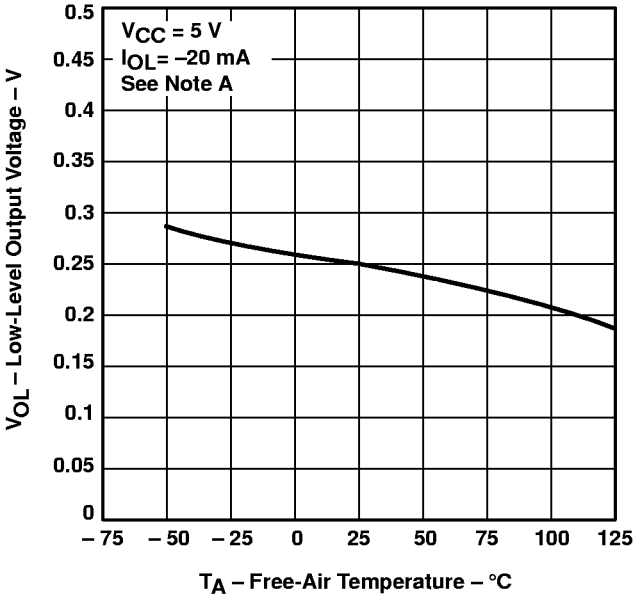

NOTE A: The A input is connected to $V_{CC}$ during the testing of the Y outputs and to ground during the testing of the Z outputs.

**Figure 10**

† Operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied.

## TYPICAL CHARACTERISTICS†

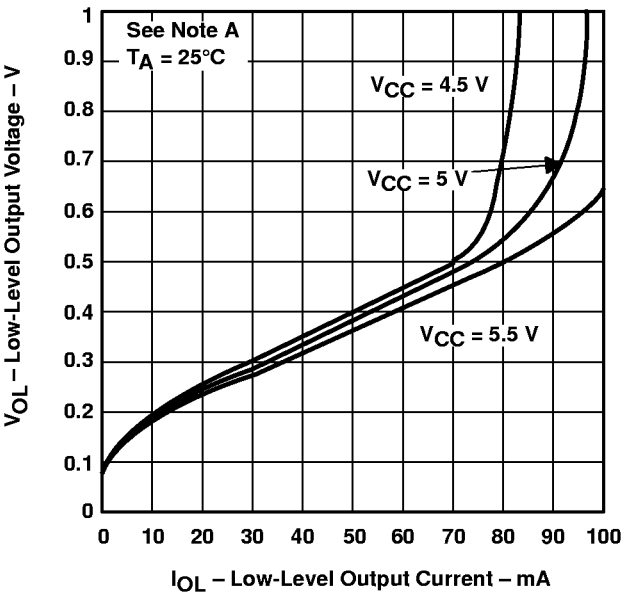
**LOW-LEVEL OUTPUT VOLTAGE vs FREE-AIR TEMPERATURE**




NOTE A: The A input is connected to GND during the testing of the Y outputs and to $V_{CC}$ during the testing of the Z outputs.

**Figure 11**

**LOW-LEVEL OUTPUT VOLTAGE vs LOW-LEVEL OUTPUT CURRENT**




NOTE A: The A input is connected to GND during the testing of the Y outputs and to $V_{CC}$ during the testing of the Z outputs.

**Figure 12**

**SUPPLY CURRENT vs SUPPLY VOLTAGE**

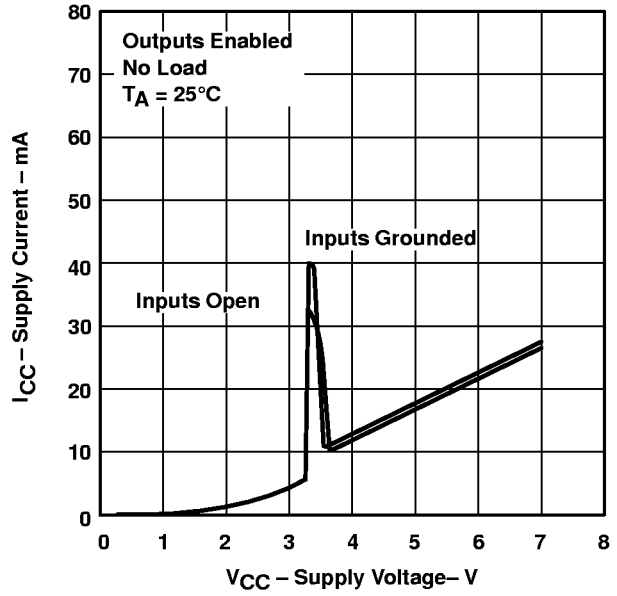



**Figure 13**

**SUPPLY CURRENT vs SUPPLY VOLTAGE**

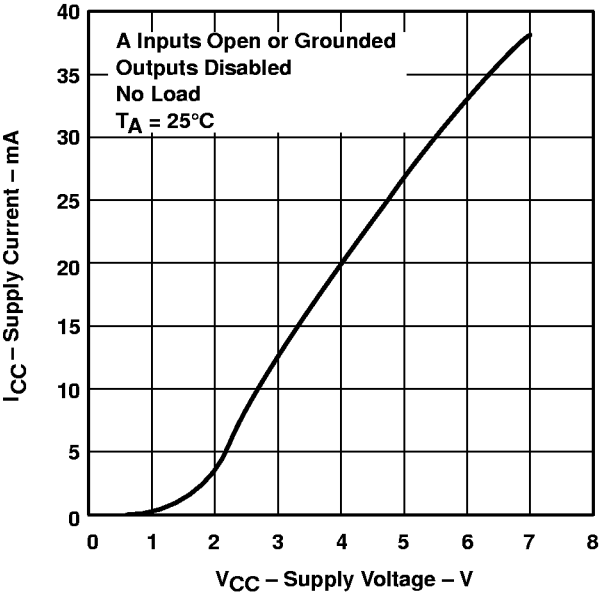



**Figure 14**

† Operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied.

## TYPICAL CHARACTERISTICS

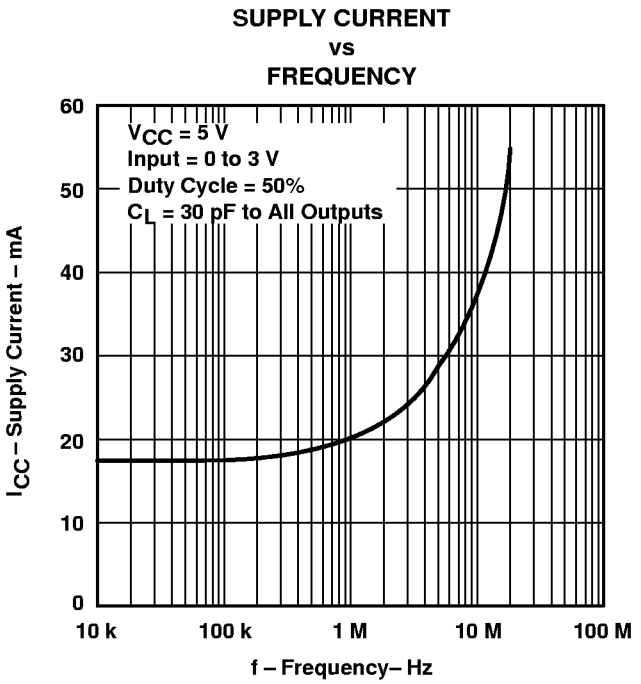



Figure 15

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