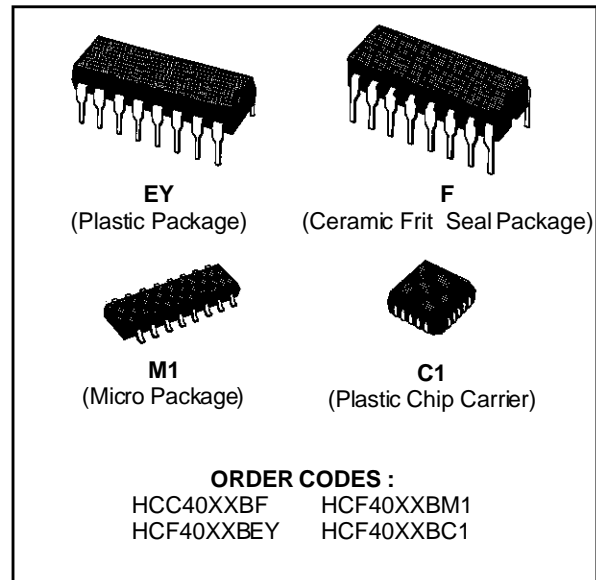


HEX BUFFER/CONVERTERS

4049UB INVERTING TYPE
4050B NON-INVERTING TYPE

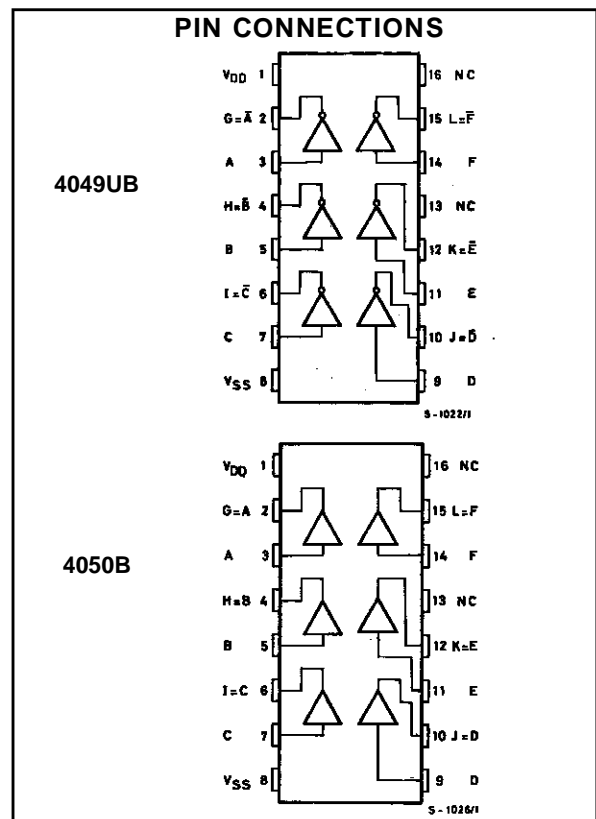
- HIGH SINK CURRENT FOR DRIVING 2 TTL LOADS
- HIGH-TO-LOW LEVEL LOGIC CONVERSION
- QUIESCENT CURRENT SPECIFIED TO 20V FOR HCC DEVICE
- HIGH "SINK" AND "SOURCE" CURRENT CAPABILITY
- 5V, 10V AND 15V PARAMETRIC RATINGS
- INPUT CURRENT OF 100 nA AT 18V AND 25°C FOR HCC DEVICE
- 100% TESTED FOR QUIESCENT CURRENT
- MEETS ALL REQUIREMENTS OF JEDEC TENTATIVE STANDARD N^o. 13A, "STANDARD SPECIFICATIONS FOR DESCRIPTION OF "B" SERIES CMOS DEVICES"



DESCRIPTION

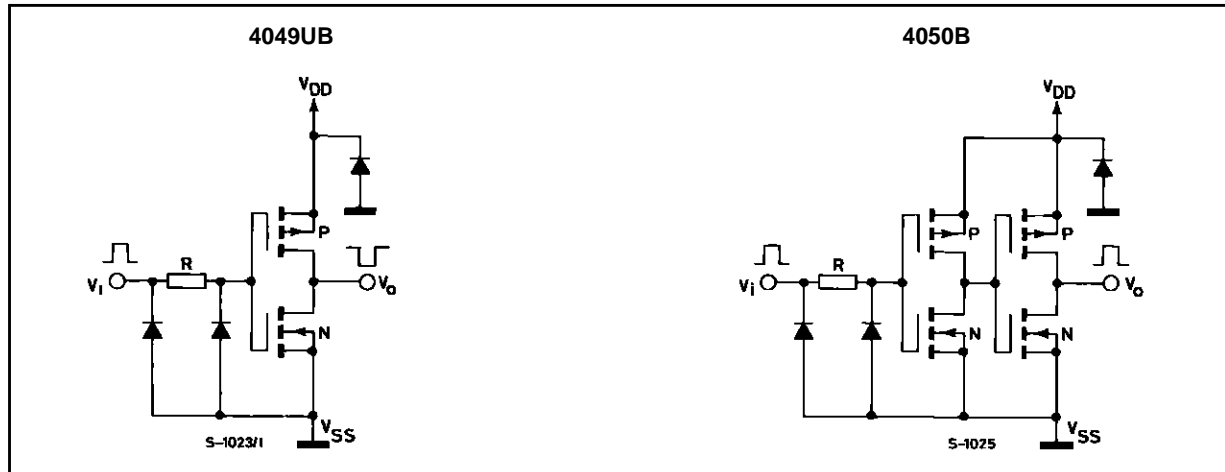
The **HCC4049UB/4050B** (extended temperature range) and the **HCF4049UB/4050B** (intermediate temperature range) are monolithic integrated circuits available in 16-lead dual in-line plastic or ceramic package and plastic micro package.

The **HCC/HCF4049UB/4050B** are inverting and non-inverting hex buffers, respectively, and feature logic-level conversion using only one supply voltage (V_{DD}). The input-signal high level (V_{IH}) can exceed the V_{DD} supply voltage when these devices are used for logic level conversions. These devices are intended for use as COS/MOS to DTL/TTL converters and can drive directly two DTL/TTL loads ($V_{DD} = 5V$, $V_{OL} \leq 0.4V$, and $I_{OL} \geq 3.2mA$).



HCC/HCF4049UB/4050B

SCHEMATIC DIAGRAMS (1 of 6 identical units)



ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|------------|---|--------------------------------|----------------------------|
| V_{DD}^* | Supply Voltage : HCC Types HCF Types | - 0.5 to + 20 - 0.5 to + 18 | V V |
| V_i | Input Voltage | - 0.5 to $V_{DD} + 0.5$ | V |
| I_i | DC Input Current (any one input) | ± 10 | mA |
| P_{tot} | Total Power Dissipation (per package) Dissipation per Output Transistor for $T_{op} =$ Full Package-temperature Range | 200 100 | mW mW |
| T_{op} | Operating Temperature : HCC Types HCF Types | - 55 to + 125 - 40 to + 85 | $^{\circ}C$ $^{\circ}C$ |
| T_{stg} | Storage Temperature | - 65 to + 150 | $^{\circ}C$ |

Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for external periods may affect device reliability.

* All voltage values are referred to V_{SS} pin voltage.

RECOMMENDED OPERATING CONDITIONS

| Symbol | Parameter | Value | Unit |
|----------|--|-------------------------------|----------------------------|
| V_{DD} | Supply Voltage : HCC Types HCF Types | 3 to 18 3 to 15 | V V |
| V_i | Input Voltage | 0 to V_{DD} | V |
| T_{op} | Operating Temperature : HCC Types HCF Types | - 55 to + 125 - 40 to + 85 | $^{\circ}C$ $^{\circ}C$ |

STATIC ELECTRICAL CHARACTERISTICS (over recommended operating conditions)

| Symbol | Parameter | | Test Conditions | | | Value | | | | | | Unit | |
|-----------------------------------|-----------------------------|-----------------|-----------------------|-----------------------|------------------------|--------------------|-------|-------|-------------------|-------------|---------------------|------|------|
| | | | V _I (V) | V _O (V) | V _{DD} (V) | T _{Low} * | | 25°C | | | T _{High} * | | |
| | | | | | | Min. | Max. | Min. | Typ. | Max. | Min. | | Max. |
| I _L | Quiescent Supply Current | HCC Types | 0/ 5 | | 5 | | 1 | | 0.02 | 1 | | 30 | µA |
| | | | 0/10 | | 10 | | 2 | | 0.02 | 2 | | 60 | |
| | | | 0/15 | | 15 | | 4 | | 0.02 | 4 | | 120 | |
| | | HCF Types | 0/ 5 | | 5 | | 4 | | 0.02 | 4 | | 30 | |
| | | | 0/10 | | 10 | | 8 | | 0.02 | 8 | | 60 | |
| | | | 0/15 | | 15 | | 16 | | 0.02 | 16 | | 120 | |
| V _{OH} | Output High Voltage | | 0/ 5 | | 5 | 4.95 | | 4.95 | | | 4.95 | V | |
| | | | 0/10 | | 10 | 9.95 | | 9.95 | | | 9.95 | | |
| | | | 0/15 | | 15 | 14.95 | | 14.95 | | | 14.95 | | |
| V _{OL} | Output Low Voltage | | 5/0 | | 5 | | 0.05 | | | 0.05 | 0.05 | V | |
| | | | 10/0 | | 10 | | 0.05 | | | 0.05 | 0.05 | | |
| | | | 15/0 | | 15 | | 0.05 | | | 0.05 | 0.05 | | |
| V _{IH} | Input High Voltage (4049UB) | | | 0.5 | 5 | 4 | | 4 | | | 4 | V | |
| | | | | 1 | 10 | 8 | | 8 | | | 8 | | |
| | | | | 2 | 15 | 12 | | 12 | | | 12 | | |
| V _{IH} | Input High Voltage (4050B) | | | 4.5 | 5 | 3.5 | | 3.5 | | | 3.5 | V | |
| | | | | 9 | 10 | 7 | | 7 | | | 7 | | |
| | | | | 13.5 | 16 | 11 | | 11 | | | 11 | | |
| V _{IL} | Input Low Voltage (4049UB) | | | 4.5 | 5 | | 1 | | | 1 | 1 | V | |
| | | | | 9 | 10 | | 2 | | | 2 | 2 | | |
| | | | | 13 | 15 | | 3 | | | 3 | 3 | | |
| V _{IL} | Input Low Voltage (4050B) | | | 0.5 | 5 | | 1.5 | | | 1.5 | 1.5 | V | |
| | | | | 1 | 10 | | 3 | | | 3 | 3 | | |
| | | | | 1.5 | 15 | | 4 | | | 4 | 4 | | |
| I _{OH} | Output Drive Current | HCC Types | 0/ 5 | 2.5 | 5 | 1.6 | | -1.25 | - 6.4 | | - 0.9 | mA | |
| | | | 0/ 5 | 4.6 | 5 | 0.64 | | -0.51 | - 1.6 | | -0.36 | | |
| | | | 0/10 | 9.5 | 10 | 1.6 | | -1.30 | - 3.6 | | - 0.9 | | |
| | | 0/15 | 13.5 | 15 | 4.7 | | -3.75 | - 12 | | - 2.7 | | | |
| | | HCF Types | 0/ 5 | 2.5 | 5 | 1.5 | | -1.25 | - 6.4 | | - 1 | | |
| | | | 0/ 5 | 4.6 | 5 | 0.61 | | -0.51 | - 1.6 | | -0.42 | | |
| 0/10 | 9.5 | | 10 | 1.5 | | -1.25 | - 3.6 | | - 1 | | | | |
| I _{OL} | Output Sink Current | HCC Types | 0/ 5 | 0.4 | 5 | 3.75 | | 3.2 | 6.4 | | 2.2 | mA | |
| | | | 0/10 | 0.5 | 10 | 10 | | 8 | 16 | | 5.6 | | |
| | | | 0/15 | 1.5 | 15 | 30 | | 24 | 48 | | 17 | | |
| | | HCF Types | 0/ 5 | 0.4 | 5 | 3.6 | | 3.2 | 6.4 | | 2.6 | | |
| | | | 0/10 | 0.5 | 10 | 9.6 | | 8 | 16 | | 6.6 | | |
| | | | 0/15 | 1.5 | 15 | 28 | | 24 | 48 | | 19 | | |
| I _{IH} , I _{IL} | Input Leakage Current | HCC Types | 0/18 | | 18 | | ± 0.1 | | ±10 ⁻⁵ | ± 0.1 | | ± 1 | |
| | | HCF Types | 0/15 | | 15 | | ± 0.3 | | ±10 ⁻⁵ | ± 0.3 | | ± 1 | |
| C _I | Input Capacitance | 4049UB 4050B | Any Input | | | | | | 15 5 | 22.5 7.5 | | pF | |

(*) T_{Low} = - 55°C for HCC device ; - 40°C for HCF device.

T_{High} = + 125°C for HCC device ; + 85°C for HCF device.

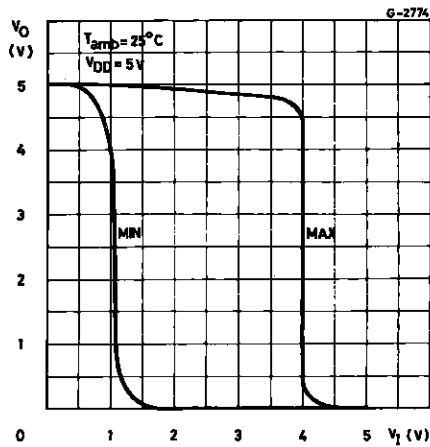
The Noise Margin (only HCC/HCF4050B type) for both "1" and "0" level is : 1V min. with V_{DD} = 5V, 2V min. with V_{DD} = 10V, 2.5V min. with V_{DD} = 15V.

HCC/HCF4049UB/4050B

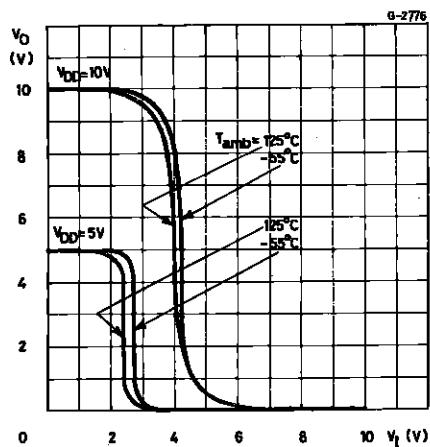
DYNAMIC ELECTRICAL CHARACTERISTICS ($T_{amb} = 25^{\circ}\text{C}$, $C_L = 50\text{pF}$, $R_L = 200\text{k}\Omega$, typical temperature coefficient for all V_{DD} values is $0.3\%/^{\circ}\text{C}$, all input rise and fall times = 20ns)

| Symbol | Parameter | Test Conditions | | Value | | | Unit |
|-----------|---------------------------------|-----------------|--------------|-------|------|------|------|
| | | V_I (V) | V_{DD} (V) | Min. | Typ. | Max. | |
| t_{PLH} | Propagation Delay Time (4049UB) | 5 | 5 | | 60 | 120 | ns |
| | | 10 | 10 | | 32 | 65 | |
| | | 10 | 5 | | 45 | 90 | |
| | | 15 | 15 | | 25 | 50 | |
| | | 15 | 5 | | 45 | 90 | |
| t_{PLH} | Propagation Delay Time (4050B) | 5 | 5 | | 70 | 140 | ns |
| | | 10 | 10 | | 40 | 80 | |
| | | 10 | 5 | | 45 | 90 | |
| | | 15 | 15 | | 30 | 60 | |
| | | 15 | 5 | | 40 | 80 | |
| t_{PHL} | Propagation delay Time (4049UB) | 5 | 5 | | 32 | 65 | ns |
| | | 10 | 10 | | 20 | 40 | |
| | | 10 | 5 | | 15 | 30 | |
| | | 15 | 15 | | 15 | 30 | |
| | | 15 | 5 | | 10 | 20 | |
| t_{PHL} | Propagation Delay Time (4050B) | 5 | 5 | | 55 | 110 | ns |
| | | 10 | 10 | | 22 | 55 | |
| | | 10 | 5 | | 50 | 100 | |
| | | 15 | 15 | | 15 | 30 | |
| | | 15 | 5 | | 50 | 100 | |
| t_{TLH} | Transition Time | 5 | 5 | | 80 | 160 | ns |
| | | 10 | 10 | | 40 | 80 | |
| | | 15 | 15 | | 30 | 60 | |
| t_{THL} | Transition Time | 5 | 5 | | 30 | 60 | ns |
| | | 10 | 10 | | 20 | 40 | |
| | | 15 | 15 | | 15 | 30 | |

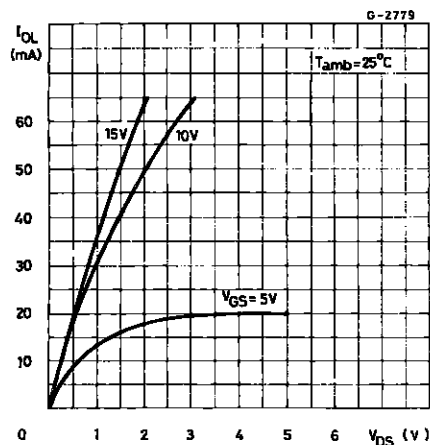
Minimum and Maximum Voltage Transfer Characteristics for 4049UB.



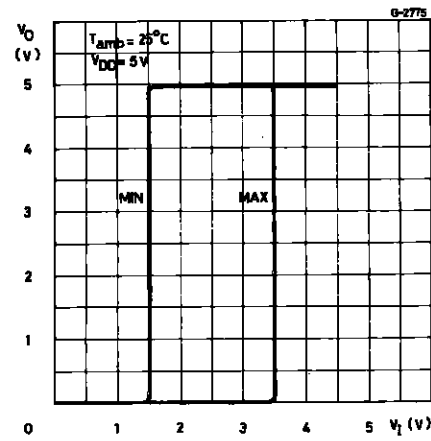
Typical Voltage Transfer Characteristics as a Function of Temperature for 4049UB.



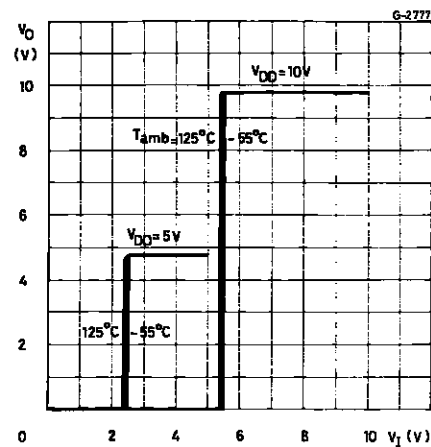
Typical Output Low (sink) Current Characteristics.



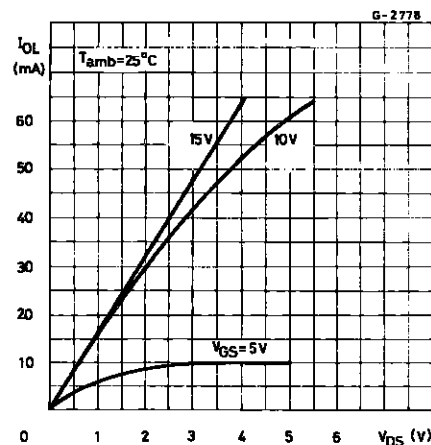
Minimum and Maximum Voltage Transfer Characteristics for 4050B.



Typical Voltage Transfer Characteristics as a Function of Temperature for 4050B.

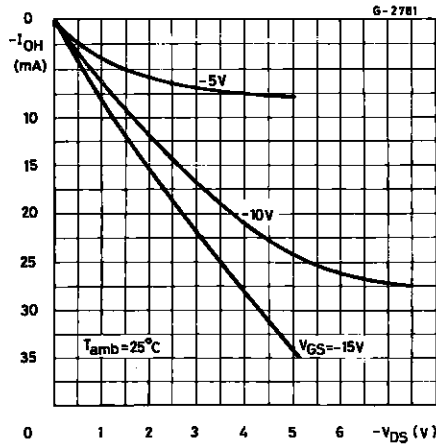


Minimum Output Low (sink) Current Characteristics.

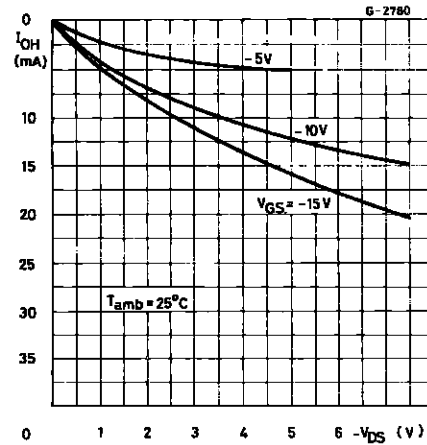


HCC/HCF4049UB/4050B

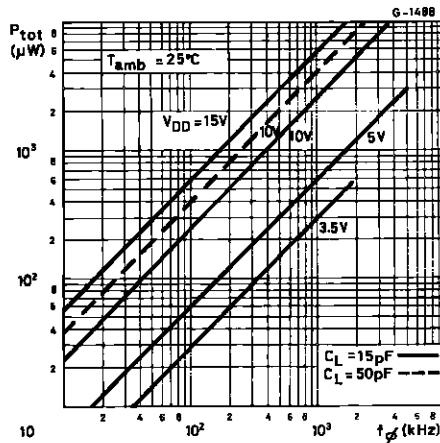
Typical Output High (source) Current Characteristics.



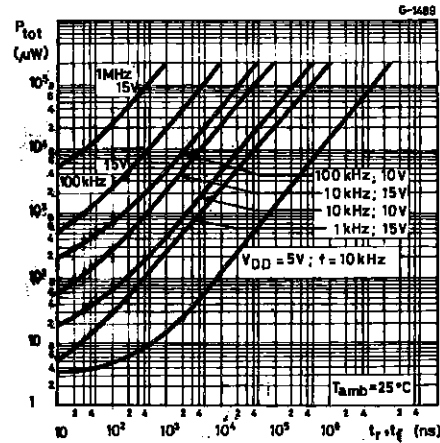
Minimum Output High (source) Current Characteristics.



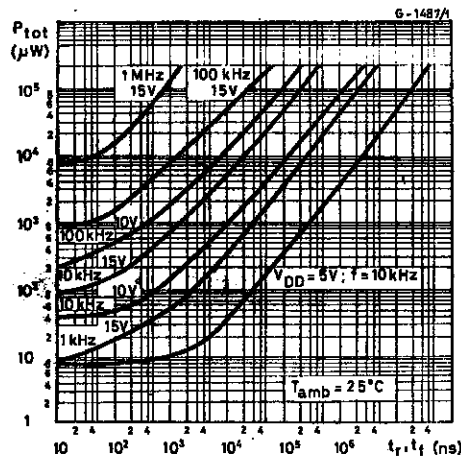
Typical Power Dissipation per Buffer/Inverter vs. Frequency.



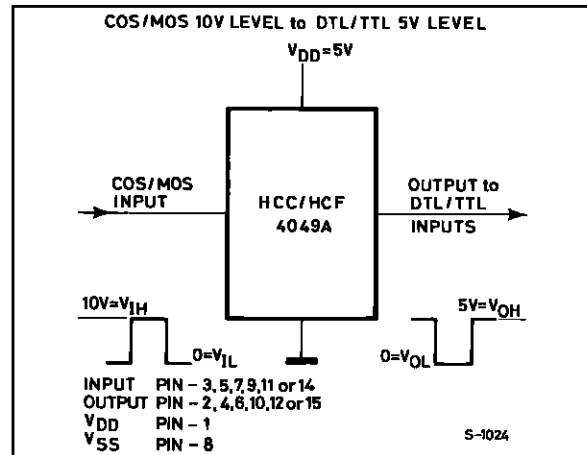
Typical Power Dissipation vs. Input Transition Time per Inverter for 4049UB.



Typical Power Dissipation vs. Input Transition Time per Inverter for 4050B.

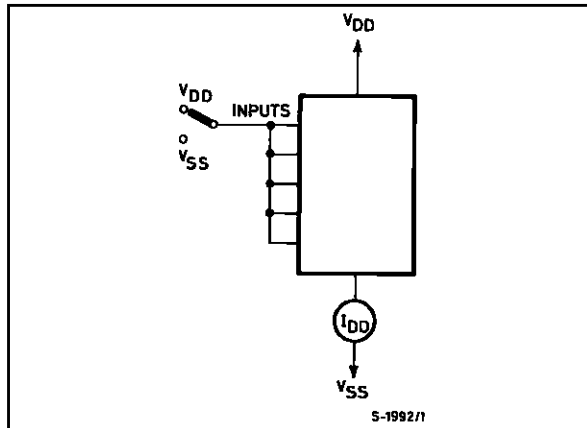


Logic-Level Conversion Application.

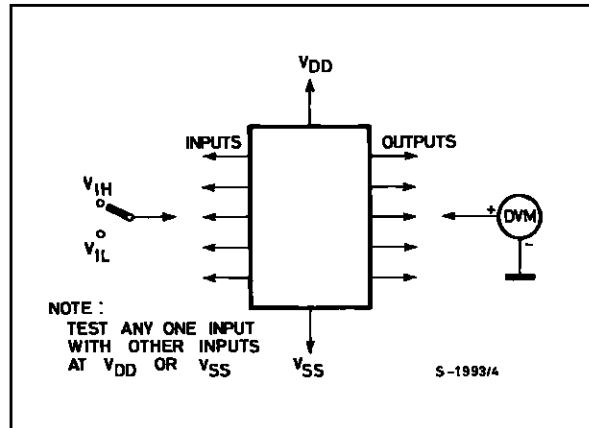


TEST CIRCUITS

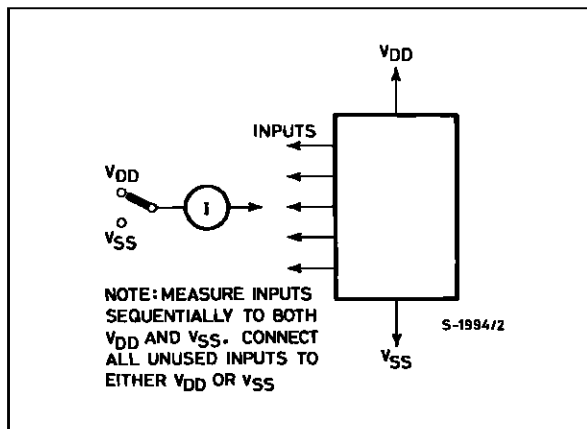
Quiescent Device Current.



Input Voltage.



Input Current.



Plastic DIP16 (0.25) MECHANICAL DATA

| DIM. | mm | | | inch | | |
|------|------|-------|------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| a1 | 0.51 | | | 0.020 | | |
| B | 0.77 | | 1.65 | 0.030 | | 0.065 |
| b | | 0.5 | | | 0.020 | |
| b1 | | 0.25 | | | 0.010 | |
| D | | | 20 | | | 0.787 |
| E | | 8.5 | | | 0.335 | |
| e | | 2.54 | | | 0.100 | |
| e3 | | 17.78 | | | 0.700 | |
| F | | | 7.1 | | | 0.280 |
| I | | | 5.1 | | | 0.201 |
| L | | 3.3 | | | 0.130 | |
| Z | | | 1.27 | | | 0.050 |



P001C

Ceramic DIP16/1 MECHANICAL DATA

| DIM. | mm | | | inch | | |
|------|------|-------|------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | | | 20 | | | 0.787 |
| B | | | 7 | | | 0.276 |
| D | | 3.3 | | | 0.130 | |
| E | 0.38 | | | 0.015 | | |
| e3 | | 17.78 | | | 0.700 | |
| F | 2.29 | | 2.79 | 0.090 | | 0.110 |
| G | 0.4 | | 0.55 | 0.016 | | 0.022 |
| H | 1.17 | | 1.52 | 0.046 | | 0.060 |
| L | 0.22 | | 0.31 | 0.009 | | 0.012 |
| M | 0.51 | | 1.27 | 0.020 | | 0.050 |
| N | | | 10.3 | | | 0.406 |
| P | 7.8 | | 8.05 | 0.307 | | 0.317 |
| Q | | | 5.08 | | | 0.200 |



SO16 (Narrow) MECHANICAL DATA

| DIM. | mm | | | inch | | |
|------|------------|------|------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | | | 1.75 | | | 0.068 |
| a1 | 0.1 | | 0.2 | 0.004 | | 0.007 |
| a2 | | | 1.65 | | | 0.064 |
| b | 0.35 | | 0.46 | 0.013 | | 0.018 |
| b1 | 0.19 | | 0.25 | 0.007 | | 0.010 |
| C | | 0.5 | | | 0.019 | |
| c1 | 45° (typ.) | | | | | |
| D | 9.8 | | 10 | 0.385 | | 0.393 |
| E | 5.8 | | 6.2 | 0.228 | | 0.244 |
| e | | 1.27 | | | 0.050 | |
| e3 | | 8.89 | | | 0.350 | |
| F | 3.8 | | 4.0 | 0.149 | | 0.157 |
| G | 4.6 | | 5.3 | 0.181 | | 0.208 |
| L | 0.5 | | 1.27 | 0.019 | | 0.050 |
| M | | | 0.62 | | | 0.024 |
| S | 8° (max.) | | | | | |



P013H

PLCC20 MECHANICAL DATA

| DIM. | mm | | | inch | | |
|------|------|------|-------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 9.78 | | 10.03 | 0.385 | | 0.395 |
| B | 8.89 | | 9.04 | 0.350 | | 0.356 |
| D | 4.2 | | 4.57 | 0.165 | | 0.180 |
| d1 | | 2.54 | | | 0.100 | |
| d2 | | 0.56 | | | 0.022 | |
| E | 7.37 | | 8.38 | 0.290 | | 0.330 |
| e | | 1.27 | | | 0.050 | |
| e3 | | 5.08 | | | 0.200 | |
| F | | 0.38 | | | 0.015 | |
| G | | | 0.101 | | | 0.004 |
| M | | 1.27 | | | 0.050 | |
| M1 | | 1.14 | | | 0.045 | |



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