

# CD54/74HC4051, CD54/74HCT4051 CD54/74HC4052, CD54/74HCT4052 CD54/74HC4053, CD54/74HCT4053

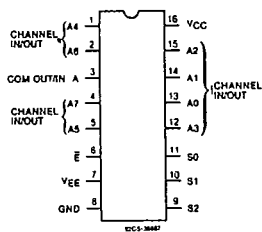
File Number 1676

## High-Speed CMOS Logic

HARRIS SEMICONDUCTOR

27E D

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CD54/74HC/HCT4051  
TERMINAL ASSIGNMENT

## Analog Multiplexers/ Demultiplexers

### Type Features:

- Wide analog input voltage range:  $\pm 5$  V max.
- Low "on" resistance:  
70  $\Omega$  typ ( $V_{CC}-V_{EE} = 4.5$  V)  
40  $\Omega$  typ ( $V_{CC}-V_{EE} = 9$  V)
- Low crosstalk between switches
- Fast switching and propagation speeds
- "Break-before-make" switching

The RCA CD54/74HC/HCT4051, 4052, and 4053 are digitally controlled analog switches which utilize silicon-gate CMOS technology to achieve operating speeds similar to LSTTL with the low power consumption of standard CMOS integrated circuits.

These analog multiplexers/demultiplexers control analog voltages that may vary across the voltage supply range (i.e.  $V_{CC}$  to  $V_{EE}$ ). They are bidirectional switches thus allowing any analog input to be used as an output and visa-versa. The switches have low "on" resistance and low "off" leakages. In addition, all three devices have an enable control which when, high, disables all switches to their "off" state.

The CD54HC/HCT4051, 4052, and 4053 are supplied in 16-lead hermetic dual-in-line ceramic packages (F suffix). The CD74HC/HCT 4051, 4052, and 4053 are supplied in 16-lead plastic packages (E suffix) and in 16-lead surface mount plastic packages (M suffix). All devices are also available in chip form (H suffix).

### Family Features:

- Wide Operating Temperature Range:  
CD74HC/HCT: -40 to +85°C
- Alternate Source is Philips/Signetics
- CD54HC/CD74HC Types:  
2 to 6 V Operation, control; 0 to 10 V, switch  
High Noise Immunity:  
 $N_{IL} = 30\%$ ,  $N_{IH} = 30\%$  of  $V_{CC}$ ; @  $V_{CC} = 5$  V
- CD54HCT/CD74HCT Types:  
4.5 to 5.5 V Operation, control; 0 to 10 V, switch  
Direct LSTTL Input Logic Compatibility  
 $V_{IL} = 0.8$  V Max.,  $V_{IH} = 2$  V Min.  
CMOS Input Compatibility  
 $I_L \leq 1 \mu A$  @  $V_{OL}$ ,  $V_{OH}$

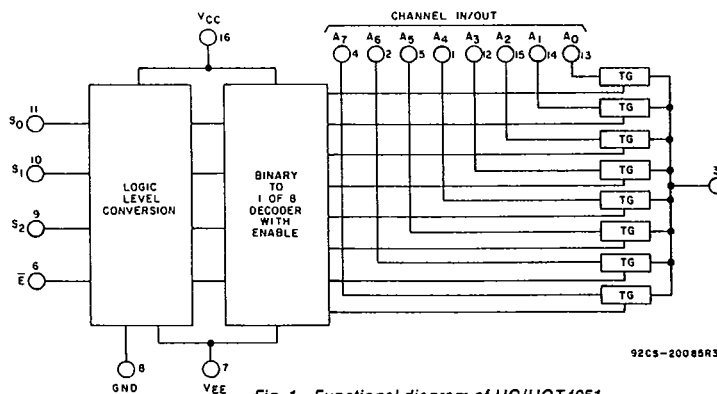


Fig. 1 - Functional diagram of HC/HCT4051.

TRUTH TABLE  
CD54/74HC/HCT4051

| INPUT STATES |    |    |    | "ON" CHANNELS |
|--------------|----|----|----|---------------|
| ENABLE       | S2 | S1 | S0 |               |
| L            | L  | L  | L  | A0            |
| L            | L  | L  | H  | A1            |
| L            | L  | H  | L  | A2            |
| L            | L  | H  | H  | A3            |
| L            | H  | L  | L  | A4            |
| L            | H  | L  | H  | A5            |
| L            | H  | H  | L  | A6            |
| L            | H  | H  | H  | A7            |
| H            | X  | X  | X  | NONE          |

X = Don't Care

T-51-12

Technical Data

# CD54/74HC4051, CD54/74HCT4051 CD54/74HC4052, CD54/74HCT4052 CD54/74HC4053, CD54/74HCT4053

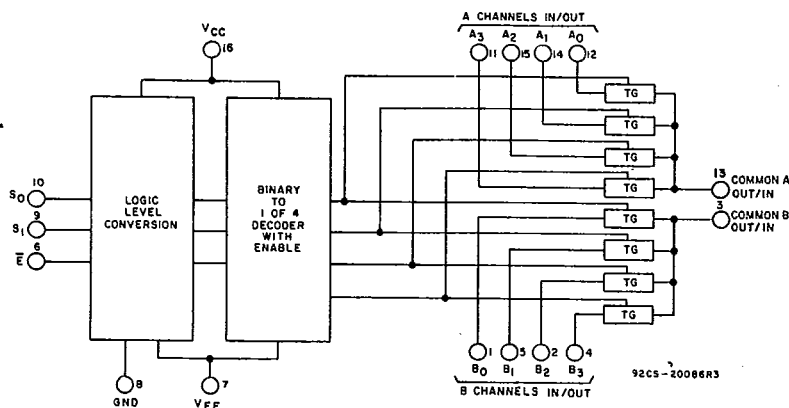
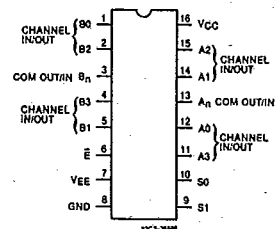


Fig. 2 - Functional diagram of HC/HCT4052.



CD54/74HC/HCT4052  
TERMINAL ASSIGNMENT

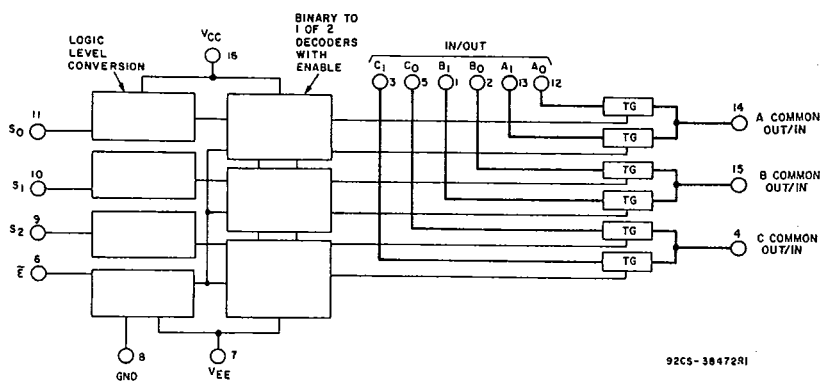
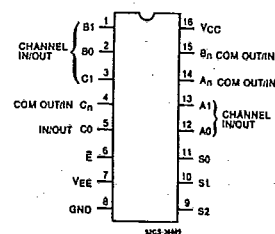


Fig. 3 - Functional diagram of HC/HCT4053.



CD54/74HC/HCT4053  
TERMINAL ASSIGNMENT

## TRUTH TABLES (Continued)

CD54/74HC/HCT4052

| INPUT STATES |    |    | "ON" CHANNELS |
|--------------|----|----|---------------|
| ENABLE       | S1 | S0 |               |
| L            | L  | L  | A0, B0        |
| L            | L  | H  | A1, B1        |
| L            | H  | L  | A2, B2        |
| L            | H  | H  | A3, B3        |
| H            | X  | X  | NONE          |

X = Don't Care

CD54/74HC/HCT4053

| INPUT STATES |    |    |    | "ON" CHANNELS |
|--------------|----|----|----|---------------|
| ENABLE       | S2 | S1 | S0 |               |
| L            | L  | L  | L  | A0 B0 C0      |
| L            | L  | L  | H  | A0 B0 C1      |
| L            | L  | H  | L  | A0 B1 C0      |
| L            | L  | H  | H  | A0 B1 C1      |
| L            | H  | L  | L  | A1 B0 C0      |
| L            | H  | L  | H  | A1 B0 C1      |
| L            | H  | H  | L  | A1 B1 C0      |
| L            | H  | H  | H  | A1 B1 C1      |
| H            | X  | X  | X  | NONE          |

X = Don't Care

# CD54/74HC4051, CD54/74HCT4051 CD54/74HC4052, CD54/74HCT4052 CD54/74HC4053, CD54/74HCT4053

## MAXIMUM RATINGS, Absolute-Maximum Values: (All voltages referenced to Gnd unless otherwise shown)

|                                                                                          |                                                           |
|------------------------------------------------------------------------------------------|-----------------------------------------------------------|
| DC SUPPLY-VOLTAGE ( $V_{CC}-V_{EE}$ )                                                    | .....-0.5 to 10.5 V                                       |
| DC SUPPLY-VOLTAGE ( $V_{CC}$ )                                                           | .....-0.5 to +7 V                                         |
| DC SUPPLY-VOLTAGE ( $V_{EE}$ )                                                           | .....+0.5 to -7 V                                         |
| DC INPUT DIODE CURRENT, $I_{IK}$ (FOR $V_i < -0.5$ V OR $V_i > V_{CC} + 0.5$ V)          | ..... $\pm 20$ mA                                         |
| DC SWITCH DIODE CURRENT, $I_{OK}$ (FOR $V_i < V_{EE} - 0.5$ V OR $V_i > V_{CC} + 0.5$ V) | ..... $\pm 20$ mA                                         |
| DC SWITCH CURRENT (FOR $V_i > V_{EE} - 0.5$ V OR $V_i < V_{CC} + 0.5$ V)                 | .....+25 mA                                               |
| DC $V_{CC}$ OR GROUND CURRENT ( $I_{CC}$ )                                               | ..... $\pm 50$ mA                                         |
| DC $V_{EE}$ CURRENT ( $I_{EE}$ )                                                         | .....-20 mA                                               |
| POWER DISSIPATION PER PACKAGE ( $P_D$ ):                                                 |                                                           |
| For $T_A = -40$ to $+60^\circ\text{C}$ (PACKAGE TYPE E)                                  | ..... 500 mW                                              |
| For $T_A = +60$ to $+85^\circ\text{C}$ (PACKAGE TYPE E)                                  | ..... Derate Linearly at 8 mW/ $^\circ\text{C}$ to 300 mW |
| For $T_A = -55$ to $+100^\circ\text{C}$ (PACKAGE TYPE F, H)                              | ..... 500 mW                                              |
| For $T_A = +100$ to $+125^\circ\text{C}$ (PACKAGE TYPE F, H)                             | ..... Derate Linearly at 8 mW/ $^\circ\text{C}$ to 300 mW |
| For $T_A = -40$ to $+70^\circ\text{C}$ (PACKAGE TYPE M)                                  | ..... 400 mW                                              |
| For $T_A = +70$ to $+125^\circ\text{C}$ (PACKAGE TYPE M)                                 | ..... Derate Linearly at 6 mW/ $^\circ\text{C}$ to 70 mW  |
| OPERATING-TEMPERATURE RANGE ( $T_A$ ):                                                   |                                                           |
| PACKAGE TYPE F, H                                                                        | ..... -55 to $+125^\circ\text{C}$                         |
| PACKAGE TYPE E, M                                                                        | ..... -40 to $+85^\circ\text{C}$                          |
| STORAGE TEMPERATURE ( $T_{stg}$ )                                                        | ..... -65 to $+150^\circ\text{C}$                         |
| LEAD TEMPERATURE (DURING SOLDERING):                                                     |                                                           |
| At distance 1/16 $\pm$ 1/32 in. (1.59 $\pm$ 0.79 mm) from case for 10 s max.             | ..... $+265^\circ\text{C}$                                |
| Unit inserted into a PC Board (min. thickness 1/16 in., 1.59 mm)                         |                                                           |
| with solder contacting lead tips only                                                    | ..... $+300^\circ\text{C}$                                |

- In certain applications, the external load-resistor current may include both  $V_{CC}$  and signal-line components. To avoid drawing  $V_{CC}$  current when switch current flows into the transmission gate inputs, the voltage drop across the bidirectional switch must not exceed 0.6 volt (calculated from  $R_{ON}$  values shown in Electrical Characteristics chart). No  $V_{CC}$  current will flow through  $R_i$  if the switch current flows into terminal 3 on the HC/HCT4051; terminals 3 and 13 on the HC/HCT4052; terminals 4, 14 and 15 on the HC/HCT4053.

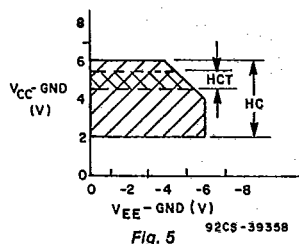
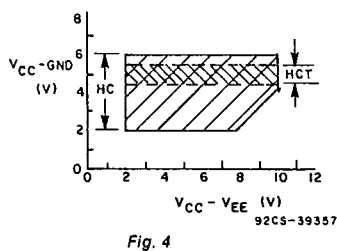
## RECOMMENDED OPERATING CONDITIONS:

For maximum reliability, nominal operating conditions should be selected so that operation is always within the following ranges:

| CHARACTERISTIC                                                                    | LIMITS     |          | UNITS            |
|-----------------------------------------------------------------------------------|------------|----------|------------------|
|                                                                                   | MIN.       | MAX.     |                  |
| Supply-Voltage Range (For $T_A$ = Full Package-Temperature Range) $V_{CC}$ :      |            |          |                  |
| CD54/74HC Types                                                                   | 2          | 6        | V                |
| CD54/74HCT Types                                                                  | 4.5        | 5.5      | V                |
| Supply-Voltage Range (For $T_A$ = Full Package-Temperature Range) $V_{CC}-V_{EE}$ |            |          |                  |
| CD54/74HC Types                                                                   | 2          | 10       | V                |
| CD54/74HCT Types                                                                  | See Fig. 4 |          |                  |
| Supply-Voltage Range (For $T_A$ = Full Package-Temperature Range) $V_{EE}$ :      |            |          |                  |
| CD54/74HC Types                                                                   | 0          | -6       | V                |
| CD54/74HCT Types                                                                  | See Fig. 5 |          |                  |
| DC Input Control Voltage, $V_i$                                                   | Gnd        | $V_{CC}$ | V                |
| Analog Switch I/O Voltage, $V_{is}$                                               | $V_{EE}$   | $V_{CC}$ | V                |
| Operating Temperature $T_A$ :                                                     |            |          |                  |
| CD74 Types                                                                        | -40        | +85      | $^\circ\text{C}$ |
| CD54 Types                                                                        | -55        | +125     | $^\circ\text{C}$ |
| Input Rise and Fall Times $t_r, t_f$                                              |            |          |                  |
| at 2 V                                                                            | 0          | 1000     | ns               |
| at 4.5 V                                                                          | 0          | 500      | ns               |
| at 6 V                                                                            | 0          | 400      | ns               |

\*Unless otherwise specified, all voltages are referenced to Ground.

## Recommended Operating Area as a Function of Supply Voltages.



# CD54/74HC4051, CD54/74HCT4051

## CD54/74HC4052, CD54/74HCT4052

## CD54/74HC4053, CD54/74HCT4053

### STATIC ELECTRICAL CHARACTERISTICS

| CHAR-<br>ACTERISTIC                                                                                                           | CD74HC/CD54HC4051,4052,4053                                                                                                                                                                                                                                                                         |                                          |                      |                      |                    |     |     |               |     |                |     | CD74HCT/CD54HCT4051,4052,4053 |                     |                      |                      |                      |     |     |                |      |                |     | UNITS |     |    |
|-------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|----------------------|----------------------|--------------------|-----|-----|---------------|-----|----------------|-----|-------------------------------|---------------------|----------------------|----------------------|----------------------|-----|-----|----------------|------|----------------|-----|-------|-----|----|
|                                                                                                                               | TEST<br>CONDITIONS                                                                                                                                                                                                                                                                                  |                                          |                      |                      | 74HC/54HC<br>TYPES |     |     | 74HC<br>TYPES |     | 54HC<br>TYPES  |     | TEST<br>CONDITIONS            |                     |                      |                      | 74HCT/54HCT<br>TYPES |     |     | 74HCT<br>TYPES |      | 54HCT<br>TYPES |     |       |     |    |
|                                                                                                                               | V <sub>IS</sub><br>V                                                                                                                                                                                                                                                                                | V <sub>I</sub><br>V                      | V <sub>EE</sub><br>V | V <sub>CC</sub><br>V | +25°C              |     |     | -40/<br>+85°C |     | -55/<br>+125°C |     | V <sub>IS</sub><br>V          | V <sub>I</sub><br>V | V <sub>EE</sub><br>V | V <sub>CC</sub><br>V | +25°C                |     |     | -40/<br>+85°C  |      | -55/<br>+125°C |     |       |     |    |
|                                                                                                                               |                                                                                                                                                                                                                                                                                                     |                                          |                      |                      | Min                | Typ | Max | Min           | Max | Min            | Max |                               |                     |                      |                      | Min                  | Typ | Max | Min            | Max  | Min            | Max |       |     |    |
| High-Level<br>Input<br>Voltage V <sub>IH</sub>                                                                                |                                                                                                                                                                                                                                                                                                     |                                          |                      | 2                    | 1.5                | —   | —   | 1.5           | —   | 1.5            | —   |                               |                     |                      | 4.5<br>to<br>5.5     | 2                    | —   | —   | 2              | —    | 2              | —   | V     |     |    |
| Low-Level<br>Input<br>Voltage V <sub>IL</sub>                                                                                 |                                                                                                                                                                                                                                                                                                     |                                          |                      | 2                    | —                  | —   | 0.5 | —             | 0.5 | —              | 0.5 |                               |                     |                      | 4.5<br>to<br>5.5     | —                    | —   | 0.8 | —              | 0.8  | —              | 0.8 | V     |     |    |
| "On"<br>Resistance<br>I <sub>O</sub> = 1 mA<br>R <sub>ON</sub><br>(Fig. 15)                                                   | V <sub>CC</sub><br>or<br>V <sub>EE</sub><br>to<br>V <sub>EE</sub>                                                                                                                                                                                                                                   | V <sub>IL</sub><br>or<br>V <sub>IH</sub> |                      | 0                    | 4.5                | —   | 70  | 160           | —   | 200            | —   | 240                           | Same<br>as<br>HC    | Same<br>as<br>HC     |                      | 0                    | 4.5 | —   | 70             | 160  | —              | 200 | —     | 240 | Ω  |
|                                                                                                                               |                                                                                                                                                                                                                                                                                                     |                                          |                      | 0                    | 8                  | —   | 60  | 140           | —   | 175            | —   | 210                           |                     |                      |                      | —                    | —   | —   | —              | —    | —              | —   | —     | —   | Ω  |
|                                                                                                                               |                                                                                                                                                                                                                                                                                                     |                                          |                      | -4.5                 | 4.5                | —   | 40  | 120           | —   | 150            | —   | 180                           |                     |                      |                      | -4.5                 | 4.5 | —   | 40             | 120  | —              | 150 | —     | 180 | Ω  |
|                                                                                                                               |                                                                                                                                                                                                                                                                                                     |                                          |                      | 0                    | 4.5                | —   | 90  | 180           | —   | 225            | —   | 270                           |                     |                      |                      | 0                    | 4.5 | —   | 90             | 180  | —              | 225 | —     | 270 | Ω  |
|                                                                                                                               |                                                                                                                                                                                                                                                                                                     |                                          |                      | 0                    | 8                  | —   | 80  | 160           | —   | 200            | —   | 240                           |                     |                      |                      | —                    | —   | —   | —              | —    | —              | —   | —     | —   | Ω  |
|                                                                                                                               |                                                                                                                                                                                                                                                                                                     |                                          |                      | -4.5                 | 4.5                | —   | 45  | 130           | —   | 162            | —   | 195                           |                     |                      |                      | -4.5                 | 4.5 | —   | 45             | 130  | —              | 162 | —     | 195 | Ω  |
| Maximum "On"<br>Resistance<br>between any<br>two channels<br>ΔR <sub>ON</sub>                                                 |                                                                                                                                                                                                                                                                                                     |                                          |                      | 0                    | 4.5                | —   | 10  | —             | —   | —              | —   | —                             |                     |                      |                      | 0                    | 4.5 | —   | 10             | —    | —              | —   | —     | —   | Ω  |
|                                                                                                                               |                                                                                                                                                                                                                                                                                                     |                                          |                      | 0                    | 6                  | —   | 8.5 | —             | —   | —              | —   | —                             |                     |                      |                      | —                    | —   | —   | —              | —    | —              | —   | —     | —   | Ω  |
|                                                                                                                               |                                                                                                                                                                                                                                                                                                     |                                          |                      | -4.5                 | 4.5                | —   | 5   | —             | —   | —              | —   | —                             |                     |                      |                      | -4.5                 | 4.5 | —   | 6              | —    | —              | —   | —     | —   | Ω  |
| Switch On/Off<br>Leakage<br>Current I <sub>LZ</sub><br>1&2 Channels<br>(4053)<br>4 Channels<br>(4052)<br>8 Channels<br>(4051) | For Switch<br>OFF:<br>When V <sub>IS</sub> =V <sub>CC</sub><br>V <sub>OE</sub> = V <sub>EE</sub> ;<br>When V <sub>IS</sub> =V <sub>EE</sub> ,<br>V <sub>OE</sub> = V <sub>CC</sub><br>For Switch<br>ON:<br>All Applicable<br>Combinations<br>of V <sub>IS</sub> & V <sub>OE</sub><br>Voltage Levels | V <sub>IL</sub><br>or<br>V <sub>IH</sub> |                      | 0                    | 8                  | —   | —   | ±0.1          | —   | ±1             | —   | ±1                            |                     |                      |                      | 0                    | 8   | —   | —              | ±0.1 | —              | ±1  | —     | ±1  | μA |
|                                                                                                                               |                                                                                                                                                                                                                                                                                                     |                                          |                      | -5                   | 5                  | —   | —   | ±0.1          | —   | ±1             | —   | ±1                            |                     |                      |                      | -5                   | 5   | —   | —              | ±0.1 | —              | ±1  | —     | ±1  | μA |
|                                                                                                                               |                                                                                                                                                                                                                                                                                                     |                                          |                      | 0                    | 8                  | —   | —   | ±0.1          | —   | ±1             | —   | ±1                            |                     |                      |                      | 0                    | 8   | —   | —              | ±0.1 | —              | ±1  | —     | ±1  | μA |
|                                                                                                                               |                                                                                                                                                                                                                                                                                                     |                                          |                      | -5                   | 5                  | —   | —   | ±0.2          | —   | ±2             | —   | ±2                            |                     |                      |                      | -5                   | 5   | —   | —              | ±0.2 | —              | ±2  | —     | ±2  | μA |
|                                                                                                                               |                                                                                                                                                                                                                                                                                                     |                                          |                      | 0                    | 8                  | —   | —   | ±0.2          | —   | ±2             | —   | ±2                            |                     |                      |                      | 0                    | 8   | —   | —              | ±0.2 | —              | ±2  | —     | ±2  | μA |
|                                                                                                                               |                                                                                                                                                                                                                                                                                                     |                                          |                      | -5                   | 5                  | —   | —   | ±0.4          | —   | ±4             | —   | ±4                            |                     |                      |                      | -5                   | 5   | —   | —              | ±0.4 | —              | ±4  | —     | ±4  | μA |
| Control Input<br>Leakage<br>Current I <sub>IL</sub>                                                                           | —                                                                                                                                                                                                                                                                                                   | V <sub>CC</sub><br>or<br>Gnd             |                      | 0                    | 8                  | —   | —   | ±0.1          | —   | ±1             | —   | ±1                            | —                   | **                   |                      | 5.5                  | —   | —   | ±0.1           | —    | ±1             | —   | ±1    | μA  |    |
| Quiescent<br>Device<br>Current I <sub>CC</sub><br>I <sub>O</sub> = 0                                                          | When<br>V <sub>IS</sub> = V <sub>EE</sub> ,<br>V <sub>OE</sub> = V <sub>CC</sub> ,<br>When<br>V <sub>IS</sub> = V <sub>CC</sub> ,<br>V <sub>OE</sub> = V <sub>EE</sub>                                                                                                                              | V <sub>CC</sub><br>or<br>Gnd             |                      | 0                    | 8                  | —   | —   | 8             | —   | 80             | —   | 160                           | Same<br>as<br>HC    | Same<br>as<br>HC     |                      | 0                    | 5.5 | —   | —              | 8    | —              | 80  | —     | 160 | μA |
|                                                                                                                               |                                                                                                                                                                                                                                                                                                     |                                          |                      | -5                   | 5                  | —   | —   | 16            | —   | 160            | —   | 320                           |                     |                      |                      | -4.5                 | 5.5 | —   | —              | 16   | —              | 160 | —     | 320 | μA |
| Additional<br>Quiescent<br>Device<br>Current<br>per input pin,<br>1 unit load<br>ΔI <sub>CC</sub> *                           |                                                                                                                                                                                                                                                                                                     |                                          |                      |                      |                    |     |     |               |     |                |     |                               |                     | V <sub>CC</sub> -2.1 |                      | 4.5<br>to<br>5.5     | —   | 100 | 360            | —    | 450            | —   | 490   | μA  |    |

\* For dual-supply systems theoretical worst case ( $V_I = 2.4$  V,  $V_{CC} = 5.5$  V) specifications is 1.8 mA.

\*\* Any voltage between  $V_{CC}$  & Gnd.

HCT Input Loading Table

| Type       | Input | Unit Loads* |
|------------|-------|-------------|
| 4051, 4053 | All   | 0.5         |
| 4052       | All   | 0.4         |

\*Unit Load is  $\Delta I_{CC}$  limit specified in Static Characteristics Chart, e.g., 360  $\mu$ A max. @ 25°C.

**CD54/74HC4051, CD54/74HCT4051**  
**CD54/74HC4052, CD54/74HCT4052**  
**CD54/74HC4053, CD54/74HCT4053**

SWITCHING CHARACTERISTICS ( $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$ , Input  $t_i$ ,  $t_r = 6\text{ ns}$ )

| CHARACTERISTIC                    | SYMBOL                              | C <sub>L</sub><br>pF | Typical |     |      |     |      |     | UNITS |
|-----------------------------------|-------------------------------------|----------------------|---------|-----|------|-----|------|-----|-------|
|                                   |                                     |                      | 4051    |     | 4052 |     | 4053 |     |       |
|                                   |                                     |                      | HC      | HCT | HC   | HCT | HC   | HCT |       |
| Propagation Delay                 | t <sub>FHL</sub>                    | 15                   | 4       | 4   | 4    | 4   | 4    | 4   | ns    |
| Switch IN to OUT                  | t <sub>PLH</sub>                    |                      |         |     |      |     |      |     |       |
| Switch Turn-off (S or $\bar{E}$ ) | t <sub>PHZ</sub> , t <sub>PLZ</sub> | 15                   | 19      | 19  | 21   | 21  | 18   | 18  | ns    |
| Switch Turn-on (S or $\bar{E}$ )  | t <sub>PZH</sub> , t <sub>PZL</sub> | 15                   | 19      | 23  | 27   | 29  | 18   | 20  | ns    |
| Power Dissipation Capacitance*    | C <sub>PD</sub>                     | —                    | 50      | 52  | 74   | 76  | 38   | 42  | pF    |

\* $C_{PD}$  is used to determine the dynamic power consumption, per package.

$$P_D = C_{PD} V_{CC}^2 f_i + \sum (C_L + C_S) V_{CC}^2 f_o$$

$f_o$  = output frequency

$f_i$  = input frequency

$C_L$  = output load capacitance

$C_S$  = switch capacitance

$V_{CC}$  = supply voltage.

SWITCHING CHARACTERISTICS ( $C_L = 50\text{ pF}$ , Input  $t_i$ ,  $t_r = 6\text{ ns}$ )

| CHARACTERISTIC                                                                 | SYMBOL                               | V <sub>EE</sub>     | V <sub>CC</sub>      | 25°C             |                     |                  |                   | -40°C to +85°C   |                      |                   |                    | -55°C to +125°C   |                      |                   |                    | UNITS |  |
|--------------------------------------------------------------------------------|--------------------------------------|---------------------|----------------------|------------------|---------------------|------------------|-------------------|------------------|----------------------|-------------------|--------------------|-------------------|----------------------|-------------------|--------------------|-------|--|
|                                                                                |                                      |                     |                      | HC               |                     | HCT              |                   | 74HC             |                      | 74HCT             |                    | 54HC              |                      | 54HCT             |                    |       |  |
|                                                                                |                                      |                     |                      | Min.             | Max.                | Min.             | Max.              | Min.             | Max.                 | Min.              | Max.               | Min.              | Max.                 | Min.              | Max.               |       |  |
| Propagation Delay,<br>Switch In to Out                                         | t <sub>PLH</sub><br>t <sub>PHL</sub> | 0<br>0<br>0<br>-4.5 | 2<br>4.5<br>6<br>4.5 | —<br>—<br>—<br>— | 60<br>12<br>10<br>8 | —<br>—<br>—<br>— | —<br>12<br>—<br>8 | —<br>—<br>—<br>— | 75<br>15<br>13<br>10 | —<br>—<br>—<br>10 | —<br>15<br>—<br>10 | —<br>—<br>—<br>12 | 90<br>18<br>15<br>12 | —<br>—<br>—<br>12 | —<br>18<br>—<br>12 | ns    |  |
| Maximum<br>Switch<br>Turn "Off"<br>Delay from<br>S or E to<br>Switch<br>Output | t <sub>PHZ</sub><br>t <sub>PLZ</sub> | 0                   | 2                    | —                | 225                 | —                | —                 | —                | 280                  | —                 | —                  | —                 | 340                  | —                 | —                  |       |  |
|                                                                                |                                      | 0                   | 4.5                  | —                | 45                  | —                | 45                | —                | 56                   | —                 | 56                 | —                 | 68                   | —                 | 68                 |       |  |
|                                                                                |                                      | 0                   | 6                    | —                | 38                  | —                | —                 | —                | 48                   | —                 | —                  | —                 | 57                   | —                 | —                  |       |  |
|                                                                                |                                      | -4.5                | 4.5                  | —                | 32                  | —                | 32                | —                | 40                   | —                 | 40                 | —                 | 48                   | —                 | 48                 |       |  |
|                                                                                |                                      | 0                   | 2                    | —                | 250                 | —                | —                 | —                | 315                  | —                 | —                  | —                 | 375                  | —                 | —                  |       |  |
|                                                                                |                                      | 0                   | 4.5                  | —                | 50                  | —                | 50                | —                | 63                   | —                 | 63                 | —                 | 75                   | —                 | 75                 |       |  |
|                                                                                |                                      | 0                   | 6                    | —                | 43                  | —                | —                 | —                | 54                   | —                 | —                  | —                 | 65                   | —                 | —                  |       |  |
|                                                                                |                                      | -4.5                | 4.5                  | —                | 38                  | —                | 38                | —                | 48                   | —                 | 48                 | —                 | 57                   | —                 | 57                 |       |  |
| Maximum<br>Switch<br>Turn "On"<br>Delay from<br>S or E to<br>Switch<br>Output  | t <sub>PZH</sub><br>t <sub>PZL</sub> | 0                   | 2                    | —                | 210                 | —                | —                 | —                | 265                  | —                 | —                  | —                 | 315                  | —                 | —                  |       |  |
|                                                                                |                                      | 0                   | 4.5                  | —                | 42                  | —                | 44                | —                | 53                   | —                 | 55                 | —                 | 63                   | —                 | 66                 |       |  |
|                                                                                |                                      | 0                   | 6                    | —                | 36                  | —                | —                 | —                | 45                   | —                 | —                  | —                 | 54                   | —                 | —                  |       |  |
|                                                                                |                                      | -4.5                | 4.5                  | —                | 29                  | —                | 31                | —                | 36                   | —                 | 39                 | —                 | 44                   | —                 | 47                 |       |  |
|                                                                                |                                      | 0                   | 2                    | —                | 225                 | —                | —                 | —                | 280                  | —                 | —                  | —                 | 340                  | —                 | —                  |       |  |
|                                                                                |                                      | 0                   | 4.5                  | —                | 45                  | —                | 55                | —                | 56                   | —                 | 69                 | —                 | 68                   | —                 | 83                 |       |  |
| Input (Control)<br>Capacitance                                                 | C <sub>i</sub>                       | 0                   | 6                    | —                | 38                  | —                | —                 | —                | 48                   | —                 | —                  | —                 | 57                   | —                 | —                  | pF    |  |
|                                                                                |                                      | -4.5                | 4.5                  | —                | 32                  | —                | 39                | —                | 40                   | —                 | 49                 | —                 | 48                   | —                 | 59                 |       |  |
|                                                                                |                                      | 0                   | 2                    | —                | 325                 | —                | —                 | —                | 405                  | —                 | —                  | —                 | 490                  | —                 | —                  |       |  |
|                                                                                |                                      | 0                   | 4.5                  | —                | 65                  | —                | 70                | —                | 81                   | —                 | 68                 | —                 | 98                   | —                 | 105                |       |  |
|                                                                                |                                      | 0                   | 6                    | —                | 55                  | —                | —                 | —                | 69                   | —                 | —                  | —                 | 83                   | —                 | —                  |       |  |
|                                                                                |                                      | -4.5                | 4.5                  | —                | 46                  | —                | 48                | —                | 58                   | —                 | 60                 | —                 | 69                   | —                 | 72                 |       |  |
|                                                                                |                                      | 0                   | 2                    | —                | 220                 | —                | —                 | —                | 275                  | —                 | —                  | —                 | 330                  | —                 | —                  |       |  |
|                                                                                |                                      | 0                   | 4.5                  | —                | 44                  | —                | 48                | —                | 55                   | —                 | 60                 | —                 | 66                   | —                 | 72                 |       |  |
|                                                                                |                                      | 0                   | 6                    | —                | 37                  | —                | —                 | —                | 47                   | —                 | —                  | —                 | 56                   | —                 | —                  |       |  |
|                                                                                |                                      | -4.5                | 4.5                  | —                | 31                  | —                | 34                | —                | 39                   | —                 | 43                 | —                 | 47                   | —                 | 51                 |       |  |

**CD54/74HC4051, CD54/74HCT4051**  
**CD54/74HC4052, CD54/74HCT4052**  
**CD54/74HC4053, CD54/74HCT4053**

**ANALOG CHANNEL CHARACTERISTICS — TYPICAL VALUES AT  $T_A = 25^\circ\text{C}$**

| CHARACTERISTIC                                                   | SYMBOL    | CONDITIONS                | TYPES                                        | $V_{EE}$ (V)          | $V_{CC}$ (V)        | HC/HCT                                         | UNITS |
|------------------------------------------------------------------|-----------|---------------------------|----------------------------------------------|-----------------------|---------------------|------------------------------------------------|-------|
| Switch Input Capacitance                                         | $C_i$     |                           | All                                          |                       |                     | 5                                              | pF    |
| Common Capacitance                                               | $C_{COM}$ |                           | 4051<br>4052<br>4053                         |                       |                     | 25<br>12<br>8                                  |       |
| Minimum Switch Frequency<br>Response @ -3 dB<br>Figs. 11, 13, 15 | $f_{MAX}$ | See Fig. 6<br>Notes 1, 2  | 4051<br>4052<br>4053<br>4051<br>4052<br>4053 | -2.25<br><br><br>-4.5 | 2.25<br><br><br>4.5 | 145<br>165<br>200<br>180<br>185<br>>200        | MHz   |
| Crosstalk Between<br>Any Two Switches<br>Note 4                  |           | See Fig. 7<br>Notes 2, 3  | 4051<br>4052<br>4053<br>4051<br>4052<br>4053 | -2.25<br><br><br>-4.5 | 2.25<br><br><br>4.5 | N/A<br>(TBE)<br>(TBE)<br>N/A<br>(TBE)<br>(TBE) | dB    |
| Sine-Wave Distortion                                             |           | See Fig. 8                | All<br>All                                   | -2.25<br>-4.5         | 2.25<br>4.5         | 0.035<br>0.018                                 | %     |
| $\bar{E}$ or S to Switch<br>Feedthrough Noise                    |           | See Fig. 9<br>Notes 2, 3  | 4051<br>4052<br>4053<br>4051<br>4052<br>4053 | -2.25<br><br><br>-4.5 | 2.25<br><br><br>4.5 | (TBE)<br><br><br>(TBE)                         | mV    |
| Switch "OFF"<br>Signal Feedthrough<br>Figs. 12, 14, 16           |           | See Fig. 10<br>Notes 2, 3 | 4051<br>4052<br>4053<br>4051<br>4052<br>4053 | -2.25<br><br><br>-4.5 | 2.25<br><br><br>4.5 | -73<br>-65<br>-64<br>-75<br>-67<br>-66         | dB    |

**Notes:**

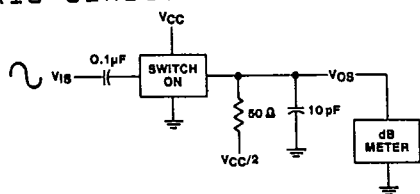
1. Adjust input voltage to obtain OdBm @  $V_{OS}$  for  $f_{in} = 1$  MHz.
2.  $V_{IS}$  is centered at  $(V_{CC} - V_{EE})/2$ .
3. Adjust input for OdBm.
4. Not applicable for HC/HCT4051.

**CD54/74HC4051, CD54/74HCT4051**  
**CD54/74HC4052, CD54/74HCT4052**  
**CD54/74HC4053, CD54/74HCT4053**

T-51-12

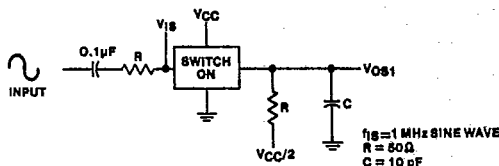
HARRIS SEMICONDUCTOR

27E D 4302271 0017927 3 HAS



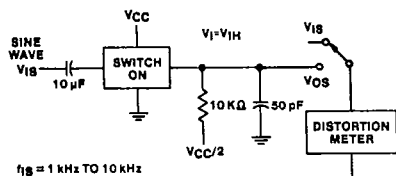
92CS-39354

Fig. 6 - Frequency response test circuit.



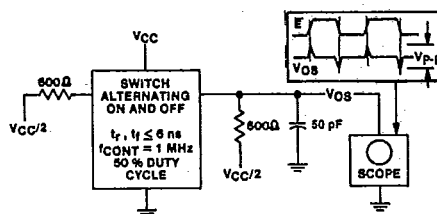
92CS-39355

Fig. 7 - Crosstalk between two switches test circuit.



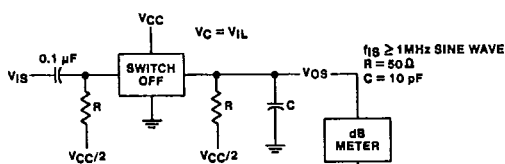
92CS-39356R1

Fig. 8 - Sine wave distortion test circuit.



92CS-39352

Fig. 9 - Control-to-switch feedthrough noise test circuit.



92CS-39353

Fig. 10 - Switch off signal feedthrough.

# CD54/74HC4051, CD54/74HCT4051 CD54/74HC4052, CD54/74HCT4052 CD54/74HC4053, CD54/74HCT4053

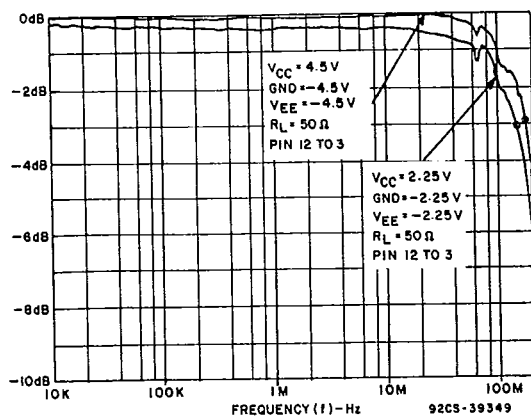


Fig. 11 - Channel on bandwidth (HC/HCT4051).

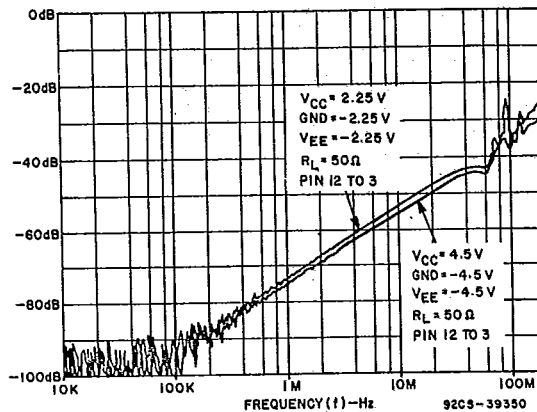


Fig. 12 - Channel off feedthrough (HC/HCT4051).

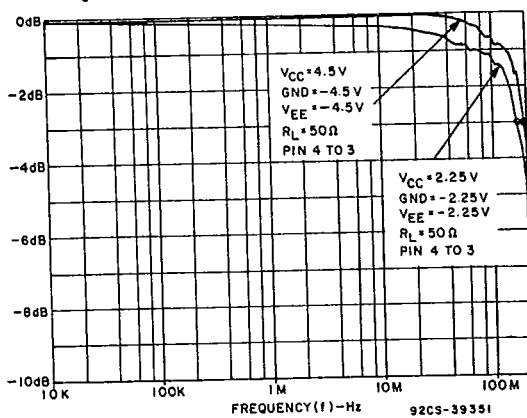


Fig. 13 - Channel on bandwidth (HC/HCT4052).

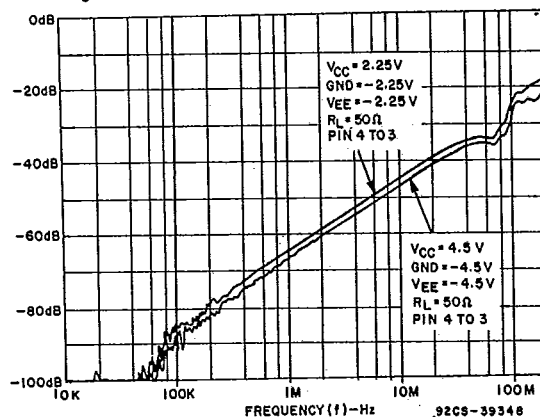


Fig. 14 - Channel off feedthrough (HC/HCT4052).

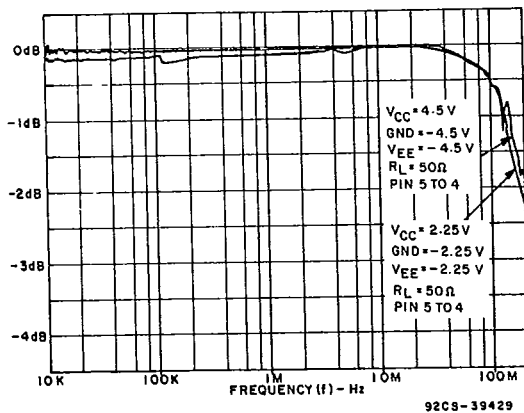


Fig. 15 - Channel on bandwidth (HC/HCT4053).

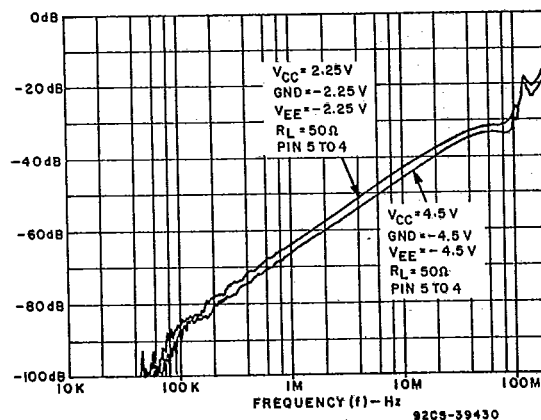


Fig. 16 - Channel off feedthrough (HC/HCT4053).



T-51-12

CD54/74HC4051, CD54/74HCT4051  
CD54/74HC4052, CD54/74HCT4052  
CD54/74HC4053, CD54/74HCT4053

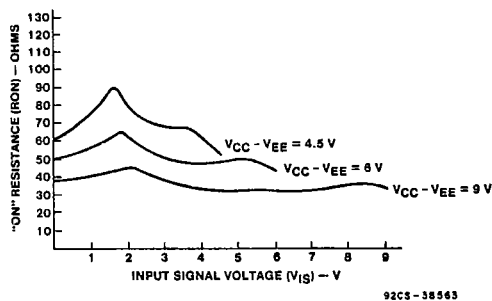
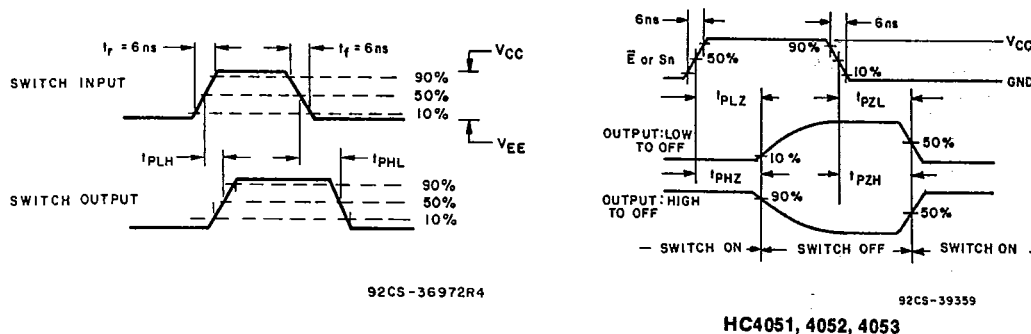
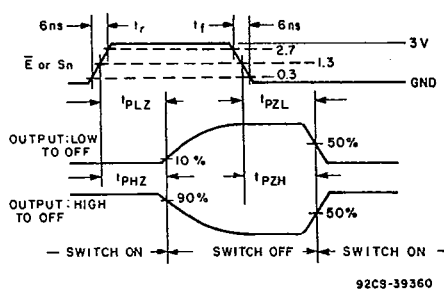


Fig. 17 - Typical ON resistance vs. Input signal voltage.



HC4051, 4052, 4053



HCT4051, 4052, 4053

Fig. 18 - Switch propagation delay, turn-on, turn-off times.

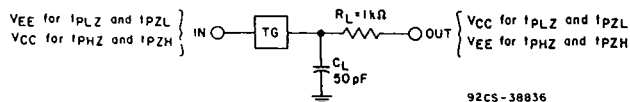


Fig. 19 - Switch on/off propagation delay test circuit.

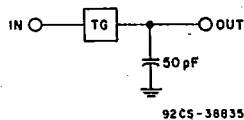


Fig. 20 - Switch In to Switch Out Propagation delay test circuit.