

DATA SHEET

74HC4052; 74HCT4052

**Dual 4-channel analog multiplexer,
demultiplexer**

Product specification
Supersedes data of 2003 May 16

2004 Nov 11

Dual 4-channel analog multiplexer, demultiplexer

74HC4052; 74HCT4052

FEATURES

- Wide analog input voltage range from -5 V to $+5\text{ V}$
- Low ON-resistance:
 - $80\ \Omega$ (typical) at $V_{CC} - V_{EE} = 4.5\text{ V}$
 - $70\ \Omega$ (typical) at $V_{CC} - V_{EE} = 6.0\text{ V}$
 - $60\ \Omega$ (typical) at $V_{CC} - V_{EE} = 9.0\text{ V}$
- Logic level translation: to enable 5 V logic to communicate with $\pm 5\text{ V}$ analog signals
- Typical “break before make” built in
- Complies with JEDEC standard no. 7A
- ESD protection:
 - HBM EIA/JESD22-A114-B exceeds 2000 V
 - MM EIA/JESD22-A115-A exceeds 200 V .
- Specified from $-40\text{ }^\circ\text{C}$ to $+85\text{ }^\circ\text{C}$ and $-40\text{ }^\circ\text{C}$ to $+125\text{ }^\circ\text{C}$.

APPLICATIONS

- Analog multiplexing and demultiplexing
- Digital multiplexing and demultiplexing
- Signal gating.

DESCRIPTION

The 74HC4052 and 74HCT4052 are high-speed Si-gate CMOS devices and are pin compatible with the HEF4052B. They are specified in compliance with JEDEC standard no. 7A.

The 74HC4052 and 74HCT4052 are dual 4-channel analog multiplexers or demultiplexers with common select logic. Each multiplexer has four independent inputs/outputs (pins nY0 to nY3) and a common input/output (pin nZ). The common channel select logics include two digital select inputs (pins S0 and S1) and an active LOW enable input (pin \bar{E}). When pin $\bar{E} = \text{LOW}$, one of the four switches is selected (low-impedance ON-state) with pins S0 and S1. When pin $\bar{E} = \text{HIGH}$, all switches are in the high-impedance OFF-state, independent of pins S0 and S1.

V_{CC} and GND are the supply voltage pins for the digital control inputs (pins S0, S1, and \bar{E}). The V_{CC} to GND ranges are 2.0 V to 10.0 V for 74HC4052 and 4.5 V to 5.5 V for 74HCT4052. The analog inputs/outputs (pins nY0 to nY3 and nZ) can swing between V_{CC} as a positive limit and V_{EE} as a negative limit. $V_{CC} - V_{EE}$ may not exceed 10.0 V .

For operation as a digital multiplexer/demultiplexer, V_{EE} is connected to GND (typically ground).

FUNCTION TABLE

| INPUT ⁽¹⁾ | | | CHANNEL BETWEEN |
|----------------------|----|----|-----------------|
| \bar{E} | S1 | S0 | |
| L | L | L | nY0 and nZ |
| L | L | H | nY1 and nZ |
| L | H | L | nY2 and nZ |
| L | H | H | nY3 and nZ |
| H | X | X | none |

Note

1. H = HIGH voltage level
L = LOW voltage level
X = don't care.

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QUICK REFERENCE DATA

 $V_{EE} = GND = 0\text{ V}$; $T_{amb} = 25\text{ °C}$; $t_r = t_f = 6\text{ ns}$.

| SYMBOL | PARAMETER | CONDITIONS | TYPICAL | | UNIT |
|-------------------|---|--|----------|-----------|------|
| | | | 74HC4052 | 74HCT4052 | |
| t_{PZH}/t_{PZL} | turn-on time \bar{E} or Sn to V_{OS} | $C_L = 15\text{ pF}$; $R_L = 1\text{ k}\Omega$; $V_{CC} = 5\text{ V}$ | 28 | 18 | ns |
| t_{PHZ}/t_{PLZ} | turn-off time \bar{E} or Sn to V_{OS} | $C_L = 15\text{ pF}$; $R_L = 1\text{ k}\Omega$; $V_{CC} = 5\text{ V}$ | 21 | 13 | ns |
| C_I | input capacitance | | 3.5 | 3.5 | pF |
| C_{PD} | power dissipation capacitance per switch | notes 1 and 2 | 57 | 57 | pF |
| C_S | maximum switch capacitance | independent (Y) | 5 | 5 | pF |
| | | common (Z) | 12 | 12 | pF |

Notes

- C_{PD} is used to determine the dynamic power dissipation (P_D in μW).

$$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma[(C_L + C_S) \times V_{CC}^2 \times f_o] \text{ where:}$$

f_i = input frequency in MHz;

f_o = output frequency in MHz;

C_L = output load capacitance in pF;

C_S = maximum switch capacitance in pF;

V_{CC} = supply voltage in Volts;

N = number of inputs switching;

$\Sigma[(C_L + C_S) \times V_{CC}^2 \times f_o]$ = sum of the outputs.

- For 74HC4052 the condition is $V_I = GND$ to V_{CC}

For 74HCT4052 the condition is $V_I = GND$ to $V_{CC} - 1.5\text{ V}$.

ORDERING INFORMATION

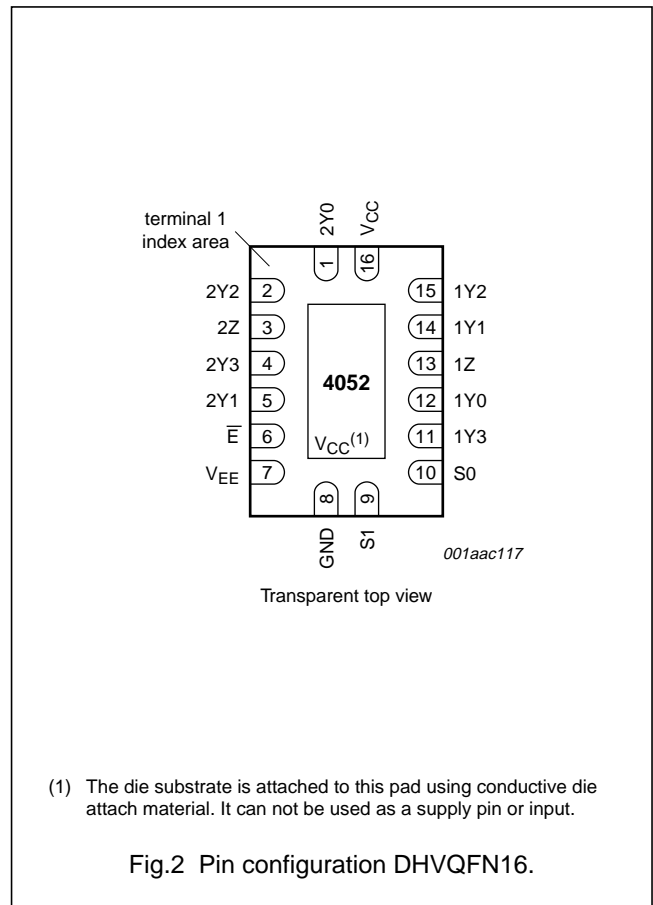
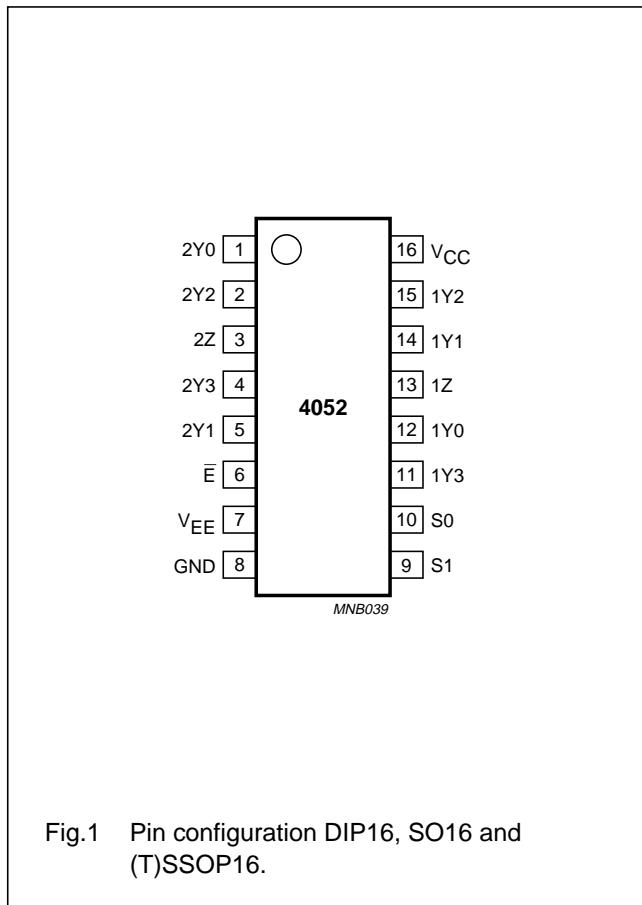
| TYPE NUMBER | PACKAGE | | | | |
|-------------|-------------------|------|----------|----------|----------|
| | TEMPERATURE RANGE | PINS | PACKAGE | MATERIAL | CODE |
| 74HC4052D | -40 °C to +125 °C | 16 | SO16 | plastic | SOT109-3 |
| 74HCT4052D | -40 °C to +125 °C | 16 | SO16 | plastic | SOT109-3 |
| 74HC4052DB | -40 °C to +125 °C | 16 | SSOP16 | plastic | SOT338-1 |
| 74HCT4052DB | -40 °C to +125 °C | 16 | SSOP16 | plastic | SOT338-1 |
| 74HC4052N | -40 °C to +125 °C | 16 | DIP16 | plastic | SOT38-9 |
| 74HCT4052N | -40 °C to +125 °C | 16 | DIP16 | plastic | SOT38-9 |
| 74HC4052PW | -40 °C to +125 °C | 16 | TSSOP16 | plastic | SOT403-1 |
| 74HC4052BQ | -40 °C to +125 °C | 16 | DHVQFN16 | plastic | SOT763-1 |
| 74HCT4052BQ | -40 °C to +125 °C | 16 | DHVQFN16 | plastic | SOT763-1 |

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PINNING

| PIN | SYMBOL | DESCRIPTION |
|-----|-----------|-----------------------------|
| 1 | 2Y0 | independent input or output |
| 2 | 2Y2 | independent input or output |
| 3 | 2Z | common input or output |
| 4 | 2Y3 | independent input or output |
| 5 | 2Y1 | independent input or output |
| 6 | \bar{E} | enable input (active LOW) |
| 7 | V_{EE} | negative supply voltage |
| 8 | GND | ground (0 V) |
| 9 | S1 | select logic input |
| 10 | S0 | select logic input |
| 11 | 1Y3 | independent input or output |
| 12 | 1Y0 | independent input or output |
| 13 | 1Z | common input or output |
| 14 | 1Y1 | independent input or output |
| 15 | 1Y2 | independent input or output |
| 16 | V_{CC} | positive supply voltage |



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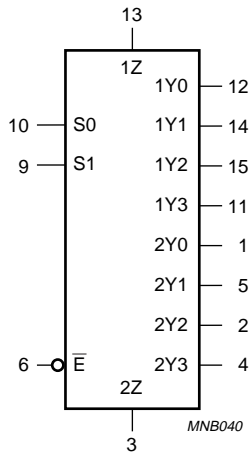


Fig.3 Logic symbol.

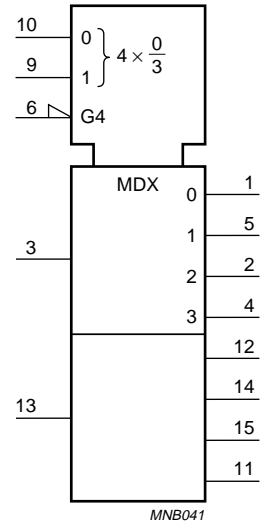


Fig.4 IEC logic symbol.

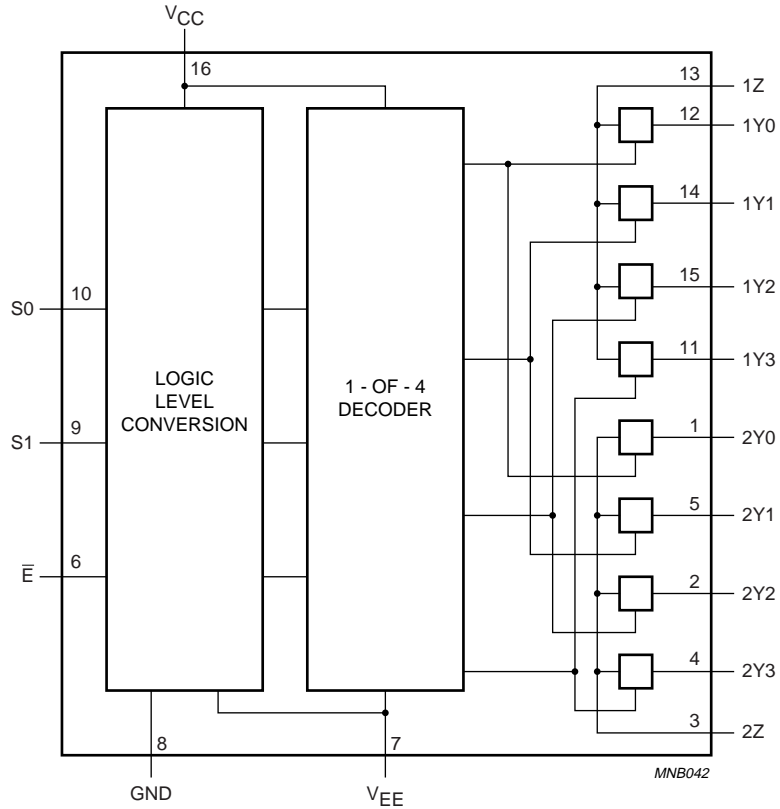
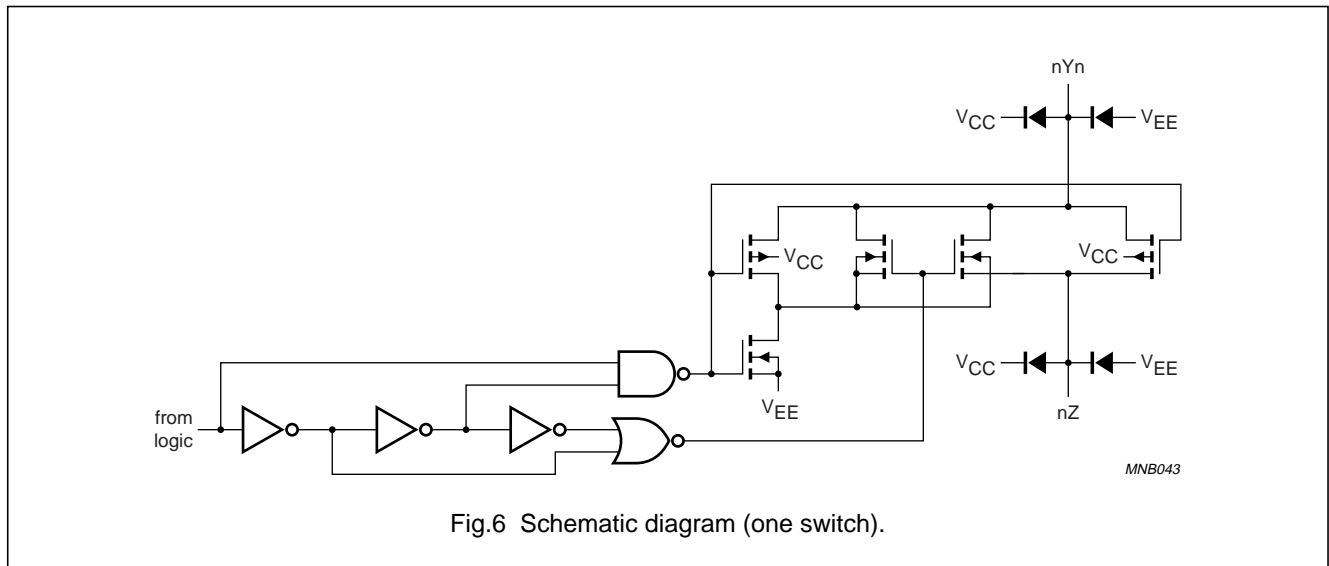


Fig.5 Functional diagram.

Dual 4-channel analog multiplexer,
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**LIMITING VALUES**

In accordance with the Absolute Maximum Rating System (IEC 60134); voltages are referenced to $V_{EE} = \text{GND}$ (ground = 0 V); note 1.

| SYMBOL | PARAMETER | CONDITIONS | MIN. | MAX. | UNIT |
|-------------------|------------------------------|--|------|----------|--------------------|
| V_{CC} | supply voltage | | -0.5 | +11.0 | V |
| I_{IK} | input diode current | $V_I < -0.5 \text{ V}$ or $V_I > V_{CC} + 0.5 \text{ V}$ | - | ± 20 | mA |
| I_{SK} | switch diode current | $V_S < -0.5 \text{ V}$ or $V_S > V_{CC} + 0.5 \text{ V}$ | - | ± 20 | mA |
| I_S | switch current | $-0.5 \text{ V} < V_S < V_{CC} + 0.5 \text{ V}$ | - | ± 25 | mA |
| I_{EE} | V_{EE} current | | - | ± 20 | mA |
| $I_{CC}; I_{GND}$ | V_{CC} or GND current | | - | ± 50 | mA |
| T_{stg} | storage temperature | | -65 | +150 | $^{\circ}\text{C}$ |
| P_{tot} | power dissipation | $T_{amb} = -40 \text{ }^{\circ}\text{C}$ to $+125 \text{ }^{\circ}\text{C}$; note | - | 500 | mW |
| P_S | power dissipation per switch | | - | 100 | mW |

Notes

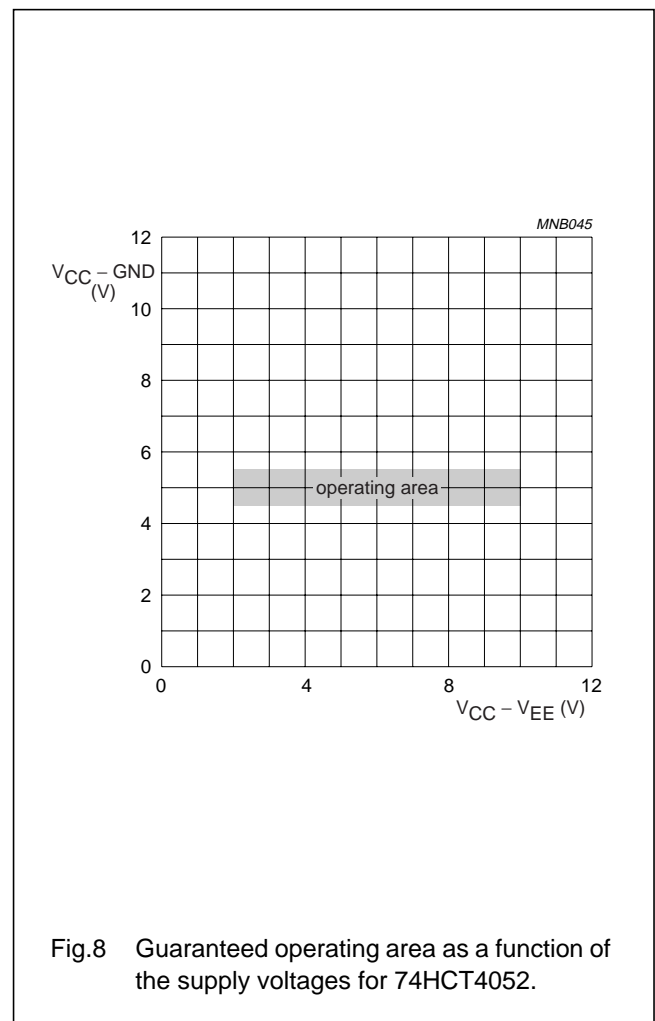
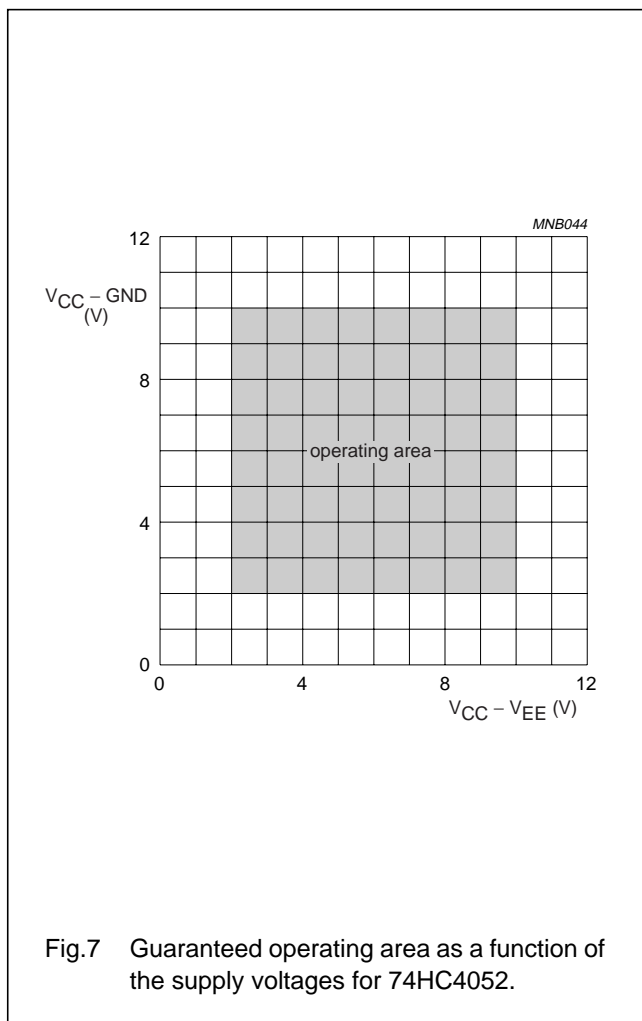
- To avoid drawing V_{CC} current out of pins nZ, when switch current flows in pins nYn, the voltage drop across the bidirectional switch must not exceed 0.4 V. If the switch current flows into pins nZ, no V_{CC} current will flow out of pins nYn. In this case there is no limit for the voltage drop across the switch, but the voltages at pins nYn and nZ may not exceed V_{CC} or V_{EE} .
- For DIP16 packages: above 70 $^{\circ}\text{C}$ derate linearly with 12 mW/K.
For SO16 packages: above 70 $^{\circ}\text{C}$ derate linearly with 8 mW/K.
For SSOP16 and TSSOP16 packages: above 60 $^{\circ}\text{C}$ derate linearly with 5.5 mW/K.
For DHVQFN16 packages: above 60 $^{\circ}\text{C}$ derate linearly with 4.5 mW/K.

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RECOMMENDED OPERATING CONDITIONS

| SYMBOL | PARAMETER | CONDITIONS | 74HC4052 | | | 74HCT4052 | | | UNIT |
|------------|-------------------------------|--|----------|------|----------|-----------|------|----------|------|
| | | | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. | |
| V_{CC} | supply voltage | see Figs 7 and 8 | | | | | | | |
| | | $V_{CC} - GND$ | 2.0 | 5.0 | 10.0 | 4.5 | 5.0 | 5.5 | V |
| | | $V_{CC} - V_{EE}$ | 2.0 | 5.0 | 10.0 | 2.0 | 5.0 | 10.0 | V |
| V_I | input voltage | | GND | – | V_{CC} | GND | – | V_{CC} | V |
| V_S | switch voltage | | V_{EE} | – | V_{CC} | V_{EE} | – | V_{CC} | V |
| T_{amb} | operating ambient temperature | see DC and AC characteristics per device | –40 | +25 | +85 | –40 | +25 | +85 | °C |
| | | | –40 | – | +125 | –40 | – | +125 | °C |
| t_r, t_f | input rise and fall times | $V_{CC} = 2.0\text{ V}$ | – | 6.0 | 1000 | – | 6.0 | 500 | ns |
| | | $V_{CC} = 4.5\text{ V}$ | – | 6.0 | 500 | – | 6.0 | 500 | ns |
| | | $V_{CC} = 6.0\text{ V}$ | – | 6.0 | 400 | – | 6.0 | 500 | ns |
| | | $V_{CC} = 10.0\text{ V}$ | – | 6.0 | 250 | – | 6.0 | 500 | ns |



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DC CHARACTERISTICS

Family 74HC4052

V_{is} is the input voltage at pins nYn or nZ, whichever is assigned as an input; V_{os} is the output voltage at pins nZ or nYn, whichever is assigned as an output; voltages are referenced to GND (ground = 0 V).

| SYMBOL | PARAMETER | TEST CONDITIONS | | | MIN. | TYP. | MAX. | UNIT |
|---|---------------------------------|--|--------------|--------------|------|------|-----------|---------------|
| | | OTHER | V_{CC} (V) | V_{EE} (V) | | | | |
| $T_{amb} = -40\text{ }^{\circ}\text{C to }+85\text{ }^{\circ}\text{C}$; note 1 | | | | | | | | |
| V_{IH} | HIGH-level input voltage | | 2.0 | – | 1.5 | 1.2 | – | V |
| | | | 4.5 | – | 3.15 | 2.4 | – | V |
| | | | 6.0 | – | 4.2 | 3.2 | – | V |
| | | | 9.0 | – | 6.3 | 4.7 | – | V |
| V_{IL} | LOW-level input voltage | | 2.0 | – | – | 0.8 | 0.5 | V |
| | | | 4.5 | – | – | 2.1 | 1.35 | V |
| | | | 6.0 | – | – | 2.8 | 1.8 | V |
| | | | 9.0 | – | – | 4.3 | 2.7 | V |
| I_{LI} | input leakage current | $V_I = V_{CC}$ or GND | 6.0 | 0 | – | – | ± 1.0 | μA |
| | | | 10.0 | 0 | – | – | ± 2.0 | μA |
| $I_{S(OFF)}$ | analog switch OFF-state current | $V_I = V_{IH}$ or V_{IL} ; $ M_S = V_{CC} - V_{EE}$; see Fig.9 per channel all channels | 10.0 | 0 | – | – | ± 1.0 | μA |
| | | | 10.0 | 0 | – | – | ± 2.0 | μA |
| $I_{S(ON)}$ | analog switch ON-state current | $V_I = V_{IH}$ or V_{IL} ; $ M_S = V_{CC} - V_{EE}$; see Fig.10 | 10.0 | 0 | – | – | ± 2.0 | μA |
| I_{CC} | quiescent supply current | $V_I = V_{CC}$ or GND; $V_{is} = V_{EE}$ or V_{CC} ; $V_{os} = V_{CC}$ or V_{EE} | 6.0 | 0 | – | – | 80.0 | μA |
| | | | 10.0 | 0 | – | – | 160.0 | μA |

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| SYMBOL | PARAMETER | TEST CONDITIONS | | | MIN. | TYP. | MAX. | UNIT |
|--|---------------------------------|--|---------------------|---------------------|------|------|-------|------|
| | | OTHER | V _{CC} (V) | V _{EE} (V) | | | | |
| T_{amb} = -40 °C to +125 °C | | | | | | | | |
| V _{IH} | HIGH-level input voltage | | 2.0 | – | 1.5 | – | – | V |
| | | | 4.5 | – | 3.15 | – | – | V |
| | | | 6.0 | – | 4.2 | – | – | V |
| | | | 9.0 | – | 6.3 | – | – | V |
| V _{IL} | LOW-level input voltage | | 2.0 | – | – | – | 0.5 | V |
| | | | 4.5 | – | – | – | 1.35 | V |
| | | | 6.0 | – | – | – | 1.8 | V |
| | | | 9.0 | – | – | – | 2.7 | V |
| I _{LI} | input leakage current | V _I = V _{CC} or GND | 6.0 | 0 | – | – | ±1.0 | μA |
| | | | 10.0 | 0 | – | – | ±2.0 | μA |
| I _{S(OFF)} | analog switch OFF-state current | V _I = V _{IH} or V _{IL} ; M _S = V _{CC} – V _{EE} ; see Fig.9 per channel all channels | 10.0 | 0 | – | – | ±1.0 | μA |
| | | | 10.0 | 0 | – | – | ±2.0 | μA |
| I _{S(ON)} | analog switch ON-state current | V _I = V _{IH} or V _{IL} ; M _S = V _{CC} – V _{EE} ; see Fig.10 | 10.0 | 0 | – | – | ±2.0 | μA |
| I _{CC} | quiescent supply current | V _I = V _{CC} or GND; V _{IS} = V _{EE} or V _{CC} ; V _{OS} = V _{CC} or V _{EE} | 6.0 | 0 | – | – | 160 | μA |
| | | | 10.0 | 0 | – | – | 320.0 | μA |

Note

1. All typical values are measured at T_{amb} = 25 °C.

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V_{is} is the input voltage at pins nYn or nZ, whichever is assigned as an input; V_{os} is the output voltage at pins nZ or nYn, whichever is assigned as an output; voltages are referenced to GND (ground = 0 V).

| SYMBOL | PARAMETER | TEST CONDITIONS | | | MIN. | TYP. | MAX. | UNIT |
|--|---|--|--------------|--------------|------|------|-----------|---------------|
| | | OTHER | V_{CC} (V) | V_{EE} (V) | | | | |
| $T_{amb} = -40\text{ }^{\circ}\text{C to }+85\text{ }^{\circ}\text{C}$; note 1 | | | | | | | | |
| V_{IH} | HIGH-level input voltage | | 4.5 to 5.5 | – | 2.0 | 1.6 | – | V |
| V_{IL} | LOW-level input voltage | | 4.5 to 5.5 | – | – | 1.2 | 0.8 | V |
| I_{LI} | input leakage current | $V_I = V_{CC}$ or GND | 5.5 | 0 | – | – | ± 1.0 | μA |
| $I_{S(OFF)}$ | analog switch OFF-state current | $V_I = V_{IH}$ or V_{IL} ; $ V_S = V_{CC} - V_{EE}$; see Fig.9 per channel | 10.0 | 0 | – | – | ± 1.0 | μA |
| | | | 10.0 | 0 | – | – | ± 2.0 | μA |
| $I_{S(ON)}$ | analog switch ON-state current | $V_I = V_{IH}$ or V_{IL} ; $ V_S = V_{CC} - V_{EE}$; see Fig.10 | 10.0 | 0 | – | – | ± 2.0 | μA |
| I_{CC} | quiescent supply current | $V_I = V_{CC}$ or GND; $V_{is} = V_{EE}$ or V_{CC} ; $V_{os} = V_{CC}$ or V_{EE} | 5.5 | 0 | – | – | 80.0 | μA |
| | | | 5.0 | –5.0 | – | – | 160.0 | μA |
| ΔI_{CC} | additional quiescent supply current per input | $V_I = V_{CC} - 2.1\text{ V}$; other inputs at V_{CC} or GND | 4.5 to 5.5 | 0 | – | 45 | 202.5 | μA |
| $T_{amb} = -40\text{ }^{\circ}\text{C to }+125\text{ }^{\circ}\text{C}$ | | | | | | | | |
| V_{IH} | HIGH-level input voltage | | 4.5 to 5.5 | – | 2.0 | – | – | V |
| V_{IL} | LOW-level input voltage | | 4.5 to 5.5 | – | – | – | 0.8 | V |
| I_{LI} | input leakage current | $V_I = V_{CC}$ or GND | 5.5 | 0 | – | – | ± 1.0 | μA |
| $I_{S(OFF)}$ | analog switch OFF-state current | $V_I = V_{IH}$ or V_{IL} ; $ V_S = V_{CC} - V_{EE}$; see Fig.9 per channel | 10.0 | 0 | – | – | ± 1.0 | μA |
| | | | 10.0 | 0 | – | – | ± 2.0 | μA |
| $I_{S(ON)}$ | analog switch ON-state current | $V_I = V_{IH}$ or V_{IL} ; $ V_S = V_{CC} - V_{EE}$; see Fig.10 | 10.0 | 0 | – | – | ± 2.0 | μA |
| I_{CC} | quiescent supply current | $V_I = V_{CC}$ or GND; $V_{is} = V_{EE}$ or V_{CC} ; $V_{os} = V_{CC}$ or V_{EE} | 5.5 | 0 | – | – | 160.0 | μA |
| | | | 5.0 | –5.0 | – | – | 320.0 | μA |
| ΔI_{CC} | additional quiescent supply current per input | $V_I = V_{CC} - 2.1\text{ V}$; other inputs at V_{CC} or GND | 4.5 to 5.5 | 0 | – | – | 220.5 | μA |

Note

1. All typical values are measured at $T_{amb} = 25\text{ }^{\circ}\text{C}$.

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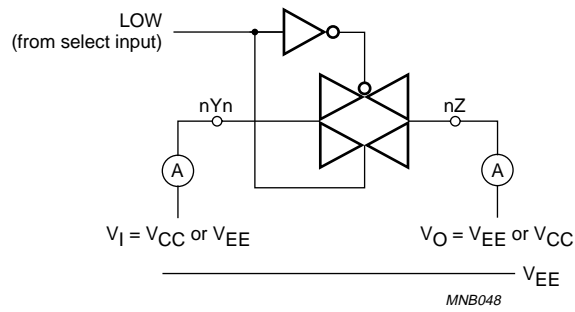


Fig.9 Test circuit for measuring OFF-state current.

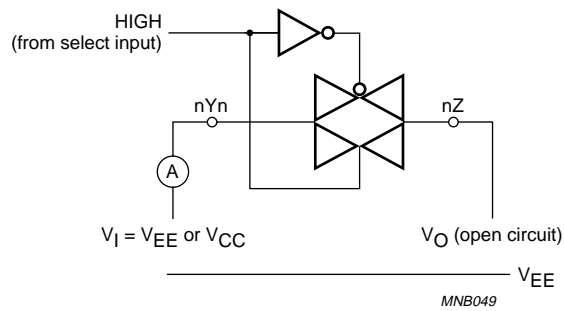


Fig.10 Test circuit for measuring ON-state current.

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Resistance R_{ON} for 74HC4052 and 74HCT4052 V_{IS} is the input voltage at pins nYn or nZ, whichever is assigned as an input; see notes 1 and 2; see Fig.11.

| SYMBOL | PARAMETER | TEST CONDITIONS | | | | MIN. | TYP. | MAX. | UNIT | |
|--|---|---|---|--------------|------------------|------|------|------|----------|----------|
| | | OTHER | V_{CC} (V) | V_{EE} (V) | I_S (μ A) | | | | | |
| $T_{amb} = -40\text{ }^{\circ}\text{C to }+85\text{ }^{\circ}\text{C}$; note 3 | | | | | | | | | | |
| $R_{ON(peak)}$ | ON-resistance (peak) | $V_{IS} = V_{CC}$ to V_{EE} ; $V_I = V_{IH}$ or V_{IL} | 2.0 | 0 | 100 | – | – | – | Ω | |
| | | | 4.5 | 0 | 1000 | – | 100 | 225 | Ω | |
| | | | 6.0 | 0 | 1000 | – | 90 | 200 | Ω | |
| | | | 4.5 | –4.5 | 1000 | – | 70 | 165 | Ω | |
| $R_{ON(rail)}$ | ON-resistance (rail) | $V_{IS} = V_{EE}$; $V_I = V_{IH}$ or V_{IL} | 2.0 | 0 | 100 | – | 150 | – | Ω | |
| | | | 4.5 | 0 | 1000 | – | 80 | 175 | Ω | |
| | | | 6.0 | 0 | 1000 | – | 70 | 150 | Ω | |
| | | | 4.5 | –4.5 | 1000 | – | 60 | 130 | Ω | |
| | | | $V_{IS} = V_{CC}$; $V_I = V_{IH}$ or V_{IL} | 2.0 | 0 | 100 | – | 150 | – | Ω |
| | | | | 4.5 | 0 | 1000 | – | 90 | 200 | Ω |
| | | | | 6.0 | 0 | 1000 | – | 80 | 175 | Ω |
| | | | | 4.5 | –4.5 | 1000 | – | 65 | 150 | Ω |
| ΔR_{ON} | maximum ON-resistance difference between any two channels | $V_{IS} = V_{CC}$ to V_{EE} ; $V_I = V_{IH}$ or V_{IL} | 2.0 | 0 | – | – | – | – | Ω | |
| | | | 4.5 | 0 | – | – | 9 | – | Ω | |
| | | | 6.0 | 0 | – | – | 8 | – | Ω | |
| | | | 4.5 | –4.5 | – | – | 6 | – | Ω | |
| $T_{amb} = -40\text{ }^{\circ}\text{C to }+125\text{ }^{\circ}\text{C}$ | | | | | | | | | | |
| $R_{ON(peak)}$ | ON-resistance (peak) | $V_{IS} = V_{CC}$ to V_{EE} ; $V_I = V_{IH}$ or V_{IL} | 2.0 | 0 | 100 | – | – | – | Ω | |
| | | | 4.5 | 0 | 1000 | – | – | 270 | Ω | |
| | | | 6.0 | 0 | 1000 | – | – | 240 | Ω | |
| | | | 4.5 | –4.5 | 1000 | – | – | 195 | Ω | |
| $R_{ON(rail)}$ | ON-resistance (rail) | $V_{IS} = V_{EE}$; $V_I = V_{IH}$ or V_{IL} | 2.0 | 0 | 100 | – | – | – | Ω | |
| | | | 4.5 | 0 | 1000 | – | – | 210 | Ω | |
| | | | 6.0 | 0 | 1000 | – | – | 180 | Ω | |
| | | | 4.5 | –4.5 | 1000 | – | – | 160 | Ω | |
| | | | $V_{IS} = V_{CC}$; $V_I = V_{IH}$ or V_{IL} | 2.0 | 0 | 100 | – | – | – | Ω |
| | | | | 4.5 | 0 | 1000 | – | – | 240 | Ω |
| | | | | 6.0 | 0 | 1000 | – | – | 210 | Ω |
| | | | | 4.5 | –4.5 | 1000 | – | – | 180 | Ω |

Notes

- For 74HC4052: $V_{CC} - GND$ or $V_{CC} - V_{EE} = 2.0, 4.5, 6.0$ and 9.0 V; for 74HCT4052: $V_{CC} - GND = 4.5$ and 5.5 V, $V_{CC} - V_{EE} = 2.0, 4.5, 6.0$ and 9.0 V.
- When supply voltages ($V_{CC} - V_{EE}$) near 2.0 V the analog switch ON-resistance becomes extremely non-linear. When using a supply of 2 V, it is recommended to use these devices only for transmitting digital signals.
- All typical values are measured at $T_{amb} = 25\text{ }^{\circ}\text{C}$.

Dual 4-channel analog multiplexer, demultiplexer

74HC4052; 74HCT4052

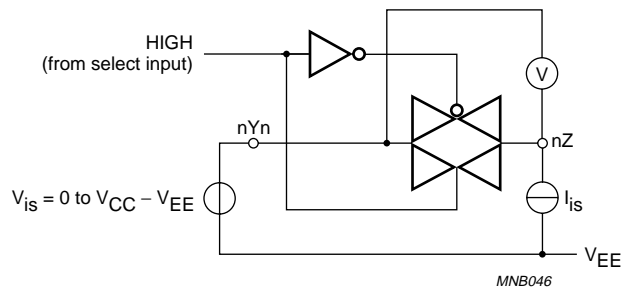
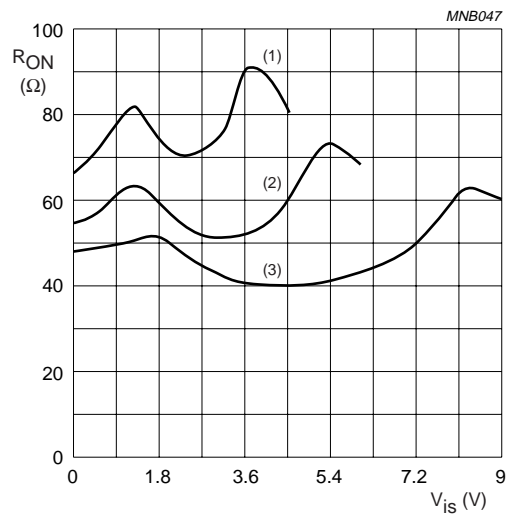


Fig.11 Test circuit for measuring R_{ON} .



$V_{is} = 0$ V to $V_{CC} - V_{EE}$
 (1) $V_{CC} = 4.5$ V
 (2) $V_{CC} = 6$ V
 (3) $V_{CC} = 9$ V

Fig.12 Typical R_{ON} as a function of input voltage V_{is} .

Dual 4-channel analog multiplexer,
demultiplexer

74HC4052; 74HCT4052

AC CHARACTERISTICS

Type 74HC4052

GND = 0 V; $t_r = t_f = 6$ ns; $C_L = 50$ pF.

| SYMBOL | PARAMETER | TEST CONDITIONS | | | MIN. | TYP. | MAX. | UNIT |
|---|--|---|--------------|--------------|------|------|------|------|
| | | OTHER | V_{CC} (V) | V_{EE} (V) | | | | |
| $T_{amb} = -40$ °C to $+85$ °C; note 1 | | | | | | | | |
| t_{PHL}/t_{PLH} | propagation delay V_{is} to V_{os} | $R_L = \infty$; see Fig.19 | 2.0 | 0 | – | 14 | 75 | ns |
| | | | 4.5 | 0 | – | 5 | 15 | ns |
| | | | 6.0 | 0 | – | 4 | 13 | ns |
| | | | 4.5 | –4.5 | – | 4 | 10 | ns |
| t_{PZH}/t_{PZL} | turn-on time \bar{E} , Sn to V_{os} | $R_L = \infty$; see Figs 20, 22 and 21 | 2.0 | 0 | – | 105 | 405 | ns |
| | | | 4.5 | 0 | – | 38 | 81 | ns |
| | | | 6.0 | 0 | – | 30 | 69 | ns |
| | | | 4.5 | –4.5 | – | 26 | 58 | ns |
| t_{PHZ}/t_{PLZ} | turn-off time \bar{E} , Sn to V_{os} | $R_L = 1$ k Ω ; see Figs 20, 22 and 21 | 2.0 | 0 | – | 74 | 315 | ns |
| | | | 4.5 | 0 | – | 27 | 63 | ns |
| | | | 6.0 | 0 | – | 22 | 54 | ns |
| | | | 4.5 | –4.5 | – | 22 | 48 | ns |
| $T_{amb} = -40$ °C to $+125$ °C | | | | | | | | |
| t_{PHL}/t_{PLH} | propagation delay V_{is} to V_{os} | $R_L = \infty$; see Fig.19 | 2.0 | 0 | – | – | 90 | ns |
| | | | 4.5 | 0 | – | – | 18 | ns |
| | | | 6.0 | 0 | – | – | 15 | ns |
| | | | 4.5 | –4.5 | – | – | 12 | ns |
| t_{PZH}/t_{PZL} | turn-on time \bar{E} , Sn to V_{os} | $R_L = \infty$; see Figs 20, 22 and 21 | 2.0 | 0 | – | – | 490 | ns |
| | | | 4.5 | 0 | – | – | 98 | ns |
| | | | 6.0 | 0 | – | – | 83 | ns |
| | | | 4.5 | –4.5 | – | – | 69 | ns |
| t_{PHZ}/t_{PLZ} | turn-off time \bar{E} , Sn to V_{os} | $R_L = 1$ k Ω ; see Figs 20, 22 and 21 | 2.0 | 0 | – | – | 375 | ns |
| | | | 4.5 | 0 | – | – | 75 | ns |
| | | | 6.0 | 0 | – | – | 64 | ns |
| | | | 4.5 | –4.5 | – | – | 57 | ns |

Note

1. All typical values are measured at $T_{amb} = 25$ °C.

Dual 4-channel analog multiplexer,
demultiplexer

74HC4052; 74HCT4052

Type 74HCT4052GND = 0 V; $t_r = t_f = 6$ ns; $C_L = 50$ pF.

| SYMBOL | PARAMETER | TEST CONDITIONS | | | MIN. | TYP. | MAX. | UNIT |
|---|--|---|--------------|--------------|------|------|------|------|
| | | OTHER | V_{CC} (V) | V_{EE} (V) | | | | |
| $T_{amb} = -40$ °C to $+85$ °C; note 1 | | | | | | | | |
| t_{PHL}/t_{PLH} | propagation delay V_{is} to V_{os} | $R_L = \infty$; see Fig.19 | 4.5 | 0 | – | 5 | 15 | ns |
| | | | 4.5 | –4.5 | – | 4 | 10 | ns |
| t_{PZH}/t_{PZL} | turn-on time \bar{E} , Sn to V_{os} | $R_L = 1$ k Ω ; see Figs 20, 22 and 21 | 4.5 | 0 | – | 41 | 88 | ns |
| | | | 4.5 | –4.5 | – | 28 | 60 | ns |
| t_{PHZ}/t_{PLZ} | turn-off time \bar{E} , Sn to V_{os} | $R_L = 1$ k Ω ; see Figs 20, 22 and 21 | 4.5 | 0 | – | 26 | 63 | ns |
| | | | 4.5 | –4.5 | – | 21 | 48 | ns |
| $T_{amb} = -40$ °C to $+125$ °C | | | | | | | | |
| t_{PHL}/t_{PLH} | propagation delay V_{is} to V_{os} | $R_L = \infty$; see Fig.19 | 4.5 | 0 | – | – | 18 | ns |
| | | | 4.5 | –4.5 | – | – | 12 | ns |
| t_{PZH}/t_{PZL} | turn-on time \bar{E} , Sn to V_{os} | $R_L = 1$ k Ω ; see Figs 20, 22 and 21 | 4.5 | 0 | – | – | 105 | ns |
| | | | 4.5 | –4.5 | – | – | 72 | ns |
| t_{PHZ}/t_{PLZ} | turn-off time \bar{E} , Sn to V_{os} | $R_L = 1$ k Ω ; see Figs 20, 22 and 21 | 4.5 | 0 | – | – | 75 | ns |
| | | | 4.5 | –4.5 | – | – | 57 | ns |

Note1. All typical values are measured at $T_{amb} = 25$ °C.

Dual 4-channel analog multiplexer, demultiplexer

74HC4052; 74HCT4052

Type 74HC4052 and 74HCT4052

Recommended conditions and typical values; GND = 0 V; $T_{amb} = 25\text{ }^{\circ}\text{C}$; $C_L = 50\text{ pF}$. V_{is} is the input voltage at pins nYn or nZ, whichever is assigned as an input. V_{os} is the output voltage at pins nYn or nZ, whichever is assigned as an output.

| SYMBOL | PARAMETER | TEST CONDITIONS | | | | TYP. | UNIT |
|-------------------------|---|--|-------------------|--------------|--------------|------|------|
| | | OTHER | $V_{is(p-p)}$ (V) | V_{CC} (V) | V_{EE} (V) | | |
| d_{sin} | sine-wave distortion | f = 1 kHz; $R_L = 10\text{ k}\Omega$; see Fig.13 | 4.0 | 2.25 | -2.25 | 0.04 | % |
| | | | 8.0 | 4.5 | -4.5 | 0.02 | % |
| | | f = 10 kHz; $R_L = 10\text{ k}\Omega$; see Fig.13 | 4.0 | 2.25 | -2.25 | 0.12 | % |
| | | | 8.0 | 4.5 | -4.5 | 0.06 | % |
| $\alpha_{OFF(feedthr)}$ | switch OFF signal feed-through | $R_L = 600\text{ }\Omega$; f = 1 MHz; see Figs 14 and 15 | note 1 | 2.25 | -2.25 | -50 | dB |
| | | | | 4.5 | -4.5 | -50 | dB |
| $\alpha_{ct(s)}$ | crosstalk between two switches/multiplexers | $R_L = 600\text{ }\Omega$; f = 1 MHz; see Fig.16 | note 1 | 2.25 | -2.25 | -60 | dB |
| | | | | 4.5 | -4.5 | -60 | dB |
| $V_{ct(p-p)}$ | crosstalk voltage between control and any switch (peak-to-peak value) | $R_L = 600\text{ }\Omega$; f = 1 MHz; \bar{E} or Sn, square-wave between V_{CC} and GND, $t_r = t_f = 6\text{ ns}$; see Fig.17 | - | 4.5 | 0 | 110 | mV |
| | | | | 4.5 | -4.5 | 220 | mV |
| f_{max} | minimum frequency response (-3dB) | $R_L = 50\text{ }\Omega$; see Figs 13 and 18 | note 2 | 2.25 | -2.25 | 170 | MHz |
| | | | | 4.5 | -4.5 | 180 | MHz |
| C_S | maximum switch capacitance | independent (Y) | - | - | - | 5 | pF |
| | | common (Z) | - | - | - | 12 | pF |

Notes

1. Adjust input voltage V_{is} to 0 dBm level (0 dBm = 1 mW into 600 Ω).
2. Adjust input voltage V_{is} to 0 dBm level at V_{os} for 1 MHz (0 dBm = 1 mW into 50 Ω).

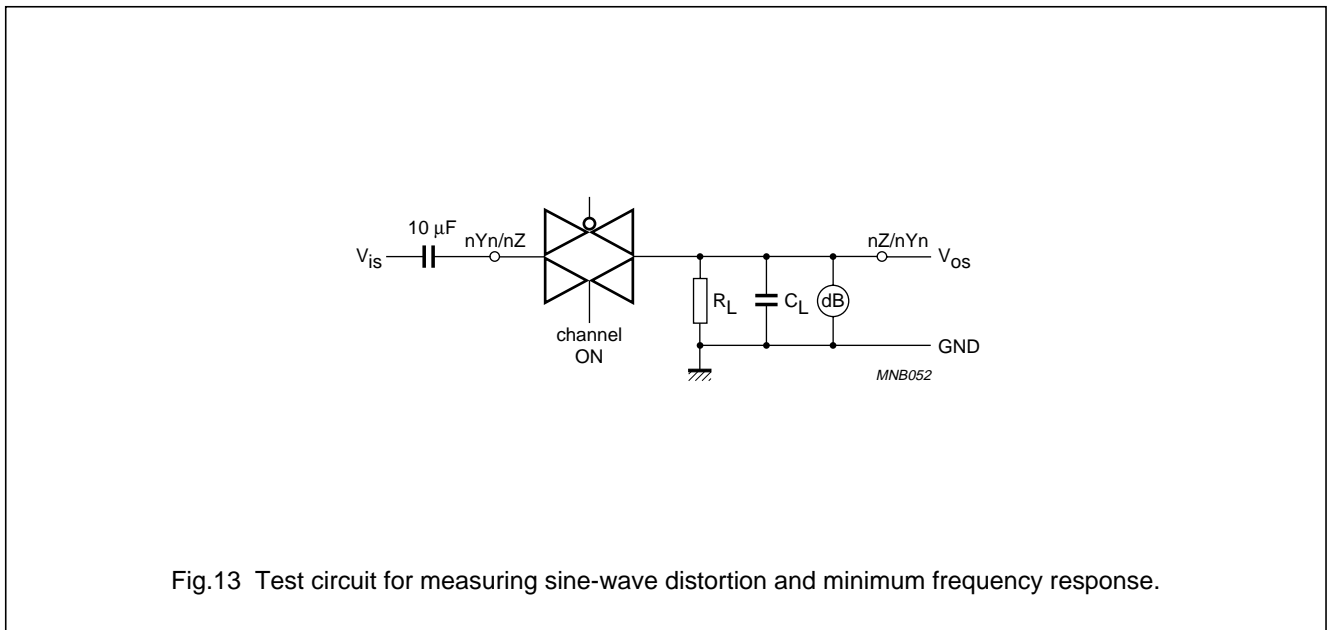


Fig.13 Test circuit for measuring sine-wave distortion and minimum frequency response.

Dual 4-channel analog multiplexer, demultiplexer

74HC4052; 74HCT4052

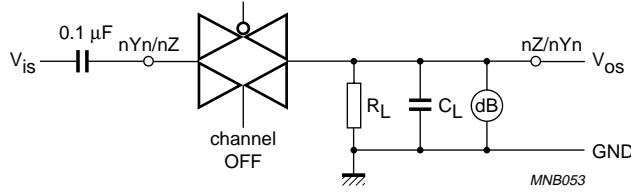
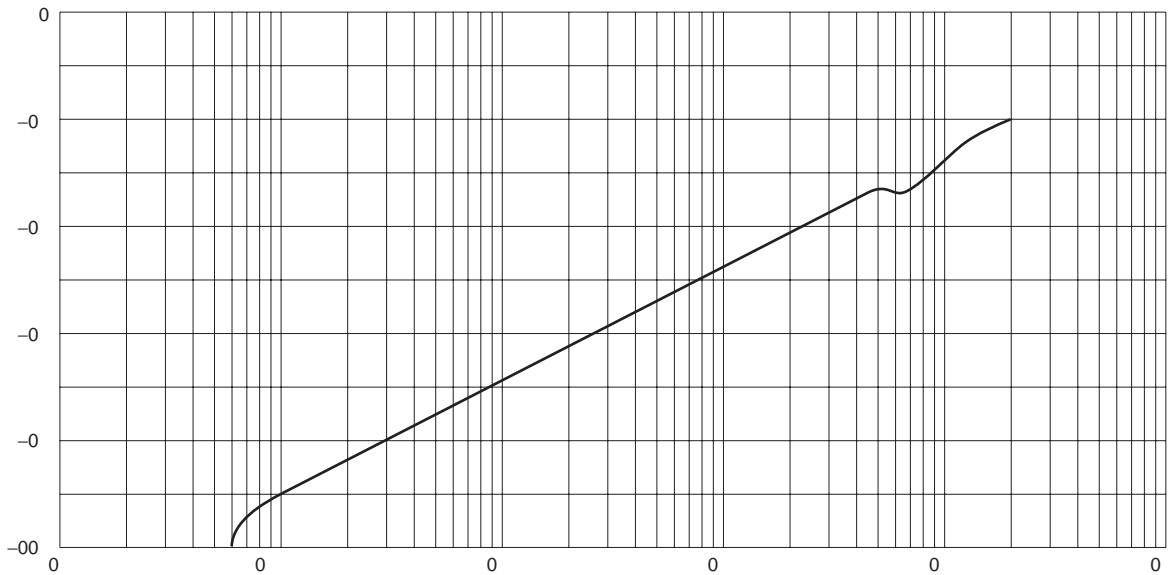
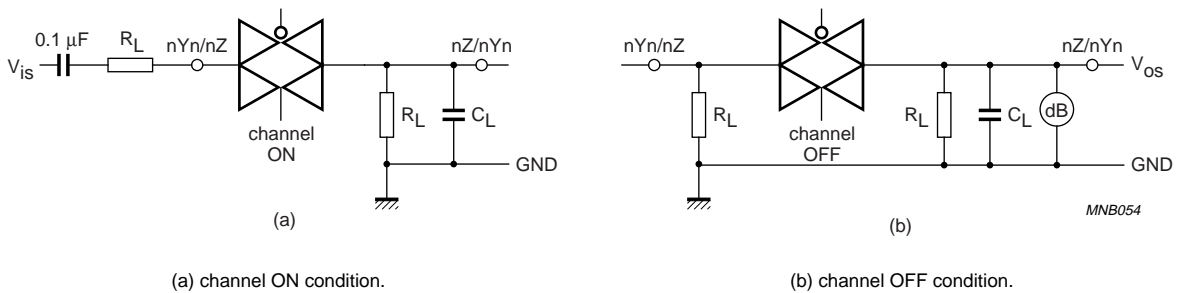


Fig.14 Test circuit for measuring switch OFF signal feed-through.



Test conditions: $V_{CC} = 4.5\text{ V}$; $GND = 0\text{ V}$; $V_{EE} = -4.5\text{ V}$; $R_L = 50\ \Omega$; $R_{source} = 1\text{ k}\Omega$.

Fig.15 Typical switch OFF signal feed-through as a function of frequency.



(a) channel ON condition.

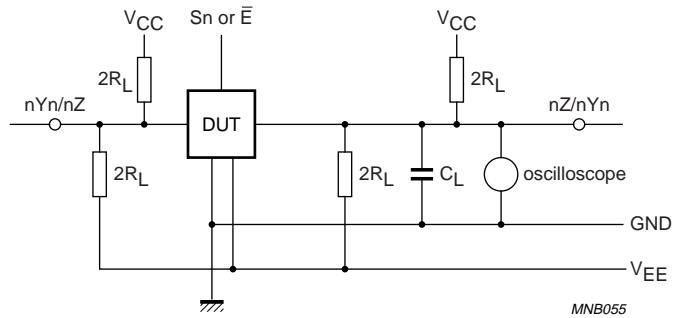
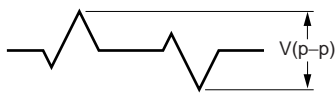
(b) channel OFF condition.

Fig.16 Test circuits for measuring crosstalk between any two switches/multiplexers.

Dual 4-channel analog multiplexer, demultiplexer

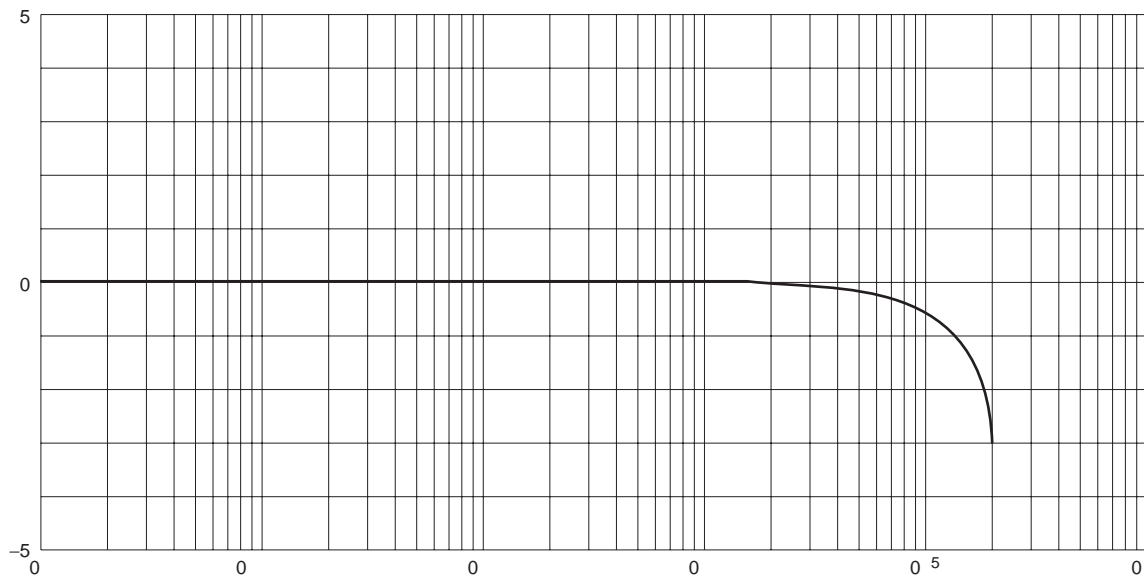
74HC4052; 74HCT4052

The crosstalk is defined as follows (oscilloscope output):



MNB055

Fig.17 Test circuit for measuring crosstalk between control and any switch.



Test conditions: $V_{CC} = 4.5\text{ V}$; $GND = 0\text{ V}$; $V_{EE} = -4.5\text{ V}$; $R_L = 50\ \Omega$; $R_{source} = 1\text{ k}\Omega$.

Fig.18 Typical frequency response.

Dual 4-channel analog multiplexer, demultiplexer

74HC4052; 74HCT4052

AC WAVEFORMS

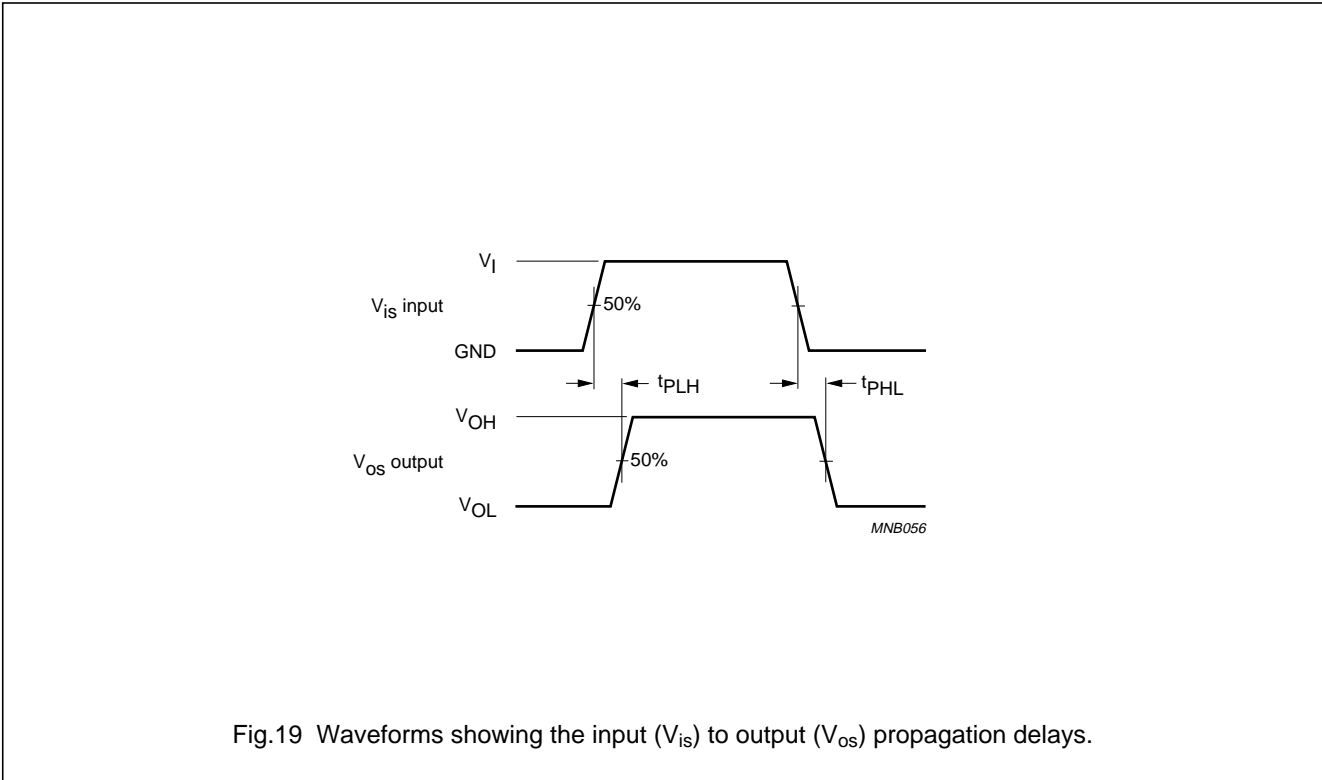
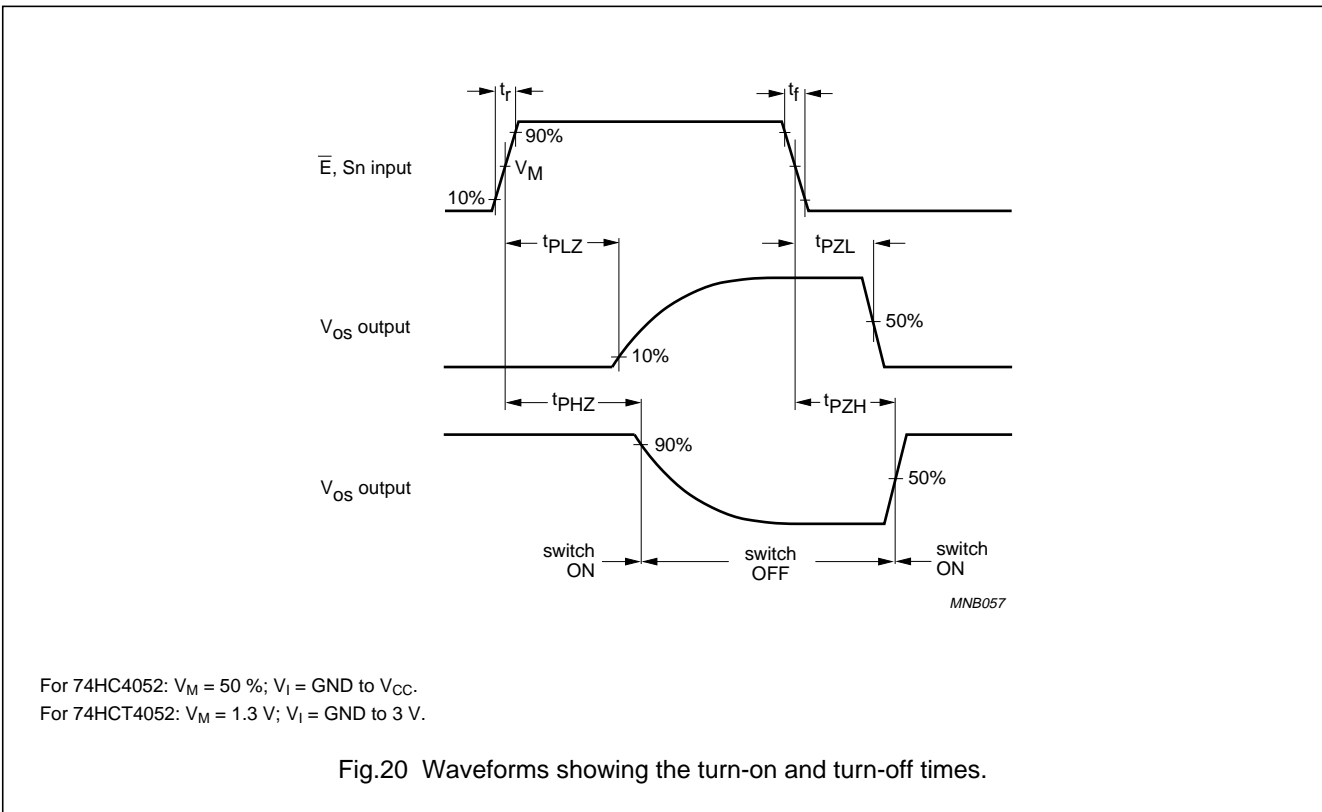


Fig.19 Waveforms showing the input (V_{is}) to output (V_{os}) propagation delays.

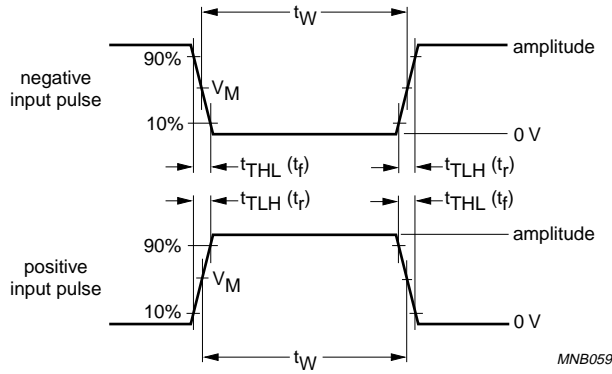


For 74HC4052: $V_M = 50\%$; $V_I = \text{GND to } V_{CC}$.
 For 74HCT4052: $V_M = 1.3 \text{ V}$; $V_I = \text{GND to } 3 \text{ V}$.

Fig.20 Waveforms showing the turn-on and turn-off times.

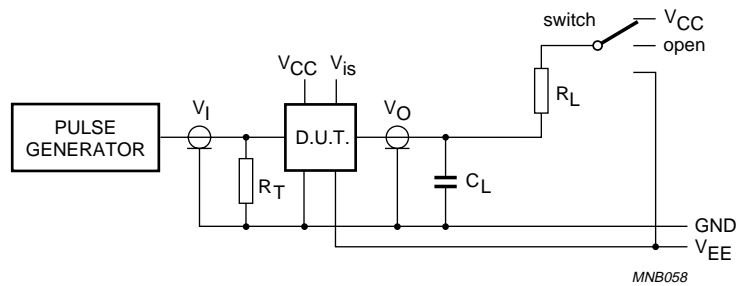
Dual 4-channel analog multiplexer, demultiplexer

74HC4052; 74HCT4052



| FAMILY | AMPLITUDE | V_M | t_r and t_f | |
|-----------|-----------|-------|-------------------------|-------|
| | | | f_{max} ; PULSE WIDTH | OTHER |
| 74HC4052 | V_{CC} | 50 % | < 2 ns | 6 ns |
| 74HCT4052 | 3.0 V | 1.3 V | < 2 ns | 6 ns |

Fig.21 Input pulse definitions.



| TEST | SWITCH | V_{is} |
|-----------|----------|----------|
| t_{PZH} | V_{EE} | V_{CC} |
| t_{PZL} | V_{CC} | V_{EE} |
| t_{PHZ} | V_{EE} | V_{CC} |
| t_{PLZ} | V_{CC} | V_{EE} |
| other | open | pulse |

Definitions for test circuit:

R_L = load resistance

C_L = load capacitance including jig and probe capacitance.

R_T = termination resistance should be equal to the output impedance Z_O of the pulse generator.

$t_r = t_f = 6$ ns; when measuring f_{max} , there is no constraint to t_r and t_f with 50 % duty factor.

Fig.22 Test circuit for measuring AC performance.

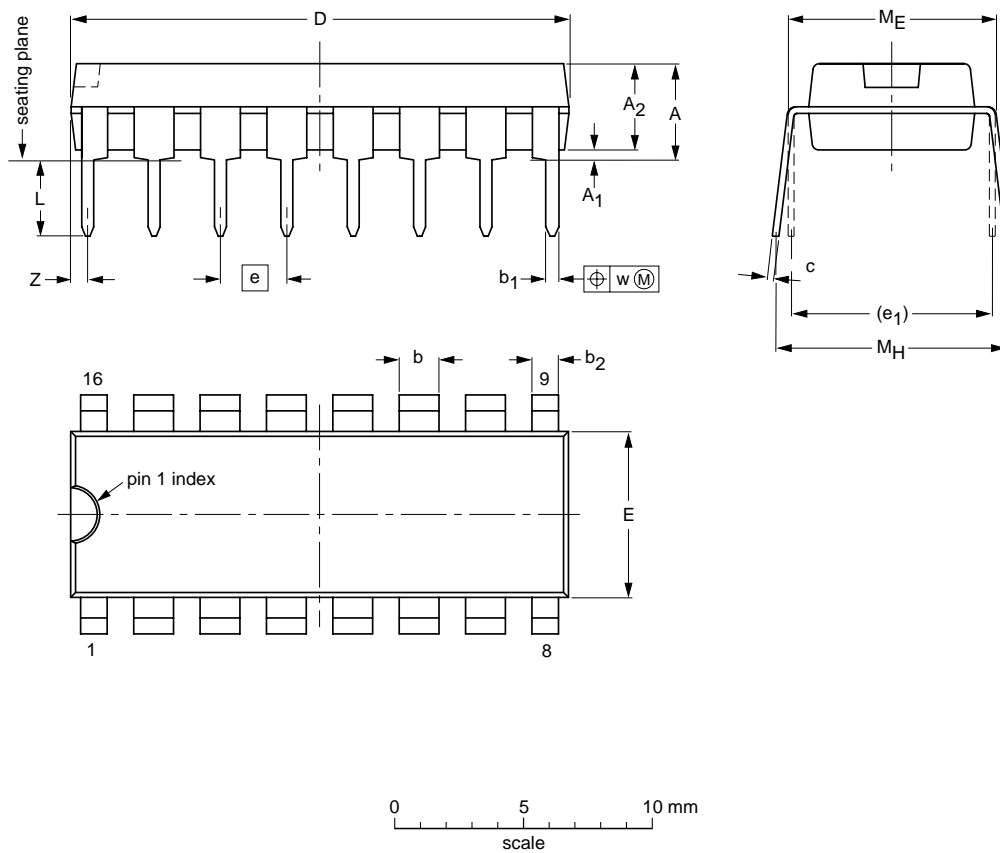
Dual 4-channel analog multiplexer,
demultiplexer

74HC4052; 74HCT4052

PACKAGE OUTLINES

DIP16: plastic dual in-line package; 16 leads (300 mil)

SOT38-9



DIMENSIONS (mm dimensions are derived from the original inch dimensions)

| UNIT | A max. | A ₁ min. | A ₂ max. | b | b ₁ | b ₂ | c | D ⁽¹⁾ | E ⁽¹⁾ | e | e ₁ | L | M _E | M _H | w | Z ⁽¹⁾ max. |
|--------|--------|---------------------|---------------------|----------------|----------------|----------------|----------------|------------------|------------------|------|----------------|----------------|----------------|----------------|-------|-----------------------|
| mm | 4.32 | 0.38 | 3.56 | 1.65 1.40 | 0.51 0.41 | 1.14 0.76 | 0.36 0.20 | 19.3 18.8 | 6.45 6.24 | 2.54 | 7.62 | 3.81 2.92 | 8.23 7.62 | 9.40 8.38 | 0.254 | 0.76 |
| inches | 0.17 | 0.015 | 0.14 | 0.065 0.055 | 0.020 0.016 | 0.045 0.030 | 0.014 0.008 | 0.76 0.74 | 0.254 0.246 | 0.1 | 0.3 | 0.150 0.115 | 0.324 0.300 | 0.37 0.33 | 0.01 | 0.03 |

Note

1. Plastic or metal protrusions of 0.25 mm (0.01 inch) maximum per side are not included.

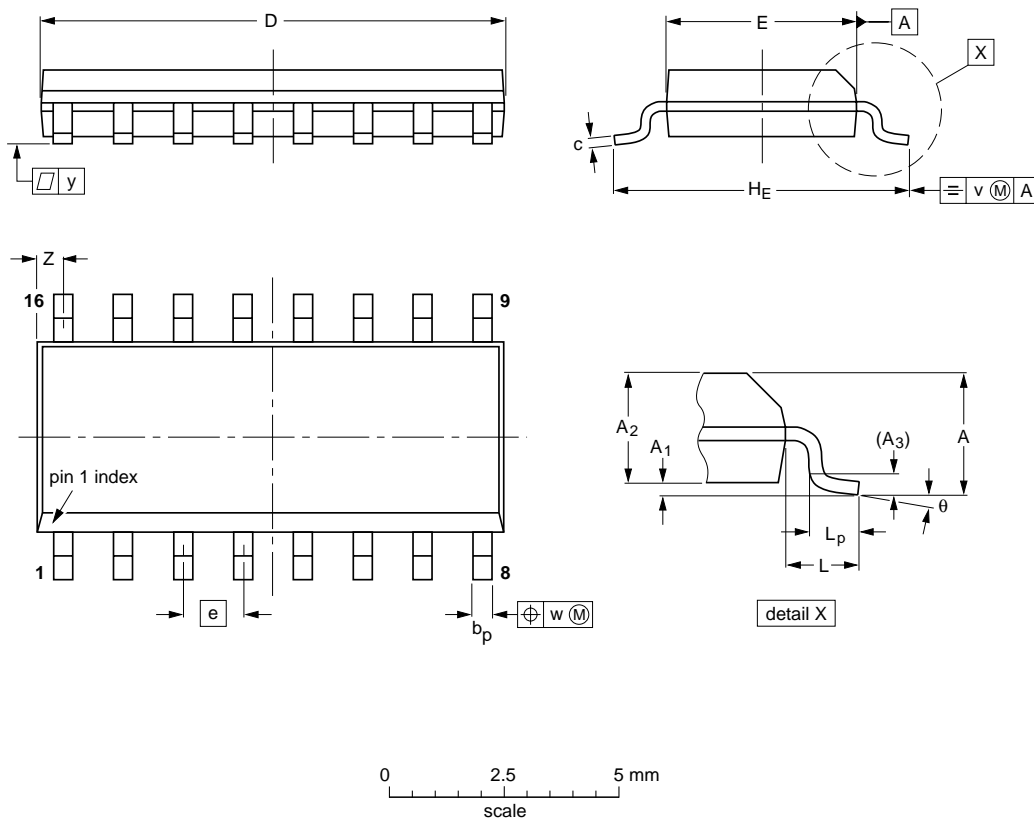
| OUTLINE VERSION | REFERENCES | | | EUROPEAN PROJECTION | ISSUE DATE |
|-----------------|------------|-------|-------|---------------------|----------------------|
| | IEC | JEDEC | JEITA | | |
| SOT38-9 | | | | | 97-07-24 03-03-12 |

Dual 4-channel analog multiplexer,
demultiplexer

74HC4052; 74HCT4052

SO16: plastic small outline package; 16 leads; body width 3.9 mm; body thickness 1.47 mm

SOT109-3



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

| UNIT | A max. | A ₁ | A ₂ | A ₃ | b _p | c | D ⁽¹⁾ | E ⁽¹⁾ | e | H _E | L | L _p | v | w | y | Z ⁽¹⁾ | θ |
|--------|--------|----------------|----------------|----------------|----------------|------------------|------------------|------------------|------|----------------|-------|----------------|------|------|-------|------------------|----------|
| mm | 1.75 | 0.25 0.10 | 1.55 1.40 | 0.25 | 0.49 0.36 | 0.25 0.19 | 10.0 9.8 | 4.0 3.8 | 1.27 | 6.2 5.8 | 1.05 | 1.0 0.4 | 0.25 | 0.25 | 0.1 | 0.7 0.3 | 8° 0° |
| inches | 0.069 | 0.010 0.004 | 0.061 0.055 | 0.01 | 0.019 0.014 | 0.0100 0.0075 | 0.39 0.38 | 0.16 0.15 | 0.05 | 0.244 0.228 | 0.041 | 0.039 0.016 | 0.01 | 0.01 | 0.004 | 0.028 0.012 | |

Note

1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.

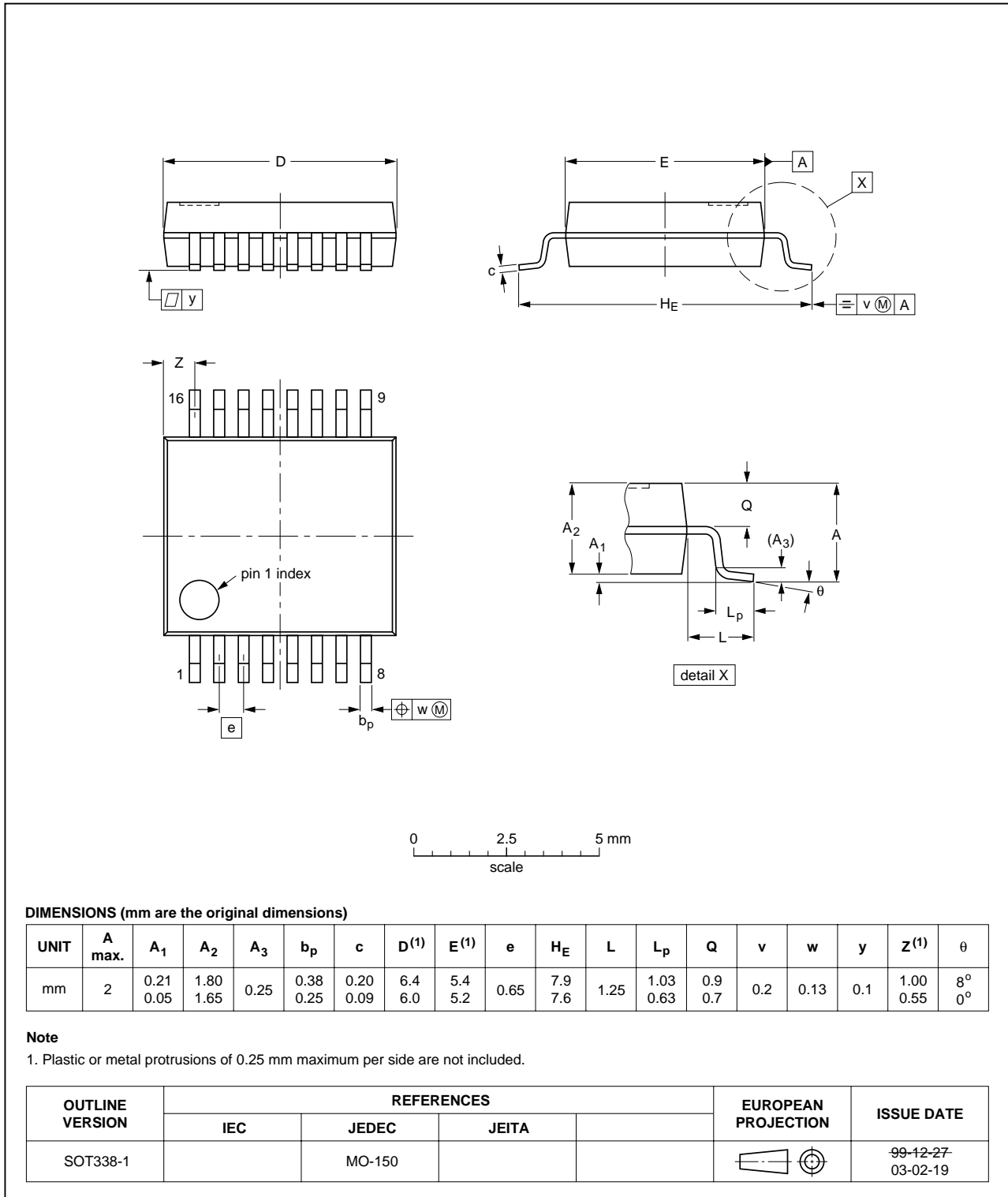
| OUTLINE VERSION | REFERENCES | | | EUROPEAN PROJECTION | ISSUE DATE |
|-----------------|------------|----------|-------|---------------------|----------------------|
| | IEC | JEDEC | JEITA | | |
| SOT109-3 | | MS-012AC | | | 98-12-23 03-02-19 |

Dual 4-channel analog multiplexer,
demultiplexer

74HC4052; 74HCT4052

SSOP16: plastic shrink small outline package; 16 leads; body width 5.3 mm

SOT338-1

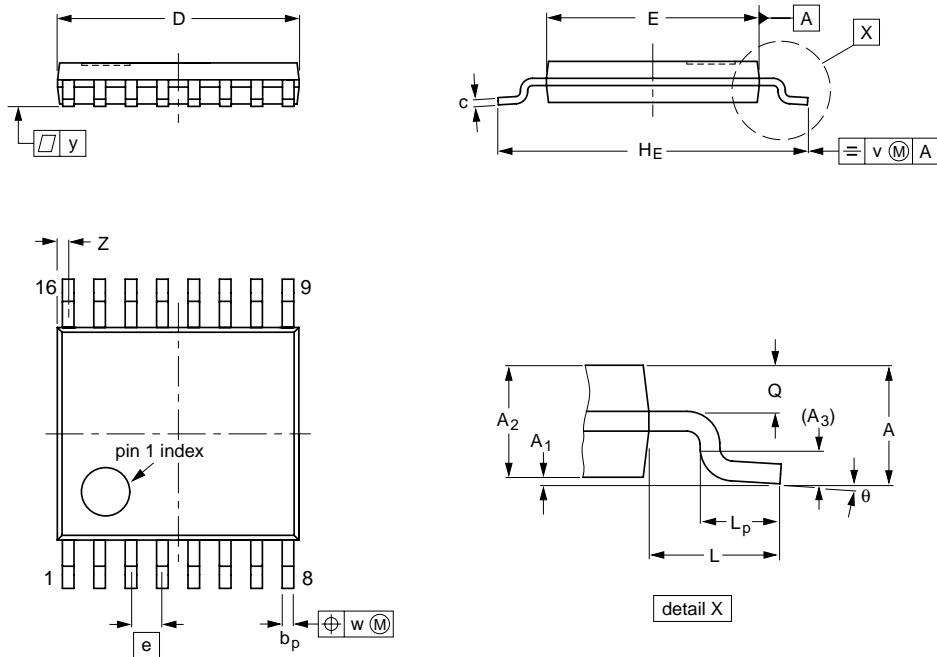


Dual 4-channel analog multiplexer, demultiplexer

74HC4052; 74HCT4052

TSSOP16: plastic thin shrink small outline package; 16 leads; body width 4.4 mm

SOT403-1



DIMENSIONS (mm are the original dimensions)

| UNIT | A max. | A ₁ | A ₂ | A ₃ | b _p | c | D ⁽¹⁾ | E ⁽²⁾ | e | H _E | L | L _p | Q | v | w | y | z ⁽¹⁾ | θ |
|------|--------|----------------|----------------|----------------|----------------|------------|------------------|------------------|------|----------------|---|----------------|------------|-----|------|-----|------------------|----------|
| mm | 1.1 | 0.15 0.05 | 0.95 0.80 | 0.25 | 0.30 0.19 | 0.2 0.1 | 5.1 4.9 | 4.5 4.3 | 0.65 | 6.6 6.2 | 1 | 0.75 0.50 | 0.4 0.3 | 0.2 | 0.13 | 0.1 | 0.40 0.06 | 8° 0° |

Notes

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic interlead protrusions of 0.25 mm maximum per side are not included.

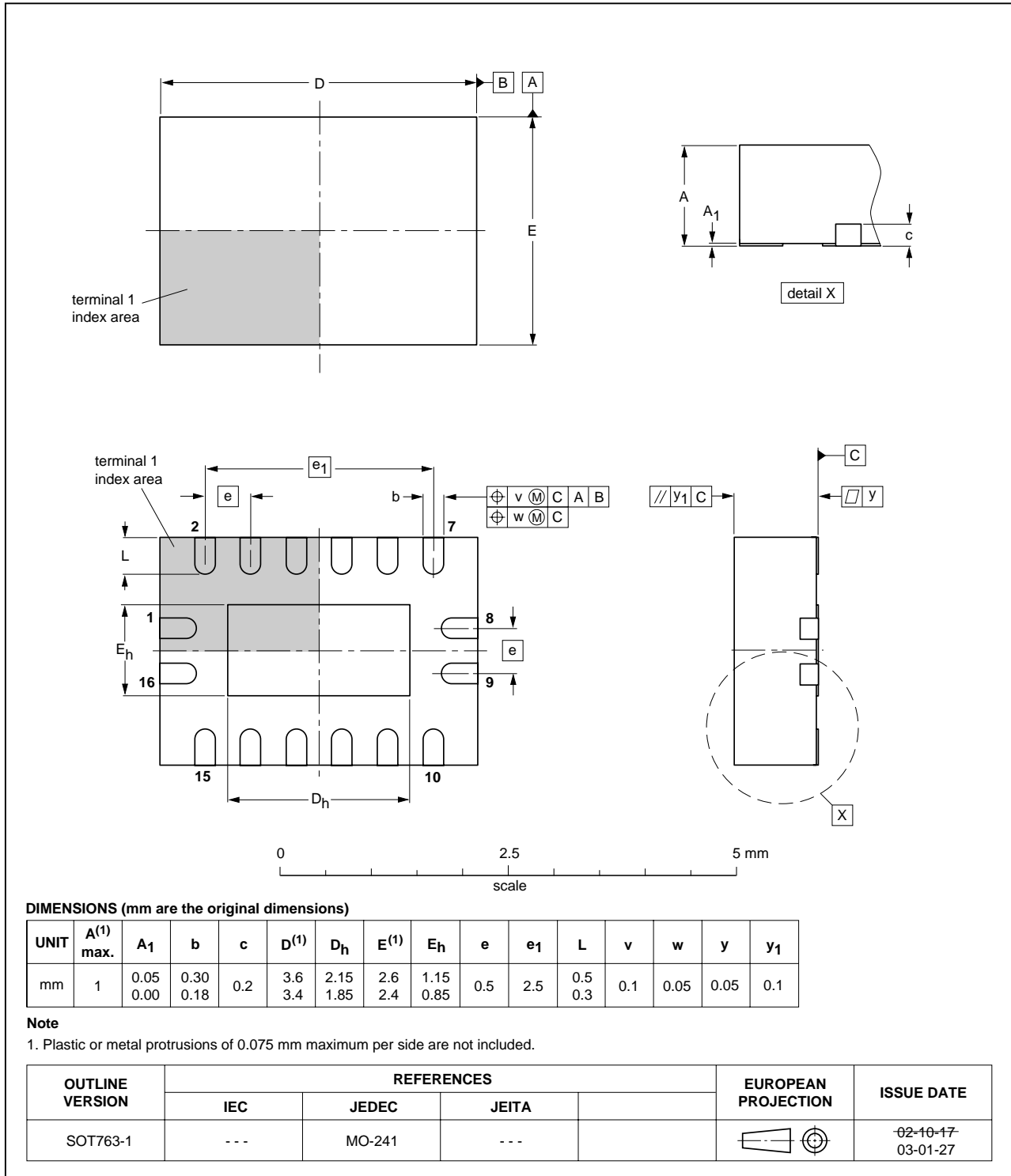
| OUTLINE VERSION | REFERENCES | | | EUROPEAN PROJECTION | ISSUE DATE |
|-----------------|------------|--------|-------|---------------------|----------------------|
| | IEC | JEDEC | JEITA | | |
| SOT403-1 | | MO-153 | | | 99-12-27 03-02-18 |

Dual 4-channel analog multiplexer, demultiplexer

74HC4052; 74HCT4052

DHVQFN16: plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 16 terminals; body 2.5 x 3.5 x 0.85 mm

SOT763-1



Dual 4-channel analog multiplexer,
demultiplexer

74HC4052; 74HCT4052

DATA SHEET STATUS

| LEVEL | DATA SHEET STATUS ⁽¹⁾ | PRODUCT STATUS ⁽²⁾⁽³⁾ | DEFINITION |
|-------|----------------------------------|----------------------------------|--|
| I | Objective data | Development | This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice. |
| II | Preliminary data | Qualification | This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product. |
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