

# DATA SHEET

## **74LVC4066** Quad bilateral switches

Product specification

2003 Aug 12

## Quad bilateral switches

## 74LVC4066

## FEATURES

- Very low ON resistance:
  - 7.5  $\Omega$  (typical) at  $V_{CC} = 2.7$  V
  - 6.5  $\Omega$  (typical) at  $V_{CC} = 3.3$  V
  - 6  $\Omega$  (typical) at  $V_{CC} = 5$  V.
- ESD protection:
  - HBM EIA/JESD22-A114-A Exceeds 2000 V
  - MM EIA/JESD22-A115-A Exceeds 200 V.
- High noise immunity
- CMOS low power consumption
- Latch up performance exceeds 250 mA
- Complies with JEDEC standard no. 8-1A
- Direct interface TTL-levels.

## DESCRIPTION

The 74LVC4066 is a high-speed Si-gate CMOS device.

The 74LVC4066 has four independent analog switches. Each switch has two input/output terminals (nY and nZ) and an active HIGH enable input (nE). When nE is LOW, the analog switch is turned off.

## QUICK REFERENCE DATA

GND = 0 V;  $T_{amb} = 25$  °C;  $t_r = t_f \leq 2.5$  ns.

| SYMBOL            | PARAMETER                     | CONDITIONS   | TYPICAL | UNIT |
|-------------------|-------------------------------|--|---------|------|
| $t_{PZH}/t_{PZL}$ | turn-on time E to $V_{os}$    | $C_L = 50$ pF; $R_L = 500$ $\Omega$ ; $V_{CC} = 3$ V | 2.5     | ns   |
|                   |                               | $C_L = 50$ pF; $R_L = 500$ $\Omega$ ; $V_{CC} = 5$ V | 1.9     | ns   |
| $t_{PHZ}/t_{PLZ}$ | turn-off time E to $V_{os}$   | $C_L = 50$ pF; $R_L = 500$ $\Omega$ ; $V_{CC} = 3$ V | 3.4     | ns   |
|                   |                               | $C_L = 50$ pF; $R_L = 500$ $\Omega$ ; $V_{CC} = 5$ V | 2.5     | ns   |
| $C_I$             | input capacitance             | $V_{CC} = 3$ V                                       | 3.5     | pF   |
| $C_{PD}$          | power dissipation capacitance | $V_{CC} = 3.3$ V; notes 1 and 2                      | 12.5    | pF   |
| $C_S$             | switch capacitance            | OFF-state  | 8.0     | pF   |
|                   |                               | ON-state   | 14.0    | pF   |

## Notes

1.  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu$ W).

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

$f_i$  = input frequency in MHz;

$f_o$  = output frequency in MHz;

$C_L$  = output load capacitance in pF;

$V_{CC}$  = supply voltage in Volts;

N = total load switching outputs;

$C_S$  = switch capacitance.

2. The condition is  $V_I = \text{GND to } V_{CC}$ .

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**FUNCTION TABLE**

See note 1.

| INPUT nE | SWITCH |
|----------|--------|
| L        | OFF    |
| H        | ON     |

**Note**

- 1. H = HIGH voltage level;  
L = LOW voltage level.

**ORDERING INFORMATION**

| TYPE NUMBER | PACKAGE           |      |          |          |          |
|-------------|-------------------|------|----------|----------|----------|
|             | TEMPERATURE RANGE | PINS | PACKAGE  | MATERIAL | CODE     |
| 74LVC4066D  | -40 to +125 °C    | 14   | SO14     | plastic  | SOT108-2 |
| 74LVC4066PW | -40 to +125 °C    | 14   | TSSOP14  | plastic  | SOT402-1 |
| 74LVC4066BQ | -40 to +125 °C    | 14   | DHVQFN14 | plastic  | SOT762-1 |

**PINNING**

| PIN | SYMBOL          | DESCRIPTION                |
|-----|-----------------|----------------------------|
| 1   | 1Y              | independent input/output   |
| 2   | 1Z              | independent output/input   |
| 3   | 2Z              | independent output/input   |
| 4   | 2Y              | independent input/output   |
| 5   | 2E              | enable input (active HIGH) |
| 6   | 3E              | enable input (active HIGH) |
| 7   | GND             | ground (0 V)               |
| 8   | 3Y              | independent input/output   |
| 9   | 3Z              | independent output/input   |
| 10  | 4Z              | independent output/input   |
| 11  | 4Y              | independent input/output   |
| 12  | 4E              | enable input (active HIGH) |
| 13  | 1E              | enable input (active HIGH) |
| 14  | V <sub>CC</sub> | supply voltage             |

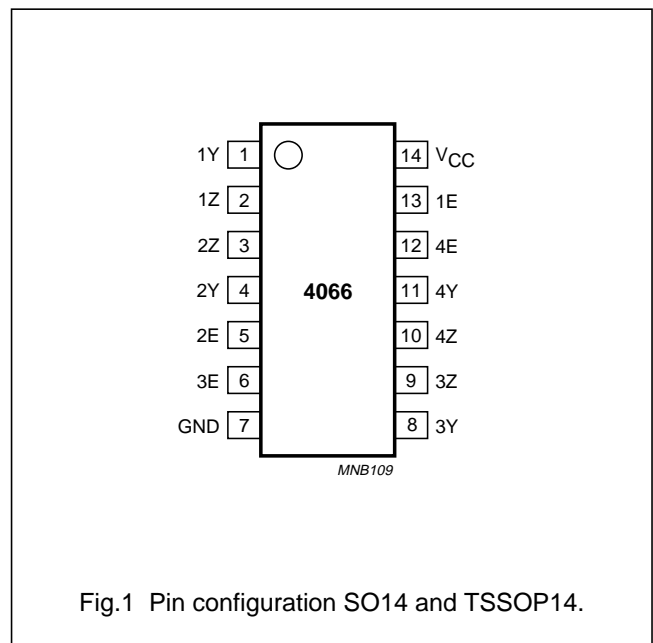
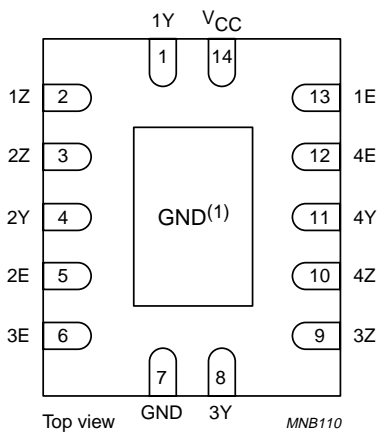


Fig.1 Pin configuration SO14 and TSSOP14.

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(1) The die substrate is attached to this pad using conductive die attach material. It can not be used as a supply pin or input.

Fig.2 Pin configuration DHVQFN14.

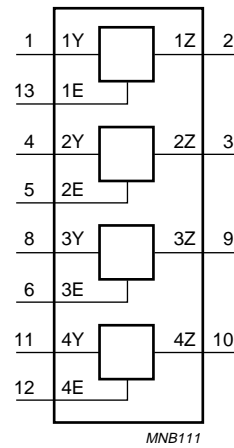


Fig.3 Logic symbol.

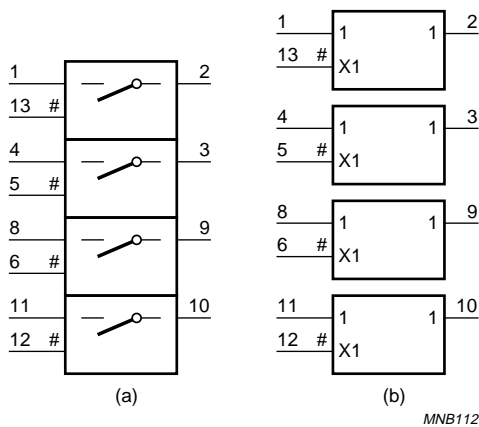


Fig.4 logic symbol (IEEE/IEC).

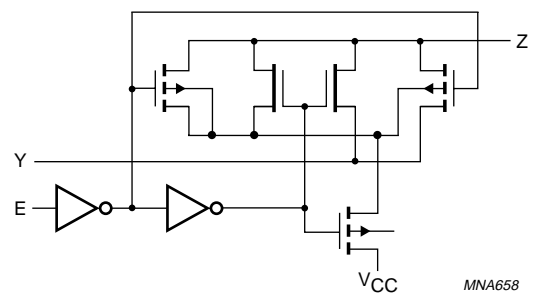


Fig.5 Logic diagram (one switch).

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## RECOMMENDED OPERATING CONDITIONS

| SYMBOL     | PARAMETER                     | CONDITIONS                 | MIN. | MAX.     | UNIT |
|------------|-------------------------------|----------------------------|------|----------|------|
| $V_{CC}$   | supply voltage                |                            | 1.65 | 5.5      | V    |
| $V_I$      | input voltage                 |                            | 0    | 5.5      | V    |
| $V_S$      | switch voltage                |                            | 0    | $V_{CC}$ | V    |
| $T_{amb}$  | operating ambient temperature |                            | -40  | +125     | °C   |
| $t_r, t_f$ | input rise and fall times     | $V_{CC} = 1.65$ to $2.7$ V | 0    | 20       | ns/V |
|            |                               | $V_{CC} = 2.7$ to $5.5$ V  | 0    | 10       | ns/V |

## LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 60134); voltages are referenced to GND (ground = 0 V); see note 1.

| SYMBOL            | PARAMETER                     | CONDITIONS                               | MIN. | MAX. | UNIT |
|-------------------|-------------------------------|--|------|------|------|
| $V_{CC}$          | supply voltage                |  | -0.5 | +6.5 | V    |
| $V_I$             | input voltage                 | note 2                                   | -0.5 | +6.5 | V    |
| $I_{IK}$          | input diode current           | $V_I < -0.5$ V or $V_I > V_{CC} + 0.5$ V | -    | -50  | mA   |
| $I_{SK}$          | switch diode current          | $V_I < -0.5$ V or $V_I > V_{CC} + 0.5$ V | -    | ±50  | mA   |
| $V_S$             | switch voltage                | enable and disable mode                  | -0.5 | +6.5 | V    |
| $I_S$             | switch source or sink current | $-0.5 < V_S < V_{CC} + 0.5$ V            | -    | ±50  | mA   |
| $I_{CC}, I_{GND}$ | $V_{CC}$ or GND current       |  | -    | ±100 | mA   |
| $T_{stg}$         | storage temperature           |  | -65  | +150 | °C   |
| $P_{tot}$         | power dissipation             | $T_{amb} = -40$ to $+125$ °C; note 3     | -    | 500  | mW   |

## Notes

- To avoid drawing  $V_{CC}$  current out of terminal Z, when switch current flows in terminal Y, the voltage drop across the bidirectional switch must not exceed 0.4 V. If the switch current flows into terminal Z, no  $V_{CC}$  current will flow out of terminal Y. In this case there is no limit for the voltage drop across the switch, but the voltage at Y and Z may not exceed  $V_{CC}$  or GND.
- The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
- For SO14 packages: above 70 °C derate linearly with 8 mW/K.  
For TSSOP14 packages: above 60 °C derate linearly with 5.5 mW/K.  
For DHVQFN14 packages: above 60 °C derate linearly with 4.5 mW/K.

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## DC CHARACTERISTICS

At recommended operating conditions; voltage are referenced to GND (ground = 0 V).

| SYMBOL   | PARAMETER   | TEST CONDITIONS   |                     | MIN.                | TYP. | MAX.                | UNIT |
|--|---|---|---------------------|---------------------|------|---------------------|------|
|  |   | OTHER   | V <sub>CC</sub> (V) |                     |      |                     |      |
| <b>T<sub>amb</sub> = -40 to +85 °C; note 1</b> |   |   |                     |                     |      |                     |      |
| V <sub>IH</sub>                                | HIGH-level input voltage                            |   | 1.65 to 1.95        | 0.65V <sub>CC</sub> | –    | –                   | V    |
|  |   |   | 2.3 to 2.7          | 1.7                 | –    | –                   | V    |
|  |   |   | 2.7 to 3.6          | 2.0                 | –    | –                   | V    |
|  |   |   | 4.5 to 5.5          | 0.7V <sub>CC</sub>  | –    | –                   | V    |
| V <sub>IL</sub>                                | LOW-level input voltage                             |   | 1.65 to 1.95        | –                   | –    | 0.35V <sub>CC</sub> | V    |
|  |   |   | 2.3 to 2.7          | –                   | –    | 0.7                 | V    |
|  |   |   | 2.7 to 3.6          | –                   | –    | 0.8                 | V    |
|  |   |   | 4.5 to 5.5          | –                   | –    | 0.30V <sub>CC</sub> | V    |
| I <sub>LI</sub>                                | input leakage current (control pin)                 | V <sub>I</sub> = 5.5 V or GND   | 5.5                 | –                   | ±0.1 | ±5                  | μA   |
| I <sub>S(OFF)</sub>                            | analog switch OFF-state current                     | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ;<br> V <sub>S</sub>   = V <sub>CC</sub> – GND; see Fig.7 | 5.5                 | –                   | ±0.1 | ±5                  | μA   |
| I <sub>S(ON)</sub>                             | analog switch ON-state current                      | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ;<br> V <sub>S</sub>   = V <sub>CC</sub> – GND; see Fig.8 | 5.5                 | –                   | ±0.1 | ±5                  | μA   |
| I <sub>CC</sub>                                | quiescent supply current                            | V <sub>I</sub> = V <sub>CC</sub> or GND;<br>V <sub>S</sub> = GND or V <sub>CC</sub> ; I <sub>O</sub> = 0 A    | 5.5                 | –                   | 0.1  | 10                  | μA   |
| ΔI <sub>CC</sub>                               | additional quiescent supply current per control pin | V <sub>I</sub> = V <sub>CC</sub> – 0.6 V;<br>V <sub>S</sub> = GND or V <sub>CC</sub> ; I <sub>O</sub> = 0 A   | 5.5                 | –                   | 5    | 500                 | μA   |

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| SYMBOL                                  | PARAMETER   | TEST CONDITIONS   |                     | MIN.                | TYP. | MAX.                | UNIT |
|---|---|---|---------------------|---------------------|------|---------------------|------|
|   |   | OTHER   | V <sub>CC</sub> (V) |                     |      |                     |      |
| <b>T<sub>amb</sub> = -40 to +125 °C</b> |   |   |                     |                     |      |                     |      |
| V <sub>IH</sub>                         | HIGH-level input voltage                            |   | 1.65 to 1.95        | 0.65V <sub>CC</sub> | –    | –                   | V    |
|   |   |   | 2.3 to 2.7          | 1.7                 | –    | –                   | V    |
|   |   |   | 2.7 to 3.6          | 2.0                 | –    | –                   | V    |
|   |   |   | 4.5 to 5.5          | 0.7V <sub>CC</sub>  | –    | –                   | V    |
| V <sub>IL</sub>                         | LOW-level input voltage                             |   | 1.65 to 1.95        | –                   | –    | 0.35V <sub>CC</sub> | V    |
|   |   |   | 2.3 to 2.7          | –                   | –    | 0.7                 | V    |
|   |   |   | 2.7 to 3.6          | –                   | –    | 0.8                 | V    |
|   |   |   | 4.5 to 5.5          | –                   | –    | 0.30V <sub>CC</sub> | V    |
| I <sub>LI</sub>                         | input leakage current (control pin)                 | V <sub>I</sub> = 5.5 V or GND   | 5.5                 | –                   | –    | ±20                 | μA   |
| I <sub>S(OFF)</sub>                     | analog switch OFF-state current                     | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ;<br> V <sub>S</sub>   = V <sub>CC</sub> – GND; see Fig.7 | 5.5                 | –                   | –    | ±20                 | μA   |
| I <sub>S(ON)</sub>                      | analog switch ON-state current                      | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ;<br> V <sub>S</sub>   = V <sub>CC</sub> – GND; see Fig.8 | 5.5                 | –                   | –    | ±20                 | μA   |
| I <sub>CC</sub>                         | quiescent supply current                            | V <sub>I</sub> = V <sub>CC</sub> or GND;<br>V <sub>S</sub> = GND or V <sub>CC</sub> ; I <sub>O</sub> = 0 A    | 5.5                 | –                   | –    | 40                  | μA   |
| ΔI <sub>CC</sub>                        | additional quiescent supply current per control pin | V <sub>I</sub> = V <sub>CC</sub> – 0.6 V;<br>V <sub>S</sub> = GND or V <sub>CC</sub> ; I <sub>O</sub> = 0 A   | 5.5                 | –                   | –    | 5000                | μA   |

**Note**

1. All typical values are measured at T<sub>amb</sub> = 25 °C.

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Resistance  $R_{ON}$

| SYMBOL   | PARAMETER                | TEST CONDITIONS  |            |              | MIN. | TYP. | MAX. | UNIT     |
|--|--------------------------|--|------------|--------------|------|------|------|----------|
|  |                          | OTHER  | $I_S$ (mA) | $V_{CC}$ (V) |      |      |      |          |
| $T_{amb} = -40$ to $+85$ °C; note 1; see Fig.6 |                          |  |            |              |      |      |      |          |
| $R_{ON(peak)}$                                 | ON-resistance (peak)     | $V_S = GND$ to $V_{CC}$ ;<br>$V_I = V_{IH}$                        | 4          | 1.65 to 1.95 | –    | 35   | 100  | $\Omega$ |
|  |                          |  | 8          | 2.3 to 2.7   | –    | 14   | 30   | $\Omega$ |
|  |                          |  | 12         | 2.7          | –    | 11.5 | 25   | $\Omega$ |
|  |                          |  | 24         | 3.0 to 3.6   | –    | 8.5  | 20   | $\Omega$ |
|  |                          |  | 32         | 4.5 to 5.5   | –    | 6.5  | 15   | $\Omega$ |
| $R_{ON(rail)}$                                 | ON-resistance (rail)     | $V_S = GND$ ; $V_I = V_{IH}$                                       | 4          | 1.65 to 1.95 | –    | 10   | 30   | $\Omega$ |
|  |                          |  | 8          | 2.3 to 2.7   | –    | 8.5  | 20   | $\Omega$ |
|  |                          |  | 12         | 2.7          | –    | 7.5  | 18   | $\Omega$ |
|  |                          |  | 24         | 3.0 to 3.6   | –    | 6.5  | 15   | $\Omega$ |
|  |                          |  | 32         | 4.5 to 5.5   | –    | 6    | 10   | $\Omega$ |
|  |                          | $V_S = V_{CC}$ ; $V_I = V_{IH}$                                    | 4          | 1.65 to 1.95 | –    | 12   | 30   | $\Omega$ |
|  |                          |  | 8          | 2.3 to 2.7   | –    | 8.5  | 20   | $\Omega$ |
|  |                          |  | 12         | 2.7          | –    | 7.5  | 18   | $\Omega$ |
|  |                          |  | 24         | 3.0 to 3.6   | –    | 6.5  | 15   | $\Omega$ |
|  |                          |  | 32         | 4.5 to 5.5   | –    | 6    | 10   | $\Omega$ |
| $R_{ON(flatness)}$                             | ON-resistance (flatness) | $V_S = GND$ to $V_{CC}$ ;<br>$V_I = V_{IH}$ ;<br>see Figs.10 to 13 | 4          | 1.8          | –    | 100  | –    | $\Omega$ |
|  |                          |  | 8          | 2.5          | –    | 17   | –    | $\Omega$ |
|  |                          |  | 12         | 2.7          | –    | 10   | –    | $\Omega$ |
|  |                          |  | 24         | 3.3          | –    | 5    | –    | $\Omega$ |
|  |                          |  | 32         | 5.0          | –    | 3    | –    | $\Omega$ |



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| SYMBOL   | PARAMETER            | TEST CONDITIONS   |                     |                     | MIN. | TYP. | MAX. | UNIT |
|--|----------------------|---|---------------------|---------------------|------|------|------|------|
|  |                      | OTHER   | I <sub>S</sub> (mA) | V <sub>CC</sub> (V) |      |      |      |      |
| <b>T<sub>amb</sub> = -40 to +125 °C; see Fig.6</b> |                      |   |                     |                     |      |      |      |      |
| R <sub>ON(peak)</sub>                              | ON-resistance (peak) | V <sub>S</sub> = GND to V <sub>CC</sub> ;<br>V <sub>I</sub> = V <sub>IH</sub> | 4                   | 1.65 to 1.95        | –    | –    | 150  | Ω    |
|  |                      |   | 8                   | 2.3 to 2.7          | –    | –    | 45   | Ω    |
|  |                      |   | 12                  | 2.7                 | –    | –    | 38   | Ω    |
|  |                      |   | 24                  | 3.0 to 3.6          | –    | –    | 30   | Ω    |
|  |                      |   | 32                  | 4.5 to 5.5          | –    | –    | 23   | Ω    |
| R <sub>ON(rail)</sub>                              | ON-resistance (rail) | V <sub>S</sub> = GND; V <sub>I</sub> = V <sub>IH</sub>                        | 4                   | 1.65 to 1.95        | –    | –    | 45   | Ω    |
|  |                      |   | 8                   | 2.3 to 2.7          | –    | –    | 30   | Ω    |
|  |                      |   | 12                  | 2.7                 | –    | –    | 27   | Ω    |
|  |                      |   | 24                  | 3.0 to 3.6          | –    | –    | 23   | Ω    |
|  |                      |   | 32                  | 4.5 to 5.5          | –    | –    | 15   | Ω    |
|  |                      | V <sub>S</sub> = V <sub>CC</sub> ; V <sub>I</sub> = V <sub>IH</sub>           | 4                   | 1.65 to 1.95        | –    | –    | 45   | Ω    |
|  |                      |   | 8                   | 2.3 to 2.7          | –    | –    | 30   | Ω    |
|  |                      |   | 12                  | 2.7                 | –    | –    | 27   | Ω    |
|  |                      |   | 24                  | 3.0 to 3.6          | –    | –    | 23   | Ω    |
|  |                      |   | 32                  | 4.5 to 5.5          | –    | –    | 15   | Ω    |

**Note**

1. Typical value R<sub>on(flatness)</sub> is measured at T<sub>amb</sub> = -40 to +85 °C, all other typical values are measured at T<sub>amb</sub> = 25 °C.

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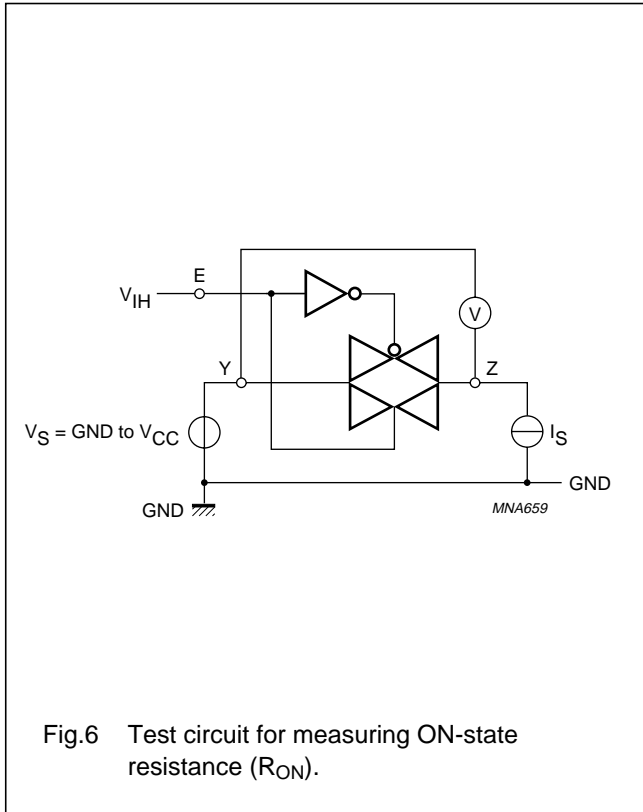


Fig.6 Test circuit for measuring ON-state resistance ( $R_{ON}$ ).

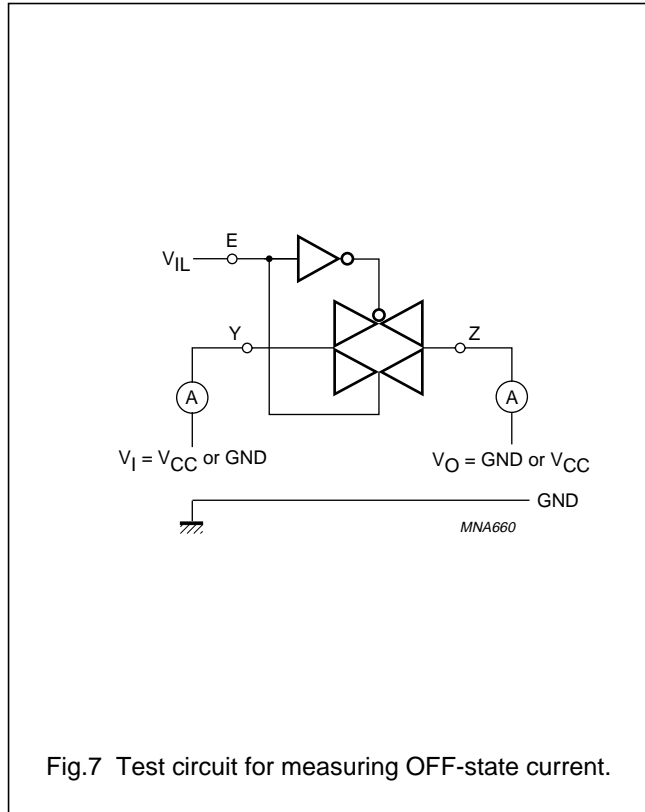


Fig.7 Test circuit for measuring OFF-state current.

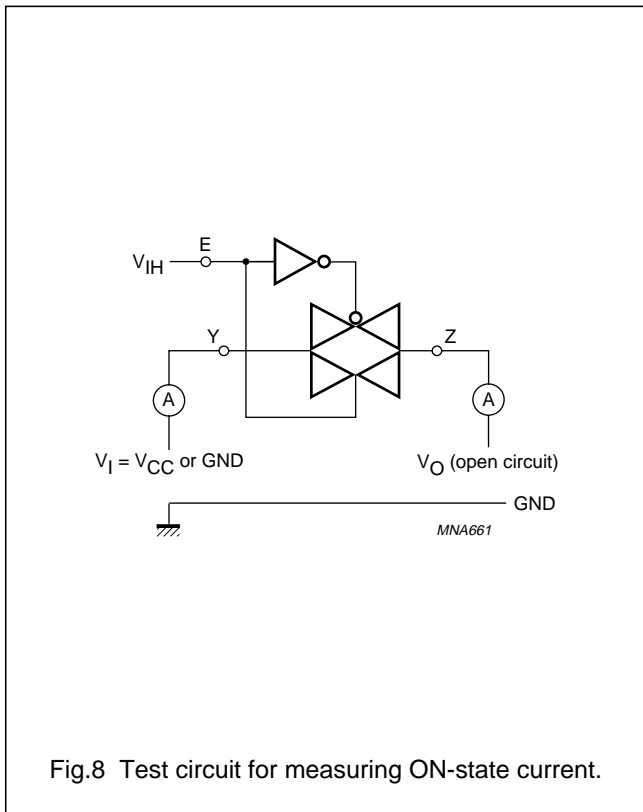


Fig.8 Test circuit for measuring ON-state current.

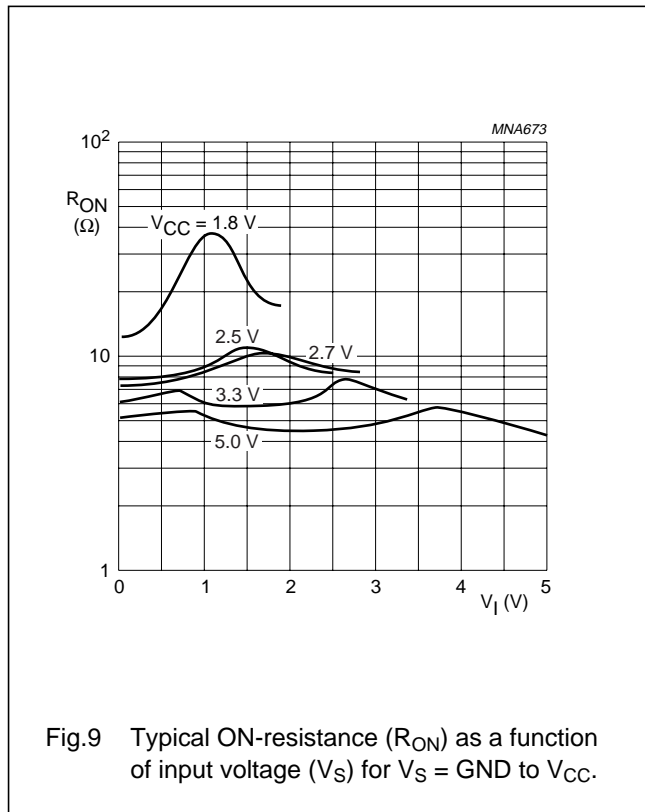
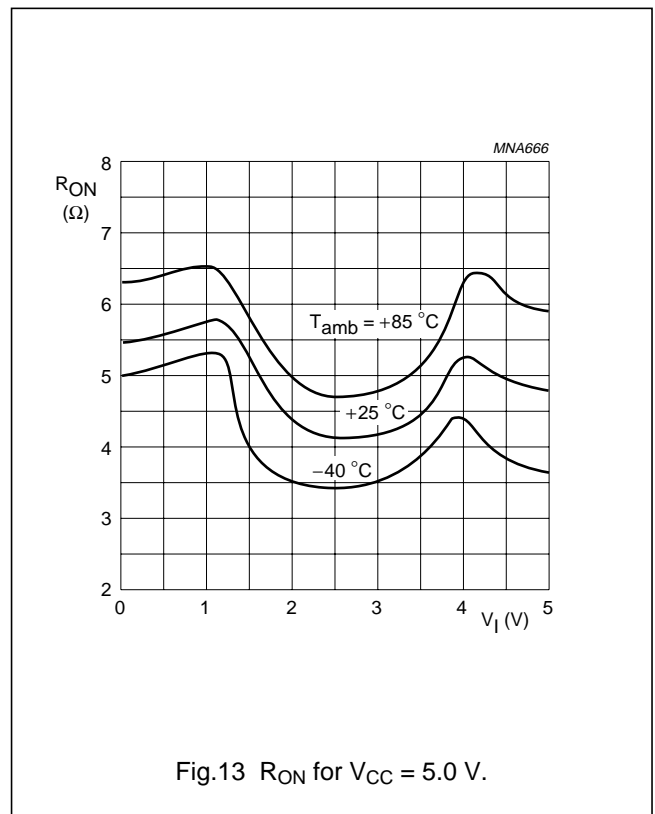
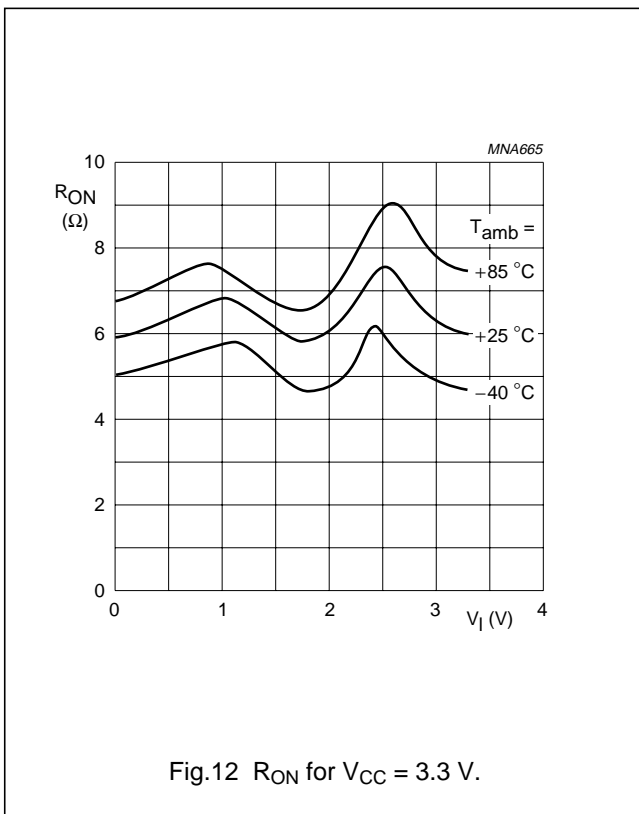
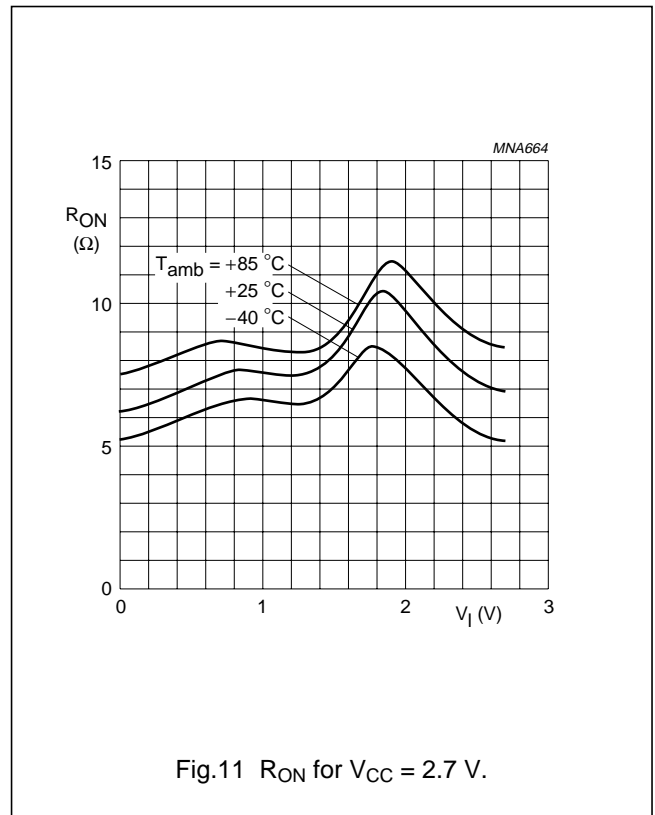
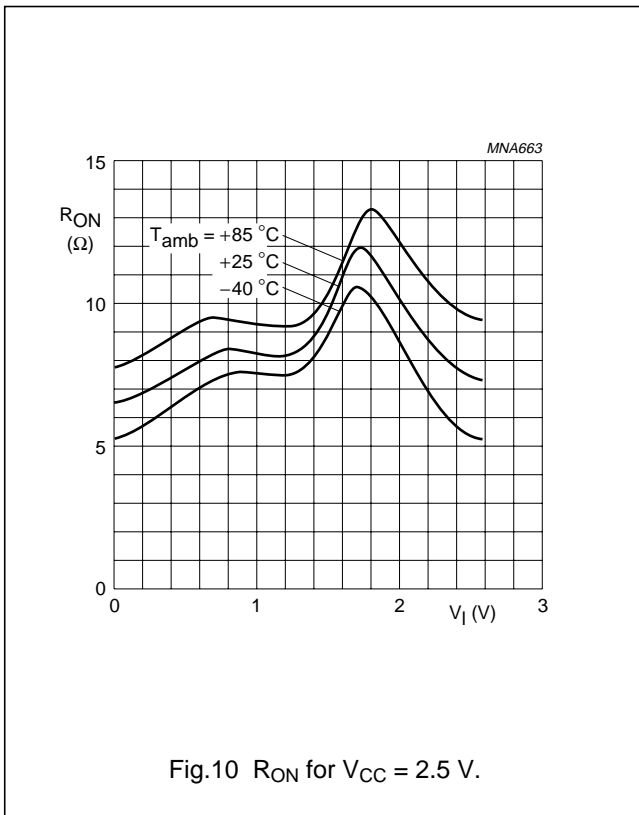


Fig.9 Typical ON-resistance ( $R_{ON}$ ) as a function of input voltage ( $V_S$ ) for  $V_S = GND$  to  $V_{CC}$ .

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## AC CHARACTERISTICS

GND = 0 V.

| SYMBOL   | PARAMETER                              | TEST CONDITIONS            |                     | MIN. | TYP. | MAX. | UNIT |
|--|--|----------------------------|---------------------|------|------|------|------|
|  |  | WAVEFORMS                  | V <sub>CC</sub> (V) |      |      |      |      |
| <b>T<sub>amb</sub> = -40 to +85 °C; note 1</b> |  |                            |                     |      |      |      |      |
| t <sub>PHL</sub> /t <sub>PLH</sub>             | propagation delay nY to nZ or nZ to nY | see Figs 14 and 16; note 2 | 1.65 to 1.95        | –    | 0.8  | 2.0  | ns   |
|  |  |                            | 2.3 to 2.7          | –    | 0.4  | 1.2  | ns   |
|  |  |                            | 2.7                 | –    | 0.4  | 1.0  | ns   |
|  |  |                            | 3.0 to 3.6          | –    | 0.3  | 0.8  | ns   |
|  |  |                            | 4.5 to 5.5          | –    | 0.2  | 0.6  | ns   |
| t <sub>PZH</sub> /t <sub>PZL</sub>             | turn-ON time E to V <sub>OS</sub>      | see Figs 15 and 16         | 1.65 to 1.95        | 1.0  | 5.3  | 10   | ns   |
|  |  |                            | 2.3 to 2.7          | 1.0  | 3.0  | 5.6  | ns   |
|  |  |                            | 2.7                 | 1.0  | 2.6  | 5.0  | ns   |
|  |  |                            | 3.0 to 3.6          | 1.0  | 2.5  | 4.4  | ns   |
|  |  |                            | 4.5 to 5.5          | 1.0  | 1.9  | 3.9  | ns   |
| t <sub>PHZ</sub> /t <sub>PLZ</sub>             | turn-OFF time E to V <sub>OS</sub>     | see Figs 15 and 16         | 1.65 to 1.95        | 1.0  | 4.2  | 9.0  | ns   |
|  |  |                            | 2.3 to 2.7          | 1.0  | 2.4  | 5.5  | ns   |
|  |  |                            | 2.7                 | 1.0  | 3.6  | 6.5  | ns   |
|  |  |                            | 3.0 to 3.6          | 1.0  | 3.4  | 6.0  | ns   |
|  |  |                            | 4.5 to 5.5          | 1.0  | 2.5  | 5.0  | ns   |
| <b>T<sub>amb</sub> = -40 to +125 °C</b>        |  |                            |                     |      |      |      |      |
| t <sub>PHL</sub> /t <sub>PLH</sub>             | propagation delay nY to nZ or nZ to nY | see Figs 14 and 16; note 2 | 1.65 to 1.95        | –    | –    | 3.0  | ns   |
|  |  |                            | 2.3 to 2.7          | –    | –    | 2.0  | ns   |
|  |  |                            | 2.7                 | –    | –    | 1.5  | ns   |
|  |  |                            | 3.0 to 3.6          | –    | –    | 1.5  | ns   |
|  |  |                            | 4.5 to 5.5          | –    | –    | 1.0  | ns   |
| t <sub>PZH</sub> /t <sub>PZL</sub>             | turn-ON time E to V <sub>OS</sub>      | see Figs 15 and 16         | 1.65 to 1.95        | 1.0  | –    | 12.5 | ns   |
|  |  |                            | 2.3 to 2.7          | 1.0  | –    | 7.0  | ns   |
|  |  |                            | 2.7                 | 1.0  | –    | 6.5  | ns   |
|  |  |                            | 3.0 to 3.6          | 1.0  | –    | 5.5  | ns   |
|  |  |                            | 4.5 to 5.5          | 1.0  | –    | 5.0  | ns   |
| t <sub>PHZ</sub> /t <sub>PLZ</sub>             | turn-OFF time E to V <sub>OS</sub>     | see Figs 15 and 16         | 1.65 to 1.95        | 1.0  | –    | 11.5 | ns   |
|  |  |                            | 2.3 to 2.7          | 1.0  | –    | 7.0  | ns   |
|  |  |                            | 2.7                 | 1.0  | –    | 8.5  | ns   |
|  |  |                            | 3.0 to 3.6          | 1.0  | –    | 7.5  | ns   |
|  |  |                            | 4.5 to 5.5          | 1.0  | –    | 6.5  | ns   |

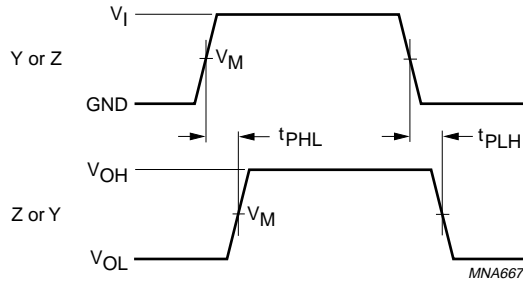
## Notes

1. All typical values are measured at T<sub>amb</sub> = 25 °C.
2. t<sub>PHL</sub>/t<sub>PLH</sub> propagation delay is the calculated RC time constant of the typical ON-state resistance of the switch and the specified capacitance when driven by an ideal voltage source (zero output impedance).

Quad bilateral switches

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AC WAVEFORMS



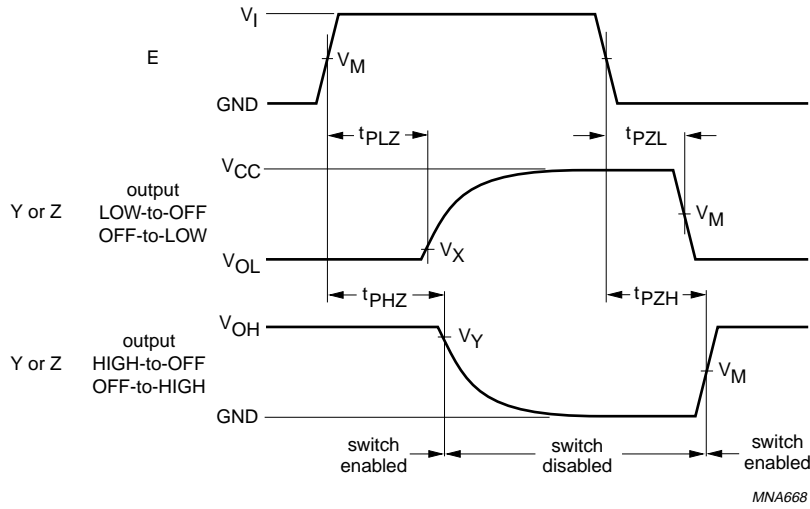
| V <sub>CC</sub>      | V <sub>M</sub>     | INPUT           |                                 |
|----------------------|--------------------|-----------------|---------------------------------|
|                      |                    | V <sub>I</sub>  | t <sub>r</sub> = t <sub>f</sub> |
| 1.65 to 1.95 V       | 0.5V <sub>CC</sub> | V <sub>CC</sub> | ≤ 2.0 ns                        |
| 2.3 to 2.7 V         | 0.5V <sub>CC</sub> | V <sub>CC</sub> | ≤ 2.0 ns                        |
| 2.7 and 3.0 to 3.6 V | 1.5 V              | 2.7 V           | ≤ 2.5 ns                        |
| 4.5 to 5.5 V         | 0.5V <sub>CC</sub> | V <sub>CC</sub> | ≤ 2.5 ns                        |

V<sub>OL</sub> and V<sub>OH</sub> are typical output voltage drop that occur with the output load.

Fig.14 The input (V<sub>S</sub>) to output (V<sub>O</sub>) propagation delays.

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| V <sub>CC</sub>      | V <sub>M</sub>     | INPUT           |                                 |
|----------------------|--------------------|-----------------|---------------------------------|
|                      |                    | V <sub>I</sub>  | t <sub>r</sub> = t <sub>f</sub> |
| 1.65 to 1.95 V       | 0.5V <sub>CC</sub> | V <sub>CC</sub> | ≤ 2.0 ns                        |
| 2.3 to 2.7 V         | 0.5V <sub>CC</sub> | V <sub>CC</sub> | ≤ 2.0 ns                        |
| 2.7 and 3.0 to 3.6 V | 1.5 V              | 2.7 V           | ≤ 2.5 ns                        |
| 4.5 to 5.5 V         | 0.5V <sub>CC</sub> | V <sub>CC</sub> | ≤ 2.5 ns                        |

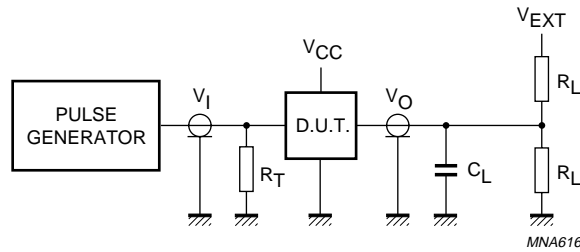
$V_X = V_{OL} + 0.3 \text{ V}$  at  $V_{CC} \geq 2.7 \text{ V}$ ;  
 $V_X = V_{OL} + 0.1 \times V_{CC}$  at  $V_{CC} < 2.7 \text{ V}$ ;  
 $V_Y = V_{OH} - 0.3 \text{ V}$  at  $V_{CC} \geq 2.7 \text{ V}$ ;  
 $V_Y = V_{OH} - 0.1 \times V_{CC}$  at  $V_{CC} < 2.7 \text{ V}$ .

V<sub>OL</sub> and V<sub>OH</sub> are typical output voltage drop that occur with the output load.

Fig.15 Turn-on and turn-off times.

Quad bilateral switches

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| V <sub>CC</sub>      | V <sub>I</sub>  | C <sub>L</sub> | R <sub>L</sub> | V <sub>EXT</sub>                   |                                    |                                    |
|----------------------|-----------------|----------------|----------------|------------------------------------|------------------------------------|------------------------------------|
|                      |                 |                |                | t <sub>PLH</sub> /t <sub>PHL</sub> | t <sub>PZH</sub> /t <sub>PHZ</sub> | t <sub>PZL</sub> /t <sub>PLZ</sub> |
| 1.65 to 1.95 V       | V <sub>CC</sub> | 30 pF          | 1 kΩ           | open                               | GND                                | 2V <sub>CC</sub>                   |
| 2.3 to 2.7 V         | V <sub>CC</sub> | 30 pF          | 500 Ω          | open                               | GND                                | 2V <sub>CC</sub>                   |
| 2.7 and 3.0 to 3.6 V | 2.7 V           | 50 pF          | 500 Ω          | open                               | GND                                | 6 V                                |
| 4.5 to 5.5 V         | V <sub>CC</sub> | 50 pF          | 500 Ω          | open                               | GND                                | 2V <sub>CC</sub>                   |

Definitions for test circuits:

R<sub>L</sub> = Load resistor.

C<sub>L</sub> = Load capacitance including jig and probe capacitance.

R<sub>T</sub> = Termination resistance should be equal to the output impedance Z<sub>o</sub> of the pulse generator.

Fig.16 Load circuitry for switching times.

**ADDITIONAL AC CHARACTERISTICS**

Recommended conditions and typical values at T<sub>amb</sub> = 25 °C.

| SYMBOL           | PARAMETER                           | TEST CONDITIONS  | V <sub>CC</sub> (V) | TYPICAL | UNIT |
|------------------|-------------------------------------|--|---------------------|---------|------|
| d <sub>sin</sub> | sine-wave distortion                | R <sub>L</sub> = 10 kΩ; C <sub>L</sub> = 50 pF; f <sub>in</sub> = 1 kHz; see Fig.18  | 1.65                | 0.032   | %    |
|                  |                                     |  | 2.3                 | 0.008   | %    |
|                  |                                     |  | 3                   | 0.006   | %    |
|                  |                                     |  | 4.5                 | 0.005   | %    |
|                  |                                     | R <sub>L</sub> = 10 kΩ; C <sub>L</sub> = 50 pF; f <sub>in</sub> = 10 kHz; see Fig.18 | 1.65                | 0.068   | %    |
|                  |                                     |  | 2.3                 | 0.009   | %    |
|                  |                                     |  | 3                   | 0.008   | %    |
|                  |                                     |  | 4.5                 | 0.006   | %    |
| f <sub>ON</sub>  | switch ON signal frequency response | R <sub>L</sub> = 600 Ω; C <sub>L</sub> = 50 pF; see Fig.17; note 1                   | 1.65                | 170     | MHz  |
|                  |                                     |  | 2.3                 | 210     | MHz  |
|                  |                                     |  | 3                   | 212     | MHz  |
|                  |                                     |  | 4.5                 | 215     | MHz  |
|                  |                                     | R <sub>L</sub> = 50 Ω; C <sub>L</sub> = 5 pF; see Fig.17; note 1                     | 1.65                | > 500   | MHz  |
|                  |                                     |  | 2.3                 | > 500   | MHz  |
|                  |                                     |  | 3                   | > 500   | MHz  |
|                  |                                     |  | 4.5                 | > 500   | MHz  |

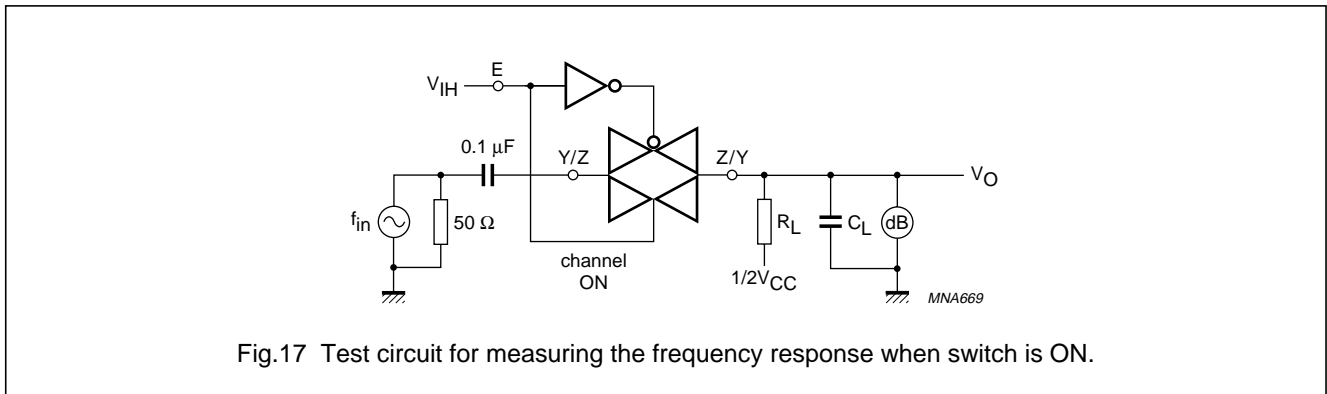
Quad bilateral switches

74LVC4066

| SYMBOL                   | PARAMETER  | TEST CONDITIONS  | V <sub>CC</sub> (V) | TYPICAL | UNIT |
|--------------------------|--|--|---------------------|---------|------|
| $\alpha_{OFF(Feedthru)}$ | switch OFF signal feed-through attenuation       | $R_L = 600 \Omega; C_L = 50 \text{ pF}; f_{in} = 1 \text{ MHz};$ see Fig.19; note 2  | 1.65                | -46     | dB   |
|                          |  |  | 2.3                 | -46     | dB   |
|                          |  |  | 3                   | -46     | dB   |
|                          |  |  | 4.5                 | -46     | dB   |
|                          |  | $R_L = 50 \Omega; C_L = 5 \text{ pF}; f_{in} = 1 \text{ MHz};$ see Fig.19; note 2  | 1.65                | -42     | dB   |
|                          |  |  | 2.3                 | -42     | dB   |
|                          |  |  | 3                   | -42     | dB   |
|                          |  |  | 4.5                 | -42     | dB   |
| $\alpha_{ct(E-Y/Z)}$     | crosstalk between control input to signal output | $R_L = 600 \Omega; C_L = 50 \text{ pF}; f_{in} = 1 \text{ MHz}; t_r = t_f = 2 \text{ ns};$ see Fig.20                                  | 1.65                | 69      | mV   |
|                          |  |  | 2.3                 | 87      | mV   |
|                          |  |  | 3                   | 156     | mV   |
|                          |  |  | 4.5                 | 302     | mV   |
| $\alpha_{ct(S)}$         | crosstalk between switches)                      | $R_L = 600 \Omega; C_L = 50 \text{ pF}; f_{in} = 1 \text{ MHz};$ see Fig.21  | 1.65                | -58     | dB   |
|                          |  |  | 2.3                 | -58     | dB   |
|                          |  |  | 3                   | -58     | dB   |
|                          |  |  | 4.5                 | -58     | dB   |
|                          |  | $R_L = 50 \Omega; C_L = 5 \text{ pF}; f_{in} = 1 \text{ MHz};$ see Fig.21  | 1.65                | -58     | dB   |
|                          |  |  | 2.3                 | -58     | dB   |
|                          |  |  | 3                   | -58     | dB   |
|                          |  |  | 4.5                 | -58     | dB   |
| $C_{PD}$                 | power dissipation capacitance                    | $f_{in} = 10 \text{ MHz}$  | 2.5                 | 11.0    | pF   |
|                          |  |  | 3.3                 | 12.5    | pF   |
|                          |  |  | 5.0                 | 15.6    | pF   |
| Q                        | charge injection                                 | $C_L = 0.1 \text{ nF}; V_{gen} = 0 \text{ V}; R_{gen} = 0 \Omega;$<br>$f = 1 \text{ MHz}; R_L = 1 \text{ M}\Omega;$ see Fig.22; note 3 | 3.3                 | 0.8     | pC   |
|                          |  |  | 5.5                 | 1.2     | pC   |

Notes

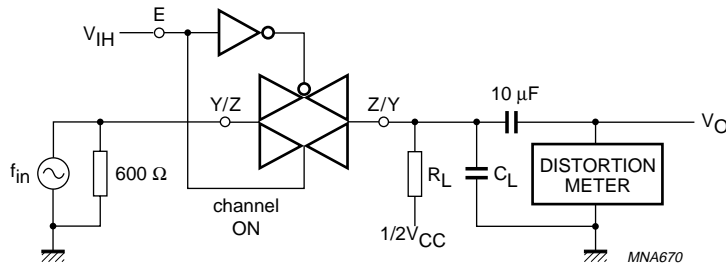
1. Adjust  $f_{in}$  voltage to obtain 0 dBm level at output. Increase  $f_{in}$  frequency until dB meter reads -3 dB.
2. Adjust  $f_{in}$  voltage to obtain 0 dBm level at input.
3. Guaranteed by design.





Quad bilateral switches

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| V <sub>CC</sub> | V <sub>IH</sub> |
|-----------------|-----------------|
| 1.65 V          | 1.4 V (p-p)     |
| 2.3 V           | 2 V (p-p)       |
| 3 V             | 2.5 V (p-p)     |
| 4. V            | 4 V (p-p)       |

Fig.18 Test circuit for measuring sine-wave distortion.

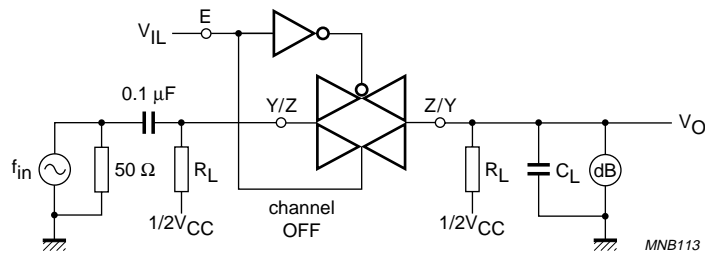


Fig.19 Test circuit for measuring feed-through when switch is OFF.

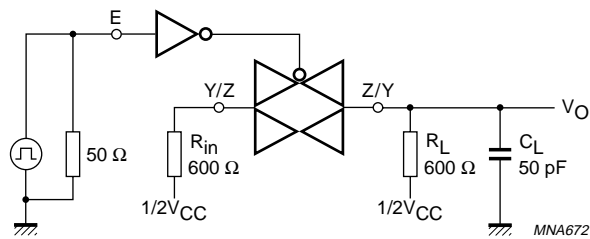
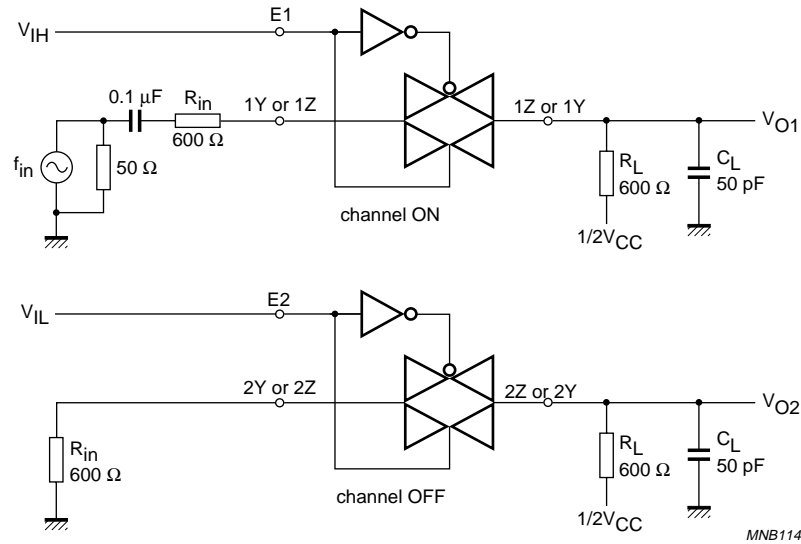


Fig.20 Crosstalk between control input to signal output.

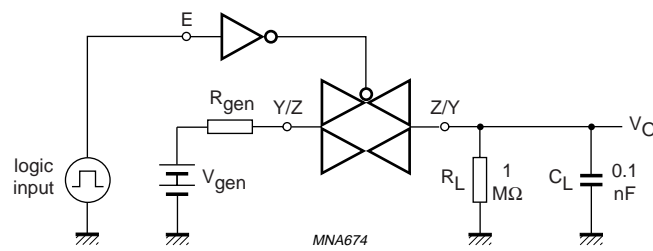
Quad bilateral switches

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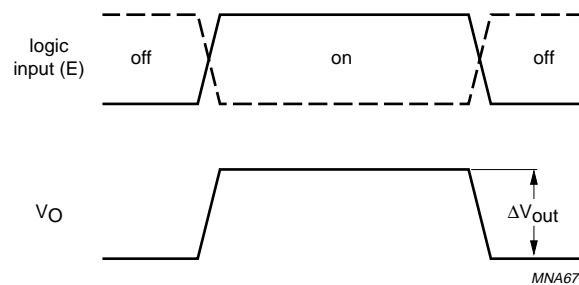


MNB114

Fig.21 Crosstalk between switches.



MNA674



MNA675

$$Q = \Delta V_{out} \times C_L$$

Fig.22 Charge injection test.

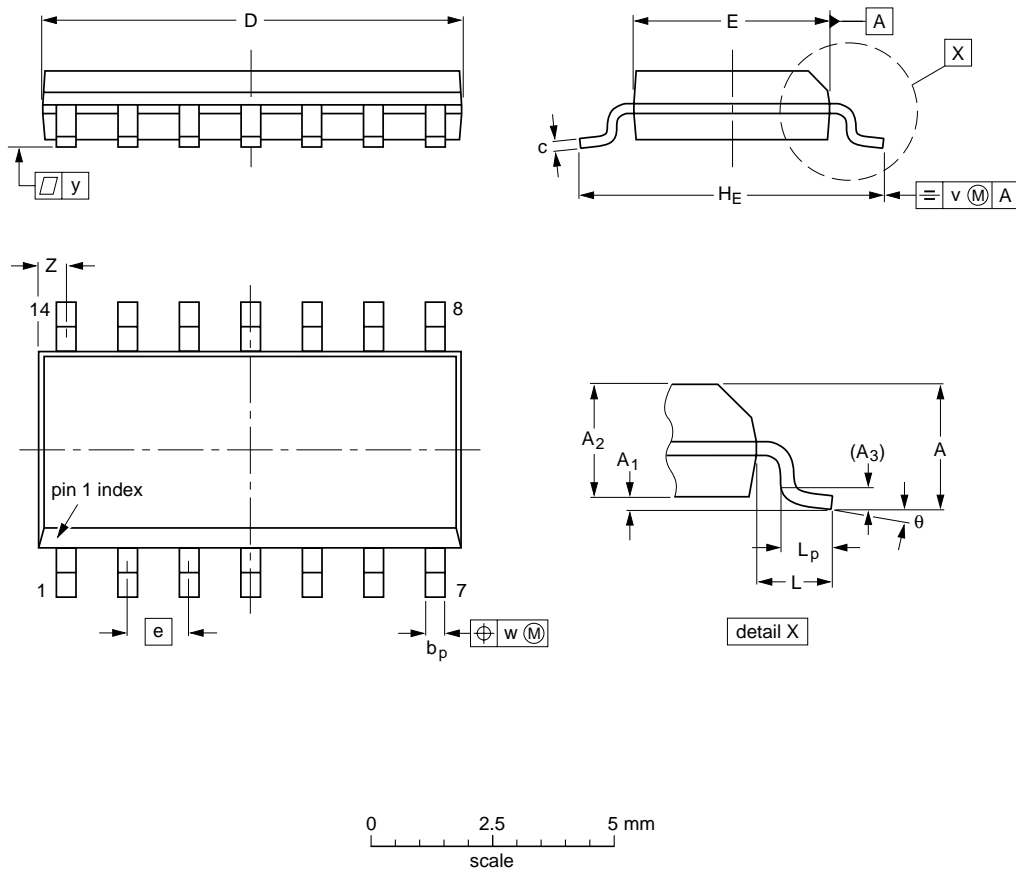
Quad bilateral switches

74LVC4066

PACKAGE OUTLINES

SO14: plastic small outline package; 14 leads; body width 3.9 mm; body thickness 1.47 mm

SOT108-2



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

| UNIT   | A max. | A <sub>1</sub> | A <sub>2</sub> | A <sub>3</sub> | b <sub>p</sub> | c                | D <sup>(1)</sup> | E <sup>(1)</sup> | e    | H <sub>E</sub> | L     | L <sub>p</sub> | v    | w    | y     | Z <sup>(1)</sup> | θ        |
|--------|--------|----------------|----------------|----------------|----------------|------------------|------------------|------------------|------|----------------|-------|----------------|------|------|-------|------------------|----------|
| mm     | 1.75   | 0.25<br>0.10   | 1.55<br>1.40   | 0.25           | 0.49<br>0.36   | 0.25<br>0.19     | 8.75<br>8.55     | 4.0<br>3.8       | 1.27 | 6.2<br>5.8     | 1.05  | 1.0<br>0.4     | 0.25 | 0.25 | 0.1   | 0.7<br>0.3       | 8°<br>0° |
| inches | 0.069  | 0.010<br>0.004 | 0.061<br>0.055 | 0.01           | 0.019<br>0.014 | 0.0100<br>0.0075 | 0.35<br>0.34     | 0.16<br>0.15     | 0.05 | 0.244<br>0.228 | 0.041 | 0.039<br>0.016 | 0.01 | 0.01 | 0.004 | 0.028<br>0.012   |          |

Note

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

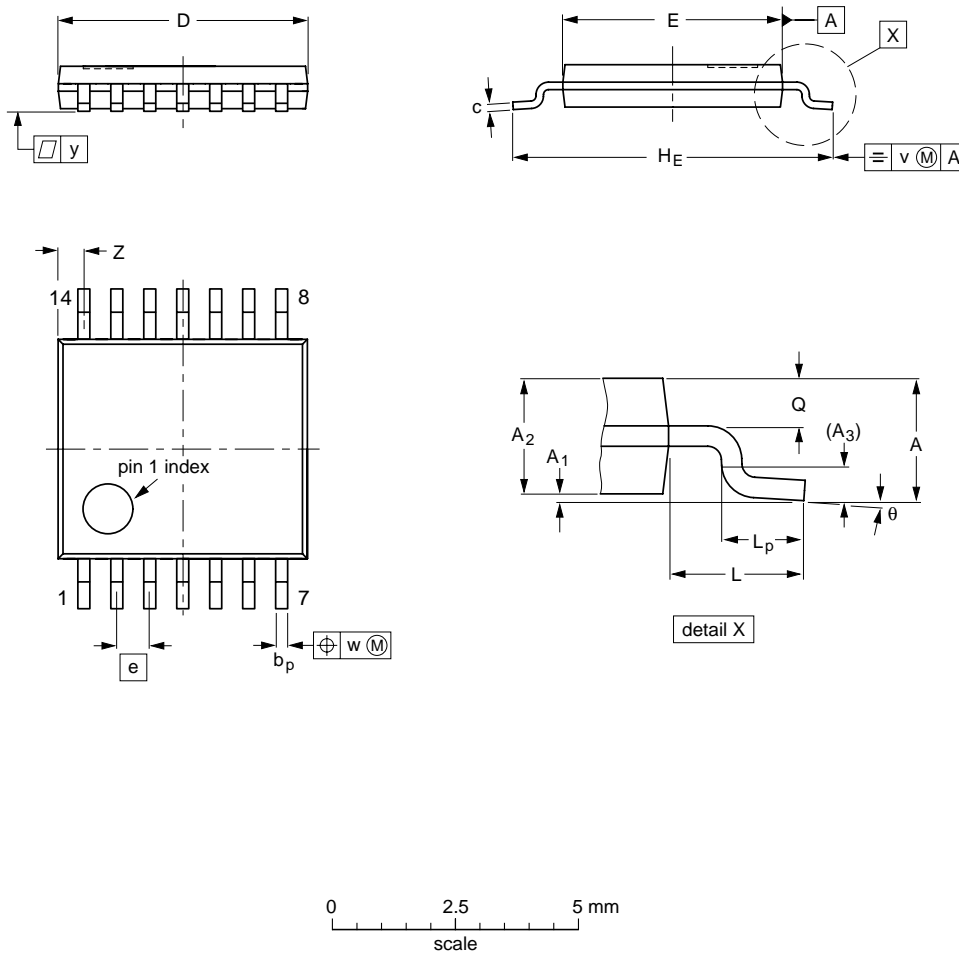
| OUTLINE VERSION | REFERENCES |        |       |  | EUROPEAN PROJECTION | ISSUE DATE           |
|-----------------|------------|--------|-------|--|---------------------|----------------------|
|                 | IEC        | JEDEC  | JEITA |  |                     |                      |
| SOT108-2        |            | MS-012 |       |  |                     | 01-05-29<br>03-02-19 |

Quad bilateral switches

74LVC4066

TSSOP14: plastic thin shrink small outline package; 14 leads; body width 4.4 mm

SOT402-1



**DIMENSIONS (mm are the original dimensions)**

| UNIT | A max. | A <sub>1</sub> | A <sub>2</sub> | A <sub>3</sub> | b <sub>p</sub> | c          | D <sup>(1)</sup> | E <sup>(2)</sup> | e    | H <sub>E</sub> | L | L <sub>p</sub> | Q          | v   | w    | y   | z <sup>(1)</sup> | θ        |
|------|--------|----------------|----------------|----------------|----------------|------------|------------------|------------------|------|----------------|---|----------------|------------|-----|------|-----|------------------|----------|
| mm   | 1.1    | 0.15<br>0.05   | 0.95<br>0.80   | 0.25           | 0.30<br>0.19   | 0.2<br>0.1 | 5.1<br>4.9       | 4.5<br>4.3       | 0.65 | 6.6<br>6.2     | 1 | 0.75<br>0.50   | 0.4<br>0.3 | 0.2 | 0.13 | 0.1 | 0.72<br>0.38     | 8°<br>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.

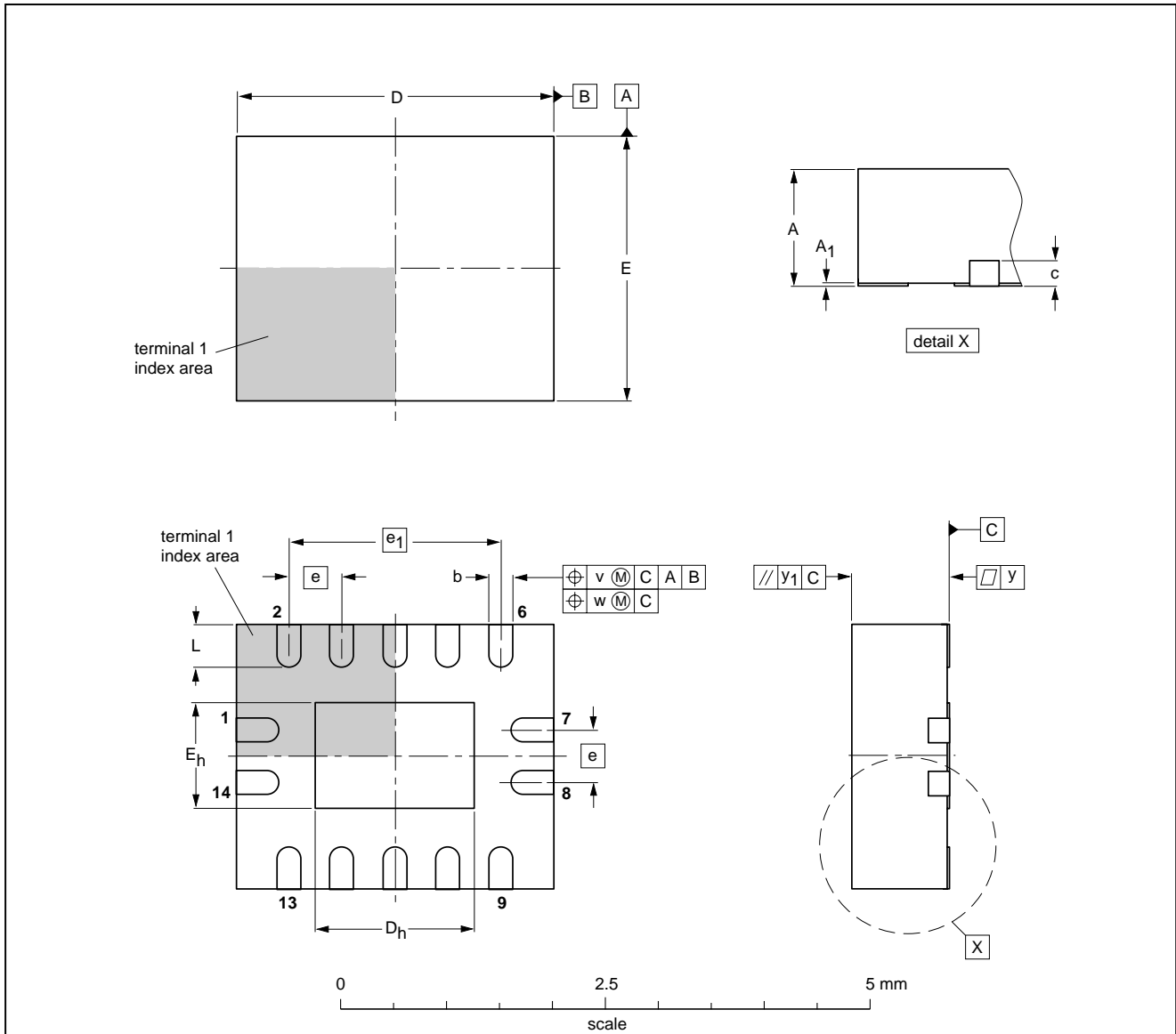
| OUTLINE VERSION | REFERENCES |        |       |  | EUROPEAN PROJECTION | ISSUE DATE           |
|-----------------|------------|--------|-------|--|---------------------|----------------------|
|                 | IEC        | JEDEC  | JEITA |  |                     |                      |
| SOT402-1        |            | MO-153 |       |  |                     | 99-12-27<br>03-02-18 |

Quad bilateral switches

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DHVQFN14: plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 14 terminals; body 2.5 x 3 x 0.85 mm

SOT762-1



DIMENSIONS (mm are the original dimensions)

| UNIT | A <sup>(1)</sup><br>max. | A <sub>1</sub> | b            | c   | D <sup>(1)</sup> | D <sub>h</sub> | E <sup>(1)</sup> | E <sub>h</sub> | e   | e <sub>1</sub> | L          | v   | w    | y    | y <sub>1</sub> |
|------|--------------------------|----------------|--------------|-----|------------------|----------------|------------------|----------------|-----|----------------|------------|-----|------|------|----------------|
| mm   | 1                        | 0.05<br>0.00   | 0.30<br>0.18 | 0.2 | 3.1<br>2.9       | 1.65<br>1.35   | 2.6<br>2.4       | 1.15<br>0.85   | 0.5 | 2              | 0.5<br>0.3 | 0.1 | 0.05 | 0.05 | 0.1            |

Note

1. Plastic or metal protrusions of 0.075 mm maximum per side are not included.

| OUTLINE VERSION | REFERENCES |        |       | EUROPEAN PROJECTION | ISSUE DATE           |
|-----------------|------------|--------|-------|---------------------|----------------------|
|                 | IEC        | JEDEC  | JEITA |                     |                      |
| SOT762-1        | ---        | MO-241 | ---   |                     | 02-10-17<br>03-01-27 |

## Quad bilateral switches

74LVC4066

## DATA SHEET STATUS

| LEVEL | DATA SHEET STATUS <sup>(1)</sup> | PRODUCT STATUS <sup>(2)(3)</sup> | 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.             |
| III   | Product data                     | Production                       | This data sheet contains data from the product specification. Philips Semiconductors reserves the right to make changes at any time in order to improve the design, manufacturing and supply. Relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN). |

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SCA75

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Printed in The Netherlands

613508/01/pp23

Date of release: 2003 Aug 12

Document order number: 9397 750 11652

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