

# HEF4952B

## Dual 3-channel analog multiplexer/demultiplexer with supplementary switches

Rev. 03 — 16 December 2009

Product data sheet

### 1. General description

The HEF4952B is a dual 3-channel analog multiplexer/demultiplexer with supplementary switches and common select logic. Each switch features three independent inputs/outputs (pins nY0, nY1 and nY2) an input/output nY3 that can be connected to nY2 or  $V_{SS}$  and an input/output (nZ) common to nY0, nY1 and nY2. Three digital select inputs (S1, S2 and S3) are common to both switches. Inputs include clamp diodes, this enables the use of current limiting resistors to interface inputs in excess of  $V_{DD}$ .

$V_{SS}$  and  $V_{DD}$  are the digital control supply pins.

The HEF4952B is suitable for use over the full industrial ( $-40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$ ) temperature range.

### 2. Features

- Fully static operation
- 5 V, 10 V, and 15 V parametric ratings
- Schmitt-trigger action at control inputs
- Small signal switch
- Standardized symmetrical output characteristics
- Operates across the full industrial temperature range  $-40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$
- Complies with JEDEC standard JESD 13-B

### 3. Applications

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

### 4. Ordering information

**Table 1. Ordering information**

All types operate from  $-40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$ .

Type number	Package		Version
	Name	Description	
HEF4952BT	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1

5. Functional diagram

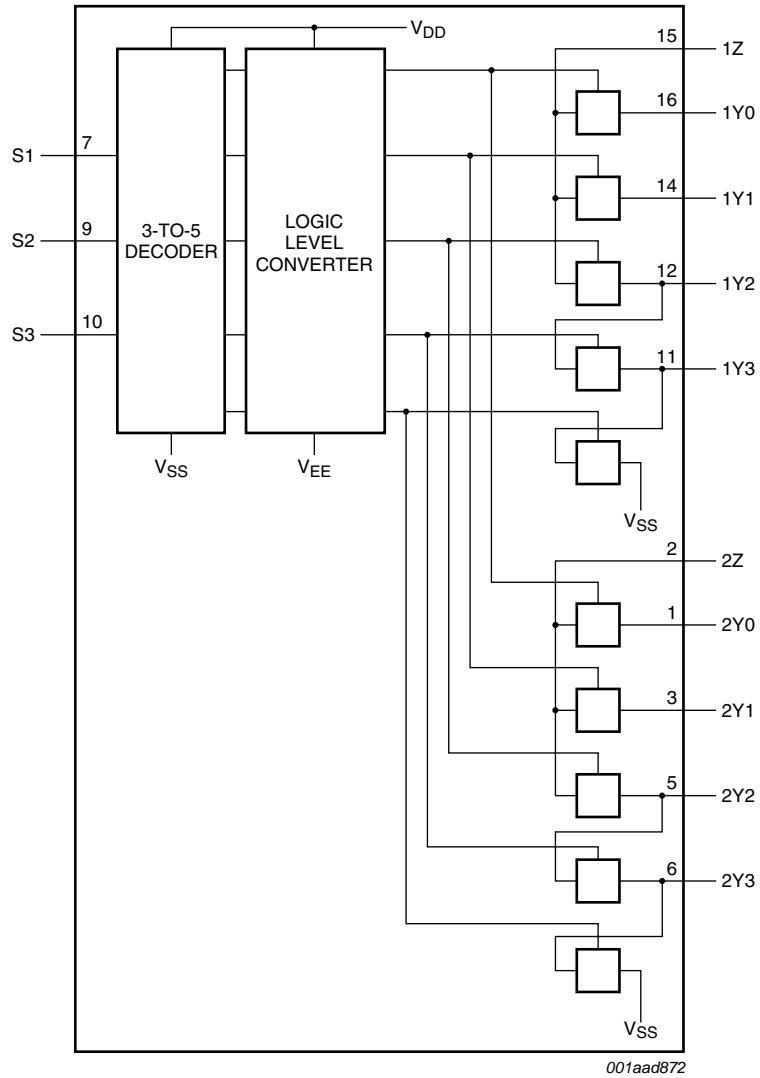


Fig 1. Functional diagram

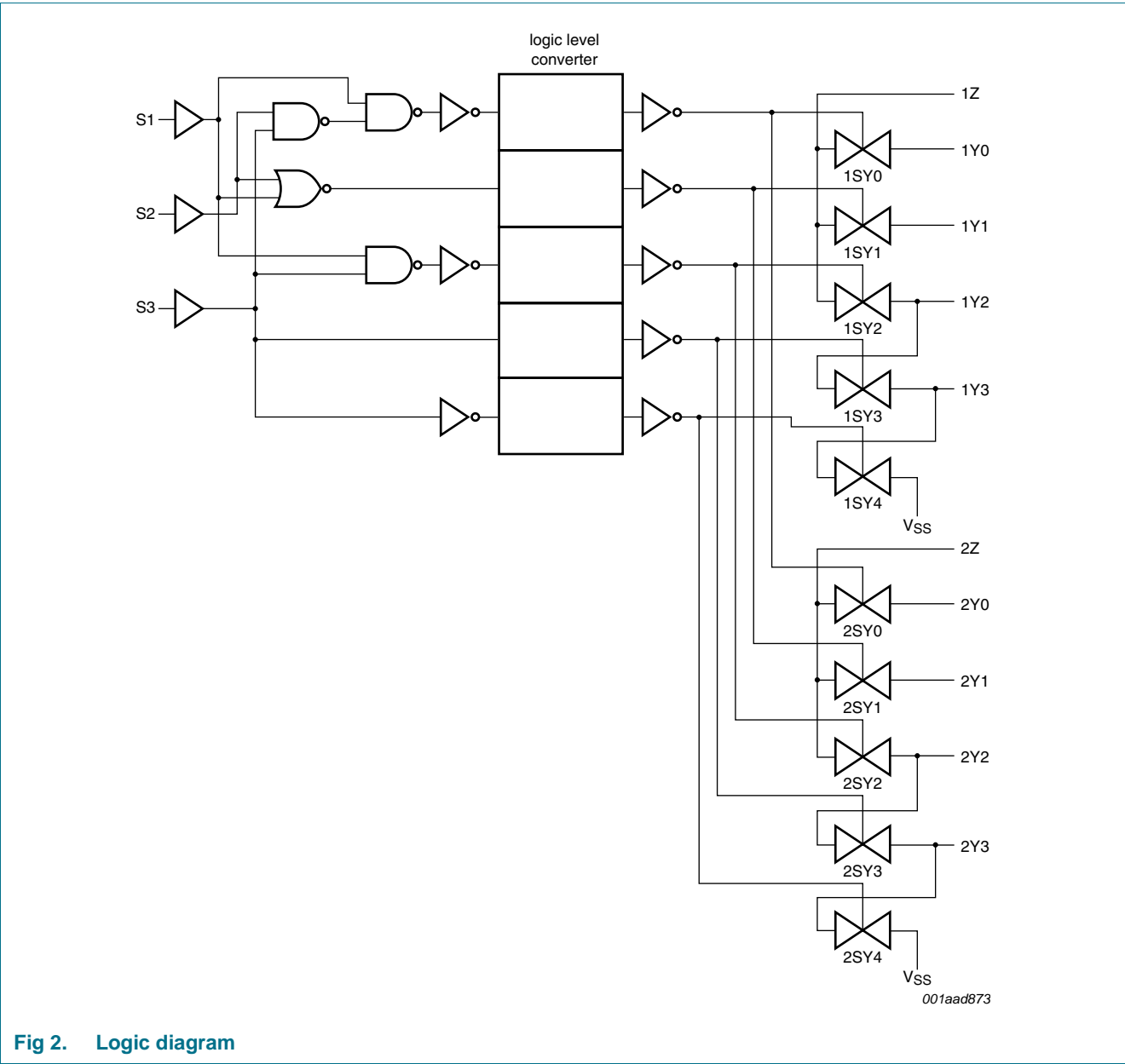


Fig 2. Logic diagram

## 6. Pinning information

### 6.1 Pinning

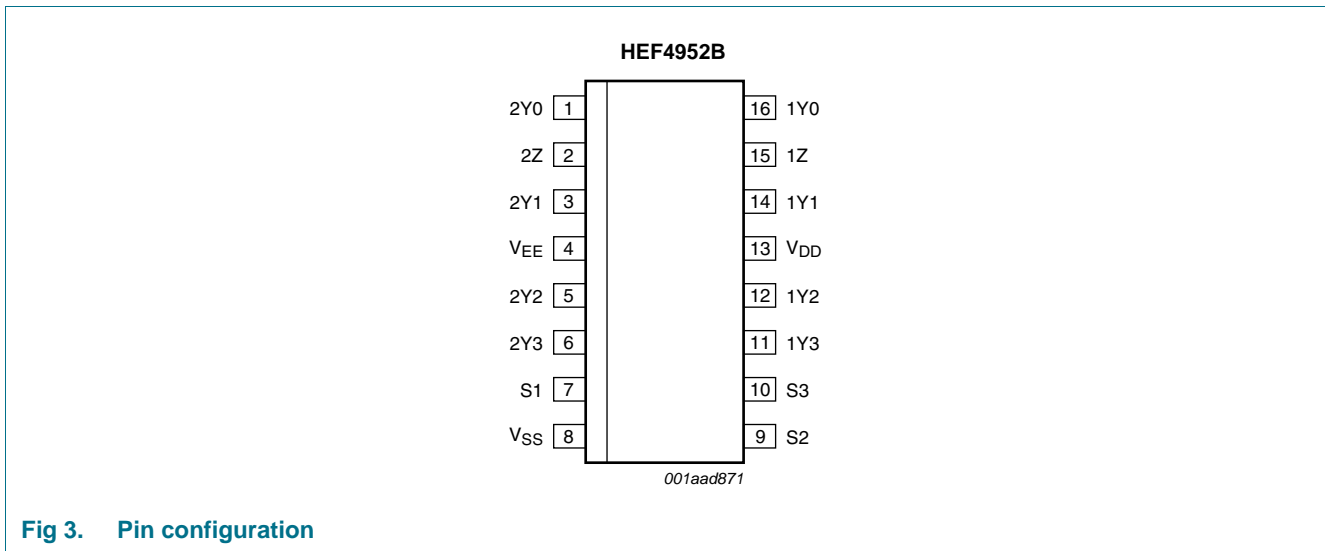


Fig 3. Pin configuration

### 6.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
V <sub>EE</sub>	4	supply voltage
V <sub>SS</sub>	8	ground supply voltage
S1, S2, S3	7, 9, 10	select input
1Y0, 1Y1, 1Y2, 1Y3, 2Y0, 2Y1, 2Y2, 2Y3	16, 14, 12, 11, 1, 3, 5, 6	independent input or output
1Z, 2Z	15, 2	common output or input
V <sub>DD</sub>	13	supply voltage

## 7. Functional description

### 7.1 Function table

Table 3. Function table

Input			Switch				
S3	S2	S1	nSY0	nSY1	nSY2	nSY3	nSY4
L	L	L	open	nY1 to nZ	open	open	nY3 to V <sub>SS</sub>
L	L	H	nY0 to nZ	open	open	open	nY3 to V <sub>SS</sub>
L	H	L	open	open	nY2 to nZ	open	nY3 to V <sub>SS</sub>
L	H	H	nY0 to nZ	open	nY2 to nZ	open	nY3 to V <sub>SS</sub>
H	L	L	open	nY1 to nZ	open	nY2 to nY3	open
H	L	H	nY0 to nZ	open	open	nY2 to nY3	open
H	H	L	open	open	nY2 to nZ	nY2 to nY3	open
H	H	H	open	open	open	nY2 to nY3	open

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

## 8. Limiting values

Table 4. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to V<sub>SS</sub> = 0 V (ground).

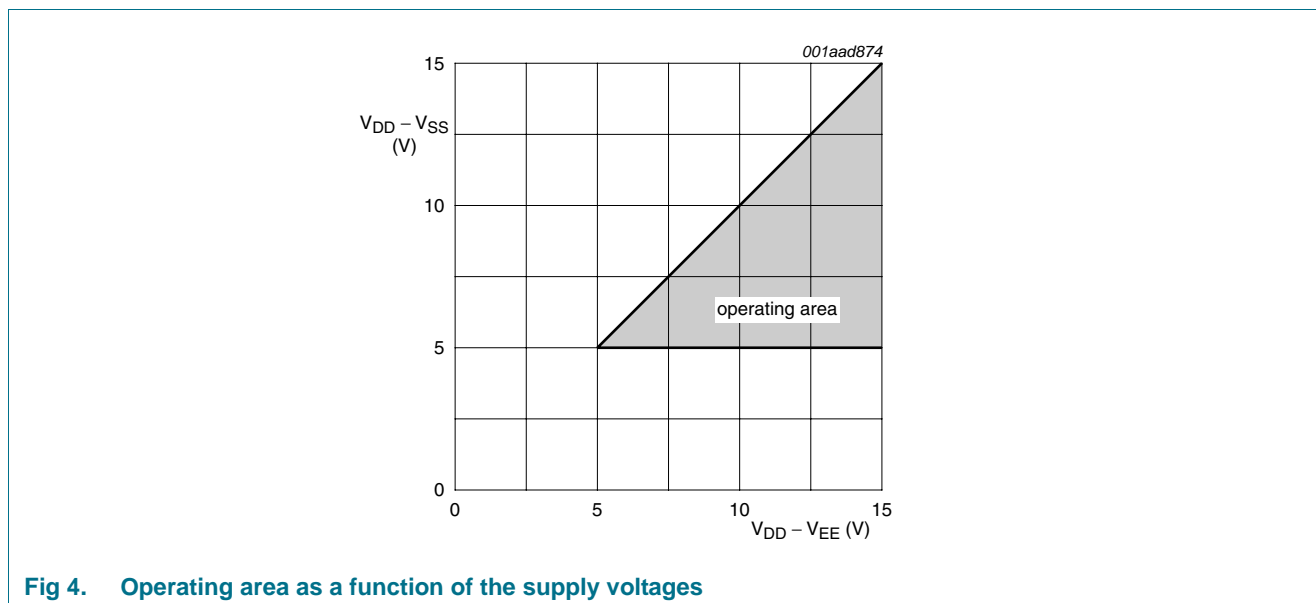
Symbol	Parameter	Conditions	Min	Max	Unit
V <sub>DD</sub>	supply voltage		-0.5	+18	V
V <sub>EE</sub>	supply voltage	referenced to V <sub>DD</sub>	[1] -18	+0.5	V
I <sub>IK</sub>	input clamping current	pins Sn; V <sub>I</sub> < -0.5 V or V <sub>I</sub> > V <sub>DD</sub> + 0.5 V	-	±10	mA
V <sub>I</sub>	input voltage		-0.5	V <sub>DD</sub> + 0.5	V
I <sub>I/O</sub>	input/output current		-	±10	mA
I <sub>DD</sub>	supply current		-	50	mA
T <sub>stg</sub>	storage temperature		-65	+150	°C
T <sub>amb</sub>	ambient temperature		-40	+85	°C
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> = -40 °C to +85 °C	[2] -	500	mW
P	power dissipation	per output	-	100	mW

- [1] To avoid drawing V<sub>DD</sub> current out of terminal Z, when switch current flows into terminals Y, the voltage drop across the bidirectional switch must not exceed 0.4 V. If the switch current flows into terminal Z, no V<sub>DD</sub> current will flow out of terminals Y, and in this case there is no limit for the voltage drop across the switch, but the voltages at Y and Z may not exceed V<sub>DD</sub> or V<sub>EE</sub>.
- [2] For SO16 package: P<sub>tot</sub> derates linearly with 8 mW/K above 70 °C.

## 9. Recommended operating conditions

**Table 5. Recommended operating conditions**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DD}$	supply voltage	see <a href="#">Figure 4</a>	5	-	15	V
$V_{EE}$	supply voltage	see <a href="#">Figure 4</a>	-15	-	0	V
$V_I$	input voltage		0	-	$V_{DD}$	V
$T_{amb}$	ambient temperature	in free air	-40	-	+85	°C



**Fig 4. Operating area as a function of the supply voltages**

## 10. Static characteristics

**Table 6. Static characteristics**

$V_{SS} = V_{EE} = 0\text{ V}$ ;  $V_I = V_{SS}$  or  $V_{DD}$  unless otherwise specified.

Symbol	Parameter	Conditions	$V_{DD}$	$T_{amb} = -40\text{ °C}$		$T_{amb} = 25\text{ °C}$		$T_{amb} = 85\text{ °C}$		Unit
				Min	Max	Min	Max	Min	Max	
$I_I$	input leakage current		15 V	-	±0.3	-	±0.3	-	±1.0	µA
$I_{S(OFF)}$	OFF-state leakage current	Y port; per channel; see <a href="#">Figure 5</a>	15 V	-	-	-	200	-	-	nA
$I_{DD}$	supply current	$I_O = 0\text{ A}$	5 V	-	20	-	20	-	150	µA
			10 V	-	40	-	40	-	300	µA
			15 V	-	80	-	80	-	600	µA
$C_I$	input capacitance	Sn inputs	-	-	-	7.5	-	-	pF	

10.1 Test circuits

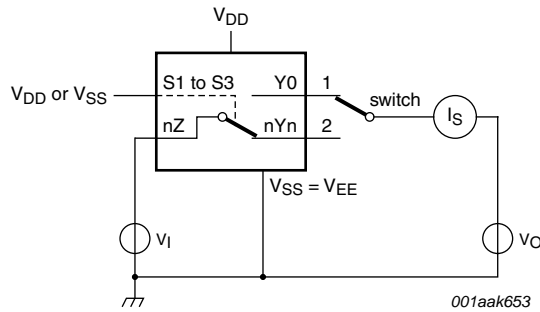


Fig 5. Test circuit for measuring OFF-state leakage current nYn port

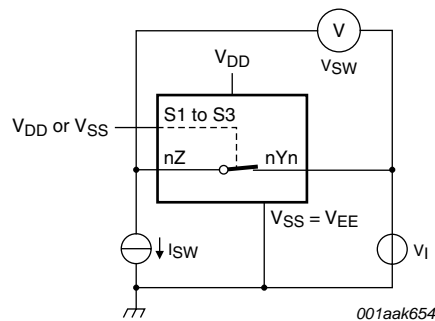
10.2 On resistance

Table 7. ON resistance

$T_{amb} = 25\text{ }^{\circ}\text{C}$ ;  $I_{SW} = 200\text{ }\mu\text{A}$ ;  $V_{SS} = V_{EE} = 0\text{ V}$ .

Symbol	Parameter	Conditions	$V_{DD} - V_{EE}$	Typ	Max	Unit
$R_{ON}$	ON resistance	$V_I = 0\text{ V}$ ; see <a href="#">Figure 6</a> and <a href="#">Figure 7</a>	10 V	45	150	$\Omega$
		$V_I = 2.5\text{ V}$ ; see <a href="#">Figure 6</a> and <a href="#">Figure 7</a>	10 V	65	365	$\Omega$
		$V_I = 5.0\text{ V}$ ; see <a href="#">Figure 6</a> and <a href="#">Figure 7</a>	10 V	110	360	$\Omega$
$\Delta R_{ON}$	ON resistance mismatch between channels	$V_I = 2.5\text{ V}$ ; see <a href="#">Figure 6</a>	10 V	10	-	$\Omega$

10.2.1 On resistance waveform and test circuit



$R_{ON} = V_{SW} / I_{SW}$ .

Fig 6. Test circuit for measuring  $R_{ON}$

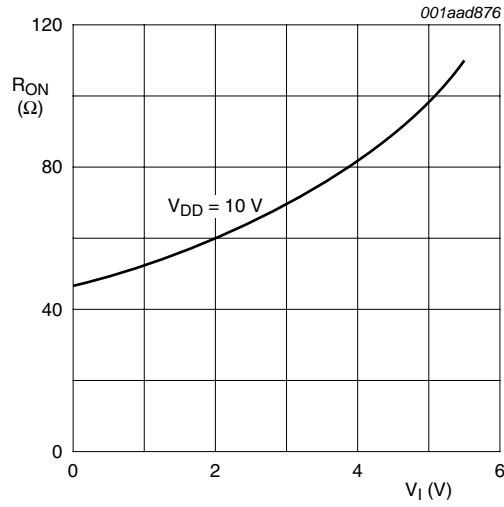


Fig 7. Typical RON as a function of input voltage

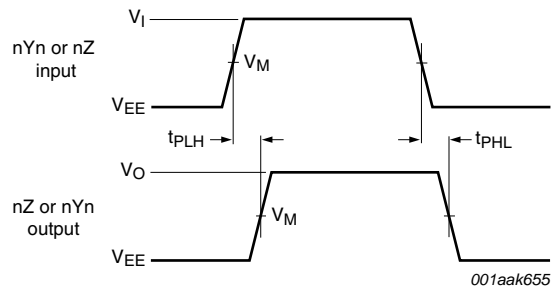
## 11. Dynamic characteristics

Table 8. Dynamic characteristics

$T_{amb} = 25\text{ °C}$ ;  $V_{SS} = V_{EE} = 0\text{ V}$ ; for test circuit see [Figure 10](#).

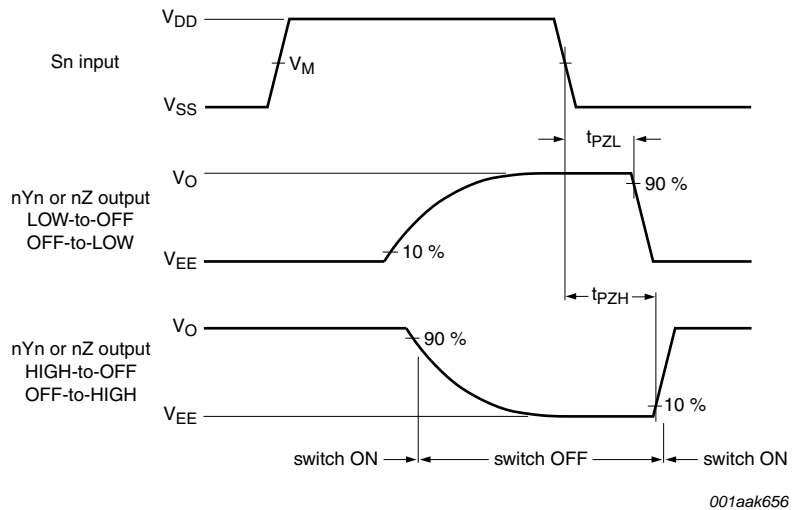
Symbol	Parameter	Conditions	V <sub>DD</sub>	Typ	Max	Unit
t <sub>PHL</sub>	HIGH to LOW propagation delay	nYn, nZ to nZ, nYn; V <sub>I</sub> = 1.0 V; see <a href="#">Figure 8</a>	5 V	5	-	ns
			10 V	3	6	ns
			15 V	2	-	ns
t <sub>PLH</sub>	LOW to HIGH propagation delay	nYn, nZ to nZ, nYn; V <sub>I</sub> = 1.0 V; see <a href="#">Figure 8</a>	5 V	5	-	ns
			10 V	3	6	ns
			15 V	2	-	ns
t <sub>PZL</sub>	OFF-state to LOW propagation delay	Sn to nYn, nZ; V <sub>I</sub> = V <sub>EE</sub> ; see <a href="#">Figure 9</a>	5 V	125	-	ns
			10 V	50	100	ns
			15 V	35	-	ns
t <sub>PZH</sub>	OFF-state to HIGH propagation delay	Sn to nYn, nZ; V <sub>I</sub> = 1.0 V; see <a href="#">Figure 9</a>	5 V	125	-	ns
			10 V	50	100	ns
			15 V	35	-	ns

11.1 Waveforms and test circuit



Measurement points are given in [Table 9](#).

Fig 8. nYn, nZ to nZ, nYn propagation delays

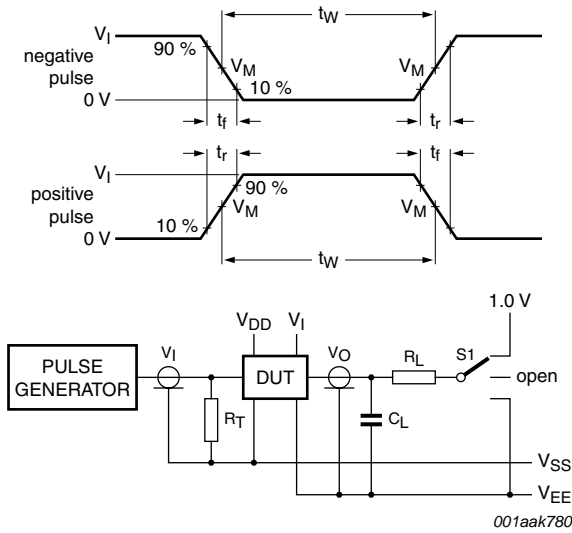


Measurement points are given in [Table 9](#).

Fig 9. Enable and disable times

Table 9. Measurement points

Supply voltage	Input	Output
$V_{DD}$	$V_M$	$V_M$
5 V to 15 V	$0.5V_{DD}$	$0.5V_{DD}$



Test data is given in [Table 10](#).

Definitions:

DUT = Device Under Test.

$R_T$  = Termination resistance should be equal to output impedance  $Z_o$  of the pulse generator.

$C_L$  = Load capacitance including test jig and probe.

$R_L$  = Load resistance.

**Fig 10. Test circuit for measuring switching times**

**Table 10. Test data**

Input				Load			S1 position			
nYn, nZ	Sn	$t_r, t_f$	$V_M$	$C_L$	$R_L$	$t_{PHL}, t_{PLH}$	$t_{PZH}$	$t_{PZL}$	Other	
$V_I$ or $V_{EE}$	$V_{DD}$ or $V_{SS}$	$\leq 20$ ns	$0.5V_{DD}$	50 pF	10 k $\Omega$	$V_{EE}$	$V_{EE}$	1.0 V	$V_{EE}$	

**Table 11. Dynamic power dissipation  $P_D$**

$P_D$  can be calculated from the formulas shown;  $V_{EE} = V_{SS} = 0$  V;  $t_r = t_f \leq 20$  ns;  $T_{amb} = 25$  °C.

Symbol	Parameter	$V_{DD}$	Typical formula for $P_D$ ( $\mu$ W)	Where:
$P_D$	dynamic power dissipation	5 V	$P_D = 1300 \times f_i + \Sigma(f_o \times C_L) \times V_{DD}^2$	$f_i$ = input frequency in MHz;
		10 V	$P_D = 6100 \times f_i + \Sigma(f_o \times C_L) \times V_{DD}^2$	$f_o$ = output frequency in MHz;
		15 V	$P_D = 15600 \times f_i + \Sigma(f_o \times C_L) \times V_{DD}^2$	$C_L$ = output load capacitance in pF;
				$V_{DD}$ = supply voltage in V;
				$\Sigma(f_o \times C_L)$ = sum of the outputs.

## 11.2 Transfer characteristics

**Table 12. Control input characteristics**

$V_{SS} = V_{EE} = 0$  V unless otherwise specified.

Symbol	Parameter	Conditions	T <sub>amb</sub> = 25 °C		T <sub>amb</sub> = -40 °C to +85 °C		Unit
			Min	Max	Min	Max	
V <sub>T+</sub>	positive-going threshold voltage	V <sub>DD</sub> = 5 V	-	2.90	-	3.00	V
		V <sub>DD</sub> = 10 V	-	4.37	-	4.50	V
V <sub>T-</sub>	negative-going threshold voltage	V <sub>DD</sub> = 5 V	1.03	-	1.00	-	V
		V <sub>DD</sub> = 10 V	2.10	-	2.00	-	V
V <sub>H</sub>	hysteresis voltage	V <sub>DD</sub> = 5 V	0.16	-	0.10	-	V
		V <sub>DD</sub> = 10 V	0.11	-	0.10	-	V

12. Package outline

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

SOT109-1

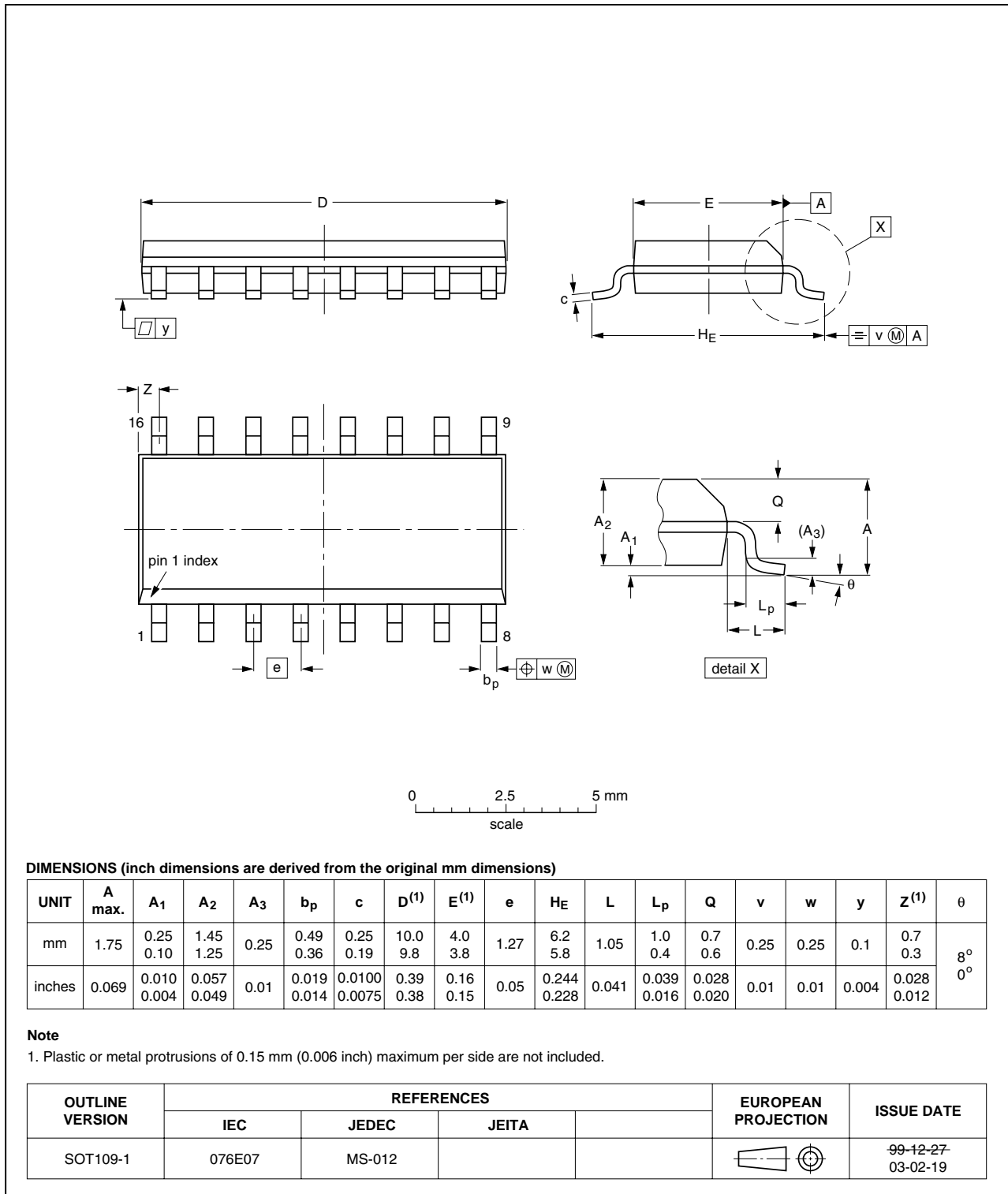


Fig 11. Package outline SOT109-1 (SO16)

## 13. Revision history

Table 13. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
HEF4952B_3	20091216	Product data sheet	-	HEF4952B_2
Modifications:		<ul style="list-style-type: none"><li>• Title changed from 8-channel analog multiplexer/demultiplexer.</li><li>• <a href="#">Section 1 “General description”</a> modified.</li><li>• <a href="#">Section 8 “Limiting values”</a> I<sub>IK</sub> conditions updated.</li><li>• Abbreviations section removed.</li></ul>		
HEF4952B_2	20091002	Product data sheet	-	HEF4952B_1
HEF4952B_1	20060320	Product data sheet	-	-

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Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
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Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

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## 16. Contents

<b>1</b>	<b>General description</b> .....	<b>1</b>
<b>2</b>	<b>Features</b> .....	<b>1</b>
<b>3</b>	<b>Applications</b> .....	<b>1</b>
<b>4</b>	<b>Ordering information</b> .....	<b>1</b>
<b>5</b>	<b>Functional diagram</b> .....	<b>2</b>
<b>6</b>	<b>Pinning information</b> .....	<b>4</b>
6.1	Pinning .....	4
6.2	Pin description .....	4
<b>7</b>	<b>Functional description</b> .....	<b>5</b>
7.1	Function table .....	5
<b>8</b>	<b>Limiting values</b> .....	<b>5</b>
<b>9</b>	<b>Recommended operating conditions</b> .....	<b>6</b>
<b>10</b>	<b>Static characteristics</b> .....	<b>6</b>
10.1	Test circuits .....	7
10.2	On resistance .....	7
10.2.1	On resistance waveform and test circuit .....	7
<b>11</b>	<b>Dynamic characteristics</b> .....	<b>8</b>
11.1	Waveforms and test circuit .....	9
11.2	Transfer characteristics .....	11
<b>12</b>	<b>Package outline</b> .....	<b>12</b>
<b>13</b>	<b>Revision history</b> .....	<b>13</b>
<b>14</b>	<b>Legal information</b> .....	<b>14</b>
14.1	Data sheet status .....	14
14.2	Definitions .....	14
14.3	Disclaimers .....	14
14.4	Trademarks .....	14
<b>15</b>	<b>Contact information</b> .....	<b>14</b>
<b>16</b>	<b>Contents</b> .....	<b>15</b>

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