

DATA SHEET

74HC2G66; 74HCT2G66 Bilateral switches

Product specification
Supersedes data of 2003 Jun 25

2003 Aug 08

Bilateral switches

74HC2G66; 74HCT2G66

FEATURES

- Wide supply voltage range from 2.0 to 9.0 V
- Very low ON-resistance:
 - 41 Ω (typical) at $V_{CC} = 4.5$ V
 - 30 Ω (typical) at $V_{CC} = 6.0$ V
 - 21 Ω (typical) at $V_{CC} = 9.0$ V.
- High noise immunity
- Low power dissipation
- Very small 8 pins package
- ± 25 mA switch current
- ESD protection:
 - HBM EIA/JESD22-A114-A exceeds 2000 V
 - MM EIA/JESD22-A115-A exceeds 200 V.
- Specified from -40 to $+85$ °C and -40 to $+125$ °C.

DESCRIPTION

The 74HC2G66/74HCT2G66 is a high-speed Si-gate CMOS device.

The 74HC2G66/74HCT2G66 provides a dual analog switch. Each switch has two pins (Y and Z) for input or output and an active HIGH enable input (pin E). When pin E is LOW, the belonging analog switch is turned off.

QUICK REFERENCE DATA

GND = 0 V; $T_{amb} = 25$ °C; $t_r = t_f = 6.0$ ns; V_{os} is the output voltage at pins nY or nZ, whichever is assigned as an output.

SYMBOL	PARAMETER	CONDITIONS	TYPICAL		UNIT
			HC2G	HCT2G	
t_{PZH}/t_{PZL}	turn-on time nE to V_{os}	$C_L = 50$ pF; $R_L = 1$ k Ω ; $V_{CC} = 4.5$ V	12	13	ns
t_{PHZ}/t_{PLZ}	turn-off time nE to V_{os}	$C_L = 50$ pF; $R_L = 1$ k Ω ; $V_{CC} = 4.5$ V	12	13	ns
C_I	input capacitance		3.5	3.5	pF
C_{PD}	power dissipation capacitance per switch	notes 1 and 2	9	9	pF
C_S	switch capacitance		8	8	pF

Notes

1. C_{PD} is used to determine the dynamic power dissipation per channel (P_D in mW).

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

f_i = input frequency in MHz;

f_o = output frequency in MHz;

C_L = output load capacitance in pF;

C_S = switch capacitance in pF;

V_{CC} = supply voltage in Volts.

2. For 74HC2G66 the condition is $V_I = \text{GND to } V_{CC}$.
For 74HCT2G66 the condition is $V_I = \text{GND to } V_{CC} - 1.5$ V.

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FUNCTION TABLE

See note 1.

INPUT nE	SWITCH
L	OFF
H	ON

Note

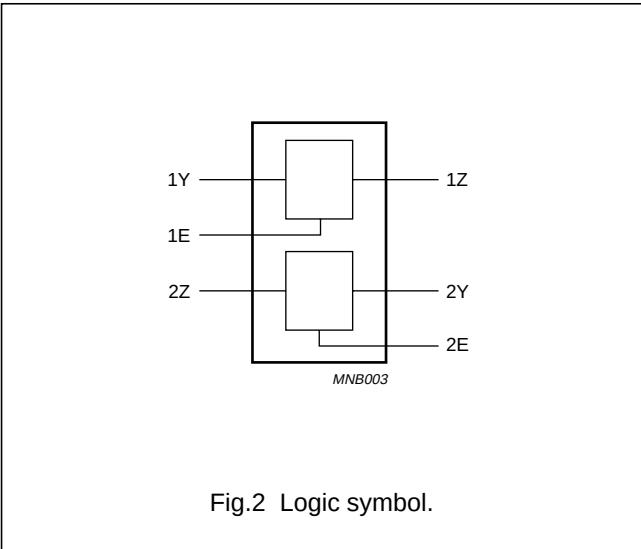
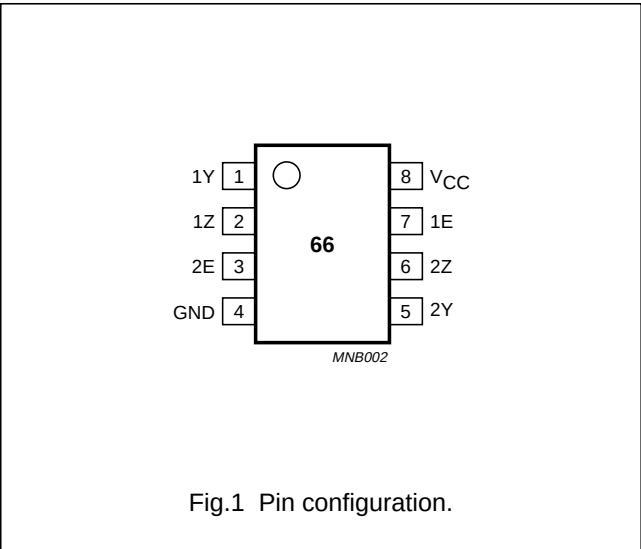
1. H = HIGH voltage level;
L = LOW voltage level.

ORDERING INFORMATION

TYPE NUMBER	TEMPERATURE RANGE	PACKAGE				
		PINS	PACKAGE	MATERIAL	OUTLINE VERSION	MARKING
74HC2G66DP	−40 to +125 °C	8	TSSOP8	plastic	SOT505-2	H66
74HCT2G66DP	−40 to +125 °C	8	TSSOP8	plastic	SOT505-2	T66

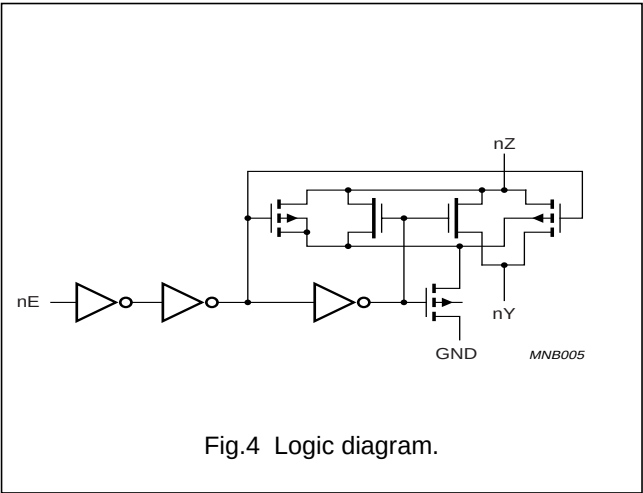
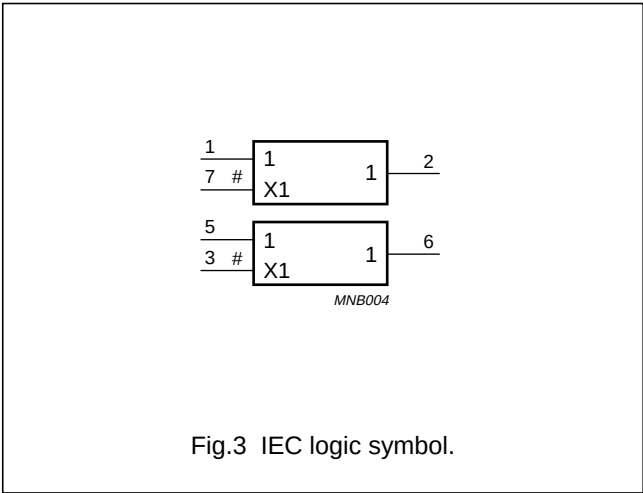
PINNING

PIN	SYMBOL	DESCRIPTION
1	1Y	independent input or output
2	1Z	independent input or output
3	2E	enable input (active HIGH)
4	GND	ground (0 V)
5	2Y	independent input or output
6	2Z	independent input or output
7	1E	enable input (active HIGH)
8	V _{CC}	supply voltage



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RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	CONDITIONS	74HC2G66			74HCT2G66			UNIT
			MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	
V _{CC}	supply voltage		2.0	5.0	10.0	4.5	5.0	5.5	V
V _I	input voltage		0	–	V _{CC}	0	–	V _{CC}	V
V _O	output voltage		0	–	V _{CC}	0	–	V _{CC}	V
T _{amb}	ambient temperature	see DC and AC characteristics per device	–40	+25	+125	–40	+25	+125	°C
t _r , t _f	input rise and fall times	V _{CC} = 2.0 V	–	–	1000	–	–	–	ns
		V _{CC} = 4.5 V	–	6.0	500	–	6.0	500	ns
		V _{CC} = 6.0 V	–	–	400	–	–	–	ns
		V _{CC} = 9.0 V	–	–	250	–	–	–	ns

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V _{CC}	supply voltage		–0.5	+11.0	V
I _{IK}	input diode current	V _I < –0.5 V or V _I > V _{CC} + 0.5 V; note 1	–	±20	mA
I _{OK}	output diode current	V _O < –0.5 V or V _O > V _{CC} + 0.5 V; note 1	–	±20	mA
I _O	output source or sink current	–0.5 V < V _O < V _{CC} + 0.5 V; note 1	–	±25	mA
I _{CC} , I _{GND}	V _{CC} or GND current	note 1	–	±30	mA
T _{stg}	storage temperature		–65	+150	°C
P _{tot}	power dissipation of package	T _{amb} = –40 to +125 °C; note 2	–	300	mW
P _s	power dissipation per switch		–	100	mW

Notes

1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
2. Above 55 °C the value of P_D derates linearly with 2.5 mW/K.

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DC CHARACTERISTICS

Type 74HC2G66

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

SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
		OTHER	V _{CC} (V)				
T _{amb} = −40 to +85 °C; note1							
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	μA
			9.0	–	–	±0.2	μA
I _{s(OFF)}	analog switch current, OFF-state	V _I = V _{IH} or V _{IL} ; V _S = V _{CC} – GND; see Fig.7	9.0	–	0.1	1.0	μA
I _{s(ON)}	analog switch current, ON-state	V _I = V _{IH} or V _{IL} ; V _S = V _{CC} – GND; see Fig.8	9.0	–	0.1	1.0	μA
I _{CC}	quiescent supply current	V _I = V _{CC} or GND; V _{IS} = GND or V _{CC} ; V _{OS} = V _{CC} or GND	6.0	–	–	10	μA
			9.0	–	–	20	μA

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SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
		OTHER	V _{CC} (V)				
T _{amb} = −40 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	μA
			9.0	–	–	±0.2	μA
I _{s(OFF)}	analog switch current, OFF-state	V _I = V _{IH} or V _{IL} ; V _S = V _{CC} – GND; see Fig.7	9.0	–	–	1.0	μA
I _{s(ON)}	analog switch current, ON-state	V _I = V _{IH} or V _{IL} ; V _S = V _{CC} – GND; see Fig.8	9.0	–	–	1.0	μA
I _{CC}	quiescent supply current	V _I = V _{CC} or GND; V _{IS} = GND or V _{CC} ; V _{OS} = V _{CC} or GND	6.0	–	–	20	μA
			9.0	–	–	40	μA

Note

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

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Type 74HCT2G66

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

SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
		OTHER	V _{CC} (V)				
T _{amb} = −40 to +85 °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	–	–	±1.0	μA
I _{s(OFF)}	analog switch current, OFF-state	V _I = V _{IH} or V _{IL} ; V _S = V _{CC} – GND; see Fig.7		–	0.1	1.0	μA
I _{s(ON)}	analog switch current, ON-state	V _I = V _{IH} or V _{IL} ; V _S = V _{CC} – GND; see Fig.8		–	0.1	1.0	μA
I _{CC}	quiescent supply current	V _I = V _{CC} or GND; V _{is} = GND or V _{CC} ; V _{os} = V _{CC} or GND	4.5 to 5.5	–	–	10	μA
ΔI _{CC}	additional supply current per input	V _I = V _{CC} – 2.1 V; I _O = 0	4.5 to 5.5	–	–	375	μA
T _{amb} = −40 to +125 °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	–	–	±1.0	μA
I _{s(OFF)}	analog switch current, OFF-state	V _I = V _{IH} or V _{IL} ; V _S = V _{CC} – GND; see Fig.7		–	–	1.0	μA
I _{s(ON)}	analog switch current, ON-state	V _I = V _{IH} or V _{IL} ; V _S = V _{CC} – GND; see Fig.8		–	–	1.0	μA
I _{CC}	quiescent supply current	V _I = V _{CC} or GND; V _{is} = GND or V _{CC} ; V _{os} = V _{CC} or GND	4.5 to 5.5	–	–	20	μA
ΔI _{CC}	additional supply current per input	V _I = V _{CC} – 2.1 V; I _O = 0	4.5 to 5.5	–	–	410	μA

Note

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

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Resistance R_{ON} for 74HC2G66 and 74HCT2G66

See notes 1 and 2.

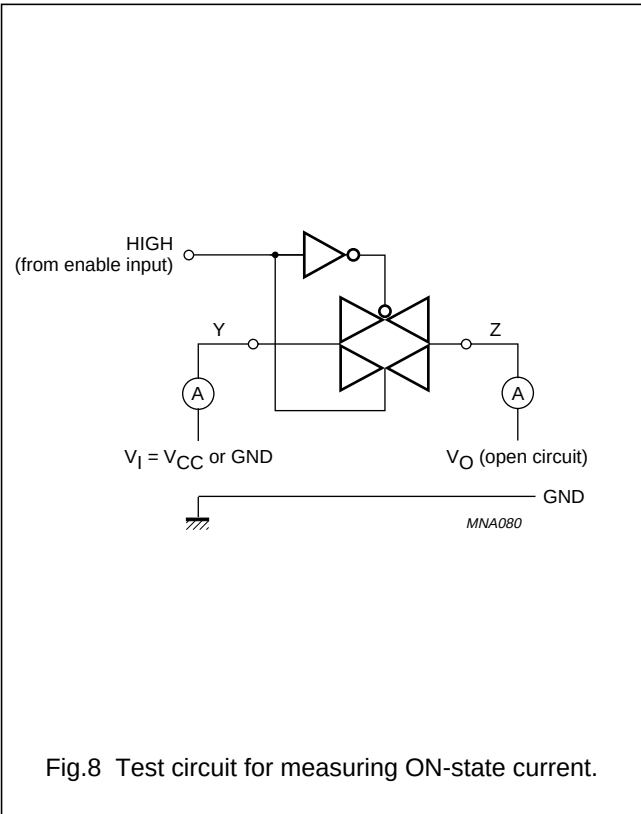
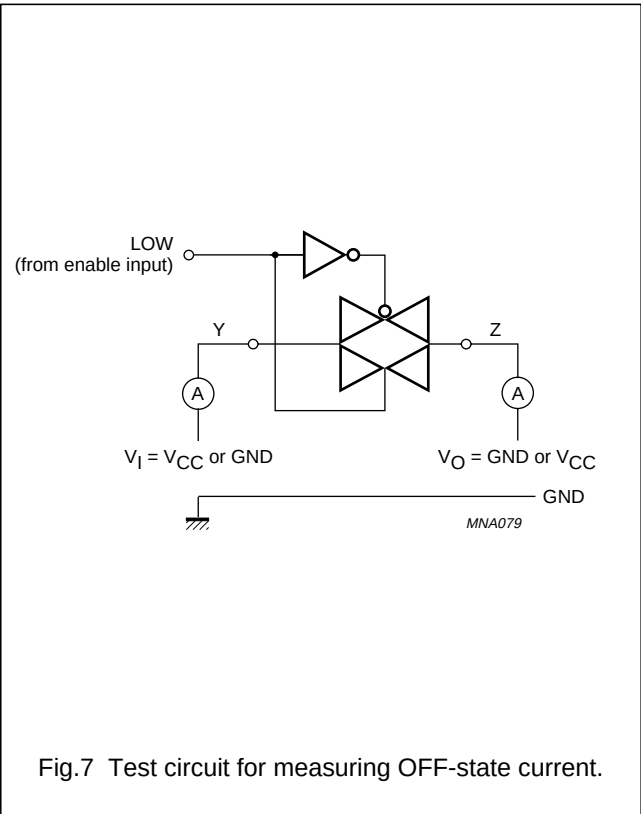
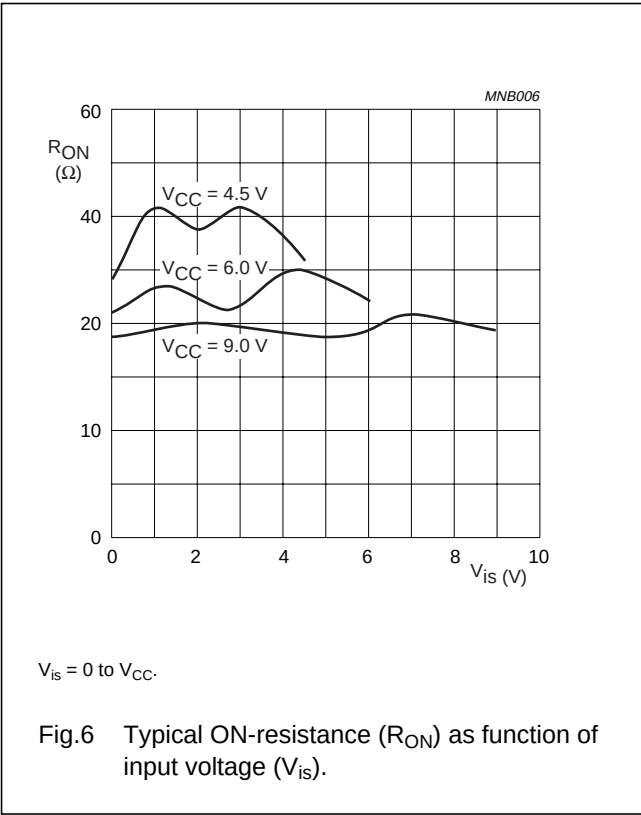
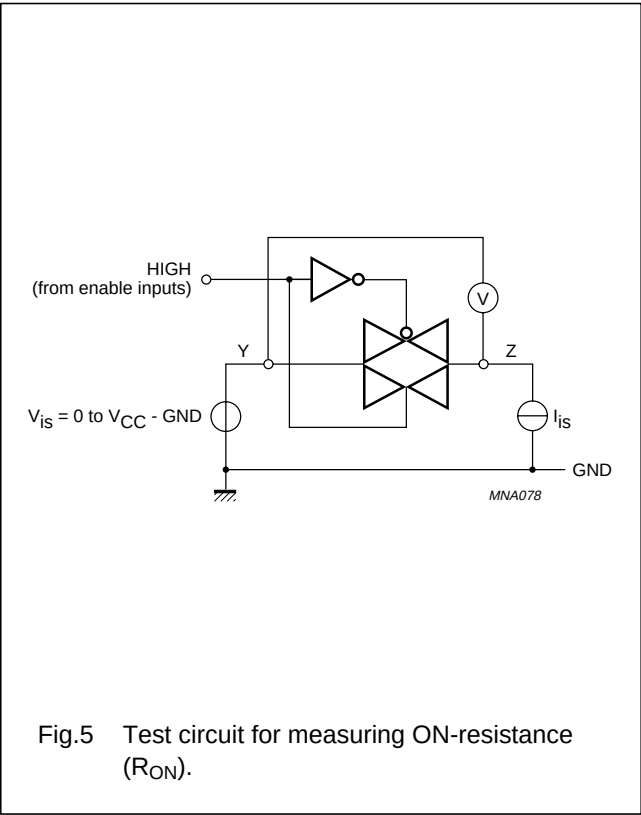
SYMBOL	PARAMETER	TEST CONDITIONS			MIN.	TYP.	MAX.	UNIT
		OTHER	V _{CC} (V)	I _S (μA)				
T _{amb} = −40 to +85 °C; note 3								
R _{ON(peak)}	ON-resistance (peak)	V _{is} = V _{CC} to GND; V _I = V _{IH} or V _{IL} ; see Figs 5 and 6	2.0	100	–	250	–	Ω
			4.5	1000	–	41	118	Ω
			6.0	1000	–	30	105	Ω
			9.0	1000	–	21	88	Ω
R _{ON(rail)}	ON-resistance (rail)	V _{is} = GND; V _I = V _{IH} or V _{IL} ; see Figs 5 and 6	2.0	100	–	65	–	Ω
			4.5	1000	–	28	95	Ω
			6.0	1000	–	22	82	Ω
			9.0	1000	–	18	70	Ω
		V _{is} = V _{CC} ; V _I = V _{IH} or V _{IL} ; see Figs 5 and 6	2.0	100	–	65	–	Ω
			4.5	1000	–	31	106	Ω
			6.0	1000	–	23	94	Ω
			9.0	1000	–	19	78	Ω
ΔR _{ON}	maximum variation of ON-resistance between the two channels	V _{is} = V _{CC} to GND; V _I = V _{IH} or V _{IL} ; see Figs 5 and 6	4.5	–	–	5	–	Ω
			6.0	–	–	4	–	Ω
			9.0	–	–	3	–	Ω
T _{amb} = −40 to +125 °C								
R _{ON(peak)}	ON-resistance (peak)	V _{is} = V _{CC} to GND; V _I = V _{IH} or V _{IL} ; see Figs 5 and 6	2.0	100	–	–	–	Ω
			4.5	1000	–	–	142	Ω
			6.0	1000	–	–	126	Ω
			9.0	1000	–	–	105	Ω
R _{ON(rail)}	ON-resistance (rail)	V _{is} = GND; V _I = V _{IH} or V _{IL} ; see Figs 5 and 6	2.0	100	–	–	–	Ω
			4.5	1000	–	–	115	Ω
			6.0	1000	–	–	100	Ω
			9.0	1000	–	–	80	Ω
		V _{is} = V _{CC} ; V _I = V _{IH} or V _{IL} ; see Figs 5 and 6	2.0	100	–	–	–	Ω
			4.5	1000	–	–	128	Ω
			6.0	1000	–	–	113	Ω
			9.0	1000	–	–	95	Ω

Notes

- For 74 HCT2G66 only $V_{CC} = 4.5$ V applies; for 74HC2G66 all V_{CC} values apply.
- At supply voltages near 2 V, the analog switch ON-resistance is extremely non linear. When using a supply of 2 V, it is recommended is to use these devices only for digital signals.
- All typical values are measured at $T_{amb} = 25$ °C.

Bilateral switches

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Bilateral switches

74HC2G66; 74HCT2G66

AC CHARACTERISTICS

Type 74HC2G66

GND = 0 V; $t_r = t_f = 6.0$ ns; V_{is} is the input voltage at pins nY or nZ, whichever is assigned as an input. V_{os} is the output voltage at pins nY or nZ, whichever is assigned as an output.

SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
		WAVEFORMS	V _{CC} (V)				
T _{amb} = −40 to +85 °C; note 1							
t _{PHL} /t _{PLH}	propagation delay V _{is} to V _{os}	R _L = ∞; see Figs 16 and 18	2.0	–	6.5	65	ns
			4.5	–	2.0	13	ns
			6.0	–	1.5	11	ns
			9.0	–	1.2	10	ns
t _{PZH} /t _{PZL}	turn-on time nE to V _{os}	R _L = 1 kΩ; see Figs 17 and 18	2.0	–	40	125	ns
			4.5	–	12	25	ns
			6.0	–	10	21	ns
			9.0	–	7	16	ns
t _{PHZ} /t _{PLZ}	turn-off time nE to V _{os}	R _L = 1 kΩ; see Figs 17 and 18	2.0	–	21	145	ns
			4.5	–	12	29	ns
			6.0	–	11	28	ns
			9.0	–	10	23	ns
T _{amb} = −40 to +125 °C							
t _{PHL} /t _{PLH}	propagation delay V _{is} to V _{os}	R _L = ∞; see Figs 16 and 18	2.0	–	–	80	ns
			4.5	–	–	15	ns
			6.0	–	–	14	ns
			9.0	–	–	12	ns
t _{PZH} /t _{PZL}	turn-on time nE to V _{os}	R _L = 1 kΩ; see Figs 17 and 18	2.0	–	–	150	ns
			4.5	–	–	30	ns
			6.0	–	–	26	ns
			9.0	–	–	20	ns
t _{PHZ} /t _{PLZ}	turn-off time nE to V _{os}	R _L = 1 kΩ; see Figs 17 and 18	2.0	–	–	175	ns
			4.5	–	–	35	ns
			6.0	–	–	33	ns
			9.0	–	–	27	ns

Note

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

Bilateral switches

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Type 74HCT2G66

GND = 0 V; $t_r = t_f = 6.0$ ns; V_{is} is the input voltage at pins nY or nZ, whichever is assigned as an input. V_{os} is the output voltage at pins nY or nZ, whichever is assigned as an output.

SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
		WAVEFORMS	V _{CC} (V)				
T _{amb} = −40 to +85 °C; note 1							
t _{PHL} /t _{PLH}	propagation delay V _{IS} to V _{OS}	R _L = ∞; see Figs 16 and 18	4.5	–	2.0	15	ns
t _{PZH} /t _{PZL}	turn-on time nE to V _{OS}	R _L = 1 kΩ; see Figs 17 and 18	4.5	–	13	30	ns
t _{PHZ} /t _{PLZ}	turn-off time nE to V _{OS}	R _L = 1 kΩ; see Figs 17 and 18	4.5	–	13	44	ns
T _{amb} = −40 to +125 °C							
t _{PHL} /t _{PLH}	propagation delay V _{IS} to V _{OS}	R _L = ∞; see Figs 16 and 18	4.5	–	–	18	ns
t _{PZH} /t _{PZL}	turn-on time nE to V _{OS}	R _L = 1 kΩ; see Figs 17 and 18	4.5	–	–	36	ns
t _{PHZ} /t _{PLZ}	turn-off time nE to V _{OS}	R _L = 1 kΩ; see Figs 17 and 18	4.5	–	–	53	ns

Note

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

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Type 74HC2G66 and 74HCT2G66

At recommended conditions and typical values. GND = 0 V; $t_r = t_f = 6.0$ ns. V_{is} is the input voltage at pins nY or nZ, whichever is assigned as an input; V_{os} is the output voltage at pins nY or nZ, whichever is assigned as an output.

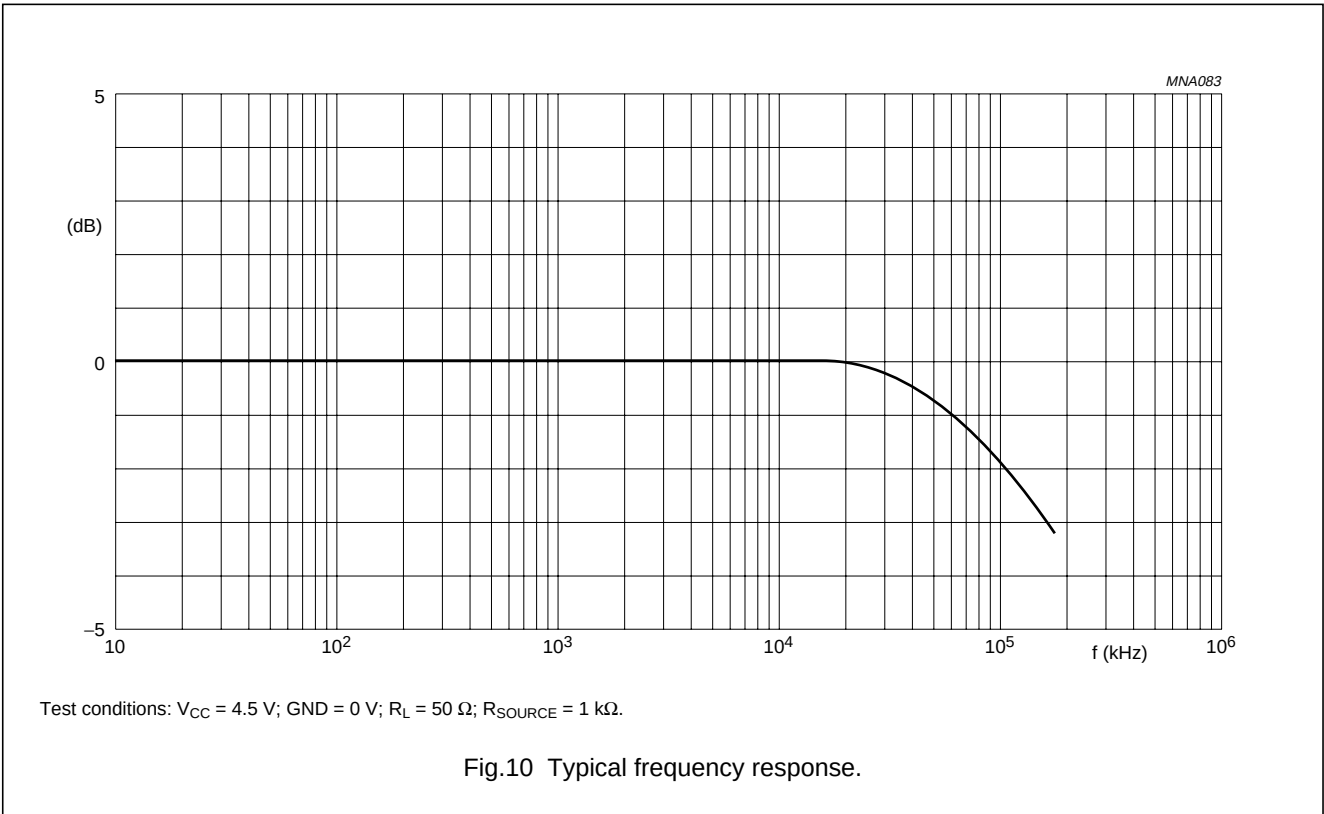
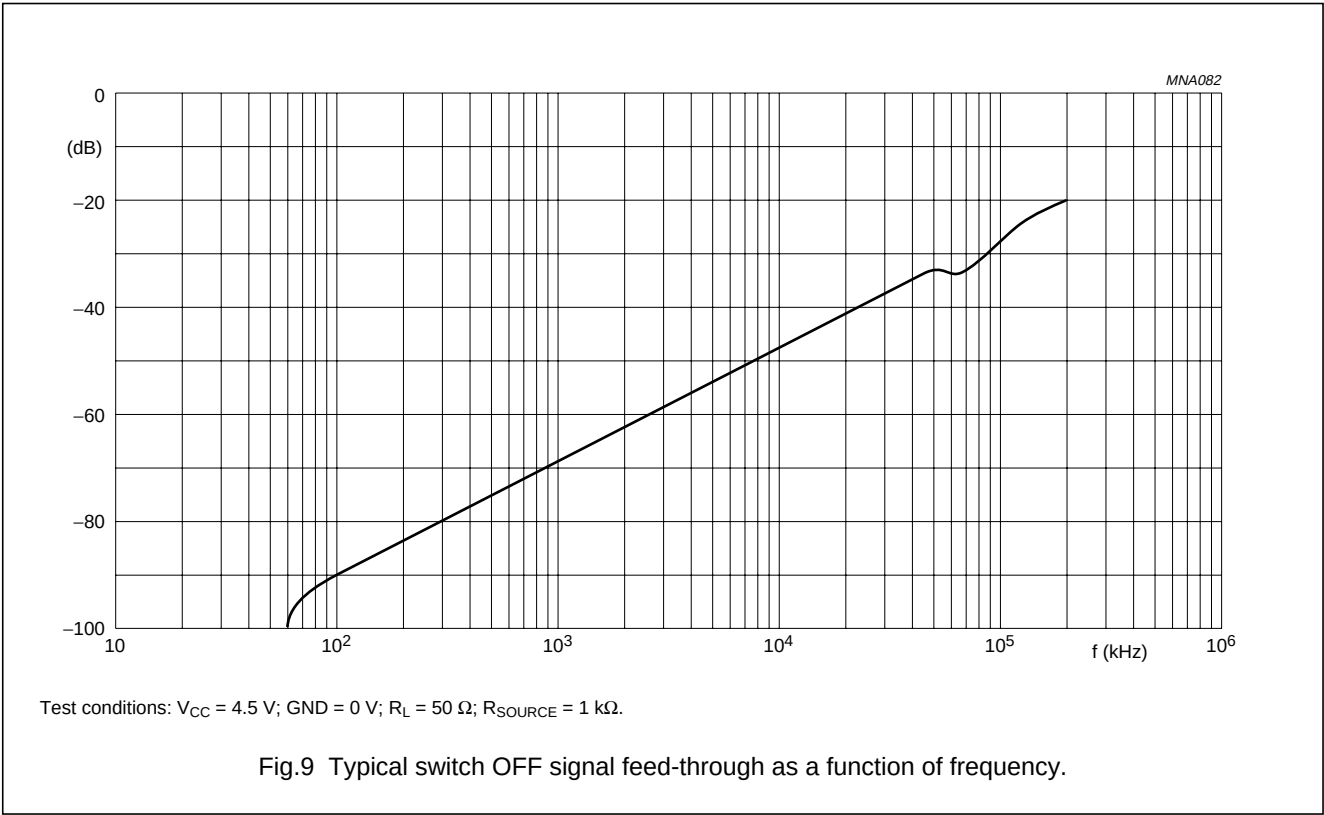
SYMBOL	PARAMETER	TEST CONDITIONS			TYP.	UNIT
		OTHER	$V_{is(p-p)}$ (V)	V_{CC} (V)		
d_{sin}	sine-wave distortion	$f = 1$ kHz; $R_L = 10$ k Ω ; $C_L = 50$ pF; see Fig.14	4.0	4.5	0.04	%
			8.0	9.0	0.02	%
		$f = 10$ kHz; $R_L = 10$ k Ω ; $C_L = 50$ pF; see Fig.14	4.0	4.5	0.12	%
			8.0	9.0	0.06	%
$\alpha_{OFF(feedthru)}$	switch OFF signal feed-through	$R_L = 600$ Ω ; $C_L = 50$ pF; $f = 1$ MHz; see Figs 9 and 15	note 1	4.5	-50	dB
				9.0	-50	dB
$\alpha_{ct(s)}$	crosstalk between the two switches	$R_L = 600$ Ω ; $C_L = 50$ pF; $f = 1$ MHz; see Fig 11	note 1	4.5	-60	dB
				9.0	-60	dB
$V_{ct(E-S)(p-p)}$	crosstalk voltage between enable input to the switches (peak-to-peak value)	$R_L = 600$ Ω ; $C_L = 50$ pF; $f = 1$ MHz (nE, square wave between V_{CC} and GND, $t_r = t_f = 6.0$ ns); see Fig 12	note 1	4.5	110	mV
				9.0	220	mV
f_{max}	frequency response (-3 dB)	$R_L = 50$ Ω ; $C_L = 10$ pF; see Figs 10 and 13	note 2	4.5	180	MHz
				9.0	200	MHz
C_S	switch capacitance				8	pF

Notes

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

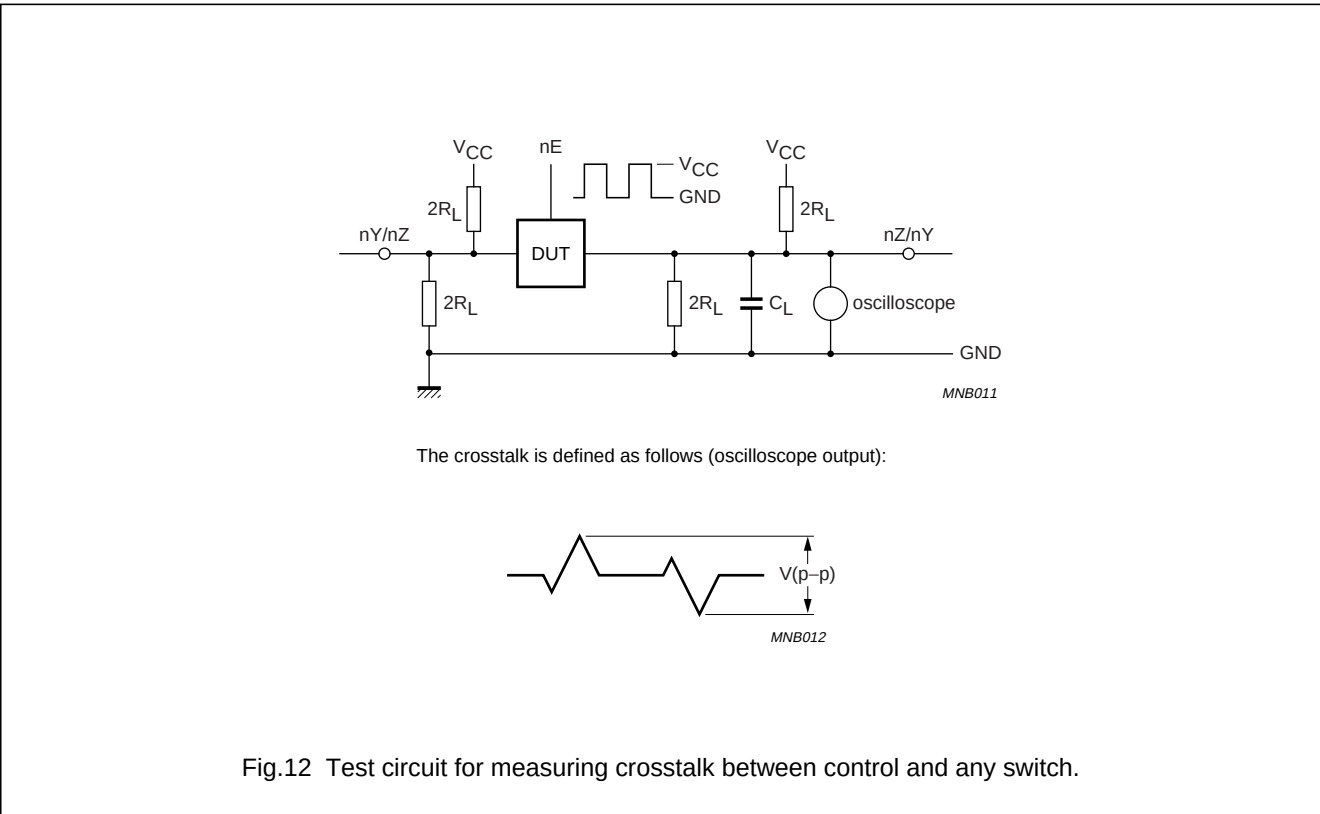
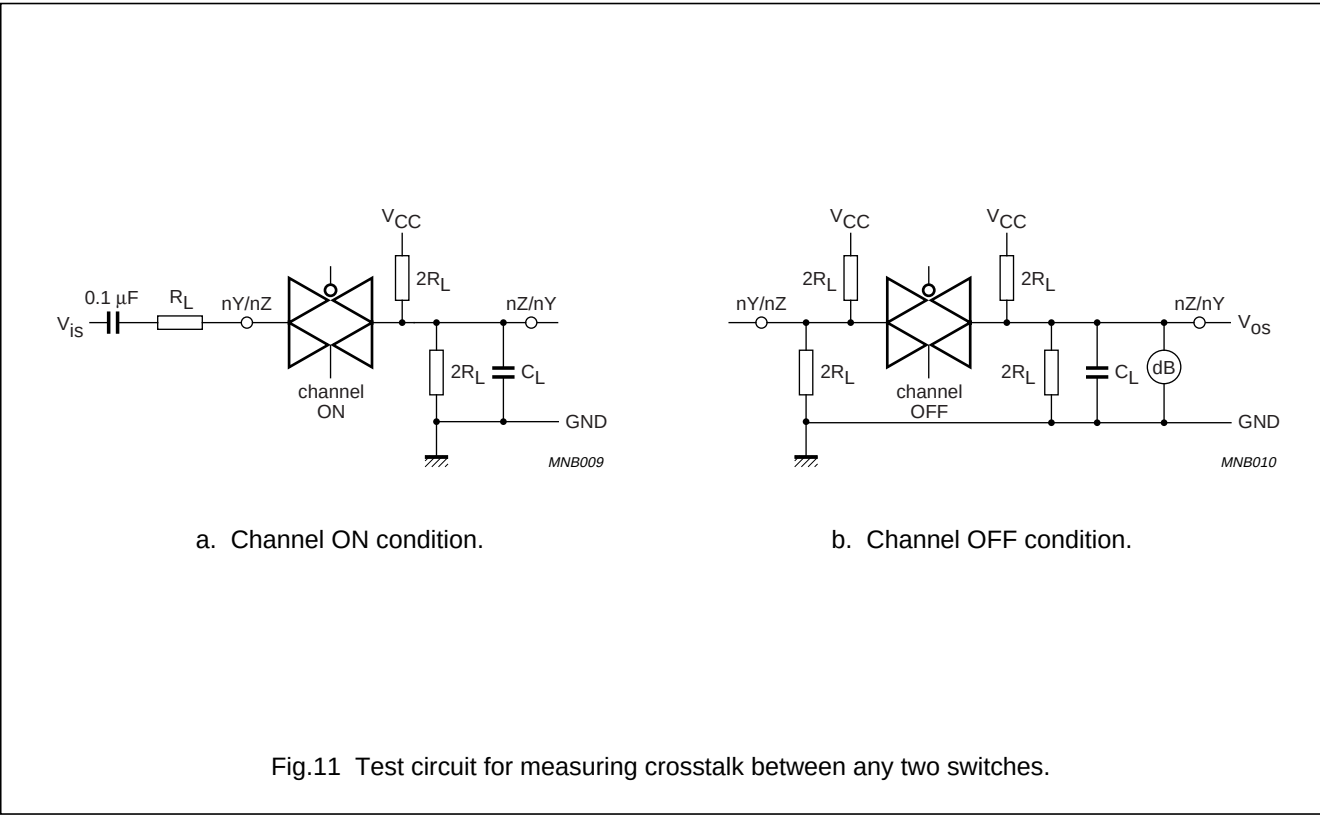
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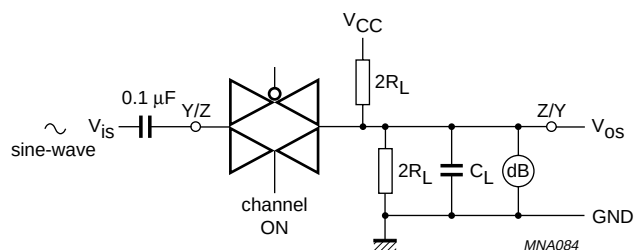
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Adjust input voltage to obtain 0 dBm at V_{os} when $f_{in} = 1 \text{ MHz}$.

After set-up, frequency of f_{in} is increased to obtain a reading of -3 dB at V_{os} .

Fig.13 Test circuit for measuring minimum frequency response.

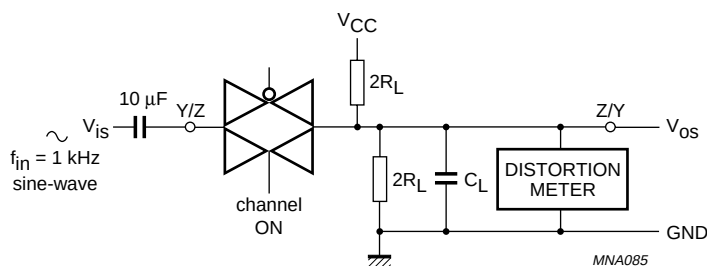


Fig.14 Test circuit for measuring sine-wave distortion.

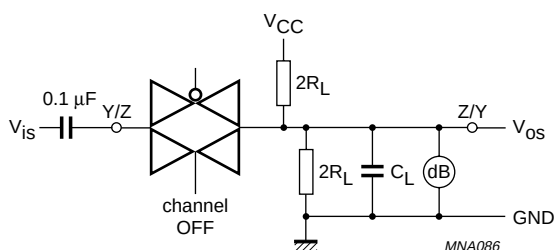
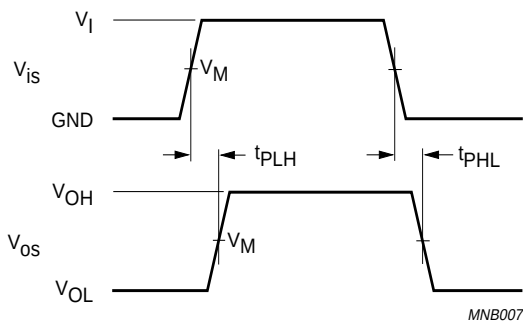


Fig.15 Test circuit for measuring switch OFF signal feed-through.

Bilateral switches

74HC2G66; 74HCT2G66

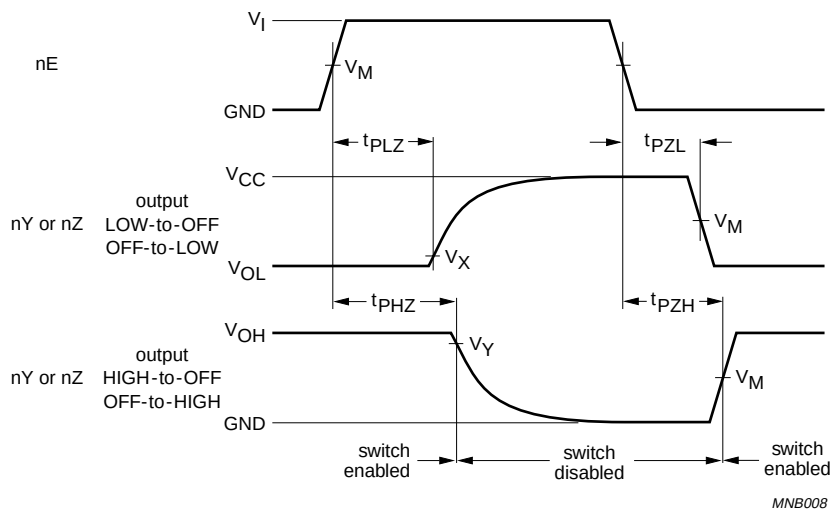
AC WAVEFORMS



MNB007

74HC2G66: $V_M = 50\%$; $V_I = \text{GND to } V_{CC}$.
74HCT2G66: $V_M = 1.3 \text{ V}$; $V_I = \text{GND to } 3.0 \text{ V}$.

Fig.16 Waveforms showing input (V_{is}) to output (V_{os}) propagation delay and the output transition time.



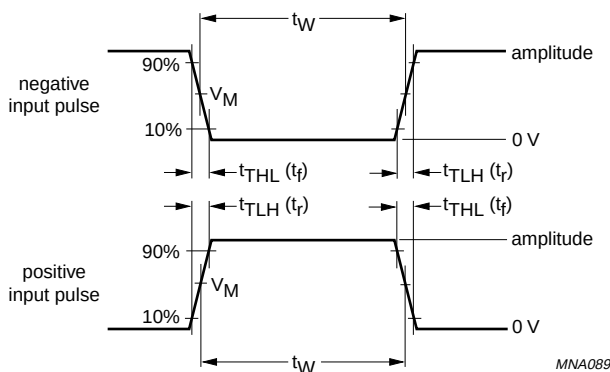
MNB008

74HC2G66: $V_M = 50\%$; $V_I = \text{GND to } V_{CC}$.
74HCT2G66: $V_M = 1.3 \text{ V}$; $V_I = \text{GND to } 3.0 \text{ V}$.

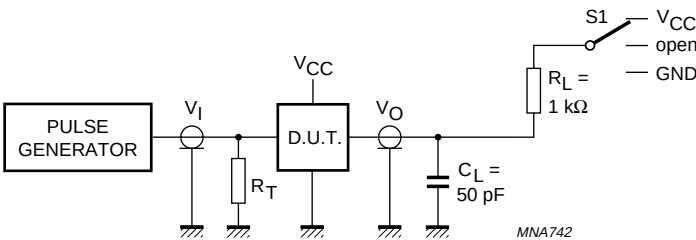
Fig.17 Waveforms showing turn-on and turn-off times.

Bilateral switches

74HC2G66; 74HCT2G66



Input pulse definition:
 $t_r = t_f = 6\text{ ns}$, when measuring f_{max} , there is no constraint on t_r , t_f with 50% duty factor.
74HC2G66: $V_M = 50\%$; $V_I = \text{GND to } V_{CC}$
74HCT2G66: $V_M = 1.3\text{ V}$; $V_I = \text{GND to } 3.0\text{ V}$.



TEST	S1
t_{PLH}/t_{PHL}	open
t_{PLZ}/t_{PZL}	V_{CC}
t_{PHZ}/t_{PZH}	GND

Definitions for test circuit:
 R_L = Load resistor.
 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.

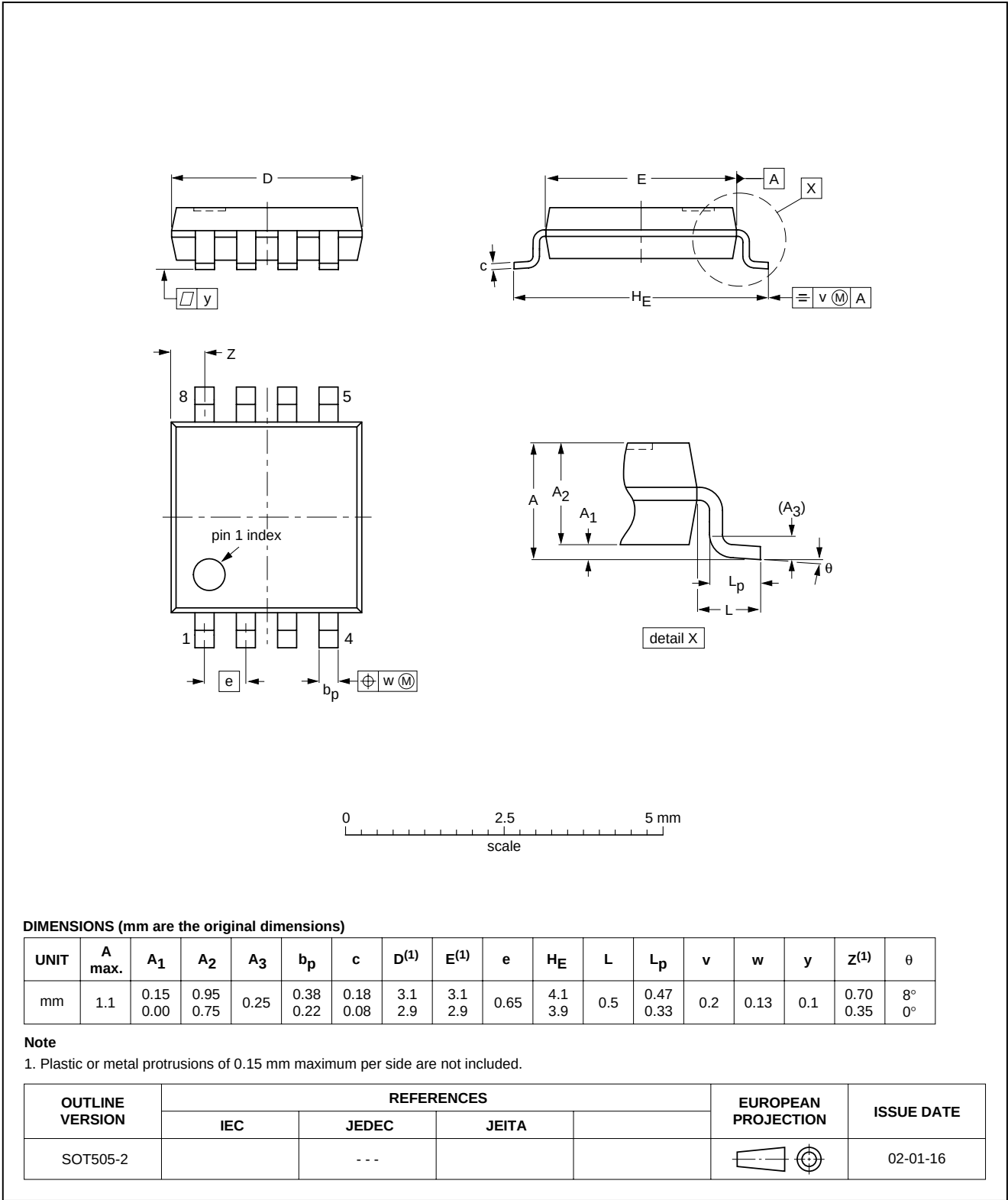
Fig.18 Load circuitry for switching times.

Bilateral switches

74HC2G66; 74HCT2G66

PACKAGE OUTLINE

TSSOP8: plastic thin shrink small outline package; 8 leads; body width 3 mm; lead length 0.5 mm SOT505-2



Bilateral switches

74HC2G66; 74HCT2G66

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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Limiting values definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

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