DATA SHEET

74HC2G66; 74HCT2G66
Bilateral switches

Product specification
Supersedes data of 2003 Nov 26

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Philips
Semiconductors

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FEATURES

- Wide supply voltage range from 2.0 V 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
- ± 25 mA switch current
- SOT505-2 package
- ESD protection:
  HBM EIA/JESD22-A114-A exceeds 2000 V
  MM EIA/JESD22-A115-A exceeds 200 V.
- Specified from –40 °C to +85 °C and
  –40 °C 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 (nY and nZ) 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 kΩ; 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 kΩ; 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 (P_D in μW).
   $P_D = C_{PD} \times V_{CC}^2 \times f_i + (C_L + C_S) \times V_{CC}^2 \times f_o$) 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 = GND to V_{CC}.
   For 74HCT2G66 the condition is V_I = GND to V_{CC} – 1.5 V.

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	OUTLINE VERSION	MARKING
74HC2G66DP	–40 °C to +125 °C	8	TSSOP8	plastic	SOT505-2	H66
74HCT2G66DP	–40 °C 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

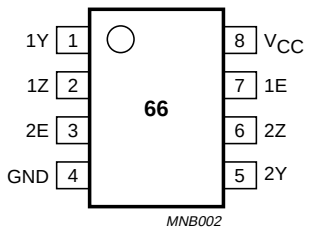


Fig.1 Pin configuration.

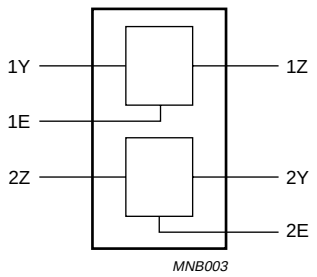


Fig.2 Logic symbol.

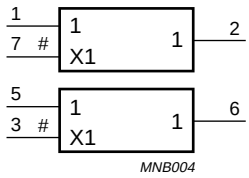


Fig.3 IEC logic symbol.

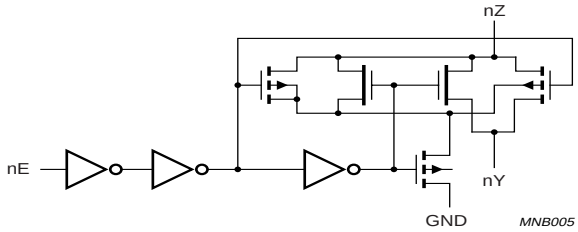


Fig.4 Logic diagram.

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 °C 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_{tot} derates linearly with 2.5 mW/K.

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 °C 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}; $\lvert V_S \rvert$ = 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}; $\lvert V_S \rvert$ = 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

SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
		OTHER	V_{CC} (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	μA
			9.0	–	–	±0.2	μA
$I_{S(OFF)}$	analog switch current, OFF-state	V_I = V_{IH} or V_{IL}; $\lvert V_S \rvert$ = 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}; $\lvert V_S \rvert$ = 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.

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 °C 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}; $\lvert V_S \rvert$ = 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}; $\lvert V_S \rvert$ = 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 A	4.5 to 5.5	–	–	375	μA
T_{amb} = −40 °C 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}; $\lvert V_S \rvert$ = V_{CC} – GND; see Fig.7		–	–	1.0	μA
$I_{S(ON)}$	analog switch current, ON-state	V_I = V_{IH} or V_{IL}; $\lvert V_S \rvert$ = 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 A	4.5 to 5.5	–	–	410	μA

Note

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

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 °C 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 °C 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

1. For 74 HCT2G66 only V_{CC} = 4.5 V applies; for 74HC2G66 all V_{CC} values apply.
2. 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.
3. All typical values are measured at T_{amb} = 25 °C.

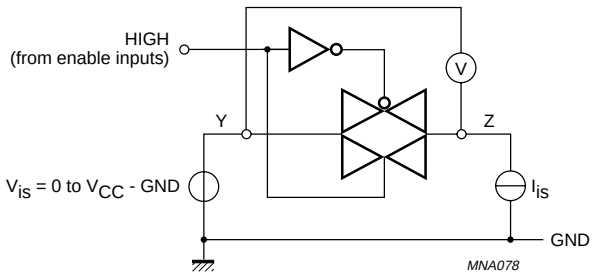
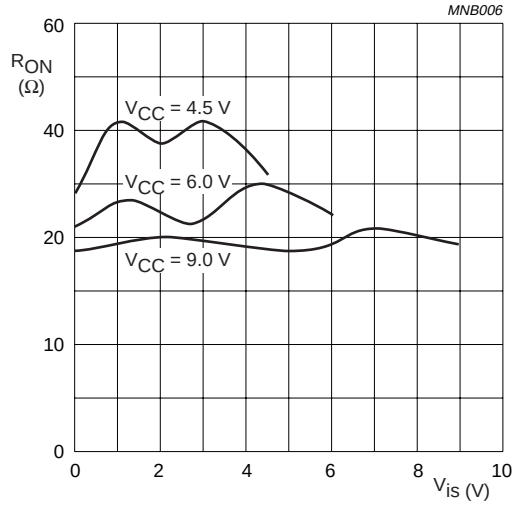


Fig.5 Test circuit for measuring ON-resistance (R_{ON}).



V_{is} = 0 V to V_{CC}.

Fig.6 Typical ON-resistance (R_{ON}) as function of input voltage (V_{is}).

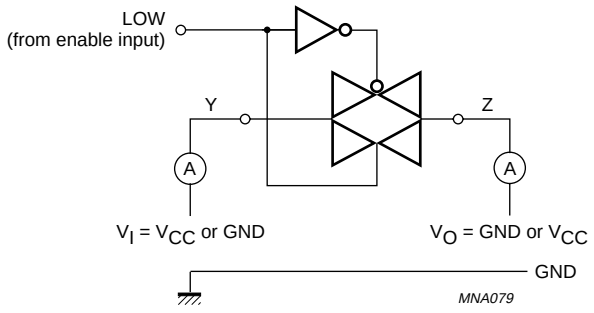


Fig.7 Test circuit for measuring OFF-state current.

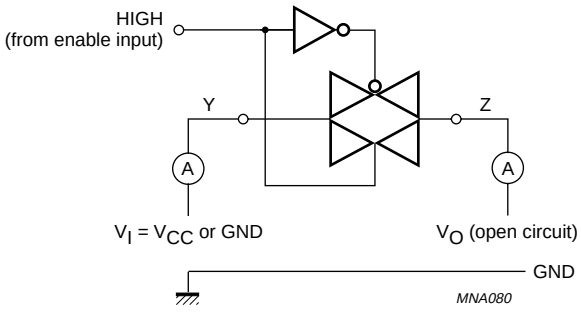


Fig.8 Test circuit for measuring ON-state current.

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 °C 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 °C 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.

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 °C to +85 °C; note 1							
t_{PHL}/t_{PLH}	propagation delay V_{is} to V_{os}	$R_L = \infty$; 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 °C to +125 °C							
t_{PHL}/t_{PLH}	propagation delay V_{is} to V_{os}	$R_L = \infty$; 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.

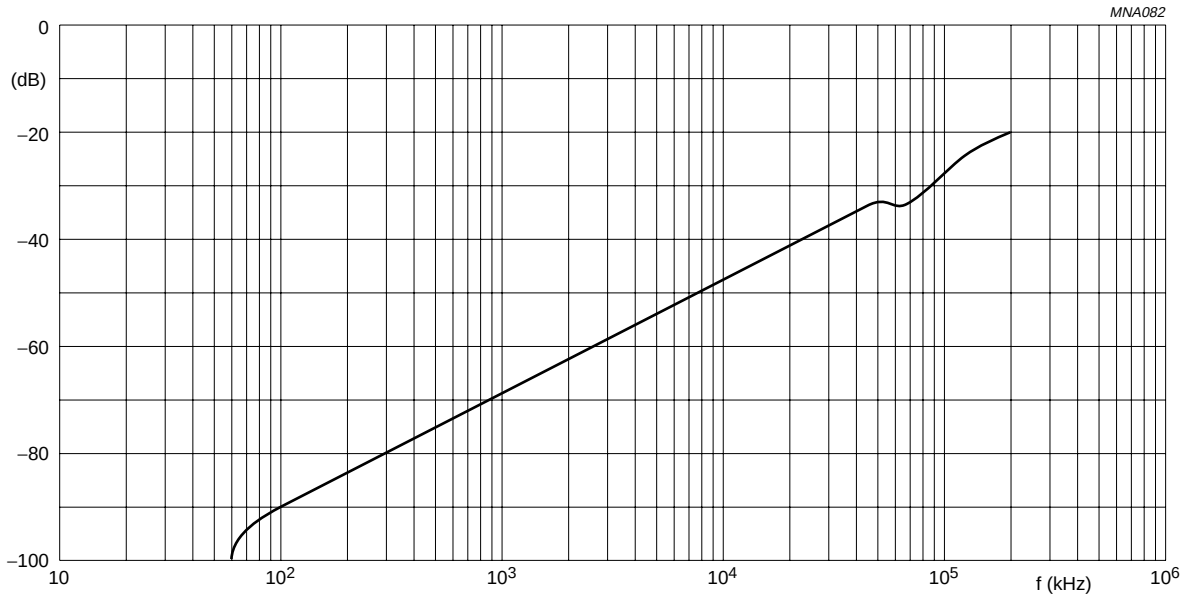
Type 74HC2G66 and 74HCT2G66

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 kΩ; 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 kΩ; 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

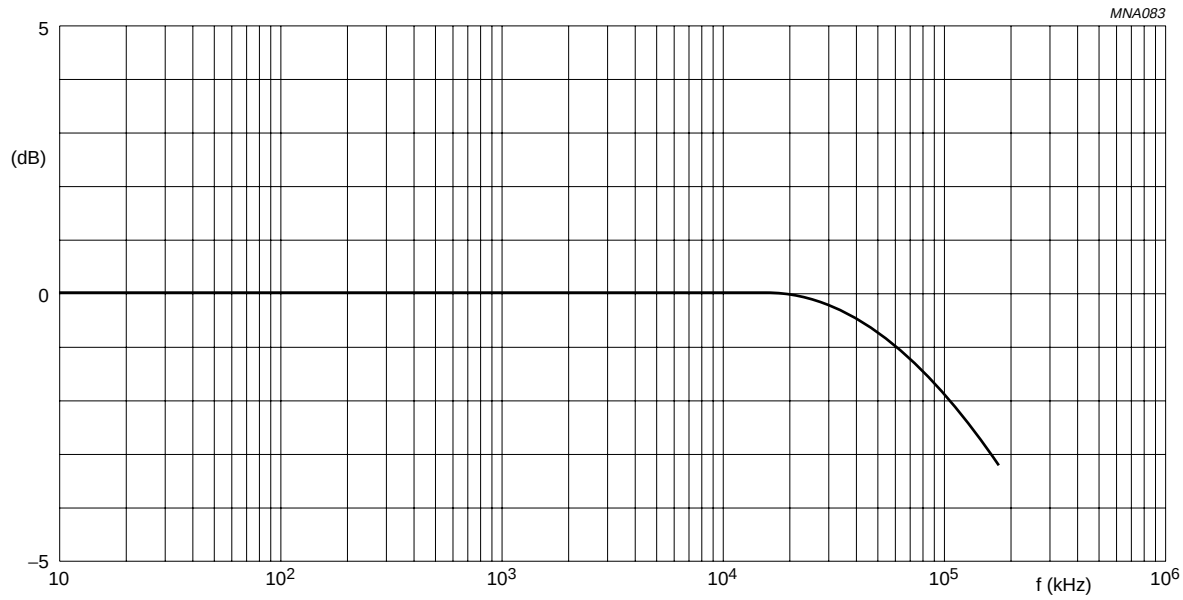
Notes

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).



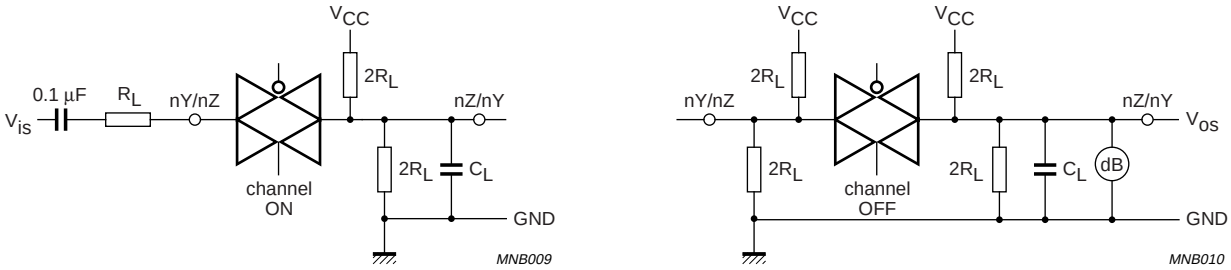
Test conditions: V_{CC} = 4.5 V; GND = 0 V; R_L = 50 Ω; R_{SOURCE} = 1 kΩ.

Fig.9 Typical switch OFF signal feed-through as a function of frequency.



Test conditions: V_{CC} = 4.5 V; GND = 0 V; R_L = 50 Ω; R_{SOURCE} = 1 kΩ.

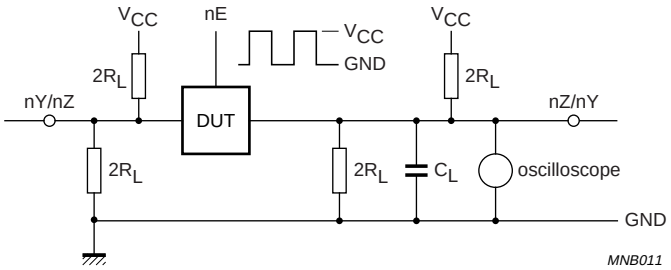
Fig.10 Typical frequency response.



a. Channel ON condition.

b. Channel OFF condition.

Fig.11 Test circuit for measuring crosstalk between any two switches.



The crosstalk is defined as follows (oscilloscope output):

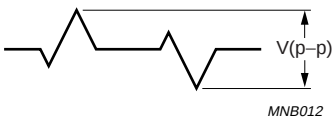
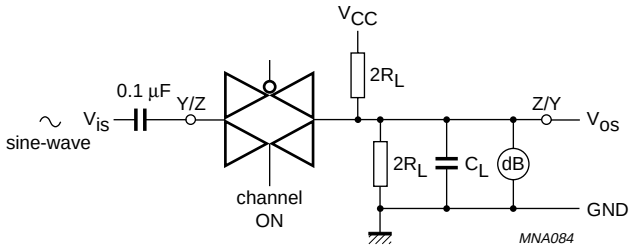


Fig.12 Test circuit for measuring crosstalk between control and any switch.



Adjust input voltage to obtain 0 dBm at V_{os} when f_i = 1 MHz.
After set-up, frequency of f_i is increased to obtain a reading of −3 dB at V_{os}.

Fig.13 Test circuit for measuring minimum frequency response.

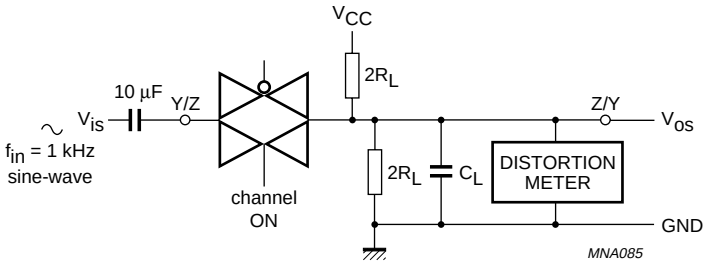


Fig.14 Test circuit for measuring sine-wave distortion.

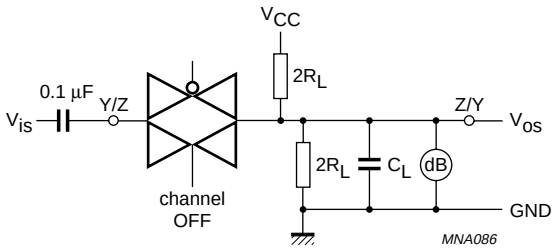
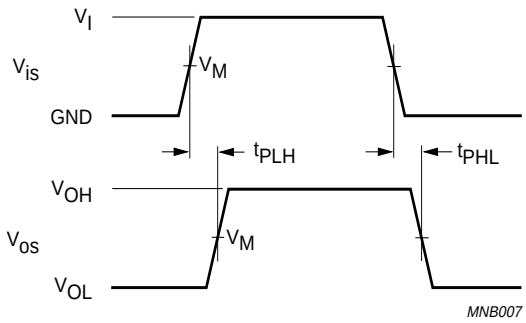


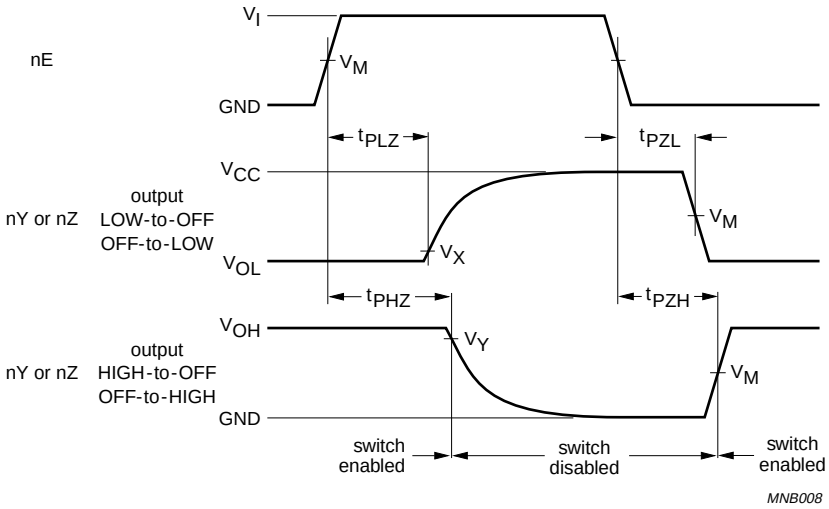
Fig.15 Test circuit for measuring switch OFF signal feed-through.

AC WAVEFORMS



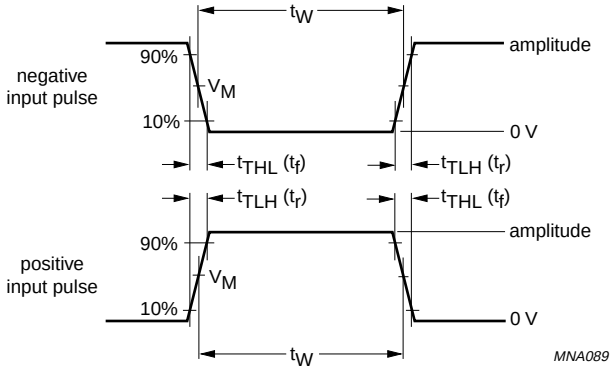
74HC2G66: V_M = 50%; V_I = GND to V_{CC}.
74HCT2G66: V_M = 1.3 V; V_I = GND to 3.0 V.

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



V_X = 10% of signal amplitude.
V_Y = 90% of signal amplitude.
74HC2G66: V_M = 50%; V_I = GND to V_{CC}.
74HCT2G66: V_M = 1.3 V; V_I = GND to 3.0 V.

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

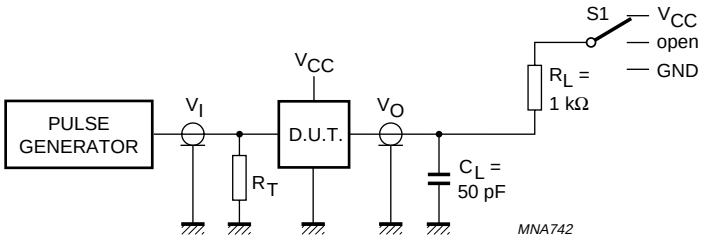


Input pulse definition:

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

74HC2G66: V_M = 50%; V_I = GND to V_{CC}.

74HCT2G66: V_M = 1.3 V; V_I = GND to 3.0 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.

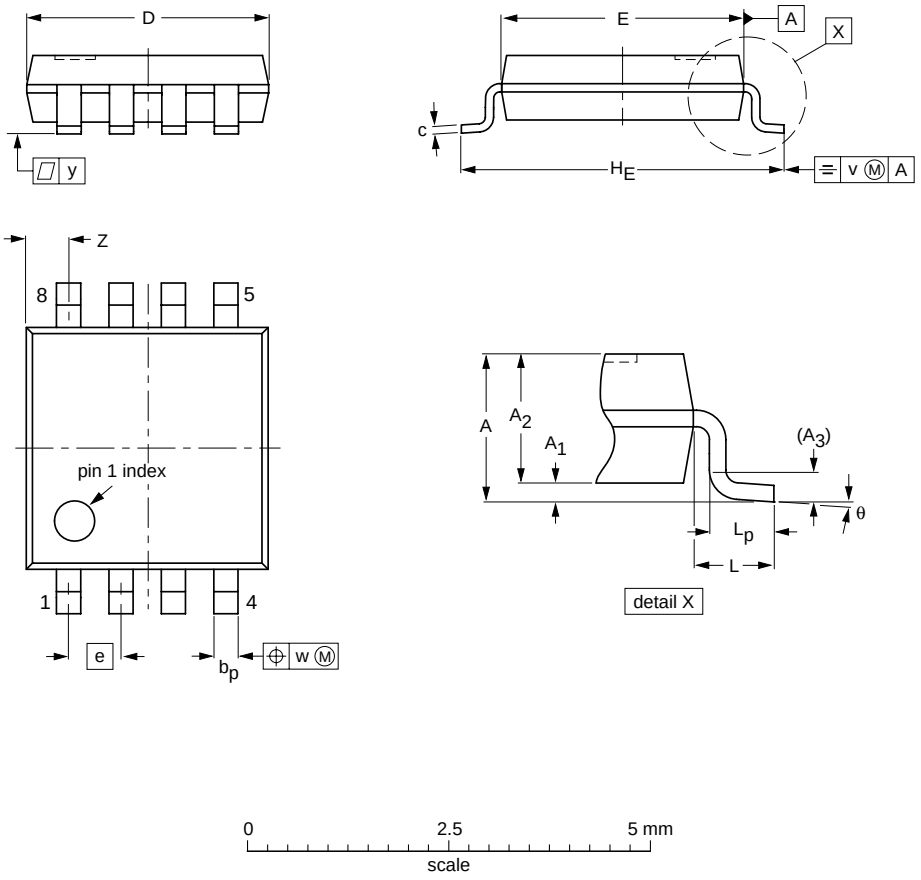
C_L = Load capacitance including jig and probe capacitance.

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

Fig.18 Load circuitry for switching times.

PACKAGE OUTLINE

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



DIMENSIONS (mm are the original 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	1.1	0.15 0.00	0.95 0.75	0.25	0.38 0.22	0.18 0.08	3.1 2.9	3.1 2.9	0.65	4.1 3.9	0.5	0.47 0.33	0.2	0.13	0.1	0.70 0.35	8° 0°

Note

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

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT505-2		- - -				02-01-16

DATA SHEET STATUS

LEVEL	DATA SHEET STATUS(1)	PRODUCT STATUS(2)(3)	DEFINITION
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