

DATA SHEET

74LVC1G66 Bilateral switch

Product specification
Supersedes data of 2002 Nov 15

2004 Apr 13

Bilateral switch**74LVC1G66****FEATURES**

- Very low ON resistance:
 - 7.5 Ω (typical) at $V_{CC} = 2.7$ V
 - 6.5 Ω (typical) at $V_{CC} = 3.3$ V
 - 6 Ω (typical) at $V_{CC} = 5$ V.
- Switch handling capability of 32 mA
- High noise immunity
- CMOS low power consumption
- Latch-up performance exceeds 100 mA per JESD78 Class II
- Direct interface TTL-levels
- Multiple package options
- ESD protection:
 - HBM EIA/JESD22-A114-B exceeds 2000 V
 - MM EIA/JESD22-A115-A exceeds 200 V.
- Specified from -40 to $+85$ °C and -40 to $+125$ °C.

DESCRIPTION

The 74LVC1G66 is a high-speed Si-gate CMOS device.

The 74LVC1G66 provides an analog switch. The switch has two input/output pins (Y and Z) and an active HIGH enable input pin (E). When pin E is LOW, the analog switch is turned off.

QUICK REFERENCE DATA

Ground = 0 V; $T_{amb} = 25$ °C; $t_r = t_f \leq 3.0$ ns.

SYMBOL	PARAMETER	CONDITIONS	TYPICAL	UNIT
t_{PZH}/t_{PZL}	turn-ON time E to V_{OS}	$C_L = 50$ pF; $R_L = 500$ Ω ; $V_{CC} = 3$ V	2.5	ns
		$C_L = 50$ pF; $R_L = 500$ Ω ; $V_{CC} = 5$ V	1.9	ns
t_{PHZ}/t_{PLZ}	turn-OFF time E to V_{OS}	$C_L = 50$ pF; $R_L = 500$ Ω ; $V_{CC} = 3$ V	3.4	ns
		$C_L = 50$ pF; $R_L = 500$ Ω ; $V_{CC} = 5$ V	2.5	ns
C_I	input capacitance		2	pF
C_{PD}	power dissipation capacitance	$C_L = 50$ pF; $f_i = 10$ MHz; $V_{CC} = 3.3$ V; notes 1 and 2	12.0	pF
C_S	switch capacitance	OFF-state	6.5	pF
		ON-state	11	pF

Notes

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

$P_D = C_{PD} \times V_{CC}^2 \times f_i + \{(C_L + C_S) \times V_{CC}^2 \times f_o\}$ 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. The condition is $V_i = \text{GND}$ to V_{CC} .

Bilateral switch

74LVC1G66

FUNCTION TABLE

See note 1.

INPUT E	SWITCH
L	OFF
H	ON

Note

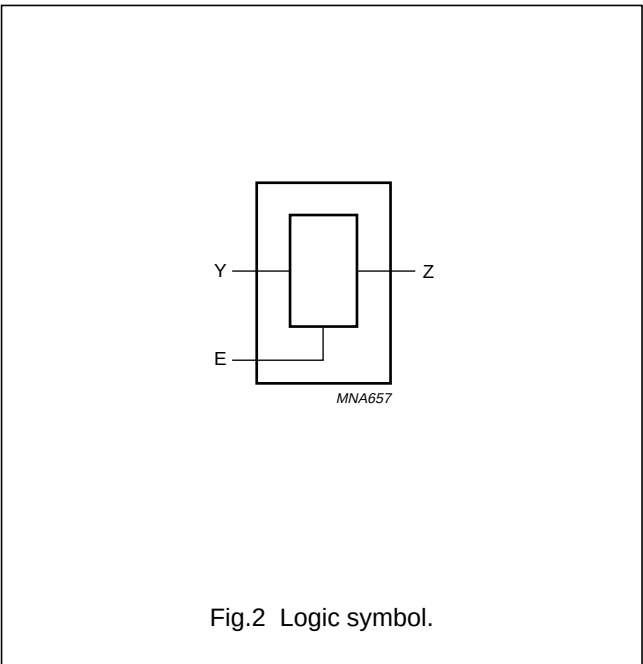
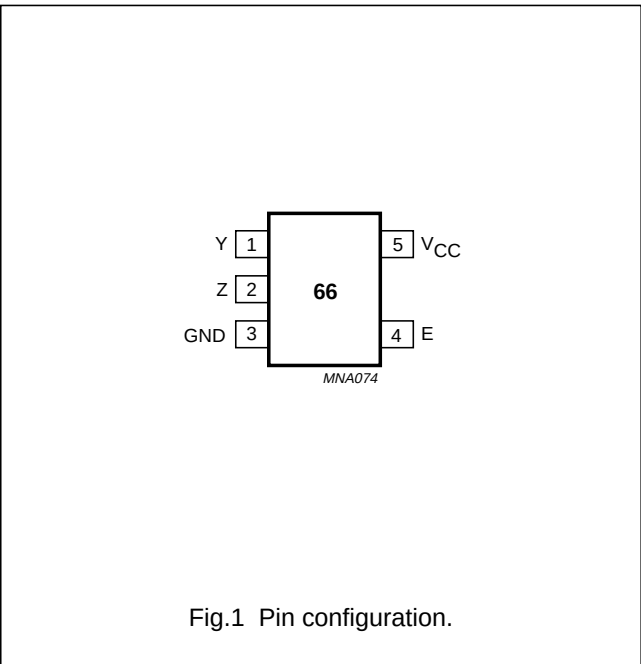
1. H = HIGH voltage level;
L = LOW voltage level.

ORDERING INFORMATION

TYPE NUMBER	PACKAGE					
	TEMPERATURE RANGE	PINS	PACKAGE	MATERIAL	CODE	MARKING
74LVC1G66GW	−40 to +125 °C	5	SC-88A	plastic	SOT353	VL
74LVC1G66GV	−40 to +125 °C	5	SC-74A	plastic	SOT753	V66

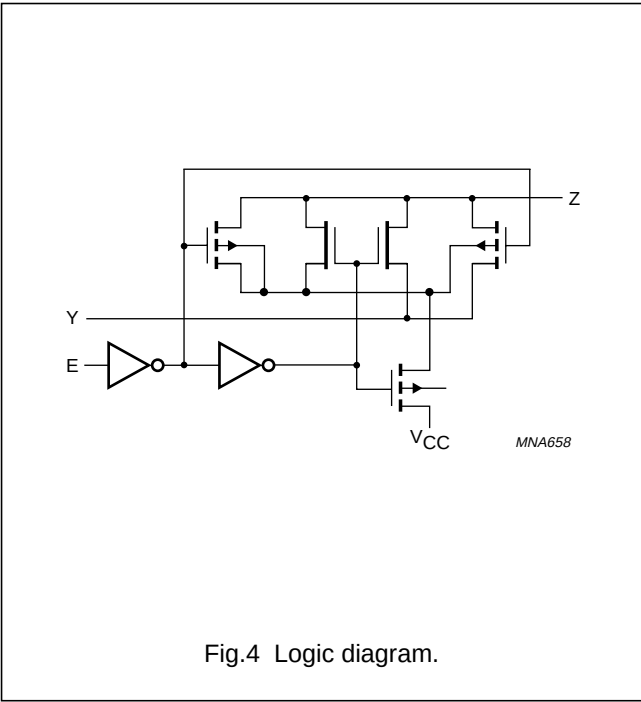
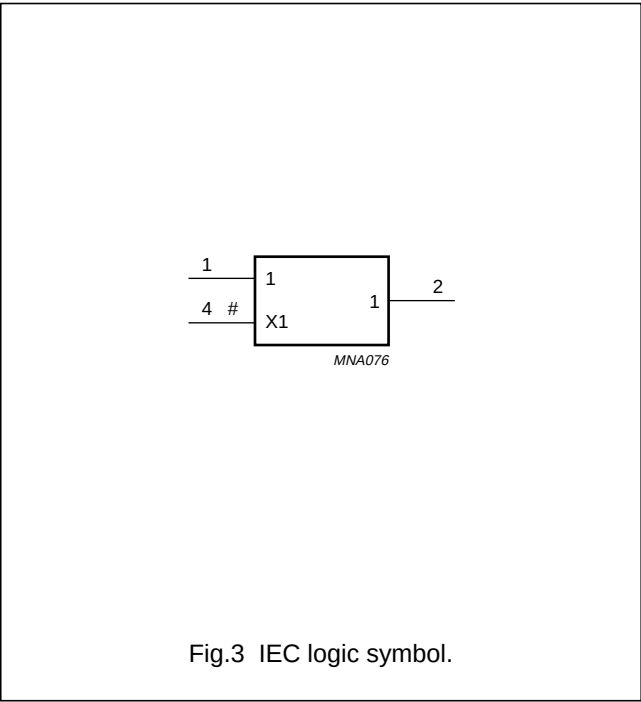
PINNING

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



Bilateral switch

74LVC1G66



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 _O	output voltage	active mode	0	V _{CC}	V
		V _{CC} = 0 V; Power-down mode	0	5.5	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

Bilateral switch

74LVC1G66

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	+6.5	V
I_{IK}	input diode current	$V_I < 0$	–	-50	mA
V_I	input voltage	note 1	-0.5	+6.5	V
V_O	output voltage	active mode; notes 1 and 2	-0.5	$V_{CC} + 0.5$	V
		Power-down mode; notes 1 and 2	-0.5	+6.5	V
I_{OS}	maximum switch current	$V_O = 0$ to V_{CC}	–	±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 2	–	250	mW

Notes

1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
2. When $V_{CC} = 0$ V (Power-down mode), the output voltage can be 5.5 V in normal operation.

DC CHARACTERISTICS

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		1.65 to 1.95	0.65 × V _{CC}	–	–	V
			2.3 to 2.7	1.7	–	–	V
			2.7 to 3.6	2.0	–	–	V
			4.5 to 5.5	0.7 × V _{CC}	–	–	V
V _{IL}	LOW-level input voltage		1.65 to 1.95	–	–	0.35 × V _{CC}	V
			2.3 to 2.7	–	–	0.7	V
			2.7 to 3.6	–	–	0.8	V
			4.5 to 5.5	–	–	0.3 × V _{CC}	V
I _{LI}	input leakage current (control pin)	V _I = 5.5 V or GND	5.5	–	±0.1	±5	µA
I _S	analog switch OFF-state current	V _I = V _{IH} or V _{IL} ; V _S = V _{CC} – GND; see Fig.5	5.5	–	±0.1	±5	µA
	analog switch ON-state current	V _I = V _{IH} or V _{IL} ; V _S = V _{CC} – GND; see Fig.6	5.5	–	±0.1	±5	µA
I _{CC}	quiescent supply current	V _I = V _{CC} or GND; V _S = GND or V _{CC} ; I _O = 0	5.5	–	0.1	10	µA

Bilateral switch

74LVC1G66

SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
		OTHER	V _{CC} (V)				
ΔI_{CC}	additional quiescent supply current per control pin	V _I = V _{CC} – 0.6 V; V _S = GND or V _{CC} ; I _O = 0	5.5	–	5	500	μA
R _{ON(peak)}	ON-resistance (peak)	V _S = GND to V _{CC} ; V _I = V _{IH} ; see Fig.7 I _S = 4 mA	1.65 to 1.95	–	35	100	Ω
		I _S = 8 mA	2.3 to 2.7	–	14	30	Ω
		I _S = 12 mA	2.7	–	11.5	25	Ω
		I _S = 24 mA	3.0 to 3.6	–	8.5	20	Ω
		I _S = 32 mA	4.5 to 5.5	–	6.5	15	Ω
R _{ON(rail)}	ON-resistance (rail)	V _S = GND; V _I = V _{IH} ; see Fig.7 I _S = 4 mA	1.65 to 1.95	–	10	30	Ω
		I _S = 8 mA	2.3 to 2.7	–	8.5	20	Ω
		I _S = 12 mA	2.7	–	7.5	18	Ω
		I _S = 24 mA	3.0 to 3.6	–	6.5	15	Ω
		I _S = 32 mA	4.5 to 5.5	–	6	10	Ω
		V _S = V _{CC} ; V _I = V _{IH} ; see Fig.7 I _S = 4 mA	1.65 to 1.95	–	12	30	Ω
		I _S = 8 mA	2.3 to 2.7	–	8.5	20	Ω
		I _S = 12 mA	2.7	–	7.5	18	Ω
		I _S = 24 mA	3.0 to 3.6	–	6.5	15	Ω
		I _S = 32 mA	4.5 to 5.5	–	6	10	Ω
R _{ON(flatness)}	ON-resistance (flatness)	V _S = GND to V _{CC} ; V _I = V _{IH} ; see Figs 9 to 13 I _S = 4 mA	1.65 to 1.95	–	100 ⁽²⁾	–	Ω
		I _S = 8 mA	2.3 to 2.7	–	17 ⁽²⁾	–	Ω
		I _S = 12 mA	2.7	–	10 ⁽²⁾	–	Ω
		I _S = 24 mA	3.0 to 3.6	–	5 ⁽²⁾	–	Ω
		I _S = 32 mA	4.5 to 5.5	–	3 ⁽²⁾	–	Ω

Bilateral switch

74LVC1G66

SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
		OTHER	V _{CC} (V)				
T _{amb} = −40 to +125 °C							
V _{IH}	HIGH-level input voltage		1.65 to 1.95	0.65 × V _{CC}	–	–	V
			2.3 to 2.7	1.7	–	–	V
			2.7 to 3.6	2.0	–	–	V
			4.5 to 5.5	0.7 × V _{CC}	–	–	V
V _{IL}	LOW-level input voltage		1.65 to 1.95	–	–	0.35 × V _{CC}	V
			2.3 to 2.7	–	–	0.7	V
			2.7 to 3.6	–	–	0.8	V
			4.5 to 5.5	–	–	0.3 × V _{CC}	V
I _{LI}	input leakage current (control pin)	V _I = 5.5 V or GND	5.5	–	–	100	μA
I _S	analog switch OFF-state current	V _I = V _{IH} or V _{IL} ; V _S = V _{CC} – GND; see Fig.5	5.5	–	–	200	μA
	analog switch ON-state current	V _I = V _{IH} or V _{IL} ; V _S = V _{CC} – GND; see Fig.6	5.5	–	–	200	μA
I _{CC}	quiescent supply current	V _I = V _{CC} or GND; V _S = GND or V _{CC} ; I _O = 0	5.5	–	–	200	μA
ΔI _{CC}	additional quiescent supply current per control pin	V _I = V _{CC} – 0.6 V; V _S = GND or V _{CC} ; I _O = 0	5.5	–	–	5000	μA
R _{ON(peak)}	ON-resistance (peak)	V _S = GND to V _{CC} ; V _I = V _{IH} ; see Fig.7 I _S = 4 mA I _S = 8 mA I _S = 12 mA I _S = 24 mA I _S = 32 mA					
			1.65 to 1.95	–	–	150	Ω
			2.3 to 2.7	–	–	45	Ω
			2.7	–	–	38	Ω
			3.0 to 3.6	–	–	30	Ω
			4.5 to 5.5	–	–	23	Ω

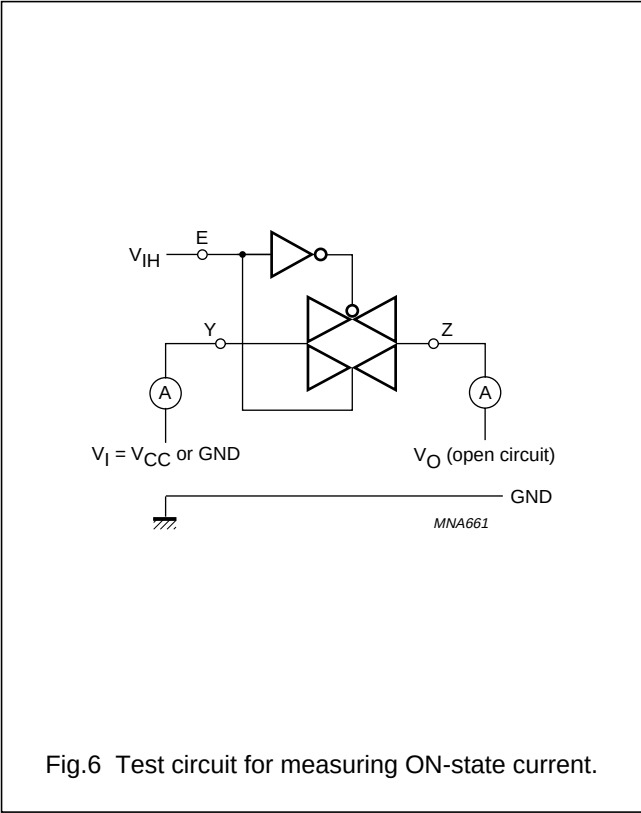
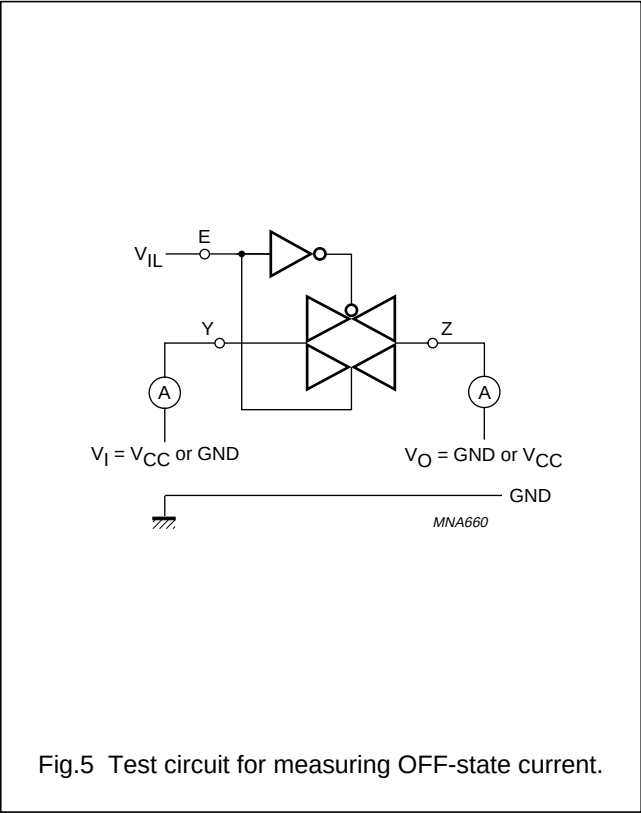
Bilateral switch

74LVC1G66

SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
		OTHER	V _{CC} (V)				
R _{ON(rail)}	ON-resistance (rail)	V _S = GND; V _I = V _{IH} ; see Fig.7 I _S = 4 mA I _S = 8 mA I _S = 12 mA I _S = 24 mA I _S = 32 mA					
			1.65 to 1.95	—	—	45	Ω
			2.3 to 2.7	—	—	30	Ω
			2.7	—	—	27	Ω
			3.0 to 3.6	—	—	23	Ω
			4.5 to 5.5	—	—	15	Ω
		V _S = V _{CC} ; V _I = V _{IH} ; see Fig.7 I _S = 4 mA I _S = 8 mA I _S = 12 mA I _S = 24 mA I _S = 32 mA					
			1.65 to 1.95	—	—	45	Ω
			2.3 to 2.7	—	—	30	Ω
			2.7	—	—	27	Ω
			3.0 to 3.6	—	—	23	Ω
			4.5 to 5.5	—	—	15	Ω

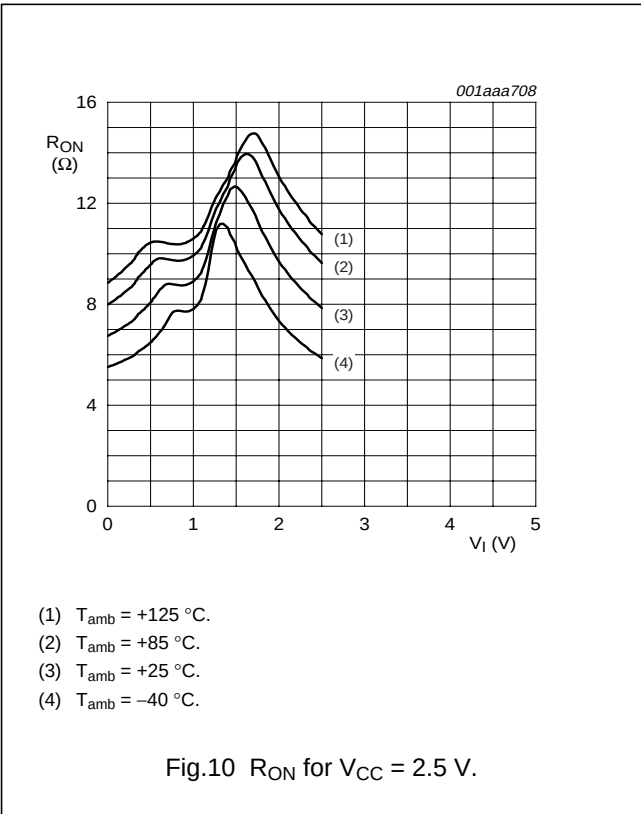
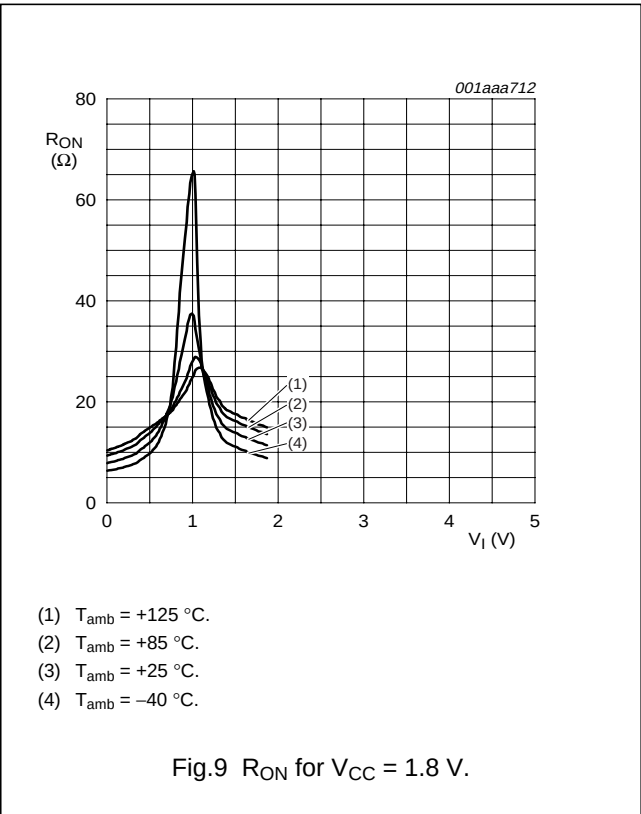
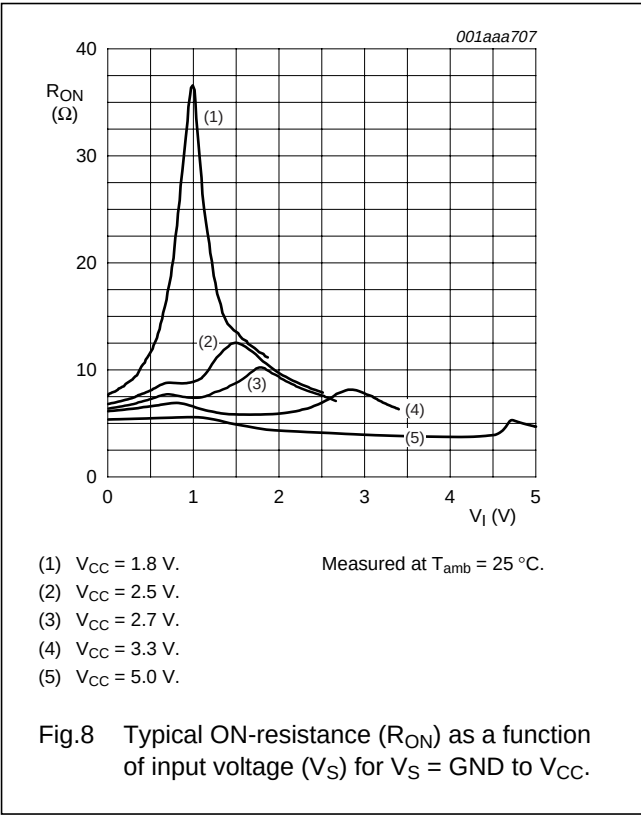
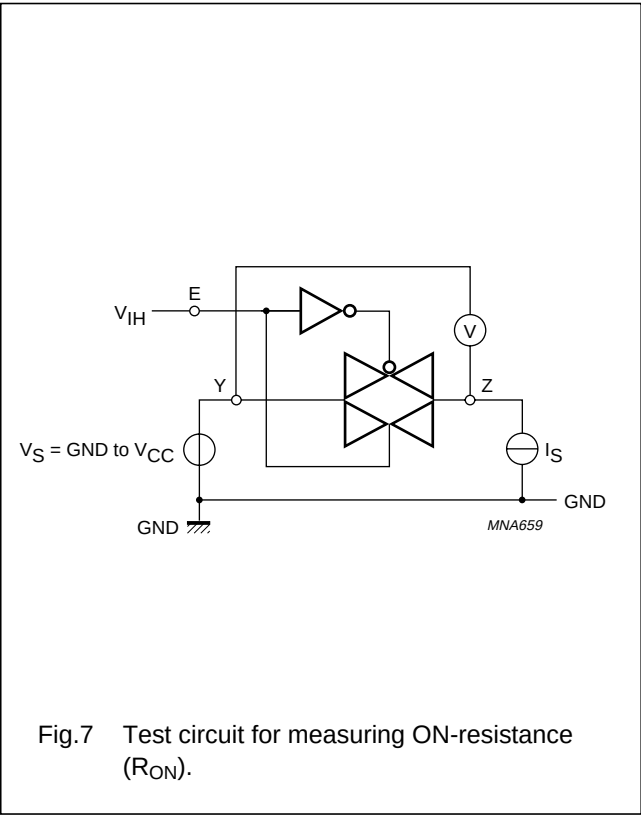
Notes

- 1. All typical values are measured at T_{amb} = 25 °C.
- 2. R_{ON} flatness over operating temperature range (T_{amb} = −40 to +85 °C).



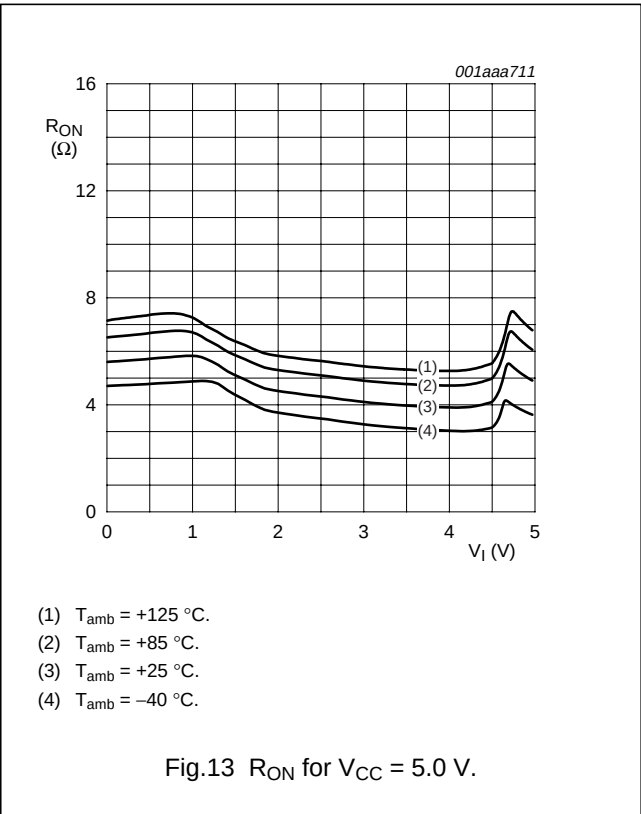
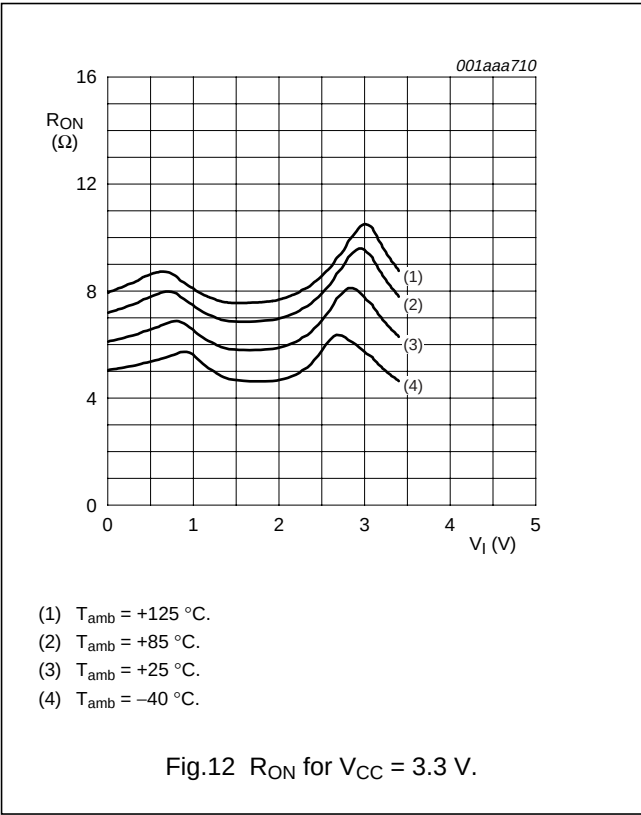
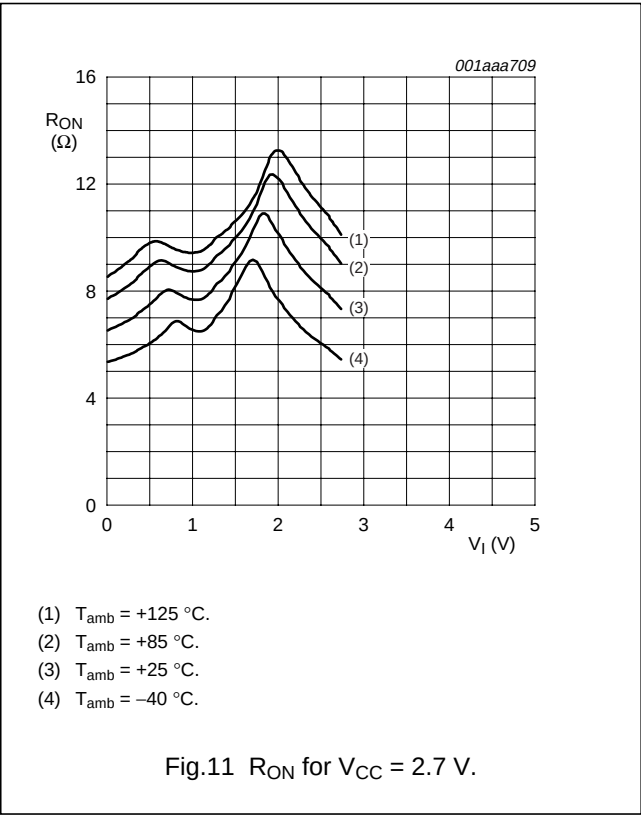
Bilateral switch

74LVC1G66



Bilateral switch

74LVC1G66



Bilateral switch

74LVC1G66

AC CHARACTERISTICS

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 Y to Z or Z to Y	see Figs 14 and 16	1.65 to 1.95	–	0.8	2	ns
			2.3 to 2.7	–	0.4	1.2	ns
			2.7	–	0.4	1	ns
			3.0 to 3.6	–	0.3	0.8	ns
			4.5 to 5.5	–	0.2	0.6	ns
t _{PZH} /t _{PZL}	turn-ON time E to V _{OS}	see Figs 15 and 16	1.65 to 1.95	1	5.3	12	ns
			2.3 to 2.7	1	3.0	6.5	ns
			2.7	1	2.6	6	ns
			3.0 to 3.6	1	2.5	5	ns
			4.5 to 5.5	1	1.9	4.2	ns
t _{PHZ} /t _{PLZ}	turn-OFF time E to V _{OS}	see Figs 15 and 16	1.65 to 1.95	1	4.2	10	ns
			2.3 to 2.7	1	2.4	6.9	ns
			2.7	1	3.6	7.5	ns
			3.0 to 3.6	1	3.4	6.5	ns
			4.5 to 5.5	1	2.5	5	ns
T _{amb} = −40 to +125 °C							
t _{PHL} /t _{PLH}	propagation delay Y to Z or Z to Y	see Figs 14 and 16	1.65 to 1.95	–	–	3	ns
			2.3 to 2.7	–	–	2	ns
			2.7	–	–	1.5	ns
			3.0 to 3.6	–	–	1.5	ns
			4.5 to 5.5	–	–	1	ns
t _{PZH} /t _{PZL}	turn-ON time E to V _{OS}	see Figs 15 and 16	1.65 to 1.95	1	–	15.5	ns
			2.3 to 2.7	1	–	8.5	ns
			2.7	1	–	8	ns
			3.0 to 3.6	1	–	6.5	ns
			4.5 to 5.5	1	–	5.5	ns
t _{PHZ} /t _{PLZ}	turn-OFF time E to V _{OS}	see Figs 15 and 16	1.65 to 1.95	1	–	13	ns
			2.3 to 2.7	1	–	9	ns
			2.7	1	–	9.5	ns
			3.0 to 3.6	1	–	8.5	ns
			4.5 to 5.5	1	–	6.5	ns

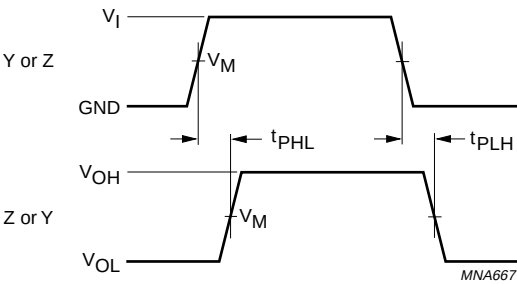
Note

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

Bilateral switch

74LVC1G66

AC WAVEFORMS



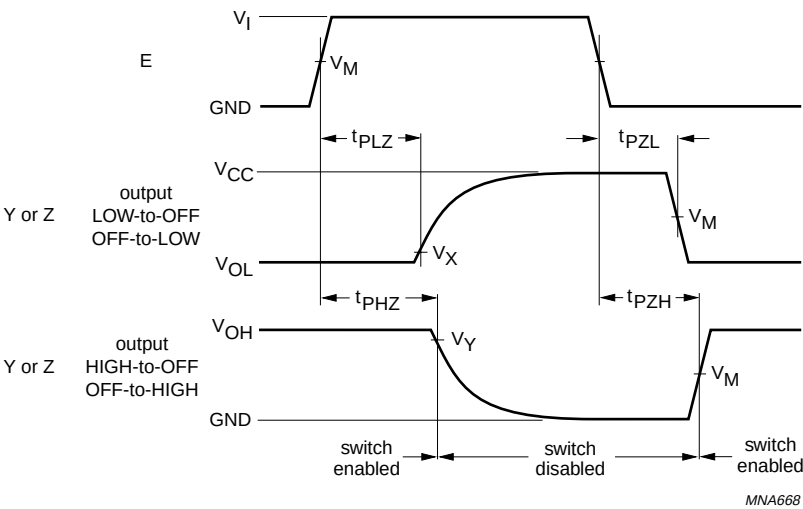
V_{CC}	V_M	V_I	INPUT $t_r = t_f$
1.65 to 1.95 V	$0.5 \times V_{CC}$	V_{CC}	≤ 2.0 ns
2.3 to 2.7 V	$0.5 \times V_{CC}$	V_{CC}	≤ 2.0 ns
2.7 V	1.5 V	2.7 V	≤ 2.5 ns
3.0 to 3.6 V	1.5 V	2.7 V	≤ 2.5 ns
4.5 to 5.5 V	$0.5 \times V_{CC}$	V_{CC}	≤ 2.5 ns

V_{OL} and V_{OH} are typical output voltage drop that occur with the output load.

Fig.14 The input (V_S) to output (V_O) propagation delays.

Bilateral switch

74LVC1G66



V_{CC}	V_M	V_I	INPUT $t_r = t_f$
1.65 to 1.95 V	$0.5 \times V_{CC}$	V_{CC}	≤ 2.0 ns
2.3 to 2.7 V	$0.5 \times V_{CC}$	V_{CC}	≤ 2.0 ns
2.7 V	1.5 V	2.7 V	≤ 2.5 ns
3.0 to 3.6 V	1.5 V	2.7 V	≤ 2.5 ns
4.5 to 5.5 V	$0.5 \times V_{CC}$	V_{CC}	≤ 2.5 ns

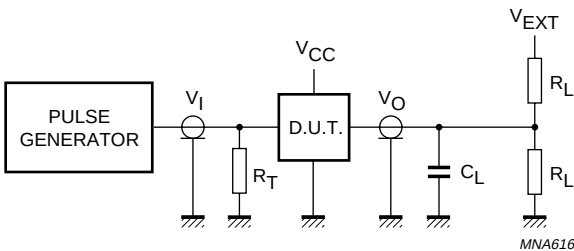
$V_x = V_{OL} + 0.3$ V at $V_{CC} \geq 2.7$ V;
 $V_x = V_{OL} + 0.1 \times V_{CC}$ at $V_{CC} < 2.7$ V;
 $V_y = V_{OH} - 0.3$ V at $V_{CC} \geq 2.7$ V;
 $V_y = V_{OH} - 0.1 \times V_{CC}$ at $V_{CC} < 2.7$ V.

V_{OL} and V_{OH} are typical output voltage drop that occur with the output load.

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

Bilateral switch

74LVC1G66



V _{CC}	V _I	C _L	R _L	V _{EXT}		
				t _{PLH} /t _{PHL}	t _{PZH} /t _{PHZ}	t _{PZL} /t _{PLZ}
1.65 to 1.95 V	V _{CC}	30 pF	1 kΩ	open	GND	2 × V _{CC}
2.3 to 2.7 V	V _{CC}	30 pF	500 Ω	open	GND	2 × V _{CC}
2.7 V	2.7 V	50 pF	500 Ω	open	GND	6 V
3.0 to 3.6 V	2.7 V	50 pF	500 Ω	open	GND	6 V
4.5 to 5.5 V	V _{CC}	50 pF	500 Ω	open	GND	2 × V _{CC}

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.16 Load circuitry for switching times.

Bilateral switch

74LVC1G66

ADDITIONAL AC CHARACTERISTICSAt recommended conditions and all typical values are measured at $T_{amb} = 25\text{ }^{\circ}\text{C}$.

SYMBOL	PARAMETER	TEST CONDITIONS	V_{CC} (V)	TYP.	UNIT
d_{sin}	sine-wave distortion	$R_L = 10\text{ k}\Omega$; $C_L = 50\text{ pF}$; $f_i = 1\text{ kHz}$; see Fig.18	1.65	0.032	%
			2.3	0.008	%
			3	0.006	%
			4.5	0.001	%
		$R_L = 10\text{ k}\Omega$; $C_L = 50\text{ pF}$; $f_i = 10\text{ kHz}$; see Fig.18	1.65	0.068	%
			2.3	0.009	%
			3	0.008	%
			4.5	0.006	%
$f_{ON(res)}$	switch ON signal frequency response	$R_L = 600\text{ }\Omega$; $C_L = 50\text{ pF}$; $f_i = 1\text{ MHz}$; see Fig.17; note 1	1.65	135	MHz
			2.3	145	MHz
			3	150	MHz
			4.5	155	MHz
		$R_L = 50\text{ }\Omega$; $C_L = 5\text{ pF}$; $f_i = 1\text{ MHz}$; see Fig.17; note 1	1.65	>500	MHz
			2.3	>500	MHz
			3	>500	MHz
			4.5	>500	MHz
$\alpha_{OFF(ft)}$	switch OFF signal feed-through attenuation	$R_L = 600\text{ }\Omega$; $C_L = 50\text{ pF}$; $f_i = 1\text{ MHz}$; see Fig.19; note 2	1.65	-46	dB
			2.3	-46	dB
			3	-46	dB
			4.5	-46	dB
		$R_L = 0\text{ }\Omega$; $C_L = 50\text{ pF}$; $f_i = 1\text{ MHz}$; see Fig.19; note 2	1.65	-37	dB
			2.3	-37	dB
			3	-37	dB
			4.5	-37	dB
V_{ct}	crosstalk (control input to signal output)	$R_L = 600\text{ }\Omega$; $C_L = 50\text{ pF}$; $f_i = 1\text{ MHz}$; $t_r = t_f = 2\text{ ns}$; see Fig.20	1.65	69	mV
			2.3	87	mV
			3	156	mV
			4.5	302	mV
f_{max}	frequency response (-3 dB)	$R_L = 50\text{ }\Omega$; $C_L = 10\text{ pF}$; see Fig.17; note 1	1.65	200	MHz
			2.3	350	MHz
			3	410	MHz
			4.5	440	MHz
C_{PD}	power dissipation capacitance	$C_L = 50\text{ pF}$; $f_i = 10\text{ MHz}$	2.5	9.8	pF
			3.3	12.0	pF
			5.0	17.3	pF
Q	charge injection	$C_L = 0.1\text{ nF}$; $V_{gen} = 0\text{ V}$; $R_{gen} = 0\text{ }\Omega$; $f_i = 1\text{ MHz}$; $R_L = 1\text{ M}\Omega$; see Fig.21; note 3	1.65 to 5.5	0.05	pC

Bilateral switch

74LVC1G66

Notes

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

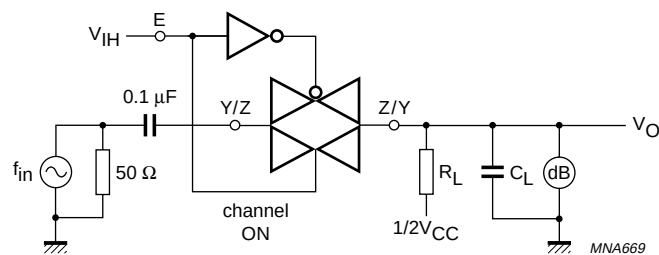
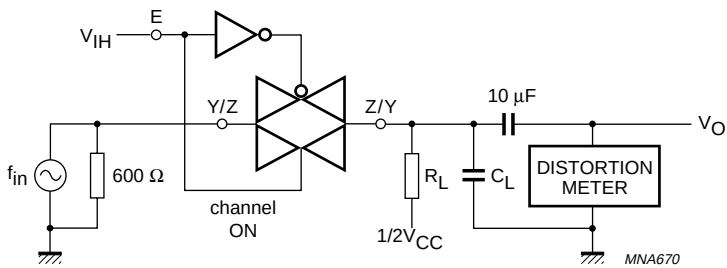


Fig.17 Test circuit for measuring the frequency response when switch is ON.

Bilateral switch

74LVC1G66



V_{CC}	V_I
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.

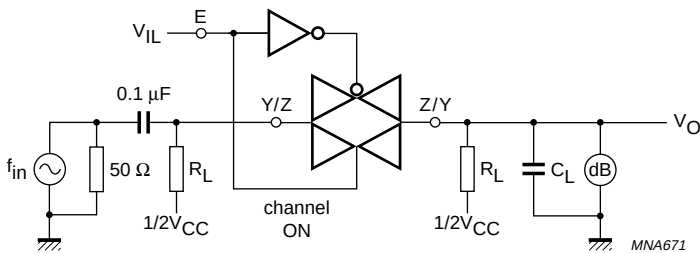


Fig.19 Test circuit for measuring feed-through when switch is OFF.

Bilateral switch

74LVC1G66

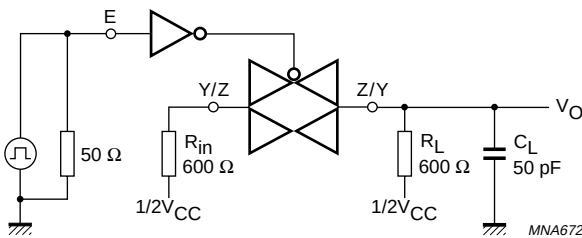


Fig.20 Crosstalk.

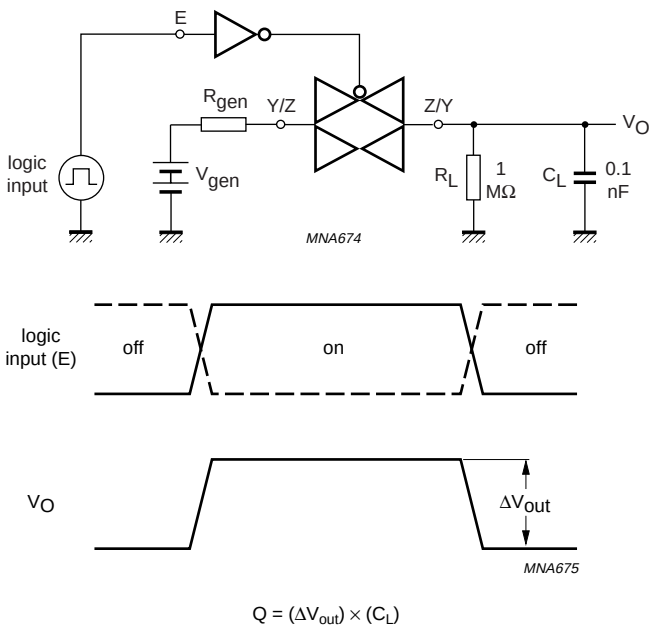


Fig.21 Charge injection test.

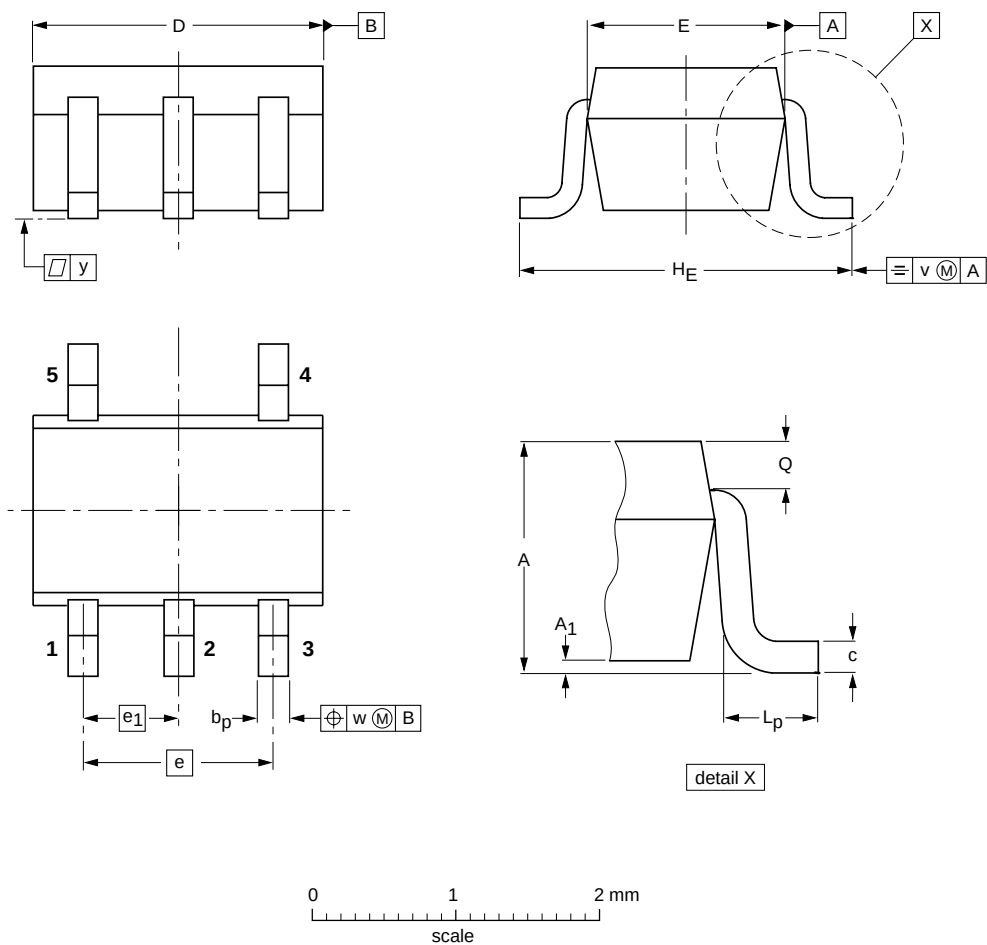
Bilateral switch

74LVC1G66

PACKAGE OUTLINES

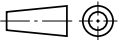
Plastic surface mounted package; 5 leads

SOT353



DIMENSIONS (mm are the original dimensions)

UNIT	A	A ₁ max	b _p	c	D	E ⁽²⁾	e	e ₁	H _E	L _p	Q	v	w	y
mm	1.1 0.8	0.1	0.30 0.20	0.25 0.10	2.2 1.8	1.35 1.15	1.3	0.65	2.2 2.0	0.45 0.15	0.25 0.15	0.2	0.2	0.1

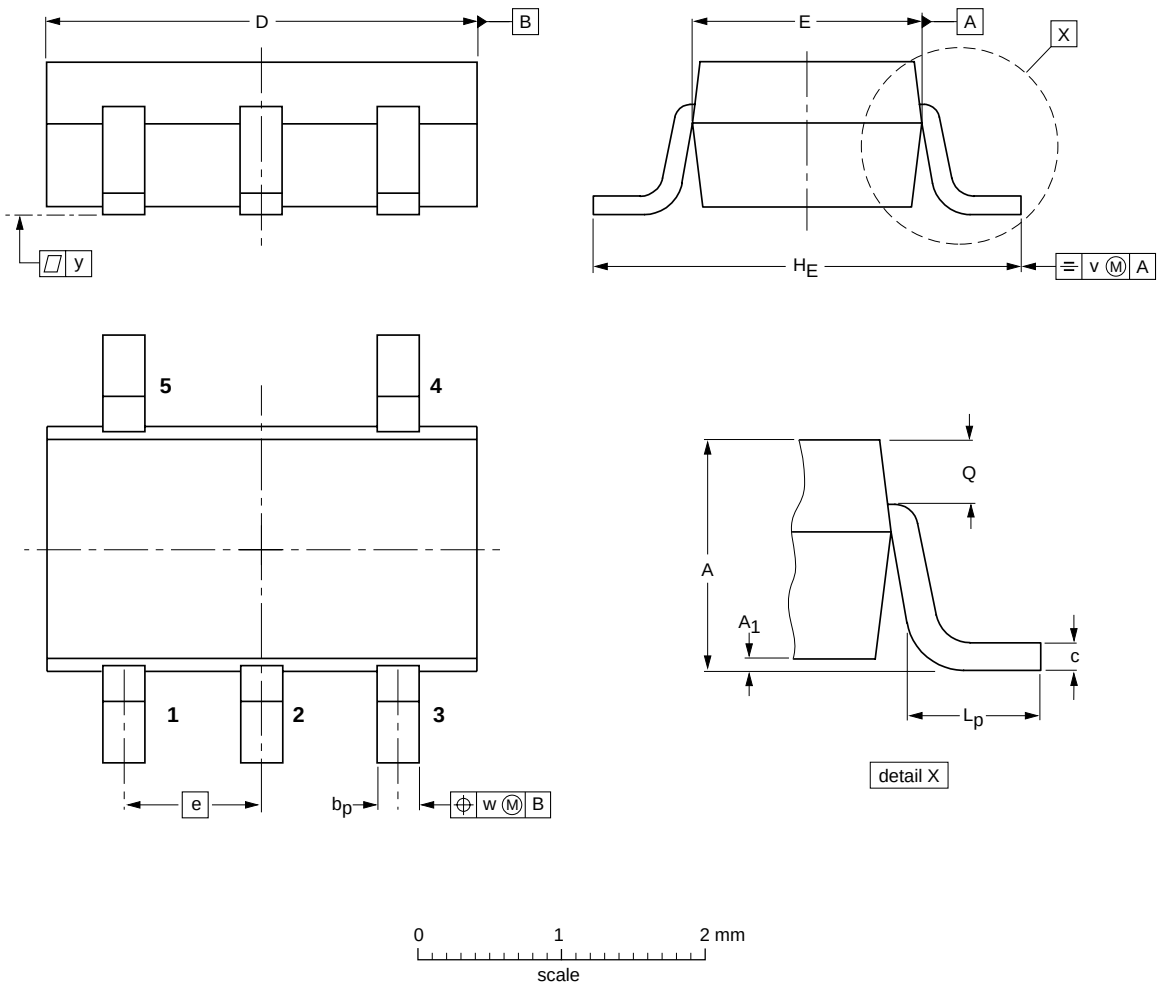
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT353			SC-88A			97-02-28

Bilateral switch

74LVC1G66

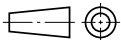
Plastic surface mounted package; 5 leads

SOT753



DIMENSIONS (mm are the original dimensions)

UNIT	A	A ₁	b _p	c	D	E	e	H _E	L _p	Q	v	w	y
mm	1.1 0.9	0.100 0.013	0.40 0.25	0.26 0.10	3.1 2.7	1.7 1.3	0.95	3.0 2.5	0.6 0.2	0.33 0.23	0.2	0.2	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT753			SC-74A			02-04-16

Bilateral switch

74LVC1G66

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SCA76

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