2-channel analog multiplexer/demultiplexer Rev. 1 — 29 January 2013

Product data sheet

General description 1.

The 74LVC1G53-Q100 is a low-power, low-voltage, high-speed, Si-gate CMOS device.

The 74LVC1G53-Q100 provides one analog multiplexer/demultiplexer with a digital select input (S), two independent inputs/outputs (Y0 and Y1), a common input/output (Z) and an active LOW enable input (E). When pin E is HIGH, the switch is turned off.

Schmitt-trigger action at the select and enable inputs makes the circuit tolerant to slower input rise and fall times across the entire V_{CC} range from 1.65 V to 5.5 V.

This product has been qualified to the Automotive Electronics Council (AEC) standard Q100 (Grade 1) and is suitable for use in automotive applications.

2. **Features and benefits**

- Automotive product qualification in accordance with AEC-Q100 (Grade 1) Specified from –40 °C to +85 °C and from –40 °C to +125 °C
- Wide supply voltage range from 1.65 V to 5.5 V
- 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 current capability of 32 mA
- High noise immunity
- CMOS low power consumption
- TTL interface compatibility at 3.3 V
- Latch-up performance meets requirements of JESD 78 Class I
- Multiple package options
- ESD protection:
 - MIL-STD-883, method 3015 exceeds 2000 V
 - HBM JESD22-A114F exceeds 2000 V
 - MM JESD22-A115-A exceeds 200 V (C = 200 pF, R = 0 Ω)



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Ordering information 3.

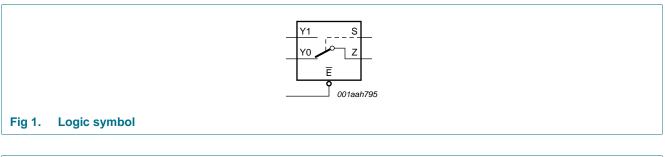
Table 1. Ordering i	nformation								
Type number	Package								
	Temperature range	Name	Description	Version					
74LVC1G53DP-Q100	–40 °C to +125 °C	TSSOP8	plastic thin shrink small outline package; 8 leads; body width 3 mm; lead length 0.5 mm	SOT505-2					
74LVC1G53DC-Q100	–40 °C to +125 °C	VSSOP8	plastic very thin shrink small outline package; 8 leads; body width 2.3 mm	SOT765-1					

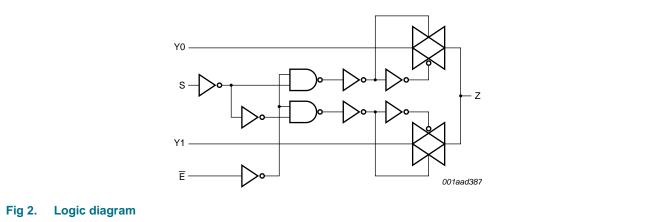
Marking 4.

Table 2. Marking codes	
Type number	Marking code ^[1]
74LVC1G53DC-Q100	V53
74LVC1G53DP-Q100	V53

[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

Functional diagram 5.

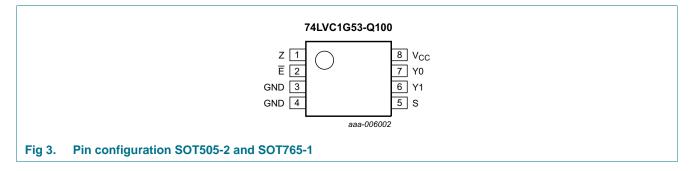




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6. Pinning information

6.1 Pinning



6.2 Pin description

Table 3.	Pin description	
Symbol	Pin	Description
Z	1	common output or input
Ē	2	enable input (active LOW)
GND	3	ground (0 V)
GND	4	ground (0 V)
S	5	select input
Y1	6	independent input or output
Y0	7	independent input or output
V _{CC}	8	supply voltage

7. Functional description

Table 4.Function table

Input		Channel on
S	Ē	
L	L	Y0 to Z or Z to Y0
Н	L	Y1 to Z or Z to Y1
X	Н	Z (switch off)

[1] H = HIGH voltage level; L = LOW voltage level; X = don't care; Z = high-impedance OFF-state.

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8. Limiting values

Table 5. 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
VI	input voltage		<u>[1]</u> –0.5	+6.5	V
I _{IK}	input clamping current	$V_{\rm I}$ < –0.5 V or $V_{\rm I}$ > $V_{\rm CC}$ + 0.5 V	-50	-	mA
I _{SK}	switch clamping current	$V_{\rm I}$ < –0.5 V or $V_{\rm I}$ > $V_{\rm CC}$ + 0.5 V	-	±50	mA
V _{SW}	switch voltage	enable and disable mode	2 –0.5	$V_{CC} + 0.5$	V
I _{SW}	switch current	V_{SW} > –0.5 V or V_{SW} < V_{CC} + 0.5 V	-	±50	mA
I _{CC}	supply current		-	100	mA
I _{GND}	ground current		-100	-	mA
T _{stg}	storage temperature		-65	+150	°C
P _{tot}	total power dissipation	$T_{amb} = -40 \ ^{\circ}C$ to +125 $^{\circ}C$	<u>[3]</u>	250	mW

[1] The minimum input voltage rating may be exceeded if the input current rating is observed.

[2] The minimum and maximum switch voltage ratings may be exceeded if the switch clamping current rating is observed.

[3] For TSSOP8 packages: above 55 °C the value of Ptot derates linearly with 2.5 mW/K.

For VSSOP8 packages: above 110 °C the value of Ptot derates linearly with 8.0 mW/K.

9. Recommended operating conditions

Table 6.Operating conditions

Symbol	Parameter	Conditions	Min	Мах	Unit
V _{CC}	supply voltage		1.65	5.5	V
VI	input voltage		0	5.5	V
V _{SW}	switch voltage	enable and disable mode	<u>[1]</u> 0	V _{CC}	V
T _{amb}	ambient temperature		-40	+125	°C
$\Delta t / \Delta V$	input transition rise and fall rate	V_{CC} = 1.65 V to 2.7 V	[2] _	20	ns/V
		V_{CC} = 2.7 V to 5.5 V	[2] _	10	ns/V

[1] To avoid sinking GND current from terminal Z when switch current flows in terminal Yn, the voltage drop across the bidirectional switch must not exceed 0.4 V. If the switch current flows into terminal Z, no GND current flows from terminal Yn. In this case, there is no limit for the voltage drop across the switch.

[2] Applies to control signal levels.

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10. Static characteristics

Table 7. Static characteristics

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

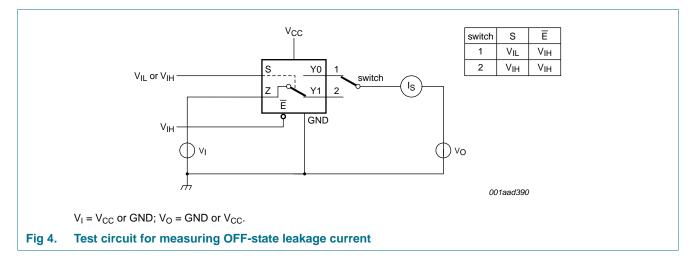
$V_{IH} \qquad \begin{array}{c} F \\ i \\ V_{IL} \\ i \\ I \\ I_{I} \\ I_{I}$	Parameter	Conditions		T _{amb} = -	40 °C to	o +85 °C	$T_{amb} = -40$ °	C to +125 °C	Unit
				Min	Typ <mark>[1]</mark>	Max	Min	Max	
V _{IH}	HIGH-level	V_{CC} = 1.65 V to 1.95 V		$0.65 \times V_{CC}$	-	-	$0.65 imes V_{CC}$	-	V
	input voltage	V_{CC} = 2.3 V to 2.7 V		1.7	-	-	1.7	-	V
		V_{CC} = 3 V to 3.6 V		2.0	-	-	2.0	-	V
		V_{CC} = 4.5 V to 5.5 V		$0.7\times V_{CC}$	-	-	$0.7\times V_{CC}$	-	V
V _{IL}	LOW-level	V_{CC} = 1.65 V to 1.95 V		-	-	$0.35\times V_{CC}$	-	$0.35 \times V_{CC}$	V
	input voltage	V_{CC} = 2.3 V to 2.7 V		-	-	0.7	-	0.7	V
		V_{CC} = 3 V to 3.6 V		-	-	0.8	-	0.8	V
		V_{CC} = 4.5 V to 5.5 V		-	-	$0.3\times V_{CC}$	-	$0.3\times V_{CC}$	V
II	input leakage current	pin S and pin \overline{E} ; V _I = 5.5 V or GND; V _{CC} = 0 V to 5.5 V	[2]	-	±0.1	±2	-	±10	μΑ
I _{S(OFF)}	OFF-state leakage current	V _{CC} = 5.5 V; see <u>Figure 4</u>	[2]	-	±0.1	±5	-	±20	μΑ
I _{S(ON)}	ON-state leakage current	V _{CC} = 5.5 V; see <u>Figure 5</u>	[2]	-	±0.1	±5	-	±20	μΑ
I _{CC}	supply current	$\label{eq:VI} \begin{array}{l} V_{I=5.5~V~or~GND;}\\ V_{SW=GND~or~V_{CC};}\\ V_{CC=1.65~V~to~5.5~V} \end{array}$	[2]	-	0.1	10	-	40	μΑ
Δl _{CC}	additional supply current	pin S and pin \overline{E} ; V _I = V _{CC} - 0.6 V; V _{SW} = GND or V _{CC} ; V _{CC} = 5.5 V	[2]	-	5	500	-	5000	μA
Cı	input capacitance			-	2.5	-	-	-	pF
$C_{S(OFF)}$	OFF-state capacitance			-	6.0	-	-	-	pF
C _{S(ON)}	ON-state capacitance			-	18	-	-	-	pF

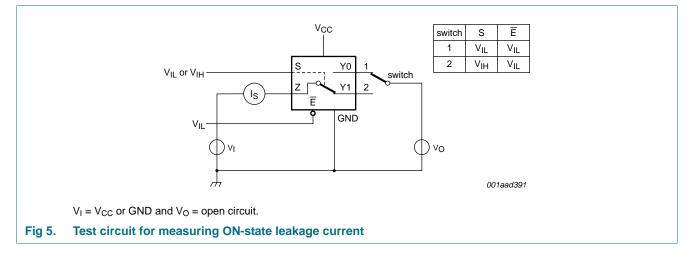
[1] Typical values are measured at $T_{amb} = 25 \ ^{\circ}C$.

[2] These typical values are measured at V_{CC} = 3.3 V.

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10.1 Test circuits





10.2 ON resistance

Table 8. ON resistance

At recommended operating conditions; voltages are referenced to GND (ground 0 V); for graphs see Figure 7 to Figure 12.

Symbol	Parameter	Conditions	-40	°C to +8	S ℃	–40 °C to	–40 °C to +125 °C	
			Min	Typ <mark>[1]</mark>	Max	Min	Max	
R _{ON(peak)}	ON resistance (peak)	$V_{I} = GND$ to V_{CC} ; see <u>Figure 6</u>						
		I _{SW} = 4 mA; V _{CC} = 1.65 V to 1.95 V	-	34.0	130	-	195	Ω
		I_{SW} = 8 mA; V_{CC} = 2.3 V to 2.7 V	-	12.0	30	-	45	Ω
		I_{SW} = 12 mA; V_{CC} = 2.7 V	-	10.4	25	-	38	Ω
		I_{SW} = 24 mA; V_{CC} = 3 V to 3.6 V	-	7.8	20	-	30	Ω
		I_{SW} = 32 mA; V_{CC} = 4.5 V to 5.5 V	-	6.2	15	-	23	Ω

74LVC1G53_Q100 Product data sheet

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74LVC1G53-Q100

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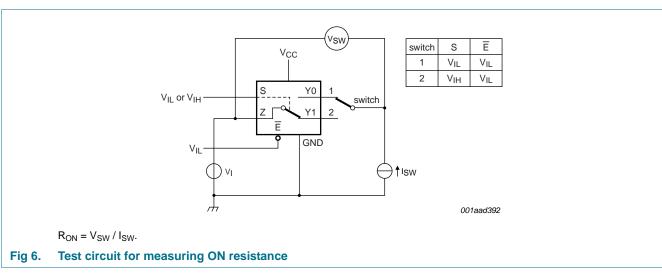
Symbol	Parameter	Conditions	-40) °C to +8	85 °C	–40 °C to	o +125 °C	Unit
			Min	Typ[1]	Max	Min	Max	
R _{ON(rail)}	ON resistance (rail)	V _I = GND; see <u>Figure 6</u>						
		I _{SW} = 4 mA; V _{CC} = 1.65 V to 1.95 V	-	8.2	18	-	27	Ω
		I_{SW} = 8 mA; V_{CC} = 2.3 V to 2.7 V	-	7.1	16	-	24	Ω
		I_{SW} = 12 mA; V_{CC} = 2.7 V	-	6.9	14	-	21	Ω
		I_{SW} = 24 mA; V_{CC} = 3 V to 3.6 V	-	6.5	12	-	18	Ω
		I_{SW} = 32 mA; V_{CC} = 4.5 V to 5.5 V	-	5.8	10	-	15	Ω
	$V_I = V_{CC}$; see <u>Figure 6</u>							
		I _{SW} = 4 mA; V _{CC} = 1.65 V to 1.95 V	-	10.4	30	-	45	Ω
		I_{SW} = 8 mA; V_{CC} = 2.3 V to 2.7 V	-	7.6	20	-	30	Ω
		I_{SW} = 12 mA; V_{CC} = 2.7 V	-	7.0	18	-	27	Ω
		I_{SW} = 24 mA; V_{CC} = 3 V to 3.6 V	-	6.1	15	-	23	Ω
		I_{SW} = 32 mA; V_{CC} = 4.5 V to 5.5 V	-	4.9	10	-	15	Ω
R _{ON(flat)}	ON resistance	$V_1 = GND$ to V_{CC}	[2]					
	(flatness)	I _{SW} = 4 mA; V _{CC} = 1.65 V to 1.95 V	-	26.0	-	-	-	Ω
		I_{SW} = 8 mA; V_{CC} = 2.3 V to 2.7 V	-	5.0	-	-	-	Ω
		I_{SW} = 12 mA; V_{CC} = 2.7 V	-	3.5	-	-	-	Ω
		I_{SW} = 24 mA; V_{CC} = 3 V to 3.6 V	-	2.0	-	-	-	Ω
		I_{SW} = 32 mA; V_{CC} = 4.5 V to 5.5 V	-	1.5	-	-	-	Ω

Table 8. **ON resistance** ... continued

es are referenced to GND (around 0 V); for aranhs see Figure 7 to Figure 12 . .

[1] Typical values are measured at T_{amb} = 25 °C and nominal V_{CC}.

[2] Flatness is defined as the difference between the maximum and minimum value of ON resistance measured at identical V_{CC} and temperature.

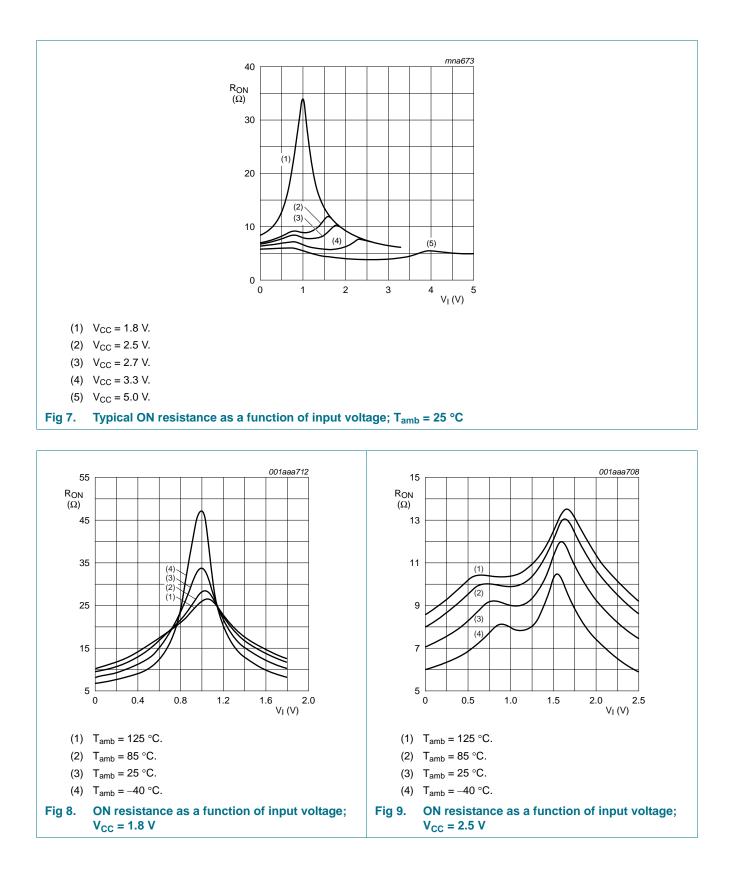


10.3 ON resistance test circuit and graphs

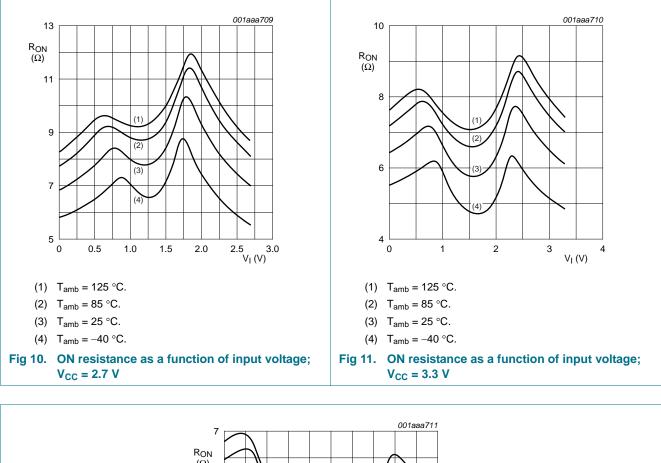
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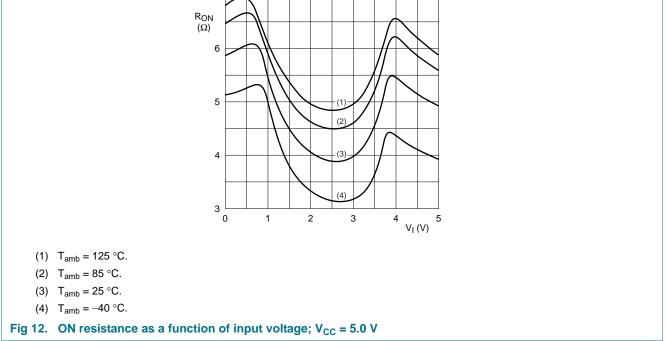
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11. Dynamic characteristics

Table 9. Dynamic characteristics

At recommended operating conditions; voltages are referenced to GND (ground = 0 V); for load circuit see Figure 15.

Symbol	Parameter	Conditions		-40) °C to +8	5 °C	–40 °C to	–40 °C to +125 °C		
				Min	Typ <mark>[1]</mark>	Max	Min	Max		
t _{pd}	propagation delay	Z to Yn or Yn to Z; see Figure 13	[2][3]							
		$V_{CC} = 1.65 \text{ V} \text{ to } 1.95 \text{ V}$		-	-	2	-	2.5	ns	
		V_{CC} = 2.3 V to 2.7 V		-	-	1.2	-	1.5	ns	
		$V_{CC} = 2.7 V$		-	-	1.0	-	1.25	ns	
		$V_{CC} = 3.0 \text{ V} \text{ to } 3.6 \text{ V}$		-	-	0.8	-	1.0	ns	
		V_{CC} = 4.5 V to 5.5 V		-	-	0.6	-	0.8	ns	
t _{en}	enable time	S to Z or Yn; see Figure 14	<u>[4]</u>							
	$V_{CC} = 1.65 \text{ V} \text{ to } 1.95 \text{ V}$		2.6	6.7	10.3	2.6	12.9	ns		
		V_{CC} = 2.3 V to 2.7 V		1.9	4.1	6.4	1.9	8.0	ns	
		$V_{CC} = 2.7 V$		1.9	4.0	5.5	1.8	7.0	ns	
		$V_{CC} = 3.0 \text{ V} \text{ to } 3.6 \text{ V}$		1.8	3.4	5.0	1.8	6.3	ns	
		V_{CC} = 4.5 V to 5.5 V		1.3	2.6	3.8	1.3	4.8	ns	
		E to Z or Yn; see Figure 14	<u>[4]</u>							
		$V_{CC} = 1.65 \text{ V} \text{ to } 1.95 \text{ V}$		1.9	4.0	7.3	1.9	9.2	ns	
		V_{CC} = 2.3 V to 2.7 V		1.4	2.5	4.4	1.4	5.5	ns	
		$V_{CC} = 2.7 V$		1.1	2.6	3.9	1.1	4.9	ns	
		$V_{CC} = 3.0 \text{ V} \text{ to } 3.6 \text{ V}$		1.2	2.2	3.8	1.2	4.8	ns	
		V_{CC} = 4.5 V to 5.5 V		1.0	1.7	2.6	1.0	3.3	ns	
t _{dis}	disable time	S to Z or Yn; see Figure 14	<u>[5]</u>							
		$V_{CC} = 1.65 \text{ V} \text{ to } 1.95 \text{ V}$		2.1	6.8	10.0	2.1	12.5	ns	
		V_{CC} = 2.3 V to 2.7 V		1.4	3.7	6.1	1.4	7.7	ns	
		$V_{CC} = 2.7 V$		1.4	4.9	6.2	1.4	7.8	ns	
		$V_{CC} = 3.0 \text{ V} \text{ to } 3.6 \text{ V}$		1.1	4.0	5.4	1.1	6.8	ns	
		V_{CC} = 4.5 V to 5.5 V		1.0	2.9	3.8	1.0	4.8	ns	
		E to Z or Yn; see Figure 14	[5]							
		V_{CC} = 1.65 V to 1.95 V		2.3	5.6	8.6	2.3	11.0	ns	
		V_{CC} = 2.3 V to 2.7 V		1.2	3.2	4.8	1.2	6.0	ns	
		$V_{CC} = 2.7 V$		1.4	4.0	5.2	1.4	6.5	ns	
		V_{CC} = 3.0 V to 3.6 V		2.0	3.7	5.0	2.0	6.3	ns	
		$V_{CC} = 4.5 V \text{ to } 5.5 V$		1.3	2.9	3.8	1.3	4.8	ns	

[1] Typical values are measured at $T_{amb} = 25 \text{ °C}$ and nominal V_{CC} .

[2] t_{pd} is the same as t_{PLH} and t_{PHL} .

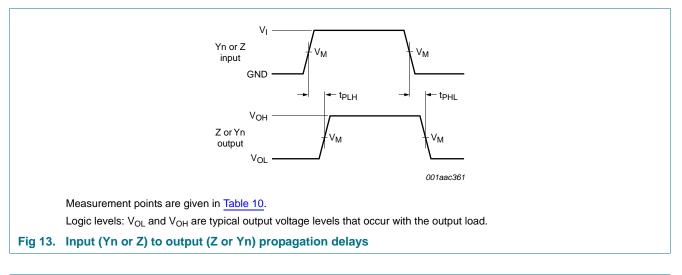
[3] Propagation delay is the calculated RC time constant of the typical ON resistance of the switch and the specified capacitance when driven by an ideal voltage source (zero output impedance).

 $\label{eq:tensor} [4] \quad t_{en} \text{ is the same as } t_{PZH} \text{ and } t_{PZL}.$

[5] t_{dis} is the same as t_{PLZ} and t_{PHZ} .

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11.1 Waveforms and test circuits



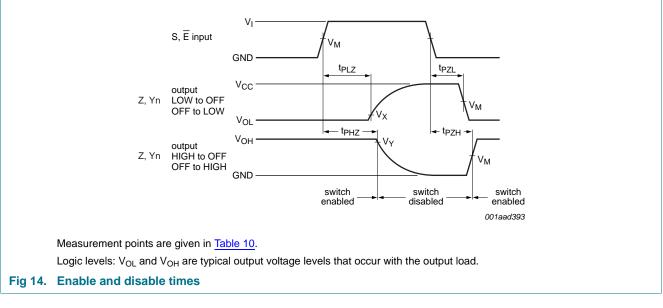
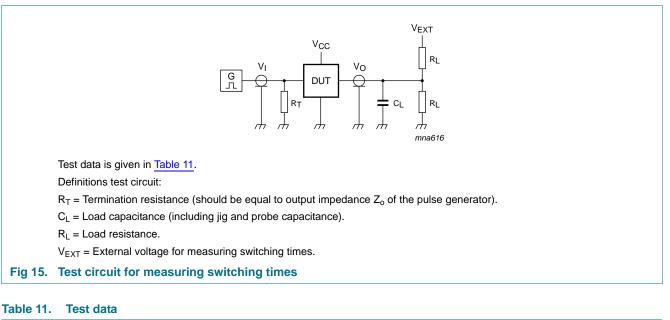


Table 10. Measurement points

Supply voltage	Input	Output	Output					
V _{cc}	V _M	V _M	V _X	V _Y				
1.65 V to 2.7 V	$0.5 imes V_{CC}$	$0.5 imes V_{CC}$	V _{OL} + 0.15 V	V _{OH} – 0.15 V				
2.7 V to 5.5 V	$0.5 \times V_{CC}$	$0.5\times V_{CC}$	V _{OL} + 0.3 V	V _{OH} – 0.3 V				

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Supply voltage	Input		Load	_oad		V _{EXT}			
V _{cc}	VI	t _r , t _f	CL	RL	t _{PLH} , t _{PHL}	t _{PZH} , t _{PHZ}	t _{PZL} , t _{PLZ}		
1.65 V to 1.95 V	V _{CC}	\leq 2.0 ns	30 pF	1 kΩ	open	GND	$2\times V_{CC}$		
2.3 V to 2.7 V	V _{CC}	\leq 2.0 ns	30 pF	500 Ω	open	GND	$2\times V_{CC}$		
2.7 V	V _{CC}	\leq 2.5 ns	50 pF	500 Ω	open	GND	$2\times V_{CC}$		
3 V to 3.6 V	V _{CC}	\leq 2.5 ns	50 pF	500 Ω	open	GND	$2\times V_{CC}$		
4.5 V to 5.5 V	V _{CC}	\leq 2.5 ns	50 pF	500 Ω	open	GND	$2\times V_{CC}$		

11.2 Additional dynamic characteristics

Table 12. Additional dynamic characteristics

At recommended operating conditions; voltages are referenced to GND (ground = 0 V); $T_{amb} = 25 \degree C$.

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
THD	total harmonic distortion	$ \begin{array}{l} f_i = 600 \text{ Hz to } 20 \text{ kHz}; \text{ R}_L = 600 \ \Omega; \\ C_L = 50 \text{ pF}; \text{ V}_I = 0.5 \text{ V} \text{ (p-p)}; \text{ see } \underline{\text{Figure 16}} \end{array} $				
		V _{CC} = 1.65 V	-	0.260	-	%
		V _{CC} = 2.3 V	-	0.078	-	%
		V _{CC} = 3.0 V	-	0.078	-	%
		V _{CC} = 4.5 V	-	0.078	-	%
f _(-3dB)	–3 dB frequency response	$R_L = 50 \Omega$; $C_L = 5 pF$; see <u>Figure 17</u>				
		V _{CC} = 1.65 V	-	200	-	MHz
		V _{CC} = 2.3 V	-	300	-	MHz
		V _{CC} = 3.0 V	-	300	-	MHz
		$V_{CC} = 4.5 V$	-	300	-	MHz

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Table 12. Additional dynamic characteristics ...continued

At recommended operating conditions; voltages are referenced to GND (ground = 0 V); T_{amb} = 25 °C.

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
α_{iso}	isolation (OFF-state)	R _L = 50 Ω; C _L = 5 pF; f_i = 10 MHz; see <u>Figure 18</u>				
		V _{CC} = 1.65 V	-	-42	-	dB
		$V_{CC} = 2.3 V$	-	-42	-	dB
		$V_{CC} = 3.0 V$	-	-40	-	dB
		$V_{CC} = 4.5 V$	-	-40	-	dB
Q _{inj}	charge injection	$C_L = 0.1 \text{ nF}; V_{gen} = 0 \text{ V}; R_{gen} = 0 \Omega;$ $f_i = 1 \text{ MHz}; R_L = 1 \text{ M}\Omega; \text{ see } \frac{\text{Figure } 19}{1000}$				
		V _{CC} = 1.8 V	-	3.3	-	рС
		$V_{CC} = 2.5 V$	-	4.1	-	рС
		$V_{CC} = 3.3 V$	-	5.0	-	рС
		$V_{CC} = 4.5 V$	-	6.4	-	рС
		$V_{CC} = 5.5 V$	-	7.5	-	рС

11.3 Test circuits

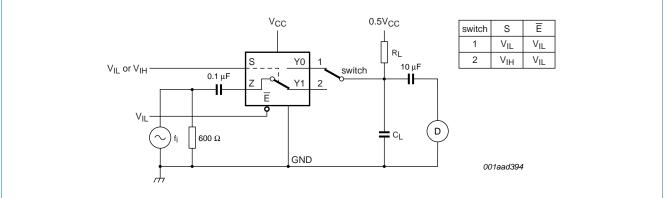
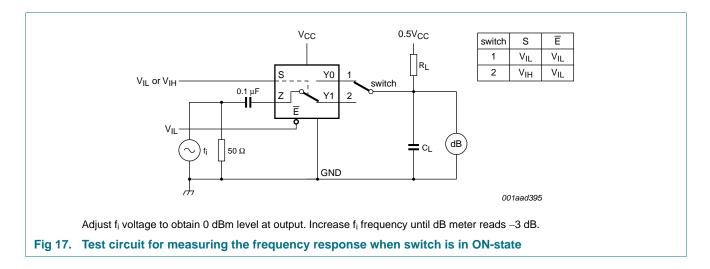


Fig 16. Test circuit for measuring total harmonic distortion

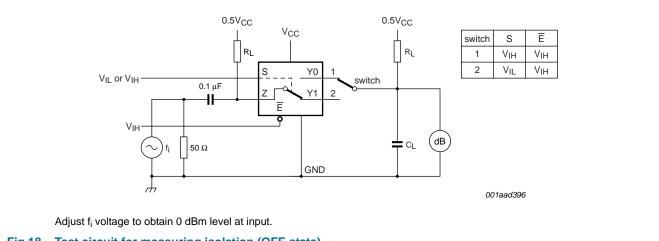


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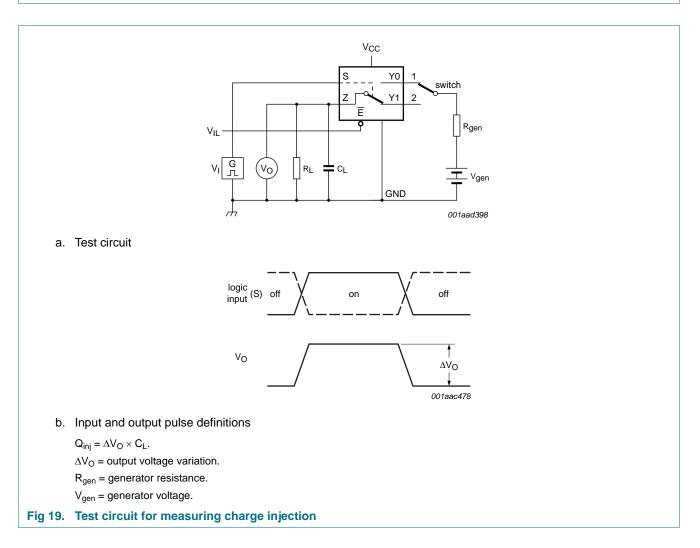
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12. Package outline

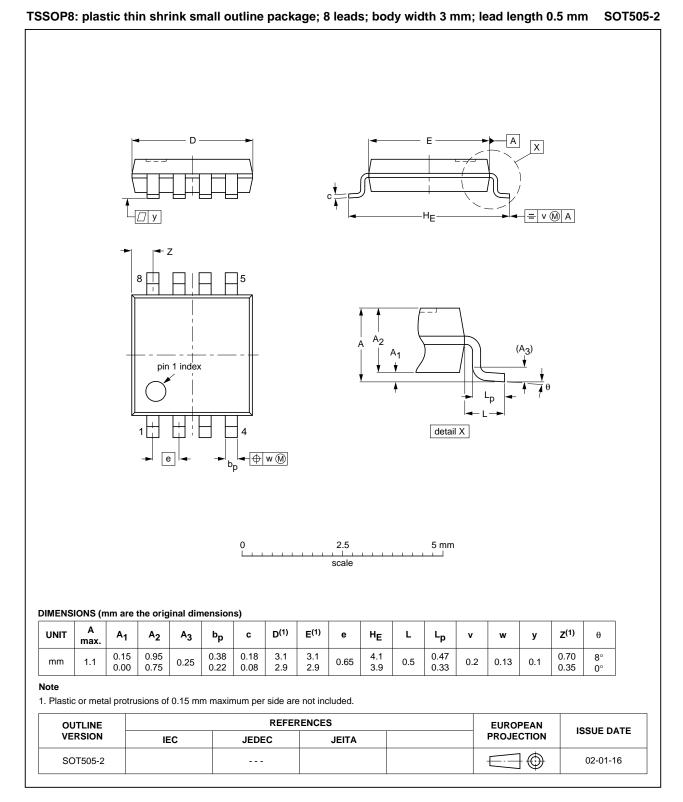


Fig 20. Package outline SOT505-2 (TSSOP8)

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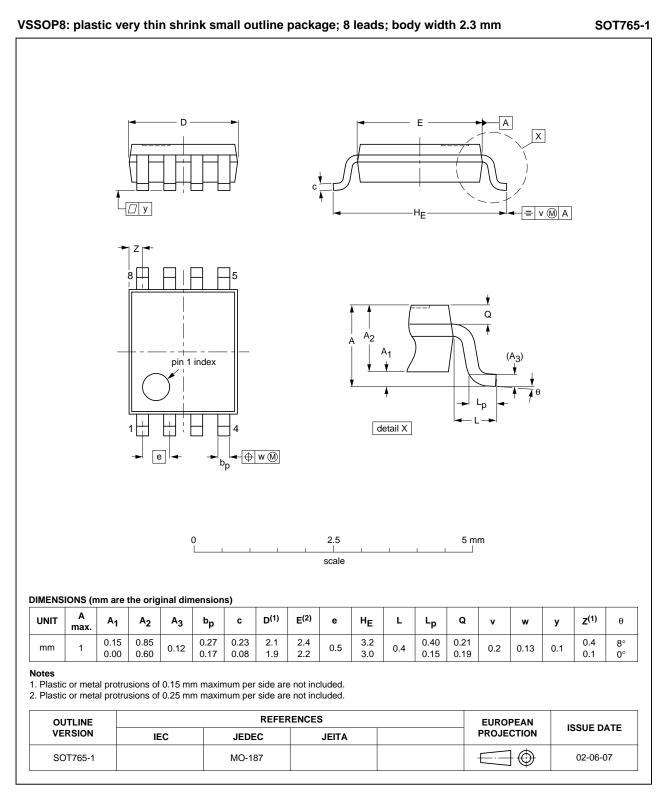


Fig 21. Package outline SOT765-1 (VSSOP8)

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13. Abbreviations

Table 13. Abbreviations			
Acronym	Description		
CMOS	Complementary Metal-Oxide Semiconductor		
TTL	Transistor-Transistor Logic		
HBM	Human Body Model		
ESD	ElectroStatic Discharge		
MM	Machine Model		
CDM	Charged Device Model		
DUT	Device Under Test		
MIL	Military		

14. Revision history

Table 14. Revision history					
Document ID	Release date	Data sheet status	Change notice	Supersedes	
74LVC1G53_Q100 v.1	20130129	Product data sheet	-	-	

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15. Legal information

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