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Dual 10  $\Omega$  single-pole double-throw analog switchRev. 2 — 15 December 2016Prode

Product data sheet

#### **General description** 1.

The 74LVC2G3157 is a dual low-ohmic single-pole double-throw analog switch suitable for use as an analog or digital 2:1 multiplexer/demultiplexer. Each switch has a digital select input (nS), two independent inputs/outputs (nY0 and nY1) and a common input/output (nZ).

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

#### **Features and benefits** 2.

- Wide supply voltage range from 1.65 V to 5.5 V
- Very low ON resistance:
  - 10.4 Ω (typical) at V<sub>CC</sub> = 2.7 V
  - 7.8 Ω (typical) at V<sub>CC</sub> = 3.3 V
  - 6.2 Ω (typical) at V<sub>CC</sub> = 5 V
- Switch current capability of 32 mA
- Break-before-make switching
- High noise immunity
- CMOS low power consumption
- TTL interface compatibility at 3.3 V
- Latch-up performance exceeds 100 mA per JESD 78 Class II
- ESD protection:
  - HBM ANSI/ESDA/JEDEC JS-001 Class 2 exceeds 2 kV
  - MM JESD22-A115-C exceeds 200 V
  - CDM JESD22-C101E exceeds 1000 V
- Select input accepts voltages up to 5.5 V
- Specified from -40 °C to +85 °C and -40 °C to +125 °C

# nexperia

Dual 10  $\Omega$  single-pole double-throw analog switch

### 3. Ordering information

Table 1. Ordering information											
Type number	Package	Package									
	Temperature range	Name	Description	Version							
74LVC2G3157DP	–40 °C to +125 °C	TSSOP10	plastic thin shrink small outline package; 10 leads; body width 3 mm	SOT552-1							
74LVC2G3157GM	–40 °C to +125 °C	XQFN10	plastic extremely thin quad flat package; no leads; 10 terminals; body $2 \times 1.55 \times 0.5$ mm	SOT1049-3							

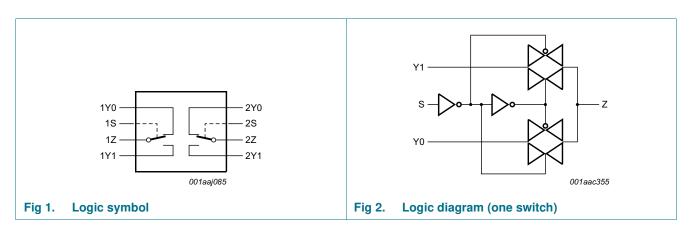
### 4. Marking

Table 2.	Marking	codes
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Type number	Marking code <sup>[1]</sup>
74LVC2G3157DP	YJ
74LVC2G3157GM	YJ

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

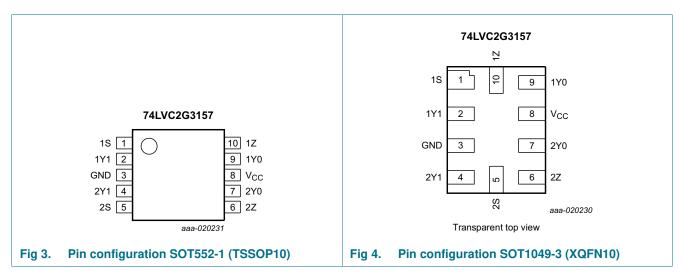
# 5. Functional diagram



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### 6. Pinning information

### 6.1 Pinning



### 6.2 Pin description

#### Table 3.Pin description

Symbol	Pin	Description		
1S	1	select input		
1Y1	2	independent input or output		
GND	3	ground (0 V)		
2Y1	4	independent input or output		
2S	5	select input		
2Z	6	common output or input		
2Y0	7	independent input or output		
V <sub>CC</sub>	8	supply voltage		
1Y0	9	independent input or output		
1Z	10	common output or input		

## 7. Functional description

### Table 4. Function table<sup>[1]</sup>

Input nS	Channel on
L	nY0
Н	nY1

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

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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 <sub>CC</sub>	supply voltage			-0.5	+6.5	V
VI	input voltage		[1]	-0.5	+6.5	V
I <sub>IK</sub>	input clamping current	V <sub>1</sub> < -0.5 V		-50	-	mA
I <sub>SK</sub>	switch clamping current	$V_{I} < -0.5$ V or $V_{I} > V_{CC} + 0.5$ V		-	±50	mA
V <sub>SW</sub>	switch voltage	enable and disable mode	[2]	-0.5	V <sub>CC</sub> + 0.5	V
I <sub>SW</sub>	switch current	$V_{SW}$ > $-0.5$ V or $V_{SW}$ < $V_{CC}$ + 0.5 V		-	±50	mA
I <sub>CC</sub>	supply current			-	100	mA
I <sub>GND</sub>	ground current			-100	-	mA
T <sub>stg</sub>	storage temperature			-65	+150	°C
P <sub>tot</sub>	total power dissipation	$T_{amb} = -40 \text{ °C to } +125 \text{ °C}$	<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 TSSOP10 package: above 55°C the value of P<sub>tot</sub> derates linearly with 2.5 mW/K.

### 9. Recommended operating conditions

#### Table 6. Recommended operating conditions

Symbol	Parameter	Conditions		Min	Тур	Max	Unit
V <sub>CC</sub>	supply voltage			1.65	-	5.5	V
VI	input voltage			0	-	5.5	V
V <sub>SW</sub>	switch voltage	enable and disable mode	[1]	0	-	V <sub>CC</sub>	V
T <sub>amb</sub>	ambient temperature			-40	-	+125	°C
$\Delta t / \Delta V$	input transition rise and fall rate	$V_{CC} = 1.65 \text{ V} \text{ to } 2.7 \text{ V}$	[2]	-	-	20	ns/V
		V <sub>CC</sub> = 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 will flow from terminal Yn. In this case, there is no limit for the voltage drop across the switch.

[2] Applies to control signal levels.

Dual 10  $\Omega$  single-pole double-throw analog switch

# **10. Static characteristics**

#### Table 7. Static characteristics

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

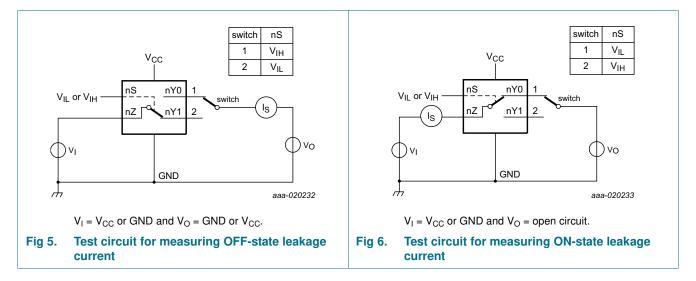
Symbol	Parameter	Conditions	-40 °	°C to +8	5 °C	–40 °C to	Unit		
				Min	Typ[1]	Max	Min	Max	-
VIH	HIGH-level	V <sub>CC</sub> = 1.65 V to 1.95 V		0.65V <sub>CC</sub>	-	-	0.65V <sub>CC</sub>	-	V
	input voltage	V <sub>CC</sub> = 2.3 V to 2.7 V		1.7	-	-	1.7	-	V
		V <sub>CC</sub> = 3 V to 3.6 V		2.0	-	-	2.0	-	V
		V <sub>CC</sub> = 4.5 V to 5.5 V		0.7V <sub>CC</sub>	-	-	0.7V <sub>CC</sub>	-	V
V <sub>IL</sub>	LOW-level	V <sub>CC</sub> = 1.65 V to 1.95 V		-	-	$0.35V_{CC}$	-	$0.35V_{CC}$	V
	input voltage	V <sub>CC</sub> = 2.3 V to 2.7 V		-	-	0.7	-	0.7	V
		V <sub>CC</sub> = 3 V to 3.6 V		-	-	0.8	-	0.8	V
		V <sub>CC</sub> = 4.5 V to 5.5 V		-	-	$0.3V_{CC}$		0.3V <sub>CC</sub>	V
l <sub>l</sub>	input leakage current	pin nS; V <sub>I</sub> = 5.5 V or GND; V <sub>CC</sub> = 0 V to 5.5 V	[2]	-	±0.1	±1	-	±1	μA
I <sub>S(OFF)</sub>	OFF-state leakage current	$V_{CC} = 5.5 \text{ V}; \text{ see } \frac{\text{Figure 5}}{1000 \text{ Figure 5}}$	[2]	-	±0.1	±0.2	-	±0.5	μA
I <sub>S(ON)</sub>	ON-state leakage current	$V_{CC} = 5.5 \text{ V}; \text{ see } \frac{\text{Figure 6}}{1000 \text{ G}}$	[2]	-	±0.1	±1	-	±2	μA
I <sub>CC</sub>	supply current	$V_{I} = 5.5 V \text{ or GND};$ $V_{SW} = GND \text{ or } V_{CC};$ $V_{CC} = 1.65 V \text{ to } 5.5 V$	[2]	-	0.1	4	-	4	μA
$\Delta I_{CC}$	additional supply current	pin nS; V <sub>I</sub> = V <sub>CC</sub> – 0.6 V; V <sub>CC</sub> = 5.5 V; V <sub>SW</sub> = GND or V <sub>CC</sub>	[2]	-	5	500	-	500	μA
CI	input capacitance			-	2.5	-	-	-	pF
$C_{S(OFF)}$	OFF-state capacitance			-	6.0	-	-	-	pF
C <sub>S(ON)</sub>	ON-state capacitance			-	18	-	-	-	pF

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

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

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### 10.2 ON resistance

#### Table 8. ON resistance

At recommended operating conditions; voltages are referenced to GND (ground 0 V); for graphs see Figure 8 to Figure 13.

Symbol	Parameter	Conditions	-40	°C to +8	5 °C	–40 °C to	o +125 ℃	Unit
			Min	Typ <mark>[1]</mark>	Max	Min	Max	
R <sub>ON(peak)</sub>	ON resistance	$V_I = GND$ to $V_{CC}$ ; see <u>Figure 7</u>						
	(peak)	I <sub>SW</sub> = 4 mA; V <sub>CC</sub> = 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
		$I_{SW} = 12 \text{ mA}; V_{CC} = 2.7 \text{ V}$	-	10.4	25	-	38	Ω
		$I_{SW}$ = 24 mA; $V_{CC}$ = 3.0 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
R <sub>ON(rail)</sub>	ON resistance (rail)	V <sub>I</sub> = GND; see <u>Figure 7</u>						
		I <sub>SW</sub> = 4 mA; V <sub>CC</sub> = 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
		$I_{SW} = 12 \text{ mA}; V_{CC} = 2.7 \text{ V}$	-	6.9	14	-	21	Ω
		$I_{SW}$ = 24 mA; $V_{CC}$ = 3.0 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 7</u>						
		I <sub>SW</sub> = 4 mA; V <sub>CC</sub> = 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
		$I_{SW} = 12 \text{ mA}; V_{CC} = 2.7 \text{ V}$	-	7.0	18	-	27	Ω
		$I_{SW}$ = 24 mA; $V_{CC}$ = 3.0 V to 3.6 V	-	6.1	15	-	23	Ω
		$I_{SW} = 32 \text{ mA}; V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	-	4.9	10	-	15	Ω

### Dual 10 $\Omega$ single-pole double-throw analog switch

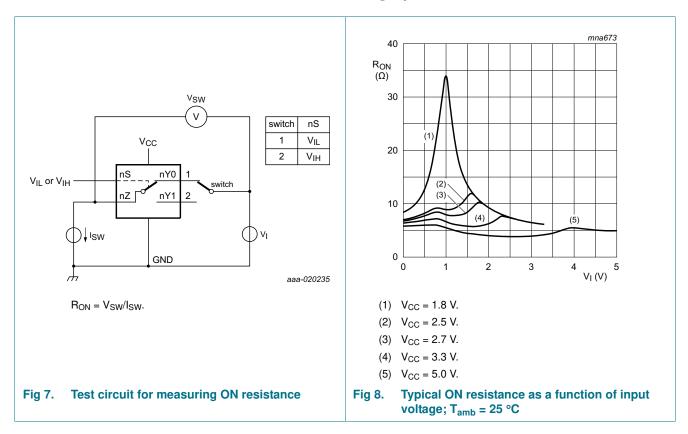
Symbol	Parameter	Conditions		–40 °C to +85 °C			–40 °C to +125 °C		
			Min	Typ <mark>[1]</mark>	Max	Min	Max		
R <sub>ON(flat)</sub>	ON resistance	$V_I = GND \text{ to } V_{CC}$ [2]							
	(flatness)	I <sub>SW</sub> = 4 mA; V <sub>CC</sub> = 1.65 V to 1.95 V	-	26.0	-	-	-	Ω	
		$I_{SW}$ = 8 mA; $V_{CC}$ = 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; $V_{CC}$ = 3.0 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

At recommended operating conditions; voltages are referenced to GND (ground 0 V); for graphs see Figure 8 to Figure 13.

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

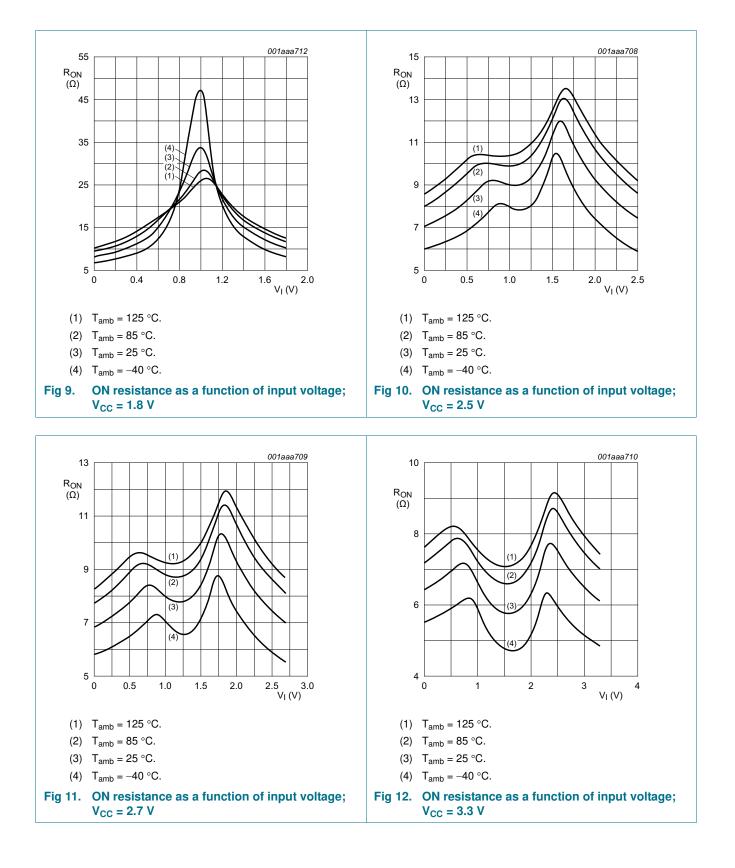
[2] Flatness is defined as the difference between the maximum and minimum value of ON resistance measured at identical V<sub>CC</sub> and temperature.



### 10.3 ON resistance test circuit and graphs

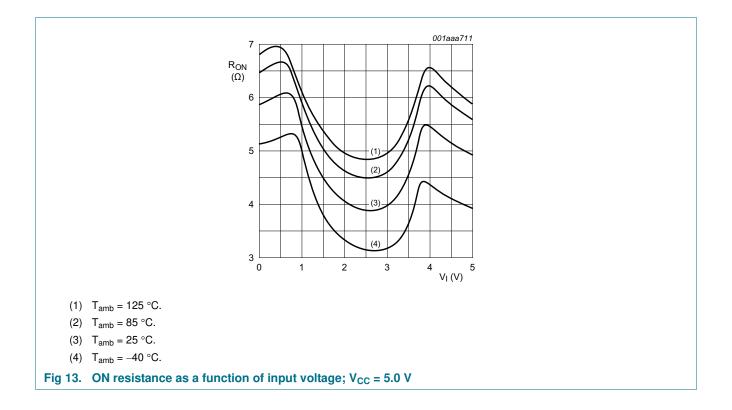
# 74LVC2G3157

#### Dual 10 $\Omega$ single-pole double-throw analog switch



# 74LVC2G3157

### Dual 10 $\Omega$ single-pole double-throw analog switch



Dual 10  $\Omega$  single-pole double-throw analog switch

### **11. Dynamic characteristics**

#### Table 9. Dynamic characteristics

At recommended operating conditions; voltages are referenced to GND (ground = 0 V); for test circuit see Figure 17.

Symbol	Parameter	Conditions	–40 °C	to +85 °C	)	–40 °C t	Unit	
				Typ[1]	Max	Min	Мах	-
t <sub>pd</sub>	propagation	nYn to nZ or nZ to nYn; see Figure 14	3]					
	delay	V <sub>CC</sub> = 1.65 V to 1.95 V	-	-	2	-	3.0	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	-	1.2	-	2.0	ns
		V <sub>CC</sub> = 2.7 V	-	-	1.0	-	1.5	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	-	-	0.8	-	1.5	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V	-	-	0.6	-	1.0	ns
t <sub>en</sub>	enable time	nS to nYn; see Figure 15	<u>4]</u>					
		V <sub>CC</sub> = 1.65 V to 1.95 V	1	8.7	24	1	26.5	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	1	5.3	14	1	15.5	ns
		V <sub>CC</sub> = 2.7 V	1	4.9	14	1	15.5	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	0.5	4	7.6	0.5	8.5	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V	0.5	3	5.7	0.5	6.6	ns
t <sub>dis</sub>	disable time	nS to nYn; see Figure 15	51					
		V <sub>CC</sub> = 1.65 V to 1.95 V	2.5	6	13	2.5	14.5	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	2	4.4	7.5	2	8.5	ns
		V <sub>CC</sub> = 2.7 V	1.5	4.2	7.5	1.5	8.5	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.5	3.6	5.3	1.5	6	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V	0.8	2.9	3.8	0.8	4.5	ns
t <sub>b-m</sub>	break-before	$C_L = 35 \text{ pF}; R_L = 50 \Omega; \text{ see } \frac{\text{Figure 16}}{1000}$	5]					
	-make time	V <sub>CC</sub> = 1.65 V to 1.95 V	0.5	-	-	0.5	-	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	0.5	-	-	0.5	-	ns
		V <sub>CC</sub> = 2.7 V	0.5	-	-	0.5	-	ns
		V <sub>CC</sub> = 3 V to 3.6 V	0.5	-	-	0.5	-	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V	0.5	-	-	0.5	-	ns

[1] Typical values are measured at  $T_{amb}$  = 25 °C and nominal V<sub>CC</sub>.

[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).

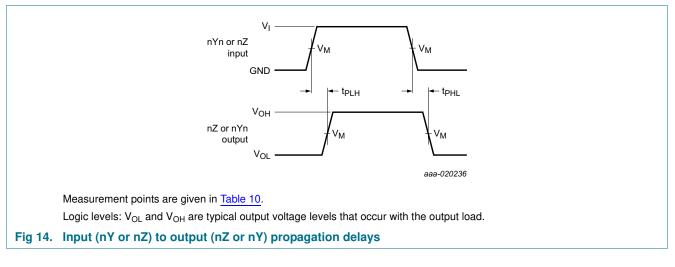
[4]  $t_{en}$  is the same as  $t_{PZH}$  and  $t_{PZL}$ .

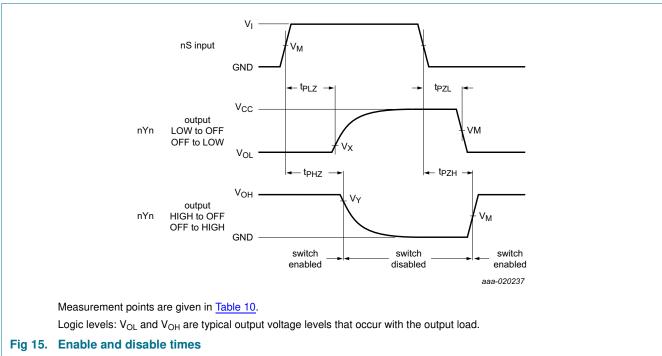
[5]  $t_{dis}$  is the same as  $t_{PLZ}$  and  $t_{PHZ}$ .

[6] Break-before-make specified by design.

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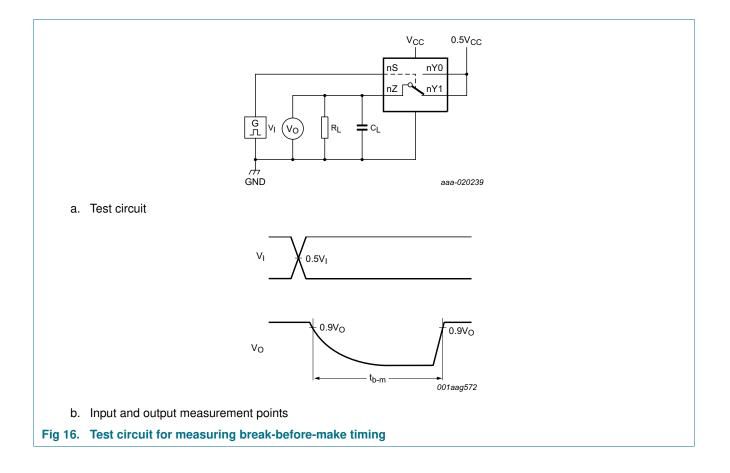


#### Table 10. Measurement points

Supply voltage	Input	Output					
V <sub>cc</sub>	V <sub>M</sub>	V <sub>M</sub>	V <sub>X</sub>	V <sub>Y</sub>			
1.65 V to 5.5 V	0.5V <sub>CC</sub>	0.5V <sub>CC</sub>	V <sub>OL</sub> + 0.3 V	V <sub>OH</sub> – 0.3 V			

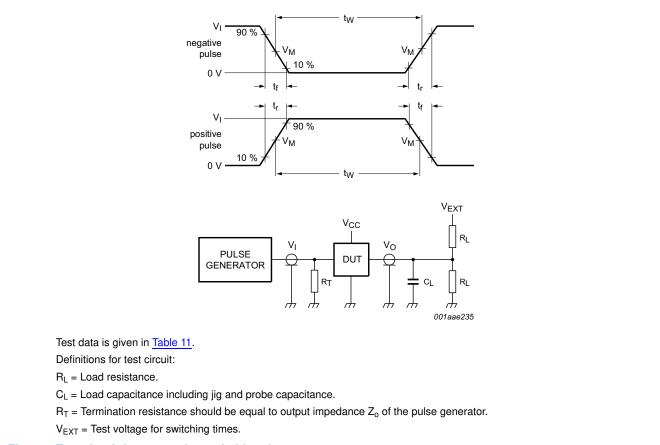
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#### Dual 10 $\Omega$ single-pole double-throw analog switch



#### Fig 17. Test circuit for measuring switching times

Tabl	o 1:	1	Test	data
labi	eг	L	iesi	uala

Supply voltage	Input	Input		Load		V <sub>EXT</sub>		
V <sub>cc</sub>	VI	t <sub>r</sub> , t <sub>f</sub>	CL	RL	t <sub>PLH,</sub> t <sub>PHL</sub>	t <sub>PZH,</sub> t <sub>PHZ</sub>	t <sub>PZL,</sub> t <sub>PLZ</sub>	
1.65 V to 1.95 V	V <sub>CC</sub>	$\leq$ 2.0 ns	50 pF	500 Ω	open	GND	2V <sub>CC</sub>	
2.3 V to 2.7 V	V <sub>CC</sub>	≤ 2.0 ns	50 pF	500 Ω	open	GND	2V <sub>CC</sub>	
2.7 V	V <sub>CC</sub>	≤ 2.5 ns	50 pF	500 Ω	open	GND	2V <sub>CC</sub>	
3 V to 3.6 V	V <sub>CC</sub>	≤ 2.5 ns	50 pF	500 Ω	open	GND	2V <sub>CC</sub>	
4.5 V to 5.5 V	V <sub>CC</sub>	≤ 2.5 ns	50 pF	500 Ω	open	GND	2V <sub>CC</sub>	

### Dual 10 $\Omega$ single-pole double-throw analog switch

### 11.2 Additional dynamic characteristics

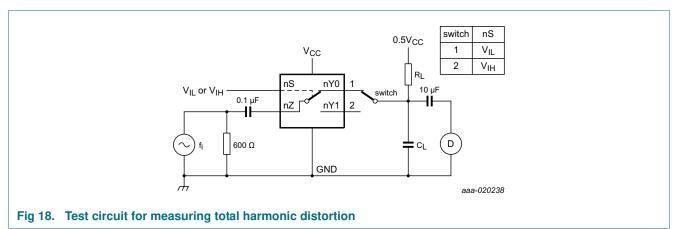
#### Table 12. Additional dynamic characteristics

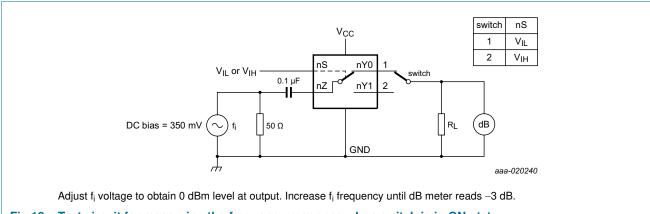
At recommended operating conditions; voltages are referenced to GND (ground = 0 V); T<sub>amb</sub> = 25 °C.

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
THD	total harmonic distortion	$f_i$ = 600 Hz to 20 kHz; R <sub>L</sub> = 600 Ω; C <sub>L</sub> = 50 pF; V <sub>I</sub> = 0.5 V (p-p); see <u>Figure 18</u>				
		V <sub>CC</sub> = 1.65 V	-	0.260	-	%
		V <sub>CC</sub> = 2.3 V	-	0.078	-	%
		V <sub>CC</sub> = 3.0 V	-	0.078	-	%
		V <sub>CC</sub> = 4.5 V	-	0.078	-	%
f <sub>(-3dB)</sub>	-3 dB frequency response	$R_L = 50 \Omega$ ; see Figure 19				
		V <sub>CC</sub> = 1.65 V	-	200	-	MHz
		V <sub>CC</sub> = 2.3 V	-	300	-	MHz
		V <sub>CC</sub> = 3.0 V	-	300	-	MHz
		V <sub>CC</sub> = 4.5 V	-	300	-	MHz
$\alpha_{iso}$	isolation (OFF-state)	$R_L = 50 \Omega$ ; $C_L = 5 pF$ ; $f_i = 10 MHz$ ; see Figure 20				
		V <sub>CC</sub> = 1.65 V	-	-42	-	dB
		V <sub>CC</sub> = 2.3 V	-	-42	-	dB
		V <sub>CC</sub> = 3.0 V	-	-40	-	dB
		V <sub>CC</sub> = 4.5 V	-	-40	-	dB
Xtalk c	crosstalk	between switches; $f_i = 10 \text{ MHz}$ ; see Figure 21				
		V <sub>CC</sub> = 1.65 V	-	-54	-	dB
		V <sub>CC</sub> = 2.3 V	-	-54	-	dB
		V <sub>CC</sub> = 3.0 V	-	-54	-	dB
		V <sub>CC</sub> = 4.5 V	-	-54	-	dB
Q <sub>inj</sub>	charge injection	$      C_L = 0.1 \text{ nF};  \text{V}_{gen} = 0  \text{V};  \text{R}_{gen} = 0  \Omega;  \text{f}_{i} = 1  \text{MHz}; \\  \text{R}_L = 1  \text{M}\Omega; \text{ see } \overline{\text{Figure 22}} $				
		V <sub>CC</sub> = 1.8 V	-	3.3	-	рС
		V <sub>CC</sub> = 2.5 V	-	4.1	-	рС
		V <sub>CC</sub> = 3.3 V	-	5.0	-	рС
		V <sub>CC</sub> = 4.5 V	-	6.4	-	рС
		V <sub>CC</sub> = 5.5 V	-	7.5	-	рС

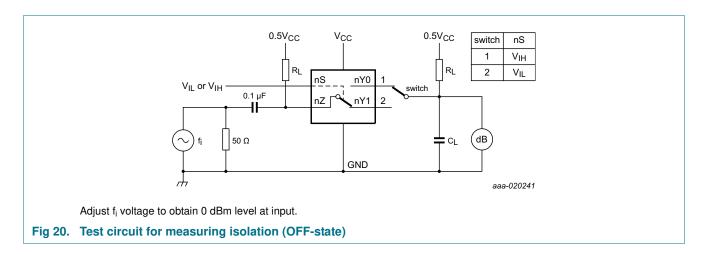
Dual 10  $\Omega$  single-pole double-throw analog switch

### 11.3 Test circuits



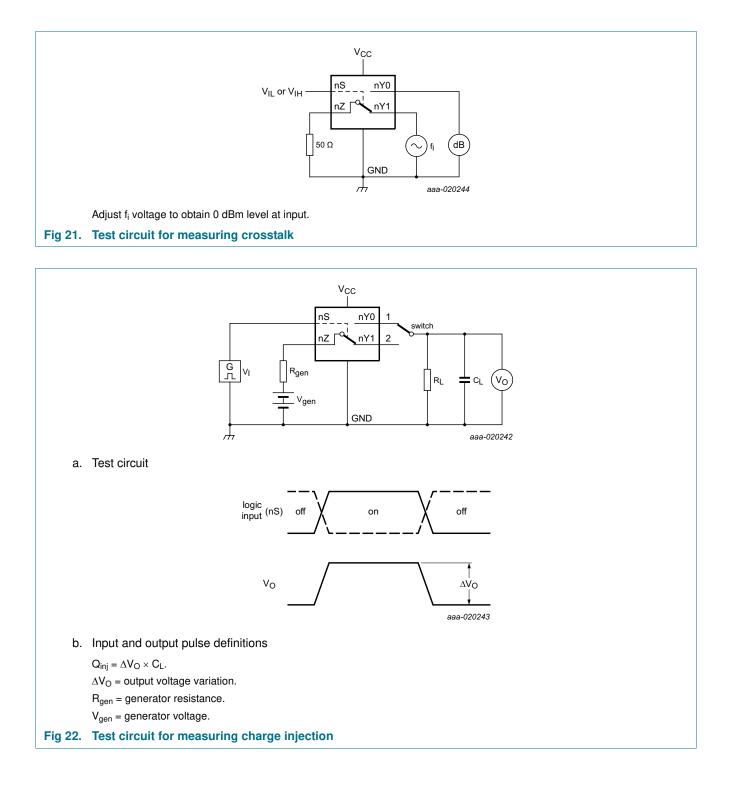






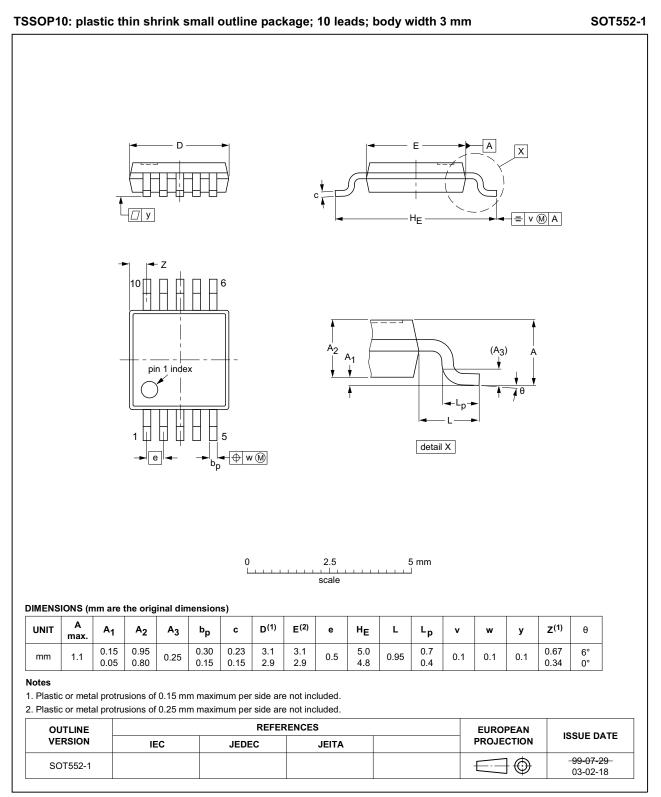
# 74LVC2G3157

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### 12. Package outline

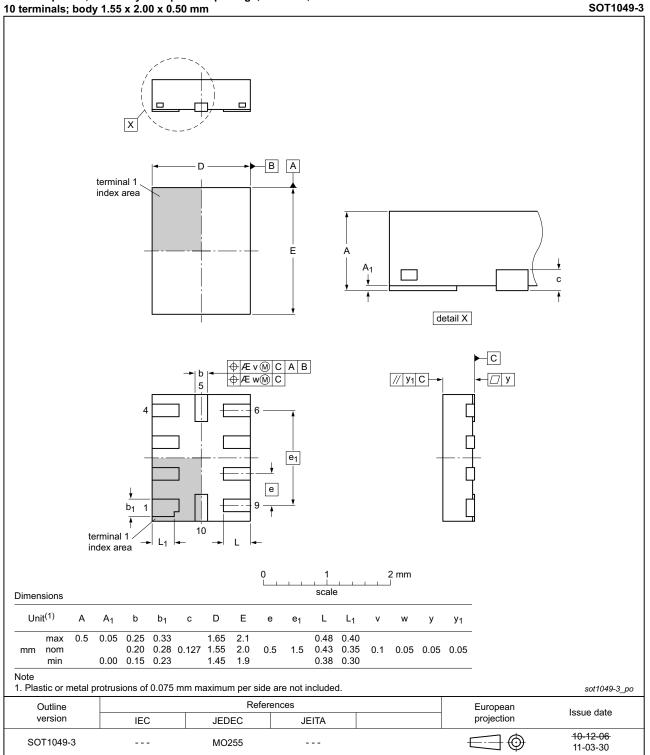


#### Fig 23. Package outline SOT552-1 (TSSOP10)

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XQFN10: plastic, extremely thin quad flat package; no leads; 10 terminals; body 1.55 x 2.00 x 0.50 mm

Fig 24. Package outline SOT1049-3 (XQFN10)

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# **13. Abbreviations**

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

# 14. Revision history

### Table 14. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes	
74LVC2G3157 v.2	20161215	Product data sheet	-	74LVC2G3157 v.1	
Modifications:	• <u>Table 7</u> : The maximum limits for leakage current and supply current have changed.				
74LVC2G3157 v.1	20151214	Product data sheet	-	-	

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### **15. Legal information**

### 15.1 Data sheet status

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

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL http://www.nexperia.com.

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Product data sheet

# 74LVC2G3157

#### Dual 10 $\Omega$ single-pole double-throw analog switch

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