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NX3L1G3157-Q100

Low-ohmic single-pole double-throw analog switch

Rev. 1 — 23 May 2013 Product data sheet

1. General description

The NX3L1G3157-Q100 is a low-ohmic single-pole double-throw analog switch suitable for use as an analog or digital 2:1 multiplexer/demultiplexer. It has a digital select input (S), two independent inputs/outputs (Y0 and Y1) and a common input/output (Z). Schmitt trigger action at the digital input makes the circuit tolerant to slower input rise and fall times.

The NX3L1G3157-Q100 allows signals with amplitude up to V_{CC} to be transmitted from Z to Y0 or Y1; or from Y0 or Y1 to Z. Its low ON resistance (0.5 Ω) and flatness (0.13 Ω) ensures minimal attenuation and distortion of transmitted signals.

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 1.4 V to 4.3 V
- Very low ON resistance:
  - 1.6 Ω (typical) at V_{CC} = 1.4 V
  - 1.0 Ω (typical) at V_{CC} = 1.65 V
  - 0.55 Ω (typical) at V_{CC} = 2.3 V
  - 0.50 Ω (typical) at V_{CC} = 2.7 V
  - 0.50 Ω (typical) at V_{CC} = 4.3 V
- Break-before-make switching
- High noise immunity
- ESD protection:
  - MIL-STD-883, method 3015 Class 3A exceeds 7500 V
  - HBM JESD22-A114F Class 3A exceeds 7500 V
  - MM JESD22-A115-A exceeds 200 V (C = 200 pF, R = 0 Ω)
  - CDM AEC-Q100-011 revision B exceeds 1000 V
  - IEC61000-4-2 contact discharge exceeds 8000 V for switch ports
- CMOS low-power consumption
- Latch-up performance exceeds 100 mA per JESD78 Class II Level A
- Direct interface with TTL levels at 3.0 V
- Control input accepts voltages above supply voltage
- High current handling capability (350 mA continuous current under 3.3 V supply)

3. Applications

- Cell phone
- PDA
- Portable media player

4. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
NX3L1G3157GW-Q100	−40 °C to +125 °C	SC-88	plastic surface-mounted package; 6 leads	SOT363

5. Marking

Table 2. Marking codes[1]

Type number	Marking code
NX3L1G3157GW-Q100	MJ

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

6. Functional diagram

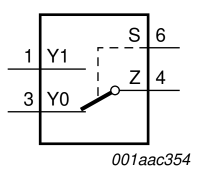


Fig 1. Logic symbol

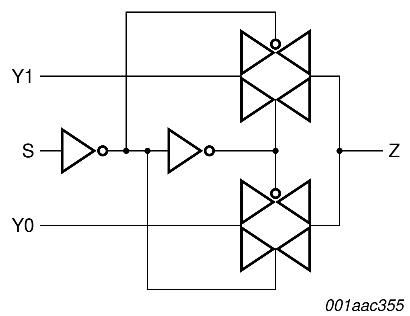


Fig 2. Logic diagram

7. Pinning information

7.1 Pinning

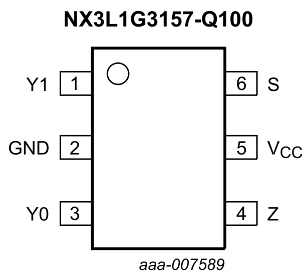


Fig 3. Pin configuration SOT363 (SC-88)

7.2 Pin description

Table 3. Pin description

Symbol	Pin	Description
Y1	1	independent input or output
GND	2	ground (0 V)
Y0	3	independent input or output
Z	4	common output or input
V_{CC}	5	supply voltage
S	6	select input

8. Functional description

Table 4. Function table[1]

Input S	Channel on
L	Y0
H	Y1

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

9. 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	+4.6	V
V_I	input voltage	select input S	[1]	–0.5	+4.6	V
V_{SW}	switch voltage		[2]	–0.5	V_{CC} + 0.5	V
I_{IK}	input clamping current	$V_I < -0.5$ V		–50	-	mA
I_{SK}	switch clamping current	$V_I < -0.5$ V or $V_I > V_{CC} + 0.5$ V		-	±50	mA
I_{SW}	switch current	$V_{SW} > -0.5$ V or $V_{SW} < V_{CC} + 0.5$ V; source or sink current		-	±350	mA
		$V_{SW} > -0.5$ V or $V_{SW} < V_{CC} + 0.5$ V; pulsed at 1 ms duration, < 10 % duty cycle; peak current		-	±500	mA
T_{stg}	storage temperature			–65	+150	°C
P_{tot}	total power dissipation	T_{amb} = –40 °C to +125 °C	[3]	-	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 but may not exceed 4.6 V.

[3] For SC-88 package: above 87.5 °C the value of P_{tot} derates linearly with 4.0 mW/K.

10. Recommended operating conditions

Table 6. Recommended operating conditions

Symbol	Parameter	Conditions		Min	Max	Unit
V_{CC}	supply voltage			1.4	4.3	V
V_I	input voltage	select input S		0	4.3	V
V_{SW}	switch voltage		[1]	0	V_{CC}	V
T_{amb}	ambient temperature			–40	+125	°C
$\Delta t/\Delta V$	input transition rise and fall rate	V_{CC} = 1.4 V to 4.3 V	[2]	-	200	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.

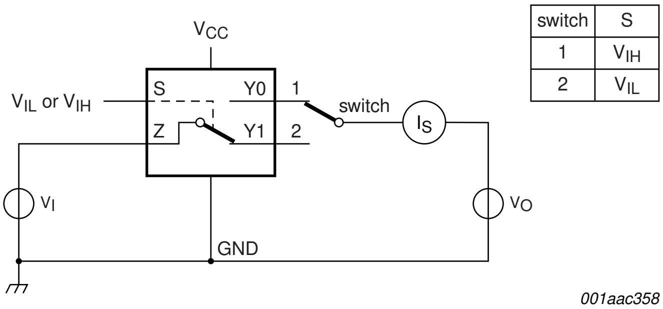
11. Static characteristics

Table 7. Static characteristics

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

Symbol	Parameter	Conditions	T_{amb} = 25 °C			T_{amb} = −40 °C to +125 °C			Unit
			Min	Typ	Max	Min	Max (85 °C)	Max (125 °C)	
V_{IH}	HIGH-level input voltage	V_{CC} = 1.4 V to 1.95 V	0.65V_{CC}	-	-	0.65V_{CC}	-	-	V
		V_{CC} = 2.3 V to 2.7 V	1.7	-	-	1.7	-	-	V
		V_{CC} = 2.7 V to 3.6 V	2.0	-	-	2.0	-	-	V
		V_{CC} = 3.6 V to 4.3 V	0.7V_{CC}	-	-	0.7V_{CC}	-	-	V
V_{IL}	LOW-level input voltage	V_{CC} = 1.4 V to 1.95 V	-	-	0.35V_{CC}	-	0.35V_{CC}	0.35V_{CC}	V
		V_{CC} = 2.3 V to 2.7 V	-	-	0.7	-	0.7	0.7	V
		V_{CC} = 2.7 V to 3.6 V	-	-	0.8	-	0.8	0.8	V
		V_{CC} = 3.6 V to 4.3 V	-	-	0.3V_{CC}	-	0.3V_{CC}	0.3V_{CC}	V
I_I	input leakage current	select input S; V_I = GND to 4.3 V; V_{CC} = 1.4 V to 4.3 V	-	-	-	-	±0.5	±1	μA
$I_{S(OFF)}$	OFF-state leakage current	Y0 and Y1 port; see Figure 4							
		V_{CC} = 1.4 V to 3.6 V	-	-	±5	-	±50	±500	nA
		V_{CC} = 3.6 V to 4.3 V	-	-	±10	-	±50	±500	nA
$I_{S(ON)}$	ON-state leakage current	Z port; see Figure 5							
		V_{CC} = 1.4 V to 3.6 V	-	-	±5	-	±50	±500	nA
		V_{CC} = 3.6 V to 4.3 V	-	-	±10	-	±50	±500	nA
I_{CC}	supply current	V_I = V_{CC} or GND; V_{SW} = GND or V_{CC}							
		V_{CC} = 3.6 V	-	-	100	-	690	6000	nA
		V_{CC} = 4.3 V	-	-	150	-	800	7000	nA
C_I	input capacitance		-	1.0	-	-	-	-	pF
$C_{S(OFF)}$	OFF-state capacitance		-	35	-	-	-	-	pF
$C_{S(ON)}$	ON-state capacitance		-	130	-	-	-	-	pF

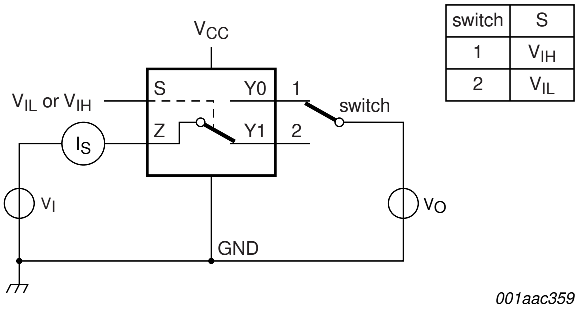
11.1 Test circuits



switch	S
1	V_{IH}
2	V_{IL}

V_I = 0.3 V or V_{CC} − 0.3 V; V_O = V_{CC} − 0.3 V or 0.3 V.

Fig 4. Test circuit for measuring OFF-state leakage current



switch	S
1	V_{IH}
2	V_{IL}

V_I = 0.3 V or V_{CC} − 0.3 V; V_O = V_{CC} − 0.3 V or 0.3 V.

Fig 5. Test circuit for measuring ON-state leakage current

11.2 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 13.

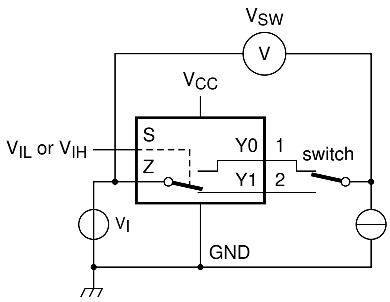
Symbol	Parameter	Conditions		T_{amb} = –40 °C to +85 °C			T_{amb} = –40 °C to +125 °C		Unit
				Min	Typ[1]	Max	Min	Max	
$R_{ON(peak)}$	ON resistance (peak)	V_I = GND to V_{CC}; I_{SW} = 100 mA; see Figure 6							
		V_{CC} = 1.4 V		-	1.6	3.7	-	4.1	Ω
		V_{CC} = 1.65 V		-	1.0	1.6	-	1.7	Ω
		V_{CC} = 2.3 V		-	0.55	0.8	-	0.9	Ω
		V_{CC} = 2.7 V		-	0.5	0.75	-	0.9	Ω
		V_{CC} = 4.3 V		-	0.5	0.75	-	0.9	Ω
ΔR_{ON}	ON resistance mismatch between channels	V_I = GND to V_{CC}; I_{SW} = 100 mA	[2]						
		V_{CC} = 1.4 V		-	0.04	0.3	-	0.3	Ω
		V_{CC} = 1.65 V		-	0.04	0.2	-	0.3	Ω
		V_{CC} = 2.3 V		-	0.02	0.08	-	0.1	Ω
		V_{CC} = 2.7 V		-	0.02	0.075	-	0.1	Ω
		V_{CC} = 4.3 V		-	0.02	0.075	-	0.1	Ω
$R_{ON(flat)}$	ON resistance (flatness)	V_I = GND to V_{CC}; I_{SW} = 100 mA	[3]						
		V_{CC} = 1.4 V		-	1.0	3.3	-	3.6	Ω
		V_{CC} = 1.65 V		-	0.5	1.2	-	1.3	Ω
		V_{CC} = 2.3 V		-	0.15	0.3	-	0.35	Ω
		V_{CC} = 2.7 V		-	0.13	0.3	-	0.35	Ω
		V_{CC} = 4.3 V		-	0.2	0.4	-	0.45	Ω

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

[2] Measured at identical V_{CC}, temperature and input voltage.

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

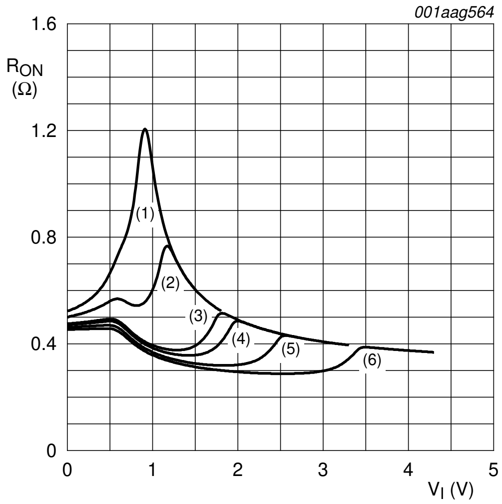
11.3 ON resistance test circuit and graphs



switch	S
1	V_{IL}
2	V_{IH}

$R_{ON} = V_{SW} / I_{SW}$.

Fig 6. Test circuit for measuring ON resistance



(1) V_{CC} = 1.5 V.

(2) V_{CC} = 1.8 V.

(3) V_{CC} = 2.5 V.

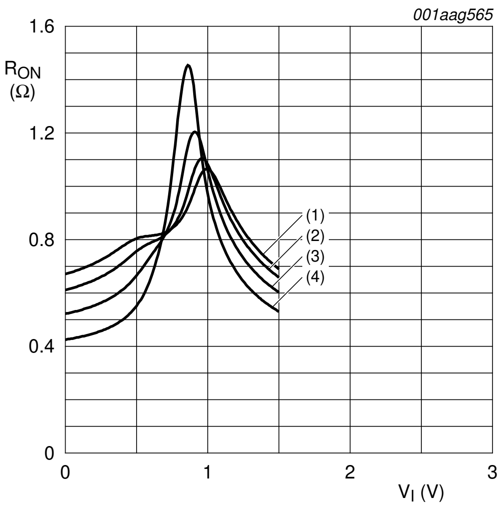
(4) V_{CC} = 2.7 V.

(5) V_{CC} = 3.3 V.

(6) V_{CC} = 4.3 V.

Measured at T_{amb} = 25 °C.

Fig 7. Typical ON resistance as a function of input voltage



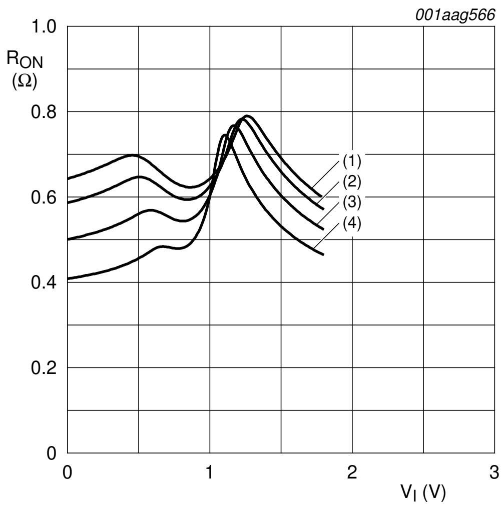
(1) T_{amb} = 125 °C.

(2) T_{amb} = 85 °C.

(3) T_{amb} = 25 °C.

(4) T_{amb} = −40 °C.

Fig 8. ON resistance as a function of input voltage; V_{CC} = 1.5 V



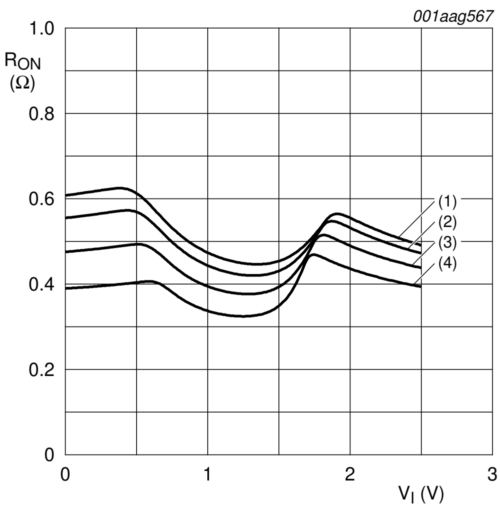
(1) T_{amb} = 125 °C.

(2) T_{amb} = 85 °C.

(3) T_{amb} = 25 °C.

(4) T_{amb} = −40 °C.

Fig 9. ON resistance as a function of input voltage; V_{CC} = 1.8 V



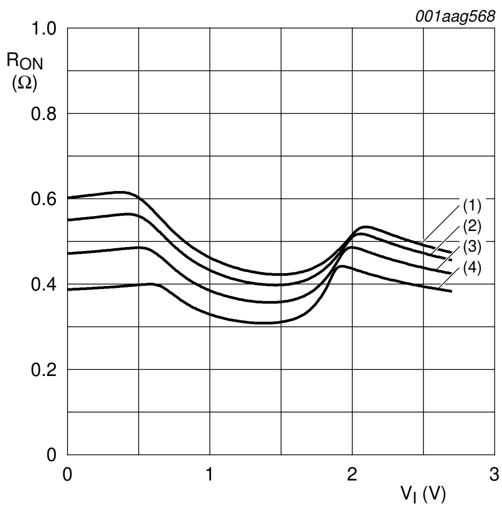
(1) T_{amb} = 125 °C.

(2) T_{amb} = 85 °C.

(3) T_{amb} = 25 °C.

(4) T_{amb} = −40 °C.

Fig 10. ON resistance as a function of input voltage; V_{CC} = 2.5 V



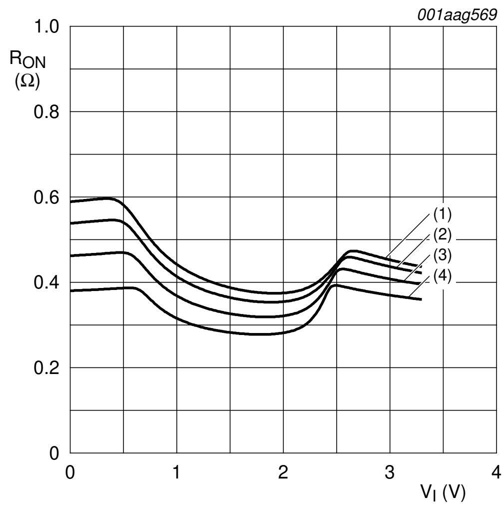
(1) T_{amb} = 125 °C.

(2) T_{amb} = 85 °C.

(3) T_{amb} = 25 °C.

(4) T_{amb} = −40 °C.

Fig 11. ON resistance as a function of input voltage; V_{CC} = 2.7 V



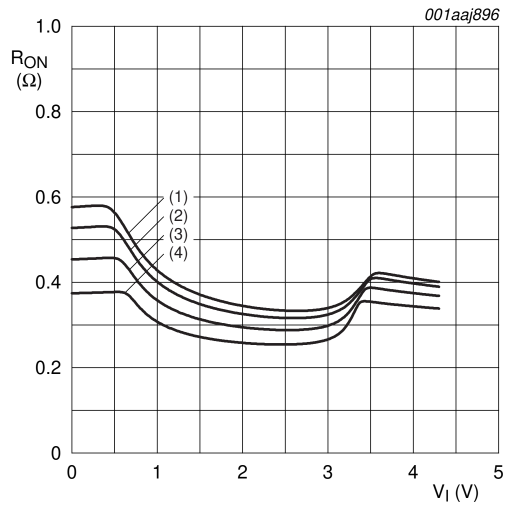
(1) T_{amb} = 125 °C.

(2) T_{amb} = 85 °C.

(3) T_{amb} = 25 °C.

(4) T_{amb} = −40 °C.

Fig 12. ON resistance as a function of input voltage; V_{CC} = 3.3 V



(1) T_{amb} = 125 °C.

(2) T_{amb} = 85 °C.

(3) T_{amb} = 25 °C.

(4) T_{amb} = −40 °C.

Fig 13. ON resistance as a function of input voltage; V_{CC} = 4.3 V

12. Dynamic characteristics

Table 9. Dynamic characteristics

At recommended operating conditions; voltages are referenced to GND (ground = 0 V); for load circuit see Figure 16.

Symbol	Parameter	Conditions	T_{amb} = 25 °C			T_{amb} = −40 °C to +125 °C			Unit
			Min	Typ[1]	Max	Min	Max (85 °C)	Max (125 °C)	
t_{en}	enable time	S to Z or Yn; see Figure 14							
		V_{CC} = 1.4 V to 1.6 V	-	28	43	-	48	52	ns
		V_{CC} = 1.65 V to 1.95 V	-	23	35	-	38	42	ns
		V_{CC} = 2.3 V to 2.7 V	-	17	27	-	29	32	ns
		V_{CC} = 2.7 V to 3.6 V	-	14	25	-	27	30	ns
		V_{CC} = 3.6 V to 4.3 V	-	14	25	-	27	30	ns
t_{dis}	disable time	S to Z or Yn; see Figure 14							
		V_{CC} = 1.4 V to 1.6 V	-	9	20	-	25	30	ns
		V_{CC} = 1.65 V to 1.95 V	-	6	15	-	20	23	ns
		V_{CC} = 2.3 V to 2.7 V	-	5	11	-	14	16	ns
		V_{CC} = 2.7 V to 3.6 V	-	4	10	-	12	14	ns
		V_{CC} = 3.6 V to 4.3 V	-	4	10	-	12	14	ns

Table 9. Dynamic characteristics *...continued*

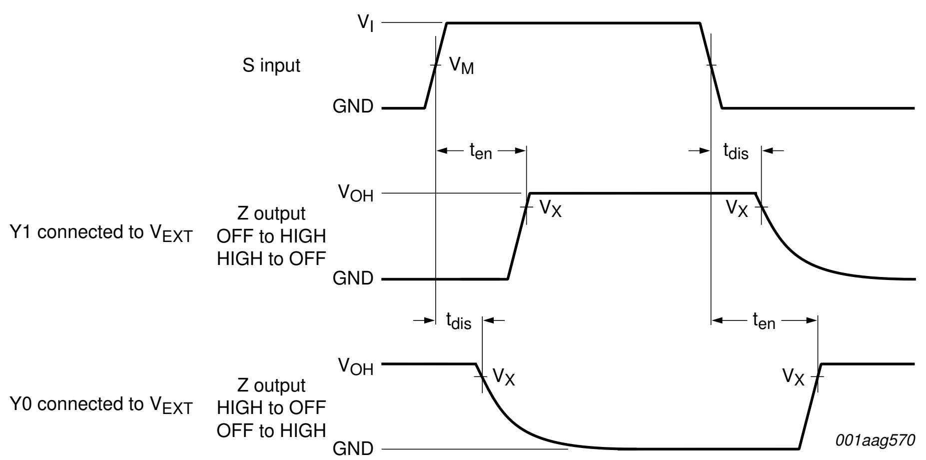
At recommended operating conditions; voltages are referenced to GND (ground = 0 V); for load circuit see Figure 16.

Symbol	Parameter	Conditions	T_{amb} = 25 °C			T_{amb} = −40 °C to +125 °C			Unit
			Min	Typ[1]	Max	Min	Max (85 °C)	Max (125 °C)	
t_{b-m}	break-before-make time	see Figure 15 [2]							
		V_{CC} = 1.4 V to 1.6 V	-	19	-	4	-	-	ns
		V_{CC} = 1.65 V to 1.95 V	-	17	-	4	-	-	ns
		V_{CC} = 2.3 V to 2.7 V	-	13	-	2	-	-	ns
		V_{CC} = 2.7 V to 3.6 V	-	10	-	2	-	-	ns
		V_{CC} = 3.6 V to 4.3 V	-	10	-	2	-	-	ns

[1] Typical values are measured at T_{amb} = 25 °C and V_{CC} = 1.5 V, 1.8 V, 2.5 V, 3.3 V and 4.3 V respectively.

[2] Break-before-make guaranteed by design.

12.1 Waveform and test circuits



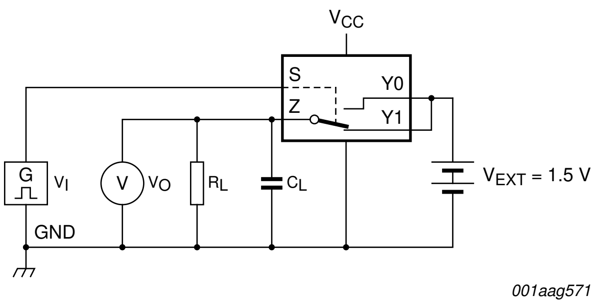
Measurement points are given in Table 10.

Logic level: V_{OH} is typical output voltage level that occurs with the output load.

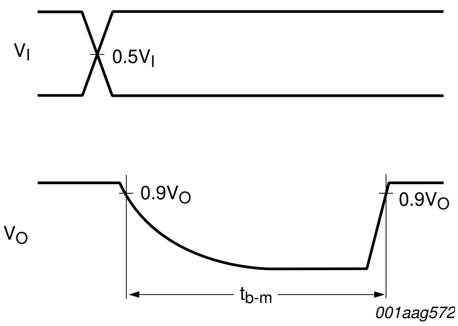
Fig 14. Enable and disable times

Table 10. Measurement points

Supply voltage	Input	Output
V_{CC}	V_M	V_X
1.4 V to 4.3 V	0.5V_{CC}	0.9V_{OH}

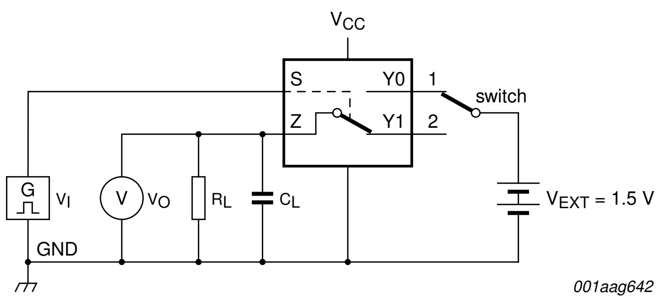


a. Test circuit



b. Input and output measurement points

Fig 15. Test circuit for measuring break-before-make timing



Test data is given in Table 11.

Definitions test circuit:

R_L = Load resistance.

C_L = Load capacitance including jig and probe capacitance.

V_{EXT} = External voltage for measuring switching times.

Fig 16. Load circuit for switching times

Table 11. Test data

Supply voltage	Input		Load	
V_{CC}	V_I	t_r, t_f	C_L	R_L
1.4 V to 4.3 V	V_{CC}	≤ 2.5 ns	35 pF	50 Ω

12.2 Additional dynamic characteristics

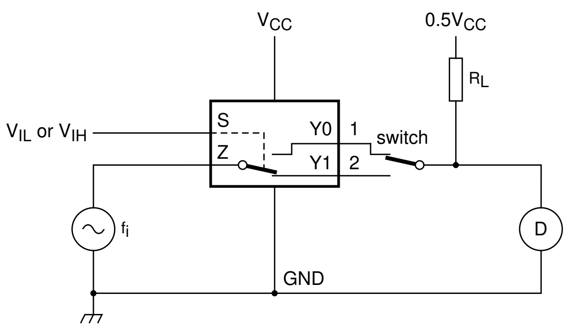
Table 12. Additional dynamic characteristics

At recommended operating conditions; voltages are referenced to GND (ground = 0 V); V_I = GND or V_{CC} (unless otherwise specified); $t_r = t_f \leq 2.5$ ns; $T_{amb} = 25$ °C.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
THD	total harmonic distortion	f_i = 20 Hz to 20 kHz; R_L = 32 Ω; see Figure 17	[1]				
		V_{CC} = 1.4 V; V_I = 1 V (p-p)		-	0.15	-	%
		V_{CC} = 1.65 V; V_I = 1.2 V (p-p)		-	0.10	-	%
		V_{CC} = 2.3 V; V_I = 1.5 V (p-p)		-	0.02	-	%
		V_{CC} = 2.7 V; V_I = 2 V (p-p)		-	0.02	-	%
		V_{CC} = 4.3 V; V_I = 2 V (p-p)		-	0.02	-	%
$f_{(-3dB)}$	−3 dB frequency response	R_L = 50 Ω; see Figure 18	[1]				
		V_{CC} = 1.4 V to 4.3 V		-	60	-	MHz
α_{iso}	isolation (OFF-state)	f_i = 100 kHz; R_L = 50 Ω; see Figure 19	[1]				
		V_{CC} = 1.4 V to 4.3 V		-	−90	-	dB
V_{ct}	crosstalk voltage	between digital inputs and switch; f_i = 1 MHz; C_L = 50 pF; R_L = 50 Ω; see Figure 20					
		V_{CC} = 1.4 V to 3.6 V		-	0.2	-	V
		V_{CC} = 3.6 V to 4.3 V		-	0.3	-	V
Q_{inj}	charge injection	f_i = 1 MHz; C_L = 0.1 nF; R_L = 1 MΩ; V_{gen} = 0 V; R_{gen} = 0 Ω; see Figure 21					
		V_{CC} = 1.5 V		-	3	-	pC
		V_{CC} = 1.8 V		-	4	-	pC
		V_{CC} = 2.5 V		-	6	-	pC
		V_{CC} = 3.3 V		-	9	-	pC
		V_{CC} = 4.3 V		-	15	-	pC

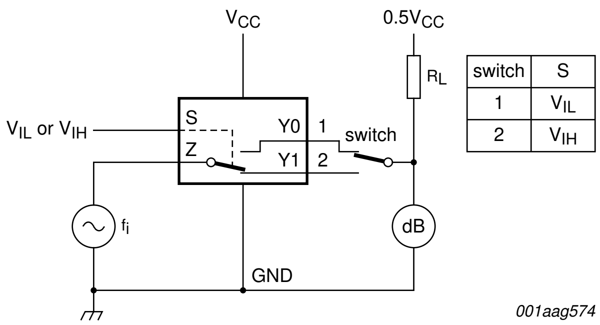
[1] f_i is biased at $0.5V_{CC}$.

12.3 Test circuits



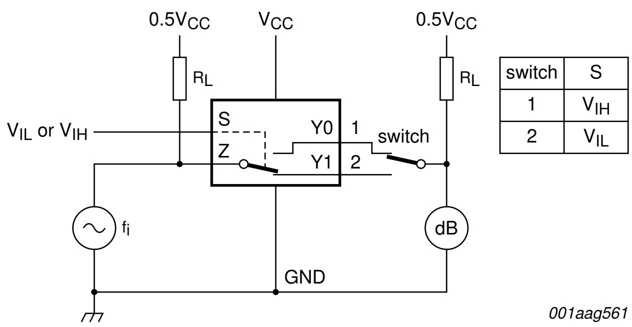
switch	S
1	V_{IL}
2	V_{IH}

Fig 17. Test circuit for measuring total harmonic distortion



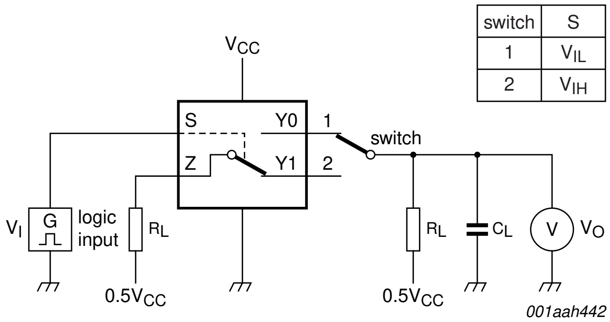
To obtain 0 dBm level at output, adjust f_i voltage. Increase f_i frequency until dB meter reads −3 dB.

Fig 18. Test circuit for measuring the frequency response when channel is in ON-state

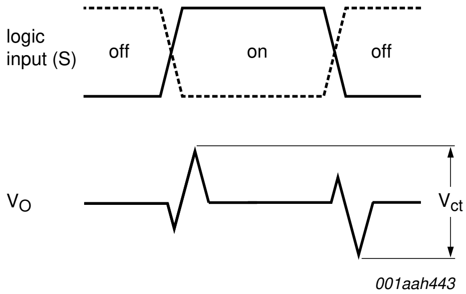


To obtain 0 dBm level at output, adjust f_i voltage.

Fig 19. Test circuit for measuring isolation (OFF-state)

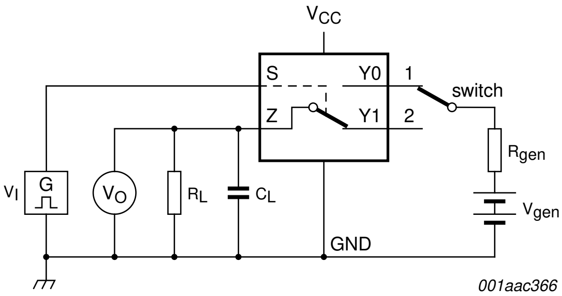


a. Test circuit

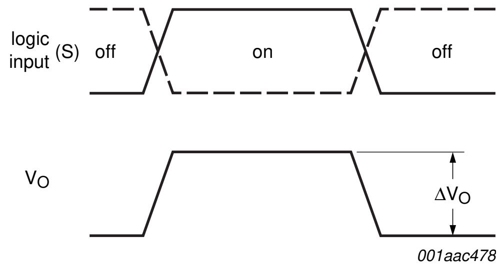


b. Input and output pulse definitions

Fig 20. Test circuit for measuring crosstalk voltage between digital inputs and switch



a. Test circuit



b. Input and output pulse definitions

Definition: $Q_{inj} = \Delta V_O \times C_L$.

ΔV_O = output voltage variation.

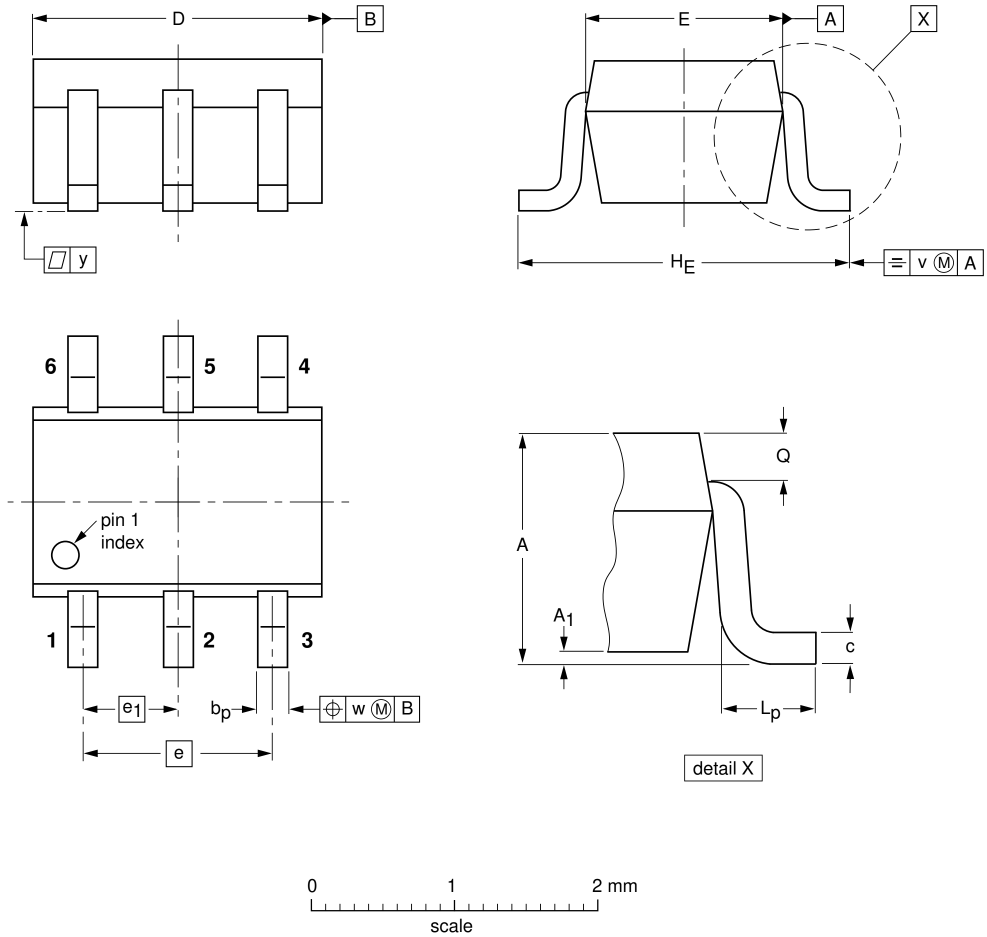
R_{gen} = generator resistance.

V_{gen} = generator voltage.

Fig 21. Test circuit for measuring charge injection

13. Package outline

Plastic surface-mounted package; 6 leads **SOT363**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1 max	b_p	c	D	E	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	JEITA			
SOT363			SC-88			~~04-11-08~~ 06-03-16

Fig 22. Package outline SOT363 (SC-88)

14. Abbreviations

Table 13. Abbreviations

Acronym	Description
CDM	Charged Device Model
CMOS	Complementary Metal-Oxide Semiconductor
ESD	ElectroStatic Discharge
HBM	Human Body Model
MIL	Military
MM	Machine Model
PDA	Personal Digital Assistant
TTL	Transistor-Transistor Logic

15. Revision history

Table 14. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
NX3L1G3157_Q100 v.1	20130523	Product data sheet	-	-

16. Legal information

16.1 Data sheet status

Document status[1][2]	Product status[3]	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.nxp.com.

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18. Contents

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