NX3L1G3157

Low-ohmic single-pole double-throw analog switch

Rev. 10 — 7 August 2012

Product data sheet

1. General description

The NX3L1G3157 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 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.

2. Features and benefits

- Wide supply voltage range from 1.4 V to 4.3 V
- Very low ON resistance:
 - 1.6 Ω (typical) at $V_{CC} = 1.4 \text{ V}$
 - 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 $V_{CC} = 2.7 \text{ V}$
 - 0.50 Ω (typical) at V_{CC} = 4.3 V
- Break-before-make switching
- High noise immunity
- ESD protection:
 - ◆ HBM JESD22-A114F Class 3A exceeds 7500 V
 - ♦ MM JESD22-A115-A exceeds 200 V
 - ◆ 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)
- Specified from -40 °C to +85 °C and from -40 °C to +125 °C



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3. Applications

- Cell phone
- PDA
- Portable media player

4. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
NX3L1G3157GW	−40 °C to +125 °C	SC-88	plastic surface-mounted package; 6 leads	SOT363
NX3L1G3157GM	–40 °C to +125 °C	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body 1 \times 1.45 \times 0.5 mm	SOT886

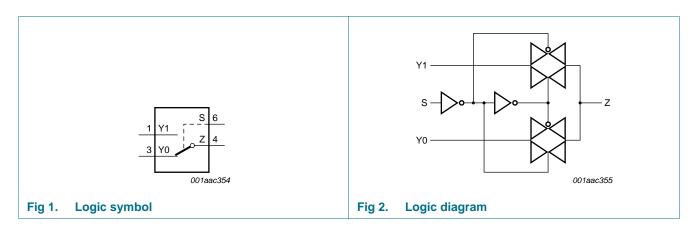
5. Marking

Table 2. Marking codes[1]

Type number	Marking code
NX3L1G3157GW	MJ
NX3L1G3157GM	MJ

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

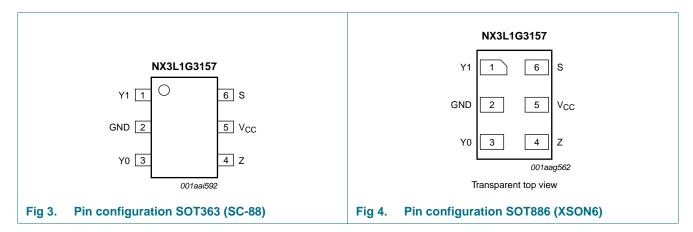
6. Functional diagram



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7. Pinning information

7.1 Pinning



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
Н	Y1

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

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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	<u>[1]</u> –0.5	+4.6	V
V_{SW}	switch voltage		<u>[2]</u> –0.5	$V_{CC} + 0.5$	V
I _{IK}	input clamping current	$V_1 < -0.5 \text{ V}$	-50	-	mΑ
I _{SK}	switch clamping current	$V_I < -0.5 \text{ V or } V_I > V_{CC} + 0.5 \text{ V}$	-	±50	mΑ
I _{SW}	switch current	$V_{SW} > -0.5 \text{ V or } V_{SW} < V_{CC} + 0.5 \text{ V};$ 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	$T_{amb} = -40 ^{\circ}\text{C}$ to +125 $^{\circ}\text{C}$	[3] _	250	mW

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

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	$V_{CC} = 1.4 \text{ V to } 4.3 \text{ V}$	[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] 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. For XSON6 package: above 118 °C the value of P_{tot} derates linearly with 7.8 mW/K.

^[2] Applies to control signal levels.

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11. Static characteristics

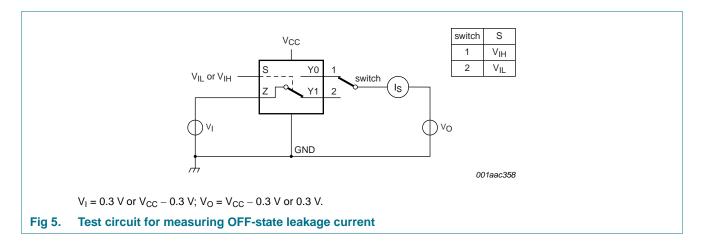
Table 7. Static characteristics

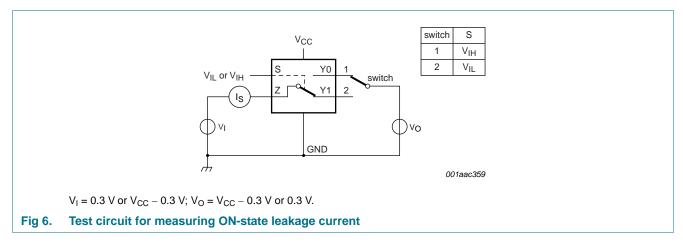
At recommended operating conditions; voltages are referenced to GND (ground 0 V).

Symbol	Parameter	Conditions	Tar	_{nb} = 25	°C	$T_{amb} = -40 ^{\circ}\text{C} \text{ to } +125 ^{\circ}\text{C}$			Unit
			Min	Тур	Max	Min	Max (85 °C)	Max (125 °C)	
V_{IH}	HIGH-level	V _{CC} = 1.4 V to 1.95 V	0.65V _{CC}	-	-	0.65V _{CC}	-	-	V
	input voltage	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	V _{CC} = 1.4 V to 1.95 V	-	-	0.35V _{CC}	-	0.35V _{CC}	0.35V _{CC}	V
	input voltage	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
II	input leakage current	select input S; $V_I = GND \text{ to } 4.3 \text{ V};$ $V_{CC} = 1.4 \text{ V to } 4.3 \text{ V}$	-	-	-	-	±0.5	±1	μΑ
I _{S(OFF)}	OFF-state leakage	Y0 and Y1 port; see <u>Figure 5</u>							
	current	$V_{CC} = 1.4 \text{ V to } 3.6 \text{ V}$	-	-	±5	-	±50	±500	nΑ
		$V_{CC} = 3.6 \text{ V to } 4.3 \text{ V}$	-	-	±10	-	±50	±500	nΑ
I _{S(ON)}	ON-state	Z port; see Figure 6							
	leakage current	$V_{CC} = 1.4 \text{ V to } 3.6 \text{ V}$	-	-	±5	-	±50	±500	nΑ
	Current	$V_{CC} = 3.6 \text{ V to } 4.3 \text{ V}$	-	-	±10	-	±50	±500	nΑ
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	nΑ
Cı	input capacitance		-	1.0	-	-	-	-	pF
$C_{S(OFF)}$	OFF-state capacitance		-	35	-	-	-	-	pF
C _{S(ON)}	ON-state capacitance		-	130	-	-	-	-	pF

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11.1 Test circuits





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11.2 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 14.

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)	$V_I = GND \text{ to } V_{CC};$ $I_{SW} = 100 \text{ mA};$ see Figure 7							
		V _{CC} = 1.4 V		-	1.6	3.7	-	4.1	Ω
		V _{CC} = 1.65 V		-	1.0	1.6	-	1.7	Ω
		$V_{CC} = 2.3 \text{ V}$		-	0.55	0.8	-	0.9	Ω
		$V_{CC} = 2.7 \text{ V}$		-	0.5	0.75	-	0.9	Ω
		$V_{CC} = 4.3 \text{ V}$		-	0.5	0.75	-	0.9	Ω
ΔR_{ON}	ON resistance mismatch between channels	$V_I = GND \text{ to } V_{CC};$ $I_{SW} = 100 \text{ mA}$	[2]						
		$V_{CC} = 1.4 \text{ V}$		-	0.04	0.3	-	0.3	Ω
		V _{CC} = 1.65 V		-	0.04	0.2	-	0.3	Ω
		$V_{CC} = 2.3 \text{ V}$		-	0.02	0.08	-	0.1	Ω
		$V_{CC} = 2.7 \text{ V}$		-	0.02	0.075	-	0.1	Ω
		$V_{CC} = 4.3 \text{ V}$		-	0.02	0.075	-	0.1	Ω
R _{ON(flat)}	ON resistance (flatness)	$V_I = GND \text{ to } V_{CC};$ $I_{SW} = 100 \text{ mA}$	[3]						
		$V_{CC} = 1.4 \text{ V}$		-	1.0	3.3	-	3.6	Ω
		V _{CC} = 1.65 V		-	0.5	1.2	-	1.3	Ω
		$V_{CC} = 2.3 \text{ V}$		-	0.15	0.3	-	0.35	Ω
		$V_{CC} = 2.7 \text{ V}$		-	0.13	0.3	-	0.35	Ω
		V _{CC} = 4.3 V		-	0.2	0.4	-	0.45	Ω

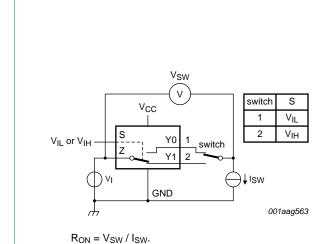
^[1] Typical values are measured at T_{amb} = 25 °C.

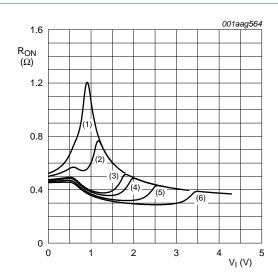
^[2] Measured at identical V_{CC} , temperature and input voltage.

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

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11.3 ON resistance test circuit and graphs



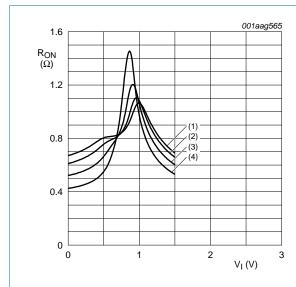


- (1) $V_{CC} = 1.5 \text{ V}.$
- (2) $V_{CC} = 1.8 \text{ V}.$
- (3) $V_{CC} = 2.5 \text{ V}.$
- (4) $V_{CC} = 2.7 \text{ V}.$
- (5) $V_{CC} = 3.3 \text{ V}.$
- (6) $V_{CC} = 4.3 \text{ V}$. Measured at $T_{amb} = 25 \,^{\circ}\text{C}$.

Fig 7. Test circuit for measuring ON resistance

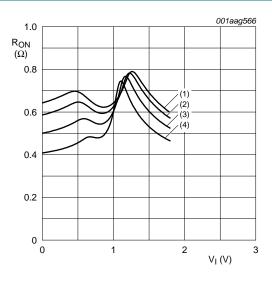
Fig 8. Typical ON resistance as a function of input voltage

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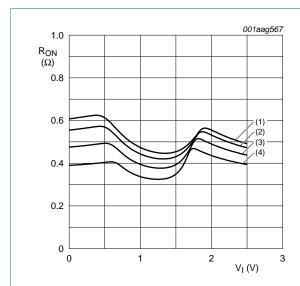
- (1) $T_{amb} = 125 \, ^{\circ}C$.
- (2) $T_{amb} = 85 \, ^{\circ}C$.
- (3) $T_{amb} = 25 \, ^{\circ}C$.
- (4) $T_{amb} = -40 \, ^{\circ}C$.

Fig 9. ON resistance as a function of input voltage; $V_{CC} = 1.5 \text{ V}$



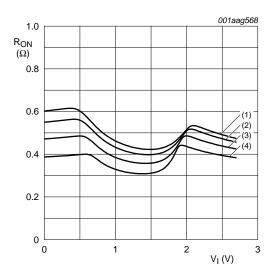
- (1) $T_{amb} = 125 \, ^{\circ}C$.
- (2) $T_{amb} = 85 \, ^{\circ}C$.
- (3) $T_{amb} = 25 \, ^{\circ}C$.
- (4) $T_{amb} = -40 \, ^{\circ}C$.

Fig 10. ON resistance as a function of input voltage; $V_{CC} = 1.8 \text{ V}$



- (1) $T_{amb} = 125 \, ^{\circ}C.$
- (2) $T_{amb} = 85 \, ^{\circ}C$.
- (3) $T_{amb} = 25 \, ^{\circ}C$.
- (4) $T_{amb} = -40 \, ^{\circ}C$.

Fig 11. ON resistance as a function of input voltage; $V_{CC} = 2.5 \text{ V}$

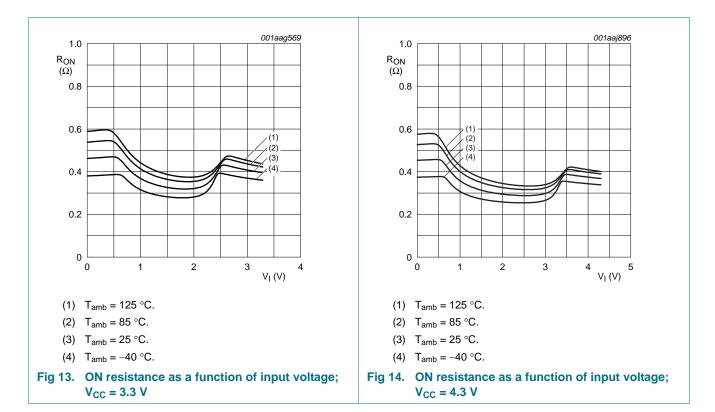


- (1) $T_{amb} = 125 \, ^{\circ}C$.
- (2) $T_{amb} = 85 \, ^{\circ}C$.
- (3) $T_{amb} = 25 \, ^{\circ}C$.
- (4) $T_{amb} = -40 \, ^{\circ}C$.

Fig 12. ON resistance as a function of input voltage; $V_{CC} = 2.7 \text{ V}$

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12. Dynamic characteristics

Table 9. Dynamic characteristics

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

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

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 Table 9.
 Dynamic characteristics ...continued

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

Symbol	Parameter	Conditions		T _{amb} = 25 °C			$T_{amb} = -40 ^{\circ}\text{C} \text{ to } +125 ^{\circ}\text{C}$			Unit
				Min	Typ[1]	Max	Min	Max (85 °C)	Max (125 °C)	
t _{b-m} break-before-make	see Figure 16	[2]								
	time	$V_{CC} = 1.4 \text{ V to } 1.6 \text{ V}$		-	19	-	4	-	-	ns
		$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$		-	17	-	4	-	-	ns
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$		-	13	-	2	-	-	ns
		$V_{CC} = 2.7 \text{ V to } 3.6 \text{ V}$		-	10	-	2	-	-	ns
		$V_{CC} = 3.6 \text{ V to } 4.3 \text{ V}$		-	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.

12.1 Waveform and test circuits

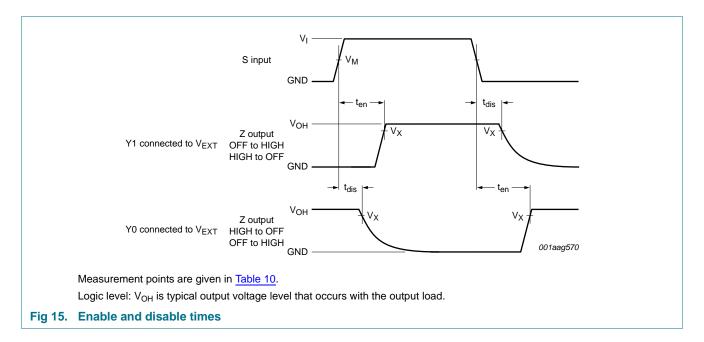


Table 10. Measurement points

Supply voltage	Input	Output
V _{CC}	V _M	V _X
1.4 V to 4.3 V	0.5V _{CC}	0.9V _{OH}

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

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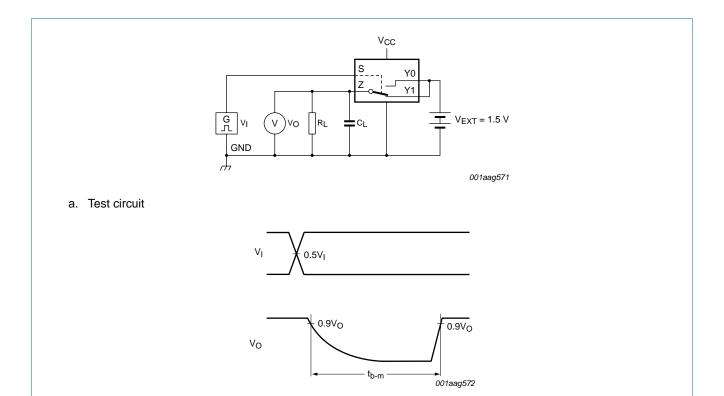


Fig 16. Test circuit for measuring break-before-make timing

b. Input and output measurement points

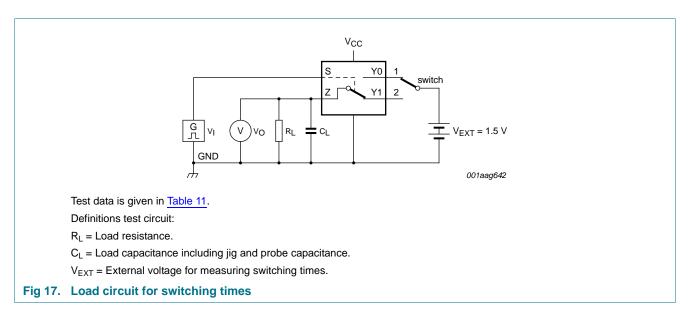


Table 11. Test data

Supply voltage	Input		Load	
V _{CC}	VI	t _r , t _f	CL	R _L
1.4 V to 4.3 V	V _{CC}	≤ 2.5 ns	35 pF	50 Ω

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12.2 Additional dynamic characteristics

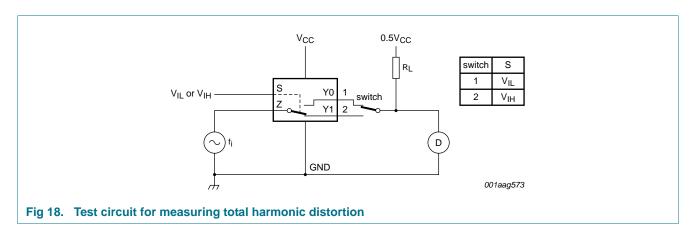
Table 12. Additional dynamic characteristics

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

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
THD	total harmonic distortion	f_i = 20 Hz to 20 kHz; R_L = 32 Ω ; see Figure 18	<u>[1]</u>			
		$V_{CC} = 1.4 \text{ V}; V_I = 1 \text{ V (p-p)}$	-	0.15	-	%
		$V_{CC} = 1.65 \text{ V}; V_I = 1.2 \text{ V (p-p)}$	-	0.10	-	%
		$V_{CC} = 2.3 \text{ V}; V_I = 1.5 \text{ V (p-p)}$	-	0.02	-	%
		$V_{CC} = 2.7 \text{ V}; V_{I} = 2 \text{ V (p-p)}$	-	0.02	-	%
		$V_{CC} = 4.3 \text{ V}; V_{I} = 2 \text{ V (p-p)}$	-	0.02	-	%
f _(-3dB)	–3 dB frequency response	$R_L = 50 \Omega$; see Figure 19	<u>[1]</u>			
		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 20	[1]			
		V _{CC} = 1.4 V to 4.3 V	-	-90	-	dB
V _{ct}	crosstalk voltage	between digital inputs and switch; $f_i = 1 \text{ MHz}$; $C_L = 50 \text{ pF}$; $R_L = 50 \Omega$; see Figure 21				
		V _{CC} = 1.4 V to 3.6 V	-	0.2	-	V
		$V_{CC} = 3.6 \text{ V to } 4.3 \text{ V}$	-	0.3	-	V
Q _{inj}	charge injection	f_i = 1 MHz; C_L = 0.1 nF; R_L = 1 M Ω ; V_{gen} = 0 V; R_{gen} = 0 Ω ; see Figure 22				
		V _{CC} = 1.5 V	-	3	-	рС
		V _{CC} = 1.8 V	-	4	-	рС
		V _{CC} = 2.5 V	-	6	-	рС
		$V_{CC} = 3.3 \text{ V}$	-	9	-	рС
		$V_{CC} = 4.3 \text{ V}$	-	15	-	рС

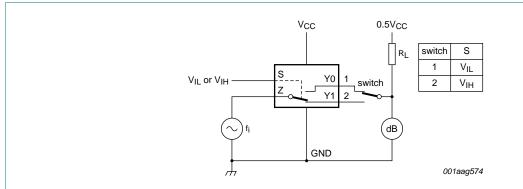
^[1] f_i is biased at $0.5V_{CC}$.

12.3 Test circuits



NX3L1G3157 **NXP Semiconductors**

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 $\label{eq:definition} \mbox{Adjust} \ f_i \ \mbox{voltage to obtain 0 dBm level at output. Increase} \ f_i \ \mbox{frequency until dB meter reads} \ -3 \ \mbox{dB}.$

Fig 19. Test circuit for measuring the frequency response when channel is in ON-state

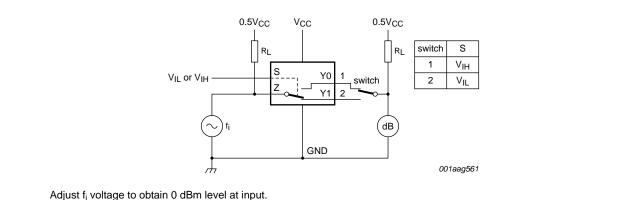
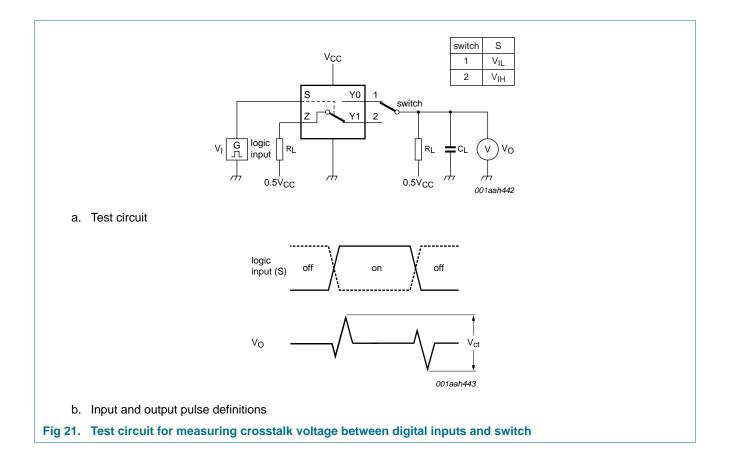
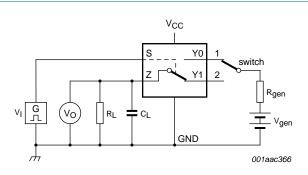


Fig 20. Test circuit for measuring isolation (OFF-state)

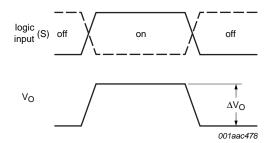
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a. Test circuit



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 22. Test circuit for measuring charge injection

13. Package outline

Plastic surface-mounted package; 6 leads **SOT363** Α X = v M A Q ⊕ w M B е detail X DIMENSIONS (mm are the original dimensions) Α1 UNIT Α D Ε С Q v е HΕ Lp w у max 0.30 0.25 0.45 0.25 1.1 2.2 1.35 2.2 0.65 1.3 0.1 1.8 0.20 0.10 8.0 1.15 0.15 0.15 **REFERENCES EUROPEAN** OUTLINE ISSUE DATE VERSION **PROJECTION** JEDEC IEC **JEITA**

Fig 23. Package outline SOT363 (SC-88)

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04-11-08

06-03-16

SOT363

SC-88

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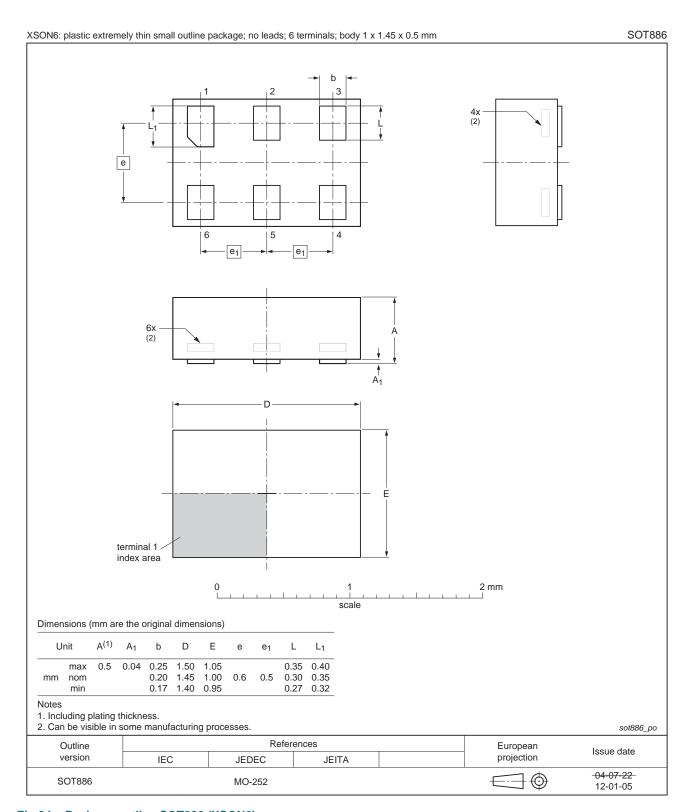


Fig 24. Package outline SOT886 (XSON6)

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14. Abbreviations

Table 13. Abbreviations

Acronym	Description
CDM	Charged Device Model
CMOS	Complementary Metal-Oxide Semiconductor
ESD	ElectroStatic Discharge
НВМ	Human Body Model
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 v.10	20120807	Product data sheet	-	NX3L1G3157 v.9
Modifications:	Package out	tline drawing of SOT886 (Fig	ure 24) modified.	
NX3L1G3157 v.9	20111109	Product data sheet	-	NX3L1G3157 v.8
Modifications:	 Legal pages 	updated.		
NX3L1G3157 v.8	20100426	Product data sheet	-	NX3L1G3157 v.7
NX3L1G3157 v.7	20100324	Product data sheet	-	NX3L1G3157 v.6
NX3L1G3157 v.6	20100208	Product data sheet	-	NX3L1G3157 v.5
NX3L1G3157 v.5	20090407	Product data sheet	-	NX3L1G3157 v.4
NX3L1G3157 v.4	20080730	Product data sheet	-	NX3L1G3157 v.3
NX3L1G3157 v.3	20080721	Product data sheet	-	NX3L1G3157 v.2
NX3L1G3157 v.2	20080415	Product data sheet	-	NX3L1G3157 v.1
NX3L1G3157 v.1	20071008	Product data sheet	-	-

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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.

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- [2] The term 'short data sheet' is explained in section "Definitions"
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