NX3L2G384

Dual low-ohmic single-pole single-throw analog switch

Rev. 01 — 18 September 2008 Product data sheet

1. General description

The NX3L2G384 provides two low-ohmic single pole single throw analog switch functions. Each switch has two input/output terminals (nY and nZ) and an active LOW enable input ($n\overline{E}$). When pin $n\overline{E}$ is HIGH, the analog switch is turned off.

Schmitt-trigger action at the enable input ($n\overline{E}$) makes the circuit tolerant to slower input rise and fall times across the entire V_{CC} range from 1.4 V to 3.6 V.

The NX3L2G384 allows signals with amplitude up to V_{CC} to be transmitted from nY to nZ; or from nZ to nY. Its low ON resistance (0.5 Ω) and flatness (0.13 Ω) ensures minimal attenuation and distortion of transmitted signals.

2. Features

- Wide supply voltage range from 1.4 V to 3.6 V
- Very low ON resistance (peak):
  - 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
- High noise immunity
- ESD protection:
  - HBM JESD22-A114E Class 3A exceeds 7500 V
  - MM JESD22-A115-A exceeds 200 V
  - CDM AEC-Q100-011 revision B exceeds 1000 V
- CMOS low-power consumption
- Latch-up performance exceeds 100 mA per JESD 78 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

3. Applications

- Cell phone
- PDA
- Portable media player

4. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
NX3L2G384GT	–40 °C to +125 °C	XSON8	plastic extremely thin small outline package; no leads; 8 terminals; body 1 × 1.95 × 0.5 mm	SOT833-1
NX3L2G384GM	–40 °C to +125 °C	XQFN8	plastic extremely thin quad flat package; no leads; 8 terminals; body 1.6 × 1.6 × 0.5 mm	SOT902-1

5. Marking

Table 2. Marking

Type number	Marking code
NX3L2G384GT	ML2
NX3L2G384GM	ML2

6. Functional diagram

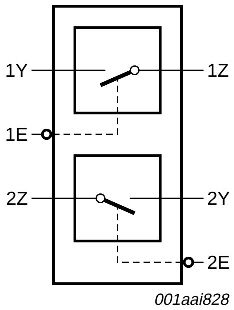


Fig 1. Logic symbol

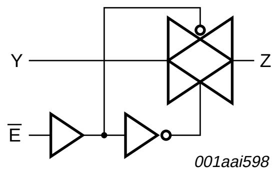


Fig 2. Logic diagram (one switch)

7. Pinning information

7.1 Pinning

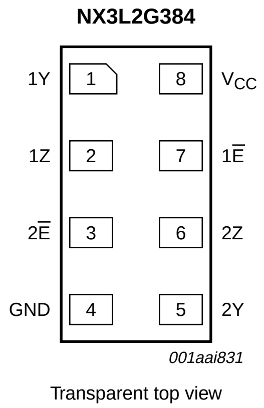


Fig 3. Pin configuration SOT833-1

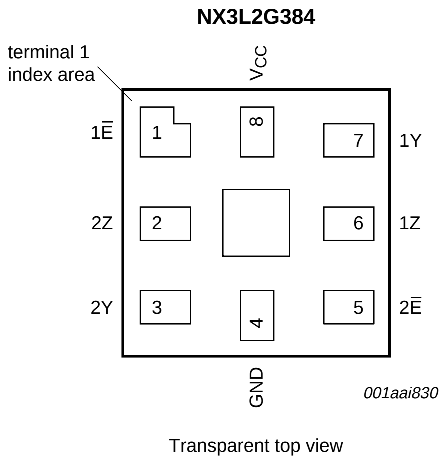


Fig 4. Pin configuration SOT902-1

7.2 Pin description

Table 3. Pin description

Symbol	Pin		Description
	SOT833-1	SOT902-1	
1Y, 2Y	1, 5	7, 3	independent input or output
1Z, 2Z	2, 6	6, 2	independent output or input
GND	4	4	ground (0 V)
$1\overline{E}$, $2\overline{E}$	7, 3	1, 5	enable input (active LOW)
V_{CC}	8	8	supply voltage

8. Functional description

Table 4. Function table[1]

Input $n\overline{E}$	Switch
L	ON
H	OFF

[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		[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.

[3] For XSON8 and XQFN8 packages: above 45 °C the value of P_{tot} derates linearly with 2.4 mW/K.

10. Recommended operating conditions

Table 6. Recommended operating conditions

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{CC}	supply voltage			1.4	-	3.6	V
V_I	input voltage	enable input $n\overline{E}$		0	-	3.6	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 3.6 V	[2]	-	-	200	ns/V

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

[2] Applies to control signal levels.

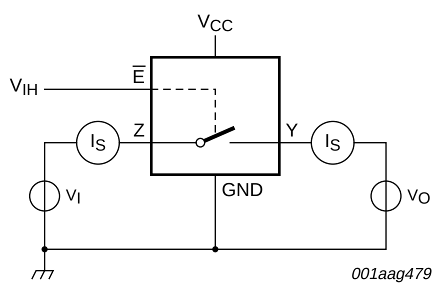
11. Static characteristics

Table 7. Static characteristics

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

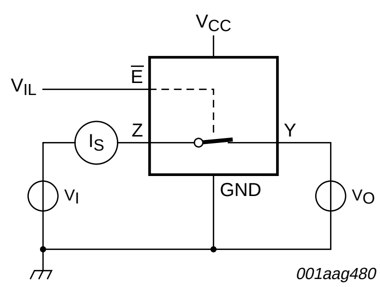
Symbol	Parameter	Conditions	25 °C			−40 °C to +125 °C			Unit
			Min	Typ	Max	Min	Max (85 °C)	Max (125 °C)	
V_{IH}	HIGH-level input voltage	V_{CC} = 1.4 V to 1.95 V	0.65V_{CC}	-	-	0.65V_{CC}	-	-	V
		V_{CC} = 2.3 V to 2.7 V	1.7	-	-	1.7	-	-	V
		V_{CC} = 2.7 V to 3.6 V	2.0	-	-	2.0	-	-	V
V_{IL}	LOW-level input 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
I_I	input leakage current	enable input n$\overline{E}$; V_I = GND to 3.6 V; V_{CC} = 1.4 V to 3.6 V	-	-	-	-	±0.5	±1	μA
$I_{S(OFF)}$	OFF-state leakage current	nY port; V_{CC} = 1.4 V to 3.6 V; see Figure 5	-	-	±5	-	±50	±500	nA
$I_{S(ON)}$	ON-state leakage current	nZ port; V_{CC} = 1.4 V to 3.6 V; see Figure 6	-	-	±5	-	±50	±500	nA
I_{CC}	supply current	V_I = V_{CC} or GND; V_{CC} = 3.6 V; V_{SW} = GND or V_{CC}	-	-	100		690	6000	nA
C_I	input capacitance		-	1.0	-	-	-	-	pF
$C_{S(OFF)}$	OFF-state capacitance		-	35	-	-	-	-	pF
$C_{S(ON)}$	ON-state capacitance		-	110	-	-	-	-	pF

11.1 Test circuits



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 OFF-state leakage current



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

Fig 6. 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 8 to Figure 13.

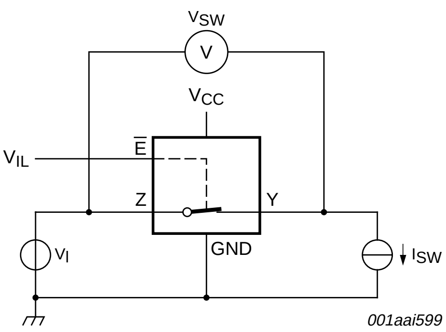
Symbol	Parameter	Conditions		−40 °C to +85 °C			−40 °C to +125 °C		Unit
				Min	Typ[1]	Max	Min	Max	
$R_{ON(peak)}$	ON resistance (peak)	V_I = GND to V_{CC}; I_{SW} = 100 mA; see Figure 7							
		V_{CC} = 1.4 V		-	1.6	3.7	-	4.1	Ω
		V_{CC} = 1.65 V		-	1.0	1.6	-	1.7	Ω
		V_{CC} = 2.3 V		-	0.55	0.8	-	0.9	Ω
		V_{CC} = 2.7 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
$R_{ON(flat)}$	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

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

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

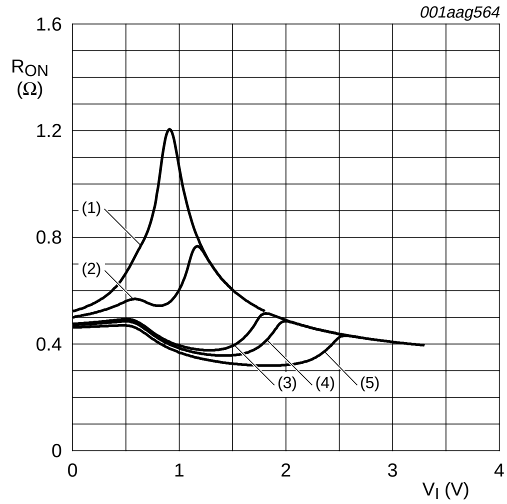
[3] Flatness is defined as the difference between the maximum and minimum value of ON resistance measured at identical V_{CC} and temperature.

11.3 ON resistance test circuit and graphs



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

Fig 7. Test circuit for measuring ON resistance



(1) V_{CC} = 1.5 V.

(2) V_{CC} = 1.8 V.

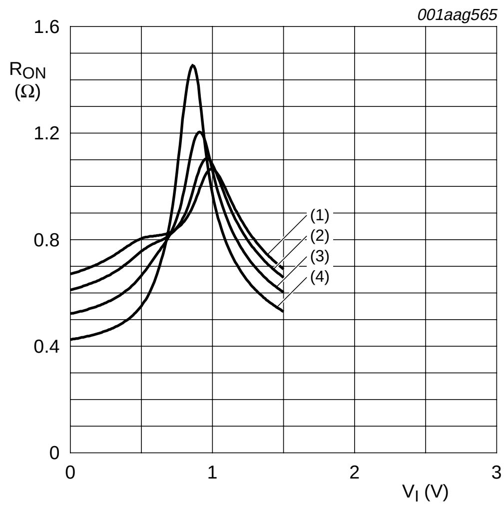
(3) V_{CC} = 2.5 V.

(4) V_{CC} = 2.7 V.

(5) V_{CC} = 3.3 V.

Measured at T_{amb} = 25 °C.

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



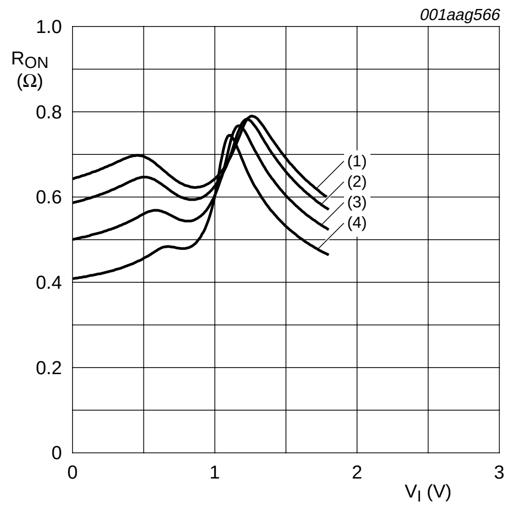
(1) T_{amb} = 125 °C.

(2) T_{amb} = 85 °C.

(3) T_{amb} = 25 °C.

(4) T_{amb} = −40 °C.

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



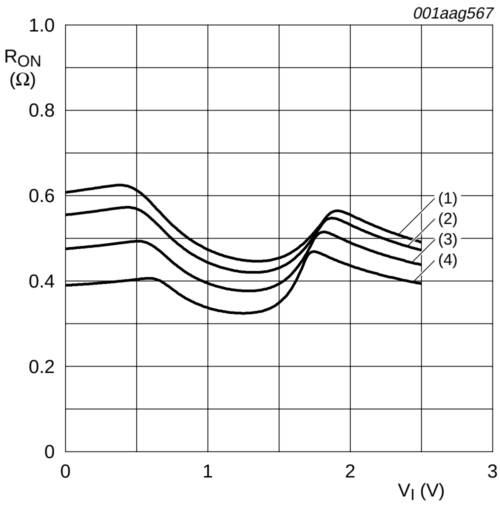
(1) T_{amb} = 125 °C.

(2) T_{amb} = 85 °C.

(3) T_{amb} = 25 °C.

(4) T_{amb} = −40 °C.

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



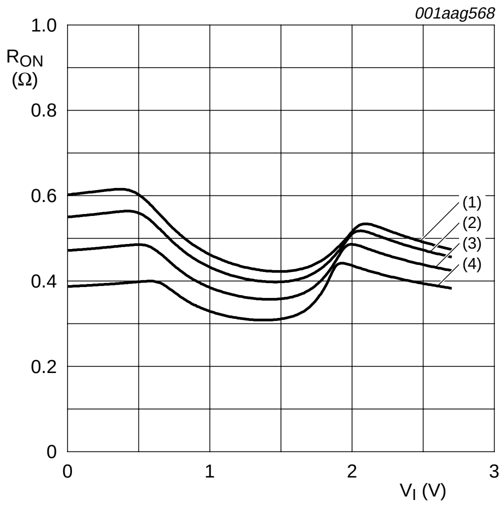
(1) T_{amb} = 125 °C.

(2) T_{amb} = 85 °C.

(3) T_{amb} = 25 °C.

(4) T_{amb} = −40 °C.

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



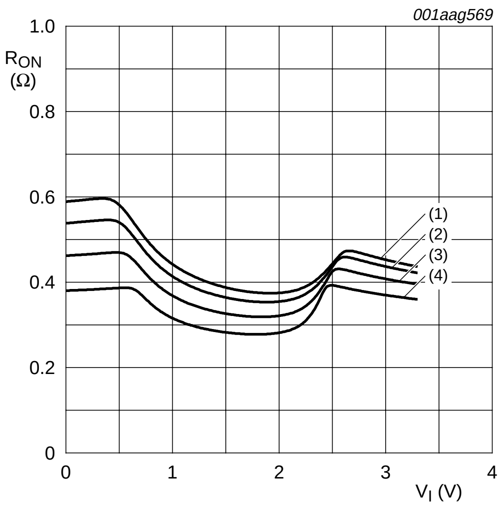
(1) T_{amb} = 125 °C.

(2) T_{amb} = 85 °C.

(3) T_{amb} = 25 °C.

(4) T_{amb} = −40 °C.

Fig 12. 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 13. ON resistance as a function of input voltage; V_{CC} = 3.3 V

12. Dynamic characteristics

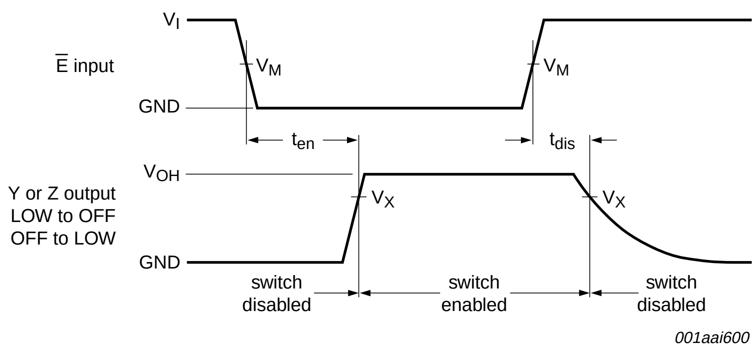
Table 9. Dynamic characteristics

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

Symbol	Parameter	Conditions	25 °C			−40 °C to +125 °C			Unit
			Min	Typ[1]	Max	Min	Max (85 °C)	Max (125 °C)	
t_{en}	enable time	n$\overline{E}$ to nZ or nY; see Figure 14							
		V_{CC} = 1.4 V to 1.6 V	-	27	41	-	44	48	ns
		V_{CC} = 1.65 V to 1.95 V	-	23	35	-	37	40	ns
		V_{CC} = 2.3 V to 2.7 V	-	17	26	-	28	31	ns
		V_{CC} = 2.7 V to 3.6 V	-	14	24	-	25	27	ns
t_{dis}	disable time	n$\overline{E}$ to nZ or nY; see Figure 14							
		V_{CC} = 1.4 V to 1.6 V	-	9	17	-	19	21	ns
		V_{CC} = 1.65 V to 1.95 V	-	7	13	-	14	15	ns
		V_{CC} = 2.3 V to 2.7 V	-	4	8	-	9	10	ns
		V_{CC} = 2.7 V to 3.6 V	-	3	7	-	8	9	ns

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

12.1 Waveform and test circuits



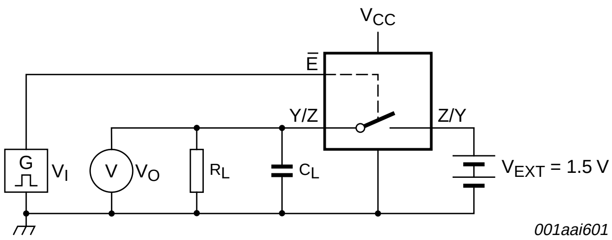
Measurement points are given in Table 10.

Logic level: V_{OH} is the typical output voltage 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 3.6 V	$0.5V_{CC}$	$0.9V_{OH}$



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 15. 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 3.6 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.

Symbol	Parameter	Conditions		25 °C			Unit
				Min	Typ	Max	
THD	total harmonic distortion	f_i = 20 Hz to 20 kHz; R_L = 32 Ω; see Figure 16	[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)		-	0.015	-	%
		V_{CC} = 2.7 V; V_I = 2 V (p-p)		-	0.024	-	%
$f_{(-3dB)}$	−3 dB frequency response	R_L = 50 Ω; see Figure 17	[1]				
		V_{CC} = 1.4 V to 3.6 V		-	60	-	MHz
α_{iso}	isolation (OFF-state)	f_i = 100 kHz; R_L = 50 Ω; see Figure 18	[1]				
		V_{CC} = 1.4 V to 3.6 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 19					
		V_{CC} = 1.4 V to 3.6 V		-	0.16	-	V
Xtalk	crosstalk	between switches; f_i = 100 kHz; R_L = 50 Ω; see Figure 20	[1]				
		V_{CC} = 1.4 V to 3.6 V		-	−90	-	dB

Table 12. Additional dynamic characteristics *...continued*

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.

Symbol	Parameter	Conditions	25 °C			Unit
			Min	Typ	Max	
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	-	3	-	pC
		V_{CC} = 2.5 V	-	3	-	pC
		V_{CC} = 3.3 V	-	3	-	pC

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

13. Test circuits

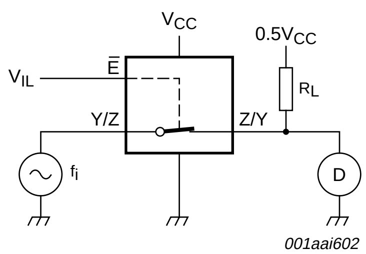
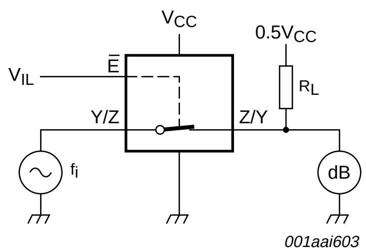
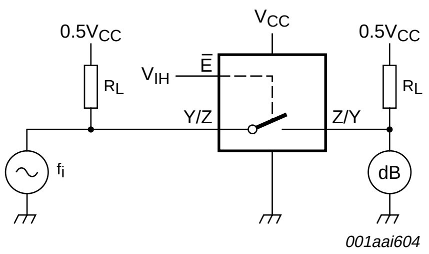


Fig 16. Test circuit for measuring total harmonic distortion



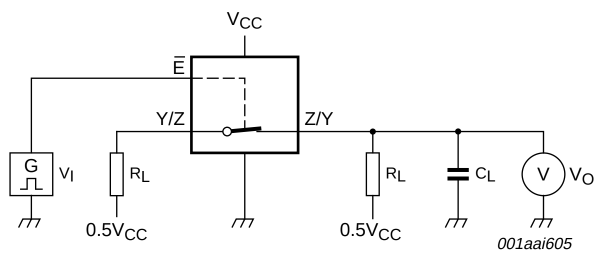
Adjust f_i voltage to obtain 0 dBm level at output. Increase f_i frequency until dB meter reads –3 dB.

Fig 17. Test circuit for measuring the frequency response when channel is in ON-state

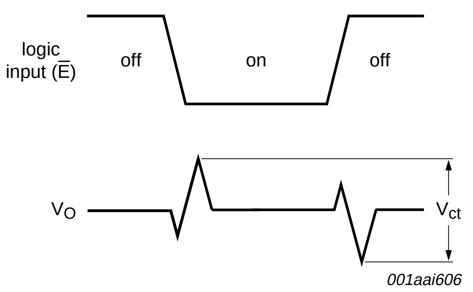


Adjust f_i voltage to obtain 0 dBm level at input.

Fig 18. Test circuit for measuring isolation (OFF-state)

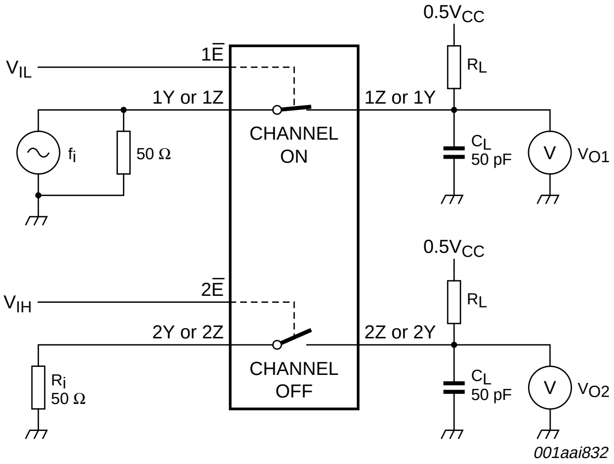


a. Test circuit



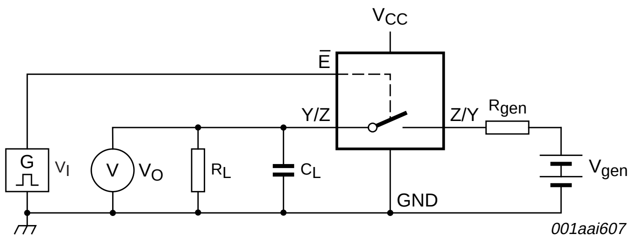
b. input and output pulse definitions

Fig 19. Test circuit for measuring crosstalk voltage between digital inputs and switch

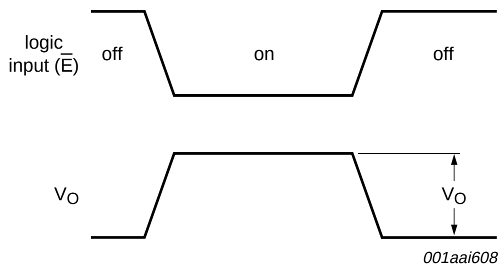


20 $\log_{10}$ (V_{O2} / V_{O1}) or 20 $\log_{10}$ (V_{O1} / V_{O2}).

Fig 20. Test circuit for measuring crosstalk between switches



a. Test circuit



b. Input and output pulse definitions

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

ΔV_O = output voltage variation.

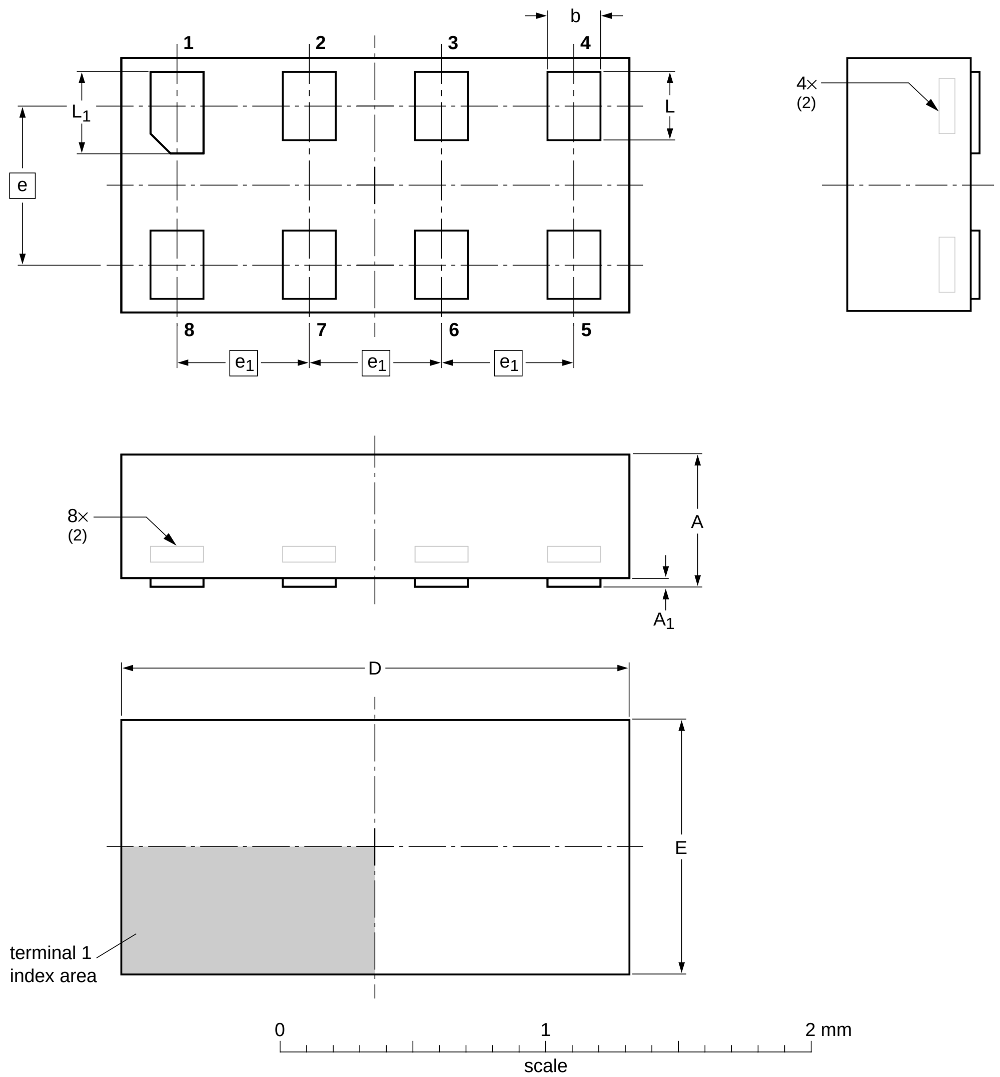
R_{gen} = generator resistance.

V_{gen} = generator voltage.

Fig 21. Test circuit for measuring charge injection

14. Package outline

XSON8: plastic extremely thin small outline package; no leads; 8 terminals; body 1 x 1.95 x 0.5 mm **SOT833-1**



DIMENSIONS (mm are the original dimensions)

UNIT	A(1) max	A_1 max	b	D	E	e	e_1	L	L_1
mm	0.5	0.04	0.25 0.17	2.0 1.9	1.05 0.95	0.6	0.5	0.35 0.27	0.40 0.32

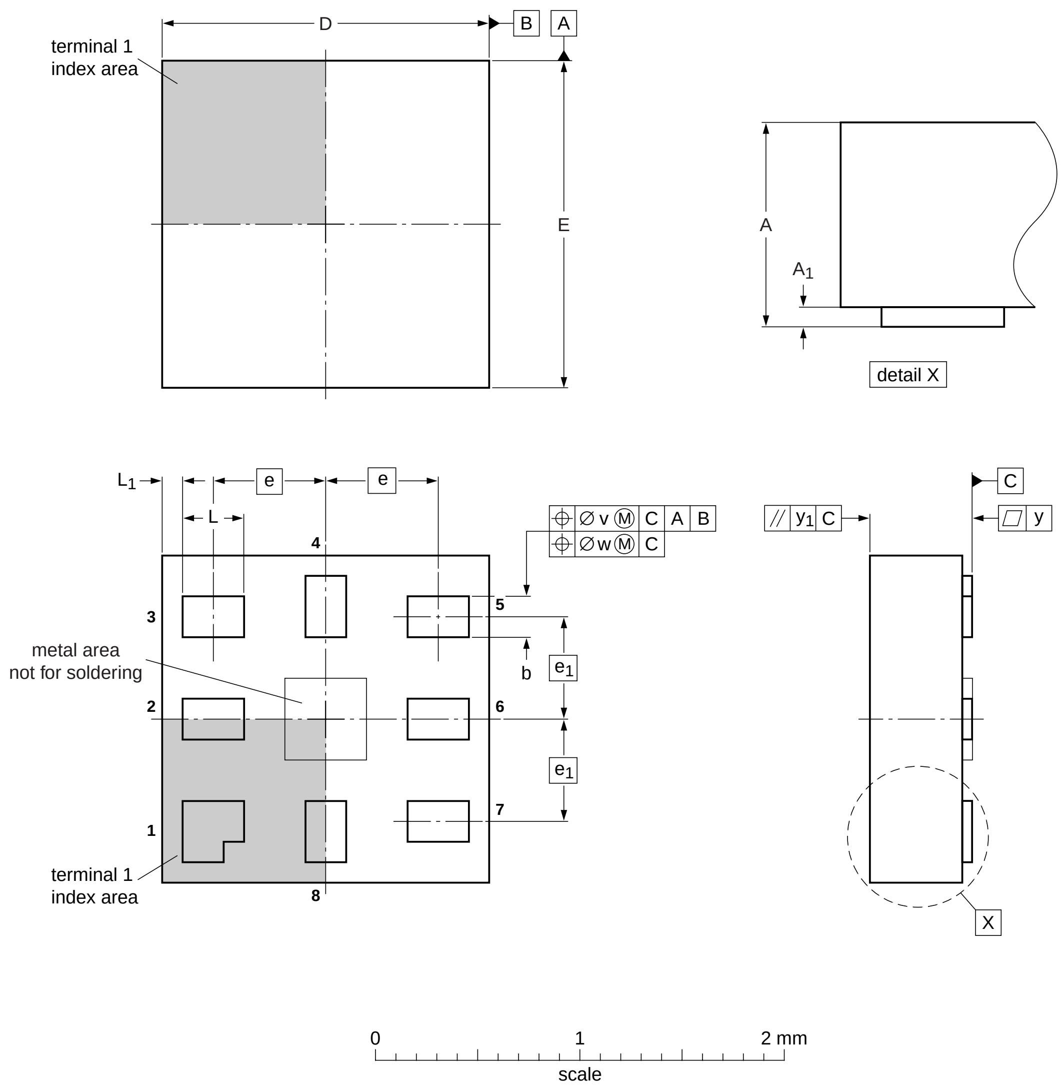
Notes

1. Including plating thickness.
2. Can be visible in some manufacturing processes.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT833-1	- - -	MO-252	- - -			~~07-11-14~~ 07-12-07

Fig 22. Package outline SOT833-1 (XSON8)

XQFN8U: plastic extremely thin quad flat package; no leads; 8 terminals; UTLP based; body 1.6 x 1.6 x 0.5 mm **SOT902-1**



DIMENSIONS (mm are the original dimensions)

UNIT	A max	A_1	b	D	E	e	e_1	L	L_1	v	w	y	y_1
mm	0.5	0.05 0.00	0.25 0.15	1.65 1.55	1.65 1.55	0.55	0.5	0.35 0.25	0.15 0.05	0.1	0.05	0.05	0.05

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT902-1	- - -	MO-255	- - -			~~05-11-25~~ 07-11-14

Fig 23. Package outline SOT902-1 (XQFN8)

15. 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

16. Revision history

Table 14. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
NX3L2G384_1	20080918	Product data sheet	-	-

17. Legal information

17.1 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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19. Contents

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Date of release: 18 September 2008

Document identifier: NX3L2G384_1