

NX3L1G3157

Low-ohmic single-pole double-throw analog switch

Rev. 10.1 — 24 November 2020

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 $V_{CC} = 1.4$ 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:
 - 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

3 Applications

- Cell phone
- PDA
- Portable media player



4 Ordering information

Table 1. Ordering information

Type number	Topside marking ^[1]	Package		
		Name	Description	Version
NX3L1G3157GM	MJ	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body 1 x 1.45 x 0.5 mm	SOT886

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

4.1 Ordering options

Table 2. Ordering options

Type number	Orderable part number	Package	Packing method	Minimum order quantity	Temperature
NX3L1G3157GM	NX3L1G3157GM,115 ^[1]	XSON6	REEL 7" Q1 NDP	5000	T _{amb} = -40 °C to +125 °C
NX3L1G3157GM	NX3L1G3157GMZ	XSON6	REEL 7" Q1 NDP SSB ^[2]	5000	T _{amb} = -40 °C to +125 °C

[1] Will go EOL - migrate to new leadframe NX3L1G3157GMZ orderable part number

[2] This packing method uses a Static Shielding Bag (SSB) solution. Material is to be kept in the sealed bag between uses.

5 Functional diagram

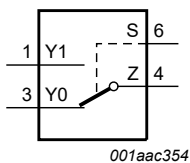


Figure 1. Logic symbol

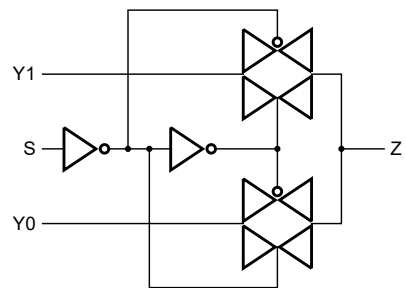
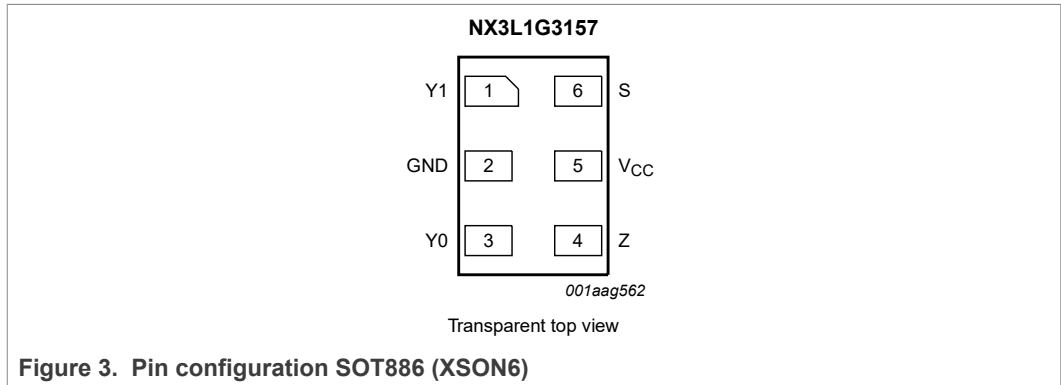


Figure 2. Logic diagram

6 Pinning information

6.1 Pinning



6.2 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

7 Functional description

Table 4. Function table^[1]

Input S	Channel on
L	Y0
H	Y1

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

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	+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

Table 5. Limiting values...continued

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Max	Unit
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 XSON6 package: above 118 °C the value of P_{tot} derates linearly with 7.8 mW/K.

9 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
Δt/ΔV	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.

10 Static characteristics

Table 7. Static characteristics

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

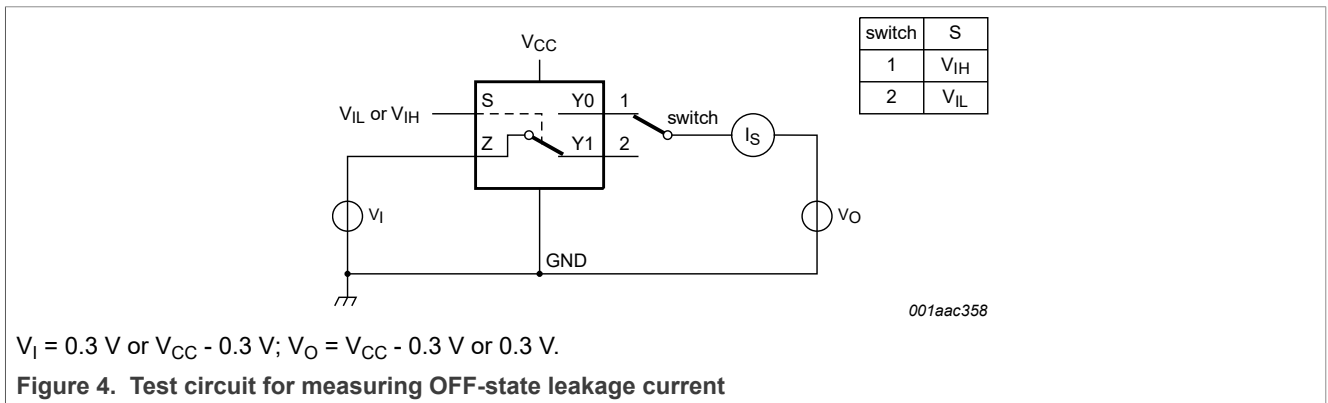
Symbol	Parameter	Conditions	T _{amb} = 25 °C			T _{amb} = -40 °C to +125 °C			Unit
			Min	Typ	Max	Min	Max (85 °C)	Max (125 °C)	
V _{IH}	HIGH-level input voltage	V _{CC} = 1.4 V to 1.95 V	0.65V _{CC}	-	-	0.65V _{CC}	-	-	V
		V _{CC} = 2.3 V to 2.7 V	1.7	-	-	1.7	-	-	V
		V _{CC} = 2.7 V to 3.6 V	2.0	-	-	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

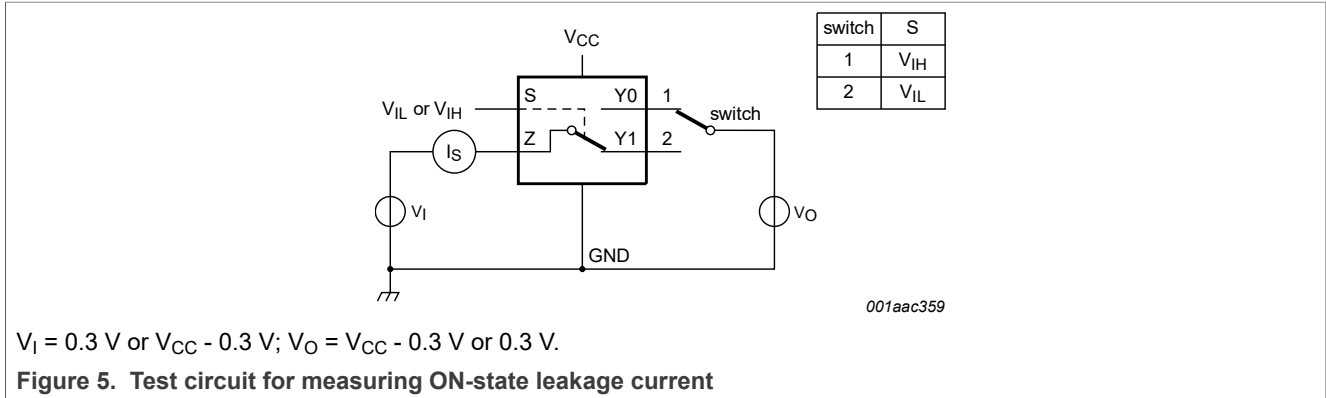
Table 7. Static characteristics...continued

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)	
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

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 13.

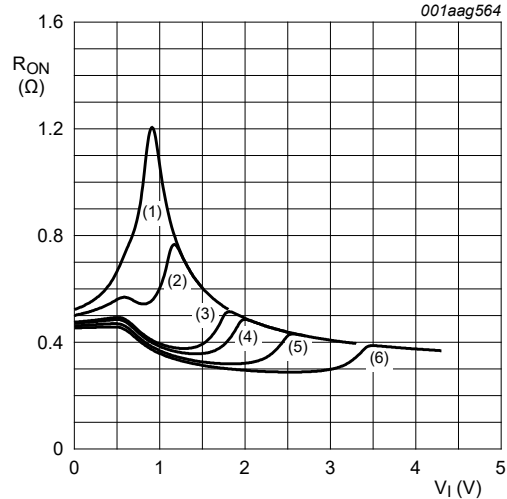
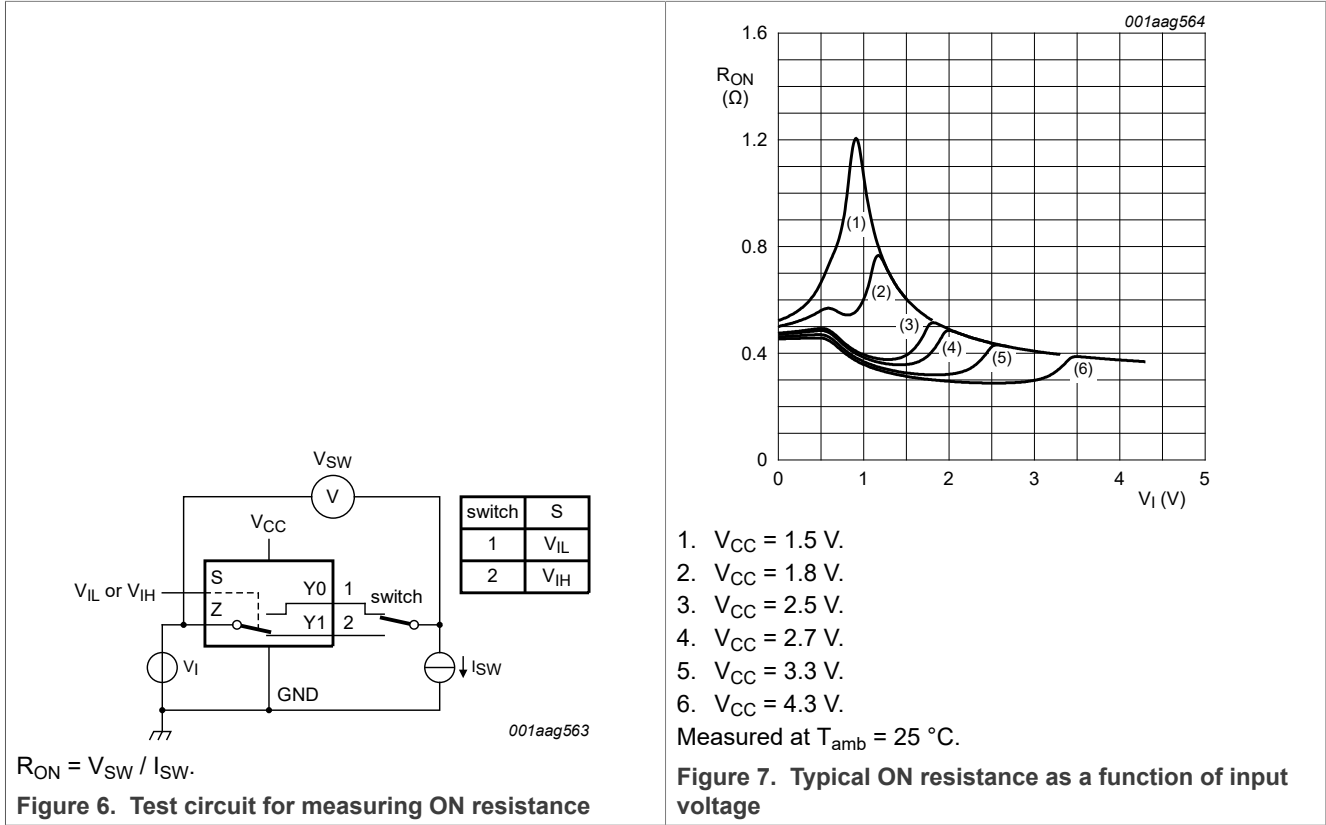
Symbol	Parameter	Conditions	T _{amb} = -40 °C to +85 °C			T _{amb} = -40 °C to +125 °C		Unit
			Min	Typ ^[1]	Max	Min	Max	
R _{ON(peak)}	ON resistance (peak)	V _I = GND to V _{CC} ; I _{SW} = 100 mA; see Figure 6						
		V _{CC} = 1.4 V	-	1.6	3.7	-	4.1	Ω
		V _{CC} = 1.65 V	-	1.0	1.6	-	1.7	Ω
		V _{CC} = 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.

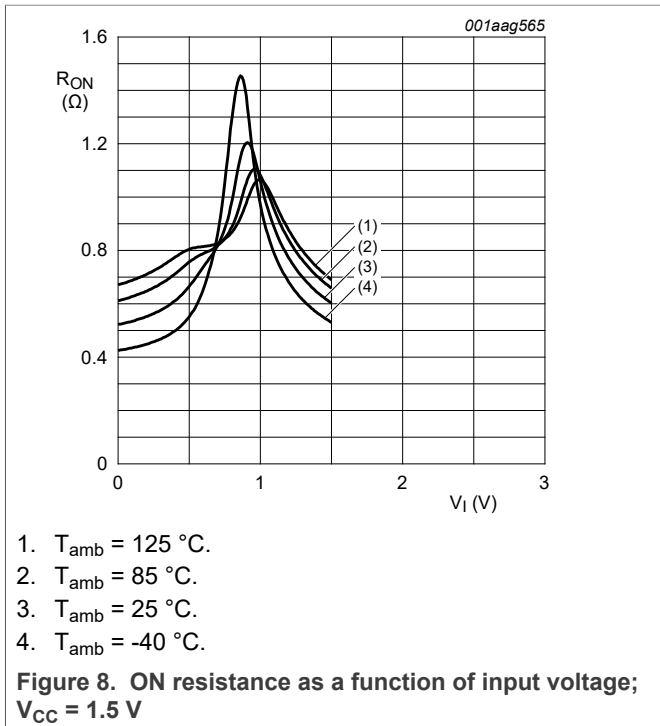
[3] Flatness is defined as the difference between the maximum and minimum value of ON resistance measured at identical V_{CC} and temperature.

10.3 ON resistance test circuit and graphs



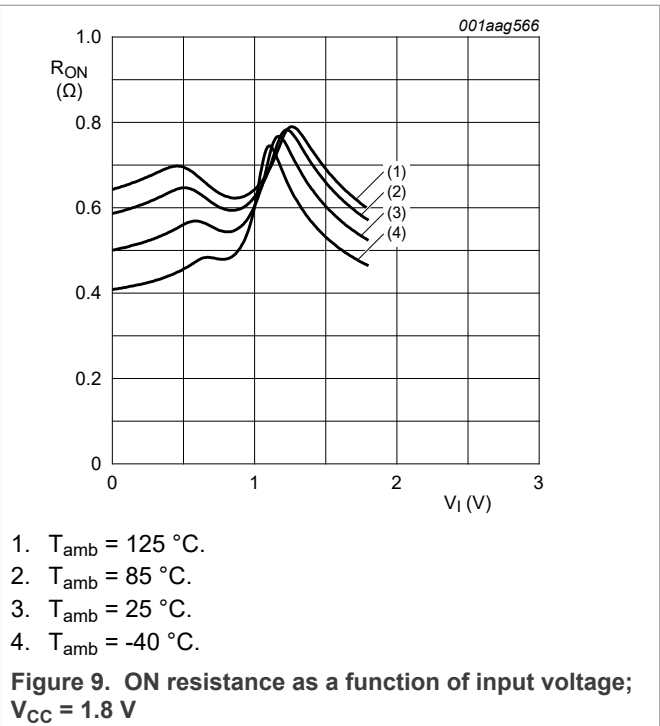
1. V_{CC} = 1.5 V.
 2. V_{CC} = 1.8 V.
 3. V_{CC} = 2.5 V.
 4. V_{CC} = 2.7 V.
 5. V_{CC} = 3.3 V.
 6. V_{CC} = 4.3 V.
- Measured at T_{amb} = 25 °C.

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



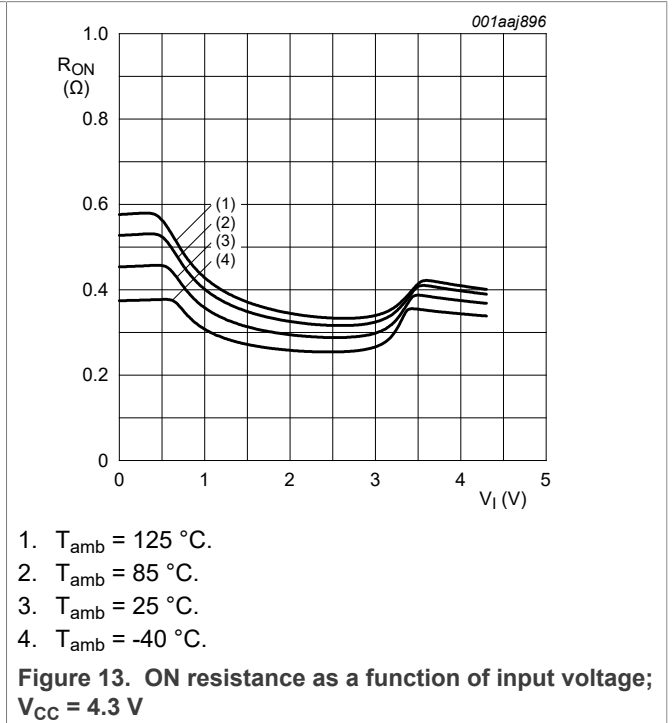
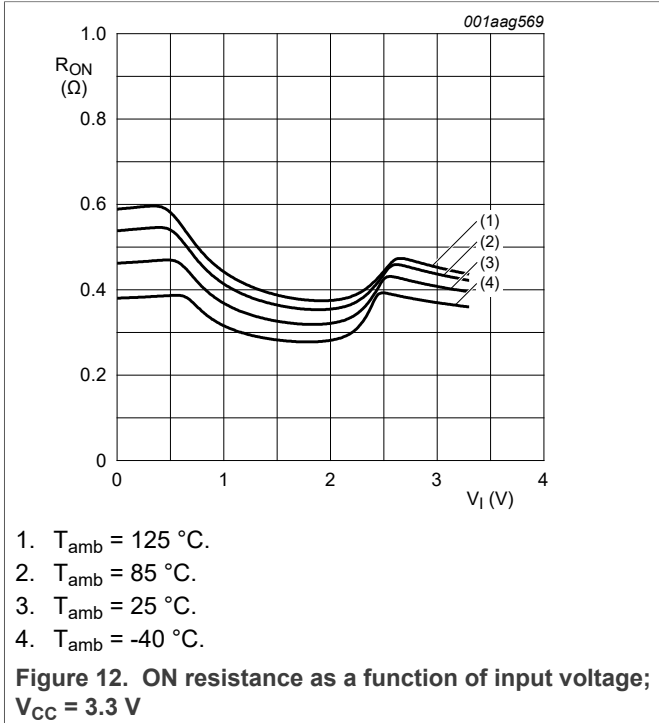
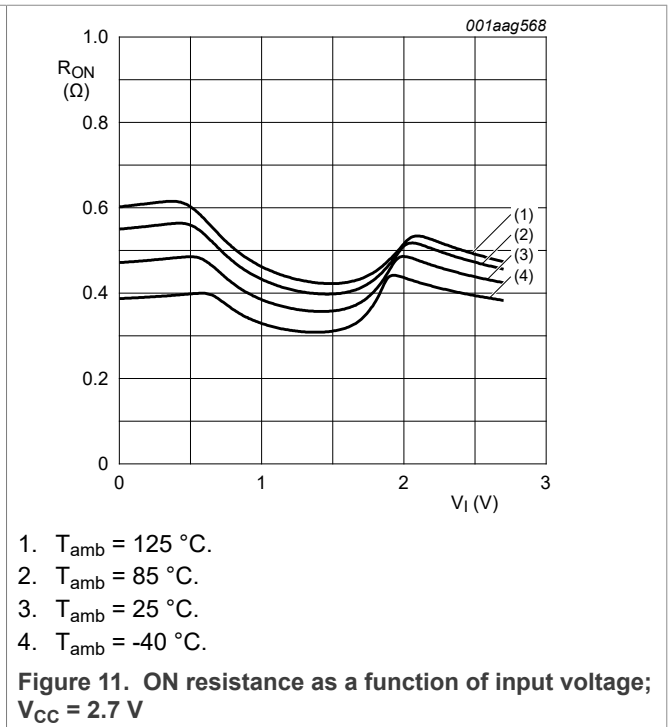
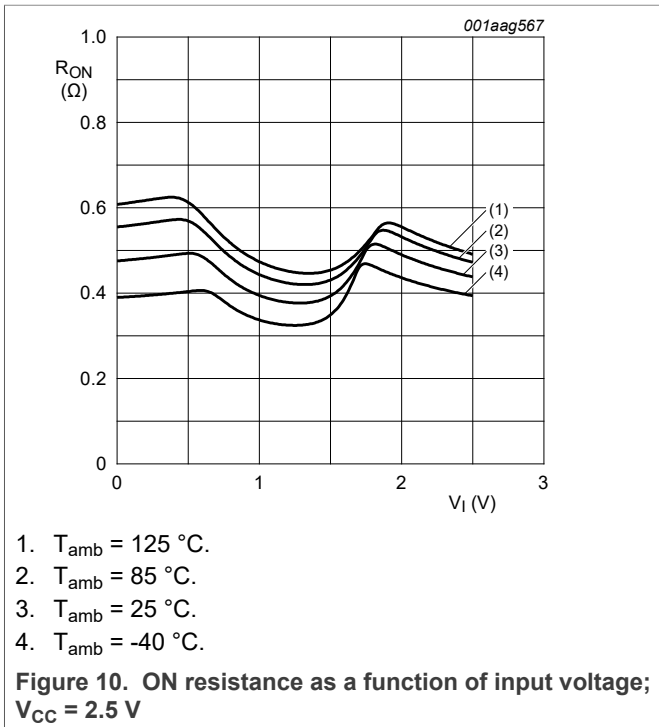
1. T_{amb} = 125 °C.
2. T_{amb} = 85 °C.
3. T_{amb} = 25 °C.
4. T_{amb} = -40 °C.

Figure 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.

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



11 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
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.

11.1 Waveform and test circuits

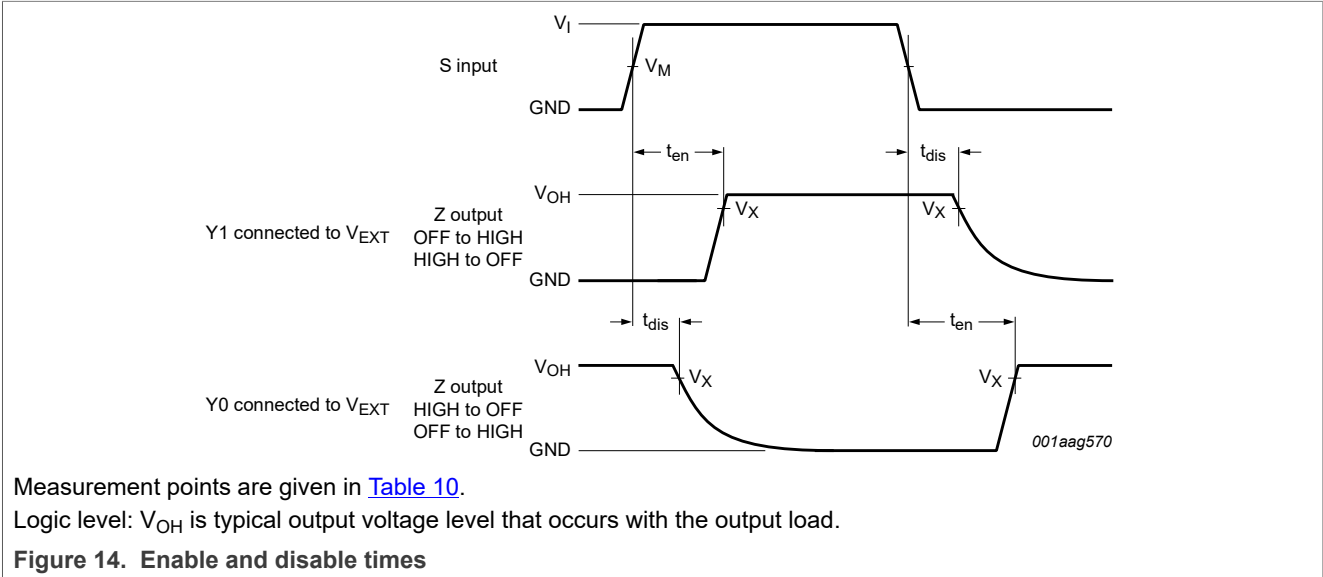


Table 10. Measurement points

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

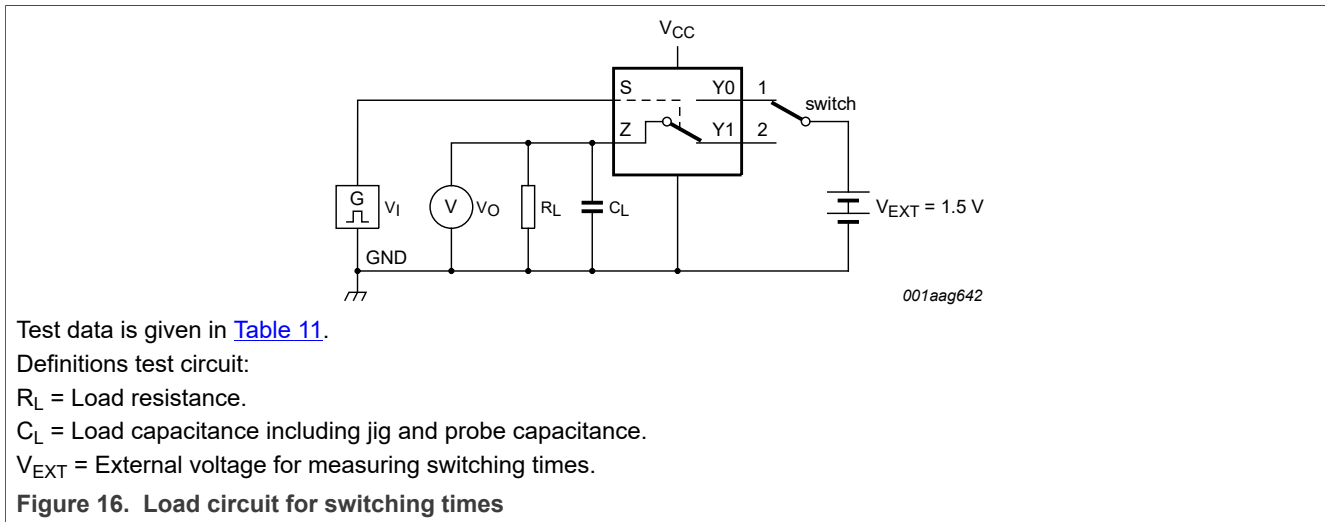
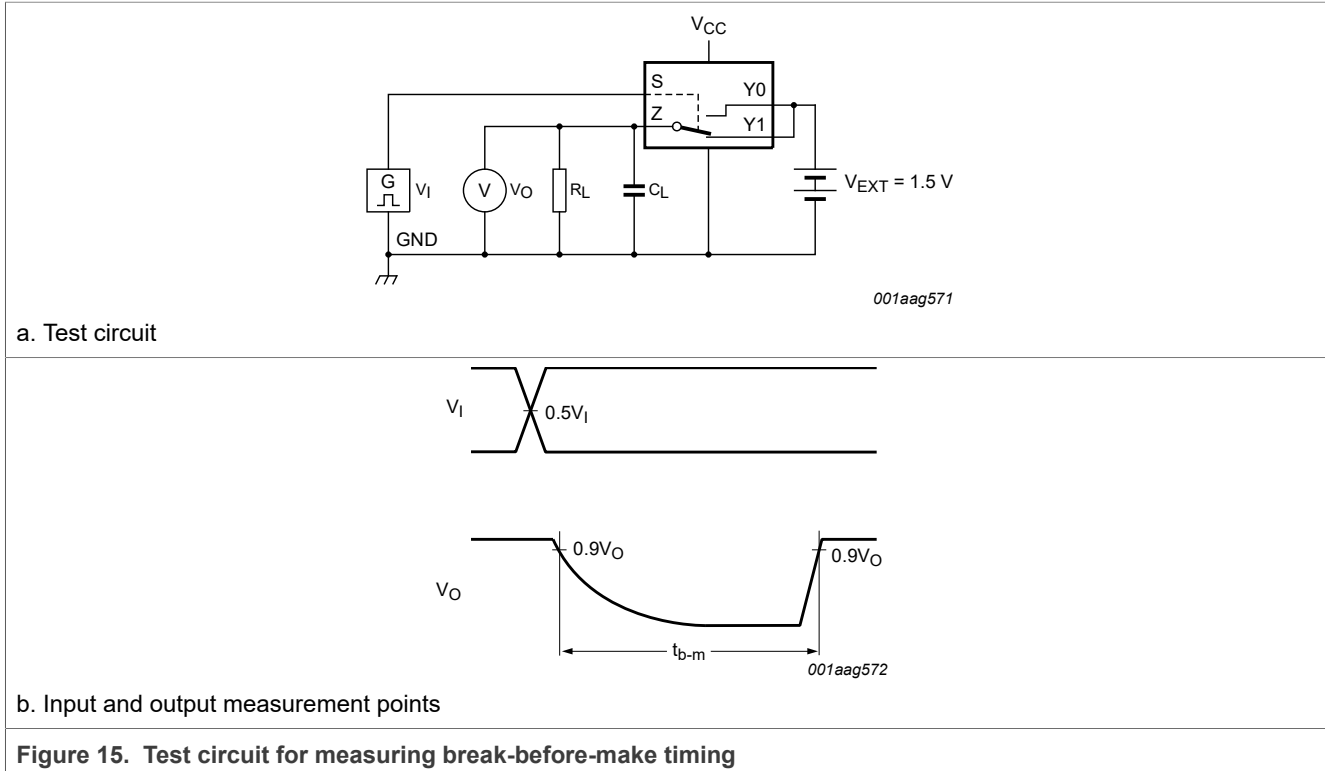


Table 11. Test data

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

11.2 Additional dynamic characteristics

Table 12. Additional dynamic characteristics

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

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

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

11.3 Test circuits

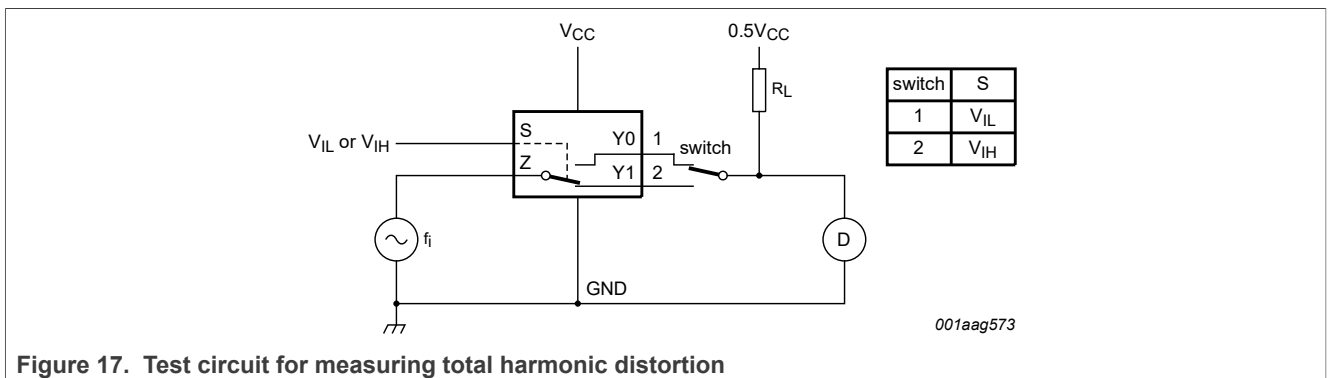
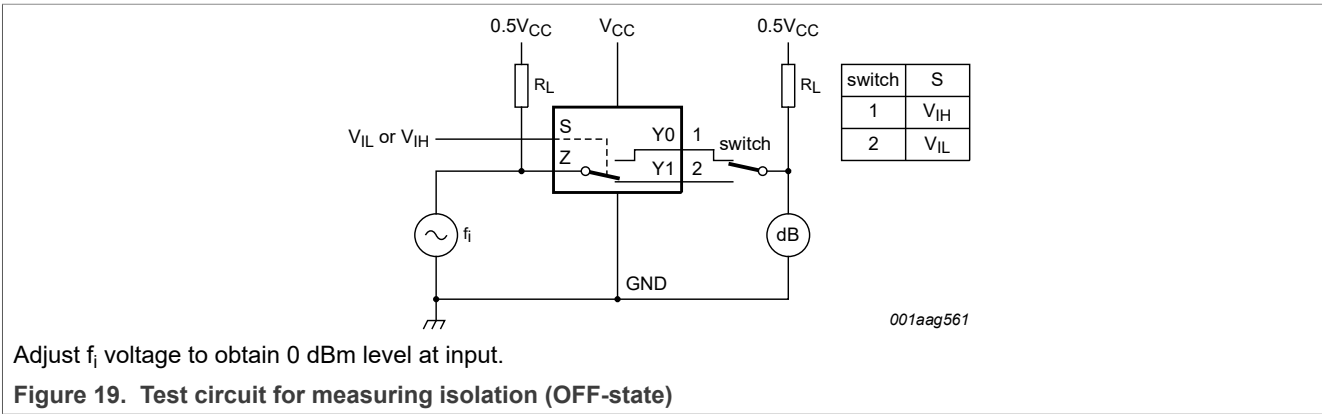
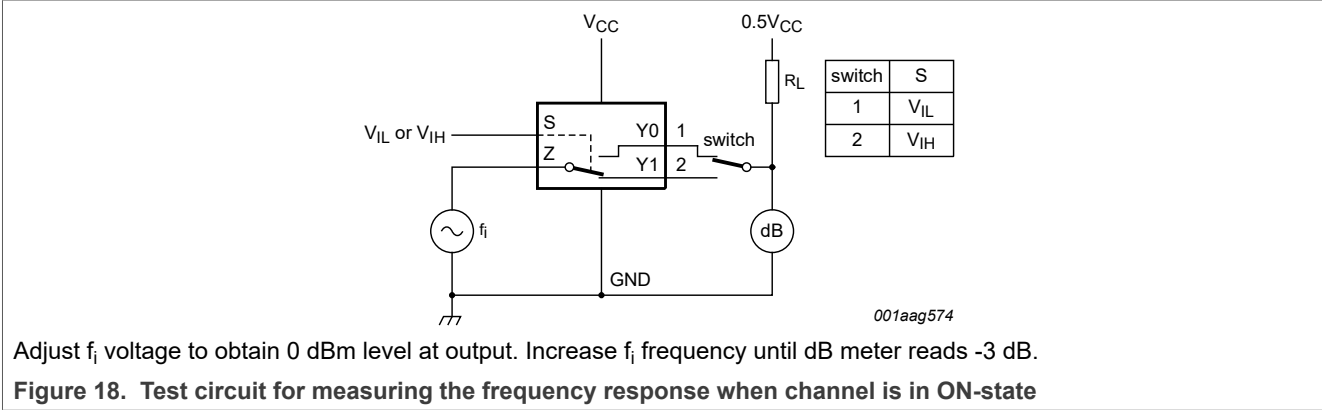
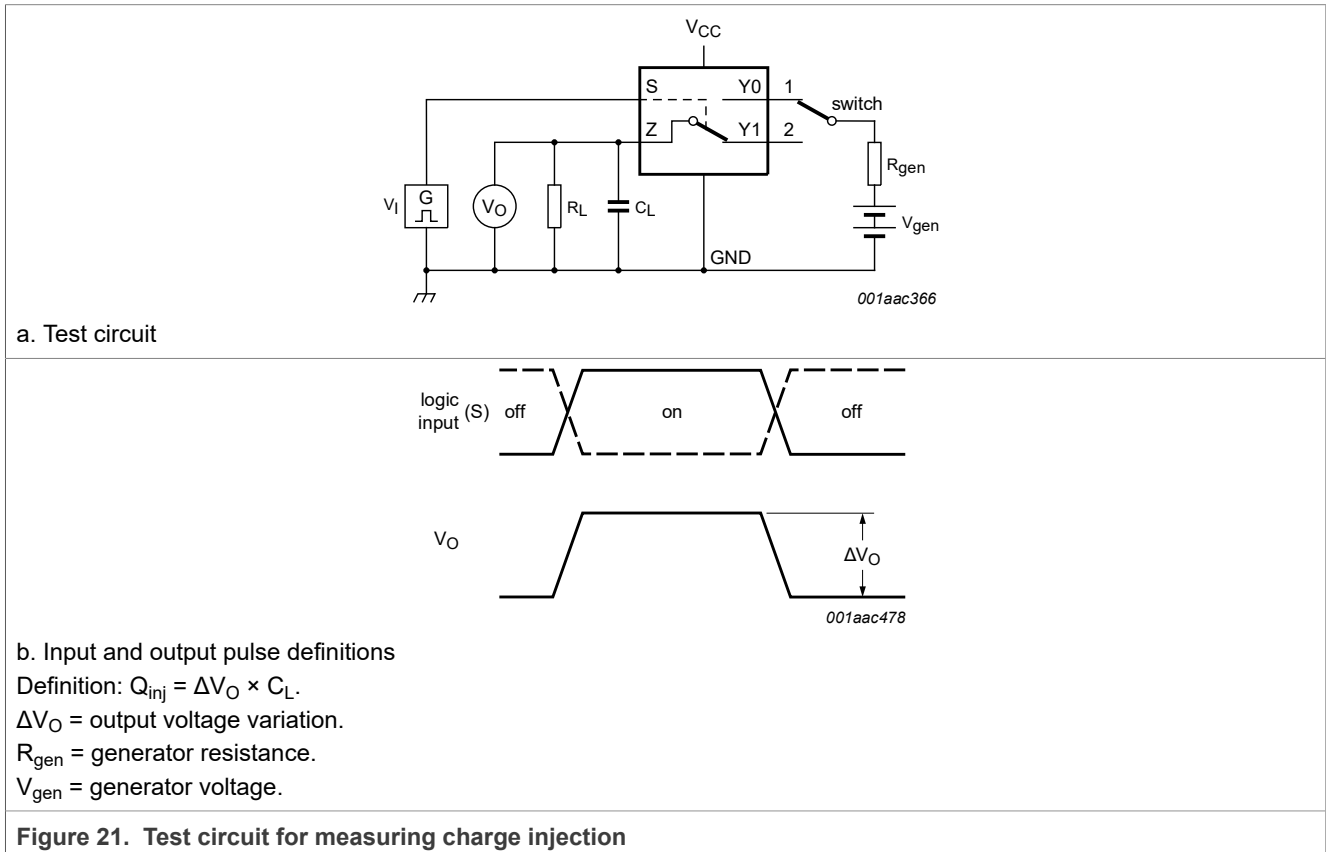
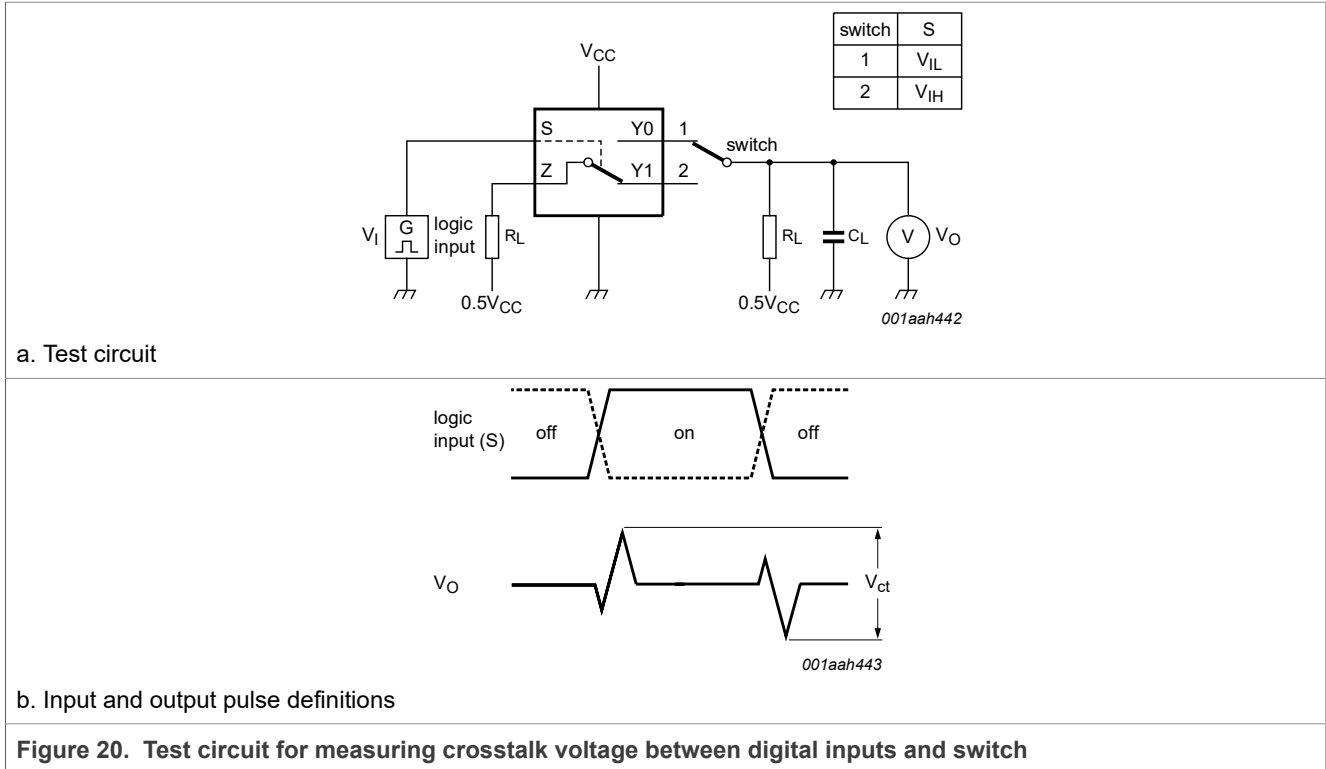


Figure 17. Test circuit for measuring total harmonic distortion





12 Package outline

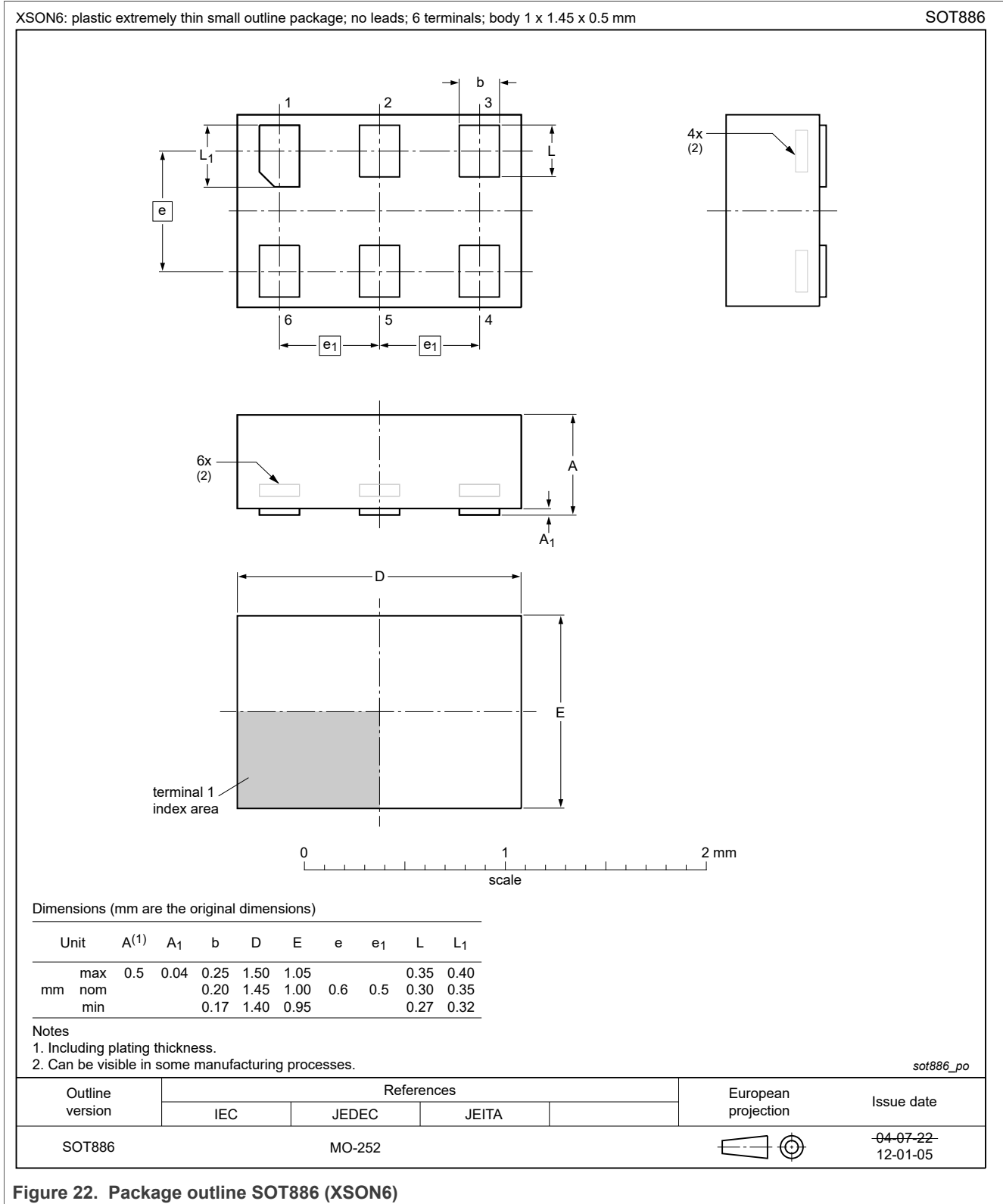


Figure 22. Package outline SOT886 (XSON6)

13 Abbreviations

Table 13. Abbreviations

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

14 Revision history

Table 14. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
NX3L1G3157 v.10.1	20201124	Product data sheet	-	NX3L1G3157 v.10
Modifications:	<ul style="list-style-type: none"> Package SOT886 requiring SSB added. Refer to PCN number 201909001 XSON6 (SOT886) Assembly/Test Transfer from ATGD and ATSN to ATBK Removed NX3L1G3157GW,125 			
NX3L1G3157 v.10	20120807	Product data sheet	-	NX3L1G3157 v.9
Modifications:	<ul style="list-style-type: none"> Package outline drawing of SOT886 (Figure 22) modified. 			
NX3L1G3157 v.9	20111109	Product data sheet	-	NX3L1G3157 v.8
Modifications:	<ul style="list-style-type: none"> 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	-	-

15 Legal information

15.1 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.
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Low-ohmic single-pole double-throw analog switch

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