

# NX3L1G66-Q100

## Low-ohmic single-pole single-throw analog switch

Rev. 1 — 28 October 2013

Product data sheet

### 1. General description

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The NX3L1G66-Q100 is a low-ohmic single-pole single-throw analog switch. It has two input/output terminals (Y and Z) and an active HIGH enable input pin (E). When E is LOW, the analog switch is turned off.

Schmitt trigger action at the enable input (E) makes the circuit tolerant to slower input rise and fall times. The NX3L1G66-Q100 allows signals with amplitude up to  $V_{CC}$  to be transmitted from Y to Z; or from Z to Y. Its low ON resistance ( $0.5\ \Omega$ ) and flatness ( $0.13\ \Omega$ ) 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

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- Automotive product qualification in accordance with AEC-Q100 (Grade 1)
  - ◆ Specified from  $-40\ ^\circ\text{C}$  to  $+85\ ^\circ\text{C}$  and from  $-40\ ^\circ\text{C}$  to  $+125\ ^\circ\text{C}$
- Wide supply voltage range from 1.4 V to 4.3 V
- Very low ON resistance (peak):
  - ◆  $1.6\ \Omega$  (typical) at  $V_{CC} = 1.4\ \text{V}$
  - ◆  $1.0\ \Omega$  (typical) at  $V_{CC} = 1.65\ \text{V}$
  - ◆  $0.55\ \Omega$  (typical) at  $V_{CC} = 2.3\ \text{V}$
  - ◆  $0.50\ \Omega$  (typical) at  $V_{CC} = 2.7\ \text{V}$
  - ◆  $0.50\ \Omega$  (typical) at  $V_{CC} = 4.3\ \text{V}$
- 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 ( $C = 200\ \text{pF}$ ,  $R = 0\ \Omega$ )
  - ◆ CDM AEC-Q100-011 revision B exceeds 1000 V
  - ◆ IEC61000-4-2 contact discharge exceeds 4000 V for switch ports
- 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)



### 3. Applications

- Cell phone
- PDA
- Portable media player

### 4. Ordering information

Table 1. Ordering information

Type number	Package			Version
	Temperature range	Name	Description	
NX3L1G66GW-Q100	-40 °C to +125 °C	TSSOP5	plastic thin shrink small outline package; 5 leads; body width 1.25 mm	SOT353-1

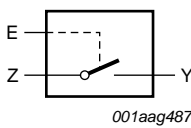
### 5. Marking

Table 2. Marking codes<sup>[1]</sup>

Type number	Marking code
NX3L1G66GW-Q100	DL

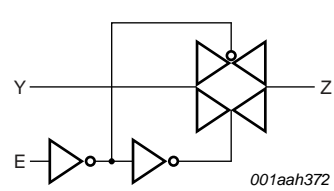
[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

### 6. Functional diagram



001aag487

**Fig 1. Logic symbol**

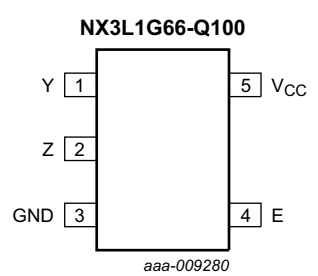


001aah372

**Fig 2. Logic diagram**

### 7. Pinning information

#### 7.1 Pinning



NX3L1G66-Q100

Y 1 5 V<sub>CC</sub>

Z 2

GND 3 4 E

aaa-009280

**Fig 3. Pin configuration SOT353-1 (TSSOP5)**

## 7.2 Pin description

**Table 3.** Pin description

Symbol	Pin	Description
Y	1	independent input or output
Z	2	independent output or input
GND	3	ground (0 V)
E	4	enable input (active HIGH)
n.c.	-	not connected
V <sub>CC</sub>	5	supply voltage

## 8. Functional description

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

Input E	Switch
L	OFF-state
H	ON-state

[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 <sub>CC</sub>	supply voltage		-0.5	+4.6	V
V <sub>I</sub>	input voltage	enable input E	<sup>[1]</sup> -0.5	+4.6	V
V <sub>SW</sub>	switch voltage		<sup>[2]</sup> -0.5	V <sub>CC</sub> + 0.5	V
I <sub>IK</sub>	input clamping current	V <sub>I</sub> < -0.5 V	-50	-	mA
I <sub>SK</sub>	switch clamping current	V <sub>I</sub> < -0.5 V or V <sub>I</sub> > V <sub>CC</sub> + 0.5 V	-	±50	mA
I <sub>SW</sub>	switch current	V <sub>SW</sub> > -0.5 V or V <sub>SW</sub> < V <sub>CC</sub> + 0.5 V; source or sink current	-	±350	mA
		V <sub>SW</sub> > -0.5 V or V <sub>SW</sub> < V <sub>CC</sub> + 0.5 V; pulsed at 1 ms duration, < 10 % duty cycle; peak current	-	±500	mA
T <sub>stg</sub>	storage temperature		-65	+150	°C
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> = -40 °C to +125 °C	<sup>[3]</sup> -	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 TSSOP5 package: above 87.5 °C the value of P<sub>tot</sub> derates linearly with 4.0 mW/K.

## 10. Recommended operating conditions

**Table 6. Recommended operating conditions**

Symbol	Parameter	Conditions	Min	Max	Unit
V <sub>CC</sub>	supply voltage		1.4	4.3	V
V <sub>I</sub>	input voltage	enable input E	0	4.3	V
V <sub>SW</sub>	switch voltage		[1] 0	V <sub>CC</sub>	V
T <sub>amb</sub>	ambient temperature		-40	+125	°C
Δt/ΔV	input transition rise and fall rate	V <sub>CC</sub> = 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 Y, 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 Y. 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 <sub>amb</sub> = 25 °C			T <sub>amb</sub> = -40 °C to +125 °C			Unit
			Min	Typ	Max	Min	Max (85 °C)	Max (125 °C)	
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 1.4 V to 1.95 V	0.65V <sub>CC</sub>	-	-	0.65V <sub>CC</sub>	-	-	V
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.7	-	-	1.7	-	-	V
		V <sub>CC</sub> = 2.7 V to 3.6 V	2.0	-	-	2.0	-	-	V
		V <sub>CC</sub> = 3.6 V to 4.3 V	0.7V <sub>CC</sub>	-	-	0.7V <sub>CC</sub>	-	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 1.4 V to 1.95 V	-	-	0.35V <sub>CC</sub>	-	0.35V <sub>CC</sub>	0.35V <sub>CC</sub>	V
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	-	0.7	-	0.7	0.7	V
		V <sub>CC</sub> = 2.7 V to 3.6 V	-	-	0.8	-	0.8	0.8	V
		V <sub>CC</sub> = 3.6 V to 4.3 V	-	-	0.3V <sub>CC</sub>	-	0.3V <sub>CC</sub>	0.3V <sub>CC</sub>	V
I <sub>I</sub>	input leakage current	enable input E; V <sub>I</sub> = GND to 4.3 V; V <sub>CC</sub> = 1.4 V to 4.3 V	-	-	-	-	±0.5	±1	μA
I <sub>S(OFF)</sub>	OFF-state leakage current	Y port; see <a href="#">Figure 4</a>							
		V <sub>CC</sub> = 1.4 V to 3.6 V	-	-	±5	-	±50	±500	nA
		V <sub>CC</sub> = 3.6 V to 4.3 V	-	-	±10	-	±50	±500	nA
I <sub>S(ON)</sub>	ON-state leakage current	Z port; see <a href="#">Figure 5</a>							
		V <sub>CC</sub> = 1.4 V to 3.6 V	-	-	±5	-	±50	±500	nA
		V <sub>CC</sub> = 3.6 V to 4.3 V	-	-	±10	-	±50	±500	nA
I <sub>CC</sub>	supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>SW</sub> = GND or V <sub>CC</sub>							
		V <sub>CC</sub> = 3.6 V	-	-	100	-	690	6000	nA
		V <sub>CC</sub> = 4.3 V	-	-	150	-	800	7000	nA

**Table 7. Static characteristics ...continued**

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

Symbol	Parameter	Conditions	T <sub>amb</sub> = 25 °C			T <sub>amb</sub> = -40 °C to +125 °C			Unit
			Min	Typ	Max	Min	Max (85 °C)	Max (125 °C)	
C <sub>I</sub>	input capacitance		-	1.0	-	-	-	-	pF
C <sub>S(OFF)</sub>	OFF-state capacitance		-	35	-	-	-	-	pF
C <sub>S(ON)</sub>	ON-state capacitance		-	110	-	-	-	-	pF

**11.1 Test circuits**

$V_I = 0.3 \text{ V or } V_{CC} - 0.3 \text{ V}; V_O = V_{CC} - 0.3 \text{ V or } 0.3 \text{ V}.$

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

$V_I = 0.3 \text{ V or } V_{CC} - 0.3 \text{ V}; V_O = \text{open circuit}.$

**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 <sub>amb</sub> = -40 °C to +85 °C			T <sub>amb</sub> = -40 °C to +125 °C		Unit
			Min	Typ <sup>[1]</sup>	Max	Min	Max	
R <sub>ON(peak)</sub>	ON resistance (peak)	V <sub>I</sub> = GND to V <sub>CC</sub> ; I <sub>SW</sub> = 100 mA; see <a href="#">Figure 6</a>						
		V <sub>CC</sub> = 1.4 V	-	1.6	3.7	-	4.1	Ω
		V <sub>CC</sub> = 1.65 V	-	1.0	1.6	-	1.7	Ω
		V <sub>CC</sub> = 2.3 V	-	0.55	0.8	-	0.9	Ω
		V <sub>CC</sub> = 2.7 V	-	0.5	0.75	-	0.9	Ω
		V <sub>CC</sub> = 4.3 V	-	0.5	0.75	-	0.9	Ω

**Table 8. ON resistance ...continued**

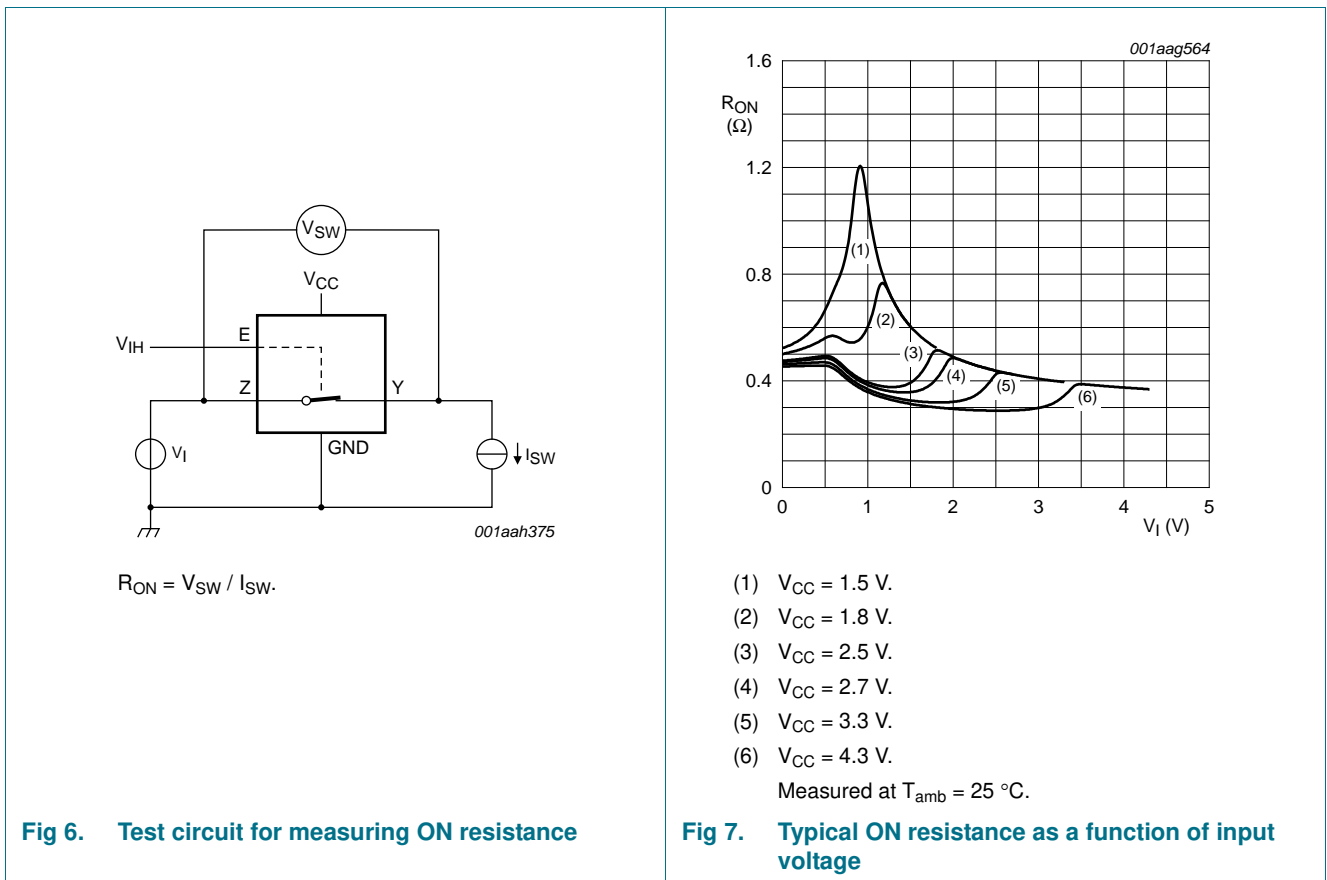
At recommended operating conditions; voltages are referenced to GND (ground = 0 V); for graphs see [Figure 7](#) to [Figure 13](#).

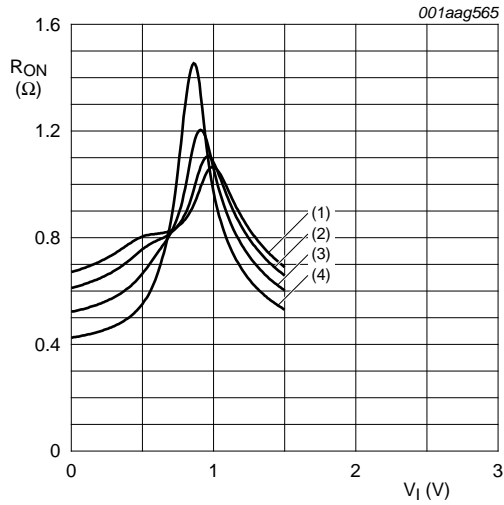
Symbol	Parameter	Conditions	T <sub>amb</sub> = -40 °C to +85 °C			T <sub>amb</sub> = -40 °C to +125 °C		Unit
			Min	Typ <sup>[1]</sup>	Max	Min	Max	
R <sub>ON(flat)</sub>	ON resistance (flatness)	V <sub>I</sub> = GND to V <sub>CC</sub> ; I <sub>SW</sub> = 100 mA						
		V <sub>CC</sub> = 1.4 V	-	1.0	3.3	-	3.6	Ω
		V <sub>CC</sub> = 1.65 V	-	0.5	1.2	-	1.3	Ω
		V <sub>CC</sub> = 2.3 V	-	0.15	0.3	-	0.35	Ω
		V <sub>CC</sub> = 2.7 V	-	0.13	0.3	-	0.35	Ω
		V <sub>CC</sub> = 4.3 V	-	0.2	0.4	-	0.45	Ω

[1] Typical values are measured at T<sub>amb</sub> = 25 °C.

[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.

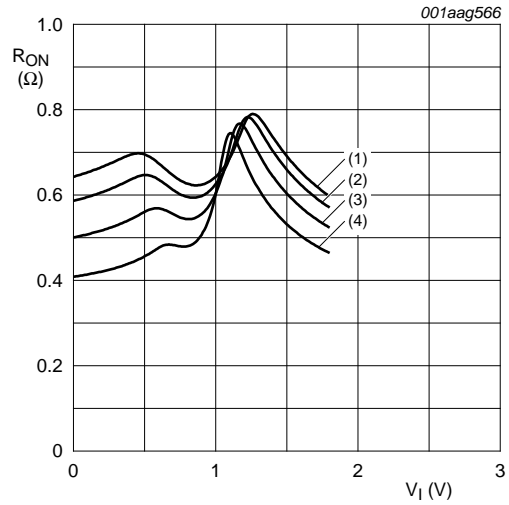
### 11.3 ON resistance test circuit and graphs





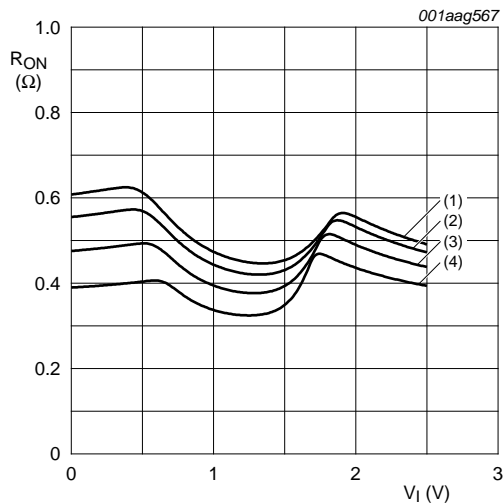
- (1)  $T_{amb} = 125$  °C.
- (2)  $T_{amb} = 85$  °C.
- (3)  $T_{amb} = 25$  °C.
- (4)  $T_{amb} = -40$  °C.

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



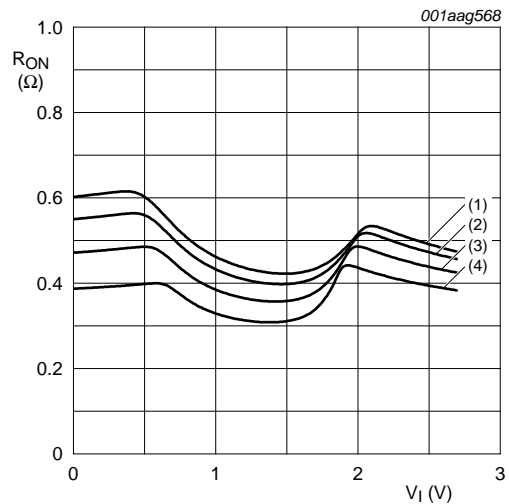
- (1)  $T_{amb} = 125$  °C.
- (2)  $T_{amb} = 85$  °C.
- (3)  $T_{amb} = 25$  °C.
- (4)  $T_{amb} = -40$  °C.

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



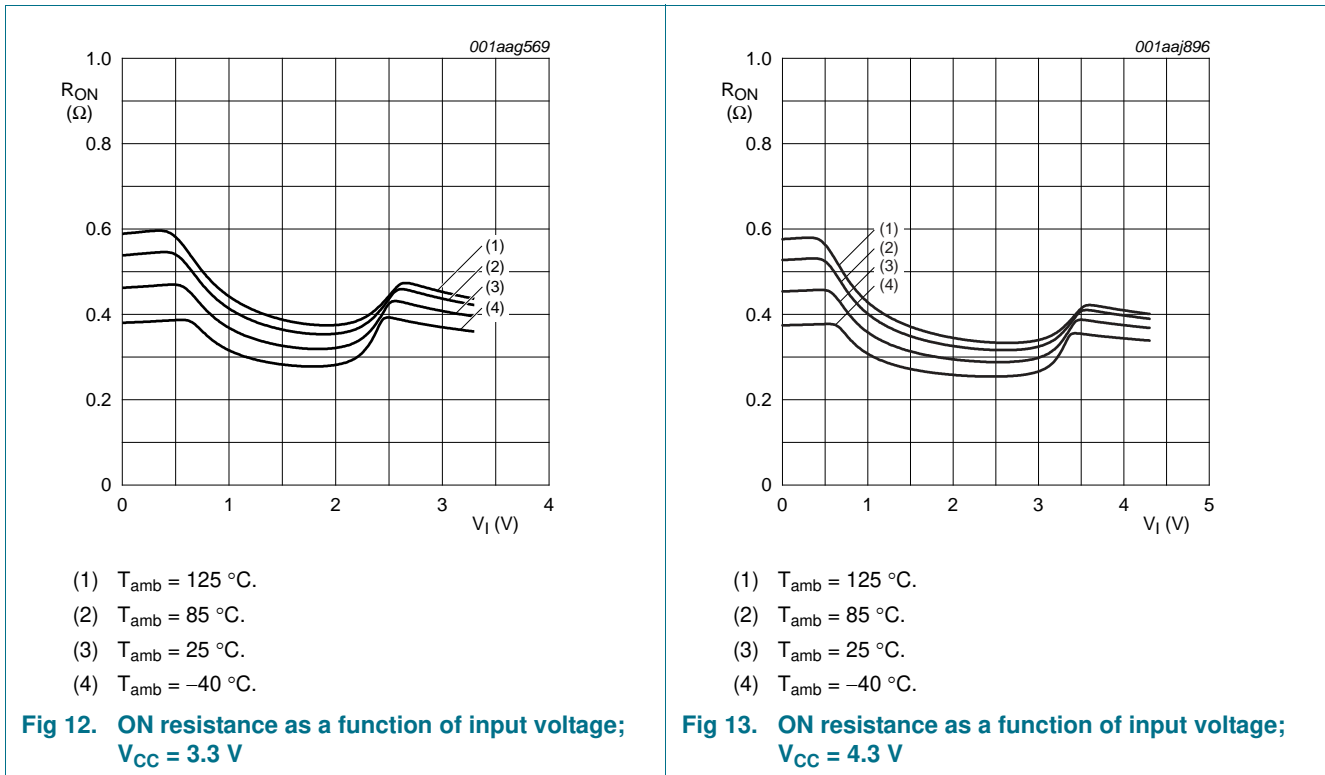
- (1)  $T_{amb} = 125$  °C.
- (2)  $T_{amb} = 85$  °C.
- (3)  $T_{amb} = 25$  °C.
- (4)  $T_{amb} = -40$  °C.

**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



## 12. Dynamic characteristics

**Table 9. Dynamic characteristics**

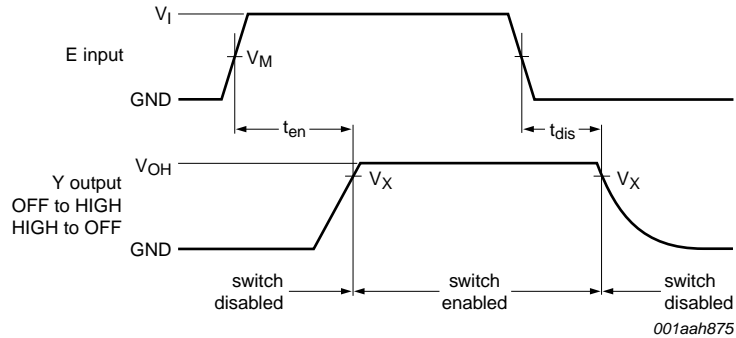
At recommended operating conditions; voltages are referenced to GND (ground = 0 V); for load circuit, see [Figure 15](#).

Symbol	Parameter	Conditions	$T_{amb} = 25\text{ °C}$			$T_{amb} = -40\text{ °C to }+125\text{ °C}$			Unit
			Min	Typ <sup>[1]</sup>	Max	Min	Max (85 °C)	Max (125 °C)	
$t_{en}$	enable time	E to Z or Y; see <a href="#">Figure 14</a>							
		$V_{CC} = 1.4\text{ V to }1.6\text{ V}$	-	27	41	-	43	48	ns
		$V_{CC} = 1.65\text{ V to }1.95\text{ V}$	-	22	33	-	34	36	ns
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	-	17	26	-	27	30	ns
		$V_{CC} = 2.7\text{ V to }3.6\text{ V}$	-	14	23	-	24	26	ns
		$V_{CC} = 3.6\text{ V to }4.3\text{ V}$	-	14	23	-	24	26	ns
$t_{dis}$	disable time	E to Z or Y; see <a href="#">Figure 14</a>							
		$V_{CC} = 1.4\text{ V to }1.6\text{ V}$	-	9	18	-	19	21	ns
		$V_{CC} = 1.65\text{ V to }1.95\text{ V}$	-	7	13	-	15	16	ns
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	-	4	8	-	9	10	ns
		$V_{CC} = 2.7\text{ V to }3.6\text{ V}$	-	4	8	-	8	9	ns
		$V_{CC} = 3.6\text{ V to }4.3\text{ V}$	-	4	8	-	8	9	ns

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



12.1 Waveform and test circuits

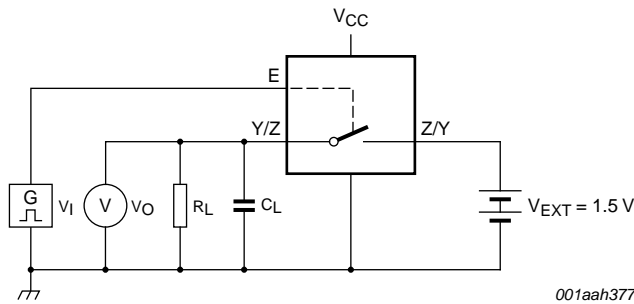


Measurement points are given in [Table 10](#).  
 Logic level:  $V_{OH}$  is the typical output voltage that occurs with the output load.

Fig 14. Enable and disable times

Table 10. Measurement points

Supply voltage	Input	Output
$V_{CC}$	$V_M$	$V_X$
1.4 V to 4.3 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
$V_{CC}$	$V_I$	$C_L$
1.4 V to 4.3 V	$V_{CC}$	$R_L$
		$t_r, t_f$
		$\leq 2.5$ ns
		35 pF
		50 $\Omega$

## 12.2 Additional dynamic characteristics

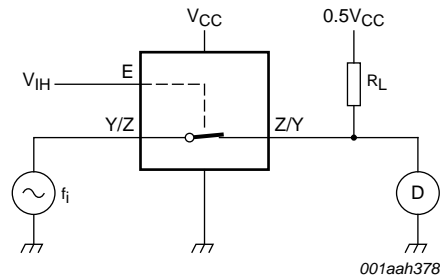
**Table 12. Additional dynamic characteristics**

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

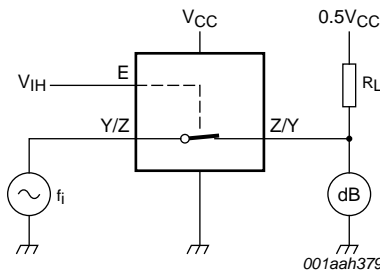
Symbol	Parameter	Conditions	T <sub>amb</sub> = 25 °C			Unit
			Min	Typ	Max	
THD	total harmonic distortion	$f_i = 20 \text{ Hz to } 20 \text{ kHz}; R_L = 32 \text{ } \Omega$ ; see <a href="#">Figure 16</a> <sup>[1]</sup>				
		$V_{CC} = 1.4 \text{ V}; V_I = 1 \text{ V (p-p)}$	-	0.15	-	%
		$V_{CC} = 1.65 \text{ V}; V_I = 1.2 \text{ V (p-p)}$	-	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 <a href="#">Figure 17</a> <sup>[1]</sup>				
		$V_{CC} = 1.4 \text{ V to } 4.3 \text{ V}$	-	60	-	MHz
$\alpha_{\text{iso}}$	isolation (OFF-state)	$f_i = 100 \text{ kHz}; R_L = 50 \text{ } \Omega$ ; see <a href="#">Figure 18</a> <sup>[1]</sup>				
		$V_{CC} = 1.4 \text{ V to } 4.3 \text{ V}$	-	-90	-	dB
$V_{\text{ct}}$	crosstalk voltage	between digital inputs and switch; $f_i = 1 \text{ MHz}; C_L = 50 \text{ pF}; R_L = 50 \text{ } \Omega$ ; see <a href="#">Figure 19</a>				
		$V_{CC} = 1.4 \text{ V to } 3.6 \text{ V}$	-	0.2	-	V
		$V_{CC} = 3.6 \text{ V to } 4.3 \text{ V}$	-	0.2	-	V
$Q_{\text{inj}}$	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 <a href="#">Figure 20</a>				
		$V_{CC} = 1.5 \text{ V}$	-	3	-	pC
		$V_{CC} = 1.8 \text{ V}$	-	3	-	pC
		$V_{CC} = 2.5 \text{ V}$	-	3	-	pC
		$V_{CC} = 3.3 \text{ V}$	-	3	-	pC
		$V_{CC} = 4.3 \text{ V}$	-	6	-	pC

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

**12.3 Test circuits**

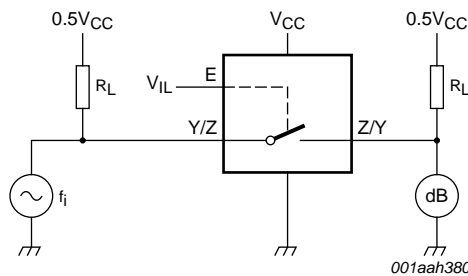


**Fig 16. Test circuit for measuring total harmonic distortion**



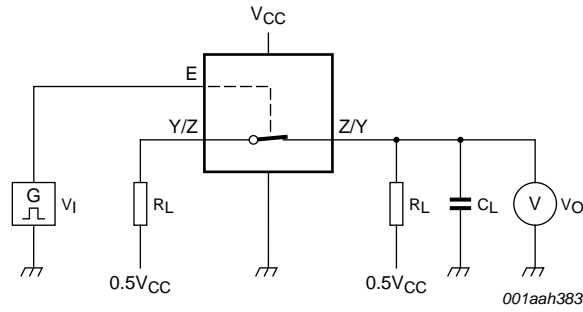
To obtain 0 dBm level at output, adjust  $f_i$  voltage. Increase  $f_i$  frequency until dB meter reads -3 dB.

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

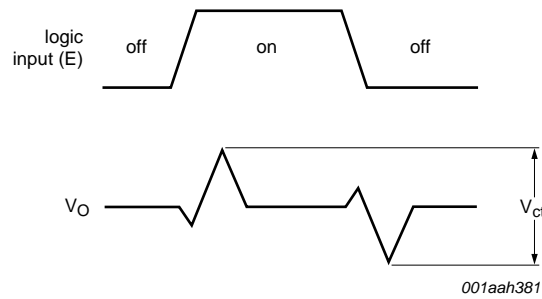


To obtain 0 dBm level at input, adjust  $f_i$  voltage.

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

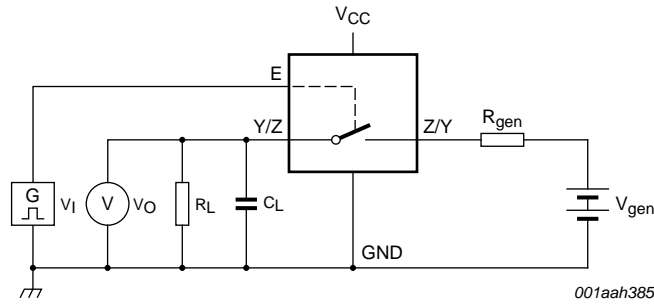


a. Test circuit

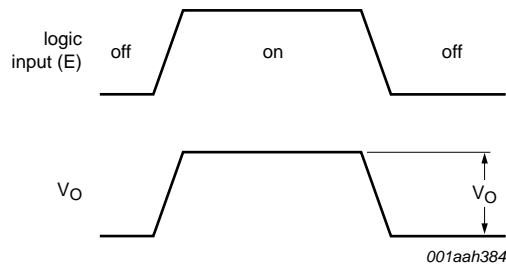


b. Input and output pulse definitions

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



a. Test circuit



b. Input and output pulse definitions

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

$\Delta V_O$  = output voltage variation.

$R_{gen}$  = generator resistance.

$V_{gen}$  = generator voltage.

**Fig 20. Test circuit for measuring charge injection**

13. Package outline

TSSOP5: plastic thin shrink small outline package; 5 leads; body width 1.25 mm

SOT353-1

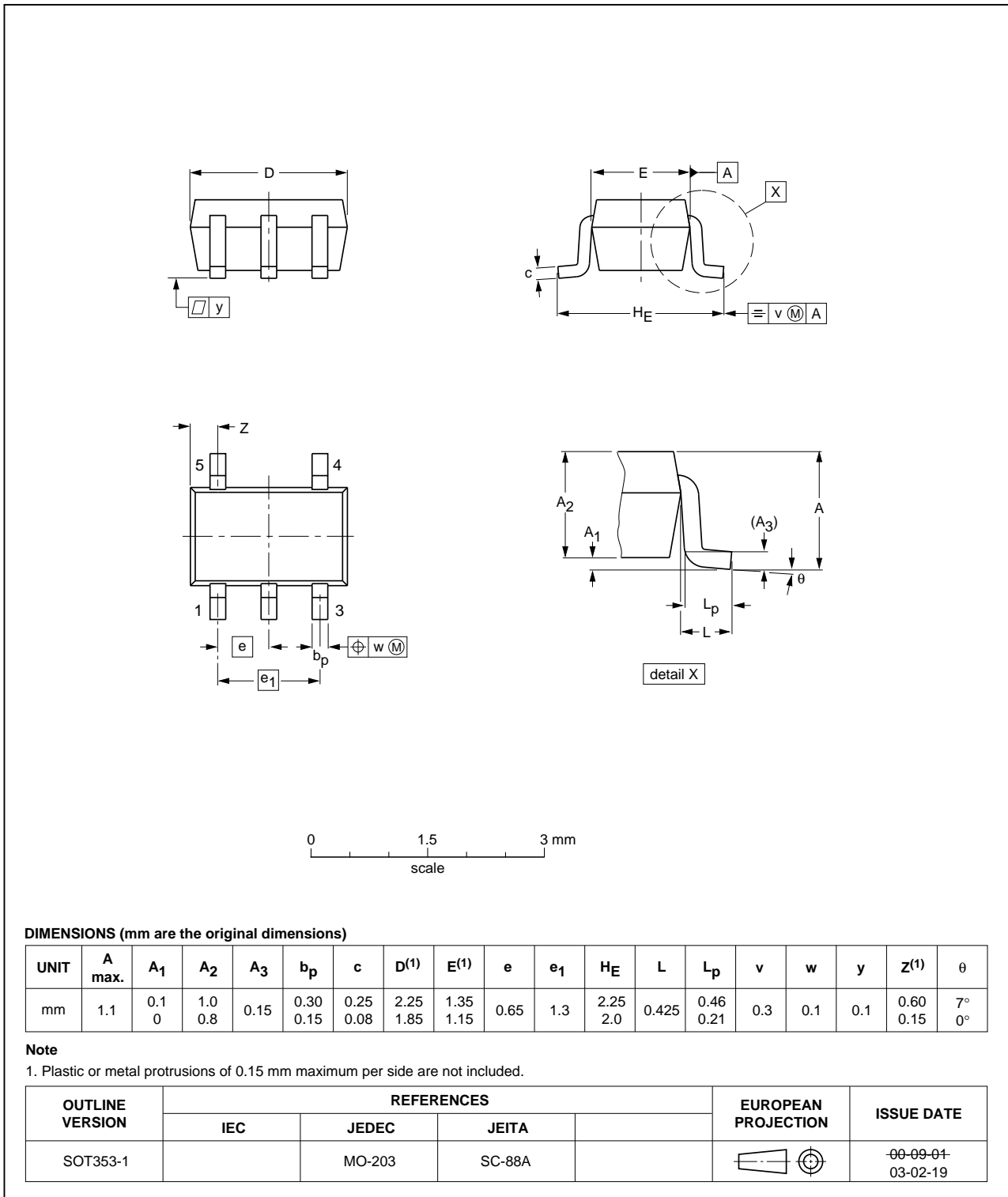


Fig 21. Package outline SOT353-1 (TSSOP5)

## 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
NX3L1G66_Q100 v.1	20131028	Product data sheet	-	-

## 16. Legal information

### 16.1 Data sheet status

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