

NX3DV3899

Dual double-pole double-throw analog switch

Rev. 3.1 — 25 June 2021

Product data sheet

1 General description

The NX3DV3899 is a dual double-pole double-throw analog data-switch suitable for use as an analog or digital multiplexer/demultiplexer. It consists of four switches, each with two independent input/outputs (nY0 and nY1) and a common input/output (nZ). The two digital inputs (1S and 2S) are used to select the switch position. Schmitt trigger action at the select input (nS) makes the circuit tolerant to slower input rise and fall times across the entire V_{CC} range from 1.4 V to 4.3 V.

A low input voltage threshold allows pin nS to be driven by lower level logic signals without a significant increase in supply current I_{CC} . This makes it possible for the NX3DV3899 to switch 4.3 V signals with a 1.8 V digital controller, eliminating the need for logic level translation. The NX3DV3899 allows signals with amplitude up to V_{CC} to be transmitted from nZ to nY0 or nY1; or from nY0 or nY1 to nZ.

2 Features and benefits

- Wide supply voltage range from 1.4 V to 4.3 V
- Very low ON resistance (peak):
 - 7.2 Ω (typical) at $V_{CC} = 1.4$ V
 - 5.4 Ω (typical) at $V_{CC} = 1.65$ V
 - 2.9 Ω (typical) at $V_{CC} = 2.5$ V
 - 2.4 Ω (typical) at $V_{CC} = 3.0$ V
 - 2.3 Ω (typical) at $V_{CC} = 3.6$ V
 - 2.2 Ω (typical) at $V_{CC} = 4.3$ V
- Break-before-make switching
- High noise immunity
- ESD protection:
 - HBM JESD22-A114F Class 2A exceeds 2000 V (all pins)
 - HBM JESD22-A114F Class 3A exceeds 5000 V (I/O pins to GND)
 - 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 78B Class II Level A
- 1.8 V control logic at $V_{CC} = 3.6$ V
- Control input accepts voltages above supply voltage
- Very low supply current, even when input is below V_{CC}
- 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

- Data switch
- Cell phone
- PDA
- Portable media player

4 Ordering information

Table 1. Ordering information

Type number	Topside marking	Package		
		Name	Description	Version
NX3DV3899HR	x99	HXQFN16U	plastic thermal enhanced extremely thin quad flat package; no leads; 16 terminals; UTLP based; body 3 x 3 x 0.5 mm	SOT1039-1
NX3DV3899GU	x9	XQFN16	plastic, extremely thin quad flat package; no leads; 16 terminals; body 1.80 x 2.60 x 0.50 mm	SOT1161-1

Table 2. Ordering options

Type number	Orderable part number	Package	Packing method	Minimum order quantity	Temperature range
NX3DV3899HR	NX3DV3899HR,115	HXQFN16U	REEL 7" Q1 NDP ^[1]	1500	-40°C to +125°C
	NX3DV3899HRZ	HXQFN16U	REEL 7" Q1 NDP SSB ^[2]	1500	-40°C to +125°C
NX3DV3899GU	NX3DV3899GU,115	XQFN16	REEL 7" Q1 NDP	4000	-40°C to +125°C

[1] Will go EOL - migrate to new leadframe NX3DV3899HRZ 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

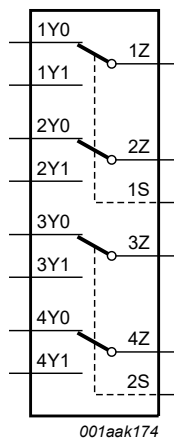


Figure 1. Logic symbol

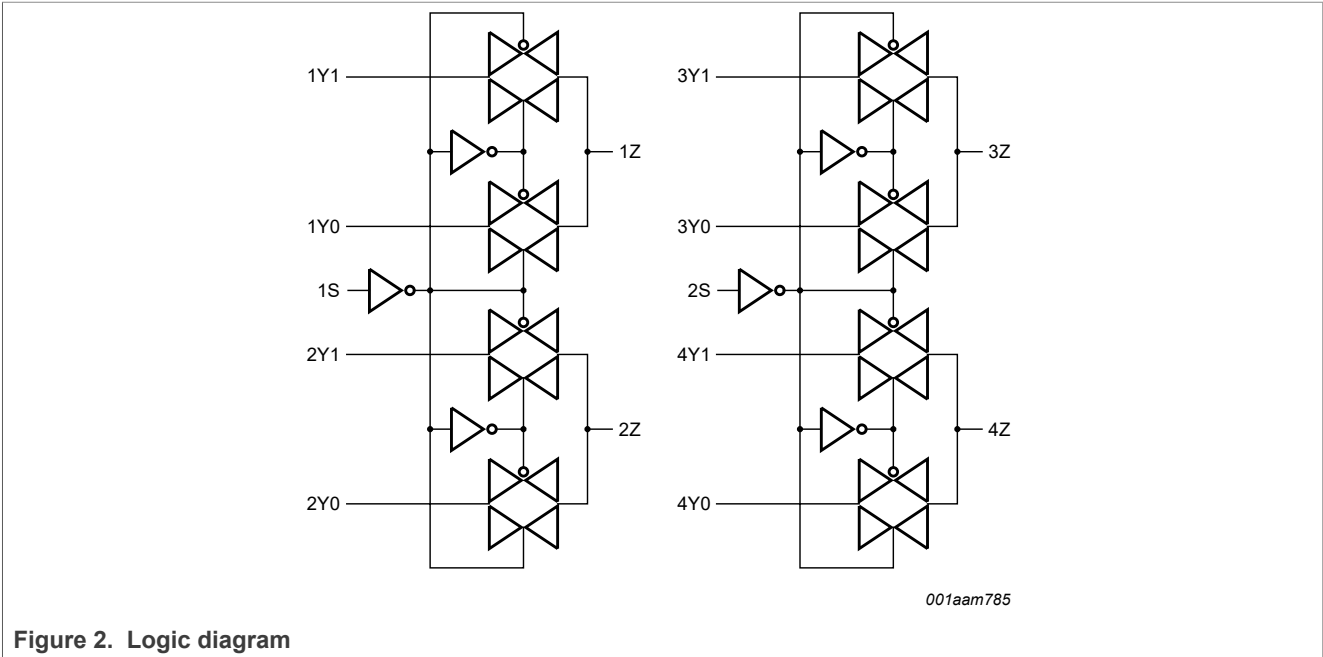


Figure 2. Logic diagram

6 Pinning information

6.1 Pinning

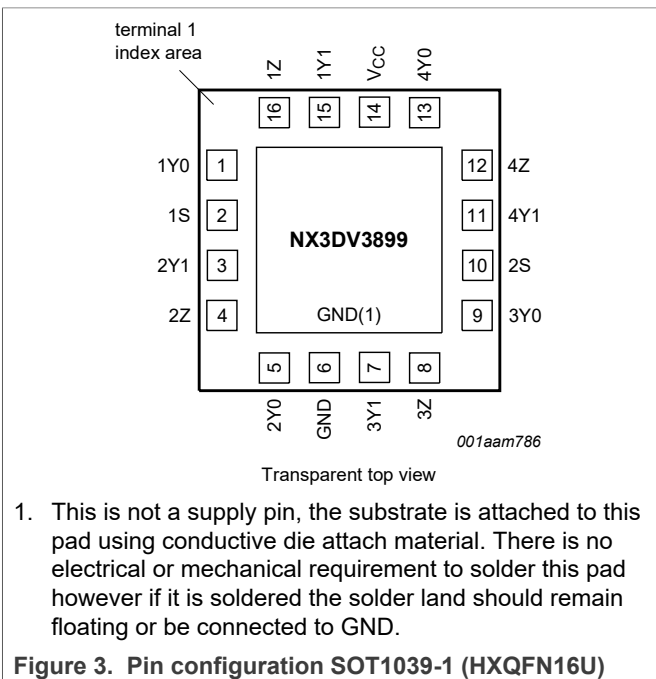


Figure 3. Pin configuration SOT1039-1 (HXQFN16U)

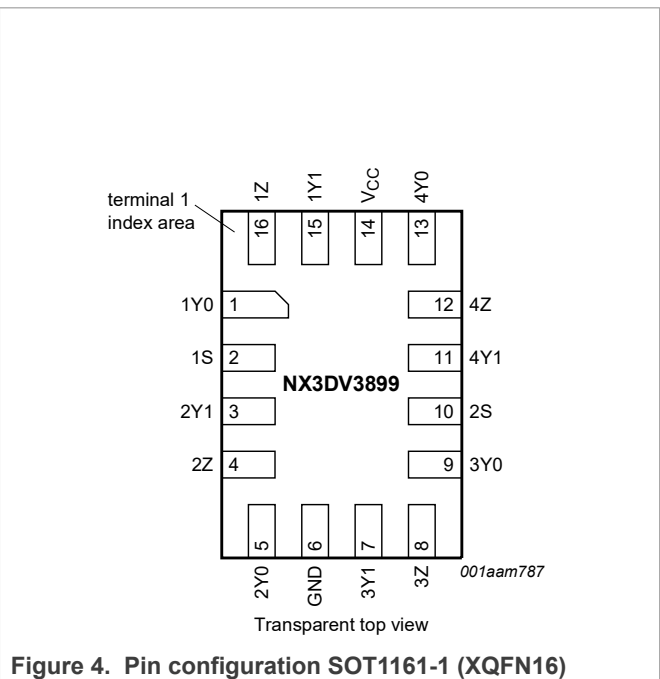


Figure 4. Pin configuration SOT1161-1 (XQFN16)

6.2 Pin description

Table 3. Pin description

Symbol	Pin	Description
1Y0, 2Y0, 3Y0, 4Y0	1, 5, 9, 13	independent input or output
1S, 2S	2, 10	select input
1Y1, 2Y1, 3Y1, 4Y1	15, 3, 7, 11	independent input or output
1Z, 2Z, 3Z, 4Z	16, 4, 8, 12	common output or input
GND	6	ground (0 V)
V _{CC}	14	supply voltage

7 Functional description

Table 4. Function table^[1]

Input nS	Channel on
L	nY0
H	nY1

[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 nS	^[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			
		HXQFN16U	^[3] -	250	mW
		XQFN16	^[4] -	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 HXQFN16U package: above 135 °C the value of P_{tot} derates linearly with 16.9 mW/K.

[4] For XQFN16 package: above 133 °C the value of P_{tot} derates linearly with 14.5 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 nS	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 nZ when switch current flows in terminal nYn, 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 nYn. 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).

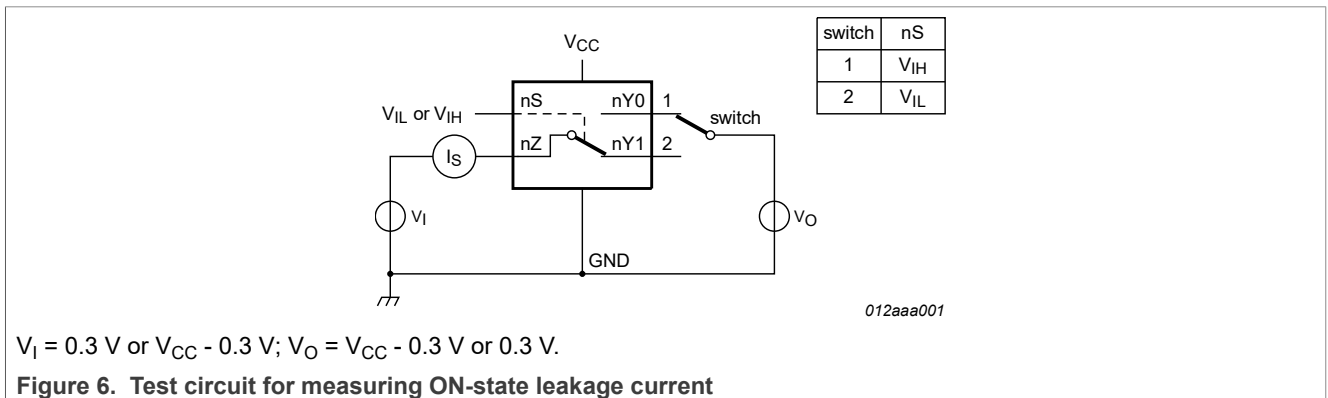
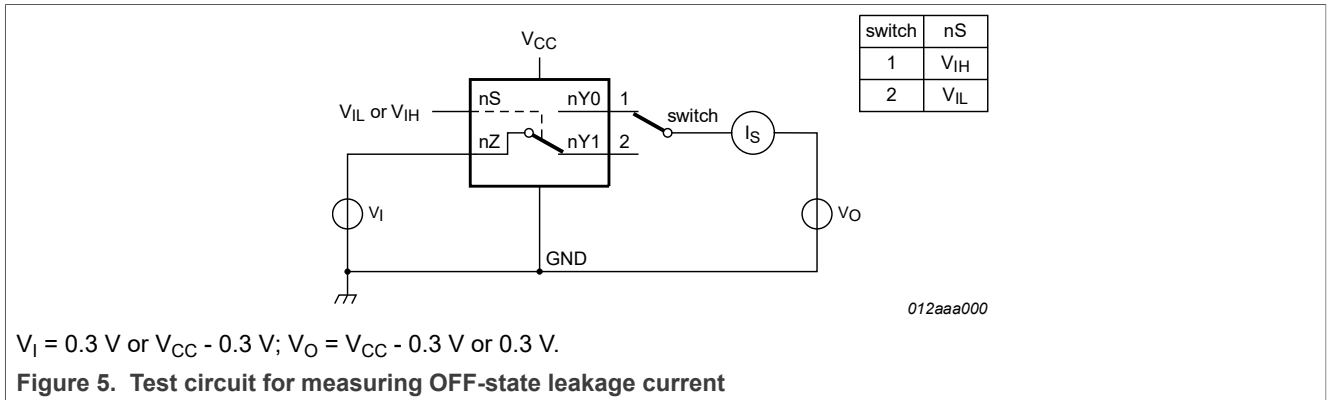
Symbol	Parameter	Conditions	T _{amb} = 25 °C			T _{amb} = -40 °C to +125 °C			Unit
			Min	Typ	Max	Min	Max (85 °C)	Max (125 °C)	
V _{IH}	HIGH-level input voltage	V _{CC} = 1.4 V to 1.6 V	0.9	-	-	0.9	-	-	V
		V _{CC} = 1.65 V to 1.95 V	0.9	-	-	0.9	-	-	V
		V _{CC} = 2.3 V to 2.7 V	1.1	-	-	1.1	-	-	V
		V _{CC} = 2.7 V to 3.6 V	1.3	-	-	1.3	-	-	V
		V _{CC} = 3.6 V to 4.3 V	1.4	-	-	1.4	-	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 1.4 V to 1.6 V	-	-	0.3	-	0.3	0.3	V
		V _{CC} = 1.65 V to 1.95 V	-	-	0.4	-	0.4	0.3	V
		V _{CC} = 2.3 V to 2.7 V	-	-	0.4	-	0.4	0.4	V
		V _{CC} = 2.7 V to 3.6 V	-	-	0.5	-	0.5	0.5	V
		V _{CC} = 3.6 V to 4.3 V	-	-	0.6	-	0.6	0.6	V
I _I	input leakage current	select input nS; 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	nY0 and nY1 port; see Figure 5							
		V _{CC} = 1.4 V to 4.3 V	-	-	±5	-	±50	±500	nA
I _{S(ON)}	ON-state leakage current	nZ port; see Figure 6							
		V _{CC} = 1.4 V to 4.3 V	-	-	±5	-	±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	-	500	5000	nA

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)	
		V _{CC} = 4.3 V	-	-	150	-	800	6000	nA
ΔI _{CC}	additional supply current	V _{SW} = GND or V _{CC}							
		V _I = 2.6 V; V _{CC} = 4.3 V	-	2.0	4.0	-	7	7	μA
		V _I = 2.6 V; V _{CC} = 3.6 V	-	0.35	0.7	-	1	1	μA
		V _I = 1.8 V; V _{CC} = 4.3 V	-	7.0	10.0	-	15	15	μA
		V _I = 1.8 V; V _{CC} = 3.6 V	-	2.5	4.0	-	5	5	μA
		V _I = 1.8 V; V _{CC} = 2.5 V	-	50	200	-	300	500	nA
C _I	input capacitance		-	1.0	-	-	-	-	pF
C _{S(OFF)}	OFF-state capacitance		-	8	-	-	-	-	pF
C _{S(ON)}	ON-state capacitance		-	30	-	-	-	-	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 8 to Figure 14.

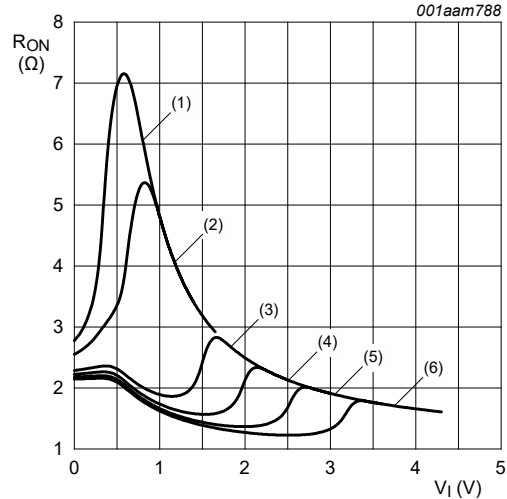
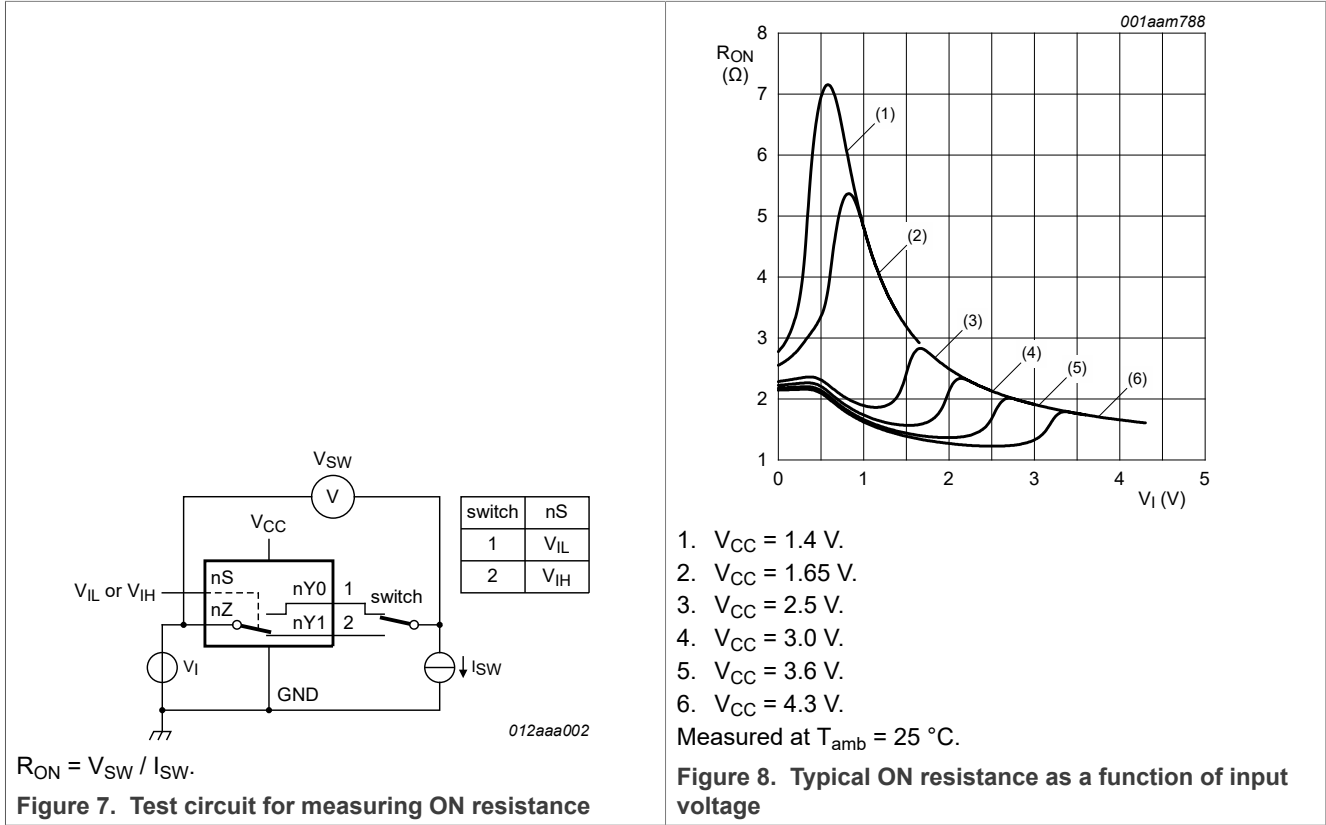
Symbol	Parameter	Conditions	T _{amb} = -40 °C to +85 °C			T _{amb} = -40 °C to +125 °C		Unit
			Min	Typ ^[1]	Max	Min	Max	
R _{ON(peak)}	ON resistance (peak)	V _I = GND to V _{CC} ; I _{SW} = 100 mA; see Figure 7						
		V _{CC} = 1.4 V	-	7.2	9.3	-	10	Ω
		V _{CC} = 1.65 V	-	5.4	7.3	-	8	Ω
		V _{CC} = 2.5 V	-	2.9	3.9	-	4.5	Ω
		V _{CC} = 3.0 V	-	2.4	3.4	-	4.5	Ω
		V _{CC} = 3.6 V	-	2.3	3.3	-	4.2	Ω
		V _{CC} = 4.3 V	-	2.2	3.3	-	4.2	Ω
ΔR _{ON}	ON resistance mismatch between channels	V _I = GND to V _{CC} ; I _{SW} = 100 mA ^[2]						
		V _{CC} = 3.0 V	-	0.8	-	-	-	Ω
		V _{CC} = 4.3 V	-	0.7	-	-	-	Ω
R _{ON(flat)}	ON resistance (flatness)	V _I = GND to V _{CC} ; I _{SW} = 100 mA ^[3]						
		V _{CC} = 1.4 V	-	4.4	-	-	-	Ω
		V _{CC} = 1.65 V	-	2.8	-	-	-	Ω
		V _{CC} = 2.5 V	-	1.0	-	-	-	Ω
		V _{CC} = 3.0 V	-	0.8	-	-	-	Ω
		V _{CC} = 3.6 V	-	0.9	-	-	-	Ω
		V _{CC} = 4.3 V	-	1.0	-	-	-	Ω

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

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

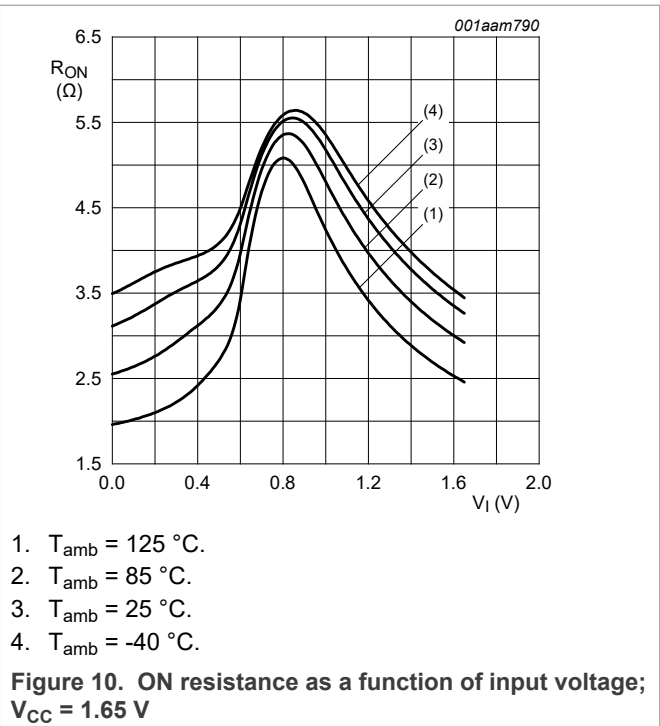
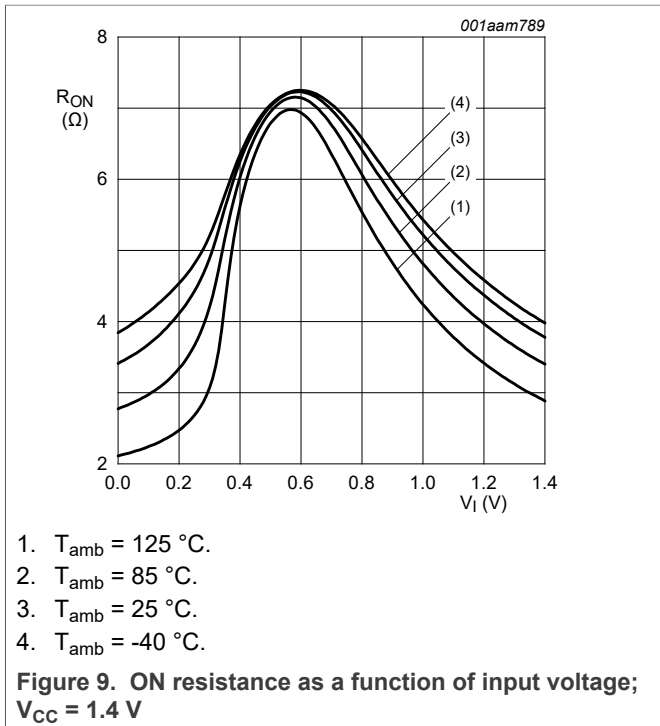
[3] Flatness is defined as the difference between the maximum and minimum value of ON resistance measured at identical V_{CC} and temperature.

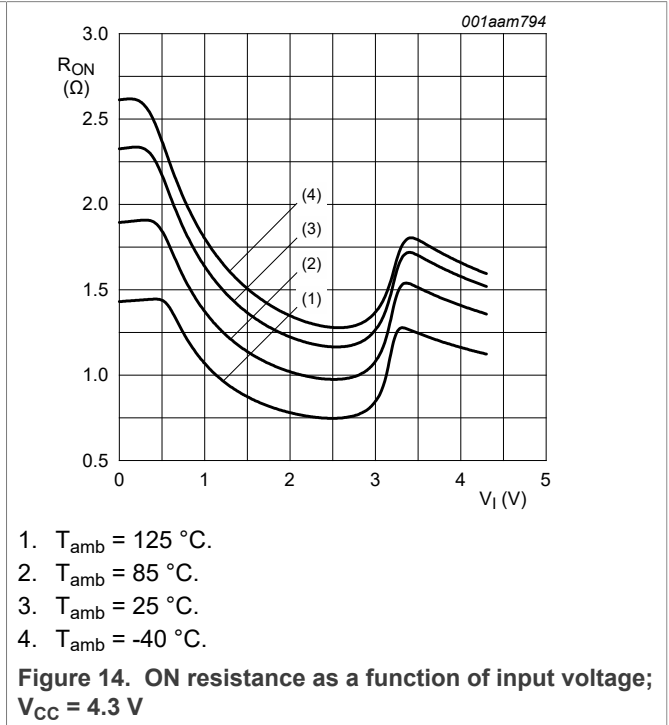
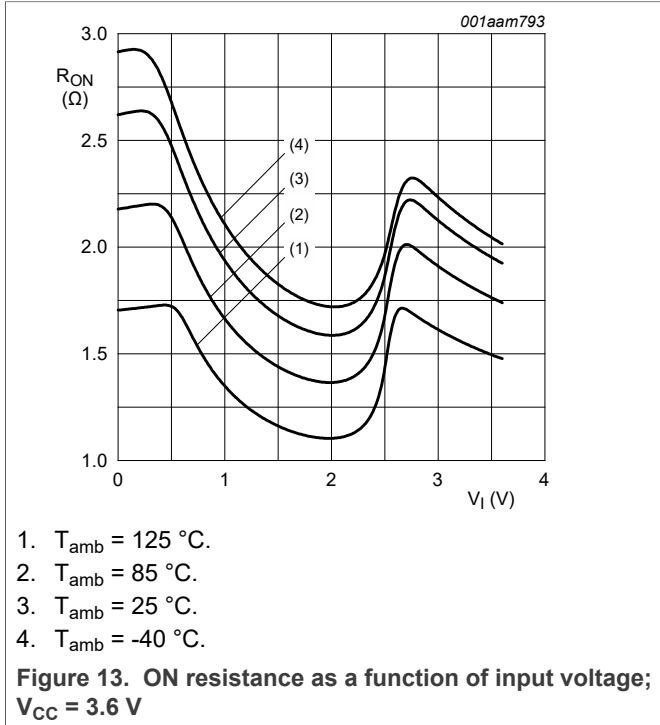
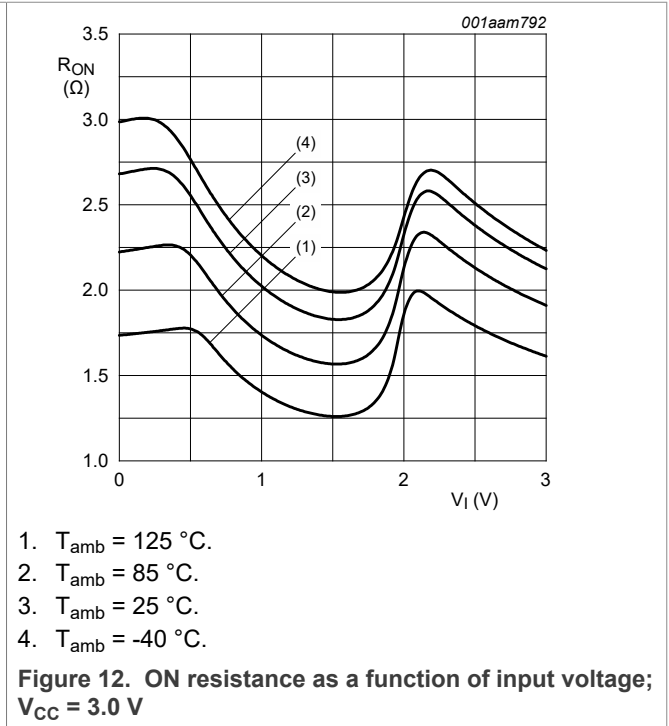
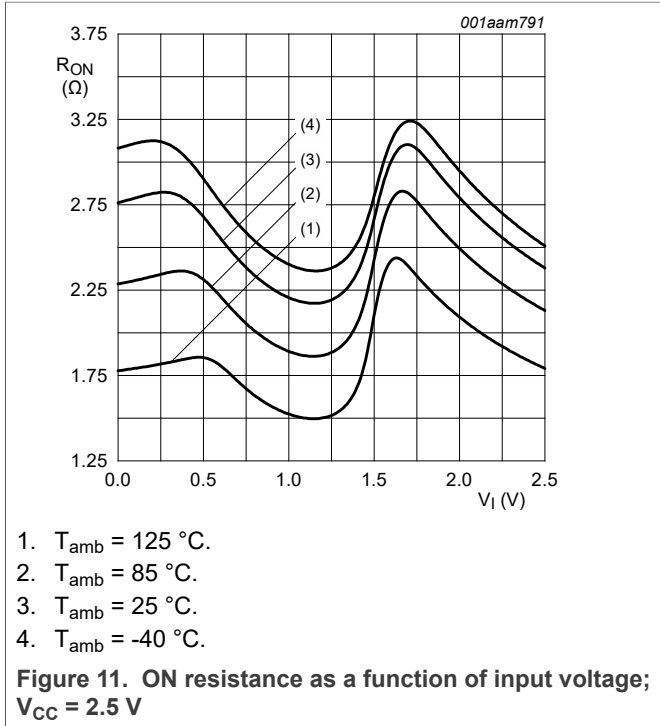
10.3 ON resistance test circuit and graphs



1. $V_{CC} = 1.4 \text{ V}$.
 2. $V_{CC} = 1.65 \text{ V}$.
 3. $V_{CC} = 2.5 \text{ V}$.
 4. $V_{CC} = 3.0 \text{ V}$.
 5. $V_{CC} = 3.6 \text{ V}$.
 6. $V_{CC} = 4.3 \text{ V}$.
- Measured at $T_{amb} = 25 \text{ }^\circ\text{C}$.

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





11 Dynamic characteristics

Table 9. Dynamic characteristics

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

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	nS to nZ or nYn; see Figure 15							
		V _{CC} = 1.4 V to 1.6 V	-	41	90	-	120	120	ns
		V _{CC} = 1.65 V to 1.95 V	-	30	70	-	80	90	ns
		V _{CC} = 2.3 V to 2.7 V	-	20	45	-	50	55	ns
		V _{CC} = 2.7 V to 3.6 V	-	19	40	-	45	50	ns
		V _{CC} = 3.6 V to 4.3 V	-	19	40	-	45	50	ns
t _{dis}	disable time	nS to nZ or nYn; see Figure 15							
		V _{CC} = 1.4 V to 1.6 V	-	24	70	-	80	90	ns
		V _{CC} = 1.65 V to 1.95 V	-	15	55	-	60	65	ns
		V _{CC} = 2.3 V to 2.7 V	-	9	25	-	30	35	ns
		V _{CC} = 2.7 V to 3.6 V	-	8	20	-	25	30	ns
		V _{CC} = 3.6 V to 4.3 V	-	8	20	-	25	30	ns
t _{b-m}	break-before-make time	see Figure 16	[2]						
		V _{CC} = 1.4 V to 1.6 V	-	20	-	9	-	-	ns
		V _{CC} = 1.65 V to 1.95 V	-	17	-	7	-	-	ns
		V _{CC} = 2.3 V to 2.7 V	-	13	-	4	-	-	ns
		V _{CC} = 2.7 V to 3.6 V	-	11	-	3	-	-	ns
		V _{CC} = 3.6 V to 4.3 V	-	11	-	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

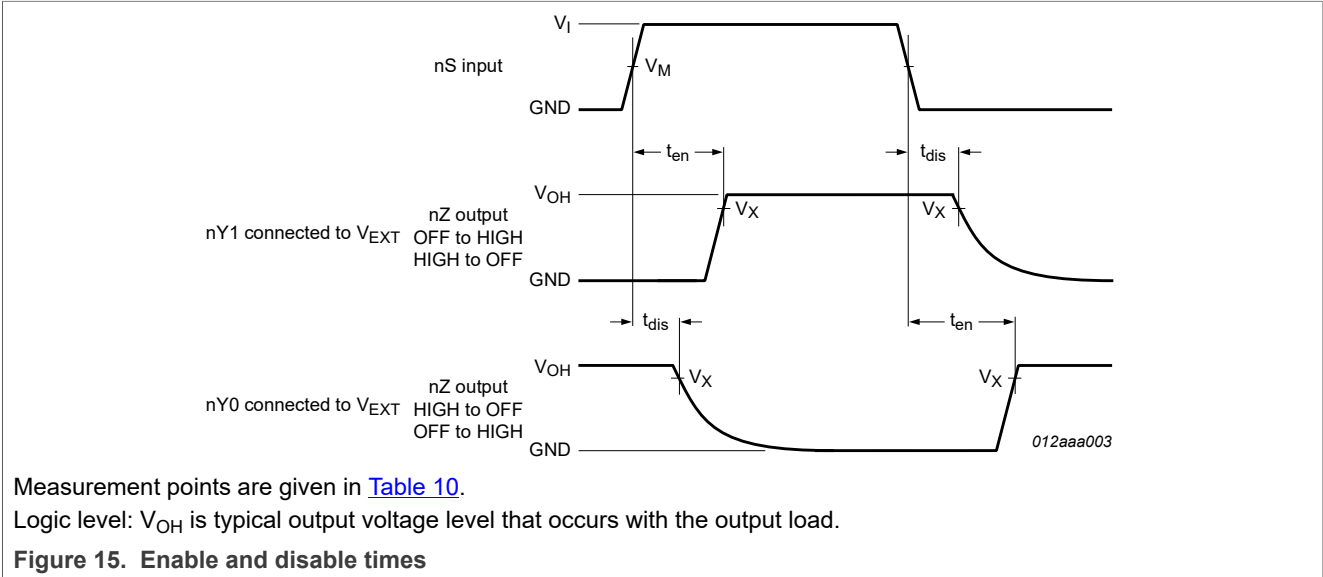


Table 10. Measurement points

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

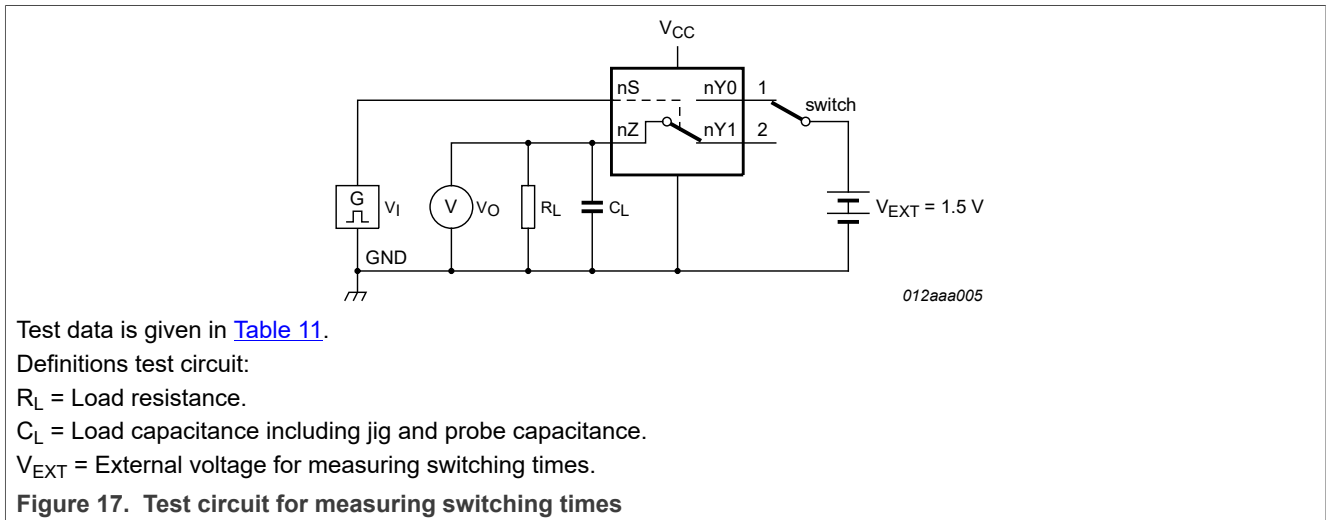
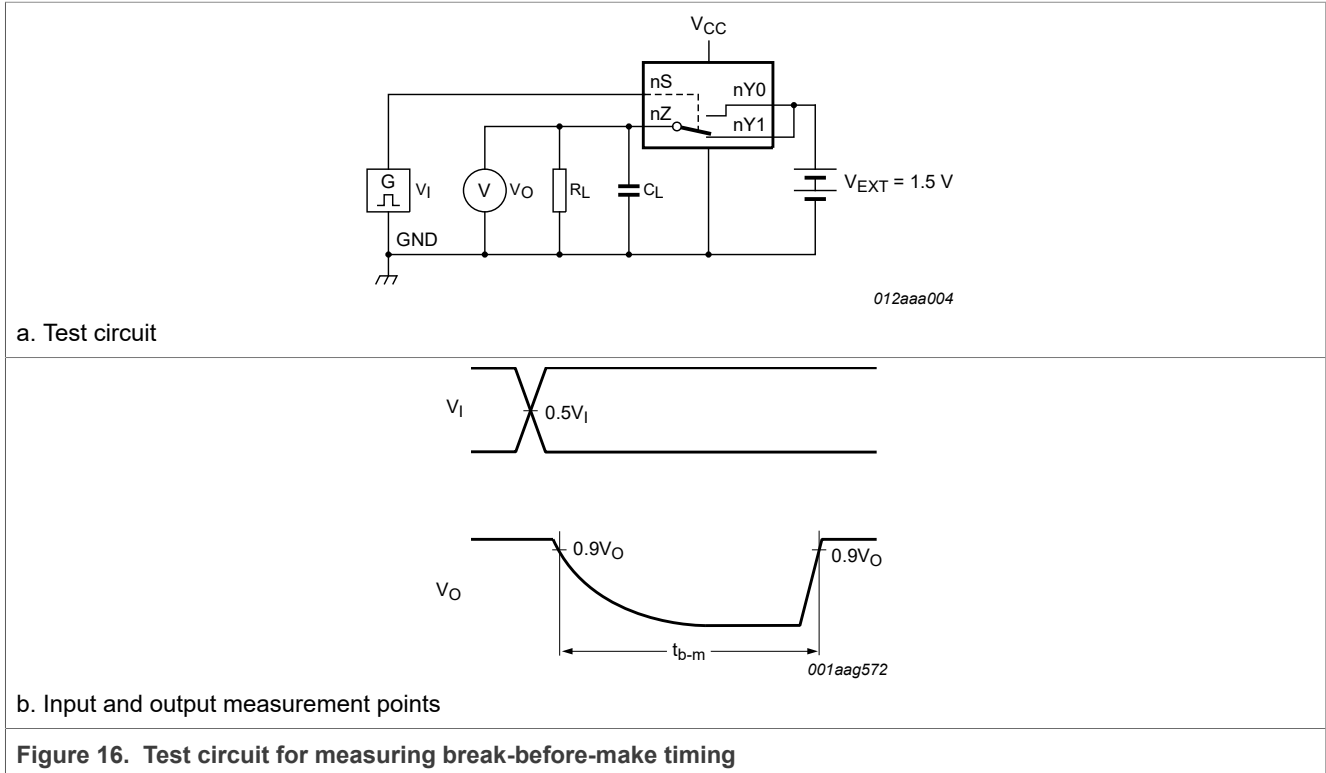


Table 11. Test data

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); $V_I = GND$ 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; $R_L = 600$ Ω ; see Figure 18	[1]				
		$V_{CC} = 1.4$ V; $V_I = 1$ V (p-p)		-	0.05	-	%
		$V_{CC} = 1.65$ V; $V_I = 1.2$ V (p-p)		-	0.02	-	%
		$V_{CC} = 2.3$ V; $V_I = 1.5$ V (p-p)		-	0.01	-	%
		$V_{CC} = 2.7$ V; $V_I = 2$ V (p-p)		-	0.01	-	%
		$V_{CC} = 3.6$ V; $V_I = 2$ V (p-p)		-	0.01	-	%
		$V_{CC} = 4.3$ V; $V_I = 2$ V (p-p)		-	0.01	-	%
$f_{(-3dB)}$	-3 dB frequency response	$R_L = 50$ Ω ; see Figure 19	[1]				
		$V_{CC} = 1.4$ V to 4.3 V		-	200	-	MHz
α_{iso}	isolation (OFF-state)	$f_i = 1$ MHz; $R_L = 50$ Ω ; see Figure 20	[1]				
		$V_{CC} = 1.4$ V to 4.3 V		-	-70	-	dB
V_{ct}	crosstalk voltage	between digital inputs and switch; $f_i = 1$ MHz; $C_L = 50$ pF; $R_L = 50$ Ω ; see Figure 21					
		$V_{CC} = 1.4$ V to 3.6 V		-	210	-	V
		$V_{CC} = 3.6$ V to 4.3 V		-	300	-	V
Xtalk	crosstalk	between switches; $f_i = 1$ MHz; $R_L = 50$ Ω ; see Figure 22	[1]				
		$V_{CC} = 1.4$ V to 4.3 V		-	-90	-	dB
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 23					
		$V_{CC} = 1.4$ V		-	0.5	-	pC
		$V_{CC} = 1.65$ V		-	0.7	-	pC
		$V_{CC} = 2.5$ V		-	1.6	-	pC
		$V_{CC} = 3.0$ V		-	2.1	-	pC
		$V_{CC} = 3.6$ V		-	2.9	-	pC
		$V_{CC} = 4.3$ V		-	4.0	-	pC

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

11.3 Test circuits

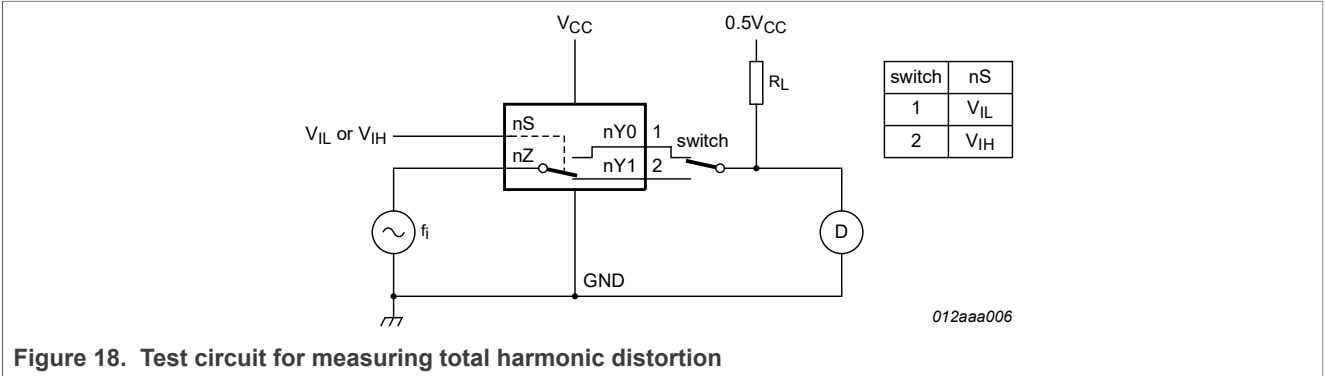
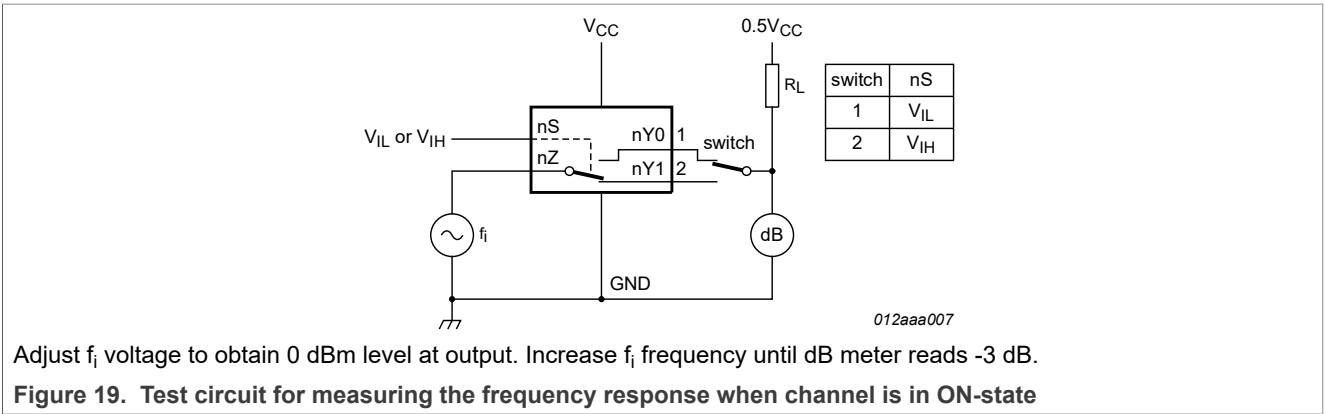
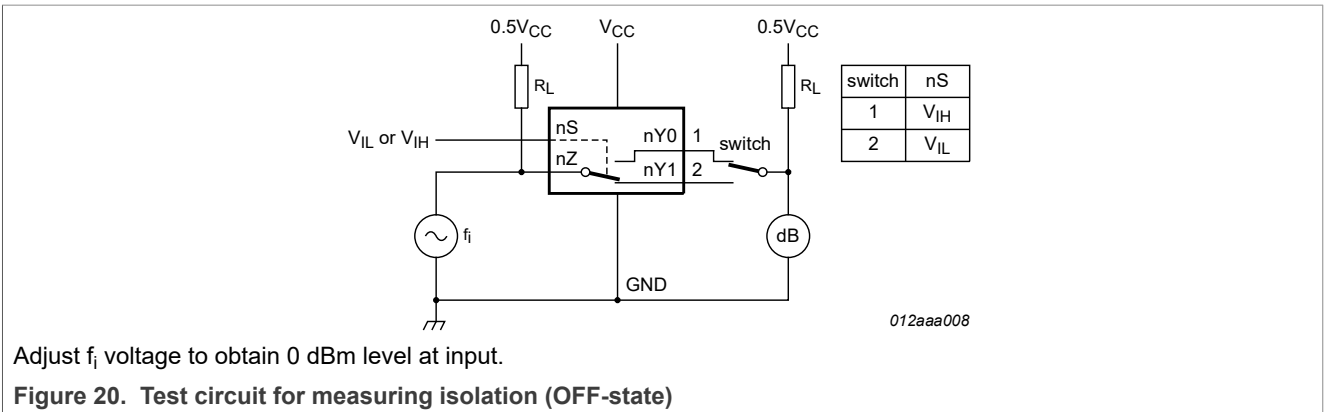


Figure 18. Test circuit for measuring total harmonic distortion



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

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



Adjust f_i voltage to obtain 0 dBm level at input.

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

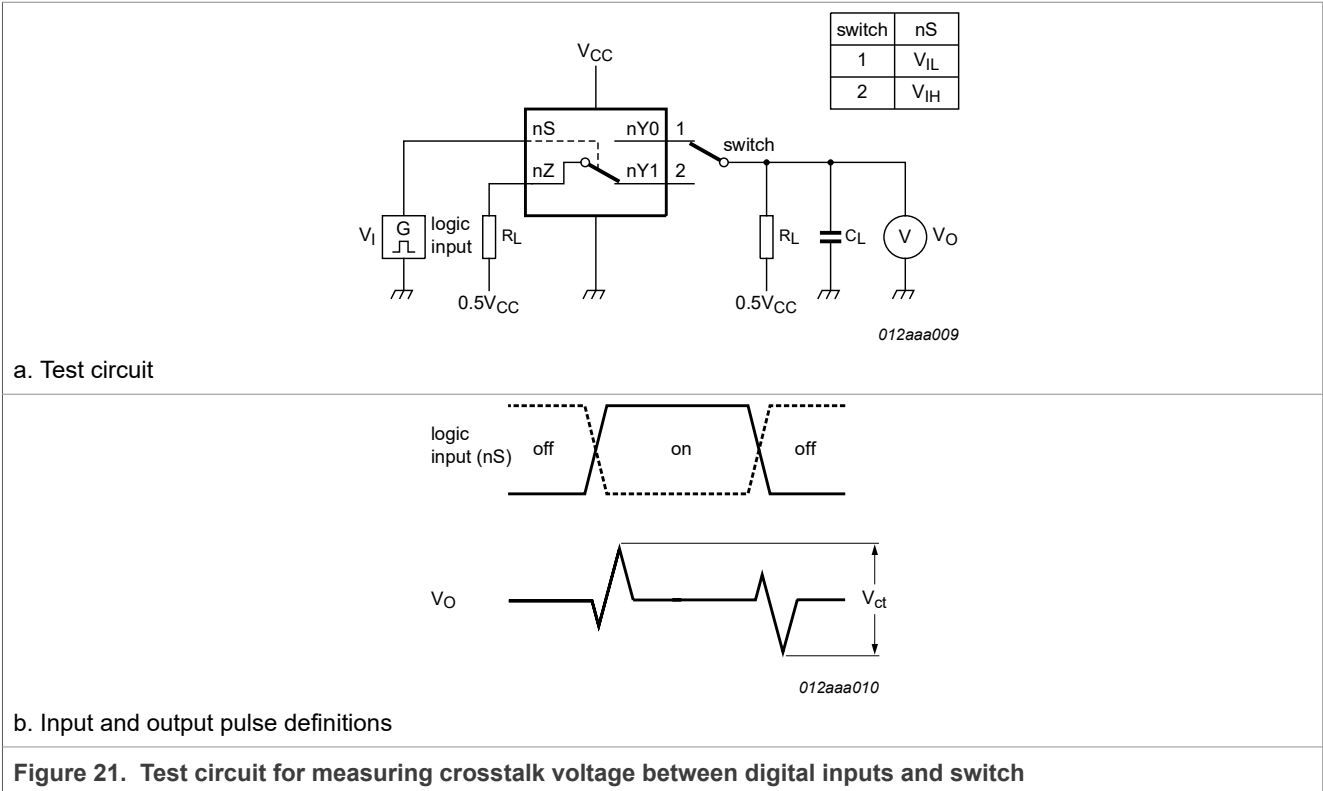


Figure 21. Test circuit for measuring crosstalk voltage between digital inputs and switch

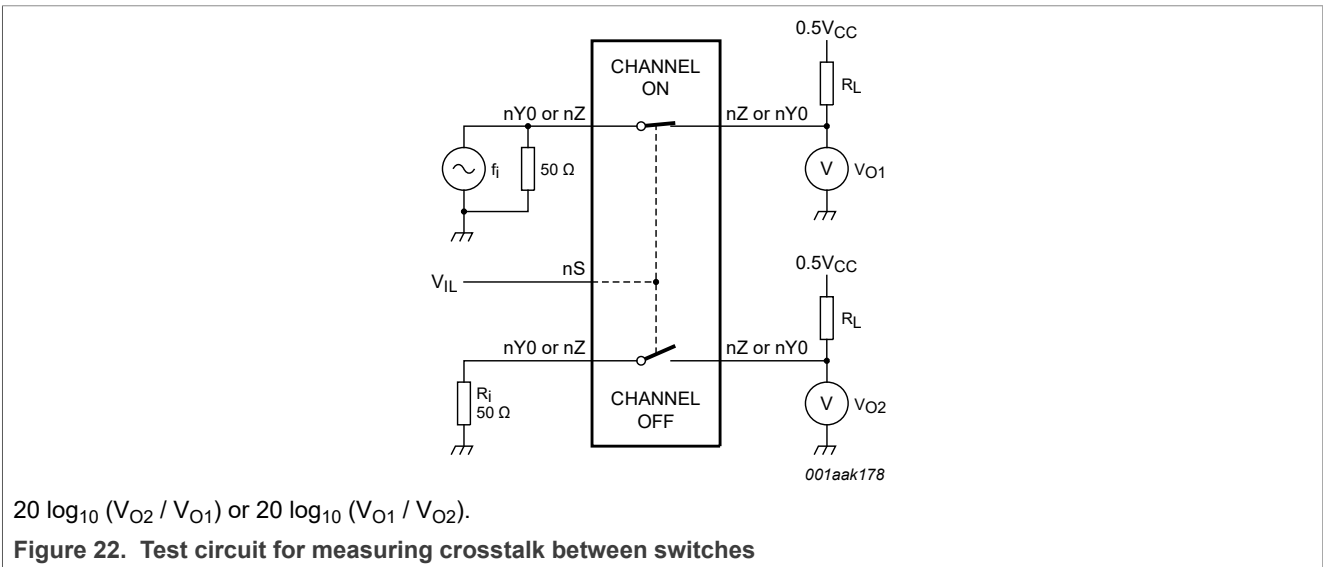
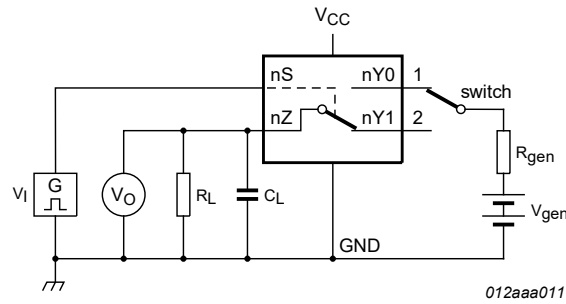
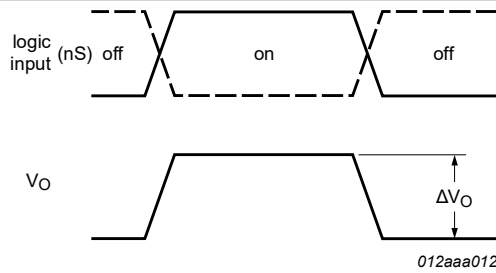


Figure 22. Test circuit for measuring crosstalk between switches



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.

Figure 23. Test circuit for measuring charge injection

12 Package outline

HXQFN16U: plastic thermal enhanced extremely thin quad flat package; no leads;
16 terminals; UTLP based; body 3 x 3 x 0.5 mm

SOT1039-1

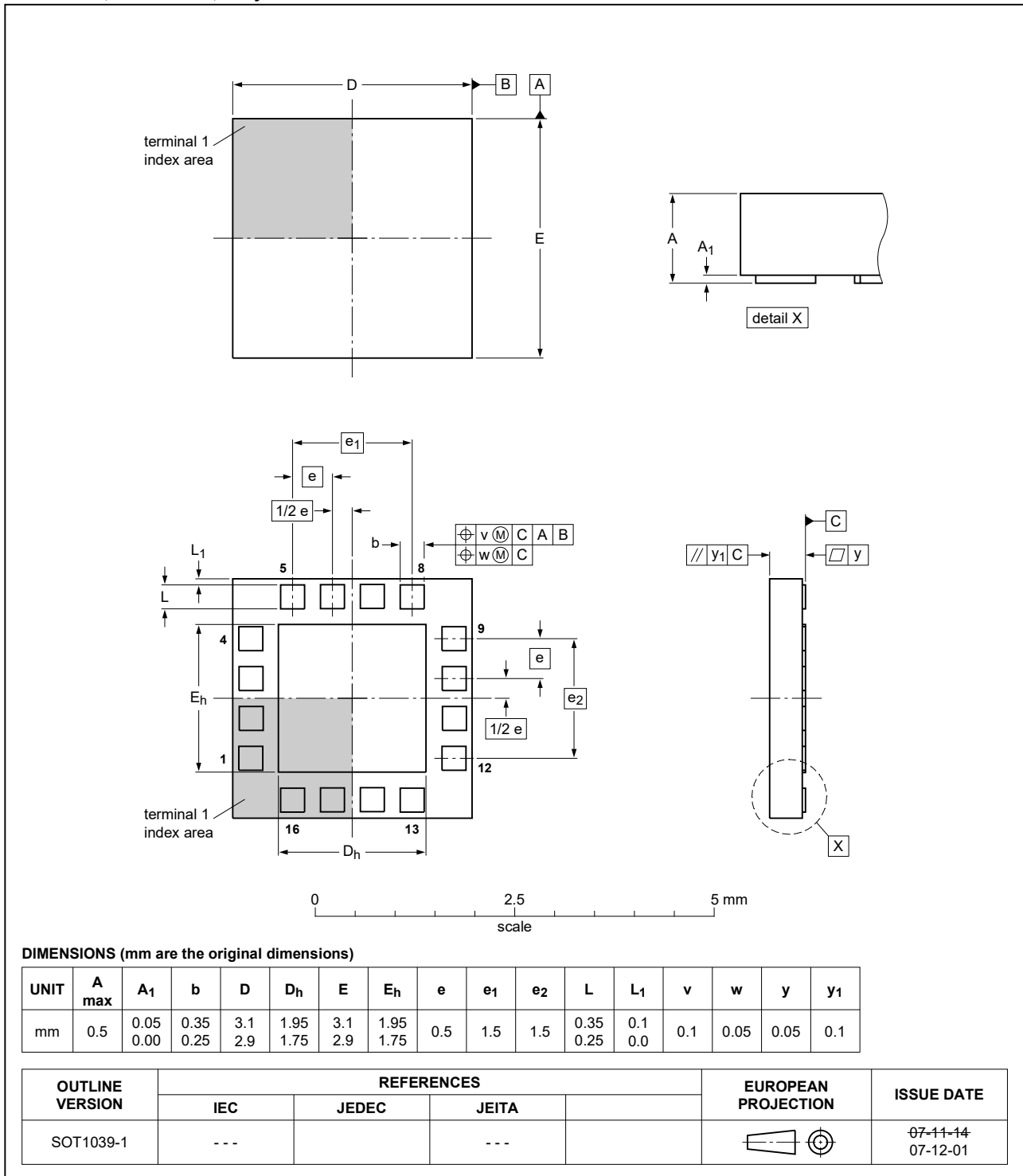
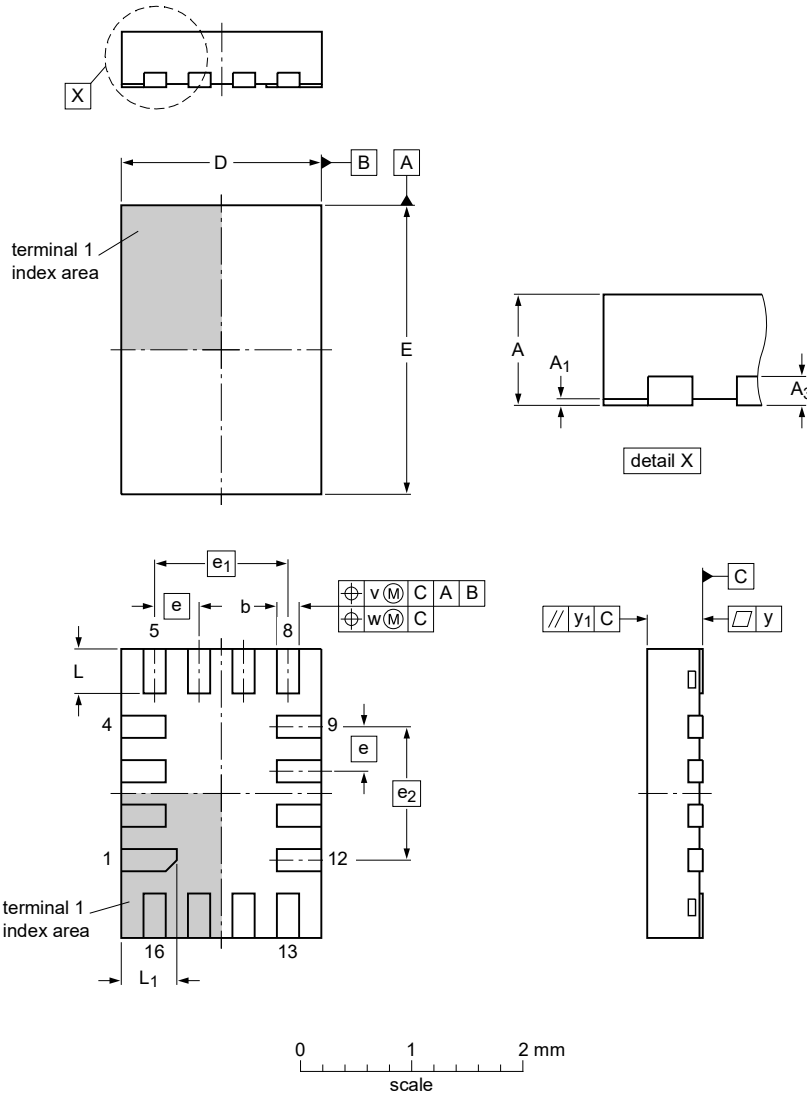


Figure 24. Package outline SOT1039-1 (HXQFN16U)

XQFN16: plastic, extremely thin quad flat package; no leads;
16 terminals; body 1.80 x 2.60 x 0.50 mm

SOT1161-1



Dimensions

Unit ⁽¹⁾	A	A ₁	A ₃	b	D	E	e	e ₁	e ₂	L	L ₁	v	w	y	y ₁
max	0.5	0.05		0.25	1.9	2.7				0.45	0.55				
mm nom			0.127	0.20	1.8	2.6	0.4	1.2	1.2	0.40	0.50	0.1	0.05	0.05	0.05
min		0.00		0.15	1.7	2.5				0.35	0.45				

Note

1. Plastic or metal protrusions of 0.075 mm maximum per side are not included.

sot1161-1_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT1161-1	---	---	---			09-12-28- 09-12-29

Figure 25. Package outline SOT1161-1 (XQFN16)

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

14 Revision history

Table 14. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
NX3DV3899 v.3.1	20210625	Product data sheet	-	NX3DV3899 v.3
Modifications:	<ul style="list-style-type: none"> Updated Section 4. 			
NX3DV3899 v.3	20111109	Product data sheet	-	NX3DV3899 v.2
NX3DV3899 v.2	20101123	Product data sheet	-	NX3DV3899 v.1
NX3DV3899 v.1	20101021	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.
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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Tables

Tab. 1.	Ordering information	2	Tab. 8.	ON resistance	7
Tab. 2.	Ordering options	2	Tab. 9.	Dynamic characteristics	10
Tab. 3.	Pin description	4	Tab. 10.	Measurement points	11
Tab. 4.	Function table	4	Tab. 11.	Test data	12
Tab. 5.	Limiting values	4	Tab. 12.	Additional dynamic characteristics	13
Tab. 6.	Recommended operating conditions	5	Tab. 13.	Abbreviations	19
Tab. 7.	Static characteristics	5	Tab. 14.	Revision history	19

Figures

Fig. 1.	Logic symbol	2	Fig. 14.	ON resistance as a function of input voltage; VCC = 4.3 V	9
Fig. 2.	Logic diagram	3	Fig. 15.	Enable and disable times	11
Fig. 3.	Pin configuration SOT1039-1 (HXQFN16U)	3	Fig. 16.	Test circuit for measuring break-before-make timing	12
Fig. 4.	Pin configuration SOT1161-1 (XQFN16)	3	Fig. 17.	Test circuit for measuring switching times	12
Fig. 5.	Test circuit for measuring OFF-state leakage current	6	Fig. 18.	Test circuit for measuring total harmonic distortion	14
Fig. 6.	Test circuit for measuring ON-state leakage current	6	Fig. 19.	Test circuit for measuring the frequency response when channel is in ON-state	14
Fig. 7.	Test circuit for measuring ON resistance	8	Fig. 20.	Test circuit for measuring isolation (OFF-state)	14
Fig. 8.	Typical ON resistance as a function of input voltage	8	Fig. 21.	Test circuit for measuring crosstalk voltage between digital inputs and switch	15
Fig. 9.	ON resistance as a function of input voltage; VCC = 1.4 V	8	Fig. 22.	Test circuit for measuring crosstalk between switches	15
Fig. 10.	ON resistance as a function of input voltage; VCC = 1.65 V	8	Fig. 23.	Test circuit for measuring charge injection	16
Fig. 11.	ON resistance as a function of input voltage; VCC = 2.5 V	9	Fig. 24.	Package outline SOT1039-1 (HXQFN16U)	17
Fig. 12.	ON resistance as a function of input voltage; VCC = 3.0 V	9	Fig. 25.	Package outline SOT1161-1 (XQFN16)	18
Fig. 13.	ON resistance as a function of input voltage; VCC = 3.6 V	9			

Contents

1	General description	1
2	Features and benefits	1
3	Applications	2
4	Ordering information	2
5	Functional diagram	2
6	Pinning information	3
6.1	Pinning	3
6.2	Pin description	4
7	Functional description	4
8	Limiting values	4
9	Recommended operating conditions	5
10	Static characteristics	5
10.1	Test circuits	6
10.2	ON resistance	7
10.3	ON resistance test circuit and graphs	8
11	Dynamic characteristics	10
11.1	Waveform and test circuits	11
11.2	Additional dynamic characteristics	13
11.3	Test circuits	14
12	Package outline	17
13	Abbreviations	19
14	Revision history	19
15	Legal information	20

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