Analog switch with negative swing audio capability Rev. 2.1 — 12 February 2020 Product data sheet

1 General description

The NX5L2750CGU is a dual low-ohmic single-pole double-throw analog switch suitable for use as an analog or digital 2 : 1 multiplexer/demultiplexer. Each switch has a digital select input (nS), two independent inputs/outputs (nY0 and nY1) and a common input/ output (nZ).

The NX5L2750CGU is capable of switching audio signals with negative swing without the need of a coupling capacitor.

Schmitt trigger action at the digital inputs makes the circuit tolerant to slower input rise and fall times. Low threshold digital inputs allows this device to be driven by 1.8 V logic levels in 3.3 V applications without significant increase in supply current I_{CC}. This makes it possible for the NX5L2750CGU to switch 5 V audio signals with a 1.8 V digital controller, eliminating the need for logic level translation.

2 Features and benefits

- Supply voltage range from 1.8 V to 5.0 V
- 0.8 Ω typical ON resistance
- 100 MHz typical bandwidth or data frequency
- CMOS low-power consumption
- 1.8 V control logic at V_{CC} = 3.6 V
- Break-before-make switching
- · ESD protection:
 - HBM JESD22-A114F Class 3A exceeds 4000 V
 - CDM AEC-Q100-011 revision B exceeds 1000 V
- · Latch-up performance exceeds 100 mA per JESD 78 Class II Level A
- Specified from -40 °C to +85 °C

3 Applications

- · Cellular phones, PDA
- · Portable media players
- Personal media players



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4 Ordering information

Fable 1. Ordering information						
Type number	Topside	Package				
	marking	Name	Description	Version		
NX5L2750CGU	LA	XQFN10	plastic, extremely thin quad flat package; no leads; 10 terminals; body 1.40 x 1.80 x 0.50 mm	SOT1160-1		

4.1 Ordering options

Table 2. Ordering options

Type number	Orderable part number	Package	Packing method	Minimum order quantity	Temperature
NX5L2750CGU	NX5L2750CGUX	XQFN10	REEL 7" Q1 NDP	4000	T_{amb} = -40 °C to +85 °C

5 Functional diagram



6 Pinning information

6.1 Pinning



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6.2 Pin description

Table 3. Pin description					
Symbol	Pin	Description			
V _{cc}	1	supply voltage			
2Y0, 1Y0	5, 7	independent input or output			
2Z, 1Z	3, 9	common output or input			
2S, 1S	4, 8	select input			
GND	6	ground (0 V)			
2Y1, 1Y1	2, 10	independent input or output			

7 Functional description

Table 4. Function table ^[1]					
Input	Channel on				
nS					
L	nY0 = nZ				
Н	nY1 = nZ				

[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	+5.5	V
VI	input voltage	pins nS	[1]	-0.5	+5.5	V
V _{SW}	switch voltage			-4.0	V _{CC} + 0.5	V
I _{IK}	input clamping current	V _I < -0.5 V		-50	-	mA
I _{SK}	switch clamping current	V_{I} < -4.0 V or V_{I} > V_{CC} + 0.5 V		-	±50	mA
I _{SW}	switch current	T _{amb} = 25 °C		-	±250	mA
		T _{amb} = 25 °C; peak current (pulsed at 1 ms duration; < 10 % duty cycle)		-	±500	mA
I _{CC}	supply current			-	+50	mA
T _{stg}	storage temperature			-65	+150	°C
P _{tot}	total power dissipation	T _{amb} = -40 °C to +85 °C		-	250	mW

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

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9 Recommended operating conditions

Table 6. Recommended operating conditions

Symbol	Parameter	Conditions		Min	Мах	Unit
V _{CC}	supply voltage			1.8	5.0	V
VI	input voltage	pins nS		0	5.0	V
V _{SW}	switch voltage		[1]	-2.5	V _{CC}	V
T _{amb}	ambient temperature			-40	+85	°C

[1] The voltage across the switch should be < 5.5 V.

10 Static characteristics

Table 7. Static characteristics

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

Symbol	Parameter	Conditions		T _{amb} =	Unit		
				Min	Typ ^[1]	Max	
V _{IH}	HIGH-level input	V _{CC} = 2.7 V to 4.3 V		1.4	-	-	V
vol	voltage	V _{CC} = 4.3 V to 5.0 V		1.5	-	-	V
VIL	LOW-level input	V _{CC} = 2.7 V to 4.3 V		-	-	0.6	V
voltage	voltage	V _{CC} = 4.3 V to 5.0 V		-	-	0.6	V
V _{IK}	input clamping voltage	V _{CC} = 3.0 V; I _I = -18 mA		-	-	-1.2	V
l _l	input leakage current	pins nS; V _I = 0 V to V _{CC} ; V _{CC} = 0 V to 4.3 V		-	-	±1	μA
I _{S(OFF)}	OFF-state leakage current	$V_{CC} = 2.7 \text{ V}; V_1 = -2.5 \text{ V} \text{ or } 2.5 \text{ V}; V_0$ = 2.5 V or -2.5 V; see Figure 3		-	-	±250	nA
I _{CC}	supply current	$V_{I} = V_{CC}$ or GND; $V_{SW} =$ GND or V_{CC} ; $V_{CC} = 2.7 V$				2	μA
ΔI _{CC}	additional supply current	V_1 = 2.6 V; V_{SW} = GND or V_{CC} ; V_{CC} = 4.3 V		-	-	10	μA
		V_1 = 1.8 V; V_{SW} = GND or V_{CC} ; V_{CC} = 4.3 V		-	-	15	μA
Cl	input capacitance	pins nS		-	1.5	-	pF
$C_{S(OFF)}$	OFF-state capacitance	pins nY0 and nY1; V _{CC} = 3.3 V; V _I = 0 V to 3.3 V		-	35	-	pF
C _{S(ON)}	ON-state capacitance	pins nZ; V _{CC} = 3.3 V; V _I = 0 V to 3.3 V		-	75	-	pF

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

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10.1 Test circuits



10.2 ON resistance

Table 8. ON resistance

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

Symbol	Symbol Parameter Conditions ^[1]		-40	Unit		
			Min	Typ ^[2]	Мах	
R _{ON}	ON resistance	$V_{I} = V_{CC}$ -4.5 V to V_{CC} ; I_{SW} = 100 mA; V_{CC} = 2.7 V; see Figure 4	-	0.8	1.3	Ω
R _{ON(flat)}	ON resistance (flatness)	$V_I = V_{CC}$ -4.5 V to V_{CC} ; I_{SW} = 100 mA; V_{CC} = 2.7 V; see Figure 4	-	0.3	-	Ω
ΔR _{ON}	ON resistance mismatch between channels	$V_I = V_{CC}$ -4.5 V; I_{SW} = 100 mA; V_{CC} = 2.7 V; see Figure 4	-	0.1	-	Ω

Measured at identical V_{CC}, temperature and input voltage. Typical values are measured at T_{amb} = 25 °C. [1] [2]

10.3 ON resistance test circuit and graphs



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11 Dynamic characteristics

Table 9. Dynamic characteristics

At recommended operating conditions; voltages are referenced to GND (ground = 0 V); for test circuit see Figure 7.

Symbol	Parameter	Conditions		T _{amb} =	Unit		
				Min	Typ ^[1]	Max	
t _{en}	enable time	nS to nZ; see <u>Figure 5</u>					
		V_{CC} = 2.7 V to 3.6 V	[2]	-	80	160	ns
		V _{CC} = 3.6 V to 4.3 V	[3]	-	70	120	ns
t _{dis}	disable time	nS to nZ; see <u>Figure 5</u>					
		V _{CC} = 2.7 V to 3.6 V	[2]	-	25	50	ns
		V _{CC} = 3.6 V to 4.3 V	[3]	-	25	50	ns
t _{b-m}	break-before-make time	see <u>Figure 6</u>	[4]				
		V _{CC} = 2.7 V to 3.6 V		15	55	-	ns
		V _{CC} = 3.6 V to 4.3 V		12	45	-	ns

Typical values are measured at T_{amb} = 25 °C. Typical values are measured at V_{CC} = 3.3 V. Typical values are measured at V_{CC} = 4.3 V. [1]

[2] [3]

[4] Guaranteed by design.

11.1 Waveform and test circuits



Figure 5. Enable and disable times

Table 10. Measurement points

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

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Table 11. Test data

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

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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); $t_r = t_f \le 2.5$ ns; $T_{amb} = 25$ °C.

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
THD	total harmonic distortion	$f_i = 20$ Hz to 20 kHz; $R_L = 32 \Omega$; see Figure 8				
		V _{CC} = 2.7 V; V _I = 2 V (p-p)	-	0.07	-	%
		V _{CC} = 4.3 V; V _I = 2 V (p-p)	-	0.03	-	%
f _(-3dB)	-3 dB frequency	$R_L = 50 \Omega$; see Figure 9				
	response	V _{CC} = 2.7 V to 4.3 V	-	100	-	MHz
α _{iso}	isolation (OFF-state)	$f_i = 100 \text{ kHz}; R_L = 50 \Omega; \text{ see } \frac{\text{Figure } 10}{10}$				
		V _{CC} = 2.7 V to 4.3 V	-	-60	-	dB
Xtalk cro	crosstalk	between switches; f_i = 100 kHz; R_L = 50 Ω ; see Figure 11				
		V _{CC} = 2.7 V to 4.3 V	-	-60	-	dB
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 12				
		V _{CC} = 2.7 V	-	3	-	рС
		V _{CC} = 3.3 V	-	4	-	рС
		V _{CC} = 4.3 V	-	5	-	рС

11.3 Test circuits



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12 Package outline



Figure 13. Package outline SOT1160-1 (XQFN10)

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13 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		
TTL	Transistor-Transistor Logic		
UART	Universal Asynchronous Receiver/Transmitter		
USB	Universal Serial Bus		

14 Revision history

Table 14. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes	
NX5L2750CGU v.2.1	20200212	Product data sheet	-	NX5L2750C v.2	
Modifications:	 <u>Section 4</u>: Updated look and feel NX5L2750C renamed NX5L2750CGU throughout data sheet 				
NX5L2750C v.2	20140507	Product data sheet	-	NX5L2750C v.1	
Modifications:	 Updated by adding the following values: <u>Table 7</u>: minimum V_{IH} level added at V_{CC} = 4.3 V to 5.0 V <u>Table 7</u>: minimum V_{IL} level added at V_{CC} = 4.3 V to 5.0 V 				
NX5L2750C v.1	20130906	Product data sheet	-	-	

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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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Product [short] data sheet	Production	This document contains the product specification.

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