

NX5L2750C

Analog switch with negative swing audio capability

Rev. 2 — 7 May 2014

Product data sheet

1. General description

The NX5L2750C 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 NX5L2750C can switch 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} . It makes it possible for the NX5L2750C 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



4. Ordering information

Table 1. Ordering information

| Type number | Package | | | Version |
|-------------|-------------------|--------|---|-----------|
| | Temperature range | Name | Description | |
| NX5L2750CGU | -40 °C to +85 °C | XQFN10 | plastic, extremely thin quad flat package; no leads; 10 terminals; body 1.40 × 1.80 × 0.50 mm | SOT1160-1 |

5. Marking

Table 2. Marking

| Type number | Marking code |
|-------------|--------------|
| NX5L2750CGU | LA |

6. Functional diagram

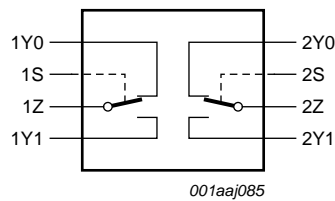


Fig 1. Logic symbol

7. Pinning information

7.1 Pinning

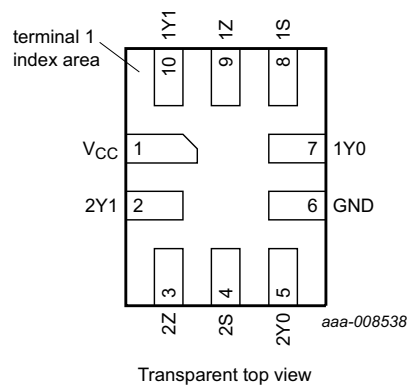


Fig 2. Pin configuration SOT1160-1 (XQFN10)

7.2 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 |

8. Functional description

Table 4. Function table^[1]

| Input (nS) | Channel on |
|------------|------------|
| L | nY0 = nZ |
| H | nY1 = nZ |

[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 | +5.5 | V |
| V _I | 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.

10. Recommended operating conditions

Table 6. Recommended operating conditions

| Symbol | Parameter | Conditions | Min | Max | Unit |
|-----------------|----------------|------------|-----|-----|------|
| V _{CC} | supply voltage | | 1.8 | 5.0 | V |

Table 6. Recommended operating conditions ...continued

| Symbol | Parameter | Conditions | Min | Max | Unit |
|------------------|---------------------|------------|----------|-----------------|------|
| V _I | 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.

11. Static characteristics

Table 7. Static characteristics

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

| Symbol | Parameter | Conditions | T _{amb} = -40 °C to +85 °C | | | Unit |
|---------------------|---------------------------|---|-------------------------------------|--------------------|------|------|
| | | | Min | Typ ^[1] | Max | |
| V _{IH} | HIGH-level input voltage | V _{CC} = 2.7 V to 4.3 V | 1.4 | - | - | V |
| | | V _{CC} = 4.3 V to 5.0 V | 1.5 | - | - | V |
| V _{IL} | LOW-level input voltage | V _{CC} = 2.7 V to 4.3 V | - | - | 0.6 | V |
| | | 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 |
| I _I | 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 V; V _I = -2.5 V or 2.5 V; V _O = 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 _I = 2.6 V; V _{SW} = GND or V _{CC} ; V _{CC} = 4.3 V | - | - | 10 | µA |
| | | V _I = 1.8 V; V _{SW} = GND or V _{CC} ; V _{CC} = 4.3 V | - | - | 15 | µA |
| C _I | 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.

11.1 Test circuits

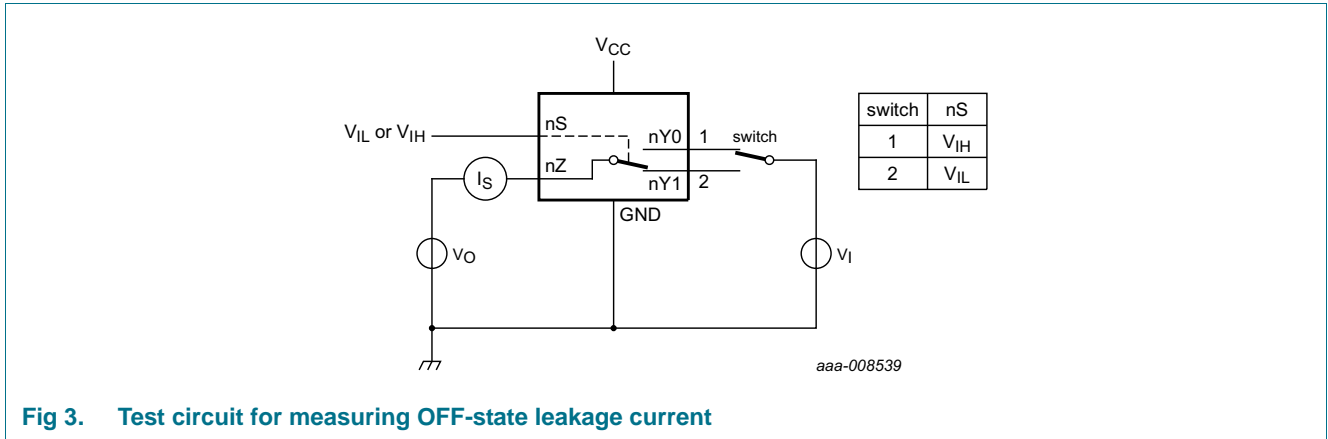


Fig 3. Test circuit for measuring OFF-state leakage current

11.2 ON resistance

Table 8. ON resistance

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

| Symbol | Parameter | Conditions | -40 °C to +85 °C | | | Unit |
|-----------------------|---|--|------------------|--------------------|-----|------|
| | | | Min | Typ ^[1] | Max | |
| 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 |

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

11.3 ON resistance test circuit and graphs

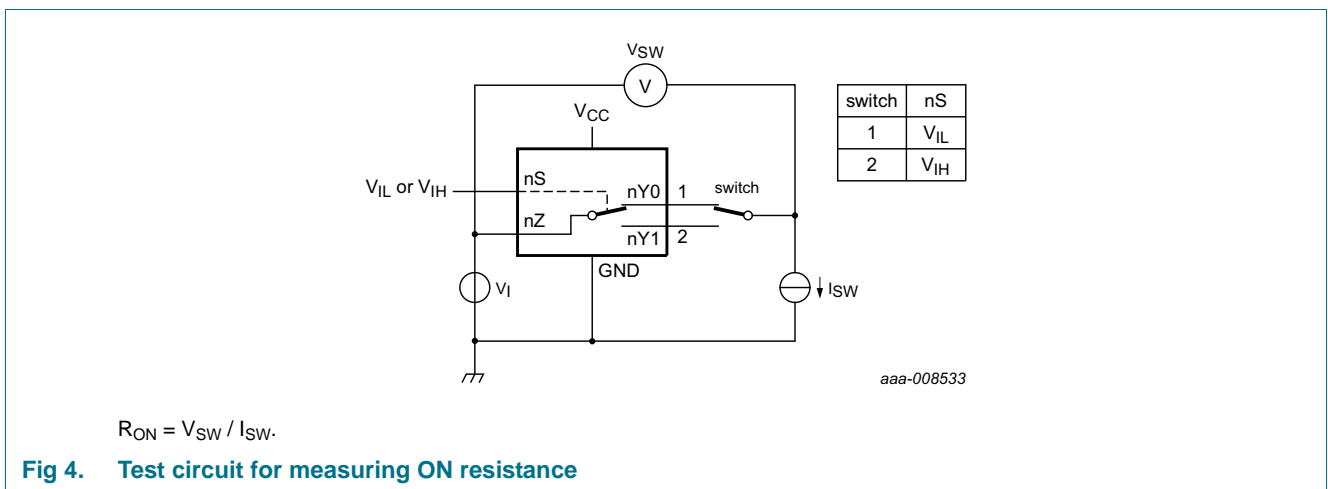


Fig 4. Test circuit for measuring ON resistance

12. 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} = -40 °C to +85 °C | | | Unit |
|------------------|------------------------|---|-------------------------------------|--------------------|-----|------|
| | | | Min | Typ ^[1] | Max | |
| t _{en} | enable time | nS to nZ; see Figure 5 | | | | |
| | | 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 Figure 5 | | | | |
| | | 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 Figure 6 ^[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 |

- [1] Typical values are measured at T_{amb} = 25 °C.
- [2] Typical values are measured at V_{CC} = 3.3 V.
- [3] Typical values are measured at V_{CC} = 4.3 V.
- [4] Guaranteed by design.

12.1 Waveform and test circuits

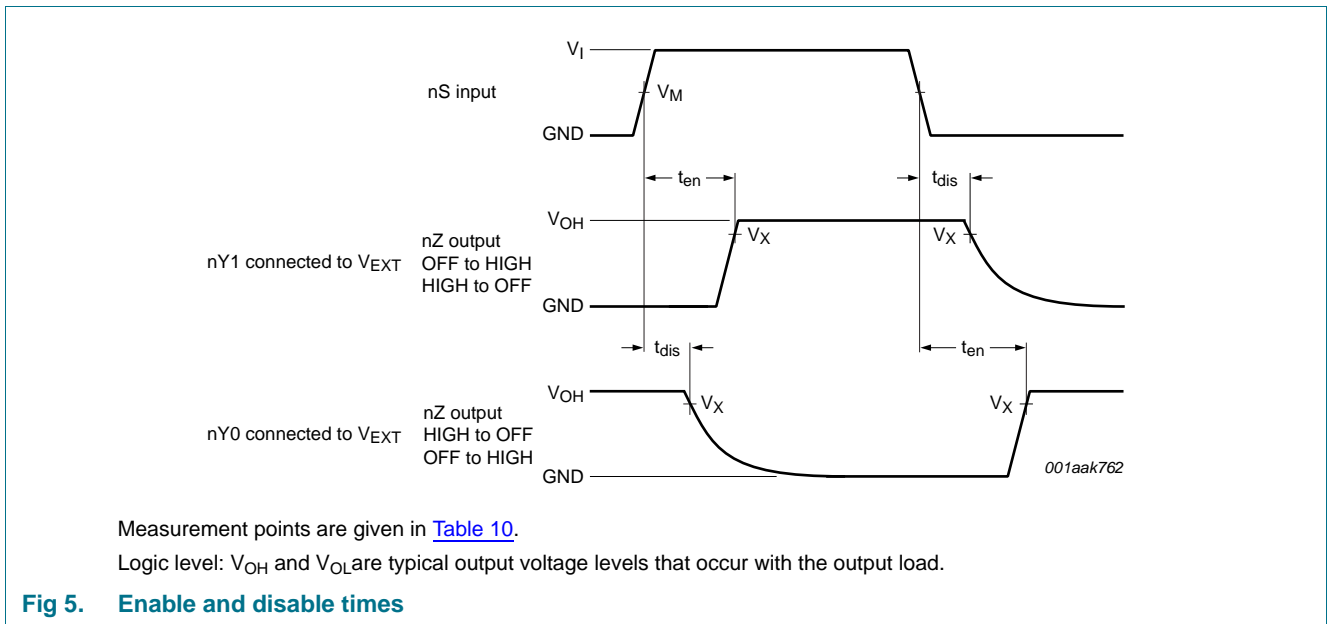
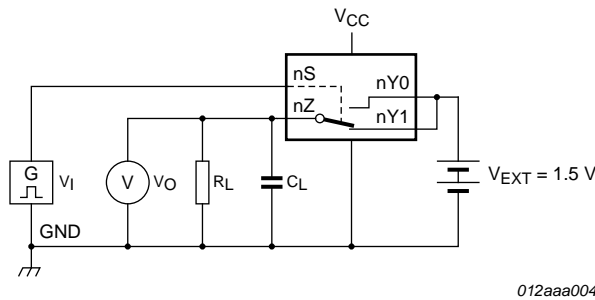
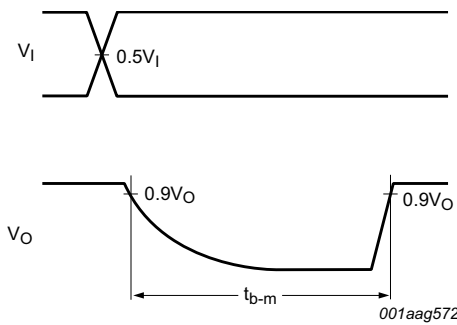


Table 10. Measurement points

| Supply voltage | Input | | Output |
|-----------------|--------------------|-----------------|--------------------|
| V _{CC} | V _M | V _I | V _X |
| 2.7 V to 4.3 V | 0.5V _{CC} | V _{CC} | 0.9V _{OH} |

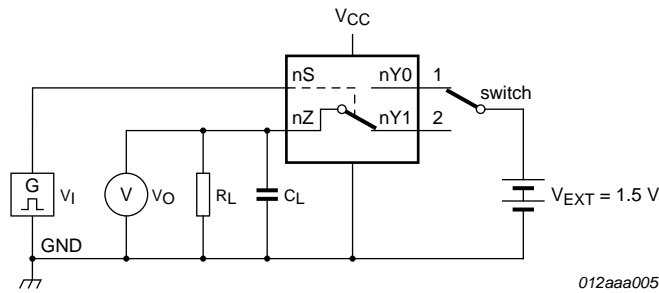


a. Test circuit.



b. Input and output measurement points

Fig 6. Test circuit for measuring break-before-make timing



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 7. Test circuit for measuring switching times

Table 11. Test data

| Supply voltage | Input | | Load | |
|----------------|----------|---------------|-------|-------------|
| V_{CC} | V_I | t_r, t_f | C_L | R_L |
| 2.7 V to 4.3 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; $T_{amb} = 25$ °C.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|----------------|---------------------------|--|-----|------|-----|------|
| THD | total harmonic distortion | $f_i = 20$ Hz to 20 kHz; $R_L = 32$ Ω ; 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 response | $R_L = 50$ Ω ; see Figure 9 | | | | |
| | | $V_{CC} = 2.7$ V to 4.3 V | - | 100 | - | MHz |
| α_{iso} | isolation (OFF-state) | $f_i = 100$ kHz; $R_L = 50$ Ω ; see Figure 10 | | | | |
| | | $V_{CC} = 2.7$ V to 4.3 V | - | -60 | - | dB |
| Xtalk | 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; $R_L = 1$ M Ω ; $V_{gen} = 0$ V; $R_{gen} = 0$ Ω ; see Figure 12 | | | | |
| | | $V_{CC} = 2.7$ V | - | 3 | - | pC |
| | | $V_{CC} = 3.3$ V | - | 4 | - | pC |
| | | $V_{CC} = 4.3$ V | - | 5 | - | pC |

12.3 Test circuits

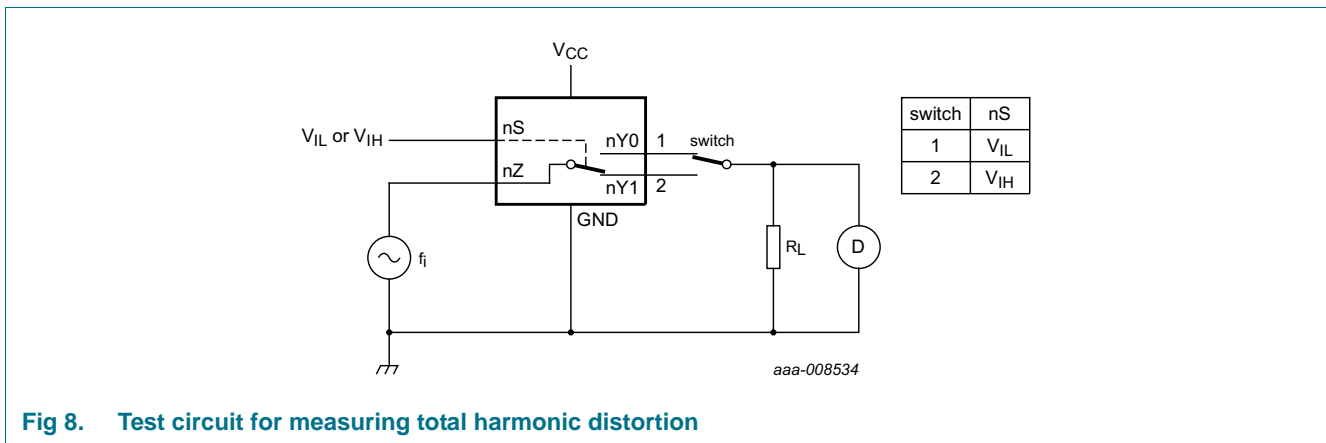
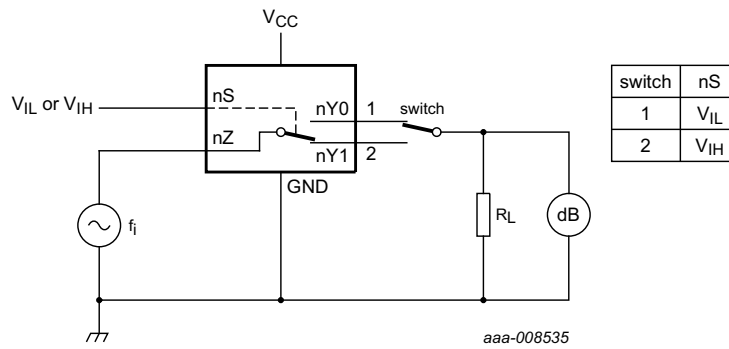
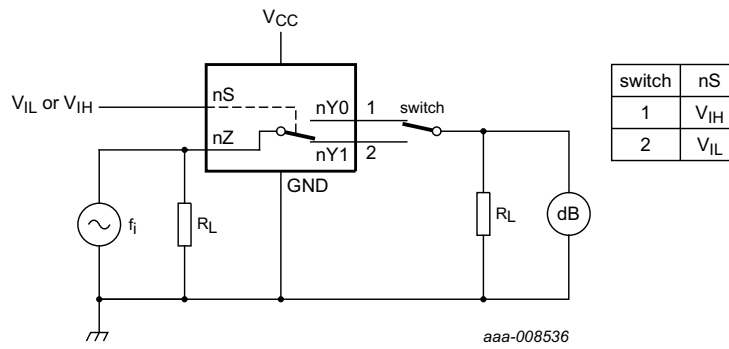


Fig 8. Test circuit for measuring total harmonic distortion



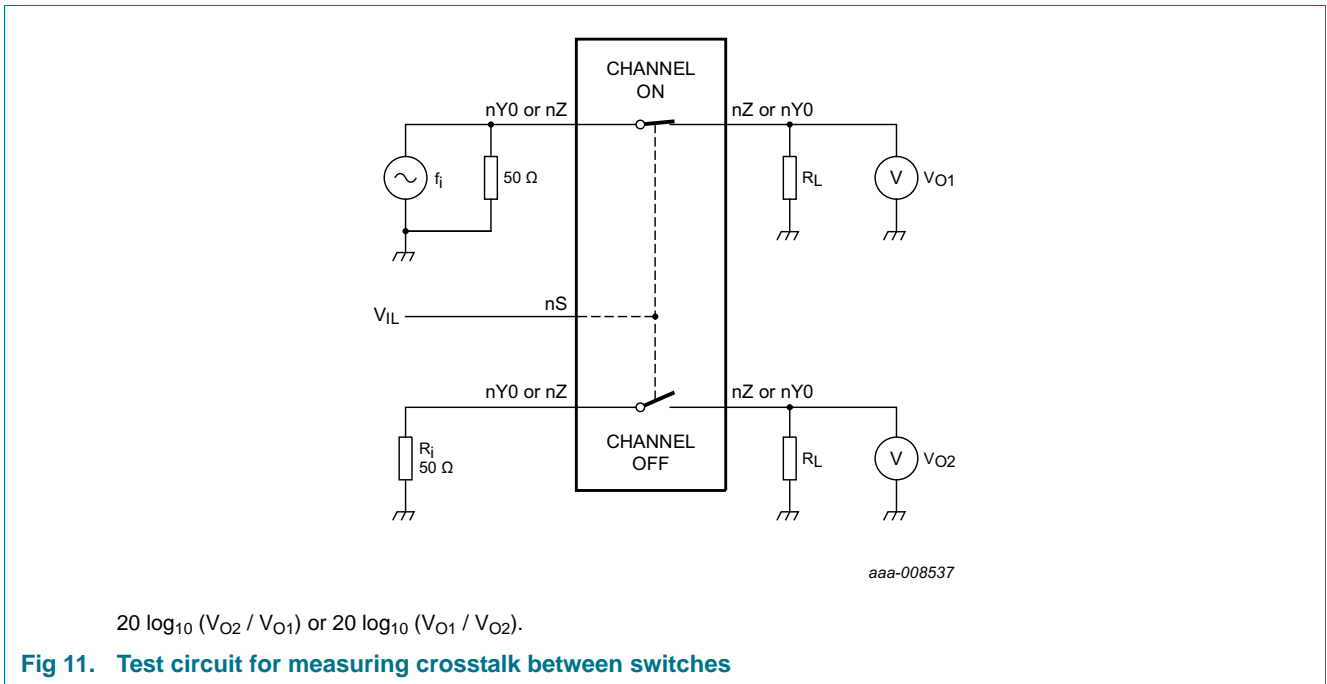
To obtain 0 dBm level at output, adjust f_i voltage. Increase f_i frequency until dB meter reads -3 dB.

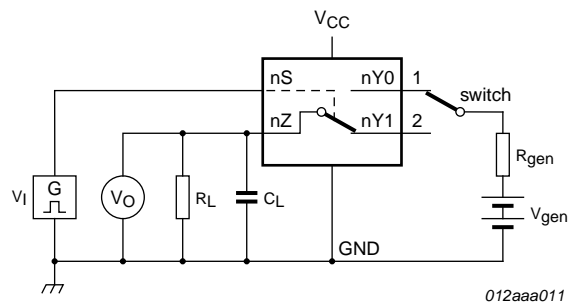
Fig 9. Test circuit for measuring the frequency response when channel is in ON-state



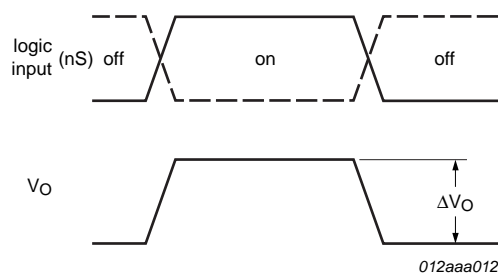
To obtain 0 dBm level at output, adjust f_i voltage.

Fig 10. Test circuit for measuring isolation (OFF-state)





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 12. Test circuit for measuring charge injection

13. Package outline

XQFN10: plastic, extremely thin quad flat package; no leads; 10 terminals; body 1.40 x 1.80 x 0.50 mm

SOT1160-1

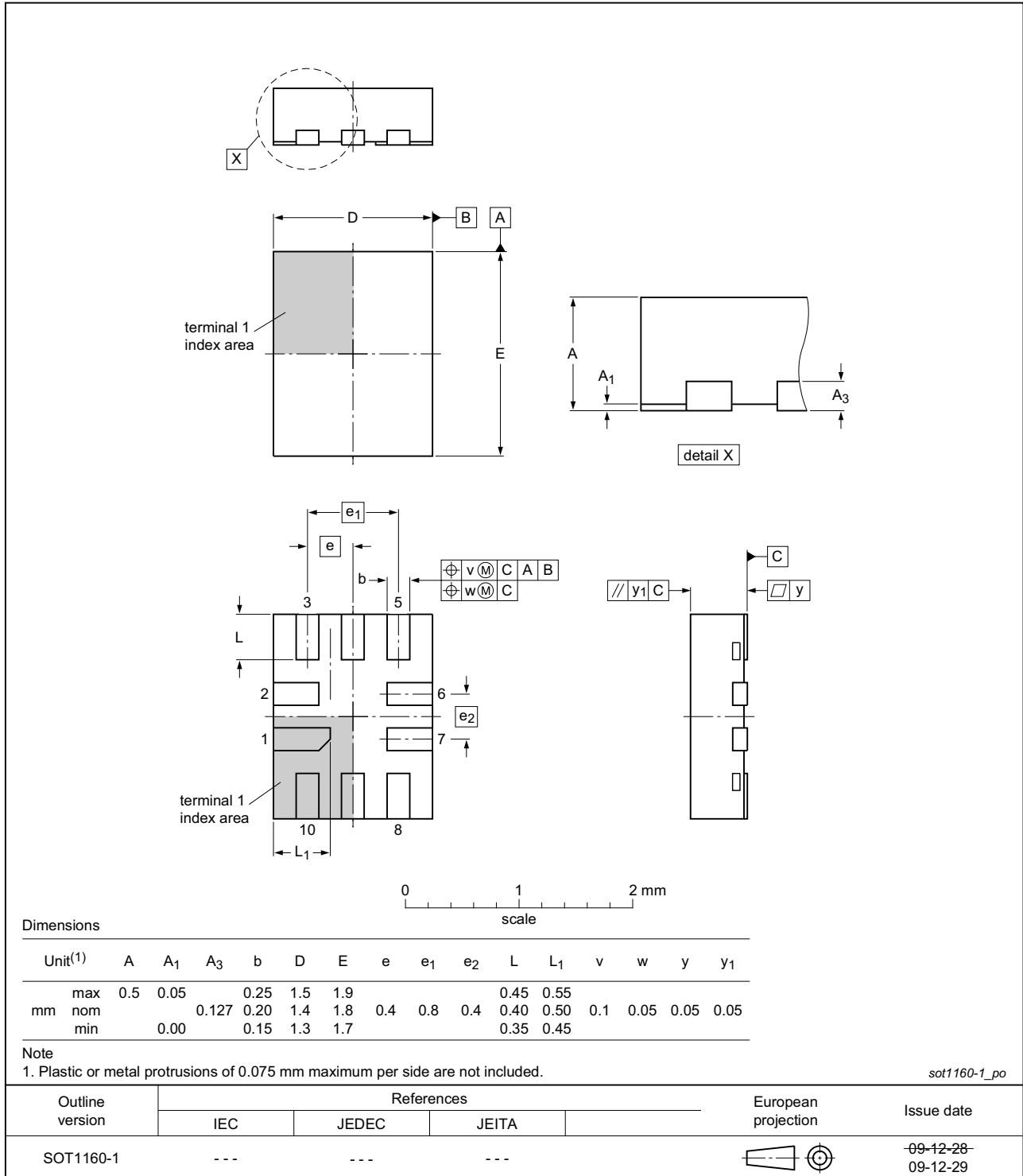


Fig 13. Package outline SOT1160-1 (XQFN10)

14. 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 |
| TTL | Transistor-Transistor Logic |
| UART | Universal Asynchronous Receiver/Transmitter |
| USB | Universal Serial Bus |

15. Revision history

Table 14. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|----------------|--|--------------------|---------------|---------------|
| NX5L2750C v.2 | 20140507 | Product data sheet | - | NX5L2750C v.1 |
| Modifications: | <ul style="list-style-type: none"> • Table 7: minimum V_{IH} level added at $V_{CC} = 4.3\text{ V}$ to 5.0 V • Table 7: minimum V_{IL} level added at $V_{CC} = 4.3\text{ V}$ to 5.0 V | | | |
| NX5L2750C v.1 | 20130906 | Product data sheet | - | - |

16. Legal information

16.1 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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[1] Please consult the most recently issued document before initiating or completing a design.

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- Поставку компонентов в любых объемах, удовлетворяющих вашим потребностям.
- Приемлемые сроки поставки, возможна ускоренная поставка.
- Доставку товара в любую точку России и стран СНГ.
- Комплексную поставку.
- Работу по проектам и поставку образцов.
- Формирование склада под заказчика.
- Сертификаты соответствия на поставляемую продукцию (по желанию клиента).
- Тестирование поставляемой продукции.
- Поставку компонентов, требующих военную и космическую приемку.
- Входной контроль качества.
- Наличие сертификата ISO.

В составе нашей компании организован Конструкторский отдел, призванный помогать разработчикам, и инженерам.

Конструкторский отдел помогает осуществить:

- Регистрацию проекта у производителя компонентов.
- Техническую поддержку проекта.
- Защиту от снятия компонента с производства.
- Оценку стоимости проекта по компонентам.
- Изготовление тестовой платы монтаж и пусконаладочные работы.



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