

# NXT4557

## SIM card interface level translator with enable pin

Rev. 1 — 3 February 2022

Product data sheet

## 1. General description

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The NXT4557 device is built for interfacing a SIM card with a single low-voltage host side interface. The NXT4557 has three level translators to convert the data, RST and CLK signals between a SIM card and a host microcontroller. A high speed level translation capable of supporting class-B, class-C SIM cards. An active HIGH EN pin enables normal operation of the translator. A HIGH to LOW transition on pin EN initiates a shutdown sequence on SIM card pins in accordance with ISO-7816-3.

The NXT4557 is compliant with all ETSI, IMT-2000 and ISO-7816 SIM/Smart card interface requirements.

## 2. Features and benefits

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- Support SIM cards and eSIM with supply voltages 1.62 V to 3.3 V
- Host micro-controller operating voltage range: 1.08 V to 1.98 V
- Automatic level translation of I/O, RST and CLK between SIM card and host side interface with capacitance isolation
- Incorporates shutdown feature for the SIM card signals according to ISO-7816-3
- High  $V_{dis(UVLO\_AC)}$  switching level, arranging quick shut down when  $V_{CC\_SIM}$  powers down
- Integrated pull-up resistors; no external resistor required
- Integrated EMI Filters suppresses higher harmonics of digital I/O's
- A HIGH EN signal enables the translation of the signals
- Low current shutdown mode  $< 1 \mu A$
- Supports clock speed beyond 5 MHz clock
- Pb-free, Restriction of Hazardous Substances (RoHS) compliant and free of halogen and antimony (Dark Green compliant)
- ESD protection:
  - HBM ANSI/ESDA/JEDEC JS-001 exceeds 2 kV
  - CDM ANSI/ESDA/JEDEC JS-002 exceeds 1 kV
  - IEC61000-4-2 level 4, contact and air discharge on all SIM card-side pins are 8kV and 15 kV
- Available in 10-pin XQFN package

## 3. Applications

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- NXT4557 can be used with a range of SIM card attached devices including:
  - Mobile and personal phones
  - Wireless modems
  - SIM card terminals

## 4. Ordering information

Table 1. Ordering information

| Type number | Package           |        |   |           |
|-------------|-------------------|--------|---|-----------|
|             | Temperature range | Name   | Description   | Version   |
| NXT4557GU   | -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[1] |
|-------------|-----------------|
| NXT4557GU   | z7              |

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

## 6. Functional diagram

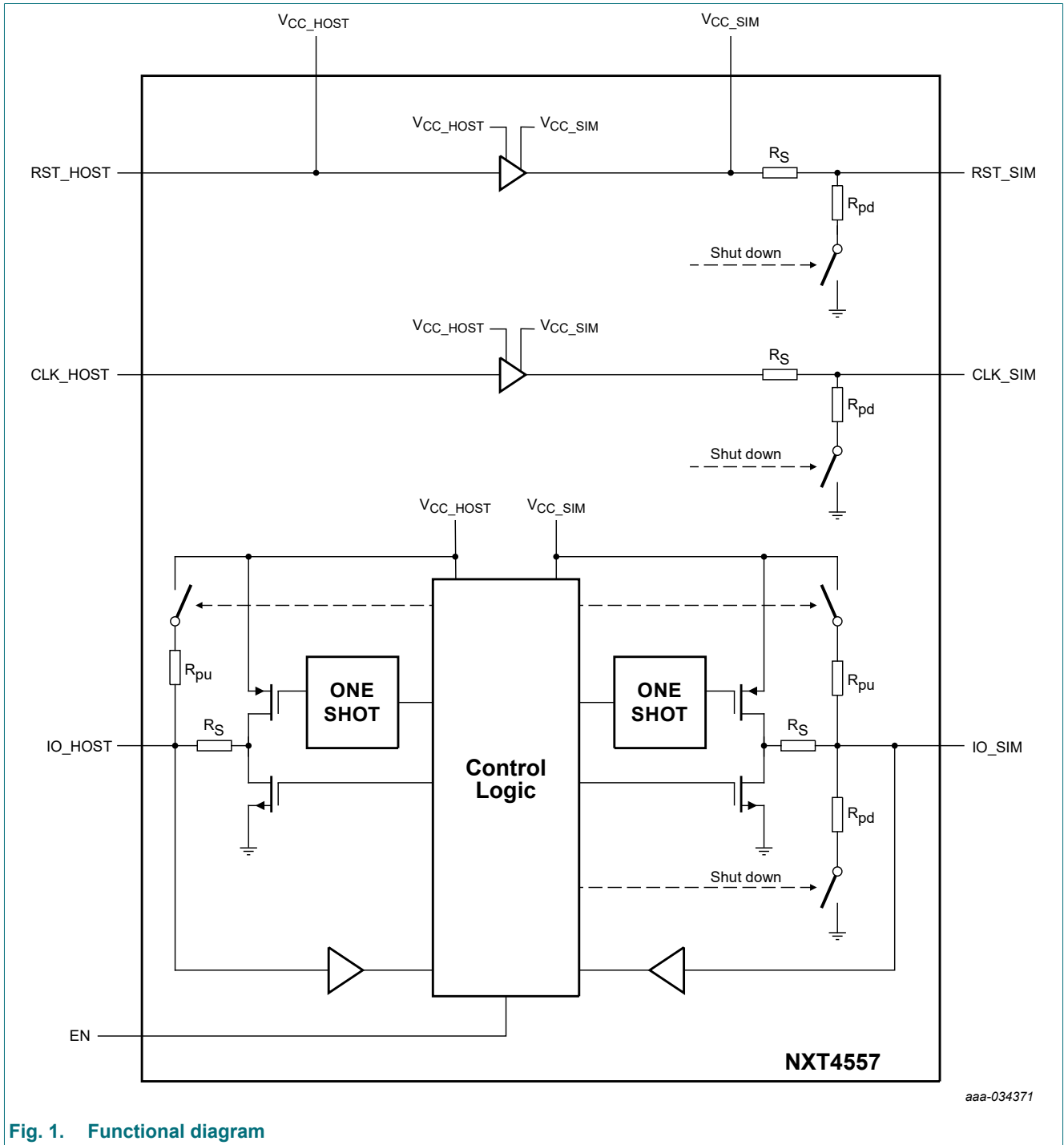
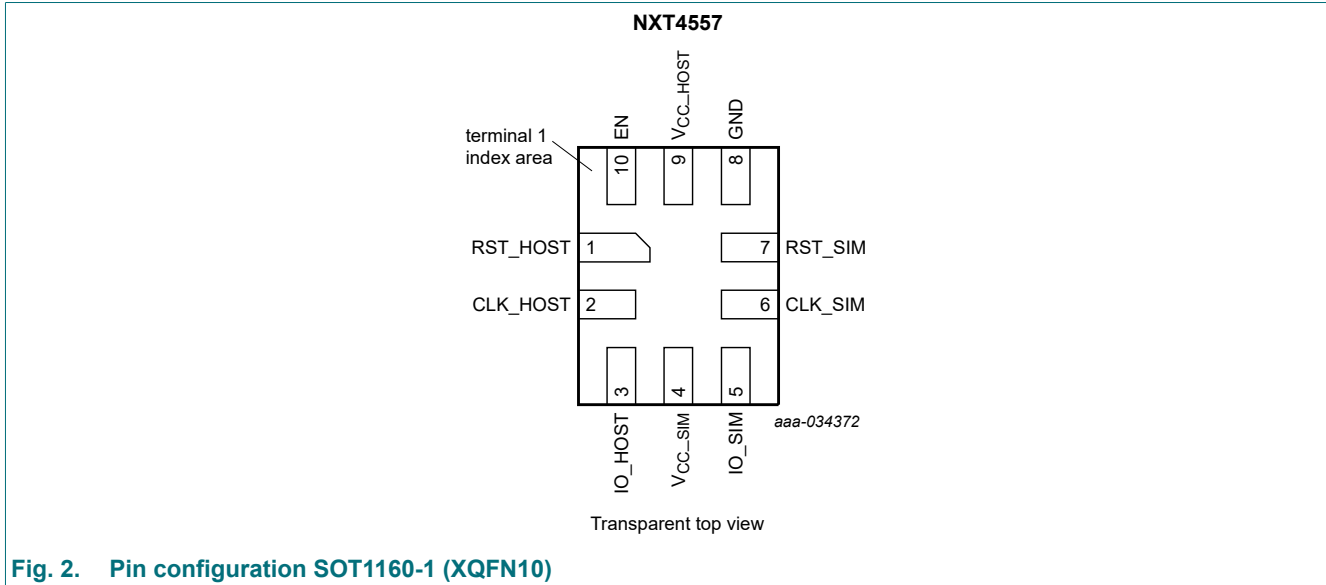


Fig. 1. Functional diagram

## 7. Pinning information

### 7.1. Pinning



### 7.2. Pin description

**Table 3. Pin description**

| Symbol   | Pin | Type   | Description  |
|----------|-----|--------|--|
| RST_HOST | 1   | I      | Reset input from host controller.  |
| CLK_HOST | 2   | I      | Clock input from host controller.  |
| IO_HOST  | 3   | I/O    | Host controller bidirectional data input/output. This pin can be driven from push pull as well as open drain drivers.  |
| VCC_SIM  | 4   | power  | Supply voltage for the SIM CARD side input/output pins. This input voltage ranges from 1.62 V to 3.3 V. This pin should be bypassed with a 0.1 $\mu$ F ceramic capacitor close to the pin. |
| IO_SIM   | 5   | I/O    | SIM card bidirectional data input/output. The SIM card output must be on an open-drain driver.   |
| CLK_SIM  | 6   | O      | Clock output pin for the SIM card.   |
| RST_SIM  | 7   | O      | Reset output pin for the SIM card.   |
| GND      | 8   | ground | Ground for the SIM card and host controller. Proper grounding and bypassing are required to meet ESD specifications.   |
| VCC_HOST | 9   | power  | Supply voltage for the host controller side input/output pins (CLK_HOST, RST_HOST, IO_HOST). This pin should be bypassed with a 0.1 $\mu$ F ceramic capacitor close to the pin.            |
| EN       | 10  | I      | Enable input from host controller to enable or disable the translator. Also used to initiate shutdown sequence   |

## 8. Functional description

### 8.1. Functional behavior

The functional diagram of the NXT4557 is shown in [Fig. 1](#).

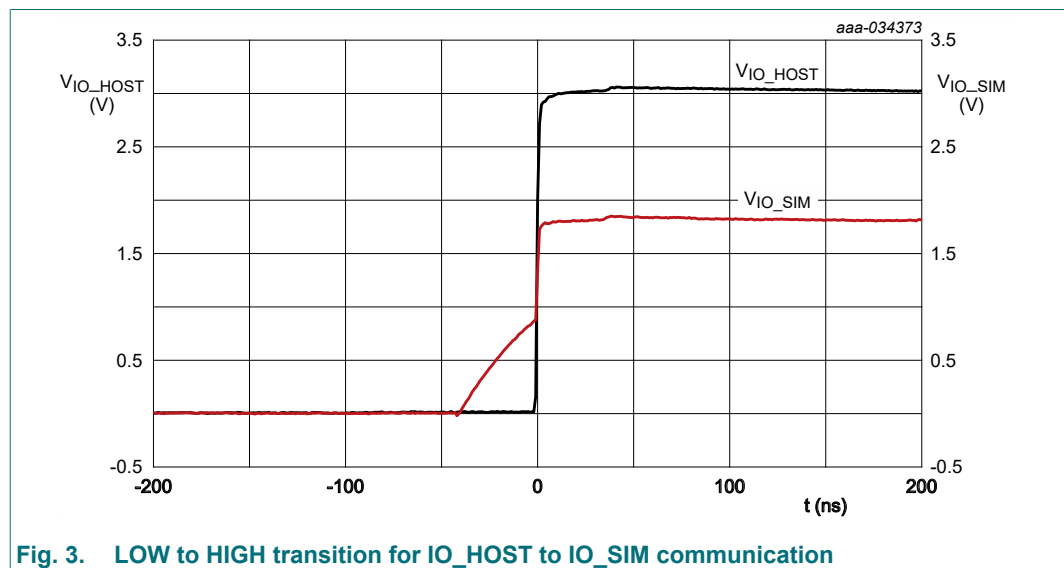
The upper part of [Fig. 1](#) shows the RST and CLK channels which are uni-directional level shifters from the host to the SIM card side.

The bottom part shows the architecture of the bidirectional I/O channel. Both on IO\_HOST and IO\_SIM a resistor  $R_{pu}$  pulls up the I/O node. On both sides an output stage is present that consists of a PMOST and an NMOST device. Each output stage drives the output through a series resistor  $R_S$ . Input stages sense the I/O nodes and pass LOW/HIGH information to the control logic that controls the translator outputs and several pull-up and pull-down resistors.

The NXT4557 I/O channel does not require a dedicated input signal to control the direction of data flow from IO\_HOST to IO\_SIM or from IO\_SIM to IO\_HOST. Change in driving direction is possible when both sides are at HIGH state. The control logic recognizes the I/O node with the first falling edge and grants control over the opposite I/O node. When for example the IO\_HOST is turned LOW, the control circuit will turn on the NMOST on the IO\_SIM side, pulling LOW IO\_SIM. The IO\_SIM pin is then an output only, until IO\_HOST is turned HIGH and the translator has turned IO\_SIM HIGH again.

The PMOST devices are used to actively turn high the outputs. Each PMOST is driven by a one-shot circuit that generates a pulse. For example: Assuming HOST to SIM communication, when the IO\_HOST is turned HIGH, it will activate the one shot circuit on the IO\_SIM side. A pulse starts, arranging a fast LOW to HIGH transition on IO\_SIM. When the pulse has finished, the PMOST is released. At that stage, the system returns to a standard open drain state whereby the pull resistors keep the I/O nodes HIGH.

At the same time, at a LOW to HIGH transition, the one shot on the input side is activated as well. In an open drain application, this creates a typical input LOW to HIGH waveform. [Fig. 3](#) shows an example of a LOW to HIGH transition in an open drain application.



**Fig. 3. LOW to HIGH transition for IO\_HOST to IO\_SIM communication**

Looking at the input signal, the first part of the LOW to HIGH transition is an exponential curve caused by the I/O node capacitance being charged via the pull-up resistor. The second part starts when the input signal crosses the input switching level. The rising edge is accelerated dramatically by the PMOST that is turned on by the one shot on the input side.

In case of a communication error or some other unforeseen incident that may drive both connected sides of the drivers at the same time, the internal logic automatically prevents stuck-at situation. This ensures that both I/Os will return to HIGH level once released from being driven LOW.

In shut down mode, the control circuit disables all output stages. Additionally, in shut down mode, the pull-up resistor on IO\_SIM side is disabled, and all pull-down resistors  $R_{pd}$  on SIM side are enabled, pulling LOW the pins on the SIM side. The shut down sequence is explained in more detail in [Section 8.3](#).

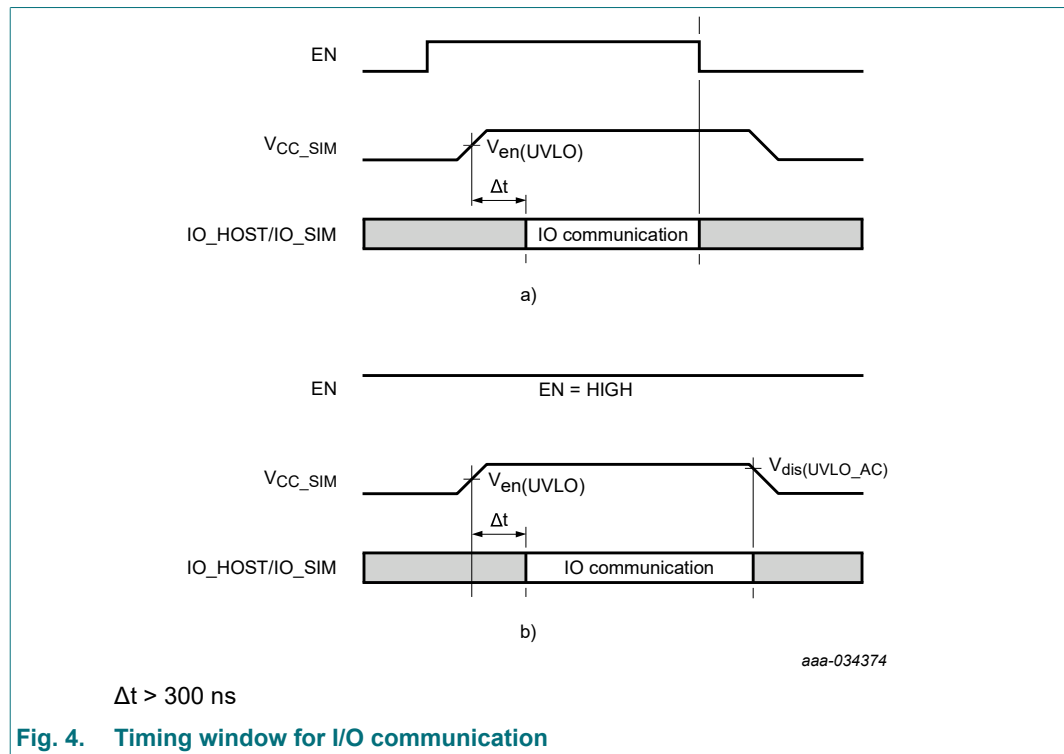
## 8.2. Window of I/O communication

When the translator is in operating mode, I/O communication can take place through the I/O channel. Communication can take place in both directions IO\_HOST ↔ IO\_SIM. Additionally, during operating mode, the RST\_HOST and CLK\_HOST signals are passed to RST\_SIM and CLK\_SIM respectively.

The translator is active when EN is turned HIGH. Another condition for the operational mode is that  $V_{CC\_HOST}$  and  $V_{CC\_SIM}$  are at a proper level. [Fig. 4](#) a)/b) shows two scenarios illustrating how EN and  $V_{CC\_SIM}$  control the translator mode.  $V_{CC\_HOST}$  is assumed to be default present and is not shown in the waveform.

When both EN and  $V_{CC\_SIM}$  have turned HIGH, I/O communication can commence after a certain amount of time:  $\Delta t > 300$  ns.

It is assumed that during the power up sequence, the nodes of IO\_HOST and IO\_SIM are not pulled down by the host controller and the SIM card. The translator has integrated pull-up resistors and will turn HIGH both IO\_HOST and IO\_SIM. The pull-up resistors  $R_{pu}$  are pointed out in [Fig. 1](#).



**Fig. 4. Timing window for I/O communication**

When either EN turns low or  $V_{CC\_SIM}$  drops below  $V_{dis(UVLO)}$ , the translator turns to shutdown mode. [Section 8.3](#) illustrates the shutdown sequence in more detail.

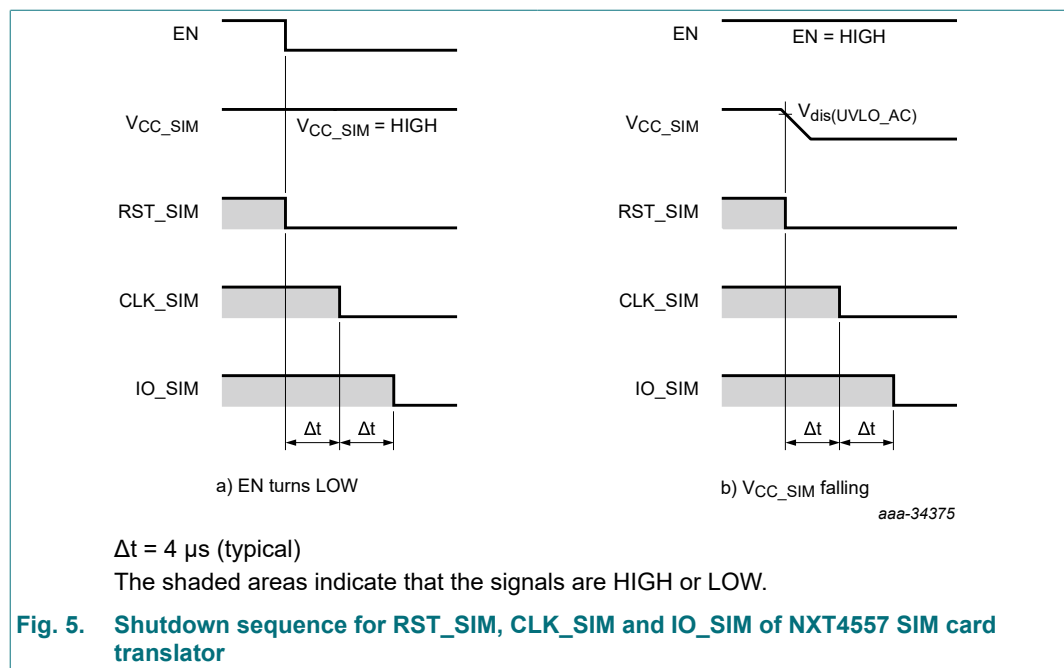
When EN turns low and during shutdown mode, the pull-down resistors are activated on all SIM card side pins (RST\_SIM, CLK\_SIM and IO\_SIM).

### 8.3. Shutdown sequence

The ISO 7816-3 specification specifies the shutdown sequence for the SIM card signals to ensure that the card is properly disabled for power savings. Also, during hot swap, the orderly shutdown of these signals helps to avoid any improper write and corruption of data.

When either the enable, EN, is asserted LOW or when  $V_{CC\_SIM}$  drops below  $V_{dis(UVLO\_AC)}$ , the shutdown sequence is initiated. Fig. 5 a) illustrates the shutdown sequence initiated by EN being asserted LOW. Fig. 5 b) illustrates the shutdown sequence initiated by  $V_{CC\_SIM}$  being powered down.

The shut down sequence starts by pulling down the RST\_SIM output. Once RST\_SIM is turned LOW, CLK\_SIM and IO\_SIM are pulled LOW sequentially, one-by-one. Internal pull-down resistors on the SIM pins are used to pull the SIM channels LOW. The internal pull-down resistors,  $R_{pd}$ , that pull down the three pins on the SIM side are shown in Fig. 1. The shutdown sequence is completed in a few microseconds. The interval time ( $\Delta t$ ), is typically 4  $\mu s$ .



### 8.4. UVLO

When  $V_{CC\_SIM}$  drops below  $V_{dis(UVLO\_AC)}$ , the translator goes to shut down mode. This is illustrated in Fig. 4 b) and Fig. 5 b). The switching level  $V_{dis(UVLO\_AC)}$  has a high value of approximately 86 % $\times V_{CC\_SIM}$ . The circuitry uses an AC detection mechanism that operates accurately with a falling slope that is typical in the SIM card application. Next to this AC detection, a standard UVLO detection is in place that has no condition with respect to the slope of the rising or falling  $V_{CC\_SIM}$ . For the standard UVLO, the parameters  $V_{en(UVLO)}$  and  $V_{dis(UVLO)}$  are involved which have lower values than  $V_{dis(UVLO\_AC)}$ . When  $V_{CC\_SIM}$  is powered up, the translator is enabled when  $V_{CC\_SIM}$  crosses  $V_{en(UVLO)}$ . This is illustrated in Fig. 4 a)/b).

### 8.5. EMI filter

All output driver stages of I/O, RST and CLK channels are equipped with EMI filters to reduce interference towards sensitive mobile communication.

### 8.6. ESD protection

The device has robust ESD protections on all SIM card pins. The architecture prevents any stress for the host: the voltage translator discharges any stress to supply ground.

## 9. Limiting values

**Table 4. Limiting values**

In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol               | Parameter                       | Conditions   | Min       | Max  | Unit |
|----------------------|---------------------------------|--|-----------|------|------|
| V <sub>ESD</sub>     | electrostatic discharge voltage | SIM card side;<br>IEC 61000-4-2, level 4; contact discharge  | -         | ±8   | kV   |
|                      |                                 | SIM card side;<br>IEC 61000-4-2, level 4; air discharge      | -         | ±15  | kV   |
|                      |                                 | all other pins;<br>IEC 61000-4-2, level 4; contact discharge | -         | ±2   | kV   |
|                      |                                 | all other pins; HBM [1]                                      | -         | ±2   | kV   |
|                      |                                 | all other pins; CDM [2]                                      | -         | ±1   | kV   |
| V <sub>CC_HOST</sub> | supply voltage                  |  | GND - 0.5 | 4.6  | V    |
| V <sub>CC_SIM</sub>  | SIM card supply voltage         |  | GND - 0.5 | 4.6  | V    |
| V <sub>I</sub>       | input voltage                   | CLK_HOST; input signal voltage, HOST side                    | GND - 0.5 | 4.6  | V    |
|                      |                                 | RST_HOST; input signal voltage, HOST side                    | GND - 0.5 | 4.6  | V    |
|                      |                                 | IO_HOST; input signal voltage, HOST side                     | GND - 0.5 | 4.6  | V    |
|                      |                                 | EN; enable input voltage, HOST side                          | GND - 0.5 | 4.6  | V    |
|                      |                                 | CLK_SIM; input signal voltage, SIM side                      | GND - 0.5 | 4.6  | V    |
|                      |                                 | RST_SIM; input signal voltage, SIM side                      | GND - 0.5 | 4.6  | V    |
|                      |                                 | IO_SIM; input signal voltage, SIM side                       | GND - 0.5 | 4.6  | V    |
| T <sub>stg</sub>     | storage temperature             |  | -55       | +125 | °C   |

[1] Human Body Model (HBM) according to JESD22-A-A114.

[2] Charged-Device Model (CDM) according to JESD22-C101.

## 10. Recommended operating conditions

**Table 5. Operating conditions**

| Symbol               | Parameter                | Conditions | Min  | Typ | Max                        | Unit |
|----------------------|--------------------------|------------|------|-----|----------------------------|------|
| V <sub>CC_HOST</sub> | supply voltage           | [1]        | 1.08 | -   | 1.98 V                     | V    |
| V <sub>CC_SIM</sub>  | card side supply voltage | [1]        | 1.62 | -   | 3.3                        | V    |
| V <sub>I</sub>       | input voltage            | HOST side  | -0.3 | -   | V <sub>CC_HOST</sub> + 0.3 | V    |
|                      |                          | SIM side   | -0.3 | -   | V <sub>CC_SIM</sub> + 0.3  | V    |
| T <sub>amb</sub>     | ambient temperature      |            | -40  | +25 | +85                        | °C   |

[1]  $V_{CC\_SIM} \geq V_{CC\_HOST}$



## 11. Electrical characteristics

**Table 6. Electrical characteristics**

$1.08\text{ V} \leq V_{CC\_HOST} \leq 1.98\text{ V}$ ;  $1.62\text{ V} \leq V_{CC\_SIM} \leq 3.3\text{ V}$ ;  $GND = 0\text{ V}$ ; unless otherwise specified.

| Symbol                    | Parameter                            | Conditions   | T <sub>amb</sub> = -40 °C to +85 °C |                         |     | Unit |
|---------------------------|--------------------------------------|--|-------------------------------------|-------------------------|-----|------|
|                           |                                      |  | Min                                 | Typ[1]                  | Max |      |
| I <sub>CC_HOST</sub>      | supply current                       | operating mode; f <sub>clk</sub> = 1 MHz; IO_HOST = IO_SIM = HIGH [2]  | -                                   | 5                       | 10  | μA   |
|                           |                                      | shutdown mode; IO_HOST = HIGH [3]                                      | -                                   | -                       | 1   | μA   |
| I <sub>CC_SIM</sub>       | card side supply current             | operating mode; IO_HOST = IO_SIM = HIGH; CLK_HOST = RST_HOST = LOW [2] | -                                   | 2                       | 8   | μA   |
| V <sub>en(UVLO)</sub>     | undervoltage lockout enable voltage  | V <sub>CC_SIM</sub> rising; V <sub>CC_HOST</sub> = 1.8 V               | 0.85                                | 1.2                     | 1.6 | V    |
| V <sub>dis(UVLO)</sub>    | undervoltage lockout disable voltage | V <sub>CC_SIM</sub> falling; V <sub>CC_HOST</sub> = 1.8 V              | 0.65                                | 1.0                     | 1.3 | V    |
| V <sub>dis(UVLO_AC)</sub> | undervoltage lockout disable voltage | V <sub>CC_SIM</sub> falling;   |                                     |                         |     |      |
|                           |                                      | -dV/dt = 0.9 V/ms to 9 V/ms; V <sub>CC_SIM</sub> = 1.8 V               | -                                   | 1.55                    | -   | V    |
|                           |                                      | -dV/dt = 1.5 V/ms to 15 V/ms; V <sub>CC_SIM</sub> = 3.0 V              | -                                   | 2.58                    | -   | V    |
|                           |                                      | -dV/dt = 0.9 V/ms to 9 V/ms; V <sub>CC_SIM</sub> = 1.71 V to 1.89 V    | -                                   | 0.86V <sub>CC_SIM</sub> | -   | V    |
|                           |                                      | -dV/dt = 1.5 V/ms to 15 V/ms; V <sub>CC_SIM</sub> = 2.85 V to 3.15 V   | -                                   | 0.86V <sub>CC_SIM</sub> | -   | V    |

[1] Typical values measured at 25 °C.

[2] Internal pull-up resistance active on IO\_HOST and IO\_SIM

[3] Internal pull-up resistance active on IO\_HOST

Table 7. Static characteristics

$1.08\text{ V} \leq V_{CC\_HOST} \leq 1.98\text{ V}$ ;  $1.62\text{ V} \leq V_{CC\_SIM} \leq 3.3\text{ V}$ ;  $GND = 0\text{ V}$ ; unless otherwise specified.

| Symbol               | Parameter                 | Conditions                                 | $T_{amb} = -40\text{ }^{\circ}\text{C to } +85\text{ }^{\circ}\text{C}$ |        |                      | Unit       |
|----------------------|---------------------------|--|---|--------|----------------------|------------|
|                      |                           |  | Min   | Typ[1] | Max                  |            |
| <b>Level shifter</b> |                           |  |   |        |                      |            |
| $V_{IH}$             | HIGH-level input voltage  | RST_HOST, CLK_HOST, EN [2]                 | $0.65V_{CC\_HOST}$  | -      | $V_{CC\_HOST} + 0.3$ | V          |
|                      |                           | IO_HOST [2]                                | $0.5V_{CC\_HOST}$   | -      | $V_{CC\_HOST} + 0.3$ | V          |
|                      |                           | IO_SIM [2]                                 | $0.5V_{CC\_SIM}$  | -      | $V_{CC\_SIM} + 0.3$  | V          |
| $V_{IL}$             | LOW-level input voltage   | RST_HOST, CLK_HOST, EN [2]                 | -0.3  | -      | $0.35V_{CC\_HOST}$   | V          |
|                      |                           | IO_HOST [2]                                | -0.3  | -      | $0.3V_{CC\_HOST}$    | V          |
|                      |                           | IO_SIM [2]                                 | -0.3  | -      | $0.25V_{CC\_SIM}$    | V          |
| $R_{pu}$             | pull-up resistance        | IO_SIM connected to $V_{CC\_SIM}$          | 3.3   | 5.3    | 7.3                  | k $\Omega$ |
|                      |                           | IO_HOST connected to $V_{CC\_HOST}$        | 2.8   | 4.3    | 6                    | k $\Omega$ |
| $V_{OH}$             | HIGH-level output voltage | RST_SIM, CLK_SIM; $I_{OH} = -1\text{ mA}$  | $0.85V_{CC\_SIM}$   | -      | $V_{CC\_SIM} + 0.3$  | V          |
|                      |                           | IO_SIM; $I_{OH} = -10\text{ }\mu\text{A}$  | $0.85V_{CC\_SIM}$   | -      | $V_{CC\_SIM} + 0.3$  | V          |
|                      |                           | IO_HOST; $I_{OH} = -10\text{ }\mu\text{A}$ | $0.85V_{CC\_HOST}$  | -      | $V_{CC\_SIM} + 0.3$  | V          |
| $V_{OL}$             | LOW-level output voltage  | RST_SIM, CLK_SIM; $I_{OL} = 1\text{ mA}$   | -   | 50     | 200                  | mV         |
|                      |                           | IO_SIM; $I_{OL} = 1\text{ mA}$             | -   | 50     | 300                  | mV         |
|                      |                           | IO_HOST; $I_{OL} = 1\text{ mA}$            | -   | 50     | 300                  | mV         |
| $R_{pd}$             | pull-down resistance      | CLK_SIM, RST_SIM, IO_SIM                   | -   | 400    | -                    | $\Omega$   |
| <b>EMI filter</b>    |                           |  |   |        |                      |            |
| $R_S$                | series resistance         | IO_SIM                                     | -   | 44     | -                    | $\Omega$   |
|                      |                           | RST_SIM                                    | -   | 44     | -                    | $\Omega$   |
|                      |                           | CLK_SIM                                    | -   | 44     | -                    | $\Omega$   |
| $C_{io}$             | input/output capacitance  | IO_SIM                                     | -   | 10     | -                    | pF         |
|                      |                           | RST_SIM                                    | -   | 10     | -                    | pF         |
|                      |                           | CLK_SIM                                    | -   | 10     | -                    | pF         |

[1] Typical values measured at 25 °C.

[2]  $V_{IL}$ ,  $V_{IH}$  depend on the individual supply voltage per interface.

**Table 8. Dynamic characteristics**push-pull: test circuit see Fig. 7;  $C_L = 50 \text{ pF}$ ;open-drain: test circuit see Fig. 8;  $C_{IO\_HOST} = 10 \text{ pF}$ ;  $C_{IO\_SIM} = 30 \text{ pF}$ 

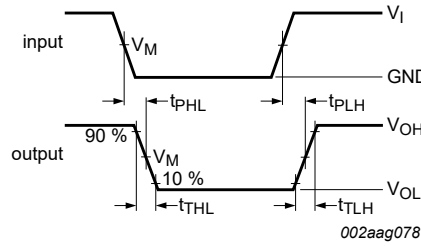
For waveform see Fig. 6

| Symbol   | Parameter         | Conditions                                     | $T_{\text{amb}} = -40 \text{ }^\circ\text{C to } +85 \text{ }^\circ\text{C}$ |        |     |  |        |     | Unit |
|--|-------------------|--|--|--------|-----|--|--------|-----|------|
|  |                   |  | $V_{\text{CC\_SIM}} = 1.8 \text{ V} \pm 0.18 \text{ V}$                      |        |     | $V_{\text{CC\_SIM}} = 3.0 \text{ V} \pm 0.3 \text{ V}$ |        |     |      |
|  |                   |  | Min  | Typ[1] | Max | Min  | Typ[1] | Max |      |
| <b><math>V_{\text{CC\_HOST}} = 1.2 \text{ V} \pm 0.12 \text{ V}</math></b> |                   |  |  |        |     |  |        |     |      |
| $t_{\text{pd}}$  | propagation delay | I/O channel; push-pull [2]                     | -  | 12     | 20  | -  | 12     | 20  | ns   |
|  |                   | I/O channel; open-drain                        | -  | 15     | 25  | -  | 15     | 25  | ns   |
|  |                   | CLK and RST channels; push-pull                | -  | 12     | 20  | -  | 12     | 20  | ns   |
| $t_t$  | transition time   | IO_HOST; push-pull [3]                         | -  | -      | 10  | -  | -      | 10  | ns   |
|  |                   | IO_SIM; RST_SIM; CLK_SIM; push-pull            | -  | -      | 10  | -  | -      | 10  | ns   |
| $t_{\text{sk}}$  | skew time         | between channels IO_SIM and CLK_SIM; push-pull | -  | 2      | -   | -  | 2      | -   | ns   |
| $f_{\text{clock}}$   | clock frequency   | CLK channel; push-pull [4]                     | -  | -      | 25  | -  | -      | 25  | MHz  |
| $f_{\text{data}}$  | data rate         | I/O channel; push-pull [4]                     | -  | -      | 5   | -  | -      | 5   | Mbps |
|  |                   | I/O channel; open-drain; see Fig. 8 [4]        | -  | -      | 800 | -  | -      | 800 | kbps |
| <b><math>V_{\text{CC\_HOST}} = 1.8 \text{ V} \pm 0.18 \text{ V}</math></b> |                   |  |  |        |     |  |        |     |      |
| $t_{\text{pd}}$  | propagation delay | I/O channel; push-pull [2]                     | -  | 7      | 12  | -  | 7      | 12  | ns   |
|  |                   | I/O channel; open-drain                        | -  | 8      | 15  | -  | 8      | 15  | ns   |
|  |                   | CLK and RST channels; push-pull                | -  | 7      | 12  | -  | 7      | 12  | ns   |
| $t_t$  | transition time   | IO_HOST; push-pull [3]                         | -  | -      | 10  | -  | -      | 10  | ns   |
|  |                   | IO_SIM; RST_SIM; CLK_SIM; push-pull            | -  | -      | 10  | -  | -      | 10  | ns   |
| $t_{\text{sk}}$  | skew time         | between channels IO_SIM and CLK_SIM; push-pull | -  | 2      | -   | -  | 2      | -   | ns   |
| $f_{\text{clock}}$   | clock frequency   | CLK channel; push-pull [4]                     | -  | -      | 25  | -  | -      | 25  | MHz  |
| $f_{\text{data}}$  | data rate         | I/O channel; push-pull [4]                     | -  | -      | 5   | -  | -      | 5   | Mbps |
|  |                   | I/O channel; open-drain; see Fig. 8 [4]        | -  | -      | 800 | -  | -      | 800 | kbps |

[1] Typical values measured at 25 °C.

[2]  $t_{\text{pd}}$  is the same as  $t_{\text{PHL}}$  and  $t_{\text{PLH}}$ .[3]  $t_t$  is the same as  $t_{\text{THL}}$  and  $t_{\text{TLH}}$ .[4] Criteria: duty cycle between 40% and 60%; Voltage swing between 10%  $V_{\text{CC1}}$  and 90%  $V_{\text{CC1}}$ .

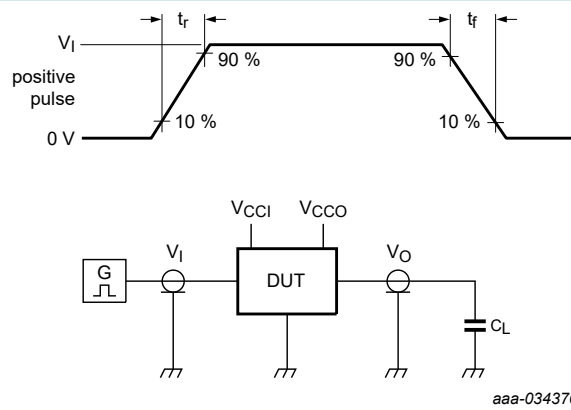
### 11.1. Waveforms and test circuits



Measurement points are given in [Table 8](#).

$V_{OL}$  and  $V_{OH}$  are typical output voltage levels that occur with the output load.

**Fig. 6. Data input to data output propagation delay times**



Test data is given in [Table 9](#).

All input pulses are supplied by generators having the following characteristics:

$PRR \leq 10 \text{ MHz}$ ;  $Z_O = 50 \Omega$ ;  $t_r, t_f \leq 2.5 \text{ ns}$ .

$C_L$  = Load capacitance including jig and probe capacitance.

$V_{CCI}$  is the supply voltage associated with the input.

$V_{CCO}$  is the supply voltage associated with the output.

**Fig. 7. Test circuit for measuring switching times for push-pull drive**

**Table 9. Test data for push-pull drive**

| Supply voltage   |                 | Direction                  | Input          |                   | Output            | Load  |
|------------------|-----------------|----------------------------|----------------|-------------------|-------------------|-------|
| $V_{CC\_HOST}$   | $V_{CC\_SIM}$   |                            | $V_I$          | $V_M$             | $V_M$             | $C_L$ |
| 1.08 V to 1.98 V | 1.62 V to 3.3 V | host side to SIM card side | $V_{CC\_HOST}$ | $0.5V_{CC\_HOST}$ | $0.5V_{CC\_SIM}$  | 50 pF |
| 1.08 V to 1.98 V | 1.62 V to 3.3 V | SIM card side to host side | $V_{CC\_SIM}$  | $0.5V_{CC\_SIM}$  | $0.5V_{CC\_HOST}$ | 50 pF |

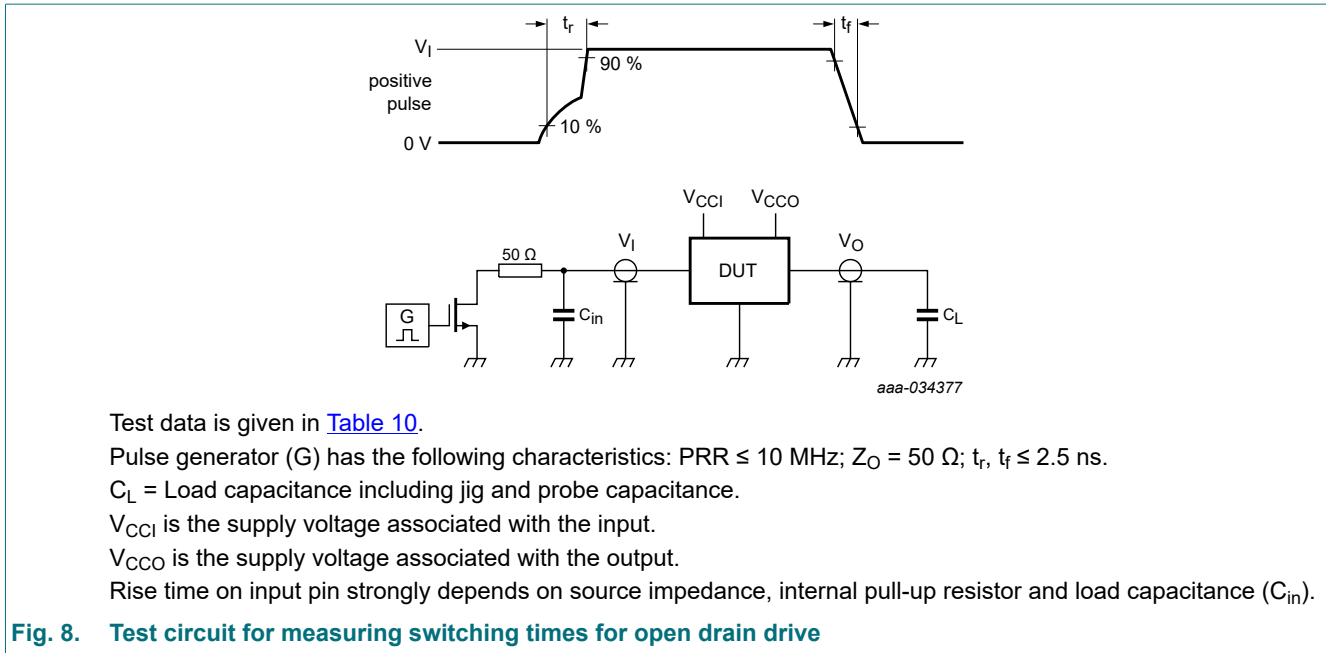
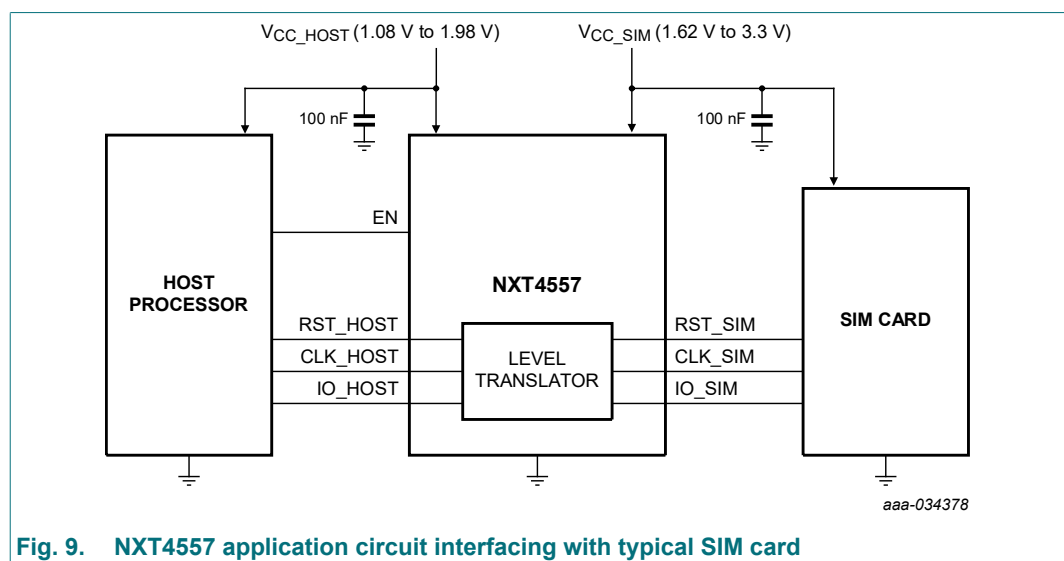


Table 10. Test data for open drain drive

| Supply voltage       |                     | Direction                  | Input                |                         | Output                  | Load            |                |
|----------------------|---------------------|----------------------------|----------------------|-------------------------|-------------------------|-----------------|----------------|
| V <sub>CC_HOST</sub> | V <sub>CC_SIM</sub> |                            | V <sub>I</sub>       | V <sub>M</sub>          | V <sub>M</sub>          | C <sub>in</sub> | C <sub>L</sub> |
| 1.08 V to 1.98 V     | 1.62 V to 3.3 V     | host side to SIM card side | V <sub>CC_HOST</sub> | 0.6V <sub>CC_HOST</sub> | 0.6V <sub>CC_SIM</sub>  | 10 pF           | 30 pF          |
| 1.08 V to 1.98 V     | 1.62 V to 3.3 V     | SIM card side to host side | V <sub>CC_SIM</sub>  | 0.5V <sub>CC_SIM</sub>  | 0.5V <sub>CC_HOST</sub> | 30 pF           | 10 pF          |

## 12. Application information

The application circuit for the NXT4557, which shows the typical interface with a SIM card, is shown in [Fig. 9](#). Supply decoupling capacitors (100 nF) are recommended and should be placed close to the translator product.



### 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

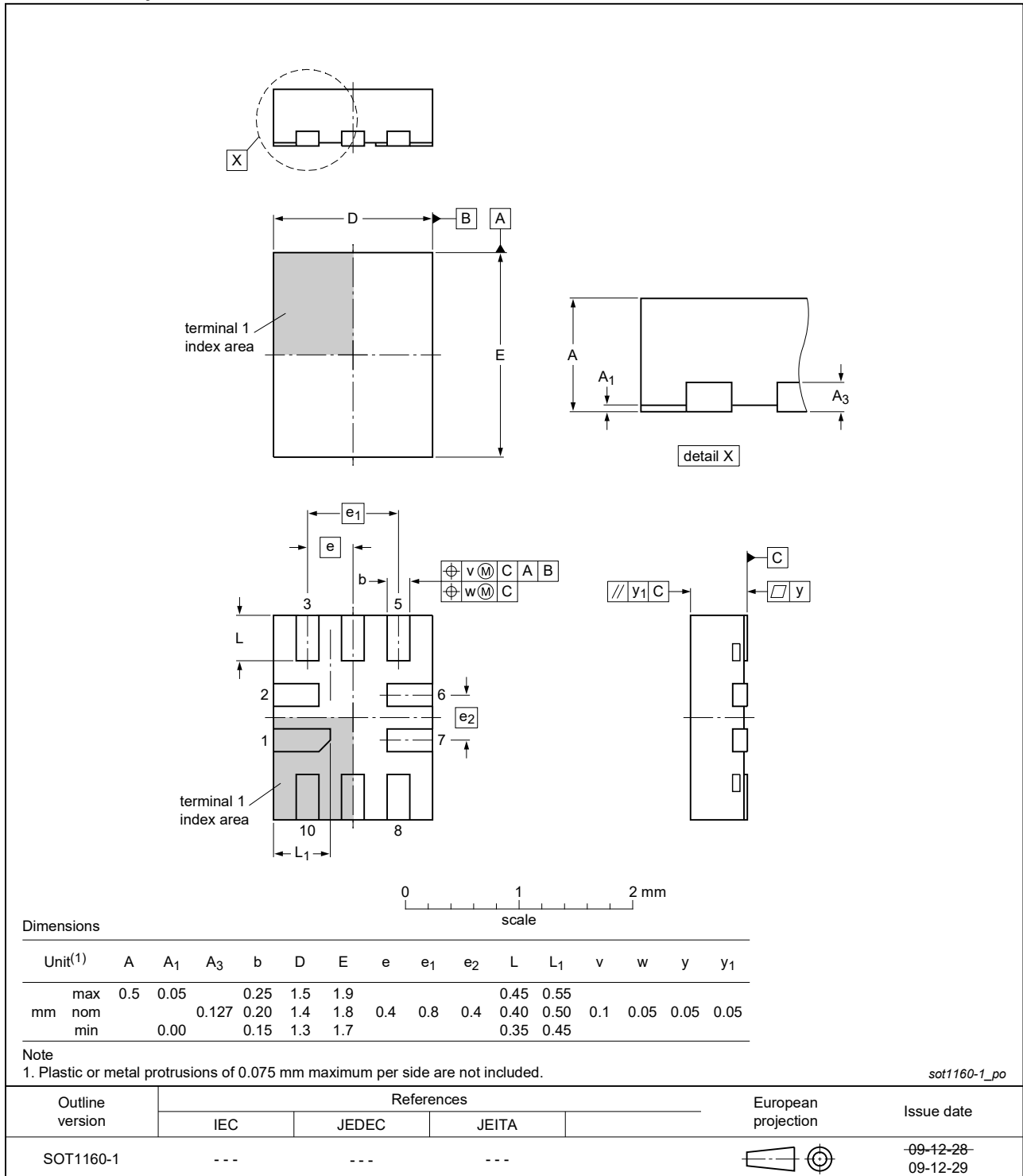


Fig. 10. Package outline SOT1160-1 (XQFN10)

## 14. Abbreviations

Table 11. Abbreviations

| Acronym | Description                      |
|---------|----------------------------------|
| CDM     | Charged-Device Model             |
| ESD     | ElectroStatic Discharge          |
| HBM     | Human Body Model                 |
| MSL     | Moisture Sensitivity Level       |
| PCB     | Printed-Circuit Board            |
| SIM     | Subscriber Identification Module |

## 15. Revision history

Table 12. Revision history

| Document ID | Release date | Data sheet status  | Change notice | Supersedes |
|-------------|--------------|--------------------|---------------|------------|
| NXT4557 v.1 | 20220203     | Product data sheet | -             | -          |

## 16. Legal information

### 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.
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## Contents

|   |           |
|---|-----------|
| <b>1. General description</b> .....               | <b>1</b>  |
| <b>2. Features and benefits</b> .....             | <b>1</b>  |
| <b>3. Applications</b> .....                      | <b>1</b>  |
| <b>4. Ordering information</b> .....              | <b>2</b>  |
| <b>5. Marking</b> .....                           | <b>2</b>  |
| <b>6. Functional diagram</b> .....                | <b>3</b>  |
| <b>7. Pinning information</b> .....               | <b>4</b>  |
| 7.1. Pinning.....                                 | 4         |
| 7.2. Pin description.....                         | 4         |
| <b>8. Functional description</b> .....            | <b>5</b>  |
| 8.1. Functional behavior.....                     | 5         |
| 8.2. Window of I/O communication.....             | 6         |
| 8.3. Shutdown sequence.....                       | 7         |
| 8.4. UVLO.....                                    | 7         |
| 8.5. EMI filter.....                              | 7         |
| 8.6. ESD protection.....                          | 7         |
| <b>9. Limiting values</b> .....                   | <b>8</b>  |
| <b>10. Recommended operating conditions</b> ..... | <b>8</b>  |
| <b>11. Electrical characteristics</b> .....       | <b>9</b>  |
| 11.1. Waveforms and test circuits.....            | 12        |
| <b>12. Application information</b> .....          | <b>13</b> |
| <b>13. Package outline</b> .....                  | <b>14</b> |
| <b>14. Abbreviations</b> .....                    | <b>15</b> |
| <b>15. Revision history</b> .....                 | <b>15</b> |
| <b>16. Legal information</b> .....                | <b>16</b> |

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