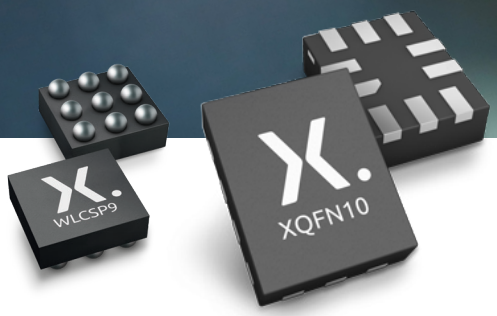
NXT4557GU & NXT4556UP support legacy and future mobile phone SIM cards



Newer process nodes have resulted in scaling down voltage of the new wireless baseband processors resulting into the need for voltage level translator to be able to communicate with the Class B and Class C SIM (Subscribers Identity Module) card solution along with supporting the future IO voltage at 1.2 V.

Nexperia's latest addendum to its voltage level translator built for interfacing with low –voltage HOST interface with SIM card. These SIM card level shifters support newest mobile chipset innovation by translating the system-on-chip low voltage IO's and latest and legacy SIM cards.

NXT4557GU and NXT4556UP feature dual-supply SIM (Subscriber Identity Module) card solution for interfacing wireless baseband processors of smartphone (HOST) with SIM cards. The dual-supply voltage translation function supports SIM card with supply voltages 1.08 V to 1.95 V range on the host processor side and either 1.8 V or 3.3 V on the SIM card side. The two SIM card interface standards Class B (3.0 V ± 10%) and Class C (1.8 V ± 10%) are supported by the Nexperia's SIM card translators. These translators features bidirectional IO and unidirectional RESET and Clock channels. The internal level translators allow HOST controller operating as low as 1.08V to interface with 1.8 V or 3 V SIM cards.

Battery life is maximized by a low operating current of 8uA and a shutdown current of less than 10uA operating current at Host side.

NXT4557GU and NXT4556UP are housed in leadless XQFN10 package (1.40 mm × 1.80 mm) and WLCSP9 (1.05 mm x 1.05 mm).

Applications

- Cell Phones, Tablets, Laptops
- Wireless Modems
- Multiple Sim Card Interfaces
- Wireless Point-to-Sale Terminals
- Telematic Control Units

nexperia

Features

- Support wide voltage range at both SIM and HOST side
  - Host Side = V_{HOST} = 1.08 V – 1.98 V
  - SIM Side = V_{CC_SIM} = 1.62 V – 3.6 V
- Incorporate SHUT-DOWN Sequence:
  - Shut-down sequence handled according to ISO7816-3
  - Low current consumption in shutdown mode < 1uA
  - High threshold switching level on V_{CC_SIM}, allowing quick shut down when SIM supply voltage powers down
  - NXT4557 is with EN pin and NXT4556 is without EN pin
- Smart ONE SHOT enabling very low propagation delays on I/O channel
- Higher clock frequency (25MHz) allows flexibility at system level
- Support 3 channels wherein, RST_HOST and CLK_HOST are Uni–directional and IO_HOST is Bidirectional
- Fully qualified between –40 °C to 85 °C

Benefits

- Low power consumption
- Low propagation delays
  - V_{HOST} = 1.2 V ; V_{CC_SIM} = 1.8 V, 3.6 V : T_{PD} = 20 ns
  - V_{HOST} = 1.8 V ; V_{CC_SIM} = 1.8 V, 3.6 V : T_{PD} = 12 ns
- Complies with EMI and ESD requirement
  - ±8 kV IEC61000-4-2 ESD protected on all SIM card contact pins
  - EMI resistors at SIM side drivers to filter EMI effects
- Support both push-pull and open-drain based applications
- Integrated pull-up resistors reduces “power consumption” at standby mode and “BOM cost”
- Available in XQFN10 and WLCSP9 packages

The bidirectional level translators NXT4557GU and NXT4556UP are built for interfacing a SIM card with a single low-voltage host side interface. The NXT4557GU and NXT4556UP have three level translators to convert the DATA, RST and CLK signals between a SIM card and a HOST microcontroller. A high-speed level translation is capable of supporting Class B, Class C SIM cards and supports future HOST processors with IO voltage of 1.2 V.

Fig1. depicts a typical input LOW to HIGH transition in an open drain application.

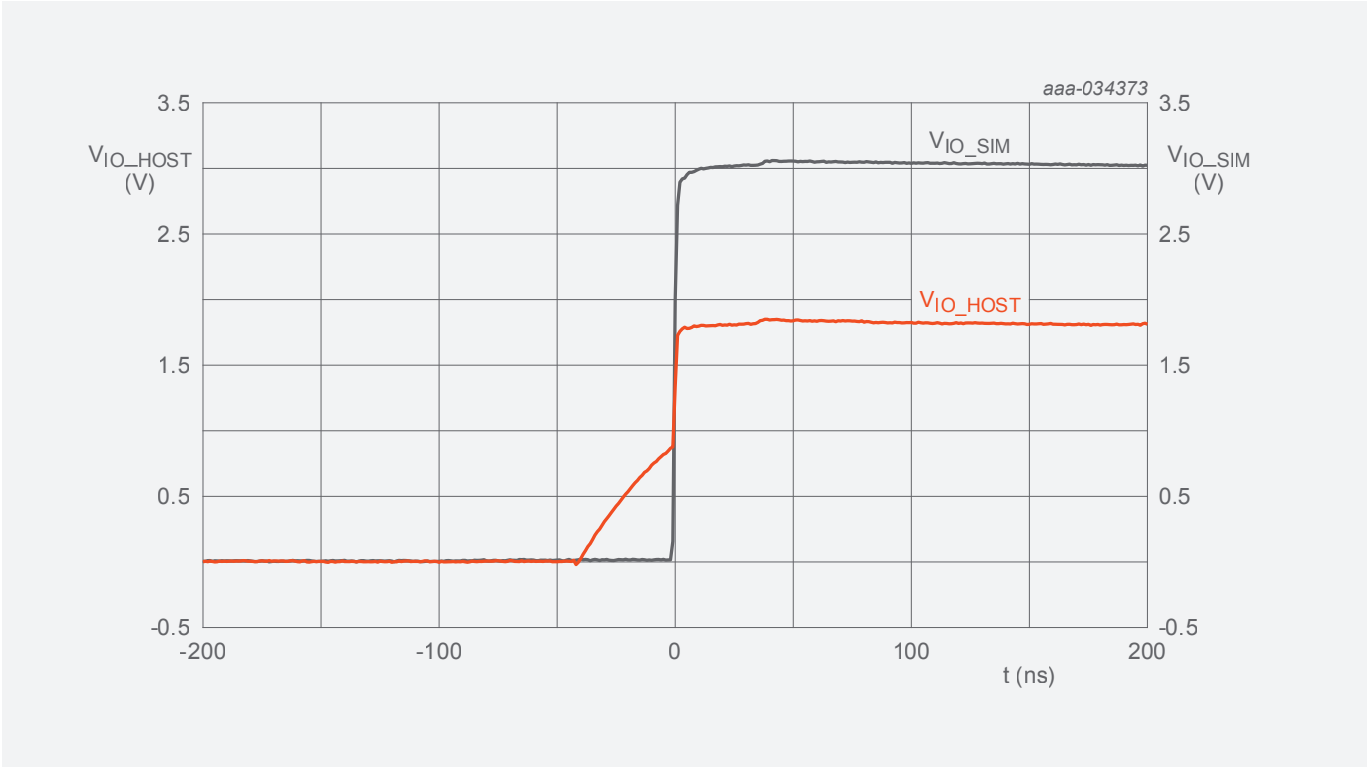
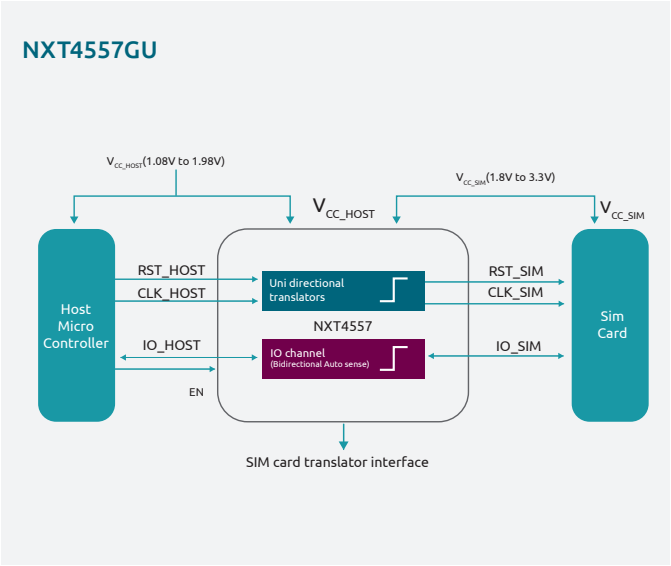
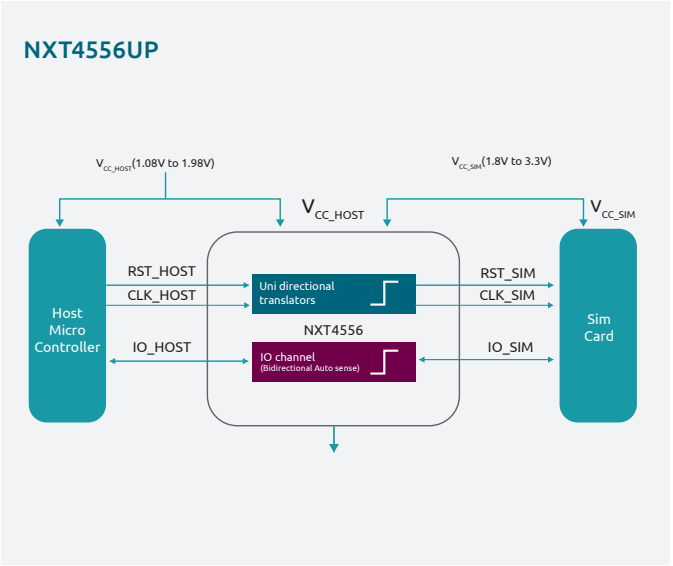


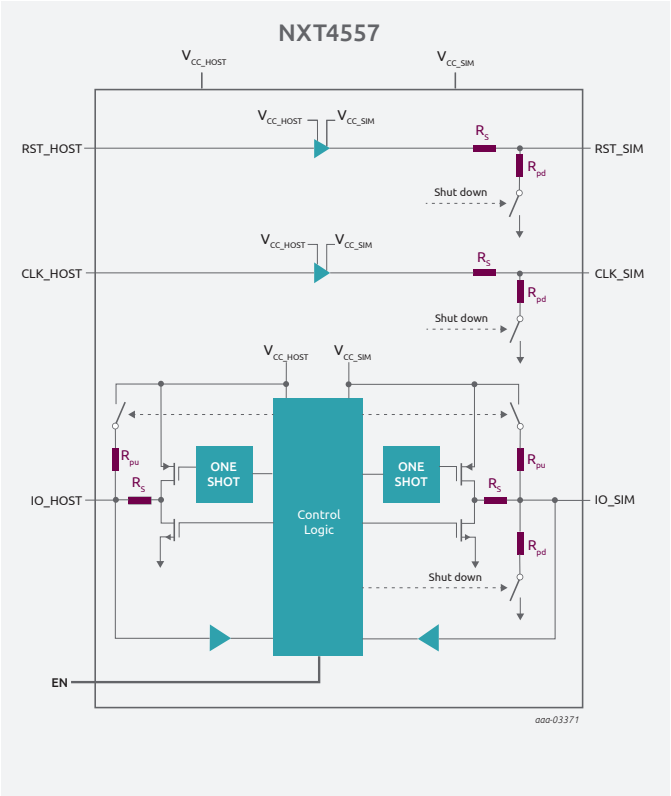
Fig. 1 LOW to HIGH transition for IO_HOST to IO_SIM communication

Fig. 2 and 3 depict the functional view of the SIM card level translator with and without EN pin. NXT4557GU is with EN pin and NXT4556UP is without EN pin as depicted in the below mentioned figures.

The RST and CLK channels which are uni-directional level shifters from the host to the SIM card side. The IO 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.







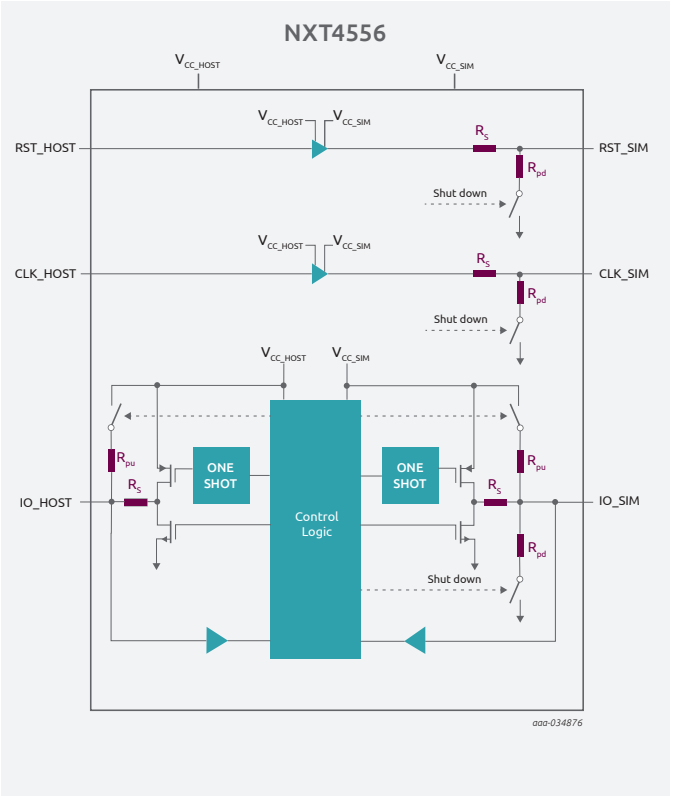


Fig. 2: Block and Functional diagram of SIM card translator with EN pin (NXT4557GU)

Fig. 3: Block and Functional diagram of SIM card translator without EN pin (NXT4556UP)

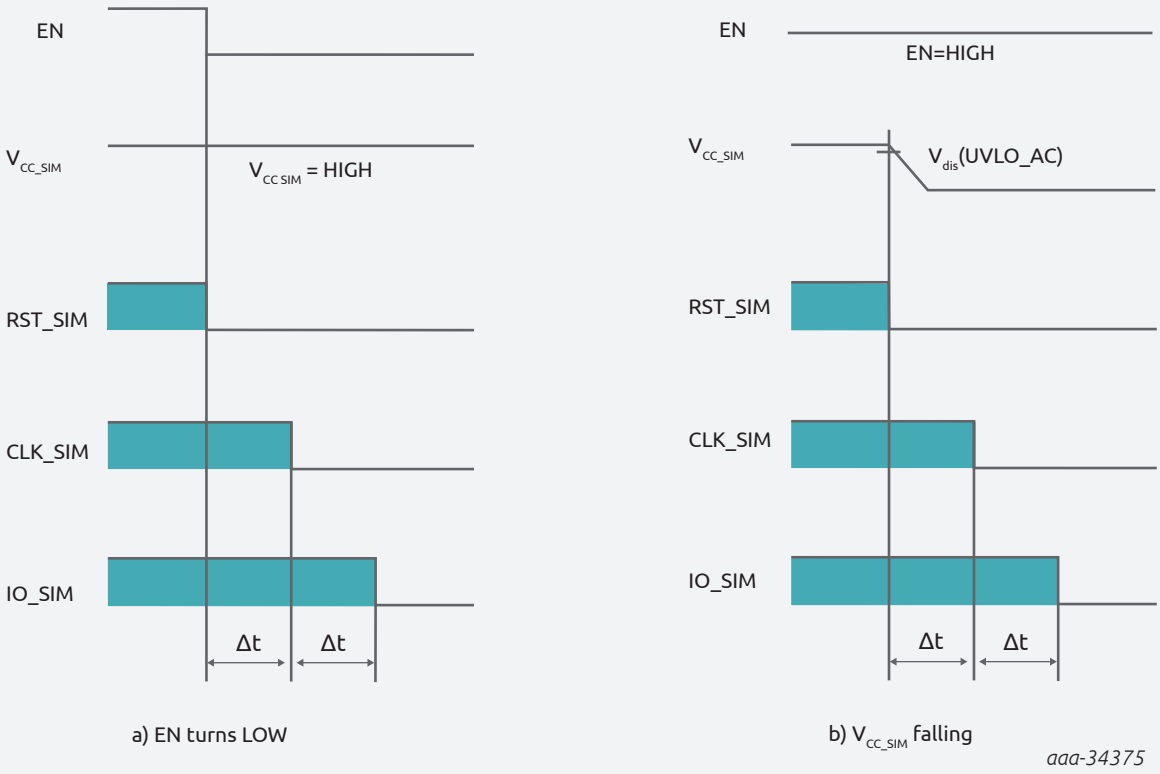
Shutdown Sequence

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. There are other scenarios such as if someone is pulling out the battery from a phone that may lead to ungraceful shutdown or if system crashes and battery power is completely low, then system LDO will discharge the supply to the SIM card quickly. All other conditions are well taken care of by the microcontroller (HOST) and properly ensures the shutdown sequence.

An active HIGH EN pin in NXT4557GU 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 NXT4557GU is compliant with all ETSI, IMT-2000 and ISO-7816 SIM/Smart card interface requirements. In case of NXT4556GU V_{CC_SIM} power-down initiates a shutdown sequence on SIM card pins in accordance with ISO-7816-3.

Shutdown sequence with EN pin – NXT4557GU

When enable (EN), is asserted LOW or when V_{CC_SIM} drops below Vdis (UVLO_AC), the shutdown sequence is initiated. Fig. 4 a) illustrates the shutdown sequence initiated by EN being asserted LOW. Fig. 4 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, Rpd, that pull down the three pins on the SIM side are shown in Fig. 2. The shutdown sequence is completed in a few microseconds. The interval time (Δt), is typically 4 µs.



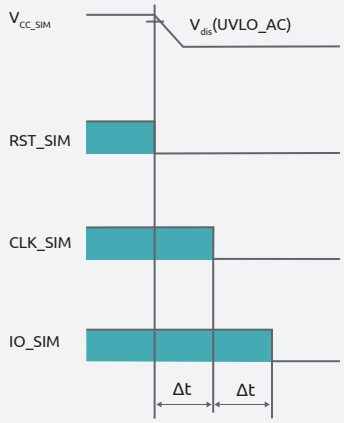
Δt = 4 µs (typical)
The shaded areas indicate that the signals are HIGH or LOW.

Fig. 4: Shutdown sequence for RST_SIM, CLK_SIM and IO_SIM of NXT4557 SIM card translator

Shutdown sequence NXT4556UP without EN pin

When V_{CC_SIM} drops below Vdis (UVLO_AC), the shut-down sequence is initiated. Fig. 5 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 shutdown sequence is completed in a few microseconds. The interval time (Δt), is typically 4 µs.

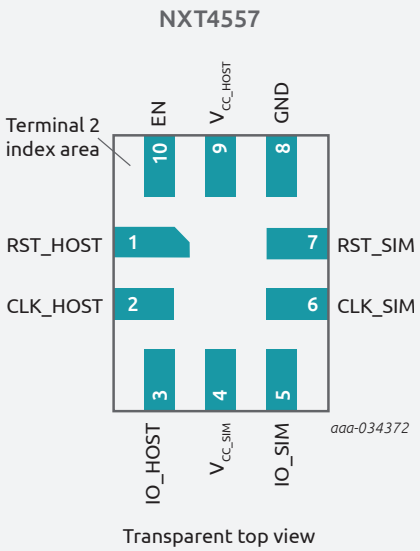


Δt = 4 µs (typical)
The shaded areas indicate that the signals are HIGH or LOW.

Fig. 5: Shutdown sequence for RST_SIM, CLK_SIM and IO_SIM of NXT4556 SIM card translator

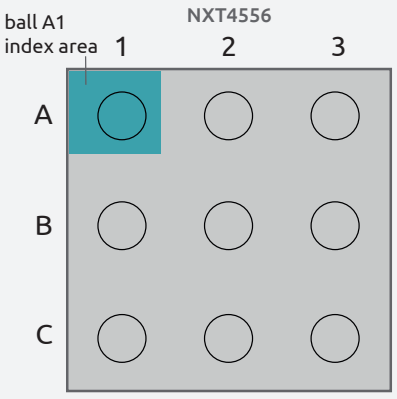
Product	Description	V_{CCA} (V)	V_{CCB} (V)	T_{amb} (°C)	Package
NXT4557GU	SIM card interface level translator with enable pin	1.08 – 1.98	1.62 – 3.3	-40 °C to +85 °C	XQFN10
NXT4556UP	SIM card interface level translator	1.08 – 1.98	1.62 – 3.3	-40 °C to +85 °C	WLCSP9

Pin Configuration SOT1160-1



Transparent top view

Bump Configuration SOT8025-1 (WLCSP16)



Transparent top view *aaa-034877*

Ball Mapping SOT8025-1 (WLCSP16)

NXT4556

	1	2	3
A	RST_HOST	V_{CC_HOST}	RST_SIM
B	CLK_HOST	GND	CLK_SIM
C	IO_HOST	V_{CC_SIM}	IO_SIM

Transparent top view *aaa-034878*

Package name	SOT #	Package suffix	No of pins / balls	Package dimensions	Pitch (mm)	Package
XQFN10	SOT1160-1	GU	10 pins	1.40 x 1.80 x 0.50 mm	0.4 mm	
WLCSP9	SOT8027-1	UP	9 balls	1.06 x 1.06 x 0.43 mm	0.4 mm	

Date of release:
June 2022