

Solutions Around the Core

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SECURE CONNECTIONS
FOR A SMARTER WORLD

Secure Interfaces & Power Overview

Secure Interface



Products

- USB Type-C & PD
- Signal Conditioner
- Signal Switch
- DisplayPort Bridge
- Authentication & Anti-Counterfeit

Voice and Audio Solutions



Products

- Boosted Smart Amp with and without DSP
- Class-D Amps
- Echo Cancellation & Noise Reduction Software

Embedded Power



Products

- DC-DC Switching
- Load Switches
- PMIC
- Wireless Charging

Smart Power



Products

- AC-DC Power Conversion
- USB PD-PPS, QC4.0+, BC1.2 Solutions

Personal Health



Products

- NTAG SmartSensor
- NFMI Hearables
- BLE Audio & Voice
- Healthcare ASICs

High Performance Analog



Products

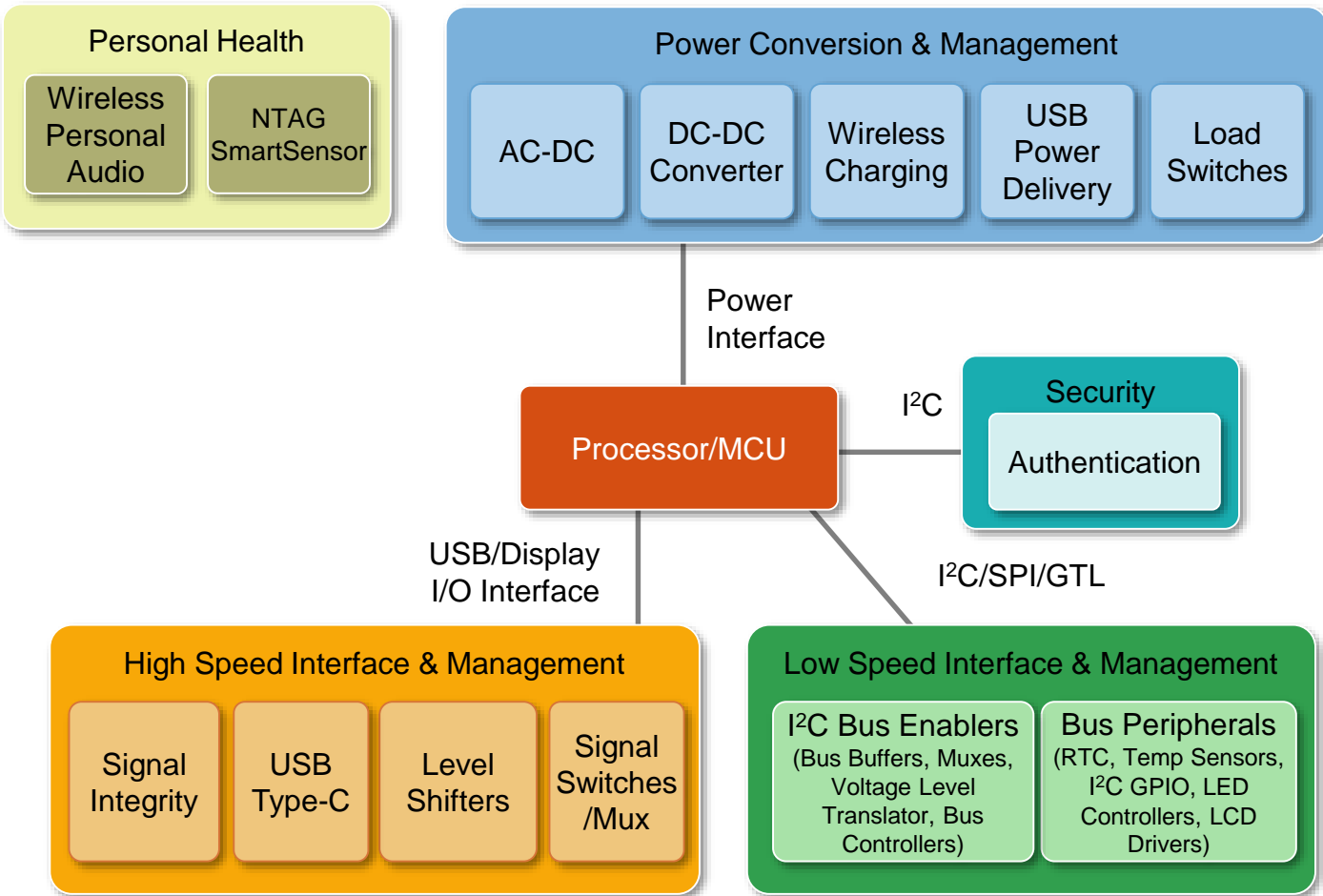
- I²C
- GPIO Expanders
- Real Time Clocks
- Voltage Level Translators
- LED Controllers

Secure Interfaces & Power Advantage

Over 35 product portfolios including...

- USB Type-C & PD, Signal Conditioner, Signal Switch, DisplayPort Bridge, Authentication & Anti-counterfeit
- Fast Charger, Smart Interface Protection, Wireless Charging, PMIC and Discrete DC-DC
- AC-DC Power Conversion, USB PD-PPS
- NTAG SmartSensor, NFMI, BLE Audio & Voice, Healthcare ASICs
- I²C, GPIO Expanders, Real-Time Clocks, Voltage Level Translators and LED Controllers

Secure Interfaces & Power Portfolio



***50+ functions are automotive qualified**

Portfolio categories		# of Devices*
Power Conversion & Management	AC-DC	60+
	DC-DC Converter	6
	Wireless Charging	7
	USB Power Delivery	5+
	Load Switches	20+
High Speed Interface & Management	Signal Integrity	6
	USB Type-C	5
	Level Shifters	12+
	Signal Switches/Mux	20+
Low Speed Interface & Management	I2C Bus Enablers (Bus Buffers, Muxes, Voltage Level Translators, Bus Controllers, Protocol Bridges)	70+
	Bus Peripherals (RTC, Temp Sensors, I2C GPIO, LED Controllers, LCD Drivers)	160+
Authentication	Authenticator for Anti-counterfeit	2
Personal Health	Wireless Personal Audio (NFMI, BLE Audio)	3
	NTAG SmartSensor	2
Voice and Audio Solution	Class AB/Headphone	2
	Class-D/Smart Amplifier	13
	DAC/ADC	3

Secure Interface Product Line Overview

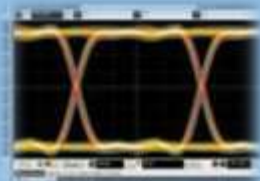
Signal Switch (Mux)



High Bandwidth Signal Switch (~12Ghz)

- High Speed Differential Data: PCIe Gen1-3 (8Gbps), DDR3/4, USB3.1, Thunderbolt2
- Digital Video: LVDS, HDMI2.0 (6Gbps), Display port 1.4 (8.1Gbps)
- USB Type-C: Alternate mode crossbar switches, USB3.1 switches
- Analog Mux: Low Ron, low current, support negative voltage & BW of 1.1GHz

Signal Conditioning



High Performance Signal Conditioner (1.65Gbps-20Gbps)

- DisplayPort adapter (level shifter) - DP-to-HDMI, DP-to-DVI
- USB3.1 redrivers and Active Switch
- Type-C USB/DP combo redriver

DisplayPort Bridge



DisplayPort Connectivity Bridge

- DisplayPort bridge - DP-to-VGA, DP-to-LVDS
- DisplayPort adapter (level shifter) - DP-to-HDMI, DP-to-DVI

USB Type-C and PD



Type-C and PD Controller

- USB PD TCPC PHY
- CC Logic

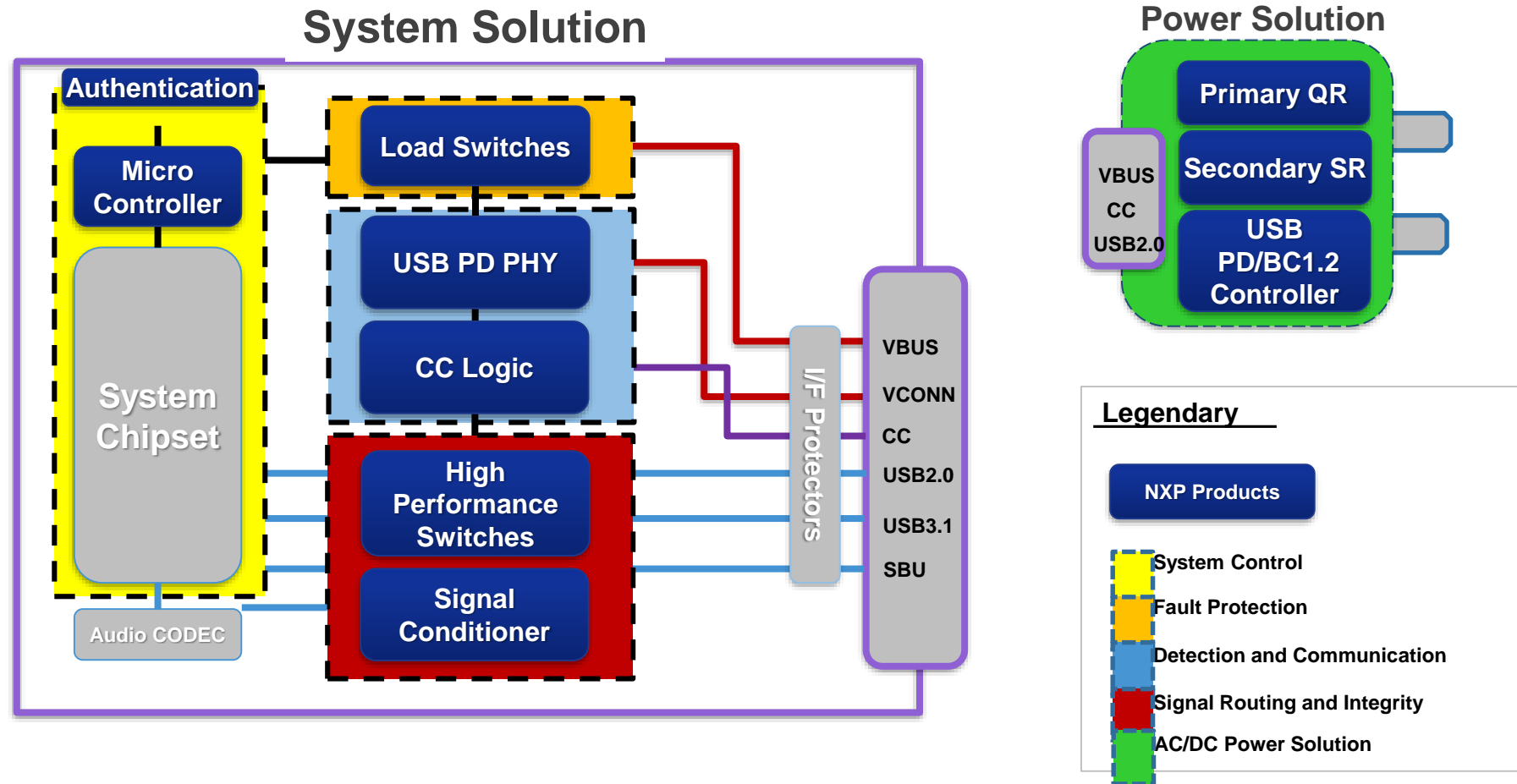
Authentication



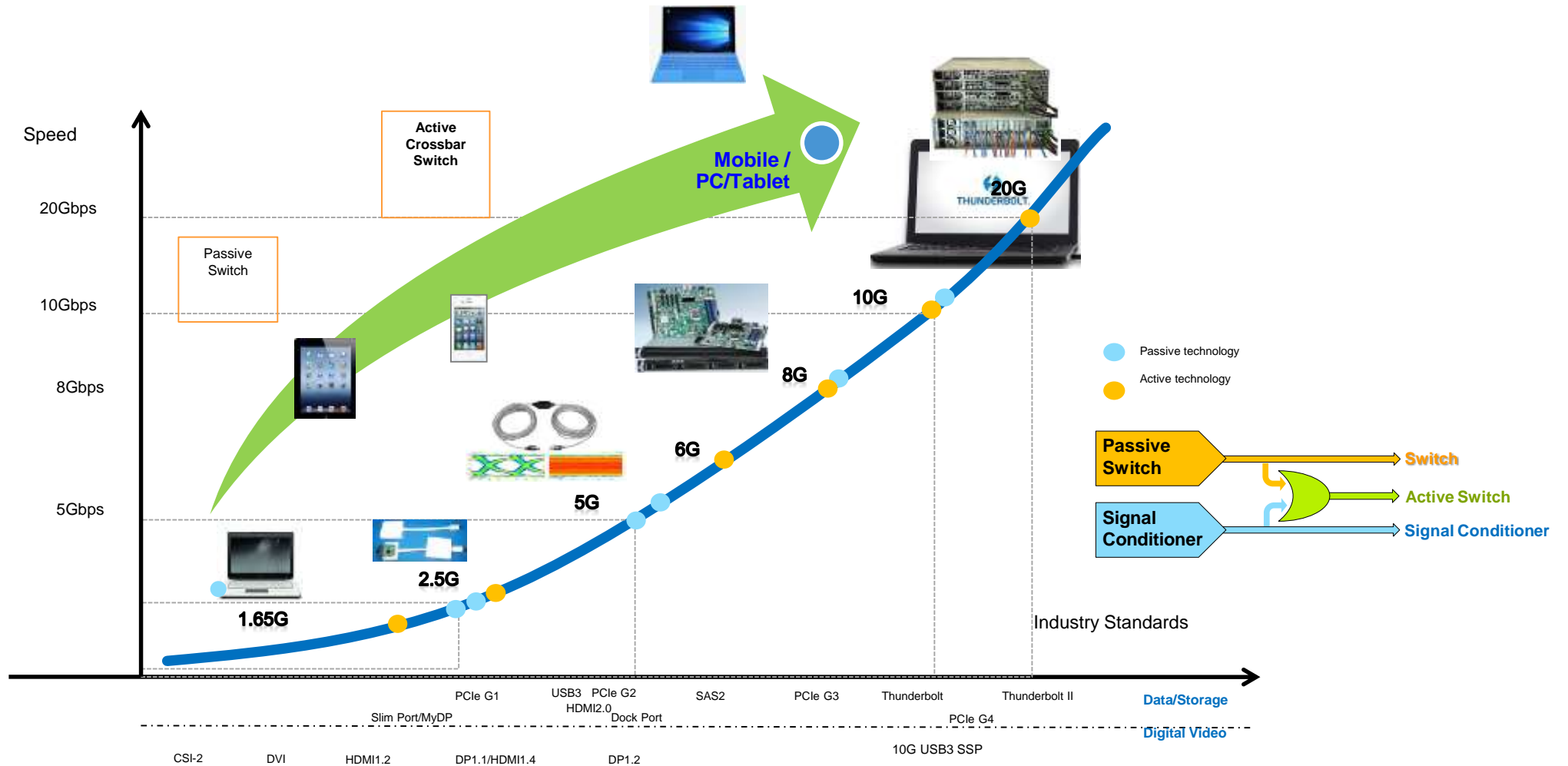
Authentication/Security

- A1006, A1007

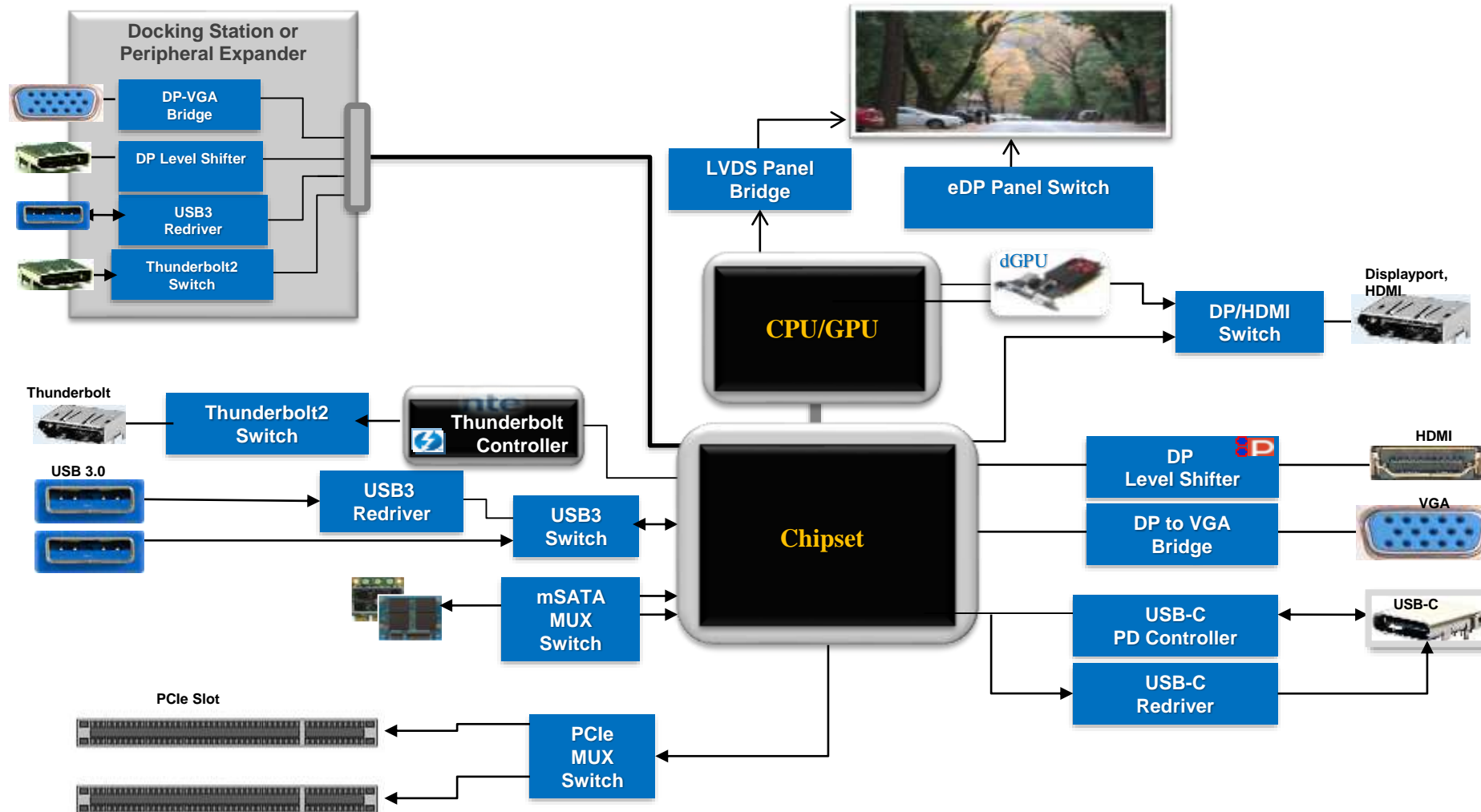
NXP End-to-End Solution for USB Type-C Connector



High Speed Interface Products for Signal Routing and Signal Integrity



High Speed Interface Solution around main processor



Tamper Resistant Authentication - A1006

- No security IC needed on host side because of PKI (Public Key Infrastructure) authentication
 - Asymmetric/public key based ECDH (Elliptic Curve Diffie-Hellman) explicit authentication protocol with NIST-b163 curve
 - Digitally signed X509v3 certificates using ECDSA signatures with NIST-p224 curve and SHA-224 digest hash
- Industry leading advanced security features include: TRNG, active shielding, security sensors, many more
- 4 kbit EEPROM supports 2 certificates, system memory, and 1kbit for user needs
- Industry's lowest power (550uA max)
 - Deep sleep power < 1 uA at 1.8V Vdd
- Industry's smallest footprint – as small as 1 mm² in WLCSP
 - Also available in HXSON6 2 x 2 mm package
- Flexible Interfaces: 400 kbps I2C or one wired interface
 - OWI bus powered (no external Vdd needed)
 - OWI interface rated 8kV IEC61000-4-2 ESD protection



Comparing A1006 vs A1007

Feature	A1006	A1007	Comment
Cryptographic Auth	ECC NIST-B163 ECDH	ECC NIST-B163 ECDH + PRESENT80 cipher MAC	Symmetric cipher MAC added for authenticated data
Authenticated Read/Write	No	Yes	Per flow diagram
Certificate Validation	X509v3 DER certificate signed with ECDSA using ECC NIST-P224 and SHA-224	X509v3 DER certificate signed with ECDSA using ECC NIST-P224 and SHA-224	No change
Authentication Protocol	Explicit using ECDH challenge-response validation	Implicit using per ECDH challenge for key agreement, followed by MAC response validation	See flow diagram
Interfaces	I2C, OWI	I2C, OWI	No change
Package	HXSON6, WLCSP4	HXSON6, WLCSP4	No change
Memory Size	4 kbit (1 kbit user memory + 2 certificate)	8 kbit (4 kbit user memory + 2 certificates)	Increase user data storage
24-bit one-way counter x 2	No	Yes	Eg. measure ink/page consumption
Non-resettable operation flag	No	16-bit individually settable, cannot be cleared	Track different usage states
ESD Level	2kV HBM (8kV IEC on OWI)	4 kV HBM (8kV IEC on OWI)	Improved robustness in high-touch environments
CRC Checksum	No	Yes	Improved data reliability
Kill Chip command	No	Yes	Permanent shut down prevents refills and other illegitimate uses

A1006 / A1007 Customer Certificate Provisioning Utility

Use Cases

- Specify customer-specific data and signing key for NXP-injected User Certificates
- Provision user-signed certificates in user's factory
- Securely control (limit) certificate provisioning at 3rd party manufacturing sites

Key Features:

- Smart-Card for secure storage of signing key and issuance of certificates

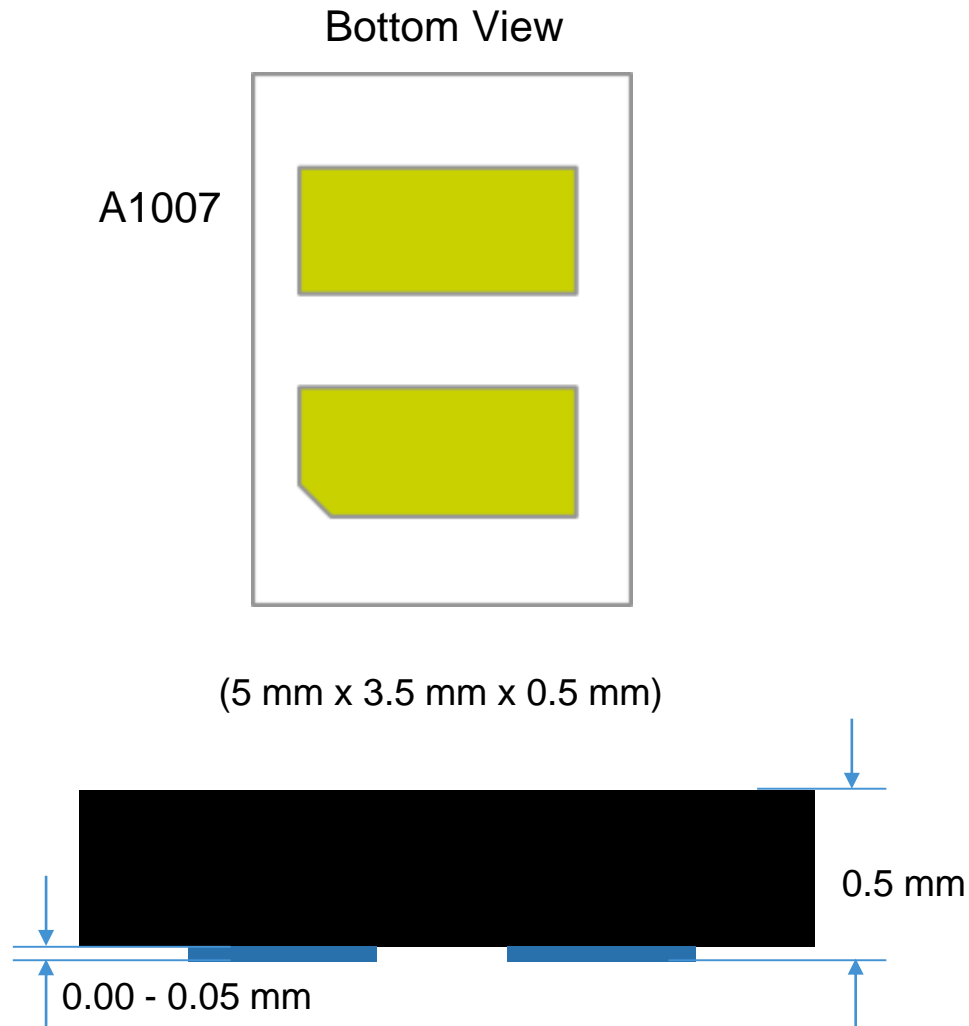
Cross-Platform Web GUI based User Interface

Capabilities:

- Create or Import User Certificate Signing Key
- Clone Signing Key to Additional Cards
- Securely provision individual A1006/A1007 with user-signed certificates
- Restrict # of devices that can be provisioned



Contact Package Option



- Attach an accessory or consumable
- 1 wire contact package
- Size - 5 x 3.5 x 0.5 mm, 2.1 pitch
- Pins - OWI, GND
- Attachment Methods
 - Permanent is recommended
 - Standard epoxies and adhesives
 - Double coated tape / foam tape
 - Over molding encapsulation
- Industry standard over molding package

Embedded Power Product Line Overview

Fast Charging



- Industry leading 98% 2:1
- Sw Cap Charger
- Hybrid Charger

Smart Interface Protection



- 28V OVP + 100V Surge
- Fast response time
- Moisture / Dust detection
- <math><9\text{m}\Omega</math> Ron

Wireless Charging



- 15W Qi Tx
- NFC Wireless Charging
- Half-bridge for wireless charging

PMIC



- LPC/Kinetis IoT PMIC
- i.MXnM PMIC

Discrete DC-DC



- 5.4V Boost for NFC

Embedded Power – Bring Value to Our Customers

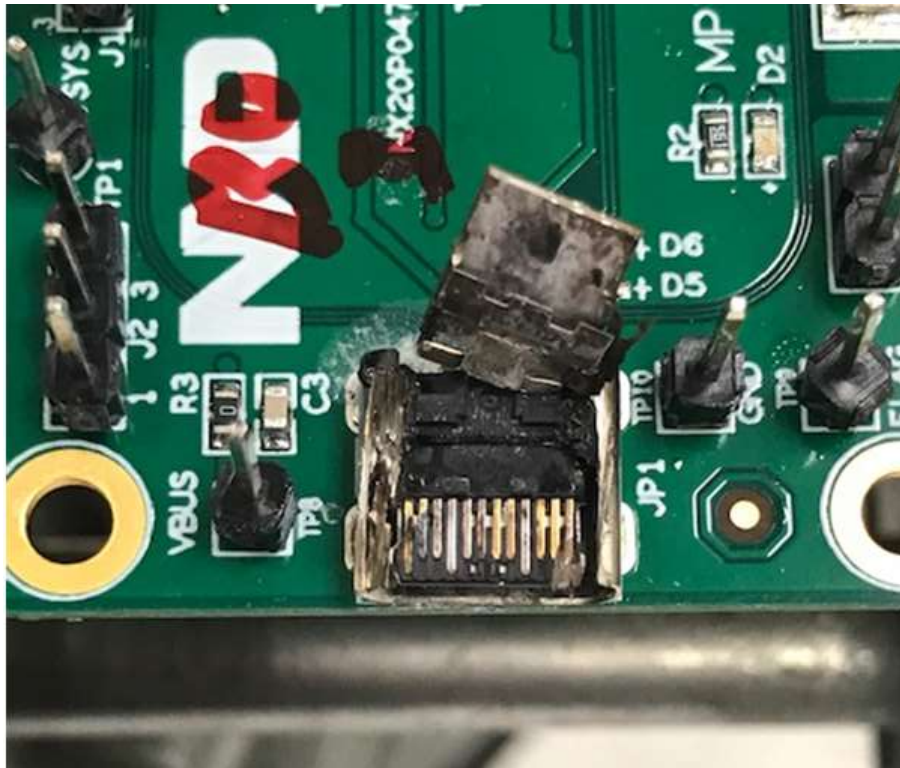
- **Complete hardware and software for Fast charging solution**
 - ✓ 98% Efficiency 2:1 Switched Capacitor Charger for cooler, faster charging
 - ✓ Fully validated hardware and software, with robust/flexible charging algorithm
- **Industry's most complete USB-C Load switch/OVP solutions**
 - ✓ Low (<9 mΩ) Rds(on) on 30 V VBUS OVP's with moisture/dust detection
 - ✓ Monolithic High Voltage Sink and Source bi-directional Switch
 - ✓ 28 V CC/SBU pin OVP
 - ✓ Complete USB-C interface solution with PTN5110 PD PHY and PTN5150 CC-Logic
- **Differentiated Wireless Charging solutions**
 - ✓ Industry first NFC wireless charging solution for smallest, highest efficiency, lowest BOM wireless charging enablement for ~1 W or less applications
 - ✓ Complete market leading Qi Transmitter solution, with flexibility and scalability
- **Low power PMIC for wearable and IoT applications**

NXP Load Switch & Protection Solutions

Part #	Description	Ref. design	Status
NX20P5090	Sink power switch including surge protection	Intel Ice lake/Kaby Lake/Whiskey Lake/I.MX7	MP now
NX5P3363	Source current-limited power switch including surge protection		MP now
NX20P0407	CC&SBU or CC&D+/-OVP @ type c application	I.MX8mini/Type C Shield Board for LPC	MP now
NX20P0477	CC OVP with corrosion protection		Samples/EVKITs now, MP Q4'19
NX20P0408	D+/D- OVP		MP now
NX20P3483	Sink & Source combo power switch @ type c application	Intel Lake field/Google Chrome book/I.MX8mini/Type C Shield Board for LPC	MP now
NX30P6093	30V OVP, 100V Surge with moisture detection, 9mohm RDSON	Qualcomm SDM670	MP now
NX30P6093A	30V Bi-directional OVP, 100V Surge with moisture detection, 16mohm RDSON, 1.5A OTG	Qualcomm SDM670	MP now
NX30P0121	Back to Back output OVP for Qualcomm's platform	Qualcomm SDM855/865	MP now

Corrosion test -NX20P0477 – CC protection with Corrosion prevention

Test with CP_EN low
(Corrosion prevention disabled)

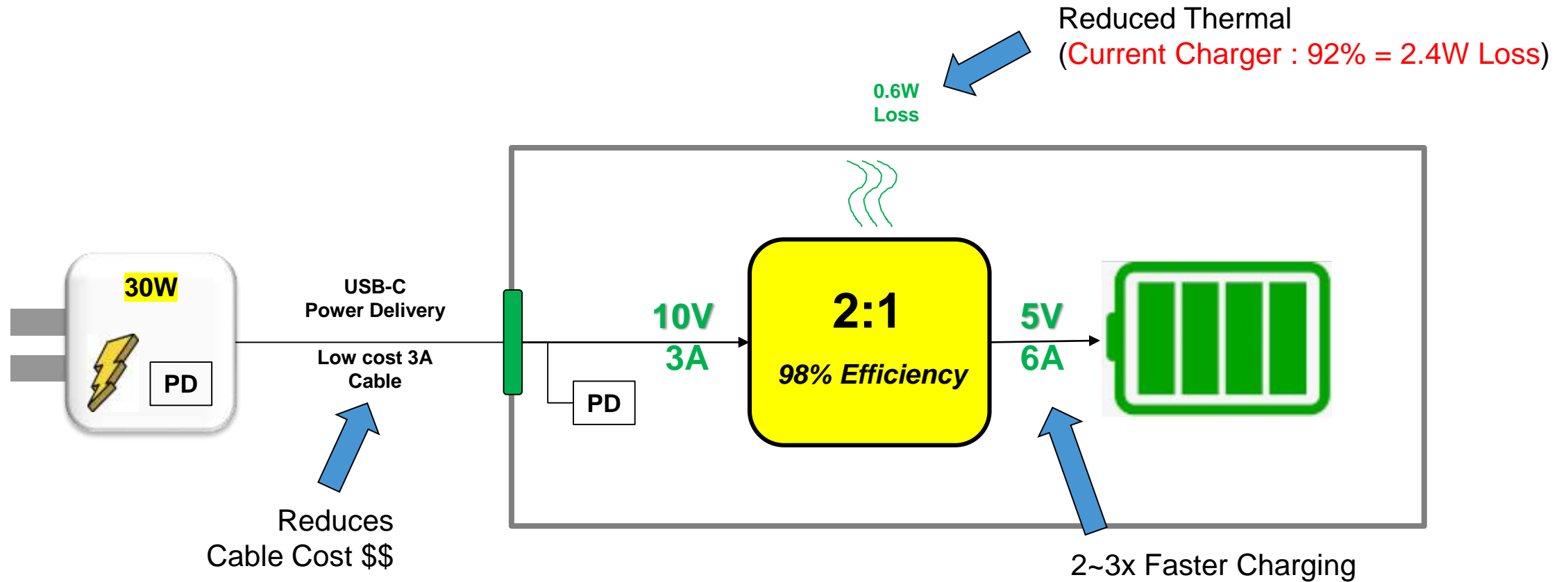


Tap water Test with CP_EN high
(Corrosion prevention Enabled)

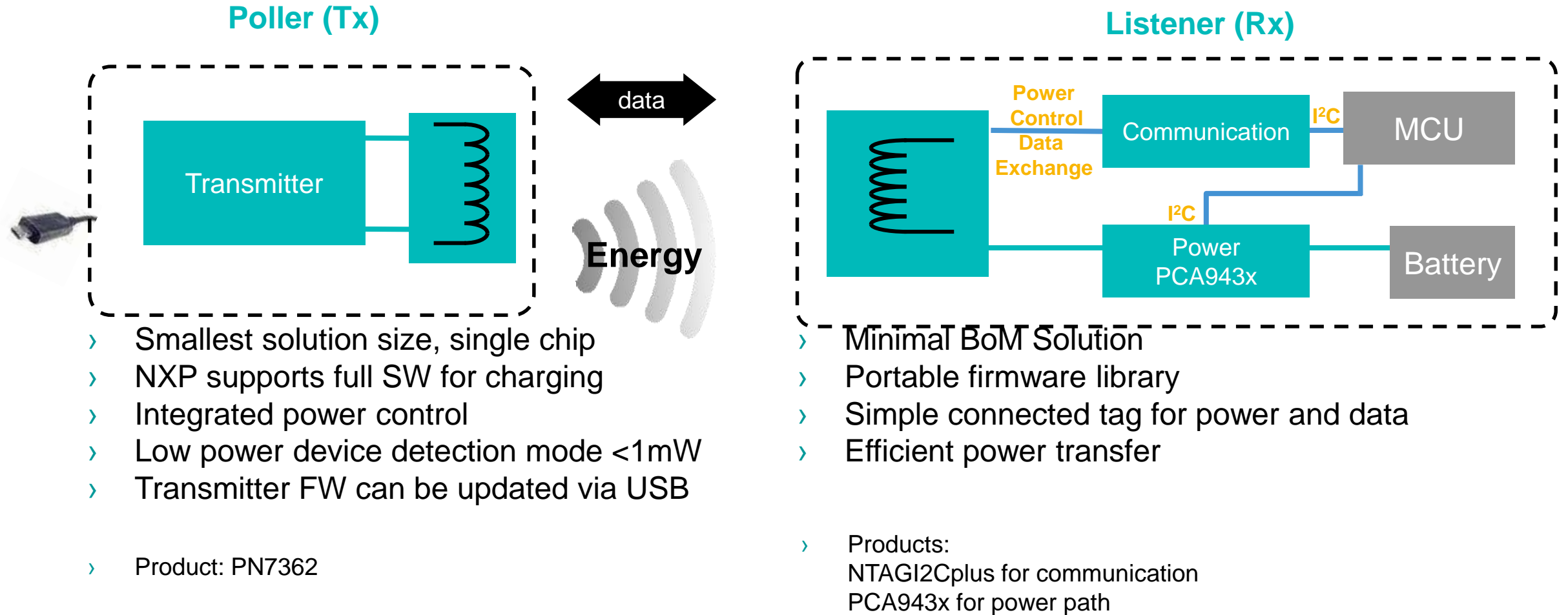


2:1 Switched Cap DC-DC transforming battery charging

High efficiency conversion overcomes thermally limited charging speed



NFC Wireless Charging Block Diagram

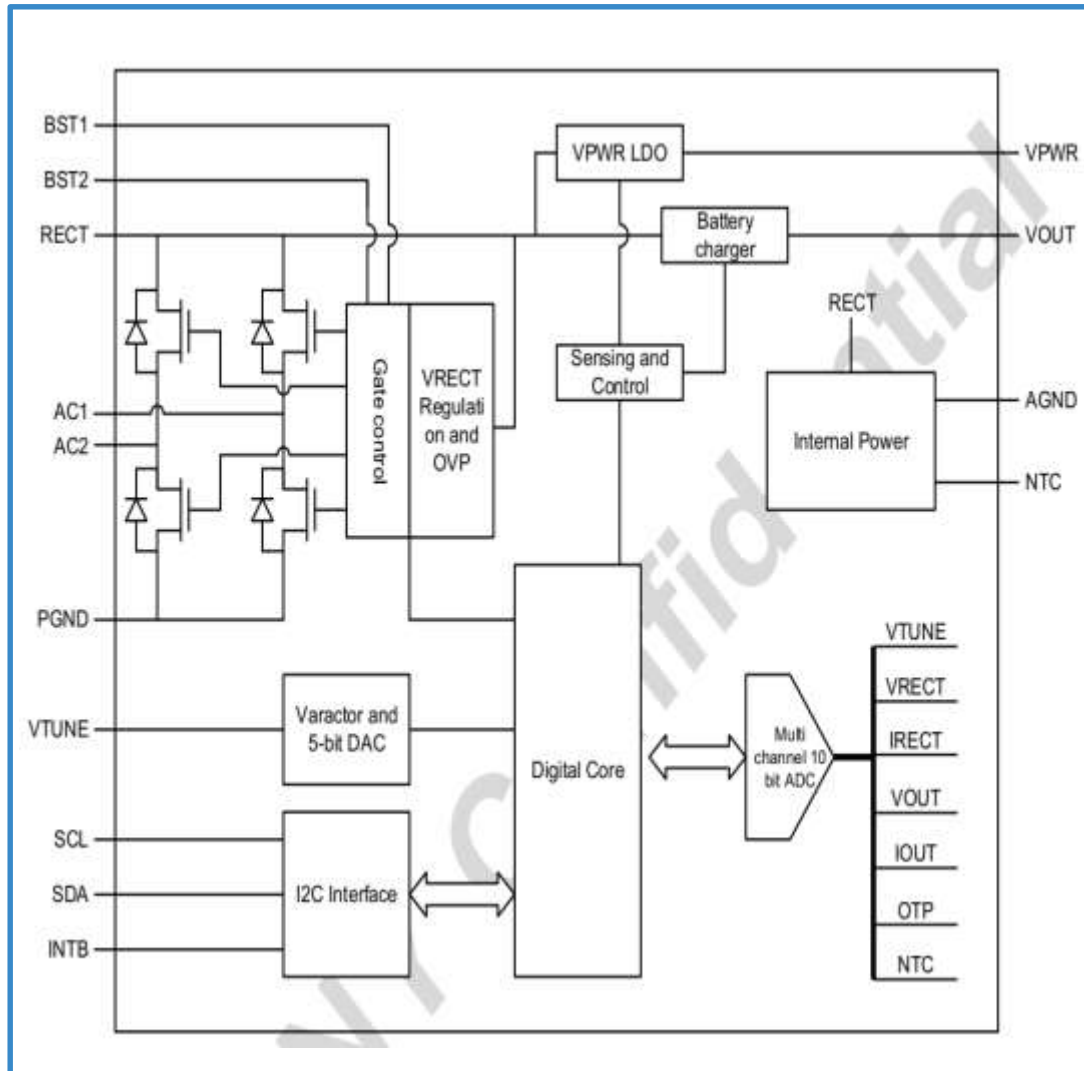


Legend:

New

Existing

PCA9430/9431 – Low Power NFC Wireless Charger Rx

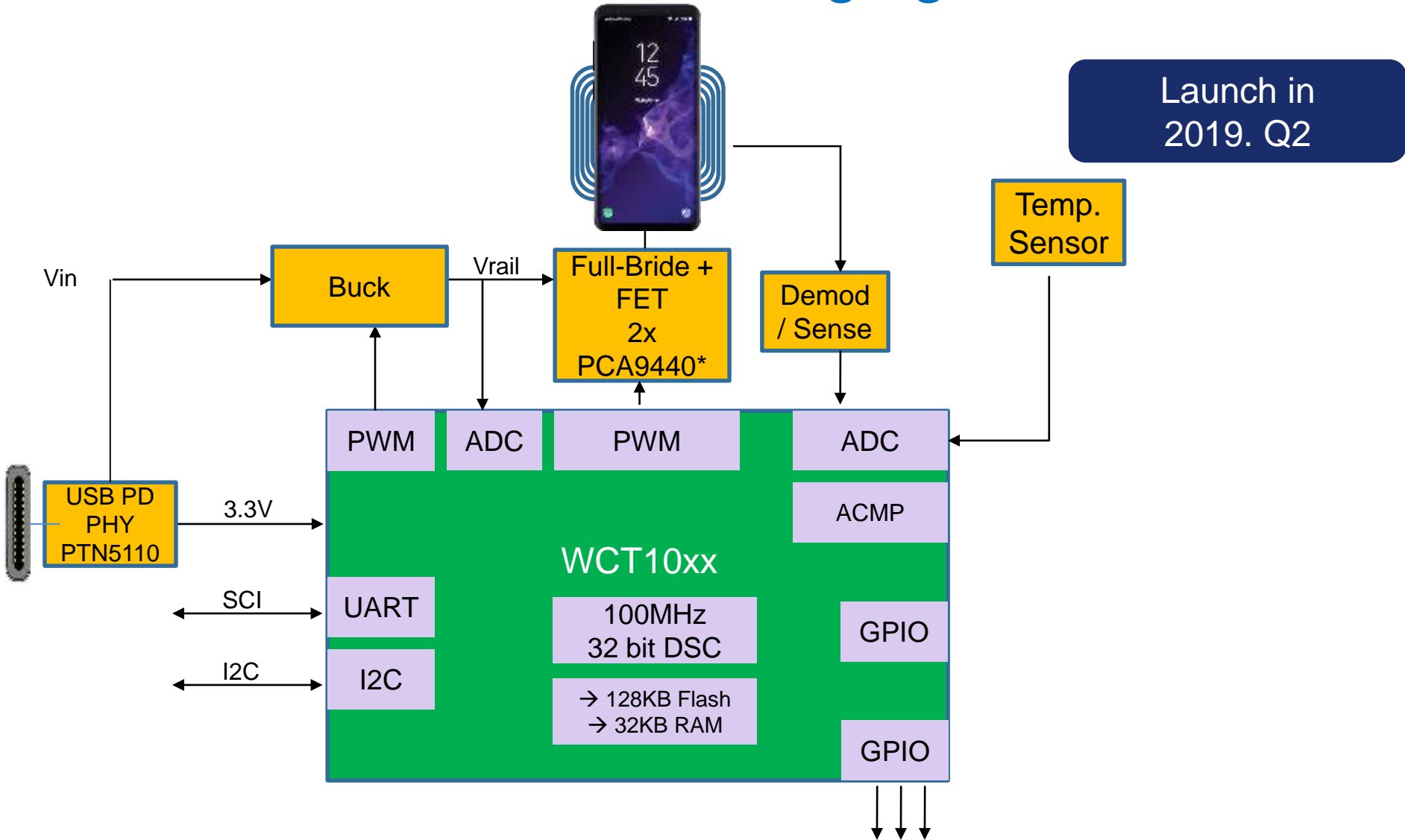
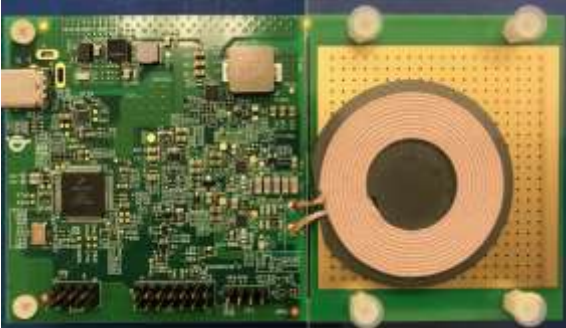


Features and Benefits

- Supports 1W NFC wireless charging
- Automatic over voltage protection of antenna inputs
- High efficiency active rectifier up to 80%
- Offered in two options:
 - Linear battery charger output – PCA9430
 - Adjustable voltage LDO output – PCA9431
- 10-bit multiple channel ADC
- 5-bit DAC for antenna tuning
- External temp. sensing analog interface for NTC
- 1MHz Fast Mode Plus I2C-bus slave interface
- Built-in protection circuitry
 - Over-temperature protection
 - VRECT over-voltage protection
 - VRECT under-voltage protection
- 2.2mm x 2.8mm XQFN16
- Samples now, MP in Q4'18

PCA9440 in Wireless Charging Reference Design

Launch in 2019. Q2



Features

- Delivers full 15W to receiver
- Variable or (customizable) fixed frequency operation
- > 70% power transfer efficiency (low cost coils)
- Foreign object detection to maximize user experience
- Integrated USB PD Stack
- Single coil configuration options
- Improved EMI protection to meet various standards
- Multiple communication peripherals integrated
- Half-bridge driver with integrated current sensor



Smart Power Product Line Overview

High Power Resonant Computing, Gaming & TV



- Optimized for 75 W to 300 W
- Superior Light-Load Efficiency
- Excellent No-Load Power
- Compliant to Energy Star, CoC, EuP Lot 6
- Highly Integrated PFC, LLC, X-Cap Discharge

Medium & Low Power Computing, Consumer & Industrial



- Optimized for 5 W to 75 W
- High Efficiency (>90 %)
- Low Stand-By Power
- Flyback & Synchronous Rectification IC's for Compact Size Solutions
- Integrated MOSFET Option for Low Power Applications

GreenChip™ ACDC Converters – Portfolio overview



Power range	PFC control	Primary control	Secondary control	STBY (control)
Resonant typ. >90W	TEA171x (TEA1713, TEA1716) TEA1916 (GreenChip Resonant /LLC)		TEA1791A TEA1792A TEA1892A TEA1795 TEA1995	Parallel supply TEA173x TEA1708 TEA183x
Flyback >75W	TEA175x (TEA1750/51/52/53/TEA1755) (GreenChip III)		TEA1761 TEA1762	TEA1703 (Green Chip Standby)
Flyback <75W	n.a.	TEA173x (TEA1731/33/38) TEA183x (TEA1832/33) TEA1836x (TEA18361/2/3) TEA1936x (TEA19361/2/3) (GreenChip MP)	TEA1791 TEA1792 TEA1892 TEA1993 TEA1998 TEA1999	TEA1708 (X-cap discharge)
Flyback <15W	n.a.	TEA1721, TEA1723 (GreenChip LPA)	n.a.	Integrated in Primary IC

- ▶ More than 2 Billion *GreenChip* controllers have been shipped to date
- ▶ Robust & proven High Voltage Process Technologies in own 8” foundries
- ▶ Proven product quality track record supported by a strong Quality System
- ▶ Top-class product development supported by application know-how and support
- ▶ Fly-back (with and without integrated switch) and resonant converters - worldwide leader in resonant converters



Road to High Performance for Resonant

GEN-1 (2016)

GEN-2 (2019)

GEN-3 (2020)

Platform Technology	Analog/digital	Digital	Digital
Efficiency benchmark	Platinum	Energy STAR 7	Energy STAR 7
Key figure of merit	Low Load eff	Audible noise	Wattage range

Chipset			
Primary controller	TEA19161	TEA2016	TEA2017
PFC controller	TEA19162	TEA1995	TEA2095x
SyncRec controller	TEA1995		

Differentiation	<ul style="list-style-type: none">✓ BiC Low Load efficiency✓ BiC efficiency at low load✓ EuP lot 6 specification✓ Vcapsense accurate BM control	<ul style="list-style-type: none">✓ Configurable state machine✓ Instant audible noise adjust✓ BiC efficiency at 10%/20% load✓ eBOM reduction	<ul style="list-style-type: none">✓ Wattage up to 1000W✓ CCM/DCM mixed mode PFC✓ Digital loop✓ Smaller form factors >300W
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Standards	←			→
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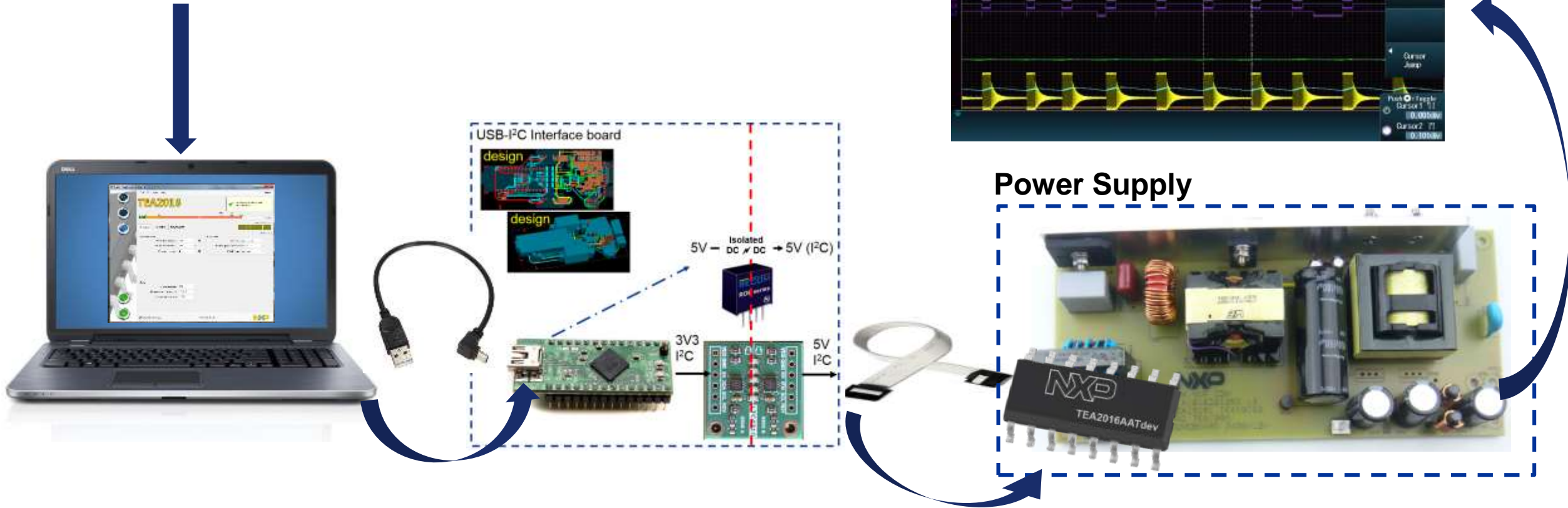
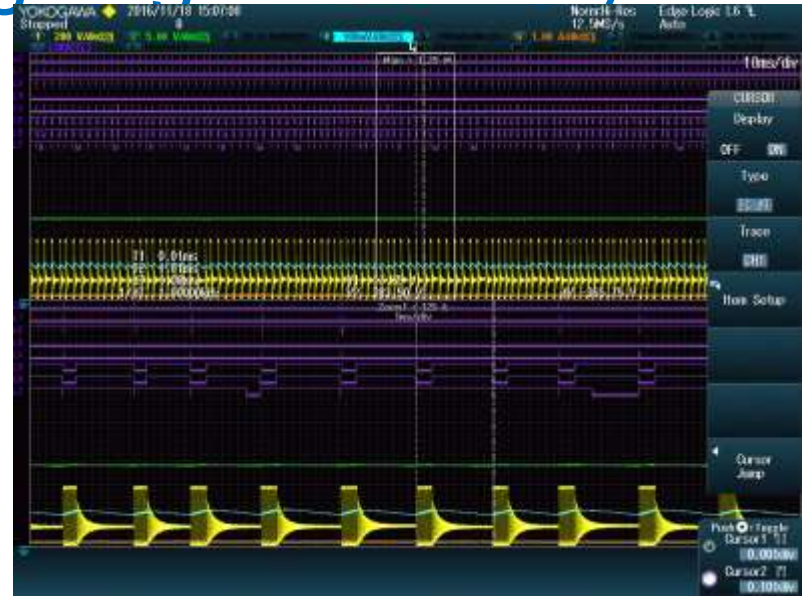
Resonant LLC

APPLICATIONS

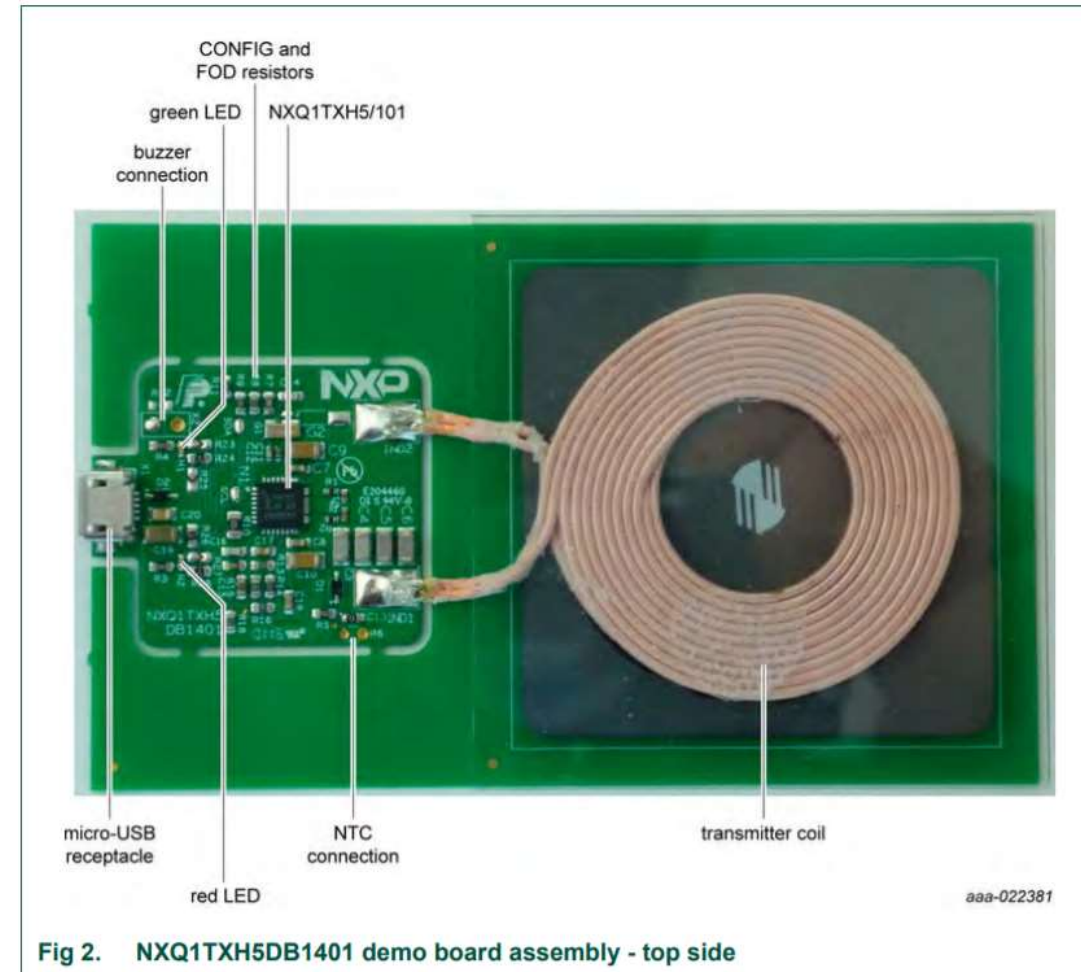
- E-Scooter and E-Bike chargers
- Power tool chargers
- Industrial power supplies
- Desktop and all-in-one (AIO) PCs
- Gaming consoles
- TV power supplies (Ultra-HD, 4K)
- Notebook adapters
- Lighting applications up to 350 W

Full Digital new LLC platform enabling high efficiency at all load levels

Example:
Via GUI set burst mode frequency to 1800Hz



5W Qi Transmitter



Personal Health Product Line Overview

Hearing Instruments



- Hearing Aids
- Hearing Implants
- NFMI
- BLE Audio
- DSP + Audio Codec
- EEPROM

Wireless Audio Hearables



- Hearables, Wireless Headsets
- NFMI
- BLE Audio
- DSP + Audio Codec

NTAG SmartSensor



- Smart Logistics e.g. Cold Chain Monitoring
- Therapy Adherence Monitoring
- Single Chip IoT Edge Nodes, Including Sensing, Processing, Logging, Connectivity (NFC)
- NFC-RFID Combo

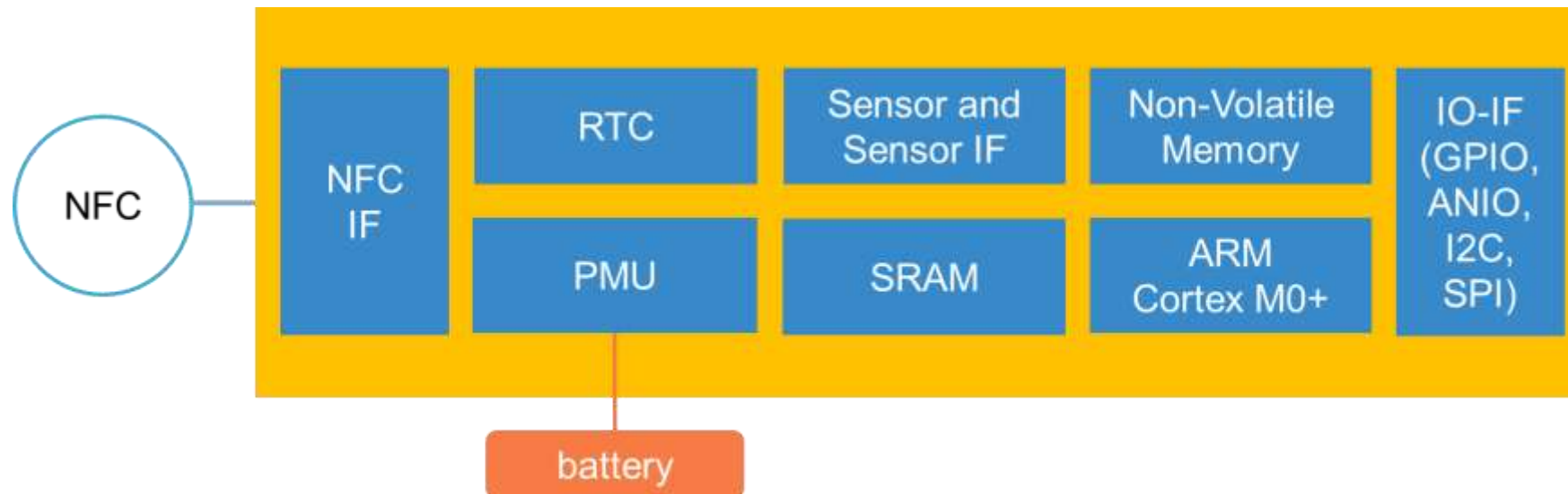
Health Screening / Monitoring



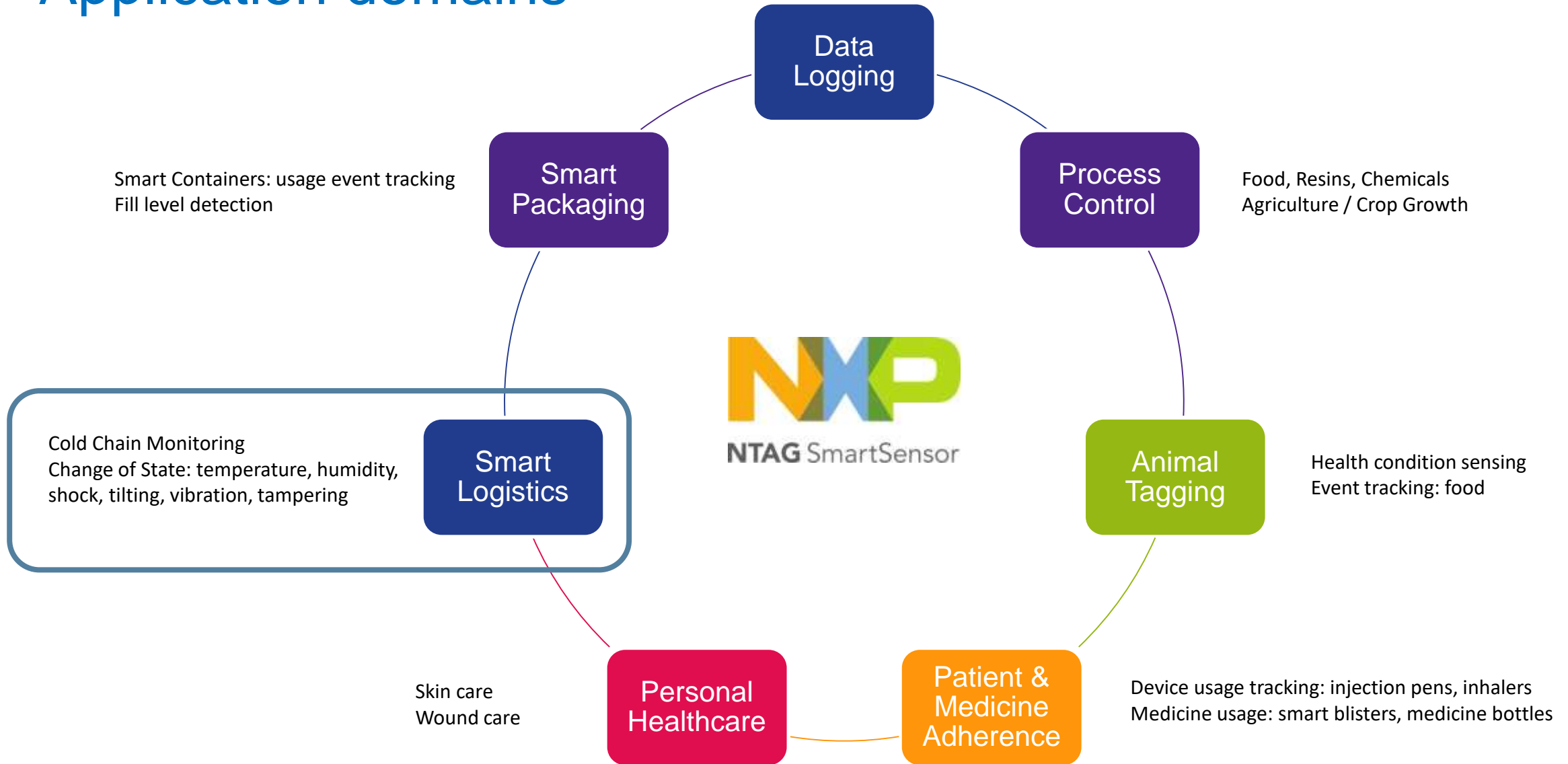
- Medical Imaging
- Body Area Networking
- Ingestible
- NFMI
- BLE
- NTAG SmartSensor

Single chip for creating semi-passive sensing NFC solutions

- Semi-passive
 - Periodic sensing powered by battery
 - Passive communication over NFC when touching
- Flexible and autonomous: open ARM Cortex M0+, large non-volatile memory
- Easy to apply: just add a battery and an NFC antenna



Application domains



What this visibility brings



- Full traceability across the whole chain
 - Systemic incidents can be tackled

High Performance Analog Product Line Overview

I²C Bus



- Buffers
- GPIO
- Switches/Muxs
- Voltage Translators

I²C Peripherals



- Real Time Clock
- Temperature Sensors
- LED Controllers
- LCD Drivers

General Analog



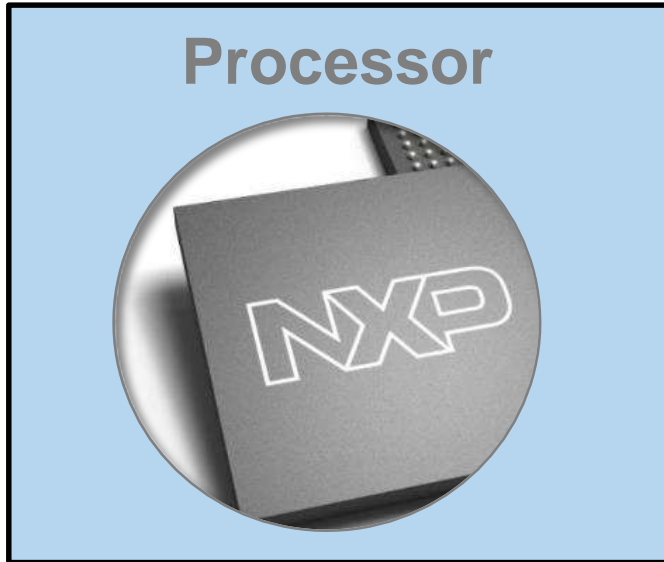
- Comparators
- Watches
- RF/IF
- UARTs

HPA Latest News

- New **PCAL6534**: 34-bit GPIO Expanders with 'Agile' features that operates down to 0.9V
- New **NTS030x**: 4 and 2-channel Voltage Level Translators with 'Smart One Shot' feature.
- New **NVT0302 (In Dev)**: 2-channel high speed (26MHz) Voltage Level Translator, ideal for the SPMI interface
- New **PCA9957 (In Dev)**: 24-ch constant current 5V/30mA LED driver
- New **PCA9959 (In Dev)**: 24-ch constant current 5V/60mA LED driver
- New **P3C9582 (In Dev)**: Quad Port Controller for common port types such as SFP+, QSFP+ (e.g. optical modules) and with I²C, I3C and SPI Control
- New **PCF2131 (In Dev)**: Nano-power (50nA) and very accurate (± 3 ppm) RTC module with integrated crystal and tamper / timestamps pins

Big processors needs external voltage level translators (VLTs)

- Big processors going towards lower geometries for higher processing power



<u>Geometry</u>	<u>I/O Voltages</u>
40nm	5V
28nm	3V
14nm	1.8V
10nm	1.2V
7nm	



When there is a MPU running at low voltage (i.e. 1.2V), there are also VLTs in the system!

1. Lower process geometries support lower voltages
→ more opportunities for **voltage level translators (VLT)** to drive the peripherals still supplied at 1.8V, 3.3V or 5V



Lower voltage
FPGAs/ASICs

NTS030x:

- NTS0304 (4-ch) released
- NTS0302 (2-ch) in development
- V_{CCA} : 0.9V to 3.6V
- V_{CCB} : 1.65V to 5.5V
- Smart One-Shot

Nano-Power RTC module PCF2131TF

In Development
Eng. samples early 2020
Release Q3 2020

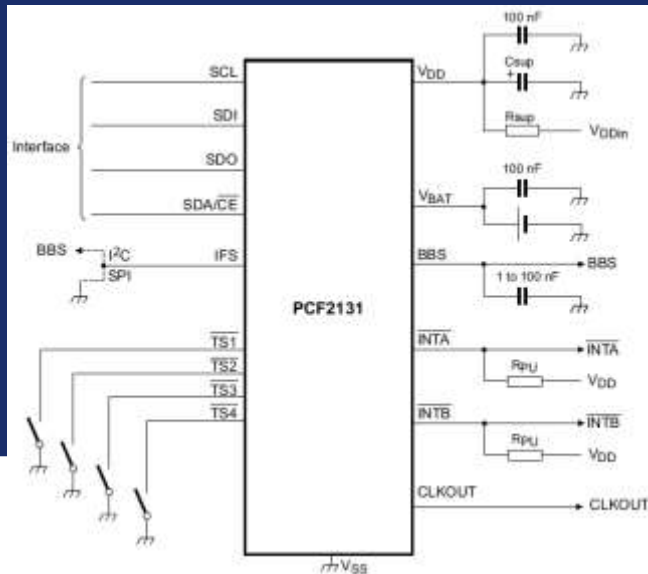
Features

- RTC module with integrated crystal
- 50nA in timekeeping mode
- ± 3 ppm @ [-40 to 85] $^{\circ}$ C
- 4 anti-tamper pins & timestamp registers
- Selectable I²C and SPI interfaces
- Battery switch-over circuitry
- HLSON16 package (3.5 x 4.5 x 1.4 mm)
- AEC-Q100 version PCA2131

Differentiation

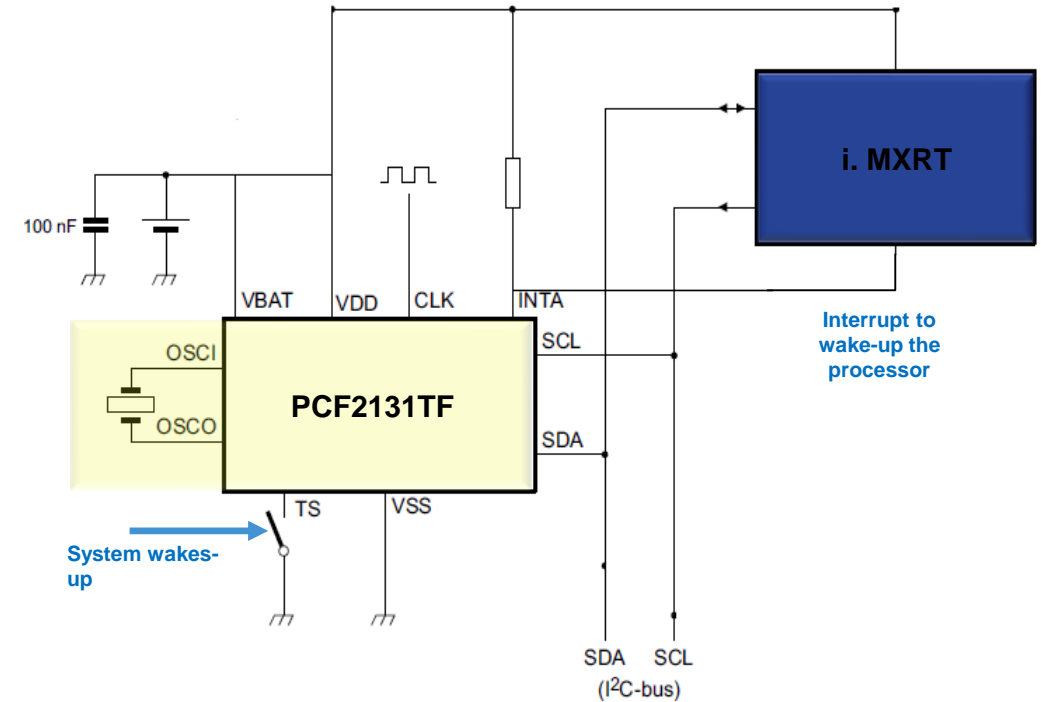
- Nano-power: 50nA (best in-class)
- Factory calibration
- Accurate timing
- Small plastic package
- High integration
 - Integrated crystal and TCXO
 - Tamper pins
 - Timestamping
 - Battery switch-over

Application Block Diagram



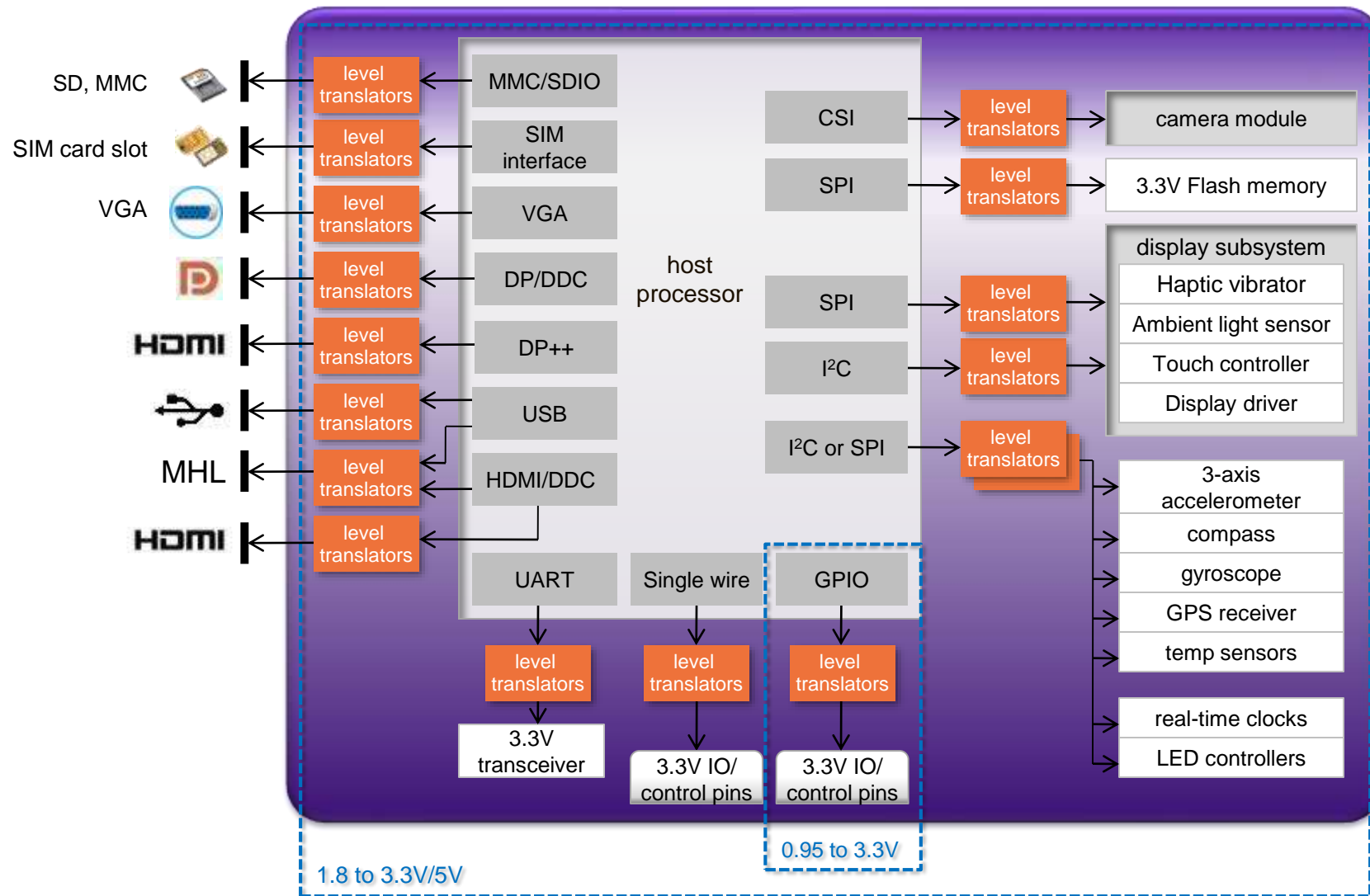
Applications

- In general, battery operated devices where ultra-low power is a key factor
- Wearables
- Metering
- Asset tracking
- Medical, i.e. Insulin pen, continuous glucose monitoring, drug injectors
- Smart home devices
- Automotive BMS



Note: i.MXRT low power mode with RTC running mode is 15uA. If the system operates only periodically, it makes sense to use an external RTC and put the processor in reset mode or, alternatively, switch off the supply of the i.MXRT processor. The Tamper/Timestamp (TS) function of the RTC

Wide Selection of Voltage Level Translators



New NTS0304: 4-ch Level Translators Offer Wider Voltage Ranges

Features

- VCC(A): 0.95V to 3.6V and VCC(B): 1.65V to 5.5V
- Family of 1, 2, 4 and 8-ch level translators
- 8kV ESD protection (B-port)
- “Smart” one-shot with 50ns pulse and EMI rejection

Benefits

- Wide voltage ranges match up with low-voltage μ C's/FPGAs
- Pin compatible packages with industry-standard footprint
- Highly robust for driving cables or across boards

Applications

- Consumer
- Communications
- Smart cards
- Interface to low-voltage systems

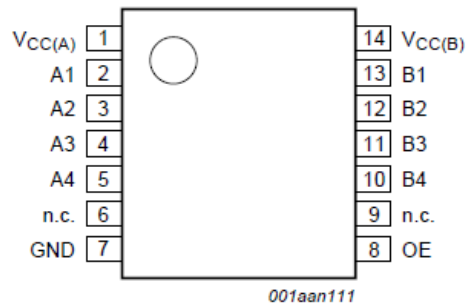


Fig 2. NTS0304PW Pin configuration

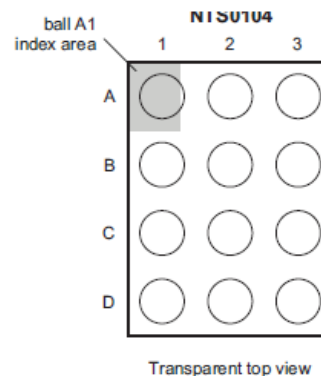
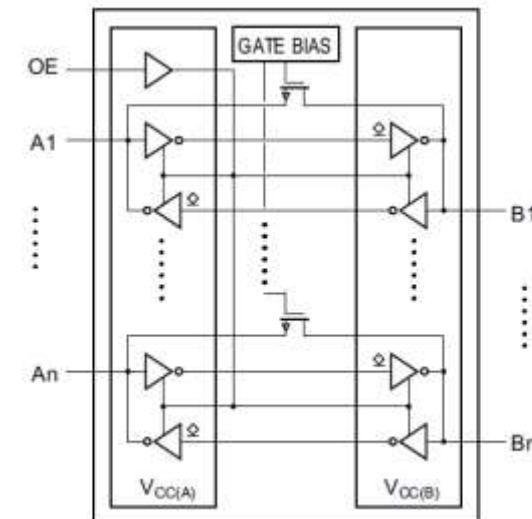


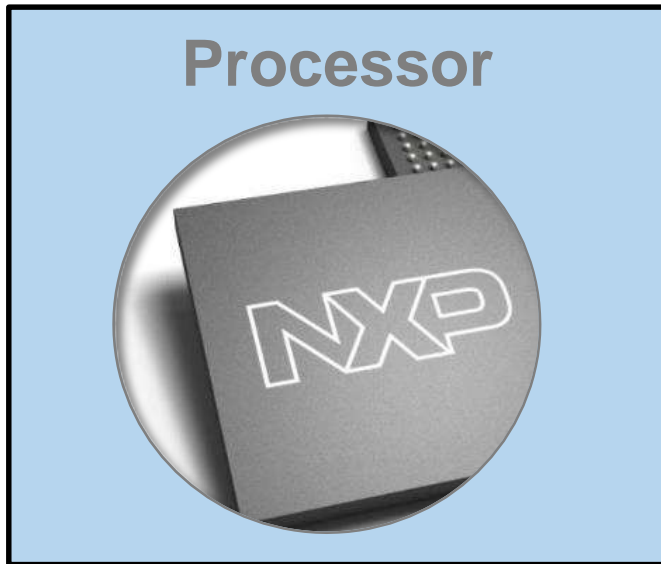
Fig 3. NTS0304UK Pin configuration WLCSP12



NTS0302 2-ch production Q3'19


Big processors needs (or will need) external GPIOs

- Big processors going towards lower geometries for higher processing power



2. Cost of silicon for lower process geometries is increasing and implementing 'high voltage' (3V or 5V) IOs is expensive
→ simpler functions like **GPIOs** are moving off the processor ICs

<u>Geometry</u>	<u>I/O Voltages</u>
40nm	5V
28nm	3V
14nm	1.8V
10nm	1.2V
7nm	

A large blue downward-pointing arrow is positioned between the 'Geometry' and 'I/O Voltages' columns, indicating a trend where lower geometries correspond to lower I/O voltages.

More IO channels

PCAL6524:

- 24-bit
- 0.8V to 3.6V

PCAL6534:

- 34-bit
- 0.9V to 5.5V

New PCAL6534: 34-bit GPIO Expander operates down to 0.9V

Features

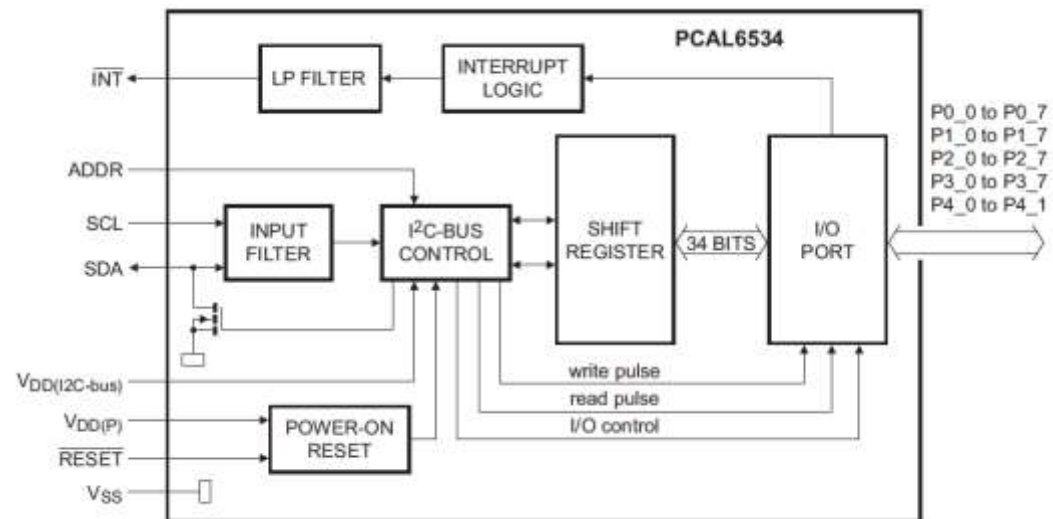
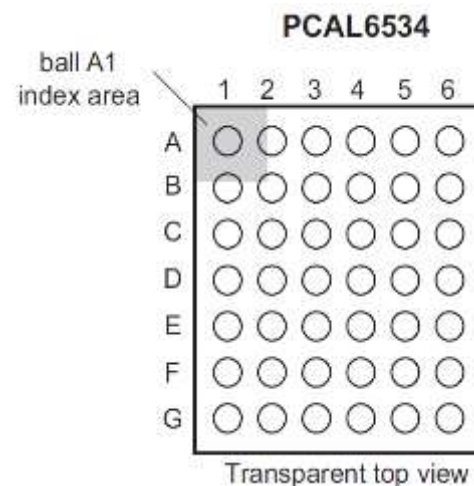
- Level translating 0.9 to 5.5V range
- 2.6mm x 3mm VFBGA-42 package
- Agile IO: input latch, programmable output current, integrated resistors

Benefits

- Wide voltage range for matching up to today's lowest voltage FPGAs/processors
- Tiny package saves cost and size of additional IO's in processor & simplifies routing

Applications

- Consumer phones and game controllers
- IO buttons
- Networking switches & routers
- Automotive window control



LED Drivers portfolio

- Voltage or constant current control
- From 4 to 24 channels
- Integrated PWM generation for precise brightness control and RGB mixing

Part	Output					Function			Qualification
	# channels	VS	CC	V _{LED}	IDD	Control I/F	PWM	Function	Consumer / Industrial
PCA9550,3,1,2	2,4,8,16		-	5 V	25mA	400kHz Fm	2x 8-bit	Blinker	Consumer / Industrial
PCA9530,3,1,2	2,4,8,16		-	5 V	25mA	400kHz Fm	2x 8-bit	Dimmer	Consumer / Industrial
PCA9624,2,6	8,16,24		-	40V	100mA	1 MHz Fm+	8-bit indiv /global	RGB - Mixer	Consumer / Industrial
PCA9632,3,4,5	4,4,8,16		-	5 V	25mA	1 MHz Fm+	8 bit indiv /global	RGB - Mixer	Consumer / Industrial
PCA9635	16		-	5 V	25mA	1 MHz Fm+	8 bit indiv	RGB - Mixer	Consumer / Industrial Automotive
PCA9685	16		-	5 V	25mA	1 MHz Fm+	12 bit indiv	RGB - Mixer	Consumer / Industrial Automotive
PCA9922	8			5 V	60mA	Serial in/out	1x 12-bit	Blinker	Consumer / Industrial
PCA9952	16	-		40V	57mA	1 MHz Fm+	8-bit indiv /global	RGB - Mixer	Consumer / Industrial Automotive
PCA9955	16	-		40V	57mA	1 MHz Fm+	8-bit indiv /global	RGB - Mixer	Consumer / Industrial Automotive
PCA9955B	16	-		20V	57mA	1 MHz Fm+	8-bit indiv /global	RGB - Mixer	Consumer / Industrial Automotive
PCA9956B	24	-		20V	57mA	1 MHz Fm+	8-bit indiv /global	RGB - Mixer	Consumer / Industrial
PCA9745B	16	-		20V	57mA	SPI Daisy	8-bit indiv /global	RGB - Mixer	Consumer / Industrial Automotive

Constant Current LED drivers

Solution:

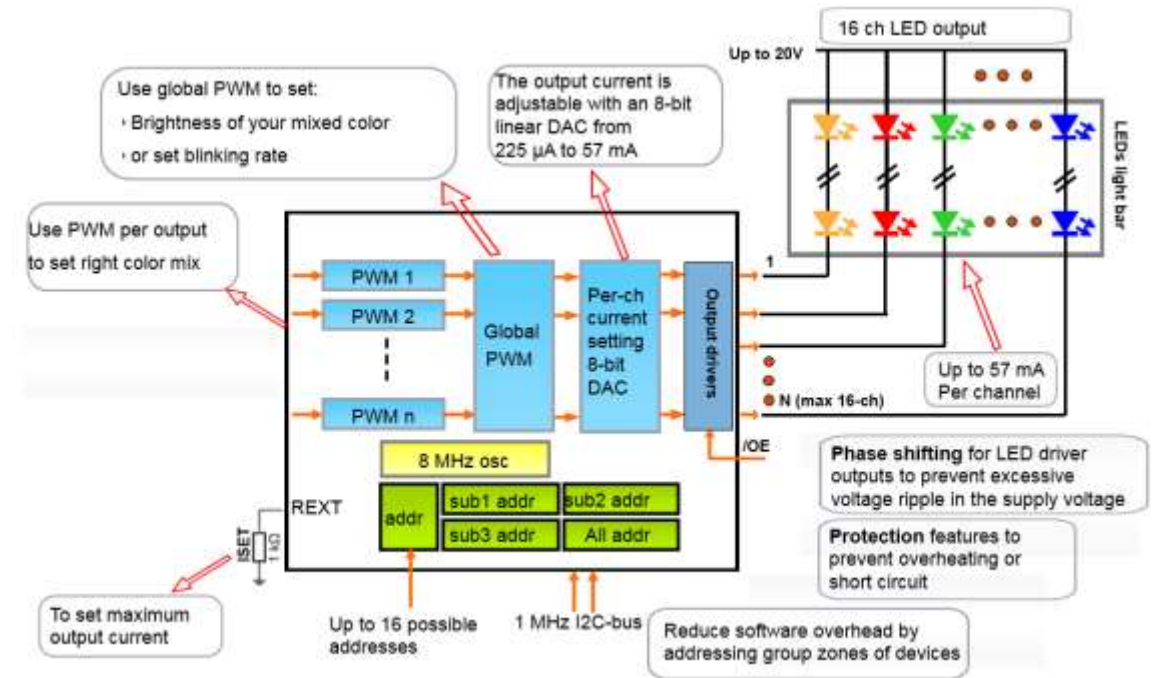
- **PCA9955BTW**: 16-ch, I2C, 20V/57mA
- **PCA9956BTW**: 24-ch, I2C, 20V/57mA
- **PCA9745BTW**: 16-ch, SPI, 20V/57mA
- **NPI PCA9957**: 24-ch, SPI, 5V/32mA

Key benefits:

- Precise current & PWM control per each channel
- Several protections integrated
- Specific PCA9957 benefits:
 - Higher accuracy of LED current: $\pm 3.5\%$ btw channels
 - Lower power consumption
 - Small footprint QFN package (5 x 5)

Key Applications:

- RGB LED drivers in consumer & appliance products
- LED status information, i.e. battery charging status
- LED displays

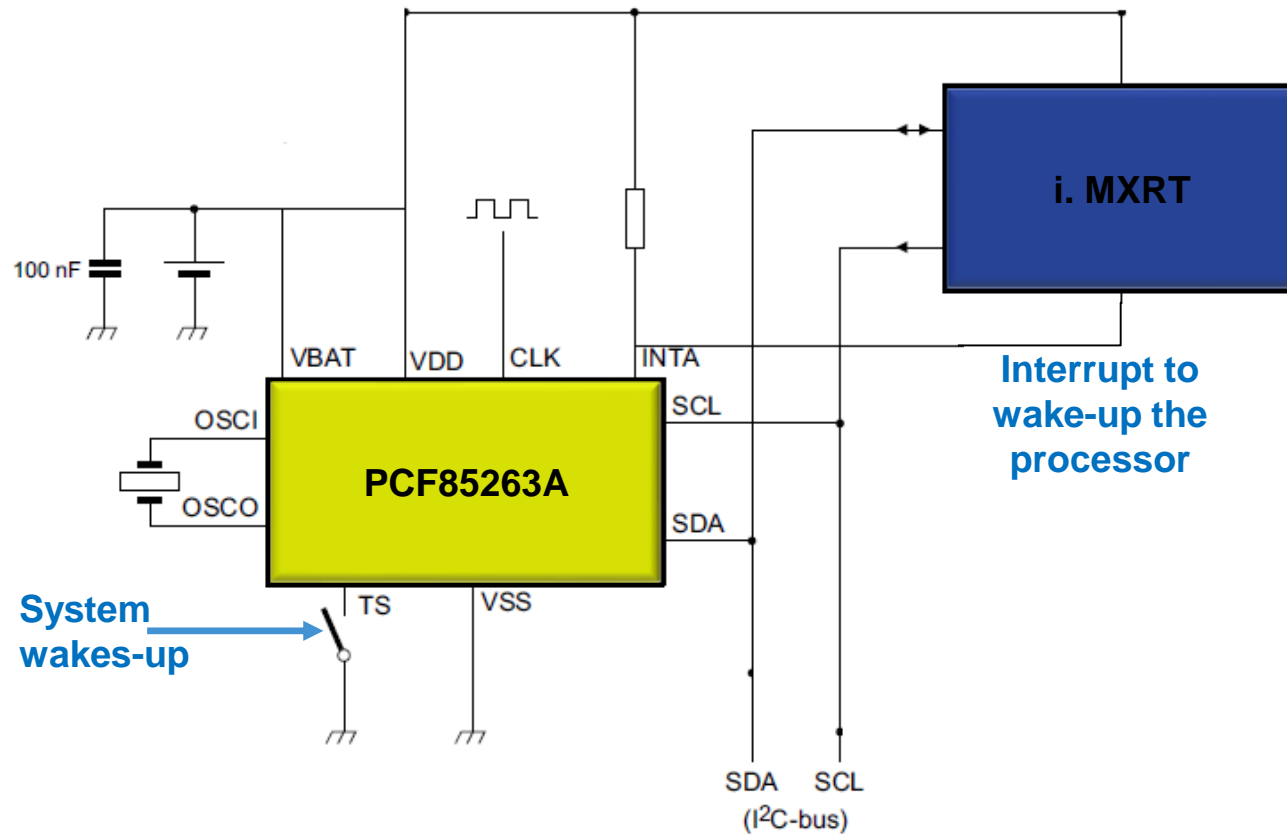


Product Type	Release Status	Package	Budgetary Price 10K Resale
PCA9955BTW	In production	HTSSOP28	\$ 0.83
PCA9956BTW	In production	HTSSOP38	\$ 0.99
PCA9745BTW	In production	HTSSOP28	\$ 0.85
PCA9957	Samples: Q2/Q3	QFN32 (5x5)	TBD

Do you need to reduce your system power consumption?

Example: battery operated systems that work only periodically.

Use the **PCF85263ATL** to keep the timing and manage the controller



i.MXRT lowest power consumption mode is 15uA with embedded RTC running. If the system operates only periodically, it makes sense to use an external RTC and put the processor in reset mode or, alternatively, switch off the supply of the i.MXRT processor. The Tamper/Timestamp (TS) function of the RTC is used to trigger the activity → the RTC via the interrupt pin will wake-up the i.MXRT. The RTC works as a system manager IC, not only as timekeeper.

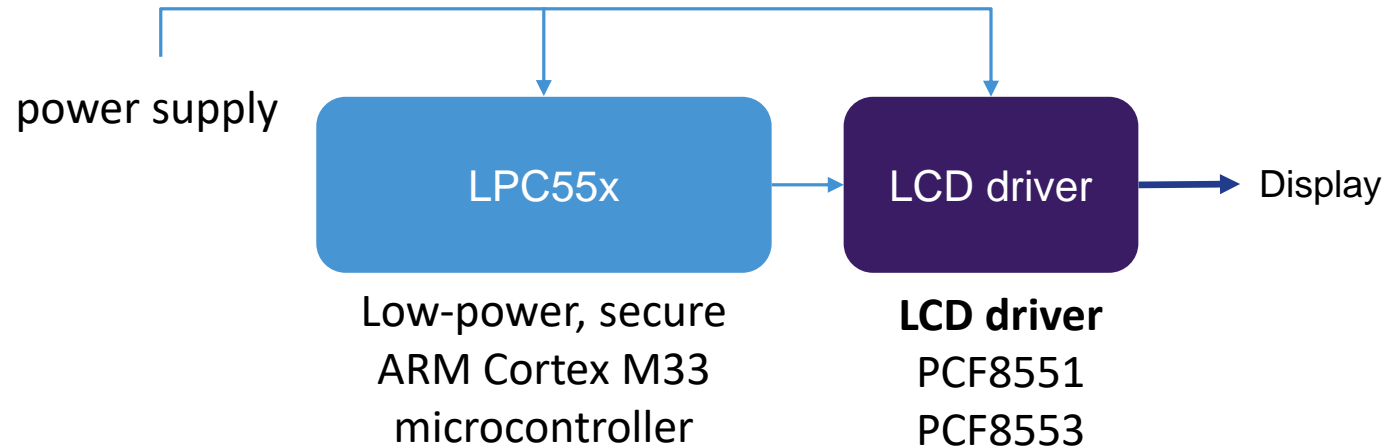
PCF85263ATL

- Low-power consumption; At VDD=3.0V, TAMB=25 °C, No bus activity and CLKOUT inactive, IDD < 300nA (typ.)
- Additional integrated features
 - 1/100 s resolution RTC, stop-watch or elapsed time counter
 - Battery backup input
 - Time Stamps for tamper detection and battery switchover
 - Watchdog
 - Elapsed time counter
 - Battery backed-up RAM (PCF85363)
- DFN2626-10 package

LCD drivers in metering applications



LPC55x + LCD driver **PCF8551 (TSSOP48)** or **PCF8553 (TSSOP56)**



E-metering

- **Low-end: single-chip e-meter Kinetis M**
 - Limited connectivity (e.g. cannot support PLC) but fully integrated solution: metrology AFE, LCD driver, RTC, temp sensor are all embedded
- **Mid and High-end:**
 - Low-power, secure and not limited in connectivity
LPC55x solution + LCD driver

Water and Gas metering:

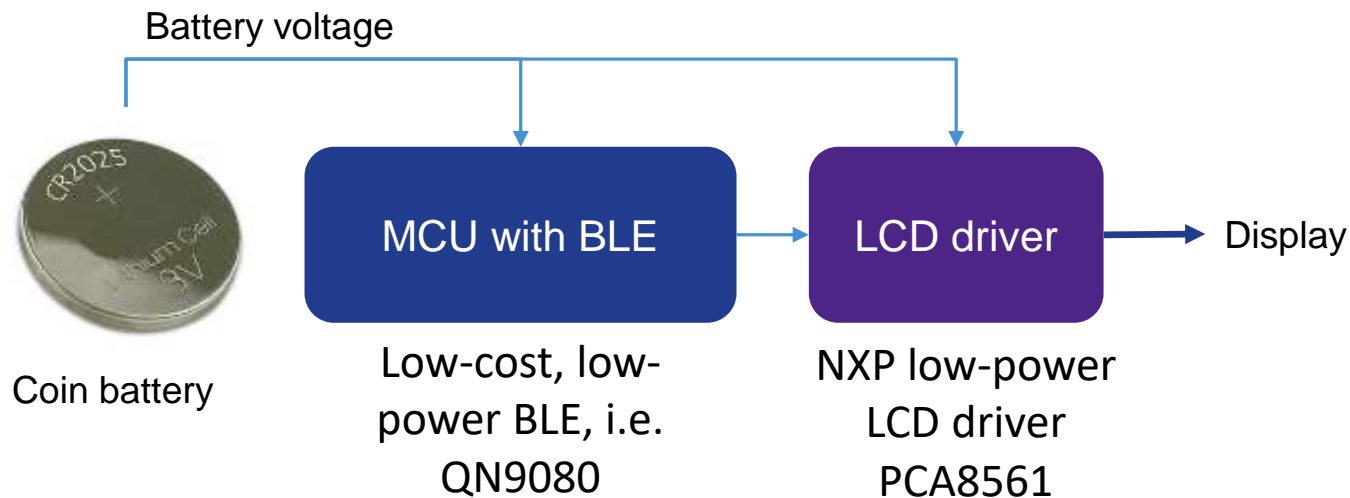
- LPC55x solution + LCD driver PCF8551/53 is the ideal solution to reduce the current consumption, extend the battery life or reduce the battery size

PCF8551/53 are low-power LCD drivers. In combination with LPC55x allows reducing the system current consumption, increase the battery lifetime or reduce the battery size (saving cost)!

Does your 'connected' device have a small display?

Example: battery operated product with BLE connectivity and a small display, i.e. medical devices (insulin pen, inhaler) or consumer healthcare or small appliance

Use the **PCA8561** to drive the display in combination with the QN90xx BLE MCU



QN908xx family MCU does not have embedded LCD driver.

PCA8561AHN (I2C) or PCA8561BHN (SPI)

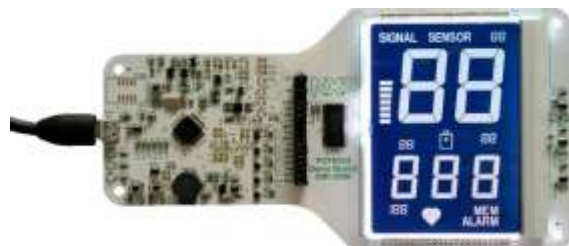
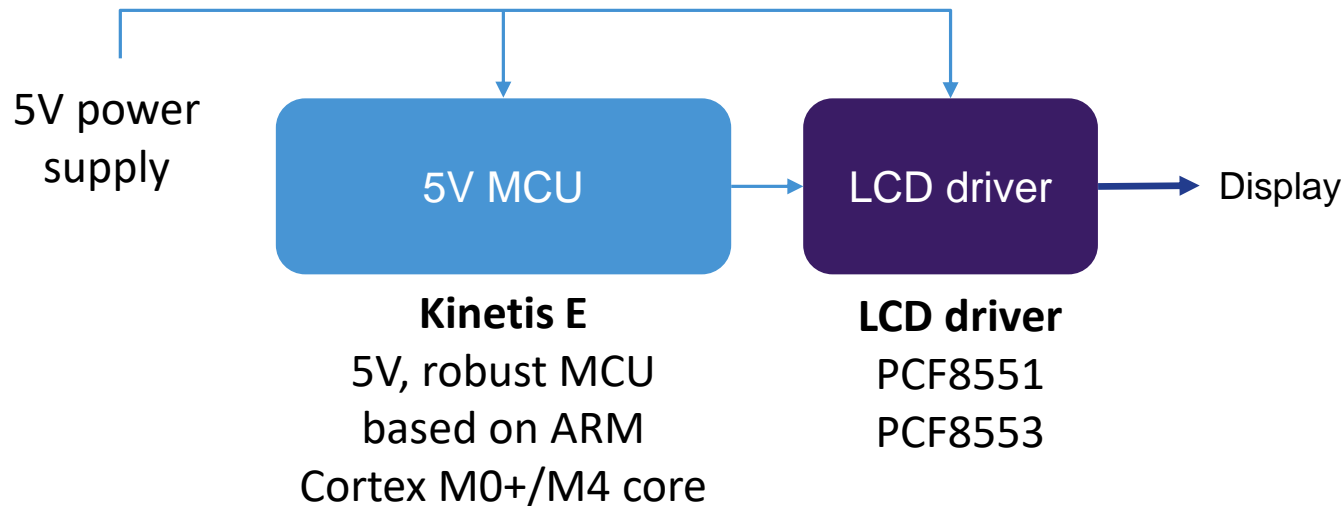
- 4 x 18 LCD segment driver in HVQFN32 package
- Small footprint (5 x 5 mm) with wettable flanks
- Low power
- Programmable frame frequency
- High robustness, i.e. HBM +/- 3.5kV
- Low cost



Does your industrial device have a small display?

Many industrial applications require a 5V MCU.

Use the **5V Kinetis E series** plus the LCD driver **PCF8551 (TSSOP48)** or **PCF8553 (TSSOP56)**



Kinetis E:

5V E series MCUs maintain high-reliability and robustness in harsh electrical noise environments—targeting white goods and industrial applications

PCF8551ATT (I2C) or PCF8551BTT (SPI)

- 4 x 36 LCD segment driver in TSSOP48 package
- VDD and VLCD up to 5.5V
- High robustness, i.e. HBM ± 5 kV

PCF8553DTT (selectable I2C or SPI interface)

- 4 x 40 LCD segment driver in TSSOP56 package
- VDD and VLCD up to 5.5V
- High robustness, i.e. HBM ± 5 kV

Automotive versions also available up to 105°C

Do you want to improve the optical performance of your small segmented LCD with no cost adder?

Full integration is not always the best solution for the customer!

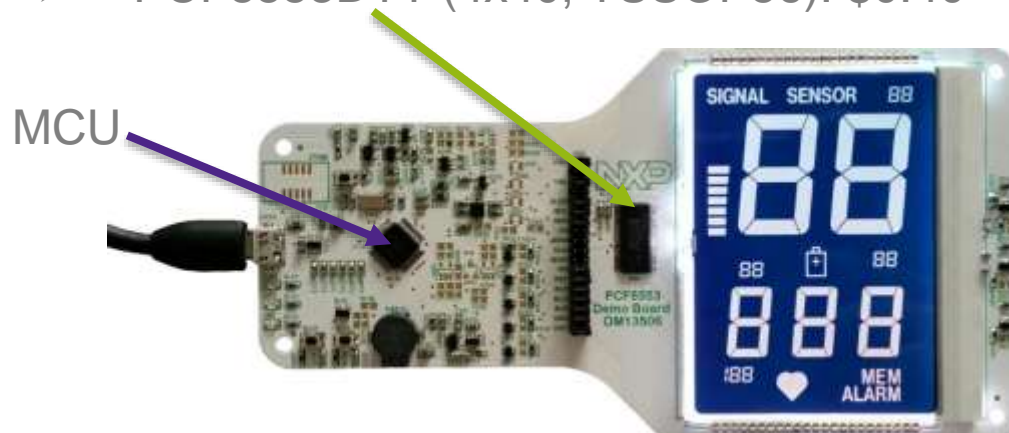
Two alternative solutions to drive a small segmented LCD:

1. Use MCU with embedded LCD driver
2. Use external LCD driver

- **Better optical performance** (higher driving capability of the LCD outputs)
- **Lower current consumption** (when using NXP latest gen, low-power LCD drivers)
- **Easier layout** (LCD driver mounted close to the display and only 2-line I2C from MCU to the driver)
- **Better cost**

Indicative prices assuming volumes of 100ku/year:

- MKL34Z64VLL4 (w/ LCD driver) vs MKL17Z64VLH4 (w/o LCD driver) : $\$1.42 - \$0.95 = \$0.47$
- MKL36Z256VLL4 (w/ LCD driver) - MKL17Z256VLH4 (w/o LCD driver): $\$2.06 - \$1.50 = \$0.56$
- PCF8553DTT (4x40, TSSOP56): $\$0.40$

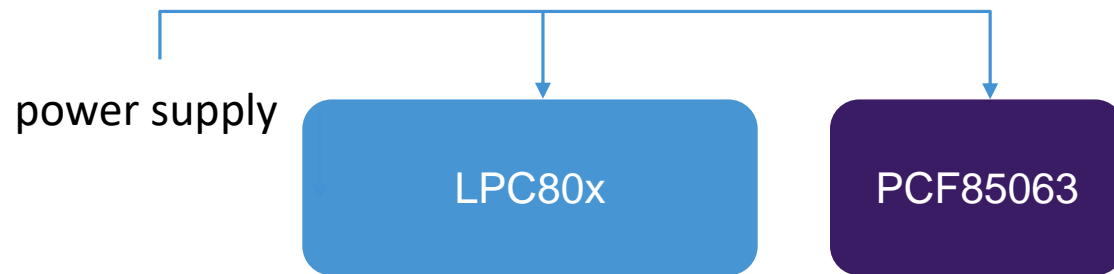


Other LCD drivers:

- PCF8551 (4x36, TSSOP48)
- PCA8561 (4x18, HVQFN32)

Solution for a very simple application

- Attach a ultra-low cost Real Time Clock (i.e. **PCF85063**) to the **LPC80x** Cortex M0+ microcontroller



Full integration is not always the best solution for the customer!

LPC804:

32-bbit Arm Cortex M0+ microcontroller
Up to 32KB Flash
4KB SRAM
12-bit ADC
Comparator
10-bit DAC
Capacitive Touch
Programmable Logic Unit

PCF85063

- PCF85063TP: HWSO8 (2x3x0.75 mm)
- PCF85063ATL: DFN2626-10 (2.6x2.6x0.5 mm)
- PCF85063ATT: TSSOP8 package
- PCF85063AT: SO8 package
- I2C interface
- Clock operating voltage: 0.9V to 5.5V
- Low-power consumption; At VDD=3.0V, TAMB=25 °C, No bus activity and CLKOUT inactive, IDD < 300nA (typ.)
- Alarm, Countdown functions

Driving the knob display of a car climate control unit

- **PCA8561** is the ideal solution to drive the display integrated in the knob of a car climate control unit

Main features	PCA8561
Resolution (max)	4 x 18 = 72 segments
VDD range [V]	1.8V ÷ 5.5V
VLCD external [V]	1.8V ÷ 5.5V
Mux rates	1:1, 1:2, 1:3, 1:4
Bias configuration	static, 1/2, 1/3
Oscillator	Internal or external selectable through command
Frame Freq.	32 Hz ÷ 256 Hz programmable
Reset	Input reset pin (RST); software reset command; POR circuit with POR enable input pin (PORE)
Interface	PCA8561 AHN : 2-lines I ² C PCA8561 BHN : 3-lines SPI
Others	A0,A1 pins for I ² C slave address selection
Operating Temp Range	-40°C to +105°C
Package	HVQFN32 (with wettable flanks)
ESD	HBM ± 3.5 kV
Qualification	AEC-Q100 grade 2

Small displays integrated in the knobs:



The TSSOP package is too big to be mounted inside the knob of a climate control



Parameter	Value
Width	5.0 mm
Length	5.0 mm
Height	0.85 mm
Pitch	0.5 mm
Soldering	wettable flanks



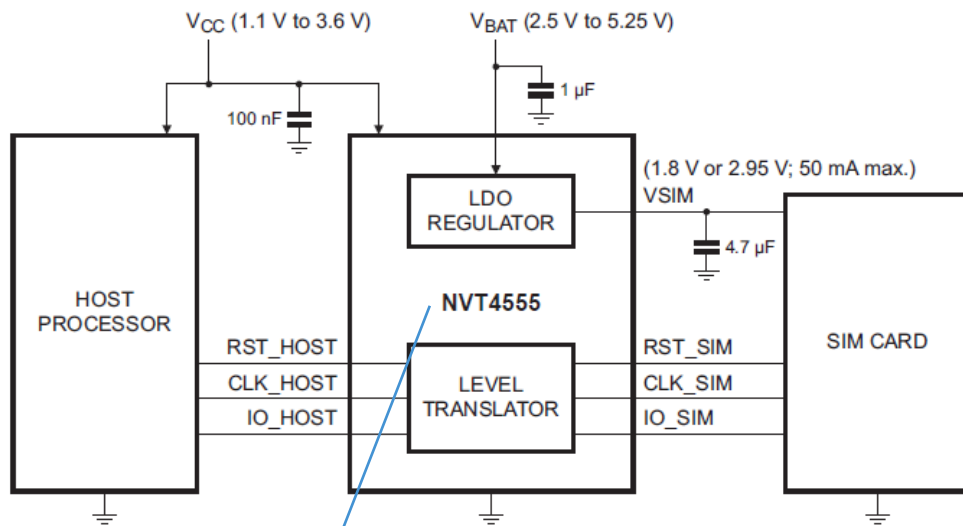
Wettable flanks:

The exposed edge of each terminal contains a small plated cavity, ensuring the solder flows into it and adheres to the side of the terminal. Non-wetting of the sides can be detected easily, allowing a **cost-effective optical inspection process**.



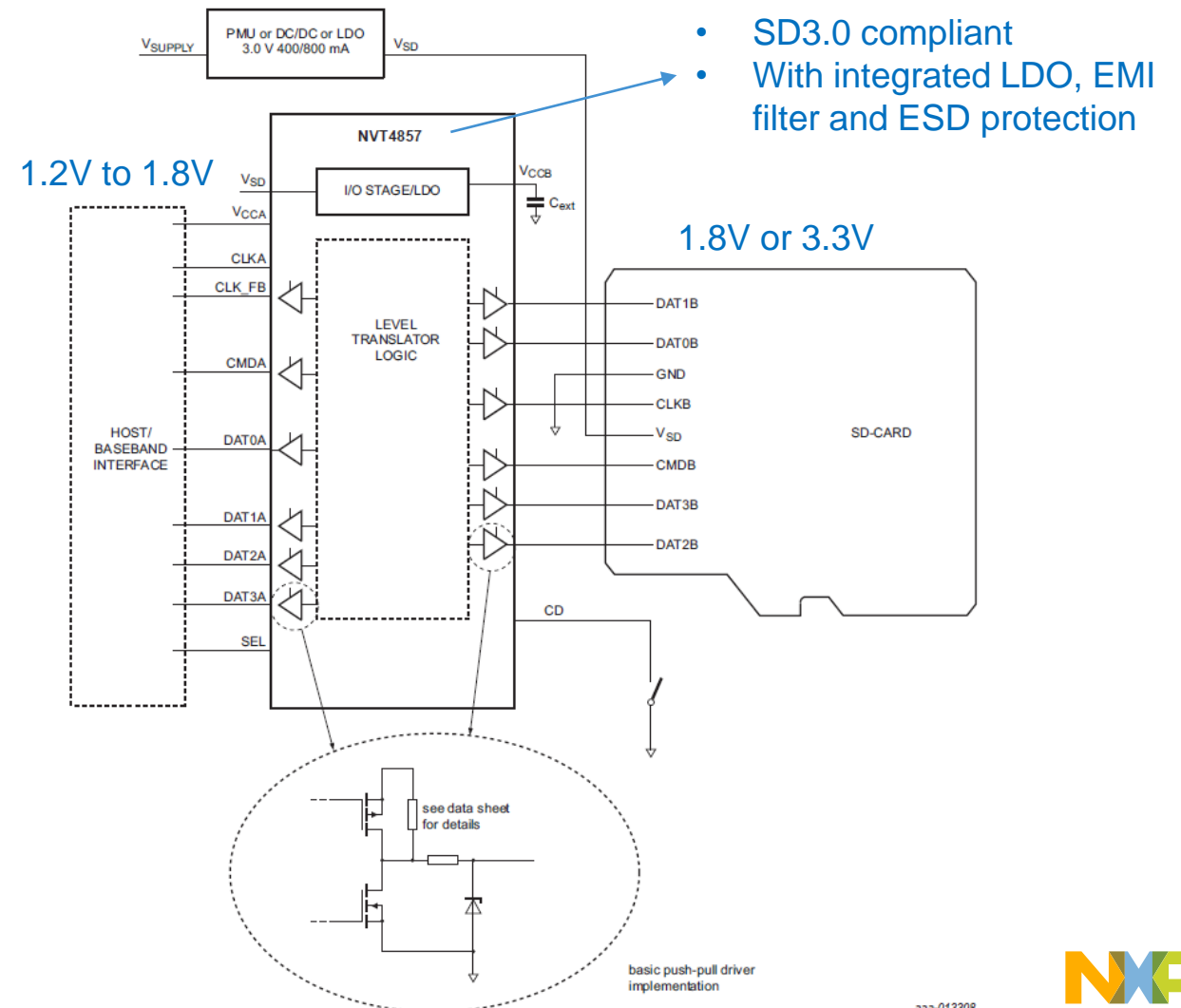
Voltage Level Translators (VLTs) in computing applications

- **NVT4555**: VLT for SIM card interface



- Complaint with SIM/smart card interface requirements
- With integrated LDO

- **NVT4857**: VLT for SD card interface



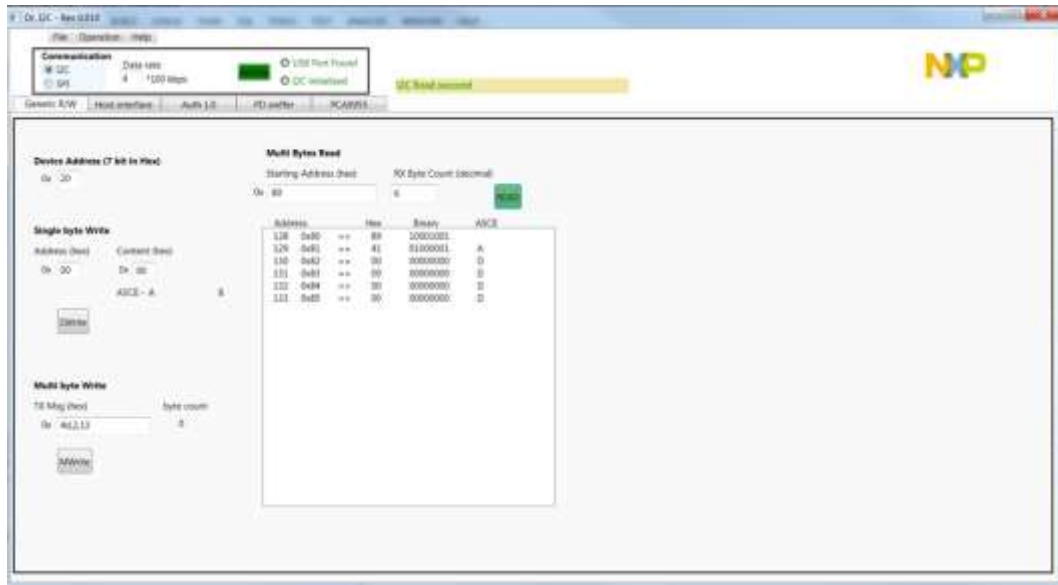
Attach to i.MX8M

BL SIP parts integrated in the reference designs

Product Category	Part Type	Description	Where Used	Key Features / Differentiators
USB-C	PTN5110DHQ	USB PD TCPC PHY IC	USB Type-C connector Power Delivery	<ul style="list-style-type: none"> • Single-port TCPC compliant USB Power Delivery (PD) PHY • Integrates VCONN load switch with programmable current limit, reverse leakage current blocking and Over Temperature Protection (OTP) • Offers tremendous flexibility to platform integrators by supporting a wide range of power supply input voltages. It can operate on VBUS to support certain system use cases needing dead battery operation.
Power Switch	NX5P3090UK	USB PD and type C current-limited power switch (5V/3A)	USB Type-C connector VBUS power switch	<ul style="list-style-type: none"> • 29V tolerance on VBUS and EN pin • Adjustable current limit from 400 mA to 3.3 A • Reverse Current Protection; Over Temperature Protection
Power Switch	NX5P3290UK	USB PD and type C current-limited power switch (5V/3A)	USB Type-C connector VBUS power switch	<ul style="list-style-type: none"> • 29V tolerance on VBUS pin; Adjustable current limit from 400 mA to 3.3 A • All time reverse current protection with ultra fast RCP recovery
Power Switch	NX20P5090UK	High voltage USB PD sink power switch	USB Type-C VBUS load switch (20V/5A)	<ul style="list-style-type: none"> • Wide supply voltage range from 2.5 V to 20 V. Isw maximum 5 A continuous current • 29V tolerance on VBUS pin and VINT pin. Adjustable VBUS over voltage protection
High Speed Switch	PTN36043BX	USB Type-C SuperSpeed active switch	USB Type-C connector USB SuperSpeed (5Gbps) interface	<ul style="list-style-type: none"> • Compliant to SuperSpeed USB 3.1 Gen 1 standard • Automatic receiver termination detection • Low active power: 203 mW/113 mA (typical) for VDD = 1.8 V • Excellent differential and common return loss performance • 14 dB differential and 15 dB common-mode return loss for 10 MHz to 1250 MHz
LED Driver	PCA9955TW/Q900	16-ch constant current LED driver		

Enablement tools

- Demo boards with Arduino connector as 'daughter' boards of the major MCU/MPU demo boards
- Drivers in the MCUXpresso environment (in progress)
- GUI available for generic I2C or SPI communication



i.MXRT1050 EVK



LPC55569-EVK



QN9080DK

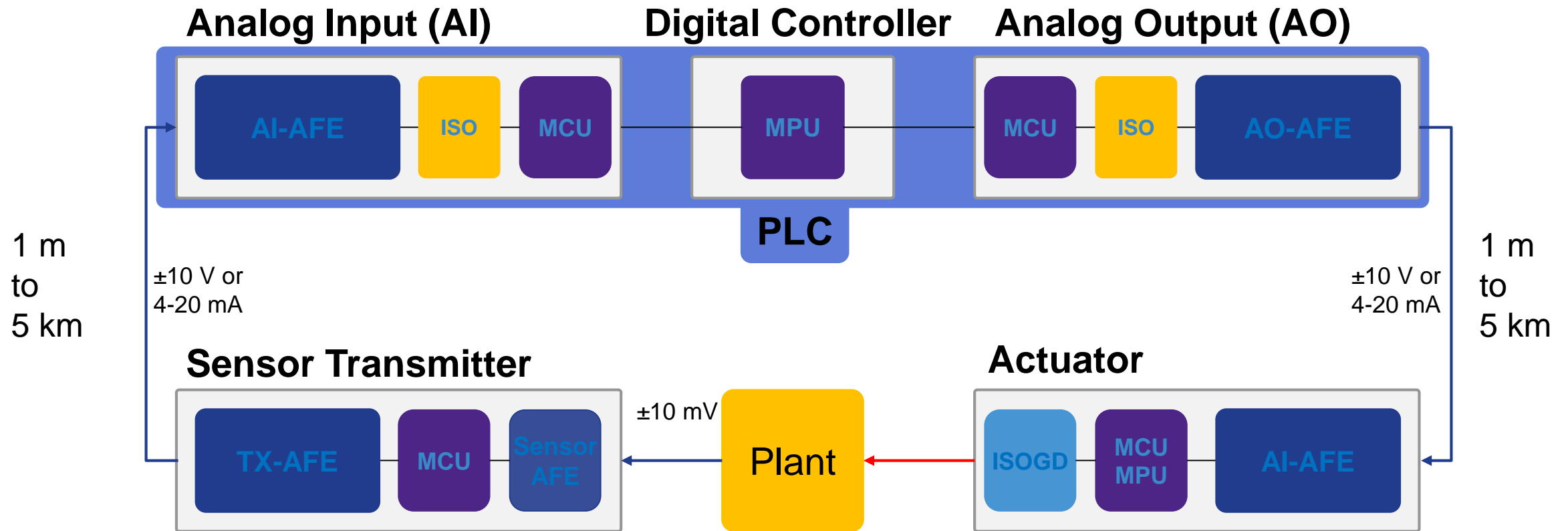


i.MX8M Mini EVK



Manufacturing and Process Automation

NXP VISION: AFE + ISO + MCU/MPU



High Precision AFE and Isolation Technologies for Industry 4.0

Sensor Transmitter



Sensor AFE
4-20mA AFE
Digital Isolators
MCU
Power Management

PLC



AI AFE
AO AFE
Digital Isolators
MCU/MPU
Power Management

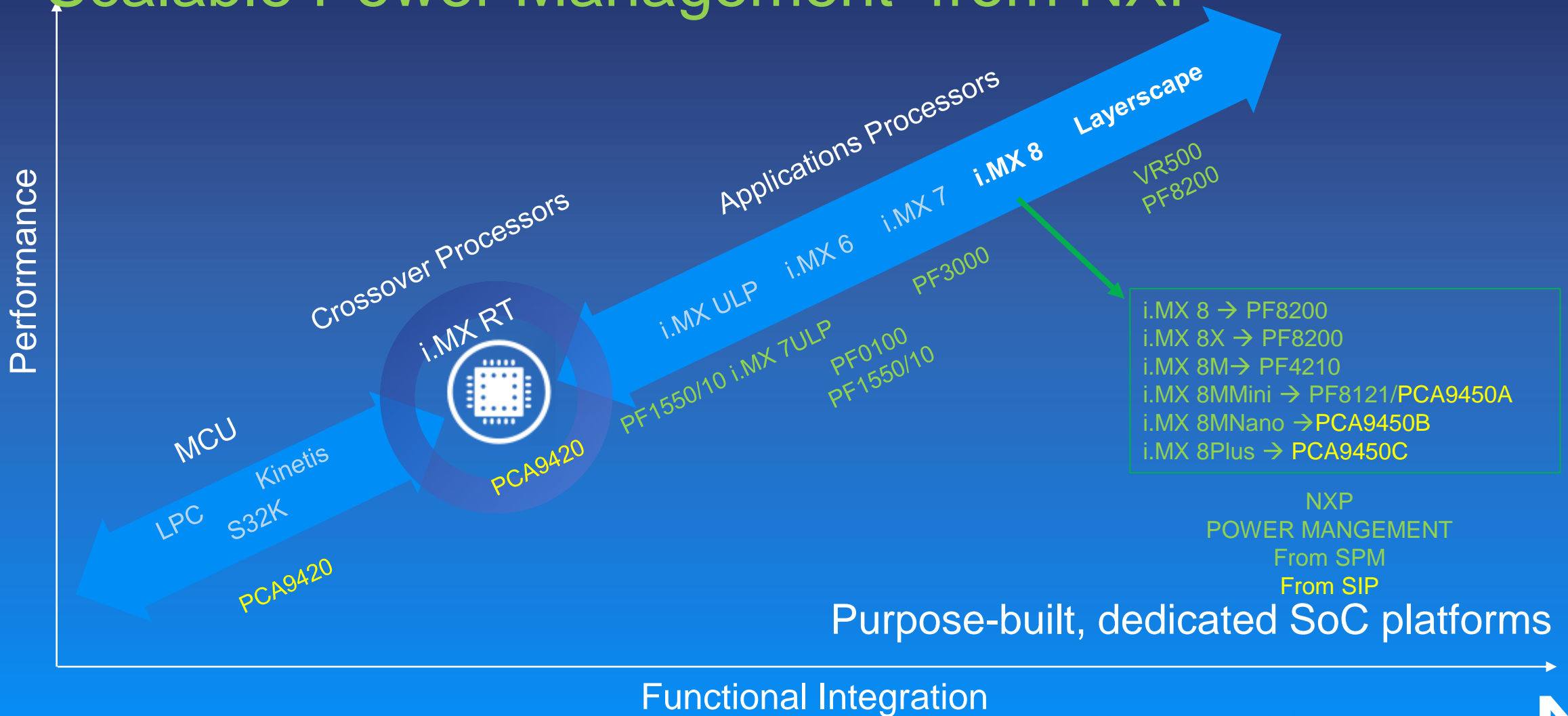
Motor Drive / Robot



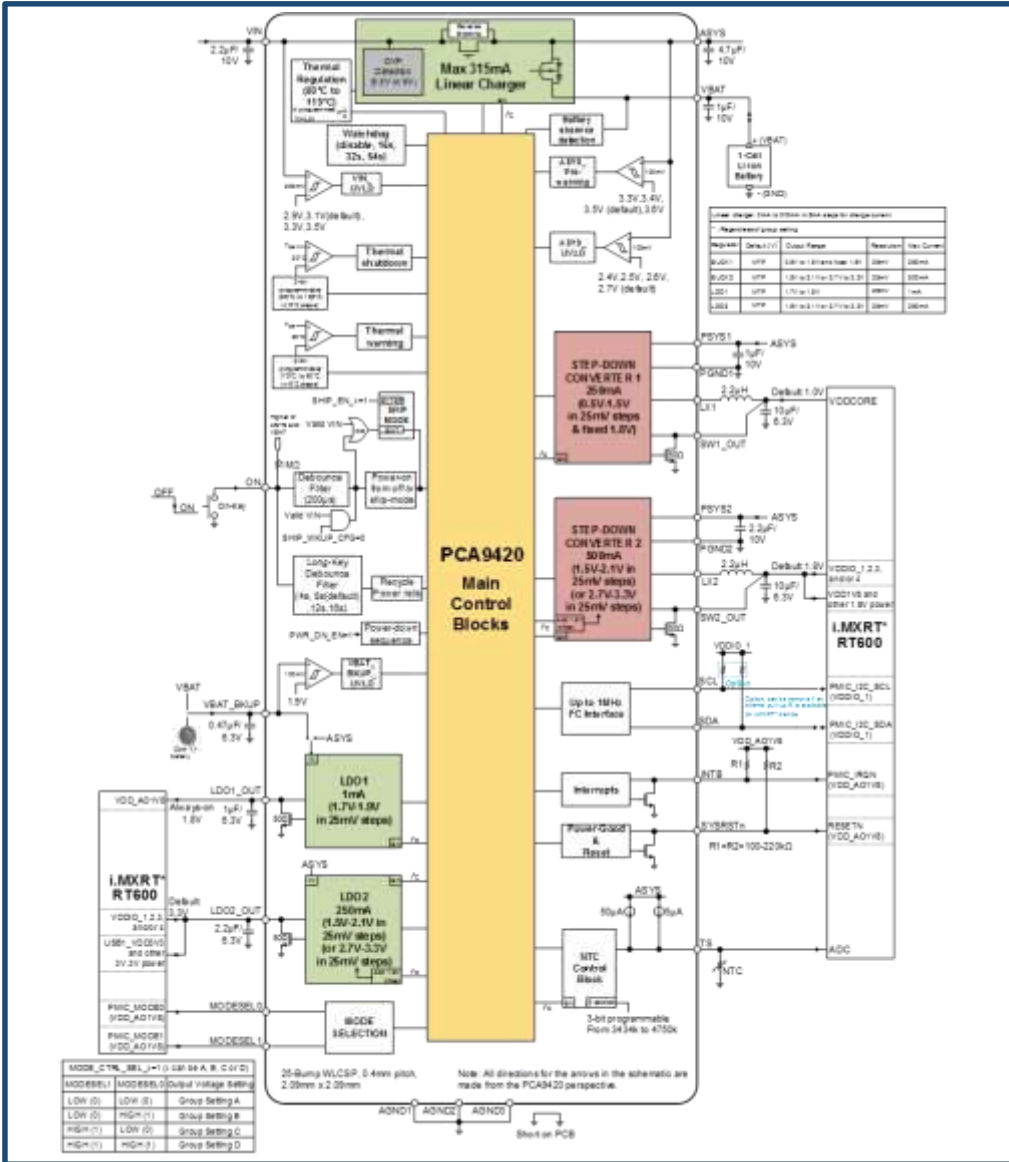
Isolated DRV
Isolated ADC
Digital Isolators
MCU/MPU
Power Management

NXP Scalable Processing Continuum

Scalable Power Management from NXP



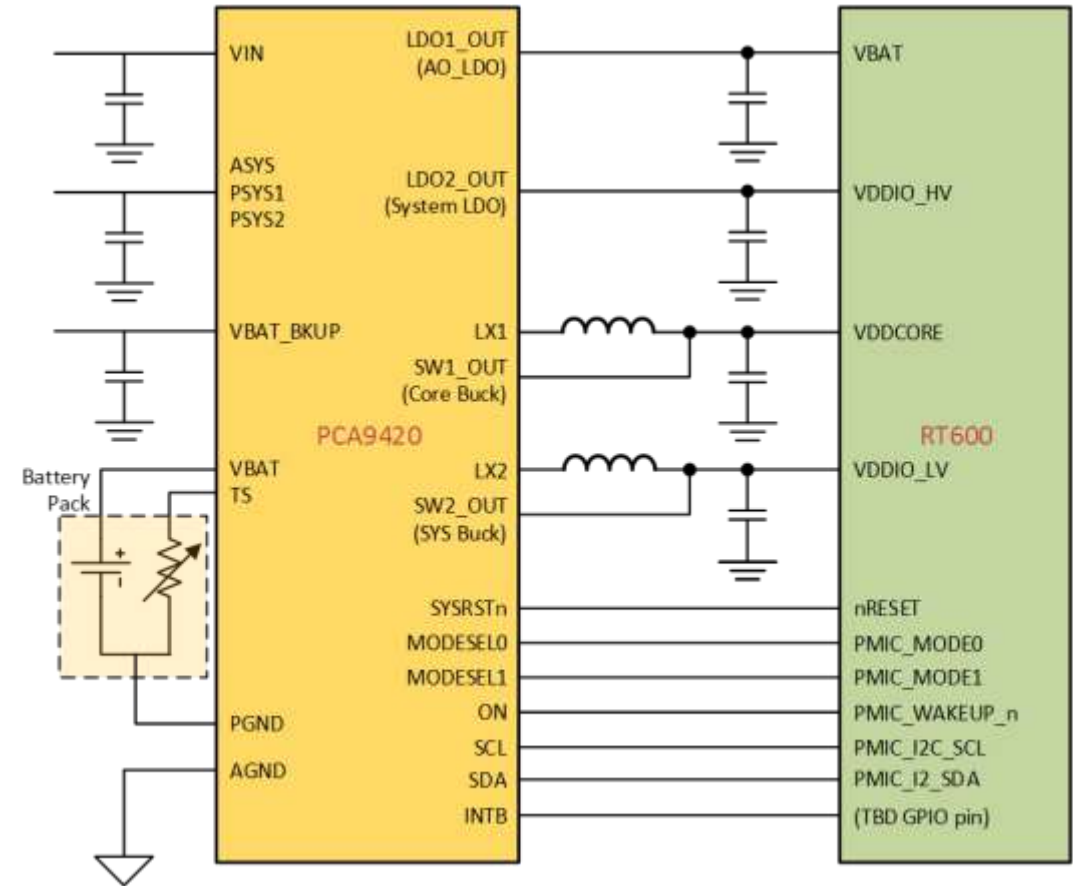
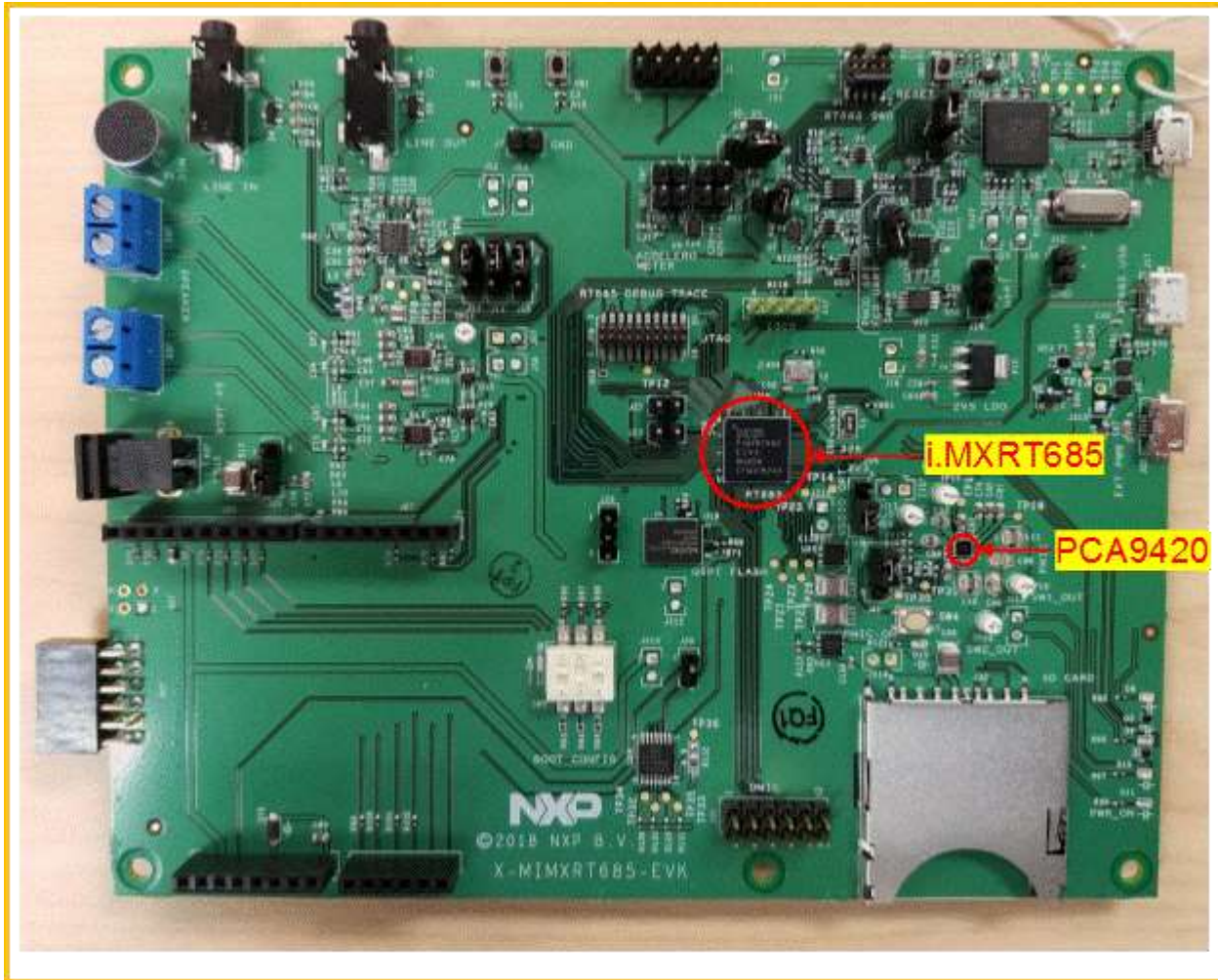
PCA9420 PMIC For i.MX RT600/500



Features and Benefits

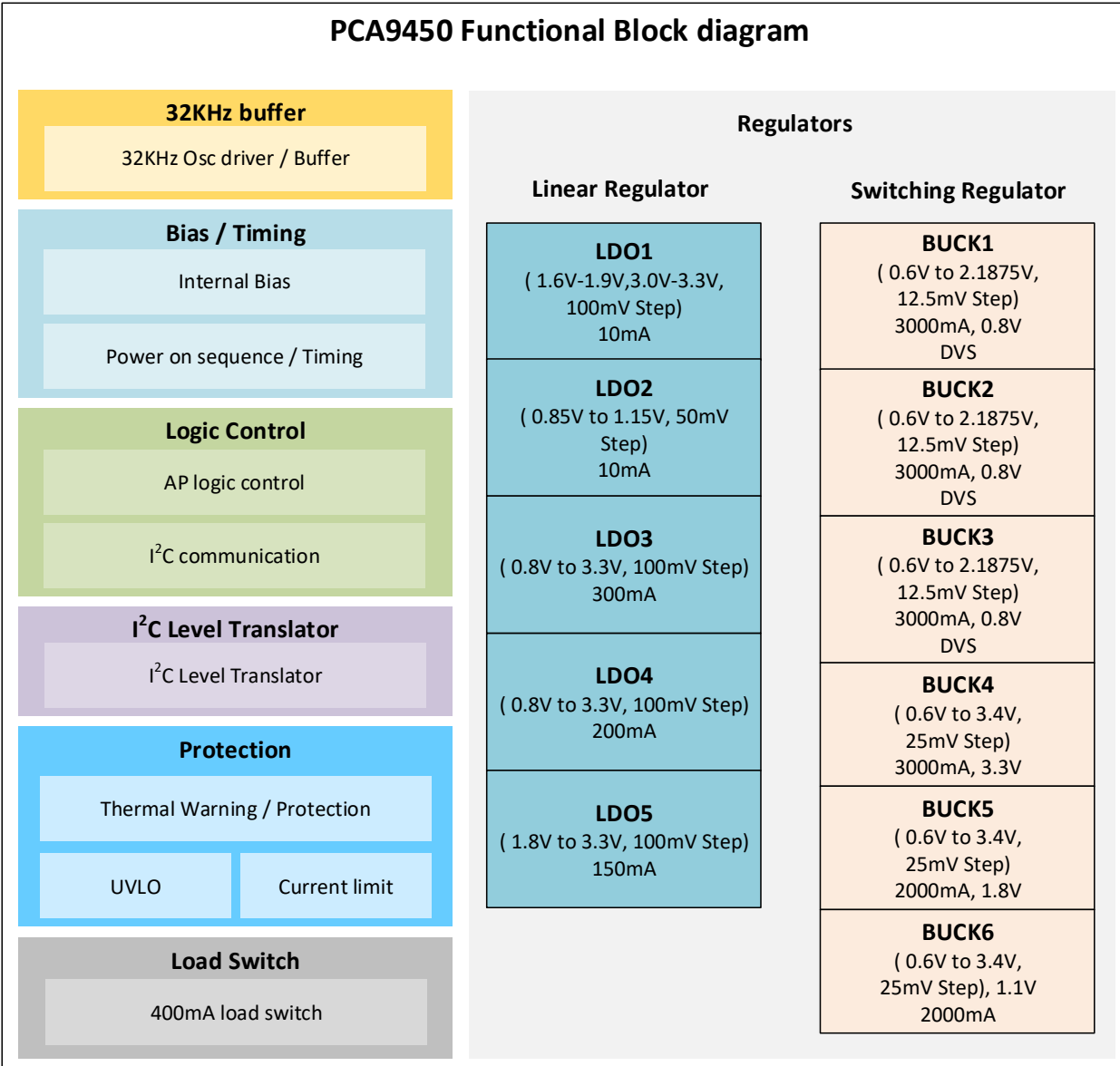
- **Ultra-compact Low-Iq PMIC for Low Power Applications**
- **Chosen PMIC for i.MX RT600/500 Standard Reference Design**
- Very low Iq, high light load efficiency, longer system standby time
 - Very Low Quiescent Current in Shipmode (< 150nA)
- Highly integrated solution, flexible programmability, small solution size
 - 1x Linear Battery Charger (up to 315mA)
 - 2x Buck Regulators (500mA, 250mA)
 - 2x LDO (250mA, 1mA)
 - Built-in “Mode” Configuration to Accommodate Fast Mode Switch Supporting Different MCU Operation Modes
 - 20V DC Tolerance on Vin Pin with Programmable OVP
 - Fm+ 1MHz I²C Interface
 - Package:
 - WLCSPP 25-bump, 2.09mm x 2.09mm, 0.4mm pitch
 - QFN 24-pin 3mm x 3mm
- **MP in Q1 ‘19**

i.MXRT685 Standard EV Kit



PCA9450 PMIC

PCA9450 Functional Block diagram



Features List

- **Optimized PMIC for i.MX 8M Mini/Nano/Plus**
 - **PCA9450A** for i.MX 8M Mini
 - **PCA9450B** for i.MX 8M Nano
 - **PCA9450C** for i.MX 8M Plus
 - All three options are pin-2-pin compatible
- Temperature Range: **-40degC ~ 105degC**
- Longevity Program: **10-year**
- 6x High-Efficiency Buck regulators
 - **3x** 3A buck regulators with DVS and remote sense capability (Buck1/Buck3 can be configured as a Dual-Phase Buck)
 - **1x** 3A buck regulator
 - **2x** 2A buck regulators
- 5x LDOs
 - **2x** 10mA LDOs for SNVS power rails
 - **1x** 150mA LDO with voltage selection pin
 - **1x** 300mA LDO, **1x** 200mA LDO
- 1x 400mA Load Switch for SD Card
- 32.768KHz Crystal Oscillator Buffer
- Integrated I²C Level Translator
- Power Control IOs
 - Power ON/OFF control
 - Standby/Run Mode control
- Fm+ 1MHz I²C interface
- Offered in HVQFN Package, 7mm x 7mm, 0.4mm pitch, 56 pins
- **Samples June'19, MP Q4'19**

PCA9450 Product Family Summary

PCA9450 supports i.MX 8M Mini/Nano/Plus by pin configuration and factory setting:

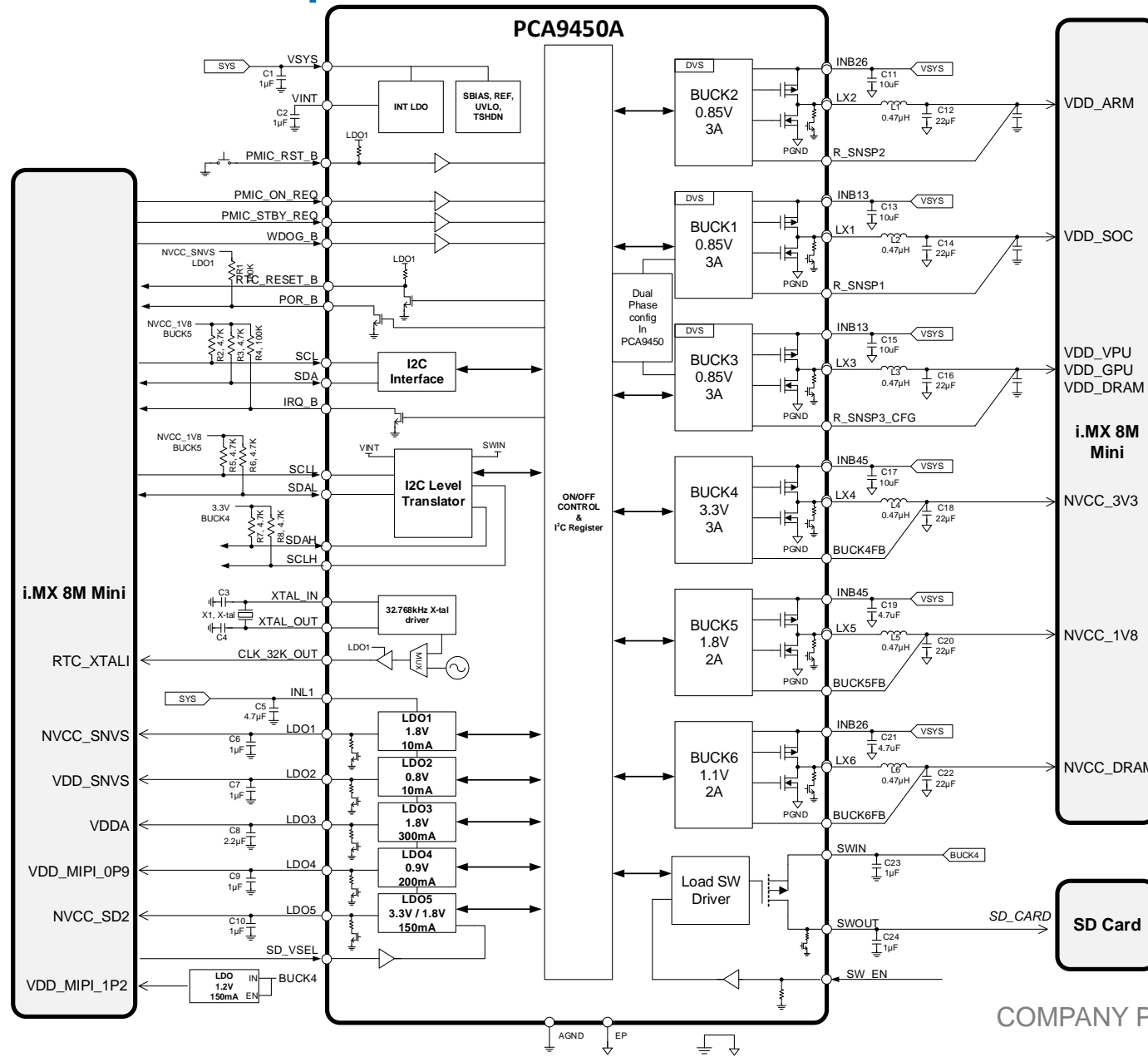
PMIC Part Number	Application Processor	Buck1	Buck3	LDO4	MTP Option (LDO4_seq_off)	Dual-Phase Buck Option
PCA9450A	i.MX 8M Mini	3A for SOC (Default ON)	3A for VPU/GPU/DRAM (Default ON)	0.9V for VDDA (Default ON)	"0"	-
PCA9450B	i.MX 8M Nano	3A for SOC/VPU/GPU/D RAM (Default ON)	- (OFF)	1.2V (Default OFF)	"1"	R_SNSP3 = VSYS (Single phase)
PCA9450C	i.MX 8M Plus	5A for SOC/VPU/GPU/DRAM (Dual phase) (Default ON)		1.2V (Default OFF)	"1"	R_SNSP3 = GND (Dual Phase)

PCA9450 Status

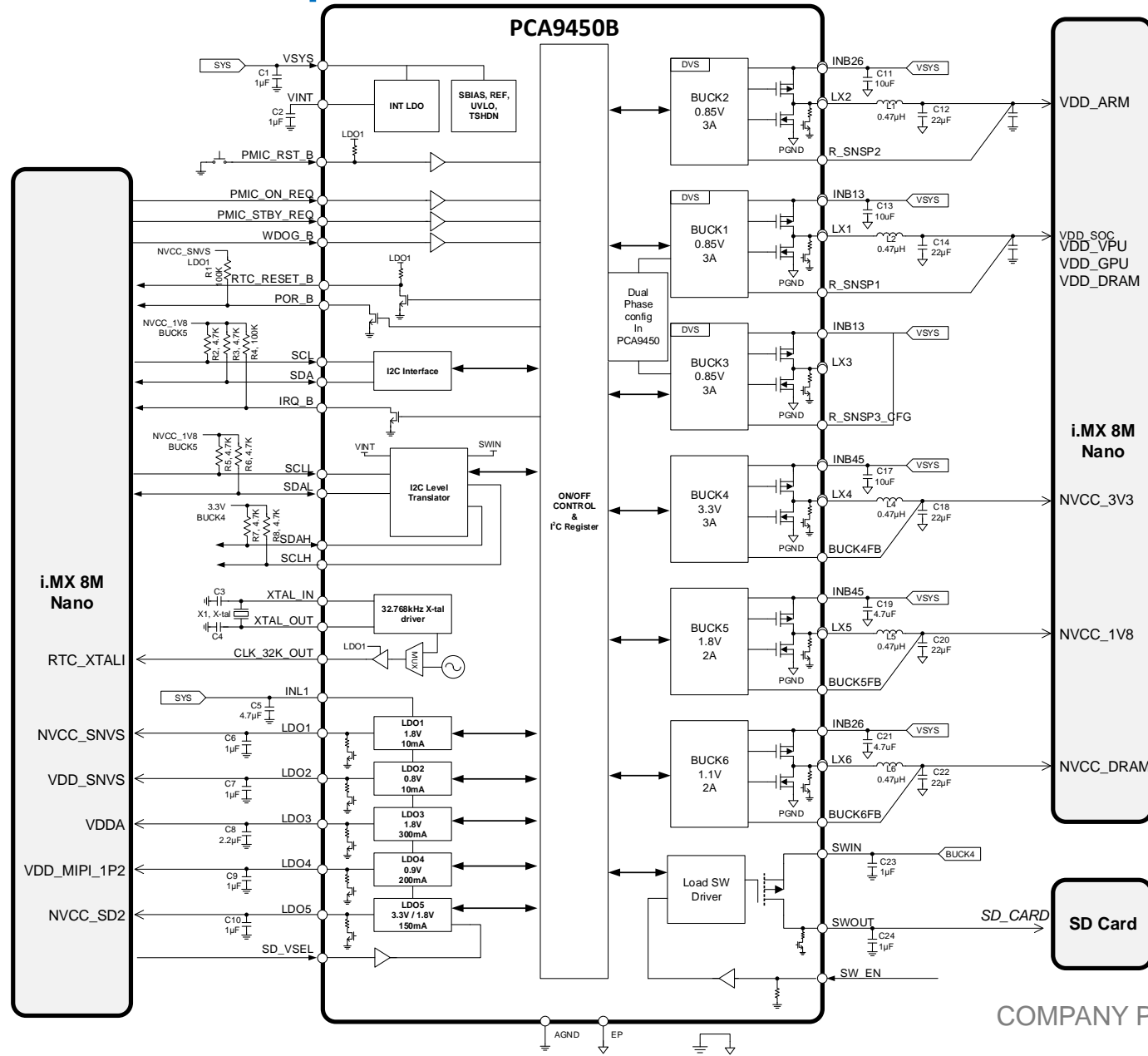
(as of Oct 2019)

Item	Note
PCA9450 Bench Evaluation	<ul style="list-style-type: none">Completed and reviewed with MICR team
PCA9450A + i.MX 8M Mini Evaluation	<ul style="list-style-type: none">PCA9450 + i.MX8M mini reference evaluationReference design Sch/layout, PMIC driver available nowSW modification from Rohm PMIC (BD718xx) to PCA9450 available
PCA9450B + i.MX 8M Nano Evaluation	<ul style="list-style-type: none">i.MX 8M Nano LPDDR4 + PCA9450BLinux SDK ready – Jan'2020; Android SDK – Jan'2020
PCA9450C + i.MX 8M Plus Evaluation	<ul style="list-style-type: none">i.MX 8M Plus + PCA9450C Board design ready by Q1'2020Linux SDK ready – Sep'2020; Android SDK – Oct'2020
PCA9450 Customer qualified samples	Sep' 2019
PCA9450 Release	Nov' 2019

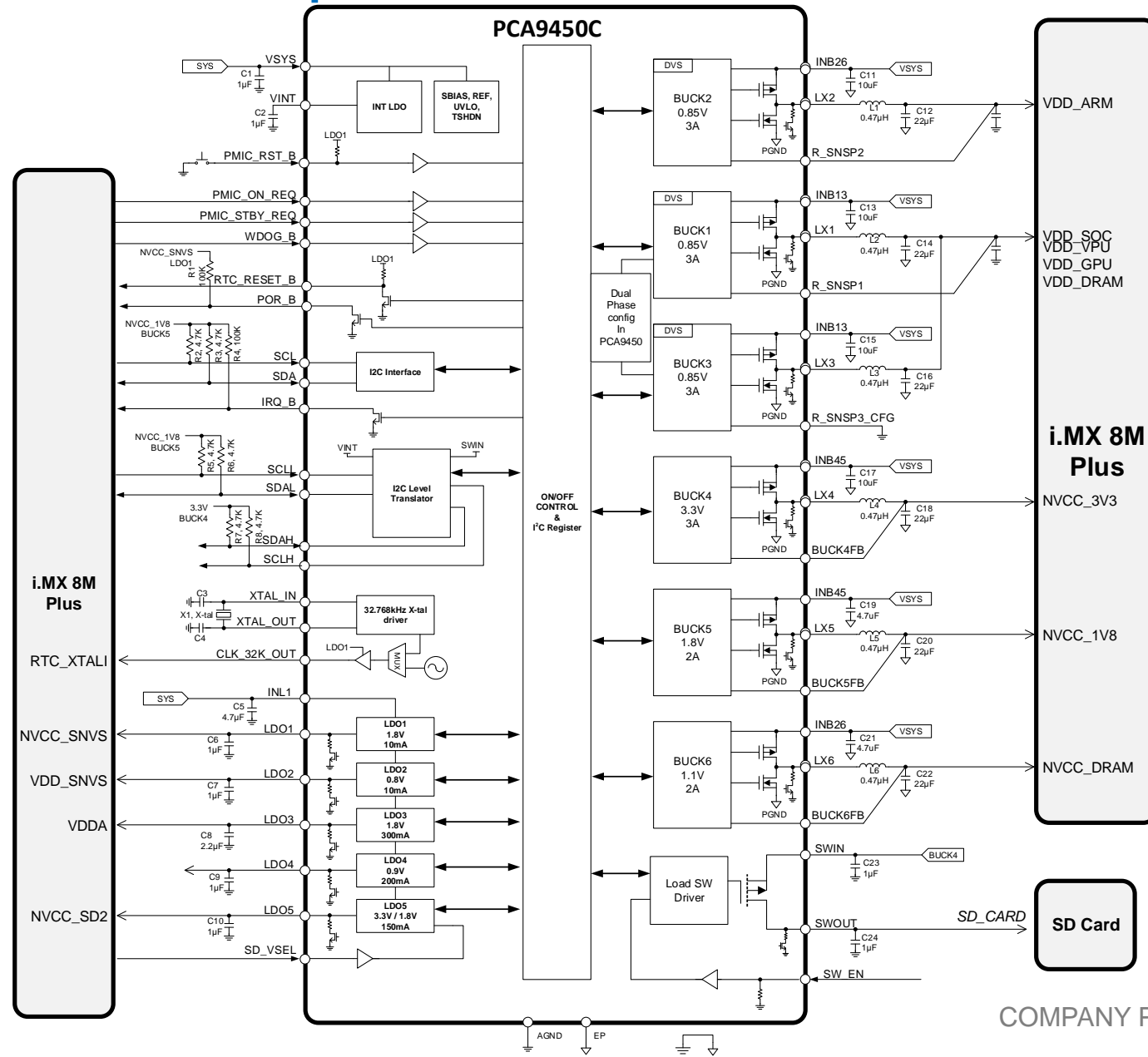
Configuration Example: PCA9450A + i.MX 8M Mini



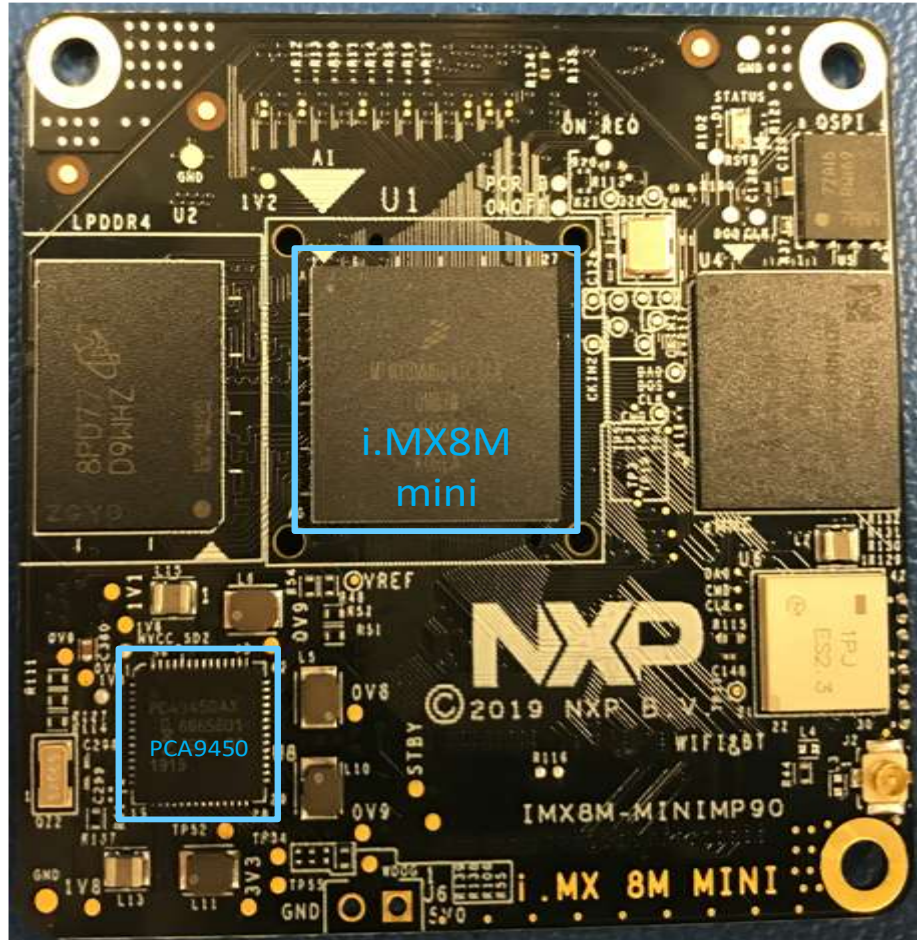
Configuration Example: PCA9450B + i.MX 8M Nano



Configuration Example: PCA9450C + i.MX 8M Plus

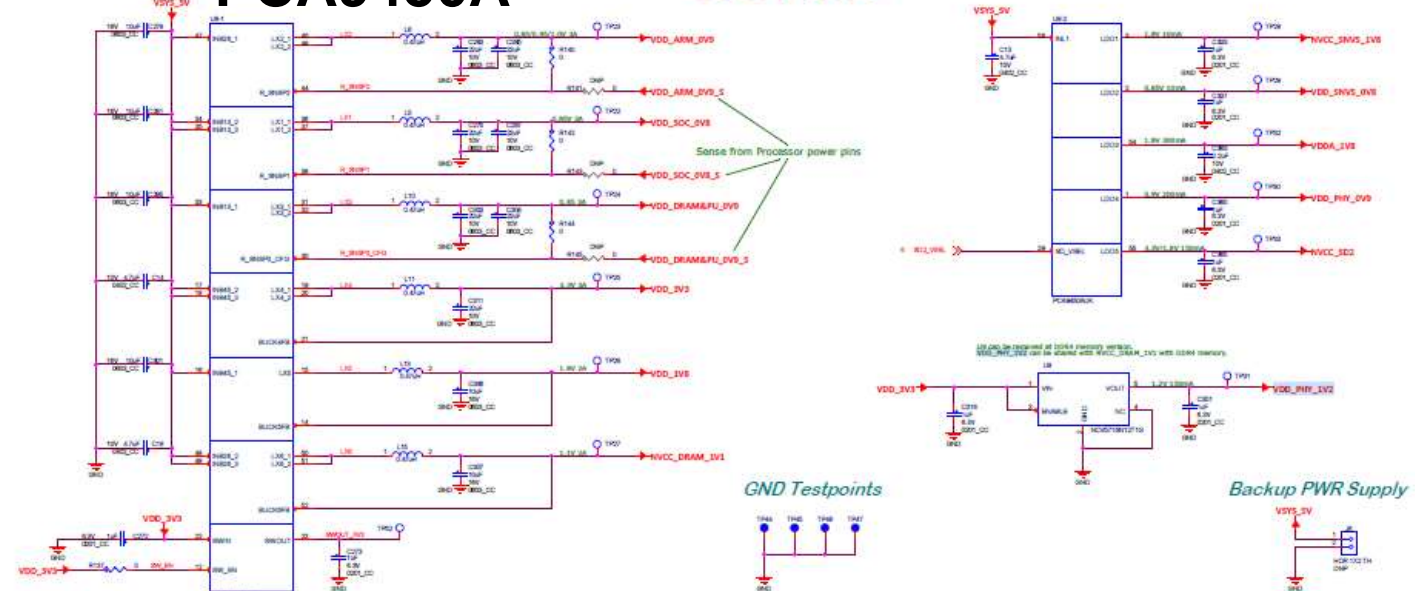


i.MX8M Mini + PCA9450 Reference Design



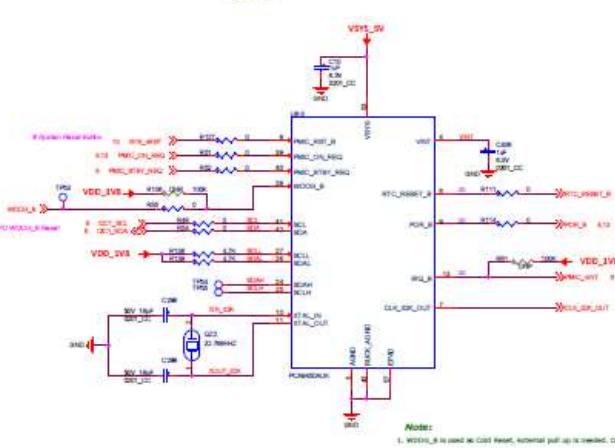
PCA9450A

SYS PMIC



i.MX8M Mini LPDDR4 EVK Power Sequence

SEQ	PWR/Signal	REG	MIN	TYP	MAX	Max Current[mA]
1	NVCC_SNV5_OV8	LDO1	1.65	1.8	1.95	10
1.1	VDD_SNV5_OV8	LDO2	0.81	0.8	0.89/0.945	10
1.1.1	RTC_RESET_B	RTC_RESET_B	--	--	--	--
1.1.2	CLK_32K_OUT	RTC_CLK	--	--	--	--
2	VDD_SOC_OV8	BUCK1	0.72	0.8	0.88	3000
2.1	VDD_DRAM&PU_OV9	BUCK3	0.72/0.81	0.8/0.9	0.88/0.945	3000
2.2	VDD_PHY_OV9	LDO4	0.81	0.9	0.945	200
3	VDD_ARM_OV9	BUCK2	0.72/0.81/0.9	0.8/0.9/1.0	0.88/0.945/1.025	3000
4	VDDA_OV8	LDO3	1.71	1.8	1.89	300
5	VDD_OV3	BUCK5	1.65	1.8	1.95	2000
6	NVCC_DRAM_OV1	BUCK6	1.045	1.1	3.6	2000
7	VDD_SV3/NVCC_OV3	BUCK4	3	3.3	3.6	3000
8	NVCC_OV2	LDO5	3.0/1.65	3.3/1.8	1.155	150
9	VDD_PHY_OV2	LDO NV571	1.14	1.2	1.26	150
10	POR_B	POR_B	--	--	--	--





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