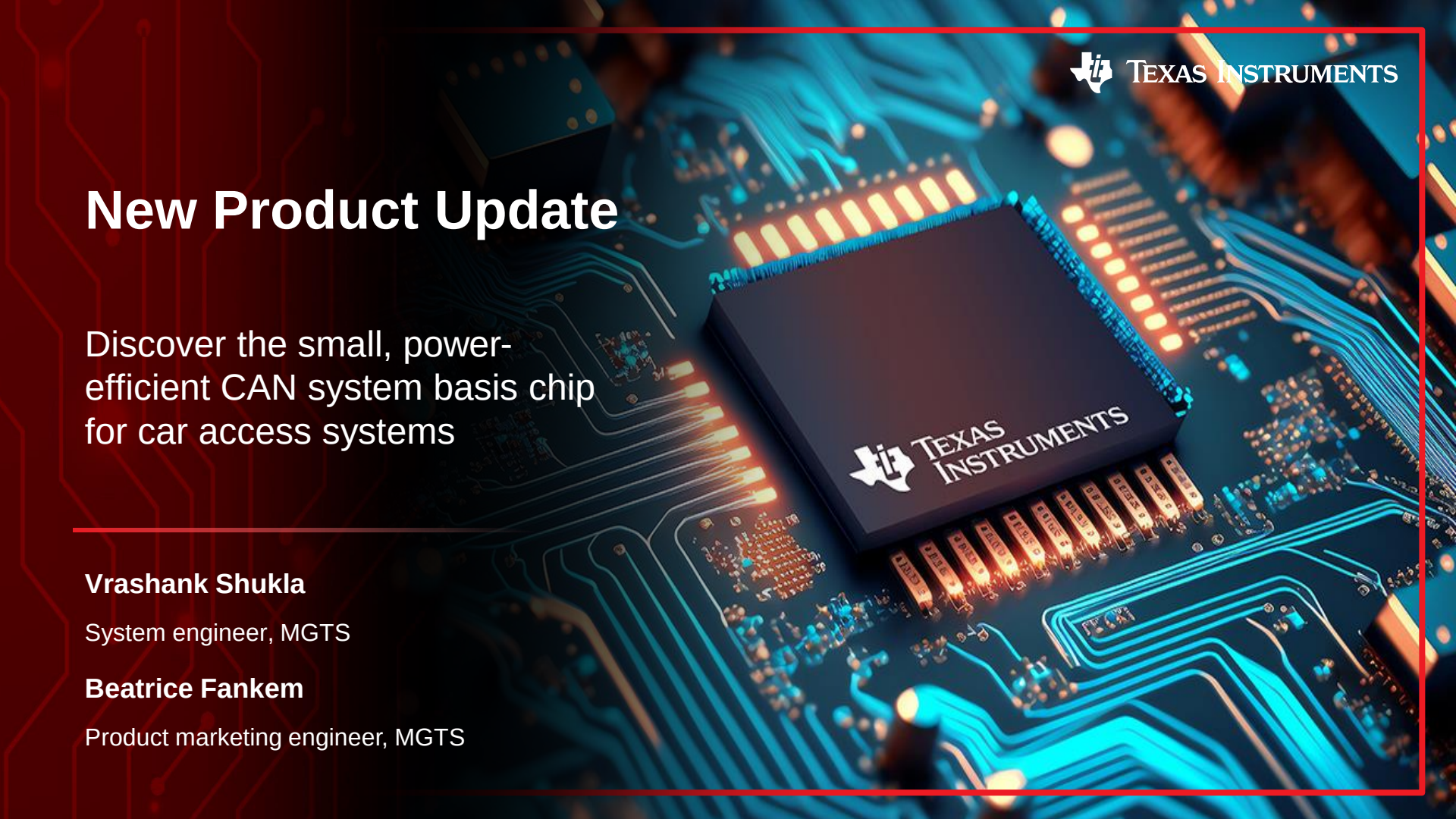
New Product Update

Discover the small, power-efficient CAN system basis chip for car access systems



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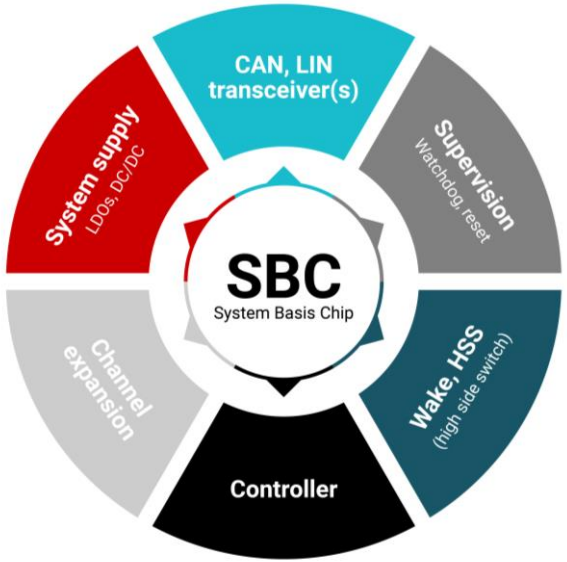
Agenda

- Introduction to system basis chips (SBC)
- Prelude to TCAN24xx Family
- Car access system overview & challenges
- Benefits of TCAN24xx in car access systems
- Summary and Q&A

TI's System Basis Chips (SBC)

Integrated CAN, LIN and voltage supply components in a single package

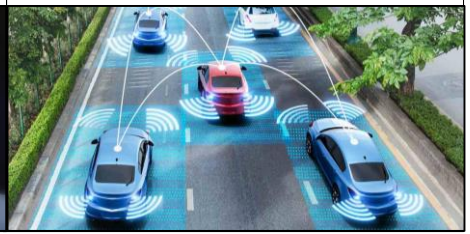


- Optimized system board space and cost for any applications that need bus communication, power supply, and supervision.
- Saves power with low quiescent current and efficient power conversion features
- Industry tested solutions with full OEM approvals for use

TRX-SBC | Top Sectors with TI Portfolio

Automotive Applications

Other

Body Electronics & Lighting	Hybrid, Electric, & Powertrain Systems	Advanced Driver Assistance Systems (ADAS)	Industrial Applications
EE Category Automotive lighting Car access & security Heating & Cooling Steering wheel column	**EE Category** Wired interface HEV/EV battery management system (BMS)	**EE Category** Automotive radar Automotive camera Sensor fusion	**TOP Sectors** Motor Drives Factory automation Appliances Industrial Transportation
Create scalable, flexible systems for enhanced performance and reliability	**Design robust powertrain and electric systems for any environment**	**Deliver advanced and adaptable safety systems for a smooth driving experience**	**Deliver advanced and adaptable safety systems for a smooth driving experience**
Combine transceiver, voltage regulators, and other features **on a single chip**	Balance the need **for high bus fault protection** and **optimized chip size**	**Functional Safety Manual** and FMEDA provided	Optimized system for combined **bus communication** and **power supply**
			

TCAN241x-Q1 / TCAN245x-Q1 (RHB-32/DCP-38)

Power-efficient CAN SBC

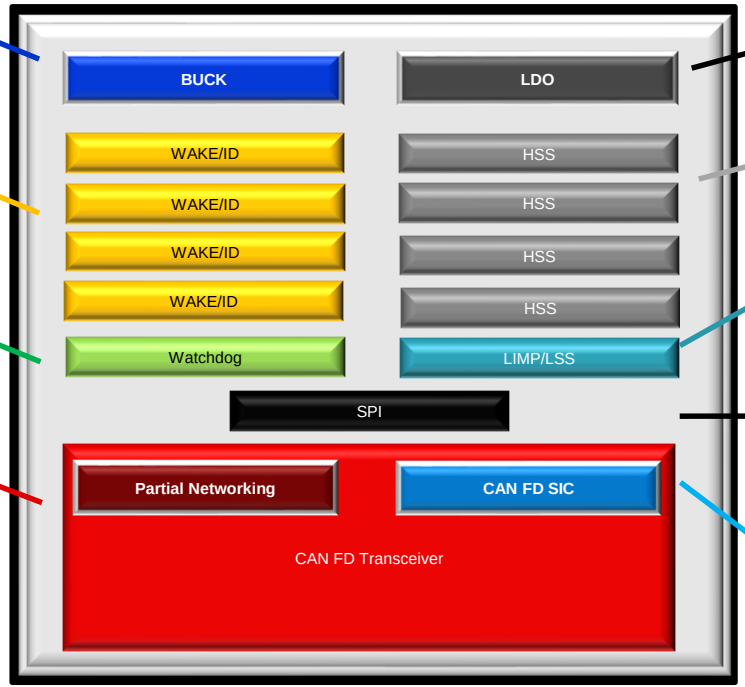
Samples: April 2024

3.3V or 5V Buck regulator w/ 1 A output capability

Wake Inputs Config. as ID pin for address encoding

Q&A, Timeout, Window watchdog support

TCAN2411-Q1 / TCAN2451-Q1 support Selective Wake



5V LDO w/ 200mA output capability

4x High side switches (7Ω RDSon)

LIMP output (with WD) Config. as low-side switch

SPI w/ CRC for device setup / control

TCAN2450-Q1 / TCAN2451-Q1 support CAN FD SIC

Choose 1

CAN FD	1
CAN PN	1
CAN FD SIC	1
SIC w/ PN	1

BUCK	1
LDO	1
HSS	4
Wake	4
Watchdog	1

Samples: April 2024

TCAN24xx-Q1: Power-efficient CAN SBC

CAN FD / CAN FD SIC SBCs w/ integrated Buck regulator and LDO

Common Features

Bus Communication

- ISO11898-2:2016 compliant → CAN FD up to 5Mbps
- ISO11898-2:2023 compliant → CAN FD SIC *(optional)*

System Supply

- Extended supply voltage operation 5.5 V – 28 V
- **3.3V** or **5V Buck regulator** (Vcc1) with **1A output** capability
- **5V LDO** (Vcc2) with 200 mA output capability

Control of power consumption

- Sleep mode with remote wake and **4x** local **wake inputs**
- Partial networking / selective wake *(Optional)*

Supervision

- **Watchdog** support (Time-out, Window and Q&A).
- LIMP output for watchdog and other critical failures

Additional features

- **Wake pins,** configurable **as ID pins** for address encoding
- **4 high-side switches-** support up to 100mA and R_{DSON} of 7Ω (typ)
- **Channel expansion-** Add more CAN or LIN channels.

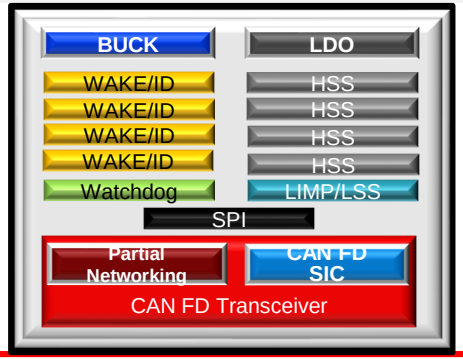
Protection features

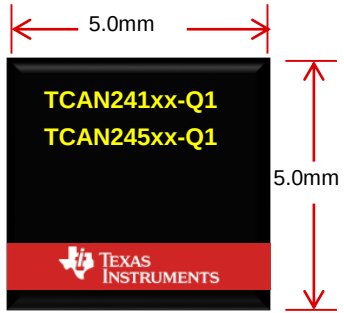
- Failsafe mode, bus fault tolerant up to ±58 V, high ESD, thermal shutdown protection

Small package (**32-Pin QFN, 5mm x5mm**) with wettable flanks

Key Benefits

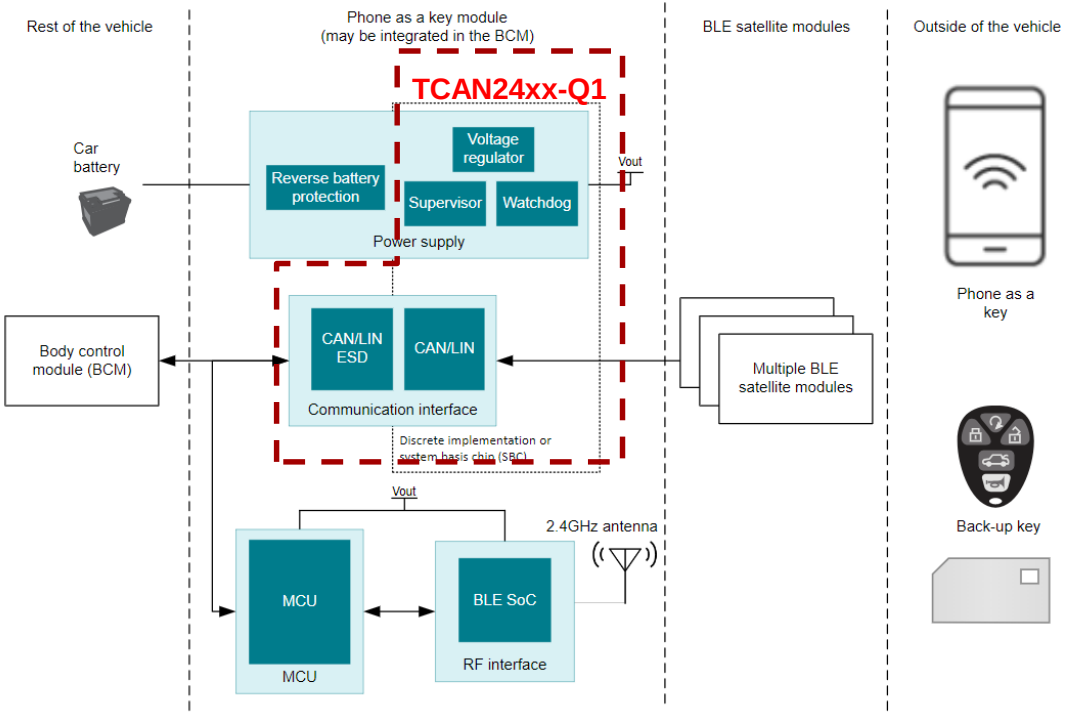
- Quickly upgrade to the latest standard of BUS communication
- Delivers a fixed output voltage, while supporting up to 1A with high efficiency
- Reduces the overall system power consumption
- WD ensures that the processor works correctly
- ID Pins Simplifies the ECU address encoding, in car access





Texas Instruments

Overview | Car Access System



Notes

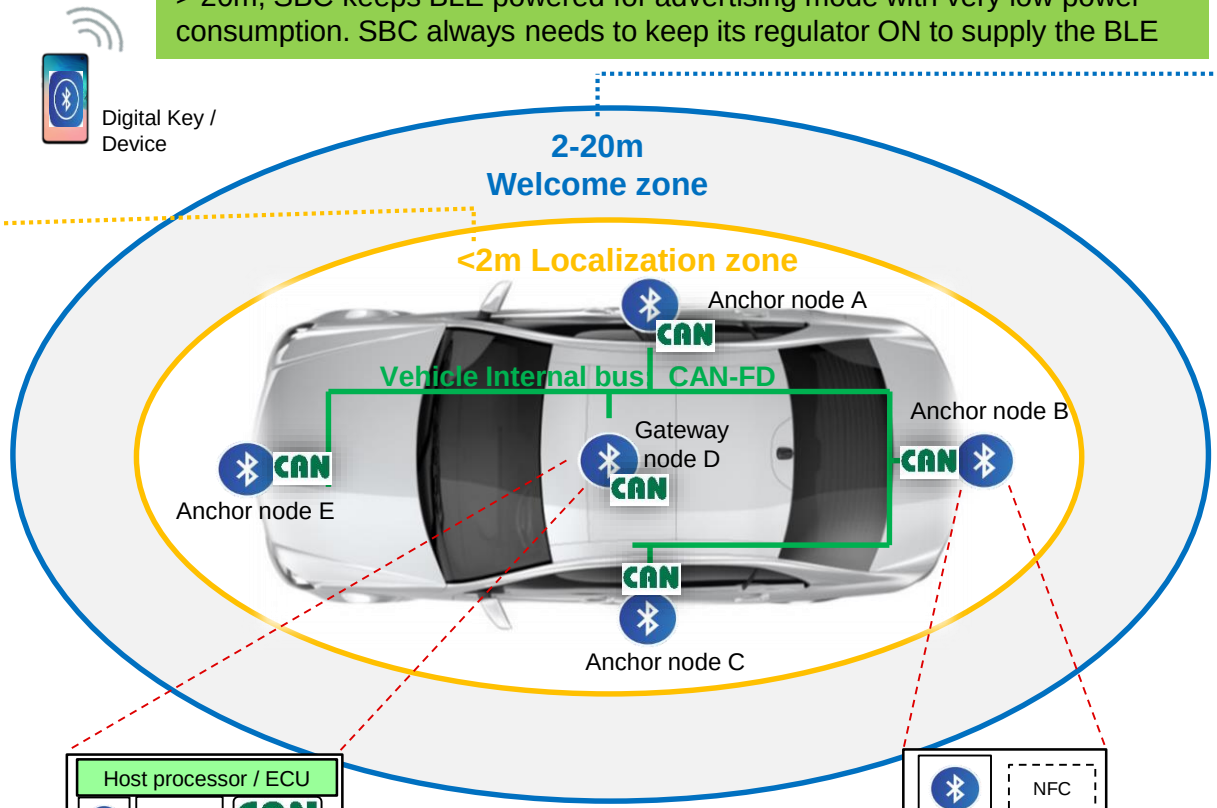
- TCAN24xx-Q1 SBC integrates bus communication, power and supervision into a single chip
- Simplifies the system implementation

Overview | Car Access Architecture

<2m Operations
- BLE connection with digital key
- Electronic Control Unit (**ECU**) in gateway node is active
- Localization using trilateration (e.g. with RSSI, UWB, Bluetooth channel sounding)

<2m Actions:
- Open door if valid digital key is detected is outside the car
- Turn on engine if valid digital key is detected inside the car

> 20m, SBC keeps BLE powered for advertising mode with very low power consumption. SBC always needs to keep its regulator ON to supply the BLE



2-20m Operations
- BLE connection with digital key
- ECU in gateway node is in sleep
- Pre-localization ranging

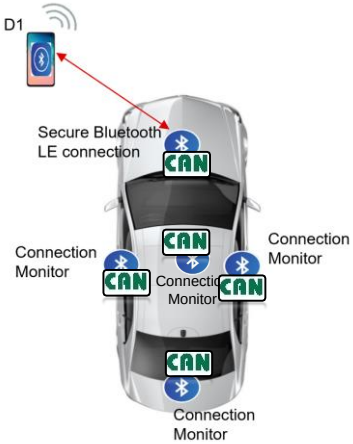
2-20m Actions:
- Turn on door lights and project OEM logo
- Determine when digital key enters <2m localization zone

Optional Component

Problem Statement | Need for “seamless” Bluetooth LE connection handover

1. Multiple Bluetooth LE nodes on vehicle are advertising (ADV)

2. When a device D1 comes in wireless range of vehicle, it connects to one of the vehicle BLE nodes.

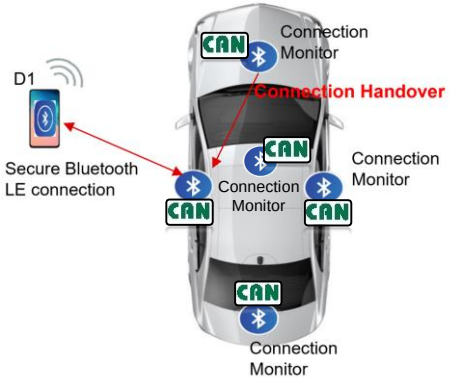


Device D1 may receive ADV from multiple BLE nodes from the same vehicle.

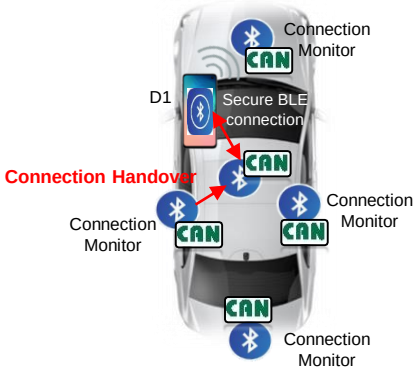
- The device connects to one BLE node.
- However, D1 does not select the optimum BLE vehicle node (e.g. based on RSSI, etc.) to establish connection.

3. After this initial connection, the device can move away from the BLE anchor node its in connection with.

3a. Move around the vehicle (e.g. walking to the trunk)



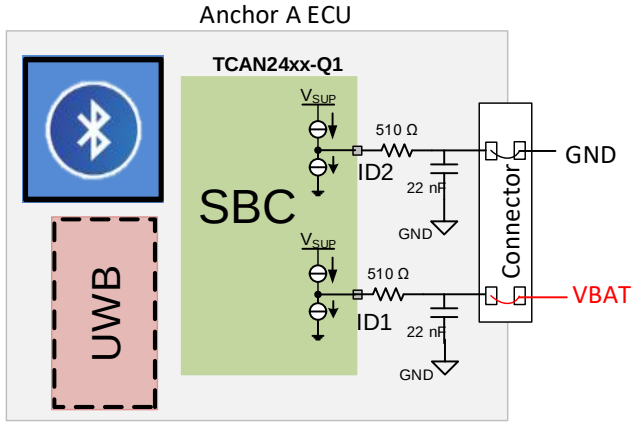
3b. Move from outside the vehicle to inside the vehicle



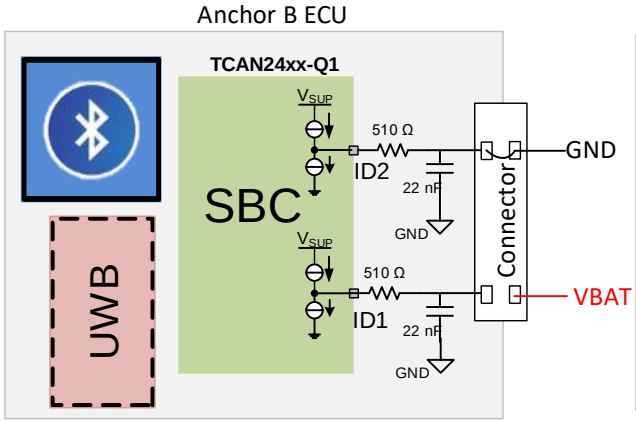
Device D1 can have bad link budget with current BLE node, leading to a disconnection of the BLE link.

- Then D1 scans ADV from vehicle BLE nodes and reconnects; this time with another BLE node.
- This disconnect/reconnect is a “hard” connection handover. It impacts the overall user-experience.
- Thus, the need for a “seamless” or soft BLE connection handover.
- **SBC’s CAN module can be turned ON** to perform the connection handover to the next node to provide a seamless or soft handover
- **SBC’s ID-pin encoded address** info can be used to perform triangulation

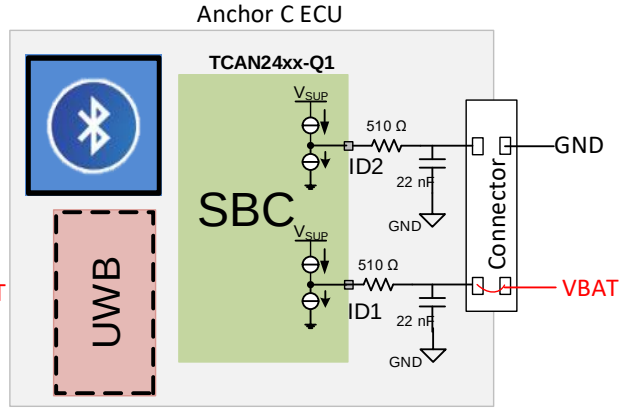
Simple Solution for Address Encoding



ID1 connected to VBAT; ID2 connected to GND



ID1 floating; ID2 connected to GND



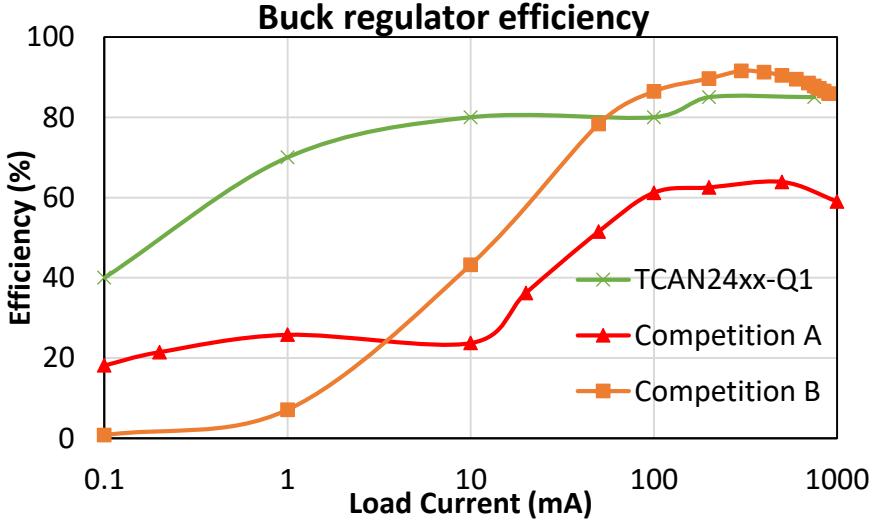
ID1 connected to VBAT; ID2 floating

0: GND 1:VBAT F: Floating	ID2	ID1
Anchor A	0	1
Anchor B	0	F
Anchor C	F	1

- **TCAN24xx-Q1 provides an easy, simple method to achieve address encoding based on the pin connection**
  - Each pin can be connected to either GND, VBAT or floating to encode location
  - Even With 2 ID pins, up to 9 addresses can be encoded
- Together with CAN, address encoding helps with connection handover, triangulation etc

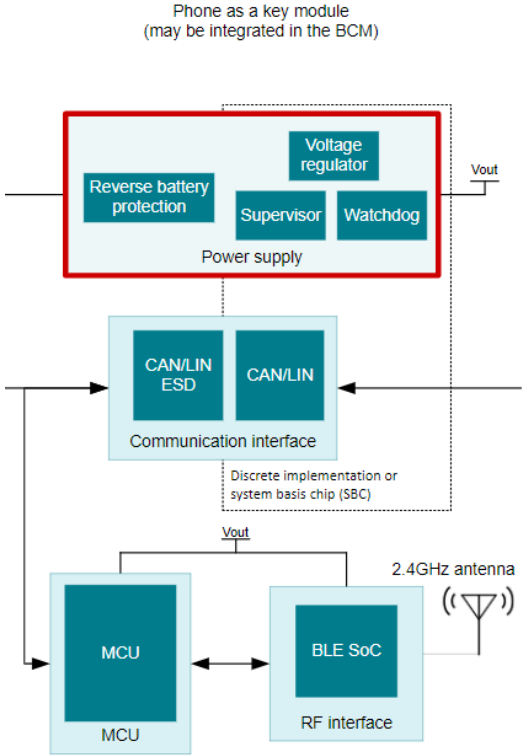
Reducing Battery Power Consumption

- BLE anchors are always in advertising mode until a connection is established
  - CAN SBC needs to keep BLE powered-on all the time
  - A low quiescent-current Sleep mode, with VCC1 powered, is needed
  - In advertising mode, load on VCC1 is on average < 100 µA
    - Regulator efficiency needs to be high at small load currents



Buck regulators with PFM mode and low quiescent current help keep the total battery current draw from the ECU below 100µA

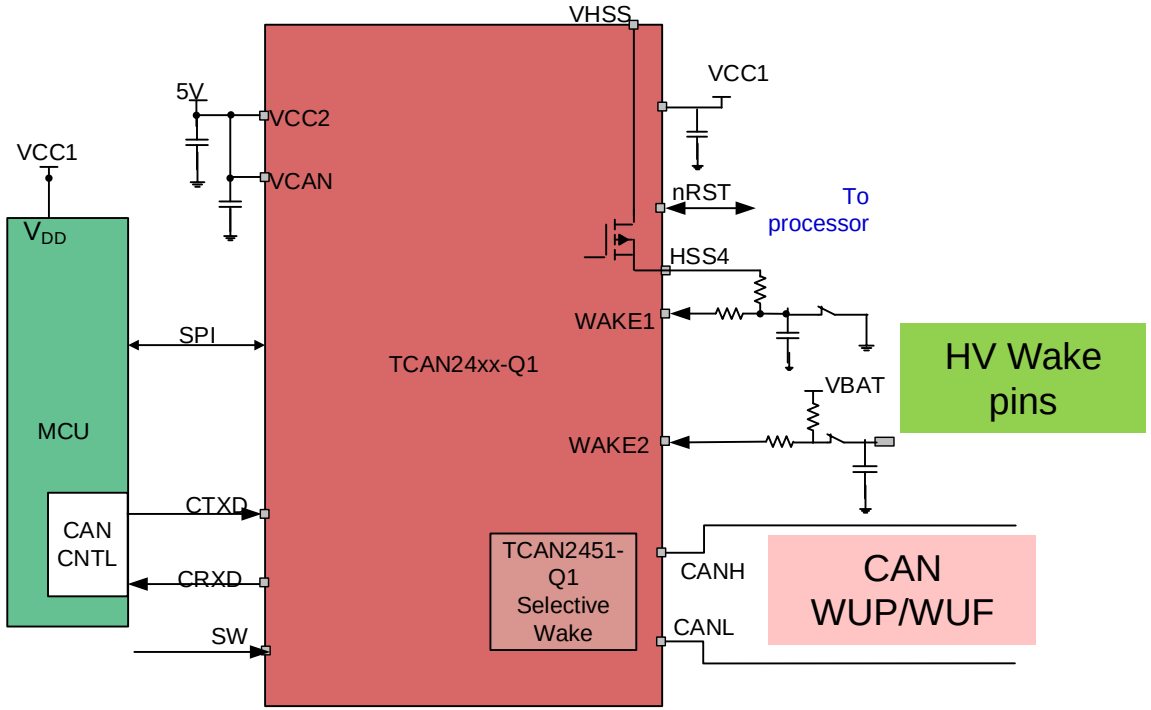
Supervision



TCAN24xx-Q1 SBC provides power supply supervision and watchdog function

- VCC1 Power Supply Supervision
  - Undervoltage (pre-warning as well as reset)
  - Overvoltage
  - Short-circuit
- VCC2 (for CAN supply)
  - Undervoltage
  - Overvoltage
- VSUP
  - Undervoltage
- Watchdog
  - Low power timeout watchdog
  - Window watchdog
  - Q&A

Wake Capabilities



SBC can be woken up from low-power mode by any of the following

- CAN wake-up (WUP)
  - Selective wake-up via frame (WUF) is available with TCAN24x1-Q1 variants
- Wake up via HV pins Wake1-4
  - Wake pin always connected to VBAT/GND (static wake)
  - Cyclic sensing wake via HSS4
- Low voltage wake pin (SW)
- Cyclic wake (internal timer based wake-up)
- SPI-based if MCU is powered

TCAN241x-Q1 / TCAN245x-Q1

Power-efficient CAN SBC for Car Access System

Features

Key features for Car access system

- Integrated 1A Buck regulator ➔ Reduce system batter power consumption.
- ID Pins ➔ enables address encoding for fast handover.
- Supervision features ➔ Helps with functional safety implementation

Discovery questions

A few things to consider

- Do you need power supply in addition to the bus communication?
- How will you manage power?
- How are you implementing address encoding ?
- Do you need to drive additional loads with High side switches ?

Getting started

You can start evaluating this device leveraging the following:

Content type	Content title	Link to content or more details
Product folder	An overview of the devices features and access to the datasheet.	**Coming Soon – April 2024 !** https://www.ti.com/product/TCAN2451-Q1 https://www.ti.com/product/TCAN2450-Q1
E2E Forum	TI's forum to submit any inquiry or technical questions on TCAN24xx-Q1 devices	https://e2e.ti.com/support/interface-group/interface/f/interface-forum
Technical blog	An overview of system basis chips, and their integrated power control capabilities.	https://www.ti.com/lit/pdf/sszt469
System basis chips Portal	A web overview of all SBCs	System basis chips (SBCs) | TI.com

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