Next generation commander/responder CAN architecture – CAN FD light

Texas Instruments

Wes Ray – March 14, 2024

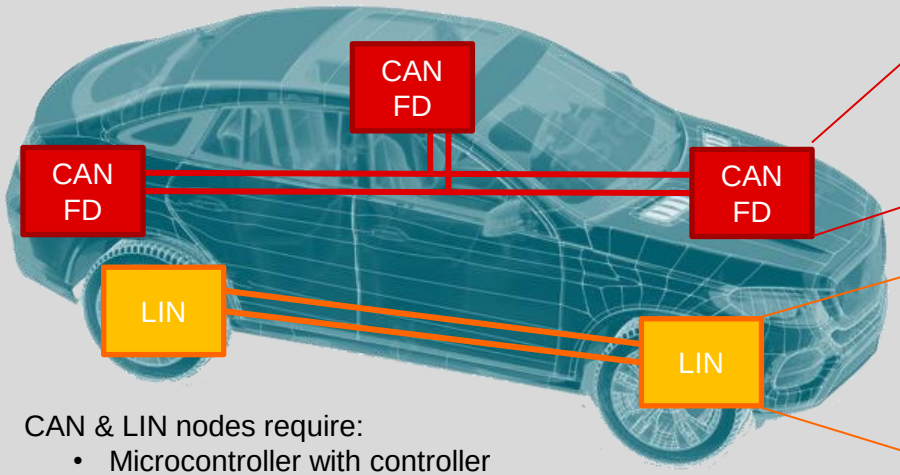
Agenda

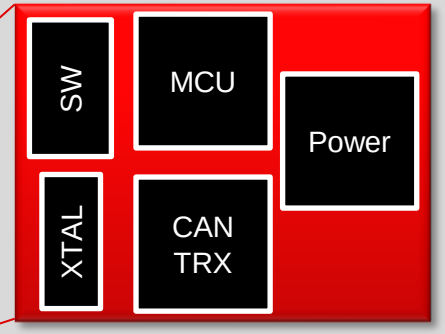
- What is CAN FD Light and Why do we need it?
- Existing CAN architecture example
- CAN FD Light architecture example
- CAN FD Light data flow example
- Application use cases
- Summary
- Demo

What is CAN FD Light and why do we need it?

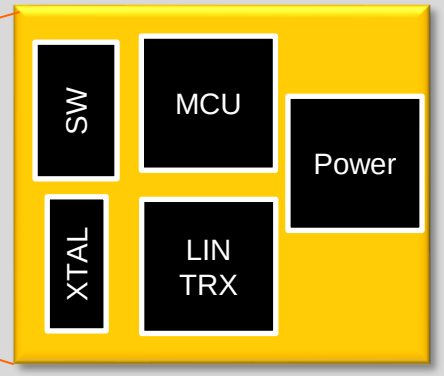
- **CAN FD Light** is a **LIGHTWEIGHT** CAN standard known as ISO11898-1:2023 Created with automotive lighting applications in mind
  - Expanding into many additional applications/markets such as BMS, white goods, and building automation
- **Supports a Commander – Responder communication bus** (similar to LIN)
  - All nodes on bus share the same differential signals
  - One commander node controlling bus – multiple responders possible
  - EMC Robustness of the existing CAN FD Physical Layer (ISO11898-2)
- **Commander ECU require:**
  - MCU and software stack
  - Commander ECU can utilize Bridge CAN FD Light controller to achieve up to 5Mbps operation
    - Existing MCU integrated CAN FD controller can also be used if 1Mbps data rates are acceptable
- **Responder ECUs do not require** MCU and software stack
  - Simplifies ECU cost / space / implementation

Existing CAN FD ECU nodes





CAN ECU

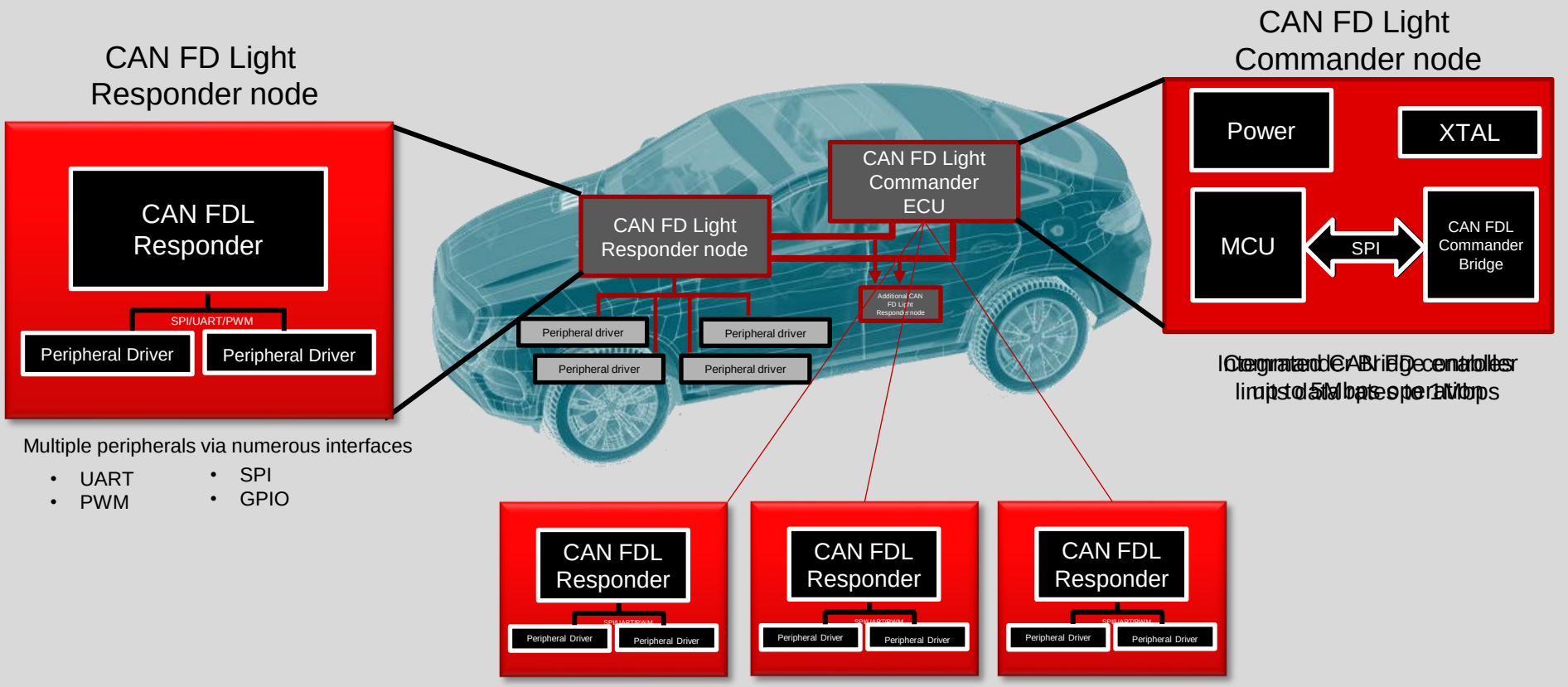


LIN ECU

CAN & LIN nodes require:

- Microcontroller with controller
- Transceiver
- Clock
- Power
- AutoSAR software stack

CAN FD Light nodes

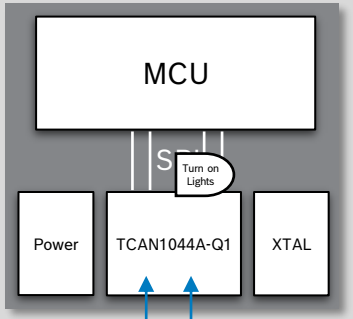


Data flow in CAN FD vs CAN FD Light

Action: Turn on lights

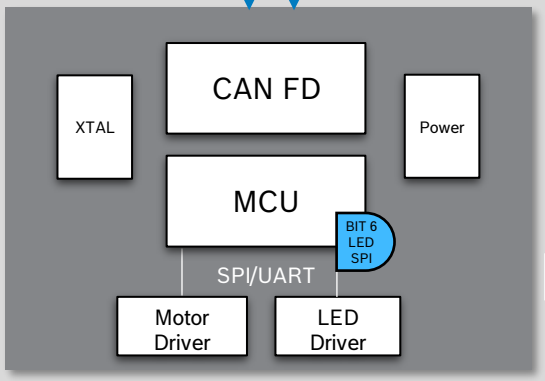
Switch causes MCU to send data to turn on lights

A CAN FD frame is sent containing a high level command

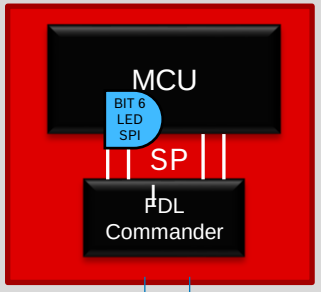


CAN FD

The node ECU interprets the command and performs the low-level actions



Action: Turn on lights

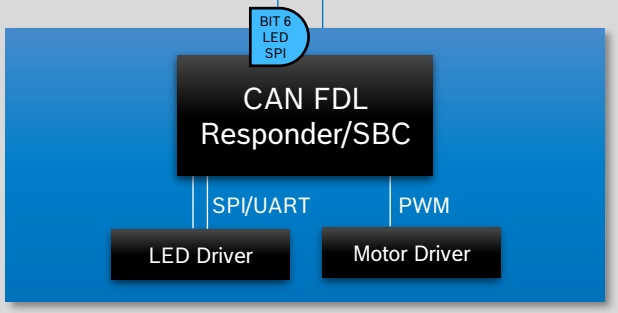


Switch causes MCU to send data to turn on lights

A CAN FD Light frame is sent containing the data to turn on the light

CAN FD Light

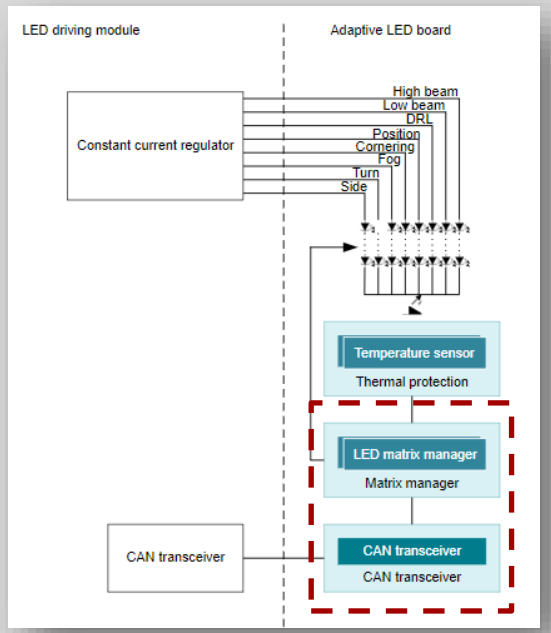
Responder knows that this data is for the LED driver via SPI



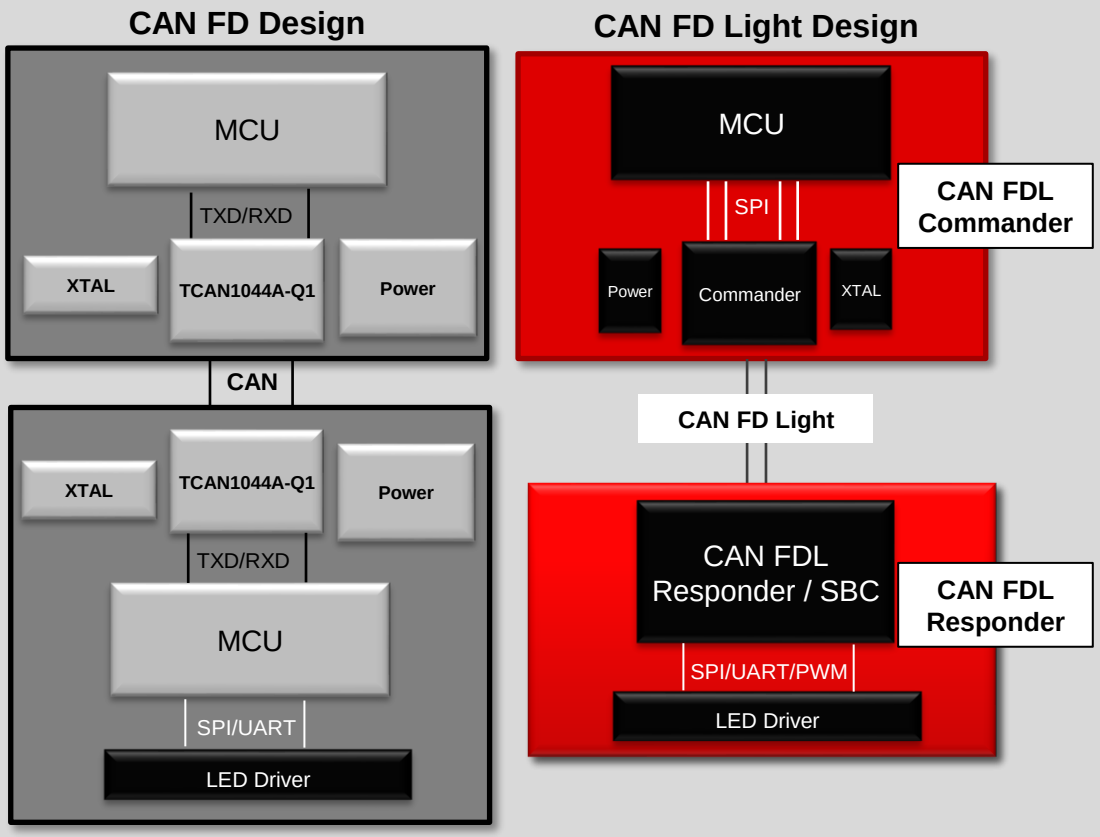
...and the lights turn on

2024-02-19

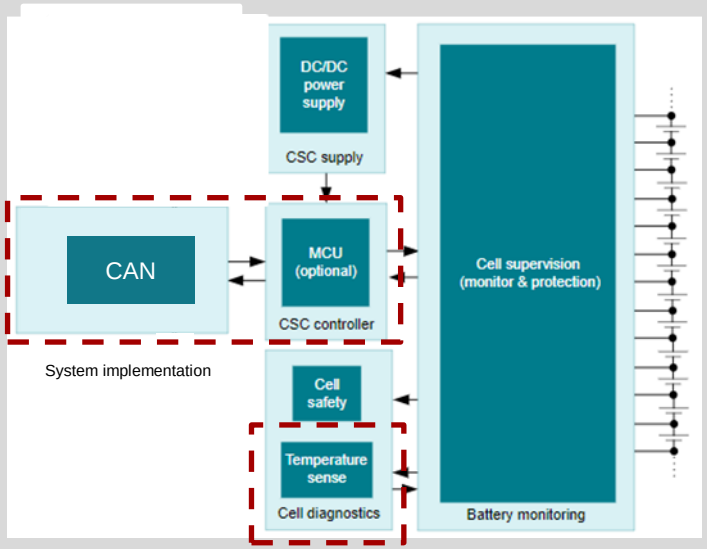
Application: Headlight (CAN FD vs CAN FD Light)



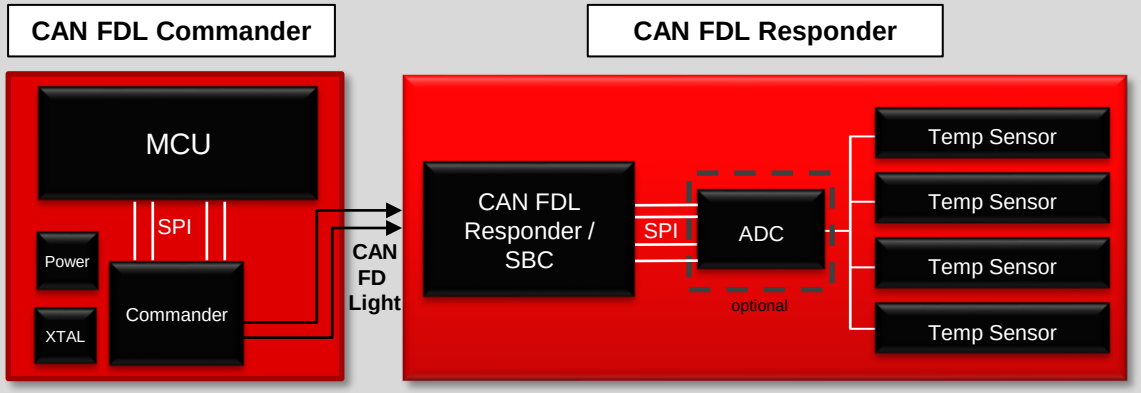
Headlight:
Adaptive LED board block diagram



Application: BMS Temperature Sensing (CAN FD Light)

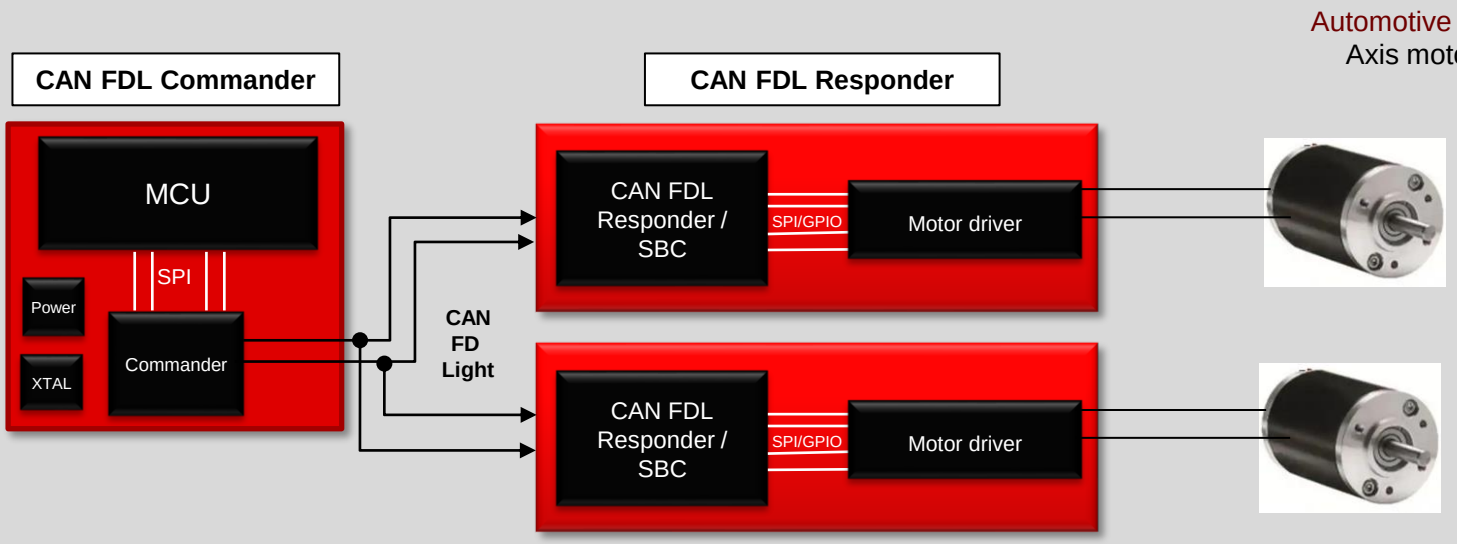


Battery Management System (BMS):
Temperature sensing / balancing



- Multiple responder nodes and/or temp sensors to meet design requirements
- Optional ADC for multiplexing, polling, and measurement
- H/W complexity reduced

Application: Motor Drive (CAN FD Light)

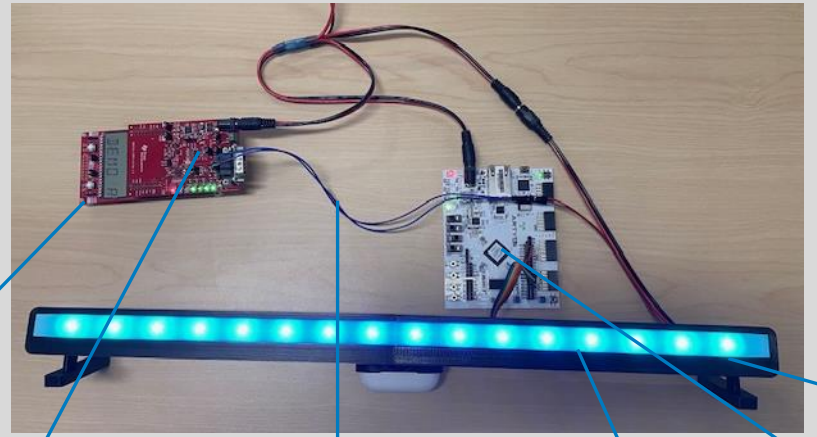


Automotive body motors
Axis motor module

CAN FD Light Summary

- **CAN FD Light** is a **LIGHTWEIGHT** CAN standard known as ISO11898-1:2023
  - Initially created with automotive lighting applications in mind
  - Expanding into many additional applications/markets such as BMS, sensors and actuators, and commander/responder busses such as LIN
- **Supports a Commander – Responder communication bus** (similar to LIN)
  - All nodes on bus share the same differential signals
  - One commander node controlling bus – multiple responders possible
- **Cost-effective solution:**
  - **Responder ECUs do not require** MCU and software stack
  - **Complimentary** to **Ethernet** 10BT1S
  - **Simplifies** ECU cost / space / implementation
- **Both** controller and responder IC solutions in development today by multiple vendors

Demo – LED Driver controller over CAN FD Light



CAN FD LIGHT

MSP430
uC

SPI

TCAN4550-Q1
CAN FD Bridge

CANH/CANL

TCAN11625-Q1
SBC

CAN
TXD
RXD

CAN FD Light Responder
FPGA

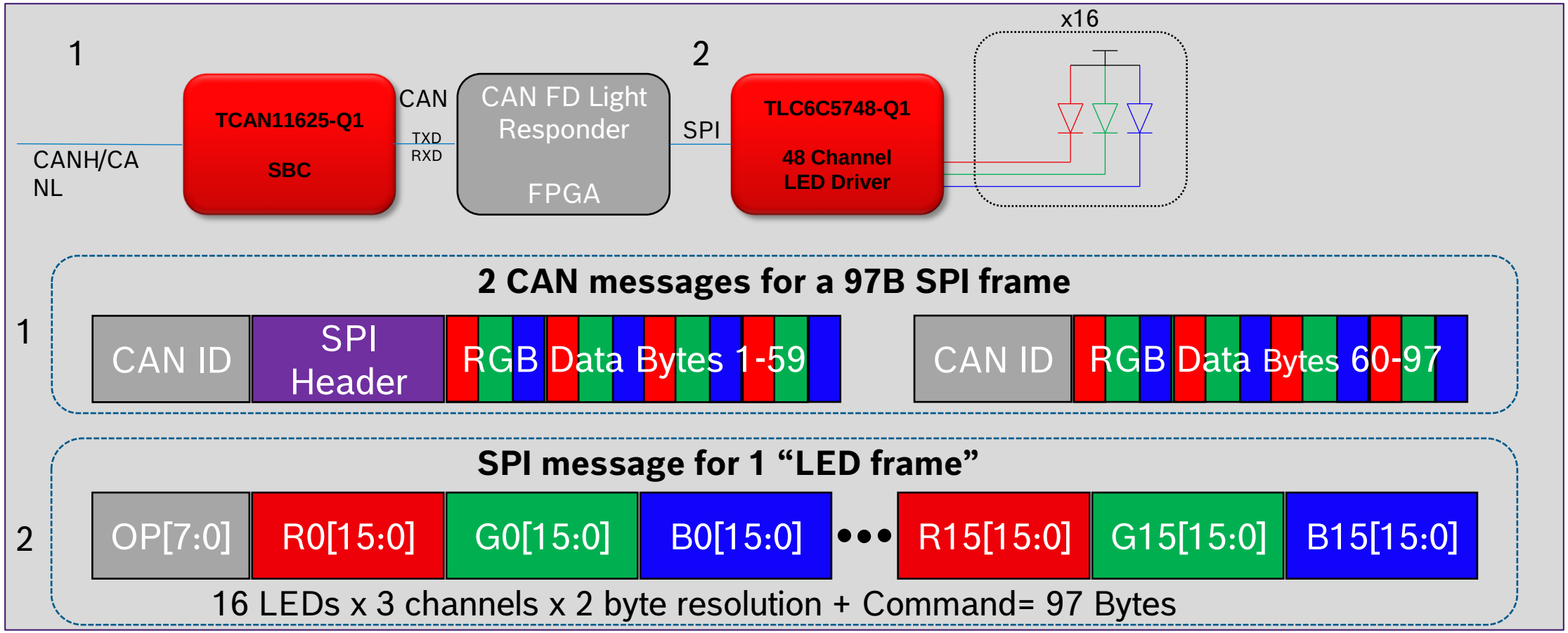
SPI

TLC6C5748-Q1
48 Channel LED Driver

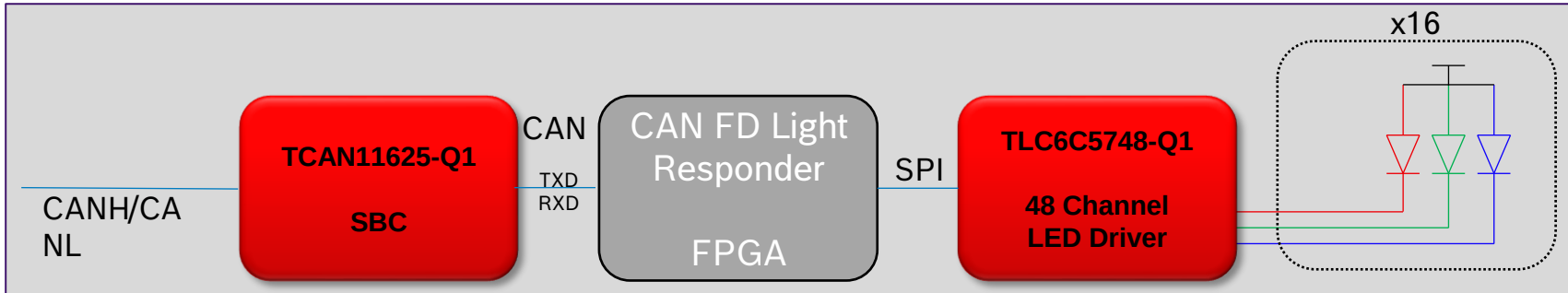
CAN FD Light Commander
"Lighting Controller"

CAN FD Light Responder (Bridging CAN to SPI)
"Lamp"

Demo – Frame control



Demo – Frame control



Specification	Value
Time to Send 64B (1 Mbps)	~710 us
CAN Frames per LED Frame	2
Total CAN transfer per LED Frame	~1.4 ms
LED Frames/sec	100 Frames/sec
Total CAN Active time/sec	142 ms
Bus Load (1 Mbps)	14.2 %

Specification	Value
# RGB LED	16
Diodes per LED (R/G/B)	3
Total LED to drive	48
Color Resolution	16-bit
Total LED Frame Size	768-bit (96 Bytes)