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Experience Digital Transformation

体验数字转型

Overview of Existing RGB system

现有的RGB控制系统

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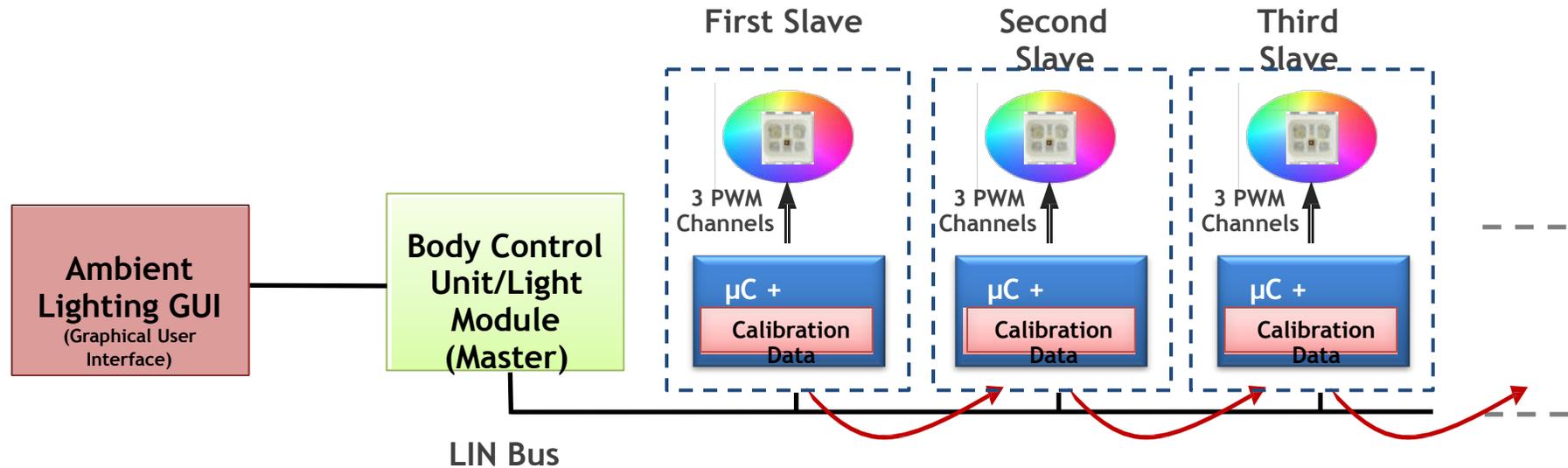
- ➤ **Large number of components and wiring requirements → Too costly for large scale system**

  大量的电子元器件和复杂的电路设计带来极为昂贵的系统

- ➤ **Calibration of each LED and drivers can only be done on module level**

  只能在成为模组后才能对每一颗LED和驱动器进行校准

- ➤ **Difficult to maintain color and brightness consistency over temperature**

  由于温度的变化会造成对LED的亮度和颜色的控制变得困难

- ➤ **One way communication to LED and sub controllers with latencies**

  单向通讯模式造成的延误

  - ➤ **high speed communication impacting EMI robustness**

    高速通讯所造成的EMI问题

New RGB Trend - Dynamic Ambient Lighting

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RGB趋势 -动态式的氛围灯设计

➢ **Growing demand on dynamic lighting effects in the car** 动态式的氛围灯需求逐渐增加

➢ **Existing solutions are limited in terms of number of LEDs and lighting effects. High implementation effort and cost.** LED的数量和效果被局限于现有的控制方式和昂贵的成本

➢ **Automotive requirements for robust and low emitting bus system** 符合汽车级的系统对高鲁棒性和低辐射的要求
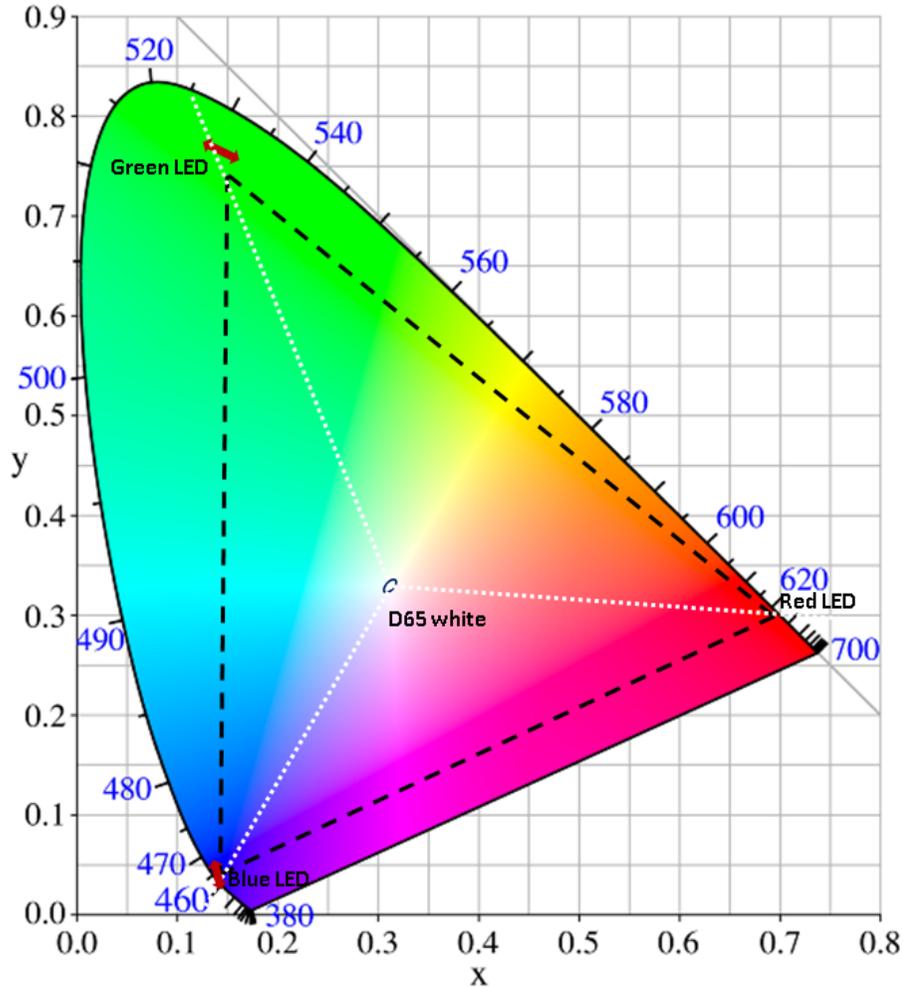

Source: Hella

Source: Mercedes

Ambient lighting

Source: Valeo

Introduction

Smart **E**mbedded **D**igital **D**river

SmartRGB – Concept and Color Control

智能RGB的概念和对颜色的控制

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➢**LED, LED Driver and advanced communication link integrated into single package**

　LED，LED驱动器及先进的通讯系统集成在单一的封装设计

➢**Dominant Wavelength and Brightness calibration during LED production**

　对每一颗LED的亮度和波长在生产时进行校准

　➢ **Pre-calibrated to 3 SDCM steps D65 white point at 1400mcd**

　　事先校准在1400mcd的亮度和3 SDCM D65 的白光

　➢ **Fully digital control RGB color and brightness by software command**

　　使用软件编程来达成颜色和亮度的控制

　➢ **Example 1: D65 White color Cx,Cy (0.313, 0.329) @ 1400mcd with command SetRGB(255,255,255)**

　➢ **Example 2: Sapphire Blue color Cx,Cy (0.150, 0.270) @ 700mcd with command SetRGB(0,168,255)**

　对温度的提及的自动补偿

➢**Auto Temperature Compensation**

　自我诊断功能

➢**Self-diagnostic function**

　快速的更新率

➢**Full-duplex 2Mbit/s differential control bus**

　更快的读取权限

　➢ **Fast update rate of 52.5µs per LED (5.25ms for 100 LEDs)**

　总线初始化，自动对新加入的LED进行检测

　➢ **Read access to all LEDs (max 4079) in less than 0.15 sec**

SmartRGB - LED Calibration
智能RGB LED的校准

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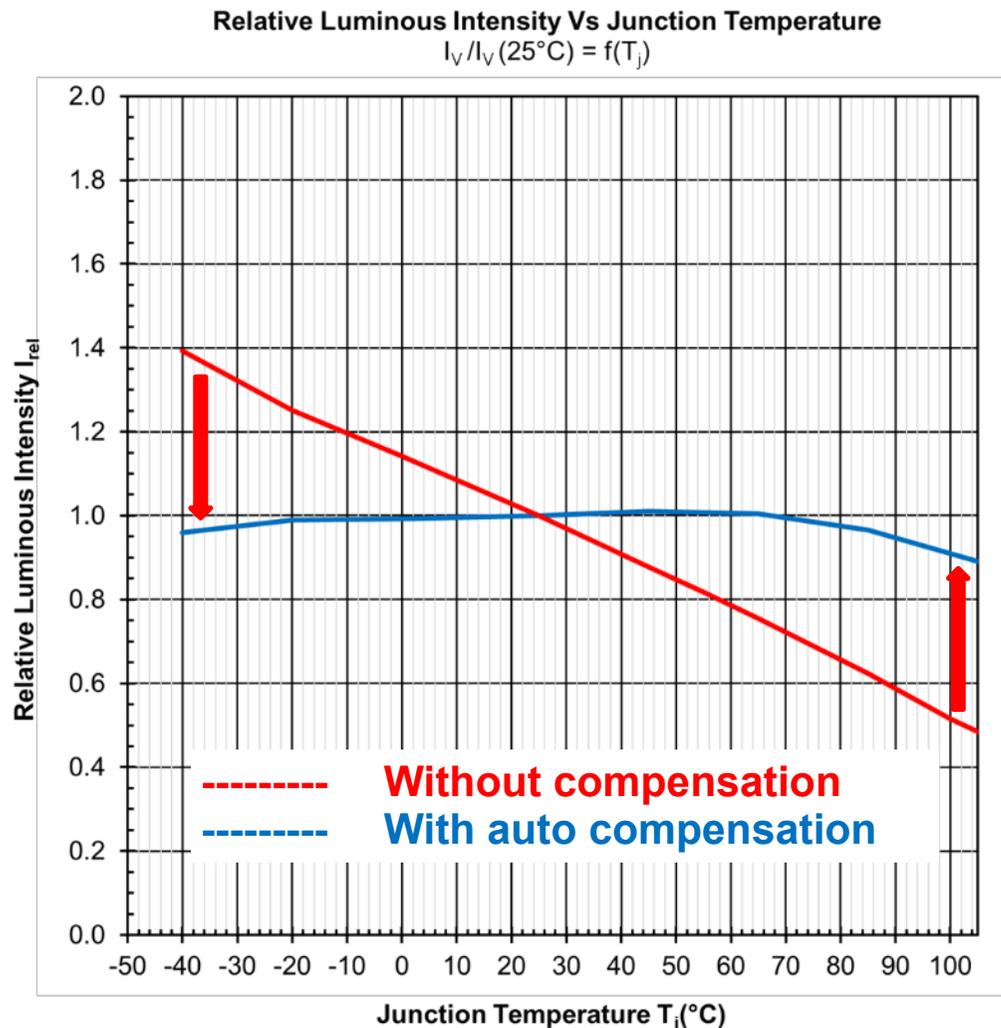*Innovating Illumination*

1 **Dominant wavelength calibration** 对LED波长的校准

2 **Calibrated to customer specific white color and brightness** 校准至客制化白光的颜色和亮度需求

3 **All calibration data store in the non-volatile memory within the driver** 所有的校准资料都储存在驱动器的内存

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SmartRGB – Brightness Compensation

智能RGB亮度补偿

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Relative Luminous Intensity Vs Junction Temperature

$I_V / I_V (25°C) = f(T_j)$

- ➤ **Built-in temperature sensor**内置温度传感器

- ➤ **AlInGaP LED luminous intensity are dependent on the junction temperature of the LED** 红光的亮度取决于LED结温

- ➤ **~40% brightness increase at cold temperature -40C°** 在-40°C增加近40%

- ➤ **~50% brightness decrease at hot temperature 105C°** 在105°C衰减近50%

- ➤ **Extreme brightness shift affected color mixed accuracy across temperature range** 亮度的大范围变化会导致颜色漂移更明显

- ➤ **SmartRGB able to auto compensate the brightness variation and maintain the color mixed consistency** 智能RGB的

SmartRGB – Dynamic Ambient Lighting System

智能RGB-动态式氛围灯系统
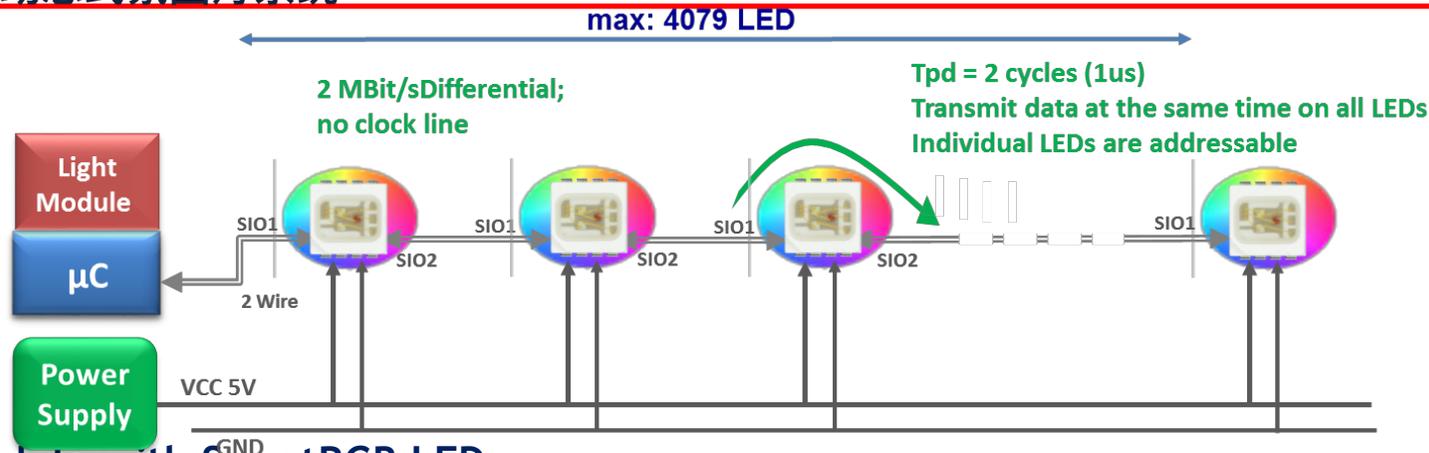
➢ **LED Module with SmartRGB LED**

智能RGB LED模组

➢ **Simplified circuitry**

电路设计简单化

➢ **4 wiring system**

4线系统

➢ **Significant system cost reduction**

明显的降低系统成本

➢ **Bi-directional differential communication between µC and SmartRGB LED with lowest latencies**

双向差分通讯系统

➢ **EMI robust design based on 2 Mbit/s communication - no dedicated clock**

降低EMI的设计

➢ **LED temperature and damage can be diagnosed individually by µC**

控制器能够诊断出LED的温度和损坏

➢ **Efficient use of bandwidth due to individual addressing of each SmartRGB LED**

提高使用效率

➢ **High density system can support up to 4079 LED**

高密度设计能够支持高达4079颗LED

➢ **Cost efficient production logistics and integration (no binning, no calibration)**

不需要做任何分bin和校准从而提高生产效能

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SmartRGB Ambient Lighting System Diagram

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智能RGB 氛围灯系统显示图

Scenario 1: Cluster with RGB Ambient Light 带氛围灯汽车仪表

BCM

SmartRGB µC

SmartRGB LEDs

Effect (color & brightness) selection via rotary switch, BCM distribute instruction to SmartRGB µC

SmartRGB µC store all the preset animation effect. µC convert the instruction to SmartRGB protocol

SmartRGB LED received command and display the effect accordingly

—— LIN
—— SmartRGB 2MBit/s Serial Bus

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SmartRGB Ambient Lighting System Diagram

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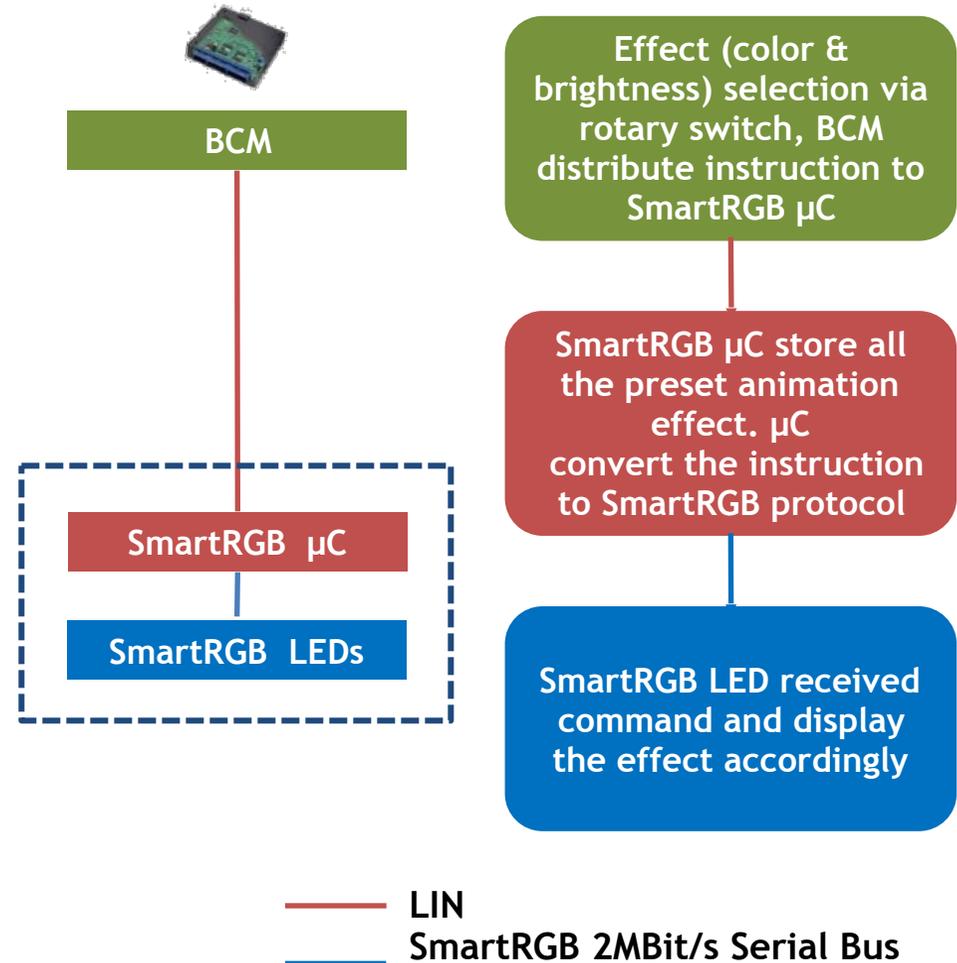
智能RGB 氛围灯系统显示图

Scenario 2: Full RGB Ambient Light System 全RGB氛围灯系统

Overhead Console

CID ECU

BCM

Lighting ECU

SmartRGB µC

SmartRGB LEDs

RGB stripes/ PCB at each location

— CAN
— LIN
— SmartRGB 2MBit/s Serial Bus
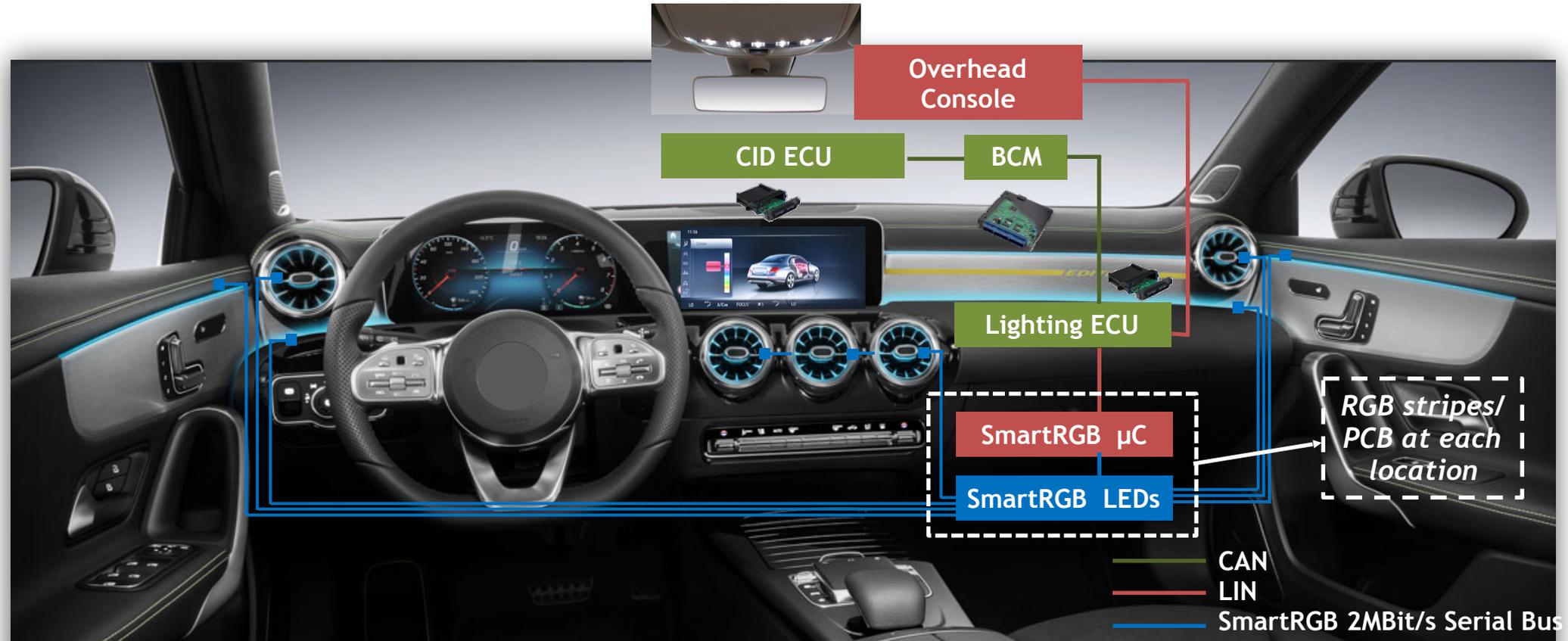
Animation effect selection via Central Information Display and send to BCM (Body Control Module)

BCM synthesize and distribute instruction to sub-system

Lighting ECU send instruction to overhead console and SmartRGB µC

SmartRGB µC store all the preset animation effect. µC convert the instruction to SmartRGB protocol

SmartRGB LED received command and display the effect accordingly

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SmartRGB Ambient Lighting System Comparison

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智能RGB氛围灯对比

Summary

	SmartRGB LED	Normal RGB LED
RGB Module Component RGB模组设计	Simplified 简单化	Complicated 非常复杂
RGB Module Calibration during SMT RGB模组校准模式	Calibrated during LED production 在生产过程已校准	Costly 非常昂贵
System Wiring 系统布线	2 wires communication with high speec at 2MBit/s 使用双线高速通讯模式	Single wire communication with slow speed at 19KBit/s 单线缓慢模式
Number of LED per system LED数量	4079	LIN only consist 16 nodes (additional LIN Hub needed)
Logistic & Handling 供货方式	Single Binning 单一bin供货	Multiple Color and IV Binning 多种亮度和颜色bin的组合

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Alliance Software and Hardware Support
联盟的软件与硬件支持

➢ **NXP Micro-Controller Software Support – Dominant ready**

➢ **LucieLabs Application and Design Software Support – Dominant ready**

➢ **TE Connectivity System Wiring and Connector Support – Dominant ready**

Development Roadmap
未来发展图

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seddLED

Smart **E**mbedded **D**igital **D**river

Q3' 2019

seddLED3.0
- Calibrated to D65 @ 1400mcd
- Interior Ambient Lighting

Q4' 2019

seddLED 3.1
- Calibrated to D65 @ 800mcd
- High Contrast Ratio Application

Q4' 2019

seddLED 3.2
- Calibrated to D65 @ 800mcd
- Build in Capacitor to Simplify Circuit Design

Coming soon

Mini seddLED
- Dimension 2.1x2.0x1.35mm
- Calibrated to D65 @ 1250mcd
- Miniature size

From Ambient Lighting to Functional Lighting
从氛围灯到功能性照明
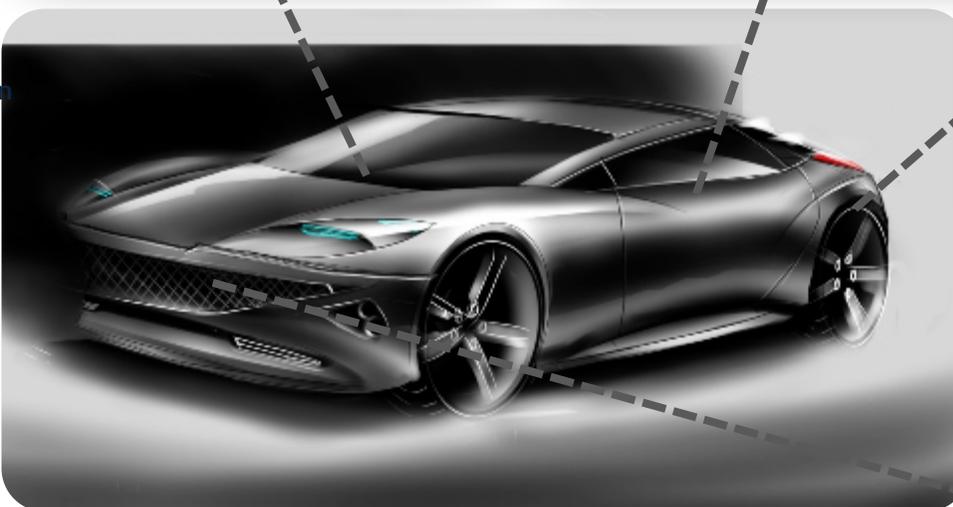
Car To Driver Communication
汽车与司机的通讯

Car To Pedestrian Communication
汽车与行人的通讯

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