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Smart Lighting Solutions

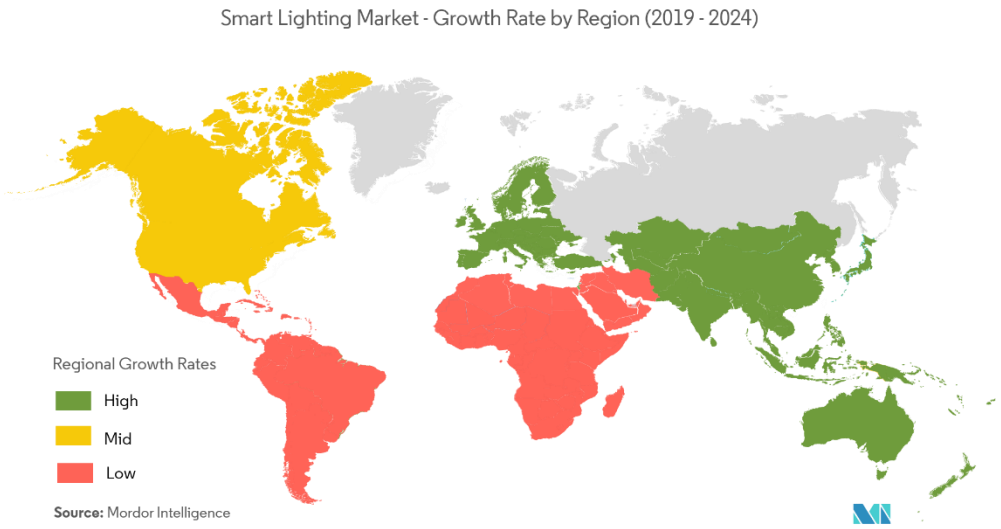
NCL310x0 – Smart LED Driver

Public Information

Connected Lighting – Fastest growing PoE segment

What is Connected Lighting and why?

- Smarter Building Management
- Efficient use of power
- Integration of sensors
  (room occupancy, temperature, humidity, CO/CO2, ...)
- CAGR >27%
- Adressable with PoE and KNX devices
- New productline under development



Study Period:	2019-2025
Base Year:	2019
Fastest Growing Market:	Asia Pacific
Largest Market:	Europe
CAGR:	27.1 %

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What the NCL31000 Brings to Intelligent Lighting

Connectivity, Integration, Control and Position Location

Connectivity

- IEEE 802.3bt PoE-PD w/ NCP1095/NCP1096
- RF compatible
- SPI/I2C serial interface
- Visual Light Comms

Increased Integration

- Efficient LED driver
- 3.3 buck converter
- 2.5-24V adjustable buck
- Power metrology

Lighting Control

- True dimming to dark
- Color Blending through dual channel capability
- Environmental settings

Indoor Positioning

- Compatible with Signify technology
- Accuracy within 30cm
- Enabled with VLC
- Communication with mobile phone

Market & Applications

- **Outdoor Lighting**
  - Connected Street Lighting
  - Architectural Lighting
- **Indoor Lighting**
  - Office Lighting
  - Industrial Lighting
  - Theater Lighting
  - Therapeutic Lighting
- **Backlighting**
  - Professional displays
  - High end Displays

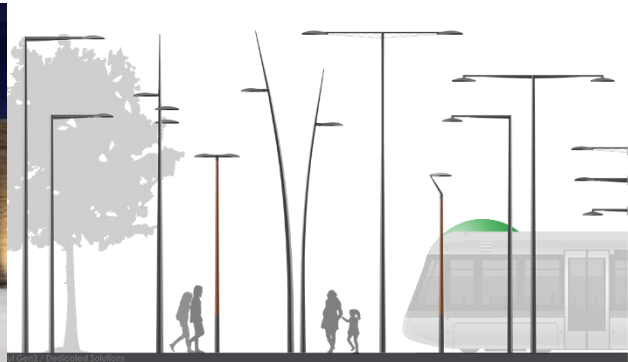










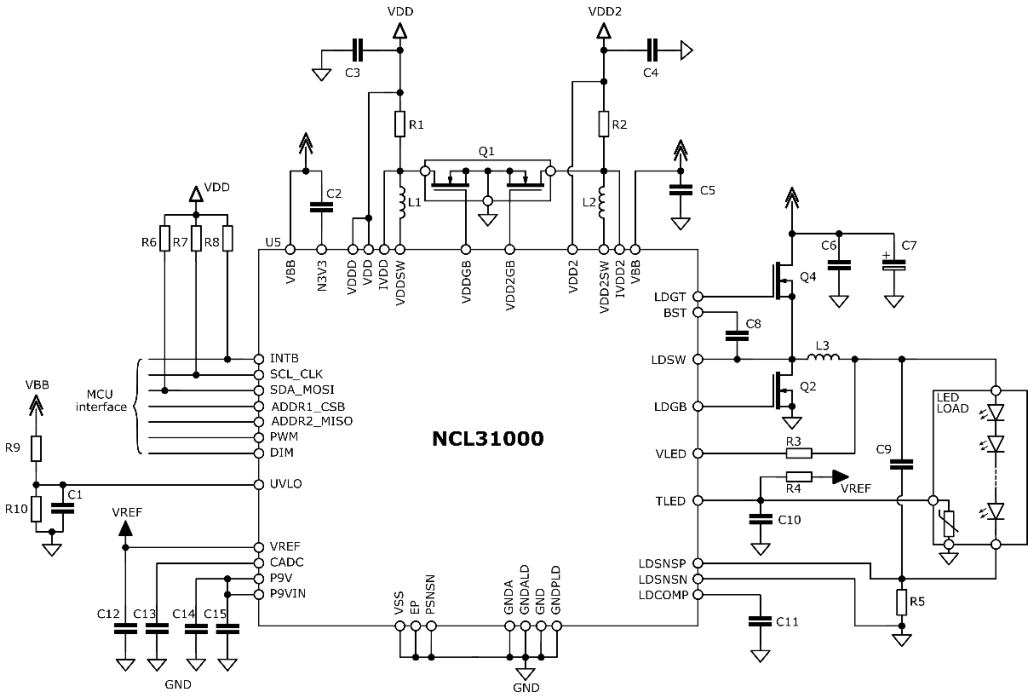
NCL31000 - Integrated LED Driver

System Power, LED driver and Metrology IC

Unique Features & Benefits

- Input Voltage from 35V to 57V
- 97% efficient Buck Controller LED driver
- Integrated 3V3 Buck Converter (150mA) for companion MCU.
- Integrated Adjustable Buck Converter 2.5-24V
- SPI or I2C interface for RF connectivity
- Active Fault protection and diagnosis for LED shorts/opens,..
  - Over/Under Voltage, Over Current, LED Temperature
- Visual Light Communication capable, Yellow-Dot ready, up to 10kb/s
- Linear, high bandwidth dimming to zero (full range linearity 0.05% INL)
- Deep dimming down to 1mA or 0.033% @3A full scale current
- Digital Dimming over I2C/SPI (Warm Boot)
- High accuracy diagnostic functions to measure voltages/currents
- Junction temperature range of -40°C to +125°C
- Available in 48-pin QFN 7x7

Typical Application Schematic



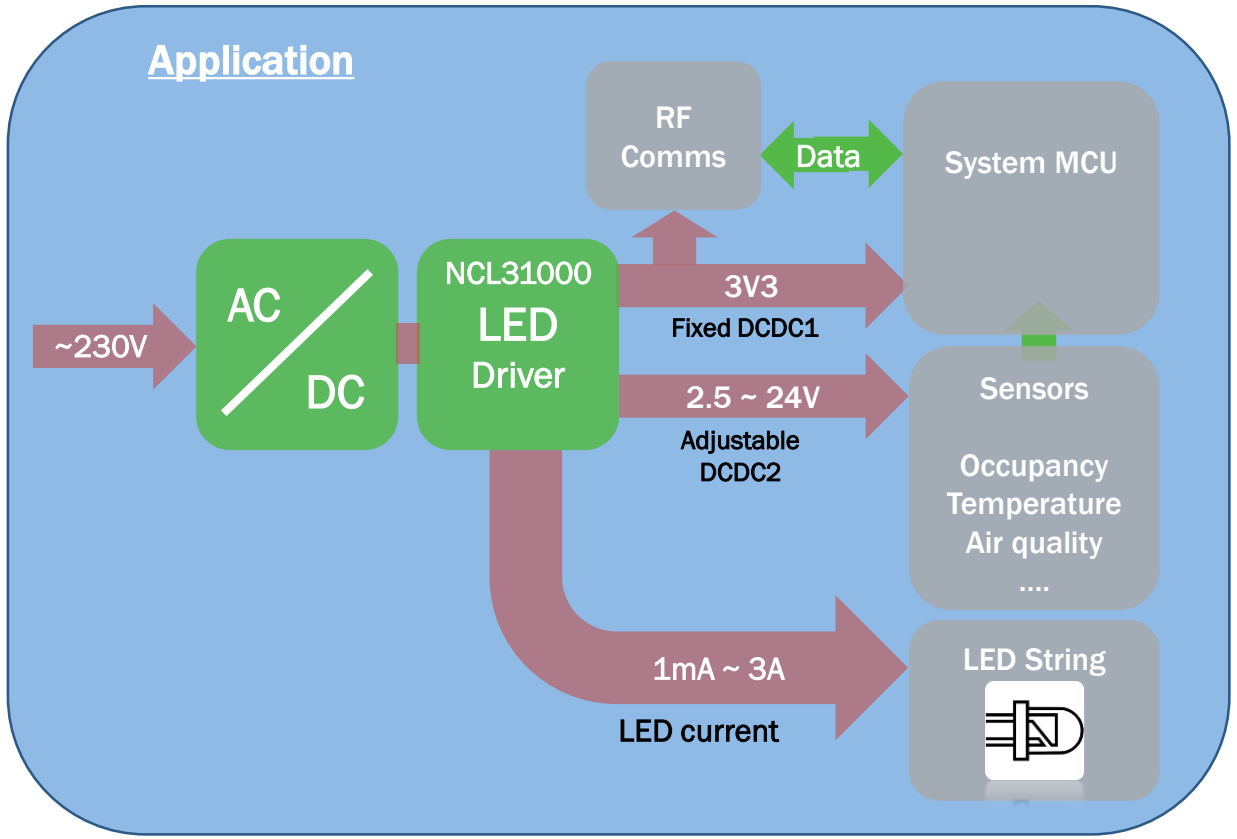
Other Features & Specifications

- Source is capable to drive high-power LED luminaires beyond 100W
- Embedded V/I measurements of the input and output stage, to calculate P_{IN}, P_{OUT} and system η
- Microcontroller communication over SPI or I2C interface
- Optional Spread Spectrum for conducted EMI reduction

Markets & Applications

- Smart LED Lighting
  - Human Centric Lighting
  - Communication Lighting
  - Energy saving lighting Systems
- IoT Home appliances

System Architecture Example



Dynamic max LED current is ~2.8A (3A DC)
Combined with 57Vin max => 160W max lighting power
Example: 48Vin x 2,8A = 135W

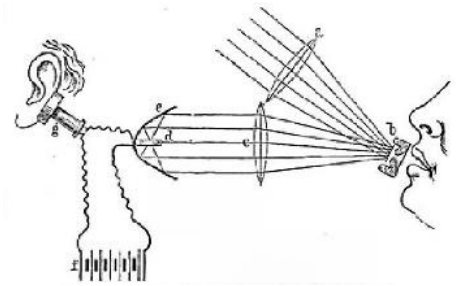
NCL31000

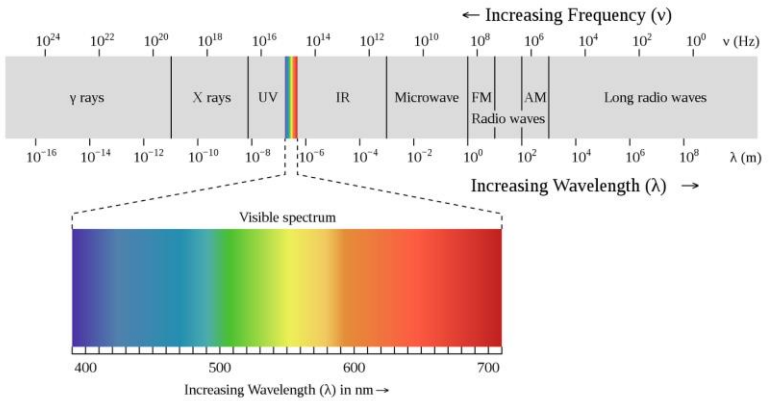
- Input voltage 35 ~ 57V
- LED Current : Up to 3A
- DCDC1: 3.3V fixed, 150mA max
- DCDC2: Adjustable, 2.5 ~ 24V

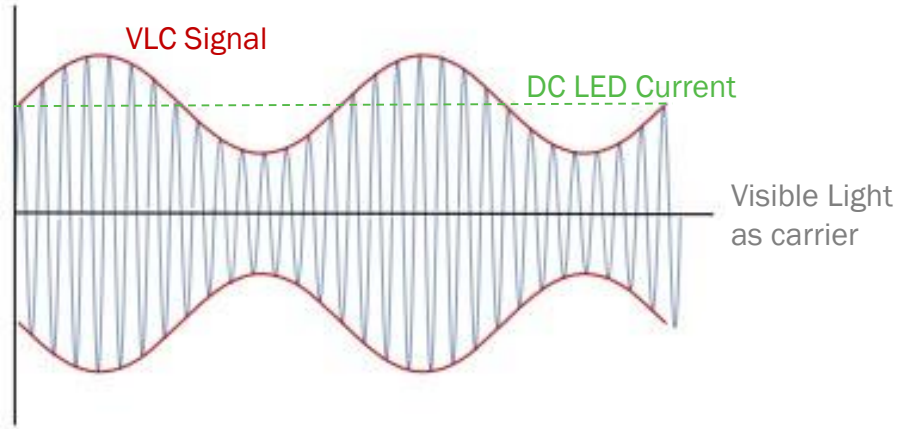
VDD2 Configurations

V_{OUT} (V)	I_{OUT} (mA)	R_{CS} (mΩ)	L (µH)
2.5	560	220	100
3.3	515		
5	510	200	
7.2	415		330
10	335	330	330
12	315		
15	285		
24	230	390	470

Visual Light Communication - VLC



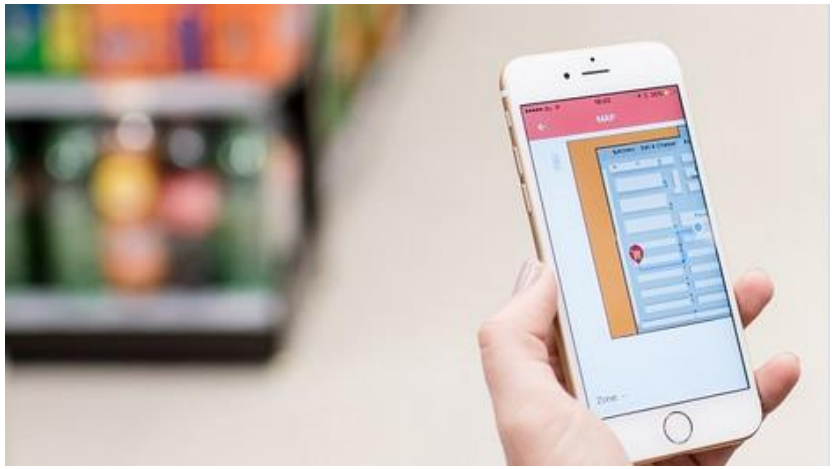




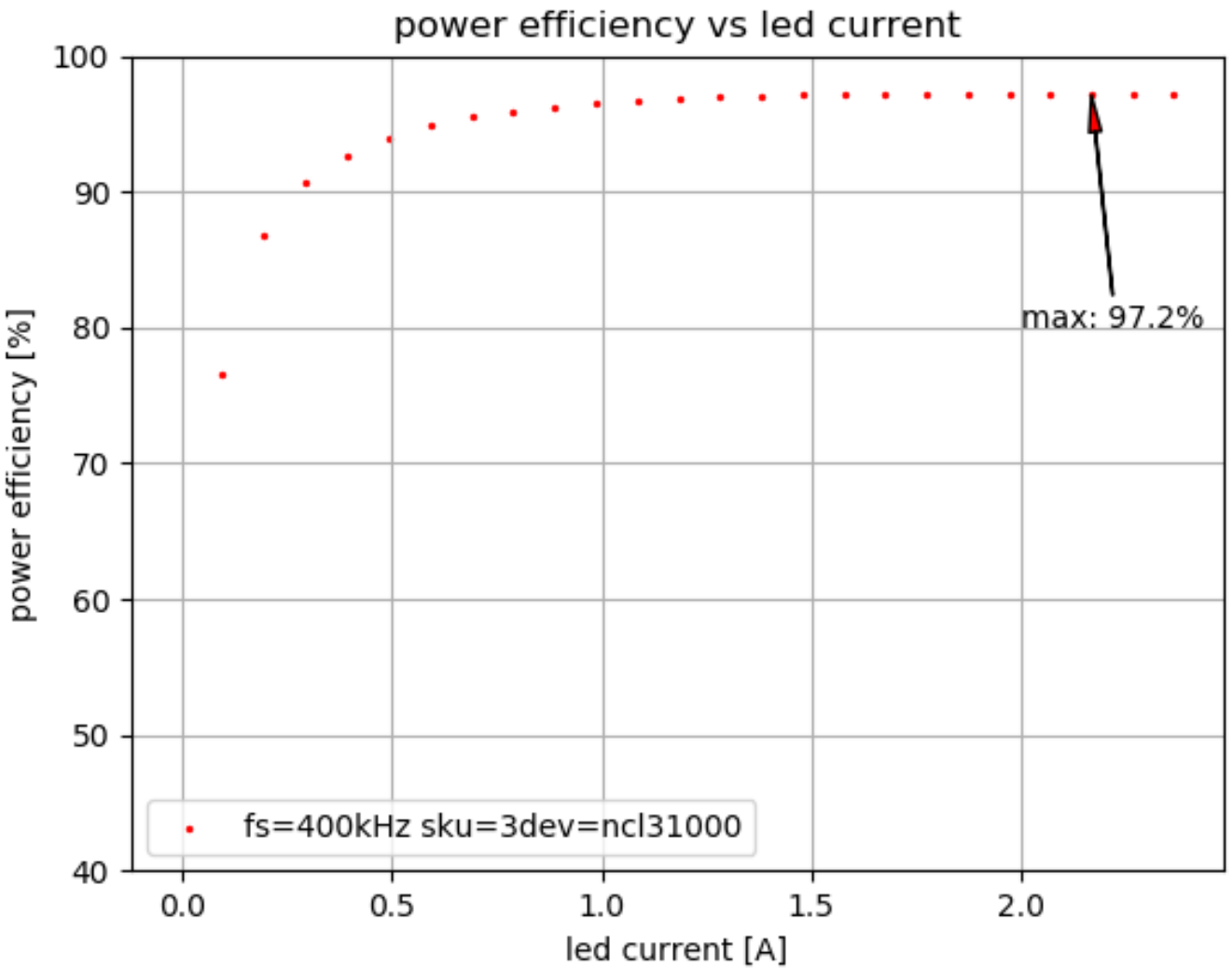
- Photophone work at Bell Labs during the 1880-ies predates radio
- **VLC is a data communication technology which uses visible light as a carrier, with low data rates (kb/s)**
- Lifi: 500 Mbit/s with a white LED over a distance of 5 metres (16 ft), and 100 Mbit/s over longer distance using five LEDs demonstrated in lab conditions

What is YellowDot?

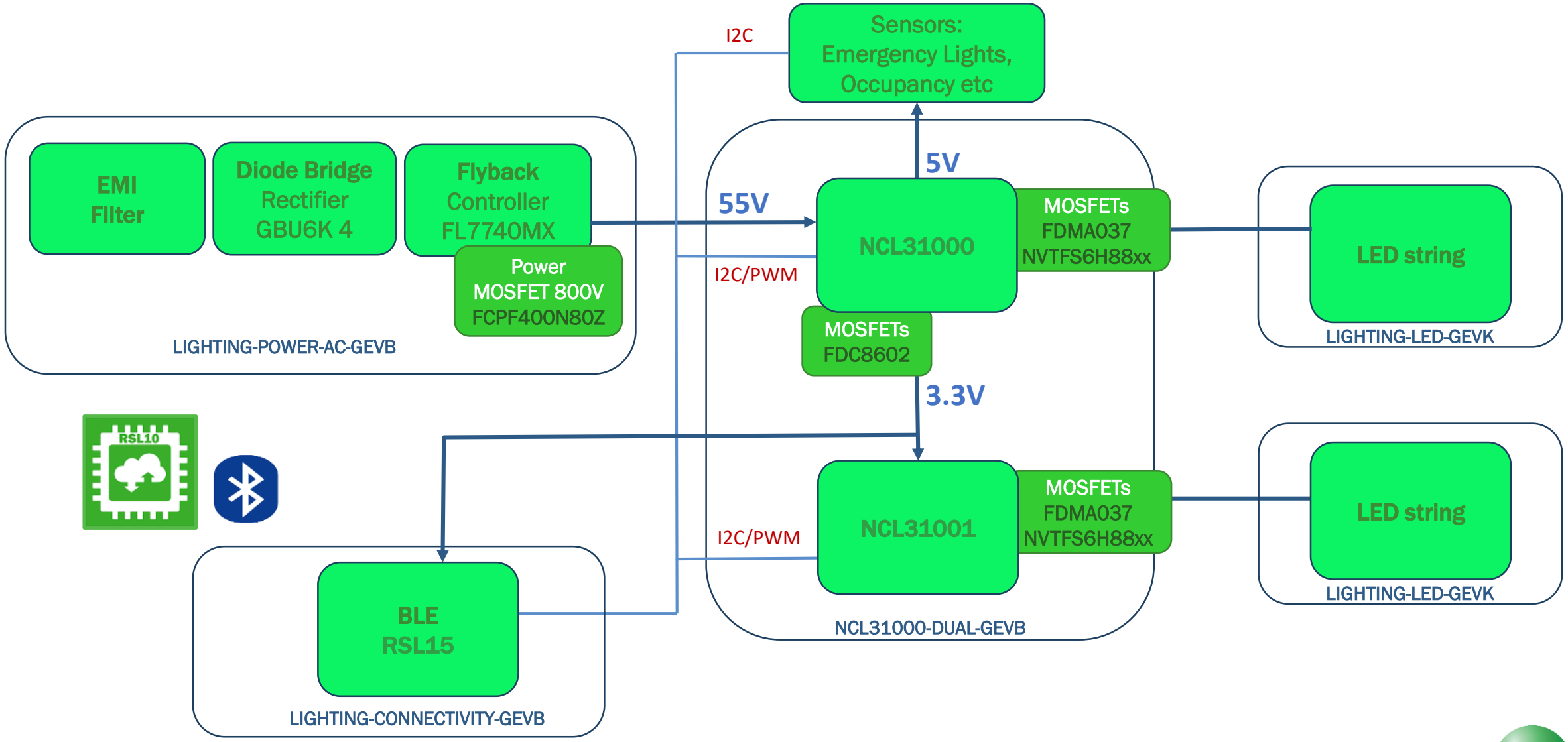
- YellowDot is an **indoor position location technology**
- **Each LED ballast has a unique identifier** that indicates the position within a building
- LED ballast signals through **visual light communication** (VLC) to a camera on a phone or tablet
- Phone's camera **detects the code** and **reveals the position**
- **Accuracy to within 30cm**; **BLE accuracy is 3 meters**
- Certification requires a range of tests; passing allows the use of the YellowDot trademark to a luminaire
- Has two defined data rates: 1kb/s and 2kb/s



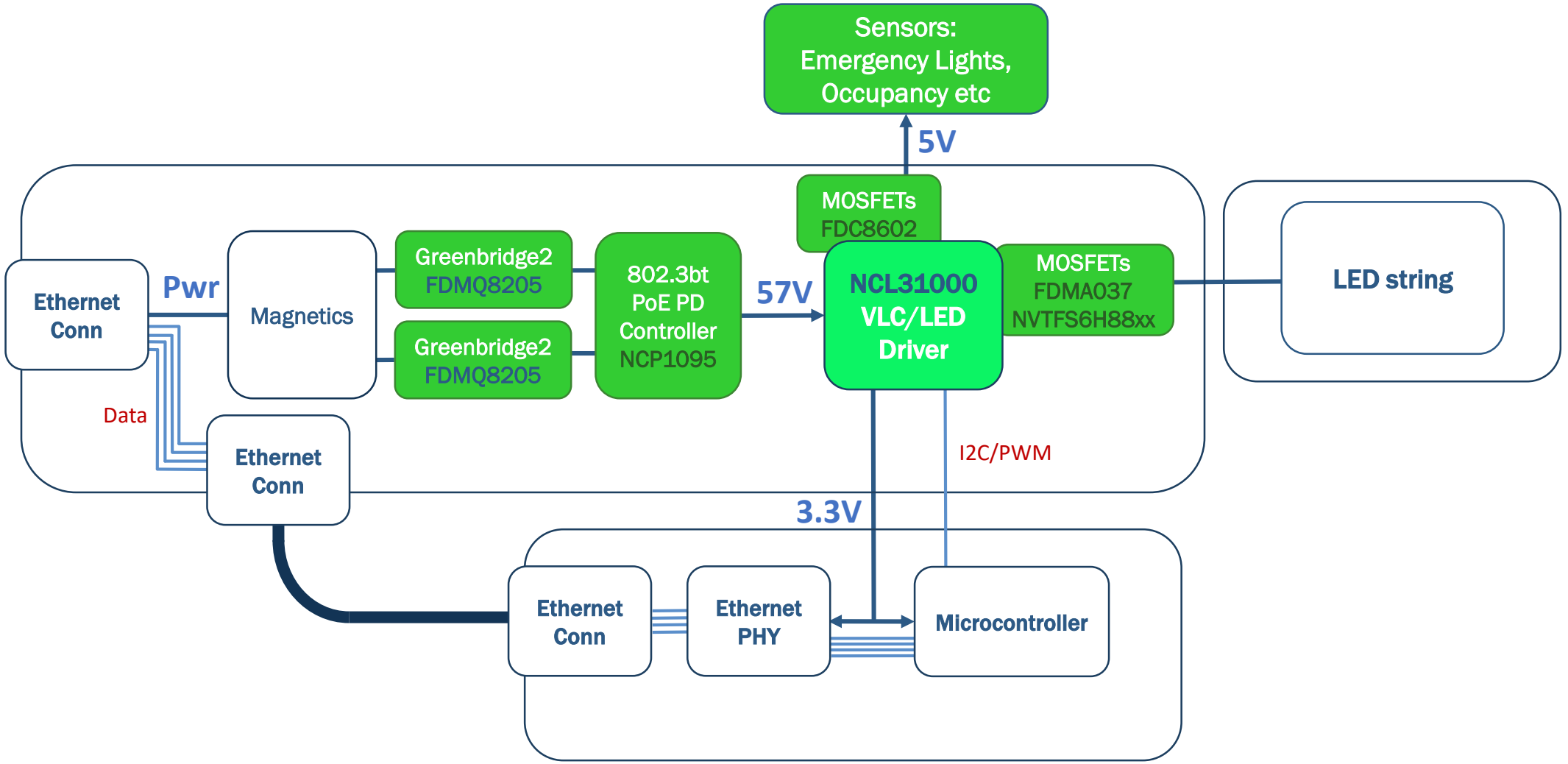
NCL31000 LED Driver full solution Efficiency (>97%)



NCL3100x in the Smart Lighting KIT (LIGHTING-1-GEVK)



NCL31000 PoE System Diagram



NCL31000ASGEVB – Demo Board

- **Arduino Shield compatible evaluation board**
- VLC/Yellow Dot capable
- LED Power capability beyond 100W
- Input voltage up to 57V
- I2C/SPI for MCU daughter card
- Efficiency of total solution ~97%
  - Incl EMC, DC-DC's, Diagnostics etc
- Very suitable for measuring/debugging

- **GUI:**
  Strata interface under development