FOR ENERGY EFFICIENT INNOVATIONS

THINK ON.

www.onsemi.com

NCL31000 – Intelligent LED Driver

Customer Presentation

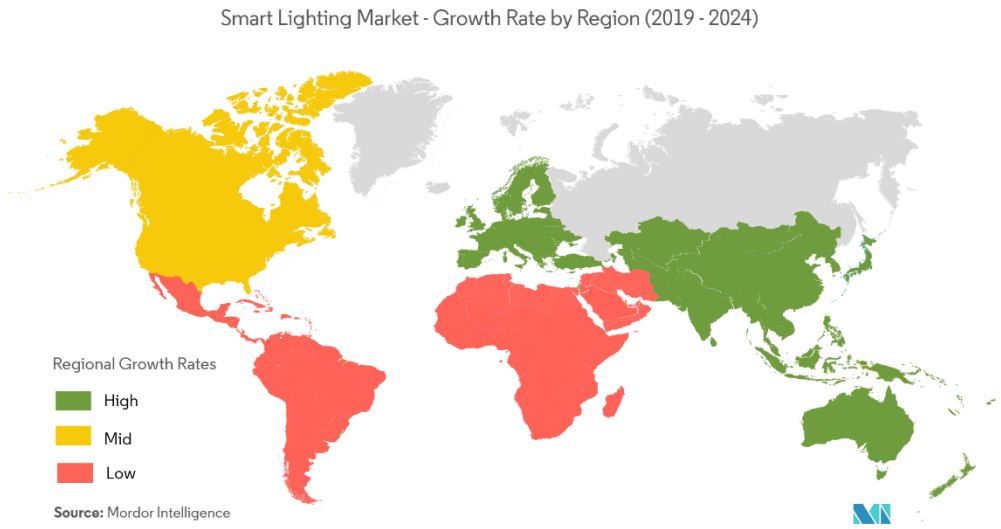
January 2021

Connected Lighting – Fastest growing PoE segment

What is it?

- 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

Smart Lighting



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

EATON wipro PHILIPS CREE

NCL31000 - Intelligent LED Driver

Product Details

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
- Visible 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

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

NCL31000 - Integrated LED Driver

System Power, LED driver, and Metrology IC

YellowDot

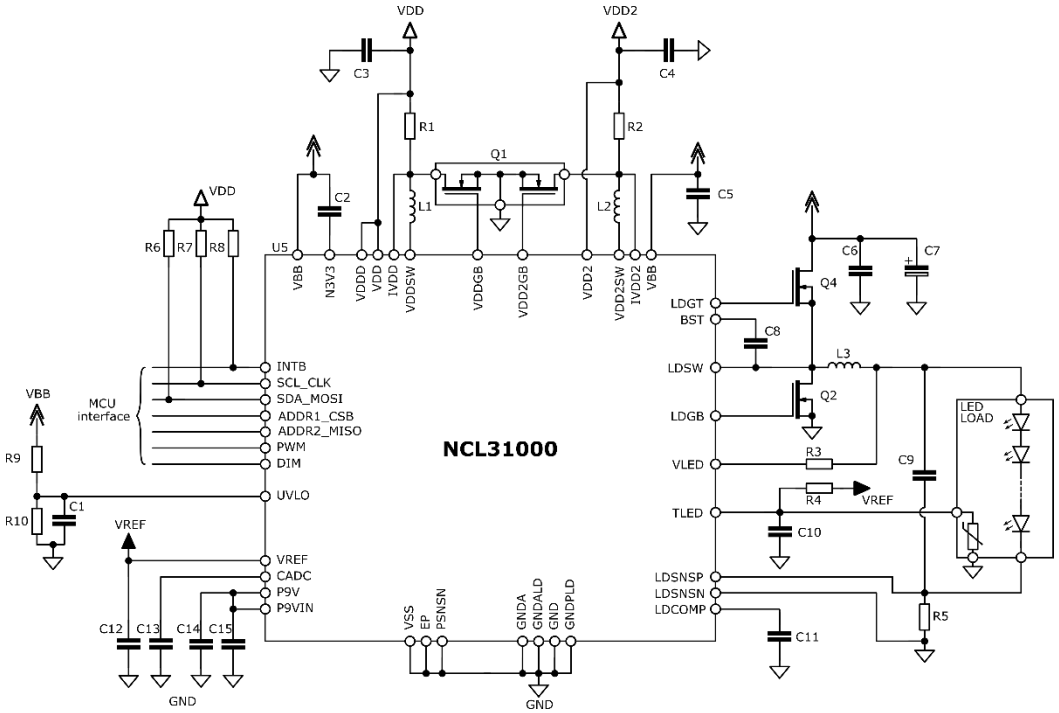
Unique Features & Benefits

- 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
- Visible 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

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

Typical Application Schematic

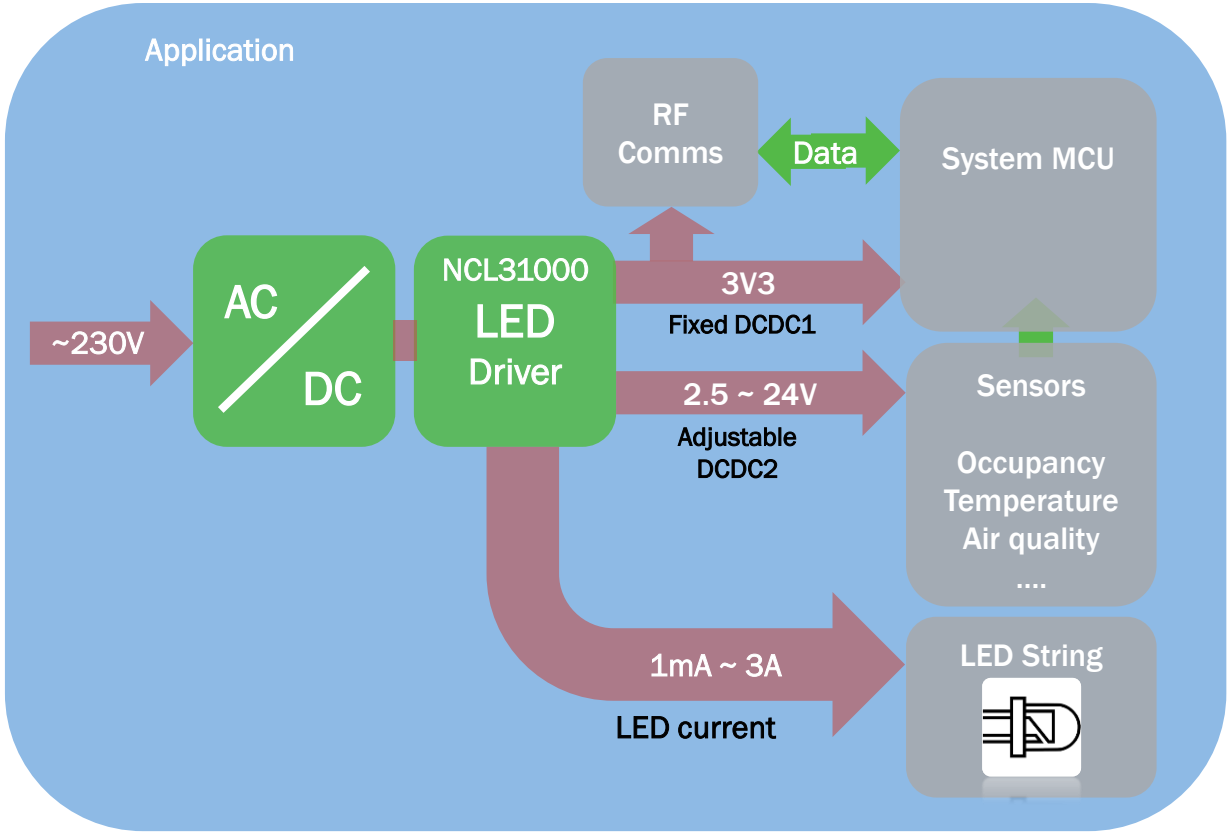


Markets & Applications

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

ON

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

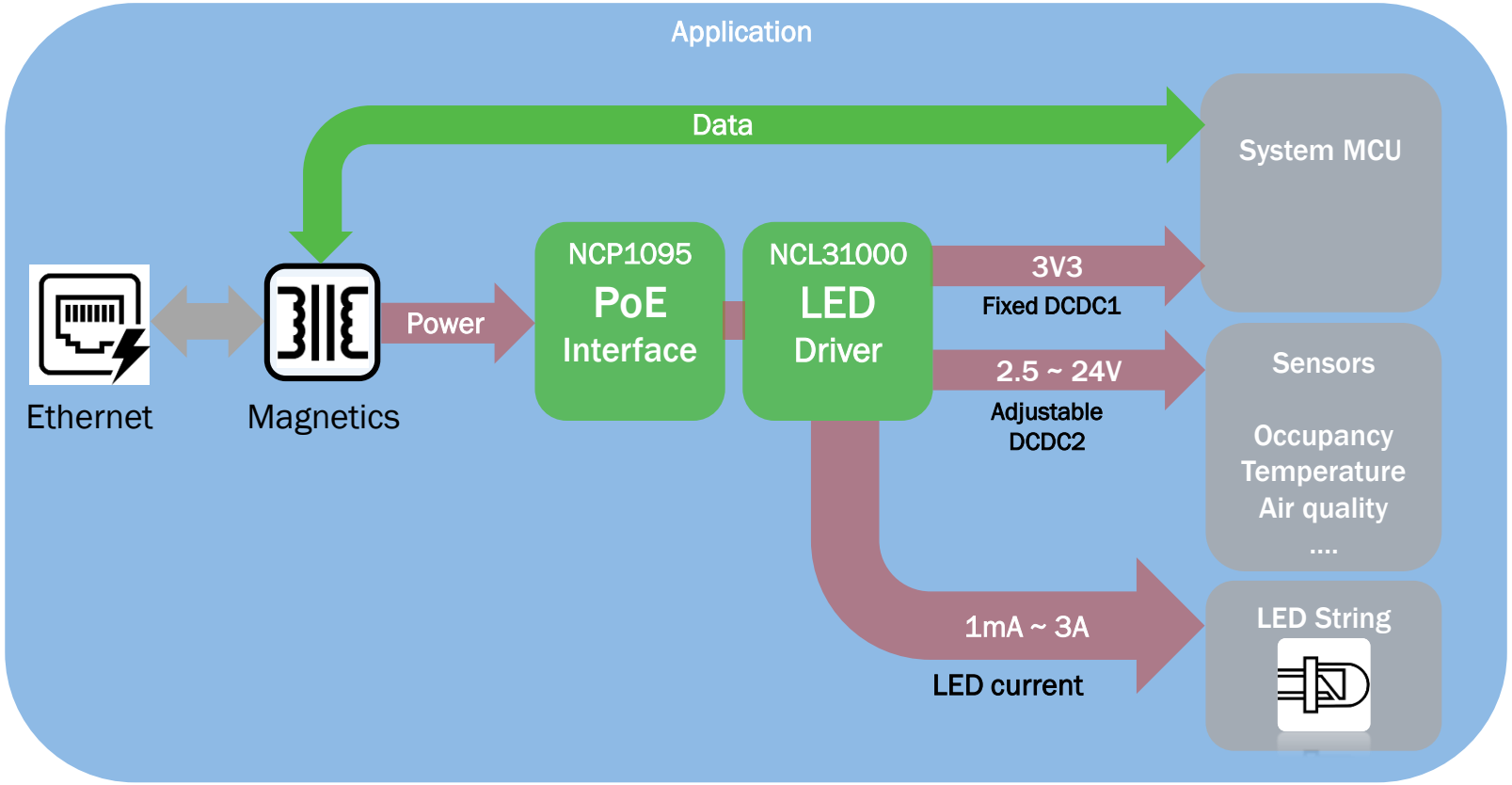
NCL31000

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

VDD2 Configurations

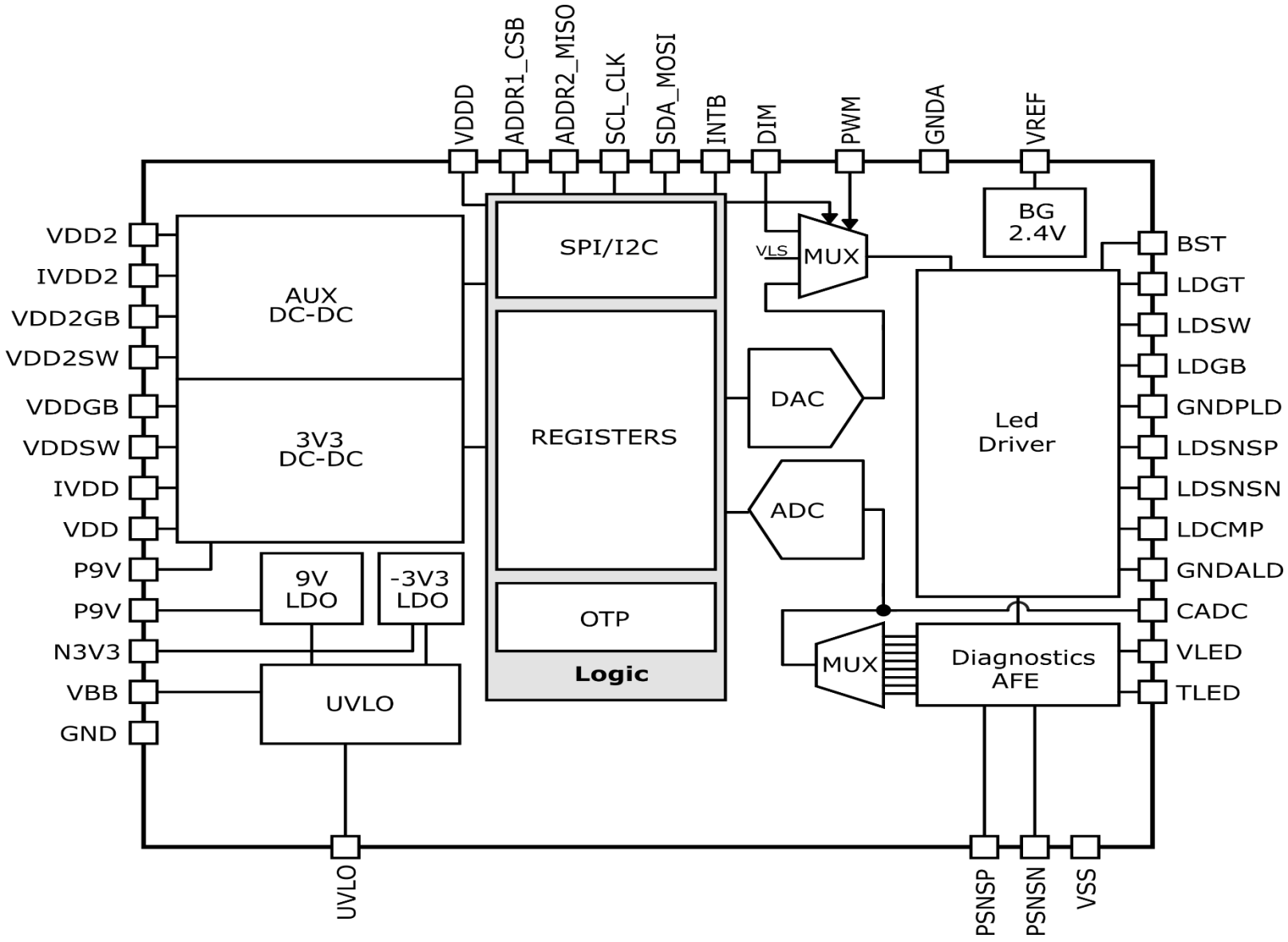
V_{OUT} (V)	I_{OUT} (mA)	R_{CS} (mΩ)	L (µH)
2.5	560	220	100
3.3	515		
5	510	200	
7.2	415		330
10	335	330	330
12	315		
15	285		
24	230	390	470

PoE System Architecture



* NCP1095 >100W capability

NCL31000 Block Diagram

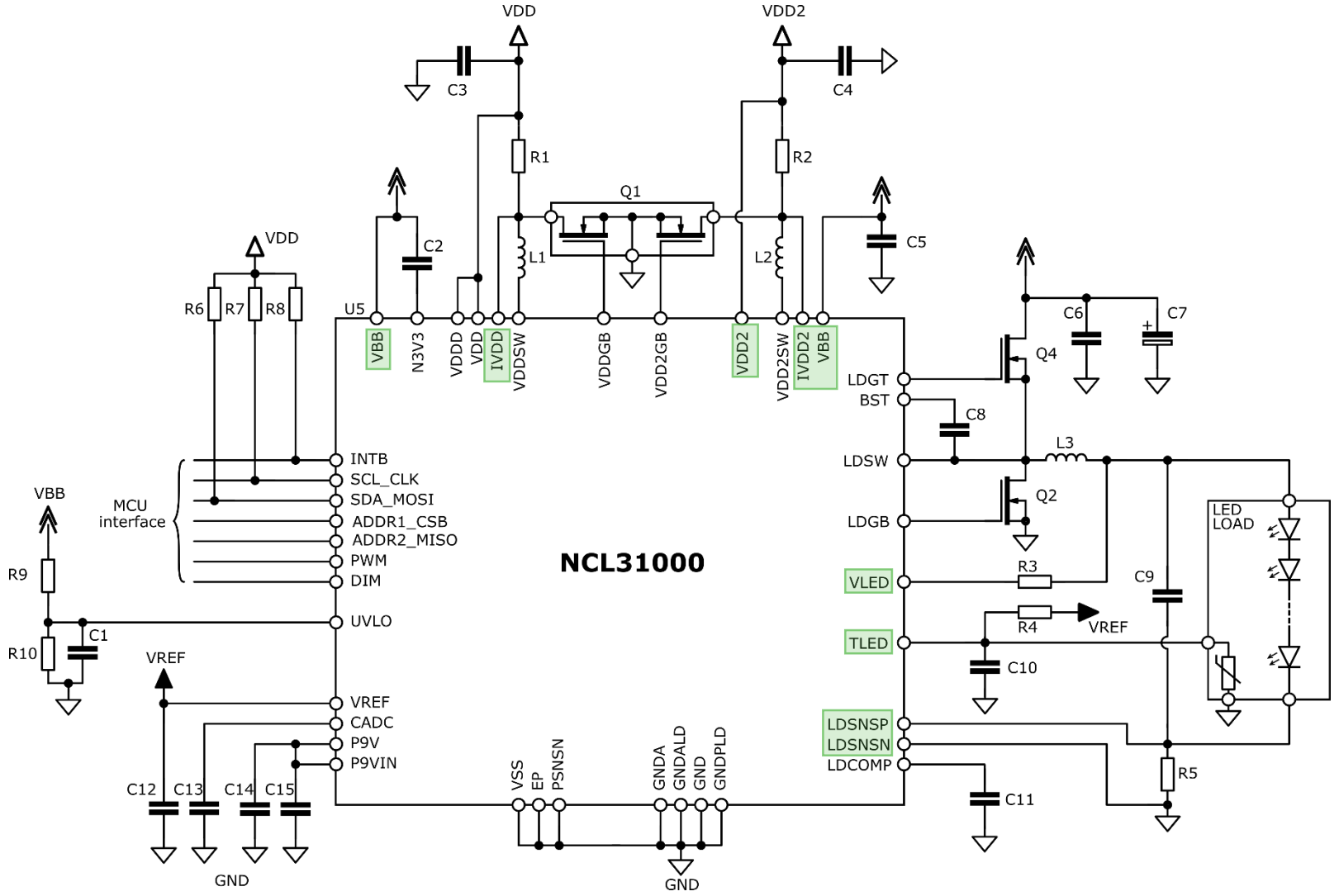


NCL31000 Metrology

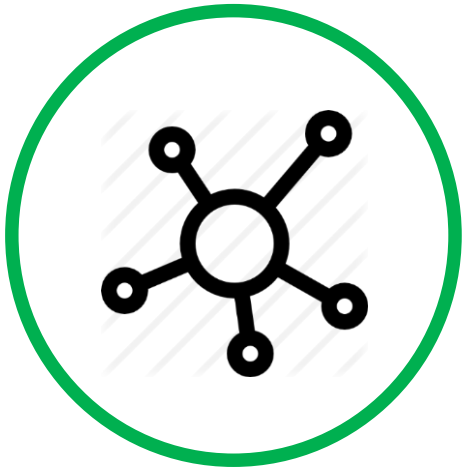
The NCL31000 Metrology incorporates a high accuracy 10-bit ADC that measures (100msec sample rate) the following system voltages, currents and temperatures:

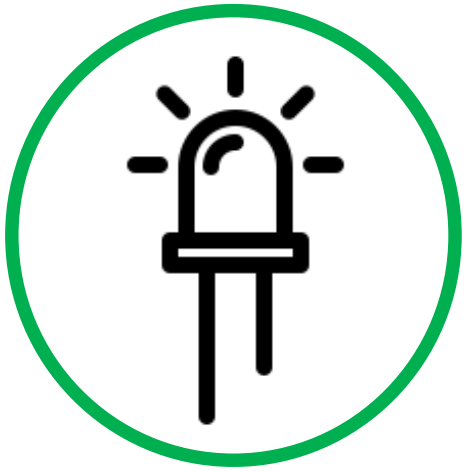
- VBB: Supply Voltage
- VDD: DCDC1 (3.3V) Voltage
- VDD2: DCDC2 (2.5V to 24V) Voltage
- VLED: LED Voltage
- ILED: LED Current
- IBB: Supply Current
- IVDD: DCDC1 (3.3V) Current
- IVDD2: DCDC2 (2.5V to 24V) Current
- TLED: LED Temp

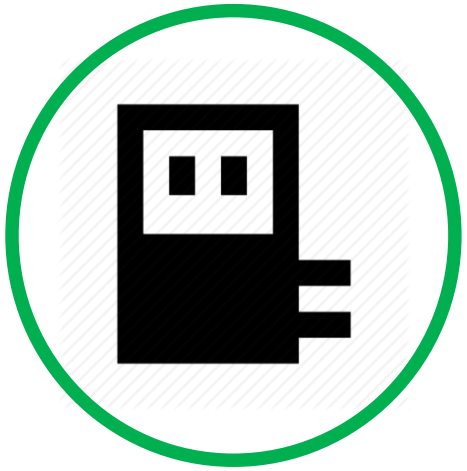
The Metrology measurements can be read out from internal 16-bit registers by the host MCU.



NCL31000 Key Specifications







NCL31000 enable intelligent lighting

Connectivity

- IEEE 802.3bt Compliant (paired with NCP1095/NCP1096)
- 0.033% Linear Deep Dimming
- VLC enables YellowDot™
- I2C or SPI serial interface option

LED Driver

- 97% Efficiency
- Integrated 3.3V Buck
- Integrated adjustable 2.5-24V Buck
- Spread spectrum PWM to reduce EMI

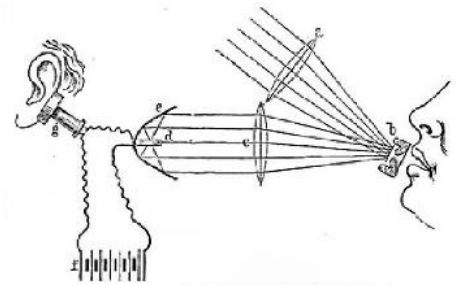
Power Metering

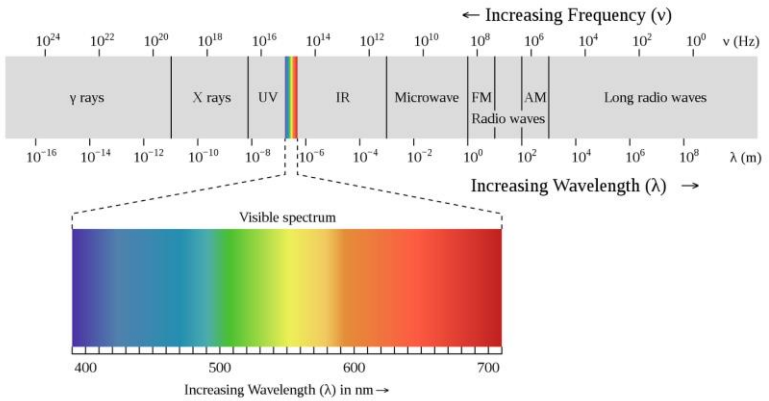
- 1% Power Metering
- Voltage and Current Monitoring
- Temperature Protection
- Accurate voltage reference

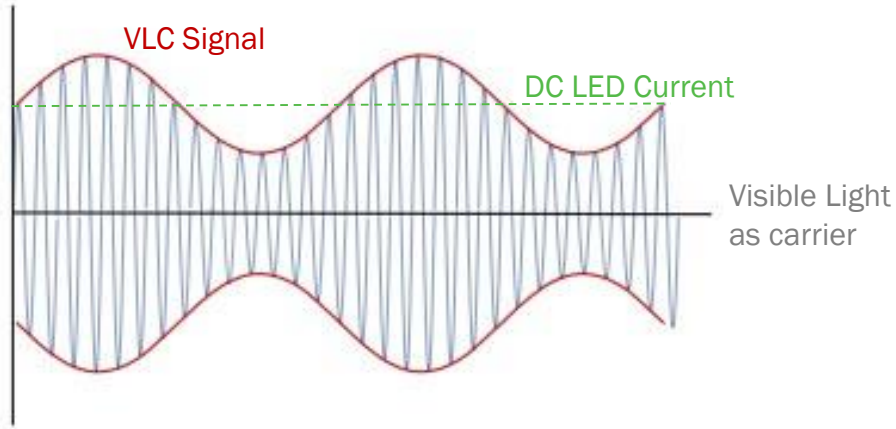
Visible Light Communication (VLC)

Background and Technology

Visible Light Communication



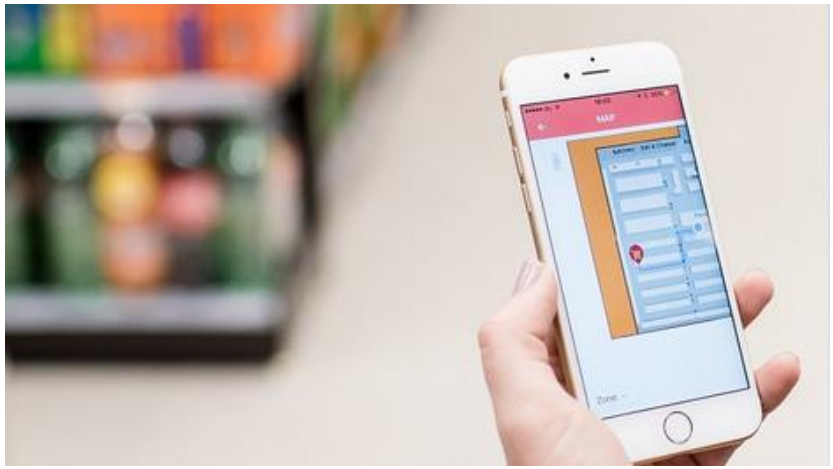




- Photophone work at Bell Labs during the 1880-ies predates radio
- **VLC is a data communication technology which uses visible light as a carrier, with low data rates (kb/s)**
- Lifi: 500 Mbit/s with a white LED over a distance of 5 metres (16 ft), and 100 Mbit/s over longer distance using five LEDs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

What is YellowDot?

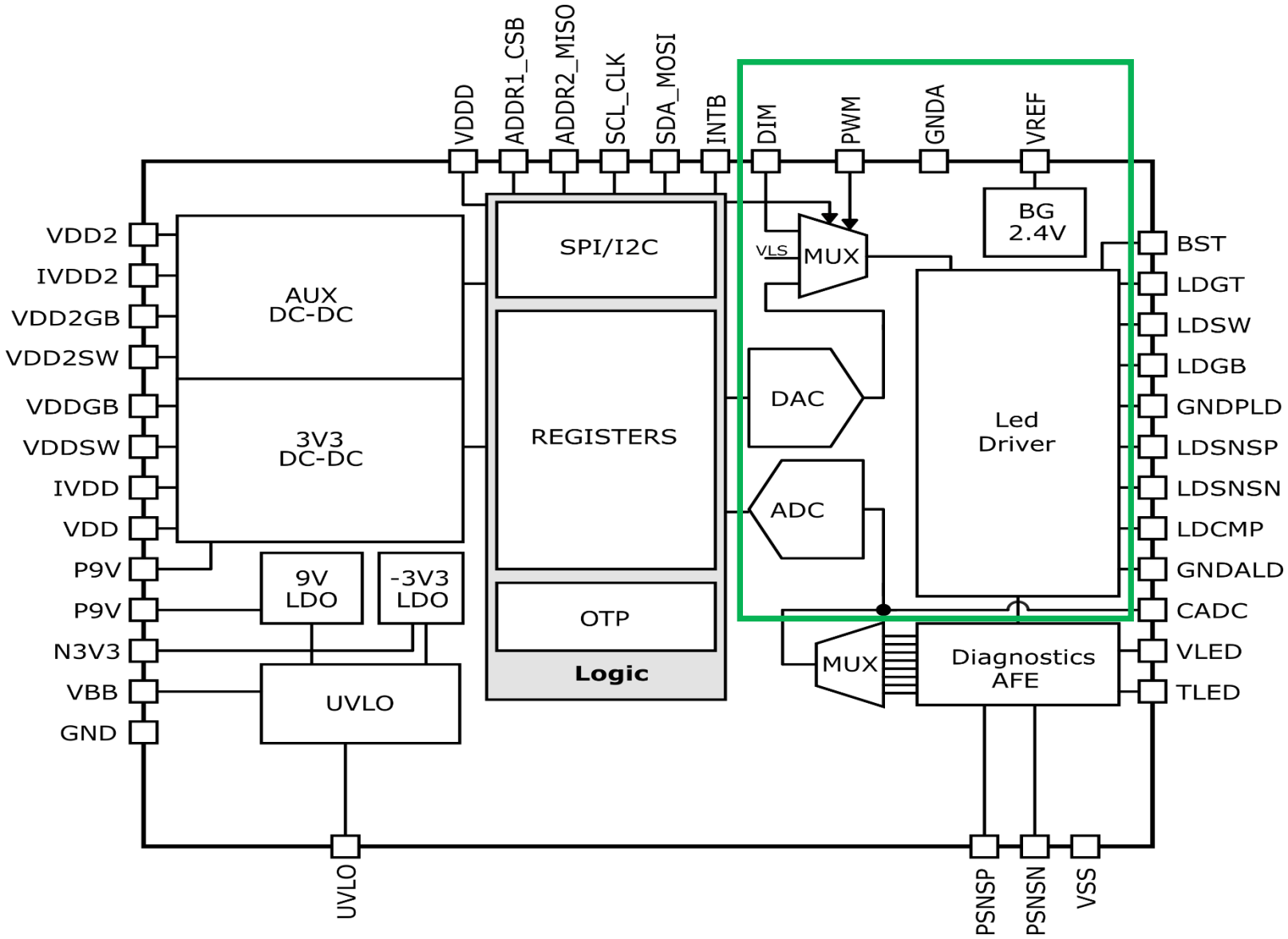
- YellowDot is an **indoor position location technology**
- **Each LED ballast has a unique identifier** that indicates the position within a building
- LED ballast signals through **visible light communication** (VLC) to a camera on a phone or tablet
- Phone's camera **detects the code** and **reveals 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



Advanced Light Engine

NCL31000 Implementation

NCL31000 – Advanced Light Engine

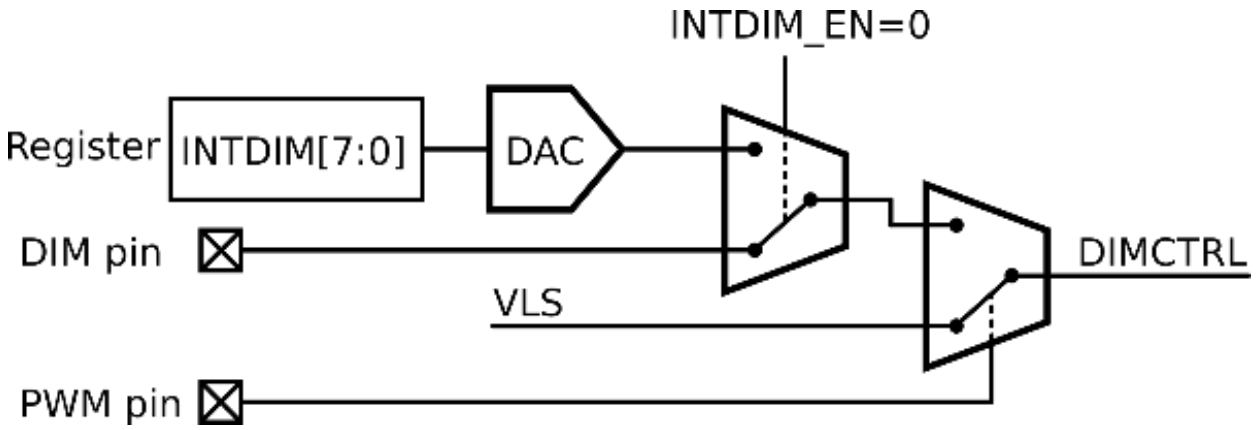


Versatile Dim Control

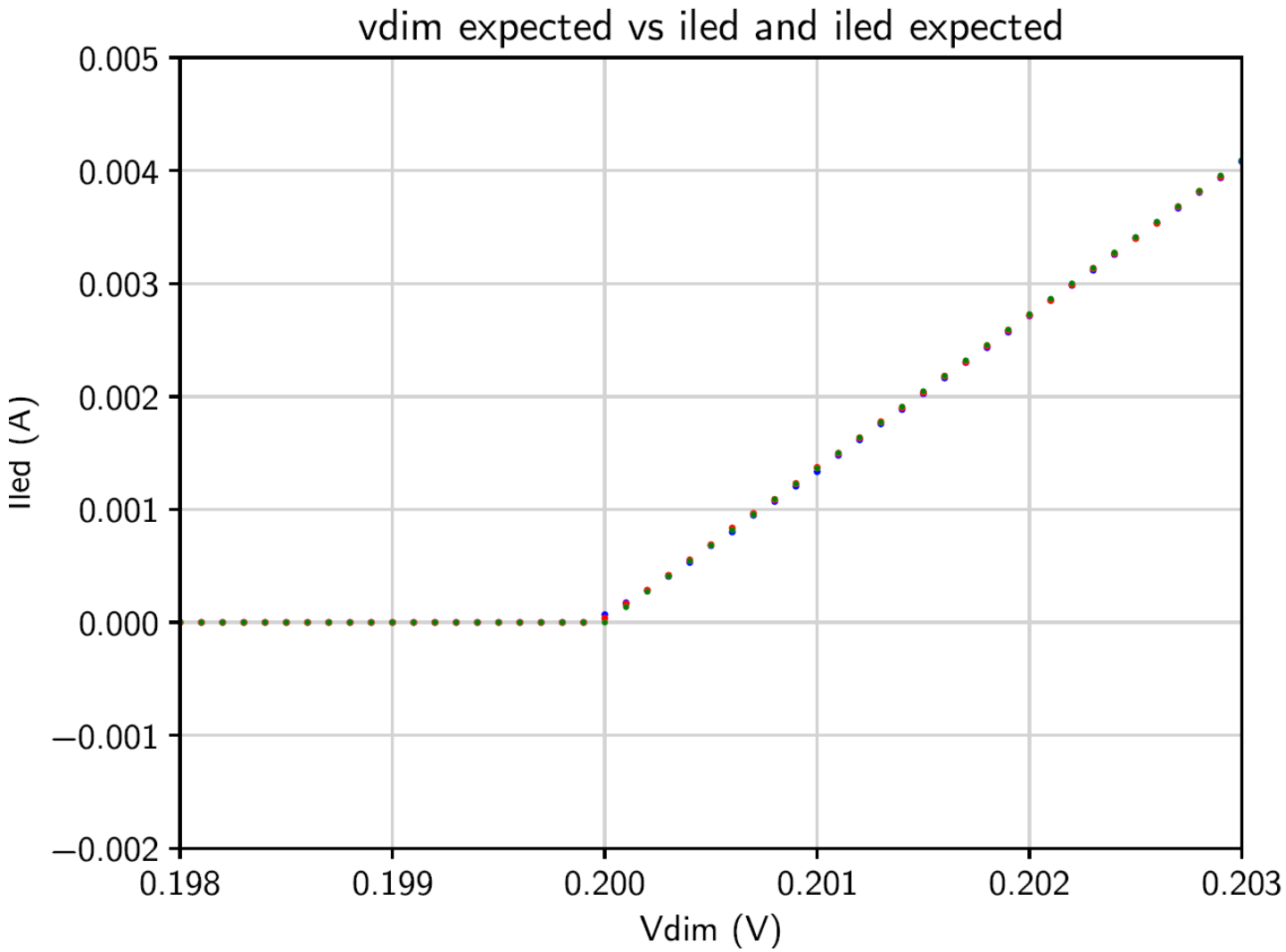
DIMCTRL is the internal analog voltage which will determine the LED current.

The dimming level can be controlled through:

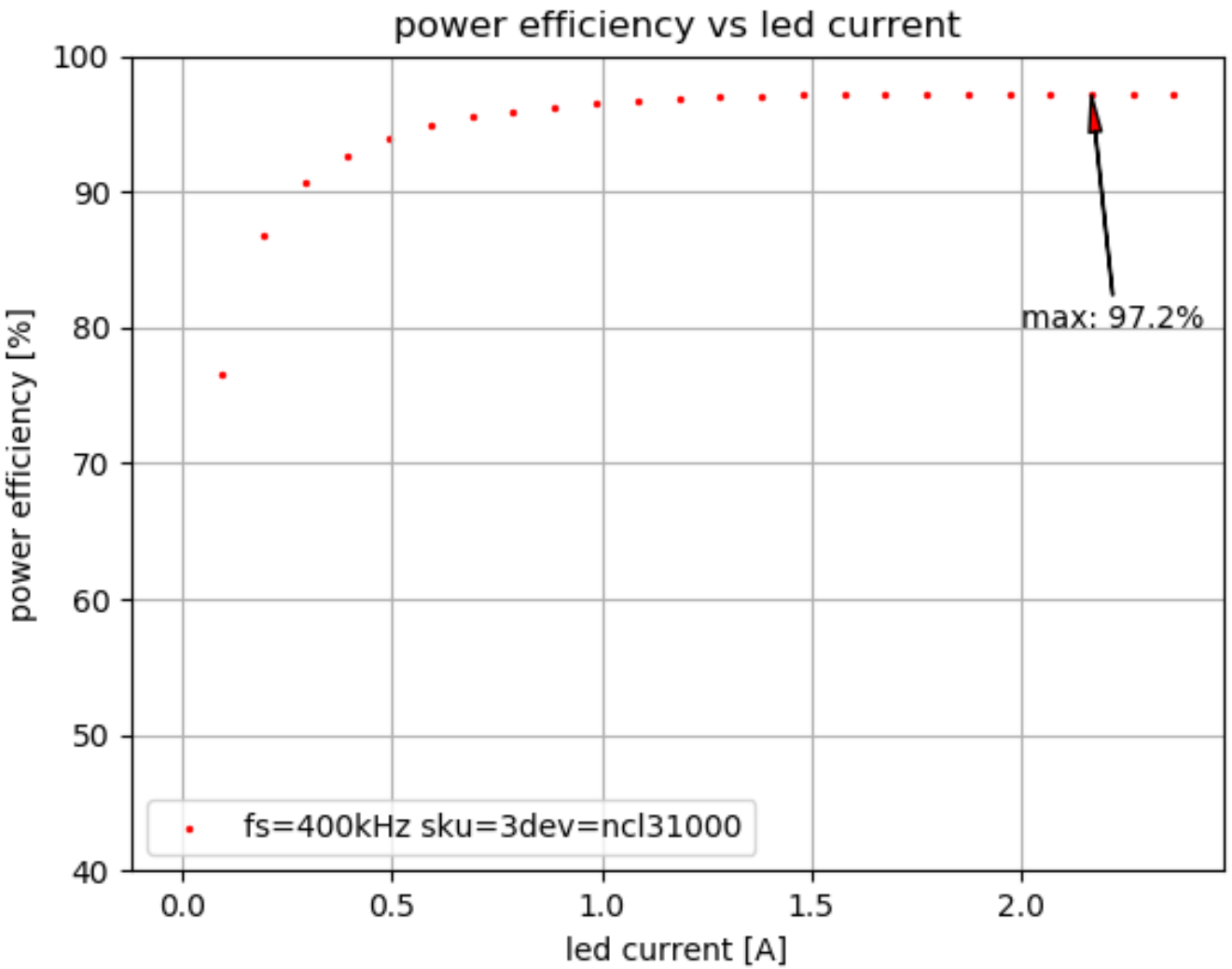
- External DIM pin:
  By default, this signal is routed to DIMCTRL
- VLS: internal reference voltage (200mV) for zero LED current
- DAC: internal DAC (register value)
- External PWM/Enable pin



NCL310xx Deep Dimming and Linearity



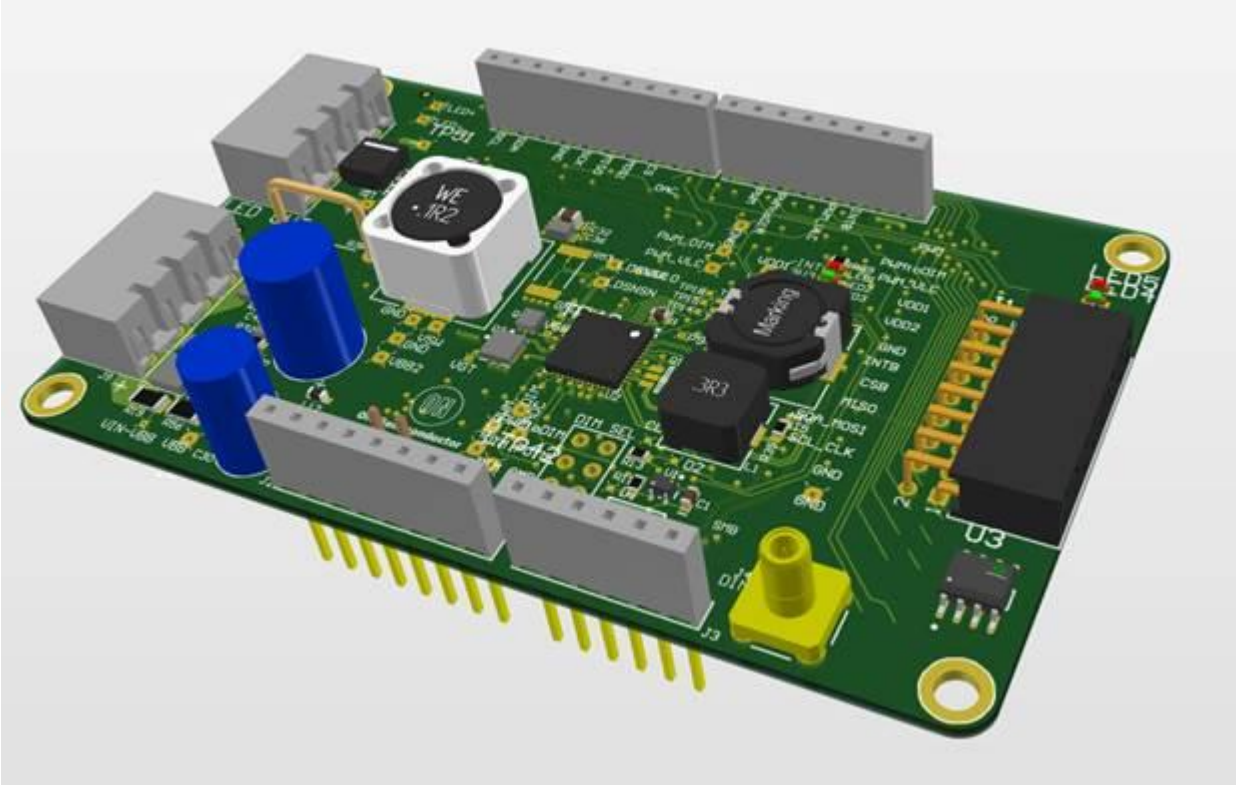
NCL31000 full solution Efficiency



NCL31000ASGEVB

- **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
- More suitable for measuring/debugging

- **GUI:**
  Strata interface under investigation / development



Applications

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

















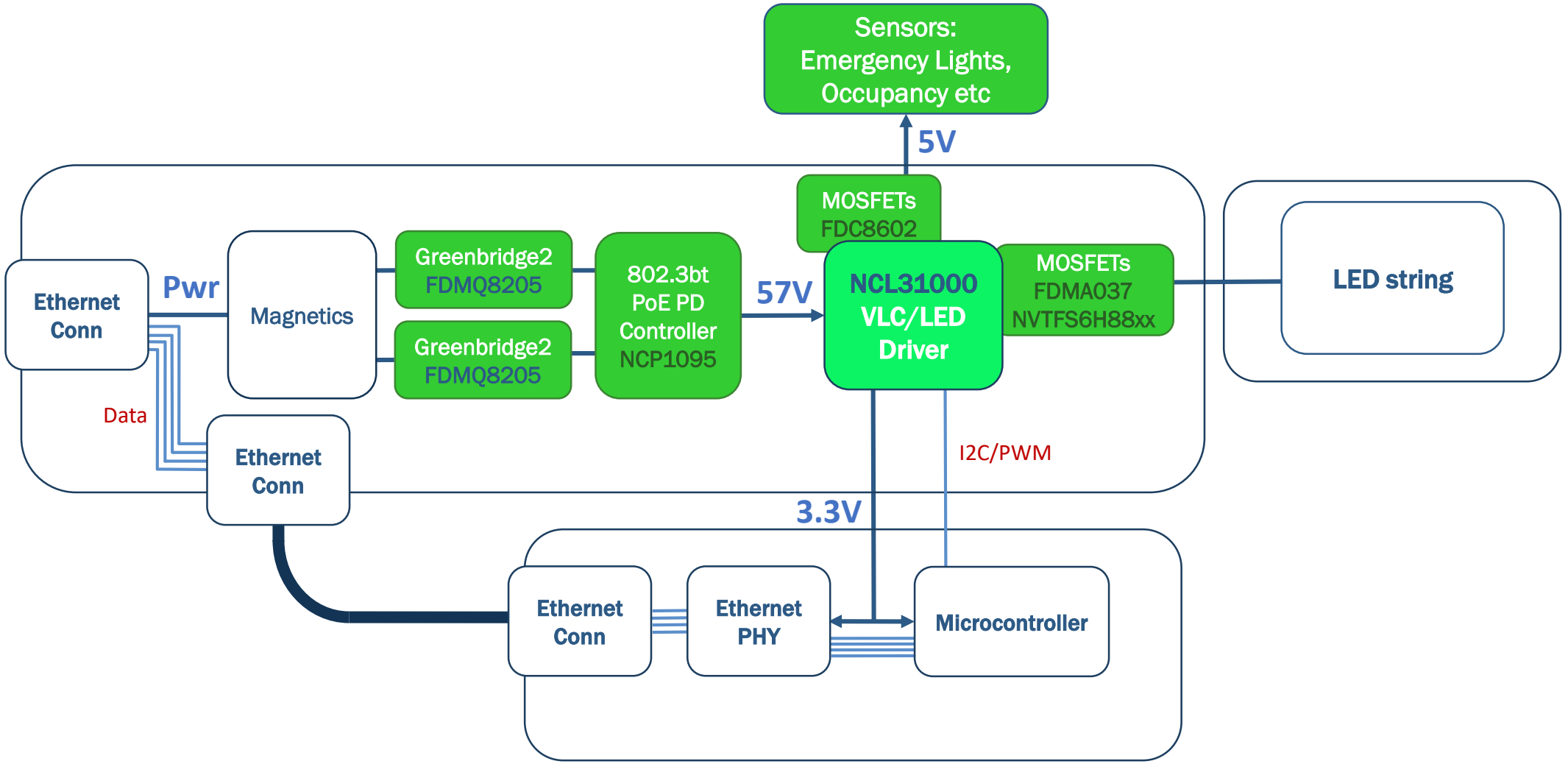
ON Intelligent LED Driver Product Family

NCL31000 Key Features
Power Supply
Integrated 3.3V Buck
Adjustable 2.5-24V Buck
Accurate Voltage (2.4V+/-0.3%)
Buck LED Driver
Linearity (full range) 0.05% INL
Deep Dimming to 1mA = 0.066% of 1.5A or 0.033% of 3A
Efficiency (97%)
Spread Spectrum PWM
Connectivity
Serial Interface SPI or I2C
Protections/Diagnostics - LED Temperature, Over/Under Voltage and Over Current
Power Metrology Accuracy (1%)

NCL31000 Product Family

Additional Information

NC31000 PoE System Diagram



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