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Submission Title: [The LED Interface Considerations for VLC]
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Re: [vlc_sg]

Abstract: [This document presents LED Interface Considerations for VLC]

Purpose: []

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LED Interface Considerations for VLC

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Introduction

- **VLC Applications**
  - Lighting and illumination
  - LED signboard
  - Automotive lighting
  - Display backlighting

- **Key elements for LED application design**
  - Topology : Serial or Parallel
  - Number of LED
  - Type of LED : Current, voltage
  - Temperature of working environment
  - source voltage of system

Why do we need LED driver for VLC?

- To drive LEDs, constant current output power converters are required.
  - Large variety of LED
  - Register Limiting
  - Linear regulator for Constant current

- Some of LED Driver has a PWM input.
  - For dimming
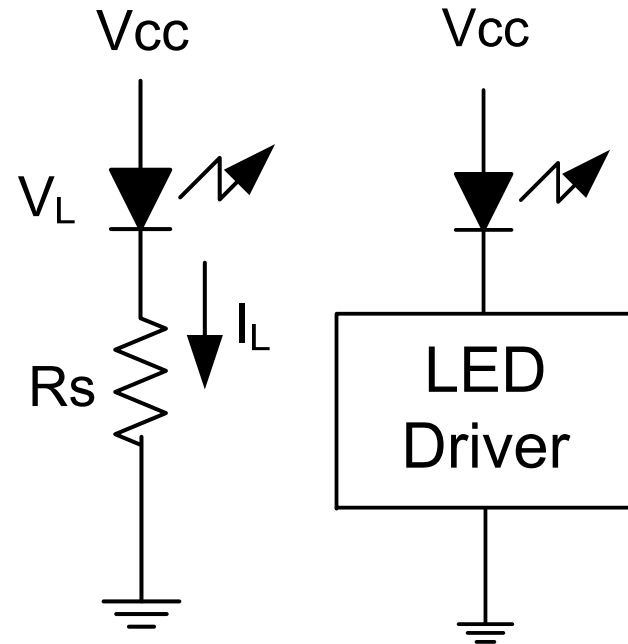 - How can we use the PWM input port for VLC?

Characteristics of LEDs

- LED's are special diodes that emit light.

- Forward Voltage (V_F) drop across LED
  - Diodes are current driven!

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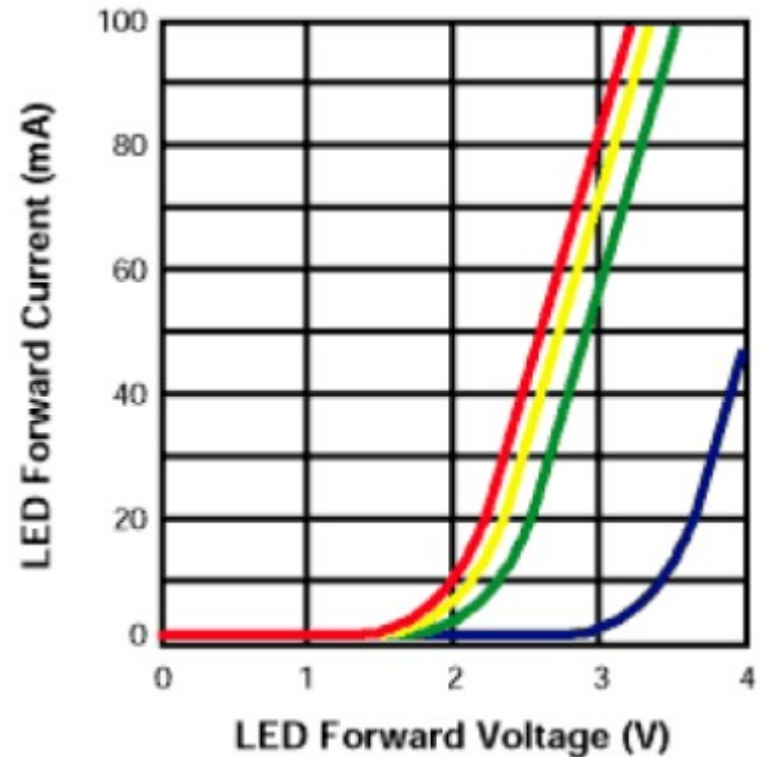
Linear Regulation

- ## Register limiting
  - ### Select $R_s=(V_{cc}-V_L)/I_L$
  - ### In Automotive system
    - 12V system : 6V~42V
    - 24V system : 12~60V

- ## IC with Constant current source
  - ### LED Driver

Vcc   Vcc

V_L

I_L

Rs   LED Driver

Type of LED Drivers

- Are configured as
  - Inductorless LED drivers for LEDs in parallel
  - Inductor based LED drivers for LEDs in series.

- Topologies include
  - Boost regulator LED drivers
  - Buck regulator LED drivers
  - Buck-boost LED drivers and more

- For accurate LED current matching

Topology based LED Drivers

- Step-Up (Boost) LED Drivers
  - generate the high voltages required to drive multiple LEDs in series, ensuring current matching betweens the LEDs.

- Step-Down (Buck) LED Drivers
  - are ideal for applications where the input voltage is above the LED voltage, as in many automotive or industrial applications.

- Buck-Boost LED Drivers
  - allow LED bias when the input voltage is either above or below the LED voltage.

Selection of LED Driver

- LED Driver can support a various types of LED
  - 5mm Lamp : I_F = 30mA
  - SuperFlux HB LED: I_F = 70mA
  - Luxeon Power LED: I_F = 350~1000mA

- High speed switching at LED Driver
  - PWM : 1 ~ 30KHz
 - More high speed switching function is required for VLC, if we want to use

VLC Architecture

VLC Sending Part

VLC Receiving Part
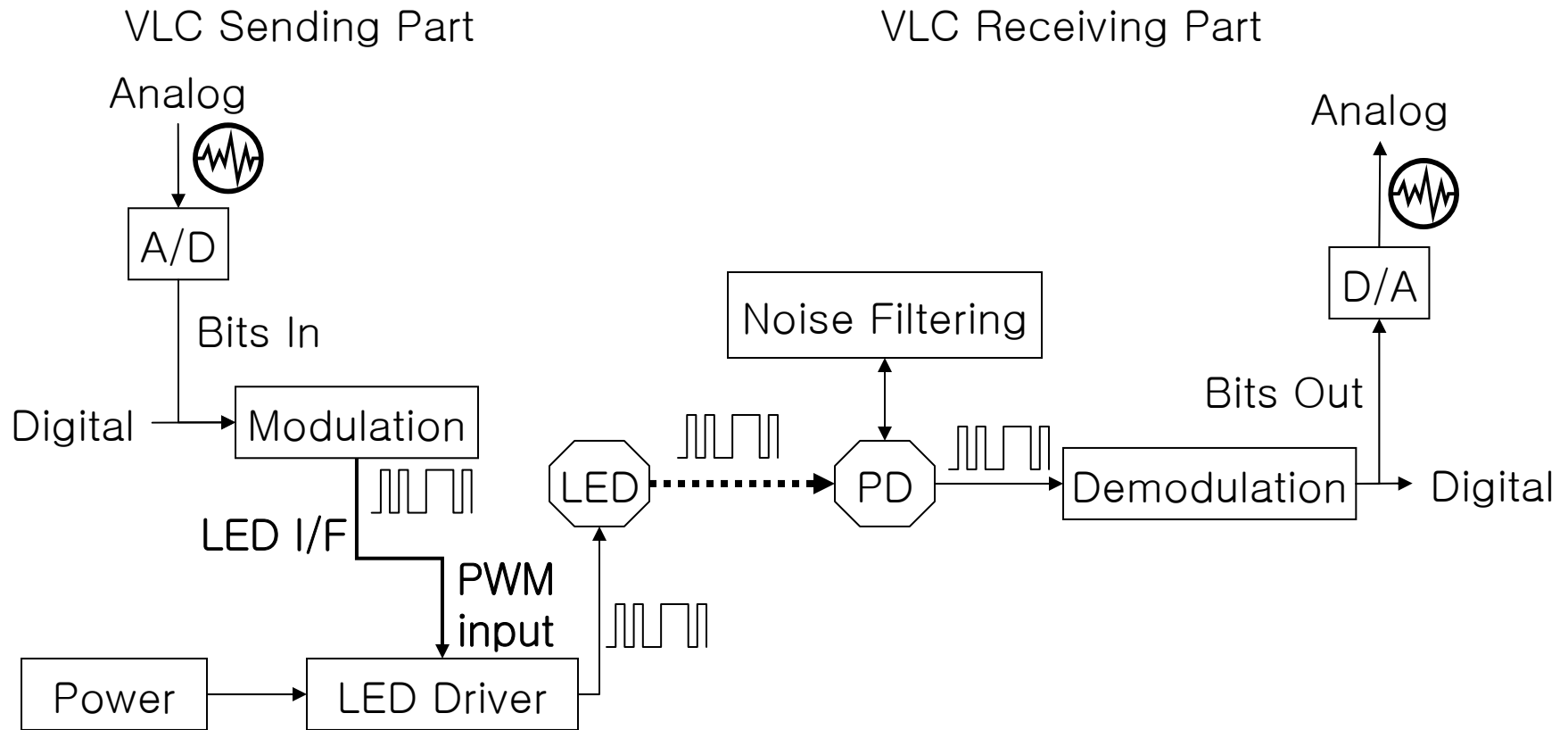
Standard Area before VLC

- ## Traditional Standard
  - MAC, PHY and MAC/PHY Interface
  - PHY and Transmitter interface is a PHY vender dependent

MAC

MAC/PHY Interface

PHY

Transmitter
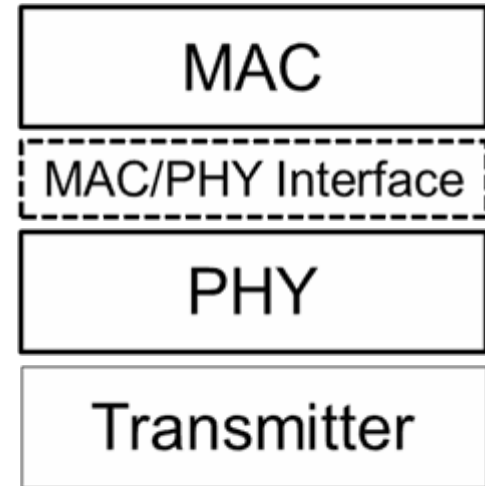
Standard Area for VLC

- For convergence of LED Applications and VLC
  - VLC and Lighting
  - VLC and Automotive
- Especially, High Brightness and High Power LEDs need LED Driver
- Standard is required between PHY and LED driver

MAC
MAC/PHY Interface
PHY
LED Interface
LED Driver
LED
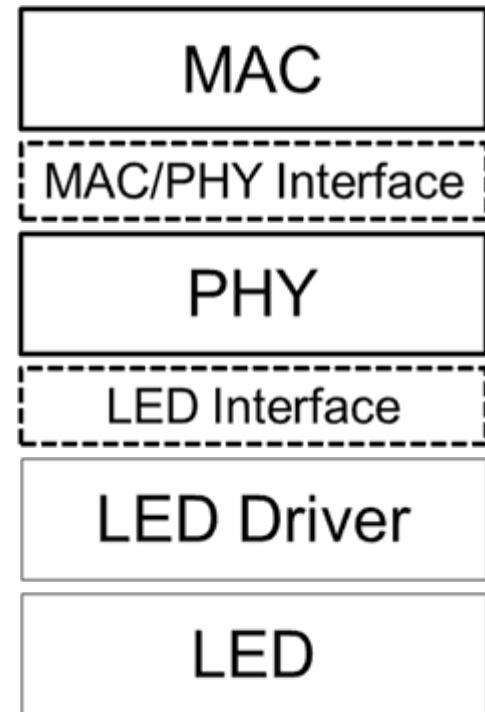
Otherwise?

- PHY can drive LED directly?

- Do we have to make the standard of constant current function for LED driving?

- How can do the one standardized PHY chip cover various types of LED?

MAC

MAC/PHY Interface

PHY

Constant Current Function

LED
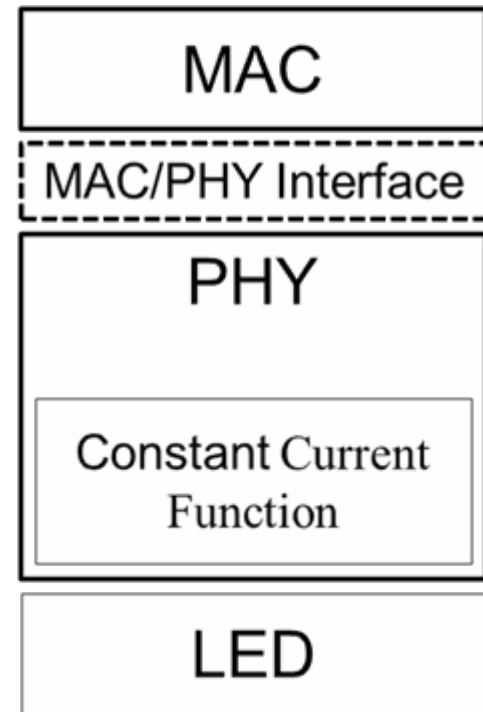
We need the LED Interface for VLC!

- Large Varity of LED
  - current driven.
  - From several mA to 1000mA

- Standardized PHY
  - Line coding, Modulation, …

- How can we connect LED with PHY?

- LED Driver drives the various type of LEDs and connects with PHY through the standardized LED interface.

Next Step

- MAC/PHY considerations for LED driving

- PD related considerations

- Light interference considerations