OLED Integration – Enabling Technologies

January 31, 2018
Introduction

• Our focus is to develop OLED application enabling technologies to accelerate OLED adoption
• Initial product set being developed with support of NYSERDA
• Working in close collaboration with OLEDWorks and their OLED product characteristics
• Other technology products (needs) defined for future development
Market Research – Who Did We Talk To?

- Lighting Designers
- Commercial Property Developer
- Marine Fixture Manufacturer
- Architectural Lighting Fixture Manufacturer
- Film/Photography Location Lighting Manufacturer
- Hospitality Fixture Manufacturer
- Commercial Fixture Manufacturer
- Elevator Manufacturer
- Retail Display Manufacturer
- Museum Lighting Manufacturer
- Lighting Research Center
- Department of Energy
- OLED Panel Substrate Manufacturer (UDC)
- OLED Panel Manufacturer (OLEDWorks)
What did we learn?

• Low voltage (Class 2) Power Distribution scheme will work for most applications (thinner wiring, no conduits, minimal fixture structure, more flexibility)
• Need for small, thin, compact low voltage drivers to be mounted on or in close proximity to OLED panels
• Need for OLED “Module” containing OLED, Driver, Mounting Frame and connection feature (Plug and Play, easy for installers)
• Mounting frame: Light, thin, minimal border, easy to connect OLED to surface
• Panel-to-panel attachment
• Other accessories to mount on tracks (aim OLED panels)
• Accessories must complement “thin”, light-weight OLED characteristics
• Drivers must be dimmable (0-10V, DALI, DMX, Triac)
• Need high efficiency power system/driver
• Need robust electrical interconnects and wiring
• Be able to support multiple panels applications
• Also need for Single and Multi-channel Line voltage drivers
• No consensus on RF (WiFi, ZigBee, other) standards – use off-the-shelf RF controls for now
OLED Products Considered

1. Amber Marker OLED Panel (OLEDWorks)

2. Brite 1 and Brite 2 OLED Panels (OLEDWorks)
OLED Electrical System Configurations

- **Consumer Products**
- **Task Lighting**

- **Commercial or Residential Lighting**
- **Large number of OLEDs separately mounted**
- **Longer wire runs (Need to consider voltage drops)**
- **Class 2 Installation:**
  - Voltage: <60v
  - Power: <100W
  - Current: <8A
OLED Electrical System Configurations (cont.)

- Commercial or Residential Light Fixture with 2 or more OLEDs
- Multi-Channel CC Driver, close to OLEDs (e.g. in fixture, canopy or ceiling)
- Class 2 Fixture Design

- Commercial or Residential Light Fixture with 2 or more OLEDs
- Single Channel CC Driver, close to OLEDs (e.g. in fixture, canopy or ceiling)
- Forward Voltage <60VDC for Class 2
- Forward Voltage >60VDC for Class 1
- OLED Short detection?
OLED Electrical System Configurations (cont.)

- Commercial or Residential Light Fixture with 2 or more OLEDs
- Low voltage Multi-Channel CC Driver, close to OLEDs (e.g. in fixture, canopy or ceiling)
- Class 2 Fixture Design

Diagram:
- CC: <26VDC
- 24-48 VDC
- Dim (0-10V, DMX, DALI)
- 120VAC
- Constant Voltage Power Supply
- Off-the-shelf
0-10V Dimming

• Use 0-10V dimmer that complies with IEC 60929 (e.g. Lutron DVTV supports Class 2)
  – One dimmer can support up to 30mA of current
  – Number of OLED Modules on circuit depends on source current of driver

![Lutron DVT Dimmer and ON/OFF Control](image1.jpg)

![Lutron PP-DV Power Pack for Switching Driver Power](image2.jpg)
Dimmer Wiring (Example)

Lutron DVTV Dimmer
- Slide for Dim
- Paddle for On/Off

Lutron PP-DV Power Pack for Switching Driver Power

Meanwell LPF-60

OLED -
OLED +

Line
Neutral
RF, 0-10V Dimming (Example)

- Lutron RMJS-8T-DV-B Power Pack and RF Receiver
- Meanwell LPF-60 Line Neutral
- Lutron Pico RF Remote
LD0196 Brite-Amber Driver

- Input Voltage: 10-24VDC
- Output Voltage: 5.8 - 21.6VDC (up to 3 panels in series)
- Output Current: 44mA constant current
- Power: 0.29W (nom), 0.33W (max)
- Efficiency: 92%
- 0-10V Dimming (IEC 60929): 10% - 100%
- Dimensions (PCBA): 1.5” x 0.80” x 0.134”
- Reverse Polarity Protection
- Short and Open Circuit Protection
- Spike and Transient Protection
- Operating Temperature: -20 to +50C
- Safety: UL/EN/CSA UL8750, IEC 61347 (CE)
- EMC: EN55022, EN61000-3-2, -3-3, -4-2, -4-3, -4-5, -4-6

In Production
LD0202 Brite-Consumer Driver

- Input Voltage: 24-28VDC
- Output Voltage: 5.8 - 26VDC
- Output Current: 260mA or 368mA constant current
- Power (@260mA): 5.2W (nom), 6.8W (max)
- Efficiency: 92%
- 0-10V Dimming (IEC 60929): 5% - 100%
- Dimensions (PCBA): 1.5” x 0.9” x 0.15”
- OLED Short Circuit Protection
- Reverse Polarity Protection
- Open Circuit Protection
- Spike and Transient Protection
- Operating Temperature: -20 to +50C
- Safety: UL/EN/CSA UL8750, IEC 61347 (CE)
- EMC: EN55022, EN61000-3-2, -3-3, -4-2, -4-3, -4-5, -4-6

In Production
LD0181-03 OLED Line Voltage Driver

- Input Voltage: 90-305VAC, 50/60Hz Universal Input
- Output Voltage: 15-26VDC @ 260mA
- Power: 7W Max
- 0-10V dimming per IEC 60929 (4%-100%)
- OLED short circuit protection
- Operating Temperature: -40 to +75C
- Ingress Protection to IP67
- Complies with emissions requirements of EN 55022; FCC Part 15
- Complies with UL/CSA Product Safety requirements (UL8750 and UL1310 Class 2)

2.7”L x 1.3”W x 1.0”H

In Production
LD0188 Brite-Commercial Driver

- Input Voltage: 24-50VDC
- Output Voltage: 18 - 26VDC
- Output Current: 260mA or 368mA constant current
- Power (@260mA): 5.2W (nom), 6.8W (max)
- Efficiency: 92%
- 0-10V Dimming (IEC 60929): 2% - 100%
- Dimensions (PCBA): 2.34” x 1.0” x 0.135”
- OLED Short Circuit Protection
- Reverse Polarity Protection
- Open Circuit Protection
- Spike and Transient Protection
- Operating Temperature: -20 to +50C
- Safety: UL/EN/CSA UL8750, IEC 61347 (CE)
- EMC: EN55022, EN61000-3-2, -3-3, -4-2, -4-3, -4-5, -4-6

In Qualification Testing
OLED Mounting Accessory

• OLED panels have no inherent methods for mechanical mounting
• OLED panels have electrical interconnect schemes that require supplemental strain relief and connectors
• Today, each user (lighting OEM, lighting designer, end user, etc.) must come up with their own method for securely mounting and electrically connecting these OLED panels (impediment to OLED adoption).
• Today, OLED drivers must be mounted remote to OLED panel
Objectives of Mounting Frame Accessory

• Provide convenient methods to mount OLED panels to flat surface or install in a light fixture
  – Ceiling, wall, shelf, furniture, etc.
• Provide mechanical structural support and protection required of OLED
• Provide durable and flexible electrical interconnect while maintaining thin profile
• Provide means for optional integrated OLED constant current driver
• Support OLEDWorks Brite series:
  – Square and Rectangular panels
  – “Integration Level 1”
Design Considerations

- Low Weight
- Very thin
- Low Cost
- Flexible mounting
- Modularity and scalability
- Minimize stress on OLED
- Ease of installation
- Serviceability
- Thermal management
- Containment of glass in case of breakage
- Electrical wiring routing and strain relief
OLED Frame Design (Square)

- **Mounting frame:**
  - More rigid base
  - Flexible mounting holes
  - Driver ("slide and snap", no hardware) pre-installed
  - Facility wiring can be attached before or after frame mounting

- **Bezel:**
  - Overall border thinner
  - Beveled design
  - OLED Panel preinstalled in Bezel under pre-molded tabs
  - Snaps engage mounting frame
  - Removable
Square Module Dimensions

[Diagram showing the dimensions of a square module with measurements labeled.]
OLED Module Design (Rectangular)
Rectangular Module Dimensions
Installation – Square Module

1. Connect wiring, screw mount to flat surface (wall, ceiling)

2. Connect OLED wires to driver, (push-in)

3. Align Bezel to mounting frame, snap in place
Installation – Rectangular Module

1. Connect wiring, screw mount to flat surface (wall, ceiling)

2. Connect OLED wires to driver, (push-in)

3. Align Bezel to mounting frame, snap in place
Further R&D Required

- Multi-channel Drivers
  - Low Voltage
  - Line Voltage
- Triac Dimmable Line Voltage Driver
- DMX Drivers
  - Low voltage and line voltage
- DALI Drivers
  - Low voltage and line voltage
- Mechanical components for multi-panel integration
- Rail Mounting Components
- Electrical Interconnect devices: Thin, robust
- Power Distribution “Configurator”
- POE
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Thank You!