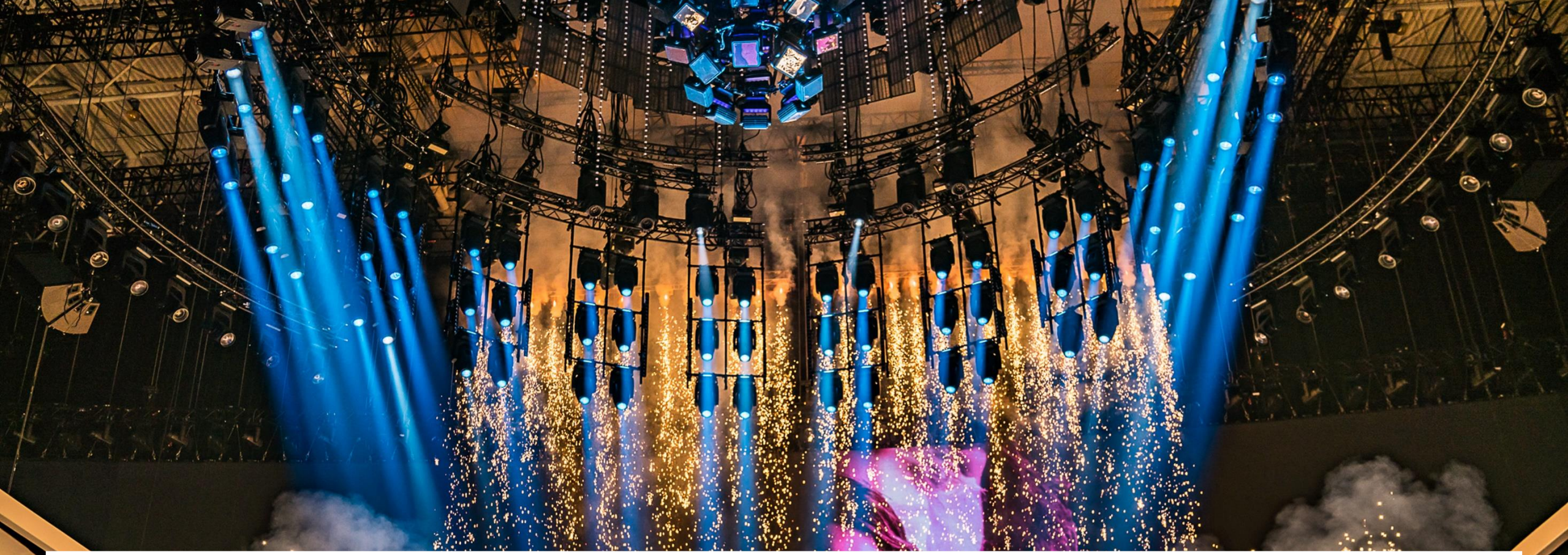

Product Presentation

OSLON® PURE 1010 - Chip-Scale Packages (CSP)

Smallest 1mm² CSP in the market

Light is OSRAM

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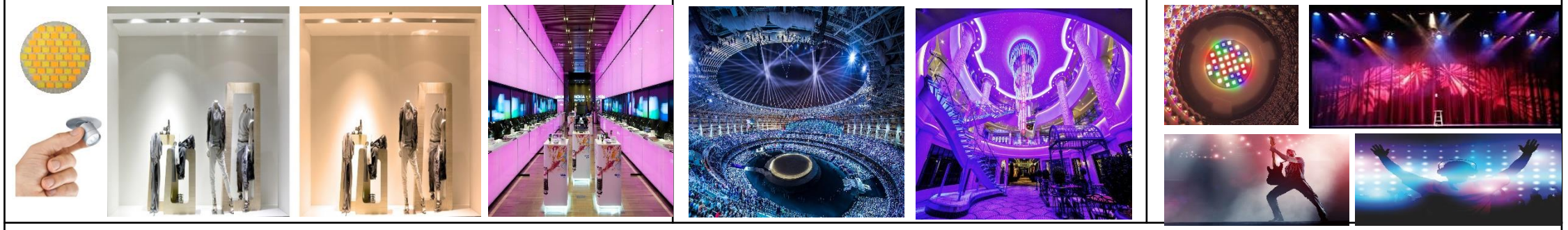
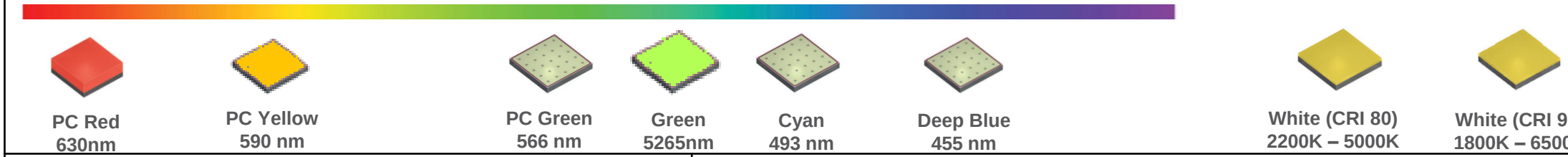
OSLON® Pure 1010 – Chip Scale Package (CSP)

Target applications and products

Indoor / Retail		Special Lighting	
High Density Cluster Spots (White & CCT-tuneable)		Architectural Lighting	Customized Spectra/ Stage Lighting



PRODUCTS:



PC Red 630nm	PC Yellow 590 nm	PC Green 566 nm	Green 5265nm	Cyan 493 nm	Deep Blue 455 nm	White (CRI 80) 2200K – 5000K	White (CRI 90) 1800K – 6500K

KEY FEATURES

- Industry's first "real" chip scale package (1 x 1 mm²)
- Superior and high flux density
- Best in class Color-Over-Angle
- Enables customized very high density clustering
- Offers best Center Beam Candela Power (CBCP) & Cd/W

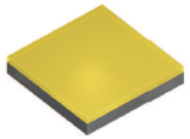
KEY FEATURES

- Industry's first "real" chip scale package (1 x 1 mm²)
- Simple customized high density clustering
- Small LES customized color spectrum feasible – color mixing happens before secondary optics
- Reduction of secondary optics size and costs

OSLON® PURE 1010 White

Overview

1010 LED
1 - 3 W



1.0 x 1.0 x 0.17 mm

Key Messages & Features

- Industry's first "real" chip scale package (1 x 1 mm^2)
- Best in class Color-Over-Angle
- Highly flexible for customized high density clustering
- Perfect for customized arrays in Spot- ,Downlights & color tunable applications

Key Applications

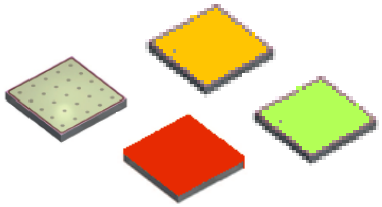
- Narrow Beam Spot Lighting
- Tunable CCT cluster
- Shop Lighting

Type	Min CRI	CCT Range (K)	Binning (mA)	Typ. Vf (V)	Typ. Flux (lm)	Typ. Eff (lm/W)	Product Release
GW VJLPE1.EM	80	2200	350	2.80	**88**	**89**	In Production
		2700			96	98	
		3000			100	102	
		4000			110	113	
		5000			115	118	
GW VJLPE1.CM	90	1800			**55**	**57**	In Production
		2700			76	78	
		3000			84	86	
		3500			88	90	
		4000			95	97	
		5000			101	103	
		6500			**103**	**105**	

OSLON® PURE 1010 Colors

Overview

1010 LED
1-3 W



1.0 x 1.0 x 0.17 mm

Key Messages & Features

- Industry's first "real" chip scale package (1 x 1 mm^2)
- Simple customized high density clustering
- Small LES customized color spectrum feasible – color mixing before secondary optics
- Reduction of secondary optics size and costs

Key Applications

- Studio Lighting
- Architectural Lighting
- Special Spectrum Lighting (e.g. Food)

Type	Ldom (nm)	Binning (mA)	Typ. Vf (V)	Typ. Power (W)	Typ. Flux (lm)	Typ. Eff (lm/W)
PC Red* (GR VJLPE1)	630	700 mA	2.8	2W	43.5	21
Green (GT VJLPE1)	525		2.8		214	108
Deep Blue (GD VJLPE1)	455				31	15
PC Yellow * (GY VJLPE1)	590		2.8		195	98
Cyan (GC VJLPE1)	493		2.8		120	62
PC Green* (GG VJLPE1)	566		2.9		274	131

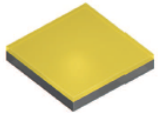
* Phosphor converted

OSLON® PURE 1010

Benefits versus volume emitting CSP

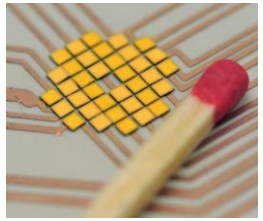
OSLON® Pure 1010

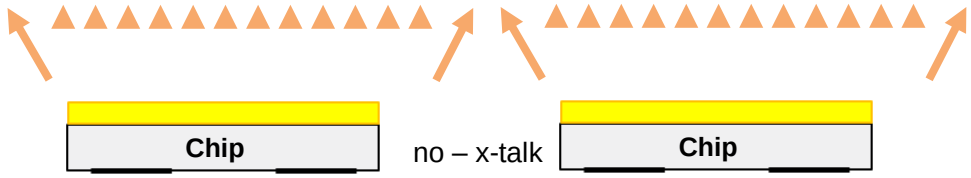
- Surface emitting Flip Chip
- Size: 1.01 x 1.01 x 0.17 mm
- Phosphor Layer on top of chip



Advantages:

- Good light control for 2nd optics design
- No cross-talk when LEDs are densely clustered



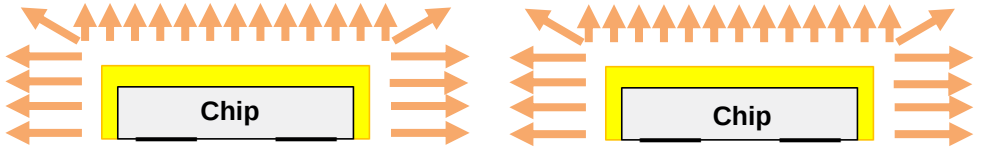


Volume Emitting CSP (Competition)

- Volume emitting Flip chip
- Size: 1.41mm x 1.41mm x 0.41
- Phosphor cover top & sides of chip

Disadvantages:

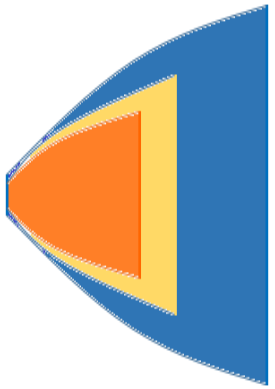
- Poor light control for 2nd optics design
- Light emitted from side is not usable and will cause cross talk / color shift when LEDs are densely clustered

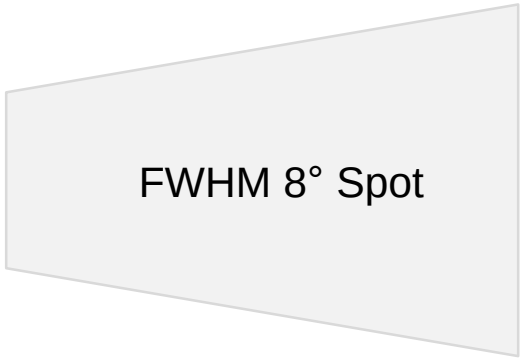


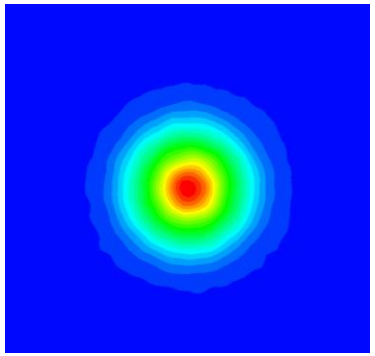
OSLON® PURE 1010 : System Level Benefits

PURE 1010 vs top emitter on optics size

Relative Reflector Size





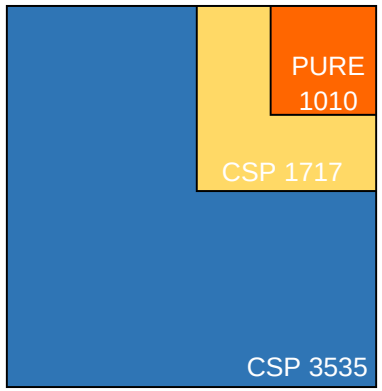


Reflector for 3535

Reflector for PURE 1010

SIZE DOES MATTER !

Relative LED Surface



***Reflector Radius Ratio**
1.0 : 1.4 : 2.3

***Reflector Height Ratio**
1.0 : 1.2 : 2.0

1717 CSP packages require 40% larger reflector radius & 20% larger reflector height.

3535 CSP packages require 230% larger reflector radius & 200% larger reflector height.

*Optical simulation result, normalized at same candela value.

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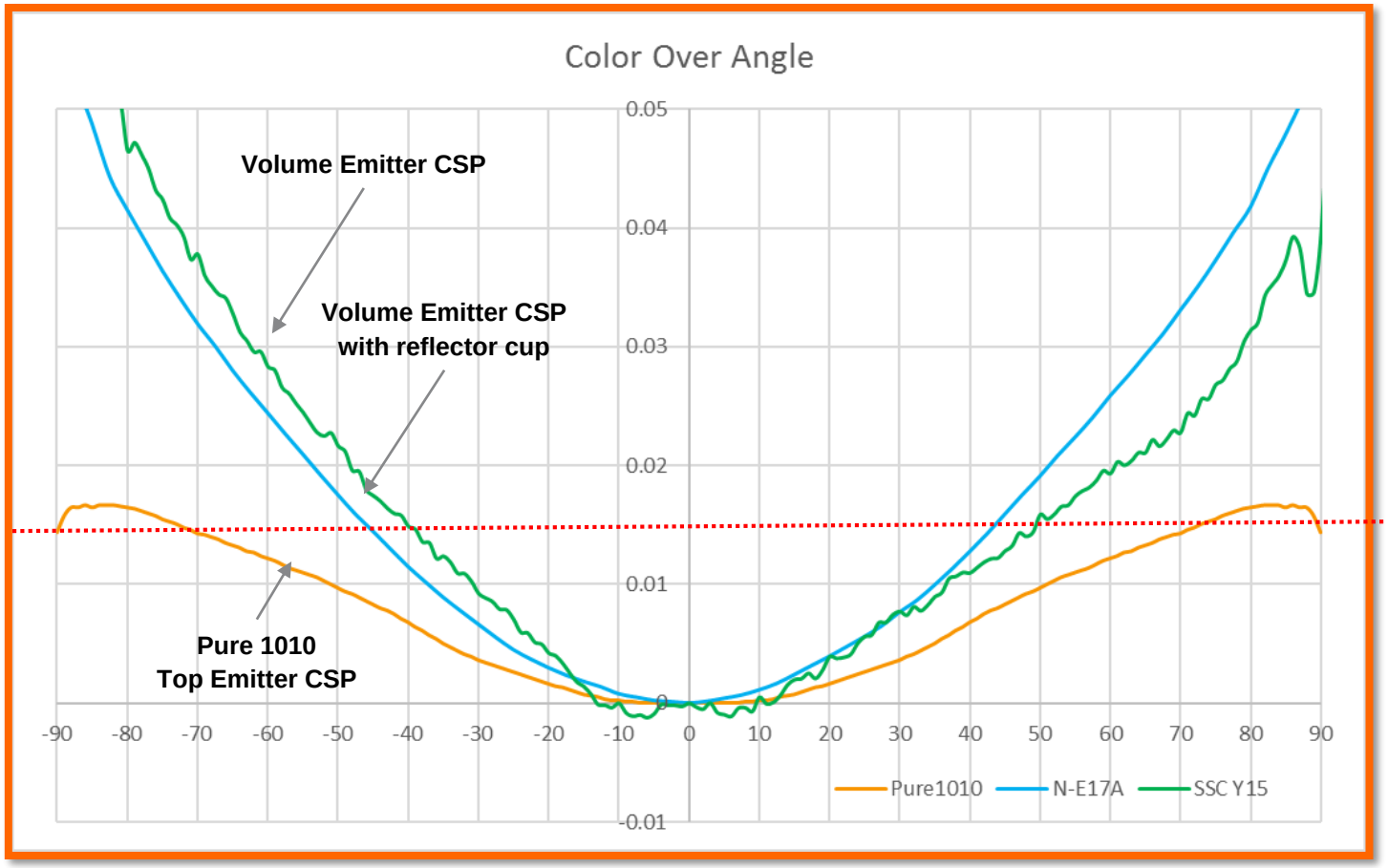
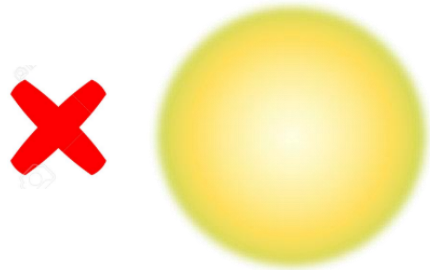
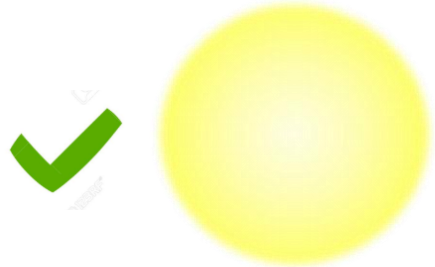
OSLON® PURE 1010 : System Level Benefits

Superior color quality – Color over angle



Poor CoA = Poor Homogeneity Control on Spot application





Good CoA = Good Homogeneity Control on Spot application

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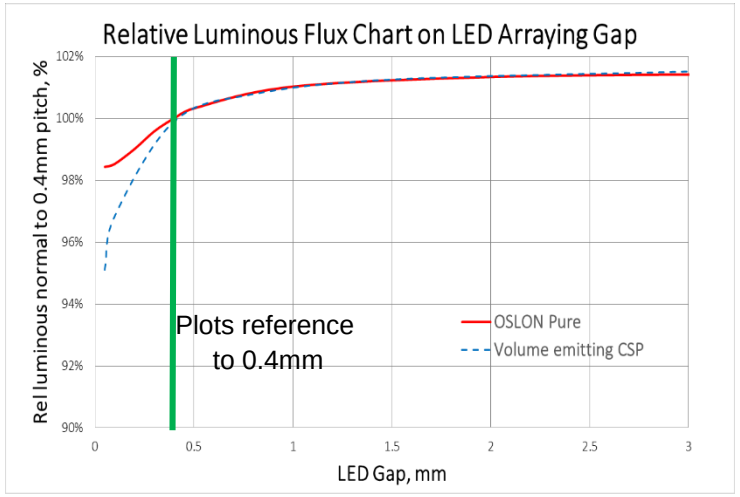
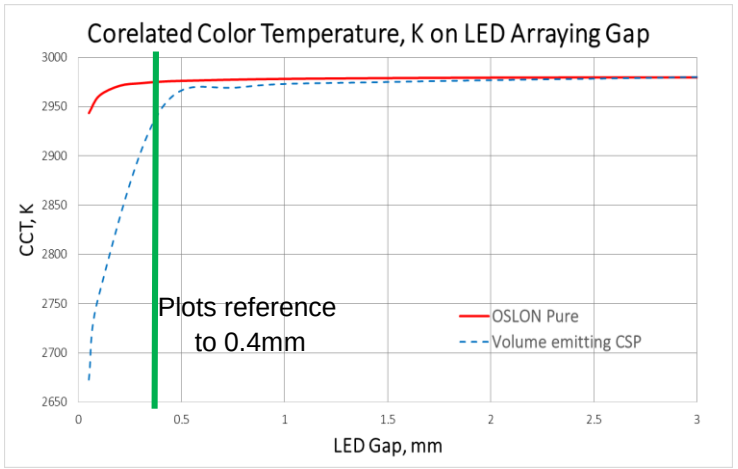
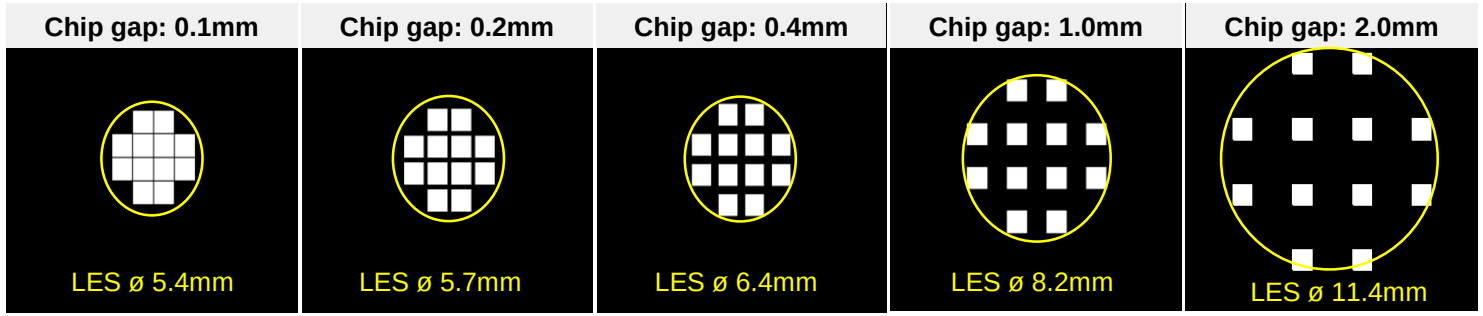
OSLON® PURE 1010 : Small LES without Performance Drop

PURE 1010 vs volume emitters – Clustering comparison







CONCLUSION:

- **Strong efficiency drop in volume-emitters CSP cluster when distance decreased, required highly reflective surface.**
- **OSLON PURE top emitter CSP radiate almost 100% to the top → tight packing possible – Chip to Chip distance <100µm possible**
- **OSLON PURE enables highest LED counts/LES with minimum light recycling → Smaller secondary optics !**
- **OSLON PURE offer minimum color shift <40K even with only 50µm LED gap, whereas volume emitters are >250K.**

OSLON® PURE 1010

Reference design

White Tunable CSP Cluster

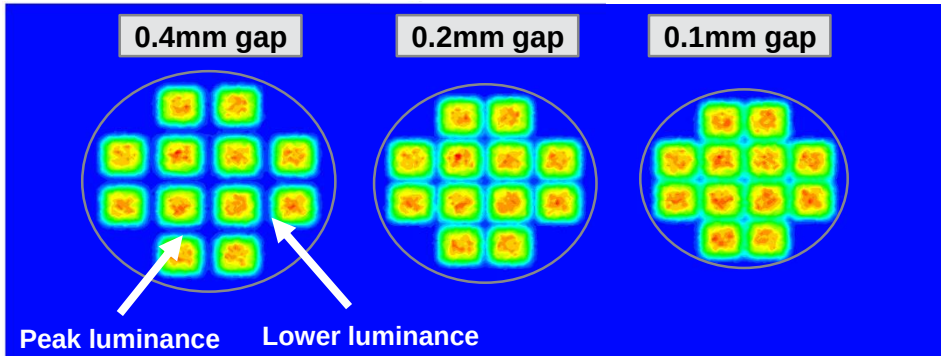
Key Features

- Lack of bond wires and CSP dimensions allow dense clustering type of module design
- Seamless and flexible assembly on boards
- Enables customer specific arrays.

Narrow Beam Spotlight

Key Features

- Small form factor and high luminance enables best-in-class spotlight optical design
- High luminance reduces optical complexity especially on narrow beam angle spots
- Enables lower system costs and slim luminaire designs



Flux Density

Lower

VS

Higher

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