THE PERFECT STREETLAMP: FROM LIGHTING COMPONENTS TO SMART CITY

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ABSTRACT: THE PERFECT STREETLAMP
FROM LIGHTING COMPONENTS TO SMART CITY

Highly efficient, long living LEDs are really a disruptive technology in lighting. However, the vast variety of available components makes the optimal choice a challenge. In this presentation, we will discuss advantages and disadvantages of the different High & Mid Power LED packages, COB and Chip Scale Packages (CSP) for street lighting. Major criteria are efficiency, optics and glare, reliability/outdoor performance, flexibility/maintenance/service, total system cost. Since system’s performance obviously is crucially linked to optics and LED drivers as well, we provide an overview of the available categories of optics and considerations for LED drivers. We address the choice of light spectra, too (Efficiency vs. light pollution, circadian rhythm, glare – also in case of fog).

Besides maximum efficiency, total cost of ownership optimized components, perfect glare-free and well-shaped light patterns, there is much more a street lamp is offering: street lamps are being hooked up the IoT. Thus dimming levels can be set and controlled remotely either manually or by means of artificial intelligence in the cloud: Thus, smart street lights are being dimmed up during times of heavy traffic, but reduced if light pollution needs to be avoided. Big data analysis allows predictive maintenance and remote performance analysis in order to cut down costs.

But this is not the only added value of smart street lamps: they are an infrastructure hub with their power connection and the IoT connectivity and their prominent position is ideal for sensors. Thus we discuss the role of street lamps in smart cities with some example cases. All discussed solutions are available in EBV’s portfolio.
AGENDA

- LED types
- Choice of light spectra
- Optics
- Driver considerations
- Luminaire as Sensor-Hub for Smart City
High Power LEDs currently standard for streetlights
+ Point-Sources → Perfect for Optics
+ High outdoor resistance for surface emitters
+ typical efficiency: 170 lm/W

Optimized cost/performance in high current
Osram OS UX:3 proven technology > 7years in automotive application

Robust vs corrosion
H₂S test 100% lm after 500hrs

Improved 2nd board reliability vs big size ceramic package on solder joint crack issue (Osconiq® P 7070)
VOLUME EMITTERS

Highest chip efficiency ($\leq 220$ lm/W) but for low current
→ e.g. Multi chip packages needed for high lumen output
→ Worse for optics
Volume emitter: Reflector like Ag needed
→ But corrosion issues possible
→ special protective coating

Osram OS proposal

Duris S8 / S10

Volume emitter chip
→ Reflector needed (e.g. Ag)
3030 HIGHEST LM/W SOLUTION (LM301B, LM302C)

World Top Class Flip chip performance & PKG Innovation (SAMSUNG Know-how / IP)

- Key technology #1 – Reflecting Layer quality
- Key technology #2 – PKG Design (SAMSUNG IP)
  - Embedded Mold structure → No Optical Loss
  - Anti-sulfurization technology: No Silver Exposure
    → Sulfurization free
    → 99% lumen maintenance (Competitor: ≤ 94%)

Flip Chip structure

Epi-up type
- more robust (no bonding wires)
- better thermal management

Flip type

Sapphire
N-GaN
N-Electrode
MQL
P-GaN
Reflecting Layer
P-Electrode

Up to 220 lm/W
CSP: CHIP SCALE PACKAGE

3030(MP)/3535(HP) could be replaced with LM101B/LH181B

World Best efficacy in Chip Scale Packages

**MP**
(205lm/W@850)

**HP**
(Free for Sulfurization, 185lm/W@750)

Conventional HP LED emits only from topside

CSP LED type with five light emitting sides (e.g. LH181A)

1st Generation CSP:

CSP LED with scattering side surfaces emits light only from topside (e.g. LH181B)

2nd Generation CSP:

+ point like light source → perfect for optics
+ no Ag-lead frame → no corrosion / sulphorization
+ small package (for cost down)
+ High thermal conductivity (due to Flip Chip)
+ Uniform Spread of electric current (due to Flip Chip)
CHIP ON BOARD (COB)

- No PCB manufacturing needed – Holders with connectors available
- Connectors integrated for easy assembly (Vero SE)
- Special new CRI 70 warm and neutral white
  - Dedicated for outdoor lighting applications
  - 3000 K (≤ 176 lm/W; T_c=25 °C; CRI 70) and
  - 4000 K (≤ 179 lm/W; T_c=25 °C; CRI 70)
- Special color point for HPS replacement:
  - 2000 K CRI 65 (Décor Series: Street and Landmark)
  - Minimize sky glare
CHIP ON BOARD (COB) – SPECIAL COLOR 2000 K, CRI 65

Décor Street & Landmark – Color Point replacement for HPS

- LED direct replacement for HPS applications
- Preserve & accentuate the beauty of historical buildings
- Improve street and neighborhood safety
- Minimize night sky glare
MODULES (ZHAGA BOOK 15 COMPLIANT)

PrevaLED BRICK HP

Standard for street lighting: Module with Highpower LEDs
+ no PCB manufacturing needed
+ standardized module (Zhaga book 15 compliant)
+ compatible to many optics (e.g. from LEDiL)
+ high lifetime (L80 B10): 100,000 h (for $T_c \leq 85 \, ^\circ C$)
  • Typical colors: 3,000 K, 4,000 K in CRI 70 (or CRI 80)
## COMPARISON MATRIX FOR LED TYPES

<table>
<thead>
<tr>
<th></th>
<th>HP</th>
<th>MP</th>
<th>CSP</th>
<th>COB</th>
<th>HP-Modul</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Outdoor Resistance</strong></td>
<td>+</td>
<td>-/+</td>
<td>+</td>
<td>0</td>
<td>+</td>
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<tr>
<td></td>
<td>(special types with protection available)</td>
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<tr>
<td><strong>Lens Compatibility</strong></td>
<td>+ +</td>
<td>-</td>
<td>+ +</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>(Optimal for Lens: High power from Point-source)</td>
<td>(many LEDs → many lenses) best without focusing optics</td>
<td>(Optimal for Lens: High power from Point-source)</td>
<td>(but no point source)</td>
<td>(Zhaga book 15)</td>
</tr>
<tr>
<td><strong>Glare</strong></td>
<td>0</td>
<td>+</td>
<td>0</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td><strong>LED Assembly</strong></td>
<td>-</td>
<td>0</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>(on MC-PCB)</td>
<td>(on PCB)</td>
<td>(on MC-PCB)</td>
<td>No PCB needed</td>
<td>No PCB needed</td>
</tr>
<tr>
<td><strong>max. Efficacy</strong></td>
<td>171 lm/W</td>
<td>220 lm/W</td>
<td>185 lm/W</td>
<td>176 lm/W</td>
<td>159 lm/W</td>
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<tr>
<td><strong>Cost: LEDs + Optics</strong></td>
<td>0</td>
<td>+</td>
<td>+</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td><strong>Examples of Typical Products</strong></td>
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<tr>
<td><strong>Efficiency</strong></td>
<td>Osram OSLON Square</td>
<td>Samsung LM561C</td>
<td>Samsung LH181B</td>
<td>Bridgelux / Samsung</td>
<td>Osram / Samsung</td>
</tr>
<tr>
<td><strong>Cost optimized</strong></td>
<td>Osram Osconiq P3737 / P7070 ; (Duris S8/S10)</td>
<td>Samsung LM281 Osram Duris S5+</td>
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</tbody>
</table>
COLOR CONSIDERATIONS

CRI – color rendering traditionally no big issue for street lighting.  
→ CRI70 preferred to reach maximum efficiency

CCT:
Light scattering strongly depends on wavelength (light color):
  Blue light about 10 x more scattered than red light
→ high glare at fog and dust for cold white

Circadian rhythm (humans, environment)
→ in residential areas at least warm white recommended
OPTICS FOR STREETLIGHT

- Polar graphs
- Area lighting classifications and examples
- General considerations on street lighting lenses
PHOTOMETRICS (POLAR GRAPH) – HOW TO READ?

Based on IES-files. IESNA files are read other way around.

Indoor:
- C0-180 (longitudinal) – along the corridor
- C90-270 (transversal) – across the corridor

Street:
- C0-180 (longitudinal) – along the road
- C90-270 (transversal) – across the road
AREA LIGHTING CLASSIFICATIONS

<table>
<thead>
<tr>
<th>IESNA types vs road width vs mounting height</th>
<th>Mounting types</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>One side mounting</td>
</tr>
<tr>
<td></td>
<td>Both side mounting</td>
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<tr>
<td>Type I (symmetrical)</td>
<td>Roadways up to 2 times MH in width</td>
</tr>
<tr>
<td>Type II</td>
<td>Up to 1 times MH</td>
</tr>
<tr>
<td></td>
<td>Up to 2 times MH</td>
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<tr>
<td>Type III</td>
<td>Up to 1.5 times MH</td>
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<td></td>
<td>Up to 3 times MH</td>
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<tr>
<td>Type IV</td>
<td>Up to 2 times MH</td>
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<tr>
<td></td>
<td>Up to 4 times MH</td>
</tr>
<tr>
<td>Type V (symmetrical)</td>
<td>Up to 4 times MH in total width</td>
</tr>
</tbody>
</table>
AREA LIGHTING CLASSIFICATIONS

TYPE 1

TYPE 2

TYPE 3

TYPE 4

TYPE 5

AREA LIGHTING CLASSIFICATIONS

CONTINUITY INNOVATION
IESNA Type classification is established by measuring where the bulk of the pattern falls on the grid.

- 10% intensity cut off
- Type 50% intensity
- MAX candela peak reach

IESNA type is defined by position of highest candela intensity.
<table>
<thead>
<tr>
<th>BEAMS</th>
<th>POLARITY</th>
<th>DESCRIPTION</th>
<th>STRADA-SQ</th>
<th>STRADA-2X</th>
<th>STRADA-2X2CS</th>
<th>STRADA-IP-2X6</th>
<th>STRADA-2X2MX</th>
<th>STRADA-2X2MXS</th>
<th>STRADE LLA</th>
<th>STRADE LLA-8/9</th>
<th>STRADE LLA-IP-28</th>
<th>STELLA</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td></td>
<td>Symmetric IESNA Type I (medium) beam for narrow roads and paths with long pole distance and tilted armature</td>
<td></td>
<td>x</td>
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<tr>
<td>T1-A</td>
<td></td>
<td>Asymmetric IESNA Type I (short) beam. Results a Type II beam with tilted poles. Targeted for Indian market.</td>
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<td></td>
<td></td>
<td>x x</td>
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<tr>
<td>T2</td>
<td></td>
<td>IESNA Type II (medium) beam, applicable for European P-class standard pedestrian lighting and M-class roads.</td>
<td>x x x x x x x x x</td>
<td>x</td>
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<tr>
<td>T2-C</td>
<td></td>
<td>IESNA Type II (medium) beam with added house side backlight. Designed for tilted and long armatures</td>
<td>x</td>
<td>x (90deg turned version)</td>
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<tr>
<td>T2-B</td>
<td></td>
<td>IESNA Type II (medium) with minimized house side backlight.</td>
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<td>x</td>
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<tr>
<td>T2-L</td>
<td></td>
<td>IESNA Type II Medium resulting great illuminance uniformity with extra wide pole spacings up to 8x mounting height. Suitable for European P-classes and path way lighting.</td>
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<td>x</td>
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<tr>
<td>T2-M</td>
<td></td>
<td>IESNA Type II Medium beam with excellent back light control, illuminance uniformity and cutoff.</td>
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<td>x</td>
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<tr>
<td>T2-S</td>
<td></td>
<td>IESNA Type II (short) beam perfect for high or dense pole setups and European ME roads. Ideal for the US car dealership front row lighting.</td>
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<td>x</td>
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<tr>
<td>T3</td>
<td></td>
<td>IESNA Type III (medium) beam for roads that are equal or wider than mounting height.</td>
<td>x x x x x x x x x x</td>
<td>x</td>
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<tr>
<td>T3-B</td>
<td></td>
<td>IESNA Type III (medium) beam with minimized backlight</td>
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<td></td>
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<td>x</td>
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<tr>
<td>T4</td>
<td></td>
<td>IESNA Type IV for wider roads and area lighting like parking lots and yards.</td>
<td>x (+NP) x</td>
<td>x</td>
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<tr>
<td>T4-B</td>
<td></td>
<td>Wide IESNA Type IV beam with forward-throw beam for wide area lighting like parking lots.</td>
<td>x x x x x x x x x x</td>
<td>x</td>
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<tr>
<td>VSM (T5)</td>
<td></td>
<td>IESNA Type V (square) beam for wide areas such as parking lots.</td>
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<td></td>
<td></td>
<td>x x</td>
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<tr>
<td>T3-B</td>
<td></td>
<td>IESNA Type III (medium) beam with minimized backlight</td>
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<td></td>
<td></td>
<td>x</td>
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</tr>
<tr>
<td>T4-B</td>
<td></td>
<td>Wide IESNA Type IV beam with forward-throw beam for wide area lighting like parking lots.</td>
<td>x x x x x x x x x x</td>
<td>x</td>
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<tr>
<td>VSM (T5)</td>
<td></td>
<td>IESNA Type V (square) beam for wide areas such as parking lots.</td>
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<td></td>
<td></td>
<td>x x x x</td>
<td>x x x x x x</td>
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<tr>
<td>A-T</td>
<td></td>
<td>Short IESNA Type II beam for narrow roads or high poles with extremely low glare.</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>x x x x</td>
<td>x x x x x x</td>
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<tr>
<td>ANZ-P</td>
<td></td>
<td>Beam for pedestrian lighting (P4 &amp; P5) in Australia and New Zealand.</td>
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<td></td>
<td></td>
<td>x</td>
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<tr>
<td>ANZ-V</td>
<td></td>
<td>Beam for vehicular road lighting (AS/NSZ V3) in Australia and New Zealand. Version with location pins. Assembly with installation tape.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
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</tr>
<tr>
<td>BEAMS</td>
<td>POLAR</td>
<td>DESCRIPTION</td>
<td>STRADA-SQ</td>
<td>STRADA-2X2</td>
<td>STRADA-2X2CSP</td>
<td>STRADA-IP-2X6</td>
<td>STRADA-2X2MX</td>
<td>STRADA-2X2MXS</td>
<td>STRADELL A</td>
<td>STRADELL A-8/9</td>
<td>STELLA</td>
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</tr>
<tr>
<td>DWC/DWC</td>
<td></td>
<td>Universal road lighting beam with excellent mixed illuminance and luminance uniformity. (Typically IESNA Type III Medium)</td>
<td>x</td>
<td>x</td>
<td></td>
<td>x (+90 deg turned version)</td>
<td>x</td>
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<tr>
<td>DWC2</td>
<td></td>
<td>Universal road lighting beam with excellent mixed illuminance and luminance uniformity. (Typically IESNA Type II Medium)</td>
<td></td>
<td></td>
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<td>x</td>
<td></td>
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<td></td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>DNW</td>
<td></td>
<td>Soft wide beam with good illuminance uniformity.</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>x</td>
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</tr>
<tr>
<td>T-DW</td>
<td></td>
<td>Soft wide beam with good illuminance uniformity.</td>
<td></td>
<td></td>
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<td>x</td>
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</tr>
<tr>
<td>FW</td>
<td></td>
<td>Beam with wide light distribution and good illuminance uniformity for residential street lighting &amp; staggered pole setups.</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
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</tr>
<tr>
<td>NHS</td>
<td></td>
<td>Narrow beam with minimal house side backlight.</td>
<td></td>
<td></td>
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<td></td>
<td>x</td>
<td></td>
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</tr>
<tr>
<td>SCL</td>
<td></td>
<td>Type II/III (Long) beam for very wide pole to pole distances. Ideal for pedestrian paths and residential roads. (EN13201 P-classes)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
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</tr>
<tr>
<td>PX</td>
<td></td>
<td>Double asymmetric beam designed to highlight pedestrian crossings for right side traffic.</td>
<td>x</td>
<td>x</td>
<td></td>
<td>x</td>
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<tr>
<td>PXL</td>
<td></td>
<td>Double asymmetric beam designed to highlight pedestrian crossings for left side traffic.</td>
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<tr>
<td>ME</td>
<td></td>
<td>Beam with excellent longitudinal luminance uniformity fulfilling EN13201 M-class requirements where road width is equal or less the pole height.</td>
<td>x (+NP)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td>x</td>
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<tr>
<td>ME-N</td>
<td></td>
<td>Beam designed for high poles and fulfilling EN13201 M-class requirements where road width is less than the pole height.</td>
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<td></td>
<td></td>
<td>x</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>ME-WIDE1</td>
<td></td>
<td>Beam with excellent longitudinal luminance uniformity fulfilling EN13201 M-class requirements where road width is equal to or less than the pole height. Added house-side backlight.</td>
<td></td>
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<td></td>
<td></td>
<td>x</td>
<td></td>
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<tr>
<td>ME-WIDE2</td>
<td></td>
<td>Beam with excellent longitudinal luminance uniformity for staggered pole setups fulfilling EN13201 M-class requirements where road width is equal to or less than the pole height</td>
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<td></td>
<td></td>
<td>x</td>
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<td></td>
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<tr>
<td>MEW</td>
<td></td>
<td>Beam with extremely low glare fulfilling EN13201 M-class requirements for wet road surfaces in North Europe</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
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<td>BEAMS</td>
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<td>DESCRIPTION</td>
<td>STRADA-SQ</td>
<td>STRADA-2X2</td>
<td>STRADA-2X2CSP</td>
<td>STRADA-IP-2X6</td>
<td>STRADA-2X2MX</td>
<td>STRADELLA</td>
<td>STRADELLA-8/9</td>
<td>STELLA</td>
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<tr>
<td>FN</td>
<td></td>
<td>Narrow forward throw beam for area lighting. Excellent for lighting stadiums and airport fields.</td>
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<tr>
<td>FT</td>
<td></td>
<td>Forward throw beam for area lighting.</td>
<td>x</td>
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<tr>
<td>FS</td>
<td></td>
<td>Forward throw beam for area lighting.</td>
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<td>x</td>
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<tr>
<td>FS3</td>
<td></td>
<td>Forward throw beam optimized for European tunnels, resulting extremely efficient lighting with counter-beam method.</td>
<td>x</td>
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<tr>
<td>FR</td>
<td></td>
<td>Asymmetric spotlight beam for floodlighting railway tracks according to Russian normative</td>
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<tr>
<td>TF</td>
<td></td>
<td>Narrow forward throw beam optimized for European tunnels.</td>
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<tr>
<td>FS2</td>
<td></td>
<td>Beam for symmetrical tunnel lighting and parking garages. Ideal for catenary street lighting.</td>
<td>x</td>
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<tr>
<td>C</td>
<td></td>
<td>Beam for area and street lighting such as parks and pedestrian walkways.</td>
<td>x</td>
<td>x</td>
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<tr>
<td>CY</td>
<td></td>
<td>Beam for canopy lighting with batwing light distribution. Suitable for symmetrical tunnel lighting.</td>
<td>x</td>
<td>x</td>
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<tr>
<td>CAT</td>
<td></td>
<td>Caternary street light beam optimized for EN13201 M-classes.</td>
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<tr>
<td>CAT-B</td>
<td></td>
<td>Narrow caternary street light beam optimized for EN13201 M-classes and tilted poles</td>
<td></td>
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<td></td>
<td></td>
<td>x</td>
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<tr>
<td>B2</td>
<td></td>
<td>Beam for area lighting and applications demanding a wide oval beam pattern</td>
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<tr>
<td>DN/T-DN</td>
<td></td>
<td>Beam for area lighting with shorter illumination distances</td>
<td>x</td>
<td>x</td>
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</tr>
</tbody>
</table>
OPTICS FOR STREETLIGHT

+ Efficiency: typically >92 % light output efficiency
+ Good optics with perfect light guidance
  - avoid glare
  - avoid light pollution
+ provide high uniformity
+ Robust materials for high lifetime and all weather conditions (including UV)
+ high flexibility:
  + various lenses for multiple applications and streetlight classifications
  + one lens type – many array options
LED DRIVER CONSIDERATIONS

- SELV driver (compared to NON-SELV drivers)
  - + lower housing issues
  - - lower efficiencies
- Programming:
  - + NFC programming available
  - + Various parameters (lumen maintenance,...)
- Flicker free
- Dimming options
- Smart city connectivity
EXAMPLE: OSRAM OPTOTRONIC® OUTDOOR 1DIM IP67

- Enlarged Guarantee: IP 67 protected
- Wide temperature area: Ta: -40...+55°C
- 100, 150 and 200W for luminaires: Up to 30k lm
- Efficiency: Up to 93%
- 100kh lifetime: @ Tcmax-15°C
- Constant Lumen Function: Improved LLMF
- Programming via NFC
- High Lighting Quality, flickerfree: for machines/scanners
- Surge protection up to 4kV
- Inrush current limiter
- AstroDIM/ON-OFF
- 100, 150 and 200W for luminaires
- Up to 30k lm

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- 100, 150 and 200W for luminaires
- Up to 30k lm
EXAMPLE: OSRAM OPTOTRONIC OUTDOOR PORTFOLIO

<table>
<thead>
<tr>
<th>Output current</th>
<th>Output voltage</th>
<th>Size</th>
<th>1DIM NFC</th>
<th>4DIM NFC</th>
</tr>
</thead>
<tbody>
<tr>
<td>22W</td>
<td>200 – 1050mA</td>
<td>10 – 38V</td>
<td>123 x 79 x 33mm</td>
<td></td>
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<tr>
<td>40W</td>
<td>200 – 1050mA</td>
<td>20 – 56V</td>
<td>123 x 79 x 33mm</td>
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<tr>
<td>75W</td>
<td>200 – 1050mA</td>
<td>35 – 115V</td>
<td>133 x 77 x 40mm</td>
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<tr>
<td>110W</td>
<td>200 – 1050mA</td>
<td>80 – 220V</td>
<td>150 x 90 x 40mm</td>
<td></td>
</tr>
</tbody>
</table>

- Same form factors and electrical characterization for 1DIM and 4DIM
- Easy switching between 1DIM and 4DIM depending on project requirements without full luminaire certification effort

- AstroDIM
- StepDIM
- MainsDIM
- DALI2
OSRAM OPTOTRONIC® OUTDOOR LED DRIVERS
ZHAGA BOOK 18 SOCKET + DEXAL INTERFACE

Standardized interface enabling easy luminaire connectivity

Connectivity driver
Zhaga socket

• Standardized and open DEXAL interface (based on DALI2)
• Integrated power supply for controllers and sensors (24V, 3W)
• Extended valuable data, first step to enable new business cases
• Diagnostic information

Partners in der market supporting this concept (examples):

In preparation:

Zhaga book 18 socket advantages:
+ Easy change between IoT-connectivity protocols in exchanging connectivity module
+ Open for new protocols and changes in LPWAN networks
+ Requested by Municipalities
+ Socket for Connectivity and Sensors
USE CASES: SMART STREETLIGHTING / SMART CITY

Public image of city: green, up-do-date / trendy,...

Preventive maintenance / automated service notifications → up to 42 % maintenance cost reduction

Automatic diming: Energy saving (e.g. 30% additional saving), Light pollution avoiding (Dependant on Schedule, Presence, Traffic,...)

Uses power grid for other applications:

   Grid constant on - Lamp smart switched

   E-charging: Cars, bicycles, drones
   Sensors: Weather, Pollution, Parking, Traffic (C2X/V2X), Crime/safety,...
   Public WiFi,
   Advertising
   ...


BUSINESS CASE: SMART STREETLIGHTING

FINANCIAL & BUSINESS CASE

FAST, ECONOMIC IMPLEMENTATION with SIGNIFICANT SAVINGS & INCOME POSSIBILITIES

- Plug & Play Adaptable to existing street lighting infrastructure
- Scalable & immediately operable
- Up to 80% energy savings
- Up to 42% maintenance cost reduction
- Additional incomes
- ESCo financing compatible
CONNECTIVITY MODULES FOR INTEGRATION

IoT-Connectivity Options:
LoRaWAN, Sigfox, NB-IoT, LTE-M, LonWorks PLC, ...

Zhaga Book 18 compliant socket → in preparation for 2019

https://www.zhagastandard.org/books/book18/

products available for each use case
INTELLILIGHT SMART STREET LIGHTING MANAGEMENT PLATFORM

IoT-Connectivity Options: LORA, Sigfox, NB-IoT, LTE-M, LonWorks PLC, ...

Environmental Sensors to be Implemented Soon: T, Hum., NOx, CO2, O3, VoC, SOx, CH4, Noise, Particle, ...

intellILIGHT® is a street lighting remote management system that enables automatic ON/OFF and dimming control of every street lighting fixture in the city. It provides in-depth grid awareness and real-time feedback of any change occurring along the grid.
• **Individual lamp management:** switching ON/OFF and dimming the streetlights

• **Electrical parameters monitoring:** Wh, VARh, V, W, A, VAR, PF and frequency

• **Management software:** SaaS or fully licensed solution, depending on requirements

• **Smart city platform:** optional sensors (motion, parking, noise, environment etc.) & **open protocols** for integrating with existing and future city systems.
SUMMARY

Parameters for choice of light source:
- Outdoor resistance
- Manufacturing (PCB needed or not)
- Lens considerations (broad light source versus point source)

Light spectra: CRI 70 3000K and 4000K typical, trend to warm white

Lenses:
- Area light classifications
- Various choices of lens type and lens arrays
  - Whether resistant materials available

More and more intelligent LED-Drivers for professional installations

Smart Lighting
- Preventive Maintenance
- New business cases for existing streetlight grid...
Publisher

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LED EVENT 2018
Ontwerp, toepassingen en techniek

CONGRESCENTRUM 1931
‘S HERTOGENBOSCH
WOENSDAG 28 NOVEMBER 2018