

Power LEDs for Infrared Surveillance & Vision: Where to go – how to get there?

Gerrit-Willem Prins | November 2019 | Moscow Light is OSRAM





Content

		Page
1.	Company introduction OSRAM / LED Engin	3
2.	Challenges in selecting LEDs for Machine Vision	8
3.	Choices in selecting LEDs: classics and customs	19
4.	Application examples, Demo's, Q&A	24



Company Introduction OSRAM / LED Engin

The new OSRAM: From Illumination to Photonics

Overview LED Engin

Business approach OSRAM and LED Engin



The New OSRAM: From Illumination to Photonics



Previous focus | Illumination Emission of light

Photonics | Enabling new applications Illumination, Sensing, Visualization, Treatment



Overview LED Engin

LED Engin, Inc. develops, manufactures, and sells advanced LED emitters, optics and light source modules in a unique, high-lumen density, compact, multi-die package.

LED Engin was acquired by OSRAM July 2017 and resides under OSRAM Opto Semiconductors



Key differentiation factors

- Patented compact high-power density multi-layer package for single and multi-die products
- Patented optics
- Broad range of product offerings to include custom solutions
- Industry leading tunable white light engine LuxiTune[™]



Business approach OSRAM and LED Engin



OSRAM is a leader in chips and packaged LEDs with focus on highperforming, professional applications by offering a solid range of highly reliable LED standards.

LED Engin offers top-of-the-bill packaged LEDS with focus on highperforming, professional beam applications by offering a range of super reliable, very compact standard LEDs and customized LEDs.

USPs LED Engin

Revolutionary packaging technology

No compromises to reliability

- Patented multi-die, high power density ceramic substrate
- Excellent heat management
- Multi-channel options with excellent colour mixing
- Low barrier to custom parts



Content

		Page
1.	Company introduction OSRAM / LED Engin	3
2.	Challenges in selecting LEDs for Machine Vision	8
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Human eye versus cameras – spectral sensitivity



Lighting LEDs are not optimal for camera vision





Lighting LEDs are not optimal for camera vision: configure your optimal LED for high S/N performance





Human eye versus cameras – detection

Machine Vision: Food Inspection



Machine Vision: Consumer Inspection



Machine Vision: Food Inspection





Lamps versus LEDs





Full spectrum Filters Reflectors / lenses

Single source Determined by lamp Fragile

Single channel Robust

Lamp weakest link

Optical:

- spectral building blocks
- electronic colour channels
- lenses

Mechanical:

- single-multi source
- determined by heat
- Robust

Electrical:

- single-multi channel
- Fragile

Reliability:

Electronics weakest link

Flexibility:

-

- Highly standardised lamps
- Very few offerings/brands
- Standards & Customised









Radiant power

Compactness / radiation density Life time reliability / stability Heat management Standard / custom





Radiant power Compactness / radiation density Life time reliability / stability Heat management Standard / custom





Compactness

- Beam definition
- Narrow beam
- Sharp cut-off
- More radiation on target
 - Lux
 - W/cm2



Radiant power Compactness / radiation density Life time reliability / stability

Heat management Standard / custom





Life time

- Defects
- Lumen maintenance

Test	Test Conditions
Lumen Maintenance Test	I _F =700mA; T _C =45C; Tj=80C

TM-21 Exponential Lifetime Prediction

%	Lifetime	Lifetime	Lifetime	Lifetime	
from	(hrs)	(hrs)	(hrs)	(hrs)	
t0	Red	Green	Blue	White	
70	>20,000	>20,000	>20,000	>20,000	



Radiant power Compactness / radiation density Life time reliability / stability **Glass lens** Heat management Standard / custom Heat management $\mathsf{R}_{\mathsf{j-b}}$ 10C higher Tj: 50% R_{TI} shorter life >50% of input power to - $\mathsf{R}_{\mathsf{spreading}}$ be heat dissipated $\mathsf{H}_{\mathsf{hs-amb}}$ Size, airflow, LED-module



Radiant power Compactness / radiation density Life time reliability / stability Heat management Standard / custom



Select die color by pull-down menu at the die location.



Customised configuration:

- 4-die up to 25-die
- Wide choice of colours
- Design your own

Content

		Page
1.	Company introduction OSRAM / LED Engin	3
2.	Challenges for LED sources in Entertainment	8
3.	Choices in selecting LEDs: classics and customs	19
4.	Application examples, Demo's, Q&A	26



Classics





Classics



LuxiGen Emitters

-		3			Kan and a second	K	ALL P
		LZ1	LZ4	LZ7	LZ9	LZC	LZP
ation	Number of die	1	4	7	9	12	24 or 25
orm	Dimensions L x W , mm	4.4 x 4.4	7.0 x 7.0	7.0 x 7.0	7.0 x 7.0	9.0 x 9.0	12.0 x 12.0
x Inf	Nominal Drive Current mA	1000	700	700	700	700	700
oqnc	Maximum Drive Current mA	1500	3000	850-1500	800	1200	1200
Ĕ	Thermal Resistance °C/W	6.0 4.2 for UV/DB	0.9	1.4	1.3	0.7	0.5
	White (CCT): 2700K, 3000K, 5500K, 6500K	4	1		-	4	4
	Direct Colors: Red, Green, Blue, Amber	-		contact factory	contact factory	-	
	Multi-color: RGB, RGBA, RGBW	NA	-		NA	-	-
_	RGBW-Cyan-Amber-Violet	NA	NA	-	NA	NA	NA
	Specialty wavelengths (λ_P):	NEW: 1050nm					
ing	Deep Red (660nm), Far Red (740nm), Infrared (850nm, 940nm)	1	1	contact factory	contact factory	contact factory	contact factory
offer	Dental Blue (460nm)	-	-		-		
SCT	UV (λ _P):						
or / (Violet (385 - 410nm)	4	-	NA	NA	-	-
ပိ	UVA (365nm)	4	1	NA	NA	NA	NA



Next to 'classics': 'customs'

Customisation directions:		LQ1	
- Reeling:			
 Exact quantity per reel (e.g. mull 	ltitudes of 90)		
 Reeling custom bin sequence 			LQ4
- Configuration:			
 Custom die configuration on 4-c 	lie to 25-die platform		
 Custom binning (flux, wavelength) 	th)		LQ7
- Reeling custom bin sequence		200	
- PC Spectrum:			
- Custom spectrum: phosphor de	velopment & gualification	CEED	LQ9
 Populated on custom MCPCB 		or and the second second	
Business case needed:			LQC
- Reeling, Configuration, Populated:	\$100k/year		
- PC Spectrum:	\$500k/year		
Start-up cost (NRE):			
 Provisional datasheet + samples: 	\$4000- \$5000 total	1 - D - D - D - D - D - D - D - D - D -	



Next to 'classics': 'customs'



Fig. 1. LuxiGenTM emitter cross-section and customizable die combination in a LZC emitter





LQP: custom config 24-25 die, 5-4 channel

LQ1: custom binning



LQ4: custom config



LQ7: custom config 7 channel



LQ9: custom config 3-channel

https://media.osram.info/im/img/osram-dam-7411798//LED_Engin_productliterature_custom_LuxiGen_emitters_rev3_11012018.pdf



Next to 'classics': 'customs'



Content

		Page
1.	Company introduction OSRAM / LED Engin	3
2.	Challenges in selecting LEDs	8
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4.	Application examples, Demo's, Q&A	26







Surveillance/ANPR applications and IR emitters





ANPR applications



Automatic Number Plate Recognition



Car park / toll gates:

- Short distance, long exposure times
- ANPR only
- Need: medium intensity IR only:
 5mm LEDs or commodity 1-die SMD



Traffic control/monitoring:

- Long distance, medium exposure times
- ANPR only
- Need: medium-high intensity IR only: 1-die SMD



Offense analysis (speeding, red-light passing etc):

- Long distance, short exposure times
- ANPR in combination with face/car recognition
- Need: high int. IR + White (or UV): 4-die IR or multicolour



ANPR applications

Automatic Number Plate Recognition



Car park / toll gates:

- Short distance, long exposure times
- ANPR only
- Need: medium intensity IR only:
 5mm LEDs or commodity 1-die SMD



Traffic control/monitoring:

- Long distance, medium exposure times
- ANPR only
- Need: medium-high int. IR only: 1-die (or 4-die) SMD



Offense analysis (speeding, red-light passing etc):

- Long distance, short exposure times
- ANPR in combination with colour face/car recognition
- Need: high int. IR + White (or UV): 4-die IR or multicolour

-



Approach with classic LEDs

171 and 17/	850nm Peak	Max C	urrent	Fl	ux
(850nm and 940nm)	Device	DC	Pulse	DC	Pulse
	LZ1-00R402	1.2A	2.0A	1.1W	1.7W
171 174	LZ1-00R602	1.2A	5.0A	1.6W	6.4W
	LZ4-00R408	1.0A	2.0A	3.5W	5.9W
	LZ4-00R608	1.0A	5.0A	5.3W	21.2W
	940nm Peak	Max C	urrent	Fl	ux
https://media.osram.info/im	Device	DC	Pulse	DC	Pulse
/img/osram-dam-	LZ1-00R702	1.2A	5.0A	1.6W	6.4W
<u>6304198//LED_Engin_prod</u> uct_literature_IR_(EN).pdf	LZ4-00R708	1.0A	5.0A	5.3W	21.2W

* Pulse current assumes a duty of 10% with a period of no more than 150 μ s



Approach with classic LEDs

LZ1 1-die: medium flux

850nm: barely visible

Parking ANPR Deterrent surveillance nearby LZ4 4-die: high flux

Toll, speeding ANPR Deterrent surveillance remote

940nm: not visible

Parking ANPR Detection surveillance nearby Toll, speeding ANPR Detection surveillance remote



Approach with custom LEDs

Combine IR with white in 1 LED

- Recognise colours: face recognition
- Enhance windscreen transmission
- Improve S/N ratio
- 1 LED 1 lens: most compact system
 - Less weight
 - Lower cost of material

Apply 12-die or 24-die IR emitter

- Up to 5x radiant power from single source
- Improve S/N ratio
- 1 LED 1 lens: most compact system
 - Less weight
 - Lower cost of material







Select classic or custom LEDs

Approach with classic LEDs:

	LZ1 1-die: medium flux	LZ4 4-die: high flux
850nm:	Parking ANPR	Toll, speeding ANPR
barely visible	Deterrent surveillance nearby	Deterrent surveillance remote
940nm:	Parking ANPR	Toll, speeding ANPR
not visible	Detection surveillance nearby	Detection surveillance remote

Approach with custom LEDs:

LQ4 4-die IR/CW: high flux & window transmission

ANPR & face recognition & alertness

LQC/LQP 12/24-die IR: highest flux

Speeding ANPR compact fixture Surveillance long range





CMOS Machine Vision applications and IR emitters





Approach with classic LEDs



Approach with classic LEDs

39





Approach with custom LEDs



LEDENGIN[®] OSRAM

Approach with custom LEDs





Approach with custom LEDs – up to 12 channels / LED





Applications custom spectra:

- Medical diagnostics
- Medical treatment
- Material surface inspection
- Material internal inspection
- Solar simulators
- Robotics



Power LEDs for IR Surveillance and Vision: Where to go – how to get there

Radiation sources: From standard lamps to classic and custom LEDs

Reliable business partner:

The new OSRAM: From Illumination to Photonics LED Engin, the OSRAM brand for flexibility, reliability and custom LEDs

Your success: Configure your custom LED and build better appliances!

Thank you.





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