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Samsung LED Business

May 2020

LED Business Division – Lighting

Samsung Electronics / Samsung Semiconductor Europe GmbH

16552233

ТД "НЕОН-ЭК" www.e-neon.ru

James UnwinLED Lighting /Europe Office(DS) 20200515150410

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Product update

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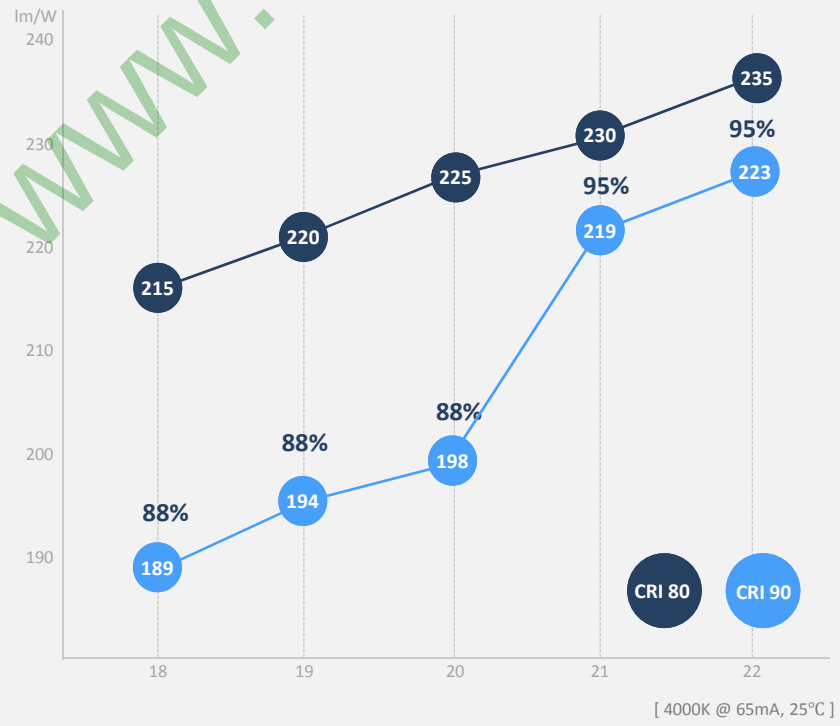
Efficacy

Leading Efficacy in All Products

CRI 90 with High Efficacy (LM301B)



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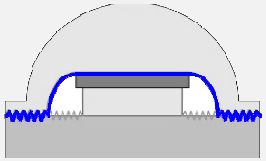
Reliability

Better Mechanical Strength

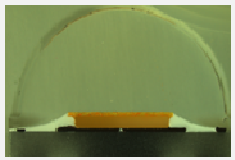
HPL LH351B

- Carefully Controlled Surface Material

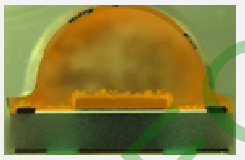


HPL 351B

- Higher Lens Peel Strength



LH351B
1.52Kg

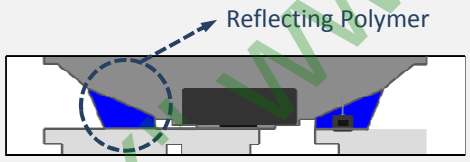


Company A
1.22Kg

Better Corrosion Resistance

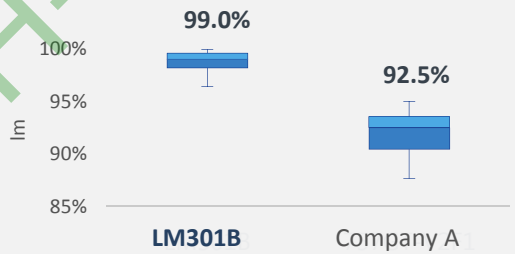
MPL LM301B

- High Reflectance without Ag Metal exposure



MPL 301B

- Lower Lumen Degradation in Harsh Environment



Better Reliability in Entry Level

MPL LM281B+ PRO

- Advanced Wire Loop and thicker wire

Thermal Cycle
200 → 500

- New Phosphor Process

WHTOL (85C, 85%)
85% → 90%

- Anti Sulfur Protective Coating

Anti H2S Corrosion
88% → 92%

※ H2S 15ppm, 25°C / 75% humidity for 504hrs

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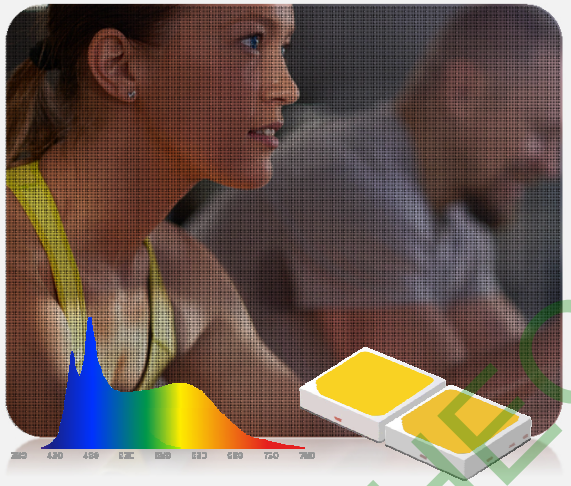
Innovation

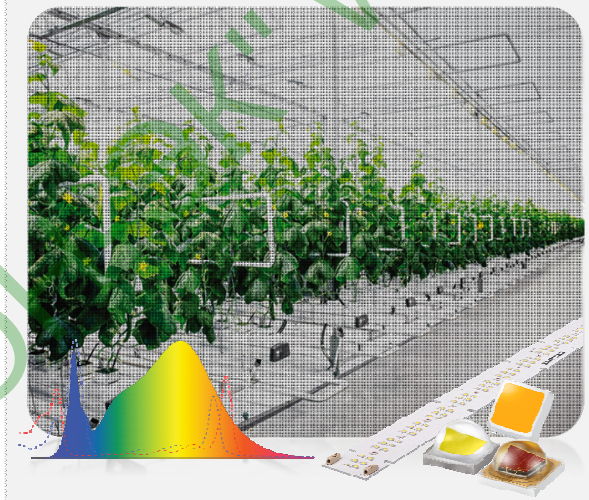
Circadian Lighting
MPL LM302N

Enhancing circadian rhythm synchronization with melanopic spectrum



Horticultural Lighting
MPL LM301H, LM561C, LH351H

Improving the plant growth with high PPF/W spectrum



IoT Module

Dual wireless protocol
BLE 5.0 & Zigbee 3.0
controlled via the SmartThings

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MPL packages

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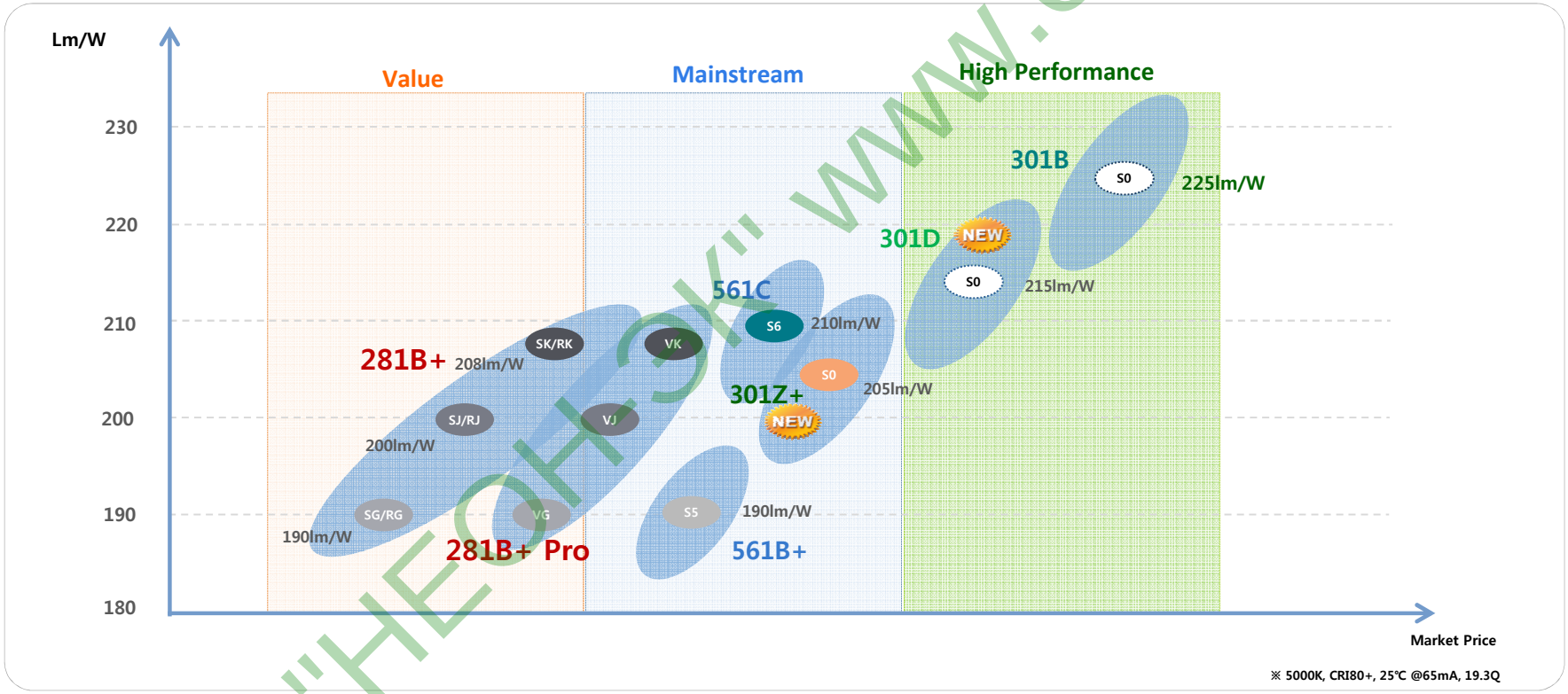
MPL Position review

3030 (Indoor & Outdoor) , 5630 (Workhorse) , 2835 (Value)

Builds up the 3030 full line-up & reliability improved 2835 ('19.3Q)

LM301B provides the world best performance (225lm/W@5000K)



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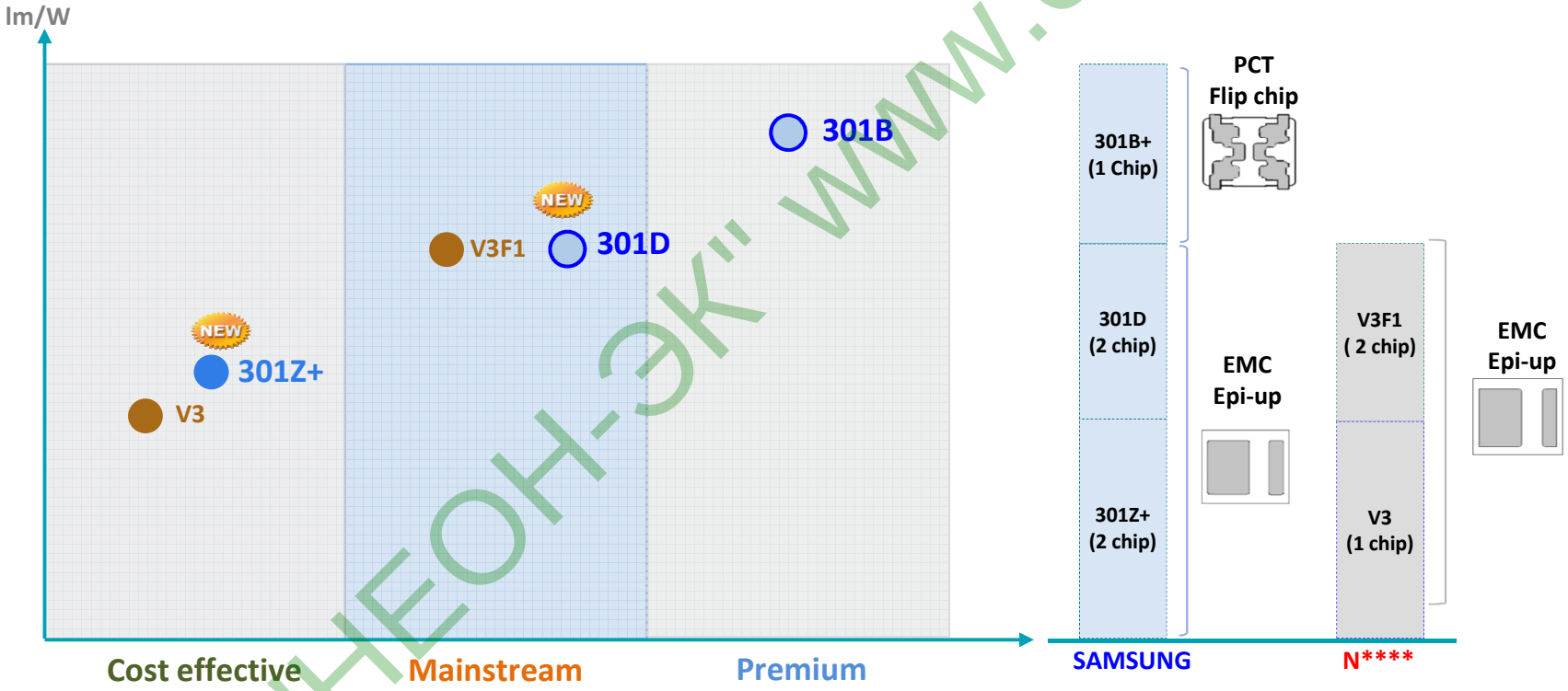
3030 Positioning

Keep leadership in efficacy evolution for LM301B



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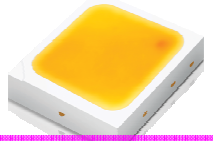
Samsung 3030 Product & Target Application

3V

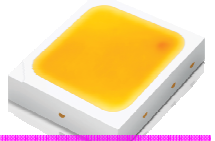
LM301B

TiO2 Reflector

LM301Z+



NEW LM301D



New: Protection Layer against H2S

6V

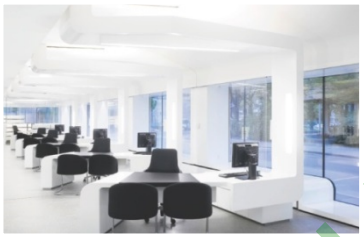
LM302Z+

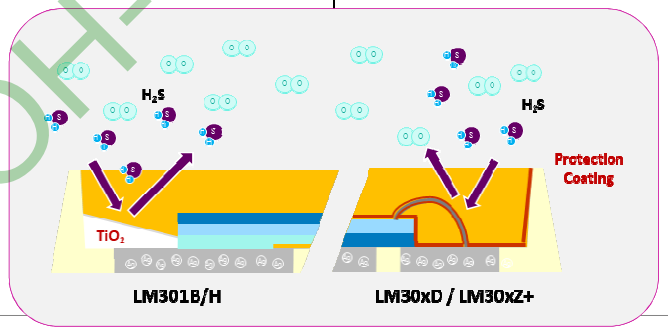
NEW LM302D

New: Protection Layer against H2S

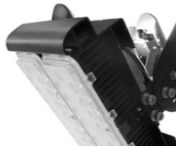
. Linear /Area/Indoor

Indoor(Ambient) lighting





. High-bay/Flood/Outdoor



Industrial lighting

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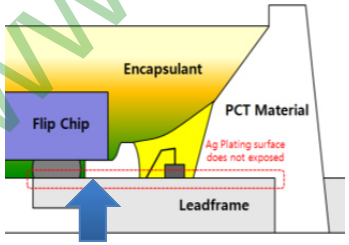
World Highest Efficacy_ LM301B

Designed for best efficacy products

Key Features

- 0.2W, 3V mid power LED
- Performance: 220lm/W (@65mA, 4000K, Ra80+)
- Anti-sulfurization - No Silver Exposure (Sulfurization free)
- Standard footprint with 3.0 × 3.0 ㎟
- LM80 Certified @200mA, 105˚C (Ts)
  (L70 > 100,000 @150mA, 105˚C)



Footprint 3.0 × 3.0 mm

Product Availability

CRI	CCT						
	2700K	3000K	3500K	4000K	5000K	5700K	6500K
70+	-	O	O	O	O	-	-
80+	O	O	O	O	O	O	O
90+	O	O	O	O	O	O	O

Sampling & Launching Schedule

	Sample	Data sheet	MP	LM80
	Approval	Final		
LM301B	Available	Available	Available	Available

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3030 Updates

Adding L2 flux kitting rank of LM301B Ra80 5000K

5000	SPMWHD32AMD5XAR●S0	SK	36.0 ~38.0
		SL	38.0 ~ 40.0
		SM	40.0 ~ 42.0
	SPMWHD32AMD5XAR●SL	SL	38.0 ~ 40.0
	SPMWHD32AMD5XAR●L2	SL	38.0 ~ 40.0
		SM	40.0 ~ 42.0
L2	SL + SM / SM+ SM		

<LM301B IV kitting Code list>

K1	SK+SK, SK+SL
K2	SK+SL, SL+SL
K3	SK+SK, SK+SL, SL+SL
K4	SK+SL, SL+SL, SL+SM
L1	SL+SL, SL+SM
L2	SL+SM, SM+SM
L3	SL+SL, SL+SM, SM+SM
L4	SL+SM, SM+SM, SM+SN

※ ex) HLG 3500K K2

SPMWHD32AMD5XAU0K2

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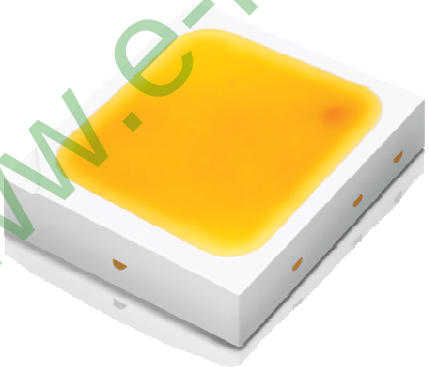
3030 Product

New Product _ LM301D

Designed for best lm/$ for Ambient, Down light

Key Features

- 0.2W, 3V mid power LED
- Performance: 207lm/W (@65mA, 4000K, Ra80+)
- Providing Single flux range & single Vf
- Standard footprint with 3.0 × 3.0 ㎟
- EMC lead frame material with high reliability
- Anti-sulfurization



Footprint 3.0 × 3.0 mm

- Identical Pad Design for market compatibility

Product Availability

CRI	CCT						
	2700K	3000K	3500K	4000K	5000K	5700K	6500K
70+	-	O	O	O	O	-	-
80+	O	O	O	O	O	O	O
90+	O	O	O	O	O	O	O

Sampling & Launching Schedule

	Sample	Data sheet	MP	LM80
	Approval	Final		
LM301D	Available	Available	Available	Available

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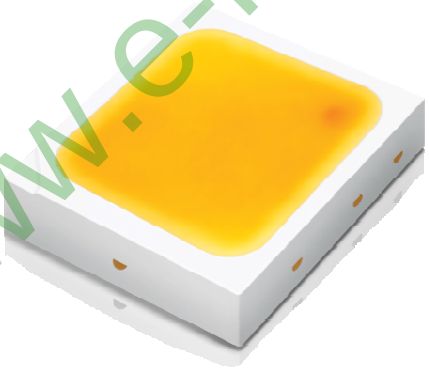
3030 Product

New Product _ LM302D

Designed for best lm/$ for Ambient, Industrial lighting

Key Features

- 0.9W, 6V mid power LED
- Performance: 160lm/W (@150mA, 4000K, Ra80+)
- Providing Single flux range
- Standard footprint with 3.0 × 3.0 ㎟
- EMC lead frame material with high reliability
- Anti-sulfurization



Footprint 3.0 × 3.0 mm

- Identical Pad Design for market compatibility

Product Availability

CRI	CCT						
	2700K	3000K	3500K	4000K	5000K	5700K	6500K
70+	-	May.'20	May.'20	May.'20	May.'20	-	-
80+	O	O	O	O	O	O	O
90+	O	O	O	O	O	O	O

Sampling & Launching Schedule

	Sample	Data sheet	MP	LM80
	Approval	Final		
LM302D	Available	Available	Available	Available

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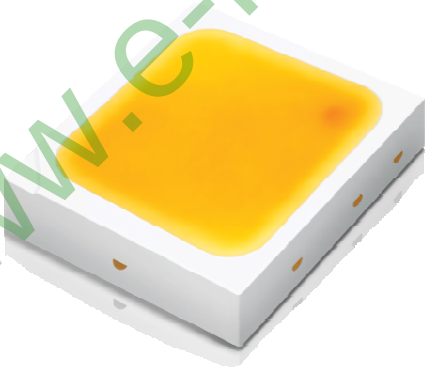
3030 Product

LM301Z+

Designed for best lm/$ for Ambient, Down light



Footprint 3.0 × 3.0 mm

Key Features

- 0.2W, 3V mid power LED
- Performance: 196lm/W (@65mA, 4000K, Ra80+)
- Providing Single flux range
- Standard footprint with 3.0 × 3.0 ㎟
- EMC lead frame material with high reliability
- Anti-sulfurization
- Identical Pad Design for market compatibility

Product Availability

CRI	CCT						
	2700K	3000K	3500K	4000K	5000K	5700K	6500K
70+	-	O	O	O	O	-	-
80+	O	O	O	O	O	O	O
90+	O	O	O	O	O	O	O

Sampling & Launching Schedule

	Sample	Data sheet	MP	LM80
	Approval	Final		
LM301Z+	Available	Available	Available	Available

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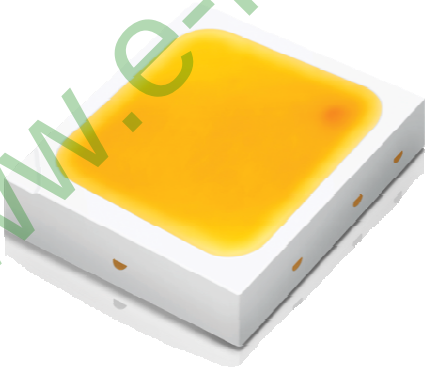
3030 Product

LM302Z+

Designed for best lm/$ for Ambient, Industrial lighting



Footprint 3.0 × 3.0 mm

Key Features

- 0.9W, 6V mid power LED
- Performance: 155lm/W (@150mA, 4000K, Ra80+)
- Providing Single flux range
- Standard footprint with 3.0 × 3.0 ㎟
- EMC lead frame material with high reliability
- Anti-sulfurization
- Identical Pad Design for market compatibility

Product Availability

CRI	CCT						
	2700K	3000K	3500K	4000K	5000K	5700K	6500K
70+	-	O	O	O	O	-	-
80+	O	O	O	O	O	O	O
90+	O	O	O	O	O	O	O

Sampling & Launching Schedule

	Sample	Data sheet	MP	LM80
	Approval	Final		
LM301Z+	Available	Available	Available	Available

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3030 Updates

Uploading new information of LM302Z+ Eco (LM302Z+ Zenerless version)

Economic and **Eco**-friendly

LM302Z+

- 0.9 W, 6 V mid power LED
- Luminous Flux: 139 lm @ 150 mA
- Luminous Efficacy: 150 lm/W

LEARN MORE

Tech Spec

Wattage	Forward Voltage	LM302Z+	LM302Z+ Eco
0.9 W	6.2 V	139 lm, 150 lm/W	143 lm, 155 lm/W

Condition
5000K, 150 mA, 25°C

Documentation

Data Sheets | Application Notes | Design Files | Product Ecology | Brochures

[Data Sheet] LM302Z+ CRI 70	v2.3	2020-04-23	DOWNLOAD
[Data Sheet] LM302Z+ CRI 80	v2.3	2020-04-23	DOWNLOAD
[Data Sheet] LM302Z+ CRI 90	v2.3	2020-04-23	DOWNLOAD
[Data Sheet] LM302Z+ Eco CRI 70	v1.3	2020-04-23	DOWNLOAD
[Data Sheet] LM302Z+ Eco CRI 80	v1.3	2020-04-23	DOWNLOAD

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Line-up

New Product _ LM281B+ Pro

Builds up the reliability improved 2835 for mainstream applications

Footprint 2.8 × 3.5 mm

Key Features

- 0.5W, 3V mid power LED
- Standard footprint with 2.8 × 3.5 ㎟
- LM80 Certified @200mA, 105˚C (Ts)
- Identical Pad Design for market compatibility

Q3 '20

VL

80~85lm @150mA

Product Availability

Model	CRI	CCT (2700~6500K)		
		VG rank	VJ rank	VK rank
LM281B+ Pro	80+	Available		
	90+			
LM281B+ Pro + Zener	80+			
	90+			

Sampling & Launching Schedule

Model	Sample	Data sheet	MP	LM80
	Approval	Final		
LM281B+ PRO	Available	Available	Available	Available

Performance(Lumen)

Model	Sorting Current	Rank	CCT	Lumen[Lm]	
				Min.	Max.
281B+ Pro. CRI80	150mA	VG	2700K	66.5	70.5
			5000K	73.0	77.0
		VJ	2700K	70.5	74.5
			5000K	77.0	81.0
	65mA	VK	2700K	32.5	34.5
			5000K	35.5	37.5

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Performance Improvement

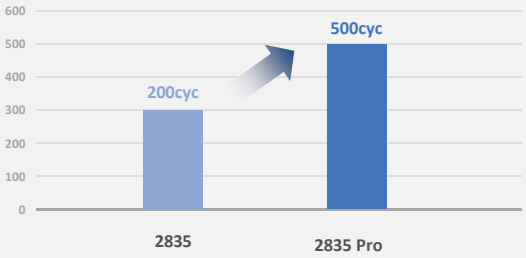
LM281B+ PRO - Upgraded Reliability Brings Higher Value

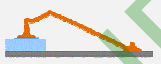
Thermal Cycle

-45℃~125 each 15min, transition time 5sec

With advanced loop, guarantee 500 cycle

T/C Test

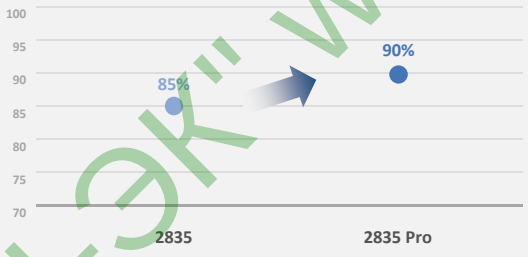


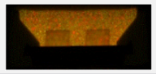
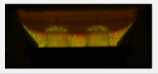
	Advanced loop
Top view	
Side view	

WHTOL(85%,85C)

85℃/85%@200mA, 1000hrs

Improved WHTOL reliability

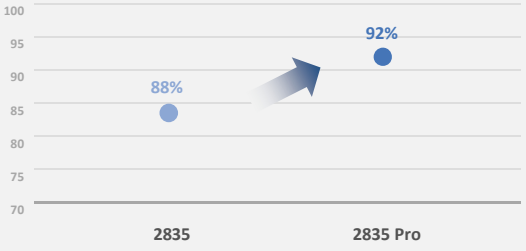


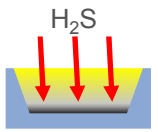
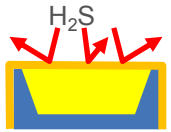
	2835	2835 PRO
Concept		
Image		

Anti sulfurization

H2S 15ppm 25℃/75%, 504hrs

Improved corrosion performance



	2835	2835 PRO
Concept		

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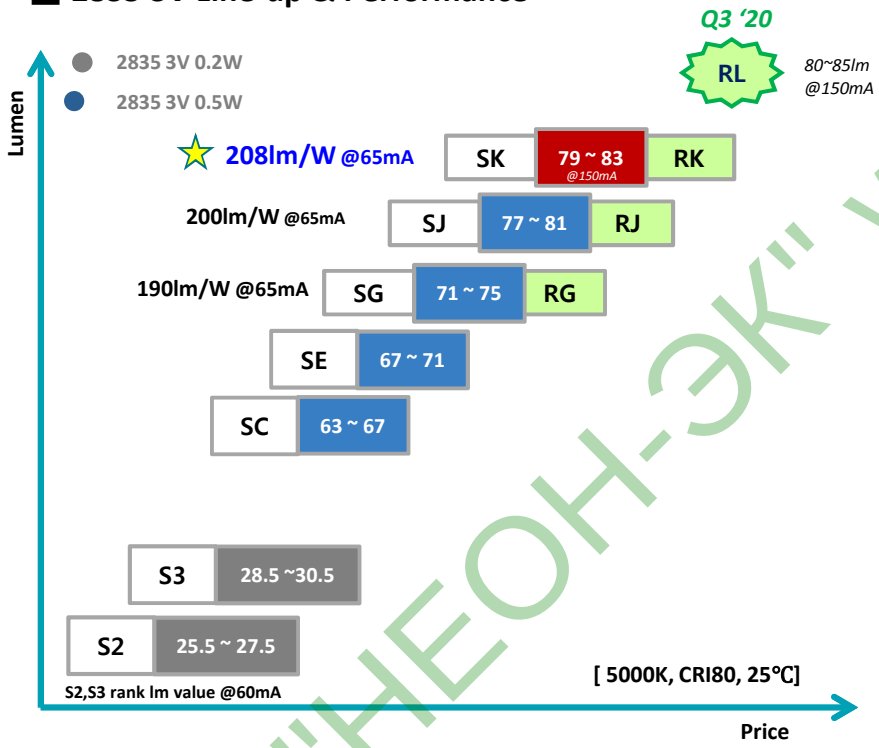
2835 3V Standard Line-up

Competitive 3V line-up → RG/RJ/RK

■ 2835 3V Line-up & Performance



■ RG, RJ & RK Specification comparison

LM281B+ SG / RG rank - MP

Nominal CCT (K)	Bin	Ra	Vf (typ)	150mA ($IF_{_op}$)	
				Min.	Max.
4000	SG	80	2.95	72	76
	RG		2.97	72	76

LM281B+ SJ / RJ rank

Nominal CCT (K)	Bin	Ra	Vf (typ)	150mA ($IF_{_op}$)	
				Min.	Max.
4000	SJ/RJ	80	2.95	76.0	80.0

LM281B+ SK / RK rank - MP

Nominal CCT (K)	Bin	Ra	Vf (typ)	65mA ($IF_{_op}$)	
				Min.	Max.
4000	SK	80	2.74	35.5	37.5
	RK		2. 74	35.0	37.0

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High Power

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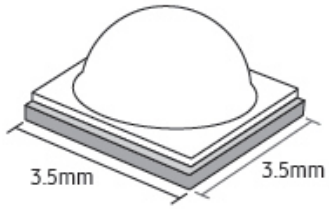
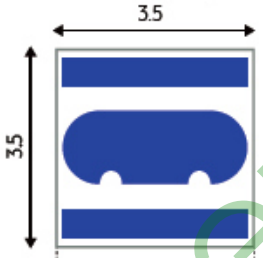
Easy to extend line-up

Greater design flexibility for various fixture designs with same footprint, chip and phosphor technology

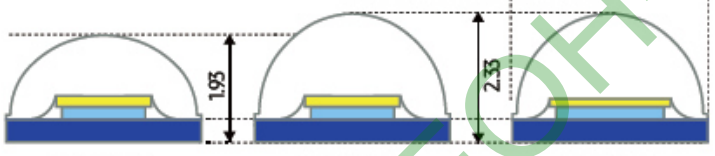
- Same Size

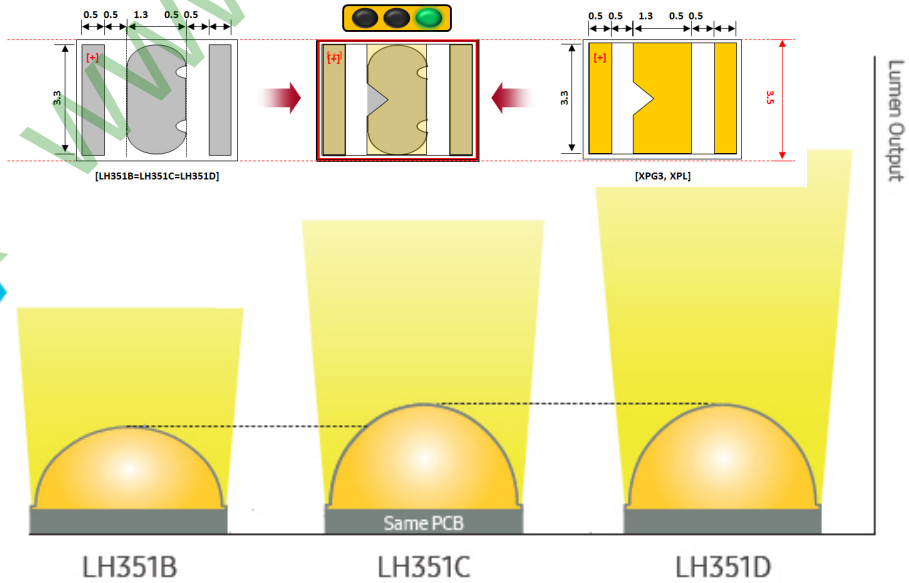


- Same Footprint



- Same Chip & Phosphor Technology





* PCB: Printed Circuit Board

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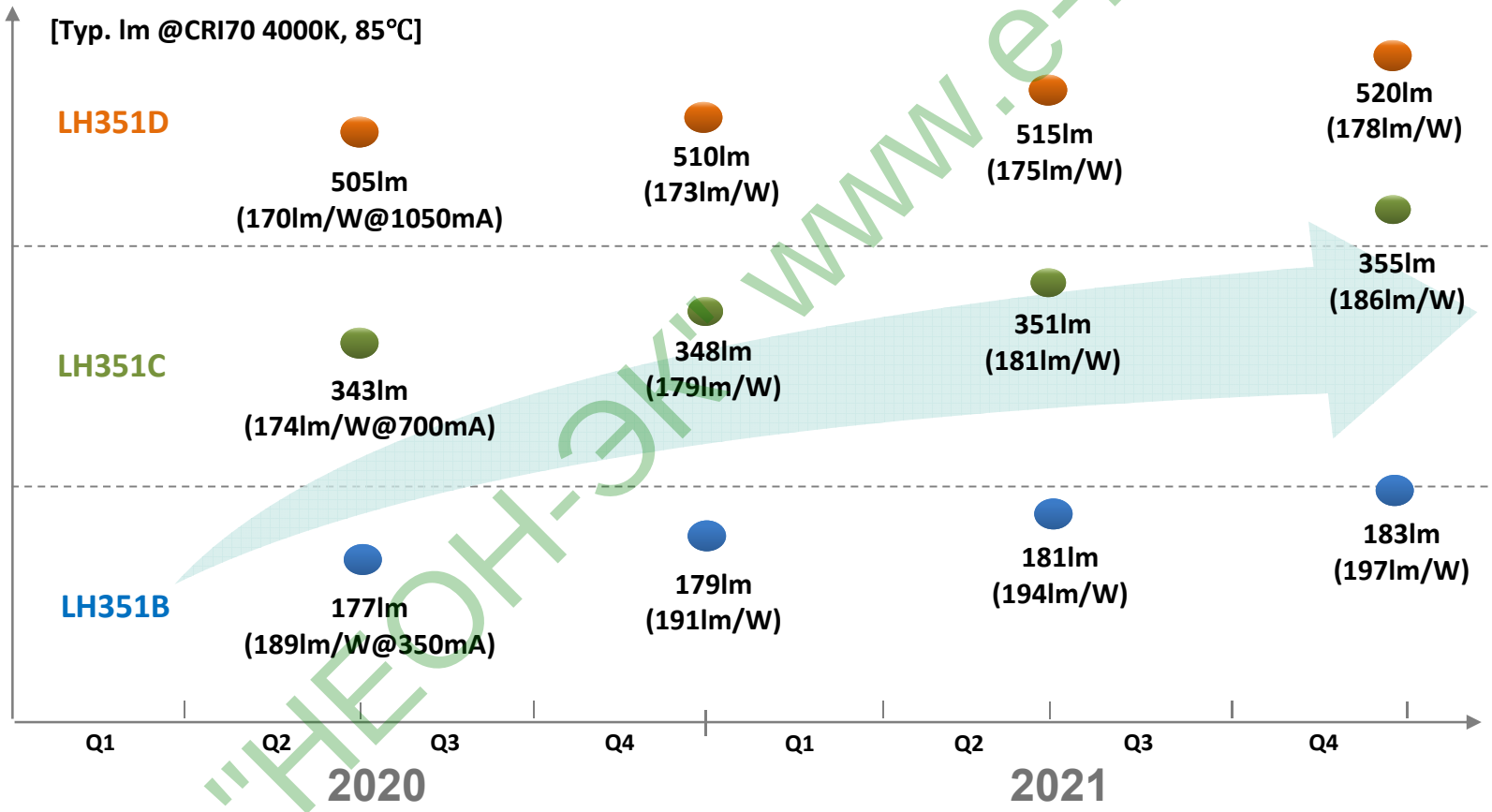
LH351B/C/D – Performance



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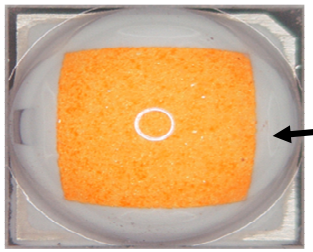
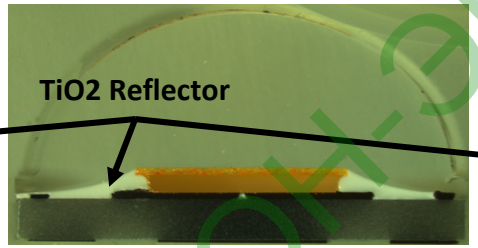
H_2S Sulfurization Test - Safe

Product	Range	Lumen Maintenance(%)	
		0 h	504 h
LH351B	Min.	100.00%	93.1%
	Max.	100.00%	100.1%
	Avg.	100.00%	97.5%
LH351C	Min.	100.00%	99.53%
	Max.	100.00%	101.26%
	Avg.	100.00%	99.97%
LH351D	Min.	100.00%	97.04%
	Max.	100.00%	102.23%
	Avg.	100.00%	99.66%

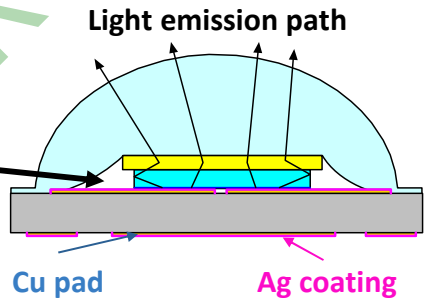
Product	Range	Chromaticity Shift(△u'v')	
		0 h	504 h
LH351B	Min.	0.0000	0.0001
	Max.	0.0000	0.0015
	Avg.	0.0000	0.0003
LH351C	Min.	0.0000	0.0004
	Max.	0.0000	0.0006
	Avg.	0.0000	0.0005
LH351D	Min.	0.0000	0.0004
	Max.	0.0000	0.0024
	Avg.	0.0000	0.0014



[Top View]



[Cross Section View]



[Diagram]

Hydrogen Sulphide

- Ambient Temperature : 25 °C
- Relative Humidity : 75%
- H_2S concentration : 15 ppm
- Applicable Standards : IEC 60068-2-43

More than 95% of Ag doesn't effect on light path

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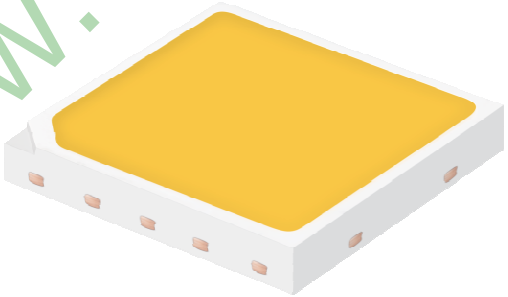
New Product _ LH508C (24V) / LH502C (6V)

5050 Highest lm/W in the world

Key Features

- approximately 8% Spec up than 508A+
  220lm/W @ 1W (4000K, CRI70, Tj=25℃)
  230lm/W @ 0.5W (4000K, CRI70, Tj=25℃)
- Max current : 220mA (24V) / 880mA (6V), Tj=125℃
- Anti Sulfurization
- Improved Color quality
- Keep exterior with LH508A+



Dimension : 5.0 × 5.0 mm

Product Availability

	CRI	CCT						
		2200K	2700K	3000K	4000K	5000K	5700K	6500K
502C	70	tbd	End May '20				End Jul '20	
	80	tbd	End May '20				End Jul '20	
508C	70	tbd	End May '20				End Jul '20	
	80	tbd	End Jun '20				End Jul '20	

Sampling & Launching Schedule

	Sample	Data sheet	MP	LM80
	Approval	Final		
LH502C	<CRI70> May '20 <CRI80> Jun '20	End May '20	Jun '20	End Jun '20
LH508C	<CRI70> Jun '20 <CRI80> End Jun '20	End May '20	Jun '20	End Jun '20

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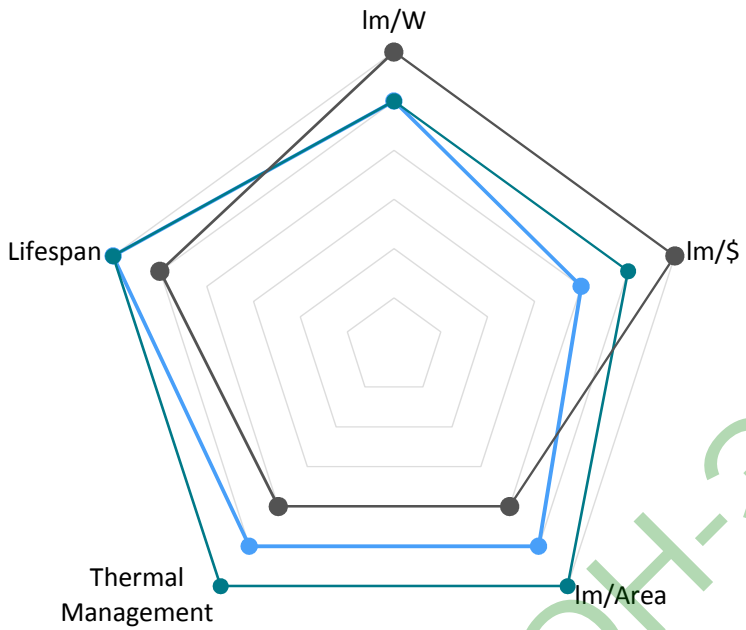
Package Platforms for Outdoor Applications



	lm/W	lm/$	lm/Area	Thermal Management	Lifespan
Ceramic	●●	●	●●	●●	●●●
CSP	●●	●●	●●●	●●●	●●●
EMC	●●●	●●●	●	●	●●

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SAMSUNG

CSP

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James UnwinLED Lighting /Europe Office(DS) 20200515150410

History & Why SAMSUNG CSP

CSP was generated for requirement of small LES & simple structure.

- Depended on world best flip-chip technology from SAMSUNG.

  SAMSUNG secured stable technology of CSP during last 5 years.

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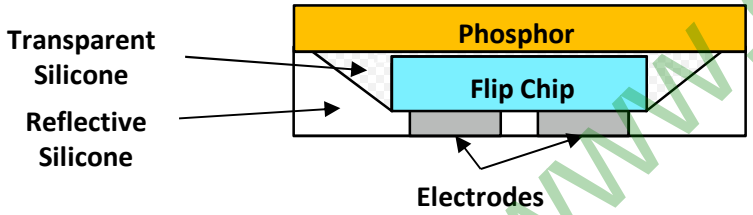
Samsung Proprietary

FEC CSP Line-up

FEC CSP Structure



Lineup

Category	LM101B (1W, 3V)	LH151B (2W, 3V)	LH181B (3W, 3V)	LH231B (5W, 3V)
Appearance		*New to come*		
Dimension (W × L × H, mm)	1.7 × 1.7 × 0.34	1.7 × 1.7 × 0.34	2.36× 2.36 × 0.35	2.80 × 2.80 × 0.35
Max Current	350mA	700mA	1400mA	2000mA
Sorting Condition	150mA, 85℃	350mA, 85℃	350mA, 85℃	700mA, 85℃

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COB

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COB lineup

D Series
Leading Performance

•3 W ~ 80 W
•CRI: 70 ~ 95+
•Efficacy: 170 lm/W (Gen. 4)

C Series
Small LES High Intensity

•10 W ~ 40 W
•LES: 6 mm, 8.5 mm, 11.5 mm, and 4mm
•Efficacy: 126 lm/W

R Series
Specialized Spectrum

•13 W ~ 40 W
•Fashion – Vivid White & Vivid Color
•Meat, Vegetable

T Series
Color Tunable

•10 W ~ 35 W
•Tunable White: 2700 K to 6500 K

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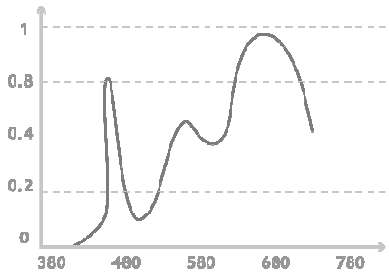
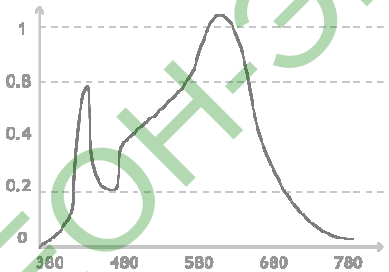
R-series with Specialized Spectrum

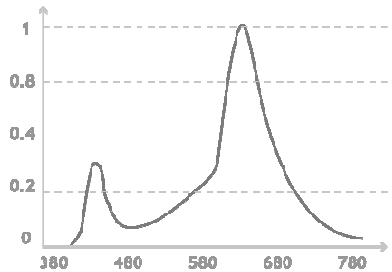
Fashion Vivid Color



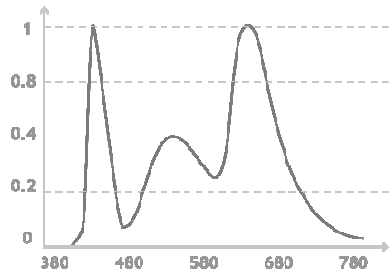
Fashion Vivid White



Meat



Vegetable



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NEW: up to 1 SDCM Product Line-up

COB D-series Platform	CCT (K)		2700	3000	3500	4000	5000	5700	6500	Performance (LC026D)
Gen.3	CRI 70+	Before		3step		3step	3step			D3 rank: 161lm/W
		New		2step		2step	2step			
	CRI 80+	Before	3step/2step	3step/2step	3step/2step	3step/2step	3step	3step	3step	
		New	1step	1step	1step	1step	2step	2step	2step	
	CRI 90+	Before	3step/2step	3step/2step	3step/2step	3step/2step	3step			
		New	1step	1step	1step	1step	1step			
Gen.2	CRI 70+	Before		3step		3step	3step			D2 rank: 151lm/W
		New		2step		2step	2step			
	CRI 80+	Before	3step/2step	3step/2step	3step/2step	3step/2step	3step	3step	3step	
		New	1step	1step	1step	1step	2step	2step	2step	
	CRI 90+	Before	3step/2step	3step/2step	3step/2step	3step/2step	3step			
		New	1step	1step	1step	1step	2step			
	CRI 95+	Before	3step/2step	3step/2step	3step/2step	3step/2step	3step			
		New	1step	1step	1step	1step	2step			

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T-series

Wide range of color temperature

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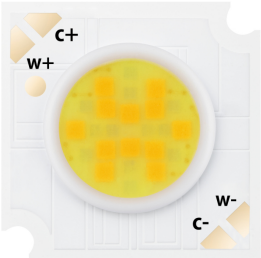
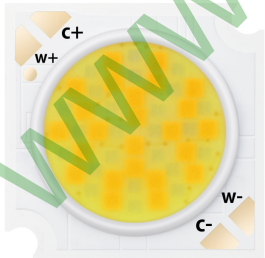
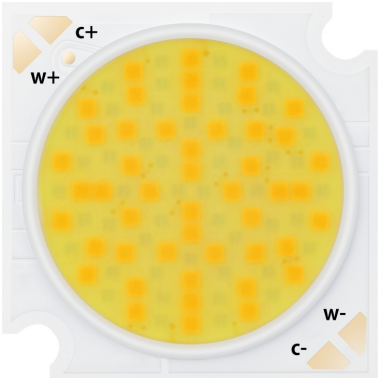
T-series with Tunablility

CRI90 available
2700~5000K

Tunable COB Design/lineup

	LC010T	LC020T	LC035T
Concept Image			
PKG size	19x19 ㎟	19x19 ㎟	28x28 ㎟
LES size	9.8 ㎜	13.0 ㎜	22.0 ㎜
No. of Chips/CSPs	12/12	24/24	48/48
If / Vf	280 mA / 35 V	560 mA / 35 V	980 mA / 35 V
Flux(@6500K, CRI80)	1313 lm	2626 lm	4802 lm
Efficacy (@6500K, CRI80)	134 lm/W	134 lm/W	140 lm/W

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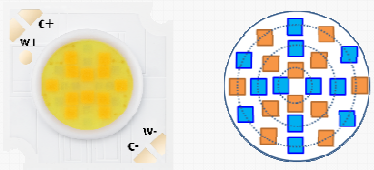
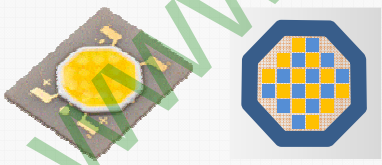
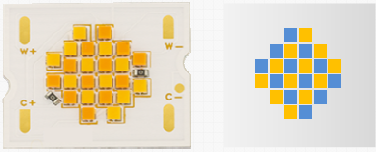
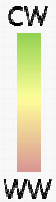
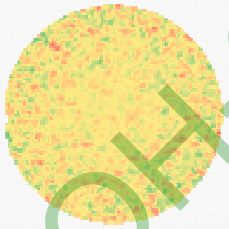
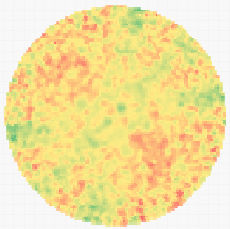
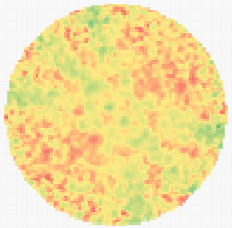
T-series with Tunablility

Excellent color uniformity with concentric chip arrangement

Company	Samsung	Competitor A	Competitor B
PKG / Chip layout			
Chip layout type / Characteristic	Concentric Circle (CSP + DP) Round Dam	Lattice arrangement (CSP + DP) Octagonal Dam	Lattice arrangement (CSP only) No Dam
CCT Distribution (Simulation) 			
STD(CCT)	42	105	146

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Human-centric Lighting Solution

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Melanopic Spectrum

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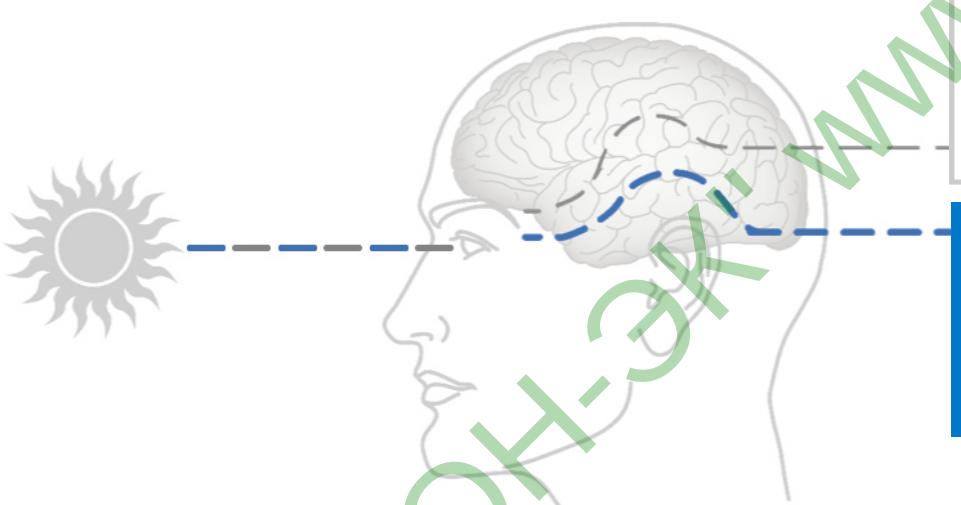
The Non-visual Effects of Light

Light-dark cycle entrains the circadian rhythms through neuroendocrine pathway



Visual Effect – Cones, Rods

Recognition of colors (hue, chroma) and brightness

Non-visual Effects – ipRGCs*

- Physiological effects (sleep and wake cycles)

* ipRGCs: intrinsically photosensitive Retinal Ganglion Cells

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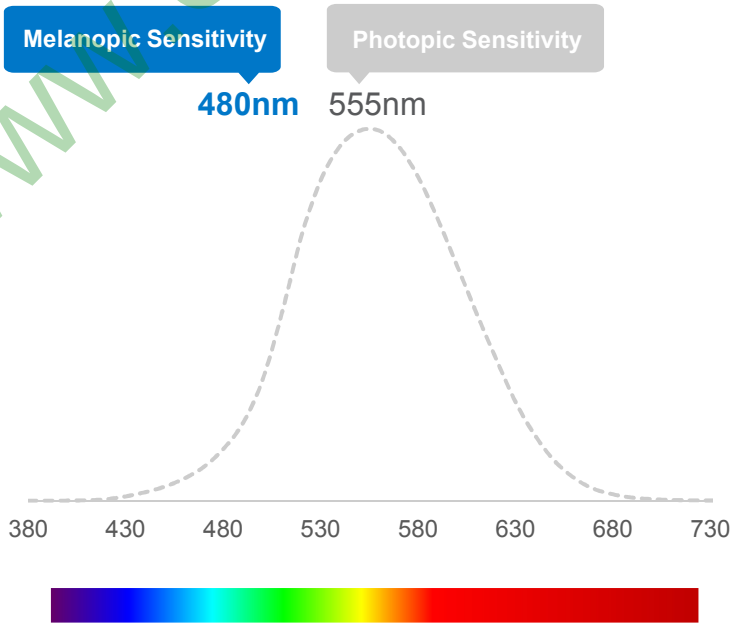
Light Sensitivity of Circadian System

Retinal phototransduction with melanopic sensitivity located around 480nm entrains the circadian rhythm by producing pineal melatonin



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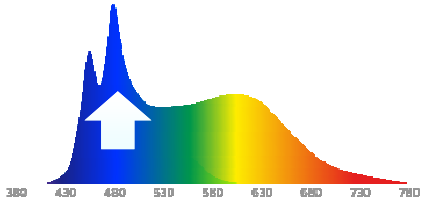
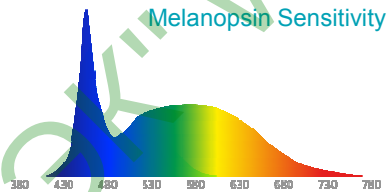
Fine-Tuned Spectra for Advanced Circadian Lighting

Dedicated Daytime Spectrum

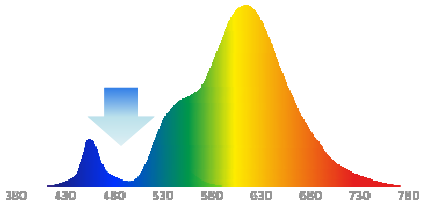


High M/P Ratio

Standard LED Spectrum



Dedicated Nighttime Spectrum



Low M/P Ratio

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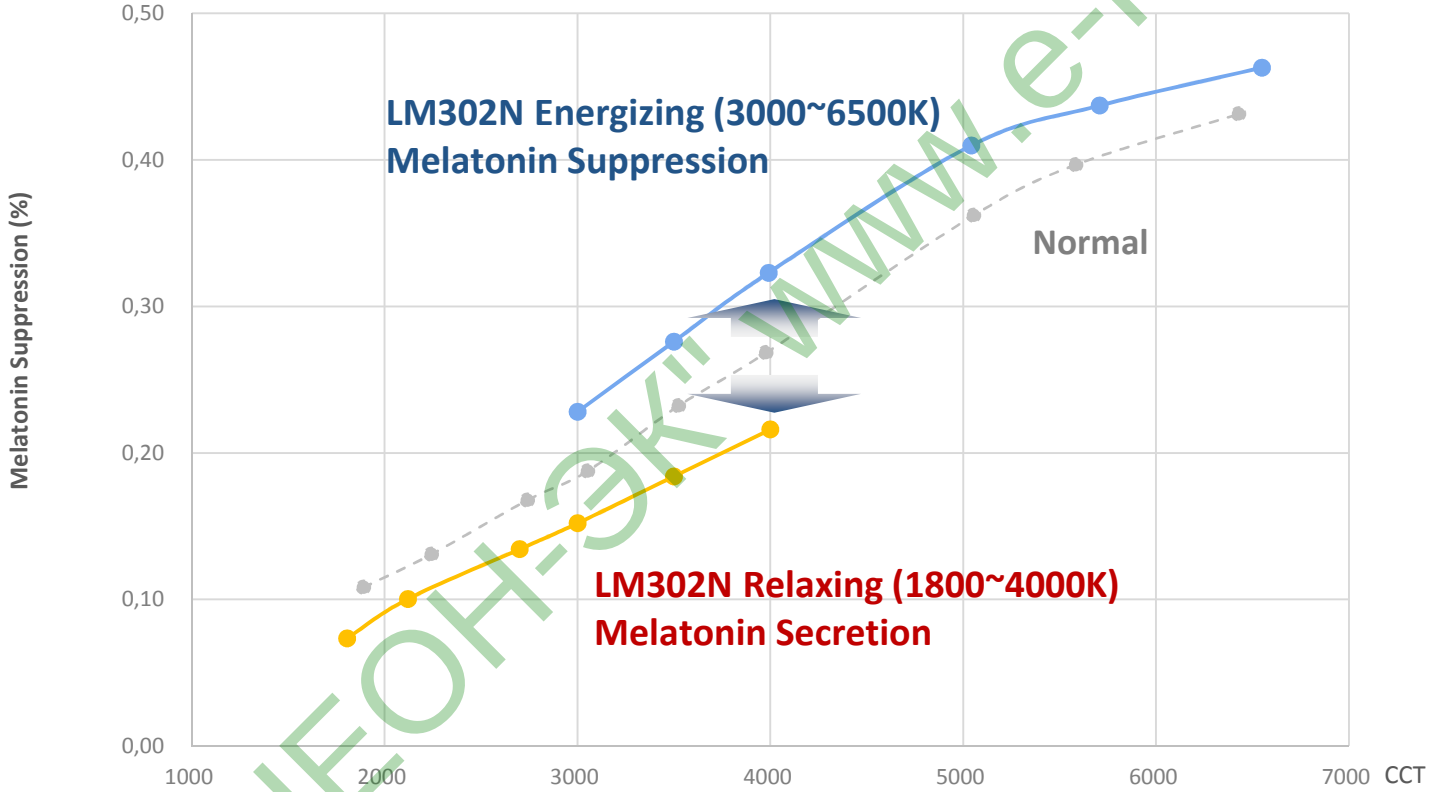
LM302N Melatonin suppression performance



[Graph generated by the tool from Lighting Research Center (LRC), RPI]

*Luminous flux indoors 150lux ≤ 3000K, 400lux ≥ 3500K

The melatonin control performance of Samsung Circadian Lighting is relatively 20%~30% higher than that of Normal LED in overall CCTs.

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Horticulture Lighting Solution

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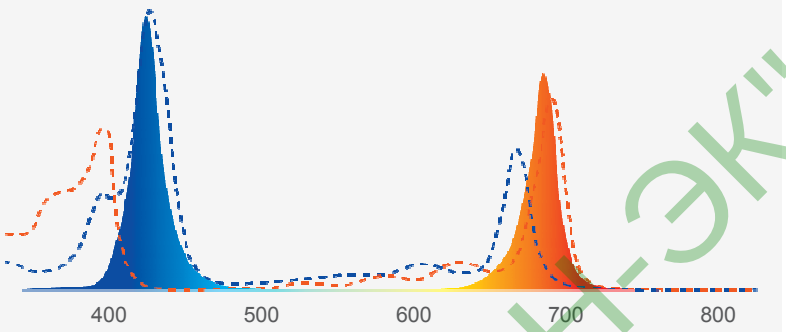
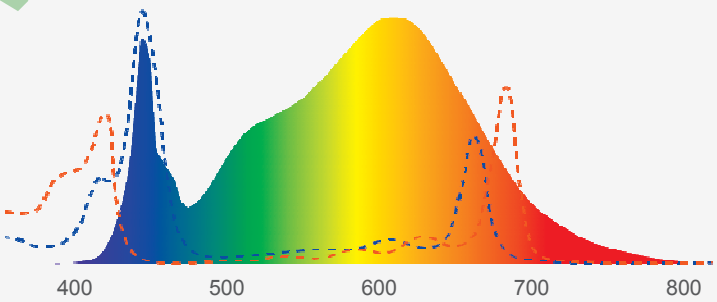
Full Spectrum LED

Full spectrum is recent trend with more cost-effective, productive, and favorable solution

Conventional Narrow Spectrum



Full Spectrum



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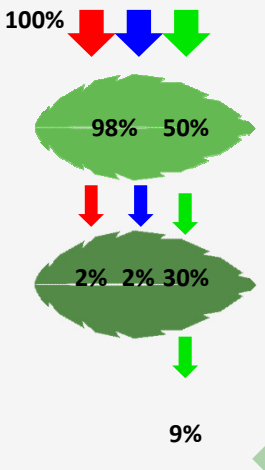
More Productive Solution

Full spectrum promotes balanced plant growth by improving many different aspects

Photosynthesis



1. Kozai, Ohmsya Pub P227 (2015)
2. Jindong, Plant Cell Physiol. (1998)

Anti-disease

1. Kudo, SRI Res Rep. (2009) 2. Kudo, Horti Res, (2013)
3. Kudo, SRI Res Rep. (2010)

Nutrition

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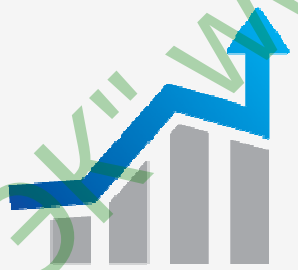
Why Samsung LED

Samsung Horticultural LED line-up is formed with the key considerations in mind

Freedom in Spectrum	Industry Leading PPF/W	Enhanced Quality
		
Spectrum of infinite possibilities enabling purpose driven plant growth	The highest efficacy increasing yield of crops and saving operation cost	Industry proven reliability under harsh horticulture environment

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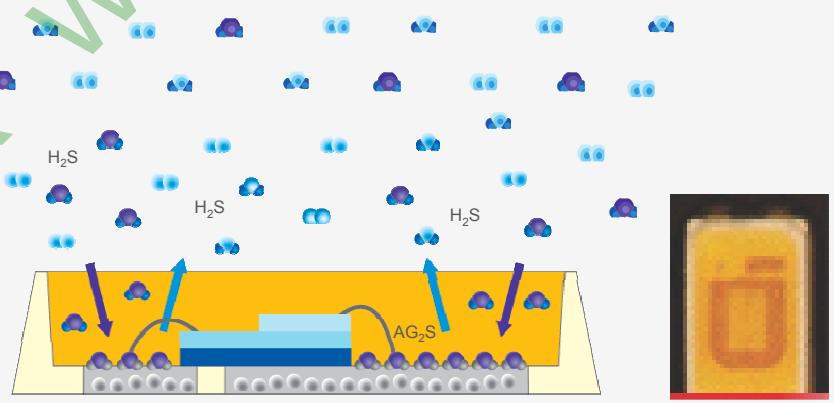
High Sulfur Environment

LEDs can be degraded by sulfur in horticulture application



- Ag in wire or electrodes can be tarnished when exposed to H_2S
- $2Ag + H_2S + 1/202 \rightarrow Ag_2S + H_2O$ (Ag_2S causes PPF degradation)

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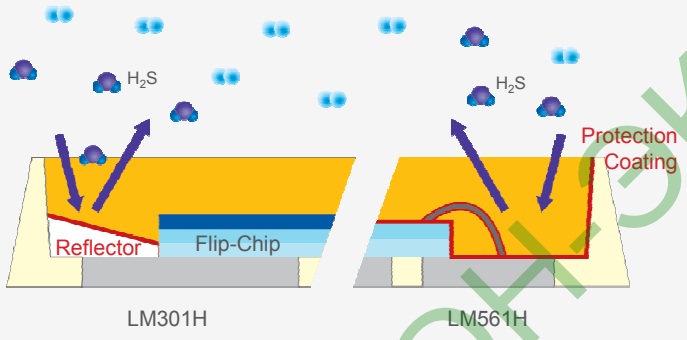
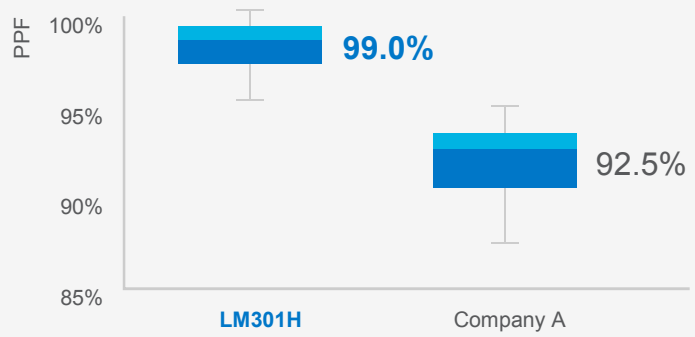
Superior Sulfur Resistance

LEDs with protection schemes are necessary to maintain PPF, Spectrum, etc.

Horticulture LEDs with Protection Schemes



H2S 15ppm, 25°C / 75% humidity for 504hrs



※ IEC Pub.68-2-43

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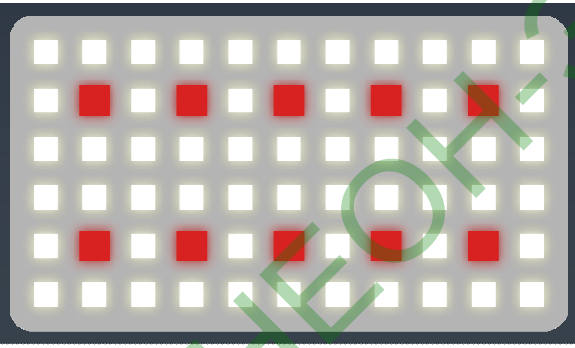
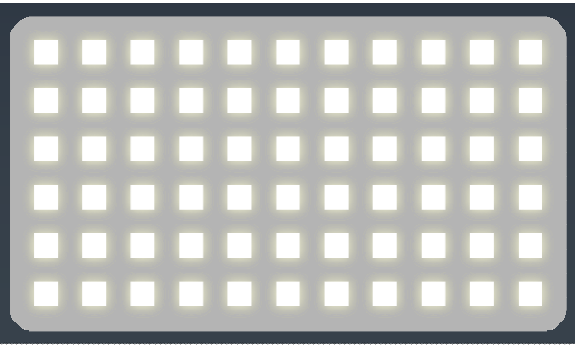
More Options for Customer Choice

High Efficacy : LM301H + LH351H Red, Easy Use : LM301H ONE

High Efficacy	Easy Use
LM301H LH351H Deep Red - High PPF/W - Flexible spectrum design	LM301H ONE (1 PKG Solution) - Simple module/lens design - Easy SMT and SKU management - More uniform light distribution - Spectrum based on experiment
	

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James UnwinLED Lighting /Europe Office(DS) 20200515150410

White LED (MPL)

3030 white LEDs deliver the highest efficacy and excellent reliability

LM301H

Key Features

- 0.2W, 3V mid power LED
- World's best efficacy
- Anti-sulfurization
- Standard footprint with 3.0 × 3.0 ㎟

Rank	Color	PPF (μmol/s)	Efficacy (μmol/J)
SL	White	0.56	**3.10**

@65mA, 25°C, 6500K, CRI80

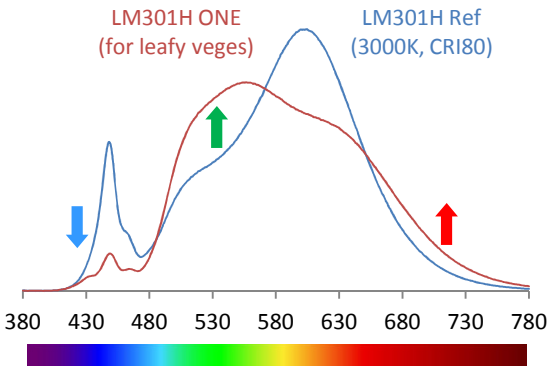
LM301H ONE

Key Features

- 0.2W, 3V mid power LED
- 1 PKG solution with optimized spectrum
- Anti-sulfurization
- Standard footprint with 3.0 × 3.0 ㎟

Rank	Color	PPF (μmol/s)	Efficacy (μmol/J)
(TBA)	White	(TBA)	(TBA)

@65mA, 25°C, 6500K, CRI80



	Ref	ONE
R:G:B	1:4:4	1:8:6
CCT	3000	3800
CRI	80	73
CIE x	0.4386	0.4218
CIE y	0.4116	0.4944

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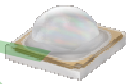
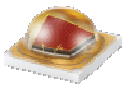
James UnwinLED Lighting /Europe Office(DS) 20200515150410

Vertical / Indoor Farming Solution

- Crop: Lettuce, Herb, etc.
- LED Lighting Requirements: Efficacy↑, Thermal Management

	White LED			Color LED				
	LM301H	LM561H	LM301H ONE	 LH351H Blue (450nm)	LH351H Red (630nm)	LH351H Deep Red (660nm)	 LH351H Deep Red (660nm) V2	LH351H Far Red (730nm)
PPF (μmol/s)	0.56	0.51	0.49	2.80	1.57	2.32	2.63	*1.96
PPF/W (μmol/J)	3.10	2.84	2.75	2.80	2.14	3.12	3.73	**2.91
Footprint (mm^2)	3.0 × 3.0	5.6 × 3.0	3.0 × 3.0	3.5 × 3.5				

*BPF, **BPF/W

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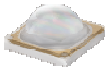
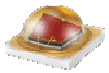
Greenhouse Farming Solution

- Crop: Tomato, Pepper, Cucumber, etc.
- LED Lighting Requirements: Cost↓, Size/Weight↓

	White LED					Color LED				
	LH241H	LH281H	LH351H-B	LH351H-C	LH351H-D	 LH351H Blue (450nm)	LH351H Red (630nm)	LH351H Deep Red (660nm)	 LH351H Deep Red (660nm) V2	LH351H Far Red (730nm)
PPF (μmol/s)	2.51	2.59	2.48	2.56	2.58	2.80	1.57	2.32	2.63	*1.96
PPF/W (μmol/J)	2.52	2.65	2.51	2.60	2.69	2.80	2.14	3.12	3.73	**2.91
Footprint (mm^2)	2.4 × 2.4	2.8 × 2.8	3.5 × 3.5			3.5 × 3.5				

*BPF, **BPF/W

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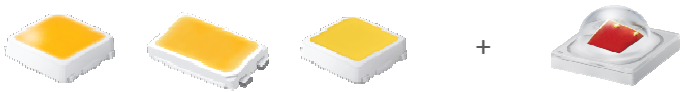
Main Applications

Vertical/Indoor Farming



LM301H LM561H LM301H ONE + LH351H Red (630, 660, 730nm)

* Crop: Lettuce, Herb → Short Size, Short Life Cycle
* LED Requirements: High Efficacy, Thermal Dissipation↓, Cost↓

Greenhouse Farming

CSP (LH241H, LH281H) LH351H B/C/D + LH351H Red (630, 660, 730nm)

* Crop: Tomato, Pepper, Cucumber → Tall Size
* LED Requirements: High power, Size↓, Weight↓

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Thank You

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