

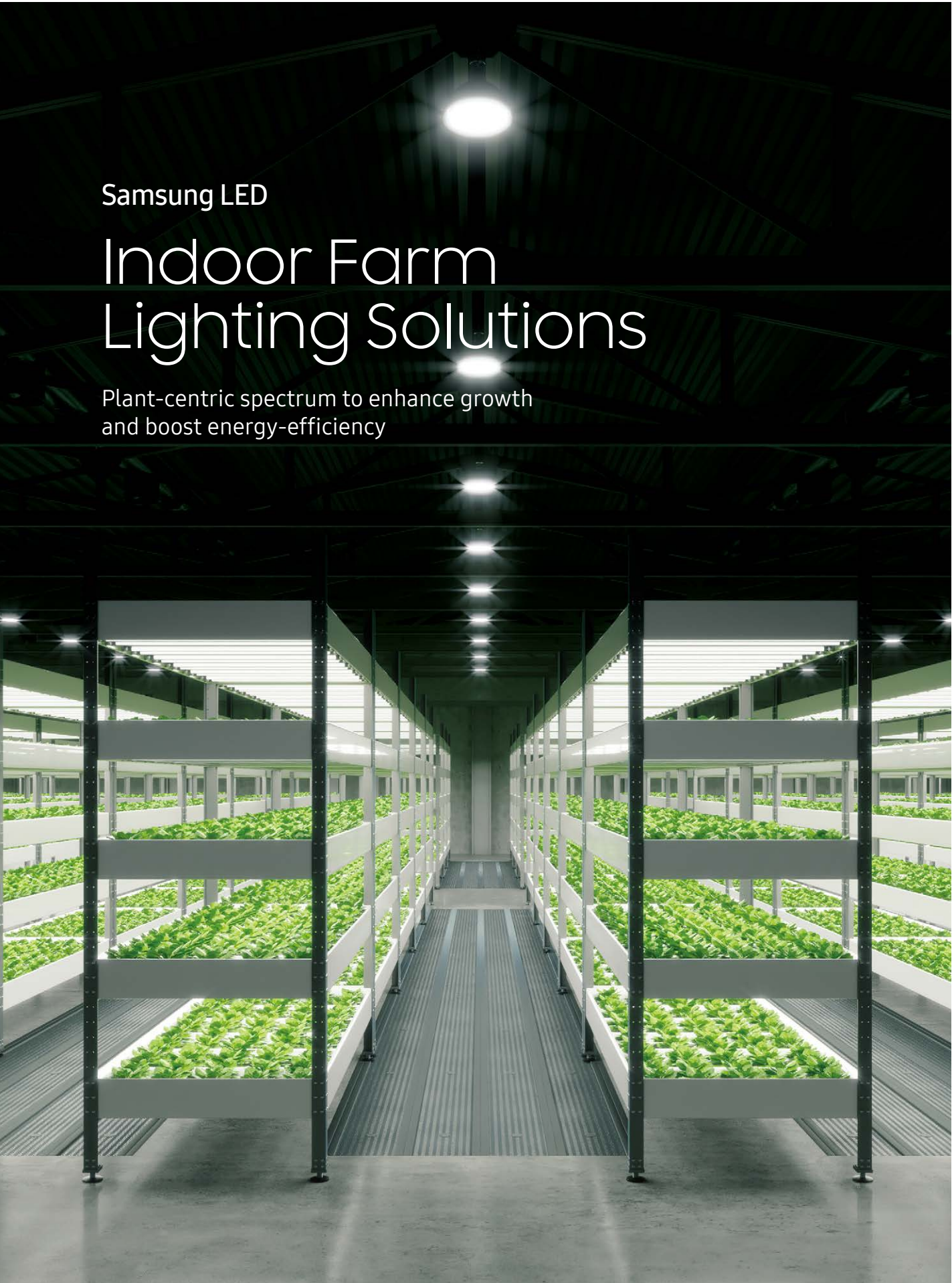
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Samsung Electronics Co., Ltd.
Samsung-ro 1, Giheung-gu, Yongin-si,
Gyeonggi-do, 17113 Korea

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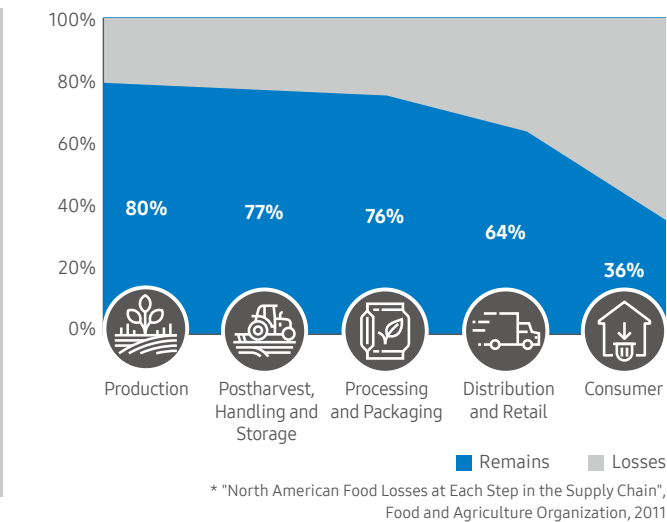
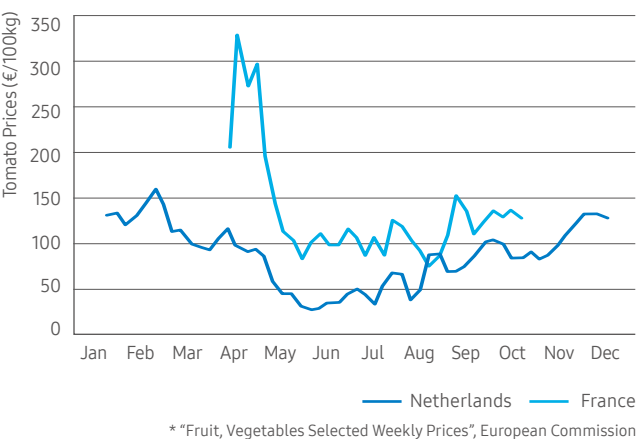




Indoor Farm Lighting Trends

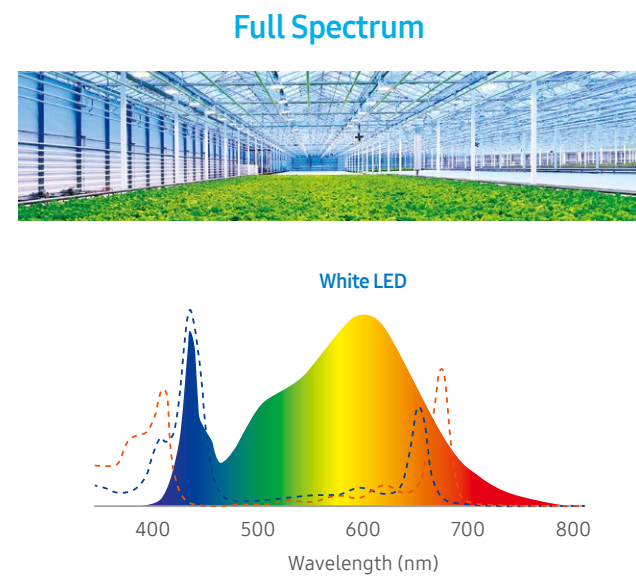
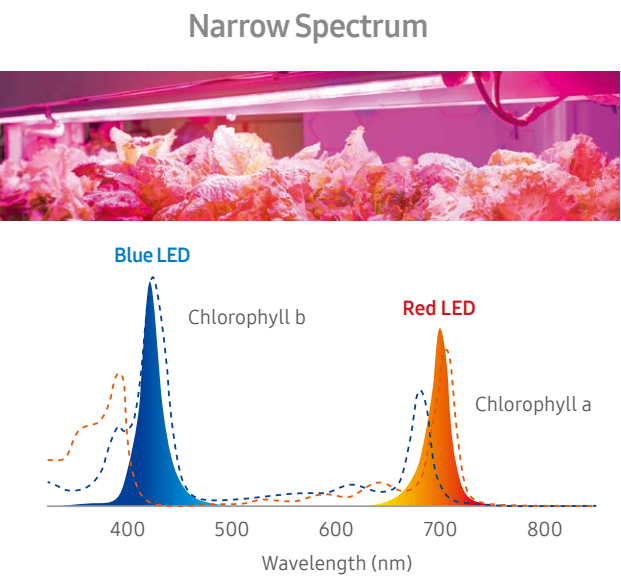
I Needs for Indoor Farm Lighting to Obtain Stable Crop Production

Due to unstable crop supplying and food losses, indoor controlled environment agriculture is becoming a new trend worldwide. It requires to provide stable lights under elaborate control for better plant growth.



I White-based Full Spectrum LED for Indoor Farm Lighting

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



Samsung Plant-centric Spectrum LEDs for Indoor Farm Lighting





Lower Operation Cost

Industry-leading PPE for energy saving




Boosting Growth

Differentiated spectrum for better plant growth



Keeping Crops Fresh

Suppressing microbial growth for longer shelf life

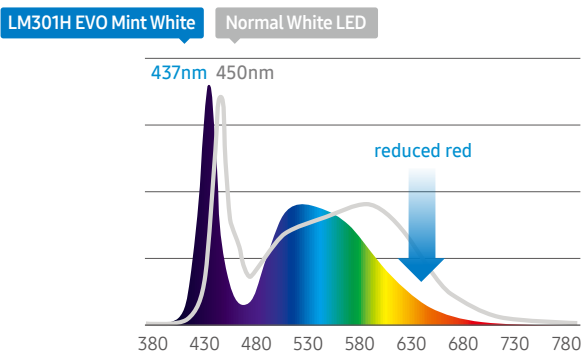
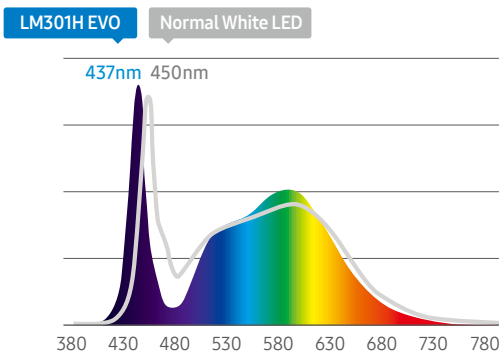


Robustness

Device architecture for durability

Industry-leading Efficacy

Samsung's Novel Plant-centric Spectrum



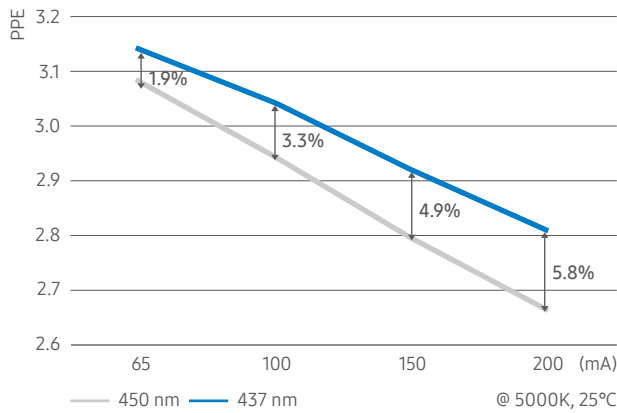
Industry-leading PPE under High Current Conditions

Ultimate Solution for Highest PPE

	Plant-centric Spectrum LED	Normal Full Spectrum LED	Remark
Form Factor (mm ²)	3.0 * 3.0	3.0 x 3.0	-
Spectrum Peak (nm)	437	450	-
PPF/W (μmol/J)	3.14	3.08	+2%

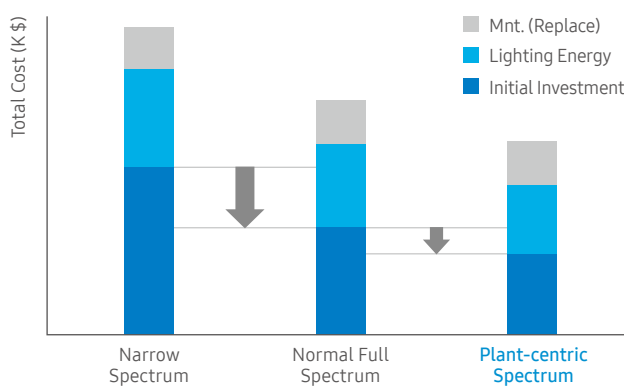
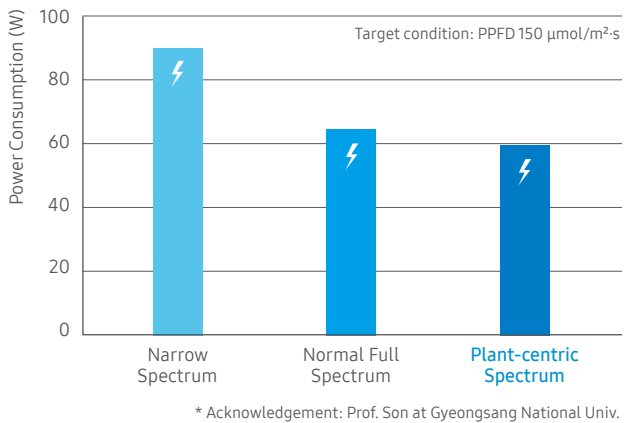
@ 65 mA, 25 °C, 5000K,

High PPE Maintenance by Current



Saving Energy Consumption for Lower Operation Cost

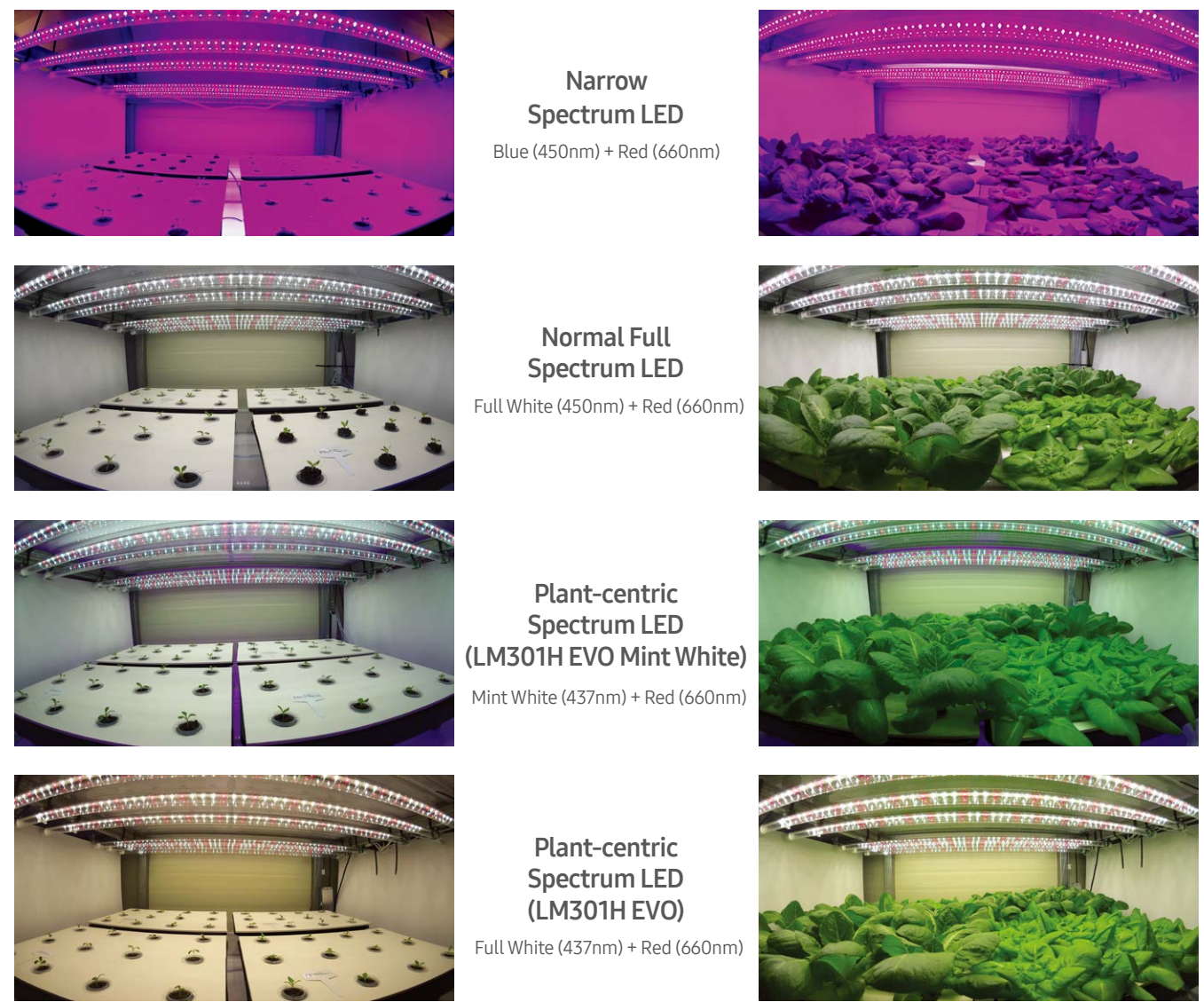
Thanks to the industry-leading PPE, Samsung's Plant-centric Spectrum LEDs bring the total cost down with the lowest initial investment and lower energy consumption.



Better Plant Growth

Spectrum Comparison Experiment

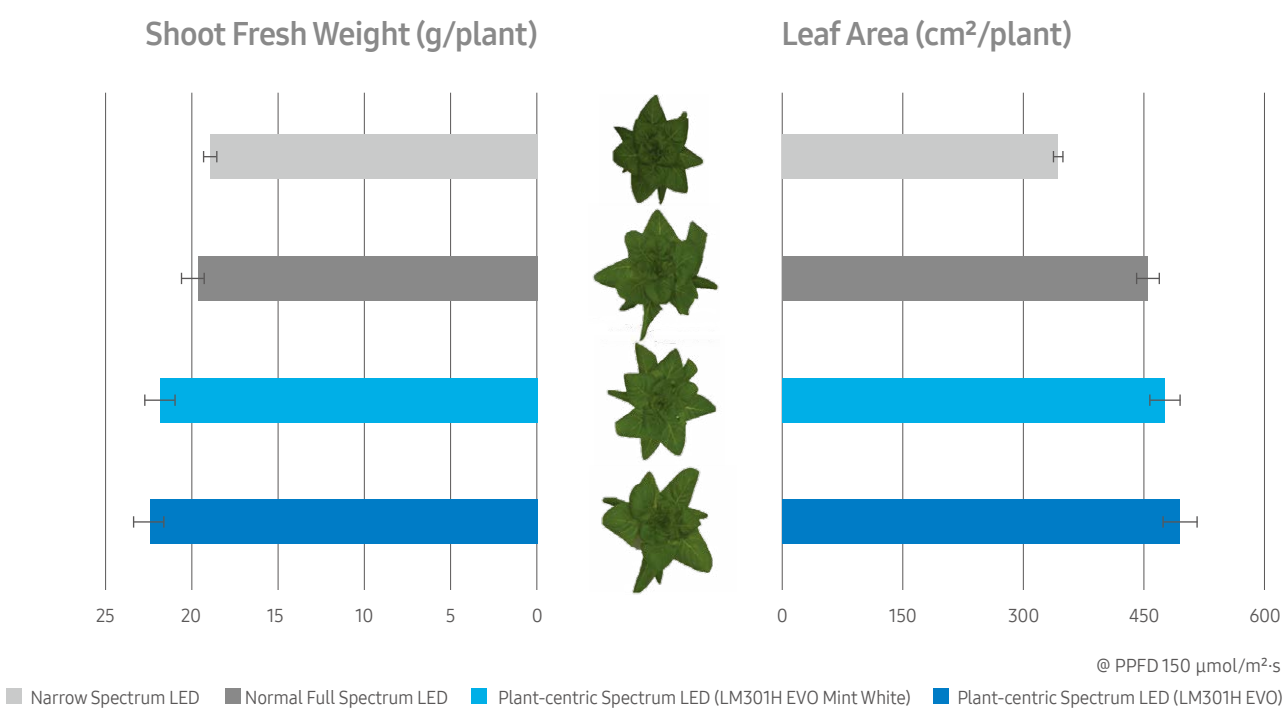
- Test Period: April 26th to June 4th, 2021
- Plants: Butterhead lettuce, Romaine lettuce
- Growth Condition
 - Temperature: ave. 20±3°C
 - Relative humidity: ave. 80
- Light Variables
 - Light spectrum under same power consumption (80W)
 - Light spectrum under same PPFD (150 μmol/m²·s)
- Measurements
 - Plant growth
 - Antioxidants concentration
 - Microbial growth



* Acknowledgement: Prof. Son at Gyeongsang National Univ.

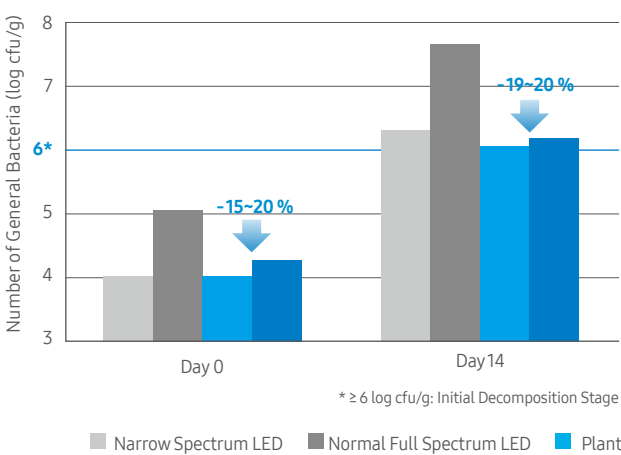
Better Plant Growth with Differentiated Spectrum

Even under the same PPFD conditions, Samsung's unique spectrum leads to larger and heavier growth.



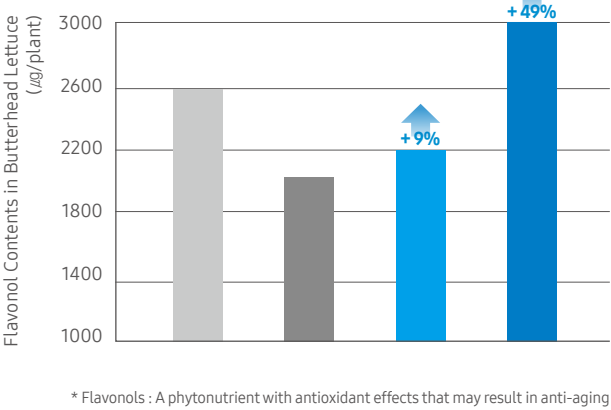
Longer Shelf Life

Shorter wavelength suppresses microbial growth leading to longer shelf life.



Enhanced Bioactive Compounds of Crops

437nm spectrum produced the highest quantity of flavonols* in butterhead lettuce.



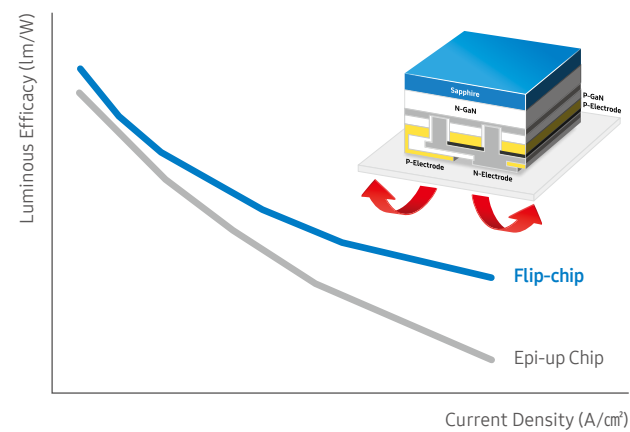
* Flavonols : A phytonutrient with antioxidant effects that may result in anti-aging

Robust Performance

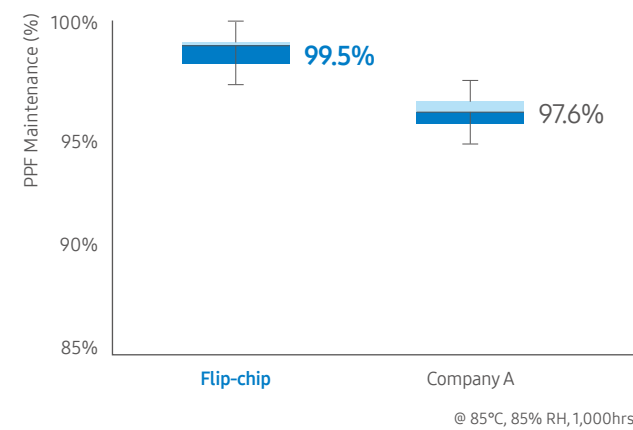
Excellent Heat Management

Samsung's flip-chip technology exhibits better thermal dissipation, resulting in preventing potential wire-open and blackout failure and maintaining superior efficacy in higher current density conditions

High Performance Maintenance by Current



High Temp/Humidity Operation Test

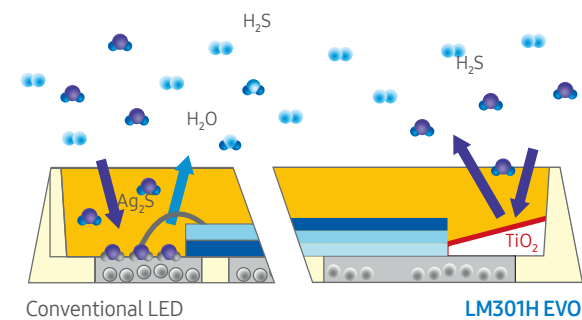


Superior Sulfur Resistance

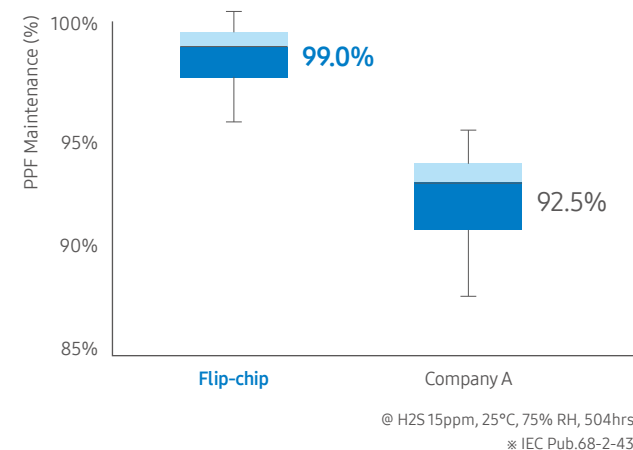
With a reflector structure and coating, Samsung's horticulture LEDs can present superior sulfur resistance in indoor farm conditions.

Samsung Horticulture Package

- Ag in wire or electrodes can be tarnished when exposed to H₂S
- 2Ag + H₂S + 1/2O₂ → Ag₂S + H₂O (Ag₂S causes PPF degradation)
- LM301H EVO: Flip-chip with no wire



Sulfur Resistance Test



Product Line-up

White Mid Power LEDs

Samsung's mid-power white LEDs deliver the highest efficacy and excellent reliability

LM301H EVO



- Plant-centric light spectrum for better growth
- World's best efficacy
- Anti-sulfurization (with flip-chip technology)

@65mA, 25°C, 5000K, CRI80+

Rank	Color	PPF (μmol/s)	PPF/W (μmol/J)	Footprint (mm²)
PR	White	0.56	3.14	3.0 × 3.0

LM301H EVO Mint White



- Plant-centric light spectrum for better growth
- World's best efficacy
- Anti-sulfurization (with flip-chip technology)

@65mA, 25°C, 5000K, CRI70+

Rank	Color	PPF (μmol/s)	PPF/W (μmol/J)	Footprint (mm²)
PM	White	0.57	3.17	3.0 × 3.0

LM301H



- Optimized light spectrum for leafy greens
- Anti-sulfurization (with flip-chip technology)

@65mA, 25°C, 5000K, CRI80+

Rank	Color	PPF (μmol/s)	PPF/W (μmol/J)	Footprint (mm²)
SL	White	0.54	3.08	3.0 × 3.0

LM301H ONE



- Optimized light spectrum for leafy greens
- Anti-sulfurization (with flip-chip technology)

@65mA, 25°C, 3500K, CRI70+

Rank	Color	PPF (μmol/s)	PPF/W (μmol/J)	Footprint (mm²)
S0	White	0.49	2.75	3.0 × 3.0

White High Power LEDs

Full line-up of high power white LEDs with industry-proven performance for various horticulture applications

LH241H



- Compact design for small LES module
- Viewing angle: 120°
- Thermal resistance: 2.0K/W

@350mA, 25°C, 5000K, CRI70+

Rank	Color	PPF (μmol/s)	PPF/W (μmol/J)	Footprint (mm²)
R1	White	2.51	2.52	2.4 × 2.4

LH281H



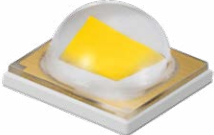
- Compact design for small LES module
- Viewing angle: 120°
- Thermal resistance: 2.0K/W

@350mA, 25°C, 5000K, CRI70+

Rank	Color	PPF (μmol/s)	PPF/W (μmol/J)	Footprint (mm²)
SB	White	2.59	2.65	2.8 × 2.8

Product Line-up

LH351H-B



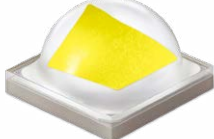
• Viewing angle: 120°

• Thermal resistance: 4.2K/W

@350mA, 25°C, 5000K, CRI70+

Rank	Color	PPF (μmol/s)	PPF/W (μmol/J)	Footprint (mm²)
Q1	White	2.48	2.51	3.5 × 3.5

LH351H-C



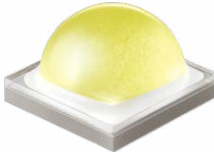
• Viewing angle: 130°

• Thermal resistance: 3.0K/W

@350mA, 25°C, 5000K, CRI70+

Rank	Color	PPF (μmol/s)	PPF/W (μmol/J)	Footprint (mm²)
RB	White	2.56	2.60	3.5 × 3.5

LH351H-D



• Viewing angle: 130°

• Thermal resistance: 2.2K/W

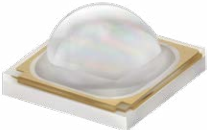
@350mA, 25°C, 5000K, CRI70+

Rank	Color	PPF (μmol/s)	PPF/W (μmol/J)	Footprint (mm²)
Y2	White	2.58	2.69	3.5 × 3.5

I Color High Power LEDs

Full line-up of high power color LEDs with industry-proven performance for various horticulture applications

LH351H Blue
(450nm)



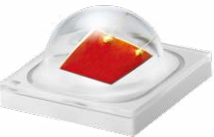
• Viewing angle: 130°

• Thermal resistance: 4.0K/W

@350mA, 25°C

Color	PPF (μmol/s)	PPF/W (μmol/J)	Footprint (mm²)
Blue	2.80	2.80	3.5 × 3.5

LH351H Red
(630nm)



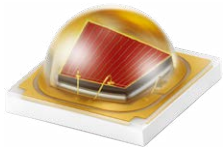
• Viewing angle: 120°

• Thermal resistance: 4.0K/W

@350mA, 25°C

Color	PPF (μmol/s)	PPF/W (μmol/J)	Footprint (mm²)
Red	1.82	2.41	3.5 × 3.5

LH351H Deep Red
(660nm)



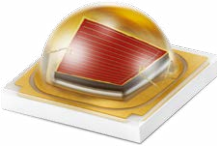
• Viewing angle: 120°

• Thermal resistance: 2.5K/W

@350mA, 25°C

Color	PPF (μmol/s)	PPF/W (μmol/J)	Footprint (mm²)
Deep Red	2.4	3.22	3.5 × 3.5

LH351H Deep Red
(660nm) V2



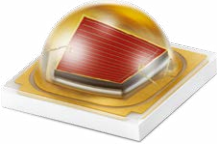
• Viewing angle: 130°

• Thermal resistance: 3.0K/W

@700mA, 25°C

Color	PPF (μmol/s)	PPF/W (μmol/J)	Footprint (mm²)
Deep Red	5.54	3.75	3.5 × 3.5

LH351H Deep Red
(660nm) V2+



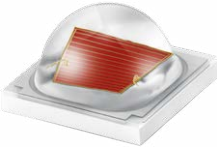
• Viewing angle: 130°

• Thermal resistance: 3.0K/W

@700mA, 25°C

Color	PPF (μmol/s)	PPF/W (μmol/J)	Footprint (mm²)
Deep Red	5.6	3.8	3.5 × 3.5

LH351H Deep Red
(660nm) V3



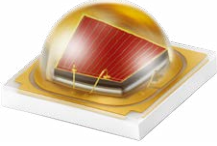
• Viewing angle: 130°

• Thermal resistance: 3.0K/W

@700mA, 25°C

Color	PPF (μmol/s)	PPF/W (μmol/J)	Footprint (mm²)
Deep Red	5.65	3.9	3.5 × 3.5

LH351H Far Red
(730nm)



• Viewing angle: 120°

• Thermal resistance: 3.9K/W

@350mA, 25°C

Color	* BPF (μmol/s)	* BPF/W (μmol/J)	Footprint (mm²)
Far Red	2.07	3.1	3.5 × 3.5

* Biologically-active Photon Flux

I Module

Customized designs are also available per customer request

Horticulture LED Module Gen2



Color	PPF (μmol/s)	PPF/W (μmol/J)	Luminous Flux (lm)	Watt (W)	Vf (V)	IF (mA)	Efficacy (lm/W)	Tp (°C)
White + Red	154.2	3.06	8,960	50.4	42	1,200	178	25

* Subject to change without notice