High Voltage LED Series
Chip on Board

LC016D – Gen.1

High efficacy COB LED package
well-suited for use in spotlight applications

Features & Benefits

- Chip on Board (COB) solution makes it easy to design in
- Simple assembly reduces manufacturing cost
- Low thermal resistance
- InGaN/GaN MQW LED with long time reliability

Applications

- Spotlight / Downlight
- LED Retrofit Bulbs
- Outdoor Illumination

SAMSUNG

Table of Contents

1. Characteristics

a) Absolute Maximum Rating

Item	Symbol	Rating	Unit	Condition
Ambient / Operating Temperature	T_a	-40 ~ +105	ºC	-
Storage Temperature	T_{stg}	-40 ~ +120	ºC	-
LED Junction Temperature	T_J	140	ºC	-
Case Temperature	Tc	105	ºC	
Forward Current	I_F	1150	mA	-
Power Dissipation	P_D	43.1	W	-
ESD (HBM)	-	±2	kV	-
ESD (MM)	-	±0.5	kV	-

b) Electro-optical Characteristics (I_F = 450 mA, T_J = 85 ºC)

Item	Unit	Rank	Min.	Typ.	Max.
Forward Voltage (V_F)	V	YZ	31.8	34.6	37.5
Color Rendering Index (R_a)	-	5	80	-	-
		7	90		
Thermal Resistance (junction to chip point)	ºC/W		-	1.1	-
Beam Angle	º		-	115	-
Nominal Power	W			16.9	

Notes:

1) The COB is tested in pulsed condition at rated test current (10 ms pulse width) and rated temperature (T_J = T_C = T_a = 85 °C)
2) Samsung maintains measurement tolerance of: forward voltage = ±5 %, CRI = ±1
3) Refer to the derating curve, '3. Typical Characteristics Graph' designed within the range.

c) Luminous Flux Characteristics (I_F = 450 mA)

CRI (R_a) Min.	Nominal CCT (K)	Flux Rank	Flux Bin	Flux @ T_J = 85 °C (lm)		
				Min.	Typ.	Max.
80	2700	H9	H9	1962	2065	-
		D1	D1	2065	2169	-
	3000	J0	J0	2073	2182	-
		D1	D1	2182	2291	-
	3500	J1	J1	2150	2263	-
		D1	D1	2263	2376	-
	4000	J1	J1	2189	2304	-
		D1	D1	2304	2419	-
	5000	J2	J2	2208	2324	-
		D1	D1	2324	2440	-
	5700	J2	J2	2208	2324	-
		D1	D1	2324	2440	-
	6500	J1	J1	2189	2304	-
		D1	D1	2304	2419	-

CRI (R_a) Min.	Nominal CCT (K)	Flux Rank	Flux Bin	Flux @ T_J = 85 °C (lm)		
				Min.	Typ.	Max.
90	2700	H6	H6	1683	1771	-
		D1	D1	1771	1860	-
	3000	H7	H7	1783	1877	-
		D1	D1	1877	1970	-
	3500	H8	H8	1836	1932	-
		D1	D1	1932	2029	-
	4000	H8	H8	1872	1971	-
		D1	D1	1971	2069	-
	5000	H8	H8	1890	1989	-
		D1	D1	1989	2089	-

Notes:

1) The COB is tested in pulsed operating condition at rated test current (10 ms pulse width) and rated temperature (T_J = T_C = 85 °C).
2) Samsung maintains measurement tolerance of: Luminous flux = ±7 %, CRI = ±1

2. Product Code Information

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
S	P	H	W	H	A	H	D	N	E	2	5	Y	Z	W	3	H	9

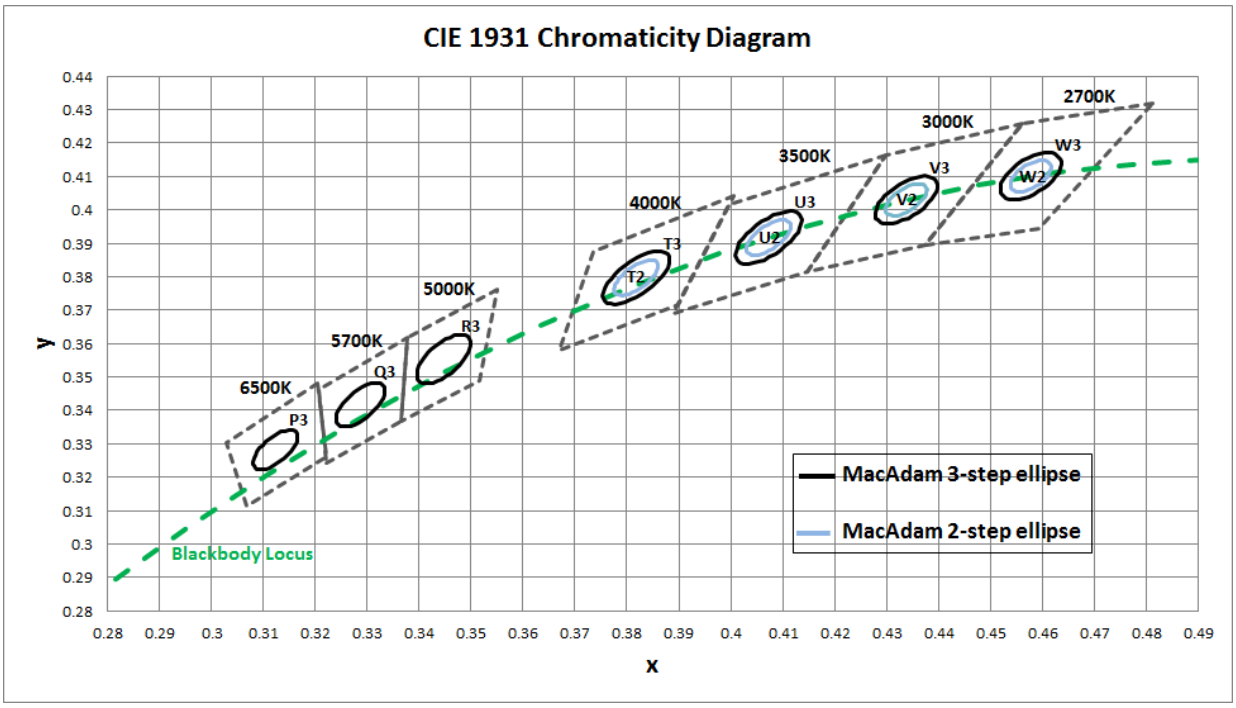
Digit	PKG Information	Code	Specification
1 2 3	Samsung Package High Power	SPH	
4 5	Color	WH	White
6	Product Version	A	
7 8	Form Factor	HD	COB
9	Lens Type	N	No lens
10	Wattage or Model	E	LC016D
11	Internal Code	2	
12	CRI & Sorting Temperature	5	Min. 80 (85℃)
		7	Min. 90 (85℃)
13 14	Forward Voltage (V)	YZ	31.8~37.5
15	CCT (K)	W	2700K
		V	3000K
		U	3500K
		T	4000K
		R	5000K
		Q	5700K
		P	6500K
16	MacAdam Step	2	MacAdam 2-step
		3	MacAdam 3-step
17 18	Luminous Flux (Lm)	H6	Min. 1600
		H7	Min. 1700
		H8	Min. 1800
		H9	Min. 1900
		J0	Min. 2000
		J1	Min. 2100
		J2	Min. 2200
		D1	Add rank

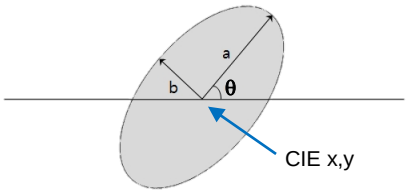
a) Binning Structure (I_F = 450 mA, T_J = 85 ºC)

CRI (R_a) Min.	Nominal CCT (K)	Product Code	V_F Rank	Color Rank	Flux Rank	Flux Range (Φ_v, lm)
80	2700	SPHWHAHDNE25YZW2H9	YZ	W2	H9	1962 ~
		SPHWHAHDNE25YZW3H9		W3		
		SPHWHAHDNE25YZW2D1		W2	D1	2065 ~
		SPHWHAHDNE25YZW3D1		W3		
	3000	SPHWHAHDNE25YZV2J0	YZ	V2	J0	2073 ~
		SPHWHAHDNE25YZV3J0		V3		
		SPHWHAHDNE25YZV2D1		V2	D1	2182 ~
		SPHWHAHDNE25YZV3D1		V3		
	3500	SPHWHAHDNE25YZU2J1	YZ	U2	J1	2150 ~
		SPHWHAHDNE25YZU3J1		U3		
		SPHWHAHDNE25YZU2D1		U2	D1	2263 ~
		SPHWHAHDNE25YZU3D1		U3		
	4000	SPHWHAHDNE25YZT2J1	YZ	T2	J1	2189 ~
		SPHWHAHDNE25YZT3J1		T3		
		SPHWHAHDNE25YZT2D1		T2	D1	2324 ~
		SPHWHAHDNE25YZT3D1		T3		
	5000	SPHWHAHDNE25YZR3J2	YZ	R3	J2	2208 ~
		SPHWHAHDNE25YZR3D1			D1	2324 ~
	5700	SPHWHAHDNE25YZQ3J2	YZ	Q3	J2	2208 ~
		SPHWHAHDNE25YZQ3D1			D1	2324 ~
	6500	SPHWHAHDNE25YZP3J1	YZ	P3	J1	2189 ~
		SPHWHAHDNE25YZP3D1			D1	2304 ~

CRI (R_a) Min.	Nominal CCT (K)	Product Code	V_F Rank	Color Rank	Flux Rank	Flux Range (Φ_v, lm)
90	2700	SPHWHAHDNE27YZW2H6	YZ	W2	H6	1683 ~
		SPHWHAHDNE27YZW3H6		W3		
		SPHWHAHDNE27YZW2D1		W2	D1	1771 ~
		SPHWHAHDNE27YZW3D1		W3		
	3000	SPHWHAHDNE27YZV2H7		V2	H7	1783 ~
		SPHWHAHDNE27YZV3H7		V3		
		SPHWHAHDNE27YZV2D1		V2	D1	1877 ~
		SPHWHAHDNE27YZV3D1		V3		
	3500	SPHWHAHDNE27YZU2H8		U2	H8	1836 ~
		SPHWHAHDNE27YZU3H8		U3		
		SPHWHAHDNE27YZU2D1		U2	D1	1932 ~
		SPHWHAHDNE27YZU3D1		U3		
	4000	SPHWHAHDNE27YZT2H8		T2	H8	1872 ~
		SPHWHAHDNE27YZT3H8		T3		
		SPHWHAHDNE27YZT2D1		T2	D1	1971 ~
		SPHWHAHDNE27YZT3D1		T3		
	5000	SPHWHAHDNE27YZR3H8		R3	H8	1890 ~
		SPHWHAHDNE27YZR3D1		R3	D1	1989 ~

b) Chromaticity Region & Coordinates (I_F = 450 mA, T_J = 85 ºC)





MacAdam Ellipse (W2, W3)					
Step	CIE x	CIE y	θ	a	b
2-step	0.4578	0.4101	53.70	0.0054	0.0028
3-step	0.4578	0.4101	53.70	0.0081	0.0042

MacAdam Ellipse (V2, V3)					
Step	CIE x	CIE y	θ	a	b
2-step	0.4338	0.403	53.22	0.0056	0.0027
3-step	0.4338	0.4030	53.22	0.0083	0.0041

MacAdam Ellipse (U2, U3)					
Step	CIE x	CIE y	θ	a	b
2-step	0.4073	0.3917	54.00	0.0062	0.0028
3-step	0.4073	0.3917	54.00	0.0093	0.0041

MacAdam Ellipse (T2, T3)					
Step	CIE x	CIE y	θ	a	b
2-step	0.3818	0.3797	53.72	0.0063	0.0027
3-step	0.3818	0.3797	53.72	0.0094	0.0040

MacAdam Ellipse (R3)					
Step	CIE x	CIE y	θ	a	b
3-step	0.3447	0.3553	59.62	0.0082	0.0035

MacAdam Ellipse (Q3)					
Step	CIE x	CIE y	θ	a	b
3-step	0.3287	0.3417	59.0950	0.0075	0.0032

MacAdam Ellipse (P3)					
Step	CIE x	CIE y	θ	a	b
3-step	0.3123	0.3282	58.5700	0.0067	0.0029

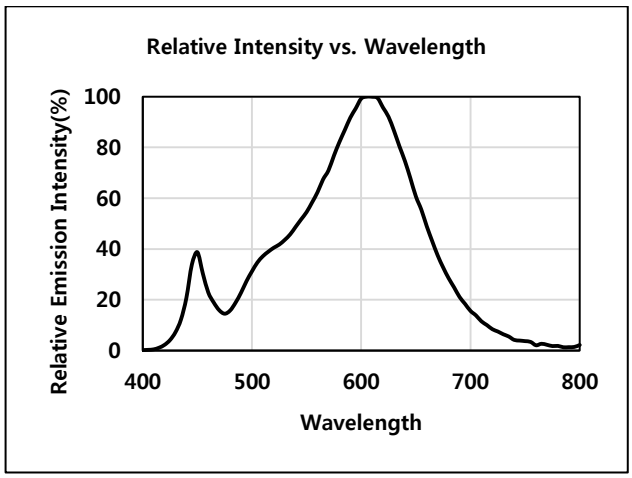
Note:

Samsung maintains measurement tolerance of: Cx, Cy = ±0.005

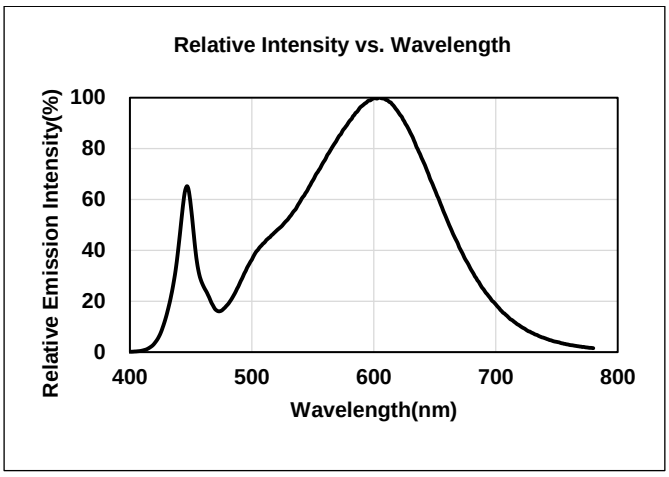
3. Typical Characteristics Graphs

a) Spectrum Distribution (I_F = 450 mA, T_J = 85 ºC)

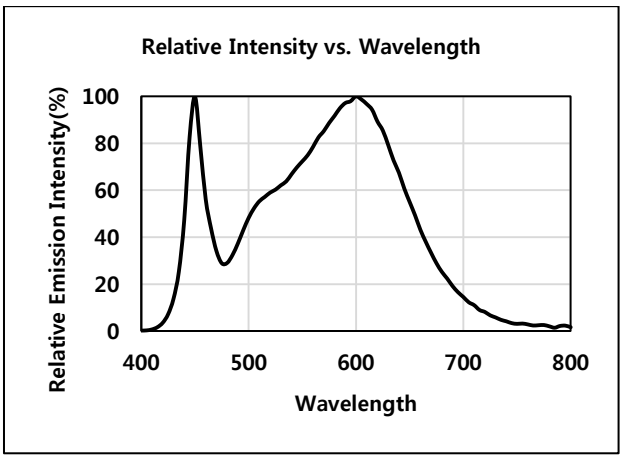
CCT: 2700 K (80 CRI)



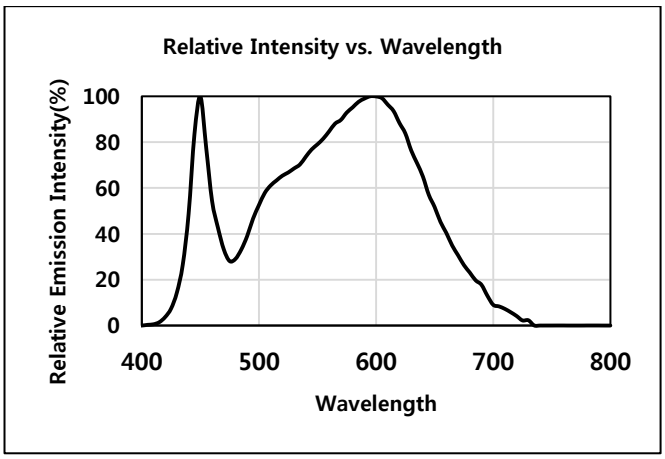
CCT: 3000 K (80 CRI)



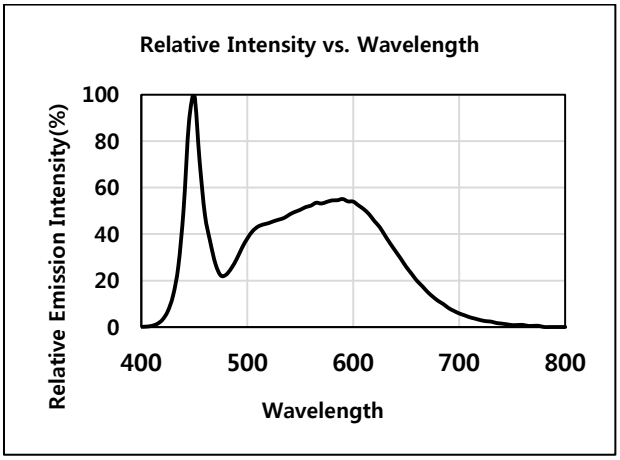
CCT: 3500 K (80 CRI)



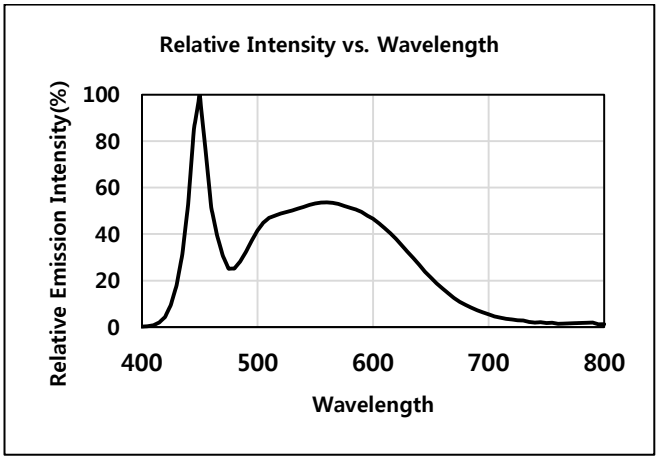
CCT: 4000 K (80 CRI)



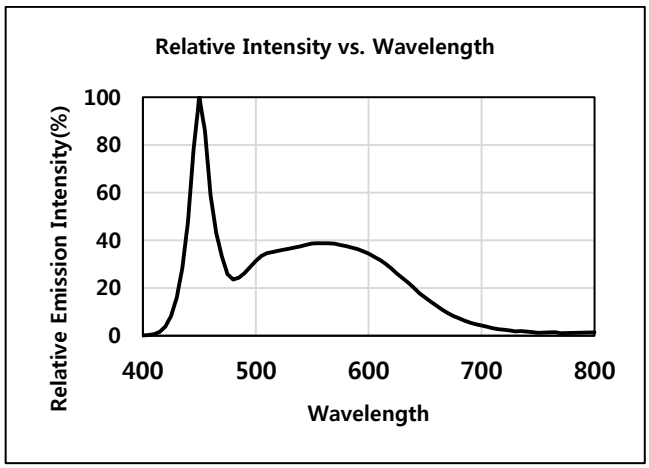
CCT: 5000 K (80 CRI)



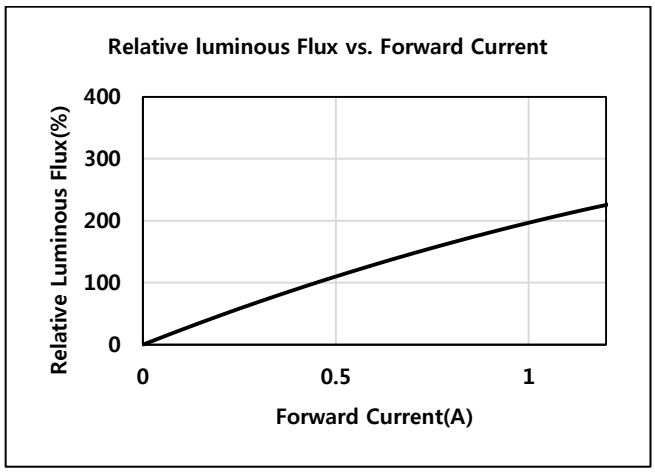
CCT: 5700 K (80 CRI)

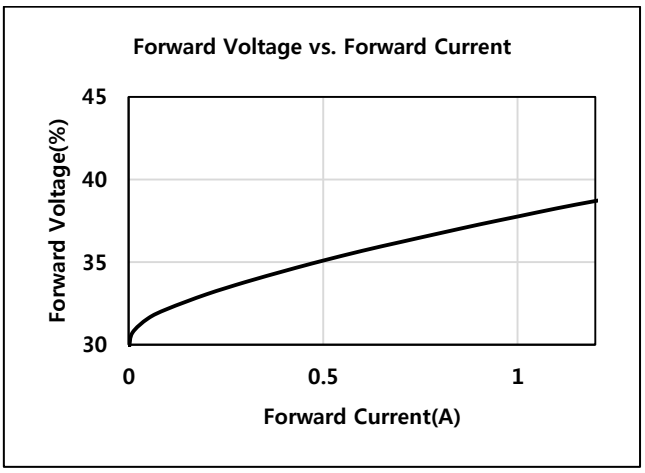


CCT: 6500 K (80 CRI)

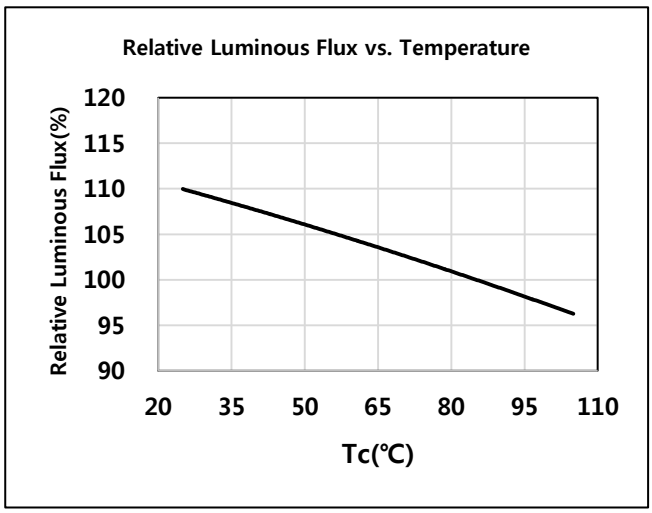


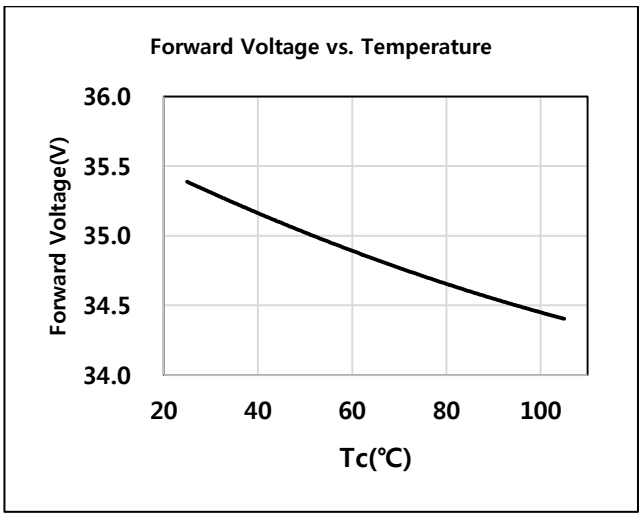
b) Forward Current Characteristics (T_J = 85 ºC)



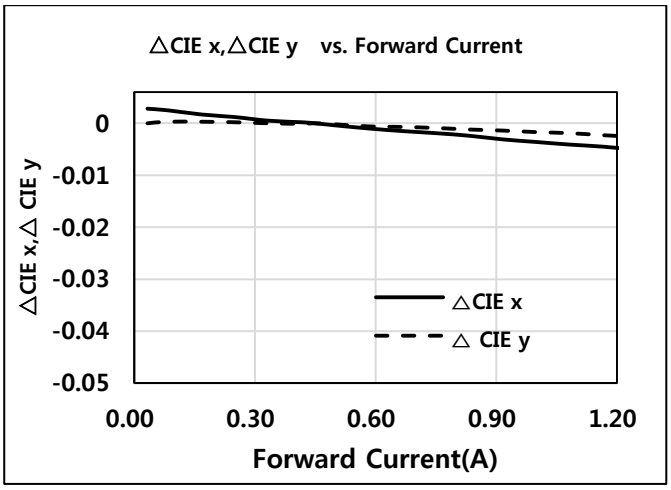


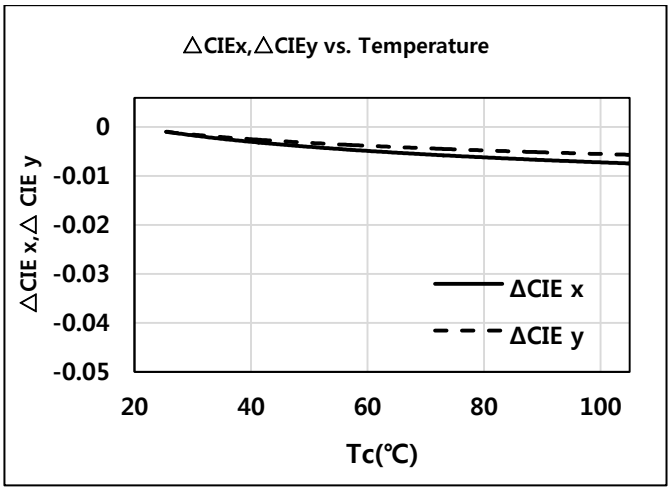
C) Temperature Characteristics (I_F = 450mA)



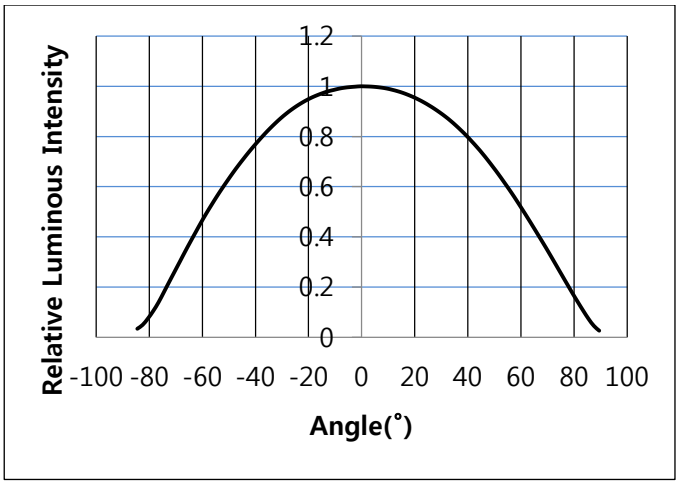


d) Color Shift Characteristics (T_J = 85 ºC, I_F = 450mA, CRI80+)

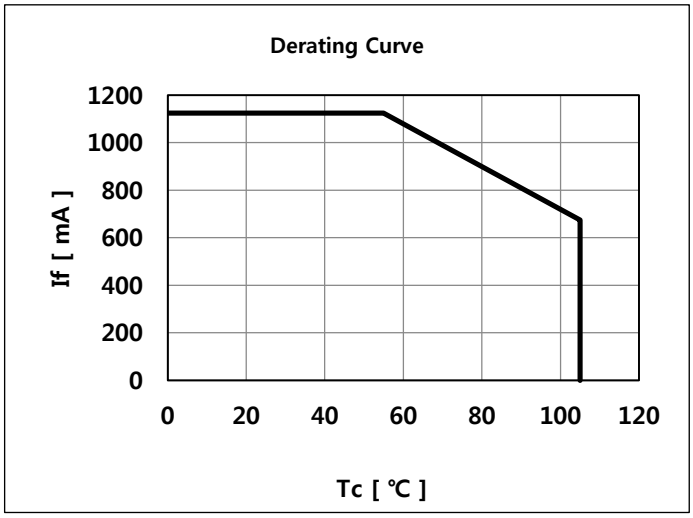




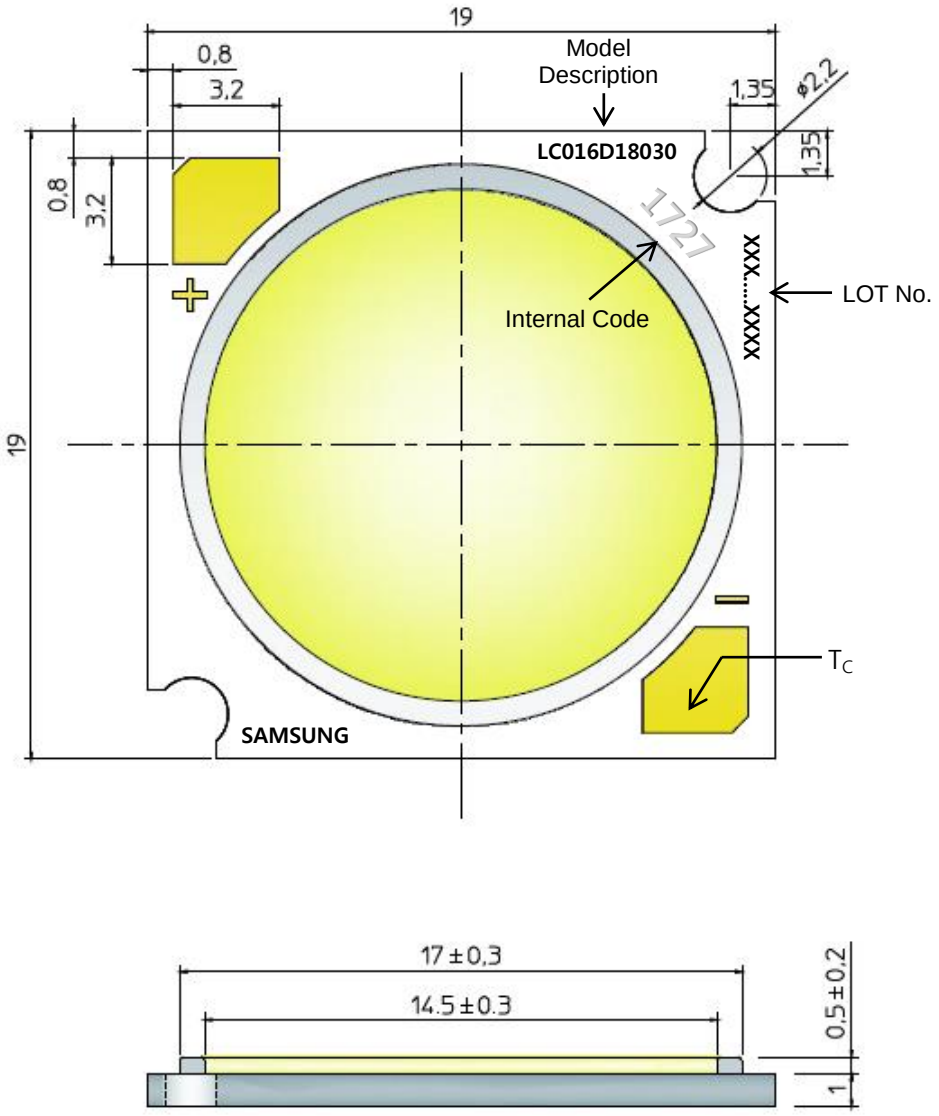
e) Beam Angle Characteristics (I_F = 450 mA, T_J = 85 ºC)



f) Derating Characteristics



4. Outline Drawing & Dimension



1. Unit: mm
2. Tolerance: ± 0.3 mm

Item	Dimension	Tolerance	Unit
Length	19.0	±0.15	mm
Width	19.0	±0.15	mm
Height	1.50	±0.30	mm
Light Emitting Surface (LES) Diameter	14.5	±0.30	mm

Note: Denoted product information above is only an example
(LC016D18030 : LC016D, CRI80+, 3000K)

5. Reliability Test Items & Conditions

a) Test Items

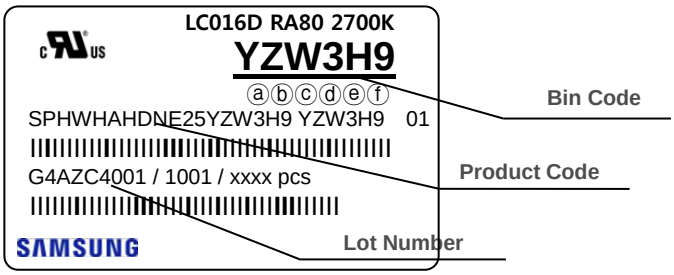
Test Item	Test Condition	Test Hour / Cycle
High Temperature Humidity Life Test	60 ºC, 90 % RH,, DC Derating, I_F	1000 h
High Temperature Life Test	85 ºC, DC Derating, I_F	1000 h
Low Temperature Life Test	-40 ºC, DC , I_F = 810 mA	1000 h
Pulsed Operating Life Test	55 ℃, Pulse width 100 μs, duty cycle 3 %	1000 h
High Temperature Storage	120 ºC	1000 h
Low Temperature Storage	-40 ºC	1000 h
Temperature Humidity Storage	60 ºC, 90% RH	1000h
Temperature Cycle On/Off Test	-40 ºC / 85 ºC each 20 min, 30 min transfer power on/off each 5 min, DC Derating, I_F = max	100 cycles
ESD (HBM)	R_1: 10 MΩ R_2: 1.5 kΩ C: 100 pF V: ±2 kV	5 times
ESD (MM)	R_1: 10 MΩ R_2: 0 kΩ C: 200 pF V: ±0.2 kV	5 times
Vibration Test	20 ~ 80 Hz (displacement: 0.06 inch, max. 20 g) 80 ~ 2 kHz (max. 20 g) min. frequency ↔ max. frequency 4 min transfer	4 times
Mechanical Shock Test	1500 g, 0.5 ms each of the 6 surfaces (3 axis x 2 sides)	5 times
Sulfur Resistance	25 °C, 75%, H2S 15 ppm	504h

b) Criteria for Judging the Damage

Item	Symbol	Test Condition (T_c = 25 ºC)	Limit	
			Min.	Max.
Forward Voltage	V_F	I_F = 450 mA	L.S.L. * 0.9	U.S.L. * 1.1
Luminous Flux	Φ_v	I_F = 450 mA	L.S.L * 0.7	U.S.L * 1.3

6. Label Structure

a) Label Structure



Note: Denoted bin code and product code above is only an example (see description on page 5)

Bin Code:

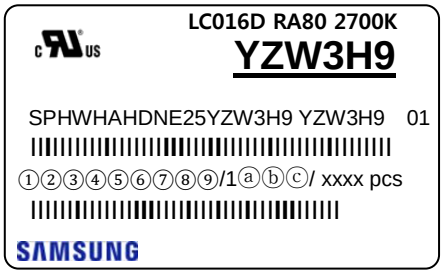
ⓐⓑ: Forward Voltage bin (refer to page 11)

ⓒⓓ: Chromaticity bin (refer to page 9-10)

ⓔⓕ: Luminous Flux bin (refer to page 6)

b) Lot Number

The lot number is composed of the following characters:



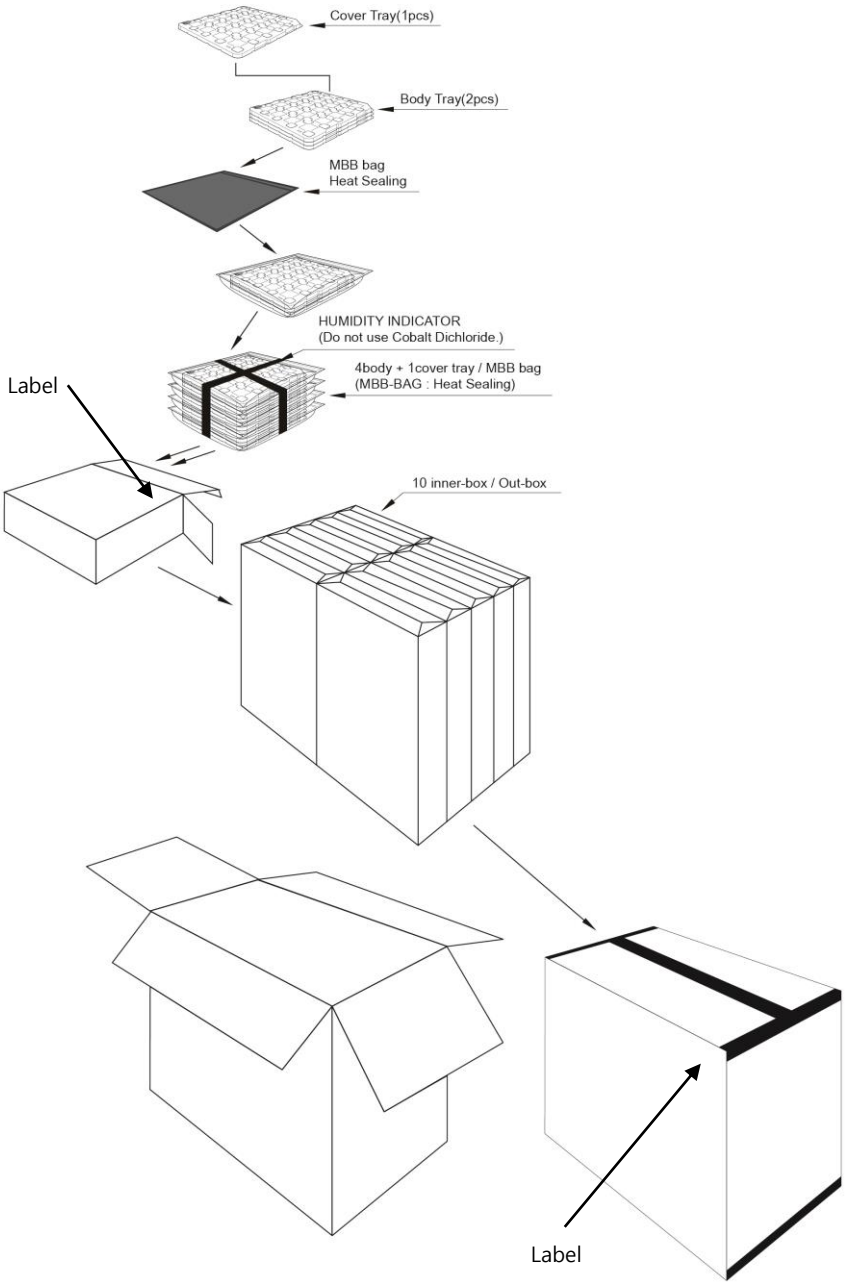
① ③④⑤⑥⑦⑧⑨ / 1ⓐⓑⓒ / xxxx pcs

①	:	Production site (S: Giheung, Korea, G: Tianjin, China)
②	:	4 (LED)
③	:	Product state (A: Normal, B: Bulk, C: First Production, R: Reproduction, S: Sample)
④	:	Year (Z: 2015, A: 2016, B: 2017…)
⑤	:	Month (1~9, A, B, C)
⑥⑦⑧⑨	:	Day (1~9, A, B~V)
ⓐⓑⓒ	:	Product serial number (001 ~ 999)

6. Packing Structure

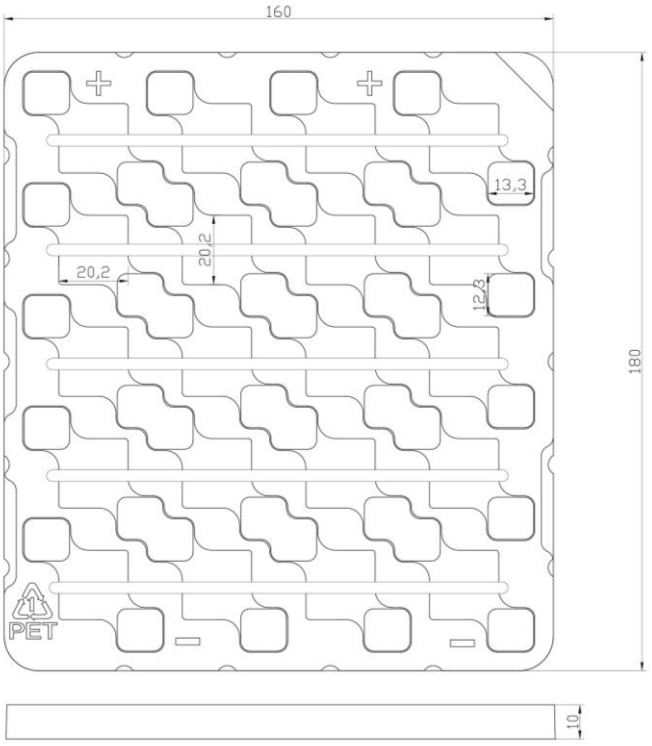
Packing material	Max. quantity in pcs of COB	Dimension(mm)			
		Length	Width	Height	Tolerance
Tray	20	160	180	10	1.0
Aluminum Bag	40(2 trays)	210	241		10
Inner Box	160	230	84	260	2
Outer Box	1600	476	445	272	5

a) Packing Structure

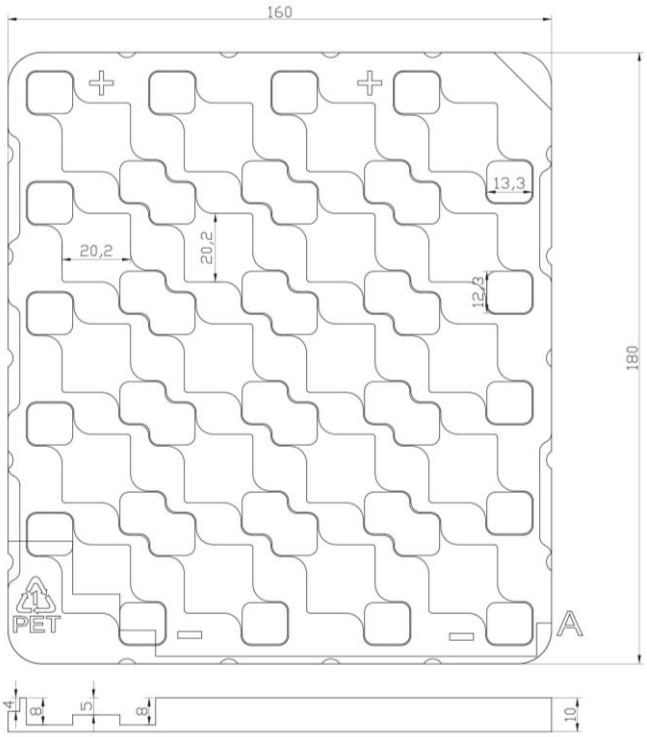


b) Tray

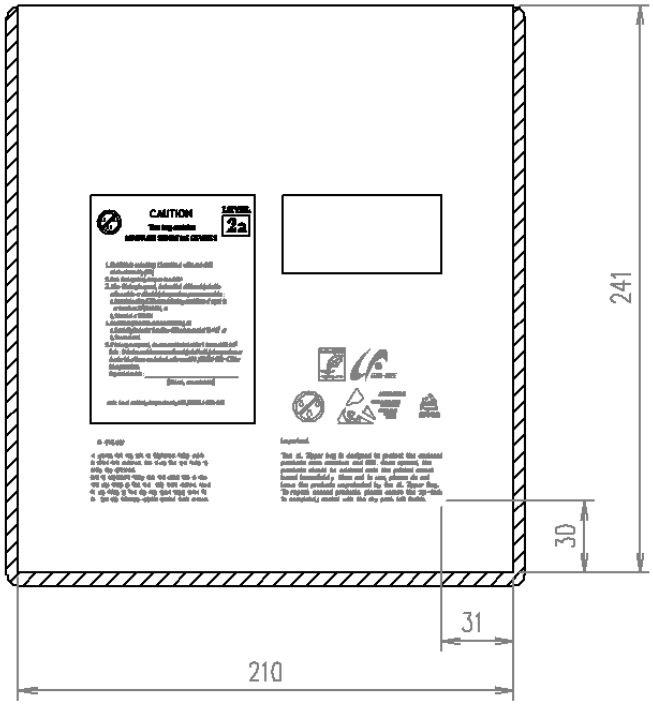
① Cover



② Body



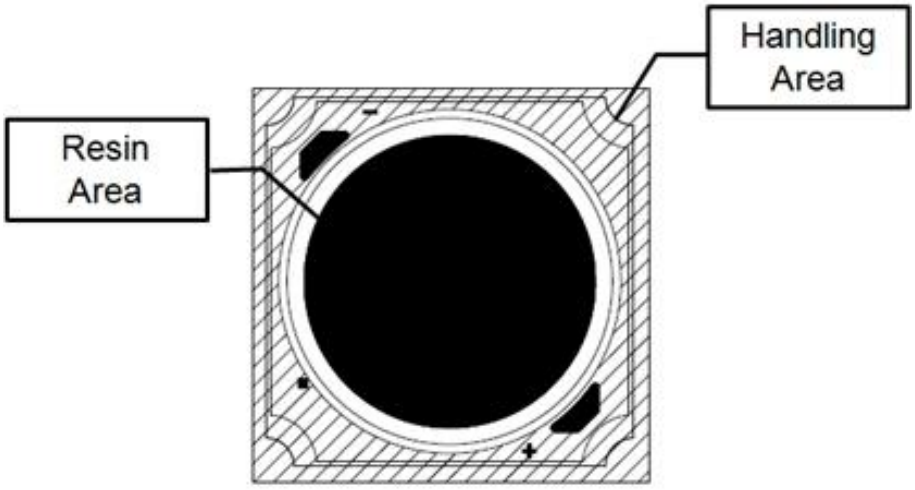
c) Aluminum Vinyl Packing Bag



8. Precautions in Handling & Use

1) This device should not be used in any type of fluid such as water, oil, organic solvent, etc. When cleaning is required, IPA is recommended as the cleaning agent. Some solvent-based cleaning agent may damage the silicone resins used in the device.
2) LEDs must be stored in a clean environment. If the LEDs are to be stored for three months or more after being shipped from Samsung, they should be packed with a nitrogen-filled container (shelf life of sealed bags is 12 months at temperature 0~40 ºC, 0~90 % RH).
3) After storage bag is opened, device subjected to soldering, solder reflow, or other high temperature processes must be:
   a. Mounted within 672 hours (28 days) at an assembly line with a condition of no more than 30 ºC / 60 % RH, or
   b. Stored at <10 % RH
4) Repack unused products with anti-moisture packing, fold to close any opening and then store in a dry place.
5) Devices require baking before mounting, if humidity card reading is >60 % at 23 ± 5 ºC.
6) Devices must be baked for 1 hour at 60 ± 5 ºC, if baking is required.
7) The LEDs are sensitive to the static electricity and surge current. It is recommended to use a wrist band or anti-electrostatic glove when handling the LEDs. If voltage exceeding the absolute maximum rating is applied to LEDs, it may cause damage or even destruction to LED devices. Damaged LEDs may show some unusual characteristics such as increase in leakage current, lowered turn-on voltage, or abnormal lighting of LEDs at low current.
8) The thermal management is one of the most critical factors for the LED lighting system. Especially the LED junction temperature should not exceed the absolute maximum rating while operation of LED lighting system.

   For more information, please refer to Application Note ‘Mechanical & Thermal Guide for COB’.
9) In case of driving LEDs around the minimum current level (If_min), chips might exhibit different brightness due to the variation in I-V characteristics of each one. This is normal and does not adversely affect the performance of product.
10) VOCs (Volatile Organic Compounds) can be generated from adhesives, flux, hardener or organic additives used in luminaires (fixtures). Transparent LED silicone encapsulant is permeable to those chemicals and they may lead to a discoloration of encapsulant when they exposed to heat or light. This phenomenon can cause a significant loss of light emitted (output) from the luminaires. In order to prevent these problems, we recommend users to know the physical properties of materials used in luminaires and they must be carefully selected.
11) The resin area is very sensitive, please do not handle, press, touch, rub, clean, or pick by with tweezers on it. Instead, please pick at the handling area as indicated below.



Legal and additional information.

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Samsung Electronics Co., Ltd. inspires the world and shapes the future with transformative ideas and technologies, redefining the worlds of TVs, smartphones, wearable devices, tablets, cameras, digital appliances, printers, medical equipment, network systems and semiconductors. We are also leading in the Internet of Things space through, among others, our Digital Health and Smart Home initiatives. We employ 307,000 people across 84 countries. To discover more, please visit our official website at www.samsung.com and our official blog at global.samsungtomorrow.com.

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