

Middle Power LED Series  
2835 0.5W Room Temp

# LM281B+

## SArank



Designed for better lm/\$ (Ambient, Linear)

### Features & Benefits

- 0.5W Class mid power LED
- Standard form factor for design flexibility (2.8 x 3.4 mm)



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## 1. Characteristics

### a) Absolute Maximum Rating

Item	Symbol	Rating	Unit	Condition
Ambient / Operating Temperature	$T_a$	$-40 \sim +85$	$^{\circ}\text{C}$	-
Storage Temperature	$T_{stg}$	$-40 \sim +85$	$^{\circ}\text{C}$	-
LED Junction Temperature	$T_j$	110	$^{\circ}\text{C}$	-
Forward Current	$I_F$	160	mA	-
Peak Pulsed Forward Current	$I_{FM}$	300	mA	Duty 1/10, pulse width 10ms
Assembly Process Temperature	-	$260 \pm 10$	$^{\circ}\text{C}$ s	-
ESD (HBM)	-	2	kV	-

#### Note:

Proper current derating must be observed to maintain junction temperature below the maximum at all time.

It is recommended minimum current 10mA in order to avoid uneven brightness, and may vary depending on circuit configuration.

**b) Electro-optical Characteristics** ( $I_F = 100 \text{ mA}$ ,  $T_A = 25^\circ\text{C}$ )

Item	Unit	Rank	Bin	Min.	Typ.	Max.
Forward Voltage ( $V_F$ )	V	WR	A1	3.0		3.0
			A3	3.0		3.1
			A4	3.1		3.2
			A5	3.2		3.3
		WR	A3	3.0		3.1
			A4	3.1		3.2
Color Rendering Index (CRI)	-	5		80	-	-
		7		90		
Special (R) (R0)	F0 (R0)			80		
Thermal Resistance (junction to solder point)	$^\circ\text{C/W}$			-	25	-
Beam Angle	$^\circ$			-	120	-

**Notes:**

Samsung maintains measurement tolerance of: forward voltage =  $\pm 0.1\%$ , CRI =  $\pm 3$ , R0 =  $\pm 0.5$

**c) Electro-optical Characteristics** ( $I_f = 150 \text{ mA}$ ,  $T_A = 25^\circ\text{C}$ )
















Item	CRI (Ra) Min.	Nominal CCT (K)	Bin	150mA	
				Min.	Max.
Luminous Flux ( $\Phi_v$ )	80	2700	SA	84.5	86.5
		3000	SA	84.5	86.5
		3600	SA	87.5	89.5
		4000	SA	89.0	91.0
		5000	SA	91.0	93.0
		5700	SA	90.5	92.5
		6500	SA	90.0	92.0
	90	2700	SA	88.5	89.5
		3000	SA	89.0	90.0
		3600	SA	91.0	92.0
		4000	SA	93.0	94.0
		5000	SA	93.0	94.0
		5700	SA	93.5	94.5
		6500	SA	93.0	94.0

**Note:**

Samsung maintains measurement tolerance of: forward voltage =  $\pm 0.1\text{V}$ , luminous flux =  $\pm 5\%$ , CRI =  $\pm 3$

## 2. Product Code Information

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
S	P	M	W	H	1	2	2	8	F	D	5	W	A	R	0	5	A

Digit	PKG Information	Code	Specification			
1 2 3	Samsung Package Middle Power	SPM	Middle power			
4 5	Color	WH	White			
6	Product Version	1	Without Zener			
7 	Form Factor	2 	2.8 x $\frac{5}{8}$ x $\frac{5}{8}$ 70 mm; 2 			
10	Sorting Current (mA)	F	1  mA			
11	Chromaticity Coordinates	D	ANSI Standard			
12	CRI	5	Min. 80			
		7	Min. 			
13 14	Forward Voltage (V)	mA, or mK	 	Bin code	A2	2.9 ~ 3.0
					A3	3.0 ~ 3.1
		 	Bin code	A4	3.1 ~ 3.2	
				A5	3.2 ~ 3.3	
mA : 4,000ea per reel ,mK : 1  000ea per reel						
mW : 4,000ea per reel ,mW : 1  000ea per reel						
15 16	CCT (K)	W☆	2700	Bin Code	W1, W2, W3, W4, W5, W6, W7, W8, W9, W10, W11, W12, W13, W14, W15, W16, W17, W18, W19, W20, W21, W22, W23, W24, W25, W26, W27, W28, W29, W30, W31, W32, W33, W34, W35, W36, W37, W38, W39, W40, W41, W42, W43, W44, W45, W46, W47, W48, W49, W50, W51, W52, W53, W54, W55, W56, W57, W58, W59, W60, W61, W62, W63, W64, W65, W66, W67, W68, W69, W70, W71, W72, W73, W74, W75, W76, W77, W78, W79, W80, W81, W82, W83, W84, W85, W86, W87, W88, W89, W90, W91, W92, W93, W94, W95, W96, W97, W98, W99, W100	
		V☆	3000		V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16, V17, V18, V19, V20, V21, V22, V23, V24, V25, V26, V27, V28, V29, V30, V31, V32, V33, V34, V35, V36, V37, V38, V39, V40, V41, V42, V43, V44, V45, V46, V47, V48, V49, V50, V51, V52, V53, V54, V55, V56, V57, V58, V59, V60, V61, V62, V63, V64, V65, V66, V67, V68, V69, V70, V71, V72, V73, V74, V75, V76, V77, V78, V79, V80, V81, V82, V83, V84, V85, V86, V87, V88, V89, V90, V91, V92, V93, V94, V95, V96, V97, V98, V99, V100	
		U☆	3500		U1, U2, U3, U4, U5, U6, U7, U8, U9, U10, U11, U12, U13, U14, U15, U16, U17, U18, U19, U20, U21, U22, U23, U24, U25, U26, U27, U28, U29, U30, U31, U32, U33, U34, U35, U36, U37, U38, U39, U40, U41, U42, U43, U44, U45, U46, U47, U48, U49, U50, U51, U52, U53, U54, U55, U56, U57, U58, U59, U60, U61, U62, U63, U64, U65, U66, U67, U68, U69, U70, U71, U72, U73, U74, U75, U76, U77, U78, U79, U80, U81, U82, U83, U84, U85, U86, U87, U88, U89, U90, U91, U92, U93, U94, U95, U96, U97, U98, U99, U100	
		T☆	4000		T1, T2, T3, T4, T5, T6, T7, T8, T9, T10, T11, T12, T13, T14, T15, T16, T17, T18, T19, T20, T21, T22, T23, T24, T25, T26, T27, T28, T29, T30, T31, T32, T33, T34, T35, T36, T37, T38, T39, T40, T41, T42, T43, T44, T45, T46, T47, T48, T49, T50, T51, T52, T53, T54, T55, T56, T57, T58, T59, T60, T61, T62, T63, T64, T65, T66, T67, T68, T69, T70, T71, T72, T73, T74, T75, T76, T77, T78, T79, T80, T81, T82, T83, T84, T85, T86, T87, T88, T89, T90, T91, T92, T93, T94, T95, T96, T97, T98, T99, T100	
		R☆	5000		R1, R2, R3, R4, R5, R6, R7, R8, R  , RA, RB, RC, RD, RE, RF, RG, RH, RI, RJ, RK, RL, RM, RN, RO, RP, RQ, RR, RS, RT, RU	
		Q☆	5700		Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q8, Q  , QA, QB, QC, QD, QE, QF, QG, QH, QI, QJ, QK, QL, QM, QN, QO, QP, QQ, QR, QS, QT, QU	
		P☆	6500		P1, P2, P3, P4, P5, P6, P7, P8, P  , PA, PB, PC, PD, PE, PF, PG, PH, PI, PJ, PK, PL, PM, PN, PO, PP, PQ, PR, PS, PT, PU	
		☆ : "0" (Whole bin), "1" (Quarter bin), "2" (Killing bin), "3" (Killing bin) or "4" (Mac3 only)				
17 18	Luminous Flux	SA	 in Code	SA		

a) Luminous Flux Bins ( $I_f = 100 \text{ mA}$ ,  $T_f = 25^\circ\text{C}$ )

CRI (R <sub>a</sub> ) Min	Nominal CCT (K)	Product Code	Flux Bin	Flux Range (lm)
80	2700	SPMWH1208F076AWH1SA	SA	54.5 - 58.5
	3000	SPMWH1208F076AW1SA	SA	54.5 - 60.5
	3500	SPMWH1208F076AU1SA	SA	57.5 - 61.5
	4000	SPMWH1208F076AT1SA	SA	60.0 - 64.0
	5000	SPMWH1208F076AR☆SA	SA	61.0 - 66.0
	5700	SPMWH1208F076AQ1SA	SA	63.5 - 64.5
	6500	SPMWH1208F076AP☆SA	SA	63.0 - 64.0
80	2700	SPMWH1208F076AWH1SA	SA	44.5 - 48.5
	3000	SPMWH1208F076AW1SA	SA	46.0 - 50.0
	3500	SPMWH1208F076AU1SA	SA	47.0 - 51.0
	4000	SPMWH1208F076AT1SA	SA	49.0 - 53.0
	5000	SPMWH1208F076AR☆SA	SA	50.0 - 54.0
	5700	SPMWH1208F076AQ1SA	SA	49.5 - 53.5
	6500	SPMWH1208F076AP☆SA	SA	49.0 - 53.0

**Note:**

"☆" can be "Q" (Whole bin), "M" (Quarter bin), "H" (Half bin), "F" (Fitting bin) or "U" (Mac3 only) of the color binning

## b) Kitting rule

## 1) Kitting bin Concept

- Under agreement between customer and SAMSUNG ELECTRONICS, SAMSUNG can supply kitting bin (VF, Color, Im).
- A forward voltage (VF) of kitting bin is combined by a pair of same VF rank such as (A<sub>1</sub>+A<sub>2</sub>), (A<sub>3</sub>+A<sub>4</sub>), (A<sub>4</sub>+A<sub>4</sub>) or (A<sub>4</sub>+A<sub>5</sub>)
- A Chromaticity Coordinates of kitting bin is mixed by kitting procedure. (below kitting simulation)

## [Kitting example]

D	E	F	G
9	A	B	C
5	6	7	8
1	2	3	4

## [Binning Information]

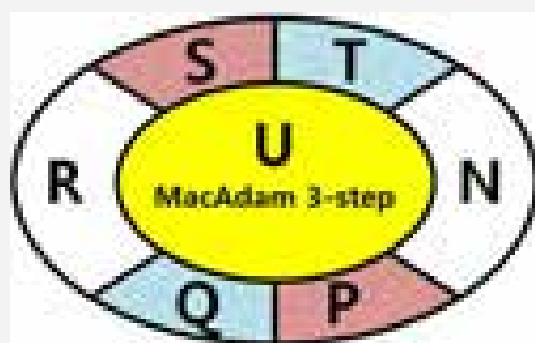
Bin #1		Bin #2
VF	A <sub>1</sub>	A <sub>1</sub>
	A <sub>3</sub>	A <sub>3</sub>
	A <sub>4</sub>	A <sub>4</sub>
	A <sub>5</sub>	A <sub>5</sub>
CIE	1, 2, 5 bin	C, F, G bin
	6, 7, A, B bin	6, 7, A, B bin
	3, 4, 8 bin	9, D, E bin



## 2) Kitting bin Concept

- Under agreement between customer and SAMSUNG ELECTRONICS, SAMSUNG can supply kitting bin (VF, Color, Im).
- A forward voltage (VF) of kitting bin is combined by a pair of same VF rank such as (A2+A2), (A3+A3), (A4+A4) or (A1+A1)
- A Chromaticity Coordinates of kitting bin is mixed by kitting procedure.(below kitting simulation)

### [Kitting example]



### [Binning Information]

		Bin #1	Bin #2
VF		A1	A1
		A3	A3
		A4	A4
		A5	A5
		U	U
CIE		N	R
		P	S
		Q	T

**c) Color Bins ( $I_F = 150 \text{ mA}$ ,  $T_A = 25^\circ\text{C}$ )**

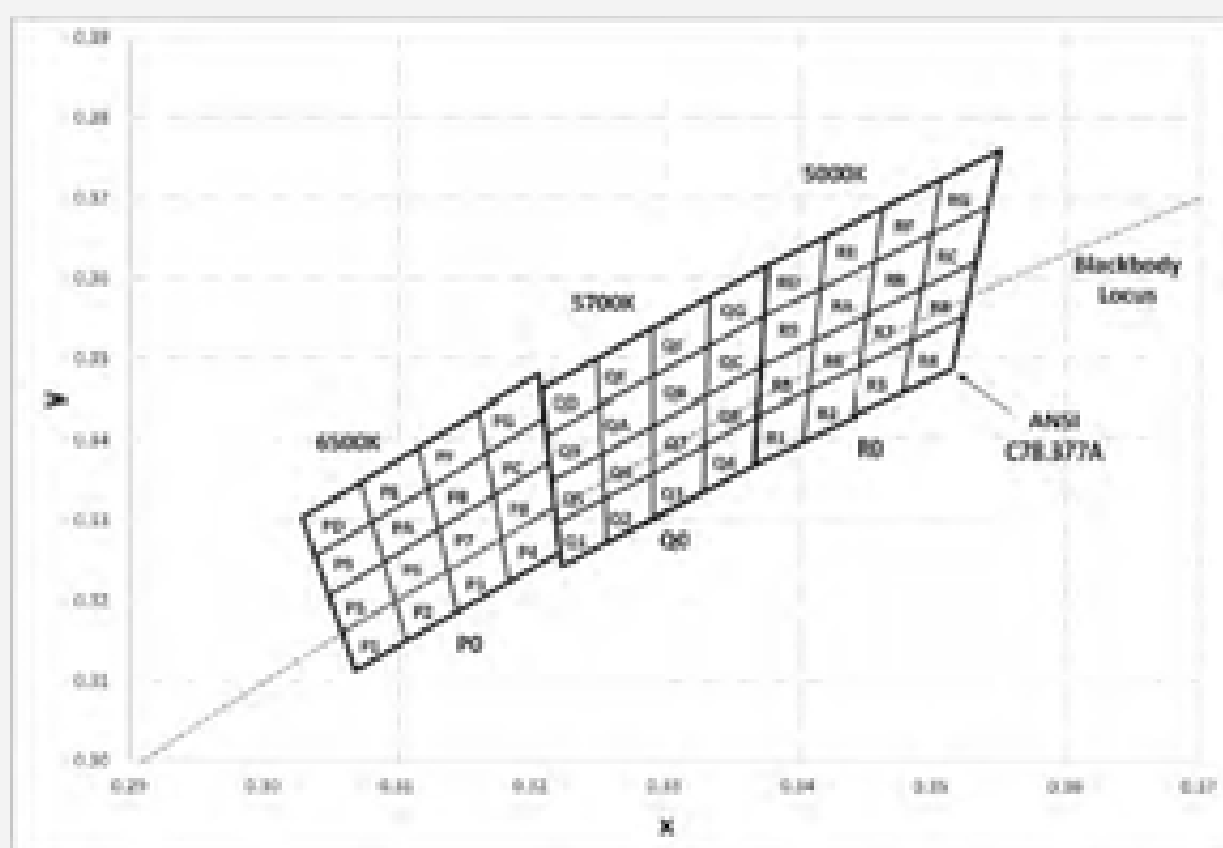
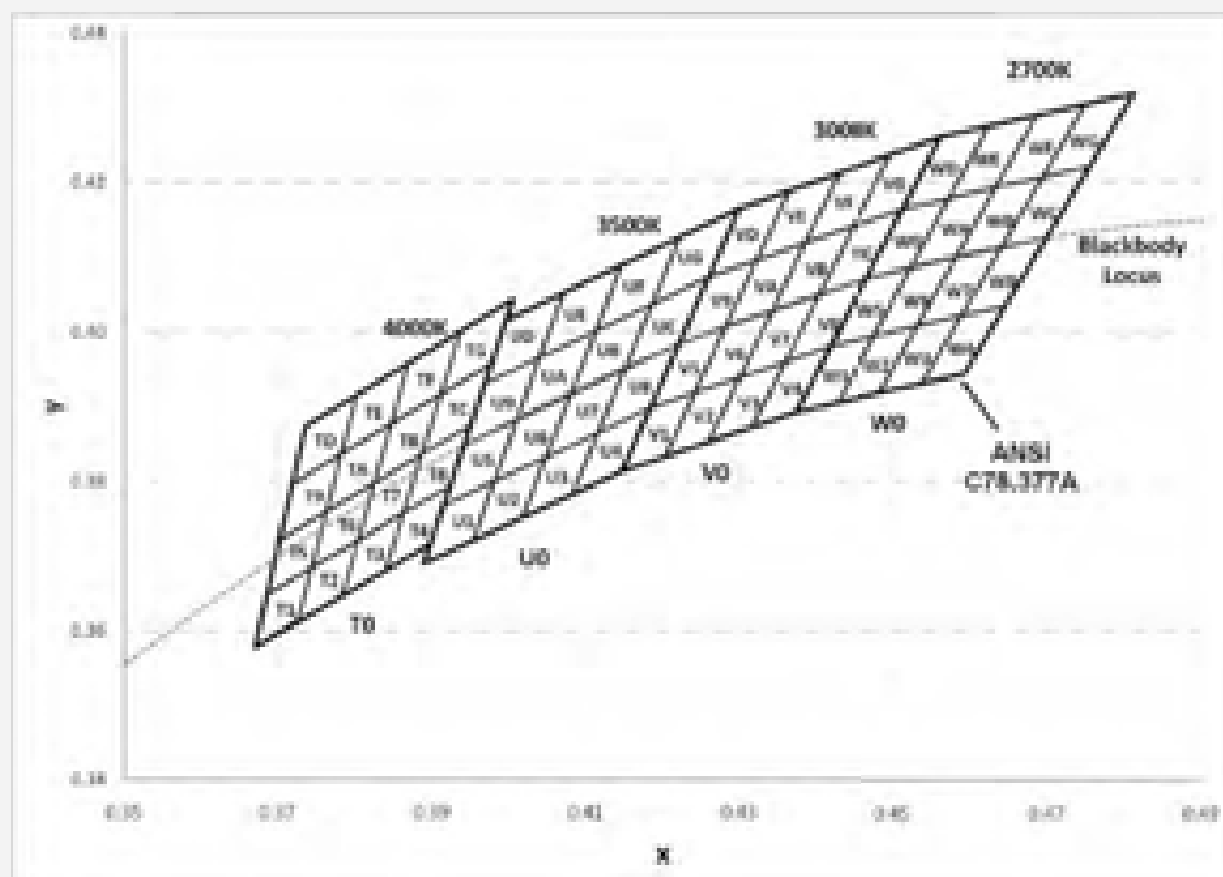
CRI (R <sub>a</sub> ) Min.	Nominal CCT (K)	Product Code	Color Rank	Chromaticity Bins
80	2700	SP655H1:WFO★WAWR1A	WR (Whole bin)	W1, W2, W3, W4, W5, W6, W7, W8, W9, W10, W11, W12, W13, W14, W15, W16, W17, W18
		SP655H1:WFO★WAWM1A	WM (Quarter bin)	W6, W7, W8, W9
		SP655H1:WFO★WAWK1A	WK (K Kitting bin)	W1, W2, W3, W4, W5, W6, W7, W8, W9, W10, W11, W12, W13, W14, W15, W16, W17, W18
		SP655H1:WFO★WAWU1A	WU (Mac3 Only)	W1
		SP655H1:WFO★WAWY1A	WY (Y Kitting bin)	W1, W2, W3, W4, W5, W6, W7, W8, W9
80	3000	SP655H1:WFO★WAV1A	VS (Whole bin)	V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16, V17, V18
		SP655H1:WFO★WAVM1A	VM (Quarter bin)	V6, V7, V8, V9
		SP655H1:WFO★WAVK1A	VK (K Kitting bin)	V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11, V12, V13, V14, V15, V16, V17, V18
		SP655H1:WFO★WAVU1A	VU (Mac3 Only)	V1
		SP655H1:WFO★WAVY1A	VY (Y Kitting bin)	V1, V2, V3, V4, V5, V6, V7, V8, V9
80	3500	SP655H1:WFO★WAL1A	US (Whole bin)	U1, U2, U3, U4, U5, U6, U7, U8, U9, U10, U11, U12, U13, U14, U15, U16, U17, U18
		SP655H1:WFO★WALM1A	UM (Quarter bin)	U6, U7, U8, U9
		SP655H1:WFO★WALK1A	UK (K Kitting bin)	U1, U2, U3, U4, U5, U6, U7, U8, U9, U10, U11, U12, U13, U14, U15, U16, U17, U18
		SP655H1:WFO★WALU1A	UU (Mac3 Only)	U1
		SP655H1:WFO★WALY1A	UY (Y Kitting bin)	U1, U2, U3, U4, U5, U6, U7, U8, U9
80 or 90	4000	SP655H1:WFO★WAT1A	TS (Whole bin)	T1, T2, T3, T4, T5, T6, T7, T8, T9, T10, T11, T12, T13, T14, T15, T16, T17, T18
		SP655H1:WFO★WATM1A	TM (Quarter bin)	T6, T7, T8, T9
		SP655H1:WFO★WATK1A	TK (K Kitting bin)	T1, T2, T3, T4, T5, T6, T7, T8, T9, T10, T11, T12, T13, T14, T15, T16, T17, T18
		SP655H1:WFO★WATU1A	TU (Mac3 Only)	T1
		SP655H1:WFO★WATY1A	TY (Y Kitting bin)	T1, T2, T3, T4, T5, T6, T7, T8, T9, T10, T11, T12, T13, T14, T15, T16, T17, T18
80	5000	SP655H1:WFO★WAR1A	RS (Whole bin)	R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11, R12, R13, R14, R15, R16, R17, R18
		SP655H1:WFO★WARM1A	RM (Quarter bin)	R6, R7, R8, R9
		SP655H1:WFO★WARK1A	RK (K Kitting bin)	R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11, R12, R13, R14, R15, R16, R17, R18
		SP655H1:WFO★WARU1A	RU (Mac3 Only)	R1
		SP655H1:WFO★WARY1A	RY (Y Kitting bin)	R1, R2, R3, R4, R5, R6, R7, R8, R9
80	5700	SP655H1:WFO★WAO1A	OS (Whole bin)	O1, O2, O3, O4, O5, O6, O7, O8, O9, O10, O11, O12, O13, O14, O15, O16, O17, O18
		SP655H1:WFO★WAOM1A	OM (Quarter bin)	O6, O7, O8, O9
		SP655H1:WFO★WAOK1A	OK (K Kitting bin)	O1, O2, O3, O4, O5, O6, O7, O8, O9, O10, O11, O12, O13, O14, O15, O16, O17, O18
		SP655H1:WFO★WAOU1A	OU (Mac3 Only)	O1
		SP655H1:WFO★WAOY1A	OY (Y Kitting bin)	O1, O2, O3, O4, O5, O6, O7, O8, O9, O10, O11, O12, O13, O14, O15, O16, O17, O18
80	6500	SP655H1:WFO★WAP1A	PS (Whole bin)	P1, P2, P3, P4, P5, P6, P7, P8, P9, P10, P11, P12, P13, P14, P15, P16, P17, P18
		SP655H1:WFO★WAPM1A	PM (Quarter bin)	P6, P7, P8, P9
		SP655H1:WFO★WAPK1A	PK (K Kitting bin)	P1, P2, P3, P4, P5, P6, P7, P8, P9, P10, P11, P12, P13, P14, P15, P16, P17, P18
		SP655H1:WFO★WAPU1A	PU (Mac3 Only)	P1
		SP655H1:WFO★WAPY1A	PY (Y Kitting bin)	P1, P2, P3, P4, P5, P6, P7, P8, P9, P10, P11, P12, P13, P14, P15, P16, P17, P18

Note: "1/2" can be "5" (Ra50) or "1" (Ra90)

d) Voltage Bins ( $f = 100 \text{ kHz}$ ,  $T_A = 25^\circ\text{C}$ )

CRI (Ra) Min.	Nominal CCT (K)	Product Code	Voltage Rank	Voltage Bin	Voltage Range (V)
-	-	-	WWL or WWC	A2	2.9 ~ 3.0
				A3	3.0 ~ 3.1
				A4	3.1 ~ 3.2
				A5	3.2 ~ 3.3
-	-	-	WWL or WWC	A3	3.0 ~ 3.1
			WWL	A4	3.1 ~ 3.2

e) Chromaticity Region & Coordinates for whole bin or quarter bin or Kitting bin ( $I_f = 150 \text{ mA}$ ,  $T_A = 25^\circ\text{C}$ )



## e| Chromaticity Region &amp; Coordinates

Region	CIE x	CIE y	Region	CIE x	CIE y
WF rank: (20100 K)					
WF1	0.4373	0.3993	WF9	0.4465	0.4071
	0.4418	0.3981		0.4513	0.4164
	0.4475	0.3994		0.4573	0.4178
	0.4428	0.3936		0.4523	0.4085
WF2	0.4428	0.3936	WF4	0.4523	0.4085
	0.4475	0.3994		0.4573	0.4178
	0.4532	0.4038		0.4634	0.4183
	0.4483	0.3919		0.4582	0.4089
WF3	0.4483	0.3919	WF5	0.4582	0.4089
	0.4532	0.4038		0.4634	0.4183
	0.4589	0.4021		0.4685	0.4257
	0.4538	0.3931		0.4641	0.4112
WF4	0.4538	0.3931	WF7	0.4641	0.4112
	0.4589	0.4021		0.4685	0.4257
	0.4646	0.4034		0.4756	0.4221
	0.4583	0.3944		0.4750	0.4126
WF5	0.4418	0.3981	WF10	0.4513	0.4164
	0.4465	0.4071		0.4562	0.4260
	0.4523	0.4085		0.4624	0.4274
	0.4475	0.3994		0.4573	0.4178
WF6	0.4475	0.3994	WF8	0.4573	0.4178
	0.4523	0.4085		0.4624	0.4274
	0.4582	0.4089		0.4687	0.4289
	0.4532	0.4038		0.4634	0.4183
WF7	0.4532	0.4038	WF11	0.4634	0.4183
	0.4582	0.4089		0.4687	0.4289
	0.4641	0.4112		0.4750	0.4304
	0.4589	0.4021		0.4685	0.4257
WF8	0.4589	0.4021	WF12	0.4685	0.4257
	0.4641	0.4112		0.4750	0.4304
	0.4750	0.4126		0.4813	0.4319
	0.4646	0.4034		0.4756	0.4221

Region	CIE x	CIE y	Region	CIE x	CIE y
VF rank: (20100 K)					
VF1	0.4147	0.3814	VF9	0.4221	0.3984
	0.4183	0.3898		0.4259	0.4073
	0.4242	0.3919		0.4302	0.4096
	0.4293	0.3833		0.4281	0.4036
VF2	0.4293	0.3833	VF4	0.4281	0.4036
	0.4242	0.3919		0.4302	0.4096
	0.4300	0.3939		0.4385	0.4119
	0.4259	0.3853		0.4342	0.4028
VF3	0.4259	0.3853	VF6	0.4342	0.4028
	0.4300	0.3939		0.4385	0.4119
	0.4359	0.3960		0.4449	0.4141
	0.4316	0.3873		0.4403	0.4049
VF4	0.4316	0.3873	VF7	0.4403	0.4049
	0.4359	0.3960		0.4449	0.4141
	0.4418	0.3981		0.4513	0.4164
	0.4373	0.3893		0.4465	0.4071
VF5	0.4183	0.3898	VF10	0.4259	0.4073
	0.4221	0.3984		0.4299	0.4163
	0.4281	0.4036		0.4364	0.4188
	0.4242	0.3919		0.4302	0.4096
VF6	0.4242	0.3919	VF8	0.4302	0.4096
	0.4281	0.4036		0.4364	0.4188
	0.4342	0.4028		0.4430	0.4212
	0.4300	0.3939		0.4385	0.4119
VF7	0.4300	0.3939	VF11	0.4385	0.4119
	0.4342	0.4028		0.4430	0.4212
	0.4403	0.4049		0.4496	0.4236
	0.4359	0.3960		0.4449	0.4141
VF8	0.4359	0.3960	VF12	0.4449	0.4141
	0.4403	0.4049		0.4496	0.4236
	0.4465	0.4071		0.4562	0.4260
	0.4418	0.3981		0.4513	0.4164

## e) Chromaticity Region &amp; Coordinates

Region	CIE x	CIE y	Region	CIE x	CIE y
$U$ (bank) ( $300 \pm 10$ )					
U1	0.3999	0.3990	U9	0.3941	0.3948
	0.3970	0.3768		0.3968	0.3930
	0.3981	0.3930		0.4040	0.3996
	0.3953	0.3720		0.4010	0.3882
U2	0.3953	0.3720	U4	0.4010	0.3882
	0.3981	0.3930		0.4040	0.3996
	0.4048	0.3832		0.4113	0.4001
	0.4017	0.3751		0.4080	0.3916
U3	0.4017	0.3751	U8	0.4080	0.3916
	0.4048	0.3832		0.4113	0.4001
	0.4116	0.3995		0.4186	0.4037
	0.4082	0.3782		0.4150	0.3950
U4	0.4082	0.3782	U5	0.4150	0.3950
	0.4116	0.3995		0.4186	0.4037
	0.4183	0.3958		0.4259	0.4073
	0.4147	0.3814		0.4221	0.3984
U5	0.3970	0.3768	U6	0.3968	0.3930
	0.3941	0.3948		0.3996	0.4010
	0.4010	0.3882		0.4071	0.4052
	0.3981	0.3930		0.4040	0.3996
U6	0.3981	0.3930	UE	0.4040	0.3996
	0.4010	0.3882		0.4071	0.4052
	0.4080	0.3916		0.4146	0.4089
	0.4048	0.3832		0.4113	0.4001
U7	0.4048	0.3832	UF	0.4113	0.4001
	0.4080	0.3916		0.4146	0.4089
	0.4150	0.3950		0.4222	0.4127
	0.4116	0.3995		0.4186	0.4037
U8	0.4116	0.3995	UG	0.4186	0.4037
	0.4150	0.3950		0.4222	0.4127
	0.4221	0.3984		0.4299	0.4165
	0.4183	0.3958		0.4259	0.4073

Region	CIE x	CIE y	Region	CIE x	CIE y
$T$ (bank) ( $400 \pm 10$ )					
T1	0.3870	0.3878	T9	0.3762	0.3722
	0.3726	0.3612		0.3763	0.3760
	0.3744	0.3685		0.3782	0.3837
	0.3686	0.3649		0.3719	0.3787
T2	0.3726	0.3612	T4	0.3763	0.3760
	0.3783	0.3646		0.3825	0.3788
	0.3804	0.3721		0.3847	0.3877
	0.3744	0.3685		0.3782	0.3837
T3	0.3783	0.3646	T8	0.3825	0.3788
	0.3840	0.3681		0.3887	0.3836
	0.3863	0.3758		0.3912	0.3917
	0.3804	0.3721		0.3847	0.3877
T4	0.3840	0.3681	T5	0.3887	0.3837
	0.3886	0.3716		0.3984	0.3876
	0.3924	0.3784		0.3978	0.3958
	0.3863	0.3758		0.3912	0.3917
T5	0.3886	0.3649	T6	0.3719	0.3787
	0.3744	0.3685		0.3782	0.3837
	0.3783	0.3760		0.3832	0.3916
	0.3782	0.3722		0.3736	0.3874
T6	0.3744	0.3685	TE	0.3782	0.3837
	0.3804	0.3721		0.3847	0.3877
	0.3825	0.3788		0.3869	0.3958
	0.3763	0.3760		0.3832	0.3916
T7	0.3804	0.3721	TF	0.3847	0.3877
	0.3863	0.3758		0.3912	0.3917
	0.3887	0.3836		0.3937	0.4001
	0.3825	0.3788		0.3869	0.3958
T8	0.3863	0.3758	T9	0.3912	0.3917
	0.3924	0.3784		0.3978	0.3958
	0.3980	0.3875		0.4006	0.4044
	0.3887	0.3836		0.3937	0.4001

## e) Chromaticity Region &amp; Coordinates

Region	CIE x	CIE y	Region	CIE x	CIE y
R1 (60% to K)					
R1	0.3366	0.3369	R1	0.3374	0.3554
	0.3369	0.3431		0.3371	0.3483
	0.3437	0.3460		0.3471	0.3523
	0.3433	0.3398		0.3475	0.3587
R2	0.3433	0.3398	R2	0.3475	0.3587
	0.3437	0.3460		0.3471	0.3523
	0.3446	0.3491		0.3451	0.3554
	0.3440	0.3427		0.3457	0.3621
R3	0.3446	0.3491	R3	0.3451	0.3554
	0.3440	0.3427		0.3457	0.3621
	0.3477	0.3458		0.3500	0.3658
	0.3485	0.3523		0.3482	0.3587
R4	0.3485	0.3523	R4	0.3482	0.3587
	0.3477	0.3458		0.3500	0.3658
	0.3514	0.3487		0.3542	0.3690
	0.3524	0.3554		0.3533	0.3620
R5	0.3371	0.3483	R5	0.3376	0.3676
	0.3369	0.3431		0.3374	0.3554
	0.3437	0.3460		0.3475	0.3587
	0.3471	0.3523		0.3420	0.3652
R6	0.3437	0.3460	R6	0.3475	0.3587
	0.3471	0.3523		0.3420	0.3652
	0.3451	0.3554		0.3483	0.3687
	0.3446	0.3491		0.3457	0.3621
R7	0.3446	0.3491	R7	0.3457	0.3621
	0.3451	0.3554		0.3483	0.3687
	0.3482	0.3587		0.3537	0.3724
	0.3485	0.3523		0.3500	0.3658
R8	0.3485	0.3523	R8	0.3500	0.3658
	0.3482	0.3587		0.3537	0.3724
	0.3533	0.3620		0.3551	0.3760
	0.3524	0.3554		0.3542	0.3690

Region	CIE x	CIE y	Region	CIE x	CIE y
Q1 (60% to K)					
Q1	0.3278	0.3298	Q1	0.3271	0.3437
	0.3223	0.3243		0.3275	0.3353
	0.3258	0.3275		0.3254	0.3388
	0.3256	0.3331		0.3252	0.3444
Q2	0.3256	0.3331	Q2	0.3252	0.3444
	0.3258	0.3275		0.3254	0.3388
	0.3294	0.3306		0.3293	0.3423
	0.3294	0.3364		0.3293	0.3481
Q3	0.3294	0.3364	Q3	0.3293	0.3481
	0.3294	0.3306		0.3293	0.3423
	0.3330	0.3338		0.3302	0.3458
	0.3331	0.3398		0.3303	0.3578
Q4	0.3331	0.3398	Q4	0.3303	0.3578
	0.3330	0.3338		0.3302	0.3458
	0.3366	0.3369		0.3371	0.3483
	0.3369	0.3431		0.3374	0.3554
Q5	0.3275	0.3353	Q5	0.3267	0.3462
	0.3278	0.3298		0.3271	0.3437
	0.3256	0.3331		0.3252	0.3444
	0.3254	0.3388		0.3250	0.3501
Q6	0.3254	0.3388	Q6	0.3250	0.3501
	0.3256	0.3331		0.3252	0.3444
	0.3294	0.3364		0.3293	0.3481
	0.3293	0.3423		0.3292	0.3539
Q7	0.3293	0.3423	Q7	0.3292	0.3539
	0.3294	0.3364		0.3293	0.3481
	0.3331	0.3398		0.3303	0.3578
	0.3302	0.3458		0.3304	0.3578
Q8	0.3302	0.3458	Q8	0.3304	0.3578
	0.3331	0.3398		0.3303	0.3578
	0.3369	0.3431		0.3374	0.3554
	0.3371	0.3483		0.3376	0.3676

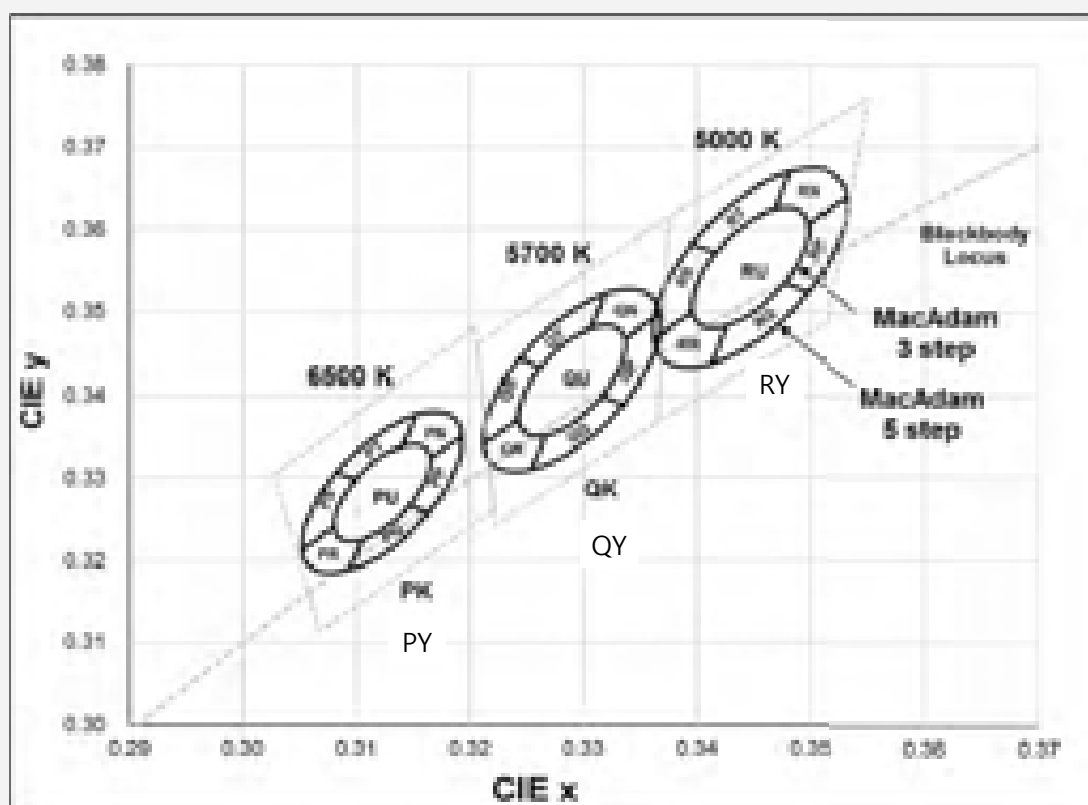
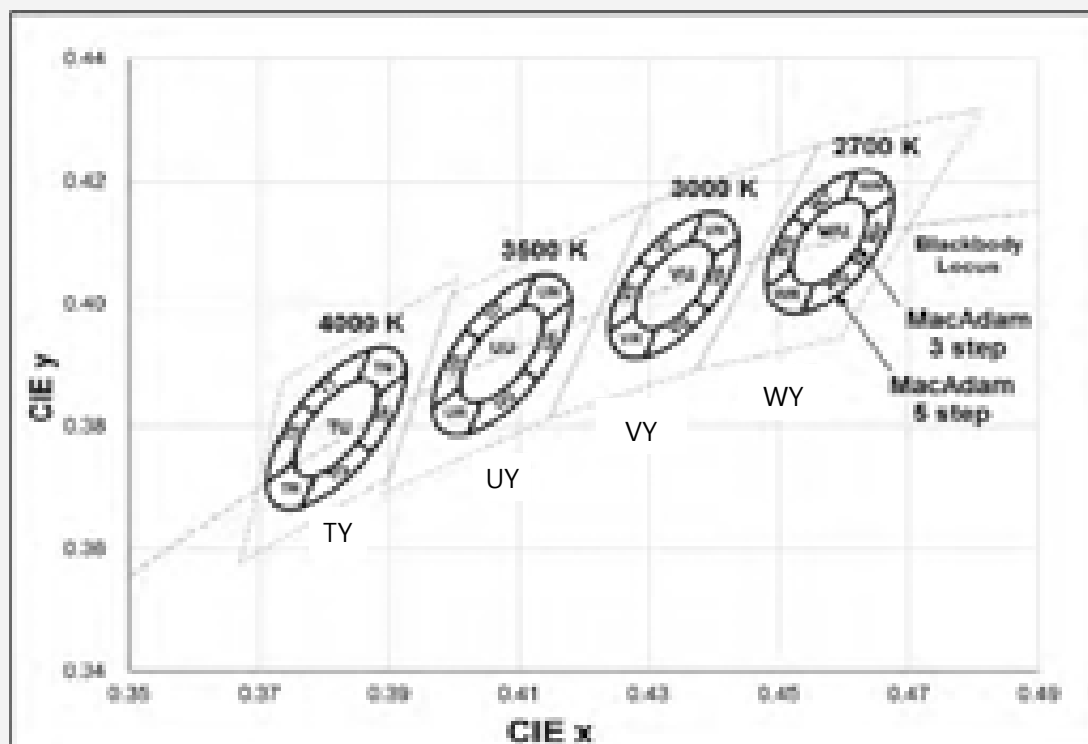
## e) Chromaticity Region & Coordinates

Region	CIE x	CIE y	Region	CIE x	CIE y
P (Rank 10000 K)					
P1	0.3068	0.3113	P1	0.3068	0.3207
	0.3106	0.3150		0.3089	0.3249
	0.3086	0.3189		0.3080	0.3298
	0.3058	0.3160		0.3038	0.3256
P2	0.3106	0.3150	P2	0.3089	0.3249
	0.3144	0.3186		0.3133	0.3290
	0.3137	0.3238		0.3123	0.3341
	0.3086	0.3189		0.3080	0.3298
P3	0.3144	0.3186	P3	0.3133	0.3290
	0.3183	0.3224		0.3172	0.3332
	0.3177	0.3276		0.3166	0.3384
	0.3137	0.3238		0.3123	0.3341
P4	0.3183	0.3224	P4	0.3172	0.3332
	0.3221	0.3261		0.3214	0.3373
	0.3218	0.3317		0.3210	0.3427
	0.3177	0.3276		0.3166	0.3384
P5	0.3068	0.3160	P5	0.3038	0.3256
	0.3086	0.3189		0.3080	0.3298
	0.3089	0.3249		0.3072	0.3348
	0.3048	0.3207		0.3028	0.3304
P6	0.3086	0.3189	PE	0.3080	0.3298
	0.3137	0.3238		0.3123	0.3341
	0.3130	0.3290		0.3115	0.3391
	0.3089	0.3249		0.3072	0.3348
P7	0.3137	0.3238	PF	0.3123	0.3341
	0.3177	0.3276		0.3166	0.3384
	0.3172	0.3332		0.3160	0.3436
	0.3133	0.3290		0.3115	0.3391
P8	0.3177	0.3276	P8	0.3166	0.3384
	0.3218	0.3317		0.3210	0.3427
	0.3214	0.3373		0.3204	0.3481
	0.3172	0.3332		0.3160	0.3436

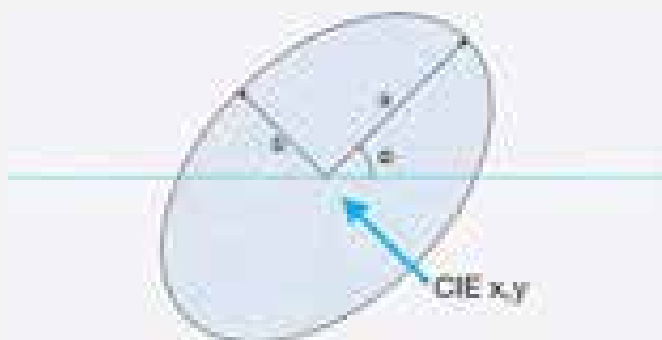
Note: Samsung maintains measurement tolerance of:  $\Delta x, \Delta y \leq \pm 0.005$



f) Chromaticity Region & Coordinates for  $\uparrow$   $\uparrow$  fitting bin or  $\uparrow$  max3 only bin ( $I_f = 150$  mA,  $T_d = 40$  K)



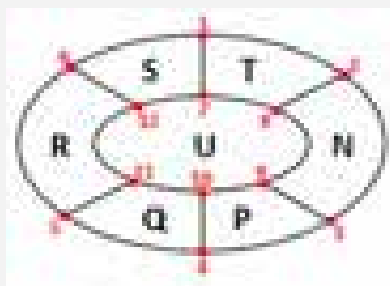
## f | Chromaticity Region & Coordinates



MacAdam	CCT (K)	Center point		Major-axis	Minor-axis	Rotation
		CIE x	CIE y	a	b	$\Phi$
3 step	2700	0.4578	0.4181	0.0081	0.0042	53.70
	3000	0.4308	0.4030	0.0083	0.0041	53.32
	3500	0.4073	0.3917	0.0083	0.0041	54.00
	4000	0.3818	0.3787	0.0084	0.0040	53.72
	5000	0.3447	0.3553	0.0082	0.0035	59.42
	5700	0.3287	0.3417	0.0075	0.0032	59.10
	6500	0.3123	0.3282	0.0067	0.0029	58.57
5 step	2700	0.4578	0.4181	0.0135	0.0070	53.70
	3000	0.4308	0.4030	0.0138	0.0068	53.32
	3500	0.4073	0.3917	0.0155	0.0068	54.00
	4000	0.3818	0.3787	0.0157	0.0067	53.72
	5000	0.3447	0.3553	0.0137	0.0058	59.42
	5700	0.3287	0.3417	0.0125	0.0053	59.10
	6500	0.3123	0.3282	0.0112	0.0048	58.57

Note: Samsung maintains measurement tolerance of:  $\Delta x, \Delta y > \pm 0.005$

## f Chromaticity Region & Coordinates



CCT	Region	CIE x	CIE y	CCT	Region	CIE x	CIE y	CCT	Region	CIE x	CIE y
2700K	1	0.4521	0.4142	3000K	1	0.4283	0.4071	3500K	1	0.4018	0.3957
	2	0.4619	0.4216		2	0.4382	0.4146		2	0.4125	0.4046
	3	0.4676	0.4175		3	0.4437	0.4105		3	0.418	0.4005
	4	0.4634	0.4059		4	0.4383	0.3989		4	0.4128	0.3877
	5	0.4537	0.3996		5	0.4283	0.3913		5	0.4022	0.3788
	6	0.4481	0.4028		6	0.4239	0.3954		6	0.3966	0.3828
	7	0.4544	0.4126		7	0.4305	0.4054		7	0.404	0.3941
	8	0.4603	0.4117		8	0.4364	0.41		8	0.4104	0.3994
	9	0.4636	0.4145		9	0.4387	0.4075		9	0.4137	0.397
	10	0.4612	0.4076		10	0.4371	0.4005		10	0.4106	0.3893
	11	0.4553	0.4032		11	0.4311	0.396		11	0.4042	0.384
	12	0.452	0.4057		12	0.4279	0.3984		12	0.4009	0.3864
4000K	1	0.3764	0.3837	5000K	1	0.3387	0.3583	5700K	1	0.3242	0.3445
	2	0.3871	0.3826		2	0.3482	0.367		2	0.332	0.3524
	3	0.3925	0.3887		3	0.3532	0.364		3	0.3365	0.3496
	4	0.3872	0.3758		4	0.3487	0.3524		4	0.3333	0.338
	5	0.3765	0.3668		5	0.3412	0.3436		5	0.3254	0.331
	6	0.3711	0.3787		6	0.3362	0.3465		6	0.3209	0.3338
	7	0.3786	0.3821		7	0.3417	0.3571		7	0.326	0.3434
	8	0.385	0.3874		8	0.3468	0.3623		8	0.3307	0.3481
	9	0.3882	0.3851		9	0.3495	0.3605		9	0.3334	0.3464
	10	0.385	0.3773		10	0.3477	0.3535		10	0.3314	0.3401
	11	0.3786	0.372		11	0.3426	0.3483		11	0.3267	0.3353
	12	0.3754	0.3743		12	0.3396	0.35		12	0.324	0.3369

## Chromaticity Region & Coordinates

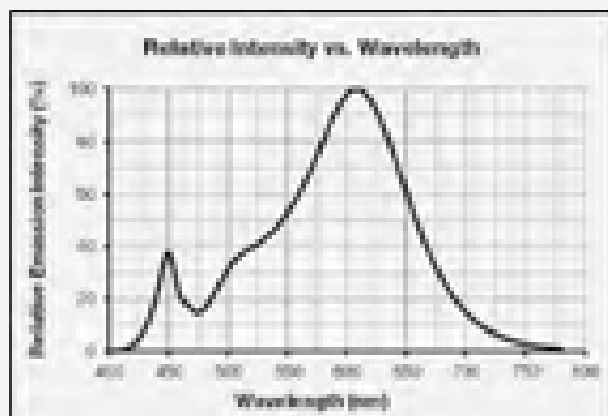
CCT	Region	CIE x	CIE y
6500K	1	0.3082	0.3267
	2	0.3153	0.3277
	3	0.3194	0.3282
	4	0.3164	0.3287
	5	0.3083	0.3187
	6	0.3052	0.3212
	7	0.3098	0.3287
	8	0.3141	0.3309
	9	0.3166	0.3324
	10	0.3148	0.3287
	11	0.3128	0.3228
	12	0.308	0.324

Note: Samsung maintains measurement tolerance of:  $\Delta x, \Delta y \leq \pm 0.005$

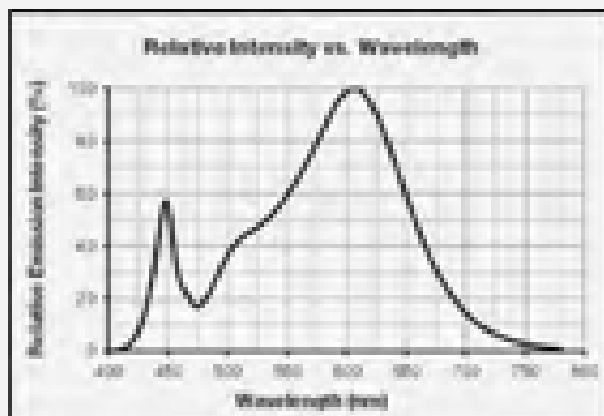
### 3. Typical Characteristics Graphs

#### a) Spectrum Distribution ( $I_f = 100 \text{ mA}$ , $T_A = 25^\circ\text{C}$ )

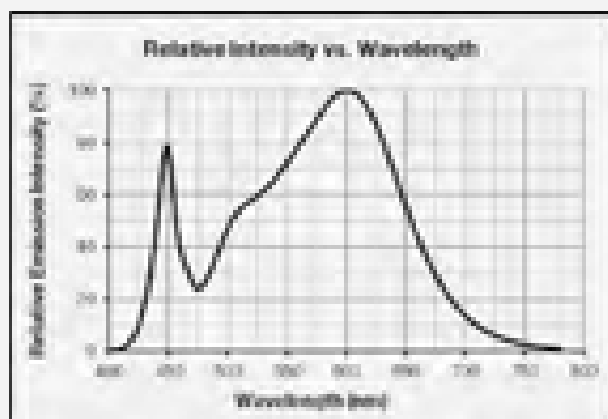
CCT: 2700K (80 CRI)



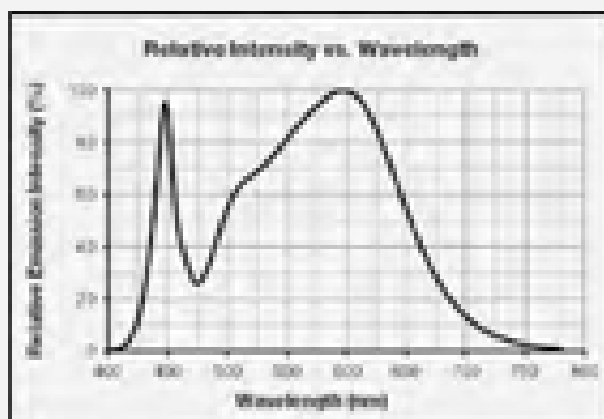
CCT: 3000K (80 CRI)



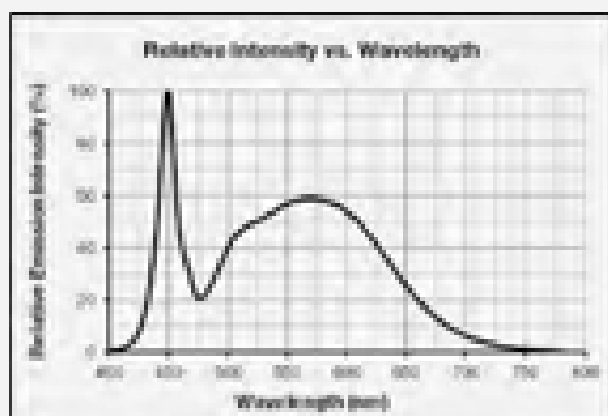
CCT: 3500K (80 CRI)



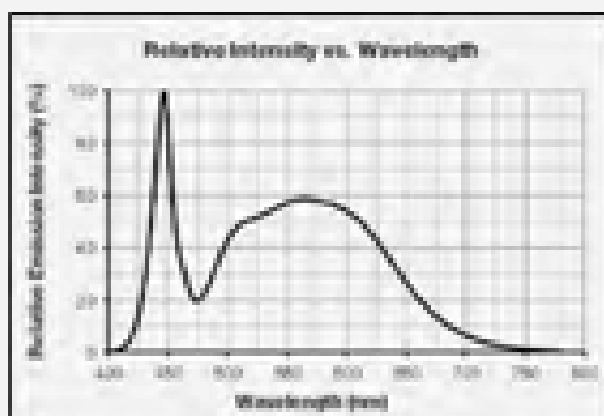
CCT: 4000K (80 CRI)



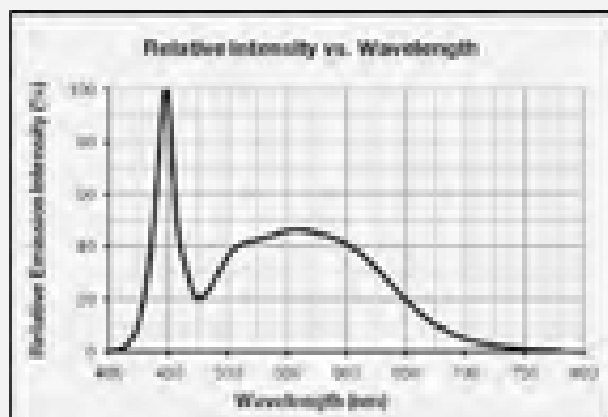
CCT: 5000K (80 CRI)



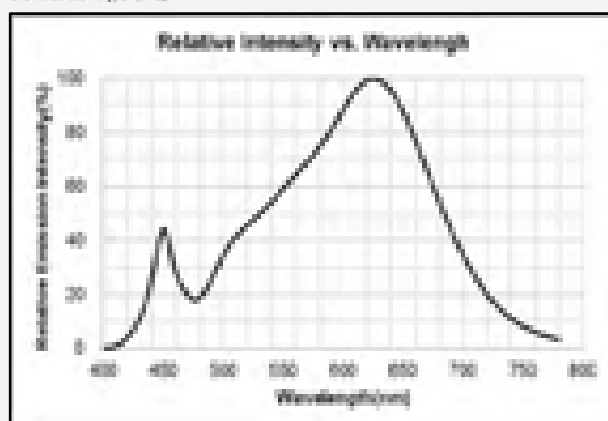
CCT: 5700K (80 CRI)



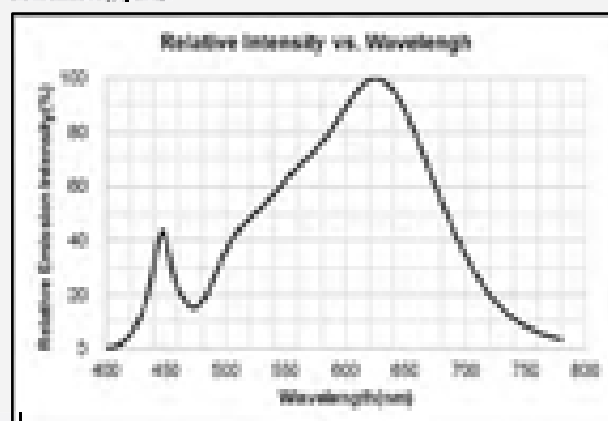
OC11 4500-K (p1) CRI=91



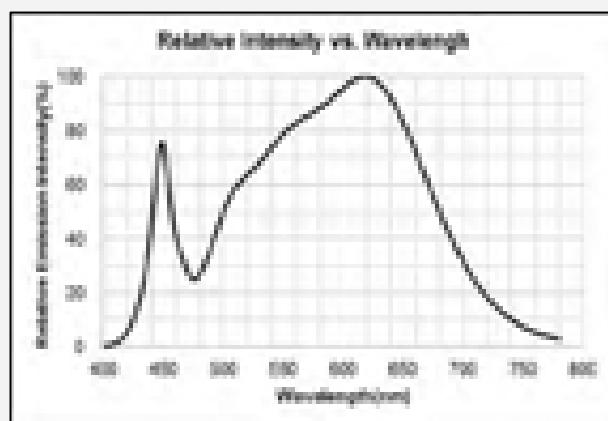
OC11 2700-K (p1) CRI=91



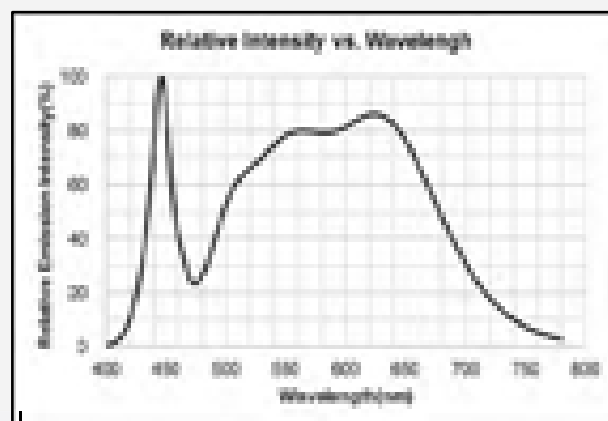
OC11 3000-K (p1) CRI=91



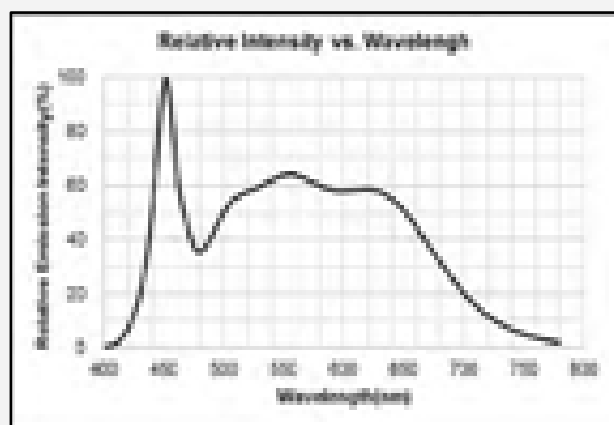
OC11 3500-K (p1) CRI=91



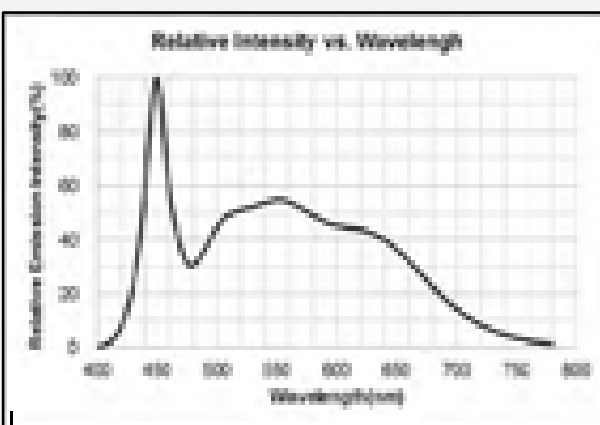
OC11 4000-K (p1) CRI=91



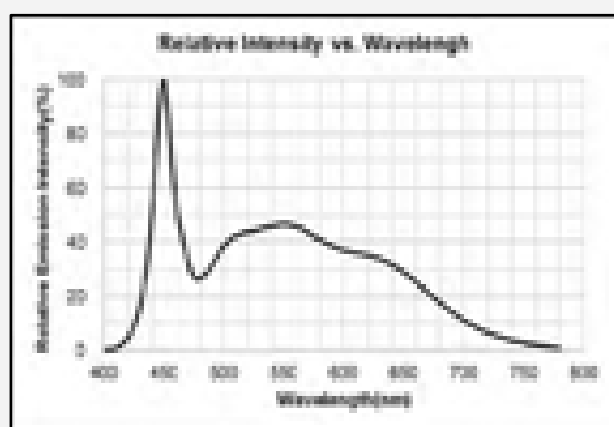
OC71 5000-K (p) CPE



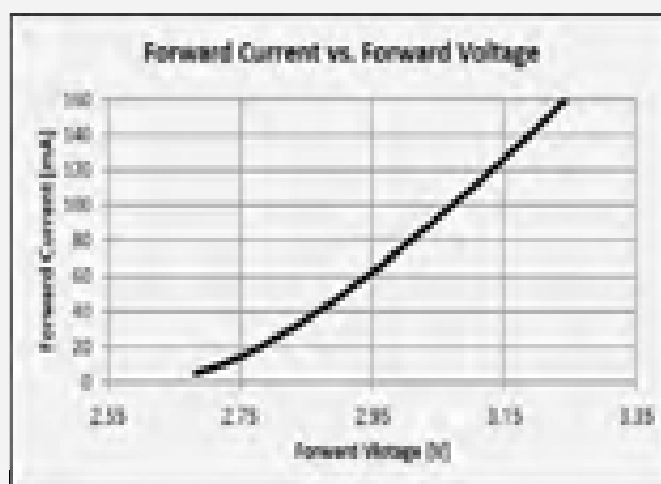
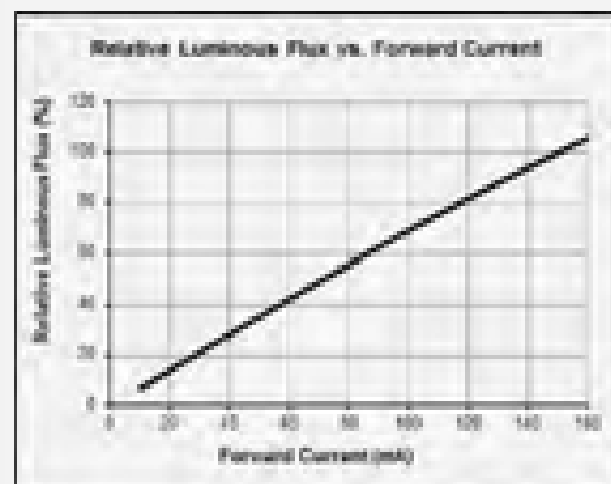
OC71 5700-K (p) CPE



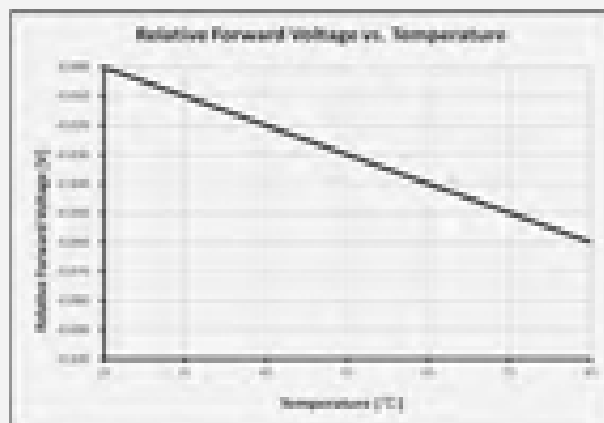
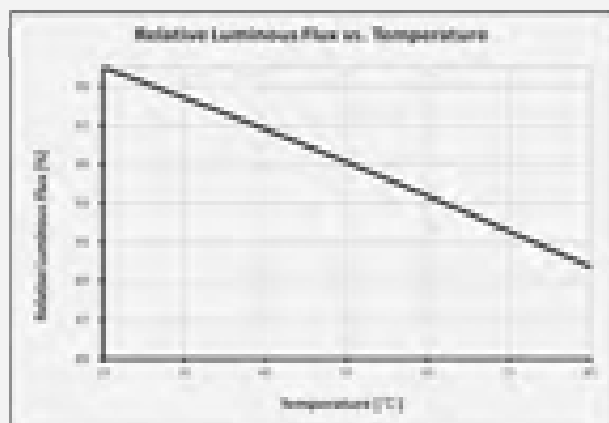
OC71 6500-K (p) CPE



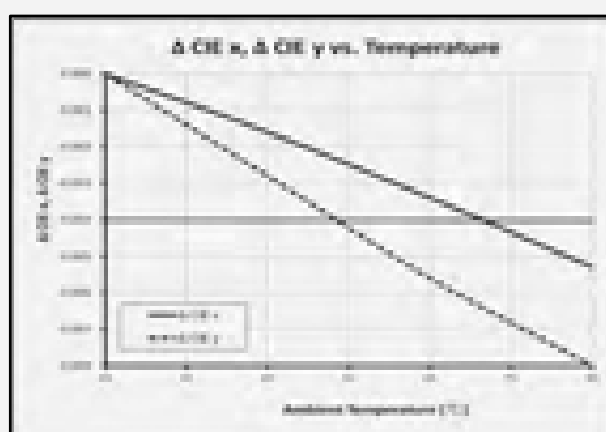
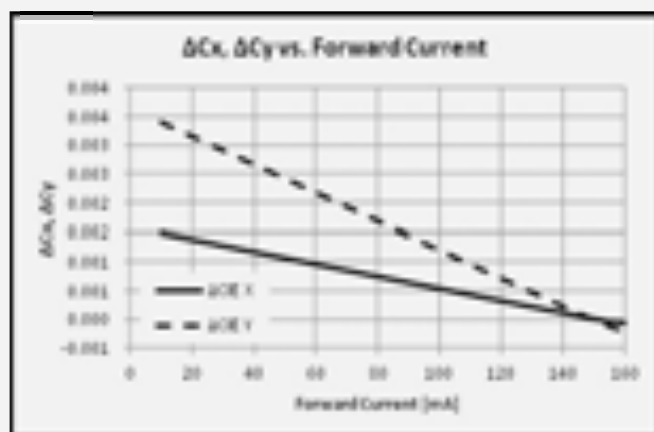
## b) Forward Current Characteristics ( $I_f = 35 \text{ mA}$ )



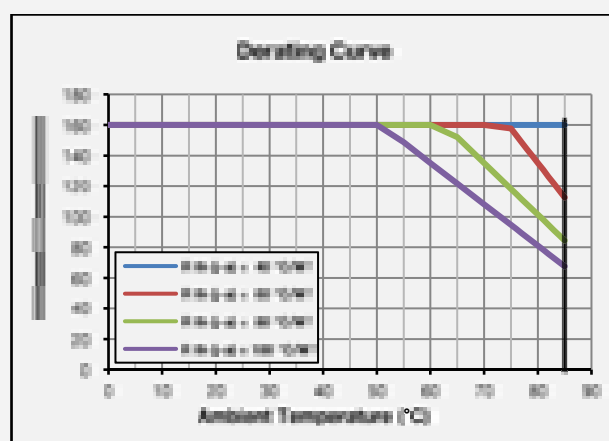
### c) Temperature Characteristics ( $I_f = 150 \text{ mA}$ )



### d) Color Shift Characteristics ( $I_f = 150 \text{ mA}$ , $T_A = 25^\circ\text{C}$ )

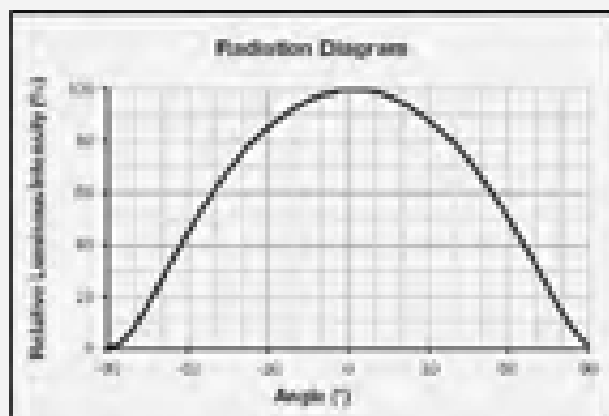


### e) Derating Curve

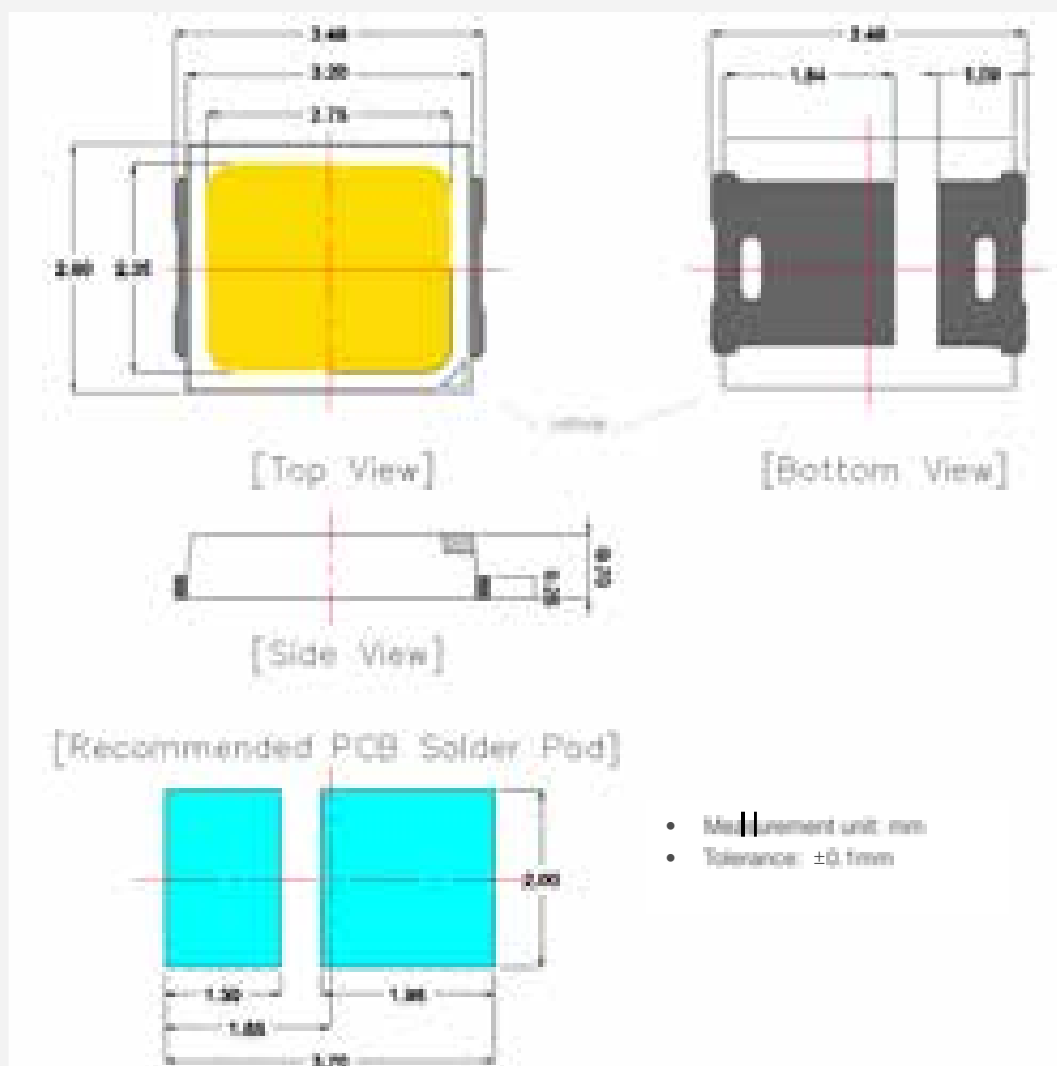




**f) Beam Angle Characteristics ( $I_f = 150 \text{ mA}$ ,  $T_A = 44^\circ\text{C}$ )**



#### 4. Outline Drawing & Dimension



#### Notes:

##### 1) $T_J$ point and measurement method:


- ① Measure the point at the die pad, if necessary remove PSR of PCB to reach  $T_J$  point.
- ② All pad must be soldered to the PCB to dissipate heat properly, otherwise the LED can be damaged.

#### Precautions:

- 1) Pressure on the LEDs will influence to the reliability of the LEDs. Precautions should be taken to avoid strong pressure on the LEDs. Do not put stress on the LEDs during heating.
- 2) Re-soldering should not be done after the LEDs have been soldered. If re-soldering is unavoidable, LED's characteristics should be carefully checked before and after such repair.
- 3) Do not stack assembled PCBs together. Since materials of LEDs is soft, abrasion between two PCB assembled with LED might cause catastrophic failure of the LEDs.

## 5. Reliability Test Items & Conditions

### a) Test Items

Test Item	Test Condition	Test Hour / Cycle	Sample No.
Room Temperature Life Test	25 °C, DC Max Current	1000 h	20
High Temperature Life Test	85 °C, DC Max Current	1000 h	20
High Temperature Humidity Life Test	85 °C, 85 % RH, DC Max Current	1000 h	20
Low Temperature Life Test	-40 °C, DC Max Current	1000 h	20
Powered Temperature Cycle Test	-55 °C, 10 min / 85 °C, 10 min, each, 30 min, d/off 5 min Temp. Change time 100min, DC Max Current	100 cycles	20
Temperature Cycle	-55 °C / 15 min ↔ 125 °C / 15 min	200 cycles	100
High Temperature Storage	85 °C	1000 h	11
Low Temperature Storage	-40 °C	1000 h	11
ESD (HBM)	 <p> <math>R_1: 10 \text{ k}\Omega</math>  <math>R_2: 1.5 \text{ k}\Omega</math>  <math>C: 100 \text{ pF}</math>  <math>V: \pm 1 \text{ kV}</math> </p>	5 times	30

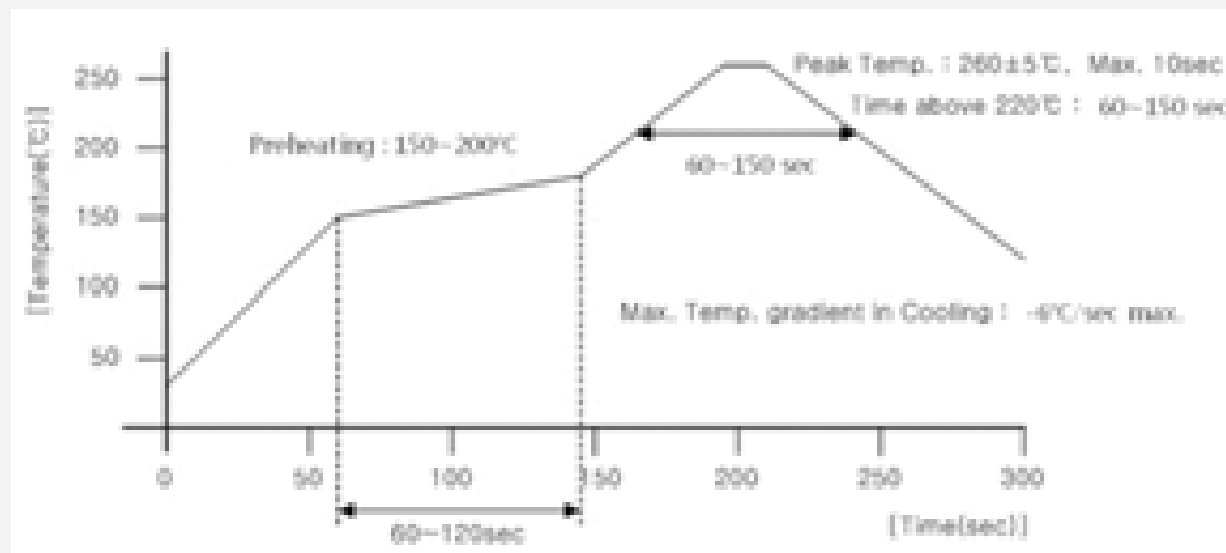
### b) Criteria for Judging the Damage

Item	Symbol	Test Condition (T <sub>s</sub> = 25 °C)	Limit	
			Min	Max
Forward Voltage	V <sub>f</sub>	I <sub>F</sub> = 10 mA	Init. Value + 0.8	Init. Value + 1.1
Luminous Flux	Φ <sub>i</sub>	I <sub>F</sub> = 10 mA	Init. Value + 0.7	Init. Value + 1.5

## 6. Soldering Conditions

### a) Reflow Conditions (Pb free)

Reflow frequency: 2 times max.

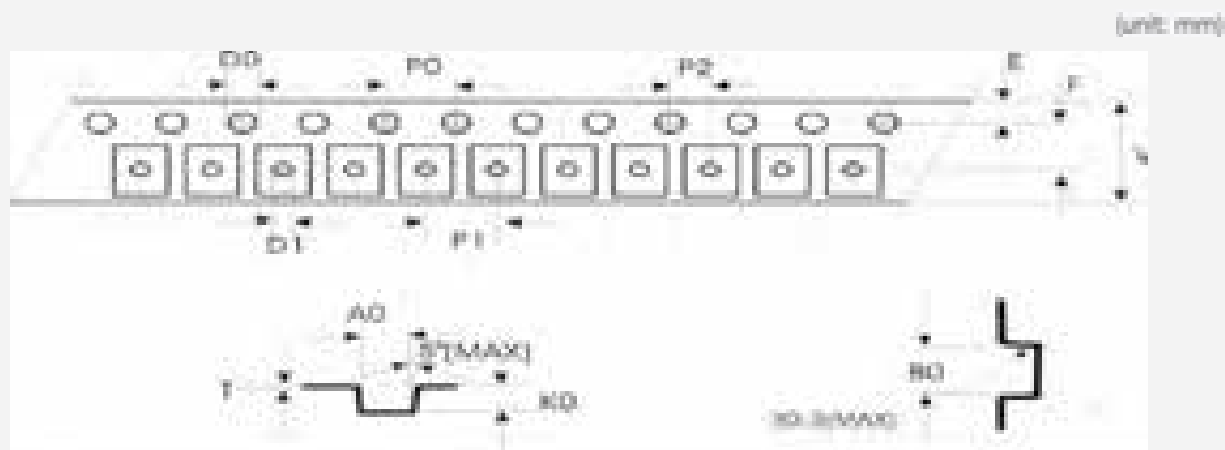


### b) Manual Soldering Conditions

Not more than 5 seconds @ max. 300 °C, under soldering iron.

## 7. Tape & Reel

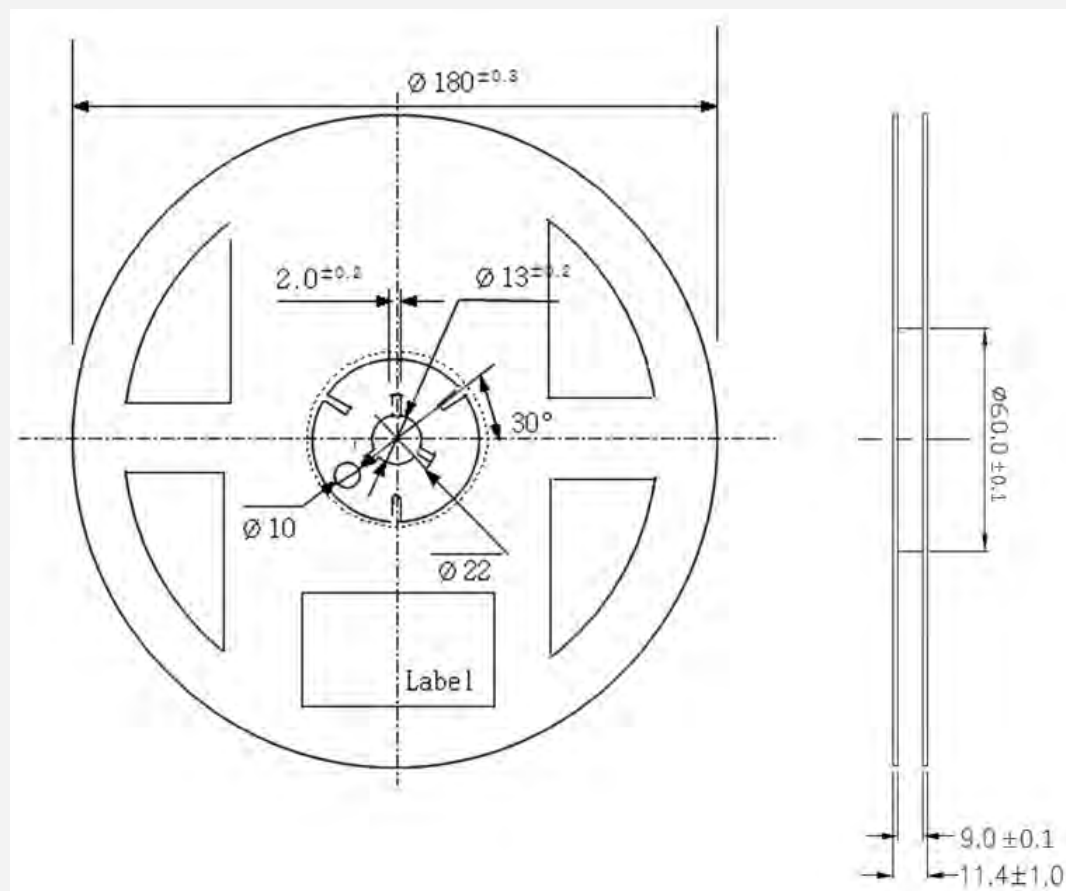
### a) Taping Dimension



A0	3.10±0.1	P0	4.00±0.1	T	0.20±0.05	D0	1.60(MAX)
B0	3.10±0.1	P1	4.00±0.1	E	1.75±0.1	D1	1.05(MIN)
K0	1.00±0.1	P2	2.00±0.1	F	3.40±0.05	V	8.00±0.1

## b) Reel Dimension (max 4,000 pcs)

(unit: mm)

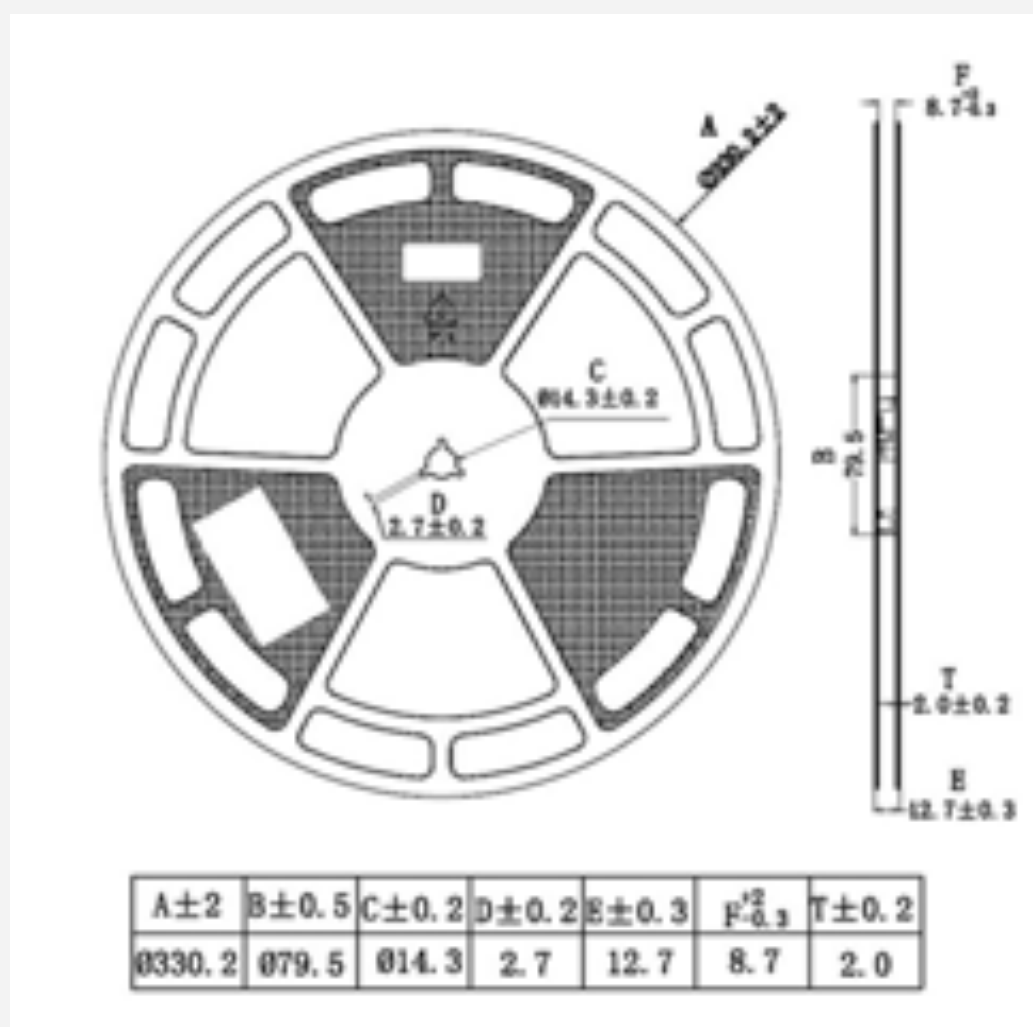


## Notes:

- 1) Quantity: The quantity/reel is 4,000 pcs
- 2) All dimensions are in millimeters (tolerance :  $\pm 0.2\text{mm}$ )
- 3) Packaging: P/N, Manufacturing data code no. and quantity are indicated on the aluminum packing bag

## c) Reel Dimension (max 16,000 pcs)

(unit: mm)

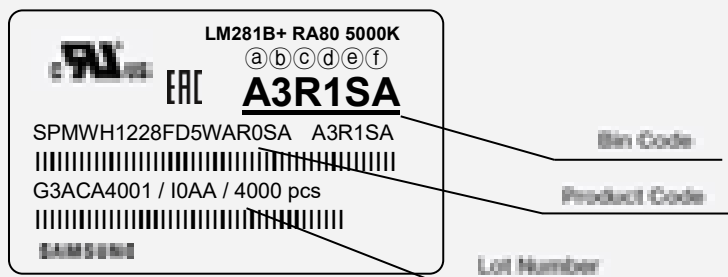


## Notes:

- Quantity: The quantity/reel is 16,000 pcs
- All dimensions are in millimeters (tolerance :  $\pm 0.2\text{mm}$ )
- Packaging: P/N, Manufacturing data code no. and quantity are indicated on the aluminum packing bag

## 8. Label Structure

### a) Label Structure



Note: Denoted bin code and product code above is only an example (see description on page 8)

Bin Code:

a b: Forward Voltage bin | (refer to page 10)

c d: Chromaticity bin | (refer to page 11-13)

e f: Luminous Flux bin | (refer to page 7)

### b) Lot Number

The lot number is composed of the following characters:



1 2 3 4 5 6 7 8 9 / a b c / 4,000 pcs

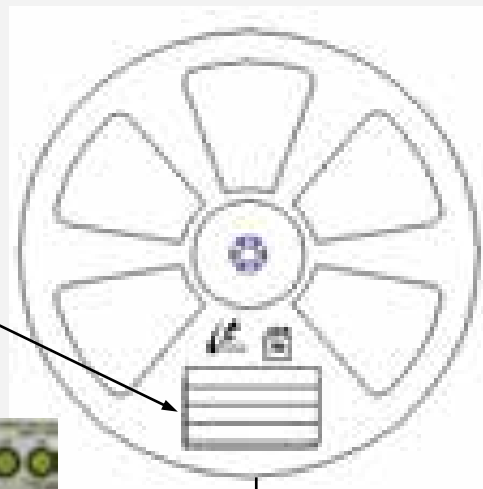
- |             |                                                                                       |
|-------------|---------------------------------------------------------------------------------------|
| 1 2         | : Production site (G3 or GP : Shenzhen, China)                                        |
| 3           | : Product state (A: Normal, B: Bulk, C: First Production, R: Reproduction, S: Sample) |
| 4           | : Year (A: 2016, B: 2017, C: 2018, D: 2019, E: 2020...)                               |
| 5           | : Month (1-9, A, B, C)                                                                |
| 6           | : Day (1-9, A, B-1)                                                                   |
| 7 8 9 a b c | : Product serial number                                                               |



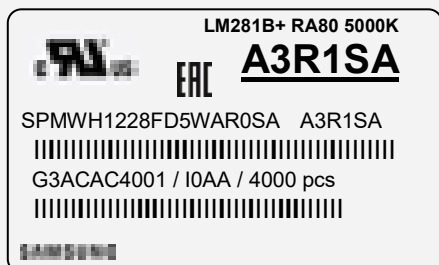
## 9. Packing Structure

### 1) Packing Process (The quantity of POG on the Reel is Max 4,000 pcs)

Reel



Aluminum Vinyl Packing Bag

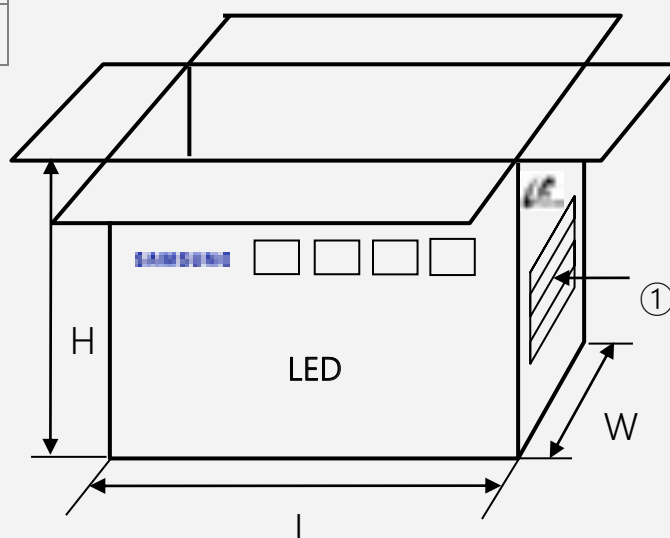
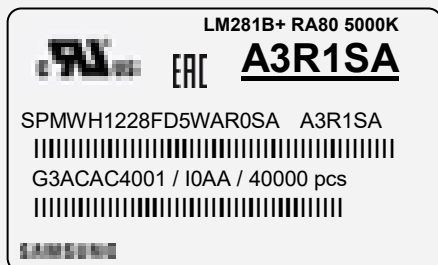


Outer Box

Material: Paper (200GSM))

Type	Size (mm)			Note
	L	W	H	
7 inch   L	240 ± 5	200 ± 5	160 ± 5	Up to 100 pcs
7 inch   H	240 ± 5	200 ± 5	80 ± 5	Up to 50 pcs

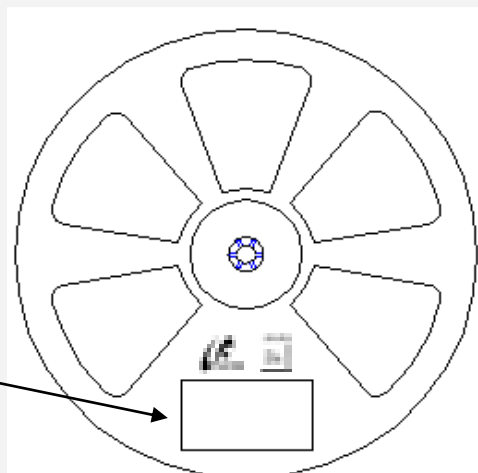
① Side Label



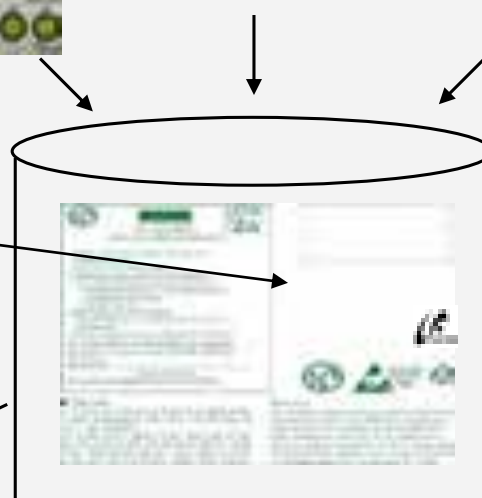
SAMSUNG

b) Packing Process (The quantity of PKG on the Reel to be Max 16,000 pcs)

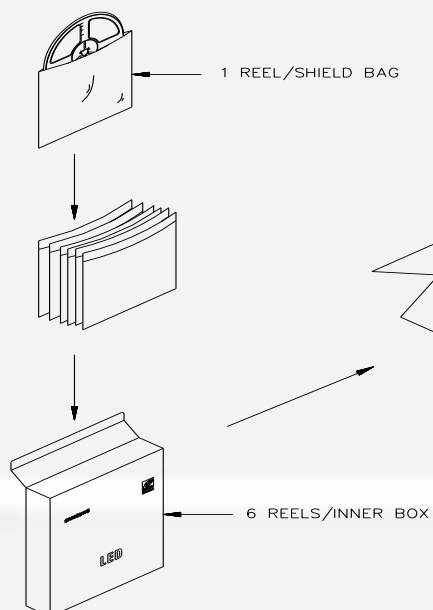
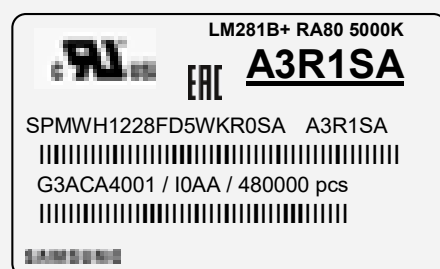
Reel



Aluminum Vinyl Backing Bag



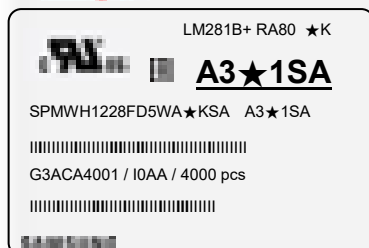
Outer Box



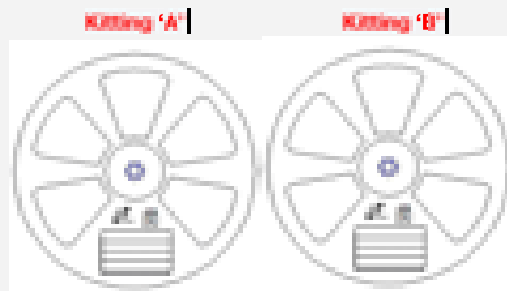
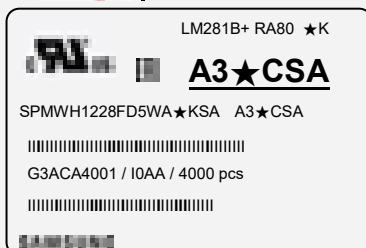
# c| Packing Process for kitting (The quantity of PKG on the Reel is to be Max 4,000 pcs)

## Reel

Kitting 'A'



Kitting 'B'

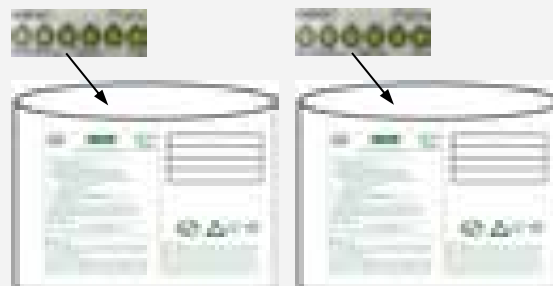
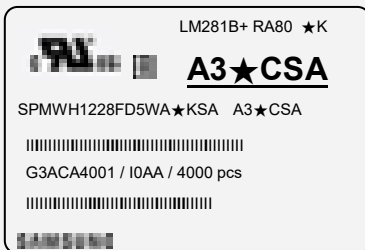


## Aluminum Vinyl Packing Bag

Kitting 'A'

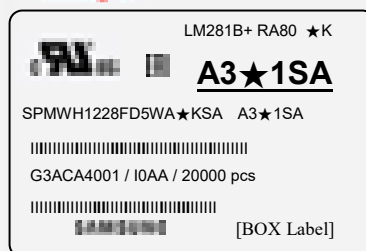


Kitting 'B'

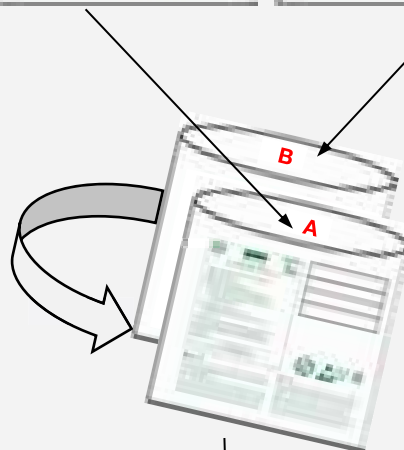
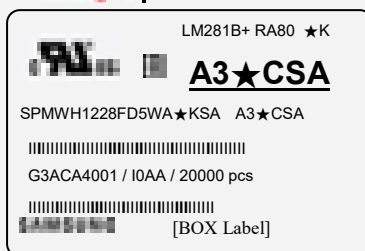


## Outer Box

Kitting 'A'

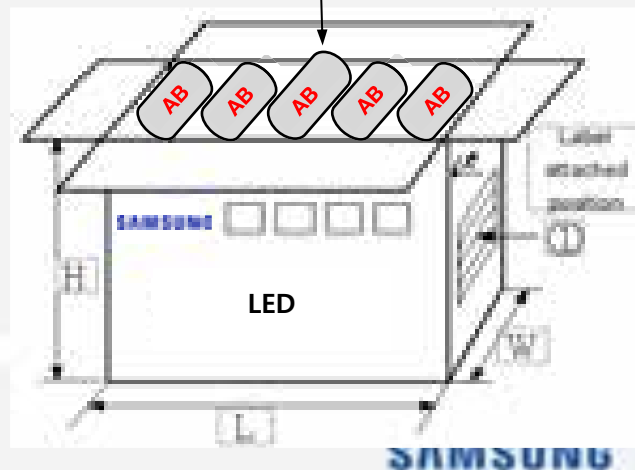


Kitting 'B'



Material: Paper (SWDB03)

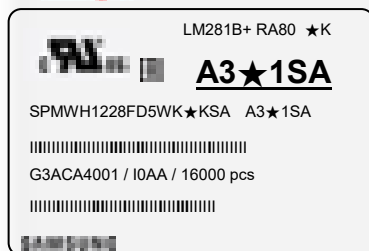
Type	Size (mm)			Note
	L	W	H	
7 inch L	245 ± 5	220 ± 5	162 ± 5	Up to 10 reels



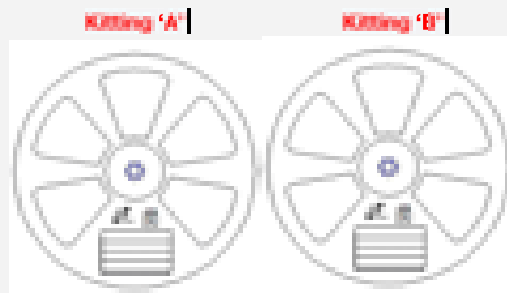
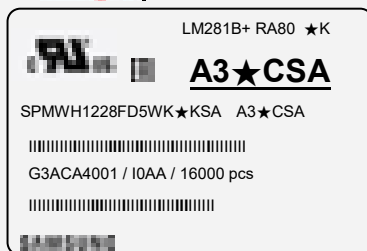
d) Packing Process for kitting (The quantity of PKQ on the Reel to be Max 16,000 pcs)

Reel

Kitting 'A'

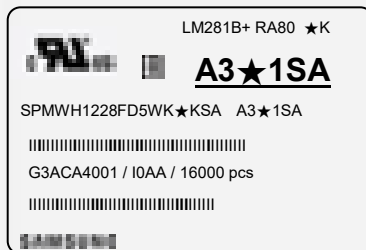


Kitting 'B'

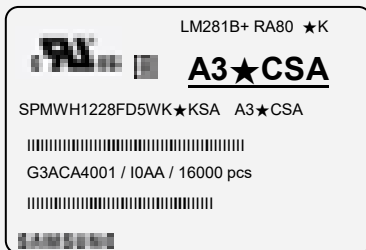


Aluminum Vinyl Packing Bag

Kitting 'A'

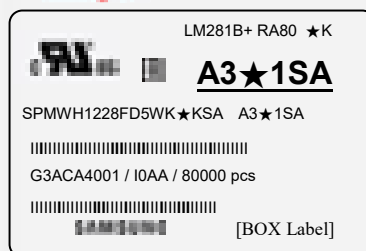


Kitting 'B'

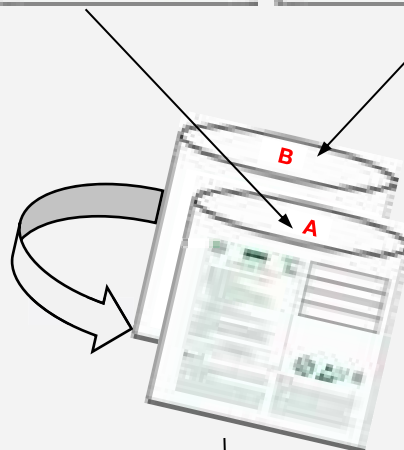
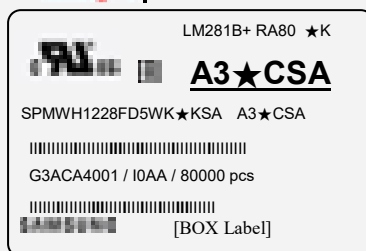


Outer Box

Kitting 'A'

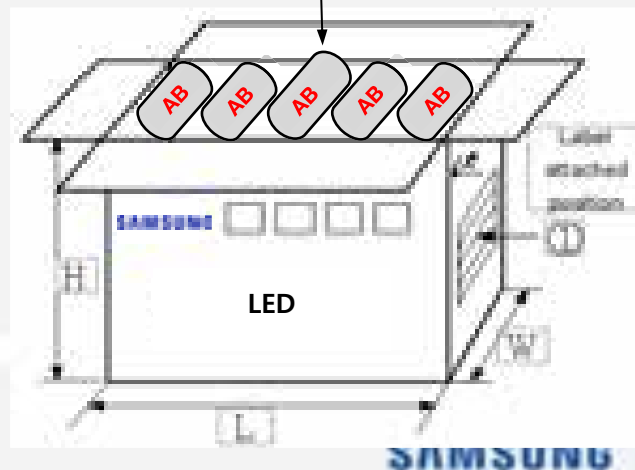


Kitting 'B'



Material: Paper (SWDB03)

Type	Size (mm)			Note
	L	W	H	
13 inch	378 ± 5	345 ± 5	405 ± 5	Up to 16 reels



## e) Aluminum Vinyl Packing Bag



**CAUTION**  
 This bag contains  
**MOISTURE SENSITIVE DEVICES**

**LEVEL**  
2a

1. Shelf life in sealed bag: 12 months at +30°C and +85% relative humidity (RH)
2. Pack package body temperature: 24±5 °C
3. After this bag is opened, devices that will be subjected to inflow, solder or other high temperature processes must be:
  - a. Mounted within 472 hours at factory conditions if equal to or less than 10°C / 60% RH, or
  - b. Stored at +10% RH
4. Devices require baking, before mounting, if:
  - a. Humidity Indicator Card is >40% when read at 20±5°C, or
  - b. It is not used.
5. If baking is required, devices must be baked for 20 - 24 hours at 160±10 °C.

Note: If device manufacturers cannot be subjected to high temperature or shorter bake times are desired, reference IPC/JEDEC J-STD-021 for bake procedures.

Bag seal date (date): \_\_\_\_\_

(If blank, see code label)

Note: Level seal body temperature by IPC/JEDEC J-STD-021



**LM281B+ RA80 5000K**  
**A3R1SA**

SPMWH1228FD5WAR0SA A3R1SA

|||||

G3ACA4001 / 10AA / 4000 pcs

|||||

**SAMSUNG**






**■ 주의 사항**

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**■ Important**

This AI Zipper bag is designed to protect the enclosed products from moisture and ESD. Once opened, the products should be soldered onto the printed circuit board immediately. When not in use, please do not leave the products unprotected by the AI Zipper Bag. To repack unused products, please ensure the zip-lock is completely sealed with the dry pack left inside.

## f) Humidity Indicator Card Inside Aluminum Vinyl Bag



## 10. Precautions in Handling & Use

- 1) For over-current protection, users are recommended to apply resistors connected in series with the LEDs to mitigate sudden change of the forward current caused by shift of forward voltage.
- 2) 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.
- 3) When the device is in operation, the forward current should be carefully determined considering the maximum ambient temperature and corresponding junction temperature.
- 4) LEDs must be stored in a clean environment.  
(Self life of sealed bags is 12 months at temperature 0–40 °C, 0–90 % RH).
- 5) After storage bag is opened, device subjected to soldering, solder reflow, or other high temperature processes must be:
  - a. Mounted within 72 hours (28 days) at an assembly line with a condition of no more than 30 °C / 60 % RH<sup>1</sup>, or
  - b. Mounted within 24 hours (1 day) at an assembly line with a condition of more than 30 °C / 60 % RH<sup>1</sup>, or
  - c. Stored at <10 % RH.

Note 1, 2: IPC/JEDEC J-STD-33A, Recommended Equivalent Total Floor Life Table

Storage Condition (Temp./Humidity)	Storage Equivalent Time	Equivalent Floor Life (months)						Reference
		0°C	25°C	40°C	55°C	70°C	85°C	
Static Protection: all time	1 (min)	∞	∞	20	7	4	1	JEDEC
		∞	∞	10	3	2	1	JEDEC
		∞	∞	5	2	1	1	JEDEC

- 6) Repack unused devices with anti-moisture packing, fold to close any opening and then store in a dry place.
- 7) Devices require baking before mounting, if humidity card reading is >60 % at 23 ± 5 °C.
- 8) Devices must be baked for 1–24 hour at 60 ± 5 °C, if baking is required.
- 9) 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.
- 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) Risk of sulfuration (or tarnishing)  
The LED from Samsung uses a silver-plated lead frame and its surface color may change to black (or dark colored) when it is exposed to sulfur (S), chlorine (Cl) or other halogen compound. Sulfuration of lead frame may cause intensity degradation, change of chromaticity coordinates and, in extreme cases, open circuit. It requires caution. Due to possible sulfuration of lead frame, LED should not be used and stored together with oxidizing substances made of materials such as rubber, plain paper, lead solder cream, etc.

# Legal and additional information.

## About Samsung Electronics Co., Ltd.

Samsung inspires the world and shapes the future with transformative ideas and technologies.

The company is redefining the worlds of TVs, smartphones, wearable devices, tablets, digital appliances, network systems, and memory, system LSI, foundry and LED solutions.

For the latest news, please visit the Samsung Newsroom at [news.samsung.com](http://news.samsung.com).

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KOREA

[www.samsungled.com](http://www.samsungled.com)

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