Middle Power LED Series
2835 0.5W Ra80

LM281B+

Designed for better lm/$ (Ambient, Linear)

Features & Benefits

- 0.5W Class mid power LED
- Standard form factor for design flexibility (2.8 × 3.5 mm)

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1. Characteristics

a) Absolute Maximum Rating

Item	Symbol	Rating	Unit	Condition
Ambient / Operating Temperature	T_a	-40 ~ +85	℃	-
Storage Temperature	T_{stg}	-40 ~ +85	℃	-
LED Junction Temperature	T_j	115	℃	-
Forward Current	I_F	160	mA	-
Peak Pulsed Forward Current	I_{Fp}	300	mA	Duty 1/10, pulse width 10ms
Assembly Process Temperature	-	260 <10	℃ 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 un-even brightness, and may vary depending on circuit configuration.

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b) Electro-optical Characteristics (I_F = 150 mA, T_s = 25 °C)

Item	Unit	Rank	Bin	Min.	Typ.	Max.
Forward Voltage (VF)	V	WA or WK	A1	2.8		2.9
			A2	2.9		3.0
			A3	3.0		3.1
			A4	3.1		3.2
			A5	3.2		3.3
Color Rendering Index (Ra)	-	5		80	-	-
Thermal Resistance (junction to solder point)	°C/W			-	25	-
Beam Angle	°			-	120	-

Note:

Samsung maintains measurement tolerance of: forward voltage = ±0.1 V, CRI = ±3

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b) Electro-optical Characteristics   (I_F = 150 mA, T_s = 25 °C)

Item	CRI (R_a) Min.	Nominal CCT (K)	Bin	150mA	
				Min.	Max.
Luminous Flux (Φv)	80	2700	SA	52.5	56.5
			SC	56.5	60.5
			SE	60.5	64.5
			SG	64.5	68.5
		3000	SA	54.5	58.5
			SC	58.5	62.5
			SE	62.5	66.5
			SG	66.5	70.5
		3500	SA	55.5	59.5
			SC	59.5	63.5
			SE	63.5	67.5
			SG	67.5	71.5
		4000	SA	58.0	62.0
			SC	62.0	66.0
			SE	66.0	70.0
			SG	70.0	74.0
		5000	SA	59.0	63.0
			SC	63.0	67.0
			SE	67.0	71.0
			SG	71.0	75.0
		5700	SA	58.5	62.5
			SC	62.5	66.5
			SE	66.5	70.5
			SG	70.5	74.5
		6500	SA	58.0	62.0
			SC	62.0	66.0
			SE	66.0	70.0
			SG	70.0	74.0

Note:

Samsung maintains measurement tolerance of: forward voltage = ±0.1V, luminous flux = ±5 %, CRI = ±3

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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	S	C

Digit	PKG Information	Code	Specification			
1 2 3	Samsung Package Middle Power	SPM	Middle power			
4 5	Color	WH	White			
6	Product Version	1	1st version			
7 8 9	Form Factor	228	2.8 x 3.5 x 0.65 mm; 2 pads			
10	Sorting Current (mA)	F	150 mA			
11	Chromaticity Coordinates	D	ANSI Standard			
12	CRI	5	Min. 80			
13 14	Forward Voltage (V)	WA or WK	2.8~3.3	Bin code	A1 A2 A3 A4 A5	2.8 ~ 2.9 2.9 ~ 3.0 3.0 ~ 3.1 3.1 ~ 3.2 3.2 ~ 3.3
			WA : 4,000ea per reel ,WK : 16,000ea per reel			
15 16	CCT (K)	W☆ V☆ U☆ T☆ R☆ Q☆ P☆	2700 3000 3500 4000 5000 5700 6500	Bin Code:	W1, W2, W3, W4, W5, W6, W7, W8, W9, WA, WB, WC, WD, WE, WF, WG V1, V2, V3, V4, V5, V6, V7, V8, V9, VA, VB, VC, VD, VE, VF, VG U1, U2, U3, U4, U5, U6, U7, U8, U9, UA, UB, UC, UD, UE, UF, UG T1, T2, T3, T4, T5, T6, T7, T8, T9, TA, TB, TC, TD, TE, TF, TG R1, R2, R3, R4, R5, R6, R7, R8, R9,RA,RB,RC,RD,RE,RF,RG Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q8, Q9,QA,QB,QC,QD,QE,QF,QG P1, P2, P3, P4, P5, P6, P7, P8, P9,PA,PB,PC,PD,PE,PF,PG	
			☆ : "0" (Whole bin) "M" (Quarter bin) or "K" (K Kitting bin)			
17 18	Luminous Flux	SA SC SE SG		Bin Code	SA SC SE SG	

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a) Luminous Flux Bins (I_F = 150 mA, T_s= 25ºC)

CRI (R$_a$) Min.	Nominal CCT (K)	Product Code	Flux Bin	Flux Range (Φ_v, lm)
80	2700	SPMWH1228FD5WAW☆SA	SA	52.5 ~ 56.5
		SPMWH1228FD5WAW☆SC	SC	56.5 ~ 60.5
		SPMWH1228FD5WAW☆SE	SE	60.5 ~ 64.5
		SPMWH1228FD5WAW☆SG	SG	64.5 ~ 68.5
	3000	SPMWH1228FD5WAV☆SA	SA	54.5 ~ 58.5
		SPMWH1228FD5WAV☆SC	SC	58.5 ~ 62.5
		SPMWH1228FD5WAV☆SE	SE	62.5 ~ 66.5
		SPMWH1228FD5WAV☆SG	SG	66.5 ~ 70.5
	3500	SPMWH1228FD5WAU☆SA	SA	55.5 ~ 59.5
		SPMWH1228FD5WAU☆SC	SC	59.5 ~ 63.5
		SPMWH1228FD5WAU☆SE	SE	63.5 ~ 67.5
		SPMWH1228FD5WAU☆SG	SG	67.5 ~ 71.5
	4000	SPMWH1228FD5WAT☆SA	SA	58.0 ~ 62.0
		SPMWH1228FD5WAT☆SC	SC	62.0 ~ 66.0
		SPMWH1228FD5WAT☆SE	SE	66.0 ~ 70.0
		SPMWH1228FD5WAT☆SG	SG	70.0 ~ 74.0
	5000	SPMWH1228FD5WAR☆SA	SA	59.0 ~ 63.0
		SPMWH1228FD5WAR☆SC	SC	63.0 ~ 67.0
		SPMWH1228FD5WAR☆SE	SE	67.0 ~ 71.0
		SPMWH1228FD5WAR☆SG	SG	71.0 ~ 75.0
	5700	SPMWH1228FD5WAQ☆SA	SA	58.5 ~ 62.5
		SPMWH1228FD5WAQ☆SC	SC	62.5 ~ 66.5
		SPMWH1228FD5WAQ☆SE	SE	66.5 ~ 70.5
		SPMWH1228FD5WAQ☆SG	SG	70.5 ~ 74.5
	6500	SPMWH1228FD5WAP☆SA	SA	58.0 ~ 62.0
		SPMWH1228FD5WAP☆SC	SC	62.0 ~ 66.0
		SPMWH1228FD5WAP☆SE	SE	66.0 ~ 70.0
		SPMWH1228FD5WAP☆SG	SG	70.0 ~ 74.0

Note:

"☆" can be "0" (Whole bin), "M" (Quarter bin) or "K" (K Kitting bin) of the color binning

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b) Kitting rule

1) K Kitting bin Concept

1. Under agreement between customer and SAMSUNG ELECTRONICS, SAMSUNG can supply kitting bin (VF, Color, lm).
2. A forward voltage (VF) of kitting bin is combined by a pair of same VF rank such as (A1+A1), (A2+A2), (A3+A3), (A4+A4) or (A5+A5).
3. 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		A1	A1
		A2	A2
		A3	A3
		A4	A4
		A5	A5
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

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c) Color Bins (I_F = 150 mA, T_s= 25 °C)

| CRI (R_a) Min.	Nominal CCT (K)	Product Code	Color Rank	Chromaticity Bins
80	2700	SPMWH1228FD5WAW0S★	W0 (Whole bin)	W1, W2, W3, W4, W5, W6, W7, W8, W9, WA, WB, WC, WD, WE, WF, WG
		SPMWH1228FD5WAWMS★	WM (Quarter bin)	W6, W7, WA, WB
		SPMWH1228FD5WAWKS★	WK (K Kitting bin)	W1, W2, W3, W4, W5, W6, W7, W8, W9, WA, WB, WC, WD, WE, WF, WG
	3000	SPMWH1228FD5WAV0S★	V0 (Whole bin)	V1, V2, V3, V4, V5, V6, V7, V8, V9, VA, VB, VC, VD, VE, VF, VG
		SPMWH1228FD5WAVMS★	VM (Quarter bin)	V6, V7, VA, VB
		SPMWH1228FD5WAVKS★	VK (K Kitting bin)	V1, V2, V3, V4, V5, V6, V7, V8, V9, VA, VB, VC, VD, VE, VF, VG
	3500	SPMWH1228FD5WAU0S★	U0 (Whole bin)	U1, U2, U3, U4, U5, U6, U7, U8, U9, UA, UB, UC, UD, UE, UF, UG
		SPMWH1228FD5WAUMS★	UM (Quarter bin)	U6, U7, UA, UB
		SPMWH1228FD5WAUKS★	UK (K Kitting bin)	U1, U2, U3, U4, U5, U6, U7, U8, U9, UA, UB, UC, UD, UE, UF, UG
	4000	SPMWH1228FD5WAT0S★	T0 (Whole bin)	T1, T2, T3, T4, T5, T6, T7, T8, T9, TA, TB, TC, TD, TE, TF, TG
		SPMWH1228FD5WATMS★	TM (Quarter bin)	T6, T7, TA, TB
		SPMWH1228FD5WATKS★	TK (K Kitting bin)	T1, T2, T3, T4, T5, T6, T7, T8, T9, TA, TB, TC, TD, TE, TF, TG
	5000	SPMWH1228FD5WAR0S★	R0 (Whole bin)	R1, R2, R3, R4, R5, R6, R7, R8, R9 RA,RB,RC,RD,RE,RF,RG
		SPMWH1228FD5WARMS★	RM (Quarter bin)	R6, R7, RA, RB
		SPMWH1228FD5WARKS★	RK (K Kitting bin)	R1, R2, R3, R4, R5, R6, R7, R8, R9 RA,RB,RC,RD,RE,RF,RG
	5700	SPMWH1228FD5WAQ0S★	Q0 (Whole bin)	Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q8, Q9 QA,QB,QC,QD,QE,QF,QG
		SPMWH1228FD5WAQMS★	QM (Quarter bin)	Q6, Q7, QA, QB
		SPMWH1228FD5WAQKS★	QK (K Kitting bin)	Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q8, Q9 QA,QB,QC,QD,QE,QF,QG
	6500	SPMWH1228FD5WAP0S★	P0 (Whole bin)	P1, P2, P3, P4, P5, P6, P7, P8, P9 PA,PB,PC,PD,PE,PF,PG
		SPMWH1228FD5WAPMS★	PM (Quarter bin)	P6, P7, PA, PB
		SPMWH1228FD5WAPKS★	PK (K Kitting bin)	P1, P2, P3, P4, P5, P6, P7, P8, P9 PA,PB,PC,PD,PE,PF,PG

Note:

"★" can be "SA", "SC", "SE" or "SG" of luminous flux bin

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d) Voltage Bins (I$_F$ = 150 mA, T$_s$ = 25 °C)

CRI (R$_a$) Min.	Nominal CCT (K)	Product Code	Voltage Rank	Voltage Bin	Voltage Range (V)
-	-	-	WA or WK	A1	2.8 ~ 2.9
				A2	2.9 ~ 3.0
				A3	3.0 ~ 3.1
				A4	3.1 ~ 3.2
				A5	3.2 ~ 3.3

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e) Chromaticity Region & Coordinates (I$_F$ = 150 mA, T$_s$ = 25 °C)

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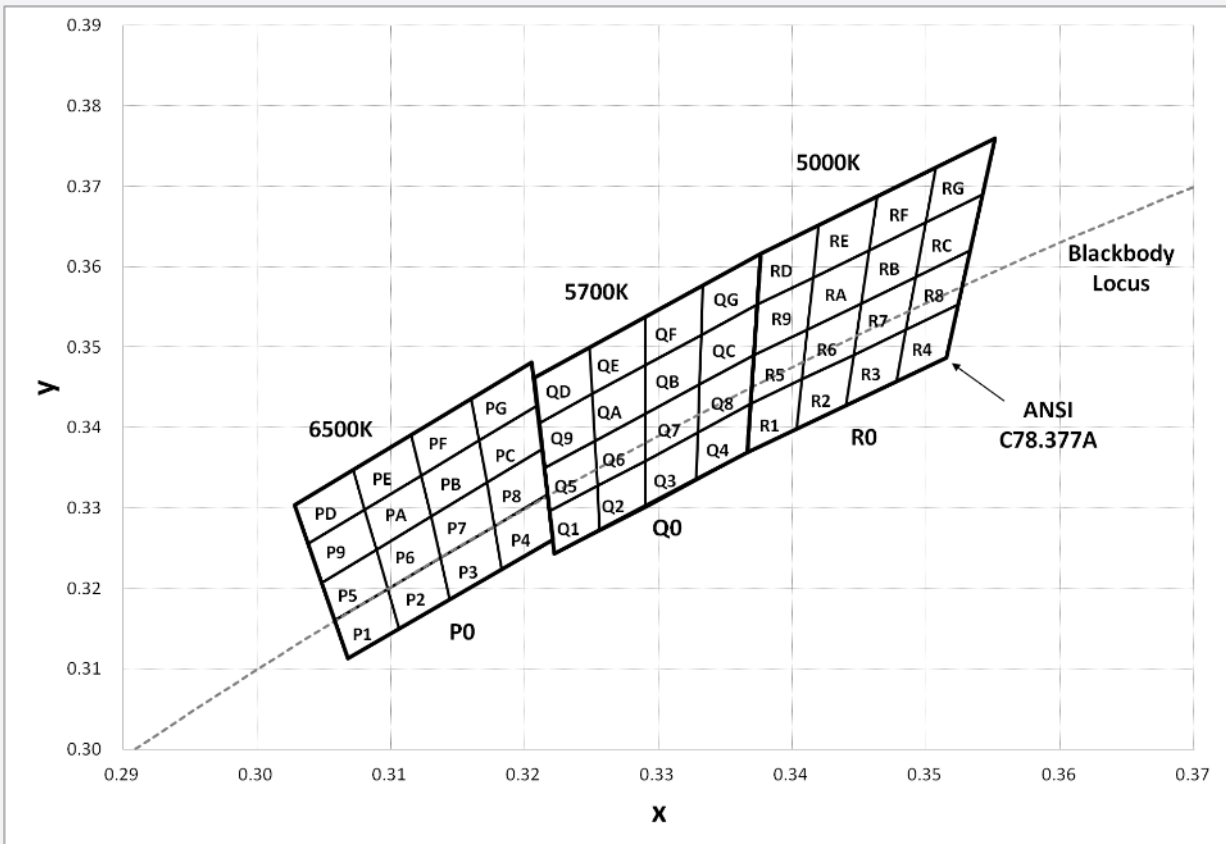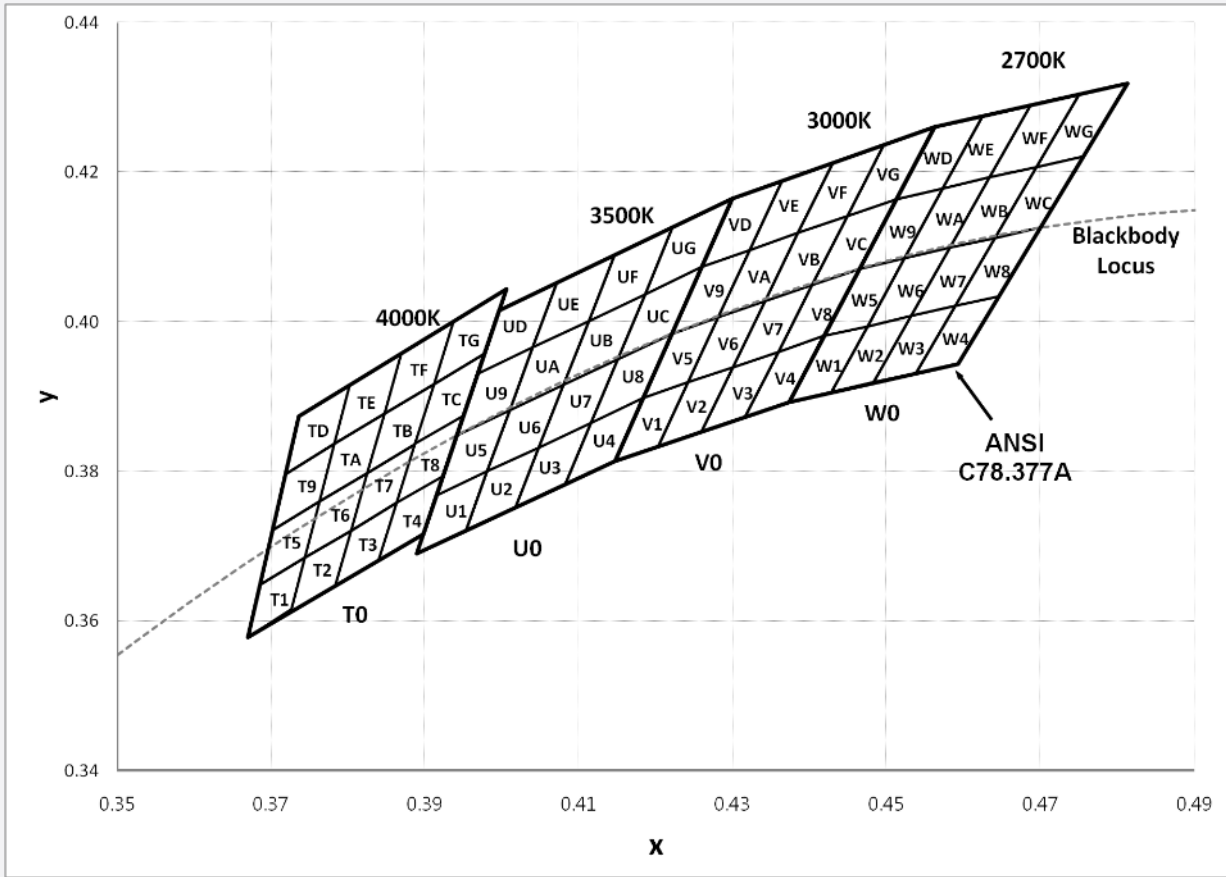
e) Chromaticity Region & Coordinates

W rank (2700 K)

Region	CIE x	CIE y	Region	CIE x	CIE y
W1	0.4373	0.3893	W9	0.4465	0.4071
	0.4418	0.3981		0.4513	0.4164
	0.4475	0.3994		0.4573	0.4178
	0.4428	0.3906		0.4523	0.4085
W2	0.4428	0.3906	WA	0.4523	0.4085
	0.4475	0.3994		0.4573	0.4178
	0.4532	0.4008		0.4634	0.4193
	0.4483	0.3919		0.4582	0.4099
W3	0.4483	0.3919	WB	0.4582	0.4099
	0.4532	0.4008		0.4634	0.4193
	0.4589	0.4021		0.4695	0.4207
	0.4538	0.3931		0.4641	0.4112
W4	0.4538	0.3931	WC	0.4641	0.4112
	0.4589	0.4021		0.4695	0.4207
	0.4646	0.4034		0.4756	0.4221
	0.4593	0.3944		0.4700	0.4126
W5	0.4418	0.3981	WD	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
W6	0.4475	0.3994	WE	0.4573	0.4178
	0.4523	0.4085		0.4624	0.4274
	0.4582	0.4099		0.4687	0.4289
	0.4532	0.4008		0.4634	0.4193
W7	0.4532	0.4008	WF	0.4634	0.4193
	0.4582	0.4099		0.4687	0.4289
	0.4641	0.4112		0.4750	0.4304
	0.4589	0.4021		0.4695	0.4207
W8	0.4589	0.4021	WG	0.4695	0.4207
	0.4641	0.4112		0.4750	0.4304
	0.4700	0.4126		0.4813	0.4319
	0.4646	0.4034		0.4756	0.4221

V rank (3000 K)

Region	CIE x	CIE y	Region	CIE x	CIE y
V1	0.4147	0.3814	V9	0.4221	0.3984
	0.4183	0.3898		0.4259	0.4073
	0.4242	0.3919		0.4322	0.4096
	0.4203	0.3833		0.4281	0.4006
V2	0.4203	0.3833	VA	0.4281	0.4006
	0.4242	0.3919		0.4322	0.4096
	0.4300	0.3939		0.4385	0.4119
	0.4259	0.3853		0.4342	0.4028
V3	0.4259	0.3853	VB	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
V4	0.4316	0.3873	VC	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
V5	0.4183	0.3898	VD	0.4259	0.4073
	0.4221	0.3984		0.4299	0.4165
	0.4281	0.4006		0.4364	0.4188
	0.4242	0.3919		0.4322	0.4096
V6	0.4242	0.3919	VE	0.4322	0.4096
	0.4281	0.4006		0.4364	0.4188
	0.4342	0.4028		0.4430	0.4212
	0.4300	0.3939		0.4385	0.4119
V7	0.4300	0.3939	VF	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
V8	0.4359	0.3960	VG	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

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e) Chromaticity Region & Coordinates

U rank (3500 K)

Region	CIE x	CIE y	Region	CIE x	CIE y
U1	0.3889	0.3690	U9	0.3941	0.3848
U1	0.3915	0.3768	U9	0.3968	0.3930
U1	0.3981	0.3800	U9	0.4040	0.3966
U1	0.3953	0.3720	U9	0.4010	0.3882
U2	0.3953	0.3720	UA	0.4010	0.3882
U2	0.3981	0.3800	UA	0.4040	0.3966
U2	0.4048	0.3832	UA	0.4113	0.4001
U2	0.4017	0.3751	UA	0.4080	0.3916
U3	0.4017	0.3751	UB	0.4080	0.3916
U3	0.4048	0.3832	UB	0.4113	0.4001
U3	0.4116	0.3865	UB	0.4186	0.4037
U3	0.4082	0.3782	UB	0.4150	0.3950
U4	0.4082	0.3782	UC	0.4150	0.3950
U4	0.4116	0.3865	UC	0.4186	0.4037
U4	0.4183	0.3898	UC	0.4259	0.4073
U4	0.4147	0.3814	UC	0.4221	0.3984
U5	0.3915	0.3768	UD	0.3968	0.3930
U5	0.3941	0.3848	UD	0.3996	0.4015
U5	0.4010	0.3882	UD	0.4071	0.4052
U5	0.3981	0.3800	UD	0.4040	0.3966
U6	0.3981	0.3800	UE	0.4040	0.3966
U6	0.4010	0.3882	UE	0.4071	0.4052
U6	0.4080	0.3916	UE	0.4146	0.4089
U6	0.4048	0.3832	UE	0.4113	0.4001
U7	0.4048	0.3832	UF	0.4113	0.4001
U7	0.4080	0.3916	UF	0.4146	0.4089
U7	0.4150	0.3950	UF	0.4222	0.4127
U7	0.4116	0.3865	UF	0.4186	0.4037
U8	0.4116	0.3865	UG	0.4186	0.4037
U8	0.4150	0.3950	UG	0.4222	0.4127
U8	0.4221	0.3984	UG	0.4299	0.4165
U8	0.4183	0.3898	UG	0.4259	0.4073

T rank (4000 K)

Region	CIE x	CIE y	Region	CIE x	CIE y
T1	0.3670	0.3578	T9	0.3702	0.3722
T1	0.3726	0.3612	T9	0.3763	0.3760
T1	0.3744	0.3685	T9	0.3782	0.3837
T1	0.3686	0.3649	T9	0.3719	0.3797
T2	0.3726	0.3612	TA	0.3763	0.3760
T2	0.3783	0.3646	TA	0.3825	0.3798
T2	0.3804	0.3721	TA	0.3847	0.3877
T2	0.3744	0.3685	TA	0.3782	0.3837
T3	0.3783	0.3646	TB	0.3825	0.3798
T3	0.3840	0.3681	TB	0.3887	0.3836
T3	0.3863	0.3758	TB	0.3912	0.3917
T3	0.3804	0.3721	TB	0.3847	0.3877
T4	0.3840	0.3681	TC	0.3887	0.3837
T4	0.3898	0.3716	TC	0.3950	0.3875
T4	0.3924	0.3794	TC	0.3978	0.3958
T4	0.3863	0.3758	TC	0.3912	0.3917
T5	0.3686	0.3649	TD	0.3719	0.3797
T5	0.3744	0.3685	TD	0.3782	0.3837
T5	0.3763	0.3760	TD	0.3802	0.3916
T5	0.3702	0.3722	TD	0.3736	0.3874
T6	0.3744	0.3685	TE	0.3782	0.3837
T6	0.3804	0.3721	TE	0.3847	0.3877
T6	0.3825	0.3798	TE	0.3869	0.3958
T6	0.3763	0.3760	TE	0.3802	0.3916
T7	0.3804	0.3721	TF	0.3847	0.3877
T7	0.3863	0.3758	TF	0.3912	0.3917
T7	0.3887	0.3836	TF	0.3937	0.4001
T7	0.3825	0.3798	TF	0.3869	0.3958
T8	0.3863	0.3758	TG	0.3912	0.3917
T8	0.3924	0.3794	TG	0.3978	0.3958
T8	0.3950	0.3875	TG	0.4006	0.4044
T8	0.3887	0.3836	TG	0.3937	0.4001

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e) Chromaticity Region & Coordinates

Region	CIE x	CIE y	Region	CIE x	CIE y
R rank (5000 K)					
R1	0.3366	0.3369	R9	0.3374	0.3554
R1	0.3369	0.3431	R9	0.3371	0.3493
R1	0.3407	0.3460	R9	0.3411	0.3522
R1	0.3403	0.3398	R9	0.3415	0.3587
R2	0.3403	0.3398	RA	0.3415	0.3587
R2	0.3407	0.3460	RA	0.3411	0.3522
R2	0.3446	0.3491	RA	0.3451	0.3554
R2	0.3440	0.3427	RA	0.3457	0.3621
R3	0.3446	0.3491	RB	0.3451	0.3554
R3	0.3440	0.3427	RB	0.3457	0.3621
R3	0.3477	0.3458	RB	0.3500	0.3655
R3	0.3485	0.3522	RB	0.3492	0.3587
R4	0.3485	0.3522	RC	0.3492	0.3587
R4	0.3477	0.3458	RC	0.3500	0.3655
R4	0.3514	0.3487	RC	0.3542	0.3690
R4	0.3524	0.3554	RC	0.3533	0.3620
R5	0.3371	0.3493	RD	0.3376	0.3616
R5	0.3369	0.3431	RD	0.3374	0.3554
R5	0.3407	0.3460	RD	0.3415	0.3587
R5	0.3411	0.3522	RD	0.3420	0.3652
R6	0.3407	0.3460	RE	0.3415	0.3587
R6	0.3411	0.3522	RE	0.3420	0.3652
R6	0.3451	0.3554	RE	0.3463	0.3687
R6	0.3446	0.3491	RE	0.3457	0.3621
R7	0.3446	0.3491	RF	0.3457	0.3621
R7	0.3451	0.3554	RF	0.3463	0.3687
R7	0.3492	0.3587	RF	0.3507	0.3724
R7	0.3485	0.3522	RF	0.3500	0.3655
R8	0.3485	0.3522	RG	0.3500	0.3655
R8	0.3492	0.3587	RG	0.3507	0.3724
R8	0.3533	0.3620	RG	0.3551	0.3760
R8	0.3524	0.3554	RG	0.3542	0.3690

Region	CIE x	CIE y	Region	CIE x	CIE y
Q rank (5700 K)					
Q1	0.3218	0.3298	Q9	0.3211	0.3407
Q1	0.3222	0.3243	Q9	0.3215	0.3353
Q1	0.3258	0.3275	Q9	0.3254	0.3388
Q1	0.3256	0.3331	Q9	0.3252	0.3444
Q2	0.3256	0.3331	QA	0.3252	0.3444
Q2	0.3258	0.3275	QA	0.3254	0.3388
Q2	0.3294	0.3306	QA	0.3293	0.3423
Q2	0.3294	0.3364	QA	0.3293	0.3481
Q3	0.3294	0.3364	QB	0.3293	0.3481
Q3	0.3294	0.3306	QB	0.3293	0.3423
Q3	0.3330	0.3338	QB	0.3332	0.3458
Q3	0.3331	0.3398	QB	0.3333	0.3518
Q4	0.3331	0.3398	QC	0.3333	0.3518
Q4	0.3330	0.3338	QC	0.3332	0.3458
Q4	0.3366	0.3369	QC	0.3371	0.3493
Q4	0.3369	0.3431	QC	0.3374	0.3554
Q5	0.3215	0.3353	QD	0.3207	0.3462
Q5	0.3218	0.3298	QD	0.3211	0.3407
Q5	0.3256	0.3331	QD	0.3252	0.3444
Q5	0.3254	0.3388	QD	0.3250	0.3501
Q6	0.3254	0.3388	QE	0.3250	0.3501
Q6	0.3256	0.3331	QE	0.3252	0.3444
Q6	0.3294	0.3364	QE	0.3293	0.3481
Q6	0.3293	0.3423	QE	0.3292	0.3539
Q7	0.3293	0.3423	QF	0.3292	0.3539
Q7	0.3294	0.3364	QF	0.3293	0.3481
Q7	0.3331	0.3398	QF	0.3333	0.3518
Q7	0.3332	0.3458	QF	0.3334	0.3578
Q8	0.3332	0.3458	QG	0.3334	0.3578
Q8	0.3331	0.3398	QG	0.3333	0.3518
Q8	0.3369	0.3431	QG	0.3374	0.3554
Q8	0.3371	0.3493	QG	0.3376	0.3616

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e) Chromaticity Region & Coordinates

Region	CIE x	CIE y	Region	CIE x	CIE y
P rank (6500 K)					
P1	0.3068	0.3113	P9	0.3048	0.3207
	0.3106	0.3150		0.3089	0.3249
	0.3098	0.3199		0.3080	0.3298
	0.3058	0.3160		0.3038	0.3256
P2	0.3106	0.3150	PA	0.3089	0.3249
	0.3144	0.3186		0.313	0.3290
	0.3137	0.3238		0.3123	0.3341
	0.3098	0.3199		0.3080	0.3298
P3	0.3144	0.3186	PB	0.3130	0.3290
	0.3183	0.3224		0.3172	0.3332
	0.3177	0.3278		0.3166	0.3384
	0.3137	0.3238		0.3123	0.3341
P4	0.3183	0.3224	PC	0.3172	0.3332
	0.3221	0.3261		0.3214	0.3373
	0.3218	0.3317		0.3210	0.3427
	0.3177	0.3278		0.3166	0.3384
P5	0.3058	0.3160	PD	0.3038	0.3256
	0.3098	0.3199		0.3080	0.3298
	0.3089	0.3249		0.3072	0.3348
	0.3048	0.3207		0.3028	0.3304
P6	0.3098	0.3199	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	0.3278		0.3166	0.3384
	0.3172	0.3332		0.3160	0.3436
	0.313	0.3290		0.3115	0.3391
P8	0.3177	0.3278	PG	0.3166	0.3384
	0.3218	0.3317		0.3210	0.3427
	0.3214	0.3373		0.3206	0.3481
	0.3172	0.3332		0.3160	0.3436

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

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3. Typical Characteristics Graphs

a) Spectrum Distribution (I$_F$ = 150 mA, T$_s$ = 25 °C)

CCT: 2700 K (80 CRI)
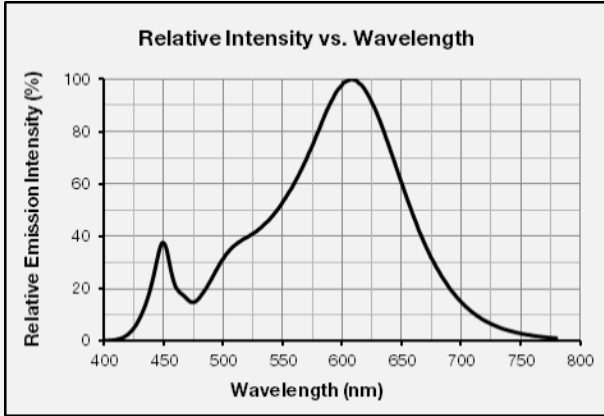
CCT: 3000 K (80 CRI)
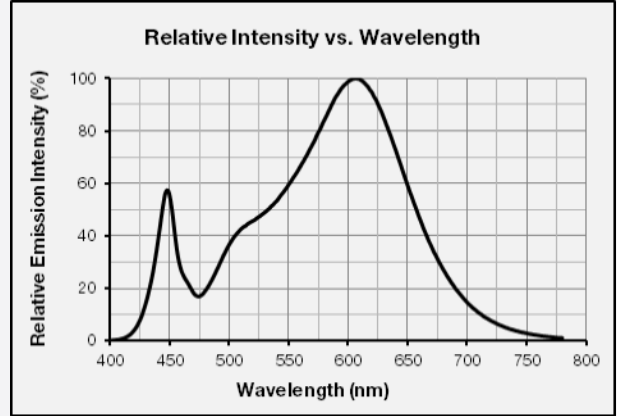
CCT: 3500 K (80 CRI)
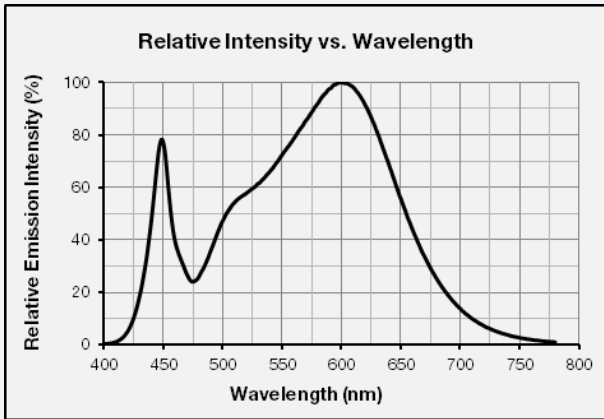
CCT: 4000 K (80 CRI)
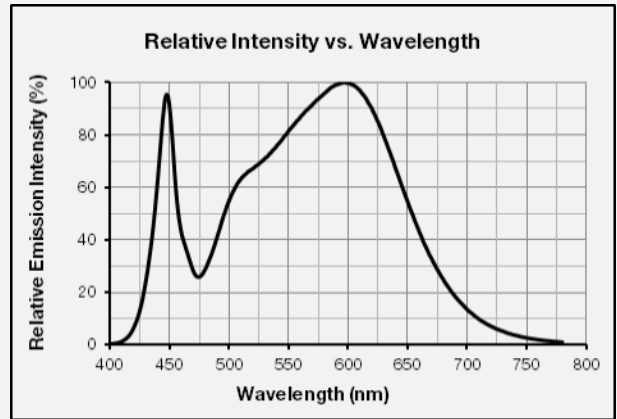
CCT: 5000 K (80 CRI)

CCT: 5700 K (80 CRI)

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CCT: 6500 K (80 CRI)

Relative Intensity vs. Wavelength
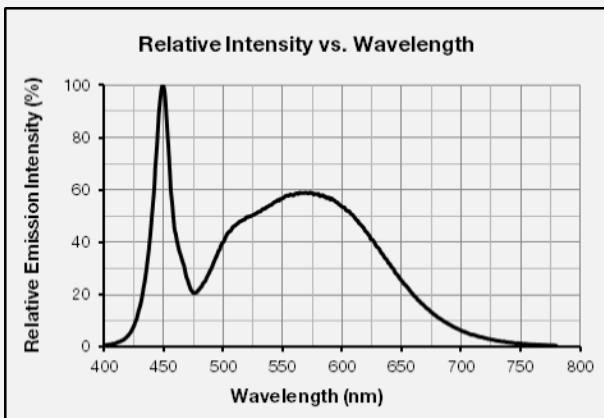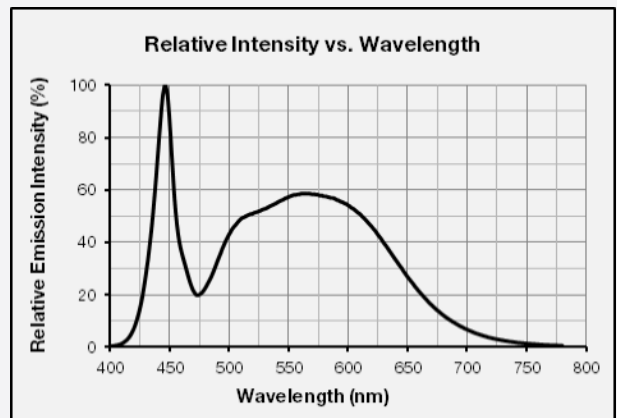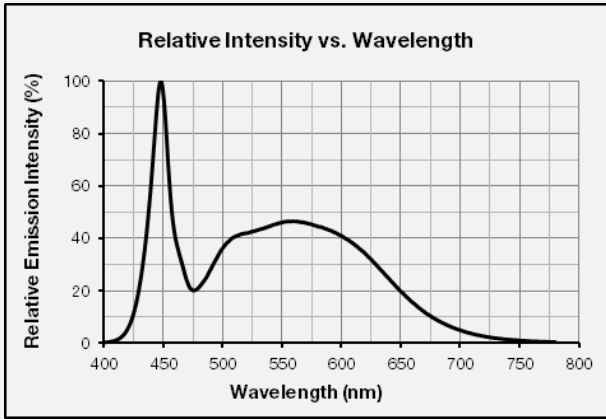
b) Forward Current Characteristics (T$_S$ = 25 °C)

Relative Luminous Flux vs. Forward Current

Forward Current vs. Relative Forward Voltage
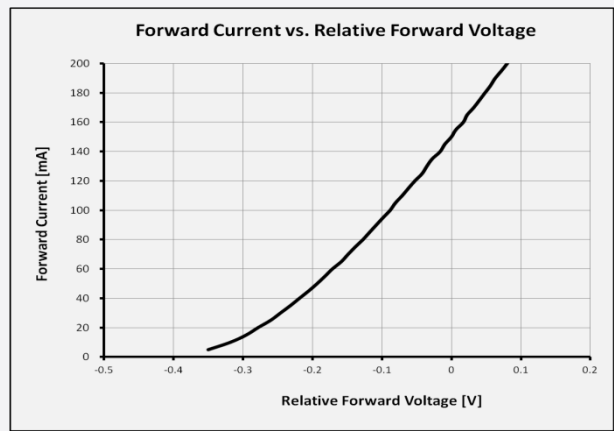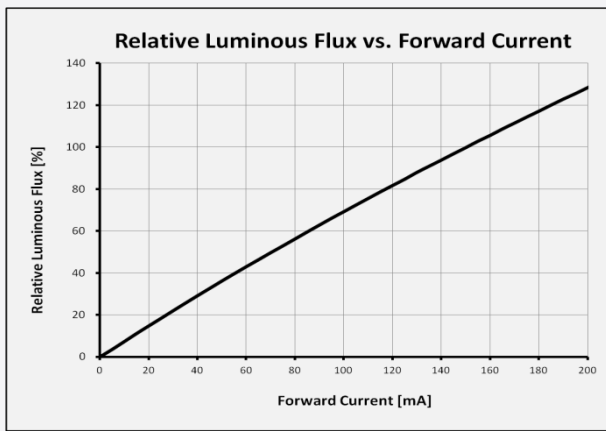
c) Temperature Characteristics (I$_F$ = 150 mA)

Relative Luminous Flux vs. Temperature

Relative Forward Voltage vs. Temperature

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d) Color Shift Characteristics (I_F = 150 mA, T_s = 25 °C)
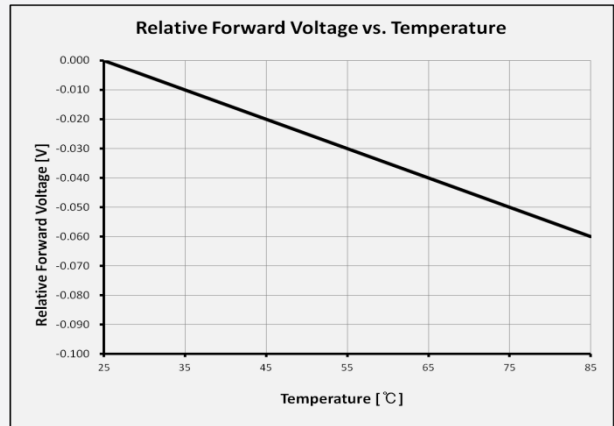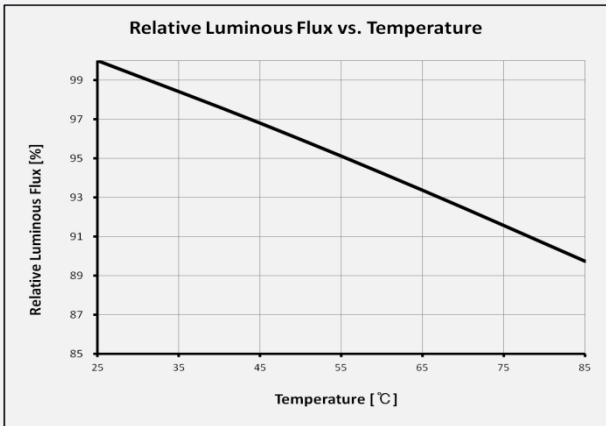
d) Color Shift Characteristics (I_F = 150 mA, T_s = 25 ℃)
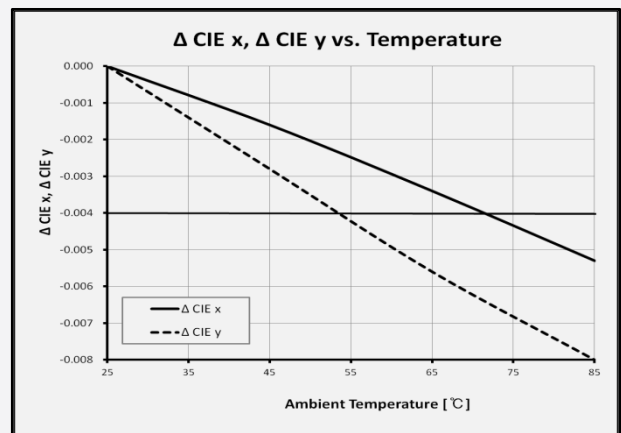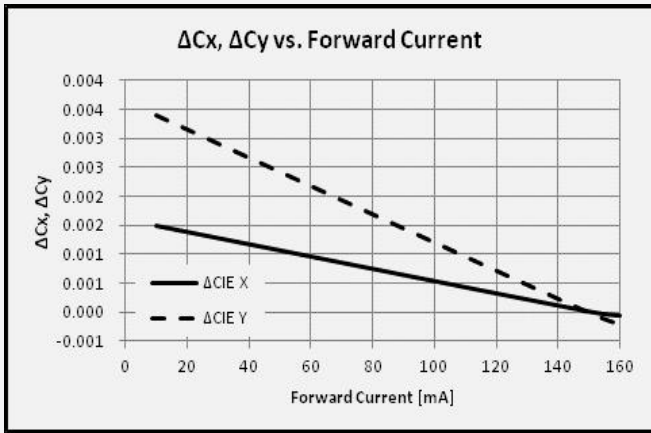
e) Derating Curve
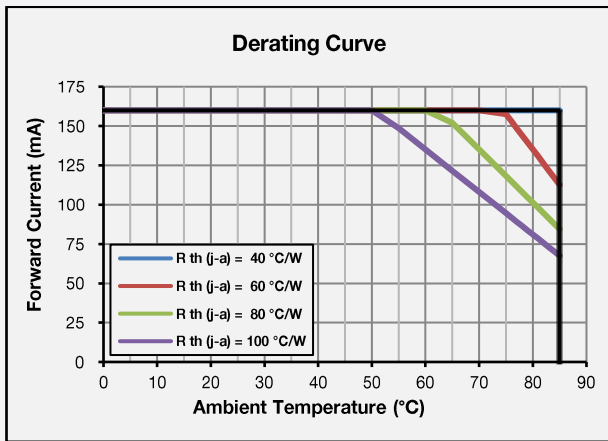
f) Beam Angle Characteristics (I_F = 150 mA, T_s = 25 ℃)

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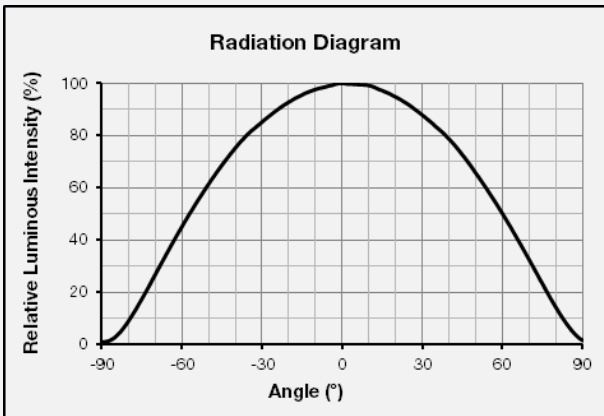
4. Outline Drawing & Dimension

[Top View]

[Bottom View]

Cathode

[Side View]

[RECOMMENDED PCB SOLDER PAD]
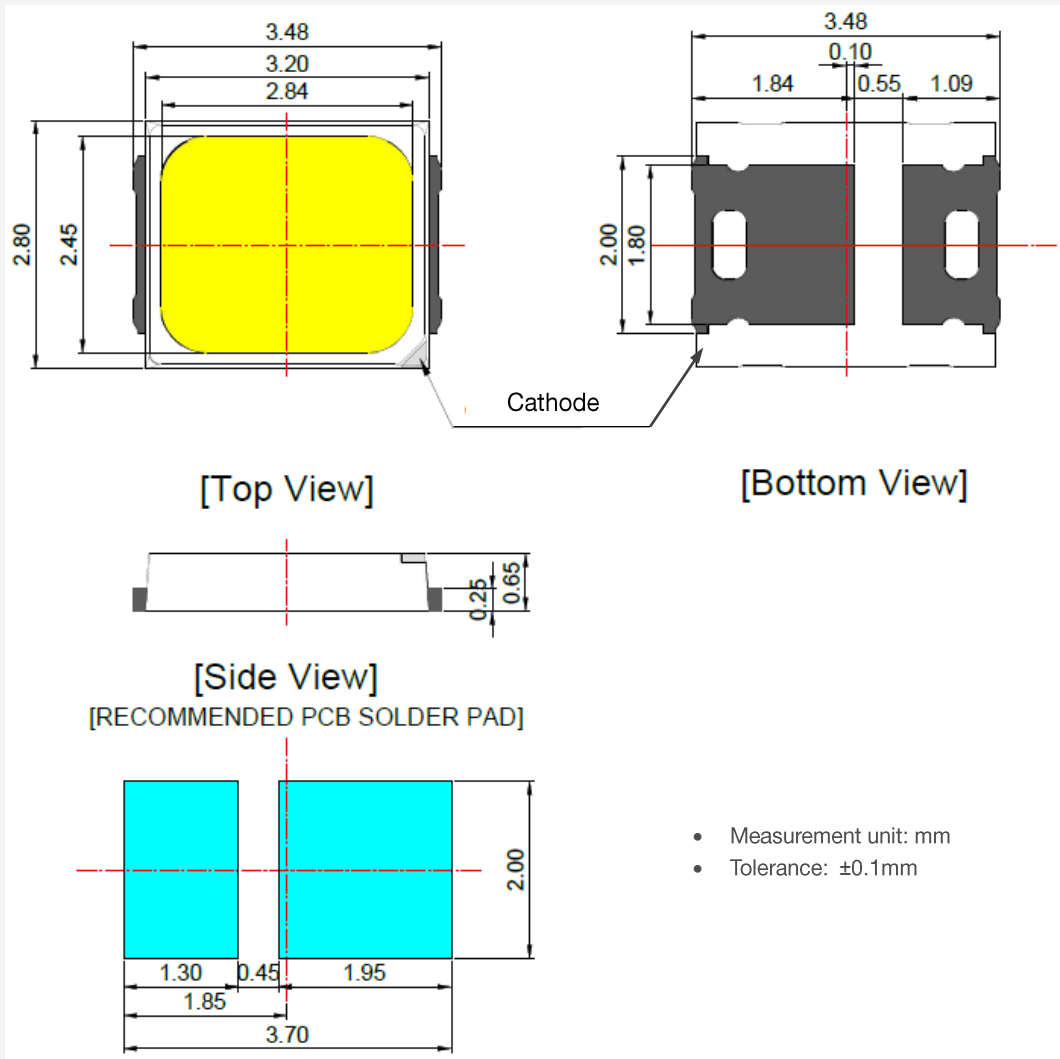
- Measurement unit: mm
- Tolerance: ±0.1mm

Notes:

1) T_s point and measurement method:

① Measure one point at the cathode pad, if necessary remove PSR of PCB to reach T_s point.

② All pads 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.

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5. Reliability Test Items & Conditions

a) Test Items

Test Item	Test Condition	Test Hour / Cycle	Sample No.
Room Temperature Life Test	25 °C, DC 160 mA	1000 h	22
High Temperature Life Test	85 °C, DC 160 mA	1000 h	22
High Temperature Humidity Life Test	85 °C, 85 % RH, DC 160 mA	1000 h	22
Low Temperature Life Test	-40 °C, DC 160 mA	1000 h	22
Powered Temperature Cycle Test	-45 °C ~ 85 °C, each 20 min, on/off 5 min Temp. Change time 100min, DC 160 mA	100 cycles	22
Temperature Cycle	-45ºC / 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)	R_1: 10 MΩ R_2: 1.5 kΩ C: 100 pF V: ±2 kV	5 times	30
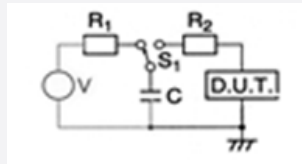
b) Criteria for Judging the Damage

Item	Symbol	Test Condition ($T_s = 25$ °C)	Limit	
			Min	Max
Forward Voltage	V_F	$I_F = 150$ mA	Init. Value * 0.9	Init. Value * 1.1
Luminous Flux	Φ_v	$I_F = 150$ mA	Init. Value * 0.7	Init. Value * 1.1

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6. Soldering Conditions

a) Reflow Conditions (Pb free)

Reflow frequency:　2 times max.
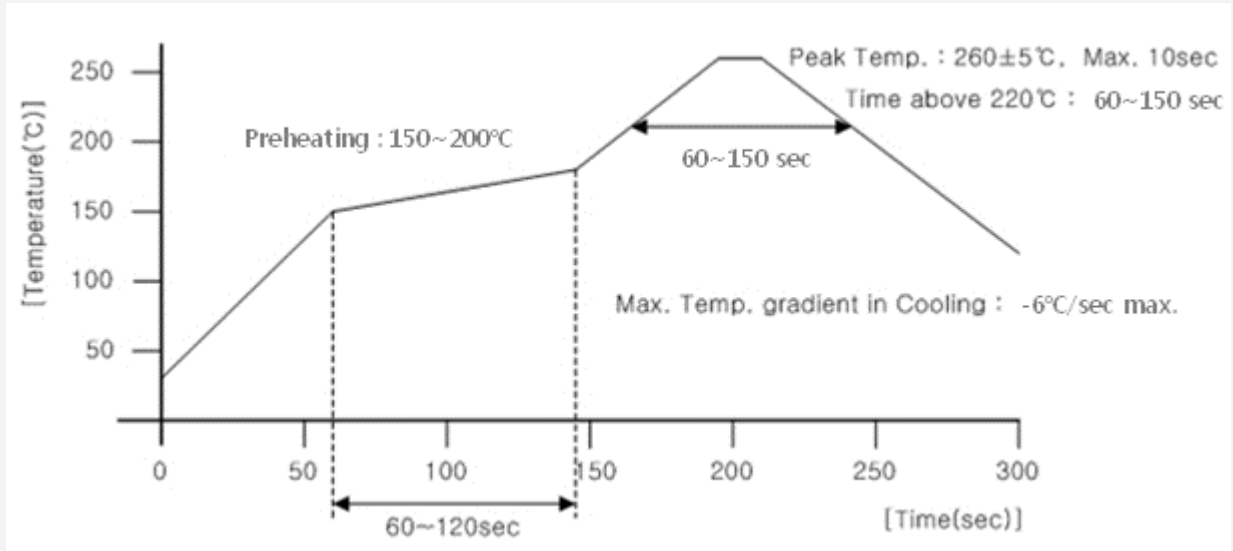
b) Manual Soldering Conditions

Not more than 5 seconds @ max. 300 ºC, under soldering iron.
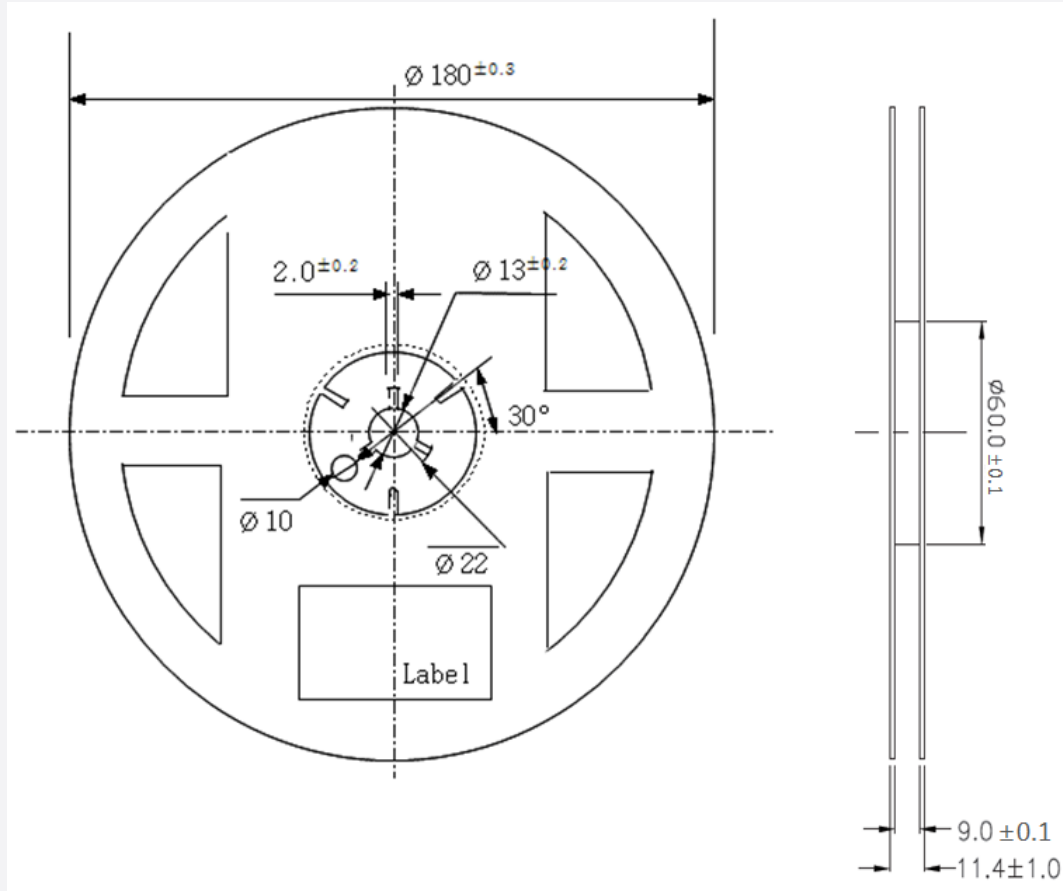
7. Tape & Reel

a)   Taping Dimension

<div align="right">(unit: mm)</div>
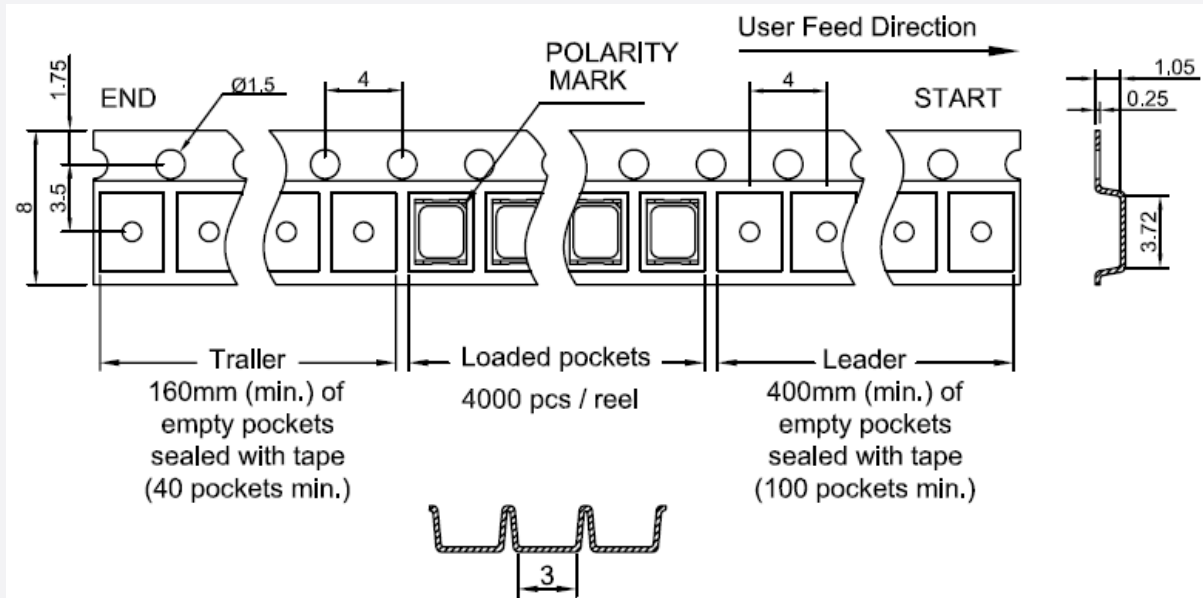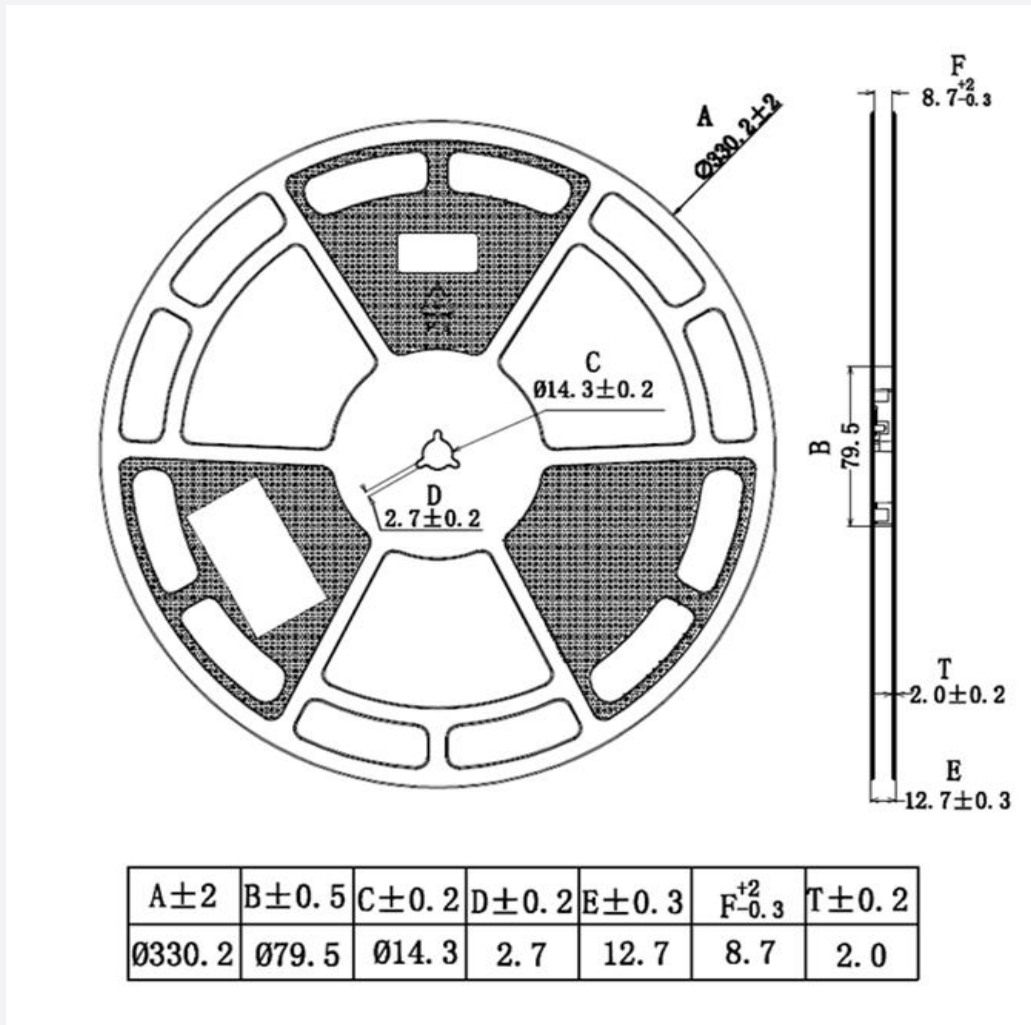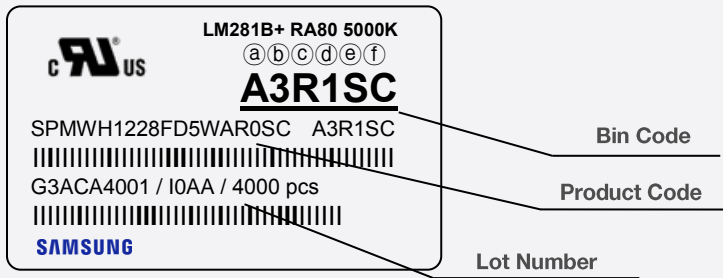
b) Reel Dimension (max 4,000 pcs)

(unit: mm)

Notes:

1) Quantity: The quantity/reel is 4,000 pcs

2) All dimensions are millimeters (tolerance : ±0.2mm)

3) Packaging: P/N, Manufacturing data code no. and quantity are indicated on the aluminum packing bag

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c) Reel Dimension (max 16,000 pcs)

(unit: mm)

A±2	B±0.5	C±0.2	D±0.2	E±0.3	F$^{+2}_{-0.3}$	T±0.2
Ø330.2	Ø79.5	Ø14.3	2.7	12.7	8.7	2.0

Notes:

1) Quantity: The quantity/reel is 16,000 pcs

2) All dimensions are millimeters (tolerance : ±0.2mm)

3) Packaging: P/N, Manufacturing data code no. and quantity are indicated on the aluminum packing bag

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8. Label Structure

a) Label Structure

LM281B+ RA80 5000K
ⓐⓑⓒⓓⓔⓕ
A3R1SC

SPMWH1228FD5WAR0SC   A3R1SC
|||||||||||||||||||||||||||||||||||||||||||||||||||||
G3ACA4001 / I0AA / 4000 pcs
|||||||||||||||||||||||||||||||||||||||||||||||||||||
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Bin Code

Product Code

Lot Number

Note: Denoted bin code and product code above is only an example (see description on page 6)

Bin Code:

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

ⓒⓓ:   Chromaticity bin   (refer to page 11-18)

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

b) Lot Number

The lot number is composed of the following characters:

LM281B+ RA80 5000K
A3R1SC

SPMWH1228FD5WAR0SC   A3R1SC
|||||||||||||||||||||||||||||||||||||||||||||||||||||
①②③④⑤⑥⑦⑧⑨/Iⓐⓑⓒ/ 4000 pcs
|||||||||||||||||||||||||||||||||||||||||||||||||||||
SAMSUNG

①②③④⑤⑥⑦⑧⑨ / Iⓐⓑⓒ / 4,000 pcs

①②	:	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…)
⑤	:	Month (1~9, A, B, C)
⑥	:	Day (1~9, A, B~V)
⑦⑧⑨ ⓐⓑⓒ	:	Product serial number

SAMSUNG

9. Packing Structure

a) Packing Process (The quantity of PKG on the Reel to be Max 4,000 pcs)

Reel

LM281B+ RA80 5000K
A3R1SC

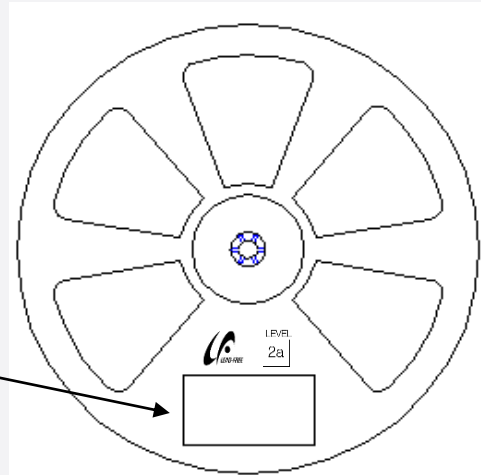SPMWH1228FD5WAR0SC   A3R1SC
G3ACAC4001 / I0AA / 4000 pcs

SAMSUNG
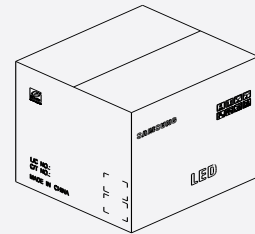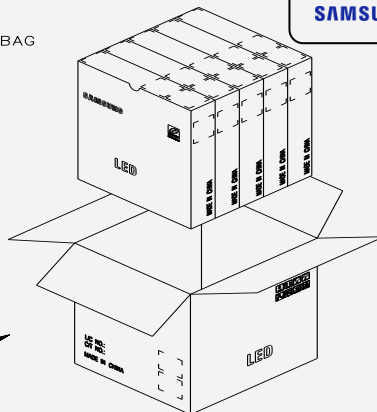
Aluminum Vinyl Packing Bag

LM281B+ RA80 5000K
A3R1SC

SPMWH1228FD5WAR0SC   A3R1SC
G3ACAC4001 / I0AA / 4000 pcs
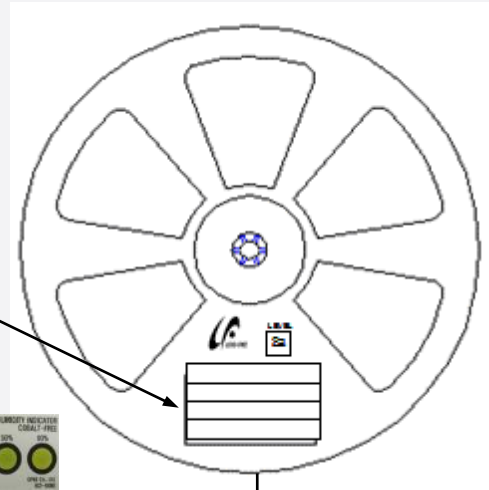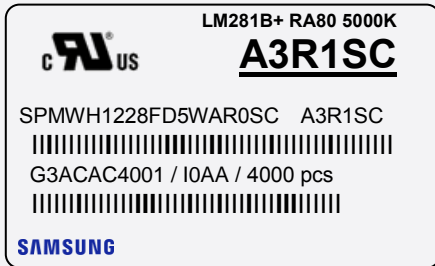
SAMSUNG
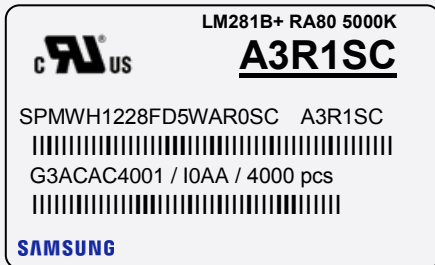
Outer Box

Material: Paper (SW3B(B))

Type	Size (mm)			Note
	L	W	H	
7 inch L	245 ± 5	220 ± 5	182 ± 5	Up to 10 reels
7 inch S	245 ± 5	220 ± 5	86 ± 5	Up to 5 reels

① Side Label

LM281B+ RA80 5000K
A3R1SC

SPMWH1228FD5WAR0SC   A3R1SC
G3ACAC4001 / I0AA / 40000 pcs

SAMSUNG

H

LED

W

L

①
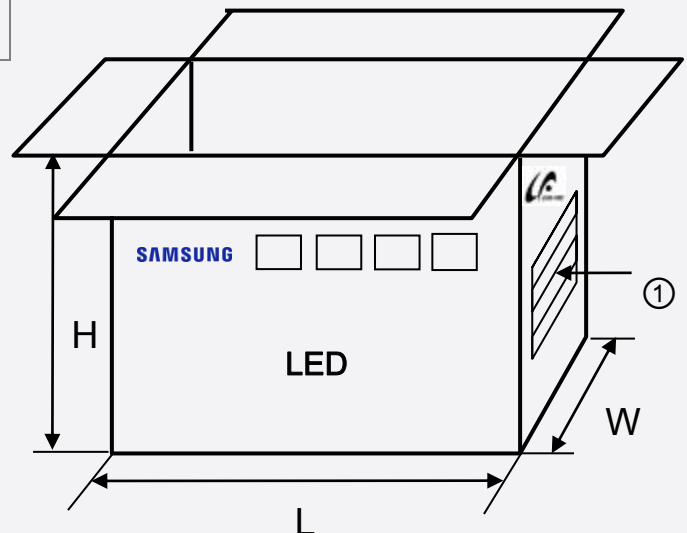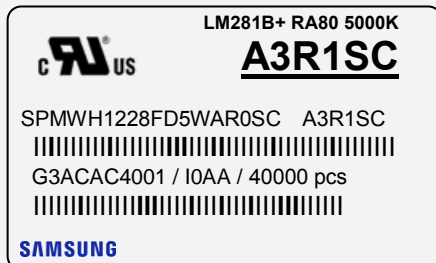
SAMSUNG

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

Reel

LM281B+ RA80 5000K
A3R1SC

SPMWH1228FD5WKR0SC   A3R1SC
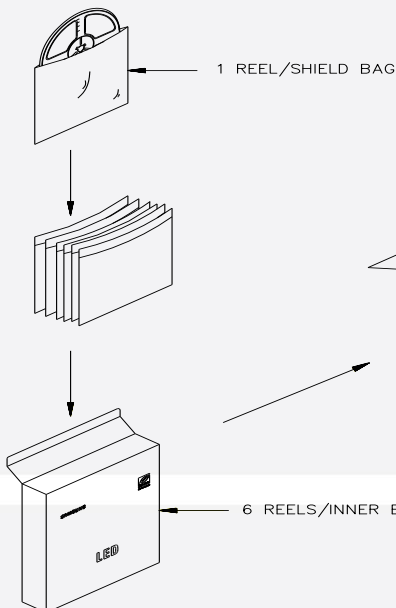G3ACA4001 / I0AA / 16000 pcs
SAMSUNG

Aluminum Vinyl Packing Bag

LM281B+ RA80 5000K
A3R1SC

SPMWH1228FD5WKR0SC   A3R1SC
G3ACA4001 / I0AA / 16000 pcs
SAMSUNG

Outer Box

LM281B+ RA80 5000K
A3R1SC

SPMWH1228FD5WKR0SC   A3R1SC
G3ACA4001 / I0AA / 480000 pcs
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1 REEL/SHIELD BAG

5 INNER/OUT BOX

6 REELS/INNER BOX

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c) Packing Process for kitting

Reel

Kitting 'A'

LM281B+ RA80 ★K
A3★1SC
SPMWH1228FD5WA★KSC   A3★1SC

||||||||||||||||||||||||||||||||||||||||||||
G3ACA4001 / I0AA / 4000 pcs
||||||||||||||||||||||||||||||||||||||||
SAMSUNG

Kitting 'B'

LM281B+ RA80 ★K
A3★CSC
SPMWH1228FD5WA★KSC   A3★CSC

||||||||||||||||||||||||||||||||||||||||||||
G3ACA4001 / I0AA / 4000 pcs
||||||||||||||||||||||||||||||||||||||||
SAMSUNG
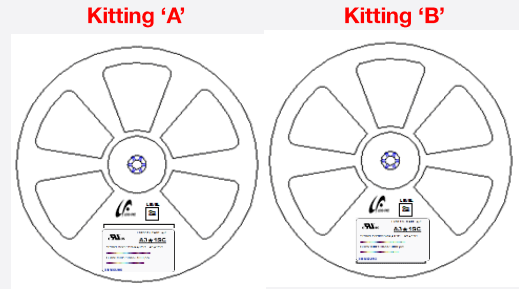
Kitting 'A'   **Kitting 'B'**

Aluminum Vinyl Packing Bag

Kitting 'A'

LM281B+ RA80 ★K
A3★1SC
SPMWH1228FD5WA★KSC   A3★1SC

||||||||||||||||||||||||||||||||||||||||||||
G3ACA4001 / I0AA / 4000 pcs
||||||||||||||||||||||||||||||||||||||||
SAMSUNG

Kitting 'B'

LM281B+ RA80 ★K
A3★CSC
SPMWH1228FD5WA★KSC   A3★CSC

||||||||||||||||||||||||||||||||||||||||||||
G3ACA4001 / I0AA / 4000 pcs
||||||||||||||||||||||||||||||||||||||||
SAMSUNG
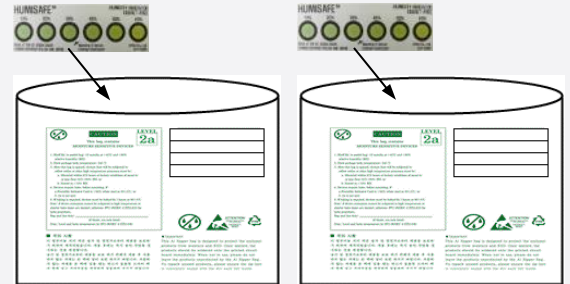
Outer Box

Kitting 'A'

LM281B+ RA80 ★K
A3★1SC
SPMWH1228FD5WA★KSC   A3★1SC

||||||||||||||||||||||||||||||||||||||||||||
G3ACA4001 / I0AA / 20000 pcs
||||||||||||||||||||||||||||||||||||||||
SAMSUNG   [BOX Label]

Kitting 'B'

LM281B+ RA80 ★K
A3★CSC
SPMWH1228FD5WA★KSC   A3★CSC

||||||||||||||||||||||||||||||||||||||||||||
G3ACA4001 / I0AA / 20000 pcs
||||||||||||||||||||||||||||||||||||||||
SAMSUNG   [BOX Label]

Material: Paper (SW3B(B))

Type	Size (mm)			Note
	L	W	H	
7 inch L	245 ± 5	220 ± 5	182 ± 5	Up to 10 reels

LED
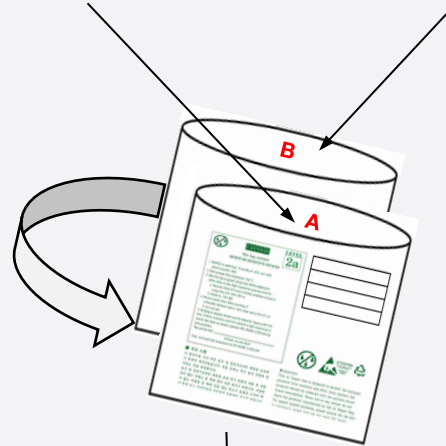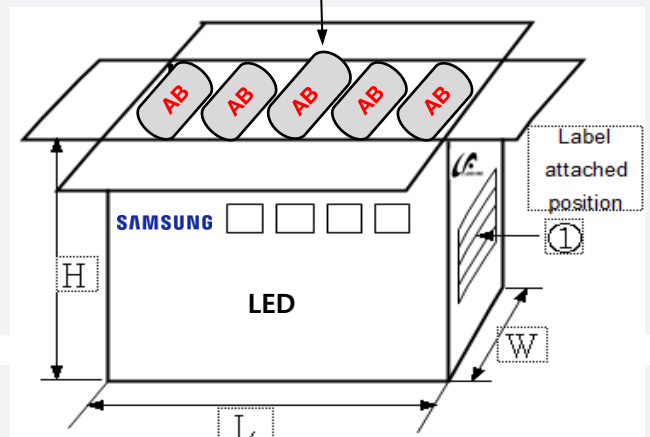
c) Aluminum Vinyl Packing Bag

<div style="border">

CAUTION
This bag contains
MOISTURE SENSITIVE DEVICES

LEVEL 2a

1. Shelf life in sealed bag: 12 months at <40℃ and <90% relative humidity (RH)
2. Peak package body temperature: 240 ℃
3. After this bag is opened, devices that will be subjected to reflow solder or other high temperature processes must be:
   a. Mounted within 672 hours at factory conditions of equal to or less than 30℃/60% RH, or
   b. Stored at <10% RH
4. Devices require bake, before mounting, if:
   a. Humidity Indicator Card is >「60% when read at 23±5℃, or
   b. 2a is not met.
5. If baking is required, devices must be baked for 10～24 hours at 60±5℃

Note: if device containers cannot be subjected to high temperature or shorter bake times are desired, reference IPC/JEDEC J-STD-033 for bake procedure,

Bag seal due date: _____

(if blank, see code label)

Note: Level and body temperature by IPC/JEDEC J-STD-020

</div>

LM281B+ RA80 5000K

A3R1SC

c ⓤⓇ us

SPMWH1228FD5WAR0SC   A3R1SC

||||||||||||||||||||||||||||||||||||||||||

G3ACA4001 / I0AA / 4000 pcs

||||||||||||||||||||||||||||||||||

SAMSUNG

LEAD-FREE

ATTENTION
OBSERVE PRECAUTIONS FOR HANDLING
ELECTROSTATIC SENSITIVE DEVICES

OTHER

■ 주의 사항

이 알루미늄 지퍼 백은 습기 및 정전기로부터 제품을 보호하기 위하여 제작되었습니다. 개봉 후에는 즉시 솔더 작업을 실시하는 것을 권장합니다.

습기 및 정전기로부터 제품을 보호 하기 위해서 개봉 후 사용하지 않는 자재는 본 팩에 넣어 보관 하시기 바랍니다. 사용하지 않는 자재를 본 팩에 넣을 때는 반드시 동봉된 드라이 팩과 함께 넣고 지퍼부분을 완전하게 밀봉하여 주시기 바랍니다.

■ Important

This Al 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 Al Zipper Bag. To repack unused products., please ensure the zip-lock is completely sealed with the dry pack left inside.

d) Humidity Indicator Card inside Aluminum Vinyl Bag

HUMISAFE™

HUMIDITY INDICATOR COBALT-FREE

| 10% | 20% | 30% | 40% | 50% | 60% |

READ AT TOP OF GREEN COLOR
CHANGE BETWEEN YELLOW AND GREEN

Warning if Green
Change Desiccant

GP&E Co., Ltd.
6CF-60NS

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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. 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 ℃, 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 672 hours (28 days) at an assembly line with a condition of no more than 30 ℃ / 60 % RH[*Note 1], or
b. Mounted within 24 hours (1 day) at an assembly line with a condition of more than 30 ℃ / 70 % RH[*Note 2], or
c. Stored at <10 % RH.
*Note 1, 2: IPC/JEDEC J-STD-033A, Recommended Equivalent Total Floor Life Table

Package Type and Body Thickness	Moisture Sensitivity Level	Maximum Percent Relative Humidity						Temperature
		40%	50%	60%	70%	80%	90%	
Body Thickness <2.1mm	Level 2a	∞	∞	28	1	1	1	30℃
		∞	∞	∞	2	1	1	25℃
		∞	∞	∞	2	2	1	20℃

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 ℃.

8) Devices must be baked for 10~24 hours at 60 ± 5 ℃, 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 sulfurization (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. Sulfurization of lead frame may cause intensity degradation, change of chromaticity coordinates and, in extreme cases, open circuit. It requires caution. Due to possible sulfurization 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.

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Legal and additional information.

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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.

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KOREA

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