

LM362A – 3623 LED PKG



Introduction

Features

- Beam Angle: 120°
- Precondition : JEDEC Level 2a
- Dimension : 3.6 x 2.3 x 0.6 mm
- ESD withstand Voltage : up to $\pm 5\text{KV}$ [HBM]

Applications

- INDOOR LIGHTING : Ambient Light, LED tube, Down light, LED bulb and Ceiling Light

SAMSUNG ELECTRONICS

95, Samsung2-Ro, Giheung-Gu,
Yongin-City, Gyeonggi-Do 446-711, KOREA

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1. Product Code Information

1) Luminous Intensity Bins (Ts = 25°C)

Nominal CCT	Minimum CRI	Product Code	Intensity Rank	Sorting Condition cd@100mA	
				Intensity Bin	Intensity Range (cd)
2700K	80	SPMWHT325AD5YBW0S0	S0	S1	16.6 ~ 18.9
				S2	18.9 ~ 22.2
				S3	22.2 ~ 25.5
	76	SPMWHT325AP4YBW0S0	S0	S1	18.9 ~ 20.8
				S2	20.8 ~ 22.8
				S3	22.8 ~ 26.1
3000K	80	SPMWHT325AD5YBV0S0	S0	S1	16.6 ~ 19.6
				S2	19.6 ~ 22.8
				S3	22.8 ~ 26.1
3500K	80	SPMWHT325AD5YBU0S0	S0	S1	16.6 ~ 20.5
				S2	20.5 ~ 23.8
				S3	23.8 ~ 27.1
4000K	80	SPMWHT325AD5YBT0S0	S0	S1	17.9 ~ 21.2
				S2	21.2 ~ 24.5
				S3	24.5 ~ 27.7
5000K	68	SPMWHT325AD3Y0R0S0	S0	S1	20.5 ~ 24.5
				S2	24.5 ~ 28.7
				S3	28.7 ~ 34.3
	80	SPMWHT325AD5YBR0S0	S0	S1	17.9 ~ 21.5
				S2	21.5 ~ 24.8
				S3	24.8 ~ 28.1
5700K	80	SPMWHT325AD5YBQ0S0	S0	S1	17.9 ~ 21.2
				S2	21.2 ~ 24.5
				S3	24.5 ~ 27.7
6500K	80	SPMWHT325AD5YBP0S0	S0	S1	17.9 ~ 21.2
				S2	21.2 ~ 24.5
				S3	24.5 ~ 27.7

Notes:

Luminous Intensity(I_v , cd) values are for representative reference only



2) Luminous Flux Bins (Ts = 25°C)

Nominal CCT	Minimum CRI	Product Code	Flux Rank	Sorting Condition Im@100mA	
				Flux Bin	Flux Range (lm)
2700K	80	SPMWHT325AD5YBW0S0	S0	S1	51 ~ 58
				S2	58 ~ 68
				S3	68 ~ 78
	76	SPMWHT325AP4YBW0S0	S0	S1	58 ~ 64
				S2	64 ~ 70
				S3	70 ~ 80
3000K	80	SPMWHT325AD5YBV0S0	S0	S1	51 ~ 60
				S2	60 ~ 70
				S3	70 ~ 80
3500K	80	SPMWHT325AD5YBU0S0	S0	S1	51 ~ 63
				S2	63 ~ 73
				S3	73 ~ 83
4000K	80	SPMWHT325AD5YBT0S0	S0	S1	55 ~ 65
				S2	65 ~ 75
				S3	75 ~ 85
5000K	68	SPMWHT325AD3Y0R0S0	S0	S1	63 ~ 75
				S2	75 ~ 88
				S3	88 ~ 105
	80	SPMWHT325AD5YBR0S0	S0	S1	55 ~ 66
				S2	66 ~ 76
				S3	76 ~ 86
5700K	80	SPMWHT325AD5YBQ0S0	S0	S1	55 ~ 65
				S2	65 ~ 75
				S3	75 ~ 85
6500K	80	SPMWHT325AD5YBP0S0	S0	S1	55 ~ 65
				S2	65 ~ 75
				S3	75 ~ 85

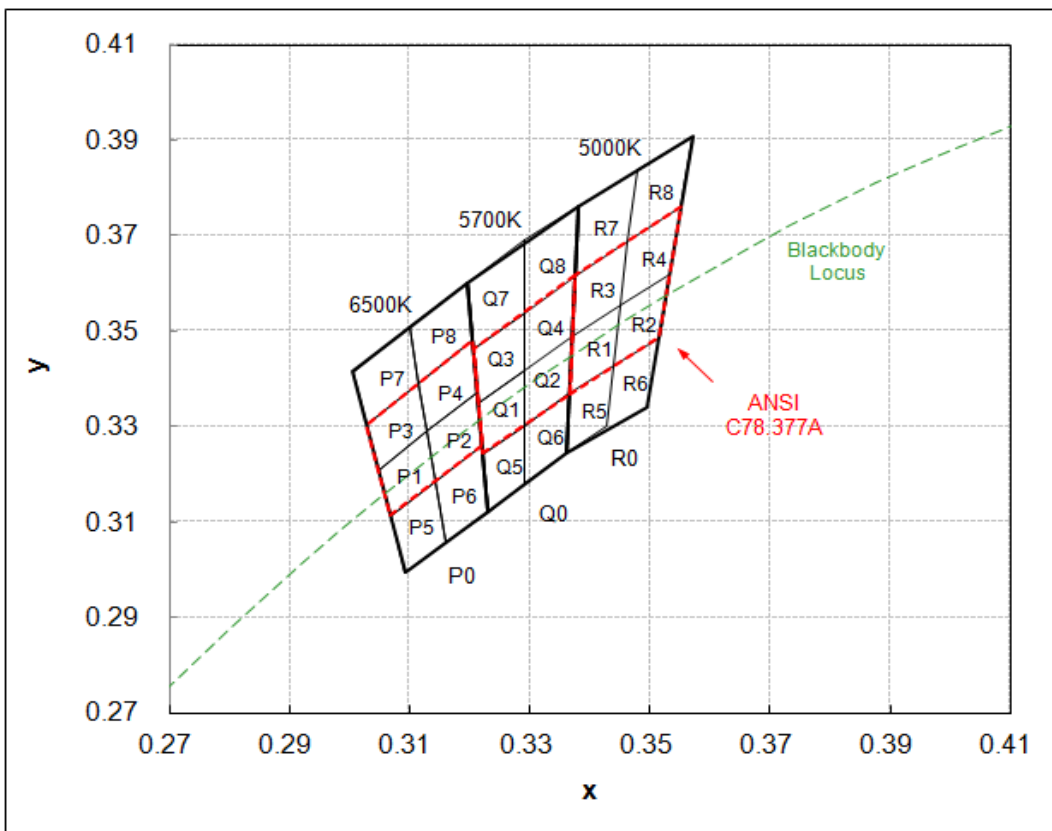
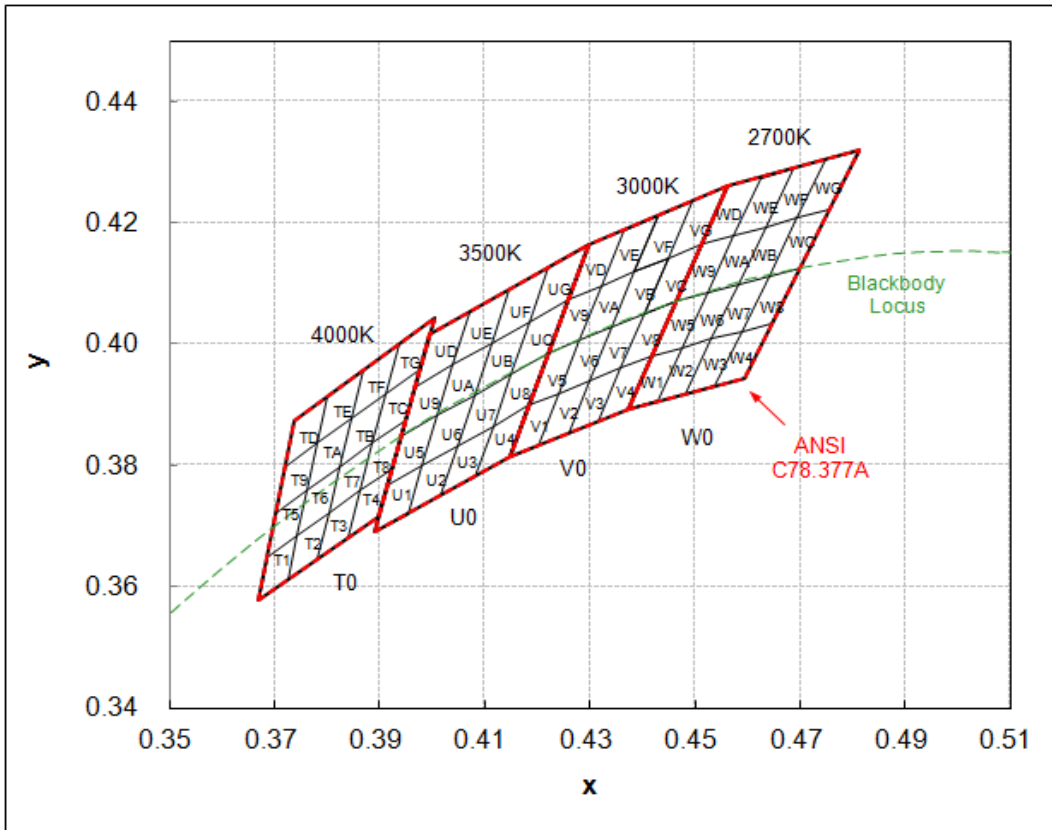
Notes: SAMSUNG ELECTRONICS maintains a tolerance of $\pm 5\%$ on Luminous Flux measurements

3) Color Bins (Ts = 25°C)

1) Color Binning

Nominal CCT	Product Code	Color Rank	Chromaticity Bins
2700K	SPMWHT325AD5YBW0S0	W0 (Whole Bin)	W1,W2,W3,W4,W5,W6,W7,W8, W9,WA,WB,WC,WD,WE,WF,WG
	SPMWHT325AD5YBWHS0	WH (Half Bin)	W5,W6,W7,W8,W9,WA,WB,WC
	SPMWHT325AD5YBWMS0	WM (M4 Bin)	W6,W7,WA,WB
3000K	SPMWHT325AD5YBV0S0	V0 (Whole Bin)	V1,V2,V3,V4,V5,V6,V7,V8, V9,VA,VB,VC,VD,VE,VF,VG
	SPMWHT325AD5YBVHS0	VH (Half Bin)	V5,V6,V7,V8,V9,VA,VB,VC
	SPMWHT325AD5YBVMS0	VM (M4 Bin)	V6,V7,VA,VB
3500K	SPMWHT325AD5YBU0S0	U0 (Whole Bin)	U1,U2,U3,U4,U5,U6,U7,U8, U9,UA,UB,UC,UD,UE,UF,UG
	SPMWHT325AD5YBUHS0	UH (Half Bin)	U5,U6,U7,U8,U9,UA,UB,UC
	SPMWHT325AD5YBUMS0	UM (M4 Bin)	U6,U7,UA,UB
4000K	SPMWHT325AD5YBT0S0	T0 (Whole Bin)	T1,T2,T3,T4,T5,T6,T7,T8, T9,TA,TB,TC,TD,TE,TF,TG
	SPMWHT325AD5YBTHS0	TH (Half Bin)	T5,T6,T7,T8,T9,TA,TB,TC
	SPMWHT325AD5YBTMS0	TM (M4 Bin)	T6,T7,TA,TB
5000K	SPMWHT325AD3Y0R0S0	R0 (Whole Bin)	R1,R2,R3,R4,R5,R6,R7,R8
	SPMWHT325AD5YBR0S0		
	SPMWHT325AD3Y0RMS0	RM (M7 Bin)	R1,R2,R3,R4
	SPMWHT325AD5YBRMS0		
5700K	SPMWHT325AD5YBQ0S0	Q0 (Whole Bin)	Q1,Q2,Q3,Q4,Q5,Q6,Q7,Q,
	SPMWHT325AD5YBQMS0	QM (M7 Bin)	Q1,Q2,Q3,Q4
6500K	SPMWHT325AD5YBP0S0	P0 (Whole Bin)	P1,P2,P3,P4,P5,P6,P7,P8
	SPMWHT325AD5YBPMS0	PM (M7 Bin)	P1,P2,P3,P4

2) Chromaticity Region & Coordinates





2) Chromaticity Region & Coordinates (Continued)

Region	CIE X	CIE Y	Region	CIE X	CIE Y
W rank (2700K)					
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

Region	CIE X	CIE Y	Region	CIE X	CIE Y
V rank (3000K)					
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



2) Chromaticity Region & Coordinates (Continued)

Region	CIE X	CIE Y	Region	CIE X	CIE Y
U rank (3500K)					
U1	0.3889	0.3690	U9	0.3941	0.3848
	0.3915	0.3768		0.3968	0.3930
	0.3981	0.3800		0.4040	0.3966
	0.3953	0.3720		0.4010	0.3882
U2	0.3953	0.3720	UA	0.4010	0.3882
	0.3981	0.3800		0.4040	0.3966
	0.4048	0.3832		0.4113	0.4001
	0.4017	0.3751		0.4080	0.3916
U3	0.4017	0.3751	UB	0.4080	0.3916
	0.4048	0.3832		0.4113	0.4001
	0.4116	0.3865		0.4186	0.4037
	0.4082	0.3782		0.4150	0.3950
U4	0.4082	0.3782	UC	0.4150	0.3950
	0.4116	0.3865		0.4186	0.4037
	0.4183	0.3898		0.4259	0.4073
	0.4147	0.3814		0.4221	0.3984
U5	0.3915	0.3768	UD	0.3968	0.3930
	0.3941	0.3848		0.3996	0.4015
	0.4010	0.3882		0.4071	0.4052
	0.3981	0.3800		0.4040	0.3966
U6	0.3981	0.3800	UE	0.4040	0.3966
	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	0.3865		0.4186	0.4037
U8	0.4116	0.3865	UG	0.4186	0.4037
	0.4150	0.3950		0.4222	0.4127
	0.4221	0.3984		0.4299	0.4165
	0.4183	0.3898		0.4259	0.4073

Region	CIE X	CIE Y	Region	CIE X	CIE Y
T rank (4000K)					
T1	0.367	0.3578	T9	0.3702	0.3722
	0.3726	0.3612		0.3763	0.376
	0.3744	0.3685		0.3782	0.3837
	0.3686	0.3649		0.3719	0.3797
T2	0.3726	0.3612	TA	0.3763	0.376
	0.3783	0.3646		0.3825	0.3798
	0.3804	0.3721		0.3847	0.3877
	0.3744	0.3685		0.3782	0.3837
T3	0.3783	0.3646	TB	0.3825	0.3798
	0.384	0.3681		0.3887	0.3836
	0.3863	0.3758		0.3912	0.3917
	0.3804	0.3721		0.3847	0.3877
T4	0.384	0.3681	TC	0.3887	0.3837
	0.3898	0.3716		0.395	0.3875
	0.3924	0.3794		0.3978	0.3958
	0.3863	0.3758		0.3912	0.3917
T5	0.3686	0.3649	TD	0.3719	0.3797
	0.3744	0.3685		0.3782	0.3837
	0.3763	0.376		0.3802	0.3916
	0.3702	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	0.3798		0.3869	0.3958
	0.3763	0.376		0.3802	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	0.3798		0.3869	0.3958
T8	0.3863	0.3758	TG	0.3912	0.3917
	0.3924	0.3794		0.3978	0.3958
	0.395	0.3875		0.4006	0.4044
	0.3887	0.3836		0.3937	0.4001



2) Chromaticity Region & Coordinates (Continued)

Region	CIE X	CIE Y	Region	CIE X	CIE Y
R rank (5000K)					
R1	0.3371	0.3490	R5	0.3366	0.3369
	0.3451	0.3554		0.3440	0.3428
	0.3440	0.3427		0.3429	0.3307
	0.3366	0.3369		0.3361	0.3245
R2	0.3451	0.3554	R6	0.3440	0.3428
	0.3533	0.3620		0.3515	0.3487
	0.3515	0.3487		0.3495	0.3339
	0.3440	0.3427		0.3429	0.3307
R3	0.3376	0.3616	R7	0.3381	0.3762
	0.3463	0.3687		0.3480	0.3840
	0.3451	0.3554		0.3463	0.3687
	0.3371	0.3490		0.3376	0.3616
R4	0.3463	0.3687	R8	0.3480	0.3840
	0.3551	0.3760		0.3571	0.3907
	0.3533	0.3620		0.3551	0.3760
	0.3451	0.3554		0.3463	0.3687
Q rank (5700K)					
Q1	0.3215	0.3350	Q5	0.3222	0.3243
	0.3290	0.3417		0.3290	0.3300
	0.3290	0.3300		0.3290	0.3180
	0.3222	0.3243		0.3231	0.3120
Q2	0.3290	0.3417	Q6	0.3290	0.3300
	0.3371	0.3490		0.3366	0.3369
	0.3366	0.3369		0.3361	0.3245
	0.3290	0.3300		0.3290	0.3180
Q3	0.3207	0.3462	Q7	0.3196	0.3602
	0.3290	0.3538		0.3290	0.3690
	0.3290	0.3417		0.3290	0.3538
	0.3215	0.3350		0.3207	0.3462
Q4	0.3290	0.3538	Q8	0.3290	0.3690
	0.3376	0.3616		0.3381	0.3762
	0.3371	0.3490		0.3376	0.3616
	0.3290	0.3417		0.3290	0.3538

Region	CIE X	CIE Y	Region	CIE X	CIE Y
P rank (6500K)					
P1	0.3068	0.3113	P5	0.3093	0.2993
	0.3144	0.3186		0.3161	0.3059
	0.3130	0.3290		0.3144	0.3186
	0.3048	0.3207		0.3068	0.3113
P2	0.3144	0.3186	P6	0.3161	0.3059
	0.3221	0.3261		0.3231	0.3120
	0.3213	0.3373		0.3221	0.3261
	0.3130	0.3290		0.3144	0.3186
P3	0.3048	0.3207	P7	0.3028	0.3304
	0.3130	0.3290		0.3115	0.3391
	0.3115	0.3391		0.3099	0.3509
	0.3028	0.3304		0.3005	0.3415
P4	0.3130	0.3290	P8	0.3115	0.3391
	0.3213	0.3373		0.3205	0.3481
	0.3205	0.3481		0.3196	0.3602
	0.3115	0.3391		0.3099	0.3509

Notes:

SAMSUNG ELECTRONICS maintains ± 0.005 tolerance of Cx, Cy



2. Luminous Flux Characteristics (Ts = 25°C)

Nominal CCT	Minimum CRI	If(mA)	Vf(V)	Power(W)	Flux(lm)	lm/W
2700K	80	50	5.67	0.28	34	121
		100	5.93	0.59	63	106
		110	5.98	0.66	68	104
		120	6.02	0.72	73	102
		130	6.06	0.79	78	99
		140	6.11	0.85	83	97
		150	6.14	0.92	88	95
		160	6.18	0.99	92	93
		170	6.21	1.06	97	92
		180	6.25	1.12	101	90
		190	6.28	1.19	105	88
		200	6.32	1.26	109	86
2700K	76	50	5.67	0.28	36	128
		100	5.93	0.59	67	113
		110	5.98	0.66	73	110
		120	6.02	0.72	78	108
		130	6.06	0.79	83	106
		140	6.11	0.85	88	103
		150	6.14	0.92	93	101
		160	6.18	0.99	98	99
		170	6.21	1.06	103	97
		180	6.25	1.12	107	96
		190	6.28	1.19	112	94
		200	6.32	1.26	116	92



Nominal CCT	Minimum CRI	If(mA)	Vf(V)	Power(W)	Flux(lm)	lm/W
3000K	80	50	5.67	0.28	35	124
		100	5.93	0.59	65	110
		110	5.98	0.66	70	107
		120	6.02	0.72	76	105
		130	6.06	0.79	81	103
		140	6.11	0.85	86	100
		150	6.14	0.92	90	98
		160	6.18	0.99	95	96
		170	6.21	1.06	100	95
		180	6.25	1.12	104	93
		190	6.28	1.19	109	91
		200	6.32	1.26	113	89
3500K	80	50	5.67	0.28	37	130
		100	5.93	0.59	68	115
		110	5.98	0.66	73	112
		120	6.02	0.72	79	110
		130	6.06	0.79	84	107
		140	6.11	0.85	90	105
		150	6.14	0.92	95	103
		160	6.18	0.99	100	101
		170	6.21	1.06	105	99
		180	6.25	1.12	109	97
		190	6.28	1.19	114	95
		200	6.32	1.26	118	94



Nominal CCT	Minimum CRI	If(mA)	Vf(V)	Power(W)	Flux(lm)	lm/W
4000K	80	50	5.67	0.28	38	134
		100	5.93	0.59	70	118
		110	5.98	0.66	76	115
		120	6.02	0.72	82	113
		130	6.06	0.79	87	110
		140	6.11	0.85	92	108
		150	6.14	0.92	98	106
		160	6.18	0.99	102	104
		170	6.21	1.06	108	102
		180	6.25	1.12	112	100
		190	6.28	1.19	117	98
		200	6.32	1.26	122	96
5000K	68	50	5.67	0.28	44	155
		100	5.93	0.59	81	137
		110	5.98	0.66	89	135
		120	6.02	0.72	96	133
		130	6.06	0.79	103	130
		140	6.11	0.85	109	128
		150	6.14	0.92	116	126
		160	6.18	0.99	122	123
		170	6.21	1.06	128	121
		180	6.25	1.12	134	119
		190	6.28	1.19	141	118
		200	6.32	1.26	147	116



Nominal CCT	Minimum CRI	If(mA)	Vf(V)	Power(W)	Flux(lm)	lm/W
5000K	80	50	5.67	0.28	38	135
		100	5.93	0.59	71	120
		110	5.98	0.66	77	118
		120	6.02	0.72	83	116
		130	6.06	0.79	89	113
		140	6.11	0.85	95	111
		150	6.14	0.92	101	109
		160	6.18	0.99	106	107
		170	6.21	1.06	111	105
		180	6.25	1.12	117	104
		190	6.28	1.19	122	103
		200	6.32	1.26	128	101
5700K	80	50	5.67	0.28	38	134
		100	5.93	0.59	70	118
		110	5.98	0.66	76	115
		120	6.02	0.72	82	113
		130	6.06	0.79	87	110
		140	6.11	0.85	92	108
		150	6.14	0.92	98	106
		160	6.18	0.99	102	104
		170	6.21	1.06	108	102
		180	6.25	1.12	112	100
		190	6.28	1.19	117	98
		200	6.32	1.26	122	96



Nominal CCT	Minimum CRI	If(mA)	Vf(V)	Power(W)	Flux(lm)	lm/W
6500K	80	50	5.67	0.28	38	134
		100	5.93	0.59	70	118
		110	5.98	0.66	76	115
		120	6.02	0.72	82	113
		130	6.06	0.79	87	110
		140	6.11	0.85	92	108
		150	6.14	0.92	98	106
		160	6.18	0.99	102	104
		170	6.21	1.06	108	102
		180	6.25	1.12	112	100
		190	6.28	1.19	117	98
		200	6.32	1.26	122	96

3. Characteristics

1) Absolute Maximum Rating

Item	Symbol	Rating	Condition
Operating temperature range	T_{op}	-40 °C ~ +85 °C	-
Storage temperature range	T_{stg}	-40 °C ~ +100 °C	-
LED junction temperature	T_J	125 °C	-
Forward Current	I_F	200 mA	-
Peak Pulsed Forward Current	I_{FP}	400 mA	Duty 1/10 pulse width 10ms
Thermal resistance	$R_{th, j-s}$	15 °C/W	Junction to solder point
Assembly Process Temperature	-	260 °C, < 10sec	-
ESD	-	5kV	HBM

2) Electro-optical Characteristics – Voltage and CRI

Item	Unit	Rank	Min	Typ	Max
Forward Voltage ¹⁾ (@100 mA, $T_j = 25^\circ\text{C}$)	V	A1	5.6	-	5.8
		A2	5.8	-	6.0
		A3	6.0	-	6.2
		A4	6.2	-	6.4
		A5	6.4	-	6.6
Reverse Voltage (@5 mA, $T_j = 25^\circ\text{C}$)	V	-	0.7	-	1.2
Color Rendering Index ²⁾	Ra	5	80	-	-
		4	76	-	-
		3	68	-	-

Notes:

1)~2) SAMSUNG ELECTRONICS maintains a tolerance of $V_F: \pm 0.1$ V, $R_a: \pm 3.0$ on measurements

3) Electro-optical Characteristics – Luminous Intensity and Flux

Item	Unit	CCT	Rank	Min	Typ	Max			
Luminous Intensity ¹⁾ (@100 mA, Ts = 25°C)	cd	2700K (Ra 80)	S0	S1	16.6	-	18.9		
				S2	18.9	-	22.2		
				S3	22.2	-	25.5		
		2700K (Ra 78)	S0	S1	18.9	-	20.8		
				S2	20.8	-	22.8		
				S3	22.8	-	26.1		
		3000K	S0	S1	16.6	-	19.6		
				S2	19.6	-	22.8		
				S3	22.8	-	26.1		
		3500K	S0	S1	16.6	-	20.5		
				S2	20.5	-	23.8		
				S3	23.8	-	27.1		
		4000K 5700K 6500K	S0	S1	17.9	-	21.2		
				S2	21.2	-	24.5		
				S3	24.5	-	27.7		
		5000K (Ra 68)	S0	S1	20.5	-	24.5		
				S2	24.5	-	28.7		
				S3	28.7	-	34.3		
		5000K (Ra 80)	S0	S1	17.9	-	21.5		
				S2	21.5	-	24.8		
				S3	24.8	-	28.1		
		Luminous Flux (@100 mA, Ts = 25°C)	lm	2700K (Ra 80)	S0	S1	51.0	-	58.0
						S2	58.0	-	68.0
						S3	68.0	-	78.0
2700K (Ra 78)	S0			S1	58.0	-	64.0		
				S2	64.0	-	70.0		
				S3	70.0	-	80.0		
3000K	S0			S1	51.0	-	60.0		
				S2	60.0	-	70.0		
				S3	70.0	-	80.0		
3500K	S0			S1	51.0	-	63.0		
				S2	63.0	-	73.0		
				S3	73.0	-	83.0		
4000K 5700K 6500K	S0			S1	55.0	-	65.0		
				S2	65.0	-	75.0		
				S3	75.0	-	85.0		
5000K (Ra 68)	S0			S1	63.0	-	75.0		
				S2	75.0	-	88.0		
				S3	88.0	-	105.0		
5000K (Ra 80)	S0			S1	55.0	-	66.0		
				S2	66.0	-	76.0		
				S3	76.0	-	86.0		

Notes:

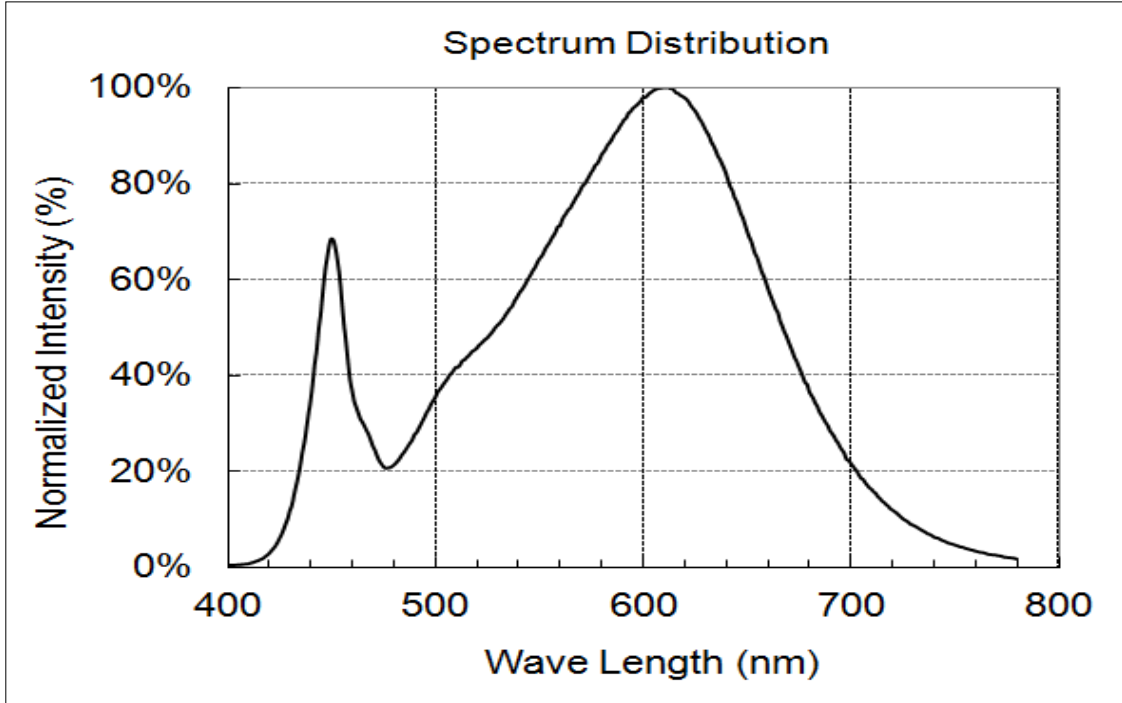
1) Luminous Intensity(I_v , cd) values are for representative reference only

4. Typical Characteristics Graph

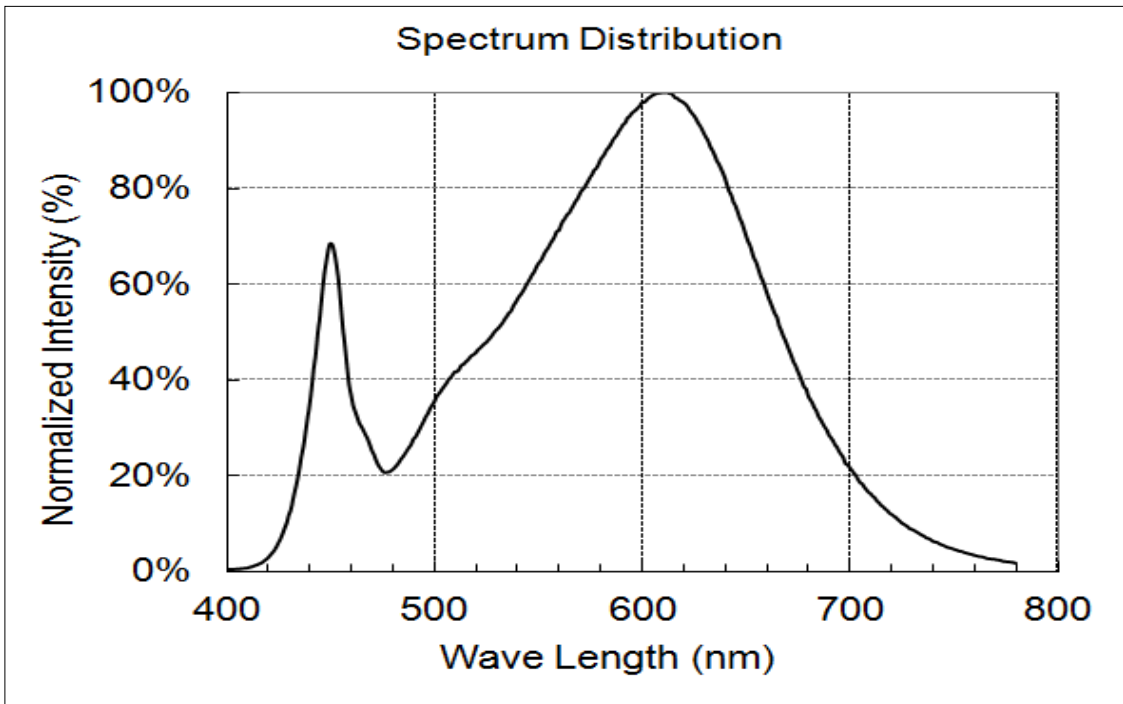
1) Spectrum Distribution

($T_s = 25^\circ\text{C}$)

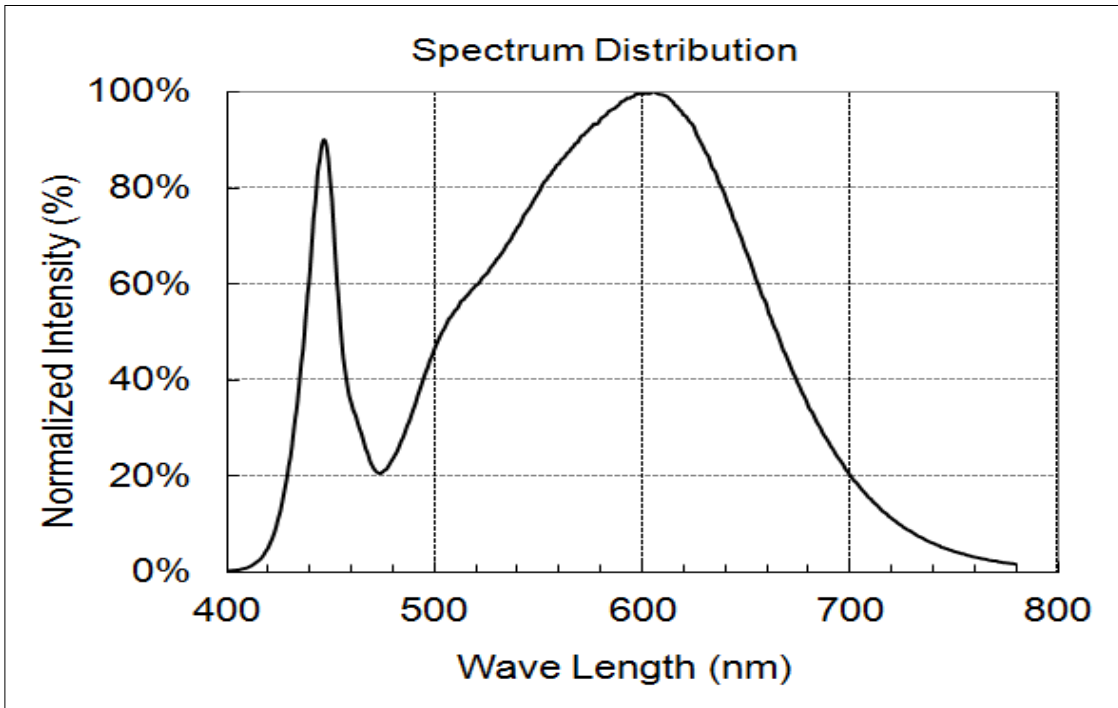
2700K



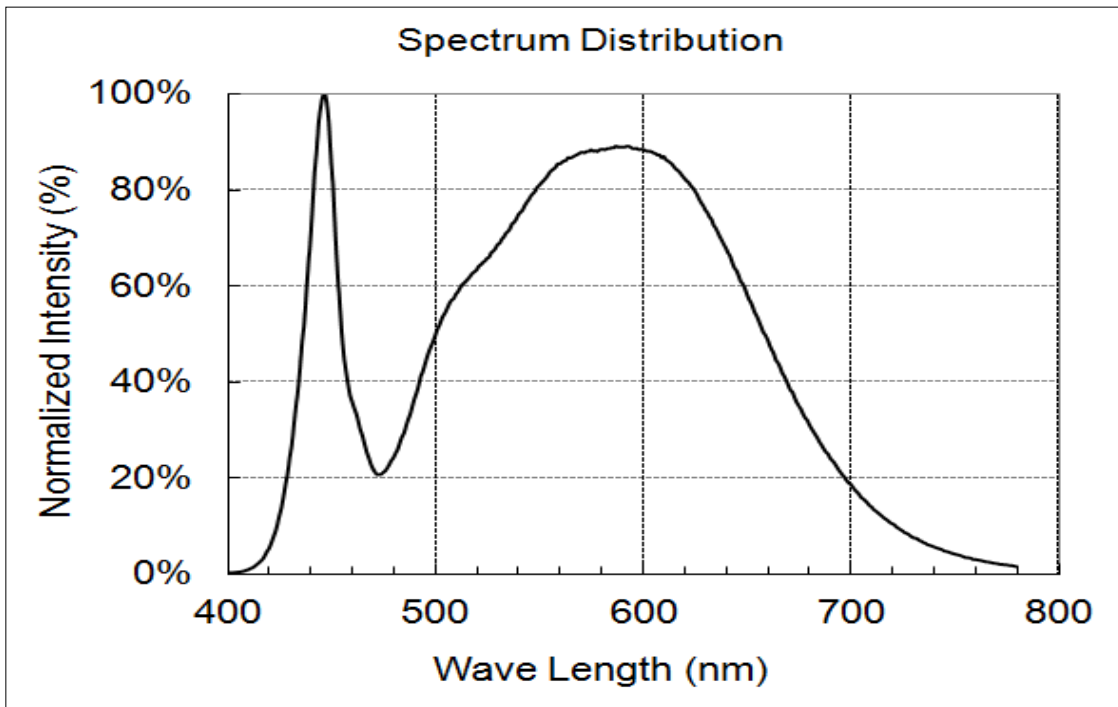
3000K



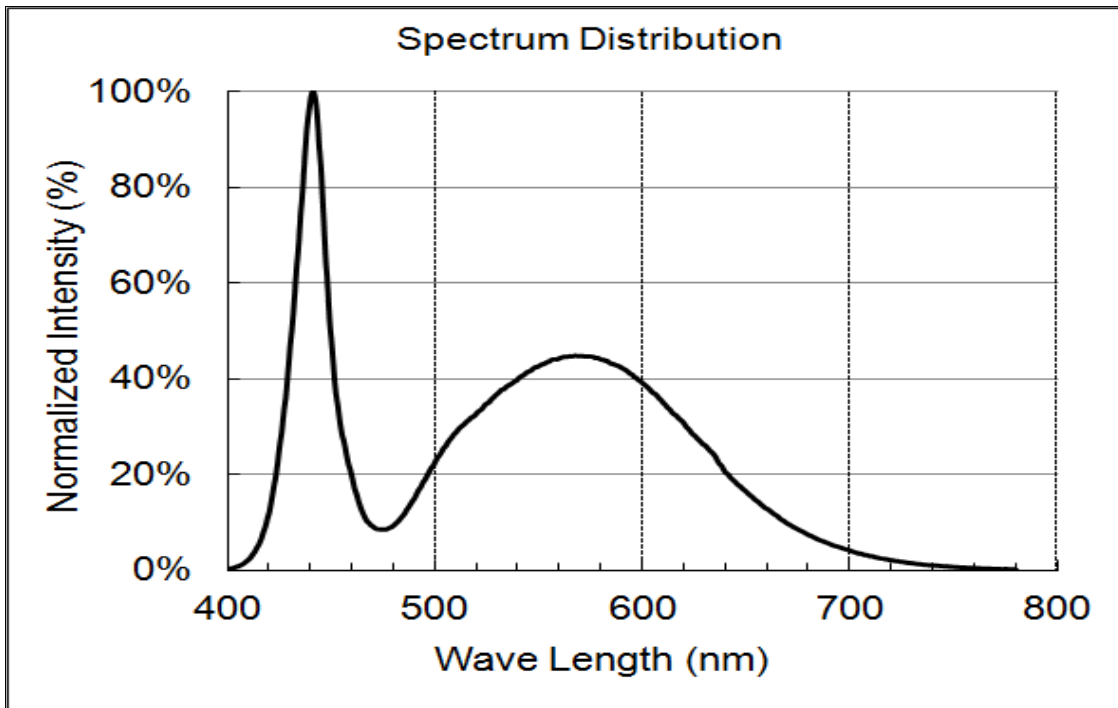
3500K



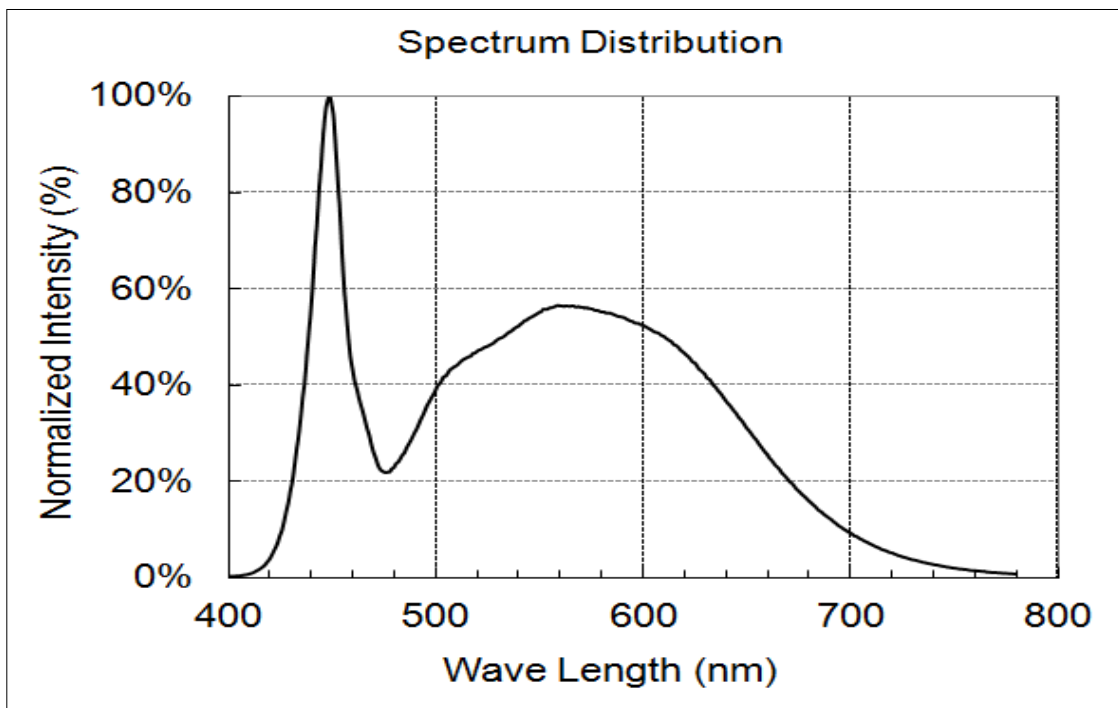
4000K



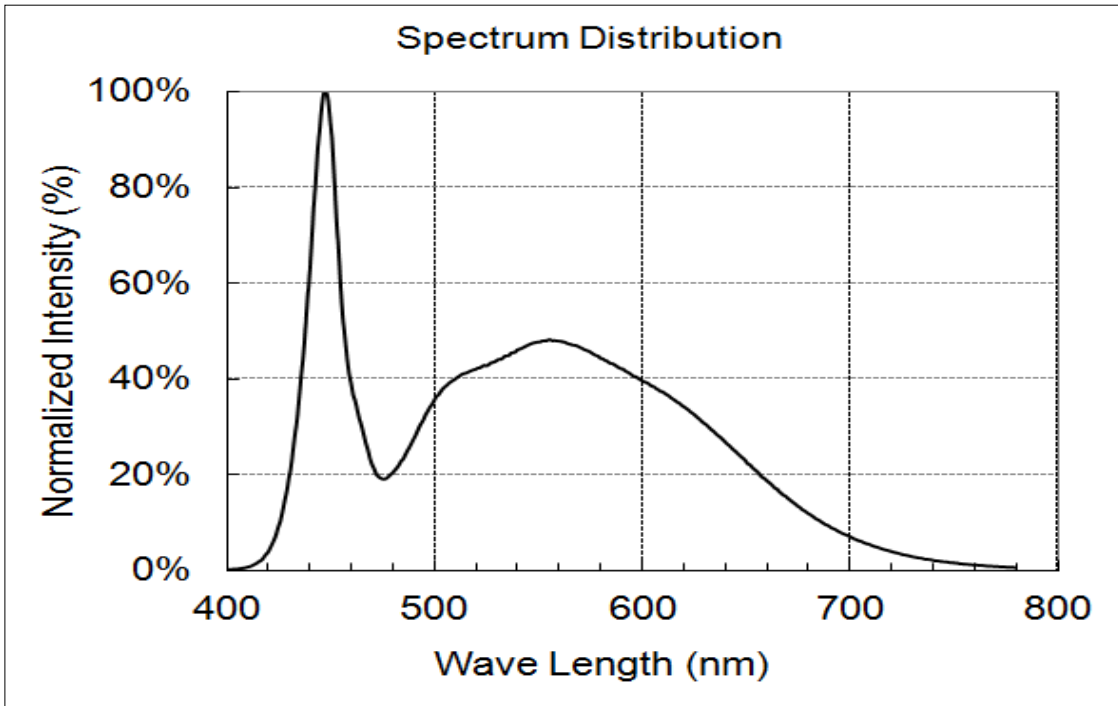
5000K - CRI68



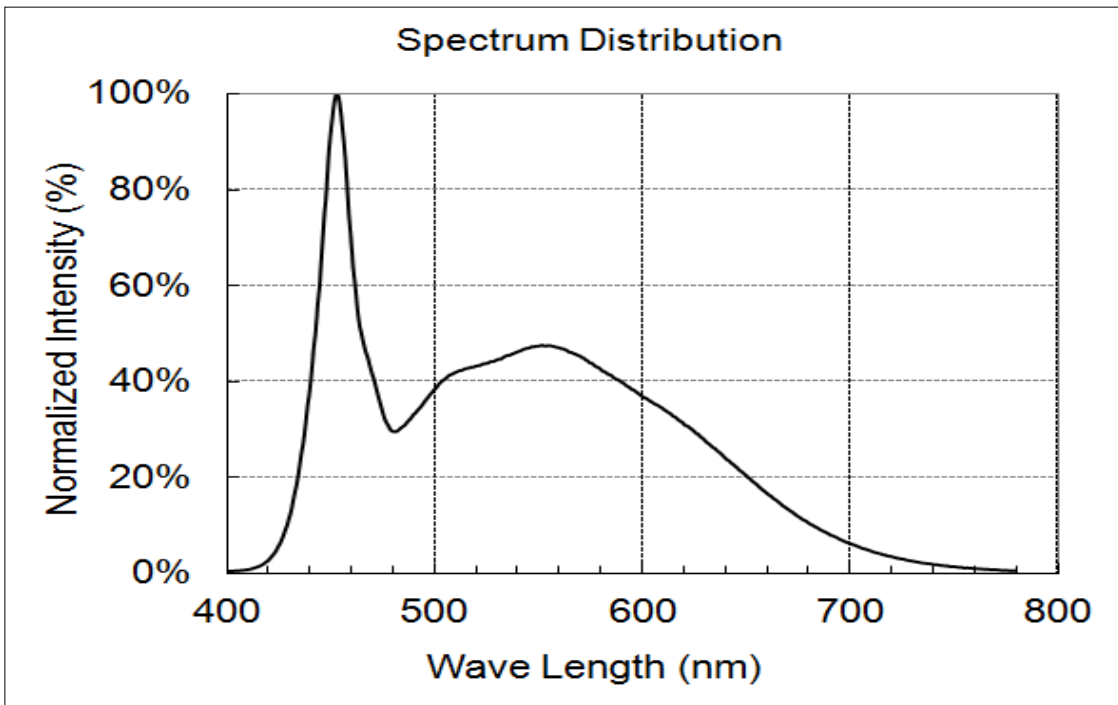
5000K - CRI80



5700K

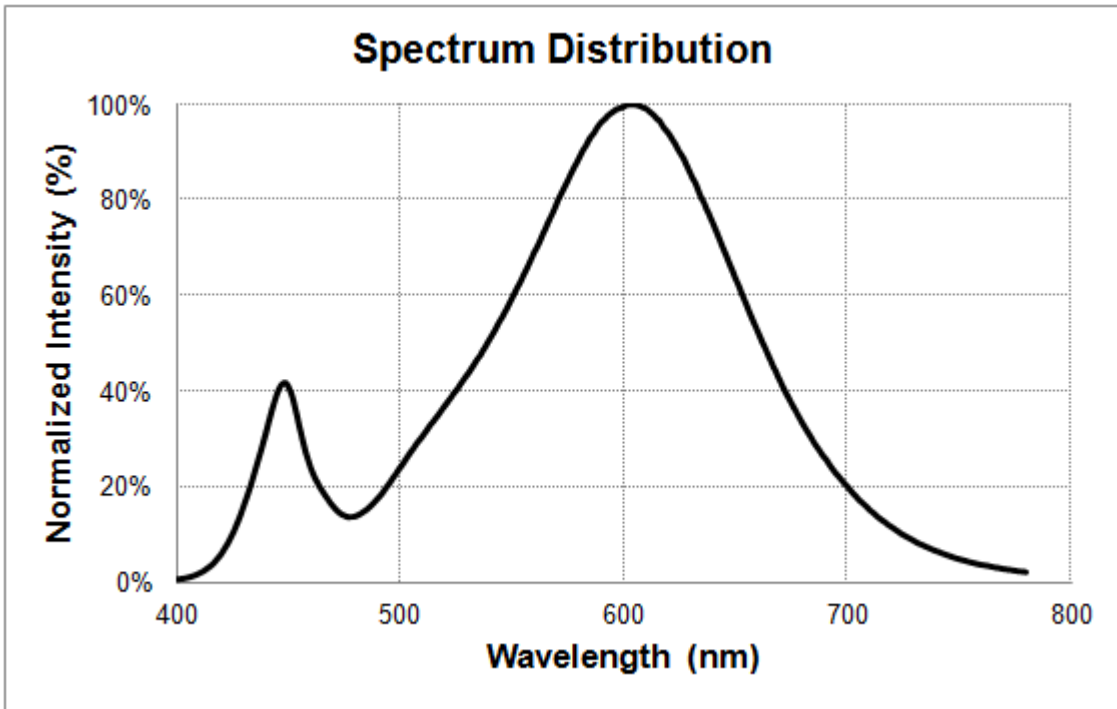


6500K



2700K - CRI76

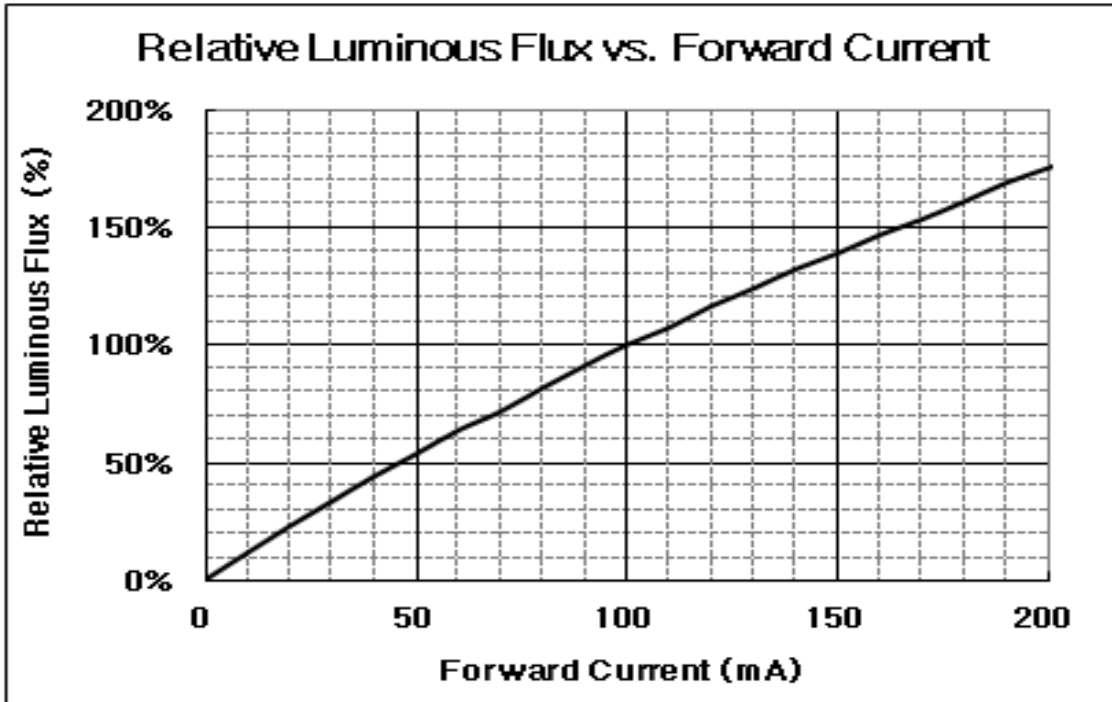
($T_s = 25^\circ\text{C}$)



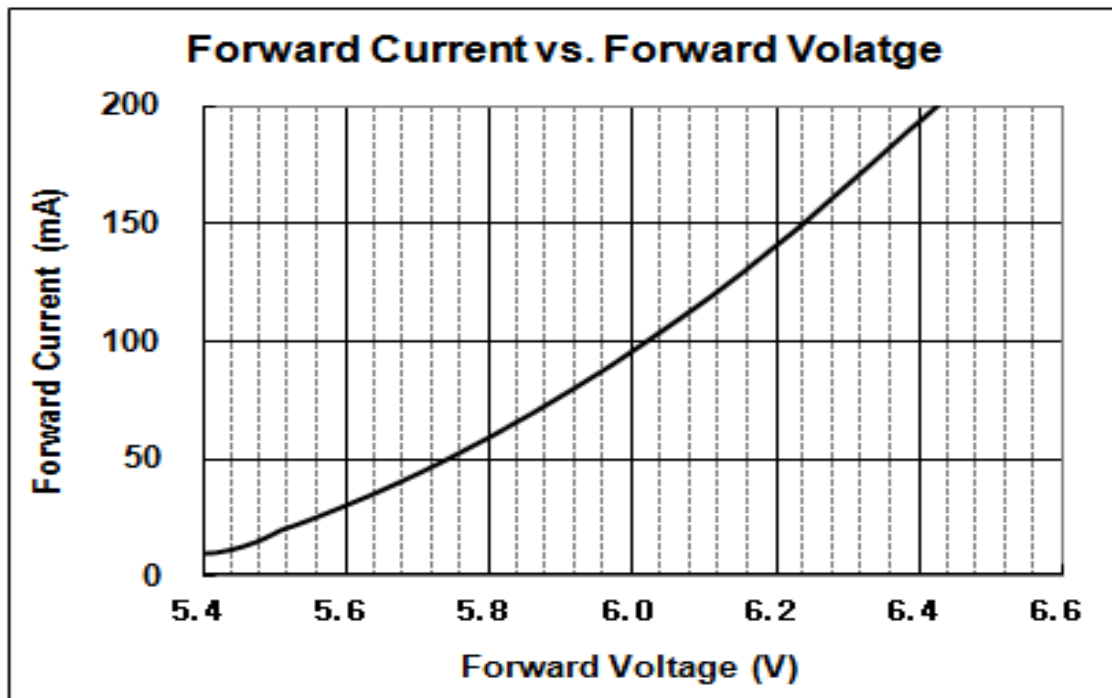
2) Forward Current Characteristics

($T_s = 25^\circ\text{C}$)

Relative Flux vs. Forward Current

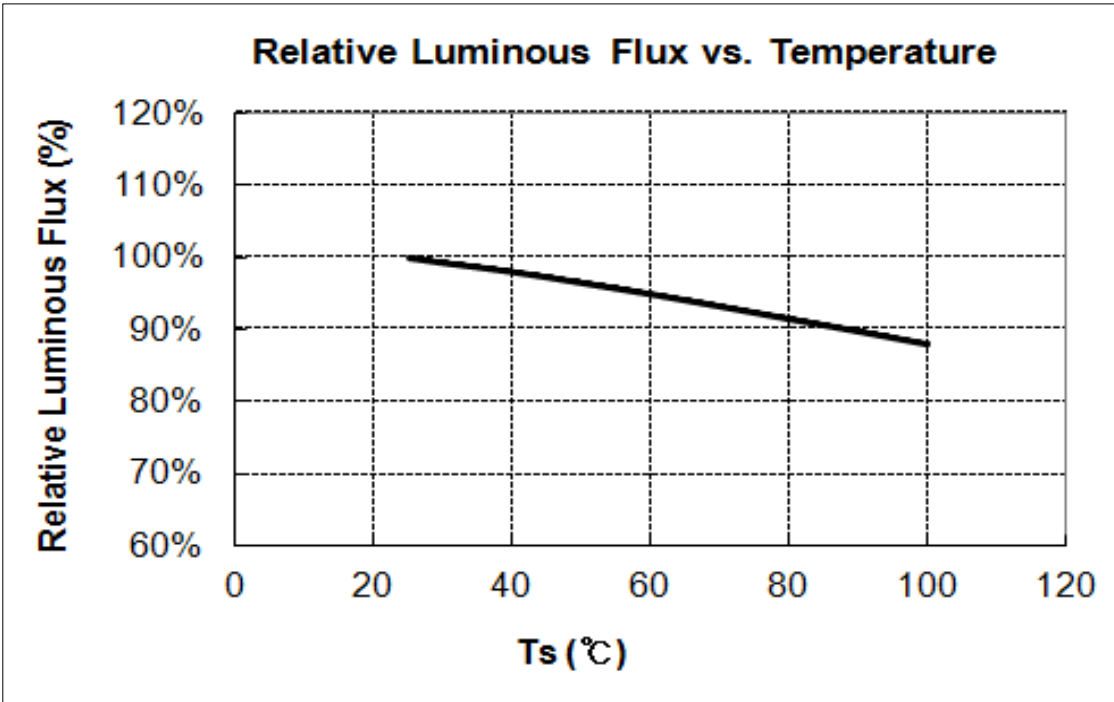


Forward Current vs. Forward Voltage

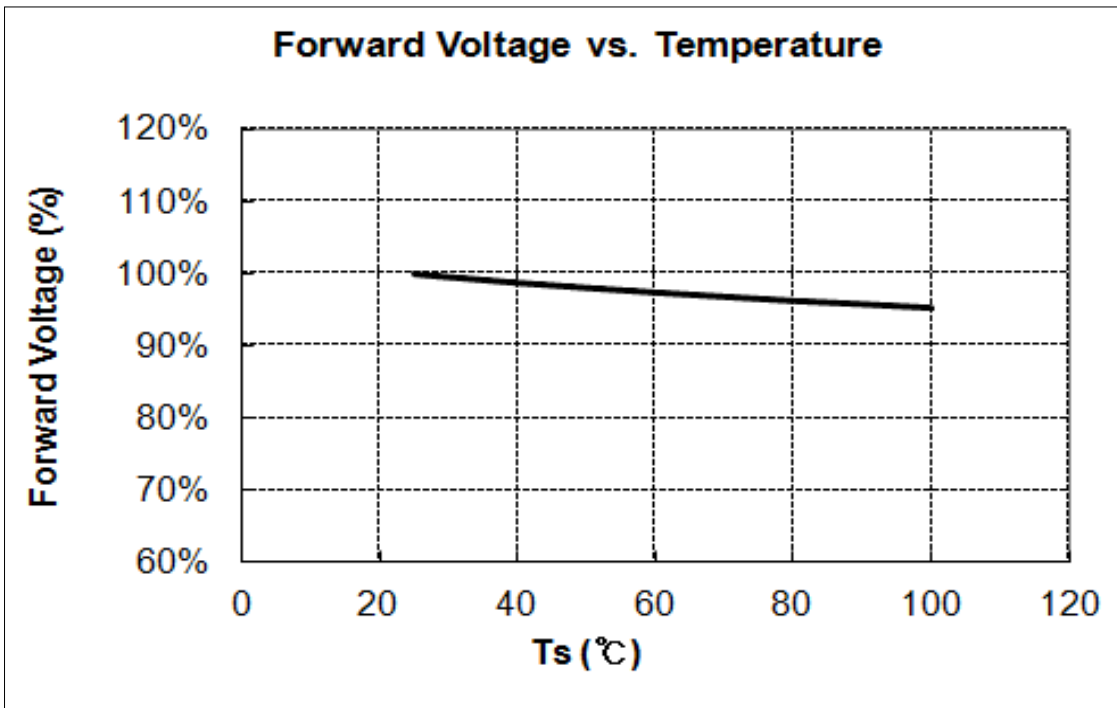


3) Temperature Characteristics

Relative Flux vs. T_s (solder temp.) @ 100mA



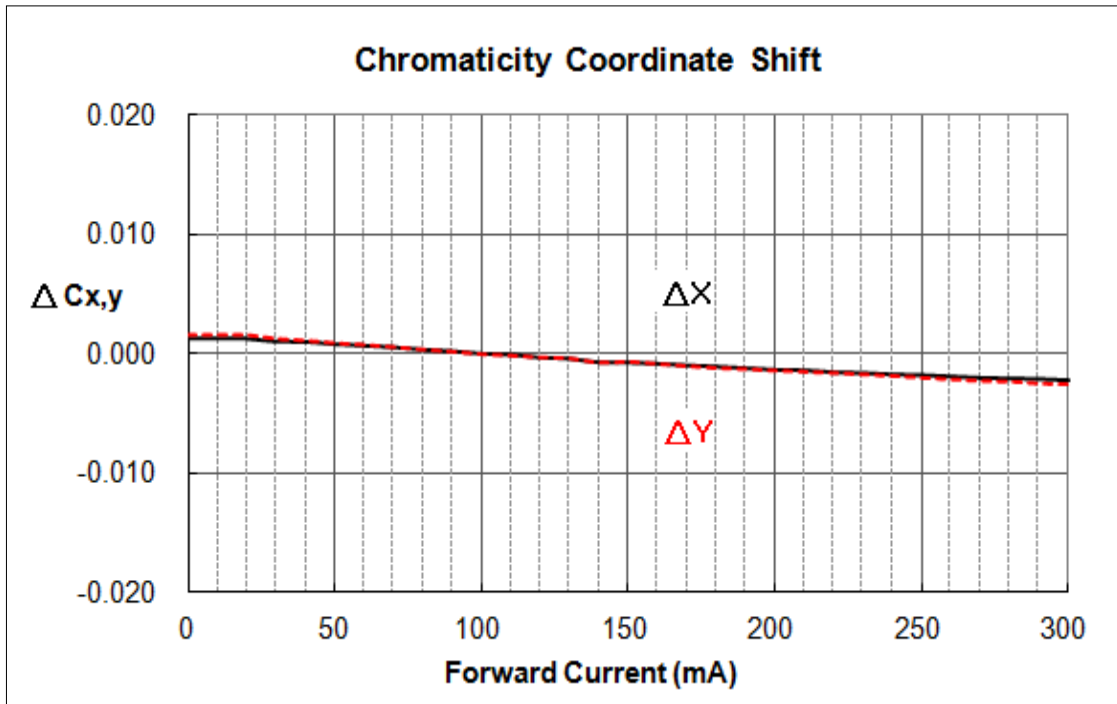
Forward Voltage vs. T_s (solder temp.) @ 100mA



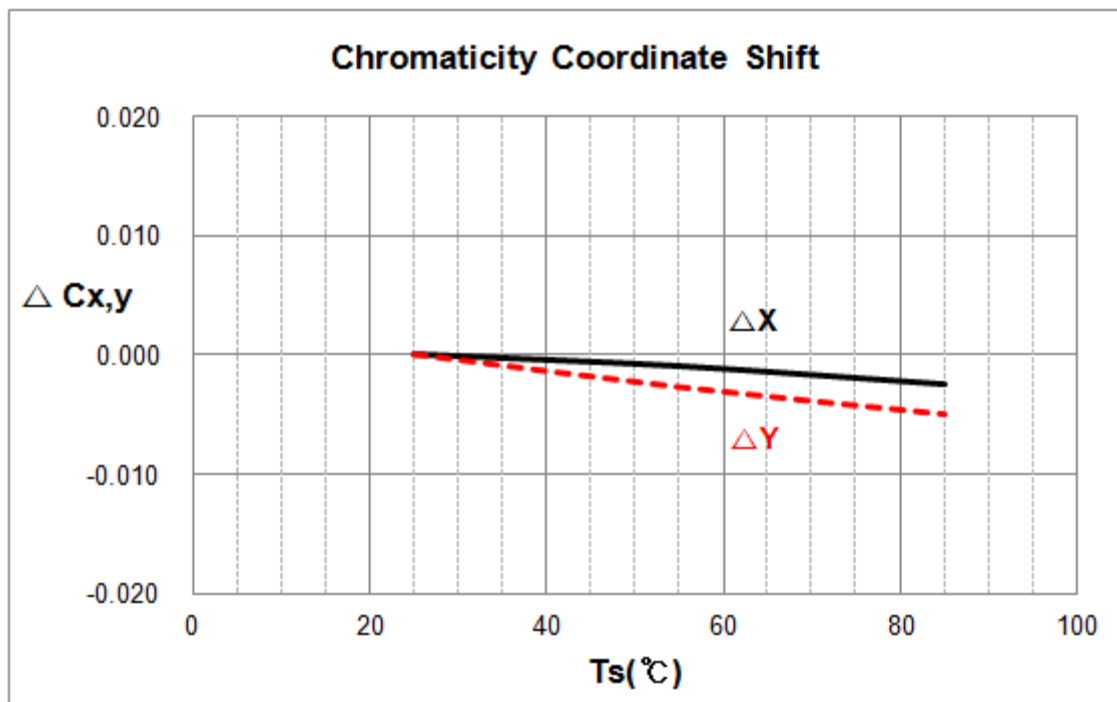
4) Color shift Characteristics

($T_s = 25^\circ\text{C}$)

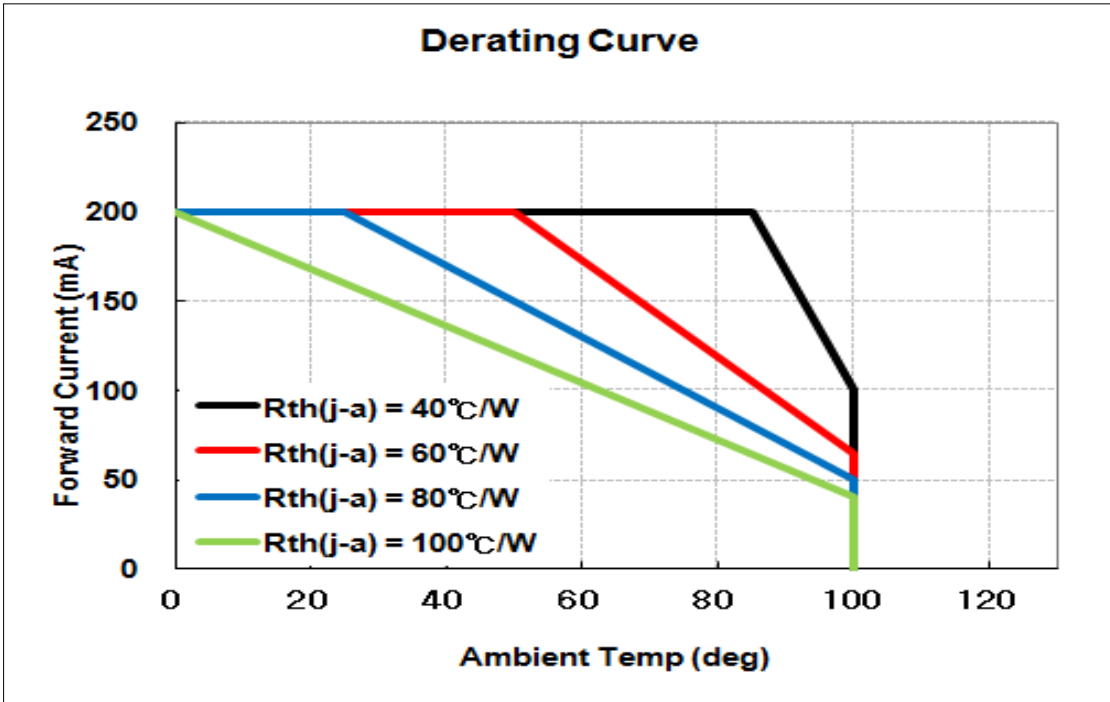
Color x,y vs. Forward Current



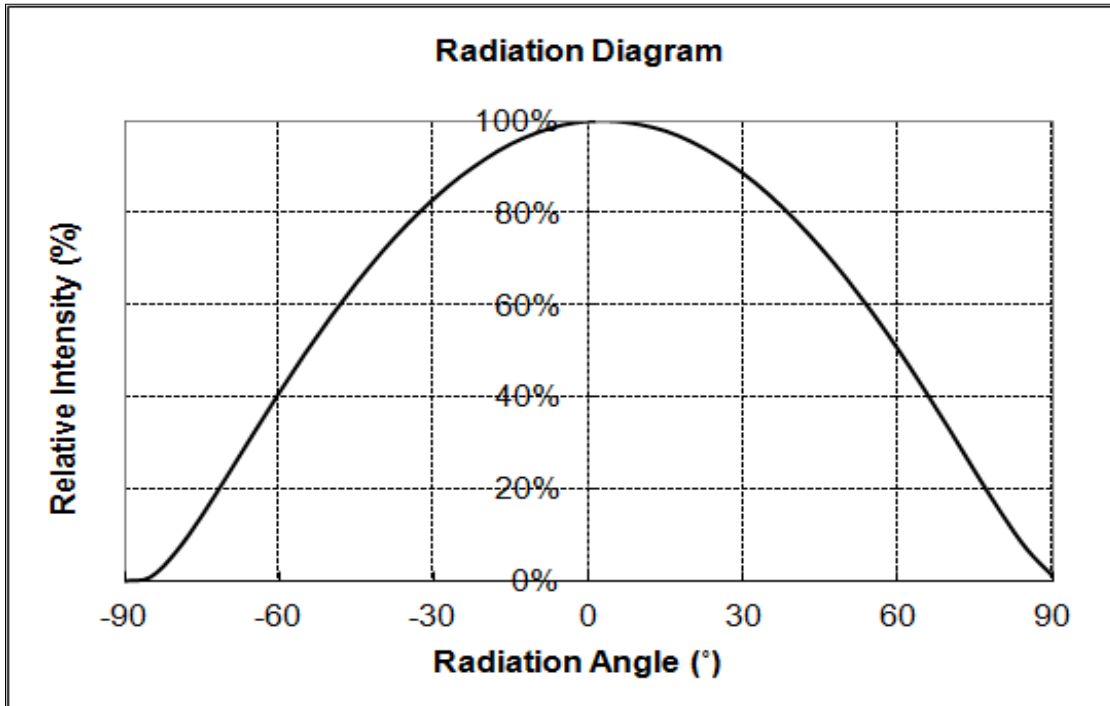
Color x,y vs. T_s (solder temp.) @ 100mA



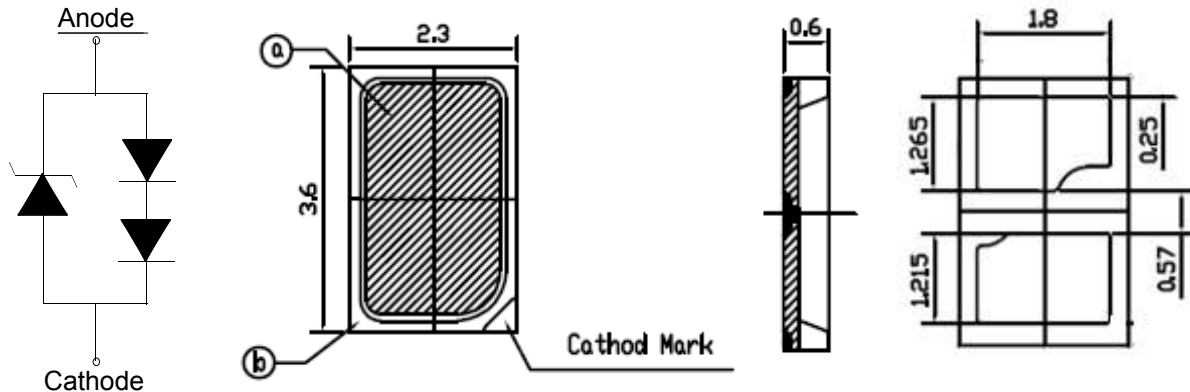
5) Derating Curve



6) Beam Angle Characteristics

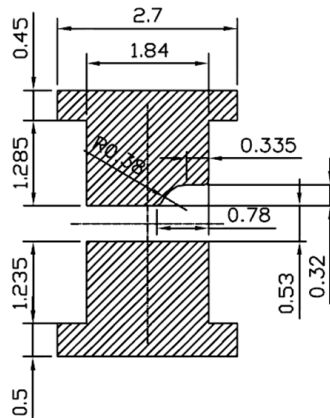


5. Outline Drawing and Dimension



1. Tolerance is ± 0.1 mm
2. The maximum compressing force is 15N on the silicone ①
3. Do not place pressure on the encapsulation resin ②

Recommended Land Pattern



Notes:

- 1) This LED has built-in ESD protection device(s) connected in parallel to LED Chip(s).
- 2) Ts point & measurement method
 - ① Measure the nearest point to the thermal pad as shown above. If necessary, remove PSR of PCB to reach Ts point.
 - ② Thermal pad must be soldered to the PCB to dissipate heat properly. Otherwise, LED can be damaged.
- 3) Precautions
 - ① The pressure on the LEDs will influence to the reliability of the LEDs. Precautions should be taken to avoid the 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.

6. Reliability Test Items and Conditions

1) Test Items and Results

Test Item	Test Conditions	Test Hours/Cycles	Sample No	
MSL Test	125 °C 24hrs drying → 60 °C, 60 %RH 120hrs → 260 °C 10sec 3 cycles	1 cycle	11	
Room Temperature life test	25 °C±3 °C, DC200mA	1,000 hrs	22	
High Temperature life test	85 °C±3 °C, DC200 mA	1,000 hrs	22	
High Temperature humidity life test	85°C±3 °C, 85 %±2 %RH, DC200 mA	1,000 hrs	22	
Low Temperature life test	-40 °C±3 °C, DC200 mA	1,000 hrs	22	
Power Temperature Cycle	-40 °C/20 min ↔ 85 °C/20 min, Temp. change within 100min, on/off 5 min	100 cycles	50	
Thermal Shock	-45 °C/15 min ↔ 125 °C/15 min, Temp. change within 5min → Hot plate 180 °C	200 cycles	100	
High Temperature Storage	Ta=120 °C±3 °C	1000 hrs	11	
Low Temperature Storage	Ta=-40 °C±3 °C	1000 hrs	11	
ESD(HBM)		R1:10 MΩ, R2:1.5 kΩ, C:100 pF, V = ±5 kV	5 times	10
ESD(MM)		R1:10 MΩ, R2:0, C:200 pF, V = ±0.5 kV	5 times	10
Vibration Test	100~2000~100 Hz, 200 m/s ² , Sweep 4 min, X, Y, Z 3 direction, each 1 cycle	4 cycles	11	
Mechanical Shock Test	1500G, 0.5 ms, 3 shocks each X-Y-Z axis	5 cycles	11	

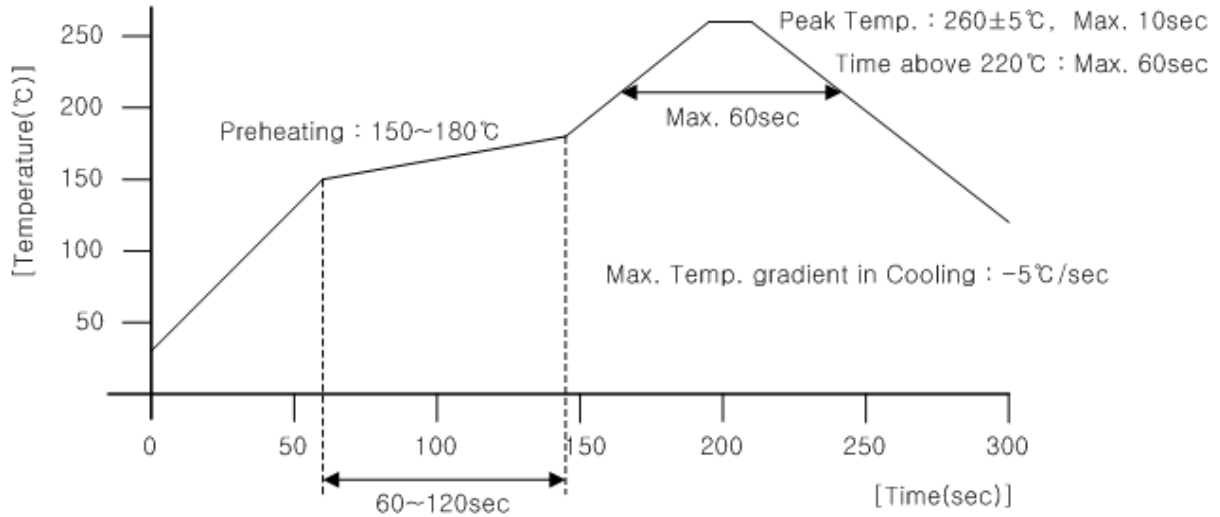
2) Criteria for Judging the Damage

Item	Symbol	Test Condition	Limit	
			Min	Max
Forward Voltage	V _F	I _F = 100 mA	Init. Value*0.9	Init. Value*1.1
Luminous Flux	Im	I _F = 100 mA	Init. Value*0.8	Init. Value*1.2

7. Solder Conditions

1) Reflow Conditions (Pb Free)

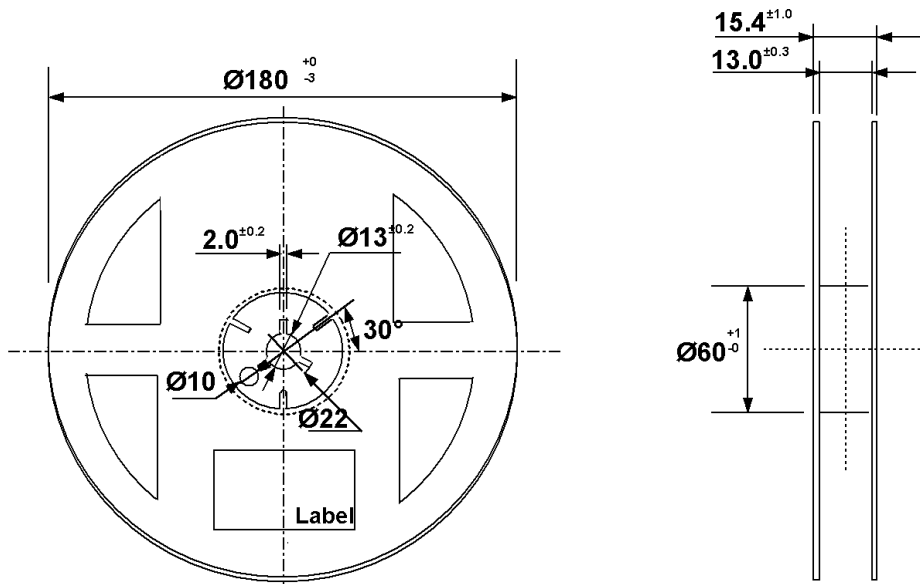
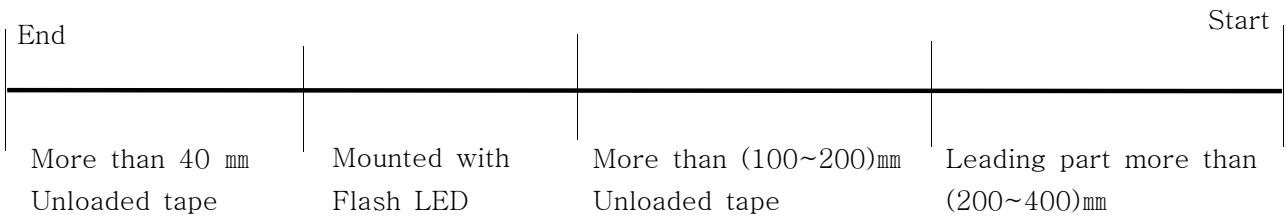
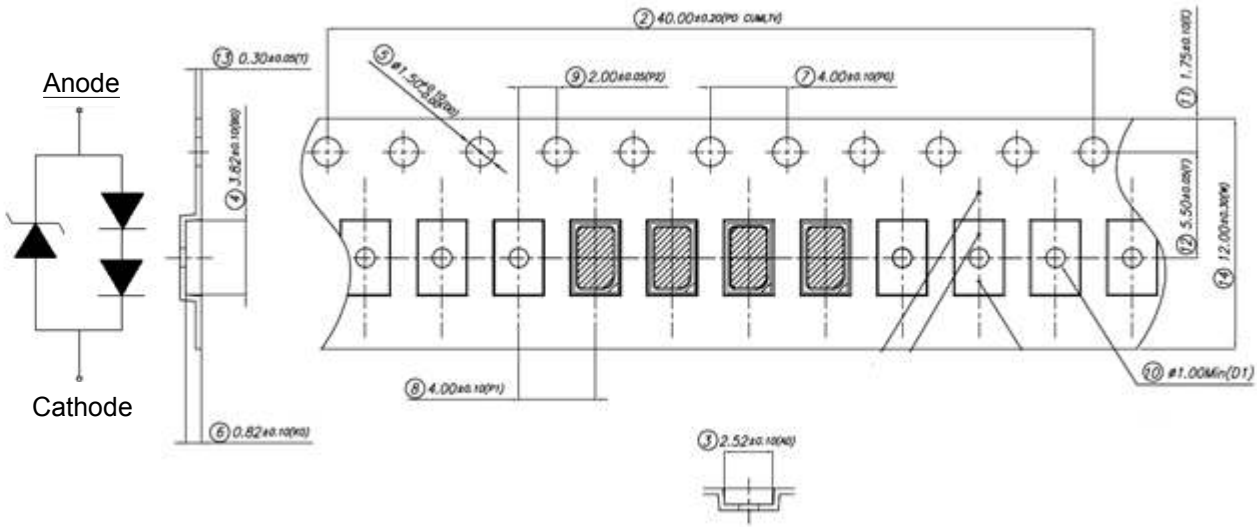
Reflow Frequency : 2 times max.



2) For Manual Soldering

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

8. Tape And Reel



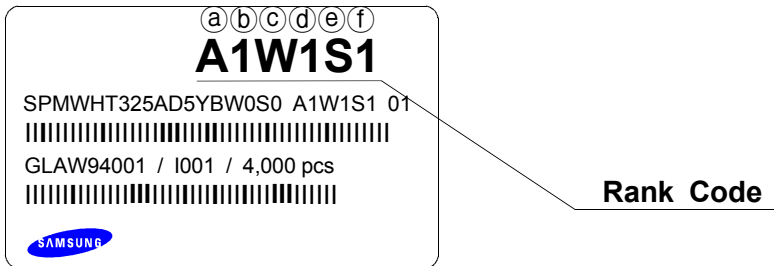
Tolerance ± 0.2 , Unit:mm

- (1) Quantity : The quantity/reel to be 4,000 pcs.
- (2) Cumulative Tolerance : Cumulative tolerance/10 pitches to be ± 0.2 mm
- (3) Adhesion Strength of Cover Tape : Adhesion strength to be 0.1-0.7N when the cover tape is turned off from the carrier tape at 10° angle to be the carrier tape.
- (4) Packaging : P/N, Manufacturing data code no. and quantity to be indicated on a damp proof package.



9. Label Structure

1) Label Structure

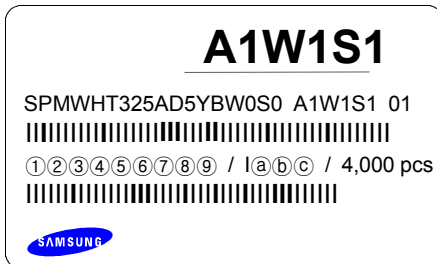


Rank Code

- (a)(b) : Forward Voltage Rank
- (c)(d) : Chromaticity Coordinate Rank
- (e)(f) : Luminous Intensity Rank

2) LOT Number

The Lot number is composed of the following characters



①②③④⑤⑥⑦⑧⑨ / I(a)(b)(c) / 4,000 PCS

- ① : Production Site (S:SAMSUNG LED, G:GOSIN CHINA)
- ② : L (LED)
- ③ : Product State (A:Normality, B:Bulk, C:First Production, R:Reproduction, S:Sample)
- ④ : Year (V:2011, W:2012, X:2013...)
- ⑤ : Month (1 ~ 9, A, B)
- ⑥ : Day (1 ~ 9, A, B ~ V)
- ⑦⑧⑨ : SAMSUNG LED Product number (1 ~ 999)
- (a)(b)(c) : Reel Number (1 ~ 999)

11. Precaution for use

- 1) For over-current-proof function, customers are recommended to apply resistors to prevent sudden change of the current caused by slight shift of the voltage.

과전류 방지를 위해 전압의 미세한 이동에 의해 야기되는 전류의 순간 변화를 방지하기 위해 저항 등의 설치를 권장함.

- 2) This device should not be used in any type of fluid such as water, oil, organic solvent, etc. When washing is required, IPA is recommended to use.

제품은 물, 오일, 유기물과 같은 액체 타입에서의 사용은 제한되며, 세정이 필요할 시에는 IPA 사용을 권장함.

- 3) When the LEDs illuminate, operating current should be decided after considering the ambient maximum temperature.

LED의 발광 시, 동작 전류는 주변 최고온도를 고려하여 결정되어야 함.

- 4) LEDs must be stored in a clean environment.

If the LEDs are to be stored for 3 months or more after being shipped from Samsung Electronics, they should be packed by a sealed container with nitrogen gas injected.(Shelf life of sealed bags: 12 months, temp. ~40°C, ~90%RH)

LED의 보관은 청정한 환경에서 보존되어야 하며, 만약 삼성전자로부터 공급받는 후 3개월 또는 그 이상 보관이 필요하다면 질소 가스를 동봉한 보존용기에 보관되어야 함. (보존 bag의 수명 : 12 개월, 보존 온도 ~40°C, 습도 ~90%RH)

- 5) After storage bag is open, device subjected to soldering, solder reflow, or other high temperature processes must be:

보존 Bag이 개봉된 후에, 납땀이나 reflow등의 높은 온도에 노출되는 제품은 다음의 사항에 부합되어야 함.

a. Mounted within 672 hours(28 days) at an assembly line with a condition of no more than 30°C/60%RH,

a. 제품은 30°C/60%RH보다 같거나 낮은 조립조건에서 672시간(28일)이내에 조립해야 함.

b. Stored at <10%RH.

b. 10% 이하의 상대습도에서 보관되어야 함.

- 6) Repack unused Products with anti-moisture packing, fold to close any opening and then store in a dry place.

사용하지 않은 제품은 방습팩에 넣어 개봉 부위를 닫아서 다시 포장한 후, 건조한 장소에서 보관할 것을 권장함.

7) Devices require baking before mounting, if humidity card reading is $>60\%$ at $23\pm 5^{\circ}\text{C}$.

만약 습도표시카드의 수치가 $23\pm 5^{\circ}\text{C}$ 에서 60% 이상이라면, 제품 실장 전에 baking해야 함.

8) Devices must be baked for 1 hour at $65\pm 5^{\circ}\text{C}$, if baking is required.

만약 baking이 필요하다면, 제품은 $65\pm 5^{\circ}\text{C}$ 에서 1시간 정도 baking 되어야 함.

9) The LEDs are sensitive to the static electricity and surge. It is recommended to use a wrist band or anti-electrostatic glove when handling the LEDs.

LED는 정전기 및 서지에 민감한 제품이므로, LED 제품을 다룰 시에는 정전기 방지장갑이나 손목밴드를 사용하기를 권장함.

If voltage exceeding the absolute maximum rating is applied to LEDs, it may cause damage or even destruction to LED devices.

만약 절대 허용치를 초과하는 전압이 LED에 가해지면, LED 소자는 파괴되거나 손상될 수 있음.

Damaged LEDs may show some unusual characteristics such as increase in leak current, lowered turn-on voltage, or abnormal lighting of LEDs at low current.

손상된 제품은 누설전류의 증가, Turn on 전압의 저하, 저 전류에서의 점등불량 등의 이상 거동을 보일 수 있음.

If the LED is applied to luminaires(fixtures), it may cause color coordinate shift.

모듈 제작 시, 색좌표 이동이 일어날 가능성이 있음.

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 a discoloration of encapsulant when they exposed to light and heat .

VOCs(휘발성 유기 화합물)는 등기구에 사용되는 접착제, Flux, 경화제, 유기물 첨가제에서 발생하여 LED의 실리콘 봉지제를 투과하고, 빛 또는 열에 노출되었을 때 변색이 발생 할 수 있음.

This phenomenon can cause a significant loss of light emitted(output) from the luminaires(fixture).

이러한 현상은 등기구로부터 나오는 빛의 중대한 손실을 줄 수 있음.

In order to prevent these problems, we recommend you to know the physical properties of materials used in luminaires, They must be selected carefully.

이러한 문제 발생 방지를 위해서, 등기구에 사용되는 자재에 대한 물성을 알고 주의하여 선택 되어야함.

11) Risk of Sulfurization(or Tarnishing)

The LED from Samsung Electronics 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.

삼성전자의 LED는 Ag(은)을 도금한 리드프레임을 사용함. 이 리드프레임의 표면이 황(S), 염소(Cl), 또는 다른 할로겐 화합물들에 노출시 Ag(은)은 검정(또는 어두운색)으로 바뀔 수 있음.

Sulfurization of lead frame may cause intensity degradation, change of chromaticity coordinates and, in extreme cases, open circuit. It requires caution.

리드 프레임의 황화(Sulfurization)는 광량 저하, 색좌표 변화 및 심한 경우 LED 무등(Open) 불량을 일으킬 수도 있으니 주의가 필요함.

Due to possible sulfurization of lead frame, LED should not be used and stored together with oxidizing substances made of materials in a following list,

: Rubber, plain paper, lead solder cream and so on.

리드 프레임 황화(Sulfurization)의 근원이 될 수 있으니 LED는 아래의 목록으로 만들어진 산화성 물질들과 함께 저장, 사용이 불가함 : 고무, 일반 종이, 납땜 크림 등



12. Hazard Substance Analysis Report



Test Report No. F690101/LF-CTSAYAA12-29933

Issued Date: 2012. 08. 20 Page 1 of 6

To: SAMSUNG ELECTRONICS CO., LTD.
24 Nongseo-dong
Giheung-gu
Yongin-si
Gyeonggido
Korea

The following merchandise was submitted and identified by the client as :

SGS File No.	: AYAA12-29933
Product Name	: LED Package
Item No./Part No.	: 3623 WHITE PKG
Received Date	: 2012. 08. 10
Test Period	: 2012. 08. 13 to 2012. 08. 20
Test Results	: For further details, please refer to following page(s)
Test Performed	: SGS Korea tested the sample(s) selected by applicant with following results.
Test Comments	: By the applicant's specific request, the sampling and testing was performed only for the part indicated in the photo without disassembly.

Timothy Jeon
Jinhee Kim
Cindy Park
Jerry Jung/ Testing Person

SGS Korea Co. Ltd.

Jeff Jang / Chemical Lab Mgr

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Test Report No. F690101/LF-CTSAYAA12-29933

Issued Date: 2012. 08. 20 Page 2 of 6

Sample No. : AYAA12-29933.001
 Sample Description : LED Package
 Item No./Part No. : 3623 WHITE PKG
 Materials : N/A

Heavy Metals

Test Items	Unit	Test Method	MDL	Results
Cadmium (Cd)	mg/kg	With reference to IEC 62321:2008, ICP	0.5	N.D.
Lead (Pb)	mg/kg	With reference to IEC 62321:2008, ICP	5	N.D.
Mercury (Hg)	mg/kg	With reference to IEC 62321:2008, ICP	2	N.D.
Hexavalent Chromium (Cr VI)	mg/kg	With reference to IEC 62321:2008, UV-VIS	1	N.D.

Flame Retardants-PBBs/PBDEs

Test Items	Unit	Test Method	MDL	Results
Monobromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Dibromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tribromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tetrabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Pentabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Hexabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Heptabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Octabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Nonabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Decabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Monobromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Dibromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tribromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tetrabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Pentabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Hexabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Heptabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Octabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Nonabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Decabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.

- NOTE: (1) N.D. = Not detected.(<MDL)
 (2) mg/kg = ppm
 (3) MDL = Method Detection Limit
 (4) - = No regulation
 (5) Negative = Undetectable / Positive = Detectable
 (6) ** = Qualitative analysis (No Unit)
 (7) * = Boiling-water-extraction:
 Negative = Absence of CrVI coating
 Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm² sample surface area.

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Test Report No. F690101/LF-CTSAYAA12-29933

Issued Date: 2012. 08. 20 Page 3 of 6

Sample No. : AYAA12-29933.001
Sample Description : LED Package
Item No./Part No. : 3623 WHITE PKG
Materials : N/A

Halogen Contents

Test Items	Unit	Test Method	MDL	Results
Fluorine(F)	mg/kg	BS EN 14582:2007 , IC	30	N.D.
Chlorine(Cl)	mg/kg	BS EN 14582:2007 , IC	30	N.D.
Bromine(Br)	mg/kg	BS EN 14582:2007 , IC	30	N.D.
Iodine(I)	mg/kg	BS EN 14582:2007 , IC	50	N.D.

Other(s)

Test Items	Unit	Test Method	MDL	Results
PFOS(Perfluorooctane Sulfonates-Acid/Metal Salt/Amide)	mg/kg	US EPA 3540C/3550C, LC/MS	1	N.D.

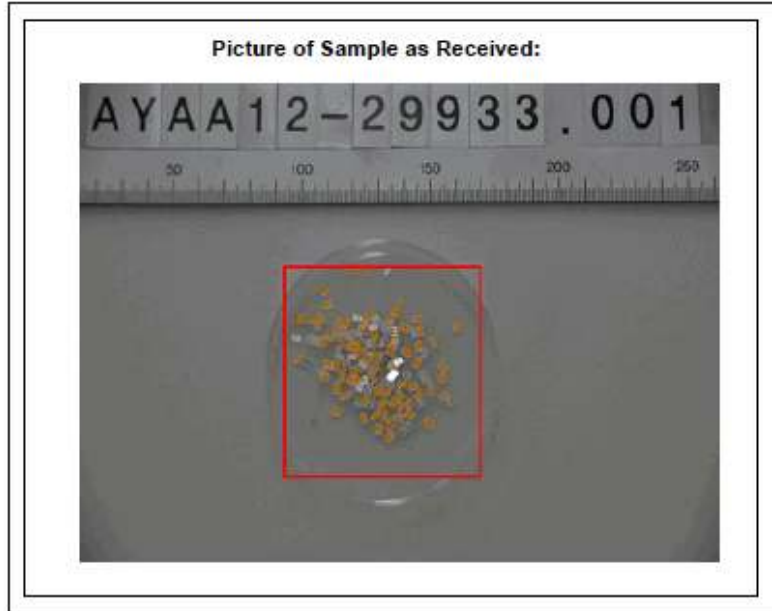
- NOTE: (1) N.D. = Not detected (<MDL)
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 (4) - = No regulation
 (5) Negative = Undetectable / Positive = Detectable
 (6) ** = Qualitative analysis (No Unit)
 (7) * = Boiling-water-extraction:
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 Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm² sample surface area.

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Issued Date: 2012. 08. 20 Page 4 of 6



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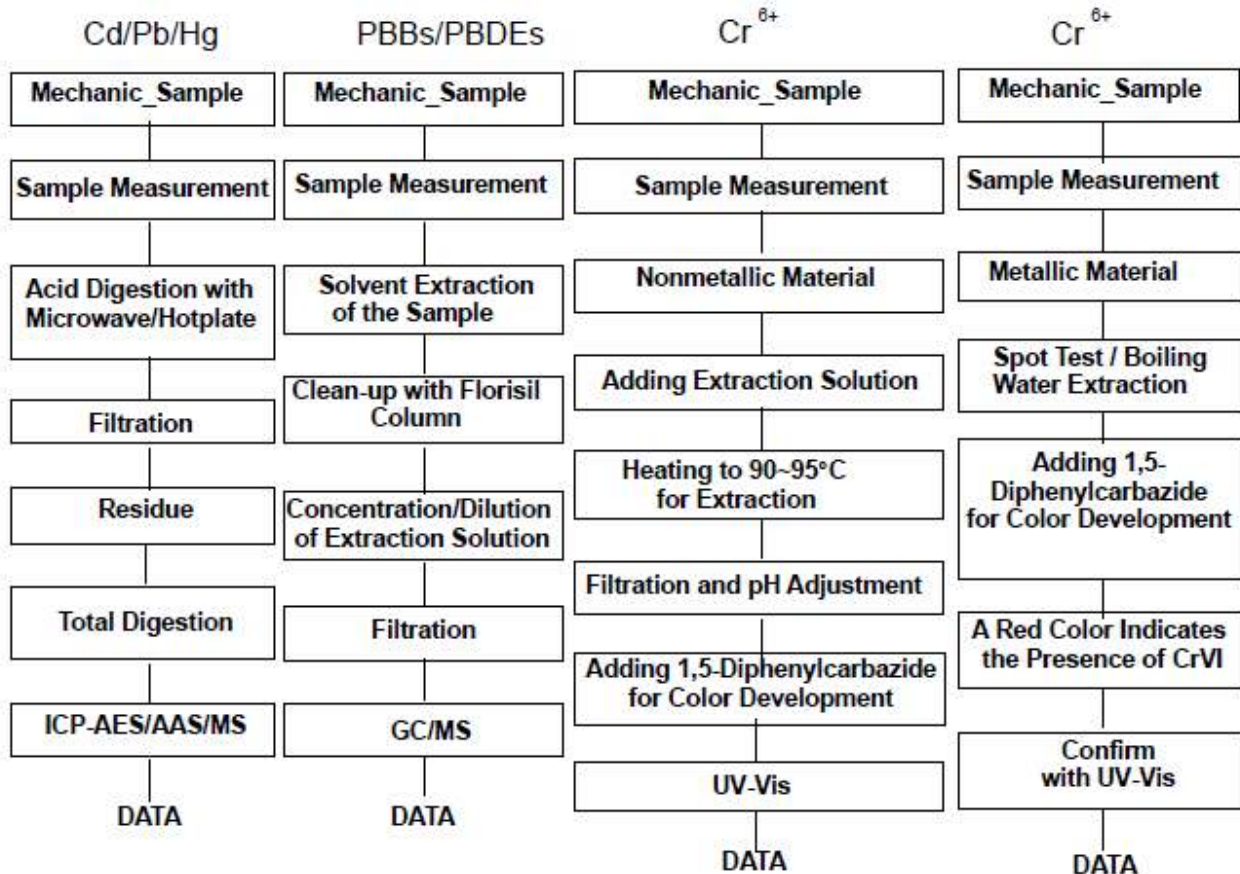
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Testing Flow Chart for RoHS: Cd/Pb/Hg/Cr⁶⁺ /PBBs&PBDEs Testing



The samples were dissolved totally by pre-conditioning method according to above flow chart for Cd,Pb,Hg.
Section Chief : Gilsae Yi

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 Negative = Absence of CrVI coating
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Test Report No. F690101/LF-CTSAYAA12-29940

Issued Date: August 20, 2012

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To: **SAMSUNG ELECTRONICS CO.,LTD.**
 24,Nongseo-dong
 Giheung-gu
 Yong-si
 Gyeonggido
 Korea

The following sample(s) was/were submitted and identified by/on behalf of the client as:-

Product Name	: LED Package
Item/Part Name	: 3623 WHITE PKG
SGS File No.	: AYAA12-29940
Received Date	: August 10, 2012
Test Period	: August 11, 2012 ~ August 20, 2012
Test Performed	: SGS Korea tested the sample(s) selected by applicant with following results
Test Requested	: Eighty-four (84) substances in the Candidate List of Substances of Very High Concern (SVHC) for authorization published by European Chemicals Agency (ECHA) on and before June 18, 2012 regarding Regulation (EC) No 1907/2006 concerning the REACH.
Test Method	: Please refer to next page(s).
Test Result(s)	: Please refer to next page(s).

Timothy Jeon
 Cindy park
 Jinhee Kim
 Sophia Kim
 /Testing Person

SGS Korea Co., Ltd

Jeff Jang / Chemical Lab Mgr

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Test Report No. F690101/LF-CTSAYAA12-29940

Issued Date: August 20, 2012

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Test Method:

SGS In-House method - Analyzed by ICP-OES, PLM, UV/VIS, LC/MS ,GC/MS and colorimetric method

Remarks:

1. The chemical analysis of specified SVHC is performed by means of currently available analytical techniques against the following SVHC related documents published by ECHA:
<http://echa.europa.eu/web/quest/candidate-list-table> (Candidate list)
 These lists are under evaluation by ECHA and may subject to change in the future.
2. In accordance with Regulation (EC) No 1907/2006, any producer or importer of articles shall notify ECHA, in accordance with paragraph 2 of Article 7, if a substance meets the criteria in Article 57 and is identified in accordance with Article 59(1) of the Regulation, if (a) the substance is present in those articles in quantities totaling over one tonne per producer or importer per year; and (b) the substance is present in those articles above a concentration of **0.1%** weight by weight (w/w).
3. Article 33 of Regulation (EC) No 1907/2006 requires supplier of an article containing a substance meeting the criteria in Article 57 and identified in accordance with Article 59(1) in a concentration above **0.1%** weight by weight (w/w) shall provide the recipient of the article with sufficient information, available to the supplier, to allow safe use of the article including, as a minimum, the name of that substance in the Candidate List.
4. SGS adopts the interpretation of ECHA for SVHC in article unless indicated otherwise. Detail explanation is available at the following link:
 - http://webstage.contribute.sgs.net/corpreach/documents/SGS-CTS_SVHC-paper-EN-11.pdf
5. Test results in this report are based on the tested sample. This report refers to testing result of composite material group by equal weight proportion. The material in each composite test group may come from one article.
6. If a SVHC is found over the reporting limit, client is suggested to identify the component which contains the SVHC and the exact concentration of the SVHC by requesting further quantitative analysis from the laboratory.

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Test Result(s)

Substance Name	CAS number	EC number	Concentration (%)	Reporting Limit (%)	Classification
Alkanes, C10-13, chloro (Short Chain Chlorinated Paraffins)	85535-84-8	287-476-5	N.D.	0.05	PBT
Anthracene	120-12-7	204-371-1	N.D.	0.05	PBT
Benzyl butyl phthalate (BBP)	85-68-7	201-622-7	N.D.	0.05	Toxic for Reproduction
Bis (2-ethylhexylphthalate) (DEHP)	117-81-7	204-211-0	N.D.	0.05	Toxic for Reproduction
Bis(tributyltin)oxide	56-35-9	200-268-0	N.D.	0.05	PBT
Cobalt dichloride*	7646-79-9	231-589-4	N.D.	0.005	Carcinogen Toxic for Reproduction
4,4-Diaminodiphenylmethane	101-77-9	202-974-4	N.D.	0.05	Carcinogen
Diarsenic pentaoxide*	1303-28-2	215-116-9	N.D.	0.005	Carcinogen
Diarsenic trioxide*	1327-53-3	215-481-4	N.D.	0.005	Carcinogen
Dibutyl phthalate (DBP)	84-74-2	201-557-4	N.D.	0.05	Toxic for Reproduction
Hexabromocyclododecane (HBCDD) and all major diastereoisomers identified (α -HBCDD, β -HBCDD, γ -HBCDD)	25637-99-4 and 3194-55-6 (134237-51-7, 134237-50-6, 134237-52-8)	247-148-4 and 221-695-9	N.D.	0.05	PBT
Lead hydrogen arsenate*	7784-40-9	232-064-2	N.D.	0.005	Carcinogen Toxic for Reproduction
Sodium dichromate (Sodium dichromate, dehydrate)	10588-01-9 (7789-12-0)	234-190-3	N.D.	0.005	Carcinogen Mutagen Toxic for Reproduction
5-tert-butyl-2,4,6-trinitro-m-xylene (musk xylene)	81-15-2	201-329-4	N.D.	0.05	vPvB
Triethyl arsenate*	15606-95-8	427-700-2	N.D.	0.005	Carcinogen

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Substance Name	CAS number	EC number	Concentration (%)	Reporting Limit (%)	Classification
Di-isobutyl phthalate(DIBP)	84-69-5	201-553-2	N.D.	0.05	Toxic for Reproduction
2,4-Dinitrotoluene	121-14-2	204-450-0	N.D.	0.05	Carcinogen
Tris(2-chloroethyl) phosphate	115-96-8	204-118-5	N.D.	0.05	Toxic for Reproduction
Anthracene oil	90640-80-5	292-602-7	N.D.	0.05	PBT; vPvB Carcinogen
Anthracene oil, anthracene paste; distrn. Lights	91995-17-4	295-278-5	N.D.	0.05	PBT; vPvB Carcinogen Mutagen
Anthracene oil, anthracene paste, anthracene fraction	91995-15-2	295-275-9	N.D.	0.05	PBT; vPvB Carcinogen Mutagen
Anthracene oil, anthracene-low	90640-82-7	292-604-8	N.D.	0.05	PBT; vPvB Carcinogen Mutagen
Anthracene oil, anthracene paste	90640-81-6	292-603-2	N.D.	0.05	PBT; vPvB Carcinogen Mutagen
Coal tar pitch, high temperature	65996-93-2	266-028-2	N.D.	0.05	PBT; vPvB Carcinogen
Lead sulfochromate yellow (C.I. Pigment Yellow 34)*	1344-37-2	215-693-7	N.D.	0.005	Carcinogen Toxic for Reproduction
Lead chromate molybdate sulfate red (C.I. Pigment Red 104)*	12656-85-8	235-759-9	N.D.	0.005	Carcinogen Toxic for Reproduction
Lead chromate*	7758-97-6	231-846-0	N.D.	0.005	Carcinogen Toxic for Reproduction
Acrylamide	79-06-01	201-173-7	N.D.	0.05	Carcinogen Mutagen

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Substance Name	CAS number	EC number	Concentration (%)	Reporting Limit (%)	Classification
Boric acid*	10043-35-3 11113-50-1	233-139-2 234-343-4	N.A.	0.005	Toxic for Reproduction
Disodium tetraborate, anhydrous*	1330-43-4 12179-04-3 1303-96-4	215-540-4	N.A.	0.005	Toxic for Reproduction
Tetraboron disodium heptaoxide, hydrate*	12267-73-1	235-541-3	N.A.	0.005	Toxic for Reproduction
Trichloroethylene	79-01-6	201-167-4	N.D.	0.05	Carcinogen
Sodium chromate*	7775-11-3	231-889-5	N.D.	0.005	Carcinogen Mutagen Toxic for Reproduction
Ammonium dichromate*	7789-09-5	232-143-1	N.D.	0.005	Carcinogen Mutagen Toxic for Reproduction
Potassium dichromate*	7778-50-9	231-906-6	N.D.	0.005	Carcinogen Mutagen Toxic for Reproduction
Potassium chromate*	7789-00-6	232-140-5	N.D.	0.005	Carcinogen Mutagen

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F052 Version 5

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Substance Name	CAS number	EC number	Concentration (%)	Reporting Limit (%)	Classification
Cobalt(II) sulphate*	10124-43-3	233-334-2	N.D.	0.005	Carcinogen Toxic for Reproduction
Cobalt(II) dinitrate*	10141-05-6	233-402-1	N.D.	0.005	Carcinogen Toxic for Reproduction
Cobalt(II) carbonate*	513-79-1	208-169-4	N.D.	0.005	Carcinogen Toxic for Reproduction
Cobalt(II) diacetate*	71-48-7	200-755-8	N.D.	0.005	Carcinogen Toxic for Reproduction
2-Methoxyethanol	109-86-4	203-713-7	N.D.	0.05	Toxic for Reproduction
2-Ethoxyethanol	110-80-5	203-804-1	N.D.	0.05	Toxic for Reproduction
Chromium trioxide*	1333-82-0	215-607-8	N.D.	0.005	Carcinogen Mutagen
Acids generated from chromium trioxide and their oligomers: Chromic acid Dichromic acid Oligomers of chromic acid and dichromic acid	7738-94-5 13530-68-2 -	231-801-5 236-881-5 -	N.D.	0.005	Carcinogen
1-methyl-2-pyrrolidone	872-50-4	212-828-1	N.D.	0.05	Toxic for Reproduction
2-ethoxyethyl acetate	111-15-9	203-839-2	N.D.	0.05	Toxic for Reproduction
1,2-benzenedicarboxylic acid, di-C6-8-branched alkyl esters, C7-rich	71888-89-6	276-158-1	N.D.	0.05	Toxic for Reproduction
1,2-benzenedicarboxylic acid, di-C7-11-branched and linear alkyl esters	68515-42-4	271-084-6	N.D.	0.05	Toxic for Reproduction
1,2,3-trichloropropane	96-18-4	202-486-1	N.D.	0.05	Carcinogen Toxic for Reproduction
Hydrazine	7803-57-8 302-01-2	206-114-9	N.D.	0.05	Carcinogen
Strontium chromate*	7789-06-2	232-142-6	N.D.	0.005	Carcinogen

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Substance Name	CAS number	EC number	Concentration (%)	Reporting Limit (%)	Classification
1,2-bis(2-methoxyethoxy)ethane (TEGDME; triglyme)	112-49-2	203-977-3	N.D.	0.05	Toxic for reproduction
1,2-dimethoxyethane;ethylene glycol dimethyl ether (EGDME)	110-71-4	203-794-9	N.D.	0.05	Toxic for reproduction
Diboron trioxide*	1303-86-2	215-125-8	N.A.	0.005	Toxic for reproduction
Formamide	75-12-7	200-842-0	N.D.	0.05	Toxic for reproduction
Lead(II) bis(methanesulfonate)*	17570-76-2	401-750-5	N.D.	0.005	Toxic for reproduction
TGIC(1,3,5-tris(oxiranylmethyl)-1,3,5-triazine-2,4,6(1H,3H,5H)-trione)	2451-62-9	219-514-3	N.D.	0.05	Mutagenic
β -TGIC (1,3,5-tris[(2S and 2R)-2,3-epoxypropyl]-1,3,5-triazine-2,4,6-(1H,3H,5H)-trione)**	59653-74-6	423-400-0	N.D.	0.05	Mutagenic
4,4'-bis(dimethylamino)benzophenone (Michler's ketone)	90-94-8	202-027-5	N.D.	0.05	Carcinogenic
N,N,N',N'-tetramethyl-4,4'-methylenedianiline (Michler's base)	101-61-1	202-959-2	N.D.	0.05	Carcinogenic
[4-[4,4'-bis(dimethylamino)benzhydrylidene]cyclohexa-2,5-dien-1-ylidene]dimethylammonium chloride (C.I. Basic Violet 3)	548-62-9	208-953-6	N.D.	0.05	Carcinogenic
[4-[[4-anilino-1-naphthyl][4-(dimethylamino)phenyl]methylene]cyclohexa-2,5-dien-1-ylidene]dimethylammonium chloride (C.I. Basic Blue 26)	2580-56-5	219-943-6	N.D.	0.05	Carcinogenic
α,α -Bis[4-(dimethylamino)phenyl]-4(phenylamino)naphthalene-1-methanol (C.I. Solvent Blue 4)	6786-83-0	229-851-8	N.D.	0.05	Carcinogenic
4,4'-bis(dimethylamino)-4''-(methylamino)trityl alcohol	561-41-1	209-218-2	N.D.	0.05	Carcinogenic

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Note:

1. RL = Reporting Limit
2. N.D. = Not detected (lower than RL)

N.A. = Not applicable for respective material type.

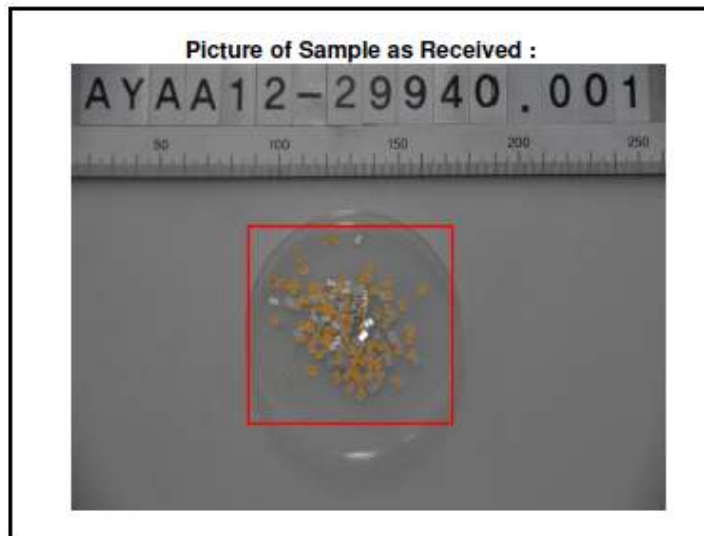
The submitted sample was found to contain significant amount of specific element(s) of SVHC. Upon further test verification and also information provided from client, the possibility that the element(s) content originate from SVHC is very unlikely, even though their presence cannot be exclude entirely. It may be assumed that the detected element(s) have a non-SVHC source.

3. Definition of classification is listed in Appendix A of this report in accordance with 67/548/EEC and Regulation (EC) No 1907/2006. For detail information, Detail explanation is available at the following link:
<http://echa.europa.eu/web/guest/candidate-list-table> (Candidate list)
- 4.. *.The test result is based on the calculation of selected element(s) / marker(s) and to the worst-case scenario. For detail information, please refer to the SGS REACH website: www.reach.sgs.com/substance-of-very-high-concern-analysis-information-page.htm

The client is advised to review the chemical formulation to ascertain above metal substances present in the article.
RL = 0.005% is evaluated for element (i.e. cobalt, arsenic, lead, sodium, chromium, chromium(VI), silicon, aluminum, zirconium, boron, and potassium respectively), except molybdenum RL=0.0005%

0.1% (w/w) = 1,000 ppm = 1,000 mg/kg

5. **.β-TGIC is one of the isomers for TGIC compounds and hence, tested together. The reported test result is based the proposed ratio as according to ECHA dossier.



*** End of Report ***

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Appendix A

Classification Definition under 67/548/EEC and Regulation (EC) No 1907/2006

- Carcinogen Category 1: Substances known to be carcinogenic to man. There is sufficient evidence to establish a causal association between human exposure to a substance and the development of cancer.
- Carcinogen Category 2: Substances which should be regarded as if they are carcinogenic to man. There is sufficient evidence to provide a strong presumption that human exposure to a substance may result in the development of cancer.
Generally on the basis of:
- appropriate long-term animal studies
- other relevant information.
- Mutagen Category 1: Substances known to be mutagenic to man. There is sufficient evidence to establish a causal association between human exposure to a substance and heritable genetic damage.
- Mutagen Category 2: Substances which should be regarded as if they are mutagenic to man. There is sufficient evidence to provide a strong presumption that human exposure to the substance may result in the development of heritable genetic damage, generally on the basis of:
- appropriate animal studies,
- other relevant information.
- Toxic to Reproduction Category 1: Substances known to impair fertility in humans. There is sufficient evidence to establish a causal relationship between human exposure to the substance and impaired fertility.
Substances known to cause developmental toxicity in humans. There is sufficient evidence to establish a causal relationship between human exposure to the substance and subsequent developmental toxic effects in the progeny.
- Toxic to Reproduction Category 2: Substances which should be regarded as if they impair fertility in humans. There is sufficient evidence to provide a strong presumption that human exposure to the substance may result in impaired fertility on the basis of:
- clear evidence in animal studies of impaired fertility in the absence of toxic effects, or, evidence of impaired fertility occurring at around the same dose levels as other toxic effects but which is not a secondary nonspecific consequence of the other toxic effects,
- other relevant information.
Substances which should be regarded as if they cause developmental toxicity to humans. There is sufficient evidence to provide a strong presumption that human exposure to the substance may result in developmental toxicity, generally on the basis of:
- clear results in appropriate animal studies where effects have been observed in the absence of signs of marked maternal toxicity, or at around the same dose levels as other toxic effects but which are not a secondary non-specific consequence of the other toxic effects,
- other relevant information.
- PBT & vPvB: Substances which are persistent, bioaccumulative and toxic (PBT) or very persistent and very bioaccumulative (vPvB) pose a particular challenge to the chemicals safety management. For these substances a "safe" concentration in the environment cannot be established with sufficient reliability.

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Revision History

Date	No.	Revision History	Writer	
			Drawn	Approved
2012.12.13	001	New version	J.W.PARK	Y.T.KIM
2013.01.25	002	To add VOCs at 11.Precaution For Use	J.W.PARK	Y.T.KIM
2013.04.03	003	Update Cx, Cy tol. : $\pm 0.01 \rightarrow \pm 0.005$ added CRI78 2700K code	J.W.PARK	Y.T.KIM