

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]
- Reliability Test : Refer to page 25

SAMSUNG ELECTRONICS

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

Copyright © 2009-2011 SAMSUNG ELECTRONICS Co.,Ltd. All rights reserved. The information in this document is subject to change without notice. SAMSUNG,  SAMSUNG is a registered trademark of SAMSUNG ELECTRONICS.

Contents

1. Product Code Information	-----	3
2. Luminous Flux Characteristics	-----	9
3. Characteristics	-----	13
4. Typical Characteristics Graph	-----	15
5. Outline Drawing & Dimension	-----	23
6. Reliability Test Items & Conditions	-----	24
7. Solder Conditions	-----	25
8. Tape & Reel	-----	26
9. Label Structure	-----	27
10. Packing Structure	-----	28
11. Kitting Rule	-----	30
12. Precaution For Use	-----	35
13. Hazard Substance Analysis Report	-----	37
Revision History	-----	62



1. Product Code Information

1) Luminous Flux Bins (Ts = 25°C)

Nominal CCT	Product Code	Flux Rank	Sorting Condition Im@100mA	
			Flux Bin	Flux Range (lm)
2700K	SPMWHT325AD5YBW0S0 SPMWHT325AD5YBWKS2	S0 S2↑	S1	51 ~ 58
			S2	58 ~ 68
			S3	68 ~ 78
3000K	SPMWHT325AD5YBV0S0 SPMWHT325AD5YBVKS2	S0 S2↑	S1	51 ~ 60
			S2	60 ~ 70
			S3	70 ~ 80
3500K	SPMWHT325AD5YBU0S0 SPMWHT325AD5YBUKS2	S0 S2↑	S1	51 ~ 63
			S2	63 ~ 73
			S3	73 ~ 83
4000K	SPMWHT325AD5YBT0S0 SPMWHT325AD5YBTKS2	S0 S2↑	S1	55 ~ 65
			S2	65 ~ 75
			S3	75 ~ 85
5000K	SPMWHT325AD5YBR0S0	S0	S1	55 ~ 66
			S2	66 ~ 76
			S3	76 ~ 86
5700K	SPMWHT325AD5YBQ0S0	S0	S1	55 ~ 65
			S2	65 ~ 75
			S3	75 ~ 85
6100K	SPMWHT325AD5YBPQS0	S0	S1	55 ~ 65
			S2	65 ~ 75
			S3	75 ~ 85
6500K	SPMWHT325AD5YBP0S0	S0	S1	55 ~ 65
			S2	65 ~ 75
			S3	75 ~ 85

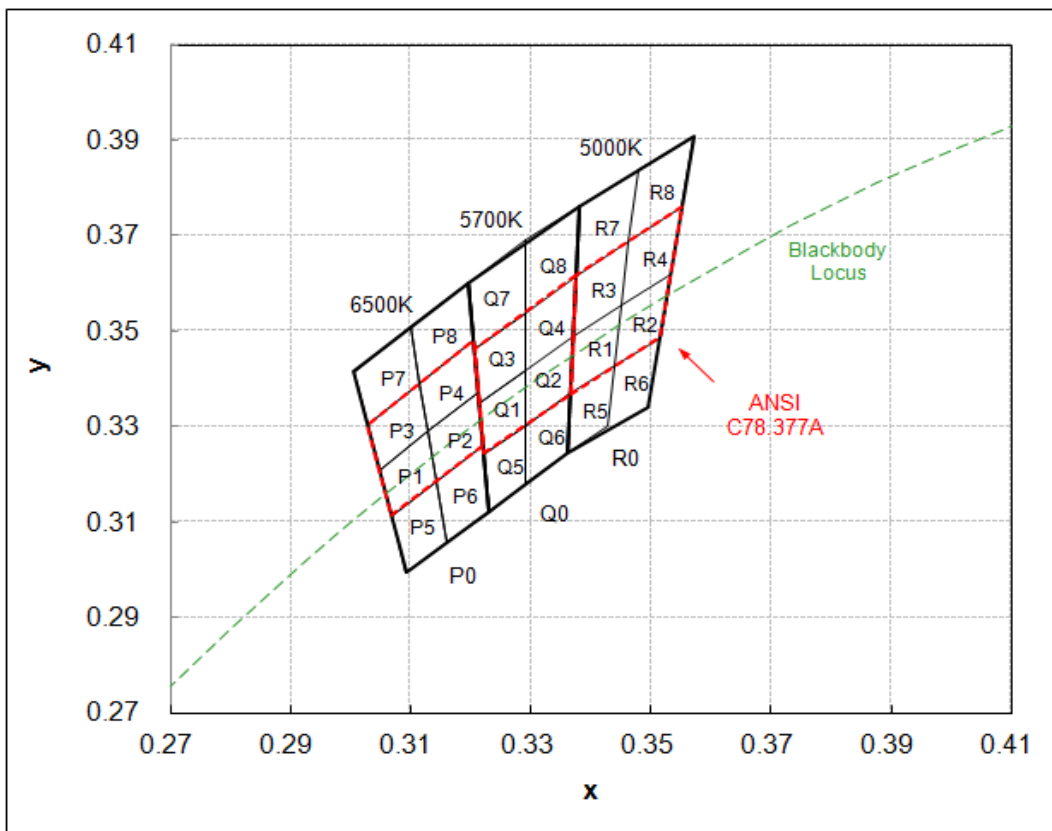
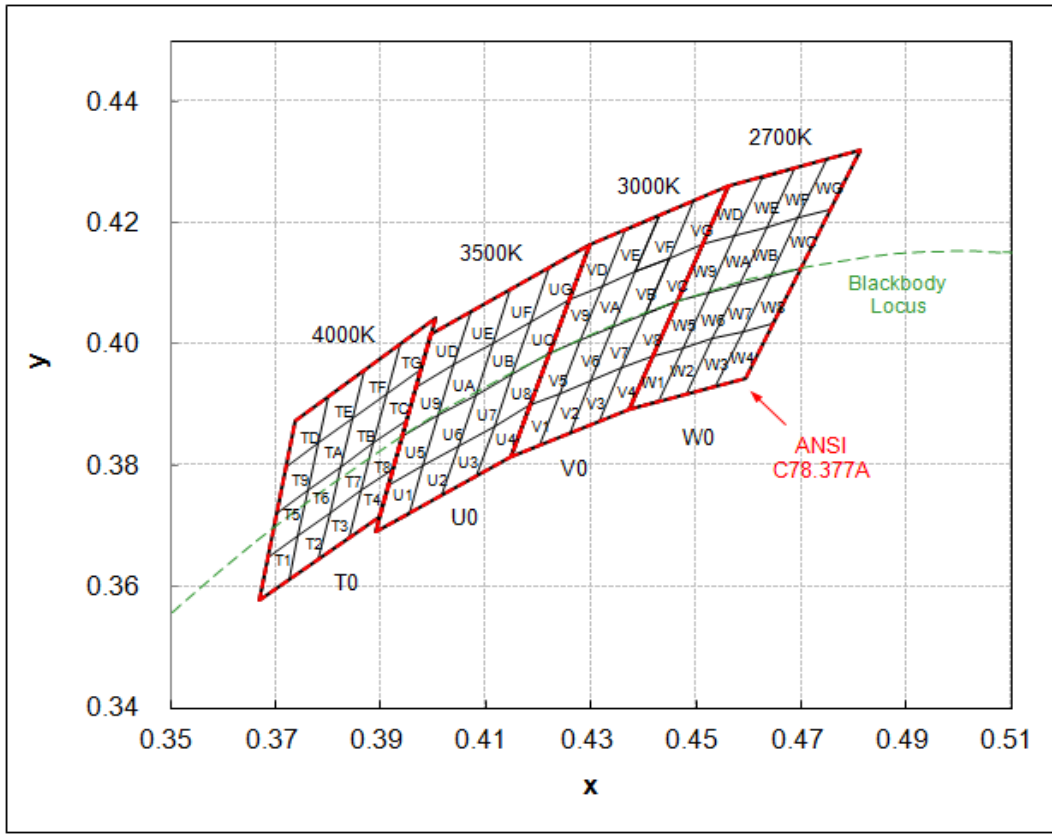
Notes: SAMSUNG ELECTRONICS maintains a tolerance of $\pm 5\%$ on Luminous Flux measurements

2) 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 (Quater Bin)	W6,W7,WA,WB
	SPMWHT325AD5YBWKS2	WK (Kitting Bin)	-
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 (Quater Bin)	V6,V7,VA,VB
	SPMWHT325AD5YBVKS2	VK (Kitting Bin)	-
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 (Quater Bin)	U6,U7,UA,UB
	SPMWHT325AD5YBUKS2	UK (Kitting Bin)	-
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 (Quater Bin)	T6,T7,TA,TB
	SPMWHT325AD5YBTKS2	TK (Kitting Bin)	-
5000K	SPMWHT325AD5YBR0S0	R0 (Whole Bin)	R1,R2,R3,R4,R5,R6,R7,R8,
	SPMWHT325AD5YBRMS0	RM (Quater Bin)	R1,R2,R3,R4
5700K	SPMWHT325AD5YBQ0S0	Q0 (Whole Bin)	Q1,Q2,Q3,Q4,Q5,Q6,Q7,Q8,
	SPMWHT325AD5YBQMS0	QM (Quater Bin)	Q1,Q2,Q3,Q4
6100K	SPMWHT325AD5YBPQS0	PQ(Special Bin)	P2,P4,P8,Q1,Q3,Q7
6500K	SPMWHT325AD5YBP0S0	P0 (Whole Bin)	P1,P2,P3,P4,P5,P6,P7,P8,
	SPMWHT325AD5YBPMS0	PM (Quater 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 ¹⁾	If(mA)	Vf(V)	Power(W)	Flux(lm)	lm/W
2700K	80	50	5.71	0.29	33	116
		100	5.96	0.60	61	103
		110	5.99	0.66	66	101
		120	6.03	0.72	72	99
		130	6.06	0.79	77	98
		140	6.09	0.85	82	96
		150	6.11	0.92	87	95
		160	6.14	0.98	91	93
		170	6.17	1.05	96	91
		180	6.20	1.12	100	90
		190	6.23	1.18	104	88
		200	6.27	1.25	109	87
3000K	80	50	5.71	0.29	34	120
		100	5.96	0.60	64	108
		110	5.99	0.66	70	106
		120	6.03	0.72	75	104
		130	6.06	0.79	81	102
		140	6.09	0.85	85	100
		150	6.11	0.92	91	99
		160	6.14	0.98	96	98
		170	6.17	1.05	101	96
		180	6.20	1.12	106	95
		190	6.23	1.18	111	93
		200	6.27	1.25	115	92



Nominal CCT	Minimum CRI ¹⁾	If(mA)	Vf(V)	Power(W)	Flux(lm)	lm/W
3500K	80	50	5.71	0.29	35	124
		100	5.96	0.60	65	109
		110	5.99	0.66	69	105
		120	6.03	0.72	75	103
		130	6.06	0.79	80	102
		140	6.09	0.85	84	99
		150	6.11	0.92	90	98
		160	6.14	0.98	96	97
		170	6.17	1.05	100	95
		180	6.20	1.12	105	94
		190	6.23	1.18	108	91
		200	6.27	1.25	112	89
4000K	80	50	5.71	0.29	36	127
		100	5.96	0.60	68	114
		110	5.99	0.66	74	112
		120	6.03	0.72	79	110
		130	6.06	0.79	85	108
		140	6.09	0.85	90	106
		150	6.11	0.92	96	104
		160	6.14	0.98	101	102
		170	6.17	1.05	105	100
		180	6.20	1.12	109	97
		190	6.23	1.18	113	96
		200	6.27	1.25	118	94



Nominal CCT	Minimum CRI ¹⁾	If(mA)	Vf(V)	Power(W)	Flux(lm)	lm/W
5000K	80	50	5.71	0.29	37	131
		100	5.96	0.60	69	116
		110	5.99	0.66	76	115
		120	6.03	0.72	82	113
		130	6.06	0.79	87	111
		140	6.09	0.85	93	109
		150	6.11	0.92	98	107
		160	6.14	0.98	104	105
		170	6.17	1.05	108	103
		180	6.20	1.12	114	102
		190	6.23	1.18	120	101
		200	6.27	1.25	124	99



Nominal CCT	Minimum CRI ¹⁾	If(mA)	Vf(V)	Power(W)	Flux(lm)	lm/W
5700K	80	50	5.71	0.29	38	132
		100	5.96	0.60	69	116
		110	5.99	0.66	75	114
		120	6.03	0.72	81	112
		130	6.06	0.79	87	110
		140	6.09	0.85	92	108
		150	6.11	0.92	98	107
		160	6.14	0.98	103	105
		170	6.17	1.05	108	103
		180	6.20	1.12	113	101
		190	6.23	1.18	118	100
		200	6.27	1.25	123	98
6500K	80	50	5.71	0.29	38	133
		100	5.96	0.60	69	115
		110	5.99	0.66	76	114
		120	6.03	0.72	82	113
		130	6.06	0.79	87	111
		140	6.09	0.85	93	109
		150	6.11	0.92	98	107
		160	6.14	0.98	102	104
		170	6.17	1.05	106	101
		180	6.20	1.12	112	100
		190	6.23	1.18	117	99
		200	6.27	1.25	123	98

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
Assembly Process Temperature	-	260°C, < 10sec	-
ESD	-	5kV	HBM

2) Electro-optical Characteristics – Voltage and CRI

Item	Unit	Rank	Min	Typ	Max	
Forward Voltage (@100 mA, $T_s = 25^\circ\text{C}$)	V	YB	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, $T_s = 25^\circ\text{C}$)	V	-	0.7	-	1.2	
Color Rendering Index	Ra	5	80	-	-	
Thermal resistance($R_{th, j-s}$)	°C	-	-	15	-	

Notes:

1)~2) SAMSUNG ELECTRONICS maintains a tolerance of $V_F: \pm 0.1$ V, $\Phi_V: \pm 5$ %, $R_a: \pm 3.0$ on measurements

3) Electro-optical Characteristics – Luminous Intensity and Flux

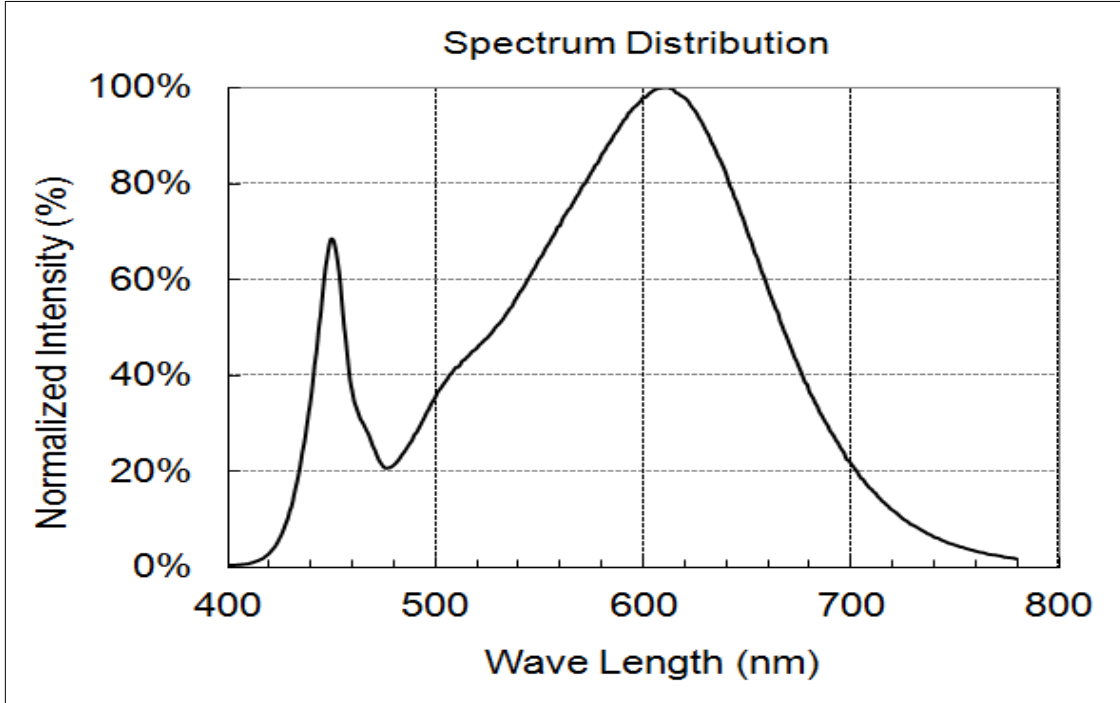
Item	Unit	CCT	Rank	Min	Typ	Max	
Luminous Flux (@100 mA, Ts = 25°C)	lm	2700K	S0	S1	51.0	-	58.0
				S2	58.0	-	68.0
				S3	68.0	-	78.0
		3000K	S0	S1	51.0	-	60.0
				S2	60.0	-	70.0
				S3	70.0	-	80.0
		3500K	S0 ⁴⁾	S1	51.0		63.0
				S2	63.0		73.0
				S3	73.0		83.0
		4000K 5700K 6500K	S0	S1	55.0		65.0
				S2	65.0		75.0
				S3	75.0		85.0
		5000K	S0	S1	55.0		66.0
				S2	66.0		76.0
				S3	76.0		86.0

4. Typical Characteristics Graph (@100mA)

1) Spectrum Distribution

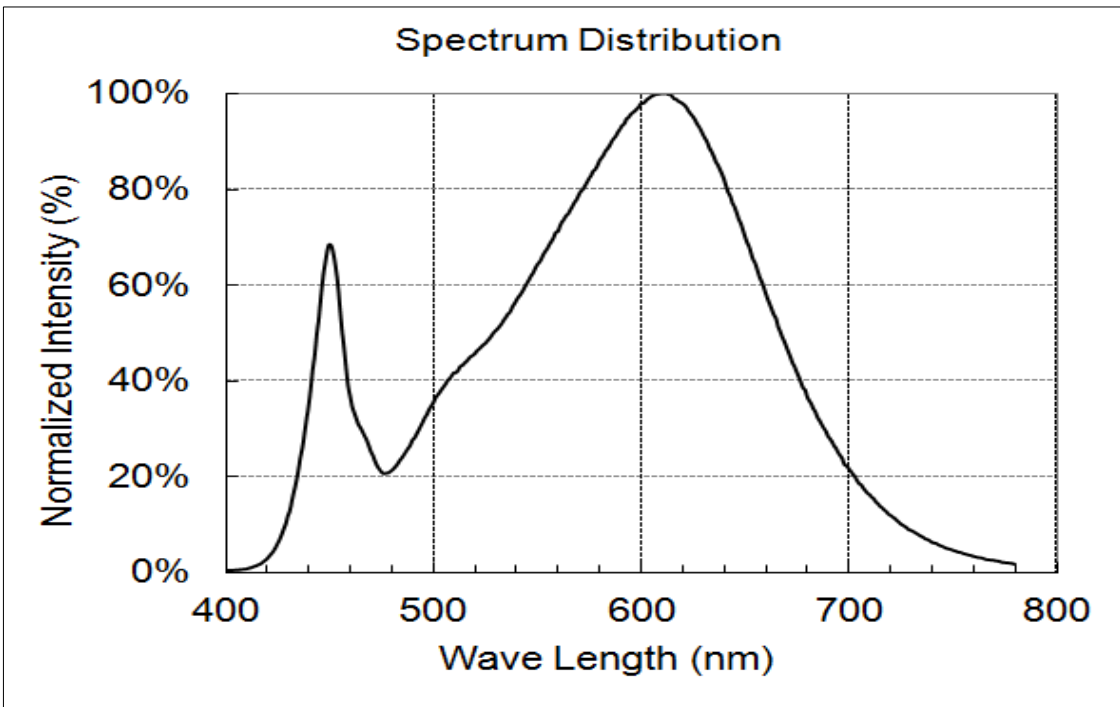
2700K

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



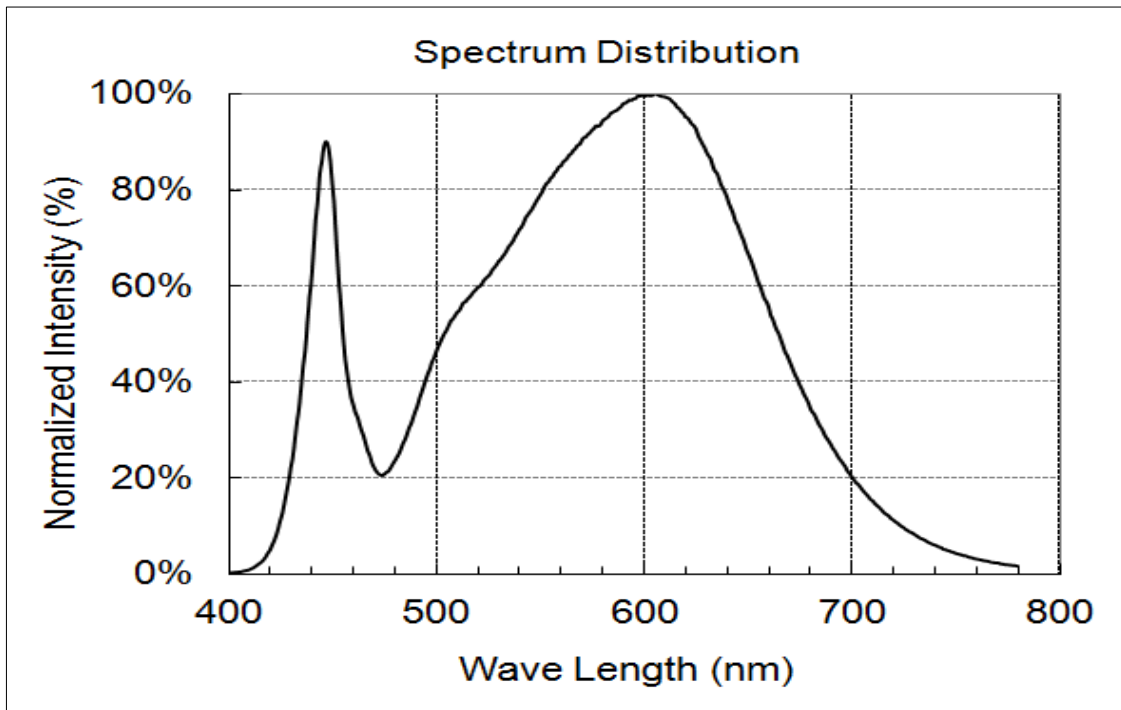
3000K

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



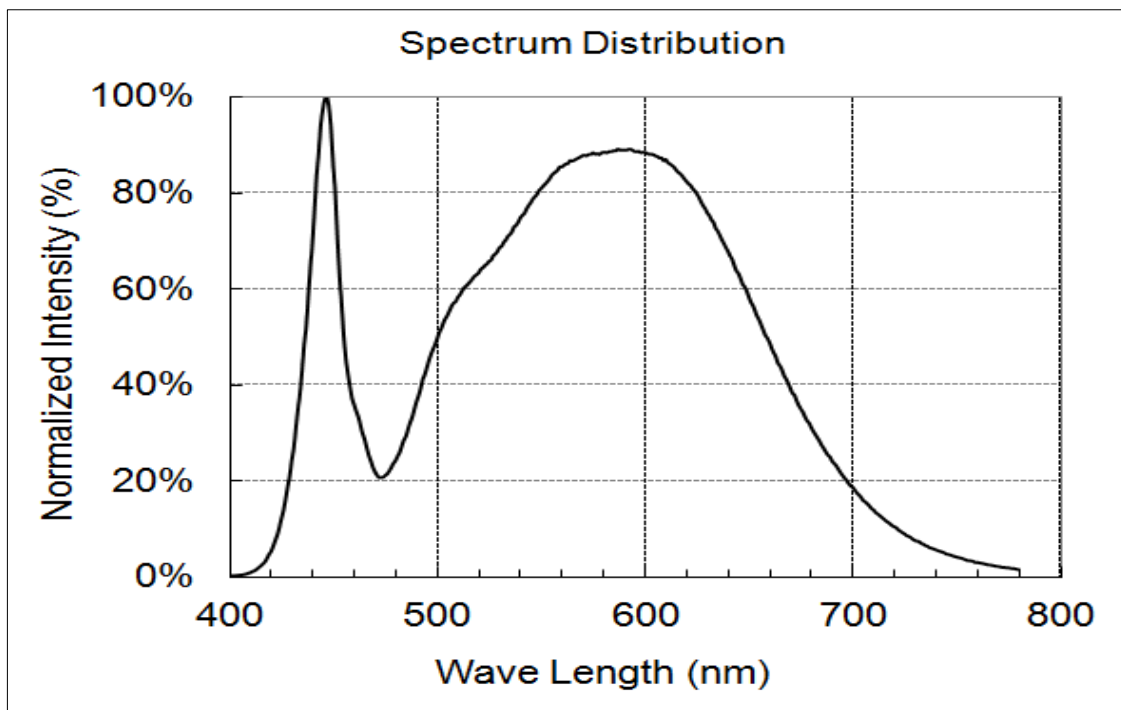
3500K

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



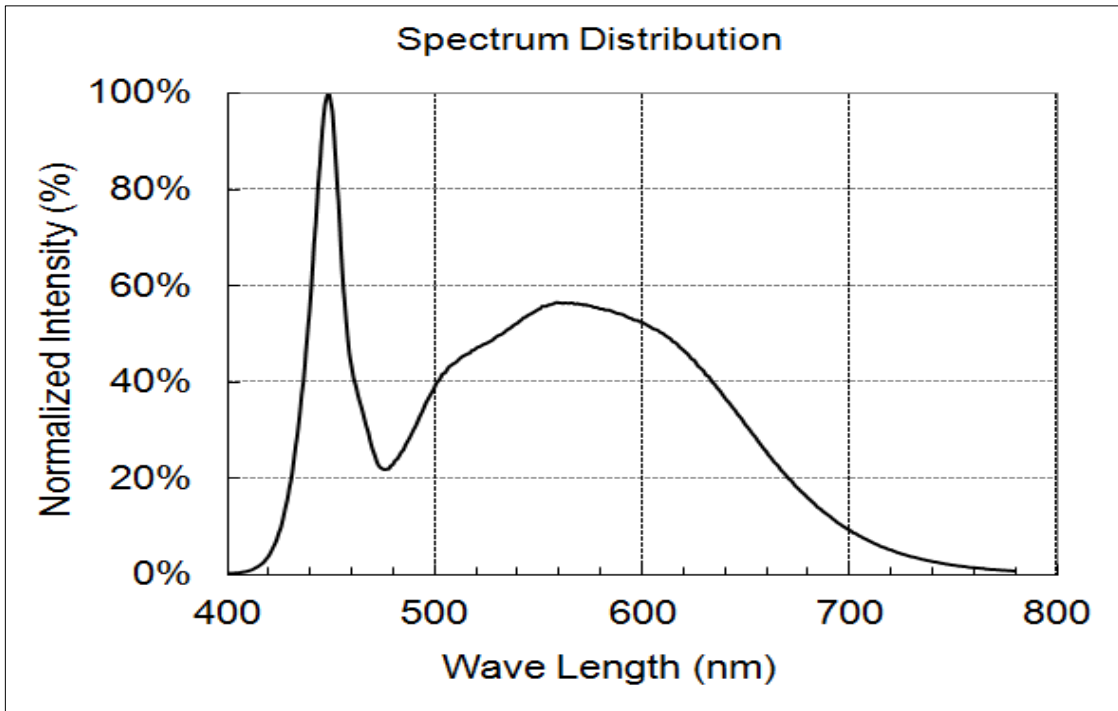
4000K

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



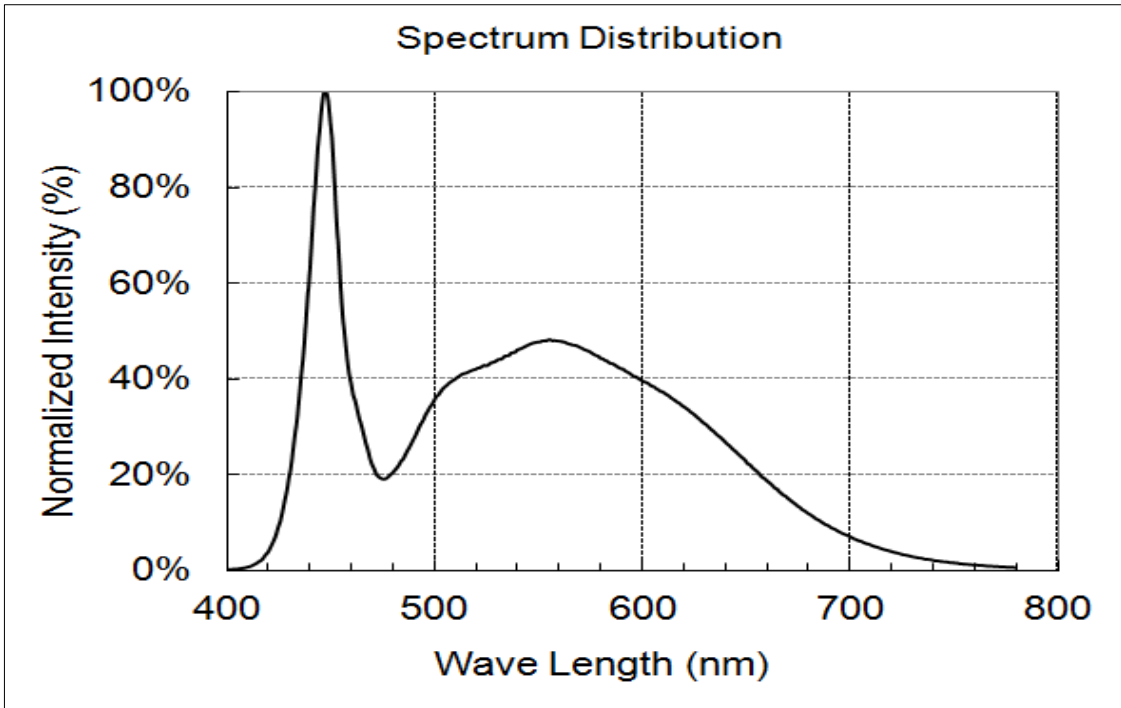
5000K - CRI80

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



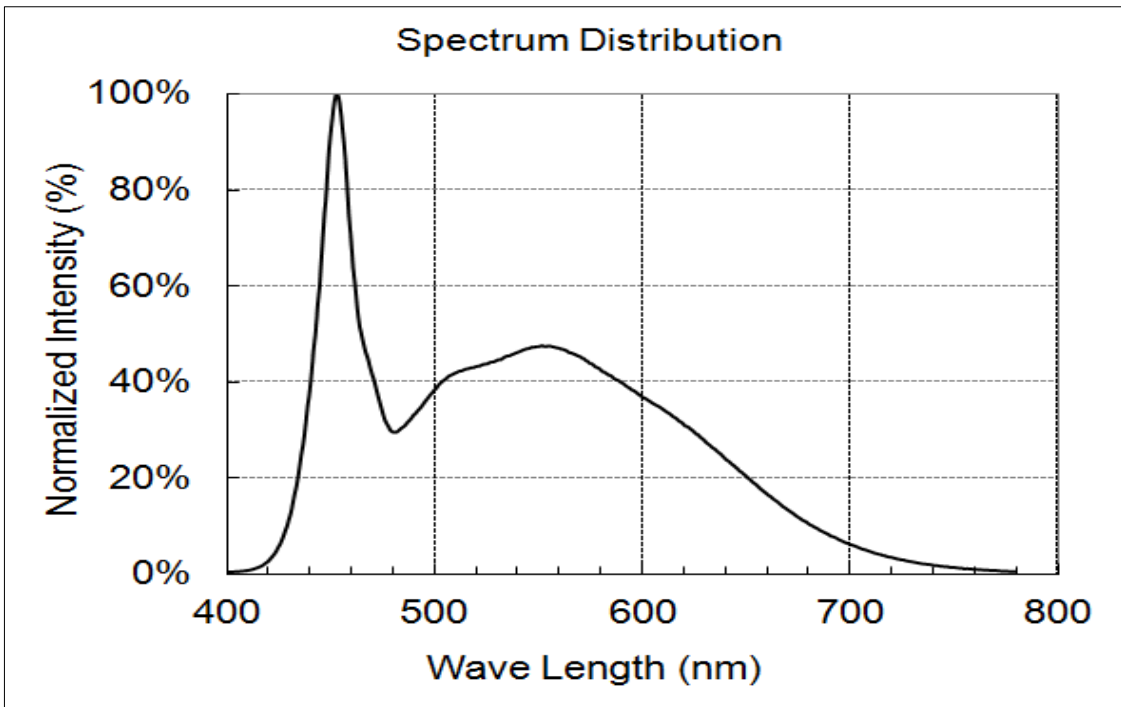
5700K

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



6500K

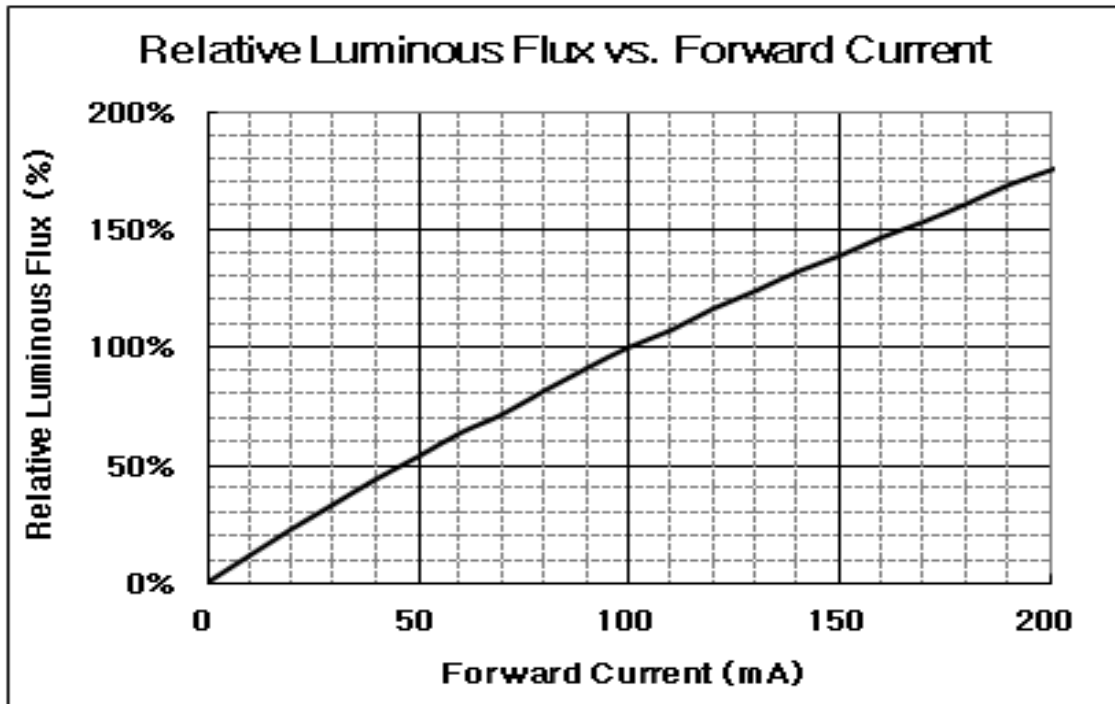
$T_s = 25^\circ\text{C}$



2) Forward Current Characteristics

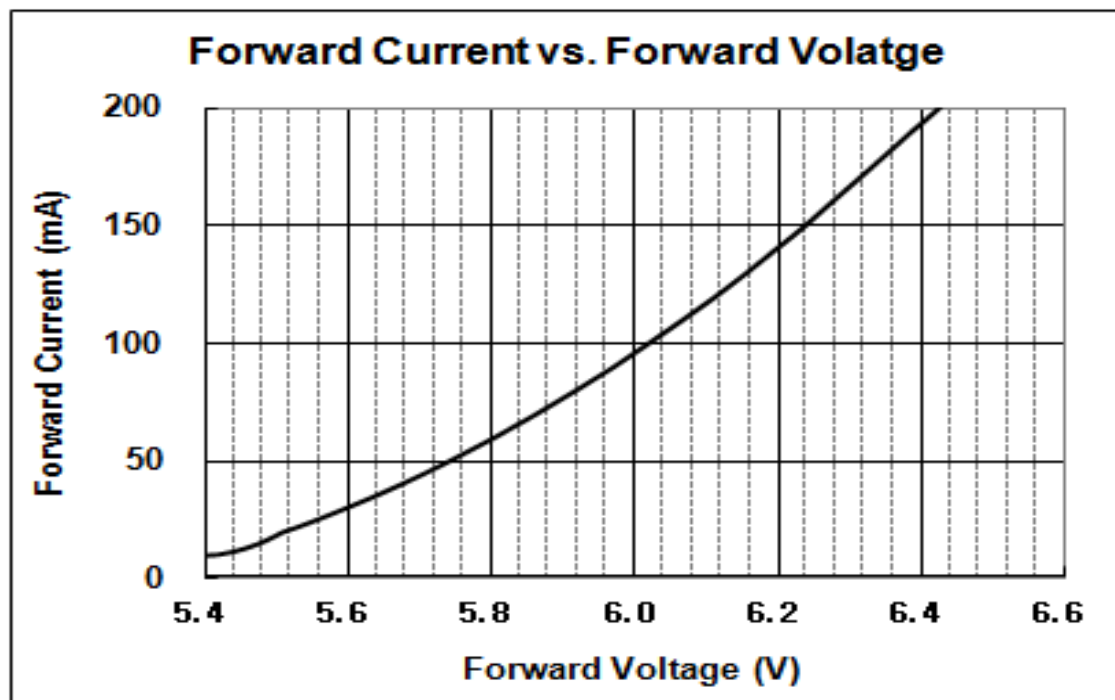
Relative Luminous Flux vs. Forward Current

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



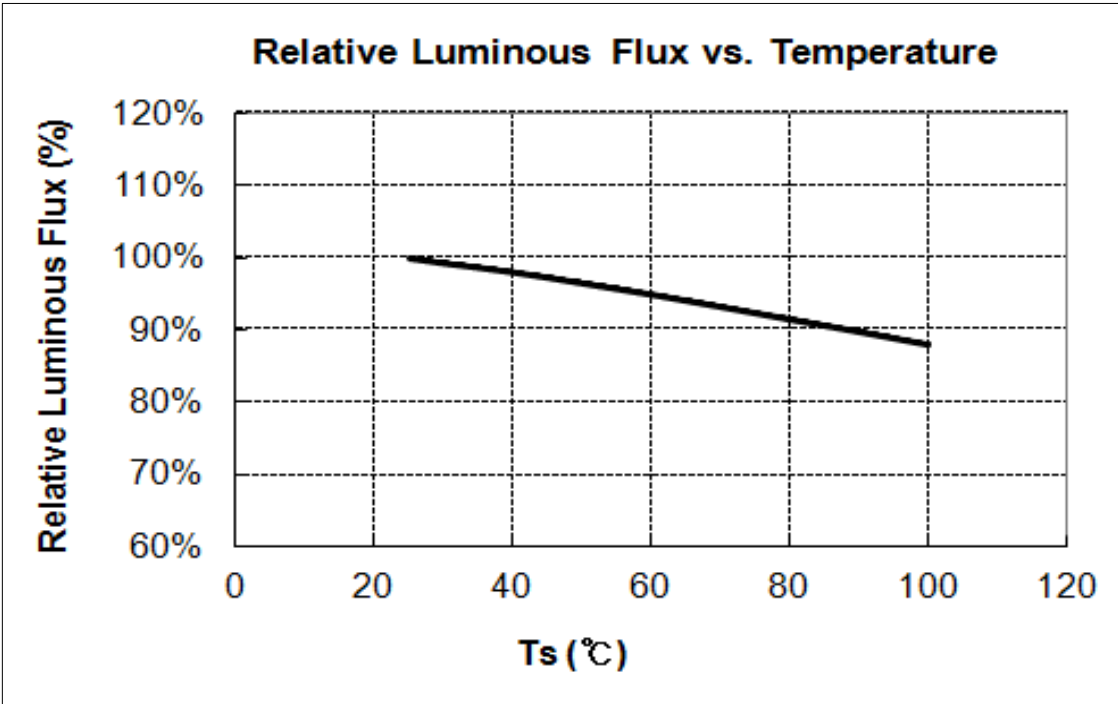
Forward Current vs. Forward Voltage

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

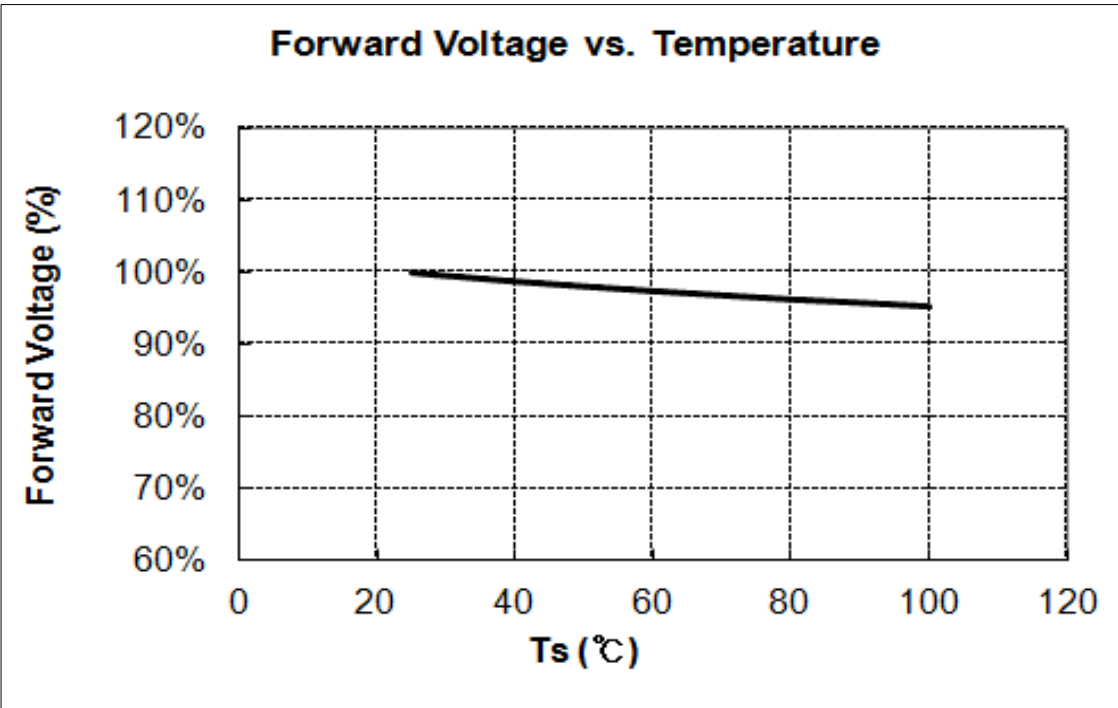


3) Temperature Characteristics (@100mA)

Relative Luminous Flux vs. Ts(solder temp.)



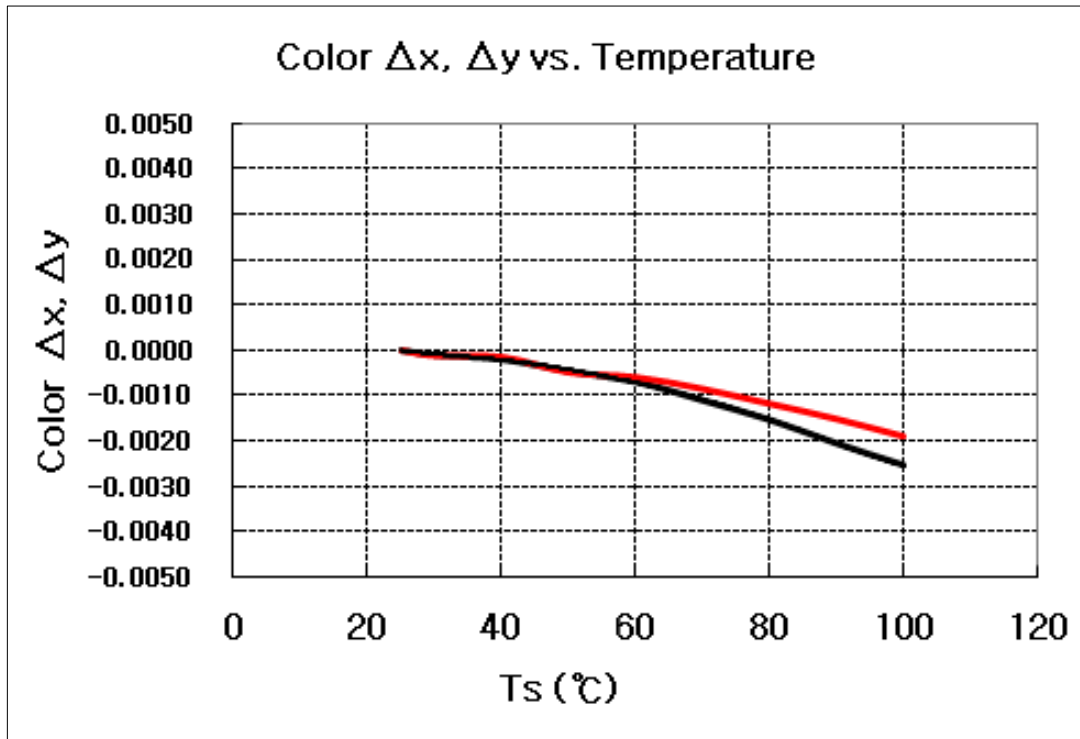
Forward Voltage vs. Ts(solder temp.)



4) Color shift Characteristics

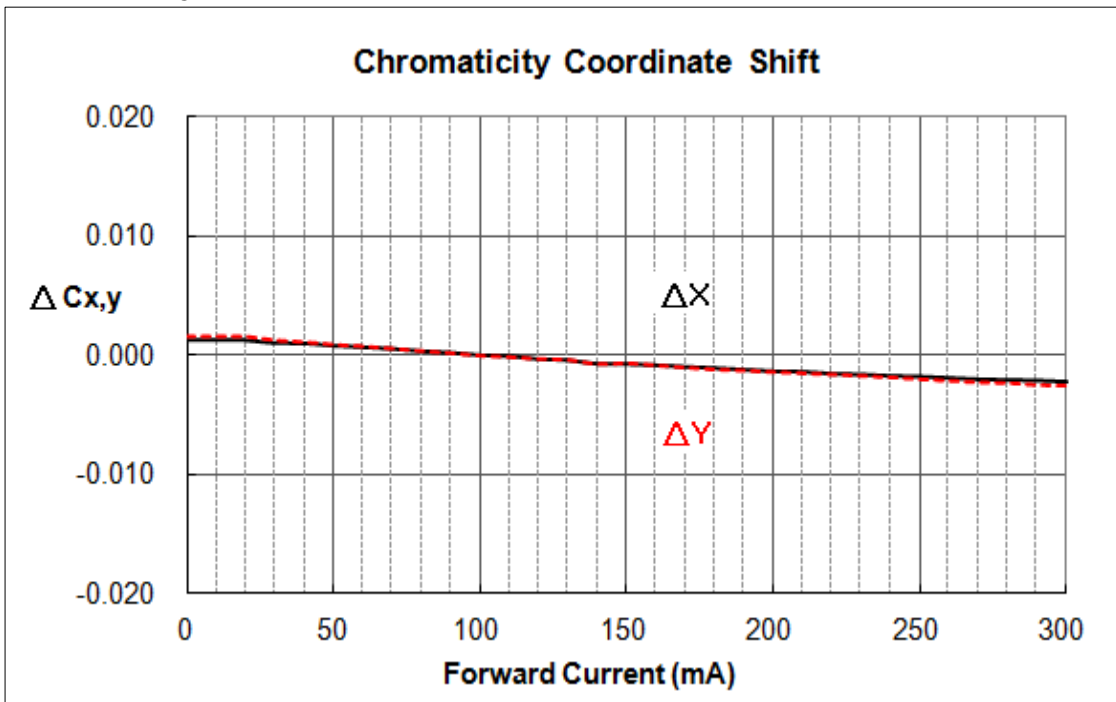
Color Δx , Δy vs. T_s (solder temp.) @100mA

CCT : 5000K



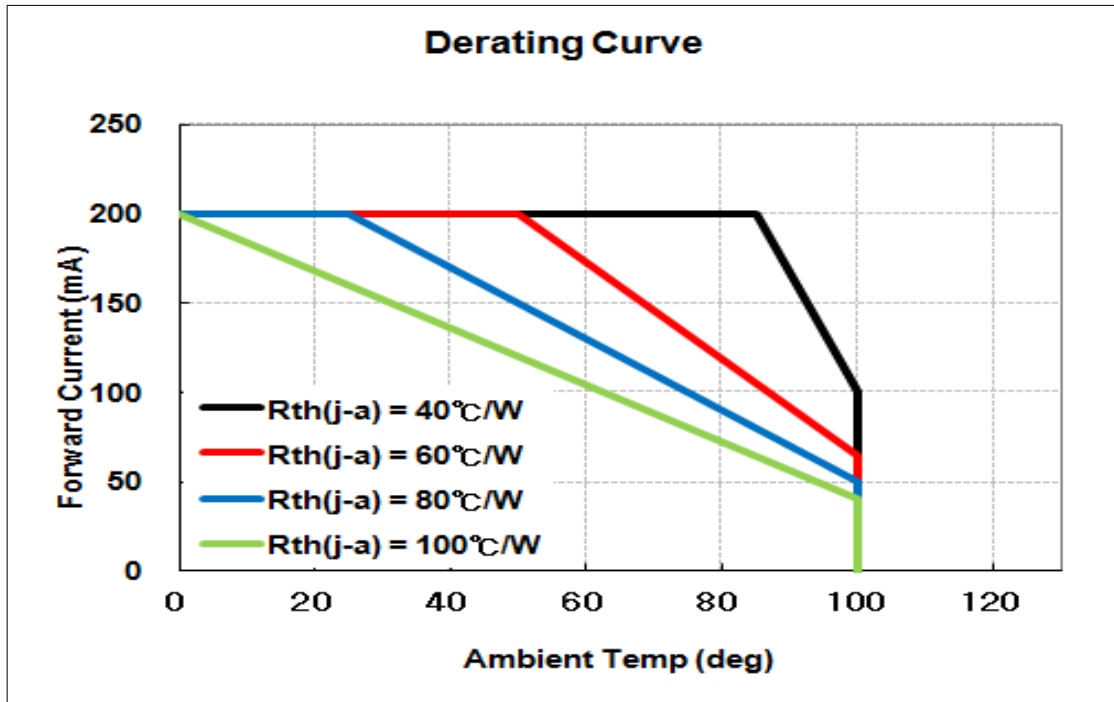
Color Δx , Δy vs. Forward Current

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



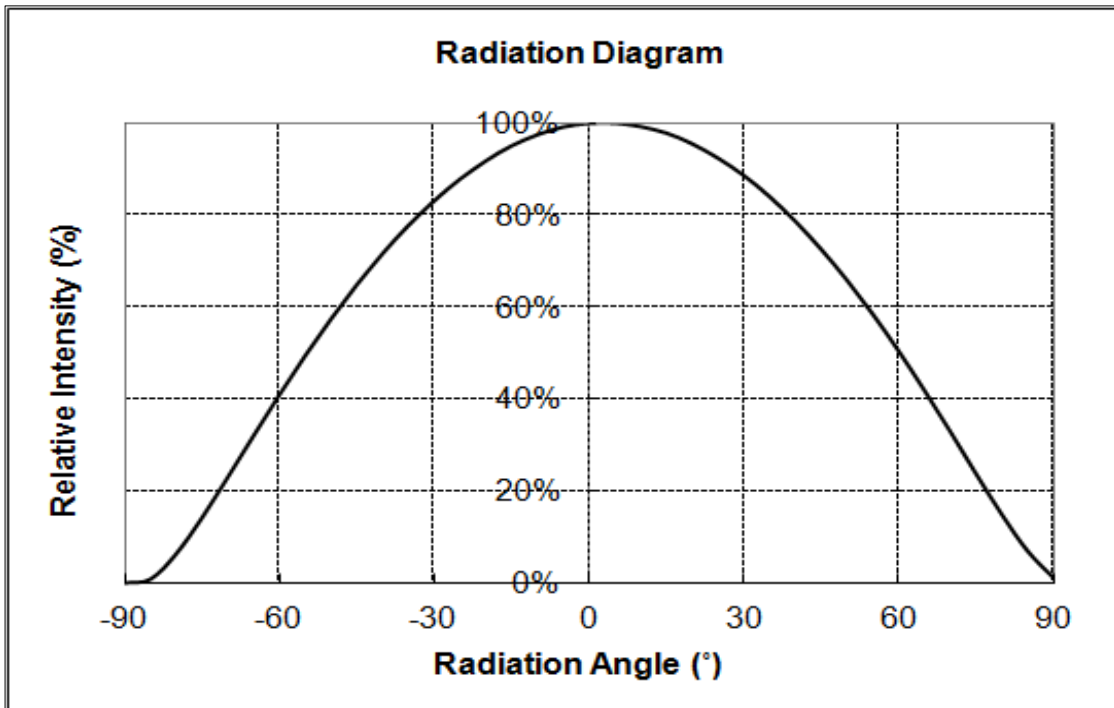
5) Derating Curve

$T_a = 25^\circ\text{C}$

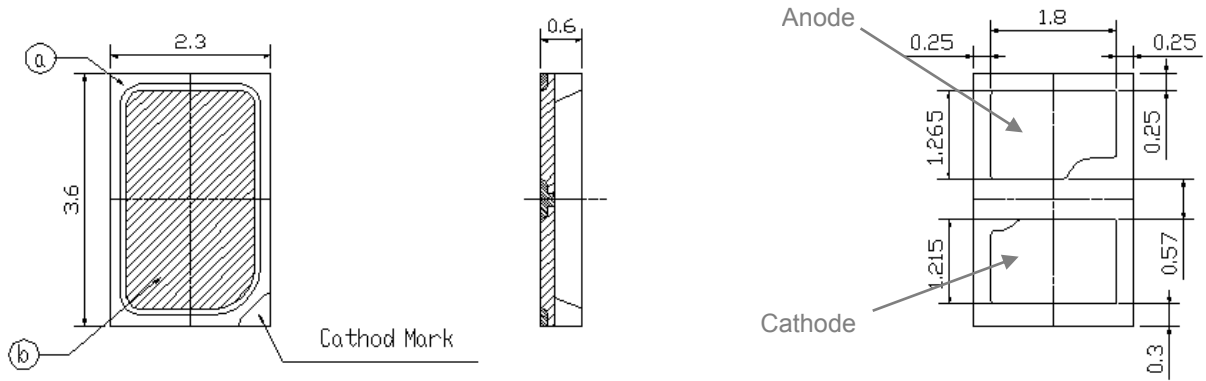


6) Viewing Angle Characteristics (@10mA, $T_s = 25^\circ\text{C}$)

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

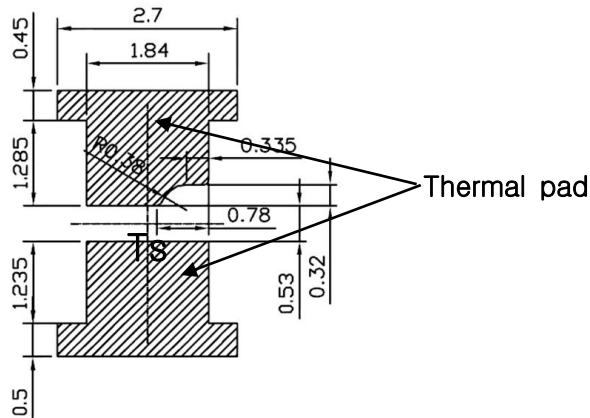


5. Outline Drawing and Dimension



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

Recommended Land Pattern

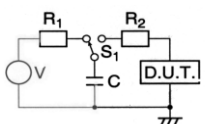


Notes:

- 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. 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) The thermal pad is electrically connected to the cathode contact pads.
- 4) 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,	5 cycles	11	

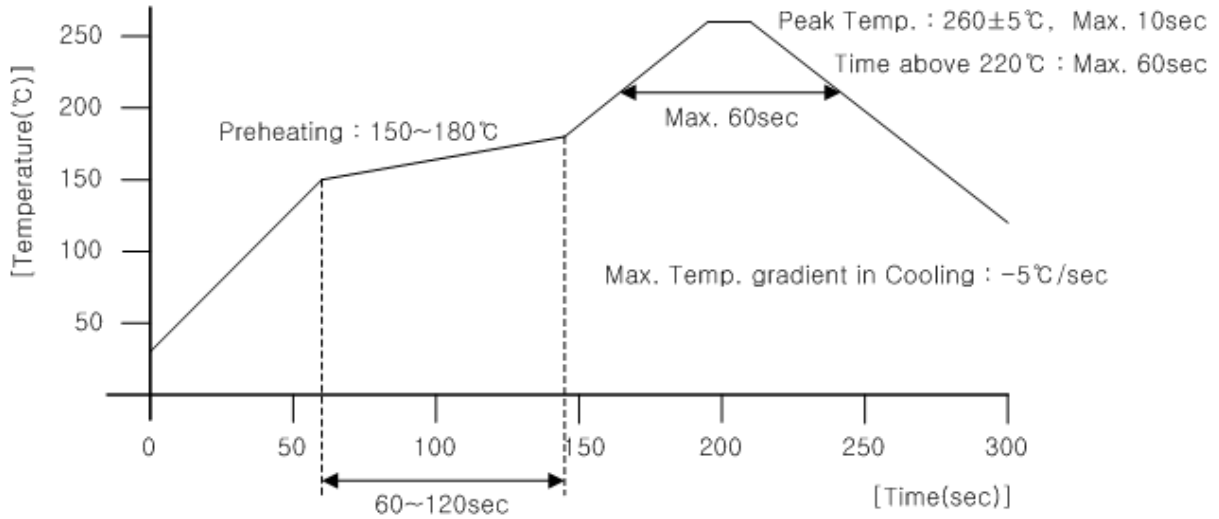
2) Criteria for Judging the Damage

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)

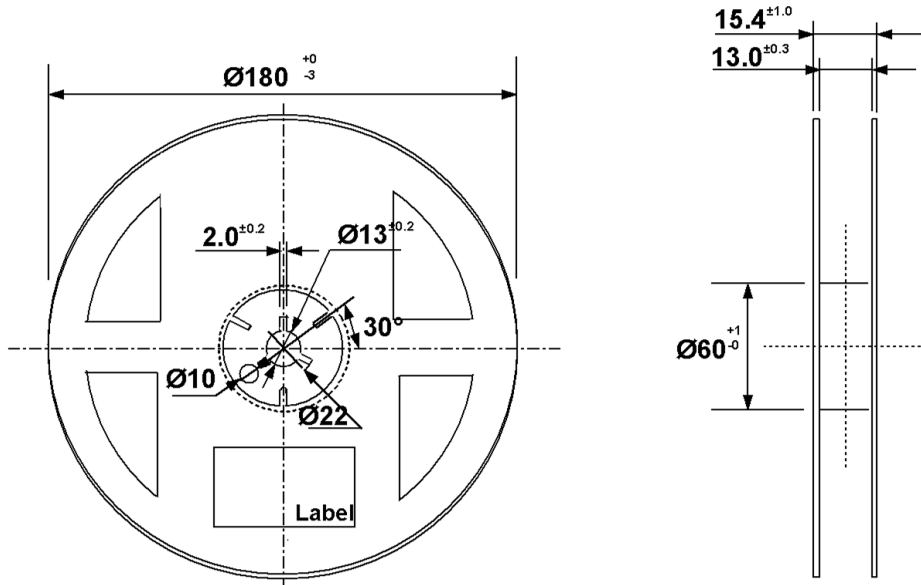
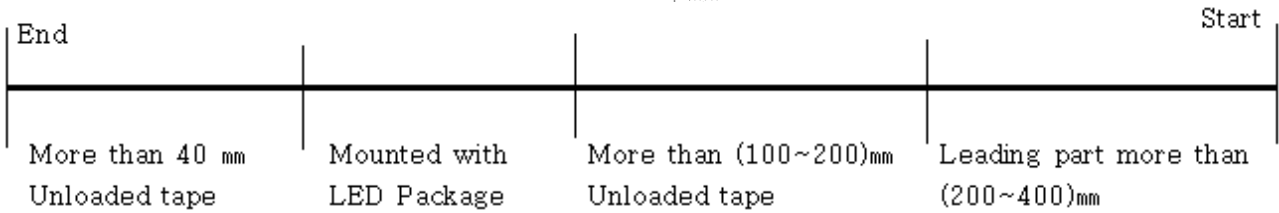
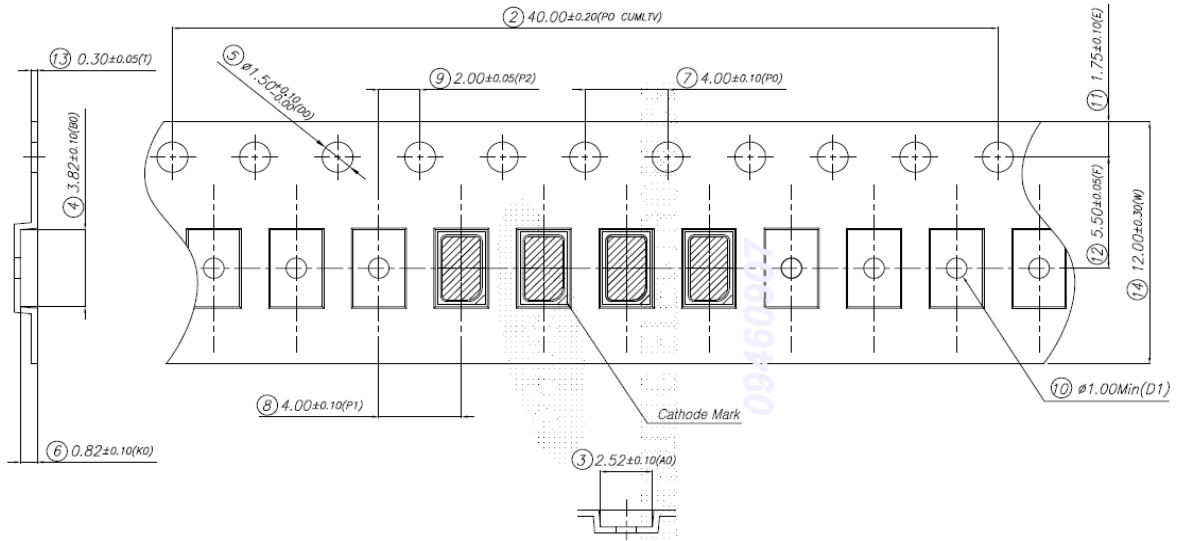
Reflow Frequency : 2 times max.



2) For Manual Soldering

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

8. Tape And Reel



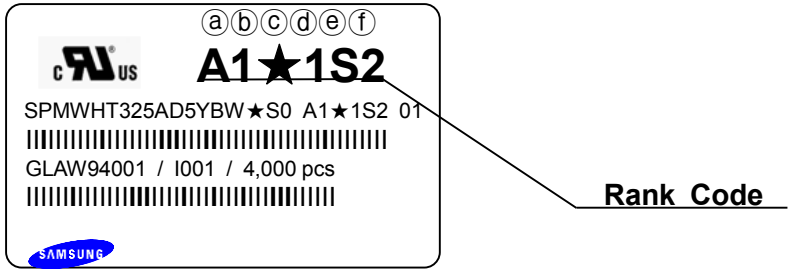
Tolerance ± 0.2 , Unit:mm

- (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

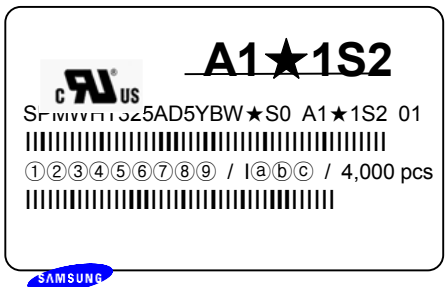


Rank Code

- ⒶⒷ : Forward Voltage Rank
- ⒸⒹ : Chromaticity Coordinate Rank
- ⒺⒻ : Luminous Intensity Rank

2) LOT Number

The Lot number is composed of the following characters



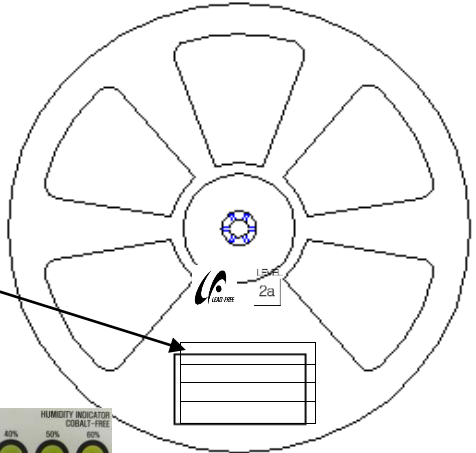
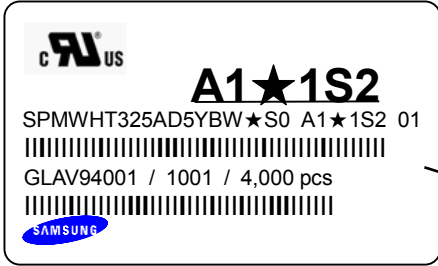
①②③④⑤⑥⑦⑧⑨ / IⒶⒷⒸ / 4,000 PCS

- 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 (X:2013, Y:2014, Z :2015, A:2016...)
- ⑤ : Month (1 ~ 9, A, B, C)
- ⑥ : Day (1 ~ 9, A, B ~ V)
- ⑦⑧⑨ : SAMSUNG LED Product number (1 ~ 999)
- ⒶⒷⒸ : Reel Number (1 ~ 999)

10. Packing Structure

1) Packing Process - SPMWHT325AD5xxx☆xx (☆ = '0'. 'M'. 'H'. 'Q')

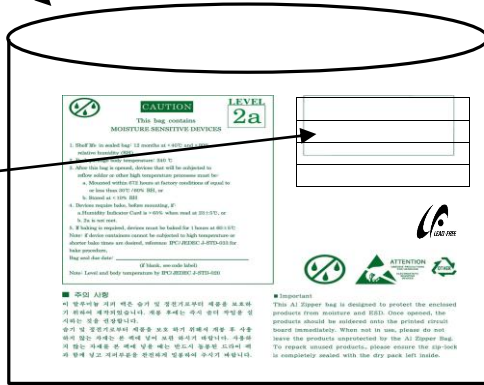
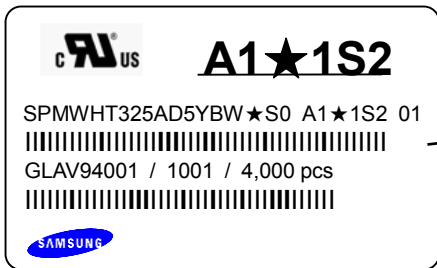
Reel



※ '★' means All kind of Chromaticity Coordinate Rank.



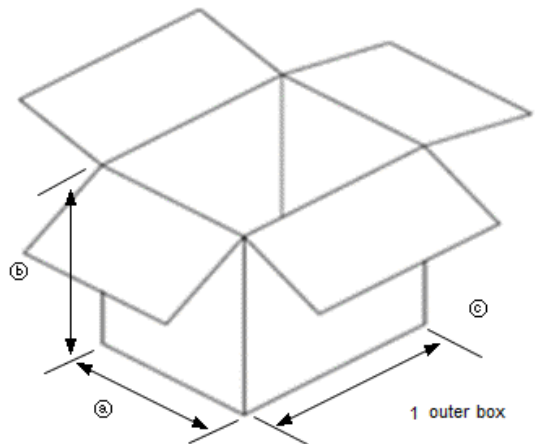
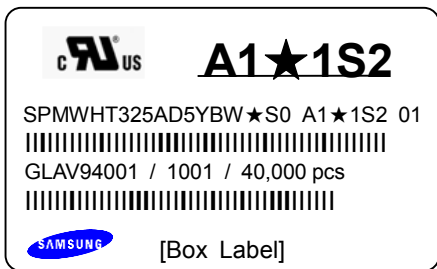
Aluminum Vinyl Bag



Material : Paper(SW3B(B))

TYPE	SIZE(mm)			Reels/ box
	a	b	c	
7inch	245±5	220±5	182±5	Up to 10 Reels
	245±5	220±5	86±5	Up to 5 Reels

① SIDE



2) Aluminum Packing Bag



CAUTION

This bag contains
MOISTURE SENSITIVE DEVICES

LEVEL

2a

1. Shelf life in sealed bag: 12 months at <math>< 40^{\circ}\text{C}</math> and <math>< 90\%</math> relative humidity (RH)
2. Peak package body temperature: 240 °C
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°C / 60% RH, or
 - b. Stored at <math>< 10\%</math> RH
4. Devices require bake, before mounting, if:
 - a. Humidity Indicator Card is >60% when read at 23±5°C, or
 - b. 2a is not met.
5. If baking is required, devices must be baked for 10 ~ 24 hours at 60±5°C

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



LEAD-FREE





ATTENTION
OBSERVE PRECAUTIONS
FOR HANDLING
ELECTROSTATIC
SENSITIVE
DEVICES



OTHER

주의 사항

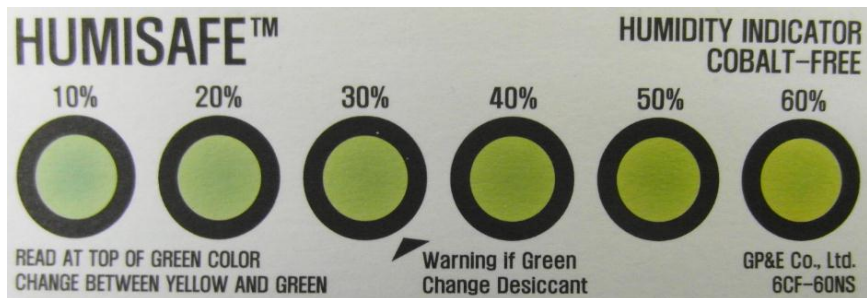
이 알루미늄 지퍼 팩은 습기 및 정전기로부터 제품을 보호하기 위하여 제작되었습니다. 개봉 후에는 즉시 솔더 작업을 실시하는 것을 권장합니다.

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.

Silica gel & Humidity Indicator Card in Aluminum Vinyl Bag





[Kitting combination – 2700K, 3000K, 3500K and 4000K]

-	RANK 1	RANK 2	RANK 1	RANK 2	RANK 1	RANK 2	RANK 1	RANK 2	RANK 1	RANK 2	RANK 1	RANK 2
1	A1☆1S2	A1☆FS2	A1☆6S2	A1☆CS2	A1☆DS2	A1☆7S2	A2☆1S2	A2☆GS2	A2☆9S2	A2☆BS2	A2☆DS2	A2☆8S2
2	A1☆1S2	A1☆FS3	A1☆6S2	A1☆CS3	A1☆DS2	A1☆7S3	A2☆1S2	A2☆GS3	A2☆9S2	A2☆BS3	A2☆DS2	A2☆8S3
3	A1☆1S3	A1☆FS3	A1☆6S3	A1☆CS3	A1☆DS3	A1☆7S3	A2☆1S3	A2☆GS3	A2☆9S3	A2☆BS3	A2☆DS3	A2☆8S3
4	A1☆1S2	A1☆BS2	A1☆6S2	A1☆8S2	A1☆DS2	A1☆3S2	A2☆1S2	A2☆CS2	A2☆9S2	A2☆7S2	A2☆DS2	A2☆4S2
5	A1☆1S2	A1☆BS3	A1☆6S2	A1☆8S3	A1☆DS2	A1☆3S3	A2☆1S2	A2☆CS3	A2☆9S2	A2☆7S3	A2☆DS2	A2☆4S3
6	A1☆1S3	A1☆BS3	A1☆6S3	A1☆8S3	A1☆DS3	A1☆3S3	A2☆1S3	A2☆CS3	A2☆9S3	A2☆7S3	A2☆DS3	A2☆4S3
7	A1☆1S2	A1☆GS2	A1☆9S2	A1☆BS2	A1☆DS2	A1☆8S2	A2☆2S2	A2☆FS2	A2☆9S2	A2☆3S2	A2☆ES2	A2☆6S2
8	A1☆1S2	A1☆GS3	A1☆9S2	A1☆BS3	A1☆DS2	A1☆8S3	A2☆2S2	A2☆FS3	A2☆9S2	A2☆3S3	A2☆ES2	A2☆6S3
9	A1☆1S3	A1☆GS3	A1☆9S3	A1☆BS3	A1☆DS3	A1☆8S3	A2☆2S3	A2☆FS3	A2☆9S3	A2☆3S3	A2☆ES3	A2☆6S3
10	A1☆1S2	A1☆CS2	A1☆9S2	A1☆7S2	A1☆DS2	A1☆4S2	A2☆2S2	A2☆BS2	A2☆9S2	A2☆CS2	A2☆ES2	A2☆2S2
11	A1☆1S2	A1☆CS3	A1☆9S2	A1☆7S3	A1☆DS2	A1☆4S3	A2☆2S2	A2☆BS3	A2☆9S2	A2☆CS3	A2☆ES2	A2☆2S3
12	A1☆1S3	A1☆CS3	A1☆9S3	A1☆7S3	A1☆DS3	A1☆4S3	A2☆2S3	A2☆BS3	A2☆9S3	A2☆CS3	A2☆ES3	A2☆2S3
13	A1☆2S2	A1☆FS2	A1☆9S2	A1☆3S2	A1☆ES2	A1☆6S2	A2☆2S2	A2☆GS2	A2☆9S2	A2☆8S2	A2☆ES2	A2☆7S2
14	A1☆2S2	A1☆FS3	A1☆9S2	A1☆3S3	A1☆ES2	A1☆6S3	A2☆2S2	A2☆GS3	A2☆9S2	A2☆8S3	A2☆ES2	A2☆7S3
15	A1☆2S3	A1☆FS3	A1☆9S3	A1☆3S3	A1☆ES3	A1☆6S3	A2☆2S3	A2☆GS3	A2☆9S3	A2☆8S3	A2☆ES3	A2☆7S3
16	A1☆2S2	A1☆BS2	A1☆9S2	A1☆CS2	A1☆ES2	A1☆2S2	A2☆2S2	A2☆CS2	A2☆9S2	A2☆4S2	A2☆ES2	A2☆3S2
17	A1☆2S2	A1☆BS3	A1☆9S2	A1☆CS3	A1☆ES2	A1☆2S3	A2☆2S2	A2☆CS3	A2☆9S2	A2☆4S3	A2☆ES2	A2☆3S3
18	A1☆2S3	A1☆BS3	A1☆9S3	A1☆CS3	A1☆ES3	A1☆2S3	A2☆2S3	A2☆CS3	A2☆9S3	A2☆4S3	A2☆ES3	A2☆3S3
19	A1☆2S2	A1☆GS2	A1☆9S2	A1☆8S2	A1☆ES2	A1☆7S2	A2☆5S2	A2☆FS2	A2☆AS2	A2☆6S2	A2☆ES2	A2☆8S2
20	A1☆2S2	A1☆GS3	A1☆9S2	A1☆8S3	A1☆ES2	A1☆7S3	A2☆5S2	A2☆FS3	A2☆AS2	A2☆6S3	A2☆ES2	A2☆8S3
21	A1☆2S3	A1☆GS3	A1☆9S3	A1☆8S3	A1☆ES3	A1☆7S3	A2☆5S3	A2☆FS3	A2☆AS3	A2☆6S3	A2☆ES3	A2☆8S3
22	A1☆2S2	A1☆CS2	A1☆9S2	A1☆4S2	A1☆ES2	A1☆3S2	A2☆5S2	A2☆BS2	A2☆AS2	A2☆2S2	A2☆ES2	A2☆4S2
23	A1☆2S2	A1☆CS3	A1☆9S2	A1☆4S3	A1☆ES2	A1☆3S3	A2☆5S2	A2☆BS3	A2☆AS2	A2☆2S3	A2☆ES2	A2☆4S3
24	A1☆2S3	A1☆CS3	A1☆9S3	A1☆4S3	A1☆ES3	A1☆3S3	A2☆5S3	A2☆BS3	A2☆AS3	A2☆2S3	A2☆ES3	A2☆4S3
25	A1☆5S2	A1☆FS2	A1☆AS2	A1☆6S2	A1☆ES2	A1☆8S2	A2☆5S2	A2☆7S2	A2☆AS2	A2☆BS2	A2☆FS2	A2☆7S2
26	A1☆5S2	A1☆FS3	A1☆AS2	A1☆6S3	A1☆ES2	A1☆8S3	A2☆5S2	A2☆7S3	A2☆AS2	A2☆BS3	A2☆FS2	A2☆7S3
27	A1☆5S3	A1☆FS3	A1☆AS3	A1☆6S3	A1☆ES3	A1☆8S3	A2☆5S3	A2☆7S3	A2☆AS3	A2☆BS3	A2☆FS3	A2☆7S3
28	A1☆5S2	A1☆BS2	A1☆AS2	A1☆2S2	A1☆ES2	A1☆4S2	A2☆5S2	A2☆GS2	A2☆AS2	A2☆7S2	A2☆FS2	A2☆3S2
29	A1☆5S2	A1☆BS3	A1☆AS2	A1☆2S3	A1☆ES2	A1☆4S3	A2☆5S2	A2☆GS3	A2☆AS2	A2☆7S3	A2☆FS2	A2☆3S3
30	A1☆5S3	A1☆BS3	A1☆AS3	A1☆2S3	A1☆ES3	A1☆4S3	A2☆5S3	A2☆GS3	A2☆AS3	A2☆7S3	A2☆FS3	A2☆3S3
31	A1☆5S2	A1☆7S2	A1☆AS2	A1☆BS2	A1☆FS2	A1☆7S2	A2☆5S2	A2☆CS2	A2☆AS2	A2☆3S2	A2☆6S2	A2☆6S2
32	A1☆5S2	A1☆7S3	A1☆AS2	A1☆BS3	A1☆FS2	A1☆7S3	A2☆5S2	A2☆CS3	A2☆AS2	A2☆3S3	A2☆6S2	A2☆6S3
33	A1☆5S3	A1☆7S3	A1☆AS3	A1☆BS3	A1☆FS3	A1☆7S3	A2☆5S3	A2☆CS3	A2☆AS3	A2☆3S3	A2☆6S3	A2☆6S3
34	A1☆5S2	A1☆GS2	A1☆AS2	A1☆7S2	A1☆FS2	A1☆3S2	A2☆5S2	A2☆8S2	A2☆AS2	A2☆CS2	A2☆7S2	A2☆7S2
35	A1☆5S2	A1☆GS3	A1☆AS2	A1☆7S3	A1☆FS2	A1☆3S3	A2☆5S2	A2☆8S3	A2☆AS2	A2☆CS3	A2☆7S2	A2☆7S3
36	A1☆5S3	A1☆GS3	A1☆AS3	A1☆7S3	A1☆FS3	A1☆3S3	A2☆5S3	A2☆8S3	A2☆AS3	A2☆CS3	A2☆7S3	A2☆7S3
37	A1☆5S2	A1☆CS2	A1☆AS2	A1☆3S2	A1☆6S2	A1☆6S2	A2☆6S2	A2☆FS2	A2☆AS2	A2☆8S2	A2☆AS2	A2☆AS2
38	A1☆5S2	A1☆CS3	A1☆AS2	A1☆3S3	A1☆6S2	A1☆6S3	A2☆6S2	A2☆FS3	A2☆AS2	A2☆8S3	A2☆AS2	A2☆AS3
39	A1☆5S3	A1☆CS3	A1☆AS3	A1☆3S3	A1☆6S3	A1☆6S3	A2☆6S3	A2☆FS3	A2☆AS3	A2☆8S3	A2☆AS3	A2☆AS3
40	A1☆5S2	A1☆8S2	A1☆AS2	A1☆CS2	A1☆7S2	A1☆7S2	A2☆6S2	A2☆BS2	A2☆AS2	A2☆4S2	A2☆BS2	A2☆BS2
41	A1☆5S2	A1☆8S3	A1☆AS2	A1☆CS3	A1☆7S2	A1☆7S3	A2☆6S2	A2☆BS3	A2☆AS2	A2☆4S3	A2☆BS2	A2☆BS3
42	A1☆5S3	A1☆8S3	A1☆AS3	A1☆CS3	A1☆7S3	A1☆7S3	A2☆6S3	A2☆BS3	A2☆AS3	A2☆4S3	A2☆BS3	A2☆BS3
43	A1☆6S2	A1☆FS2	A1☆AS2	A1☆8S2	A1☆AS2	A1☆AS2	A2☆6S2	A2☆7S2	A2☆BS2	A2☆7S2	A3☆1S2	A3☆FS2
44	A1☆6S2	A1☆FS3	A1☆AS2	A1☆8S3	A1☆AS2	A1☆AS3	A2☆6S2	A2☆7S3	A2☆BS2	A2☆7S3	A3☆1S2	A3☆FS3
45	A1☆6S3	A1☆FS3	A1☆AS3	A1☆8S3	A1☆AS3	A1☆AS3	A2☆6S3	A2☆7S3	A2☆BS3	A2☆7S3	A3☆1S3	A3☆FS3
46	A1☆6S2	A1☆BS2	A1☆AS2	A1☆4S2	A1☆BS2	A1☆BS2	A2☆6S2	A2☆GS2	A2☆BS2	A2☆3S2	A3☆1S2	A3☆BS2
47	A1☆6S2	A1☆BS3	A1☆AS2	A1☆4S3	A1☆BS2	A1☆BS3	A2☆6S2	A2☆GS3	A2☆BS2	A2☆3S3	A3☆1S2	A3☆BS3
48	A1☆6S3	A1☆BS3	A1☆AS3	A1☆4S3	A1☆BS3	A1☆BS3	A2☆6S3	A2☆GS3	A2☆BS3	A2☆3S3	A3☆1S3	A3☆BS3
49	A1☆6S2	A1☆7S2	A1☆BS2	A1☆7S2	A2☆1S2	A2☆FS2	A2☆6S2	A2☆CS2	A2☆DS2	A2☆7S2	A3☆1S2	A3☆GS2
50	A1☆6S2	A1☆7S3	A1☆BS2	A1☆7S3	A2☆1S2	A2☆FS3	A2☆6S2	A2☆CS3	A2☆DS2	A2☆7S3	A3☆1S2	A3☆GS3
51	A1☆6S3	A1☆7S3	A1☆BS3	A1☆7S3	A2☆1S3	A2☆FS3	A2☆6S3	A2☆CS3	A2☆DS3	A2☆7S3	A3☆1S3	A3☆GS3
52	A1☆6S2	A1☆GS2	A1☆BS2	A1☆3S2	A2☆1S2	A2☆BS2	A2☆6S2	A2☆8S2	A2☆DS2	A2☆3S2	A3☆1S2	A3☆CS2
53	A1☆6S2	A1☆GS3	A1☆BS2	A1☆3S3	A2☆1S2	A2☆BS3	A2☆6S2	A2☆8S3	A2☆DS2	A2☆3S3	A3☆1S2	A3☆CS3
54	A1☆6S3	A1☆GS3	A1☆BS3	A1☆3S3	A2☆1S3	A2☆BS3	A2☆6S3	A2☆8S3	A2☆DS3	A2☆3S3	A3☆1S3	A3☆CS3



[Kitting combination - 2700K, 3000K, 3500K and 4000K]

-	RANK 1	RANK 2	RANK 1	RANK 2	RANK 1	RANK 2	RANK 1	RANK 2	RANK 1	RANK 2	RANK 1	RANK 2
1	A3☆2S2	A3☆FS2	A3☆9S2	A3☆3S2	A3☆ES2	A3☆6S2	A4☆2S2	A4☆GS2	A4☆9S2	A4☆8S2	A4☆ES2	A4☆7S2
2	A3☆2S2	A3☆FS3	A3☆9S2	A3☆3S3	A3☆ES2	A3☆6S3	A4☆2S2	A4☆GS3	A4☆9S2	A4☆8S3	A4☆ES2	A4☆7S3
3	A3☆2S3	A3☆FS3	A3☆9S3	A3☆3S3	A3☆ES3	A3☆6S3	A4☆2S3	A4☆GS3	A4☆9S3	A4☆8S3	A4☆ES3	A4☆7S3
4	A3☆2S2	A3☆BS2	A3☆9S2	A3☆CS2	A3☆ES2	A3☆2S2	A4☆2S2	A4☆CS2	A4☆9S2	A4☆4S2	A4☆ES2	A4☆3S2
5	A3☆2S2	A3☆BS3	A3☆9S2	A3☆CS3	A3☆ES2	A3☆2S3	A4☆2S2	A4☆CS3	A4☆9S2	A4☆4S3	A4☆ES2	A4☆3S3
6	A3☆2S3	A3☆BS3	A3☆9S3	A3☆CS3	A3☆ES3	A3☆2S3	A4☆2S3	A4☆CS3	A4☆9S3	A4☆4S3	A4☆ES3	A4☆3S3
7	A3☆2S2	A3☆GS2	A3☆9S2	A3☆8S2	A3☆ES2	A3☆7S2	A4☆5S2	A4☆FS2	A4☆AS2	A4☆6S2	A4☆ES2	A4☆8S2
8	A3☆2S2	A3☆GS3	A3☆9S2	A3☆8S3	A3☆ES2	A3☆7S3	A4☆5S2	A4☆FS3	A4☆AS2	A4☆6S3	A4☆ES2	A4☆8S3
9	A3☆2S3	A3☆GS3	A3☆9S3	A3☆8S3	A3☆ES3	A3☆7S3	A4☆5S3	A4☆FS3	A4☆AS3	A4☆6S3	A4☆ES3	A4☆8S3
10	A3☆2S2	A3☆CS2	A3☆9S2	A3☆4S2	A3☆ES2	A3☆3S2	A4☆5S2	A4☆BS2	A4☆AS2	A4☆2S2	A4☆ES2	A4☆4S2
11	A3☆2S2	A3☆CS3	A3☆9S2	A3☆4S3	A3☆ES2	A3☆3S3	A4☆5S2	A4☆BS3	A4☆AS2	A4☆2S3	A4☆ES2	A4☆4S3
12	A3☆2S3	A3☆CS3	A3☆9S3	A3☆4S3	A3☆ES3	A3☆3S3	A4☆5S3	A4☆BS3	A4☆AS3	A4☆2S3	A4☆ES3	A4☆4S3
13	A3☆5S2	A3☆FS2	A3☆AS2	A3☆6S2	A3☆ES2	A3☆8S2	A4☆5S2	A4☆7S2	A4☆AS2	A4☆BS2	A4☆FS2	A4☆7S2
14	A3☆5S2	A3☆FS3	A3☆AS2	A3☆6S3	A3☆ES2	A3☆8S3	A4☆5S2	A4☆7S3	A4☆AS2	A4☆BS3	A4☆FS2	A4☆7S3
15	A3☆5S3	A3☆FS3	A3☆AS3	A3☆6S3	A3☆ES3	A3☆8S3	A4☆5S3	A4☆7S3	A4☆AS3	A4☆BS3	A4☆FS3	A4☆7S3
16	A3☆5S2	A3☆BS2	A3☆AS2	A3☆2S2	A3☆ES2	A3☆4S2	A4☆5S2	A4☆GS2	A4☆AS2	A4☆7S2	A4☆FS2	A4☆3S2
17	A3☆5S2	A3☆BS3	A3☆AS2	A3☆2S3	A3☆ES2	A3☆4S3	A4☆5S2	A4☆GS3	A4☆AS2	A4☆7S3	A4☆FS2	A4☆3S3
18	A3☆5S3	A3☆BS3	A3☆AS3	A3☆2S3	A3☆ES3	A3☆4S3	A4☆5S3	A4☆GS3	A4☆AS3	A4☆7S3	A4☆FS3	A4☆3S3
19	A3☆5S2	A3☆7S2	A3☆AS2	A3☆BS2	A3☆FS2	A3☆7S2	A4☆5S2	A4☆CS2	A4☆AS2	A4☆3S2	A4☆6S2	A4☆6S2
20	A3☆5S2	A3☆7S3	A3☆AS2	A3☆BS3	A3☆FS2	A3☆7S3	A4☆5S2	A4☆CS3	A4☆AS2	A4☆3S3	A4☆6S2	A4☆6S3
21	A3☆5S3	A3☆7S3	A3☆AS3	A3☆BS3	A3☆FS3	A3☆7S3	A4☆5S3	A4☆CS3	A4☆AS3	A4☆3S3	A4☆6S3	A4☆6S3
22	A3☆5S2	A3☆GS2	A3☆AS2	A3☆7S2	A3☆FS2	A3☆3S2	A4☆5S2	A4☆8S2	A4☆AS2	A4☆CS2	A4☆7S2	A4☆7S2
23	A3☆5S2	A3☆GS3	A3☆AS2	A3☆7S3	A3☆FS2	A3☆3S3	A4☆5S2	A4☆8S3	A4☆AS2	A4☆CS3	A4☆7S2	A4☆7S3
24	A3☆5S3	A3☆GS3	A3☆AS3	A3☆7S3	A3☆FS3	A3☆3S3	A4☆5S3	A4☆8S3	A4☆AS3	A4☆CS3	A4☆7S3	A4☆7S3
25	A3☆5S2	A3☆CS2	A3☆AS2	A3☆3S2	A3☆6S2	A3☆6S2	A4☆6S2	A4☆FS2	A4☆AS2	A4☆8S2	A4☆AS2	A4☆AS2
26	A3☆5S2	A3☆CS3	A3☆AS2	A3☆3S3	A3☆6S2	A3☆6S3	A4☆6S2	A4☆FS3	A4☆AS2	A4☆8S3	A4☆AS2	A4☆AS3
27	A3☆5S3	A3☆CS3	A3☆AS3	A3☆3S3	A3☆6S3	A3☆6S3	A4☆6S3	A4☆FS3	A4☆AS3	A4☆8S3	A4☆AS3	A4☆AS3
28	A3☆5S2	A3☆8S2	A3☆AS2	A3☆CS2	A3☆7S2	A3☆7S2	A4☆6S2	A4☆BS2	A4☆AS2	A4☆4S2	A4☆BS2	A4☆BS2
29	A3☆5S2	A3☆8S3	A3☆AS2	A3☆CS3	A3☆7S2	A3☆7S3	A4☆6S2	A4☆BS3	A4☆AS2	A4☆4S3	A4☆BS2	A4☆BS3
30	A3☆5S3	A3☆8S3	A3☆AS3	A3☆CS3	A3☆7S3	A3☆7S3	A4☆6S3	A4☆BS3	A4☆AS3	A4☆4S3	A4☆BS3	A4☆BS3
31	A3☆6S2	A3☆FS2	A3☆AS2	A3☆8S2	A3☆AS2	A3☆AS2	A4☆6S2	A4☆7S2	A4☆BS2	A4☆7S2	A5☆1S2	A5☆FS2
32	A3☆6S2	A3☆FS3	A3☆AS2	A3☆8S3	A3☆AS2	A3☆AS3	A4☆6S2	A4☆7S3	A4☆BS2	A4☆7S3	A5☆1S2	A5☆FS3
33	A3☆6S3	A3☆FS3	A3☆AS3	A3☆8S3	A3☆AS3	A3☆AS3	A4☆6S3	A4☆7S3	A4☆BS3	A4☆7S3	A5☆1S3	A5☆FS3
34	A3☆6S2	A3☆BS2	A3☆AS2	A3☆4S2	A3☆BS2	A3☆BS2	A4☆6S2	A4☆GS2	A4☆BS2	A4☆3S2	A5☆1S2	A5☆BS2
35	A3☆6S2	A3☆BS3	A3☆AS2	A3☆4S3	A3☆BS2	A3☆BS3	A4☆6S2	A4☆GS3	A4☆BS2	A4☆3S3	A5☆1S2	A5☆BS3
36	A3☆6S3	A3☆BS3	A3☆AS3	A3☆4S3	A3☆BS3	A3☆BS3	A4☆6S3	A4☆GS3	A4☆BS3	A4☆3S3	A5☆1S3	A5☆BS3
37	A3☆6S2	A3☆7S2	A3☆BS2	A3☆7S2	A4☆1S2	A4☆FS2	A4☆6S2	A4☆CS2	A4☆DS2	A4☆7S2	A5☆1S2	A5☆GS2
38	A3☆6S2	A3☆7S3	A3☆BS2	A3☆7S3	A4☆1S2	A4☆FS3	A4☆6S2	A4☆CS3	A4☆DS2	A4☆7S3	A5☆1S2	A5☆GS3
39	A3☆6S3	A3☆7S3	A3☆BS3	A3☆7S3	A4☆1S3	A4☆FS3	A4☆6S3	A4☆CS3	A4☆DS3	A4☆7S3	A5☆1S3	A5☆GS3
40	A3☆6S2	A3☆GS2	A3☆BS2	A3☆3S2	A4☆1S2	A4☆BS2	A4☆6S2	A4☆8S2	A4☆DS2	A4☆3S2	A5☆1S2	A5☆CS2
41	A3☆6S2	A3☆GS3	A3☆BS2	A3☆3S3	A4☆1S2	A4☆BS3	A4☆6S2	A4☆8S3	A4☆DS2	A4☆3S3	A5☆1S2	A5☆CS3
42	A3☆6S3	A3☆GS3	A3☆BS3	A3☆3S3	A4☆1S3	A4☆BS3	A4☆6S3	A4☆8S3	A4☆DS3	A4☆3S3	A5☆1S3	A5☆CS3
43	A3☆6S2	A3☆CS2	A3☆DS2	A3☆7S2	A4☆1S2	A4☆GS2	A4☆9S2	A4☆BS2	A4☆DS2	A4☆8S2	A5☆2S2	A5☆FS2
44	A3☆6S2	A3☆CS3	A3☆DS2	A3☆7S3	A4☆1S2	A4☆GS3	A4☆9S2	A4☆BS3	A4☆DS2	A4☆8S3	A5☆2S2	A5☆FS3
45	A3☆6S3	A3☆CS3	A3☆DS3	A3☆7S3	A4☆1S3	A4☆GS3	A4☆9S3	A4☆BS3	A4☆DS3	A4☆8S3	A5☆2S3	A5☆FS3
46	A3☆6S2	A3☆8S2	A3☆DS2	A3☆3S2	A4☆1S2	A4☆CS2	A4☆9S2	A4☆7S2	A4☆DS2	A4☆4S2	A5☆2S2	A5☆BS2
47	A3☆6S2	A3☆8S3	A3☆DS2	A3☆3S3	A4☆1S2	A4☆CS3	A4☆9S2	A4☆7S3	A4☆DS2	A4☆4S3	A5☆2S2	A5☆BS3
48	A3☆6S3	A3☆8S3	A3☆DS3	A3☆3S3	A4☆1S3	A4☆CS3	A4☆9S3	A4☆7S3	A4☆DS3	A4☆4S3	A5☆2S3	A5☆BS3
49	A3☆9S2	A3☆BS2	A3☆DS2	A3☆8S2	A4☆2S2	A4☆FS2	A4☆9S2	A4☆3S2	A4☆ES2	A4☆6S2	A5☆2S2	A5☆GS2
50	A3☆9S2	A3☆BS3	A3☆DS2	A3☆8S3	A4☆2S2	A4☆FS3	A4☆9S2	A4☆3S3	A4☆ES2	A4☆6S3	A5☆2S2	A5☆GS3
51	A3☆9S3	A3☆BS3	A3☆DS3	A3☆8S3	A4☆2S3	A4☆FS3	A4☆9S3	A4☆3S3	A4☆ES3	A4☆6S3	A5☆2S3	A5☆GS3
52	A3☆9S2	A3☆7S2	A3☆DS2	A3☆4S2	A4☆2S2	A4☆BS2	A4☆9S2	A4☆CS2	A4☆ES2	A4☆2S2	A5☆2S2	A5☆CS2
53	A3☆9S2	A3☆7S3	A3☆DS2	A3☆4S3	A4☆2S2	A4☆BS3	A4☆9S2	A4☆CS3	A4☆ES2	A4☆2S3	A5☆2S2	A5☆CS3
54	A3☆9S3	A3☆7S3	A3☆DS3	A3☆4S3	A4☆2S3	A4☆BS3	A4☆9S3	A4☆CS3	A4☆ES3	A4☆2S3	A5☆2S3	A5☆CS3



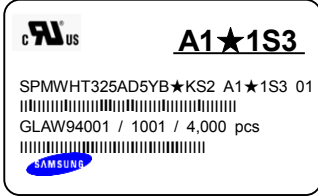
[Kitting combination – 2700K, 3000K, 3500K and 4000K]

-	RANK 1	RANK 2	RANK 1	RANK 2	RANK 1	RANK 2	RANK 1	RANK 2	RANK 1	RANK 2	RANK 1	RANK 2
1	A5☆5S2	A5☆FS2	A5☆AS2	A5☆6S2	A5☆ES2	A5☆8S2						
2	A5☆5S2	A5☆FS3	A5☆AS2	A5☆6S3	A5☆ES2	A5☆8S3						
3	A5☆5S3	A5☆FS3	A5☆AS3	A5☆6S3	A5☆ES3	A5☆8S3						
4	A5☆5S2	A5☆BS2	A5☆AS2	A5☆2S2	A5☆ES2	A5☆4S2						
5	A5☆5S2	A5☆BS3	A5☆AS2	A5☆2S3	A5☆ES2	A5☆4S3						
6	A5☆5S3	A5☆BS3	A5☆AS3	A5☆2S3	A5☆ES3	A5☆4S3						
7	A5☆5S2	A5☆7S2	A5☆AS2	A5☆BS2	A5☆FS2	A5☆7S2						
8	A5☆5S2	A5☆7S3	A5☆AS2	A5☆BS3	A5☆FS2	A5☆7S3						
9	A5☆5S3	A5☆7S3	A5☆AS3	A5☆BS3	A5☆FS3	A5☆7S3						
10	A5☆5S2	A5☆GS2	A5☆AS2	A5☆7S2	A5☆FS2	A5☆3S2						
11	A5☆5S2	A5☆GS3	A5☆AS2	A5☆7S3	A5☆FS2	A5☆3S3						
12	A5☆5S3	A5☆GS3	A5☆AS3	A5☆7S3	A5☆FS3	A5☆3S3						
13	A5☆5S2	A5☆CS2	A5☆AS2	A5☆3S2	A5☆6S2	A5☆6S2						
14	A5☆5S2	A5☆CS3	A5☆AS2	A5☆3S3	A5☆6S2	A5☆6S3						
15	A5☆5S3	A5☆CS3	A5☆AS3	A5☆3S3	A5☆6S3	A5☆6S3						
16	A5☆5S2	A5☆8S2	A5☆AS2	A5☆CS2	A5☆7S2	A5☆7S2						
17	A5☆5S2	A5☆8S3	A5☆AS2	A5☆CS3	A5☆7S2	A5☆7S3						
18	A5☆5S3	A5☆8S3	A5☆AS3	A5☆CS3	A5☆7S3	A5☆7S3						
19	A5☆6S2	A5☆FS2	A5☆AS2	A5☆8S2	A5☆AS2	A5☆AS2						
20	A5☆6S2	A5☆FS3	A5☆AS2	A5☆8S3	A5☆AS2	A5☆AS3						
21	A5☆6S3	A5☆FS3	A5☆AS3	A5☆8S3	A5☆AS3	A5☆AS3						
22	A5☆6S2	A5☆BS2	A5☆AS2	A5☆4S2	A5☆BS2	A5☆BS2						
23	A5☆6S2	A5☆BS3	A5☆AS2	A5☆4S3	A5☆BS2	A5☆BS3						
24	A5☆6S3	A5☆BS3	A5☆AS3	A5☆4S3	A5☆BS3	A5☆BS3						
25	A5☆6S2	A5☆7S2	A5☆BS2	A5☆7S2								
26	A5☆6S2	A5☆7S3	A5☆BS2	A5☆7S3								
27	A5☆6S3	A5☆7S3	A5☆BS3	A5☆7S3								
28	A5☆6S2	A5☆GS2	A5☆BS2	A5☆3S2								
29	A5☆6S2	A5☆GS3	A5☆BS2	A5☆3S3								
30	A5☆6S3	A5☆GS3	A5☆BS3	A5☆3S3								
31	A5☆6S2	A5☆CS2	A5☆DS2	A5☆7S2								
32	A5☆6S2	A5☆CS3	A5☆DS2	A5☆7S3								
33	A5☆6S3	A5☆CS3	A5☆DS3	A5☆7S3								
34	A5☆6S2	A5☆8S2	A5☆DS2	A5☆3S2								
35	A5☆6S2	A5☆8S3	A5☆DS2	A5☆3S3								
36	A5☆6S3	A5☆8S3	A5☆DS3	A5☆3S3								
37	A5☆9S2	A5☆BS2	A5☆DS2	A5☆8S2								
38	A5☆9S2	A5☆BS3	A5☆DS2	A5☆8S3								
39	A5☆9S3	A5☆BS3	A5☆DS3	A5☆8S3								
40	A5☆9S2	A5☆7S2	A5☆DS2	A5☆4S2								
41	A5☆9S2	A5☆7S3	A5☆DS2	A5☆4S3								
42	A5☆9S3	A5☆7S3	A5☆DS3	A5☆4S3								
43	A5☆9S2	A5☆3S2	A5☆ES2	A5☆6S2								
44	A5☆9S2	A5☆3S3	A5☆ES2	A5☆6S3								
45	A5☆9S3	A5☆3S3	A5☆ES3	A5☆6S3								
46	A5☆9S2	A5☆CS2	A5☆ES2	A5☆2S2								
47	A5☆9S2	A5☆CS3	A5☆ES2	A5☆2S3								
48	A5☆9S3	A5☆CS3	A5☆ES3	A5☆2S3								
49	A5☆9S2	A5☆8S2	A5☆ES2	A5☆7S2								
50	A5☆9S2	A5☆8S3	A5☆ES2	A5☆7S3								
51	A5☆9S3	A5☆8S3	A5☆ES3	A5☆7S3								
52	A5☆9S2	A5☆4S2	A5☆ES2	A5☆3S2								
53	A5☆9S2	A5☆4S3	A5☆ES2	A5☆3S3								
54	A5☆9S3	A5☆4S3	A5☆ES3	A5☆3S3								

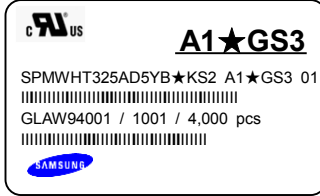
5) Kitting bin Packing process - SPMWHT325AD5xxxKxx

Reel

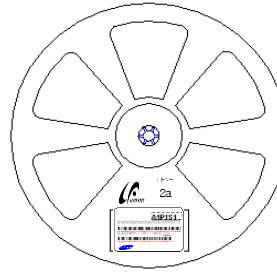
Kitting 'A'



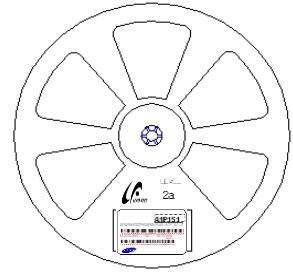
Kitting 'B'



Kitting 'A'



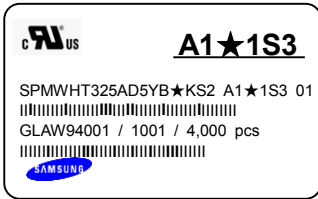
Kitting 'B'



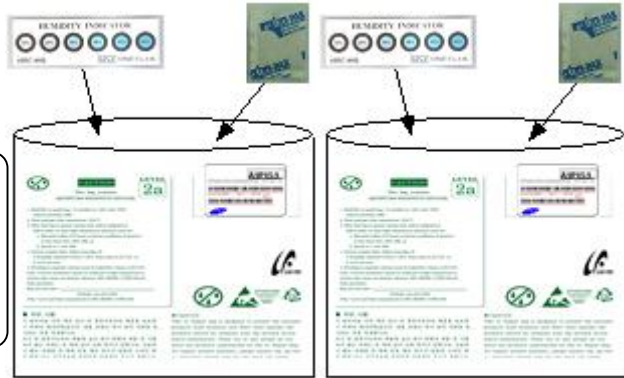
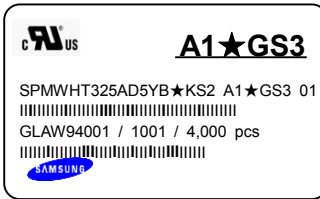
※ '★' means All kind of Chromaticity Coordinate Rank.

Aluminum Vinyl Bag

Kitting 'A'

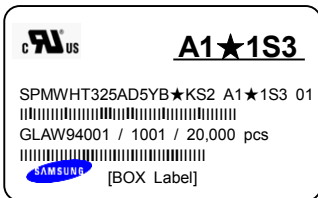


Kitting 'B'

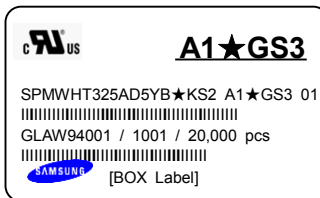


Outer Box(Max. 10 Aluminum Vinyl Bag)

Kitting 'A'

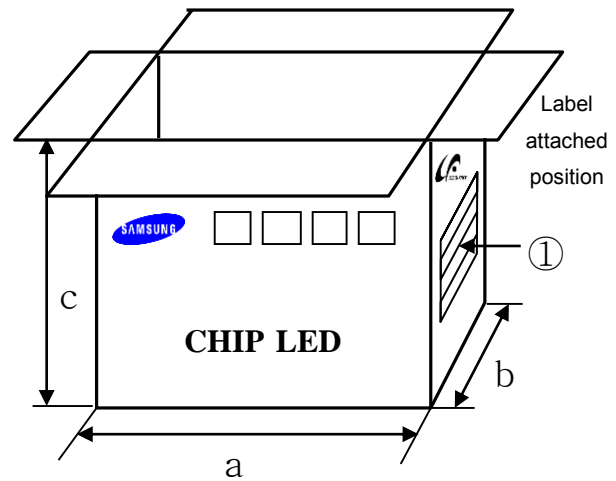


Kitting 'B'



Material : Paper(SW3B(B))

TYPE	SIZE(mm)		
	a	b	c
7inch	245	220	182



12. 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.
- 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.
- 3) When the LEDs illuminate, operating current should be decided after considering the ambient maximum temperature.
- 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. $\sim 40^{\circ}\text{C}$, $\sim 90\%$ RH)
- 5) After storage bag is open, 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 $30^{\circ}\text{C}/60\%$ RH,
 - b. Stored at $<10\%$ RH.
- 6) Repack unused Products 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 $23\pm 5^{\circ}\text{C}$..
- 8) Devices must be baked for 1 hour at $65\pm 5^{\circ}\text{C}$, if baking is required.
- 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. 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 leak 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 a discoloration of encapsulant when they exposed to light and heat. This phenomenon can cause a significant loss of light emitted(output) from the luminaires(fixture). In order to prevent these problems, we recommend you to know the physical properties of materials used in luminaires, They must be selected carefully.

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.

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 in a following list,

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

13. Hazard Substance Analysis Report



Test Report No. F690101/LF-CTSAYAA14-55874

Issued Date : 2014. 12. 11

Page 1 of 6

SAMSUNG ELECTRONICS CO., LTD.
95 Samsung 2-ro, Giheung-gu
Yongin-si, Gyeonggi-do
Korea

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

SGS File No. : AYAA14-55874
Product Name : 3623 white PKG
Item No./Part No. : N/A
Received Date : 2014. 12. 04
Test Period : 2014. 12. 05 to 2014. 12. 11
Test Comments : By the applicant's specific request, the sampling and testing was performed only for the part indicated in the photo without disassembly.
Test Results : For further details, please refer to following page(s)

SGS Korea Co., Ltd.

Jeff Jang / Chemical Lab Mgr

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com/en/terms-and-conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at www.sgs.com/terms_e-document.htm http://www.sgs.com/terms_e-document.htm. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s).

SGS Korea Co., Ltd.

322, The O valley, 75, LS-ro, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 431-080
t +82 (0)31 4608 000 f +82 (0)31 4608 059 <http://www.sgs.com/kr>

F401 Version2

Member of the SGS Group (Société Générale de Surveillance)

Sample No. : AYAA14-55874.001
Sample Description : 3623 white PKG
Item No./Part No. : N/A
Materials : N/A

Heavy Metals

Test Items	Unit	Test Method	MDL	Results
Cadmium (Cd)	mg/kg	With reference to IEC 62321-5:2013 (Determination of Cadmium by ICP-OES)	0.5	N.D.
Lead (Pb)	mg/kg	With reference to IEC 62321-5:2013 (Determination of Lead by ICP-OES)	5	N.D.
Mercury (Hg)	mg/kg	With reference to IEC 62321-4:2013 (Determination of Mercury by ICP-OES)	2	N.D.
Hexavalent Chromium (Cr VI)	mg/kg	With reference to IEC 62321:2008 (Determination of Hexavalent Chromium by spot test/Colorimetric Method using 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 (Determination of PBBs and PBDEs by GC-MS)	5	N.D.
Dibromobiphenyl	mg/kg	With reference to IEC 62321:2008 (Determination of PBBs and PBDEs by GC-MS)	5	N.D.
Tribromobiphenyl	mg/kg	With reference to IEC 62321:2008 (Determination of PBBs and PBDEs by GC-MS)	5	N.D.
Tetrabromobiphenyl	mg/kg	With reference to IEC 62321:2008 (Determination of PBBs and PBDEs by GC-MS)	5	N.D.
Pentabromobiphenyl	mg/kg	With reference to IEC 62321:2008 (Determination of PBBs and PBDEs by GC-MS)	5	N.D.
Hexabromobiphenyl	mg/kg	With reference to IEC 62321:2008 (Determination of PBBs and PBDEs by GC-MS)	5	N.D.
Heptabromobiphenyl	mg/kg	With reference to IEC 62321:2008 (Determination of PBBs and PBDEs by GC-MS)	5	N.D.
Octabromobiphenyl	mg/kg	With reference to IEC 62321:2008 (Determination of PBBs and PBDEs by GC-MS)	5	N.D.
Nonabromobiphenyl	mg/kg	With reference to IEC 62321:2008 (Determination of PBBs and PBDEs by GC-MS)	5	N.D.
Decabromobiphenyl	mg/kg	With reference to IEC 62321:2008 (Determination of PBBs and PBDEs by GC-MS)	5	N.D.
Monobromodiphenyl ether	mg/kg	With reference to IEC 62321:2008 (Determination of PBBs and PBDEs by GC-MS)	5	N.D.
Dibromodiphenyl ether	mg/kg	With reference to IEC 62321:2008 (Determination of PBBs and PBDEs by GC-MS)	5	N.D.
Tribromodiphenyl ether	mg/kg	With reference to IEC 62321:2008 (Determination of PBBs and PBDEs by GC-MS)	5	N.D.
Tetrabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008 (Determination of PBBs and PBDEs by GC-MS)	5	N.D.

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com/en/terms-and-conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at www.sgs.com/terms_e-document.htm http://www.sgs.com/terms_e-document.htm. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained herein reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s).

SGS Korea Co., Ltd.

322, The O valley, 76, L9-ro, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 431-080
 t +82 (0)31 4608 000 f +82 (0)31 4608 059 <http://www.sgsgroup.kr>

F401 Version2

Member of the SGS Group (Société Générale de Surveillance)


Test Report No. F690101/LF-CTSAYAA14-55874

Issued Date : 2014. 12. 11

Page 3 of 6

Sample No. : AYAA14-55874.001
Sample Description : 3623 white PKG
Item No./Part No. : N/A
Materials : N/A

Flame Retardants-PBBs/PBDEs

Test Items	Unit	Test Method	MDL	Results
Pentabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008 (Determination of PBBs and PBDEs by GC-MS)	5	N.D.
Hexabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008 (Determination of PBBs and PBDEs by GC-MS)	5	N.D.
Heptabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008 (Determination of PBBs and PBDEs by GC-MS)	5	N.D.
Octabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008 (Determination of PBBs and PBDEs by GC-MS)	5	N.D.
Nonabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008 (Determination of PBBs and PBDEs by GC-MS)	5	N.D.
Decabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008 (Determination of PBBs and PBDEs by GC-MS)	5	N.D.

Halogen Content

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

Other(s)

Test Items	Unit	Test Method	MDL	Results
PFOA (Perfluorooctanoic acid)	mg/kg	US EPA 3540C/3550C, LC/MS	1	N.D.
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)
 - (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.

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at www.sgs.com/terms-e-document.htm / <http://www.sgs.com/terms-e-document.htm>. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained herein reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s).

SGS Korea Co., Ltd.

 322, The O valley, 76, LG-ro, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 431-080
 t +82 (0)31 4608 000 f +82 (0)31 4608 059 <http://www.sgs.or.kr>

F401 Version2

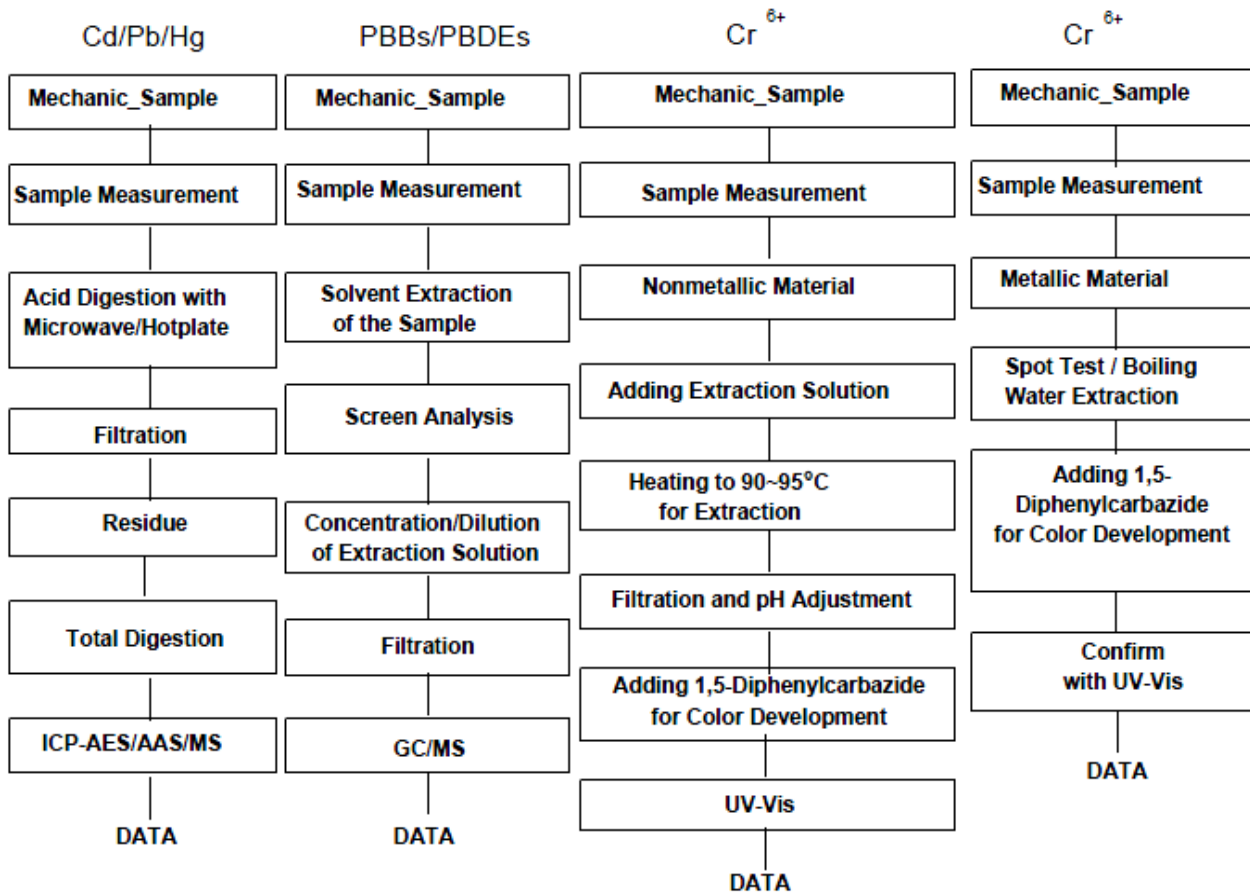
Member of the SGS Group (Société Générale de Surveillance)



This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com/en/terms-and-conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at www.sgs.com/terms_e-document.htm / http://www.sgs.com/terms_e-document.htm. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained herein reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s).



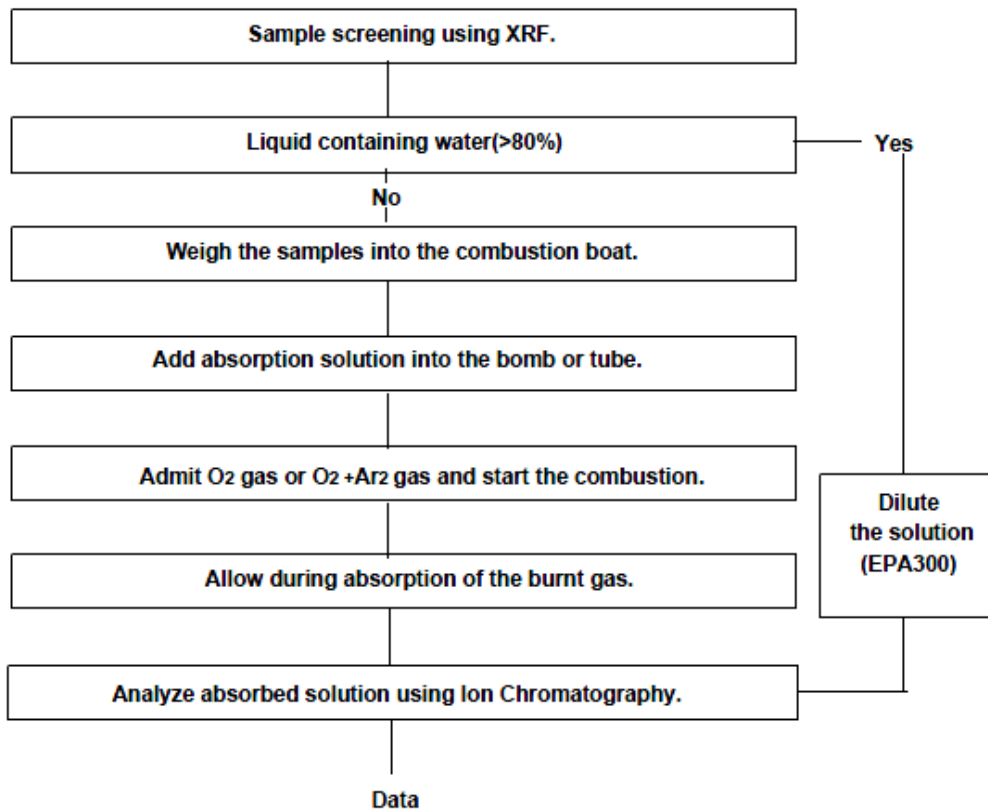
Testing Flow Chart for RoHS: Cd/Pb/Hg/Cr⁶⁺ /PBBs&PBDEs Testing



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

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at www.sgs.com/terms_e-document.htm <http://www.sgs.com/terms_e-document.htm>. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained herein reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s).

Flow Chart for Halogen Test



*** End of Report ***

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com/en/terms-and-conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at www.sgs.com/terms_e-document.htm ->http://www.sgs.com/terms_e-document.htm. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s).

Test Report

No. F690101/LF-CTSAYAA14-55873

Issued Date: 2014. 12. 15

Page 1 of 19

SAMSUNG ELECTRONICS CO., LTD.
95, Samsung2-ro, Giheung-gu
Yongin-si, Gyeonggi-do
Korea

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

SGS File No. : AYAA14-55873

Product Name : 3623 white PKG

Item/Part Name : N/A

Received Date : 2014. 12. 04

Test Period : 2014. 12. 05 ~ 2014. 12. 15

Test Requested : One hundred-fifty five (155) substances in the Candidate List of Substances of Very High Concern (SVHC) for authorization published by European Chemicals Agency (ECHA) on June 16, 2014 regarding Regulation (EC) No 1907/2006 concerning the REACH.

Six(6) substances in the Public Consultation List of potential Substances of Very High Concern (SVHC) published by European Chemicals Agency (ECHA) on September 01, 2014 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).

Summary : According to the specified scope and analytical technique, concentrations of all SVHC are <0.1% in the submitted sample(s).

SGS Korea Co., Ltd



Jeff Jang / Chemical Lab Mgr

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at www.sgs.com/terms_e-document.htm. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s).

SGS Korea Co., Ltd.

322, The O valley, 76, LS-ro, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 431-080
t +82 (0)31 4608 000 f +82 (0)31 4608 059 <http://www.sgzgroup.kr>

Member of the SGS Group (Société Générale de Surveillance)

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/guest/candidate-list-table> (Candidate list)
http://echa.europa.eu/proposals-to-identify-substances-of-very-high-concern-previous-consultations?p_p_id=substancetypelist_WAR_substanceortlet&p_p_lifecycle=0&p_p_state=normal&p_p_mode=view&p_p_col_id=column-1&p_p_col_pos=2&p_p_col_count=4&substancetypelis
 (Proposals to identify SVHC consultations)
 This list is 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.

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at www.sgs.com/terms_e-document.htm. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s).

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-ethylhexyl)phthalate (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 3194-55-6 (134237-51-7, 134237-50-6, 134237-52-8)	247-148-4 221-695-9	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

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at www.sgs.com/terms_e-document.htm. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained herein reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s).

SGS Korea Co., Ltd.

322, The O valley, 76, LS-ro, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 431-080
t +82 (0)31 4608 000 f +82 (0)31 4608 059 <http://www.sgsgroup.kr>

Member of the SGS Group (Société Générale de Surveillance)

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; distn. 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

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at www.sgs.com/terms_e-document.htm. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s).

SGS Korea Co., Ltd.

322, The O valley, 76, LG-ro, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 431-080
t +82 (0)31 4608 000 f +82 (0)31 4608 059 <http://www.sgsgroup.kr>

Member of the SGS Group (Société Générale de Surveillance)

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.D.	0.005	Toxic for Reproduction
Disodium tetraborate, anhydrous*	1330-43-4 12179-04-3 1303-96-4	215-540-4	N.D.	0.005	Toxic for Reproduction
Tetraboron disodium heptaoxide, hydrate*	12267-73-1	235-541-3	N.D.	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

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at www.sgs.com/terms_e-document.htm. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s).

SGS Korea Co., Ltd.

322, The O valley, 76, LG-ro, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 431-080
 t +82 (0)31 4608 000 f +82 (0)31 4608 059 <http://www.sgsgroup.kr>

Member of the SGS Group (Société Générale de Surveillance)

F401 Version 2

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

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at www.sgs.com/terms_e-document.htm. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained herein reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s).

SGS Korea Co., Ltd.

322, The O valley, 76, LS-ro, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 431-080
t +82 (0)31 4608 000 f +82 (0)31 4608 059 <http://www.sgsgroup.kr>

Member of the SGS Group (Société Générale de Surveillance)

F401 Version 2

Substance Name	CAS number	EC number	Concentration (%)	Reporting Limit (%)	Classification
1,2-Dichloroethane	107-06-2	203-458-1	N.D.	0.05	Carcinogenic
2,2'-dichloro-4,4'-methylenedianiline (MOCA)	101-14-4	202-918-9	N.D.	0.05	Carcinogenic
2-Methoxyaniline o-Anisidine	90-04-0	201-963-1	N.D.	0.05	Carcinogenic
4-(1,1,3,3-tetramethylbutyl) phenol, (4-tert-Octylphenol)	140-66-9	205-426-2	N.D.	0.05	Equivalent level of concern having probable serious effects to the environment
Aluminosilicate Refractory Ceramic Fibres* (RCF)	650-017-00-8 (Index no.)	-	N.D.	0.005	Carcinogenic
Arsenic acid*	7778-39-4	231-901-9	N.D.	0.005	Carcinogenic
Bis(2-methoxyethyl) ether	111-96-6	203-924-4	N.D.	0.05	Toxic for reproduction
Bis(2-methoxyethyl) phthalate	117-82-8	204-212-6-	N.D.	0.05	Toxic for reproduction
Calcium arsenate*	7778-44-1	231-904-5	N.D.	0.005	Carcinogenic
Dichromium tris(chromate)*	24613-89-6	246-356-2	N.D.	0.005	Carcinogenic
Formaldehyde, oligomeric reaction products with aniline (technical MDA)	25214-70-4	500-036-1	N.D.	0.05	Carcinogenic
Lead diazide*	13424-46-9	236-542-1	N.D.	0.005	Toxic for reproduction
Lead dipicrate*	6477-64-1	229-335-2	N.D.	0.005	Toxic for reproduction
Lead styphnate*	15245-44-0	239-290-2	N.D.	0.005	Toxic for reproduction
N,N-dimethylacetamide (DMAC)	127-19-5	204-826-4	N.D.	0.05	Toxic for reproduction
Pentazinc chromate octahydroxide*	49663-84-5	256-418-0	N.D.	0.005	Carcinogenic
Phenolphthalein	77-09-8	201-004-7	N.D.	0.05	Carcinogenic
Potassium hydroxyoctaoxidizincatedichromate*	11103-86-9	234-329-8	N.D.	0.005	Carcinogenic
Trilead diarsenate*	3687-31-8	222-979-5	N.D.	0.005	Carcinogenic Toxic for reproduction

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at www.sgs.com/terms_e-document.htm. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained herein reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s).

SGS Korea Co., Ltd.

322, The O valley, 75, LG-ro, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 431-080
t +82 (0)31 4608 000 f +82 (0)31 4608 059 <http://www.sgsgroup.kr>

Member of the SGS Group (Société Générale de Surveillance)

F401 Version 2

Test Report

No. F690101/LF-CTSAYAA14-55873

Issued Date: 2014. 12. 15

Page 8 of 19

Substance Name	CAS number	EC number	Concentration (%)	Reporting Limit (%)	Classification
Zirconia Aluminosilicate Refractory Ceramic Fibres (Zr-RCF)*	650-017-00-8 (Index no.)	-	N.D.	0.005	Carcinogenic
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.D.	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 (oxiranyl methyl)-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

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at www.sgs.com/terms_e-document.htm. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s).

SGS Korea Co., Ltd.

322, The O valley, 76, LS-ro, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 431-080
t +82 (0)31 4608 000 f +82 (0)31 4608 059 <http://www.sgsgroup.kr>

Member of the SGS Group (Société Générale de Surveillance)

Substance Name	CAS number	EC number	Concentration (%)	Reporting Limit (%)	Classification
Bis(pentabromophenyl) ether (DecaBDE)	1163-19-5	214-604-9	N.D.	0.05	PBT vPvB
Pentacosafuorotridecanoic acid	72629-94-8	276-745-2	N.D.	0.05	vPvB
Tricosafuorododecanoic acid	307-55-1	206-203-2	N.D.	0.05	vPvB
Henicosafuoroundecanoic acid	2058-94-8	218-165-4	N.D.	0.05	vPvB
Heptacosafuorotetradecanoic acid	376-06-7	206-803-4	N.D.	0.05	vPvB
4-(1,1,3,3-tetramethylbutyl) phenol, ethoxylated - covering well-defined substances and UVCB substances, polymers and homologues	-	-	N.D.	0.05	Equivalent level of concern - probable serious effects on the environment
4-Nonylphenol, branched and linear - substances with a linear and/or branched alkyl chain with a carbon number of 9 covalently bound in position 4 to phenol, covering also UVCB- and well-defined substances which include any of the individual isomers or a combination thereof	-	-	N.D.	0.05	Equivalent level of concern - probable serious effects on the environment
Diazene-1,2-dicarboxamide (C,C'-azodi(formamide))	123-77-3	204-650-8	N.D.	0.05	Equivalent level of concern - probable serious effects on human health
Cyclohexane-1,2-dicarboxylic anhydride (Hexahydrophthalic anhydride - HHPA)	85-42-7	201-604-9	N.D.	0.05	Equivalent level of concern - probable serious effects on human health

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at www.sgs.com/terms_e-document.htm. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained herein reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s).

SGS Korea Co., Ltd.

322, The O valley, 76, LS-ro, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 431-080
t +82 (0)31 4508 000 f +82 (0)31 4508 059 <http://www.sgsgroup.kr>

Member of the SGS Group (Société Générale de Surveillance)

F401 Version 2

Substance Name	CAS number	EC number	Concentration (%)	Reporting Limit (%)	Classification
Hexahydromethylphthalic anhydride, Hexahydro-4-methylphthalic anhydride, Hexahydro-1-methylphthalic anhydride, Hexahydro-3-methylphthalic anhydride	25550-51-0, 19438-60-9, 48122-14-1, 57110-29-9	247-094-1, 243-072-0, 256-356-4, 260-566-1	N.D.	0.05	Equivalent level of concern - probable serious effects on human health
Methoxy acetic acid	625-45-6	210-894-6	N.D.	0.05	Toxic for reproduction equivalent level of concern -probable serious effects on human health and the environment
1,2-Benzenedicarboxylic acid, dipentylester, branched and linear	84777-06-0	284-032-2	N.D.	0.05	Toxic for reproduction
Diisopentylphthalate (DIPP)	605-50-5	210-088-4	N.D.	0.05	Toxic for reproduction
N-pentyl-isopentylphthalate	-	-	N.D.	0.05	Toxic for reproduction
1,2-Diethoxyethane	629-14-1	211-076-1	N.D.	0.05	Toxic for reproduction
N,N-dimethylformamide; dimethyl formamide	68-12-2	200-679-5	N.D.	0.05	Toxic for reproduction
Dibutyltin dichloride (DBT)	683-18-1	211-670-0	N.D.	0.05	Toxic for reproduction
Acetic acid, lead salt, basic*	51404-69-4	257-175-3	N.D.	0.005	Toxic for reproduction
Basic lead carbonate (trilead bis(carbonate)dihydroxide)*	1319-46-6	215-290-6	N.D.	0.005	Toxic for reproduction
Lead oxide sulfate (basic lead sulfate)*	12036-76-9	234-853-7	N.D.	0.005	Toxic for reproduction
[Phthalato(2-)]dioxotrilead (dibasic lead phthalate)*	69011-06-9	273-688-5	N.D.	0.005	Toxic for reproduction

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at www.sgs.com/terms_e-document.htm. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained herein reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s).

SGS Korea Co., Ltd.

322, The O valley, 76, LS-ro, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 431-080
t +82 (0)31 4608 000 f +82 (0)31 4608 059 <http://www.sgsgroup.kr>

Member of the SGS Group (Société Générale de Surveillance)

F401 Version 2

Substance Name	CAS number	EC number	Concentration (%)	Reporting Limit (%)	Classification
Dioxobis(stearato)trilead*	12578-12-0	235-702-8	N.D.	0.005	Toxic for reproduction
Fatty acids, C16-18, lead salts*	91031-62-8	292-966-7	N.D.	0.005	Toxic for reproduction
Lead bis(tetrafluoroborate)*	13814-96-5	237-486-0	N.D.	0.005	Toxic for reproduction
Lead cyanamidate*	20837-86-9	244-073-9	N.D.	0.005	Toxic for reproduction
Lead dinitrate*	10099-74-8	233-245-9	N.D.	0.005	Toxic for reproduction
Lead oxide (lead monoxide)*	1317-36-8	215-267-0	N.D.	0.005	Toxic for reproduction
Lead tetroxide (orange lead)*	1314-41-6	215-235-6	N.D.	0.005	Toxic for reproduction
Lead titanium trioxide*	12060-00-3	235-038-9	N.D.	0.005	Toxic for reproduction
Lead Titanium Zirconium Oxide*	12626-81-2	235-727-4	N.D.	0.005	Toxic for reproduction
Pentalead tetraoxide sulphate*	12065-90-6	235-067-7	N.D.	0.005	Toxic for reproduction
Pyrochlore, antimony lead yellow*	8012-00-8	232-382-1	N.D.	0.005	Toxic for reproduction
Silicic acid, barium salt, lead-doped*	68784-75-8	272-271-5	N.D.	0.005	Toxic for reproduction
Silicic acid, lead salt*	11120-22-2	234-363-3	N.D.	0.005	Toxic for reproduction
Sulfurous acid, lead salt, dibasic*	62229-08-7	263-467-1	N.D.	0.005	Toxic for reproduction
Tetraethyllead*	78-00-2	201-075-4	N.D.	0.005	Toxic for reproduction
Tetralead trioxide sulphate*	12202-17-4	235-380-9	N.D.	0.005	Toxic for reproduction

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at www.sgs.com/terms_e-document.htm. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s).

SGS Korea Co., Ltd.

322, The O valley, 75, LS-ro, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 431-080
t +82 (0)31 4608 000 f +82 (0)31 4608 059 <http://www.sgsgroup.kr>

Member of the SGS Group (Société Générale de Surveillance)

F401 Version 2

Substance Name	CAS number	EC number	Concentration (%)	Reporting Limit (%)	Classification
Trilead dioxide phosphonate*	12141-20-7	235-252-2	N.D.	0.005	Toxic for reproduction
Furan	110-00-9	203-727-3	N.D.	0.05	Carcinogenic
Propylene oxide; 1,2-epoxypropane; methyloxirane	75-56-9	200-879-2	N.D.	0.05	Carcinogenic Mutagenic
Diethyl sulphate	64-67-5	200-589-6	N.D.	0.05	Carcinogenic Mutagenic
Dimethyl sulphate	77-78-1	201-058-1	N.D.	0.05	Carcinogenic
3-ethyl-2-methyl-2-(3-methylbutyl)-1,3-oxazolidine	143860-04-2	421-150-7	N.D.	0.05	Toxic for reproduction
Dinoseb	88-85-7	201-861-7	N.D.	0.05	Toxic for reproduction
4,4'-methylenedi-o-toluidine	838-88-0	212-658-8	N.D.	0.05	Carcinogenic
4,4'-oxydianiline and its salts	101-80-4	202-977-0	N.D.	0.05	Carcinogenic Mutagenic
4-Aminoazobenzene; 4-Phenylazoaniline	60-09-3	200-453-6	N.D.	0.05	Carcinogenic
4-methyl-m-phenylenediamine (2,4-toluene-diamine)	95-80-7	202-453-1	N.D.	0.05	Carcinogenic
6-methoxy-m-toluidine (p-cresidine)	120-71-8	204-419-1	N.D.	0.05	Carcinogenic
Biphenyl-4-ylamine	92-67-1	202-177-1	N.D.	0.05	Carcinogenic
o-aminoazotoluene	97-56-3	202-591-2	N.D.	0.05	Carcinogenic
o-Toluidine; 2-Aminotoluene	95-53-4	202-429-0	N.D.	0.05	Carcinogenic
N-methylacetamide	79-16-3	201-182-6	N.D.	0.05	Toxic for reproduction
1-bromopropane; n-propyl bromide	106-94-5	203-445-0	N.D.	0.05	Toxic for reproduction

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at www.sgs.com/terme_e-document.htm. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s).

SGS Korea Co., Ltd.

322, The O valley, 76, LS-ro, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 431-080
t +82 (0)31 4608 000 f +82 (0)31 4608 059 <http://www.sgsgroup.kr>

Member of the SGS Group (Société Générale de Surveillance)

Substance Name	CAS number	EC number	Concentration (%)	Reporting Limit (%)	Classification
Cadmium	7440-43-9	231-152-8	N.D.	0.005	Carcinogenic
Cadmium oxide*	1306-19-0	215-146-2	N.D.	0.005	Carcinogenic
Dipentyl phthalate (DPP)	131-18-0	205-017-9	N.D.	0.05	Toxic for reproduction
4-Nonylphenol, branched and linear, ethoxylated [substances with a linear and/or branched alkyl chain with a carbon number of 9 covalently bound in position 4 to phenol, ethoxylated covering UVCB- and well-defined substances, polymers and homologues, which include any of the individual isomers and/or combinations thereof]	-	-	N.D.	0.05	Equivalent level of concern having probable serious effects to the environment
Ammonium pentadecafluorooctanoate (APFO)	3825-26-1	223-320-4	N.D.	0.05	Toxic for reproduction
Pentadecafluorooctanoic acid (PFOA)	335-67-1	206-397-9	N.D.	0.05	Toxic for reproduction

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at www.sgs.com/terms_e-document.htm. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained herein reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s).

SGS Korea Co., Ltd.

322, The O valley, 76, LS-ro, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 431-080
 t +82 (0)31 4608 000 f +82 (0)31 4608 059 <http://www.sgsgroup.kr>

Member of the SGS Group (Société Générale de Surveillance)

F401 Version 2

Substance Name	CAS number	EC number	Concentration (%)	Reporting Limit (%)	Classification
Dihexyl phthalate	84-75-3	201-559-5	N.D.	0.05	Toxic for reproduction
Trixylyl phosphate	25155-23-1	246-677-8	N.D.	0.05	Toxic for reproduction
Imidazolidine-2-thione; 2-imidazoline-2-thiol	96-45-7	202-506-9	N.D.	0.05	Toxic for reproduction
Disodium 4-amino-3-[[4'-((2,4-diaminophenyl)azo)[1,1'-biphenyl]-4-yl]azo]-5-hydroxy-6-(phenylazo)naphthalene-2,7-disulphonate (C.I. Direct Black 38)	1937-37-7	217-710-3	N.D.	0.05	Carcinogenic
Disodium 3,3'-[[1,1'-biphenyl]-4,4'-diylbis(azo)]bis(4-aminonaphthalene-1-sulphonate) (C.I. Direct Red 28)	573-58-0	209-358-4	N.D.	0.05	Carcinogenic
Cadmium sulphide*	1306-23-6	215-147-8	N.D.	0.005	Carcinogenic Equivalent level of concern having probable serious effects to human health
Lead di(acetate)*	301-04-2	206-104-4	N.D.	0.005	Toxic for reproduction

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at www.sgs.com/terms_e-document.htm. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained herein reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s).

SGS Korea Co., Ltd.

322, The O valley, 76, LG-ro, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 431-080
 t +82 (0)31 4608 000 f +82 (0)31 4608 059 <http://www.sgs.com>

Member of the SGS Group (Société Générale de Surveillance)

Substance Name	CAS number	EC number	Concentration (%)	Reporting Limit (%)	Classification
1,2-Benzenedicarboxylic acid, dihexyl ester, branched and linear	68515-50-4	271-093-5	N.D.	0.05	Toxic for reproduction
Cadmium chloride*	10108-64-2	233-296-7	N.D.	0.005	Carcinogenic Mutagenic Toxic for Reproduction Equivalent level of concern having probable serious effects to human health
Sodium perborate*; perboric acid, sodium salt*	-	239-172-9 234-390-0	N.D.	0.005	Toxic for reproduction
Sodium peroxometaborate*	7632-04-4	231-556-4	N.D.	0.005	Toxic for reproduction

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at www.sgs.com/terms_e-document.htm. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s).

SGS Korea Co., Ltd.

322, The O valley, 76, LG-ro, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 431-080
t +82 (0)31 4608 000 f +82 (0)31 4608 059 <http://www.sgsgroup.kr>

Member of the SGS Group (Société Générale de Surveillance)

F401 Version 2

Substance Name	CAS number	EC number	Concentration (%)	Reporting Limit (%)	Classification
2-benzotriazol-2-yl-4,6-di-tert-butylphenol (UV-320)	3846-71-7	223-346-6	N.D	0.05	PBT vPvB
2-(2H-benzotriazol-2-yl)-4,6-ditertpentylphenol (UV-328)	25973-55-1	247-384-8	N.D	0.05	PBT vPvB
2-ethylhexyl 10-ethyl-4,4-dioctyl-7-oxo-8-oxa-3,5-dithia-4-stannatetradecanoate (DOTE)	15571-58-1	239-622-4	N.D	0.05	Toxic for Reproduction
Reaction mass of 2-ethylhexyl 10-ethyl-4,4-dioctyl-7-oxo-8-oxa-3,5-dithia-4-stannatetradecanoate and 2-ethylhexyl 10-ethyl-4-[[2-((2-ethylhexyl)oxy)-2-oxoethyl]thio]-4-octyl-7-oxo-8-oxa-3,5-dithia-4-stannatetradecanoate (reaction mass of DOTE and MOTE)	-	-	N.D	0.05	Toxic for Reproduction
Cadmium fluoride	7790-79-6	232-222-0	N.D	0.005	Carcinogenic Mutagenic Toxic for Reproduction Equivalent level of concern having probable serious effects to human health
Cadmium sulphate	10124-36-4; 31119-53-6	233-331-6	N.D	0.005	Carcinogenic Mutagenic; Toxic for Reproduction Equivalent level of concern having probable serious effects to human health

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at www.sgs.com/terms_e-document.htm. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s).

SGS Korea Co., Ltd.

322, The O valley, 76, LG-ro, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 431-080
t +82 (0)31 4608 000 f +82 (0)31 4608 059 <http://www.sgsgroup.kr>

Member of the SGS Group (Société Générale de Surveillance)

F401 Version 2

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/quest/candidate-list-table> (Candidate list)

http://echa.europa.eu/proposals-to-identify-substances-of-very-high-concern-previous-consultations?p_p=id=substancetypelist_WAR_substanceportlet&p_p=lifecycle=0&p_p=state=normal&p_p=mode=view&p_p=col=id=column-1&p_p=col=pos=2&p_p=col=count=4&substancetypelis
(Proposals to identify SVHC consultations)

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.

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at www.sgs.com/terms_e-document.htm. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s).



*** End of Report ***

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at www.sgs.com/terms_e-document.htm. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s).

SGS Korea Co., Ltd.

322, The O valley, 76, LS-ro, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 431-080
t +82 (0)31 4608 000 f +82 (0)31 4608 059 <http://www.sgzgroup.kr>

Member of the SGS Group (Société Générale de Surveillance)

Appendix A

Classification	Definition under 67/548/EEC and Regulation (EC) No 1907/2006
Carcinogen Category 1:	<u>Substances known to be carcinogenic to man.</u> There is sufficient evidence to establish a causal association between human exposure to a substance and the development of cancer.
Carcinogen Category 2:	<u>Substances which should be regarded as if they are carcinogenic to man.</u> 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:	<u>Substances known to be mutagenic to man.</u> There is sufficient evidence to establish a causal association between human exposure to a substance and heritable genetic damage.
Mutagen Category 2:	<u>Substances which should be regarded as if they are mutagenic to man.</u> 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:	<u>Substances known to impair fertility in humans.</u> There is sufficient evidence to establish a causal relationship between human exposure to the substance and impaired fertility. <u>Substances known to cause developmental toxicity in humans.</u> 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:	<u>Substances which should be regarded as if they impair fertility in humans.</u> 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. <u>Substances which should be regarded as if they cause developmental toxicity to humans.</u> 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.

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at www.sgs.com/terms_e-document.htm. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s).

Revision History

Date	No.	Revision History	Writer	
			Drawn	Approved
2012.12.13	000	New version	J.W.PARK	Y.T.KIM
2013.01.04	001	Change of Model MP36S → LM362A	J.W.PARK	Y.T.KIM
2013.02.04	002	Addition of Precaution for VOCs	J.W.PARK	Y.T.KIM
2013.04.03	003	Change of Cx, Cy tolerance ±0.01 → ±0.005	J.W.PARK	Y.T.KIM
2013.04.04	004	Addition of Model code CRI78 2700K	J.W.PARK	Y.T.KIM
2014.01.21	005	Addition of Out box	N.R.KIM	S.B.YUN
2014.08.14	006	Addition of Kitting combination Addition of UL Authentication	N.R.KIM	S.B.YUN
2014.11.11	007	Addition of PQ rank	H.Y.EOM	J.K.PARK
2014.11.18	008	Change of Kitting bin Packing Process Addition UL mark of reel	H.Y.EOM	J.K.PARK