





LM80 Test Report

IES LM-80-08 Approved Method for Measuring Lumen Maintenance of LED Light Sources

Samsung Electronics LED Business Quality Team Report

Report No. : SLED-13-001
Test Initiated Date : 2013.01.21
Report issued Date : 2013.10.10

Test result reported for	Testing performed by
	SAMSUNG ELECTRONICS LED BUSINESS QUALITY TEAM San#24 Nongseo-Dong Giheung-Gu, Yongin-City Gyeonggi-Do 446-711, Korea
Tested By HaYong, Sim	Approved by HeeYoung, Lee
	
Test Personal Name & Signatory	Approval Name & Signatory

SAMSUNG ELECTRONICS LED BUSINESS Executive Vice President (signatory)
Accredited by KOLAS, Republic of KOREA

The above testing certificate is the accredited testing items by Korea Laboratory Accreditation Scheme, which signed the ILAC-MRA.

■ Test Summary ■

Life test condition			Summary of result		
Test condition	Current (mA)	Case temperature (°C)	Test duration (h)	Average lumen maintenance (%)	Maximum chromaticity shift ($\Delta u'v'$)
1	100	53.8°C	6000	98.9	0.0010
2	100	84.6°C	6000	97.8	0.0018
3	100	104.9°C	6000	92.4	0.0032

1. Number of LED light sources tested

- 25 Packages tested at actual case temperature 53.8°C
- 25 Packages tested at actual case temperature 84.6°C
- 25 Packages tested at actual case temperature 104.9°C

2. Description of LED light sources

- Samsung Electronics LED Package : LM561B
- IF = 100mA, CCT(Nominal) = 3000K
- Package Dimension : 5.6 × 3.0 × 0.8 mm

3. Description of auxiliary equipment

- 1) Instrument Integrating sphere ISP1000-100
- 2) Instrument CAS140-CT
- 3) Keithley 2425 Sourcemeater

4. Operating time

LED packages are driven with a constant direct current.

- Number of units : 25 at 55°C, 85°C and 105°C
- Drive current : 100mA
- Typical voltage : 2.9 V

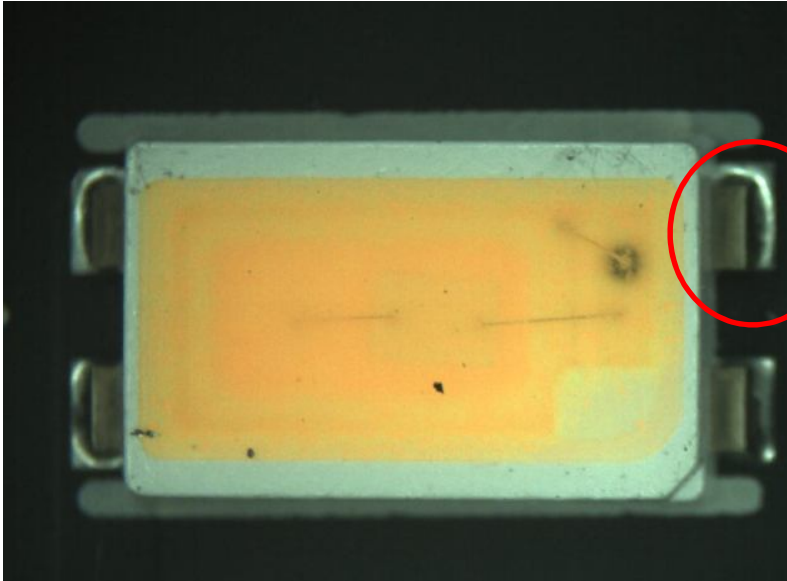
5. Ambient conditions including airflow, temperature and relative humidity

The minimal airflow is maintained in chamber.

The ambient temperature around the LED packages inside chamber is controlled by air flowing and the thermocouple readings are monitored.

- Case temperature : Contorlled to -2°C
- Surrounding air temperature : Contorlled to -5°C
- Relative humidity : < 65%RH

6. Case temperature (Test point temperature)



Ts Measurement Point

7. Drive current of the LED light source during lifetime test

See Sub-clause 9.1, 9.2 and 9.3

8. Initial luminous flux and forward voltage

See the table

9. Lumen maintenance data for each individual LED light source

See the table

No.	CCT (K)	CCT(K)						
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h
1	3011	3012	3012	3020	3032	3026	3025	3024
2	3038	3036	3040	3046	3054	3054	3055	3056
3	3010	3011	3011	3024	3025	3025	3024	3027
4	3041	3041	3040	3050	3054	3057	3044	3044
5	3019	3022	3023	3032	3034	3037	3032	3037
6	3006	3015	3007	3016	3022	3023	3023	3020
7	2988	2990	2990	3001	3016	3008	3004	3004
8	3021	3020	3031	3035	3037	3044	3046	3043
9	3018	3016	3018	3028	3034	3033	3035	3031
10	3024	3022	3023	3030	3033	3034	3035	3030
11	3005	3011	3006	3013	3019	3019	3025	3024
12	2954	2957	2961	2968	2975	2985	2981	2978
13	2995	2995	3000	3009	3023	3025	3020	3021
14	3021	3022	3024	3030	3034	3034	3043	3037
15	2987	2983	2980	2988	2996	2995	2997	2996
16	2999	3013	3007	3013	3014	3020	3023	3020
17	3008	3008	3012	3023	3024	3024	3025	3023
18	2948	2947	2950	2955	2960	2961	2963	2957
19	2986	2985	2987	2995	2999	3002	3002	3002
20	3001	3001	3008	3013	3017	3019	3019	3022
21	2993	2996	3007	3010	3009	3009	3009	3008
22	2968	2967	2970	2979	2981	2980	2981	2983
23	3003	3005	3004	3006	3012	3013	3013	3014
24	2994	2994	2997	3001	3003	3005	3005	3006
25	3009	3006	3010	3015	3016	3026	3020	3019
Mean	3002	3003	3005	3012	3017	3018	3018	3017
Median	3005	3008	3007	3013	3019	3023	3023	3021
std.dev	22	23	22	23	23	22	22	22
Max	3041	3041	3040	3050	3054	3057	3055	3056
Min	2948	2947	2950	2955	2960	2961	2963	2957

No.	CCT (K)	CCT(K)						
	0h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h
1	3022	3027	3035	3037	3042	3043	3044	3042
2	3005	3008	3015	3026	3025	3028	3028	3029
3	3018	3025	3030	3038	3048	3050	3050	3053
4	2966	2968	2974	2980	2984	2987	2990	2991
5	3045	3048	3057	3058	3066	3067	3069	3071
6	3030	3042	3039	3045	3054	3055	3054	3056
7	3010	3015	3031	3034	3038	3040	3040	3042
8	3029	3055	3068	3063	3079	3065	3065	3067
9	3001	3003	3007	3013	3022	3022	3024	3023
10	3006	3021	3019	3023	3035	3036	3039	3035
11	2973	2983	2987	2988	2995	2999	2997	2997
12	3013	3016	3027	3026	3031	3034	3033	3034
13	2972	2973	2984	2988	2990	2995	2993	2994
14	2955	2956	2960	2964	2972	2974	2974	2976
15	2979	2988	2988	2995	3005	3003	3003	3003
16	2985	2990	2999	3003	3020	3013	3014	3016
17	3009	3013	3020	3021	3026	3031	3031	3031
18	2987	2988	2995	2999	3005	3002	3003	3007
19	3022	3024	3027	3034	3037	3037	3040	3042
20	3008	3008	3015	3020	3030	3032	3032	3033
21	3042	3045	3051	3054	3063	3069	3065	3065
22	2988	2997	3001	3007	3036	3020	3020	3032
23	2958	2960	2970	2975	2980	2980	2982	2981
24	3047	3048	3055	3062	3067	3068	3065	3066
25	3048	3049	3057	3061	3069	3068	3068	3071
Mean	3005	3010	3016	3021	3029	3029	3029	3030
Median	3008	3013	3019	3023	3031	3032	3032	3033
std.dev	28	29	30	29	30	29	29	29
Max	3048	3055	3068	3063	3079	3069	3069	3071
Min	2955	2956	2960	2964	2972	2974	2974	2976



9.3 Test condition 3 105°C
Drive Current 100mA
Measurement Current 100mA

No.	Flux (lm)	Vf (V)	Lumen Maintenance (%)						
	0 h		500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h
1	22.5	2.976	100.6	101.0	100.8	99.9	98.2	94.9	92.4
2	22.6	2.971	100.2	100.7	100.4	99.5	97.5	94.2	91.6
3	22.7	2.972	100.3	100.6	100.2	99.3	97.3	93.9	91.0
4	22.5	2.965	100.1	100.5	99.9	99.1	97.2	93.6	90.7
5	22.7	3.006	100.6	101.1	100.8	100.1	98.7	96.8	95.2
6	22.8	2.969	100.0	100.5	100.3	99.3	97.7	94.7	92.3
7	22.6	2.970	100.0	100.3	100.1	98.8	97.8	95.3	93.1
8	22.8	2.976	100.4	100.6	100.4	99.7	97.3	93.6	91.0
9	23.2	3.023	100.2	100.4	100.2	99.5	98.1	96.5	94.7
10	23.1	2.973	100.0	100.5	100.3	99.4	97.7	95.2	93.1
11	22.9	2.972	100.0	100.4	100.3	99.1	97.0	93.6	90.8
12	23.1	2.978	100.2	100.6	100.3	98.7	97.8	94.9	92.3
13	23.3	2.986	100.1	100.5	100.1	99.5	97.5	94.8	92.7
14	23.1	2.988	100.1	100.5	100.2	99.4	96.7	94.1	91.8
15	23.0	2.970	100.2	100.5	100.3	99.2	97.3	94.3	91.8
16	23.0	2.970	100.0	100.3	100.0	99.2	97.6	94.0	91.0
17	22.6	3.003	100.5	101.0	101.3	100.4	98.8	96.6	94.8
18	22.6	2.970	100.0	100.4	100.4	98.0	96.6	93.4	91.0
19	23.1	2.974	100.1	100.4	100.1	99.1	97.0	94.5	92.0
20	22.9	2.973	100.2	100.5	100.4	98.9	97.8	94.9	92.4
21	22.7	3.005	100.4	101.0	101.0	99.5	99.1	96.9	95.2
22	23.3	3.024	100.0	100.3	100.1	99.4	97.8	95.7	93.4
23	22.9	2.986	100.1	100.7	100.6	99.3	97.1	94.5	91.9
24	22.7	2.975	100.1	100.5	100.5	99.3	97.4	94.3	91.4
25	22.5	3.020	100.0	100.2	100.2	99.1	98.0	94.9	92.2
Mean	22.86	2.98	100.17	100.56	100.37	99.30	97.64	94.81	92.40
Median	22.83	2.97	100.12	100.49	100.28	99.33	97.61	94.70	92.24
std.dev	0.25	0.02	0.19	0.24	0.33	0.47	0.60	1.01	1.38
Max	23.30	3.02	100.58	101.07	101.32	100.44	99.08	96.91	95.24
Min	22.46	2.97	99.96	100.22	99.95	97.96	96.64	93.45	90.65

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No.	Cx	Cy	Chromaticity Shift ($\Delta u'v'$)						
	0h		500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h
1	0.4404	0.4067	0.0003	0.0003	0.0003	0.0002	0.0005	0.0017	0.0025
2	0.4358	0.4059	0.0004	0.0005	0.0002	0.0000	0.0006	0.0018	0.0027
3	0.4353	0.4023	0.0004	0.0003	0.0002	0.0002	0.0008	0.0021	0.0031
4	0.4391	0.4067	0.0002	0.0003	0.0003	0.0003	0.0008	0.0023	0.0032
5	0.4326	0.3999	0.0003	0.0003	0.0001	0.0003	0.0005	0.0011	0.0016
6	0.4377	0.4040	0.0004	0.0003	0.0002	0.0001	0.0005	0.0015	0.0023
7	0.4378	0.4043	0.0002	0.0003	0.0001	0.0001	0.0004	0.0014	0.0020
8	0.4342	0.4033	0.0003	0.0004	0.0001	0.0002	0.0009	0.0023	0.0032
9	0.4365	0.4030	0.0003	0.0003	0.0003	0.0003	0.0003	0.0008	0.0013
10	0.4371	0.4044	0.0003	0.0003	0.0002	0.0001	0.0004	0.0016	0.0022
11	0.4361	0.4023	0.0006	0.0006	0.0005	0.0003	0.0006	0.0018	0.0028
12	0.4371	0.4045	0.0003	0.0003	0.0002	0.0006	0.0007	0.0018	0.0026
13	0.4350	0.4039	0.0004	0.0004	0.0002	0.0002	0.0007	0.0017	0.0025
14	0.4357	0.4013	0.0002	0.0003	0.0002	0.0001	0.0008	0.0018	0.0024
15	0.4377	0.4045	0.0002	0.0003	0.0003	0.0001	0.0007	0.0018	0.0026
16	0.4378	0.4052	0.0002	0.0002	0.0001	0.0002	0.0006	0.0020	0.0031
17	0.4331	0.4005	0.0003	0.0003	0.0003	0.0003	0.0004	0.0013	0.0019
18	0.4414	0.4082	0.0002	0.0002	0.0001	0.0006	0.0010	0.0022	0.0030
19	0.4352	0.4054	0.0002	0.0002	0.0001	0.0002	0.0009	0.0016	0.0025
20	0.4378	0.4042	0.0003	0.0003	0.0002	0.0003	0.0007	0.0017	0.0024
21	0.4325	0.3986	0.0005	0.0004	0.0003	0.0008	0.0004	0.0011	0.0016
22	0.4372	0.4049	0.0002	0.0002	0.0002	0.0002	0.0007	0.0015	0.0019
23	0.4341	0.4028	0.0003	0.0003	0.0002	0.0001	0.0012	0.0018	0.0028
24	0.4372	0.4040	0.0001	0.0002	0.0002	0.0003	0.0008	0.0020	0.0028
25	0.4392	0.4059	0.0002	0.0003	0.0003	0.0001	0.0006	0.0015	0.0022
Mean	0.4365	0.4039	0.0003	0.0003	0.0002	0.0002	0.0007	0.0017	0.0025
Median	0.4371	0.4042	0.0003	0.0003	0.0002	0.0002	0.0007	0.0017	0.0025
std.dev	0.0023	0.0022	0.0001	0.0001	0.0001	0.0002	0.0002	0.0004	0.0005
Max	0.4414	0.4082	0.0006	0.0006	0.0005	0.0008	0.0012	0.0023	0.0032
Min	0.4325	0.3986	0.0001	0.0002	0.0001	0.0000	0.0003	0.0008	0.0013

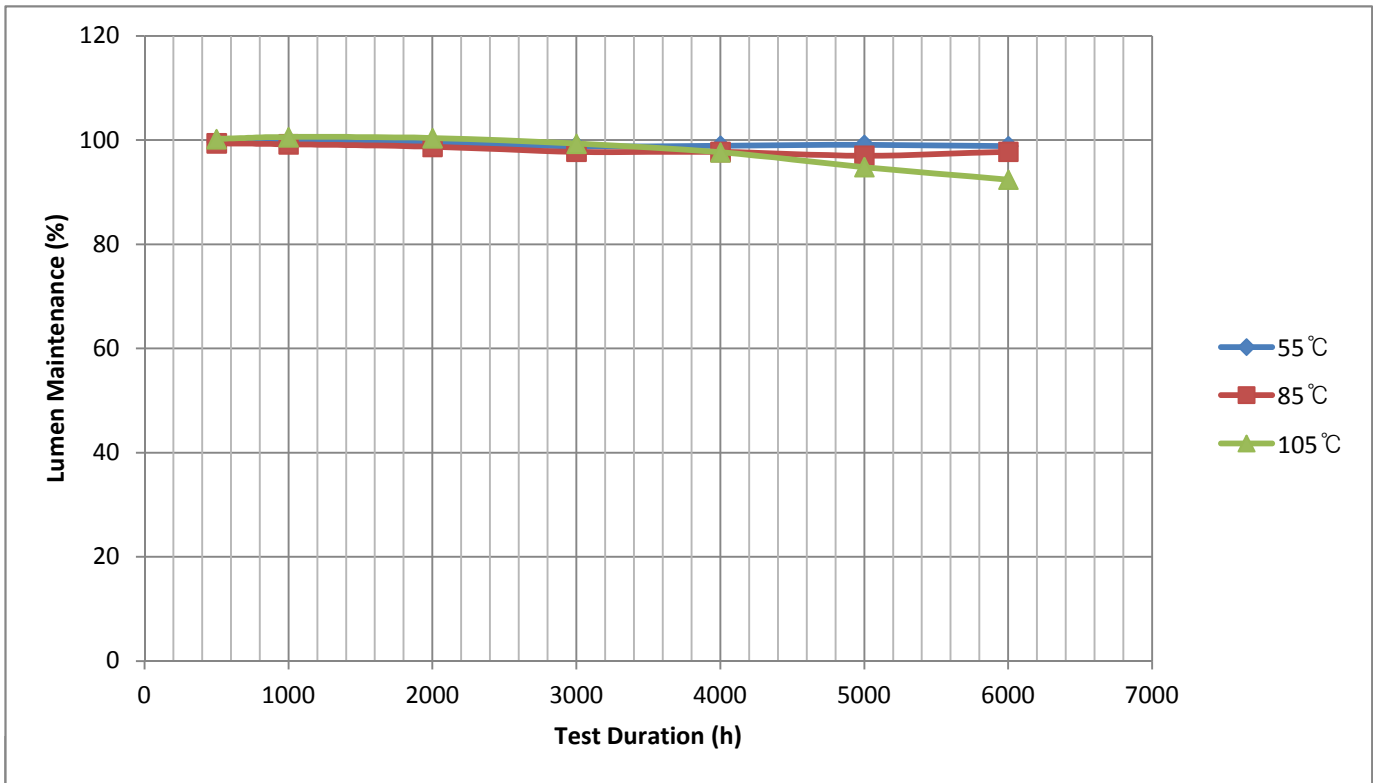
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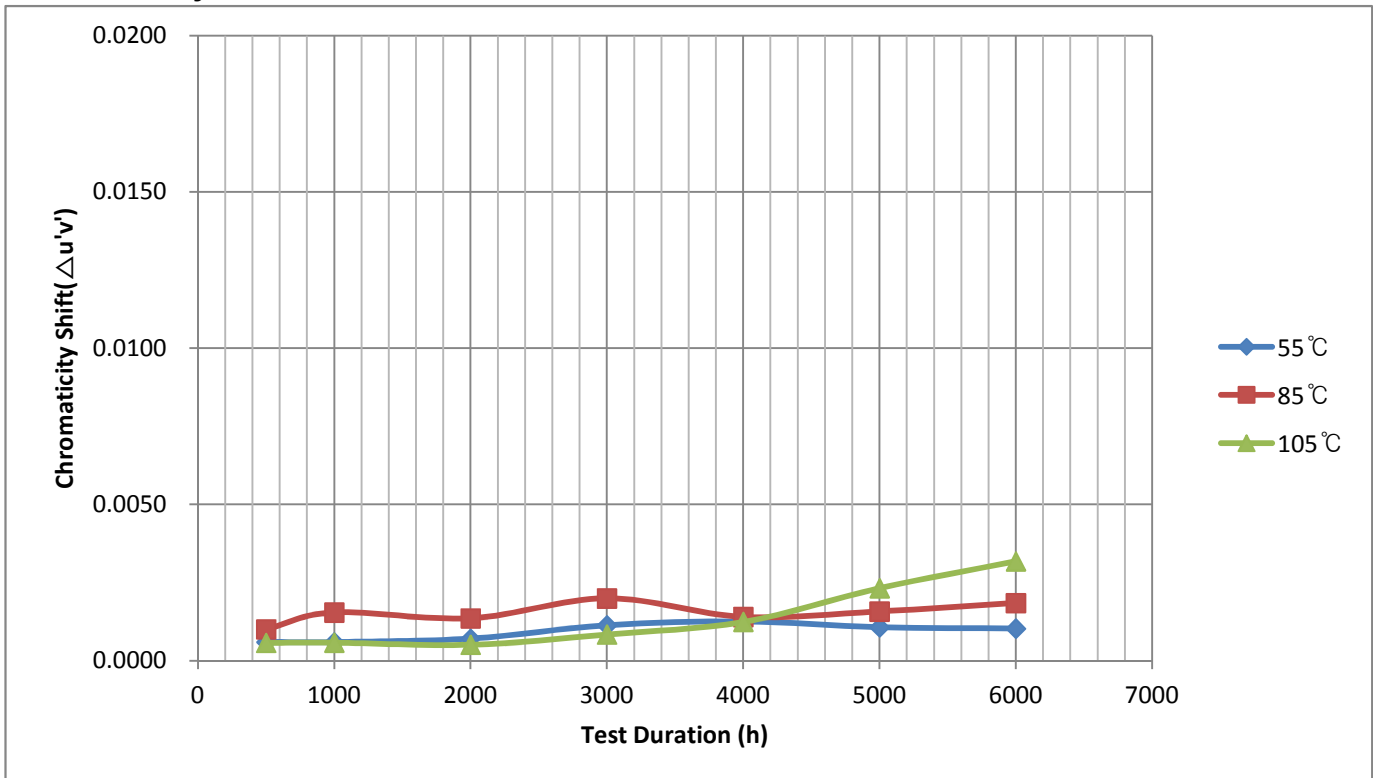
No.	CCT (K)	CCT(K)						
	0h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h
1	2963	2960	2957	2962	2965	2975	3001	3021
2	3034	3024	3023	3030	3034	3048	3071	3094
3	3014	3009	3009	3011	3019	3032	3061	3082
4	2985	2981	2979	2991	2992	3004	3035	3055
5	3041	3036	3036	3041	3049	3050	3064	3077
6	2988	2981	2983	2985	2986	2999	3020	3038
7	2987	2984	2979	2986	2989	2996	3014	3028
8	3040	3035	3034	3042	3046	3061	3092	3112
9	2999	2996	2996	3002	3003	3007	3018	3029
10	3000	2995	2995	2998	3000	3010	3034	3050
11	2999	2987	2985	2988	2991	3012	3036	3058
12	3001	2996	2996	3000	3016	3018	3041	3059
13	3032	3025	3024	3030	3035	3048	3069	3089
14	2998	2997	2991	2994	3000	3017	3033	3050
15	2990	2989	2986	2988	2992	3008	3029	3049
16	2994	2991	2995	2996	2998	3009	3038	3064
17	3037	3036	3038	3037	3043	3047	3068	3083
18	2960	2957	2955	2958	2973	2983	3007	3028
19	3041	3037	3039	3038	3045	3063	3076	3097
20	2986	2982	2982	2983	2993	3004	3025	3039
21	3030	3022	3026	3025	3052	3040	3056	3067
22	3001	2999	3000	2998	3004	3020	3035	3044
23	3038	3035	3033	3035	3040	3069	3079	3105
24	2995	2993	2993	2992	3003	3016	3039	3060
25	2976	2975	2973	2972	2975	2990	3009	3025
Mean	3005	3001	3000	3003	3010	3021	3042	3060
Median	2999	2996	2995	2998	3003	3016	3036	3058
std.dev	25	24	25	25	26	26	25	26
Max	3041	3037	3039	3042	3052	3069	3092	3112
Min	2960	2957	2955	2958	2965	2975	3001	3021

9.4 Chart

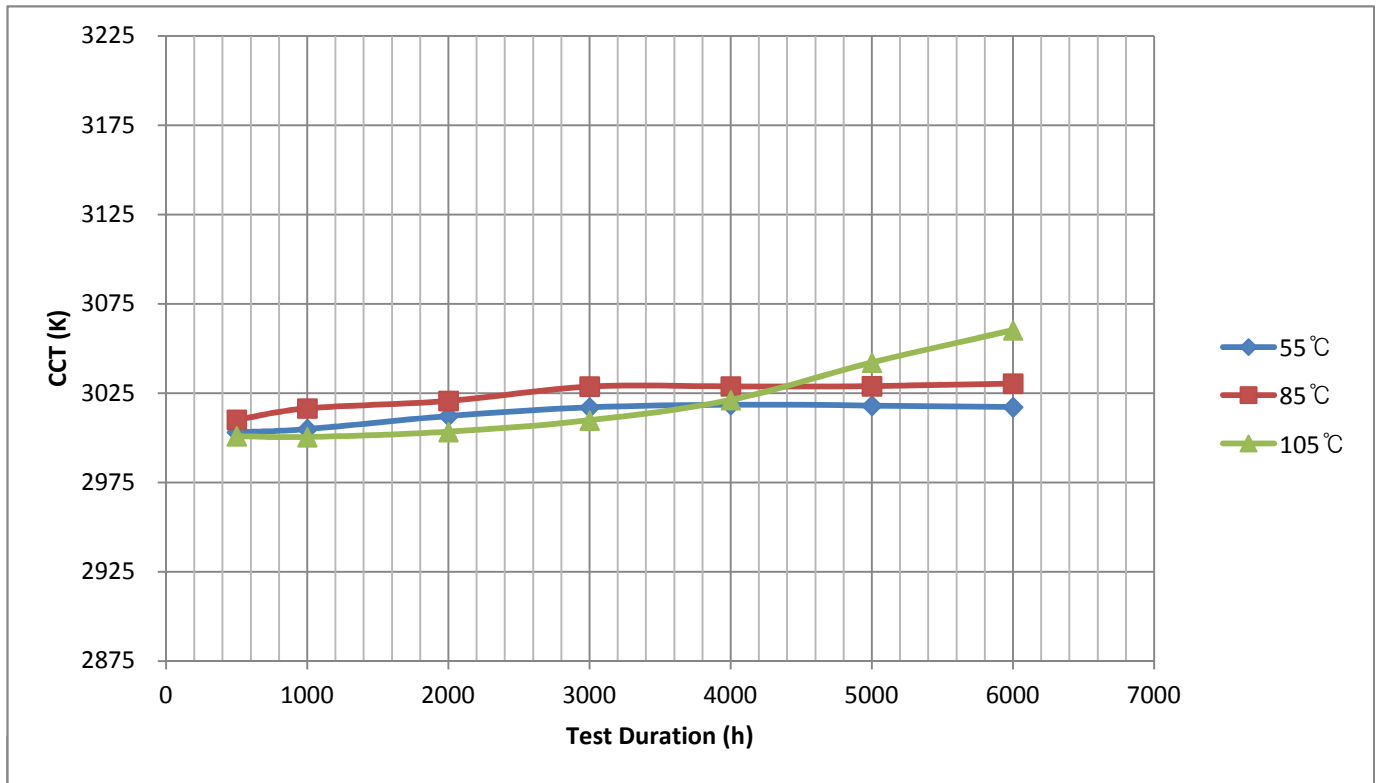
<Lumen Maintenance>



<Chromaticity Shift>



<CCT>



10. Observation of failures

No optical, Electrical or mechanical failure of any LED Package was seen during the lifetime testing.

11. LED light source monitoring interval

0 500 1000 2000 3000 4000 5000 6000

12. Photometric measurement uncertainty

2%

13. TM-21-11 Report : Projecting Long Term Lumen Maintenance of LED Light Source

Table 1: Report at each LM-80 Test Condition					
Description of LED Light Source Tested (manufacturer, model, catalog number)		Samsung Electronics LM561B 100mA			
Test Condition 1 - 55°C Case Temp		Test Condition 2 - 85°C Case Temp		Test Condition 3 - 105°C Case Temp	
Sample size	25	Sample size	25	Sample size	25
Number of failures	0	Number of failures	0	Number of failures	0
DUT drive current used in the test (mA)	100	DUT drive current used in the test (mA)	100	DUT drive current used in the test (mA)	100
Test duration (hours)	6,000	Test duration (hours)	6,000	Test duration (hours)	6,000
Test duration used for projection (hour to hour)	1,000 - 6,000	Test duration used for projection (hour to hour)	1,000 - 6,000	Test duration used for projection (hour to hour)	1,000 - 6,000
Tested case temperature (°C)	55	Tested case temperature (°C)	85	Tested case temperature (°C)	105
α	1.749E-06	α	3.602E-06	α	1.745E-05
B	0.998	B	0.993	B	1.036
Calculated L70(6k) (hours)	203,000	Calculated L70(6k) (hours)	97,000	Calculated L70(6k) (hours)	22,000
Reported L70(6k) (hours)	>36000	Reported L70(6k) (hours)	>36000	Reported L70(6k) (hours)	22,000

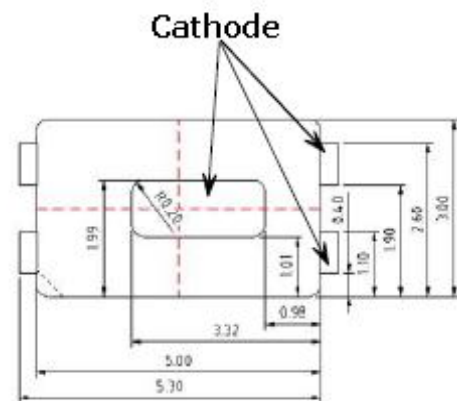
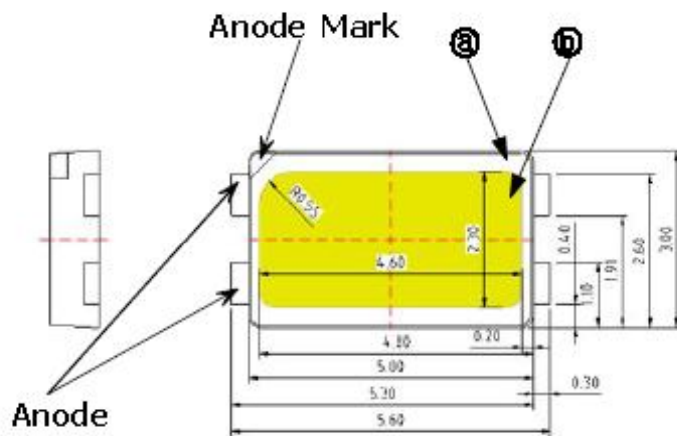
14. Photo of samples



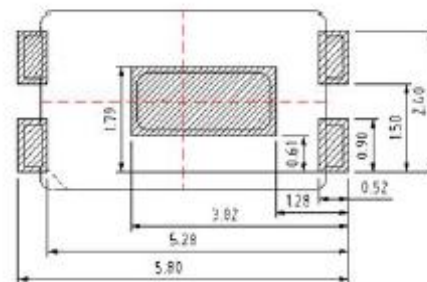
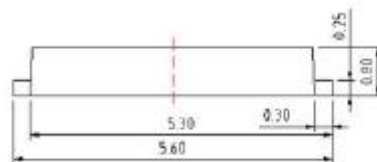
Left Side View

Top View

Bottom View



Front View



Recommended Land Pattern

*******END OF TEST REPORT*******