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-13-002
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.

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QUALITY TEAM
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Giheung-Gu, Yongin-City
Gyeonggi-Do 446-711, Korea

■ Test Summary ■

Life test condition			Summary of result		
Test condition	Current (mA)	Case temperature (℃)	Test duration (h)	Average lumen maintenance (%)	Maximum chromaticity shift (△u'v')
1	150	54.1℃	6000	98.6	0.0008
2	150	83.3℃	6000	97.6	0.0015
3	150	105.1℃	6000	92.2	0.0031

1. Number of LED light sources tested

-25 Packages tested at actual case temperature 54.1℃

-25 Packages tested at actual case temperature 83.3℃

-25 Packages tested at actual case temperature 105.1℃

2. Description of LED light sources

- Samsung Elctronics LED Package : LM561B
- IF = 150㎃, CCT(Nominal) = 3000K
- Package Dimension : 5.6 × 3.0 × 0.8 ㎜

3. Description of auxiliary equipment

1) Instrument Integrating sphere ISP1000-100

2) Instrument CAS140-CT

3) Keithley 2425 Sourcemeter

4. Operating time

LED packages are driven with a constant direct current.

- Number of units : 25 at 55℃, 85℃ and 105℃
- Drive current : 150㎃
- Typical voltage : 3.1 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℃
- Surrounding air temperature : Contorlled to -5℃
- Relative humidity : ＜ 65%RH

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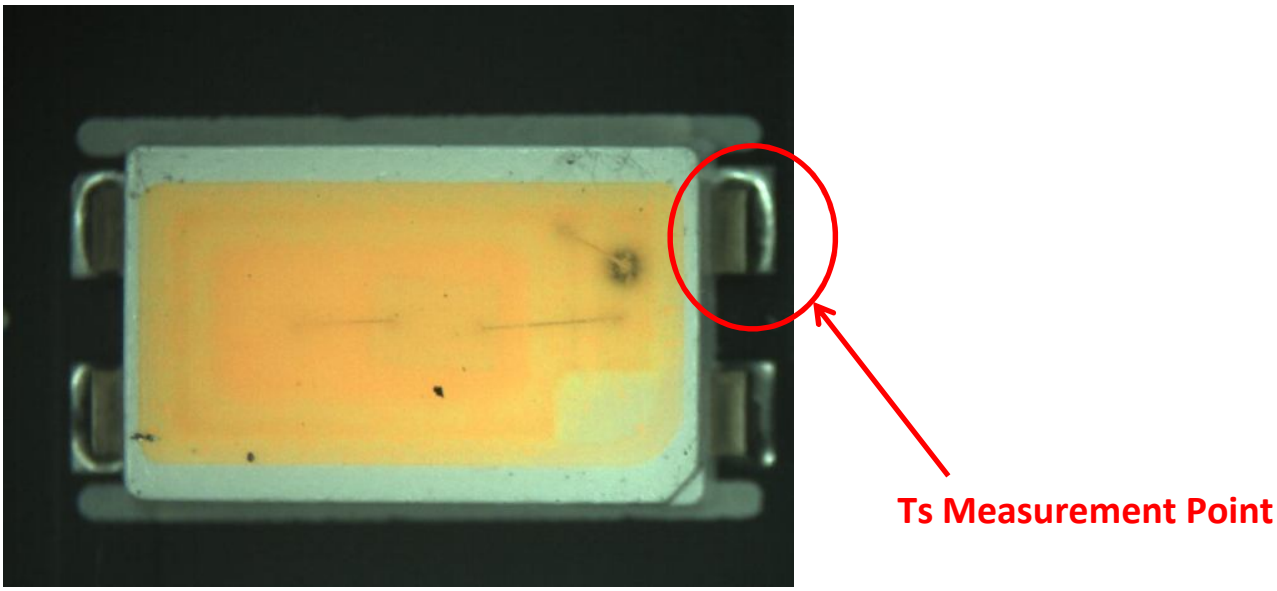
6. Case temperature (Test point temperature)



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

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9.1 Test condition 1 **55℃**

Dirve Current **150mA**

Measurement Current **150mA**

No.	Flux (lm)	Vf (V)	Lumen Maintenance (%)						
	0 h		500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h
1	32.8	3.128	99.4	99.5	97.1	98.5	98.9	98.6	98.6
2	32.2	3.115	99.5	99.5	99.5	98.8	98.4	97.9	98.0
3	32.6	3.117	99.4	99.6	99.7	98.9	99.1	98.7	98.5
4	32.5	3.131	99.8	100.0	100.1	99.4	99.4	99.1	99.4
5	32.4	3.110	99.4	99.8	99.3	98.6	98.8	98.3	98.3
6	32.2	3.119	99.6	99.9	99.5	99.0	98.6	98.0	98.5
7	33.2	3.125	99.3	99.5	99.8	99.2	98.8	98.6	98.8
8	32.8	3.114	98.4	98.5	98.9	98.4	98.2	98.0	98.1
9	32.5	3.112	98.3	98.6	98.5	97.9	98.2	98.0	98.1
10	32.4	3.109	99.8	100.0	99.8	99.0	99.2	98.6	98.9
11	31.7	3.120	99.1	99.6	99.2	98.5	98.3	97.9	98.1
12	32.9	3.115	100.0	100.1	99.7	99.2	99.1	98.6	98.6
13	32.9	3.112	99.7	99.7	99.7	98.8	97.9	98.1	98.3
14	33.0	3.111	99.4	99.8	99.5	98.6	98.5	98.0	98.1
15	32.5	3.107	100.1	100.4	100.1	99.7	99.5	99.0	99.3
16	33.1	3.121	99.7	99.9	99.5	98.9	98.7	98.3	98.3
17	33.2	3.117	100.0	100.1	99.9	99.2	99.2	98.7	98.8
18	33.0	3.107	100.2	100.4	100.2	99.4	99.7	99.3	99.4
19	33.1	3.110	99.8	99.8	99.5	98.7	98.7	98.3	98.4
20	32.7	3.109	100.2	100.5	100.3	99.7	99.9	99.8	100.1
21	32.8	3.119	99.6	99.6	99.4	99.0	98.9	98.1	98.2
22	32.7	3.112	99.9	100.1	99.2	98.5	98.8	98.2	98.1
23	33.2	3.138	99.5	99.5	99.4	98.7	98.7	98.2	98.1
24	33.1	3.143	99.8	99.9	99.3	98.8	98.6	98.1	98.4
25	32.1	3.104	99.6	99.8	99.6	99.2	99.4	98.8	98.7
Mean	32.70	3.12	99.59	99.77	99.48	98.91	98.86	98.44	98.56
Median	32.75	3.11	99.63	99.78	99.52	98.92	98.76	98.31	98.41
std.dev	0.40	0.01	0.47	0.46	0.63	0.40	0.48	0.48	0.51
Max	33.25	3.14	100.22	100.47	100.27	99.71	99.88	99.81	100.08
Min	31.73	3.10	98.29	98.50	97.13	97.94	97.90	97.85	98.02

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No.	Cx	Cy	Chromaticity Shift (△u'v')						
	0 h		500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h
1	0.4383	0.4064	0.0001	0.0008	0.0013	0.0013	0.0005	0.0005	0.0007
2	0.4358	0.4052	0.0002	0.0002	0.0004	0.0005	0.0008	0.0006	0.0005
3	0.4368	0.4022	0.0002	0.0002	0.0002	0.0005	0.0004	0.0004	0.0005
4	0.4328	0.4019	0.0002	0.0001	0.0002	0.0003	0.0002	0.0003	0.0002
5	0.4375	0.4045	0.0001	0.0002	0.0005	0.0005	0.0007	0.0008	0.0008
6	0.4344	0.4027	0.0000	0.0001	0.0004	0.0004	0.0006	0.0006	0.0005
7	0.4373	0.4050	0.0002	0.0002	0.0003	0.0005	0.0006	0.0005	0.0005
8	0.4403	0.4075	0.0004	0.0009	0.0005	0.0006	0.0008	0.0008	0.0007
9	0.4370	0.4034	0.0005	0.0004	0.0006	0.0008	0.0007	0.0006	0.0006
10	0.4332	0.3998	0.0001	0.0004	0.0003	0.0004	0.0004	0.0005	0.0004
11	0.4326	0.3992	0.0001	0.0003	0.0005	0.0007	0.0011	0.0009	0.0008
12	0.4368	0.4045	0.0002	0.0002	0.0002	0.0003	0.0003	0.0003	0.0003
13	0.4378	0.4014	0.0002	0.0001	0.0005	0.0007	0.0005	0.0005	0.0006
14	0.4392	0.4072	0.0001	0.0002	0.0005	0.0006	0.0010	0.0009	0.0008
15	0.4334	0.3978	0.0002	0.0002	0.0002	0.0004	0.0005	0.0003	0.0003
16	0.4405	0.4073	0.0001	0.0000	0.0002	0.0003	0.0004	0.0005	0.0005
17	0.4385	0.4028	0.0002	0.0002	0.0003	0.0004	0.0005	0.0005	0.0006
18	0.4339	0.3963	0.0001	0.0001	0.0002	0.0003	0.0003	0.0004	0.0003
19	0.4395	0.4052	0.0000	0.0002	0.0004	0.0006	0.0007	0.0006	0.0005
20	0.4335	0.4022	0.0000	0.0001	0.0004	0.0009	0.0006	0.0004	0.0005
21	0.4388	0.4068	0.0001	0.0004	0.0008	0.0005	0.0005	0.0009	0.0005
22	0.4356	0.4048	0.0001	0.0001	0.0004	0.0004	0.0004	0.0005	0.0005
23	0.4400	0.4074	0.0001	0.0002	0.0004	0.0005	0.0005	0.0007	0.0007
24	0.4389	0.4064	0.0001	0.0001	0.0005	0.0005	0.0005	0.0005	0.0006
25	0.4354	0.4009	0.0003	0.0002	0.0004	0.0004	0.0005	0.0006	0.0006
Mean	0.4367	0.4035	0.0002	0.0002	0.0004	0.0005	0.0006	0.0006	0.0005
Median	0.4370	0.4045	0.0001	0.0002	0.0004	0.0005	0.0005	0.0005	0.0005
std.dev	0.0025	0.0031	0.0001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0001
Max	0.4405	0.4075	0.0005	0.0009	0.0013	0.0013	0.0011	0.0009	0.0008
Min	0.4326	0.3963	0.0000	0.0000	0.0002	0.0003	0.0002	0.0003	0.0002

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No.	CCT (K)	CCT(K)						
	0 h	500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h
1	2996	2997	3017	3029	3029	3009	3010	3012
2	3027	3029	3031	3037	3041	3047	3043	3041
3	2986	2990	2991	2991	3000	2997	2995	2998
4	3054	3054	3053	3060	3061	3059	3061	3059
5	2993	2996	2998	3007	3007	3012	3013	3013
6	3031	3032	3030	3041	3042	3046	3045	3046
7	3001	3005	3005	3008	3014	3016	3013	3013
8	2971	2981	2992	2984	2986	2992	2990	2988
9	2994	3005	3004	3007	3013	3010	3008	3009
10	3028	3026	3021	3035	3037	3039	3041	3039
11	3035	3038	3042	3048	3054	3062	3057	3055
12	3006	3002	3004	3011	3013	3014	3013	3015
13	2963	2967	2965	2975	2981	2977	2977	2979
14	2988	2988	2993	2999	3003	3012	3009	3007
15	3008	3009	3008	3013	3016	3020	3016	3017
16	2966	2966	2965	2971	2974	2977	2977	2978
17	2963	2964	2966	2970	2972	2976	2974	2976
18	2986	2986	2986	2990	2995	2993	2996	2994
19	2967	2967	2971	2977	2981	2984	2980	2980
20	3043	3043	3043	3054	3066	3057	3054	3055
21	2992	2992	3001	3011	3005	3004	3013	3005
22	3029	3028	3029	3038	3040	3039	3040	3042
23	2975	2978	2981	2987	2987	2988	2992	2994
24	2986	2985	2988	2998	2999	2998	2997	3001
25	3000	3003	3004	3011	3010	3012	3013	3014
Mean	3000	3001	3004	3010	3013	3014	3013	3013
Median	2994	2997	3004	3008	3010	3012	3013	3012
std.dev	26	26	25	27	27	27	26	26
Max	3054	3054	3053	3060	3066	3062	3061	3059
Min	2963	2964	2965	2970	2972	2976	2974	2976

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9.2 Test condition 2 **85℃**

Dirve Current **150mA**

Measurement Current **150mA**

No.	Flux (lm)	Vf (V)	Lumen Maintenance (%)						
	0 h		500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h
1	32.5	3.124	99.2	99.1	98.5	97.4	97.5	97.4	97.3
2	32.8	3.114	99.6	99.5	98.9	97.6	97.8	97.6	97.6
3	32.8	3.119	99.3	99.3	98.6	97.2	96.9	96.8	97.2
4	32.6	3.124	99.3	99.4	99.0	98.2	98.4	98.3	98.4
5	32.2	3.110	99.3	99.4	97.5	96.7	97.1	96.8	97.0
6	31.7	3.135	99.6	99.5	99.0	98.0	97.6	97.6	97.8
7	32.4	3.118	99.1	99.1	98.4	97.7	97.4	97.5	97.8
8	33.2	3.137	99.4	99.5	98.9	98.0	97.6	97.6	97.6
9	32.9	3.111	99.3	99.4	98.8	97.7	97.7	97.4	97.6
10	32.9	3.136	99.7	99.8	99.1	98.0	97.7	97.1	97.7
11	32.9	3.120	99.6	99.6	99.1	98.1	97.9	97.7	97.9
12	33.2	3.123	99.3	99.3	98.7	97.6	97.5	97.2	97.3
13	33.1	3.117	99.4	99.5	98.9	97.7	97.7	97.2	97.6
14	32.8	3.113	99.1	99.1	98.7	98.0	97.7	97.4	97.8
15	32.8	3.117	98.8	99.0	98.4	97.6	97.4	96.8	97.3
16	33.2	3.120	99.4	99.4	99.0	97.9	97.9	97.7	98.0
17	33.1	3.135	99.6	98.4	98.0	97.1	96.7	96.6	96.9
18	33.0	3.114	99.6	99.6	99.1	98.1	97.8	97.4	97.7
19	32.8	3.112	99.6	99.6	99.1	98.0	97.7	97.4	97.7
20	32.5	3.124	99.2	99.2	98.7	98.1	98.0	97.8	98.2
21	33.2	3.122	98.9	98.8	98.4	97.3	97.1	96.7	97.2
22	32.8	3.121	99.5	99.4	99.0	98.2	97.8	97.4	97.6
23	32.8	3.114	99.3	99.4	98.8	97.9	97.5	97.2	97.4
24	32.8	3.114	99.5	99.5	98.9	97.9	97.7	97.4	97.7
25	32.8	3.131	99.4	99.3	99.1	97.6	97.9	97.5	97.8
Mean	32.80	3.12	99.36	99.32	98.75	97.75	97.60	97.33	97.61
Median	32.83	3.12	99.36	99.39	98.85	97.89	97.69	97.38	97.65
std.dev	0.36	0.01	0.23	0.28	0.38	0.38	0.36	0.39	0.35
Max	33.24	3.14	99.72	99.78	99.13	98.21	98.38	98.26	98.44
Min	31.68	3.11	98.75	98.44	97.54	96.67	96.73	96.56	96.88

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No.	Cx	Cy	Chromaticity Shift (△u'v')						
	0h		500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h
1	0.4341	0.3990	0.0002	0.0009	0.0007	0.0012	0.0013	0.0014	0.0014
2	0.4380	0.4055	0.0002	0.0005	0.0007	0.0009	0.0011	0.0013	0.0013
3	0.4371	0.4065	0.0001	0.0002	0.0005	0.0014	0.0012	0.0014	0.0011
4	0.4325	0.4003	0.0002	0.0003	0.0005	0.0008	0.0011	0.0011	0.0009
5	0.4348	0.4047	0.0003	0.0003	0.0015	0.0015	0.0017	0.0016	0.0015
6	0.4372	0.4036	0.0003	0.0005	0.0006	0.0008	0.0011	0.0012	0.0011
7	0.4343	0.4001	0.0002	0.0005	0.0008	0.0009	0.0010	0.0011	0.0010
8	0.4371	0.4059	0.0001	0.0002	0.0005	0.0007	0.0009	0.0011	0.0010
9	0.4388	0.4059	0.0002	0.0004	0.0005	0.0009	0.0011	0.0011	0.0012
10	0.4382	0.4063	0.0001	0.0002	0.0005	0.0011	0.0009	0.0012	0.0011
11	0.4381	0.4055	0.0002	0.0003	0.0005	0.0009	0.0009	0.0011	0.0009
12	0.4403	0.4055	0.0002	0.0005	0.0007	0.0010	0.0011	0.0013	0.0013
13	0.4359	0.4047	0.0001	0.0004	0.0006	0.0010	0.0011	0.0010	0.0011
14	0.4336	0.3998	0.0004	0.0004	0.0006	0.0008	0.0010	0.0012	0.0010
15	0.4329	0.3983	0.0010	0.0003	0.0006	0.0008	0.0011	0.0017	0.0012
16	0.4317	0.3992	0.0001	0.0002	0.0004	0.0007	0.0007	0.0009	0.0008
17	0.4389	0.4053	0.0003	0.0007	0.0007	0.0009	0.0012	0.0013	0.0012
18	0.4372	0.4049	0.0001	0.0003	0.0005	0.0009	0.0012	0.0012	0.0011
19	0.4393	0.4058	0.0001	0.0003	0.0005	0.0008	0.0011	0.0012	0.0012
20	0.4363	0.4053	0.0001	0.0003	0.0005	0.0007	0.0007	0.0009	0.0008
21	0.4389	0.4050	0.0009	0.0005	0.0007	0.0014	0.0011	0.0014	0.0013
22	0.4360	0.4021	0.0002	0.0003	0.0006	0.0009	0.0009	0.0012	0.0011
23	0.4358	0.4039	0.0002	0.0004	0.0006	0.0009	0.0011	0.0014	0.0013
24	0.4365	0.4000	0.0001	0.0003	0.0006	0.0007	0.0010	0.0013	0.0011
25	0.4325	0.3992	0.0002	0.0004	0.0006	0.0010	0.0009	0.0011	0.0011
Mean	0.4362	0.4033	0.0002	0.0004	0.0006	0.0009	0.0011	0.0012	0.0011
Median	0.4365	0.4047	0.0002	0.0003	0.0006	0.0009	0.0011	0.0012	0.0011
std.dev	0.0024	0.0028	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
Max	0.4403	0.4065	0.0010	0.0009	0.0015	0.0015	0.0017	0.0017	0.0015
Min	0.4317	0.3983	0.0001	0.0002	0.0004	0.0007	0.0007	0.0009	0.0008

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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	3007	3012	3030	3026	3035	3040	3041	3041
2	2994	3000	3006	3013	3017	3022	3025	3028
3	3018	3016	3022	3028	3051	3044	3049	3044
4	3045	3049	3052	3056	3065	3072	3071	3069
5	3041	3047	3050	3079	3079	3083	3079	3078
6	2992	2998	3003	3007	3011	3018	3021	3020
7	3012	3016	3025	3032	3034	3036	3039	3038
8	3013	3014	3018	3024	3030	3034	3038	3037
9	2983	2989	2993	2996	3005	3009	3010	3011
10	2997	2999	3002	3007	3022	3018	3023	3023
11	2991	2995	2998	3003	3014	3012	3016	3014
12	2956	2962	2969	2972	2980	2983	2984	2988
13	3024	3026	3033	3039	3047	3051	3047	3052
14	3022	3033	3033	3039	3043	3047	3052	3048
15	3021	3044	3029	3034	3039	3046	3059	3051
16	3050	3052	3056	3059	3067	3068	3071	3071
17	2976	2984	2995	2994	2999	3005	3005	3007
18	3002	3004	3007	3015	3023	3030	3029	3028
19	2974	2976	2981	2986	2992	3000	3003	3002
20	3021	3023	3028	3033	3037	3036	3040	3040
21	2975	2997	2987	2992	3009	3002	3006	3007
22	3000	3005	3007	3014	3022	3022	3027	3027
23	3017	3022	3027	3032	3040	3044	3047	3047
24	2975	2977	2984	2989	2992	3000	3004	3000
25	3035	3040	3045	3052	3061	3057	3063	3063
Mean	3006	3011	3015	3021	3029	3031	3034	3033
Median	3007	3012	3018	3024	3030	3034	3038	3037
std.dev	25	24	24	26	25	25	25	24
Max	3050	3052	3056	3079	3079	3083	3079	3078
Min	2956	2962	2969	2972	2980	2983	2984	2988

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9.3 Test condition 3 **105℃**

Dirve Current **150mA**

Measurement Current **150mA**

No.	Flux (lm)	Vf (V)	Lumen Maintenance (%)						
	0 h		500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h
1	32.8	3.125	99.9	100.1	100.0	99.0	97.0	93.3	90.9
2	32.5	3.111	99.9	100.0	99.9	99.0	97.3	94.3	92.3
3	32.8	3.124	99.7	100.1	99.8	99.3	97.5	95.0	92.9
4	32.1	3.110	99.8	100.1	99.8	98.8	97.1	93.9	91.4
5	32.2	3.116	100.2	100.4	100.2	99.1	98.0	94.7	92.3
6	33.0	3.137	100.1	100.3	100.2	99.3	96.8	92.8	90.5
7	32.9	3.129	99.5	99.8	99.7	99.3	97.7	94.5	92.7
8	33.1	3.125	99.6	100.0	100.1	99.3	97.9	94.5	92.5
9	33.0	3.118	100.2	100.4	100.3	99.3	97.3	93.6	91.4
10	32.8	3.113	100.2	100.3	100.2	99.2	98.1	95.5	93.8
11	32.8	3.118	98.9	99.4	99.4	98.8	97.5	93.8	91.2
12	33.2	3.127	100.0	100.3	100.2	99.4	98.4	95.9	94.7
13	32.5	3.107	100.0	100.3	100.1	99.5	98.3	94.9	92.9
14	32.0	3.102	100.1	100.5	100.0	99.1	97.4	94.3	92.3
15	32.9	3.121	99.8	100.0	99.9	99.0	96.5	92.3	90.0
16	32.9	3.142	100.7	100.9	100.9	100.4	99.7	97.3	96.2
17	32.7	3.113	99.9	100.3	99.9	99.1	97.0	93.0	90.7
18	32.8	3.120	100.1	100.1	100.0	99.1	97.0	93.4	91.4
19	33.0	3.127	100.1	100.3	100.2	98.9	96.8	92.5	89.9
20	33.2	3.131	100.1	100.6	100.2	99.6	97.8	95.1	93.2
21	32.7	3.124	99.9	100.2	100.3	99.6	98.5	96.0	94.6
22	32.6	3.111	100.3	100.5	100.3	98.9	98.2	95.5	94.1
23	32.6	3.129	100.4	100.4	100.1	99.3	98.4	94.8	92.9
24	32.5	3.116	99.9	100.3	99.7	99.1	96.9	92.6	89.8
25	32.3	3.126	100.3	100.5	100.5	99.4	96.8	92.9	90.2
Mean	32.71	3.12	99.98	100.25	100.08	99.23	97.60	94.25	92.20
Median	32.77	3.12	99.99	100.29	100.09	99.25	97.51	94.31	92.30
std.dev	0.32	0.01	0.34	0.29	0.30	0.34	0.73	1.27	1.66
Max	33.19	3.14	100.69	100.88	100.91	100.42	99.74	97.30	96.17
Min	31.95	3.10	98.94	99.37	99.42	98.77	96.53	92.27	89.79

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No.	Cx	Cy	Chromaticity Shift (△u'v')						
	0h		500 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h
1	0.4346	0.4048	0.0002	0.0003	0.0003	0.0003	0.0005	0.0017	0.0026
2	0.4365	0.4029	0.0002	0.0002	0.0003	0.0003	0.0004	0.0013	0.0020
3	0.4348	0.4013	0.0002	0.0003	0.0002	0.0002	0.0004	0.0014	0.0019
4	0.4365	0.4040	0.0002	0.0002	0.0002	0.0002	0.0005	0.0017	0.0024
5	0.4376	0.4035	0.0002	0.0003	0.0002	0.0001	0.0004	0.0015	0.0022
6	0.4338	0.4011	0.0002	0.0003	0.0002	0.0001	0.0006	0.0020	0.0029
7	0.4373	0.4025	0.0002	0.0001	0.0001	0.0003	0.0005	0.0015	0.0022
8	0.4344	0.4015	0.0001	0.0002	0.0002	0.0002	0.0003	0.0014	0.0022
9	0.4359	0.4025	0.0002	0.0003	0.0003	0.0001	0.0005	0.0017	0.0025
10	0.4349	0.4018	0.0002	0.0003	0.0002	0.0002	0.0003	0.0011	0.0018
11	0.4382	0.4041	0.0003	0.0009	0.0004	0.0004	0.0006	0.0015	0.0025
12	0.4338	0.4006	0.0001	0.0001	0.0002	0.0002	0.0001	0.0010	0.0015
13	0.4365	0.4048	0.0001	0.0002	0.0001	0.0002	0.0002	0.0012	0.0019
14	0.4392	0.4059	0.0002	0.0003	0.0002	0.0001	0.0004	0.0016	0.0023
15	0.4351	0.4036	0.0002	0.0002	0.0002	0.0001	0.0007	0.0020	0.0030
16	0.4396	0.4055	0.0004	0.0003	0.0004	0.0004	0.0003	0.0005	0.0009
17	0.4375	0.4036	0.0001	0.0002	0.0001	0.0002	0.0007	0.0020	0.0028
18	0.4403	0.4074	0.0003	0.0003	0.0003	0.0003	0.0004	0.0015	0.0023
19	0.4380	0.4039	0.0002	0.0002	0.0002	0.0002	0.0007	0.0021	0.0031
20	0.4323	0.3994	0.0001	0.0002	0.0003	0.0002	0.0005	0.0011	0.0016
21	0.4350	0.4007	0.0002	0.0002	0.0002	0.0002	0.0001	0.0008	0.0013
22	0.4336	0.4009	0.0004	0.0003	0.0002	0.0002	0.0003	0.0011	0.0016
23	0.4347	0.4010	0.0002	0.0002	0.0002	0.0005	0.0003	0.0014	0.0021
24	0.4413	0.4075	0.0001	0.0001	0.0001	0.0003	0.0010	0.0023	0.0031
25	0.4327	0.3986	0.0002	0.0003	0.0004	0.0003	0.0010	0.0022	0.0030
Mean	0.4362	0.4029	0.0002	0.0003	0.0002	0.0002	0.0005	0.0015	0.0022
Median	0.4359	0.4029	0.0002	0.0002	0.0002	0.0002	0.0004	0.0015	0.0022
std.dev	0.0024	0.0023	0.0001	0.0001	0.0001	0.0001	0.0002	0.0005	0.0006
Max	0.4413	0.4075	0.0004	0.0009	0.0004	0.0005	0.0010	0.0023	0.0031
Min	0.4323	0.3986	0.0001	0.0001	0.0001	0.0001	0.0001	0.0005	0.0009

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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	3045	3049	3041	3048	3052	3057	3081	3106
2	2998	2996	2996	2999	3001	3009	3025	3042
3	3013	3013	3012	3012	3015	3024	3046	3058
4	3006	3005	3006	3007	3011	3020	3043	3061
5	2984	2981	2978	2986	2987	2993	3014	3032
6	3029	3026	3024	3028	3030	3044	3070	3096
7	2981	2982	2981	2982	2985	2994	3013	3030
8	3022	3019	3018	3019	3018	3029	3049	3071
9	3005	3000	2998	3002	3005	3018	3041	3060
10	3017	3013	3012	3014	3019	3024	3040	3057
11	2979	2986	3001	2986	2990	2994	3011	3035
12	3026	3024	3025	3027	3027	3030	3047	3061
13	3012	3011	3009	3012	3009	3017	3036	3053
14	2977	2974	2970	2977	2978	2987	3011	3030
15	3028	3025	3024	3025	3029	3044	3070	3097
16	2967	2960	2960	2962	2958	2962	2977	2987
17	2987	2984	2986	2987	2991	3004	3029	3048
18	2972	2968	2970	2974	2975	2982	3002	3023
19	2980	2975	2975	2975	2977	2997	3022	3047
20	3041	3040	3040	3046	3047	3054	3062	3074
21	3006	3001	3002	3003	3002	3006	3020	3035
22	3031	3024	3024	3031	3034	3039	3053	3068
23	3013	3010	3017	3012	3026	3021	3042	3063
24	2955	2958	2958	2958	2962	2980	3006	3025
25	3028	3026	3024	3026	3029	3052	3075	3098
Mean	3004	3002	3002	3004	3006	3015	3035	3054
Median	3006	3005	3006	3007	3009	3018	3040	3057
std.dev	25	25	24	25	26	25	26	28
Max	3045	3049	3041	3048	3052	3057	3081	3106
Min	2955	2958	2958	2958	2958	2962	2977	2987

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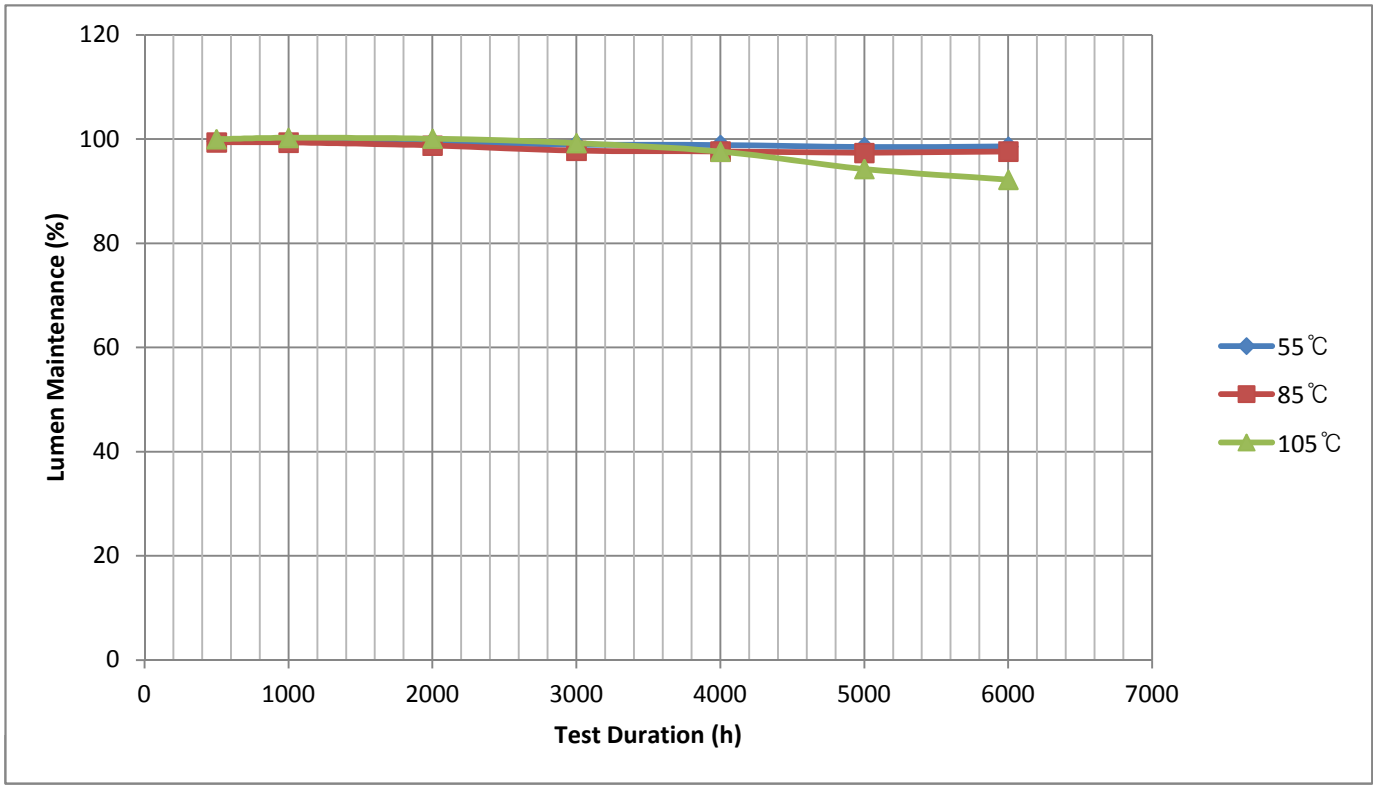
9.4 Chart

<Lumen Maintenance>



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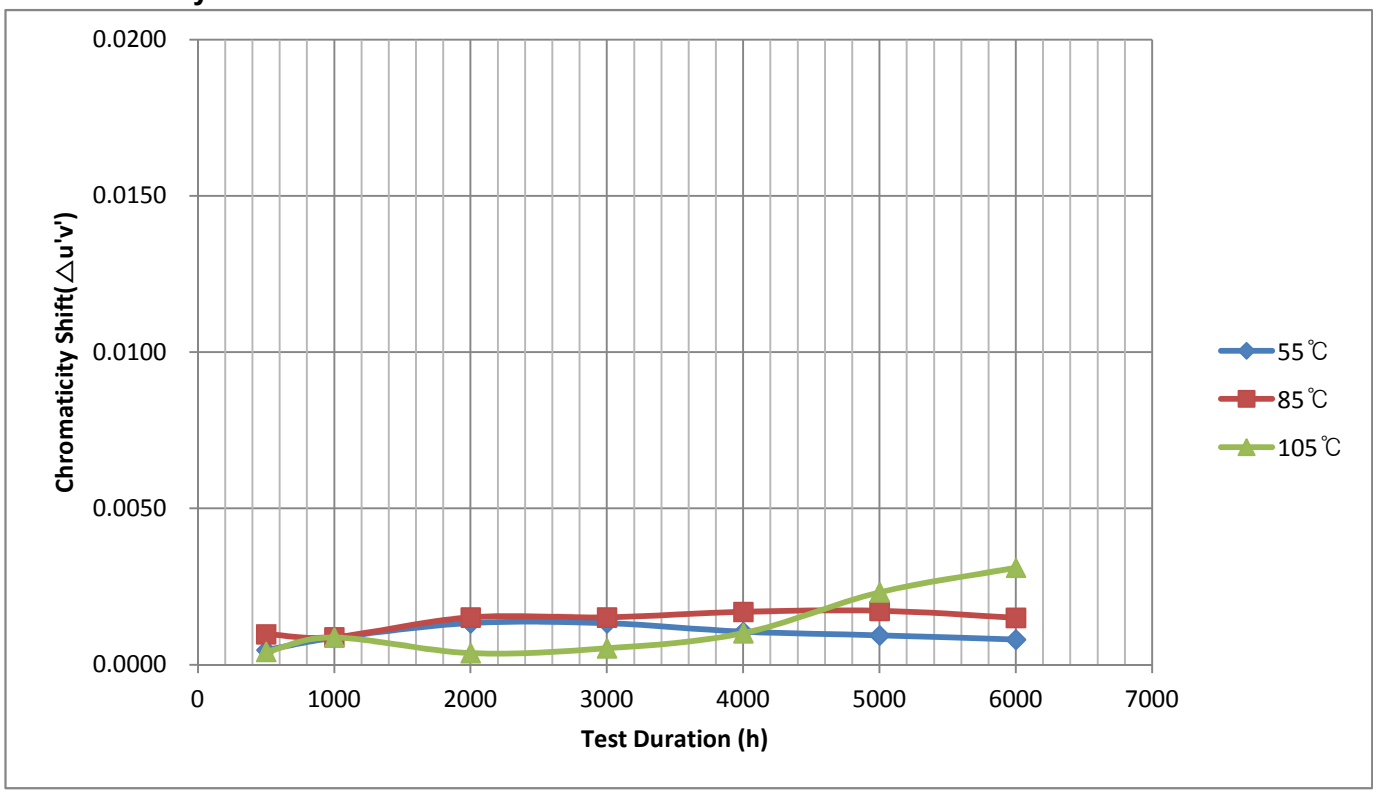

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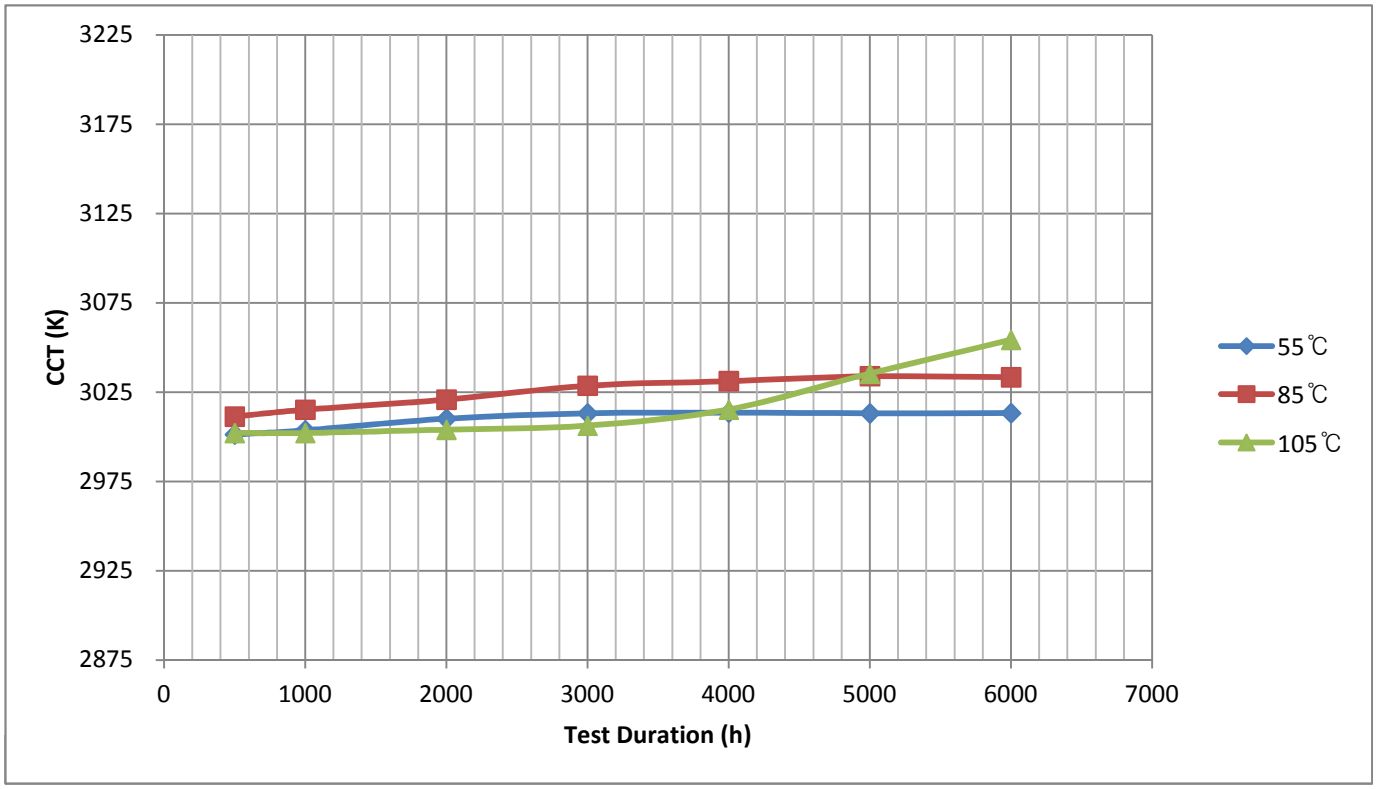
<CCT>



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 Elctronics LM561B 150mA				
Test Condition 1 - 55ºC Case Temp		**Test Condition 2 - 85ºC Case Temp**		**Test Condition 3 - 105ºC 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)	150	DUT drive current used in the test (mA)	150	DUT drive current used in the test (mA)	150
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 (ºC)	55	Tested case temperature (ºC)	85	Tested case temperature (ºC)	105
α	2.642E-06	α	3.767E-06	α	1.758E-05
B	0.999	B	0.994	B	1.034
Calculated L70(6k) (hours)	135,000	Calculated L70(6k) (hours)	93,000	Calculated L70(6k) (hours)	22,000
Reported L70(6k) (hours)	>36000	Reported L70(6k) (hours)	>36000	Reported L70(6k) (hours)	22,000

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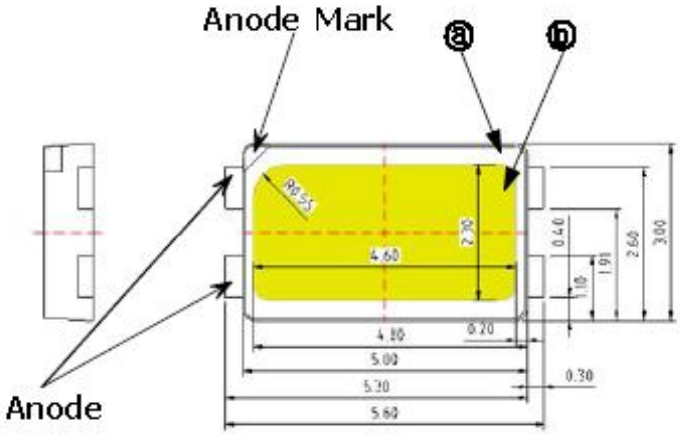
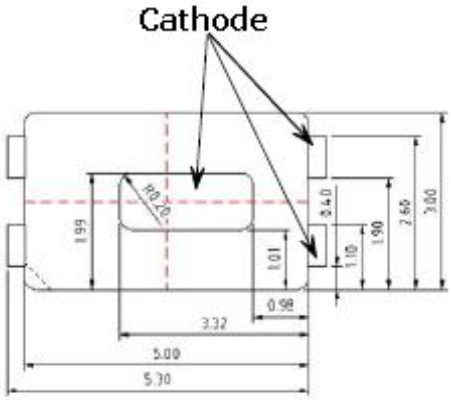
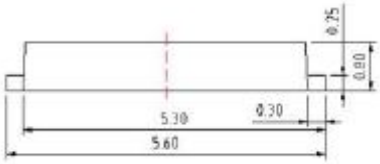
14. Photo of samples

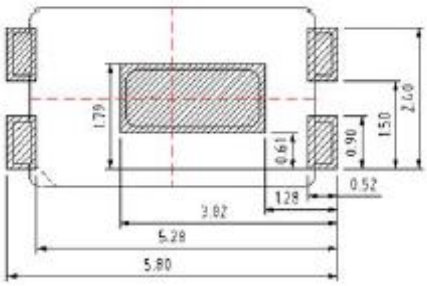
Left Side View **Top View** **Bottom View**





Front View





Recommended Land Pattern

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

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