



LM-80 TEST REPORT

Test Initiation Date : 15.04.2023
Test Completion Date : 26.05.2024
Test Duration : 10,000 hours

Description of Product Samples:

Classification : LED Package
Model Name : Always White
Model Number : FL09COB3030

Test Summary

Test Condition	Case Temperature [T _s]	Ambient Temperature [T _A]	Drive Current [I _F]	Lumen Maintenance	Chromaticity Shift ($\Delta u'v'$)	TM-21 Projection L ₇₀ (6K)
1	55 °C	> 50 °C	200mA	98.06 %	0.0021	>60500 Hours
2	85 °C	> 80 °C	200mA	95.92 %	0.0025	>55900 Hours
3	105 °C	> 100 °C	200mA	93.1 %	0.0054	42800 Hours

LM 80 Test Report Requirement:

1. Number of Led Light Sources tested:

- 25 Packages tested at case temperature 55 °C
- 25 Packages tested at case temperature 85 °C
- 25 Packages tested at case temperature 105 °C

2. Description of LED light Sources:

- If = 200mA
- Package Dimensions: (30 x 30) mm

3. Description of Auxiliary Equipment:

Active cooling life test system consisting of small boxes, in which each box contains a reliability test board, and a water-cooled heat sink or a heater to control device temperature.

LED Tester consisting of an integrating sphere, a programmable current-source meter, and a spectroradiometer.

4. Operating Time:

- 10,000 Hours at 55 °C, 85 °C, 105 °C.
- Drive Current: 200mA
- Forward Voltage: 3V
- Constant Direct Current (DC).

5. Ambient conditions including airflow, temperature and relative humidity

Ambient Temperature is the temperature of the air at a distance of 1.0 mm above the reliability test board.

- Air Flow: < 0.1 m/s
- Relative Humidity: < 45%
- Case temperature: Controlled to -2 °C.
- Surrounding Air Temperature: Controlled to -5 °C.

6. Lumen Maintenance data for each individual LED light source along with median value, standard deviation, Minimum and Maximum Lumen Maintenance value for all of the LED light sources.

SEE TABLES.

7. LED Light Source Monitoring Interval

8. Observation of LED light Sources failures including the failure conditions and time of failure.

No failure observed

9. Initial Luminous Flux and Forward voltage

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	1000	2000	3000	4000	5000	6000
7000	8000	9000	10000			

12. Photometric Measurement Uncertainty:

- Flux Measurement: 4.8 % (k=2)
- Lumen Maintenance: 1.8% (k=2)

Test Condition 1	55 °C
Drive Current	200mA
Measurement Current	200mA

Table: Initial Characteristics

LED No.	Luminous flux	Forward voltage	CCT	CIE1931		CIE1976	
	Φ_V [lm]	V_F [V]	T_{CP} [K]	x	y	u'	v'
1	296	27	4465	0.455	0.404	0.262	0.524
2	296	27	4465	0.448	0.399	0.26	0.521
3	296	27	4465	0.459	0.41	0.263	0.526
4	296	27	4465	0.454	0.401	0.262	0.523
5	296	27	4465	0.455	0.406	0.261	0.525
6	296	27	4465	0.442	0.391	0.26	0.516
7	296	27	4465	0.459	0.411	0.262	0.527
8	296	27	4465	0.438	0.389	0.258	0.516
9	296	27	4465	0.456	0.404	0.263	0.525
10	296	27	4465	0.451	0.406	0.261	0.524
11	296	27	4465	0.445	0.398	0.26	0.52
12	296	27	4465	0.456	0.409	0.262	0.526
13	296	27	4465	0.454	0.402	0.262	0.524
14	296	27	4465	0.455	0.403	0.263	0.525
15	296	27	4465	0.46	0.406	0.264	0.526
16	296	27	4465	0.472	0.42	0.265	0.532
17	296	27	4465	0.443	0.394	0.259	0.518
18	296	27	4465	0.45	0.401	0.262	0.522
19	296	27	4465	0.455	0.406	0.263	0.525
20	296	27	4465	0.443	0.392	0.26	0.518
21	296	27	4465	0.443	0.392	0.26	0.518
22	296	27	4465	0.471	0.421	0.266	0.533
23	296	27	4465	0.456	0.404	0.262	0.525
24	296	27	4465	0.463	0.412	0.265	0.527
25	296	27	4465	0.456	0.403	0.264	0.525
Avg.	296	27	4465	0.454	0.404	0.262	0.525
Med.	296	27	4465	0.455	0.404	0.262	0.525
Std. dev	0	0	0	0.01	0.009	0.002	0.005
Min.	296	27	4465	0.438	0.389	0.258	0.516
Max.	296	27	4465	0.472	0.421	0.266	0.533

Test Condition 1	55 °C
Drive Current	200mA
Measurement Current	200mA

Table: Chromaticity Shift

LED No.	1000h	2000h	3000h	4000h	5000h	6000h	7000h	8000h	9000h	10000h
1	0.0001	0.0001	0.0002	0.0003	0.0004	0.0005	0.0006	0.0008	0.0009	0.0011
2	0.0001	0.0001	0.0002	0.0003	0.0004	0.0005	0.0007	0.0008	0.001	0.0011
3	0.0001	0.0002	0.0003	0.0003	0.0004	0.0005	0.0007	0.0008	0.001	0.0011
4	0.0001	0.0002	0.0002	0.0003	0.0004	0.0005	0.0007	0.0008	0.0009	0.0011
5	0.0001	0.0001	0.0002	0.0003	0.0004	0.0006	0.0007	0.0009	0.001	0.0012
6	0.0001	0.0002	0.0002	0.0004	0.0004	0.0006	0.0007	0.0008	0.001	0.0011
7	0.0001	0.0002	0.0003	0.0004	0.0005	0.0006	0.0007	0.0009	0.001	0.0012
8	0.0001	0.0001	0.0002	0.0004	0.0005	0.0006	0.0007	0.0009	0.001	0.0012
9	0.0001	0.0001	0.0002	0.0003	0.0004	0.0005	0.0006	0.0008	0.0009	0.0011
10	0.0001	0.0002	0.0003	0.0004	0.0005	0.0006	0.0007	0.0009	0.0011	0.0012
11	0.0001	0.0001	0.0002	0.0003	0.0004	0.0005	0.0006	0.0008	0.0009	0.0011
12	0.0001	0.0002	0.0003	0.0004	0.0005	0.0006	0.0007	0.0009	0.0011	0.0012
13	0.0001	0.0001	0.0002	0.0003	0.0004	0.0005	0.0006	0.0008	0.0009	0.001
14	0.0001	0.0001	0.0002	0.0003	0.0004	0.0005	0.0006	0.0008	0.0009	0.0011
15	0.0001	0.0001	0.0002	0.0004	0.0005	0.0006	0.0007	0.0008	0.001	0.0011
16	0.0001	0.0001	0.0002	0.0003	0.0004	0.0006	0.0007	0.0008	0.001	0.0011
17	0.0001	0.0002	0.0003	0.0003	0.0004	0.0006	0.0007	0.0009	0.001	0.0011
18	0.0001	0.0002	0.0003	0.0004	0.0005	0.0007	0.0008	0.0009	0.0011	0.0012
19	0.0001	0.0001	0.0002	0.0003	0.0004	0.0006	0.0007	0.0009	0.001	0.0012
20	0.0001	0.0001	0.0002	0.0003	0.0004	0.0005	0.0007	0.0008	0.001	0.0012
21	0.0001	0.0001	0.0002	0.0004	0.0005	0.0006	0.0007	0.0009	0.001	0.0012
22	0.0001	0.0002	0.0003	0.0004	0.0005	0.0006	0.0007	0.0008	0.001	0.0012
23	0.0001	0.0001	0.0003	0.0004	0.0005	0.0006	0.0007	0.0008	0.001	0.0012
24	0.0001	0.0002	0.0003	0.0004	0.0005	0.0006	0.0007	0.0009	0.001	0.0012
25	0.0001	0.0001	0.0002	0.0003	0.0004	0.0006	0.0007	0.0008	0.001	0.0012
Avg.	0.0001	0.00014	0.00024	0.00034	0.00044	0.00057	0.00068	0.00084	0.00099	0.00115
Med.	0.0001	0.0001	0.0002	0.0003	0.0004	0.0006	0.0007	0.0008	0.001	0.0012
Std. dev	0	0.00005	0.00005	0.00005	0.00005	0.00006	0.00005	0.00005	0.00006	0.00006
Min.	0.0001	0.0001	0.0002	0.0003	0.0004	0.0005	0.0006	0.0008	0.0009	0.001
Max.	0.0001	0.0002	0.0003	0.0004	0.0005	0.0007	0.0008	0.0009	0.0011	0.0012

Test Condition 1	55 °C
Drive Current	200mA
Measurement Current	200mA

Table: Lumen Maintenance

Led No.	Flux(lm)	Vf(V)	Lumen Maintenance(%)									
	0h		1000h	2000h	3000h	4000h	5000h	6000h	7000h	8000h	9000h	10000h
1	296	27	99.1	99.49	99.36	98.82	99.05	98.58	98.26	98.49	97.98	98.24
2	296	27	99.53	99.66	98.93	98.87	98.91	98.48	98.78	98.14	98.07	98.06
3	296	27	99.57	99.46	98.93	98.88	98.85	98.5	98.71	98.04	98.16	98.23
4	296	27	99.56	99.42	98.95	98.98	98.99	98.76	98.3	98.3	98.02	98.15
5	296	27	99.52	99.3	98.92	98.96	98.57	98.72	98.21	98.2	97.94	97.94
6	296	27	99.44	99.54	99.28	98.81	98.55	98.35	98.77	98.1	98.1	98
7	296	27	99.96	99.23	98.98	99.12	99.02	98.52	98.62	98.53	98.46	98.02
8	296	27	99.92	99.2	99.45	99.02	98.93	98.46	98.57	98.01	98.37	97.72
9	296	27	99.59	99.25	99.04	99.13	98.51	98.39	98.33	98.17	98.22	98.07
10	296	27	99.66	99.66	99.11	98.95	99.06	98.88	98.45	98.04	98.46	98.12
11	296	27	99.73	99.37	99.01	99.22	98.66	98.72	98.55	98.04	98.38	98.24
12	296	27	99.53	99.56	99.09	99.35	99.1	98.54	98.8	98.11	98.04	97.99
13	296	27	99.87	99.38	99	98.92	98.93	98.61	98.3	98.31	98.37	98.1
14	296	27	99.75	99.44	99.46	99.16	98.69	98.3	98.67	98.42	97.95	97.89
15	296	27	99.86	99.54	99.07	98.88	99.04	98.53	98.49	98.39	98.49	97.96
16	296	27	99.97	99.54	99.37	99.19	98.92	98.86	98.63	98.52	98.26	98.11
17	296	27	99.91	99.2	99.31	98.83	98.71	98.6	98.24	98.02	98.44	97.88
18	296	27	99.67	99.12	98.92	98.8	98.91	98.82	98.41	98.54	98.01	97.94
19	296	27	99.69	99.45	99.25	98.76	98.62	98.77	98.54	98.53	98.29	97.99
20	296	27	99.92	99.4	98.98	98.83	98.58	98.43	98.77	98.03	98.06	98.05
21	296	27	99.1	99.27	99.28	98.81	98.83	98.5	98.24	98.51	98.02	98.09
22	296	27	99.73	99.63	98.91	98.85	98.72	98.33	98.64	98.39	98.39	98.1
23	296	27	99.79	99.42	98.94	98.86	98.68	98.32	98.6	98.32	98.05	98.11
24	296	27	99.61	99.43	99.41	99.06	98.59	98.79	98.73	98.45	98.23	97.98
25	296	27	99.1	99.58	99.05	99	98.56	98.74	98.58	98.26	98.06	97.9
Avg.	296	27	99.66	99.41	99.05	98.96	98.83	98.58	98.57	98.31	98.23	98.06
Med.	296	27	99.66	99.44	99.04	98.92	98.83	98.58	98.58	98.32	98.22	98.06
Std. dev	0	0	0.2	0.17	0.15	0.14	0.14	0.14	0.16	0.15	0.14	0.11
Min.	296	27	99.1	99.12	98.91	98.76	98.32	98.1	98.21	98.01	97.94	97.72
Max.	296	27	99.97	99.66	99.46	99.35	99.1	98.88	98.8	98.53	98.49	98.24

Test Condition 2	85 °C
Drive Current	200mA
Measurement Current	200mA

Table: Lumen Maintenance

Led No.	Flux(lm)	Vf(V)	Lumen Maintenance(%)									
	0h		1000h	2000h	3000h	4000h	5000h	6000h	7000h	8000h	9000h	10000h
1	296	27.0	98.89	98.36	98.35	97.89	97.7	97.09	96.89	96.31	96.3	95.64
2	296	27.0	98.85	98.32	98.25	97.69	97.7	96.97	97.15	96.25	96.3	95.82
3	296	27.0	98.87	98.71	98	97.96	97.58	96.95	96.93	96.49	96.38	95.85
4	296	27.0	98.83	98.45	98.3	98.03	97.85	97.32	96.93	96.61	96.36	95.92
5	296	27.0	98.82	98.85	98.6	97.76	97.51	97.09	97.09	96.47	96.46	95.78
6	296	27.0	98.74	98.9	98.38	97.65	97.84	96.95	96.77	96.5	95.94	95.62
7	296	27.0	99.04	98.7	98.57	98.12	97.89	97.06	96.99	96.3	95.95	95.86
8	296	27.0	98.65	98.83	98.28	97.63	97.36	97.17	96.89	96.66	96.14	96.06
9	296	27.0	99.08	98.84	98.3	98.12	97.84	97.25	97.12	96.59	96.05	96.03
10	296	27.0	98.69	98.79	98.04	97.94	97.75	97.46	97.07	96.75	96.17	95.68
11	296	27.0	98.95	98.5	98.22	97.88	97.76	97.15	96.92	96.59	96.48	96.03
12	296	27.0	99.18	98.44	98.06	97.92	97.66	97.45	97.12	96.21	95.99	96.05
13	296	27.0	99.1	98.4	98.23	97.97	97.43	97.49	97.19	96.32	95.96	95.96
14	296	27.0	98.98	98.41	98.3	98.04	97.42	97.5	96.78	96.7	96.11	95.9
15	296	27.0	98.95	98.81	98.59	98.2	97.52	97.44	96.88	96.73	96.01	96.19
16	296	27.0	99.15	98.86	98.08	97.61	97.43	97.32	96.63	96.61	95.96	95.64
17	296	27.0	99.07	98.67	98.45	97.67	97.71	97.09	96.93	96.73	96.25	95.69
18	296	27.0	98.82	98.37	98.6	97.97	97.44	97.21	97.13	96.24	96.43	96.16
19	296	27.0	98.65	98.59	98.41	98.16	97.79	96.98	96.95	96.56	96.14	95.72
20	296	27.0	98.97	98.6	98.1	97.63	97.74	97.18	96.92	96.51	96.07	96
21	296	27.0	98.85	98.49	98.27	97.69	97.32	96.92	96.99	96.33	96.14	95.65
22	296	27.0	98.79	98.83	98.41	98.16	97.46	97.25	96.85	96.79	96.37	95.64
23	296	27.0	98.85	98.58	98.55	97.61	97.3	97.44	96.67	96.4	96.34	95.63
24	296	27.0	98.82	98.86	98.35	98.19	97.34	97.06	96.64	96.28	96.44	96.14
25	296	27.0	98.71	98.61	98.12	97.63	97.58	97.19	96.71	96.62	96.41	96.17
Avg.	296	27.0	98.91	98.58	98.34	97.96	97.63	97.3	96.92	96.55	96.21	95.92
Med.	296	27.0	98.87	98.58	98.35	97.94	97.58	97.32	96.92	96.56	96.17	95.85
Std. dev	0	0	0.14	0.16	0.17	0.19	0.2	0.18	0.18	0.15	0.16	0.19
Min.	296	27.0	98.65	98.32	98	97.61	97.3	96.95	96.63	96.24	95.95	95.64
Max.	296	27.0	99.18	98.9	98.6	98.2	97.89	97.49	97.19	96.79	96.46	96.19

Test Condition 2	85 °C
Drive Current	200mA
Measurement Current	200mA

Table: Initial Characteristics

LED No.	Luminous flux	Forward voltage	CCT	CIE1931		CIE1976	
	Φ_V [lm]	V_F [V]	T_{CP} [K]	x	y	u'	v'
1	296	27	4465	0.441	0.391	0.258	0.515
2	296	27	4465	0.44	0.392	0.258	0.516
3	296	27	4465	0.451	0.399	0.261	0.519
4	296	27	4465	0.458	0.405	0.263	0.523
5	296	27	4465	0.457	0.404	0.263	0.523
6	296	27	4465	0.455	0.402	0.264	0.522
7	296	27	4465	0.441	0.392	0.259	0.516
8	296	27	4465	0.464	0.411	0.265	0.527
9	296	27	4465	0.449	0.401	0.26	0.52
10	296	27	4465	0.456	0.402	0.264	0.521
11	296	27	4465	0.452	0.4	0.262	0.52
12	296	27	4465	0.467	0.416	0.265	0.529
13	296	27	4465	0.463	0.412	0.265	0.527
14	296	27	4465	0.466	0.414	0.266	0.528
15	296	27	4465	0.445	0.393	0.26	0.518
16	296	27	4465	0.454	0.406	0.262	0.523
17	296	27	4465	0.466	0.414	0.266	0.528
18	296	27	4465	0.45	0.4	0.261	0.52
19	296	27	4465	0.453	0.404	0.261	0.522
20	296	27	4465	0.455	0.406	0.261	0.523
21	296	27	4465	0.458	0.407	0.263	0.524
22	296	27	4465	0.449	0.4	0.261	0.52
23	296	27	4465	0.466	0.414	0.266	0.528
24	296	27	4465	0.447	0.398	0.26	0.519
25	296	27	4465	0.445	0.395	0.26	0.517
Avg.	296	27	4465	0.454	0.404	0.262	0.523
Med.	296	27	4465	0.454	0.404	0.262	0.523
Std. dev	0	0	0	0.009	0.008	0.003	0.005
Min.	296	27	4465	0.44	0.391	0.258	0.515
Max.	296	27	4465	0.467	0.416	0.266	0.529

Test Condition 2	85 °C
Drive Current	200mA
Measurement Current	200mA

Table: Chromaticity Shift

LED No.	1000h	2000h	3000h	4000h	5000h	6000h	7000h	8000h	9000h	10000h
1	0.0007	0.0009	0.0011	0.0013	0.0015	0.0016	0.0017	0.0019	0.002	0.0022
2	0.0006	0.0008	0.001	0.0012	0.0014	0.0016	0.0017	0.0019	0.0021	0.0023
3	0.0008	0.001	0.0011	0.0013	0.0016	0.0017	0.0018	0.0019	0.0021	0.0024
4	0.0007	0.0009	0.001	0.0013	0.0015	0.0016	0.0018	0.0019	0.002	0.0022
5	0.0006	0.0008	0.001	0.0012	0.0014	0.0016	0.0018	0.002	0.0022	0.0025
6	0.0009	0.0011	0.0013	0.0015	0.0016	0.0018	0.0019	0.0021	0.0022	0.0024
7	0.0007	0.0009	0.0012	0.0014	0.0016	0.0018	0.0019	0.0021	0.0023	0.0025
8	0.0006	0.0008	0.001	0.0012	0.0015	0.0016	0.0017	0.0019	0.002	0.0022
9	0.0005	0.0007	0.0009	0.0011	0.0013	0.0015	0.0016	0.0018	0.002	0.0021
10	0.0007	0.001	0.0012	0.0014	0.0016	0.0018	0.0019	0.0021	0.0023	0.0024
11	0.001	0.0013	0.0016	0.0018	0.002	0.0022	0.0023	0.0025	0.0026	0.0028
12	0.001	0.0012	0.0015	0.0018	0.002	0.0022	0.0024	0.0025	0.0027	0.0029
13	0.0009	0.0011	0.0013	0.0015	0.0017	0.0019	0.002	0.0022	0.0023	0.0025
14	0.0008	0.001	0.0012	0.0015	0.0017	0.0019	0.0021	0.0023	0.0024	0.0026
15	0.0009	0.0011	0.0013	0.0016	0.0018	0.002	0.0022	0.0024	0.0026	0.0028
16	0.001	0.0012	0.0014	0.0017	0.0019	0.0021	0.0023	0.0025	0.0027	0.0029
17	0.0009	0.0011	0.0013	0.0016	0.0018	0.002	0.0021	0.0023	0.0025	0.0027
18	0.0008	0.001	0.0012	0.0014	0.0016	0.0018	0.0019	0.0021	0.0022	0.0024
19	0.0009	0.0011	0.0014	0.0016	0.0018	0.002	0.0021	0.0023	0.0025	0.0026
20	0.0008	0.001	0.0012	0.0015	0.0017	0.0019	0.002	0.0022	0.0024	0.0025
21	0.0008	0.001	0.0012	0.0015	0.0017	0.0019	0.002	0.0022	0.0023	0.0025
22	0.0009	0.0011	0.0013	0.0016	0.0019	0.0021	0.0023	0.0025	0.0026	0.0028
23	0.0007	0.0009	0.0011	0.0013	0.0015	0.0017	0.0019	0.002	0.0022	0.0023
24	0.0008	0.001	0.0012	0.0014	0.0017	0.0019	0.002	0.0022	0.0023	0.0025
25	0.0008	0.001	0.0011	0.0014	0.0016	0.0018	0.0019	0.0021	0.0023	0.0024
Avg.	0.00082	0.00102	0.00124	0.0015	0.00168	0.00188	0.00202	0.0022	0.00236	0.00254
Med.	0.0008	0.001	0.0012	0.0015	0.0016	0.0019	0.002	0.0022	0.0023	0.0025
Std. dev	0.00012	0.00013	0.00019	0.00021	0.00022	0.00022	0.00023	0.00021	0.00022	0.00022
Min.	0.0005	0.0007	0.0009	0.0011	0.0013	0.0015	0.0016	0.0018	0.002	0.0021
Max.	0.001	0.0013	0.0016	0.0018	0.002	0.0022	0.0024	0.0025	0.0027	0.0029

Test Condition 3	105 °C
Drive Current	200mA
Measurement Current	200mA

Table: Lumen Maintenance

Led No.	Flux(lm)	Vf(V)	Lumen Maintenance(%)									
	0h		1000h	2000h	3000h	4000h	5000h	6000h	7000h	8000h	9000h	10000h
1	296	27	98.5	97.88	97.15	96.67	96.07	95.35	94.86	94.1	93.63	93.15
2	296	27	98.48	97.83	97.11	96.76	95.92	95.04	94.61	94.38	93.45	93.36
3	296	27	98.5	98.06	97.26	96.5	96.23	95.12	94.75	93.99	93.52	93.03
4	296	27	98.53	97.94	97.05	96.49	95.92	95.41	94.77	94.14	93.21	93.15
5	296	27	98.76	97.91	97.46	96.45	96	95.24	94.92	93.96	93.37	93.09
6	296	27	98.24	98.1	97.12	96.63	95.73	95.44	94.76	94.35	93.31	92.8
7	296	27	98.38	97.66	97.59	96.5	96.14	95.14	94.76	94.2	93.31	92.97
8	296	27	98.41	97.82	97.17	96.55	95.91	95.37	94.89	93.94	93.53	93.5
9	296	27	98.72	97.88	97.34	96.76	95.88	95.4	94.95	94.01	93.56	93.32
10	296	27	98.78	97.98	97.54	96.33	95.99	95.43	94.78	93.97	93.58	93.14
11	296	27	98.49	97.98	97.35	96.84	96.27	95.08	94.86	94.27	93.44	93.36
12	296	27	98.56	98.06	97.54	96.39	96.23	95.46	94.71	94.39	93.49	93.19
13	296	27	98.59	97.87	97.41	96.85	96.27	95.37	94.72	93.94	93.21	93.19
14	296	27	98.46	97.87	97.08	96.62	95.85	95.09	94.59	94.03	93.64	93.12
15	296	27	98.32	97.68	97.53	96.75	96.03	95.05	94.64	93.84	93.36	92.93
16	296	27	98.21	97.88	97.38	96.54	95.71	95.06	94.64	94.08	93.24	93.37
17	296	27	98.27	97.79	97.14	96.82	96.05	95.2	94.76	94.1	93.21	93.14
18	296	27	98.5	98.11	97.04	96.36	95.74	95.09	94.58	94.28	93.27	93.13
19	296	27	98.57	98.04	97.47	96.67	95.82	95.22	94.69	93.98	93.79	92.81
20	296	27	98.43	97.98	97.12	96.72	95.88	95.38	94.68	94.35	93.67	92.91
21	296	27	98.52	97.96	97.16	96.8	96.22	95.05	94.6	93.86	93.52	93.18
22	296	27	98.36	98.18	97.12	96.59	95.96	95.03	94.88	94.24	93.37	93.36
23	296	27	98.55	97.81	97.34	96.61	96.09	95.39	94.53	93.84	93.7	92.94
24	296	27	98.47	97.8	97.58	96.59	95.72	95.54	94.65	94.04	93.78	93.02
25	296	27	98.78	97.91	97.52	96.44	95.91	95.27	94.73	94.21	93.77	93.05
Avg.	296	27	98.52	97.95	97.35	96.66	96	95.32	94.78	94.23	93.56	93.11
Med.	296	27	98.52	97.91	97.34	96.62	95.92	95.22	94.71	94.14	93.56	93.15
Std. dev	0	0	0.17	0.13	0.18	0.12	0.13	0.12	0.14	0.14	0.21	0.17
Min.	296	27	98.21	97.66	97.04	96.36	95.71	95.03	94.53	93.84	92.81	92.91
Max.	296	27	98.78	98.18	97.59	96.85	96.27	95.54	94.92	94.38	93.79	93.37

Test Condition 3	105 °C
Drive Current	200mA
Measurement Current	200mA

Table: Initial Characteristics

Led No.	Luminous flux	Forward voltage	CCT	CIE1931		CIE1976	
	Φ_V [lm]	V_F [V]	T_{CP} [K]	x	y	u'	v'
1	296	27	4465	0.445	0.398	0.257	0.518
2	296	27	4465	0.456	0.408	0.261	0.523
3	296	27	4465	0.44	0.391	0.258	0.515
4	296	27	4465	0.441	0.394	0.256	0.516
5	296	27	4465	0.445	0.396	0.259	0.518
6	296	27	4465	0.444	0.394	0.26	0.517
7	296	27	4465	0.46	0.412	0.262	0.524
8	296	27	4465	0.441	0.392	0.258	0.516
9	296	27	4465	0.444	0.393	0.26	0.517
10	296	27	4465	0.445	0.394	0.26	0.517
11	296	27	4465	0.447	0.4	0.258	0.52
12	296	27	4465	0.454	0.408	0.26	0.523
13	296	27	4465	0.446	0.394	0.261	0.519
14	296	27	4465	0.443	0.392	0.259	0.517
15	296	27	4465	0.458	0.41	0.262	0.525
16	296	27	4465	0.443	0.395	0.258	0.518
17	296	27	4465	0.449	0.402	0.258	0.521
18	296	27	4465	0.444	0.394	0.26	0.517
19	296	27	4465	0.46	0.408	0.261	0.524
20	296	27	4465	0.444	0.395	0.259	0.518
21	296	27	4465	0.447	0.401	0.258	0.521
22	296	27	4465	0.442	0.395	0.258	0.517
23	296	27	4465	0.444	0.396	0.259	0.518
24	296	27	4465	0.447	0.398	0.259	0.52
25	296	27	4465	0.455	0.408	0.26	0.523
Avg.	296	27	4465	0.447	0.399	0.26	0.52
Med.	296	27	4465	0.445	0.396	0.259	0.518
Std. dev	0	0	0	0.006	0.006	0.002	0.003
Min.	296	27	4465	0.44	0.391	0.256	0.515
Max.	296	27	4465	0.46	0.412	0.262	0.525

Test Condition 3	105 °C
Drive Current	200mA
Measurement Current	200mA

Table: Chromaticity Shift

LED No.	1000h	2000h	3000h	4000h	5000h	6000h	7000h	8000h	9000h	10000h
1	0.0013	0.0015	0.0018	0.0021	0.0025	0.0029	0.0034	0.0037	0.0041	0.0045
2	0.001	0.0013	0.0016	0.0019	0.0023	0.0026	0.003	0.0033	0.0037	0.004
3	0.0014	0.0018	0.0021	0.0024	0.0029	0.0033	0.0036	0.0039	0.0045	0.005
4	0.0011	0.0013	0.0016	0.0019	0.0022	0.0026	0.0029	0.0033	0.0037	0.0041
5	0.001	0.0012	0.0015	0.0018	0.0022	0.0026	0.003	0.0034	0.0038	0.0043
6	0.0015	0.0017	0.002	0.0024	0.0028	0.0032	0.0036	0.004	0.0044	0.0048
7	0.0012	0.0014	0.0017	0.002	0.0024	0.0028	0.0032	0.0036	0.004	0.0044
8	0.001	0.0013	0.0016	0.0019	0.0023	0.0027	0.0031	0.0035	0.0039	0.0043
9	0.0009	0.0011	0.0014	0.0017	0.002	0.0024	0.0027	0.0031	0.0035	0.0039
10	0.0012	0.0015	0.0018	0.0022	0.0026	0.003	0.0034	0.0038	0.0042	0.0046
11	0.0017	0.002	0.0024	0.0028	0.0031	0.0035	0.0039	0.0043	0.0046	0.005
12	0.0016	0.0019	0.0023	0.0027	0.0031	0.0034	0.0038	0.0042	0.0046	0.005
13	0.0015	0.0018	0.0021	0.0025	0.0029	0.0033	0.0037	0.004	0.0044	0.0048
14	0.0013	0.0016	0.0019	0.0023	0.0027	0.0031	0.0035	0.0039	0.0042	0.0046
15	0.0016	0.0019	0.0023	0.0026	0.003	0.0034	0.0038	0.0042	0.0046	0.005
16	0.0017	0.002	0.0024	0.0028	0.0032	0.0036	0.004	0.0044	0.0048	0.0052
17	0.0015	0.0018	0.0021	0.0025	0.0029	0.0033	0.0036	0.004	0.0044	0.0048
18	0.0014	0.0016	0.0019	0.0023	0.0027	0.0031	0.0035	0.0039	0.0042	0.0046
19	0.0016	0.0019	0.0023	0.0027	0.0031	0.0034	0.0038	0.0042	0.0046	0.0049
20	0.0013	0.0015	0.0018	0.0022	0.0026	0.003	0.0034	0.0038	0.0041	0.0045
21	0.0013	0.0016	0.0019	0.0023	0.0027	0.003	0.0034	0.0038	0.0041	0.0045
22	0.0015	0.0018	0.0022	0.0026	0.003	0.0034	0.0038	0.0042	0.0046	0.005
23	0.0012	0.0014	0.0017	0.0021	0.0025	0.0029	0.0033	0.0036	0.004	0.0043
24	0.0013	0.0016	0.0019	0.0023	0.0027	0.003	0.0034	0.0038	0.0041	0.0045
25	0.0013	0.0016	0.0019	0.0022	0.0026	0.003	0.0034	0.0038	0.0042	0.0046
Avg.	0.0013	0.0016	0.0019	0.0023	0.0027	0.0031	0.0035	0.0039	0.0043	0.0047
Med.	0.0013	0.0016	0.0019	0.0023	0.0027	0.0031	0.0035	0.0039	0.0043	0.0046
Std. dev	0.0002	0.0002	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
Min.	0.0009	0.0011	0.0014	0.0017	0.002	0.0024	0.0027	0.0031	0.0035	0.0039
Max.	0.0017	0.002	0.0024	0.0028	0.0032	0.0036	0.004	0.0044	0.0048	0.0052

Chart:

Lumen Maintenance:

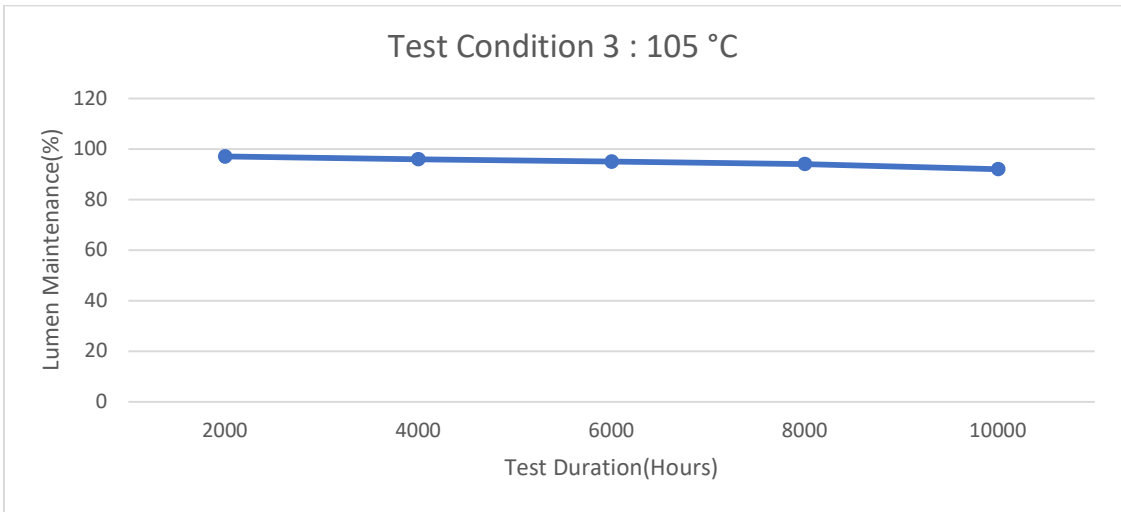
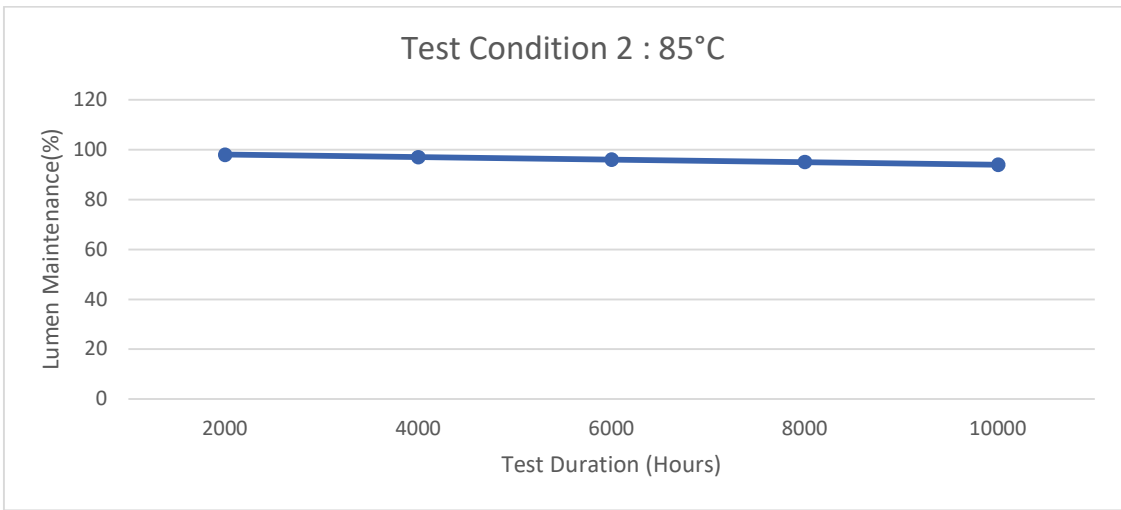
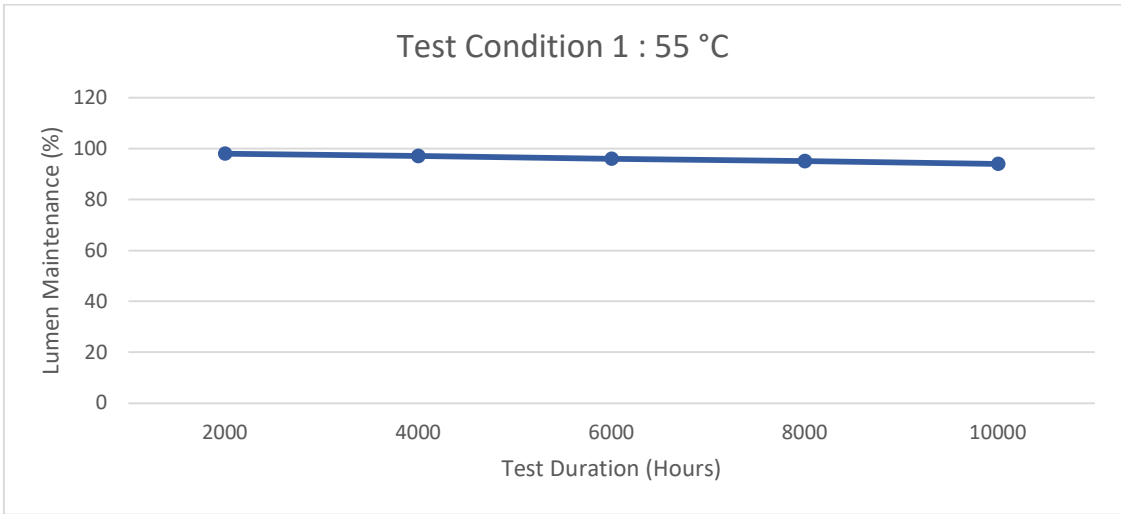
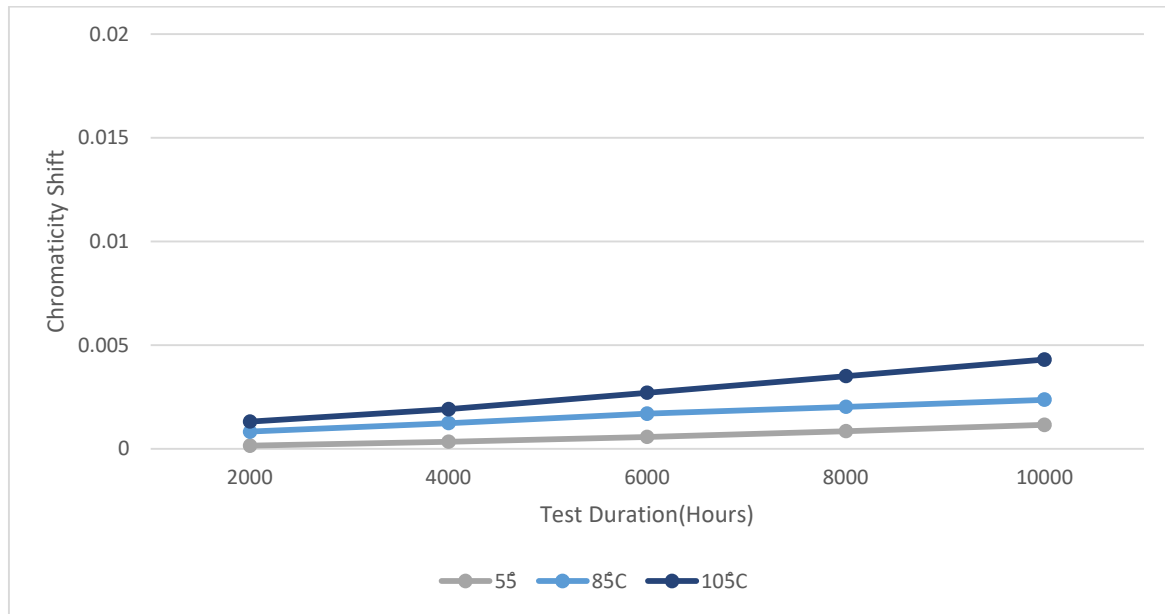


Chart:

Chromaticity Shift:



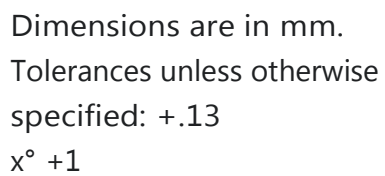
TM-21 Report: Projecting Long Term Lumen Maintenance of LED Light Source:

Test condition 1 - 55°C Case Temperature	
Sample size	25
No. of Failures	0
DUT drive Current used in the test mA	200
Test Duration(Hours)	10,000
Test Duration used for projection (Hour to hour)	5,000-10,000
Tested Case Tempereaure (°C)	55
α	3.239437×10^{-2}
β	0.98
Reported L70 (10k) (Hours)	>60500

Test condition 2 - 85°C Case Temperature	
Sample size	25
No. of Failures	0
DUT drive Current used in the test mA	200
Test Duration(Hours)	10,000
Test Duration used for projection (Hour to hour)	5,000-10,000
Tested Case Temperature (°C)	85
α	3.262872×10^{-2}
β	1
Reported L70 (10k) (Hours)	>55900

Test condition 3 - 105°C Case Temperature	
Sample size	25
No. of Failures	0
DUT drive Current used in the test mA	200
Test Duration(Hours)	10,000
Test Duration used for projection (Hour to hour)	5,000-10,000
Tested Case Temperature (°C)	105
α	3.344572×10^{-2}
β	1
Reported L70 (10k) (Hours)	42800

The COB dimensions are 30 X 30 mm.
Tolerances Unless otherwise specified: +/-0.3

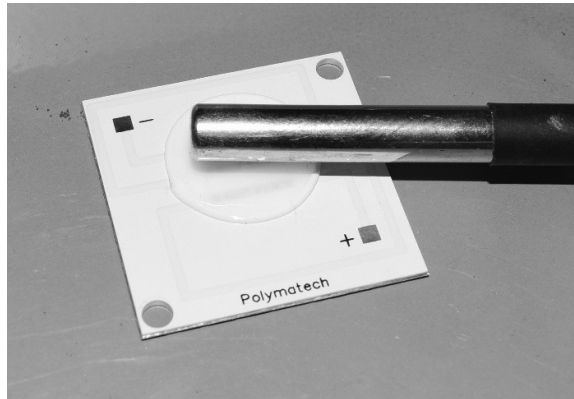


Test setup

Lumen Maintenance

Temperature Measurement Point (TMP) Definition

Ta (Measured Point of Ambient Temperature)



Ts (Measured Point of Case Temperature)

