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OSRAM
Opto Semiconductors

DURIS[®] S 5 White (CCT 2700 K – 6500 K)

IES LM-80-08 Test Report

Test Documentation No.: 150109W7 – 5th November 2015



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Document Information

Testing Laboratory

OSRAM Opto Semiconductors (Malaysia) Sdn. Bhd.
Reliability Engineering Test & Analysis Laboratory
Bayan Lepas Free Industrial Zone, 11900 Penang

Accreditation by DAkkS – No.: D-PL-19681-01-00



<http://www.osram-os.com/media/resource/HIRES/511891/1382448/d-pl-19681-01-00-zertifikat.pdf>

Customer Information

OSRAM Opto Semiconductors (Malaysia) Sdn. Bhd.
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Document Data

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	first version 18.03.2015

Conclusion

All tests have been performed according to the specified requirements described in IES LM-80-08. The results relate only to the listed amount of tested samples.

Confirmation

Test report prepared by

A handwritten signature in black ink, appearing to read 'Chen Kiat Pang', written over a horizontal line.

Chen Kiat Pang
Technical Coordinator LM-80

Test report approved by

A handwritten signature in black ink, appearing to read 'Joanne Ooi', written over a horizontal line.

Joanne Ooi
Technical Coordinator LM-80

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Disclaimer

Please carefully read the below terms and conditions before using the Information.
If you do not agree with any of these terms and conditions, do not use the Information.

The Information contained in this document does not constitute an independent warranty. The committed behavior is described in the Product data sheet.

Further explanations:

Data: The Data used in this Document consider the reliability test results under the mentioned driving conditions only. For Product information on the maximum operating conditions please refer to the Product data sheet or contact your local sales partner.

Conditions: The conditions for the generation of the data are as follows:

1. The Data and curves shown in this Document are based on experiments carried out under laboratory conditions on a random sample size of LED with readouts at discrete readout times (where applicable). Thus, the Data above represent a limited number of production lots only and may differ between different assembly lots over time (including chip or package changes). Thus, the behavior of the LED in the final application may differ from the Data. The behavior of the LED at conditions or readout times deviating from those stated above may not be deduced from the Data.
2. For long term operation additional failure modes of the chip or package can occur which are not shown in this Document.
3. Possible differences in the thermal management of OSRAM OS and customer's setup may lead to a different aging behavior.
4. The lifetime projection data presented in this Document has been evaluated in accordance with the lifetime extrapolation method described and defined in IES TM-21-11. The lifetime projection is based on the Data shown in this Document. The Data had been collected and assembled according to IES LM-80-08.

Test Report

1. Number of LED light sources tested

75 randomly selected samples from mass production.

2. Description of LED light sources

Devices tested

- DURIS S 5 GW PSLRS1.EC with CCT 3000 K

3. Description of auxiliary equipment

Devices are soldered to metal-core PCB and mounted in a thermal chamber on hot-plates to maintain the desired solder-point temperature. Reliability test boards are removed from the thermal chamber to cool down to room temperature for electrical and optical characterization.

Soldering equipment: Heller 1812 MKIII,

Stress equipment: Customized thermal chambers,

Electrical characterization: Keithley 2425-C controlled by customized software,

Measurement equipment: integrating sphere/spectroradiometer: Instrument systems CAS140CT

4. Operating cycle

The devices are tested at constant solder-point temperature and constant direct current.

5. Ambient conditions including airflow, temperature and relative humidity

Boards with devices under test are operated on controlled thermal plates in an oven with controlled environmental conditions according to section 4.4 of LM-80-08. Case temperature is controlled within $-2\text{ }^{\circ}\text{C}$; ambient temperature in the oven is controlled within $-5\text{ }^{\circ}\text{C}$ of case temperature; humidity is below 65 % r.H. and airflow is minimized (not forced) in the oven.

The ambient temperature during lumen and chromaticity measurements is set to $25 \pm 2\text{ }^{\circ}\text{C}$.

6. Case temperature (test point temperature)

The devices under test are operated at three constant case temperatures of $55\text{ }^{\circ}\text{C}$, $85\text{ }^{\circ}\text{C}$ and $105\text{ }^{\circ}\text{C}$. The test point temperature at device is marked in the isometric view graph on page 7.

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

The devices under test are operated at constant forward current. The operating current is listed in the test data tables.

8. Initial luminous flux and forward voltage at photometric measurement current

Please refer to the test data tables on pages 9 – 11.

9. Lumen maintenance data for each individual LED light source

Please refer to the test data tables on pages 9 - 11.

10. Observation of LED light source failures including the failure conditions and time of failure

None.

11. LED light source monitoring interval

Devices were electrically and optically characterized at room temperature at 0 h, 504 h, 1000 h, 2000 h, 3000 h, 4000 h, 5000 h, 6000 h, 7000 h, 8000 h.

12. Photometric measurement uncertainty

Measurement uncertainty for luminous flux (GUM): 4.6%

13. Chromaticity shift reported over the measurement time

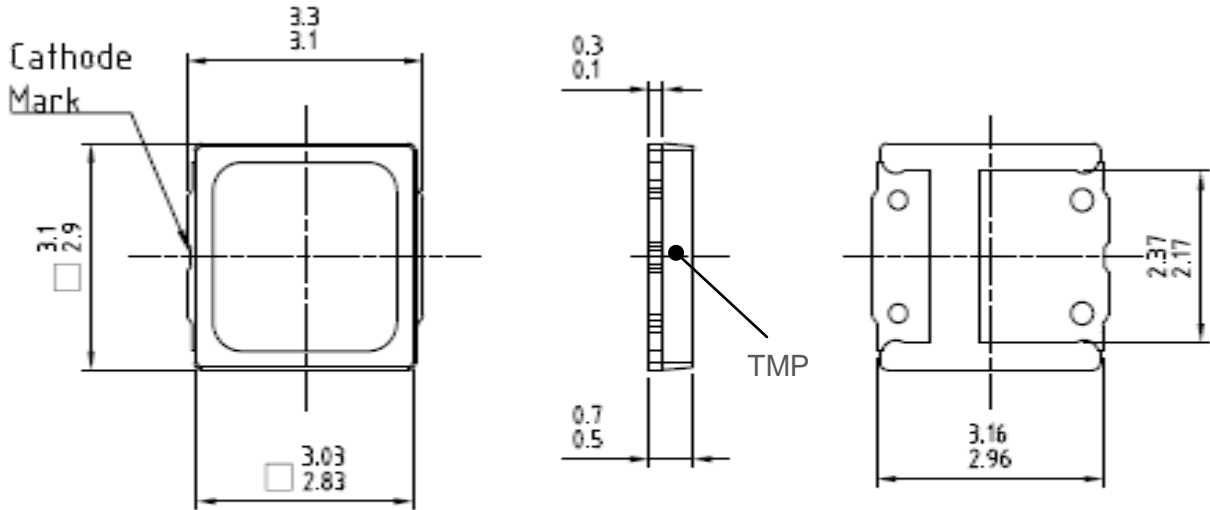
Please refer to the test data tables on pages 9 - 11.

Summary of Testing Conditions

	I	II	III
Case temperature (solder point)	T _S = 55 °C	T _S = 85 °C	T _S = 105 °C
Device drive current	I _F = 200 mA	I _F = 200 mA	I _F = 200 mA
Number of samples	25	25	25
Test start	15.08.2014	15.08.2014	15.08.2014
Test duration	8,000 hours	7,000 hours	8,000 hours
Nr. of failures	0	0	0

Isometric View Graphs and Temperature Measurement Point (TMP)

Device: DURIS S 5 (GW PSLRS1.xC)

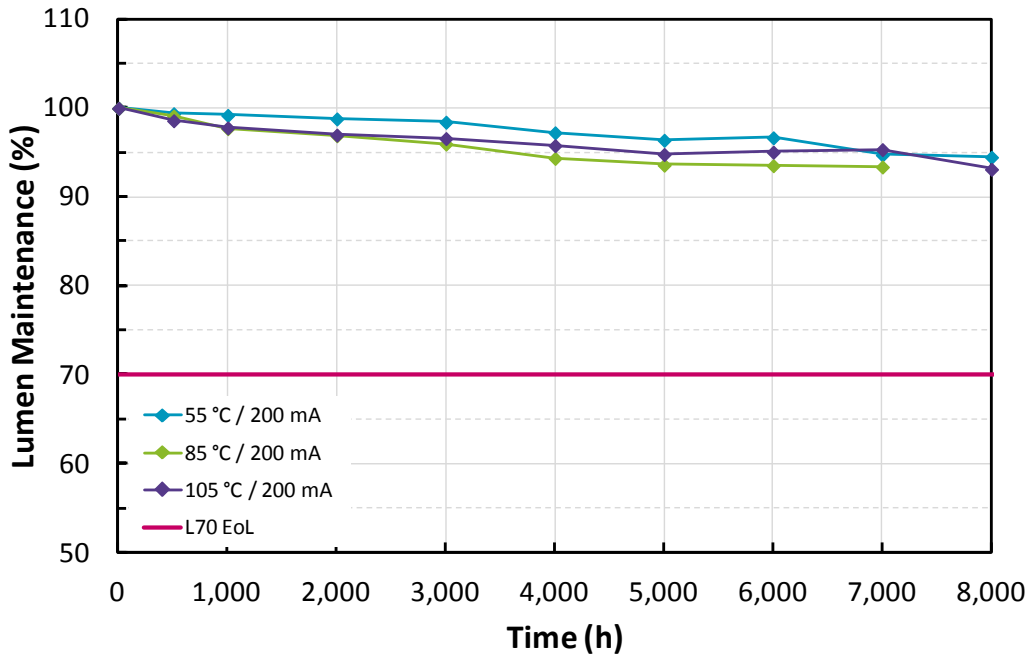


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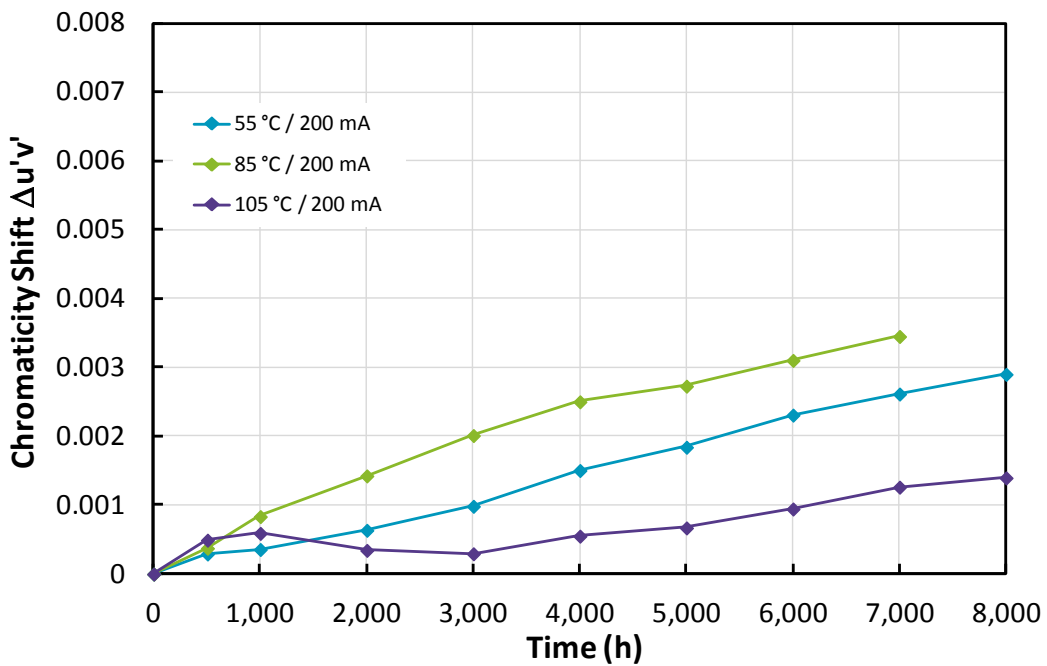
Test Results

1. Graphic charts

Lumen maintenance ($I_F = 200 \text{ mA}$) – Normalized to 0 h



Chromaticity shift $\Delta u'v'$ ($I_F = 200 \text{ mA}$) – Normalized to 0 h



2. Tables

Test condition I: $T_S = 55\text{ }^\circ\text{C}$, $I_F = 200\text{ mA}$

Lumen maintenance ($I_F = 200\text{ mA}$) – Normalized to 0 h

	U_F [V] Φ_V [lm]		Measurement Time of Lumen Maintenance									
	0 h	0 h	0 h	504 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h
1	6.31	139.00	100.00	99.38	99.48	99.40	99.18	98.48	97.56	97.69	95.61	95.09
2	6.30	139.40	100.00	99.39	99.34	99.25	99.12	97.91	97.21	97.48	95.62	95.25
3	6.31	131.50	100.00	99.36	99.22	98.84	98.72	97.85	97.25	97.49	95.76	95.72
4	6.24	132.40	100.00	99.36	99.38	99.14	98.88	98.17	97.57	97.96	96.16	96.05
5	6.30	131.00	100.00	99.28	99.07	98.77	98.25	97.46	96.55	96.95	95.06	94.87
6	6.31	138.10	100.00	99.53	99.48	99.26	98.59	97.89	96.96	97.17	95.01	94.41
7	6.30	137.60	100.00	99.60	99.26	98.69	98.14	96.86	95.93	96.22	94.27	93.81
8	6.24	136.30	100.00	99.08	98.81	98.33	97.97	96.68	95.30	95.52	93.63	93.45
9	6.32	126.10	100.00	99.49	99.59	99.56	99.43	98.30	97.68	98.02	96.06	96.17
10	6.27	128.30	100.00	99.19	98.66	98.00	97.57	96.38	95.46	95.40	93.48	93.27
11	6.27	134.00	100.00	99.44	99.09	98.54	98.00	96.70	95.51	95.67	93.60	93.04
12	6.29	135.30	100.00	99.30	98.95	98.40	97.95	96.80	96.08	96.52	94.76	94.44
13	6.28	131.20	100.00	99.43	99.14	98.47	97.87	96.24	95.18	95.28	93.32	92.89
14	6.29	133.90	100.00	99.51	99.31	98.84	98.30	97.14	96.26	96.56	94.49	94.23
15	6.25	127.30	100.00	99.26	98.88	98.23	97.71	96.43	95.57	96.00	94.14	94.01
16	6.24	127.50	100.00	99.26	98.96	98.46	98.11	96.91	95.90	96.55	94.93	94.96
17	6.28	125.10	100.00	99.49	99.42	98.70	98.30	96.84	96.05	96.33	94.36	94.38
18	6.33	130.20	100.00	99.35	99.21	99.00	98.78	97.59	96.99	97.00	95.26	95.06
19	6.24	130.30	100.00	99.58	99.75	99.68	99.47	98.44	97.84	98.00	96.10	95.84
20	6.25	128.50	100.00	99.42	98.66	98.62	98.13	96.85	96.24	96.58	94.81	94.69
21	6.29	135.00	100.00	99.52	99.76	99.93	99.89	98.80	98.15	98.37	96.30	95.83
22	6.24	128.00	100.00	99.26	98.97	98.39	98.04	96.53	95.68	96.02	94.25	94.04
23	6.34	127.40	100.00	99.34	99.12	98.31	97.55	95.80	94.71	94.90	92.73	92.44
24	6.25	135.40	100.00	99.52	99.24	98.47	97.96	96.44	95.64	96.01	93.88	93.48
25	6.30	128.60	100.00	99.50	99.44	98.92	99.07	97.71	96.87	97.36	95.05	95.00
median	6.29	131.20	100.00	99.39	99.22	98.70	98.25	96.91	96.24	96.56	94.81	94.44
average	6.28	131.90	100.00	99.39	99.21	98.81	98.44	97.25	96.41	96.68	94.75	94.50
std. dev.	0.03	4.27	0.00	0.13	0.30	0.49	0.64	0.82	0.95	0.96	0.98	1.04
min.	6.24	125.10	100.00	99.08	98.66	98.00	97.55	95.80	94.71	94.90	92.73	92.44
max.	6.34	139.40	100.00	99.60	99.76	99.93	99.89	98.80	98.15	98.37	96.30	96.17

Chromaticity shift $\Delta u'v'$ ($I_F = 200\text{ mA}$) – Normalized to 0 h

	CCT [K]	u'		v'		Measurement Time of Color Shift $\Delta u'v'$							
		0 h	0 h	0 h	0 h	504 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h
1	3117	0.247	0.519	0.0000	0.0002	0.0001	0.0002	0.0004	0.0007	0.0009	0.0013	0.0017	0.0020
2	3124	0.246	0.519	0.0000	0.0003	0.0002	0.0004	0.0006	0.0011	0.0013	0.0017	0.0020	0.0022
3	3064	0.250	0.516	0.0000	0.0002	0.0002	0.0005	0.0007	0.0011	0.0013	0.0017	0.0020	0.0022
4	3067	0.249	0.518	0.0000	0.0002	0.0002	0.0004	0.0007	0.0009	0.0010	0.0014	0.0017	0.0019
5	3108	0.248	0.515	0.0000	0.0002	0.0003	0.0006	0.0010	0.0014	0.0017	0.0022	0.0025	0.0029
6	3048	0.250	0.518	0.0000	0.0002	0.0002	0.0004	0.0007	0.0011	0.0015	0.0020	0.0023	0.0026
7	3147	0.246	0.517	0.0000	0.0002	0.0003	0.0007	0.0011	0.0016	0.0021	0.0026	0.0029	0.0030
8	3078	0.249	0.518	0.0000	0.0005	0.0006	0.0009	0.0013	0.0018	0.0023	0.0030	0.0033	0.0036
9	3075	0.248	0.519	0.0000	0.0004	0.0004	0.0005	0.0007	0.0011	0.0013	0.0016	0.0018	0.0020
10	3094	0.248	0.517	0.0000	0.0002	0.0005	0.0009	0.0013	0.0019	0.0024	0.0031	0.0035	0.0039
11	3125	0.247	0.516	0.0000	0.0002	0.0003	0.0007	0.0012	0.0018	0.0022	0.0028	0.0032	0.0035
12	3131	0.247	0.516	0.0000	0.0005	0.0006	0.0011	0.0015	0.0022	0.0024	0.0029	0.0032	0.0037
13	3116	0.248	0.516	0.0000	0.0002	0.0004	0.0008	0.0012	0.0020	0.0026	0.0032	0.0036	0.0039
14	3057	0.249	0.519	0.0000	0.0003	0.0002	0.0005	0.0008	0.0012	0.0016	0.0020	0.0022	0.0024
15	3068	0.249	0.518	0.0000	0.0003	0.0004	0.0008	0.0011	0.0017	0.0021	0.0024	0.0027	0.0032
16	3085	0.248	0.517	0.0000	0.0005	0.0006	0.0009	0.0013	0.0018	0.0020	0.0026	0.0029	0.0031
17	3118	0.247	0.517	0.0000	0.0003	0.0005	0.0009	0.0013	0.0019	0.0023	0.0028	0.0031	0.0033
18	3056	0.249	0.519	0.0000	0.0002	0.0002	0.0005	0.0007	0.0013	0.0015	0.0019	0.0022	0.0024
19	3106	0.248	0.517	0.0000	0.0002	0.0001	0.0003	0.0005	0.0009	0.0011	0.0016	0.0019	0.0022
20	3099	0.248	0.516	0.0000	0.0002	0.0005	0.0007	0.0013	0.0019	0.0020	0.0025	0.0027	0.0029
21	3076	0.248	0.519	0.0000	0.0002	0.0000	0.0001	0.0002	0.0006	0.0009	0.0013	0.0016	0.0019
22	3064	0.249	0.517	0.0000	0.0005	0.0006	0.0009	0.0014	0.0020	0.0024	0.0029	0.0030	0.0033
23	3100	0.248	0.516	0.0000	0.0002	0.0004	0.0008	0.0015	0.0023	0.0029	0.0034	0.0038	0.0040
24	3162	0.246	0.515	0.0000	0.0006	0.0007	0.0011	0.0018	0.0024	0.0028	0.0032	0.0036	0.0039
25	3068	0.249	0.518	0.0000	0.0001	0.0001	0.0003	0.0006	0.0009	0.0014	0.0018	0.0021	0.0025
median	3094	0.248	0.517	0.0000	0.0002	0.0003	0.0007	0.0011	0.0016	0.0020	0.0024	0.0027	0.0029
average	3094	0.248	0.517	0.0000	0.0003	0.0004	0.0006	0.0010	0.0015	0.0018	0.0023	0.0026	0.0029
std. dev.	31	0.001	0.001	0.0000	0.0001	0.0002	0.0003	0.0004	0.0005	0.0006	0.0007	0.0007	0.0007
min.	3048	0.246	0.515	0.0000	0.0001	0.0000	0.0001	0.0002	0.0006	0.0009	0.0013	0.0016	0.0019
max.	3162	0.250	0.519	0.0000	0.0006	0.0007	0.0011	0.0018	0.0024	0.0029	0.0034	0.0038	0.0040

Test condition II: $T_S = 85 \text{ }^\circ\text{C}$, $I_F = 200 \text{ mA}$

Lumen maintenance ($I_F = 200 \text{ mA}$) – Normalized to 0 h

	U_F [V] Φ_V [lm]		Measurement Time of Lumen Maintenance									
	0 h	0 h	0 h	504 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	
1	6.36	137.90	100.00	99.81	98.68	97.90	96.84	95.12	94.19	94.05	93.41	
2	6.31	132.50	100.00	98.91	96.89	95.79	94.63	92.95	92.35	92.00	91.72	
3	6.30	131.60	100.00	98.90	97.93	97.12	96.27	94.95	94.20	94.15	94.09	
4	6.25	132.20	100.00	99.13	97.56	97.05	96.44	95.13	94.38	94.33	94.19	
5	6.27	138.70	100.00	99.24	98.47	98.05	97.22	96.09	95.46	95.53	95.46	
6	6.23	132.10	100.00	98.83	97.64	96.38	95.15	93.15	92.03	91.60	91.10	
7	6.42	129.20	100.00	98.80	96.96	96.02	94.95	93.53	92.69	92.88	93.06	
8	6.25	129.20	100.00	99.35	98.43	97.78	97.05	95.48	94.79	94.66	94.53	
9	6.30	135.70	100.00	99.22	97.77	96.73	95.44	93.41	92.10	92.04	92.13	
10	6.35	127.30	100.00	99.02	97.70	96.91	95.65	93.83	92.82	92.62	92.49	
11	6.33	129.30	100.00	98.96	97.04	96.25	95.34	93.85	93.40	93.74	93.92	
12	6.24	129.40	100.00	99.19	98.05	97.55	96.98	95.79	95.19	95.29	95.39	
13	6.33	127.50	100.00	99.18	97.63	96.53	95.34	93.60	92.75	92.71	92.74	
14	6.24	134.50	100.00	98.85	97.53	96.71	95.84	94.40	93.66	93.68	93.70	
15	6.27	123.90	100.00	98.76	96.27	95.43	94.70	93.16	92.77	92.90	92.78	
16	6.30	134.90	100.00	99.00	97.83	97.23	96.23	94.34	93.46	93.40	93.12	
17	6.30	134.60	100.00	99.15	97.68	96.86	96.00	94.33	93.67	93.69	93.70	
18	6.27	127.60	100.00	99.03	98.18	97.54	96.85	95.34	94.49	94.36	94.00	
19	6.35	128.80	100.00	99.34	98.74	98.54	97.90	96.39	95.63	95.50	94.98	
20	6.27	128.80	100.00	99.34	98.58	98.08	97.35	95.77	94.93	94.72	94.44	
21	6.29	136.90	100.00	99.30	97.86	96.82	95.56	93.62	92.46	92.04	91.54	
22	6.28	129.60	100.00	99.19	97.59	96.79	96.05	94.48	94.03	93.98	93.93	
23	6.31	130.40	100.00	99.35	97.30	96.05	94.53	92.83	91.99	91.95	91.98	
24	6.31	134.00	100.00	99.22	97.74	96.85	96.20	94.75	94.09	94.10	94.05	
25	6.32	122.50	100.00	98.99	96.80	95.88	94.96	92.92	92.61	92.74	92.62	
median	6.30	130.40	100.00	99.15	97.70	96.85	96.00	94.34	93.66	93.69	93.70	
average	6.30	131.16	100.00	99.12	97.71	96.91	95.98	94.37	93.61	93.55	93.40	
std. dev.	0.04	4.09	0.00	0.24	0.62	0.79	0.93	1.07	1.12	1.16	1.18	
min.	6.23	122.50	100.00	98.76	96.27	95.43	94.53	92.83	91.99	91.60	91.10	
max.	6.42	138.70	100.00	99.81	98.74	98.54	97.90	96.39	95.63	95.53	95.46	

Chromaticity shift $\Delta u'v'$ ($I_F = 0 \text{ mA}$) – Normalized to 0 h

	CCT [K]	u'		v'		Measurement Time of Color Shift $\Delta u'v'$						
		0 h	0 h	0 h	0 h	504 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h
1	3145	0.246	0.516	0.0000	0.0004	0.0007	0.0015	0.0023	0.0031	0.0039	0.0045	0.0054
2	3155	0.246	0.516	0.0000	0.0004	0.0012	0.0021	0.0028	0.0034	0.0036	0.0043	0.0048
3	3070	0.249	0.518	0.0000	0.0004	0.0007	0.0014	0.0018	0.0021	0.0022	0.0025	0.0026
4	3067	0.249	0.518	0.0000	0.0004	0.0008	0.0012	0.0015	0.0017	0.0018	0.0020	0.0022
5	3142	0.247	0.515	0.0000	0.0004	0.0005	0.0009	0.0014	0.0016	0.0016	0.0019	0.0021
6	3094	0.248	0.517	0.0000	0.0004	0.0008	0.0016	0.0023	0.0030	0.0033	0.0038	0.0041
7	3106	0.248	0.517	0.0000	0.0004	0.0011	0.0018	0.0024	0.0028	0.0033	0.0033	0.0033
8	3098	0.248	0.518	0.0000	0.0002	0.0005	0.0010	0.0015	0.0018	0.0021	0.0026	0.0029
9	3090	0.248	0.518	0.0000	0.0002	0.0007	0.0015	0.0023	0.0030	0.0033	0.0037	0.0040
10	3082	0.248	0.518	0.0000	0.0003	0.0007	0.0014	0.0023	0.0030	0.0035	0.0040	0.0043
11	3093	0.248	0.519	0.0000	0.0005	0.0012	0.0017	0.0023	0.0028	0.0029	0.0031	0.0031
12	3095	0.248	0.516	0.0000	0.0004	0.0007	0.0011	0.0015	0.0017	0.0018	0.0019	0.0021
13	3141	0.247	0.514	0.0000	0.0003	0.0009	0.0016	0.0025	0.0031	0.0035	0.0040	0.0042
14	3125	0.247	0.518	0.0000	0.0005	0.0008	0.0013	0.0017	0.0021	0.0021	0.0023	0.0026
15	3103	0.248	0.517	0.0000	0.0006	0.0016	0.0021	0.0028	0.0032	0.0033	0.0036	0.0045
16	3115	0.247	0.517	0.0000	0.0005	0.0008	0.0012	0.0018	0.0025	0.0026	0.0029	0.0031
17	3092	0.248	0.517	0.0000	0.0003	0.0007	0.0013	0.0018	0.0022	0.0022	0.0025	0.0026
18	3090	0.249	0.516	0.0000	0.0004	0.0007	0.0012	0.0018	0.0021	0.0024	0.0029	0.0036
19	3050	0.249	0.518	0.0000	0.0002	0.0002	0.0004	0.0008	0.0013	0.0017	0.0021	0.0026
20	3088	0.248	0.517	0.0000	0.0002	0.0004	0.0008	0.0012	0.0017	0.0019	0.0023	0.0024
21	3157	0.246	0.517	0.0000	0.0004	0.0009	0.0018	0.0027	0.0035	0.0041	0.0050	0.0058
22	3106	0.247	0.518	0.0000	0.0003	0.0008	0.0015	0.0019	0.0024	0.0024	0.0028	0.0032
23	3057	0.249	0.520	0.0000	0.0004	0.0012	0.0019	0.0025	0.0030	0.0032	0.0036	0.0040
24	3177	0.245	0.518	0.0000	0.0004	0.0007	0.0013	0.0017	0.0020	0.0019	0.0022	0.0023
25	3102	0.248	0.516	0.0000	0.0007	0.0016	0.0023	0.0030	0.0036	0.0036	0.0038	0.0046
median	3098	0.248	0.517	0.0000	0.0004	0.0008	0.0014	0.0019	0.0025	0.0026	0.0029	0.0032
average	3106	0.248	0.517	0.0000	0.0004	0.0008	0.0014	0.0020	0.0025	0.0027	0.0031	0.0035
std. dev.	32	0.001	0.001	0.0000	0.0001	0.0003	0.0004	0.0006	0.0007	0.0008	0.0009	0.0011
min.	3050	0.245	0.514	0.0000	0.0002	0.0002	0.0004	0.0008	0.0013	0.0016	0.0019	0.0021
max.	3177	0.249	0.520	0.0000	0.0007	0.0016	0.0023	0.0030	0.0036	0.0041	0.0050	0.0058

Test condition III: $T_S = 105\text{ }^\circ\text{C}$, $I_F = 200\text{ mA}$

Lumen maintenance ($I_F = 200\text{ mA}$) – Normalized to 0 h

	U_F [V]	Φ_V [lm]	Measurement Time of Lumen Maintenance									
			0 h	0 h	0 h	504 h	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h
1	6.28	132.40	100.00	98.30	97.57	97.20	96.83	96.12	95.15	95.24	95.11	92.96
2	6.30	131.10	100.00	98.74	98.15	96.96	96.87	96.23	95.33	95.65	95.90	93.72
3	6.27	137.50	100.00	98.72	97.95	96.61	96.02	95.26	94.17	94.54	94.84	92.56
4	6.31	137.00	100.00	98.65	97.72	96.46	95.71	95.02	94.01	94.45	94.75	92.32
5	6.31	130.50	100.00	98.66	98.37	97.71	97.24	96.37	95.15	95.56	96.11	94.08
6	6.28	137.50	100.00	98.51	97.87	97.33	97.05	96.42	95.49	95.71	95.86	93.58
7	6.27	127.90	100.00	98.40	97.79	97.08	96.46	95.98	95.36	95.47	96.04	94.04
8	6.26	133.20	100.00	98.16	97.20	96.40	95.57	94.79	93.90	94.22	94.76	92.70
9	6.25	128.70	100.00	98.10	96.87	96.17	95.71	94.91	93.83	93.94	93.97	91.66
10	6.27	128.10	100.00	98.87	98.11	97.31	96.94	96.29	95.45	95.79	96.04	93.81
11	6.27	132.40	100.00	98.15	97.11	96.31	96.07	95.36	94.24	94.56	94.96	92.80
12	6.27	127.90	100.00	98.48	97.48	96.46	95.91	95.11	94.26	94.61	95.02	92.94
13	6.30	128.60	100.00	98.72	97.96	97.16	96.64	95.76	94.92	95.18	95.59	93.45
14	6.25	127.50	100.00	98.63	97.16	96.37	96.13	95.49	94.80	95.22	95.63	93.55
15	6.30	128.40	100.00	98.80	97.96	97.31	97.03	95.60	94.60	94.55	94.73	92.50
16	6.25	126.90	100.00	98.16	97.07	96.60	96.35	95.78	94.53	94.17	94.12	91.94
17	6.27	129.90	100.00	98.58	97.90	97.33	96.99	96.20	95.36	95.46	95.86	93.59
18	6.27	128.00	100.00	98.56	97.87	97.23	96.94	96.06	95.05	95.24	95.81	93.81
19	6.31	133.30	100.00	98.76	98.11	97.36	97.08	96.45	95.34	95.65	96.03	93.60
20	6.29	129.80	100.00	98.89	98.21	97.40	96.99	96.19	95.05	95.46	95.71	93.35
21	6.34	129.00	100.00	98.88	98.28	97.47	97.20	96.40	95.56	95.89	96.22	94.01
22	6.30	127.70	100.00	98.79	98.18	97.54	97.24	96.68	95.59	95.77	95.80	93.40
23	6.35	127.40	100.00	98.87	98.02	96.76	96.05	95.01	93.45	94.20	94.38	92.13
24	6.28	130.90	100.00	99.05	98.23	97.26	97.02	96.00	95.09	95.34	95.51	93.18
25	6.34	121.70	100.00	98.66	97.76	97.00	96.91	95.51	94.53	94.83	95.11	92.74
median	6.28	129.00	100.00	98.66	97.90	97.16	96.87	95.98	95.05	95.24	95.59	93.35
average	6.29	130.13	100.00	98.60	97.80	96.99	96.60	95.80	94.81	95.07	95.35	93.14
std. dev.	0.03	3.63	0.00	0.26	0.42	0.45	0.54	0.56	0.62	0.60	0.66	0.69
min.	6.25	121.70	100.00	98.10	96.87	96.17	95.57	94.79	93.45	93.94	93.97	91.66
max.	6.35	137.50	100.00	99.05	98.37	97.71	97.24	96.68	95.59	95.89	96.22	94.08

Chromaticity shift $\Delta u'v'$ ($I_F = 0\text{ mA}$) – Normalized to 0 h

	CCT [K]	u'	v'	Measurement Time of Color Shift $\Delta u'v'$									
				0 h	0 h	0 h	0 h	504 h	1000 h	2000 h	3000 h	4000 h	5000 h
1	3093	0.248	0.518	0.0000	0.0007	0.0007	0.0003	0.0001	0.0004	0.0003	0.0008	0.0015	0.0016
2	3084	0.249	0.516	0.0000	0.0004	0.0003	0.0004	0.0004	0.0002	0.0008	0.0008	0.0010	0.0012
3	3070	0.249	0.517	0.0000	0.0004	0.0004	0.0001	0.0001	0.0002	0.0003	0.0007	0.0009	0.0010
4	3070	0.249	0.516	0.0000	0.0004	0.0006	0.0004	0.0003	0.0006	0.0007	0.0009	0.0013	0.0014
5	3132	0.247	0.516	0.0000	0.0004	0.0002	0.0003	0.0004	0.0002	0.0008	0.0008	0.0012	0.0016
6	3129	0.247	0.518	0.0000	0.0004	0.0007	0.0004	0.0002	0.0006	0.0007	0.0009	0.0012	0.0013
7	3074	0.249	0.518	0.0000	0.0005	0.0007	0.0004	0.0004	0.0008	0.0006	0.0009	0.0011	0.0013
8	3103	0.248	0.518	0.0000	0.0005	0.0007	0.0004	0.0003	0.0007	0.0005	0.0008	0.0010	0.0011
9	3093	0.248	0.518	0.0000	0.0008	0.0009	0.0007	0.0004	0.0010	0.0011	0.0017	0.0023	0.0025
10	3109	0.248	0.516	0.0000	0.0006	0.0007	0.0005	0.0004	0.0006	0.0008	0.0011	0.0014	0.0016
11	3083	0.248	0.519	0.0000	0.0005	0.0006	0.0003	0.0002	0.0004	0.0007	0.0010	0.0012	0.0015
12	3144	0.247	0.516	0.0000	0.0007	0.0009	0.0007	0.0008	0.0010	0.0008	0.0011	0.0012	0.0014
13	3081	0.248	0.518	0.0000	0.0007	0.0008	0.0005	0.0004	0.0007	0.0006	0.0008	0.0010	0.0011
14	3101	0.248	0.516	0.0000	0.0007	0.0009	0.0008	0.0005	0.0008	0.0007	0.0009	0.0012	0.0012
15	3130	0.247	0.517	0.0000	0.0004	0.0007	0.0002	0.0001	0.0004	0.0006	0.0009	0.0012	0.0012
16	3097	0.248	0.519	0.0000	0.0007	0.0008	0.0004	0.0002	0.0007	0.0005	0.0010	0.0015	0.0014
17	3105	0.248	0.517	0.0000	0.0004	0.0004	0.0001	0.0002	0.0002	0.0007	0.0008	0.0012	0.0013
18	3067	0.249	0.518	0.0000	0.0004	0.0004	0.0001	0.0000	0.0003	0.0005	0.0007	0.0010	0.0012
19	3086	0.248	0.517	0.0000	0.0004	0.0004	0.0001	0.0000	0.0002	0.0007	0.0007	0.0010	0.0010
20	3091	0.248	0.517	0.0000	0.0003	0.0004	0.0001	0.0001	0.0004	0.0009	0.0010	0.0013	0.0015
21	3079	0.248	0.519	0.0000	0.0003	0.0002	0.0001	0.0001	0.0002	0.0008	0.0008	0.0012	0.0015
22	3085	0.249	0.517	0.0000	0.0004	0.0004	0.0002	0.0001	0.0004	0.0004	0.0009	0.0015	0.0017
23	3123	0.247	0.517	0.0000	0.0004	0.0005	0.0005	0.0007	0.0012	0.0011	0.0015	0.0017	0.0019
24	3078	0.249	0.515	0.0000	0.0004	0.0005	0.0003	0.0003	0.0007	0.0007	0.0010	0.0012	0.0013
25	3088	0.248	0.518	0.0000	0.0006	0.0008	0.0006	0.0006	0.0009	0.0007	0.0011	0.0013	0.0015
median	3091	0.248	0.517	0.0000	0.0004	0.0006	0.0004	0.0003	0.0006	0.0007	0.0009	0.0012	0.0014
average	3096	0.248	0.517	0.0000	0.0005	0.0006	0.0003	0.0003	0.0006	0.0007	0.0009	0.0013	0.0014
std. dev.	21	0.001	0.001	0.0000	0.0001	0.0002	0.0002	0.0002	0.0003	0.0002	0.0002	0.0003	0.0003
min.	3067	0.247	0.515	0.0000	0.0003	0.0002	0.0001	0.0000	0.0002	0.0003	0.0007	0.0009	0.0010
max.	3144	0.249	0.519	0.0000	0.0008	0.0009	0.0008	0.0008	0.0012	0.0011	0.0017	0.0023	0.0025

----- End of the accredited section of the report -----

Appendix A: Lumen Maintenance Projection (IES TM-21-11)

For Information Only!

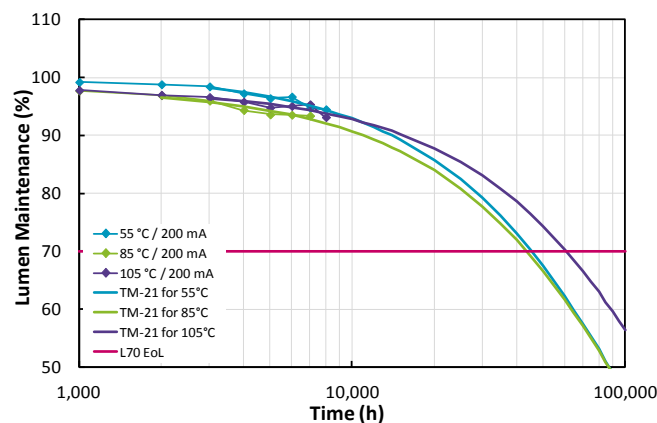
1. General Information

Description of LED light source tested	DURIS S 5 GW PSLRS1.EC
Sample size per temperature	25
LED drive current used in the test	200 mA
Test duration	8,000 hours for Test Condition I & III 7,000 hours for Test Conditions II
Test duration used for projection	3,000 hours to 8,000 hours for Test Conditions I & III 2,000 hours to 7,000 hours for Test Condition II

2. Projection Data

	I	II	III
Case temperature (solder point)	$T_S = 55\text{ °C}$	$T_S = 85\text{ °C}$	$T_S = 105\text{ °C}$
α	7.991E-06	7.703E-06	5.534E-06
B	1.007E+00	9.796E-01	9.806E-01
Reported L70	45,451 hours	>42,000 hours	>48,000 hours

3. Graphic chart



Appendix B: Additional Models Covered By Testing

The 9 September 2011 ENERGY STAR® *Program Guidance Regarding LED Package, LED Array and LED Module Lumen Maintenance Performance Data Supporting Qualification of Lighting Products* defines conditions for which a LM-80 report may be applied to cover models that have not been directly tested.

The following list of models may be covered by the test results in this report:

- DURIS S 5 GW PSLRS1.EC with CCT 2700 K – 6500 K
- DURIS S 5 GW PSLRS1.PC with CCT 3000 K – 6500 K
- DURIS S 5 GW PSLRS1.CC with CCT 2700 K – 4000 K
- DURIS S 5 GW PSLR31.EM with CCT 2700 K – 6500 K
- DURIS S 5 GW PSLR32.EM with CCT 2700 K – 6500 K
- DURIS S 5 GW PSLR31.CM with CCT 2700 K – 4000 K
- DURIS S 5 GW PSLR32.CM with CCT 2700 K – 4000 K
- DURIS S 5 GW PSLM31.EM with CCT 2700 K – 6500 K
- DURIS S 5 GW PSLM31.CM with CCT 2700 K – 4000 K

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