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OSCONIQ® P 3737 (2W version) White (CCT 2700 K – 6500 K)

IES LM-80-15 Test Report

Test Documentation No.: 180448W3 (Document No.: OSRM019-01-170) – 17th Dec 2018



LM80 12000 Hour Interval Test Report

IES LM-80-15 Approved Method for Measuring Lumen Maintenance of LED Light Sources

CSA Group Report: OSRM019-01-170

November 16, 2018

Manufacturer: **OSRAM**

Models tested: **GW PUSRA1.PM**

Test conditions: 24 devices @ 55.0 C, 0.700 A
24 devices @ 85.0 C, 0.700 A
24 devices @ 105.0 C, 0.700 A

Prepared for:

OSRAM Opto Semiconductors (Malaysia) Sdn.
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Attn:

Test report prepared by:

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KC Fletcher

Project Manager,
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1.0 Statement of test conditions, summary of results, and reporting requirements:

Part number: GW PUSRA1.PM					
Life test conditions			Summary of results		
Test condition	Drive current (A)	Case temperature (°C)	Elapsed life test time (hrs)	Average lumen maintenance (%)	Average chromaticity shift ($\Delta u'v'$)
TC1	0.700	55	12000	98.0	0.0015
TC2	0.700	85	12000	97.7	0.0014
TC3	0.700	105	12000	97.5	0.0015
LM80-15 Reporting requirements					
1. Number of samples tested:			24 per test condition		
2. Description of LED light sources			LED Package ¹		
3. Description of auxiliary equipment			see section 6.1 below		
4. Operating cycle			LED packages are driven at constant current for life test and are pulsed for photometric test.		
5. Ambient conditions, airflow, relative humidity			LED's are operated on controlled thermal plates in an environment that complies with the requirements given in Section 4.4 of LM80-15. Case temperature (Ts): controlled to within -2°C, Surrounding air temp: controlled to within -5°C of Ts, Humidity: < 65 RH, No forced air flow		
6. Case temperature (test point temperature)			See summary table above for test conditions. The temperature measurement point is shown in Sec. 6.3.		
7. Drive current during life test			see summary table above		
8. Initial luminous flux and forward voltage			see data tables for individual test conditions		
9. Lumen maintenance data for each individual LED light source			see data tables for individual test conditions		
10. Observation of LED light source failures			see data tables for individual test conditions		
11. LED light source monitoring intervals			see data tables for individual test conditions		
12. Photometric measurement uncertainty			k=2 expanded measurement uncertainty for relative luminous flux measurements is $\pm 2.0\%$		
13. Chromaticity shift reported over the measurement time			see data tables for individual test conditions		
14. Test start date			June 20, 2017		
15. ANSI target and calculated CCT values			see data tables		

Notes:

- per ANSI/IESNA RP-16-05 Addendum b, *Nomenclature and Definitions for Illuminating Engineering*

TABLE 1.1 - Initial ANSI Target & Calculated CCT Results

GW PUSRA1.PM

Load board ID	Device number	Zero hour measurements		Load board ID	Device number	Zero hour measurements		Load board ID	Device number	Zero hour measurements	
		ANSI Target* CCT (K)	Initial Calculated CCT (K)			ANSI Target* CCT (K)	Initial Calculated CCT (K)			ANSI Target* CCT (K)	Initial Calculated CCT (K)
100000108DAF031C	D1	3045±175	2966	B40000109337031C	D1	3045±175	2969	32000010952E031C	D1	3045±175	2965
	D2	3045±175	2960		D2	3045±175	2933		D2	3045±175	2973
	D3	3045±175	2972		D3	3045±175	2962		D3	3045±175	2960
	D4	3045±175	2994		D4	3045±175	2964		D4	3045±175	2967
	D5	3045±175	2950		D5	3045±175	2938		D5	3045±175	2934
	D6	3045±175	2975		D6	3045±175	2965		D6	3045±175	2943
	D7	3045±175	2963		D7	3045±175	2976		D7	3045±175	2973
	D8	3045±175	2971		D8	3045±175	2947		D8	3045±175	2947
	D9	3045±175	2939		D9	3045±175	2953		D9	3045±175	2948
	D10	3045±175	2962		D10	3045±175	2968		D10	3045±175	2953
	D11	3045±175	2955		D11	3045±175	2953		D11	3045±175	2946
	D12	3045±175	2955		D12	3045±175	2975		D12	3045±175	2952
DD0000108DAE031C	D1	3045±175	2933	F10000109779031C	D1	3045±175	2969	D0000010966C031C	D1	3045±175	2965
	D2	3045±175	2964		D2	3045±175	2971		D2	3045±175	2955
	D3	3045±175	2936		D3	3045±175	2950		D3	3045±175	2951
	D4	3045±175	2935		D4	3045±175	2937		D4	3045±175	2968
	D5	3045±175	2962		D5	3045±175	2962		D5	3045±175	2961
	D6	3045±175	2976		D6	3045±175	2964		D6	3045±175	2937
	D7	3045±175	2942		D7	3045±175	2929		D7	3045±175	2927
	D8	3045±175	2941		D8	3045±175	2969		D8	3045±175	2936
	D9	3045±175	2980		D9	3045±175	2934		D9	3045±175	2964
	D10	3045±175	2994		D10	3045±175	2940		D10	3045±175	2980
	D11	3045±175	3001		D11	3045±175	2930		D11	3045±175	2941
	D12	3045±175	2930		D12	3045±175	2937		D12	3045±175	2960

* target CCT as defined in ANSI C78.377-2008

Test Condition 1 55 °C 0.700 A														
TABLE 2.0 - LUMEN MAINTENANCE RESULTS														
Test Condition 1 55 °C 0.700 A														
Load board ID	Device number	Zero hour measurements		Photometric test drive current: 0.700 A Photometric test ambient temperature: 25 ± 2 °C Failures observed: none										
		Flux (lm)	Vf (V)	Lumen Maintenance (%)										
				2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000
100000108DAF031C	D1	292.51	3.05	98.2	98.6	98.4	98.3	98.3	98.3	98.0	98.0	98.0	97.9	97.8
	D2	296.17	3.14	98.5	98.8	98.7	98.5	98.5	98.6	98.3	98.3	98.2	98.0	98.0
	D3	297.93	3.23	98.6	98.8	98.6	98.5	98.5	98.5	98.4	98.2	98.2	98.1	98.0
	D4	293.45	3.21	98.6	98.8	98.8	98.8	98.5	98.6	98.3	98.4	98.3	98.2	98.2
	D5	295.12	3.17	98.3	98.7	98.5	98.4	98.2	98.4	98.1	98.1	98.0	97.9	97.9
	D6	295.52	3.21	98.4	98.8	98.6	98.6	98.3	98.4	98.2	98.1	98.0	97.9	97.9
	D7	296.57	3.21	98.9	99.2	99.0	99.0	98.8	98.9	98.7	98.6	98.5	98.3	98.4
	D8	293.96	3.24	98.2	98.6	98.4	98.2	98.1	98.4	98.0	98.1	97.9	97.8	97.8
	D9	290.38	3.15	98.5	98.9	98.9	98.8	98.6	98.8	98.5	98.5	98.4	98.3	98.2
	D10	294.48	3.18	98.5	98.8	98.6	98.5	98.4	98.5	98.2	98.1	98.1	98.0	98.0
	D11	296.95	3.23	98.3	98.6	98.5	98.3	98.3	98.3	98.1	98.0	98.0	97.9	97.8
	D12	295.77	3.24	98.4	98.7	98.6	98.6	98.3	98.5	98.2	98.2	98.1	98.1	98.1
DD0000108DAE031C	D1	291.68	3.12	98.3	98.5	98.4	98.4	98.2	98.4	98.1	98.0	97.9	97.9	97.8
	D2	293.46	3.15	98.7	98.9	98.8	98.8	98.7	98.8	98.4	98.3	98.4	98.4	98.2
	D3	292.84	3.17	98.5	98.7	98.6	98.7	98.5	98.7	98.4	98.2	98.2	98.1	98.1
	D4	294.18	3.23	98.6	98.9	98.9	98.8	98.7	98.8	98.5	98.3	98.4	98.3	98.2
	D5	293.80	3.23	98.5	98.7	98.6	98.5	98.3	98.4	98.1	98.0	98.0	98.1	97.8
	D6	294.78	3.22	98.7	98.9	98.8	98.8	98.6	98.7	98.4	98.2	98.3	98.3	98.1
	D7	293.71	3.24	98.3	98.6	98.5	98.5	98.3	98.3	98.0	98.0	97.9	98.0	97.8
	D8	293.60	3.17	98.3	98.5	98.5	98.4	98.2	98.4	98.1	98.0	98.0	98.0	97.8
	D9	296.72	3.22	98.5	98.6	98.6	98.5	98.3	98.5	98.1	98.1	98.1	98.1	97.8
	D10	298.08	3.21	98.5	98.7	98.7	98.7	98.4	98.6	98.3	98.2	98.1	98.1	98.1
	D11	298.27	3.27	98.5	98.7	98.7	98.6	98.4	98.6	98.2	98.2	98.2	98.1	97.9
	D12	295.14	3.25	98.5	98.7	98.6	98.5	98.5	98.7	98.3	98.2	98.2	98.1	98.0
n				24	24	24	24	24	24	24	24	24	24	24
mean				98.5	98.7	98.6	98.6	98.4	98.5	98.3	98.2	98.1	98.1	98.0
median				98.5	98.7	98.6	98.5	98.4	98.5	98.2	98.2	98.1	98.1	98.0
std. dev.				0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
min				98.2	98.5	98.4	98.2	98.1	98.3	98.0	98.0	97.9	97.8	97.8
max				98.9	99.2	99.0	99.0	98.8	98.9	98.7	98.6	98.5	98.4	98.4

Test Condition 1 55 °C 0.700 A															
TABLE 2.1 - CHROMATICITY SHIFT RESULTS															
Test Condition 1 55 °C 0.700 A															
Load board ID	Device number	Zero hour measurements			Photometric test drive current: 0.700 A Photometric test ambient temperature: 25 ± 2 °C Failures observed: none										
		u'	v'		Chromaticity shift ($\Delta u'v'$)										
					2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000
100000108DAF031C	D1	0.2506	0.5267		0.0011	0.0011	0.0009	0.0009	0.0009	0.0013	0.0014	0.0014	0.0013	0.0015	0.0016
	D2	0.2512	0.5254		0.0013	0.0014	0.0012	0.0012	0.0011	0.0015	0.0016	0.0017	0.0016	0.0016	0.0016
	D3	0.2504	0.5265		0.0013	0.0013	0.0012	0.0013	0.0011	0.0016	0.0016	0.0015	0.0017	0.0016	0.0016
	D4	0.2501	0.5244		0.0011	0.0012	0.0010	0.0012	0.0010	0.0014	0.0013	0.0015	0.0013	0.0013	0.0014
	D5	0.2515	0.5259		0.0010	0.0010	0.0009	0.0009	0.0009	0.0013	0.0012	0.0014	0.0013	0.0014	0.0013
	D6	0.2506	0.5252		0.0012	0.0013	0.0010	0.0010	0.0012	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015
	D7	0.2510	0.5257		0.0014	0.0012	0.0012	0.0010	0.0010	0.0014	0.0016	0.0016	0.0016	0.0016	0.0015
	D8	0.2510	0.5244		0.0011	0.0012	0.0010	0.0011	0.0009	0.0014	0.0014	0.0014	0.0012	0.0015	0.0014
	D9	0.2519	0.5260		0.0012	0.0011	0.0008	0.0008	0.0008	0.0013	0.0013	0.0014	0.0013	0.0014	0.0013
	D10	0.2510	0.5258		0.0014	0.0014	0.0012	0.0012	0.0012	0.0017	0.0016	0.0017	0.0017	0.0016	0.0017
	D11	0.2514	0.5254		0.0012	0.0013	0.0010	0.0010	0.0009	0.0013	0.0014	0.0015	0.0014	0.0015	0.0014
	D12	0.2515	0.5253		0.0014	0.0013	0.0012	0.0011	0.0012	0.0014	0.0015	0.0016	0.0015	0.0016	0.0016
DD0000108DAE031C	D1	0.2520	0.5267		0.0013	0.0012	0.0012	0.0011	0.0011	0.0014	0.0014	0.0014	0.0015	0.0017	0.0015
	D2	0.2511	0.5252		0.0013	0.0011	0.0011	0.0011	0.0012	0.0014	0.0015	0.0015	0.0015	0.0016	0.0016
	D3	0.2521	0.5259		0.0013	0.0013	0.0012	0.0012	0.0013	0.0015	0.0015	0.0016	0.0015	0.0018	0.0016
	D4	0.2521	0.5264		0.0015	0.0013	0.0013	0.0012	0.0014	0.0015	0.0015	0.0016	0.0016	0.0017	0.0016
	D5	0.2511	0.5255		0.0013	0.0014	0.0013	0.0013	0.0013	0.0015	0.0015	0.0016	0.0015	0.0018	0.0015
	D6	0.2507	0.5247		0.0014	0.0012	0.0012	0.0012	0.0012	0.0014	0.0015	0.0013	0.0015	0.0018	0.0014
	D7	0.2518	0.5261		0.0014	0.0013	0.0011	0.0010	0.0013	0.0014	0.0015	0.0016	0.0014	0.0016	0.0015
	D8	0.2516	0.5269		0.0013	0.0011	0.0012	0.0010	0.0012	0.0014	0.0013	0.0013	0.0014	0.0018	0.0014
	D9	0.2501	0.5265		0.0013	0.0013	0.0010	0.0011	0.0012	0.0014	0.0013	0.0015	0.0015	0.0015	0.0015
	D10	0.2497	0.5259		0.0012	0.0013	0.0012	0.0011	0.0012	0.0015	0.0014	0.0016	0.0015	0.0016	0.0015
	D11	0.2495	0.5256		0.0013	0.0014	0.0013	0.0011	0.0012	0.0015	0.0015	0.0016	0.0017	0.0017	0.0016
	D12	0.2524	0.5258		0.0014	0.0013	0.0012	0.0012	0.0012	0.0014	0.0015	0.0014	0.0016	0.0018	0.0015
n					24	24	24	24	24	24	24	24	24	24	24
mean					0.0013	0.0012	0.0011	0.0011	0.0011	0.0014	0.0014	0.0015	0.0015	0.0016	0.0015
median					0.0013	0.0013	0.0012	0.0011	0.0012	0.0014	0.0015	0.0015	0.0015	0.0016	0.0015
std. dev.					0.0001	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
min					0.0010	0.0010	0.0008	0.0008	0.0008	0.0013	0.0012	0.0013	0.0012	0.0013	0.0013
max					0.0015	0.0014	0.0013	0.0013	0.0014	0.0017	0.0016	0.0017	0.0017	0.0018	0.0017

Test Condition 1 55 °C 0.700 A														
TABLE 2.2 - FORWARD VOLTAGE MAINTENANCE RESULTS														GW PUSRA1.PM
Test Condition 1 55 °C 0.700 A														
Load board ID	Device number	Zero hour measurements		Photometric test drive current: 0.700 A Photometric test ambient temperature: 25 ± 2 °C Failures observed: none										
				Forward Voltage Maintainence (%)										
		Vf (V)		2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000
100000108DAF031C	D1		3.05	98.47	98.43	99.52	98.59	98.57	98.66	98.51	98.58	99.77	98.78	98.65
	D2		3.14	98.40	98.47	99.49	98.69	98.62	98.80	98.63	98.78	99.74	98.86	98.91
	D3		3.23	97.03	97.07	97.69	97.30	97.21	97.31	97.28	97.40	97.35	97.30	97.42
	D4		3.21	97.95	97.90	98.64	98.04	98.17	98.17	98.15	98.27	98.39	98.14	98.20
	D5		3.17	98.80	98.73	99.22	98.84	99.03	99.07	99.00	99.12	99.11	98.91	99.00
	D6		3.21	98.26	98.22	98.59	98.41	98.32	98.40	98.36	98.33	98.28	98.35	98.39
	D7		3.21	98.11	98.02	98.37	98.14	98.00	98.03	98.00	97.99	98.07	98.44	98.16
	D8		3.24	98.67	98.60	98.39	98.46	98.39	98.37	98.64	98.22	98.28	98.56	98.27
	D9		3.15	99.71	99.62	99.44	99.61	99.59	99.77	100.30	99.86	99.79	99.83	99.60
	D10		3.18	99.29	99.08	99.27	99.06	99.05	99.26	99.48	99.36	99.33	99.32	99.07
	D11		3.23	98.88	98.64	98.88	98.53	98.48	98.57	98.53	98.63	98.83	98.57	98.55
	D12		3.24	98.99	98.69	98.86	98.58	98.51	98.65	98.53	98.67	98.89	98.63	98.62
DD0000108DAE031C	D1		3.12	97.83	97.78	98.60	97.92	97.83	97.90	97.89	97.63	98.26	97.73	98.20
	D2		3.15	97.78	97.79	98.51	98.00	98.16	98.31	98.12	97.95	98.64	98.18	98.32
	D3		3.17	98.49	98.51	99.02	98.65	98.91	98.87	98.80	98.62	99.35	98.79	98.95
	D4		3.23	97.96	98.05	98.56	98.13	98.16	98.18	98.30	98.27	98.46	98.19	98.16
	D5		3.23	98.18	98.31	98.33	98.12	98.06	97.96	98.07	98.17	98.35	98.04	97.84
	D6		3.22	98.58	98.71	98.67	98.45	98.46	98.40	98.55	98.48	98.95	98.45	98.42
	D7		3.24	98.67	98.10	98.51	98.09	97.91	97.95	98.02	98.08	98.07	97.74	97.84
	D8		3.17	99.79	99.09	99.06	99.27	99.33	99.21	99.34	99.41	99.95	99.12	99.24
	D9		3.22	98.52	98.37	98.10	98.37	98.55	98.44	98.44	98.40	99.09	98.40	98.48
	D10		3.21	98.67	98.47	98.60	98.46	98.50	98.61	98.61	98.55	98.59	98.53	98.56
	D11		3.27	99.49	98.15	98.43	98.17	98.20	98.20	98.27	98.22	98.14	98.17	98.07
	D12		3.25	99.50	98.18	98.56	98.26	98.37	98.21	98.26	98.22	98.16	98.30	98.15
n mean median std. dev. min max				24	24	24	24	24	24	24	24	24	24	24
				98.6	98.4	98.7	98.4	98.4	98.5	98.5	98.5	98.7	98.5	98.5
				98.5	98.4	98.6	98.4	98.4	98.4	98.5	98.4	98.6	98.4	98.4
				0.7	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.7	0.5	0.5
				97.0	97.1	97.7	97.3	97.2	97.3	97.3	97.4	97.3	97.3	97.4
				99.8	99.6	99.5	99.6	99.6	99.8	100.3	99.9	100.0	99.8	99.6

Test Condition 2 85 °C 0.700 A														
TABLE 3.0 - LUMEN MAINTENANCE RESULTS														
Test Condition 2 85 °C 0.700 A														
Load board ID	Device number	Zero hour measurements		Photometric test drive current: 0.700 A Photometric test ambient temperature: 25 ± 2 °C Failures observed: none										
		Flux (lm)	Vf (V)	Lumen Maintenance (%)										
				2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000
B40000109337031C	D1	294.93	3.11	98.1	98.3	98.4	98.2	98.1	98.2	97.9	97.9	97.6	97.6	97.6
	D2	293.21	3.20	98.2	98.3	98.3	98.1	98.1	98.1	97.9	97.9	97.8	97.7	97.8
	D3	295.14	3.22	98.0	98.2	98.1	98.0	97.8	98.0	97.7	97.7	97.6	97.5	97.5
	D4	293.64	3.17	98.2	98.2	98.2	98.2	97.9	98.0	97.7	97.8	97.7	97.5	97.6
	D5	292.84	3.15	97.9	98.2	98.1	97.9	97.8	97.9	97.5	97.5	97.5	97.5	97.5
	D6	293.71	3.24	98.1	98.3	98.3	98.2	98.0	98.1	97.9	97.8	97.8	97.7	97.6
	D7	295.67	3.23	98.4	98.5	98.5	98.4	98.3	98.3	98.0	98.0	97.9	97.8	97.8
	D8	292.63	3.22	98.0	98.1	98.2	98.1	97.9	98.0	97.8	97.8	97.6	97.5	97.6
	D9	294.10	3.18	98.2	98.3	98.3	98.2	98.1	98.2	97.9	97.9	97.7	97.8	97.7
	D10	294.05	3.27	98.2	98.4	98.3	98.2	98.0	98.2	97.9	97.9	97.9	97.8	97.7
	D11	294.27	3.26	98.4	98.5	98.5	98.3	98.2	98.3	97.9	97.9	97.9	97.9	97.8
	D12	295.53	3.26	98.3	98.4	98.4	98.3	98.1	98.2	97.9	97.9	97.9	97.7	97.8
F10000109779031C	D1	295.40	3.12	98.6	98.6	98.5	98.3	98.1	98.2	97.9	97.9	97.8	97.6	97.6
	D2	292.80	3.20	98.6	98.6	98.3	98.2	98.0	98.2	97.9	97.9	97.9	97.7	97.6
	D3	292.45	3.23	98.6	98.5	98.3	98.3	98.1	98.1	97.9	98.0	97.9	97.8	97.8
	D4	293.97	3.23	98.5	98.5	98.4	98.2	98.0	98.2	97.9	98.0	98.0	97.7	97.7
	D5	294.21	3.22	98.5	98.4	98.3	98.0	97.9	98.0	97.7	97.7	97.6	97.5	97.5
	D6	297.21	3.20	98.7	98.6	98.4	98.3	98.2	98.4	98.2	98.2	98.0	97.9	97.9
	D7	292.98	3.23	98.6	98.6	98.4	98.3	98.1	98.3	97.9	98.0	97.9	97.8	97.8
	D8	297.12	3.23	98.7	98.6	98.4	98.3	98.0	98.2	97.9	98.0	97.9	97.9	97.8
	D9	293.04	3.16	98.5	98.5	98.2	98.1	98.0	98.2	97.8	97.9	97.8	97.7	97.6
	D10	293.51	3.27	98.6	98.6	98.5	98.3	98.2	98.3	98.0	98.0	97.9	97.7	97.8
	D11	293.25	3.28	98.5	98.5	98.2	98.2	98.0	98.2	97.8	97.9	97.1	96.9	97.0
	D12	293.52	3.28	98.6	98.6	98.3	98.2	98.1	98.3	98.1	98.1	98.0	97.8	97.8
n				24	24	24	24	24	24	24	24	24	24	24
mean				98.4	98.4	98.3	98.2	98.0	98.2	97.9	97.9	97.8	97.7	97.7
median				98.4	98.5	98.3	98.2	98.0	98.2	97.9	97.9	97.8	97.7	97.7
std. dev.				0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2
min				97.9	98.1	98.1	97.9	97.8	97.9	97.5	97.5	97.1	96.9	97.0
max				98.7	98.6	98.5	98.4	98.3	98.4	98.2	98.2	98.0	97.9	97.9

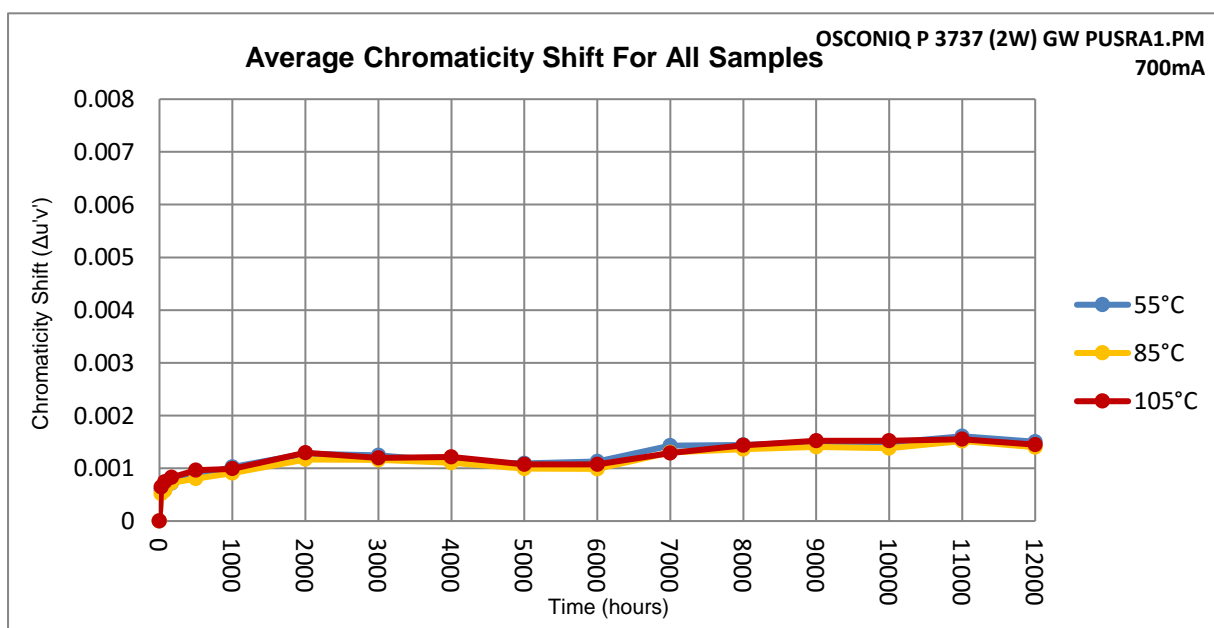
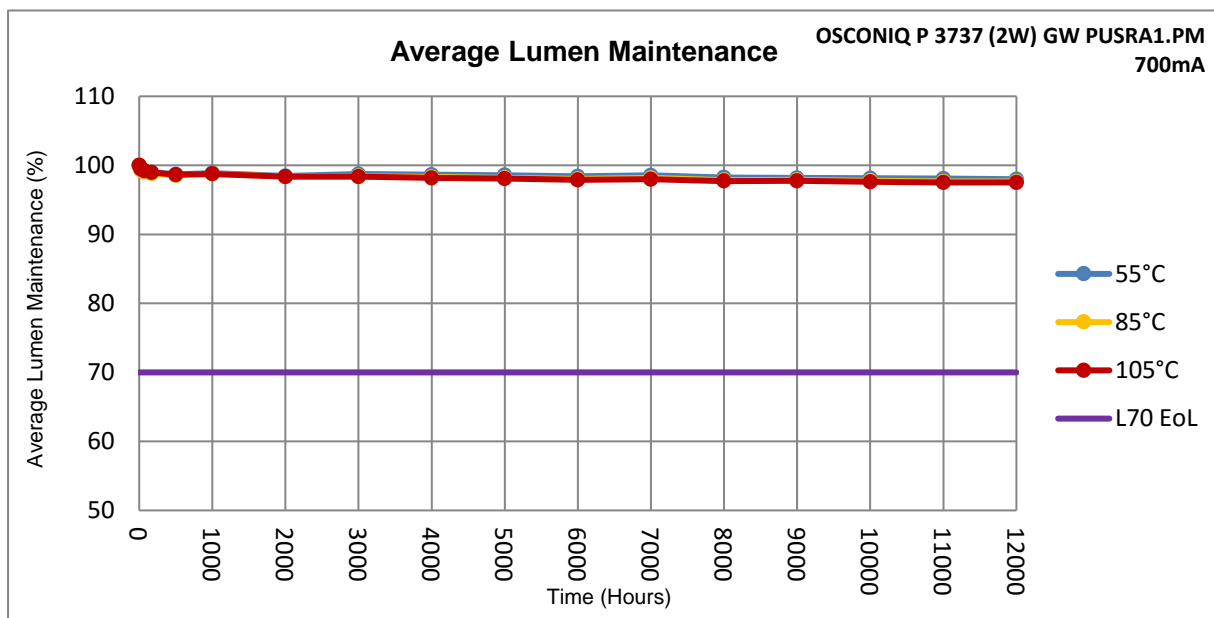
Test Condition 2 85 °C 0.700 A														
TABLE 3.2 - FORWARD VOLTAGE MAINTENANCE RESULTS														
Test Condition 2 85 °C 0.700 A														
Load board ID	Device number	Zero hour measurements		Photometric test drive current: 0.700 A Photometric test ambient temperature: 25 ± 2 °C Failures observed: none										
		Vf (V)		Forward Voltage Maintenance (%)										
				2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000
B40000109337031C	D1		3.11	98.53	98.46	99.12	98.74	98.69	98.95	99.13	99.37	99.17	98.60	98.66
	D2		3.20	98.32	98.26	99.34	98.85	98.36	99.41	98.84	99.43	99.06	98.16	98.13
	D3		3.22	98.57	98.57	99.56	99.04	98.54	100.14	98.67	99.03	98.89	98.32	98.38
	D4		3.17	98.90	98.98	99.58	99.03	98.94	99.95	99.17	99.22	99.61	99.14	99.19
	D5		3.15	99.20	99.63	99.41	99.21	99.15	100.78	99.41	99.50	101.18	99.40	99.27
	D6		3.24	99.34	99.62	99.48	98.99	99.04	100.26	99.02	99.09	100.32	98.80	98.67
	D7		3.23	99.03	98.61	99.43	98.82	98.74	99.77	98.79	98.97	98.75	98.54	98.90
	D8		3.22	99.58	99.17	99.74	99.22	99.29	100.32	99.08	99.32	99.24	99.06	99.38
	D9		3.18	99.74	99.60	100.22	99.91	99.91	99.93	99.77	99.88	99.83	99.78	99.79
	D10		3.27	98.70	98.54	99.12	99.29	98.52	98.74	98.67	98.62	98.51	98.32	98.43
	D11		3.26	98.47	98.38	100.52	98.94	98.43	98.59	98.42	99.53	98.73	98.37	98.44
	D12		3.26	99.17	98.87	101.31	98.96	99.10	99.08	99.79	100.94	99.39	98.98	99.22
F10000109779031C	D1		3.12	98.05	97.98	98.69	98.83	98.03	98.56	98.44	98.58	98.57	98.14	98.70
	D2		3.20	98.21	98.17	98.60	98.70	97.88	98.09	98.40	98.17	98.38	98.07	97.95
	D3		3.23	99.30	98.65	98.74	98.44	98.57	98.63	98.47	98.41	99.02	98.38	98.38
	D4		3.23	99.27	98.87	98.89	98.57	98.81	99.09	98.54	98.47	99.85	98.48	98.86
	D5		3.22	99.11	98.70	98.73	98.69	99.17	99.04	98.57	98.63	101.58	98.64	99.05
	D6		3.20	100.02	99.09	99.45	99.32	100.07	99.18	99.36	99.17	101.17	99.07	99.28
	D7		3.23	98.83	98.52	99.07	98.94	98.91	98.37	98.58	98.33	98.45	98.17	99.33
	D8		3.23	99.16	99.10	98.91	99.45	99.22	99.20	99.23	99.54	99.56	99.20	100.36
	D9		3.16	99.64	99.41	99.07	99.39	99.45	99.54	99.65	99.93	100.26	99.65	99.54
	D10		3.27	98.42	98.64	98.41	98.25	98.19	98.26	98.26	98.33	98.73	98.27	98.53
	D11		3.28	99.09	99.25	98.74	98.75	98.19	98.46	98.65	98.30	98.31	97.95	98.44
	D12		3.28	99.36	99.25	99.57	100.16	98.81	98.75	99.12	98.60	99.22	100.09	98.46
n				24	24	24	24	24	24	24	24	24	24	24
mean				99.0	98.8	99.3	99.0	98.8	99.2	98.9	99.1	99.4	98.7	98.9
median				99.1	98.8	99.2	99.0	98.8	99.1	98.8	99.1	99.2	98.6	98.8
std. dev.				0.5	0.5	0.7	0.4	0.5	0.7	0.5	0.7	0.9	0.6	0.6
min				98.0	98.0	98.4	98.2	97.9	98.1	98.3	98.2	98.3	98.0	98.0
max				100.0	99.6	101.3	100.2	100.1	100.8	99.8	100.9	101.6	100.1	100.4

Test Condition 3 105 °C 0.700 A														
TABLE 4.0 - LUMEN MAINTENANCE RESULTS														
Test Condition 3 105 °C 0.700 A														
Load board ID	Device number	Zero hour measurements		Photometric test drive current: 0.700 A Photometric test ambient temperature: 25 ± 2 °C Failures observed: none										
		Flux (lm)	Vf (V)	Lumen Maintenance (%)										
				2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000
32000010952E031C	D1	286.20	3.13	98.4	98.6	98.3	98.2	98.0	98.2	98.1	97.9	97.9	97.8	97.7
	D2	294.03	3.13	98.2	98.5	98.2	98.1	98.0	98.1	97.8	97.9	97.8	97.7	97.7
	D3	293.22	3.21	98.1	98.3	98.0	97.9	97.8	97.8	97.6	97.7	97.5	97.2	97.4
	D4	294.08	3.23	98.2	98.4	98.3	98.3	98.1	98.2	98.1	98.1	98.0	97.8	97.9
	D5	292.83	3.14	98.0	98.2	97.8	97.8	97.6	97.8	97.4	97.5	97.4	97.3	97.2
	D6	295.89	3.25	98.1	98.3	98.0	97.8	97.6	97.7	97.5	97.4	97.3	97.1	97.1
	D7	296.33	3.21	97.9	97.9	97.6	97.3	97.2	97.2	96.9	96.8	96.6	96.3	96.4
	D8	295.48	3.21	98.2	98.3	98.1	98.0	97.9	98.1	97.8	97.9	97.6	97.6	97.5
	D9	293.37	3.24	98.0	98.1	97.9	97.8	97.7	97.7	97.5	97.5	97.3	97.3	97.3
	D10	295.19	3.21	98.1	98.4	98.1	98.0	97.9	98.0	97.7	97.8	97.7	97.6	97.6
	D11	291.29	3.20	98.3	98.6	98.5	98.3	98.1	98.2	98.1	98.1	98.0	97.8	97.9
	D12	295.89	3.26	98.3	98.4	98.2	98.1	98.0	98.1	97.8	97.8	97.7	97.5	97.5
D0000010966C031C	D1	293.40	3.13	98.4	97.9	97.8	97.6	97.4	97.5	97.2	97.1	97.0	96.8	96.9
	D2	293.02	3.11	98.5	98.3	98.2	98.2	97.9	98.0	97.6	97.7	97.5	97.5	97.6
	D3	288.55	3.15	99.0	98.9	98.8	98.7	98.5	98.6	98.4	98.4	98.4	98.2	98.2
	D4	292.06	3.18	98.3	98.1	98.0	97.9	97.7	97.8	97.4	97.6	97.3	97.3	97.3
	D5	292.67	3.16	98.6	98.4	98.2	98.3	98.1	98.1	98.0	97.9	97.7	97.7	97.7
	D6	292.43	3.17	98.7	98.6	98.5	98.4	98.2	98.3	98.0	98.0	97.8	97.9	97.8
	D7	293.45	3.25	98.6	98.5	98.3	98.2	98.0	98.2	97.8	97.8	97.7	97.7	97.7
	D8	293.32	3.17	98.5	98.4	98.3	98.2	98.0	98.1	97.8	97.9	97.6	97.6	97.7
	D9	296.96	3.20	98.4	98.3	98.2	98.0	97.8	97.9	97.5	97.7	97.5	97.5	97.4
	D10	297.32	3.26	98.7	98.6	98.4	98.3	98.0	98.1	97.7	97.9	97.6	97.6	97.6
	D11	295.18	3.22	98.2	98.2	98.0	98.0	97.9	98.0	97.6	97.7	97.6	97.5	97.6
	D12	294.21	3.26	98.7	98.6	98.5	98.5	98.2	98.4	98.1	98.1	98.1	98.0	98.0
n mean median std. dev. min max				24	24	24	24	24	24	24	24	24	24	24
				98.4	98.4	98.2	98.1	97.9	98.0	97.7	97.8	97.6	97.5	97.5
				98.3	98.4	98.2	98.1	98.0	98.1	97.8	97.8	97.6	97.6	97.6
				0.3	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4
				97.9	97.9	97.6	97.3	97.2	97.2	96.9	96.8	96.6	96.3	96.4
				99.0	98.9	98.8	98.7	98.5	98.6	98.4	98.4	98.4	98.2	98.2

Test Condition 3					105 °C	0.700 A										
TABLE 4.1 - CHROMATICITY SHIFT RESULTS															GW PUSRA1.PM	
Test Condition 3					105 °C	0.700 A										
Load board ID	Device number	Zero hour measurements			Photometric test drive current: 0.700 A Photometric test ambient temperature: 25 ± 2 °C Failures observed: none											
		u'	v'		Chromaticity shift (Δu'v')											
					2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000	
32000010952E031C	D1	0.2510	0.5255		0.0013	0.0011	0.0011	0.0009	0.0011	0.0012	0.0014	0.0016	0.0014	0.0015	0.0014	
	D2	0.2509	0.5247		0.0013	0.0013	0.0013	0.0011	0.0010	0.0013	0.0013	0.0016	0.0014	0.0015	0.0013	
	D3	0.2511	0.5261		0.0014	0.0012	0.0011	0.0010	0.0010	0.0012	0.0014	0.0015	0.0015	0.0015	0.0015	
	D4	0.2508	0.5258		0.0013	0.0012	0.0011	0.0010	0.0010	0.0012	0.0014	0.0016	0.0014	0.0015	0.0013	
	D5	0.2520	0.5268		0.0014	0.0015	0.0012	0.0011	0.0010	0.0013	0.0014	0.0017	0.0016	0.0017	0.0014	
	D6	0.2518	0.5259		0.0012	0.0013	0.0012	0.0012	0.0009	0.0012	0.0014	0.0015	0.0014	0.0016	0.0014	
	D7	0.2505	0.5261		0.0014	0.0012	0.0010	0.0010	0.0010	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	
	D8	0.2514	0.5268		0.0013	0.0011	0.0011	0.0010	0.0010	0.0013	0.0014	0.0015	0.0014	0.0015	0.0013	
	D9	0.2517	0.5254		0.0014	0.0011	0.0011	0.0010	0.0009	0.0012	0.0015	0.0015	0.0015	0.0016	0.0015	
	D10	0.2514	0.5260		0.0011	0.0011	0.0010	0.0007	0.0009	0.0011	0.0014	0.0014	0.0013	0.0014	0.0011	
	D11	0.2516	0.5262		0.0013	0.0012	0.0011	0.0009	0.0009	0.0012	0.0014	0.0014	0.0014	0.0014	0.0012	
	D12	0.2513	0.5264		0.0014	0.0012	0.0013	0.0012	0.0011	0.0011	0.0016	0.0016	0.0015	0.0015	0.0013	
D0000010966C031C	D1	0.2508	0.5263		0.0013	0.0012	0.0013	0.0010	0.0011	0.0013	0.0013	0.0014	0.0015	0.0015	0.0014	
	D2	0.2514	0.5255		0.0014	0.0012	0.0012	0.0012	0.0012	0.0014	0.0014	0.0015	0.0017	0.0015	0.0016	
	D3	0.2516	0.5254		0.0012	0.0012	0.0014	0.0011	0.0012	0.0013	0.0016	0.0014	0.0016	0.0016	0.0015	
	D4	0.2508	0.5258		0.0012	0.0011	0.0012	0.0010	0.0011	0.0014	0.0013	0.0015	0.0014	0.0016	0.0015	
	D5	0.2510	0.5262		0.0014	0.0013	0.0013	0.0013	0.0012	0.0015	0.0016	0.0016	0.0017	0.0018	0.0018	
	D6	0.2521	0.5260		0.0013	0.0010	0.0013	0.0011	0.0011	0.0012	0.0015	0.0016	0.0017	0.0015	0.0015	
	D7	0.2525	0.5259		0.0012	0.0012	0.0013	0.0011	0.0012	0.0013	0.0014	0.0015	0.0016	0.0015	0.0015	
	D8	0.2520	0.5262		0.0014	0.0013	0.0014	0.0012	0.0012	0.0015	0.0016	0.0017	0.0017	0.0017	0.0018	
	D9	0.2508	0.5263		0.0012	0.0012	0.0014	0.0012	0.0012	0.0014	0.0015	0.0016	0.0016	0.0017	0.0017	
	D10	0.2503	0.5256		0.0013	0.0012	0.0014	0.0012	0.0011	0.0013	0.0015	0.0015	0.0017	0.0017	0.0016	
	D11	0.2517	0.5266		0.0012	0.0011	0.0013	0.0011	0.0012	0.0014	0.0015	0.0016	0.0016	0.0015	0.0015	
	D12	0.2511	0.5260		0.0012	0.0011	0.0012	0.0010	0.0010	0.0012	0.0014	0.0014	0.0016	0.0015	0.0014	
n					24	24	24	24	24	24	24	24	24	24	24	
mean					0.0013	0.0012	0.0012	0.0011	0.0011	0.0013	0.0014	0.0015	0.0015	0.0016	0.0015	
median					0.0013	0.0012	0.0012	0.0011	0.0011	0.0013	0.0014	0.0015	0.0015	0.0015	0.0015	
std. dev.					0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	
min					0.0011	0.0010	0.0010	0.0007	0.0009	0.0011	0.0013	0.0014	0.0013	0.0014	0.0011	
max					0.0014	0.0015	0.0014	0.0013	0.0012	0.0015	0.0016	0.0017	0.0017	0.0018	0.0018	

Test Condition 3				105 °C	0.700 A									
TABLE 4.2 - FORWARD VOLTAGE MAINTENANCE RESULTS														GW PUSRA1.PM
Test Condition 3				105 °C	0.700 A									
Load board ID	Device number	Zero hour measurements		Photometric test drive current: 0.700 A Photometric test ambient temperature: 25 ± 2 °C Failures observed: none										
		Vf (V)		Forward Voltage Maintainece (%)										
				2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000
32000010952E031C	D1		3.13	98.86	98.91	99.56	98.66	98.38	98.76	99.88	98.36	98.80	98.91	98.62
	D2		3.13	99.22	99.52	100.14	99.14	99.17	99.46	99.74	99.63	100.65	100.70	99.55
	D3		3.21	98.64	98.59	99.59	99.04	98.78	99.11	99.42	99.91	99.61	99.54	98.89
	D4		3.23	98.71	98.68	99.66	99.89	98.99	99.52	99.51	99.87	99.50	98.78	99.44
	D5		3.14	100.05	99.56	100.24	100.45	100.18	100.15	100.73	99.91	100.95	100.37	100.44
	D6		3.25	99.61	99.17	99.82	99.83	100.77	99.58	100.83	99.73	99.91	99.92	99.61
	D7		3.21	99.15	100.25	99.60	99.46	100.17	99.66	100.26	100.00	99.35	99.28	99.26
	D8		3.21	99.93	101.07	99.44	99.68	99.85	100.02	100.53	100.08	99.73	99.87	99.52
	D9		3.24	99.85	99.29	98.94	99.32	99.70	99.68	100.15	98.90	98.98	99.24	99.04
	D10		3.21	101.47	99.20	99.91	99.69	100.12	100.22	100.16	99.39	99.63	99.72	99.74
	D11		3.20	101.08	99.13	99.98	99.45	99.61	99.74	99.48	100.48	99.26	99.40	99.36
	D12		3.26	99.03	98.81	99.26	98.96	99.24	99.31	99.29	100.32	99.10	99.19	99.10
D0000010966C031C	D1		3.13	98.65	98.57	100.95	100.64	99.86	100.62	100.47	98.97	99.45	99.22	100.31
	D2		3.11	99.02	99.20	102.48	100.22	100.68	101.07	101.21	99.76	99.93	99.76	100.78
	D3		3.15	99.34	99.25	101.51	99.82	100.04	99.89	100.24	99.94	100.41	99.34	99.38
	D4		3.18	99.37	99.05	99.94	99.49	99.66	100.84	100.12	99.57	100.21	99.06	99.57
	D5		3.16	99.34	99.42	100.17	100.02	99.82	101.73	100.47	100.10	99.94	99.77	100.24
	D6		3.17	99.25	99.64	100.33	100.10	100.83	100.66	100.23	100.13	100.04	99.93	99.82
	D7		3.25	98.55	99.98	100.91	99.92	100.35	99.26	99.16	99.29	98.62	98.79	98.52
	D8		3.17	99.82	101.22	101.23	101.02	100.65	100.79	101.47	100.76	100.54	100.47	100.33
	D9		3.20	99.44	100.11	99.25	101.44	100.34	100.46	101.93	100.31	100.37	99.99	100.07
	D10		3.26	98.86	99.57	99.21	101.27	99.72	99.89	100.39	99.95	100.69	101.06	102.25
	D11		3.22	99.08	99.24	100.04	100.41	99.57	100.00	99.76	99.78	101.48	101.23	102.25
	D12		3.26	98.63	99.25	99.81	99.79	99.90	99.73	100.41	99.74	100.15	99.62	99.45
n				24	24	24	24	24	24	24	24	24	24	24
mean				99.4	99.4	100.1	99.9	99.9	100.0	100.2	99.8	99.9	99.7	99.8
median				99.2	99.3	99.9	99.8	99.9	99.9	100.2	99.9	99.9	99.7	99.6
std. dev.				0.7	0.7	0.8	0.7	0.6	0.7	0.7	0.5	0.7	0.7	0.9
min				98.6	98.6	98.9	98.7	98.4	98.8	99.2	98.4	98.6	98.8	98.5
max				101.5	101.2	102.5	101.4	100.8	101.7	101.9	100.8	101.5	101.2	102.3

5.0 Charts:



6.0 Additional Information

6.1 Auxilliary Equipment

Lifetest thermal chamber:	Orb Optronix Thermal Platform - resistive heating, liquid cooling, no forced air flow
Lifetest current source:	Orb Optronix 40-100364-101
Photometric test current source:	Keithley 2425
Photometric test thermal control:	Orb Optronix TEC-100
Spectrometer:	Orb Optronix SP-75
Integrating Sphere:	Gamma Scientific 20"
Photometric reference standards:	LabSphere SCL-50

6.2 Additional Test Information

6.3 Photographs



Fig. 1 OSRM019-01 load board example.

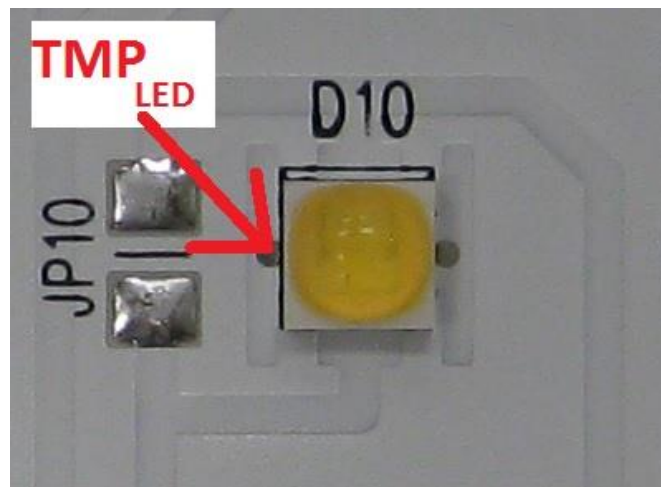


Fig. 2 OSCONIQ P 3737 (2W) type LED model GW PUSRA1.PM and temperature measurement point.

6.4 Dimensional Drawing*

* all dimension in millimeters

This report alone may not be used to claim product certification, approval or endorsement by NVLAP, NIST, or any agency of the Federal Government.

- END OF REPORT -

Appendix A: Energy Star® LM-80 Application

ENERGY STAR® LM-80 Cover Page

Administrative Information

Tested subcomponent series	OSCONIQ® P 3737 (2W version)
Tested subcomponent model number	GW PUSRA1.PM
Report issue date	17 th Dec 2018
Report revision date (if applicable)	Not Applicable
Testing start date	20 th Jun 2017
Testing completion date	16 th Nov 2018
DUT sampling method	According to ANSI/IES LM-80 Test Method

DUT Identification

DUT manufacturer's name	OSRAM Opto Semiconductors (Malaysia) Sdn Bhd
DUT identification	GW PUSRA1.PM
Description of DUT	LED Package

DUT Characteristics

Total input power (W)	2.24
Average current density per LED die (mA/mm ²)	350.00
Average power density per LED Package (W/mm ²)	0.16
Representative CRI (Ra) of the tested sample set	70
Minimum die edge to die edge spacing	Not Applicable

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

For Information Only!

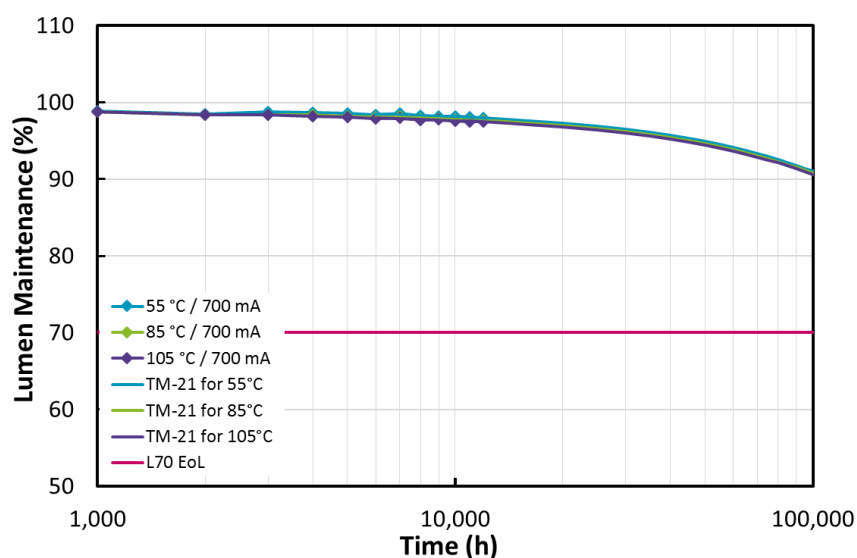
1. General Information

Description of LED light source tested	OSCONIQ® P 3737 (2W version) GW PUSRA1.PM
Sample size per temperature	24
LED drive current used in the test	700 mA
Current per die	700 mA
Test duration	12,000 hours
Test duration used for projection	6,000 hours to 12,000 hours

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	8.368E-07	8.268E-07	8.323E-07
B	9.897E-01	9.860E-01	9.846E-01
Reported L70	> 72,000 hours	> 72,000 hours	> 72,000 hours

3. Graphic chart



Appendix C: Additional Models Covered By Testing

The 28 September 2017 *ENERGY STAR® Requirements for the Use of LM-80 Data* defines conditions for which a LM-80 report is applied to cover models that have not been directly tested.

The test results in this report applies to the following list of models:

- OSCONIQ® P 3737 (2W version) GW PUSRA1.PM with CCT 2700 K – 6500 K

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-80-15.

END OF DOCUMENT

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