

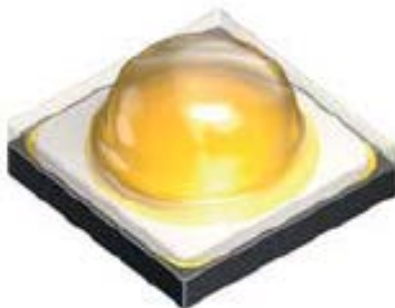
Light is OSRAM

**OSRAM**  
Opto Semiconductors

# OSLON Square<sup>®</sup> White (CCT 4000 K – 6500 K)

IES LM-80-08 Test Report

Test Documentation No.: 150446W1 (OSRM004-140) – 30<sup>th</sup> October 2015



## LM-80 9000 Hour Interval Test Report

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

#### CSA Group Report OSRM004-140

March 10, 2015

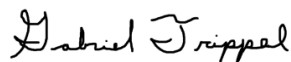
Manufacturer: **OSRAM Opto Semiconductors GmbH**  
Models tested: **GW CSSRM1.PC**

Test conditions: TC1: 55 °C, 0.700 A  
TC2: 85 °C, 0.700 A  
TC3: 105 °C, 0.700 A

Prepared for:  
OSRAM Opto Semiconductors GmbH  
Leibnizstrasse 4  
93055 REGENSBURG  
GERMANY

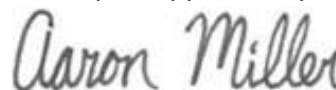
Testing performed by:  
CSA Group, Orb Optronix  
1003 7th Ave.  
Kirkland, WA 98033  
425-605-8500  
[www.OrbOptronix.com](http://www.OrbOptronix.com)

Test report prepared by:



Project Engineer,  
Test and Measurement Services

Test report approved by:



Laboratory Manager,  
Test and Measurement Services

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

Part number: GW CSSRM1.PC					
Life test conditions				Summary of results	
Test condition	Drive current (A)	Case temperature (°C)	Elapsed life test time (hrs)	Average lumen maintenance (%)	Maximum chromaticity shift ( $\Delta u'v'$ )
1	0.700	55	9000	99.3	0.0012
2	0.700	85	9000	99.1	0.0021
3	0.700	105	9000	98.6	0.0046
LM80-08 Reporting requirements					
1. Number of samples tested:			24 per test condition		
2. Description of LED light sources			LED Package <sup>1</sup>		
3. Description of auxiliary equipment			see section 6.1 below		
4. Operating cycle			LED's are driven at constant current for life test and with a 25 msec pulse 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 LM80-08. 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 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 2.0%		
13. Chromaticity shift reported over the measurement time			see data tables for individual test conditions		
14. Test start date			24 January 2014		
15. ANSI target and calculated CCT values			see data tables		

Notes:

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

## 2.0 TEST CONDITION 1: 55 °C 0.700 A

TABLE 2.1 - LUMEN MAINTENANCE RESULTS

GW CSSRM1.PC

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)	V <sub>F</sub> (V)	Lumen Maintenance (%)											
				168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	
2300000COA1A031C	1	254.29	3.28	99.6	100.0	99.0	99.5	99.6	99.5	99.4	99.3	99.4	99.2	98.9	
	2	258.59	3.20	99.3	99.7	98.9	99.2	99.4	99.4	99.3	99.4	99.4	99.5	99.2	
	3	255.89	3.20	99.3	99.7	98.8	99.1	99.3	99.4	99.3	99.3	99.2	99.2	98.9	
	4	258.78	3.27	99.2	99.9	98.8	99.2	99.4	99.4	99.3	99.3	99.2	99.2	98.9	
	5	258.33	3.33	99.1	99.7	98.7	99.1	99.2	99.3	99.1	99.3	99.4	99.2	99.0	
	6	254.31	3.29	99.5	100.1	99.1	99.4	99.5	99.5	99.4	99.4	99.5	99.4	99.1	
	7	257.93	3.31	99.5	100.0	99.0	99.3	99.5	99.5	99.4	99.2	99.4	99.2	98.9	
	8	257.22	3.31	99.5	100.0	99.0	99.3	99.6	99.6	99.4	99.6	99.6	99.6	99.3	
	9	251.20	3.30	99.5	100.1	99.0	99.4	99.5	99.6	99.5	99.5	99.5	99.5	99.2	
	10	253.82	3.29	99.6	100.1	99.1	99.4	99.5	99.6	99.5	99.5	99.5	99.5	99.2	
	11	254.85	3.27	99.2	99.9	99.1	99.4	99.6	99.7	99.5	99.6	99.6	99.6	99.3	
	12	257.95	3.19	99.2	99.7	98.8	99.3	99.4	99.4	99.2	99.5	99.4	99.4	99.1	
E800000C072F031C	1	248.71	3.32	99.4	99.7	99.2	98.9	99.5	99.4	99.2	99.3	99.5	99.2	99.1	
	2	251.38	3.21	99.8	100.1	99.3	99.4	99.7	99.9	99.4	99.7	100.0	99.7	99.6	
	3	252.64	3.21	99.1	99.5	98.9	99.0	99.4	99.4	99.0	99.2	99.4	99.3	99.0	
	4	253.35	3.31	99.3	99.6	98.9	98.9	99.5	99.5	99.2	99.3	99.4	99.3	99.1	
	5	252.16	3.33	99.5	99.8	99.2	99.1	99.6	99.6	99.2	99.5	99.8	99.5	99.4	
	6	250.34	3.31	99.8	100.0	99.1	99.3	99.7	99.7	99.3	99.4	99.6	99.5	99.3	
	7	249.70	3.37	99.3	99.8	99.1	99.1	99.5	99.5	99.1	99.3	99.6	99.3	99.3	
	8	249.53	3.32	99.1	100.0	99.4	99.4	99.9	99.8	99.5	99.8	100.0	99.9	99.8	
	9	249.66	3.30	99.6	99.9	99.3	99.2	99.7	99.6	99.3	99.6	99.8	99.5	99.4	
	10	253.52	3.33	99.5	99.8	99.0	98.9	99.3	99.4	99.1	99.2	99.5	99.3	99.1	
	11	253.49	3.30	99.6	99.9	99.5	99.4	99.9	99.9	99.5	99.9	100.0	99.8	99.7	
	12	250.73	3.21	100.0	100.4	99.7	99.7	100.2	100.3	99.8	100.1	100.4	100.3	100.1	
n				24	24	24	24	24	24	24	24	24	24	24	
mean				99.4	99.9	99.1	99.2	99.5	99.6	99.3	99.5	99.6	99.5	99.3	
median				99.5	99.9	99.1	99.3	99.5	99.5	99.3	99.4	99.5	99.4	99.2	
std. dev.				0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	
min				99.1	99.5	98.7	98.9	99.2	99.3	99.0	99.2	99.2	99.2	98.9	
max				100.0	100.4	99.7	99.7	100.2	100.3	99.8	100.1	100.4	100.3	100.1	

**TABLE 2.2 - CHROMATICITY SHIFT RESULTS**

**GW CSSRM1.PC**

**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 ( $\Delta u'v'$ )										
					168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000
2300000C0A1A031C	1	0.2164	0.4794		0.0003	0.0004	0.0001	0.0002	0.0005	0.0004	0.0003	0.0003	0.0003	0.0006	0.0008
	2	0.2154	0.4766		0.0006	0.0006	0.0002	0.0003	0.0006	0.0005	0.0001	0.0002	0.0001	0.0005	0.0009
	3	0.2151	0.4735		0.0004	0.0004	0.0001	0.0003	0.0006	0.0003	0.0002	0.0003	0.0002	0.0006	0.0010
	4	0.2153	0.4811		0.0004	0.0003	0.0001	0.0001	0.0005	0.0004	0.0003	0.0002	0.0004	0.0006	0.0009
	5	0.2156	0.4769		0.0006	0.0007	0.0002	0.0001	0.0005	0.0005	0.0002	0.0002	0.0001	0.0004	0.0007
	6	0.2162	0.4788		0.0008	0.0008	0.0004	0.0005	0.0008	0.0008	0.0002	0.0003	0.0002	0.0004	0.0005
	7	0.2141	0.4782		0.0005	0.0005	0.0002	0.0005	0.0005	0.0006	0.0001	0.0001	0.0002	0.0005	0.0007
	8	0.2152	0.4760		0.0006	0.0005	0.0004	0.0003	0.0005	0.0005	0.0001	0.0003	0.0000	0.0004	0.0007
	9	0.2163	0.4725		0.0005	0.0004	0.0003	0.0002	0.0007	0.0004	0.0002	0.0002	0.0001	0.0002	0.0008
	10	0.2163	0.4778		0.0004	0.0003	0.0002	0.0002	0.0004	0.0003	0.0003	0.0003	0.0002	0.0007	0.0010
	11	0.2161	0.4770		0.0007	0.0005	0.0001	0.0002	0.0005	0.0004	0.0003	0.0003	0.0004	0.0005	0.0008
	12	0.2157	0.4761		0.0007	0.0005	0.0001	0.0003	0.0004	0.0003	0.0001	0.0002	0.0001	0.0005	0.0008
E800000C072F031C	1	0.2167	0.4696		0.0003	0.0009	0.0002	0.0002	0.0006	0.0003	0.0004	0.0003	0.0005	0.0007	0.0009
	2	0.2181	0.4757		0.0005	0.0009	0.0002	0.0002	0.0008	0.0005	0.0002	0.0001	0.0002	0.0004	0.0008
	3	0.2175	0.4768		0.0005	0.0008	0.0001	0.0004	0.0006	0.0004	0.0002	0.0002	0.0002	0.0006	0.0007
	4	0.2154	0.4737		0.0001	0.0007	0.0001	0.0002	0.0003	0.0001	0.0004	0.0005	0.0007	0.0008	0.0012
	5	0.2174	0.4742		0.0005	0.0010	0.0002	0.0002	0.0006	0.0004	0.0001	0.0004	0.0004	0.0006	0.0009
	6	0.2157	0.4723		0.0003	0.0007	0.0002	0.0001	0.0005	0.0003	0.0002	0.0002	0.0003	0.0006	0.0007
	7	0.2168	0.4702		0.0004	0.0007	0.0003	0.0002	0.0007	0.0003	0.0003	0.0004	0.0005	0.0006	0.0008
	8	0.2158	0.4698		0.0002	0.0007	0.0000	0.0001	0.0005	0.0003	0.0004	0.0004	0.0007	0.0008	0.0012
	9	0.2160	0.4704		0.0003	0.0008	0.0001	0.0003	0.0007	0.0005	0.0004	0.0003	0.0003	0.0005	0.0008
	10	0.2151	0.4725		0.0005	0.0012	0.0001	0.0004	0.0008	0.0006	0.0001	0.0001	0.0001	0.0003	0.0005
	11	0.2157	0.4744		0.0006	0.0009	0.0002	0.0003	0.0007	0.0005	0.0002	0.0002	0.0001	0.0005	0.0007
	12	0.2165	0.4768		0.0003	0.0007	0.0002	0.0002	0.0005	0.0003	0.0002	0.0003	0.0003	0.0006	0.0008
n					24	24	24	24	24	24	24	24	24	24	24
mean					0.0005	0.0007	0.0002	0.0002	0.0006	0.0004	0.0002	0.0003	0.0003	0.0005	0.0008
median					0.0005	0.0007	0.0002	0.0002	0.0006	0.0004	0.0002	0.0003	0.0002	0.0006	0.0008
std. dev.					0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0001	0.0002
min					0.0001	0.0003	0.0000	0.0001	0.0003	0.0001	0.0001	0.0001	0.0000	0.0002	0.0005
max					0.0008	0.0012	0.0004	0.0005	0.0008	0.0008	0.0004	0.0005	0.0007	0.0008	0.0012

**TABLE 2.3 - ANSI Target and Calculated CCT Results**

**GW CSSRM1.PC**

**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										
		ANSI Target* CCT (K)	Calculated CCT (K)	Calculated CCT										
				168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000
2300000C0A1A031C	1	5028±283	4921	4932	4921	4928	4931	4939	4933	4919	4912	4912	4892	4892
	2	5028±283	5070	5089	5081	5080	5089	5089	5088	5069	5079	5062	5052	5032
	3	5028±284	5201	5219	5209	5209	5220	5220	5211	5199	5199	5199	5170	5161
	4	5028±285	4922	4921	4910	4917	4922	4930	4917	4910	4917	4902	4893	4883
	5	5028±286	5049	5061	5049	5051	5051	5059	5060	5039	5050	5039	5021	5012
	6	5028±287	4952	4979	4970	4973	4980	4980	4979	4963	4968	4958	4938	4940
	7	5028±288	5083	5097	5090	5093	5103	5093	5098	5080	5079	5073	5057	5052
	8	5028±289	5101	5130	5120	5122	5119	5120	5129	5111	5112	5100	5088	5073
	9	5028±290	5170	5190	5180	5190	5190	5200	5190	5180	5180	5170	5160	5150
	10	5028±291	4981	4999	4990	4999	4992	4990	4999	4982	4991	4978	4952	4951
	11	5028±292	5020	5040	5020	5021	5022	5031	5029	5009	5009	5000	4992	4989
	12	5028±293	5071	5091	5072	5080	5081	5081	5082	5071	5071	5062	5049	5048
E800000C072F031C	1	5028±294	5270	5279	5289	5259	5280	5301	5280	5261	5261	5239	5230	5230
	2	5028±295	4960	4970	4970	4970	4970	4980	4960	4951	4950	4940	4931	4920
	3	5028±296	4949	4969	4969	4951	4970	4970	4960	4949	4940	4931	4919	4919
	4	5028±297	5179	5180	5190	5179	5190	5189	5171	5169	5160	5140	5139	5129
	5	5028±298	5050	5070	5070	5060	5060	5070	5060	5040	5040	5030	5020	5010
	6	5028±299	5220	5230	5230	5230	5220	5240	5220	5210	5210	5200	5181	5189
	7	5028±300	5241	5260	5260	5250	5249	5259	5239	5241	5229	5221	5210	5200
	8	5028±301	5310	5311	5320	5310	5310	5321	5310	5300	5290	5270	5260	5250
	9	5028±302	5280	5290	5300	5280	5290	5311	5290	5270	5260	5260	5250	5240
	10	5028±303	5249	5260	5280	5249	5260	5270	5260	5250	5249	5240	5220	5220
	11	5028±304	5131	5151	5159	5150	5150	5151	5141	5140	5129	5130	5101	5101
	12	5028±304	5008	5009	5011	5002	5008	5010	5009	4998	4991	4989	4978	4970
n mean median std. dev. min max				24	24	24	24	24	24	24	24	24	24	24
				5114	5111	5106	5111	5117	5109	5096	5095	5085	5071	5065
				5094	5086	5086	5096	5091	5093	5076	5079	5067	5055	5050
				122	128	122	122	126	122	123	120	120	120	119
				4921	4910	4917	4922	4930	4917	4910	4912	4902	4892	4883
				5311	5320	5310	5310	5321	5310	5300	5290	5270	5260	5250

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

**TABLE 2.4 - FORWARD VOLTAGE RESULTS** **GW CSSRM1.PC**  
**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										
			V <sub>F</sub> (V)	Forward Voltage (normalized to 0 hour)										
				168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000
2300000C0A1A031C	1		3.28	1.00	0.99	1.00	1.00	1.00	0.99	1.00	1.01	0.99	0.99	0.99
	2		3.20	0.99	0.99	0.99	1.00	0.99	0.99	1.00	1.00	1.00	1.00	1.00
	3		3.20	0.99	1.00	1.00	1.00	0.99	0.99	1.00	1.00	0.99	1.00	0.99
	4		3.27	0.99	0.98	0.99	0.99	0.99	0.99	0.98	1.00	0.99	0.99	0.99
	5		3.33	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
	6		3.29	0.99	0.99	0.99	0.99	0.99	0.99	0.99	1.00	1.00	1.00	1.00
	7		3.31	1.00	1.00	1.00	1.01	0.99	1.00	1.00	1.01	1.00	0.99	1.00
	8		3.31	0.99	0.99	0.99	1.00	0.99	0.99	0.99	1.00	1.00	0.99	1.00
	9		3.30	0.99	1.00	1.00	1.00	0.99	0.99	1.01	1.00	0.99	0.99	1.00
	10		3.29	0.99	0.99	0.99	0.99	0.99	0.99	1.00	1.01	1.00	1.00	1.00
	11		3.27	0.99	0.98	0.99	0.99	0.99	0.99	0.99	1.00	0.99	1.00	0.99
	12		3.19	0.99	0.99	1.00	1.00	0.99	0.99	1.00	1.00	0.99	1.00	0.99
E800000C072F031C	1		3.32	1.00	0.99	1.00	1.00	1.00	0.99	1.00	0.99	0.99	1.00	0.99
	2		3.21	0.99	0.99	1.00	1.00	0.99	0.99	1.00	0.99	1.00	1.00	1.00
	3		3.21	0.99	1.00	1.00	1.01	1.00	0.99	1.00	0.99	0.99	1.00	0.99
	4		3.31	0.99	0.98	0.99	0.99	0.99	0.99	0.99	0.97	0.99	0.99	0.99
	5		3.33	0.99	0.98	0.99	0.99	0.99	0.99	0.99	1.00	0.99	0.99	0.99
	6		3.31	0.99	0.98	0.99	0.99	0.99	0.99	0.99	1.01	0.99	0.99	0.99
	7		3.37	0.99	1.00	1.00	1.01	0.99	0.99	1.00	0.98	1.00	1.00	0.99
	8		3.32	0.99	0.99	0.99	1.00	0.99	0.99	0.99	0.99	1.00	0.99	0.99
	9		3.30	0.99	1.00	1.00	1.00	0.99	0.99	1.00	0.99	0.99	0.99	1.00
	10		3.33	0.99	0.99	0.98	0.99	0.99	0.99	0.99	0.98	1.00	0.99	0.99
	11		3.30	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.98	1.00	1.00	0.99
	12		3.21	0.99	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	1.00
n				24	24	24	24	24	24	24	24	24	24	
mean				0.99	0.99	0.99	1.00	0.99	0.99	1.00	0.99	0.99	1.00	0.99
median				0.99	0.99	0.99	1.00	0.99	0.99	1.00	1.00	0.99	0.99	0.99
std. dev.				0.003	0.005	0.005	0.007	0.002	0.002	0.006	0.010	0.003	0.002	0.001
min				0.99	0.98	0.98	0.99	0.99	0.99	0.98	0.97	0.99	0.99	0.99
max				1.00	1.00	1.00	1.01	1.00	1.00	1.01	1.01	1.00	1.00	1.00

### 3.0 TEST CONDITION 2: 85 °C 0.700 A

TABLE 3.1 - LUMEN MAINTENANCE RESULTS

GW CSSRM1.PC

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)	V <sub>F</sub> (V)	Lumen Maintenance (%)											
				168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	
8900000C1082031C	1	252.44	3.28	99.5	99.7	99.2	98.7	99.1	99.2	99.0	98.8	98.9	98.6	99.0	
	2	254.76	3.24	99.2	99.3	98.8	98.4	98.9	99.2	98.9	98.9	99.1	98.9	99.1	
	3	252.88	3.24	99.4	99.7	99.0	98.7	98.9	99.1	98.8	98.8	99.0	98.7	99.0	
	4	252.50	3.27	99.5	99.8	99.2	99.0	99.3	99.5	99.3	99.3	99.4	99.1	99.4	
	5	251.66	3.37	99.0	99.2	98.6	98.1	98.5	98.7	98.4	98.5	98.7	98.4	98.7	
	6	252.66	3.32	99.5	99.7	99.2	98.9	99.2	99.3	99.0	99.1	99.3	99.0	99.2	
	7	252.96	3.34	99.4	99.6	99.0	98.7	99.1	99.3	99.1	99.1	99.3	99.0	99.3	
	8	252.98	3.35	99.5	99.9	99.1	98.8	99.1	99.3	99.1	99.1	99.3	99.1	99.5	
	9	254.76	3.32	99.2	99.6	98.8	98.5	98.8	99.0	98.8	98.9	99.0	98.8	99.1	
	10	256.21	3.28	99.4	99.6	99.1	98.7	99.0	99.2	98.9	98.9	99.0	98.6	99.1	
	11	252.04	3.26	99.6	99.9	99.1	98.7	99.2	99.3	98.7	99.1	99.2	98.8	99.0	
	12	255.00	3.23	99.1	99.5	98.9	98.6	99.0	99.2	98.7	98.9	99.1	98.9	99.1	
C300000C1354031C	1	251.83	3.28	99.8	100.0	99.2	98.8	99.3	99.2	99.2	99.2	99.3	99.1	99.2	
	2	252.68	3.21	99.5	99.8	99.1	98.6	99.2	99.2	99.1	99.2	99.3	99.2	99.3	
	3	249.05	3.21	99.5	99.4	98.8	98.5	98.9	98.5	98.2	98.6	98.8	97.8	98.5	
	4	253.93	3.30	99.4	99.6	98.8	98.6	99.0	99.0	99.0	99.0	99.0	98.8	99.0	
	5	252.68	3.34	99.7	100.0	99.2	98.8	99.1	99.2	99.1	99.3	99.3	98.9	99.3	
	6	248.07	3.28	99.4	99.3	98.7	98.3	98.3	98.2	97.9	98.3	98.4	97.3	98.1	
	7	250.15	3.32	99.4	99.5	99.1	98.7	99.2	99.3	99.3	99.4	99.4	99.2	99.4	
	8	252.39	3.32	99.6	99.7	99.0	98.8	99.1	99.1	99.0	99.2	99.2	99.1	99.4	
	9	254.72	3.30	98.7	99.0	98.4	98.1	98.4	98.5	98.5	98.7	98.9	98.8	98.9	
	10	251.34	3.28	99.8	99.9	99.3	99.0	99.3	99.3	99.2	99.3	99.4	99.3	99.4	
	11	255.94	3.27	99.4	99.7	98.9	98.6	99.0	98.9	99.0	98.7	98.9	98.1	98.5	
	12	254.11	3.21	99.5	99.8	99.0	98.7	98.9	98.9	98.8	99.0	99.0	98.9	99.1	
n				24	24	24	24	24	24	24	24	24	24	24	
mean				99.4	99.6	99.0	98.6	99.0	99.1	98.9	99.0	99.1	98.8	99.1	
median				99.4	99.7	99.0	98.7	99.1	99.2	99.0	99.0	99.1	98.9	99.1	
std. dev.				0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.5	0.3	
min				98.7	99.0	98.4	98.1	98.3	98.2	97.9	98.3	98.4	97.3	98.1	
max				99.8	100.0	99.3	99.0	99.3	99.5	99.3	99.4	99.4	99.3	99.5	



**TABLE 3.2 - CHROMATICITY SHIFT RESULTS**

**GW CSSRM1.PC**

**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										
		u'	v'		Chromaticity shift (Δu'v')										
					168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000
8900000C1082031C	1	0.2166	0.4771		0.0005	0.0008	0.0006	0.0003	0.0005	0.0002	0.0006	0.0010	0.0006	0.0011	0.0017
	2	0.2159	0.4757		0.0002	0.0008	0.0005	0.0003	0.0005	0.0004	0.0003	0.0007	0.0007	0.0012	0.0016
	3	0.2168	0.4753		0.0003	0.0008	0.0006	0.0003	0.0006	0.0003	0.0003	0.0007	0.0007	0.0011	0.0017
	4	0.2158	0.4797		0.0000	0.0005	0.0002	0.0002	0.0003	0.0001	0.0006	0.0013	0.0010	0.0015	0.0021
	5	0.2151	0.4703		0.0001	0.0005	0.0002	0.0002	0.0004	0.0001	0.0007	0.0010	0.0008	0.0013	0.0019
	6	0.2153	0.4731		0.0002	0.0007	0.0003	0.0004	0.0005	0.0002	0.0006	0.0010	0.0008	0.0014	0.0021
	7	0.2155	0.4759		0.0001	0.0007	0.0003	0.0003	0.0002	0.0002	0.0007	0.0013	0.0012	0.0016	0.0020
	8	0.2167	0.4732		0.0004	0.0007	0.0004	0.0002	0.0007	0.0003	0.0004	0.0008	0.0006	0.0011	0.0019
	9	0.2164	0.4754		0.0005	0.0008	0.0005	0.0003	0.0004	0.0004	0.0004	0.0010	0.0009	0.0014	0.0018
	10	0.2155	0.4773		0.0004	0.0009	0.0005	0.0004	0.0006	0.0004	0.0003	0.0008	0.0007	0.0011	0.0017
	11	0.2172	0.4736		0.0004	0.0008	0.0005	0.0003	0.0005	0.0002	0.0006	0.0010	0.0006	0.0014	0.0017
	12	0.2168	0.4756		0.0004	0.0008	0.0006	0.0003	0.0006	0.0002	0.0004	0.0010	0.0007	0.0014	0.0019
C300000C1354031C	1	0.2156	0.4744		0.0002	0.0008	0.0005	0.0003	0.0004	0.0004	0.0005	0.0005	0.0005	0.0010	0.0012
	2	0.2155	0.4755		0.0003	0.0009	0.0005	0.0004	0.0004	0.0005	0.0005	0.0003	0.0004	0.0010	0.0012
	3	0.2172	0.4702		0.0004	0.0012	0.0004	0.0003	0.0006	0.0006	0.0004	0.0002	0.0004	0.0009	0.0011
	4	0.2164	0.4767		0.0001	0.0007	0.0003	0.0004	0.0002	0.0001	0.0008	0.0006	0.0009	0.0016	0.0018
	5	0.2174	0.4765		0.0002	0.0008	0.0003	0.0004	0.0007	0.0006	0.0005	0.0003	0.0003	0.0008	0.0011
	6	0.2187	0.4705		0.0005	0.0012	0.0005	0.0003	0.0008	0.0007	0.0005	0.0002	0.0005	0.0010	0.0013
	7	0.2172	0.4730		0.0000	0.0006	0.0002	0.0003	0.0002	0.0001	0.0009	0.0010	0.0010	0.0016	0.0020
	8	0.2162	0.4739		0.0004	0.0008	0.0006	0.0003	0.0007	0.0006	0.0001	0.0003	0.0002	0.0007	0.0009
	9	0.2157	0.4782		0.0002	0.0008	0.0003	0.0003	0.0004	0.0004	0.0005	0.0004	0.0005	0.0012	0.0012
	10	0.2171	0.4765		0.0001	0.0009	0.0004	0.0003	0.0003	0.0004	0.0005	0.0006	0.0006	0.0014	0.0015
	11	0.2159	0.4779		0.0003	0.0008	0.0003	0.0002	0.0004	0.0002	0.0007	0.0006	0.0008	0.0012	0.0014
	12	0.2157	0.4769		0.0004	0.0009	0.0004	0.0003	0.0006	0.0003	0.0004	0.0004	0.0006	0.0010	0.0012
n mean median std. dev. min max					24	24	24	24	24	24	24	24	24	24	24
					0.0003	0.0008	0.0004	0.0003	0.0005	0.0003	0.0005	0.0007	0.0007	0.0012	0.0016
					0.0003	0.0008	0.0004	0.0003	0.0005	0.0003	0.0005	0.0007	0.0007	0.0012	0.0017
					0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0002	0.0003	0.0002	0.0003	0.0004
					0.0000	0.0005	0.0002	0.0002	0.0002	0.0001	0.0001	0.0002	0.0002	0.0007	0.0009
					0.0005	0.0012	0.0006	0.0004	0.0008	0.0007	0.0009	0.0013	0.0012	0.0021	

**TABLE 3.3 - ANSI Target and Calculated CCT Results**

**GW CSSRM1.PC**

**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										
		ANSI Target* CCT (K)	Calculated CCT (K)	Calculated CCT										
				168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000
8900000C1082031C	1	5028±283	4990	5001	5010	5022	5011	5010	5000	4982	4971	4979	4951	4938
	2	5028±283	5072	5080	5091	5100	5090	5091	5090	5069	5062	5052	5032	5021
	3	5028±284	5040	5040	5060	5070	5059	5059	5050	5040	5030	5019	4999	4979
	4	5028±285	4941	4940	4949	4949	4949	4948	4940	4929	4912	4909	4882	4878
	5	5028±286	5330	5330	5340	5340	5340	5340	5330	5310	5290	5300	5270	5259
	6	5028±287	5201	5211	5230	5229	5229	5221	5211	5200	5189	5189	5151	5132
	7	5028±288	5092	5091	5110	5111	5100	5108	5091	5072	5061	5051	5032	5028
	8	5028±289	5120	5140	5150	5150	5140	5150	5130	5111	5100	5101	5080	5061
	9	5028±290	5060	5070	5080	5081	5071	5071	5069	5050	5032	5030	5002	4999
	10	5028±291	5041	5060	5069	5069	5070	5061	5059	5048	5031	5029	5008	4998
	11	5028±292	5080	5100	5110	5110	5100	5110	5090	5090	5069	5070	5030	5030
	12	5028±293	5030	5040	5050	5061	5050	5051	5040	5030	5011	5011	4979	4968
C300000C1354031C	1	5028±294	5141	5160	5180	5172	5160	5161	5170	5148	5151	5130	5119	5118
	2	5028±295	5108	5122	5140	5139	5130	5121	5129	5100	5102	5092	5070	5080
	3	5028±296	5209	5230	5261	5239	5241	5240	5229	5210	5220	5199	5170	5181
	4	5028±297	5010	5012	5022	5012	5012	5002	5009	4990	4992	4979	4951	4949
	5	5028±298	4961	4971	4990	4980	4980	4989	4990	4961	4961	4961	4939	4931
	6	5028±299	5108	5142	5149	5141	5129	5143	5140	5111	5120	5102	5069	5070
	7	5028±300	5100	5100	5120	5110	5100	5110	5110	5081	5070	5070	5040	5030
	8	5028±301	5129	5141	5160	5160	5141	5150	5151	5131	5140	5120	5099	5101
	9	5028±302	4998	4998	5018	5009	5001	5000	4999	4979	4990	4972	4951	4961
	10	5028±303	4981	4990	5011	5002	5000	4999	5000	4982	4981	4970	4940	4941
	11	5028±304	5000	5011	5020	5020	5011	5009	5011	4989	4991	4979	4959	4967
	12	5028±304	5048	5061	5080	5070	5061	5060	5061	5050	5058	5032	5013	5012
n mean median std. dev. min max				24	24	24	24	24	24	24	24	24	24	24
				5085	5100	5098	5091	5092	5087	5069	5064	5056	5031	5026
				5075	5086	5091	5080	5081	5080	5060	5059	5042	5021	5017
				90	92	90	91	91	89	89	89	89	88	88
				4940	4949	4949	4949	4948	4940	4929	4912	4909	4882	4878
				5330	5340	5340	5340	5340	5330	5310	5290	5300	5270	5259

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

**TABLE 3.4 - FORWARD VOLTAGE RESULTS**

**GW CSSRM1.PC**

**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											
			V <sub>F</sub> (V)	Forward Voltage (normalized to 0 hour)											
				168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	
8900000C1082031C	1		3.28	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
	2		3.24	0.99	0.99	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	1.00	
	3		3.24	0.99	1.00	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	1.00	
	4		3.27	0.99	0.98	0.99	0.99	0.99	0.99	0.99	1.00	0.99	1.00	0.99	
	5		3.37	0.99	0.99	1.00	1.00	1.00	1.00	0.99	0.98	0.99	0.99	1.00	
	6		3.32	0.99	0.99	1.00	1.01	1.00	1.00	0.99	0.99	1.00	1.00	1.00	
	7		3.34	0.99	1.00	1.00	1.00	0.99	0.99	1.00	0.99	0.99	1.00	1.00	
	8		3.35	0.99	0.99	0.99	0.99	1.00	0.99	0.99	0.99	0.99	1.00	1.00	
	9		3.32	0.99	1.00	1.00	1.01	1.00	1.00	1.01	0.99	1.00	1.00	1.00	
	10		3.28	0.99	0.99	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
	11		3.26	0.99	0.99	0.99	1.00	1.00	1.01	1.00	1.00	1.00	1.00	1.00	
	12		3.23	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	1.01	
C300000C1354031C	1		3.28	1.00	1.00	1.00	1.01	1.00	0.99	1.00	1.00	1.00	1.00	1.00	
	2		3.21	0.99	0.99	1.00	1.00	1.00	1.00	1.00	1.01	1.00	1.00	1.00	
	3		3.21	0.99	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.00	1.00	1.00	
	4		3.30	0.99	0.98	0.99	0.99	0.99	0.99	0.99	0.98	0.99	1.00	0.99	
	5		3.34	0.99	0.99	0.99	1.00	0.99	0.99	0.99	1.00	0.99	0.99	0.99	
	6		3.28	0.99	0.99	1.00	1.00	1.00	1.00	0.99	1.01	1.00	1.00	1.00	
	7		3.32	1.00	1.00	1.00	1.01	0.99	1.00	1.01	1.00	1.00	1.00	1.00	
	8		3.32	0.99	0.99	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
	9		3.30	0.99	1.00	1.00	1.00	1.00	1.00	1.01	1.00	1.00	1.00	1.00	
	10		3.28	0.99	0.99	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
	11		3.27	0.99	0.99	0.99	1.00	1.00	1.01	1.00	1.00	1.00	1.00	1.00	
	12		3.21	0.99	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
n				24	24	24	24	24	24	24	24	24	24	24	
mean				0.99	0.99	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	1.00	
median				0.99	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
std. dev.				0.003	0.005	0.005	0.005	0.003	0.004	0.006	0.009	0.003	0.003	0.003	
min				0.99	0.98	0.98	0.99	0.99	0.99	0.99	0.98	0.99	0.99	0.99	
max				1.00	1.00	1.00	1.01	1.00	1.01	1.01	1.01	1.00	1.00	1.01	

#### 4.0 TEST CONDITION 3: 105 °C 0.700 A

TABLE 4.1 - LUMEN MAINTENANCE RESULTS

GW CSSRM1.PC

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)	V <sub>F</sub> (V)	Lumen Maintenance (%)											
				168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	
4D00000C0377031C	1	249.69	3.28	99.7	99.9	98.9	98.4	98.7	98.8	98.8	98.9	99.1	98.6	98.2	
	2	253.28	3.21	99.7	100.0	99.2	98.6	99.1	99.3	99.2	99.2	99.5	99.0	99.1	
	3	250.25	3.21	99.5	99.8	98.9	98.3	98.7	98.9	98.9	99.0	99.2	98.8	98.6	
	4	256.37	3.30	99.4	99.7	98.9	98.3	98.8	98.9	98.9	98.9	99.1	98.5	98.6	
	5	253.08	3.36	99.1	99.3	98.5	98.0	98.5	98.8	98.7	98.7	98.9	98.4	98.5	
	6	253.76	3.29	99.6	99.9	98.8	98.2	98.4	98.7	98.7	98.8	98.8	98.5	98.5	
	7	254.14	3.34	99.5	99.8	98.6	98.4	99.0	99.1	99.2	99.2	99.4	98.9	98.8	
	8	254.11	3.32	99.7	99.6	98.8	98.2	98.8	99.0	98.9	99.0	99.2	98.6	98.8	
	9	253.80	3.30	99.6	99.8	98.7	98.2	98.7	98.9	98.8	98.9	99.1	98.4	98.5	
	10	254.57	3.31	99.4	99.6	98.6	98.2	98.8	98.8	98.9	98.8	99.1	98.4	98.4	
	11	253.09	3.27	99.5	99.7	98.5	98.1	98.5	98.9	98.8	99.0	99.1	98.6	98.7	
	12	254.33	3.21	99.3	99.6	98.7	98.1	98.5	98.9	98.8	98.7	98.9	98.5	98.5	
6400000C05C8031C	1	249.41	3.28	99.5	99.7	99.0	98.3	99.0	99.0	99.0	99.0	99.3	98.8	98.6	
	2	251.12	3.20	99.1	99.2	98.1	97.5	97.8	98.2	98.0	98.1	98.6	97.2	97.5	
	3	252.07	3.22	99.2	99.4	98.7	98.2	98.7	98.8	98.8	98.8	99.1	98.7	98.5	
	4	251.24	3.27	99.6	99.8	98.9	98.5	99.2	99.1	99.1	99.1	99.4	98.9	98.7	
	5	249.96	3.34	99.6	99.7	99.0	98.6	99.0	99.2	99.0	99.2	99.4	99.1	98.9	
	6	247.24	3.28	99.7	99.7	98.9	98.4	98.8	98.8	98.6	98.8	98.9	98.6	98.3	
	7	253.68	3.32	99.9	99.9	99.1	98.6	99.2	99.3	99.0	99.1	99.2	98.7	98.6	
	8	250.00	3.33	99.8	99.8	99.1	98.8	99.1	99.3	99.2	99.2	99.5	99.2	99.0	
	9	253.15	3.29	99.4	99.3	98.2	98.3	98.5	98.7	98.2	98.6	98.8	98.0	98.2	
	10	252.20	3.28	99.7	99.7	98.9	98.4	99.0	98.9	98.7	99.0	99.1	98.6	98.4	
	11	252.50	3.27	99.4	99.5	98.8	98.4	98.9	99.2	98.9	99.0	99.3	99.0	98.9	
	12	252.87	3.21	99.3	99.5	98.7	98.2	98.5	98.9	98.6	99.0	99.3	98.7	98.7	
n				24	24	24	24	24	24	24	24	24	24	24	
mean				99.5	99.7	98.8	98.3	98.8	98.9	98.8	98.9	99.1	98.6	98.6	
median				99.5	99.7	98.8	98.3	98.8	98.9	98.8	99.0	99.1	98.6	98.6	
std. dev.				0.2	0.2	0.3	0.3	0.3	0.2	0.3	0.2	0.2	0.4	0.3	
min				99.1	99.2	98.1	97.5	97.8	98.2	98.0	98.1	98.6	97.2	97.5	
max				99.9	100.0	99.2	98.8	99.2	99.3	99.2	99.2	99.5	99.2	99.1	

**TABLE 4.2 - CHROMATICITY SHIFT RESULTS**

**GW CSSRM1.PC**

**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')										
					168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000
4D00000C0377031C	1	0.2161	0.4709		0.0002	0.0004	0.0004	0.0008	0.0004	0.0008	0.0017	0.0023	0.0029	0.0030	0.0039
	2	0.2150	0.4757		0.0001	0.0004	0.0004	0.0007	0.0004	0.0007	0.0015	0.0020	0.0027	0.0028	0.0036
	3	0.2158	0.4733		0.0003	0.0006	0.0002	0.0006	0.0003	0.0006	0.0016	0.0023	0.0028	0.0029	0.0037
	4	0.2152	0.4797		0.0001	0.0003	0.0005	0.0009	0.0008	0.0011	0.0018	0.0024	0.0029	0.0031	0.0040
	5	0.2169	0.4745		0.0002	0.0004	0.0004	0.0007	0.0003	0.0007	0.0018	0.0021	0.0028	0.0030	0.0039
	6	0.2169	0.4781		0.0002	0.0006	0.0003	0.0006	0.0004	0.0006	0.0017	0.0022	0.0026	0.0028	0.0035
	7	0.2155	0.4760		0.0002	0.0002	0.0004	0.0009	0.0007	0.0007	0.0015	0.0023	0.0029	0.0031	0.0041
	8	0.2161	0.4775		0.0003	0.0006	0.0004	0.0006	0.0005	0.0007	0.0016	0.0022	0.0030	0.0027	0.0036
	9	0.2152	0.4764		0.0002	0.0004	0.0003	0.0009	0.0005	0.0008	0.0018	0.0025	0.0031	0.0036	0.0044
	10	0.2155	0.4757		0.0005	0.0007	0.0003	0.0006	0.0004	0.0007	0.0014	0.0022	0.0028	0.0031	0.0041
	11	0.2160	0.4744		0.0004	0.0003	0.0002	0.0008	0.0005	0.0008	0.0017	0.0024	0.0029	0.0032	0.0040
	12	0.2169	0.4777		0.0004	0.0006	0.0003	0.0004	0.0001	0.0005	0.0014	0.0018	0.0027	0.0029	0.0038
6400000C05C8031C	1	0.2171	0.4733		0.0007	0.0012	0.0006	0.0003	0.0002	0.0006	0.0011	0.0015	0.0019	0.0028	0.0036
	2	0.2176	0.4763		0.0008	0.0013	0.0005	0.0004	0.0002	0.0008	0.0014	0.0017	0.0020	0.0026	0.0036
	3	0.2166	0.4742		0.0007	0.0011	0.0003	0.0003	0.0004	0.0007	0.0013	0.0019	0.0023	0.0030	0.0038
	4	0.2166	0.4753		0.0004	0.0007	0.0003	0.0003	0.0005	0.0008	0.0015	0.0017	0.0022	0.0032	0.0039
	5	0.2168	0.4735		0.0005	0.0010	0.0006	0.0005	0.0003	0.0007	0.0011	0.0017	0.0016	0.0024	0.0032
	6	0.2182	0.4712		0.0007	0.0011	0.0004	0.0003	0.0002	0.0005	0.0015	0.0023	0.0025	0.0036	0.0046
	7	0.2174	0.4799		0.0003	0.0011	0.0004	0.0002	0.0003	0.0007	0.0011	0.0016	0.0019	0.0027	0.0037
	8	0.2170	0.4730		0.0004	0.0010	0.0005	0.0004	0.0001	0.0008	0.0012	0.0014	0.0015	0.0024	0.0029
	9	0.2161	0.4766		0.0005	0.0011	0.0004	0.0003	0.0003	0.0006	0.0014	0.0022	0.0028	0.0036	0.0045
	10	0.2163	0.4753		0.0004	0.0010	0.0003	0.0003	0.0005	0.0007	0.0013	0.0014	0.0018	0.0027	0.0034
	11	0.2166	0.4757		0.0007	0.0012	0.0006	0.0004	0.0001	0.0007	0.0011	0.0013	0.0017	0.0025	0.0032
	12	0.2157	0.4751		0.0008	0.0012	0.0007	0.0006	0.0002	0.0002	0.0011	0.0017	0.0018	0.0027	0.0035
n					24	24	24	24	24	24	24	24	24	24	
mean					0.0004	0.0008	0.0004	0.0005	0.0004	0.0007	0.0014	0.0020	0.0024	0.0029	0.0038
median					0.0004	0.0007	0.0004	0.0005	0.0004	0.0007	0.0014	0.0021	0.0026	0.0029	0.0038
std. dev.					0.0002	0.0004	0.0001	0.0002	0.0002	0.0002	0.0002	0.0004	0.0005	0.0004	0.0004
min					0.0001	0.0002	0.0002	0.0002	0.0001	0.0002	0.0011	0.0013	0.0015	0.0024	0.0029
max					0.0008	0.0013	0.0007	0.0009	0.0008	0.0011	0.0018	0.0025	0.0031	0.0036	0.0046

**TABLE 4.3 - ANSI Target and Calculated CCT Results**

**GW CSSRM1.PC**

**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										
		ANSI Target* CCT (K)	Calculated CCT (K)	Calculated CCT										
				168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000
4D00000C0377031C	1	5028±283	5250	5260	5270	5260	5250	5260	5240	5210	5189	5161	5141	5109
	2	5028±283	5122	5128	5131	5141	5120	5129	5113	5091	5071	5052	5039	5010
	3	5028±284	5170	5189	5179	5171	5161	5169	5150	5131	5102	5079	5068	5038
	4	5028±285	4972	4979	4982	4971	4971	4957	4957	4947	4918	4908	4881	4856
	5	5028±286	5070	5080	5080	5079	5071	5070	5061	5030	5012	4990	4970	4949
	6	5028±287	4938	4949	4950	4949	4940	4939	4928	4912	4887	4880	4850	4839
	7	5028±288	5089	5092	5100	5092	5089	5082	5079	5067	5037	5010	4992	4960
	8	5028±289	5001	5019	5028	5013	5010	5002	5001	4978	4958	4930	4918	4902
	9	5028±290	5089	5100	5099	5102	5088	5091	5080	5058	5029	5001	4973	4951
	10	5028±291	5098	5118	5120	5110	5099	5091	5078	5068	5033	5018	4988	4960
	11	5028±292	5120	5140	5130	5130	5129	5121	5110	5081	5060	5041	5011	4992
	12	5028±293	4951	4971	4971	4970	4969	4958	4949	4930	4913	4889	4862	4839
6400000C05C8031C	1	5028±294	5100	5120	5130	5130	5120	5110	5080	5080	5060	5041	5000	4971
	2	5028±295	4960	4990	5000	4990	4980	4961	4942	4940	4919	4911	4880	4852
	3	5028±296	5091	5121	5130	5119	5111	5091	5071	5069	5041	5022	4990	4962
	4	5028±297	5051	5070	5071	5071	5070	5049	5040	5029	5011	4991	4952	4928
	5	5028±298	5110	5130	5150	5140	5140	5120	5099	5099	5071	5061	5029	5001
	6	5028±299	5109	5128	5141	5141	5131	5099	5089	5080	5040	5030	4980	4940
	7	5028±300	4851	4860	4879	4871	4861	4848	4837	4838	4812	4803	4761	4739
	8	5028±301	5110	5130	5150	5140	5140	5120	5100	5091	5081	5080	5030	5011
	9	5028±302	5030	5049	5061	5051	5050	5030	5012	5008	4980	4951	4909	4887
	10	5028±303	5070	5089	5100	5089	5090	5062	5050	5038	5031	5028	4981	4961
	11	5028±304	5039	5060	5070	5069	5060	5041	5019	5011	5008	4990	4960	4937
	12	5028±304	5110	5140	5149	5150	5140	5120	5111	5090	5078	5060	5017	5001
n mean median std. dev. min max				24	24	24	24	24	24	24	24	24	24	24
				5080	5086	5081	5075	5063	5050	5037	5014	4997	4966	4941
				5096	5100	5097	5089	5086	5075	5062	5032	5014	4981	4956
				85	85	85	84	87	84	81	81	79	81	78
				4860	4879	4871	4861	4848	4837	4838	4812	4803	4761	4739
				5260	5270	5260	5250	5260	5240	5210	5189	5161	5141	5109

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

**TABLE 4.4 - FORWARD VOLTAGE RESULTS**

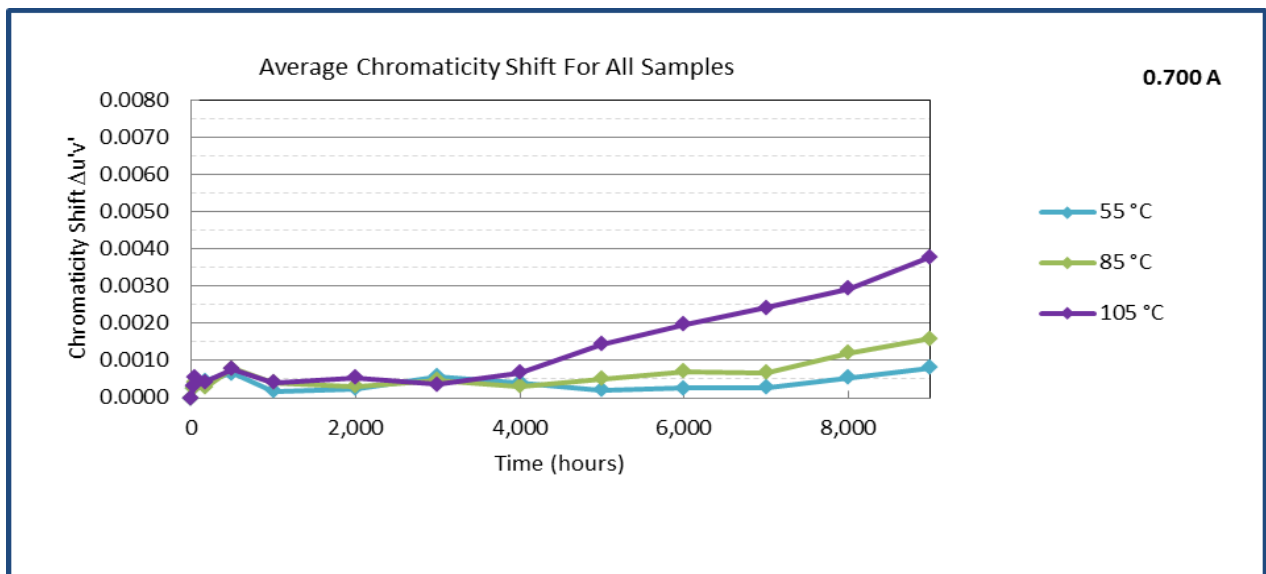
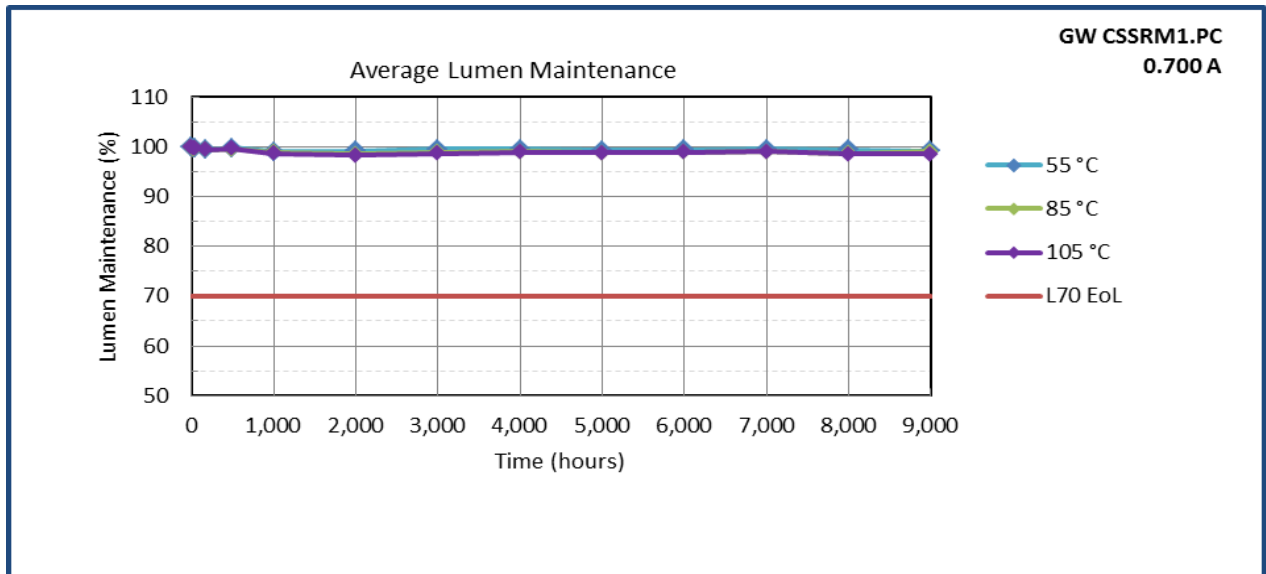
**GW CSSRM1.PC**

**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											
			V <sub>F</sub> (V)	Forward Voltage (normalized to 0 hour)											
				168	500	1000	2000	3000	4000	5000	6000	7000	8000	9000	
4D00000C0377031C	1		3.28	1.00	1.00	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.01	1.03	
	2		3.21	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.01	
	3		3.21	0.99	1.00	1.00	1.01	1.00	1.00	1.01	1.00	1.00	1.02	1.00	
	4		3.30	0.99	0.99	0.99	0.99	1.00	1.00	1.00	0.99	1.00	1.02	1.00	
	5		3.36	0.99	0.99	1.00	1.00	0.99	0.99	0.99	0.99	1.00	1.00	1.00	
	6		3.29	0.99	0.99	1.00	1.01	1.00	1.00	1.00	1.01	1.00	1.00	1.01	
	7		3.34	1.00	1.00	1.02	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.06	
	8		3.32	0.99	1.00	1.01	1.00	1.00	1.01	1.00	1.00	1.00	1.00	1.05	
	9		3.30	0.99	1.00	1.00	1.00	1.00	1.00	1.01	1.00	1.00	1.00	1.00	
	10		3.31	0.99	0.99	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.01	
	11		3.27	0.99	0.99	0.99	1.01	1.00	1.00	1.00	1.01	1.01	1.00	1.01	
	12		3.21	0.99	0.99	1.00	1.01	1.00	1.00	1.01	1.01	1.00	1.00	1.01	
6400000C05C8031C	1		3.28	1.00	1.00	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
	2		3.20	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
	3		3.22	1.00	1.00	1.00	1.01	1.00	1.00	1.01	1.00	1.00	1.00	1.00	
	4		3.27	0.99	0.99	0.99	1.00	1.00	1.00	0.99	0.99	1.00	1.00	1.00	
	5		3.34	0.99	0.99	1.01	1.01	0.99	1.00	0.99	0.99	1.00	1.00	1.00	
	6		3.28	1.00	0.99	1.01	1.01	1.00	1.00	1.00	1.02	1.00	1.01	1.01	
	7		3.32	1.00	1.00	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
	8		3.33	1.00	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
	9		3.29	0.99	1.01	1.00	1.01	1.00	1.01	1.01	1.00	1.00	1.00	1.00	
	10		3.28	0.99	0.99	0.99	1.01	1.00	1.01	1.00	1.00	1.00	1.00	1.00	
	11		3.27	0.99	0.99	0.99	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.02	
	12		3.21	0.99	1.00	1.00	1.01	1.00	1.01	1.01	1.00	1.01	1.01	1.02	
n				24	24	24	24	24	24	24	24	24	24	24	
mean				0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.01	
median				0.99	0.99	1.00	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
std. dev.				0.003	0.005	0.009	0.005	0.004	0.005	0.006	0.006	0.003	0.006	0.016	
min				0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	1.00	1.00	1.00	
max				1.00	1.01	1.02	1.01	1.01	1.01	1.01	1.02	1.01	1.02	1.06	



## 5.0 Charts:





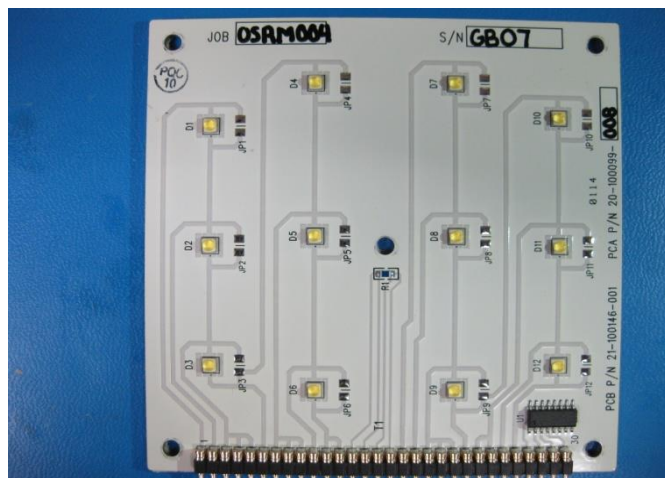
## 6.0 Additional Information

### 6.1 Auxiliary Equipment

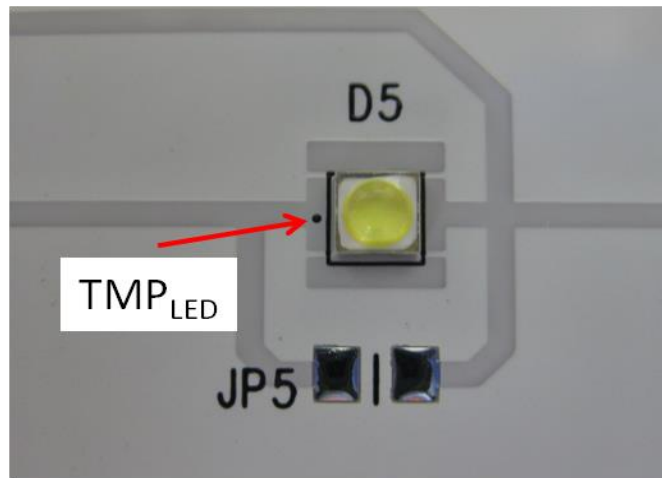
Lifetest thermal chamber:	Orb Optronix Thermal Platform - resistive heating, liquid cooling, no forced air flow
Lifetest current source:	Orb Optronix LM80-12D-150-01
Photometric test current source:	Keithley 2425
Photometric test thermal control:	Orb Optronix TEC-100
Spectrometer:	Orb Optronix SP-75
Integrating Sphere:	SphereOptics 20"
Photometric reference standards:	LabSphere SCL-50

### 6.2 Additional Test Information

### 6.3 Photographs



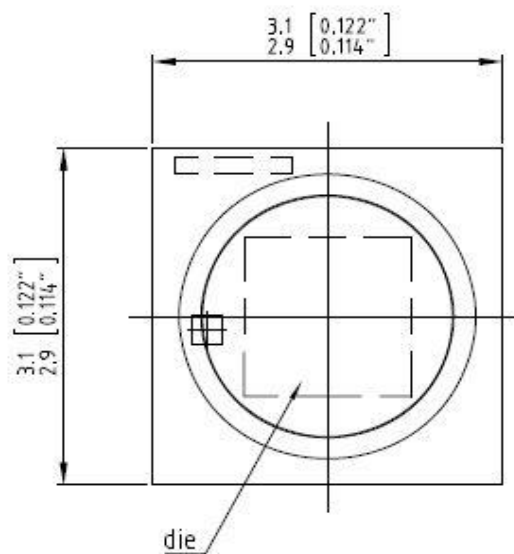
**Fig. 1** Load board with 12 samples. Absorption correction measurements are made for each load board measurement.



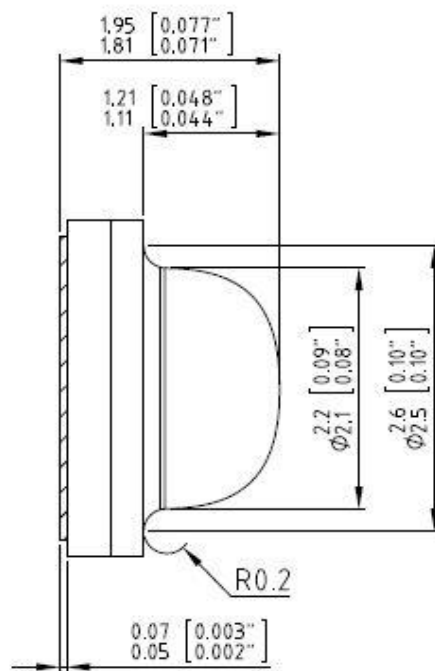
**Fig. 2** OSRAM OSOLON GW CSSRM1.PC LED and temperature measurement point.

#### 6.4 Isometric Drawing\*

\* all dimension in millimeters



Top View



Side View

This report 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: Lumen Maintenance Projection (IES TM-21-11)

For Information Only!

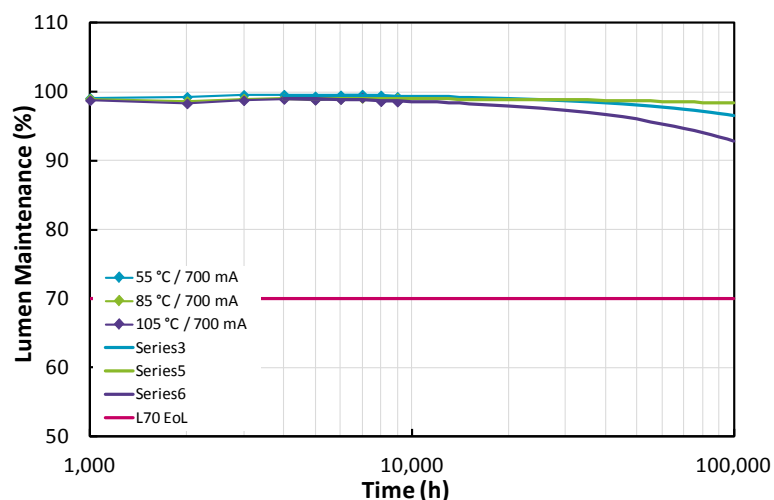
## 1. General Information

Description of LED light source tested	OSLON Square GW CSSRM1.PC
Sample size per temperature	24
LED drive current used in the test	700 mA
Test duration	9,000 hours
Test duration used for projection	4,000 hours to 9,000 hours

## 2. Projection Data

	I	II	III
Case temperature (solder point)	$T_S = 55\text{ °C}$	$T_S = 85\text{ °C}$	$T_S = 105\text{ °C}$
$\alpha$	3.124E-07	7.057E-08	6.699E-07
B	9.965E-01	9.902E-01	9.926E-01
Reported L70	> 54,000 hours	> 54,000 hours	> 54,000 hours

## 3. Graphic chart



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## 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:

- |                              |                          |
|------------------------------|--------------------------|
| • OSOLON Square GW CSSRM1.CC | with CCT 4000 K – 6500 K |
| • OSOLON Square GW CSSRM1.EC | with CCT 4000 K – 5000 K |
| • OSOLON Square GW CSSRM1.PC | with CCT 4000 K – 6500 K |
| • OSOLON Square GW CSSRM2.PM | with CCT 4000 K – 6500 K |

END OF DOCUMENT

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