

RELIABILITY DATASHEET

Intematix ChromaLit 360 (Candle, Ellipse, Dome, Contour)

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Introduction

Remote phosphor is a lighting system architecture where a separate phosphor component is powered by blue LEDs. Light fixtures and lamps use this architecture and the increased light extraction it brings to reduce LED component count and costs. Lighting uniformity and consistency are also improved and supply chains are simplified. LED light fixtures and lamps must also be designed to maintain specified luminous output over many tens of thousands of hours. This document presents results of long term lumen maintenance testing of remote phosphor LED lighting modules. By implementing lumen maintenance projection using standard methodology, this datasheet may be used as a guideline in the design of high performance remote phosphor light fixtures (luminaires) and lamps. While this report discusses reliability testing completed to date, new tests and additional results are expected in the future including additional products, temperatures, power levels and certified compliance to standards. Please consult an Intematix sales representative for more information about reliability testing and qualification of remote phosphor.

Note about LM-80: This document presents a summary of results of long-term operating life tests, some of which have been performed in accordance with IESNA LM-80 standard test methodology for LED components and modules. However, this document does not constitute a certified LM-80 report and should not be used for submission of products to qualification organizations. For more information about Intematix's certified remote phosphor LM-80 testing program and reliability qualification support, please contact Intematix sales and applications staff.

Definitions and Diagrams

Remote phosphor component:

An element or component that is mechanically separable from the LED package and contains phosphor materials. The element is used in conjunction with LED packages and arrays to construct LED lamps, LED light engines, and LED luminaires.

Conversion Efficacy (CE):

Ratio of luminous flux emitted to the radiant flux incident on the interior of the remote phosphor. CE is expressed as lumens per radiant watt ($\text{lm}/\text{W}_{\text{rad}}$) at a specified CCT and CRI and incident wavelength.

Maximum Surface Temperature (T_{max}):

Highest temperature measured on the surface of the remote phosphor component.

Irradiance:

Density of radiant flux of blue light incident on the interior of the remote phosphor expressed as watts per square centimeter (W/cm^2). Irradiance may be calculated as the sum of all the radiant watts emitted by the LEDs divided by the area of the interior of the remote phosphor.






LM-80:

Standardized methodology and procedure for testing the lumen and chromaticity maintenance of LED components, arrays and modules under operating life conditions. It is defined and published by the Illuminating Engineering Society of North America (IESNA).

TM-21:

Standardized computational methodology for projecting lifetime of LED components, arrays and modules using an exponential curve fit to LM-80 lumen maintenance data sets. It is defined and published by the IESNA.

Remote Phosphor Product Families

ChromaLit Platform	Product Examples	Performance Highlights	Applications
PC		<ul style="list-style-type: none"> Uniform, glare free lighting Rugged and impact resistant 	<ul style="list-style-type: none"> Down lights Light panels Tasklighting
XT/XTS		<ul style="list-style-type: none"> High lumen output Tempered glass option Off state neutral color 	<ul style="list-style-type: none"> Down lights Outdoor High bay / Industrial
360		<ul style="list-style-type: none"> 3D light emission surface Omni-directional lighting Energy Star pattern capable 	<ul style="list-style-type: none"> Retrofit lamps Decorative lamps Pendants, Sconces
360XT		<ul style="list-style-type: none"> High lumen output Omni-directional 300° beam Enables incandescent look 	<ul style="list-style-type: none"> Retrofit lamps Down lights Reflector lamps
Linear		<ul style="list-style-type: none"> High lumen output Unlimited length possibilities Uniform, glare free lighting 	<ul style="list-style-type: none"> Area lighting Troffers Under cabinet Mid and High bay

For more details about ChromaLit remote phosphor products consult Intematix technical specifications.

Intematix ChromaLit Qualification Reliability Testing

This document summarizes the reliability qualification of Intematix ChromaLit (PC) products. Please refer to product datasheet as well as application notes for recommended and maximum operating conditions.

Item	Stress Test	Stress Conditions	Stress Duration	Failure Criteria	Result
1	High Temp. Operating Life (HTOL)	$T_{max}=120^{\circ}\text{C}$	1000hrs		PASS
2	Wet High Temp. Operating Life (WHTOL)	$60^{\circ}\text{C}/90\%\text{RH}$	500hrs	>5% variation in conversion efficacy >0.007 variation in CIE chromaticity	PASS
3	Non-Operating Thermal Shock (TMSK)	-40°C to 125°C	1000 cycles		PASS

Lumen Maintenance Testing

Testing Process: Remote phosphor modules consist of remote phosphor components fastened to blue LED arrays with reflective surfaces. These modules are attached to heat sinks and placed into chambers with controlled air temperature. Thermocouples or infrared sensors are used to set and monitor the remote phosphor surface temperature. The electrical and photometric properties of each module are initially measured in an integrating sphere before testing begins. These measurements are recorded for the conversion efficacy of the remote phosphor in addition to the luminous radiance of the blue LEDs separately. Each 1000 hours subsequently, the modules are removed from the test chambers and measured again in an integrating sphere for each of the system components.

Results: The following charts summarize the lumen maintenance behavior of each remote phosphor system. Using IESNA TM-21 standardized methodology, lifetime for each module configuration is projected where applicable.

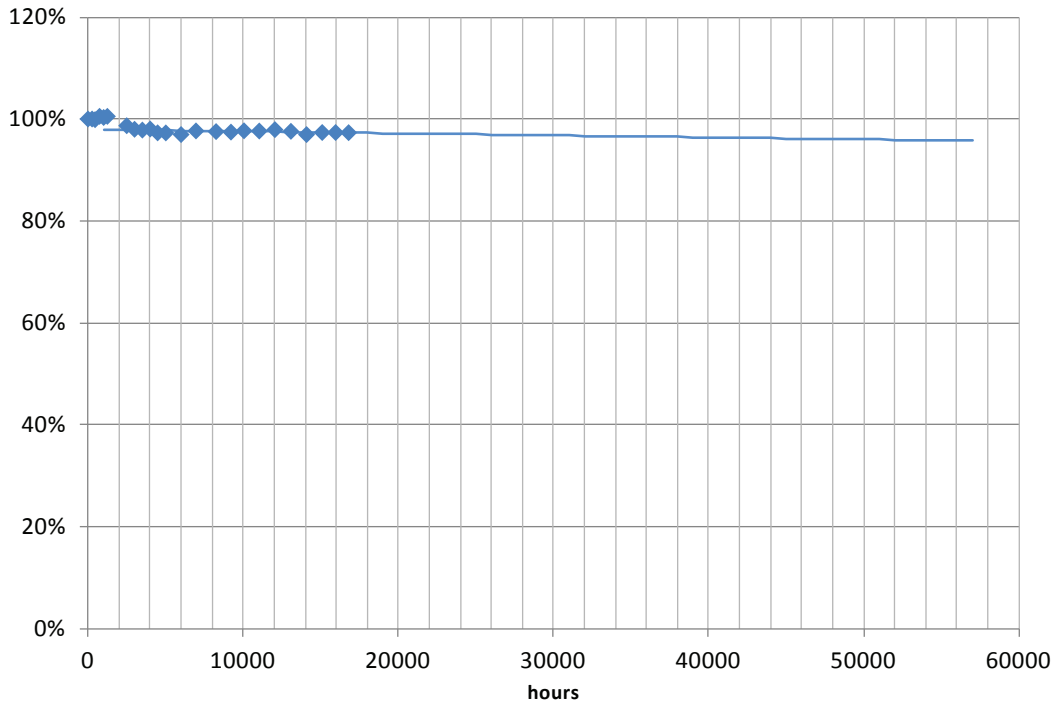
Product: Intematix ChromaLit Contour (360) Remote Phosphor

Description: This lumen maintenance test report is applicable to the following order codes
CL-xxx-CTRxx-PC

Time Point Reached: 8000 hours

Data Set	Part	Case Temp. (T_{MAX})	Amb. Temp. (T_a)	Irradiance / Drive Current (I_f)	Average CE / Radiance Maintenance	Average Chromaticity Shift ($\Delta u'v'$)	TM-21 Projected Lifetime*
H0178	PC 360 Contour Remote Phosphor	72°C	25°C	$0.25\text{W}/\text{cm}^2$	94.0%	0.0004	L90(8K)= 30,000 hrs L70 100,800 hrs expected
	Blue LED (LUXEON)	72°C	25°C	750mA	97.7%	0.0011	

TM-21 Lifetime Projection - ChromaLit Contour



Product: Intematix ChromaLit CAN40 Remote Phosphor

Description: These lumen maintenance test reports are applicable to the following order codes

CL-xxx-CANxx-PC

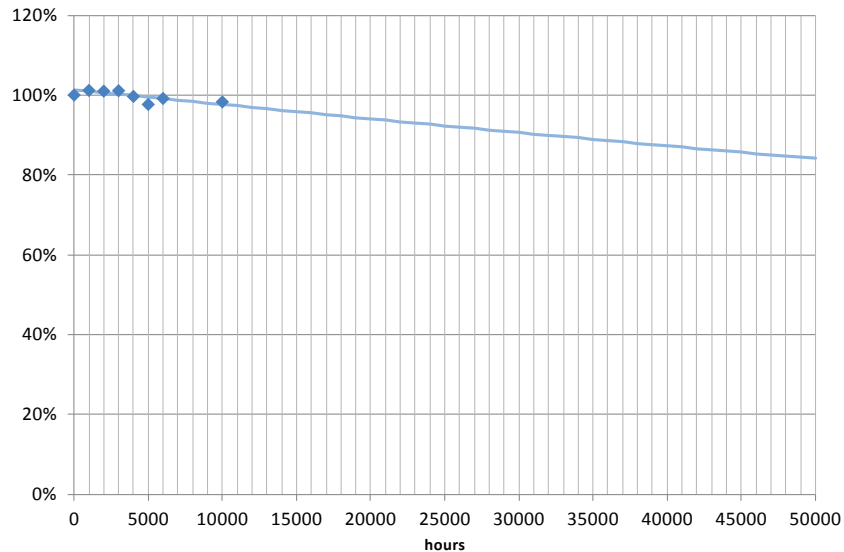
CL-xxx-ELPxx-PC

CL-xxx-DOMxxx-PC

Time Point Reached: 10,000 hours

Data Set	Part	Case Temp. (T _{MAX})	Amb. Temp. (T _a)	Irradiance / Drive Current (I _f)	Average CE / Radiance Maintenance	Average Chromaticity Shift (Δ u'v')	TM-21 Projected Lifetime*
jj1206810	PC 360 Remote Phosphor	79°C	25°C	0.24W/cm ²	99.2%	0.0047	L90(10K)= 31,800 hrs L70 60,000 hrs expected
	Blue LED (LUXEON)	54°C	25°C	500mA	98.8%	0.0009	

TM-21 Lifetime Projection - CAN40



* TM-21 methodology permits data projections of 6 times data hours maximum. Lifetime performance is an estimate.

Discussion of Results

Remote phosphor LED lighting systems have been tested in various configurations to up to tens of thousands of hours. The resulting trends and projections indicate L70 lifetimes of more than 50,000 hours for remote phosphor when operated within specifications. As general guidelines, 50,000 hour or greater lifetimes may be obtained when operating polycarbonate remote phosphor components at lower than 100°C sustained temperatures. At 80°C or below, L70 lifetime is expected to extend to 100,000 hours or more. Additional tests and qualified certification of remote phosphor systems are ongoing. Please consult your Intematix sales representative for more information.

About Intematix

Intematix develops essential phosphor materials to drive the LED lighting revolution. The company's comprehensive range of products and solutions can be used to build foundations for the world's LED lighting products and systems including general lighting, displays, automotive and many others. A broad selection of products and innovative delivery systems accelerate time-to-market, improve light quality and efficacy and reduce costs. For more information, please visit www.intematix.com.

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