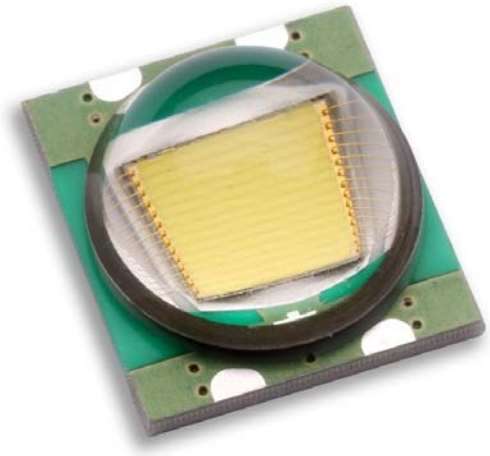
PRODUCT DATA SHEET

PRELIMINARY

PhlatLight® White LED Illumination Products

SST-90 Series



PhlatLight® LEDs enable a new class of illumination applications.

Features

- Extremely high optical output: Over 2,250 lumens from a single chip (white)
- Extremely high efficiency: Over 100 lumens per watt at 350 mA/mm^2
- High thermal conductivity package - junction to case thermal resistance of only 0.64 °C/W
- Large, monolithic chip with uniform emitting area of 9 mm^2
- Lumen maintenance of greater than 70% after 60,000 hours
- Environmentally friendly: RoHS compliant
- Variable drive currents: less than 1 A through 9 A to full reliability specifications.
- High reliability
- Electrically isolated thermal path

Applications

- Architectural Lighting
- Retail Lighting
- Residential Lighting
- Consumer Portable
- Spot Lighting
- High Bay Lighting
- Wide Area Lighting
- Street Lighting

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Technology Overview

PhlatLight LEDs benefit from a suite of innovations in the fields of chip technology, packaging, and thermal management. These breakthroughs allow illumination designers to achieve efficient light engine designs and deliver high brightness solutions.

PhlatLight Technology

The name PhlatLight is derived from Photonic Lattice. Photonic lattice technology creates true surface emission from the source, which enables large area LED chips with uniform brightness over the entire LED chip surface. The optical power and brightness produced by these large monolithic chips enable solutions which replace arc and halogen lamps where arrays of traditional high power LEDs cannot.

Packaging Technology

Thermal management is critical in high power LED applications. With a thermal resistance from junction to case of 0.64°C/W, PhlatLight SST-90 devices have the lowest thermal resistance of any LED on the market. This allows the LED to be driven at higher current densities while maintaining a low junction temperature, thereby resulting in brighter and longer lifetimes. The package is easy to use, and ready to be mounted in the lighting system.

Reliability

Designed from the ground up, PhlatLight LEDs are one of the most reliable light sources in the world today. PhlatLight LEDs have passed a rigorous suite of environmental and mechanical stress tests, including mechanical shock, vibration, temperature cycling and humidity, and have been fully qualified for use in extreme high power and high current applications. With very low failure rates and median lifetimes that are well above 60,000 hours, PhlatLight LEDs are ready for the most demanding applications.

Environmental Benefits

PhlatLight LEDs help reduce power consumption and the amount of hazardous waste entering the environment. All PhlatLight products manufactured by Luminus are RoHS compliant and free of hazardous materials, including lead and mercury.

Understanding PhlatLight Test Specifications

Every PhlatLight LED device is fully tested to ensure that it meets the high quality standards of Luminus' products.

Multiple Operating Points (3.2 A, 9.0 A)

The tables on the following pages provide typical optical and electrical characteristics. Since the LEDs can be operated over a wide range of drive conditions (currents from less than 1.0 A to 9.0 A, and duty cycle from <1% to 100%) multiple drive conditions are listed.

PhlatLight SST-90 devices are production tested at 3.2 A. The values shown at 9.0 A are for additional reference at other possible drive conditions.

PhlatLight White Binning Structure

PhlatLight SST-90 White LEDs are tested for luminous flux and chromaticity at a drive current of 3.2 A (0.35 A/mm^2) and placed into one of the following luminous flux (FF) and chromaticity (WW) bins:

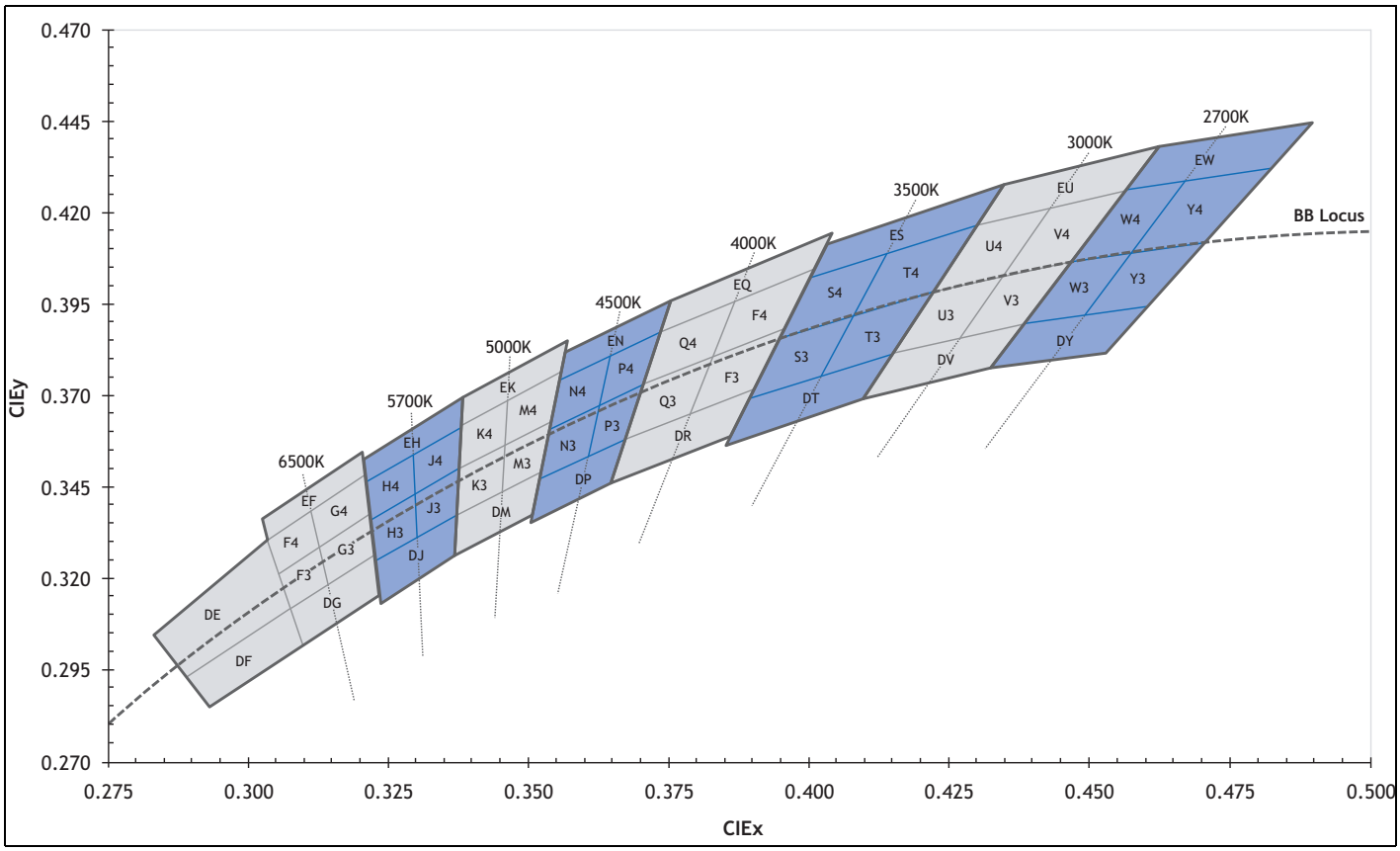
Flux Bins

Color	Flux Bin (FF)	Minimum Flux (lm) @ 3.2 A	Maximum Flux (lm) @ 3.2 A
W65S 6500K, Standard CRI (typ. 70)	WK	600	700
	WL	700	850
	WM	850	1,000
	WN	1,000	1,200
W40S 4000K, Standard CRI, (typ. 70)	WJ	500	600
	WK	600	700
	WL	700	850
	WM	850	1,000
W30M 3000K, Moderate CRI, (typ. 83)	WH	425	500
	WJ	500	600
	WK	600	700
	WL	700	850

PRELIMINARY

Chromaticity Bins

Luminus' Standard Chromaticity Bins: 1931 CIE Curve



The following tables describe the four chromaticity points that bound each chromaticity bin. Chromaticity bins are grouped together based on the color temperature.

6500K Chromaticity Bins		
Bin Code (WW)	CIEx	CIEy
DG	0.307	0.311
	0.322	0.326
	0.323	0.316
	0.308	0.301
F3*	0.305	0.321
	0.312	0.328
	0.315	0.319
	0.307	0.311
F4*	0.303	0.330
	0.313	0.338
	0.312	0.328
	0.305	0.321
G3*	0.312	0.328
	0.321	0.336
	0.322	0.326
	0.315	0.319
G4*	0.313	0.338
	0.321	0.348
	0.322	0.336
	0.312	0.328
EF	0.303	0.338
	0.320	0.356
	0.321	0.346
	0.303	0.330
DE	0.283	0.304
	0.303	0.330
	0.307	0.311
	0.289	0.293
DF	0.289	0.293
	0.307	0.311
	0.308	0.301
	0.293	0.285

5700K Chromaticity Bins		
Bin Code (WW)	CIEx	CIEy
DJ	0.322	0.324
	0.337	0.337
	0.336	0.326
	0.323	0.316
H3*	0.321	0.336
	0.329	0.342
	0.329	0.331
	0.322	0.324
H4*	0.321	0.346
	0.329	0.353
	0.329	0.342
	0.321	0.336
J3*	0.329	0.342
	0.338	0.349
	0.337	0.337
	0.329	0.331
J4*	0.329	0.353
	0.338	0.362
	0.337	0.349
	0.329	0.342
EH	0.320	0.356
	0.337	0.370
	0.338	0.362
	0.321	0.346

5000K Chromaticity Bins		
Bin Code (WW)	CIEx	CIEy
EK	0.337	0.370
	0.356	0.384
	0.355	0.376
	0.338	0.362
K3*	0.337	0.349
	0.345	0.355
	0.344	0.342
	0.337	0.337
K4*	0.338	0.362
	0.346	0.367
	0.345	0.355
	0.337	0.349
M3*	0.345	0.355
	0.353	0.360
	0.352	0.349
	0.344	0.342
M4*	0.346	0.367
	0.355	0.376
	0.353	0.360
	0.345	0.355
DM	0.337	0.337
	0.352	0.349
	0.350	0.337
	0.336	0.326

* Sub-bins within ANSI defined quadrangles per ANSI C78.377-2008

4500k Chromaticity Bins		
Bin Code (WW)	CIEx	CIEy
EN	0.356	0.384
	0.375	0.397
	0.374	0.387
	0.355	0.374
N3*	0.353	0.360
	0.361	0.366
	0.360	0.354
	0.351	0.347
N4*	0.355	0.374
	0.364	0.381
	0.361	0.366
	0.353	0.360
P3*	0.361	0.366
	0.370	0.372
	0.367	0.358
	0.360	0.354
P4*	0.364	0.381
	0.374	0.387
	0.370	0.372
	0.361	0.366
DP	0.351	0.347
	0.367	0.358
	0.365	0.348
	0.350	0.337

4000K Chromaticity Bins		
Bin Code (WW)	CIEx	CIEy
EQ	0.375	0.397
	0.404	0.414
	0.401	0.404
	0.374	0.387
Q3*	0.370	0.372
	0.382	0.380
	0.379	0.365
	0.367	0.358
Q4*	0.374	0.387
	0.387	0.394
	0.382	0.380
	0.370	0.372
R3*	0.382	0.380
	0.395	0.386
	0.390	0.372
	0.379	0.365
R4*	0.387	0.394
	0.401	0.404
	0.395	0.386
	0.382	0.380
DR	0.367	0.358
	0.390	0.372
	0.386	0.360
	0.365	0.348

3500K Chromaticity Bins		
Bin Code (WW)	CIEx	CIEy
ES	0.404	0.414
	0.435	0.429
	0.430	0.417
	0.400	0.402
S3*	0.395	0.386
	0.407	0.392
	0.403	0.378
	0.390	0.369
S4*	0.400	0.402
	0.415	0.409
	0.407	0.392
	0.395	0.386
T3*	0.407	0.392
	0.422	0.399
	0.415	0.381
	0.403	0.378
T4*	0.415	0.409
	0.430	0.417
	0.3422	0.399
	0.407	0.392
DT	0.390	0.369
	0.415	0.381
	0.411	0.372
	0.386	0.360

3000K Chromaticity Bins		
Bin Code (WW)	CIEx	CIEy
EU	0.435	0.429
	0.462	0.437
	0.456	0.426
	0.430	0.417
U3*	0.422	0.399
	0.434	0.403
	0.426	0.386
	0.415	0.381
U4*	0.430	0.417
	0.443	0.421
	0.434	0.403
	0.422	0.399
V3*	0.434	0.403
	0.447	0.408
	0.437	0.389
	0.426	0.386
V4*	0.443	0.421
	0.456	0.426
	0.447	0.408
	0.434	0.403
DV	0.415	0.381
	0.437	0.389
	0.432	0.378
	0.411	0.372

2700K Chromaticity Bins		
Bin Code (WW)	CIEx	CIEy
EW	0.462	0.437
	0.489	0.444
	0.481	0.432
	0.456	0.426
W3*	0.447	0.408
	0.458	0.410
	0.449	0.392
	0.437	0.389
W4*	0.456	0.426
	0.469	0.429
	0.458	0.410
	0.447	0.408
Y3*	0.458	0.410
	0.471	0.413
	0.459	0.394
	0.449	0.392
Y4*	0.469	0.429
	0.481	0.432
	0.471	0.431
	0.458	0.410
DY	0.437	0.389
	0.459	0.394
	0.452	0.382
	0.432	0.378

* Sub-bins within ANSI defined quadrangles per ANSI C78.377-2008

PhlatLight Product Shipping and Labeling Information

All PhlatLight products are packaged and labeled with their respective bin as outlined in the tables on pages 3 and 4. When shipped, each package will only contain one bin. The part number designation is as follows:

SST —— **90** —— **WNNX** —— **F11** —— **FF** —— **WW**

Product Family	Chip Area	Color	Package Configuration	Flux Bin	Wavelength Bin
SST:Surface mount	90: 9.0 mm^2	WNNX: CCT and CRI See Note 1 Below	F11: 10 x 11mm emitter	See page 3 for bins	See pages 4-5 for bins

Note 1. WNNX nomenclature corresponds to the following:
W = White
NN = color temperature, where:
65 corresponds to 6500K
40 corresponds to 4000K
30 corresponds to 3000K, etc.
X = color rendering index, where:
S (standard) corresponds to a typical CRI of 70
M (moderate) corresponds to a typical CRI of 83
H (high) corresponds to a typical CRI of 92.

Note 2. Some flux and chromaticity bins may have limited availability. Application specific bin kits, consisting of multiple bins, may be available. For ordering information, please refer to page 13 and reference the PhlatLight White Binning and Labeling document.

Example: The part number SST-90-W65S-F11-WN-G4 refers to a 6500K standard CRI white, SST-90 emitter, F11 package configuration, with a minumum flux value of 1,000 lumens and a chromaticity value within the box defined by the four points (0.313, 0.338), (0.321, 0.348), (0.322, 0.336), (0.312, 0.328).

Example: The part number SST-90-W30M-F11-WL-U3 refers to a 3000K moderate CRI white, SST-90 emitter, F11 package configuration, with a minumum flux value of 700 lumens and a chromaticity value within the box defined by the four points (0.422, 0.399), (0.434, 0.403), (0.426, 0.386), (0.415, 0.381).

Optical and Electrical Characteristics[1]

White				
Drive Condition[2]		3.2A Continuous	9.0 A Continuous	
Parameter	**Symbol**	**Typical Values at Test Current**	**Values at Indicated Currents[3]**	**Unit**
Current Density	j	0.35	1.0	A/mm^2
Forward Voltage	V_F	3.1	3.6	V
Luminous Flux	$\Phi_{V\ typ}$	1,000	2,250	lm

Common Characteristics

	Symbol	Values	Unit
Emitting Area		9.0	mm^2
Emitting Area Dimensions		3 x 3	mmxmm
Forward Voltage Temperature Coefficient[4]		-2.45	mV/ºC

Absolute Maximum Ratings

	Symbol	Values	Unit
Maximum Current[5]		9	A
Maximum Junction Temperature[6]	$T_{j\text{-}max}$	150	ºC
Storage Temperature Range		-40/+100	ºC

Note 1: All ratings are based on test conditions of Tj=25C, 20 millisecond pulse. See Thermal Resistance section for Tj definition.

Note 2: Listed drive conditions are typical for common applications. PhlatLight SST-90-W devices can be driven at currents ranging from <1A to 9A and at duty cycles ranging from <1% to 100%. Drive current and duty cycle should be adjusted as necessary to maintain the junction temperature desired to meet application lifetime requirements.

Note 3: Unless otherwise noted, values listed are typical.

Note 4: Forward voltage temperature coefficient at current density of 0.35 A/mm^2. Contact Luminus for value at other drive conditions.

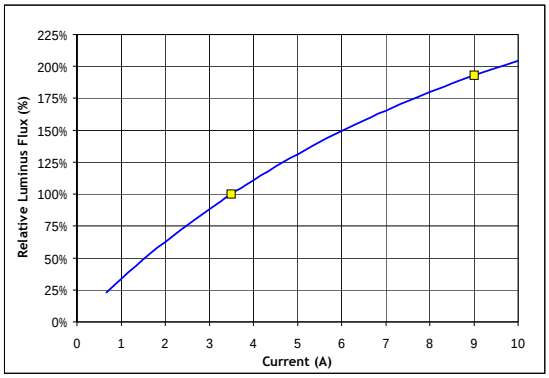
Note 5: Luminus PhlatLight White LEDs are designed for operation to an absolute maximum forward drive current density of 1.0 A/mm2. Product lifetime data is specified at recommended forward drive currents. Sustained operation at absolute maximum currents will result in a reduction of device lifetime compared to recommended forward drive currents. Actual device lifetimes will also depend on junction temperature. Refer to the lifetime derating curves for further information. In pulsed operation, rise time from 10-90% of forward current should be larger than 0.5 microseconds.

Note 6: Lifetime dependent on LED junction temperature . Thermal calculations based on input power and thermal management system should be performed to ensure Tj is maintained below Tjmax rating or life may be reduced. Refer to lifetime plots on pg 8 and lifetime and reliability application note for further information.

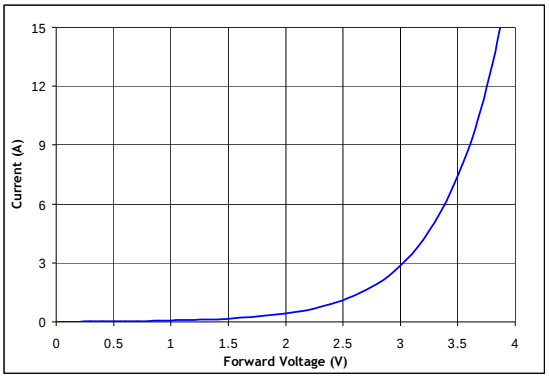
Note 7: Special design considerations must be observed for operation under 1 A. Please contact Luminus for further information.

Note 8: Caution must be taken not to stare at the light emitted from these LEDs. Under special circumstances, the high intensity could damage the eye.

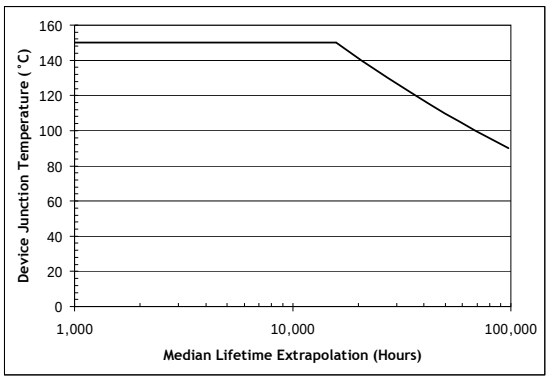
Relative Output Flux vs. Forward Current[1]



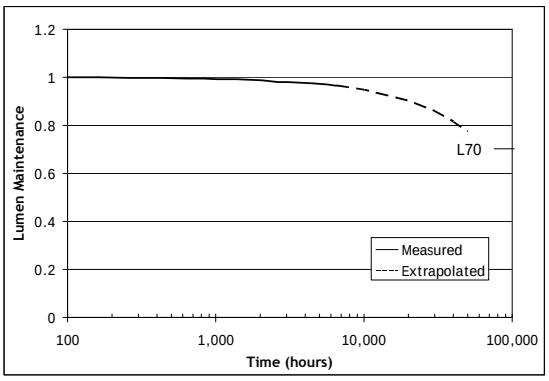
Forward Current vs. Forward Voltage



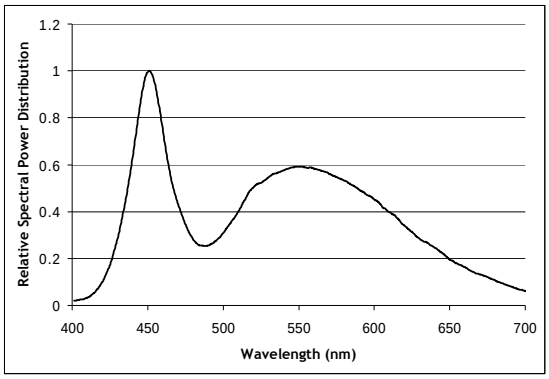
Mean Lifetime[2]



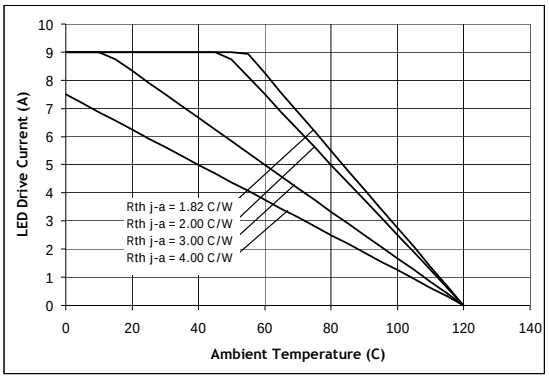
Lumen Maintenance vs. Time[3]



Typical Spectrum[4]



Current Derating Curve



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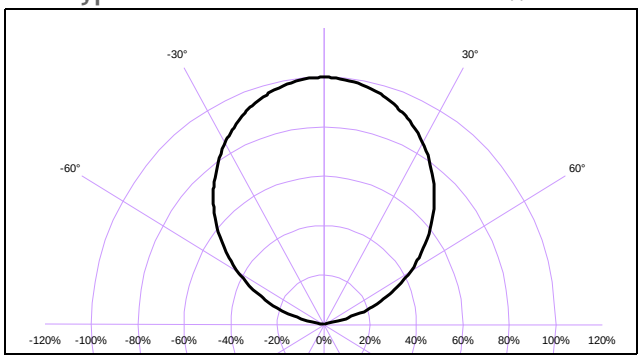
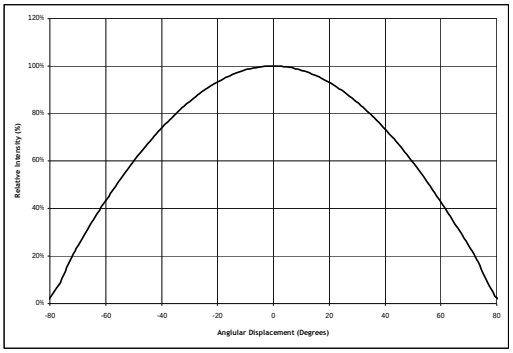
1. *Yellow squares indicate typical operating conditions.*
2. *Mean expected lifetime in dependence of junction temperature at 0.35 A/mm^2 in continuous operation. Lifetime defined as time to 70% of initial intensity. Based on lifetime test data of uncoated GaN devices at this time. Data can be used to model failure rate over typical product lifetime.*
3. *Lumen maintenance in dependence of time at 0.35 A/mm^2 in continuous operation with junction temperatures of 100 ^{o}C.*
4. *Typical spectrum at current density of 0.35 A/mm^2 in continuous operation.*

Typical Radiation Pattern

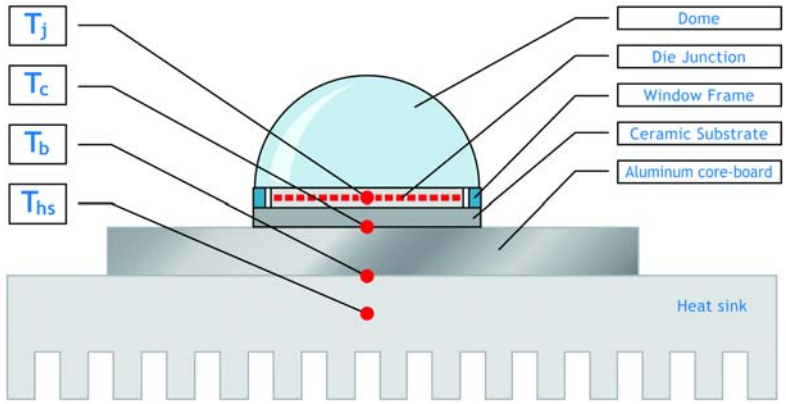
Typical Polar Radiation Pattern for White



Typical Angular Radiation Pattern for White



Thermal Resistance



T_{hs} definition = 3 mm from core-board

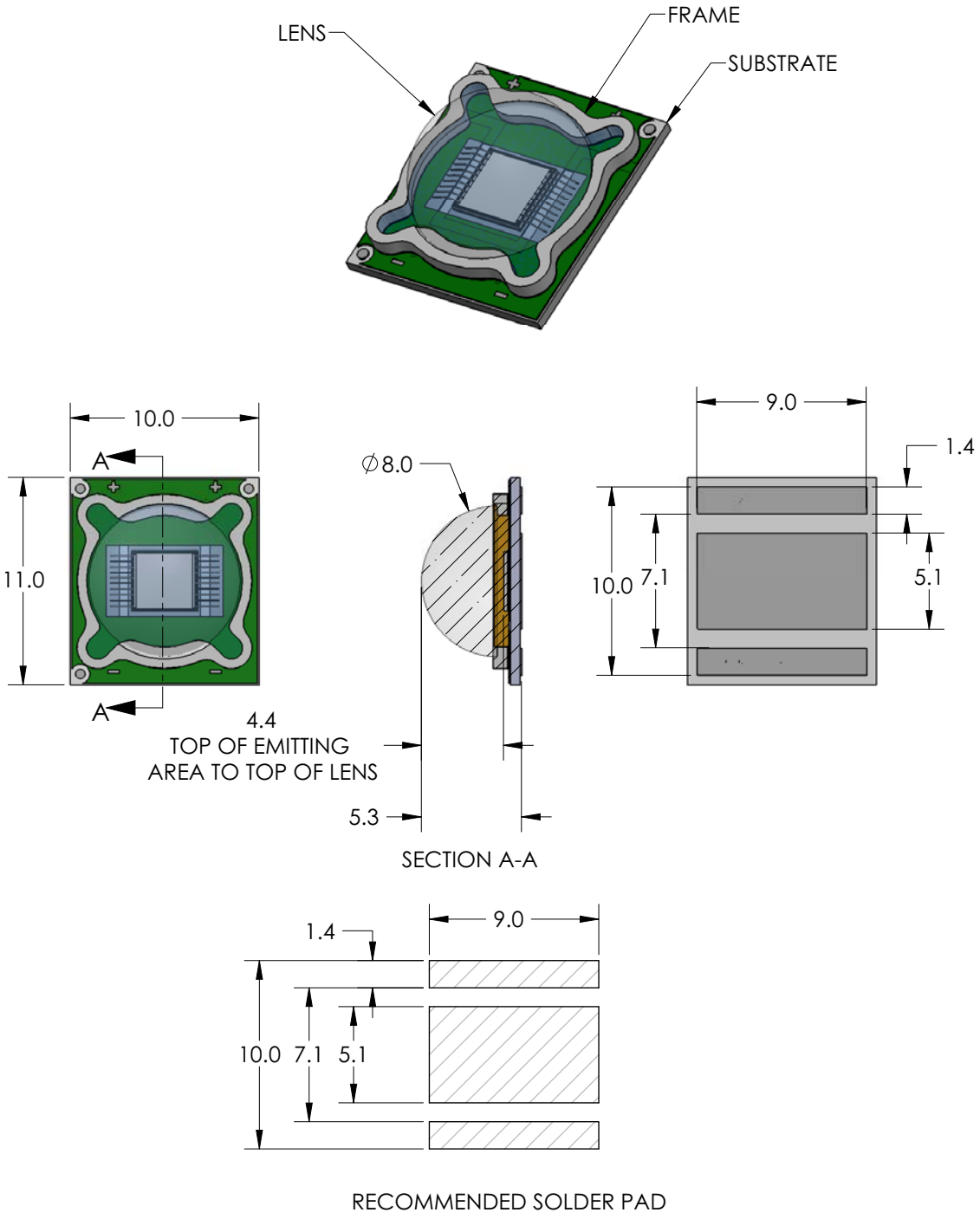
Typical Thermal Resistance

$R_{j\text{-}c}$ [1]	0.64 ºC/W
$R_{j\text{-}b}$ [1]	2.02 °C/W
$R_{j\text{-}hs}$ [2]	2.15 ºC/W

Note 1: Thermal resistance values are based on FEA model results correlated to measured $R_{\theta j\text{-}hs}$ data.

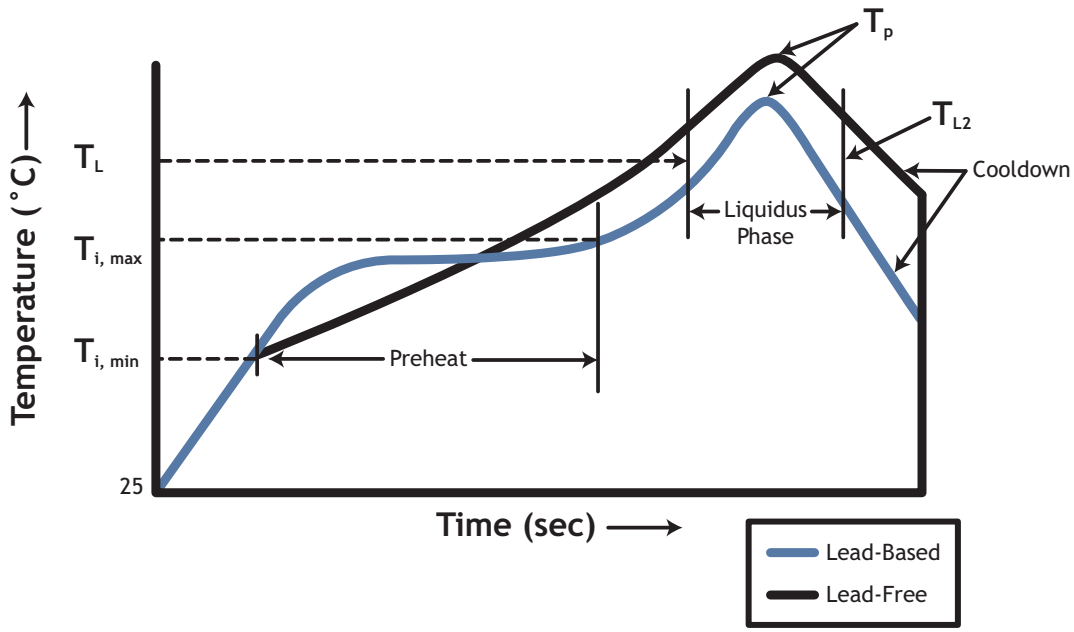
Note 2: Thermal resistance is measured using a SAC305 solder, an Al-clad MCPCB, and eGraf 1205 thermal interface material.

Mechanical Dimensions



For detailed drawing please refer to DWG-001277 document

Solder Profile



Solder Profile Stage	Lead-Free Solder	Lead-Based Solder
Rate of Rise	2°C/sec max	2°C/sec max
Preheat Min Temp ($T_{i,min}$)	100°C	120°C
Preheat Max Temp ($T_{i,max}$)	175°C	130°C
Preheat Time (T_i,min to $T_{i,max}$)	90 seconds	120 seconds
Liquidus Min Temp: (T_L)	185°C	160°C
Liquidus to Liquidus Time (T_L to T_{L2})	30-60 seconds	30 seconds
Liquidus Peak Temp (T_p)	240°C max	220°C max
Cooldown	≤ 4°C/sec	≤ 6°C/sec
Profile Length (Ambient to Peak)	4 min	3.5 - 4 min

1. *Temperatures are taken and monitored at the component copper layer*
2. *Optimum profile may differ due to oven type, circuit board or assembly layout*
3. *Recommended lead free, no-clean solder: AIM NC254-SAC305*
4. *Refer to soldering and handling application note for further information.*

Ordering Information

Ordering Part Number[1,2]	Color	Description
SST-90-W65S-F11-GK100	6500K White	White PhlatLight SST-90 surface mount module consisting of a domed 9mm^2 LED mounted on a ceramic substrate.
SST-90-W40S-F11-GJ500	4000K White	White PhlatLight SST-90 surface mount module consisting of a domed 9mm^2 LED mounted on a ceramic substrate.
SST-90-W30M-F11-GH700	3000K White	White PhlatLight SST-90 surface mount module consisting of a domed 9mm^2 LED mounted on a ceramic substrate.

Note 1: GK100 - denotes a bin kit comprising of all flux and chromaticity bins at the 6500K color point
GJ500 - denotes a bin kit comprising of all flux and chromaticity bins at the 4000K color point
GH700 - denotes a bin kit comprising of all flux and chromaticity bins at the 3000K color point
See PhlatLight White Binning and Labeling document for more information.
Note 2: For ordering information on all available bin kits, please see PhlatLight White Binning and Labeling document.

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