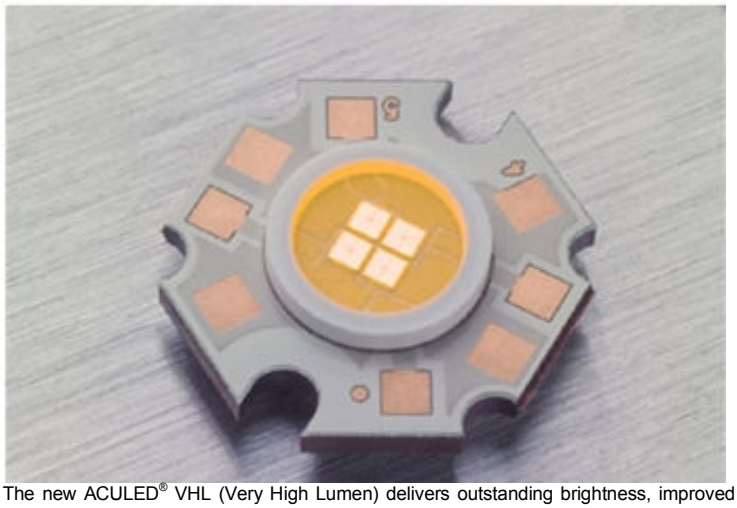
DATASHEET

ACULED® VHL™
Yellow
ACL01-SC-YYYY-007-C01-L-0000



DESIGN YOUR OWN!
Custom DYO product line also available

The new ACULED® VHL (Very High Lumen) delivers outstanding brightness, improved luminous efficacy and excellent thermal management, all in a compact, easy-to-assemble package.

Introduction

The ACULED® VHL™ (Very High Lumen) is the newest addition to the growing ACULED® family of standard and custom high-power LED solutions based on Excelitas Elcos' superior Chip-on-Board (COB) technology.
The new ACULED® VHL delivers superior brightness, luminous efficacy, and a step-change improvement in thermal management. It is based on an enhanced ACULED® board utilizing an Insulated Metal Core Substrate (IMS) made of copper and a highly sophisticated isolation material with low thermal resistance between the copper and the chip pads.

Excelitas's ACULED VHL is compact in size, easy to assemble and has a superior optical design.
In addition, each chip has a separate anode and cathode enabling each chip to be driven individually, thus increasing flexibility in electrical layout.

The ACULED® VHL is available standard in monochromatic (UV, Blue, Green, Yellow, Red, IR) as well as multi-colored four-chip combinations including an RGBY version which offers a higher color rendering index than our basic ACULED® RGGB.
Additional optics can be easily attached.
For ESD sensitive chip types, safe and reliable ESD protection is enabled using Zener diodes.
The ACULED® VHL - as well as all members of the ACULED® product family - is fully RoHS-compliant.

Features and Benefits

- High power light source utilizing multi Chip-on-Board (COB) technology
- Outstanding brightness and luminous efficacy
- Step-change improvement in thermal management based on ACULED VHL's enhanced IMS board - thermal resistance of the package can be as low as 4.5 K/W, depending upon chip configuration
- Each chip has a separate anode and cathode - increases flexibility in electrical layout
- Ultra-compact footprint and easy-to-assemble design
- Various standard configurations - monochromatic and multi-colored four-chip versions
- Designed for high current applications
- No thermal cross talk between chips
- Fully RoHS-compliant

Applications

- High power light source for general illumination
- Specialty lighting - vision systems Architectural and landscape lighting
- Entertainment and mood lighting
- Medical lighting
- Backlighting and projection
- Displays and signs

Table of Contents

Product Nomenclature

Position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Order number	A	C	L	0	1	-	P	F	-	M	C	O	-	C1	C2	C3	C4	-	P	W	C	-	C	0	1	-	L	-	B	I	N	S
Example	A	C	L	0	1	-	M	C	-	0	0	0	-	R	G	Y	B	-	E	0	8	-	C	0	1	-	L	-	Q	2	5	0

Position 1–3: Product name

Position 4–5: Product generation
01 = VHL

Position 7–8: Product family
SC: Single color
MC: Multi-color
OD: On demand (Design Your Own)
MD: Multi-die

Position 10–12: Manu-facturing code (BOM)
Design-Your-Own: alpha-numerical code
VHL: 000 (will typically be left out in datasheets)

Position 14–17: Pads C1–C4
U = UV
D = Deep blue
B = Blue
C = Cyan
G = Green
Y = Yellow
A = Amber
R = Red
I = Near infrared
J = Infrared
White:
3 = 3200 K
4 = 4500 K
5 = 5400 K
6 = 6500 K
Sensors
P = Photo-diode
N = NTC

Position 19: ESD-protection
0 = none
E = ESD protection

Position 20–21: Input-Power in Watts (T_B = 25°C at rated current)

Position 23–25: **Package type**
23: Substrate material
C = copper IMS
24 + 25:
00 undefined
01 dielectric layer
VHL-version

Position 27: Beam pattern:
0 = not defined
L = Lambertian

Position 29: Intensity bin alpha-numerical
(0 = open)

Position 30–31: Color bin (00 = open):
SC colored: wavelength (1, 2, 3, ...)
SC white: area in xy diagram (A, B, C, ...)
MC: wavelength combination (0, 1, 2, ...)
OD: 00
MD: 00
Position 32: not used = 0

Average Lumen Maintenance Characteristics

Typically, the lifetime for solid-state lighting devices, or LEDs, is derived from the percentage of initial light output that remains after a specific time period - generally referred to as lumen maintenance.

Excelitas projects that ACULED® VHL products, operating at a forward current of 350 mA, will average 70% lumen maintenance after 30,000 hours of constant current operation with junction temperature maintained at or below 110° C.

This performance is based on three criteria - independent test data, Excelitas historical data from tests run on similar material systems, and internal ACULED reliability testing. To achieve this level of lumen maintenance, all design limits included in this datasheet must be adhered to carefully.

Environmental Compliance

Excelitas is proud of its commitment to providing the best in environmentally- friendly products to customers in the solid state lighting market. The ACULED® VHL is no exception - and complies with the European Union directives on the restriction of hazardous substances in electronic equipment as stated within the RoHS directive. The following restricted materials will not intentionally be added to the ACULED® VHL - lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE).

Ordering Information and Flux Characteristics

Board temperature T_B = 25°C

Part-Number	Description	Type	Color	Luminous Flux Φ_V [lm] I_F=700 mA		Luminous Intensity I_V [cd] I_F=700 mA
				Min.	Typ.	Typ.
E001701	ACULED VHL Yellow	ACL01-SC-YYYY-007-C01-L-Q000	yellow	128	170	39

Table 1: Intensity Bins

Board temperature T_B = 25° C; I_F = 700 mA

Luminous Flux Φ_V [lm]		
Rank	**Min.**	**Max.**
P	102	161
Q	128	203
R	161	256

Table 2: Wavelength Bins

Board temperature T_B = 25°C; I_F = 700 mA

Dominant Wavelength λ_{dom} [nm]		
Rank	**Min.**	**Max.**
0	585	600
24	585	590
25*	**590**	**595**
26	595	600

* Main wavelength binning

Optical and Electronic Characteristics***

Ambient temperature T_A = 25°C

Parameter			**Symbol**	**Value**	**Unit**
Luminous flux*	@ 700 mA	typ.	Φ_V	245	lm
Luminous flux*	@ 350 mA	typ.	Φ_V	135	lm
Luminous flux**	@ 700 mA	typ.	Φ_V	170	lm
Luminous flux**	@ 350 mA	typ.	Φ_V	110	lm
Luminous intensity*	@ 700 mA	typ.	I_V	55	cd
Luminous intensity**	@ 700 mA	typ.	I_V	39	cd
Dominant wavelength	@ 700 mA	typ.	λ_{dom}	595	nm
Peak emission wavelength	@ 700 mA	typ.	λ_{peak}	598	nm
Spectral half bandwidth	@ 700 mA	typ.	$\Delta\lambda$	20	nm
Forward voltage per chip	@ 350 mA @ 700 mA	typ.	V_F	2.2 2.4	V
Optical efficacy*	@ 350 mA	typ.	η_{opt}	43	lm/W
Optical efficacy**	@ 350 mA	typ.	η_{opt}	36	lm/W
Temperature coefficient for λ_{dom}	@ 700 mA	typ.	$TC_{(\lambda\ dom)}$	0.09	nm/K
Temperature coefficient for λ_{peak}	@ 700 mA	typ.	$TC_{(\lambda\ peak)}$	0.09	nm/K
Temperature coefficient for	V_F per chip @ 700 mA	typ.	$TC_{(Vf)}$	- 2.2	mV/K
Viewing angle at 50%		typ.	2ψ	125	degree
Radiating surface****		typ.	A_{rad}	4.0	mm^2
Luminance*	@ 700 mA	typ.		1375	Cd/cm^2
Luminance**	@ 700 mA	typ.		975	Cd/cm^2
Thermal resistance	junction - board	typ.	$R_{th\ JB}$	5	K/W

* Values for junction temperature T_J = 25°C

** Values for board temperature of T_B = 25°C

For intensity rank Q

* 0.2 mm gap between chips not included

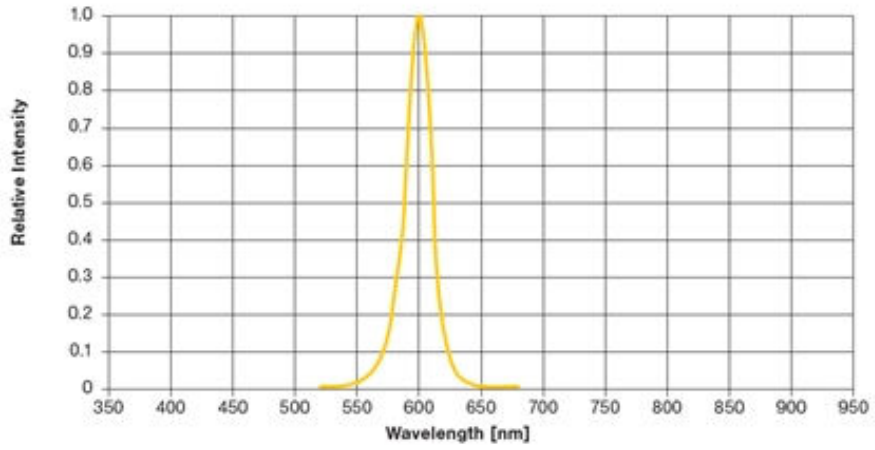
Adequate heat sink is required. Derating must be observed to maintain junction temperature below maximum.

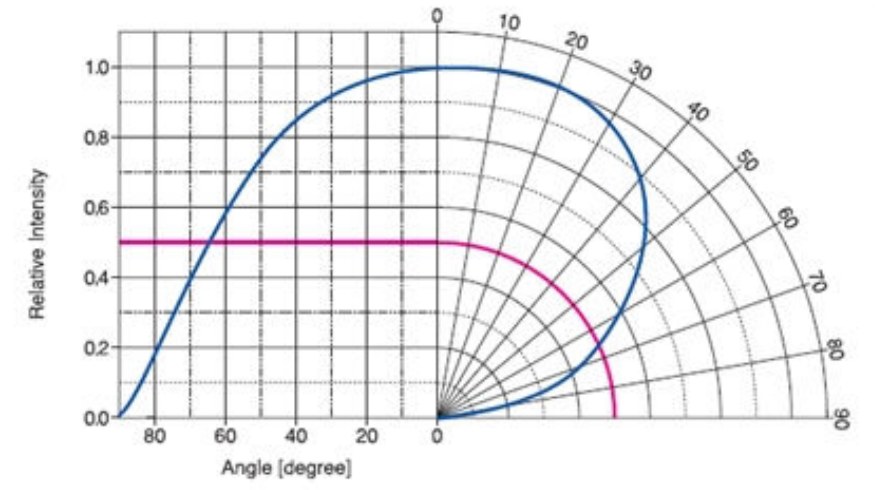
Maximum Ratings at 25°C

Parameter		Symbol	Value	Unit
Operating temperature range		T_{op}	-40 to 80	°C
Storage temperature		T_{st}	-40 to 80	°C
Junction temperature		T_J	125	°C
Forward current per chip		I_F	700	mA
Surge current per chip		I_{FM}	1000	mA
Forward voltage per chip	@ 700 mA	V_F	3.5	V
Reverse voltage per chip		V_R	5	V
Reverse current (V_R=5 V)		I_R	2	µA
Power consumption	@ 700 mA	P_{tot}	9.8	W
ESD sensitivity			2	kV
Soldering temperature	Reflow (10 sec) Hand (3 sec.)	T_{sold} T_{sold}	260 400	°C

Tables of Characteristics

Typical Spectral Distribution (I_F = 700 mA, T_B = 25°C)

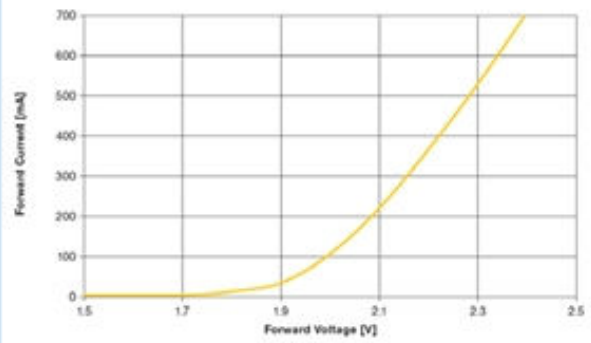




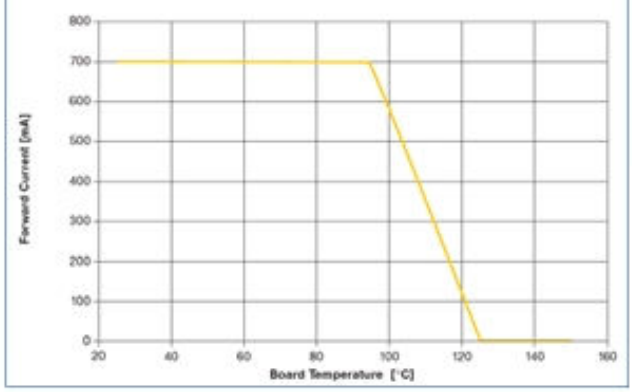
Board temperature T_B = 25°C

Forward current I_F = 700 mA

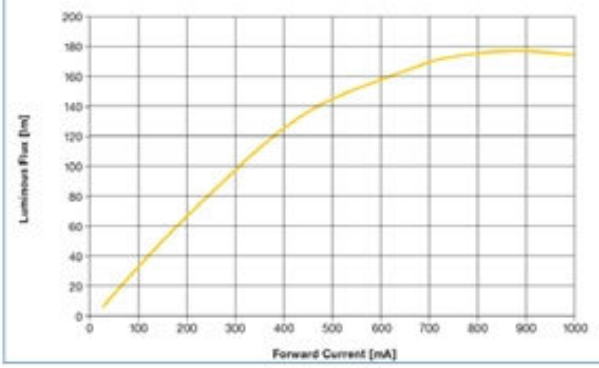
Forward Current / Chip $I_F = f(V_F)$



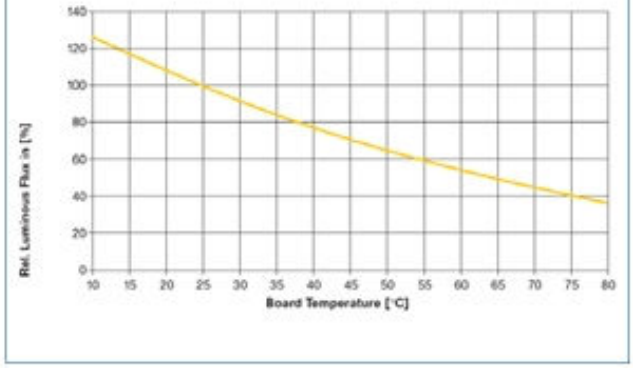
Maximum Forward Current / Chip $I_F = f(T_B)$



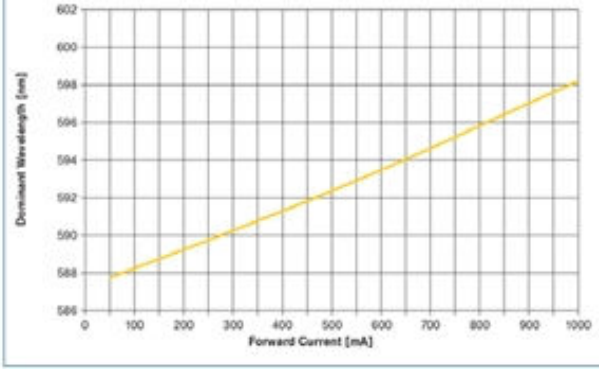
Luminous Flux $\Phi_V = f(I_F)$



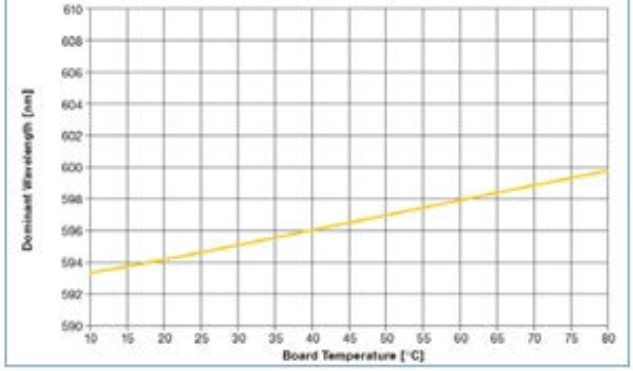
Relative Luminous Flux = $f(T_B)$



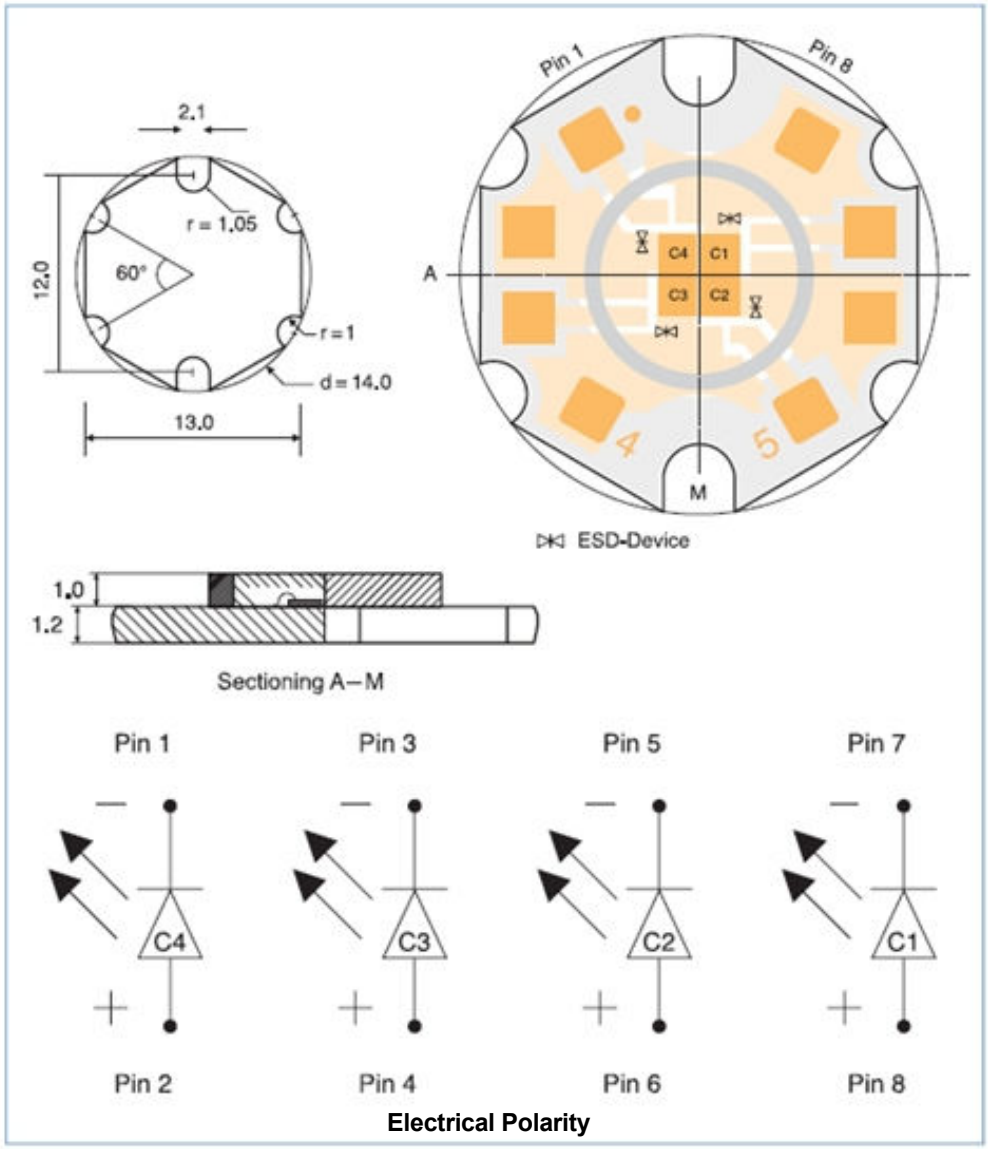
Dominant Wavelength $\lambda_{dom} = f(I_F)$



Dominant Wavelength $\lambda_{dom} = f(T_B)$



Mechanical and Electrical Specification



Electrical Polarity

Chip Pad	Chip Color
C1	Yellow
C2	Yellow
C3	Yellow
C4	Yellow

Package:	IMS
Encapsulating Resin:	Silicone
Ring:	PPA based
Electrodes:	Au Plating

Reliability Information

Excelitas Reliability Test Program					
Test Item	**Content of Test**	**Test Condition**	**Remarks**	**Measurement**	**Ref. Standard**
Resistance to Soldering Heat (Reflow Soldering)	Stability of the device for RoHS conform soldering conditions	T_{sold} = 260°C for 10s (Pre treatment of the DUT: T_{sold}=30°C, 70%, 12h)	One soldering cycle. Non operation of DUT during test *)	Visual Inspection. Measurement of illuminance E_v before and after test	JEDEC J-STD-020C
Temperature Cycle Test, TCT	Stability of device under thermal stress, fast change of temperature	T_A =-40°C to 120°C dwell time: 30 min cycles: 200, cycle time: 1h	Operation of DUT at 10% of nominal current *)	Visual Inspection. Measurement of E_v after 0, 100, 200 cycles	IEC 60068-2-14
High Temperature Test, HTS	Stability of device at long term storage at high temp.	T_A = 110°C test duration: 1000h	Operation of DUT at 10% of nominal current *)	Visual Inspection. Measurement of E_v after 0, 1000h	IEC 60068-2-2
Low Temperature Test, LTS	Stability of device at long term storage at low temp.	T_A = -40°C test duration: 1000h	Operation of DUT at 10% of nominal current *)	Visual Inspection. Measurement of E_v after 0, 1000h	IEC 60068-2-1
Temperature Humidity Storage, THS	Stability of device stored for a long term at high temperature and high humidity.	T_{env} = 85°C RH=85%, test duration: 1000h	Operation of DUT at 10% of nominal current *)	Visual Inspection. Measurement of E_v after 0, 1000h	IEC 60068-2-67
Operation Life Test	Stability of device operated under nominal conditions	T_A = 25°C, RH=30%, test duration: 1000h	Operation of DUT at nominal current I_{fn} *)	Visual Inspection. Measurement of E_v after 0, 250, 500,1000h	IEC 60068-1
Steady State Operating Life of High Humidity Heat	Stability of device under electrical and thermal stress and high humidity	T_A = 60°C RH=90%, test duration: 1000h	Operation of DUT at nominal current I_{fn} *)	Visual Inspection. Measurement of E_v after 0, 250, 500 and 1000h	IEC 60068-2-78
Operation Life Test at High Temperature	Stability of device at high junction temperature and operated at nominal current	T_A = 85°C test duration: 1000h	Operation of DUT at nominal current I_{fn} *)	Visual Inspection. Measurement of E_v after 0, 250, 500 and 1000h	IEC 60068-2-2
Vibration Test	Stability of device under mechanical stress. Sinusoidal vibration	f=20-2000Hz acceleration: 200m/s² amplitude: ±0.751 sweep rate: 3,2 octave/min	Number of cycles: 4, test duration: 3x16min Non-operation of DUT during test	Visual Inspection. Measurement of E_v before and after test.	IEC 60068-2-6
Electrostatic Discharge	Stability of device under electrostatic stress	Test Voltage=2kV (R=1,5kΩ, C=100pF)	Positive and negative dis-charges: 3x with ESD-generator. Non-operation of DUT during test	Visual Inspection. Measurement of illuminance before and after test.	JEITA ED-4701

*) The test is done after the sample is cooled down to room temperature
T_{sold}=Soldering temperature, T_A=Ambient temperature, I_{fn}=350mA, DUT = Device under Test. The tests are performed on top of Excelitas Elcos standard heat sink.

Soldering

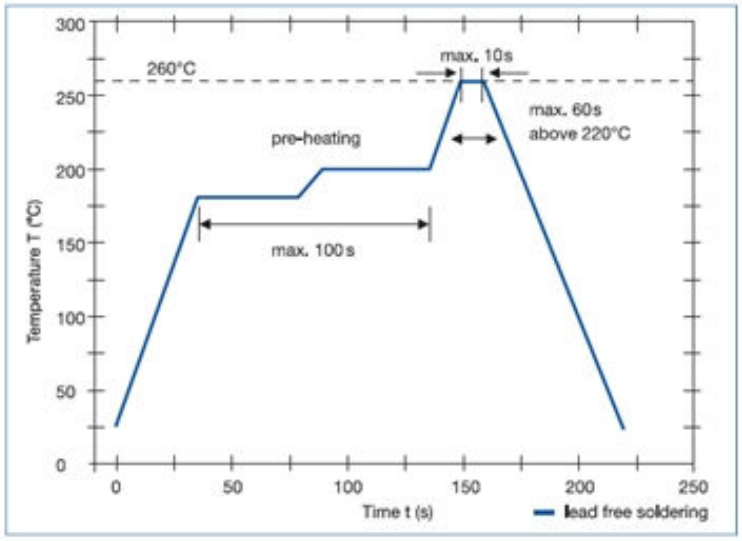


Figure 1
Reflow Soldering Profile

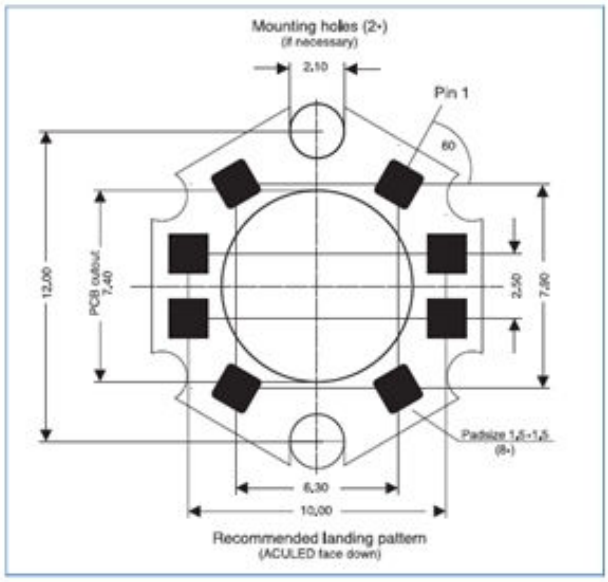


Figure 2
Recommended Solder Pad Geometry

Hand Soldering

- Pre-heat ACULED on a hot plate at 100° C.
- Cover silicone surface with protection cap or similar.
- Use 95 W soldering iron.
- Apply soldering temperature of 400° C for max. three seconds.

Please refer to the Application Note “ACULED Mounting” for further details on soldering.

Cautions

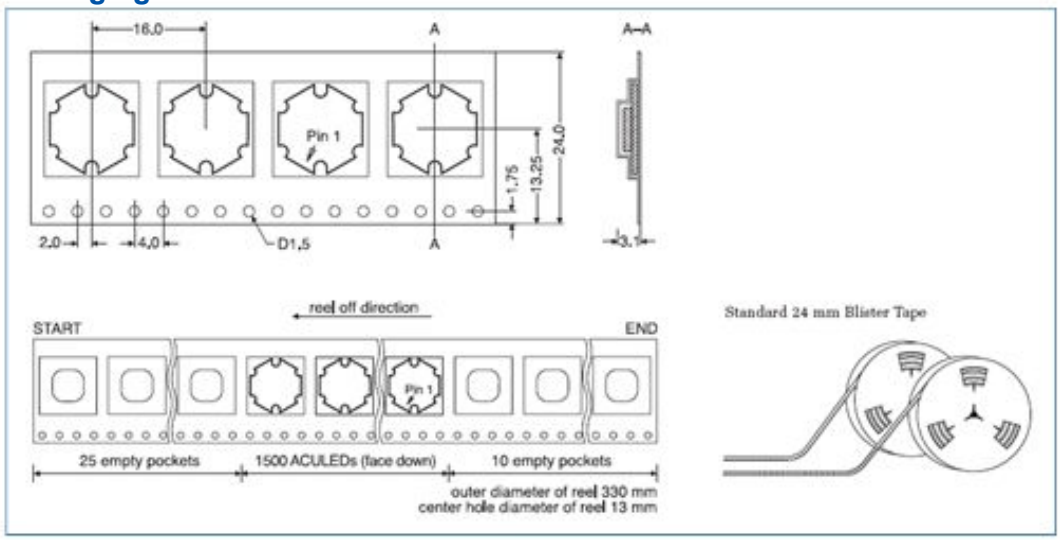
Note: according IEC 60825-1 (EN 60826):
LED radiation. Do not view directly with optical instruments.
The products ACULED VHL UV and ACULED VHL IR mainly emit invisible radiation that can cause severe damage to the human eye.

Notes

1. Excelitas maintains a tolerance of ± 5% on flux and power measurements.
2. ACULED VHL products with even higher luminous flux and radiometric power levels will become available in the future.
3. Dominant wavelength is derived from the CIE 1931 chromaticity diagram and represents the perceived color.
4. Excelitas maintains a tolerance of ± 2 nm for dominant wavelength measurements.
5. Excelitas maintains a tolerance of ± 1 nm for peak wavelength measurements.
6. Excelitas maintains a tolerance of ± 2 K/W for thermal resistance measurements depending on chip properties.
7. All green, cyan, blue, and UV products are built with Indium Gallium Nitride (InGaN).
8. All red and yellow products are built with Aluminum Indium Gallium Phosphide (AlInGaP).
9. All infrared products are built with Aluminum Gallium Arsenide (AlGaAs).
10. Blue and royal blue power light sources represented here are IEC825 class 2 for eye safety.
11. Proper current derating must be observed to maintain junction temperature below the maximum.
12. LEDs are not designed to be driven in reverse bias.
13. Stresses in excess of the absolute maximum ratings can cause damage to the emitter. Maximum rating limits apply to each parameter in isolation, all parameters having values within the current derating curve. It should not be assumed that limiting values of more than one parameter can be applied to the product at the same time. Exposures to the absolute maximum ratings for extended periods can adversely affect device reliability.
14. Due to the special conditions of the manufacturing processes of LEDs, the typical data or calculated correlations of technical parameters can only reflect statistical figures. These do not necessarily correspond to the actual parameters of each single product, which could differ from the typical data and calculated correlations or the typical characteristic line. If requested, e.g. because of technical improvements, these typ. data will be changed without any further notice.
15. All drawings are not to scale.
16. All dimensions are specified in mm.
17. For general mounting instructions and thermal management requirements, please refer to our application notes accordingly.

Please consult Excelitas or its distributors for more information.

Packaging



Optics

Currently, the ACULED lens holder system offers two different collimating optics. With an opening angle of approximately 32°, the ACULED LHS-AL25-L32 (E000525) provides a medium opening, whereas the LHS-AL25-L22 (E000524) has a tight collimating optic with an aperture angle of approximately 22°.

Due to their superior optical quality, both optics increase luminous intensity and, thereby, enable new application fields for the ACULED. Please contact us for further information or to receive the datasheet ACULED LHS-AL25.

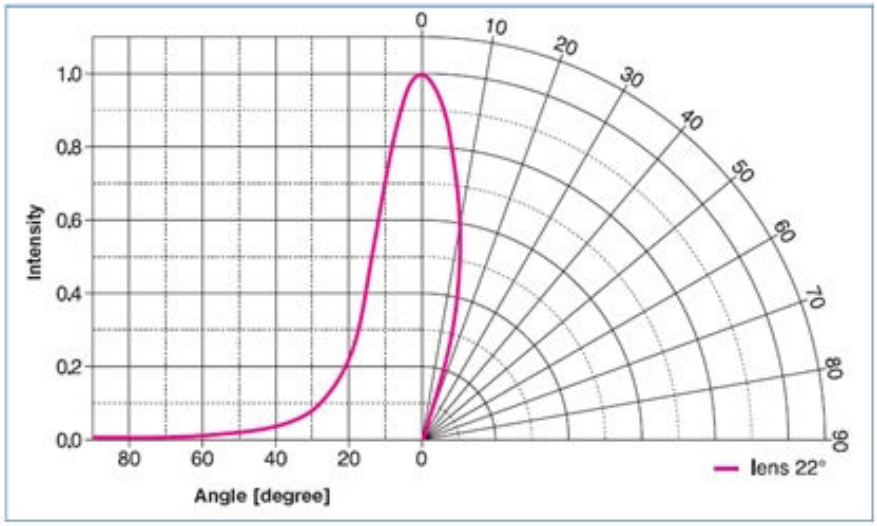


Figure 3
Opening Angle: Example RGB with Lens

Heat Sink Recommendations

The maximum junction temperature of the ACULED should not exceed 125° C. Therefore, an adequate heat sink is required for operating the LED with currents between 50 mA and 700 mA. Due to the ACULED's superior thermal management, heat dissipation is optimized when the LED is screwed down with thermal grease onto a planar substrate. For details please refer to the Application Note "Thermal Management of the ACULED VHL".

ACULED Designer Kit

Excelitas has designed a Designer Kit to run and test the ACULED in your application. It is easy to use and does not require specialized technical know-how. Please contact us to receive a product description and additional information on how to obtain the Designer Kit.

ACULED DYO - Flexibility to "Design-Your-Own" High Power LED

In addition to the ACULED VHL, Excelitas's new line of standard monochromatic and multi-colored high powered LEDs, Excelitas is also debuting its exclusive new "DesignYour-Own" line, the ACULED® DYO™.

The ACULED DYO gives customers the total flexibility to design their own four-chip LED configuration to suit their specific application.

For more information on our new ACULED DYO line, please refer to the ACULED DYO Custom Design Guide.

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