ACULED®
RGGB
ACL00-MC-GBGR-005-C02-L-0000

DATASHEET

Superior brightness and excellent color mixing in a compact size, ACULED is truly "setting the mood" with illumination. Test it out with our Evaluation Kit.

Overview

Excelitas' ACULED - or All Color Ultrabright LED - is a multiuse, compact LED designed for operation in specialty lighting applications.

Typical applications include mood lighting, indoor/ outdoor illumination, architectural or stage lighting, automotive interior lighting and much more.

The ACULED is a high-power light source utilizing multi chip-on-board (COB) technology. The close chip placement achieves an exquisite white color mix. Excellent multi-color mixing is also achievable by driving each chip individually using one blue, one red, and two green power chips. Each color has a separate anode and cathode. The two green chips are serially connected; additional optics can be easily attached.

The Excelitas ACULED boasts a compact size and superior optical design. In addition, the copper board provides for superior thermal conductivity.

An Evaluation Kit is also available for testing.

With global resources and manufacturing capabilities, Excelitas customers continue to benefit from the company's years of experience and expertise in LED technology and specialty lighting applications.

Features and Benefits

- High-power light source utilizing multi chip-on-board (COB) technology
- Superior brightness resulting from excellent quality LED chips and superior thermal management
- Compact size
- Excellent color mixing achieved by a separate anode and cathode for each color (red, green, blue)
- Close individual chip placement to produce an exquisite white color mix
- One blue, one red and two green chips (green connected serially)
- Lambertian emitter with 120° aperture
- Up to 4.5 W electrical power
- Fully RoHS compliant and reflow soldreable

Applications

- High-power light source for general illumination
- Vision systems
- Architectural lighting
- Mood lighting
- Medical lighting
- Backlighting
- Displays and signs

EXCELITAS TECHNOLOGIES

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	0	-	M	C	-	0	0	0	-	G	B	G	R	-	0	0	5	-	C	0	2	-	L	-	N	2	5	0

Position 1–3: Product name

Position 4–5: Product generation
00 = ACULED

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

Position 10–12: Manufacturing 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

Position 19: ESD-protection
0 = none

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

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

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® 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® 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® - 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=350 mA		Luminous Intensity I_V [cd] I_F=350 mA
				Min.	Typ.	Typ.
E000986	ACULED GBGR	ACL00-MC-GBGR-005-C02-L-N000	Red Green[1] Blue	Total 64	19 57 4.7	9 16 1.5

[1] two chips in series

Table 1: Intensity Bins

Board temperature T_B = 25°C; I_F = 350 mA

Luminous Flux Φ_V [lm]		
Rank	**Min.**	**Max.**
L	40	64
M	51	81
N	64	102
O	81	128
P	102	161

Table 2: Wavelength Bins

Board temperature T_B = 25°C; I_F = 350 mA

Dominant Wavelength λ_{dom} [nm]			
Rank	**Red**	**Green**	**Blue**
22	620-630	515-520	455-460

Optical and Electronic Characteristics***

Ambient temperature T_A = 25°C, I_F = 350 mA

Parameter			Symbol	Red	Green	Blue	Unit
Luminous flux*		typ.	Φ_V	22	60	4.8	lm
Luminous flux**		typ.	Φ_V	19	57	4.7	lm
Luminous intensity*		typ.	I_V	12	17	1.5	cd
Luminous intensity**		typ.	I_V	9	16	1.5	cd
Dominant wavelength***		typ.	λ_{dom}	625	518	458	nm
Peak emission wavelength		typ.	λ_{peak}	638	513	452	nm
Spectral half bandwidth		typ.	$\Delta\lambda$	20	35	25	nm
Forward voltage per chip		typ.	V_F	2.3	6.6	3.3	V
Optical efficacy*		typ.	η_{opt}	27	25	4	lm/W
Optical efficacy**		typ.	η_{opt}	24	25	4	lm/W
Temperature coefficient	for λ_{dom}	typ.	$TC_{(\lambda\ dom)}$	0.05	0.05	0.04	nm/K
Temperature coefficient	for λ_{peak}	typ.	$TC_{(\lambda\ peak)}$	0.14	0.04	0.05	nm/K
Temperature coefficient	for V_f per chip	typ.	$TC_{(Vf)}$	- 2.6	- 4.4	- 4.3	mV/K
Viewing angle at 50%		typ.	2Ψ		130		degree
Radiating surface		typ.	A_{rad}	1.0	2x1.0	1.0	mm^2
Luminance*		typ.			690		Cd/cm^2
Luminance**		typ.			600		Cd/cm^2
Thermal resistance	junction - board	typ.	$R_{th\ JB}$		10		K/W

* Values for junction temperature T_J = 25°C

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

For intensity rank N; all colors operated separately

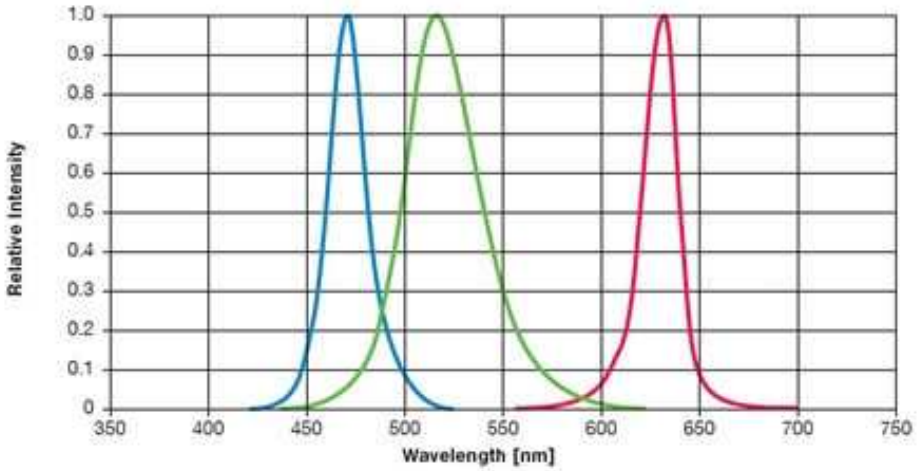
Adequate heat sink is required. Derating must be observed to maintain junction temperature below maximum.

Maximum Ratings at 25°C

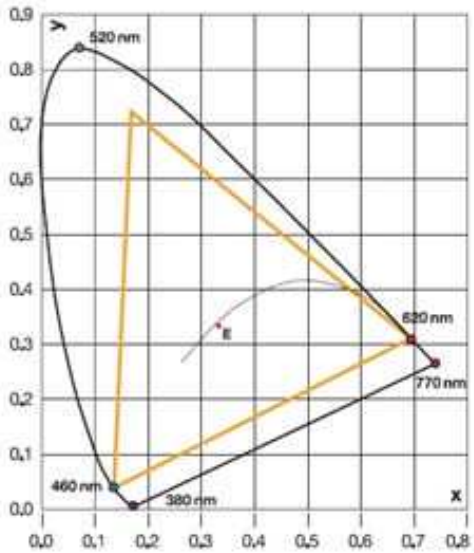
Parameter		Symbol	Value	Unit
Operating temperature range		T_{op}	-40 to 100	°C
Storage temperature		T_{st}	-40 to 100	°C
Junction temperature		T_J	125	°C
Forward current per chip		I_F	350	mA
Surge current per chip		I_{FM}	700	mA
Forward voltage per chip	@ 350 mA	V_F	3 (R) / 8 (G) / 3.8 (B)	V
Reverse voltage per chip		V_R	5	V
Reverse current (V_R=5 V)		I_R	2	µA
Power consumption	@ 350 mA	P_{tot}	5.2	W
ESD sensitivity			2	kV
Soldering temperature	Reflow (10 sec) Hand (3 sec.)	T_{sold} T_{sold}	260 400	°C

Tables of Characteristics

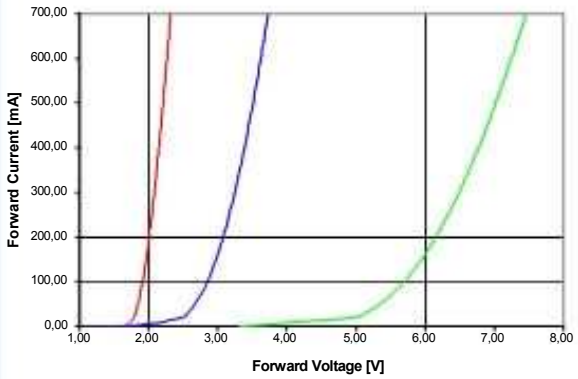
Typical Spectral Distribution (I_F = 350 mA, T_B = 25°C)



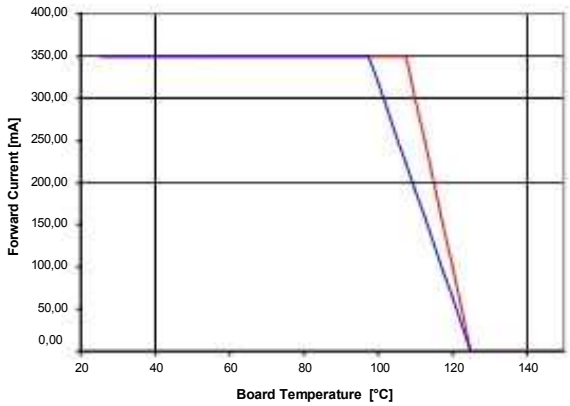
Color Coordinates ACULED® (CIE 1931)



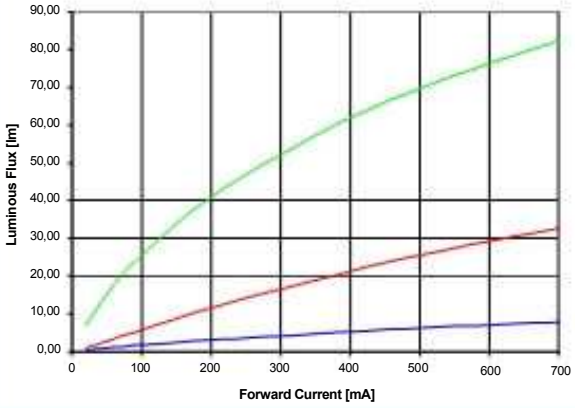
Forward Current I = f(V)



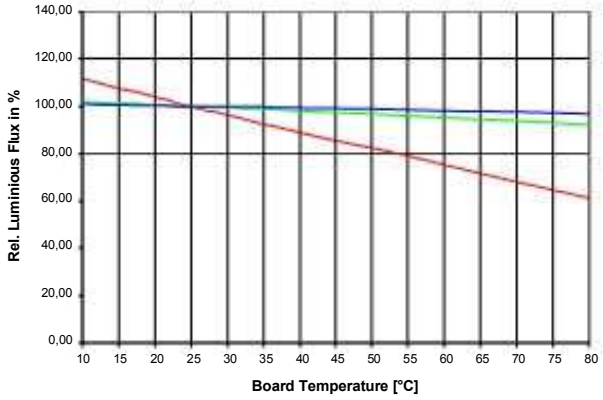
Maximum Forward Current / Chip $I_F = f(T_B)$



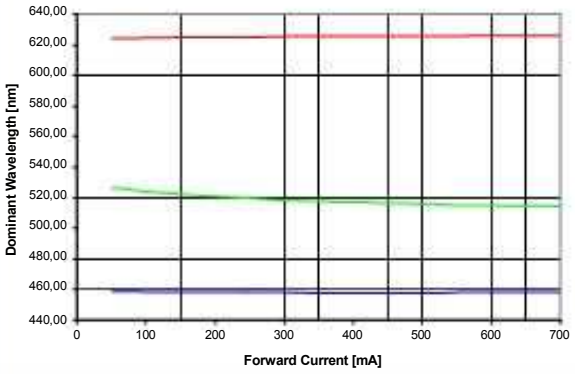
Luminous Flux $\Phi_V = f(I_F)$



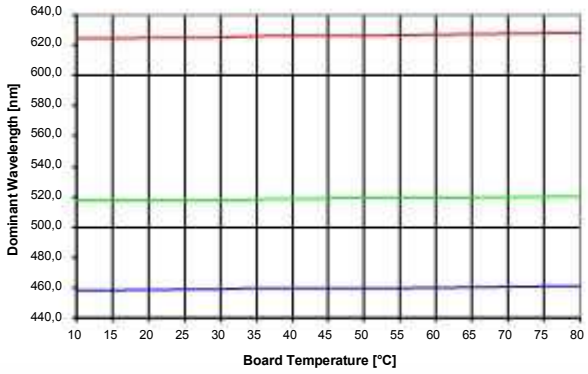
Relative Luminous Flux = $f(T_B)$



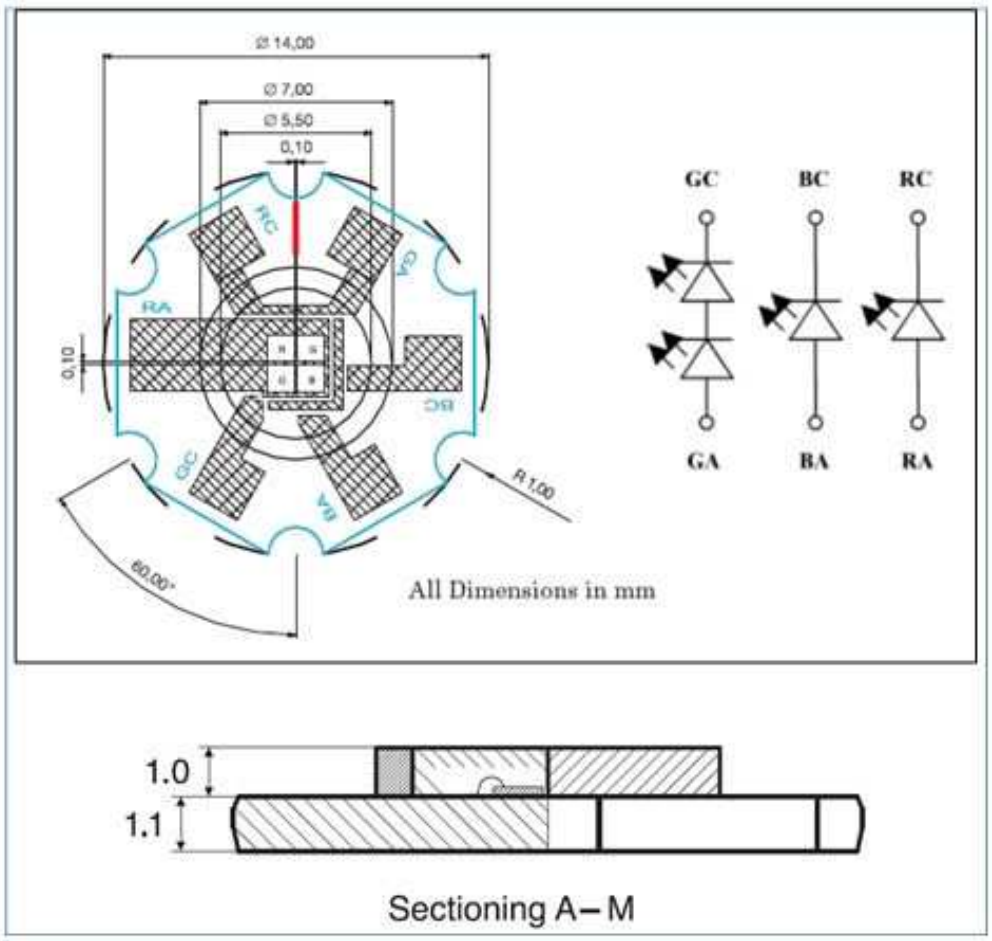
Dominant Wavelength $\lambda_{dom} = f(I_F)$



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



Mechanical and Electrical Specification



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 standard heat sink.

Soldering

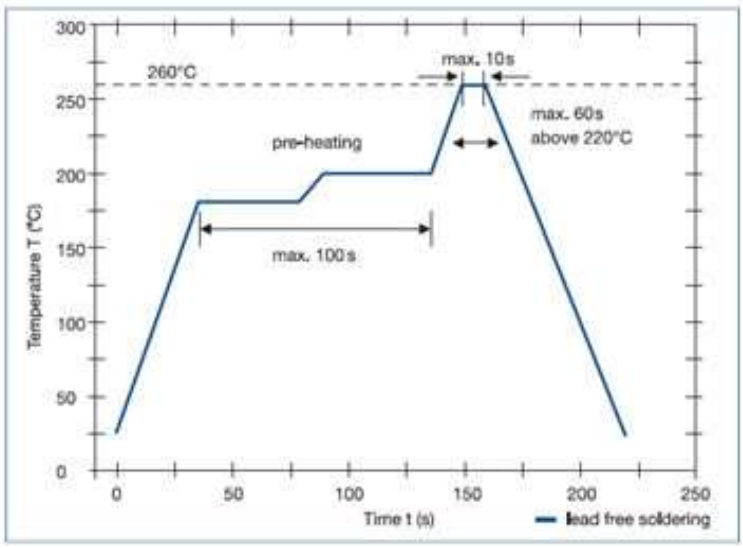


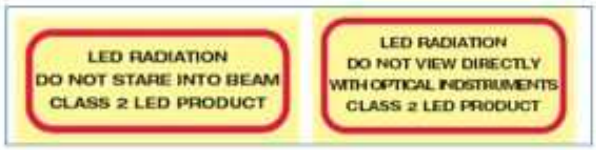
Figure 1
Reflow Soldering Profile

Hand Soldering

- Pre-heat ACULED on a hot plate at 100° C.
- Use 95 W soldering iron.
- Apply soldering temperature of 400° C for max. three seconds.

Cautions

Note: according IEC 60825-1 (EN 60826):
LED radiation. Do not view directly with optical instruments.

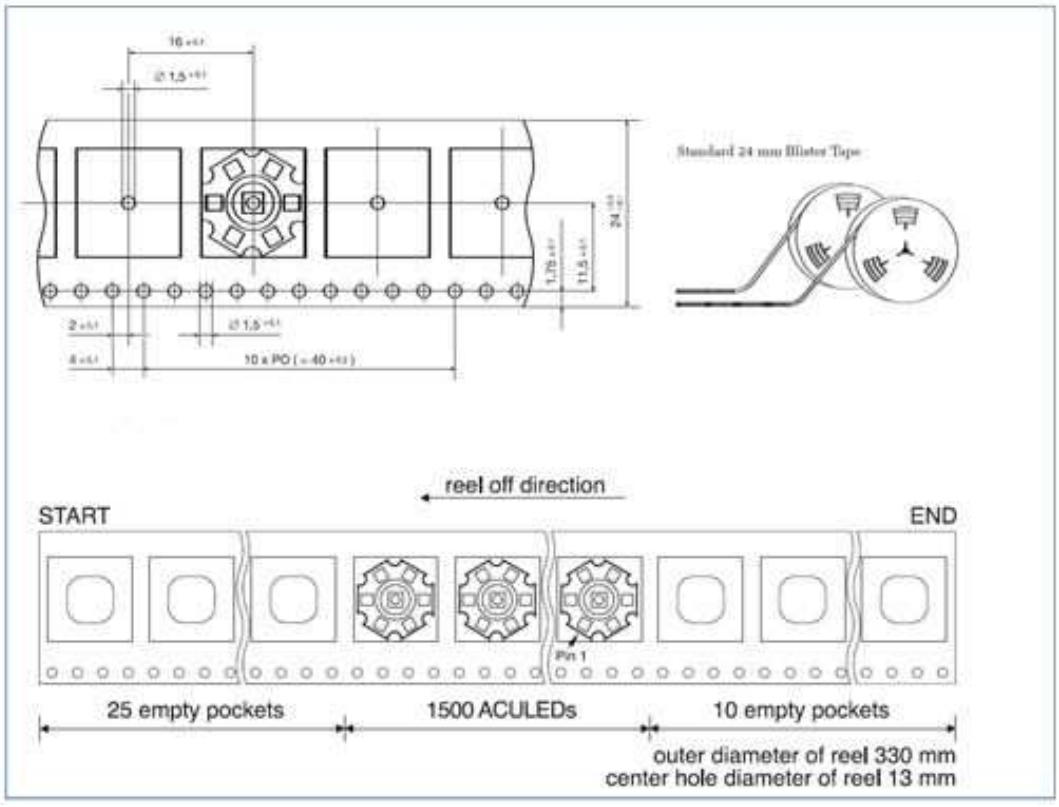


Notes

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. Green and blue chips are based on Indium Gallium Nitride (InGaN).
8. Red chips are based on Aluminum Indium Gallium Phosphide (AlInGaP).
9. Blue chips represented here are IEC825 class 2 for eye safety.
10. Proper current derating must be observed to maintain junction temperature below the maximum.
11. LEDs are not designed to be driven in reverse bias.
12. 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.
13. 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.
14. All drawings are not to scale.
15. All dimensions are specified in mm.
16. 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.

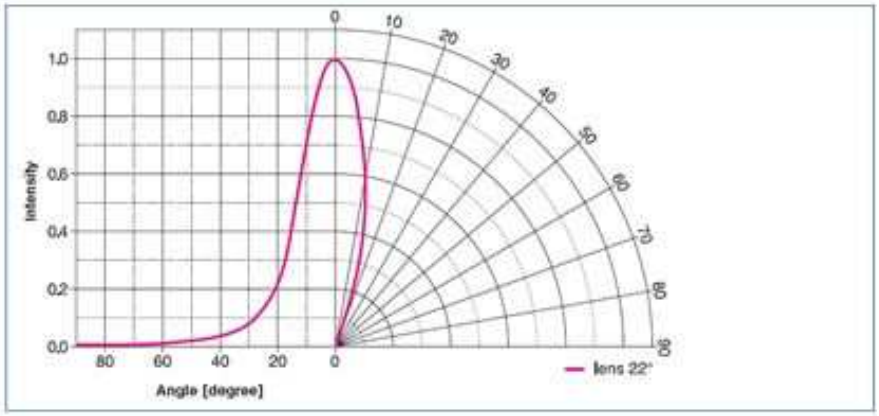


Figure 3
Opening Angle: Example RGB with Lens

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 350 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.

ACULED Evaluation Kit

Excelitas has designed an Evaluation 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 Evaluation Kit.

ACULED VHL™ - Very High Lumen for the ACULED

Additionally to the RGGB ACULED Excelitas has extended and improved its product line by the ACULED VHL, Excelitas' new line of standard monochromatic and multi-colored high powered LEDs. This results in improved chip types, higher brightness and additional features. Please refer to the ACULED VHL datasheets accordingly.

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

Excelitas is also debuting its exclusive new "Design-Your-Own" line, the ACULED® DYO™. The ACULED DYO gives customers the total flexibility to design their own fourchip 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.

North American Sales Office
Excelitas Technologies
35 Congress Street
Salem, MA 01970, USA
Telephone: +1 978-745-3200
Toll free: (North America) +1 800-950-3441
Fax: +1 978-745-0894
generalinquiries@excelitas.com
www.excelitas.com

European Headquarters
Excelitas Technologies
Wenzel-Jaksch-Str. 31
65199 Wiesbaden, Germany
Telephone: (+49) 611-492-247
Fax: (+49) 611-492-170

Asia Headquarters
Excelitas Technologies
47 Ayer Rajah Crescent #06-12
Singapore 139947
Telephone: (+65) 6775-2022
Fax: (+65) 6775-1008

For a complete listing of our global offices, visit www.excelitas.com

600034_07 DTS0108