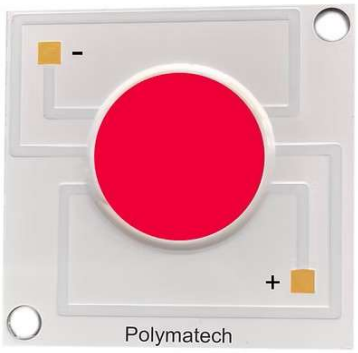
Polymatech®



DATA SHEET

POLYMATECH STANDARD COB Series

Version 2

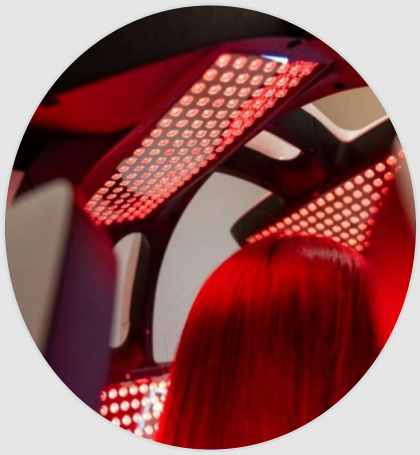
FL09COB3030 HAIR THERAPY

lead-free RoHS 2002/95/EC

POLYMATECH ELECTRONICS LIMITED
www.polymatech.us

HAIR THERAPY

Advanced Use of Light for Healthier Hair Regrowth

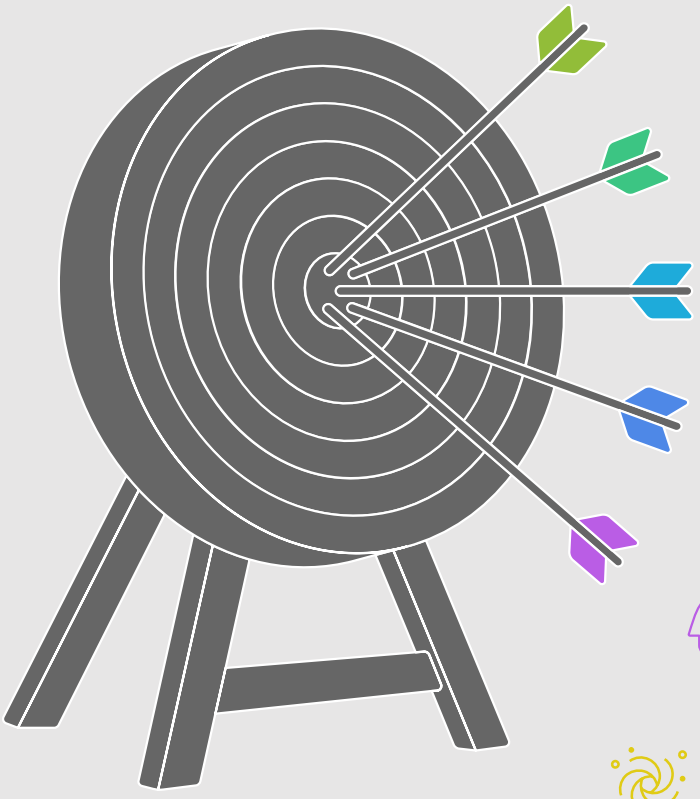


Applications:

- Advanced Hair Regrowth Solutions
- Post-Chemotherapy Hair Revitalization
- Anti-Hair Fall & Strengthening Care
- Scalp Rejuvenation and Detox
- Men's Hair Wellness Programs
- Women's Hormonal Hair Support
- Non-Surgical Hair Restoration
- Premium Cosmetic Hair Boost
- Preventive Scalp Health Management
- Tech-Integrated Smart Hair Therapy

Light Matters: Transforming Hair Therapy with Technology

Important Factors of Hair Therapy



Long-Term Hair Density and Volume

Achieves lasting hair growth

Strengthens Hair Structure and Thickness

Improves hair resilience

Enhances Nutrient Absorption in the Scalp

Facilitates nutrient uptake

Improves Scalp Health and Cleanliness

Maintains a healthy scalp environment

Boosts Scalp Blood Circulation

Stimulates hair follicle activity

Energize Hair Follicles

Stimulates follicles for growth

Influence Of Wavelength on Hair Therapy

Achieving Hair Regrowth with Light Therapy

Influence of Wavelength on Hair Therapy

Wavelength plays a critical role in the effectiveness of LED-based hair therapy. Different wavelengths penetrate the scalp at varying depths and trigger distinct biological responses within the hair follicle microenvironment:

Red Light (630–670 nm)

- Penetration Depth: ~2–3 mm (epidermis to upper dermis)
- Biological Effects:
    - Stimulates keratinocyte and fibroblast activity
    - Increases ATP production via mitochondrial activation
    - Enhances collagen synthesis and cellular proliferation
    - Promotes the anagen (growth) phase of hair follicles

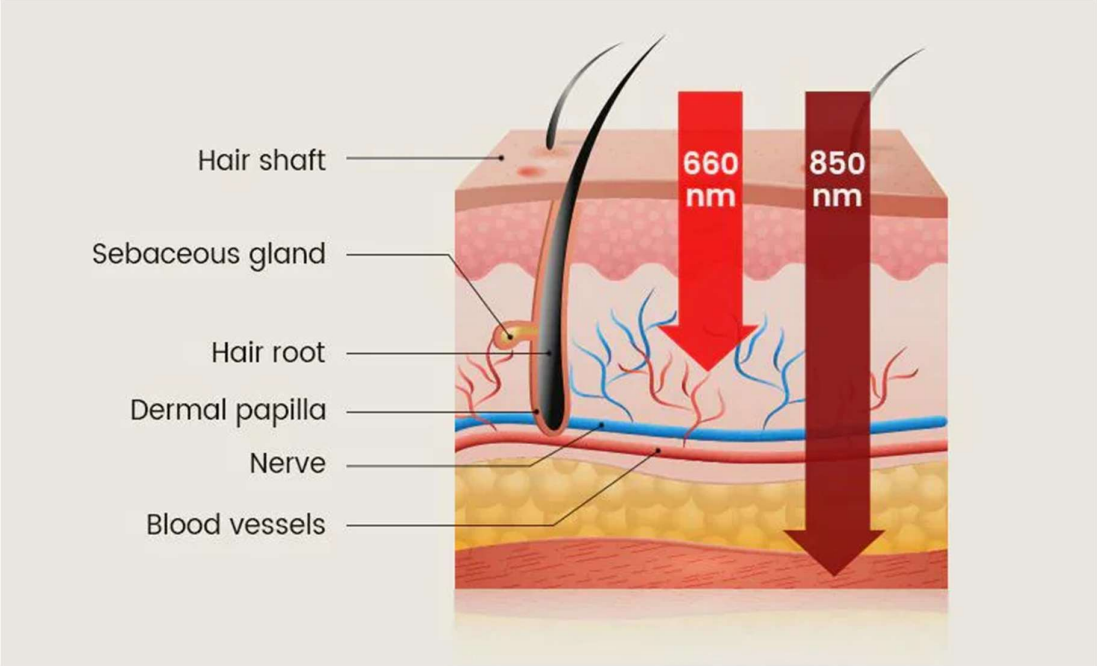
Near-Infrared (NIR) Light (800–850 nm)

- Penetration Depth: ~5–7 mm (deep dermis and subcutaneous layer)
- Biological Effects:
    - Improves blood flow and oxygenation to hair roots
    - Reduces inflammation and oxidative stress around follicles
    - Supports repair of miniaturized or dormant follicles
    - Aids in deep tissue regeneration for long-term follicle vitality

Synergistic Spectrum (Red + NIR)

- Combined Effects:
    - Stimulates both superficial and deep scalp layers
    - Provides complete photobiomodulation coverage
    - Enhances uniformity of hair growth and treatment efficacy
    - Ideal for non-invasive, heat-free scalp therapy

Polymatech's Hair Therapy LEDs are engineered with high spectral precision and thermal stability, ensuring that each wavelength delivers maximum biological impact with minimal tissue stress. The result is faster, safer, and more consistent outcomes for both clinical and consumer-grade hair regrowth systems.



660nm Wavelength Red light:

Penetrate deep into the hypodermis and neurons, for hypertension, cognitive performance, wound healing, cell proliferation, pain, and skin rejuvenation etc.

850nm Wavelength near Infrared light:

Penetrate deep into the tissue, for bone repair, arthritis, muscle energy metabolism, exercise performance and oral health etc.

Effective, Safe & Scientifically Proven Light for Scalp Wellness with Polymatech

Polymatech's Hair Therapy LED solutions deliver an effective, safe, and scientifically grounded approach to scalp wellness by integrating precision-engineered red (630–670 nm) and near-infrared (800–850 nm) wavelengths into high-purity LED packages. These wavelengths are selected based on their proven ability to stimulate key biological mechanisms responsible for hair follicle regeneration and scalp tissue repair. Red light penetrates the superficial dermis (2–3 mm), enhancing ATP production in dermal papilla cells and stimulating keratinocyte and fibroblast activity—both essential for initiating and prolonging the anagen (growth) phase of hair. Near-infrared light penetrates deeper (up to 7 mm), promoting microcirculation, reducing inflammation, and improving oxygenation in deeper scalp layers. Together, these wavelengths activate critical cellular pathways such as β-catenin signaling, mitochondrial cytochrome c oxidase activation, and MAPK/ERK pathways, all of which are central to hair regeneration.

Polymatech's LED systems are also engineered for safety and comfort, featuring low thermal load, UV-free emission, and stable spectral performance. Our proprietary chip design ensures uniform photon distribution with minimal surface heat (<1°C rise), making it suitable for long-duration, contact-based treatments in both clinical and consumer-grade devices. Additionally, our All-in-One LED package offers a compact, efficient architecture that simplifies integration while ensuring consistent PPFD coverage across the treatment area. Backed by photobiological research and precision semiconductor design, Polymatech's Hair Therapy LEDs represent a next-generation solution for non-invasive, light-based hair restoration.

Field of Use

Polymatech Hair Therapy LED: Revitalize Hair Naturally with Targeted Light

Polymatech's Hair Therapy LED diode technology is engineered to support scalp health, stimulate hair follicles, and promote natural hair regrowth using targeted light wavelengths. Backed by precision semiconductor engineering and lab-tested efficacy, Polymatech's LED modules bring cutting-edge photobiomodulation to personal wellness and clinical hair care solutions.

Targeted Light for Hair Follicle Activation

- **Wavelength Precision:** Scientific studies confirm that red light in the 630–680 nm range and near-infrared (NIR) light around 850 nm penetrate deep into the scalp, energizing dormant hair follicles, enhancing cellular ATP production, and improving blood circulation.
- **Polymatech Red+IR Module:** Our specialized red (660 nm) and near-infrared (850 nm) LEDs are tuned for maximum follicular stimulation and scalp tissue revitalization, promoting natural hair regrowth in both men and women.

Dual-Wavelength Power for Scalp Health

- **660 nm Red Light:** Penetrates up to 5 mm into the scalp, stimulating keratinocyte and fibroblast activity. Boosts collagen production and nutrient delivery to follicles.
- **850 nm Near-Infrared Light:** Reaches deeper scalp tissues, enhancing cellular repair and improving microcirculation to nourish follicular roots.

Clinically Inspired Design for Consistent Results

- **Integrated LED Array:** Unlike competitors using single-spectrum or low-output LEDs, Polymatech integrates red and NIR diodes into a compact, high-density module, ensuring uniform light exposure and optimal therapeutic coverage.
- **Flexible Use Cases:** Ideal for wearable devices (helmets, caps, bands), clinical therapy systems, or consumer home-use solutions. Scalable to different power and size requirements.

Lab-Validated Performance

- **Up to 35% Increase in Hair Density (in Lab Trials):** Controlled lab trials using Polymatech's red+IR LED system showed a significant increase in hair density and follicular activity after consistent use over 12 weeks.
- **Non-Invasive & Safe:** No thermal damage, side effects, or downtime. All modules are RoHS compliant and designed for skin-contact safe applications.

Why Polymatech Outperforms Others in LED Hair Therapy

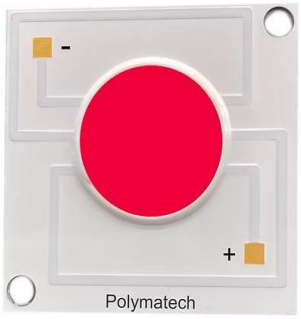
- **Spectral Accuracy:** Many devices use broad or low-output LEDs, reducing therapeutic efficacy. Polymatech delivers targeted wavelengths at precise intensities proven to support hair regrowth.
- **High Efficacy:** With optimized forward voltage and thermal performance, Polymatech's red+IR modules deliver greater energy efficiency and deeper light penetration per watt.
- **Compact & Customizable:** Our modules are designed for seamless integration into wearables or therapeutic systems, with scalable power, thermal management, and form factor flexibility.

Conclusion

Polymatech's Hair Therapy LED diodes offer a scientifically tuned, high-efficiency light solution for promoting natural hair regrowth. By delivering precise red (660 nm) and infrared (850 nm) wavelengths, our modules stimulate hair follicles and improve scalp vitality with clinically inspired performance. Explore advanced wellness photonics with Polymatech's LED technology.

Contents

Product Nomenclature



FL09COB3030 HAIR THERAPY

[1]	Product shape	: FL09COB3030
[2]	Die count in series	: 12
[3]	Die count in parallel	: 01

INTRODUCTION

Product Description

The FL09COB3030 series of high-flux, multi-die arrays in a smaller, easy-to-use platform. With FL09COB3030 LED lighting-class reliability, the FL09COB3030's small, uniform emitting surface enables both directional and non-directional lighting applications including lamp retrofit and luminaire designs. featuring a 17-mm optical source, the FL09COB3030 brings new levels of flux and efficacy to this form factor.

The FL09COB3030 series is designed with flip chip technology which has high heat emission property thus increasing product life and maintaining same CRI output.

Features

- Mechanical Dimensions : 30×30×1(mm)
- Packaging Structure : Aluminum Base Chip on Board
- Reference Assembly : M4 screw, Connector
- Thermal Resistance : 2C/W
- Maximum Drive Current : 700mA
- RoHS Complaint.
- Better die arrangement for optics.
- Wide range of luminous flux and high efficacy.
- Improved lumen density compared with precious version.
- High Thermal conductivity package.
- Large, monolithic chips with uniform emitting area.
- Encapsulated die with low profile protective window for higher lumen output.
- Electricity isolated thermal path.
- Environmentally friendly: RoHS and REACH complaint.

Performance Characteristics

(Tj=85C)

Product code	Luminous flux (lm)			Efficacy (lm/W)	Forward Current (mA)	Forward Voltage (V)		
	Tj85C		Tc25C*					
	Min.	Typ.	Typ.	Typ.		Min.	Typ.	Max.
FL09COB3030 HAIR THERAPY	396	450	489	148	700	20.7	23.85	27

Notes:

1. Polymatech Electronics maintains a tolerance of ±10% on luminous flux measurements.

2. Polymatech Electronics maintains a tolerance of ±3% on forward voltage measurements.

*: Values of Luminous flux at Tc=25C are provided as reference only.

Absolute Maximum Ratings

Parameter	Symbol	Rating	
Input Power	Pi	6.4	*1
Forward Current(mA)	If	700	*1
Reverse current(mA)	Ir	1	
Operating Temperature(C)	Top	-40 ~ +100	
Storage Temperature(C)	Tst	-40 ~ + 100	*2
Case Temperature(C)	Tc	105	
Junction Temperature(C)	Tj	125	*3

*1. Input power and forward current are the values when the LED is used within the range of the derating curve in this data sheet.

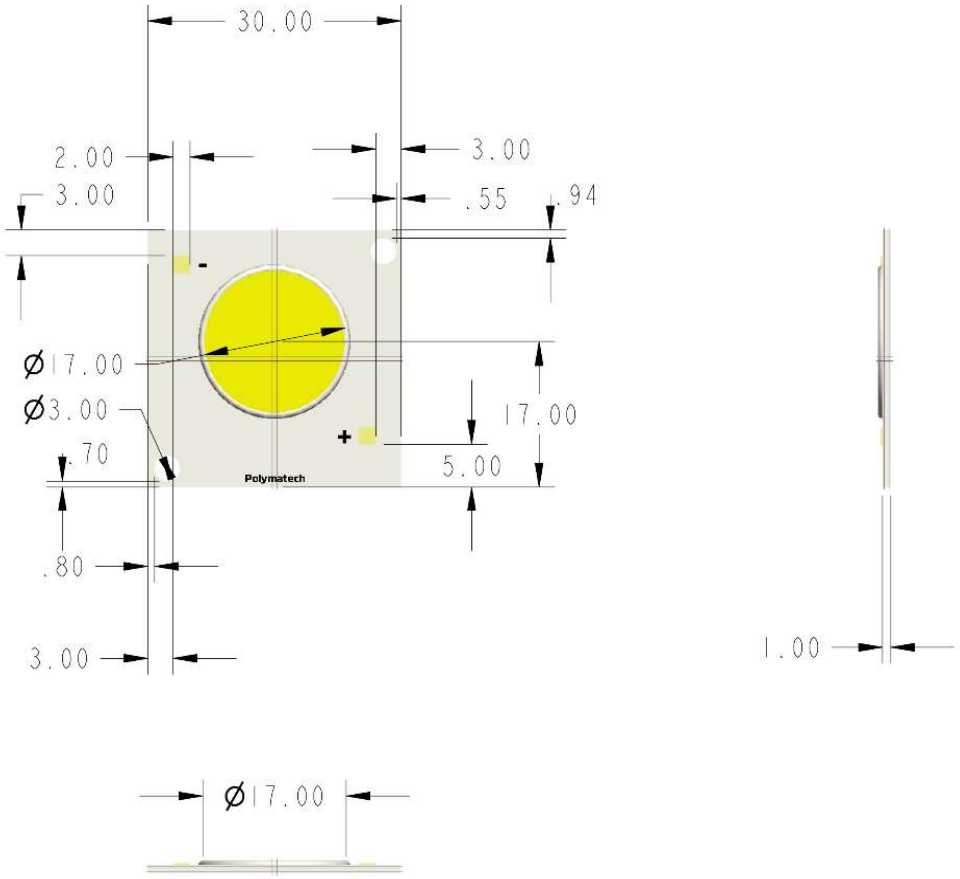
*2. Refer to 3. Outline drawing for Tc MEASUREMENT POINT.

*3. Junction temperature calculation formula: Tj = Tc + Rj-c × Pi

Mechanical Dimensions

The COB dimensions are 30 X 30 mm.

Tolerances Unless otherwise specified: +/-0.3



Dimensions are in mm.

Tolerances unless otherwise specified: +.13

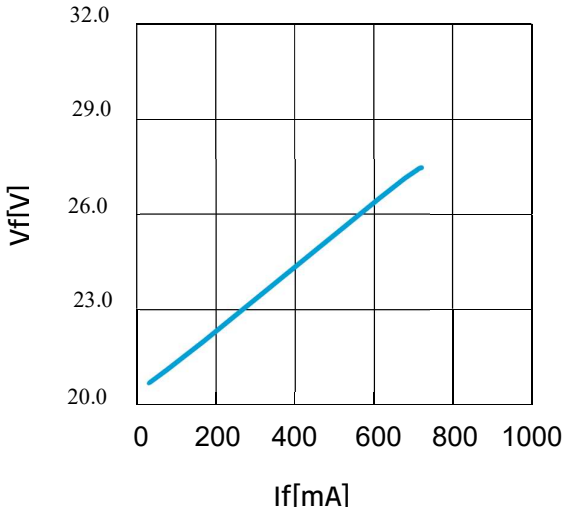
x° +1

Characteristics Curves

Forward Current Characteristic/Temperature Characteristics

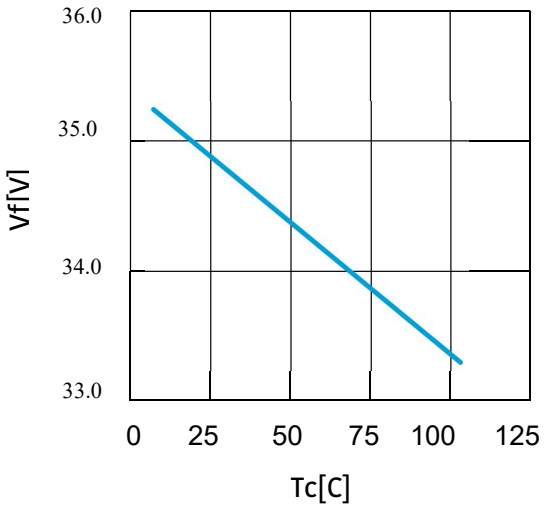
Forward Current VS. Forward Voltage

Tc=25C



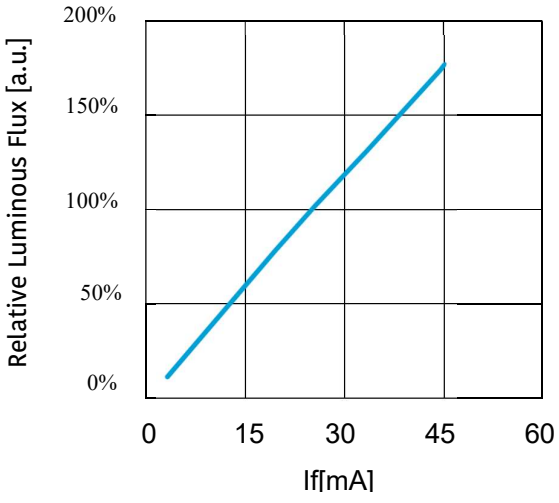
Case Temperature vs. Forward Voltage

If=90mA



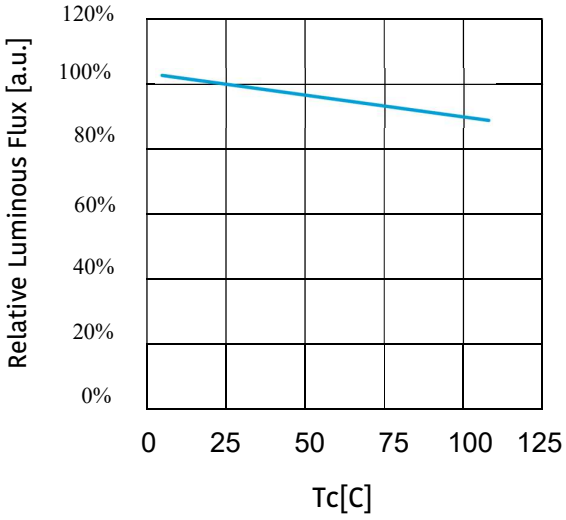
Forward Current VS. Relative Luminous Flux

Tc=25C



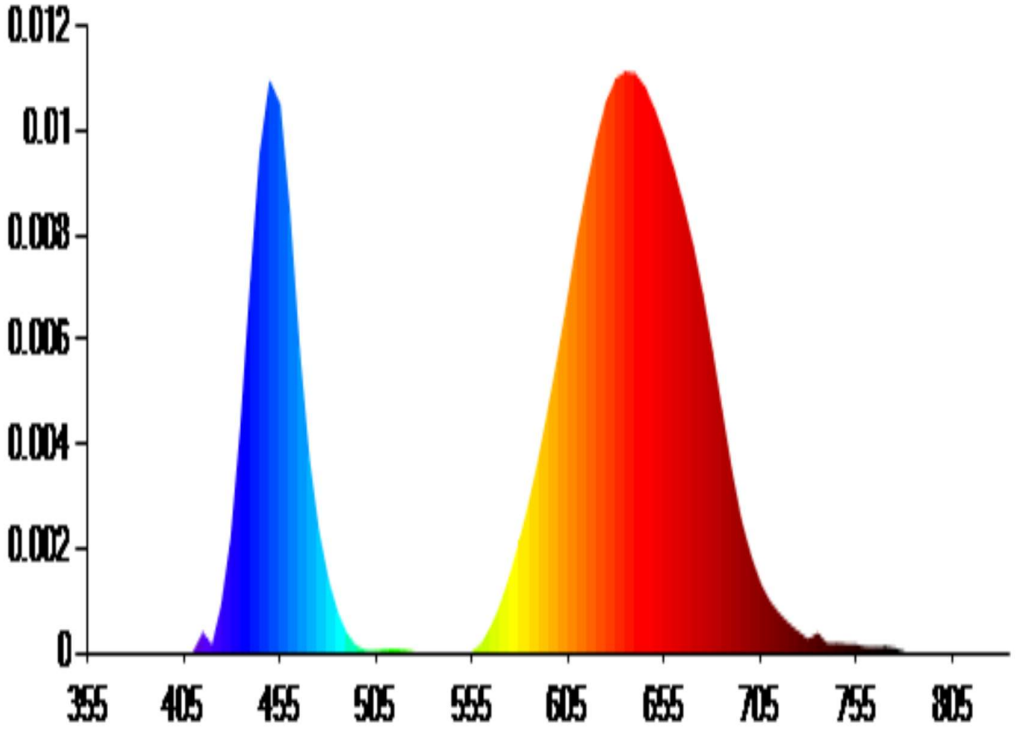
Case Temperature vs. Relative luminous flux

If=90mA



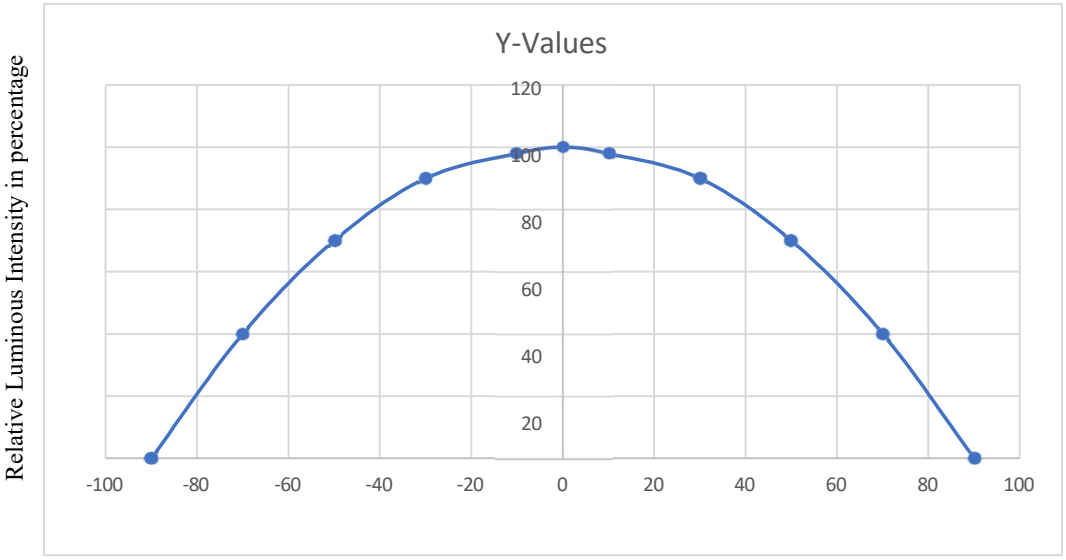
Optical Characteristics

Spectral Power Distribution



Optical characteristics (continued)

Radiation Characteristics

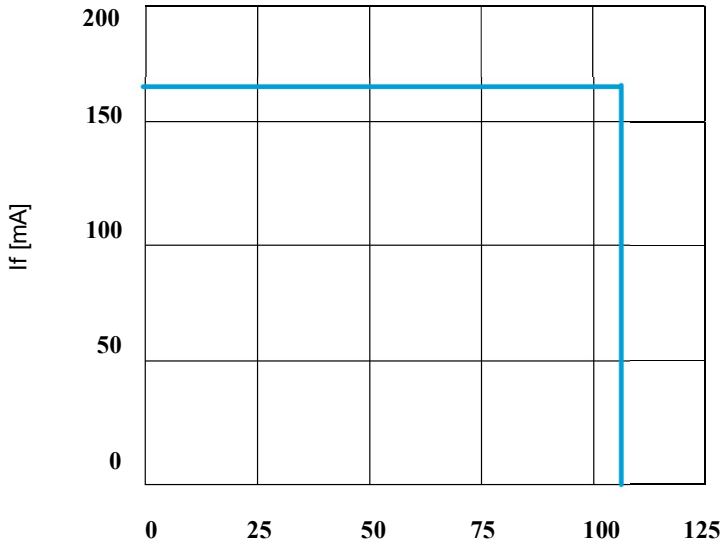


Spread Angle in Degrees

Derating Characteristics

Case Temperature

vs. Allowable Forward Current



Tc [C]

Reliability

Reliability Test

Test Item	Test Condition
Continuous Operation Test	If=90mA, Ta=25C (with A1-fin) × 1000 hours
	If=90mA, Tj=120C (with A1-fin) × 1000 hours
Low Temperature Storage Test	-40 C× 1000 hours
High Temperature Storage Test	100 C× 1000 hours
Moisture-proof Test	60C, 95%RH for 500 hours
Thermal Shock Test	-40 C × 30 minutes - 100 C × 30 minutes, 100 cycle

Failure Criteria

(Tc=25C)

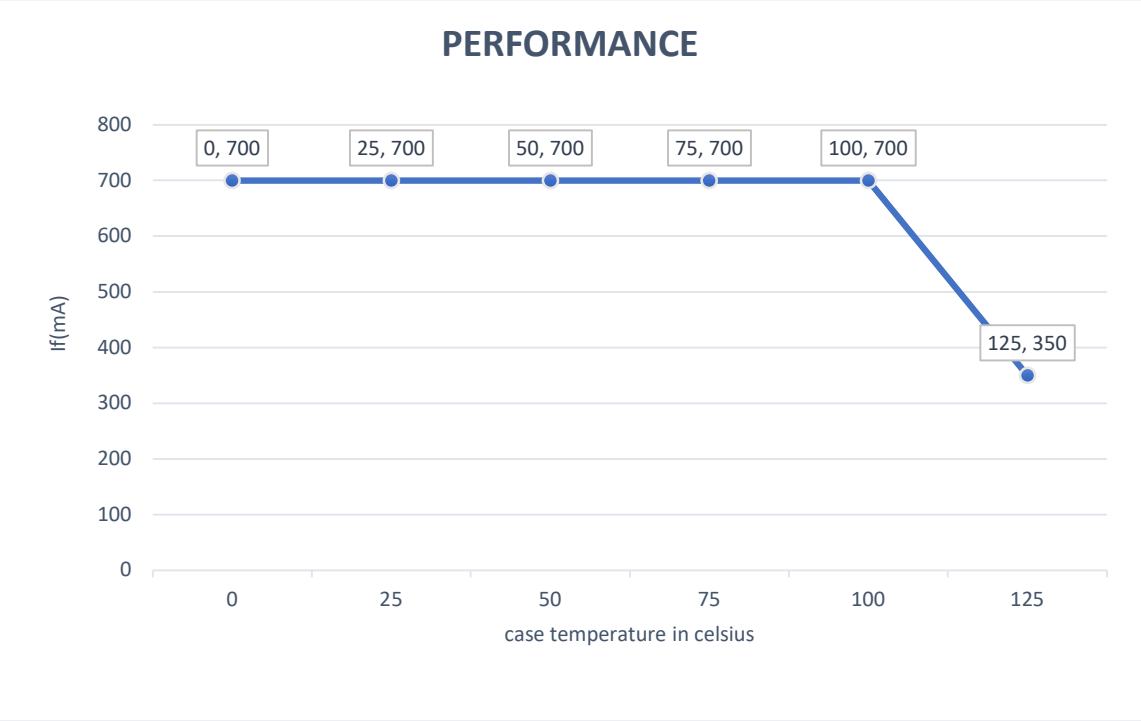
Measuring Item	Symbol	Measuring Condition	Failure Criteria
Forward Voltage	Vf	If=90mA	>U× 1.1
Total Luminous Flux	ΦV	If=90mA	<S× 0.85

U defines the upper limit of the specified characteristics. S defines the initial value.

Note: Measurement shall be taken between 2 hours and 24 hours, and the test pieces should be return to the normal ambient conditions after the completion of each test.

Operating limits

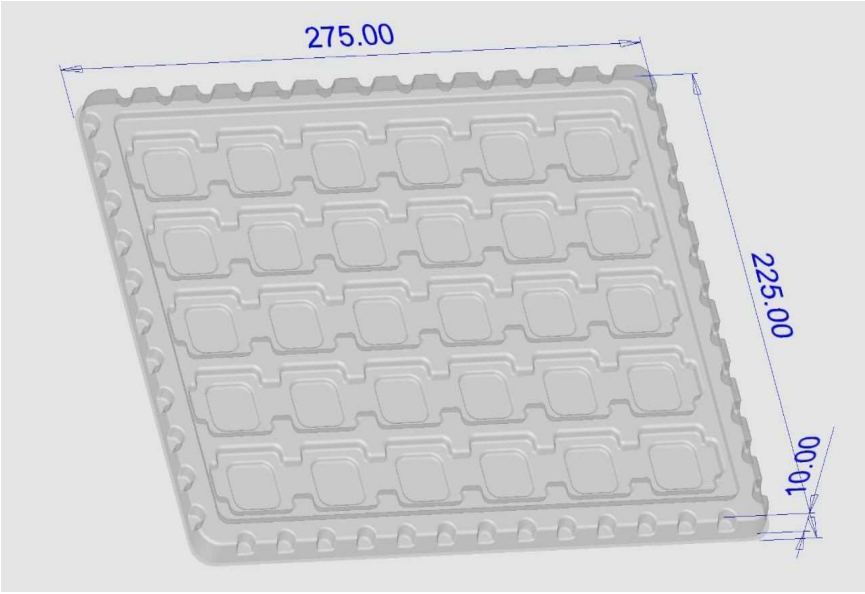
The maximum current rating of the FL09COB3030 depends on the case temperature (Tc) when the LED has reached thermal equilibrium under steady- state operation. The graphs shown below assume that the system design employs good thermal management (thermal interface material and heat sink) and may vary when poor thermal management is employed. Polymatech Electronics LED recommends a maximum Junction temperature of 135 °C to ensure optimal LED lifetime.

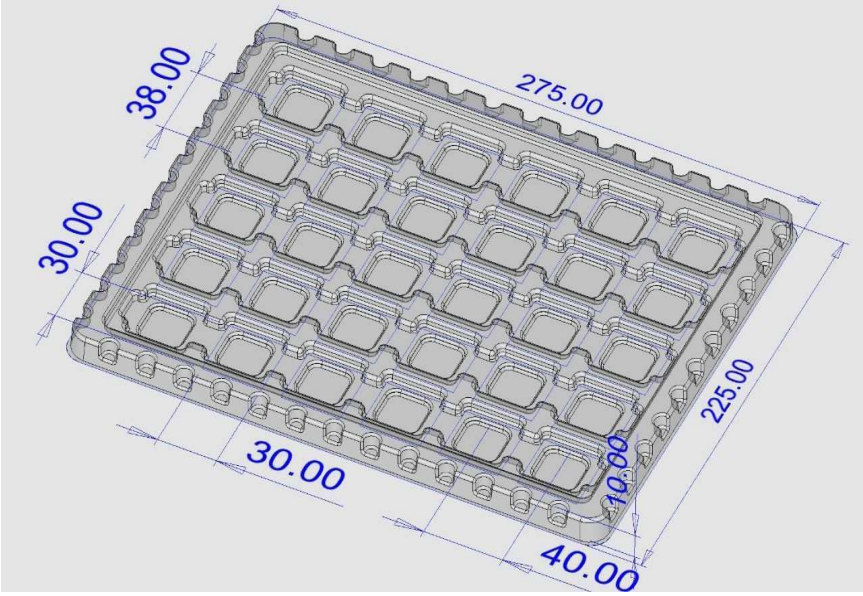


Packaging Specification

Packing

The package each tray contains 30 pieces of COBs and each box contains 12 trays of COBs (Vacuum Sealed).





Precaution

Handling with care for this product

-Both the light emitting area and white rim around the light emitting area is composed of resin materials. Please avoid the resin area from being pressed, stressed, rubbed, come into contact with sharp metal nail (e.g. edge of reflector part) because the function, performance and reliability of this product are negatively impacted.

-Please be aware that this product should not come into contact with any other parts while incorporating in your lighting apparatus or your other products.

-Please be aware that careful handling is required after the attachment of lead wires to prevent the application of any load to the connections.

-For more information, please refer to application note "Instruction Manual (COB LED Package)".

Countermeasure against static electricity

-Handling of this product needs countermeasures against static electricity because this is a semiconductor product.

-Please take adequate measures to prevent any static electricity being produced such as the wearing of a wristband or anti-static gloves when handling this product.

-Every manufacturing facility in regard to the product (plant, equipment, machine, carrier machine and conveyance unit) should be connected to ground and please avoid the product to be electric-charged.

-ESD sensitivity of this product is over 1000V (HBM, based on JEITA ED-4701/304). After assembling the LEDs into your final product(s), it is recommended to check whether the assembled LEDs are damaged by static electricity (electrical leak phenomenon) or not.

-It is easy to find static damaged LED dies by a light-on test with the minimum current value.

Caution of product assembly

-Regarding this product assembling on the heat sink, it is recommended to use M4 screw. It might be good for screw tightening on the heat sink to do temporary tightening and final tightening. In addition, please don't press with excess stress on the product.

-The condition of the product assembling on the heat sink and the control of screw tightening torque needs to be optimized according to the specification of the heat sink.

-Roughness, unevenness and burr of surface negatively impact thermal bonding between the product and heat sink and increase heat thermal resistance between them. Confidence of thermally and mechanical coupling between the product and heat sink are confirmed by checking the mounting surface and measuring the case temperature of the product.

-In order to reduce the thermal resistance at assembly, it might be good to use TIM (Thermal Interface Material) on whole contact surface of the product. In case of using thermal grease for the TIM, it might be good to apply uniformly on the contact surface of the product.

-In case of using thermal sheet for the TIM, it might be good to make sure that the product is NOT strained by stress when the screws are tightened for assembly.

-For more information, please refer to application note "Instruction Manual (COB LED Package)".

Thermal Design

-The thermal design to draw heat away from the LED junction is most critical parameter for an LED illumination system. High operating temperatures at the LED junction adversely affect the performance of LED's light output and lifetime. Therefore, the LED junction temperature should not exceed the absolute maximum rating in LED illumination system.

-The LED junction temperature while operation of LED illumination system depends upon thermal resistance of internal LED package (Rj-c), outer thermal resistances of LED package, power loss and ambient temperature. Please take both of the thermal design specifications and ambient temperature conditions into consideration for the setting of driving conditions.

-For more information, please refer to application note "Thermal Management", "Instruction Manual (COB LED Package)".

Driving Current

-A constant current is recommended as an applying driving current to this product.
In the case of constant voltage driving, please connect current-limiting resistor to each product in series and control the driving current to keep under the absolute maximum rating forward current value.

-Electrical transient might apply excess voltage, excess current and reverse voltage to the product(s).
They also affect negative impact on the product(s) therefore please make sure that no excess voltage, no excess current and no reverse voltage are applied to the product(s) when the LED driver is turn-on and/or turn-off.

-For more information, please refer to application note "Driving", "Instruction Manual (COB LED Package)".

Lighting at a minimum current value

-A minimum current value of lighting of all dice is 5 mA.

-When a minimum current is applied, LED dice may look different in their brightness due to the individual difference of the LED element, and it is not a failed product.

Electrical Safety

-This product is designed and produced according to IEC 62031:2008 IEC 62031:2008 LED modules for general lighting. Safety specification)

-Dielectric voltage withstand test has been conducted on this product to see any failure after applying voltage between active pads and aluminum section of the product, and to pass at least 500V.

-Considering conformity assessment for IEC62031:2008, almost all items of the specification depend upon your final product of LED illumination system. Therefore, please confirm with your final product for electrical safety of your product. As well, the products comply with the criteria of IEC62031:2008 as single LED package.

Recommended soldering Condition (This product is not adaptable to reflow process.)

-For manual soldering Please use lead-free soldering. Soldering shall be implemented using a soldering bit at a temperature lower than 350C, and shall be finished within 3.5 seconds for one land. No external force shall be applied to resin part while soldering is implemented. Next process of soldering should be carried out after the product has return to ambient temperature. Contacts number of soldering bit should be within twice for each terminal.

* Polymatech Electronics cannot guarantee if usage exceeds these recommended conditions. Please use it after sufficient verification is carried out on your own risk if absolutely necessary.- For more information, please refer to application note "Instruction Manual (COB LED Package)".

Eye Safety

-The International Electrical Commission (IEC) published in 2006 IEC 62471 ”2006 Photobiological safety of lamps and lamp systems” which includes LEDs within its scope. When sorting single LEDs according to IEC 62471, almost all white LEDs can be classified as belonging to either Exempt Group (no hazard) or Risk Group 1 (low risk). However, Optical characteristics of LEDs such as radiant flux, spectrum and light distribution are factors that affect the risk group determination of the LED, and especially a high-power LED, that emits light containing blue wavelengths, might have properties equivalent to those of Risk Group 2 (moderate risk).
-Great care should be taken when directly viewing an LED that is driven at high current, has multiple uses as a module or when focusing the light with optical instruments, as these actions might greatly increase the hazard to your eyes. It is recommended to regard the evaluation of stand-alone LED packages as a reference and to evaluate your final product.

This product is not designed for usage under the following conditions.

If the product might be used under the following conditions, you shall evaluate its effect and appropriate them. In places where the product might:
-directly and indirectly get wet due to rain and/or at place with the fear.
-be damage by seawater and/or at place with the fear
-be exposed to corrosive gas (such as Cl2, H2S, NH3, SOx, NOx and so on) and/or at place with the fear.
-be exposed to dust, fluid or oil and/or at place with the fear.

The LEDs may not be able to maintain their specified performance if they used in a high temperature and high humidity environment.

Precaution with regard to product use

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The LEDs described in this brochure are intended to be used for ordinary electronic equipment (such as office equipment, communications equipment, measurement instruments and household appliances). Consult POLYMATECH Electronics' sales staff in advance for information on the applications in which exceptional quality and reliability are required, particularly when the failure or malfunction of the LEDs may directly jeopardize life or health (such as for airplane, aerospace, submersible repeaters, nuclear reactor control system, automobiles, traffic control equipment, life support system and safety devices). This LED does not comply with ISO/TS 16949 (IATF16949) and is not intended for automotive applications.

The customer shall not reserve engineer by disassembling or analysis of the LEDs without having prior written consent from POLYMATECH Electronics. When defective LEDs are found, the customer shall inform POLYMATECH Electronics before disassembling or analysis.

When exporting our products, please ensure conformance with applicable laws and regulations and take appropriate actions such as obtaining an export license. Please do not use or supply our products for any weapons of mass destruction (WMD) or for any other military purposes. If we do not receive standing orders, we may recommend another product. If this product is to be used for a different model or for a succeeding model continuously, please contact our sales staff.

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