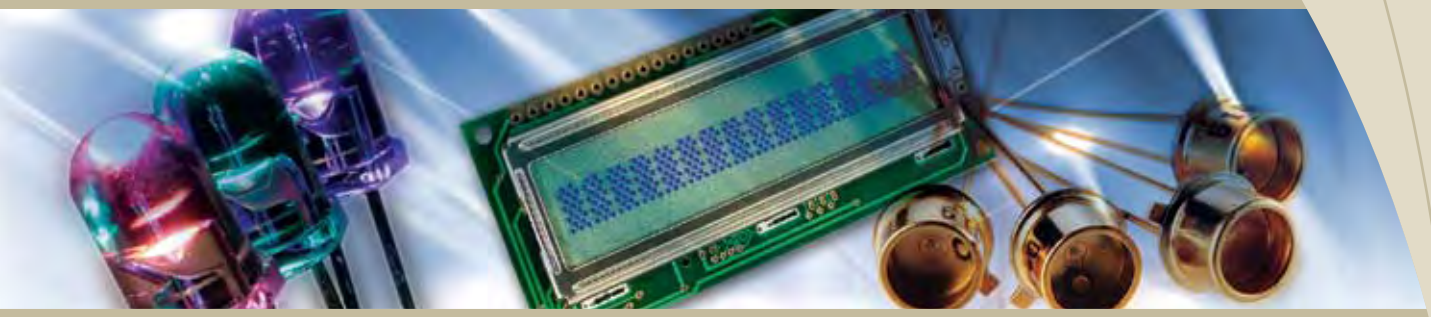
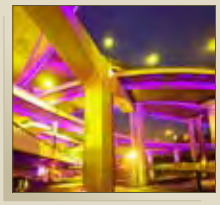


LED and LCD Design Guide

Issue 1 V.0211






ISO 9001 :2008

LUMEX®
Creating LED and LCD Solutions Together™

Lumex, a member of the ITW Photonics Group

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LUMEX®
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About Lumex

For over 30 years, Lumex, a member of the ITW Photonics Group, has been a global leader in the optoelectronics industry. With the broadest range of high efficiency, high performance LEDs and LCDs in the industry, Lumex provides thousands of standard products and specializes in semi-custom and custom designs.

Lumex's optical range encompasses a wide spectrum including UV, visible and infrared wavelengths.

Lumex's Technical Design Specialists are experts in collaboratively developing effective, smart solutions to design dilemmas. Lumex is unique in the market due to the unprecedented level of complimentary technical support provided to large and small customers alike. Lumex works closely with clients to identify the best standard or customized technology for each specific application need.

Global Headquarters
Palatine, IL, USA

Asia Headquarters
Taiwan

Manufacturing Facilities
United States, China, Taiwan, Thailand

Countries Served
24 countries in the Americas, Europe and Asia

Markets Served
Over 23 industries

Customers Served
More than 80,000

ISO 9001
Lumex received its initial ISO 9001 registration in 1996.

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ITW Photonics Group www.itwphotonicsgroup.com

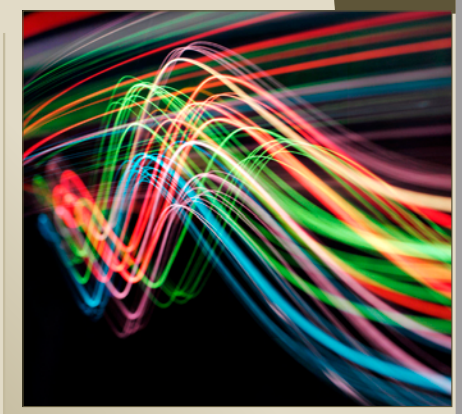
The ITW Photonics Group was created to bring together and build on the technical expertise of individual companies that specialize in photonics technology and span the full spectrum of wavelengths. The group consists of:

- **Lumex** - LED and LCD technology
  Optical range encompasses visible infrared wavelengths of 355 nm through 1,720 nm
- **Cal Sensors** - IR Detector and Emitter Technology
  Detectors are sensitive in the 1 to 5.5 micron wavelength region. Standard emitter wavelengths can range from 2.5 microns to 10 microns, although possible maximum wavelength is infinite without optical window
- **Opto Diode Corp** - LED, Silicon Photodiodes and Electro-Optical Assembly technology
  Product speciality wavelength range runs from 365 nm to 1,000 nm

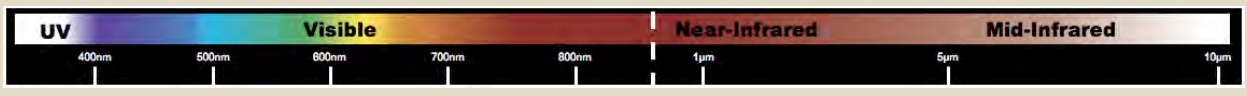
The synergy of these three industry front-runners provides an unsurpassed range of photonic capabilities within a broad spectrum of markets, including medical, military and industrial controls.

The ITW Photonics Group provides integrated solutions that encompass the technology and experience from all three business units, offering design engineers higher performance with greater feature enhancements. When integrating technology from multiple business units, the ITW Photonics Group can provide significant cost savings, enhanced technology performance and reduced time to market.

The ITW Photonics Group has a global footprint and is headquartered in Palatine, IL, USA. For more information on the ITW Photonics Group, go to **www.itwphotonicsgroup.com**



Range of Product Wavelengths



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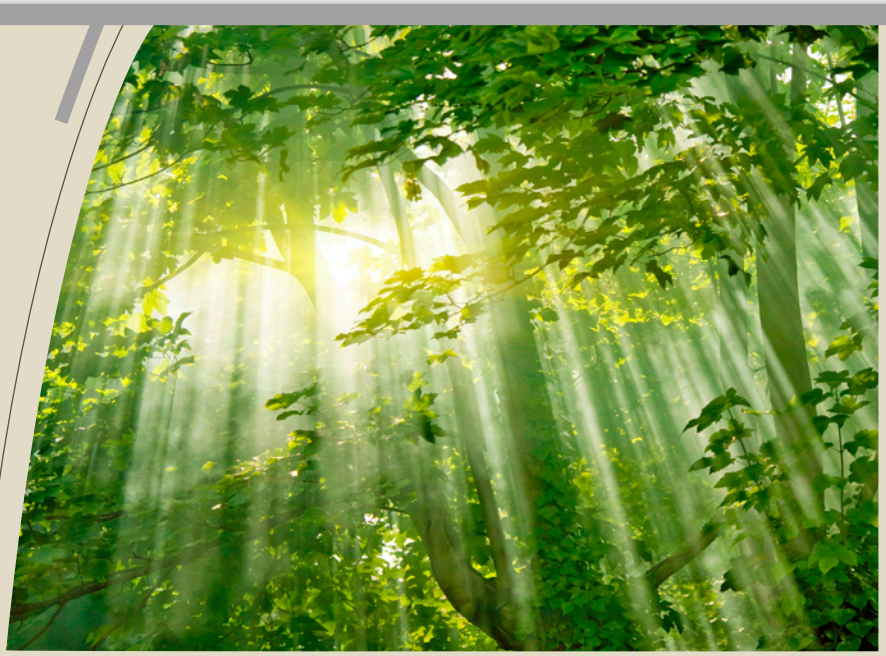
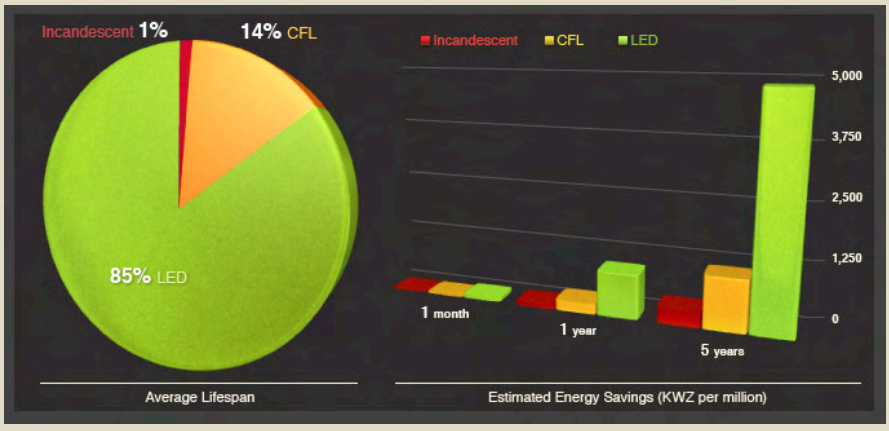


The Green Advantage

The term "going green" has come to mean many things to different people in different industries. From small lifestyle changes to radical alterations in how companies configure their manufacturing lines, going green is evident in every aspect of daily life. Green initiatives have global visibility, global impact and make good business sense.

At Lumex, going green means advancing technologies and solutions that reduce, minimize or attempt to reverse the potential negative impact of technology on the planet. Even as user interfaces continually become more detailed and sophisticated, there are ways to ensure that we all play a role as responsible citizens. The LEDs, LCDs, back lights and light pipes that Lumex makes contribute to going green in several ways:

1. Once designed in, they may never have to be replaced in the lifetime of the equipment, reducing maintenance and waste



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2. LEDs use 50% less energy than a traditional lighting source like incandescent or fluorescents
3. Higher efficiency/higher brightness LED and LCD solutions means you can get more for less
4. Lower power consumption means fewer greenhouse gas emissions
5. Lower power consumption means greater battery life on portable and disposable equipment
6. They contain no toxic mercury
7. The vast majority are lead free

The best example of the positive impact LED technology can have on the environment in the short and long term is LED lighting. A 13 watt LED lamp produces 450 to 650 lumens which is equivalent to a standard 40 watt incandescent bulb. A standard 40 W incandescent bulb has an expected lifespan of 1,000 hours while an LED can continue to operate with reduced efficiency for more than 50,000 hours, 50 times longer than the incandescent bulb.

According to the US Department of Energy, a single kilowatt-hour of electricity will generate 1.34 pounds (610 g) of CO_2 emissions. Assuming the average light bulb is on for 10 hours a day, a single 40-watt incandescent bulb will generate 196 pounds (89 kg) of CO_2 every year. The 13-watt LED equivalent will only be responsible for 63 pounds (29 kg) of CO_2 over the same time span. A building's carbon footprint from lighting can be reduced by 68% in a single year by exchanging all incandescent bulbs for new LEDs. Over a 5 year period, the total carbon emissions removed from the environment would be greater than 665 pounds (301 kg) per building. In a city the size of Chicago, that could mean a reduction of up to 766,080,000 pounds (347,488,042 kg) of CO_2 in five years. That is close to removing 63,840 cars from the road.

LEDs are a vastly superior solution to existing lighting technologies, which can lead to dramatic energy savings.

Think Outside the Bulb™

* Greater application efficiency
* Consistent color quality
* Extended life hours
* Greater power reduction/energy efficiency

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Industries

Markets

Lumex has been supporting a full range of markets, such as Industrial Controls, Appliance, Communications and Medical, throughout the world for the last 30 years. Our customers are the global leaders and technology innovators of their market segments. These industry leaders rely on Lumex to be able to supply a full breadth of optoelectronics and displays as well as identify opportunities to create feature rich, high value solution. Because use of optoelectronics is expanding rapidly throughout all market segments, customers are also looking for a single supplier partner like Lumex to ease the burden of sourcing multiple vendors.

Customer Driven

Whether we are supporting standard SMT and through hole LEDs or working on a fully integrated solution, our engineering design team is focused on ensuring that the end product being designed to fit the customer needs for the application, versus bending a product design to meet the components available. This means that we are always engaged with our customers to fine-tune our offering and designs to meet their needs.

We believe that design collaboration has consistently offered the best results for meeting the demands in all of the markets we serve and the increasing complexity of user-interface designs. Today's customers are looking for rugged, smarter, faster and higher value solutions which is what Lumex has been delivering since our inception.

Lumex recognizes that there are many niches within any market segment that have many different requirements. Some of Lumex's focus niches include:

- Appliance
- Aerospace
- Academic
- Audio / Visual Equipment
- Automotive
- Communications Equipment
- Computers
- Consumer Electronics
- Electronic Signage
- General Lighting
- Government
- Industrial Controls
- Life Safety
- Medical
- Military
- Office Furniture
- Retail
- Security
- Test and Measurement
- Transportation (non-automotive)

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Industries

Communications

The Communications Industry is a constantly evolving sector driven by consumers. One of the greatest challenges for this exciting industry is the ability to meet its continually expanding technological capacity in both socially and economically productive uses. There are critical capabilities required for designing applications within this market, such as speed to market, robustness and durability. Examples of applications within this industry include:

- Wireless technology
- Telecommunications
- Gaming systems

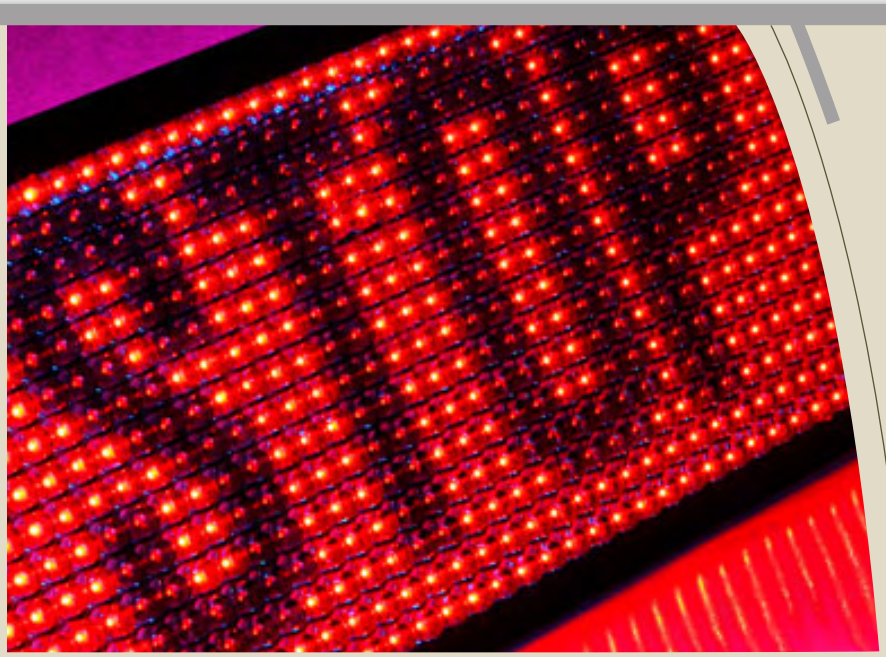
Lumex's product technology is inherently designed to deliver these critical capabilities.

Electronic Signage

The Electronics Signage market faces unique challenges by the very nature of the application. The greatest benefit of electronic signage is that the content can be exchanged more easily, animations can be shown, and the signs can adapt to the audience. Electronic signage can offer superior return on investment compared to traditional, static signage. Lumex offers a wide range of LED and LCD products specifically suited to the Electronic Signage market, including our exclusive OctoLEDs™. Lumex OctoLEDs represent a direct replacement to standard 5mm through-hole LEDs, making them ideal for any situation where there is a need to transition from through-hole to SMT technology, without sacrificing the light emission features of epoxy lenses. Lumex OctoLEDs are the first technology in the market to combine SMT convenience with through-hole features.

Medical

The on-going trend for products design in the Medical Industry is toward smaller, more portable, devices. This trend is driving the demand for micro-sized solutions for the next-generation healthcare systems. Lumex's Technical Design specialists are experts in bringing the latest medical technologies to a broader audience more efficiently.



Industrial Controls

Applications designed within this industry require user-interface solutions that provide effective and reliable operation of the device, sometimes in extreme conditions. Our customers are the global leaders and technology innovators of their market segments. Lumex offers both standard and custom product technologies developed specifically for this robust industry.

Security and Life Safety

The security equipment market has changed and expanded greatly over the last 10 years. Security equipment design engineers rely on Lumex to be able to supply a full breadth of optoelectronics and displays as well as identify opportunities to create feature rich, high value solutions.

Test and Measurement

The test and measurement market faces unique challenges by the very nature of the application. Products designed for this industry tend to have long shelf-lives and design engineers need a high-level of confidence that the components will be available as long as the end product. Lumex's Technical Design Specialists are experts at working with a wide array of requirements, essential to adapting test and measurement products to the types of harsh operating environment typical to this type of industry.

Industry Experts

Regardless of the type of industry, companies have come to rely on Lumex to be able to supply a full breadth of optoelectronics and displays, as well as identify opportunities to create feature rich, high value solutions. Because use of optoelectronics is expanding rapidly, customers are also looking for a single supplier partner like Lumex to ease the burden of sourcing multiple vendors.

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Custom Solutions

For many customers, standard LED and LCD display offerings can be the simple solution to what is often the greatest challenge to the most visible and important part of any product; the user interface.

Increasingly, however, engineers are finding that many standard, off-the-shelf LED and LCD technologies do not meet all of their specific design needs. At the same time, technological enhancements over the past decade have made custom and semi-custom technologies more cost-effective than ever before. As a result, custom or semi-custom technologies can often more efficiently meet specific performance requirements.

Lumex is unique in the market due to the unprecedented level of complimentary technical support provided to large and small customers alike. We offer a wide range of semi-custom and custom products that are extensively supported by the most responsive Technical Design Specialists in the industry.

Lumex has proven success at translating initial design concepts into reality. Benefits a Lumex application-specific design can offer include:

Simplify product design processes

- *Cost savings:*
  Complimentary product design support from Lumex´s team of Technical Design Specialists
- *Time Savings:*
  - Lumex is an innovative company with its finger on the pulse of market developments. Our knowledge of emerging technologies allows us to quickly identify the most efficient products for your specific application performance needs.

- Lumex can provide comprehen sive technical solution eliminating the need to test how individual components work together. We integrate LEDs and LCDs with various optics, switches, connectors, PCBs, etc.
- Global footprint often allows for design support within your time zone and in your language

Simplify production processes

- *Real Estate Savings*
  Integrate all of your optoelectronic components into a single sub-assembly
- *Simplified Production*
  Reduce the amount of components on your bill of materials

Enhance product performance

- *Enhance product attractiveness* through consistent quality and reliability
- *Improve design reliability* with application-specific parts
- *Reduce product failure* by understanding the performance requirements of specific technologies – like LCDs that must operate under extreme heat or cold conditions.

Lumex has Technical Design Specialists who are experts in the particular performance requirements of over 20 industries including industrial controls, communications, medical device, test and measurement, security and life safety and electronic signage.

Whether addressing a design challenge with a new, enhanced product design, or integrating multiple components into a single sub-assembly, Lumex's Technical Design Specialists collaborate with you from initial prototype through final production. A Lumex Technical Design specialist can act as an integrated member of your design team helping to enhance product performance, generate cost savings, uncover opportunities for greater efficiency and speeding time to market.

Our experience, quality and innovation will help to bring your products to market faster, and more cost-effectively, providing a vital edge in a competitive market.

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Custom Solutions - A Case Study

Cool White LED Module

The Challenge

A global appliance manufacturer was looking to transition away from incandescent bulbs to illuminate the cavity for their ice and water dispenser. The goal was to have higher intensity, better light distribution and energy savings. They came to Lumex with the idea that they could use a 1 watt high power white LED in order to achieve this goal. They also needed a "cool white" color temperature with a very specific light distribution within the cavity. They needed the light to hit the activation paddles, the water dispenser and the ice dispenser, preferably all with the same light intensity and color. The illumination module also had to be easily field replaceable.

The Solution

The Lumex Technical Design Team reviewed the options and quickly concluded that using the high power LED would create additional challenges including heat management, shorter life hours and uneven light distribution in the cavity. As an alternative, we proposed using 3 white 5mm LEDs in a small molded module with an integrated PCB and quick disconnect 2-pin connector at the end of a wire assembly. The LEDs would all be color and intensity matched so that every LED within the module and every module would have the same 2700° Kelvin cold color temperature. This solution would also allow light to be pointed from each of the three LEDs into the exact location in the cavity where light was needed, rather than relying on over-saturating the entire cavity with light.

The Value Proposition

The appliance manufacturer ended up going with the Lumex proposed modular solution, which exceeded their goals. Lumex was able to reduce the customer's service costs by replacing an incandescent bulb with an LED solution which would last more than 10 years without replacement. The module used less power by driving 3 LEDs at 18mA vs 1 high power at 1 watt which increased the energy rating of the refrigerator. Finally, the custom configuration achieved light distribution exactly where the customer wanted it. In addition, Lumex was able to achieve 0 ppm failures over a five year period, further saving the customer time and cost on potential field failures and returns from the consumer.

Custom Solutions - A Case Study

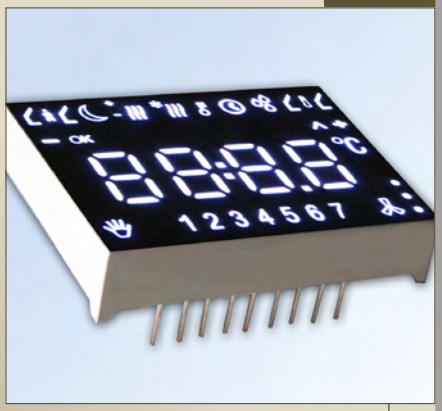
7-Segment LED Display

The Challenge

An electronic control company in the residential and commercial appliance market was trying to use an existing printed circuit board (PCB) in one of their controls but add a new user interface to communicate more information to the consumer. The engineer needed a 7-segment LED display but could not locate a standard display that would conform to their product's design requirements. The amount of space in the enclosure was so small that standard displays would not work and with the size of some of the application specific displays available, the information would not be easily readable. In addition, the display needed to be right angled in order to mount with the legacy PCB and ensure full visibility of the display data on the face on the device.

The Solution

Lumex met the customer's challenge by combining two technologies into one great solution.Lumex was able to take advantage of a previous proprietary reflector concept and combine it with the a new display for an application specific design created to work with the existing PCB. The Lumex PCB within the display had a custom pinout design allowing the customer to directly interface the display with the data from their microprocessor. The unique design also ensured that the brightness and viewing angle requirements would be met consistently and reliably. Lumex developed prototypes for the customer and after some minor tooling adjustments, the new part was born.



The Value Proposition

The customer was ecstatic with the results! By accessing a prior technology and combining it with the new display, the customer was able to save costs by not having to tool a new motherboard and significantly increased manufacturing throughput with the highly reliable new display. The display was visible at the exact angle required by the customer and presented a prominent, attractive view of the data from their microprocessor. An attractive, space-saving solution!

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Custom Solutions - A Case Study

LCD Module

The Challenge

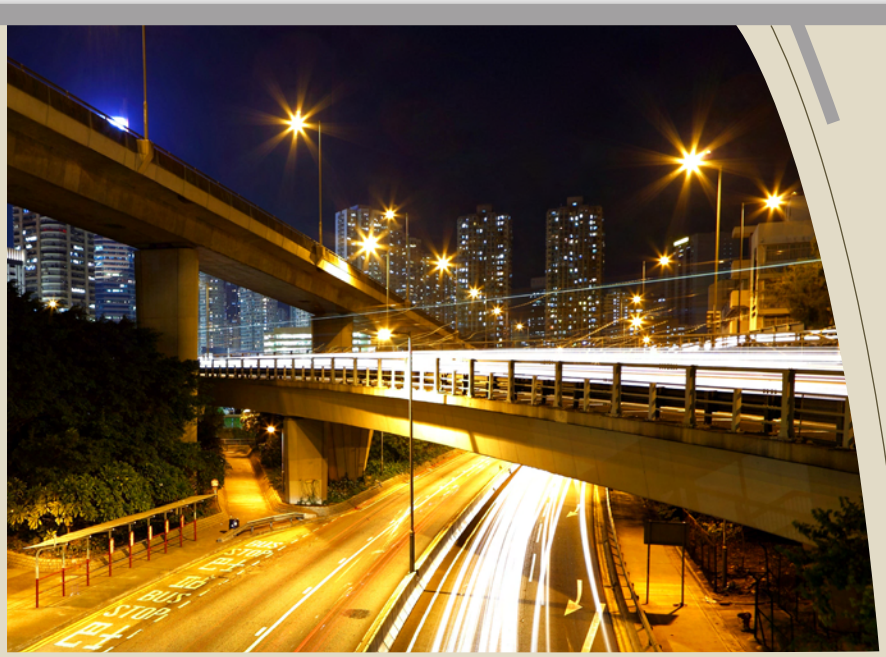
A customer needed to have a safety indicator on their portable device that would display when the device was safe to use. The indicator needed to be battery friendly, as well as small, yet easily visible.

The Solution

The Lumex Technical Design Specialists provided the customer with a 1" square LCD with screen printing on the back side. The LCD offered extremely low power draw and the color screen printing immediately drew the eye to the LCD, ensuring the user would check the safety status.

The Value Proposition

The Lumex product solution met the customers needs of both functionality and branding. Lumex was able to provide the customer with a small, extremely energy efficient LCD solution perfectly packaged in an attractive eye-catching design.



TitanBrite™ High Power LEDs

High-power (or high-brightness LEDs) represent the next generation of LED lighting and the Lumex TitanBrite™ family of high-power LEDs is on the cutting edge of design innovation.

Lumex TitanBrite high-power LEDs provide:

- **Exceptionally long life**
  - Up to 50,000 hours
- **Reduced energy consumption**
  - Extremely efficient lumens per watt performance.
  - Average output of > 80 lumens/Watt compared to:
    - 15 lumens/Watt for incandescent lights
    - 70 lumens/Watt for CFLs
- **Environmentally Friendly**
  - No hazardous materials (like mercury, which is commonly found in CFLs)
  - Reduced energy consumption
  - Longer life cycles equate to less waste with traditional, disposable bulbs
- **Durability and Cost Savings**
  - Superior resistance to temperature changes, vibrations and other environmental stresses for enhanced durability.
  - Reduced maintenance and product replacement expense
- **Superior Performance & Design Flexibility**
  - Vivid, full-color performance;
  - Compact, space-saving RGB option (up to 30% cost savings and 67% real estate savings) vs. separate packages;
  - Opportunity for integration with sensors, dimmers, daylight controls and dynamic color tuning.

As the use of high power LEDs continues to increase in design integration, the Lumex family of high power products will continue to evolve with the introduction of new models and ever-increasing light output levels and color efficacy.

In addition to our standard product offering, Lumex can also customize any LED to suit your specific design needs. **For a complete list of all of Lumex's TitanBrite™ High Power LEDs, visit us online at www.lumex.com.**

INSIDE THIS SECTION

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There are several integral design considerations to be taken into account when working with high power LEDs. The following are some of the main considerations. For a more in-depth look at designing with any Lumex high power LED, please feel free to contact any one of our Technical Design Specialists at (800) 278-5666.

Color Temperature

Color temperature describes the relative warmth or coolness of all light. In the LED industry, this term is used when describing white light. There are generally three classifications for white light: warm, neutral or cool.

Color Rendering Index (CRI)

The Color Rendering Index (CRI), is the system derived to compare the quality of white light against something that is most familiar, daylight. The color rendering index is a scale from 0 ~ 100, where 100 is an exact duplication of daylight conditions. This is important because LEDs emit monochromatically (one wavelength), therefore it is difficult to approximate daylight conditions (presence of all wavelengths). So when we make a white LED, we make it by phosphor conversion. This process overlays phosphor onto a blue LED. The effect works similar to that of a florescent light in that the blue LED will excite the phosphor and the phosphor fluoresces white. The color temperature of the white light emitted is based on the chemical construction of the phosphor as well as the amount of phosphor placed. A warmer white will have the presence of more yellow and orange light than a cooler white due to the phosphor. For a phosphor converted warm white LED, the CRI would be above 80; whereas a cool white LED would be in the range of 70~80.

Some examples of common and competitive light sources color temperature and CRI values are:

Common Light Sources Color Temperature & CRI Values		
Light Source	Color Temp	CRI Value
Candle	1,700k	100 CRI
Incandescent Bulb	2,700k	100 CRI
Halogen Lamp	3,200k	95 CRI
Natural Sunlight	5-6,000k	100 CRI
Daylight Bulb	6,400k	80 CRI
TitanBrite 3-Watt LED	3,000k	80-85 CRI
TitanBrite 5-Watt LED	6,000k	70-80 CRI

Efficacy - Equivalency Table

The efficacy is the amount of luminous flux emitted by the high power LED, divided by the amount of power taken to energize the LED. Simply put, this rating describes lumens per watt.

The following table compares the output of traditional lighting sources based on their input power:

LED Wattage Comparison			
Lumens	Incandescent	CFL	LED
80	12~15W		1.3 W
250	25W	5-6W	3W
350	30W	7-9W	5W
800	60W	13-15W	6-8W
1,100	75W	18-25W	9-13W
1,600	100W	23-30W	16-20W
2,600	150W	30-55W	25-28W

Thermal Management

Thermal management is the most overlooked design consideration when using high power LEDs. It is also the most important consideration. Poor thermal management will lead to a loss of efficacy, life hours and color uniformity. Some simple ways to overcome these thermal considerations could be the addition of a thermal compound to interface the thermal slug on the LED to a metal core PCB. Some cases may require further heat sinking or the use of active cooling techniques such as induced airflow by fans. It is highly recommended when designing with high power LEDs to consult with a Lumex Technical Design Specialists to ensure that all thermal considerations have been addressed.

Optics

Most high power LEDs emit in approximately 120˚ Lambertian beam pattern. When designing a complete lighting system utilizing high power LEDs, this beam pattern may not be the most desirable. Therefore, special optics, such as dome or flat lenses, are used to take the light from multiple LED sources and combine them into the desired uniform pattern. A design consideration for the end user of any product is to ensure that the bright light is diffused enough to not cause any eye damage to the viewer.

Drivers

Utilizing the right LED driving scheme is paramount to ensuring proper function and lifetime of the LED. There are a plethora of driving schemes and commercially accessible drivers available in the market today. Please contact a Lumex Technical Design Specialist for guidance on appropriate drivers and suggestions for integration of any complete design assembly.

Environmental Considerations

Lumex's high power LEDs are RoHS 6 of 6 compliant and are built using stable homogenous materials that are not as damaging to the environment as other traditional lighting technologies such as fluorescent. Additionally, the lifetime of LEDs is significantly longer than that of competing technologies. Longer lifetime translates into less replacement materials and therefore less waste.

Precautions

- *Eye Safety Precautions:*
  High power LEDs are extremely bright point sources similar to that of lasers. Proper eye protection should be worn at all times when looking directly into the light. For eye safety, do not stare into the light beam of any LED at close range.

- *Static Electricity and Surge:*
  During handling and assembly, static electricity and surge damage LEDs. It is recommended to use a wrist band or anti-electrostatic glove when handling the LEDs. All devices, equipment and machinery must be electrically grounded.

- *Current:*
  High power LEDs are high current devices and care should be made to ensure proper handling at all times to reduce the risk of shock. This is an especially important design consideration when designing products for the end user.

Driver Losses

Fluorescent and high-intensity discharge (HID) light sources cannot function without a ballast, which provides a starting voltage and limits electrical current to the lamp. LEDs also require supplementary electronics, usually called drivers. The driver converts line power to the appropriate voltage (typically between 2 and 4 volts DC for high-brightness LEDs) and current (generally 200-1000 milliamps or mA), and may also include dimming and/or color correction controls.

LUMEX®
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RoHS Compliant

TitanBrite™ High Power LEDs

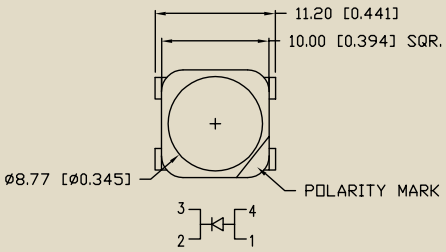
.5 Watt, PLCC-4, SMD SuperFlux LED

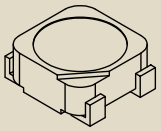
Features / Options

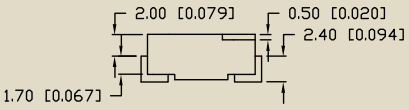
- Available in either flat or dome lens
- State-of-the-art, high brightness chip technology
- SMD package eliminates through-hole soldering
- Very long operational life

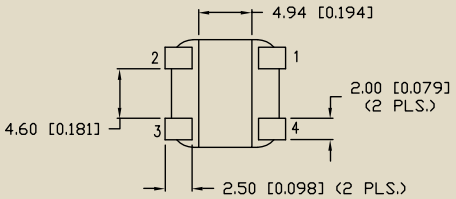
Applications / Uses

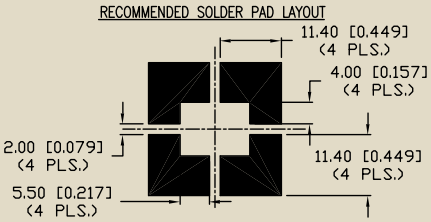
- Industrial Controls
- Medical Equipment
- Illuminating Signs/Artwork







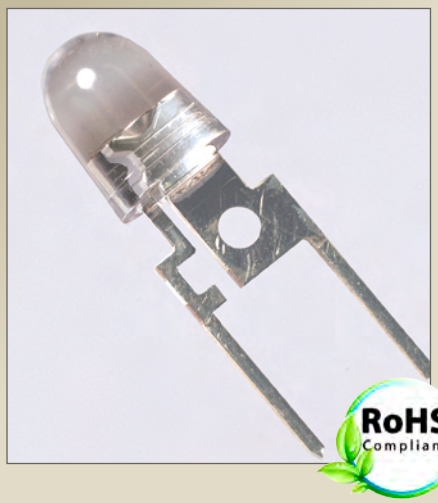




SKU	Emitted Color	Chip Material	Peak Wavelength (nm)	Lens Type	Typ. Vf(V)	If (mA)	Intensity Typ.	View Angle 2x Theta
SML-LX1110SOC	Orange/Red	InGaAlP	620	Clear	2.5	350	25000 mcd	90
SML-LX1110SYC	Yellow	InGaAlP	590	Clear	2.5	350	11000 mcd	90
SML-LX1110UPGC	Green	InGaAlP	525	Clear	3.5	350	10000 mcd	90
SML-LX1110USBC	Blue	InGaAlP	470	Clear	3.5	350	2800 mcd	90
SML-LX1110UWC	Blue	InGaN	-	Clear	3.5	350	15000 mcd	90

* Viewing angle 2 x Theta = 90 (ATR) for flat lens; 120 for dome lens (BTR)

Note: Illustrations shown are for representation **ONLY**. *Exact specifications should be obtained from the product data sheet. Additional product drawings of Lumex's TitanBrite™ High Power LEDs are available by logging onto* **www.lumex.com**. *Any Lumex standard product can be customized to fit your specific needs. Call* **1.800.278.5666** *to speak with one of our Technical Design Specialists.*



TitanBrite™ High Power LEDs

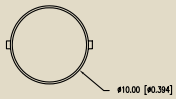
1-Watt, Through-Hole, 10mm SuperBeamLED

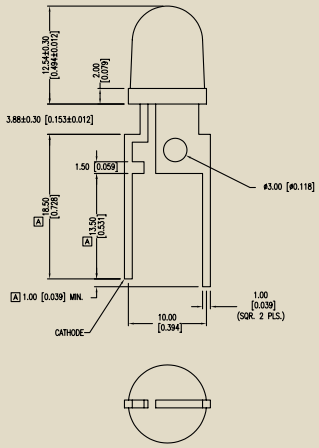
Features / Options

- State-of-the-art, high brightness chip technology
- Through-hole design provides narrow viewing angle

Applications / Uses

- Industrial Controls
- Medical Equipment
- Illuminating Signs/Artwork





SKU	Emitted Color	Chip Material	Peak Wavelength (nm)	Lens Type	Typ. Vf(V)	I_f (mA)	Intensity Typ.	View Angle 2x Theta
SSL-LX100T123SIC	Red	AlInGaP	630	Clear	2.0	350	35 lm	25
SSL-LX100T123SYC	Yellow	AlInGaP	590	Clear	2.0	350	35 lm	25

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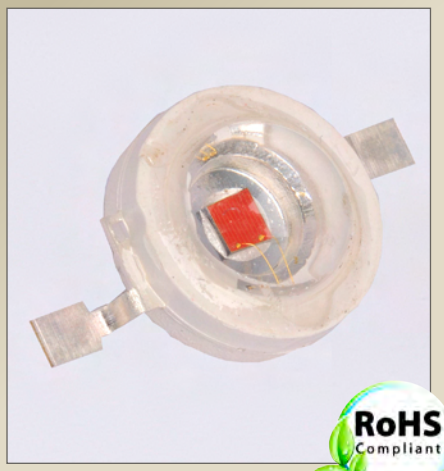


TitanBrite™ High Power LEDs

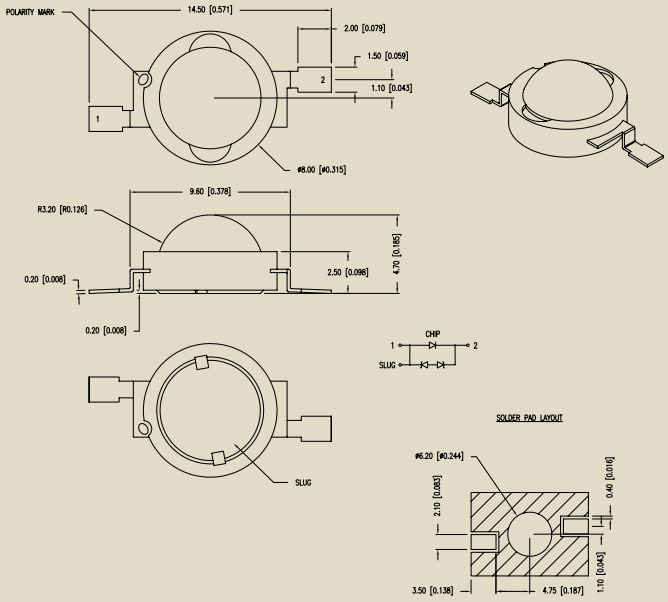
2-Watt, 8mm Round Package

Features / Options

- State-of-the-art, high brightness chip technology
- SMD package eliminates through-hole soldering
- Very long operational life

Applications / Uses

- Electronic Signage
- General Illumination
- Backlighting



SKU	Emitted Color	Chip Material	Peak Wavelength (nm)	Lens Type	Typ. Vf(V)	I_f (mA)	Intensity Typ.	View Angle 2x Theta
SML-LXL8047SICTR/2	Red	InGaN	635	Clear	2.7	500	50 lm	100
SML-LXL8047SYCTR/2	Yellow	InGaN	598	Clear	2.5	500	55 lm	100

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TitanBrite™ High Power LEDs

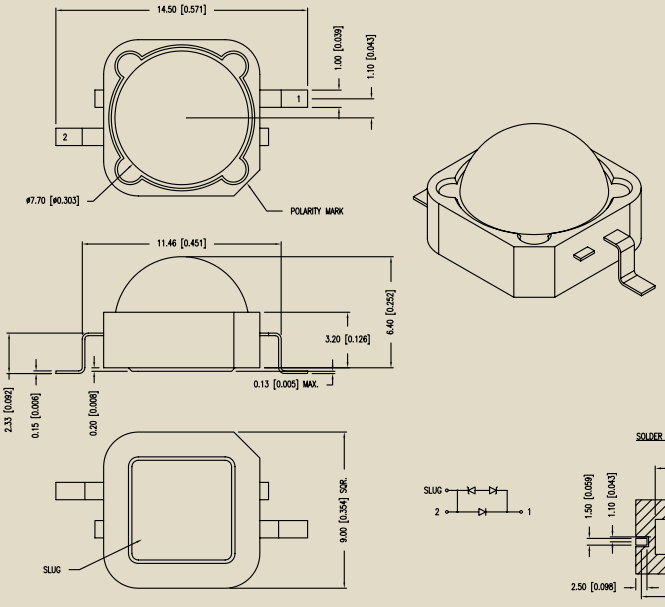
2-Watt, 9mm Square Package

Features / Options

- State-of-the-art, high brightness chip technology
- SMD package eliminates through-hole soldering
- Very long operational life

Applications / Uses

- Electronic Signage
- Illuminating Signs/Artwork
- Decorative Lighting



SKU	Emitted Color	Chip Material	Peak Wavelength (nm)	Lens Type	Typ. Vf(V)	I_f (mA)	Intensity Typ.	View Angle 2x Theta
SML-LXL99SIC-TR/2	Red	Varied	635	Clear	2.7	500	42 lm	100
SML-LXL99SYC-TR/2	Yellow	InGaN	598	Clear	2.5	500	58 lm	100

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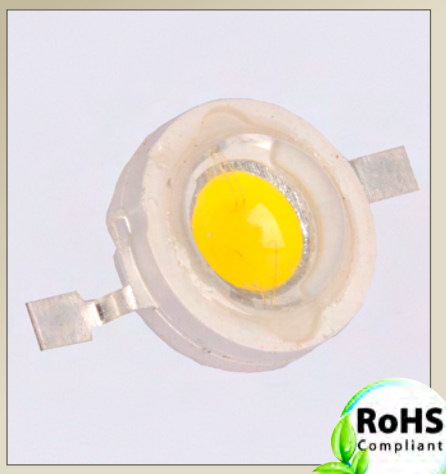


TitanBrite™ High Power LEDs

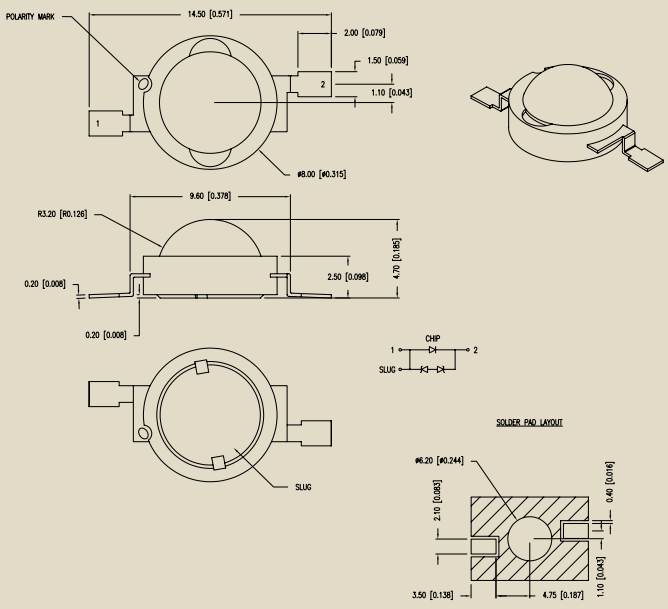
3-Watt, 8mm Round Package

Features / Options

- State-of-the-art, high brightness chip technology
- SMD package eliminates through-hole soldering
- Very long operational life

Applications / Uses

- Electronic Signage
- Illuminating Signs/Artwork
- Decorative Lighting



SKU	Emitted Color	Chip Material	Peak Wavelength (nm)	Color Temp.	Typ. Vf(V)	I_f (mA)	Intensity Typ.	View Angle 2x Theta
SML-LXL8047MWC-TR3	Warm White	InGaN	-	3000k	4.6	700	140 lm	100
SML-LXL8047USBC-TR3	Blue	InGaN	454	-	4.6	350	20 .m	100
SML-LXL8047UWC-TR3	Cool White	InGaN	-	6000k	4.6	700	160 lm	100

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TitanBrite™ High Power LEDs

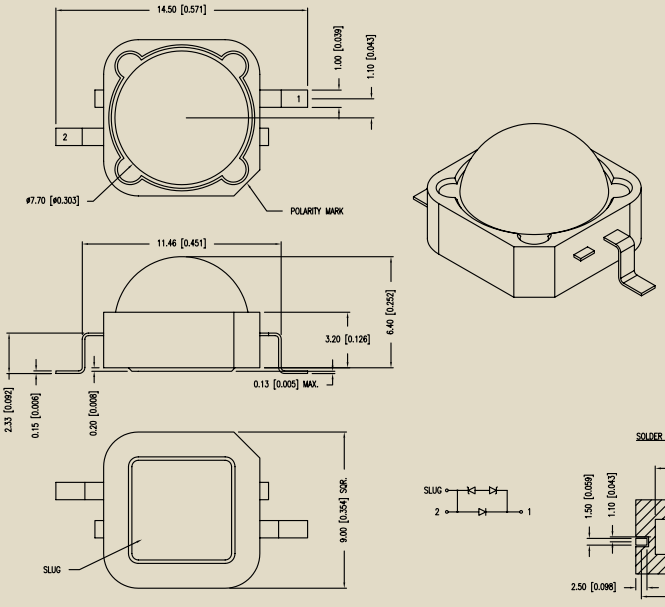
5-Watt, 9mm Square Package

Features / Options

- State-of-the-art, high brightness chip technology
- SMD package eliminates through-hole soldering
- Very long operational life

Applications / Uses

- Electronic Signage
- Illuminating Signs/Artwork
- Decorative Lighting



SKU	Emitted Color	Chip Material	Peak Wavelength (nm)	Color Temp.	Typ. Vf(V)	If (mA)	Intensity Typ.	View Angle 2x Theta
SML-LXL99MWC-TR/5	Warm White	InGaN	-	2700k	4.5	1200	220 lm	100
SML-LXL99USBC-TR/5	Blue	InGaN	465	-	4.5	1200	55 lm	100
SML-LXL99UWC-TR/5	Cool White	InGaN	-	6000k	4.5	1200	180 lm	100

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TitanBrite™ High Power LEDs

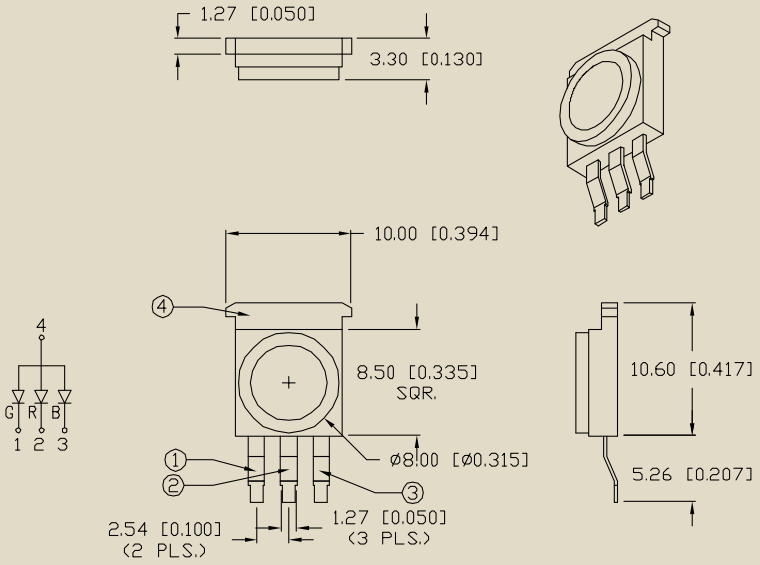
3-Watt, 10.6mm x 10.00mm, SMD, AstraLED RGB

Features / Options

- State-of-the-art, high brightness chip technology
- SMD package eliminates through-hole soldering
- Very long operational life

Applications / Uses

- Electronic Signage
- Illuminating Signs/Artwork
- Decorative Lighting



SKU	Emitted Color	Chip Material	Peak Wavelength (nm)	Lens Type	Typ. Vf(V)	I_f (mA)	Intensity Typ.	View Angle 2x Theta
SML-LX1610RGBW/A	RGB	Varied	636/525/470	Clear	2.0/3.5/3.5	350	25/25/8 lm	110

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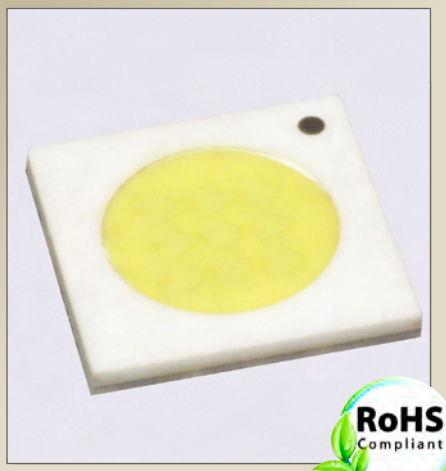


TitanBrite™ High Power LEDs

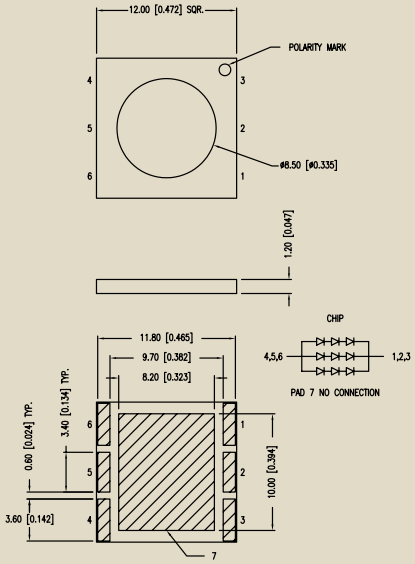
10-Watt, Square Package

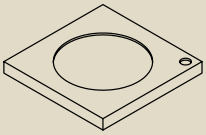
Features / Options

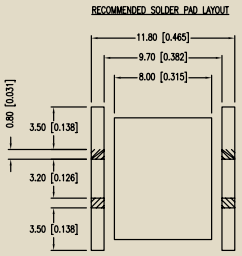
- Single package chip array produces up to 600 lumens and beyond, based on color
- Superior thermal management due to ceramic substrate
- Thermal resistance of 8.2˚C/W
- SMT package can be RoHS Reflow Solderable

Applications / Uses

- Electronic Signage
- Illuminating Signs/Artwork
- Decorative Lighting







SKU	Emitted Color	Chip Material	Color Temperature	Lens Type	Typ. Vf(V)	If (mA)	Intensity Typ.	View Angle 2x Theta
SML-LX4747MWC-TR10	Warm White	InGaN	3000 typ	Clear	10.4	1000	530 lm	120
SML-LX4747NWC-TR10	Neutral White	InGaN	4000 typ	Clear	10.4	1000	550 lm	120
SML-LX4747UWC-TR10	Cool White	InGaN	6000 typ	Clear	10.4	1000	600 lm	120

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QuasarBrite™ Light Emitting Diodes (LEDs)

A pioneer in the art of LED technology, Lumex offers one of the industry's largest selections of through-hole and surface-mount LEDs with an expansive selection of viewing and packaging options.

In today's marketplace, it's not uncommon to hear LEDs being heralded for their long life span and energy efficiency.

According to the U.S. Department of Energy, in the next 20 years, rapid adoption of LED lighting in the U.S. can:

- **Reduce electricity demands from lighting by one-third;**
- **Eliminate 258 million metric tons of carbon emissions; and**
- **Create financial savings that could exceed $200 billion.**

However, LEDs have several other unique features which make them ideal candidates for many of today's evolving consumer and industry applications:

- **LEDs are virtually impervious to vibration, thereby making LEDs nearly indestructible;**
- **The small size of LEDs offer tremendous freedom for design innovation;**
- **LEDs are a natural fit for outdoor applications; and**
- **LED performance inherently increases as the operating temperature drops.**

All Lumex LED products are 100% RoHS compliant and ideally suited for a wide range of markets. Lumex also offers prototype designs made to fit your application by tooling PCBs and lens combinations to suit your needs.

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Light Source Terminology

LEDs are different from other types of light sources. LEDs are semiconductor devices, while incandescent, flourescent, and high-intensity discharge (HID) lamps are all based on glass enclosures containing a filament or electrodes, with filled gases and coatings of various types.

Incandescent Lighting: A source of light that works by heat-driven light emissions

Flourescent Lighting: a gas-discharge lamp that uses electricity to excite mercury vapor in argon or neon gas, resulting in a plasma that produces short-wave ultraviolet light. This light then causes a phosphor to floresce, producing visible light.

Solid-state lighting (SSL) technology uses semiconducting materials to convert electricity into light.

Correlated color temperature (CCT) is the measure used to describe the relative color appearance of a white light source. CCT indicates whether a light source appears more yellow/gold/orange or more blue, in terms of the range of available shades of "white." CCT is given in kelvins (unit of absolute temperature).

Color rendering index (CRI) indicates how well a light source renders colors of people and objects, compared to a reference source.

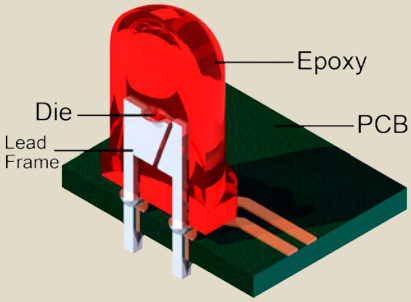
RGB stands for red, green, and blue, the three primary colors of light. When the primaries are mixed, the resulting light appears white to the human eye. Mixing the light from red, green, and blue LEDs is one way to produce white light.

LED Construction

The actual construction of an LED is very simple. An LED begins with the semi-conductor chip located in the center of the lead frame reflector cup, then joined to the outer landscape by wire bond. The entire chip and wire bond is enclosed within either a clear, or many times, colored epoxy encasement, thereby making the LED virtually indestructible. The LED is then set into a assembling package for mounting on a circuit board in either a through-hole or surface-mount construction.

Through-hole LEDs have two leads that extend below the LED epoxy enclosure. These leads allow the LED to pass through the holes on a circuit board, and can be fixed into place through soldering underneath the board. Surface-Mount Devices or SMD LEDs have no extending leads. Rather, they sit on the surface of the circuit board and are soldered so that the solder joint is on the top of the circuit board. SMD LEDs come in a wide range of sizes, varying from ultra-small 0.5 x 1.5 x 0.3mm LEDs to LEDs measuring 20 x 20 x 2.5mm or larger.

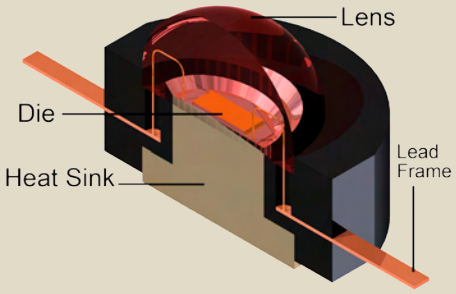
Unlike through-hole LEDs, newer SMT LEDs can be mechanically assembled onto circuit



boards very quickly and accurately. They are usually packaged by winding onto tape and reel. A typical tape and reel can supply anywhere from 1,000 to 3,000 SMD LEDs dependent up on the size of the LED and reel.

How LEDs Work

LEDs differ from traditional light sources in the way they produce light. In an incandescent lamp, a tungsten filament is heated by electric current until it glows or emits light. In a fluorescent lamp, an electric arc excites mercury atoms, which emit ultraviolet (UV)



radiation. After striking the phosphor coating on the inside of glass tubes, the UV radiation is converted and emitted as visible light.

An LED, in contrast, is a semiconductor diode. It consists of a chip of semiconducting material treated to create a structure called a p-n (positive-negative) junction. When connected to a power source, current flows from the p-side or anode to the n-side, or cathode, but not in the reverse direction. Charge-carriers (electrons and electron holes) flow into the junction from electrodes. When an electron meets a hole, it falls into a lower energy level, and releases energy in the form of a photon (light). A small portion of energy is released as heat, but for standard LEDs, this is a non issue.

The specific wavelength or color emitted by the LED depends on the materials used to make the diode.

Red LEDs are based on aluminum gallium arsenide (AlGaAs). Blue LEDs are made from indium gallium nitride (InGaN) and green from aluminum gallium phosphide (AlGaP). "White" light is created by combining the light from red, green, and blue (RGB) LEDs or by coating a blue LED with yellow phosphor.

Common LED Types and Packages

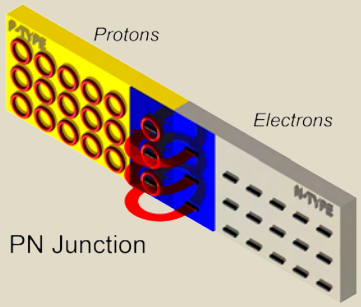
LEDs come in two basic categories:

Low power LEDs commonly come in through-hole or surface mount packages. These are fractional wattage devices, typically 0.1 watt, operate at low current (~20 milliamps) and low voltage (3.2 volts DC), and produce a small amount of light, perhaps 2 to 4 lumens.

High power LEDs come in 1-10 watt packages. They are driven at much higher current, typically 350, 700, or 1000 mA, and—with current technology—can produce 40-100 lumens per 1-watt package.

What Causes an LED to Emit Light?

The semi-conductor chip is divided into two regions that are separated by a P-N Junction. The "P" region is controlled by positive electric charges (Positive holes) and the N region is controlled by negative electric charges (Negative Electrons).



As shown in the figure above, the adjacent P-type material acquires a small negative charge as a result of gaining electrons. The adjacent N-type material develops a small positive because of its loss of electrons. This space-charge prevents further diffusion across the PN Junction.

The PN Junction acts as a barrier to the flow of electrons between the P and the N regions. When proper voltage is applied to the semiconductor chip, the current will flow and the electrons from the N region will cross the juction.

When an electron crosses from the N region to the P region, it will release energy in the form of electromagnetic vadiation (light).

How is Brightness Defined?

Axial intensity is measured in candle power or candelas. Typical indicators range from 10~50mcd (0.010~0.050 candles). Still brighter indicators can be as bright as 1cd (candle) and beyond. Axial intensity is measured directly above an LED. The measurement would be different if the sensor is askew. This is different from Luminous Flux as luminous flux is a measurement of ALL light emitted from any direction. Most lighting applications are measured this way. There is no direct conversion from one to the other, but a milicandela (mcd) measurement can be estimated, in lumens, by using this over simplified relationship: a 30mcd LED with a 60˚ viewing angle is approximately 0.03 lumens.

Shape, Size and Viewing Angle

LEDs can range from 2mm to 22mm in size and can be shaped in rectangular, round, square and triangular packaging. The viewing angle of LEDs indicates how much the beam of light spreads out from the circuit board. LEDs also have a wide variety of viewing angles available. Standard LEDs have a viewing angle of 60˚, however others may have a narrow beam of 30˚ or less. The LED viewing angle is directly correlated to the epoxy lens that distributes the light. A higher luminous intensity (mcd rating) does not equate to the highest visibility. Light output from an LED chip is very directional. Higher light output is achieved by concentrating light in a tight beam. The higher the mcd rating, the narrower the viewing angle.

SMD LEDs come in sizes as low as 0.04" x 0.02". They are assembled in automated processes. They have view angles from 100˚ ~ 170˚.

Cautions to be Used in Production

Generally Lumex LEDs can be used in the same manner as other general semi-conductors. However the following precautions must be taken:

Cleaning: cleaning can be accomplished using alcohol, Freon, RE or Chlorosen at room temperature for less than one (1) minute. Other chemical solutions may crack or haze the epoxy line.

Forming of Leads: Forming must be done before soldering. Any stresses applied to the epoxy lens can break the thin gold wire connecting the chip to the anode lead.

Common Soldering Methods: Use soldering irons rated 30W to prevent overheating.

Overcurrent Prevention: In order to operate under stable conditions, current limiting resistors can be connected in series with Lumex LEDs. Additional care must also be taken to prevent transient voltage spikes commonly caused by on / off switching from reaching the device.

QuasarBrite™ UV LEDs

Use of Ultra Violet (UV) LEDs will continue to grow sharply during the next three to five years, especially in lower wavelengths ranging from 210nm to 415nm.

Despite the many benefits of UV LED technology, adoption has been limited in the past due to the epoxy lens used in LEDs. The epoxy degraded the overall lifespan of UV LEDs to less than 5,000 hours. Replacing the epoxy lenses with a robust TO-46 package with glass lens, **QuasarBrite UV LEDs have life expectancy of greater than 10 times the original epoxy designs, which evaluates to more than 50,000 hours.**

Lumex QuasarBrite UV technology is ideal for a wide range of applications including:

• Bacterial and superficial sterilization for medical device technologies related to phototherapy, dental, and dermatology equipment

• Industrial control device technology related to leak and biohazard detection

• Forensic applications related to counterfeit detection and forensic analysis of bodily fluids

• Ink fluorescing

The following pages provide an overview of the types of UV LED products Lumex provides.

In addition to our standard product offering, Lumex can also customize any UV LED to suit your specific design needs. **For a complete list of all of Lumex's QuasarBrite™ UV LEDs, visit us online at www.lumex.com.**

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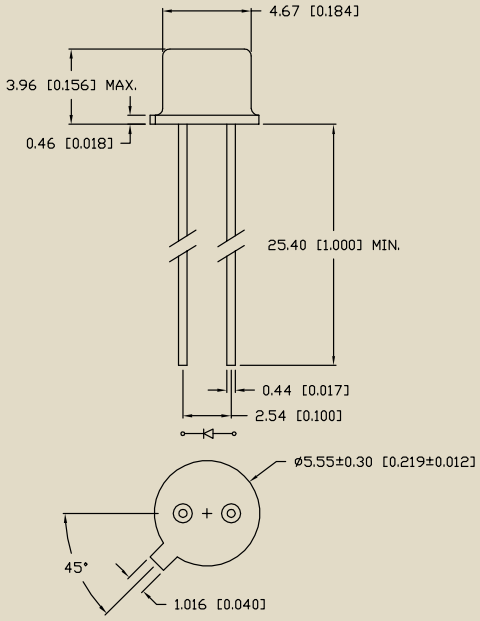
QuasarBrite UV LEDs™

Features / Options

- TO-46 package with glass lens
- Custom wavelengths available

Applications / Uses

- Optical sensors and instrumentation
- Forensic and bodily fluid detection and analysis
- Medical light therapy
- Polymer and ink printing
- Counterfeit detection
- Superficial sterilization



SKU	Emitted Color	Chip Material	Peak Wavelegth (nm)	Lens Type	Typ. Vf	If (mA)	Intensity Typ.	View Angle 2x Theta
SSL-LXTO46UV1C	Ultra Violet	InGaN	385	Glass / Water Clear	3.3	20	4.0 mW	80
SSL-LXTO46UV2C	Ultra Violet	InGaN	405	Glass / Water Clear	3.7	20	6.0 mW	80
SSL-LXTO46UV3C	Ultra Violet	InGaN	415	Glass / Water Clear	3.3	20	6.0 mW	80

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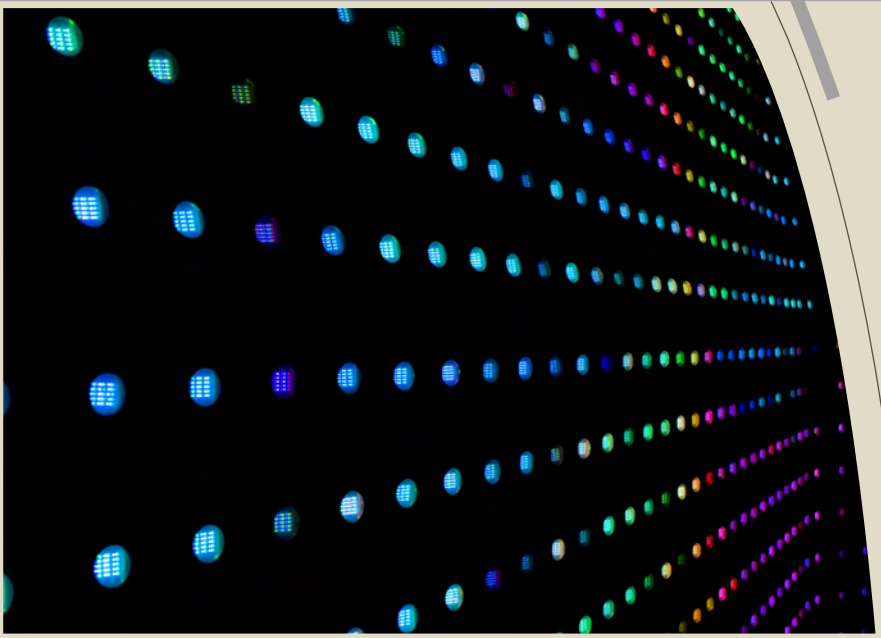

QuasarBrite™ SMT LEDs

Lumex offers a wide range of high quality surface mount LEDs in various packages, colors and brightness, along with axial and dome lens SMDs.

The slimmer footprint of surface-mounted LEDs makes them ideal for space-restricted applications. With over 30 years experience in lighting and illumination applications, Lumex has the expertise to ensure truly efficient design and performance.

In addition to space conservation, Lumex's QuasarBrite™ Surface Mount LEDs offer additional product design advantages, including:

- Lower PCB costs through reduced area, less drilling and fewer plated through-hole LEDs
- Components are packaged in standard tape and reel
- Lower component height compared to through-hole LEDs
- Ability to uniformly place components and provide uniform soldering techniques
- Greater flexibility during assembly

Our light pipes can be designed to be perfectly mated with our SMD LEDs so that not only do we minimize light loss at light pipe entry, we also minimize the amount of light lost due to the geometry of the design in order to achieve maximum light output at the viewing end of the light pipe.

The following pages provide an overview of the types of surface-mount LED products Lumex provides.

In addition to our standard product offering, Lumex can also customize any LED to suit your specific design needs. **For a complete list of all of Lumex's QuasarBrite™ Surface Mount LEDs, visit us online at www.lumex.com.**

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Creating LED and LCD Solutions Together™

QuasarBrite™ SMD LEDs - Index

The index above is representative of some of Lumex's latest innovative and more diverse product offerings. **For a complete list of all of Lumex's QuasarBrite™ Surface Mount LEDs, visit us online at www.lumex.com.**

QuasarBrite™ SMD LEDs

OctoLED™ - *Transitioning from Through-Hole to Surface-Mount*

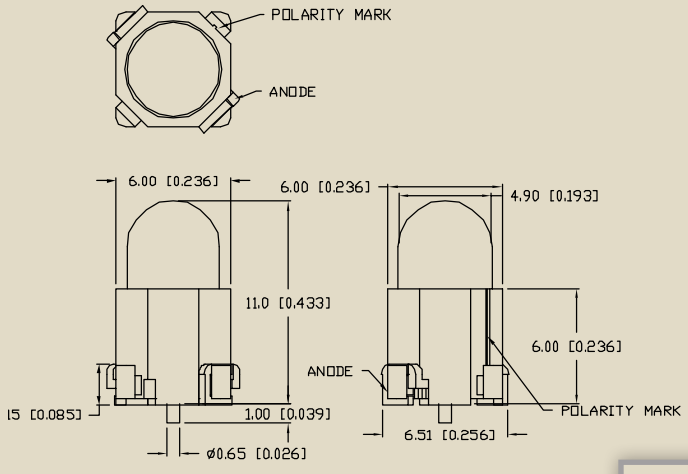
Features / Options

- Direct replacement from through-hole T5mm LEDs
- Brightness levels of up to 14,000mcd or greater. Infinite capability based on compatible brightness of through-hole LED
- Available on standard 24mm tape for automation insertion
- Meets RoHS soldering profile requirements of up to 10 seconds at +255˚C
- Choice of colors and lens finishes
- Custom solutions available

Applications / Uses

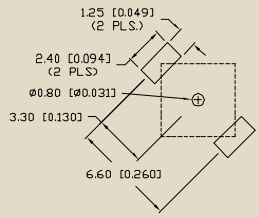
- Electronic Signage, including high-way billboards, Jumbotrons, etc.
- Mobile signage displays
- Architectural design

OctoLED™, **SML-H1505 Series**



Patent # 61/030,763

Recommended Solder Pad Layout



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QuasarBrite™ SMD LEDs

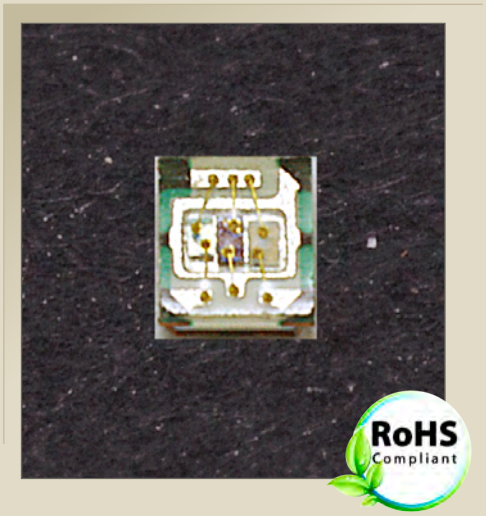
0404 Package, RGB

Features / Options

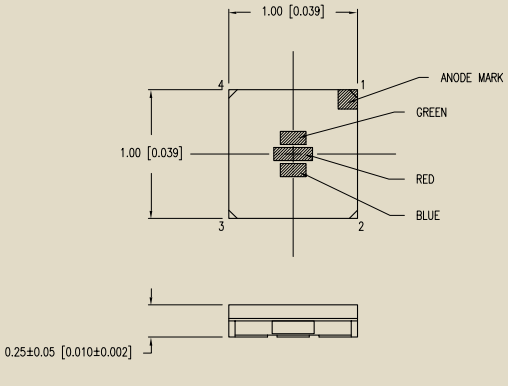
- Full color RGB with the smallest size possible
- Low current operation
- Maximum operating currents are only 30/25/10 mA respectively for R/G/B
- Custom solutions available

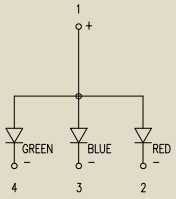
Applications / Uses

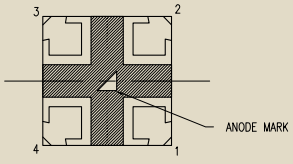
- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement
- Security electronics



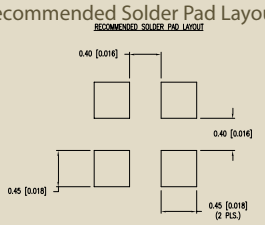
0404 Package, RGB, **SML-LX0404SIUPGUB**







Recommended Solder Pad Layout



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QuasarBrite™ SMD LEDs

Ceramic

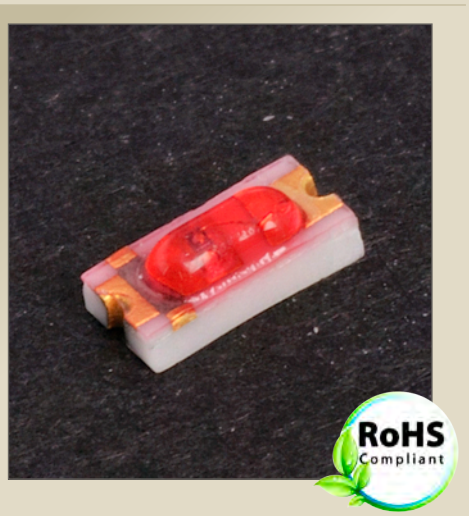
0805 Package

Features / Options

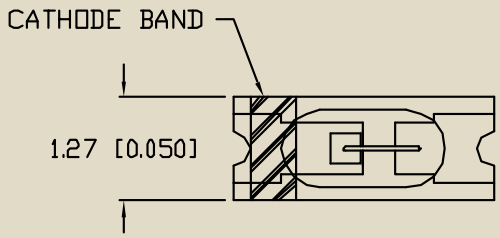
- Superior heat dissipation
- Choice of colors and lens finishes
- Lead frame / lens casting reliability
- Easy-to-solder leads
- Available in tape and reel
- Custom solutions available

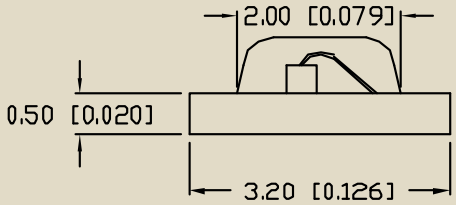
Applications / Uses

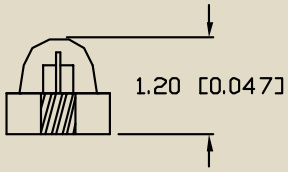
- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement
- Security electronics



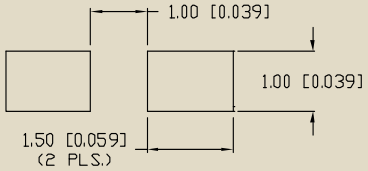
0805 Package, **CCL-LX45 Series**







Recommended Solder Pad Layout



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QuasarBrite™ SMD LEDs

Ceramic

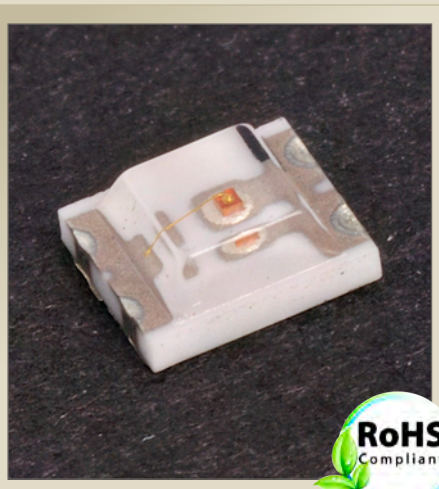
1210 Package

Features / Options

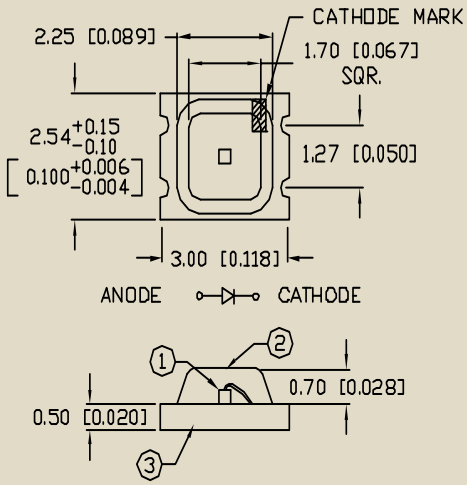
- Superior heat dissipation
- Choice of colors and lens finishes
- Lead frame / lens casting reliability
- Easy-to-solder leads
- Available in tape and reel
- Custom solutions available

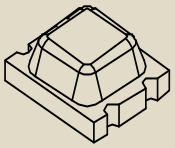
Applications / Uses

- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement
- Security electronics

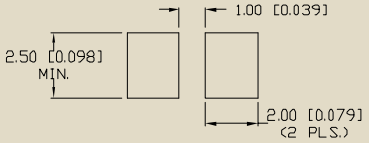


1210 Package, **CCL-CRS10 Series**





Recommended Solder Pad Layout



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QuasarBrite™ SMD LEDs

0402 Package

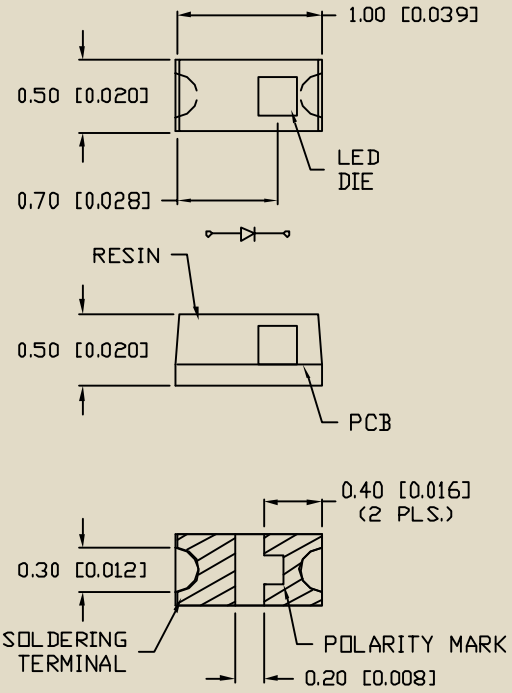
Features / Options

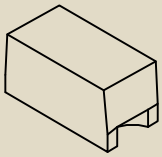
- Choice of colors
- Lead frame / lens casting reliability
- Easy-to-solder leads, gold finish
- Available in tape and reel
- Custom solutions available

Applications / Uses

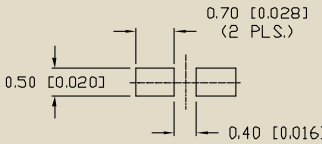
- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement
- Security electronics

Standard, **SML-LX0402xxx-TR Series**





Recommended Solder Pad Layout



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QuasarBrite™ SMD LEDs

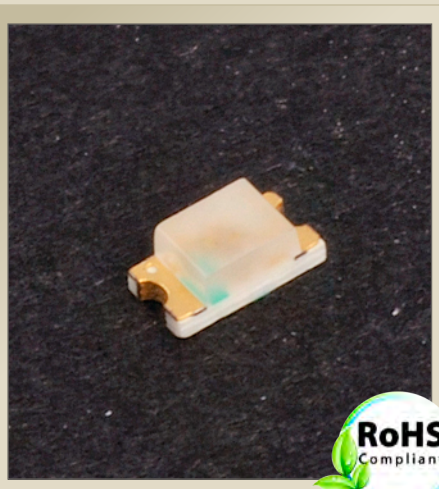
0603 Package

Features / Options

- Choice of colors
- Lead frame / lens casting reliability
- Easy-to-solder leads, gold finish
- Available in tape and reel
- Custom solutions available

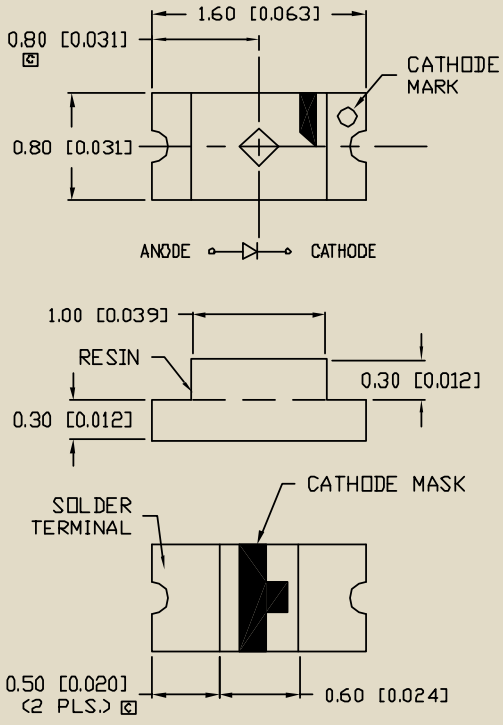
Applications / Uses

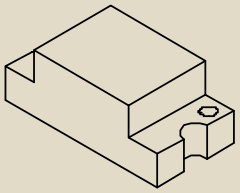
- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement
- Security electronics



Half Moon Solder Terminals

SML-LX0603xxx-TR Series





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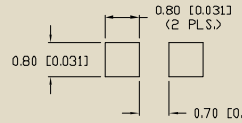

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QuasarBrite™ SMD LEDs

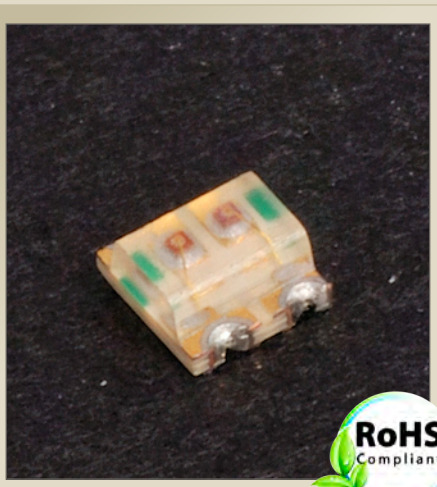
0606 Package

Features / Options

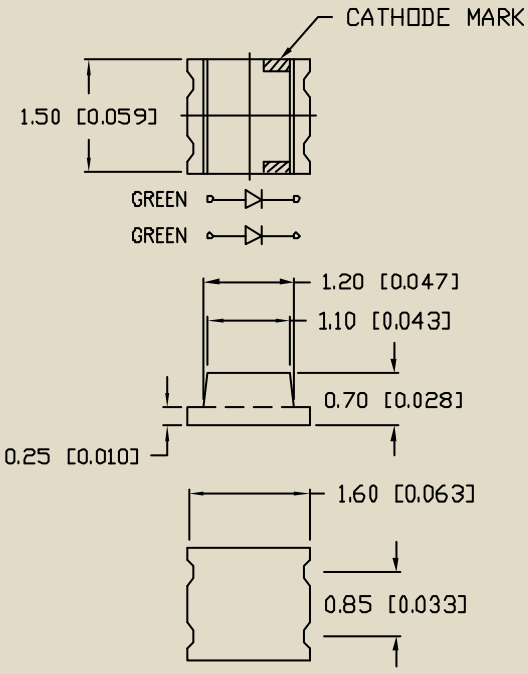
- Choice of colors
- Lead frame / lens casting reliability
- Easy-to-solder leads, gold finish
- Available in tape and reel
- Custom solutions available

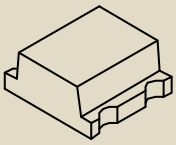
Applications / Uses

- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement
- Security electronics

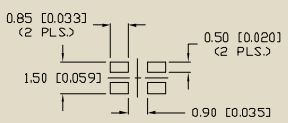


Standard, **SML-LX0606xxx-TR Series**





Recommended Solder Pad Layout



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QuasarBrite™ SMD LEDs

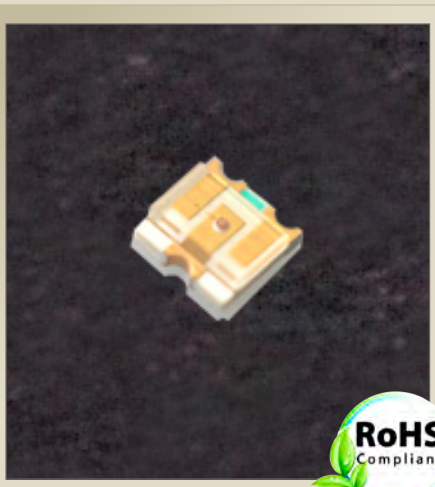
SOT-23 Package

Features / Options

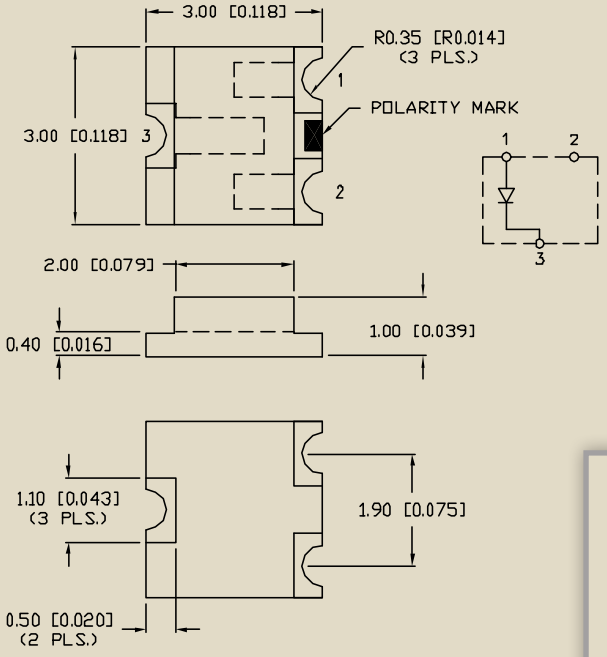
- Choice of colors
- Lead frame / lens casting reliability
- Easy-to-solder leads, gold finish
- Available in tape and reel
- Custom solutions available

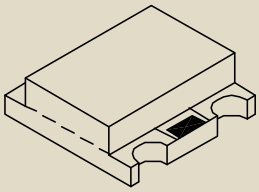
Applications / Uses

- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement
- Security electronics

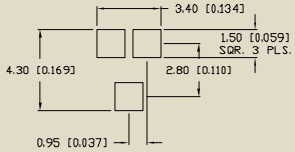


Standard, **SML-LX15xxx-TR**





Recommended Solder Pad Layout



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QuasarBrite™ SMD LEDs

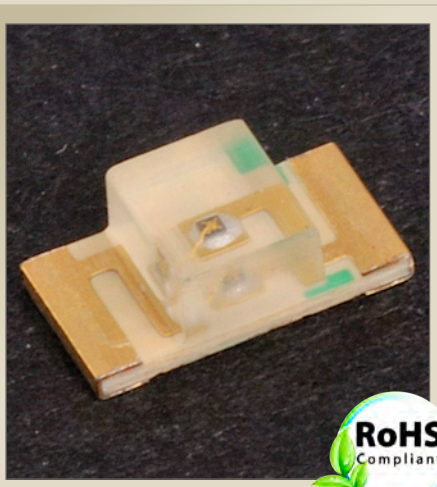
1206 Package

Features / Options

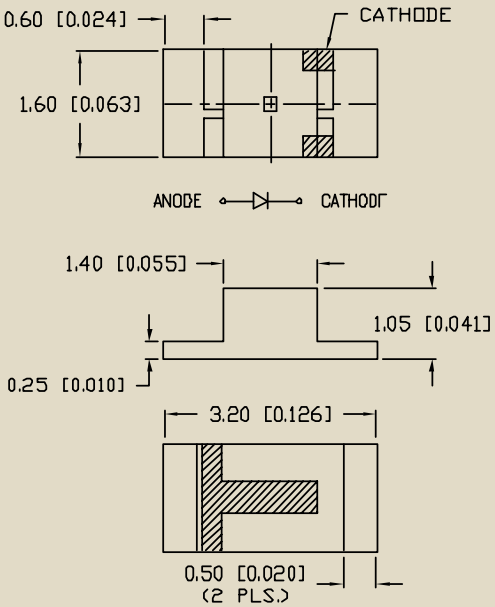
- Choice of colors
- Lead frame / lens casting reliability
- Easy-to-solder leads, gold finish
- Available in tape and reel
- Custom solutions available

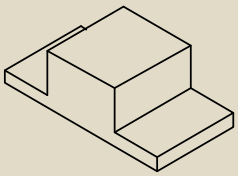
Applications / Uses

- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement
- Security electronics

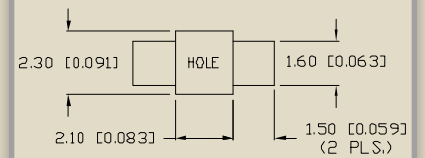


Flat Solder Terminals, Reverse Mount,
SML-LXR1206xxx-TR Series





Recommended Solder Pad Layout



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QuasarBrite™ SMD LEDs

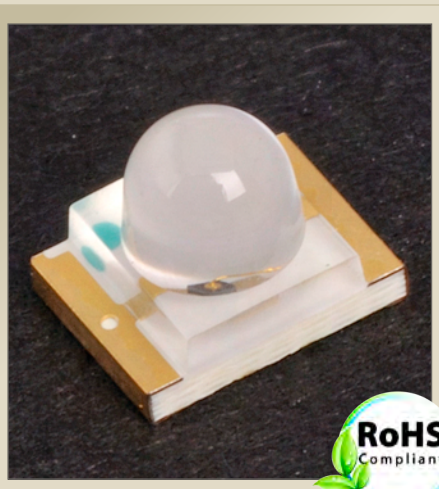
1206 Package

Features / Options

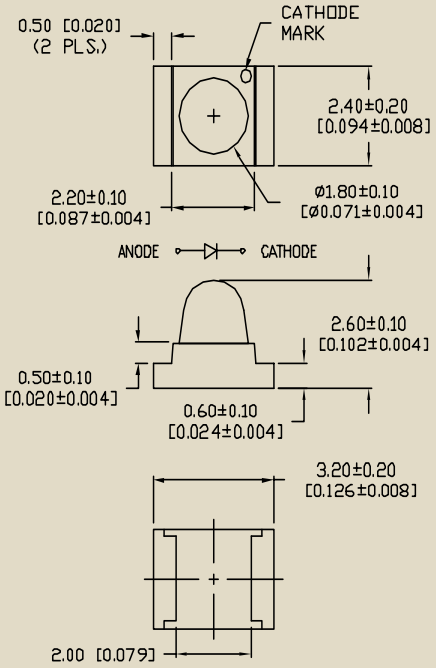
- Choice of colors
- Lead frame / lens casting reliability
- Easy-to-solder leads, gold finish
- Available in tape and reel
- Custom solutions available

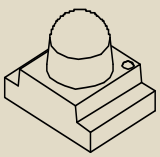
Applications / Uses

- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement
- Security electronics

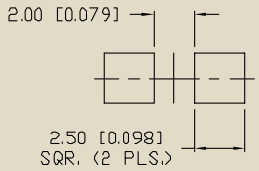


Flat Solder Terminals, Dome Lens,
SML-LXL1209xx-TR Series





Recommended Solder Pad Layout



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QuasarBrite™ SMD LEDs

1210 Package

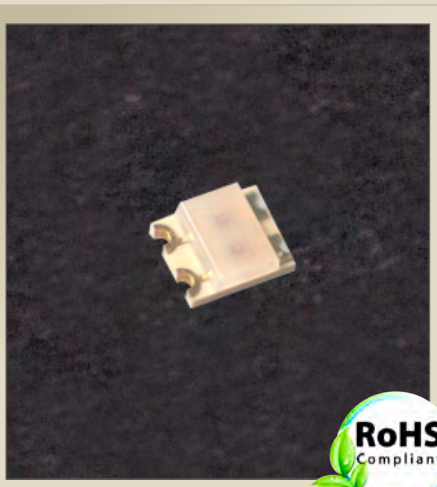
Standard

Features / Options

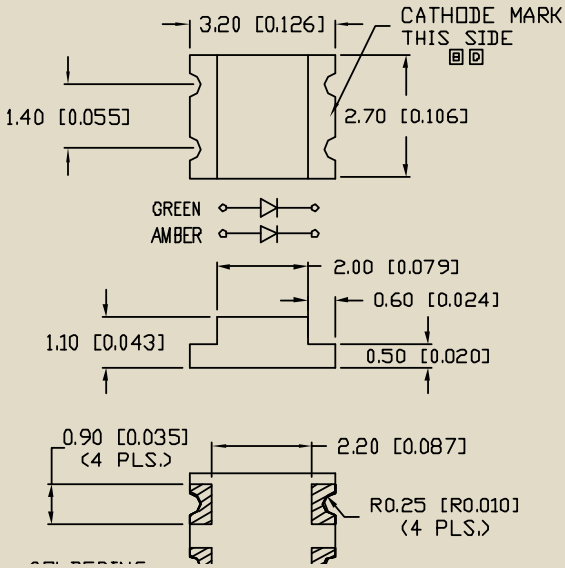
- Choice of colors
- Lead frame / lens casting reliability
- Easy-to-solder leads, gold finish
- Available in tape and reel
- Custom solutions available

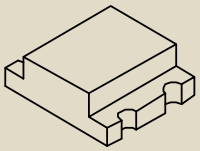
Applications / Uses

- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement
- Security electronics

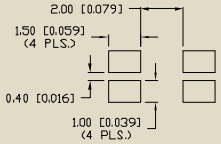


Standard, **SML-LX1210xxx-TR Series**





Recommended Solder Pad Layout



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LUMEX®
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QuasarBrite™ SMD LEDs

1210 Package

Lensed

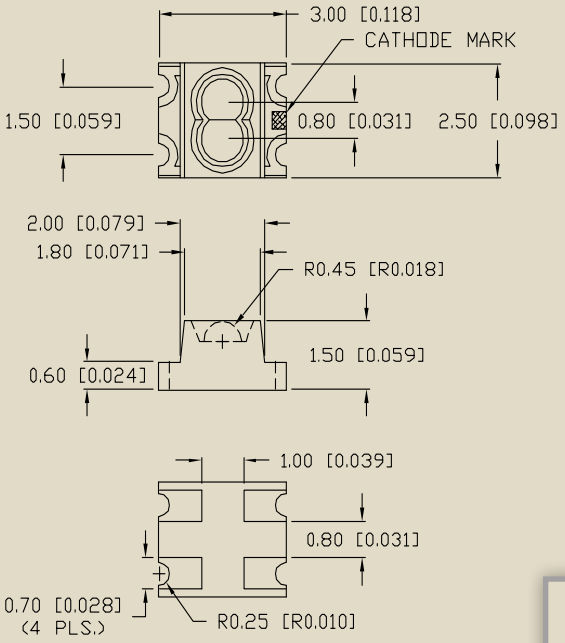
Features / Options

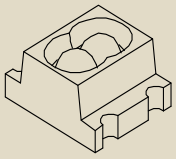
- Choice of colors
- Lead frame / lens casting reliability
- Easy-to-solder leads, gold finish
- Available in tape and reel
- Custom solutions available

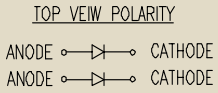
Applications / Uses

- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement
- Security electronics

Lensed, **SML-LXL1210xxx-TR Series**







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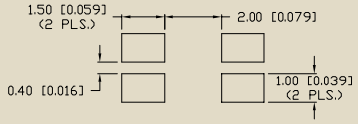

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QuasarBrite™ SMD LEDs

1309 Plastic, PLCC

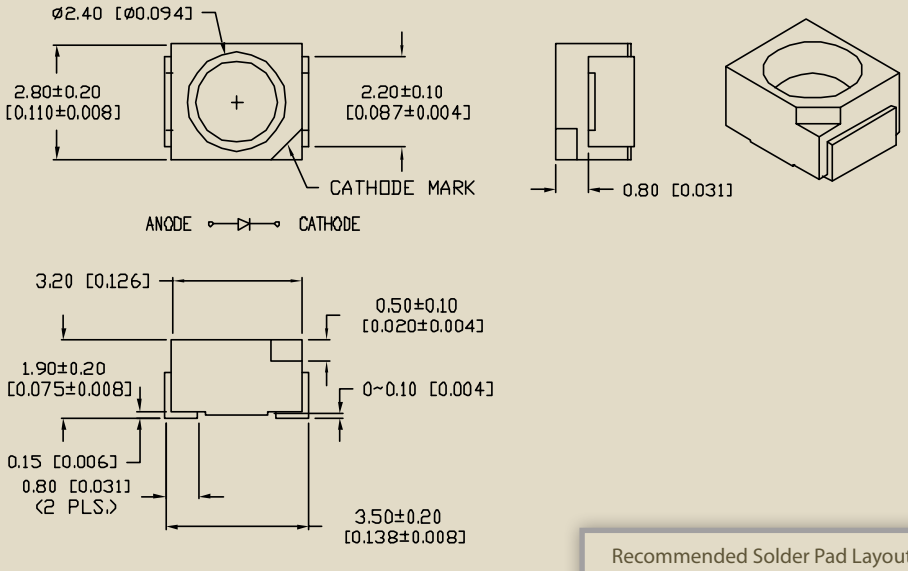
Features / Options

- Choice of colors
- Lead frame / lens casting reliability
- Easy-to-solder leads
- Available in tape and reel
- Custom solutions available

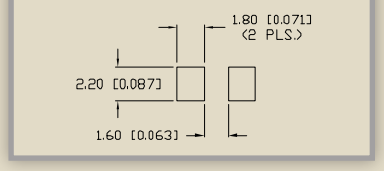
Applications / Uses

- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement
- Security electronics

Standard, **SML-LX2832xxx-TR Series**



Recommended Solder Pad Layout



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QuasarBrite™ SMD LEDs

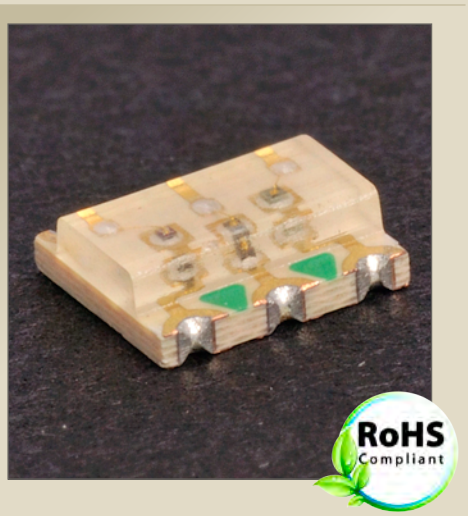
1412 Package
Standard Chip LED

Features / Options

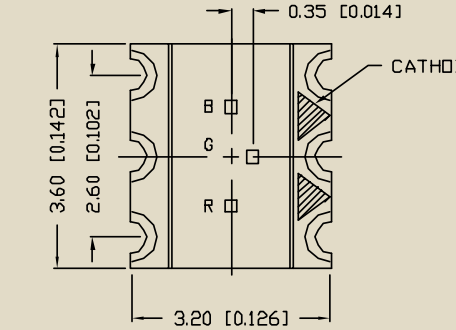
- Choice of colors
- Lead frame / lens casting reliability
- Easy-to-solder leads, gold finish
- Available bulk or tape and reel
- Custom solutions available

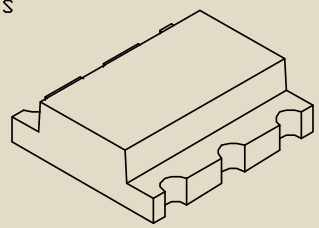
Applications / Uses

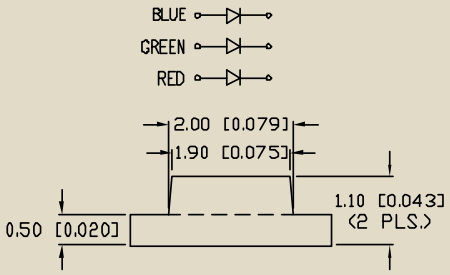
- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement
- Security electronics



Standard, **SML-LX3632xxx Series**







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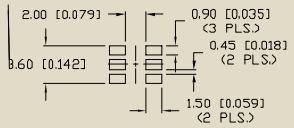

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QuasarBrite™ SMD LEDs

1206 Plastic
2mm x 3mm PLCC

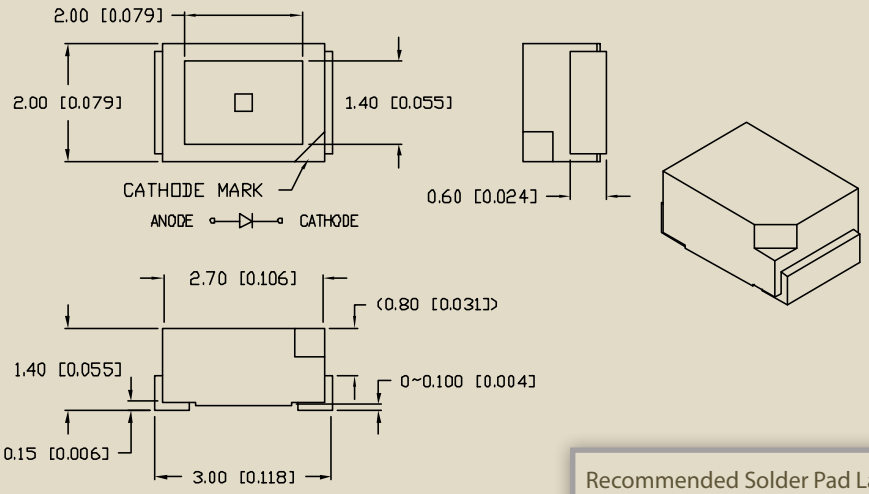
Features / Options

- Choice of colors
- Lead frame / lens casting reliability
- Easy-to-solder leads, tin finish
- Available in tape and reel
- Custom solutions available

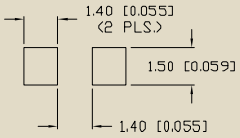
Applications / Uses

- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement
- Security electronics

Standard, **SML-LX23xxx-TR Series**



Recommended Solder Pad Layout



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LUMEX®
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QuasarBrite™ SMD LEDs

Right Angle

1mm x 2.8mm PLCC

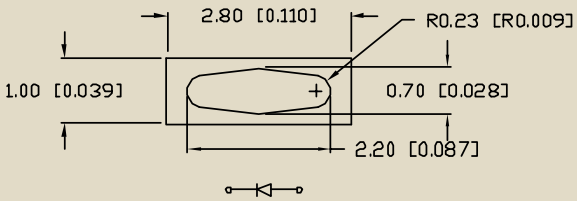
Features / Options

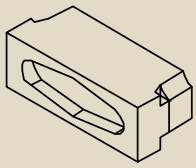
- Choice of colors and lens finishes
- Lead frame / lens casting reliability
- Easy-to-solder leads, multiple finishes
- Available bulk or tape and reel
- Custom solutions available

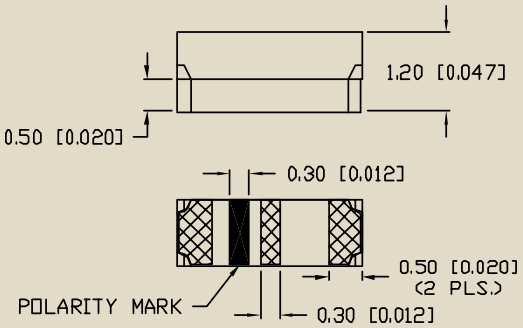
Applications / Uses

- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement
- Security electronics

1mm x 2.8mm Standard,
SML-LXR128xxx-TR Series







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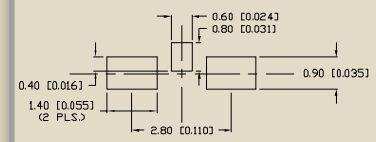

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QuasarBrite™ SMD LEDs

Right Angle

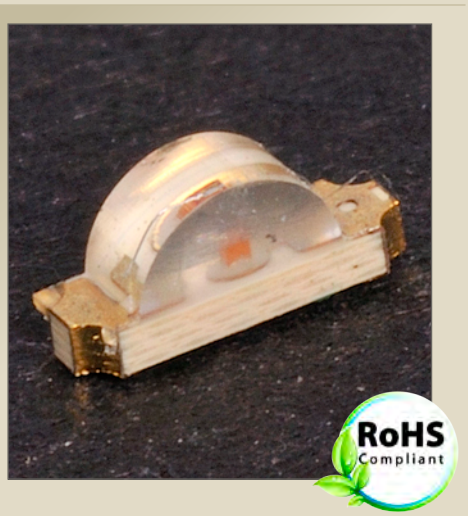
3mm, Standard Chip LED

Features / Options

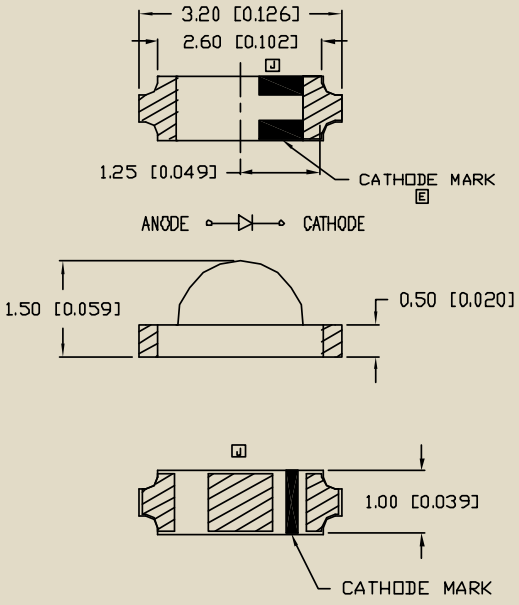
- Choice of colors and lens finishes
- Lead frame / lens casting reliability
- Easy-to-solder leads, multiple finishes
- Available bulk or tape and reel
- Custom solutions available

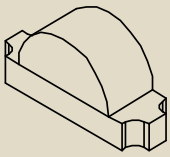
Applications / Uses

- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement
- Security electronics



Right Angle, 3mm Standard
SML-LXR85XC-TR Series





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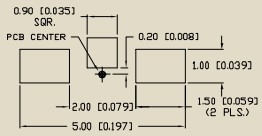

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QuasarBrite™ SMD LEDs

Right Angle

4mm x 3.6mm, PLCC

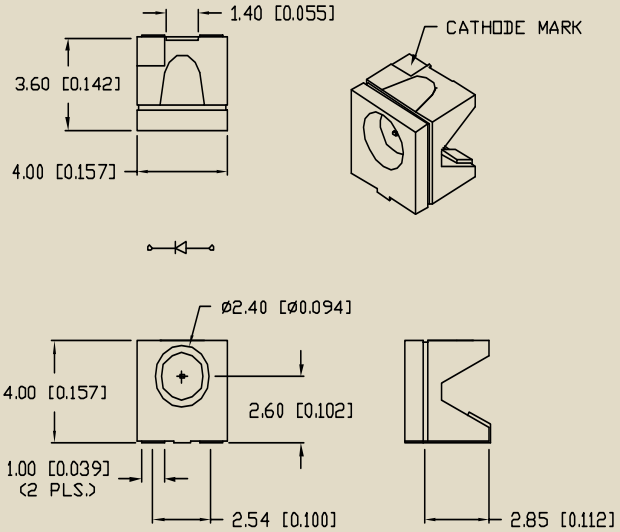
Features / Options

- Choice of colors and lens finishes
- Lead frame / lens casting reliability
- Easy-to-solder leads, multiple finishes
- Available bulk or tape and reel
- Custom solutions available

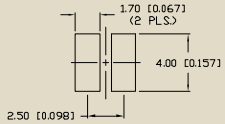
Applications / Uses

- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement
- Security electronics

Right Angle, 4mm x 3.6mm Standard
SML-LXR44xx-TR Series



Recommended Solder Pad Layout



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QuasarBrite™ Through-Hole LEDs

For over 30 years Lumex has been recognized as a world leader in the development and delivery of today's high-performance and innovation LED solutions. We offer the broadest selection of high reliability and quality through-hole LEDs manufactured to efficiently and effectively meet our customer's needs.

In addition to providing superior performance, Lumex's through-hole LEDs offer several characteristics and styles for increased design flexibility, including:

- Superior high temperature performance ;
- Excellent moisture resistance;
- Low power consumption;
- Broad range of standard and non-traditional colors;
- Wide variety of package styles including round, square, triangular and rectangular, ranging from 1.80mm to 23mm;
- Bi-color, RGB and integrated resistors in standard and low current options also available.

The following pages provide an overview of the types of through-hole LED products Lumex provides.

In addition to our standard product offering, Lumex can also customize any LED to suit your specific design needs. **For a complete list of all of Lumex's QuasarBrite™ Through-Hole LEDs, visit us online at www.lumex.com.**

LUMEX®
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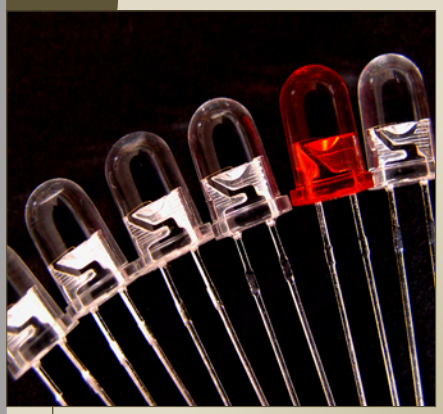
QuasarBrite™ Through-Hole LEDs - Index



The index above is representative of some of Lumex's latest innovative and more diverse product offerings. **For a complete list of all of Lumex's QuasarBrite™ Through-Hole LEDs, visit us online at www.lumex.com.**

LUMEX®
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QuasarBrite™ Through-Hole LEDs

4-Leaded RGB LED

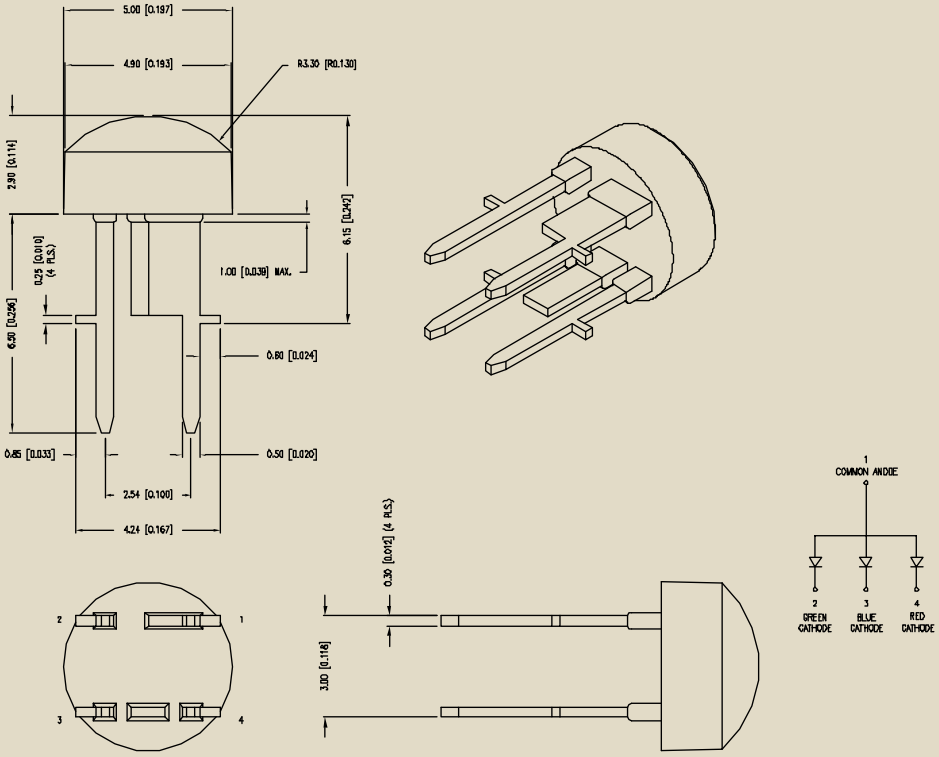
Features / Options

- 120˚ viewing angle (versus traditional 30˚ viewing angle from other through-hole LEDs
- Superior thermal design leadframe
- Enhanced off-the-board thermal design
- Compact 5mm package size
- Custom solutions available

Applications / Uses

- High output signage (close proximity)
- Decorative lighting
- Indicator lighting
- Portable medical devices
- Multi-color applications

4-Leaded RGB LED, **SSL-LX503SIUPGUSBC**



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LUMEX®
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QuasarBrite™ Through-Hole LEDs

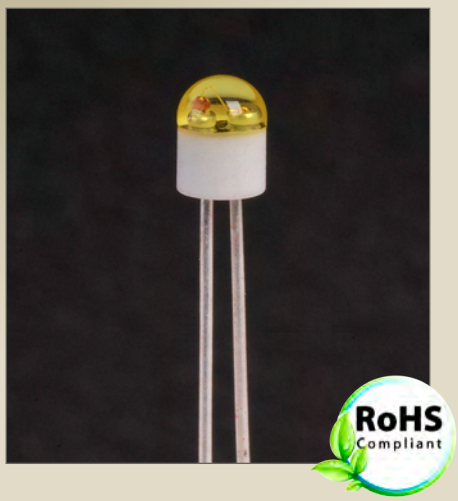
2mm Round

Features / Options

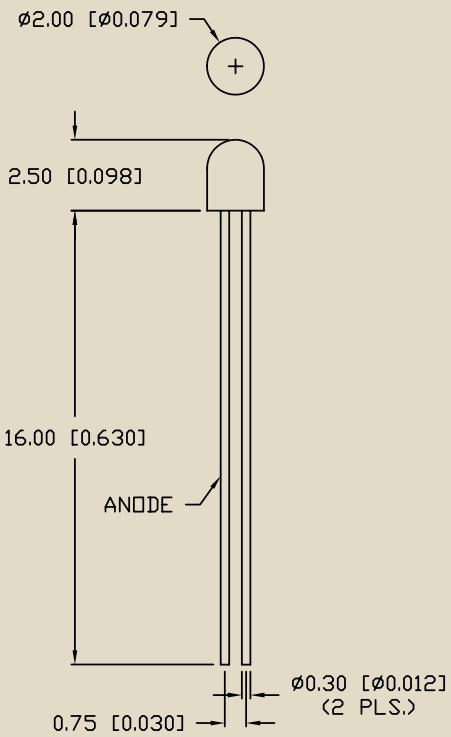
- Ceramic substrate
- Choice of colors and lens finishes
- Lead frame / lens casting reliability
- Easy-to-solder leads, tin finish
- Available bulk or tape and reel
- Custom solutions available

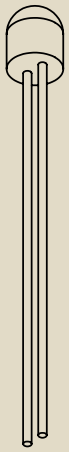
Applications / Uses

- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement
- Security electronics



Ceramic Stem: **SSL-LX203C Series**





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QuasarBrite™ Through-Hole LEDs

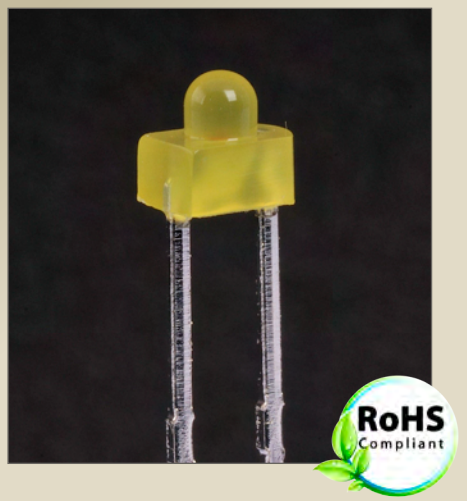
2mm Round

Features / Options

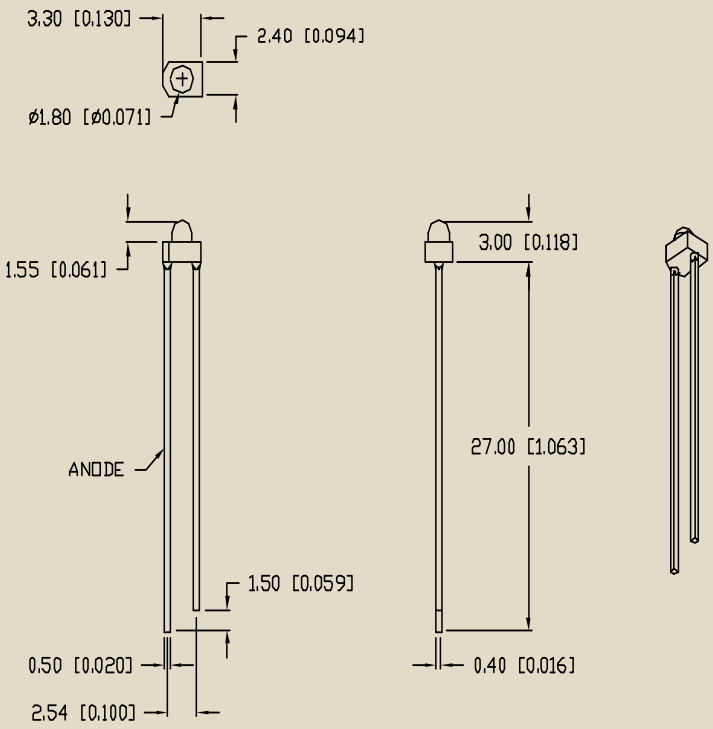
- Choice of colors and lens finishes
- Lead frame / lens casting reliability
- Easy-to-solder leads, tin finish
- Available bulk or tape and reel
- Custom solutions available

Applications / Uses

- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement
- Security electronics



Stove Pipe Lens: SSL-LX20333 Series



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QuasarBrite™ Through-Hole LEDs

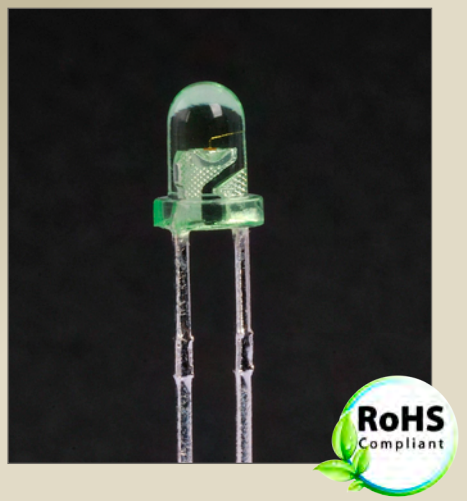
3mm Round

Features / Options

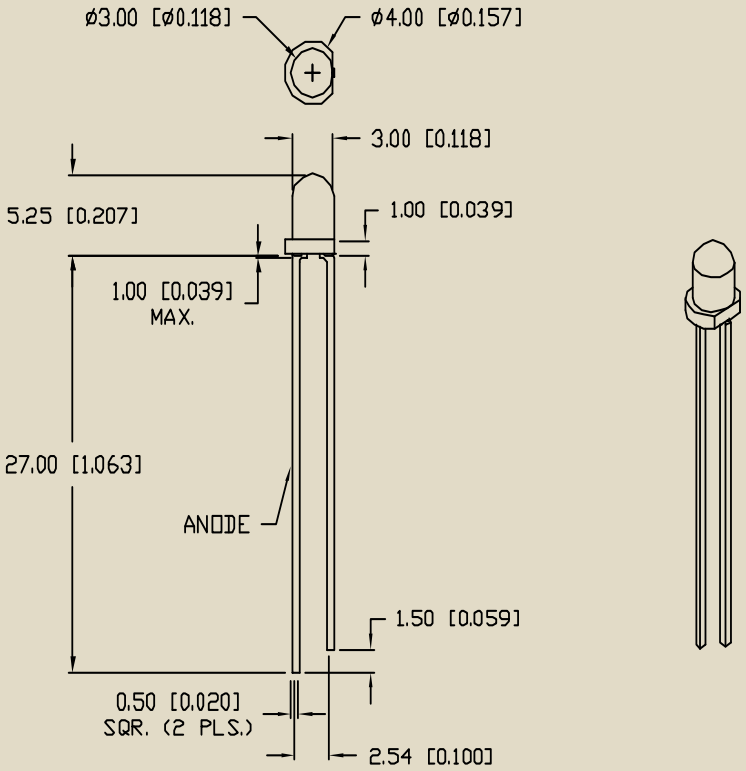
- Choice of colors and lens finishes
- Lead frame / lens casting reliability
- Easy-to-solder leads, tin finish
- Available bulk or tape and reel
- Custom solutions available

Applications / Uses

- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement
- Security electronics



Standard, SSL-LX3054 Series



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QuasarBrite™ Through-Hole LEDs

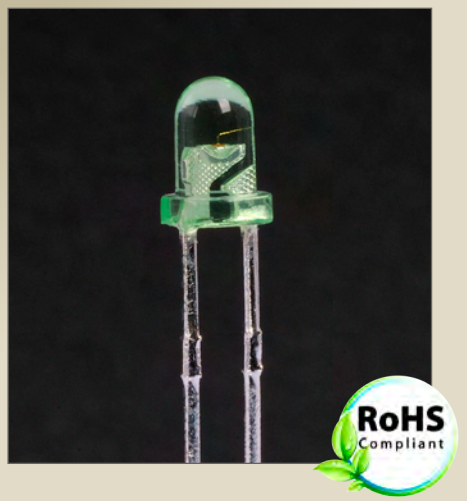
3mm Round

Features / Options

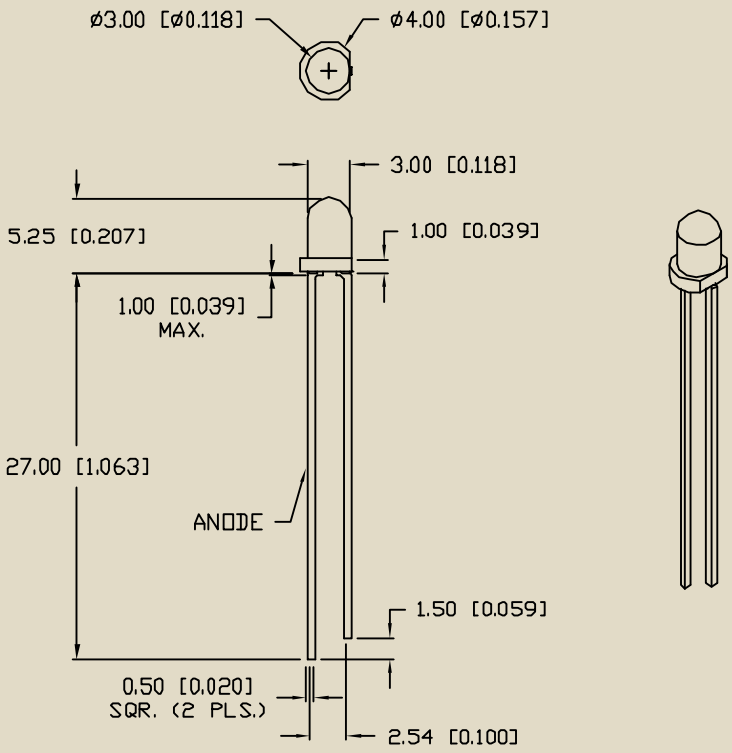
- Choice of colors and lens finishes
- Lead frame / lens casting reliability
- Easy-to-solder leads, tin finish
- Available bulk or tape and reel
- Custom solutions available

Applications / Uses

- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement
- Security electronics



5V Operation, SSL-LX3054xx-5V Series



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QuasarBrite™ Through-Hole LEDs

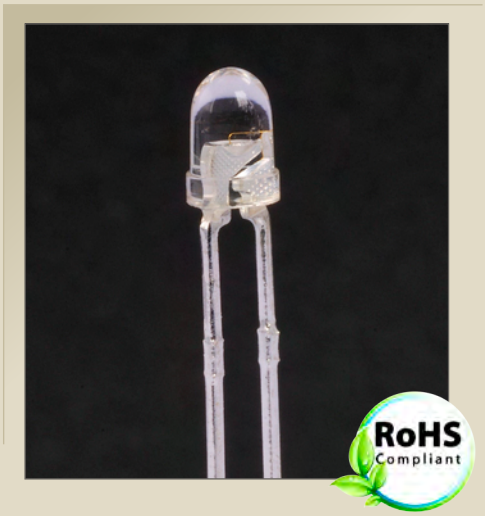
3mm Round

Features / Options

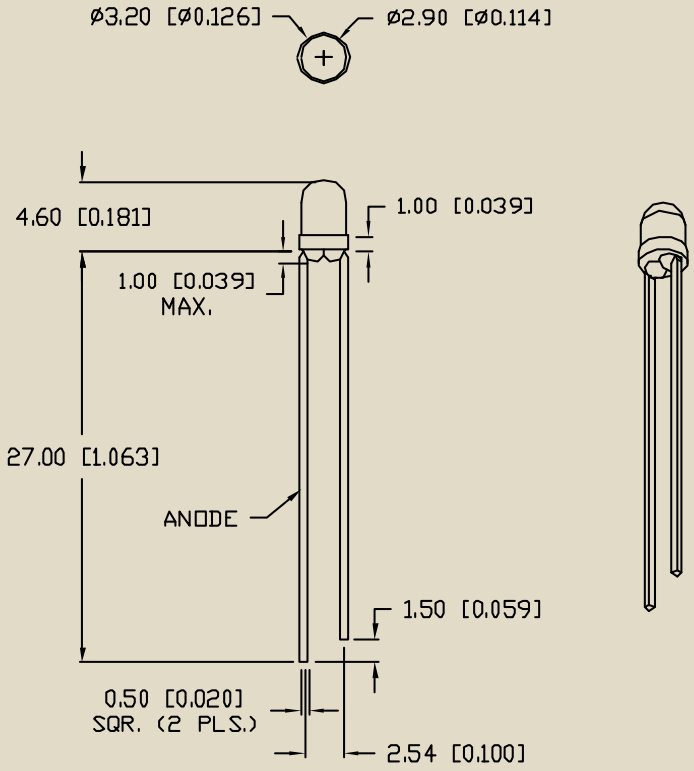
- Choice of colors and lens finishes
- Lead frame / lens casting reliability
- Easy-to-solder leads, tin finish
- Available bulk or tape and reel
- Custom solutions available

Applications / Uses

- Communications equipment
- Industrial controls
- Life safety equipment
- Medical equipment
- Meter displays
- Security electronics
- Test and measurement



Short lens, SSL-LX3044 Series



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QuasarBrite™ Through-Hole LEDs

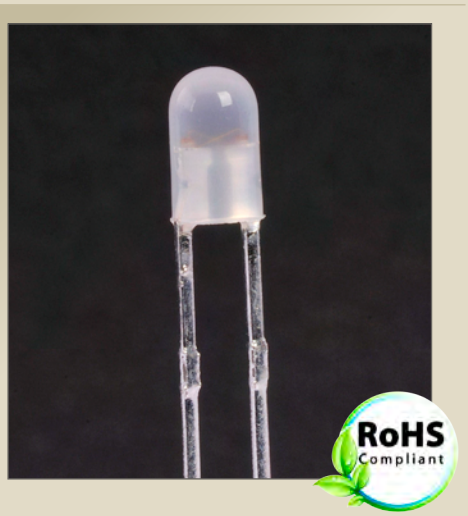
3mm Round

Features / Options

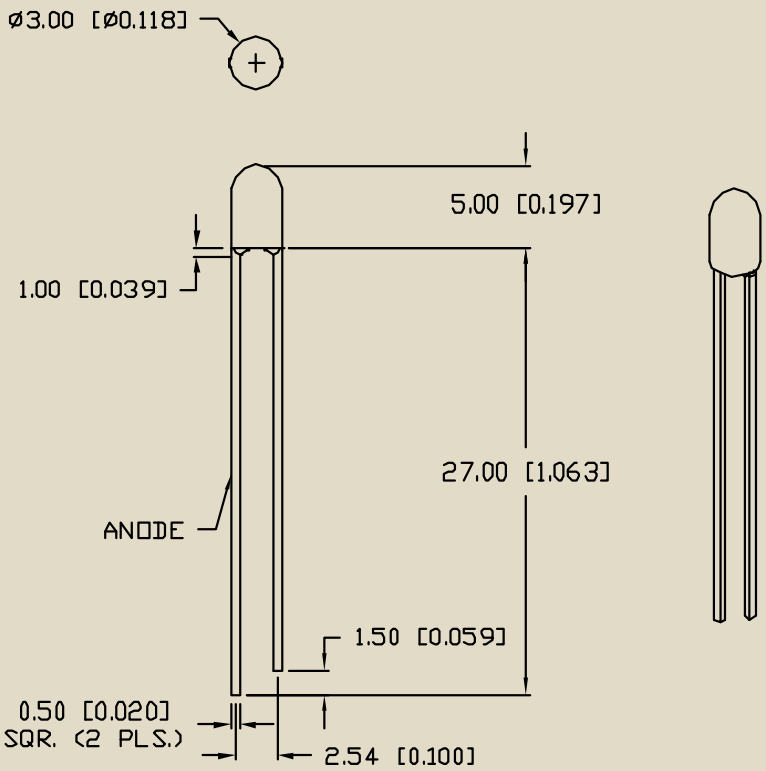
- Choice of colors and lens finishes
- Lead frame / lens casting reliability
- Easy-to-solder leads, tin finish
- Available bulk or tape and reel
- Custom solutions available

Applications / Uses

- Communications equipment
- Industrial controls
- Life safety equipment
- Medical equipment
- Meter displays
- Security electronics
- Test and measurement



Flangeless, SSL-LX305F4 Series



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QuasarBrite™ Through-Hole LEDs

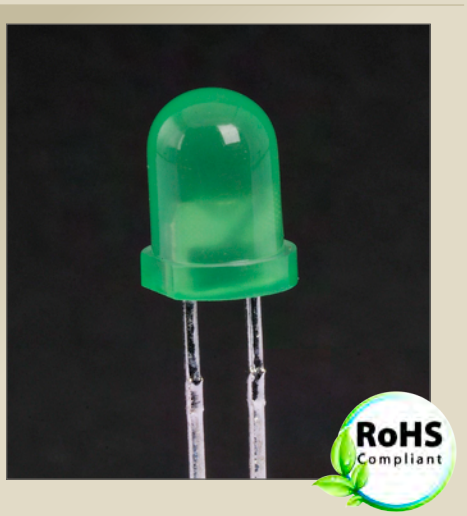
4mm Round

Features / Options

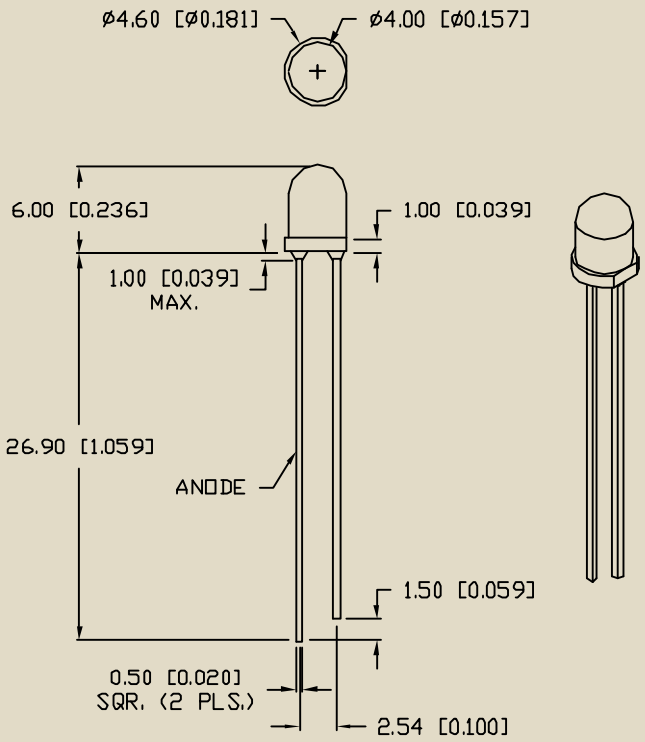
- Choice of colors and lens finishes
- Lead frame / lens casting reliability
- Easy-to-solder leads, tin finish
- Available bulk or tape and reel
- Custom solutions available

Applications / Uses

- Communications equipment
- Industrial controls
- Life safety equipment
- Medical equipment
- Meter displays
- Security electronics
- Test and measurement



Standard, SSL-LX4064 Series



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QuasarBrite™ Through-Hole LEDs

5mm Round

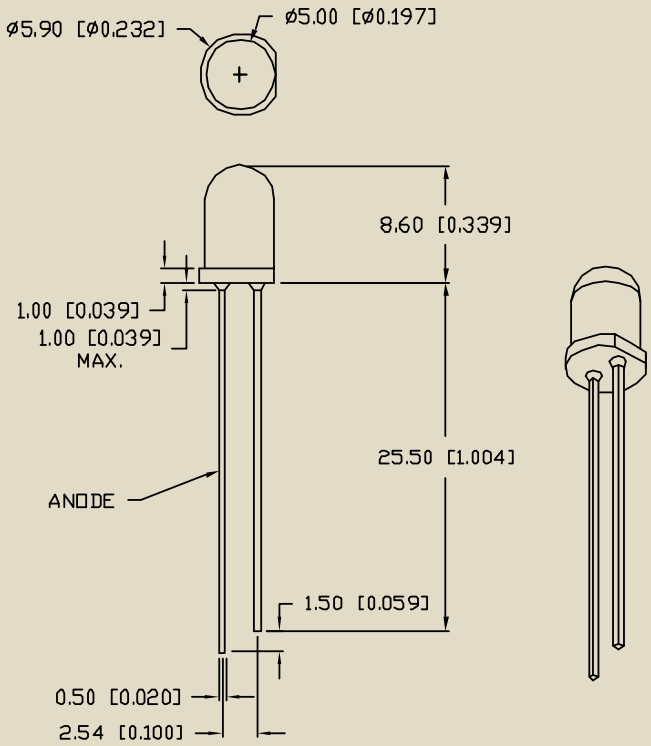
Features / Options

- Available in pink, purple and turquoise colors
- State-of-the-art, high-brightness chip technology
- T5mm packaging

Applications / Uses

- Logo illumination
- Personal electronics
- Accent lighting
- Appliances
- Promotional products

Inspriration™ LEDs, SSL-LX5093xC Series



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QuasarBrite™ Through-Hole LEDs

5mm Round

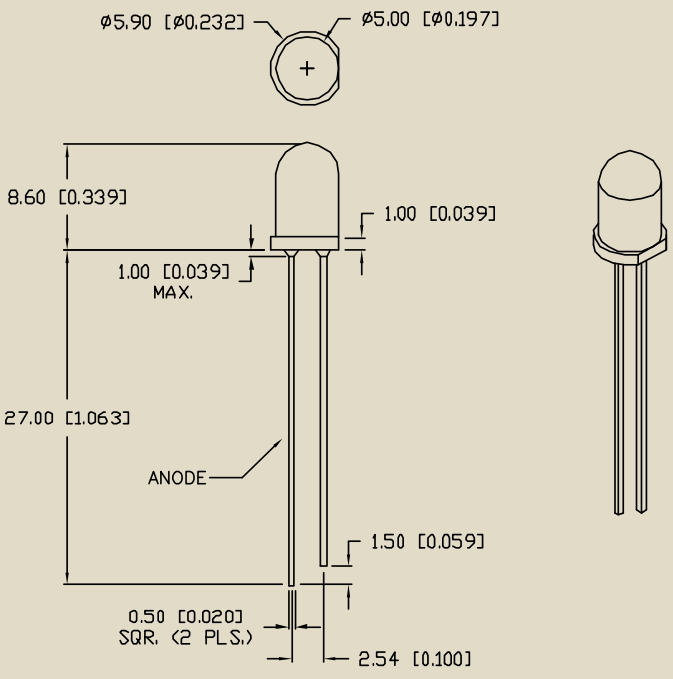
Features / Options

- Choice of colors and lens finishes
- Lead frame / lens casting reliability
- Easy-to-solder leads, tin finish
- Available bulk or tape and reel
- Custom solutions available

Applications / Uses

- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement
- Security electronics

Standard, SSL-LX5093 Series



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QuasarBrite™ Through-Hole LEDs

5mm Round

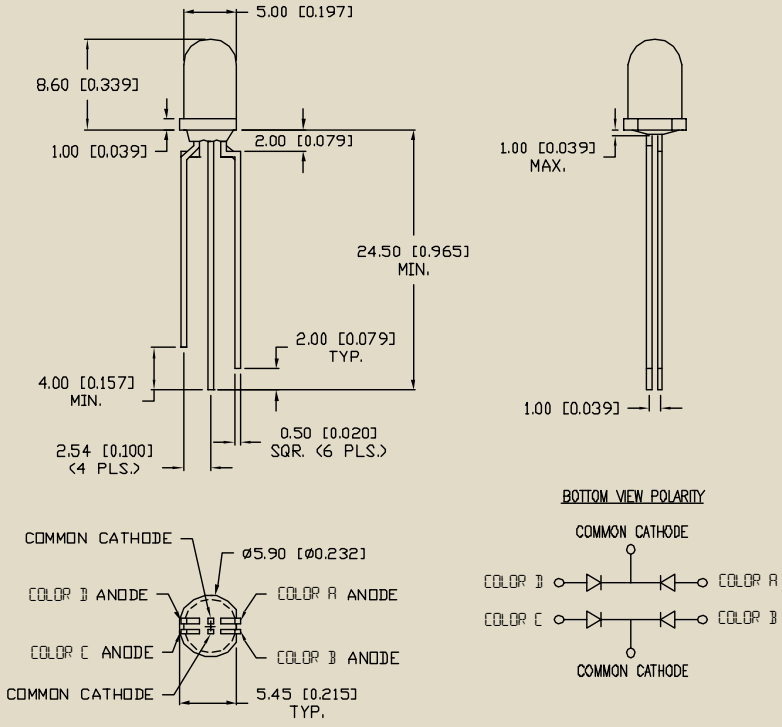
Features / Options

- Choice of colors and lens finishes
- Lead frame / lens casting reliability
- Easy-to-solder leads, tin finish
- Available bulk or tape and reel
- Custom solutions available

Applications / Uses

- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement
- Security electronics

Tri-Color, SSL-LX5099 Series



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QuasarBrite™ Through-Hole LEDs

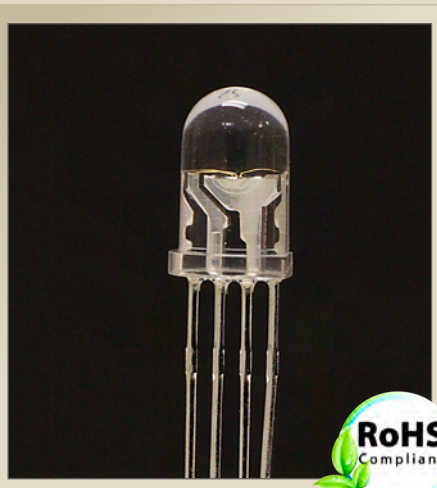
5mm Round

Features / Options

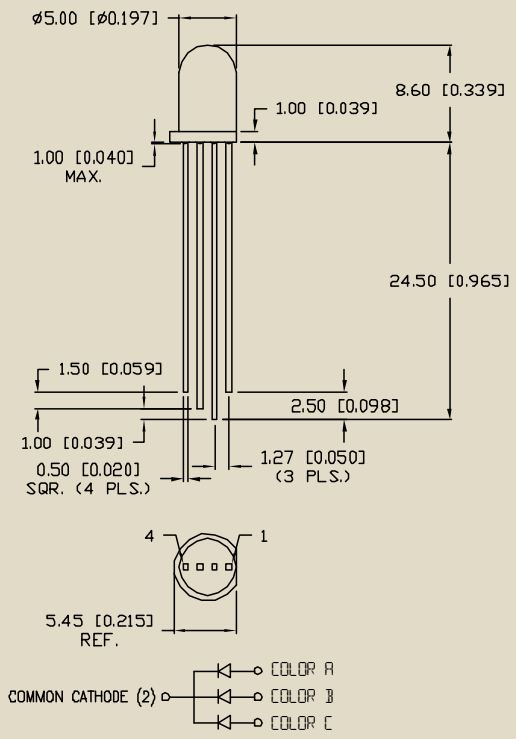
- Choice of colors and lens finishes
- Lead frame / lens casting reliability
- Easy-to-solder leads, tin finish
- Available bulk or tape and reel
- Custom solutions available

Applications / Uses

- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement
- Security electronics



RGB, SSL-LX5097 Series



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QuasarBrite™ Through-Hole LEDs

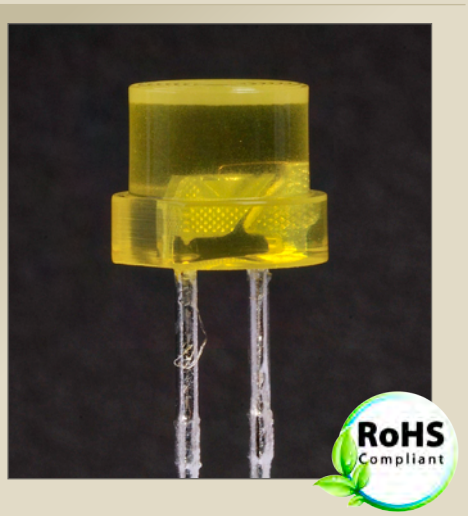
5mm Round

Features / Options

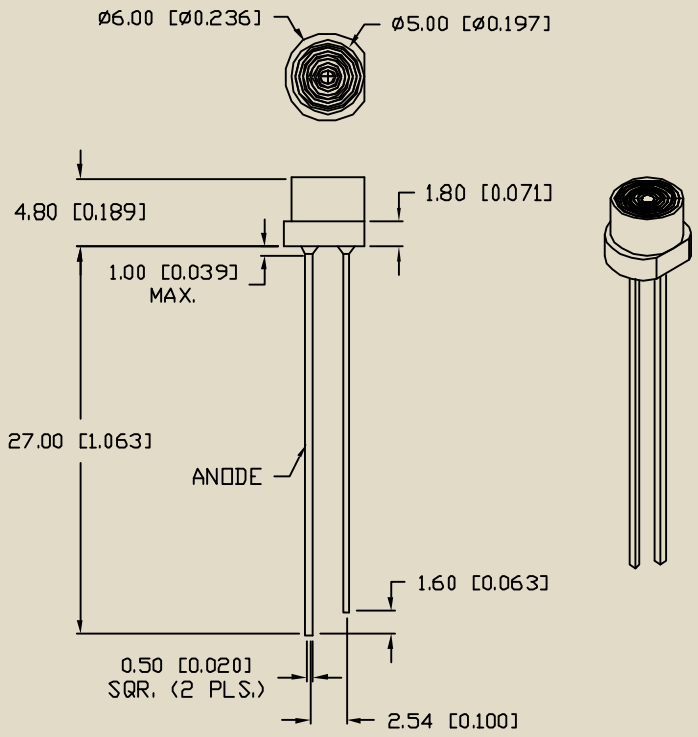
- Choice of colors and lens finishes
- Lead frame / lens casting reliability
- Easy-to-solder leads, tin finish
- Available bulk or tape and reel
- Custom solutions available

Applications / Uses

- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement
- Security electronics



Freznel Lens, SSL-LX433 Series



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LUMEX®
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QuasarBrite™ Through-Hole LEDs

5mm Round

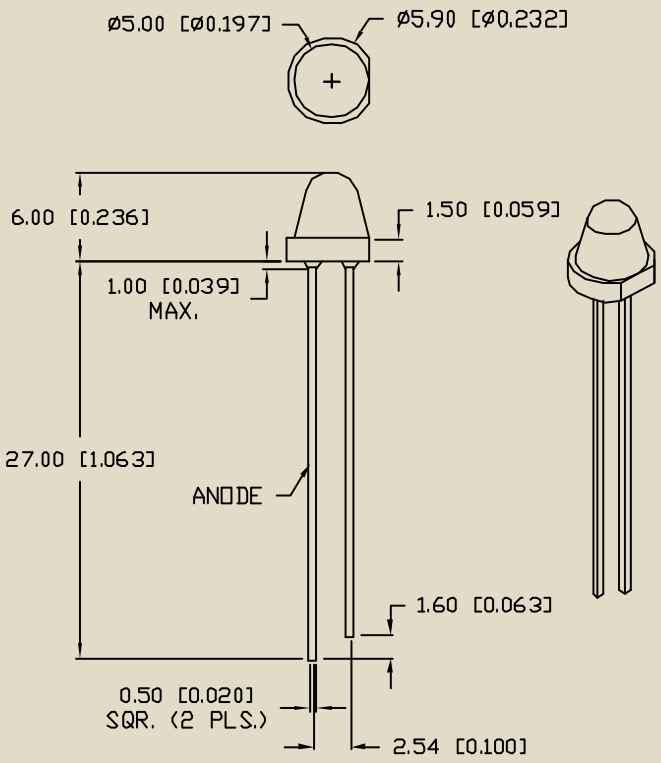
Features / Options

- Choice of colors and lens finishes
- Lead frame / lens casting reliability
- Easy-to-solder leads, tin finish
- Available bulk or tape and reel
- Custom solutions available

Applications / Uses

- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement
- Security electronics

Short Profile, SSL-LX5063 Series



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QuasarBrite™ Through-Hole LEDs

5mm Round

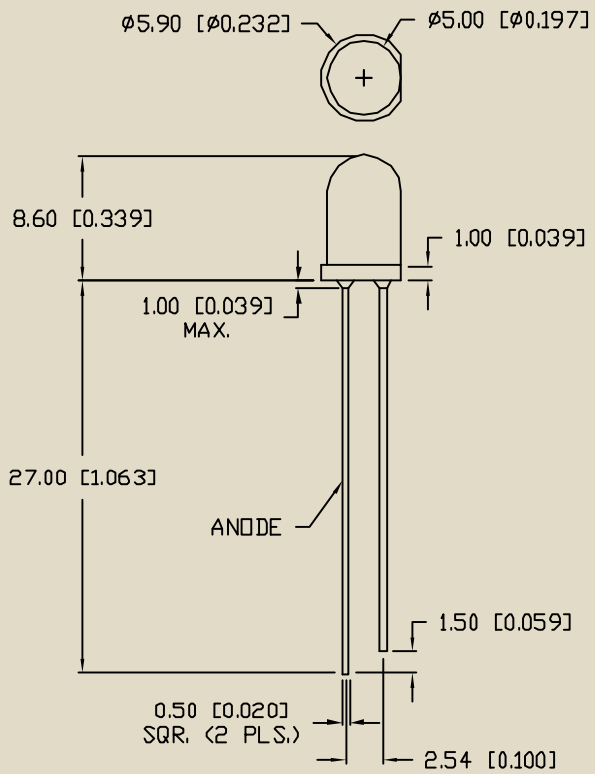
Features / Options

- Choice of colors and lens finishes
- Lead frame / lens casting reliability
- Easy-to-solder leads, tin finish
- Available bulk or tape and reel
- Custom solutions available

Applications / Uses

- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement
- Security electronics

12 Volt, SSL-LX5093xx-12V Series



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QuasarBrite™ Through-Hole LEDs

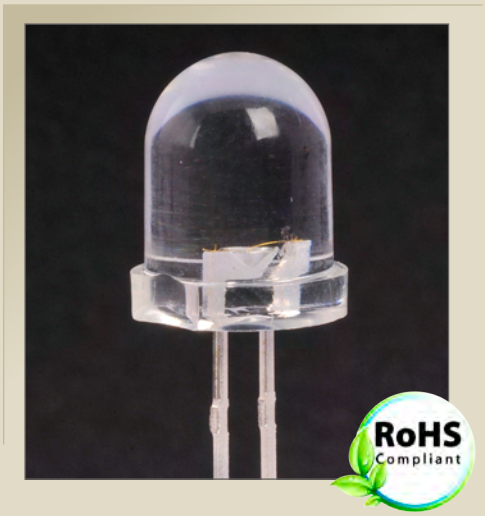
8mm Round

Features / Options

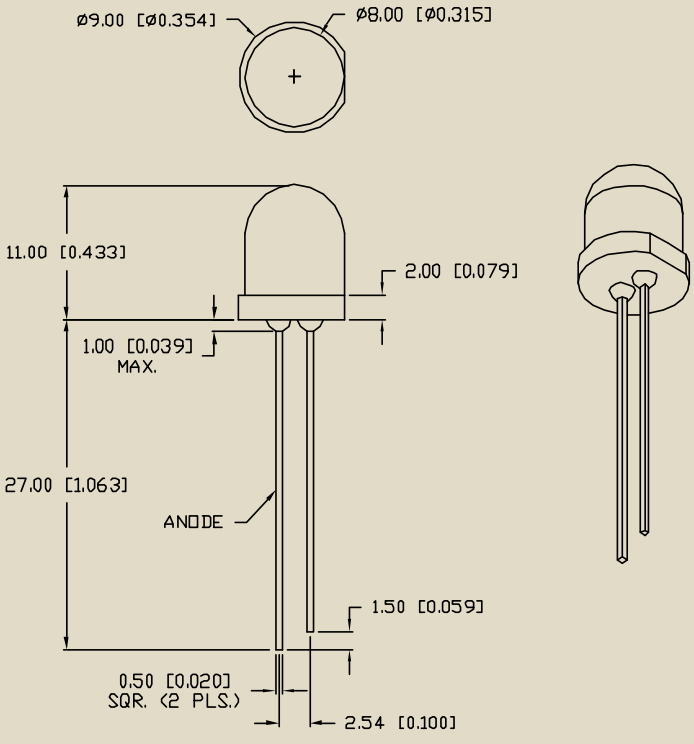
- Choice of colors and lens finishes
- Lead frame / lens casting reliability
- Easy-to-solder leads, tin finish
- Available bulk or tape and reel
- Custom solutions available

Applications / Uses

- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement
- Security electronics



Standard, SSL-LX80113 Series



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QuasarBrite™ Through-Hole LEDs

10mm Round

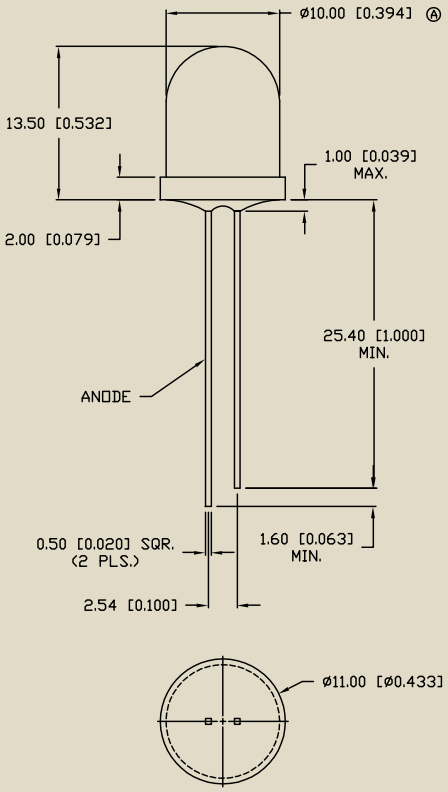
Features / Options

- Choice of colors and lens finishes
- Lead frame / lens casting reliability
- Easy-to-solder leads, tin finish
- Available bulk or tape and reel
- Custom solutions available

Applications / Uses

- Communications equipment
- Industrial controls
- Life safety equipment
- Medical equipment
- Meter displays
- Security electronics
- Test and measurement

Standard, SSL-LX100133 Series



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QuasarBrite™ Through-Hole LEDs

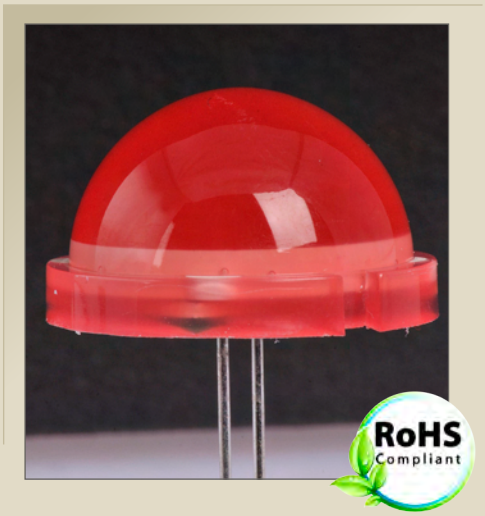
22mm Round

Features / Options

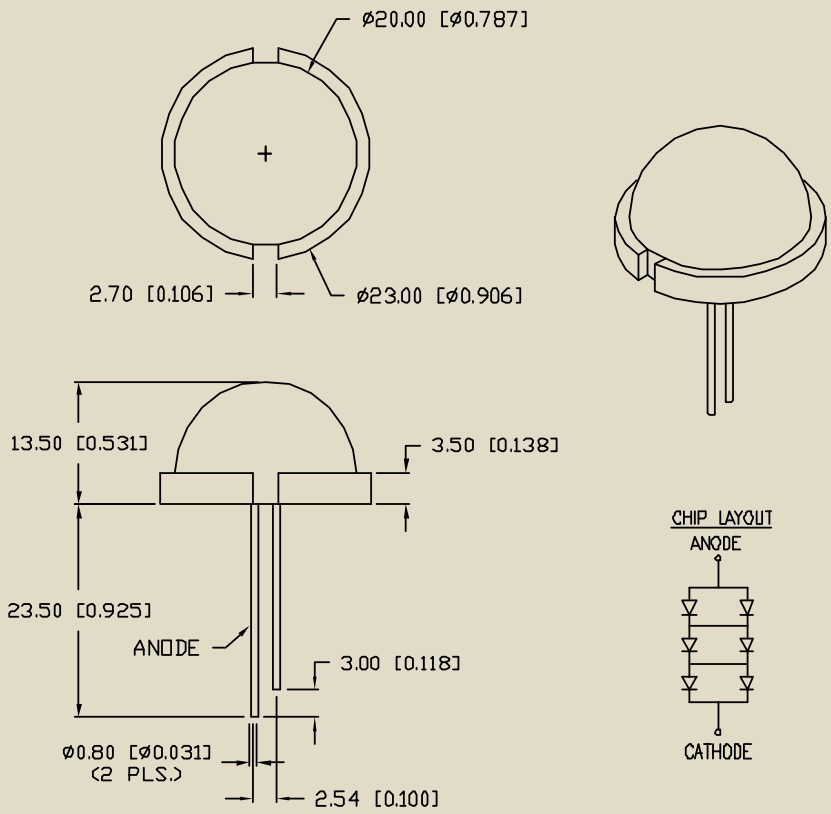
- Choice of colors and lens finishes
- Lead frame / lens casting reliability
- Easy-to-solder leads, tin finish
- Available bulk or tape and reel
- Custom solutions available

Applications / Uses

- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement
- Security electronics



2-Pin, SSL-LX20R6 Series



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QuasarBrite™ Through-Hole LEDs

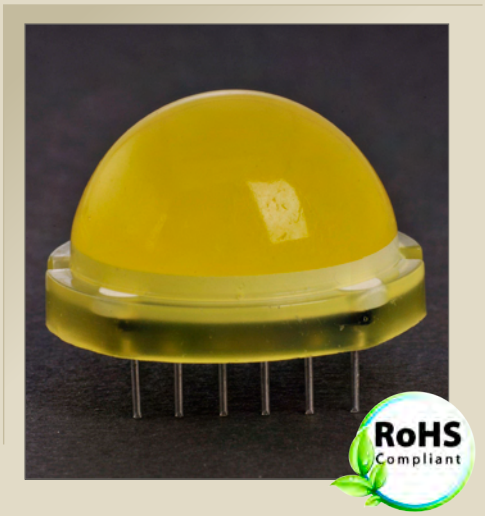
22mm Round

Features / Options

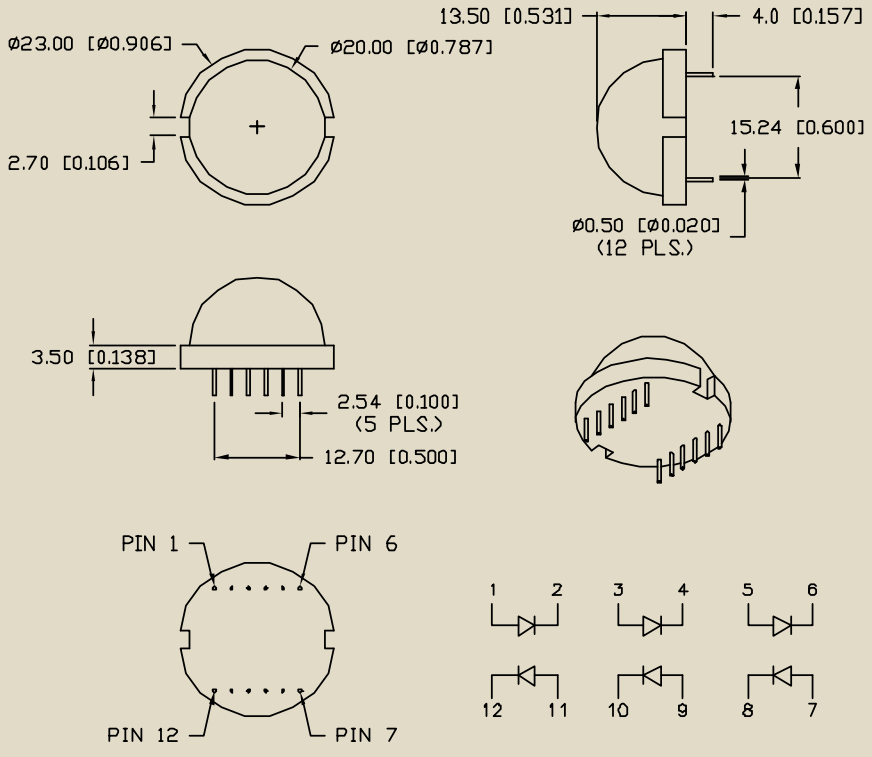
- Choice of colors and lens finishes
- Lead frame / lens casting reliability
- Easy-to-solder leads, tin finish
- Available bulk or tape and reel
- Custom solutions available

Applications / Uses

- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement
- Security electronics



12-Pin, SSL-LX22R13 Series



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QuasarBrite™ Through-Hole LEDs

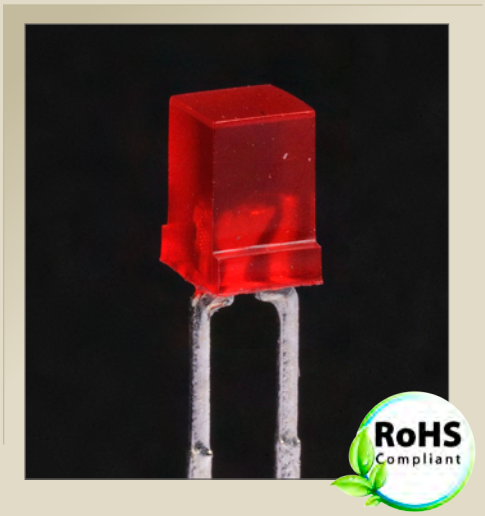
3mm x 3mm Square

Features / Options

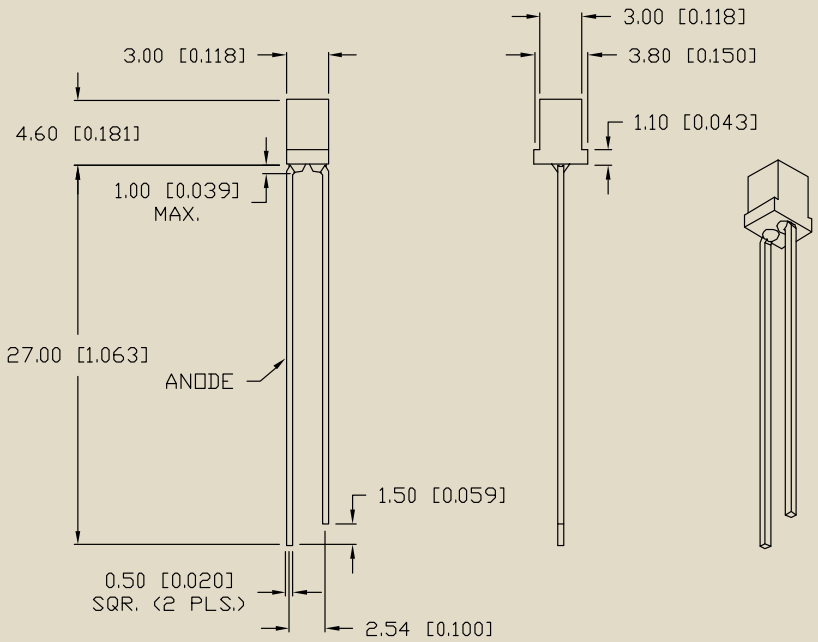
- Choice of colors and lens finishes
- Lead frame / lens casting reliability
- Easy-to-solder leads, tin finish
- Available bulk or tape and reel
- Custom solutions available

Applications / Uses

- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement
- Security electronics



Standard, SSL-LX3353 Series



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QuasarBrite™ Through-Hole LEDs

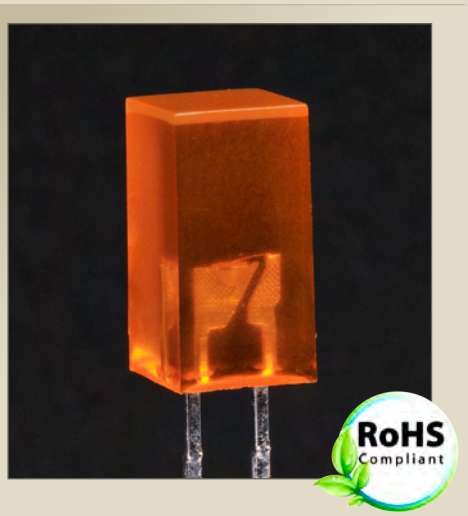
5mm x 5mm Square

Features / Options

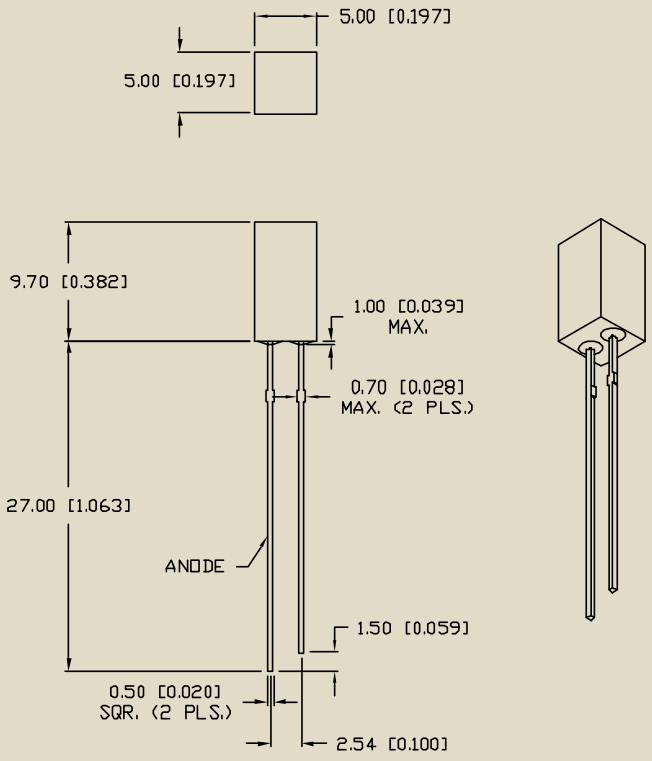
- Choice of colors and lens finishes
- Lead frame / lens casting reliability
- Easy-to-solder leads, tin finish
- Available bulk or tape and reel
- Custom solutions available

Applications / Uses

- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement
- Security electronics



Flangeless, SSL-LX55103xx-FL Series



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QuasarBrite™ Through-Hole LEDs

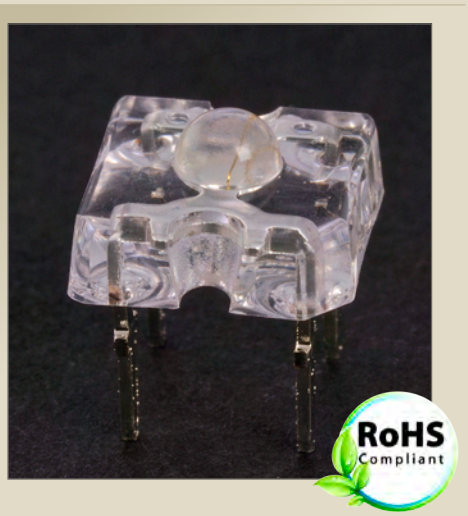
7.6mm x 7.6mm Square

Features / Options

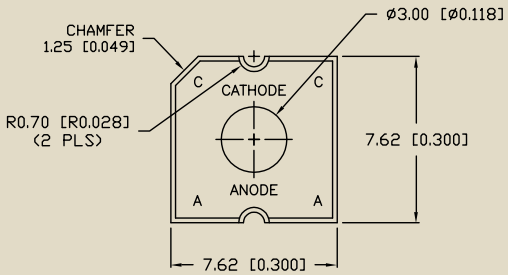
- Choice of colors and lens finishes
- Lead frame / lens casting reliability
- Easy-to-solder leads, tin finish
- Available bulk or tape and reel
- Custom solutions available

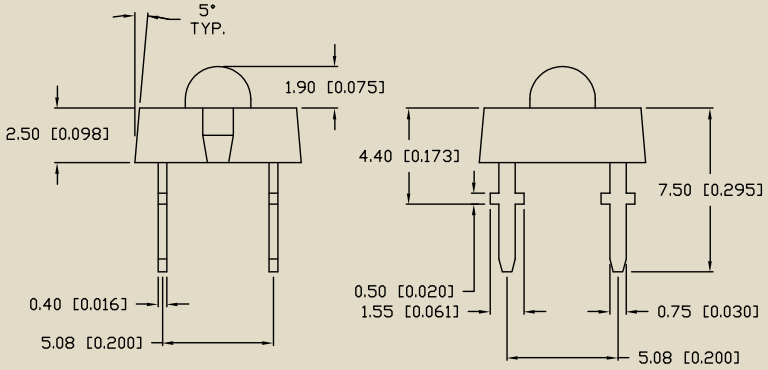
Applications / Uses

- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement
- Security electronics



Standard, SSL-LX30448 Series





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LUMEX®
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QuasarBrite™ Through-Hole LEDs

8mm x 8mm Square

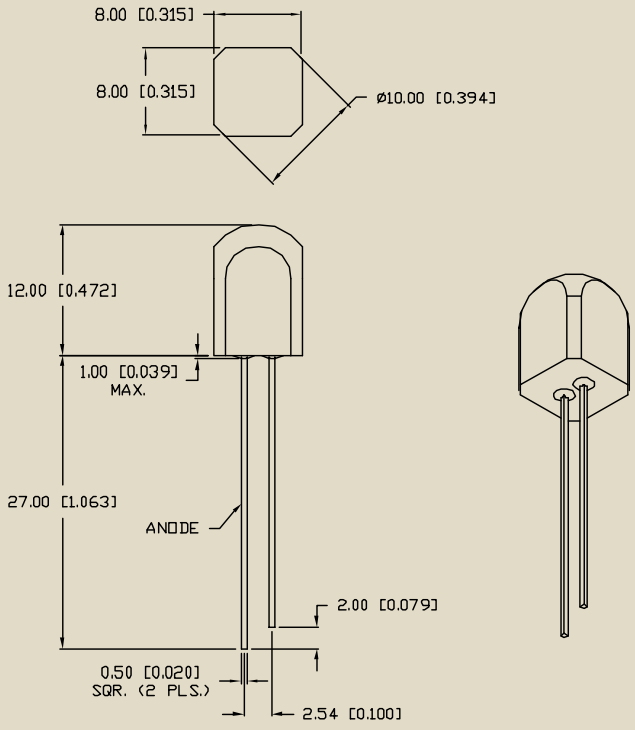
Features / Options

- Choice of colors and lens finishes
- Lead frame / lens casting reliability
- Easy-to-solder leads, tin finish
- Available bulk or tape and reel
- Custom solutions available

Applications / Uses

- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement
- Security electronics

Standard, SSL-LX88123 Series



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LUMEX®
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QuasarBrite™ Through-Hole LEDs

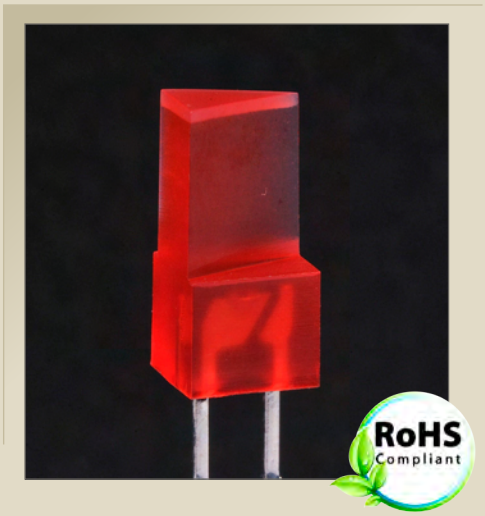
4.5mm x 3mm Triangle

Features / Options

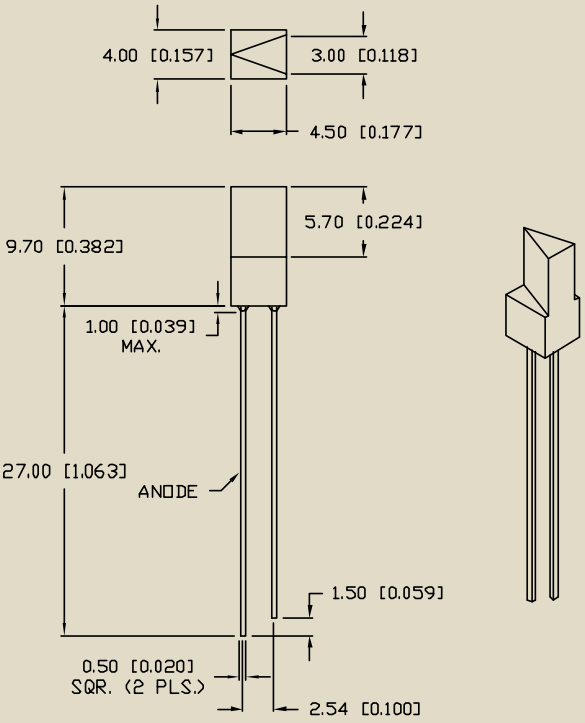
- Choice of colors and lens finishes
- Lead frame / lens casting reliability
- Easy-to-solder leads, tin finish
- Available bulk or tape and reel
- Custom solutions available

Applications / Uses

- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement
- Security electronics



Standard, SSL-LX3T453 Series



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QuasarBrite™ Through-Hole LEDs

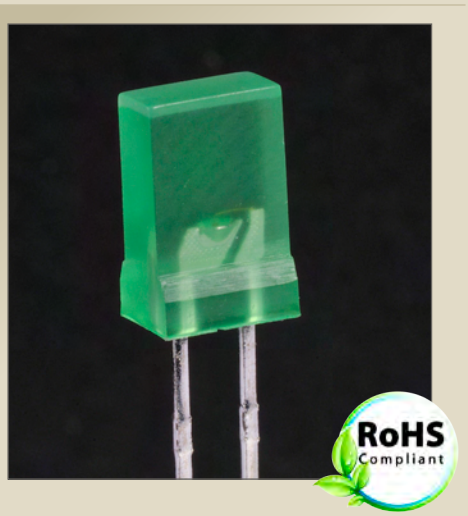
1mm x 5mm Rectangle

Features / Options

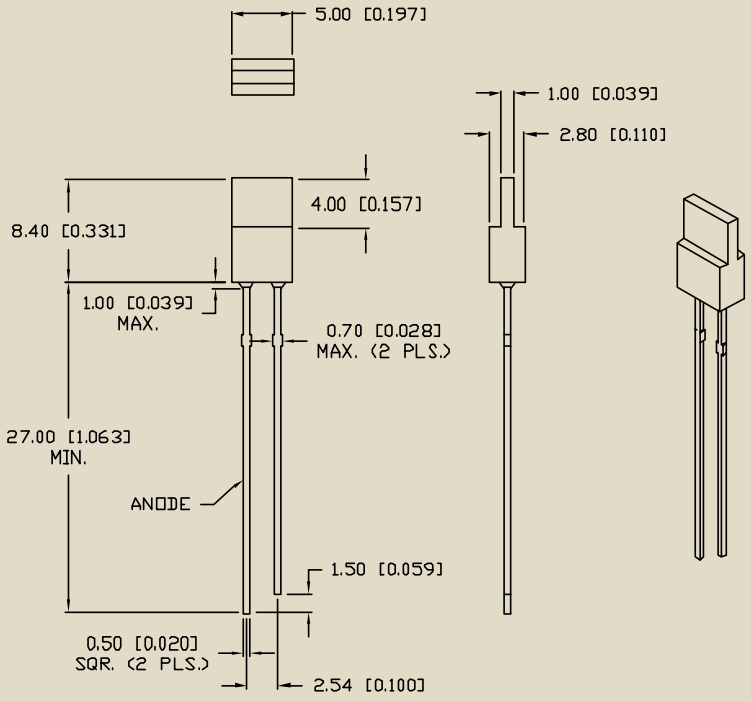
- Choice of colors and lens finishes
- Lead frame / lens casting reliability
- Easy-to-solder leads, tin finish
- Available bulk or tape and reel
- Custom solutions available

Applications / Uses

- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement
- Security electronics



Standard, SSL-LX15583 Series



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QuasarBrite™ Through-Hole LEDs

2mm x 3mm Rectangle

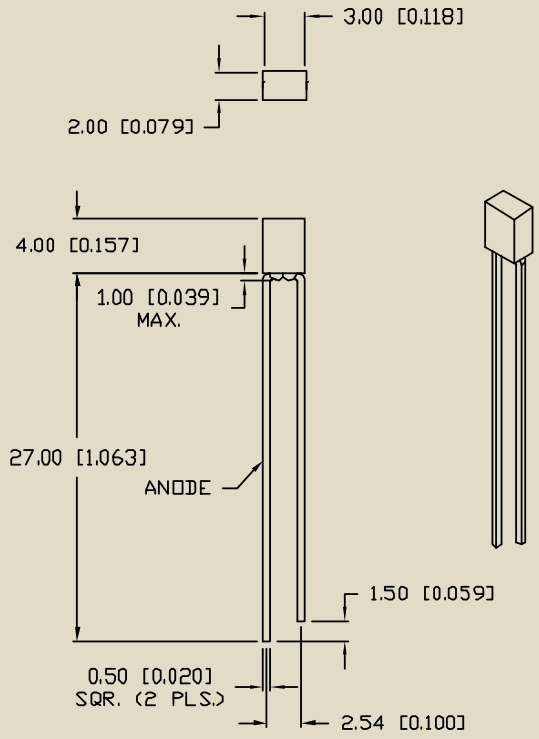
Features / Options

- Choice of colors and lens finishes
- Lead frame / lens casting reliability
- Easy-to-solder leads, tin finish
- Available bulk or tape and reel
- Custom solutions available

Applications / Uses

- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement
- Security electronics

Standard, SSL-LX2344 Series



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QuasarBrite™ Through-Hole LEDs

2mm x 4mm Rectangle

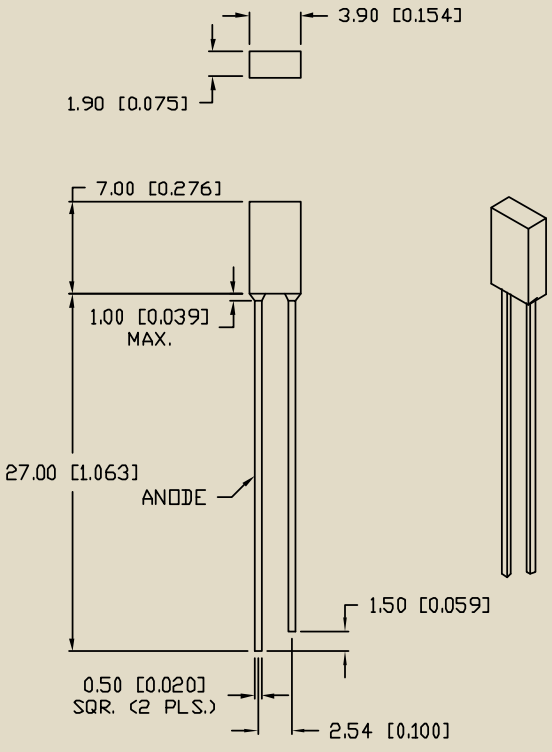
Features / Options

- Choice of colors and lens finishes
- Lead frame / lens casting reliability
- Easy-to-solder leads, tin finish
- Available bulk or tape and reel
- Custom solutions available

Applications / Uses

- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement
- Security electronics

Standard, SSL-LX2473 Series



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QuasarBrite™ Through-Hole LEDs

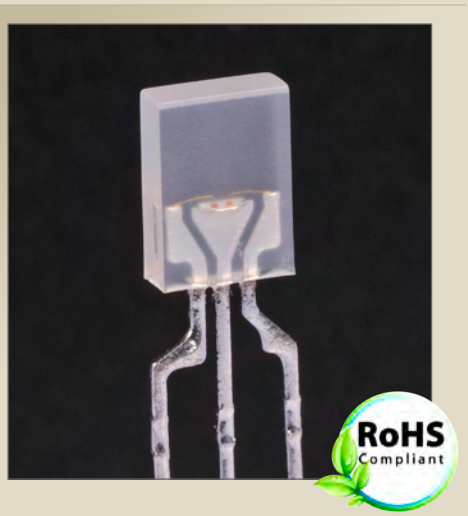
2mm x 5mm Rectangle

Features / Options

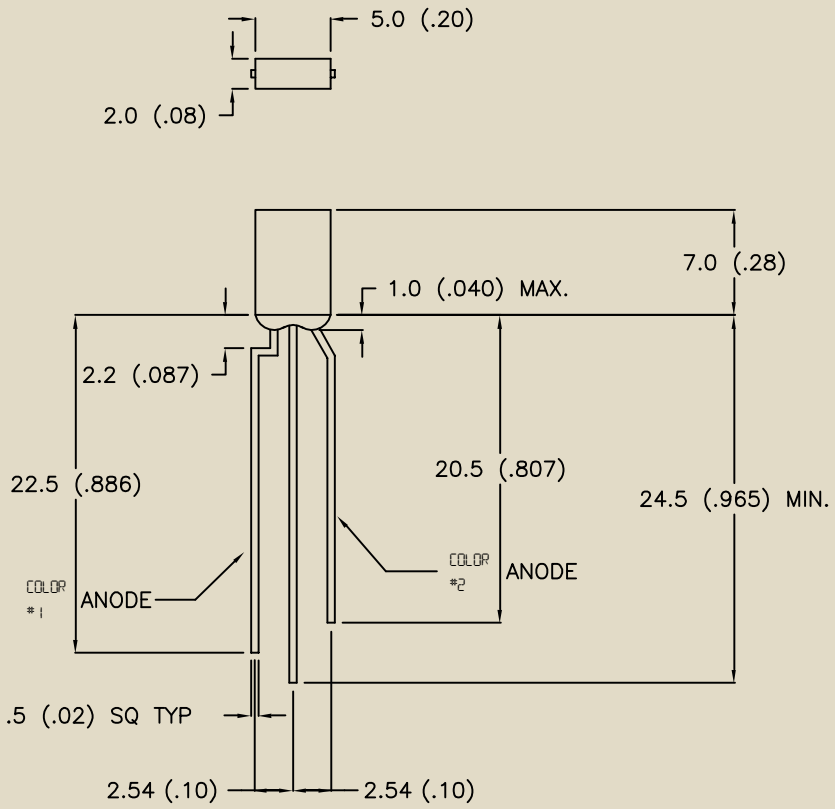
- Choice of colors and lens finishes
- Lead frame / lens casting reliability
- Easy-to-solder leads, tin finish
- Available bulk or tape and reel
- Custom solutions available

Applications / Uses

- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement
- Security electronics



Tri-Color, SSL-LX2579 Series



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QuasarBrite™ Through-Hole LEDs

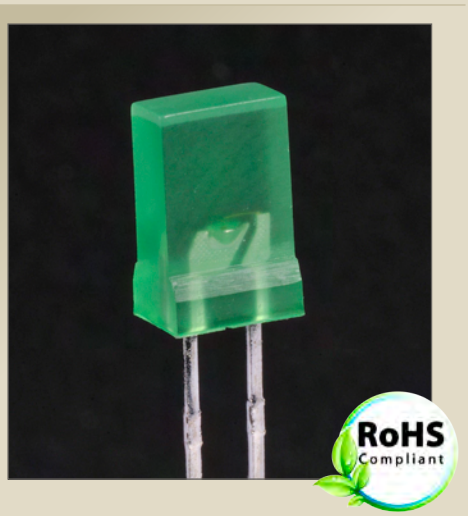
2mm x 5.5mm Rectangle

Features / Options

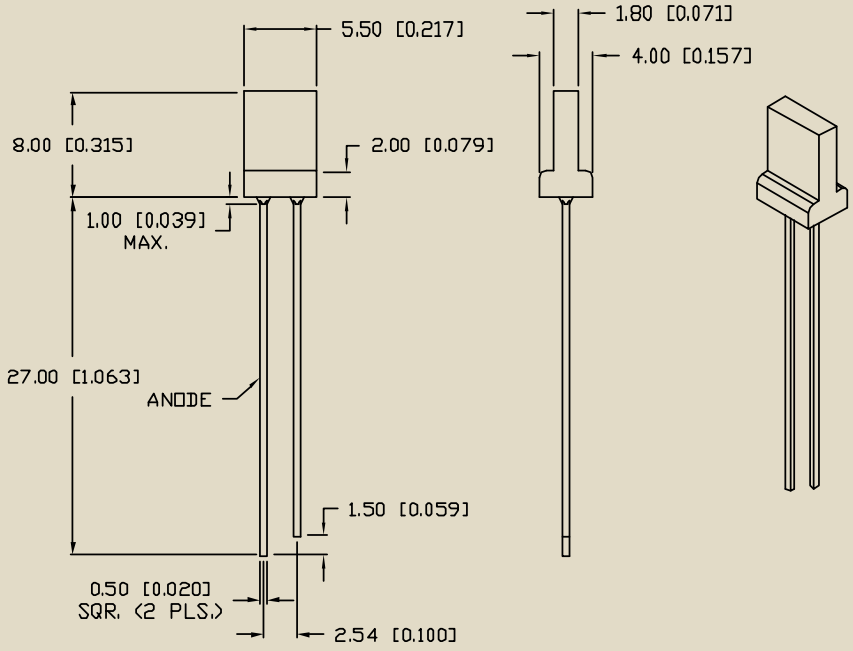
- Choice of colors and lens finishes
- Lead frame / lens casting reliability
- Easy-to-solder leads, tin finish
- Available bulk or tape and reel
- Custom solutions available

Applications / Uses

- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement
- Security electronics



Standard, SSL-LX2583 Series



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QuasarBrite™ Through-Hole LEDs

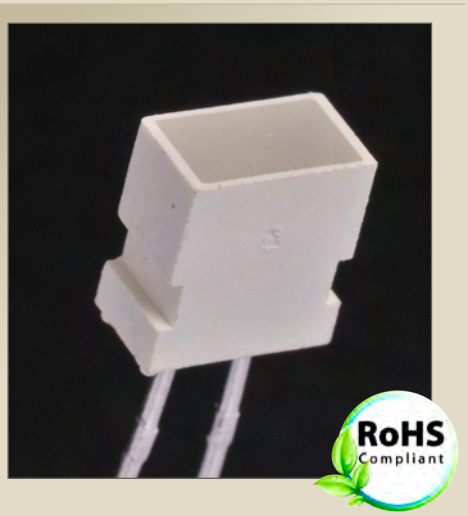
4mm x 6mm Rectangle

Features / Options

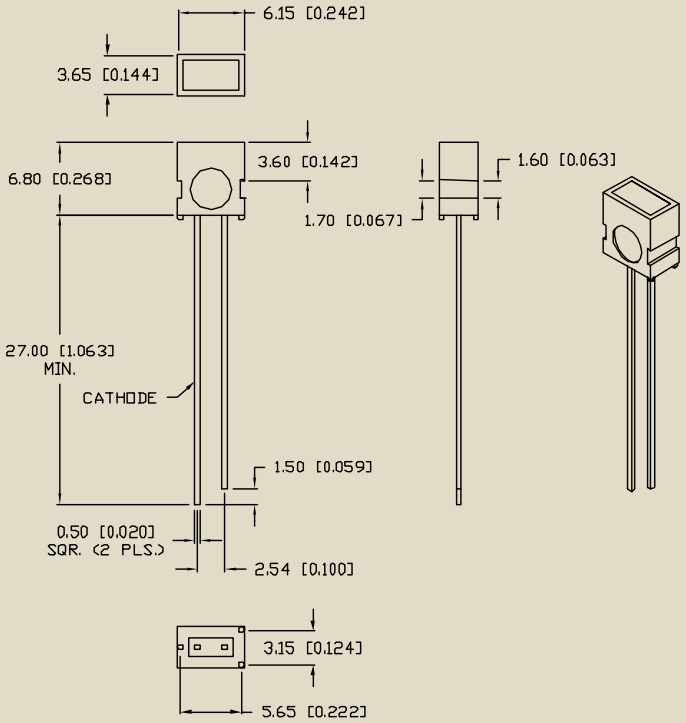
- Choice of colors and lens finishes
- Lead frame / lens casting reliability
- Easy-to-solder leads, tin finish
- Available bulk or tape and reel
- Custom solutions available

Applications / Uses

- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement
- Security electronics



Standard, SSL-LX4673xxx-LA20 Series



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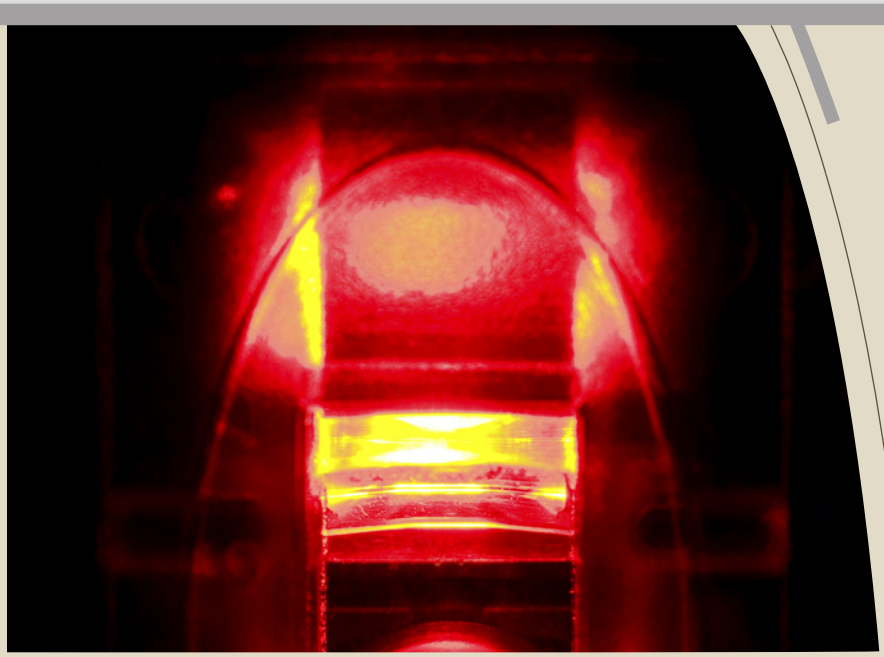

MicronSensIR™ Infrared LEDs

Lumex offers an extensive range of infrared LED capabilities with our family of QuasarBrite™ Infrared LEDs. Offered in both emitter and detector packages, Lumex's QuasarBrite Infrared LEDs can be developed in a spectrum range of 750nm to 1700nm..

QuasarBrite™ Infrared LEDs are well suited for a unique range of applications, including:

- **Security systems, such as electronic gates, motion detectors and night vision cameras**
- **Medical devices or cosmetic procedure equipment**
- **Utility meters for transmitting data for easy meter reading**
- **Transferring data between electronic consumer devices such as mobile phones**

The following pages provide an overview of the types of infrared LED products Lumex provides.

In addition to our standard product offering, Lumex can also customize any LED to suit your specific design needs. **For a complete list of all of Lumex's QuasarBrite™ Infrared LEDs, visit us online at www.lumex.com.**

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QuasarBrite™ Infrared LEDs

P/N	Type	Wavelength	
Emitters			
OED-CL-1L1	Standard, Thru-Hole	880nm	Page 85
OED-EL-1L1	Standard, Thru-Hole	940nm	Page 86
OED-CL-1556SN	Side Fire, Thru-Hole	880nm	Page 87
Detectors			
OED-ST-1556SN	Thru-Hole	900nm	Page 88
OED-ST-1L1	Thru-Hole	450~1050nm	Page 89

The index above is representative of some of Lumex's latest innovative and more diverse product offerings. **For a complete list of all of Lumex's QuasarBrite™ Infrared LEDs, visit us online at www.lumex.com.**

QuasarBrite™ Infrared LEDs

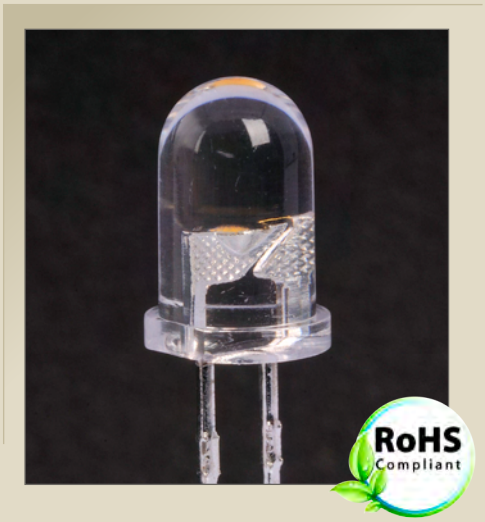
Emitters

Features / Options

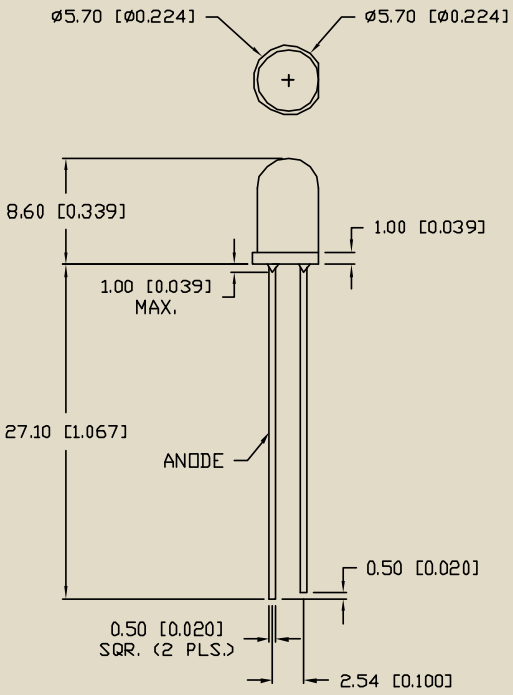
- Available bulk or on tape and reel
- Lead frame / lens casting reliability
- Lead trimming and forming available
- Custom solutions available

Applications / Uses

- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement equipment
- Security electronics
- Life safety equipment



Standard Thru-Hole, **OED-CL-1L1**



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QuasarBrite™ Infrared LEDs

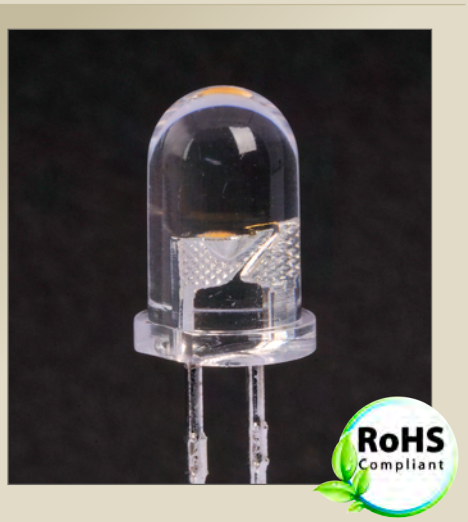
Emitters

Features / Options

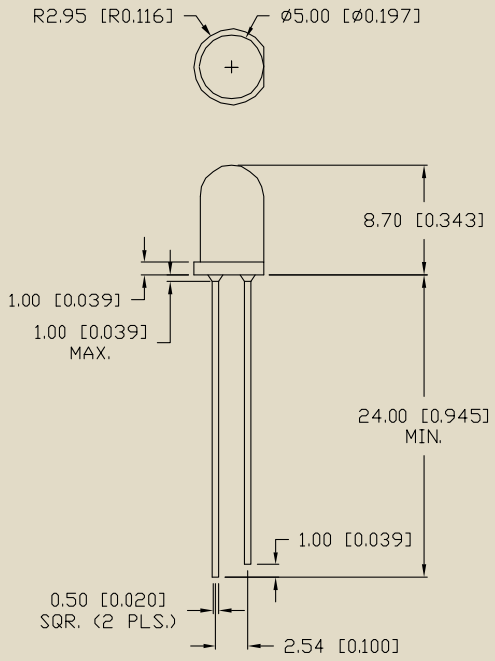
- Available bulk or on tape and reel
- Lead frame / lens casting reliability
- Lead trimming and forming available
- Custom solutions available

Applications / Uses

- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement equipment
- Security electronics
- Life safety equipment



Standard Thru-Hole, **OED-EL-1L1**



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QuasarBrite™ Infrared LEDs

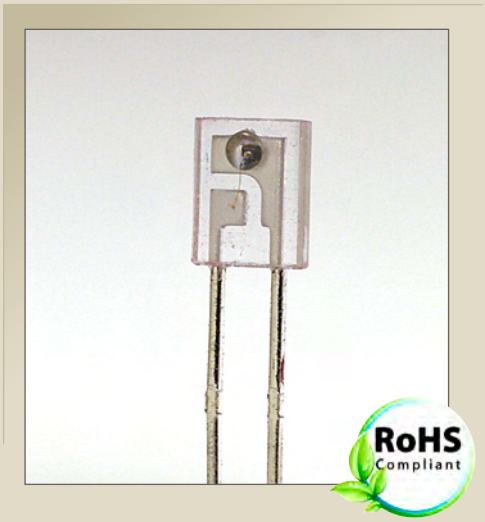
Emitters

Features / Options

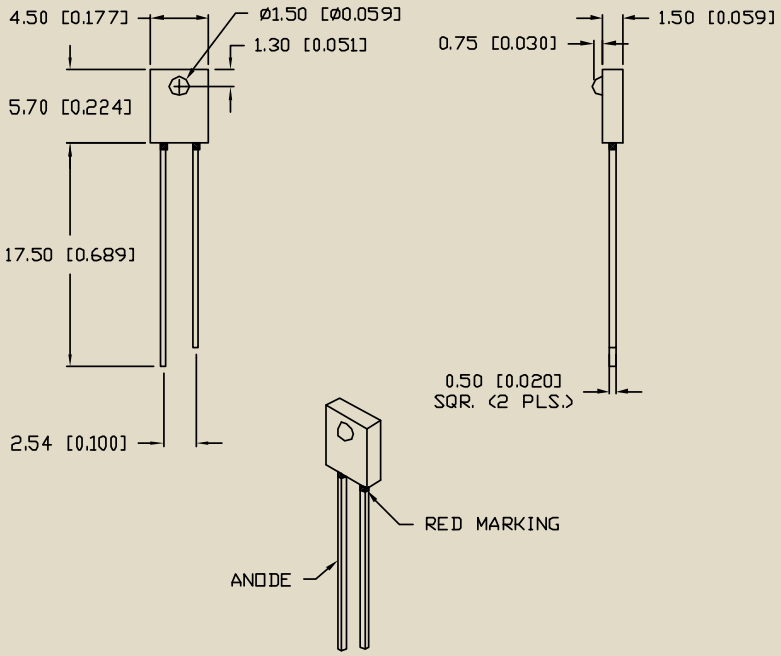
- Available bulk or on tape and reel
- Lead frame / lens casting reliability
- Lead trimming and forming available
- Custom solutions available

Applications / Uses

- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement equipment
- Security electronics
- Life safety equipment



Side Fire Thru-Hole, **OED-CL-1556SN**



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QuasarBrite™ Infrared LEDs

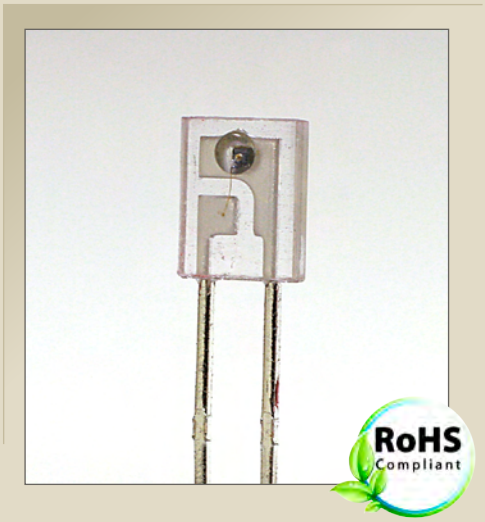
Detectors

Features / Options

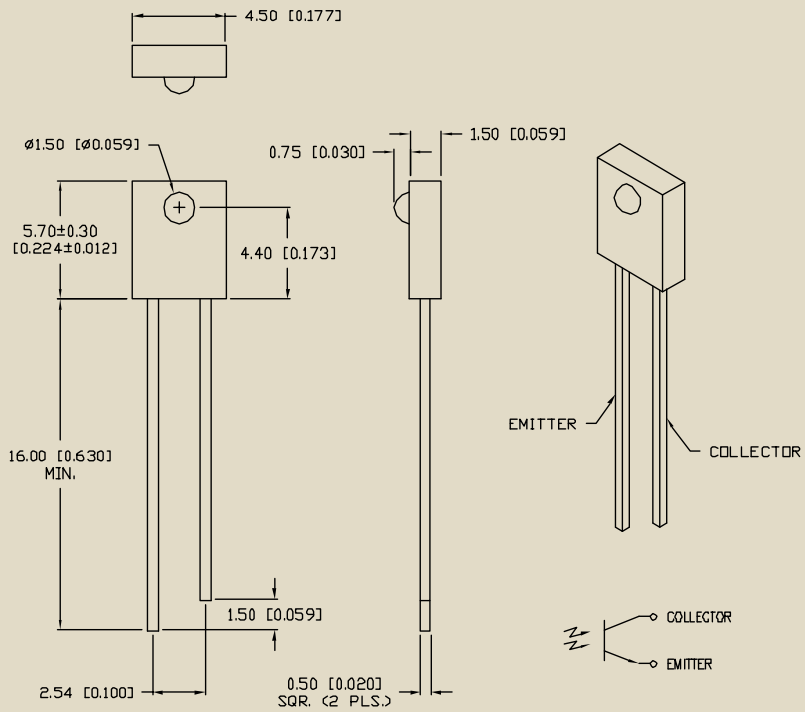
- Available bulk or on tape and reel
- Lead frame / lens casting reliability
- Lead trimming and forming available
- Custom solutions available

Applications / Uses

- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement equipment
- Security electronics
- Life safety equipment



Standard Thru-Hole, **OED-ST-1556SN**



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QuasarBrite™ Infrared LEDs

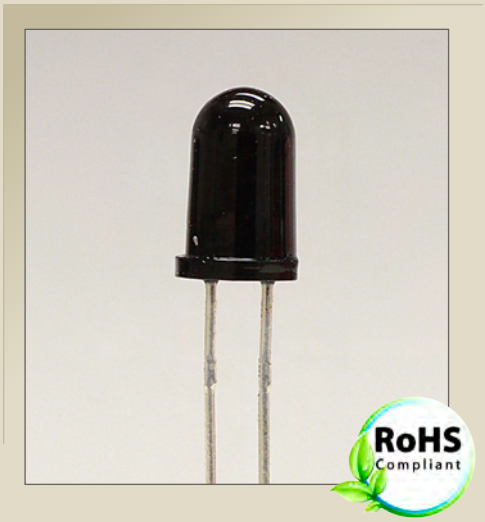
Detectors

Features / Options

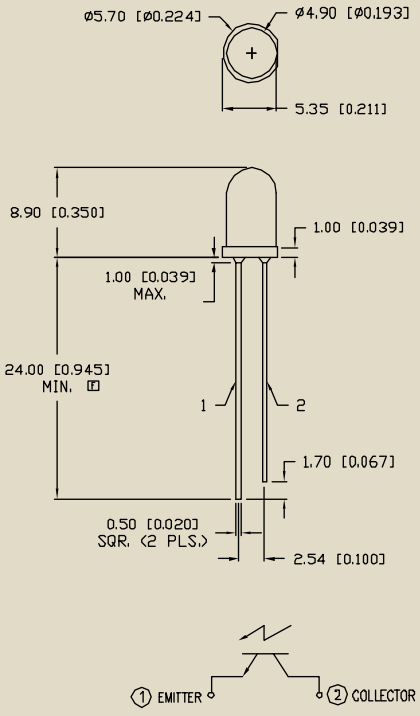
- Available bulk or on tape and reel
- Lead frame / lens casting reliability
- Lead trimming and forming available
- Custom solutions available

Applications / Uses

- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement equipment
- Security electronics
- Life safety equipment



Standard Thru-Hole, **OED-ST-1L1**



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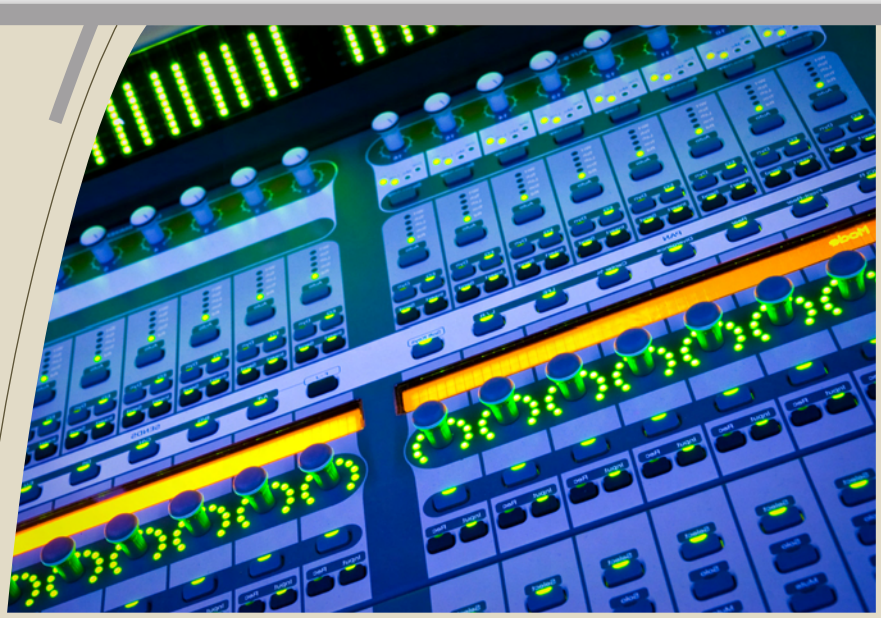

QuasarBrite™ LED Arrays and Light Bars

LED arrays and light bars each offer unique design opportunities. All of Lumex's QuasarBrite™ LED Arrays and Light Bars are color matched with all other LEDs within each array or light bar unit in order to ensure that intensity and color are always uniform.

QuasarBrite™ LED Arrays are ideal for applications that need to show a level indication such as volume, power or altitude, etc.

Lumex offers two types of LED arrays: molded and assembled. The assembled versions are packaged as molded plastic housing with one of our LEDs inserted into it. Lumex's molded LED arrays are similar to light bars except that there is generally only one LED per light segment and the segments are smaller.

Our QuasarBrite LED Light Bars are designed in a chip-on-board style die placement into a reflector with a diffused epoxy finish. Our QuasarBrite™ LED Light Bars are ideal as a backlight for icons or elevator icons. Our standard light bar product offering includes single, dual and quad packages.

All QuasarBrite LED Arrays and Light Bars can be customized with specific sizes, colors and pins. There are size limitations on how small we can make the segments. All of our Arrays and Light Bars are offered in temperature ranges from -40°C ~ +85°C. Lumex can also customize designs to suit either a straight or curved package. We can also recommend the appropriate QuasarBrite LED to be utilized for ensuring daylight visibility, etc.

The following pages provide an overview of the types of LED Arrays and Light Bar products Lumex provides.

In addition to our standard product offering, Lumex can also customize any LED to suit your specific design needs. **For a complete list of all of Lumex's QuasarBrite™ LED Array or Light Bar, visit us online at www.lumex.com.**

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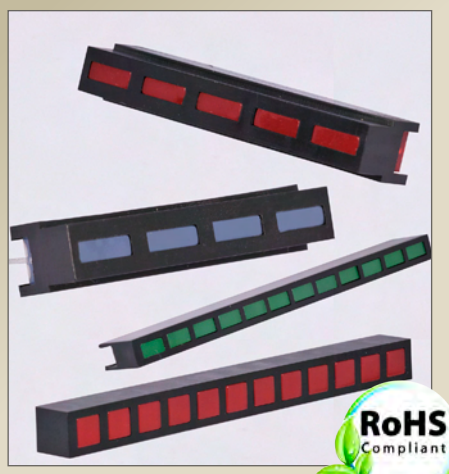


QuasarBrite™ LED Arrays

Assembled

Features / Options

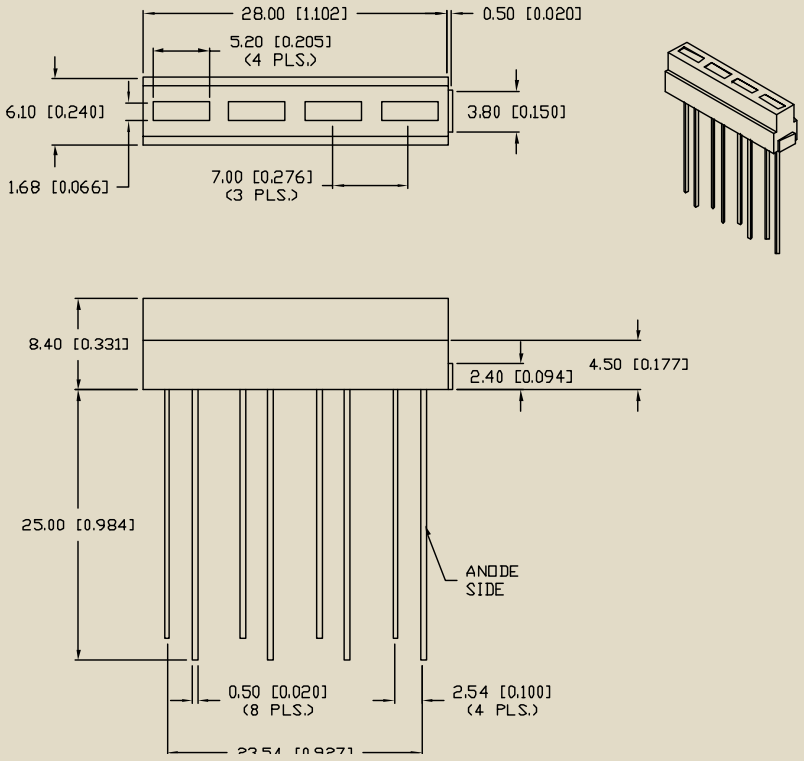
- Pre-sorted for color and brightness uniformity
- Easy installation over using invididual LEDs
- Choice of colors and color combinations, including: Red, Yellow, Orange, Blue, Green, White
- Lens shape options include rectangle, square and oval
- Black or grey holders for high contrast
- Available with internal resistor for 5V and 12V operation
- Custom solutions available

Applications / Uses

- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement equipment
- Security electronics
- Life safety equipment

SKU	# of Segments	Lens Shape
SSA-LXB425 series	4	Rectangular
SSA-LXB525 series	5	Rectangular
SSA-LXH1025 series	10	Rectangular
SSA-LXB120 series	12	Squared
SSA-LXH1225 series	12	Rectangular

Note: Illustration shown is for part number SSA-LXB425 Series.



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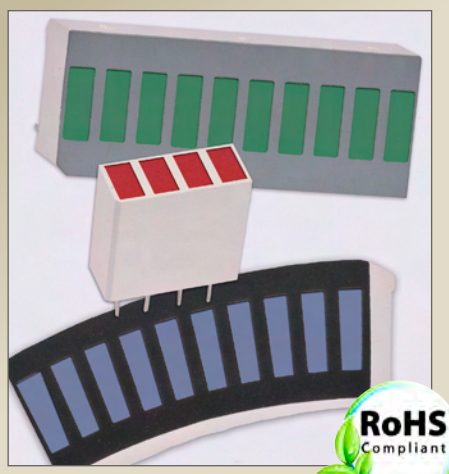


QuasarBrite™ LED Arrays

Molded

Features / Options

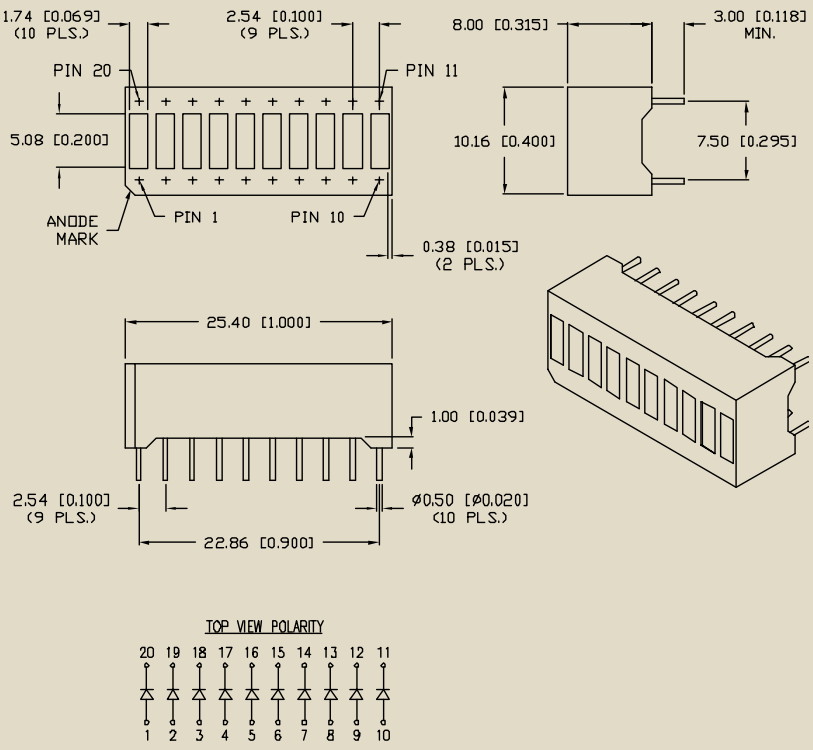
- Pre-sorted for color and brightness uniformity
- Easy installation over using individual LEDs
- Choice of colors and color combinations, including: Red, Yellow, Orange, Blue, Green, White
- Lens shape options include rectangle, square and oval
- Curved, right angle and low profile options
- Chips On Board
- Black or grey holders for high contrast
- Available with internal resistor for 5v and 12v operation
- Custom solutions available

Applications / Uses

- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement equipment
- Security electronics
- Life safety equipment

SKU	# of Segments	Packaging Option
SSA-LXB4355 series	4	Molded
SSA-LXB10 series	10	Molded
SSA-LXB10xx-CUR series	10	Molded / Curved
SSA-LXB10xx-GF/LP series	10	Molded, Low Profile
SSA-LXB10xx-RA series	10	Molded, Right Angle
SSA-LXB20 series	20	Molded
SSA-LXB40 series	40	Molded

Note: Illustration shown is for part number SSA-LXB10 Series.



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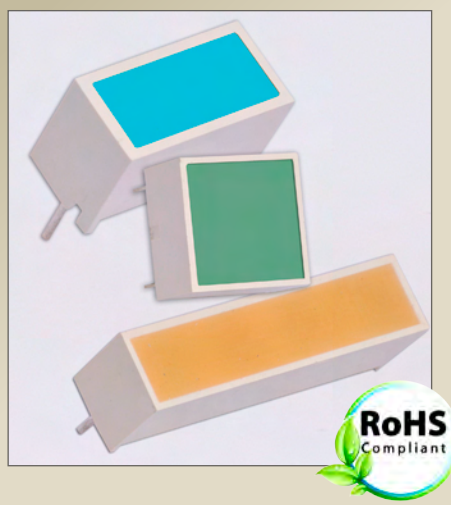


QuasarBrite™ LED Light Bars

Single Segment

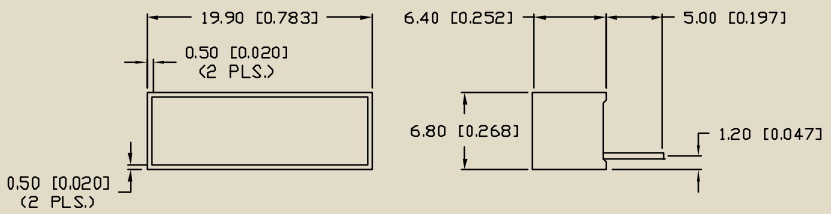
Features / Options

- Available colors: Red, Yellow, Green, Orange, Blue, White
- Longer operational life
- Low power consumption
- Compact size, low profile
- Defined and shift-free color
- Maintenance free long life
- Available in milky white or diffused color

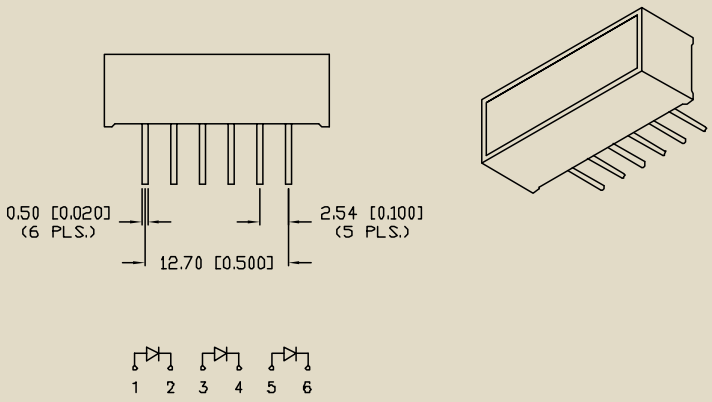
Applications / Uses

- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement equipment
- Security electronics
- Life safety equipment
- Lighting

SKU	Size (mm)
SSB-LX2x00 series	5 mm x 10 mm
SSB-LX2x50 series	5 mm x 20 mm
SSB-LX620 series	6 mm x 20 mm
SSB-LX2x55 series	10 mm x 10 mm
SSB-LX2x85 series	10 mm x 20 mm



Note: Illustration shown is for part number SSB-LXB20 Series.



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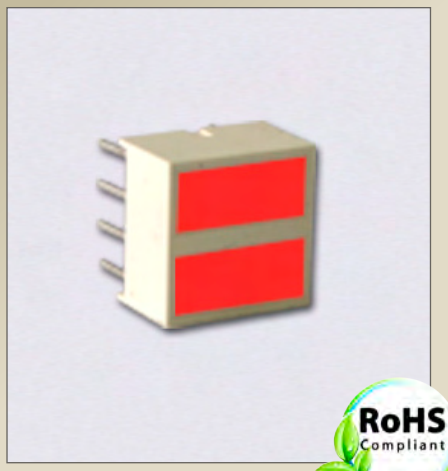


QuasarBrite™ LED Light Bars

Dual Segment

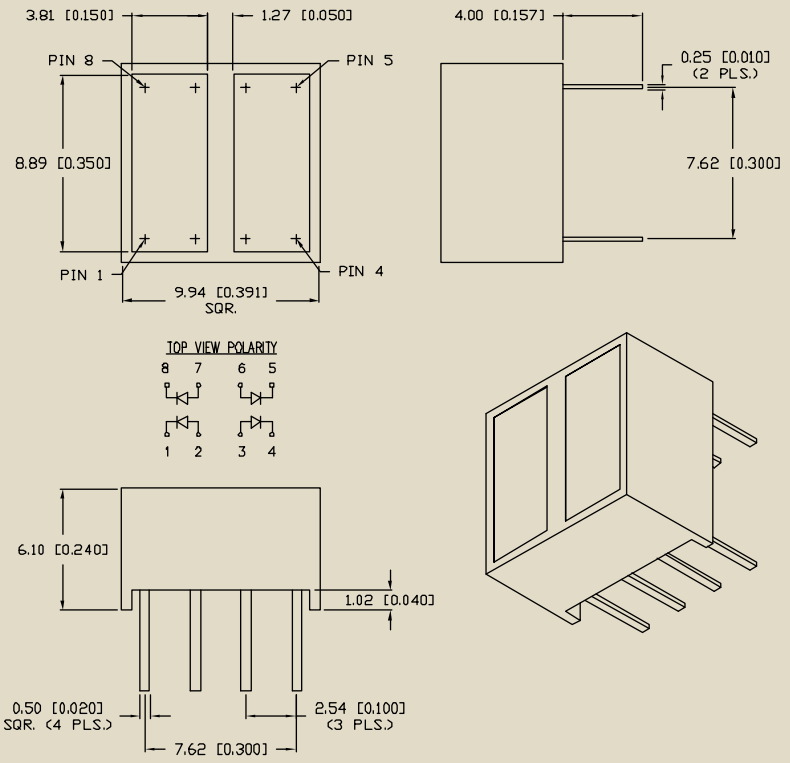
Features / Options

- Available colors: Red, Yellow, Green, Orange, Blue, White
- Longer operational life
- Low power consumption
- Compact size, low profile
- Defined and shift-free color
- Maintenance free long life
- Available in milky white or diffused color

Applications / Uses

- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement equipment
- Security electronics
- Life safety equipment
- Lighting

SKU	Size (mm)
SSB-LX2x00 series	10 mm x 10 mm



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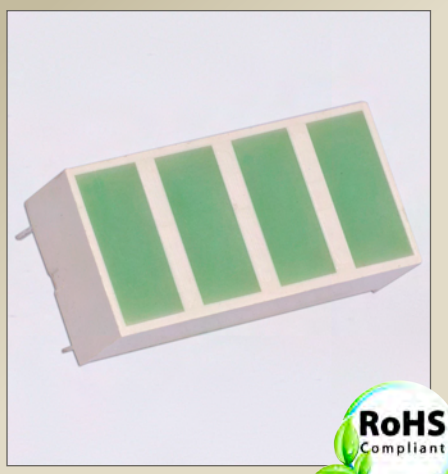


QuasarBrite™ LED Light Bars

Quad Segment

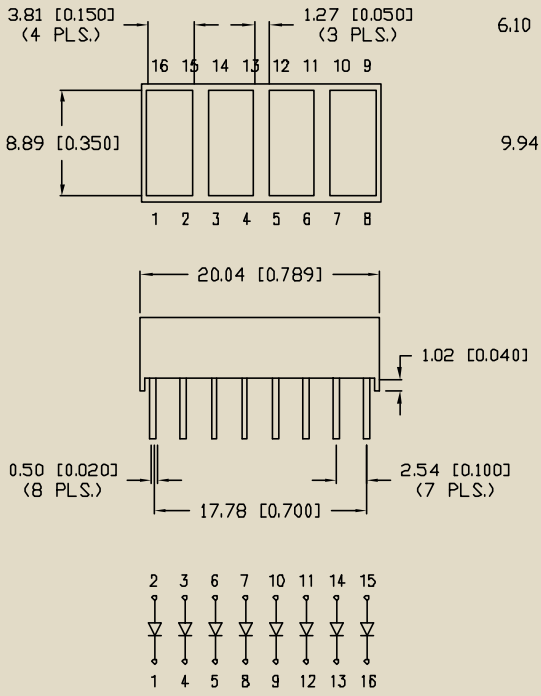
Features / Options

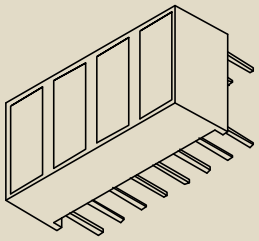
- Available colors: Red, Yellow, Green, Orange, Blue, White
- Longer operational life
- Low power consumption
- Compact size, low profile
- Defined and shift-free color
- Maintenance free long life
- Available in milky white or diffused color

Applications / Uses

- Industrial controls
- Medical equipment
- Communications equipment
- Test and measurement equipment
- Security electronics
- Life safety equipment
- Lighting

SKU	Size (mm)
SSB-LX2x20 series	10 mm x 20 mm





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QuasarBrite™ LED Displays

LED Displays are an ideal technology for markets such as industrial controls, medical devices, set-top box communications equipment, white goods and aerospace. Lumex's QuasarBrite™ Family of LED Displays are available in a wide range of sizes, styles and options to suit any design requirements.

Lumex's QuasarBrite LED Displays provide:

- **Segment Shape** – These are offered in three primary cuts: rectangular, diamond or round.
- **Polarity** – We offer both common anode or common cathode.
- **Drive Method** – Lumex offers several options for driving the displays. Direct drive uses a common and a separate pin for each segment which is the simplest way of driving a display but adds to the number of pins required on the display. Duplex and multiplexed displays have common pins which reduce the number of required connections. Driving this way for a multiple digit display means pulsing current to specific segments over the common pins to get the desired number.
- **Face and Segment Color** – options for the reflector include black on white and gray on white as standards, and a full range of colors in custom reflectors. Lumex also offers a whole range of custom overlays for the display face.
- **Character Height** – We offer standard and custom displays from 0.2 inches to 7.0 inches
- **Number of Digits** – We offer standard and custom displays from 1 digit to 6 digits, multiple rows and customized icons.

The following pages provide an overview of the types of QuasarBrite™ LED Display products Lumex provides.

In addition to our standard product offering, Lumex can also customize any LED Display to suit your specific design needs.

For a complete list of all of Lumex's QuasarBrite™ LED Displays, visit us online at www.lumex.com.

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QuasarBrite™ LED Displays - Index

The index above is representative of some of Lumex's latest innovative and more diverse product offerings. **For a complete list of all of Lumex's QuasarBrite™ LED Displays, visit us online at www.lumex.com.**

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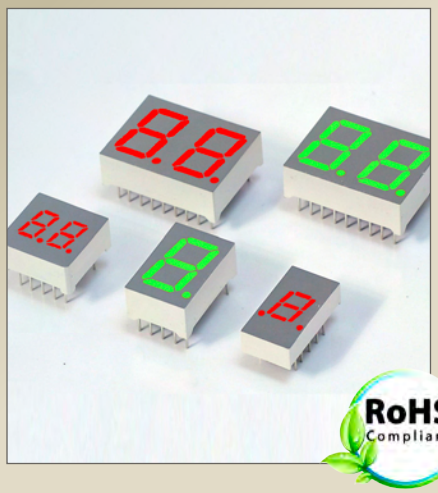


QuasarBrite™ LED Displays

High Temp LED Displays

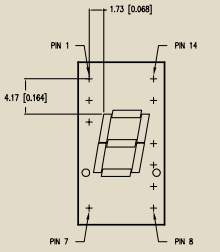
Features / Options

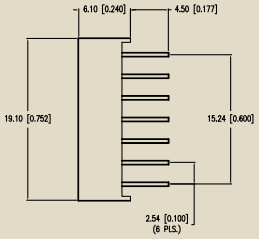
- Operating temp up to +105˚C
- 0.30" & 0.56" character heights
- Single and dual digit displays standard
- Choice of LED Colors
- Maintenance free long life
- State-of-the-art, LED technology
- Triple or quad sizes available
- Custom icons also available

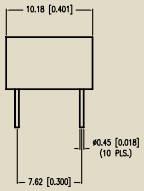
Applications / Uses

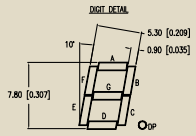
- Industrial Controls
- Medical Equipment
- Communications Equipment
- Test and Measurement Equipment
- Security Electronics
- Life Safety Equipment
- Large Panel Indicators

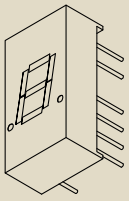
SKU	# of Segments	Character Height
LDS-HTx30x Series	1	0.30"
LDS-HTx51x Series	1	0.56"
LDD-HTx30x Series	2	0.30"
LDS-HTx51x Series	2	0.56"

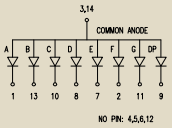












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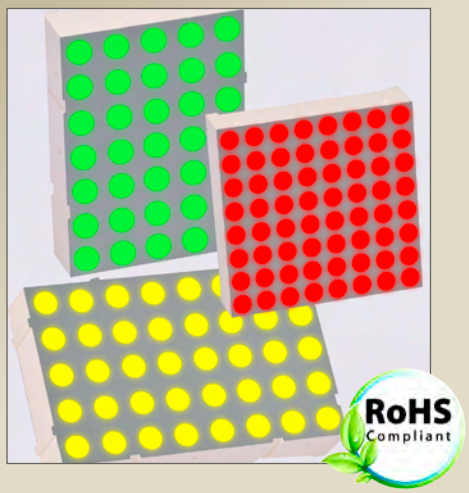


QuasarBrite™ LED Displays

Dot Matrix

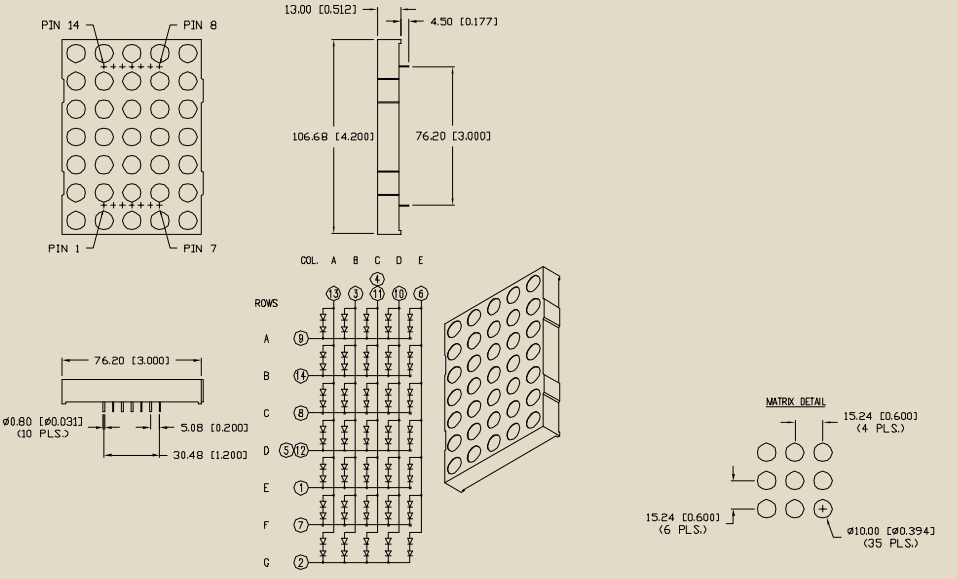
Features / Options

- 5 x 7; 5 x 8 and 8 x8 sizes available
- Display heights ranging from 0.70" to 2.4"
- Wide range of single LED colors available, as well as RGB
- Standard and high brightness chips
- Intensity grading available
- Face and segment colors in gray and milky white
- Custom sizes available

Applications / Uses

- Industrial Controls
- Medical Equipment
- Communications Equipment
- Test and Measurement Equipment
- Security Electronics
- Life Safety Equipment
- Large Panel Indicators
- Meter Displays
- Information displays

SERIES	SIZE	DISPLAY HEIGHT
LDM-07x51x Series	5 x 7	.70"
LDM-12x57xx Series	5 x 7	1.2"
LDM-15x57xx Series	5 x 7	1.5"
LDM-212475 Series	5 x 7	2.0"
LDM-212475NI	5 x 7	2.1" RGB
LDM-21x57xx Series	5 x 7	2.1"
LDM-42x57xx Series	5 x 7	4.2"
LDM-15x58xx Series	5 x 8	1.5"
LDM-24x58xx Series	5 x 8	2.4"
LDM-42x58xx Series	5 x 8	4.2"
LDM-4825758xx-IGUB	5 x 8	4.8"
LDM-08x88xx Series	8 x 8	.80"
LDM-13x88xx Series	8 x 8	1.3"
LDM-15x88xx Series	8 x 8	1.5"
LDM-1924788xx-IGUB	8 x 8	1.9"
LDM-24x88xx Series	8 x 8	2.4"



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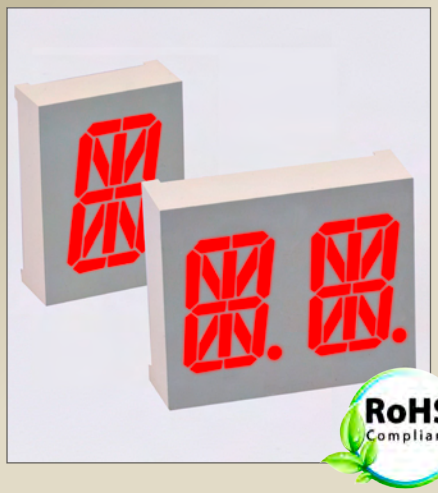


QuasarBrite™ LED Displays

Alpha-Numeric

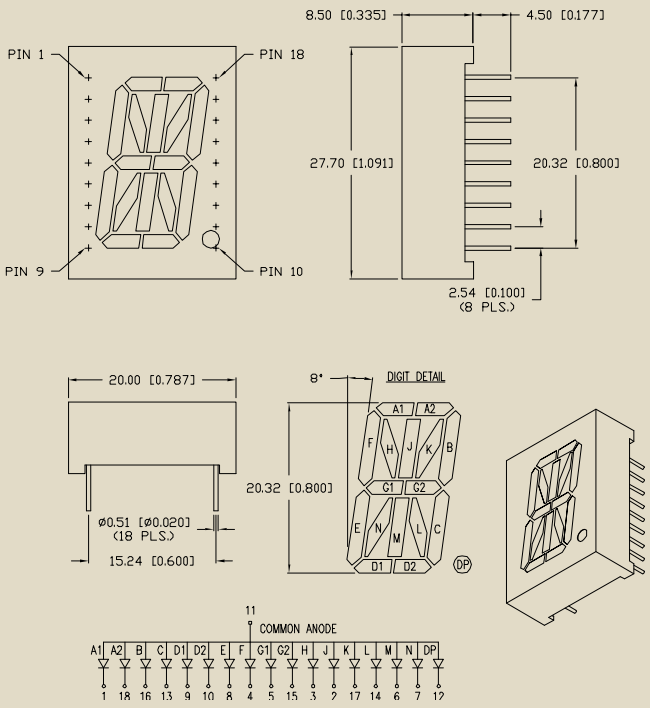
Features / Options

- Standard sizes from 0.39″ ~ 2.3″
- Wide range of single LED colors available, as well as RGB
- Standard and high brightness chips
- Intensity grading available
- Face and segment colors in gray and milky white
- Custom sizes available

Applications / Uses

- Industrial Controls
- Medical Equipment
- Communications Equipment
- Test and Measurement Equipment
- Security Electronics
- Life Safety Equipment
- Large Panel Indicators
- Meter Displays
- Information displays

Series	Digits	Display Height
LDS-x390xRI	Single	0.39″
LDS-x500XRI	Single	0.50″
LDSx800xRI	Single	0.80″
LDS-xB232xRI	Single	2.3″
LDD-x540xRI	Dual	0.54″



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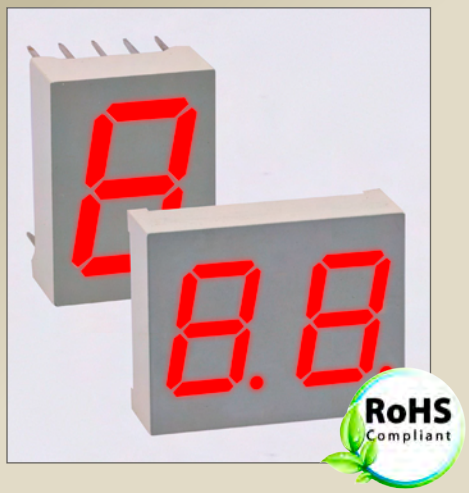


QuasarBrite™ LED Displays

Numeric - Single & Dual Displays

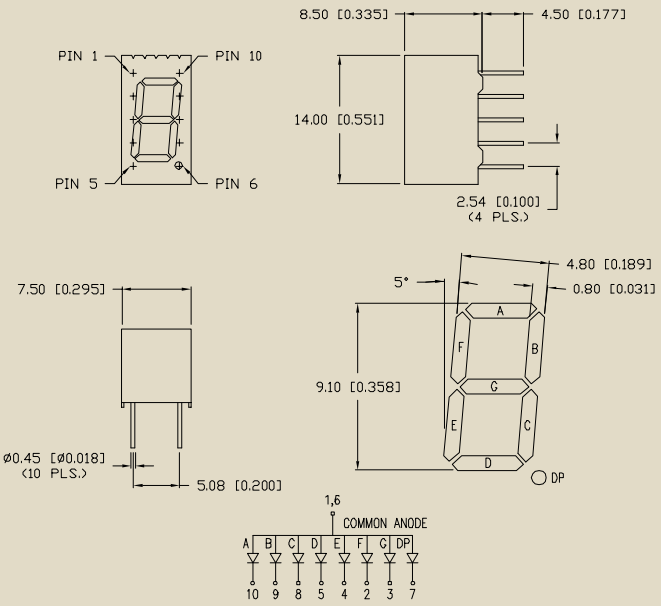
Features / Options

- Display heights ranging from 0.28″ ~ 4.0″
- Standard, Round, diamond & rectangle cuts available
- Wide range of single LED colors as well as RGB
- Standard and high brightness chips
- Intensity grading available
- Face and segment colors in gray and milky white
- Custom sizes & segment cuts available

Applications / Uses

- Industrial Controls
- Medical Equipment
- Communications Equipment
- Test and Measurement Equipment
- Security Electronics
- Life Safety Equipment
- Large Panel Indicators
- Meter Displays
- Information displays

Series	Digit(s)	Display Height	Description
LDS-x280xRI Series	Single	0.28″	Seven Segment
LDS-x302xRI Series	Single	0.30″	Standard, Rectangle Cut
LDF-U300xRI Series	Single	0.30″	Overflow
LDS-x322xRI Series	Single	0.36″	Standard
LDS-x391xRI Series	Single	0.39″	Standard, Diamond Cut
LDS-x40xRI Series	Single	0.40″	Standard, Rectangle Cut
LDS-x41xBI Series	Single	0.43″	Standard, Diamond Cut
LDF-x500xRI Series	Single	0.50″	Overflow
LDS-x520xRI Series	Single	0.52″	Standard, Diamond Cut
LDS-x51xRI Series	Single	0.56″	Standard, Diamond Cut
LDS-x564xRI Series	Single	0.56″	Standard, Rectangular Cut
LDS-x600xRI Series	Single	0.60″	Standard, Round Cut
LDS-x802xRI Series	Single	0.80″	Standard, Round Cut
LDS-x81xRI Series	Single	0.80″	Standard, Diamond Cut
LDS-xx1xRI Series	Single	1.0″	Standard, Round Cut
LDS-xD1xRI Series	Single	2.25″	Standard, Round Cut
LDS-x51xRI Series	Single	0.56″	Right Angle
LDS-xA40xRI Series	Single	4.0″	Standard, Diamond Cut
LDD-x30xNI Series	Dual	0.30″	Standard
LDD-x30xNI Series	Dual	0.30″	Right Angle
LDD-x40xNI Series	Dual	0.39″	Standard
LDD-x430xRI Series	Dual	0.43″	Standard
LDD-x500xRI Series	Dual	0.50″	Standard
LDD-x564xRI Series	Dual	0.56″	Standard
LDD-M51xRI Series	Dual	0.56″	Right Angle
LDD-x81xRI Series	Dual	0.80″	Standard
LDD-xA10xRI Series	Dual	1.0″	Standard
LDD-xA23xRI Series	Dual	2.3″	Standard
LDD-xA40xRi Series	Dual	4.0″	Standard



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QuasarBrite™ LED Displays

Numeric - Triple and Quad Displays

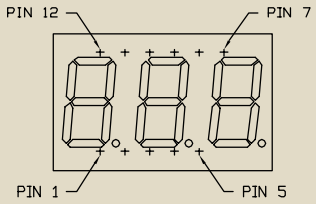
Features / Options

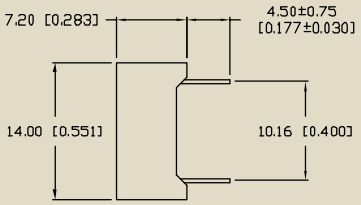
- Display heights from 0.28" ~ 0.56"
- Wide range of single LED colors as well as RGB
- Standard and high brightness chips
- Intensity grading available
- Face and segment colors in gray and milky white
- Custom sizes & segment cuts available

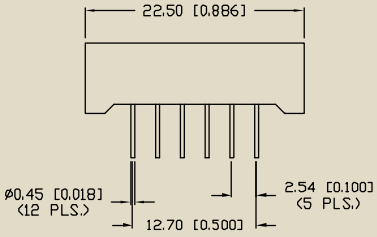
Applications / Uses

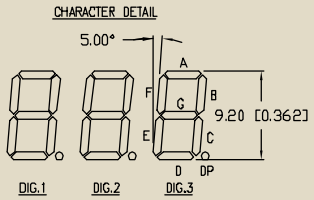
- Industrial Controls
- Medical Equipment
- Communications Equipment
- Test and Measurement Equipment
- Security Electronics
- Life Safety Equipment
- Large Panel Indicators
- Meter Displays
- Information displays

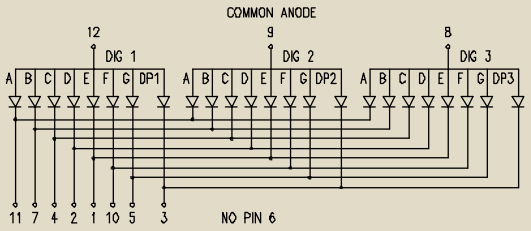
Series	Digit(s)	Display Height	Description
LDT-x280xRI Series	Triple	0.28"	Seven Segment
LDT-x360xRI Series	Triple	0.36"	Standard
LDT-x400xRI Series	Triple	0.40"	Standard
LDT-x51xRI Series	Triple	0.56"	Standard
LDT-x800xRI Series	Triple	0.80"	Standard
LDQ-x221xRI Series	Quad	0.22"	Standard
LDQ-x28xRI Series	Quad	0.28"	Standard
LDQ-x51xRI Series	Quad	0.56"	Standard











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Numeric, Five Digit
LDP-x56xRI Series

QuasarBrite™ LED Displays

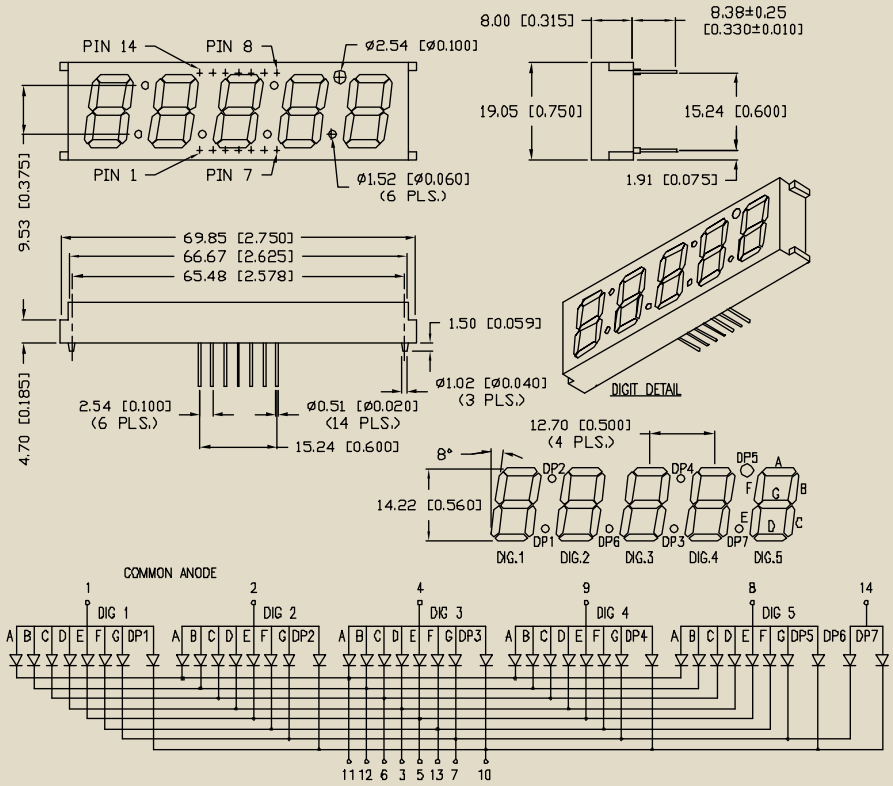
Numeric, Five Digit Display

Features / Options

- Wide range of single LED colors available, as well as RGB
- Standard and high brightness chips
- Intensity grading available
- Face and segment colors in gray and milky white
- Custom sizes and segment cuts available

Applications / Uses

- Industrial Controls
- Medical Equipment
- Communications Equipment
- Test and Measurement Equipment
- Security Electronics
- Life Safety Equipment
- Large Panel Indicators
- Meter Displays
- Information displays



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QuasarBrite™ LED Displays

Through-Hole, Clock

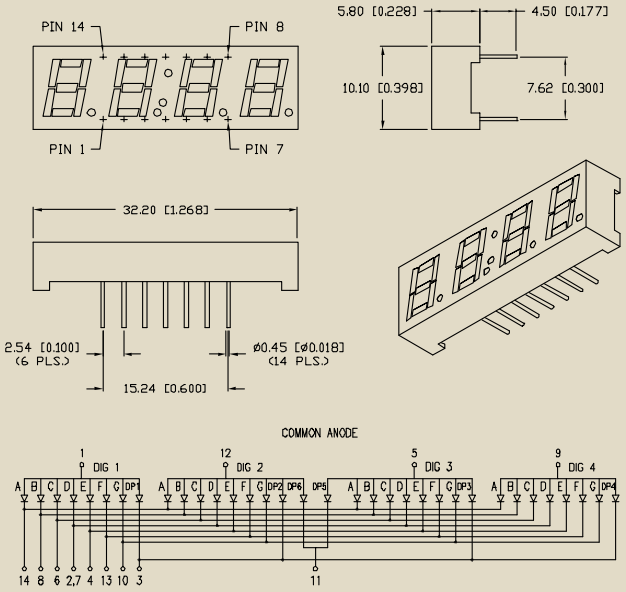
Features / Options

- Standard display heights ranging from 0.25" ~ 0.56"
- Wide range of single LED colors available, as well as RGB
- Standard and high brightness chips
- Intensity grading available
- Face and segment colors in gray and milky white
- Custom sizes available

Applications / Uses

- Industrial Controls
- Medical Equipment
- Communications Equipment
- Test and Measurement Equipment
- Security Electronics
- Life Safety Equipment
- Large Panel Indicators
- Meter Displays
- Information displays

Series	Digit(s)	Display Height	Description
LDC-x250xRI Series	Quad	0.25"	Clock, Standard
LDC-x281xRI Series	Quad	0.28"	Clock, Standard
LDC-x300xRI Series	Quad	0.30"	Clock, Standard
LDC-x561xNI Series	Quad	0.56"	Clock, Standard



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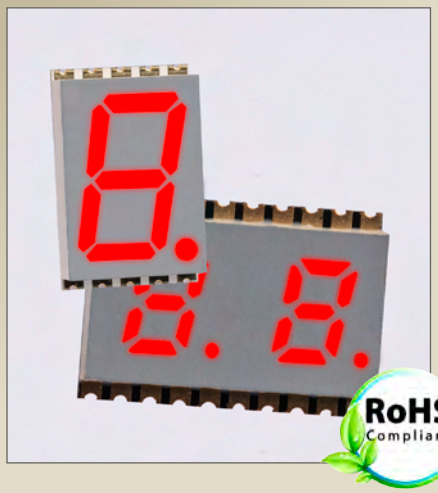


QuasarBrite™ LED Displays

Surface-Mount LED Displays

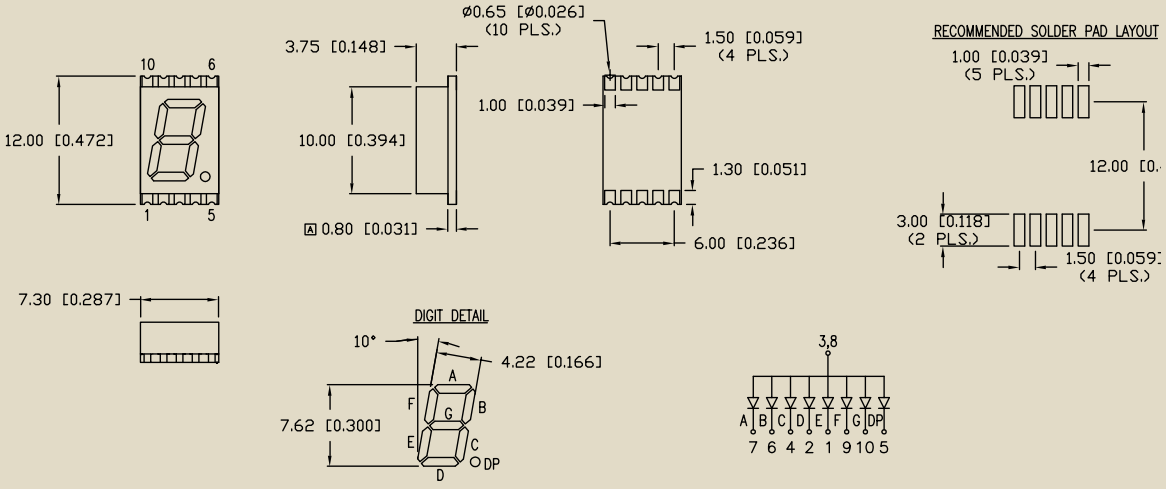
Features / Options

- Standard display heights ranging from 0.20″ ~ 0.56″
- Wide range of single LED colors available, as well as RGB
- Standard and high brightness chips
- Intensity grading available
- Face and segment colors in gray and milky white
- Custom sizes available

Applications / Uses

- Industrial Controls
- Medical Equipment
- Communications Equipment
- Test and Measurement Equipment
- Security Electronics
- Life Safety Equipment
- Large Panel Indicators
- Meter Displays
- Information displays

Series	Digit(s)	Display Height	Description
LDS-SMx200xRI Series	Single	0.20″	SMD, Standard
LDS-SMx300xRI Series	Single	0.30″	SMD, Standard
LDS-SMx561xRI Series	Single	0.56″	SMD, Standard
LDD-SMx200xRI Series	Dual	0.20″	SMD, Standard
LDD-SMx300xRI Series	Dual	0.30″	SMD, Standard
LDD-SMx560xRI Series	Dual	0.56″	SMD, Standard



Note: Illustrations shown are for representation **ONLY**. *Exact specifications should be obtained from the product data sheet. Additional product drawings of Lumex's QuasarBrite™ LEDs are available by logging onto* **www.lumex.com**. *Any Lumex standard LED products can be customized to fit your specific needs. Call* **1.800.278.5666** *to speak with one of our Technical Design Specialists.*

QuasarBrite™ LED Panel Mount and PCB Indicators

Lumex continues to be a leader in designing and manufacturing environmentally friendly low power usage, long life LED Panel Indicators and PCB Indicators.

Our wide range of LED indicator products are ideal for every market from industrial, utilities, automotive, telecommunications, data communications, medical and military.

Panel Mount LED Indicators feature wire leads of various colors and lengths, as well as a variety of termination options. Lumex's Panel Mount LED Indicators can also be made water resistant for more demanding applications such as industrial equipment or food service equipment. Additionally, Panel Mount LED Indicators can be customized should the application not meet with one of Lumex's standard product offerings.

PCB LED Indicators are available in many standard shapes, sizes and arrays. As with Panel Mount Indicators, there exists a wide variety of semi-custom options such as lead length, LED size, LED color and termination options. Finally, fully customized features are also available.

The following pages provide an overview of the types of LED indicators Lumex provides. **For a complete list of all of Lumex's QuasarBrite Panel Mount and PCB Indicators, visit us online at www.lumex.com.**

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QuasarBrite™ LED Indicators - Index

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QuasarBrite™ Panel Indicators

Headers

Features / Options

- Custom wire lengths
- Connectors available on demand
- Water resistant versions available
- Custom designs upon request

Applications / Uses

- Industrial Controls
- Medical Equipment
- Communications Equipment
- Test and Measurement Equipment
- Life Safety Equipment
- Large Panel Indicators
- Information displays

Series	Shape	Type	Insert Direction	Housing	Panel Cutout (mm)
SSI-LXMP5011xC-xxx	Square	Flush	Front	Plastic	10.25x10.25
SSI-LXMP059xx-xxx	Rectangular	Flush	Front	Plastic	4.50x6.55
SSI-LXH072xx-xxx	Rectangular	Flush	Front	Plastic	5.30x11.00
SSI-RM3091xx-xxx	Round	Protrude	Rear	Rubber	Ø5.08
SSI-LXH9xx-xxx	Round	Protrude	Rear	Rubber	Ø8.26
SSI-LXH387xx-xxx	Round	Flush	Front	Plastic	Ø7.94
SSI-LXH312xx-xxx	Round	Protrude	Front	Plastic	Ø4.37
SSI-LXH600xx-xxx	Round	Protrude	Front	Plastic	Ø6.35
SSI-LXR1612xx-xxx	Round	Flush	Front / Lock Washer	Chrome	Ø6.20
SSI-LXR3612xx-xxx	Round	Flush	Front / Lock Washer	Chrome	Ø6.20
SSI-LXR3816xx-xxx	Round	Protrude	Front / Lock Washer	Chrome	Ø8.20
SSI-LXR4815xx-xxx	Round	Flush	Front / Lock Washer	Chrome	Ø8.20
SSI-LXR4915xx-xxx	Round	Flush	Front / Lock Washer	Chrome	Ø14.20
SSI-LXH20R6xx-xxx	Round	Protrude	Front	Plastic	Ø27.10

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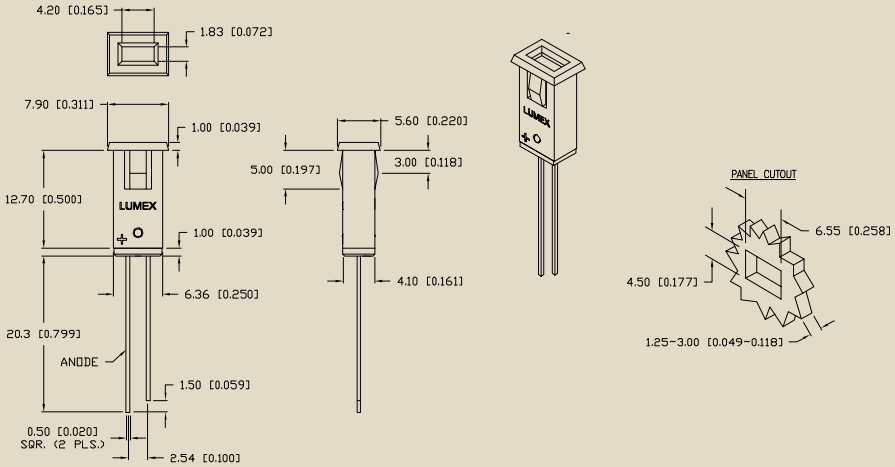
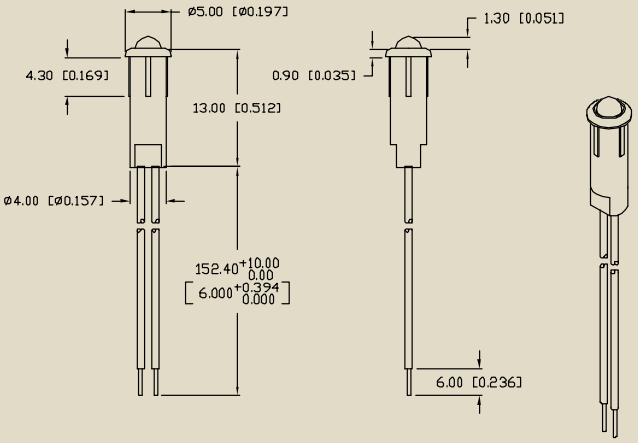
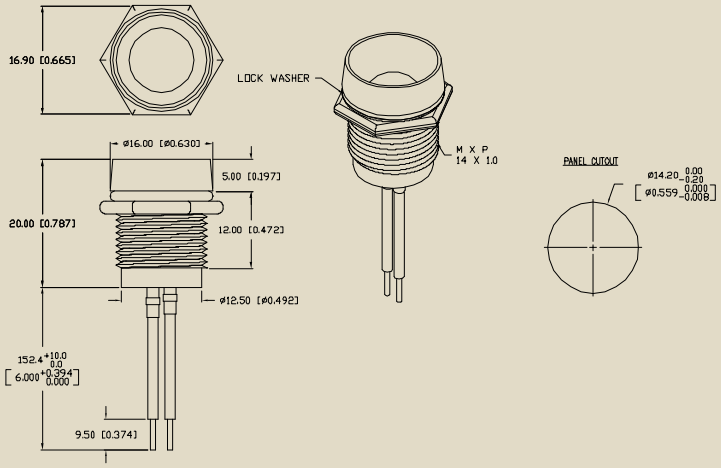
Square Flush, Plastic Housing
Sample Illustration is of Lumex P/N,
SSI-LXMP059BID



Round, Protruding, Plastic Housing
Sample Illustration is of Lumex P/N,
SSI-LXH312BID-150



Round Flush, Chrom Housing
Sample Illustration is of Lumex P/N,
SSI-LXR4915USBD150



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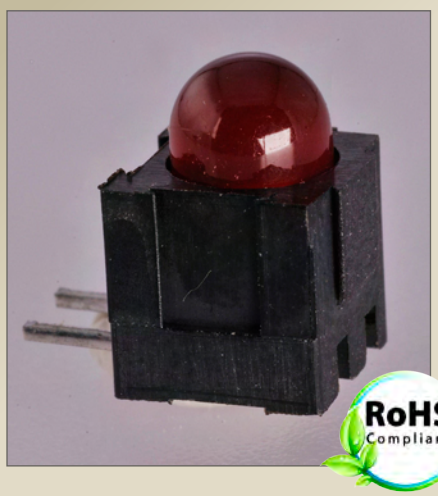

QuasarBrite™ Panel Indicators

Single LEDs

Features / Options

- Available in standard colors
- Custom sizes and colors available
- Custom lead lengths available
- Can be integrated with any other standard or semi-custom Lumex products

Applications / Uses

- Industrial Controls
- Medical Equipment
- Communications Equipment
- Test and Measurement Equipment
- Life Safety Equipment
- Large Panel Indicators
- Information displays

Series, P/N	LED Center from PCB (mm)	Type	Shape	Leads	LED Size
SSF-LXHM107xx	5.08	Mating	Round	2	Ø3.00
SSF-LXH103xx	5.08	Non-Mating	Round	2	Ø3.00
SSF-LXH100xx	3.00	Non-Mating	Round	2	Ø5.00
SSF-LXH4RAxx	5.10	Non-Mating	Round	2	Various
SSF-LXH109xx	2.42	Non-Mating	Round	3	Ø3.00
SSF-LXH409xx	5.08	Non-Mating	Round	2 or 3	Various
SSF-LXH25780	5.08	Non-Mating	Rectangular	2	1.80 x 5.50
SSF-LXH2579xx	5.08	Non-Mating	Rectangular	2	5.00 x 2.00

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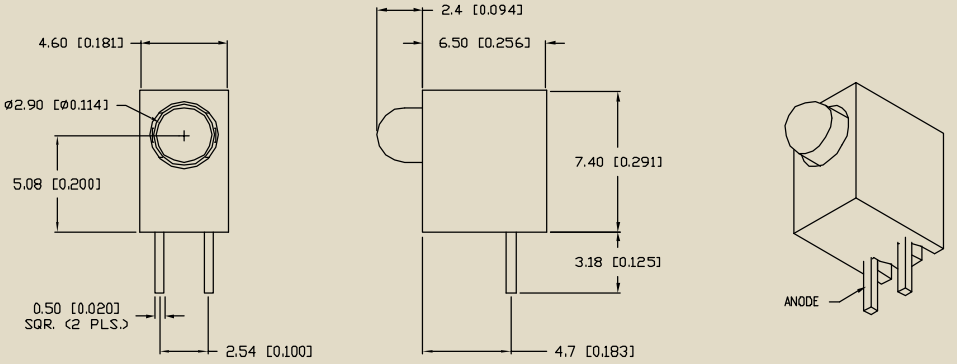
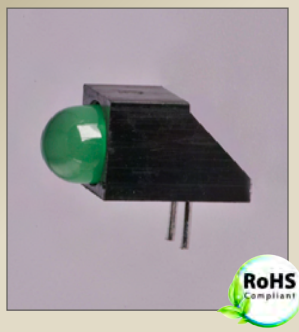
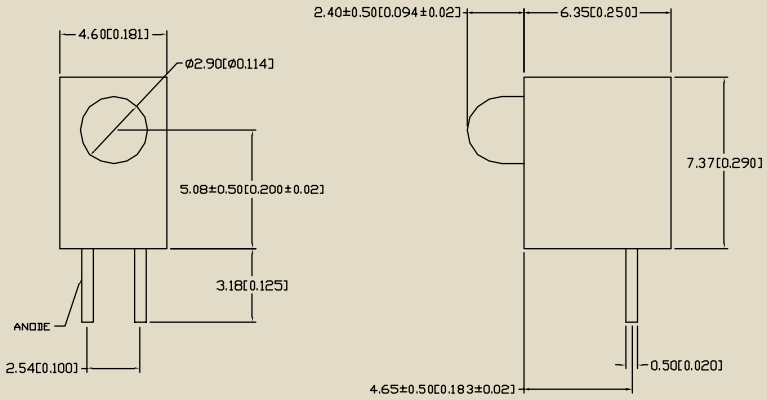
Round, Non-Mating
Sample Illustration is of Lumex P/N,
SSF-LXH103ID

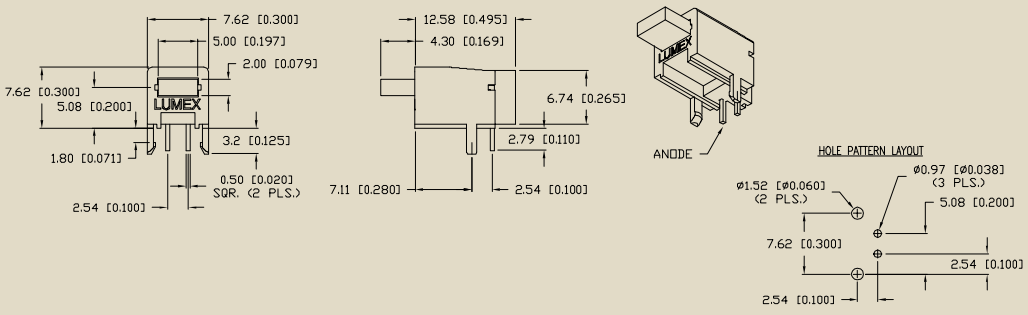




Round, Non-Mating
Sample Illustration is of Lumex P/N,
SSF-LXH100GD



Rectangular, Non-Mating
Sample Illustration is of Lumex P/N,
SSF-LXH2579AD



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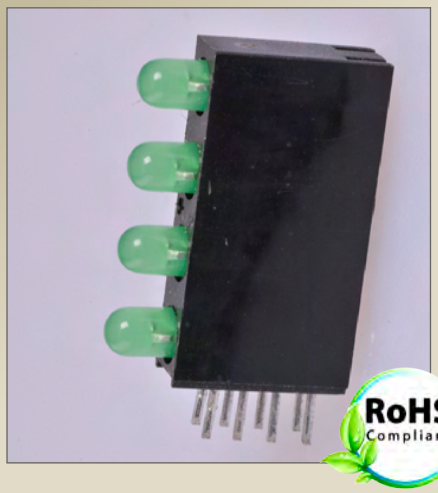

QuasarBrite™ Panel Indicators

Multiple LEDs

Features / Options

- Available in standard color
- Custom sizes and colors available
- Custom lead lengths available

Applications / Uses

- Industrial Controls
- Medical Equipment
- Communications Equipment
- Test and Measurement Equipment
- Life Safety Equipment
- Large Panel Indicators
- Information displays

Series	LED Count	Type	Orientation	Shape
SSF-LXH240xxx	2	Protrude	Stack	Round
SSF-LXH450xxx	4	Flush	Stack	Round
SSF-LXH5147xxxxx	4	Protrude	Stack	Round
SSF-LXH340xxxx	3	Protrude	Stack	Round
SSF-LXH400xxxxx	4	Protrude	Ranch	Round

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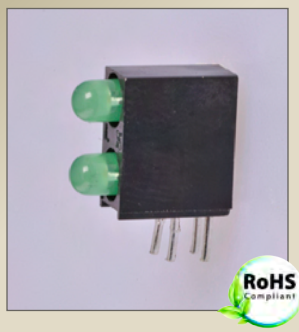
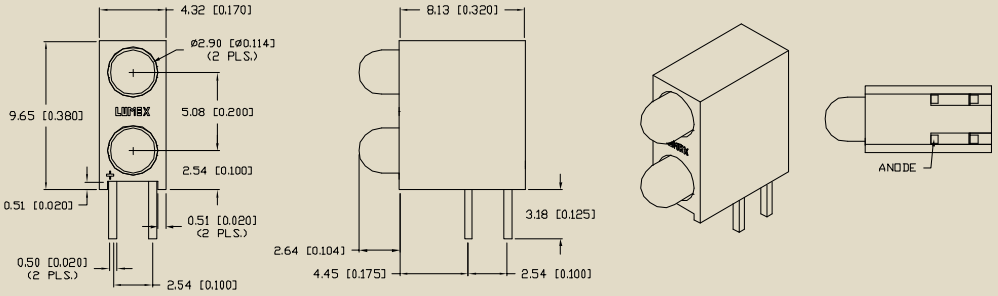
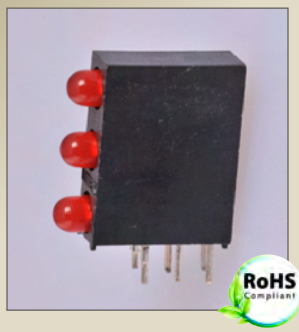
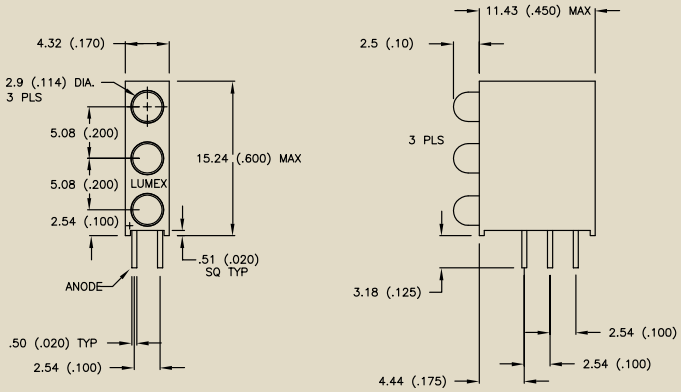


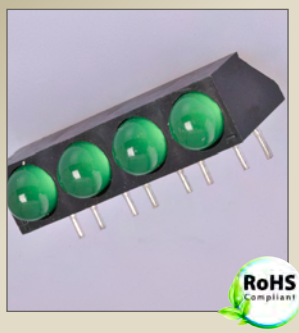


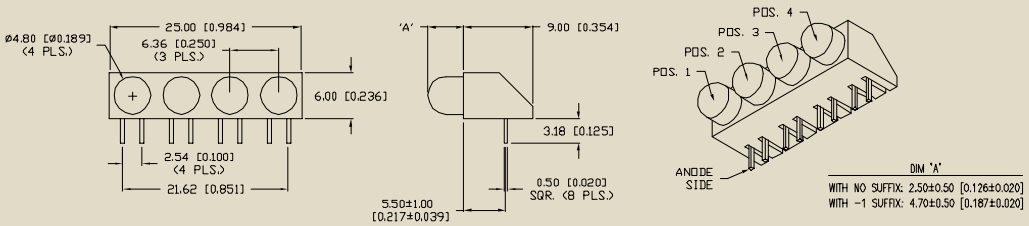
2-Count LED, Stacked
Sample Illustration is of Lumex P/N,
SSF-LXH240GGD





3-Count LED, Stacked
Sample Illustration is of Lumex P/N,
SSF-LXH340IIID





4-Count LED, Ranch
Sample Illustration is of Lumex P/N,
SSF-LXH400GD

InfoVue™ Liquid Crystal Displays (LCDs)

Lumex has become increasingly well-known for our broad range of quality LCD products such as standard glass, seven segment, character and graphic displays.

The Lumex InfoVue family of LCDs has also expanded to include standard TFT displays with touch screen capability, as well as our Extreme Temperature modules.

InfoVue LCDs provide:

- **Wide range of sizes**
- **Space savings**
- **Lower power consumption**
- **Improved image contrast**
- **Plug and play / easy installation**
- **Cost effectiveness**
- **Custom solutions**

LCD modules from Lumex offer the widest, most comprehensive choice of formats to fit your mechanical and interface requirements.

The following pages provide an overview of the types of LCD products Lumex provides.

In addition to our standard product offering, Lumex can also customize any LCD to suit your specific design needs. **For a complete list of all of Lumex's InfoVue™ LCD products, visit us online at www.lumex.com.**

INSIDE THIS SECTION

LUMEX®
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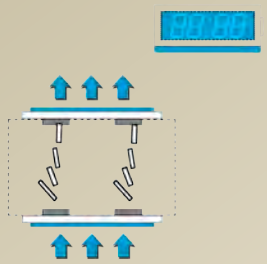
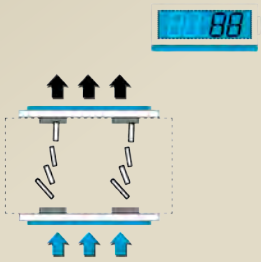
Structure of an LCD

A basic LCD consists of two polarizers, two glass panels and liquid crystal that fits in between them. The front layer of glass is etched on the inside surface to form a template for the artwork to be shown by the liquid crystal. Liquid crystal bends light in response to the electric field.



Each crystal acts like a shutter, either allowing light to pass through or blocking the light. The pattern of transparent and dark crystals form the images on the display.

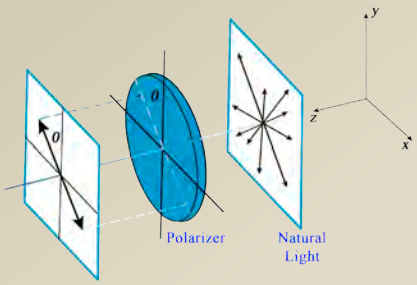


What is Liquid Crystal?

The name suggests that it is both solid and liquid. That isn't quite accurate. Liquid crystal is really in a state between both solid and liquid. Basically, the crystals in an LCD are able to maintain their orientation like a solid, but they can also move around to different positions, like a liquid.

Polarization

Polarizers are responsible for creating the image that is displayed on an LCD. The science of how light is polarized through the LCD can be a bit confusing. Simply stated, the



light dispersed through the LCD is not actually created by the liquid crystals themselves. Ambient light is actually reflected off the reflective rear polarizer out the front of the LCD. The image that is seen with the naked eye is the light that is blocked by the front polarizer. Without these polarizers, the LCD would be completely transparent, with no image displayed.

Liquid Crystal Behavior

Liquid crystals behave as a collection of metal shavings do when exposed to a magnetic field. Metal shavings with align themselves in the direction of the magnetic field. A similar phenomenon occurs when exposing liquid crystal to an electric field. The crystals will orient themselves in the same direction of the electric field. The visible pattern that you see in an LCD is limited by the etching on the glass, essentially limiting the movement of the crystals to create specific images.

Resting State (no electric field applied):

Molecules are twisted by a certain angle dependent on the liquid crystal material (i.e. 90˚). The polarized light is de-polarized by reflecting off the crystal structure and passes through the linear front polarizer.

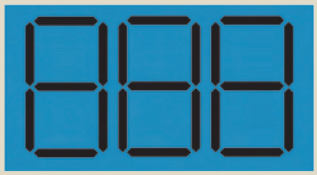
Active State (electric field applied):

The molecules orient towards the electric field. The polarized light does not reflect off the crystal structure and is blocked by the front polarizer and an image is seen.

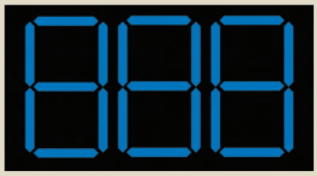
Viewing Mode

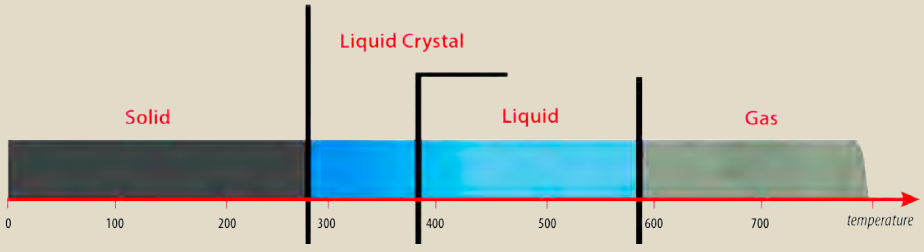
The orientation of the front and rear polarizer films on the LCD cell determines whether the display features a positive (crossed polarizers) or a negative (parallel polarizers) image viewing mode.

Positive:



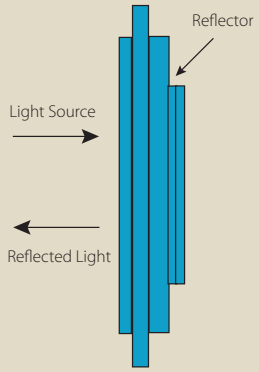
Negative:



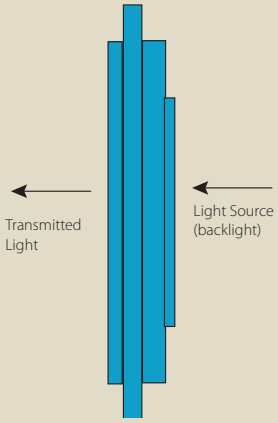


Lighting Methods

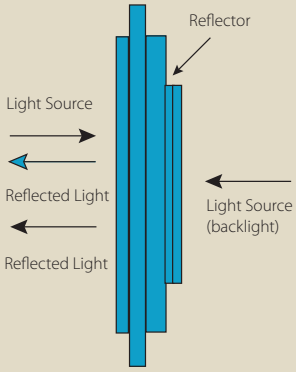
Reflective: In reflective mode, ambient light is used to illuminate a display. By combining a reflector with the rear polarizer, this layer reflects polarized ambient light which enters the front of the display to create the reflective mode. Reflective mode LCDs provide high brightness, excellent contrast, and wide viewing angles, and are ideal for outdoor applications or indoor applications where the area is well lit. Reflective LCD's cannot be backlit, however they can be front lighted in some applications.



Transmissive: These displays have a transparent polarizer on the front and the back. Transmissive displays do not reflect light. Because of this, the display requires a backlight to be visible. Most transmissive displays are negative image and work best in low light conditions.

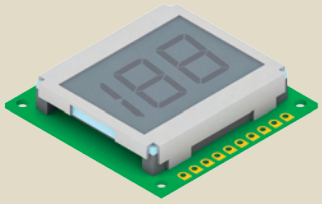


Transreflective: Transreflective displays are a combination of the reflective and transmissive types. These displays have a rear polarizer which includes a translucent material that reflects a portion of ambient light. These displays are not as bright and have a lower contrast than reflective displays. Transreflective displays do not wash out in direct sunlight. They are also more energy efficient, as the backlight can be left off when there is sufficient lighting outside. When indoors, the backlight can be turned on to brighten the display.

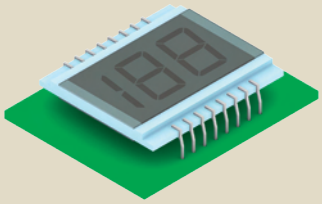


Connector and LCD Mounting Method (to connect LCD to the drive circuit)

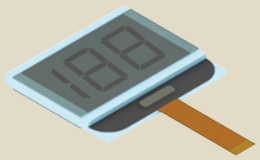
Elastomer Zebra Connector



Pin Connector



Flexible Connector



Types of Liquid Technology

The type of LCD fluid technology used is determined by the specific performance set for the display design.

TN: small viewing angle, average contrast. Coloration: Black on Gray. Static preferred, but operates well up to a 8:1 Mux rate. LCD Glass favorite.

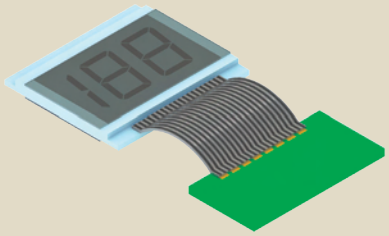
STN: average viewing angle, average contrast. Coloration: Black on Green, or Dark Blue on Gray. Works well at high Multiplex rates. LCD Module favorite, high end LCD glass choice.

FSTN: Good viewing angle, excellent contrast. Coloration Black on White. Works well at high Multiplex rates. Higher end LCD Module favorite.

DSTN: Excellent viewing angle and contrast. Coloration Black on White. Works well at high Multiplex rates. High end / wide temperature LCD Module favorite.

Temperature Considerations

The temperature range of an LCD is based on the fluid inside the display. Lumex's standard InfoVue LCDs offer a temperature range of 0˚C to 50˚C, however for applications that require a wider temperature range, Lumex offers an extended temperature of -40˚C to +85˚C.



Types of LCD Images

InfoVue LCDs can be customized to display segments, character icons, graphic dot arrays or any combination.

Icons: By making a custom LCD, you can place images on the glass that specifically complement your product, these are called "Icons". These icons can take the shape of any image you may need and count as one pixel or dot on the LCD.

Segments: Segments on an LCD display make up a larger character, such as a segment in a seven segment numeric character (displays 0-9), or a segment in a 14 segment alpha-numeric character (displays 0-9 & A-Z).

Dot Arrays: These dot arrays can be made in almost any size and dot count. Examples would be character displays that use a series of 5x7 dot arrays to create a string of alpha numeric characters, or the larger 320 x 240 graphic arrays that make images along with variable size alpha-numeric characters.

Viewing Direction

The viewing direction of a LCD part is defined as the angles above and below the point-of-view that is perpendicular to the center of the display.

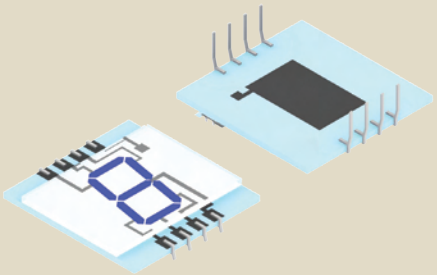
6:00 viewing direction (Bottom)

12:00 viewing direction (Top)

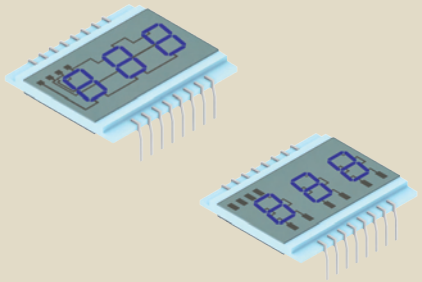
Drive Method

The Drive Method specifies how each segment of the LCD display is connected to the LCD driving circuitry. There are two methods offered.

Static Drive : LCD Glass or LCD Modules with one side of all of the Liquid Crystal Display segments are tied to a common, or backplane, and the other side of each of the segments are routed to individual connection points that are tied to the driver control circuitry. This means that there is an individual control line to select each LCD segment and there is only a single common line that connects to them all. This method uses a large number of interconnects (more than a multiplexed drive would require) and therefore is not feasible for complex displays. However, this configuration produces the best display with the widest temperature range.



Multiplexed Drive : A Multiplexed Drive configuration uses more than a single backplane or common segment. This means that each segment control line selects several LCD segments and the final selection is made by selecting the correct backplane/common segment. This configuration minimizes the number of interconnections making it more cost effective for smaller displays, and mandatory for high density dot array displays. This configuration may degrade the temperature and image performance slightly.



Reliability Test

Item	Temperature		Test Condition	Judgement
Storage temperature	Special	Normal		
upper spec. limit	85˚C	70˚C		
lower spec. limit	-40˚C	-20˚C		
Operation temperature				
upper spec. limit	85˚C	50˚C		
lower spec. limit	-40˚C	0˚C		
Low temperature / test			Lower spec. limit of storage temp. for 4 hr	LCD can be used normally
High temperature / test High temp & humidity			Upper spec. limit of operation temp. 60 ~ 65˚C, 90 ~ 95% RH 240HR	LCD can be used normally LCD can be used normally after test
Temperature Cycling Test	85˚C	70˚C	• LSL of storage temp. for 30 min. • 1˚C / 1 min increase to USL of storage temp. for 30 min. • 1˚C / 1 min decrease to LSL of storage temp for 30 min. • 5 cycle	LCD can be used normally after test
	-40˚C	-20˚C		
Thermal shock upper spec. limit	85˚C	70˚C	• LSL of storage temp for 30 min. • USL of storage temp. within 10s • USL of storage temp. for 30 min. • Reach LSL of storage temp. within 10s • 5 cycle	LCD can be used normally after test
lower spec. limit	-40˚C	-20˚C		

Typical Operating Characteristics

Classification of Specification		Drive Duty		Static		1/2 Duty		1/3 Duty		1/4 Duty	1/8 duty	1/16 Duty	1/32 Duty	1/64 Duty	1/80 Duty
		Temp. Grade		Commercial	High Temp	Commercial	High Temp	Commercial	High Temp	Commercial	Commercial	Commercial	Commercial	Commercial	Commercial
Operating Voltage			Vop	3.0	5.0	3.0	5.0	3.0	5.0	3.0	4.5	5.0	8.0	10.0	13.0
Operating Frequency			Hz	32-100	32-100	32-100	32-100	32-100	32-100	32-100	32-100	32-100	32-100	32-100	32-100
Power Consumption			nA/mm²	5	10	5	10	5	10	5	5	5	5	5	5
Capacitance			PF/mm²	18	18	18	18	18	18	18	18	18	18	18	18
Response Time	Turn on Time	0˚C	ms	300	150	300	150	300	150	300	300	300	300	300	300
		25˚C	ms	100	50	100	50	100	50	100	100	100	100	100	100
	Turn off Time	0˚C	ms	350	200	350	200	350	200	350	350	350	350	350	350
		25˚C	ms	150	100	150	100	150	100	150	150	150	150	150	150
Viewing Angle	Vertical		degree	+15 ~ -30	+15 ~ -30	+15 ~ -30	+15 ~ -30	+15 ~ -30	+15 ~ -30	+15 ~ -30	+10 ~ -30	+0 ~ -30	+0 ~ -30	+0 ~ -30	+0 ~ -30
	Horizontal		degree	±45	±45	±45	±45	±45	±45	±45	±45	±45	±45	±45	±45
Operating Temp.			˚C	-5 ~ +60	-20 ~ +80	-5 ~ +60	-20 ~ +80	-5 ~ +60	-5 ~ +50	-5 ~ +50	-5 ~ +50	-5 ~ +50	-5 ~ +50	-5 ~ +50	-5 ~ +50
Storage Temp.			˚C	-20 ~ +80	-40 ~ +85	-20 ~ +80	-40 ~ +85	-20 ~ +80	-20 ~ +80	-20 ~ +80	-20 ~ +80	-20 ~ +80	-20 ~ +80	-20 ~ +80	-20 ~ +80
Contrast Ratio				20:1	20:1	20:1	20:1	20:1	20:1	20:1	20:1	10:1	10:1	10:1	10:1

Note: Data shown above can be tailored to customer specification.

TN type ~ Twisted Nematic

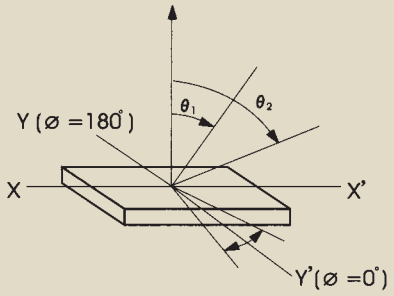
Item	Symbol	Min.	Typ.	Max.	Unit	Condition	Note
Viewing Angle	$\frac{\theta_2 - \theta_1}{\varnothing}$	40	-	-	deg.	Cr = 2.0	1 , 2
Contrast Ratio	Cr	-	4	-	-	$\theta = 20$ $\varnothing = 0^\circ$	3
Response Time (rise)	Tr	-	110	-	ms	$\theta = 20^\circ$ $\varnothing = 0^\circ$	4
Response Time (fall)	Tf	-	110	-	ms	$\theta = 20^\circ$ $\varnothing = 0^\circ$	4

STN type ~ Super Twisted Nematic

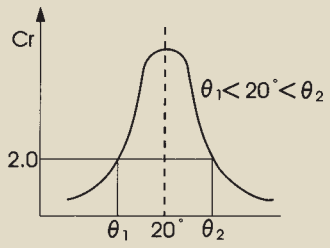
Item	Symbol	Min.	Typ.	Max.	Unit	Condition	Note
Viewing Angle	$\frac{\theta_2 - \theta_1}{\varnothing}$	70 -90	-	+90	deg.	Cr = 2.0	1 , 2
Contrast Ratio	Cr	-	4	-	-	$\theta = 20$ $\varnothing = 0^\circ$	3
Response Time (rise)	Tr	-	110	-	ms	$\theta = 20^\circ$ $\varnothing = 0^\circ$	4
Response Time (fall)	Tf	-	110	-	ms	$\theta = 20^\circ$ $\varnothing = 0^\circ$	4

Definitions

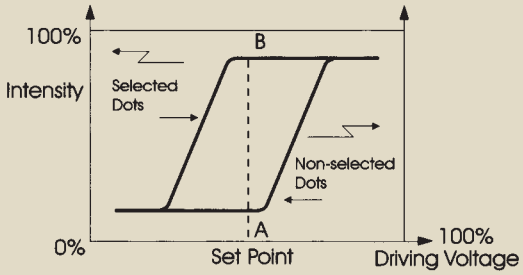
1 - Definition of angle θ & $\varnothing$



2 - Definition of viewing angle θ_1 & $\varnothing_2$

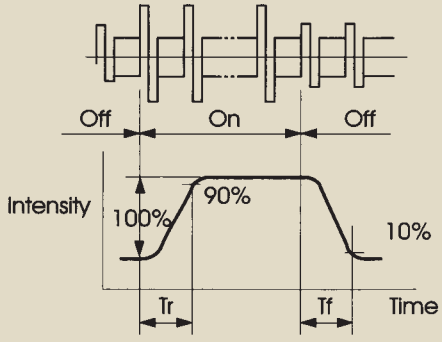


3 - Definition of contrast Cr



$Cr=(A/B)^P$ Negative : P= -1
Positive : P=+1

4 - Definition of Optical Response



LUMEX®
Creating LED and LCD Solutions Together™

Custom LCD Technologies

Lumex's strength lies in it's custom LCD products. If you have a need for a unique display tailored to your particular application, discussions with our Technical Design Specialists will help determine the criteria that best suits your design needs, including:

- Layout
- Display size
- Liquid crystal fluid
- Voltage
- Duty
- Bias
- Temperature
- Backlighting
- Connection method
- Packaging requirements
- LCD driver
- LCD controller-driven selection assistance

In addition, to further enhance your LCD design's visibility, the Lumex Technical Design Team has developed several unique custom technologies designed to enhance any of our LCD solutions.

Lumex InfoVue™ Extreme Temp LCD displays are designed to perform in extreme heat or cold while also providing enhanced visual display quality and significant technology cost and energy savings.

InfoVue™ Extreme Temperature LCD Technology for Hostile Conditions

InfoVue™ Extreme Temp series of custom, high-duty LCD displays for applications that perform in extreme heat or extreme cold. InfoVue™ Extreme Temp LCD displays provide a number of key benefits including reliable performance in a wider range of extreme temperatures, enhanced visual display quality and significant technology cost and energy savings.

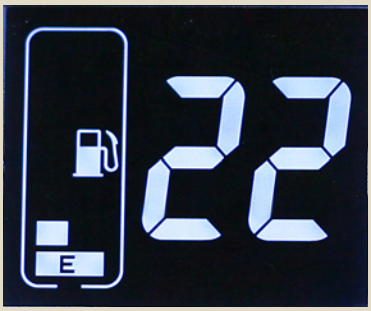
Previously LCDs that operated in extreme cold or extreme heat required bulky built-in heaters and coolers in order to ensure performance. The special liquid crystal used in the InfoVue Extreme Temp series eliminates the need for coolers and allows us to use low-power heaters -- allowing our LCDs to perform in more extreme conditions.

Whereas existing LCD technology performed in the -20°C to +70°C temperature range, **InfoVue Extreme Temp displays provide reliable, consistent high-quality performance from -40°C to +85°C** –, making Lumex LCD technology a viable solution for a growing number of extreme condition applications. The growing demand for extreme-condition LCD technology can be seen in military, freezer, gas pumps/fuel meters, non-automotive transportation, and non-climate controlled facility applications.

InfoVue Extreme Temp LCD displays can be produced in sizes ranging from 8 x 1 character displays to 320 x 240 pixel graphic displays.

InfoVue™ Enhanced Background Twisted Nematic LCD Technology

Lumex's InfoVue EBTN (Enhanced Background Twisted Nematic) family of custom negative image TN LCD technology provides significant performance and cost savings benefits including **contrast up to 6x higher than**



Lumex's EBTN LCD Technology

Standard Negative TN Technology

standard TN LCDs, technology costs up to 40% lower, and energy requirements up to 50% lower than alternative technologies.

InfoVue EBTN technology is compatible with standard LCD drivers and is ideal for a wide range of applications including:

- industrial control device technology (including gas pumps, flow meters, control panels, test chambers);
- medical device technology (including portable heart monitors, gas analysis monitors, portable defribulators, and disposable glucometers);
- communications equipment (including routers, switches and gateways)
- appliance displays (including displays on ovens, microwaves, refrigerators, dishwashers and washers)

Our new proprietary masking technology used between the two glass panels is very effective at blocking light and allows the InfoVue EBTN to provide the highest contrast TN negative image available in the LCD market today. The resulting sharp, high contrast negative image promotes brand image and ensures easy and accurate display viewing.

InfoVue EBTN LCDs provide key performance benefits compared to traditional LCD technology. InfoVue EBTN LCDs offer a contrast ration of 300 to 1, compared to traditional LCDs which offer a contrast ration of 50 to 1. Sharp, crisp negative images can be displayed using any color backlight.

InfoVue EBTN LCDs also generate significant cost savings compared to alternative technologies like VFDs (Vacuum Florescent Displays). **InfoVue EBTN LCDs can cost up to 40% less than VFDs and also require 50% lower energy consumption.**

The RoHs compliant InfoVue EBTN LCDs are available in sizes ranging from 1.0 inches^2 squared to 5 inches^2.

Custom LCD Technologies

InfoVue™ Bi-Stable LCD Technology

InfoVue Bi-Stable LCD technology offers a low-power LCD solution well-suited for a wide range of applications where display information is not changed more than a few times a day and reduced energy consumption is critical. For some applications, such as wireless, battery operated climate controls or retail shelf purchase displays, this can mean that the LCD *requires up to 99% less energy consumption* than traditional LCD technologies.

A traditional LCD module requires 25-50mW of constant power to display even a static, unchanging image. Lumex´s Bi-Stable LCDs

Lumex InfoVue Bi-Stable family of displays offer a low-power LCD solution well-suited for a wide range of applications where display information is not changed more than a few times a day.

can display the same information for over a year after power has been turned off with just a onetime 2-5 second burst of 10mW of power. The new technology enables users to more easily update vital display information while also generating cost and manpower savings.

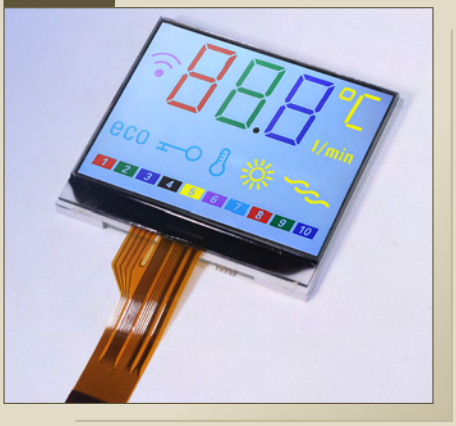
Compatible with a variety of LCD configurations, the bi-stable technology can replace standard LCD technology or printed displays where information changes with less frequency than is the case for traditional LCD applications.

Field Sequential Color (FSC) Technology

LCD displays, are a cost-effective alternative for monochromatic devices looking to transition to color. InfoVue FSC LCDs help drive brand differentiation as color display technology can now be affordably integrated into a wide range of applications.

InfoVue FSC LCDs feature integrated RGB LED backlights that allow for a wide range of color display options. The innovative chips-on-glass technology provides simple color programming with high color saturation performance. The simplified manufacturing process eliminates the need for color filters, transistors and brightness enhancement film.

InfoVue FSC LCDs are ideally suited for applications that need to migrate from monochromatic to color display or for those who already have color displays but are looking for a low cost alternative to full-color, graphic TFT and CSTN technology.



Lumex FSC LCD Technology is a Cost-Effective Option for Monochromatic Devices Looking to Transition to Color.

InfoVue™ TFT LCDs with Touch Screen Capacity

Lumex´s RoHs compliant InfoVue™ TFT LCDs are available in standard and touch-screen formats in 3.5", 4.3", 5.7" and 7.0" diagonal screen sizes.

InfoVue™ TFT LCDs feature:

- An extended temperature range (-20°C to +70°C)
- Industry-leading thin profile, starting at 3mm
- LED backlight for wider color gamut

Compatible with standard LCD drivers, InfoVue TFT technology is ideal for a wide range of applications including:

- Industrial control device technology
- Medical device technology

InfoVue TFT technology comes with industry-leading, complimentary integration support from Lumex´s team of Technical Design Specialists who can:

- Integrate the TFT technology with switches, connectors, cables covers, heaters, custom daughter boards and other key components to create solutions that maximize performance and efficiency in each individual application.

- Help generates cost savings, speed time to market and reduce opportunity for product failure due to integration issues.

InfoVue TFT LCDs provide an extended temperature range. Whereas standard TFT LCDs operate from 0°C to +60°C, the InfoVue TFT LCD can operate effectively at temperatures ranging from -20°C to +70°C, making the technology an ideal fit for applications that require consistent performance in extended temperature environments.

The following pages provide an overview of the types of TFT LCD displays Lumex provides. **For a complete list of all of Lumex's InfoVue™ TFT LCD Modules, visit us online at www.lumex.com.**

INSIDE THIS SECTION

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What is TFT?

Short for Thin Film Transistor, a type of LCD flat-panel display screen, in which each pixel is controlled by one to four transistors. TFT screens are sometimes called active-matrix LCDs.

Benefits of TFT Technology

A TFT display delivers crisp text, vibrant color and an improved response time for visual applications at the best resolution of all the flat-panel techniques. TFT displays use a separate tiny transistor for each pixel on the display. Because each transistor is so small, the amount of charge needed to control it is also small. This allows for very fast re-drawing of the display, as the image is refreshed several times per second.

TFT vs. Color STN

TFT displays utilize active matrix technology and feature transistors on every pixel. Color STN (CSTN) is a passive matrix graphic LCD with a color filter. It only has one transistor per each pixel row and column and features a lower refresh rate than TFTs.

Touch Screen TFT Modules

Touch screen displays transform a display into an interactive interface.

Daylight Visibility

Sunlight readability is a function of brightness contrast, reflectivity, and glare. With luminance output up to 1,500 nits for our TFTs, Lumex displays provide legibility and image clarity in high ambient light environments.

Lumex's transreflective displays offer both reflective and transmissive modes resulting in high light reflectance, for a "bright display," in varying lighting environments.

Extreme Operating Temperatures

Lumex's TFT LCD modules are operational at -20C° to +70C°, and has a storage temperature of -30C° to +80C°.

Wide Viewing Angles

Wide viewing technology permits display readability at angles up to 170˚. Viewing angle is defined as an angle with a contrast ratio of more than 10:1. Higher values represent better performance from stated viewing directions. All of our TFT LCDs meet or exceed 100 deg (H) and 90 deg (V).

LED Backlighting

LED backlighting enhances image quality on the screen. The LED backlight provides wider color gamut enabling for rich colors on the screen. The LED backlight offers longer life hours compared to CCFL backlights.

InfoVue™ TFT LCD Modules - Index

P/N	Active Area (Diagonal)	Resolution	Touch Screen Capacity	
3.5″ Display				
LCT-H320240M35W	3.5″	320 x 240	No	Page 126
LCT-H320240M35WT	3.5″	320 x 240	Yes	Page 126
4.3″ Display				
LCT-H480272M43W	4.3″	480 x 272	No	Page 127
LCT-H480272M43WT	4.3″	480 x 272	Yes	Page 127
5.7″ Display				
LCT-H320240M57W	5.7″	320 x 240	No	Page 128
LCT-H320240M57WT	5.7″	320 x 240	Yes	Page 128
7.0″ Display				
LCT-H800480M70W	7.0″	800 x 480	No	Page 129
LCT-H800480M70WT	7.0″	800 x 480	Yes	Page 129

The index above is representative of some of Lumex's latest innovative and more diverse product offerings. **For a complete list of all of Lumex's InfoVue™ TFT LCD Modules, visit us online at www.lumex.com.**

InfoVue™ TFT LCD Modules

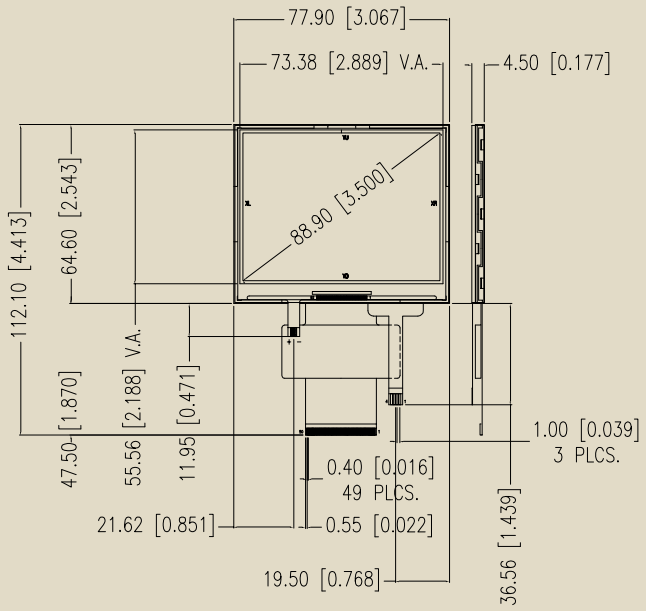
3.5″ Displays

Features / Options

- Available in standard and touch-screen formats
- Operating temperature: -20°C to +70°C
- Custom sizes available

Applications / Uses

- Communications equipment
- Industrial controls
- Medical equipment
- Security electronics
- Test and measurement



SKU	Overall Size (W x H) (mm)	Active Area (Directional)	Resolution	Touch Screen Capacity	Pixel Size (W x H)µm	Contrast Ratio
LCT-H320240M35W	77.9 x 64.6	3.5″	320 x 240	No	73 x 219	250:1
LCT-H320240M35WT	77.9 x 64.6	3.5″	320 x 240	Yes	73 x 219	250:1

Note: Illustrations shown are for representation **ONLY**. *Exact specifications should be obtained from the product data sheet. Additional product drawings of Lumex's InfoVue™ LCDs are available by logging onto* **www.lumex.com**. *Any Lumex standard LCD products can be customized to fit your specific needs. Call* **1.800.278.5666** *to speak with one of our Technical Design Specialists.*

InfoVue™ TFT LCD Modules

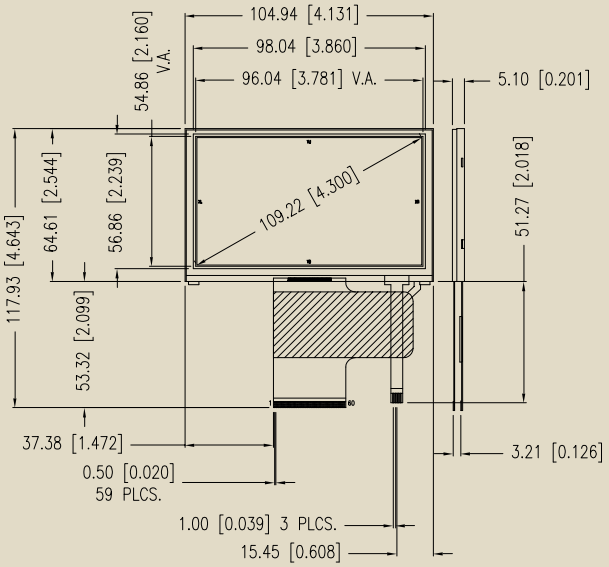
4.3″ Displays

Features / Options

- Available in standard and touch-screen formats
- Operating temperature: -20°C to +70°C
- Custom sizes available

Applications / Uses

- Communications equipment
- Industrial controls
- Medical equipment
- Security electronics
- Test and measurement



SKU	Overall Size (W x H) (mm)	Active Area (Directional)	Resolution	Touch Screen Capacity	Pixel Size (W x H)µm	Contrast Ratio
LCT-H480272M43W	104.9 x 66.0	4.3″	480 x 272	No	202 x 202	250:1
LCT-H480272M43WT	104.9 x 66.0	4.3″	480 X 272	Yes	202 x 202	250:1

Note: Illustrations shown are for representation ***ONLY****. Exact specifications should be obtained from the product data sheet. Additional product drawings of Lumex's InfoVue™ LCDs are available by logging onto* ***www.lumex.com****. Any Lumex standard LCD products can be customized to fit your specific needs. Call* ***1.800.278.5666*** *to speak with one of our Technical Design Specialists.*

InfoVue™ TFT LCD Modules

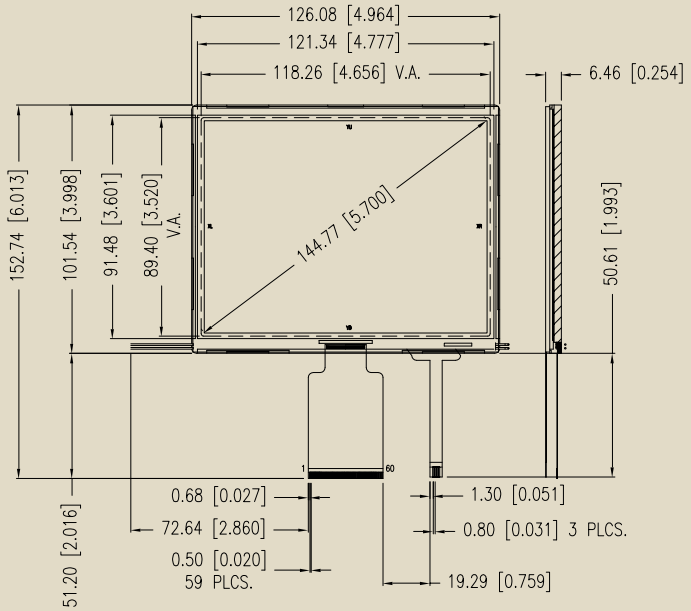
5.7″ Displays

Features / Options

- Available in standard and touch-screen formats
- Operating temperature: -20°C to +70°C
- Custom sizes available

Applications / Uses

- Communications equipment
- Industrial controls
- Medical equipment
- Security electronics
- Test and measurement



SKU	Overall Size (W x H) (mm)	Active Area (Directional)	Resolution	Touch Screen Capacity	Pixel Size (W x H)µm	Contrast Ratio
LCT-H320240M57W	126.0 x 101.5	5.7″	320 x 240	No	120 x 360	250:1
LCT-H320240M57WT	126.0 x 101.5	5.7″	320 x 240	Yes	120 x 360	250:1

Note: Illustrations shown are for representation ***ONLY****. Exact specifications should be obtained from the product data sheet. Additional product drawings of Lumex's InfoVue™ LCDs are available by logging onto* ***www.lumex.com****. Any Lumex standard LCD products can be customized to fit your specific needs. Call* ***1.800.278.5666*** *to speak with one of our Technical Design Specialists.*

InfoVue™ TFT LCD Modules

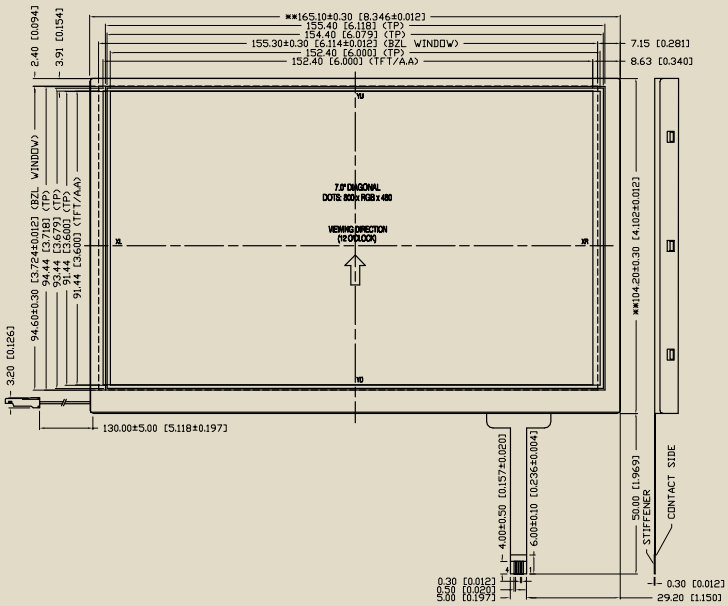
7.0″ Displays

Features / Options

- Available in standard and touch-screen formats
- Operating temperature: -20°C to +70°C
- Custom sizes available

Applications / Uses

- Communications equipment
- Industrial controls
- Medical equipment
- Security electronics
- Test and measurement



SKU	Overall Size (W x H) (mm)	Active Area (Directional)	Resolution	Touch Screen Capacity	Pixel Size (W x H)µm	Contrast Ratio
LCT-H800480M70W	165.10 x 104.20	7.0″	800 x 480	No	120 x 360	250:1
LCT-H800480M70WT	165.10 x 104.20	7.0″	800 x 480	Yes	120 x 360	250:1

Note: Illustrations shown are for representation ***ONLY****. Exact specifications should be obtained from the product data sheet. Additional product drawings of Lumex's InfoVue™ LCDs are available by logging onto* ***www.lumex.com****. Any Lumex standard LCD products can be customized to fit your specific needs. Call* ***1.800.278.5666*** *to speak with one of our Technical Design Specialists.*

InfoVue™ Extreme Temp LCDs

Lumex's InfoVue™ Extreme Temp series of high-duty LCD displays are ideal for applications that perform in extreme heat or extreme cold.

Previously LCDs that operated in extreme cold or extreme heat required bulky built-in heaters and coolers in order to ensure performance. However, the proprietary liquid crystal used in the InfoVue Extreme Temp series eliminates the need for coolers and allowing Lumex to use low-power heaters. This makes the InfoVue Extreme Temp LCDs better able to perform in more hostile conditions.

InfoVue Extreme Temp LCD displays provide reliable, consistent high-quality performance from -40°C to +85°C , making Lumex LCD technology a viable solution for a growing number of applications. The growing demand for high performance LCD technology can be seen in military, freezer, gas pumps/fuel meters, non-automotive transportation, and non-climate controlled facility applications.

Extreme Temp LCDs also offer significant visual performance benefits, providing full graphic capability and daylight visibility. When combined with LED backlighting technology, a wide range of color options are available. All InfoVue Extreme Temp LCDs are available with either a monochromatic screen with any color of LED backlight, or select negative image option with mono colored pixels and a black background.

InfoVue Extreme Temp LCD displays can be produced in sizes ranging from 8 x 1 to 20 x 4 character displays and 128 x 64 to 320 x 240 pixel graphic displays.

The following pages provide an overview of the types of extreme temp standard products Lumex provides.

In addition to our standard product offering, Lumex can also customize any LCD to suit your specific design needs. **For a complete list of all of Lumex's InfoVue™ Extreme Temp LCDs, visit us online at www.lumex.com.**

LUMEX®
Creating LED and LCD Solutions Together™

Selecting Technology Best Suited to the Environment

When designing LCDs that can perform in extreme conditions, there are a host of demanding challenges that must be considered. Interface technology must be able to perform consistently even in the most challenging of environments. When designing applications for extreme conditions some important factors to include are: shock and vibration, varying light conditions and extreme temperature changes.

Influence of Extreme Temperatures on LCDs

The liquid crystal material in a standard LCD can be damaged permanently by extreme temperatures. The molecules within the LCD can solidify into crystals and bubbles to form on the display (see image below).

- Extreme temperature affects visual performance
- LCDs tend to lighten up, bleach out or go dark in extreme temperatures

Technology Drivers

In order for a display to work instantly and consistently within a hostile environment, several technologies need to be brought together to work in parallel to get the best performance. These include:

- The liquid crystal mixture itself. Lumex's proprietary LCD fluid mixture has a temperature range of -40˚C ~ +85˚C.
- The operating heat threshold of the backlight which can be prone to fail at high temperatures. Lumex's backlight temperature range is available up to +100˚C.
- The size and power draw of the heater for extreme cold temperatures. Preferrably a thin profile, low power integrated heater.
- The backlight brightness which is important for increased visibility in full daylight or evening views. Also, avoiding the use of high power LEDs, in order to reduce thermal management requirements. Our white LED backlight does not require current derating at +85˚C temperature.
- The polarizers are built to withstand the extremely low and high temperatures over a range of humidities. These polarizers are also UV resistant to help prevent solar damage over time.

Lumex is able to bring all of these technologies together into a single, integrated solution with either standard or custom displays.

Testing Conditions

Lumex's extreme temperature displays have been rigorously tested in order to ensure instant and consistent performance in the field. The tests were designed to exceed the operating environment and ensure that the design would provide best-in-class performance.

- Vibrated at 40G for six days
- Constant cycling between -40˚C ~ +100˚C for full duration
- One (1) hour max temp; one (1) hour at minimum temperature
- Temperature transition from high to low over 7~12 minutes

Additional Design Enhancements

Lumex can alter LCD products to accommodate a wide variety of extreme temperatures and can make other modifications to standard product offerings as well.

- Numeric displays, character modules and graphic modules up to 320 x 240.
- English, simplified Chinese, Japanese and European font sets
- Various assembly technologies, including: chips on board, chips on glass and chips on tab
- Adding in switches, keypads and indicator lamps
- Various connection methods:
  - pins
  - heat seal connector (HSC)
  - flexible flat cable (FFC) or flexible printed circuit (FPC) to satisfy virtually any mounting configuration.

InfoVue™ Extreme Temp LCD Modules - Index

The index above is representative of some of Lumex's latest innovative and more diverse product offerings. **For a complete list of all of Lumex's InfoVue™ Extreme Temp LCDs, visit us online at www.lumex.com.**

InfoVue™ Extreme Temp LCDs

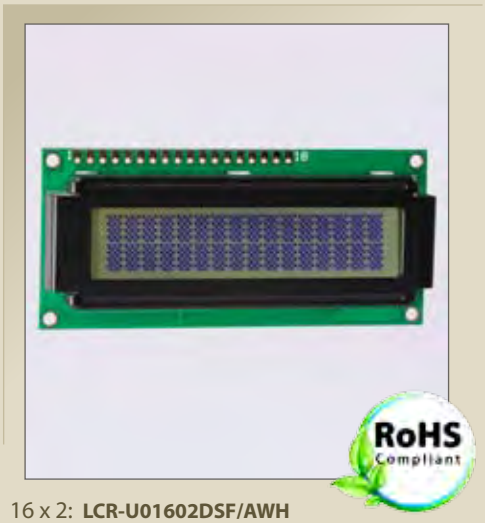
Character Modules 16 x 2

Features / Options

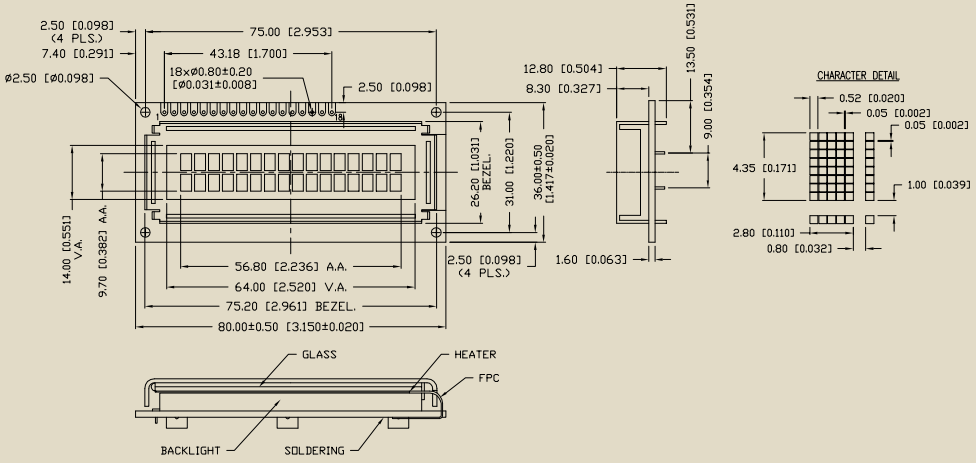
- -40˚C ~ +85˚C
- High-resolution, high-duty daylight visibility
- Wide variety of color choices paired with LED backlights

Applications / Uses

- Communications equipment
- Industrial controls
- Life safety equipment
- Medical equipment
- Meter displays
- Security electronics
- Test and measurement



16 x 2: **LCR-U01602DSF/AWH**



SKU	Operating Temperature	Overall Size (L x W x H) (mm)	Viewing Area (mm)	Character Height (W x H) mm	Duty
LCR-U01602DSF/AWH	-40˚ C ~ +85˚C	75 x 36 x 12.80	64 x 14	2.80 x 4.35	1/16

Note: Illustrations shown are for representation ***ONLY****. Exact specifications should be obtained from the product data sheet. Additional product drawings of Lumex's InfoVue™ LCDs are available by logging onto* **www.lumex.com**. *Any Lumex standard LCD products can be customized to fit your specific needs. Call* **1.800.278.5666** *to speak with one of our Technical Design Specialists.*

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InfoVue™ Extreme Temp LCDs

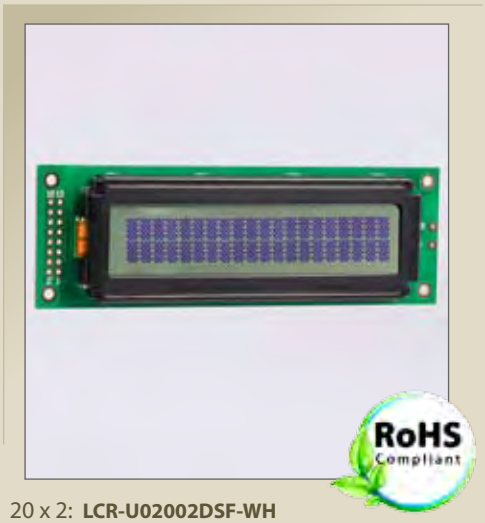
Character Modules 20 x 2

Features / Options

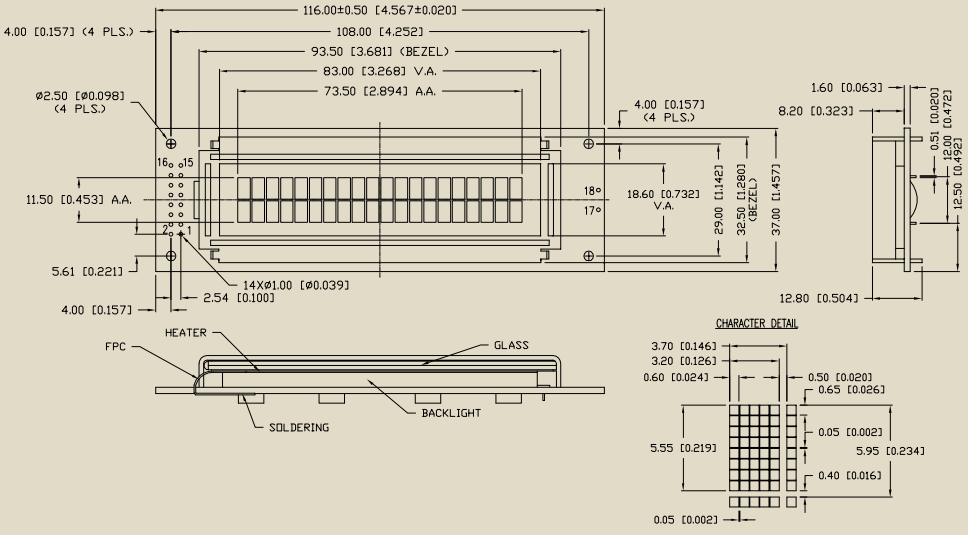
- -40˚C ~ +85˚C
- High-resolution, high-duty daylight visibility
- Wide variety of color choices paired with LED backlights

Applications / Uses

- Communications equipment
- Industrial controls
- Life safety equipment
- Medical equipment
- Meter displays
- Security electronics
- Test and measurement



20 x 2: **LCR-U02002DSF-WH**



SKU	Operating Temperature	Overall Size (L x W x H) (mm)	Viewing Area (mm)	Character Height (W x H) mm	Duty
LCR-U02002DSF-WH	-40˚ C ~ +85˚C	116 x 37 x 8.2	83 x 18.60	3.20 x 5.55	1/16

Note: Illustrations shown are for representation **ONLY**. *Exact specifications should be obtained from the product data sheet. Additional product drawings of Lumex's InfoVue™ LCDs are available by logging onto* **www.lumex.com**. *Any Lumex standard LCD products can be customized to fit your specific needs. Call* **1.800.278.5666** *to speak with one of our Technical Design Specialists.*

InfoVue™ Extreme Temp LCDs

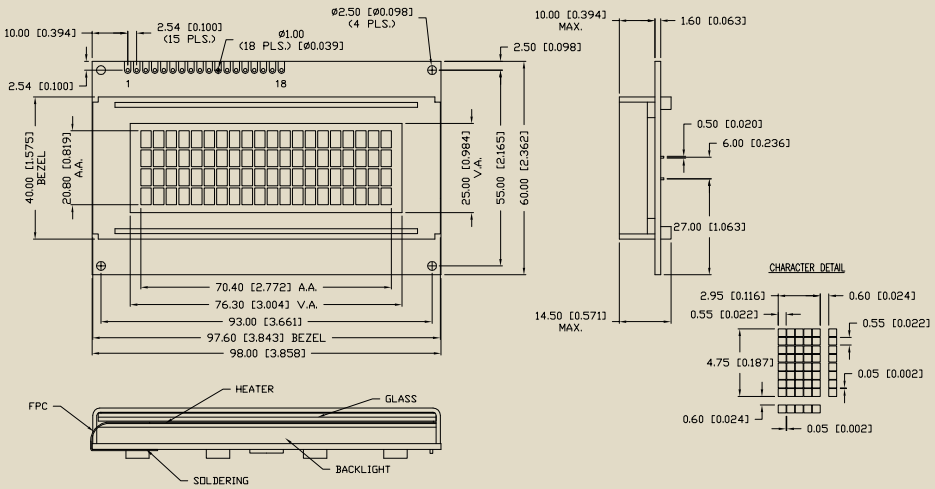
Character Modules 20 x 4

Features / Options

- -40˚C ~ +85˚C
- High-resolution, high-duty daylight visibility
- Wide variety of color choices paired with LED backlights

Applications / Uses

- Communications equipment
- Industrial controls
- Life safety equipment
- Medical equipment
- Meter displays
- Security electronics
- Test and measurement



SKU	Operating Temperature	Overall Size (L x W x H) (mm)	Viewing Area (mm)	Character Height (W x H) mm	Duty
LCR-U02004DSF-WH	-40˚ C ~ +85˚C	98 x 60 x 14.50	76.30 x 25	4.75 x 2.95	1/16

Note: Illustrations shown are for representation ***ONLY****. Exact specifications should be obtained from the product data sheet. Additional product drawings of Lumex's InfoVue™ LCDs are available by logging onto* **www.lumex.com**. *Any Lumex standard LCD products can be customized to fit your specific needs. Call* **1.800.278.5666** *to speak with one of our Technical Design Specialists.*

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InfoVue™ Extreme Temp LCDs

Graphic Modules 128 x 64

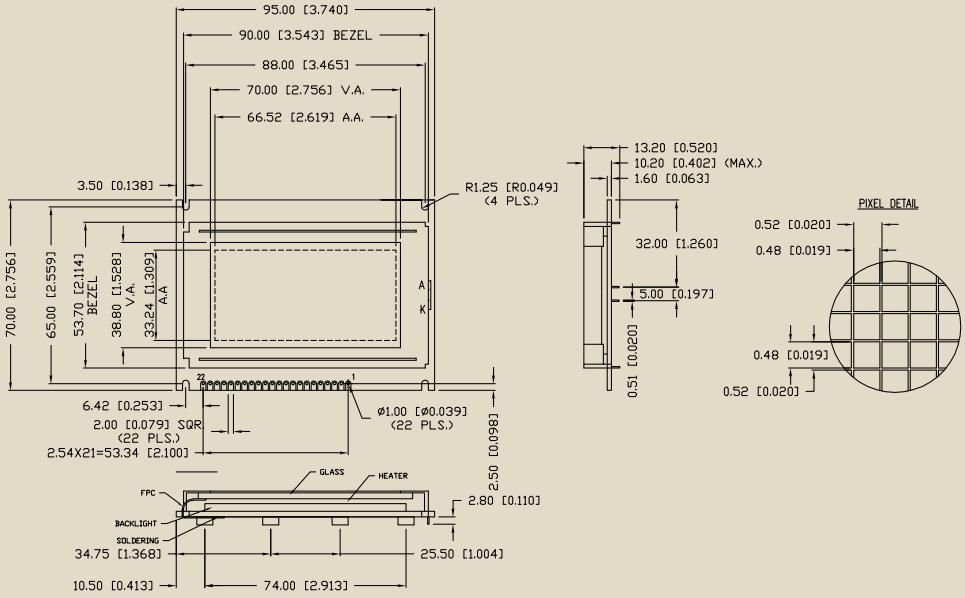
Features / Options

* -40˚C ~ +85˚C

- High-resolution, high-duty daylight visibility
- Wide variety of color choices paired with LED backlights

Applications / Uses

- Communications equipment
- Industrial controls
- Life safety equipment
- Medical equipment
- Meter displays
- Security electronics
- Test and measurement



SKU	Operating Temperature	Overall Size (L x W x H) (mm)	Viewing Area (mm)	Character Height (W x H) mm	Duty
LCR-U12864GSF-WH	-40˚C ~ +85˚C	95 x 70 x 10.20	70.00 x 38.30	0.48 x 0.48	1/64

Note: Illustrations shown are for representation **ONLY**. *Exact specifications should be obtained from the product data sheet. Additional product drawings of Lumex's InfoVue™ LCDs are available by logging onto* **www.lumex.com**. *Any Lumex standard LCD products can be customized to fit your specific needs. Call* **1.800.278.5666** *to speak with one of our Technical Design Specialists.*

InfoVue™ Extreme Temp LCDs

Graphic Modules 240 x 128

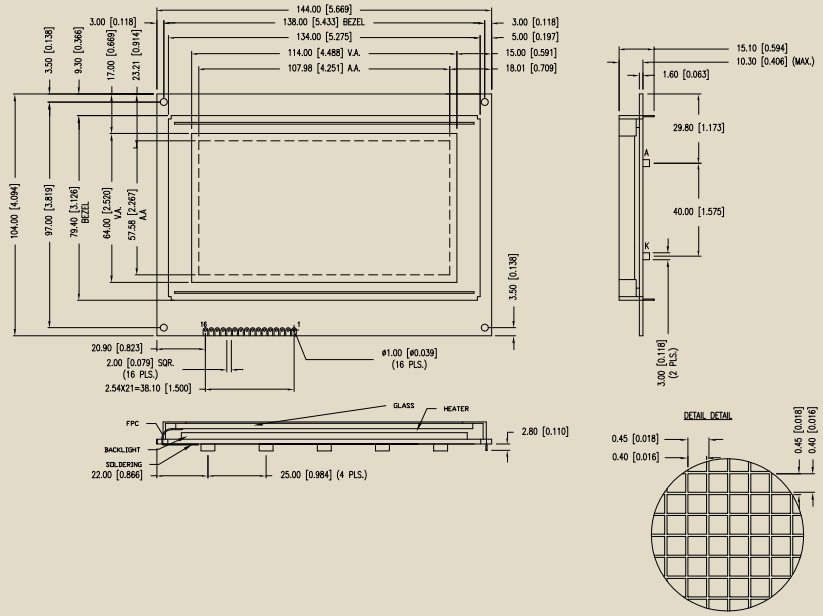
Features / Options

* -40˚C ~ +85˚C

- High-resolution, high-duty daylight visibility
- Wide variety of color choices paired with LED backlights

Applications / Uses

- Communications equipment
- Industrial controls
- Life safety equipment
- Medical equipment
- Meter displays
- Security electronics
- Test and measurement



SKU	Operating Temperature	Overall Size (L x W x H) (mm)	Viewing Area (mm)	Character Height (W x H) mm	Duty
LCR-U240128GWF-WH	-40˚C ~ +85˚C	144 x 104 x 15	114 x 64	0.45 x 0.45	1/128

Note: Illustrations shown are for representation **ONLY**. *Exact specifications should be obtained from the product data sheet. Additional product drawings of Lumex's InfoVue™ LCDs are available by logging onto* **www.lumex.com**. *Any Lumex standard LCD products can be customized to fit your specific needs. Call* **1.800.278.5666** *to speak with one of our Technical Design Specialists.*

InfoVue™ Graphic LCDs

Lumex's InfoVue™ Graphic LCD Modules graphics displays are available in a variety of sizes, ranging from 122 x 32 to 320 x 240. The following options are available on most Lumex InfoVue Graphic LCD Modules:

Controllers

The most important consideration in choosing an LCD display is the controller. Lumex employs various controllers from Toshiba, Epson and others. The actual selection is based on the resolution of the module.

Display Type

There are three basic display types, TN, STN, and FSTN. However, only STN and FSTN have the response time to be used in graphic modules. DFSTN is used in high end applications that have very specific criteria.

Backlight

Backlights also come in three basic varieties, EL, LED, and CCFL. Lumex predominately uses LED backlights when possible. Lumex offers a wide array of color options to enable brand differentiation.

Viewing Angle

The two basic viewing angles are defined as 12:00 and 6:00. A 12:00 display is best viewed below eye level, and a 6:00 display is best viewed above eye level.

Custom Solutions

Lumex can offer near infinite variations to custom graphic modules. This ranges from the full custom COB, COG, COF, TAB architectures to full integration with the inclusion of LED indicators, switches and additional logic.

Semi-custom solutions are available, such as custom LED backlight colors or specialized PCB options.

The following pages provide an overview of the types of graphic LCD displays Lumex provides.

For a complete list of all of Lumex's InfoVue™ Graphic LCD Modules, visit us online at www.lumex.com.

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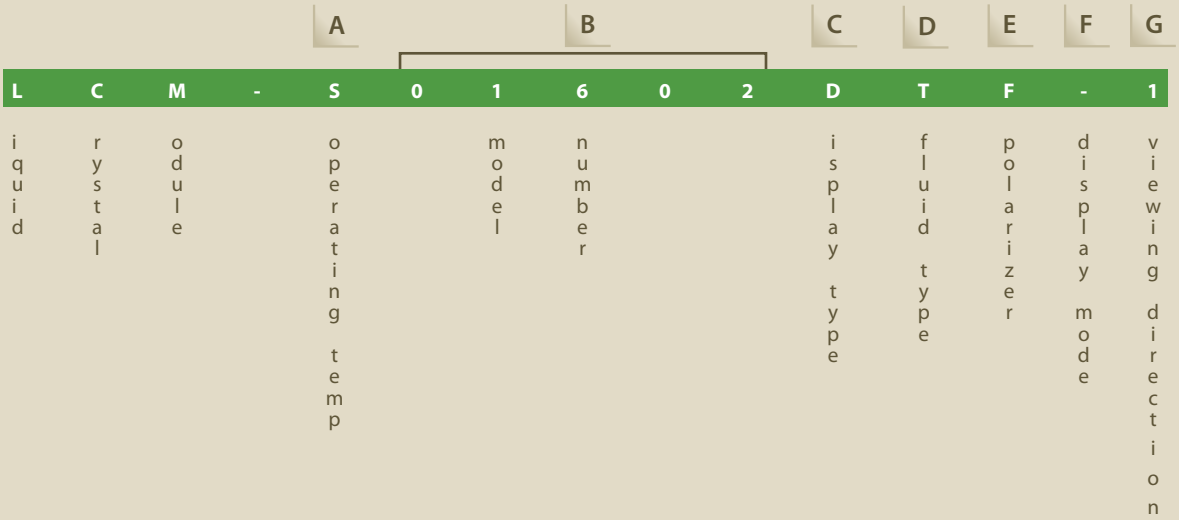
InfoVue™ Graphic LCD Modules - Part Numbering Guide



A **Operating Temperature**
S = Standard (0˚ C to 50˚ C)
H = High Temp (-20˚ C to +70˚ C)
U = Extreme Temp (-40˚C to +85˚C)

B **Model Number (for alphanumeric and numeric**
For Dot Matrix & Graphic Model
01602 = 16 character x 2 lines
12864 = 128 columns x 64 rows

For Alphanumeric & Numeric
401C40 = 4 character x 1 line, 0.40"
4x1C45 = 4.5 character x 1 line, 0.45"
x - represents 1/2 column

C **Display Type**
D = Dot Matrix
G = Graphic
M = Custom

D **Fluid Type**
T = Twisted Nematic (TN), 5.0V operation
S = Super Twisted Nematic (STN), 5.0V operation
W = Flim Compensated (FSTN), 5.0V operation
K = Twisted Nematic (TN), 3.3V operation
L = Super Twisted Nematic (STN), 3.3V operation
F = Flim Compensated (FSTN) 3.3V operation

E **Polarizer Mode**
R = Reflective
F = Transreflective
M = Transmissive

**** Additional part number sequence for non-default setting

F **Display Mode**
Default = Positive image (no letter, or if more description follows, use "-"
N = Negative image

F **Viewing Direction**
Default = 6 O'Clock (no number)
1 = 12 O'Clock

InfoVue™ Graphic LCD Modules - Index

P/N	Overall Size (W x H)	Viewing Area (W x H)	Dot Pitch	
122 x 32 Display Format (character x line)				
LCM-X12232GXX	84.0 x 44.0	60.5 x 18.5	0.44 x 0.49	Page 141
128 x 32 Display Format (character x line)				
LCM-S12832GSF/A-Y	66.0 x 26.0	51.0 x 14.8	0.38 x 0.37	Page 142
128 x 64 Display Format (character x line)				
LCM-X12864GXX	93.0 x 70.0	72.0 x 40.0	0.52 x 0.52	Page 143
160 X 160 Display Format (character x line)				
LCM-X160160GXX	88.8 x 88.8	62.0 x 62.0	0.38 x 0.38	Page 144
240 x 64 Display Format (character x line)				
LCM-X24064GXX(-X)	180.0 x 65.0	133.0 x 40.0	0.53 x 0.53	Page 145
240 x 128 Display Format (character x line)				
LCM-X240128GXX(-X)	144.0 X 104.0	114.0 X 64.0	0.45 X 0.45	Page 146

The index above is representative of some of Lumex's latest innovative and more diverse product offerings. **For a complete list of all of Lumex's InfoVue™ Graphic LCD Modules, visit us online at www.lumex.com.**

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InfoVue™ Graphic LCD Modules

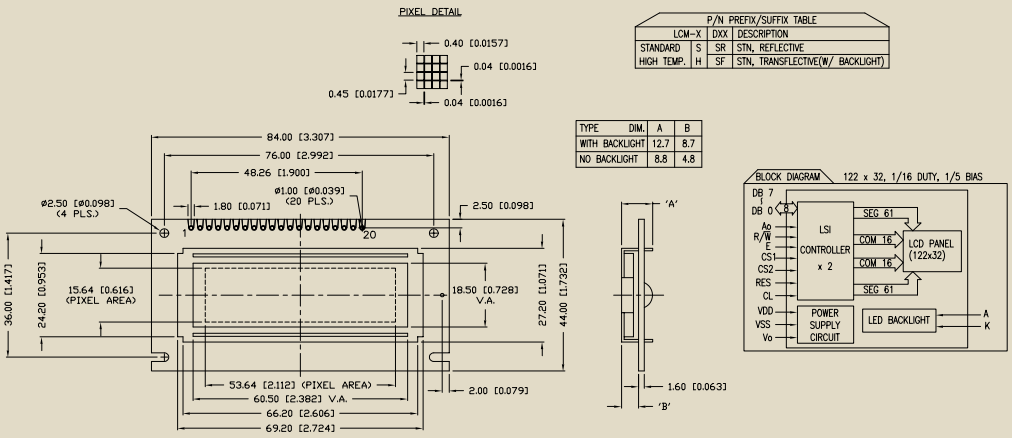
122 x 32 Display

Features / Options

- Reliable user-interface display
- Low power consumption
- Very long operational life
- Custom sizes available

Applications / Uses

- Communications equipment
- Industrial controls
- Life safety equipment
- Medical equipment
- Meter displays
- Security electronics
- Test and measurement



SKU	Overall Size (W x H) mm	Viewing Area (W x H) mm	Dot Pitch (W x H) mm	Dot Size (W x H) mm	Duty
LCM-X12232GXX	84.0 x 44.0	60.5 x 18.5	0.44 x 0.49	0.40 x 0.45	1/32

Note: Illustrations shown are for representation **ONLY**. *Exact specifications should be obtained from the product data sheet. Additional product drawings of Lumex's InfoVue™ LCDs are available by logging onto* **www.lumex.com**. *Any Lumex standard LCD products can be customized to fit your specific needs. Call* **1.800.278.5666** *to speak with one of our Technical Design Specialists.*

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InfoVue™ Graphic LCD Modules

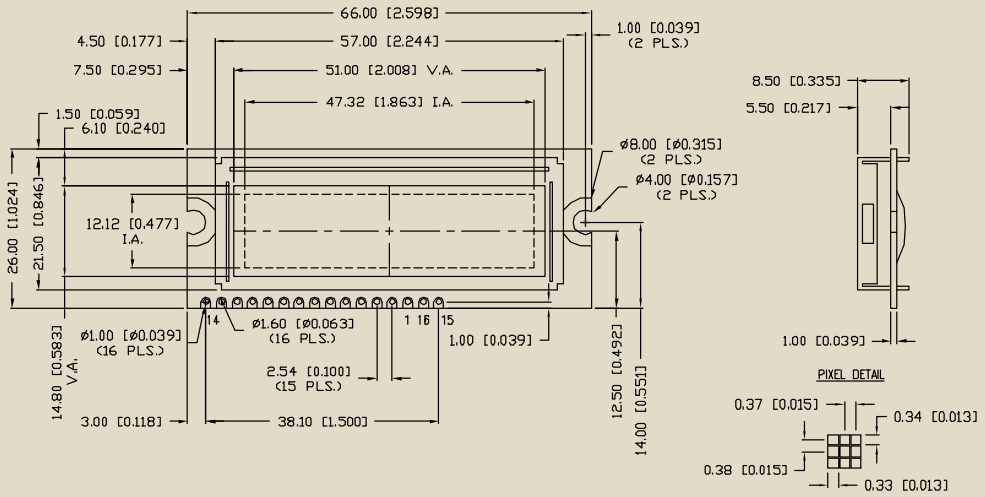
128 x 32 Display

Features / Options

- Reliable user-interface display
- Low power consumption
- Very long operational life
- Custom sizes available

Applications / Uses

- Communications equipment
- Industrial controls
- Life safety equipment
- Medical equipment
- Meter displays
- Security electronics
- Test and measurement



SKU	Overall Size (W x H) mm	Viewing Area (W x H) mm	Dot Pitch (W x H) mm	Dot Size (W x H) mm	Duty
LCM-S12832GSF/A-Y	66.0 x 26.0	51.0 x 14.8	0.38 x 0.37	0.34 x 0.33	1/32

Note: Illustrations shown are for representation ***ONLY****. Exact specifications should be obtained from the product data sheet. Additional product drawings of Lumex's InfoVue™ LCDs are available by logging onto* ***www.lumex.com****. Any Lumex standard LCD products can be customized to fit your specific needs. Call* ***1.800.278.5666*** *to speak with one of our Technical Design Specialists.*

InfoVue™ Graphic LCD Modules

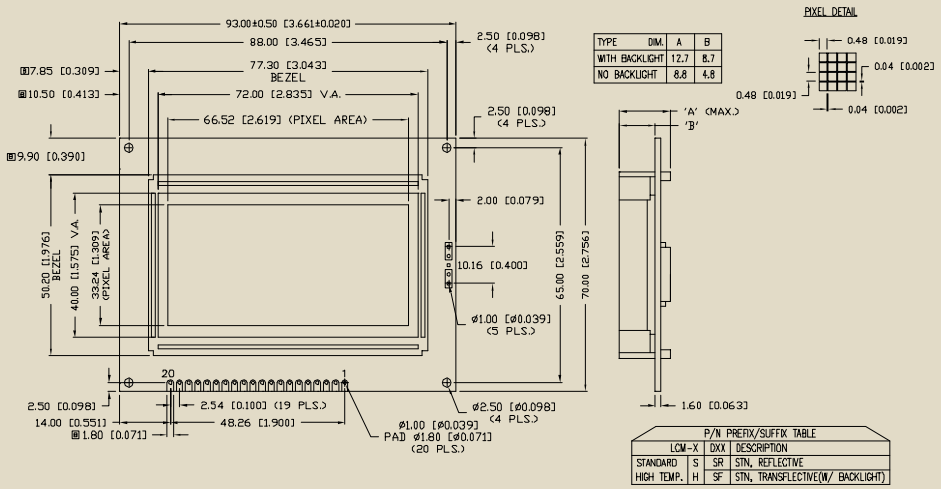
128 x 64 Display

Features / Options

- Reliable user-interface display
- Low power consumption
- Very long operational life
- Custom sizes available

Applications / Uses

- Communications equipment
- Industrial controls
- Life safety equipment
- Medical equipment
- Meter displays
- Security electronics
- Test and measurement



SKU	Overall Size (W x H) mm	Viewing Area (W x H) mm	Dot Pitch (W x H) mm	Dot Size (W x H) mm	Duty
LCM-X12864GXX	93.0 x 70.0	72.0 x 40.0	0.52 x 0.52	0.48 x 0.48	1/64

Note: Illustrations shown are for representation **ONLY**. *Exact specifications should be obtained from the product data sheet. Additional product drawings of Lumex's InfoVue™ LCDs are available by logging onto* **www.lumex.com**. *Any Lumex standard LCD products can be customized to fit your specific needs. Call* **1.800.278.5666** *to speak with one of our Technical Design Specialists.*

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InfoVue™ Graphic LCD Modules

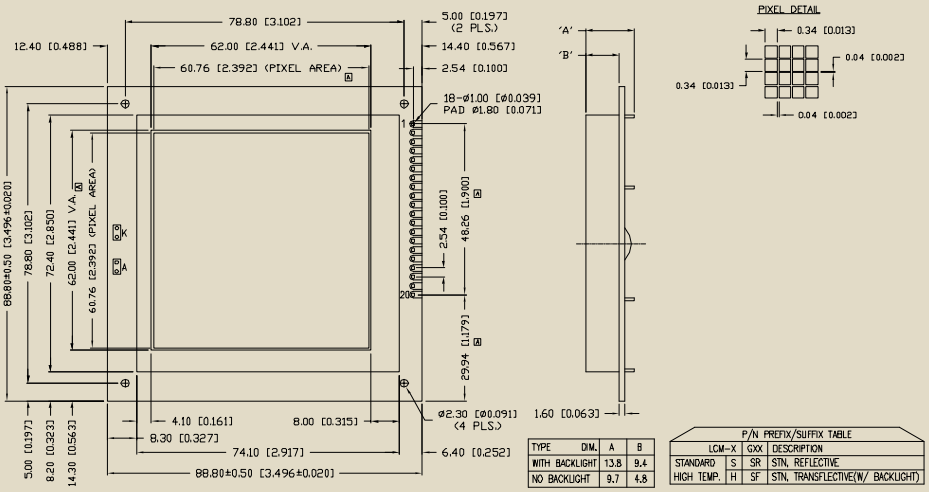
160 x 160 Display

Features / Options

- Reliable user-interface display
- Low power consumption
- Very long operational life
- Custom sizes available

Applications / Uses

- Communications equipment
- Industrial controls
- Life safety equipment
- Medical equipment
- Meter displays
- Security electronics
- Test and measurement



SKU	Overall Size (W x H) mm	Viewing Area (W x H) mm	Dot Pitch (W x H) mm	Dot Size (W x H) mm	Duty
LCM-X160160GXX	88.8 x 88.8	62.0 x 62.0	0.38 x 0.38	0.34 x 0.34	1/160

Note: Illustrations shown are for representation **ONLY**. *Exact specifications should be obtained from the product data sheet. Additional product drawings of Lumex's InfoVue™ LCDs are available by logging onto* **www.lumex.com**. *Any Lumex standard LCD products can be customized to fit your specific needs. Call* **1.800.278.5666** *to speak with one of our Technical Design Specialists.*

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InfoVue™ Graphic LCD Modules

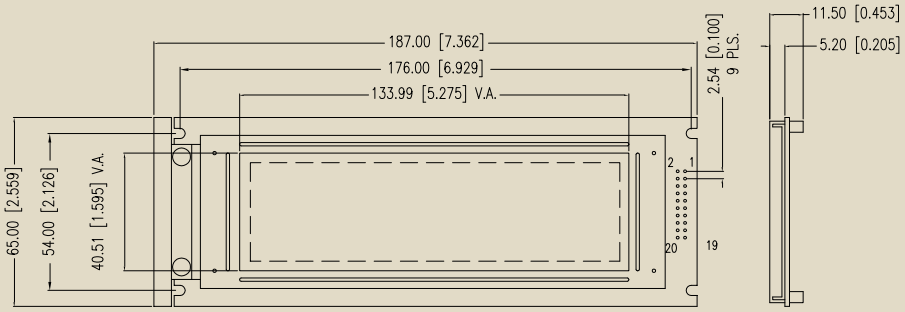
240 x 64 Display

Features / Options

- Reliable user-interface display
- Low power consumption
- Very long operational life
- Custom sizes available

Applications / Uses

- Communications equipment
- Industrial controls
- Life safety equipment
- Medical equipment
- Meter displays
- Security electronics
- Test and measurement



SKU	Overall Size (W x H) mm	Viewing Area (W x H) mm	Dot Pitch (W x H) mm	Dot Size (W x H) mm	Duty
LCM-X24064GXX(-X)	180.0 x 65.0	113.0 x 40.0	0.53 x 0.53	0.49 x 0.49	1/64

Note: Illustrations shown are for representation **ONLY**. *Exact specifications should be obtained from the product data sheet. Additional product drawings of Lumex's InfoVue™ LCDs are available by logging onto* **www.lumex.com**. *Any Lumex standard LCD products can be customized to fit your specific needs. Call* **1.800.278.5666** *to speak with one of our Technical Design Specialists.*

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InfoVue™ Graphic LCD Modules

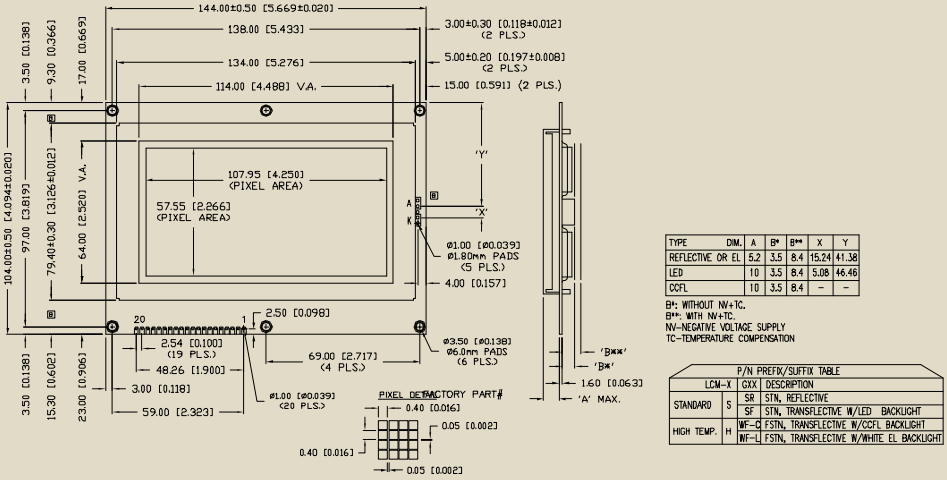
240 x 128 Display

Features / Options

- Reliable user-interface display
- Low power consumption
- Very long operational life
- Custom sizes available

Applications / Uses

- Communications equipment
- Industrial controls
- Life safety equipment
- Medical equipment
- Meter displays
- Security electronics
- Test and measurement



TYPE	DIM.	A	B*	B**	X	Y
REFLECTIVE OR EL		5.2	3.5	8.4	15.24	41.38
LED		10	3.5	8.4	5.08	46.46
CCFL		10	3.5	8.4	–	–

B*: WITHOUT NV+TC.
B**: WITH NV+TC.
NV–NEGATIVE VOLTAGE SUPPLY
TC–TEMPERATURE COMPENSATION

P/N PREFIX/SUFFIX TABLE		
LCM–X	GXX	DESCRIPTION
STANDARD	S	SR STN, REFLECTIVE
		SF STN, TRANSFLECTIVE W/LED BACKLIGHT
HIGH TEMP.	H	WF–C FSTN, TRANSFLECTIVE W/CCFL BACKLIGHT
		WF–L FSTN, TRANSFLECTIVE W/WHITE EL BACKLIGHT

SKU	Overall Size (W x H) mm	Viewing Area (W x H) mm	Dot Pitch (W x H) mm	Dot Size (W x H) mm	Duty
LCM-X240128GXX(-X)	144.0 x 104.0	114.0 x 64.0	0.45 x 0.45	0.40 x 0.40	1/128

Note: Illustrations shown are for representation **ONLY**. *Exact specifications should be obtained from the product data sheet. Additional product drawings of Lumex's InfoVue™ LCDs are available by logging onto* **www.lumex.com**. *Any Lumex standard LCD products can be customized to fit your specific needs. Call* **1.800.278.5666** *to speak with one of our Technical Design Specialists.*

InfoVue™ Character LCD Modules

Lumex's InfoVue™ Character LCD Modules are made up of an array of pixels, such as 5 x 8, evenly spaced apart in columns and rows as with 8 characters by 1 row. Each module comes with an integrated controller, usually the Sitronix ST7066U. This controller contains a built-in CGROM for each 5 x 8 pixel array with the prerequisite characters for English and Japanese.

Character modules are generally used to display fairly complex data within a menu system for user control.

The main design considerations for a character LCD module are:

• Controller - Generally SitronixST7066 with other language options available

• Fluid Type - TN, STN, and FSTN are standard options each with their strengths and weaknesses. DFSTN is available for more visually demanding situations.

• LED Backlight - For low light situations. Lumex has a wide range of color choices available.

• Interconnect locations - Lumex offers a variety of PCB layouts for optimum fit.

• Custom capabilities - Lumex can offer near infinite variations in custom character modules. This ranges from the full custom COB, COG and TAB architectures to full integration with the inclusion of LED indicators, switches and additional logic. Semi-custom solutions are available, such as custom LED backlight colors or specialized PCB options.

The following pages provide an overview of the types of character LCD displays Lumex provides.

For a complete list of all of Lumex's InfoVue™ Character LCD Modules, visit us online at www.lumex.com.

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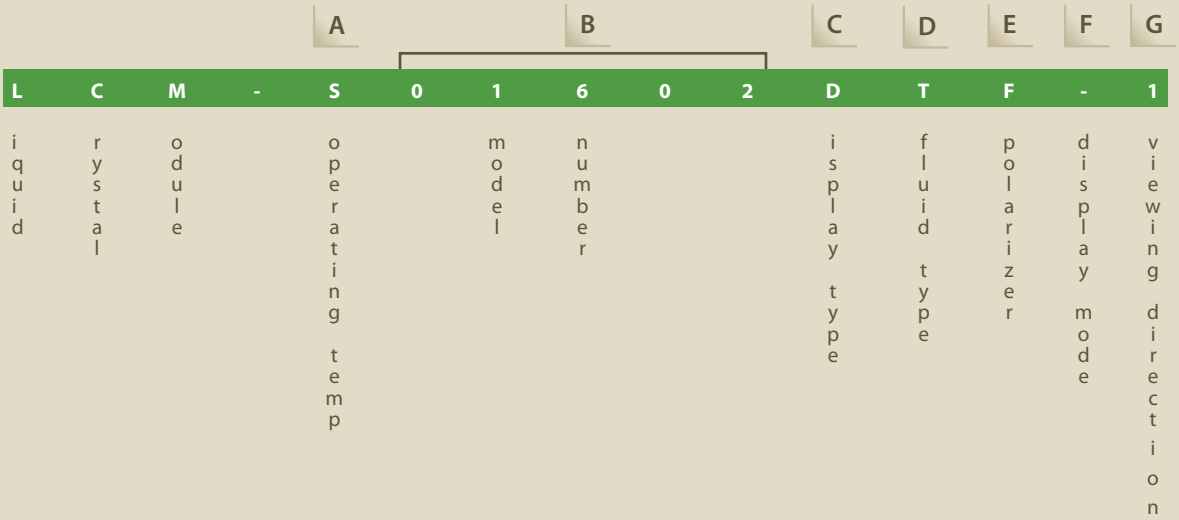
InfoVue™ Character LCD Modules - Part Numbering Guide



A **Operating Temperature**
S = Standard (0˚ C to 50˚ C)
H = High Temp (-20˚ C to +70˚ C)

B **Model Number (for alphaCharacter and Character**
For Dot Matrix & Graphic Model
01602 = 16 character x 2 lines
12864 = 128 columns x 64 rows

For AlphaCharacter & Character
401C40 = 4 character x 1 line, 0.40"
4x1C45 = 4.5 character x 1 line, 0.45"
x - represents 1/2 column

C **Display Type**
D = Dot Matrix
G = Graphic
M = Custom

D **Fluid Type**
T = Twisted Nematic (TN), 5V
S = Super Twisted Nematic (STN), 5V
W = Flim Compensated (FSTN), 5V
K = Twisted Nematic (TN), 3V
L = Super Twisted Nematic (STN), 3V
F = Flim Compensated (FSTN), 3V

E **Polarizer Mode**
R = Reflective
F = Transreflective
M = Transmissive

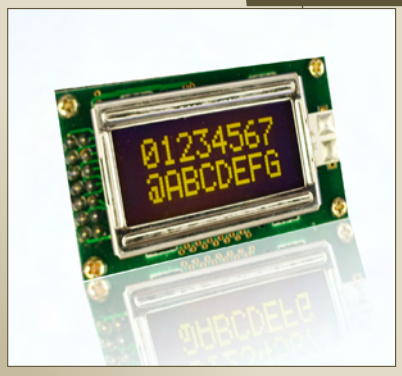
**** Additional part number sequence for non-default setting

F **Display Mode**
Default = Positive image (no letter, or if more description follows, use "-"
N = Negative image

G **Viewing Direction**
Default = 6 O'Clock (no number)
1 = 12 O'Clock

InfoVue™ Character LCD Modules - Index

P/N	Overall Size (W x H x T1/T2) T1 = w/LED Backlight T2 = no LED Backlight	Viewing Area mm (W x H)	Character Height mm	
8 x 1 Display Format (character x line)				
LCM-X00801DSF-Y	60 x 37.5 x 13	45 x 13.5	4.43 x 7.93	Page 150
16 x 1 Display Format (character x line)				
LCM-X01601DXX	80 x 36 x 12.7	66 x 16	3.07 x 6.56	Page 151
16 x 2 Display Format (character x line)				
LCM-X01602DXX/A	80 x 36 x 12.7	66 x 16	2.96 x 5.56	Page 152
LCM-X01602DXX/D	122 x 44 x 13/8.8	99 x 24	4.84 x 9.63	Page 153
LCM-X01602DXX/G	84 x 44 x 12.0	63 x 19	2.96 x 5.56	Page 154
LCM-X01602DXX/M	66 x 26	52 x 16	2.46 x 5.56	Page 155
LCM-X01602DXX/N	66 x 26 x 6.5	52 x 16	2.46 x 5.56	Page 156
16 x 4 Display Format (character x line)				
LCM-X01604DXX	87.0 x 60.0 x 12.7/8.8	62.0 x 25.6	2.95 x 4.75	Page 157
20 x 2 Display Format (character x line)				
LCM-X02002DXX	116.0 x 37.0 x 12.7/8.8	85.0 x 18.6	3.20 x 5.55	Page 158
20 x 4 Display Format (character x line)				
LCM-X02004DXX	146.0 x 62.5 x 13.0/11.0	123.5 x 43.0	4.84 x 9.22	Page 159
LCM-X02004DXX/D-Y	146 x 55.5 x 11	123.5 x 43	0.92 x 1.10	Page 160
24 x 2 Display Format (character x line)				
LCM-X02402DXX	118 x 36 x 12.70	93.5 x 16	3.2 x 5.55	Page 161
40 x 2 Display Format (character x line)				
LCM-X04002DXX	182.0 x 33.5 x 12.7/8.8	154.0 x 15.3	3.20 x 5.55	Page 162
40 x 4 Display Format (character x line)				
LCM-X04004DXX	190.0 x 54.0 x 14.5/10.0	149.0 x 29.5	2.78 x 4.89	Page 163

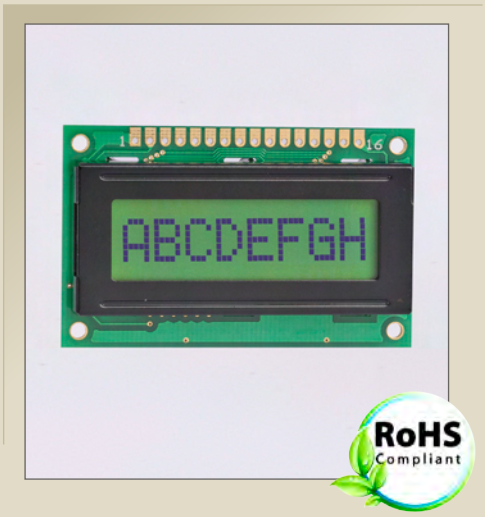


The index above is representative of some of Lumex's latest innovative and more diverse product offerings. **For a complete list of all of Lumex's InfoVue™ Character LCD Modules, visit us online at www.lumex.com.**

LUMEX®
Creating LED and LCD Solutions Together™

InfoVue™ Character LCD Modules

8 x 1 (character x line)

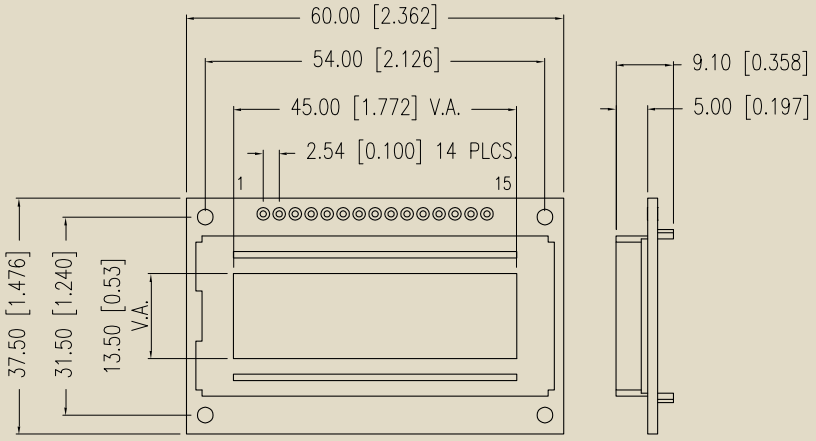


Features / Options

- Reliable user-interface display
- Low power consumption
- Very long operational life
- Custom sizes available

Applications / Uses

- Communications equipment
- Industrial controls
- Life safety equipment
- Medical equipment
- Meter displays
- Security electronics
- Test and measurement



SKU	Overall Size (W x H x T1/T2) T1 = with LED Backlight T2 = no LeD Backlight	Viewing Area (W x H)	Character Height (W x H)	Dot Size (W x H)	Font	Duty
LCM-X00801DXX-Y	60 x 37.5 x 13/9.1	45 x 13.5	4.43 x 7.93	0.83 x 0.93	5 x 8	1/8

Note: Illustrations shown are for representation **ONLY**. *Exact specifications should be obtained from the product data sheet. Additional product drawings of Lumex's InfoVue™ LCDs are available by logging onto* **www.lumex.com**. *Any Lumex standard LCD products can be customized to fit your specific needs. Call* **1.800.278.5666** *to speak with one of our Technical Design Specialists.*

LUMEX®
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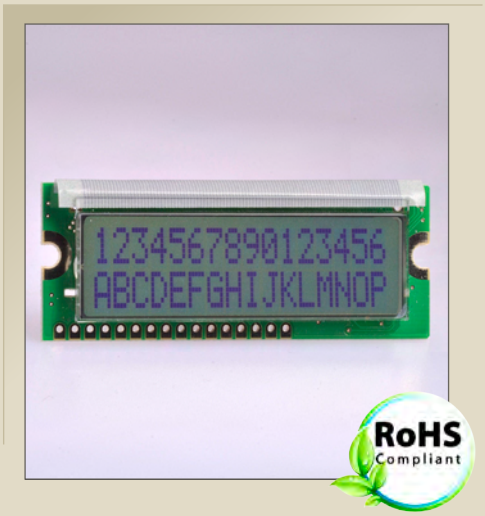
InfoVue™ Character LCD Modules

16 x 1 (character x line)

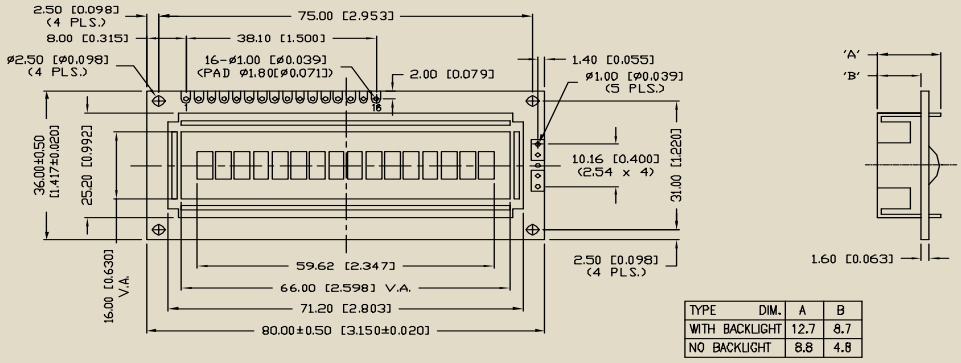


Features / Options

- Reliable user-interface display
- Low power consumption
- Very long operational life
- Custom sizes available

Applications / Uses

- Communications equipment
- Industrial controls
- Life safety equipment
- Medical equipment
- Meter displays
- Security electronics
- Test and measurement



TYPE DIM.	A	B
WITH BACKLIGHT	12.7	8.7
NO BACKLIGHT	8.8	4.8

SKU	Overall Size (W x H x T1/T2) T1 = with LED Backlight T2 = no LeD Backlight	Viewing Area (W x H)	Character Height (W x H)	Dot Size (W x H)	Font	Duty
LCM-X01601DXX	80 x 36 x 12.7	66 x 16	3.07 x 6.56	0.55 x 0.75	5 x 8	1/16

Note: Illustrations shown are for representation **ONLY**. *Exact specifications should be obtained from the product data sheet. Additional product drawings of Lumex's InfoVue™ LCDs are available by logging onto* **www.lumex.com**. *Any Lumex standard LCD products can be customized to fit your specific needs. Call* **1.800.278.5666** *to speak with one of our Technical Design Specialists.*

LUMEX®
Creating LED and LCD Solutions Together™

InfoVue™ Character LCD Modules

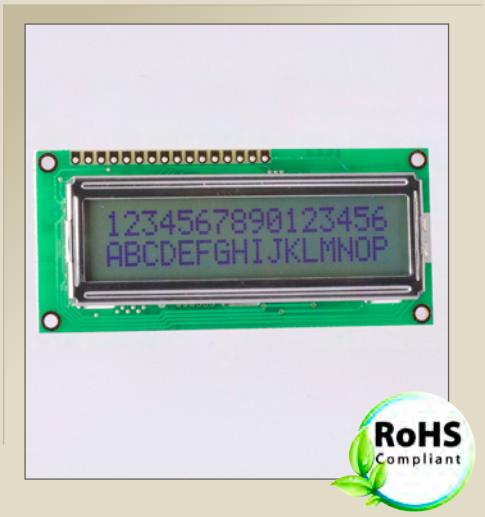
16 x 2 (character x line)

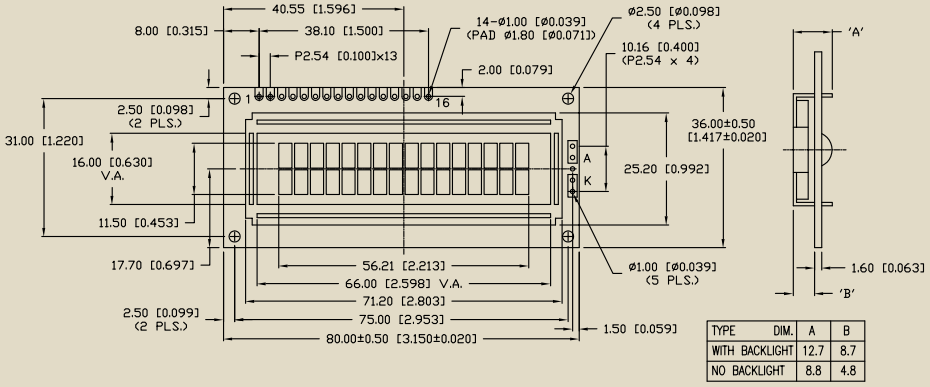
Features / Options

- Reliable user-interface display
- Low power consumption
- Very long operational life
- Custom sizes available

Applications / Uses

- Communications equipment
- Industrial controls
- Life safety equipment
- Medical equipment
- Meter displays
- Security electronics
- Test and measurement





SKU	Overall Size (W x H x T1/T2) T1 = with LED Backlight T2 = no LeD Backlight	Viewing Area (W x H)	Character Height (W x H)	Dot Size (W x H)	Font	Duty
LCM-X01602DXX/A	80 x 36 x 12.78.8	66 x 16	2.96 x 5.56	0.56 x 0.66	5 x 8	1/16

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LUMEX®
Creating LED and LCD Solutions Together™

InfoVue™ Character LCD Modules

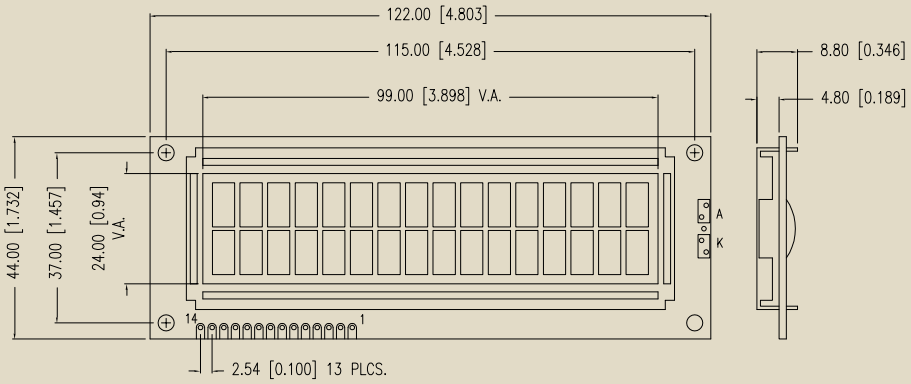
16 x 2 (character x line)

Features / Options

- Reliable user-interface display
- Low power consumption
- Very long operational life
- Custom sizes available

Applications / Uses

- Communications equipment
- Industrial controls
- Life safety equipment
- Medical equipment
- Meter displays
- Security electronics
- Test and measurement



SKU	Overall Size (W x H x T1/T2) T1 = with LED Backlight T2 = no LeD Backlight	Viewing Area (W x H)	Character Height (W x H)	Dot Size (W x H)	Font	Duty
LCM-X01602DXX/D	122.0 x 44.0 x 13.0/8.8	99.0 x 24.0	4.84 x 9.63	0.92 x 1.16	5 x 8	1/16

Note: Illustrations shown are for representation ***ONLY****. Exact specifications should be obtained from the product data sheet. Additional product drawings of Lumex's InfoVue™ LCDs are available by logging onto* ***www.lumex.com****. Any Lumex standard LCD products can be customized to fit your specific needs. Call* ***1.800.278.5666*** *to speak with one of our Technical Design Specialists.*

LUMEX®
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InfoVue™ Character LCD Modules

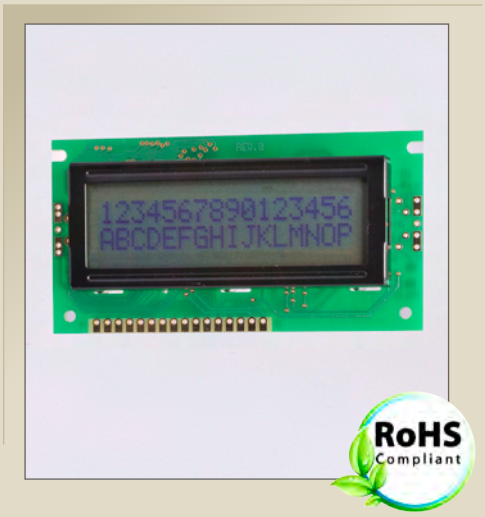
16 x 2 (character x line)

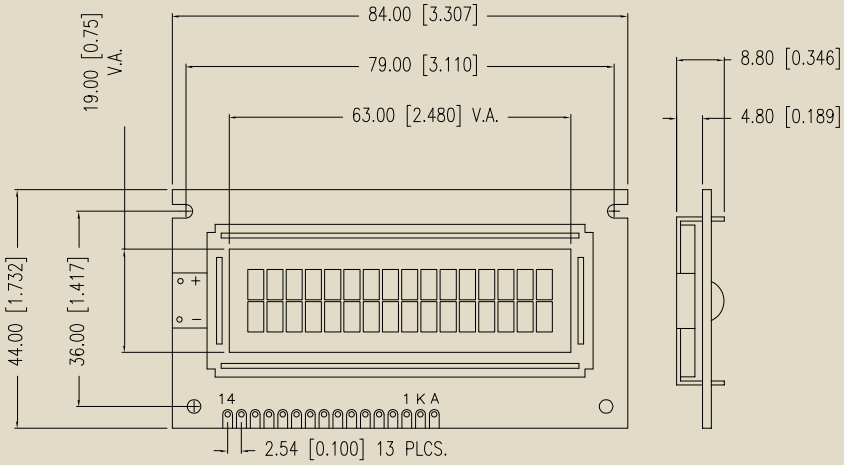
Features / Options

- Reliable user-interface display
- Low power consumption
- Very long operational life
- Custom sizes available

Applications / Uses

- Communications equipment
- Industrial controls
- Life safety equipment
- Medical equipment
- Meter displays
- Security electronics
- Test and measurement





SKU	Overall Size (W x H x T1/T2) T1 = with LED Backlight T2 = no LeD Backlight	Viewing Area (W x H)	Character Height (W x H)	Dot Size (W x H)	Font	Duty
LCM-X01602DXX/G	84 x 44 x 12.0/8.1	63 x 19	2.96 x5.56	0.56 x 0.66	5 x 8	1/16

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InfoVue™ Character LCD Modules

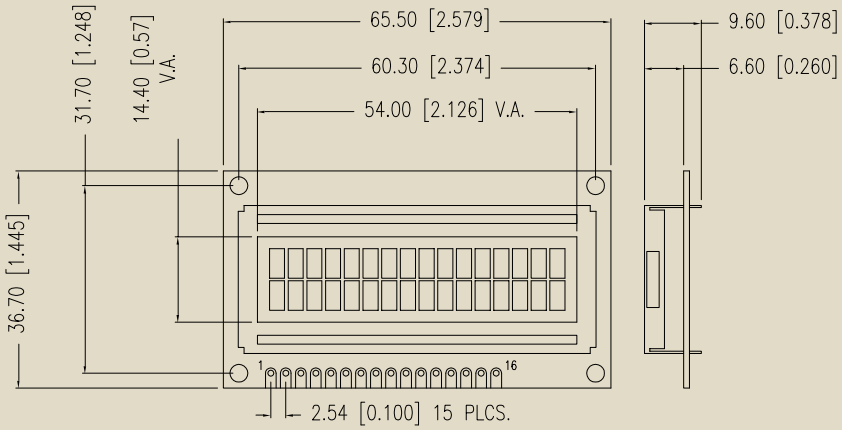
16 x 2 (character x line)

Features / Options

- Reliable user-interface display
- Low power consumption
- Very long operational life
- Custom sizes available

Applications / Uses

- Communications equipment
- Industrial controls
- Life safety equipment
- Medical equipment
- Meter displays
- Security electronics
- Test and measurement



SKU	Overall Size (W x H x T1/T2) T1 = with LED Backlight T2 = no LeD Backlight	Viewing Area (W x H)	Character Height (W x H)	Dot Size (W x H)	Font	Duty
LCM-X01602XXX/M	66 x 26	52 x 16	2.46 x 5.56		5 x 8	1/16

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LUMEX®
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InfoVue™ Character LCD Modules

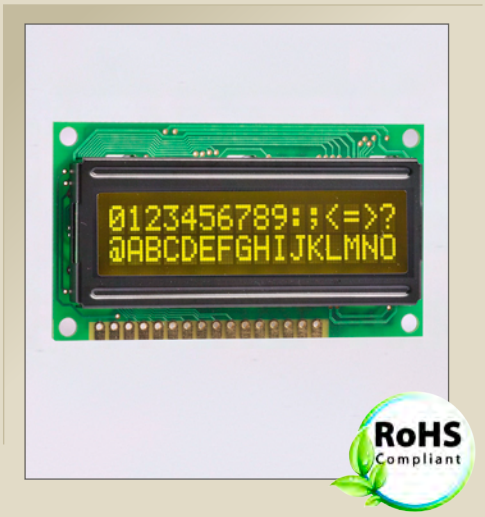
16 x 2 (character x line)

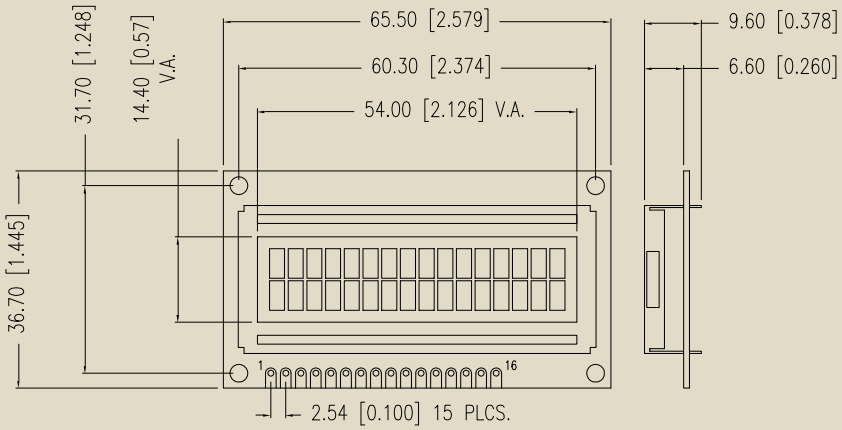
Features / Options

- Reliable user-interface display
- Low power consumption
- Very long operational life
- Custom sizes available

Applications / Uses

- Communications equipment
- Industrial controls
- Life safety equipment
- Medical equipment
- Meter displays
- Security electronics
- Test and measurement





SKU	Overall Size (W x H x T1/T2) T1 = with LED Backlight T2 = no LeD Backlight	Viewing Area (W x H)	Character Height (W x H)	Dot Size (W x H)	Font	Duty
LCM-X01602XXX/N	65.5 x 36.7 x 12.7/8.9	54.0 x 14.4	2.55 x 4.19	0.47 x 0.58	5 x 8	1/16

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InfoVue™ Character LCD Modules

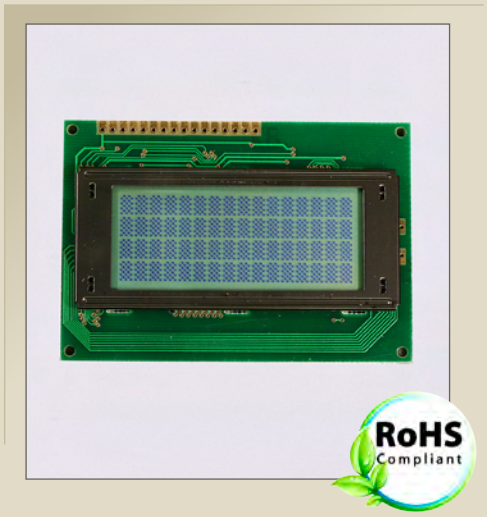
16 x 4 (character x line)

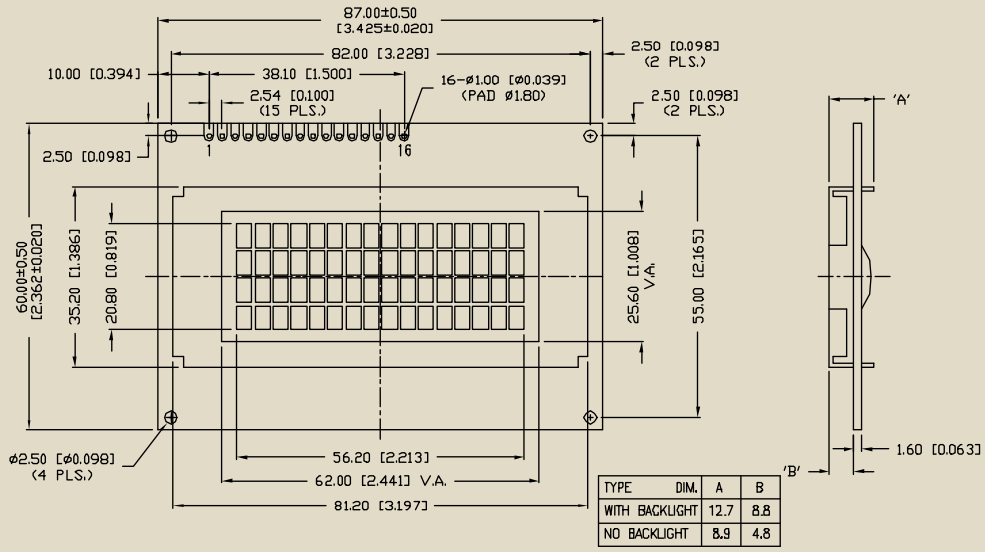
Features / Options

- Reliable user-interface display
- Low power consumption
- Very long operational life
- Custom sizes available

Applications / Uses

- Communications equipment
- Industrial controls
- Life safety equipment
- Medical equipment
- Meter displays
- Security electronics
- Test and measurement





SKU	Overall Size (W x H x T1/T2) T1 = with LED Backlight T2 = no LeD Backlight	Viewing Area (W x H)	Character Height (W x H)	Dot Size (W x H)	Font	Duty
LCM-X01604DXX	87.0 x 60.0 x 12.7/8.9	62.0 x 25.6	2.95 x 4.75	0.55 x 0.55	5 x 8	1/16

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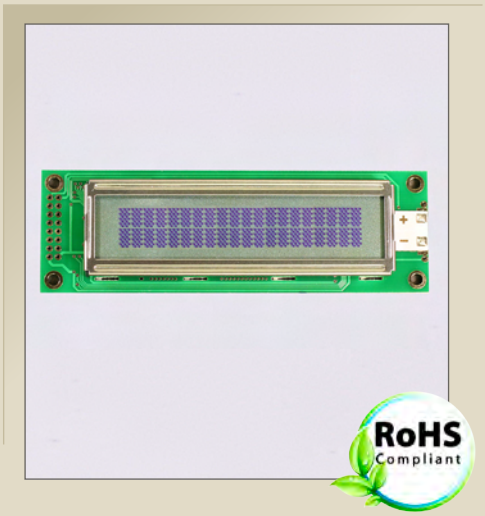
InfoVue™ Character LCD Modules

20 x 2 (character x line)

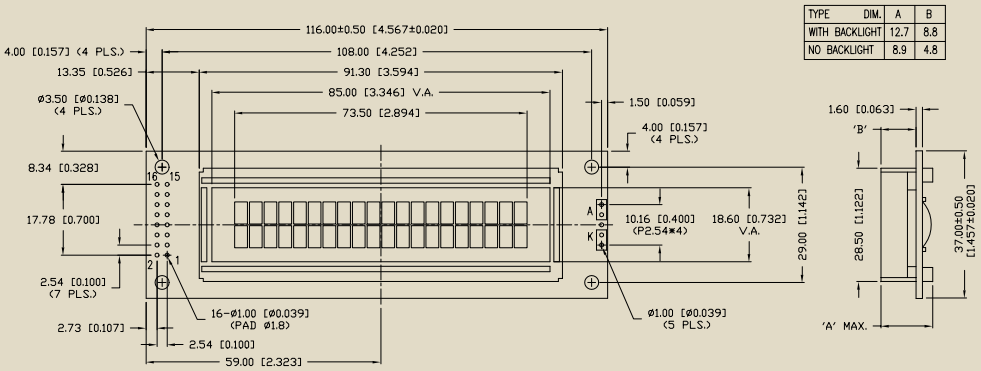


Features / Options

- Reliable user-interface display
- Low power consumption
- Very long operational life
- Custom sizes available

Applications / Uses

- Communications equipment
- Industrial controls
- Life safety equipment
- Medical equipment
- Meter displays
- Security electronics
- Test and measurement



SKU	Overall Size (W x H x T1/T2) T1 = with LED Backlight T2 = no LeD Backlight	Viewing Area (W x H)	Character Height (W x H)	Dot Size (W x H)	Font	Duty
LCM-X02002Dxx	116 x 37 x 12.7/8.9	85 x 18.6	3.20 x 5.55	0.60 x 0.65	5 x 8	1/16

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InfoVue™ Character LCD Modules

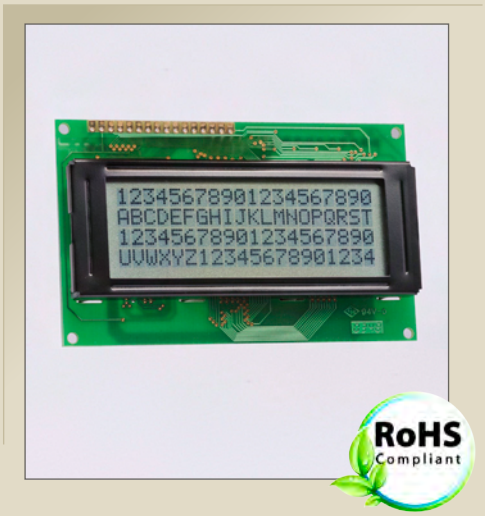
20 x 4 (character x line)

Features / Options

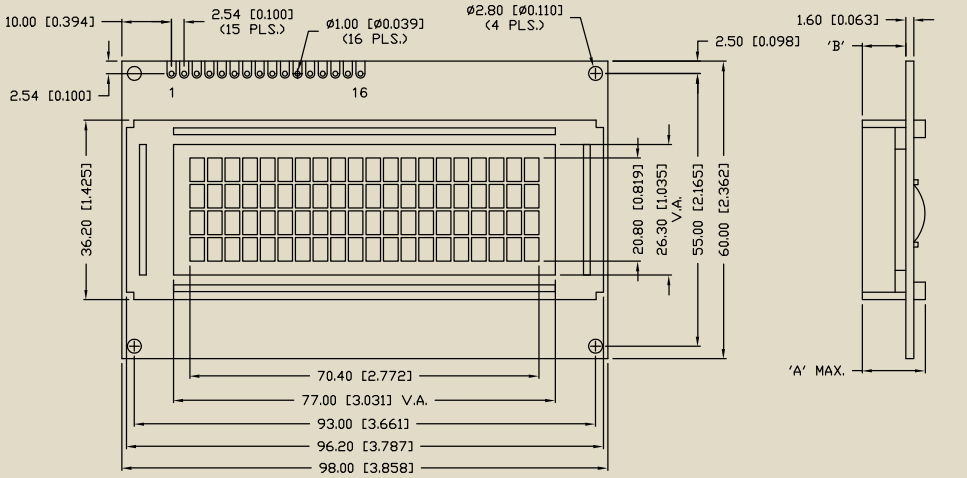
- Reliable user-interface display
- Low power consumption
- Very long operational life
- Custom sizes available

Applications / Uses

- Communications equipment
- Industrial controls
- Life safety equipment
- Medical equipment
- Meter displays
- Security electronics
- Test and measurement



TYPE DIM.	A	B
WITH BACKLIGHT	12.7	8.7
NO BACKLIGHT	8.8	4.8



SKU	Overall Size (W x H x T1/T2) T1 = with LED Backlight T2 = no LeD Backlight	Viewing Area (W x H)	Character Height (W x H)	Dot Size (W x H)	Font	Duty
LCM-X02004Dxx	98 x 60 x 12.7/8.8	77.0 x 26.3	2.95 x 4.75	0.55 x 0.55	5 x 8	1/16

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LUMEX®
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InfoVue™ Character LCD Modules

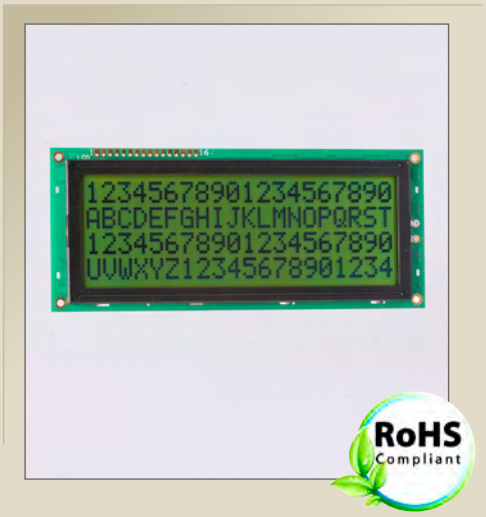
20 x 4 (character x line)

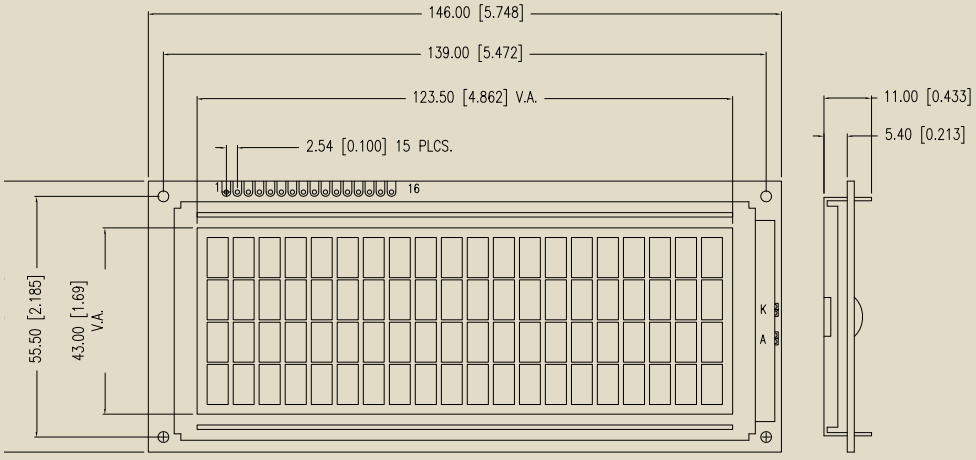
Features / Options

- Reliable user-interface display
- Low power consumption
- Very long operational life
- Custom sizes available

Applications / Uses

- Communications equipment
- Industrial controls
- Life safety equipment
- Medical equipment
- Meter displays
- Security electronics
- Test and measurement





SKU	Overall Size (W x H x T1/T2) T1 = with LED Backlight T2 = no LED Backlight	Viewing Area (W x H)	Character Height (W x H)	Dot Size (W x H)	Font	Duty
LCM-X02004DXX/D-Y	146 x 55.5 x 13/11	123.5 x 43	3.84 x 9.22	0.92 x 1.10	5 x 8	1/16

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InfoVue™ Character LCD Modules

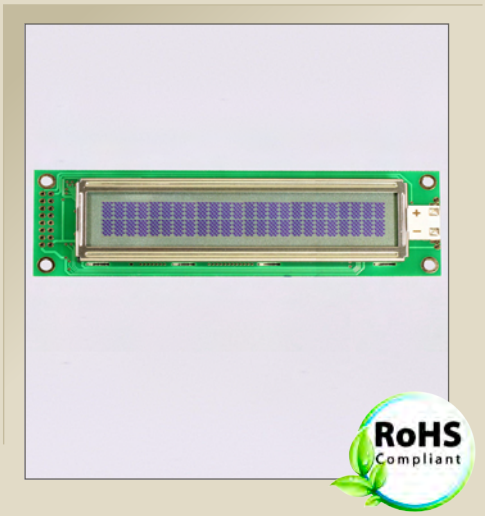
24 x 2 (character x line)

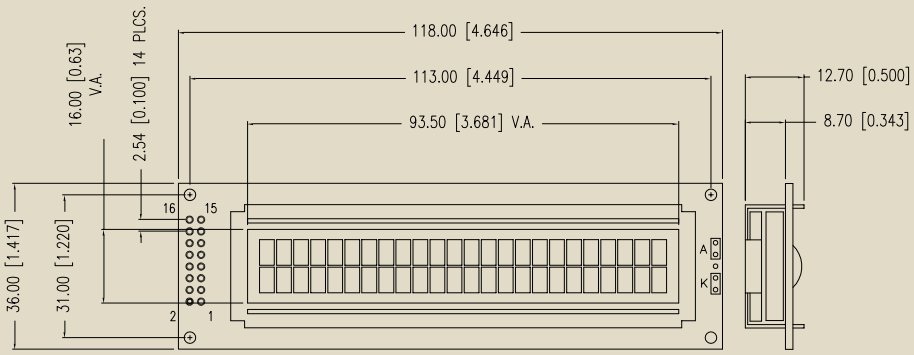
Features / Options

- Reliable user-interface display
- Low power consumption
- Very long operational life
- Custom sizes available

Applications / Uses

- Communications equipment
- Industrial controls
- Life safety equipment
- Medical equipment
- Meter displays
- Security electronics
- Test and measurement





SKU	Overall Size (W x H x T1/T2) T1 = with LED Backlight T2 = no LED Backlight	Viewing Area (W x H)	Character Height (W x H)	Dot Size (W x H)	Font	Duty
LCM-X02402DXX	118 x 36 12.70/8.8	93.5 x 16	3.2 x 5.55	0.60 x 0.65	5 X 8	1/16

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LUMEX®
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InfoVue™ Character LCD Modules

40 x 2 (character x line)

Features / Options

- Reliable user-interface display
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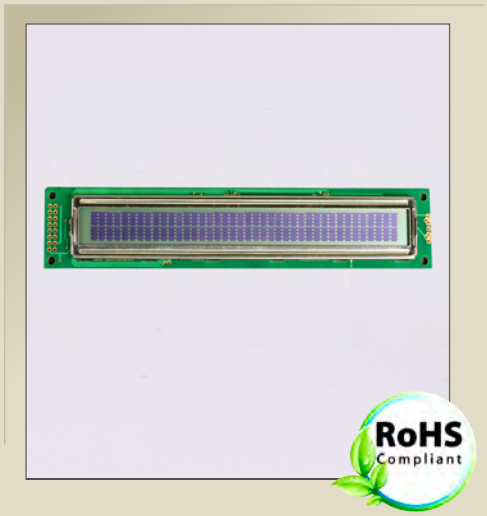
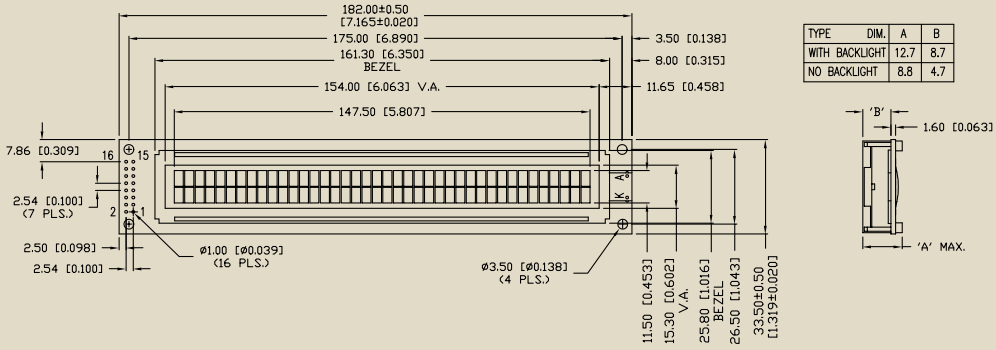
- Very long operational life
- Custom sizes available

Applications / Uses

- Communications equipment
- Industrial controls
- Life safety equipment
- Medical equipment
- Meter displays
- Security electronics
- Test and measurement





SKU	Overall Size (W x H x T1/T2) T1 = with LED Backlight T2 = no LED Backlight	Viewing Area (W x H)	Character Height (W x H)	Dot Size (W x H)	Font	Duty
LCM-X04002DXX	182 x 33.5 x12.7/8.8	154 x 15.3	3.20 x 5.55	0.60 x 0.65	5 X 8	1/16

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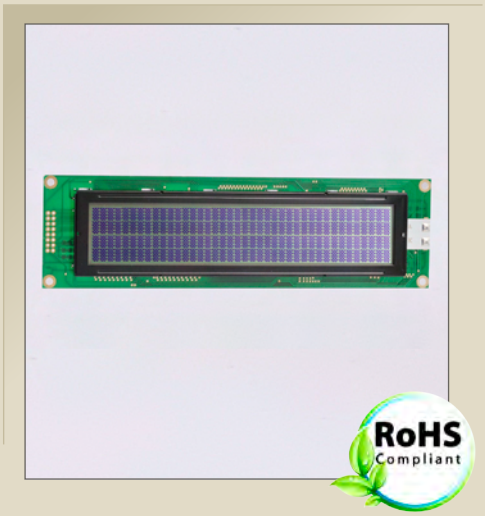
InfoVue™ Character LCD Modules

40 x 4 (character x line)



Features / Options

- Reliable user-interface display
- Low power consumption
- Very long operational life
- Custom sizes available

Applications / Uses

- Communications equipment
- Industrial controls
- Life safety equipment
- Medical equipment
- Meter displays
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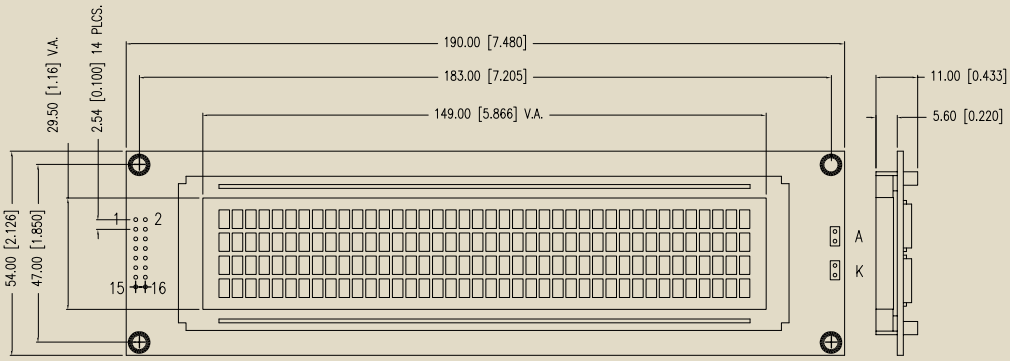

SKU	Overall Size (W x H x T1/T2) T1 = with LED Backlight T2 = no LED Backlight	Viewing Area (W x H)	Character Height (W x H)	Dot Size (W x H)	Font	Duty
LCM-X04004Dxx	190 x 54 x 14.5 /10	149 x 29.5	2.78 x 4.89	0.50 x 0.55	5 x 8	1/16

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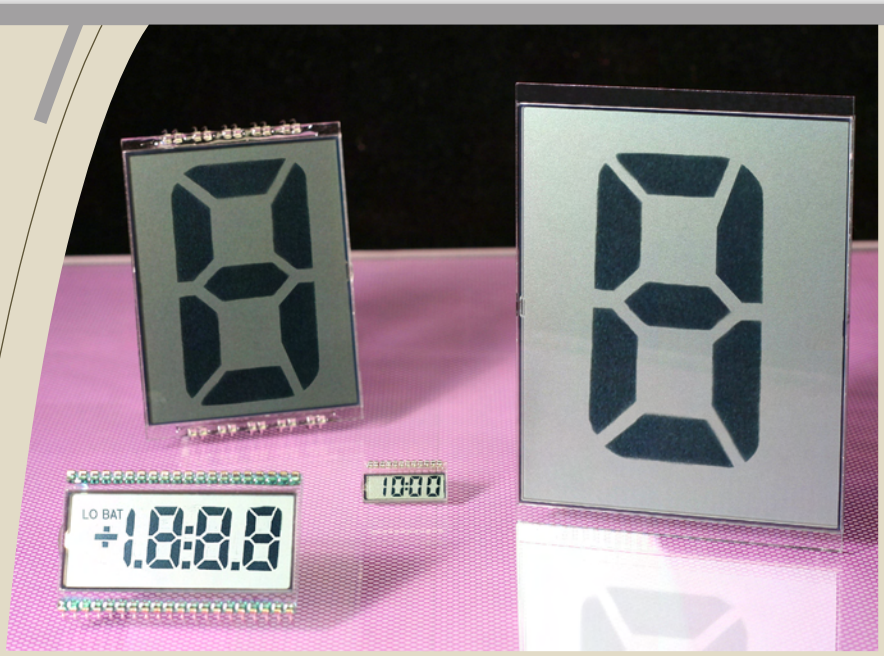

InfoVue™ Numeric LCD Modules

Lumex's InfoVue™ Numeric LCDs are an easy, cost-effective way to communicate numeric information in a user-friendly environment.

Typically, these modules display 7, 14 and 16 segment digits with a variety of graphic icons for status, such as polarity (+/-), temperature, °C/°F battery level indicators or decimal points.

The relatively low non-recurring engineering (NRE) charges allow Lumex's InfoVue Numeric LCDs displays to be easily customizable. Every feature of the display can be customized from icons to the digital segments to the complete mechanical design.

Features:

- Wide range of operating temperatures:
  - Standard: 0° ~ +50°C
  - High: -30°C ~ +80°C
  - Ultra High: -40°C ~ +85°C
- Custom solutions available
- Monochrome TN displays
- Positive and negative image modules
- Very long operational life
- Low power consumption
- Reliable user-interface display

Applications / Uses:

- Industrial Controls
- Medical Equipment
- Communications Equipment
- Test and Measurement Equipment
- Security Electronics
- Life Safety Equipment
- Meter Displays

The following pages provide an overview of the types of numeric LCD displays Lumex provides.

In addition to our standard product offering, Lumex can also customize any LCD to suit your specific design needs. **For a complete list of all of Lumex's InfoVue™ Numeric LCD Modules, visit us online at www.lumex.com.**

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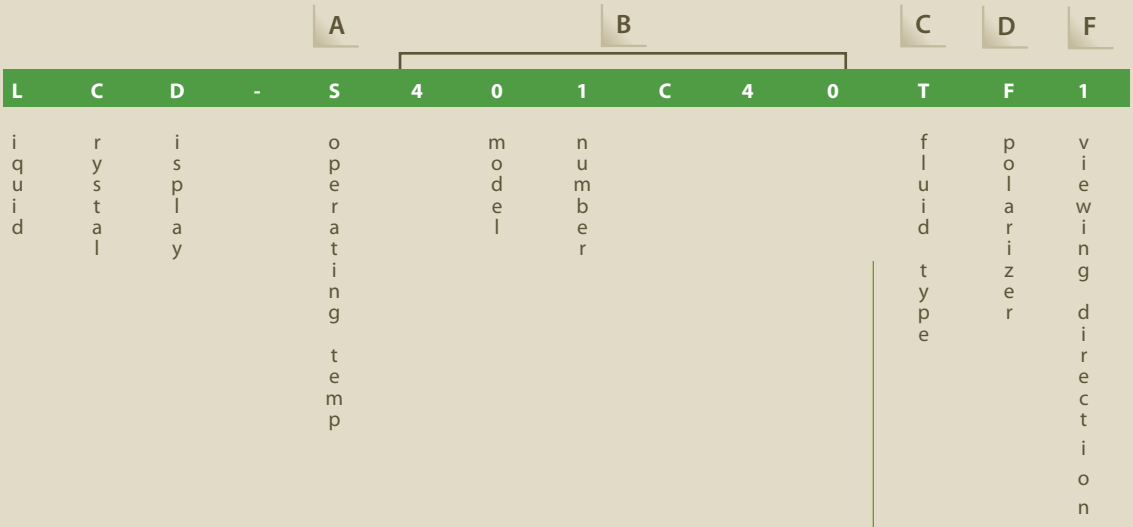
InfoVue™ Numeric LCD Modules - Part Numbering Guide



A **Operating Temperature**

S = Standard (0˚ C to 50˚ C)
H = High Temp (-30˚ C to +75˚ C)
U - Ultra High Temp (-40˚ C to +85˚ C)

B **Model Number (for alphanumeric and numeric**

A = Alphanumeric <1.0"
B = Alphanumeric ≥ 1.0"
C = Numeric < 1.0"
D = Numeric ≥ 1.0"
M = Custom Display < 1.0"
N = custom Display ≥ 1.0"
401C40 = 4 Character x 1 line, 0.40"
4x1C45 = 4.5 Character x 1 line, 0.45"
x - represents 1/2 column
101D23 = 1 Character x 1 Line, 2.3"
101D40 = 1 Character x 1 Line, 4.0"

C **Fluid Type**

T = TN, 5.0V operation
S = STN, 5.0V operation
W = FSTN, 5.0V operation
K = TN, 3.3 V operation
L = STN, 3.3V operation
F = FSTN, 3.3V operation
E = EBTN (Enhanced Background TN)

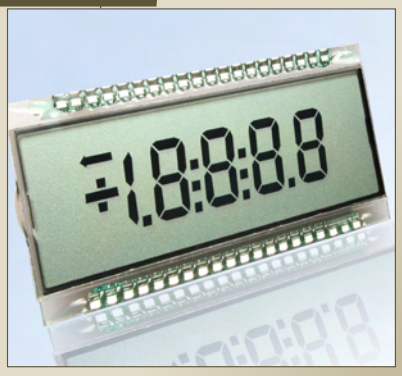
D **Polarizer Mode**

R = Reflective
F = Transreflective
M = Transmissive
N = Negative image / transmissive

F **Viewing Direction**

Default = 6 O'Clock (no number)
1 = 12 O'Clock

InfoVue™ Numeric LCD Modules - Index



1 Digit				
P/N	Over Size (W x H) mm	Viewing Area (W x H) mm	Digit Height mm	
LCD-S101D14TR	33.00 x 50.00	27.90 x 38.90	34.54 (1.40)	Page 167
2.5 Digits				
P/N	Over Size (W x H) mm	Viewing Area (W x H) mm	Digit Height mm	
LCD-S2X1C50TR	30.00 x 26.17	26.00 x 17.17	12.70 (0.50)	Page 168
3 Digits				
P/N	Over Size (W x H) mm	Viewing Area (W x H) mm	Digit Height mm	
LCD-S301C31TR	30.70 X 16.20	27.90 X 10.00	7.87 (0.31)	Page 169
3.5 Digits				
P/N	Over Size (W x H) mm	Viewing Area (W x H) mm	Digit Height mm	
LCD-S3X1C50TR/A	50.80 X 30.48	45.72 X 16.51	12.70 (0.50)	Page 170
4 Digits				
P/N	Over Size (W x H) mm	Viewing Area (W x H) mm	Digit Height mm	
LCD-S401C39TR	50.80 X 22.73	43.18 x 12.70	9.92 (0.39)	Page 171
4.5 Digits				
P/N	Over Size (W x H) mm	Viewing Area (W x H) mm	Digit Height mm	
LCD-S4X1C50TR	50.80 X 30.48	46.80 X 16.51	12.70 (0.50)	Page 172
5 Digits				
P/N	Over Size (W x H) mm	Viewing Area (W x H) mm	Digit Height mm	
LCD-S501C39TR	50.80 X 30.40	45.80 X 17.80	10.00 (0.39)	Page 173
6 Digits				
P/N	Over Size (W x H) mm	Viewing Area (W x H) mm	Digit Height mm	
LCD-S601C71TR	93.85 X 38.10	86.36 X 24.13	18.00 (0.71)	Page 174
8 Digits				
P/N	Over Size (W x H) mm	Viewing Area (W x H) mm	Digit Height mm	
LCD-S801C42TR	63.50 X 20.32	61.70 X 13.46	10.70 (0.42)	Page 175

The index above is representative of some of Lumex's latest innovative and more diverse product offerings. **For a complete list of all of Lumex's InfoVue™ Numeric LCD Modules, visit us online at www.lumex.com.**

InfoVue™ Numeric LCD Modules

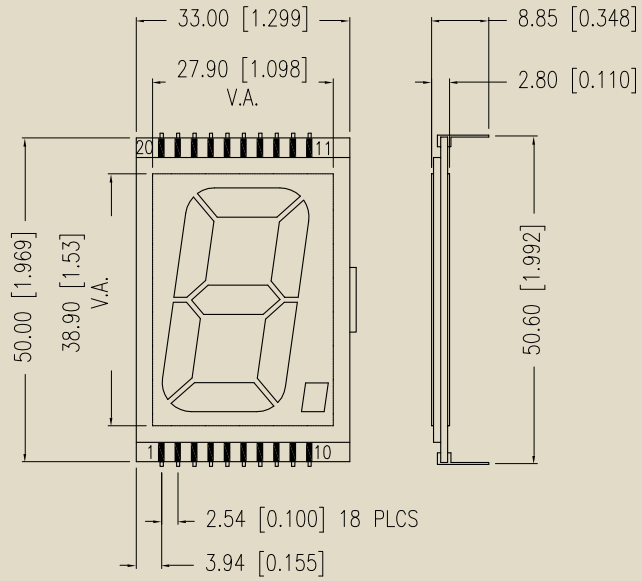
1 Digit

Features / Options

- Reliable user-interface display
- Low power consumption
- Very long operational life
- Custom sizes available

Applications / Uses

- Communications equipment
- Industrial controls
- Life safety equipment
- Medical equipment
- Meter displays
- Security electronics
- Test and measurement



SKU	# of Digits	Overall Size W x H (mm)	Viewing Area W x H (mm)	Digit Height (mm / inches)	Duty
LCD-S101D14TR	1 Digit	33.00 X 50.00	27.90 X 38.90	34.54 / 1.40"	1/1

Note: Illustrations shown are for representation **ONLY**. *Exact specifications should be obtained from the product data sheet. Additional product drawings of Lumex's InfoVue™ LCDs are available by logging onto* **www.lumex.com**. *Any Lumex standard LCD products can be customized to fit your specific needs. Call* **1.800.278.5666** *to speak with one of our Technical Design Specialists.*

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InfoVue™ Numeric LCD Modules

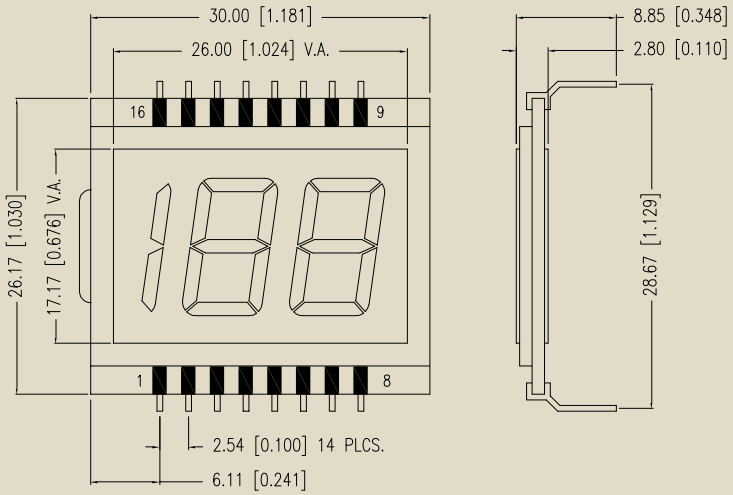
2.5 Digit

Features / Options

- Reliable user-interface display
- Low power consumption
- Very long operational life
- Custom sizes available

Applications / Uses

- Communications equipment
- Industrial controls
- Life safety equipment
- Medical equipment
- Meter displays
- Security electronics
- Test and measurement



SKU	# of Digits	Overall Size W x H (mm)	Viewing Area W x H (mm)	Digit Height (mm / inches)	Duty
LCD-S2X1C50TR	2.5 Digits	30.00 x 26.17	26.00 x 17.17	12.70 / 0.50"	1/1

Note: Illustrations shown are for representation **ONLY**. *Exact specifications should be obtained from the product data sheet. Additional product drawings of Lumex's InfoVue™ LCDs are available by logging onto* **www.lumex.com**. *Any Lumex standard LCD products can be customized to fit your specific needs. Call* **1.800.278.5666** *to speak with one of our Technical Design Specialists.*

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InfoVue™ Numeric LCD Modules

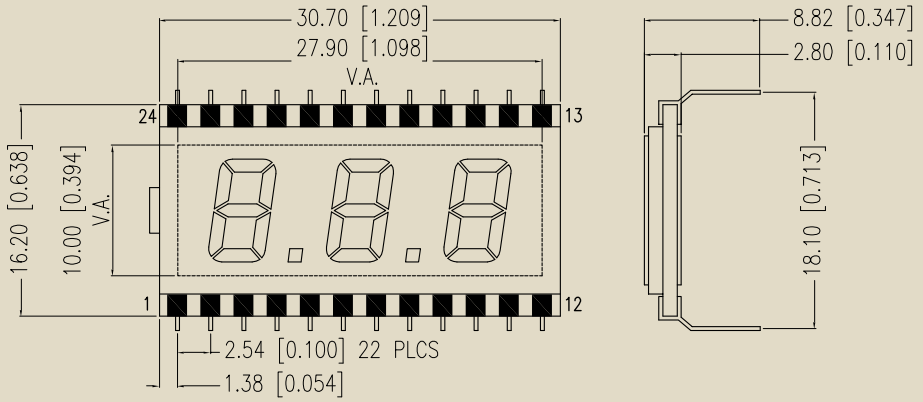
3 Digit

Features / Options

- Reliable user-interface display
- Low power consumption
- Very long operational life
- Custom sizes available

Applications / Uses

- Communications equipment
- Industrial controls
- Life safety equipment
- Medical equipment
- Meter displays
- Security electronics
- Test and measurement



SKU	# of Digits	Overall Size W x H (mm)	Viewing Area W x H (mm)	Digit Height (mm / inches)	Duty
LCD-S301C31TR	3 Digits	30.70 x 16.20	27.9 x 10.0	7.87 / 0.31"	1/1

Note: Illustrations shown are for representation **ONLY**. *Exact specifications should be obtained from the product data sheet. Additional product drawings of Lumex's InfoVue™ LCDs are available by logging onto* **www.lumex.com**. *Any Lumex standard LCD products can be customized to fit your specific needs. Call* **1.800.278.5666** *to speak with one of our Technical Design Specialists.*

InfoVue™ Numeric LCD Modules

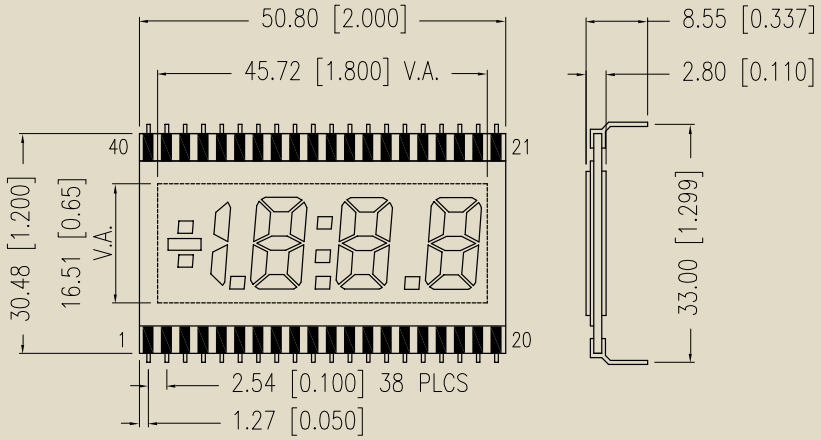
3.5 Digit

Features / Options

- Reliable user-interface display
- Low power consumption
- Very long operational life
- Custom sizes available

Applications / Uses

- Communications equipment
- Industrial controls
- Life safety equipment
- Medical equipment
- Meter displays
- Security electronics
- Test and measurement



SKU	# of Digits	Overall Size W x H (mm)	Viewing Area W x H (mm)	Digit Height (mm / inches)	Duty
LCD-S3X1C50TR/A	3.5 Digits	50.80 x 30.48	45.72 x 16.51	12.70 / 0.50"	1/1

Note: Illustrations shown are for representation **ONLY**. *Exact specifications should be obtained from the product data sheet. Additional product drawings of Lumex's InfoVue™ LCDs are available by logging onto* **www.lumex.com**. *Any Lumex standard LCD products can be customized to fit your specific needs. Call* **1.800.278.5666** *to speak with one of our Technical Design Specialists.*

InfoVue™ Numeric LCD Modules

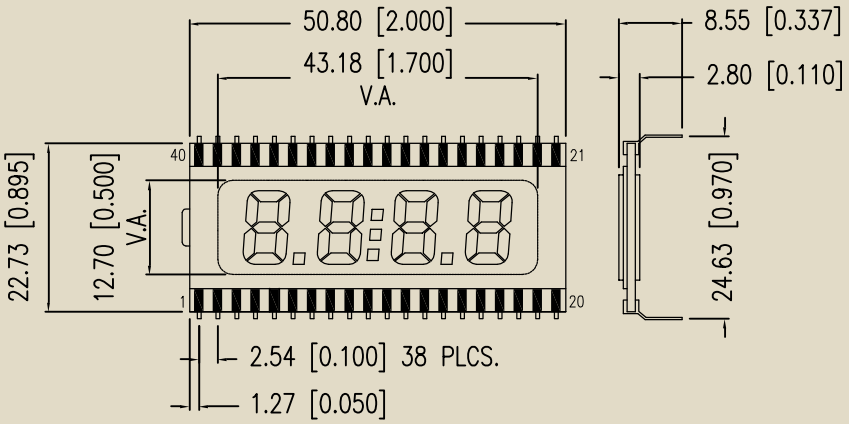
4 Digit

Features / Options

- Reliable user-interface display
- Low power consumption
- Very long operational life
- Custom sizes available

Applications / Uses

- Communications equipment
- Industrial controls
- Life safety equipment
- Medical equipment
- Meter displays
- Security electronics
- Test and measurement



SKU	# of Digits	Overall Size W x H (mm)	Viewing Area W x H (mm)	Digit Height (mm / inches)	Duty
LCD-S401C39TR	4 Digits	50.80 x 22.73	43.18 x 12.70	9.92 / 0.39"	1/1

Note: Illustrations shown are for representation **ONLY**. *Exact specifications should be obtained from the product data sheet. Additional product drawings of Lumex's InfoVue™ LCDs are available by logging onto* **www.lumex.com**. *Any Lumex standard LCD products can be customized to fit your specific needs. Call* **1.800.278.5666** *to speak with one of our Technical Design Specialists.*

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InfoVue™ Numeric LCD Modules

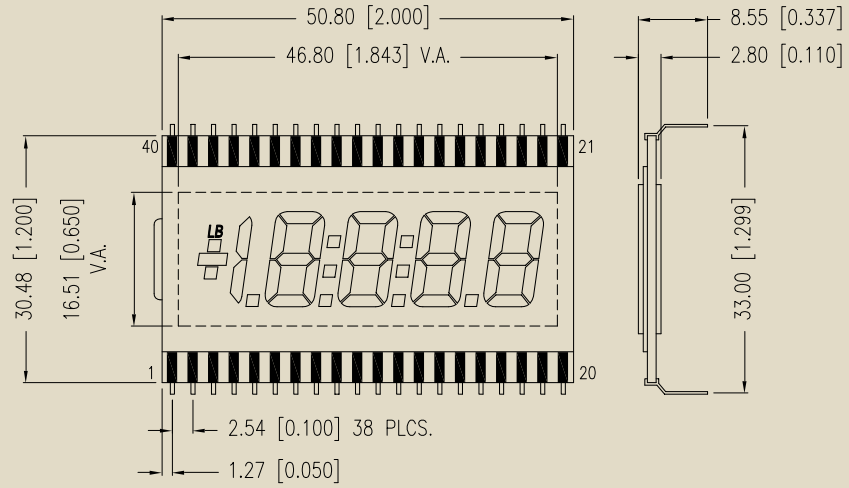
4.5 Digit

Features / Options

- Reliable user-interface display
- Low power consumption
- Very long operational life
- Custom sizes available

Applications / Uses

- Communications equipment
- Industrial controls
- Life safety equipment
- Medical equipment
- Meter displays
- Security electronics
- Test and measurement



SKU	# of Digits	Overall Size W x H (mm)	Viewing Area W x H (mm)	Digit Height (mm / inches)	Duty
LCD-S4X1C50TR	4.5 Digits	50.80 x 30.48	46.80 x 16.51	12.70 / 0.50"	1/1

Note: Illustrations shown are for representation **ONLY**. *Exact specifications should be obtained from the product data sheet. Additional product drawings of Lumex's InfoVue™ LCDs are available by logging onto* **www.lumex.com**. *Any Lumex standard LCD products can be customized to fit your specific needs. Call* **1.800.278.5666** *to speak with one of our Technical Design Specialists.*

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InfoVue™ Numeric LCD Modules

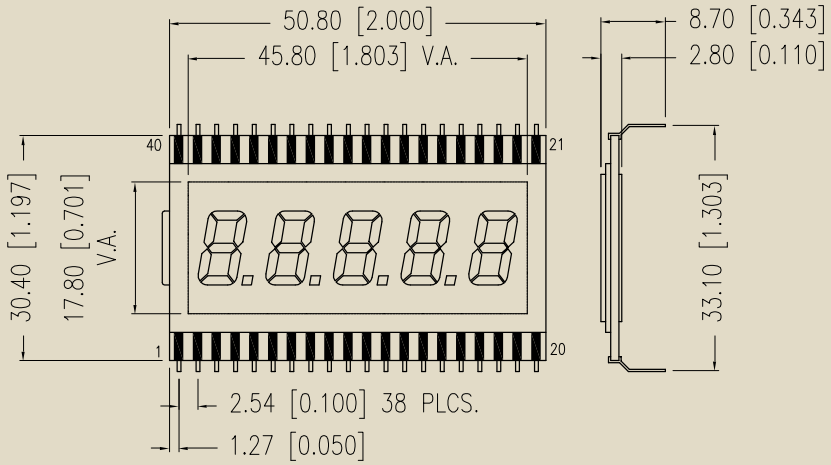
5 Digit

Features / Options

- Reliable user-interface display
- Low power consumption
- Very long operational life
- Custom sizes available

Applications / Uses

- Communications equipment
- Industrial controls
- Life safety equipment
- Medical equipment
- Meter displays
- Security electronics
- Test and measurement



SKU	# of Digits	Overall Size W x H (mm)	Viewing Area W x H (mm)	Digit Height (mm / inches)	Duty
LCD-S501C39TR	5 Digits	50.80 x 30.40	45.80 x 17.80	10.00 / 0.39"	1/1

Note: Illustrations shown are for representation **ONLY**. *Exact specifications should be obtained from the product data sheet. Additional product drawings of Lumex's InfoVue™ LCDs are available by logging onto* **www.lumex.com**. *Any Lumex standard LCD products can be customized to fit your specific needs. Call* **1.800.278.5666** *to speak with one of our Technical Design Specialists.*

InfoVue™ Numeric LCD Modules

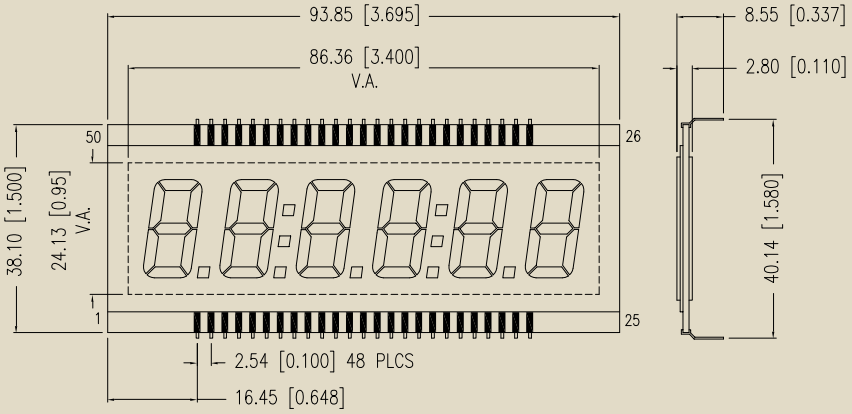
6 Digit

Features / Options

- Reliable user-interface display
- Low power consumption
- Very long operational life
- Custom sizes available

Applications / Uses

- Communications equipment
- Industrial controls
- Life safety equipment
- Medical equipment
- Meter displays
- Security electronics
- Test and measurement



SKU	# of Digits	Overall Size W x H (mm)	Viewing Area W x H (mm)	Digit Height (mm / inches)	Duty
LCD-S601C71TR	6 Digits	93.85 x 38.10	86.36 x 24.13	18.00 / 0.71"	1/1

Note: Illustrations shown are for representation **ONLY**. *Exact specifications should be obtained from the product data sheet. Additional product drawings of Lumex's InfoVue™ LCDs are available by logging onto* **www.lumex.com**. *Any Lumex standard LCD products can be customized to fit your specific needs. Call* **1.800.278.5666** *to speak with one of our Technical Design Specialists.*

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InfoVue™ Numeric LCD Modules

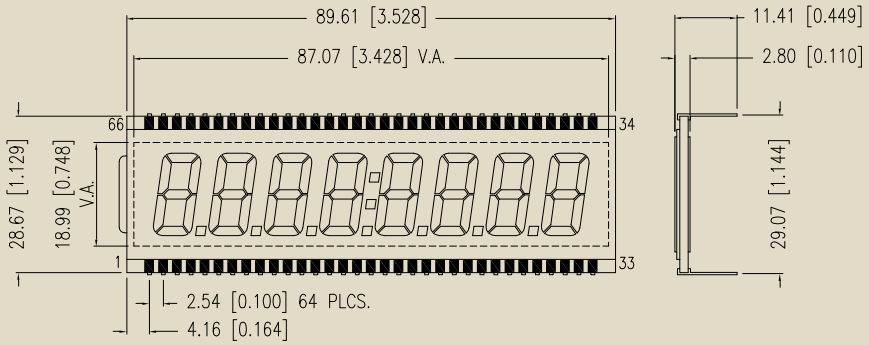
8 Digit

Features / Options

- Reliable user-interface display
- Low power consumption
- Very long operational life
- Custom sizes available

Applications / Uses

- Communications equipment
- Industrial controls
- Life safety equipment
- Medical equipment
- Meter displays
- Security electronics
- Test and measurement



SKU	# of Digits	Overall Size W x H (mm)	Viewing Area W x H (mm)	Digit Height (mm / inches)	Duty
LCD-S801C42TR	8 Digits	63.50 x 20.32	61.70 x 13.46	10.70 / 0.42"	1/1

Note: Illustrations shown are for representation **ONLY**. *Exact specifications should be obtained from the product data sheet. Additional product drawings of Lumex's InfoVue™ LCDs are available by logging onto* **www.lumex.com**. *Any Lumex standard LCD products can be customized to fit your specific needs. Call* **1.800.278.5666** *to speak with one of our Technical Design Specialists.*

QuantumBrite™ LED Backlights

Lumex's QuantumBrite™ family of LED Backlights represents a new generation of backlight technology. To further enhance LCD design visibility, Lumex's Technical Design Specialists can work with you to develop backlight solutions that can easily be customized with a variety of technologies including LED Edge Lit and LED Chips On Board.

QuantumBrite™ LED Backlights provide:

- **High Brightness Outputs**
  - Intensities up to 10X that of normal backlights
  - Full daylight visibility
  - Increased backlight illumination through unique brightness enhancement films
- **Longer lifespan**
  - Up to 100,000 hours
- **Reduced energy consumption**
  - Lower power consumption than traditional backlighting sources
- **Environmentally Friendly**
  - LEDs do not contain hazardous materials such as mercury
  - Saves resources as LEDs are replaced less often than CCFLs
- **Durability and Cost Savings**
  - LEDs are thinner in design than conventional CCFL backlit displays
  - LEDs maintain their brightness intensity over a longer period of time

Lumex also offers solutions that go beyond traditional backlighting applications such as direct and indirect lighting, indication, logo enhancement and more. All of Lumex's backlight solutions come in a wide array of standard colors, including RGB on a custom basis.

The following pages provide an overview of the types of backlight products Lumex provides.

In addition to our standard product offering, Lumex can also customize any LED to suit your specific design needs. **For a complete list of all of Lumex's QuantumBrite™ Backlights, visit us online at www.lumex.com.**

LUMEX®
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What is a Backlight?

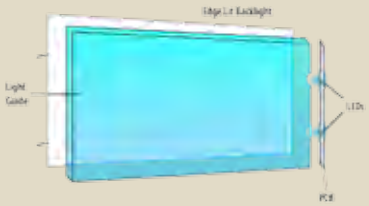
A backlight is used to illuminate an object from behind. In the electronics industry, backlighting is typically used to make a display easier to view in low light conditions. Backlights are traditionally used to provide enhanced illumnation for flat plan devices such as LCDs.

LED vs. CCFL

LED backlighting has numerous advantages over conventional CCFL (Cold Cathode Fluorescent Tube) lamps. Some of the main advantages of LED backlighting include:

- Compact size
- Longer life span
- Lower cost
- Durability
- Low power consumption
- Environmental improvements

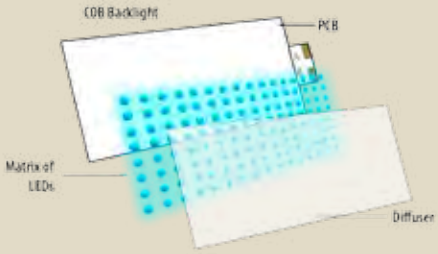
Edge Lit



An Edge Lit (EL) backlight is constructed of LEDs that run along the outer axis of the backlight.

Chips On Board (COB)

A typical COB backlight is constructed in an LED matrix format mounted on a PCB along the entire emitting plane of the backlight.



Edge Lit vs. COB Construction

Both Edge Lit and COB technologies have advantages and disadvantages, and no one method is right for all applications.

With the COB design, there are many LEDs mounted uniformly behind the display. This approach can offer more uniform and brighter lighting, however, it does consume more power than edge lit construction.

With an Edge Lit configuration, LEDs are only mounted to the edges of the display. This allows the design to offer a thinner package and consume less power. However, the display may not be as brilliant as with a COB construction.

The choice of which backlight technology to use in a particular design depends on the requirements for brightness, contrast and size of the final product.

Advanced Backlight Technology

Advancements in LED technology have contributed significantly to the flexibility in use of backlights for non-traditional applications. Because of this, backlights are now being considered as replacements for many non-traditional backlight applications, such as the use of direct and indirect lighting.

Lumex's advanced backlight technology meets the needs of these non-traditional design applications. **Lumex backlight technologies feature high brightness outputs with intensities up to 10,000 nits, almost twice that of normal backlights.** Lumex's advanced backlight technology also offers designers the ability to allow for full daylight visibility when incorporating a backlight into a product design.

Lumex Technical Design Specialists are experts in modifying backlights for non-traditional applications. Lumex can increase backlight illumination through the use of its unique brightness enhancement films, or altering the curvature of the backlight for additional lighting effects.

LUMEX®
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QuantumBrite™ LED Backlights

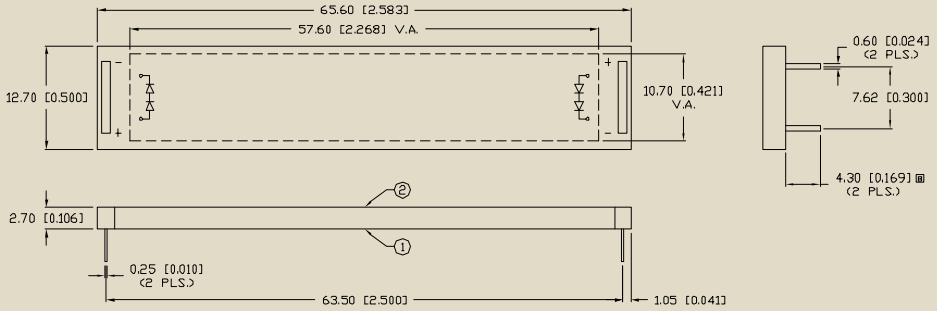
Dual Edge Lit

Features / Options

- Longer operational life
- Low Power Consumption
- Compact Size, Low Profile
- Defined and Shift-Free Color

Applications / Uses

- Industrial Controls
- Medical Equipment
- Communications Equipment
- Test and Measurement Equipment
- Security Electronics
- Life Safety Equipment
- Lighting



SKU	Color	Brightness (cd/m²)	Overall Size (L x H mm)	Viewing Angle (L x H mm)	Total Thickness (mm)	V_f (v)	Current I_f (mA)	# of Chips
SSB-DL10033GG	Green	10	100.00 x 33.50	100.00 x 28.00	3.00	4.2	20mA x 18	18 x 2
SSB-DL2010GC/A	Green	24	20.32 x 10.16	17.00 x 8.00	2.20	4.4	20	1 x 2
SSB-DL2917USBC	Blue	50	34.00 x 20.62	28.80 x 16.80	2.20	7.2	20	1 x 2
SSB-DL5216GC	Green	24	50.00 x 16.00	48.00 x 14.00	2.70	4.2	20	2 x 2
SSB-DL6011GW	Green	100	60.42 x 11.05	60.42 x 9.00	3.00	4.2	20mA x 6	6 x 2
SSB-DL6028GC	Green	46	54.60 x 28.96	54.60 x 26.00	3.05	4.2	20mA x 5	5 x 2
SSB-DL6613UWC/B	White	350	65.60 x 12.70	57.60 x 10.70	2.70	7.2	20mA x 2	2 x 2

Note: Illustrations shown are for representation ***ONLY****. Exact specifications should be obtained from the product data sheet. Additional product drawings of Lumex's QuantumBrite™ Backlights are available by logging onto* ***www.lumex.com****. Any Lumex standard backlight products can be customized to fit your specific needs. Call* ***1.800.278.5666*** *to speak with one of our Technical Design Specialists.*

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QuantumBrite™ LED Backlights

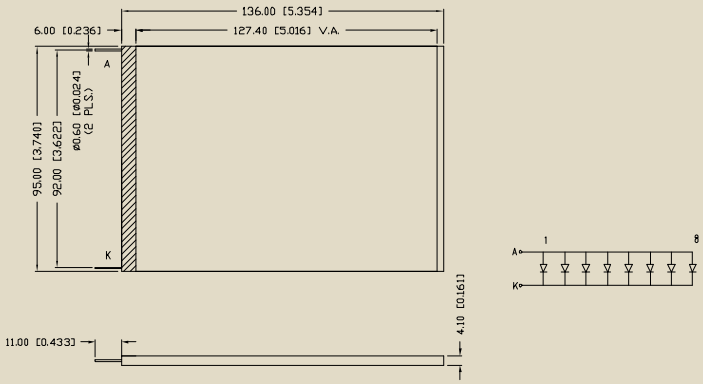
Chip Edge Lit

Features / Options

- Longer operational life
- Low Power Consumption
- Compact Size, Low Profile
- Defined and Shift-Free Color

Applications / Uses

- Industrial Controls
- Medical Equipment
- Communications Equipment
- Test and Measurement Equipment
- Security Electronics
- Life Safety Equipment
- Lighting



SKU	Color	Brightness (cd/m²)	Overall Size (L x H mm)	Viewing Angle (L x H mm)	Total Thickness (mm)	V_f (v)	Current I_f (mA)	# of Chips
SSB-CEL12795AW-8	Amber	150	136.00 x 95.00	127.40 x 95.00	4.10	2.1	160	8
SSB-CEL12795UWW	White	350	136.00 x 95.00	127.40 x 95.00	4.10	3.5	200	10
SSB-CEL12795UWW-8	White	190	136.00 x 95.00	127.40 x 95.00	4.10	3.3	160	8
SSB-CEL2417SUGC	Green	12	30.00 x 20.00	24.00 x 20.00	3.00	2.2	40	2
SSB-CEL5326SUGW	Green	20	59.34 x 30.56	53.34 x 30.56	3.50	4.4	20 x 2	4
SSB-CEL6334UPGW/A	Green	95	71.00 X 37.00	62.50 X 34.00	2.10	3.3	60	3
SSB-CEL6334UWW/A	White	170	71.0 x 37.00	62.50 x 34.00	2.10	3.3	60	3
SSB-CEL7172UWW	White	230	76.50 x 72.00	70.80 x 72.00	2.70	3.5	140	7
SSB-CEL7741UPGW	Green	125	84.00 x 43.50	76.50 x 41.00	3.50	3.3	60	3
SSB-CEL7741USBW	Blue	75	84.00 x 43.50	76.50 x 41.00	3.50	3.3	60	3
SSB-CEL7741UWW	White	280	84.00 x 43.50	76.50 x 41.00	3.50	3.3	60	3
SSB-CEL8364USBW	Green	45	94.00 x 67.70	83.00 x 63.90	2.40	3.3	120	6
SSB-CEL8364UWW	White	150	94.00 x 67.70	83.00 x 63.90	2.40	3.3	120	6

Note: Illustrations shown are for representation **ONLY**. *Exact specifications should be obtained from the product data sheet. Additional product drawings of Lumex's QuantumBrite™ Backlights are available by logging onto* **www.lumex.com**. *Any Lumex standard backlight products can be customized to fit your specific needs. Call* **1.800.278.5666** *to speak with one of our Technical Design Specialists.*

LUMEX®
Creating LED and LCD Solutions Together™

QuantumBrite™ LED Backlights

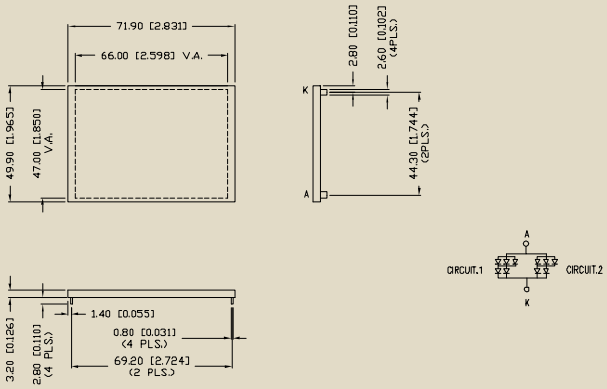
Chip Edge Lit with Reflector

Features / Options

- Longer operational life
- Low Power Consumption
- Compact Size, Low Profile
- Defined and Shift-Free Color

Applications / Uses

- Industrial Controls
- Medical Equipment
- Communications Equipment
- Test and Measurement Equipment
- Security Electronics
- Life Safety Equipment
- Lighting



SKU	Color	Brightness (cd/m^2)	Overall Size (L x H mm)	Viewing Angle (L x H mm)	Total Thickness (mm)	V_f (v)	Current I_f (mA)	# of Chips
SSB-CER6647GW	Green	35	71.90 x 49.90	66.00 x 47.00	3.20	4.2	50 x 2	20

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QuantumBrite™ LED Backlights

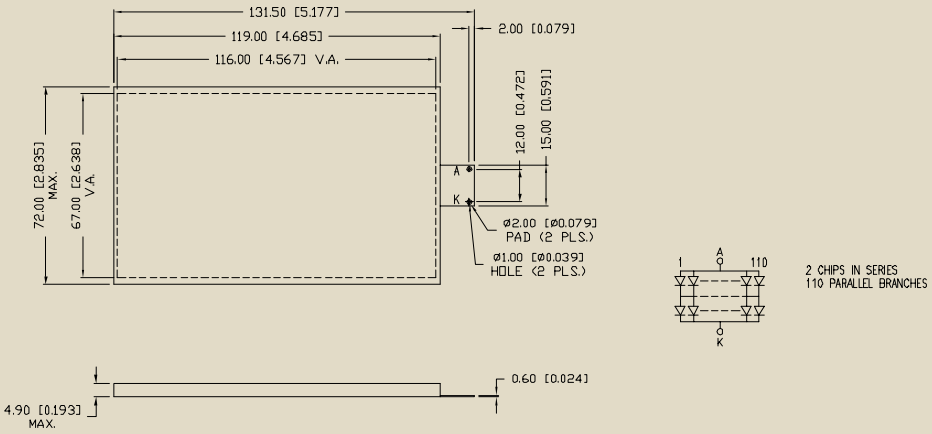
Chips On Board

Features / Options

- Longer operational life
- Low Power Consumption
- Compact Size, Low Profile
- Defined and Shift-Free Color

Applications / Uses

- Industrial Controls
- Medical Equipment
- Communications Equipment
- Test and Measurement Equipment
- Security Electronics
- Life Safety Equipment
- Lighting



SKU	Color	Brightness (cd/m²)	Overall Size (L x H mm)	Viewing Angle (L x H mm)	Total Thickness (mm)	V_f (v)	Current I_f (mA)	# of Chips
SSB-COB10025GW	Green	250	102.80 x 28.80	100.40 x 25.50	5.20	4.2	360	72
SSB-COB10125GW	Green	220	103.80 x 28.00	100.70 x 25.00	5.50	4.2	260	52
SSB-COB11667GW	Green	340	119.50 x 72.00	116.00 x 67.00	4.90	4.2	1100	220
SSB-COB15031GW	Green	259	153.70 x 35.20	149.60 x 31.20	5.00	4.2	600	120
SSB-COB6119SYW	Yellow	875	64.40 x 21.00	61.40 x 19.00	4.70	4	110	22
SSB-COB6363AW	Amber	150	67.00 X 67.00	63.00 X 63.00	5.80	4.1	500	100
SSB-COB6519GW-B	Green	210	68.70 x 24.00	65.10 x 19.00	5.50	4.2	120	24
SSB-COB6527GW	Green	300	67.00 x 29.00	65.00 x 27.00	5.10	4.2	220	44
SSB-COB6631GW	Green	380	70.00 x 35.20	66.00 x 31.20	5.10	4.2	110	53
SSB-COB7575GW	Green	195	77.30 x 77.60	75.00 x 75.00	6.00	4.2	605	121
SSB-COB8027GW	Green	270	85.00 x 30.00	80.00 x 27.50	5.60	4.2	280	56

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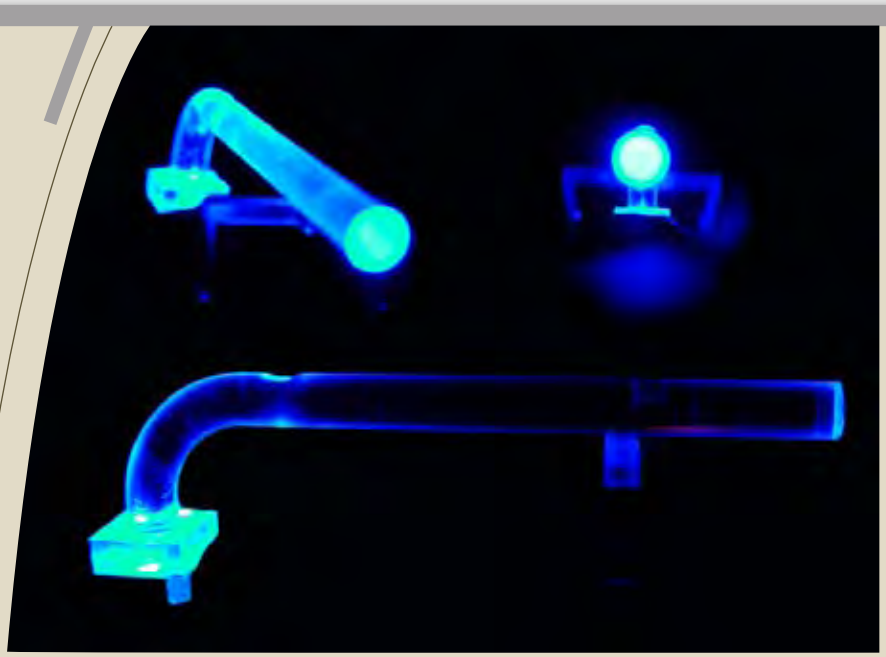


TransBrite™ Light Pipes

Lumex offers an extensive line of TransBrite™ LED Light Pipes for applications that require light but are not well-suited to surface mount or through-hole LED technology.

TransBrite Light Pipes provide:

- Right angle and vertical packaging solutions
- Design flexibility
- Uniform illumination over various lengths
- Easy installation
- Highly efficient optical design
- Reduced shadowing and glare
- Cost savings

Lumex uses state-of-the-art Ray Trace Software with precise 3D CAD/CAM models to ensure proper design and optimal light transmittance, with minimal light losses.

The following pages provide an overview of the types of light pipe products Lumex provides.

In addition to our standard product offering, Lumex can also customize any light pipe to suit your specific design needs.

For a complete list of all of Lumex's TransBrite™ Light Pipes , visit us online at www.lumex.com.

LUMEX®
Creating LED and LCD Solutions Together™

What is an LED Light Pipe?

An LED Light Pipe is a practical solution to conduct light from board-mounted LED(s) to the exterior, or in some cases, a photodetector. Light pipes can be produced in either rigid or flexible constructions and can be designed to include right angle and vertical or horizontal packaging with either single or multiple pipes. Light pipes can enhance display quality and add greater flexibility to light distribution. The integration of an LED Light Pipe is a cost-effective option to help eliminate many of the varied, complicated steps otherwise required to transport light from one place to another.

Attributes of a Light Pipe

Although specific design considerations may vary, a standard Light Pipe construction is typically:

- Optically clear for specified wavelengths
- Made out of polycarbonate
- Capable of being panel or PCB mounted
- Compatible for use with either surface-mount or through-hole LEDs
- Include an oval, round or rectangular lens cap in the display end.

Rigid Light Pipes

Rigid Light Pipes are ideal if the LED is mounted on a board immediately behind a front panel. As their name implies, a Rigid Light Pipe is produced with a hard plastic material and will have either a vertical or a right-angle construction, capable of redirecting the LED's light output to the desired location with minimal loss of intensity.

Flexible Light Pipes

Flexible Light Pipes function much the same as their rigid counterparts, however Flexible Light pipes are constructed of an optical fiber material that provides less rigidity allowing them to transport light from a board at custom, user-specified subtle angles.

Design Considerations

There are several design considerations to be examined working with light pipes:

1) The light pipe has to be designed in such a way so that it captures the maximum possible amount of light from the LED without reflecting it away.

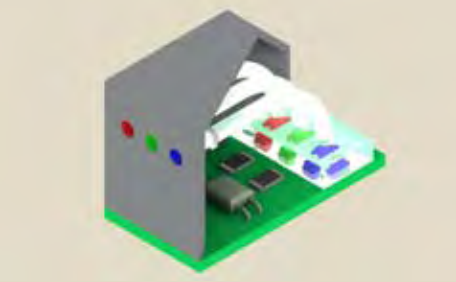
2) Having the light leave the light pipe in the desired location becomes the goal once the light has been captured. The light travels on a direct course within straight light pipes. More consideration needs to be given to effectively route light inside angled light pipes.

3) Working around objects can also present a challenge to a design. There are a variety of options available for working around objects which can be addressed through software modeling, such as Lumex's Ray Trace Software.

4) Design the geometry to allow the light to escape through the exit surface with minimal loss.

Uniformity

Lumex's LED Light Pipes can be configured at the output end with a variety of geometric emitting surfaces, such as an oval, round or rectangular lens cap to provide the exact display pattern desired.



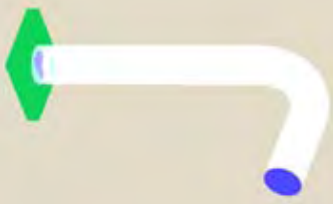
Brightness

Generally speaking, the brightness emitted will be dependent upon the LED utilized and the number of turns and shape of the light pipe. The ideal light pipe will emit the same brightness as the LED, minimizing the amount of light lost.

Prototyping

Lumex specializes in an providing different configurations and creating special shapes to fit an exact requirement.

In addition, Lumex uses state-of-the-art ray trace software with precise 3D CAD/CAM models to ensure proper design and optimal light transmittance, with minimal light loss. This advanced technology system helps to advance the design of the light directly from the LED(s) into the Light Pipe(s) to help eliminate many intermediate steps and ensure minimal light loss.



TransBrite™ Light Pipes and Light Bars - Index

The index above is representative of some of Lumex's latest innovative and more diverse product offerings. **For a complete list of all of Lumex's TransBrite™ Light Pipes, visit us online at www.lumex.com.**

TransBrite™ LED Light Pipes

Right Angle

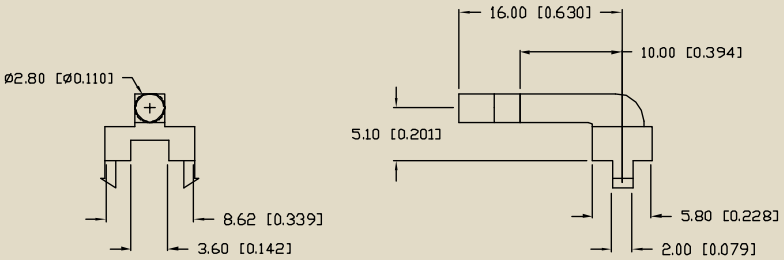
Standard 2.8mm Round, Lower Stackable

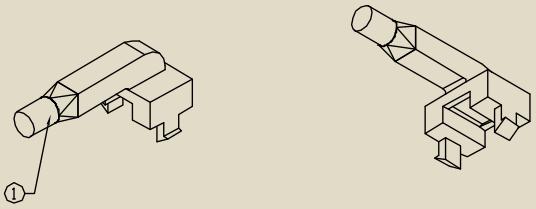
Features / Options

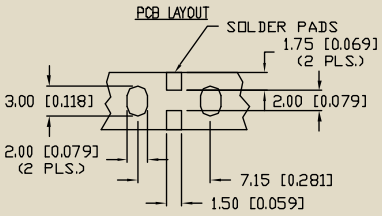
- Easy Board Installation
- Accommodates All Colors
- No Tooling Costs
- Custom Solutions Available

Applications / Uses

- Front Panel and Fault Indicator
- Light Transporter
- Legend Backlight
- Switch Illumination
- Any Form of Brand Differentiation







SKU	Light Pipe Material	Ideal LED
LPF-C011304S	PC Clear UL 94V-0	SML-LX1206 Series

Note: Illustrations shown are for representation **ONLY**. *Exact specifications should be obtained from the product data sheet. Additional product drawings of Lumex's TransBrite™ Light Pipes are available by logging onto* **www.lumex.com**. *Any Lumex standard LED products can be customized to fit your specific needs. Call* **1.800.278.5666** *to speak with one of our Technical Design Specialists.*

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TransBrite™ LED Light Pipes

Vertical

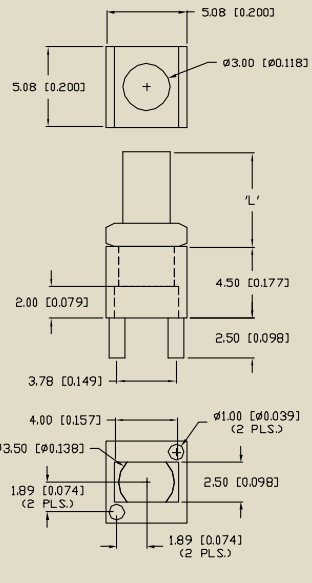
Single Unit, 3mm Round, 2mm ~ 50mm Tall

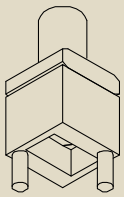
Features / Options

- Easy Board Installation
- Accommodates All Colors
- No Tooling Costs
- Custom Solutions Available

Applications / Uses

- Industrial Controls
- Medical Equipment
- Communications Equipment
- Test and Measurement Equipment
- Security Electronics
- Life Safety Equipment
- Illuminated Switches





SKU	Light Pipe Material	Ideal LED
LPA-C011310S-10	PC Clear UL 94V-0	SML-LX0805 Series
LPA-C011301S-15	PC Clear UL 94V-0	SML-LX0805 Series
LPA-C011301S-2	PC Clear UL 94V-0	SML-LX0805 Series
LPA-C011301S-20	PC Clear UL 94V-0	SML-LX0805 Series
LPA-C011301S-30	PC Clear UL 94V-0	SML-LX0805 Series

SKU	Light Pipe Material	Ideal LED
LPA-C011301S-4	PC Clear UL 94V-0	SML-LX0805 Series
LPA-C011301S-40	PC Clear UL 94V-0	SML-LX0805 Series
LPA-C011301S-5.4	PC Clear UL 94V-0	SML-LX0805 Series
LPA-C011301S-50	PC Clear UL 94V-0	SML-LX0805 Series

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TransBrite™ LED Light Pipes

Vertical

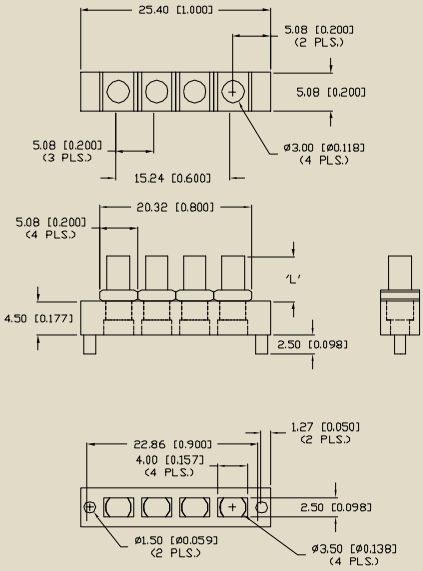
Vertical Array, Quad Unit, 3mm Round

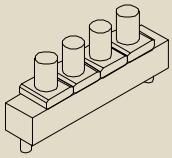
Features / Options

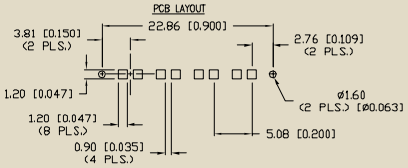
- Easy Board Installation
- Accommodates All Colors
- No Tooling Costs
- Custom Solutions Available

Applications / Uses

- Industrial Controls
- Medical Equipment
- Communications Equipment
- Test and Measurement Equipment
- Security Electronics
- Life Safety Equipment
- Illuminated Switches







SKU	Light Pipe Material	Ideal LED
LPA-C041301S-X	PC Clear UL 94V-0	SML-LX0805 Series

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TransBrite™ LED Light Pipes

Vertical

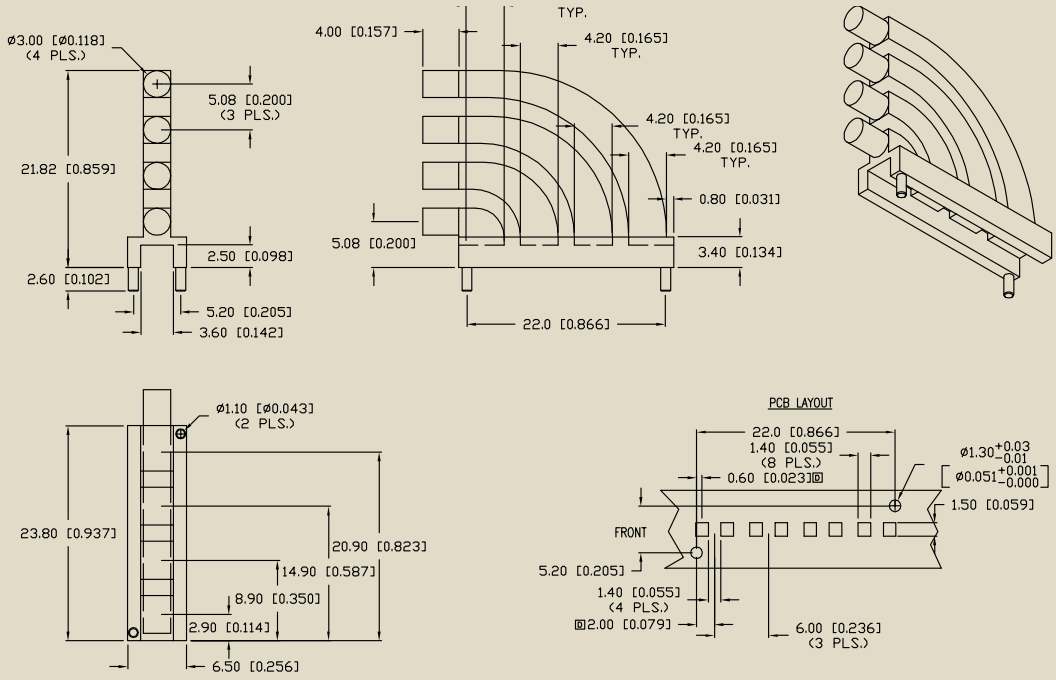
Vertical Array, Right Angle, 4 High, 3mm Round

Features / Options

- Easy Board Installation
- Accommodates All Colors
- No Tooling Costs
- Custom Solutions Available

Applications / Uses

- Front Panel and Fault Indicator
- Light Transporter
- Legend Backlight
- Switch Illumination
- Any Form of Brand Differentiation



SKU	Light Pipe Material	Ideal LED
LPF-C014301S	PC Clear UL 94V-0	SML-LX23 Series

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TransBrite™ LED Light Pipes

Right Angle

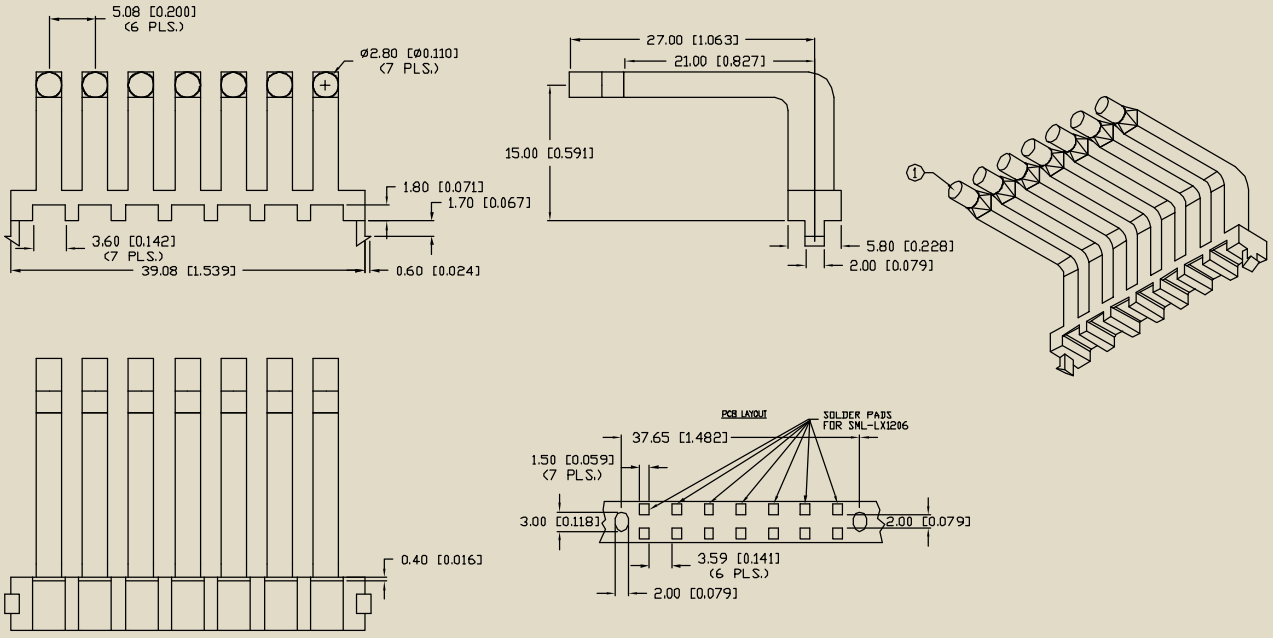
Horizontal Array, 7 Unit

Features / Options

- Easy Board Installation
- Accommodates All Colors
- No Tooling Costs
- Custom Solutions Available

Applications / Uses

- Front Panel and Fault Indicator
- Light Transporter
- Legend Backlight
- Switch Illumination
- Any Form of Brand Differentiation



SKU	Light Pipe Material	Ideal LED
LPF-C071303S	PC Clear UL 94V-0	SML-LX1206 Series

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TransBrite™ LED Light Pipes

Horizontal

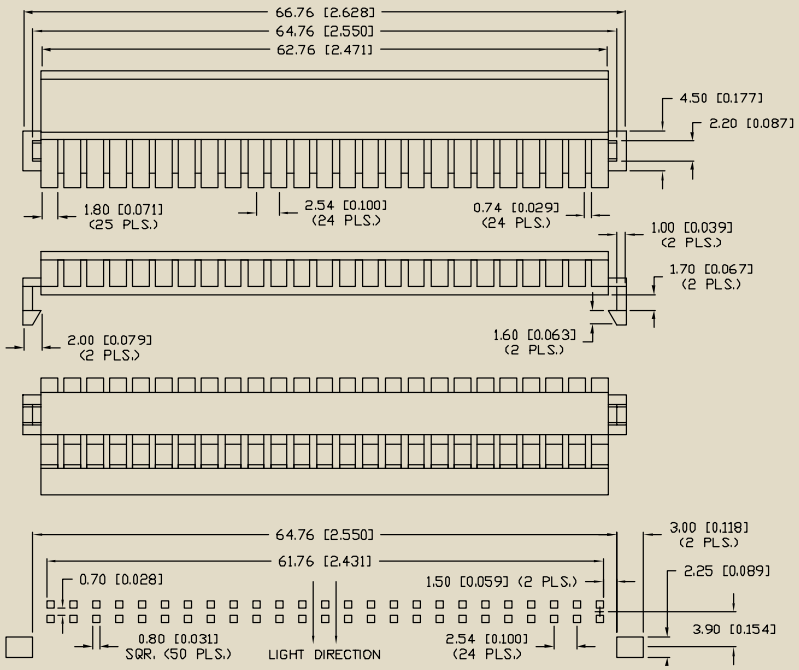
Right Angle, Horizontal Array, 25 Unit

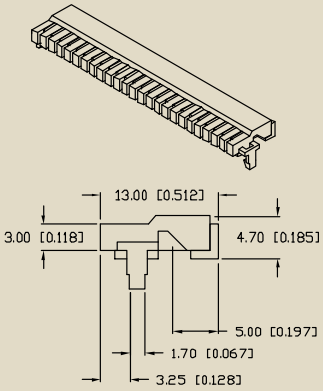
Features / Options

- Easy Board Installation
- Accommodates All Colors
- No Tooling Costs
- Custom Solutions Available

Applications / Uses

- Front Panel and Fault Indicator
- Light Transporter
- Legend Backlight
- Switch Illumination
- Any Form of Brand Differentiation





SKU	Light Pipe Material	Ideal LED
LPF-R251321S	PC Clear UL 94V-0	SML-LX0603 Series

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LUMEX®
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TransBrite™ LED Light Bars

Light Bars

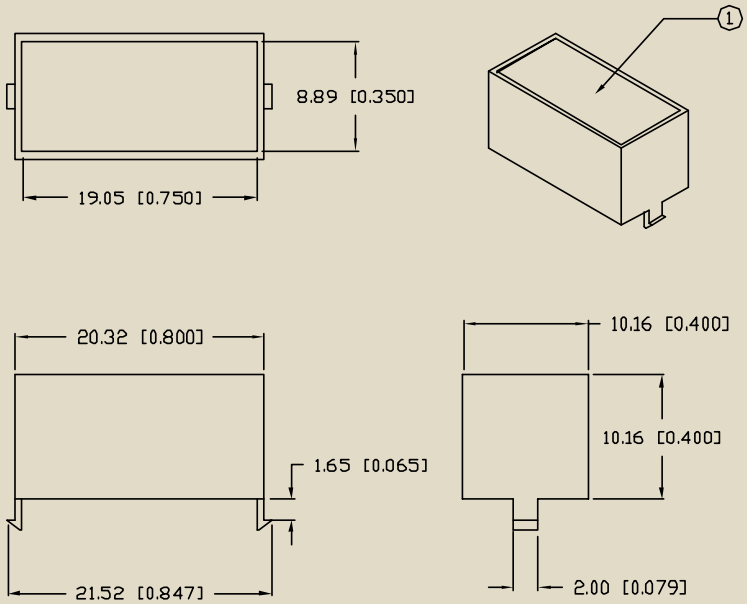
Single, Dual & Quad, Available in Square and Rectangle Packages

Features / Options

- Low Power Consumption
- Compact Size; Low Profile
- Custom Solutions Available

Applications / Uses

- Industrial Controls
- Medical Equipment
- Communications Equipment
- Test and Measurement Equipment
- Security Electronics
- Life Safety Equipment



SKU	Light Pipe Material	Ideal LED
LPB-S0111515S	PC Milky White UL 94 V-0	SML-LX2832 Series
LPB-S01110101S	PC Milky White UL 94 V-0	SML-LX2832 Series
LPB-R01113071D	PC Milky White UL 94 V-0	SSL-LX3064 Series
LPB-R0112051S	PC Milky White UL 94 V-0	SML-LX2832 Series

SKU	Light Pipe Material	Ideal LED
LPB-R01120101S	PC Milky White UL 94 V-0	SML-LX2832 Series
LPB-R0111481S	PC Milky White UL 94 V-0	SML-LX2832 Series
LPB-RO111051S	PC Milky White UL 94 V-0	SML-LX2832 Series

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TransBrite™ Light Pipes

Custom Capabilities

Lumex offers one of the most extensive ranges of light pipes and light guides in the electronics industry. Lumex's capabilities extend far beyond discrete components. In the case of light pipes/guides, most designs are custom because the final technology layout tends to vary for different applications. Lumex's Technical Design Specialists utilize 3D modeling and ray tracing software to create customer collaborative designs that are as simple or sophisticated as the application requires.

Many of Lumex's OEM and Distribution customers require increasingly complex designs that go into a host of different applications, including; automotive cup holders, networking equipment, medical device illumination, professional soundboards, graphics processing units, luxury appliances, logo enhancement and more. In addition, these light pipe and light guide designs benefit from the value added capabilities Lumex has to offer like SMD and through hole LEDs, LCDS, and integration of a PCB with connectors, wire harnesses, sensors and other components.

In one case, Lumex was brought in to quote on a tightly binned, custom wavelength SMD LED. After approval of the LED, Lumex did a design review with the customer's engineering team and discovered that the LED was going into an assembly for accent lighting. The goal was to illuminate two dissimilar circumference cup holders that were on a 5 degree angle between them. There were multiple space constrictions and the design called for only 2 LEDs to provide uniform illumination throughout the cup holder.

Lumex used 3D modeling software to import the customer's STP file, analyze their design and create a model of a single piece figure eight light pipe. We then used our ray tracing software to analyze over 36 variations of thickness, curvature, diffusion, and material composition to ensure optical clarity in the transmission wavelength. We then built 8 rapid prototypes with a range of diffusion to present to the customer so they could make a determination based on both the data and a visual representation.

After working closely with the customer's design team, the Lumex Technical Design Specialists were able to create a unique, brand differentiating product that exceeded all of their goals. The customer's design team was able to focus on other elements of the design as Lumex's team took responsibility for delivering the completed assembly with the LED, light pipe, wire harness assembly and the PCBs.

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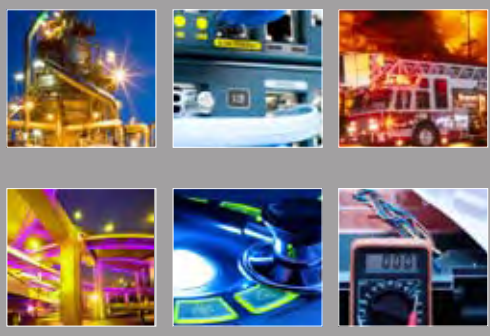

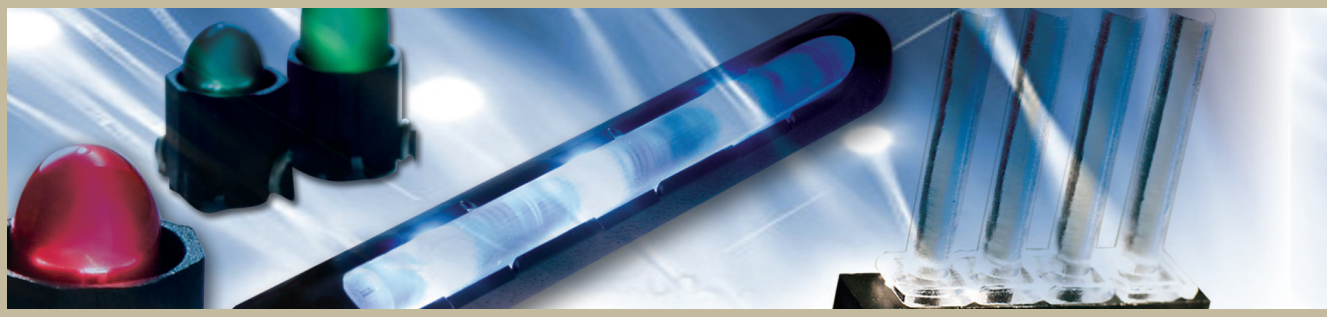

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