LUXEON XF-3014 CV

Assembly and Handling Information



Introduction

This application brief addresses the recommended assembly and handling procedures for the LUXEON XF-3014 CV product line. LUXEON XF-3014 CV is for constant voltage driven applications that require a flexible design capable of maintaining uniform light distribution over long lengths. These current regulated flexible strips come in variable length options and are either cuttable or include snap-together connectors for precision design. LUXEON XF-3014 CV is designed for ease of system integration, faster time to market, and best-in-class reliability.

Scope

The assembly and handling guidelines in the Application Brief apply to the following products:

LUXEON XF-3014 CV, 96mm/6-LED, cuttable (L219-xxyyC06FV0000)
LUXEON XF-3014 CV, 96mm/6-LED, with connectors (L219-xxyy006FV0C00)
LUXEON XF-3014 CV, 480mm/30-LED, with connectors (L219-xxyy030FV0C00)

Any assembly or handling requirements that are specific to a subset of LUXEON XF-3014 CV products are clearly marked. In the remainder of this document the term LUXEON XF-3014 CV or flexible strip(s), simply refers to any product in the LUXEON XF-3014 CV product line.

“xx” and “yy” in the part numbers above refer to variables defining CCT and CRI. Refer to LUXEON XF-3014 CV product datasheet DS156 for detailed part number nomenclature.

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1. Component

1.1 Description

The LUXEON XF-3014 CV flexible strips feature LUXEON 3014 LEDs, a flexible substrate, electrical connections, and backside adhesive for easy attachment to heat sink. LUXEON XF-3014 CV is available in three mechanical configurations:

- 6 LEDs per segment cuttable every 96mm
- 6 LEDs, 96mm segments with connectors
- 30 LEDs, 480mm segments with connectors

The top side of the flexible strip is labeled with Lumileds logo, part number, date code, maximum input voltage, maximum LED solder joint temperature (T_c), environmental approbation logos, and positive/negative connector polarities.

The LUXEON XF-3014 CV flexible strips also feature integrated constant current regulators which provide 45mA/LED nominal when driven at a typical input voltage of 24V DC. The fixed current is set by an external resistor.

The polyamide-based copper-clad laminate flexible substrate has excellent bending stability. The recommended minimum bending diameter is 5cm. A smaller diameter is possible, but the product should not be flattened afterwards. Flexible strips should not be bent at solder joints where segments are daisy chained together.

A high reflectivity white silicone coating is applied to the substrate providing very stable neutral white coating with light reflectivity of about 90% in the visible wavelengths of light (425~750nm range).

1.2 Optical Center

Refer to application brief AB208 for a description of the LUXEON 3014 single emitter optical center.

1.3 Handling Precautions

LUXEON XF-3014 CV is designed to maximize light output and reliability. However, improper handling of the flexible strips may damage the product and affect the overall performance and reliability. In order to minimize the risk of damage to the product, LUXEON XF-3014 CV flexible strips should only be picked up by the substrate and should not be bent with a radius of less than 5cm during handling.

Although in general bending the LUXEON XF-3014 CV with a radius of less than 5cm should be avoided during handling, the flexible strips can withstand greater bending when mounted. For example, LUXEON XF-3014 CV can be folded or bent at right angles. Caution: this should only be done ± 2mm away from any surface mount components and only once. Folding the strip more than once may cause the strip to fail.

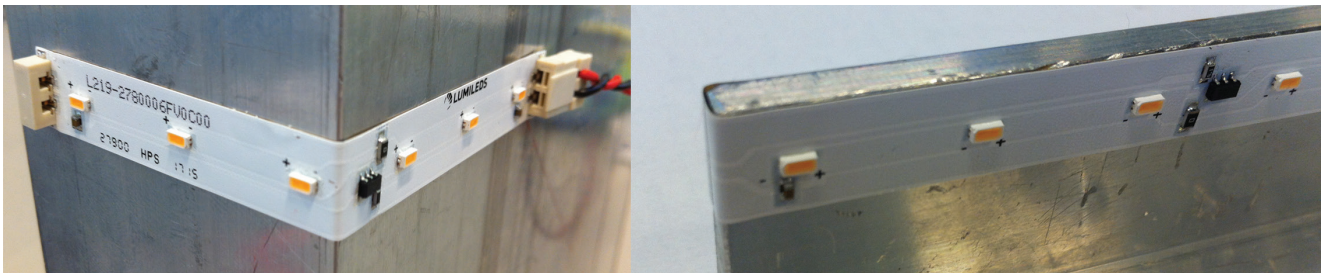


Figure 1: Application examples—bending at right angle.

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1.4 Cleaning

LUXEON XF-3014 CV strips should not be exposed to dust and debris. Excessive dust and debris may cause a drastic decrease in optical output. In the event that a LUXEON XF-3014 CV strip requires cleaning, first try a gentle swabbing using a lint-free swab. If needed, a lint-free swab and isopropyl alcohol (IPA) can be used to gently remove dirt from the silicone coating of the emitters. Do not use other solvents as they may adversely react with the LED assembly. For more information regarding chemical compatibility, see Packaging Considerations.

1.5 Mechanical Files

Refer to LUXEON XF-3014 CV product datasheet DS156 for complete 2D drawings.

2. Electrical Connection

When attached wires to LUXEON XF-3014 CV cuttable configurations, care must be taken to correctly identify the positive and negative connection points on the ends of the flexible strips. + and – marks are printed on the strips as shown in Figure 2.

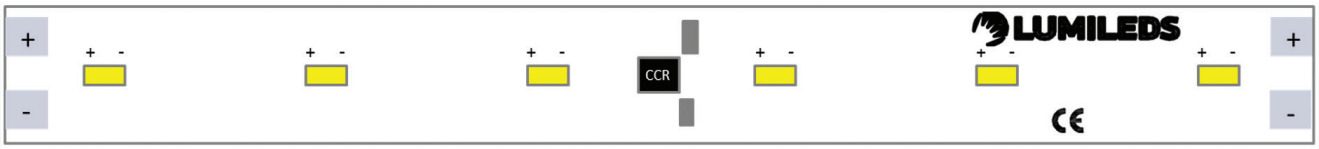
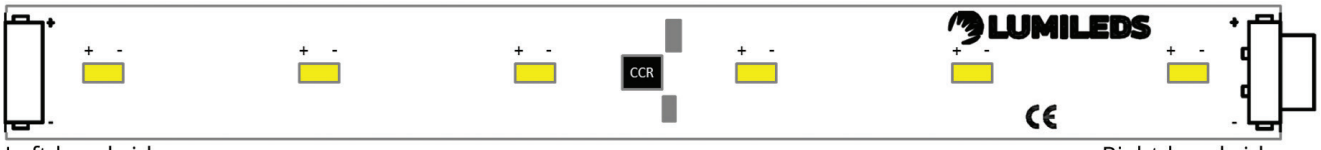


Figure 2: identifying +/- connection points for L219-xxyyC06FV0000.

The LUXEON XF-3014 CV connector configurations feature AVX horizontal plugs and sockets for easy snap together connection. + and – marks are printed on the strips as shown in Figure 3.



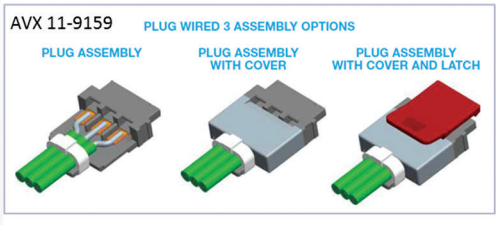
Left-hand side:
AVX 20-9159 horizontal socket

Right-hand side:
AVX 10-9159 horizontal plug

Figure 3: identifying +/- connection points for L219-xxyy006FV0C00 and L219-xxyy030FV0C00.

Power input wires can be supplied to the connectors via off-the-shelf adapters from AVX. These adapters can be purchased from many online distributors.

1) Solder-cup wire-to-board mating connector



or 2) IDC wire-to-board (plug or socket) mating connectors

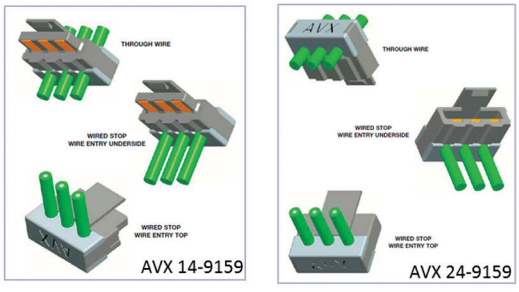


Figure 4: Compatible wire connectors.

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2.1 Assembly of AVX Connectors

Solder Connectors

Parts Needed – Body: 11-9159-002-101-116, Lock: 60-9159-340-201-000, Cover: 60-9159-330-201-000

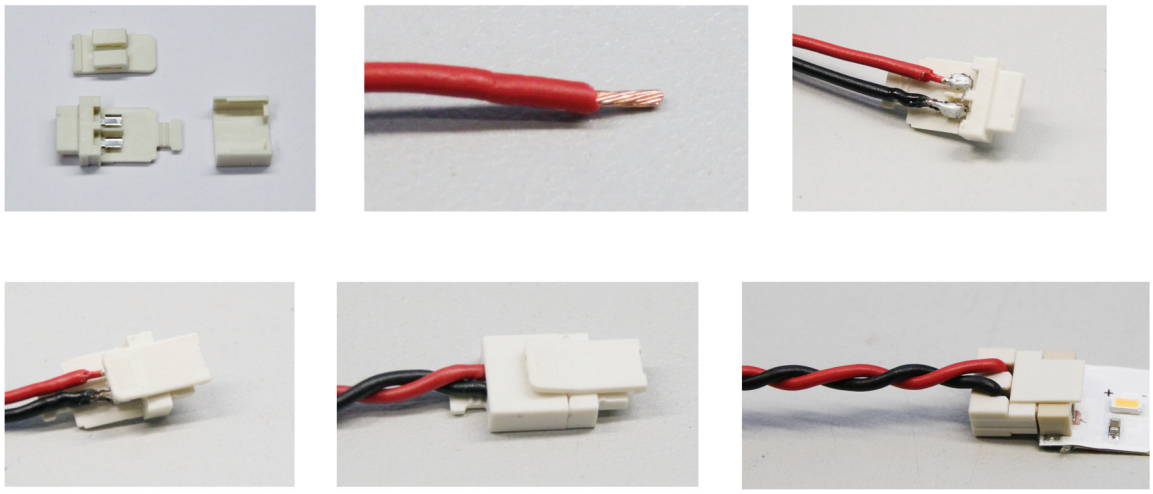


Figure 5: Assembly using solder connectors.

Strip and pre-tin the wires. Solder the wires onto the connector, work quickly to avoid melting the connector. Slide the lock in place. Slide the cover in place. A small Ty-Rap® can be used as strain relief. Attach the finished connector to the flex strip.

IDC Connectors

Parts Needed – Female: 24-9159-002-122-106 or Male: 14-9159-002-112-106

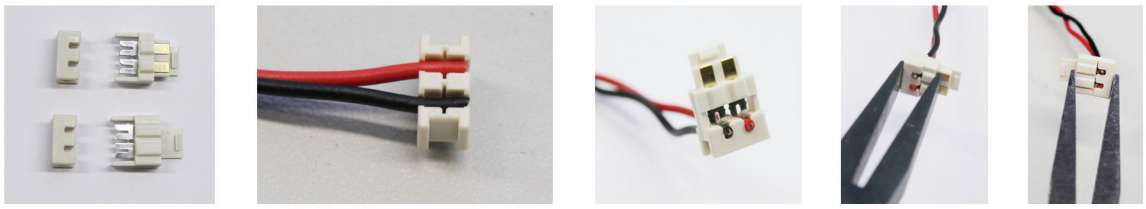


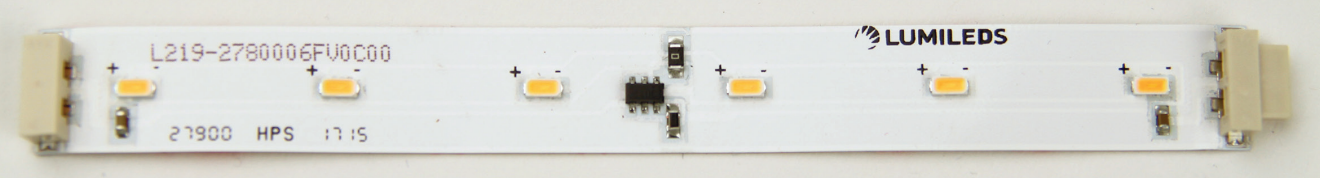
Figure 6: Assembly using IDC connectors.

Place the wires in the holder (1.2mm insulation diameter works best), make sure they don't stick out. Place the connector onto the holder. Use a press or flat nose pliers to press the contacts into the wires. The connector can now be attached to the flex strip.

These IDC connectors are much easier and quicker to work with than the solder connectors.

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2.2 Wire connection scenarios



Power input wires can be connected at the same end (1) or opposite ends of multiple segments in parallel (2):

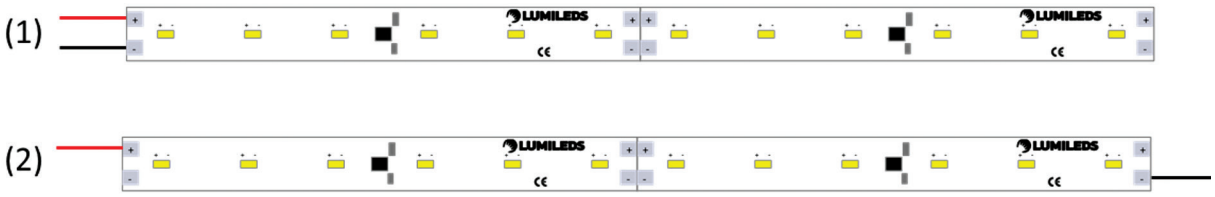


Figure 7: Electrical Connection Scenarios for LUXEON XF-3014 CV.

When operating with an input voltage of 24V and +/- wires connected to one end of the flex, constant light output uniformity can be achieved over 10 meters length. When operating with an input voltage of 24V and +/- wires connected to opposite ends of the flex, constant light output uniformity can be achieved over 18 meters length. When a longer flex is used, the voltage of the last segment drops below 19V and the LED current becomes lower, causing possible light output uniformity variance.

2.3 Parallel Connection

LUXEON XF-3014 CV are designed to be daisy chained in 96mm, 6 LED segments. These flex strips are supplied in tape and reel packaging with segments connected in parallel by default. See figures 8 and 9 for example of 3 segments connected in parallel.



Figure 8: Parallel connection example for L219-xxyyC06FV0000.



Figure 9: Parallel connection example for L219-xxyy006FV0C00.

LUXEON XF-3014 CV is recommended to be used with a constant voltage driver. A typical 24VDC driver should be capable of supplying ~45mA per 96mm, 6 LED segment connected in parallel. For example, 2 segments require 2 x ~45mA or ~90mA of total input current. N strings require N x ~45mA of total input current (where N is the number of parallel 96mm, 6 LED segments).

LUXEON XF-3014 CV flexible strips integrate constant current regulators, fixing the current flow per LED at ~45mA, for all input voltages between 19V to 27V (for connector configurations) or to 32V (for the cuttable configuration). See Figure 10. See the LUXEON XF-3014 CV product datasheet for maximum input voltage ratings.

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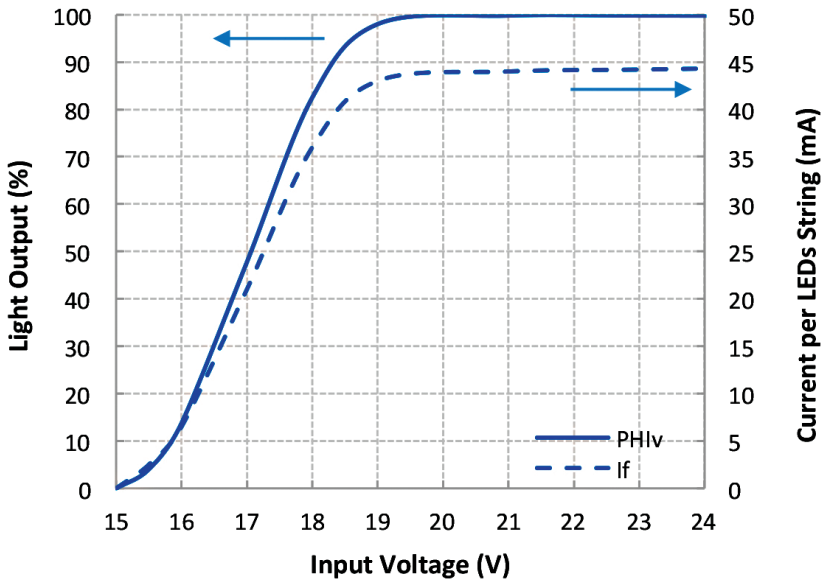


Figure 10: Typical light output and regulation current vs. input voltage for LUXEON XF-3014 CV.

As the 96mm, 6LED segments are daisy chained together, the supplied voltage stays constant but the input current required increases at about 450mA per meter of flex strip length (or ~10W/m). Optimal driver voltage depends on luminous efficacy and overall strip length requirements. A user may want to minimize driving voltage to maximize luminous efficacy (see Figure 11), but must take into the unavoidable voltage drops that will occur over length due to the finite resistance of the copper electrical traces.

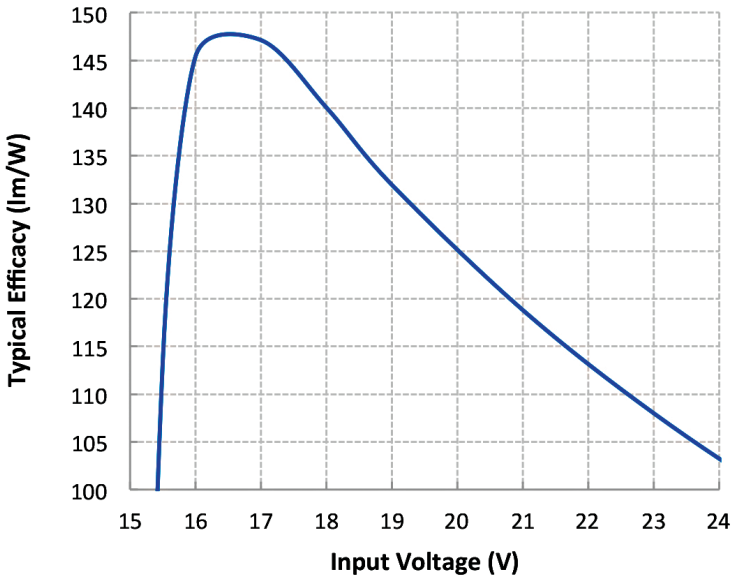


Figure 11: Typical efficacy vs. input voltage for LUXEON XF-3014 CV.

LUXEON XF-3014 CV demonstrates <2% of light output attenuation over 10m length with a single Class-2 driver. The maximum allowable input current for LUXEON XF-3014 CV is 12A due to the current carrying limitation of the copper traces. This means that theoretically a 25.6m length of daisy chained strips is possible with a single power supply, but the voltage drops would be significant and it is recommended not to use LUXEON XF-3014 CV in lengths of >20m with a single driver. The flex strips that are equipped with AVX connectors are limited to a max current of 5A when connected on one end and 10A when connected from both ends.

2.4 Drivers

Additional drivers that may be used with LUXEON XF-3014 CV can be found on LUXEON Ecosystem (including manufacturer ordering information): lumileds.pnwsoft.com. Other driver choices are available and may optimize efficiency in specific applications. LUXEON XF-3014 CV is UL-recognized for use with Class 2 drivers.

Table 1: Standard drivers that may be used with LUXEON XF-3014 CV.

APPLICATION LENGTHS	CAPABLE DRIVER	DESCRIPTION	MAX OUTPUT POWER (W)	MAX LENGTH (ft)	MAX # OF PARALLEL STRINGS 96MM (0.315 FT), 6 LEDS)	TYP. LUMINOUS FLUX (lm) AT 4000K CCT
< 5 ft	APV-12-24	APV-12 Series 12 W Single Output 0.5 A 24 Vdc Constant Voltage Power Supply	12	3.5	11	1100
<10 ft	RSLP035-24	STRATO 35 Series 36 W 1.5 A 24 Vdc Single Output Constant Voltage Power Supply	36	10.4	33	3300
<15 ft	LEDINTA0024V20DLO	Xitanium 48 W 2 A 24 V UL Class II Dimmable Outdoor LED Driver Module	44	13.9	44	4400
<20 ft	LPV-60-24	LPV-60 Series 60 W Single Output 2.5A 24 Vdc Constant Voltage Power Supply	60	17.3	55	5500
	LEDINTA0024V30DLO	Xitanium 72 W 24 V UL Class II Dimmable Outdoor LED Driver Module	72	20.8	66	6600
<30 ft	LEDINTA0024V41DLO	Xitanium 100 W 24 V UL Class II Dimmable Outdoor LED Driver Module	100	28.7	91	9100

2.5 Electrical Isolation and Safety

Most jurisdictions around the world impose some basic safety requirements on electrical appliances. For the US it is covered by UL standards (UL 8750). Within the EU, equipment must conform to Low Voltage Directive (LVD) 2006/95/EC. The LVD ensures that electrical equipment within certain voltage limits provides a high level of protection. The Directive covers electrical equipment with a voltage between 50 and 1000 V for alternating current and between 75 and 1500 V for direct current. It should be noted that these voltage ratings refer to the voltage of the electrical input or output, not to voltages that may appear inside the equipment. For most electrical equipment, the health aspects of emissions of Electromagnetic Fields are also under the domain of the Low Voltage Directive.

It is also recommended that care should be taken to provide sufficient isolation at the strip ends when mounted to metal parts.

3. Manual Assembly and Mounting

To securely apply LUXEON XF-3014 CV onto a substrate, follow these general steps:

- Cut the strip to the desired length (optional)
  - Note: Only applies to L219-xxyyC06FV0000)
- Clean the mounting surface
- Apply the strip
- Solder the strip
- Rework (if needed)

These steps are detailed in the following sections.

3.1 Cutting strips

The LUXEON XF-3014 CV cuttable configurations can be trimmed to the desired length by cutting with sharp scissors at the cell boundaries, see Figure 12. If a large number of strips are to cut ceramic scissors could be considered.

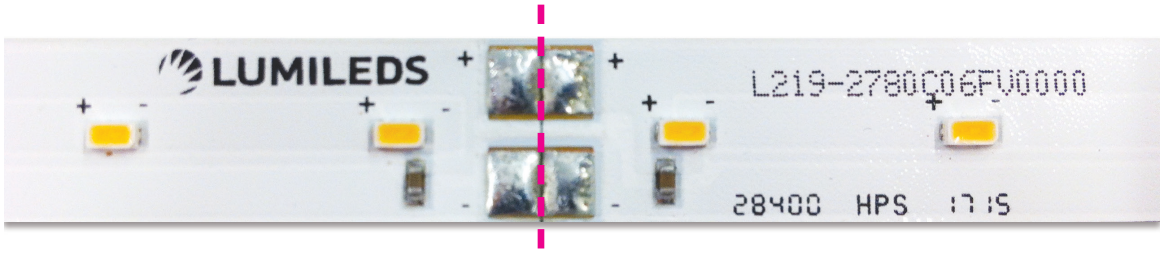


Figure 12: Indication where to cut

Do not cut the strip at the reflective foil as this will render the strip unusable.

3.2 Surface Cleaning

Use a new lint-free swab and IPA to clean the mounting surface (heat sink) and let it dry.

3.3 Mounting the strip to a surface or heat sink

The LUXEON XF-3014 CV is supplied with a high performance 3M adhesive tape. This tape has high bond and sheer strength on materials with a high surface energy. These materials include glass, stainless steel, aluminum and high surface energy plastics (e.g. ABS and PC). The recommended methods for mounting a strip is by using a wallpaper seam roller, e.g. from Perfax: wallpaperwebstore.com/perfax-naadroller.

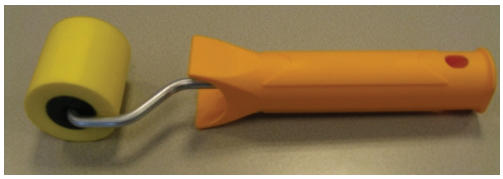


Figure 13: Roller to apply the flex strip.

It is recommended the roller is made from non-porous foam modulus so it can be easily cleaned, and thus avoiding damaging the strip or the LEDs. The strip can also be mounted without a roller by applying pressure to the strip with the hands; do not press on the LEDs directly as this may damage the LEDs. If so desired, ESD-safe polyester clean-room gloves can be used.

To ensure desired alignment of the strip, mark the mount points for the end of the strip. This can be done with removable tape as shown in Figure 14.



Figure 14: Mark surface with alignment strips.

Remove a few centimeters of the liner from the LUXEON XF-3014 CV strip and carefully place using the alignment strips as reference. Take care the other end of the strip is properly aligned with the marker. Once part of the strip is fixed to the surface, it is difficult to adjust.

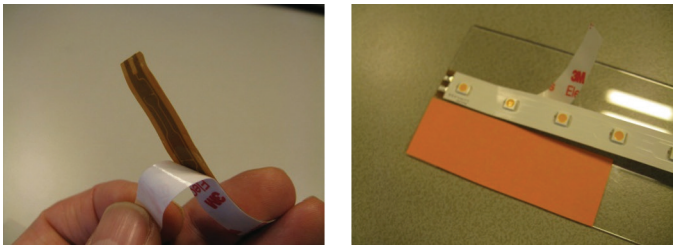


Figure 15: Remove 3-4cm of the protective foil and fix one end of the strip.

When the one side of the strip is fixed, remove most of the liner. Leave just enough liner to hold the strip at the end without getting glue on the fingers. Ensure the strip remains straight preventing the strip from accidentally gluing itself to the surface and avoid kinking the strip at the mount point.

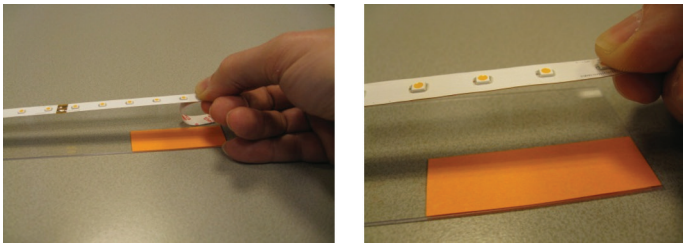


Figure 16: Remove almost all of the protective foil and align the end, but do not place.

Keep the strip stretched tight to the second marker without touching the surface with the glue (Figure 16). Remove almost all of the protective foil and align the end, but do not place. Apply the roller with steady pressure at the starting (glued) end and run smoothly towards the far end maintaining alignment as the tool travels (Figure 17).

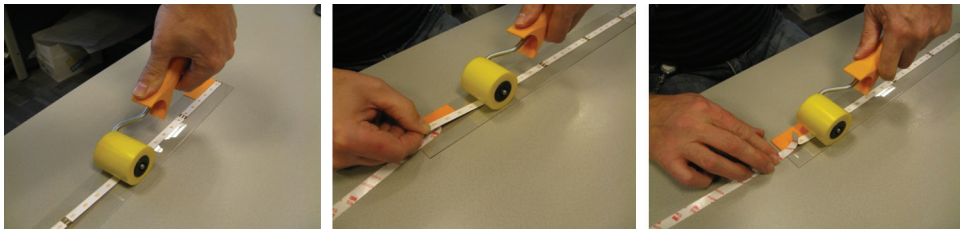


Figure 17: Using the roller to fix the strip

When the roller is near the end, the remainder of the liner can be removed.



Figure 18: Finished

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It may happen that small pockets of air are trapped below the strip. This can be visible as a small bump. This does not impact the performance or lifetime of the LUXEON XF-3014 CV.

The adhesion of the PSA to the mounting surface will reach 90% of its peak strength after 1 day. Heat and pressure can be used to accelerate the curing cycle. For example, good adhesion has been achieved by storing the LUXEON XF-3014 CV for one hour at 80°C. Results may vary with different heat sink materials. Lumileds recommends that customers always perform their own testing.

3.4 Solder Wires to the Strip

Wires can be soldered before or after fixing the strip to the surface. The following process is suggested.

- **Pre-requisites:**

  Grounded soldering iron, capable of reaching 350°C

  Stranded copper wire of 24 AWG or larger

  SAC305 solder wire

- **Prepare the electrical wires:**

  Cut the wires to size.

  Strip a few millimeters of insulating material from the ends of the wires.

  Pre-tin the wires with a small amount of solder.

- **Prepare the LUXEON XF-3014 CV flex strip:**

  Clean the electrical pads of the LUXEON XF-3014 CV flex strip with a lint-free swab and isopropyl alcohol to remove any debris or particles.

- **Solder the pre-tinned wires to the pre-tinned electrical pads:**

  Place the pre-tinned LUXEON XF-3014 CV flex strip on a thermally insulating surface.



Figure 19: Solder points

  Place the pre-tinned wire on the pre-tinned electrical pad.

  Place the tip of the soldering iron on the electrical pad and allow the solder to reflow around the wire. Do not place the soldering iron on the electrical pad for more than 3 seconds to prevent any damage to the LUXEON XF-3014 CV flex strip. If a solder joint cannot be established within this time, allow the LUXEON XF-3014 CV flex strip to cool before reapplying the heat.

  Remove the soldering iron and allow the solder joint to cool.

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3.5 Rework

If a flex strip was not placed correctly, it has to be removed as quickly as possible. The longer it remains in place, the stronger the bond. After 3 minutes it cannot be re-glued. It is recommended that if the flex needs to be removed it should be done within 1 minute of application

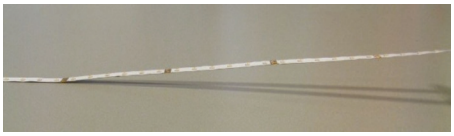


Figure 20: Removal of strip from surface.

Note: the angle between the surface and the strip being pulled should not exceed 20 degrees, see Figure 20. Carefully inspect the flex for damage, especially the copper traces right next to the LEDs. These are stressed the most during removal. If in doubt, replace the flex.

In case the strip has been in place too long, the LUXEON XF-3014 CV flex strip may be very hard to remove without causing damage to the flex or the luminaire. The strip should not be re-used in that case. Removal could be done in various ways:

- **Cutting:** Cutting the bond line is effective on small assemblies. This can be done with a sharp cutting tool or a fine tooth saw or a textured wire, using liquid soap as a lubricant.
- **High Frequency Shock:** Small parts can be cooled to below -40°C where the 3M™ Tape will become rigid. A sharp impact focused near the bond line, should fracture the adhesive. Once the part is warmed up to room temperature, the residual adhesive can be removed.

The Residual adhesive can be removed using several methods:

- **The Stripe Off Wheel** (3M part number 07498: Figure 21) is a special rubber disk which mounts onto a standard 3/8in electric drill.



Figure 21: Stripe Off Wheel.

  When the rotating disk is brought in contact with the adhesive residue, it lifts the adhesive from the surface. When used properly the wheel does not damage painted surfaces. It helps to remove the bulk of the adhesive residue with a razor scrapper or knife before using the wheel. This operation can be followed by using a cleaning wipe to remove debris.

- **Abrading:** If surface damage is not an issue, residual adhesive can be removed with a porous abrasive disk or wheel. A detackifying agent such as detergent/water solution or dry talc may be used to facilitate removal and help prevent clogging of the abrasive. Low speeds are generally more effective than high speeds for removal to prevent excessive heat buildup. Once the adhesive is lifted off the surface, a cleaning wipe can be used to remove the debris.
- **Solvents:** The adhesive residue can be wet with a solvent then covered with a plastic film and allowed to soak for 5-15 minutes. Once the adhesive is softened use a scrapper to remove the adhesive. The Solvents to use include:
  - 3M™ Citrus Base Cleaner
  - MEK (Methyl-Ethyl-Ketone)
  - Other commercial adhesive removers

Note: Follow all manufacture's safety precautions when using solvents. These cleaning recommendations may not be compliant with the requirements of certain Air Quality Management jurisdictions — consult applicable rules before use.

If in doubt, follow the guide **'3M VHBTM Tape—Disassembly of VHB Tape bonded materials and removal of residue adhesive'** Technical Bulletin.

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3.6 Electrostatic discharge measures during mounting

ESD precautions should be followed during mounting/assembling of the LUXEON XF-3014 CV flex strip onto a product.

Production Environment

The LUXEON XF-3014 CV flex strip requires ESD measures in a production environment where values can exceed the max ratings shown in the LUXEON XF-3014 CV datasheet. An ESD-safe production environment comprises of, among other things, a grounded floor, work tables as well as other attributes. ESD-safe clothing and grounding of workers should also be considered. (Figure 22)

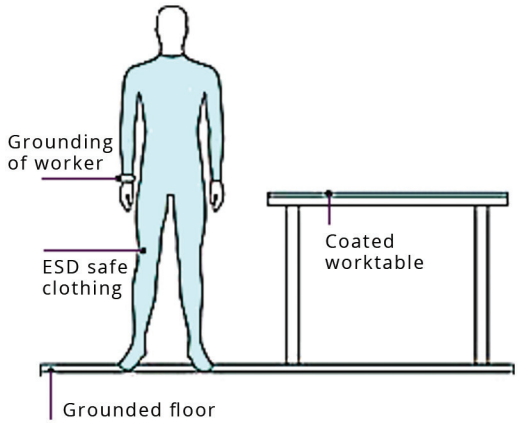


Figure 22: ESD measures.

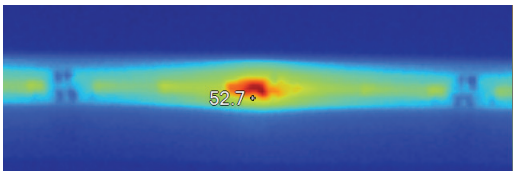
Servicing and installing luminaires

When servicing luminaires on site, grounding of the service field engineer should be considered.

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4. Thermal Considerations

The LUXEON XF-3014 CV is provided with a copper layer that spreads the heat of the LEDs across the strip. This heat-spreading function allows the LUXEON XF-3014 CV to be used without a large heat-sink. This allows flexibility in choosing a housing and heat sink. For some applications, this built-in heat sink is sufficient.



4.1 Thermal Verification

Given the length of the LUXEON XF-3014 CV flex strip and the various methods by which it could be applied in a product, there could be a significant temperature differences between different parts of the strip. It is recommended that to ensure the maximum junction temperature of the LEDs is not exceeded, the following procedure is followed:

- Determine the hottest part in the product. This will be the current regulator in most cases.
  A thermocouple or alternatively a contactless infra-red camera could be used.
- Current regulators:
  - Maximum junction temperature is 150°C, with 50°C/W typical thermal resistance (junction to solder point)
  - It is recommended not to exceed 105°C solder point temperature for these components.
- **LEDs**: use a thermocouple on the hottest LED to measure the temperature of the LED solder pad (T_c). See section 4.2 for details on how to measure this.
  - If T_c is above 85°C additional heat sinking is needed.
  - Using this measured T_c, calculate the junction temperature (T_j) of the LED using the following formula $T_j = T_c + R_{\theta j\text{-}c} \times P$, where $R_{\theta j\text{-}c}$ = 40°C/W and P is the electrical power applied to the LED in Watts.
  - Verify T_j thus obtained is below the maximum junction temperature allowed for the LUXEON 3014 LUXEON emitter; i.e. T_j must be below 100°C.
    If T_j is above 100°C, additional heat sinking is needed.

4.2 Mounting a thermocouple

Before mounting the thermocouple first determine the location of the hottest LED with the LUXEON XF-3014 CV mounted in the application. Attach all fixtures (e.g. heat sink, lens and any cover) to closely simulate the actual application environment, and use an input voltage that corresponds to normal operating conditions. The preferred mounting method for the thermocouple is to glue it to the solder pad. Soldering is also possible, but this carries a risk of either overheating the LED or overheating the adhesive of the LUXEON XF-3014 CV.

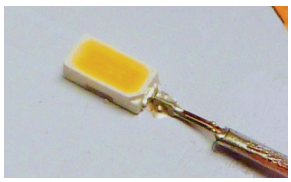


Figure 23: Location of sensor pad.

The location of the sensor pad is right next to the cathode of the LUXEON emitter on the flex strip, as shown in Figure 23. To ensure accurate readings, the thermocouple must make direct contact with the copper of the foil onto which the LUXEON emitter pads are soldered, i.e. any solder mask or other masking layer must be first removed before mounting the thermocouple onto the sensor pad of the LED.

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Supplies and Equipment

Below is a list of supplies and equipment that is needed for T_j measurements:

- Type T precision fine wire (0.003in gauge diameter) thermal couple from Omega Engineering Inc. (part number: 5SRTC-TT-T-40-36)
- Arctic Alumina Thermal Adhesive compound from Arctic Silver Inc. (part number: AATA-5G)
- Disposable 3CC barrel syringe from EFD Inc. (part number 5109LL-B)
- Disposable 0.016 inch inner diameter fine needle tip from EFC Inc. (part number: 5122-B)
- Kapton tape
- Thermometer
- Magnifying glass or low power microscope (e.g. 5x to 30x)

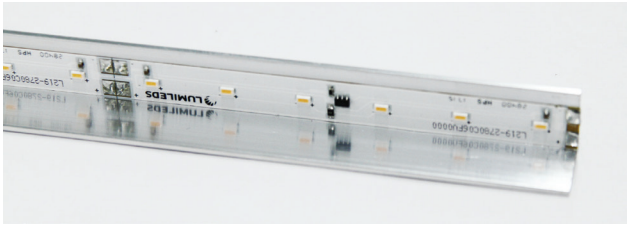
Thermocouple Mounting Procedure

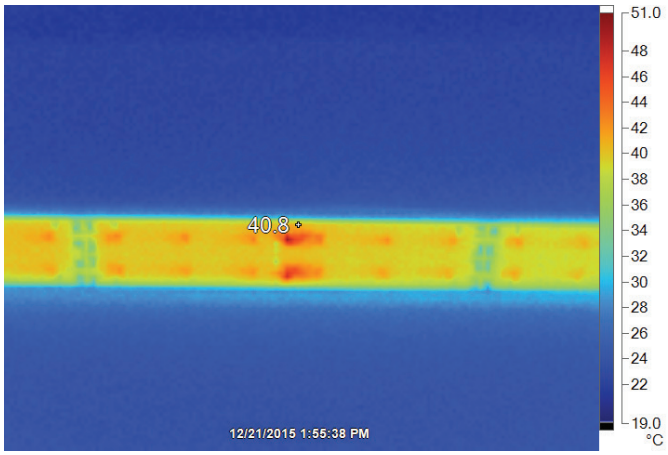
- Familiarize yourself with the MSDS and preparation procedures for the epoxy or adhesive compound.
- Place the thermocouple tip on the sensor pad area (see Figure 23). The thermocouple tip must touch the sensor pad.
- Use Kapton tape to secure the thermocouple wire onto the LUXEON XF-3014 CV.
- Use Arctic Alumina Thermal Adhesive compound to thermally connect the thermocouple to the sensor pad area.
  - Since this is a two part epoxy system with an approximate pot-life at room temperature after mixing of 3-4 minutes, make sure that proper setup is done to ensure that the epoxy can be dispensed within the pot-life span.
  - After mixing, put the epoxy immediately into the 3cc barrel syringe with the fine needle tip and dispense onto the thermocouple tip. Close to the end of the pot-life, it becomes difficult to dispense.
  - Alternatively, you can dip the fine needle tip into the epoxy mix and then “touch” the thermocouple tip to dispense the epoxy via surface tension.
  - Cure the epoxy at room temperature (25°C) for at least two hours.
- Plug in the thermocouple connector to the thermometer. The thermocouple now measures the temperature T_c.
- Connect the power supply to the LUXEON XF-3014 CV and power up with a drive current that corresponds to normal operating conditions
- Record the temperature T_c once the LUXEON XF-3014 CV stabilizes. This may take several minutes or more depending on the overall design and thermal mass.
- The junction temperature can then be estimated as described in the thermal verification section above.

Typical use examples

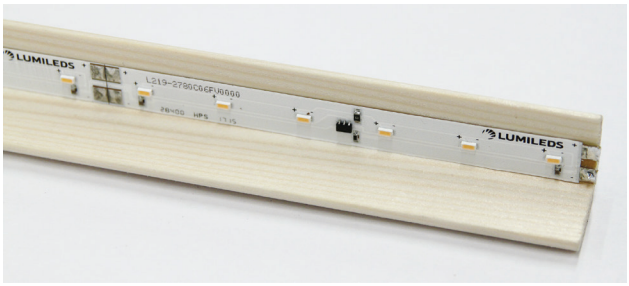
Three “L” shaped profiles were use to show the effect of various widely used materials to mount LED strips on. The flex strip was run at 24V.

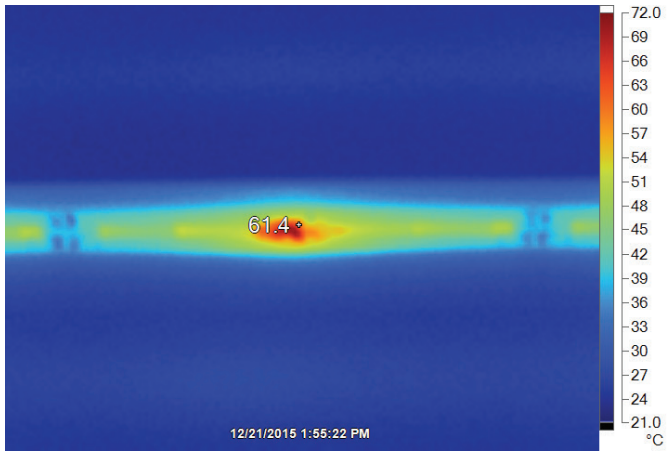
1 – Aluminum: This profile will spread out the heat very effectively thereby lowering the LED and chip temperature considerably.





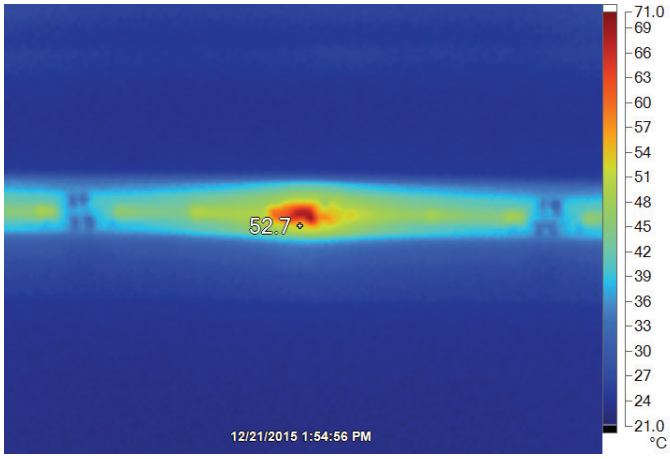
2 – Wood: This profile does not spread out the heat very much, but it’s still better than no heatsink at all. At room temperature there are no thermal issues.





3 – Plastic (PVC): Like wood this does not spread out the heat very much. It is better at conducting heat away to the environment. At room temperature the LED temperature is well within specification.





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5. Packaging Considerations — Chemical Compatibility

The LUXEON emitter package contains a silicone overcoat to protect the LED chip and extract the maximum amount of light. As with most silicones used in LED optics, care must be taken to prevent any incompatible chemicals from directly or indirectly reacting with the silicone.

The silicone overcoat used in the LUXEON emitter is gas permeable. Consequently, oxygen and volatile organic compound (VOC) gas molecules can diffuse into the silicone overcoat. VOCs may originate from adhesives, solder fluxes, conformal coating materials, potting materials and even some of the inks that are used to print the PCBs.

Some VOCs and chemicals react with silicone and produce discoloration and surface damage. Other VOCs do not chemically react with the silicone material directly but diffuse into the silicone and oxidize during the presence of heat or light. Regardless of the physical mechanism, both cases may affect the total LED light output. Since silicone permeability increases with temperature, more VOCs may diffuse into and/or evaporate out from the silicone.

Careful consideration must be given to whether LUXEON emitters are enclosed in an “air tight” environment or not. In an “air tight” environment, some VOCs that were introduced during assembly may permeate and remain in the silicone. Under heat and “blue” light, VOCs captured inside the silicone may partially oxidize and create a silicone discoloration, particularly on the surface of the LED where the flux energy is the highest. In an air rich or “open” air environment, VOCs have a chance to leave the area (driven by the normal air flow). Transferring the devices which were discolored in the enclosed environment back to “open” air may allow the oxidized VOCs to diffuse out of the silicone and may restore the original optical properties of the LED.

Determining suitable threshold limits for the presence of VOCs is very difficult since these limits depend on the type of enclosure used to house the LEDs and the operating temperatures. Also, some VOCs can photo-degrade over time.

Table 2 provides a list of commonly used chemicals that should be avoided as they may react with the silicone material. Note that Lumileds does not warrant that this list is exhaustive since it is impossible to determine all chemicals that may affect LED performance.

The chemicals in Table 2 are typically not directly used in the final products that are built around LUXEON emitters. However, some of these chemicals may be used in intermediate manufacturing steps (e.g. cleaning agents). Consequently, trace amounts of these chemicals may remain on (sub) components, such heat sinks. Lumileds, therefore, recommends the following precautions when designing your application:

- When designing secondary lenses to be used over an LED, provide a sufficiently large air-pocket and allow for “ventilation” of this air away from the immediate vicinity of the LED.
- Use mechanical means of attaching lenses and circuit boards as much as possible. When using adhesives, potting compounds and coatings, carefully analyze its material composition and do thorough testing of the entire fixture under High Temperature over Life (HTOL) conditions.

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Table 2. List of commonly used chemicals that will damage the silicone overcoat of the LUXEON emitter. Avoid using any of these chemicals in the housing that contains the LED package.

CHEMICAL NAME	NORMALLY USED AS
Hydrochloric acid	acid
Sulfuric acid	acid
Nitric acid	acid
Acetic acid	acid
Sodium hydroxide	alkali
Potassium hydroxide	alkali
Ammonia	alkali
MEK (Methyl Ethyl Ketone)	solvent
MIBK (Methyl Isobutyl Ketone)	solvent
Toluene	solvent
Xylene	solvent
Benzene	solvent
Gasoline	solvent
Mineral spirits	solvent
Dichloromethane	solvent
Tetracholorometane	solvent
Castor oil	oil
Lard	oil
Linseed oil	oil
Petroleum	oil
Silicone oil	oil
Halogenated hydrocarbons (containing F, Cl, Br elements)	misc
Rosin flux	solder flux
Acrylic tape	adhesive

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Lumileds is the global leader in light engine technology. The company develops, manufactures and distributes groundbreaking LEDs and automotive lighting products that shatter the status quo and help customers gain and maintain a competitive edge. With a rich history of industry "firsts," Lumileds is uniquely positioned to deliver lighting advancements well into the future by maintaining an unwavering focus on quality, innovation and reliability.

To learn more about our portfolio of light engines, visit lumileds.com.

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