

LUXEON XF-3535L

*Turnkey solution on flexible substrate
with optimized performance and uniform
light distribution*



Introduction

LUXEON XF is a family of fully integrated solutions optimized for lighting applications requiring linear arrays that can easily fit into any luminaire housing form factor. The turnkey solution minimizes time to market and simplifies supply chain by reducing optical and mechanical design efforts. Combined with LUXEON 3535L emitters, LUXEON XF-3535L provides the same powerful optical performance guaranteed by LUXEON LEDs. The overall solution delivers optimized performance in combination with the quality of light needed for distributed light source applications.

LUXEON XF-3535L features LUXEON 3535L LEDs, flexible substrate, electrical connectors, and backside adhesive for easy attachment to a heat sink. This document contains the electrical, mechanical, and optical performance data needed to design and engineer applications using LUXEON XF-3535L.

Features

- Complete integrated solution
- Flexible, ultra-thin substrate
- Backside adhesive for attachment to heat sink
- Features LUXEON 3535L Mid-Power LEDs

Benefits

- Simplified supply chain and faster time to market
- Freedom of design to fit any form factor
- Ease of mounting and assembly
- Full Range of CCTs and CRI configurations

Key Applications

- Indoor and Outdoor linear arrays
 - T-LED
 - Under Cabinets
 - Troffers
- Custom Form Factors
 - Accent Lighting
 - Decorative

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General Information

Part Number Nomenclature

The nominal current for LUXEON XF-3535L is 100mA x the number of parallel LED strings. A LUXEON XF-3535L configuration with 6 parallel strings has a nominal drive current of 600mA

The LEDs on LUXEON XF-3535L are tested and specified individually at a junction temperature of 25°C with a drive current of 100 mA and pulse duration of 20 ms. The minimum, typical, and maximum performance numbers for LUXEON XF-3535L in this datasheet are derived from the individual LED measurements. The confidence level on all minimum and maximum performance parameters in this datasheet is 99% to within individual LED tolerance.

The part number designation for the L235 series is explained as follows:

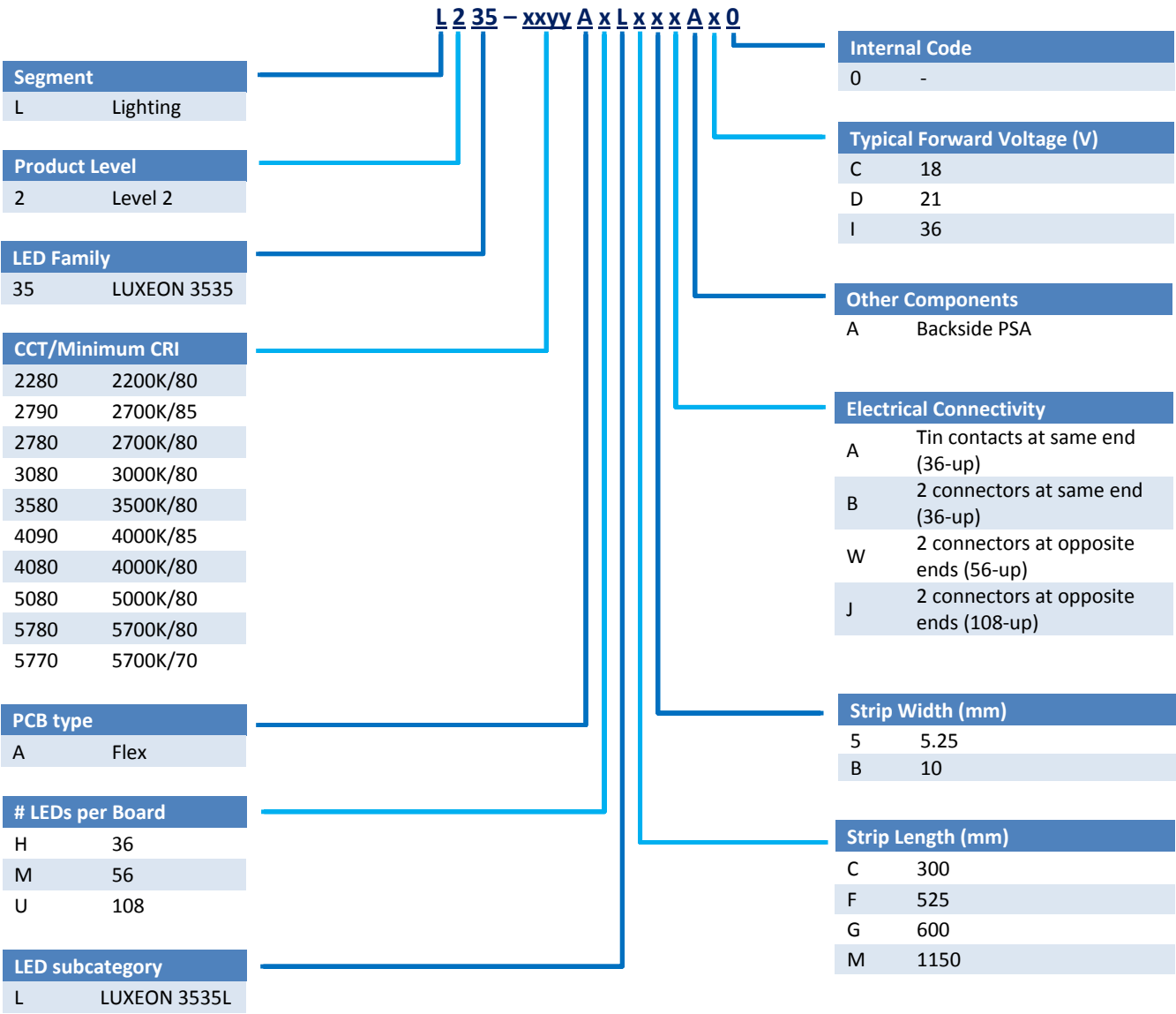


Figure 1.

Average Lumen Maintenance Characteristics

LUXEON 3535L LEDs are tested in accordance with LM-80-08. Please contact your Philips Lumileds sales person for more detailed information or visit the Philips Lumileds website at www.philipslumileds.com.

Environmental Compliance

Philips Lumileds is committed to providing environmentally friendly products to the solid-state lighting market. LUXEON XF-3535L is compliant to the European Union directives on the restriction of hazardous substances in electronic equipment, namely the RoHS directive. Philips Lumileds will not intentionally add the following restricted material to LUXEON XF-3535L: lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE).

Product Performance and Characterization Guide

Table 1. Product Selection Guide

Typical Performance Characteristics at 100mA/LED with a Junction Temperature = 25°C ^[1]							
Part Number ^[4]	Nominal ANSI CCT	CRI ^[2]	Nominal Drive Current	Luminous Flux		Forward Voltage	Efficacy
		Minimum	(mA)	Minimum (lm) ^[3]	Typical (lm)	Typical (V)	Typical (lm/W)
L235-2280AHLxByACO L235-2280AMLF5WADO L235-2280AULM5JAIO	2200K	80	600 800 900	1080 1680 3240	1206 1876 3618	18 21 36	112
L235-2790AHLxByACO L235-2790AMLF5WADO L235-2790AULM5JAIO	2700K	85	600 800 900	1080 1680 3240	1224 1904 3672	18 21 36	113
L235-2780AHLxByACO L235-2780AMLF5WADO L235-2780AULM5JAIO	2700K	80	600 800 900	1368 2128 4104	1476 2296 4428	18 21 36	137
L235-3080AHLxByACO L235-3080AMLF5WADO L235-3080AULM5JAIO	3000K	80	600 800 900	1368 2128 4104	1512 2352 4536	18 21 36	140
L235-3580AHLxByACO L235-3580AMLF5WADO L235-3580AULM5JAIO	3500K	80	600 800 900	1512 2352 4536	1548 2408 4644	18 21 36	143
L235-4090AHLxByACO L235-4090AMLF5WADO L235-4090AULM5JAIO	4000K	85	600 800 900	1224 1904 3672	1368 2128 4104	18 21 36	127
L235-4080AHLxByACO L235-4080AMLF5WADO L235-4080AULM5JAIO	4000K	80	600 800 900	1512 2352 4536	1584 2464 4752	18 21 36	147
L235-5080AHLxByACO L235-5080AMLF5WADO L235-5080AULM5JAIO	5000K	80	600 800 900	1512 2352 4536	1692 2632 5076	18 21 36	157
L235-5780AHLxByACO L235-5780AMLF5WADO L235-5780AULM5JAIO	5700K	80	600 800 900	1512 2352 4536	1548 2408 4644	18 21 36	143
L235-5770AHLxByACO L235-5770AMLF5WADO L235-5770AULM5JAIO	5700K	70	600 800 900	1584 2464 4752	1692 2632 5076	18 21 36	157

Notes for Table 1:

1. The nominal drive current is 100 mA x the number of parallel strings in LUXEON XF-3535L. See table 2 for physical configurations.
2. Philips Lumileds maintains a tolerance of ± 2 on CRI measurements for individual LUXEON 3535L LEDs.
3. Philips Lumileds maintains a tolerance of $\pm 7.5\%$ on luminous flux measurements for individual LUXEON 3535L LEDs.
4. "x" and "y" are part number attributes as described in the Product Nomenclature section: here x/y = G/A, G/B, C/A, or C/B.
5. Maximum luminous flux non-uniformity (i.e. LED to LED luminous flux variation) = 15 %.

Physical Dimensions and Configurations

Table 2 shows the physical parameters for the L235 series of products.

Table 2.

Part Number ^[1]	LED Count	Flex Strip Length (mm)	Flex Strip Width (mm)	LED Pitch ^[2,3] (mm)	Electrical Configuration	Electrical Connection ^[4]
L235-xyyyAHLGBAAC0	36	600	10	16.67	6 Parallel x 6 Series LEDs	Tin Contacts
L235-xyyyAHLGBBAC0	36	600	10	16.67	6 Parallel x 6 Series LEDs	IDC Connectors
L235-xyyyAHLCBAAAC0	36	300	10	8	6 Parallel x 6 Series LEDs	Tin Contacts
L235-xyyyAHLCBBAAC0	36	300	10	8	6 Parallel x 6 Series LEDs	IDC Connectors
L235-xyyyAMLF5WAD0	56	525	5.25	8.45	8 Parallel x 7 Series LEDs	IDC Connectors
L235-xyyyAULM5JAI0	108	1150	5.25	10	9 Parallel x 12 Series LEDs	IDC Connectors

Notes for Table 2:

1. "x" and "y" are part number attributes as described in the Product Nomenclature section (Figure 1).
2. LED pitch is measured from optical center to optical center of neighboring LED packages.
3. LED pitch varies for 300mm and 600mm length flex strips. See mechanical drawings for details.
4. See Appendix I for details on electrical connectors.

Electrical Characteristics

Table 3.

Typical Performance Characteristics at 100mA/LED, Junction Temperature = 25°C						
Part Number ^[1]	Forward Voltage (V) ^[2]			Typical Temperature Coefficient of Forward Voltage ^[3] (mV/°C) $\Delta V_F / \Delta T_J$	Typical Thermal Resistance (°C/W) ^[4, 5]	
	Minimum	Typical	Maximum		$R\theta_{J-S}$	$R\theta_{S-B}$
L235-xyyyAHLGBzAC0	16.8	18	19.2	-9	0.69	0.69
L235-xyyyAHLCBzAC0	16.8	18	19.2	-9	0.69	0.83
L235-xyyyAMLF5WAD0	19.6	21	22.4	-10.5	0.45	0.54
L235-xyyyAULM5JAI0	33.6	36	38.4	-18	0.23	0.28

Notes for Table 3:

1. "xyyy" and "z" are part number attributes as described in the Product Nomenclature section (Figure 1).
2. Philips Lumileds maintains a tolerance of $\pm 0.1V$ on forward voltage measurements for individual LUXEON 3535L LEDs.
3. LED $\Delta V_F / \Delta T_J$ measured between $T_J = 25^\circ C$ and $T_J = 85^\circ C$.
4. $R\theta_{J-S}$ specified from peak LED junction to T_S (thermal contact point) next to LED. See [Application Brief AB203](#) for details.
5. $R\theta_{S-B}$ specified from T_S (thermal contact point) next to LED, to bottom of flexible adhesive (heat sink).

Absolute Maximum Ratings

Table 4.

Parameter	Maximum Performance
DC Forward Current ^[1]	200mA x Number of parallel strings
Peak Pulsed Forward Current ^[2]	240mA x Number of parallel strings
ESD Sensitivity	IEC 61000 4-2 Level 1 (±2kV contact/air discharge)
LED Junction Temperature ^[3]	125°C
Operating Temperature ^[4]	-40°C – 85°C
Flex Substrate ^[5]	105°C
Storage Temperature	<30°C <65%RH for ≤1 year
Reverse Voltage ^[6, 7]	-5V x Number of series LEDs
UL Recognition	LUXEON XF-3535L UL recognized for Class 2 drivers. Substrate and white reflective coating UL94 V0 flammability rated.
LED Shear Force	≥ 5 kgF

Notes for Table 4:

1. Ripple current with a frequency of 50-150Hz is allowed, as long as the average of the current waveform is below 200mA/LED, and the maximum of the current waveform is lower than 240mA/LED.
2. At 10% duty cycle and pulse width 10ms.
3. Proper current de-rating must be observed to maintain junction temperature below the maximum.
4. T_s thermal contact point as defined in [Application Brief AB203](#).
5. As per UL746 rating.
6. LUXEON 3535L LEDs are not designed to be driven in reverse bias.
7. At maximum reverse current of 10µA/LED.

Mechanical Drawings and Electrical Circuit Diagrams

L235-xyyyAHLGBAAC0

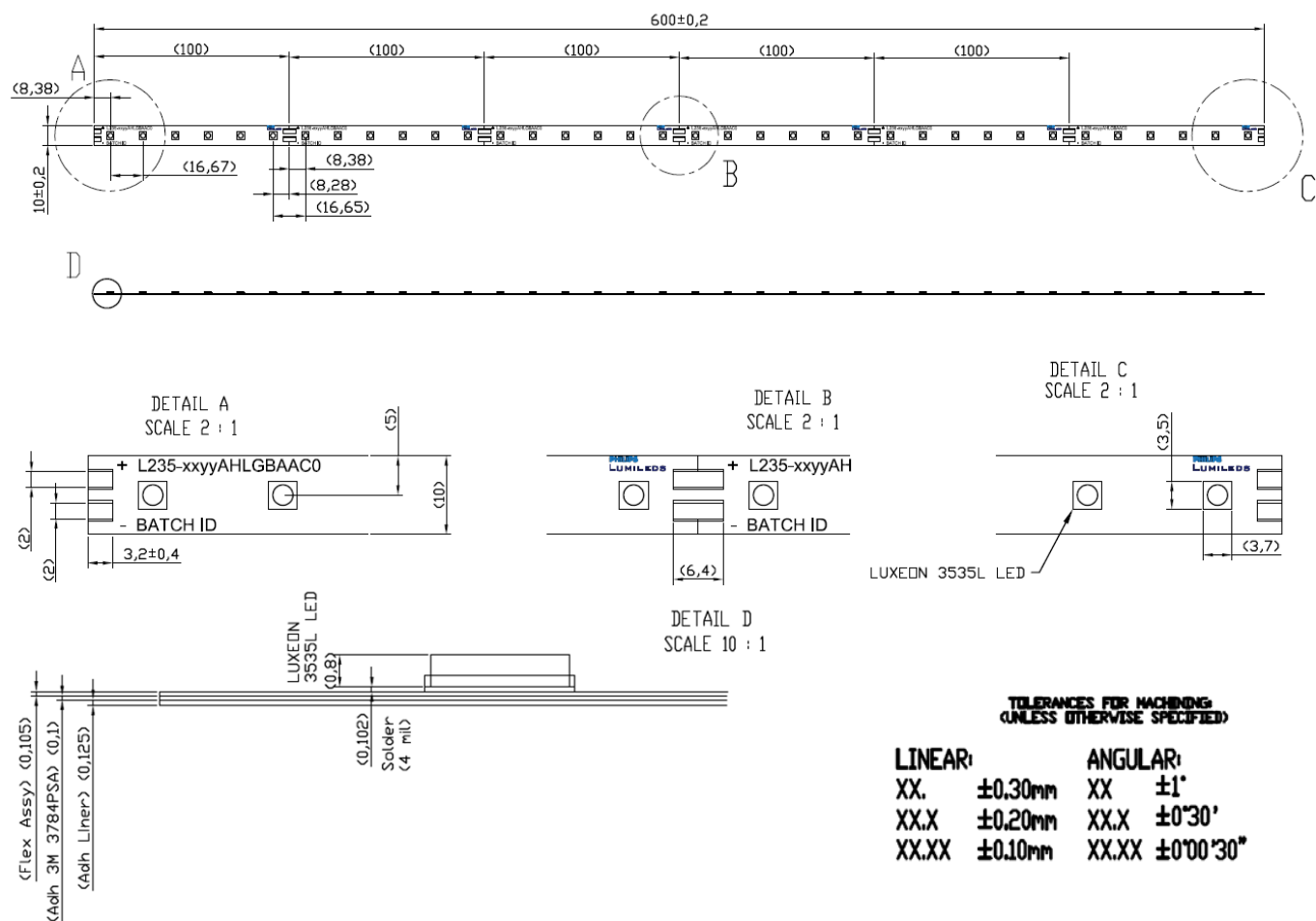


Figure 2. Mechanical drawing for L235-xyyyAHLGBAAC0.

Notes for Figure 2:
1. All dimensions in millimeters.

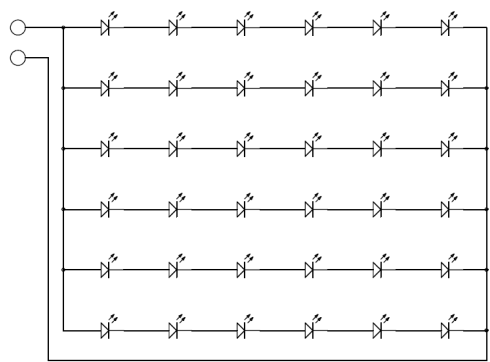


Figure 3. Electrical circuit diagram for L235-xyyyAHLGBAAC0.

L235-xyyyAHLGGBACO

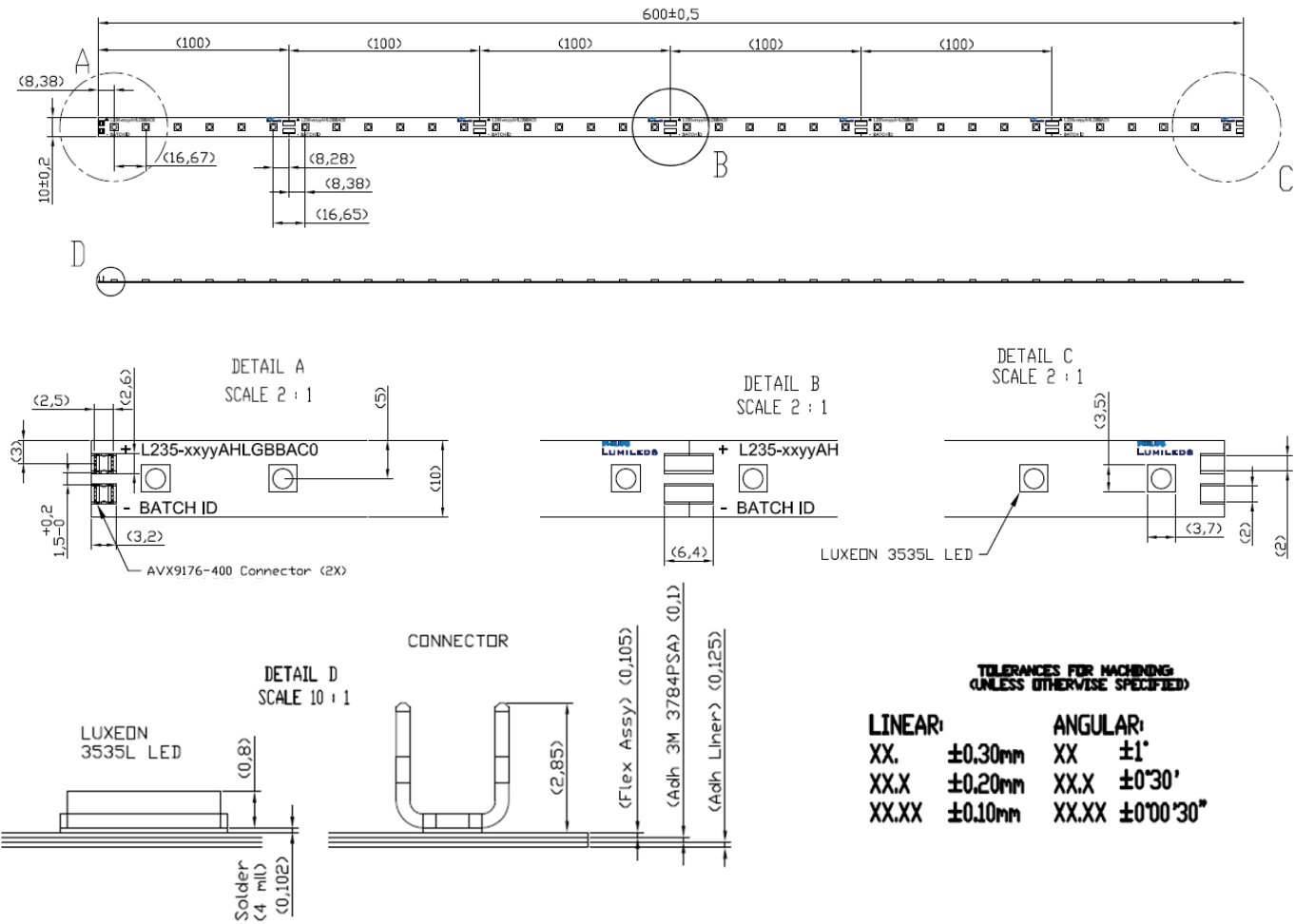


Figure 4. Mechanical drawing for L235-xyyyAHLGGBACO.

- Notes for Figure 4:
1. All dimensions in millimeters.
 2. For connector detail, refer to Figure 14.

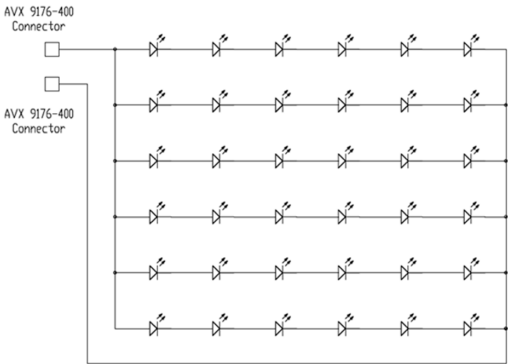


Figure 5. Electrical circuit diagram for L235-xyyyAHLGGBACO.

L235-xyyyAHL CBAACO

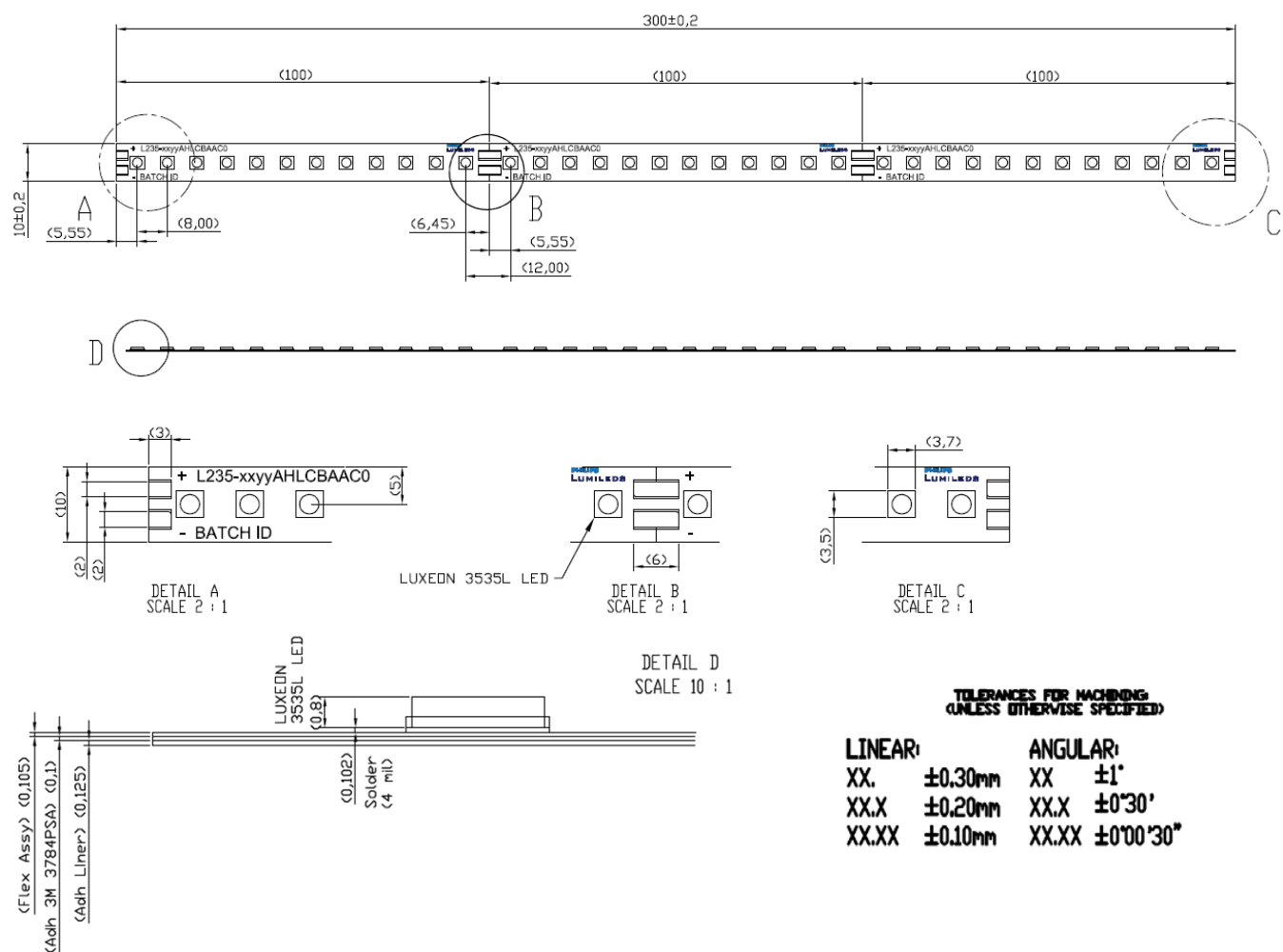


Figure 6. Mechanical drawing for L235-xyyyAHL CBAACO.

Notes for Figure 6:
1. All dimensions in millimeters.

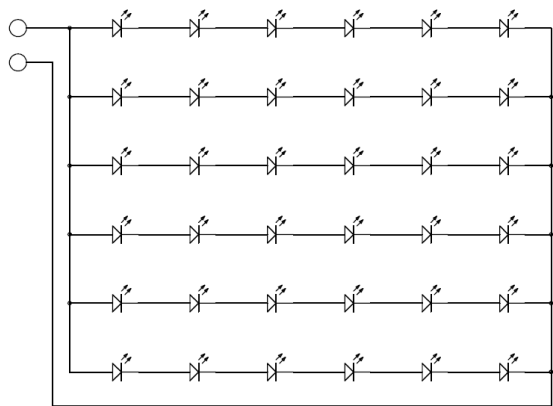


Figure 7. Electrical circuit diagram for L235-xyyyAHL CBAACO.

L235-xyyyAHLCCBBACO

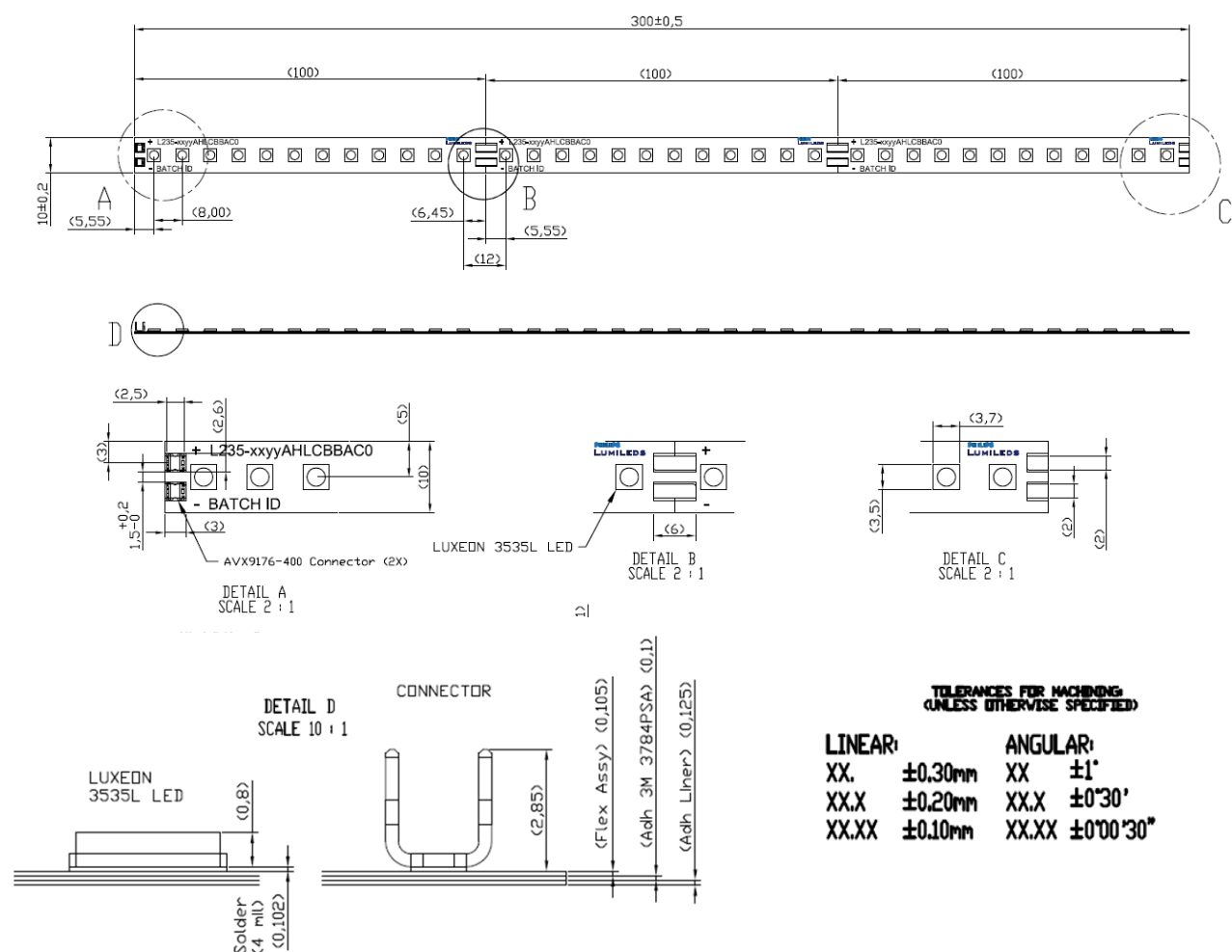


Figure 8. Mechanical drawing for L235-xyyyAHLCCBBACO.

- Notes for Figure 8:
- 1. All dimensions in millimeters.
 - 2. For connector detail, refer to Figure 14.

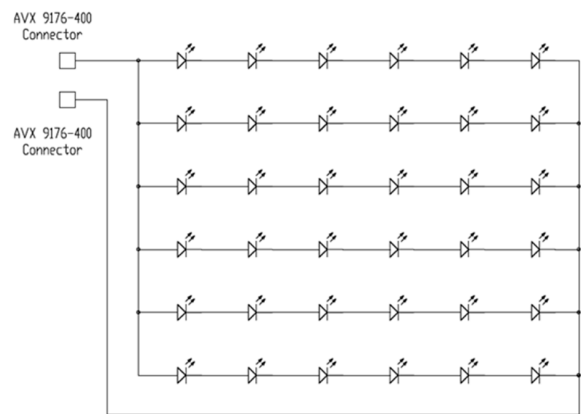


Figure 9. Electrical circuit diagram for L235-xyyyAHLCCBBACO.

L235-xyyyAMLF5WAD0

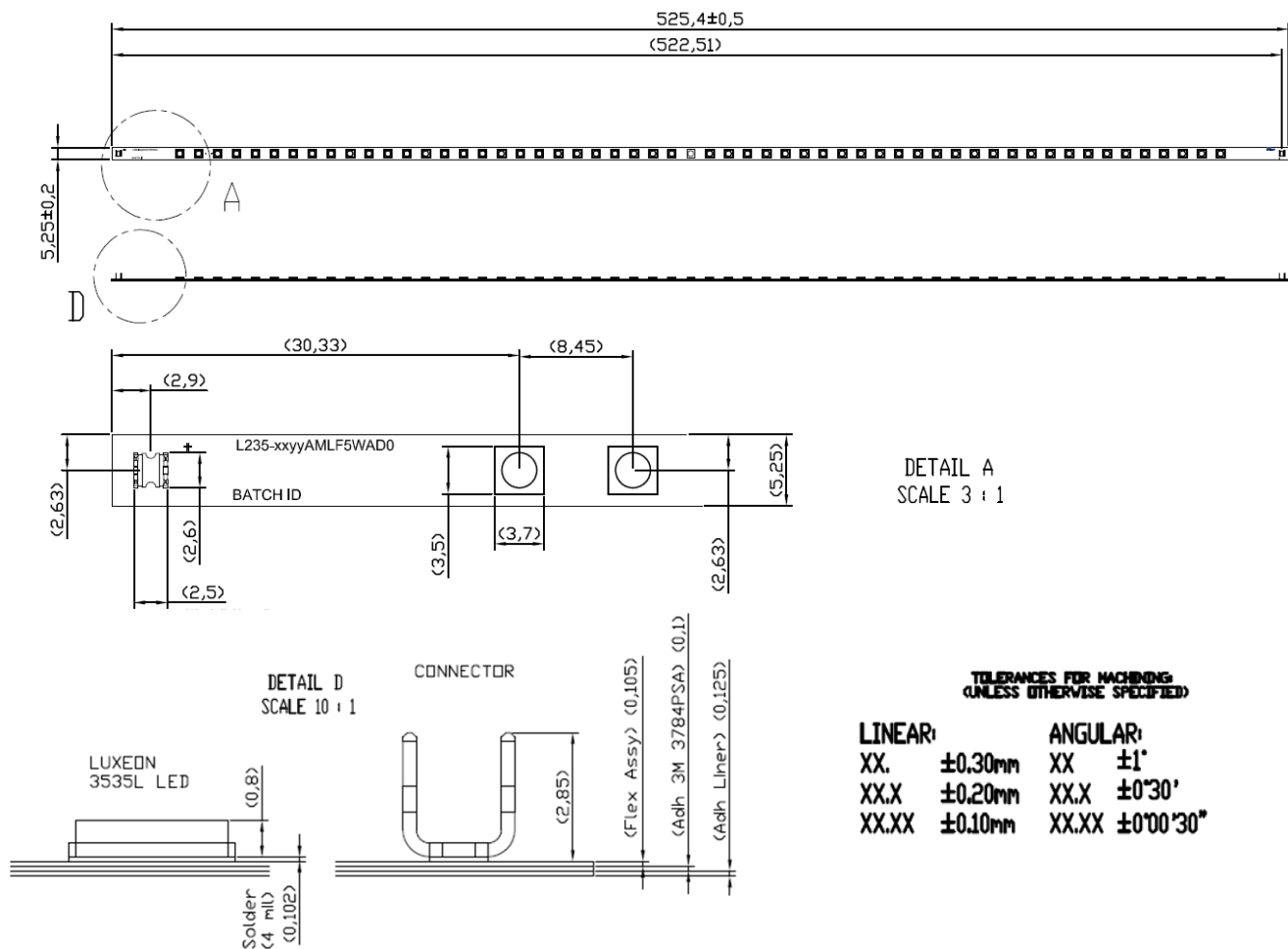


Figure 10. Mechanical drawing for L235-xyyyAMLF5WAD0.

- Notes for Figure 10:
- 1. All dimensions in millimeters.
 - 2. For connector detail, refer to Figure 14.

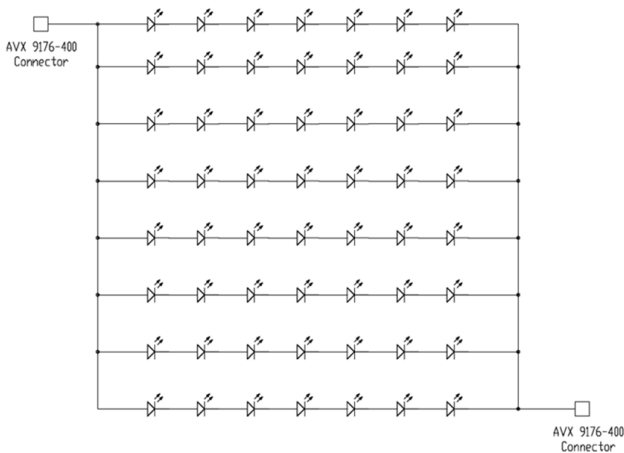


Figure 11. Electrical circuit diagram for L235-xyyyAMLF5WAD0.

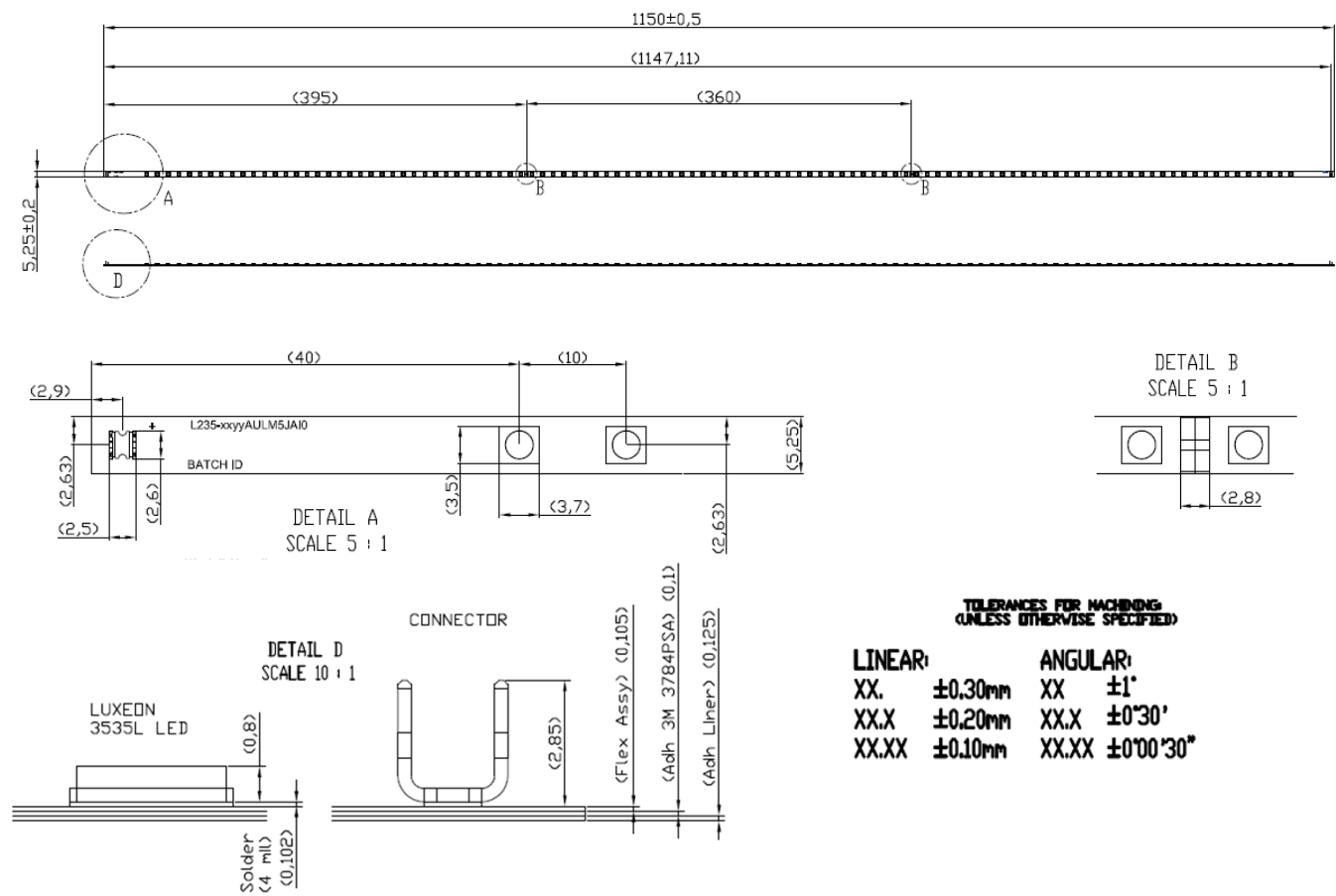


Figure 12. Mechanical drawing for L235-xyyyAULM5JAIO.

Notes for Figure 12:

1. All dimensions in millimeters.
2. For connector detail, refer to Figure 14.

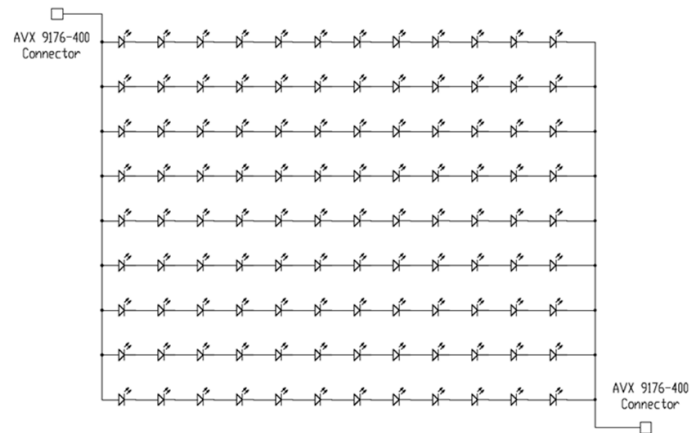


Figure 13. Electrical circuit diagram for L235-xyyyAULM5JAIO.

IDC Connector

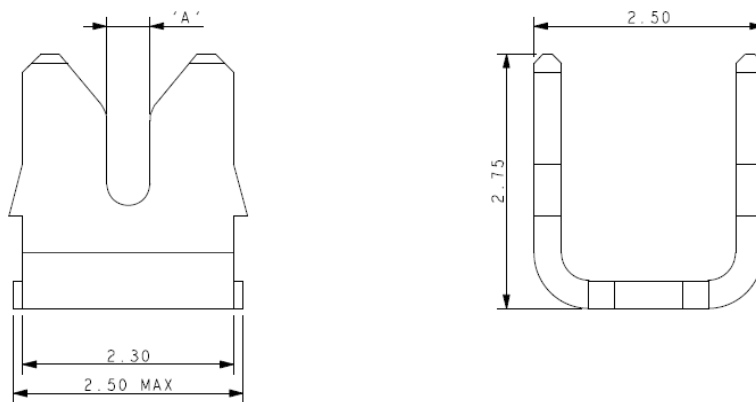


Figure 14. AVX Series 9176-400 IDC Connector.

Notes for Figure 14:

1. All dimensions in millimeters
2. Contact material: Phosphor Bronze. Contact Plating: Pure Tin.
3. Accepted Wire Gauge: 24 Gauge Solid or Stranded. Dimension 'A' = 0.37.

Assembly Precautions

The LUXEON 3535L 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.

Please refer to [Application Brief AB203](#) for more details on VOCs and other incompatible chemicals.

Tape and Reel Packaging

Pre-cut individual units delivered mechanically in tape and reel. Units joined together by small Kapton tape for easy separation.

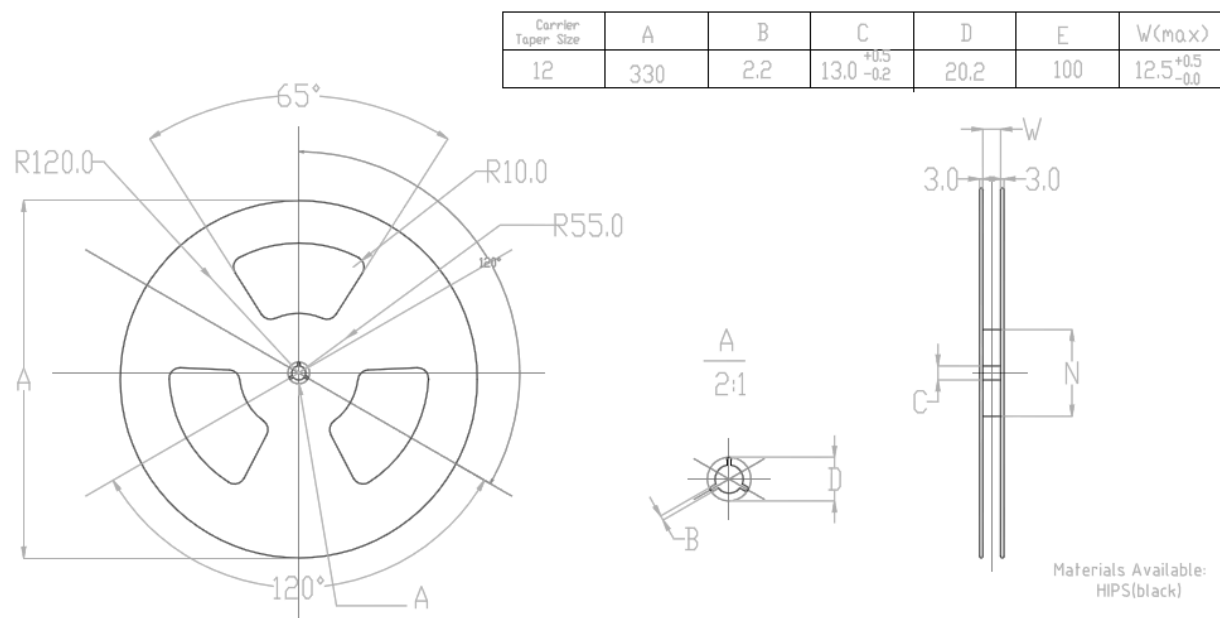


Figure 15.

All part numbers use the same reel size. The following table specifies the maximum number of units per reel for the various part numbers:

Table 5.

Part Number	Max. Units per Reel (SPI)
L235-xyyyAHLGBAAC0	100
L235-xyyyAHLCBAA0	200
L235-xyyyAHLGBBAC0	25
L235-xyyyAHLCCBBAC0	50
L235-xyyyAMLF5WAD0	25
L235-xyyyAULM5JAI0	13

LUXEON XF 3535L 5-Step MacAdam Ellipse Color Definition

Tested at 100mA/LED, Junction Temperature = 25°C

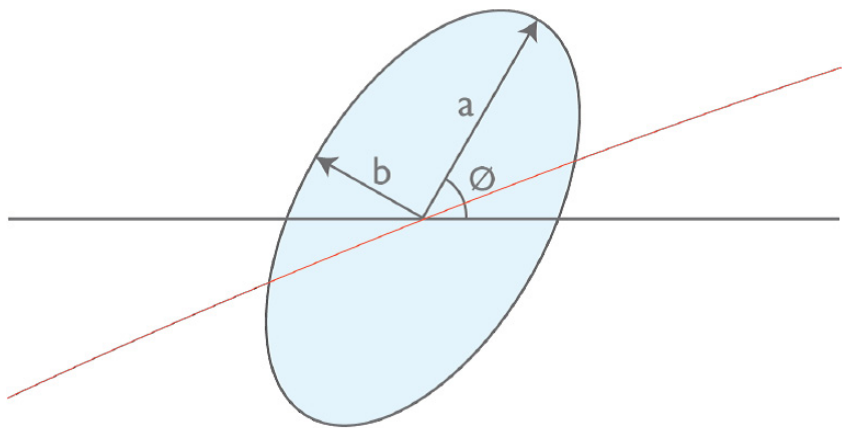


Table 6.

Nominal ANSI CCT (K)	Color Space	Center Point (cx, cy)	Major Axis, a	Minor Axis, b	Ellipse Rotation Angle
2200	Single 5-step MacAdam Ellipse	(0.5056, 0.4152)	0.01211	0.00666	50.8°
2700	Single 5-step MacAdam Ellipse	(0.4578, 0.4101)	0.01350	0.00700	53.7°
3000	Single 5-step MacAdam Ellipse	(0.4338, 0.4030)	0.01390	0.00680	53.2°
3500	Single 5-step MacAdam Ellipse	(0.4073, 0.3917)	0.01545	0.00690	54.0°
4000	Single 5-step MacAdam Ellipse	(0.3818, 0.3797)	0.01565	0.00670	53.7°
5000	Single 5-step MacAdam Ellipse	(0.3447, 0.3553)	0.01370	0.00590	59.6°
5700	Single 5-step MacAdam Ellipse	(0.3287, 0.3417)	0.01243	0.00533	59.1°

Notes for Table 6:

- 1. Philips Lumileds maintains a tolerance of ± 0.01 on color point measurements for individual LUXEON 3535L LEDs.
- 2. Individual LUXEON 3535L LEDs are tested at $T_j = 25^{\circ}\text{C}$ and $I_f = 100\text{mA}$, 20ms pulse conditions.

LUXEON XF-3535L Typical Radiation Pattern

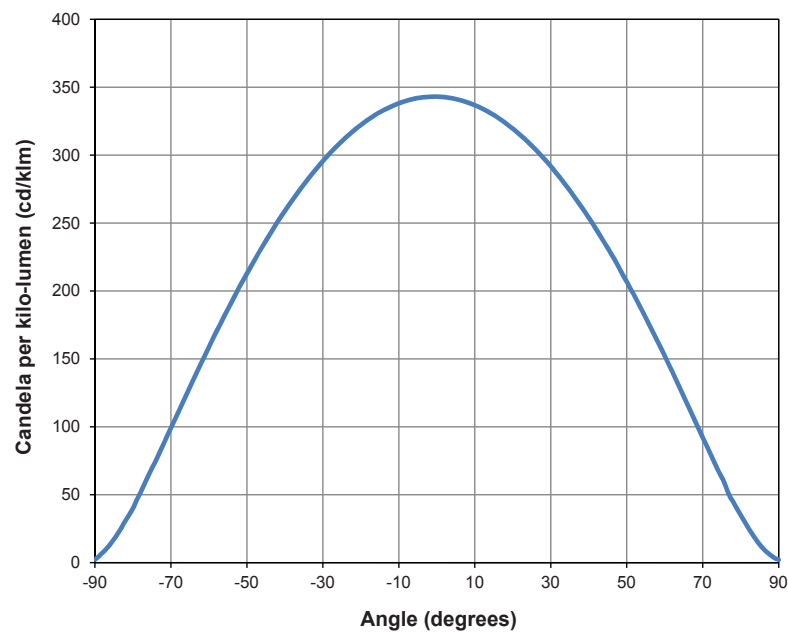


Figure 16.

LUXEON 3535L LED Color Spectrum (80 CRI)

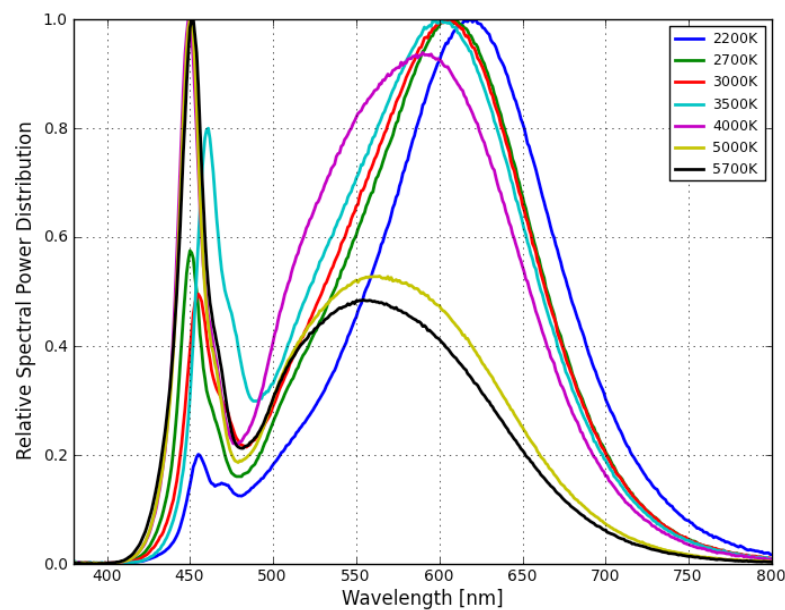


Figure 17. Typical relative intensity vs. wavelength .

Notes for Figure 17:
1. Individual LUXEON 3535L LEDs are tested at $T_j = 25^{\circ}\text{C}$ and $I_F = 100\text{mA}$, 20ms pulse conditions.

Appendix I

Flexible Substrate Material

The polyimide-based copper-clad laminate flexible substrate has very good bending stability. Recommended usage: bending radius >10mm. The base dielectric is a 1-mil-thick polyimide layer with typical dielectric strength of 5.75 kV_{DC}/mil. A high-reflectivity high-reliability white coating with reflectivity of about 90% in the visible light wavelength range is applied over the flexible substrate. This coating has a typical dielectric strength of 2.85kV_{DC}/mil.

TIM/PSA Material

LUXEON XF-3535L is included with a backside thermally conductive PSA (pressure sensitive adhesive). The backside PSA is designed to provide an improved thermal interface to the heat-sink.

LUXEON XF-3535L adhesive has a typical 4kV dielectric strength (for this 0.1mm thick-layer).

Recommended application process (Flex with backside PSA). See Application Brief for more details:

1. Use a new, lint-free swab and 50:50 mix of IPA and water to clean the mounting surface.
2. Remove the liner on the PSA.
3. Apply the tape to substrate with use of a squeegee, hand roller or finger pressure to help reduce the potential for air entrapment under the tape during its application.
4. 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 LUXEON XF-3535L for one hour at 80°C. Results may vary with different heat sink materials. Philips Lumileds recommends that customers always perform their own testing.

Connectors

The LUXEON XF-3535L is available with optional electrical connectors. See Table 2 for standard options.

There are two connectors positioned at the same end for the 10mm-wide Flex strips and two connectors at opposite ends for the 5.25-wide Flex strips.

The AVX 9176-400 Series of connectors are Insulation-Displacement Connectors that allow direct wire to board electrical connection. Manufacturer Part Number: 709176001432006.

The connectors allow the use of unstripped (insulated) wires, without soldering and can handle very high drive currents (up to 6000mA at Ta = 105°C). See ELCO Product Test Report: 202-01-034.

Accepted Wire Gauge Size is: 24 Gauge Solid or Stranded.

Optional white mating cap to cover the wire can be acquired from AVX (MPN: 609176001415100).

Who We Are

Philips Lumileds focuses on one goal: Creating the world's highest performing LEDs. The company pioneered the use of solid-state lighting in breakthrough products such as the first LED backlit TV, the first LED flash in camera phones, and the first LED daytime running lights for cars. Today we offer the most comprehensive portfolio of high quality, reliable LEDs along with uncompromising service.

Philips Lumileds brings LED's qualities of energy efficiency, digital control and long life to spotlights, downlights, high bay and low bay lighting, indoor area lighting, architectural and specialty lighting as well as retrofit lamps. Our products are engineered for optimal light quality and unprecedented efficacy at the lowest overall cost. By offering LEDs in chip and packaged form, plus infinitely configurable rigid and flex substrates, we deliver supply chain flexibility to the inventors of next generation illumination.

Philips Lumileds understands that solid state lighting is not just about energy efficiency. It is about elegant design. Reinventing form. Engineering new materials. Pioneering markets and simplifying the supply chain. It's about a shared vision. Learn more about our comprehensive portfolio of LEDs at www.philipslumileds.com.



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