LUMILEDS

ILLUMINATION

# LUXEON 3535L Line

## High efficacy in a 3535 package with full range of CCTs and CRIs

The LUXEON 3535L Line boasts the efficacy and reliability required by the indoor and outdoor illumination markets. It delivers optimized performance in combination with the Quality of Light needed for distributed light source applications in three performance levels.

In addition to offering specified correlated color temperature and color rendering combinations, LUXEON 3535L Line is available in three products:

- LUXEON 3535L – Entry Flux and Efficacy
- LUXEON 3535L HE – Medium Flux and Efficacy
- LUXEON 3535L HE Plus – High Flux and Highest Efficacy

### FEATURES AND BENEFITS

- Supports ENERGY STAR® lumen maintenance certification requirements
- Meets DLC Premium requirements
- Maximum drive current of 300mA delivers superior lumens for reduced LED count for LUXEON 3535L HE and LUXEON 3535L HE Plus
- 1/7th ANSI color binning delivers tight color control
- Enables $T_s$ points of 105°C which allows for higher board temperature
- Full range of CCTs and CRI configurations for design flexibility
- UL-recognized component [E352519]

### PRIMARY APPLICATIONS

- Architectural
- Downlights
- High Bay & Low Bay
- Indoor Area Lighting
- Lamps
- Outdoor

c UL us No. E352519

RoHS COMPLIANT

DS203 LUXEON 3535L Product Datasheet ©2017 Lumileds Holding B.V. All rights reserved.

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# General Product Information

## Product Test Conditions

LUXEON 3535L Line LEDs are tested and binned with a 20ms monopulse of 100mA at a junction temperature, $T_j$, of 25°C.

## Part Number Nomenclature

Part numbers for LUXEON 3535L and LUXEON 3535L HE follow the convention below:

M X A **B** - P W **C C** - **D E E E**

Where:

- **B** – designates minimum CRI (7=70CRI, 8=80CRI and 9=85CRI or 90CRI)
- **C C** – designates nominal ANSI CCT (22=2200K, 25=2500K, 27=2700K, 30=3000K, 35=3500K, 40=4000K, 50=5000K, 57=5700K, 65=6500K)
- **D** – designates product family in standard parts (0 or 9=LUXEON 3535L, H=LUXEON 3535L HE)
- **E E E** – designates options for detailed product specification

Therefore, the following part number is used for a LUXEON 3535L HE 3000K 80CRI:

M X A **8** - P W **3 0** - **H 0 0 1**

Part numbers for LUXEON 3535L HE Plus follow the convention below:

L 1 3 5 - **A A B B C C** 3 5 **D D D D D**

Where:

- **A A** – designates nominal ANSI CCT (27=2700K, 30=3000K, 35=3500K, 40=4000K, 50=5000K, 57=5700K, 65=6500K)
- **B B** – designates minimum CRI (70=70CRI, 80=80CRI, 90=90CRI)
- **C C** – designates options for lead frame (CA=Round Light Emitting Surface (LES), SA=Square LES)
- **D D D D D** – designates options for detailed product specification

Therefore, the following part number is used for a LUXEON 3535L HE Plus 3000K 80CRI (Round LES):

L 1 3 5 - **3 0 8 0 C A** 3 5 **0 0 0 P 1**

LUXEON 3535L Line is available in three performance levels:

- LUXEON 3535L – Entry Flux and Efficacy
- LUXEON 3535L HE – Medium Flux and Efficacy
- LUXEON 3535L HE Plus – High Flux and Highest Efficacy

## Lumen Maintenance

Please contact your local Sales Representative or Lumileds Technical Solutions Manager for more information about the long-term performance of this product.

## Environmental Compliance

Lumileds LLC is committed to providing environmentally friendly products to the solid-state lighting market. LUXEON 3535L Line is compliant to the European Union directives on the restriction of hazardous substances in electronic equipment, namely the RoHS Directive 2011/65/EU and REACH Regulation (EC) 1907/2006. Lumileds LLC will not intentionally add the following restricted materials to its products: lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE).

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# Performance Characteristics

## Product Selection Guide

**Table 1. Product performance of LUXEON 3535L Line at 100mA and 65mA, $T_j$=25°C.**

| PRODUCT | NOMINAL CCT [1] | MINIMUM CRI [2, 3] | LUMINOUS FLUX [3] (lm) | | TYPICAL LUMINOUS EFFICACY (lm/W) | TYPICAL LUMINOUS FLUX (lm) | TYPICAL LUMINOUS EFFICACY (lm/W) | PART NUMBER |
|---|---|---|---|---|---|---|---|---|
| | | | MINIMUM | TYPICAL | | | | |
| | | | 100mA | | | 65mA | | |
| LUXEON 3535L | 4000K | 70 | 40 | 49 | 161 | 33 | 176 | MXA7-PW40-0000 |
| | 5000K | 70 | 40 | 49 | 161 | 33 | 176 | MXA7-PW50-0000 |
| | 5700K | 70 | 40 | 49 | 161 | 33 | 176 | MXA7-PW57-0000 |
| | 6500K | 70 | 40 | 47 | 155 | 32 | 168 | MXA7-PW65-0000 |
| | 2200K | 80 | 28 | 33 | 109 | 22 | 117 | MXA8-PW22-0000 |
| | 2500K | 80 | 28 | 34 | 112 | 23 | 121 | MXA8-PW25-0000 |
| | 2700K | 80 | 36 | 44 | 145 | 30 | 156 | MXA8-PW27-0000 |
| | 3000K | 80 | 34 | 44 | 145 | 30 | 156 | MXA8-PW30-0000 |
| | 3500K | 80 | 34 | 44 | 145 | 30 | 156 | MXA8-PW35-0000 |
| | 4000K | 80 | 36 | 46 | 151 | 31 | 163 | MXA8-PW40-0000 |
| | 5000K | 80 | 36 | 47 | 155 | 32 | 167 | MXA8-PW50-0000 |
| | 5700K | 80 | 36 | 45 | 148 | 30 | 160 | MXA8-PW57-0000 |
| | 6500K | 80 | 36 | 45 | 148 | 30 | 160 | MXA8-PW65-0000 |
| | 2700K | 90 | 31 | 36 | 119 | 24 | 128 | MXA9-PW27-9000 |
| | 3000K | 90 | 31 | 36 | 119 | 24 | 128 | MXA9-PW30-0000 |
| | 4000K | 90 | 34 | 40 | 132 | 27 | 142 | MXA9-PW40-0000 |
| LUXEON 3535L HE | 4000K | 70 | 42 | 51 | 176 | 34 | 186 | MXA7-PW40-H001 |
| | 5000K | 70 | 42 | 51 | 176 | 34 | 186 | MXA7-PW50-H001 |
| | 5700K | 70 | 42 | 51 | 176 | 34 | 186 | MXA7-PW57-H001 |
| | 6500K | 70 | 42 | 51 | 176 | 34 | 186 | MXA7-PW65-H001 |
| | 2200K | 80 | 30 | 35 | 121 | 23 | 128 | MXA8-PW22-H001 |
| | 2500K | 80 | 30 | 36 | 125 | 24 | 132 | MXA8-PW25-H001 |
| | 2700K | 80 | 38 | 46 | 164 | 32 | 172 | MXA8-PW27-H001 |
| | 3000K | 80 | 38 | 46 | 164 | 32 | 172 | MXA8-PW30-H001 |
| | 3500K | 80 | 40 | 46 | 164 | 32 | 172 | MXA8-PW35-H001 |
| | 4000K | 80 | 42 | 52 | 183 | 33 | 190 | MXA8-PW40-H001 |
| | 5000K | 80 | 42 | 51 | 183 | 33 | 190 | MXA8-PW50-H001 |
| | 5700K | 80 | 42 | 51 | 183 | 33 | 190 | MXA8-PW57-H001 |
| | 6500K | 80 | 42 | 51 | 183 | 33 | 190 | MXA8-PW65-H001 |
| | 2700K | 90 | 32 | 37 | 128 | 25 | 135 | MXA9-PW27-H001 |
| | 3000K | 90 | 32 | 37 | 128 | 25 | 135 | MXA9-PW30-H001 |
| | 3500K | 90 | 32 | 40 | 138 | 27 | 146 | MXA9-PW35-H001 |
| | 4000K | 90 | 32 | 41 | 142 | 27 | 150 | MXA9-PW40-H001 |
| | 5000K | 90 | 32 | 41 | 142 | 27 | 150 | MXA9-PW50-H001 |
| | 5700K | 90 | 32 | 40 | 138 | 27 | 146 | MXA9-PW57-H001 |
| | 6500K | 90 | 32 | 40 | 138 | 27 | 146 | MXA9-PW65-H001 |

Notes for Table 1:
1. Correlated color temperature is based upon mounted die on highly reflective surface at $T_j$=25°C.
2. Typical CRI is approximately 2 points higher than the minimum CRI specified, but this is not guaranteed.
3. Lumileds maintains a tolerance of ±2 on CRI and ±6.5% on luminous flux measurements.

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Table 1. Product performance of LUXEON 3535L Line at 100mA and 65mA, $T_j$=25°C (continued) .

| PRODUCT | NOMINAL CCT [1] | MINIMUM CRI [2, 3] | LUMINOUS FLUX [3] (lm) | | TYPICAL LUMINOUS EFFICACY (lm/W) | TYPICAL LUMINOUS FLUX (lm) | TYPICAL LUMINOUS EFFICACY (lm/W) | PART NUMBER |
|---|---|---|---|---|---|---|---|---|
| | | | MINIMUM | TYPICAL | | | | |
| | | | 100mA | | | 65mA | | |
| LUXEON 3535L HE Plus (Round LES) | 2700K | 80 | 44 | 47 | 165 | 30 | 172 | L135-2780CA35000P1 |
| | 3000K | 80 | 44 | 47 | 165 | 30 | 172 | L135-3080CA35000P1 |
| | 3500K | 80 | 44 | 47 | 165 | 30 | 172 | L135-3580CA35000P1 |
| | 4000K | 80 | 48 | 53 | 186 | 34 | 194 | L135-4080CA35000P1 |
| | 5000K | 80 | 48 | 52 | 186 | 34 | 194 | L135-5080CA35000P1 |
| | 5700K | 80 | 48 | 52 | 186 | 34 | 194 | L135-5780CA35000P1 |
| | 6500K | 80 | 48 | 52 | 186 | 34 | 194 | L135-6580CA35000P1 |
| LUXEON 3535L HE Plus (Square LES) | 2700K | 70 | 45 | 52 | 183 | 34 | 191 | L135-2770SA35000P1 |
| | 3000K | 70 | 47 | 53 | 190 | 35 | 197 | L135-3070SA35000P1 |
| | 3500K | 70 | 48 | 54 | 193 | 36 | 203 | L135-3570SA35000P1 |
| | 4000K | 70 | 50 | 56 | 200 | 37 | 208 | L135-4070SA35000P1 |
| | 5000K | 70 | 50 | 56 | 200 | 37 | 208 | L135-5070SA35000P1 |
| | 5700K | 70 | 49 | 55 | 197 | 36 | 203 | L135-5770SA35000P1 |
| | 6500K | 70 | 49 | 55 | 197 | 36 | 203 | L135-6570SA35000P1 |
| | 2700K | 80 | 45 | 50 | 183 | 34 | 191 | L135-2780SA35000P1 |
| | 3000K | 80 | 46 | 52 | 186 | 34 | 191 | L135-3080SA35000P1 |
| | 3500K | 80 | 47 | 53 | 190 | 35 | 197 | L135-3580SA35000P1 |
| | 4000K | 80 | 48 | 54 | 193 | 36 | 203 | L135-4080SA35000P1 |
| | 5000K | 80 | 48 | 54 | 193 | 36 | 203 | L135-5080SA35000P1 |
| | 5700K | 80 | 48 | 54 | 193 | 36 | 203 | L135-5780SA35000P1 |
| | 6500K | 80 | 47 | 53 | 190 | 35 | 197 | L135-6580SA35000P1 |
| | 2700K | 90 | 38 | 43 | 154 | 28 | 158 | L135-2790SA35000P1 |
| | 3000K | 90 | 39 | 44 | 158 | 29 | 163 | L135-3090SA35000P1 |
| | 3500K | 90 | 40 | 45 | 161 | 30 | 169 | L135-3590SA35000P1 |
| | 4000K | 90 | 41 | 46 | 165 | 30 | 169 | L135-4090SA35000P1 |
| | 5000K | 90 | 41 | 46 | 165 | 30 | 169 | L135-5090SA35000P1 |
| | 5700K | 90 | 41 | 46 | 165 | 30 | 169 | L135-5790SA35000P1 |
| | 6500K | 90 | 40 | 45 | 161 | 30 | 169 | L135-6590SA35000P1 |

Notes for Table 1:
1. Correlated color temperature is based upon mounted die on highly reflective surface at $T_j$=25°C.
2. Typical CRI is approximately 2 points higher than the minimum CRI specified, but this is not guaranteed.
3. Lumileds maintains a tolerance of ±2 on CRI and ±6.5% on luminous flux measurements.

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# Optical Characteristics

**Table 2. Optical characteristics for LUXEON 3535L Line at 100mA, $T_j$=25°C.**

| PART NUMBER | TYPICAL TOTAL INCLUDED ANGLE [1] | TYPICAL VIEWING ANGLE [2] |
|---|---|---|
| MXAx-PWxx-xxxx | 140° | 115° |
| L135-xxxxxx35000P1 | 140° | 115° |

Notes for Table 2:
1. Total angle at which 90% of total luminous flux is captured.
2. Viewing angle is the off axis angle from the LED centerline where the luminous intensity is ½ of the peak value.

# Electrical and Thermal Characteristics

**Table 3. Electrical and thermal characteristics for LUXEON 3535L Line at 100mA, $T_j$=25°C.**

| PART NUMBER | FORWARD VOLTAGE [1] ($V_f$) | | | TYPICAL TEMPERATURE COEFFICIENT OF FORWARD VOLTAGE [2] (mV/°C) | TYPICAL THERMAL RESISTANCE—JUNCTION TO SOLDER PAD (°C/W) |
|---|---|---|---|---|---|
| | MINIMUM | TYPICAL | MAXIMUM | | |
| MXAx-PWxx-x000 | 2.8 | 3.0 | 3.4 | -2.0 to -4.0 | 18 |
| MXAx-PWxx-H001 | 2.7 | 2.9 | 3.2 | -2.0 to -4.0 | 16 |
| L135-xxxxxx35000P1 | 2.7 | 2.8 | 3.1 | -2.0 to -4.0 | 14 |

Notes for Table 3:
1. Lumileds maintains a tolerance of ±0.06V on forward voltage measurements.
2. Measured between 25°C and 110°C.

# Absolute Maximum Ratings

**Table 4. Absolute maximum ratings for LUXEON 3535L Line.**

| PARAMETER | MAXIMUM PERFORMANCE |
|---|---|
| DC Forward Current [1, 2] | 200mA for MXAx-PWxx-x000<br>300mA for MXAx-PWxx-H001 and L135-xxxxxx35000P1 |
| Peak Pulsed Forward Current [1, 3] | 240mA for MXAx-PWxx-x000<br>350mA for MXAx-PWxx-H001 and L135-xxxxxx35000P1 |
| LED Junction Temperature [1] (DC & Pulse) | 125°C |
| ESD Sensitivity (ANSI/ESDA/JEDEC JS-001-2012) | Class 2 |
| Operating Case Temperature [1] | -40°C to 105°C |
| LED Storage Temperature | -40°C to 105°C |
| Soldering Temperature | JEDEC 020D 260°C |
| Allowable Reflow Cycles | 3 |
| Reverse Voltage ($V_{reverse}$) | -5V |

Notes for Table 4:
1. Residual periodic variations due to power conversion from alternating current (AC) to direct current (DC), also called "ripple," are acceptable if the following conditions are met:
   – The frequency of the ripple current is 100Hz or higher
   – The average current for each cycle does not exceed the maximum allowable DC forward current
   – The maximum amplitude of the ripple does not exceed the maximum peak pulsed forward current
2. At 10% duty cycle with pulse width of 10ms.
3. Proper current derating must be observed to maintain the junction temperature below the maximum allowable junction temperature.

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# Characteristic Curves

## Spectral Power Distribution Characteristics

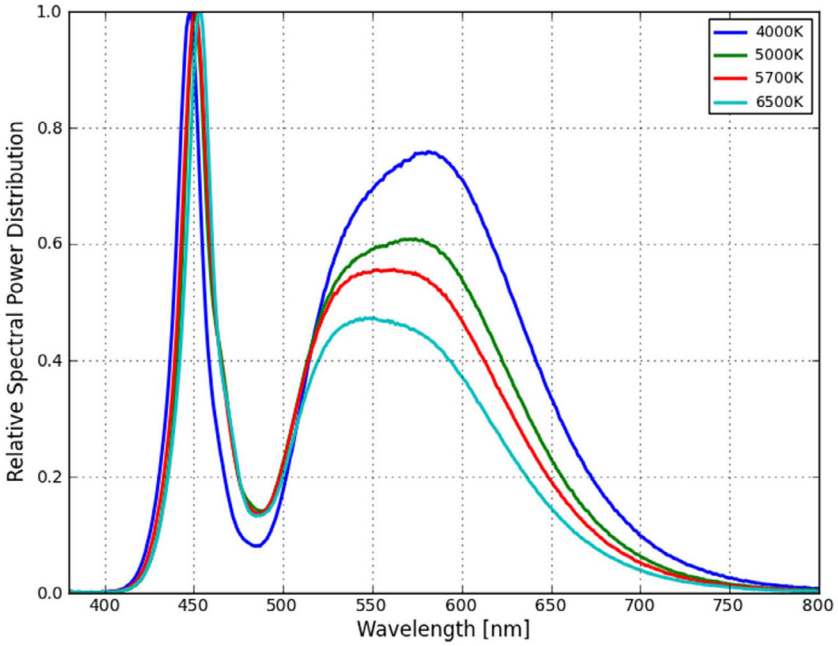


Figure 1a. Typical normalized power vs. wavelength for 70CRI LUXEON 3535L Line at 100mA, $T_j$=25°C.

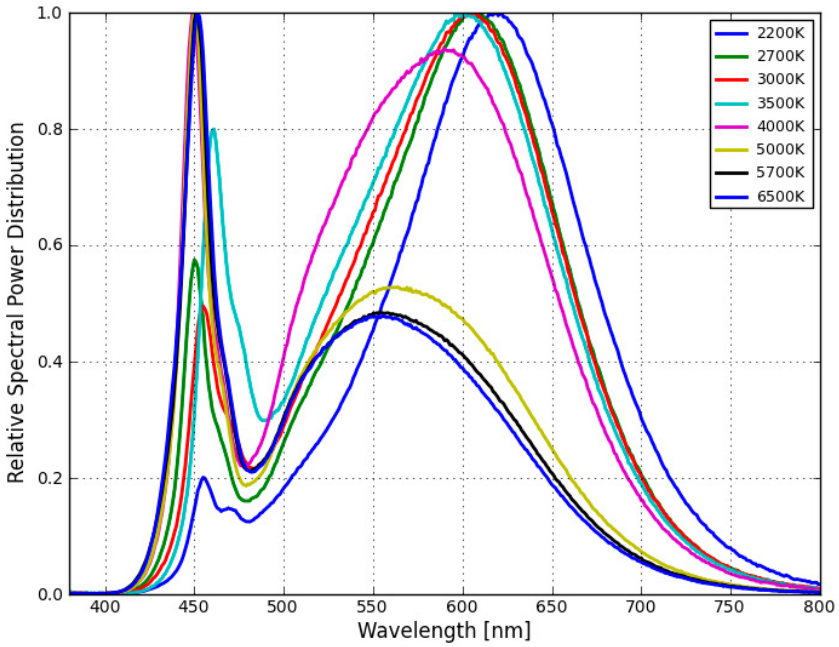


Figure 1b. Typical normalized power vs. wavelength for 80CRI LUXEON 3535L Line at 100mA, $T_j$=25°C.

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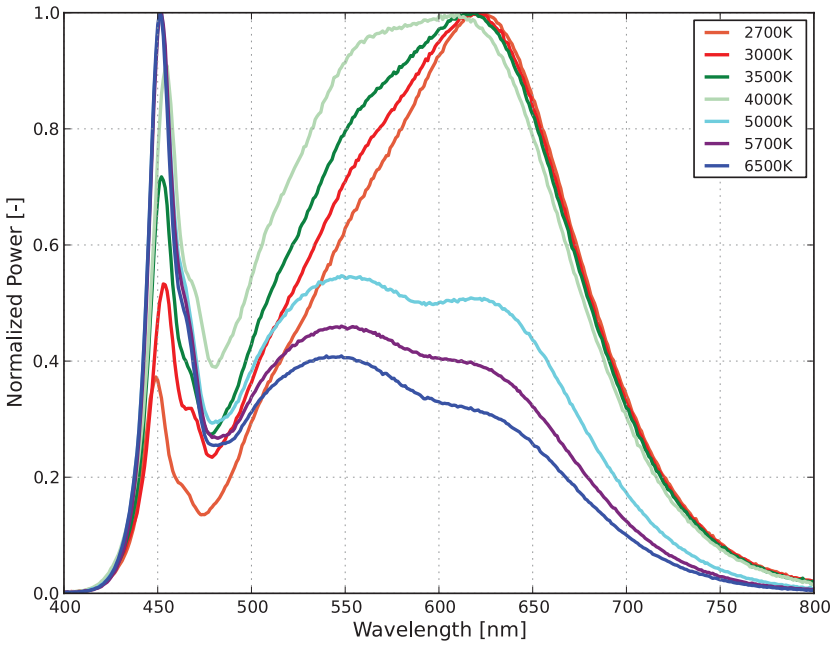


Figure 1c. Typical normalized power vs. wavelength for 90CRI LUXEON 3535L Line, except LUXEON 3535L HE Plus (Square LES), at 100mA, $T_j$=25°C.

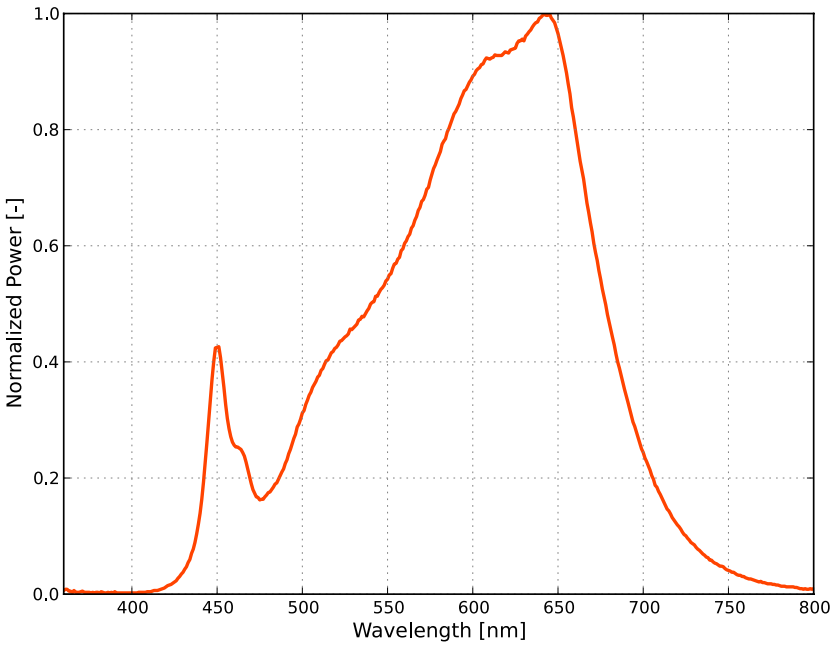


Figure 1d. Typical normalized power vs. wavelength for 90CRI LUXEON 3535L HE Plus (Square LES) only at 100mA, $T_j$=25°C.

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# Light Output Characteristics

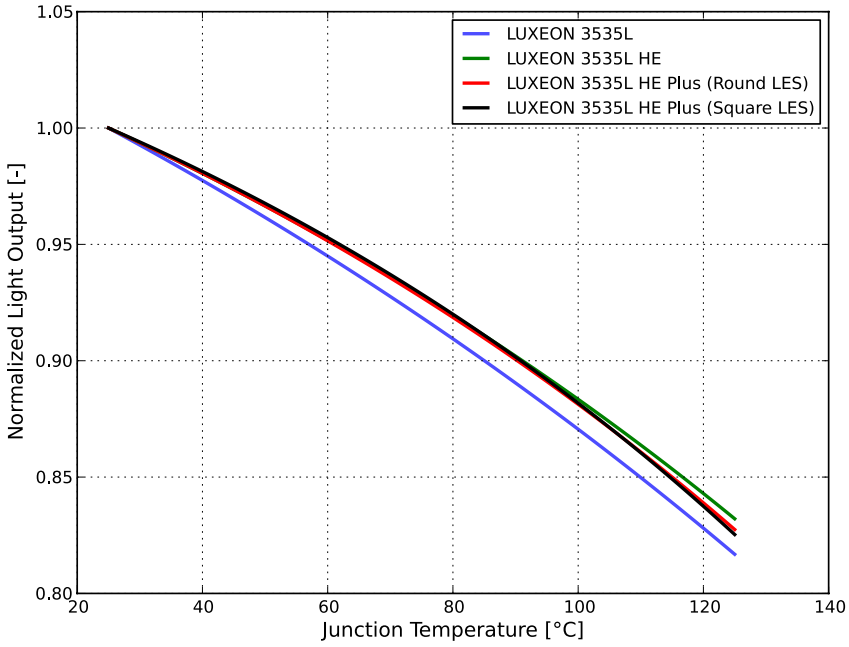


Figure 2. Typical normalized light output vs. junction temperature for LUXEON 3535L Line at 100mA.

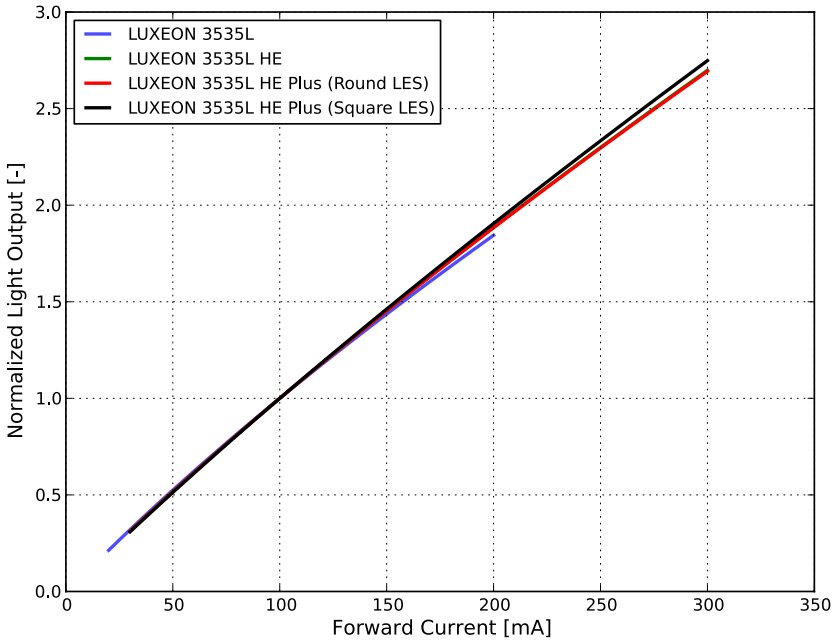


Figure 3. Typical normalized light output vs. forward current for LUXEON 3535L Line at $T_j$=25°C.

# Forward Current Characteristics

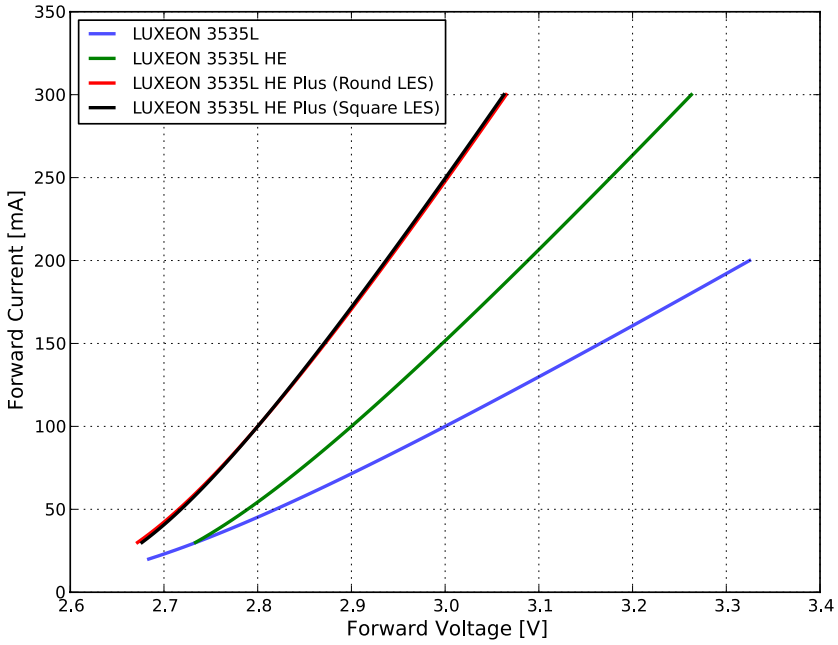


**Figure 4. Typical forward current vs. forward voltage for LUXEON 3535L Line at $T_j$=25°C.**

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# Radiation Pattern Characteristics

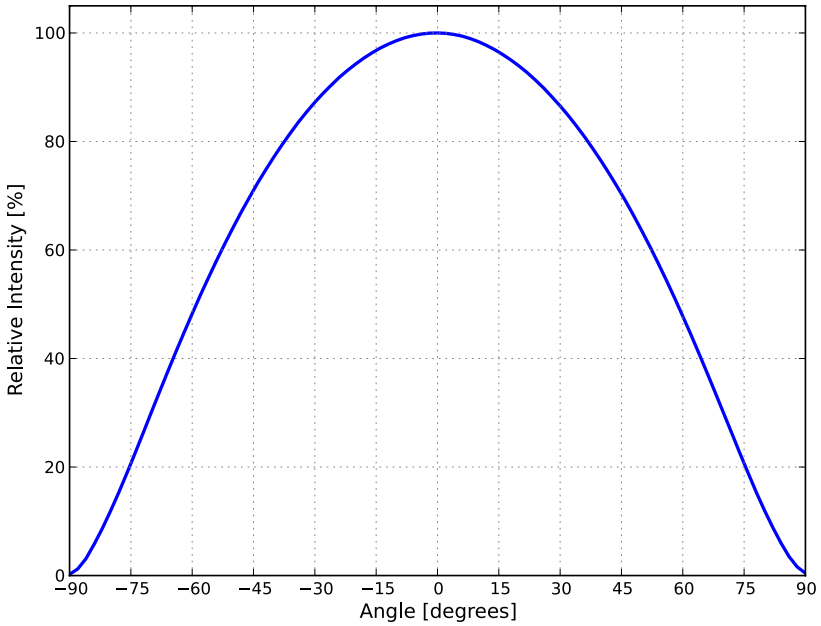


Figure 5. Typical radiation pattern for LUXEON 3535L Line at 100mA, $T_j$=25ºC.

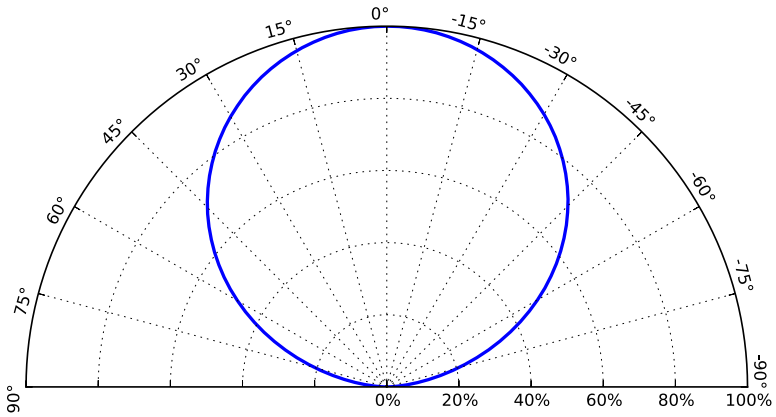


Figure 6. Typical polar radiation pattern for LUXEON 3535L Line at 100mA, $T_j$=25ºC.

# Product Bin and Labeling Definitions

## Decoding Product Bin Labeling

In the manufacturing of semiconductor products, there are variations in performance around the average values given in the technical datasheet. For this reason, Lumileds bins LED components for luminous flux or radiometric power, color point, peak or dominant wavelength and forward voltage.

LUXEON 3535L Line LEDs are labeled using a 4 or 5-digit alphanumeric CAT code following the format below:

**A B C D** or **A x B C D**

Where:

- **A** – designates luminous flux bin (example: M=36 to 40 lumens, R=48 to 52 lumens)
- **x** – designates internal Lumileds code
- **B C** – designates color bin (example: 7Z, 71, 72, 73, 74, 75, 76 for 3000K parts)
- **D** – designates forward voltage bin (example: S=2.70 to 2.80V, T=2.80 to 2.90V)

Therefore, a LUXEON 3535L HE with a lumen range of 36 to 40, color bin of 7Z and a forward voltage range of 2.80 to 2.90V has the following CAT code:

**M 7 Z T**

## Luminous Flux Bins

Table 5 lists the standard photometric luminous flux bins for LUXEON 3535L Line emitters. Although several bins are outlined, product availability in a particular bin varies by production run and by product performance. Not all bins are available in all CCTs.

**Table 5. Luminous flux bin definitions for LUXEON 3535L Line.**

| BIN | LUMINOUS FLUX [1] (lm) | |
|---|---|---|
| | MINIMUM | MAXIMUM |
| J | 24 | 28 |
| K | 28 | 32 |
| L | 32 | 36 |
| M | 36 | 40 |
| P | 40 | 44 |
| Q | 44 | 48 |
| R | 48 | 52 |
| S | 52 | 56 |
| T | 56 | 60 |
| U | 60 | 64 |

Notes for Table 5:
1. Lumileds maintains a tolerance of ±6.5% on luminous flux measurements.

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# Color Bin Definitions

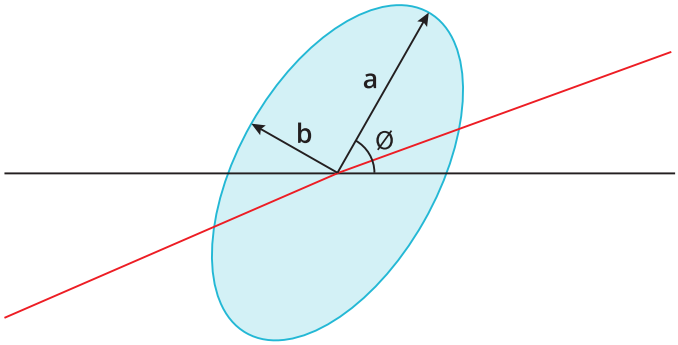


Figure 7. 3- and 5-step MacAdam ellipse illustration for Tables 6a-6i.

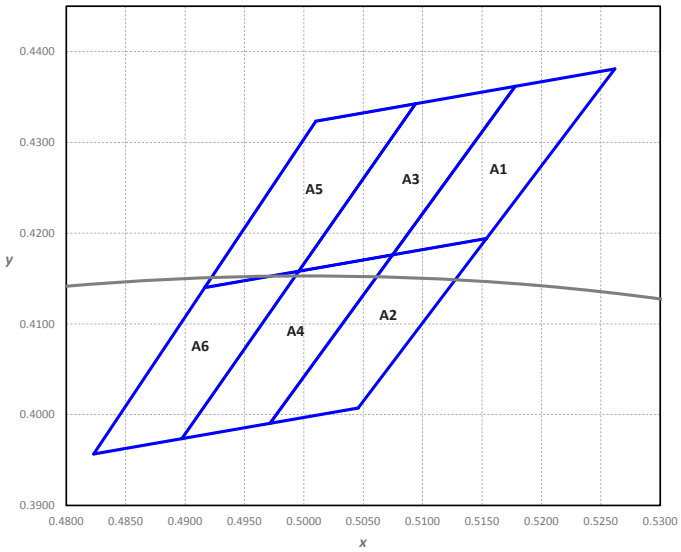


Figure 8a. Color bin structure for LUXEON 3535L Line 2200K.

Table 6a. Color bin definitions for LUXEON 3535L Line for MXAx-PW22-xxxx.

| BIN | x | y | BIN | x | y |
|---|---|---|---|---|---|
| A1 | 0.5178 | 0.4362 | A4 | 0.4996 | 0.4158 |
| | 0.5262 | 0.4381 | | 0.5075 | 0.4176 |
| | 0.5154 | 0.4194 | | 0.4972 | 0.3990 |
| | 0.5075 | 0.4176 | | 0.4897 | 0.3974 |
| A2 | 0.5075 | 0.4176 | A5 | 0.5010 | 0.4323 |
| | 0.5154 | 0.4194 | | 0.5094 | 0.4343 |
| | 0.5046 | 0.4007 | | 0.4996 | 0.4158 |
| | 0.4972 | 0.3990 | | 0.4917 | 0.4140 |
| A3 | 0.5094 | 0.4343 | A6 | 0.4917 | 0.4140 |
| | 0.5178 | 0.4362 | | 0.4996 | 0.4158 |
| | 0.5075 | 0.4176 | | 0.4897 | 0.3974 |
| | 0.4996 | 0.4158 | | 0.4823 | 0.3957 |

Notes for Table 6a:
1. Lumileds maintains a tolerance of ±0.007 on x and y coordinates in the CIE 1931 color space.
2. Tested and binned at 25ºC and $I_f$=100mA.

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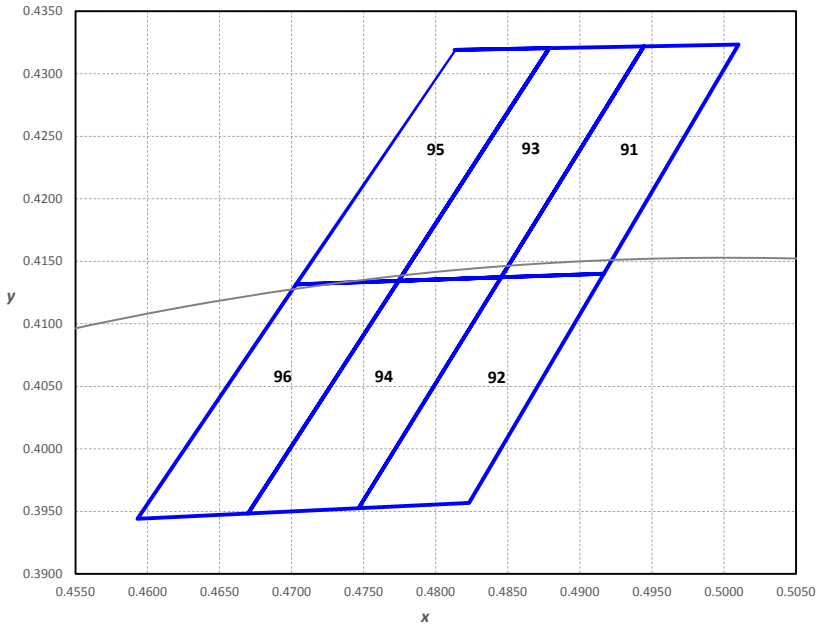


Figure 8b. Color bin structure for LUXEON 3535L Line 2500K.

Table 6b. Color bin definitions for LUXEON 3535L Line for MXAx-PW25-xxxx.

| BIN | x | y | BIN | x | y |
|---|---|---|---|---|---|
| 91 | 0.4944 | 0.4322 | 94 | 0.4774 | 0.4134 |
| | 0.5010 | 0.4323 | | 0.4845 | 0.4137 |
| | 0.4917 | 0.4140 | | 0.4746 | 0.3952 |
| | 0.4845 | 0.4137 | | 0.4670 | 0.3948 |
| 92 | 0.4845 | 0.4137 | 95 | 0.4813 | 0.4319 |
| | 0.4917 | 0.4140 | | 0.4879 | 0.4320 |
| | 0.4823 | 0.3957 | | 0.4774 | 0.4134 |
| | 0.4746 | 0.3952 | | 0.4703 | 0.4132 |
| 93 | 0.4879 | 0.4320 | 96 | 0.4703 | 0.4132 |
| | 0.4944 | 0.4322 | | 0.4774 | 0.4134 |
| | 0.4845 | 0.4137 | | 0.4670 | 0.3948 |
| | 0.4774 | 0.4134 | | 0.4593 | 0.3944 |

Notes for Table 6b:
1. Lumileds maintains a tolerance of ±0.007 on x and y coordinates in the CIE 1931 color space.
2. Tested and binned at 25ºC and $I_f$=100mA.

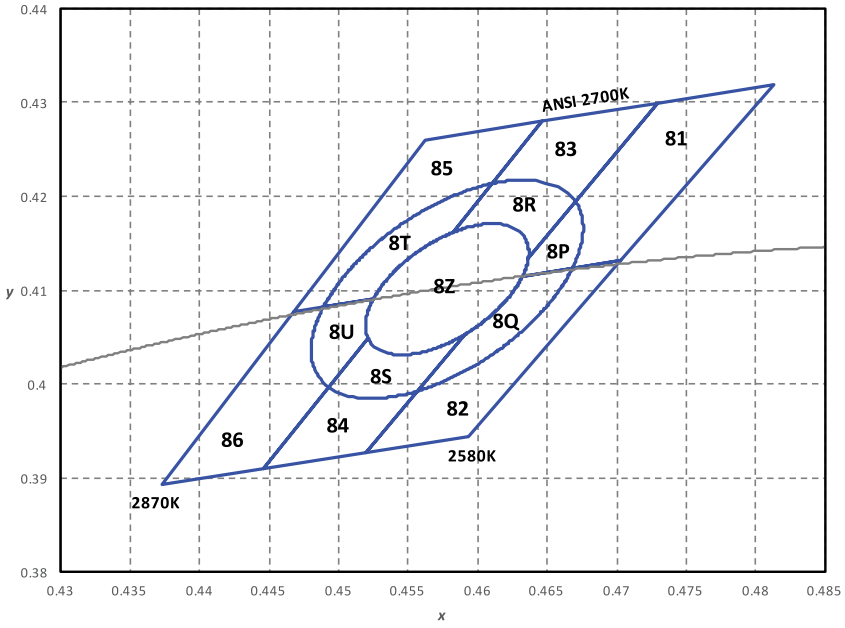


Figure 8c. Color bin structure for LUXEON 3535L Line 2700K.

Table 6c-1. Color bin definitions for LUXEON 3535L Line for MXAx-PW27-xxxx and L135-27xxxx35000P1.

| BIN | x | y | BIN | x | y |
|---|---|---|---|---|---|
| 81 | 0.4625 | 0.4113 | 84 | 0.4446 | 0.3910 |
| | 0.4729 | 0.4299 | | 0.4546 | 0.4095 |
| | 0.4813 | 0.4319 | | 0.4625 | 0.4113 |
| | 0.4703 | 0.4132 | | 0.4520 | 0.3927 |
| 82 | 0.4520 | 0.3927 | 85 | 0. 4468 | 0.4077 |
| | 0.4625 | 0.4113 | | 0. 4562 | 0.4260 |
| | 0.4703 | 0.4132 | | 0.4646 | 0.4280 |
| | 0.4593 | 0.3944 | | 0.4546 | 0.4095 |
| 83 | 0.4546 | 0.4095 | 86 | 0.4373 | 0.3893 |
| | 0.4646 | 0.4280 | | 0.4468 | 0.4077 |
| | 0.4729 | 0.4299 | | 0.4546 | 0.4095 |
| | 0.4625 | 0.4113 | | 0.4446 | 0.3910 |

Table 6c-2. 3- and 5-step MacAdam ellipse color bin definitions for MXAx-PW27-xxxx and L135-27xxxx35000P1.

| NOMINAL CCT | COLOR SPACE | CENTER POINT (cx, cy) | MAJOR AXIS, a | MINOR AXIS, b | ELLIPSE ROTATION ANGLE, θ |
|---|---|---|---|---|---|
| 2700K | Single 3-Step MacAdam ellipse | (0.4578, 0.4101) | 0.0081 | 0.0042 | 53.70° |
| 2700K | Single 5-Step MacAdam ellipse [3] | (0.4578, 0.4101) | 0.0135 | 0.0070 | 53.70° |

Notes for Tables 6c-1 and 6c-2:
1. Lumileds maintains a tolerance of ±0.007 on x and y coordinates in the CIE 1931 color space.
2. Tested and binned at 25ºC and $I_f$=100mA.

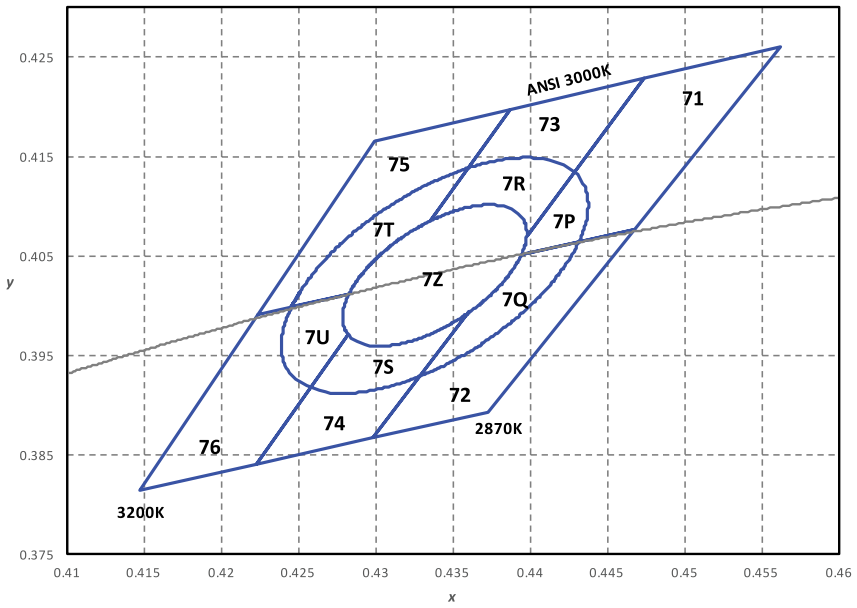


Figure 8d. Color bin structure for LUXEON 3535L Line 3000K.

Table 6d-1. Color bin definitions for LUXEON 3535L Line for MXAx-PW30-xxxx and L135-30xxxx35000P1.

| BIN | x | y | BIN | x | y |
|---|---|---|---|---|---|
| 71 | 0.4386 | 0.4048 | 74 | 0.4222 | 0.3840 |
| | 0.4474 | 0.4228 | | 0.4305 | 0.4019 |
| | 0.4562 | 0.4260 | | 0.4386 | 0.4048 |
| | 0.4468 | 0.4077 | | 0.4298 | 0.3867 |
| 72 | 0.4298 | 0.3867 | 75 | 0.4223 | 0.3990 |
| | 0.4386 | 0.4048 | | 0.4299 | 0.4165 |
| | 0.4468 | 0.4077 | | 0.4387 | 0.4197 |
| | 0.4373 | 0.3893 | | 0.4305 | 0.4019 |
| 73 | 0.4305 | 0.4019 | 76 | 0.4147 | 0.3814 |
| | 0.4387 | 0.4197 | | 0.4223 | 0.3990 |
| | 0.4474 | 0.4228 | | 0.4305 | 0.4019 |
| | 0.4386 | 0.4048 | | 0.4222 | 0.3840 |

Table 6d-2. 3- and 5-step MacAdam ellipse color bin definitions for MXAx-PW30-xxxx and L135-30xxxx35000P1.

| NOMINAL CCT | COLOR SPACE | CENTER POINT (cx, cy) | MAJOR AXIS, a | MINOR AXIS, b | ELLIPSE ROTATION ANGLE, θ |
|---|---|---|---|---|---|
| 3000K | Single 3-Step MacAdam ellipse | (0.4338, 0.4030) | 0.00834 | 0.00408 | 53.22° |
| 3000K | Single 5-Step MacAdam ellipse [3] | (0.4338, 0.4030) | 0.01390 | 0.00680 | 53.22° |

Notes for Tables 6d-1 and 6d-2:
1. Lumileds maintains a tolerance of ±0.007 on x and y coordinates in the CIE 1931 color space.
2. Tested and binned at 25ºC and $I_F$=100mA.

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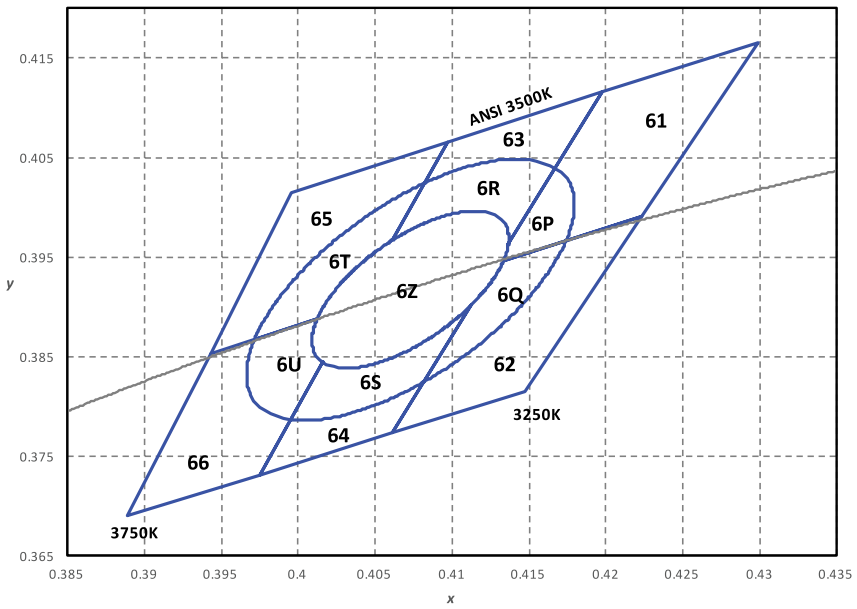


Figure 8e. Color bin structure for LUXEON 3535L Line 3500K.

Table 6e-1. Color bin definitions for LUXEON 3535L Line for MXAx-PW35-xxxx and L135-35xxxx35000P1.

| BIN | x | y | BIN | x | y |
|---|---|---|---|---|---|
| 61 | 0.4130 | 0.3944 | 64 | 0.3975 | 0.3731 |
| | 0.4198 | 0.4115 | | 0.4036 | 0.3898 |
| | 0.4299 | 0.4165 | | 0.4130 | 0.3944 |
| | 0.4223 | 0.3990 | | 0.4061 | 0.3773 |
| 62 | 0.4061 | 0.3773 | 65 | 0.3943 | 0.3853 |
| | 0.4130 | 0.3944 | | 0.3996 | 0.4015 |
| | 0.4223 | 0.3990 | | 0.4097 | 0.4065 |
| | 0.4147 | 0.3814 | | 0.4036 | 0.3898 |
| 63 | 0.4036 | 0.3898 | 66 | 0.3889 | 0.3690 |
| | 0.4097 | 0.4065 | | 0.3943 | 0.3853 |
| | 0.4198 | 0.4115 | | 0.4036 | 0.3898 |
| | 0.4130 | 0.3944 | | 0.3975 | 0.3731 |

Table 6e-2. 3- and 5-step MacAdam ellipse color bin definitions for MXAx-PW35-xxxx and L135-35xxxx35000P1.

| NOMINAL CCT | COLOR SPACE | CENTER POINT (cx, cy) | MAJOR AXIS, a | MINOR AXIS, b | ELLIPSE ROTATION ANGLE, θ |
|---|---|---|---|---|---|
| 3500K | Single 3-Step MacAdam Ellipse | (0.4073, 0.3917) | 0.00927 | 0.00414 | 54.00° |
| 3500K | Single 5-Step MacAdam ellipse [3] | (0.4073, 0.3917) | 0.01545 | 0.00690 | 54.00° |

Notes for Tables 6e-1 and 6e-2:
1. Lumileds maintains a tolerance of ±0.007 on x and y coordinates in the CIE 1931 color space.
2. Tested and binned at 25ºC and $I_f$=100mA.

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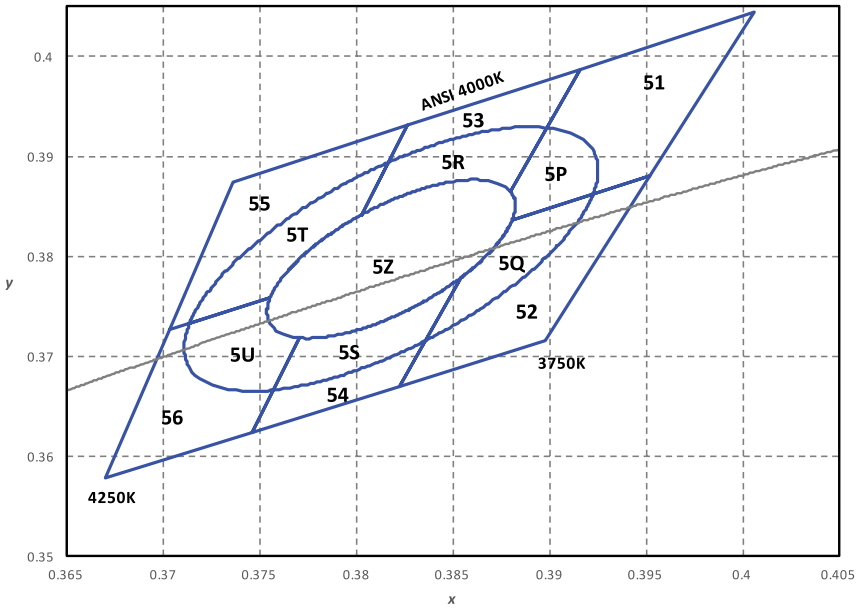


Figure 8f. Color bin structure for LUXEON 3535L Line 4000K.

Table 6f-1. Color bin definitions for LUXEON 3535L Line for MXAx-PW40-xxxx and L135-40xxxx35000P1.

| BIN | x | y | BIN | x | y |
|---|---|---|---|---|---|
| 51 | 0.3869 | 0.3829 | 54 | 0.3746 | 0.3624 |
| | 0.3916 | 0.3987 | | 0.3786 | 0.3777 |
| | 0.4006 | 0.4044 | | 0.3869 | 0.3829 |
| | 0.3952 | 0.3880 | | 0.3822 | 0.3670 |
| 52 | 0.3822 | 0.3670 | 55 | 0.3703 | 0.3726 |
| | 0.3869 | 0.3829 | | 0.3736 | 0.3874 |
| | 0.3952 | 0.3880 | | 0.3826 | 0.3931 |
| | 0.3898 | 0.3716 | | 0.3786 | 0.3777 |
| 53 | 0.3786 | 0.3777 | 56 | 0.3670 | 0.3578 |
| | 0.3826 | 0.3931 | | 0.3703 | 0.3726 |
| | 0.3916 | 0.3987 | | 0.3786 | 0.3777 |
| | 0.3869 | 0.3829 | | 0.3746 | 0.3624 |

Table 6f-2. 3- and 5-step MacAdam ellipse color bin definitions for MXAx-PW40-xxxx and L135-40xxxx35000P1.

| NOMINAL CCT | COLOR SPACE | CENTER POINT (cx, cy) | MAJOR AXIS, a | MINOR AXIS, b | ELLIPSE ROTATION ANGLE, θ |
|---|---|---|---|---|---|
| 4000K | Single 3-Step MacAdam ellipse | (0.3818, 0.3797) | 0.00939 | 0.00402 | 53.72° |
| 4000K | Single 5-Step MacAdam ellipse [3] | (0.3818, 0.3797) | 0.01565 | 0.00670 | 53.72° |

Notes for Tables 6f-1 and 6f-2:
1. Lumileds maintains a tolerance of ±0.007 on x and y coordinates in the CIE 1931 color space.
2. Tested and binned at 25ºC and $I_f$=100mA.

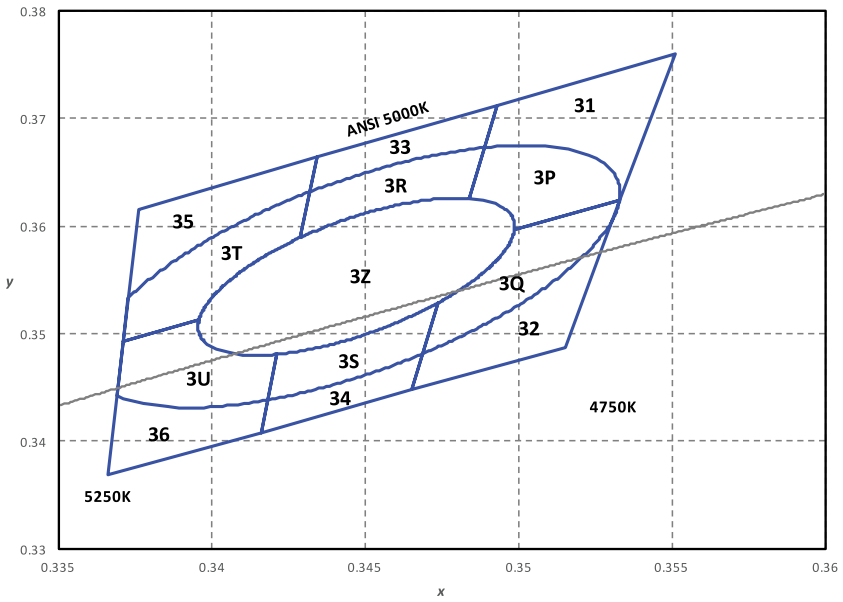


Figure 8g. Color bin structure for LUXEON 3535L Line 5000K.

Table 6g-1. Color bin definitions for LUXEON 3535L Line for MXAx-PW50-xxxx and L135-50xxxx35000P1.

| BIN | x | y | BIN | x | y |
|---|---|---|---|---|---|
| 31 | 0.3479 | 0.3580 | 34 | 0.3416 | 0.3408 |
| | 0.3493 | 0.3712 | | 0.3425 | 0.3536 |
| | 0.3551 | 0.3760 | | 0.3479 | 0.3580 |
| | 0.3533 | 0.3624 | | 0.3465 | 0.3448 |
| 32 | 0.3465 | 0.3448 | 35 | 0.3371 | 0.3493 |
| | 0.3479 | 0.3580 | | 0.3376 | 0.3616 |
| | 0.3533 | 0.3624 | | 0.3434 | 0.3664 |
| | 0.3515 | 0.3487 | | 0.3425 | 0.3536 |
| 33 | 0.3425 | 0.3536 | 36 | 0.3366 | 0.3369 |
| | 0.3434 | 0.3664 | | 0.3371 | 0.3493 |
| | 0.3493 | 0.3712 | | 0.3425 | 0.3536 |
| | 0.3479 | 0.3580 | | 0.3416 | 0.3408 |

Table 6g-2. 3- and 5-step MacAdam ellipse color bin definitions for MXAx-PW50-xxxx and L135-50xxxx35000P1.

| NOMINAL CCT | COLOR SPACE | CENTER POINT (cx, cy) | MAJOR AXIS, a | MINOR AXIS, b | ELLIPSE ROTATION ANGLE, θ |
|---|---|---|---|---|---|
| 5000K | Single 3-Step MacAdam ellipse | (0.3447, 0.3553) | 0.00822 | 0.00354 | 59.62° |
| 5000K | Single 5-Step MacAdam ellipse [3] | (0.3447, 0.3553) | 0.01370 | 0.00590 | 59.62° |

Notes for Tables 6g-1 and 6g-2:
1. Lumileds maintains a tolerance of ±0.007 on x and y coordinates in the CIE 1931 color space.
2. Tested and binned at 25ºC and $I_f$=100mA.

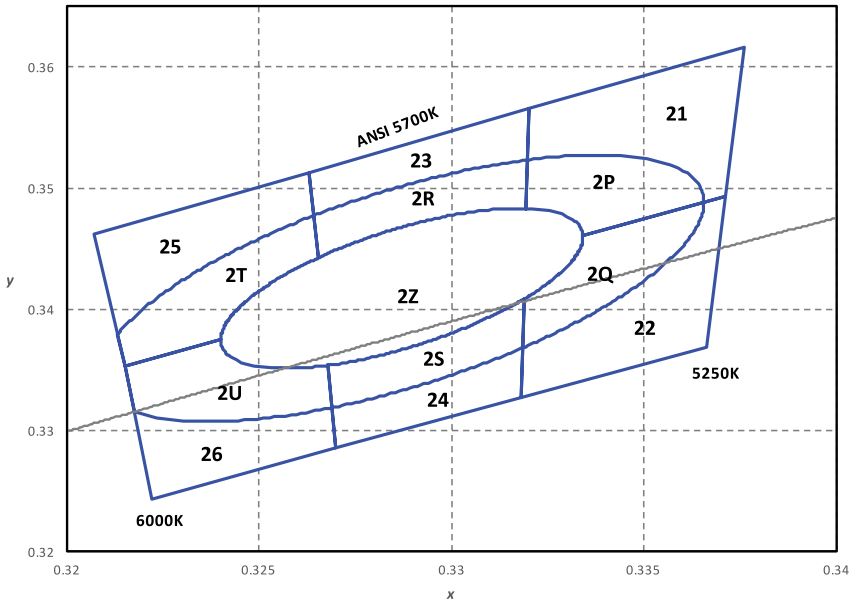


Figure 8h. Color bin structure for LUXEON 3535L Line 5700K.

Table 6h-1. Color bin definitions for LUXEON 3535L Line for MXAx-PW57-xxxx and L135-57xxxx35000P1.

| BIN | x | y | BIN | x | y |
|---|---|---|---|---|---|
| 21 | 0.3319 | 0.3446 | 24 | 0.3270 | 0.3285 |
| | 0.3320 | 0.3565 | | 0.3267 | 0.3399 |
| | 0.3376 | 0.3616 | | 0.3319 | 0.3446 |
| | 0.3371 | 0.3493 | | 0.3318 | 0.3327 |
| 22 | 0.3318 | 0.3327 | 25 | 0.3215 | 0.3353 |
| | 0.3319 | 0.3446 | | 0.3207 | 0.3462 |
| | 0.3371 | 0.3493 | | 0.3263 | 0.3513 |
| | 0.3366 | 0.3369 | | 0.3267 | 0.3399 |
| 23 | 0.3267 | 0.3399 | 26 | 0.3222 | 0.3243 |
| | 0.3263 | 0.3513 | | 0.3215 | 0.3353 |
| | 0.3320 | 0.3565 | | 0.3267 | 0.3399 |
| | 0.3319 | 0.3446 | | 0.3270 | 0.3285 |

Table 6h-2. 3- and 5-step MacAdam ellipse color bin definitions for MXAx-PW57-xxxx and L135-57xxxx35000P1.

| NOMINAL CCT | COLOR SPACE | CENTER POINT (cx, cy) | MAJOR AXIS, a | MINOR AXIS, b | ELLIPSE ROTATION ANGLE, θ |
|---|---|---|---|---|---|
| 5700K | Single 3-Step MacAdam ellipse | (0.3287, 0.3417) | 0.00746 | 0.00320 | 59.09° |
| 5700K | Single 5-Step MacAdam ellipse [3] | (0.3287, 0.3417) | 0.01243 | 0.00533 | 59.09° |

Notes for Tables 6h-1 and 6h-2:
1. Lumileds maintains a tolerance of ±0.007 on x and y coordinates in the CIE 1931 color space.
2. Tested and binned at 25ºC and $I_f$=100mA.

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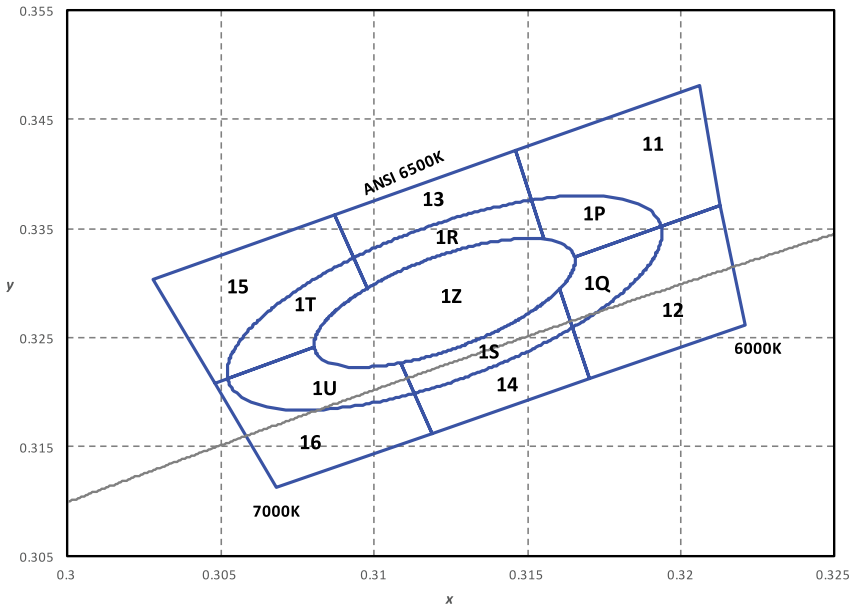


Figure 8i. Color bin structure for LUXEON 3535L Line 6500K.

Table 6i-1. Color bin definitions for LUXEON 3535L Line for MXAx-PW65-xxxx and L135-65xxxx35000P1.

| BIN | x | y | BIN | x | y |
|---|---|---|---|---|---|
| 11 | 0.3158 | 0.3317 | 14 | 0.3119 | 0.3162 |
| | 0.3146 | 0.3422 | | 0.3103 | 0.3263 |
| | 0.3206 | 0.3481 | | 0.3158 | 0.3317 |
| | 0.3213 | 0.3371 | | 0.3170 | 0.3212 |
| 12 | 0.3170 | 0.3212 | 15 | 0.3048 | 0.3209 |
| | 0.3158 | 0.3317 | | 0.3028 | 0.3304 |
| | 0.3213 | 0.3371 | | 0.3087 | 0.3363 |
| | 0.3221 | 0.3261 | | 0.3103 | 0.3263 |
| 13 | 0.3103 | 0.3263 | 16 | 0.3068 | 0.3113 |
| | 0.3087 | 0.3363 | | 0.3048 | 0.3209 |
| | 0.3146 | 0.3422 | | 0.3103 | 0.3263 |
| | 0.3158 | 0.3317 | | 0.3119 | 0.3162 |

Table 6i-2. 3- and 5-step MacAdam ellipse color bin definitions for MXAx-PW65-xxxx and L135-65xxxx35000P1.

| NOMINAL CCT | COLOR SPACE | CENTER POINT (cx, cy) | MAJOR AXIS, a | MINOR AXIS, b | ELLIPSE ROTATION ANGLE, θ |
|---|---|---|---|---|---|
| 6500K | Single 3-Step MacAdam ellipse | (0.3123, 0.3282) | 0.00669 | 0.00285 | 58.57° |
| 6500K | Single 5-Step MacAdam ellipse [3] | (0.3123, 0.3282) | 0.01115 | 0.00475 | 58.57° |

Notes for Tables 6i-1 and 6i-2:
1. Lumileds maintains a tolerance of ±0.007 on x and y coordinates in the CIE 1931 color space.
2. Tested and binned at 25ºC and $I_f$=100mA.

# Forward Voltage Bins

**Table 7. Forward voltage bin definitions for LUXEON 3535L Line.**

| BIN | FORWARD VOLTAGE [1] ($V_f$) | |
|---|---|---|
| | MINIMUM | MAXIMUM |
| R | 2.60 | 2.70 |
| S | 2.70 | 2.80 |
| T | 2.80 | 2.90 |
| V | 2.90 | 3.00 |
| W | 3.00 | 3.10 |
| X | 3.10 | 3.20 |
| Y | 3.20 | 3.30 |
| Z | 3.30 | 3.40 |

Notes for Table 7:
1. Lumileds maintains a tolerance of ±0.06V on forward voltage measurements.
2. Tested and binned at 25ºC and $I_f$=100mA.

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# Mechanical Dimensions

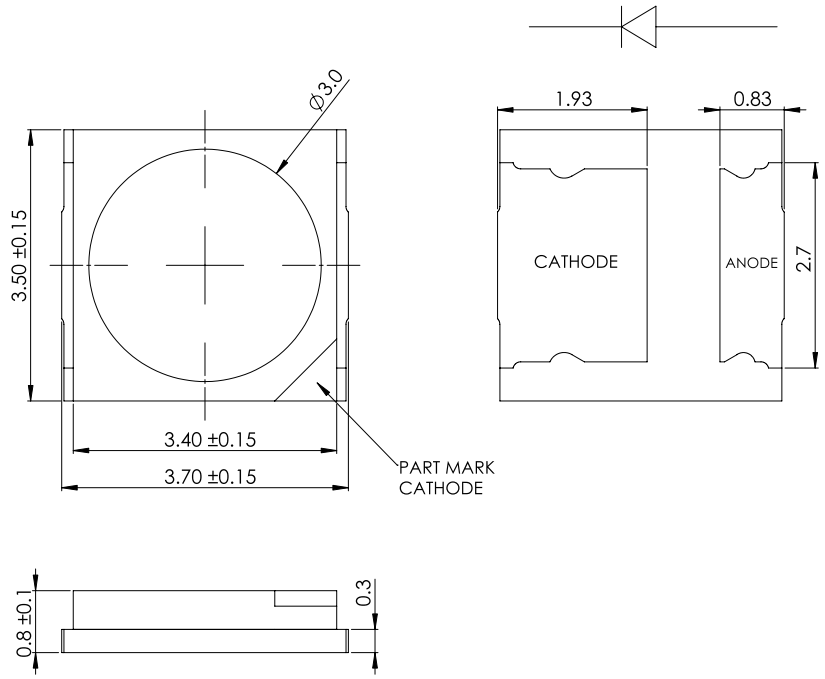


**Figure 9a. Mechanical dimensions for MXAx-PWxx-xxxx and L135-xxxxCA35000P1.**

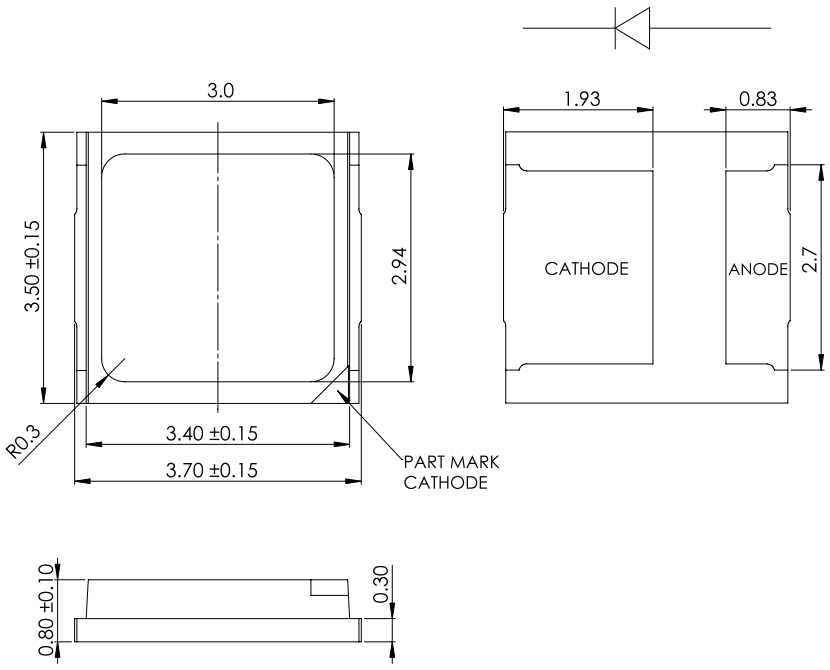


**Figure 9b. Mechanical dimensions for L135-xxxxSA35000P1.**

Notes for Figures 9a and 9b:
1. Drawings are not to scale.
2. All dimensions are in millimeters.

# Reflow Soldering Guidelines

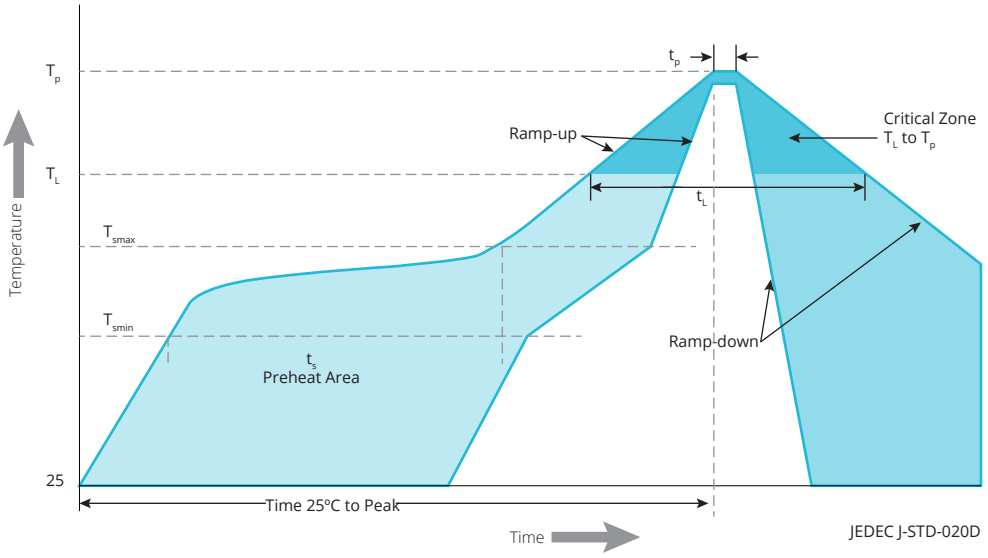


**Figure 10. Visualization of the acceptable reflow temperature profile as specified in Table 8.**

**Table 8. Reflow profile characteristics for LUXEON 3535L Line.**

| PROFILE FEATURE | LEAD-FREE ASSEMBLY |
|---|---|
| Preheat Minimum Temperature ($T_{smin}$) | 150°C |
| Preheat Maximum Temperature ($T_{smax}$) | 200°C |
| Preheat Time ($t_{smin}$ to $t_{smax}$) | 60 to 120 seconds |
| Ramp-Up Rate ($T_L$ to $T_p$) | 3°C / second maximum |
| Liquidus Temperature ($T_L$) | 217°C |
| Time Maintained Above Temperature $T_L$ ($t_L$) | 60 to 150 seconds |
| Peak / Classification Temperature ($T_p$) | 260°C |
| Time Within 5°C of Actual Temperature ($t_p$) | 20 to 40 seconds |
| Ramp-Down Rate ($T_p$ to $T_L$) | 6°C / second maximum |
| Time 25°C to Peak Temperature | 8 minutes maximum |

## JEDEC Moisture Sensitivity

**Table 9. Moisture sensitivity levels for LUXEON 3535L Line.**

| LEVEL | FLOOR LIFE | | SOAK REQUIREMENTS STANDARD | |
|---|---|---|---|---|
| | TIME | CONDITIONS | TIME | CONDITIONS |
| 2 | 1 Year | ≤30°C / 60% RH | 168 Hours +5 / -0 | 85°C / 60% RH |

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## Solder Pad Design

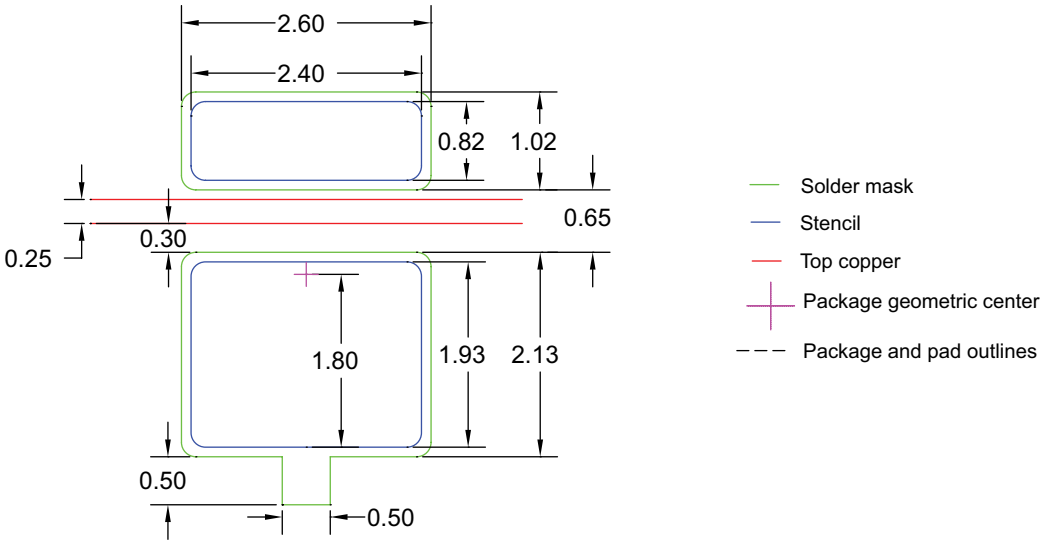


**Figure 11. Recommended PCB solder pad layout for LUXEON 3535L Line.**

Notes for Figure 11:
1. Drawings are not to scale.
2. All dimensions are in millimeters.

# Packaging Information

## Pocket Tape Dimensions

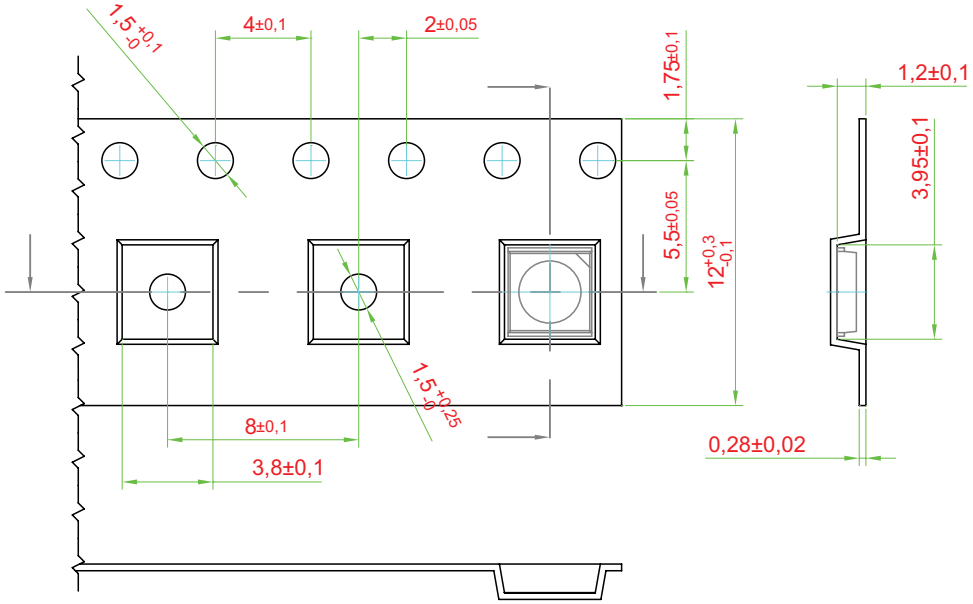


**Figure 12. Pocket tape dimensions for LUXEON 3535L Line.**

Notes for Figure 12:
1. Drawings are not to scale.
2. All dimensions are in millimeters.

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# Reel Dimensions

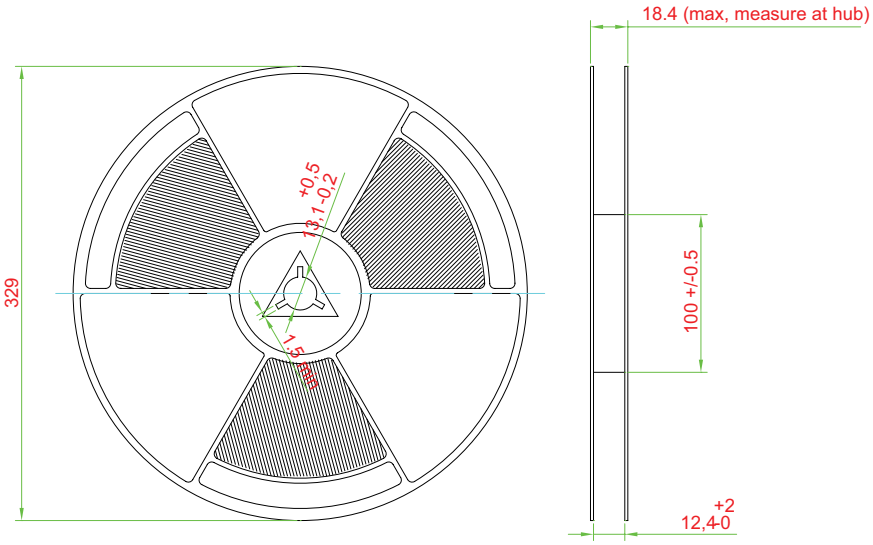


**Figure 13. Reel dimensions for LUXEON 3535L Line.**

Notes for Figure 13:
1. Drawings are not to scale.
2. All dimensions are in millimeters.

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Companies developing automotive, mobile, IoT and illumination lighting applications need a partner who can collaborate with them to push the boundaries of light. With over 100 years of inventions and industry firsts, Lumileds is a global lighting solutions company that helps customers around the world deliver differentiated solutions to gain and maintain a competitive edge. As the inventor of Xenon technology, a pioneer in halogen lighting and the leader in high performance LEDs, Lumileds builds innovation, quality and reliability into its technology, products and every customer engagement. Together with its customers, Lumileds is making the world safer, better and more beautiful—with light.

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