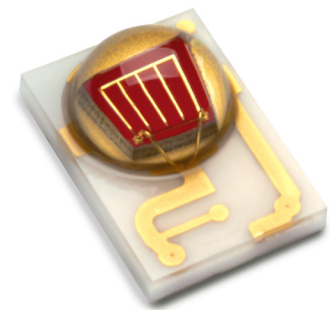




# LUXEON Rebel

## Bright domed solution

Automotive grade LUXEON Rebel LEDs are designed and tested to meet and exceed expectations for reliability, performance and lifetime in rear lighting applications. LUXEON Rebel is a bright domed AlInGaP LED in the market well suited for lightguide tail and small footprint stop-tail and rear fog applications.



LUXEON Rebel is available in the following color wavelengths:

- Red Orange (615nm)
- Super Red (635nm)

### FEATURES AND BENEFITS

- Higher drive current capability for increased flux performance
- Low thermal resistance and power consumption results in simplified thermal management and system cost
- High flux output provides flexibility in styling and optical design

### PRIMARY APPLICATIONS

- Rear Fog
- Stop/Tail

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# General Product Information

## Product Test Conditions

LUXEON Rebel LEDs for automotive are tested and binned using a 20ms monopulse (MP) at 350mA drive current, case temperature,  $T_c$ , of 25°C.

## Part Number Nomenclature

Part numbers for LUXEON Rebel follow the convention below:

L X M A - **A B** 0 3 - **C D E F**

Where:

- A** – designates radiation pattern (P=Lambertian)
- B** – designates color variant (H=Red Orange, S=Super Red)
- C D** – reserved for future product offerings
- E F** – designates minimum flux performance for standard parts or customer specific code for customized part number

Therefore, the following part number is used for a LUXEON Rebel Red Orange, 80 lumens minimum flux:

L X M A - **P H** 0 3 - **0 0 8 0**

## Environmental Compliance

Lumileds LLC is committed to providing environmentally friendly products to the solid-state lighting market. LUXEON Rebel 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).

# Performance Characteristics

## Product Selection Guide

Table 1. Product selection for LUXEON Rebel for automotive at 20ms MP, 350mA,  $T_c=25^\circ\text{C}$ .

COLOR	DOMINANT WAVELENGTH <sup>[1,2]</sup> (nm)	PART NUMBER
Red Orange	615	LXMA - PH03
Super Red	635	LXMA - PS03

**Notes for Table 1:**

1. Dominant wavelength is derived from the CIE 1931 Chromaticity diagram and represents perceived color.
2. Lumileds maintains a tolerance of  $\pm 1\text{nm}$  for dominant wavelength measurements.

## Optical Characteristics

Table 2. Typical optical characteristics for LUXEON Rebel for automotive at 20ms MP, 350mA,  $T_c=25^\circ\text{C}$ .

PART NUMBER	TYPICAL TOTAL INCLUDED ANGLE <sup>[1]</sup> $\theta_{0.90V}$	TYPICAL VIEWING ANGLE <sup>[2]</sup> $2\theta_{1/2}$
LXMA - Px03	150°	125°

**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 1/2 of the peak value.

## Electrical and Thermal Characteristics

Table 3. Typical electrical and thermal characteristics for LUXEON Rebel for automotive at 20ms MP, 350mA,  $T_c=25^\circ\text{C}$ .

PARAMETER	PERFORMANCE
Forward Voltage, $V_f$	2.3V
Electrical Thermal Resistance, $R_{th\text{-}j\text{-}c\text{-}electr}$ <sup>[1]</sup> (Maximum)	8°C/W
Real Thermal Resistance, $R_{th\text{-}j\text{-}c\text{-}real}$ <sup>[2]</sup> (Maximum)	13°C/W
Temperature Coefficient of $V_f$ , $TCv$ $I_f = 350\text{mA}$ , $10^\circ\text{C} \leq T_c \leq 110^\circ\text{C}$	-4.0 mV/°C

**Notes for Table 3:**

1.  $R_{th\text{-}j\text{-}c\text{-}electr}$ : Electrical thermal resistance (junction to case).
2.  $R_{th\text{-}j\text{-}c\text{-}real}$ : Real thermal resistance (junction to case) with wall plug efficiency included. Reference JESD51-51, JESD51-14, 4.1.3.
3. All values are typical unless otherwise stated.

# Absolute Ratings

Table 4. Absolute ratings for LUXEON Rebel for automotive.

PARAMETER	PERFORMANCE
Minimum DC Forward Current	50mA
Maximum DC Forward Current	1.2A
Maximum Junction Temperature <sup>[1]</sup>	150°C
Operating Case Temperature at Test Current <sup>[1]</sup>	-40°C to 130°C
Operating Case Temperature at Maximum Current <sup>[1]</sup>	-40°C to 130°C
LED Storage Temperature	-40°C to 135°C
Soldering Temperature	JEDEC 020c 260°C
Allowable Reflow Cycles	3
Minimum ESD performance <sup>[2]</sup>	8kV HBM, 400V MM
Reverse Voltage (V <sub>r</sub> )	LUXEON Rebel LEDs are not designed to be driven in reverse bias

**Notes for Table 4:**

1. Proper current derating must be observed to maintain junction temperature below the maximum, so that the LED is maintained below the maximum rated operating case temperature. LUXEON Rebel LEDs driven at or above the maximum rated operating case temperature may have shorter lifetime.
2. Measured using human body model (per ANSI/ESDA/JEDEC JS-001-2010) and charged device model (per JESD22-C101F).

# Characteristic Curves

## Spectral Power Distribution Characteristics

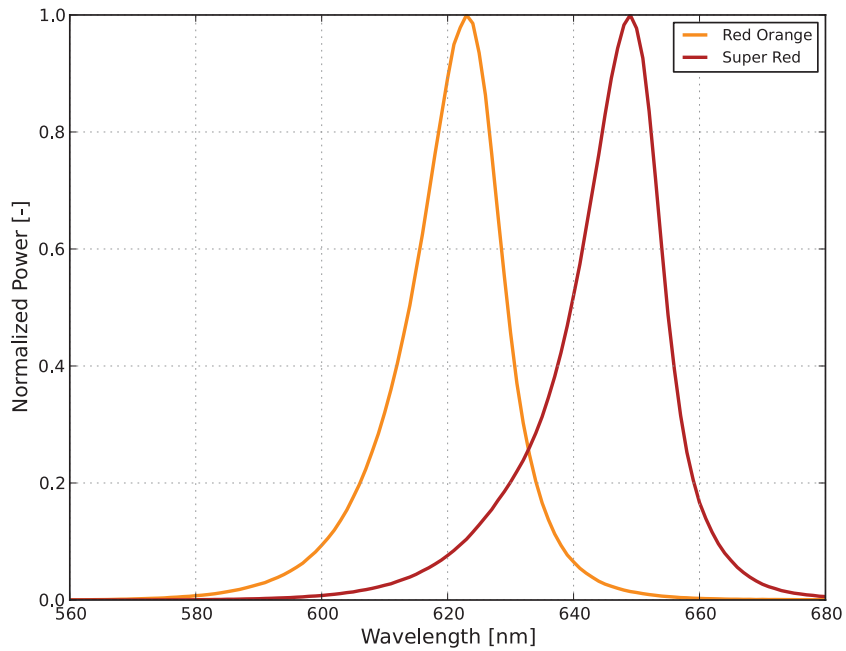


Figure 1: Typical normalized power vs. wavelength for LUXEON Rebel for automotive at 20ms MP, 350mA,  $T_c=25^\circ\text{C}$ .

## Light Output Characteristics

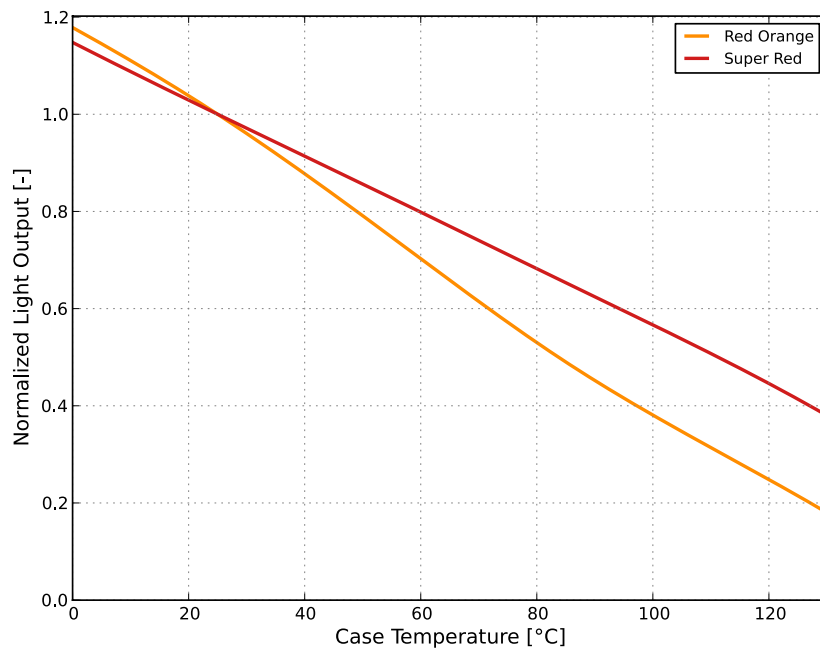


Figure 2a: Typical normalized light output vs. case temperature for LUXEON Rebel for automotive at 20ms MP, 350mA.

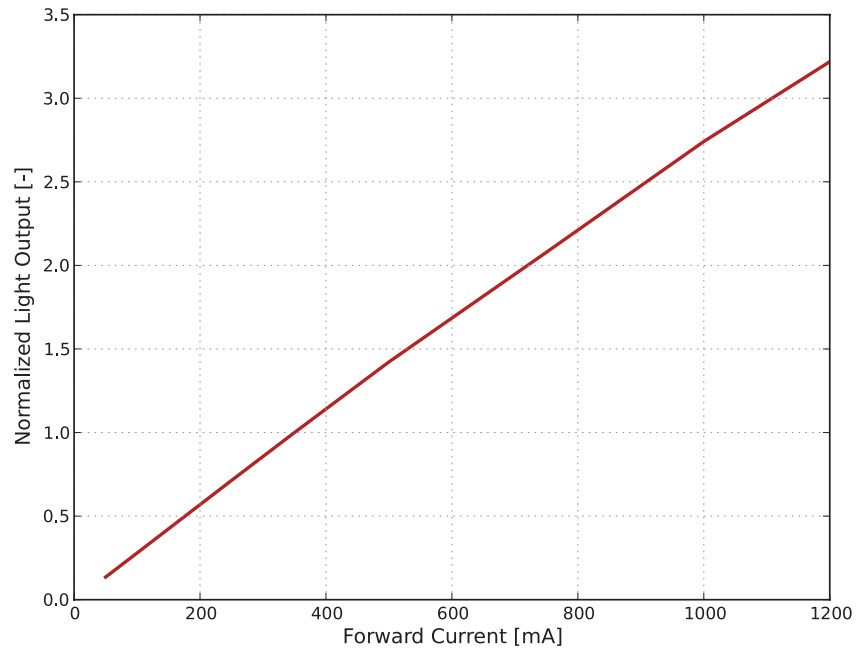


Figure 2b: Typical normalized light output vs. forward current for LUXEON Rebel for automotive,  $T_c=25^\circ\text{C}$ .

## Forward Current Characteristics

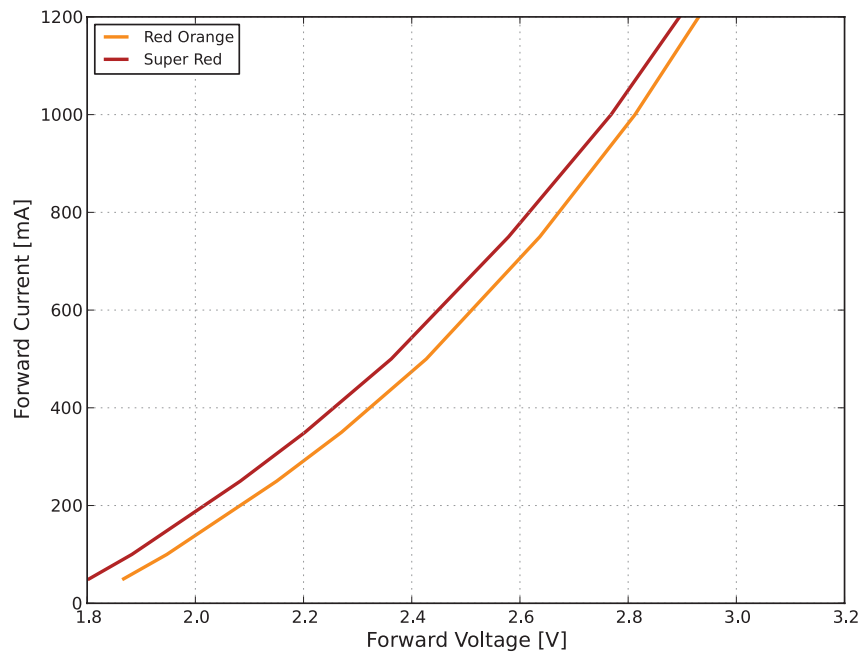


Figure 3a: Typical forward current vs. forward voltage for LUXEON Rebel for automotive,  $T_c=25^\circ\text{C}$ .

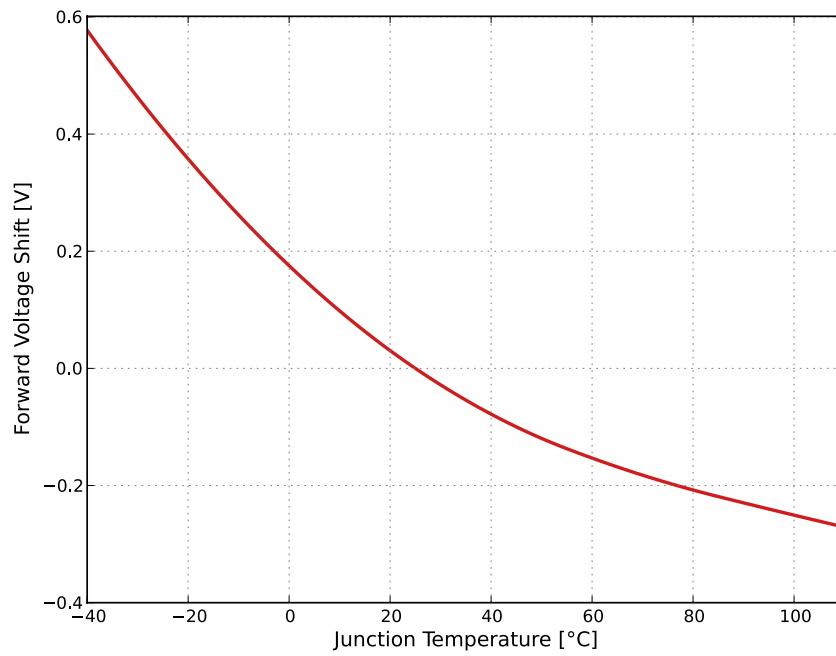


Figure 3b: Typical forward voltage shift vs. case temperature for LUXEON Rebel for automotive at 20ms MP, 350mA.

## Radiation Pattern Characteristics

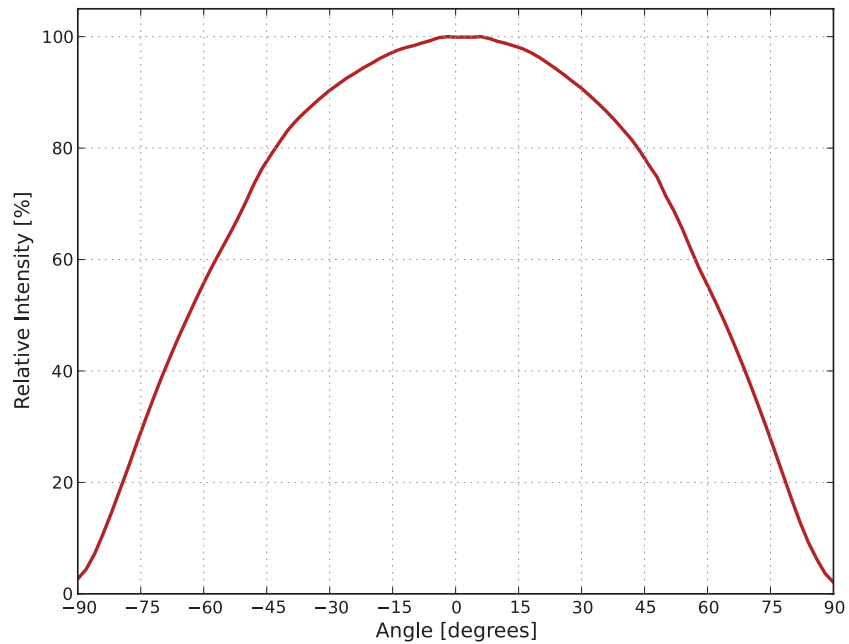


Figure 4: Typical radiation pattern for LUXEON Rebel for automotive at 20ms MP, 350mA,  $T_c=25$ .



# Operating Limits Characteristics

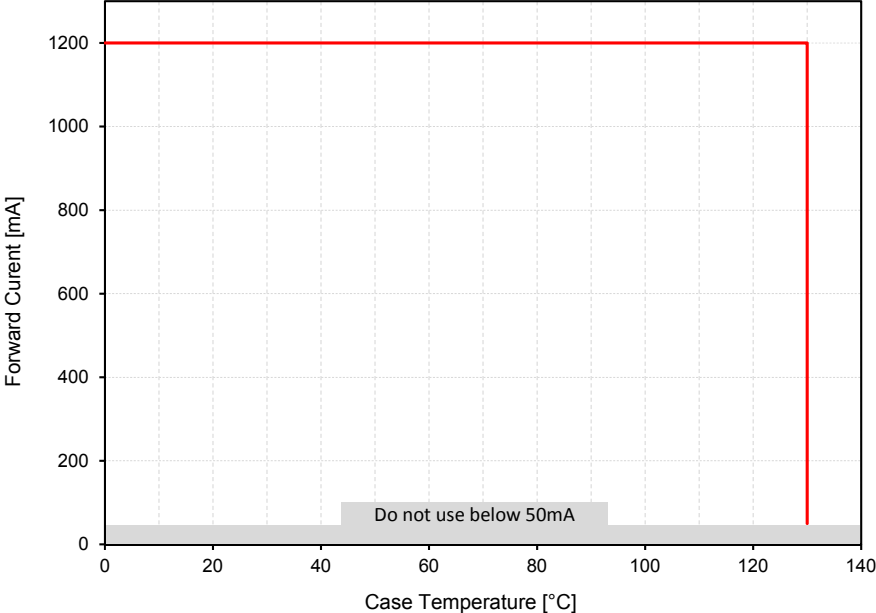


Figure 5: Maximum forward current vs. case temperature for LUXEON Rebel for automotive.

# 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 datasheets. For this reason, Lumileds bins the LED components for luminous flux, color and forward voltage.

LUXEON Rebel LEDs for automotive are labeled using a 3-digit alphanumeric CAT code following the format below:

### A B C

- A** – designates luminous flux bin (example: L=80 lumens to 90 lumens)
- B** – designates color code (example: 5=632nm to 638nm)
- C** – designates forward voltage bin (example: W=2.00V to 2.20V)

## Luminous Flux Bins

Table 5 lists the standard photometric luminous flux bins for LUXEON Rebel LEDs for automotive. 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 colors.

Table 5. Luminous flux bin definitions for LUXEON Rebel for automotive at 20ms MP, 350mA,  $T_c = 25^\circ\text{C}$ .

BIN	LUMINOUS FLUX (lm)	
	MINIMUM	MAXIMUM
F	30	40
G	40	50
H	50	60
J	60	70
K	70	80
L	80	90
M	90	100
N	100	110

**Notes for Table 5:**

1. Lumileds maintains a tolerance of  $\pm 6.5\%$  on luminous flux measurements.

## Color Codes

Table 6. Color code definitions for LUXEON Rebel for automotive at 20ms MP, 350mA,  $T_c = 25^\circ\text{C}$ .

CODE	DOMINANT WAVELENGTH (nm)	
	MINIMUM	MAXIMUM
3	612	618
5	632	638

Notes for Table 6:

1. Lumileds maintains a tolerance of  $\pm 0.5\text{nm}$  on dominant wavelength measurements.

## Forward Voltage Bins

Table 7. Forward voltage bin definitions for LUXEON Rebel for automotive at 20ms MP, 350mA,  $T_c = 25^\circ\text{C}$ .

BIN	FORWARD VOLTAGE (V)	
	MINIMUM	MAXIMUM
V	1.80	2.00
W	2.00	2.20
X	2.20	2.40

Notes for Table 7:

1. Lumileds maintains a tolerance of  $\pm 0.06\text{V}$  on forward voltage measurements.

# Mechanical Dimensions

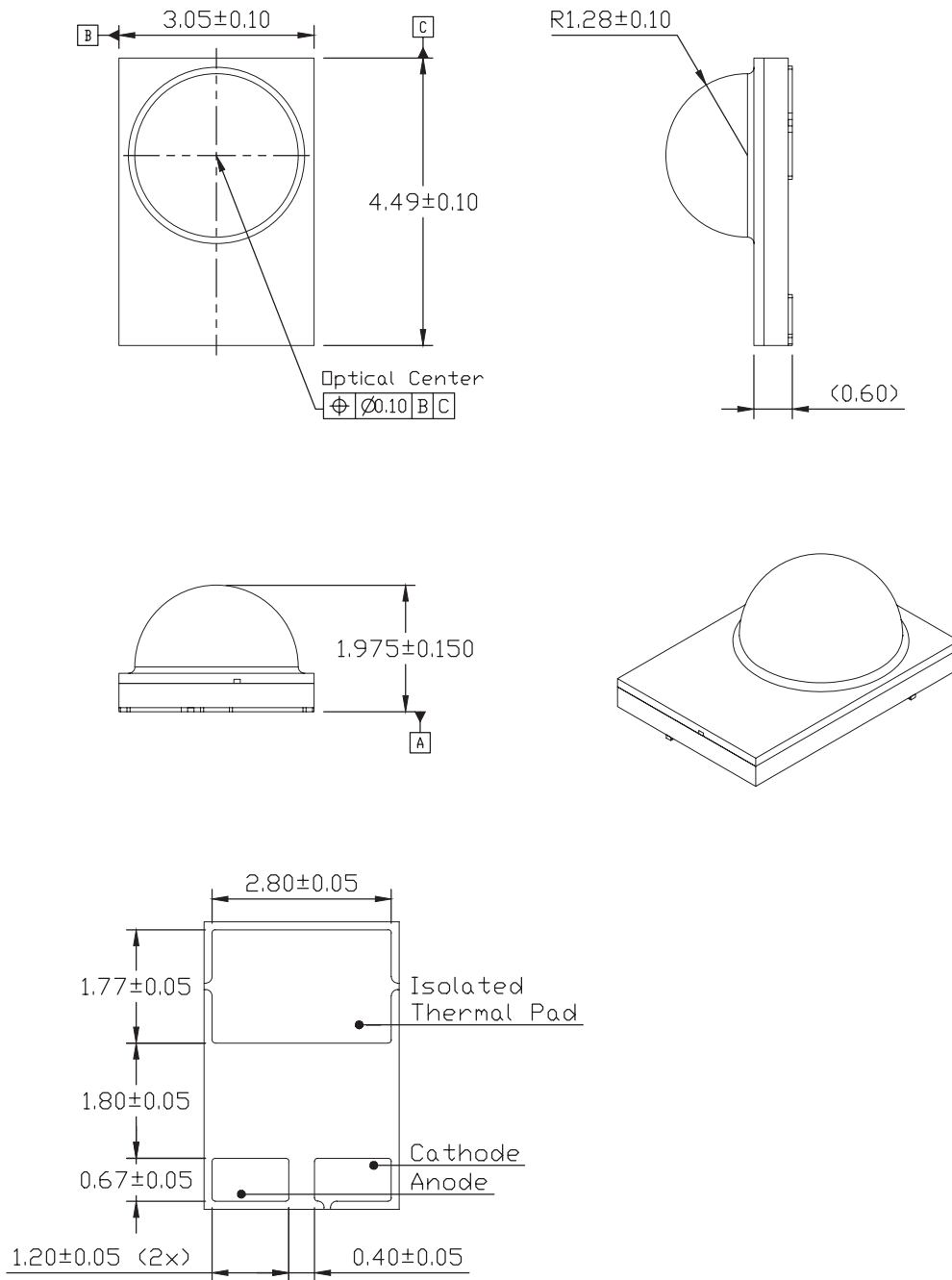


Figure 6: Mechanical dimensions for LUXEON Rebel for automotive.

**Notes for Figure 6:**

1. Drawings are not to scale.
2. All dimensions are in millimeters.

# Reflow Soldering Guidelines

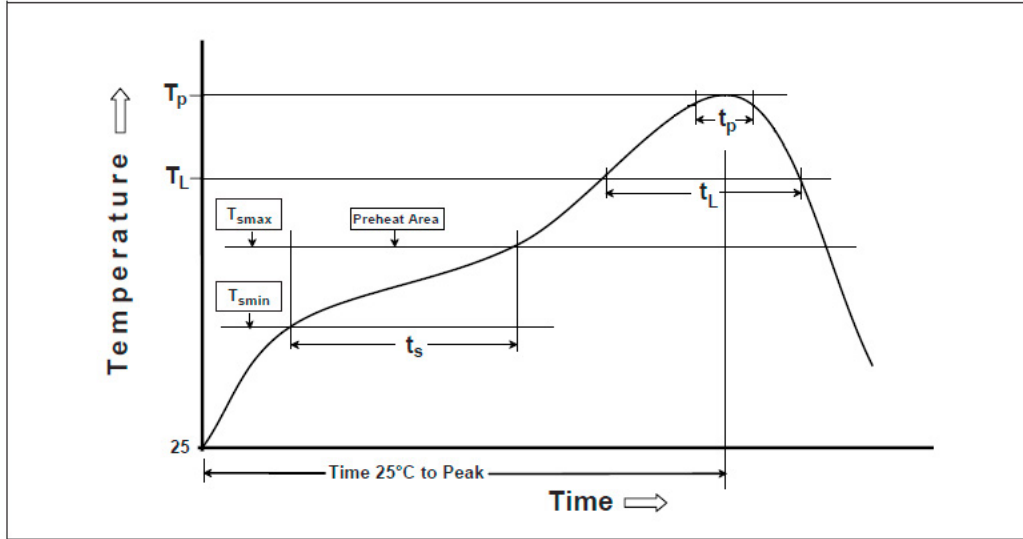


Figure 7: Visualization of the acceptable reflow temperature profile as specified in Table 8.

Table 8. Reflow profile characteristics for LUXEON Rebel for automotive.

PROFILE FEATURE	LEAD FREE ASSEMBLY
Average Ramp-Up Rate ( $T_{smax}$ to $T_p$ )	3°C / second maximum
Minimum Preheat Temperature ( $T_{smin}$ )	150°C
Maximum Preheat Temperature ( $T_{smax}$ )	200°C
Preheat Time ( $t_{smin}$ to $t_{smax}$ )	60 to 180 seconds
Liquidus Temperature ( $T_L$ )	217°C
Time Maintained Above Temperature ( $T_L$ )	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	6°C / second maximum
Time 25°C to Peak Temperature	8 minutes maximum

**Notes for Table 8:**

1. All temperatures refer to the application Printed Circuit Board (PCB), measured on the surface adjacent to the package body.

## JEDEC Moisture Sensitivity

Table 9. Moisture sensitivity levels for LUXEON Rebel for automotive.

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

# Solder Pad Design

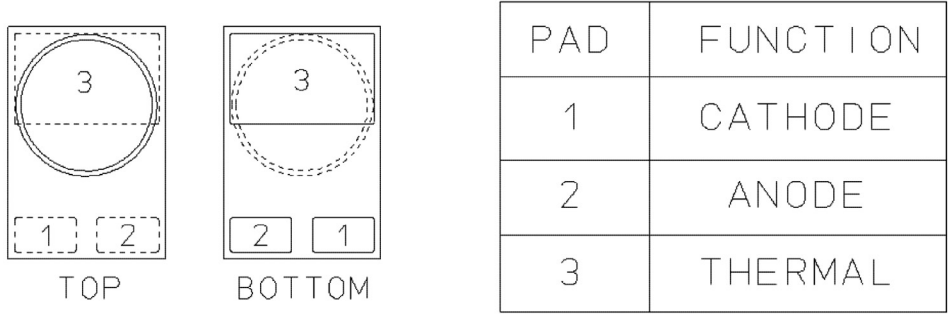


Figure 8: Recommended PCB solder pad layout for LUXEON Rebel for automotive.

- Notes for Figure 8:
1. The drawing shows the recommended LUXEON Rebel layout on Printed Circuit Board (PCB).
  2. All dimensions are in millimeters.

# Packaging Information

## Pocket Tape Dimensions

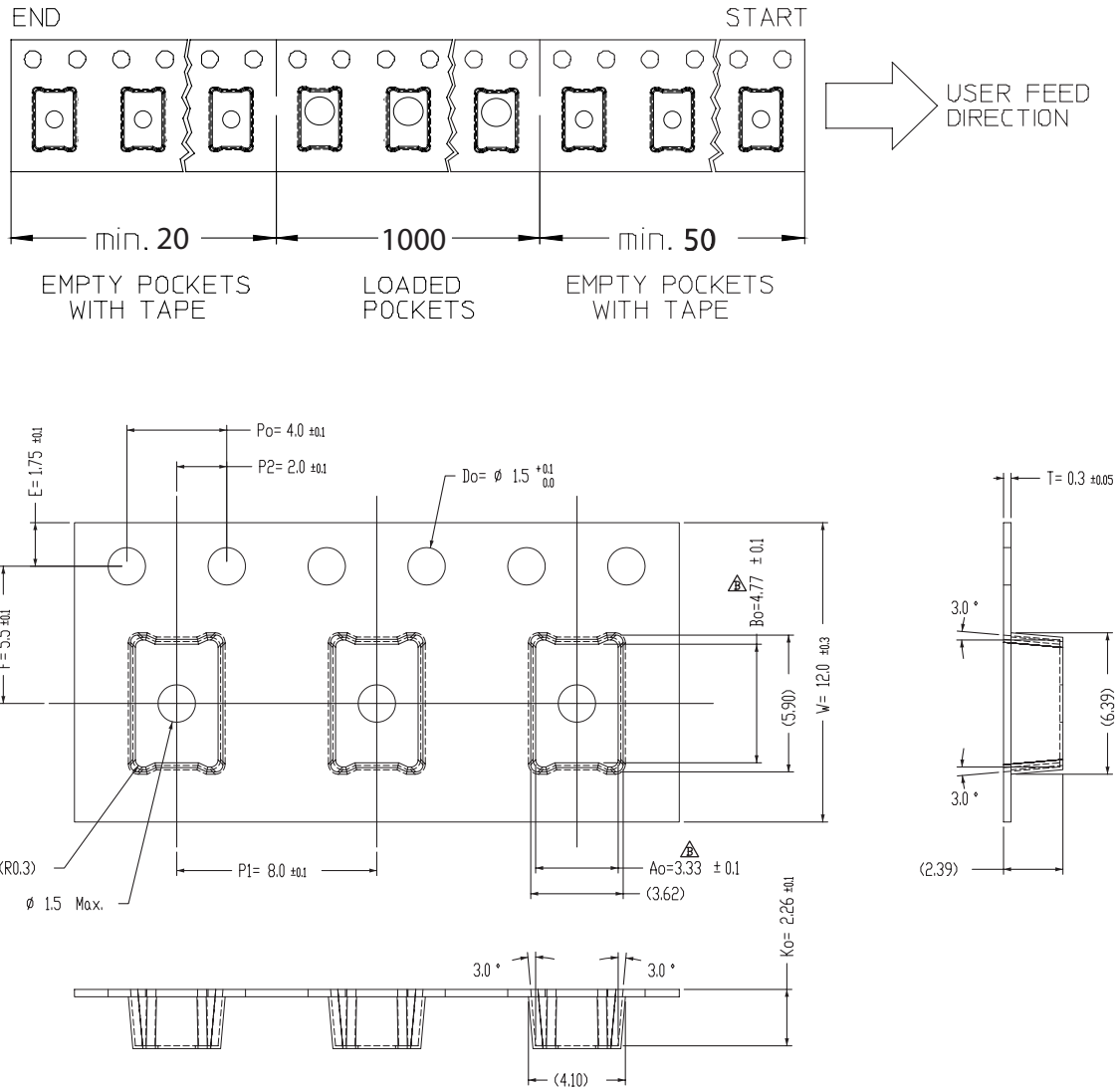


Figure 9: Pocket tape dimensions for LUXEON Rebel for automotive.

Notes for Figure 9:

1. Drawings are not to scale.
2. All dimensions are in millimeters.
3. SPI 1000.

# Reel Dimensions

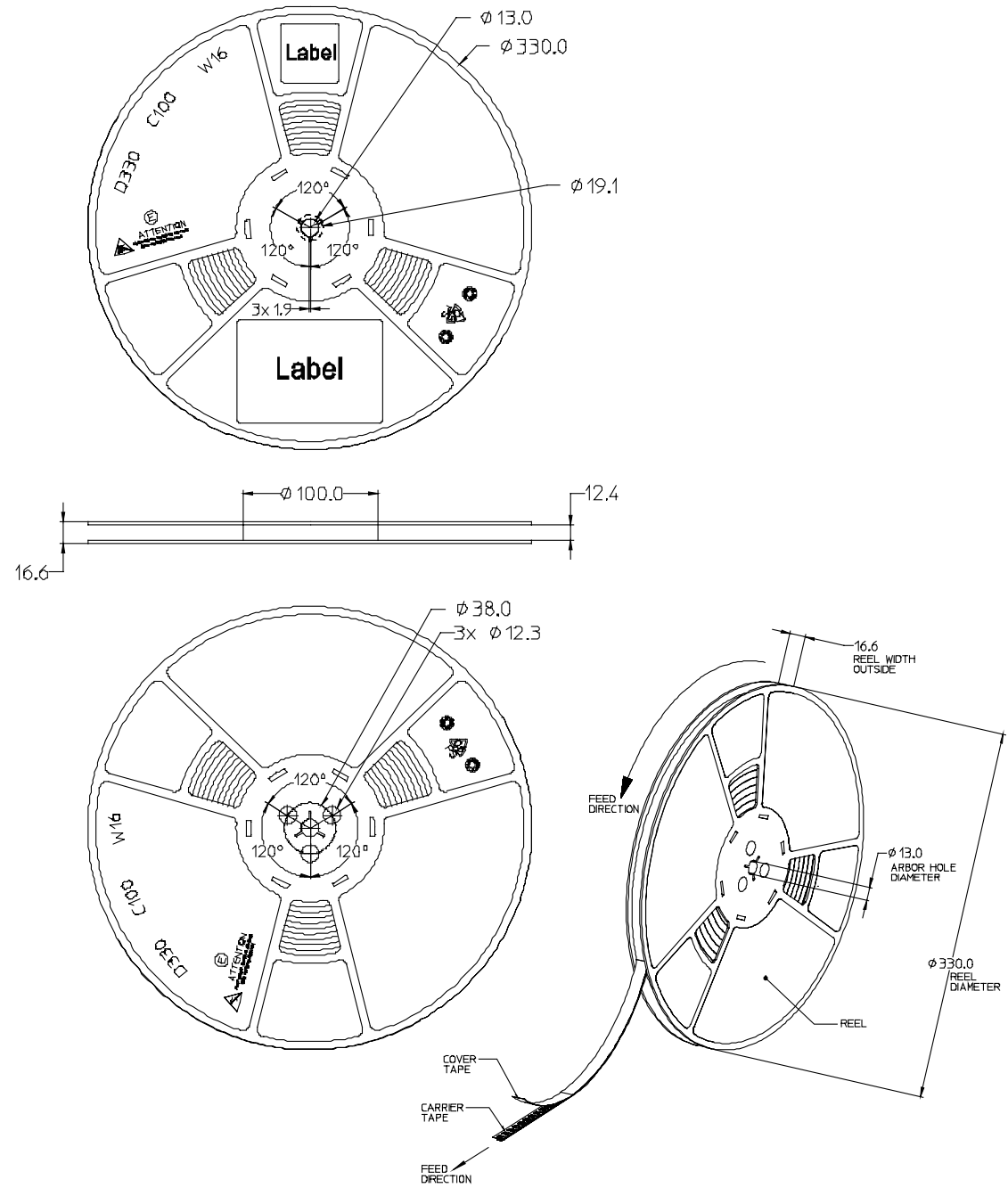


Figure 10: Reel dimensions for LUXEON Rebel for automotive.

Notes for Figure 10:

1. Drawings are not to scale.
2. All dimensions are in millimeters.



## About Lumileds

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](http://lumileds.com).



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