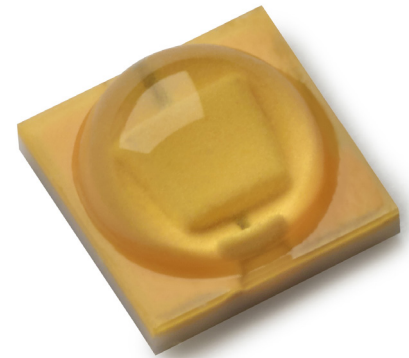




# LUXEON Q

Standard ceramic 3535 footprint delivering high efficacy at high-drive current

LUXEON Q delivers superior performance in a high-power LED that serves as a drop-in replacement for products that use the standard 3535 surface mount package. LUXEON Q is the first high-power LED based on the Lumileds FlipChip Technology chip-scale package (CSP) device architecture. LUXEON Q takes advantage of a fully developed ecosystem for 3535 components, including optics, to speed the time-to-market for indoor and outdoor luminaires.



## FEATURES AND BENEFITS

- Industry standard 3535 package for optimization with existing designs
- Lumileds FlipChip Technology for industry leading performance
- High efficacy at high drive current enables high lumen and lm/\$ at high lm/W
- 3-step MacAdam ellipse color definition: *Freedom from Binning* for color consistency
- UL-recognized component [E352519]

## PRIMARY APPLICATIONS

- Downlights
- High Bay & Low Bay
- Lamps
- Outdoor
- Spotlights

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# General Information

## Product Nomenclature

LUXEON Q emitters are specified and binned “hot” under conditions comparable to those found in “real-world” lighting products. The test conditions for LUXEON Q are 350mA DC with junction temperature at 85°C.

The part number designation is explained as follows:

L1Q0 - x x y y 0 0 0 0 0 z z z 0

Where:

- xx — designates nominal ANSI CCT (27 for 2700K, 30 for 3000K)
- yy — designates minimum CRI performance (70 for 70CRI, 80 for 80CRI)
- zzz — designates minimum flux performance at standard binning current and temperature (e.g., 090 for 90 lumens, 110 for 110 lumens, etc). 000 designates full distribution flux performance.

Therefore, 80CRI products tested and binned at 3000K with a 110lm minimum flux at binning current and temperature will have the part numbering scheme:

L1Q0-3080000001100

Therefore, 70CRI products tested and binned at 5700K with a 130lm minimum flux at binning current and temperature will have the following part numbering scheme:

L1Q0-5770000001300

## Average Lumen Maintenance Characteristics

LUXEON Q products are tested in compliance with LM-80. Please contact your local Lumileds Technical Solutions Manager for TM-21 extrapolations or other support.

## Environmental Compliance

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

# Product Selection & Optical Characteristics

## Product Selection Guide for LUXEON Q Emitters Junction Temperature = 85°C

Table 1.

Typical Performance Characteristics at 350mA, 700mA, and 1000mA for LUXEON Q, Junction Temperature = 85°C												
Part Number	Nominal ANSI CCT	CRI	Luminous Flux (Lm) Min	Typical Luminous Flux (Lm)			Typical Forward Voltage (V <sub>f</sub> )			Typical Efficacy (Lm/W)		
			350mA	350 mA	700 mA	1000 mA	350 mA	700 mA	1000 mA	350 mA	700 mA	1000 mA
L1Q0-278000000zzz0	2700K	80	80	113	199	261	2.81	2.93	2.99	115	97	87
L1Q0-308000000zzz0	3000K	80	90	115	204	270	2.81	2.93	2.99	117	99	88
L1Q0-358000000zzz0	3500K	80	90	117	209	278	2.81	2.93	2.99	119	102	92
L1Q0-407000000zzz0	4000K	70	110	132	236	313	2.81	2.93	2.99	134	115	104
L1Q0-507000000zzz0	5000K	70	110	133	237	315	2.81	2.93	2.99	135	116	105
L1Q0-577000000zzz0	5700K	70	110	134	241	320	2.81	2.93	2.99	136	118	106

Notes for Table 1:

1. Lumileds maintains a tolerance of ± 6.5% on luminous flux and ± 2 on CRI measurements.

## Optical Characteristics LUXEON Q at Test Current <sup>[1]</sup>, Junction Temperature = 85°C

Table 2.

Nominal ANSI CCT	Part Number	Typical Color Temperature CCT	Typical Total Included Angle <sup>[2]</sup> (degrees) $\theta_{0.90V}$	Typical Viewing Angle <sup>[3]</sup> (degrees) $2\theta_{1/2}$
2700K	L1Q0-278000000zzz0	2725K	160	135
3000K	L1Q0-308000000zzz0	3045K	160	135
3500K	L1Q0-358000000zzz0	3465K	160	135
4000K	L1Q0-407000000zzz0	3985K	160	135
5000K	L1Q0-507500000zzz0	5028K	160	135
5700K	L1Q0-577000000zzz0	5665K	160	135

Notes for Table 2:

1. Test current is 350mA D.C. for all L1Q0-xyyy00000zzz0 emitters.
2. Total angle at which 90% of total luminous flux is captured.
3. Viewing angle is the off axis angle from lamp centerline where the luminous intensity is 1/2 of the peak value.

# Electrical Characteristics

## Electrical Characteristics at test current for LUXEON Q Junction Temperature = 85°C

Table 3.

Nominal ANSI CCT	Forward Voltage $V_f$ (V) <sup>[1]</sup>		Typical Temperature Coefficient of Forward Voltage <sup>[2]</sup> (mV/°C) $DV_f / DT_J$	Typical Thermal Resistance Junction to Thermal Pad (°C/W) $R\theta_{J-C}$
	Minimum	Maximum		
2700K	2.50	3.25	-1.6	7
3000K	2.50	3.25	-1.6	7
3500K	2.50	3.25	-1.6	7
4000K	2.50	3.25	-1.6	7
5000K	2.50	3.25	-1.6	7
5700K	2.50	3.25	-1.6	7

Notes for Table 3:

1. Lumileds maintains a tolerance of  $\pm 0.06V$  on forward voltage measurements.
2. Measured between  $T_J = 25^\circ C$  and  $T_J = 110^\circ C$  at  $I_f = 350mA$ .

## Absolute Maximum Ratings

Table 4.

Parameter	LUXEON Q
DC Forward Current (mA) <sup>[1][2]</sup>	1050
Peak Pulsed Forward Current (mA) <sup>[1][3]</sup>	1200
ESD Sensitivity	< 8000V Human Body Model (HBM) Class 3A JESD22-A114-E
LED Junction Temperature <sup>[1]</sup>	135°C
Operating Case Temperature at 700mA	-40°C - 135°C
Storage Temperature	-40°C - 135°C
Soldering Temperature	JEDEC 020c 260°C
Allowable Reflow Cycles	3
Reverse Voltage (Vr) <sup>[4][5]</sup>	LUXEON Q 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. For additional information on thermal measurement guidelines please refer to Application Brief AB118 (not available yet).
2. Residual periodic variations due to power conversion from alternating current (AC) to direct current (DC), also called "ripple", with frequencies  $\geq 100$  Hz and amplitude  $\leq 150mA$  are acceptable, assuming the average current throughout each cycle does not exceed 1050mA.
3. Pulsed operation with a peak drive current of 1200mA is acceptable if the pulse on-time is  $\leq 5$  ms per cycle and the duty cycle is  $\leq 50\%$ .
4. Transient reverse voltages and surge currents due to electrical switching or supply interruptions are acceptable if these events do not last for more than 10ms, the amplitude of the reverse voltage does not exceed 5V and the reverse current is less than 200 $\mu A$ .
5. Max 5V reverse for up to 10s is an acceptable beginning of life, one time test condition.

# JEDEC Moisture Sensitivity

Table 5.

Level	Floor Life		Soak Requirements Standard	
	Time	Conditions	Time	Conditions
1	unlimited	30°C / 85% RH	168h + 5 / - 0	85°C / 85% RH

## Reflow Soldering Characteristics

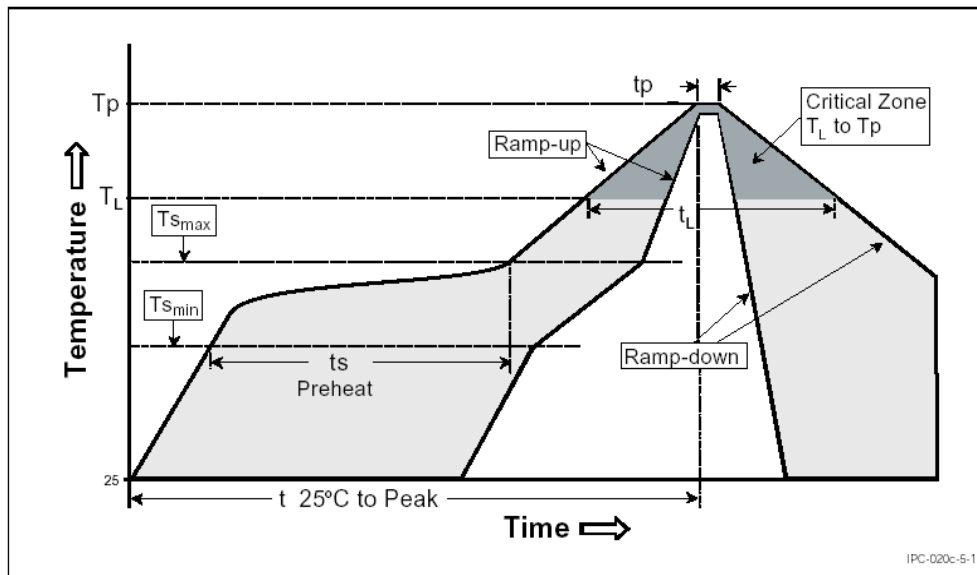


Figure 1. Temperature Profile for Table 6.

Table 6.

Profile Feature	Lead Free Assembly
Average Ramp-Up Rate ( $T_{s_{max}}$ to $T_p$ )	3°C / second max
Preheat Temperature Min ( $T_{s_{min}}$ )	150°C
Preheat Temperature Max ( $T_{s_{max}}$ )	200°C
Preheat Time ( $t_{s_{min}}$ to $t_{s_{max}}$ )	60 - 180 seconds
Time Maintained Above Temperature $T_L$	217°C
Time Maintained Above Time ( $t_L$ )	60 - 150 seconds
Peak / Classification Temperature ( $T_p$ )	260°C
Time Within 5°C of Actual Peak Temperature ( $t_p$ )	20 - 40 seconds
Ramp-Down Rate	6°C / second max
Time 25°C to Peak Temperature	8 minutes max

# Mechanical Dimensions

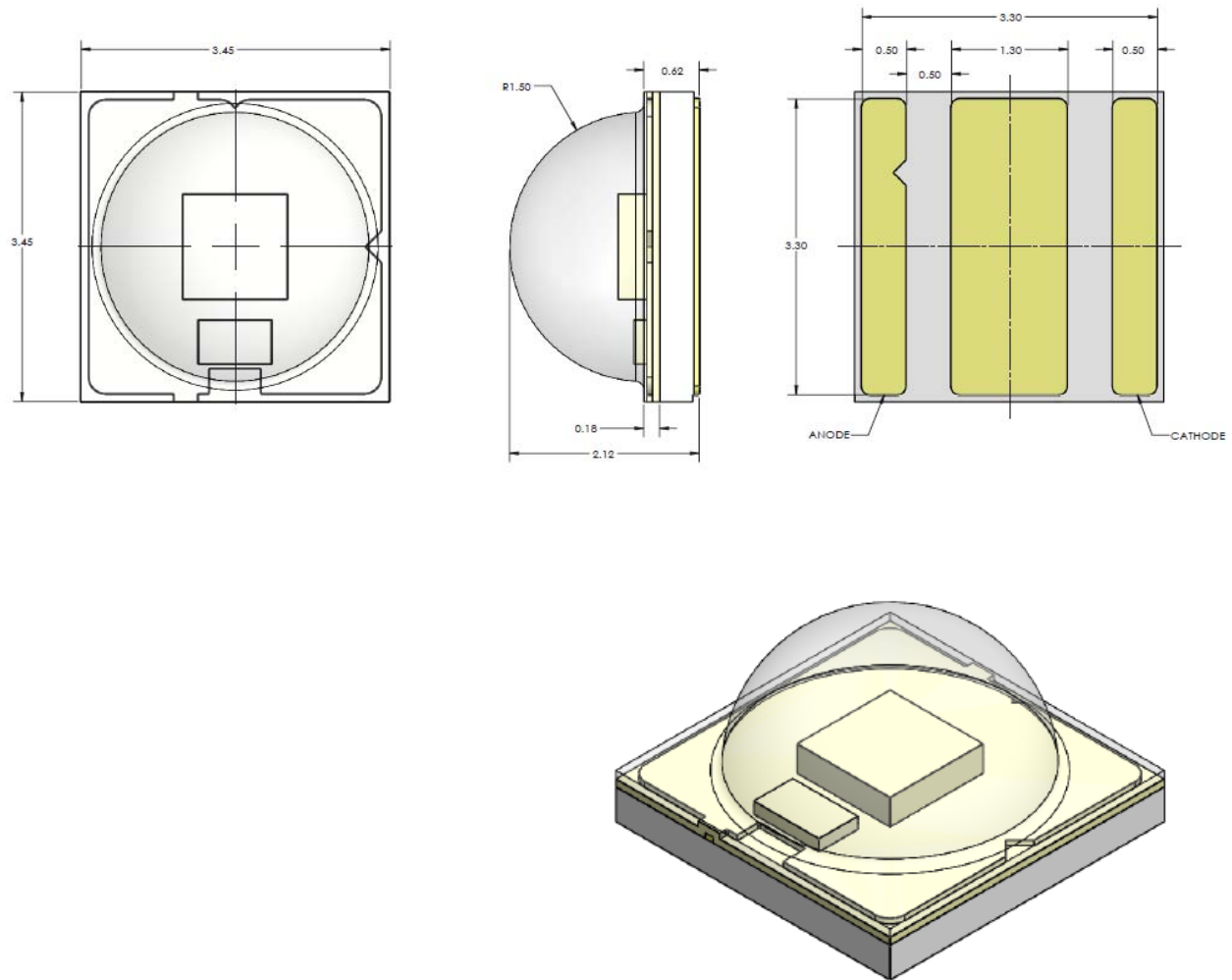


Figure 2. Package outline drawing for LUXEON Q.

## Notes for Figure 2:

1. Drawings not to scale.
2. All dimensions are in millimeters.
3. The thermal pad is electrically isolated from the anode and cathode contact pads.
4. Do not handle the device by the lens. Excessive force on the lens may damage the lens itself or the interior of the device.
5. Tolerances (UNLESS OTHERWISE SPECIFIED)
  - LINEAR: ANGULAR:
  - XX.  $\pm 0.125$  mm XX  $\pm 1^\circ$

## Solder Pad Design

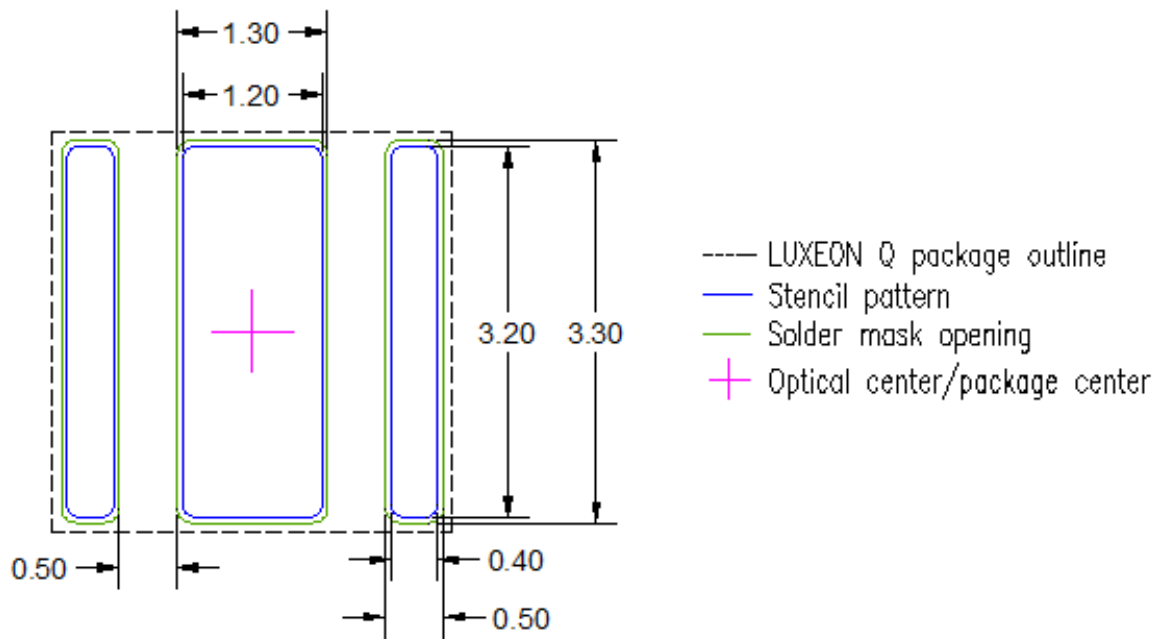


Figure 3. Solder pad layout.

### Notes for Figure 3:

- The photograph shows the recommended LUXEON Q layout on Printed Circuit Board (PCB).
- For more information on assembly and layout, please refer to Application Brief 118 (AB118).
- The .dmg files are available at [www.lumileds.com](http://www.lumileds.com).



# Relative Spectral Distribution vs. Wavelength Characteristics

Relative Spectra at Test Current, Junction Temperature = 85°C

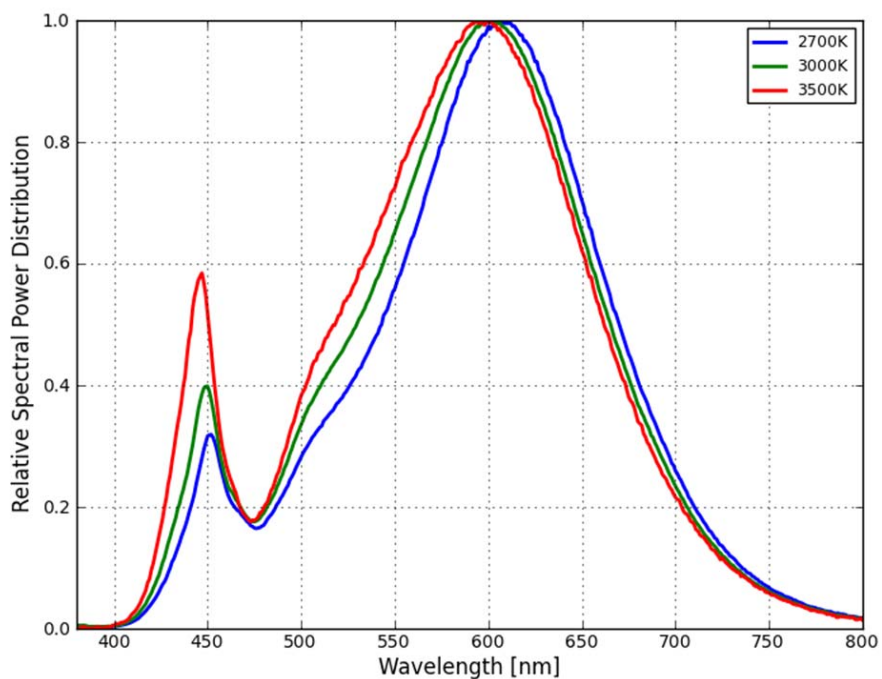


Figure 4. Color Spectrum of L1Q0-xx8000000zzz0.

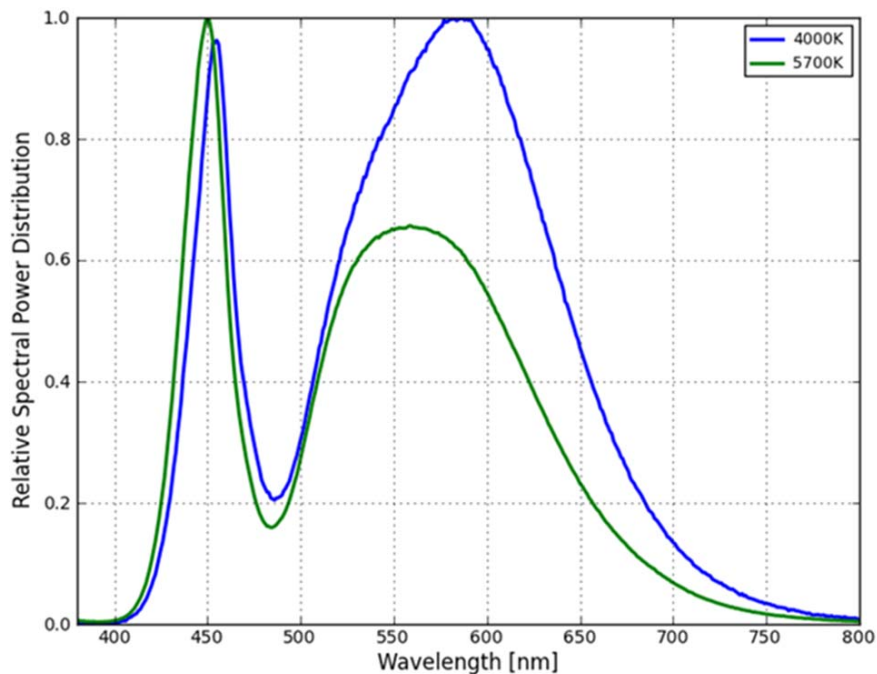


Figure 5. Color Spectrum of L1Q0-xx7000000zzz0.

# Typical Light Output Characteristics

## Relative Light Output vs. Junction Temperature, Test Current = 350mA

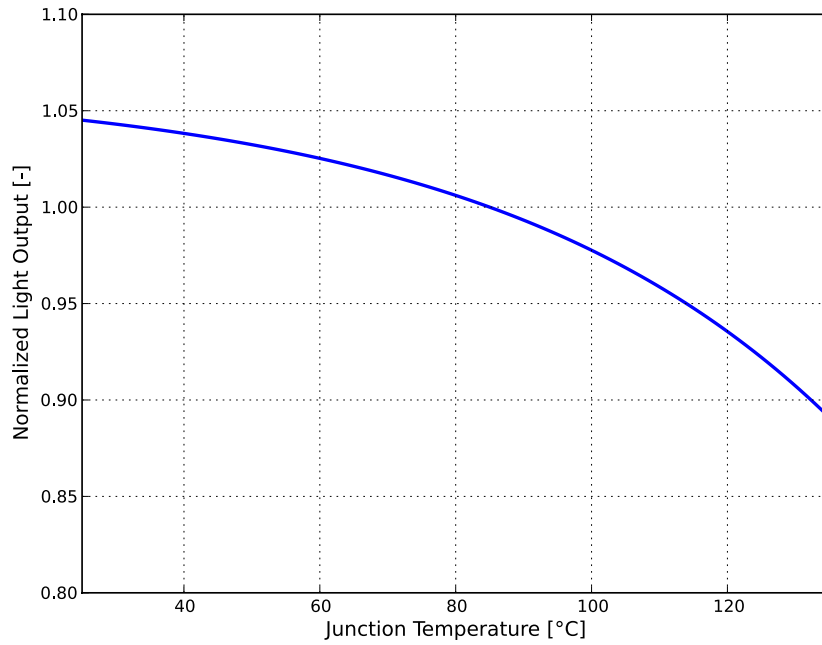


Figure 6. Relative light output vs. junction temperature, L1Q0-xxyy00000zzz0.

## Relative Light Output vs. Forward Current, Junction Temperature = 85°C

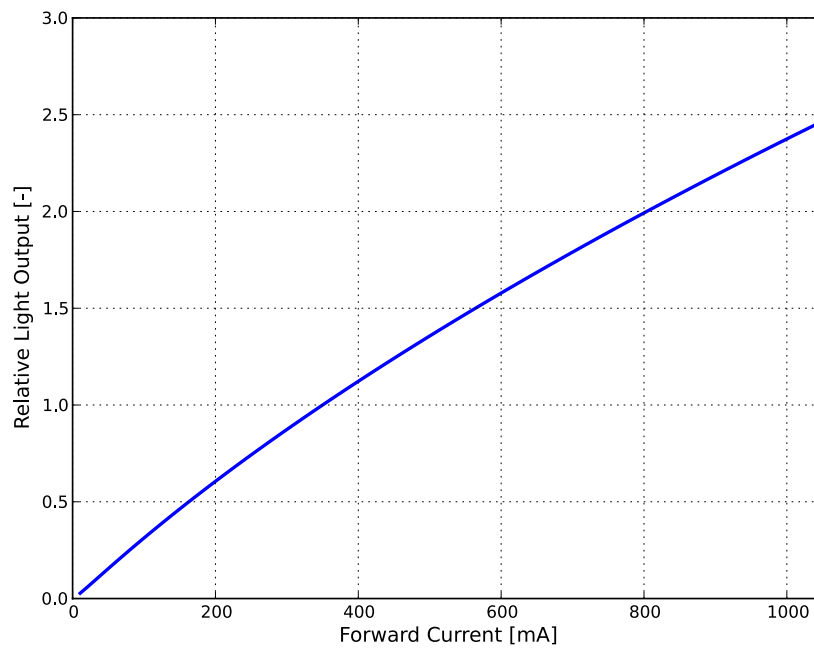


Figure 7. Typical relative luminous flux vs. forward current, L1Q0-xxyy00000zzz0.

# Typical Forward Current Characteristics

Forward Current vs. Forward Voltage  
Junction Temperature = 85°C

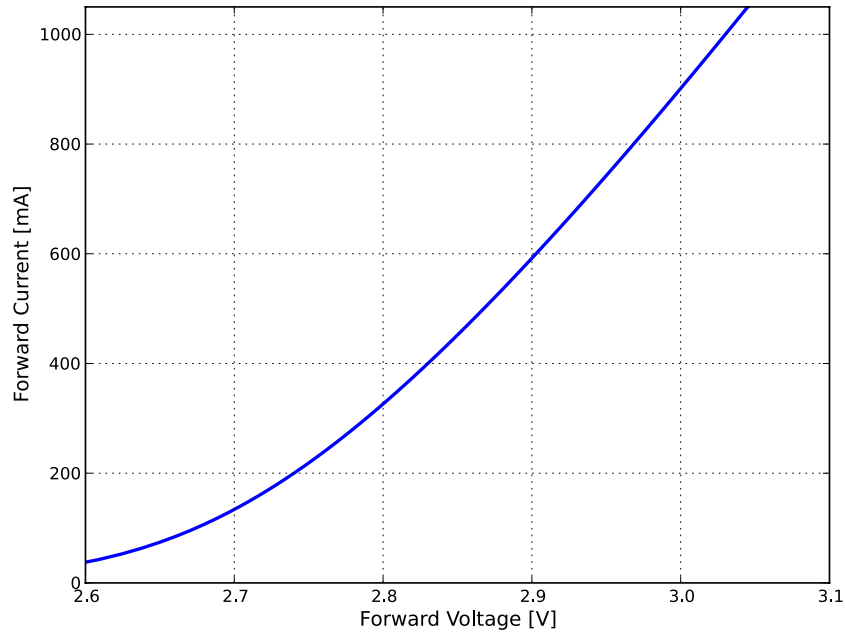


Figure 8. Typical forward current vs. forward voltage, L1Q0-xyy00000zzz0.

# Typical Radiation Patterns

## Typical Spatial Radiation Pattern

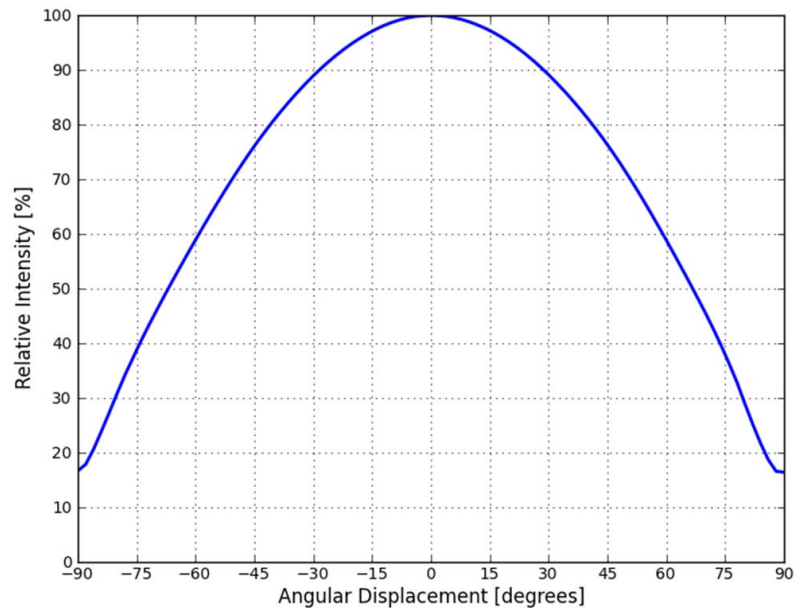


Figure 9. Typical representative spatial radiation pattern for L1Q0-xxyy00000zzz0.

## Typical Polar Radiation Pattern

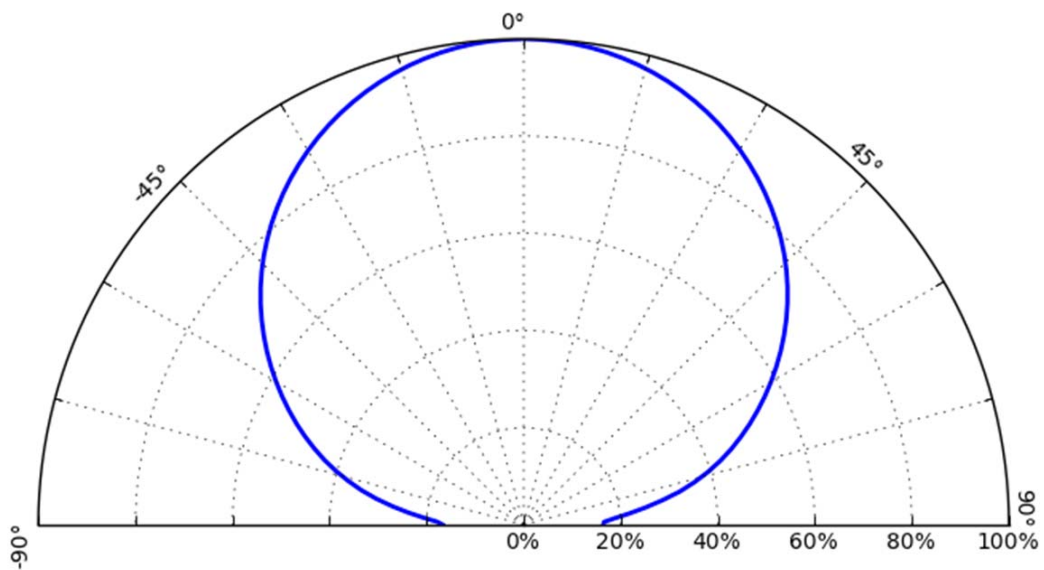


Figure 10. Typical representative polar radiation pattern for L1Q0-xxyy00000zzz0.

# Emitter Pocket Tape Packaging

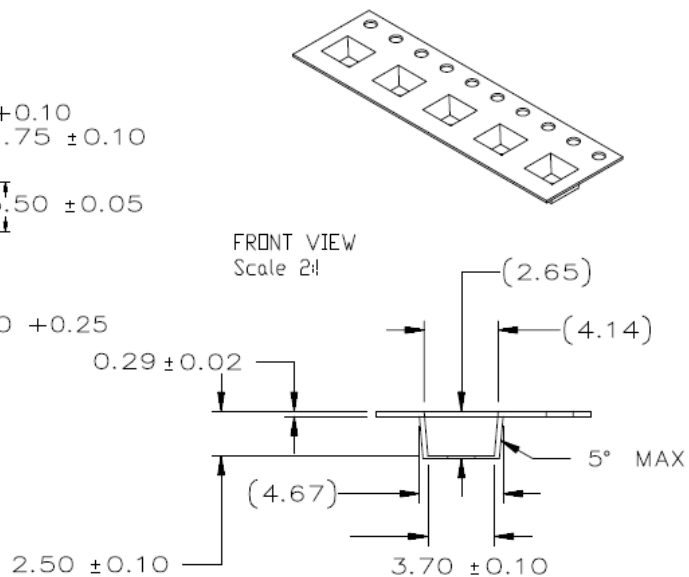
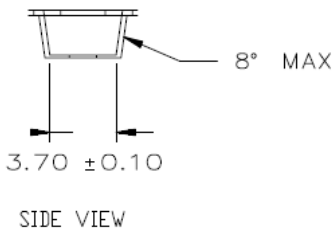
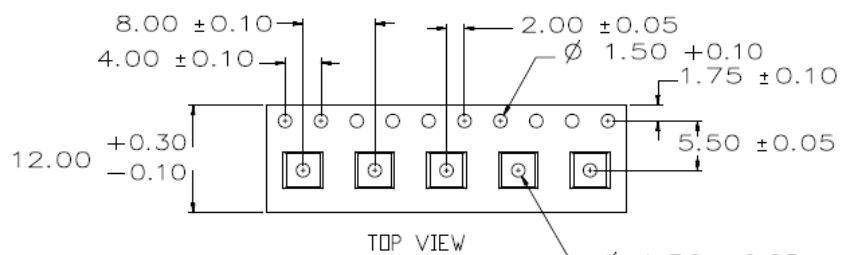
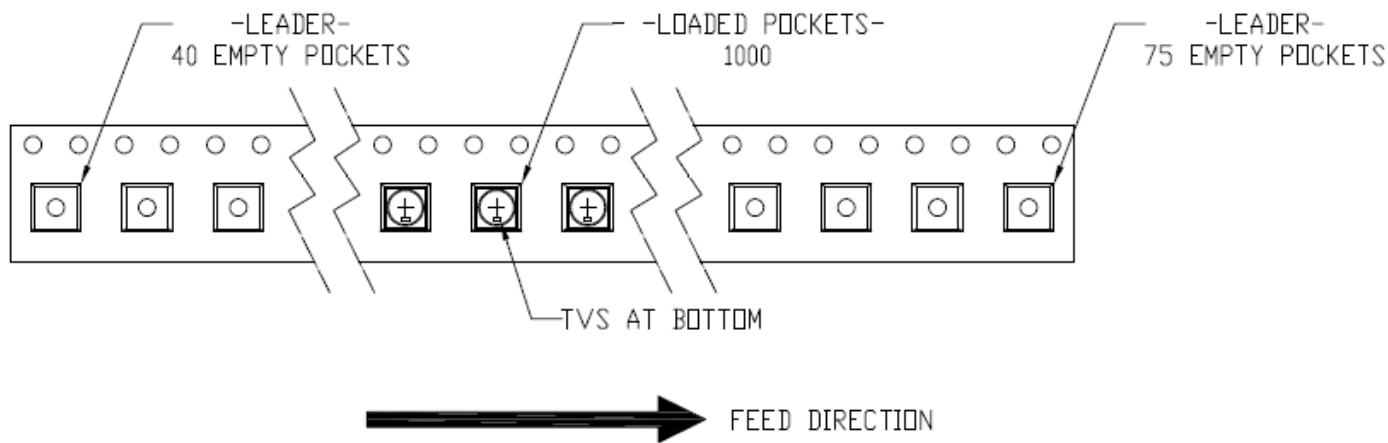


Figure 11. Emitter pocket tape packaging.

# Emitter Reel Packaging

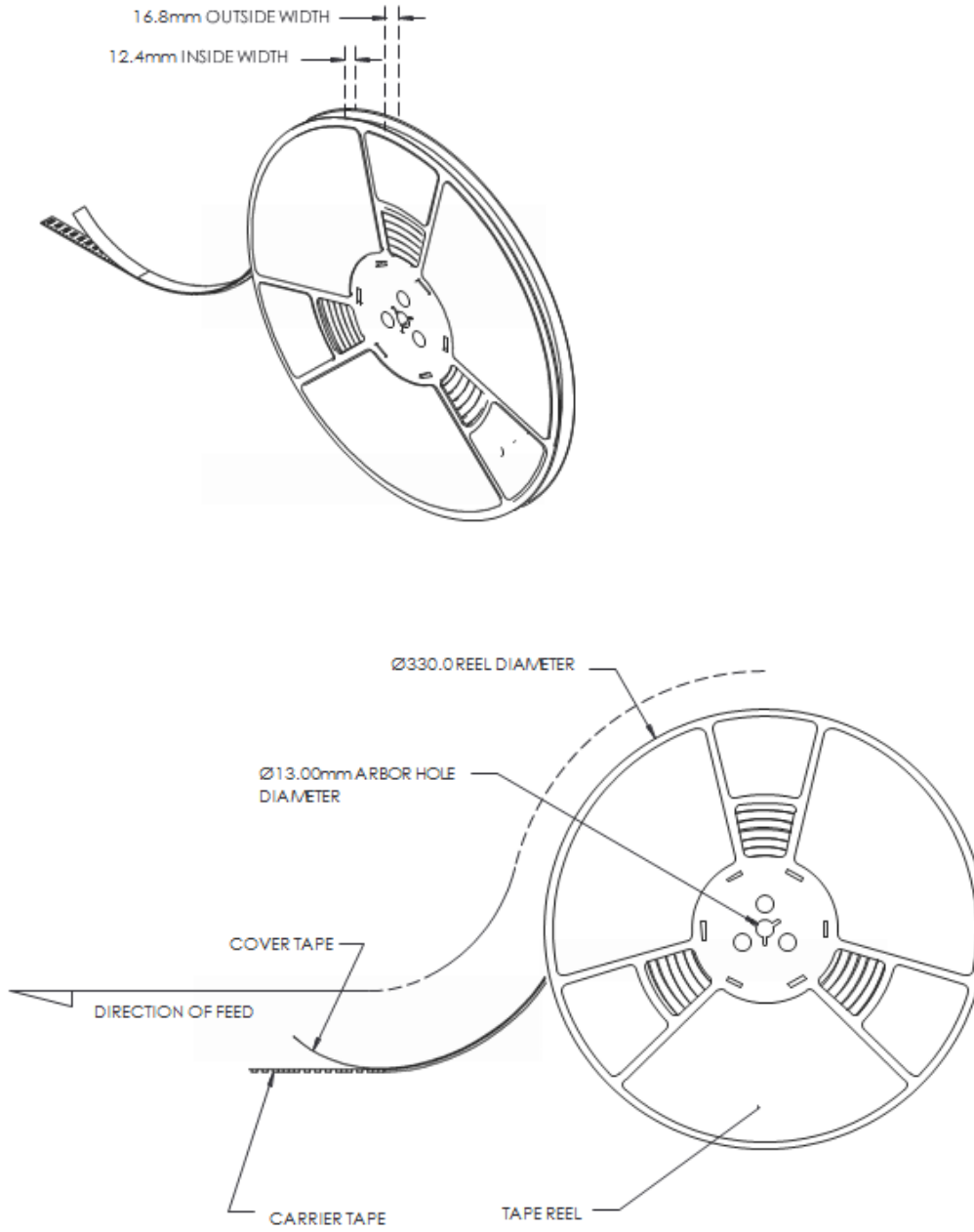


Figure 12. Emitter reel packaging.

# Product Binning and Labeling

## Purpose of Product Binning

In the manufacturing of semiconductor products, there are variations in performance around the average values given in the technical data sheets. For this reason, Lumileds bins the LED components for luminous flux and forward voltage ( $V_f$ ). Color is offered in a single 3-step or 5-step MacAdam ellipse color space centered on the ANSI CCT color bins. For additional information please review the MacAdam ellipse technical definition section.

## Decoding Product Bin Labeling

LUXEON Q emitters are labeled using a four digit alphanumeric code (CAT code) depicting the bin values for emitters packaged on a single reel. All emitters packaged within a reel are of the same 3-variable bin combination.

Reels of LUXEON Q emitters are labeled with a four digit alphanumeric CAT code following the format below:

ABCD

A = Flux/Radiometric power bin (D, E, etc.)

B, C = Color bin (30, 3U, 3L, 5A, 5B, 5C, 5D etc.)

D =  $V_f$  bin (Q, R, S)

# Luminous Flux and Forward Voltage Bins

Table 7 lists the standard photometric luminous flux bins for LUXEON Q emitters (tested and binned at 350mA and  $T_j = 85^\circ\text{C}$ ). 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 7. Flux Bins

Bin Code	Minimum Photometric Flux (Lm)	Maximum Photometric Flux (Lm)
8	80	90
9	90	100
A	100	110
B	110	120
C	120	130
D	130	140
E	140	150
F	150	160
G	160	170

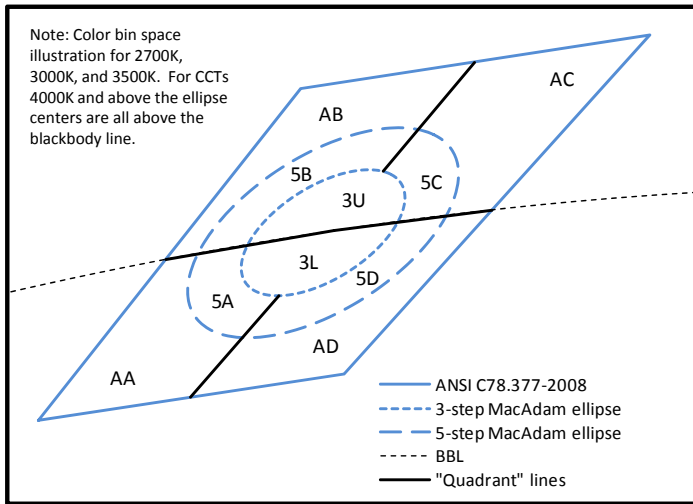
Table 8 lists minimum and maximum  $V_f$  bin values per emitter. Although several bins are outlined, product availability in a particular bin varies by production run and by product performance.

Table 8.  $V_f$  Bins

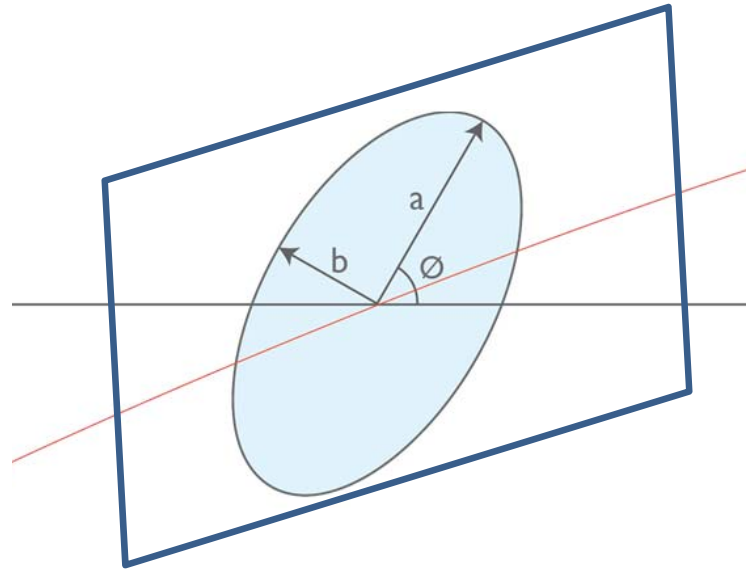
Bin Code	Minimum Forward Voltage (V)	Maximum Forward Voltage (V)
Q	2.50	2.75
R	2.75	3.00
S	3.00	3.25



# LUXEON Q 3-step and 5-step MacAdam ellipse Color Definition



Color Space Definition for Above and Below Blackbody



Parameter Definition of MacAdam ellipse

Table 9. LUXEON Q Product Characteristics for 3-step MacAdam ellipse

Part Number	Nominal ANSI CCT	Color Space	Center Point (cx, cy)	Major Axis, a	Minor Axis, b	Ellipse Rotation Angle
L1Q0-278000000zzz0	2700K	Single 3-step MacAdam ellipse	(0.4578, 0.4101)	0.00810	0.00420	53.7
L1Q0-308000000zzz0	3000K	Single 3-step MacAdam ellipse	(0.4338, 0.4030)	0.00834	0.00408	53.2
L1Q0-358000000zzz0	3500K	Single 3-step MacAdam ellipse	(0.4073, 0.3917)	0.00927	0.00414	54.0
L1Q0-407000000zzz0	4000K	Single 3-step MacAdam ellipse	(0.3818, 0.3797)	0.00939	0.00402	53.7
L1Q0-507000000zzz0	5000K	Single 3-step MacAdam ellipse	(0.3447, 0.3553)	0.00822	0.00354	59.6
L1Q0-577000000zzz0	5700K	Single 3-step MacAdam ellipse	(0.3287, 0.3417)	0.00745	0.00319	59.1

Min 80CRI 3-step color bins available above (3U) and below (3L) the blackbody line. Min 70CRI 3-step is not divided into bins above and below the blackbody line and is defined as bin 30.

Table 10. LUXEON Q Product Characteristics for 5-step MacAdam ellipse

Part Number	Nominal ANSI CCT	Color Space	Center Point (cx, cy)	Major Axis, a	Minor Axis, b	Ellipse Rotation Angle
L1Q0-278000000zzz0	2700K	Single 5-step MacAdam ellipse	(0.4578, 0.4101)	0.01350	0.00700	53.7
L1Q0-308000000zzz0	3000K	Single 5-step MacAdam ellipse	(0.4338, 0.4030)	0.01390	0.00680	53.2
L1Q0-358000000zzz0	3500K	Single 5-step MacAdam ellipse	(0.4073, 0.3917)	0.01545	0.00690	54.0
L1Q0-407000000zzz0	4000K	Single 5-step MacAdam ellipse	(0.3818, 0.3797)	0.01565	0.00670	53.7
L1Q0-507000000zzz0	5000K	Single 5-step MacAdam ellipse	(0.3447, 0.3553)	0.01370	0.00590	59.6
L1Q0-577000000zzz0	5700K	Single 5-step MacAdam ellipse	(0.3287, 0.3417)	0.01234	0.00533	59.1

Min 70 and min 80CRI 5-step is divided into quadrants (5A, 5B, 5C, and 5D).

Notes for Tables 9 & 10:

1. Lumileds maintains a tester tolerance of  $\pm 0.005$  on x, y color coordinates.

# About Lumileds

Lumileds is the light engine leader, delivering innovation, quality, and reliability.

For 100 years, Lumileds commitment to innovation has helped customers pioneer breakthrough products in the automotive, consumer and illumination markets.

Lumileds is shaping the future of light with our LEDs and automotive lamps, and helping our customers illuminate how people see the world around them.

To learn more about our portfolio of light engines visit [www.lumileds.com](http://www.lumileds.com).



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