LUXEON never before possible

LUXEON® Product
Binning and Labeling

Purpose of Product Binning

In the manufacturing of semiconductor products, there is a variation of performance around the average values given in the technical data sheets. For this reason, Philips Lumileds bins the LED components for flux, color and forward voltage (V_f).

Decoding Product Bin Labeling

LUXEON® Emitters are labeled using either a three or 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. Standard LUXEON arrays are labeled with either a four or five digit alphanumeric code depicting luminous flux, wavelength, and forward voltage per emitter on the array. Using these codes it is possible to determine optimum mixing and matching of products for consistency in a given application.

Standard LUXEON arrays (Star, Line, Ring and Flood) are specified to accept full manufacturing distribution in terms of flux, color, and forward voltage. Although Philips Lumileds does not bin these standard products, they are labeled in a manner that allows for decoding the characteristics of the individual array.

LUXEON array products are individually marked with this information. LUXEON Stars are built from the same combination of color, V_f, and flux bins for all units contained in the carrier array.

Features

- Highest flux per LED in the world
- 50,000 hours operation with 70% lumen maintenance
- Available in white, warm white, green, blue, royal blue, cyan, red, red-orange and amber
- Lambertian, batwing, side emitting or collimated distribution pattern
- More energy efficient than incandescent and most halogen lamps
- Low voltage DC operated
- Cool beam, safe to the touch
- Instant light (less than 100 ns)
- Fully dimmable
- No UV
- Superior ESD protection

Typical Applications

- Reading lights (car, bus, aircraft)
- Portable (flashlight, bicycle)
- General Illumination
- Orientation
- Mini-accent
- Decorative
- Fiber optic alternative
- Appliance
- Sign and channel letter
- Architectural detail
- Cove lighting
- Automotive exterior (stop-tail-turn, CHMSL, mirror side repeat)
- Edge-lit signs (exit, point of sale)

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LUXEON arrays are marked with a 13 digit, machine printed one or two line label on the back of the aluminum core PCB. See Table 1 for details.

Format of Labeling for Arrays

LUXEON arrays are labeled following one of the formats listed in Table 1.

Table 1. Formats for labeling of LUXEON, LUXEON Dental, LUXEON III, LUXEON V, and LUXEON V Portable arrays.

Label Type	Applicable LUXEON Products	Format of Label
Printed label on back of aluminum core PCB	Colored Star/C, Star/O, Line, Ring, Flood	ABCDXXXXXXX WWYYPPPPPPPP
Printed label on back of aluminum core PCB	White Star/C, Star/O, Line, Ring, Flood	ABCDEXXXXXXX WWYYPPPPPPPP
Printed label on back of aluminum core PCB	Colored Star	ABCD WWYY
Printed label on back of aluminum core PCB	White Star	ABCDE WWYY

Format of Labeling for Emitters

Reels of emitters are labeled with either a three or four digit alphanumeric CAT code following the formats below. All non-white LUXEON, LUXEON K2, LUXEON Dental, LUXEON III and LUXEON V emitters are labeled using the 3-digit CAT code format. All white LUXEON, LUXEON K2, LUXEON III and LUXEON V Portable emitters are labeled using the 4-digit CAT code format.

ABC

A = Flux bin (G, H, J, K, etc.)
B = Color bin (1, 2, 3, 4, etc.)
C = VF bin (E, F, G, etc.)

ABCD

A = Flux bin (G, H, J, K, etc.)
B and C = Color bin (V0, X0, W0, etc.)
D = VF bin (E, F, G, etc.)

The tables included in this application note can be used to identify the bin values contained in this code.

Table 2a indicates the properties of the characters listed in the label formats shown in Table 1 for colored products. Table 2b indicates the properties of the characters listed in the label formats shown in Table 1 for white products binned in accordance with the LUXEON white binning structure (2-digit color code).

Table 2a. Label character representation for colored LUXEON, LUXEON Dental, LUXEON III and LUXEON V arrays.

Label Character	Interpretation
A	Flux or power bin (L, M, N etc.)
B	Color bin (1, 2, 3 etc.)
C	Forward voltage (V_F), bin (E, F, G etc.)
D	Color identifier (see table 3)
XXXXXXX	Batch or serial number where applicable
WW	Work week of production
YY	Work year of production
PPPPPPPP	Part number

Table 2b. Label character representation for white (including warm white) LUXEON, LUXEON III and LUXEON V Portable arrays.

Label Character	Interpretation
A	Flux or power bin (L, M, N etc.)
B and C	Color bin (VO, XO, WO etc.)
D	Forward voltage (V_F), bin (E, F, G etc.)
E	Color identifier (see table 3)
XXXXXXX	Batch or serial number where applicable
WW	Work week of production
YY	Work year of production
PPPPPPPP	Part number

The color identifier is a one digit alpha code indicating the color range of the array (i.e. blue, green, white, etc.). Color identifiers are defined in Table 3.

Table 3. Color identifier code for LUXEON, LUXEON Dental, LUXEON III, LUXEON V and LUXEON V Portable arrays.

Color Identifier (character D or E)	Color
W	White
Y	Royal Blue
Y	Dental Blue
B	Blue
C	Cyan
G	Green
A	Amber
H	Red-orange
R	Red

Luminous Flux Bins

Table 4 lists the standard photometric luminous flux bins for LUXEON emitters and arrays. Values listed are per emitter values. For multiple emitter arrays it is necessary to calculate total array minimum flux based on number of emitters per array (array flux is equivalent to the number of emitters multiplied by minimum flux value per emitter).

Royal blue and dental blue products are tested and binned by radiometric power instead of photometric flux, a more meaningful characterization value as the eye response is much lower in this short blue wavelength range. Table 8 indicates the radiometric power binning structure that is applicable to royal blue and dental blue products (emitters and arrays) only.

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 4. Photometric luminous flux bin structure for white, cool-white, neutral-white, warm-white, blue, cyan, green, amber, red-orange and red LUXEON, LUXEON K2 (excluding LXK2PW14x00 series), LUXEON V, and LUXEON V Portable emitters and arrays. Also applicable for blue, cyan, and green LUXEON III emitters and arrays and white LUXEON III side-emitting emitters and arrays.

Bin Code	Minimum Photometric Flux (lm)	Maximum Photometric Flux (lm)
J	6.3	8.2
K	8.2	10.7
L	10.7	13.9
M	13.9	18.1
N	18.1	23.5
P	23.5	30.6
Q	30.6	39.8
R	39.8	51.7
S	51.7	67.2
T	67.2	87.4
U	87.4	113.6
V	113.6	147.7
W	147.7	192.0
X	192.0	249.6

Table 5. Photometric luminous flux bin structure for white LUXEON III Lambertian Emitters, Side Emitters and Arrays (applicable for LXHL-PW09, LXHL-DW09, LXHL-LW3C AND LXHL-FW3C).

Bin Code	Minimum Photometric Flux (lm)	Maximum Photometric Flux (lm)
S	60.0	67.2
T	67.2	87.4
U	87.4	113.6
V	113.6	147.7
W	147.7	192.0
X	192.0	249.6

Table 6. Photometric luminous flux bin structure for red, red-orange, and amber LUXEON III emitters and arrays.

Bin Code	Minimum Photometric Flux (lm)	Maximum Photometric Flux (lm)
D	70	90
E	90	120
F	120	155
G	155	200
H	200	260
J	260	340

Table 7. Photometric luminous flux bin structure for white LUXEON K2 Lambertian Emitters (applicable for LXK2-PW14-x00).

Bin Code	Minimum Photometric Flux (lm)	Maximum Photometric Flux (lm)
T	80.0	87.4
U	87.4	113.6
V	113.6	147.7

Table 8. Radiometric power bin structure for royal blue and dental blue LUXEON, LUXEON K2, LUXEON Dental, LUXEON III, LUXEON V emitters and arrays.

Bin Code	Minimum Radioometric Power (mW)	Maximum Radiometric Power (mW)
F	55	70
G	70	85
H	85	115
J	115	145
K	145	175
L	175	225
M	225	275
N	275	355
P	355	435
Q	435	515
R	515	635
S	635	755
T	755	875
U	875	1050
V	1050	1225
W	1225	1400
X	1400	1680

Color Bins

LUXEON emitters and arrays are also tested and binned for dominant wavelength, peak wavelength (royal blue and dental blue products only), correlated color temperature (CCT, white products only) or by x,y coordinates (white products only). Effective April 24, 2006, a new white binning structure has been introduced for all LUXEON, LUXEON K2, LUXEON III and LUXEON V array white products. This new binning structure (see figure 1) has been completely imple mented as of September 1, 2006. Warm-White LUXEON products have a similar binning structure, which can be seen in Figure 3. Tables 9-14 illustrate the relevant wavelength, CCT and x,y bins for all LUXEON products.

Table 9. Dominant wavelength bin structure for amber LUXEON, LUXEON K2 and LUXEON III emitters and arrays.

Bin Code	Minimum Dominant Wavelength (nm)	Maximum Dominant Wavelength (nm)
1	584.5	587.0
2	587.0	589.5
4	589.5	592.0
6	592.0	594.5
7	594.5	597.0

Table 10. Dominant wavelength bin structure for red and red-orange LUXEON, LUXEON K2 and LUXEON III emitters and arrays .

Bin Code	Minimum Dominant Wavelength (nm)	Maximum Dominant Wavelength (nm)
2	613.5	620.5
4	620.5	631.0
5	631.0	645.0

Table 11. Peak wavelength bin structure for royal blue and dental blue LUXEON, LUXEON K2, LUXEON Dental, LUXEON III and LUXEON V emitters and arrays.

Bin Code	Minimum Peak Wavelength (nm)	Maximum Peak Wavelength (nm)
3	440	445
4	445	450
5	450	455
6	455	460
7	460	465
8	465	470

Table 12. Dominant wavelength bin structure for blue LUXEON, LUXEON K2, LUXEON III and LUXEON V emitters and arrays.

Bin Code	Minimum Dominant Wavelength (nm)	Maximum Dominant Wavelength (nm)
1	460	465
2	465	470
3	470	475
4	475	480
5	480	485
6	485	490

Table 13. Dominant wavelength bin structure for cyan LUXEON, LUXEON K2, LUXEON III and LUXEON V emitters and arrays.

Bin Code	Minimum Dominant Wavelength (nm)	Maximum Dominant Wavelength (nm)
1	490	495
2	495	500
3	500	505
4	505	510
5	510	515
6	515	520

Table 14. Dominant wavelength bin structure for green LUXEON, LUXEON K2, LUXEON III and LUXEON V emitters and arrays.

Bin Code	Minimum Dominant Wavelength (nm)	Maximum Dominant Wavelength (nm)
1	520	525
2	525	530
3	530	535
4	535	540
5	540	545
6	545	550

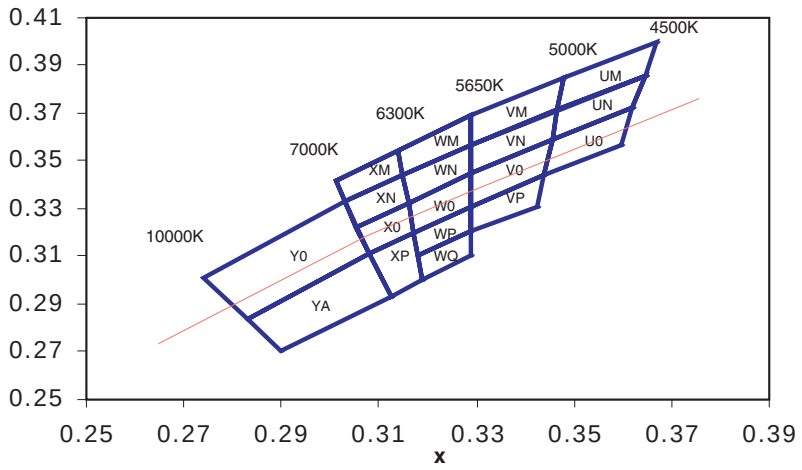

Figure 2. New LUXEON white binning structure graphical representation for LUXEON, LUXEON K2, LUXEON III and LUXEON V emitter and array products. Coordinates listed in Table 15.

Table 15. New white LUXEON bin structure for white LUXEON, LUXEON K2, LUXEON III and LUXEON V Portable emitters and arrays.

Bin Code	X	Y	Typical CCT (K)
U0	0.362	0.372	4750
	0.360	0.357	
	0.344	0.344	
	0.346	0.359	
UN	0.364	0.383	4750
	0.362	0.372	
	0.346	0.359	
	0.347	0.372	
UM	0.364	0.383	4750
	0.367	0.400	
	0.348	0.385	
	0.347	0.372	
VP	0.329	0.331	5300
	0.344	0.344	
	0.343	0.331	
	0.329	0.320	
V0	0.329	0.331	5300
	0.329	0.345	
	0.346	0.359	
	0.344	0.344	
VN	0.329	0.345	5300
	0.329	0.357	
	0.347	0.372	
	0.346	0.359	
VM	0.329	0.357	5300
	0.329	0.369	
	0.348	0.385	
	0.347	0.372	
WQ	0.329	0.321	6000
	0.329	0.310	
	0.319	0.300	
	0.318	0.310	
WP	0.329	0.331	6000
	0.329	0.320	
	0.318	0.310	
	0.317	0.320	

Bin Code	X	Y	Typical CCT (K)
W0	0.329	0.345	6000
	0.329	0.331	
	0.317	0.320	
	0.316	0.333	
WN	0.329	0.345	6000
	0.316	0.333	
	0.315	0.344	
	0.329	0.357	
WM	0.329	0.369	6000
	0.329	0.357	
	0.315	0.344	
	0.314	0.355	
XP	0.308	0.311	6700
	0.317	0.320	
	0.319	0.300	
	0.311	0.293	
X0	0.308	0.311	6700
	0.305	0.322	
	0.316	0.333	
	0.317	0.320	
XN	0.305	0.322	6700
	0.303	0.333	
	0.315	0.344	
	0.316	0.333	
XM	0.301	0.342	6700
	0.314	0.355	
	0.315	0.344	
	0.303	0.333	
Y0	0.308	0.311	8000
	0.283	0.284	
	0.274	0.301	
	0.303	0.333	
YA	0.308	0.311	8000
	0.311	0.293	
	0.290	0.270	
	0.283	0.284	

Note for Table 15:

1. 1. Philips Lumileds maintains a tester tolerance of ± 0.005 on x, y color coordinates.

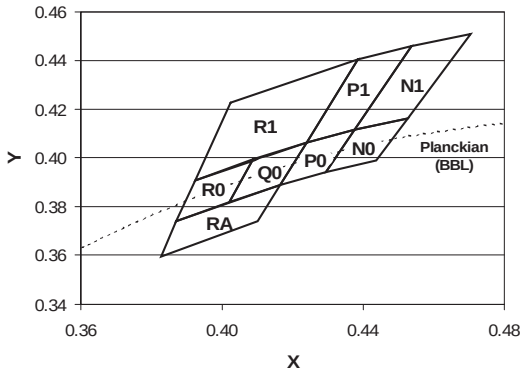

Figure 3. Warm white LUXEON white binning structure graphical representation (applicable for LXHL-BW03, LXHL-MWGC and LXHL-NWG8). Coordinates listed in Table 16.

Table 16. Warm white LUXEON bin structure (applicable for LXHL-BW03, LXHL-MWGC and LXHL-NWG8).

Bin Code	X	Y	Typical CCT (K)
N0	0.438	0.412	2950
	0.429	0.394	
	0.444	0.399	
	0.453	0.416	
NI	0.454	0.446	2950
	0.438	0.412	
	0.453	0.416	
	0.471	0.451	
P0	0.424	0.406	3150
	0.416	0.389	
	0.429	0.394	
	0.438	0.412	
PI	0.438	0.440	3150
	0.424	0.406	
	0.438	0.412	
	0.454	0.446	
Q0	0.409	0.400	3370
	0.402	0.382	
	0.416	0.389	
	0.424	0.406	
R0	0.392	0.391	3640
	0.387	0.374	
	0.402	0.382	
	0.409	0.400	
RI	0.402	0.423	3500
	0.392	0.391	
	0.424	0.406	
	0.438	0.440	
RA	0.387	0.374	3500
	0.383	0.360	
	0.410	0.374	
	0.416	0.389	

Note for Table 16:

1. Philips Lumileds maintains a tester tolerance of ± 0.005 on x, y color coordinates.

Forward Voltage Bins

Table 17 lists minimum and maximum V_F bin values per emitter. For multiple emitter arrays maximum and minimum voltage is based on the array layout as indicated in the product data sheets. 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 17. Forward voltage bin structure for all LUXEON, LUXEON K2, LUXEON Dental, LUXEON III, LUXEON V and LUXEON V Portable emitters and arrays.

Bin Code	Minimum Forward Voltage (V)	Maximum Forward Voltage (V)
E	2.31	2.55
F	2.55	2.79
G	2.79	3.03
H	3.03	3.27
J	3.27	3.51
K	3.51	3.75
L	3.75	3.99
M	3.99	4.23
N	4.23	4.47
P	4.47	4.71
Q	4.71	4.95
R	5.43	5.91
S	5.91	6.39
T	6.39	6.87
U	6.87	7.35
V	7.35	7.83
W	7.83	8.31

Table 18. Applicable forward voltage bin ranges by product type for all LUXEON, LUXEON K2, LUXEON warm white, LUXEON Dental, LUXEON III, LUXEON V and LUXEON V Portable emitters and arrays.

Product Type	Applicable V_F Bins
LUXEON Red and Amber (Batwing)	Bins E - H
LUXEON Red, Amber and Red-orange (Lambertian and Side Emitting)	Bins E - J
LUXEON White, Warm White, Royal Blue Dental Blue, Blue, Green and Cyan (Batwing, Lambertian and Side Emitting)	Bins G - L
LUXEON III White, Royal Blue, Blue, Green and Cyan (Batwing, Lambertian and Side Emitting)	Bins H - N
LUXEON III Red, Red-Orange and Amber (Lambertian and Side Emitting)	Bins E - J
LUXEON V Royal Blue, Blue, Green, Cyan and LUXEON V Portable (Lambertian and Side Emitting)	Bins R - W
LUXEON K2 red, red-orange and amber (Lambertian)	Bins E - J
LUXEON K2 (LXK2-XX12-XXX) White, Royal Blue, Blue, Green and Cyan (Lambertian)	Bins G-M
LUXEON K2 (LXK2-XX14-XXX) White, Royal Blue, Blue, Green, Cyan (Lambertian)	Bins H-Q

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Company Information

Philips Lumileds is the world's leading provider of power LEDs for everyday lighting applications. The company's records for light output, efficacy and thermal management are direct results of the ongoing commitment to advancing solid-state lighting technology and enabling lighting solutions that are more environmentally friendly, help reduce CO_2 emissions and reduce the need for power plant expansion. Philips Lumileds LUXEON® LEDs are enabling never before possible applications in outdoor lighting, shop lighting and home lighting.

Philips Lumileds is a fully integrated supplier, producing core LED material in all three base colors, (Red, Green, Blue) and white. Philips Lumileds has R&D centers in San Jose, California and in the Netherlands, and production capabilities in San Jose, Singapore and Penang Malaysia. Founded in 1999, Philips Lumileds is the high flux LED technology leader and is dedicated to bridging the gap between solid-state technology and the lighting world. More information about the company's LUXEON LED products and solid-state lighting technologies can be found at www.philipslumileds.com.

Philips Lumileds may make process or materials changes affecting the performance or other characteristics of our products. These products supplied after such changes will continue to meet published specifications, but may not be identical to products supplied as samples or under prior orders.

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