

LuxeonTM Product Binning and Labeling

application brief AB21

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, 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 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 individual marked with this information. Luxeon Stars, which are manufactured in a 4x4 16-Up array, are built from the same combination of color, V_f , and flux bins for all units contained in the 16-up carrier array.



Luxeon is available in white, warm white, green, blue, royal blue, cyan, red, red-orange and amber.

Features

- Highest flux per LED in the world
- Very long operating life (up to 100k hours)
- Available in 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)
- 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)

Luxeon arrays are marked either with an 11-digit bar code sticker on the front of the product, with a hand printed 4-digit alphanumeric code on the back of the aluminum core PCB, or with a machine printed one or two line label on the back of the aluminum core PCB. Over time all Luxeon array product labeling will evolve to the printed label on the back of the aluminum core PCB, rendering the barcode label and hand printed labeling obsolete.

Format of Labeling for Emitters

Reels of emitters are labeled with either a three or four digit alphanumeric CAT code following the formats below. Prior to WW27 2003, all Luxeon, Luxeon Dental, Luxeon V and Luxeon V Portable emitters are labeled using the 3-digit CAT code format. After WW27 2003, only non-white Luxeon, Luxeon Dental, Luxeon V, and Luxeon III emitters are labeled using the 3-digit CAT code format (LXHL-BW01 is the one white exception, labeled with the three digit CAT code format).

ABC

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

ABCD

- A = Flux bin (G, H, J, K, etc.)
- B and C = Color bin (V0, X1, WA, etc.)
- D = V_F bin (E, F, G, etc.)

The following white emitter products will transition to the 4-digit CAT code format through WW35 2003 to account for the implementation of a new white binning structure (see figure 2 and table 14). This 4-digit CAT code format also applies to white Luxeon III and warm white Luxeon products as indicated below.

LXHL-BW02	LXHL-PW01	LXHL-DW01	LXHL-PW03
LXHL-DW03	LXHL-BW03	LXHL-DW09	LXHL-PW09

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

Format of Labeling for Arrays

Luxeon arrays are labeled following one of the formats listed in table 1.

LABEL TYPE	APPLICABLE LUXEON PRODUCTS	FORMAT OF LABEL
HAND PRINTED TEXT	LUXEON STAR, STAR/C STAR/O, AND RINGS	ABCD
STICKER WITH BAR CODE	LUXEON LINE, FLOODS, STAR, STAR/C, STAR/O	ABCDXXXXXX
PRINTED LABEL ON BACK OF ALUMINUM CORE PCB	STAR/C, STAR/O, STAR/DC	ABCDXXXXXX WWYYPPPPPPP
PRINTED LABEL ON BACK OF ALUMINUM CORE PCB	STAR/C	ABCDEXXXXXX WWYYPPPPPPP
PRINTED LABEL ON BACK OF ALUMINUM CORE PCB	STAR	ABCD WWYY
PRINTED LABEL ON BACK OF ALUMINUM CORE PCB	STAR	ABCDE WWYY

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

The following array products will transition to a 2-digit color code format through WW35 2003 to account for the implementation of a new white binning structure (see figure 2 and table 14). This 2-digit color code format also applies to white Luxeon III and warm white Luxeon array products as indicated below.

LXHL-MW1D LXHL-FW1C LXHL-MWEC LXHL-MW1B
 LXHL-LW6C LXHL-FW6C LXHL-LW3C LXHL-MWGC
 LXHL-NWG8 LXHL-FW3C

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 and white products binned to the old Luxeon white binning structure. 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 new Luxeon white binning structure (2-digit color code).

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 2a.
Label character representation for Luxeon, Luxeon III, Luxeon Dental, Luxeon V and Luxeon V Portable arrays (prior to WW27 2003, no change for non-white products or for the following white products: LXHL-MW1C, LXHL-MW1A, LXHL-NW98, LXHL-MW1E, LXHL-NW99, LXHL-NW97, LXHL-NW96, LXHL-MWCA and LXHL-MWJA).

LABEL CHARACTER	INTERPRETATION
A	FLUX OR POWER BIN (L, M, N ETC.)
B AND C	COLOR BIN (VO, XI, WA 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

Table 2b.
Label character representation for white (including warm white) Luxeon, Luxeon III and Luxeon V Portable arrays (beginning WW27 2003, applicable for LXHL-MW1D, LXHL-FW1C, LXHL-MWEC, LXHL-MW1B, LXHL-LW6C, LXHL-FW6C, LXHL-LW3C, LXHL-FW3C, LXHL-MWGC and LXHL-NWG8).

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.

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

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

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 6 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.

BIN CODE	MINIMUM PHOTOMETRIC FLUX (LM)	MAXIMUM PHOTOMETRIC FLUX (LM)
F	2.9	3.8
G	3.8	4.9
H	4.9	6.3
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

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

BIN CODE	MINIMUM RADIOMETRIC 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

Table 4.
Photometric luminous flux bin structure for white, warm white, blue, cyan, green, amber, red-orange and red Luxeon, 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.

Table 5.
Photometric luminous flux bin structure for white Luxeon III lambertian emitters and arrays (applicable for LXHL-PW09 and LXHL-LW3C)

Table 6.
Radiometric power bin structure for royal blue and dental blue Luxeon, Luxeon Dental, Luxeon III, Luxeon V emitters and arrays.

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 WW27 2003 a new white binning structure has been introduced for all Luxeon, Luxeon III, and Luxeon V white products (with a few exceptions.) This new binning structure (see figure 2) will be phased in through WW35 2003, becoming the sole binning structure for these white products WW36 2003. A similar binning structure has been developed for the warm white Luxeon products, which can be seen in figure 3. Tables 7-15 illustrate the relevant wavelength, CCT and x,y bins for all Luxeon products.

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 7.
Dominant wavelength bin structure for amber Luxeon 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 8.
Dominant wavelength bin structure for red and red-orange Luxeon 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 9.
Peak wavelength bin structure for royal blue and dental blue Luxeon, Luxeon Dental, 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 10. Dominant wavelength bin structure for blue Luxeon, 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 11. Dominant wavelength bin structure for cyan Luxeon, 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

Table 12. Dominant wavelength bin structure for green Luxeon, Luxeon III and Luxeon V emitters and arrays.

BIN CODE	MINIMUM CCT (K)	MAXIMUM CCT (K)
1	4500	5000
2	5000	5500
3	5500	6000
4	6000	7000
5	7000	8000

Table 13. Correlated Color Temperature (CCT) bin structure for white Luxeon and Luxeon V Portable emitters and arrays (prior to WW27 2003, no change for LXHL-BW01, LXHL-MW1C, LXHL-MW1A, LXHL-NW98, LXHL-MW1E, LXHL-NW99, LXHL-NW97, LXHL-NW96, LXHL-MWCA and LXHL-MWJA).

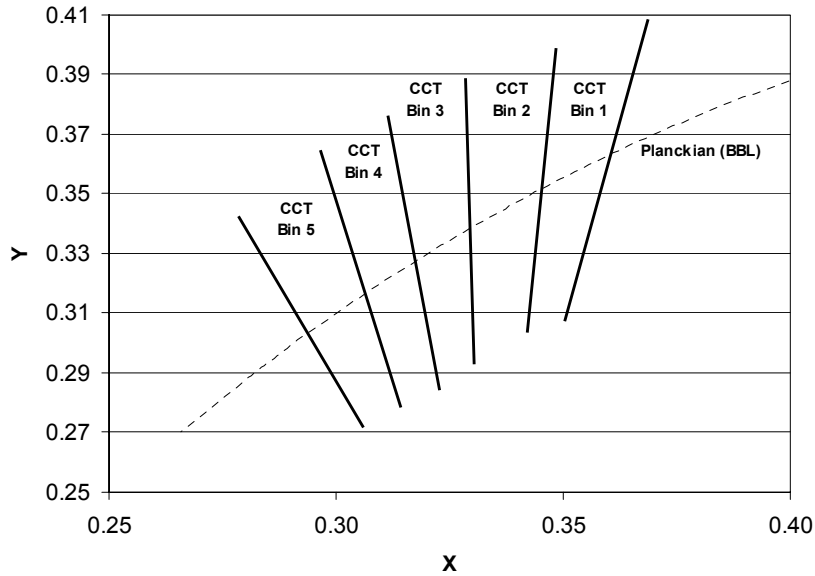


Figure 1.
Existing Luxeon white binning structure graphical representation (prior to WW27 2003 for Luxeon and Luxeon V Portable products, still applicable for LXHL-BW01, LXHL-MW1C, LXHL-MW1A, LXHL-NW98, LXHL-MW1E, LXHL-NW99, LXHL-NW97, LXHL-NW96, LXHL-MWCA and LXHL-MWJA).

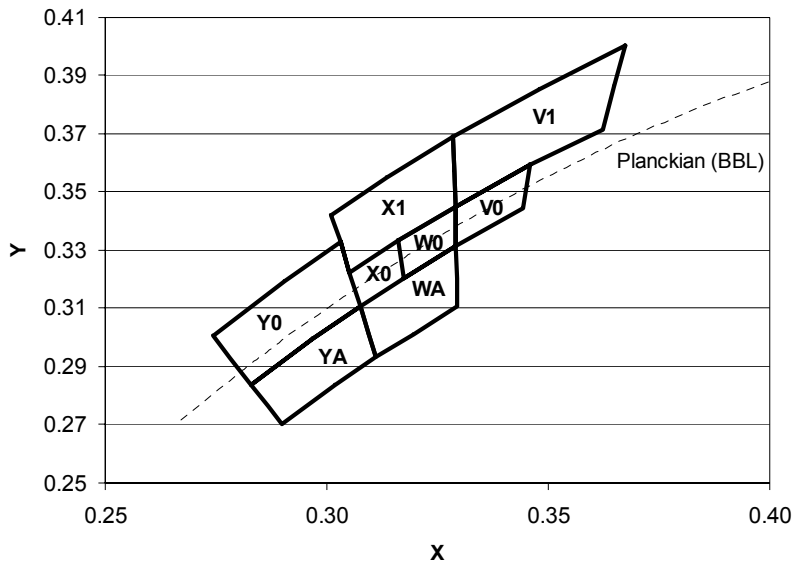


Figure 2.
New Luxeon white binning structure graphical representation for Luxeon, Luxeon III and Luxeon V emitter and array products (beginning WW27 2003, applicable for LXHL-PW01, LXHL-DW01, LXHL-BW02, LXHL-PW03, LXHL-DW03, LXHL-MW1D, LXHL-FW1C, LXHL-MWEC, LXHL-MW1B, LXHL-LW6C, LXHL-FW6C, LXHL-DW09, LXHL-FW3C, LXHL-PW09 and LXHL-LW3C). Coordinates listed in table 14.

BIN CODE	X	Y	TYPICAL CCT (K)
VO	0.346	0.359	5350
	0.344	0.344	
	0.329	0.331	
	0.329	0.345	
VI	0.367	0.400	5500
	0.362	0.372	
	0.329	0.345	
	0.329	0.369	
WO	0.329	0.345	6050
	0.329	0.331	
	0.317	0.320	
	0.316	0.333	
WA	0.329	0.331	6300
	0.330	0.310	
	0.311	0.293	
	0.308	0.311	
XO	0.316	0.333	6700
	0.317	0.320	
	0.308	0.311	
	0.305	0.322	
XI	0.329	0.369	6300
	0.329	0.345	
	0.305	0.322	
	0.301	0.342	
YA	0.308	0.311	8000
	0.311	0.293	
	0.290	0.270	
	0.283	0.284	
YO	0.303	0.333	8000
	0.308	0.311	
	0.283	0.284	
	0.274	0.301	

Table 14.

New white Luxeon bin structure for white Luxeon, Luxeon III and Luxeon V Portable emitters and arrays (beginning WW27 2003, applicable for LXHL-PW01, LXHL-DW01, LXHL-BW02, LXHL-PW03, LXHL-DW03, LXHL-MW1D, LXHL-FW1C, LXHL-MWEC, LXHL-MW1B, LXHL-LW6C, LXHL-FW6C, LXHL-PW09 LXHL-LW3C, LXHL-DW09 and LXHL-FW3C).

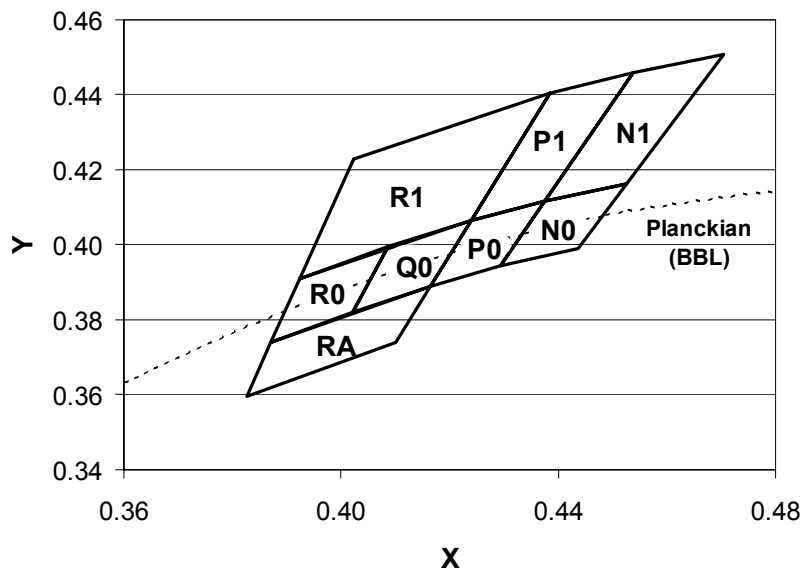


Figure 3. Warm white Luxeon white binning structure graphical representation (applicable for LXHL-BW03, LXHL-MWGC and LXHL-NWG8). Coordinates listed in table 15.

BIN CODE	X	Y	TYPICAL CCT (K)
NO	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	
PO	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	
QO	0.409	0.400	3370
	0.402	0.382	
	0.416	0.389	
	0.424	0.406	
RO	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	

Table 15.
Warm white Luxeon bin structure
(applicable for LXHL-BW03, LXHL-MWGC
and LXHL-NWG8).

Forward Voltage Bins

Table 16 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.

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
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

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 V ROYAL BLUE, BLUE, GREEN, CYAN AND LUXEON V PORTABLE (LAMBERTIAN AND SIDE EMITTING)	BINS R – W

Table 16. Forward voltage bin structure for all Luxeon, warm white Luxeon, Luxeon Dental, Luxeon III, Luxeon V and Luxeon V Portable emitters and arrays.

Table 17. Applicable forward voltage bin ranges by product type for all Luxeon, warm white Luxeon, Luxeon Dental, Luxeon III, Luxeon V and Luxeon V Portable emitters and arrays.

About Luxeon



Luxeon is the new world of solid-state lighting (LED) technology. Luxeon Power Light Source Solutions offer huge advantages over conventional lighting and huge advantages over other LED solutions. Luxeon enables partners to create and market products that, until now, were impossible to create. This means the opportunity to create products with a clear competitive advantage in the market. Products that are smaller, lighter, sleeker, cooler, and brighter. Products that are more fun to use, more efficient, and more environmentally conscious than ever before possible!



Company Information

Luxeon is developed, manufactured and marketed by Lumileds Lighting, U.S., LLC. Lumileds is a world-class supplier of Light Emitting Diodes (LEDs) producing billions of LEDs annually. Lumileds is a fully integrated supplier, producing core LED material in all three base colors (Red, Green, Blue) and White. Lumileds has R&D development centers in San Jose, California and Best, The Netherlands. Production capabilities in San Jose, California and Malaysia.

Lumileds is pioneering the high-flux LED technology and bridging the gap between solid state LED technology and the lighting world. Lumileds is absolutely dedicated to bringing the best and brightest LED technology to enable new applications and markets in the Lighting world.



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

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