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## Application Note 1-1

**Z-POWER LED series****Binning and Labeling**

Z-Power series is designed for high current operation and high flux output applications.



Z-Power LED's thermal management perform exceeds other power LED solutions.

It incorporates state of the art SMD design and Thermal emission material.

Z Power LED is ideal light sources for general illumination applications, custom designed solutions, automotive large LCD backlights

This application note provides binning and labeling information of Z-Power LED series.

It includes the Z-Power LED bins for luminous flux, wavelength (or x,y coordinates), correlated color temperature (CCT) for white and forward voltage.

**P4****Features**

- Super high flux output and high luminance
- Designed for high current operation
- Low thermal resistance
- SMT solderability
- Lead free product
- RoHS compliant

**Applications**

- Mobile phone flash
- Automotive interior / Exterior lighting
- Automotive signal lighting
- Automotive forward lighting
- Torch
- Architectural lighting
- LCD TV / Monitor backlight
- Projector light source
- Traffic signals
- Task lighting
- Decorative / Pathway lighting
- Remote / Solar powered lighting
- Household appliances



**Part Number**

Part numbers specify color, Z-Power series, Lens type, P<sub>d</sub>, size, PCB and Grade of characteristic code type of Z-Power LED.

• Example: X<sub>1</sub> X<sub>2</sub> X<sub>3</sub> X<sub>4</sub> X<sub>5</sub> X<sub>6</sub> X<sub>7</sub> -X<sub>8</sub> X<sub>9</sub> <sup>1)</sup>

X <sub>1</sub>	Color
W	Pure White
N	Warm White
S	Natural White
D	Royal Blue
B	Blue
C	Cyan
G	Green
A	Amber
R	Red
P	Photosynthetic Red
F	Full Color (7-color)

X <sub>2</sub>	Z-Power Series
S	P3-II
4	P4
5	P5-II
7	P7
9	P9

X <sub>3</sub>	LENS Type
0	P5-II Flat Type
2	P4,P7,P9 Dome Type <sup>2)</sup>
9	P4 narrow Type <sup>3)</sup>

Note:

- 1) X<sub>8</sub>, X<sub>9</sub> is a internal code number
- 2) Hemispherical dome type
- 3) View angle : 93°



<b>X<sub>4</sub></b>	<b>Chip Quantity (or Power Dissipation)</b>
1	1 chip (1W)
2	2 chip (2.5W)
3	Full Color (7-color)
4	4 chip (5W)

<b>X<sub>5</sub></b>	<b>Package Outline Size</b>
9	9 X 9 mm
8	D 8 mm
6	5 X 6 mm
5	D 5 mm

<b>X<sub>6</sub></b>	<b>Metal PCB Type</b>
0	Emitter Only
2	Star

<b>X<sub>7</sub></b>	<b>Grade of Characteristic Code</b>
H	P4 Warm, Natural White Code
C	P9 Characteristic Code

## Code Labeling

### 1. Flux Bins

1-1. Luminous flux bin structure for pure white, warm white, blue, cyan, green, amber and red Z-Power.

Bin Code		Luminous Flux [lm]
J		6 ~ 8.5
K		8.5 ~ 11.0
L		11.0 ~ 14.5
M		14.5 ~ 19.0
O		19.0 ~ 24.5
P		24.5 ~ 32.0
Q		32.0 ~ 41.5
R		41.5 ~ 54.0
S	S1	54.0 ~ 60.0
	S2	60.0 ~ 70.0
T	T1	70.0 ~ 80.0
	T2	80.0 ~ 91.0
U	U1	91.0 ~ 100.0
	U2	100.0 ~ 109.0
	U3	109.0 ~ 118.5
V1		118.5 ~ 130.0
V2		130.0 ~ 140.0
V3		140.0 ~ 154.0
W		154.0 ~ 200.0
X		200.0 ~ 260.0
Y		260.0 ~ 340.0

1-2. Radiant flux bin structure for Photosynthetic red Z-Power

Bin Code	Radiant Flux [W]
A	0.15 ~ 0.30

## Code Labeling

### 1. Flux Bins

1-3. Radiant flux bin structure for Royal blue Z-Power

Bin Code	Radiant Flux [W]
G	0.250 ~ 0.305
H	0.305 ~ 0.400
I	0.400 ~ 0.490
J	0.490 ~ 0.595

The list explains the photometric luminous flux bins for Z-Power LED. Z-Power LED are tested and binned by photometric luminous flux. Not all bins are available in all colors.

Tolerance :  $\pm 10\%$  of Luminous flux value

## 2. Color Bins

Z-Power are tested and binned for dominant wavelength (blue, green, amber, red) or x,y coordinates (pure white, warm white)

### 2 -1 Blue, Green, Amber, Red

Bin Code	Color	Dominant Wavelength [nm]
BB1	Blue	455 ~ 460
BB2		460 ~ 465
BB3		465 ~ 470
BB4		470 ~ 475
GG1	Green	520 ~ 525
GG2		525 ~ 530
GG3		530 ~ 535
AA1	Amber	585 ~ 587.5
AA2		587.5 ~ 590
AA3		590 ~ 592.5
AA4		592.5 ~ 595
RR1	Red	618 ~ 625
RR2		625 ~ 632

### 2 -2 Photosynthetic Red

Bin Code	Color	Peak Wavelength [nm]
PR1	Red	655 ~ 665

### 2 -3 Royal Blue

Bin Code	Color	Dominant Wavelength [nm]
DD1	Blue	455 ~ 460
DD2		460 ~ 465

Tolerance

Dominant wavelength :  $\pm 0.5$  nm

Peak wavelength :  $\pm 2.0$  nm



2-3. Pure White CIE

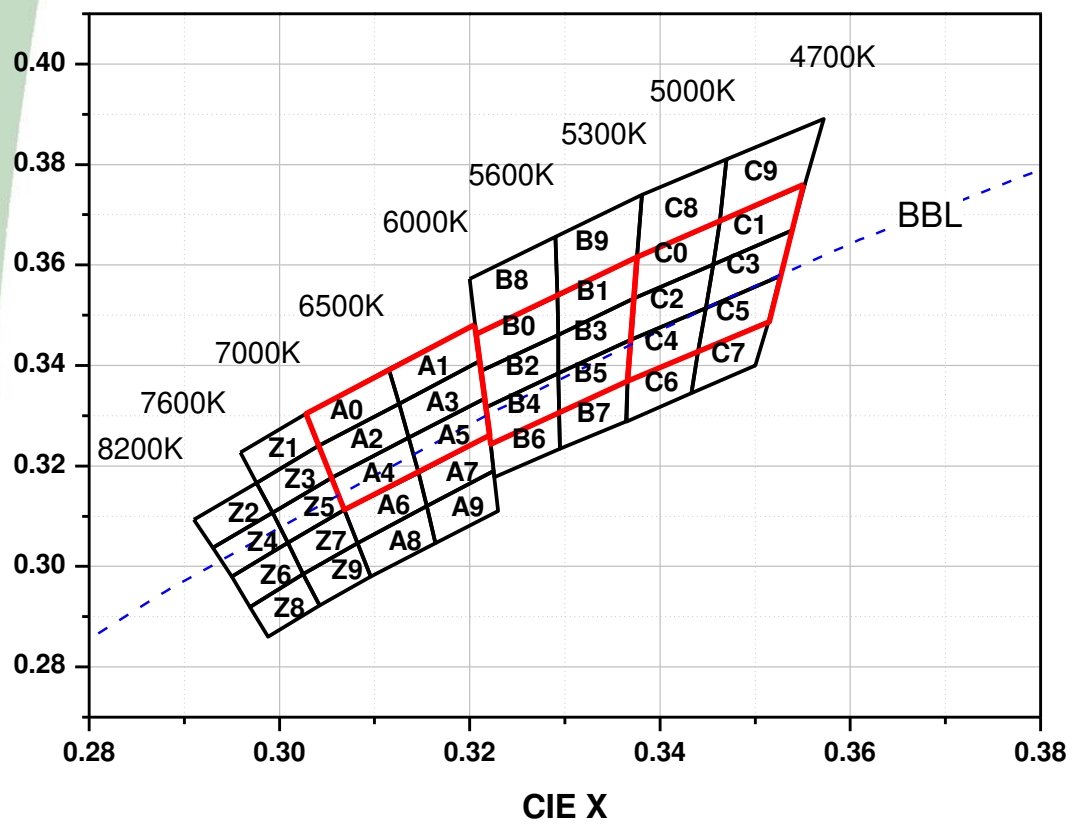
Pure white product tested and binned by x,y coordinates and CCT

- Pure white bin structure

bin	CIE x	CIE y	bin	CIE x	CIE y	bin	CIE x	CIE y	bin	CIE x	CIE y
Z1	0.2959	0.3227	A0	0.3028	0.3304	B0	0.3207	0.3462	C0	0.3376	0.3616
	0.2976	0.3166		0.3041	0.3240		0.3212	0.3389		0.3373	0.3534
	0.3041	0.3240		0.3126	0.3324		0.3293	0.3461		0.3456	0.3601
	0.3028	0.3304		0.3115	0.3393		0.3292	0.3539		0.3463	0.3687
	0.2959	0.3227		0.3028	0.3304		0.3207	0.3462		0.3376	0.3616
Z2	0.2910	0.3093	A1	0.3115	0.3393	B1	0.3292	0.3539	C1	0.3463	0.3687
	0.2930	0.3037		0.3126	0.3324		0.3293	0.3461		0.3456	0.3601
	0.2993	0.3107		0.3210	0.3408		0.3373	0.3534		0.3539	0.3669
	0.2976	0.3166		0.3205	0.3481		0.3376	0.3616		0.3552	0.3760
	0.2910	0.3093		0.3115	0.3393		0.3292	0.3539		0.3463	0.3687
Z3	0.2976	0.3166	A2	0.3041	0.3240	B2	0.3212	0.3389	C2	0.3373	0.3534
	0.2993	0.3107		0.3055	0.3177		0.3217	0.3316		0.3369	0.3451
	0.3055	0.3177		0.3136	0.3256		0.3293	0.3384		0.3448	0.3514
	0.3041	0.3240		0.3126	0.3324		0.3293	0.3461		0.3456	0.3601
	0.2976	0.3166		0.3041	0.3240		0.3212	0.3389		0.3373	0.3534
Z4	0.2930	0.3037	A3	0.3126	0.3324	B3	0.3293	0.3461	C3	0.3456	0.3601
	0.2950	0.2980		0.3136	0.3256		0.3293	0.3384		0.3448	0.3514
	0.3009	0.3047		0.3216	0.3334		0.3369	0.3451		0.3526	0.3578
	0.2993	0.3107		0.3210	0.3408		0.3373	0.3534		0.3539	0.3669
	0.2930	0.3037		0.3126	0.3324		0.3293	0.3461		0.3456	0.3601
Z5	0.2993	0.3107	A4	0.3055	0.3177	B4	0.3217	0.3316	C4	0.3369	0.3451
	0.3009	0.3047		0.3068	0.3113		0.3222	0.3243		0.3366	0.3369
	0.3068	0.3113		0.3146	0.3187		0.3294	0.3306		0.3440	0.3428
	0.3055	0.3177		0.3136	0.3256		0.3293	0.3384		0.3448	0.3514
	0.2993	0.3107		0.3055	0.3177		0.3217	0.3316		0.3369	0.3451
Z6	0.2950	0.2980	A5	0.3136	0.3256	B5	0.3293	0.3384	C5	0.3448	0.3514
	0.2969	0.2919		0.3146	0.3187		0.3294	0.3306		0.3440	0.3428
	0.3025	0.2985		0.3221	0.3261		0.3366	0.3369		0.3514	0.3487
	0.3009	0.3047		0.3216	0.3334		0.3369	0.3451		0.3526	0.3578
	0.2950	0.2980		0.3136	0.3256		0.3293	0.3384		0.3448	0.3514
Z7	0.3009	0.3047	A6	0.3068	0.3113	B6	0.3222	0.3243	C6	0.3366	0.3369
	0.3025	0.2985		0.3082	0.3046		0.3226	0.3178		0.3364	0.3288
	0.3082	0.3046		0.3155	0.3120		0.3295	0.3234		0.3433	0.3345
	0.3068	0.3113		0.3146	0.3187		0.3294	0.3306		0.3440	0.3428
	0.3009	0.3047		0.3068	0.3113		0.3222	0.3243		0.3366	0.3369
Z8	0.2969	0.2919	A7	0.3146	0.3187	B7	0.3294	0.3306	C7	0.3440	0.3428
	0.2988	0.2860		0.3155	0.3120		0.3295	0.3234		0.3433	0.3345
	0.3042	0.2922		0.3225	0.3190		0.3364	0.3288		0.3500	0.3400
	0.3025	0.2985		0.3221	0.3261		0.3366	0.3369		0.3514	0.3487
	0.2969	0.2919		0.3146	0.3187		0.3294	0.3306		0.3440	0.3428
Z9	0.3025	0.2985	A8	0.3082	0.3046	B8	0.3200	0.3572	C8	0.3381	0.3740
	0.3042	0.2922		0.3096	0.2980		0.3207	0.3462		0.3470	0.3810
	0.3096	0.2980		0.3164	0.3046		0.3292	0.3539		0.3463	0.3687
	0.3082	0.3046		0.3155	0.3120		0.3290	0.3656		0.3376	0.3616
	0.3025	0.2985		0.3082	0.3046		0.3200	0.3572		0.3381	0.3740
<b>Tolerance</b>			A9	0.3155	0.3120	B9	0.3290	0.3656	C9	0.3470	0.3810
<b>Color coordinate: ±0.005</b>				0.3164	0.3046		0.3292	0.3539		0.3463	0.3687
<b>CCT: ±5% of value</b>				0.3230	0.3110		0.3376	0.3616		0.3552	0.3760
				0.3225	0.3190		0.3381	0.3740		0.3572	0.3891
				0.3155	0.3120		0.3290	0.3656		0.3470	0.3810

- Pure white binning structure graphical representation

CIE Y



**\* Note**

**Red area is ANSI Pure White bin.**

2-4. Natural white

Natural white product tested and binned by x,y coordinates and CCT

- Natural white bin structure

bin	CIE x	CIE y	bin	CIE x	CIE y	bin	CIE x	CIE y	bin	CIE x	CIE y
D0	0.3548	0.3736	D5	0.3608	0.3616	E0	0.3736	0.3874	E5	0.3813	0.3751
	0.3536	0.3646		0.3590	0.3521		0.3714	0.3775		0.3783	0.3646
	0.3625	0.3711		0.3670	0.3578		0.3842	0.3855		0.3898	0.3716
	0.3641	0.3804		0.3692	0.3677		0.3869	0.3958		0.3934	0.3825
	0.3548	0.3736		0.3608	0.3616		0.3736	0.3874		0.3813	0.3751
D1	0.3641	0.3804	D6	0.3512	0.3465	E1	0.3869	0.3958	E6	0.3670	0.3578
	0.3625	0.3711		0.3497	0.3385		0.3842	0.3855		0.3650	0.3489
	0.3714	0.3775		0.3575	0.3441		0.3970	0.3935		0.3758	0.3550
	0.3736	0.3874		0.3590	0.3521		0.4006	0.4044		0.3783	0.3646
	0.3641	0.3804		0.3512	0.3465		0.3869	0.3958		0.3670	0.3578
D2	0.3536	0.3646	D7	0.3590	0.3521	E2	0.3714	0.3775	E7	0.3783	0.3646
	0.3524	0.3555		0.3575	0.3441		0.3692	0.3677		0.3758	0.3550
	0.3608	0.3616		0.3650	0.3489		0.3813	0.3751		0.3863	0.3610
	0.3625	0.3711		0.3670	0.3578		0.3842	0.3855		0.3898	0.3716
	0.3536	0.3646		0.3590	0.3521		0.3714	0.3775		0.3783	0.3646
D3	0.3625	0.3711	D8	0.3562	0.3826	E3	0.3842	0.3855	E8	0.3760	0.3974
	0.3608	0.3616		0.3548	0.3736		0.3813	0.3751		0.3736	0.3874
	0.3692	0.3677		0.3641	0.3804		0.3934	0.3825		0.3869	0.3958
	0.3714	0.3775		0.3661	0.3900		0.3970	0.3935		0.3902	0.4067
	0.3625	0.3711		0.3562	0.3826		0.3842	0.3855		0.3760	0.3974
D4	0.3524	0.3555	D9	0.3661	0.3900	E4	0.3692	0.3677	E9	0.3902	0.4067
	0.3512	0.3465		0.3641	0.3804		0.3670	0.3578		0.3869	0.3958
	0.3590	0.3521		0.3736	0.3874		0.3783	0.3646		0.4006	0.4044
	0.3608	0.3616		0.3760	0.3974		0.3813	0.3751		0.4044	0.4160
	0.3524	0.3555		0.3661	0.3900		0.3692	0.3677		0.3902	0.4067

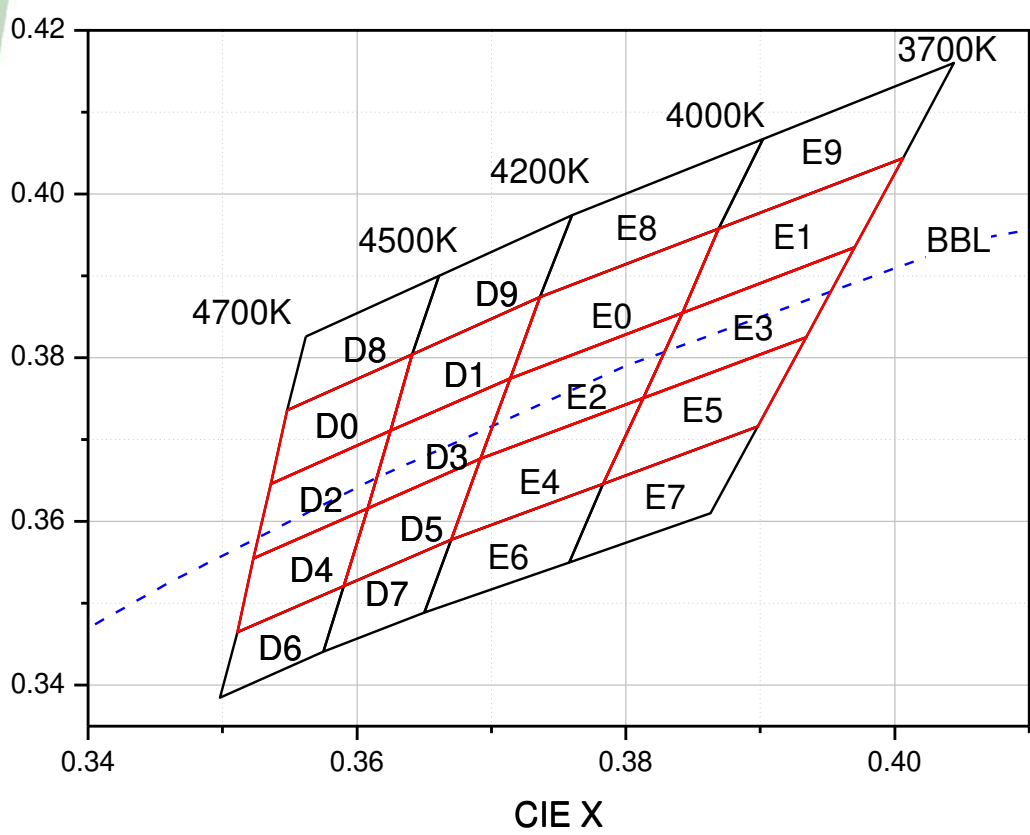
Tolerance

Color coordinate :  $\pm 0.005$

CCT :  $\pm 5\%$  of value

- Natural white binning structure graphical representation

CIE Y



**\* Note**

**Red area is ANSI Neutral White bin.**

2-5. Warm White

Warm white product tested and binned by x,y coordinates and CCT

- Warm white bin structure

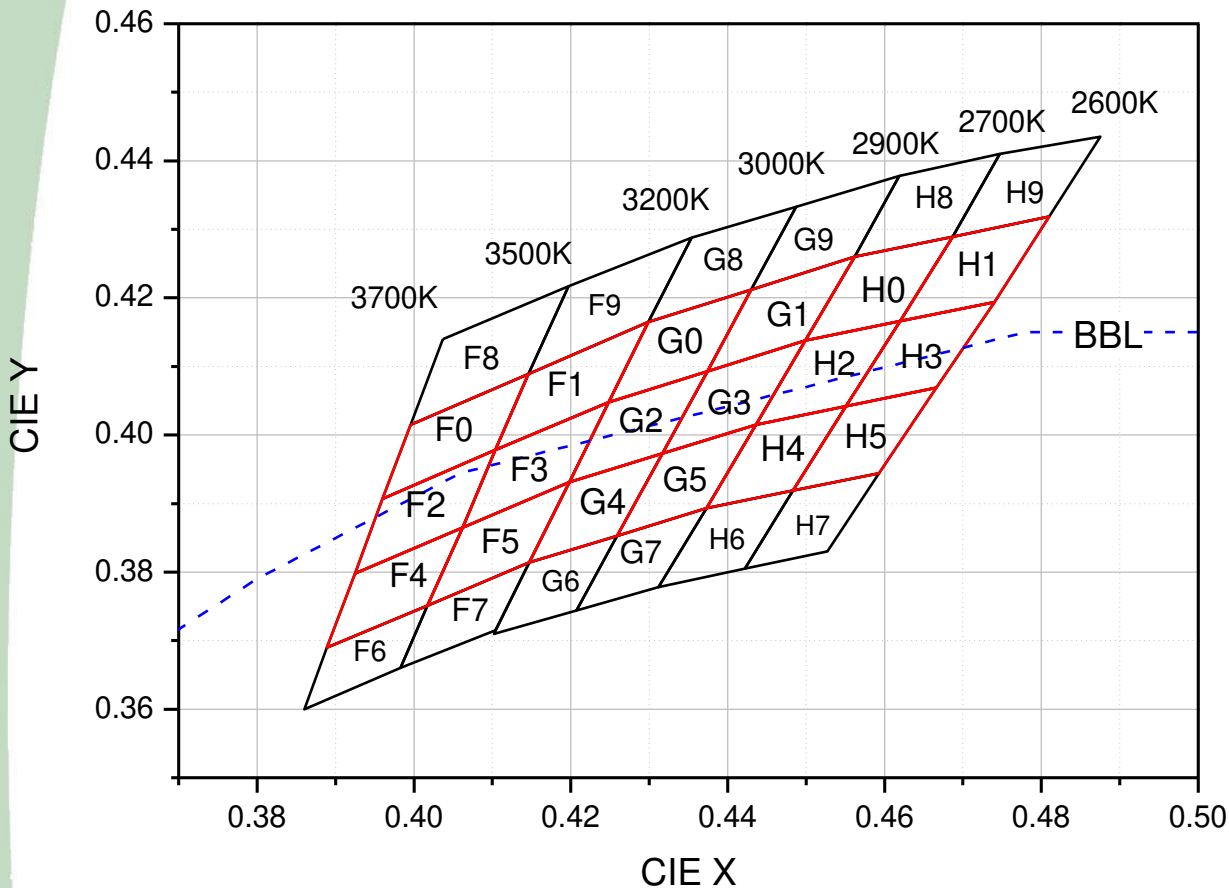
	CIE x	CIE y		CIE x	CIE y		CIE x	CIE y		CIE x	CIE y
F0	0.3996	0.4015	F8	0.4037	0.4140	G6	0.4147	0.3814	H4	0.4436	0.4015
	0.3960	0.3907		0.3996	0.4015		0.4102	0.3710		0.4373	0.3893
	0.4104	0.3978		0.4146	0.4089		0.4207	0.3744		0.4483	0.3919
	0.4146	0.4089		0.4197	0.4217		0.4259	0.3853		0.4551	0.4042
	0.3996	0.4015		0.4037	0.4140		0.4147	0.3814		0.4436	0.4015
F1	0.4146	0.4089	F9	0.4197	0.4217	G7	0.4259	0.3853	H5	0.4551	0.4042
	0.4104	0.3978		0.4146	0.4089		0.4207	0.3744		0.4483	0.3919
	0.4248	0.4048		0.4299	0.4165		0.4312	0.3778		0.4593	0.3944
	0.4299	0.4165		0.4354	0.4288		0.4373	0.3893		0.4666	0.4069
	0.4146	0.4089		0.4197	0.4217		0.4259	0.3853		0.4551	0.4042
F2	0.3960	0.3907	G0	0.4299	0.4165	G8	0.4354	0.4288	H6	0.4373	0.3893
	0.3925	0.3798		0.4248	0.4048		0.4299	0.4165		0.4312	0.3778
	0.4062	0.3865		0.4374	0.4093		0.4430	0.4212		0.4422	0.3805
	0.4104	0.3978		0.4430	0.4212		0.4487	0.4333		0.4483	0.3919
	0.3960	0.3907		0.4299	0.4165		0.4354	0.4288		0.4373	0.3893
F3	0.4104	0.3978	G1	0.4430	0.4212	G9	0.4487	0.4333	H7	0.4483	0.3919
	0.4062	0.3865		0.4374	0.4093		0.4430	0.4212		0.4422	0.3805
	0.4198	0.3931		0.4499	0.4138		0.4562	0.4260		0.4527	0.3830
	0.4248	0.4048		0.4562	0.4260		0.4619	0.4378		0.4593	0.3944
	0.4104	0.3978		0.4430	0.4212		0.4487	0.4333		0.4483	0.3919
F4	0.3925	0.3798	G2	0.4248	0.4048	H0	0.4562	0.4260	H8	0.4619	0.4378
	0.3889	0.3690		0.4198	0.3931		0.4499	0.4138		0.4562	0.4260
	0.4017	0.3751		0.4317	0.3973		0.4620	0.4166		0.4687	0.4289
	0.4062	0.3865		0.4374	0.4093		0.4687	0.4289		0.4747	0.4410
	0.3925	0.3798		0.4248	0.4048		0.4562	0.4260		0.4619	0.4378
F5	0.4062	0.3865	G3	0.4374	0.4093	H1	0.4687	0.4289	H9	0.4747	0.4410
	0.4017	0.3751		0.4317	0.3973		0.4620	0.4166		0.4687	0.4289
	0.4147	0.3814		0.4436	0.4015		0.4740	0.4194		0.4810	0.4319
	0.4198	0.3931		0.4499	0.4138		0.4810	0.4319		0.4875	0.4435
	0.4062	0.3865		0.4374	0.4093		0.4687	0.4289		0.4747	0.4410
F6	0.3889	0.3690	G4	0.4198	0.3931	H2	0.4499	0.4138			
	0.3860	0.3600		0.4147	0.3814		0.4436	0.4015			
	0.3983	0.3660		0.4259	0.3853		0.4551	0.4042			
	0.4017	0.3751		0.4317	0.3973		0.4620	0.4166			
	0.3889	0.3690		0.4198	0.3931		0.4499	0.4138			
F7	0.4017	0.3751	G5	0.4317	0.3973	H3	0.4620	0.4166			
	0.3983	0.3660		0.4259	0.3853		0.4551	0.4042			
	0.4104	0.3715		0.4373	0.3893		0.4666	0.4069			
	0.4147	0.3814		0.4436	0.4015		0.4740	0.4194			
	0.4017	0.3751		0.4317	0.3973		0.4620	0.4166			

Tolerance

Color coordinate : ±0.005

CCT : ±5% of value

- Warm white binning structure graphical representation



**\* Note**

**Red area is ANSI Warm White bin.**



### 3. Forward Voltage Bins

Bin Code	Forward Voltage [V]
D	2.00 ~ 2.25
E	2.25 ~ 2.50
F	2.50 ~ 2.75
G	2.75 ~ 3.00
H	3.00 ~ 3.25
I	3.25 ~ 3.50
J	3.50 ~ 3.75
K	3.75 ~ 4.00
L	4.00 ~ 4.25
M	4.25 ~ 4.50

Tolerance :  $\pm 0.06V$