Federal Series

Application Guide

EDISON
www.edison-opto.com

Here are a bunch of passionate people who work and live to contribute to a better tomorrow.

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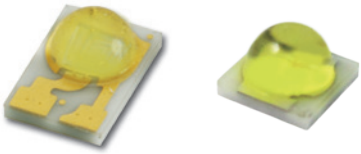
I. Product Introduction



Federal is a surface mount, compact, high brightness LED that is built for various illumination needs. A single Cool White Federal can deliver typical luminous flux of 110 lm while driving under 350mA. Suitable for any kind of lighting sources, including general illumination, flashlights, streetlights, spotlights, signal lights, industrial and commercial lightings.

The small physical dimension free customers from any constrains or limitations in any fields of applications. Furthermore, the reflow-solderable nature of Federal provides an easy path towards the optimum thermal management to achieve a promising reliability.
Federal offers you an extraordinary LED experience.

Features

- High lumen performance
- Promising lumen maintenance characteristics
- High efficiency package
- Level 1 on JEDEC moisture sensitivity analysis
- 350mA – 700mA drive current
- RoHS compliant

Applications

- Ceiling lights
- LCD Backlights
- Garden lights
- Reading lights
- Spot lights
- General lightings
- Flash lights
- Architectural lightings

Environmental Compliance

Federal series are compliant to the Restriction of Hazardous Substances Directive or RoHS. The restricted materials including lead, mercury cadmium hexavalent chromium, polybrominated biphenyls (PBB) and polybrominated diphenyl ether (PBDE) are not used in Federal to provide an environmentally friendly product to the customers.

II. Nomenclature and Characteristic Ranks

Nomenclature

EF	E	W	-	1	A	E	1
X1	X2	X3		X4	X5	X6	X7

X1 Items		X2 Module		X3 Emitting Color		X4 Power	
Code	Type	Code	Type	Code	Type	Code	Type
EP	Federal	E	Emitter	W	Cool White	1	350mA
		S	Star	H	Neutral White	3	700mA
				X	Warm White		
				R	Red		
				A	Amber (615nm)		
				T	True Green		
				B	Blue		
				D	Dental Blue		
				C	Royal Blue		
				J	Cyan		
				E	Deep Red		
				F	Cherry Red		
				I	IR 850nm		
				N	IR 940nm		
				V	UV		

X5 Dimension (mmxmm)		X6 Emitter Type		X7 Serial No.	
Code	Type	Code	Type	Code	Type
A	4.5x3.0	E	E-type	-	Serial No.
B	3.5x3.5				

Characteristic Ranks

Edison Opto has binned several characteristic of LED performance. Through the following rank tables, you may easily understand the code and specifications on the labels and reclassified by your own orders.

Photometric Luminous Flux Ranks for white light(lm)

Group	Min. (lm)	Max. (lm)
A	0.1	1.0
B	1.0	1.3
C	1.3	1.7
D	1.7	2.2
E	2.2	2.9
F	2.9	3.7
G	3.7	4.8
H	4.8	6.3
J	6.3	8.2
K	8.2	10.6
L	10.6	13.8
M	13.8	17.9
N	17.9	23.3
P	23.3	30.3
Q	30.3	39.4

Group	Min. (lm)	Max. (lm)
R	39.4	51.2
S1	51.2	58.8
S2	58.8	66.5
T1	66.5	70.0
T2	70.0	80.0
T3	80.0	86.5
U1	86.5	90
U2	90	100
U3	100	112.5
V1	112.5	129.4
V2	129.4	146.2
W1	146.2	168.1
W2	168.1	190.0
X	190.0	247.1
Y	247.1	321.2
Z	321.2	417.5

Photometric luminous flux ranks for single color

A~Z (lm)

Group	Min.	Max.	Group	Min.	Max.
A	0.1	1.0	N	17.9	23.3
B	1.0	1.3	P	23.3	30.3
C	1.3	1.7	Q	30.3	39.4
D	1.7	2.2	R	39.4	51.2
E	2.2	2.9	S	51.2	66.5
F	2.9	3.7	T	66.5	86.5
G	3.7	4.8	U	86.5	112.5
H	4.8	6.3	V	112.5	146.2
J	6.3	8.2	W	146.2	190.0
K	8.2	10.6	X	190.0	247.1
L	10.6	13.8	Y	247.1	321.2
M	13.8	17.9	Z	321.2	417.5

Radiometric power ranks for single color

A~T (mW)

Group	Min.	Max.	Group	Min.	Max.
A	10.0	15.0	K	384.4	576.7
B	15.0	22.5	L	576.7	865.0
C	22.5	33.8	M	865.0	1,298
D	33.8	50.6	N	1,298	1,946
E	50.6	75.9	P	1,946	2,919
F	75.9	113.9	Q	2,919	4,379
G	113.3	170.9	R	4,379	6,659
H	170.9	256.3	S	6,659	9,853
J	256.3	384.4	T	9,853	14,779

Forward voltage ranks

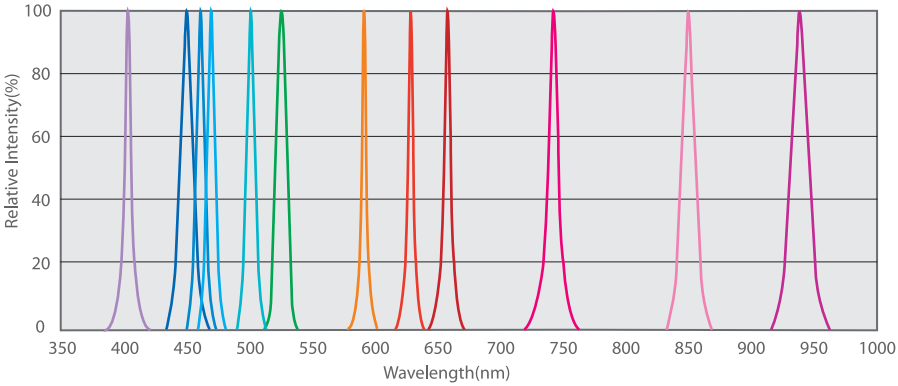
V_F(V)	
V01	2.8-3.1
V02	3.1-3.4
V03	3.4-3.7
V04	3.7-4.0
V05	4.0-4.3
V06	4.3-4.6
V07	4.6-4.9
V08	4.9-5.2

V_F(V)	
V01	2.0-2.25
V02	2.25-2.5
V03	2.5-2.75
V04	2.75-3.0
V05	3.0-3.25

IR 850-940

V_F(V)	
V01	1.5-1.75
V02	1.75-2.0

Wavelength ranks



*Ultraviolet	*Royal Blue	*Dental Blue	Blue	Cyan	True Green	Amber
V 390 — 395	V 440 — 445	W 450 — 455	V 455 — 460	W 490— 495	V 515 — 520	X 585 — 588
W 395 — 400	W 445 — 450	X 455 — 460	W 460 — 465	X 495— 500	W 520 — 525	Y 588 — 591
X 400 — 405	X 450 — 455	Y 460 — 465	X 465 — 470	Y 500— 505	X 525 — 530	Z 591 — 595
Y 405 — 410	Y 455 — 460	Z 465 — 470	Y 470 — 475	Z 505— 510	Y 530 — 535	

Red	*Deep Red	*Cherry Red	*IR 850	*IR 940
X 620 — 630	IR 650 — 670	IR 730 — 750	IR 840 — 860	IR 930 — 950

Note: *=λp

Dominant Wavelength and CIE Coordinate

Royal Blue	Wavelength/nm @350mA			CIE color coordinates		
	Min. λ_P	Max. λ_P	Avg. λ_P	saturation	average x	average y
Royal Blue W	440	445	442.5	99.6%	0.1645	0.0114
Royal Blue X	445	450	447.5	99.6%	0.1597	0.0169
Royal Blue Y	450	455	452.5	99.2%	0.1554	0.0226
Royal Blue Z	455	460	457.5	98.7%	0.1500	0.0299

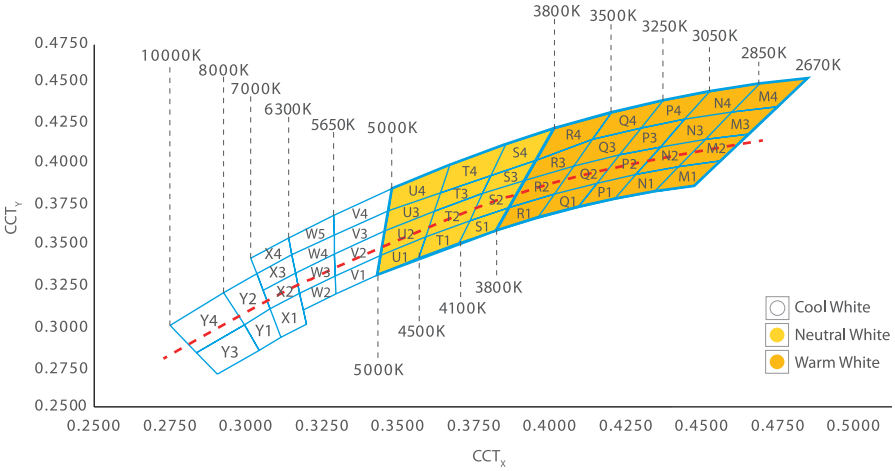
Blue	Wavelength/nm @350mA			CIE color coordinates		
	Min. λ_d	Max. λ_d	Avg. λ_d	saturation	average x	average y
Blue V	455	460	457.5	98.7%	0.1500	0.0299
Blue W	460	465	462.5	98.2%	0.1434	0.0396
Blue X	465	470	467.5	96.8%	0.1367	0.0568
Blue Y	470	475	472.5	95.8%	0.1263	0.0817

Green	Wavelength/nm @350mA			CIE color coordinates		
	Min. λ_d	Max. λ_d	Avg. λ_d	saturation	average x	average y
Green V	515	520	517.5	73.0%	0.1307	0.6939
Green W	520	525	522.5	75.0%	0.1538	0.7077
Green X	525	530	527.5	80.0%	0.1744	0.7021
Green Y	530	535	532.5	83.5%	0.2003	0.7181

Amber	Wavelength/nm @350mA			CIE color coordinates		
	Min. λ_d	Max. λ_d	Avg. λ_d	saturation	average x	average y
Amber X	585	588	586.5	99.3%	0.5480	0.4490
Amber Y	588	591	589.5	99.3%	0.5631	0.4339
Amber Z	591	595	593.0	89.2%	0.5864	0.4059

Red	Wavelength/nm @350mA			CIE color coordinates		
	Min. λ_d	Max. λ_d	Avg. λ_d	saturation	average x	average y
Red	620	630	625	99.8%	0.7011	0.2982

CCT Ranks -Edison Opto Standard Ranks

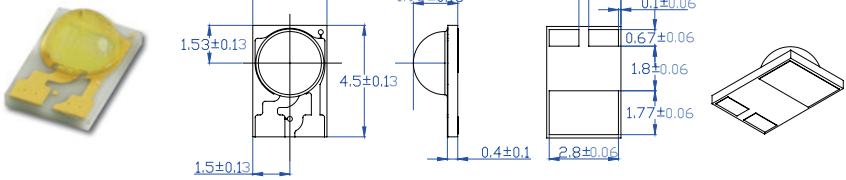


Group/ CCT (Typ.)	X	Y	Group/ CCT (Typ.)	X	Y	Group/ CCT (Typ.)	X	Y	Group/ CCT (Typ.)	X	Y
	0.4436	0.3991		0.4293	0.3942		0.4293	0.3942		0.4164	0.3890
M1	0.4576	0.4028	N1	0.4436	0.3991	P1	0.4221	0.3789	Q1	0.4021	0.3821
2,700K	0.4489	0.3875	2,900K	0.4355	0.3837	3,150K	0.4100	0.3738	3,300K	0.4100	0.3738
	0.4355	0.3837		0.4221	0.3789		0.4164	0.3890		0.3965	0.3672
	0.4525	0.4162		0.4375	0.4116		0.4239	0.4064		0.4085	0.3995
M2	0.4671	0.4196	N2	0.4293	0.3942	P2	0.4375	0.4116	Q2	0.4239	0.4064
2,700K	0.4576	0.4028	2,900K	0.4436	0.3991	3,150K	0.4293	0.3942	3,300K	0.4164	0.3890
	0.4436	0.3991		0.4525	0.4162		0.4164	0.3890		0.4021	0.3821
	0.4614	0.4333		0.4614	0.4333		0.4311	0.4233		0.4085	0.3995
M3	0.4767	0.4366	N3	0.4525	0.4162	P3	0.4456	0.4286	Q3	0.4147	0.4161
2,700K	0.4671	0.4196	2,900K	0.4375	0.4116	3,150K	0.4375	0.4116	3,300K	0.4311	0.4233
	0.4525	0.4162		0.4456	0.4286		0.4239	0.4064		0.4239	0.4064
	0.4705	0.4508		0.4538	0.4459		0.4384	0.4404		0.4384	0.4404
M4	0.4866	0.4541	N4	0.4705	0.4508	P4	0.4538	0.4459	Q4	0.4311	0.4233
2,700K	0.4767	0.4366	2,900K	0.4614	0.4333	3,150K	0.4456	0.4286	3,300K	0.4147	0.4161
	0.4614	0.4333		0.4456	0.4286		0.4311	0.4233		0.4209	0.4326

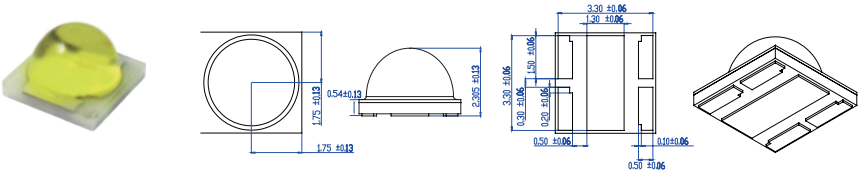
Group/ CCT (Typ.)	X	Y	Group/ CCT (Typ.)	X	Y	Group/ CCT (Typ.)	X	Y	Group/ CCT (Typ.)	X	Y
	0.3870	0.3739		0.3594	0.3556		0.3292	0.3313		0.3075	0.3107
R1	0.4021	0.3821	T1	0.3570	0.3425	V1	0.3444	0.3442	X1	0.3174	0.3204
3,650K	0.3965	0.3672	4,300K	0.3705	0.3519	5,300K	0.3433	0.3320	6,650K	0.3196	0.3013
	0.3826	0.3595		0.3740	0.3658		0.3293	0.3200		0.3111	0.2931
	0.3923	0.3909		0.3622	0.3716		0.3292	0.3313		0.3075	0.3107
R2	0.3870	0.3739	T2	0.3782	0.3824	V2	0.3290	0.3450	X2	0.3051	0.3223
3,650K	0.4021	0.3821	4,300K	0.3740	0.3658	5,300K	0.3457	0.3591	6,650K	0.3160	0.3332
	0.40859	0.3995		0.3594	0.3556		0.3444	0.3442		0.3174	0.3204
	0.40859	0.3995		0.3642	0.3828		0.3290	0.3450		0.3051	0.3223
R3	0.39237	0.3909	T3	0.3811	0.3937	V3	0.3288	0.3569	X3	0.3030	0.3327
3,650K	0.39628	0.4035	4,300K	0.3782	0.3824	5,300K	0.3469	0.3717	6,650K	0.3147	0.3444
	0.41478	0.4161		0.3622	0.3716		0.3457	0.3591		0.3160	0.3332
	0.40227	0.4227		0.3672	0.4002		0.3288	0.3569		0.3030	0.3327
R4	0.42094	0.4326	T4	0.3859	0.4129	V4	0.3286	0.3689	X4	0.3010	0.3422
3,650K	0.41478	0.4161	4,300K	0.3811	0.3937	5,300K	0.3481	0.3856	6,650K	0.3136	0.3549
	0.39628	0.4035		0.3642	0.3828		0.3469	0.3717		0.3147	0.3444
	0.3470	0.3658		0.3444	0.3442		0.3292	0.3313		0.3040	0.2850
S1	0.3870	0.3738	U1	0.3433	0.3320	W2	0.3293	0.3202	Y1	0.2990	0.3010
3,900K	0.3825	0.3595	4,750K	0.3570	0.3425	6,000K	0.3186	0.3102	7,500K	0.3075	0.3107
	0.3705	0.3519		0.3594	0.3556		0.3174	0.3204		0.3111	0.2931
	0.3782	0.3824		0.3622	0.3716		0.3290	0.3450		0.2990	0.3010
S2	0.3923	0.3909	U2	0.3594	0.3556	W3	0.3292	0.3313	Y2	0.2920	0.3210
3,900K	0.3870	0.3738	4,750K	0.3444	0.3442	6,000K	0.3174	0.3204	7,500K	0.3030	0.3327
	0.3740	0.3658		0.3457	0.3591		0.3160	0.3332		0.3075	0.3107
	0.3782	0.3824		0.3642	0.3828		0.3290	0.3450		0.3040	0.2850
S3	0.3811	0.3937	U3	0.3622	0.3716	W4	0.3160	0.3332	Y3	0.2899	0.2703
3,900K	0.3962	0.4035	4,750K	0.3457	0.3591	6,000K	0.3147	0.3444	9,000K	0.2829	0.2837
	0.3923	0.3909		0.3469	0.3717		0.3288	0.3569		0.2990	0.3010
	0.3859	0.4129		0.3642	0.3828		0.3147	0.3444		0.2920	0.3210
S4	0.4022	0.4227	U4	0.3672	0.4002	W5	0.3136	0.3549	Y4	0.2742	0.3006
3,900K	0.3962	0.4035	4,750K	0.3481	0.3856	6,000K	0.3186	0.3689	9,000K	0.2829	0.2837
	0.3811	0.3937		0.3469	0.3717		0.3288	0.3569		0.2990	0.3010

III. Product Dimensions

FR Series



FX Series



Notes:

1. Dimension: mm
2. Drawings are not to scale

IV. Specifications

FR Series

White	Part No.	CCT(K)	V_F (V) Min.	V_F (V) Max.	Test Current (mA)	Flux (lm) T_j=25°C Group	Flux (lm)	Rth (° C/W)	CRI	$2\theta_{1/2}$
1W 3045	EFEW-1AE7	5000-10000	3.0	4.0	350	U3	100	9	70	120°
						V1	112.5			
	EFEH-1AE7	3800-5000	3.0	4.0	350	T3	80	9	75	120°
						U1	86.5			
						U2	90			
	EFEX-1AE7	2670-3800	3.0	4.0	350	T2	70	9	80	120°
						T3	80			
						U1	86.5			
						U2	90			
	EFEW-1AE1	5000-10000	3.0	4.0	350	T2	70	10	70	120°
						T3	80			
						U1	86.5			
						U2	90			
						U3	100			
	EFEH-1AE1	3800-5000	3.0	4.0	350	S2	58.8	10	75	120°
						T1	66.5			
						T2	70			
						T3	80			
						U1	86.5			
	EFEX-1AE1	2670-3800	3.0	4.0	350	S1	51.2	10	80	120°
						S2	58.8			
						T1	66.5			
						T2	70			
3W 3045	EFEW-3AE1	5000-10000	3.4	4.4	700	V2	129.4	8	70	120°
						W1	146.2			
						W2	168.1			
	EFEH-3AE1	3800-5000	3.4	4.4	700	U3	100	8	75	120°
						V1	112.5			
						V2	129.4			
	EFEX-3AE1	2670-3800	3.4	4.4	700	U1	86.5	8	80	120°
						U2	90			
						U3	100			

Single Color	Part No.	CCT(K)	V_F (V) Min.	Max.	Test Current (mA)	Flux (lm) T_J=25°C Group	Flux (lm)	Rth (° C/W)	CRI	$2\theta_{1/2}$
1W	EFER-1AE1	Red	2.0	3.0	350	Q R S	30.3 39.4 51.2	lm	10	120°
	EFEA-1AE1	Amber	2.0	3.0	350	Q R S	30.3 39.4 51.2	lm	10	120°
	EFET-1AE1	True Green	3.0	4.0	350	S T U	51.2 66.5 86.5	lm	10	120°
	EFEB-1AE1	Blue	3.0	4.0	350	L M N	10.6 13.8 17.9	lm	10	120°
	EFED-1AE1	Dental Blue	3.0	4.0	350	J	256.3	mW	10	120°
	EFEC-1AE1	Royal Blue	3.0	4.0	350	J K	256.3 384.4	mW	10	120°
	EFEJ-1AE1	Cyan	2.8	4.0	350	R S	39.4 51.2	lm	10	120°
	EFEE-1AE1	Deep Red	2.0	3.0	350	G H	113.9 170.9	mW	10	120°
	EFEF-1AE1	Cherry Red	2.0	3.0	350	F G	75.9 113.9	mW	10	120°
	EFEV-1AE1	UV	3.0	4.0	350	G H J	113.9 170.9 256.3	mW	10	120°
	EFEI-1AE1	IR 850nm	1.5	2.5	350	H J	170.9 256.3	mW	10	120°
	EFEN-1AE1	IR 940nm	1.5	2.5	350	G	113.9	mW	10	120°
3W	EFER-3AE1	Red	2.2	3.2	700	T U	66.5 86.5	lm	8	120°
	EFET-3AE1	True Green	3.6	4.6	700	U V	86.5 112.5	lm	8	120°
	EFEB-3AE1	Blue	3.4	4.4	700	P Q	23.3 30.3	lm	8	120°
	EFEA-3AE1	Amber	2.3	3.3	700	T U	66.5 86.5	lm	8	120°

FX Series

Single Color	Part No.	CCT(K)	V_F (V) Min.	V_F (V) Max.	Test Current (mA)	Flux (lm) T_J=25°C Group	Flux (lm) T_J=25°C Flux (lm)	Rth (° C/W)	CRI	$2\theta_{1/2}$
1W	EFEW-1BE7	5000~10000	3.0	3.7	350	U3	100	9	70	100°
						V1	112.5			
	EFEH-1BE7	3800~5000	3.0	3.7	350	T3	80	9	75	100°
						U1	86.5			
						U2	90			
	EFEX-1BE7	2670~3800	3.0	3.7	350	T2	70	9	80	100°
						T3	80			
						U1	86.5			
						U2	90			

Single Color	Part No.	CCT(K)	V_F (V) Min.	V_F (V) Max.	Test Current (mA)	Flux (lm) T_J=25°C Group	Flux (lm) T_J=25°C Flux (lm)	Rth (° C/W)	$2\theta_{1/2}$
1W	EFER-1BE1	Red	2.0	2.4	350	R	39.4	10	138°
						S	51.2		
	EFEA-1BE1	Amber	2.0	2.4	350	T	66.5	10	126°
						U	86.5		
	EFET-1BE1	True Green	3.0	3.8	350	N	17.9	10	121°
						P	23.3		
	EFEB-1BE7	Blue	3.0	3.7	350	R	39.4	10	128°
						S	51.2		

Notes:
1. The luminous flux performance is guaranteed within published operating conditions. Edison maintains a tolerance of ±10% on flux measurements.
2. Flux tolerance: ±10%
3. Wavelength tolerance: ±0.5nm
4. Peak wavelength tolerance: ±2nm
5. CCT tolerance: ±5%
6. V_F tolerance: 0.06V

Absolute Maximum Ratings

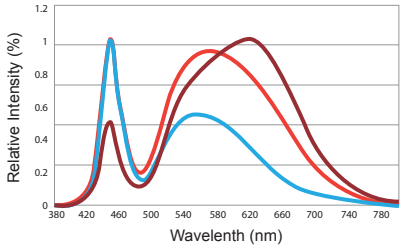
Parameter	Symbol	Rating	Unit
DC Forward Current [1]	I_F	350(1W) /700(3W)	mA
Peak Pulsed Current (tp≤100μs,duty cycle=0.25)	I_{Pulse}	1000	V
Transient Surge Voltage	V_{TS}	8	V
Reverse Voltage	V_R	[2]	° C
LED Junction Temperature[3]	T_J	150/125[4]	° C
Operating Temperature	T_{opr}	-40~+80	° C
Storage Temperature	T_{stg}	-40~+120	° C
ESD Sensitivity	V_B	8000	V
Allowable Reflow Cycles		3	Cycle
Soldering Temperature		260	° C

Notes :
1. Maximum forward current for 1W and 3W are 350mA and 700mA respectively.
2. LEDs are not designed to drive in reverse bias.
3. Proper current derating must be observed to maintain junction temperature below the maximum
4. The maximum junction temperature for Red, Amber, Deep Red and Cherry Red is 125° C.

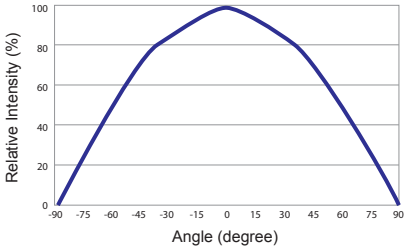
V. Color Spectrum and Radiation Pattern

Color Spectrum (T_J=25°C)

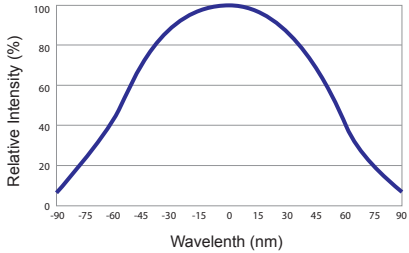
Color Spectrum at T_J=25 ° C



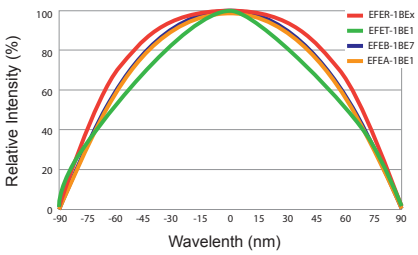
Radiation Pattern for FR Series-White, Single Color.



Radiation Pattern for FR Series-White



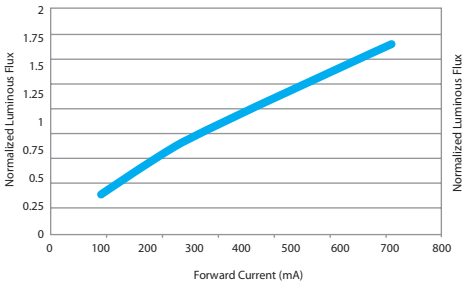
Radiation Pattern for FR Series-Single Color



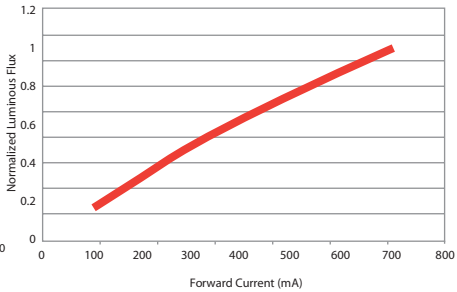
Electric Curves (T_J=25°C)

Relative luminous flux vs. forward current

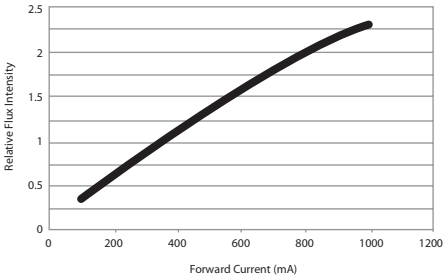
EFEx-xAE1



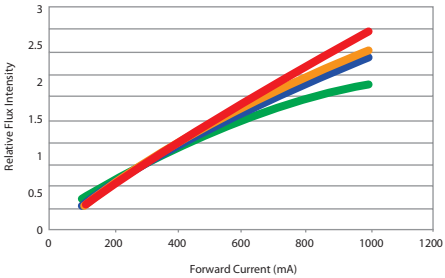
EFEx-xAE1



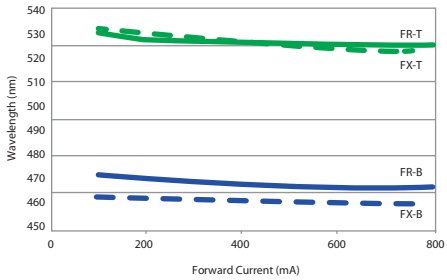
EFEx-1xE7

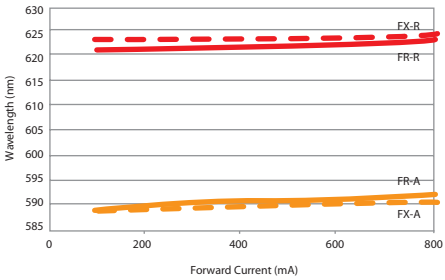


EFEx-xBEx

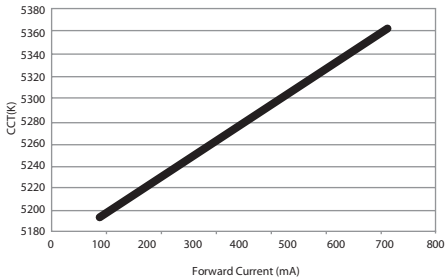


Wavelength length vs. forward current

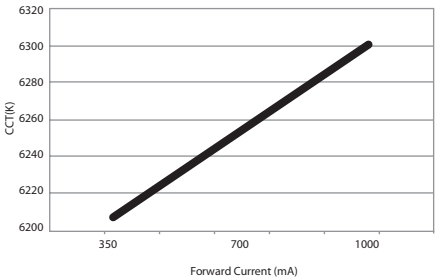




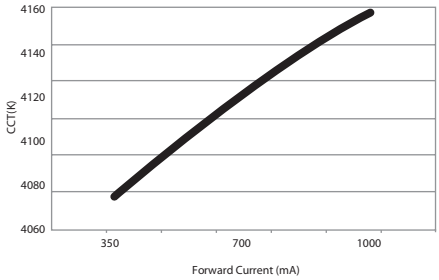
EFEW-xAE1



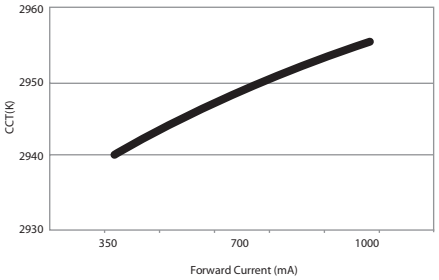
EFEW-1xA7



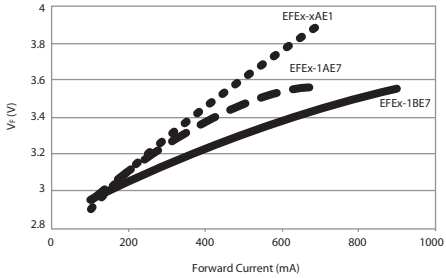
EFEH-1xE7

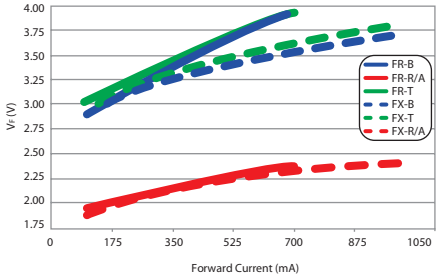


EFEX-1xE7



Forward voltage vs. forward current

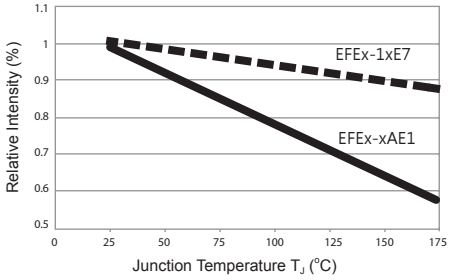




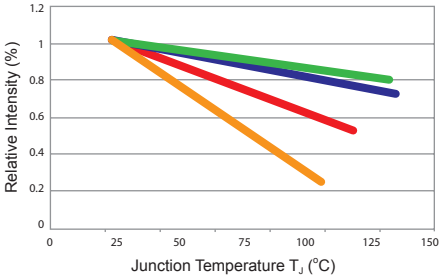
T_J Influence Curve

Relative luminous flux vs. thermal pad temperature

White

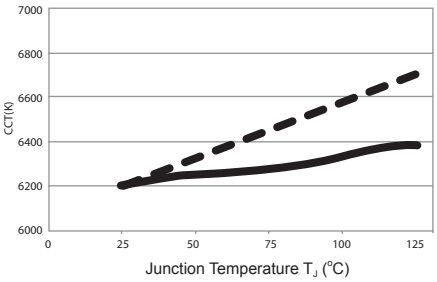


Single Color

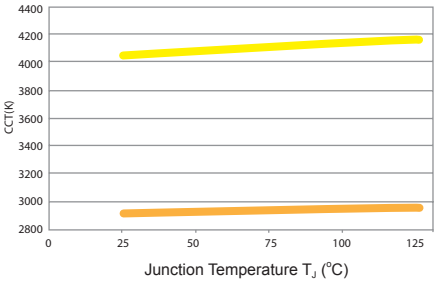


Typical CCT vs.T_J

White

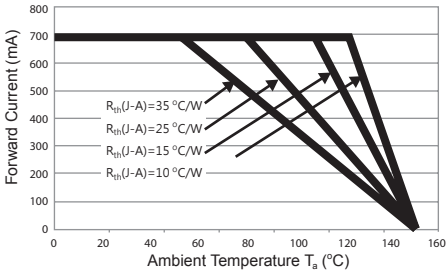


Neutral White & Warm White

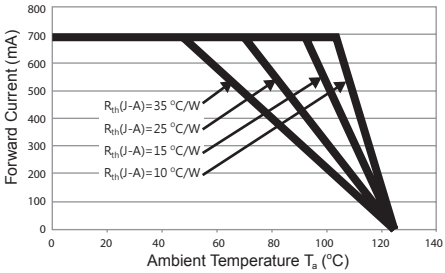


Maximum Operating Current vs Ambient Temperature

T_J = 150°C Maximum operating current



T_J = 125°C Maximum operating current



VI. Reliability Test Items

The following table describes operating life, mechanical, and environmental tests performed on Federal series package at T_J=25°C

Stress Test	Stress Conditions	Duration	Failure Criteria
Room Temperature Operating Life	55°C, I_F=DC_{max} (1)	1000Hrs	Note 2
High Temperature High Humidity Operating Life	85°C/ 85%RH, I_F=DC_{max} (1)	1000Hrs	Note 2
High Temperature Operating Life	85°C, I_F=DC_{max} (1)	1000Hrs	Note 2
Low Temperature Operating Life	-40°C, I_F=DC_{max} (1)	1000Hrs	Note 2
High Temperature Storage Life	150°C	1000Hrs	Note 2
Low Temperature Storage Life	-40°C	1000Hrs	Note 2
Non-Operating Thermal Shock	-40°C/125°C 20 min dwell / <10 sec transfer	500 cycles	No catastrophic
Mechanical Shock	1500 G, 0.5 msec pulse, 5 shocks each 6 axis		No catastrophic
Free Drop	On concrete from 1.2 m	3 times	No catastrophic
Variable Vibration Frequency	10-2000-10 Hz, log or linear sweep rate, 20 G about 1 min, 1.5 mm, 3X/ axis	--	No catastrophic
Solder Heat Resistance (SHR)	Fellow IPC/JEDEC J-STD-020D Pb-free reflow profile	3 times	No catastrophic

Notes:
1.DC max is defined to be 350mA and 700mA for 1W and 3W Federal respectively
2. Failure Criteria:
- Electrical failures: V_F shifts ≥10%
- Light Output Degradation: Percentage level shift ≥ 50% at 1,000hrs or 500cycle
- Visual failures: Broken or damaged package on lens or substrate

Failure Types

Catastrophic failures are failures that result in the LED emitting no light or very little light at normal current levels (e.g. 350 mA). Catastrophic failures are not expected for Federal emitters that are handled and operated within the limits specified in Federal documentation. Please refer to Absolute Maximum Ratings for more information on design limits.

Parametric failures are failures that cause key characteristics to shift outside of acceptable bounds. The most common parametric failure, for a high-power LED, is permanent light output degradation over operating life. Most other light sources experience catastrophic failure at the end of their useful life, providing a clear indication that the light source must be replaced. For instance, the filament of an incandescent light bulb breaks and the bulb ceases to create light. In contrast, high-power LEDs generally do not experience catastrophic failure but simply become too dim to be useful in the intended application. Further discussion of this matter can be found in the Long-Term Lumen Maintenance Testing section of this document.

Another parametric failure common to white LEDs is a large and permanent shift in the exact color of white light output, called the white point or color point. A shift in white point may not be detectable in one LED by itself, but would be obvious in a side-by-side comparison of multiple LEDs. Since each lighting installation commonly uses many high-power LEDs, white point stability is a point of concern for lighting designers. Typically, white high-power LEDs, created by combining blue LEDs with yellow (and sometimes red) phosphor, will shift towards blue over operational life. This shift can be accelerated by high temperatures and high drive currents.

VII. Package, Transportation and Storage

Tags and Package

When receive a package, please check the items as below:

1. Confirm the all the packages are intact. The anti-static bags have no damages or punctures.
2. Confirm the information written on the tag is corresponded to the order.
3. Check the quantity is corresponded to the information on the tag.

If there are any inconsistencies, please contact EDISON OPTO.

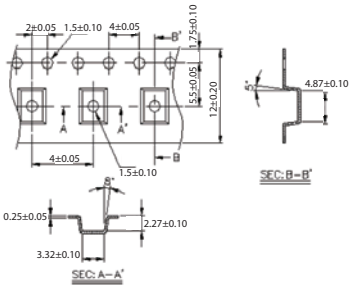
Tag:

Notes:

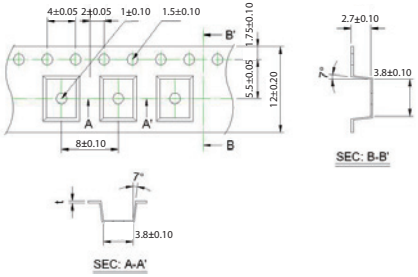
1. Part Number
2. Bin Group (Flux—CCT/Wavelength--V_F)
3. Lot. Number
4. Color
5. Total Quantity

Tape and Reel Dimension

FR Series



FX Series

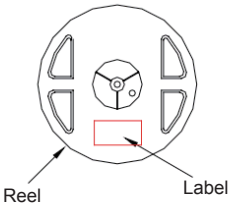


Quantity and Package Dimension

Please confirm the noted quantity before unseal.

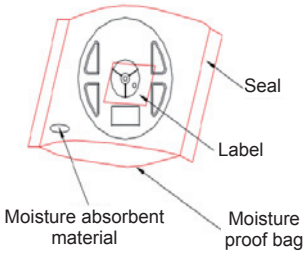
FR Series

Item	Quantity	Total Quantity	Dimension (mm)
Reel	1000 pcs	1000 pcs	R=178
Box	4 Reels	4,000 pcs	L240×W235×H67
Carton	5 Boxes	20,000 pcs	L353×W254×H256
starting with 50 pcs empty, and 50pcs empty at the last			



FX Series

Item	Quantity	Total Quantity	Dimension (mm)
Reel	500 pcs	500 pcs	R=178
Box	4 Reels	2,000 pcs	L240×W235×H67
Carton	5 Boxes	10,000 pcs	L353×W254×H256
starting with 50 pcs empty, and 50pcs empty at the last			



Moisture Sensitivity Levels

JEDEC Moisture Sensitivity Levels is a resume to classify the humidity and temperature tolerance of an electronic device. Base on these levels, LEDs may be identified, store and be re-used properly to avoid the moisture damage during the reflow process. According to " IPC/JEDEC J-STD-020D.1(ver. 2008)", there are six levels from low to high to distinguish the limited exposure time for LEDs in a factory environment.

Federal Series products are leveled as "1", which are able to be stored without limitation time under 30°C and RH85%. (Strongly recommend to proceed the components within 1 year)

Level	Floor Life		Soak Requirements			
			Standard		Accelerated Environment	
	Time	Condition	Time (hours)	Condition	Time (hours)	Condition
1	Unlimited	≤30˚C /85% RH	168 +5/-0	85˚C/85% RH	NA	NA
2	1 year	≤30˚C /60% RH	168 +5/-0	85˚C/60% RH	NA	NA
2a	4 weeks	≤30˚C /60% RH	696[1] +5/-0	30˚C/60% RH	120 +1/-0	60˚C/60% RH
3	168 hours	≤30˚C /60% RH	192[1] +5/-0	30˚C/60% RH	40 +5/-0	60˚C/60% RH
4	72 hours	≤30˚C /60% RH	96[1] +5/-0	30˚C/60% RH	20 +5/-0	60˚C/60% RH
5	48 hours	≤30˚C /60% RH	72[1] +5/-0	30˚C/60% RH	15 +5/-0	60˚C/60% RH
5a	24 hours	≤30˚C /60% RH	48[1] +5/-0	30˚C/60% RH	10 +5/-0V	60˚C/60% RH
6	Time on tabel (TOL)	≤30˚C /60% RH	TOL	30˚C/60% RH	NA	NA

Note: The standard soak time includes a default value of 24 hours for semiconductor manufacturer's exposure time (MET) between bake and bag and includes the maximum time allowed out of the bag at the distributor's facility.

Ref.IPC/JEDEC J-STD-020D.1 (March.2008)

VIII. Handling with Federal Series

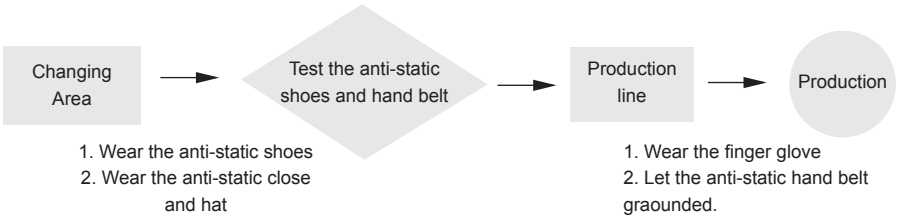
Notification on anti-static

LED device are combine by many accurate parts which belong to static sensitive device. A human body may aware of the discharge voltage about 2-3KV, which is much larger than an electronic device may bear. Therefore, to keep the LED operation environment away from static and lower the exits static become an important issue in a LED manufacture.

1. Anti-Static Steps:

All staffs who have the possibility to contact with the LED components should follow the instructions to eliminate the static

- Put on the hand or finger gloves before touch a LED device. (Do not use a nylon or rubber Glove)
- Do not do any actions that may generate the static in the protection area. Such as wipe hands and foot, put on/off the clothes.



2. Environmental anti-static protection

- Use an anti-static floor and make earth. Materials such as plastic or rubber contain carbon or conductive polyester is recommended.
- LEDs should be operated on the desk which is laid by the static discharge material.
- Protection area with a temperature at 22±5°C and a relative humidity at 70±10%RH are recommended.
- Layout an appropriate earth system. All the equipments should earth isolated into the ground or pillar.
- All soldering and testing equipments should also provide earth ability.
- Prevent the accumulation and the fractions between stuffs.

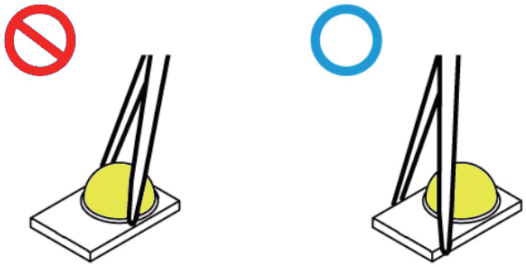
3. Anti-Static steps for package, transportation and storage.

- Package: All the bags must have the ability of anti-static. Do not use any nylon bag, normal plastic bag or polyester bag for package. Do not open the bag if a LED is not ready to be handling. Open the bag at the protection area and put in a conductive case.
- Transportation: The cart should install the conductive wheels. Avoid the mechanical vibration and impacts.
- Storage: Be attention of the temperature and the relative humidity under the suggest condition.

Handling with Federal Series

1. Automatic pick and place

- Automatic pick and place can achieve the optimal placement for Federal Series emitters. Please follow the recommended parameter listed below.
- Vacuum:-20KPa
- The nozzle will over travel by 0.3mm from the top of the reel.
- The Federal Series is placed 0.25 μm into the solder paste.



2. Manual pick

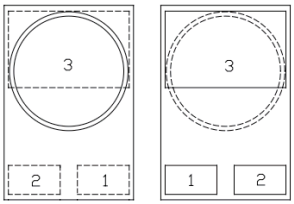
- Use tweezers to pick up the external sides of the ceramic substrate carefully.
- Do not grab, puncture or push the emitting region. Over stress on the lens may cause the damage of component and raise the risk to break the wire inside the package.
- Use only the IPA and swab to clean the flux/dust of the Federal LED surface. Other organic solvent may cause the failure.

Notification of Installation

1. Polarity

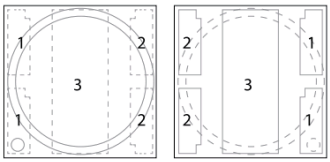
The figures below show the polarity for Federal products. Before installation with PCBs, be sure the relative polarities are correct. An error installation would cause the shortage of component.

FR Series



Top View Bottom View

FX Series



Top View Bottom View

Code	FR Series/ FX Series (W、R、A、T)	FX Series(B)
1	Anode	Cathode
2	Cathode	Anode
3	Thermal Pad (electrically isolated from polarity)	Thermal Pad (electrically isolated from polarity)

2. Automatic Installation

Selection of Nozzle

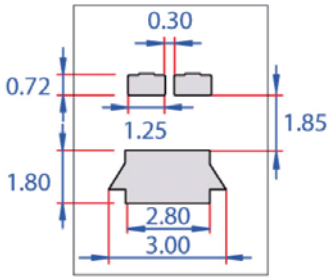
Type	FR Series	FX Series
OD	1.5mm	3.5mm
ID	1.0mm	1.7mm
		
Model recommended	JUKI504	JUKI505

Selection of Solder

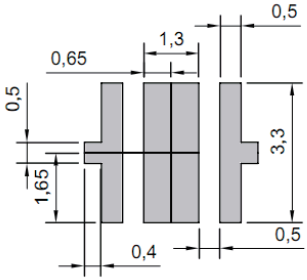
The choice of solder and the application method will dictate the specific amount of solder. For most consistent results, an automated dispensing system or a solder stencil printer is recommended:

- Solder stencil print design

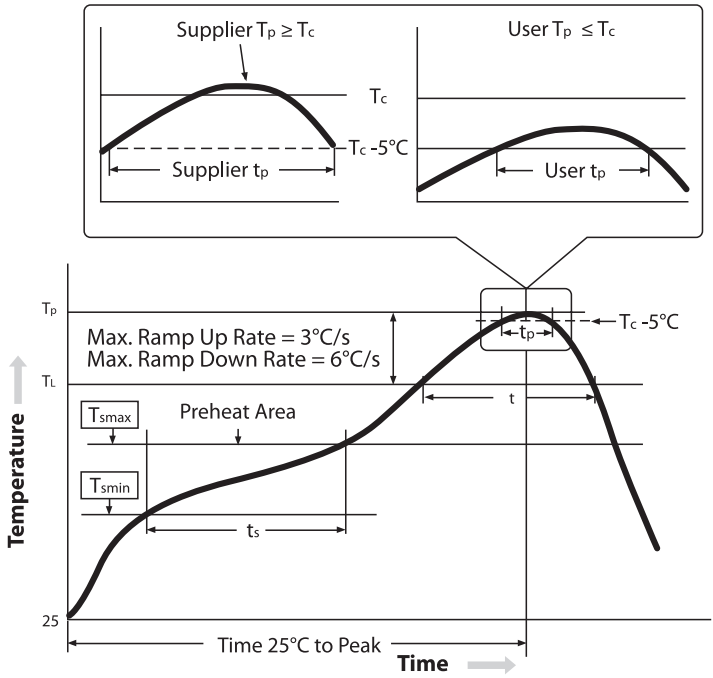
FR Series



FX Series



- Choice of solder paste: High or low temperature Pb-free solder paste is recommended.
- Thickness for solder paste: 50μm (depends on the characters of paste)
- Thermal conductivity of solder paste: >50W/m · K
- Reflow program: IPC/JEDEC J-STD-020D



Profile Feature	Pb-Free Assembl
Temperature Min (T_{smin})	150° C
Temperature Max (T_{smax})	200° C
Time (ts) from (T_{smin} to T_{smax})	60-120 seconds
Ramp-up rate (T_{smin} to T_P)	3° C/ second max.
Liquidous temperature (TL)	217° C
Time (tL) maintained above (tL)	60-150 seconds
Peak package body temperature (T_P) (1)	255° C~260° C
Classification temperature (Tc)	260° C
Time (tp) within 5° C of the specified classification temperature (Tc) (2)	30 seconds
Average ramp-down rate (T_P to T_{smax})	6° C/second max.
Time 25° C to peak temperature	8 minutes max

Notes:
1. Tolerance for peak profile temperature (Tp) is defined as a supplier minimum and a user maximum.
2. Tolerance for time at peak profile temperature (tp) is defined as a supplier minimum and a user maximum.

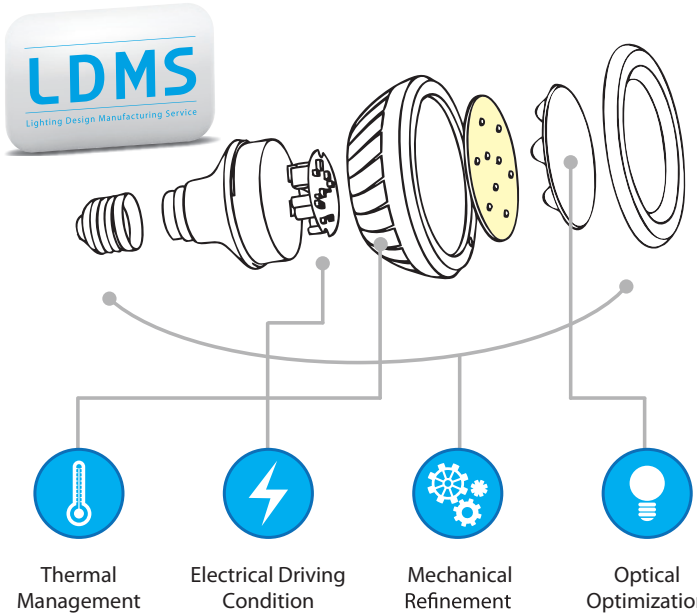
3. Manual Installation

- When automated pick and place is not available or only a small quantity is required, one can perform pick and place manually. The following steps are developed for this purpose:
- Use a sawing needle taking solder paste to soldering pad. Keep the solder paste inside the contact area to prevent the Interference between polars.
- Place baked Federal component to the designated polar position.
- Press it gently to make sure the attachment with PCB by solder paste.
- Place the PCBs onto a preheat hot plate with a temperature of 250°C, wait for the paste melt about 1~2 minutes.
- After the melting of paste, use a tweezers to touch the substrate and be sure the components have stick with the PCB well.
- Remove the PCBs from the hotplate and place on a shelf for cool down. (Do not put the PCBs on a high thermal conductive heat sink to avoid the deformation of PCBs or crack of encapsulation material cause by the rapid temperature drop.)

Note: step d~f are able to be replace by a reflow process.

IX. Lighting Design Manufacture Service

The LDMS is a unique idea which we provide our service program to meet our customers' needs. LDMS integrates the four essential technologies in LED Lighting applications, including thermal management, electrical driving condition, mechanical refinement and optical optimization. From level 1(Emitter) to level 6 (Solution), we provide our customers the best service and satisfactions.



Edison Opto R&D team has developed a complete TEMO auxiliary system for Federal Series products. You may easily find your needs from the following sections.

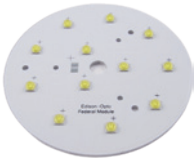
Our team is dedicated to working with you and offering our pre/after sales support. For more information, please contact LED.Detective@edison-opto.com.tw

X. Applications

Federal Series products are able to apply in various lighting fixture and places. Through the professional TEMO support team by Edison Opto, we provide you all the Federal Series products solutions for your requirements at different stage of light business.

Module Applications





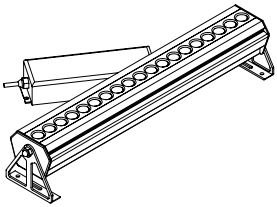
Federal Module Series

Street Light Module

Solid State Lighting Applications

4inch TD Downlight

PAR38 Spot Light



Stage Light

Environmental Applications



XI. Optical Support

Edison Opto provide a series of reflectors which suitable for Federal Series products. We also offer the professional optical design service to customize your special light patterns needs.

Features

- Multi-emitting angle selection
- Total Reflective design
- Lambertian performance
- New single piece, housing or housing-less design
- Easy to assemble
- Improved Performance/cost ratio

Applications

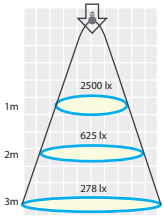
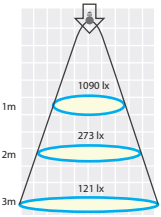
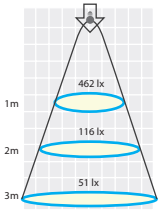
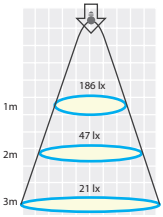
- Reading Lamps
- Architectural Lighting
- Streets Lighting
- Decoration Lights
- Downlights

Characteriestics

- Lens Material: Optical Grade PMMA
- Housing Material: PC
- Operating Temperature Range: -40°C~+70°C
- Storage Temperature Range:-40°C~+70°C

Notes

- Clean Lenses with mild soap and water and a soft cloth
- Do not use any commercial cleaning solvents on lenses, like alcohol.
- Please handle or install lenses with wearing gloves, skin oils may damage lens or optical characteristic.

Item	EDOL-ZZ10L-Mx	EDOL-ZZ25L-Mx	EDOL-ZZ40L-Mx	EDOL-ZZ60L-Mx
				
Dimension (mm)	Diameter : 22.2 Height : 9.6	Diameter : 22.2 Height : 9.6	Diameter : 22.2 Height : 9.6	Diameter : 22.2 Height : 9.6
Typical Lux using EFEW-1AE7				
Beam Angle	16°	17°	28°	40°
Field Angle	27°	32°	50°	70°

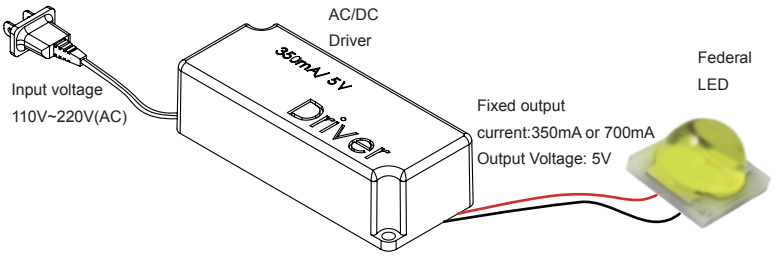
XII. Simple Driving Method

Please according to the circuit method of the components to offer the actual voltage and current.

Single component

For single Federal LED: suggest driving method is below:

- Fixed output current: 350mA (1W) / 700mA (3W)
- Output voltage (min.): 5V



Multi component

When combine more Federal LEDs, calculate the parallel and serial LED number first, and use the following equation to give the appropriate input voltage and current by a driver.

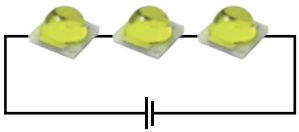
Parallel:

Total voltage:

LED single voltage × no. of LEDs

Total current:

single LED current



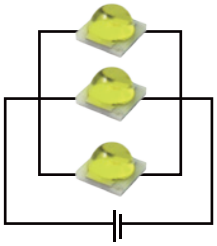
Serial:

Total voltage:

single LED voltage

Total current:

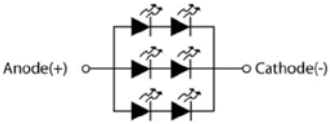
LED single current × no. of LEDs



Example:

A LED PCB board with 6 LEDs mounted, layout is shown as figure on the right.

The matrix is “2 parallel, 3 serial”



Assuming a typical Federal LED needs a forward voltage is 3.5V at 350mA, therefore

Total voltage: 2×3.5=7V

Total current: 350×3=1050mA=1.05A

From equation ”P(power)= V(voltage)×I(current)”, the total power this PBC need is

P=7×1.05=7.35 W,

Driver need to support 1.05A and no less than 7V.

XIII. Thermal Management

About 80% of input power of a LED transform into heat. A high temperature operation condition always easily causes the LEDs to decrease of flux and the decay of LED dies. The highest operation temperature of a component is able to be found by the indication of junction temperature in its data sheet. The power dissipation ability, the ambient temperature between the LED junction, environment, thermal path and its thermal resistance are the mean parameters which affect the performance of a LED device. Therefore, the limitation of the junction temperature has become an important issue when designing a LED product.

The following paragraphs describe how to determine the junction temperature and a simple ideal to heat sink design.

Thermal Resistance and Junction Temperature (T_J) Calculation

Thermal resistance is the temperature difference across a structure when a unit of heat energy flows through it in unit time. Unit is °C/W. For LEDs, it present the temperature between a die PN junction and package substrate. Under the same package form and turn on condition, less thermal resistance a LED has, less temperature on this LED. With lower operation temperature, a LED would keep its original performance longer.

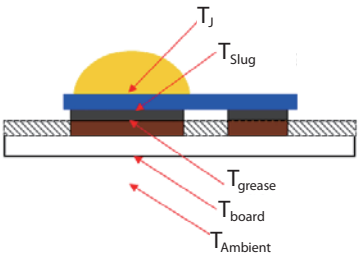
By estimate the PN junction temperature, users may aware of if the thermal management had been well designed.

From basic thermal equation for thermal resistance:

$$Rth_{(J-A)} = \frac{\Delta T_{(J-A)}}{P_D}$$

Therefore the junction temperature (T_J) is:

$$T_J = T_A + Rth_{(J-A)} \times P_D$$



which,

T_A: Ambient temperature (assume 25°C)

$Rth_{(J-A)}$: Total thermal resistance = $Rth_{(J-S)}$+ $Rth_{(S-G)}$+ $Rth_{(G-B)}$+ $Rth_{(B-A)}$

P_D: Power dissipation =Forward voltage (V_F)× Forward current (I_F)

1. Calculation of total thermal resistance:

From component to PCB, total thermal resistance($Rth_{(J-A)}$) includes: (ex:EFEx-xAE1)

Code	Note	Parameter
$R_{th(J-S)}$	Thermal resistance between junction to slug. (Rth of component)	10(° C/W)
$R_{th(S-G)}$	Thermal resistance of conductive paste $R_{th}=\frac{\text{Thickness (μm)}}{\text{Thermal conductivity (W/m · K)xContact Area (mm}^2\text{)}}$	0.14(° C/W) (Recommend thickness : 50μm Thermal conductivity of paste : 50W/ m · K Paste Area : 7mm^2)
$R_{th(G-B)}$	Thermal resistance of PCB	1.5 (° C/W)
$R_{th(B-A)}$	Thermal resistance of air	$R_{th(B-A)}\cong\frac{500}{\text{PCB Area(cm}^2\text{)}}$

From above, for different PCB surface area, their total Rth would be:

Area=30cm^2, $R_{th(B-A)}$=16.7 $R_{th(J-A)}$=10+0.14+1.5+16.7=28.34 °C/W

Area=60cm^2, $R_{th(B-A)}$=8.3 $R_{th(J-A)}$=10+0.14+1.5+8.3=19.94 °C/W

Area=90cm^2, $R_{th(B-A)}$=5.5 $R_{th(J-A)}$=10+0.14+1.5+5.5=17.14 °C/W

2. List of Federal Series

Part No.	Thermal conductivity
EFEx-xAE1	10 ° C/W
EFEx-xAE7	9° C/W
EFEx-1BE7 (white)	9° C/W
EFEx-1BEx (single color)	10 ° C/W
EFEx-3AE1	8° C/W

3. Calculation of Junction Temperature(T_J)

A typical forward voltage of 3.3V at 350mA for a Federal LED, the total power dissipation is PD=3.3×0.35=1.155(W)

From different thermal resistance due to the various of surface area, under an ambient temperature of 25°C, the T_J are,

Area=30cm^2 T_J =25+28.34×1.155=57.7(°C)

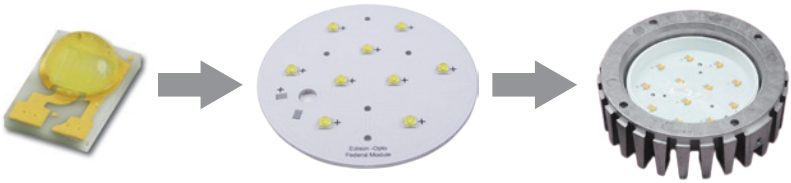
Area=60cm^2 T_J =25+19.94×1.155=48.0(°C)

Area=90cm^2 T_J =25+17.14×1.155=44.8(°C)

Above this, all operation temperature are below its maximum(150°C), Therefore, the selection of conductive paste or PCB surface area are sufficient to keep the temperature below maximum, and provide a well performance and lifetime.

Tips for Thermal Management

Federal Series products are not recommended to be operating without a heat sink. Through MCPCB, users may realize better performance by module.



For LEDs, choose an appropriate operation environment and conduct the heat to the air after light on LEDs may maintain the better performance and lifetime. Four major thermal path are as follow:

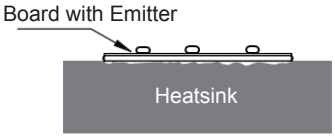
(1) From heat source (component) to heat sink. (By conduction)

(2) Conduction from within the heat sink to its surface. (By conduction)

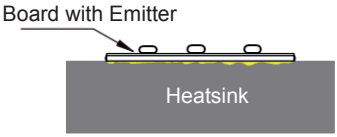
(3) Transfer from the surface to the surrounding air. (By convection)

(4) Emit heat from the heat sink surface. (By Radiation)

Path(1): The contact surface of the MCPCB and heat sink are not perfectly flat, they are not able to meet each other completely. Air between these two materials will result high thermal resistance and reduce the effect of heat transfer. To enhance the ability of thermal conduction, one common method is applying thermal grease between the two interfaces and use the screws to enforce the adhesion between two surface.



Sectional View(no grease)



Sectional View(grease-yellow area)

Recommended thermal Grease Parameters

Characteristics	Value	Unit
Thermal Conductivity (K)	>3.0	W/m · K
Thickness	≤0.1	mm
Thickness for silicone thermal pad	≈0.3	mm

Path(2): Temperature gradient depends on time of a heat sink. The total heat flux(Q) is consist:

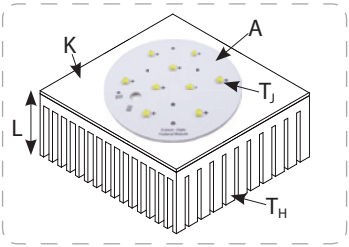
(1) The temperature difference from the heat source(T_J) and heat sink(T_h)

(2) Conductivity of the heat sink (K).

(3) Total surface area of the heat sink (A)

(4) The linear path distance of the heat transfer (L).

This is represented by the Fourier's Law as follow:



$$Q = K \times A \times \frac{\Delta T}{L}$$

When design LEDs, there is always a limitation of the junction temperature. By choose higher thermal conductivity, increase the surface area of the heat sink (add the number of fins) or shorten the distance of the linear path of heat, may improve the heat flux per unit time. Among all materials, metals have the best choice between its high thermal conductivity and the price.

List of thermal conductivity for some usual materials

Materials	K(W/m · K)
Copper	391
C1100	384
Aluminum	230
Aluminum 5000 series	225
ADC-12	96.2
Magnesium	156
Air	0.024

Sample Heat sink Design

LED numbers	Total Surface Area (cm^2)	Fin Design	
		Thickness	Pitch
1	10~30	>1.5mm	>2.5mm
5	50~90		
10	100~170		

Note: This table is suggested under nature convection and control the MCPCB under 55 ° C。Special shapes or close spaces are not suitable for use. Please contact EDISON OPTO. for further technical support.

Path (3) Heat Dissipation includes Convection and Radiation. Those two transfer type are proportional to the surface area of the heat sink. By add the number of fin may increase the total surface area. In a restricted volume, the number of fin cannot be added with any limitation. Too much fins may cause inhabitation of convection. There are many other novels thermal management methods such as by install a fan to reach obliged convection. However, this design involves the issue such as noise or circuit design. It will not be overtalk in this document.

Path (4): Compare with an unfinished heat sink, the one that covered by high emissivity material, such as ceramic powder or deep color paint, usually has better radiation ability. Both anodizing and etching are also effective to increase the thermal dissipation.

Key Points for thermal management:

- The contact surface flatness and smoothness of the component and heat sink.
- The total surface area of heat sink.
- The choice of heat sink material.
- Optimization of the number of fins. (Aerodynamic optimization)

XIV. Federal Module Series

Federal Module

Federal modules are the most versatile solutions for the emerging solid state lighting. Federal modules are designed to satisfy even the most demanding lighting application with high power LEDs, from LED lamps to sophisticated high profile lighting systems.

With completed circuit layout provided, customers can easily integrate these modules into their fixture designs. Besides the standard product lines, customization is also available for maximum flexibility.

Features

- Available in various sizes and shapes
- Circuit layout finished
- Compatible multiple lens are available
- Optimized for color mixing uniformity
- Easy installation design

Nomenclature

The following table describes the available color, power consumption, and lens type. For detailed flux and forward voltage information, please consult Chapter II-Characteristic Ranks.

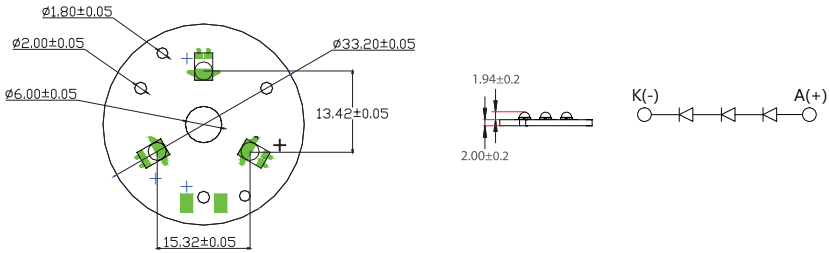
F	M	P	W	-	A	1	1	1	1	A	-	0	1	1	L
X1	X2	X3	X4		X5			X6	X7	X8	X9		X10	X11	X12

X1 LED Item		X2 Module		X3 Item		X4 Emitter Color		X5 AL PCB Dimension		X6 Lens Angle	
Code	Type	Code	Type	Code	Type	Code	Type	Code	Type	Code	Type
F	Federal	M	Module	P	Plan Module	W	Cool White			0	None
				L	Line Module	H	Neutral White			1	25
				R	Ring Module	X	Warm White			2	40
				C	Circle Module	R	Red			3	
				PH	Plane with Heatsink	A	Amber			4	
				LH	Line with Heatsink	T	True Green				
				RH	Ring with Heatsink	B	Blue				
						RTB	Red/True Green/ Blue				
						M	RGB 3 Chips				

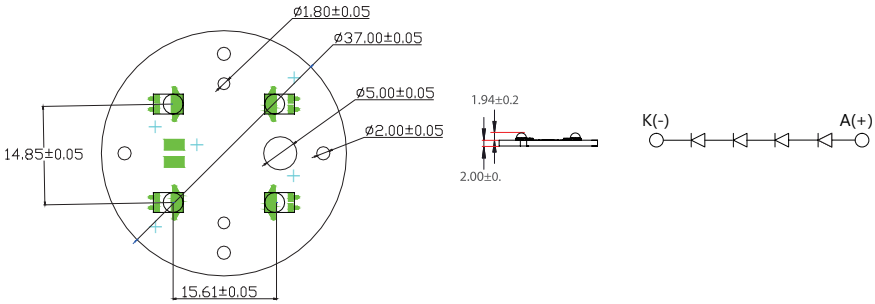
X7 Housing		X8 Connector Dimension		X9 Circuit Type		X10 LED		X11 AL PCB Dimension		X12 Emitter Type	
Code	Type	Code	Type	Code	Type	Code	Type	Code	Type	Code	Type
0	None	0	None	A	Single	01	1 Emiiter	1	1W	L	Lambertian
1	White			B	Parallel	02	2 Emiiter	3	3W		
2	Black			C	Serial	03	3 Emiiter	5	5W		
3	Clear			D	Parallel with 2 Serial	04	4 Emiiter				
						05	5 Emiiter				
						06	6 Emiiter				
						07	7 Emiiter				
						09	9 Emiiter				
						12	12 Emiiter				

Outline Dimensions & Circuits

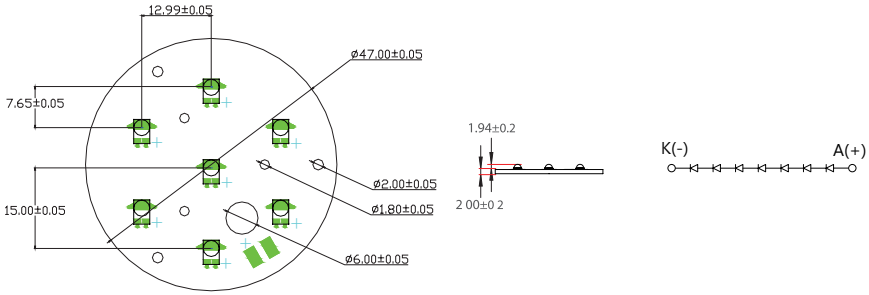
FMCx-A18000C-03xL



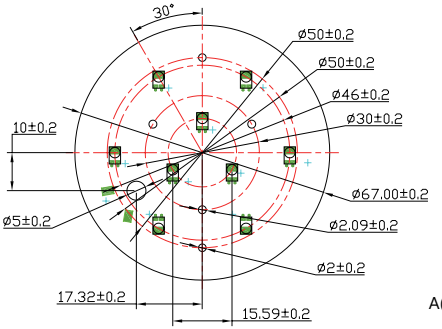
FMCx-A19000C-04xL

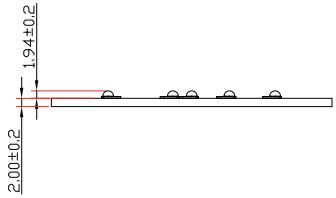


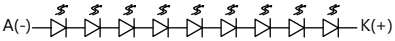
FMCx-A20000C-07xL



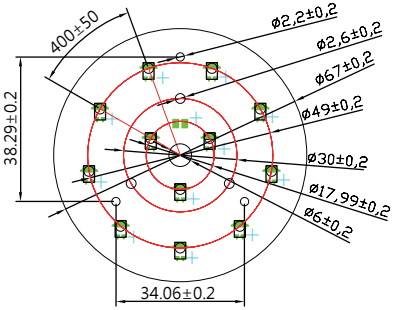
FMCx-A21000C-09xL

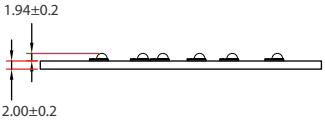


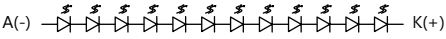




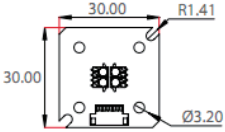
FMCx-A22000C-12xL

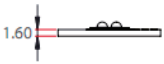


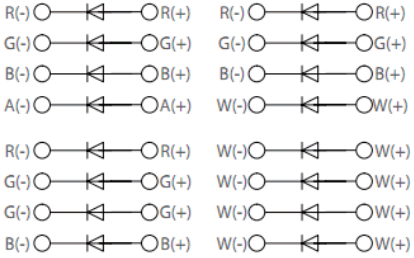




FMPx-A3000Z-04xL







Notes :
1 Unit : mm
2 It is strongly recommended that the temperature of the leads do not exceed 55° C

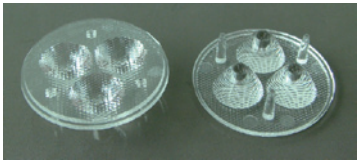
Specifications

	Part No.	CCT(K)/ Wavelength(nm)	V_F(V) (Typ.)	Flux(lm)(Typ.) I_F =350mA
Circle Module 3 in1 	FMCW-A18000C-03xL	5000~10000K	10.2	270
	FMCH-A18000C-03xL	3800 ~ 5000K		240
	FMCX-A18000C-03xL	2760 ~ 3800K		210
Circle Module 4 in1 	FMCW-A19000C-04xL	5000 ~10000K	13.6	360
	FMCH-A19000C-04xL	3800 ~ 5000K		320
	FMCX-A19000C-04xL	2760 ~ 3800K		280
Circle Module 7 in1 	FMCW-A20000C-07xL	5000 ~10000K	23.8	630
	FMCH-A20000C-07xL	3800 ~ 5000K		560
	FMCX-A20000C-07xL	2760 ~ 3800K		490
Circle Module 9 in1 	FMCW-A21000C-09xL	5000 ~10000K	30.6	810
	FMCH-A21000C-09xL	3800 ~ 5000K		720
	FMCX-A21000C-09xL	2760 ~ 3800K		630
Circle Module 12 in1 	FMCW-A22000C-12xL	5000 ~10000K	40.8	1080
	FMCH-A22000C-12xL	3800 ~ 5000K		960
	FMCX-A22000C-12xL	2760 ~ 3800K		840
Plane Module 4 in1 	FMPW-A3000Z-04xx	6000K	3.3	360
	FMPRTBW-A3000Z-04xx	5000 ~10000K	3.3	80
		620-630nm	2.2	50
		515-535nm	3.4	70
		455-475nm	3.4	20
	FMPRTBA-A3000Z-04xx	620-630nm	2.2	50
		585-595nm	2.2	45
		515-535nm	3.4	70
		455-475nm	3.4	20
	FMPRTTB-A3000Z-04xx	620-630nm	2.2	50
		515-535nm	3.4	70
		515-535nm	3.4	70
		455-475nm	3.4	20

Optical Solution

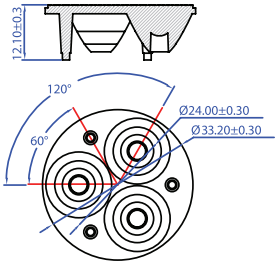
Federal Module has design to fit the commercial lens. EDISON OPTO. also provide a series optical lens solution to enhance the optical performance. EDISON OPTO. always stand by to shorten your layout schedule, provide the best optical design service, and customaries optimal solution.

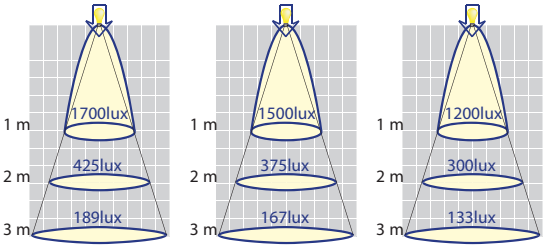
40° Lens : 3 in1 (Sample Emitter EFEx-1AE1)



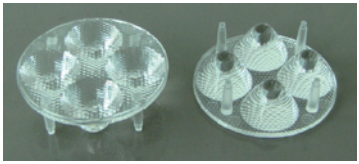
Part No: ED03ED-GK40L

Typical on-axis efficiency (lux/lm)		
Cool White	Neutral White	Warm White
6.30	6.25	5.71



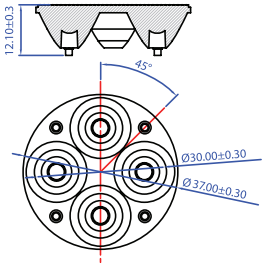


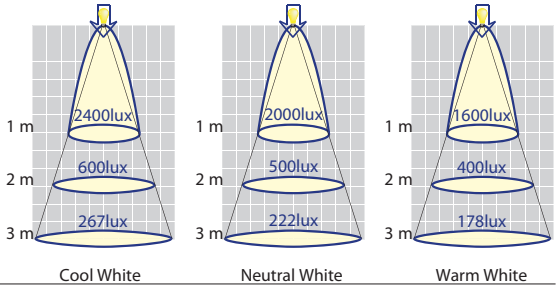
40° Lens : 4 in1



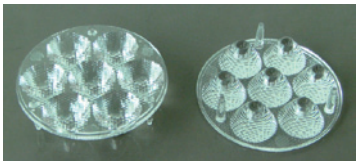
Part No: ED04ED-GK40L

Typical on-axis efficiency (lux/lm)		
Cool White	Neutral White	Warm White
6.67	6.25	5.71



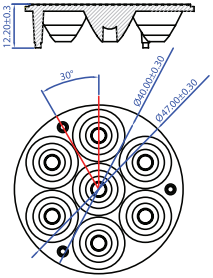


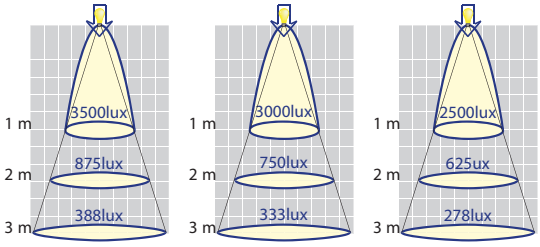
40° Lens : 7 in1



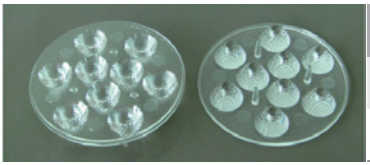
Typical on-axis efficiency (lux/lm)		
Cool White	Neutral White	Warm White
5.55	5.35	5.10

Part No: ED07ED-GK40L



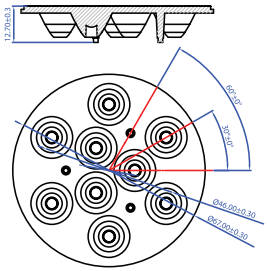


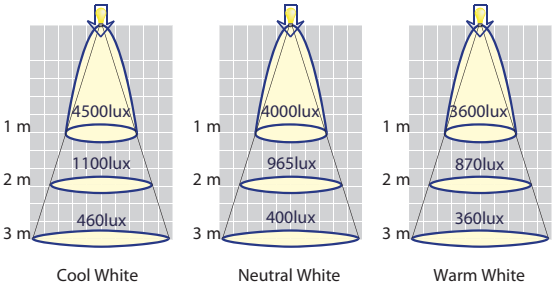
40° Lens : 9 in1



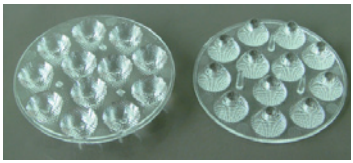
Typical on-axis efficiency (lux/lm)		
Cool White	Neutral White	Warm White
5.60	5.50	5.00

Part No: ED09ED-GK40L



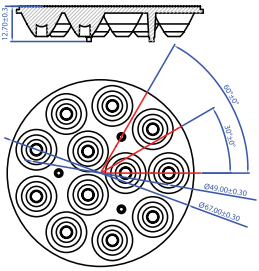


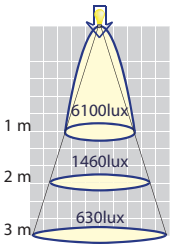
40° Lens : 12 in1



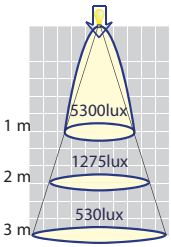
Part No: ED12ED-GK40L

Typical on-axis efficiency (lux/lm)		
Cool White	Neutral White	Warm White
5.80	5.60	5.10

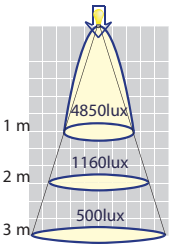




Cool White



Neutral White



Warm White

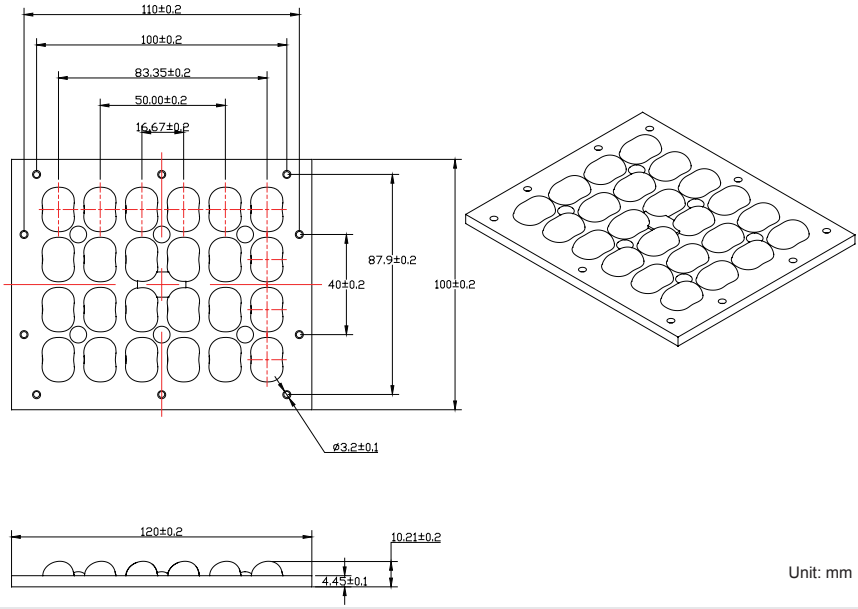
Street Lighting Module

EDIS 27W Street Lighting Module use 24 high brightness Federal FR series LEDs. With specially designed elliptical lens, each EDIS 27W Street Lighting Module can be assembled 4 pcs, suitable in application such as 4 to 12 meters road lamp.

Features :

- Light weight easy assembly
- Design-in quick expansion
- Elliptical light distribution

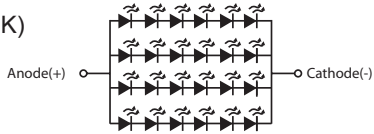
Dimension



Unit: mm

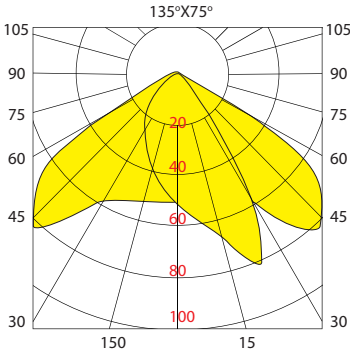
Specification

Part No.	FMPW-A36700G-241L
Light source	Federal FX series ×24
CCT	Cool White (5000-10000K)
Flux	2160
Power	27W
Const Current Driver	1400mA / 24V

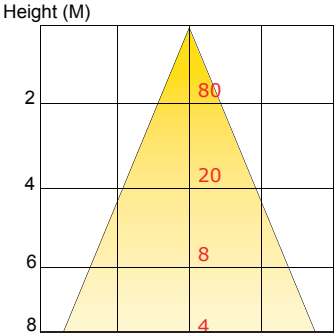


Light Characters

Light Pattern



Illumination Distribution



Driver Recommendation

Part No.	Picture	SPC
LPC-35-1400		DC Output Voltage 24V / Rated Output Current 1.4 A AC Input Voltage 90~264VAC

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