

Federal 5050 Series Datasheet



Features :

- High lumen/flux performance
- Promising lumen maintenance characteristics
- High efficiency package
- Level 1 on JEDEC moisture sensitivity analysis
- Max pulse current: 1000mA
- RoHS compliant

Typical Applications :

- | | |
|-----------------------------|-----------------------|
| ■ Reading lights | ■ Portable flashlight |
| ■ Up-lights and Down-lights | ■ LCD Backlights |
| ■ General lighting | ■ Contour lights |
| ■ Ceiling lights | ■ Garden lighting |

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General Information

Introduction

Federal 5050 Series is a smaller and brighter multi-chip LED which provides multi-color packaging flexibility. Federal is a surface mount, compact, high brightness LED that is suitable for various illumination needs such as general illumination, ashlights, streetlights, spot lights as well as industrial and commercial lightings. The multi-color LEDs (RGBW/ RGBA) are especially suitable for stage lights, and with its smallest dimensions in the world, enables a higher flexibility for optical design. All the Edison products are carefully tested in order to achieve reliability and optimal performance, for giving you an extraordinary LED experience.

Ordering Code Format

<u>2</u>	<u>F</u>	<u>M 0</u>	<u>0 4</u>	<u>M x</u>	<u>x x</u>	<u>F 0 3</u>	<u>x x x</u>
X1	X2	X3	X4	X5	X6	X7	X8
X1	X2	X3	X4	X5			
Type	Component		Series		Wattage		Color
2	Emitter	F	Federal	M0	5050	04	4W
							M2
							M3
							M4
							M6
							M7
							RGBW
							RGBA
							RGGB
							RGBH
							RGBX
X6	X7	X8					
Internal code	PCB Board		Serial Number				
-	-	F03	5050	-	-		

Absolute Maximum Ratings

Parameter	Symbol	Value	Units
DC Forward Current ^[1]	I_F	350/700	mA
Peak Pulsed Current; (tp≤100μs, Duty cycle=0.25)	I_{pulse}	1000	mA
Transient Surge Voltage	-	8	V
Reverse Voltage ^[2]	V_R	Note 2	V
LED Junction Temperature ^[3]	T_J	125	°C
Operating Temperature	-	-40 ~ +85	°C
Storage Temperature	-	-40 ~ +125	°C
Soldering Temperature	-	260	°C

Notes:

- Maximum forward current for 1W and 3W are 350mA and 700mA respectively.
- LEDs are not designed to drive in reverse bias.
- Proper current derating must be observed to maintain junction temperature below the maximum.

Characteristics

Parameter	Symbol	Value	Units
Viewing Angle	$2\Theta_{1/2}$	R / B / A : 120 T : 125 CW / NW / WW : 130	Degree
Forward voltage@350mA	V_F	R / A : 1.7-2.7 T : 3.0-4.0 B / CW / NW / WW : 2.8-4.0	V
Thermal resistance	-	2.5	°C/W
CCT/Wavelength	-	R : 620 - 630 T : 520 - 535 B : 450 - 470 A : 585 - 595 CW : 5,000-10,000 NW : 3,800-5,000 WW : 2,670-3,800	K/nm
JEDEC Moisture Sensitivity	-	Level 1 Floor Life Conditions: ≤30°C / 85% RH Soak Requirements(Standard) Time (hours): 168+5/-0 Conditions: 85°C / 85% RH	-

Notes:

- Edison maintains a tolerance of ±1nm for dominant wavelength.
- Viewing angle is measured with accuracy of ±10%.
- CIE_x/y tolerance: ±0.005.

Luminous Flux Characteristic

Luminous Flux Characteristics, $I_f=350\text{mA}$ and $T_j=25^\circ\text{C}$

Emitter Type	Color	Group	Min Luminous Flux@350mA (lm)	Min Luminous Flux@700mA (lm)	Order Code
RTBW	Red	R0	39.4	75	Non on star 2FM004M206F03001 on star (5FM004M2S0010002)
	True Green	T2	70.0	112	
	Blue	M0	13.8	25	
	Cool White	U2	90.0	155	
RTBA	Red	R0	39.4	75	2FM004M300F03001
	True Green	T2	70.0	112	
	Blue	M0	13.8	25	
	Amber	R0	39.4	75	
RTTB	Red	R0	39.4	75	2FM004M400F03002
	True Green	T2	70.0	112	
	Blue	M0	13.8	25	
RTBH	Red	R0	39.4	75	2FM004M601F03001
	True Green	T2	70.0	112	
	Blue	M0	13.8	25	
	Neutral White	T0	66.5	115	
RTBX	Red	R0	39.4	75	2FM004M701F03001
	True Green	T2	70.0	112	
	Blue	M0	13.8	25	
	Warm White	T0	66.5	115	

Note:

The luminous flux performance is guaranteed within published operating conditions. Edison Opto maintains a tolerance of $\pm 10\%$ on flux measurements.

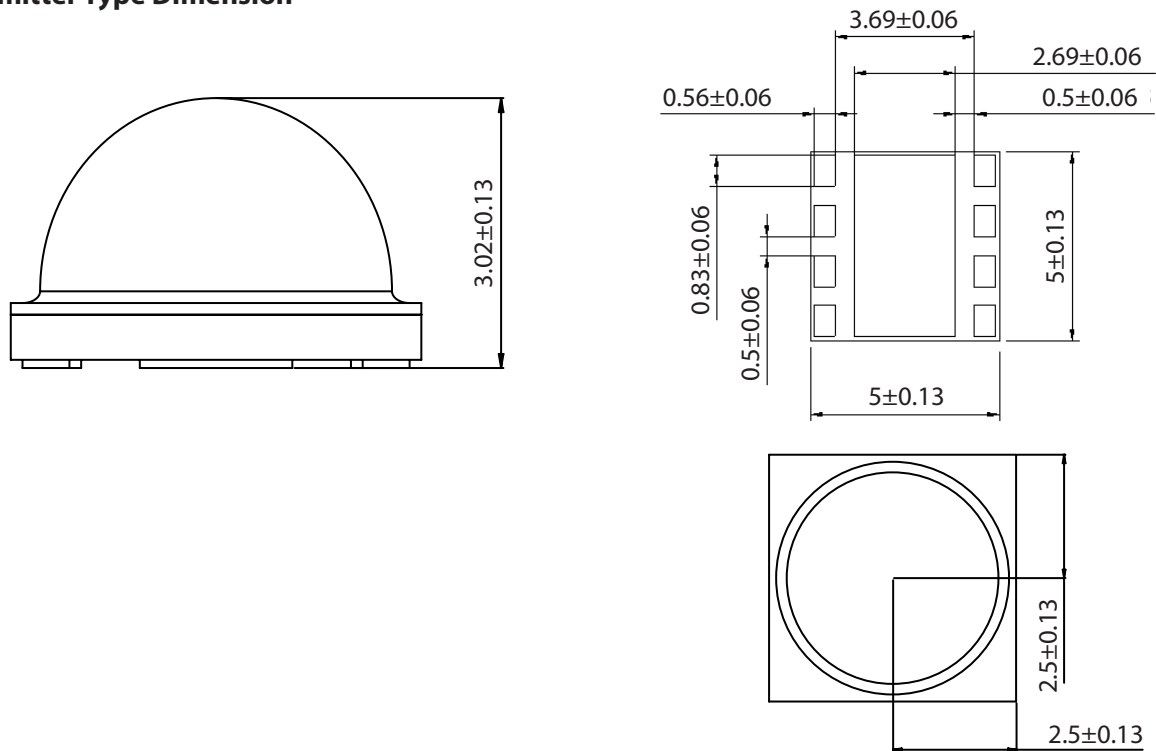
Wavelength Bin Structure

Color	Group	Min. Wd (nm)	Max. Wd (nm)
Red	RX0	620	630
True Green	TV0	515	520
	TW0	520	525
	TX0	525	530
	TY0	530	535
Blue	BU0	450	455
	BV0	455	460
	BW0	460	465
	BX0	465	470
Amber	AX0	585	587.5
	AY0	587.5	590
	AZ0	590	596

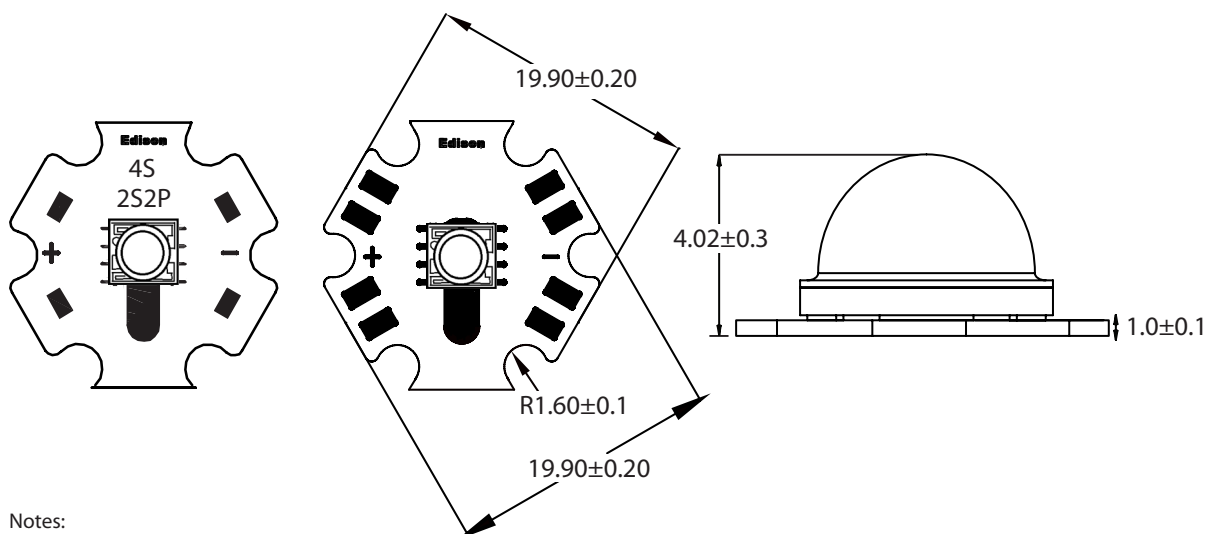
Note:
Dominant wavelength measurement allowance: $\pm 1\text{nm}$.

Mechanical Dimensions

Emitter Type Dimension



Star PCB Type Dimension

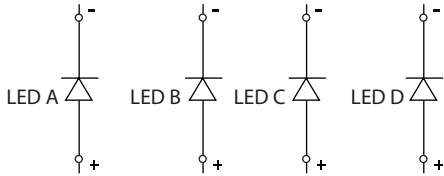


Notes:

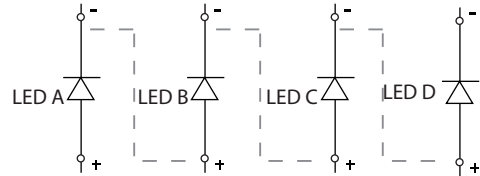
1. All dimensions are measured in mm.
2. Drawings are not to scale.

Circuit and applications

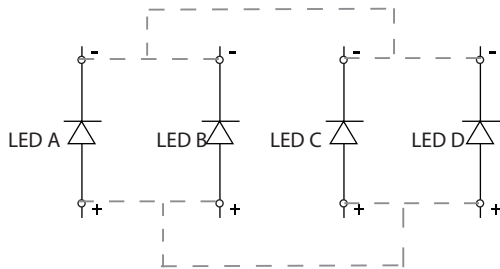
1. Separate operation (4 Single Star)



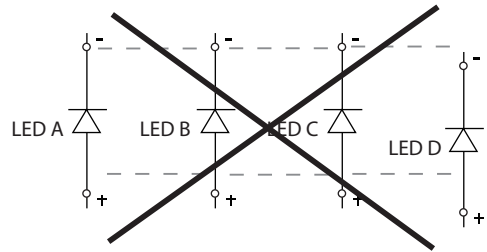
2. Four S (4 Series Star)



3. Two S and Two P (2 Series 2 Paralle Star)



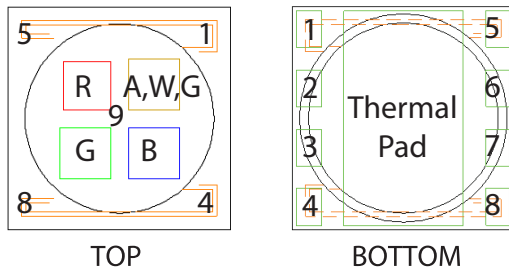
4. Not Available



Note:

The circuit design depends on your PCB design.

PCB Layout



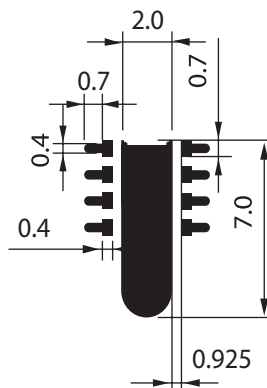
Note:

The thermal pad is electrically isolated from anode and cathode.

Pad Configuration

Color	FUNCTION	
	Anode	Cathode
Red	6	2
Green	7	3
Blue	8	4
Amber White Green	5	1

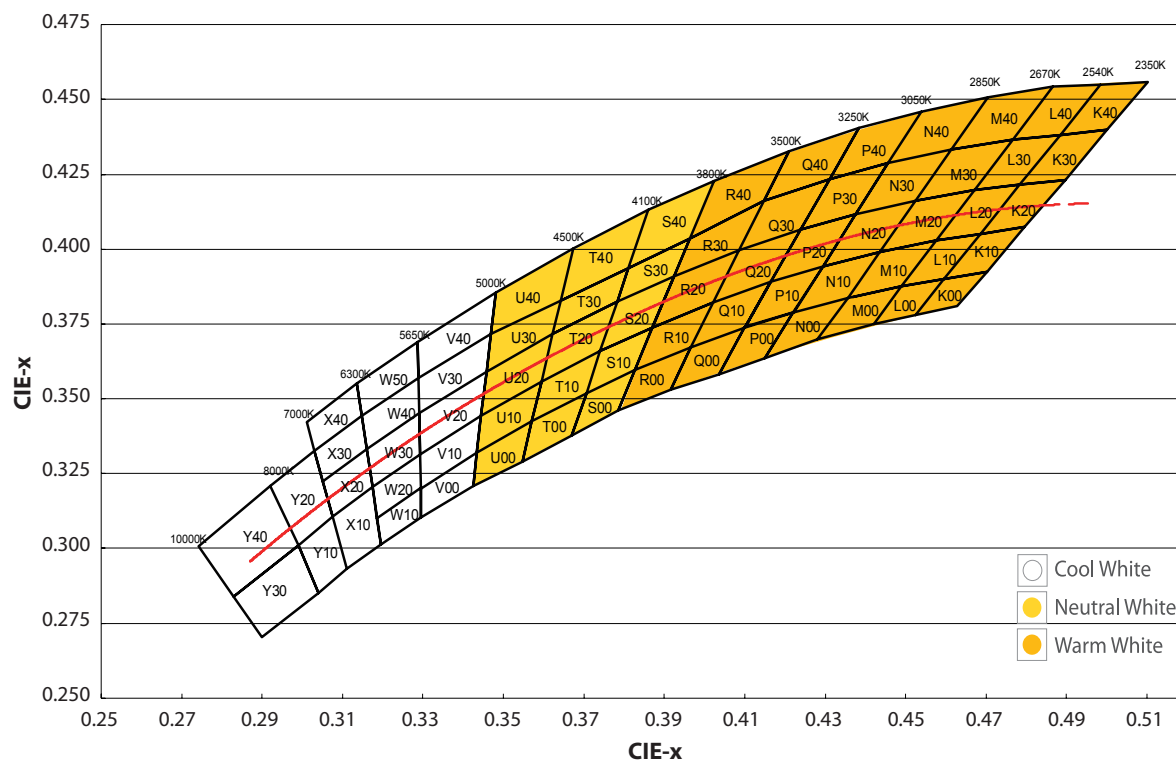
Solder Pad



Notes:

1. All dimensions are measured in mm.
2. Drawings are not to scale.

Color BIN code



Cool White

Y10		Y20		Y30		Y40	
X	Y	X	Y	X	Y	X	Y
0.3040	0.2850	0.2990	0.3010	0.3040	0.2850	0.2920	0.3210
0.2990	0.3010	0.2920	0.3210	0.2899	0.2703	0.2742	0.3007
0.3076	0.3108	0.3031	0.3327	0.2830	0.2838	0.2830	0.2838
0.3112	0.2932	0.3076	0.3108	0.2990	0.3010	0.2990	0.3010

X10		X20		X30		X40	
X	Y	X	Y	X	Y	X	Y
0.3076	0.3108	0.3076	0.3108	0.3052	0.3224	0.3031	0.3327
0.3174	0.3204	0.3052	0.3224	0.3031	0.3327	0.3011	0.3422
0.3196	0.3013	0.3160	0.3332	0.3148	0.3444	0.3136	0.3550
0.3112	0.2932	0.3175	0.3204	0.3160	0.3332	0.3148	0.3444

W10		W20		W30		W40		W50	
X	Y	X	Y	X	Y	X	Y	X	Y
0.3294	0.3202	0.3292	0.3313	0.3290	0.3451	0.3290	0.3451	0.3148	0.3444
0.3295	0.3105	0.3294	0.3202	0.3292	0.3313	0.3160	0.3332	0.3136	0.3550
0.3196	0.3013	0.3186	0.3102	0.3175	0.3204	0.3148	0.3444	0.3286	0.3690
0.3186	0.3102	0.3175	0.3204	0.3160	0.3332	0.3288	0.3569	0.3288	0.3569

V00		V10		V20		V30		V40	
X	Y	X	Y	X	Y	X	Y	X	Y
0.3434	0.3320	0.3292	0.3313	0.3292	0.3313	0.3290	0.3451	0.3288	0.3569
0.3425	0.3208	0.3444	0.3442	0.3290	0.3451	0.3288	0.3569	0.3286	0.3690
0.3295	0.3105	0.3434	0.3320	0.3458	0.3592	0.3469	0.3717	0.3481	0.3856
0.3294	0.3200	0.3294	0.3200	0.3444	0.3442	0.3458	0.3592	0.3469	0.3717

Neutral White

U00		U10		U20		U30		U40	
X	Y	X	Y	X	Y	X	Y	X	Y
0.3571	0.3426	0.3444	0.3442	0.3622	0.3716	0.3642	0.3829	0.3642	0.3829
0.3548	0.3290	0.3434	0.3320	0.3594	0.3557	0.3622	0.3716	0.3673	0.4003
0.3425	0.3208	0.3571	0.3426	0.3444	0.3442	0.3458	0.3592	0.3481	0.3856
0.3434	0.3320	0.3594	0.3557	0.3458	0.3592	0.3469	0.3717	0.3469	0.3717

T00		T10		T20		T30		T40	
X	Y	X	Y	X	Y	X	Y	X	Y
0.3706	0.3520	0.3594	0.3557	0.3622	0.3716	0.3642	0.3829	0.3673	0.4003
0.3670	0.3377	0.3571	0.3426	0.3783	0.3825	0.3811	0.3937	0.3860	0.4130
0.3548	0.3290	0.3706	0.3520	0.3741	0.3658	0.3783	0.3825	0.3811	0.3937
0.3571	0.3426	0.3741	0.3658	0.3594	0.3557	0.3622	0.3716	0.3642	0.3829

S00		S10		S20		S30		S40	
X	Y	X	Y	X	Y	X	Y	X	Y
0.3826	0.3595	0.3741	0.3658	0.3783	0.3825	0.3783	0.3825	0.3860	0.4130
0.3785	0.3460	0.3871	0.3739	0.3924	0.3909	0.3811	0.3937	0.4023	0.4228
0.3670	0.3377	0.3826	0.3595	0.3871	0.3739	0.3963	0.4035	0.3963	0.4035
0.3706	0.3520	0.3706	0.3520	0.3741	0.3658	0.3924	0.3909	0.3811	0.3937

R00		R10		R20		R30		R40	
X	Y	X	Y	X	Y	X	Y	X	Y
0.3966	0.3673	0.3871	0.3739	0.3924	0.3909	0.4086	0.3995	0.4023	0.4228
0.3917	0.3530	0.4021	0.3822	0.3871	0.3739	0.3924	0.3909	0.4209	0.4326
0.3785	0.3460	0.3966	0.3673	0.4021	0.3822	0.3963	0.4035	0.4148	0.4161
0.3826	0.3595	0.3826	0.3595	0.4086	0.3995	0.4148	0.4161	0.3963	0.4035

Warm White

Q00		Q10		Q20		Q30		Q40	
X	Y	X	Y	X	Y	X	Y	X	Y
0.4100	0.3740	0.4165	0.3890	0.4086	0.3995	0.4086	0.3995	0.4385	0.4404
0.4035	0.3580	0.4100	0.3738	0.4240	0.4065	0.4148	0.4161	0.4312	0.4234
0.3917	0.3530	0.4021	0.3822	0.4165	0.3890	0.4312	0.4234	0.4148	0.4161
0.3966	0.3673	0.3966	0.3673	0.4021	0.3822	0.4240	0.4065	0.4209	0.4326

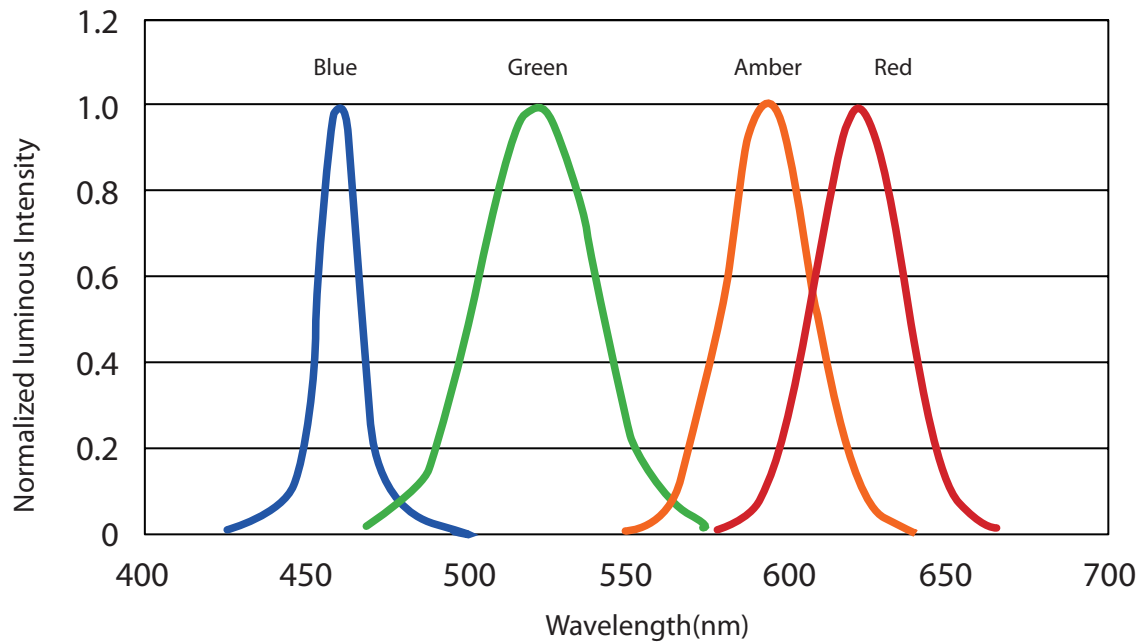
P00		P10		P20		P30		P40	
X	Y	X	Y	X	Y	X	Y	X	Y
0.4220	0.3790	0.4294	0.3943	0.4240	0.4065	0.4312	0.4234	0.4385	0.4404
0.4150	0.3635	0.4221	0.3790	0.4376	0.4116	0.4456	0.4287	0.4538	0.4460
0.4035	0.3580	0.4100	0.3738	0.4294	0.3943	0.4376	0.4116	0.4456	0.4287
0.4100	0.3740	0.4165	0.3890	0.4165	0.3890	0.4240	0.4065	0.4312	0.4234

N00		N10		N20		N30		N40	
X	Y	X	Y	X	Y	X	Y	X	Y
0.4356	0.3837	0.4294	0.3943	0.4376	0.4116	0.4614	0.4333	0.4538	0.4460
0.4280	0.3700	0.4436	0.3991	0.4294	0.3943	0.4525	0.4162	0.4705	0.4508
0.4150	0.3635	0.4356	0.3837	0.4436	0.3991	0.4376	0.4116	0.4614	0.4333
0.4220	0.3790	0.4221	0.3790	0.4525	0.4162	0.4456	0.4287	0.4456	0.4287

M00		M10		M20		M30		M40	
X	Y	X	Y	X	Y	X	Y	X	Y
0.4490	0.3875	0.4436	0.3991	0.4525	0.4162	0.4614	0.4333	0.4705	0.4508
0.4420	0.3750	0.4577	0.4029	0.4671	0.4196	0.4767	0.4366	0.4866	0.4542
0.4280	0.3700	0.4490	0.3875	0.4577	0.4029	0.4671	0.4196	0.4767	0.4366
0.4356	0.3837	0.4356	0.3837	0.4456	0.4287	0.4525	0.4162	0.4614	0.4333

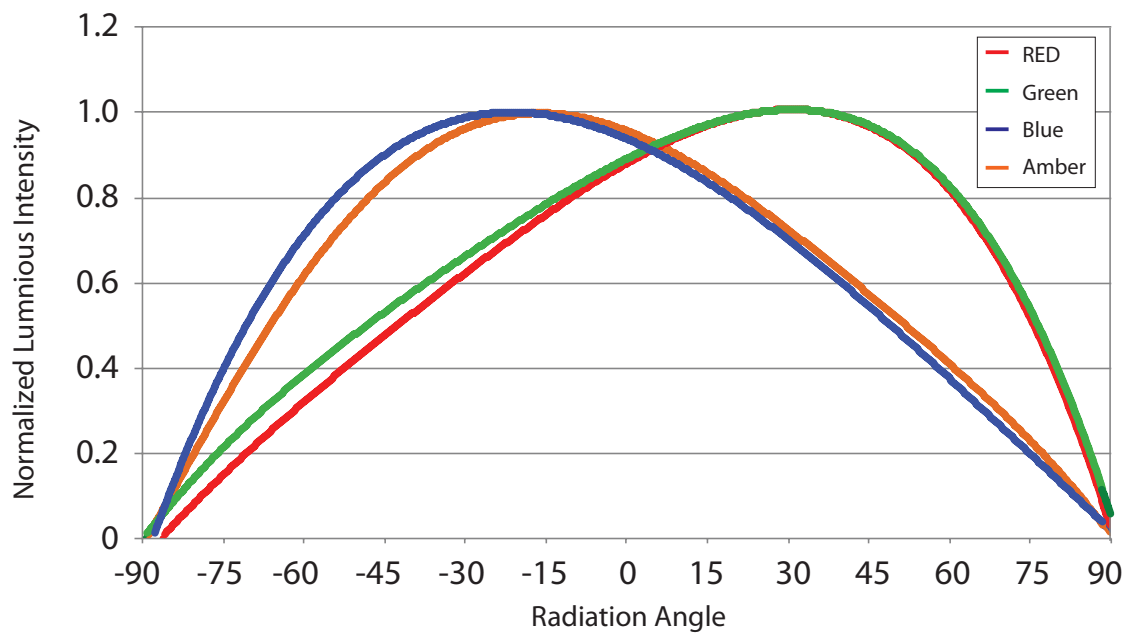
Characteristic curve

Color Spectrum



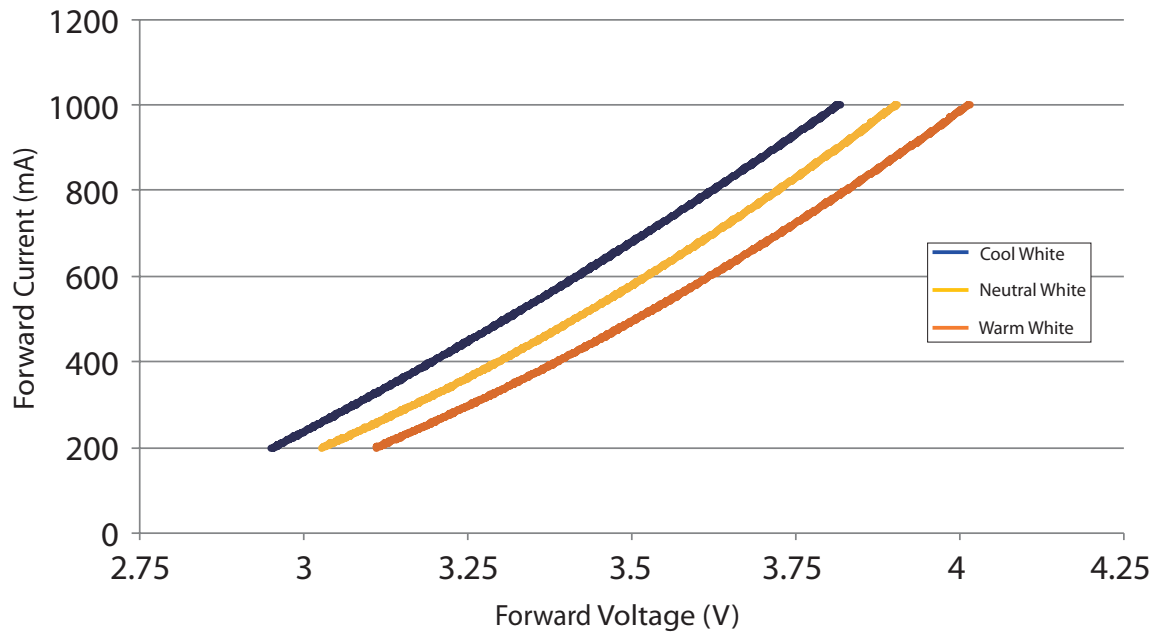
Color Spectrum at a typical CCT for Red, Blue, Green & Amber

Beam Pattern

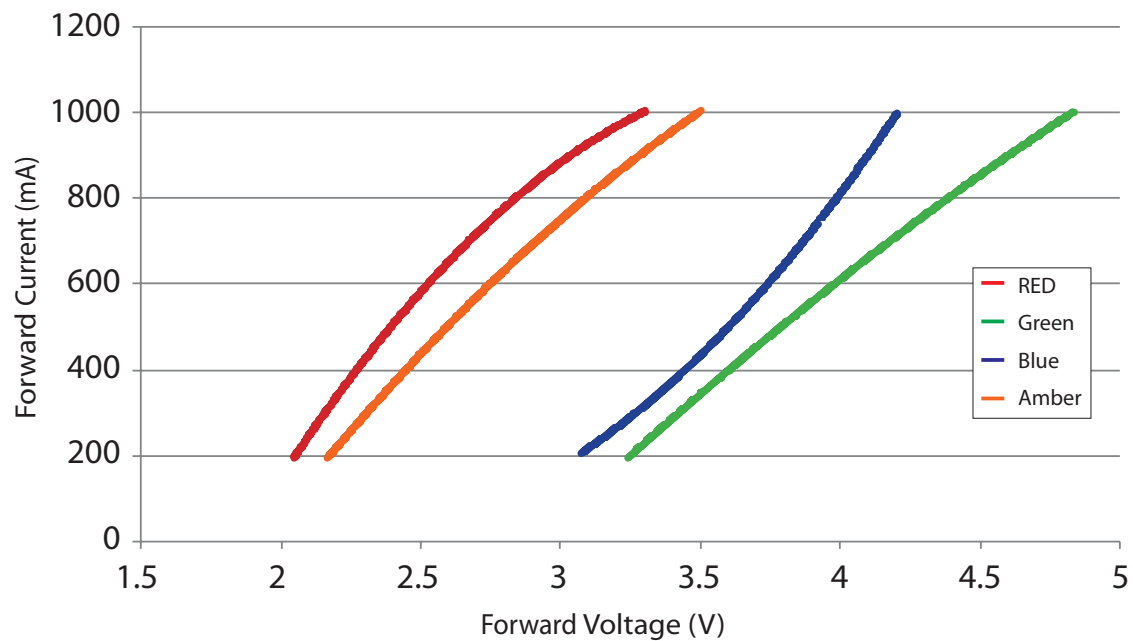


Beam pattern diagram for Red, Blue, Green & Amber

Forward Current vs. Forward Voltage

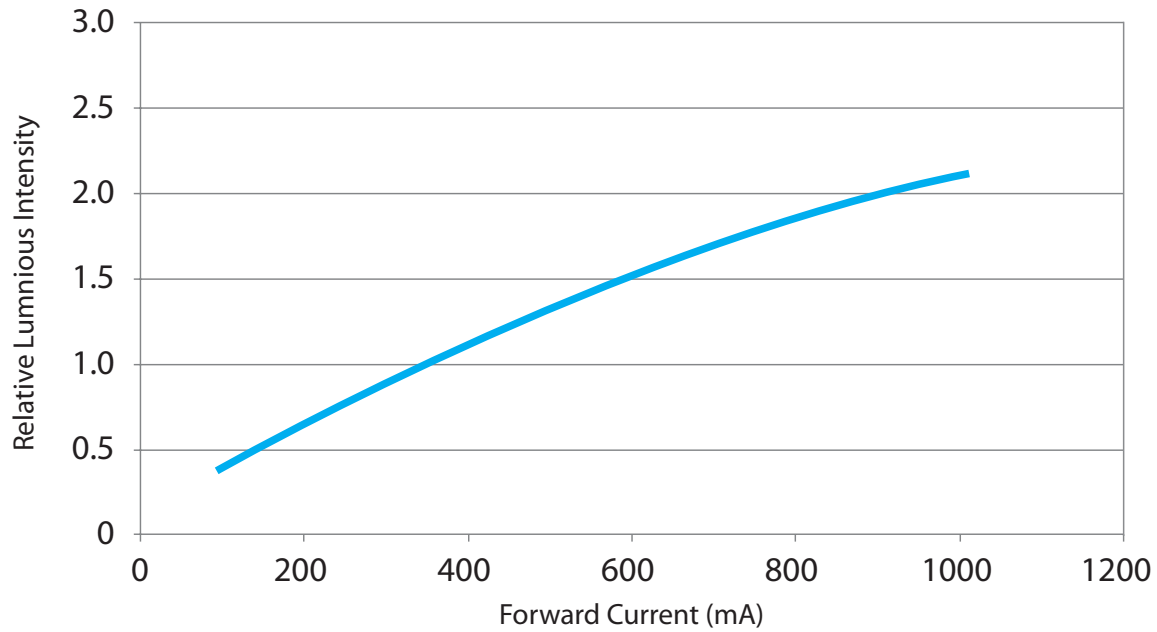


Forward Current vs. Forward Voltage for Federal 5050 White Series

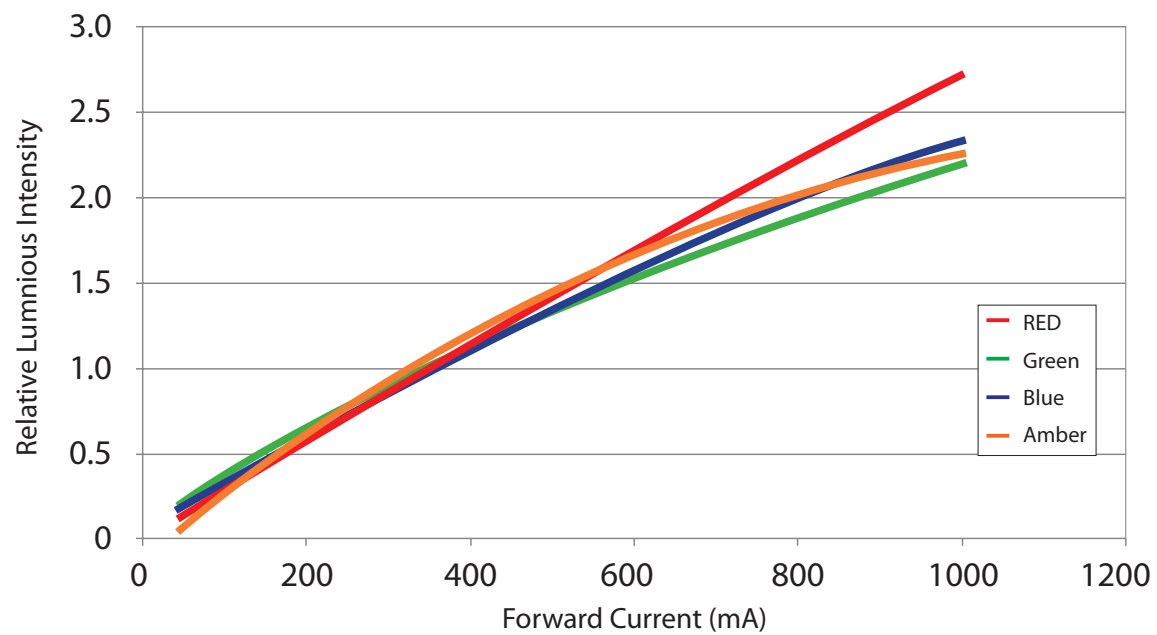


Forward Current vs. Forward Voltage for Red, Blue, Green & Amber

Relative Luminous Intensity vs. Forward Current

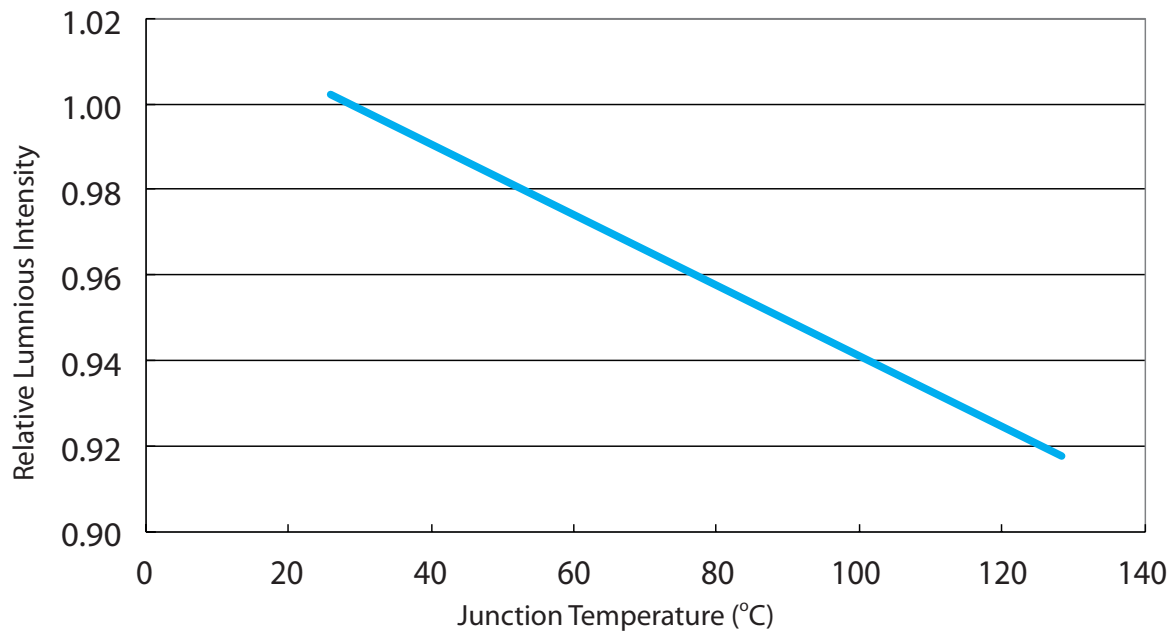


Relative Luminous Intensity vs. Forward Current for Federal 5050 White Series

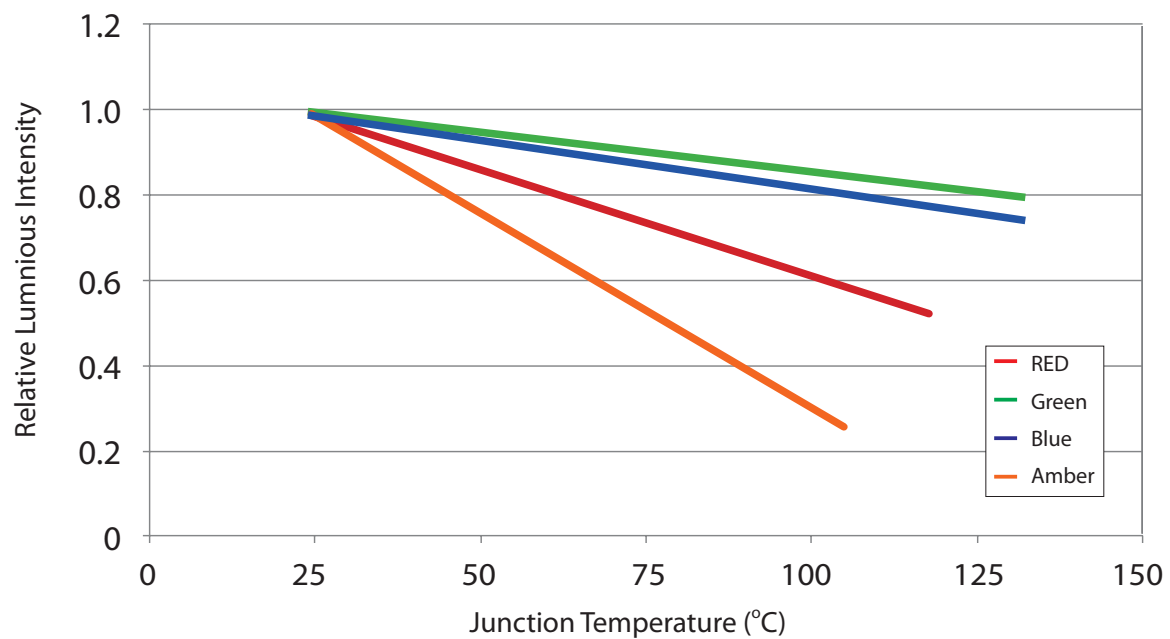


Relative Luminous Intensity vs. Forward Current for Red, Blue, Green & Amber

Relative Luminous Flux vs. Junction Temperature

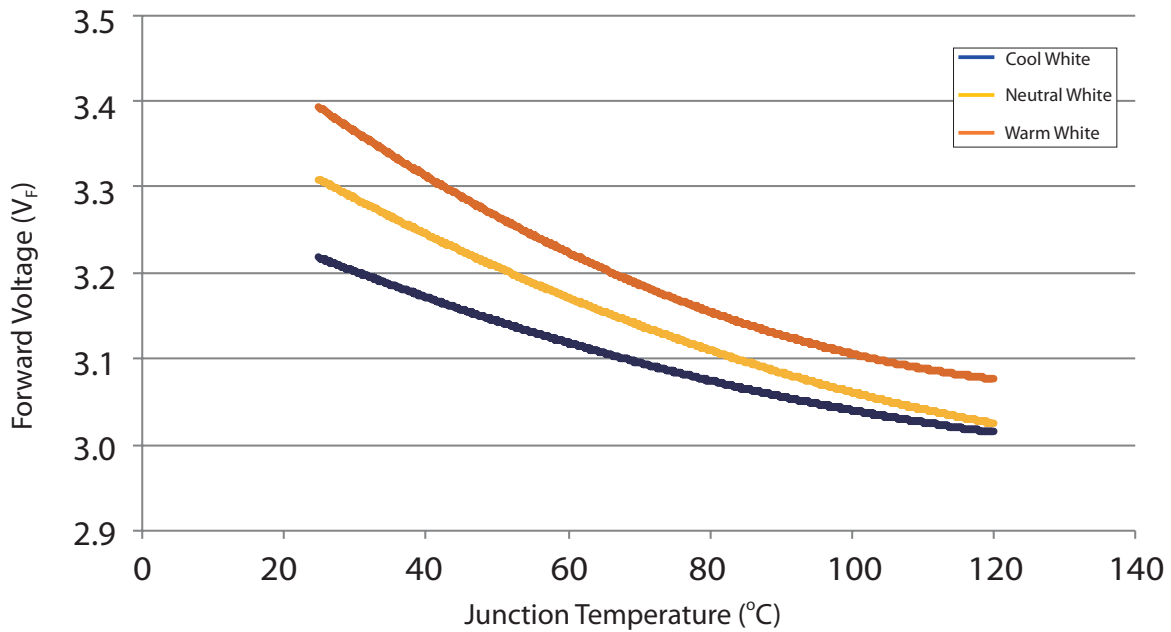


Relative Luminous flux vs. junction temperature for Federal 5050 White Series

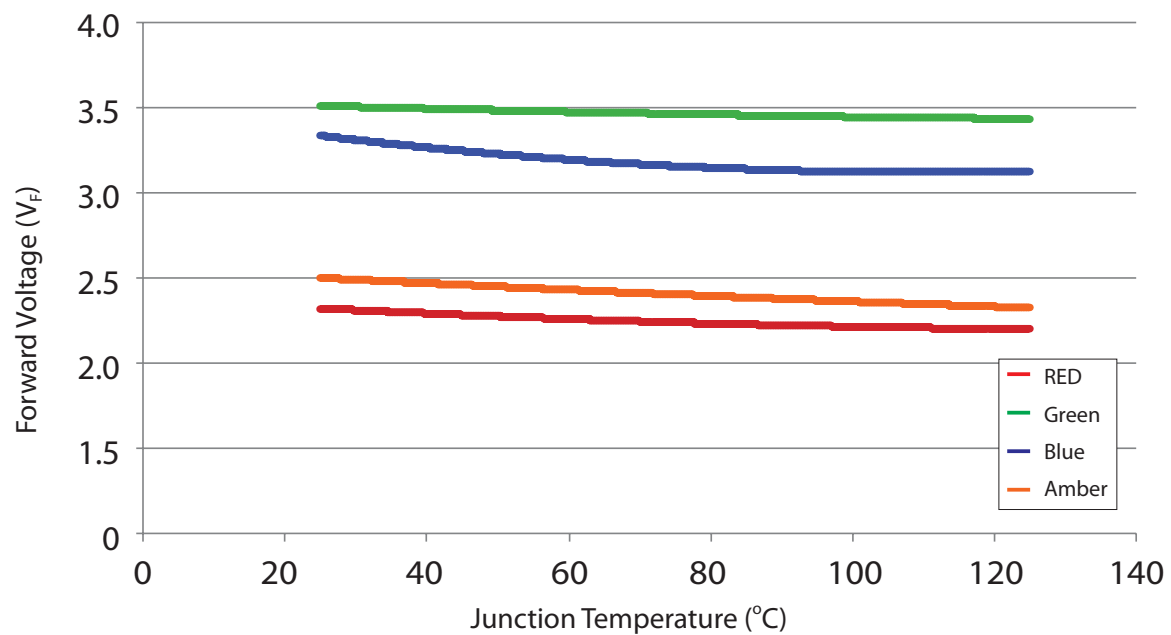


Forward voltage vs. junction temperature for Red, Blue, Green & Amber

Forward Voltage vs. Junction Temperature

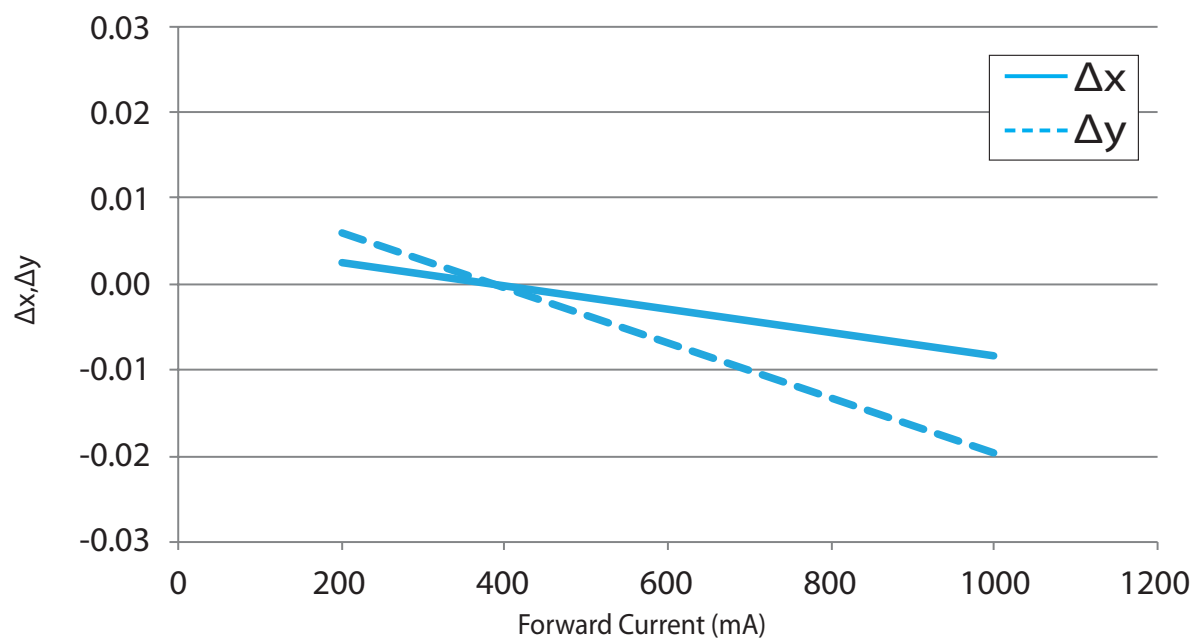


Forward voltage vs. junction temperature for Federal 5050 White Series

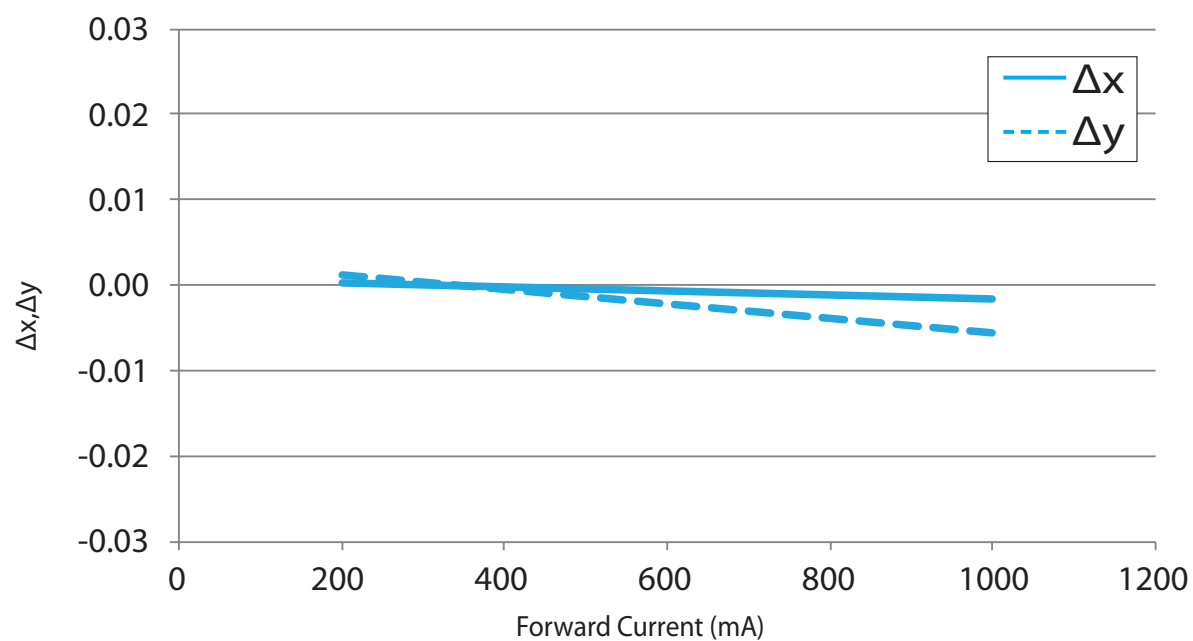


Forward voltage vs. junction temperature for Red, Blue, Green & Amber

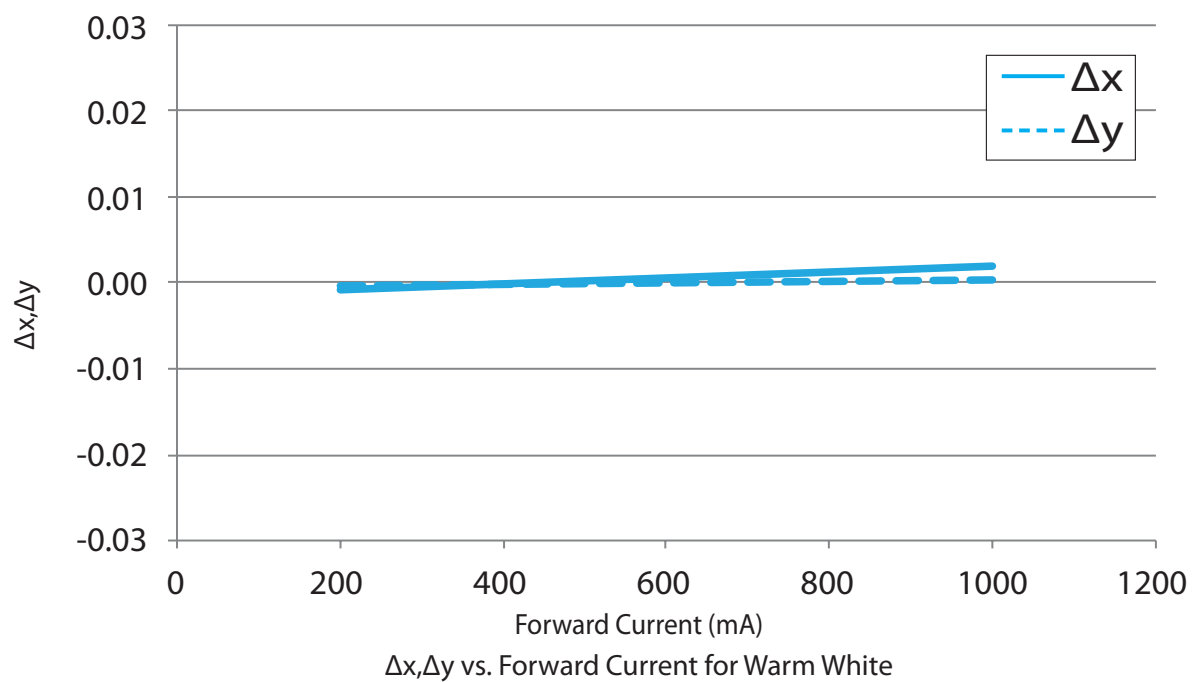
$\Delta x, \Delta y$ vs. Forward Current



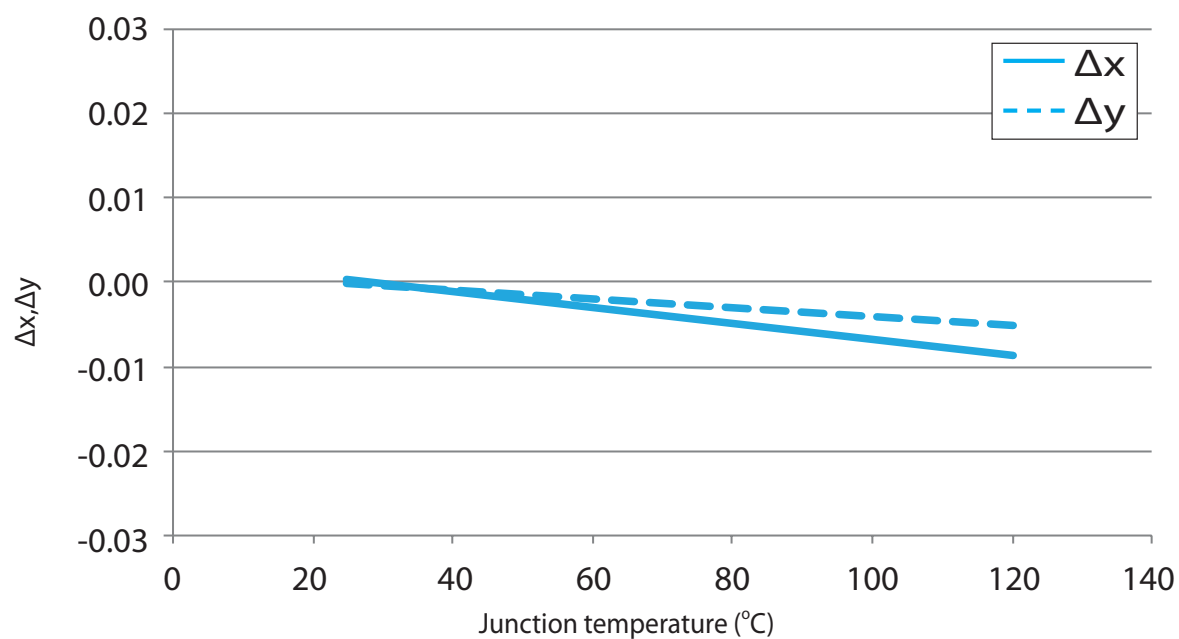
$\Delta x, \Delta y$ vs. Forward Current for Cool White



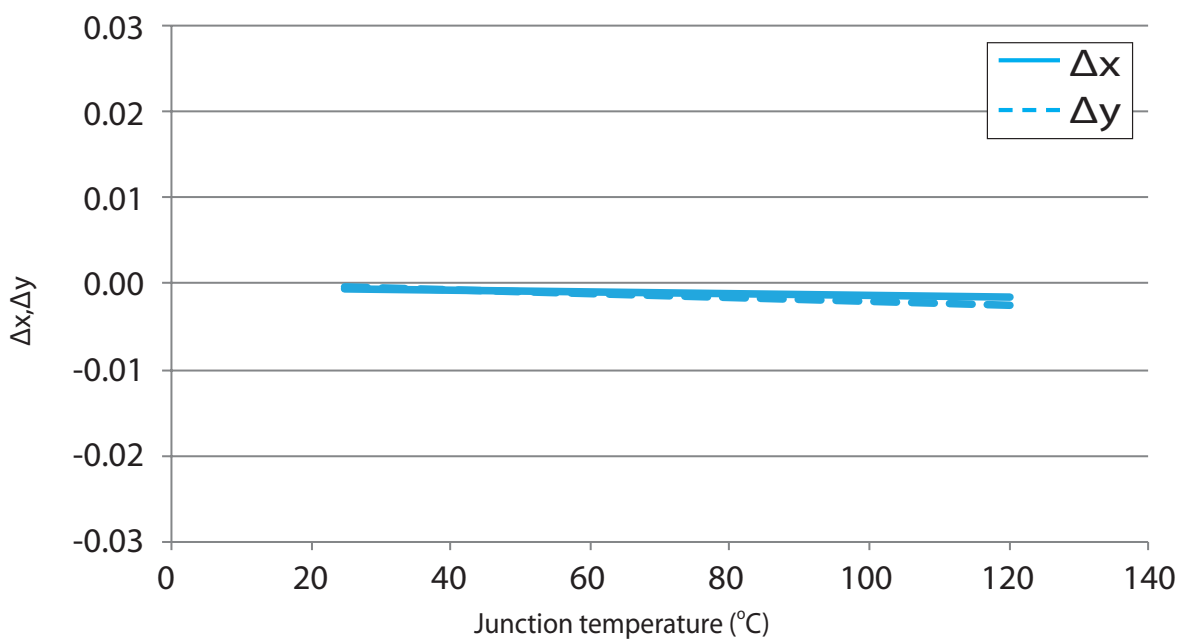
$\Delta x, \Delta y$ vs. Forward Current for Neutral White



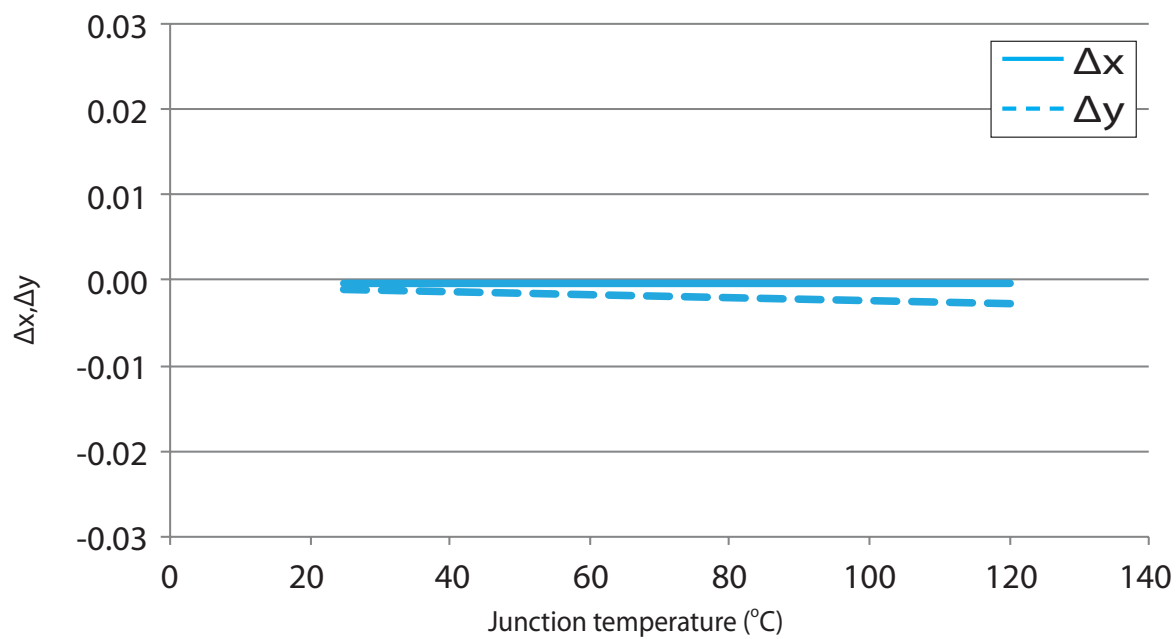
$\Delta x, \Delta y$ vs. Junction Temperature



$\Delta x, \Delta y$ vs. Junction temperature for Cool White

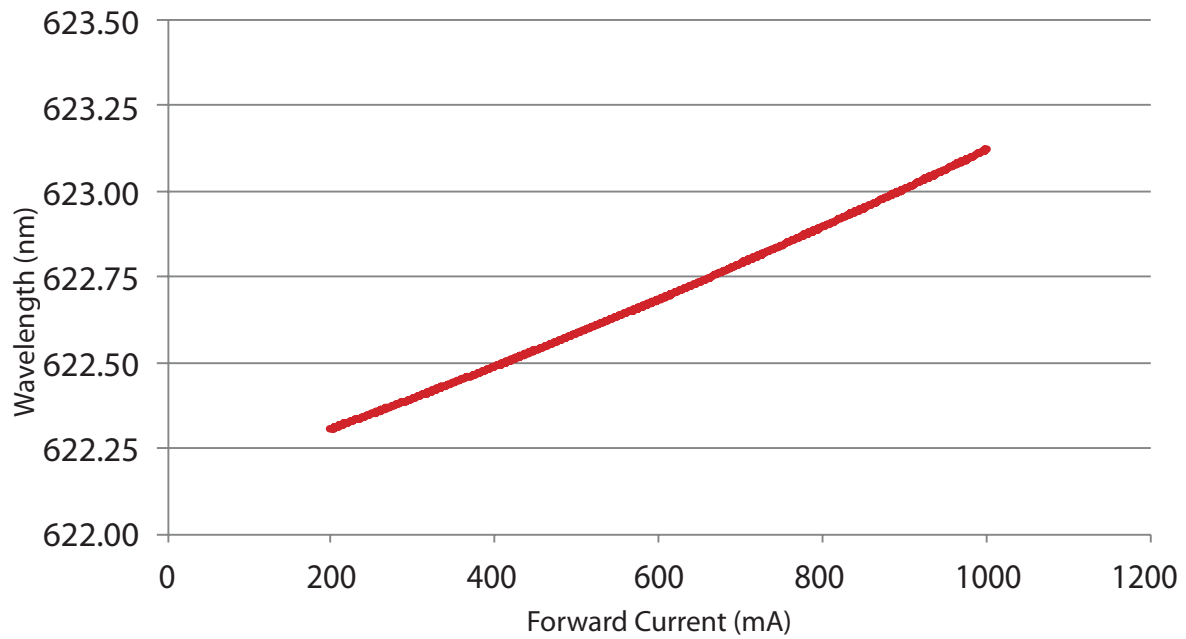


$\Delta x, \Delta y$ vs. Junction temperature for Neutral White

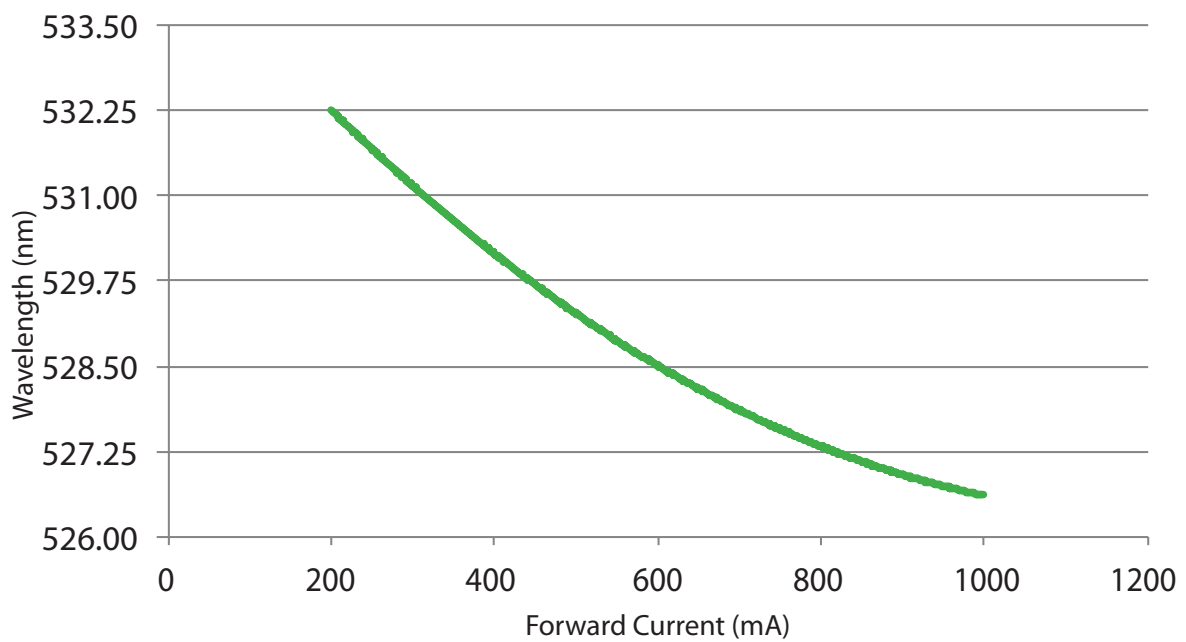


$\Delta x, \Delta y$ vs. Junction temperature for Warm White

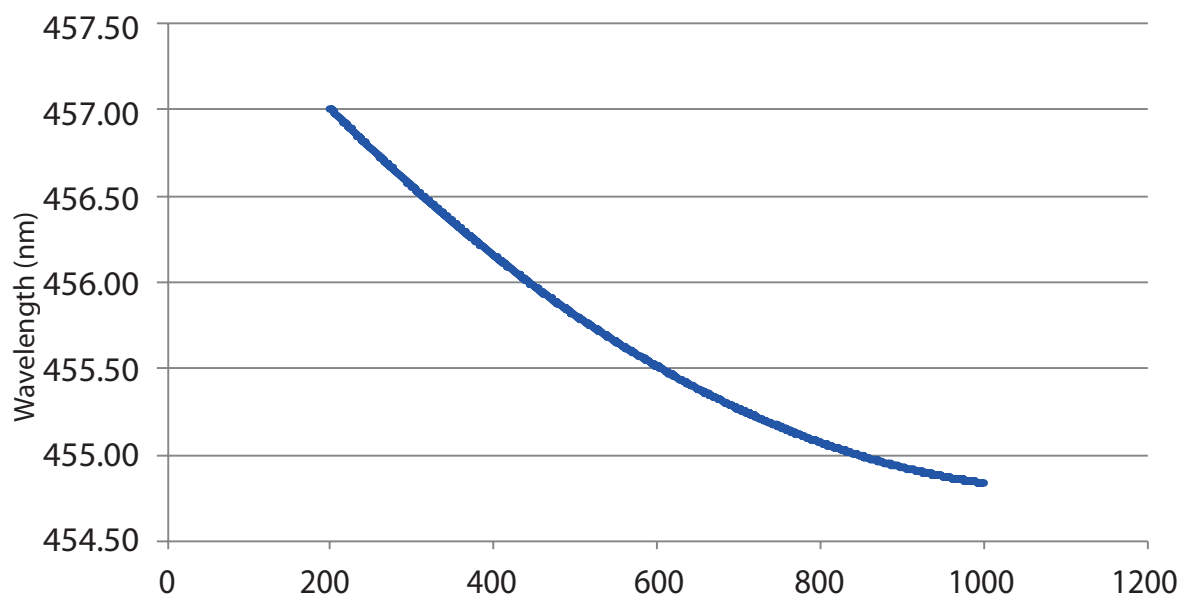
Wavelength vs. Forward Current



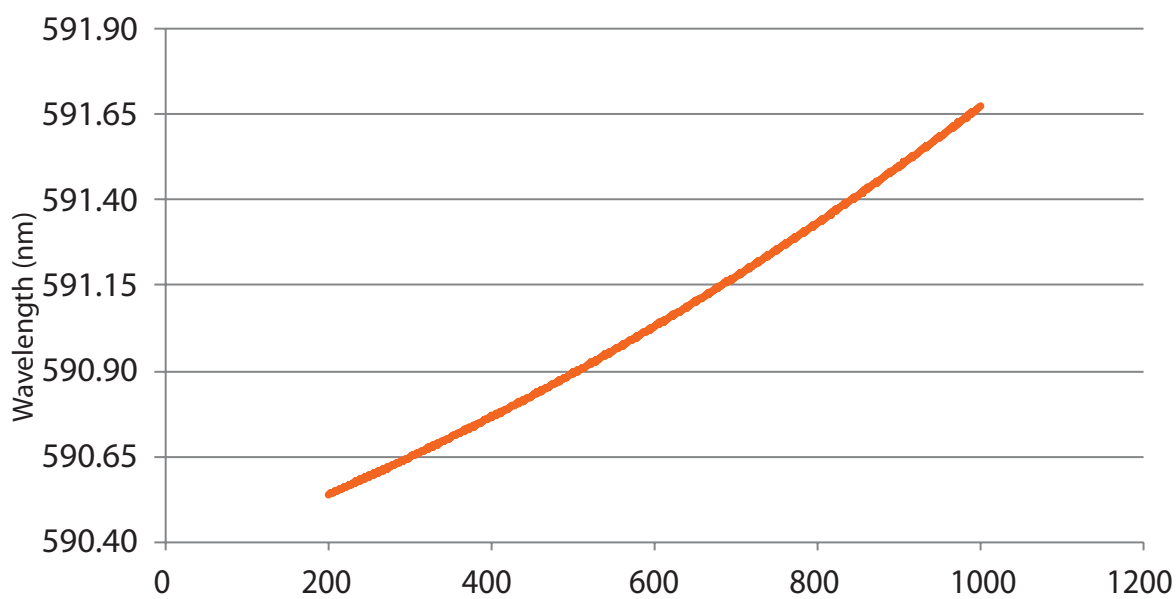
Wavelength vs. Forward Current for Red



Wavelength vs. Forward Current for True Green

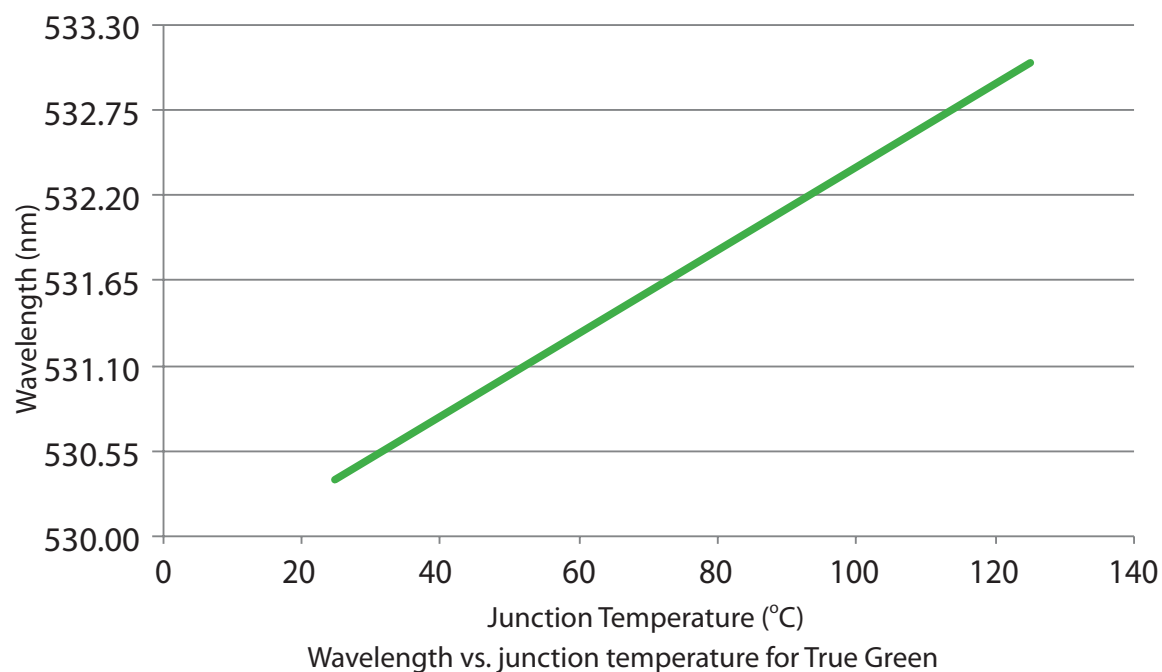
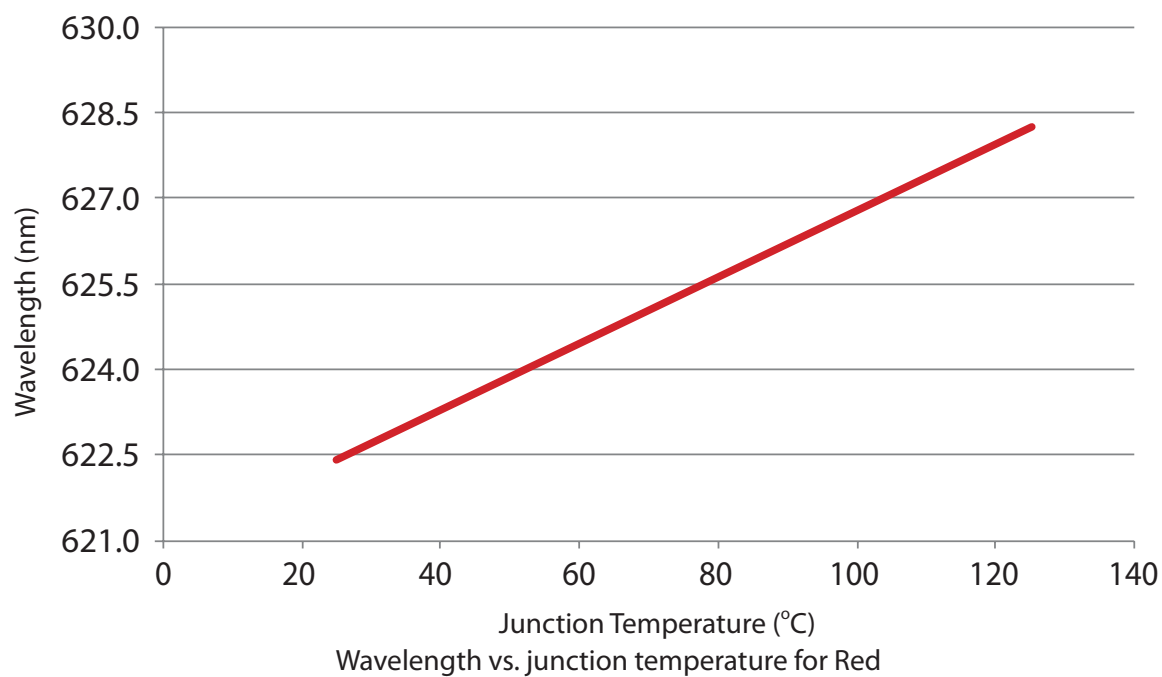


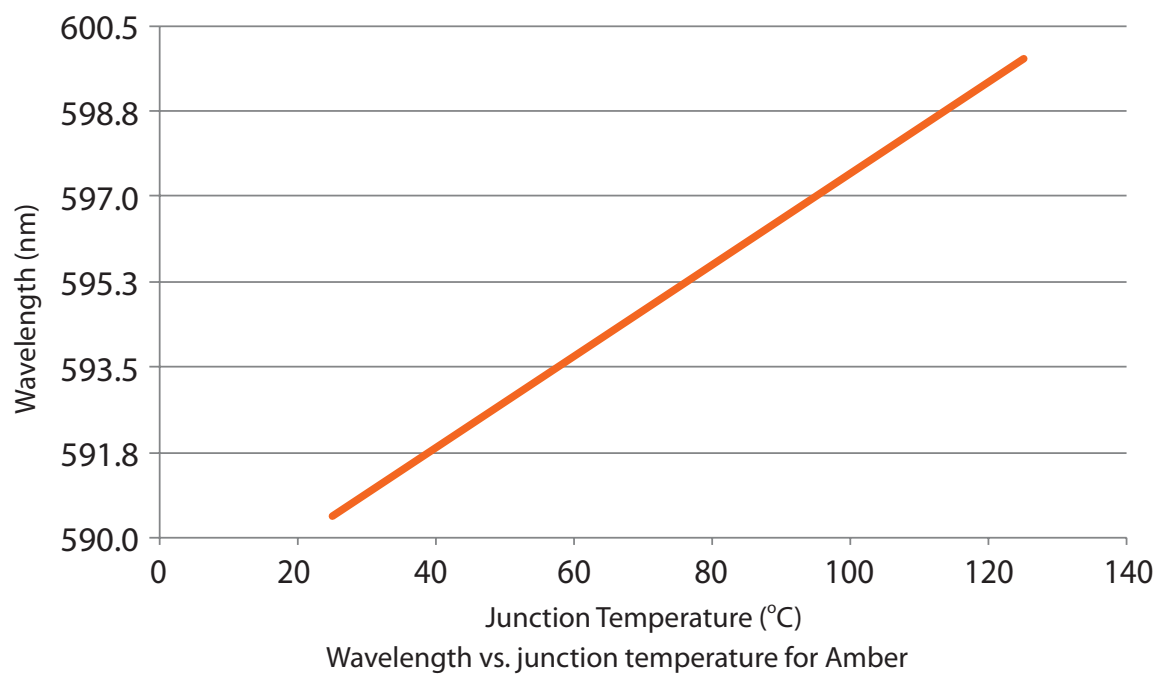
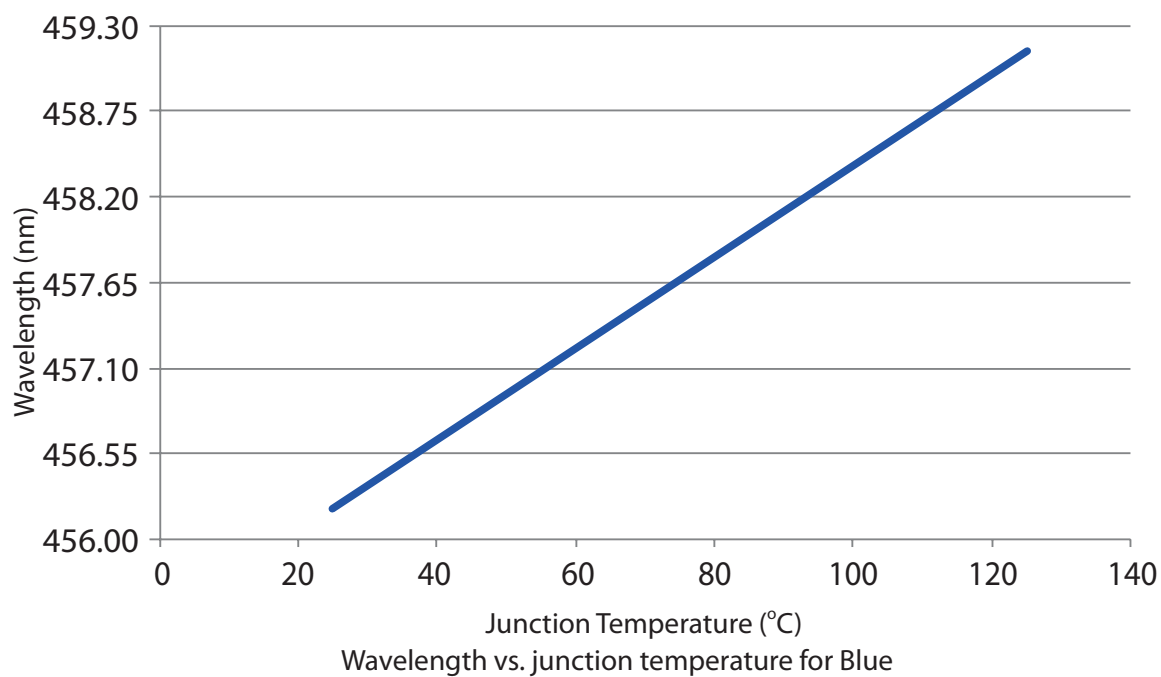
Wavelength vs. Forward Current for Blue



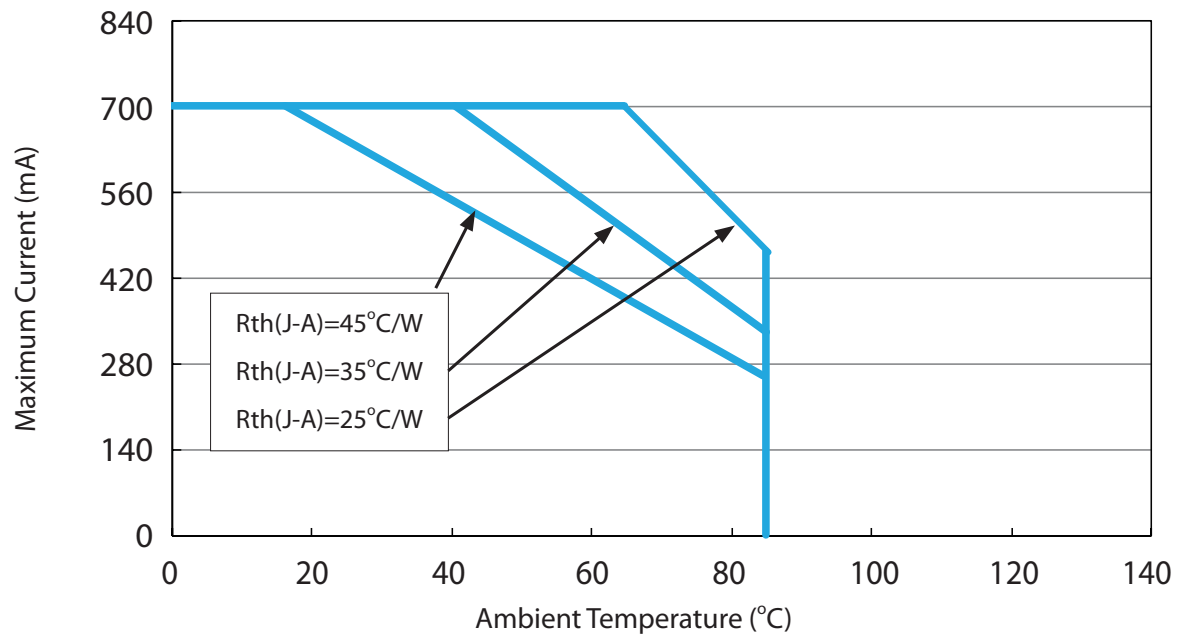
Wavelength vs. Forward Current for Amber

Wavelength vs. Junction Temperature

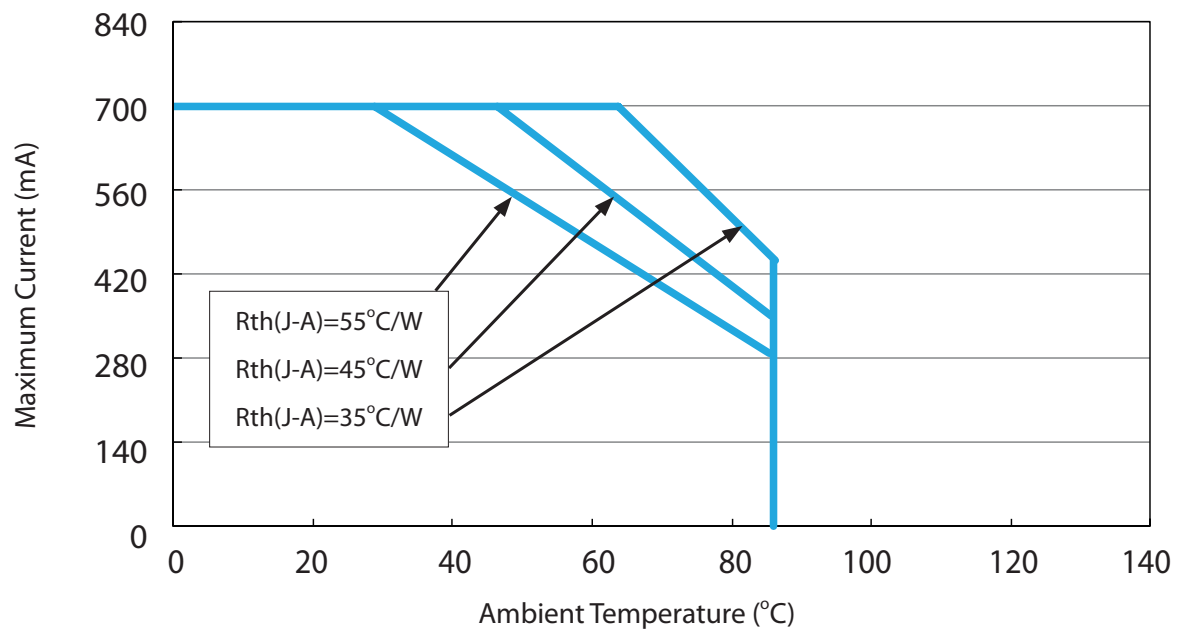




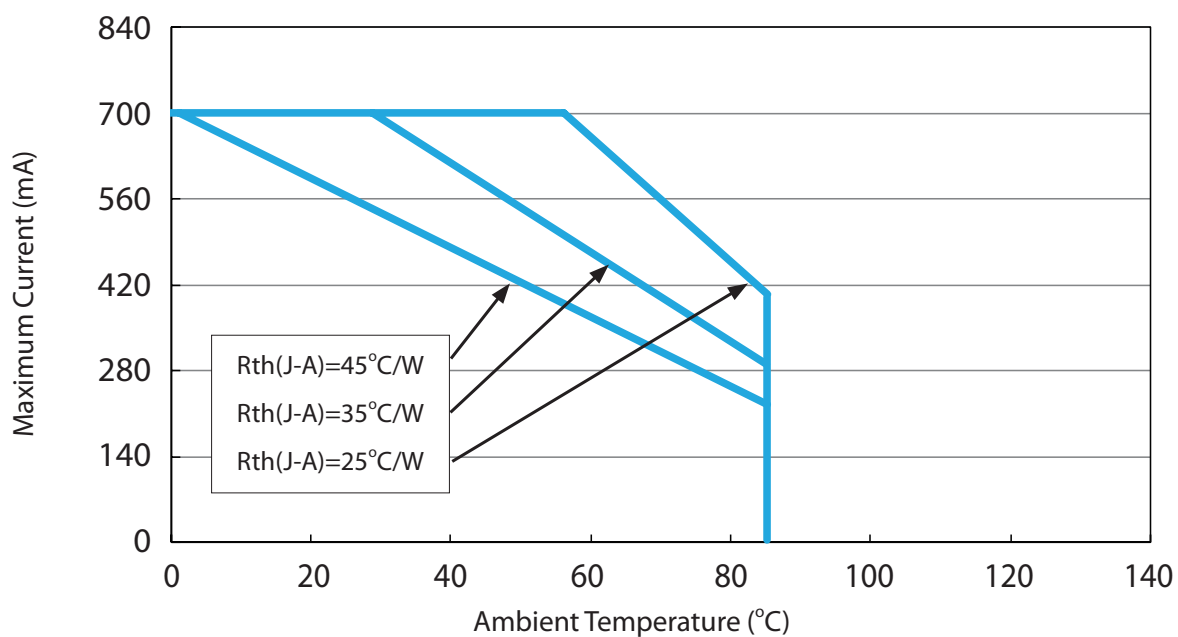
Maximum Current vs. Ambient Temperature



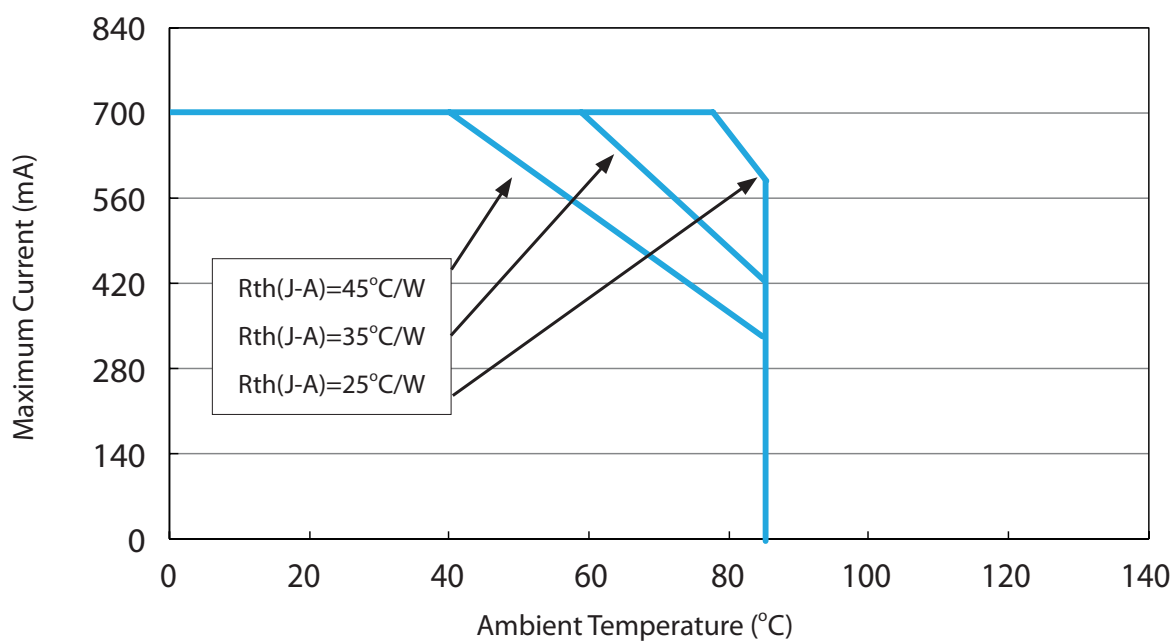
Maximum Current vs. Ambient Temperature for White & Blue



Maximum Current vs. Ambient Temperature for Red



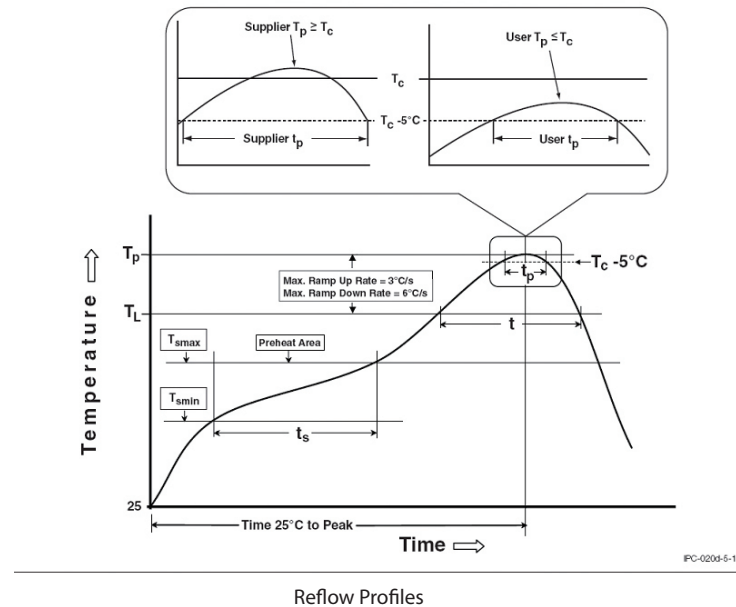
Maximum Current vs. Ambient Temperature for True Green



Maximum Current vs. Ambient Temperature for Amber

Reflow Profile

The following reflow profile is from IPC/JEDEC J-STD-020D which provided here for reference.



Reflow Profiles

Classification Reflow Profiles

Profile Feature	Pb-Free Assembly
Preheat & Soak	
Temperature min (T _{smin})	150 °C
Temperature max (T _{smax})	200 °C
Time (T _{smin} to T _{smax}) (t _s)	60-120 seconds
Average ramp-up rate (T _{smax} to T _p)	3 °C/second max.
Liquidous temperature (T _L)	217 °C
Time at liquidous (t _L)	60-150 seconds
Peak package body temperature (T _p)*	255 °C ~260 °C *
Classification temperature (T _c)	260 °C
Time (t _p)** within 5 °C of the specified classification temperature (T _c)	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:

- * Tolerance for peak profile temperature (T_p) is defined as a supplier minimum and a user maximum.
- ** Tolerance for time at peak profile temperature (t_p) is defined as a supplier minimum and a user maximum.

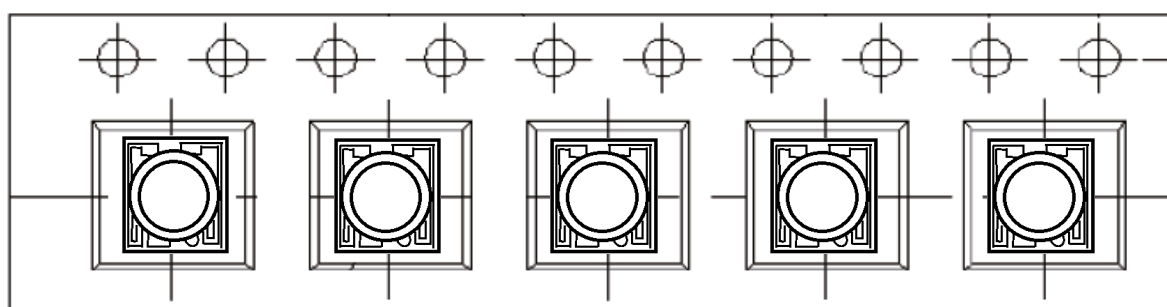
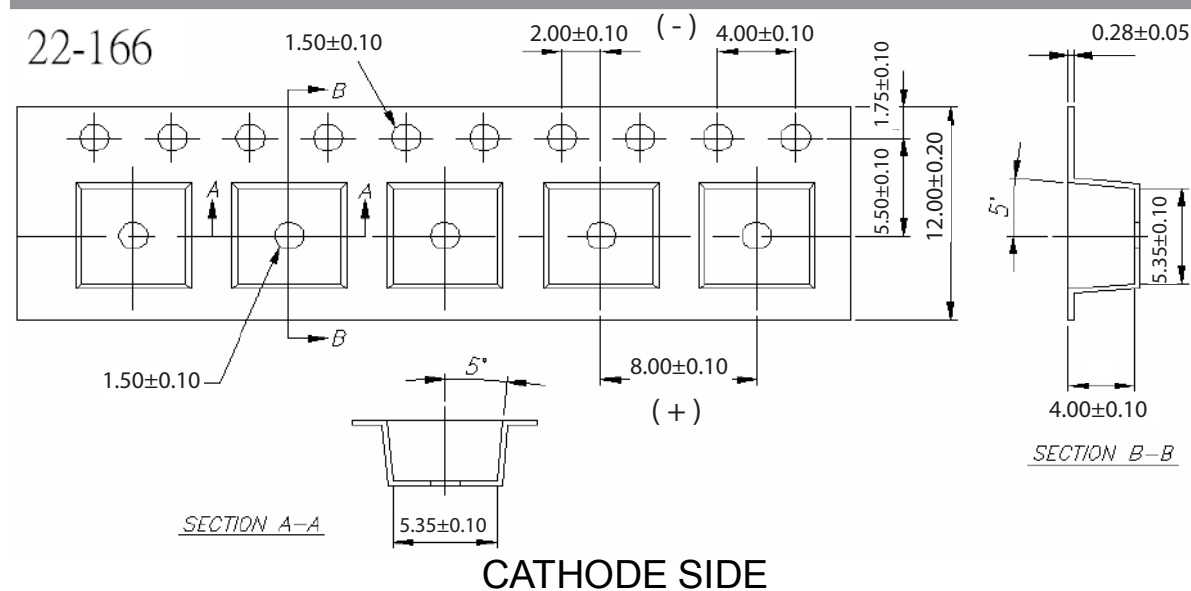
Reliability

NO .	Test Item	Test Condition	Remark
1	Temperature Cycle	-40°C~100°C 30, 30, mins	100 Cycle
2	Thermal Shock	-40°C~100°C 15, 15 mins $\leq$ 10 sec	100 Cycle
3	Resistance to Soldering Heat	T _{SOL} =260°C, 30 sec	3 times
4	Moisture Resistance	25°C~65°C 90% RH 24 hrs / 1 cycle	10 Cycle
5	High-Temperature Storage	T _A =100°C	1,000 hrs
6	Humidity Heat Storage	T _A =85°C RH=85%	1,000 hrs
7	Low-Temperature Storage	T _A =-40°C	1,000 hrs
8	Operation Life test	25°C	1,000 hrs
9	High Temperature Operation Life test	85°C	1,000 hrs
10	High Humidity Heat Life Test	85°C, 85%RH	1,000 hrs
11	ON/OFF Test	30 sec ON, 30 sec OFF	1.5W times

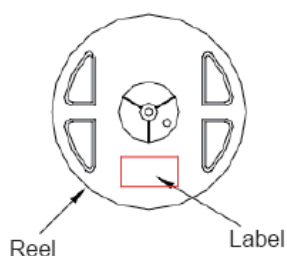
Failure Criteria

Item	Criteria for Judgment	
	Min.	Max.
Lumen Maintenance	85%	-
$\Delta u'v'$	-	0.006
Forward Voltage	-	Initial Data x 1.1
Reverse Current	-	10 μ A
Resistance to Soldering Heat	No dead lamps or visual damage	

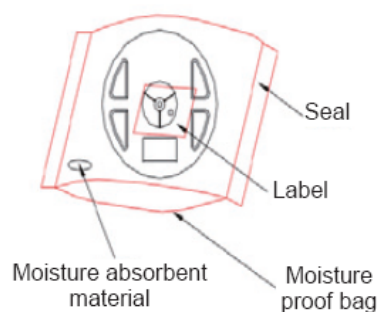
Product Packaging Information



ANODE SIDE



Taping reel dimensions



Federal 5050 Package

Item	Quantity	Total	Dimensions(mm)
Reel	500pcs	500pcs	R-178
Box	4 Reels	2,000pcs	240*235*67
Carton	5 boxes	10,000pcs	353*354*256

Starting with 50pcs empty, and 50pcs empty at the last

Revision History

Versions	Description	Release Date
1	Establish order code information	2012/12/20
2	Add the Characteristic curve	2013/2/26
3	Add the dimension of Solder pad	2014/04/03
4	1. Add Order code 2. Update Luminous flux characteristic 3. Add Reliability & Reflow Profile	2014/08/26
5	Update Order code	2014/09/12
6	1. Add on-star order code 2. Update characteristic curve 3. Add Voltage BIN Structure 4. Add Color BIN Code 5. Revise the photo of front page	2014/12/31

About Edison Opto

Edison Opto is a leading manufacturer of high power LED and a solution provider experienced in LDMS. LDMS is an integrated program derived from the four essential technologies in LED lighting applications- Thermal Management, Electrical Scheme, Mechanical Refinement, Optical Optimization, to provide customer with various LED components and modules. More Information about the company and our products can be found at www.edison-opto.com

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