



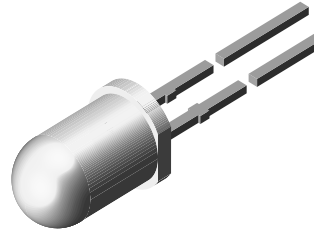
## Ultrabright LED, $\varnothing$ 5 mm Untinted Non-Diffused

### Description

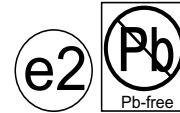
The TLC.51.. series is a clear, non diffused 5 mm LED for high end applications where supreme luminous intensity required.

These lamps with clear untinted plastic case utilize the highly developed ultrabright AllnGaP (AS) and InGaN technologies.

The lens and the viewing angle is optimized to achieve best performance of light output and visibility.



19223



### Features

- Untinted non diffused lens
- Utilizing ultrabright AllnGaP (AS) and InGaN technology
- High luminous intensity
- High operating temperature:  $T_j$  (chip junction temperature) up to 125 °C for AllnGaP devices
- Luminous intensity and color categorized for each packing unit
- ESD-withstand voltage: 2 kV acc. to MIL STD 883 D, Method 3015.7 for AllnGaP, 1 kV for InGaN
- Lead-free device

### Applications

- Interior and exterior lighting
- Outdoor LED panels
- Instrumentation and front panel indicators
- Central high mounted stop lights (CHMSL) for motor vehicles
- Replaces incandescent lamps
- Traffic signals
- Light guide design

### Parts Table

Part	Color, Luminous Intensity	Angle of Half Intensity ( $\pm\phi$ )	Technology
TLCS5100	Red, $I_V$ 7500 mcd (typ)	9 °	AllnGaP on GaAs
TLCR5100	Red, $I_V$ 12000 mcd (typ.)	9 °	AllnGaP on GaAs
TLCO5100	Orange, $I_V$ 12000 mcd (typ.)	9 °	AllnGaP on GaAs
TLCY5100	Yellow, $I_V$ 10000 mcd (typ.)	9 °	AllnGaP on GaAs
TLCY5101	Yellow, $I_V$ 6900 mcd to 16000 mcd	9 °	AllnGaP on GaAs
TLCYG5100	Yellow green, $I_V$ 3500 mcd (typ.)	9 °	AllnGaP on GaAs
TLCPG5100	Pure green, $I_V$ 1250 mcd (typ.)	9 °	AllnGaP on GaAs
TLCTG5100	True green, $I_V$ 6000 mcd (typ.)	9 °	InGaN on SiC
TLCBG5100	Blue green, $I_V$ 6000 mcd (typ.)	9 °	AllnGaP on GaAs
TLCB5100	Blue, $I_V$ 1500 mcd (typ.)	9 °	InGaN on SiC

### Absolute Maximum Ratings

$T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified

TLCS5100, TLCS5100, TLCO5100, TLCY5100, TLCYG5100, TLCPG5100

Parameter	Test condition	Symbol	Value	Unit
Reverse voltage		$V_R$	5	V
DC Forward current	$T_{amb} \leq 85\text{ }^{\circ}\text{C}$	$I_F$	50	mA
Surge forward current	$t_p \leq 10\text{ }\mu\text{s}$	$I_{FSM}$	1	A
Power dissipation	$T_{amb} \leq 85\text{ }^{\circ}\text{C}$	$P_V$	135	mW
Junction temperature		$T_j$	125	$^{\circ}\text{C}$
Operating temperature range		$T_{amb}$	- 40 to + 100	$^{\circ}\text{C}$
Storage temperature range		$T_{stg}$	- 40 to + 100	$^{\circ}\text{C}$
Soldering temperature	$t \leq 5\text{ s}$ , 2 mm from body	$T_{sd}$	260	$^{\circ}\text{C}$
Thermal resistance junction/ambient		$R_{thJA}$	300	K/W

TLCTG5100, TLCS5100, TLCS5100

Parameter	Test condition	Symbol	Value	Unit
Reverse voltage		$V_R$	5	V
DC Forward current	$T_{amb} \leq 60\text{ }^{\circ}\text{C}$	$I_F$	30	mA
Surge forward current	$t_p \leq 10\text{ }\mu\text{s}$	$I_{FSM}$	0.1	A
Power dissipation	$T_{amb} \leq 60\text{ }^{\circ}\text{C}$	$P_V$	135	mW
Junction temperature		$T_j$	100	$^{\circ}\text{C}$
Operating temperature range		$T_{amb}$	- 40 to + 100	$^{\circ}\text{C}$
Storage temperature range		$T_{stg}$	- 40 to + 100	$^{\circ}\text{C}$
Soldering temperature	$t \leq 5\text{ s}$ , 2 mm from body	$T_{sd}$	260	$^{\circ}\text{C}$
Thermal resistance junction/ambient		$R_{thJA}$	300	K/W

### Optical and Electrical Characteristics

$T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified

#### Super red

TLCS5100

Parameter	Test condition	Part	Symbol	Min	Typ.	Max	Unit
Luminous intensity <sup>1)</sup>	$I_F = 50\text{ mA}$	TLCS5100	$I_V$	2400	7500		mcd
Dominant wavelength	$I_F = 50\text{ mA}$		$\lambda_d$	626	630	638	nm
Peak wavelength	$I_F = 50\text{ mA}$		$\lambda_p$		641		nm
Spectral bandwidth at 50 % $I_{rel\ max}$	$I_F = 50\text{ mA}$		$\Delta\lambda$		20		nm
Angle of half intensity	$I_F = 50\text{ mA}$		$\phi$		$\pm 9$		deg
Forward voltage	$I_F = 50\text{ mA}$		$V_F$		2.1	2.7	V
Reverse voltage	$I_R = 10\text{ }\mu\text{A}$		$V_R$	5			V
Temperature coefficient of $V_F$	$I_F = 50\text{ mA}$		$TC_{VF}$		- 2		mV/K
Temperature coefficient of $\lambda_d$	$I_F = 50\text{ mA}$		$TC_{\lambda_d}$		0.04		nm/K

<sup>1)</sup> in one Packing Unit  $I_{Vmax}/I_{Vmin} \leq 2.0$



### Red

#### TLCR5100

Parameter	Test condition	Part	Symbol	Min	Typ.	Max	Unit
Luminous intensity <sup>1)</sup>	I <sub>F</sub> = 50 mA	TLCR5100	I <sub>V</sub>	4300	12000		mcd
Dominant wavelength	I <sub>F</sub> = 50 mA		λ <sub>d</sub>	611	616	622	nm
Peak wavelength	I <sub>F</sub> = 50 mA		λ <sub>p</sub>		622		nm
Spectral bandwidth at 50 % I <sub>rel max</sub>	I <sub>F</sub> = 50 mA		Δλ		18		nm
Angle of half intensity	I <sub>F</sub> = 50 mA		φ		± 9		deg
Forward voltage	I <sub>F</sub> = 50 mA		V <sub>F</sub>		2.1	2.7	V
Reverse voltage	I <sub>R</sub> = 10 μA		V <sub>R</sub>	5			V
Temperature coefficient of V <sub>F</sub>	I <sub>F</sub> = 50 mA		TC <sub>V<sub>F</sub></sub>		- 3.2		mV/K
Temperature coefficient of λ <sub>d</sub>	I <sub>F</sub> = 50 mA		TC <sub>λ<sub>d</sub></sub>		0.08		nm/K

<sup>1)</sup> in one Packing Unit I<sub>Vmax</sub>/I<sub>Vmin</sub> ≤ 2.0

### Soft orange

#### TLCO5100

Parameter	Test condition	Part	Symbol	Min	Typ.	Max	Unit
Luminous intensity <sup>1)</sup>	I <sub>F</sub> = 50 mA	TLCO5100	I <sub>V</sub>	4300	12000		mcd
Dominant wavelength	I <sub>F</sub> = 50 mA		λ <sub>d</sub>	600	605	611	nm
Peak wavelength	I <sub>F</sub> = 50 mA		λ <sub>p</sub>		611		nm
Spectral bandwidth at 50 % I <sub>rel max</sub>	I <sub>F</sub> = 50 mA		Δλ		17		nm
Angle of half intensity	I <sub>F</sub> = 50 mA		φ		± 9		deg
Forward voltage	I <sub>F</sub> = 50 mA		V <sub>F</sub>		2.1	2.7	V
Reverse voltage	I <sub>R</sub> = 10 μA		V <sub>R</sub>	5			V
Temperature coefficient of V <sub>F</sub>	I <sub>F</sub> = 50 mA		TC <sub>V<sub>F</sub></sub>		- 2.5		mV/K
Temperature coefficient of λ <sub>d</sub>	I <sub>F</sub> = 50 mA		TC <sub>λ<sub>d</sub></sub>		0.08		nm/K

<sup>1)</sup> in one Packing Unit I<sub>Vmax</sub>/I<sub>Vmin</sub> ≤ 2.0

### Yellow

#### TLCY5100

Parameter	Test condition	Part	Symbol	Min	Typ.	Max	Unit
Luminous intensity <sup>1)</sup>	I <sub>F</sub> = 50 mA	TLCY5100	I <sub>V</sub>	3200	10000		mcd
		TLCY5101	I <sub>V</sub>	6900		16000	mcd
Dominant wavelength	I <sub>F</sub> = 50 mA		λ <sub>d</sub>	585	590	597	nm
Peak wavelength	I <sub>F</sub> = 50 mA		λ <sub>p</sub>		593		nm
Spectral bandwidth at 50 % I <sub>rel max</sub>	I <sub>F</sub> = 50 mA		Δλ		15		nm
Angle of half intensity	I <sub>F</sub> = 50 mA		φ		± 9		deg
Forward voltage	I <sub>F</sub> = 50 mA		V <sub>F</sub>		2.1	2.7	V
Reverse voltage	I <sub>R</sub> = 10 μA		V <sub>R</sub>	5			V
Temperature coefficient of V <sub>F</sub>	I <sub>F</sub> = 50 mA		TC <sub>V<sub>F</sub></sub>		- 2.1		mV/K
Temperature coefficient of λ <sub>d</sub>	I <sub>F</sub> = 50 mA		TC <sub>λ<sub>d</sub></sub>		0.1		nm/K

<sup>1)</sup> in one Packing Unit I<sub>Vmax</sub>/I<sub>Vmin</sub> ≤ 2.0

### Yellow green

#### TLCYG5100

Parameter	Test condition	Part	Symbol	Min	Typ.	Max	Unit
Luminous intensity <sup>1)</sup>	$I_F = 50 \text{ mA}$	TLCYG5100	$I_V$	1350	3500		mcd
Dominant wavelength	$I_F = 50 \text{ mA}$		$\lambda_d$	565	572	577	nm
Peak wavelength	$I_F = 50 \text{ mA}$		$\lambda_p$		574		nm
Spectral bandwidth at 50 % $I_{rel \text{ max}}$	$I_F = 50 \text{ mA}$		$\Delta\lambda$		15		nm
Angle of half intensity	$I_F = 50 \text{ mA}$		$\phi$		$\pm 9$		deg
Forward voltage	$I_F = 50 \text{ mA}$		$V_F$		2.2	2.7	V
Reverse voltage	$I_R = 10 \mu\text{A}$		$V_R$	5			V
Temperature coefficient of $V_F$	$I_F = 50 \text{ mA}$		$TC_{V_F}$		- 4.5		mV/K
Temperature coefficient of $\lambda_d$	$I_F = 50 \text{ mA}$		$TC_{\lambda_d}$		0.1		nm/K

<sup>1)</sup> in one Packing Unit  $I_{V_{max}}/I_{V_{min}} \leq 2.0$

### Pure green

#### TLCPG5100

Parameter	Test condition	Part	Symbol	Min	Typ.	Max	Unit
Luminous intensity <sup>1)</sup>	$I_F = 50 \text{ mA}$	TLCPG5100	$I_V$	430	1250		mcd
Dominant wavelength	$I_F = 50 \text{ mA}$		$\lambda_d$	555	562	567	nm
Peak wavelength	$I_F = 50 \text{ mA}$		$\lambda_p$		563		nm
Spectral bandwidth at 50 % $I_{rel \text{ max}}$	$I_F = 50 \text{ mA}$		$\Delta\lambda$		20		nm
Angle of half intensity	$I_F = 50 \text{ mA}$		$\phi$		$\pm 9$		deg
Forward voltage	$I_F = 50 \text{ mA}$		$V_F$		2.2	2.7	V
Reverse voltage	$I_R = 10 \mu\text{A}$		$V_R$	5			V
Temperature coefficient of $V_F$	$I_F = 50 \text{ mA}$		$TC_{V_F}$		- 3.5		mV/K
Temperature coefficient of $\lambda_d$	$I_F = 50 \text{ mA}$		$TC_{\lambda_d}$		0.1		nm/K

<sup>1)</sup> in one Packing Unit  $I_{V_{max}}/I_{V_{min}} \leq 2.0$

### True green

#### TLCTG5100

Parameter	Test condition	Part	Symbol	Min	Typ.	Max	Unit
Luminous intensity <sup>1)</sup>	$I_F = 30 \text{ mA}$	TLCTG5100	$I_V$	1800	6000		mcd
Dominant wavelength	$I_F = 30 \text{ mA}$		$\lambda_d$	515	525	535	nm
Peak wavelength	$I_F = 30 \text{ mA}$		$\lambda_p$		520		nm
Spectral bandwidth at 50 % $I_{rel \text{ max}}$	$I_F = 30 \text{ mA}$		$\Delta\lambda$		35		nm
Angle of half intensity	$I_F = 30 \text{ mA}$		$\phi$		$\pm 9$		deg
Forward voltage	$I_F = 30 \text{ mA}$		$V_F$		3.9	4.5	V
Reverse voltage	$I_R = 10 \mu\text{A}$		$V_R$	5			V
Temperature coefficient of $V_F$	$I_F = 30 \text{ mA}$		$TC_{V_F}$		- 3.8		mV/K
Temperature coefficient of $\lambda_d$	$I_F = 30 \text{ mA}$		$TC_{\lambda_d}$		0.03		nm/K

<sup>1)</sup> in one Packing Unit  $I_{V_{max}}/I_{V_{min}} \leq 2.0$



## Blue green

### TLCBG5100

Parameter	Test condition	Part	Symbol	Min	Typ.	Max	Unit
Luminous intensity <sup>1)</sup>	I <sub>F</sub> = 30 mA	TLCBG5100	I <sub>V</sub>	1800	6000		mcd
Dominant wavelength	I <sub>F</sub> = 30 mA		λ <sub>d</sub>	496	505	514	nm
Peak wavelength	I <sub>F</sub> = 30 mA		λ <sub>p</sub>		502		nm
Spectral bandwidth at 50 % I <sub>rel max</sub>	I <sub>F</sub> = 30 mA		Δλ		30		nm
Angle of half intensity	I <sub>F</sub> = 30 mA		φ		± 9		deg
Forward voltage	I <sub>F</sub> = 30 mA		V <sub>F</sub>		3.9	4.5	V
Reverse voltage	I <sub>R</sub> = 10 μA		V <sub>R</sub>	5			V
Temperature coefficient of V <sub>F</sub>	I <sub>F</sub> = 30 mA		TC <sub>V<sub>F</sub></sub>		- 3.5		mV/K
Temperature coefficient of λ <sub>d</sub>	I <sub>F</sub> = 30 mA		TC <sub>λ<sub>d</sub></sub>		0.01		nm/K

<sup>1)</sup> in one Packing Unit I<sub>Vmax</sub>/I<sub>Vmin</sub> ≤ 2.0

## Blue

### TLCB5100

Parameter	Test condition	Part	Symbol	Min	Typ.	Max	Unit
Luminous intensity <sup>1)</sup>	I <sub>F</sub> = 30 mA	TLCB5100	I <sub>V</sub>	575	1500		mcd
Dominant wavelength	I <sub>F</sub> = 30 mA		λ <sub>d</sub>	462	470	476	nm
Peak wavelength	I <sub>F</sub> = 30 mA		λ <sub>p</sub>		464		nm
Spectral bandwidth at 50 % I <sub>rel max</sub>	I <sub>F</sub> = 30 mA		Δλ		26		nm
Angle of half intensity	I <sub>F</sub> = 30 mA		φ		± 9		deg
Forward voltage	I <sub>F</sub> = 30 mA		V <sub>F</sub>		3.9	4.5	V
Reverse voltage	I <sub>R</sub> = 10 μA		V <sub>R</sub>	5			V
Temperature coefficient of V <sub>F</sub>	I <sub>F</sub> = 30 mA		TC <sub>V<sub>F</sub></sub>		- 4.7		mV/K
Temperature coefficient of λ <sub>d</sub>	I <sub>F</sub> = 30 mA		TC <sub>λ<sub>d</sub></sub>		0.02		nm/K

<sup>1)</sup> in one Packing Unit I<sub>Vmax</sub>/I<sub>Vmin</sub> ≤ 2.0

## Color Classification

Group	Dominant Wavelength (nm)													
	Red		Softorange		Yellow		Pure green		Truegreen		Bluegreen		Blue	
	min	max	min	max	min	max	min	max	min	max	min	max	min	max
0					585	588	555	559						
1	611	618	598	601	587	591	558	561						
2	614	622	600	603	589	594	560	563	509	517	492	498	458	464
3			602	605	592	597	562	565	515	523	496	502	462	468
4			604	607			564	567	521	529	500	506	466	472
5			606	609			566	569	527	535	504	510	470	476
6			608	611			568	571			508	514		
7							570	573						
8							572	575						
9							574	577						

## Luminous Intensity Classification

Group	Light Intensity (mcd) / Luminous Flux [mlm]	
	min	max
AA	320	640
BB	430	860
CC	575	1150
DD	750	1500
EE	1000	2000
FF	1350	2700
GG	1800	3600
HH	2400	4800
II	3200	6400
KK	4300	8600
LL	5750	11500
MM	7500	15000
NN	10000	20000
PP	13500	27000
QQ	18000	36000
RR	24000	48000
SS	32000	64000
TT	43000	86000
UU	57500	115000

## Typical Characteristics (T<sub>amb</sub> = 25 °C unless otherwise specified)

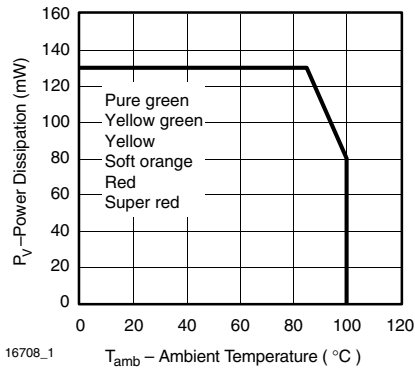


Figure 1. Power Dissipation vs. Ambient Temperature

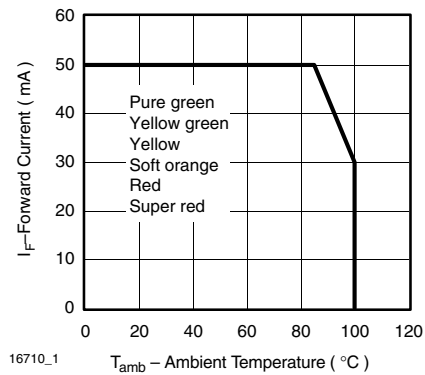


Figure 2. Forward Current vs. Ambient Temperature

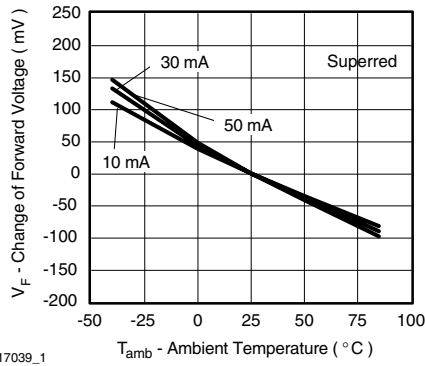


Figure 3. Change of Forward Voltage vs. Ambient Temperature

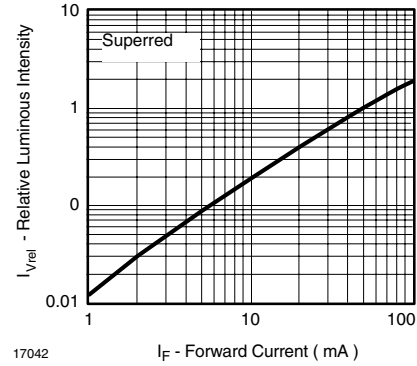


Figure 6. Relative Luminous Flux vs. Forward Current

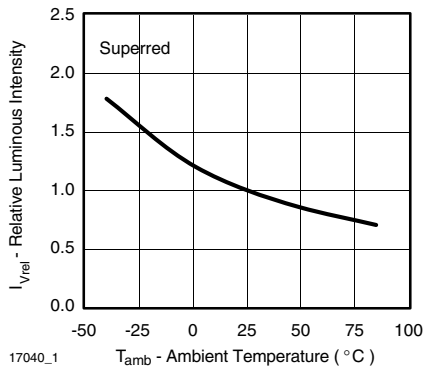


Figure 4. Relative Luminous Intensity vs. Ambient Temperature

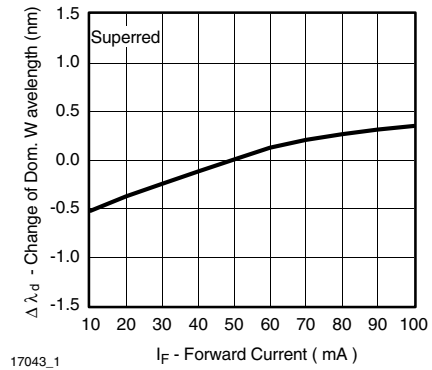


Figure 7. Change of Dominant Wavelength vs. Forward Current

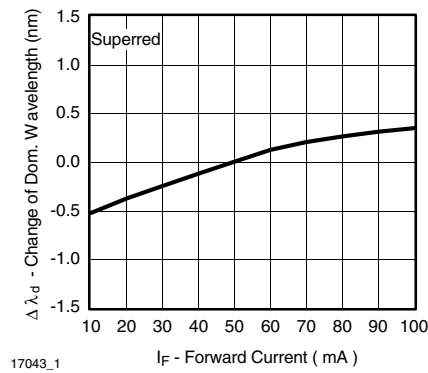


Figure 5. Change of Dominant Wavelength vs. Ambient Temperature

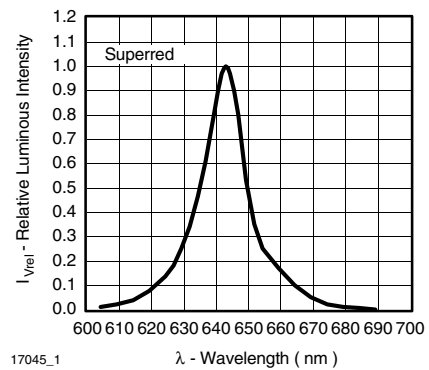
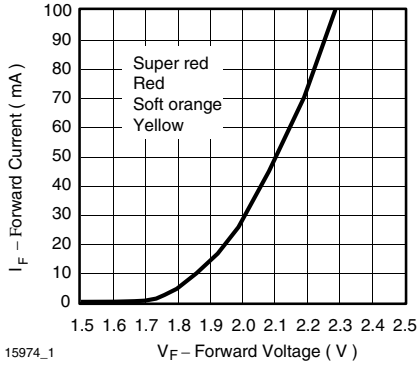
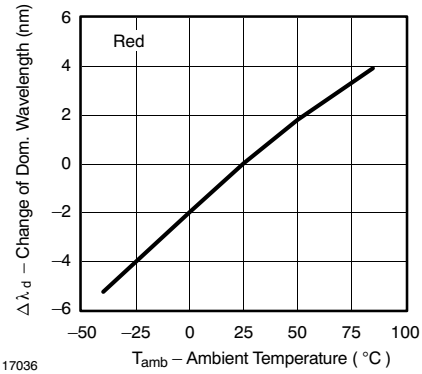


Figure 8. Relative Intensity vs. Wavelength



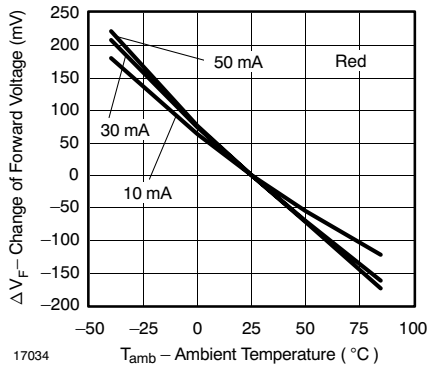
15974\_1

Figure 9. Forward Current vs. Forward Voltage



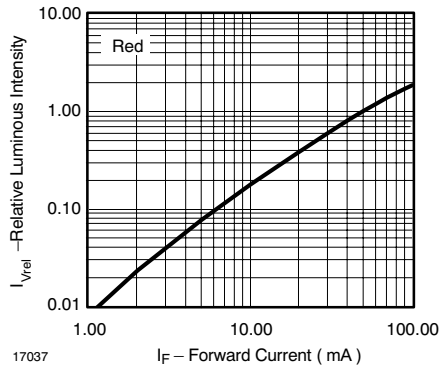
17036

Figure 12. Change of Dominant Wavelength vs. Ambient Temperature



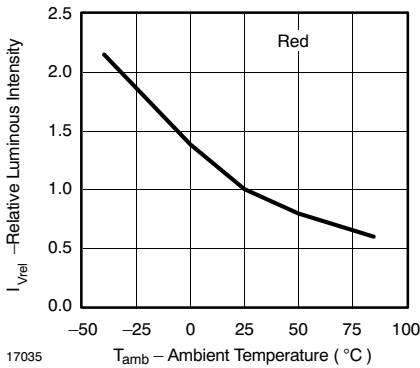
17034

Figure 10. Change of Forward Voltage vs. Ambient Temperature



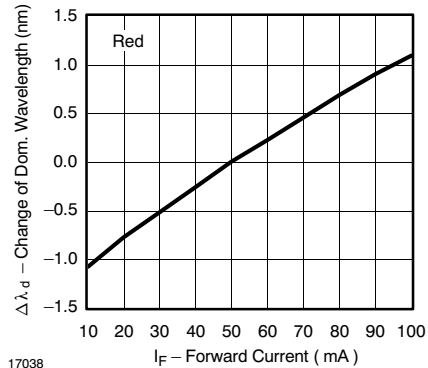
17037

Figure 13. Relative Luminous Flux vs Forward Current



17035

Figure 11. Relative Luminous Intensity vs. Ambient Temperature



17038

Figure 14. Changes of Dominant Wavelength vs. Forward Current



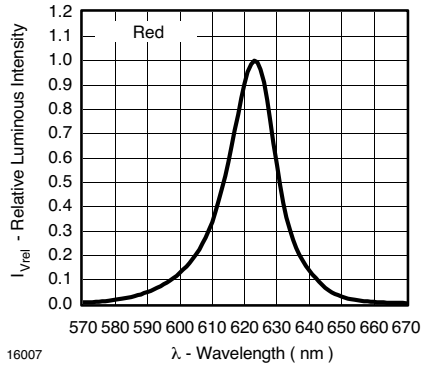


Figure 15. Relative Intensity vs. Wavelength

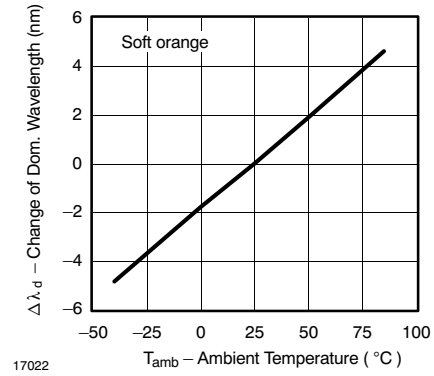


Figure 18. Change of Dominant Wavelength vs. Ambient Temperature

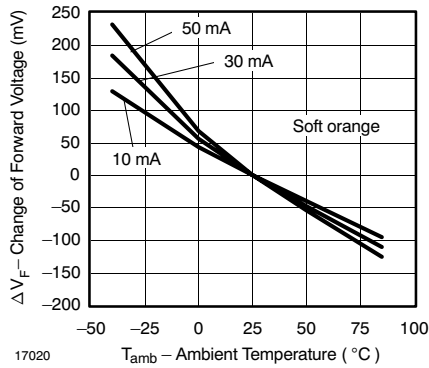


Figure 16. Change of Forward Voltage vs. Ambient Temperature

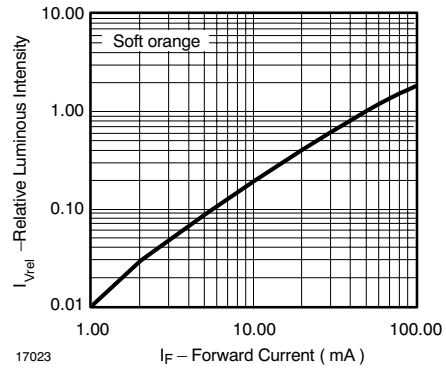


Figure 19. Relative Luminous Flux vs. Forward Current

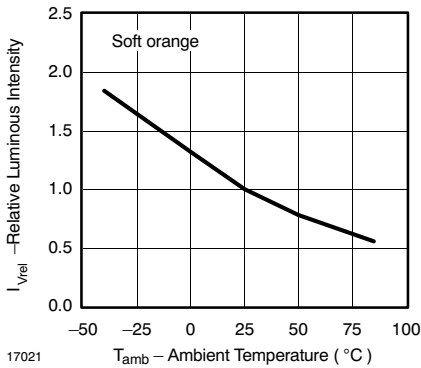


Figure 17. Relative Luminous Intensity vs. Ambient Temperature

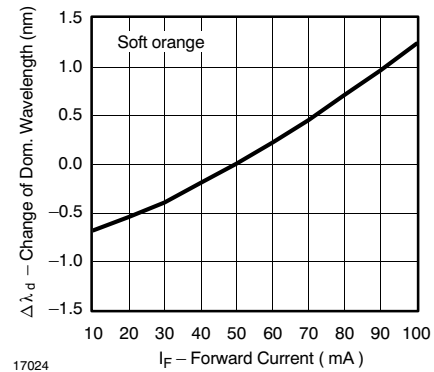


Figure 20. Change of Dominant Wavelength vs. Forward Current

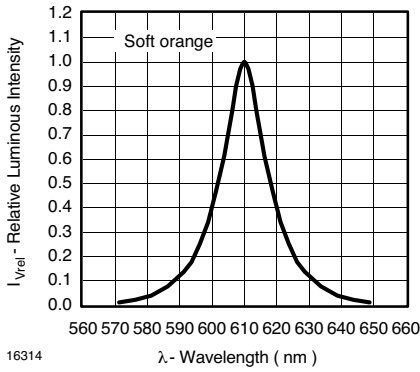


Figure 21. Relative Intensity vs. Wavelength

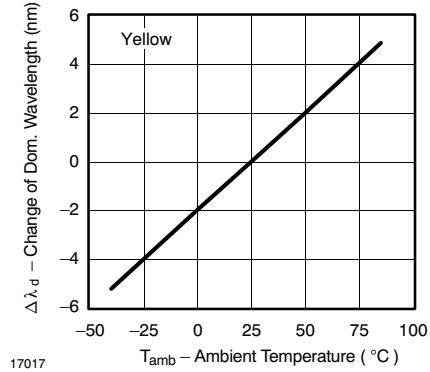


Figure 24. Change of Dominant Wavelength vs. Ambient Temperature

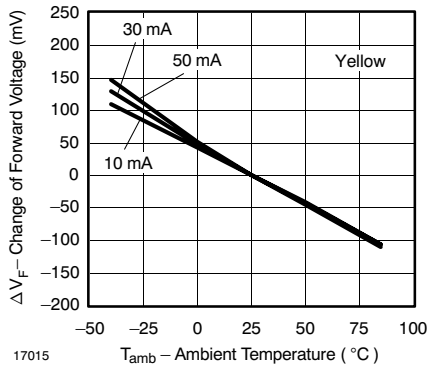


Figure 22. Change of Forward Voltage vs. Ambient Temperature

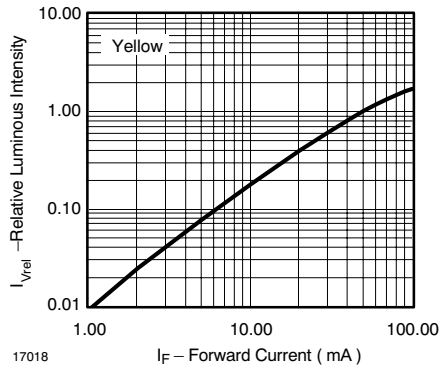


Figure 25. Relative Luminous Flux vs. Forward Current

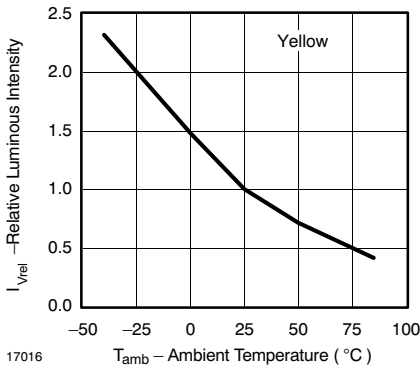


Figure 23. Relative Luminous Intensity vs. Ambient Temperature

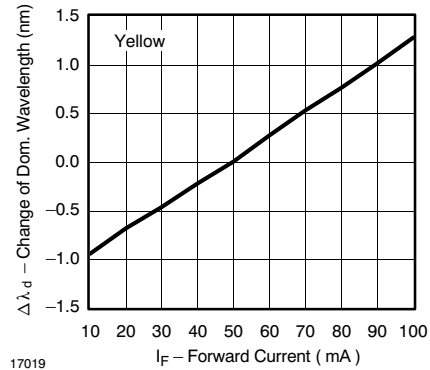


Figure 26. Change of Dominant Wavelength vs. Forward Current

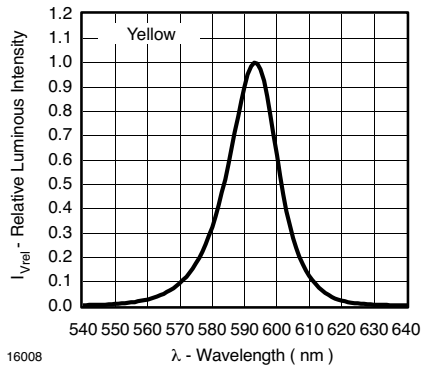


Figure 27. Relative Intensity vs. Wavelength

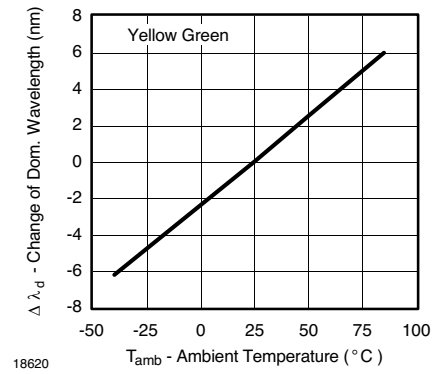


Figure 30. Change of Dominant Wavelength vs. Ambient Temperature

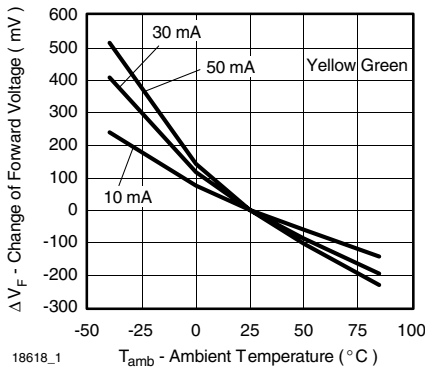


Figure 28. Change of Forward Voltage vs. Ambient Temperature

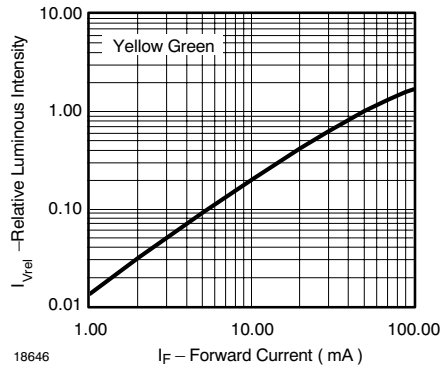


Figure 31. Relative Luminous Flux vs. Forward Current

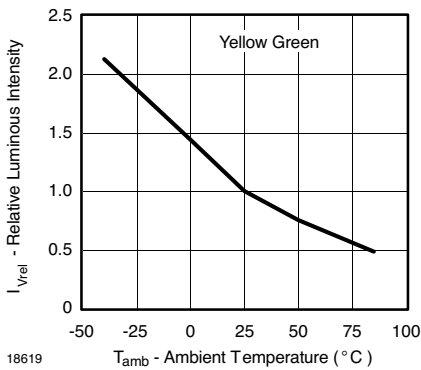


Figure 29. Relative Luminous Intensity vs. Ambient Temperature

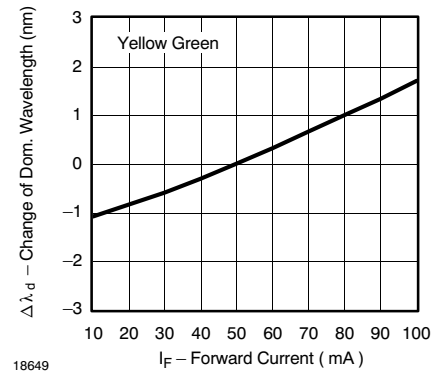


Figure 32. Change of Dominant Wavelength vs. Forward Current

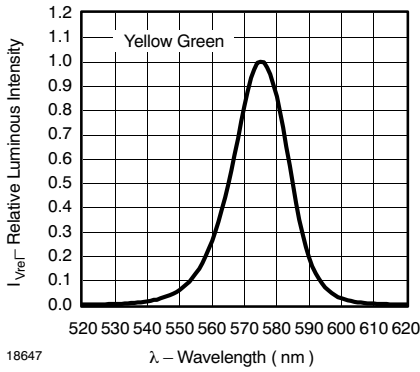


Figure 33. Relative Intensity vs. Wavelength

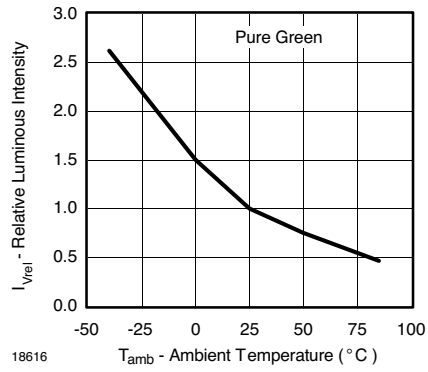


Figure 36. Relative Luminous Intensity vs. Ambient Temperature

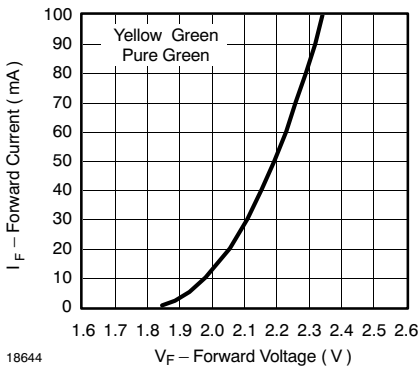


Figure 34. Forward Current vs. Forward Voltage

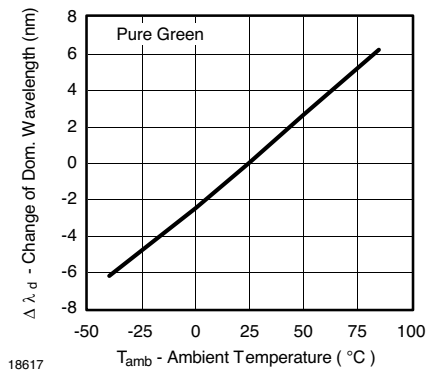


Figure 37. Change of Dominant Wavelength vs. Ambient Temperature

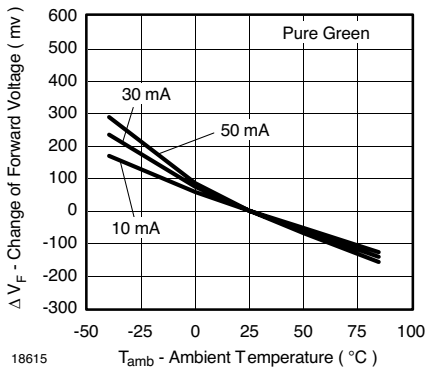


Figure 35. Change of Forward Voltage vs. Ambient Temperature

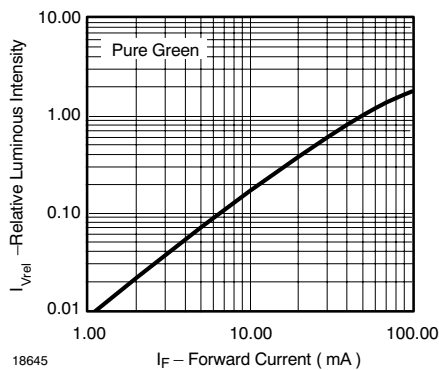


Figure 38. Relative Luminous Flux vs. Forward Current

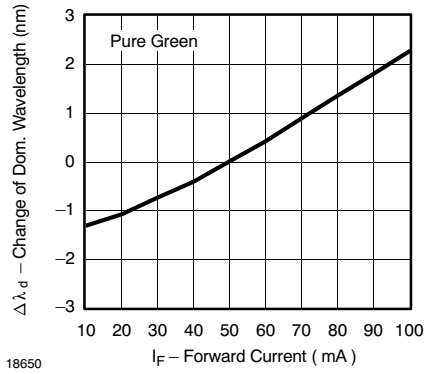


Figure 39. Change of Dominant Wavelength vs. Forward Current

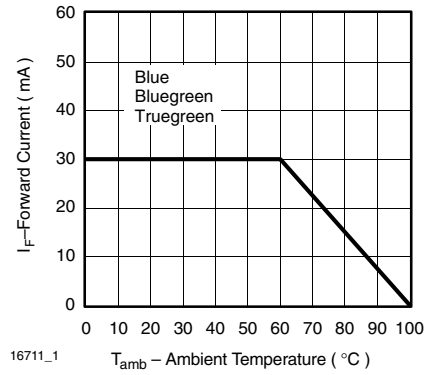


Figure 42. Forward Current vs. Ambient Temperature

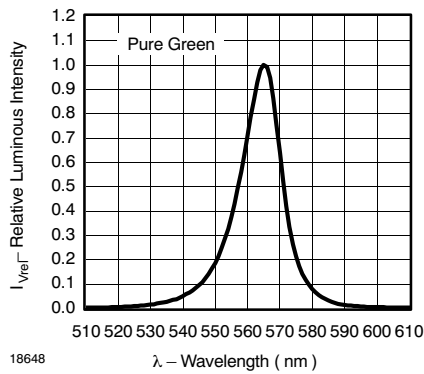


Figure 40. Relative Intensity vs. Wavelength

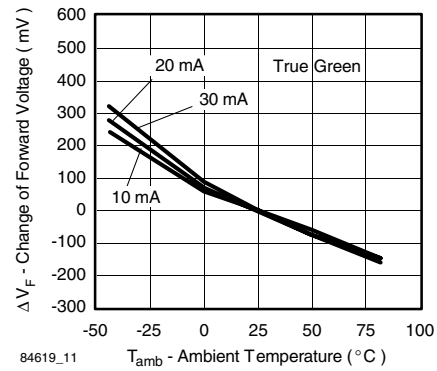


Figure 43. Change of Forward Voltage vs. Ambient Temperature

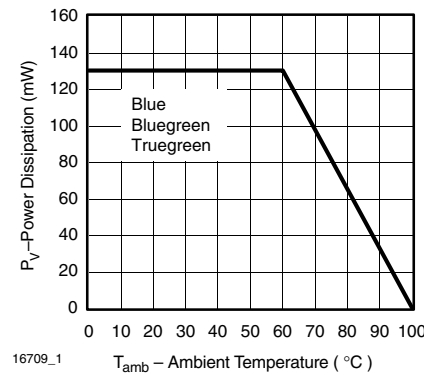


Figure 41. Power Dissipation vs. Ambient Temperature

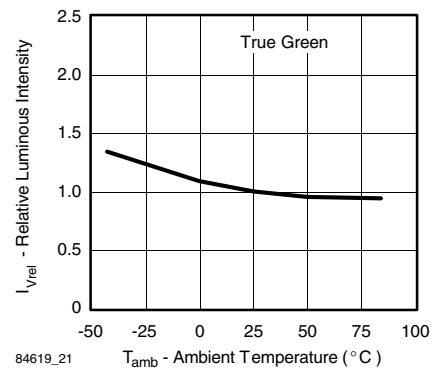


Figure 44. Relative Luminous Intensity vs. Ambient Temperature

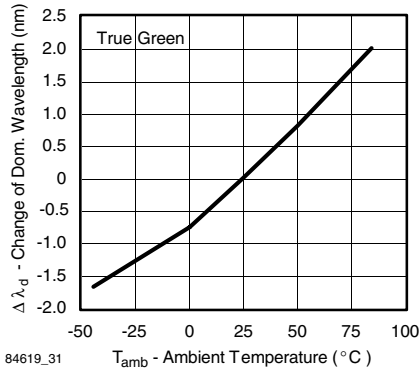


Figure 45. Change of Dominant Wavelength vs. Ambient Temperature

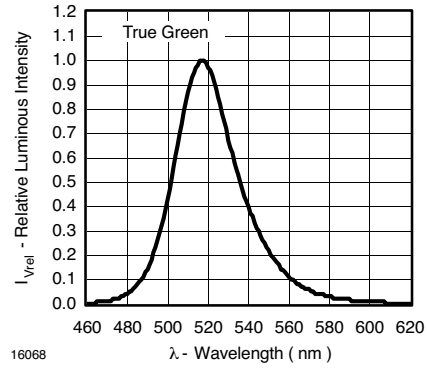


Figure 48. Relative Intensity vs. Wavelength

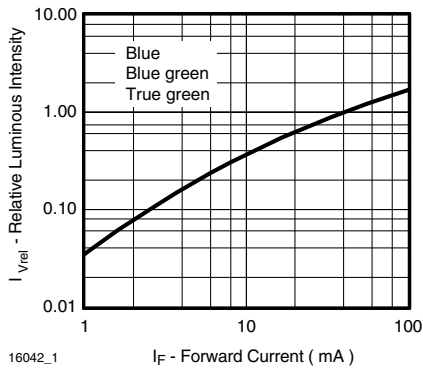


Figure 46. Relative Luminous Flux vs. Forward Current

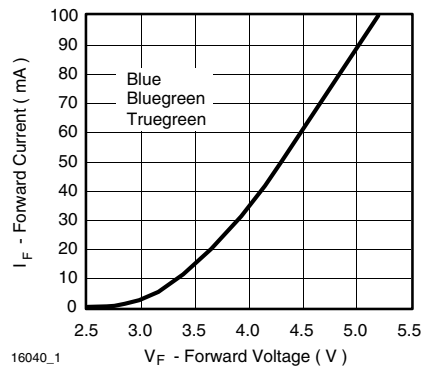


Figure 49. Forward Current vs. Forward Voltage

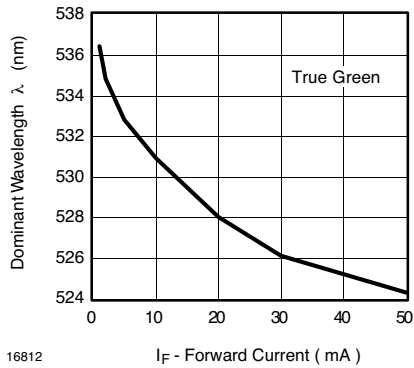


Figure 47. Change of Dominant Wavelength vs. Forward Current

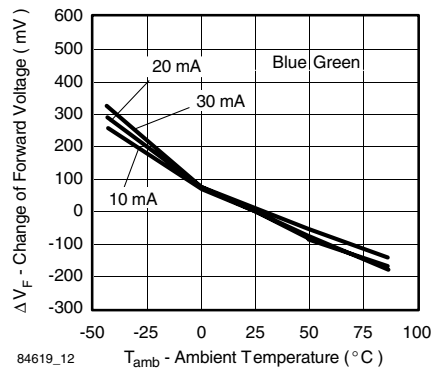


Figure 50. Change of Forward Voltage vs. Ambient Temperature

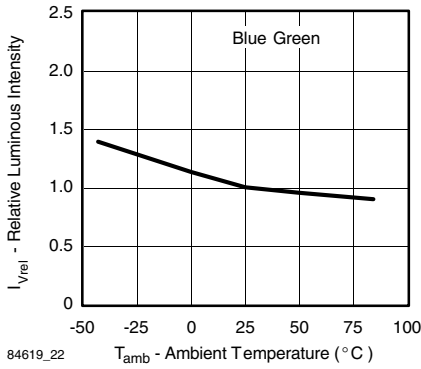


Figure 51. Relative Luminous Intensity vs. Ambient Temperature

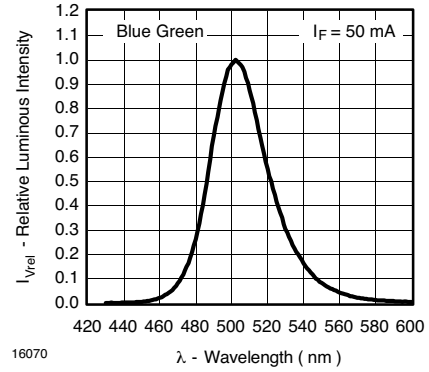


Figure 54. Relative Intensity vs. Wavelength

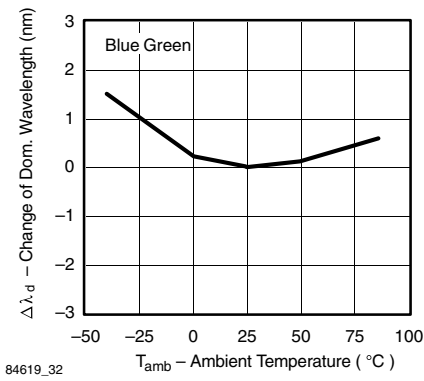


Figure 52. Change of Dominant Wavelength vs. Ambient Temperature

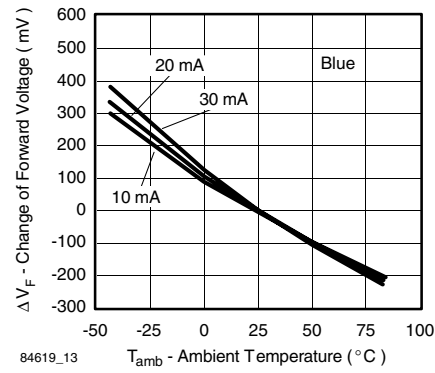


Figure 55. Change of Forward Voltage vs. Ambient Temperature

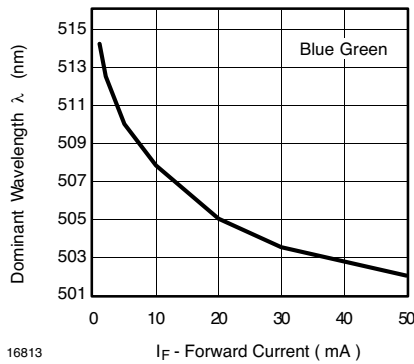


Figure 53. Change of Dominant Wavelength vs. Forward Current

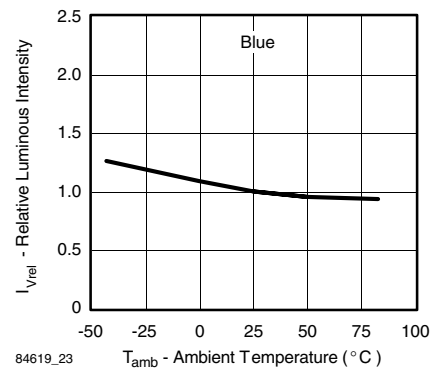


Figure 56. Relative Luminous Intensity vs. Ambient Temperature

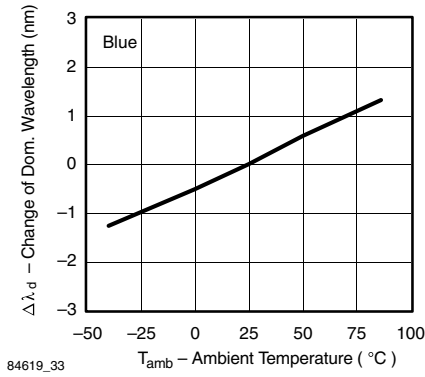


Figure 57. Change of Dominant Wavelength vs. Ambient Temperature

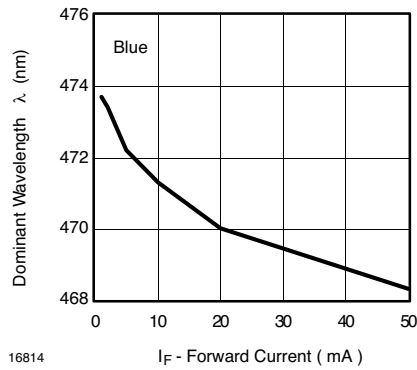


Figure 58. Change of Dominant Wavelength vs. Forward Current

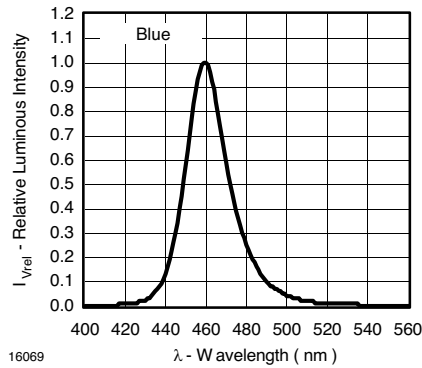
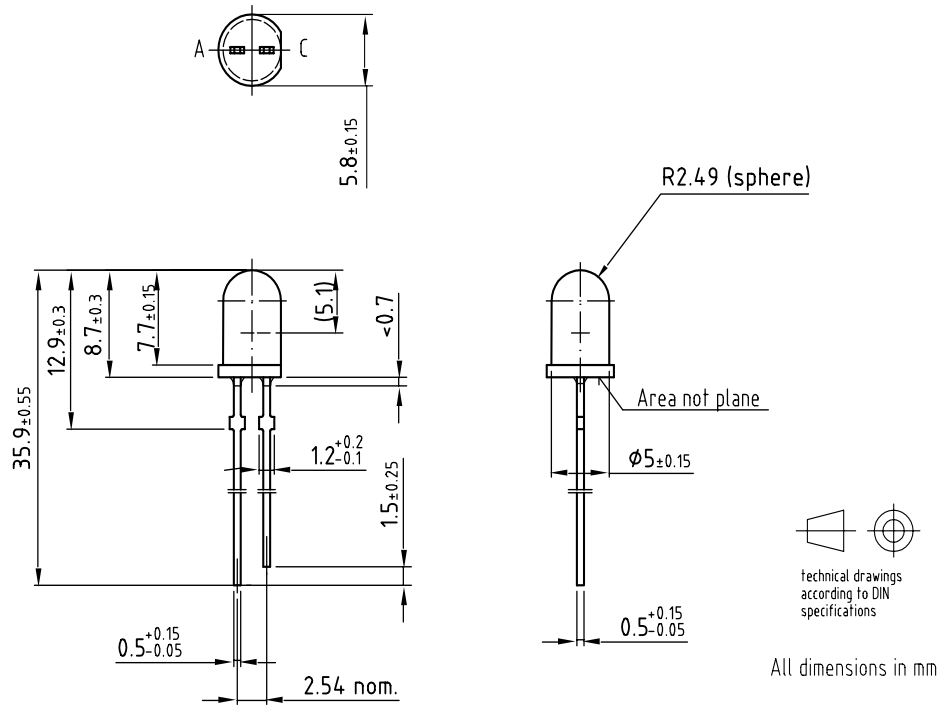


Figure 59. Relative Intensity vs. Wavelength





## Package Dimensions in mm



Drawing-No.: 6.544-5258.04-4  
Issue: 6; 04.07.03

9612121

**Ozone Depleting Substances Policy Statement**

It is the policy of Vishay Semiconductor GmbH to

1. Meet all present and future national and international statutory requirements.
2. Regularly and continuously improve the performance of our products, processes, distribution and operating systems with respect to their impact on the health and safety of our employees and the public, as well as their impact on the environment.

It is particular concern to control or eliminate releases of those substances into the atmosphere which are known as ozone depleting substances (ODSs).

The Montreal Protocol (1987) and its London Amendments (1990) intend to severely restrict the use of ODSs and forbid their use within the next ten years. Various national and international initiatives are pressing for an earlier ban on these substances.

Vishay Semiconductor GmbH has been able to use its policy of continuous improvements to eliminate the use of ODSs listed in the following documents.

1. Annex A, B and list of transitional substances of the Montreal Protocol and the London Amendments respectively
2. Class I and II ozone depleting substances in the Clean Air Act Amendments of 1990 by the Environmental Protection Agency (EPA) in the USA
3. Council Decision 88/540/EEC and 91/690/EEC Annex A, B and C (transitional substances) respectively.

Vishay Semiconductor GmbH can certify that our semiconductors are not manufactured with ozone depleting substances and do not contain such substances.

We reserve the right to make changes to improve technical design and may do so without further notice.

Parameters can vary in different applications. All operating parameters must be validated for each customer application by the customer. Should the buyer use Vishay Semiconductors products for any unintended or unauthorized application, the buyer shall indemnify Vishay Semiconductors against all claims, costs, damages, and expenses, arising out of, directly or indirectly, any claim of personal damage, injury or death associated with such unintended or unauthorized use.

Vishay Semiconductor GmbH, P.O.B. 3535, D-74025 Heilbronn, Germany  
Telephone: 49 (0)7131 67 2831, Fax number: 49 (0)7131 67 2423



### Notice

Specifications of the products displayed herein are subject to change without notice. Vishay Intertechnology, Inc., or anyone on its behalf, assumes no responsibility or liability for any errors or inaccuracies.

Information contained herein is intended to provide a product description only. No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document. Except as provided in Vishay's terms and conditions of sale for such products, Vishay assumes no liability whatsoever, and disclaims any express or implied warranty, relating to sale and/or use of Vishay products including liability or warranties relating to fitness for a particular purpose, merchantability, or infringement of any patent, copyright, or other intellectual property right.

The products shown herein are not designed for use in medical, life-saving, or life-sustaining applications. Customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Vishay for any damages resulting from such improper use or sale.