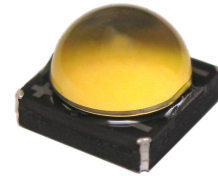


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LedEngin, Inc.

High Luminous Efficacy Warm White LED Emitter **LZ1-00WW05**



Key Features

- High Luminous Efficacy 5W Warm White LED
- Ultra-small foot print – 4.4mm x 4.4mm x 3.2mm
- Surface mount ceramic package with integrated glass lens
- Very low Thermal Resistance (5.5°C/W)
- Very high Luminous Flux density
- Color Rendering Index CRI 95, R9 30
- New industry standard for Lumen Maintenance (>90% at 100,000 Hours)
- Autoclave complaint (JEDEC JESD22-A102-C)
- JEDEC Level 1 for Moisture Sensitivity Level
- Lead (Pb) free and RoHS compliant
- Reflow solderable (up to 6 cycles)
- Emitter available on [Standard](#) or [Miniature](#) MCPCB (optional)

Typical Applications

- General Lighting
- Museum Lighting
- Retail & Display Lighting
- Hospitality Lighting
- Accent & Task Lighting
- Architectural Detail Lighting

Description

The LZ1-00WW05 Warm White LED emitter provides 5W power in an extremely small package. With a 4.4mm x 4.4mm x 3.2mm ultra-small footprint, this package provides exceptional luminous flux density. LedEngin's patent-pending thermally insulated phosphor layers provide a spatially uniform color across the radiation pattern and a consistent CCT, CRI 85 and R9 30 over time and temperature. The high quality materials used in the package are chosen to optimize light output and minimize stresses which results in monumental reliability and lumen maintenance. The robust product design thrives in outdoor applications with high ambient temperatures and high humidity.

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Product Nomenclature

The LZ Series part number designation is defined as follows:



Where:

- A – designates the number of LED die in the package (“1” for 5W)
- B – designates the package level (“0” for Emitter)
- C – designates the radiation pattern (“0” for Lambertian)
- D and E – designate the color (“WW” for Warm White: 2600 K < CCT < 3800 K)
- F and G – designate the Power (“05” for 5W typical rating)
- H – designates the Luminous Flux bin (See Table 1)
- J and K – designate the CCT bin groups (see Figure 1 and Table 3)
- L – designates the V_F bin (See Table 2)

Luminous Flux Bins

Table 1:

Bin Code	Minimum Luminous Flux (Φ_V) @ $I_F = 1000\text{mA}$ ^[1,2] (lm)	Maximum Luminous Flux (Φ_V) @ $I_F = 1000\text{mA}$ ^[1,2] (lm)	Typical Luminous Flux (Φ_V) @ $I_F = 1500\text{mA}$ ^[2] (lm)
M	117	146	160
N	146	182	200
P	182	228	250

Notes for Table 1:

- Luminous flux performance guaranteed within published operating conditions. LedEngin maintains a tolerance of $\pm 10\%$ on flux measurements.
- Future products will have even higher levels of luminous flux performance. Contact LedEngin Sales for updated information.

Forward Voltage Bins

Table 2:

Bin Code	Minimum Forward Voltage (V_F) @ $I_F = 1000\text{mA}$ ^[1] (V)	Maximum Forward Voltage (V_F) @ $I_F = 1000\text{mA}$ ^[1] (V)
F	3.20	3.44
G	3.44	3.68
H	3.68	3.92
J	3.92	4.16
K	4.16	4.40

Notes for Table 2:

- LedEngin maintains a tolerance of $\pm 0.04\text{V}$ for forward voltage measurements.

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Warm White Chromaticity Groups

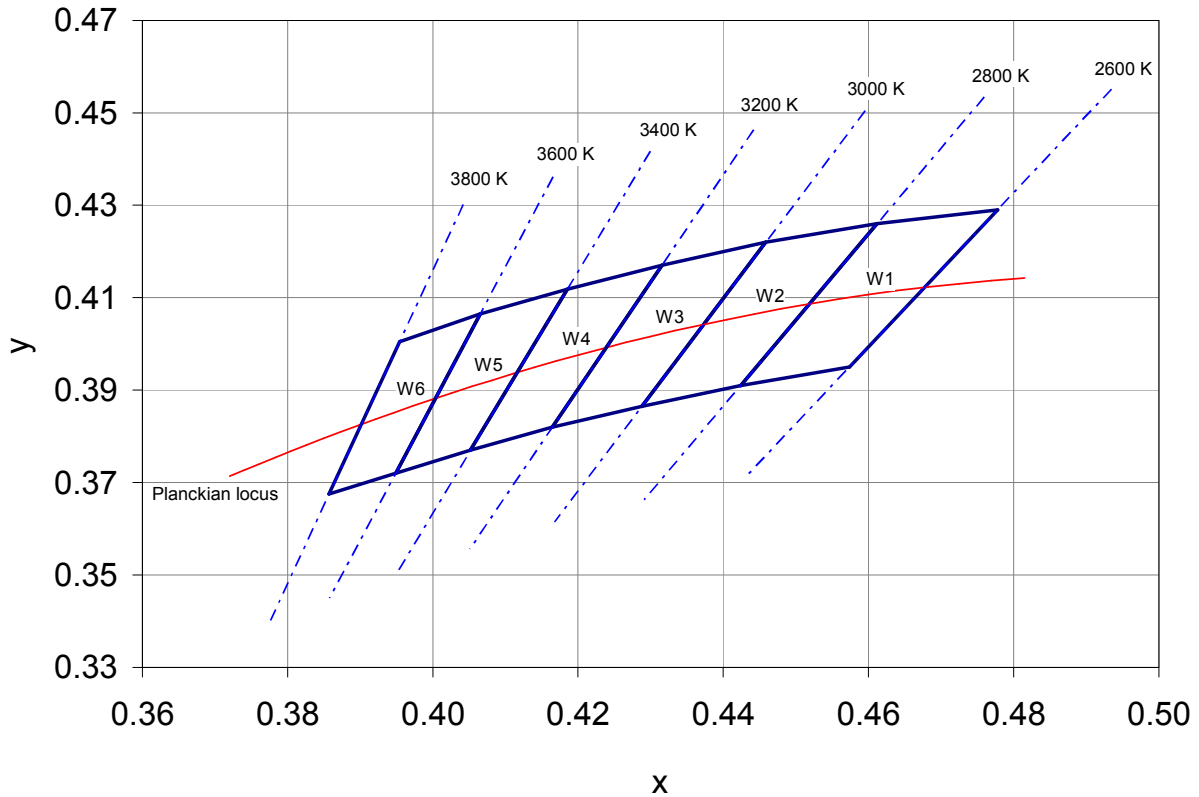


Figure 1: Standard Chromaticity Groups plotted on excerpt from the CIE 1931 (2°) x-y Chromaticity Diagram. Coordinates are listed below in Table 3.

Warm White Chromaticity Coordinates

Table 3:

Bin Code	x	y	Typical CCT (K)	Bin Code	x	y	Typical CCT (K)
W1	0.4574	0.3950	2700	W4	0.4165	0.3820	3300
	0.4778	0.4290			0.4315	0.4170	
	0.4612	0.4260			0.4185	0.4118	
	0.4424	0.3910			0.4052	0.3770	
W2	0.4424	0.3910	2900	W5	0.4052	0.3770	3500
	0.4612	0.4260			0.4185	0.4118	
	0.4459	0.4220			0.4066	0.4065	
	0.4288	0.3865			0.3949	0.3720	
W3	0.4288	0.3865	3100	W6	0.3949	0.3720	3700
	0.4459	0.4220			0.4066	0.4065	
	0.4315	0.4170			0.3954	0.4005	
	0.4165	0.3820			0.3857	0.3675	

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IPC/JEDEC Moisture Sensitivity Level

Table 4 - IPC/JEDEC J-STD-20D.1 MSL Classification:

Level	Floor Life		Soak Requirements			
	Time	Conditions	Standard	Standard	Accelerated	Accelerated
	Time (hrs)	Conditions	Time (hrs)	Conditions	Time (hrs)	Conditions
1	Unlimited	≤ 30°C/ 85% RH	168 +5/-0	85°C/ 85% RH	n/a	n/a

Notes for Table 4:

1. 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.

Average Lumen Maintenance Projections

Lumen maintenance generally describes the ability of a lamp to retain its output over time. The useful lifetime for solid state lighting devices (Power LEDs) is also defined as Lumen Maintenance, with the percentage of the original light output remaining at a defined time period.

Based on long-term WHTOL testing, LedEngin projects that the LZ Series will deliver, on average, 90% Lumen Maintenance at 100,000 hours of operation at a forward current of 1000 mA. This projection is based on constant current operation with junction temperature maintained at or below 125°C.

Typical Radiation Pattern

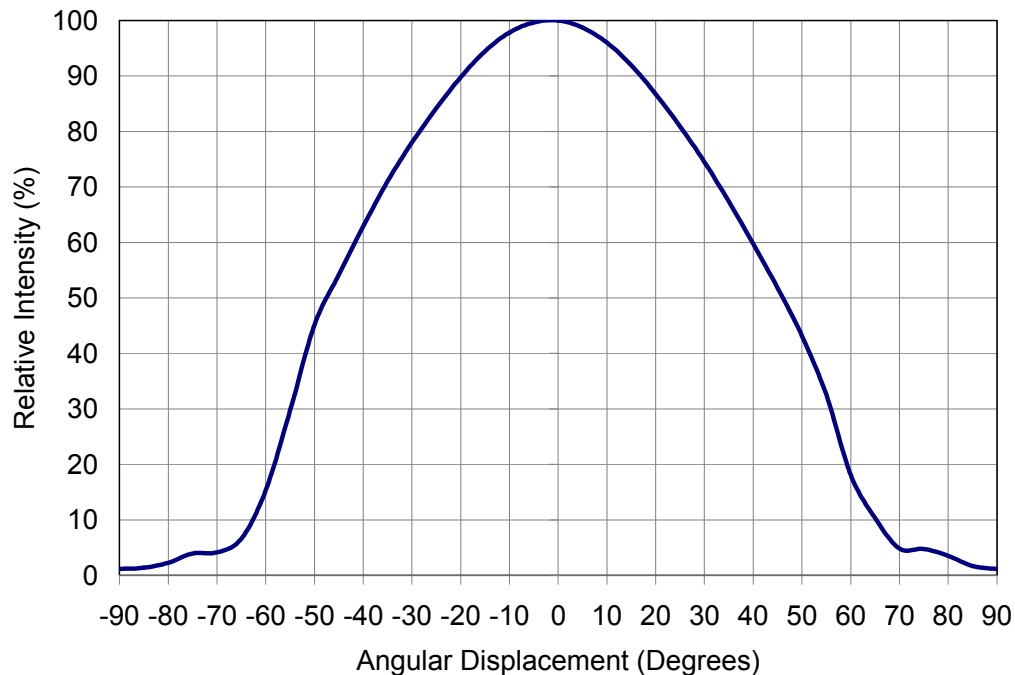


Figure 2: Typical representative spatial radiation pattern.

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Absolute Maximum Ratings

Table 5:

Parameter	Symbol	Value	Unit
DC Forward Current ^[1]	I_F	1500	mA
Peak Pulsed Forward Current ^[2]	I_{FP}	2000	mA
Reverse Voltage	V_R	See Note 3	V
Storage Temperature	T_{stg}	-40 ~ +150	°C
Junction Temperature	T_J	150	°C
Soldering Temperature ^[4]	T_{sol}	260	°C
Allowable Reflow Cycles		6	
Autoclave Conditions ^[5]		121°C at 2 ATM, 100% RH for 168 hours	
ESD Sensitivity ^[6]		> 8,000 V HBM Class 3B JESD22-A114-D	

Notes for Table 5:

1. Maximum DC forward current is determined by the overall thermal resistance and ambient temperature. Follow the curves in Figure 10 for current derating.
2. Pulse forward current conditions: Pulse Width \leq 10msec and Duty cycle \leq 10%.
3. LEDs are not designed to be reverse biased.
4. Solder conditions per JEDEC 020D. See Reflow Soldering Profile Figure 5.
5. Autoclave Conditions per JEDEC JESD22-A102-C.
6. LedEngin recommends taking reasonable precautions towards possible ESD damages and handling the LZ1-00WW05 in an electrostatic protected area (EPA). An EPA may be adequately protected by ESD controls as outlined in ANSI/ESD S6.1.

Optical Characteristics @ $T_C = 25^\circ\text{C}$

Table 6:

Parameter	Symbol	Typical	Unit
Luminous Flux (@ $I_F = 1000\text{mA}$)	Φ_V	150	lm
Luminous Flux (@ $I_F = 1500\text{mA}$)	Φ_V	185	lm
Luminous Efficacy (@ $I_F = 350\text{mA}$)		65	lm/W
Correlated Color Temperature	CCT	3100	K
Chromaticity Coordinates	x,y	0.430, 0.402	
Color Rendering Index (CRI / R9)	R_a / R_9	85 / 30	
Viewing Angle ^[1]	$2\Theta_{1/2}$	95	Degrees
Total Included Angle ^[2]	$\Theta_{0.9V}$	125	Degrees

Notes for Table 6:

1. Viewing Angle is the off axis angle from emitter centerline where the luminous intensity is $\frac{1}{2}$ of the peak value.
2. Total Included Angle is the total angle that includes 90% of the total luminous flux.

Electrical Characteristics @ $T_C = 25^\circ\text{C}$

Table 7:

Parameter	Symbol	Typical	Unit
Forward Voltage (@ $I_F = 1000\text{mA}$)	V_F	3.6	V
Forward Voltage (@ $I_F = 1500\text{mA}$)	V_F	3.8	V
Temperature Coefficient of Forward Voltage	$\Delta V_F / \Delta T_J$	-2.8	mV/°C
Thermal Resistance (Junction to Case)	$R\Theta_{J-C}$	5.5	°C/W

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Mechanical Dimensions (mm)

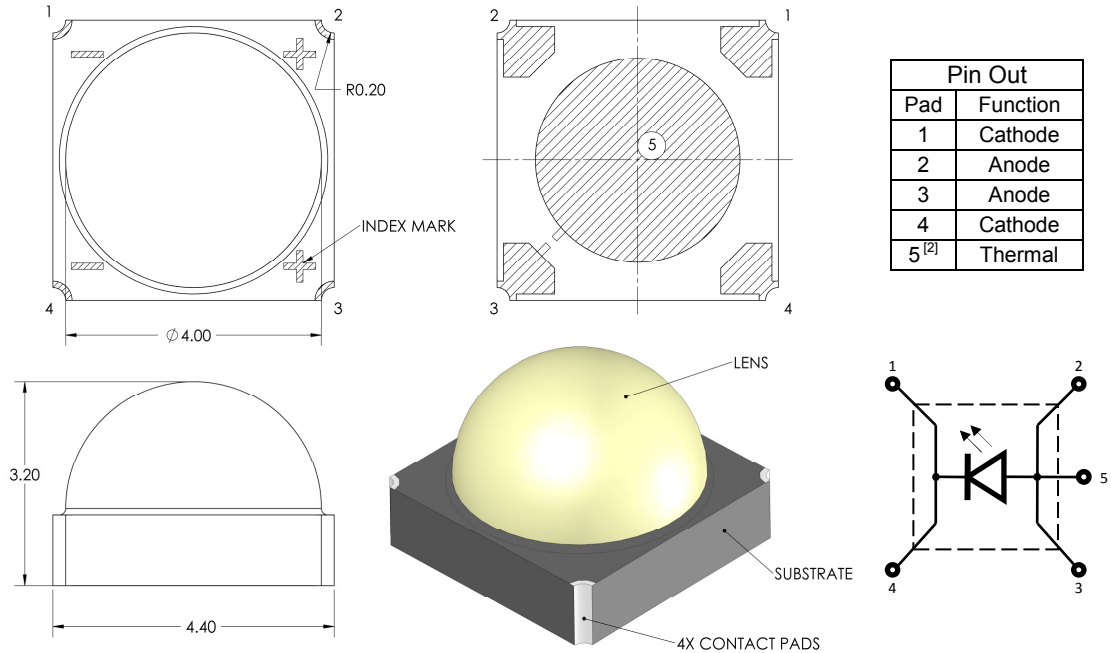


Figure 3: Package outline drawing.

Notes for Figure 3:

1. Unless otherwise noted, the tolerance = ± 0.20 mm.
2. Thermal contact, Pad 5, is electrically connected to the Anode, Pads 2 and 3. Do not electrically connect any electrical pads to the thermal contact, Pad 5. LedEngin recommends mounting the LZ1-00WW05 to a MCPCB that provides insulation between all electrical pads and the thermal contact, Pad 5. LedEngin offers [LZ1-10WW05](#) and [LZ1-30WW05](#) MCPCB options which provide both electrical and thermal contact insulation with low thermal resistance. Please refer to Application Note MCPCB Options 1 and 3, or contact a LedEngin sales representative for more information.

Recommended Solder Pad Layout (mm)

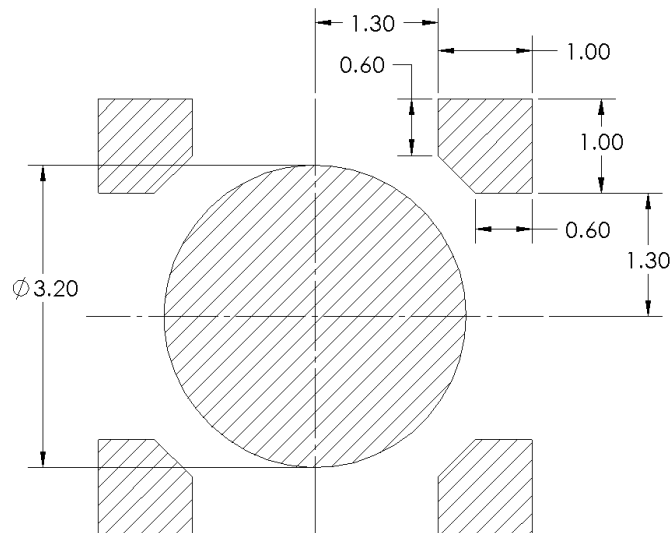


Figure 4: Recommended solder mask opening (hatched area) for anode, cathode, and thermal pad.

Note for Figure 4:

1. Unless otherwise noted, the tolerance = ± 0.20 mm.

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Reflow Soldering Profile

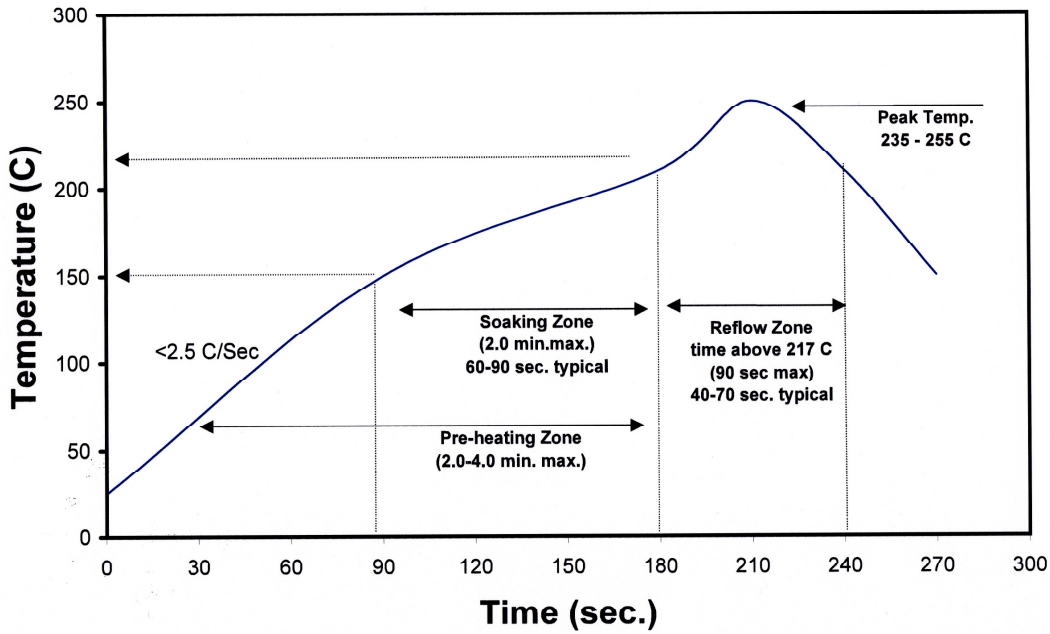


Figure 5: Reflow soldering profile for lead free soldering.

Typical Relative Spectral Power Distribution

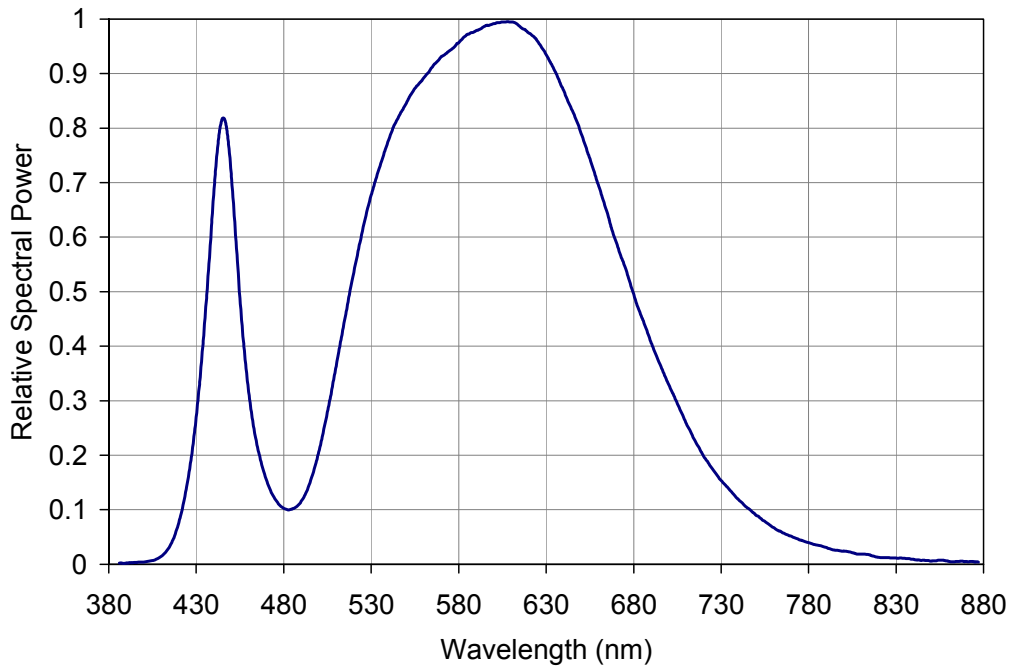


Figure 6: Relative spectral power vs. wavelength @ $T_C = 25^\circ\text{C}$.

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Typical Relative Light Output

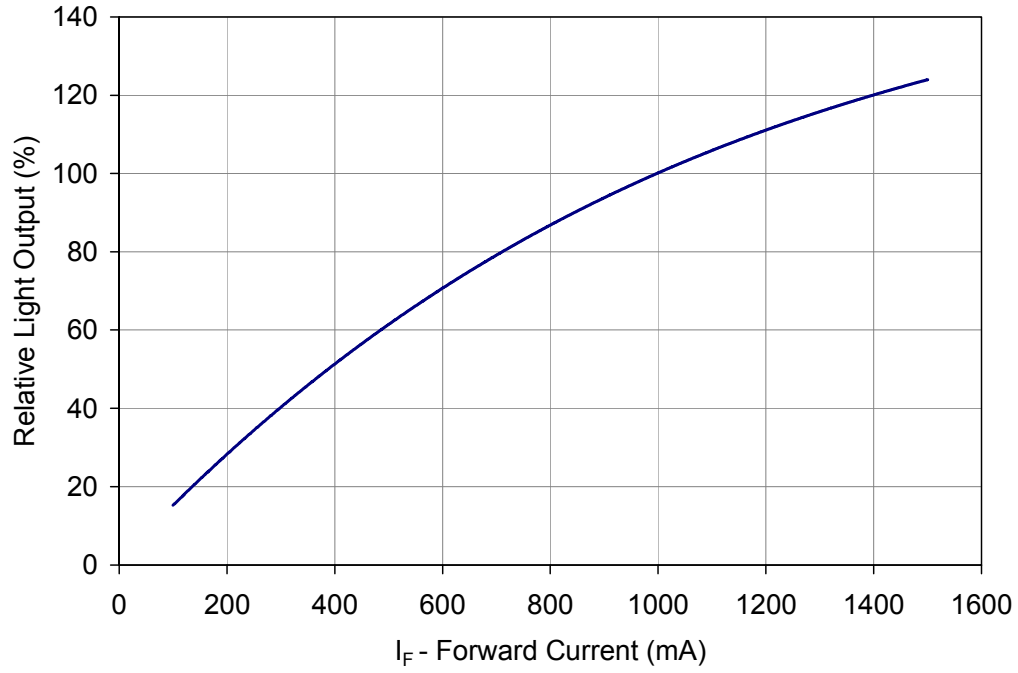


Figure 7: Typical relative light output vs. forward current @ T_C = 25°C.

Typical Relative Light Output over Temperature

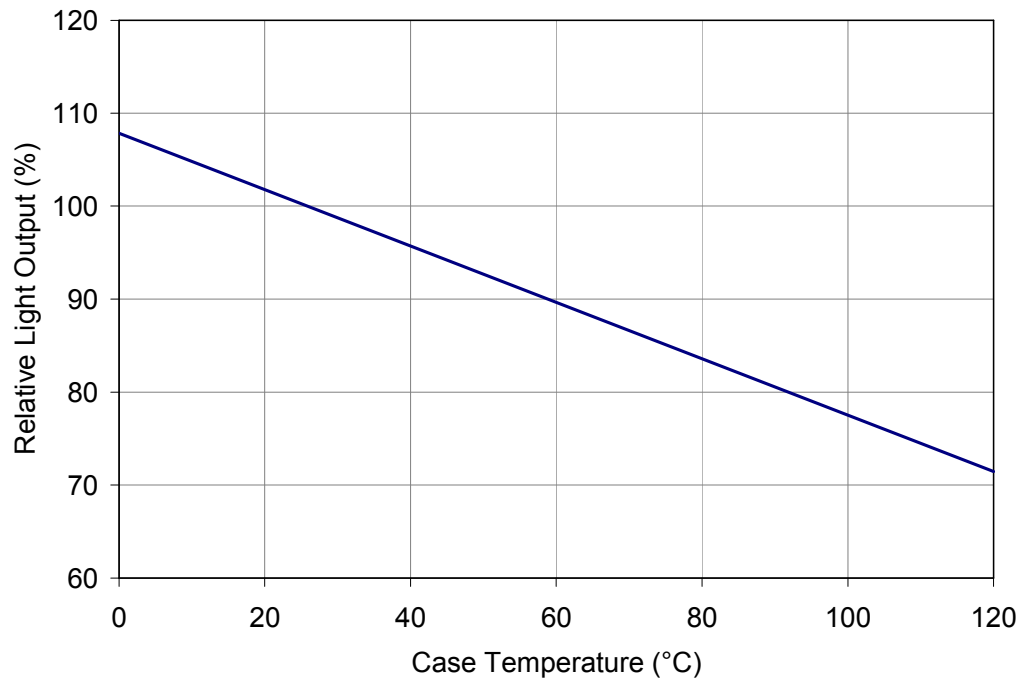


Figure 8: Typical relative light output vs. case temperature.

