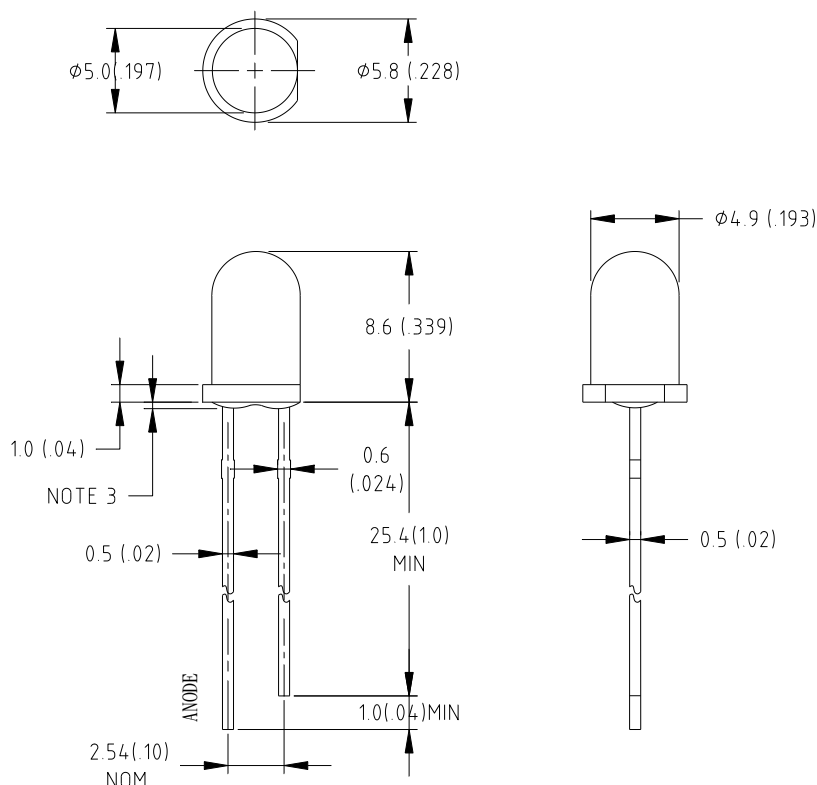


Features:

- ◆ High intensity
- ◆ Standard 5mm diameter package
- ◆ General purpose leads
- ◆ Pb-free

Package Dimensions:



Part NO.	Chip Material	Lens Color	Emission Color
LL-50ABD2E-017	InGaN	Blue Diffused	Super Bright Blue

Notes:

1. All dimensions are in millimeters (inches).
2. Tolerance is $\pm 0.25\text{mm}$ (.010") unless otherwise noted.
3. Protruded resin under flange is 1.0mm (.04") max.
4. Lead spacing is measured where the leads emerge from the package.
5. Specifications are subject to change without notice.

6. Precautions for ESD:

Static electricity and surge can damages the LED. It is recommended to use a wrist band or anti-electrostatic glove when handling the LED. All devices, equipment and machinery must be properly grounded.

Absolute Maximum Ratings at Ta=25°C

Parameter	MAX.	Unit
Power Dissipation	80	mW
Peak Forward Current (1/10 Duty Cycle, 0.1ms Pulse Width)	100	mA
Continuous Forward Current	20	mA
Derating Linear From 50°C	0.4	mA/°C
Reverse Voltage	5	V
Electrostatic Discharge (ESD)	150	V
Operating Temperature Range	-30°C to +80°C	
Storage Temperature Range	-40°C to +100°C	
Lead Soldering Temperature [4mm(.157") From Body]	280°C for 5 Seconds	

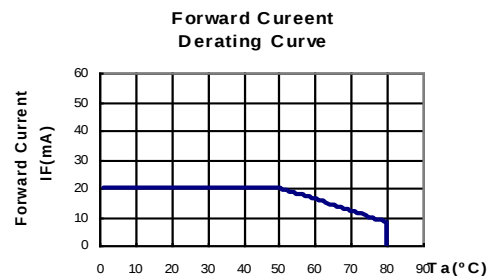
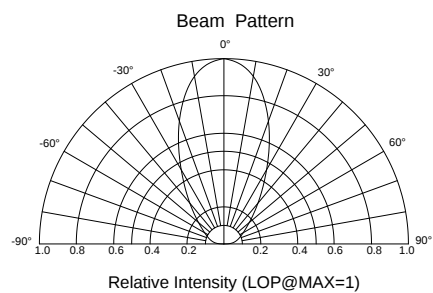
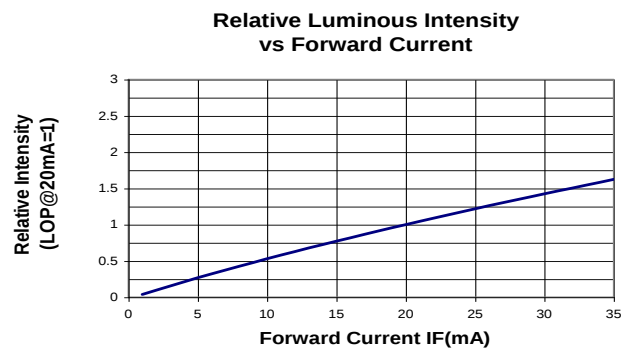
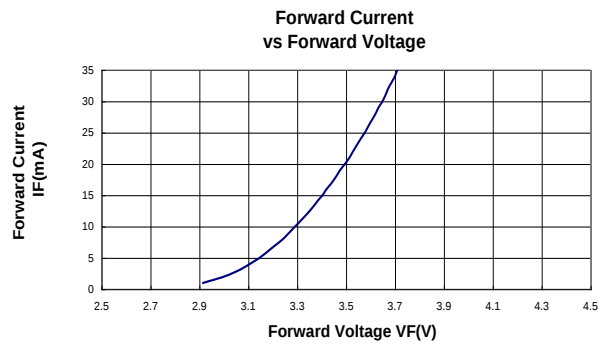
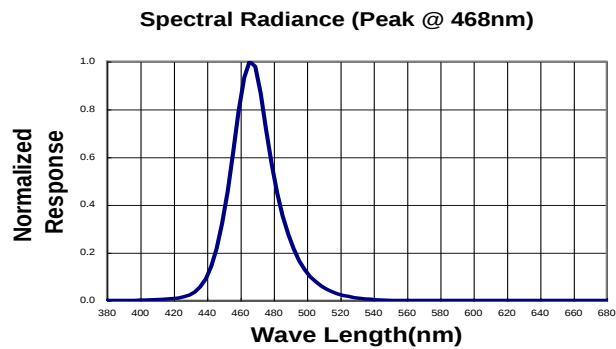
Electrical Optical Characteristics at Ta=25°C

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Condition
Luminous Intensity	I_V	140	350		mcd	$I_F=20\text{mA}$ (Note 1)
Viewing Angle	$2\theta_{1/2}$	45	55	65	Deg	(Note 2)
Peak Emission Wavelength	λ_p	463	468	473	Nm	$I_F=20\text{mA}$
Dominant Wavelength	λ_d	465	470	475	Nm	$I_F=20\text{mA}$ (Note 3)
Spectral Line Half-Width	$\triangle\lambda$	20	25	30	Nm	$I_F=20\text{mA}$
Forward Voltage	V_F	2.8	3.5	3.8	V	$I_F=20\text{mA}$
Reverse Current	I_R			10	μA	$V_R=5\text{V}$

Notes:

1. Luminous intensity is measured with a light sensor and filter combination that approximates the CIE eye-response curve.
2. $\theta_{1/2}$ is the off-axis angle at which the luminous intensity is half the axial luminous intensity.
3. The dominant wavelength (λ_d) is derived from the CIE chromaticity diagram and represents the single wavelength which defines the color of the device.
4. Forward voltage measurement allowance is $\pm 0.1\text{V}$
5. Luminous Intensity Measurement Allowance is $\pm 10\%$

Typical Electrical / Optical Characteristics Curves
(25°C Ambient Temperature Unless Otherwise Noted)





DONGGUAN CITY PENG YUAN OPTOELECTRONICS TECHNOLOGY CO LTD
东莞市鹏远光电科技有限公司

TEL:0769-81208888 81732500 FAX:0769-81830111 87711335

承认书

specification For Approval

客户名称 (Customer Name) : _____

产品编号 (Product ID) : UT1871-81-M1-R

产品型号 (Product Model) : UT1871-81-M1-R

产品规格 (Product Specifications) : 5MM 圆头有边

送样日期 (Date) : _____

客户确认 (Customer acknowledges that)			鹏远光电 (Pengyuan Optoelectronics)		
核准	审核	确认	业务	工程	制作
Approved	Audit	Confirm	Business	Engineering	Make

客户确认 (Customer acknowledges that) : 合格 Qualified ☐ 不合格 Failure ☐

客户意见 (Customer feedback) :

客户第一 质量第一 服务第一

Customer first, quality first, service first

地址: 广东省东莞市石龙镇黄州工业区

Address: Huangzhou Industrial Zone, Shilong Town, Dongguan City, Guangdong Province, China

网址: www.gdpengyuan.com

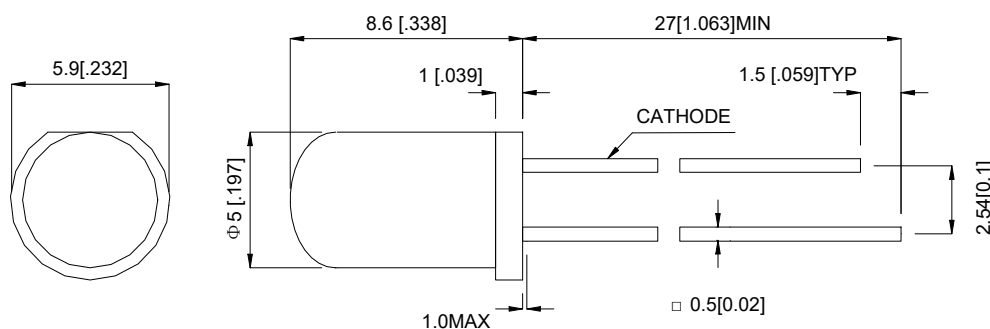


DONGGUAN CITY PENG YUAN OPTOELECTRONICS TECHNOLOGY CO LTD
东莞市鹏远光电科技有限公司

TEL:0769-81208888 81732500 FAX:0769-81830111 87711335

产品型号 Product Model: UT1871-81-M1-R

尺寸 Dimensions: 单位 Unit: 毫米 mm [英寸] [inch]



备注 (Notes:)

- 1.所有尺寸单位是 mm
All dimension units are millimeters.
- 2.所有未标注尺寸公差为±0.2mm
All dimension tolerance is ±0.2mm unless otherwise noted.
- 3.所有胶体底部与引脚处多胶部分大约为 1.5mm
An epoxy meniscus may extend about 1.5mm down the leads.
- 4.胶体底部毛边小于等于 0.5mm
Burr around bottom of epoxy may be 0.5mm max.

LED Chip (LED 芯片)		胶体颜色
材料 Material	发光颜色 Emitting Color	Lens Color
InGaN	Red	Color lens Red

客户第一 质量第一 服务第一

Customer first, quality first, service first

地址: 广东省东莞市石龙镇黄州工业区

Address: Huangzhou Industrial Zone, Shilong Town, Dongguan City, Guangdong Province, China

网址: www.gdpengyuan.com



DONGGUAN CITY PENG YUAN OPTOELECTRONICS TECHNOLOGY CO LTD
东莞市鹏远光电科技有限公司

TEL:0769-81208888 81732500 FAX:0769-81830111 87711335

产品型号 Product Model: UT1871-81-M1-R

最大绝对额定值(室温 = 25℃)Absolute Maximum Ratings at (Ta = 25℃)

项目 ITEMS	符号 SYMBOL	最大绝对额定值 ABSOLUTE MAXIMUM RATING	单位 UNIT
正向电流 Forward Current	IF	50	mA
峰值正向电流 Peak Forward Current	IFP	220	mA
连续工作电流 Continuous Forward Current	IL	20	mA
反向电压 Reverse Voltage	VR	5	V
功耗 Power Dissipation	PD	170	mW
工作温度 Operation Temperature	Topr	-40 ~ +80	℃
贮存温度 Storage Temperature	Tstg	-40 ~ +80	℃
引脚镀锡温度 Lead Soldering Temperature	Tsol	最大温度 260℃,最长时间 5 秒 Max.260℃ for 5 sec Max.	

主要光电特性 (室温 = 25℃)Typical Electrical & Optical Characteristics (Ta = 25℃)

项目 ITEMS	符号 Symbol	测试条件 Test Condition	最小值 Min.	典型值 Typ.	最大值 Max.	单位 Unit
发光强度 Luminous Intensity	Iv	IF=20mA	65		75	mcd
正向电压 Forward Voltage	IF	IF=20mA	1.8	1.8	2.1	V
峰值波长 Peak Wavelength	λP	IF=20mA		--		nm
主波长 Dominant Wavelength	λD	IF=20mA	640	643	645	nm
视角 Viewing Angle	2θ1/2	IF=20mA	--	30	--	Deg
光通量 Luminous flux	Iv	IF=20mA				LM
显色指数坐标 Color Rendering Index Calculation	Spm	X				
	Spm	Y				
色温 Color Temperature						

客户第一 质量第一 服务第一

Customer first, quality first, service first

地址: 广东省东莞市石龙镇黄州工业区

Address: Huangzhou Industrial Zone, Shilong Town, Dongguan City, Guangdong Province, China

网址: www.gdpengyuan.com



DONGGUAN CITY PENG YUAN OPTOELECTRONICS TECHNOLOGY CO LTD
东莞市鹏远光电科技有限公司

TEL:0769-81208888 81732500 FAX:0769-81830111 87711335

产品型号 Product Model: UT1871-81-M1-R

可靠性试验

Reliability Performance

测试分类 Test Classification	测试项目 Test Item	测试条件 Test Conditions	持续时间 Test Duration	抽样大小 Sample Size	判定 Standard
寿命测试 Life Test	寿命测试 Life Test	Ta=25℃±5℃, IF=20mA	1000 小时(hrs)	10PCS	
环境测试 Environment Test	热冲击测试 Thermal Shock Test	-10℃±5℃↔+100℃±5℃ 5min. 10sec. 5min.	100 循环(cycles)	10PCS	
	冷热循环测试 Temperature Cycle Test	-55℃±5℃↔+85℃±5℃ 30min. 5min. 30min.	100 循环(cycles)	10PCS	
	高温高湿测试 High Temperature & High Humidity Test	Ta=85℃±5℃ RH=85%±0.5 %RH	240 小时(hrs)	10PCS	
	高温贮存测试 High Temperature Storage	Ta=100℃±5℃	1000 小时(hrs)	10PCS	
	低温贮存测试 Low Temperature Storage	Ta=-55℃±5℃	1000 小时(hrs)	10PCS	
机械测试 Mechanical Test	抗焊接热度 Resistance to Soldering Heat	Ta=260℃±5℃	5 秒(sec.)	10PCS	
	引脚折弯 Lead Integrity	负荷 2.5 牛顿(0.25 千克) 0°~90°~0°	3 回合(times)	10PCS	

客户第一 质量第一 服务第一

Customer first, quality first, service first

地址: 广东省东莞市石龙镇黄州工业区

Address: Huangzhou Industrial Zone, Shilong Town, Dongguan City, Guangdong Province, China

网址: www.gdpengyuan.com



DONGGUAN CITY PENG YUAN OPTOELECTRONICS TECHNOLOGY CO LTD

东莞市鹏远光电科技有限公司

TEL:0769-81208888 81732500 FAX:0769-81830111 87711335

尊敬的用户：

欢迎使用我司的产品，在此我们为您介绍一些关于 LED 保存及使用的常识，以避免在储存时或使用过程中造成损失，使用及保存时请注意以下事项：

存储：

A: 为了防潮，LED 要存放在干燥通风的环境中，储存环境温度在 5-30℃，相对湿度在 60%以下。

B: LED 在它的原包装条件下 3 个月内使用完为佳，以避免支架生锈，当 LED 的包装袋开封后，要尽快使用完。

清洁：

不要使用不明化学液体清洗 LED，因为那样可能会损伤 LED 树脂表面，甚至引起胶体裂缝，如有必要，请在常温下把 LED 浸入工业酒精中清洗，时间在一分钟之内。

对管脚的成形

不要在焊接期间或是在焊接后成形，如有必要的话，成形一定在焊接前完成。

切记任何挤压树脂的行为都有可能损伤的 LED 灯内部金线

焊接

A: 在焊接过程中，不要对灯体施加任何外部压力，否则 LED 内部会出现裂纹，这样会影响其内部金线连接而导致品质问题。

B: 胶体一定不能进入焊锡之中

C: 焊接时，焊接点离胶体下边至少有 2MM 的间隙，焊接完成后需要用三分钟的时间让 LED 从高温状态降回到常温。

D: 如用烙铁焊接同一的 PCB 上线性排列的 LED，不要同时焊接同一 LED 的两个管脚

E: 烙铁焊接时要求用 30W 以下的烙铁。

F: LED 的焊接方式有两种规格产品，具体参数如下：

烙铁焊接温度：295° C +5° C 间焊接时间：3 秒以内（仅一次）

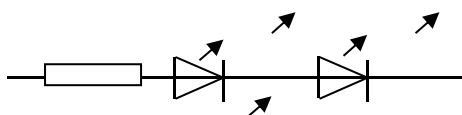
波峰焊焊接温度：240° C +5° C 焊接时间：5 秒以内

说明：焊接温度或焊接时间控制不当可以引起灯体变形或者灯芯内部开路导致死灯。

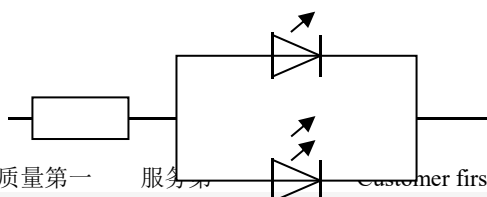
建议使用方法：

A: 在使用过程中无论是单颗使用还是多颗使用，每颗 LED 的 DC 驱动电流推荐使用 IF 的范围为 10-20 Ma. 驱动电路

1. 串联方式



2. 并联方式



客户第一 质量第一

服务第一

Customer first, quality first, service first

地址：广东省东莞市石龙镇黄州工业区

Address: Huangzhou Industrial Zone, Shilong Town, Dongguan City, Guangdong Province, China

网址：www.gdpengyuan.com



DONGGUAN CITY PENG YUAN OPTOELECTRONICS TECHNOLOGY CO LTD

东莞市鹏远光电科技有限公司

TEL:0769-81208888 81732500 FAX:0769-81830111 87711335

B.瞬间的脉冲会破坏 LED 内部固定连接，所以电路必须仔细设计，这样在线路开启闭合时，LED 不会受到过压(过流)冲击。

C.LED 在多颗使用时要求发光亮度及颜色的一致性，因此对于驱动方式及驱动条件要充分了解，正常的条件下我司保证 20MA 分光的颜色和亮度的一致性

D. 要获得均匀的亮度和颜色，同批量的 LED 应使用同样的电流，使用时不可多包混用，以免造成亮度差异。

LED 的 VF、IF、IV、WL 以及温度之间的关系特性详见每款的参数表。

ESD(静电的防护)

A: 静电可以引起 LED 功能失效，建议防止 ESD 损害 LED。

- 1.LEDs 检测和组装时作业人员一定要带防静电手环及防静电的手套。
- 2.焊接设备和测试设备、工作桌子、贮存架、等等必须良好接地。
- 3.使用离子风机消除 LED 在贮存和组装期间由于磨擦而产生的静电。
- 4.装材料的料盒采用防静电料盒，包装袋采用防静电袋。

B: 被 ESD 损伤的 LED 会出现的异常现象有：

- 1.反向漏电，轻者将会引起亮度降低，严重者灯不亮。
- 2.顺向低电压值变小。
- 3.低电流驱动时 LED 不能起动

客户第一 质量第一 服务第一

Customer first, quality first, service first

地址：广东省东莞市石龙镇黄州工业区

Address:Huangzhou Industrial Zone, Shilong Town, Dongguan City, Guangdong Province, China

网址：www.gdpengyuan.com

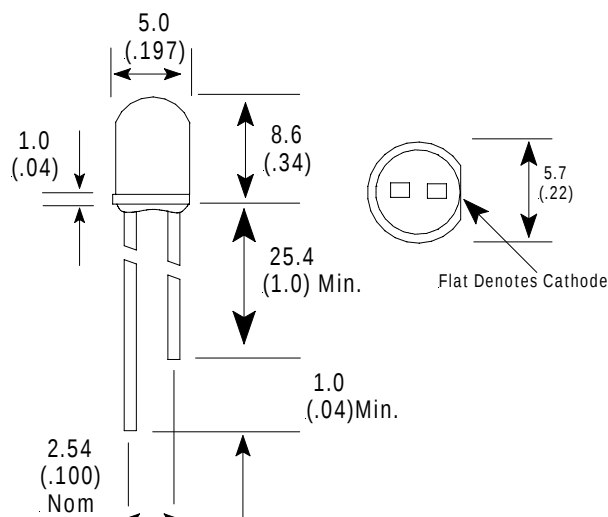


MCDL-5013XXD (5MM 60°)

Lens Color: See Below
Dimension: 5 mm

Absolute Maximum Rating: (Ta=25°C)

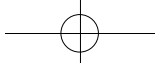
Parameter			Unit
DC Forward Current	10		mA
Reverse Voltage	5		V
Power Dissipation	115		mW
Peak Forward Current, $t_w = 1$ msec. Duty, $= 1/20$	180		mA
Operation Temperature	-40°	+80°	°C
Storage Temperature	-40°	+100°	°C
Solder DIP (5 seconds, 1.6 mm from body)	260°	± 5°	°C
Temperature			



Part Number	Emitted Color		Lens Color	Peak Wavelength λ PEAK	Pd mW	V_F (V) Typ.	I_F mA	Viewing Angle 2 θ Deg.	I_V ($I_F = 10$ mA) MCD	
									Min	Typ.
MCDL-5013RD	GaAsP	Red	Red	655	110	1.7	40	60	0.5	3.0
MCDL-5013HD	GaP	Bright Red	Red	700	45	2.1	15	60	0.8	5.0
MCDL-5013ED	GaAsP/GaP	Hi Eff. Red	Red	635	100	2.0	30	60	3.0	20.0
MCDL-5013ED-E	GaAsP/GaP	Orange	Orange	635	100	2.0	30	60	3.0	20.0
MCDL-5013LED	GaAlInP	Orange	Orange	620	115	2.0	2.4	60	40.0	80.0
MCDL-5013UED	GaAlInP	Orange	Orange	620	115	2.0	2.4	60	80.0	120.0
MCDL-5013VED	GaAlInP	Orange	Orange	620	115	2.0	2.4	60	120.0	160.0
MCDL-5013GD	GaP	Green	Green	565	100	2.1	30	60	2.5	12.5
MCDL-5013SGD	GaP	Green	Green	565	100	2.1	30	60	12.5	40.0
MCDL-5013LGD	GaP	Green	Green	565	100	2.1	30	60	30.0	60.0
MCDL-5013UGD	GaP	Green	Green	565	100	2.1	30	60	60.0	90.0
MCDL-5013YD	GaAsP/GaP	Yellow	Yellow	585	100	2.1	30	60	5.0	20.0
MCDL-5013LYD	GaAlInP	Yellow	Yellow	595	115	2.0	2.4	60	40.0	80.0
MCDL-5013UYD	GaAlInP	Yellow	Yellow	595	115	2.0	2.4	60	80.0	120.0
MCDL-5013VYD	GaAlInP	Yellow	Yellow	595	115	2.0	2.4	60	120.0	160.0
MCDL-5013AD	GaAlAs/GaP	Amber	Amber	585	100	2.1	30	60	5.0	20.0
MCDL-5013ID	GaAlAs	Hi Eff. Red	Red	625	60	1.8	20	60	20.0	50.0
MCDL-5013SRD	GaAlAs	Super Red	Red	660	60	1.8	20	60	50.0	200.0
MCDL-5013LRD	GaAlAs	Super Red	Red	660	60	1.8	20	60	200.00	300.00
MCDL-5013URD	GaAlAs	Super Red	Red	660	60	1.8	20	60	300.0	500.0
MCDL-5013URD-U12	GaAlAs	Super Red	Red	660	60	1.8	20	60	300.0	400.0
MCDL-5013URD-U14	GaAlAs	Super Red	Red	660	60	1.8	20	60	400.0	500.0

Notes:

1. All Dimensions are in millimeters (inches).
2. Tolerance is ± 0.25 mm (0.010") unless otherwise specified.
3. Protruded resin under flange is 1.5mm (0.059") max.
4. Specifications are subject to change without notice.



LITEON

T-1 3/4 (5mm) Solid State LED Lamps

LTL-307R/307RE Red

LTL-307P/307PE Bright Red

LTL-307E/307EE High Efficiency Red

LTL-307G/307GE Green

LTL-307Y/307YE Yellow

Features

- High intensity.
- Popular T-1 3/4 Diameter package.
- Selected minimum intensities.
- Wide viewing angle.
- General purpose leads.
- Reliable and rugged.

Description

The Red source color devices are made with Gallium Arsenide Phosphide on Gallium Arsenide Red Light Emitting Diode.

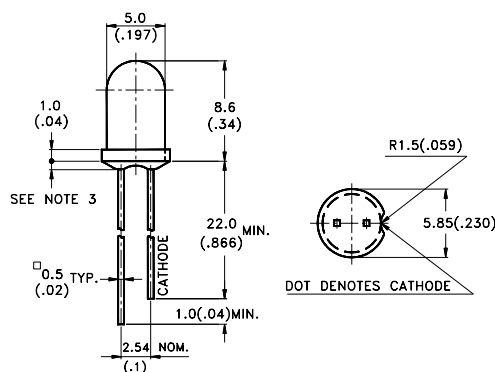
The Bright Red source color devices are made with Gallium Phosphide on Gallium Phosphide Red Light Emitting Diode.

The High Efficiency Red and Orange source color devices are made with Gallium Arsenide Phosphide on Gallium Phosphide Orange Light Emitting Diode.

The Green source color devices are made with Gallium Phosphide on Gallium Phosphide Green Light Emitting Diode.

The Yellow source color devices are made with Gallium Arsenide Phosphide on Gallium Phosphide Yellow Light Emitting Diode.

Package Dimensions



Notes:

1. All dimensions are in millimeters (inches).
2. Tolerance is $\pm 0.25\text{mm}$ (.010") unless otherwise noted.
3. Protruded resin under flange is 1.5mm (.059") max.
4. Lead spacing is measured where the leads emerge from the package.
5. Specifications are subject to change without notice.

Devices

Part No. LTL-	Lens	Source Color
307R	Red Diffused	Red
307RE	Red Transparent	
307P	Red Diffused	Bright Red
307PE	Red Transparent	
307E	Red Diffused	Hi. Eff. Red
307EE	Red Transparent	
307G	Green Diffused	Green
307GE	Green Transparent	
307Y	Yellow Diffused	Yellow
307YE	Yellow Transparent	

Absolute Maximum Ratings at Ta=25°C

Parameter	Red	Bright Red	Green	Yellow	Hi. Eff. Red	Unit
Power Dissipation	80	40	100	60	100	mW
Peak Forward Current (1/10 Duty Cycle, 0.1ms Pulse Width)	200	60	120	80	120	mA
Continuous Forward Current	40	15	30	20	30	mA
Derating Linear From 50°C	0.5	0.2	0.4	0.25	0.4	mA/°C
Reverse Voltage	5	5	5	5	5	V
Operating Temperature Range	-55°C to +100°C					
Storage Temperature Range	-55°C to +100°C					
Lead Soldering Temperature [1.6mm (.063 in.) from body]	260°C for 5 Seconds					

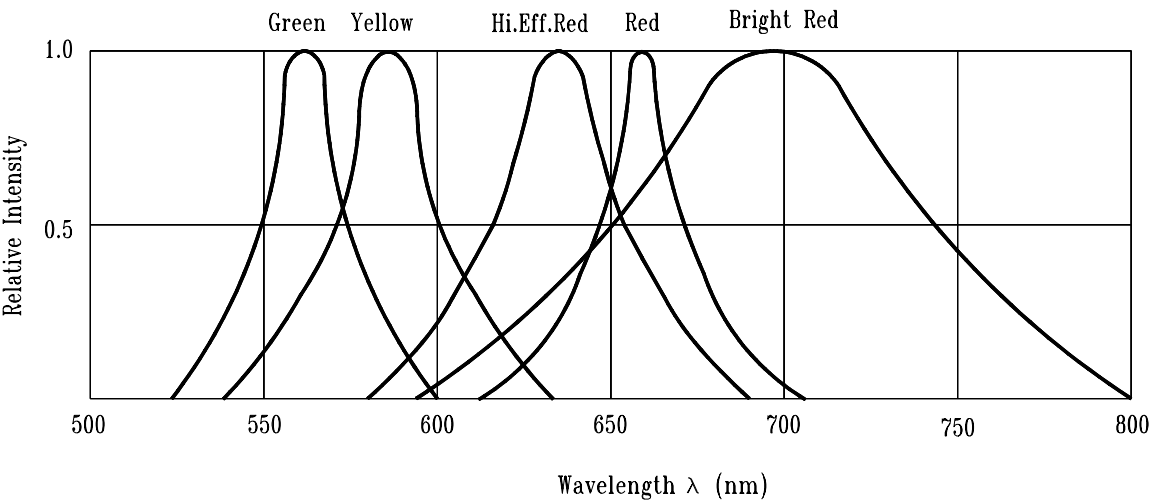
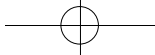


Fig.1 Relative Intensity vs. Wavelength



Electrical/Optical Characteristics at Ta=25°C

Parameter	Symbol	Part No. LTL-	Min.	Typ.	Max.	Unit.	Test Condition.
Luminous Intensity	I _v	307R 307P 307E 307G 307Y	0.5 1.7 5.6 5.6 8.7	1.7 5.6 19 19 29		mcd	I _F =10 mA Note 1,4
Viewing Angle	2 θ 1/2	307x		50		deg	Note 2 (Fig.7)
Peak Emission Wavelength	λ P	307R 307P 307E 307G 307Y		655 697 635 565 585		nm	Measurement @Peak (Fig.1)
Dominant Wavelength	λ d	307R 307P 307E 307G 307Y		651 657 623 569 588		nm	Note 3
Spectral Line Half Width	Δ λ	307R 307P 307E 307G 307Y		24 90 40 30 35		nm	
Forward Voltage	V _F	307R 307P 307E 307G 307Y		1.7 2.1 2.0 2.1 2.1	2.0 2.6 2.6 2.6 2.6	V	I _F =20mA
Reverse Current	I _R	307x			100	μ A	V _R =5V
Capacitance	C	307R 307P 307E 307G 307Y		30 55 20 35 15		pF	V _F =0 , f=1MHz

Notes:1.Luminous intensity is measured with a light sensor and filter combination that approximates the CIE eye-response curve.

2. θ 1/2 is the off-axis angle at which the luminous intensity is half the axial luminous intensity.

3.The dominant wavelength, λ d is derived from the CIE chromaticity diagram and represents the single wavelength which defines the color of the device.

4.I_v needs ± 15% additionalary for guaranteed limits.

Electrical/Optical Characteristics at Ta=25°C

Parameter	Symbol	Part No. LTL-	Min.	Typ.	Max.	Unit.	Test Condition.
Luminous Intensity	I_v	307RE 307PE 307EE 307GE 307YE	1.1 2.5 29 19 12.6	3.7 8.7 90 60 40		mcd	$I_F=10\text{ mA}$ Note 1,4
Viewing Angle	$2\theta_{1/2}$	307xE		40		deg	Note 2 (Fig.15)
Peak Emission Wavelength	λ_P	307RE 307PE 307EE 307GE 307YE		655 697 635 565 585		nm	Measurement @Peak (Fig.1)
Dominant Wavelength	λ_d	307RE 307PE 307EE 307GE 307YE		651 657 623 569 588		nm	Note 3
Spectral Line Half Width	$\Delta\lambda$	307RE 307PE 307EE 307GE 307YE		24 90 40 30 35		nm	
Forward Voltage	V_F	307RE 307PE 307EE 307GE 307YE		1.7 2.1 2.0 2.1 2.1	2.0 2.6 2.6 2.6 2.6	V	$I_F=20\text{mA}$
Reverse Current	I_R	307xE			100	μA	$V_R=5\text{V}$
Capacitance	C	307RE 307PE 307EE 307GE 307YE		30 55 20 35 15		pF	$V_F=0$, $f=1\text{MHz}$

Notes:1.Luminous intensity is measured with a light sensor and filter combination that approximates the CIE eye-response curve.

2. $\theta_{1/2}$ is the off-axis angle at which the luminous intensity is half the axial luminous intensity.

3.The dominant wavelength, λ_d is derived from the CIE chromaticity diagram and represents the single wavelength which defines the color of the device.

4. I_v needs $\pm 15\%$ additionalary for guaranteed limits.

Typical Electrical/Optical Characteristic Curves (25°C Ambient Temperature Unless Otherwise Noted)

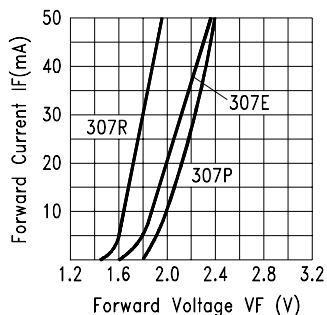


Fig.2 FORWARD CURRENT VS. FORWARD VOLTAGE

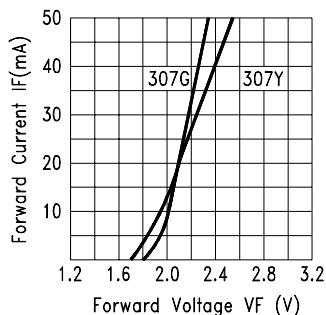


Fig.3 FORWARD CURRENT VS. FORWARD VOLTAGE

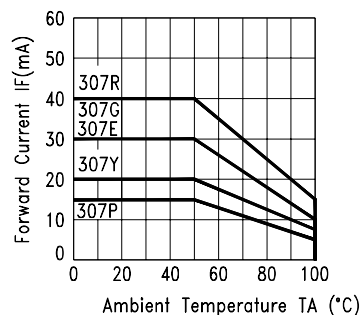


Fig.4 FORWARD CURRENT DERATING CURVE

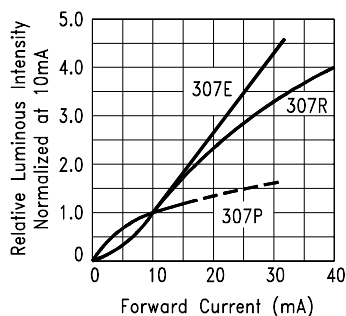


Fig.5 RELATIVE LUMINOUS INTENSITY VS. FORWARD CURRENT

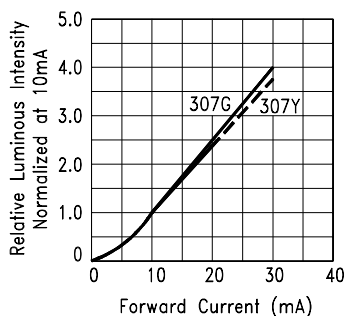


Fig.6 RELATIVE LUMINOUS INTENSITY VS. FORWARD CURRENT

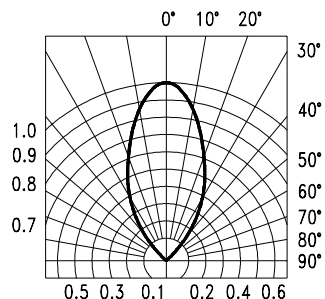


Fig.7 SPATIAL DISTRIBUTION

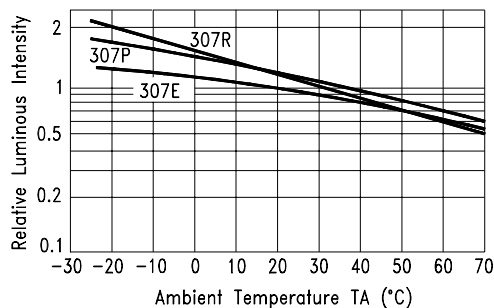


Fig.8 LUMINOUS INTENSITY VS. AMBIENT TEMPERATURE

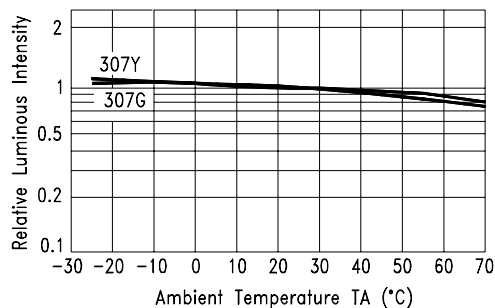


Fig.9 LUMINOUS INTENSITY VS. AMBIENT TEMPERATURE

Typical Electrical/Optical Characteristic Curves (25°C Ambient Temperature Unless Otherwise Noted)

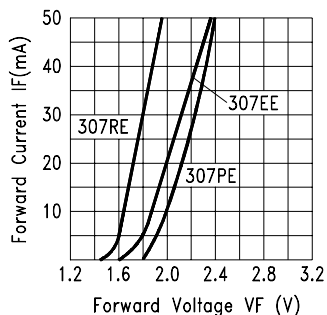


Fig.10 FORWARD CURRENT VS. FORWARD VOLTAGE

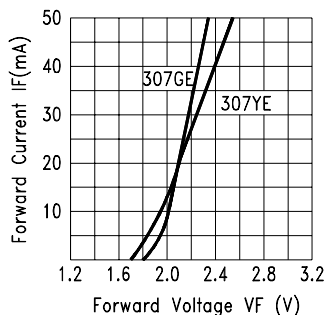


Fig.11 FORWARD CURRENT VS. FORWARD VOLTAGE

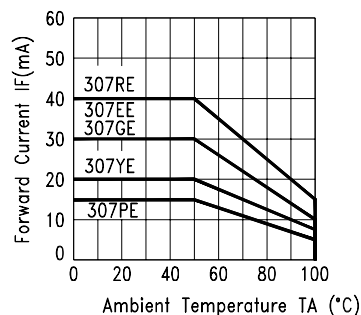


Fig.12 FORWARD CURRENT DERATING CURVE

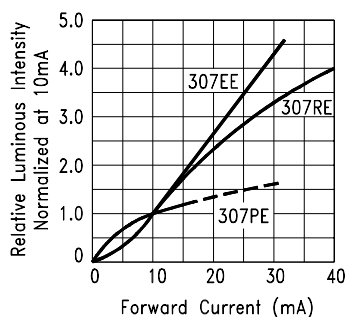


Fig.13 RELATIVE LUMINOUS INTENSITY VS. FORWARD CURRENT

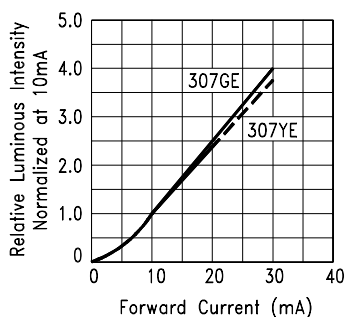


Fig.14 RELATIVE LUMINOUS INTENSITY VS. FORWARD CURRENT

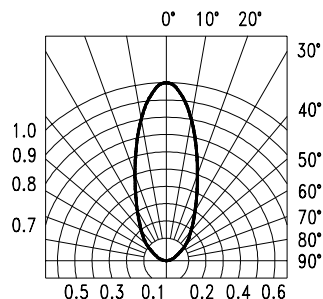


Fig.15 SPATIAL DISTRIBUTION

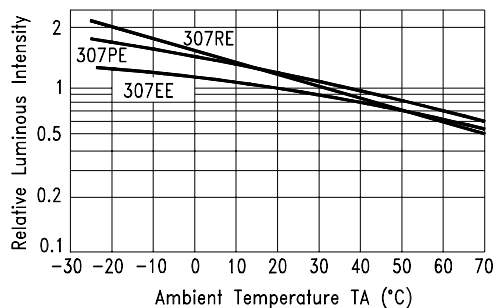


Fig.16 LUMINOUS INTENSITY VS. AMBIENT TEMPERATURE

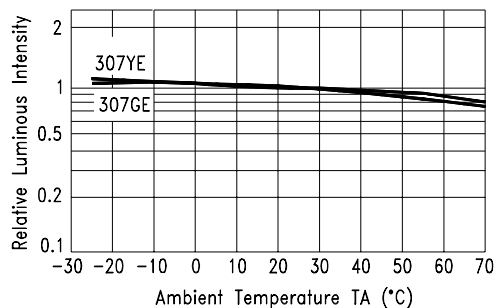


Fig.17 LUMINOUS INTENSITY VS. AMBIENT TEMPERATURE