

# SPECTRAFILL Red LED

ESL1R11

## Broadband Light-emitting Diode

Spectrafill red LED is a broadband (wide emission spectrum) solid-state light emitter. Its spectral width is roughly three times wider than that of usual narrow band LEDs. The polychromatic emission from this device contains correspondingly more shades of red color, making it suitable for high fidelity illumination applications. This LED can be used on its own or as one of a red, green, blue (RGB) full color LED set. The device is available in through hole, surface mount and power packages. The figure on the right shows the low power surface mount version of Spectrafill Red LED.



### Typical Applications

- Decorative and architectural RGB lighting systems
- High CRI white light luminaires.
- Plant grow lights
- Broadband red lighting for machine vision applications
- Spectroscopy and microscopy
- Full colour projector lamps and scanners

### Key Features

- Broad emission in the red region
- Emitted light contains infrared and orange components as well
- Lead free and RoHS compliant
- ESD and reverse voltage protection

### Principal Parameters

Forward voltage drop: 3.0 V  
 Peak emission wavelength: 647 nm  
 Wavelength spread (FWHM): 60 nm  
 Emission angle: 120 °  
 Typical CIE chromaticity coordinates: 0.53 (x), 0.22 (y)  
 Typical luminous intensity (low power LED): 3500 mcd  
 Typical luminous intensity (high power LED): 40 Lumens  
 Typical operating current (low power LED): 20 mA  
 Typical operating current (high power LED): 250 mA  
 Operating temperature range: -40 °C to 80 °C  
 Lifetime: 30,000 hours  
 Lens geometry: Round

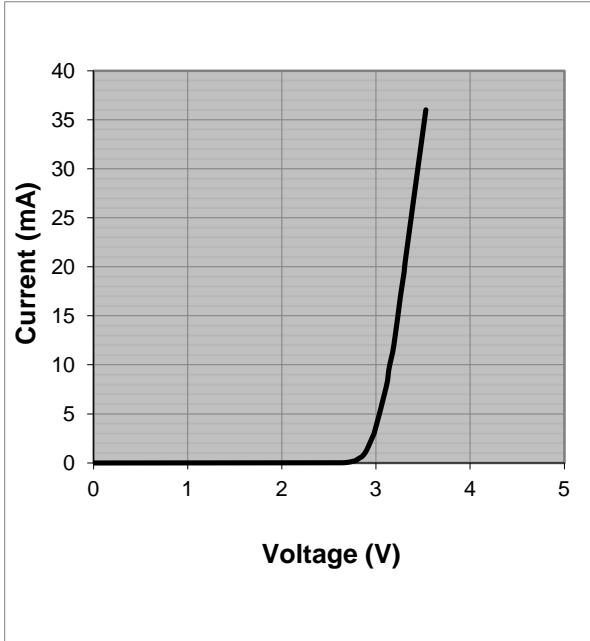
### Absolute Maximum Ratings

Maximum continuous operating Current (low power LED): 30 mA  
 Maximum continuous operating Current (high power LED): 300 mA  
 Maximum power dissipation (low power LED): 120 mW  
 Maximum power dissipation (high power LED): 1W  
 Maximum reverse voltage: 5 V  
 Maximum soldering temperature: 280 °C for 5 sec

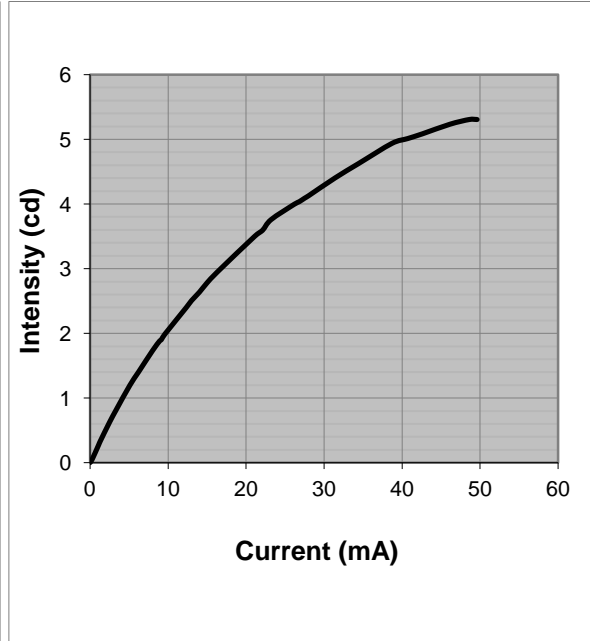
Packaging: ESL1R11 is available in T-1 3/4 5 mm diameter through hole transparent epoxy package, plastic leaded chip carrier (PLCC) surface mount device (SMD) 3528 package and 1W power package.

Electrical and Optical Characteristics

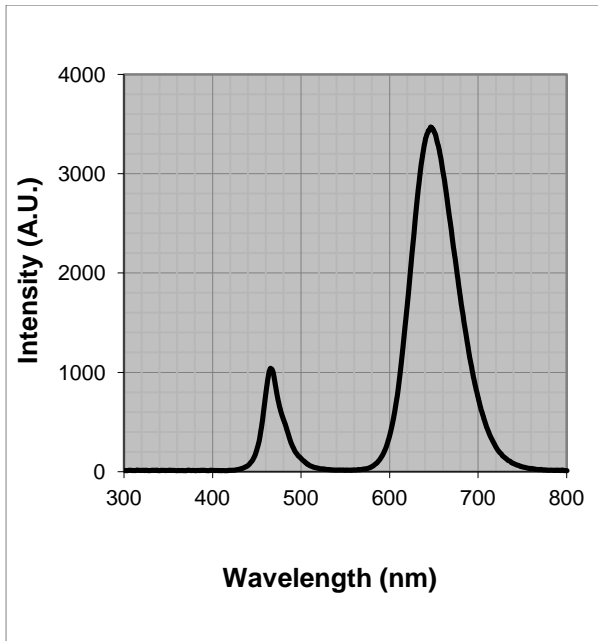
Current-voltage characteristics



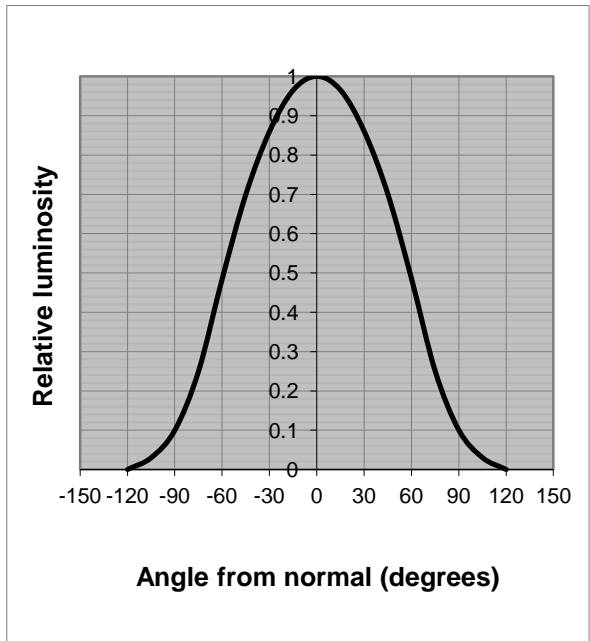
Light intensity versus LED drive current



Optical spectrum



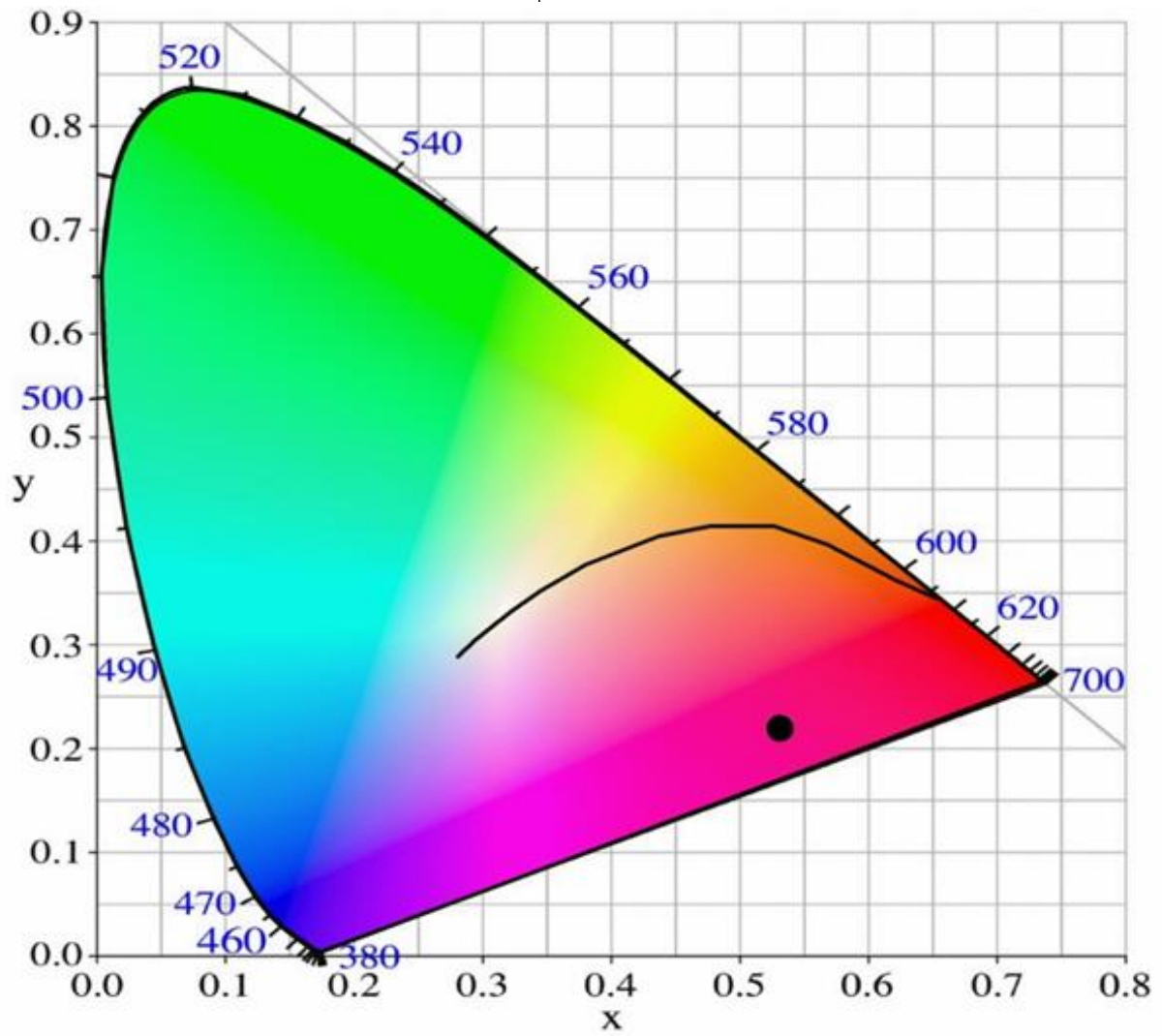
Angular light emission pattern



Note: The secondary peak at 460 nm is residual pump light from the LED chip and generally has no impact on system performance when Spectrafill RGB set is used together.

# CIE Chromaticity Diagram

(Measured at 20 mA drive current at 25 °C LED junction temperature)



CIE chromaticity coordinates: X = 0.531186 Y = 0.219693

## Application Information

### General

Spectrafill LEDs can be operated in both continuous and pulsed modes. The latter may be more power-efficient in certain applications. Like other LEDs, these devices start emitting light once their forward voltage drop exceeds their emission threshold. Thereafter, the light continues to increase in intensity as the drive current increases. The output optical power begins to saturate at high drive currents due to carrier saturation and thermal effects. This saturation is reached at lower currents when the device is operated at higher ambient temperatures. Adequate heat sinking must be provided to ensure satisfactory performance in terms of optical output, lumens maintenance and device lifetime. See more about this in the Design Considerations section below.

### Analogue Drive

Spectrafill LEDs can be driven by a continuous current drive. A stable, high internal impedance current source is recommended for this purpose. There are both fixed and variable current sources commercially available that are suitable for this purpose. Fixed current sources, such as the NSI45030AT1G from ON Semiconductor provide a set current through an LED whereas the current output from a variable source, such as the PSSI2021SAY from NXP or the LM134 from Linear Technology can be adjusted using a trimming resistor. The current drive from all these and other similar devices is stable enough to drive Spectrafill LEDs at constant brightness and colour point.

### Digital Drive

For more precise control and reproducible colour generation, Spectrafill LEDs can be driven by a digital pulse width modulation (PWM) signal. Generally, 8 bit precision is sufficient for most applications but if needed 10 or 16 bit systems can also be implemented. This approach requires the use of either a

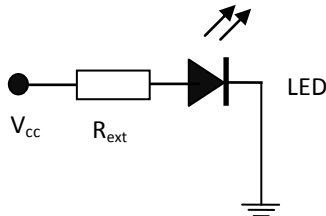
microcontroller or a dedicated PWM generator. Most general-purpose microcontrollers are suitable for this application although some manufacturers also offer devices optimised for lighting control. Please note that digital drive requires a MOSFET power driver external to the microcontroller in order to handle the drive current requirements of Spectrafill LEDs. ElectrosPELL can provide details of a reference design based on Atmel AVR 8-bit microcontrollers.

### Design Considerations

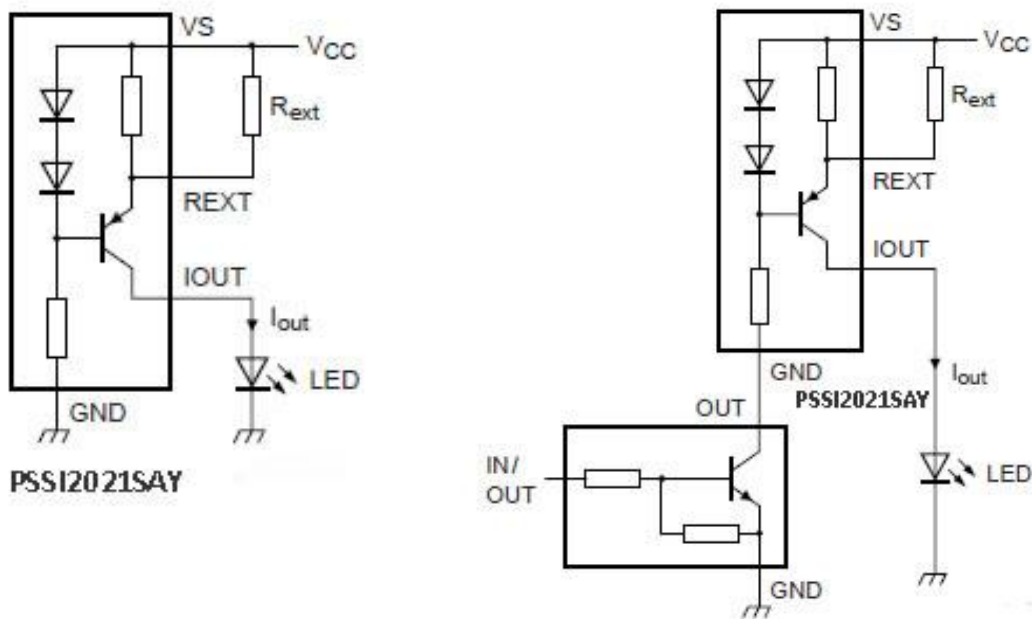
Good electrical, thermal and optical designs are the keys to obtaining good performance from LEDs. Please make sure that stable, noise-free power is provided to these LEDs for best performance and long operating life. This can be done by placing a voltage regulator before the constant current source that drives LEDs. Also make sure that printed circuit board (PCB) tracks are wide and thick enough to handle current fed to LEDs. These devices should be mounted with proper heat sinking if they are to be driven at high power levels. Placing the LED package body on a metal core PCB (MC-PCB) or in contact with a metal heat sink is recommended. Filling the space between the LED and the heat sink with a suitable thermal interface material, such as Thermadime, is also recommended. Please note that significant increase of LED temperature can lead to reduced performance and premature failure. Spectrafill LEDs emit light in a circularly symmetric Lambertian pattern with most light emitted normal to the device and the intensity falling at larger angles from the normal according to a cosine distribution function. In order to collect the maximum amount of light, proper reflectors should be used. These could be a feature of the product housing or can be inserted as accessory components. Proper choice and placement of reflector can maximise the amount of light that can be obtained from a lighting system.

### Circuit Examples

A simple resistor-connected circuit such as the one shown below can be used to drive Spectrafill LEDs. For most applications, a current between 20 and 30 mA will drive the LED at sufficient brightness. Power LEDs can be driven similarly at higher current levels, using a resistor with a suitable power rating.

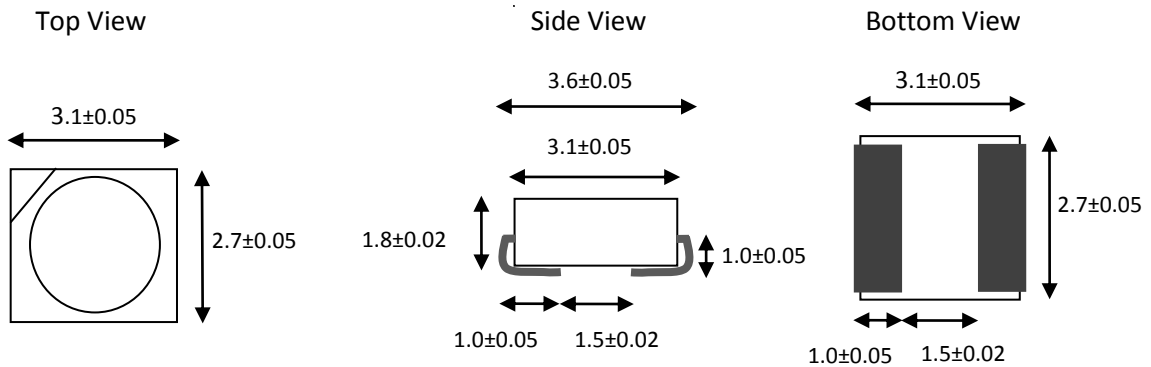


For better performance, where the supply voltage can change, use of constant current sources is recommended. The PSS1202SAY constant current IC can be used for this purpose for currents up to 50 mA, as shown below. Please refer to the PSS1202SAY datasheet for further information. For higher currents, use a transistor-based constant current source.



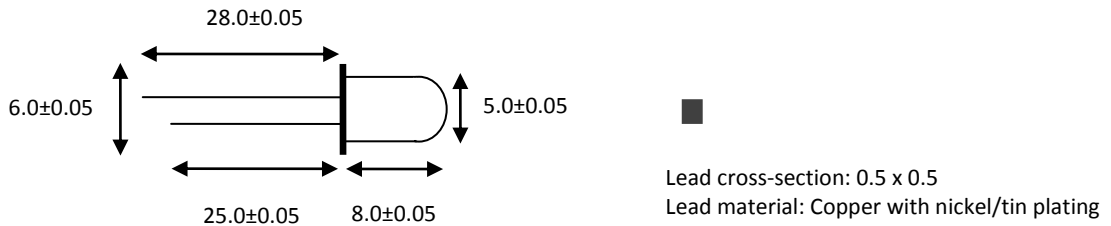
For digital PWM drive at low current levels, low power Spectrafill LEDs can be directly connected to microcontroller I/O pins with a suitable series resistor. For driving power Spectrafill LEDs, a power interface circuit using a MOSFET such as IRFZ34 and a MOSFET driver such as LT1910 are needed. Please contact ElectrosPELL for further information about LED drive electronics.

**SMD PLCC (3528) Package Drawing - All dimensions are in mm**

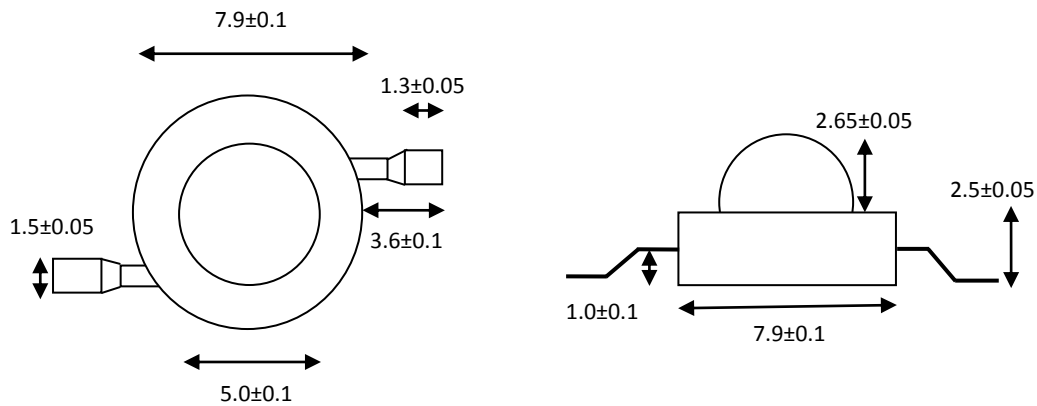


Emitting Aperture Diameter: 2.5 mm

**Through-hole (T1-3/4) Package Drawing - All dimensions are in mm**



**1W Power Package Drawing - All dimensions are in mm**

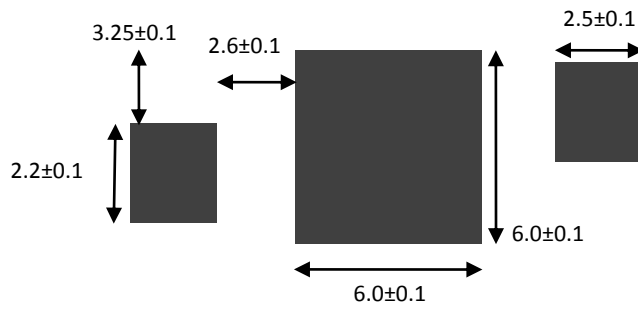


Note: Drawings are not to scale - to obtain values in inches, multiply by 0.04

### Recommended land pattern and through-hole solder pattern



### Recommended land pattern for 1W power package



Note: Drawings are not to scale - to obtain values in inches, multiply by 0.04

## Product availability and ordering information

Spectrafill Red LEDs are available in the following three packaging styles:

Through hole T-1 ¾ (5 mm diameter) clear epoxy package  
[Longer lead identifies the anode (+) terminal]  
Product code: ESL1R11-TH01



Surface Mount Device PLCC plastic package  
[Corner depression identifies the cathode (-) terminal]  
Product code: ESL1R11-SMD01



This product is also available in 1000 piece tape-and-reel packaging in moisture-sealed bags.

Surface Mount Power LED package  
[Circular notch on solder terminal identifies the Cathode (-) terminal]  
Product code: ESL1R11-P01



This product is available in tube packaging.  
This product is also available in 50 piece trays contained in moisture-sealed bags.

## Handling information

Spectrafill LEDs are static and moisture sensitive. Handle devices with appropriate precautions against electrostatic charge transfer to LEDs. Once a sealed LED package is open, reflow solder LEDs as soon as possible and in all cases within six months of package opening date. Baking devices before soldering is highly recommended and is essential if LEDs have not been stored in a dry environment. Recommended baking is at 110 °C for one hour or 70 °C for seven to eight hours.

To purchase Spectrafill Red LEDs please contact Electrospell using the contact information below.

Electrospell/PRP Inc  
4200 E La Palma Avenue  
Anaheim  
CA 92807  
United States of America  
Tel: (714)-528-5001  
E-mail: sales@electrospell.com

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