

Infrared Emitters - SPF Series

Key Features:

- Fast Pulsable Source of Black-body Radiation
- Emulates a Black-body in Spectral Distribution
- Ultra-thin Metallic Foil Active Element
- Parabolic Reflector for Collimation and Uniformity
- Fast Pulse Rates, up to 180 Hz with 50% Modulation Depth
- High Output Emitter .04 Watts/cm²
- Broadband Output with Typical 0.88 Emissivity



The SPF Series IR emitters are designed to be used as fast pulsed sources of black-body radiation. The design has been optimized for high modulation depth and optical output.

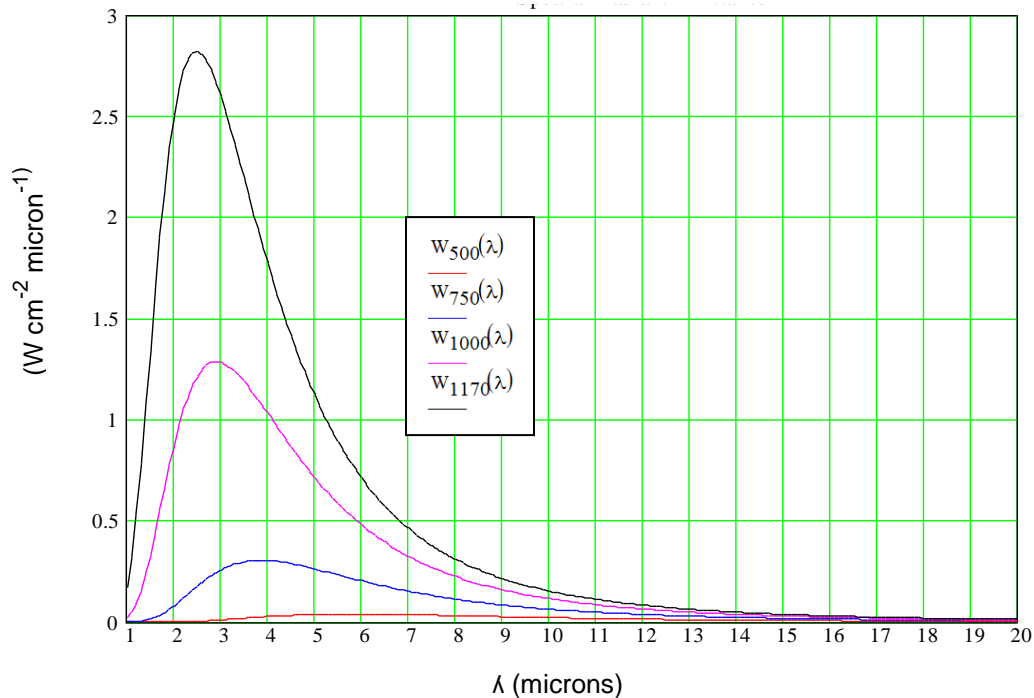
The radiating element in the pulsable emitter is an ultra-thin Opto Diode specific comb metallic foil configured so that radiation from both sides of the heated foil is efficiently directed out of the package along the optic axis. The foil material has a typical emissivity of 0.88 and closely emulates a black-body source in spectral distribution. The emitter is designed to operate at a rated maximum foil temperature of 1000° Kelvin. The emitter is offered in a hermetically sealed TO-5 package with integral standard parabolic reflector to provide near collimated and uniform radiation output.

Applications:

- Gas analysis, medical and industrial
- Environmental monitoring
- Spectroscopy
- Process control systems

Black-body Radiant Emittance

SPF Series emitters approximate black-body sources at their particular operating temperature. Below is a reference graph showing ideal black-body curves at various temperatures, in °K.



Filament Temperature vs. Input Power

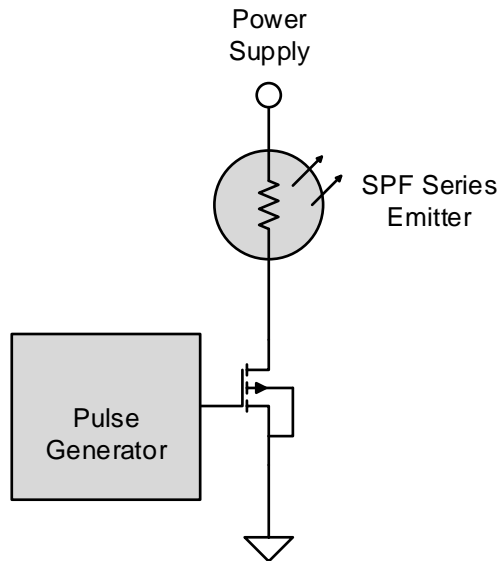
The SPF pulsable emitter is designed to operate with maximum element temperatures of approximately 1000° K (727° C) at the rated input power. Since the radiated energy is proportional to the fourth power of the absolute temperature (T^4) accurate control of the input power and proper heat sinking of the package are essential to maintain consistent output. The heat sink must limit the package temperature to not more than 120°C. The relationship between peak wavelength (λ_{pk} in microns) and temperature (T in ° Kelvin) for the black-body spectrum is expressed by Wien's law:

$$\lambda_{pk} (\text{microns}) \times T (^{\circ}\text{K}) = 2898$$

Thus, the wavelength for maximum excitation varies inversely with the absolute temperature. For 1000° K this maximum is at 2.9 microns. The input pulse should have sufficient energy to produce a maximum filament temperature of 1000K.

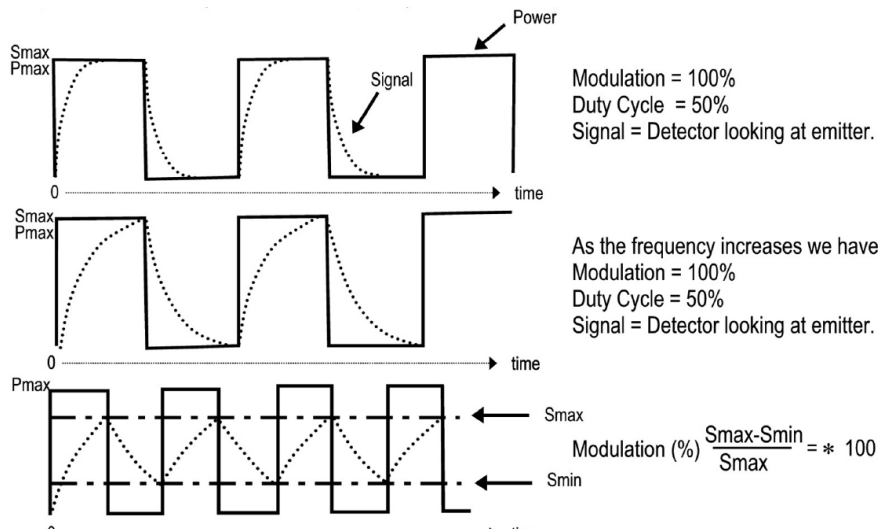
Drive Circuit

Switching device like a single N-channel MOSFET with, very low on-state resistance combined with high transconductance, superior reverse energy and diode recovery dv/dt capability to switch the emitter on and off is suitable.



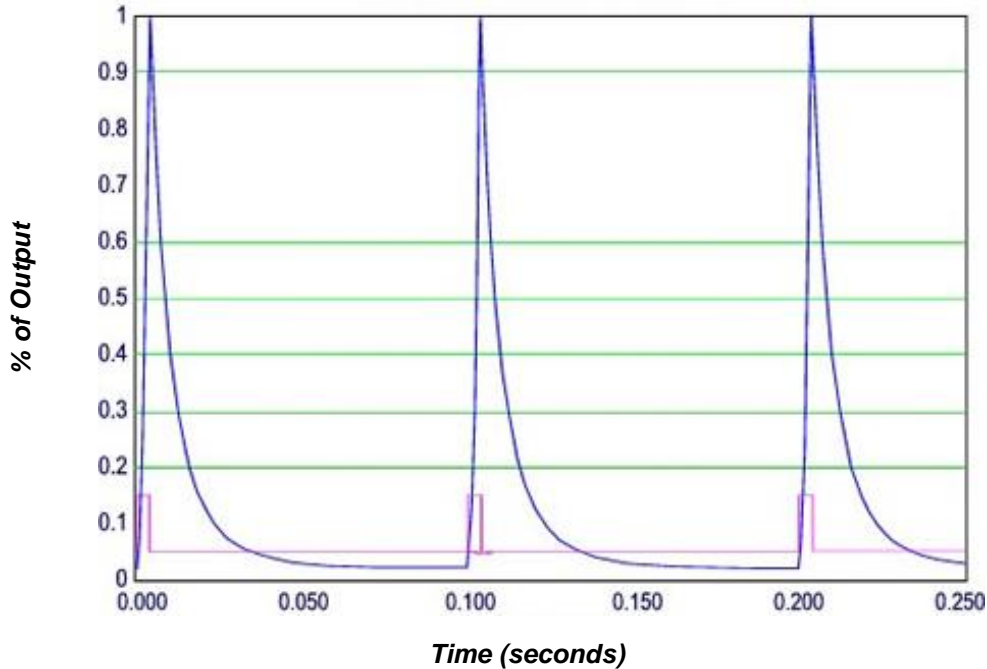
Source Modulation

The modulation (%) versus frequency is measured by first adjusting input power to give an average filament temperature of 1000 degrees Kelvin at 1Hz. Because of very rapid heating, the filament can be observed to reach a steady state temperature within a 0.5 second pulse. Modulation (%) is measured from this point by increasing the frequency. Waveforms will appear as follows:

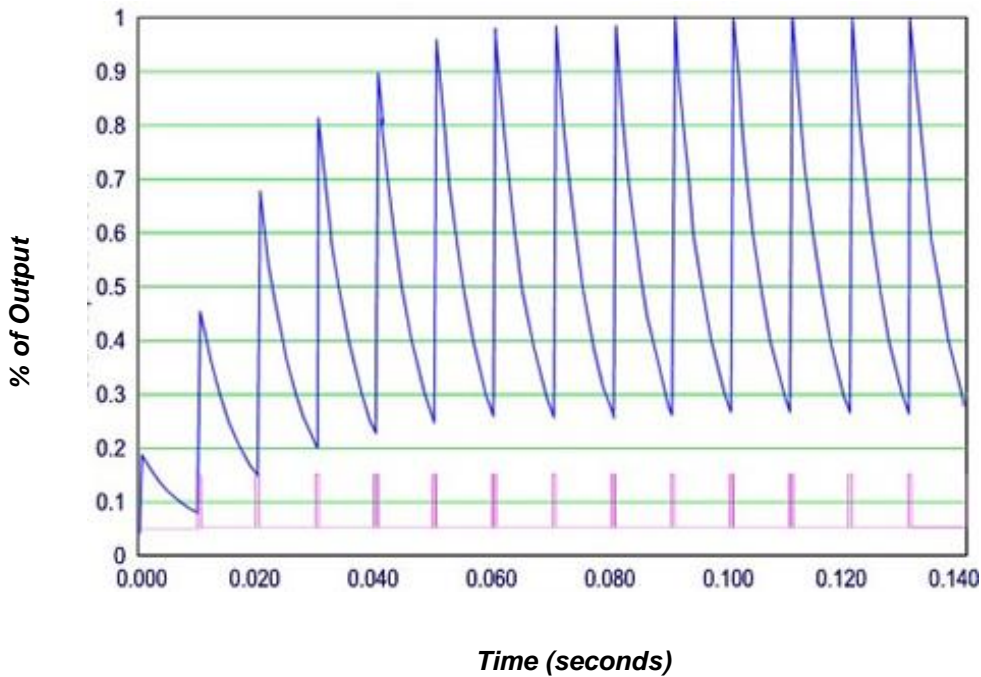


At low frequencies the signal reaches its maximum swing. The filament goes “full on” reaching its steady state temperature and “full off”. As the frequency increases, the signal swing “saw tooth” decreases and the filament temperature is not able to achieve its full “on” and “off” values during each portion of the cycle because of its thermal mass. The optical power (radiant flux in watts or irradiance in watts/cm²) will then vary with the fourth power of the absolute temperature (T^4).

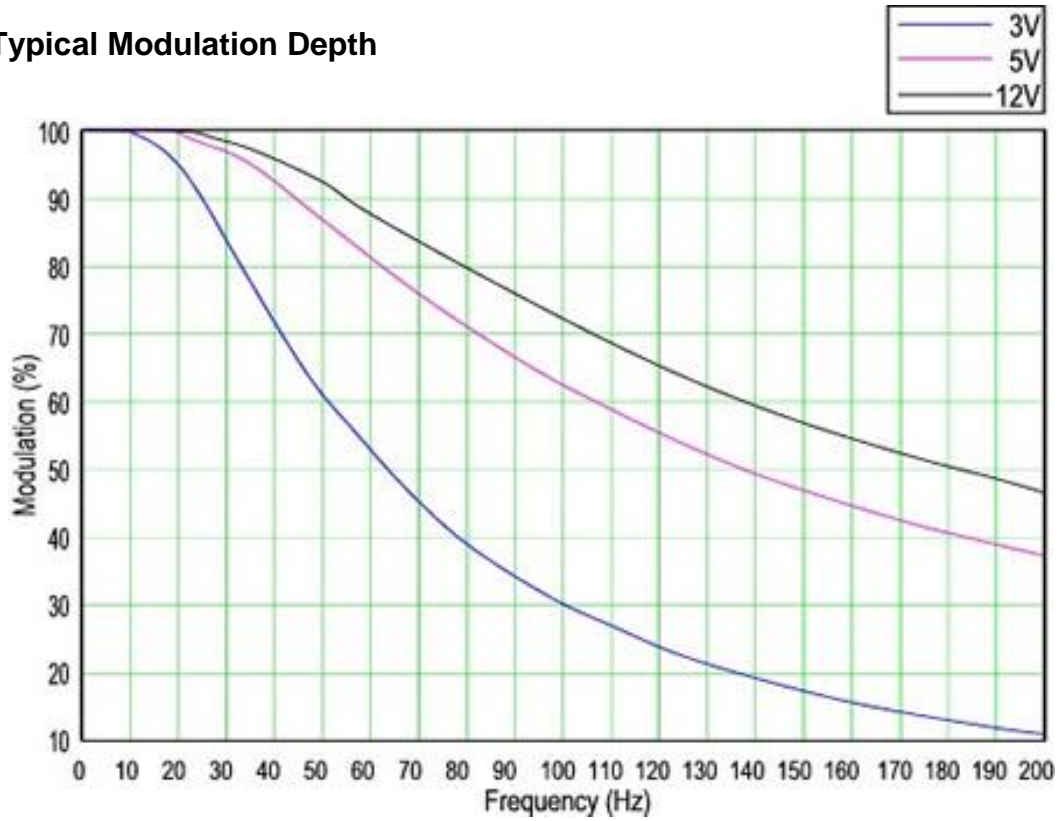
Typical Output Modulation at 10 Hz



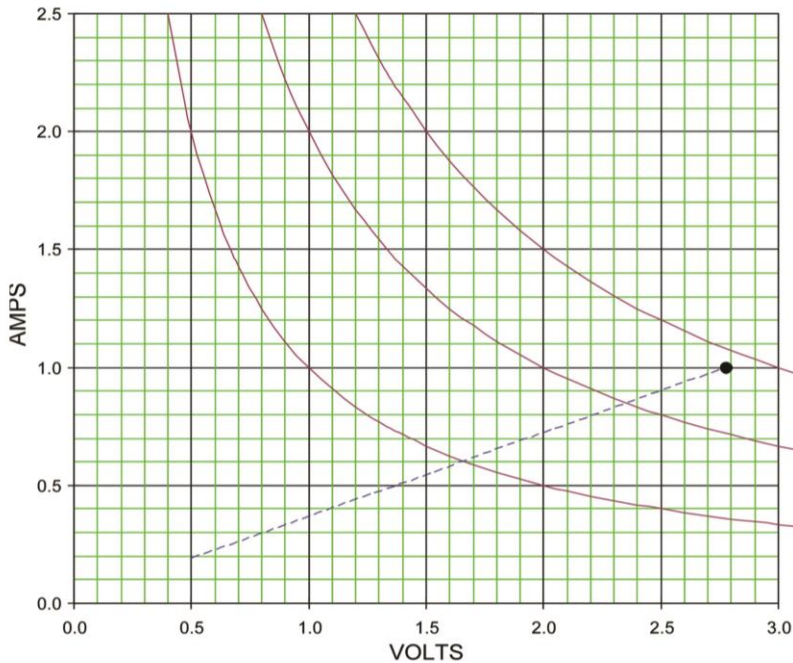
Typical Output Modulation at 100 Hz



Typical Modulation Depth



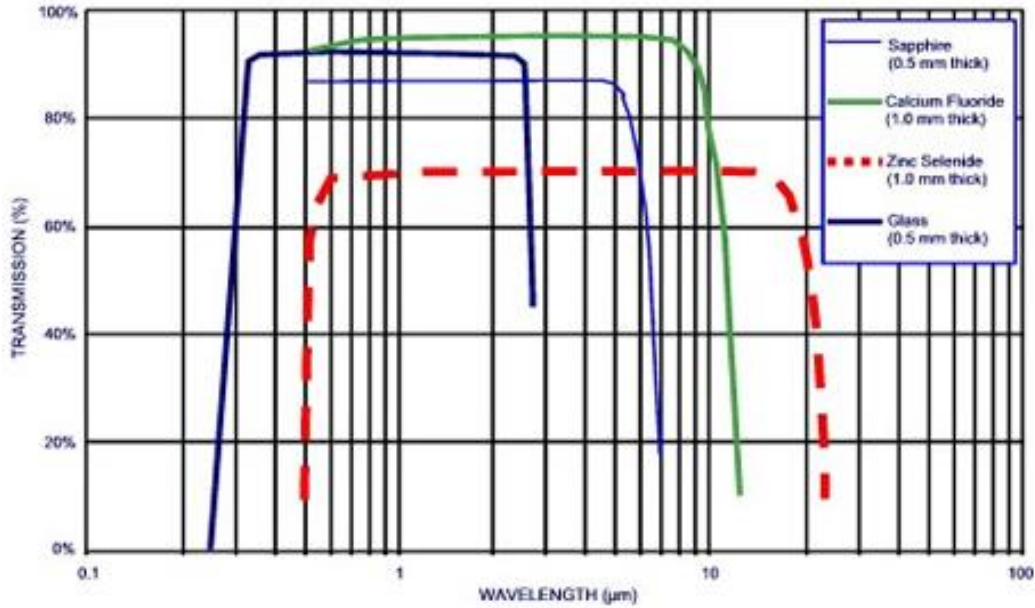
DC Power Curve (I vs V)¹



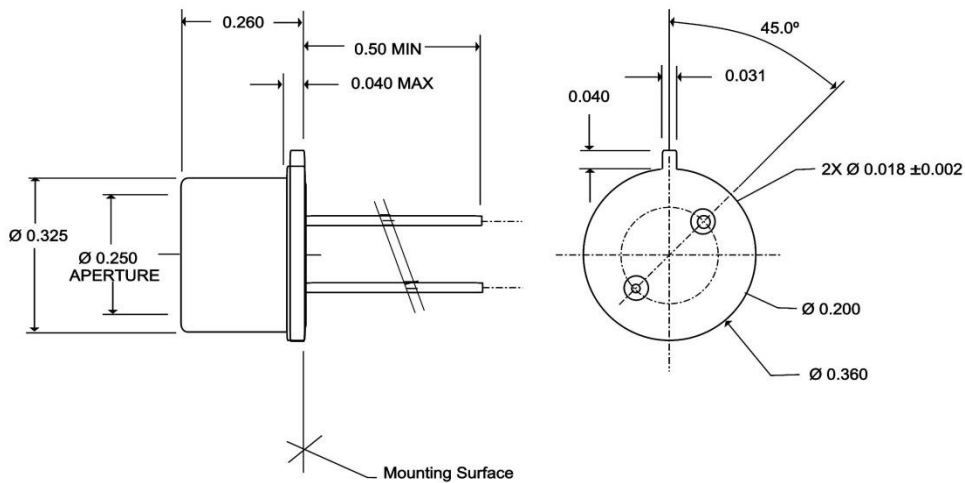
curve no.	source model	Pk DC power (watts)
1	SPF220-5M2	2.78

¹ 1000°K at power indicated, exceeding this value will raise element temperature and decrease source lifetime.

Window Spectral Transmission Options



Package Dimensions



Ordering Information

SPF-XXXXX-YYY
 SPF – S Source, PF Pulsable Fast
 XXXXX – Filament and Foil Dimensions
 YYY – Packaging Options and Window Options

SPF220-5M2 (40101) Steady State Emitter 220 in TO5 Package with Sapphire Window