Standard pulsable infrared emitters

Cal Source SVF-Series infrared (IR) emitters are designed to be used as pulsable emitters of blackbody radiation.

The radiating element in the pulsable emitters is an ultra-thin Cal Sensors specific 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 an emissivity of 0.88 and closely emulates a blackbody source in spectral distribution.

Standard SVF-series emitters are offered in sealed TO-5 or TO-8 packages in a variety of foil thicknesses and widths. Several standard window materials are available to tailor the output to specific wavelength ranges of interest.

SVF-series emitters are offered with an integral reflector. Standard parabolic reflectors provide near collimated and uniform radiation output. A variety of elliptical reflectors with varying focal lengths are also available for coupling into optical fibers or other applications.

Model Number	Rated Input Power (DC @ 1000 ° K)		Rated Avg. Power (at 50% Duty Cycle)	Pulse Rate at 50% Modulation	Package
	V	I	Square Wave (W)	(Hz)	
SVF230-5M( )[1]	1.1	0.6	0.3	15	TO-5
SVF350-5M( )[1]	0.9	1.5	0.7	10	TO-5
SVF360-8M( )[1]	1.6	1.6	1.3	7	TO-8

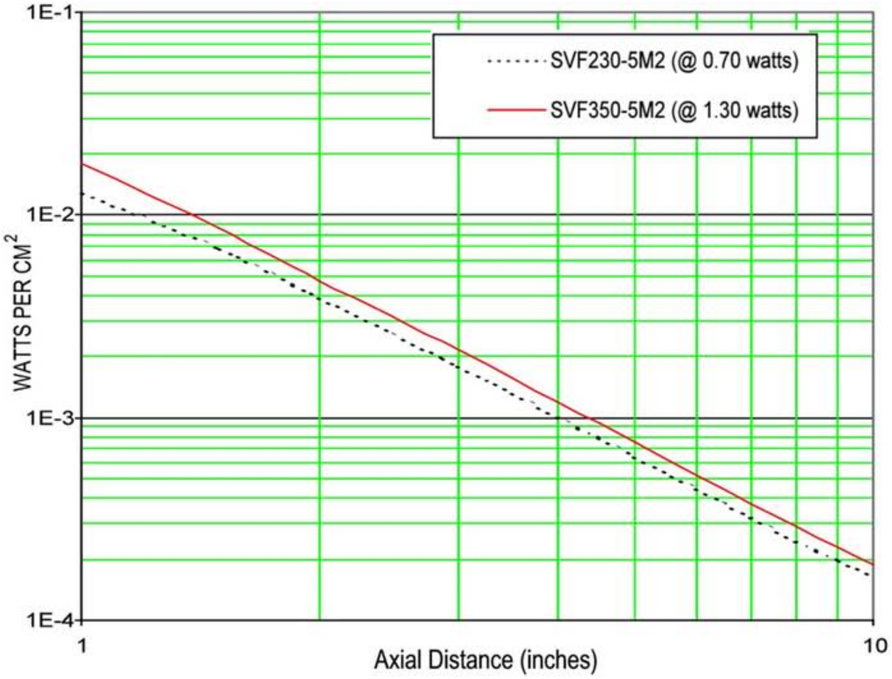
Notes:

1. Cal Sensors' standard window materials are denoted in a model designation by the parentheses ( ) in the table above. Replace ( ) with; “2” = Sapphire for 0.2 to 6μm, “3” = Calcium Fluoride for 0.2 to 10 μm or “8” = Zinc Selenide for 1.0 to 16 μm. Custom coated windows and filters can be installed upon request.
2. All specifications are subject to change without notice.

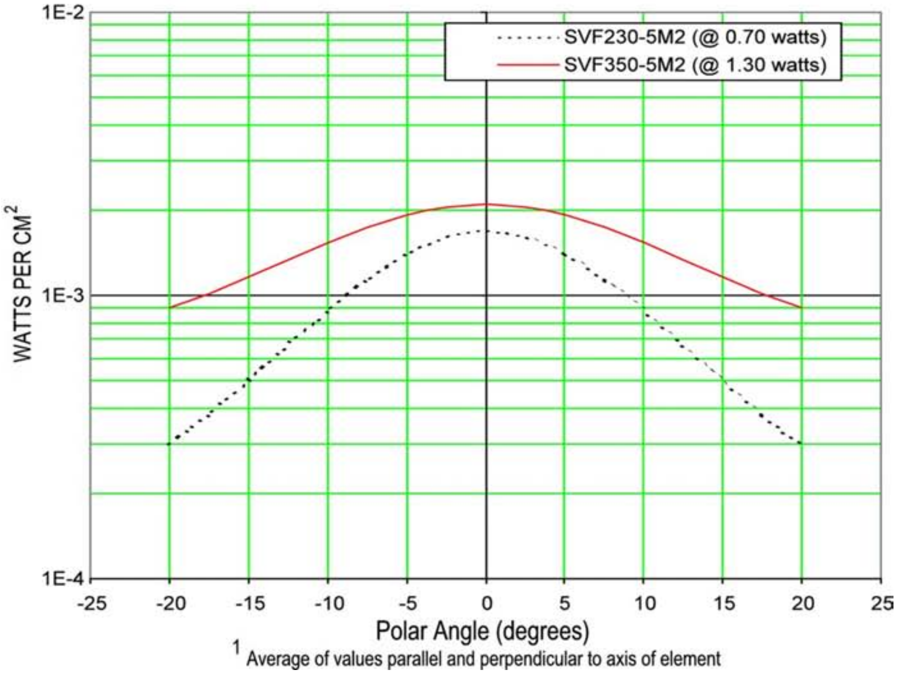
If our standard products are not a match for your requirements, please feel free to contact us for further discussion.

SVF Series in TO-5 can

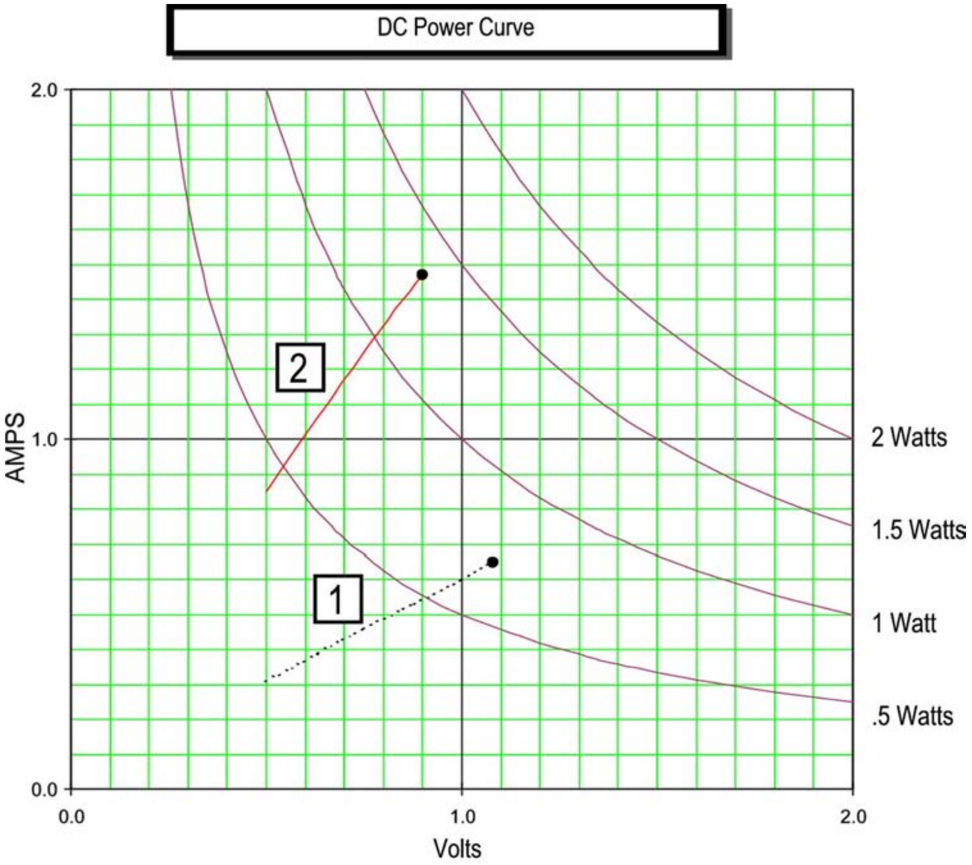
DC Intensity (@1000ºK) vs. Distance



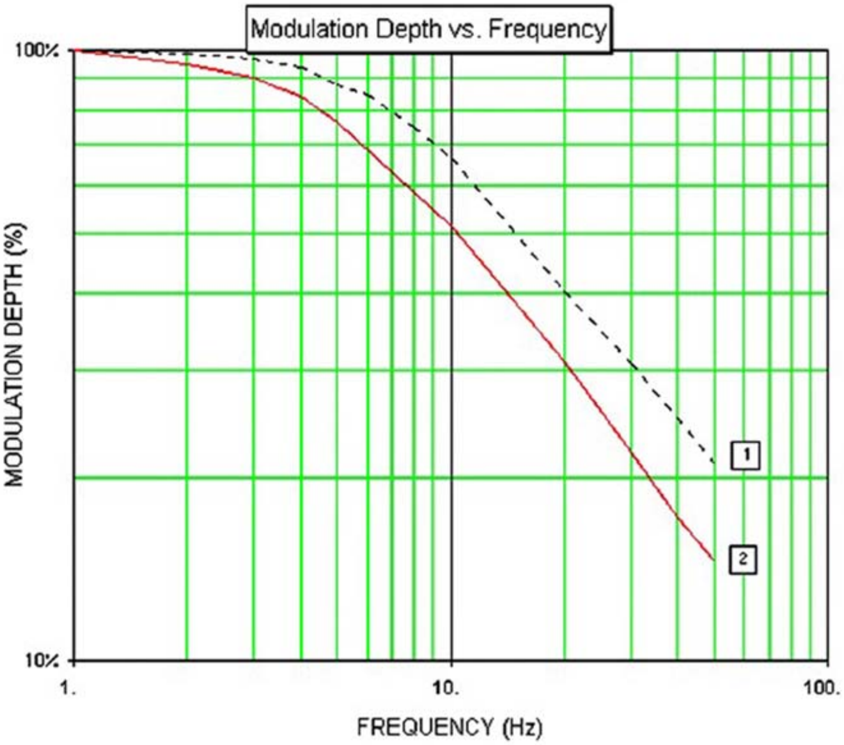
Average DC Intensity[1] (@1000ºK) vs. Angle (@ 3 inches)



[1] Average of values parallel and perpendicular to axis of element



Curve No.	Emitter Model	Pk DC power (watts)
1	SVF230-5M( )	0.70
2	SVF350-5M( )	1.30

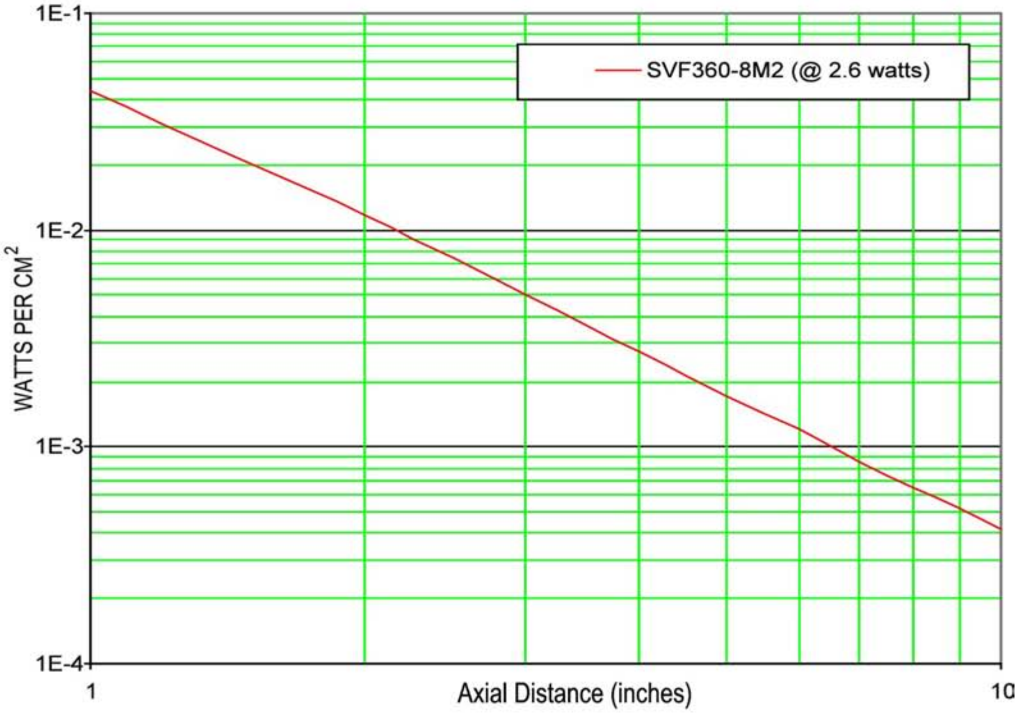


Curve no.	Source Model	Avg. Power* (watts)	Freq.@50% Modulation
1	SVF230-5M( )	0.35	15 Hz
2	SVF350-5M( )	0.65	10 Hz

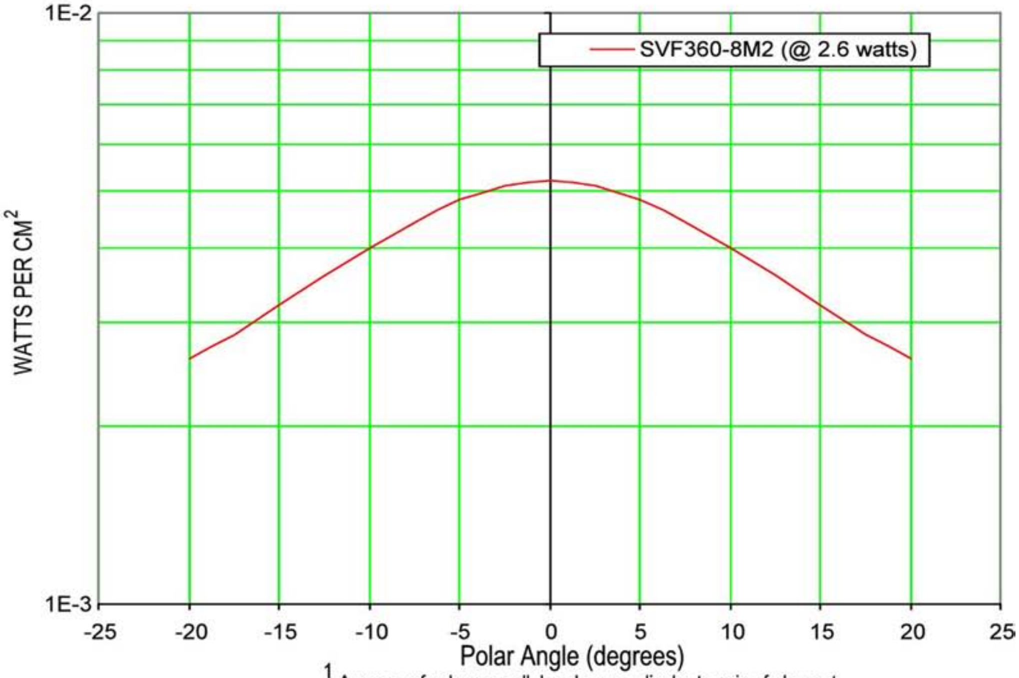
* 50% duty-cycle, square wave

SVF Series in TO-8 can

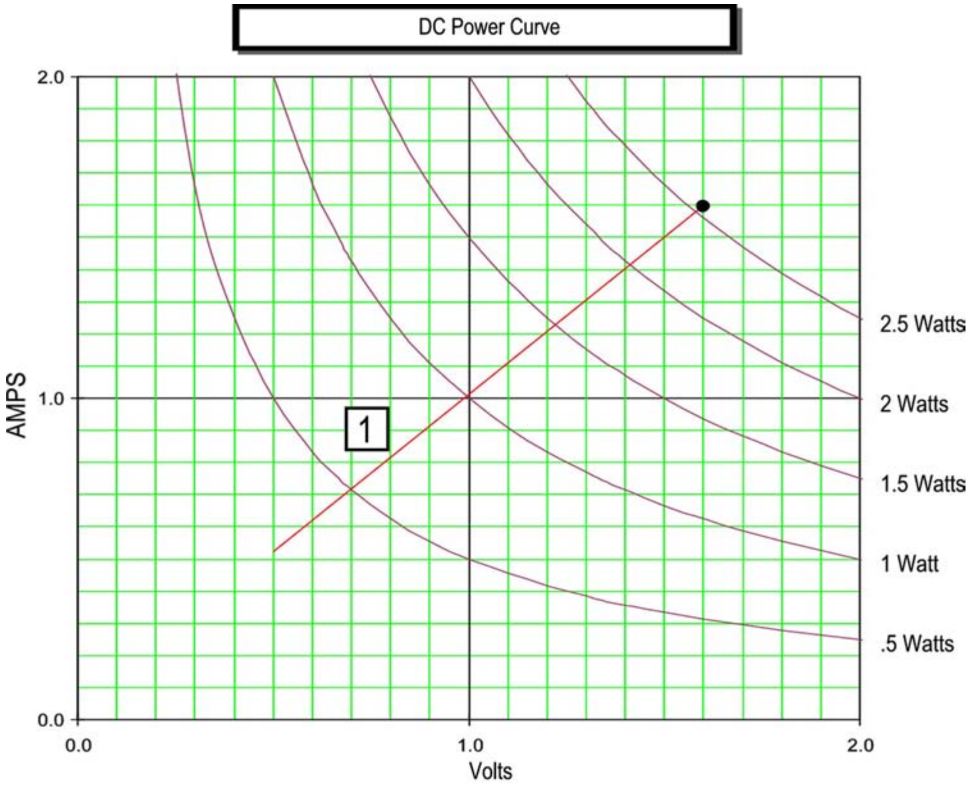
DC Intensity (@1000ºK) vs. Distance



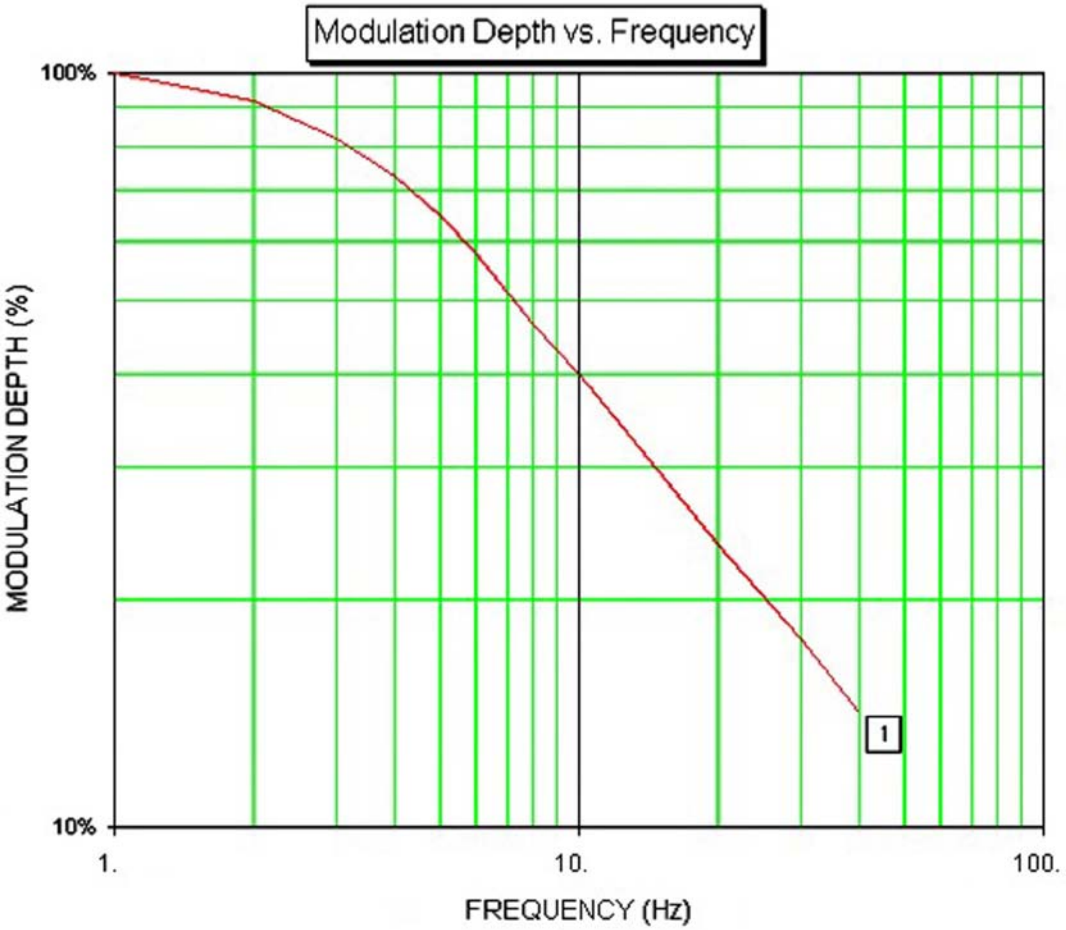
Average DC Intensity[1] (@1000ºK) vs. Angle (@ 3 inches)



[1] Average of values parallel and perpendicular to axis of element

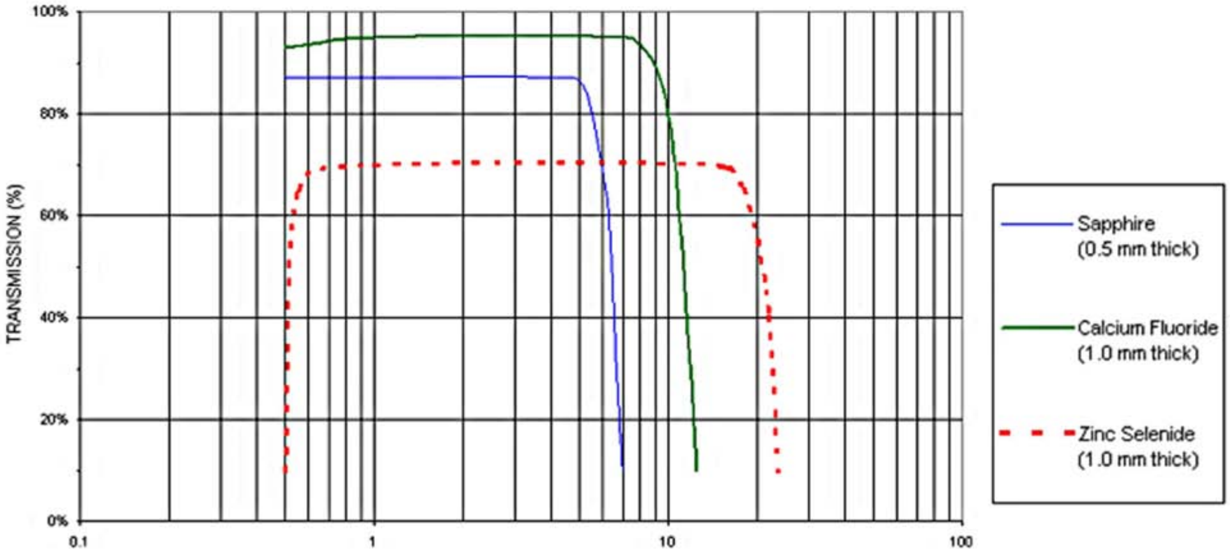


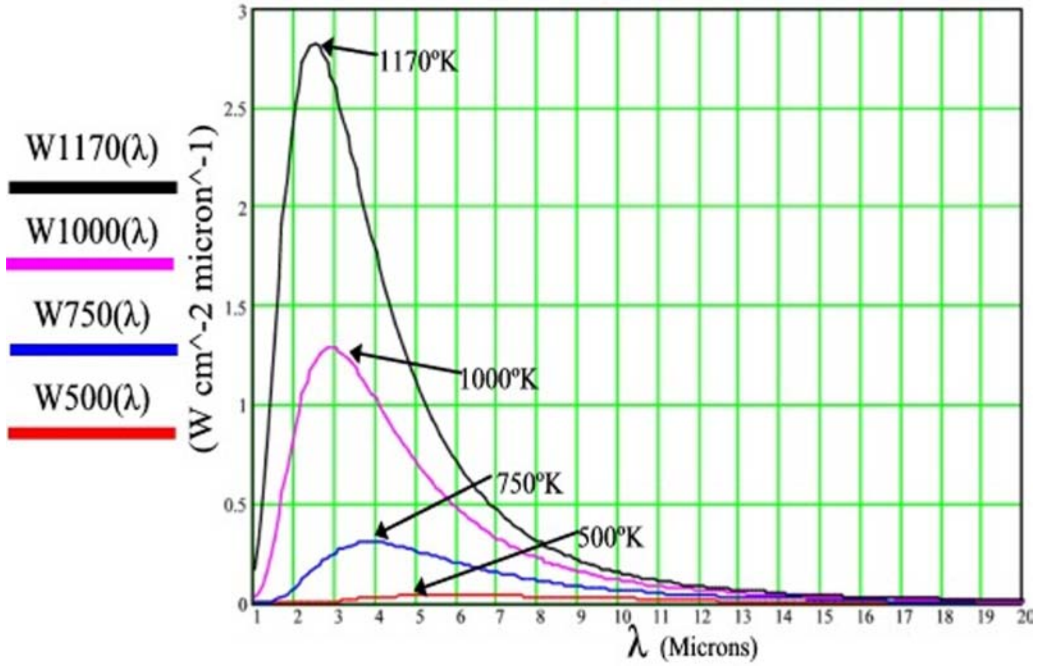
Curve No.	Emitter Model	Pk DC power (watts)
1	SVF360-8M( )	2.6



Curve no.	Source Model	Avg. Power* (watts)	Freq. @ 50% Modulation
1	SVF360-8M( )	1.30	7 Hz

* 50% duty-cycle, square wave

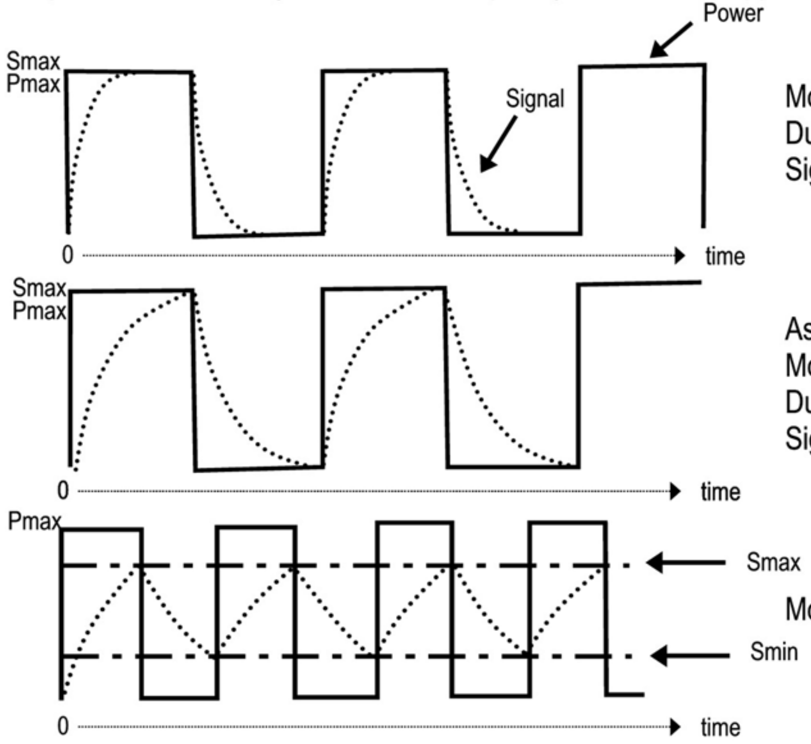




Cal Source Emitters approximate blackbody sources at their particular operating temperature. Above is a reference graph showing ideal blackbody curves at various temperatures in ºK.

Source Modulation (See our website for modulation depth vs. frequency curve.)

The modulation (%) versus frequency is measured by first adjusting the input power to give a filament temperature of 1000 degrees Kelvin at 1 Hz. Because of the very rapid heating, the filament can be observed by a steady state temperature for approximately 0.5 seconds (each cycle) to get an accurate measurement. Modulation (%) is measured from this point by increasing the frequency. The temperature is not readjusted at each frequency. Wave forms appear as follows:



Modulation = 100%
Duty Cycle = 50%
Signal = Detector looking at emitter.

As the frequency increases we have:
Modulation = 100%
Duty Cycle = 50%
Signal = Detector looking at emitter.

$$\text{Modulation (\%)}\ \frac{\text{Smax-Smin}}{\text{Smax}} = * \ 100$$

With increasing frequency the filament temperature is not able to achieve its full value during the “on” portion of the cycle because of its thermal mass and the signal wave form develops a “saw tooth” shape. The optical power (radiant flux (watts) or excitance (watts/cm2)) will then vary with the fourth power of the absolute temperature (T^4).

In this example the input electrical power has a square wave form with a 50% duty cycle. In general, the duty cycle, D, which is the portion (or %) of time that the voltage, V, and current, I, are in the “on” state can be any value. The Root Mean Square (RMS) Voltage, V_{RMS}, RMS Current, I_{RMS} and the Average Power, P_{AVG} are expressed as:

$$V_{RMS} = \sqrt{D} * V$$
$$I_{RMS} = \sqrt{D} * I$$
$$P_{AVG} = V_{RMS} * I_{RMS} = D * V * I$$

Cal-Source™ INFRARED EMITTERS Pulsable Source – SVF Series Design Application Notes

Drive Circuit

Any switchable constant voltage or constant current power supply with square wave output and variable (or fixed) duty cycle. For example, the modulation (%) versus frequency data was taken with constant voltage square wave input and 50% duty cycle.

Lifetime

Cal Sensors does not provide quantitative lifetime data for the SVF-series pulsable sources. The factors that influence lifetime change in relative importance with each application so that a statistical life test based on a particular set of conditions may not be relevant to a specific application.

In general, three factors influence the lifetime most significantly. These are: peak temperature, temperature variation (D T) and pulse repetition rate (frequency).

Peak temperature influences the rate of filament evaporation. Although this rate is very small even at the maximum rated source temperature of 1000° K, operating at a lower temperature may significantly extend the actual lifetime. Temperature variation (D T) and frequency influence the overall rate of evaporation as well. Certain tradeoffs are inherent among these factors such as a decrease in D T with increasing frequency or an increase in D T with rising temperature (input power) at constant frequency, etc. These factors should be used as general guidelines to maximize lifetime.

Filament Temperature vs. Input Power

Pulsable sources are all 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 (T4) accurate control of the input power and proper heat sinking of the package are essential to maintain constant element temperature and output. The heat sink must limit the package temperature to not more than 100°C. Re-rating of the element above 1000° K may significantly reduce the lifetime. However, it should be noted that as the pulse frequency increases, e.g. 5 to10 Hz, it is possible to increase the input power somewhat above the nominal rated value and still maintain the element temperature at or below 1000° K. For example, one source operated DC can be used as a visual transfer standard to adjust the input power (and temperature) of the pulsing source.

The relationship between peak wavelength (l pk in microns) and temperature (T in ° Kelvin) for the blackbody spectrum is expressed by Wien's law as,

$$l\ pk\ (\text{microns}) \times T\ (°\ K) = 2898$$

Thus, the wavelength for maximum excitance varies inversely with the absolute temperature. For 1000° K this maximum is at 2.9 microns.