

SPM Scintillator Demonstration Kit

The ScintPack-SL contains essential equipment necessary to perform testing and evaluation of the SensL SPM detectors for use in radiation detection applications. A variety of SPM detectors and scintillation crystals have been provided, along with the necessary accessories, to give the widest scope for evaluation. The ScintPack-SL is suitable for demonstration of the SPM's capabilities, evaluation of the SPM technology for OEM or research applications, and educational purposes.



Overview

SensL MicroSL detectors are based on the silicon photomultiplier concept and form a range of high gain, single-photon sensitive, visible light sensors. They have performance characteristics similar to a conventional vacuum PMT, whilst benefiting from the practical advantages of solid-state technology: low operating voltage, robustness, compactness, insensitivity to magnetic fields and light over-exposure, and low cost.

The MicroSL is a family of detectors that are available in a variety of miniature packages to suit a wide range of applications. The 3mm detectors contained in the ScintPack-SL come in two variants that represent different performance trade-offs, as determined by the 'microcell size'. The performance of each detector is summarized in Table 2. More information is available at www.sensl.com.

The MicroSL detector is mounted in a ceramic package with epoxy fill and has been specifically designed to facilitate efficient coupling to scintillators. The epoxy is highly transparent, flat and flush with the top of package and fully protects the silicon and wire bond connections. The maximum distance between the top of the epoxy and the detector's sensitive surface is $<250\mu\text{m}$. This maximizes the light coupling from scintillator to the SPM.

CONTENTS

- MicroSL-30035-X13 (9mm², 35 μm cell SPM)
- MicroSL-30020-X13 (9mm², 20 μm cell SPM)
- MicroSL-60035-X13 (36mm², 35 μm cell SPM)
- Micro-EVB (preamplifier and power supply boards)
- 5mL optical grease (BC-630)
- 3 x 3 x 15mm³ BGO (ESR covered on 5 sides)
- 3 x 3 x 15mm³ LYSO (ESR covered on 5 sides)
- 3 x 3 x 15mm³ CsI(Tl) (white epoxy covered on 5 sides)

- 6 x 6 x 15mm³ CsI(Tl) (white epoxy covered on 5 sides)
- CD with all product datasheets, user manuals and measurement instructions
- Mains adapter cable
- Storage case

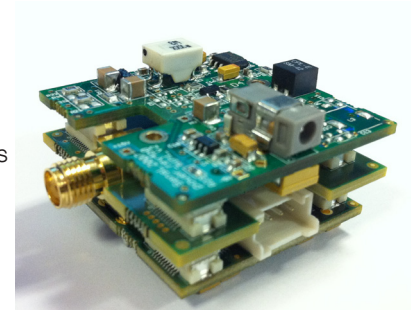
ADDITIONAL HARDWARE REQUIRED

- Oscilloscope and/or multichannel analyzer
- Multimeter
- Radioactive sources

Content Details

MICRO-EVB

The Micro-EVB preamplifier and power supply module provides a simple 'plug and play' solution for use with SensL's MicroSL detectors, eliminating the need for separate bench-top supplies and other electronics. It is comprised of three boards: a preamplifier board that interfaces with the detector and provides signal amplification, a power supply board that, via a mains adapter, provides the detector bias and power for the preamp, and a shield board between the two to prevent interference. Together these three boards allow the user to work with the MicroSL SPMs with minimal additional support equipment.



SPM GENERAL SPECIFICATIONS

Table 1

Parameter	Value
Spectral Range	400 - 1000 nm
Peak Spectral Response	500 nm
Breakdown Voltage (V_{br})	27.5V
Operating Voltage (V_{op})	29.5V
Recommended Max. Reverse Bias	35V
Recommended operating temperature range	0°C - +40°C
Recommended storage temperature range	-40°C - +80°C
Encapsulant material Refractive Index ²	1.569
Encapsulant material Spectral Transmission ¹	>98%

¹ At 550 - 900nm, from Epotek datasheet

² At 543nm, cured epoxy as measured by J. Va'vra, DIRC Note #140

SPM PERFORMANCE SPECIFICATIONS

Table 2

Detector Parameter @ V_{op}	SPM Type		
	30020	30035	60035
SPM pixel Active Area	3 x 3 mm ²		6 x 6 mm ²
Number of Microcells	10998	4774	19096
Gain	1.2x10 ⁶	2.4x10 ⁶	2.4x10 ⁶
PDE	8%	14%	14%

³ The 6mm SPM is composed of four 3mm SPM die arranged in a 2x2 configuration.

SCINTILLATION CRYSTALS

Three types of scintillation crystal are provided with the ScintPack-SL: BGO, LYSO(Ce) and CsI(Tl) and are sized to match the SPM detectors included. Each crystal has all sides polished, and is then coated on 5 sides with a material that acts as a reflector for maximizing the light output to the detector. One of the small crystal faces is left open to couple to the SPM. The properties of the three scintillator materials are summarized below in Table 3 below, along with the sizes and reflector types used for each crystal type. The reflectors used are the result of experimental tests to give the best energy resolution for that material.

Table 3

Scintillator Property	BGO	LYSO(Ce)	CsI(Tl)
Light Yield (photons/MeV)	8,200	27,000	52,000
Density (g/cc)	7.13	7.4	4.51
Decay time (ns)	300	40	1000
Peak Emission (nm)	480	420	560
Radiation Length (mm)	1.13	1.14	1.85
Refractive Index	2.15	1.82	1.78
Dimensions of Crystal(s) included in the ScintPack-SL	3 x 3 x 15 mm ³	3 x 3 x 15 mm ³	3 x 3 x 15 mm ³ 6 x 6 x 15 mm ³
Reflector used on Crystal in ScintPack-SL	ESR ⁴	ESR ⁴	White epoxy

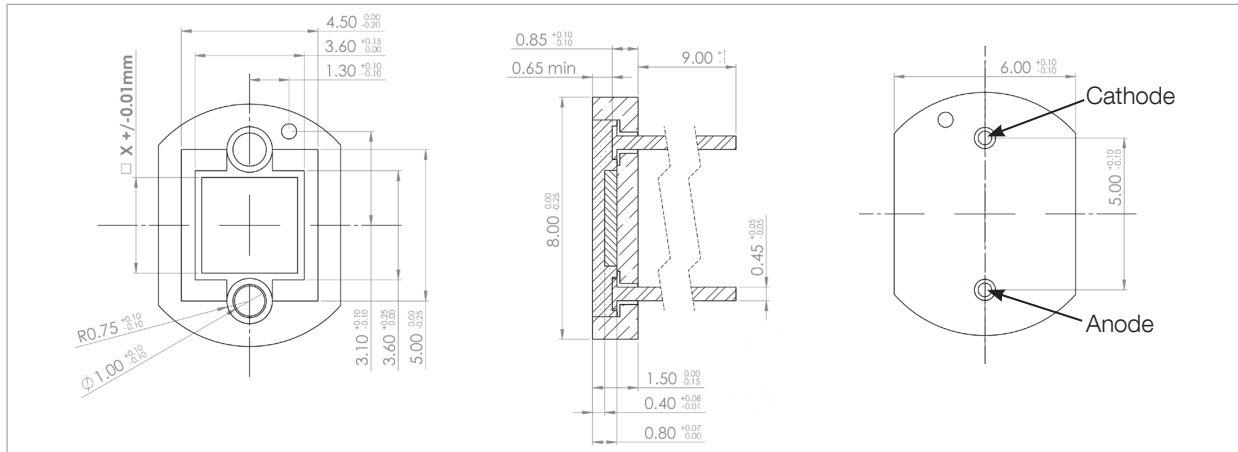
⁴ Enhanced Specular Reflector film

OPTICAL GREASE

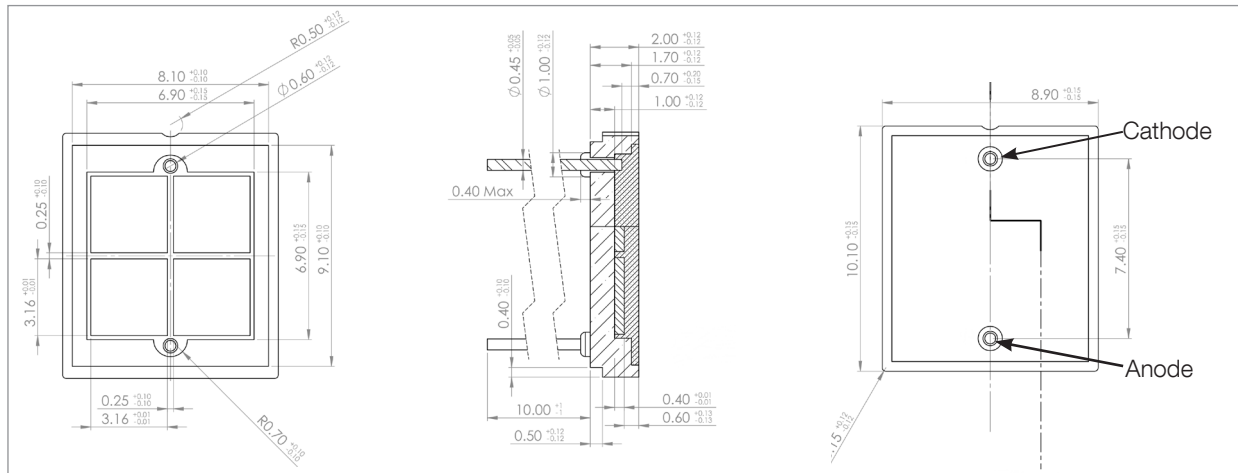
The optical grease is a clear, colorless, silicone coupling compound which features excellent light transmission and low evaporation and blend at 25°C. It has a specific gravity of 1.06 and an Index of Refraction of 1.465. The optical grease is supplied in a sealed plastic syringe for ease of storage and application. When coupling crystals to the detector surface, a small amount of the optical grease can be used to provide a better index matching medium for optimum light transfer.

SCHEMATICS (ALL DIMENSIONS IN MM)

MicroSL 30000 Series X13 Ceramic Package



MicroSL 60000 Series X13 Ceramic Package



ORDERING INFORMATION

Product Code	Description
ScintPack-SL	SPM Scintillator Demo Pack containing the following: MicroSL-30035-X13, MicroSL-30020-X13, MicroSL-60035-X13, Optical grease, BGO, LYSO and CsI(Tl) crystals, Micro-EVB, Mains adapter cable, CD, Storage case