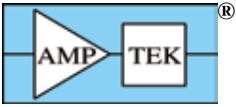


This is the true State-of-the-Art!



Ultra High Performance Silicon Drift Detector

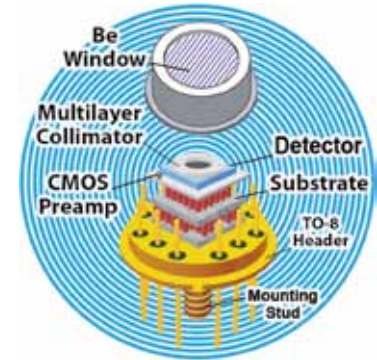
FAST SDD®

Amptek recently brought silicon wafer manufacturing in-house and improved the process. The result is a detector with lower noise, lower leakage current, better charge collection, and uniformity from detector to detector. This makes it the best performing silicon drift detector available and the true state-of-the-art.

The FAST SDD® represents Amptek's highest performance silicon drift detector (SDD), capable of count rates over 1,000,000 CPS (counts per second) while maintaining excellent resolution. The FAST SDD® is also available with our C-Series (Si₃N₄) low energy windows for soft x-ray analysis.

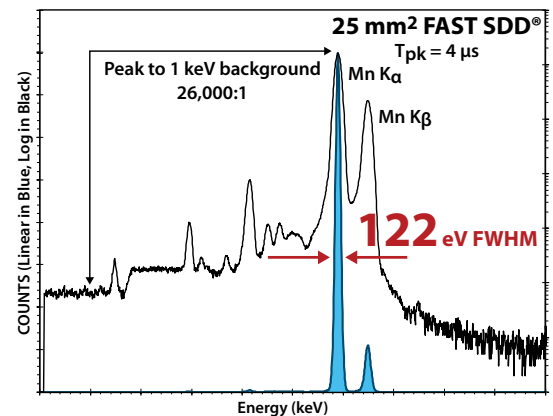
Features

- 25 mm² active area collimated to 17 mm²
- Also available 70 mm² collimated to 50 mm²
- 122 eV FWHM resolution at 5.9 keV
- Count rates > 1,000,000 CPS
- High peak-to-background ratio – 26,000/1
- Preamplifier Output Rise Time <35 ns
- Windows: Be (0.5 mil) 12.5 μm, or C Series (Si₃N₄)
- Radiation hard
- Detector thickness 500 μm
- TO-8 Package
- Cooling ΔT > 85 K
- Multilayer Collimator



Applications

- Ultra-fast benchtop and handheld XRF analyzers
- Scanning/mapping of samples in an SEM as part of an EDS system
- On-line process control
- X-Ray Sorting Machines
- OEM



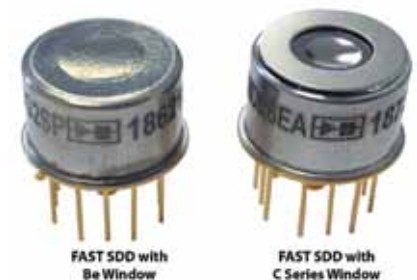
The True State-of-the-Art

- Lower noise → Better resolution down to 122 eV FWHM
- Lower leakage current → Higher temperature operation (save battery life)
- Better charge collection → Better photopeak shape (no tailing)
- Quality → Detectors have consistent performance allowing for easier calibrations

OEM's #1 Choice

Overview

Unlike our conventional SDDs which use a junction gate field-effect transistor (JFET) inside the hermetically sealed TO-8 package, along with an external preamplifier, the FAST SDD uses a complementary metal-oxide-semiconductor (CMOS) preamplifier inside the TO-8 package, and replaces the JFET with a metal-oxide-semiconductor field-effect transistor (MOSFET). This significantly reduces capacitance, providing much lower series noise and yielding improved resolution at very short peaking times. The FAST SDD® uses the same detector but with a preamplifier giving lower noise at short peaking times. Improved (lower) resolution enables isolation/separation of fluorescent X-rays with close energy values where peaks would otherwise overlap, permitting users better identification all of the elements in their sample(s). Short peaking times also yield significant improvements in count rates; more counts provide better statistics.




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AMETEK®
MATERIALS ANALYSIS DIVISION

Specifications

General	
Detector Type	Silicon Drift Detector (SDD) with CMOS preamplifier
Detector Size	25 mm ² - collimated to 17 mm ² Also available 70 mm ² - collimated to 50 mm ²
Silicon Thickness	500 μm
Collimator	Internal Multilayer Collimator (ML)
Energy Resolution @ 5.9 keV (⁵⁵ Fe)	122 - 129 eV FWHM at 4 μs peaking time (guaranteed)
Peak to Background	20000:1 (ratio of counts from 5.9 keV to 1 keV) (typical)
Detector Window Options	Beryllium (Be): 0.5 mil (12.5 μm or 0.3 mil (8 μm) C Series (Si ₃ N ₄) Low energy windows
Charge Sensitive Preamplifier	CMOS
Gain Stability	<20 ppm/°C (typical)
Size	
Detector Module	TO-8 package (0.640 in. high including pins, 0.600 in. diameter)
XR100 Box	3.00 x 1.75 x 1.13 in (7.6 x 4.4 x 2.9 cm)
X-123 Box	3.94 x 2.67 x 1.0 in (10.0 x 6.78 x 2.54 cm)
OEM	Configurations vary
Weight	
Detector Module	0.14 oz (4.1 g)
XR100 Box	4.4 oz (125 g)
X-123 Box	6.3 oz (180 g)
OEM	Configurations vary
Total Power	<2 Watt
Warranty Period	1 Year
Device Lifetime	Typical 5 to 10 years, depending on use
Operation conditions	-35°C to +80°C

Long-term Storage	10+ years in dry environment
Typical Storage & Shipping	-40°C to +85°C, 10 to 90% humidity noncondensing
	TUV Certification Certificate #: CU 72072412 02 Tested to: UL 61010-1: 2004 R7 .05 CAN/CSA-C22.2 61010-1: 2004

XR-100SDD Inputs

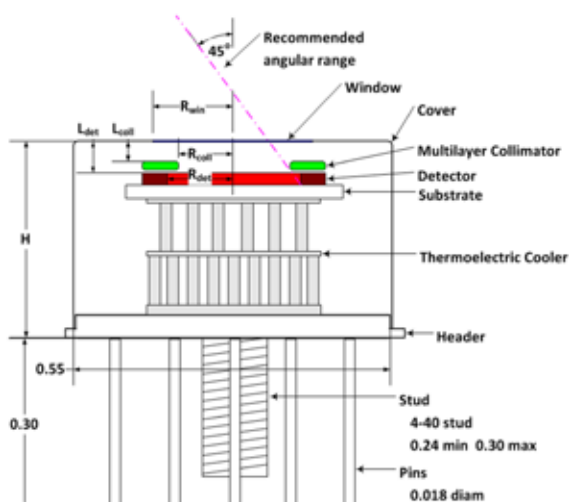
Preamp Power	XR100 configuration: ±8 V @ 15 mA with no more than 50 mV peak-to-peak noise OEM configuration (PA210/230 or X-123): ±5 V
Detector Power	-100 to -180 V @ 25 μA, very stable <0.1% variation
Cooler Power	
Current	450 mA maximum
Voltage	3.5 V maximum with <100 mV peak-to-peak noise

Note: The XR-100SDD includes its own temperature controller

Outputs

Preamplifier	
Sensitivity	3.6 mV/keV typical (may vary for different detectors)
Polarity	Positive signal output (1 kΩ max. load)
Feedback	Reset
Temperature Monitor Sensitivity	Varies with configuration When used with PX5, DP5, or X-123: direct reading in Kelvin through software.
Preamplifier Output Rise Time	<35 ns

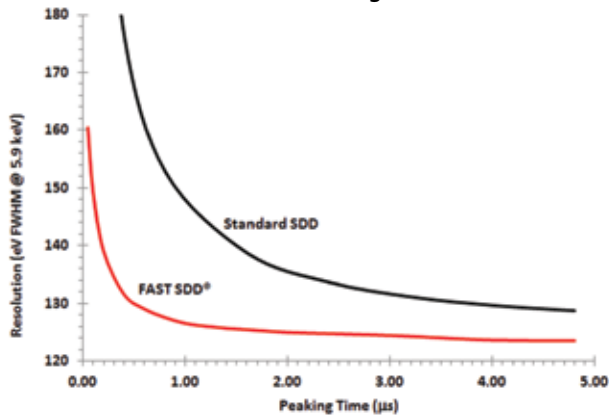
Detector Geometry



Detector Type	Area/Thickness	R _{det} (mm)	A _{det} (mm ²)	R _{coll} (mm)	A _{coll} (mm ²)	L _{coll} (mm)	L _{coll} (mm)
SDD	25 mm ² /500 μm	2.82	25.0	2.33	17.0	0.9	1.4
Si-PIN	6 mm ² /500 μm	1.38	6.0	1.19	4.4	1.0	1.7
Si-PIN	13 mm ² /500 μm	2.03	13.0	1.88	11.1	1.0	1.7
Si-PIN	25 mm ² /500 μm	2.82	25.0	2.62	21.5	1.0	1.7

Performance

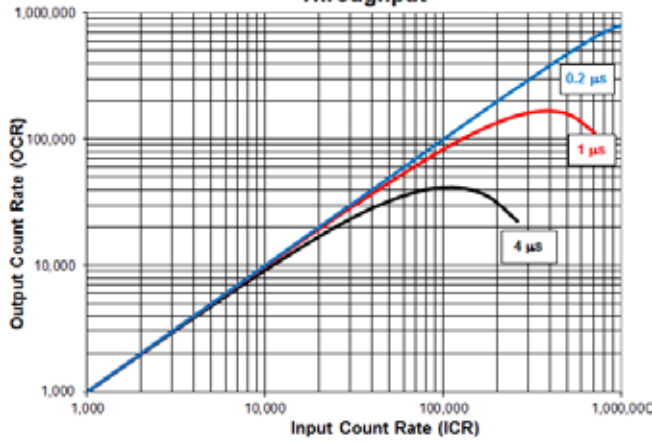
Resolution vs Peaking Time



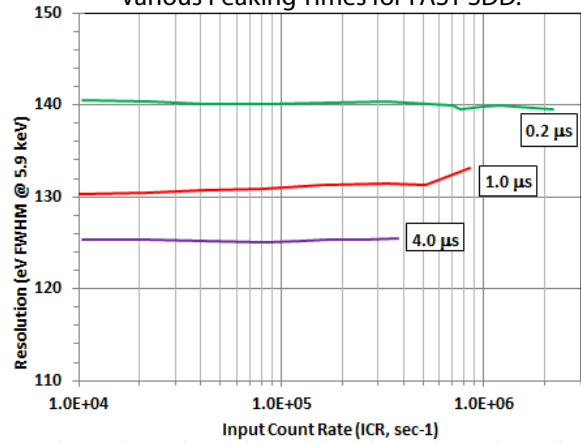
Typical Performance Characteristics

Resolution	Peaking Time
124 eV FWHM	4 μs
126 eV FWHM	1 μs
139 eV FWHM	0.2 μs
160 eV FWHM	0.05 μs

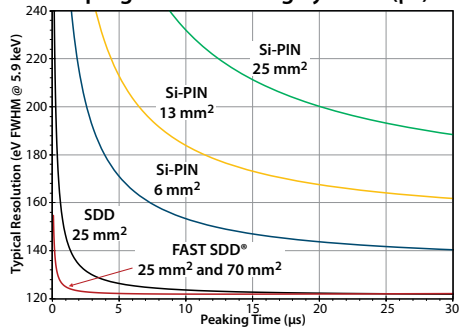
Throughput



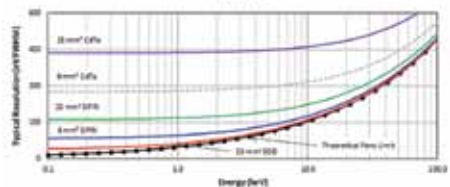
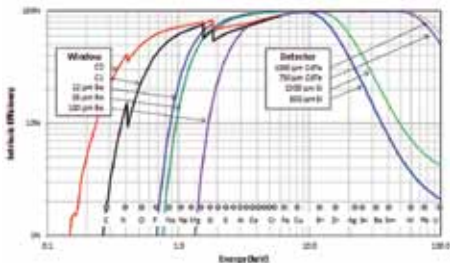
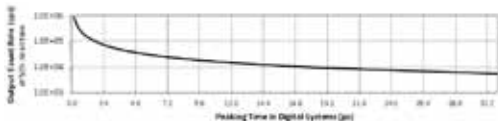
Resolution vs. Input Counts Rate (ICR) for Various Peaking Times for FAST SDD.



Shaping Time in Analog Systems (μs)

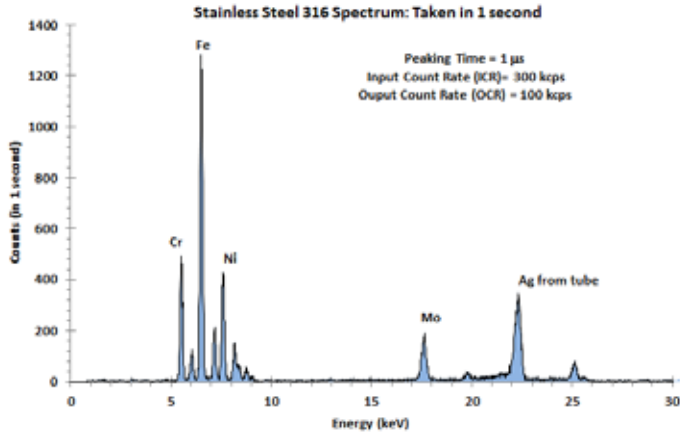


Energy Resolution and Count Rate: This plot shows how the energy resolution at 5.9 keV is related to the output count rate for Amptek's X-ray detectors, as a function of the pulse shaping time and the equivalent peaking time in a digital processor. These are typical values at full cooling (220K). For example, at a T_{peak} of 9.6 microseconds (equivalent to 4.0 microsecond pulse shaping time) the output count rate at 50% dead time is 18 kcps. This is a function only of the pulse processing so is the same for all detectors. The energy resolution for a 6 mm² Si-PIN is just under 160 eV FWHM while for a 25 mm² SDD it is 130 eV FWHM.



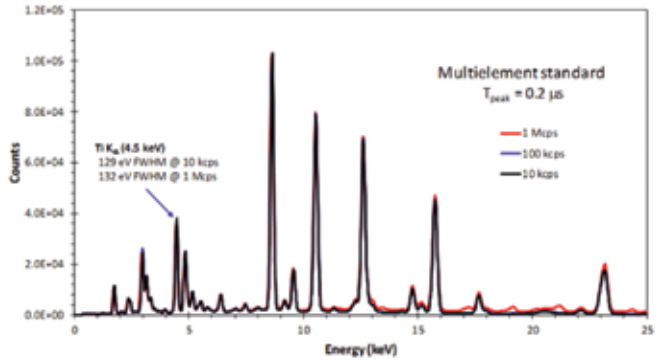
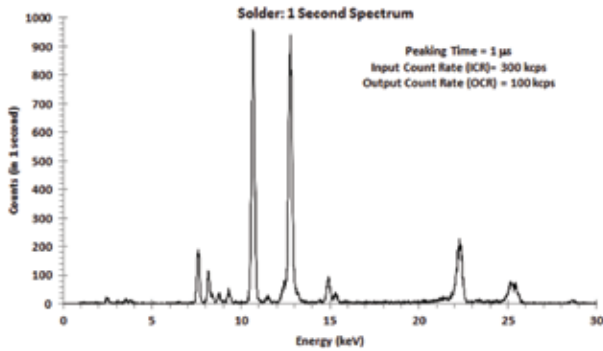
Energy resolution, efficiency, and X-ray energy: This plot shows how the intrinsic efficiency (top) and energy resolution (bottom) depend on the X-ray energy. In the bottom plot, the black curve represents "Fano broadening", the theoretical limit with a Si based detectors, arising from quantum fluctuations in the charge production process. The colored curves represent the combination of Fano broadening and intrinsic electronic noise under optimum conditions (full cooling and long peaking time). The detector selection is most important at the lowest energies because Fano broadening dominates at high enough energies. In the top plot, the efficiency at low energies is determined by transmission through the window and detector dead layer. The efficiency at high energies is determined by attenuation in the active depth of the detector. A Si detector with Be window is recommended between about 2 and 30 keV. A Si detector with a C1 or C2 window is recommended at lower energies, while a CdTe detector is best at energies above 30 keV.

Application Spectra



The below table displays the quantitative analysis of the data from the figure at left.

Element	Certified Concentration	Fast SDD® Result in 1 s
V	0.05	0.16 ± 0.28
Cr	18.45	18.32 ± 0.80
Mn	1.63	0.40 ± 0.55
Fe	64.51	65.89 ± 1.64
Co	0.10	0.00 ± 0.40
Ni	12.18	12.56 ± 0.47
Cu	0.17	0.19 ± 0.02
Mo	2.38	2.34 ± 0.08



Configurations

X-123FASTSDD®



Complete X-Ray Spectrometer Includes:
 1 Silicon Drift Detector and Preamplifier
 2 Digital Pulse Processor and MCA
 3 Power Supply

OEM FASTSDD®



The FAST SDD with its preamplifier is available in several OEM configurations

XR-100FASTSDD®



X-Ray Detector and Digital Pulse Processor with MCA

FASTSDD® Vacuum Applications



Experimenter's XRF Kit with FASTSDD®

Complete XRF System Includes:
 X-123SDD Complete Spectrometer
 Mini-X USB Controlled X-Ray Tube
 XRF-FP Quantitative Analysis Software
 Test stand with shielding and sample enclosure



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