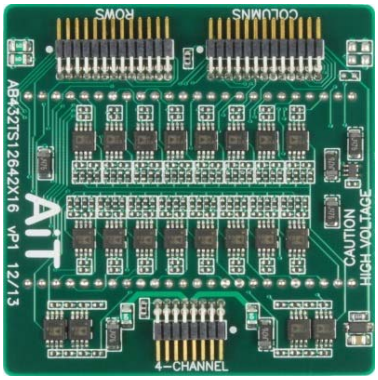
Summary

Features

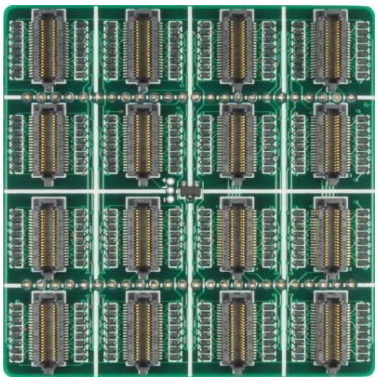
- Supports up to 16 Hamamatsu S12642-0404PB 4x4 TSV MPPC arrays for up to 16x16 3mm MPPCs
- 4-channel readout or 32-channel readout
    - Four encoded position signals for event centroid calculations: X+, X-, Y+, Y-
    - 16 row signals and 16 column signals
- Patent-pending diode-coupled readout, superior to traditional resistive readout
    - Improved spatial uniformity
    - Faster rise time
    - Reduced image noise
- < 10ns rise time
- DC-coupled signal path
- Low power consumption
- Precision temperature sensor

Mechanical

- Installs within the perimeter of the SiPM array for 4-sided tileable installation
- 0.050” pitch signal connectors use low-profile micro IDC cable assemblies for versatile placement



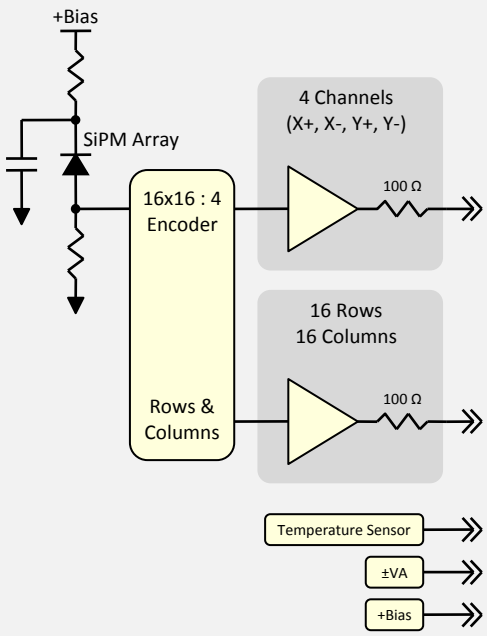
(Top View)



SiPM arrays not included

(Bottom View)

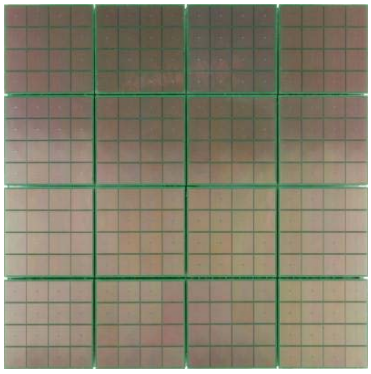
4+32 Channel 16x16 Base



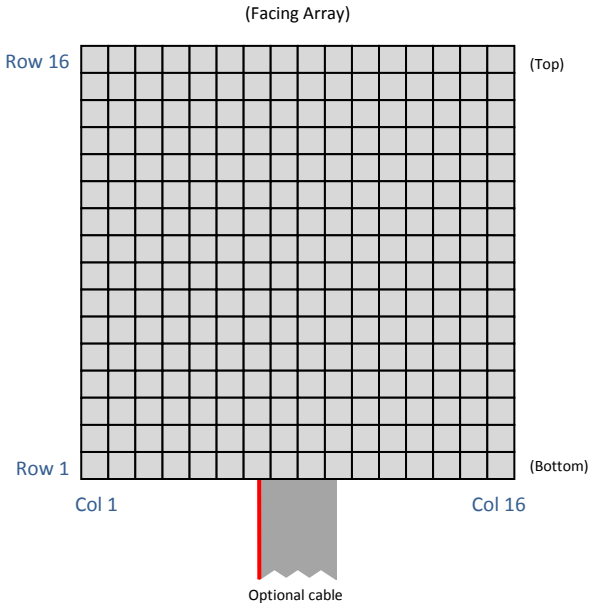
4-Channel Specifications

Position Signal Output	
Channels	4
Encoding	Charge division multiplexed to 4 output channels: X+, X-, Y+, Y-
Encoder gain	375Ω transimpedance gain (high-Z load)
Rise time	< 10 ns
Output voltage	0 → ±1V (100Ω load)
Output impedance	100Ω
Output current	50mA max.
Temperature Sensor	
Output voltage	500mV + 10mV per °C
Output current	10mA
Output impedance	100Ω
Accuracy	±0.5°C
Bias Voltage	+67.4V typ. (refer to manufacturer's data)
Over-voltage clamp	82V Zener diode
Amplifier Voltage (±VA)	±2.8V typ.; ±5V max.
Current	±65mA typ. (Iq, no signal, no load)
Signal Connector	Right angle 16-pin 2-row header 0.050" pin pitch
Mating assembly	Samtec FFSD-08-D-XX.XX-01-N (XX.XX = length in inches)

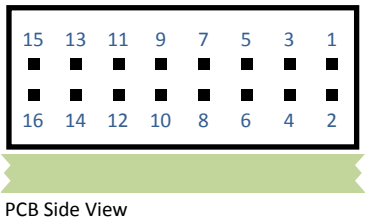
S12642-0404PB 4x4 Arrangement



Array Channel Map



Signal Connector



PCB Side View

Pin	Function	Pin	Function
1	Temperature	2	GND
3	X-	4	GND
5	X+	6	GND
7	-VA	8	GND
9	+VA	10	GND
11	Y-	12	GND
13	Y+	14	GND
15	+Bias	16	GND

32-Channel Specifications

Position Signal Output

Channels	32
Encoding	16 rows & 16 columns
Encoder gain	750Ω transimpedance gain (high-Z load)
Rise time	< 10 ns
Output voltage	0 → -1V (100Ω load)
Output impedance	100Ω
Output current	50mA max.

Temperature Sensor

Output voltage	500mV + 10mV per °C
Output current	10mA
Output impedance	100Ω
Accuracy	±0.5°C

Bias Voltage +67.4V typ. (refer to manufacturer's data)

Over-voltage clamp	82V Zener diode
NOTE	Bias voltage is on the ROWS connector only. Bias voltage is disconnected from the COLUMNS connector.

Amplifier Voltage (±VA) ±2.8V typ.; ±5V max.

Current	±65mA typ. (Iq, no signal, no load)

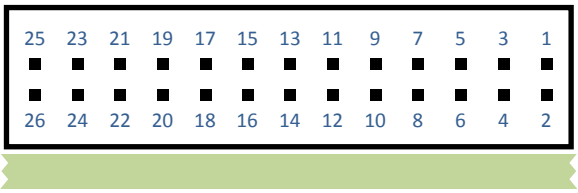
Signal Connectors (2) Right angle 26-pin 2-row header 0.050" pin pitch

Mating assembly	Samtec FFSD-13-D-XX.XX-01-N (XX.XX = length in inches)

CAUTION

Connect either the 4-channel connector or the ROWS & COLUMNS connectors, NOT BOTH. Applying bias voltage and power through the 4-channel connector and the ROWS connector at the same time may cause damage.

Signal Connectors (2)



PCB Side View

ROWS Connector

Pin	Function	Pin	Function
1	Row 1	2	Temperature
3	Row 2	4	GND
5	Row 4	6	Row 3
7	Row 5	8	GND
9	Row 6	10	Row 7
11	Row 8	12	-VA
13	Row 9	14	GND
15	Row 10	16	+VA
17	Row 12	18	Row 11
19	Row 13	20	GND
21	Row 14	22	Row 15
23	Row 16	24	GND
25	+Bias	26	GND

COLUMNS Connector

Pin	Function	Pin	Function
1	Column 1	2	Temperature
3	Column 2	4	GND
5	Column 4	6	Column 3
7	Column 5	8	GND
9	Column 6	10	Column 7
11	Column 8	12	no connect
13	Column 9	14	GND
15	Column 10	16	no connect
17	Column 12	18	Column 11
19	Column 13	20	GND
21	Column 14	22	Column 15
23	Column 16	24	GND
25	no connect	26	GND

4-Channel Position Encoder

Row & Column Encoder Weighs

Row# or Col# (for X- or Y-)	Row# or Col# (for X+ or Y+)	Fraction (ideal)	Fraction (actual)	% Error	Notes
1	16	0.0625	0.0625	0.00 %	Sum of X- and X+ fractions or Y- and Y+ fractions = **1.0625** Independent of signal position
2	15	0.1250	0.1250	0.00 %	
3	14	0.1875	0.1861	-0.75 %	
4	13	0.2500	0.2483	-0.68 %	
5	12	0.3125	0.3158	1.06 %	
6	11	0.3750	0.3731	-0.51 %	
7	10	0.4375	0.4412	0.85 %	
8	9	0.5000	0.5000	0.00 %	
9	8	0.5625	0.5618	-0.12 %	
10	7	0.6250	0.6250	0.00 %	
11	6	0.6875	0.6818	-0.83 %	
12	5	0.7500	0.7500	0.00 %	
13	4	0.8125	0.8021	-1.28 %	
14	3	0.8750	0.8876	1.44 %	
15	2	0.9375	0.9375	0.00 %	
16	1	1.0000	1.0000	0.00 %	

Note: Errors exclude 1% component tolerances

Output Signals

X- = (SiPM signal) * (encoder gain) * (X- fraction)
X+ = (SiPM signal) * (encoder gain) * (X+ fraction)
Y- = (SiPM signal) * (encoder gain) * (Y- fraction)
Y+ = (SiPM signal) * (encoder gain) * (Y+ fraction)

Typical event position calculation:

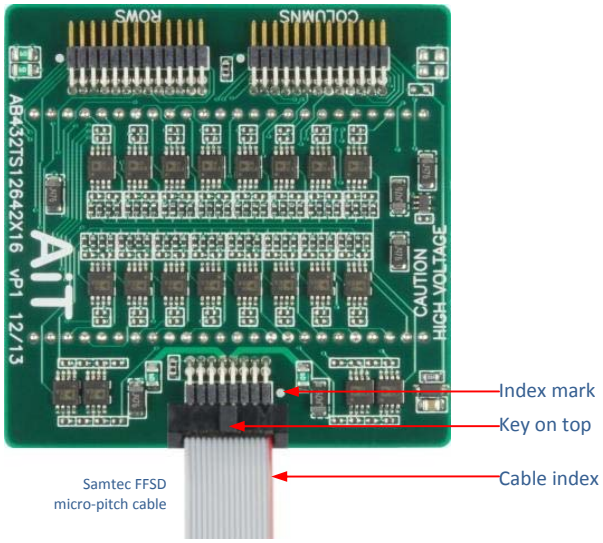
X column = (X+ - X-) / (X+ + X-)
Y row = (Y+ - Y-) / (Y+ + Y-)

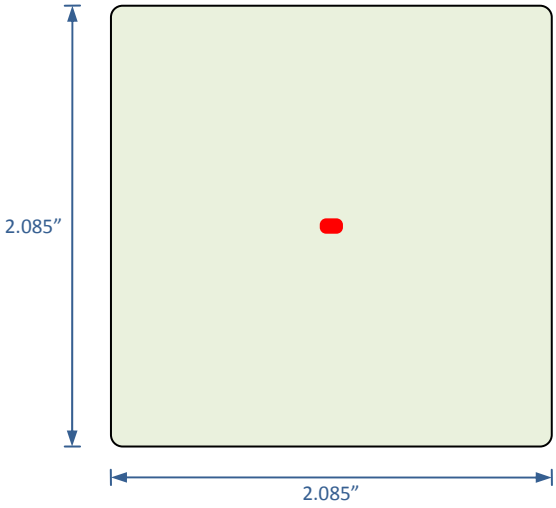
Example

SiPM signal at column=4, row=3 (excluding encoder gain)			
X- = (Col4 signal) * 0.2483	**X+** = (Col4 signal) * 0.8021	**Y-** = (Row3 signal) * 0.1861	**Y+** = (Row3 signal) * 0.8876

Mechanical

Top View

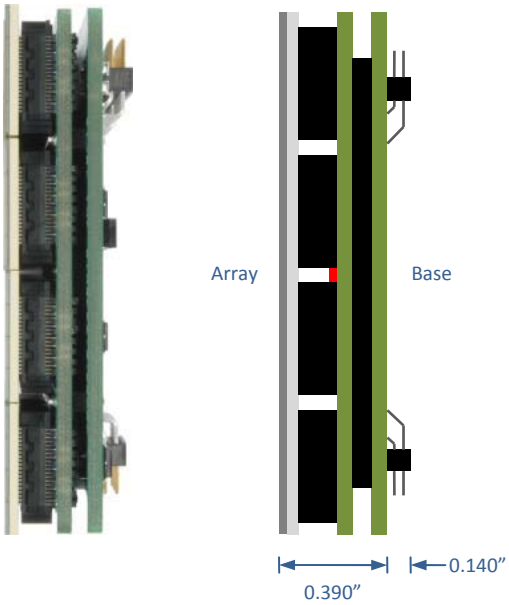




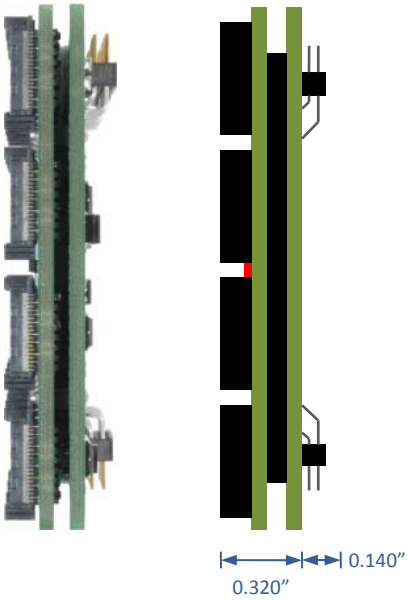
Approximate location of temperature sensor on bottom side of PCB

Measurement tolerance: ±0.020”

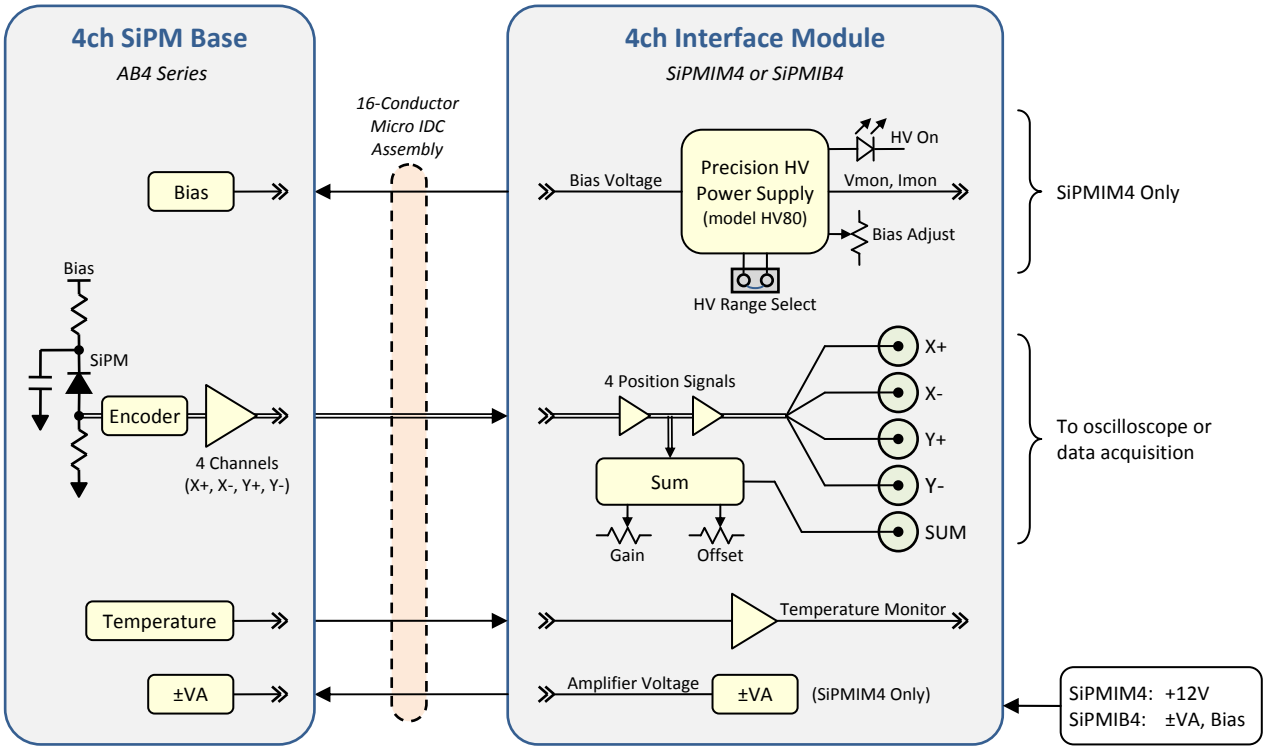
Side View, Base Attached to Array



Side View, Base Only



AB4 Series 4-Channel SiPM Evaluation System



Summary

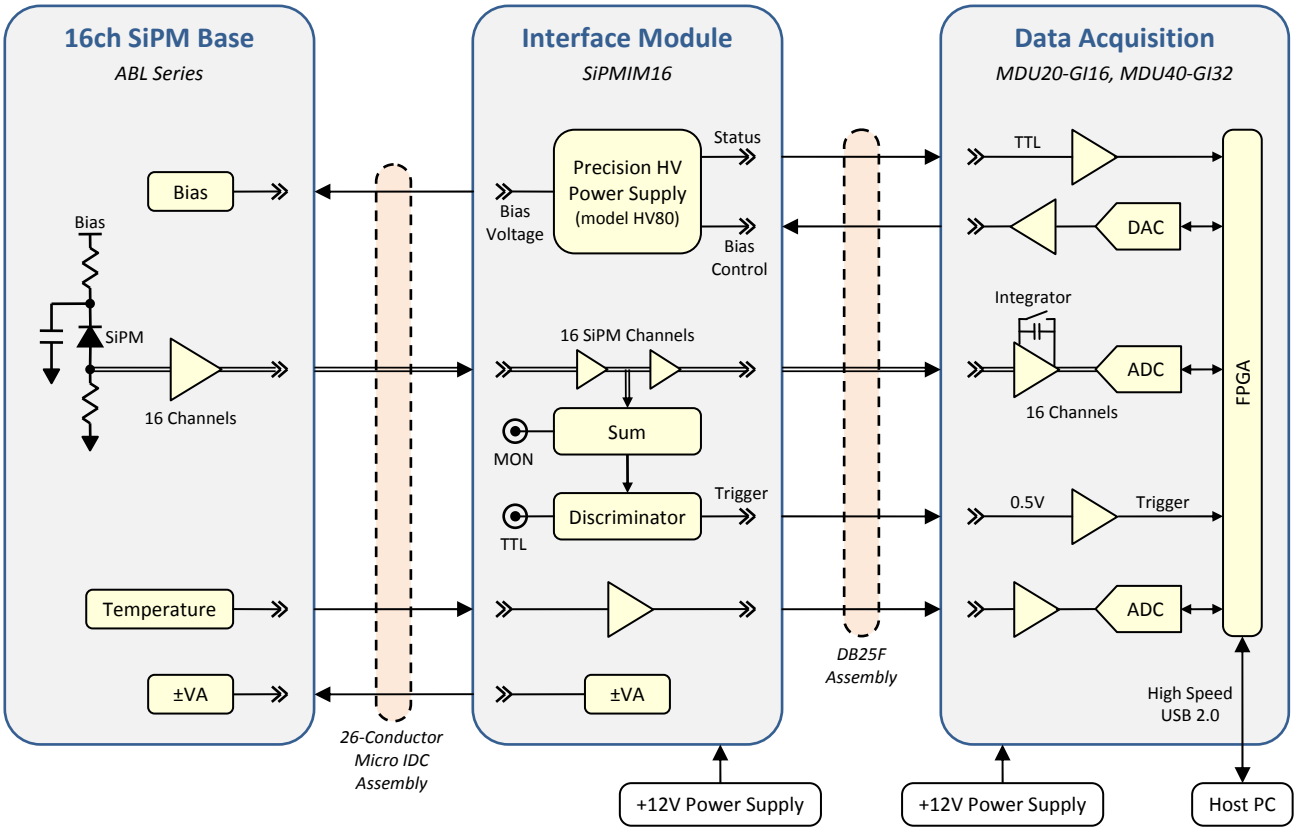
A 4-channel SiPM array evaluation system consists of an AB4 series 4-channel SiPM Base plus a SiPMIM4 (“IM4”) Interface Module or SiPMIB4 (“IB4”) Interface Board. The AB4 connects to the IM4 or IB4 through a micro-pitch ribbon cable that permits versatile placement of the Base.

The IM4 and IB4 buffers four SiPM position signals and forms an analog sum of all SiPM position signals. Position signals and sum are provided on five BNC receptacles or optional LEMO EP.00 coaxial receptacles for use with an oscilloscope or external data acquisition. The sum may be used to form a trigger.

SiPMIM4 and SiPMIB4 Differences

The IM4 is provided in an aluminum enclosure and requires only an external 12V power supply to operate. It internally generates amplifier voltages and bias voltage required by the Base. The IB4 is a low-cost unenclosed circuit board. It requires external amplifier voltages and bias voltage to be provided through screw terminals.

16-Channel SiPM Readout System



Summary

A 16-channel SiPM array readout system consists of an ABL series 16-channel SiPM Base, a SiPMIM16 ("IM16") Interface Module, and a 16/32-channel simultaneous sampling USB gated integrator model MDU20-GI16 or MDU40-GI32.

SiPM Base and Interface Module

The ABL Base connects to the IM16 through a micro-pitch ribbon cable that permits versatile placement of the Base. The IM16 powers the Base, buffers SiPM signals, and forms a trigger from the discriminated analog sum of all SiPM signals.

MDU20-GI16 and MDU40-GI32

The MDU20-GI16 has 16 simultaneous gated integrators followed by 16 simultaneous sampling ADCs. Each integrator is preceded by a 100ns analog delay to compensate for trigger latency. A 16-bit DAC controls SiPM bias and a 16-bit ADC monitors SiPM temperature. The IM16 connects to the MDU20-GI16 through a DB25F cable assembly. The MDU40-GI32 is a dual version of the MDU20-GI16 capable of controlling two IM16s.

Safety Information

WARNING – High Voltage

- High voltage may be present during operation
- High voltage stored on capacitors may be present after power is removed
- Improper handling may result in personnel injury or equipment damage

This high-voltage device must be used only by personnel trained and qualified in safe handling, installation, and operation of high-voltage equipment.

CAUTION – Electrostatic Discharge (ESD) Sensitivity

The circuit board can be damaged by electrostatic discharge. Observe precautions for handling electrostatic sensitive devices. Handle only at static-safe workstations.

High-Gain Photodetectors

High-gain photodetectors such as silicon photomultipliers may conduct damaging currents if exposed to high optical signal levels while the bias voltage is applied, or if the bias voltage exceeds the recommended operating range. These devices must be operated only in low-light conditions, and only within the manufacturer's recommended bias voltage range.

Handling and Disassembly

This product may be provided with or without a protective enclosure. Disassembled enclosure components and circuit boards may contain sharp edges. Take appropriate safety precautions while assembling or disassembling the enclosure and handling disassembled components.

Indoor Use Only

Do not operate this product in a wet/damp environment. Do not operate in an explosive atmosphere.

Use of this product, and AiT Instruments' liability related to use of this product, is further governed by AiT Instruments' standard terms and conditions of sale, which were provided upon purchase of this product.