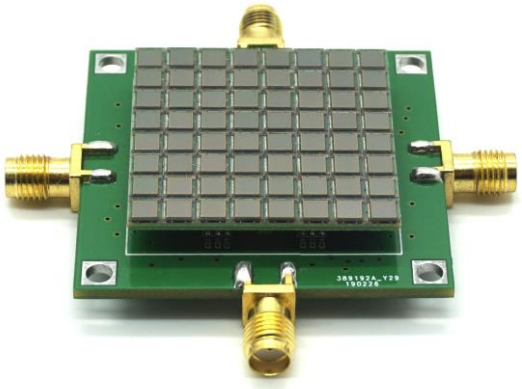
Joinbon
PASSION FOR LIGHT DETECTION

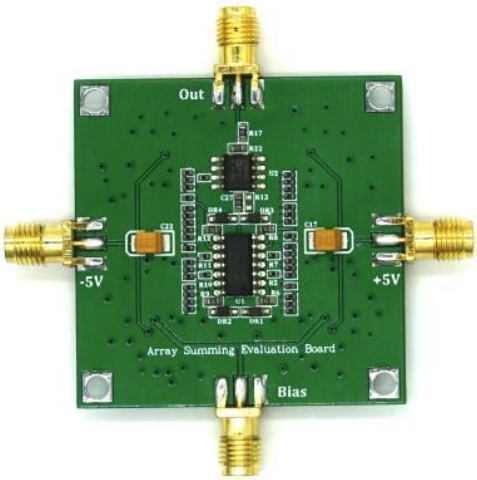
Array Sum Evaluation Board

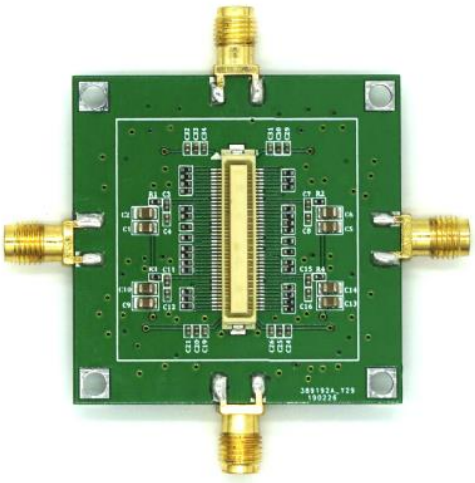
High SNR and high amplitude for multichannel summation

Introduction to Diode-Coupling Array Sum Evaluation Board

The JEVB-8×8SUM-SMA Array Sum Evaluation Board is designed for Joinbon's TN series 8×8 SiPM array with one sum for 64 channels. A multi-channel adder is formed by the amplifier to realize the summation of 64 channels of the SiPM array and form one channel output. A diode-coupling circuit is employed to provide a superior signal-to-noise ratio with a low background noise below 10mV, which makes it an ideal choice for demanding applications.

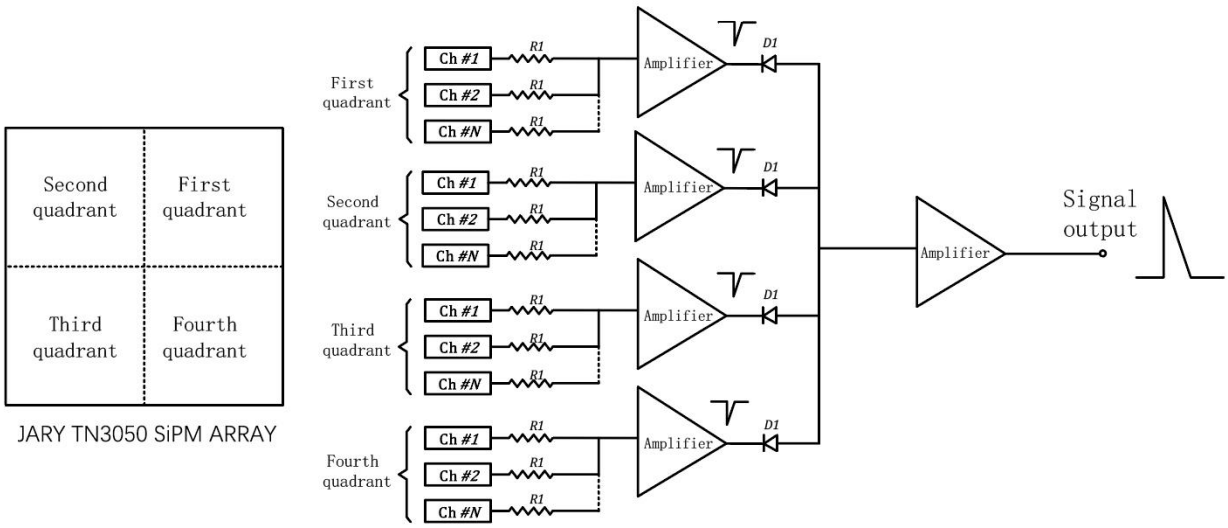






Fundamental

On the sum board, The JARY-TN3050-8×8C array is divided into four quadrants, and the SiPM in each quadrant is coupling to the inverting input of the first-stage amplifier through resistors with the same value, so that each quadrant constitutes one reversal adder, thus we get 4-channel signal from 4 quadrants. The 4-channel inverting adders is coupling to the inverting input of the second stage amplifier through four identical diodes, ultimately achieving the summing output of 64 channels. Since the JARY-TN3050-8×8C array is powered from the cathode and output a positive signal from the anode, the output of the first stage amplifier should be a negative signal, so the diode cathode should be connected to the output of the first-stage amplifier, and the anode of the four diodes are connected in parallel to the inverting input terminal of the second-stage amplifier, thus realizing the summed positive signal output. The circuit diagram of the JEVB-8×8SUM-SMA array summation evaluation board is shown in the figure below.



The diode coupling method can effectively isolate the interference between the quadrants, and since the diode needs to reach a certain voltage to turn it on, the diode coupling method can greatly reduce the noise of the summed signal. However, the diode will have a certain turn-on voltage drop, which will reduce the output amplitude of the sum signal. Choosing the right diode is critical to the performance of the diode-coupling circuit. Schottky diodes are generally recommended because Schottky diodes have a relatively low turn-on voltage drop (0.15V to 0.4V) and are fast (switching times are on the order of hundreds of ps). The diode model on this evaluation board is SDMK0340L-7-F.

General Parameters

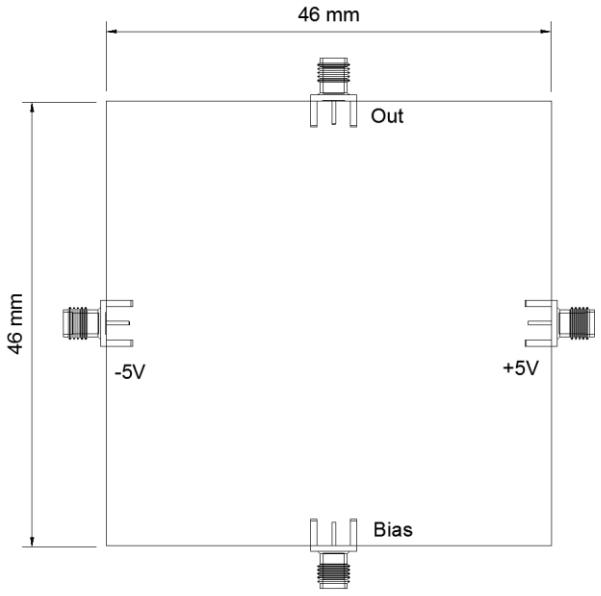
Parameter	Value
Array Model	JARY-TN3050-8×8C，JARY-TP3050-8×8C
Array Size	33.6mm×33.6mm（TN series），25.3mm×25.3mm（TP series）
Number of Channels	64
Operating Temperature Range	-45℃~+85℃
Storage Temperature Range	-45℃~+100℃
Array Operating Voltage	26~30V, typical 28V
Amplifier Operating Voltage	+5V and -5V，(Typical operating current 25mA)
Evaluation Board Size	46mm×46mm
Output Signal	1.4V (@LED 500KHz, 20ns pulse width, SiPM 29V operating voltage) [1]
	1.37V (@Cs137+NaI crystal, 662KeV, SiPM 29V operating voltage)[2]
Signal Baseline	<20mV (@LED 500KHz, 20ns pulse width, SiPM 29V operating voltage)[1]
	<10mV (@Cs137+NaI crystal, 662KeV, SiPM 29V operating voltage)[2]

[1] See typical signal diagram 1

[2] See typical signal diagram 2

Interface Diagram

The JEVB-8×8SUM-SMA Array Summing Evaluation Board is an evaluation board with four SMA connectors. One is the signal output and the rest three are the power supply. The interface diagram is as follows:



The specific description of each SMA connector is as follows:

SMA Interface (inner hole type) Assignment	
SMA ID	Description
Bias	SiPM's bias voltage input port (between +26V and +30V)
+5V	5V positive voltage (positive voltage input port of the amplifier)
-5V	5V negative voltage (negative voltage input port of the amplifier)
Out	Summed signal output port

Typical Signal

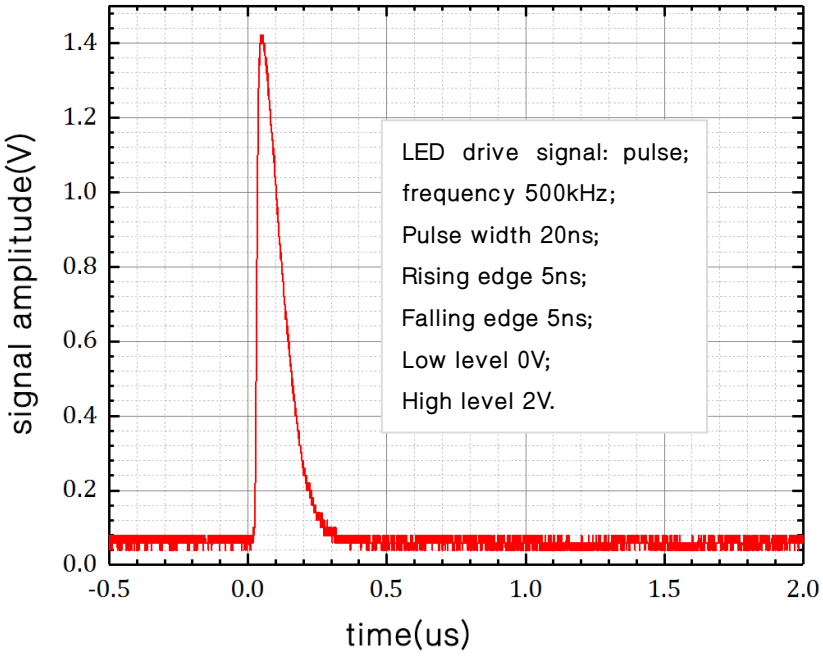


Figure 1 Source LED (500kHz, 20ns pulse width), SiPM bias voltage of 29V

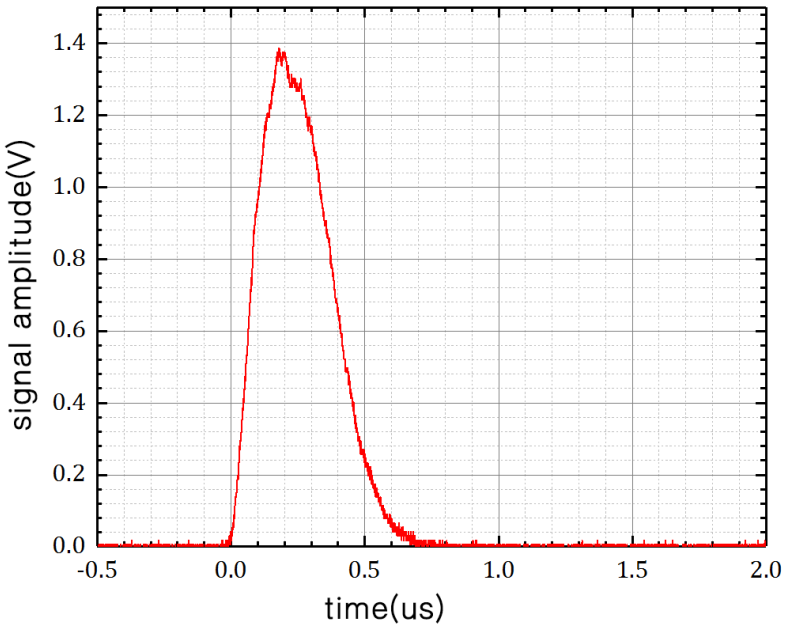


Figure 2 Radiation source Cs137@662KeV, NaI crystal (4cm in diameter, 4cm high), response signal at SiPM bias voltage of 29V

Way of Use

The JEVB-8×8SUM-SMA Array Summing Evaluation Board is extremely easy to use:

①Assemble the JARY-TN3050-8×8C array onto the evaluation board and gently press it in vertical to ensure good contact between the array and the evaluation board.

②Connect the "+5V" connector to the DC power supply with positive output voltage, and set the DC power supply output voltage to "+5V";

③Connect the "-5V" connector to the DC power supply with negative output voltage, and set the DC power supply output voltage to "-5V";

④Connect the "Bias" connector to the SiPM DC bias supply with positive output voltage, and set the output voltage of the SiPM DC bias supply to be between +26V and +30V.

⑤Connect the "Out" connector to the input interface of the test instrument, such as the oscilloscope sampling channel interface (requires SMA to BNC cable);

⑥ Turn on the "+5V", "-5V" DC power supply and the SiPM DC bias power supply.

■ Note:

①When connecting the "Bias", "+5V" and "-5V" connectors of the JEVB-8×8SUM-SMA Array Sum Evaluation Board, do not turn on the power to avoid electric shock.

②When both the "+5V" and "-5V" connectors are connected to the DC power supply, the output current of the corresponding DC power supply is about 25 mA, which can be used to determine whether the amplifier is operating normally.

③Before turning on the DC power supply, set the output current limit of the DC power supply (such as current limiting 0.1A) to avoid the amplifier or circuit failure caused by excessive current.

④When the power supply voltage of the amplifier is greater than 12V, it will cause permanent damage to the amplifier. Please check whether the SiPM bias terminal and the amplifier power supply terminal are connected correctly or not to avoid damage to the amplifier and circuit before turning on the power.

⑤If you need to perform additional replacement components, wire bonding, etc. on the evaluation board, please consult the sales or after-sales personnel to avoid damage to the evaluation board.

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