

eMUSIC08

enhanced Multiple Use SiPM IC for photodetector readout

Design overview

8 channel SiPM anode readout ASIC based on a novel low input impedance current conveyor¹. Ready to operate with different sensors at the same time.

- Inputs: 8 channel and SPI port communication.
- Three operation modes: (1) SiPM pixel summing in differential mode; (2) individual analog single ended (SE) channels and; (3) digital outputs (one A/D is selectable per channel).
- Additional Outputs: A trigger pulse performing an OR between any binary signal.
- \bullet Developed using AMS 0.35 μ m SiGe BiCMOS technology. Available in a 64-QFN 9x9 mm package.

An evaluation board is available to check full functionality and performance.

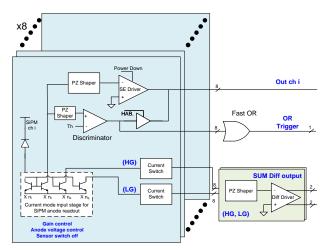


Fig. 1: Functional block diagram

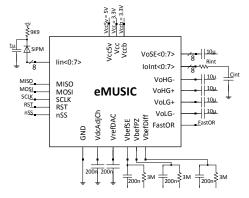


Fig. 2 SiPM application circuit.

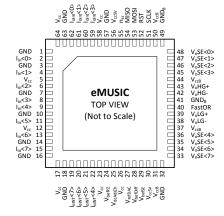


Fig. 3: Pin configuration

Functional highlights

- On-chip anode voltage control allowing equalization of over-voltage of each SiPM (adjustable range around 1V).
- It can operate with different SiPM signals:
 - Tunable Pole Zero Cancellation (PZ) of the SiPM recovery time constant (up to 100ns).
- PZ cancellation can be used or bypassed in any operation mode.
- Every block and channel can be disabled (power down mode) and several parameters can be tuned using the SPI block.

Applications

- Application requiring high speed ultrasensitive (single photon) photo-sensors with large detection area (≥ 1 cm2) like in:
 - Medical imaging (PET, SPECT, γ-camera)
 - Spectrophotometers, fluorescence microscopy, telescopes, radiation detection, scientific installations (synchrotron, particle accelerators).
- PMT substitution by SiPM arrays (area summation).
- eMUSIC is being used in:
 - Read out of SiPM's for Cherenkov Telescope Array (CTA) cameras.
 - Beam loss monitor prototype to use in various facilities.
 - ToF timing detector in the SHIP experiment at CERN.

Specification

- Adder with configurable Zt gains:
 - High Gain (HG): $690\Omega//90\Omega$.
 - Low Gain (LG): $315\Omega//45\Omega$.
- Dual Zt gain for SE:
 - HG: 480Ω.
 - LG: 180Ω.
- Sum: linear response in dynamic range.
- SE: linear first half dynamic range and non-linear second half.

- Dynamic Range:
 - Sum output 1.25V.
 - SE high impedance load: 2V.
 - SE low impedance load (50 Ω): 1V.
- Output pulse FWHM < 10ns (using PZ).
- 500MHz bandwidth for the adder and 150MHz for the individual channels.
- Op. Temp. range: -40°C to +125°C (for lower temp. ask for further info.)

- Noise (ENC)@10ns I.T. and 1nF cap.
 - Sum HG: 1.25e5 electrons for channel and 4e5 electrons for 7.
 - SE HG: 4e5 electrons.
- 32Ω input impedance in the signal BW.
- Jitter < 100ps rms (binary channel).
- Power: 424mW@3.3V (all ch. ON).
- Input range: 27.8mA (Sum), 11mA (SE).

Contact Information

¹ Patented.