



# Optical Front End ASIC

## SF107

### BRIEF DESCRIPTION

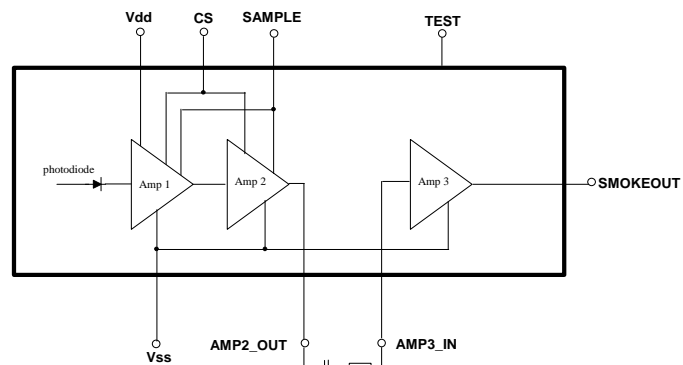
Designed specifically for the optical smoke detector market, the Semefab SF107 is a high performance, low cost, low noise and low power interface between an optical smoke detector chamber and a microprocessor. With an integrated low capacitance photodiode and low noise amplifiers, the SF107 is synchronised with the IR pulse to minimise noise and cancel offset.



### FEATURES

- Output voltage proportional to chamber smoke level
- 8 pin SOIC(N) with glass aperture.
- Supply voltage range 3.0 – 5.5V
- 10nA typical quiescent current
- 110µA typical active current
- 7V/µW/cm<sup>2</sup> photo sensitivity
- High rejection of ambient light
- Possibility to eliminate lenses from sensors due to the high signal to noise ratio
- Very low temperature coefficient over the operating temperature range
- Low impedance, high amplitude output removes the need for conformal coating or guard tracks on the PCB
- High immunity to impressed EMC
- Bias Voltage on output to improve accuracy of low smoke levels

### BLOCK DIAGRAM





SF107

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### GENERAL DESCRIPTION

The SF107 ASIC is manufactured using Semefab's OPTO-CMOS process. It is designed specifically to provide a robust, low power, and very easy to use interface between a microprocessor and the smoke chamber in an optical smoke detector sensor unit.

The ASIC contains a 1.0mm<sup>2</sup> PIN photodiode. The photodiode has low self capacitance which allows a rapid response to light and assists the design of the low noise amplification and integration circuit.

The SF107 includes internal circuits to cancel ambient light, amplifier input offset voltage, and noise.

Only two control signals are required between the ASIC and the micro. Chip Select (CS) switches the chip between standby mode and active mode. When the CS input is logic 1, the chip is active. When the CS input is logic 0, the chip is held in low power quiescent state. A logic 1 at the SAMPLE input during the CS period enables the reading of a smoke sample. The SAMPLE time period must coincide with the switching of the IR LED into the smoke chamber. Depending on the application and the system current requirements, a typical timing cycle could be CS enabled for 10ms at 2-second intervals.

### PIN DESCRIPTION

PIN	NAME	FUNCTION
1	TEST	This pin is allocated for testing. For normal use connect it to pin 2.
2	CS	Control input from the micro. The device is active when CS is at logic
3	SAMPLE	Control input from the micro. A positive pulse at this input initiates the smoke reading. The SAMPLE pulse should coincide with the pulse to the IR LED.
4	SMOKEOUT	The analogue voltage representing the smoke reading appears at this pin after the back edge of SAMPLE . A sample and hold function holds the SMOKEOUT voltage to the end of the CS pulse.
5	AMP3_IN	The input to the third amplifier. AMP2_OUT is connected externally to AMP3_IN via a 1N cap and a 10K resistor.
6	AMP2_OUT	The output of the second amplifier.
7	VSS	Negative input pin (GND). Common with the micro GND.
8	VDD	Positive power supply for the ASIC. The Vdd range is 3.0 to 5.5V. The SF107 would normally operate between the same supply rails as the microprocessor.



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**DEVICE PARAMETERS**

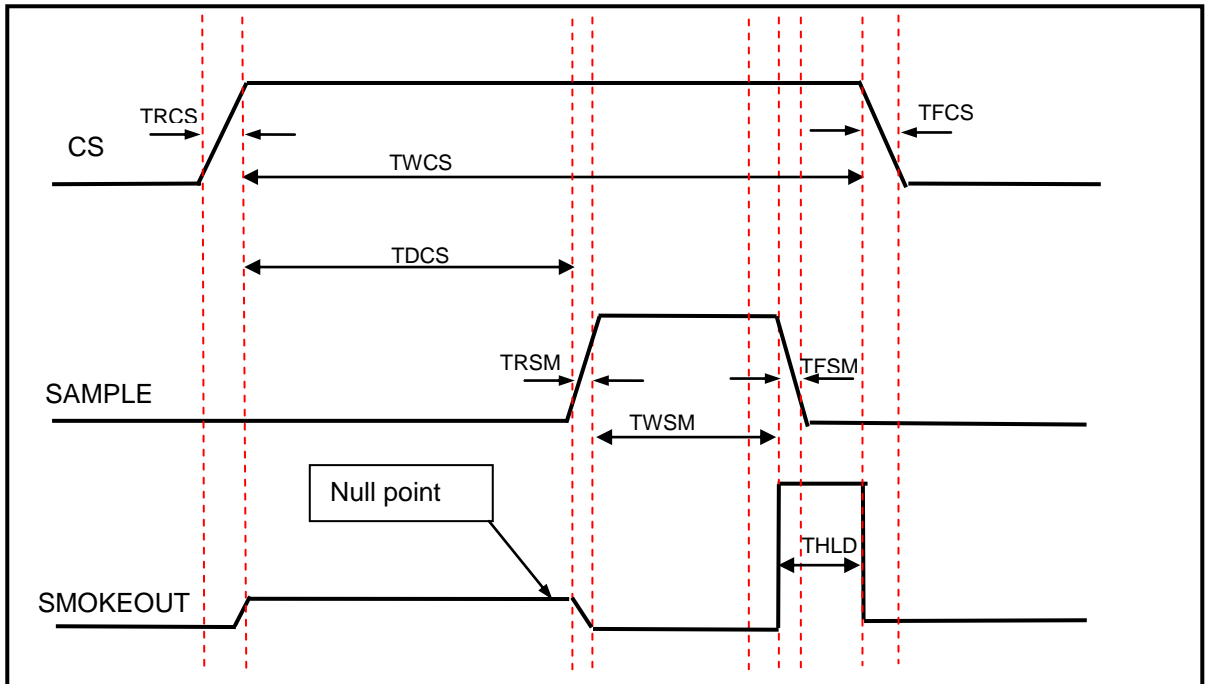
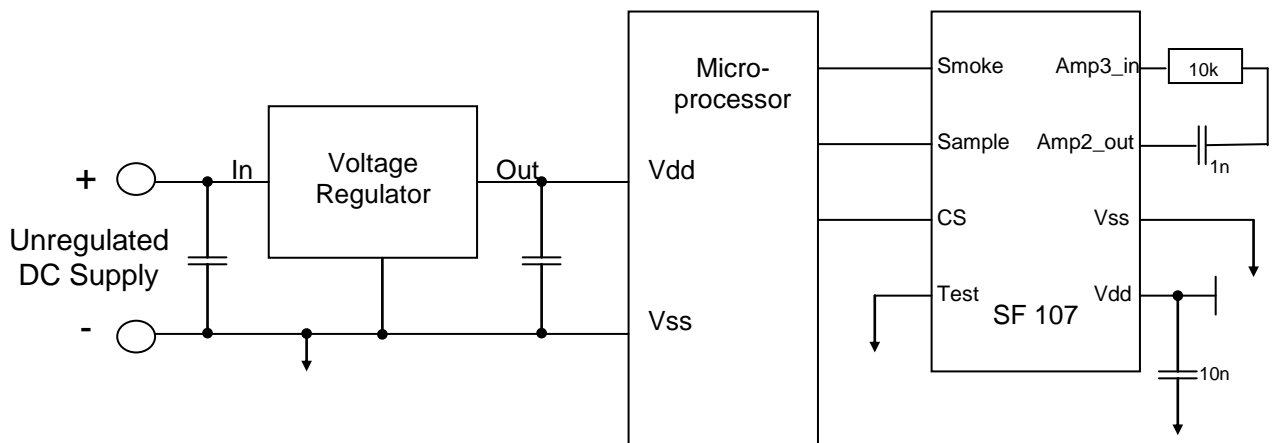
Parameter	Symbol	Min	Typical	Max	Unit
Width of CS pulse	TWCS	4.5	10		ms
Width of SAMPLE pulse	TWSM	450	500	550	μs
Rise time of CS (10% to 90%)	TRCS			10	μs
Fall time of CS (90% to 10%)	TFCS			10	μs
Rise time of SAMPLE (10% to 90%)	TRSM			10	μs
Fall time of SAMPLE	TFSM			10	μs
Delay from leading edge of CS (90%) to leading edge of SAMPLE (10%)	TDCS	4.0			ms
Hold time for falling edge of SAMPLE (10%) to falling edge of CS	THLD	300			μs
Operating voltage		3.0	3.3	5.5	Vdc
Operating temperature range		-40		+85	°C
Standby current - Cs low			0.01	1.0	μA
Operating current -Cs high			0.1	0.25	mA
SMOKEOUT voltage swing from bias				Vdd-0.3	Vdc
SMOKEOUT bias voltage (dark) (Note1)		0.05	0.15	0.25	Vdc
Photo responsivity (Note 2)		5.6	7	8.4	V/μW/cm <sup>2</sup>
Noise equivalent power density			0.5	1	nW/cm <sup>2</sup>
Logic 1 level for CS and SAMPLE		Vdd-0.4		Vdd	V
Logic 0 level for CS and SAMPLE		GND		0.4	V
Temp co. of SMOKEOUT voltage			-2000		ppm/°C
Change in responsivity with background light level of 0.06μW/cm <sup>2</sup>		-10		+10	%

Note 1. The ASIC design can be modified with a metal mask change to adjust the bias voltage.

Note 2. The ASIC design and layout permits other versions to be supplied with typical photo responsivity between 5 and 50V/μW/cm<sup>2</sup>

**TIMING DIAGRAM**

CS and Sample are active high control signals from the micro.


**TYPICAL APPLICATION CIRCUIT**




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**PRODUCT QUALIFICATION**

		Conditions
Moisture Sensitivity Level	MSL3	
High Temperature Operating Life	PASS	Temp = 85°C Vdd = 3.3V
High Temperature Storage	PASS	Temp = 125°C
Temperature Humidity Bias	PASS	Temp = 85°C Relative Humidity = 85% Vdd = 3.3V

**ORDERING INFORMATION**

Order products using the following codes :-  
SF107\_8 in an 8 pin SOIC IR (window) package

Preliminary datasheets contain specifications based on prototype analysis and are current on publication date. Semefab Ltd. may change this specification at any time without notification. Supply of products conforms to Semefab Ltd's Terms and Conditions

Semefab Ltd  
Newark Road South  
Eastfield Industrial Estate  
Glenrothes, Fife KY7 4NS  
Telephone: +44 (0) 1592 630 630  
Fax: +44 (0) 1592 775 265  
Email [sales@semefab.co.uk](mailto:sales@semefab.co.uk)  
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