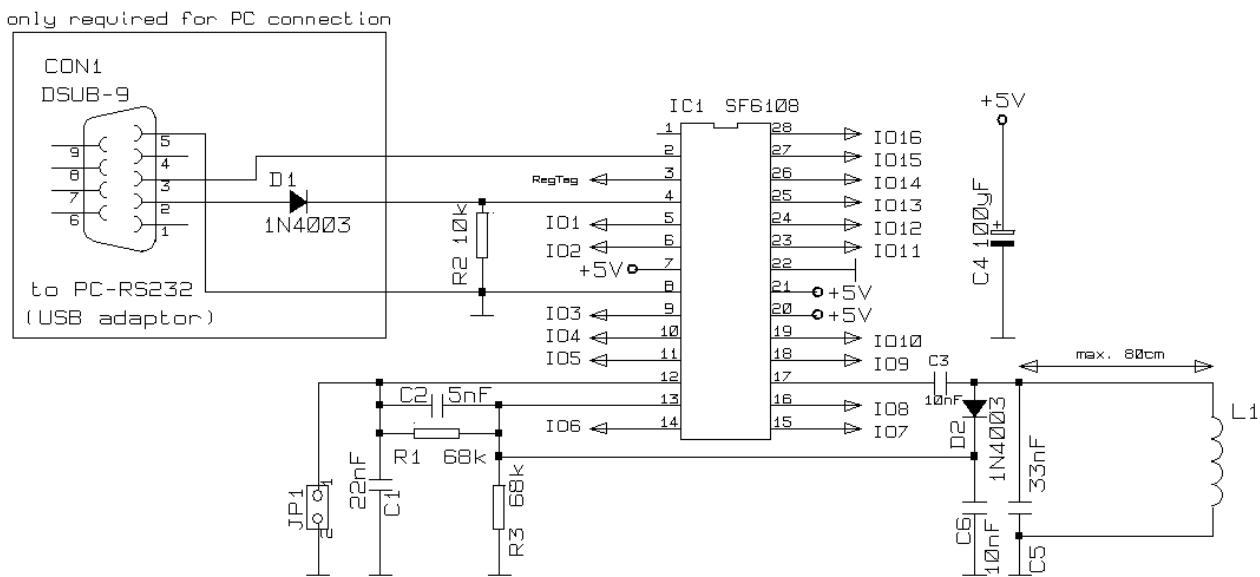


The SF6108 is a 28 pin Special Function Chip and applicable for:

- ✓ Stand-alone application (door opener for one master and up to 99 tags)
- ✓ RS232 PC connection to transfer any tag ID to that PC
- ✓ Set 16 GPIO (user IO) ports per registered RFID tags
- ✓ Write or read 16 GPIO or 6 ADC per RS232
- ✓ connect the SF6108 to a micro controller to send any tag ID to it

1 Features of the SF6108

- stand-alone application (door opener for one master and up to 99 tags)
- RS232 PC connection (USB with adaptor) for transferring tag ID to a PC or to a MC (micro controller with TTL-RS232)
- after reset immediately RS232-output of the number of all registered tags in the internal memory and its ID's
- RS232-output of a recognized tag id of any tag (whether it is registered or not)
- programmable baud rates (4800-57600), default 38400 8N1
- automatic detection whether a PC-RS232 or TTL-RS232 is connected to the device (pull-up or pull-low on pin 4)
- one active high output pin (3) as a detection signal of all registered tags (door opener)
- 16 extra output pins (GPIO), programmable for using with the registered tags
- GPIO mode 1: tag-1 sets IO-1, tag-2 sets IO-2, tag-3 sets IO-3.....
- GPIO mode 2: tag-1 sets IO1, tag-2 IO2, tag-3 IO1 and IO2, tag-4 sets IO3.....
- GPIO mode 3: tag-1 reads ADC1, tag-2 reads ADC2.....
- GPIO pins (including 6 AD channels) are setting and reading by RS232
- supply 5 V/20 mA (on PC connection supply voltage from the RS232 port possible, see SF6107 data sheet)
- reading distance up to 5 cm
- special mode (JP-1) for measuring of the resonance of L1/C5 (per JP1)
- distance between electronic and L1 (max. wire length) 80 cm
- monitor function with a piezoelectric disk (speaker) on pin 2

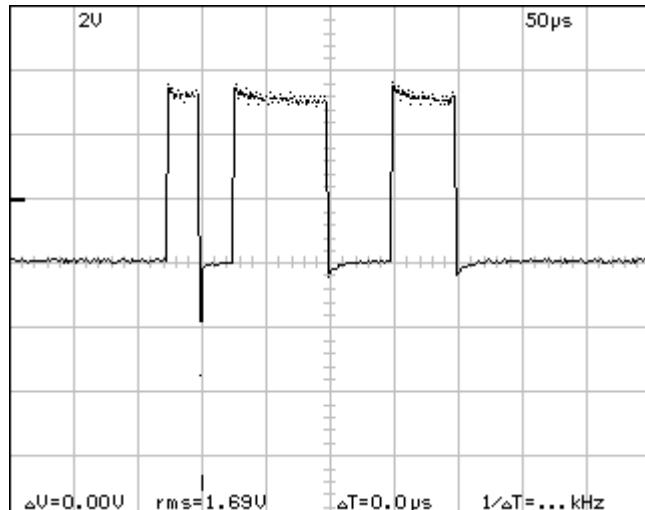


Drawing 1: test board with SF6108

2 The RS232 interface

Drawing 1 shows the SF6108 in a test board. If the chip has recognized any tag at L1, in every case the ID will output on pin 2 (RS232) to a PC or MC. For the communication of the SF6108 with a PC you can use every terminal program.

Drawing 2 shows the output of one byte to a PC on pin 2 (38400 Baud, 8N1). For a communication with a MC the signal is inverted between pin 4 and +5V (pull-up).



Drawing 2: RS232-output on pin2, 38400 baud

If you put any tag near the coil (L1), the SF6108 is automatically sending the recognized ID (an example):

1C027E34BD

The ID string ever is terminated with CR/LF (two ascii codes decimal 13 and decimal 10).

Ever at reset or power on the device is sending out the number of registered tags in the system (#Txx) , the ID ('#Rxx:YYYYYYYYYYYY) of every registered tag in the memory of the device and the version number of the device ('#Vxxxx). Therefore an example:

```
#T3
#R00:D8023021DD
#R01:1C027E34BD
#R02:1C029E1CFC
#V0112
```

In the example the SF6108 has registered 3 tags (master=00 and two other), version number of the SF6108 is 0112.

2.1 Setting the baud rate

The default baud rate of the device is 38400 8N1, but the speed is adjustable from 4800 baud up to 57600 baud. If JP-1 is set (pin 12 is at ground level) at reset, the baud rate is ever set to 9600 baud. The baud rate of the SF6108 (when it works without JP-1) is adjustable (sending a command line from the PC to the RS232 input of the SF6108 =pin 4):

```
*W 510, XYZ
```

The command line must be ever terminated with CR (decimal 13).

The command writes the value XYZ to the memory at address 510. For 7 baud rates XYZ is set to the following values:

57.6k=17, 38.4k=26, 28.8k=35, 19.2k=52, 14.4k=69, 9.6k=104, 4.8k=208

With the command:

```
*R 510
```

on every time you can read back the value of the baud rate memory.

As an answer of this request (*R510) the SF6108 is send out:

```
%R 01FE=11
```

In this case the format of the answer is hex. A setup to decimal is possible.

Hex 11 = decimal 17: the device is setting to 57600 baud. The setting baud rate is stable until a new *W510 command was executed or JP-1 was set. When JP-1 is set for at least 10 seconds, the complete memory is cleared (set to hex FF = decimal 255). A value of 255 at memory position 510 is baud rate 38.4kbaud (default value).

2.2 RS232 protocol specification

Use any terminal program or a special software to communicate with the SF6108. General all commands to the SF6108 are starting with a "*" following by a character and parameters (see table 1 below). Before or between the parameters optional spaces are allowed.

The SF6108 starts the sending of bytes in three different ways:

The answer of a request from the PC (the example shows an answer of a read command):
 %R 01FE=11

The SF6108 sends a message (the example shows the version number):
 #V0100

The SF6108 send the ID of a just readed tag:

1C005ED9F7

All the sended telegrams are terminated by CRLF (decimal 13 and decimal 10).

2.2.1 commands from the PC to the SF6108

syntax	n.of param.	
*R P1	1	Read memory from address P1 (P1=0...511)
*W P1,P2	2	Write memory, value of P2 puts in address P1 (P1=0...511, P2=0....255)
*T	0	Tags, shows the number of registered tags in the memory and it's ID's
*I P1	1	Input, reads digital value on pin P1 (P1=5,6,9-11,14-16,18,19,23-28)
*I 0	1 (P1 ever 0)	Input of all 16 GPIO pins (IO-1...IO-16)
*D P1,P2	2	Direction, set pin P1 for input (P2=0) or output (P2=1)
*D 0,P2	2 (P1 ever 0)	Direction, set all 16 GPIO pins direction with the value of P2
*O P1,P2	2	Output, if the direction of that pin was set to output, pin P1 will be set to the level of P2 (0 or 1), else (pin P1 is an input pin), a pull-up is switch on (P2=1) or off (P2=0)
*O 0,P2	2 (P1 ever 0)	Output of all 16 GPIO pins with the value of P2
*A P1	1	ADC, reads one of 6 AD-channels (P1=23-28, ret value: 0V=0, 5V=1023)
*S P1	1	Setup of diverses functions (accumulated bit value, P1=0...255) Bit-0 = 1: output of 16 GPIO inputs if input at least one bit was changed Bit-1 = 1: output of numbers as decimal, Bit-1 = 0: output as hex Bit-2 = 1: writes a '0x' before all hex values Bit-7 = 1: no output of recognized tag ID , Bit-7 = 0: normal output

Table 1: commands to the SF6108

It is possible, to send parameters as decimal or hexadecimal numbers. Hexadecimal numbers must start with 0x. After every sended command, the SF6108 sends a response '%_' as an echo. If the command was wrong, the SF6108 sends an error message.

2.2.1.1 error table

Error	description
ERR34	Memory read needs one parameter
ERR36	Memory write needs two parameters
ERR37	Value to write into the memory is >255
ERR38	Command must start with a '#'
ERR46	Unknown command
ERR47	Command 'I' must have one parameter
ERR48	Command 'D' must have two parameters
ERR49	Command 'O' must have two parameters

Table 2: error messages

2.2.1.2 command examples

command	response	description
*I6	%I 06 =01	Command reads high level (01) at pin 6
*I 0	%I 00 =7FF2	Read all 16 ports (IO-1....IO-16)
*A 23	%A 1C =07	Read the first AD channel
*A 28	%A 1C =0145	Read the last AD channel
*A 0x1c	%A 1C =0145	Same command with hex argument
*A 3	%A 03 ERR51	Error: no ADC on pin 3 !
*i0x0e	%I 0E =01	High level on pin 14
*D 14,0	%D 0E, 00	Set direction of pin 14 to input
*S1	%S 01	Switch on the pin watchdog
*S 5	%S 05	Switch on the pin watchdog and 0x output before hex numbers
	%I 0x7FF2	Watchdog has recognized a change of any pin
	%I 0x3FF2	Watchdog has recognized a change on pin IO15
*S 0	%S 00	Switch off the pin watchdog

Table 3: command examples

2.2.2 commands from the SF6108 to the PC

syntax	description
DOAA332211	40 bit number (hex value) of any just recognized tag (whether registered or not)
#Tyy	y = 0...99, number (decimal) of the registered tag in the memory of the SF6108
#Ryy:3F0045ABC1	y = 00..63, tag ID of the registered tag number yy (hex), 00=master tag
#Vyyy	y = version number of the SF6108
#Nyy	y = 00..63, a new tag (hex number yy) was just registered
#Syy	Y = 40..7F, timercount (seconds) for shift mode (time for registering new tags)

Table 4: commands from the SF6108

3 Registering of the master tag and other tags

3.1 Registering the master

The SF6108 can register up to one master and 99 other tags in it's memory. When JP-1 is setting for at least 10 seconds, the memory is cleared and no tag is registered in the memory. The tag ID's are in the memory area from 0-499 and every time also readable or writeable per RS232. A free place for a new tag is ever 0xFFFFFFFF. Of course, it is not required to setup the ID of a new tag per RS232. If the SF6108 is cleared (no tag is registered), **the first tag, the unit is reading will be the master tag.** The master tag is registered as number 0, it's position in memory is 0-4.

3.2 Registering other tags

For **registering new tags**, put the **master** tag to the coil (L1) for **at least 30 seconds**, remove it and **now you have time to register up to 10 new tags**. You can repeat the registering procedure every time until 99 tags have been registered. On every time after reset, power on or the command *T the device shows you the registered tags (#Tx #Vxxxx).

3.3 Relay output pin

Pin 3 of the SF6108 is ever going to high level (+5V), whether a registered tag is moving to the coil (L1). Pin 3 is going back to low level (0V), when you remove the tag. On the pin 3 you can connect a R+LED or a transistor for driving a relay (see data sheet SF6107). Be careful when power supply is using from PC-RS232, it allows only a current of 20 mA.

3.4 Control GPIO (IO-1 to IO-16) with RFID tags

It is possible to program the SF6108 for 3 special modes. You can switch the SF6108 into one of the tree modes with the command:

*W 509, Y (Y=mode=1...3, Y=255=off)

3.4.1 GPIO mode 1

tag-1 sets IO-1 (pin 5) to high level

tag-2 sets IO-2 (pin 6) to high level

.....

Tag-16 sets IO-16 (pin28) to high level

3.4.2 GPIO mode 2

IO1-IO16 will set as binary value of the tag

examples:

tag 32 sets IO-6, tag 33 sets IO-6 and IO-1,

tag 3 sets IO-1 and IO-2, tag 64 sets IO-7

3.4.3 GPIO mode 3

RS232-output of ADC values of the pins 23-28,

dependent of the tag 1 to tag 6

tag 1 reads pin 23, tag 6 reads pin28

examples:

%A 1B=3 (ADC on pin 27=hex1B)

%A 19=03FF (ADC on pin 23=hex19)

The timeout of mode 1 and mode 2 (pin is going back to low level) is programmable:

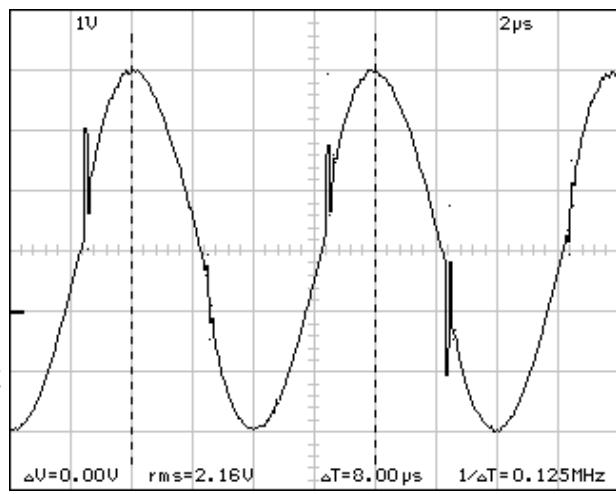
*W 508, seconds

The parameter seconds can have values from 0 to 255: 1 for one second, 60 for one minute. If you choose 0, the pin has no timeout (high level remains until reset, power on or a RS232-command is activated).

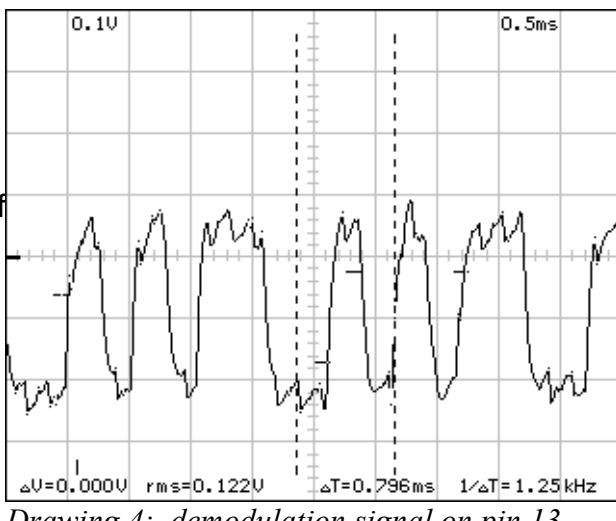
4 Connecting and testing the RFID network

4.1 The coil and it's resonance

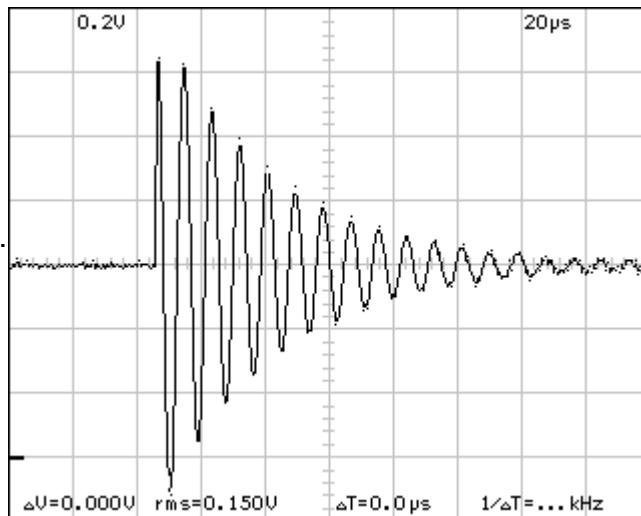
The coil (L1) and the capacity (C5) is a transceiver circuit. It transmits a electromagnetic field into the tag and receives a modulation from the tag. Therefore the SF6108 generates a signal of 125 kHz on it's pin 17. Of course, on pin 17 of the SF6108 you can find a rectangle signal. But we need a sine wave. That's why C3 is connected to the circuit (L1/C5). With an oscilloscope you can see a near sine wave at the coil (see drawing 3).



The demodulation signal on pin 13 of the SF6108 shows drawing 4. The controller unit of the SF6108 can decode the signal on pin 13 and computes the ID of the tag. Pin 12 is the invertet input of the comparator of the SF6108, therefore C1 holds the signal stable.



The SF6108 scans pin 12 after reset. If the device finds a ground level (JP-1 is set), the frequency on pin 17 will be set down to 1ms. This allows, to measure the circuit (L1/C5) for it's resonance frequency (see drawing 5)



Drawing 5:

4.2 Calculation of C5 and L1

Table 5 shows the possible values for C5/L1

C5 (nF)	L1 in μH
68	24
47	35
33	50
22	74
16	100
10	160

Table 5: possible values for C5/L1

Table 6 shows how to use diverses coils (windings, diameter of wire, diameter of the coil)

1. Coil L1	2. C5	3. Res. freq..
20 W, 0,5mm wire, 6,5 cm	47 nF	123 kHz
30 W, 0,5mm wire, 5,5 cm	17 nF	118 kHz
10 W, 0,5mm wire, 9,5 cm	78 nF	117 kHz
100 W, 0,5mm wire, 3,5 cm	3,4 nF	114 kHz

Table 6: examples for diverses coils and the appropriate values for C5

Formulas for the calculation of C5 and L1:

$$L (\mu H) = \frac{25}{F (\text{MHz})^2 \times C (\text{nF})}$$

$$C (\text{nF}) = \frac{25}{F (\text{MHz})^2 \times L (\mu H)}$$

5 Characteristics

5.1 Electrical characteristics

	min	typical	max
Maximum operating voltage (pins 7,20,21)	0 V		+6 V
Operating voltage (pins 7,20,21)	+4,5V		+5,5V
Storage temperature	-65 °C		+150 °C
Operating temperature	0 °C		45 °C
DC current (GPIO pins)	0		+20 mA
Max. accum. DC current (all GPIO pins)	0		+80mA
Suppl. Curr.(without L1/C5, without GPIO)		14mA	
Suppl. Curr.(with L1/C5, without GPIO)	15mA	19mA	22mA

Table 7: electrical characteristics

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