SW027
125KHz read only transponder chip

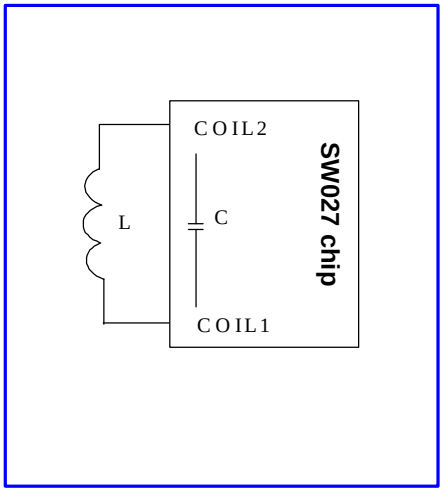
DATA SHEET

Typical Applications

- ➔ **Transponders with additional cap**
- ➔ **Transponder without additional cap**
- ➔ **Ferrite core modules, injectable glass tubes**
- ➔ **Air coil transponders**

Features

- ➔ **Fully compatible with industry-standard 125 KHz R/O chips.**
- ➔ **64 bits memory array custom configurable**
- ➔ **In factory mixed mask and electrical coding simplify delivery**
- ➔ **Manchester coding for transmission**
- ➔ **Wide dynamic range due to on-chip buffer capacitance and voltage limiter on chip**
- ➔ **Full wave rectifier on chip**
- ➔ **Typical reading speed is 2 Kbauds at 125 KHz**
- ➔ **Low power consumption**
- ➔ **Optional on-chip resonant capacitor to obtain a resonant system with external adapted coil only**



Product Description

The SW027 is a fully integrated 125KHz RFID transponder circuit. It is specially designed for being a space and cost efficient kernel of a read-only tag module. SW027 is a monolithic CMOS ASIC which provides full compatibility with other industry-standard 125KHz read-only tags. Thanks to its on-chip integrated capacitor, SW027 can be mounted with additional coil only, in order to complete the resonant circuit necessary for inductive 125KHz reading.

General functional description

FUNCTIONAL DIAGRAM

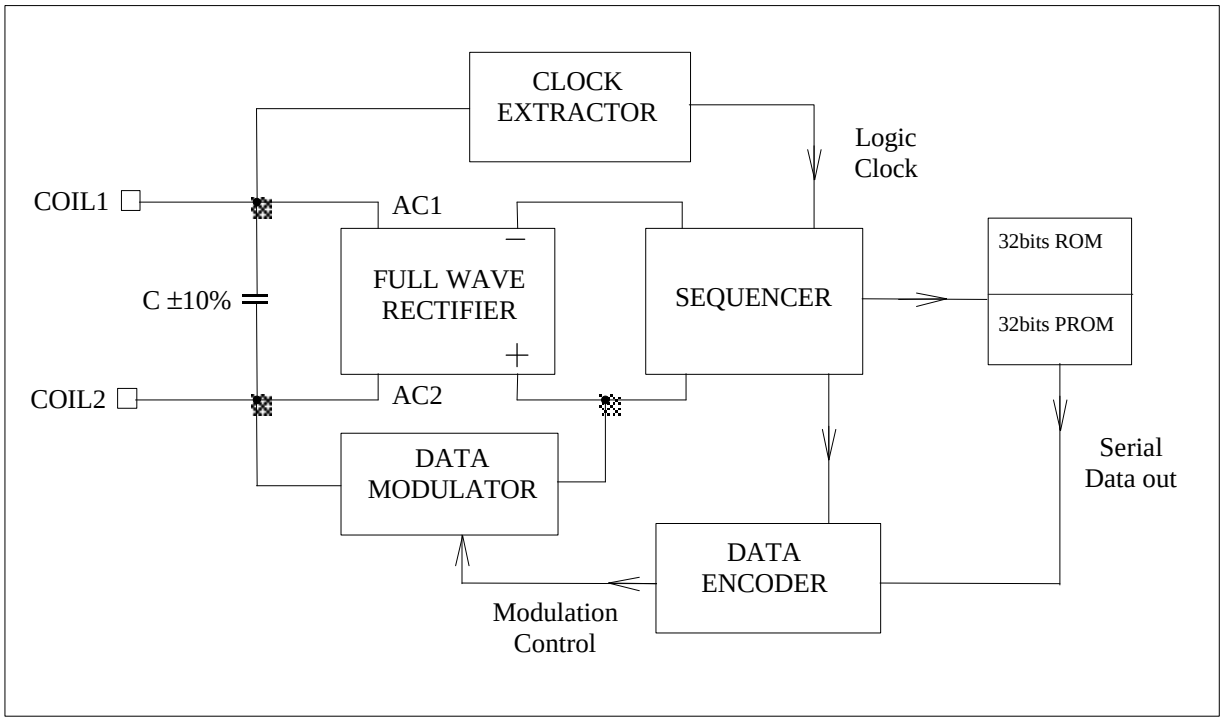


Figure 1 : Block diagram

GENERAL FEATURES

SW027A is a CMOS integrated circuit for use in transponders. The circuit is powered by an external coil placed in a magnetic field and gets its clock via the coil terminals.

The chip is divided in two parts – high power and low power parts, separated by two Graetz bridges, having a common ground.

The modulator is in the “high power” part of the chip, controlled by the digital part. Load modulation is implemented. The modulator acts directly on the voltage, limited by the voltage limiter, and, over the voltage drop on the diodes -– on the voltage on the coil. 64 bits of information, contained in a factory defined memory array, are transmitted continuously as long as the chip is powered. 34 bits (MSB) and the last 64th bit are defined by mask in the ROM part of the chip. Programming of the 29 remaining bits is performed by electrical fusing of polysilicon links in order to store a unique code on each chip. The serial output data string contains a 9 bit header, 40 bits of data, 14 parity bits, and 1 stop bit.

Due to the low power consumption of the logic core, no supply capacitor other than the on-chip one is required. Only an external coil and capacitor (if not on chip) are required to obtain the chip function.

VOLTAGE LIMITER

The voltage limiter, situated in the “high power” part of the chip, limits the voltage between 2.0V up to 4.5V with different AC coil currents.

This limited voltage (Vlim) can be seen on the coil (Vcoil voltage, that is two diode voltage drops higher). The digital part power supply VDD is close to Vlim. With small currents Vlim almost coincides with VDD. With high currents, because of the different diode voltage drops (high current flows only through the high power part diodes), the digital part power supply VDD is limited between 2.0V up to 5.0V.

DIGITAL PART

The digital part consists of control logic, memory array and digital modulator.

- **Control Logic.**

One coil terminal is used to obtain the clock signal for the logic. The output of the clock extractor drives a sequencer, thus providing all necessary signals to address the memory array and serially output the data.

- **Memory Array.**

SW027A contains 64 bits, divided in five groups of information: 9 bits for the header, 10 row parity bits (P0 - P9), 4 column parity bits (PC0 - PC4), 40 data bits (D00 - D93), and 1 stop bit set to logic 0.

1	1	1	1	1	1	1	1	1	➡ 9bits header
8 version bits or customer ID ⇆				D00	D01	D02	D03	P0	➡ 4data bit & associated even row parity bit
				D10	D11	D12	D13	P1	
				D20	D21	D22	D23	P2	
				D30	D31	D32	D33	P3	
				D40	D41	D42	D43	P4	
20 data bits, allowing 1 ← Meg of combinations, are electrically prog.				D50	D51	D52	D53	P5	
				D60	D61	D62	D63	P6	
				D70	D71	D72	D73	P7	
				D80	D81	D82	D83	P8	
				D90	D91	D92	D93	P9	
				PC0	PC1	PC2	PC3	C	➡ 4 column even parity bits, NO row parity bit.
							↓		
							C=0 as a stop bit		

The header is composed of 9 bits (sent first), which are programmed to 111111111. 10 groups of data bits and 1 group of column parity bits follow this sequence. Each group of data bits consists of 4 data bits and an even row parity bit. The last group consists of 4 even column parity bits without a row parity bit – there is a stop bit set to logic 0 at its place.

Bits D00 to D03 and bits D10 to D13 are customer specific identification.

These 64 bits are outputted serially in order to control the modulator. When 64 bits of data are sent, the output sequence is repeated continuously until power goes off.

- **Digital Coder.**

Data bits are modulated using Manchester coding. Data bit rate used corresponds to 64 periods of the field frequency – Figure 2

MODULATOR

As mentioned above, the modulator is in the "high power" part of the chip. It is controlled by the digital part, according to the data, programmed in the chip.

When the digital control signal is ON additional load is switched in the chip, higher current flows through the coil and the voltage on the coil (Vcoil) decreases – Figure 2.

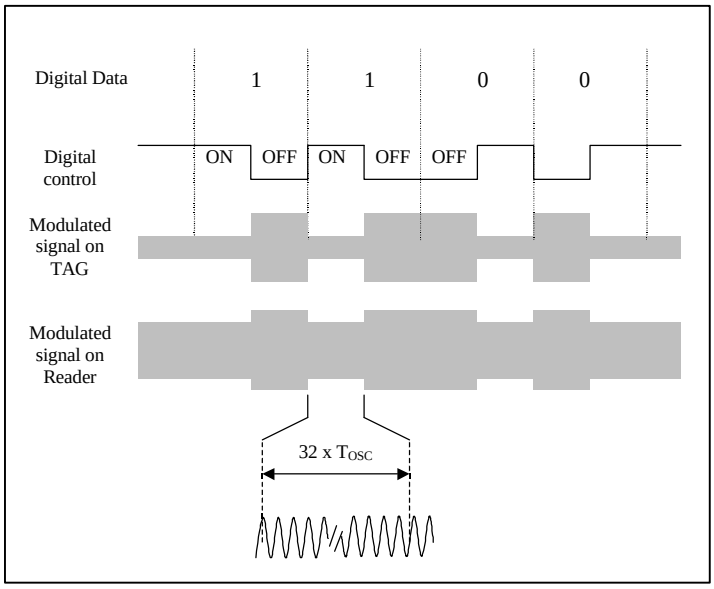


Figure 2 : Modulation

RESONANCE CAPACITOR

An on chip custom adjusted ± 10% capacitor is provided to obtain a resonant LC circuit together with the external coil. The integrated capacitor value varies from 0 (no cap) to 200pF, according to part number.

Electrical features

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Conditions
Maximum AC peak current induced between COIL 1 and COIL 2	I_{COIL}	±60 mAp
Max storage temperature	$T_{STOREmax}$	+200 °C
in storage temperature	$T_{STOREmin}$	-55 °C
Electrostatic discharge according to MIL-STD 883C method 3015	V_{ESD}	750 V

Stressed above these listed maximum ratings may cause permanent damage to the device. Exposure beyond specified conditions may affect device reliability or cause malfunction.

OPERATING CONDITIONS

Parameter	Symbol	Min	Typ	Max	Units
Operating temperature	T_A	-40		+85	°C
AC supply voltage	V_{COIL}	5.1		*note	V_{PP}
AC coil current	I_{COIL}			40	mA
Supply frequency	f_{COIL}	100		200	kHz

*note : the supply voltage is internally limited for reliability purpose

ELECTRICAL CHARACTERISTICS

(V_{AC} = 5.8V_{PP}, V_{COIL} ≅ 5.1V_{PP}, R=1k*, L=1.5mH, C=1nF, f_{COIL} = 130 kHz sine wave, T_A = +25 °C, unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Demodulated voltage	U_{DEMOD}	fig.4	0.25			V
Coil1-Coil2 on-chip capacitance	C_S		±10% tolerance on typical value			pF
Capacitor series resistance	R_S		According to chosen part#			Ω

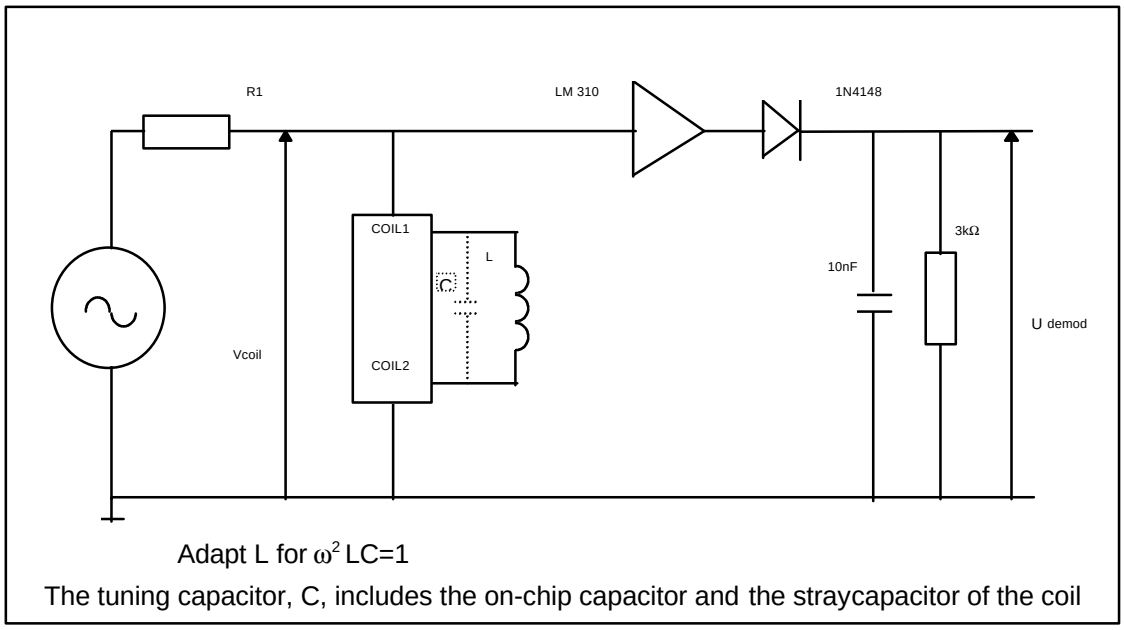


Figure 3 : Testing configuration of electrical parameters

TIMING CHARACTERISTICS

(V_{COIL2} = 0V, V_{COIL1} = 5.1 V_{PP}, sine wave)

Parameter	Symbol	Min	Typ	Max	Units
Coil clock frequency	f_{COIL}	100		400	kHz
Ratio between coil period and bit period (Manchester code)	R_{MCH}		64		

Handling Procedure

This device has built-in protection against high static voltages or electric fields. However, due to the unique properties of this device, anti-static precautions should be taken as for other CMOS component. Unless otherwise specified, proper operation can only occur when all terminal voltages are kept within the supply voltage range. Unused inputs must always be tied to a defined logic voltage level.

Ordering information

Product form	On-chip tuning cap value	Order Code
Chip form	no tuning cap	SW027AF-U/P(xx)*
	75pF	SW027BF-U/P(xx)*
	200 pF	SW027CF-U/P(xx)*
Package form in PDIP (sampling only)	no tuning cap	SW027AF-DC

* xx is the hex. value for Header code

DELIVERY FORMS: - Un-sawn wafers
- Sawn wafers on foil

Mechanical characteristics

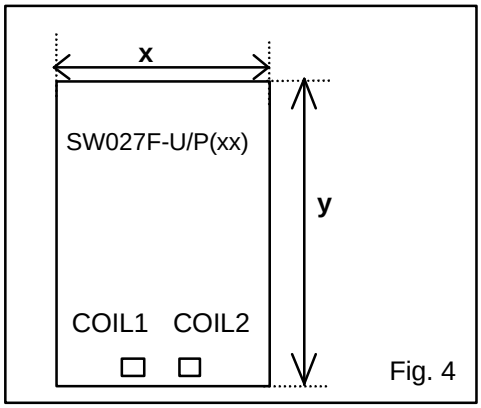


Fig. 4

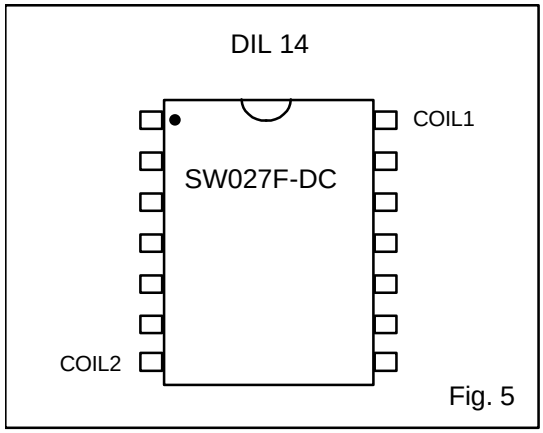


Fig. 5

Order Code	Dimension (mm)	
	x	y
SW027AF-U/P(xx)*	1.03	1.68
SW027BF-U/P(xx)*	1.10	1.68
SW027CF-U/P(xx)*	1.19	1.68

Notes:

- Standard die thickness is 450µm.
Thinner circuits are available on request.

- Bonding pad size is 120 x 120 µm

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