IC for Contactless Identification

Features

- 64-bit single time programmable memory array
- on chip resonance capacitor
- on chip supply buffer capacitor
- on chip voltage limiter
- full wave rectifier on chip
- information storing by switched off supply voltage
- operating frequency 100 - 150 kHz

6602(C)(2802-A) ICs for transponders with amplitude modulation and is intended for use in contactless identification systems. IC is fabricated in accordance with CMOS technology with 0.8 μm design rules.

IC power supply is carrying out from outer inductance coil, placed into electromagnetic field, that are electromagnetic vibrations with frequency 100-150 kHz. IC synchronization is implementing through selecting of tact synchropulses from the same field. By means of modulation current changing, chip sends back 64 information bits, containing data, programmed into the memory.

Data transmission speed 64 periods of carrier frequency per one data bit. Data coding is implementing by Manchester code.

IC Application Field:

Systems of control and access restriction at enterprises and off-limits objects;
- electronic switch;
- motor transport identification;
- animals identifications.

Functional Description

Microcircuit is supplied from outer electromagnetic field, induced at swiched outer inductance coil. Alternating voltage is converted internally into continued supply voltage. When last information bit, stored into the memore is read, circuit continue to be read from first bit till power supply is switched on.

IC contains following blocks: full-wave rectifier, synchronization signal extractor, divider, control unit, 64-bit data memory, data coder and data modulator.

Full-Wave Rectifier

Outer alternating voltage is converting into the direct supply voltage by inner rectifying bridge. Bridge should limit direct voltage in intense electromagnetic field.

Synchronization Signal Extractor

Unit is intended for extraction of the synchronization signal from carrier frequency of outer radio-frequency field.

Control Unit

Control unit receives synchrosignals and generates signals of memory control and data coding.

Data Modulator

Data modulator is controlled by the signal, that is received from data coder, and applies modulated according with data sequence to the circuit pin COIL2.

External inductance coil (aerial), connected to the pins COIL1 and COIL2 of the microcircuit converts the modulated sequence into the electric magnetic oscillations, received by the external reading device. The kind of signals on the transponder inductance coils and the reading device is indicated in Fig. 1.

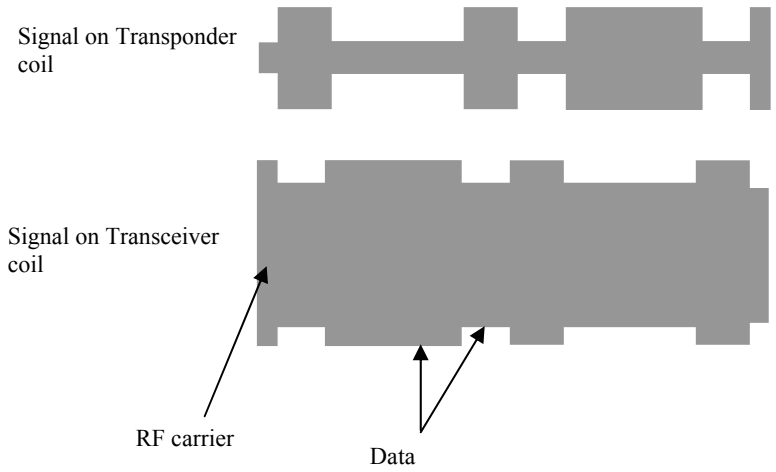


Figure 1 – Kind of signals on the transponder coils and the reading device

Data Memory

Memory consists from 64 data bits, separated into 5 groups:

- 9 bits are used for headline,
- 10 bits of parity control by rows (P0 – P9),
- 4 bits of parity control by columns (PC0 – PC3),
- 40 data bits (D00 – D93),
- 1 stop bit S0, set to "0".

First 9 bits – headline, consisting from all "1"

Headline is followed by 10 data rows, every row consist of 4 data bit and 1 bit of row parity control. Last is the row consisting of 4 bits of parity control by columns and of 1-st stop bit S0, set to "0".

When circuit gets into reader`s electromagnetic field reading of its memory contents is carried out, at that after reading of last 64-st bit, reading is repeated at cycle, beginning from the first bit till circuit is in reader`s field. Thus, continuous data stream is created.

Parity bits are equal to "0" by even quality of "units" in rows and are equal to "1" by uneven quantity of "units" in rows, i.e. data organization in memory storage (except headline) is that in data stream can be no more than 4 "units" one after another. 9-bit "unit" headline is an exception, separates 64-bit data block in continuous stream and serves for organization of synchronization with reader.

Bits D00-D03, D10-D13 (8 bits) determine the version or code of the Customer. The remaining bits D20-D93 (32 bits) – data bits, determining the unique code of the chip. Programming of chips is performed by the manufacturer as per the Consumer's order.

1	1	1	1	1	1	1	1	1
				D00	D01	D02	D03	P0
				D10	D11	D12	D13	P1
				D20	D21	D22	D23	P2
				D30	D31	D32	D33	P3
				D40	D41	D42	D43	P4
				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	S0

Figure 2 - Transponder memory structure

Manchester Code

1) There is always a transition from ON to OFF or from OFF to ON in the middle of bit period. At the transition from logic bit "1" to logic bit "0"or from logic bit "0" to logic bit "1" the phase change. Value high of data stream (signal Modulation control) presented below modulator switch OFF, low represents switch ON (Figure 3).

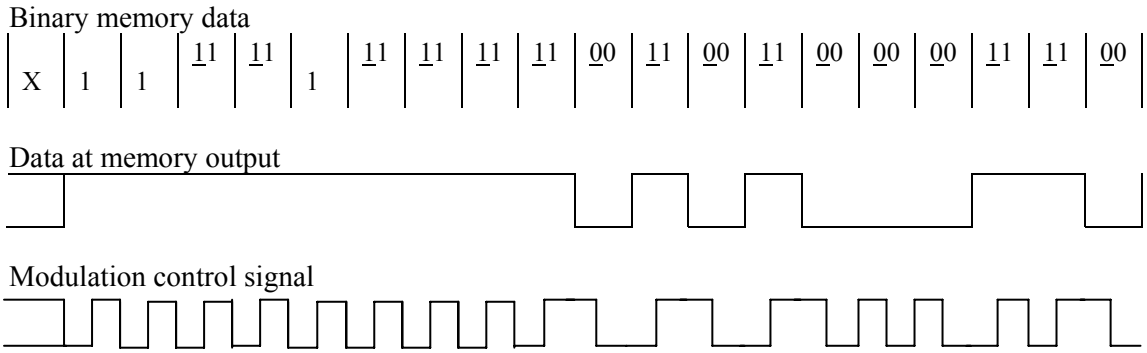


Figure 3 - Manchester code

Block Diagram

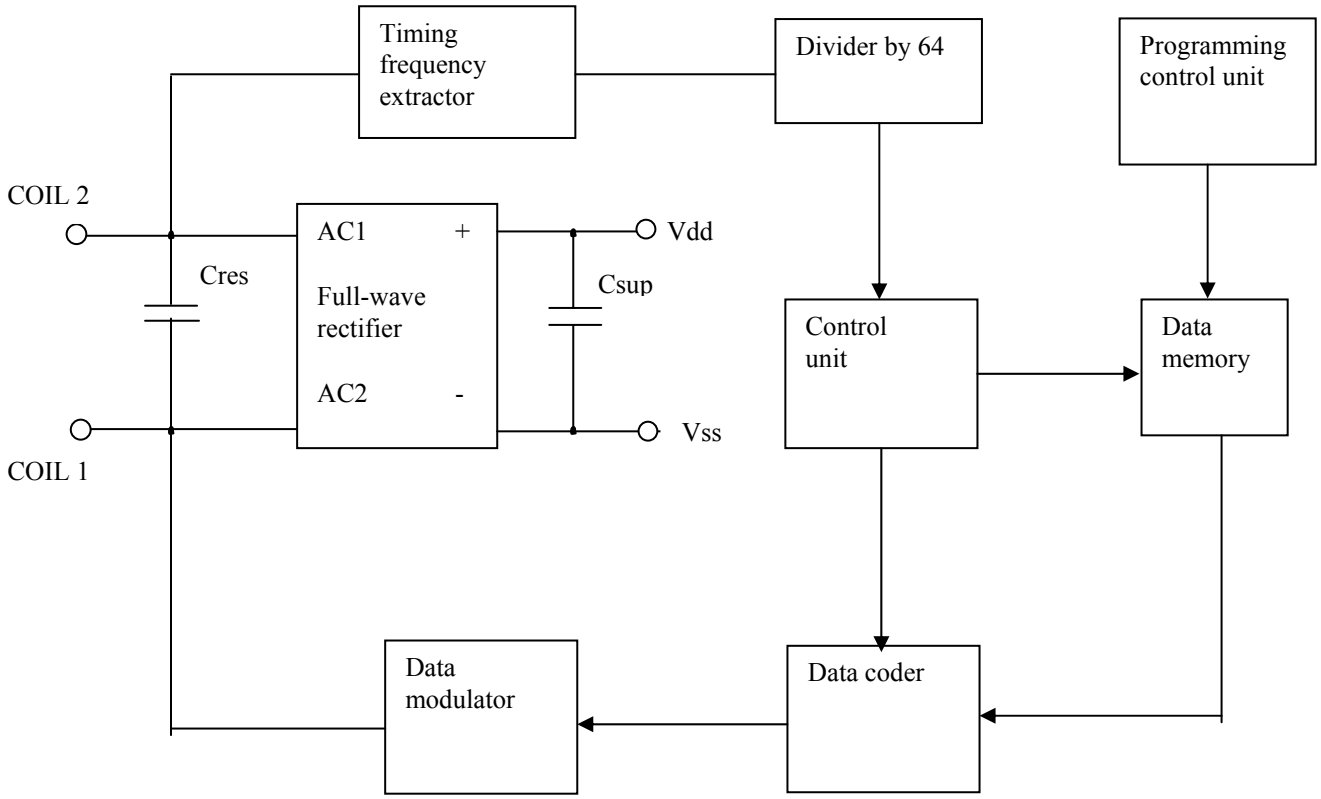


Figure 4

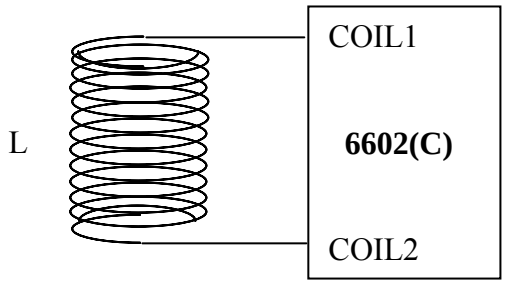


Figure 5 – Outer inductance coil connection

Value of outer coil inductance is calculated from resonant frequency formula

$$f_0 = 1/2\pi\sqrt{LC},$$

where L – antenna coil inductance, mH
C – resonant capacitance, pF,
f_0 =125 kHz.

Contact Pads Indication

Contact Pad No.	Denomination	Function
01	COIL1	Signal input from inductance coil
02	COIL2	Modulated data signal output
03	VCC	Supply voltage
04	TEST1	Test pin
05	TEST2	Test pin
06	TEST3	Test pin
07	TEST4	Test pin
08	TEST5	Test pin
09	TEST6	Test pin
10	GND	Ground

Operational Temperatures Range

Operational temperature range from 0°C to +70°C.

Tolerance Limits

Parameter Symbol	Parameter Denomination	Norm		Measurement Unit
		minimum	maximum	
V_{CC}	Supply voltage, V	3.0	6.0	V
I_{COIL}	Maximum coil current	-10	+10	mA
T	Temperature range	-40	+85	°C

Limiting Modes

Parameter Symbol	Parameter Denomination	Norm		Measurement Unit
		minimum	maximum	
V_{CC}	Supply voltage	-0.3	+7.5	B
I_{COIL}	Maximum coil current	-30	+30	мA
T	Temperature range	-60	+125	°C

By affecting of limiting modes serviceability of circuits is not guaranteed. After limiting modes eliminating operation within tolerance limits is guaranteed.

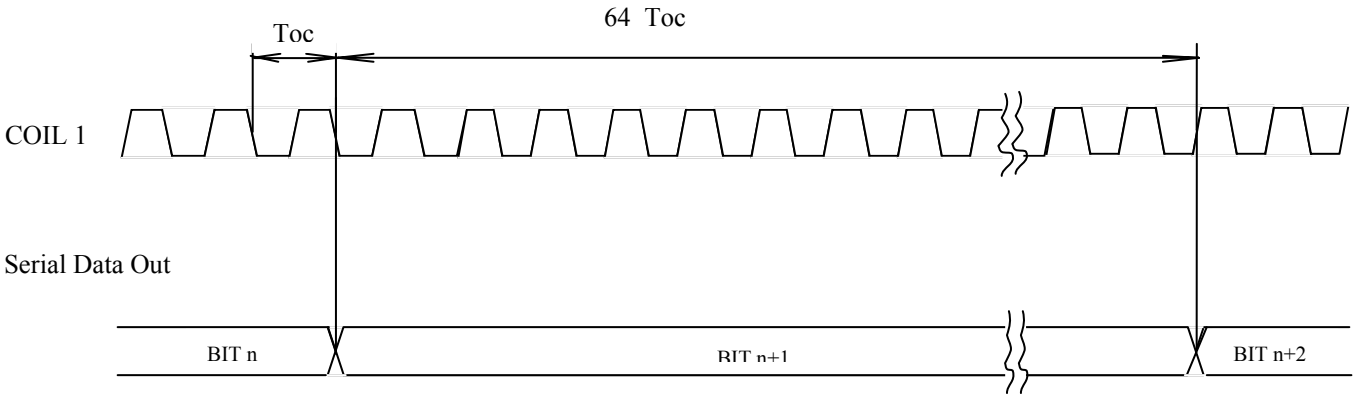
Static Parameters

T = 25 °C

Parameter Symbol	Parameter Denomination	Measurements Conditions	Norm		Measurement Unit
			minimum	maximum	
V_{CC}	Supply voltage		3.0	6.0	V
V_{COIL}	Alternating voltage at	F = 134 kHz	3.0	15.0	V

	outer inductance coil				
I_{OCC}	Dynamic consumption current	V_{CC} =3.0 V F = 150 kHz	-	10	µA
V_{ONC2}	Voltage reducing by modulation (Manchester and two-phase coding version)	V_{CC} = 5.0 V I_{COIL}= 1 mA	150	-	mV
F_{COIL}	Operation frequency		100	150	kHz
Cres (for 2802-5)	Resonance capacitor		60	90	pF
Cres (for 6602(C))	Resonance capacitor		380	520	pF

Timing Waveforms



Where Toc = 1/ F_{COIL};

Figure 6 – Number of periods of the carrier frequency per one data bit

Chip Surface Appearance Including Contact Pads Assignment

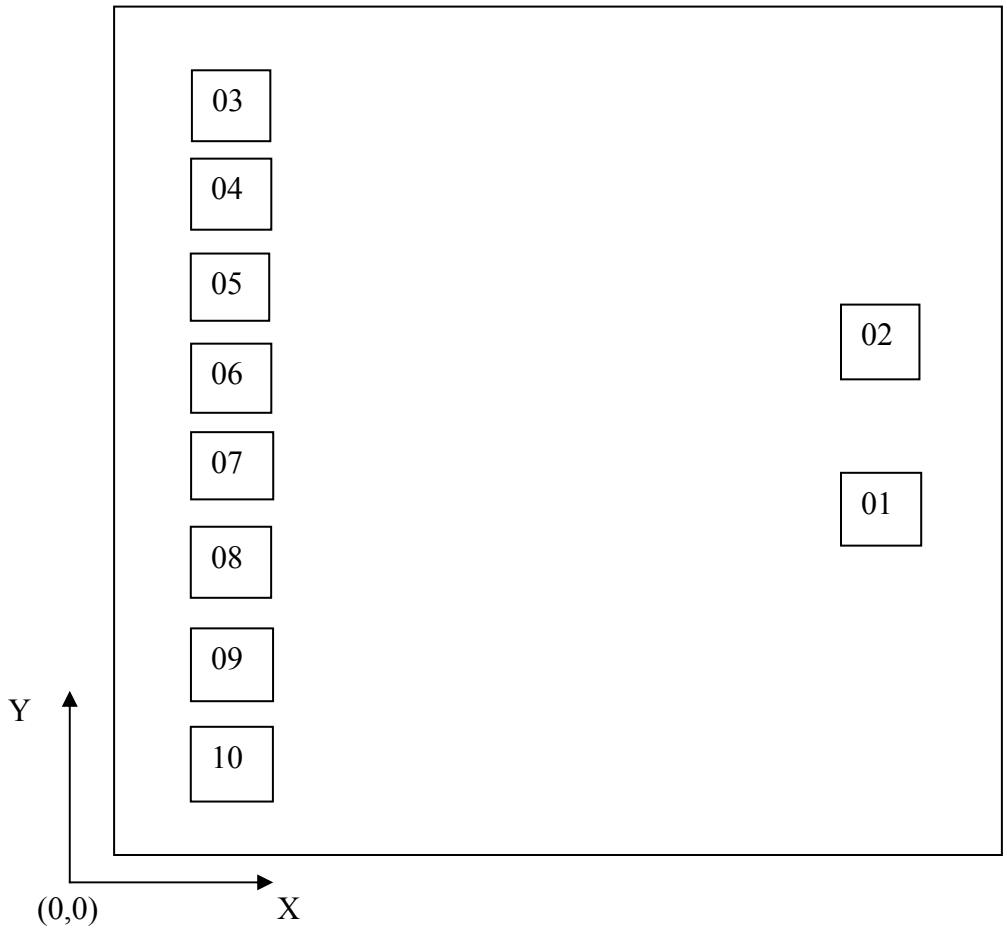


Table of Contact Pads Coordinates

Contact Pad	Identification	Coordinates (um)	
		X	Y
01	COIL1	1057	480
02	COIL2	1057	734
03	VCC	103	1082
04	TEST1	103	944
05	TEST2	103	806
06	TEST3	103	667
07	TEST4	103	529
08	TEST5	103	390
09	TEST6	103	252
10	GND	103	116

Note: Size of the contact pads by the layer "passivation" 92×92 um for the pads COIL1 and COIL2, pads 03-10 test, are used only at the production stage and have the size of 72 x 72 um. Coordinates of the contact pads are indicated by the layer «passivation», by the left lower corner of the contact pad.

Chip size: 1290 × 1300 μm x μm.