

IZE4428

1K-byte EEPROM microcircuit with function of protection for writing and programmable secret code.

Microcircuit IZE4428 is designed to use in intellectual plastic cards. Sphere of application: medical insurance, excess control systems, member cards, smart cards.

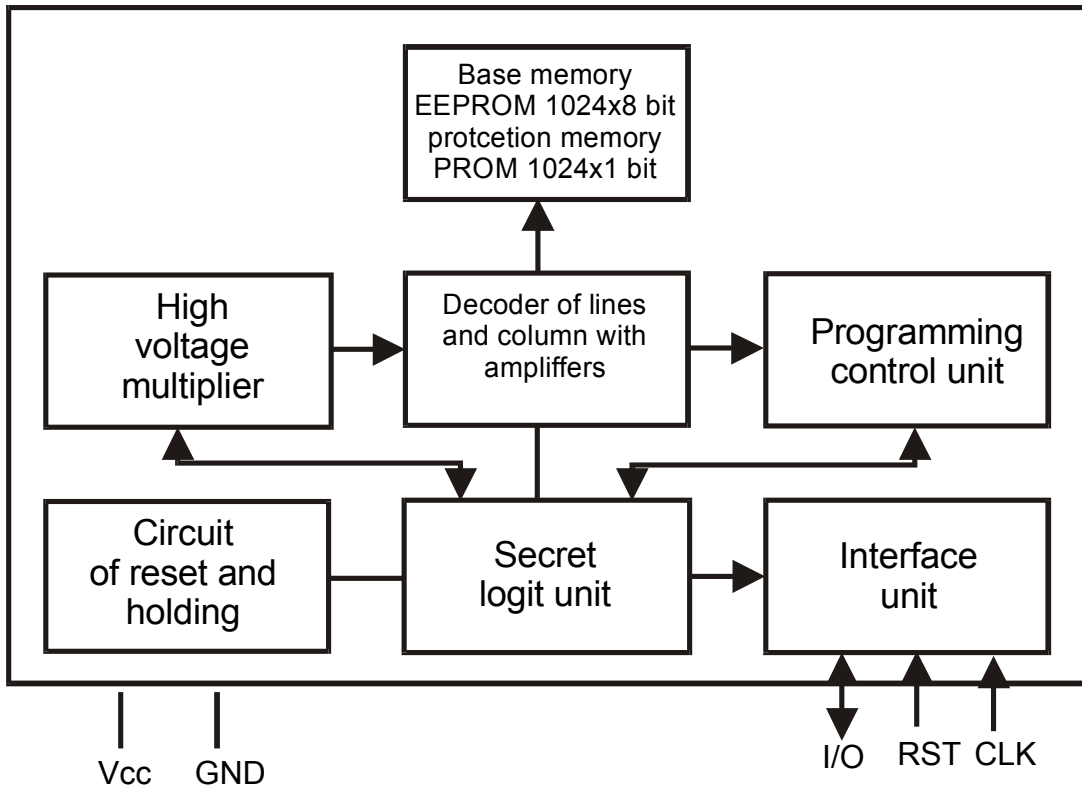
Features:

1024 x 8 - arrangement of EEPROM;
Byte - directed addressing;
Protection of memory writing;
1024 x 1 bit arrangement of memory protection ;
Response for reset;
Minimum 10000 cycles of erasure / writing ;
Information storage time - 5 years ;
Location of contact pads and serial interface in accordance with ISO 7816 standard;
Data in memory can be changed only after introduction of correct 2-byte programmable secret code (PSC);

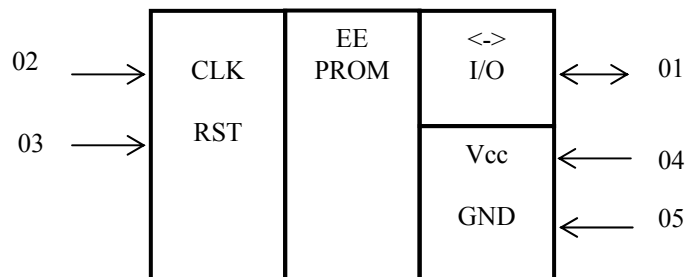
Purpose of IC contact pads

CP	Symbol	Function
01	I/O	Bidirectional data line (open drain)
02	CLK	clock rate input
03	RST	control input (reset)
04	Vcc	supply voltage
05	GND	general

Block diagram



Graphical symbol of IC



Operating temperature range

Operating temperature range from -35°C to +100°C.

Extreme modes

Symbol	Name of parameter	Standard	Measurement
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		min	max	unit
V_{CC}	Supply voltage	4,5	5,5	V
V_{IH}	Input voltage of high level	3,5	V_{CC}	V
V_{IL}	Input voltage of low level	0	0,8	V
T	Operating temperature range	-35	+100	°C

Limiting modes

Symbol	Name of parameter	Standard		Measurement unit
		min	max	
V_{CC}	Supply voltage	-0,3	6,0	V
V_{IH}	Input voltage of high level	-	6,0	B
V_{IL}	Input voltage of low level	-0,3	-	V
T_{stg}	Storage temperature	-40	+125	°C

They do not guarantee efficiency of ICs at limiting modes. After removal of limiting modes they guarantee efficiency in extreme mode.

Static parameters

T_A = from -35 to +100°C

Symbol	Name of parameter	measurement conditions	Standard		unit of measurement
			min	max	
V_{IL}	Input voltage of low level	V_{CC} =from 4,5 to 5,5V	0	0,8	V
V_{IH}	Input voltage of high level	V_{CC} =from 4,5 to 5,5V	3,5	V_{CC}	V
I_{OL}	Output current of low level	V_{CC} =from 4,5 to 5,5V $V_{OL} = 0,4V$	0,5	-	mA
I_{OH}	Output leakage current of high level	$V_{CC}=5,5V$ $V_{OH}=5,5V$	-	10	μA
I_{IH}	Input current of high level (I/O,CLK,RST)	$V_{CC}=5,5V$ $V_{IH}=5,5V$	-	10	μA
I_{CC}	consumption current	$V_{CC}=5,5V$, $V_{IL}=0V$, $V_{IH}=V_{CC}$	-	10	mA

Dynamic parameters

V_{CC} = from 4,5 to 5,5V, T_A = from -35 to +100°C

Symbol	Name of parameter	Standard		Unit of measurement
		min	max	

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t_{d1}	setting up time (D/CLK)	4,0	-	μs
t_{d2}	delay time (CLK/D)	6,0	-	μs
t_{d3}	setting up time (CLK/RST)		-	μs
t_{d4}	setting up time (RST/CLK)	4,0	-	μs
t_{d5}	hold-in time (D/CLK)	4,0	-	μs
t_{d6}	hold-in time (RST)	20,0	-	μs
t_L	CLK low level	10,0	-	μs
t_H	CLK high level	10,0	-	μs
t_W	writing time ($f_c=20$ kHz)	5,0	-	μs
t_E	erasure time ($f_c=20$ kHz)	5,0	-	μs
t_{RE}	delay time	9,0	-	μs
t_R	Time of rise front (I/O, CLK, RST)	-	1,0	μs
t_F	Time of fall (I/O, CLK, RST)	-	1,0	μs

Memory

Memory of microcircuit consists of base memory with the structure of 1024 x 8 bit EEPROM and protection memory with the structure of 1024 x 1 bit PROM. Every byte of memory can be protected separately from erasure/writing by the way of programming the corresponding bit of protection memory. They programm Bit of protection only one time and it can not be erased.

Also microcircuit has protection with programmable secret code (PSC), which controls excess to erasure/writing of memory. For this purpose the last three bytes of the base memory intended for error counter (one byte with the address 1021) and PSC (two byte with addresses 1022 and 1023).

Without verification of PSC only reading of base memory from the address 0 to address 1021 is possible (storage range of PSC is zero notated) and error counter writing. After successful verification of PSC all base memory from address 0 to address 1023 is readable and available for operations of erasure/writing. This state of microcircuit retain to power supply switch off. After switching on of power supply the PSC verification procedure should be carried out again.

After eight unsuccessful attempts to verify PSC, error counter blocks irreversibly any possibility to change contents of memory.

Response for reset

Reset can be supplied at any time during microcircuit operates. After reset during 32-clock pulses to the line I/O, contents of first 4 bytes of memory are read.

System of commands

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Base commands of introduction Base enter commands

Byte 1						Byte 2		Byte 3		Operation
S0	S1	S2	S3	S4	S5	A8	A9	A0-A7	D0-D7	
1	0	0	0	1	1	address bits 8 and 9		address bits 0-7	input data	writing and erasure with protection bit
1	1	0	0	1	1				input data	writing and erasure without protection bit
0	0	0	0	1	1				data compared	writing of protection bit with data verification
0	0	1	1	0	0				have no value	reading of 9 bit, data with protection bit
0	1	1	1	0	0				have no value	reading of 8 bit, data without protection bit

Commands of enter for PSC verification

byte 1						byte 2		byte 3		operation
S0	S1	S2	S3	S4	S5	A8	A9	A0-A7	D0-D7	
0	1	0	0	1	1	1	1	253	mask bit	writing of error counter
1	0	1	1	0	0	1	1	254	byte 1 ПСК	verification of the first byte PSC
1	0	1	1	0	0	1	1	255	byte 2 ПСК	verification of the second byte PSC

In erased state memory cells shall be read as logic "1". After operation of writing memory cells shall be read as logic "0".

There are three kind of operations of writing /erasure, that are implemented automatically by the microcircuit:

- erasure and following writing (duration is 203 timing pulses CLK, f=20 kHz);
- only writing, if no one of the 8 bit in addressed byte requires to be turned from "0" into "1" (duration is 103 timing pulses CLK, f=20 kHz);
- only erasure - if there are no turns from "1" into "0" in addressed byte (duration is 103 timing pulses CLK, f=20 kHz).

Time diagrams

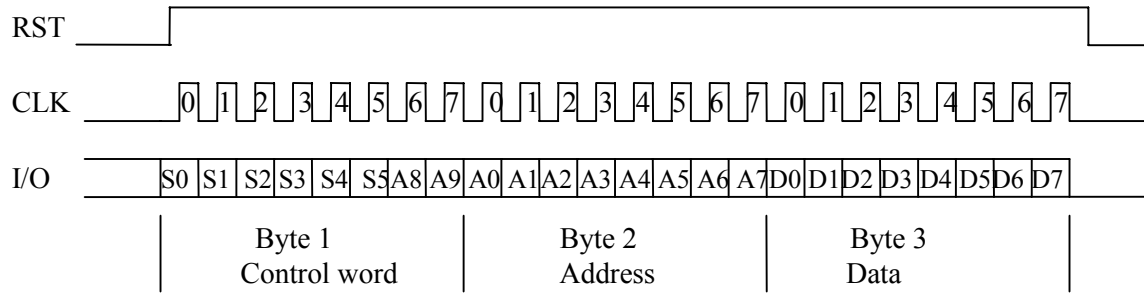


Figure 1 - introduction of the command

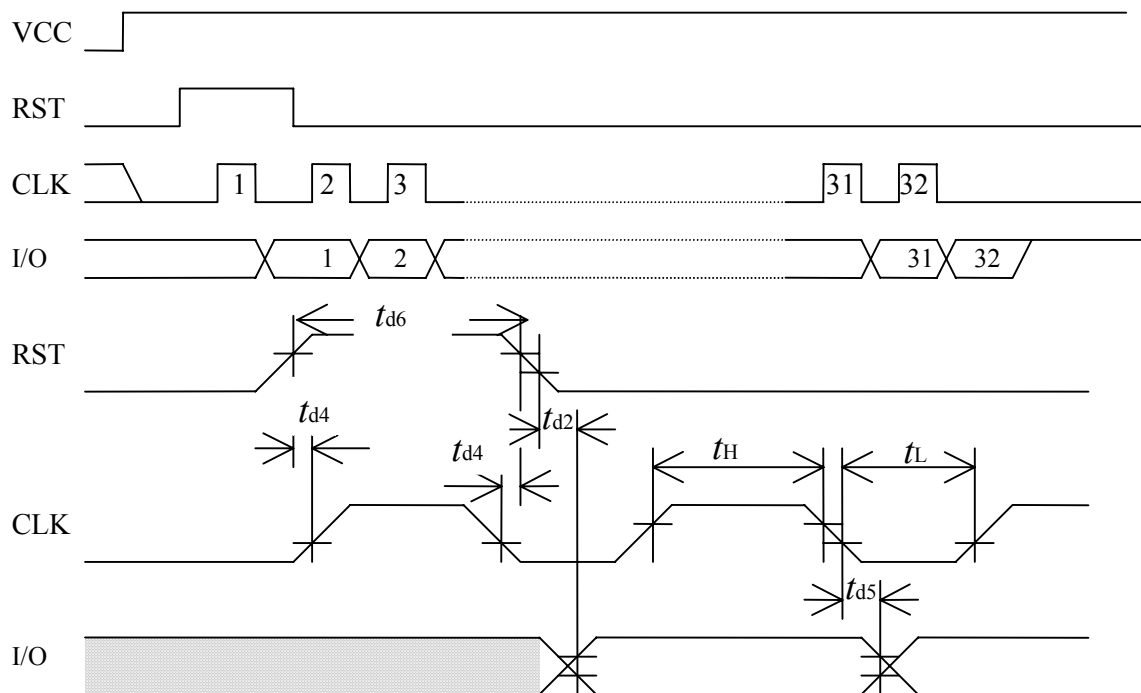


Figure 2 - Reset and response for reset

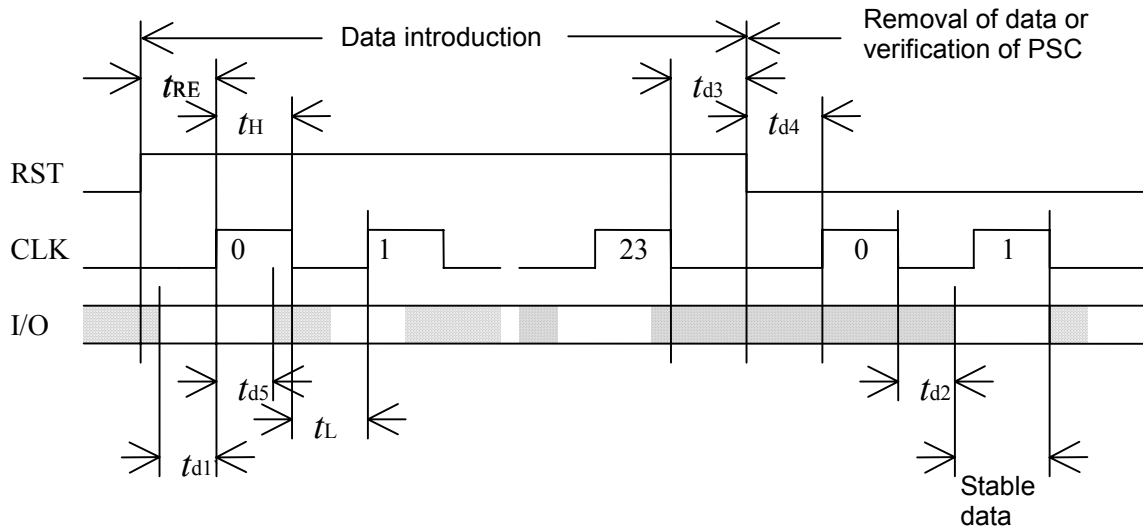


Figure 3 - Data introduction, removal of data and verification of programmable secret code

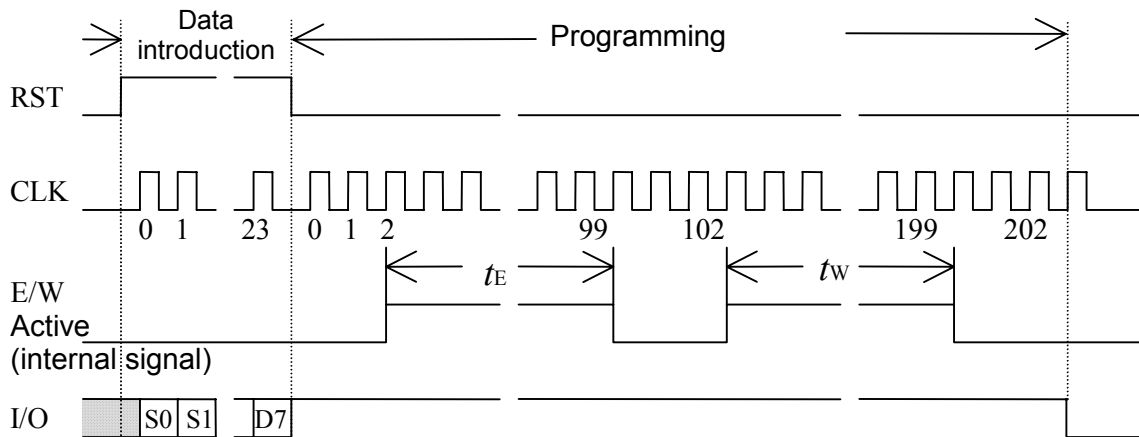


Figure 4 - programming: erasure and writing

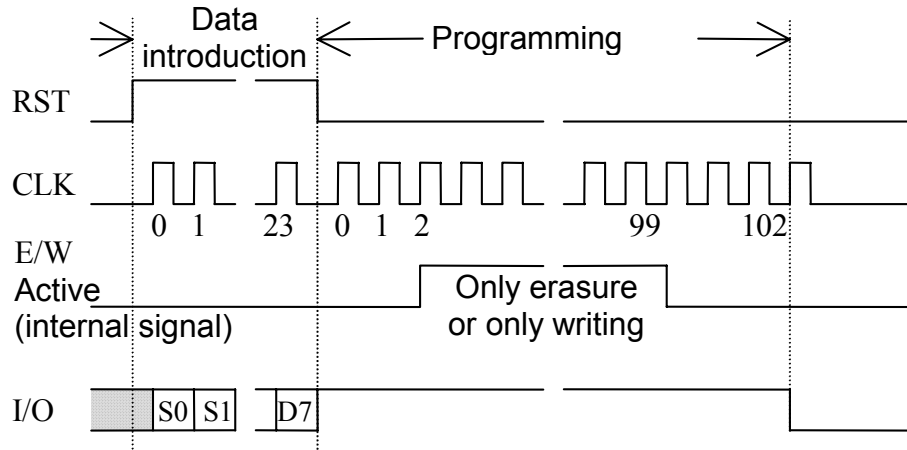


Figure 5 - programming: erasure or writing

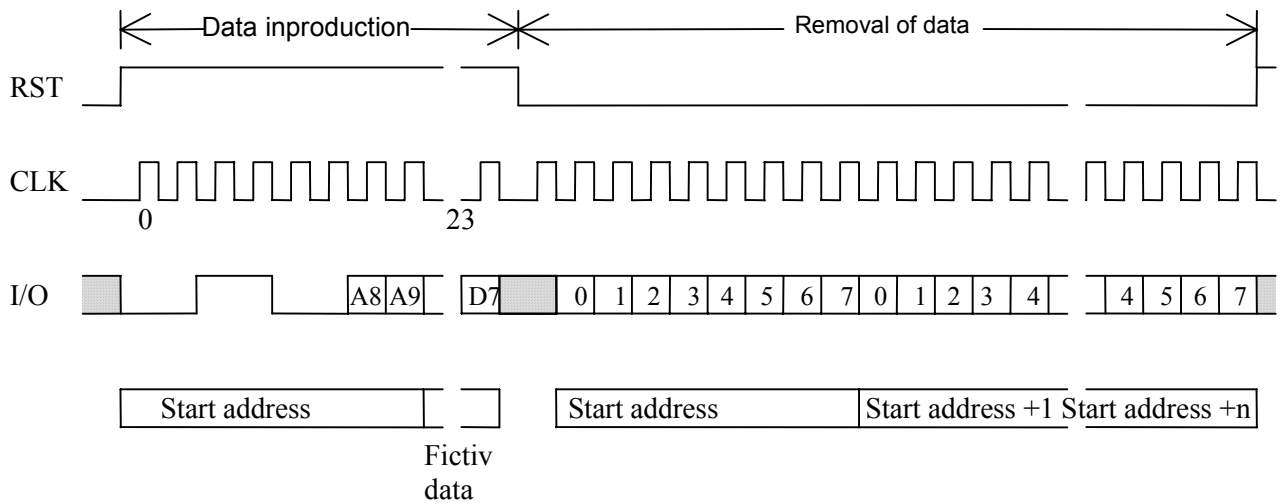


Figure 6 - data byte reading: reading of 8 bit data D0-D7

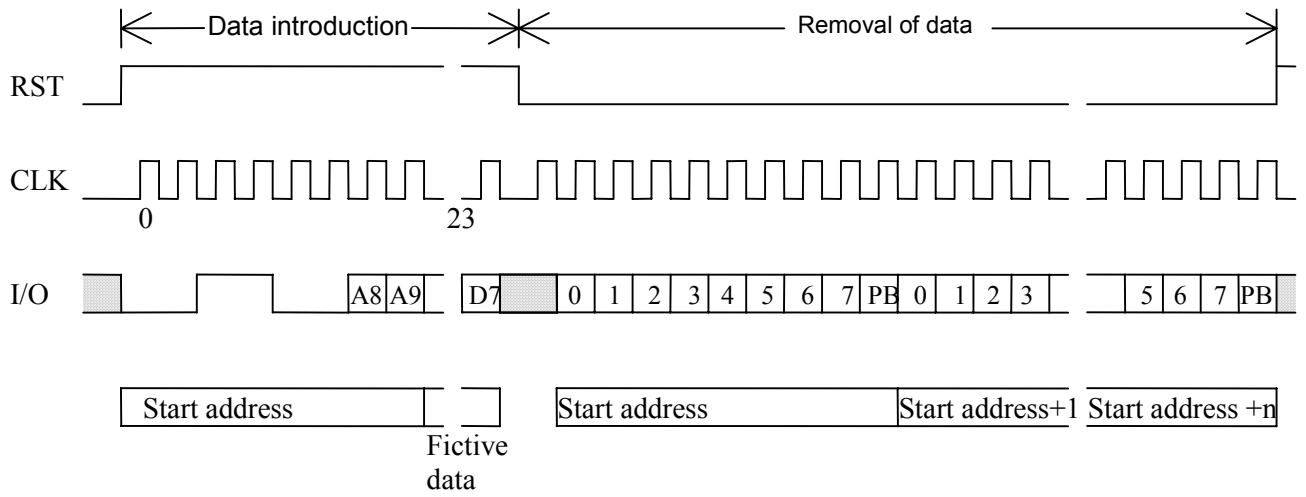


Figure 7 - reading of 9 bit: D0-D7 data byte and PB protection byte

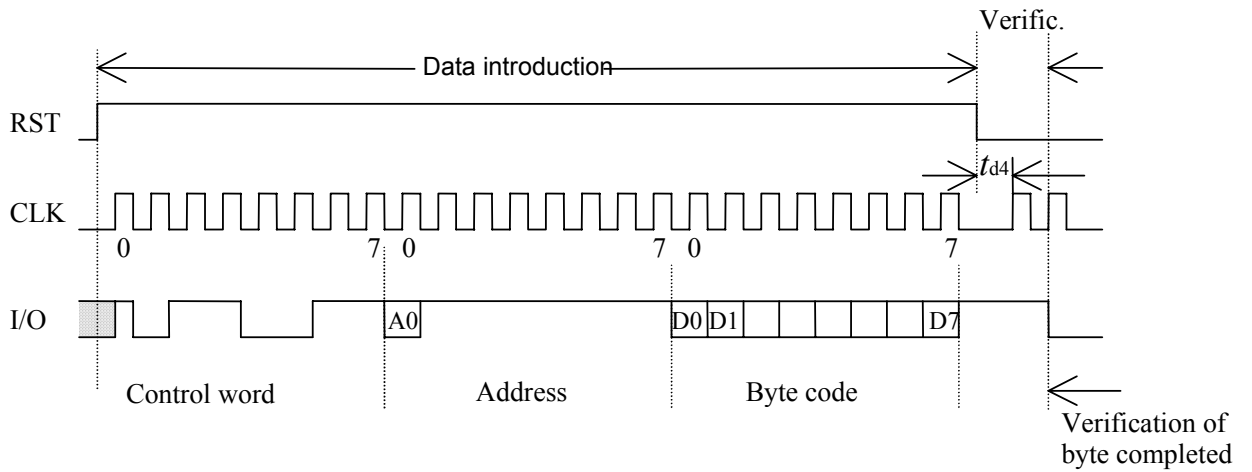


Figure 8 - Verification of programmable secret code byte

Appearance of chip with location of contact pads.

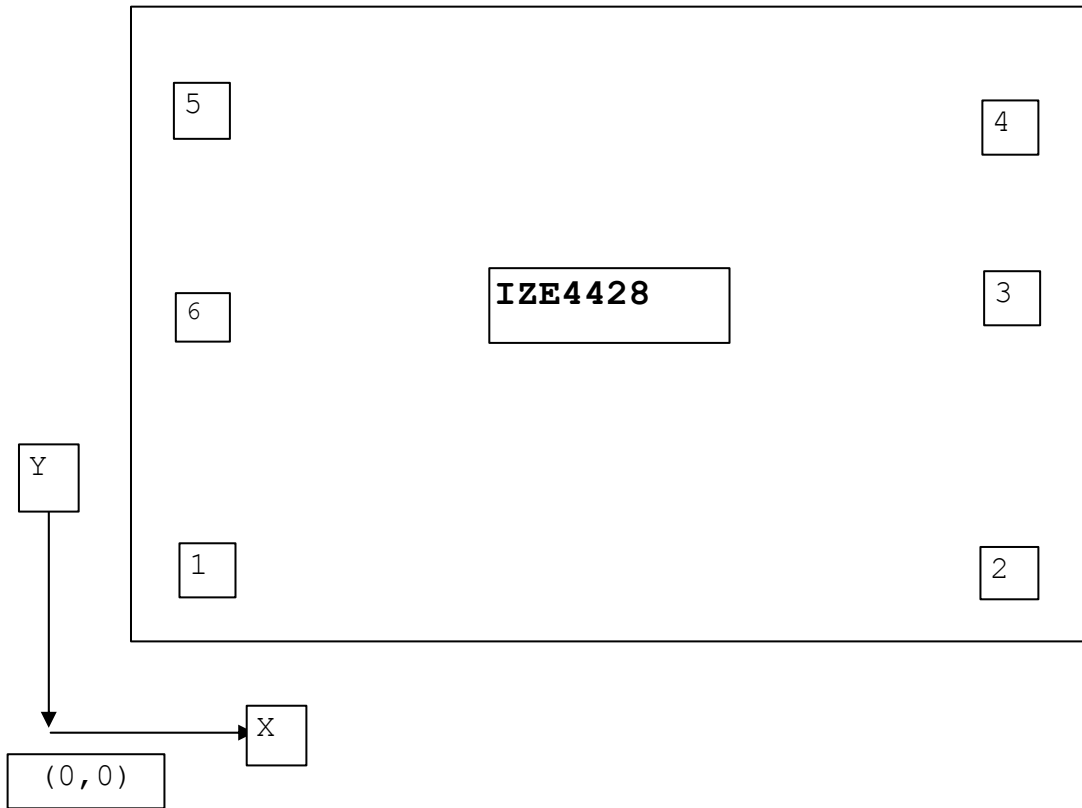


Table of contact pad coordinates.

pad	symbol	coordinates (μ)	
		X	Y
1	I/O	150	228.5
2	CLK	2624.5	206
3	RST	2624.5	1030
4	Vcc	2619.5	1693
5	GND	150	1740
6	TEST	150.5	954

Note :Contact pads size is 115Ч115 μ for «passivation» layer. Contact pads coordinates are given for «passivation» layer, for left bottom corner of contact pad. Contact pad 06 shall not be boiled soft , its size for «passivation» layer is 90Ч90 μ.

Chip size: 2890 Ч 2060 μ.