

LCD Controller with Built-in ROM of Sign Generator

IZ7066

Purpose

- Controller –driver of matrix LCD
- Built-in LCD control (16 lines and 40 columns)
- Symbol format: 5× 7 points + cursor,
5×10 points + cursor
- Compatible with 4 and 8 digit microprocessors
- Set of ROM symbols of the sign generator:
format 5×7 points - 192 symbols,
5×10 points - 32 symbols
- ROM of sign generator can be programmed by the special symbols
- ROM of sign generator can be programmed by Customer
- Flexible set of commands:
«Clear the screen», «Shift of cursor»,
«Switch on / Switch off screen»,
«Swift of Screen», «Enable / Disable cursor»,
«Read-out, write of data»,
«Shift of cursor»

Peculiarities

- Internal memory
 - ROM of symbol generator: 8320 bits
 - RAM of symbol generator: 512 bits
 - RAM of display data: 80×8 bits for 80 digits
- Built-in automatic reset by power supply on Built-in generator circuit
- Supply voltage: +2.7 ~ 5.5 V
Voltage of LCD driver: 3 ~13 V.
multiplex 1/8: 5×7 points,
1 line multiplex 1/11: 5×10 points,
1 line multiplex 1/16: 5×7 points, 2 lines
- Packageless version
- Pin designation complies with the microcircuits KS0066, HD44780, SED1278
- Temperature range -30 ~ +85°C

Description

Microcircuit IZ7066 performs the functions of controller and matrix liquid crystal display driver, displaying the signs and symbols. All functions, which are necessary for control of the matrix LCD, are realized on the single chip.

Functional Description

Controller of the liquid crystal display IZ7066 can function under control of both the four digit and eight digit micro-processor. Table 1 lists description of the IZ7066 microcircuit pins, used for connection to the microprocessor.

Microprocessor can control only the command register and data register of the liquid crystal display of the microcircuit IZ7066. Command register stores the command codes, such as «Clear Display» and «Shift Cursor or Display» and information about the addresses of DD RAM and symbol generator RAM (CG RAM). The data from the microprocessor can be written only into this register. The data register serves for the temporary data storage or storage of those data, written or read into/from display data RAM and the symbol generator RAM.

The data, written into the data register from the microprocessor, by means of the internal operation, are automatically rewritten into DD RAM or CG RAM. The data register is used also for the data storage, when they are read out from DD RAM or CG RAM.

When the information about the address is written into the command register, the data from DD RAM or CG RAM rewritten into the data register by means of the internal operation. The data transfer to the microprocessor is completed by the microprocessor's reading the data register's contents. After this, the data, contained in DD RAM or CG RAM by the next address, are placed into the data register for the subsequent reading by the microprocessor. These two registers are selected by means of the signal "Select Register" (RS). Prior to initiation of the internal operation of the controller the control information is stored in these registers, so as to ensure the interface with the various microprocessors, which operate at the different cycle frequencies or with the peripheral control different devices.

Table 1

Signal	Number of lines	Input or Output	Interface	Designation
RS	1	input	microprocessor	Register selection. 0 : -Register of commands (RGC) 1 : -Register of data (RGD)
R/W	1	input	microprocessor	Selection of read-out/write. 0 : -Write. 1 : -Read-out.
E	1	input	microprocessor	Signal (strobe) of read-out/write. 0 : -No exchange with processor 1 : -Operation of read-out/write
DB4-DB7	4	input/output	microprocessor	Four lines of the senior digits of the bi-directional data bus with the three statuses. They are used for the data exchange between the microprocessor and controller of the liquid crystal display. Digit DB7 can be used as flag «Busy».
DB0-DB3	4	input/output	microprocessor	Four lines of the junior digits of the bi-directional data bus with the three statuses. They are used for the data exchange between the microprocessor and the dot liquid crystal display controller. These digits are not used during the four digit operations.
GND, V _{DD}	2		supply source	V _{SS} - Ground (GND), V _{DD} -supply voltage of the IC logic part.

Block Diagram

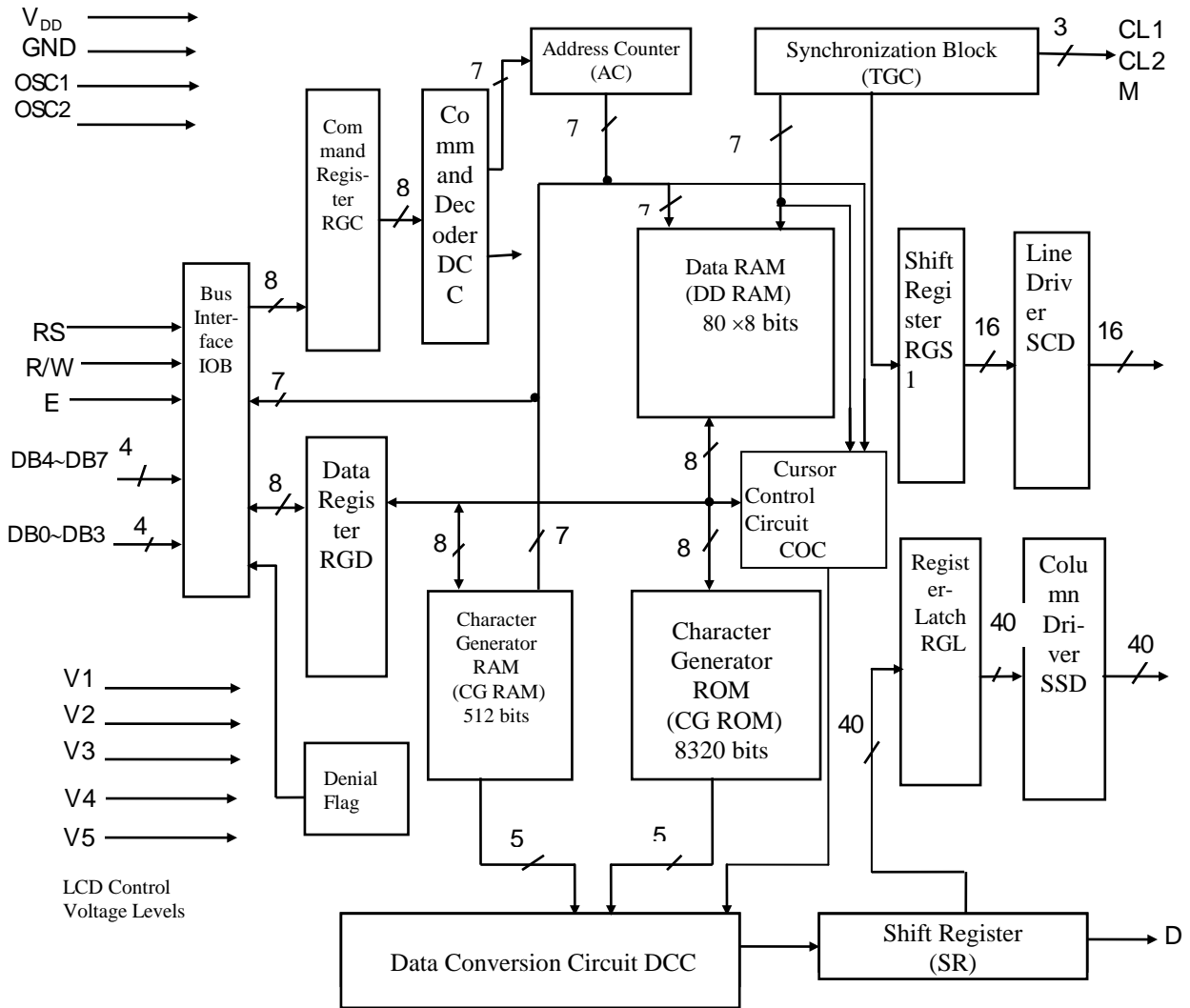


Figure 1. Block Diagram of LIC of Controller and Driver of LC Display IZ7066

Identification of Contact Pads

No. of Contact Pad	Identification	Purpose
01	SEG22	LCD columns control pin
02	SEG21	LCD columns control pin
03	SEG20	LCD columns control pin
04	SEG19	LCD columns control pin
05	SEG18	LCD columns control pin
06	SEG17	LCD columns control pin
07	SEG16	LCD columns control pin
08	SEG15	LCD columns control pin
09	SEG14	LCD columns control pin
10	SEG13	LCD columns control pin
11	SEG12	LCD columns control pin
12	SEG11	LCD columns control pin
13	SEG10	LCD columns control pin
14	SEG9	LCD columns control pin
15	SEG8	LCD columns control pin
16	SEG7	LCD columns control pin
17	SEG6	LCD columns control pin
18	SEG5	LCD columns control pin
19	SEG4	LCD columns control pin
20	SEG3	LCD columns control pin
21	SEG2	LCD columns control pin
22	SEG1	LCD columns control pin
23	GND	Pin for connection of voltage 0 V.
24	OSC1	Pins are used for connection of the external resistor or quartz resonator
25	OSC2	
26	V1	Pins for connection of the potentials, commutated to the pins, controlled by means of the dot LCD matrix
27	V2	
28	V3	
29	V4	
30	V5	
31	CL1	Pins serve for transfer control of the serial data into the columns driver
32	CL2	
33	V _{DD}	Pin for connection of voltage.
34	M	Pin serves for cycling the signal on the LCD elements
35	D	Pin serves for transfer of the serial data
36	RS	«0»- selection of command register «1»- selection of command register
37	R/W	«0»- data write «1»- data read-out

Identification of Contact Pads (continued)

No. of Contact Pad	Identification	Purpose
38	E	Permission of write/read-out operation
39	DB0	Serves for data exchange between processor and controller
40	DB1	Serves for data exchange between processor and controller
41	DB2	Serves for data exchange between processor and controller
42	DB3	Serves for data exchange between processor and controller
43	DB4	Serves for data exchange between processor and controller
44	DB5	Serves for data exchange between processor and controller
45	DB6	Serves for data exchange between processor and controller
46	DB7	Serves for data exchange between processor and controller
47	COM1	LCD lines control pin
48	COM2	LCD lines control pin
49	COM3	LCD lines control pin
50	COM4	LCD lines control pin
51	COM5	LCD lines control pin
52	COM6	LCD lines control pin
53	COM7	LCD lines control pin
54	COM8	LCD lines control pin
55	COM9	LCD lines control pin
56	COM10	LCD lines control pin
57	COM11	LCD lines control pin
58	COM12	LCD lines control pin
59	COM13	LCD lines control pin
60	COM14	LCD lines control pin
61	COM15	LCD lines control pin
62	COM16	LCD lines control pin
63	SEG23	LCD columns control pin
64	SEG24	LCD columns control pin
65	SEG25	LCD columns control pin
66	SEG26	LCD columns control pin
67	SEG27	LCD columns control pin
68	SEG28	LCD columns control pin
69	SEG29	LCD columns control pin
70	SEG30	LCD columns control pin
71	SEG31	LCD columns control pin
72	SEG32	LCD columns control pin
73	SEG33	LCD columns control pin
74	SEG34	LCD columns control pin
75	SEG35	LCD columns control pin
76	SEG36	LCD columns control pin
77	SEG37	LCD columns control pin
78	SEG38	LCD columns control pin
79	SEG39	LCD columns control pin
80	SEG40	LCD columns control pin

System of Commands

Table 3

	Codes										Execution Time (max)
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	
Clear display	0	0	0	0	0	0	0	0	0	1	1.53 ms
Return to start	0	0	0	0	0	0	0	0	1	*	1.53 ms
Set the entry mode	0	0	0	0	0	0	0	1	I/D	S	39 ms
Switch on/switch off display	0	0	0	0	0	0	1	D	C	S	39 us
Shift cursor or display	0	0	0	0	0	1	S/C	R/L	*	*	39 us
Set function	0	0	0	0	1	DL	N	F	*	*	39 us
Set address CG RAM	0	0	0	1	Acg	Acg	Acg	Acg	Acg	Acg	39 us
Set address DD RAM	0	0	1	Add	Add	Add	Add	Add	Add	Add	39 us
Read «Busy» and address	0	1	BF	Ac	Ac	Ac	Ac	Ac	Ac	Ac	0
Write data into DD RAM or CG RAM	1	0	Written data								39 us
Read data into DD RAM or CG RAM	1	1	Read-out data								39 us

Functional Time Parameter Charts of LCD Controller

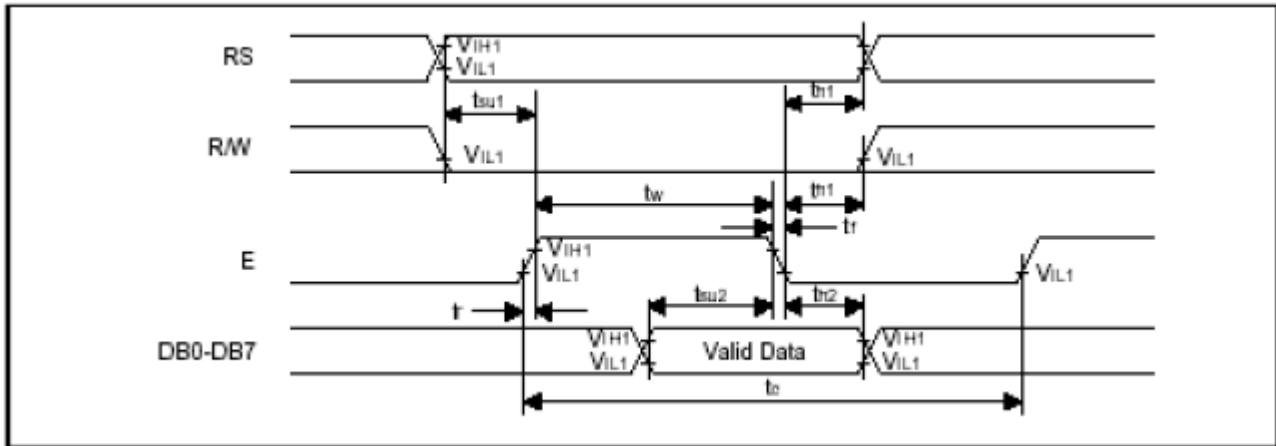


Figure 2. Time charts of write operation

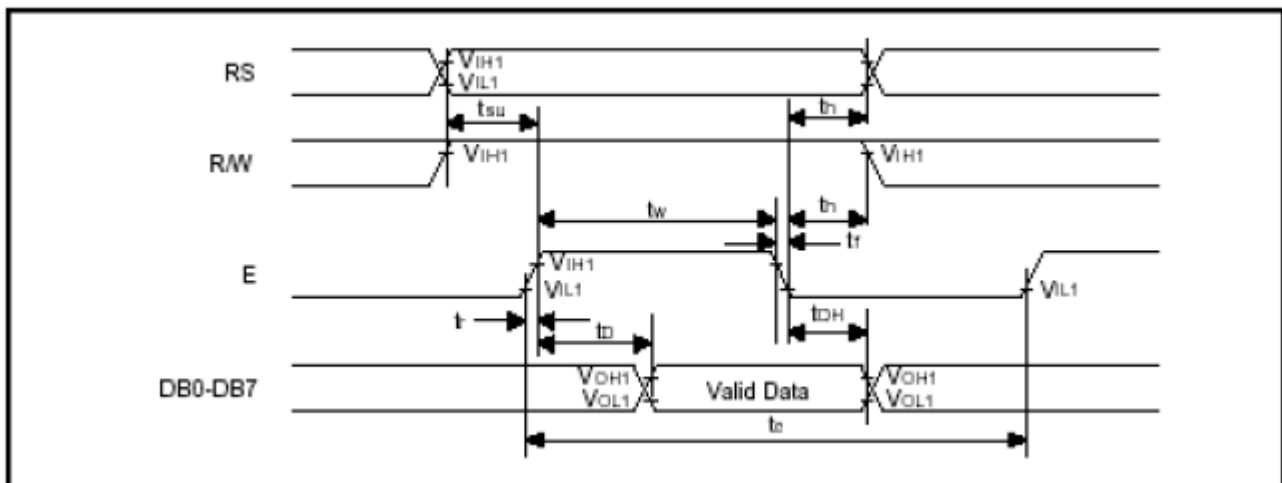


Figure 3. Time charts of read-out operation

Functional Time Charts of LCD Controller

Functional Time Parameters ($V_{DD} = 4.5\sim 5.5\text{ V}$)

Table 4.

Mode	Parameter	Identification	Min.	Typ.	Max.	Unit of measurement
Write mode	Period E	t_c	500	–	–	ns
	Time of rise/fall pulse E	t_r, t_f	–	–	20	
	Duration of pulse E	t_w	230	–	–	
	Pre-setting time R/W and RS versus E	t_{SU1}	40	–	–	
	Hold time R/W and RS versus E	t_{H1}	10	–	–	
	Data pre-setting time DB[7..0] versus E	t_{SU2}	80	–	–	
	Data hold time DB[7..0] versus E	t_{H2}	10	–	–	
Read-out mode	Period E	t_c	500	–	–	ns
	Time of rise/fall pulse E	t_r, t_f	–	–	20	
	Duration of pulse E	t_w	230	–	–	
	Presetting time R/W and RS versus E	t_{SU}	40	–	–	
	Hold time R/W and RS versus E	t_H	10	–	–	
	Data presetting time DB[7..0] versus E	t_D	–	–	120	
	Data hold time DB[7..0] versus E	t_{DH}	5	–	–	

Functional time parameters ($V_{DD} = 2.7\sim 4.5\text{ V}$)

Table 5.

Mode	Parameter	Identification	Min.	Typ.	Max.	Units of measurement
Write mode	Period E	t_c	1000	–	–	ns
	Time of rise/fall pulse E	t_r, t_f	–	–	25	
	Duration of pulse E	t_w	450	–	–	
	Presetting time R/W and RS versus E	t_{SU1}	60	–	–	
	Hold time R/W and RS versus E	t_{H1}	20	–	–	
	Data presetting time DB[7..0] versus E	t_{SU2}	195	–	–	
	Data hold time DB[7..0] versus E	t_{H2}	10	–	–	
Read mode	Period E	t_c	1000	–	–	ns
	Time of rise/fall pulse E	t_r, t_f	–	–	25	
	Duration of pulse E	t_w	450	–	–	
	Presetting time R/W and RS versus E	t_{SU}	60	–	–	
	Hold time R/W and RS versus E	t_H	20	–	–	
	Data presetting time DB[7..0] versus E	t_D	–	–	360	
	Data presetting time DB[7..0] versus E	t_{DH}	5	–	–	

Operating Temperature range

Operating temperature range from -30 °C to +85 °C.

Limit and Limit Permissible Modes

Under influence of the limit modes functionality of the microcircuits is not guaranteed. After measurement of the limit modes functionality is guaranteed in the limit permissible mode.

Table 6.

Parameter Description, Unit of Measurement	Letter Identification	Limit-Permissible Mode		Limit Mode	
		Norm		Norm	
		Not less	Not more	Not less	Not more
Supply voltage of the low voltage part, V	V_{DD}	2.7	5.5	-0.3	7.0
Supply voltage of the high voltage part, V	$V_{Icd}=V_{DD} - V_5$	3.0	13.0	-0.3	13.5
Low level input voltage, V for pins E, R/W, RS, DB0-DB7	V_{il1}	0.0	0.6 ($V_{DD}=4.5\sim 5.5V$) 0.55 ($V_{DD}=2.7\sim 4.5V$)	-0.3	$V_{DD}+0.3$
Low level input voltage, V for pins OSC1	V_{il2}		1.0 ($V_{DD}=4.5\sim 5.5V$) $0.2V_{DD}$ ($V_{DD}=2.7\sim 4.5V$)		
High level input voltage, V for pins E, R/W, RS, DB0-DB7	V_{ih1}	$V_{DD}-2.3$ ($V_{DD}=4.5\sim 5.5V$) $0.7 V_{DD}$ ($V_{DD}=2.7\sim 4.5V$)	V_{DD} ($V_{DD}=4.5\sim 5.5V$) V_{DD} ($V_{DD}=2.7\sim 4.5V$)	-0.3	$V_{DD}+0.3$
High level input voltage, V for pins OSC1	V_{ih2}	$V_{DD}-1.0$ ($V_{DD}=4.5\sim 5.5V$) $0.7 V_{DD}$ ($V_{DD}=2.7\sim 4.5V$)	V_{DD} ($V_{DD}=4.5\sim 5.5V$) V_{DD} ($V_{DD}=2.7\sim 4.5V$)		

* Stresses beyond those listed under “absolute maximum ratings” (“limit mode”) may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” (“Limit-Permissible Mode”) is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

Electric Characteristics ($T_a = 25 \pm 10^\circ\text{C}$)

Electric Parameters ($V_{DD} = 4.5 \sim 5.5 \text{ V}$)

Table 7.

Parameter Description, Unit of Measurement	Letter Identification	Description of Pins	Measurement mode	Norm		Remarks
				Not less	Not more	
High level output voltage, V	Voh1	DB0-DB7	loh= -0.205 mA	2.4	-	
	Voh2	CLK1, CLK2, M, D	loh= -40uA	$0.9V_{DD}$	-	
Low level output voltage, V	Vol1	DB0-DB7	lol= 1.2 mA	-	0.4	
	Vol2	CLK1, CLK2, M, D	lol=40uA	-	$0.1V_{DD}$	
Output voltage drop at the formers, V	Vd	COM1-COM16, SEG1-SEG40	lo=□ 0.1mA		1	(1)
High level input current, uA	Iih	E	$V_{in} = V_{DD}$ $V_{DD} = 5 \text{ V}$	-	1.0	
Low level input current, uA	I _{IL1}	E	$V_{in} = 0$ $V_{DD} = 5 \text{ V}$	-	-1.0	
Low level input current, uA	I _{IL2}	RS,R/W DB0-DB7	$V_{in} = 0 \text{ V}$ $V_{DD} = 5 \text{ V}$	-50	-250	
Consumption current, mA	I _{DD}		$F_{ext} = 270 \text{ kHz}$ $V_{DD} = 5 \text{ V}$		0.6	
Frequency of the internal generator, kHz	Fec		$R_f = 91 \text{ k}\Omega \pm 2\%$, $V_{DD} = 5 \text{ V low level}$	190	350	

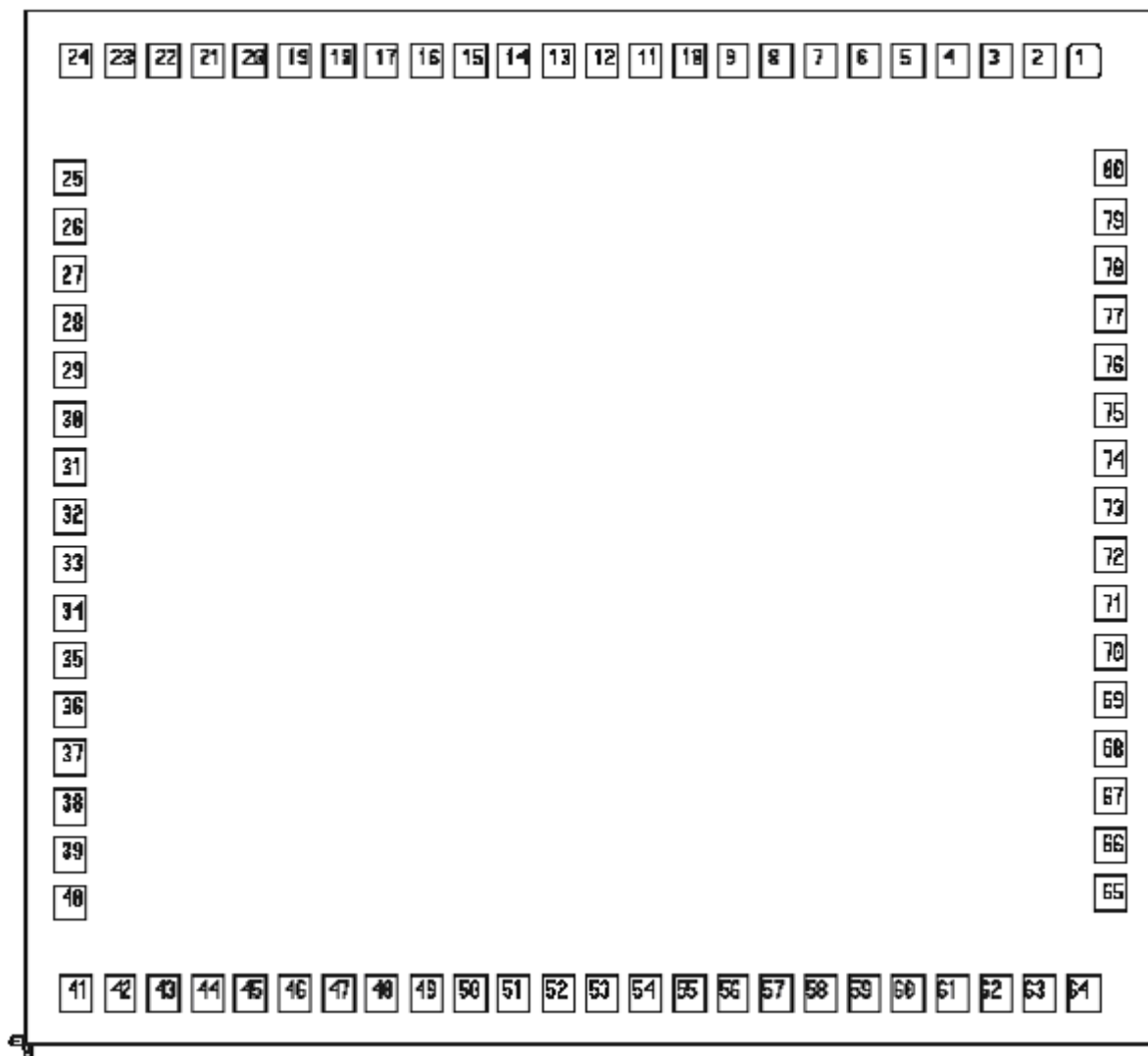
Electric Parameters ($V_{DD} = 2.7\sim 4.5\text{ V}$)

Table 8.

Parameter Description Unit of Measurement	Letter Identification	Description of Pins	Measurement Mode	Norm		Remarks
				Not less	Not more	
High level output voltage, V	Voh1	DB0–DB7	Ioh= -0.1 mA	0.75 V_{DD}	-	
	Voh2	CLK1, CLK2, M, D	Ioh= -40uA	0.8 V_{DD}	-	
Low level output voltage, V	Vol1	DB0–DB7	Iol= 0.1 mA	-	0.2 V_{DD}	
	Vol2	CLK1, CLK2, M, D	Iol=40 uA	-	0.2 V_{DD}	
Output Voltage Drop at Formers, V	Vd	COM1–COM16, SEG1–SEG40	Io=□ 0.1mA		1	(1)
High level input current, uA	Iih	E	Vin= V_{DD} $V_{DD} = 3V$	-	1.0	
Low level input current, uA	I _{IL1}	E	Vin=0 $V_{DD} = 3V$	-	-1.0	
Low level input current, uA	I _{IL2}	RS,R/W DB0–DB7	Vin=0V $V_{DD} = 3V$	-10	-120	
Consumption current, mA	I _{DD}		Fext=270 kHz $V_{DD} = 3V$		0.3	
Frequency of internal generator, kHz	Fec		Rf=75kOhm±2%, $V_{DD} = 3V$	190	350	

1) Parameter Vd is controlled by means of measuring the output voltage of the formers under the preset load, Vi – commutated levels V1, V2, V3, V4: $V5 \leq V4 \leq V3 \leq V2 \leq V1 \leq U_{dd}$
For levels V1, V2 norm rated value - “not less”,
For levels V3, V4 norm rated value - “not more”.

Layout Diagram of Contact Pads



Chip IZ7066, Chip size: 2670 x 3230 um,
 contact pad size: 90 x 90 um by the «passivation» layer

Coordinates Table of Contact Pads

Pad No.	Pad Name	X	Y	Pad No.	Pad Name	X	Y	Pad No.	Pad Name	X	Y
1	SEG22	2976	2495	28	V3	86	1820	55	COM9	1851	85
2	SEG21	2851	2495	29	V4	86	1695	56	COM10	1976	85
3	SEG20	2726	2495	30	V5	86	1570	57	COM11	2101	85
4	SEG19	2601	2495	31	CL1	86	1445	58	COM12	2226	85
5	SEG18	2476	2495	32	CL2	86	1320	59	COM13	2351	85
6	SEG17	2351	2495	33	UDD	86	1195	60	COM14	2476	85
7	SEG16	2226	2495	34	M	86	1070	61	COM15	2601	85
8	SEG15	2101	2495	35	D	86	945	62	COM16	2726	85
9	SEG14	1976	2495	36	RS	86	820	63	SEG40	2851	85
10	SEG13	1851	2495	37	R/W	86	695	64	SEG39	2976	85
11	SEG12	1726	2495	38	E	86	570	65	SEG38	3055	344
12	SEG11	1601	2495	39	DB0	86	445	66	SEG37	3055	469
13	SEG10	1476	2495	40	DB1	86	320	67	SEG36	3055	594
14	SEG9	1351	2495	41	DB2	101	85	68	SEG35	3055	719
15	SEG8	1226	2495	42	DB3	226	85	69	SEG34	3055	844
16	SEG7	1101	2495	43	DB4	351	85	70	SEG33	3055	969
17	SEG6	976	2495	44	DB5	476	85	71	SEG32	3055	1094
18	SEG5	851	2495	45	DB6	601	85	72	SEG31	3055	1219
19	SEG4	726	2495	46	DB7	726	85	73	SEG30	3055	1344
20	SEG3	601	2495	47	COM1	851	85	74	SEG29	3055	1469
21	SEG2	476	2495	48	COM2	976	85	75	SEG28	3055	1594
22	SEG1	351	2495	49	COM3	1101	85	76	SEG27	3055	1719
23	GND	226	2495	50	COM4	1226	85	77	SEG26	3055	1844
24	OSC1	101	2495	51	COM5	1351	85	78	SEG25	3055	1969
25	OSC2	86	2195	52	COM6	1476	85	79	SEG24	3055	2094
26	V1	86	2070	53	COM7	1601	85	80	SEG23	3055	2219
27	V2	86	1945	54	COM8	1726	85				