

IZ1228/IZ1228M

8-DIGIT CALCULATOR

The IZ1228/IZ1228M are a single chip CMOS LSI with 8-digit arithmetic operation, single memory, extraction-of-square-root, percentage calculation and auto power off function, designed for FEM LCD operation with a 1.5V power supply. The IZ1228M has special keys (C1, C2, SM) for currency exchange calculations and special memory for save currency rate.

FUNCTIONS

- Four standard functions (+, -, ×, ÷)
- Auto constant calculations
- Mark-up and mark-down calculations
- Percentage calculations
- Chain multiplication and division
- Power calculations
- Rough estimate calculations
- Clear key: ON/C, CE
- Currency exchange calculations :
Currency 1 → Currency 2 and
Currency 2 → Currency 1

FEATURES

- Single chip CMOS construction
- Floating decimal point
- LCD direct drive
- Special memory for currency rates
- Overflow indication: "E"
- On chip oscillator components
- Direct (IZ1228) or Mirror (IZ1228M) LCD
- Punctuation comma
- Auto Power off
- Saving special memory contents when auto power off
- Accumulating memory: M+, M-, MR, MC, MRC
- Bare chip is available

ABSOLUTE MAXIMUM RATINGS (T_a = 25°C)

Characteristic	Symbol	Value	Unit
Terminal Voltage	V _{DD}	- 0.3 ~ + 2.1	V
	V _{IN}	- 0.3 ~ V _{DD} + 0.3	V
Supply Voltage (Battery)	V _{DD}	1.1 ~ 1.8	V
Operating Temperature	T _a	0 ~ + 50	°C
Storage Temperature	T _{stg}	- 55 ~ + 125	°C

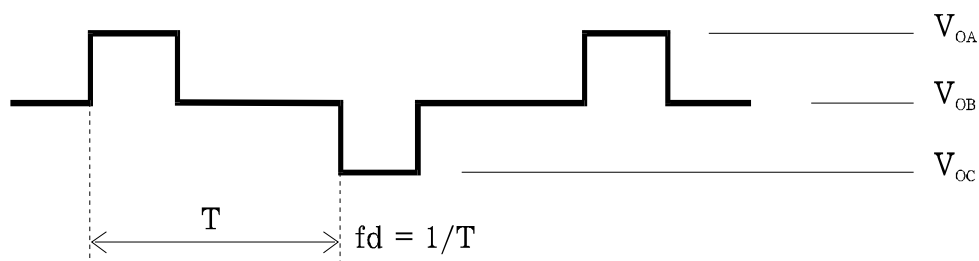
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ELECTRICAL CHARACTERISTICS

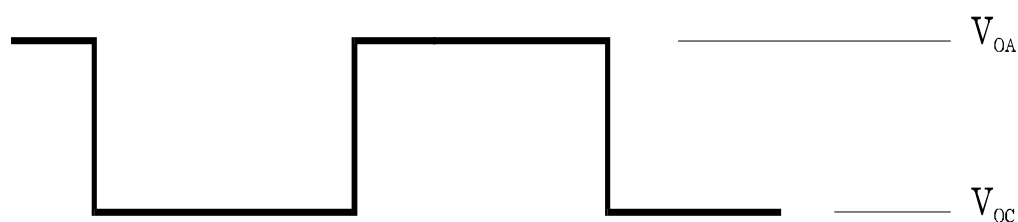
($T_a = 25^\circ\text{C}$, $V_{DD} = 1.5\text{V}$, unless otherwise specified)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Input Voltage (Pins K2 ~ K6)	V_{IH}		$V_{DD} - 0.4$			V
	V_{IL}				0.4	
Input Current (Pins K2 ~ K6)	I_{IH}	$V_{IN} = V_{DD}$			1	μA
	I_{IL}	$V_{IN} = 0\text{V}$	0.3	1	3	
Output Voltage 1 (P1, P2, A2~A5)	V_{OH}	without load	$V_{DD} - 0.15$			V
	V_{OL}	$I_{OL} = 15\mu\text{A}$			0.15	
Output Voltage 2 (H1 ~ H3, a1 ~ a9, b1 ~ b8, c1 ~ c8)	V_{OA}	without load	2.80	2.95		V
	V_{OB}	without load	1.30	1.50	1.70	
	V_{OC}	without load		0	0.20	
Display Frequency	F_d	$V_{DD} = 1.3\text{V}$ while display is on, $R_f = 560\text{K}$	55	75		Hz
Supply Current	I_{OFF}	display is off			1	μA
	I_{DIS}	$V_{DD} = 1.3\text{V}$ while display is on		3.5	5	
	I_{OP}	$V_{DD} = 1.1\text{V}$, while operation		5.6		

OUTPUT WAVEFORM 1; H_i ($i = 1, 2, 3$)



OUTPUT WAVEFORM 2; a_i, b_i, c_i ($i = 1, 2, \dots, 8$)



FUNCTIONAL DESCRIPTION

Decimal point system

Complete floating decimal point system. 8 digits leading zero suppression. Zero shift.

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Symbols : - : negative number display
E : error display
, : punctuation comma
M : non-zero memory indicator
C1, C2 : currency exchange operations indicator

Error detections

- **System errors occur when:**

- 1) The division by zero.
- 2) The extraction of square root of a negative number.

- **Rough estimate calculation error occur when**

The integral part of the result of any standard functions, percentage, square, reciprocal, or power calculations exceed 8 digits.

Error indication

- **System error**

“0” is indicated in the 1-digit position and “E” in the sign-digit position.

- **Rough estimate calculation error**

The high-order 8-digit calculation result is indicated together with “E”.

The decimal point is indicated in the position corresponding to a calculation result of time 10^{-8} , and no zero shift is performed

Error release

- **System error**

A system error can be release by the ON/C key.

- **Rough estimate calculation error**

A rough estimate calculation error can be released by the ON/C, CE key.

Number entry

Numerical can be entered up to 8 digits. Numerical entries equal to 9 digits or more are ignored.

Memory protection

In any error detection, the special memory content is retained when auto power off.

Key bounce protection

Front edge

Down to 1 word and up to about 3 words.

Trailing edge

9 words

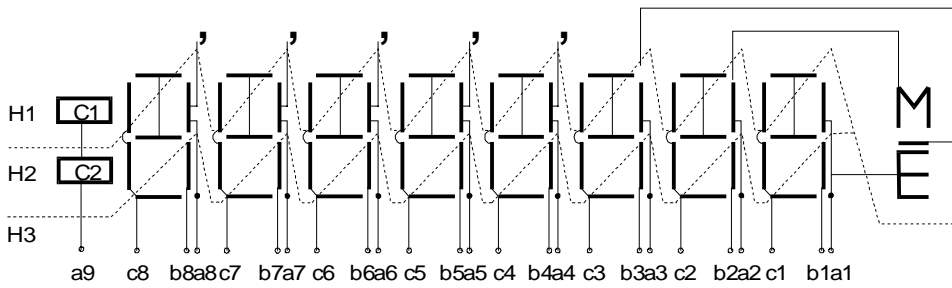
1 word is 3.3ms when display frequency is $f_d = 100\text{Hz}$.

Auto power OFF

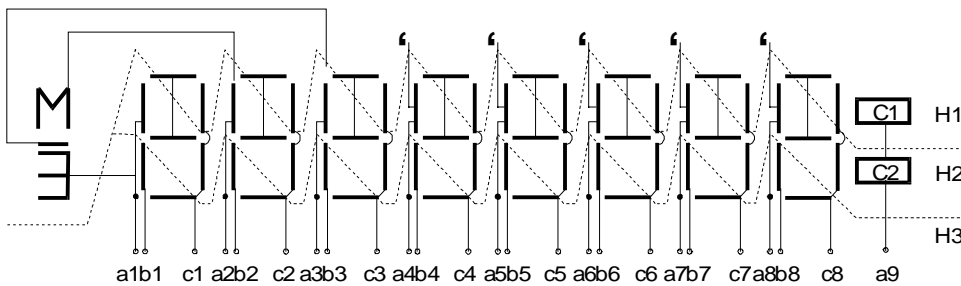
Power automatically turns off after 9 - 11 minutes pass from the last key pressure. The special memory content is saving when power auto off.

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LCD CONNECTION

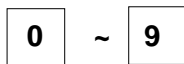


Direct LCD
with IZ1228

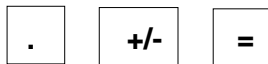


Mirror LCD
with IZ1228M

KEY DESCRIPTION



Numerals input keys



Decimal point key, Sign change key, Enter key



Clear keys

ON/C: Power ON/All clear (system reset) except special memory contents
CE: Entry clear such as only the entered data is cleared



Four standard function keys



Percent key, Extraction of square root key



Currency exchange keys.

Entered Data multiplied (when press C1) or divided (when press C2) to the currency rate (content of special memory)

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SM

Set Currency rate C1/C2
(Entered Data set into special memory by this key)

MR

MC

MRC

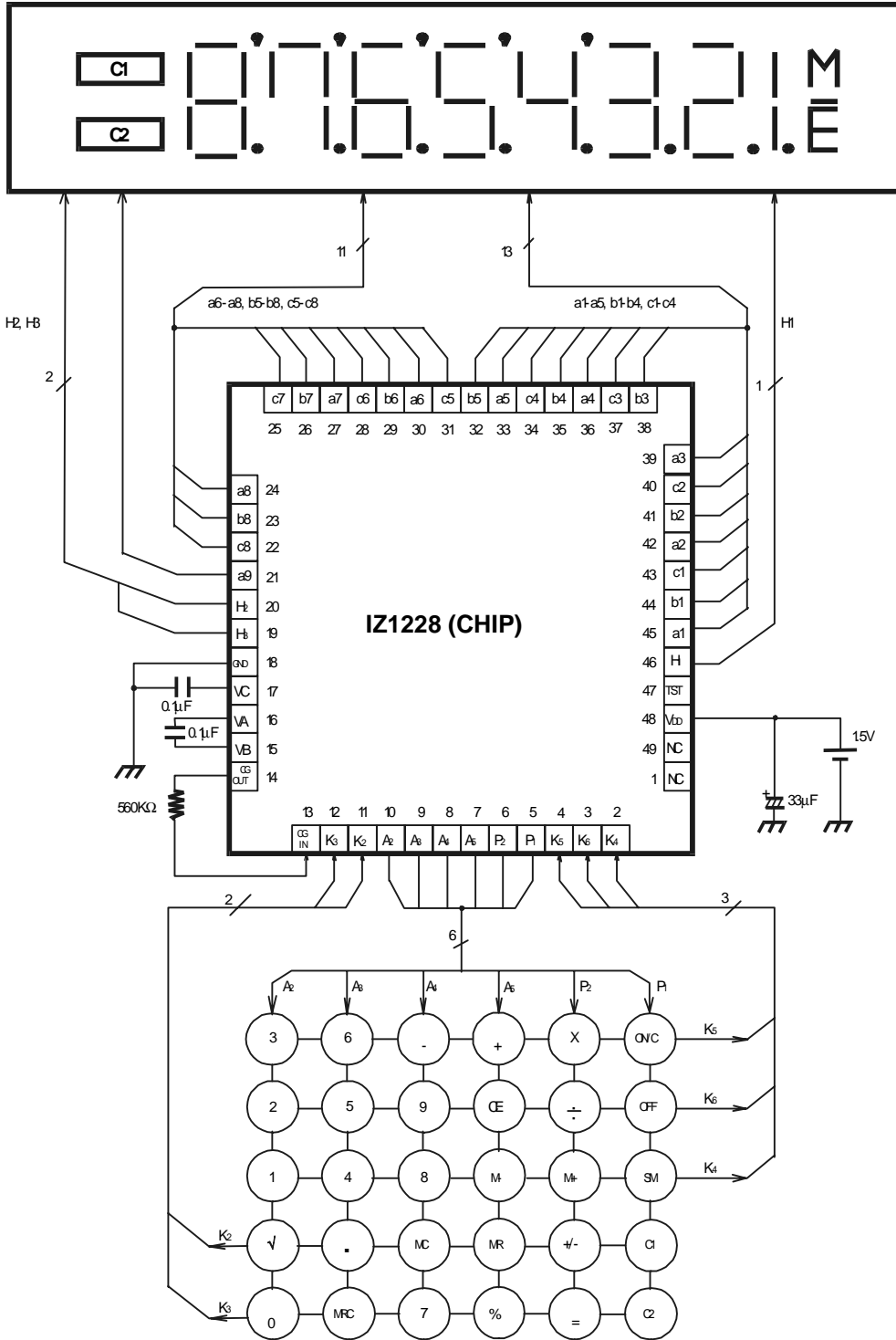
Recall memory, clear memory, recall and clear memory

OFF

Off key

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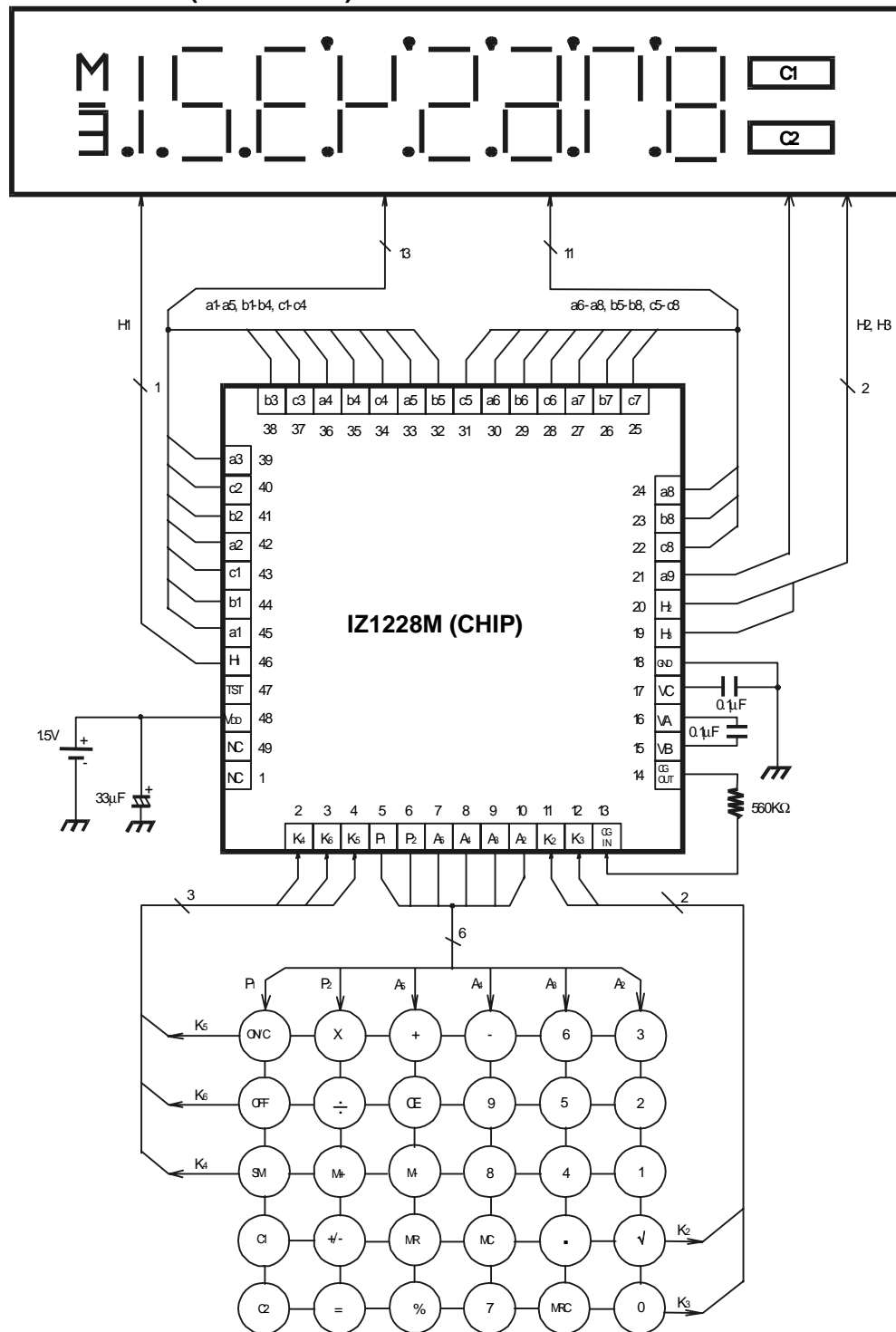
APPLICATION CIRCUIT (direct LCD)



NOTE1: Chip substrate must be floating or connected to GND

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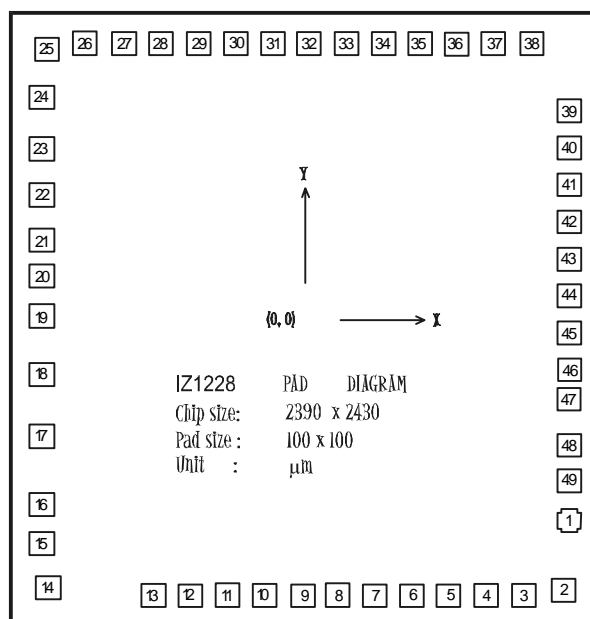
APPLICATION CIRCUIT (mirror LCD)



NOTE1: Chip substrate must be floating or connected to GND

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PAD DIAGRAM

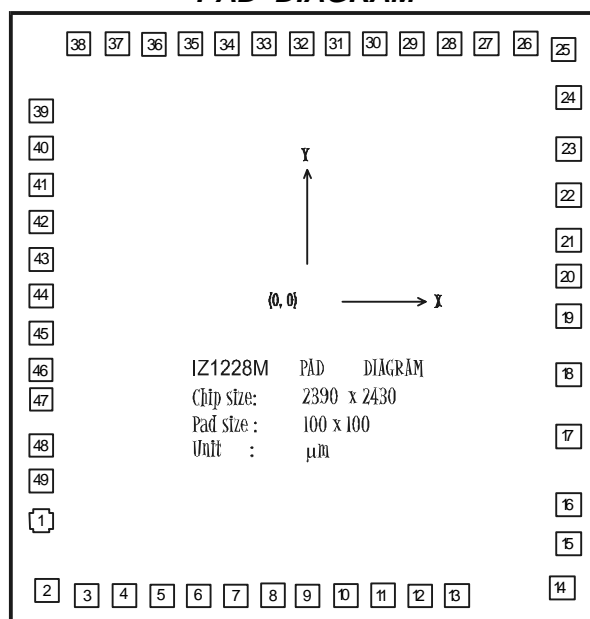


PAD LOCATION

Pad No.	Pad Name	Description	X	Y	Pad No.	Pad Name	Description	X	Y
1	NC	No Connection	1065	-821	26	b7	Display output	-890	1085
2	K4	Key input	1045	-1065	27	a7	Display output	-740	1085
3	K6	Key input	880	-1085	28	c6	Display output	-590	1085
4	K5	Key input	730	-1085	29	b6	Display output	-440	1085
5	P1	Strobe output	580	-1085	30	a6	Display output	-240	1085
6	P2	Strobe output	430	-1085	31	c5	Display output	-140	1085
7	A5	Strobe output	280	-1085	32	b5	Display output	10	1085
8	A4	Strobe output	130	-1085	33	a5	Display output	160	1085
9	A3	Strobe output	-20	-1085	34	c4	Display output	310	1085
10	A2	Strobe output	-170	-1085	35	b4	Display output	460	1085
11	K2	Key input	-320	-1085	36	a4	Display output	610	1085
12	K3	Key input	-470	-1085	37	c3	Display output	760	1085
13	CG in	Resistor terminal	-620	-1085	38	b3	Display output	910	1085
14	CG out	Resistor terminal	-1035	-1065	39	a3	Display output	1065	849
15	VB	Capacitor terminal	-1065	-913	40	c2	Display output	1065	694
16	VA	Capacitor terminal	-1065	-763	41	b2	Display output	1065	544
17	VC	Capacitor terminal	-1065	-487	42	a2	Display output	1065	394
18	GND	Ground	-1065	-223	43	c1	Display output	1065	244
19	H3	Display output	-1065	17	44	b1	Display output	1065	89
20	H2	Display output	-1065	177	45	a1	Display output	1065	-61
21	a9	Display output	-1065	327	46	H1	Display output	1065	-211
22	c8	Display output	-1065	507	47	TST	Test	1065	-340
23	b8	Display output	-1065	697	48	V _{DD}	Power supply	1065	-521
24	a8	Display output	-1065	902	49	NC	No Connection	1065	-671
25	c7	Display output	-1045	1065					

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