IZ1239M

8 - DIGITS CURENCY CALCULATOR

The IZ1239M 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 IZ1239M has special keys (C1, C2, SM, RM) for currency exchange calculations and special memory for save currency rate. The result of currency exchange operations formatted to two decimal always and rounded if it exceeds two decimal.

FUNCTIONS

- Four standard functions (**+**, **-**, ×, ÷)
- The result of currency exchange operation is rounded to two decimal
- 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
- Mirror LCD
- Punctuation comma
- Auto Power off
- Saving special memory contents when auto power off
- Accumulating memory: M+, M-, MR, MC, MRC
- Currencies C1, C2, SMR, SMW and Rate indication
- Rounded function (option)
- Formatting function
- Bare chip is available

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^oC$)

| 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	^oC
Storage Temperature	T_{stg}	- 55 ~ + 125	^oC

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ELECTRICAL CHARACTERISTICS

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

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Operating Voltage			1.1	1.5	1.8	V
Input Voltage (Pins K2 ~ K6)	V_{IH}		$V_{DD} - 0.4$			V
	V_{IL}				0.4	
Input Current (Pins K2 ~ K6)	I_{IH}	$V_{IN} = V_{DD}$	0.3		1	μA
	I_{IL}	$V_{IN} = 0V$		1	3	
Output Voltage 1 (P1, P2, A2~A5)	V_{OH}	without load	$V_{DD} - 0.15$			V
	V_{OL}	$I_{OL} = 15\mu A$			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	$V_{DD} = 1.3V$ while display is on	55	75		Hz
Supply Current	I_{OFF}	display is off			1	μA
	I_{DIS}	$V_{DD} = 1.3V$ while display is on		3.5	5	
	I_{OP}	$V_{DD} = 1.1V$, while operation		5.6		

OUTPUT WAVEFORM 1; Hi (i = 1, 2, 3)

$$fd = 1/T$$
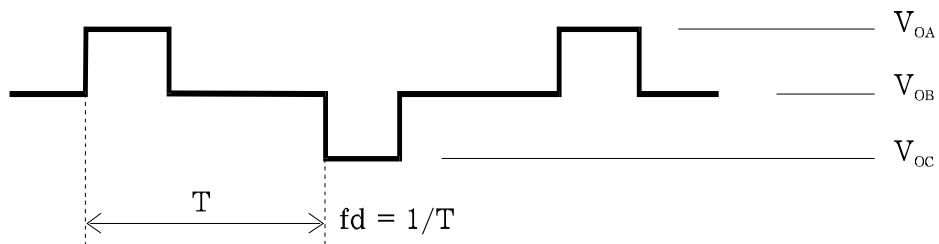
OUTPUT WAVEFORM 2; ai, bi, ci, (i = 1, 2, ... , 8)
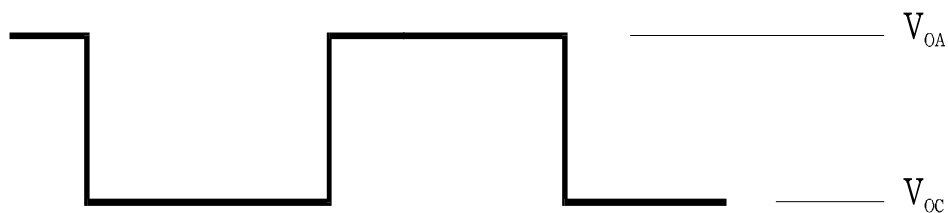
FUNCTIONAL DESCRIPTION

Decimal point system

Complete floating decimal point system. 8 digits leading zero suppression. Zero shift.
At currency exchange operations the result is formatted to two decimal.

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

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Error detection

• **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 fd = 100Hz.

Option

• The rounding and formatting functions are enabled when pad F1 is opened or connected to V_{DD} and disabled when pad F1 is connected to V_{SS}.
• During special memory recall the icon RATE only is on if pad F2 is opened or connected to V_{DD} and icons RATE, C1, C2 are on if pad F2 is connected to V_{SS}.

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
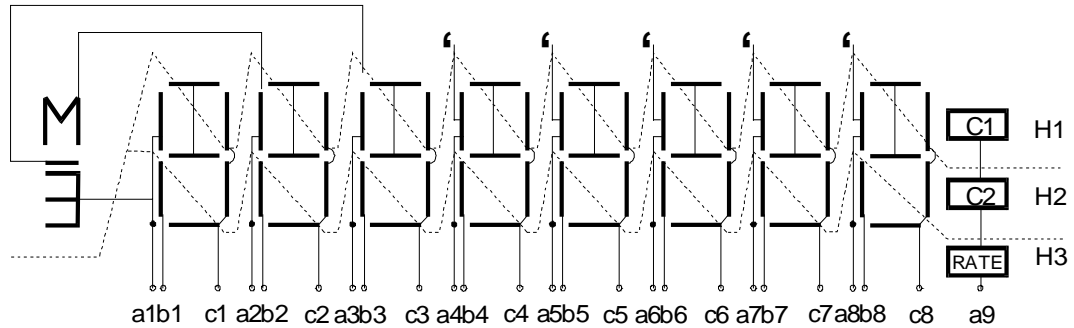
Mirror LCD with IZ1239M

KEY DESCRIPTION

| 0 | ~ | 9 | Numerals input keys

| . | | +/ | | = | **Decimal point key, Sign change key, Enter key**

| ON/ | | CE | **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**

| C1 | | C2 | **Currency exchange keys**

Entered Data multiplied (when press C1) or divided
(when press C2) to the currency rate (content of special
memory). During this operation icon C1 or C2 is on.

| SM | *Set Currency rate C1/C2*
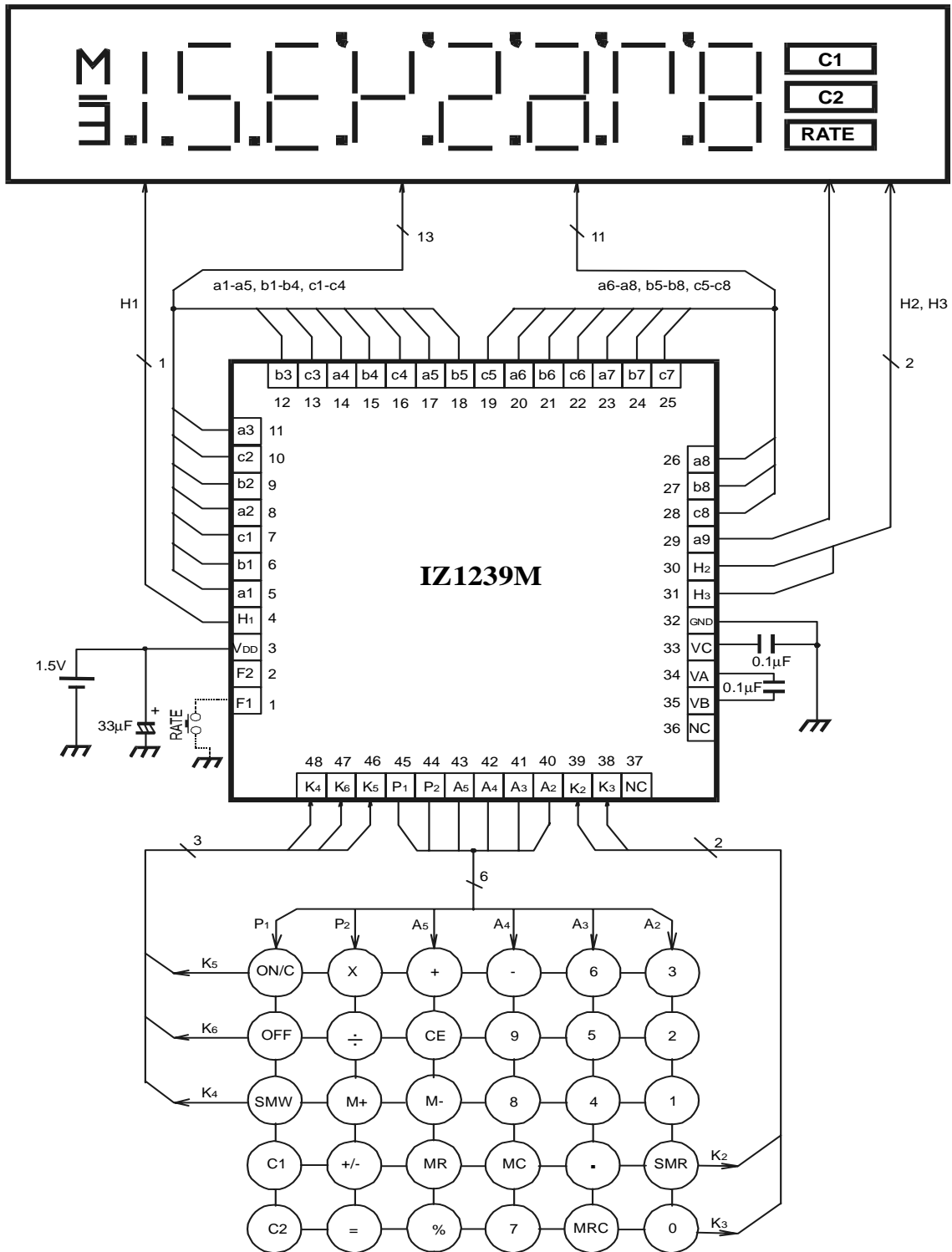(Entered Data setted into special memory by this key).

| RM | **Recall special memory. When press RM, icon RATE is ON**

| MR | | MC | | MRC | Recall memory, clear memory, recall and clear memory
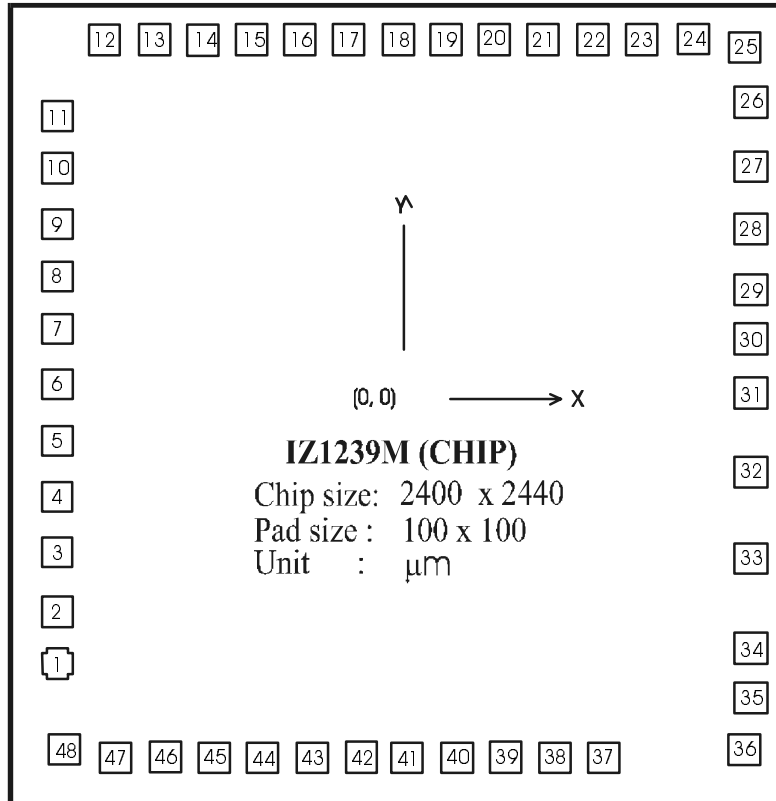
| OFF | Off key

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APPLICATION CIRCUIT (mirror LCD)

C1

C2

RATE

13   11

a1-a5, b1-b4, c1-c4   a6-a8, b5-b8, c5-c8

H1   H2, H3

1   2

b3	c3	a4	b4	c4	a5	b5	c5	a6	b6	c6	a7	b7	c7
12	13	14	15	16	17	18	19	20	21	22	23	24	25

a3 11

c2 10   26 a8

b2 9   27 b8

a2 8   28 c8

c1 7   29 a9

b1 6   30 H_2

a1 5   31 H_3

H_1 4   32 GND

V_{DD} 3   33 VC

F2 2   34 VA   0.1μF

F1 1   35 VB   0.1μF

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1.5V

RATE

33μF

48	47	46	45	44	43	42	41	40	39	38	37
K_4	K_6	K_5	P_1	P_2	A_5	A_4	A_3	A_2	K_2	K_3	NC

3   6   2

P_1 P_2 A_5 A_4 A_3 A_2

K_5 ON/C   X   +   -   6   3

K_6 OFF   ÷   CE   9   5   2

K_4 SMW   M+   M-   8   4   1

C1   +/-   MR   MC   .   SMR K_2

C2   =   %   7   MRC   0 K_3

NOTE: Chip substrate must be floating or connected to GND

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PAD DIAGRAM

IZ1239M (CHIP)
Chip size: 2400 x 2440
Pad size: 100 x 100
Unit: μm

PAD LOCATION

Pad No.	Pad Name	Description	X	Y	Pad No.	Pad Name	Description	X	Y
1	F1	Option	-1070	-810	25	c7	Display output	1050	1070
2	F2	Option	-1070	-650	26	a8	Display output	1070	905
3	V_{DD}	Power supply	-1070	-470	27	b8	Display output	1070	705
4	H1	Display output	-1070	-300	28	c8	Display output	1070	515
5	a1	Display output	-1070	-130	29	a9	Display output	1070	330
6	b1	Display output	-1070	40	30	H2	Display output	1070	180
7	c1	Display output	-1070	210	31	H3	Display output	1070	15
8	a2	Display output	-1070	370	32	GND	Ground	1070	-225
9	b2	Display output	-1070	530	33	V_C	Capacitor terminal	1070	-485
10	c2	Display output	-1070	700	34	V_A	Capacitor terminal	1070	-765
11	a3	Display output	-1070	860	35	V_B	Capacitor terminal	1070	-915
12	b3	Display output	-915	1090	36	NC	No Connection	1050	-1070
13	c3	Display output	-765	1090	37	NC	No Connection	615	-1090
14	a4	Display output	-615	1090	38	K3	Key input	465	-1090
15	b4	Display output	-465	1090	39	K2	Key input	315	-1090
16	c4	Display output	-315	1090	40	A2	Strobe output	165	-1090
17	a5	Display output	-165	1090	41	A3	Strobe output	15	-1090
18	b5	Display output	-15	1090	42	A4	Strobe output	-135	-1090
19	c5	Display output	135	1090	43	A5	Strobe output	-285	-1090
20	a6	Display output	285	1090	44	P2	Strobe output	-435	-1090
21	b6	Display output	435	1090	45	P1	Strobe output	-585	-1090
22	c6	Display output	585	1090	46	K5	Key input	-735	-1090
23	a7	Display output	735	1090	47	K6	Key input	-885	-1090
24	b7	Display output	885	1090	48	K4	Key input	-1050	-1050

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