IZ1229M

10-DIGITS CALCULATOR

The IZ1229M is a single chip CMOS LSI with 10-digit arithmetic operation, single memory, extraction-of-square-root, percentage calculation, auto power off and punctuation and touch tone function, designed for FEM LCD operation with a 1.5V power supply.
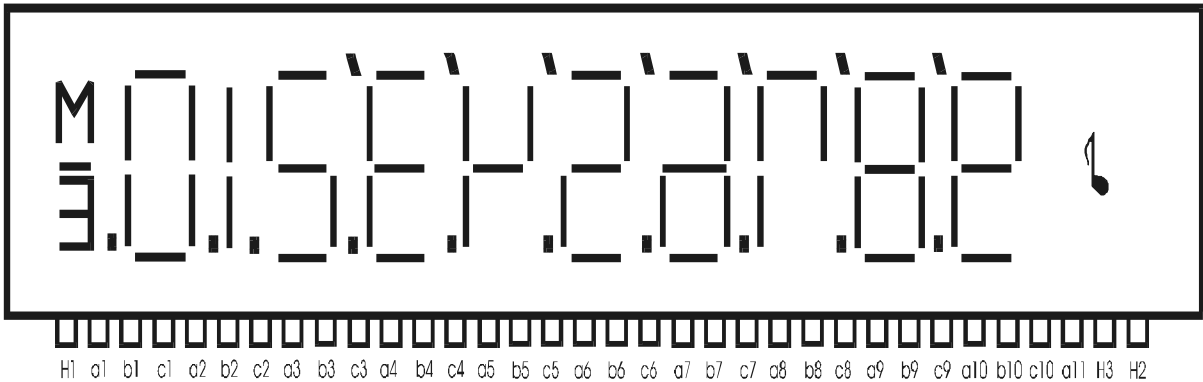
FUNCTIONS

- Four standard functions (**+**, **-**, ×, ÷)
- Square and reciprocal calculations
- Extraction of square root
- Auto constant calculations (constant: multiplicand, divisor,
   addend and subtrahend)
- Mark-up and mark-down calculations
- Percentage calculations
- Chain multiplication and division
- Power calculations
- Rough estimate calculations
- Punctuation comma and touch tone mark display
- Clear key: ON/C, CE
- Touch tone function

FEATURES

- Single chip CMOS construction
- Floating decimal point
- LCD direct drive
- Overflow indication: "E"
- On chip oscillator components
- Auto Power off
- Accumulating memory: M+, M-, MR, MC, MRC
- Bare chip is available
   Mirror type

LCD CONNECTION

H1 a1 b1 c1 a2 b2 c2 a3 b3 c3 a4 b4 c4 a5 b5 c5 a6 b6 c6 a7 b7 c7 a8 b8 c8 a9 b9 c9 a10 b10 c10 a11 H3 H2

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

Characteristic	Symbol	Value	Unit
Terminal Voltage	V_{CC}	- 0.3 ~ + 2.1	V
	V_{IN}	- 0.3 ~ V_{CC} + 0.3	V
Operating Temperature	T_a	0 ~ + 50	^oC
Storage Temperature	T_{stg}	- 55 ~ + 125	^oC

ELECTRICAL CHARACTERISTICS ($T_a = 25^oC$, $V_{CC} = 1.5V$, unless otherwise specified)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Operating Voltage	V_{OP}		1.1	1.5	1.8	V
Input Voltage	V_{IH}		V_{CC} - 0.4			V
(pins FDISB, EXT)	V_{IL}				0.4	
Input Current 1	I_{IH1}	$V_{IN} = V_{CC}$			1	μA
(pins FDISB, EXT)	I_{IL1}	$V_{IN} = 0V$	1.5	2.5	3	
Input Current 2	I_{IH2}	$V_{IN} = V_{CC}$; APODISB = 0V			1	μA
(pins K4 ÷ K6)	I_{IL2}	$V_{IN} = 0V$; FDISB = 0V	3	5.5	7.5	
Output Voltage	V_{OA}	Without load	2.80	2.95		V
(pins a1÷a11, b1÷b10,	V_{OB}	Without load	1.30	1.50	1.70	
c1÷c10, H1÷H3)	V_{OC}	Without load		0	0.20	
Display Frequency	F_d	$V_{CC} = 1.3V$, Display is on	55	75		Hz
Touch Tone Output Drive	I_{OH}	$V_{OH} = 1.0V$, APODISB = 0V, FDISB = 0V	1.3	2		mA
Current	I_{OL}	$V_{OL} = 0.5V$, APODISB = 0V, FDISB = 1.5V	1.3	2		
Supply Current	I_{OFF}	Display is off			1	μA
	I_{DIS}	$V_{CC} = 1.3V$, Ddisplay is on		6	10	

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FUNCTIONAL DESCRIPTION

Decimal point system

Complete floating decimal point system.

Integral number

10 digits leading zero suppression. Zero shift.

Symbols   **-** : negative number display
       E : error display
    , : punctuation comma

    ♪   : touch tone indicator

Error detections

- **System errors occur when:**
  1) The division by zero.
  2) The extraction of square root of a negative number.
  3) The integral part of any memory calculation result exceeds 10 digits.
- **Rough estimate calculation error occur when**
  The integral part of any calculation – any standard functions, percentage, square root, reciprocal or power calculations result exceeds 10 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 10-digit calculation result is indicated together with "E".
  The decimal point is indicated if the position corresponding to a calculation result of time 10^{-10}, 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**
  ON/C key can release a rough estimate-calculation error and clear calculation result at once. CE key can release only a rough estimate calculation error ("E" flag).

Number entry
Numericals can be entered up to 10 digits. Numerical entries equal to 11 digits or more are ignored.

Memory protection
In any error detection, the memory contents present before the error detection are protected.

Memory indication

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If the memory content is not zero, "M" is indicated in the sign-digit position.

Key bounce protection
Front edge
  Minimum 3 words
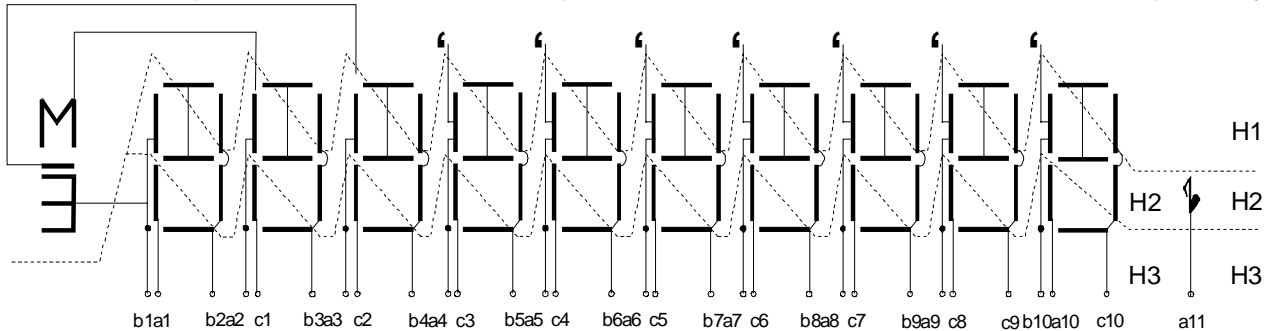**Trailing edge**
  Minimum 16 words
  1 word is 3.3ms when display frequency is F_d = 100Hz.

Auto power OFF
Power automatically turns off after 7 - 8 minutes pass from the last key pressure. By connecting the APODISB pin to GND or V_{CC}, the auto power off function is disabled or enabled, respectively.

H1

H2 H2

H3 H3

b1a1 b2a2 c1 b3a3 c2 b4a4 c3 b5a5 c4 b6a6 c5 b7a7 c6 b8a8 c7 b9a9 c8 c9 b10a10 c10 a11

Mirror LCD with IZ1229M

TOUCH TONE (♪) KEY

• When power is ON, the touch tone function is enable and the beep sound with f=2KHz is generated output during 125ms and
  ♪ sign is displayed on LCD.
• Selection of touch tone function is toggled by touch tone key.

CLEAR KEY DESCRIPTION

ON/C key
• Power-on function.
• All operations are cleared by the ON/C key (except memory contents).

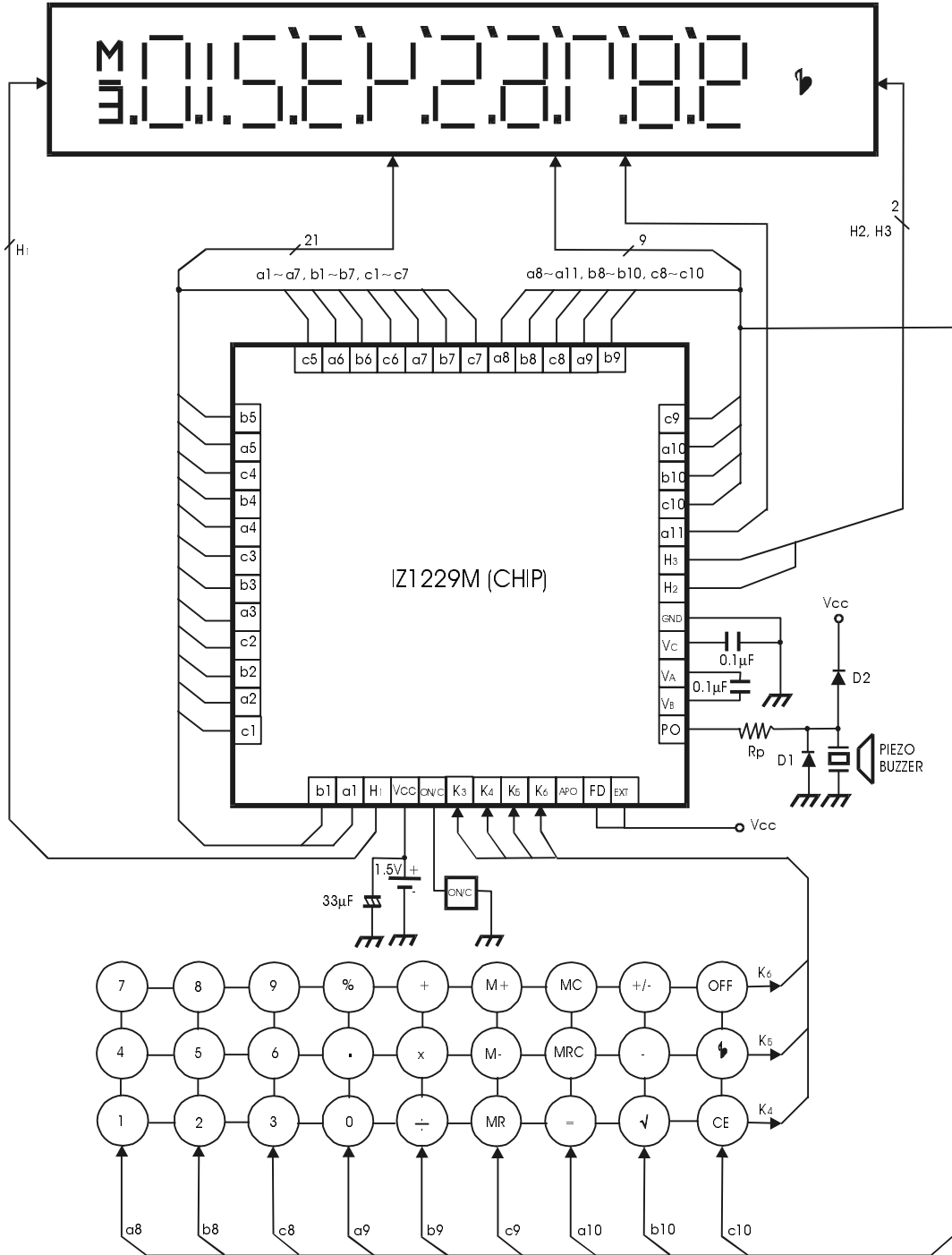### CE key
• CE key can edit the last operand or operator.

MARK-UP AND MARK-DOWN CALCULATION

ENTRY		DISPLAY	
A	A	A	A
+/-	×	A	A
B	B	B	B
%	%	A $\pm$ AM/100	AM/100
	+ OR -		AM/100
	=		A + AM/100 OR A – AM/100

Note: AM: AMOUNT

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APPLICATION CIRCUIT (mirror LCD)

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AUTO POWER OFF CONDITION

D1, D2: Protection Diode
Rp   : Protection Resistor (0.5 ~1.5KΩ)

APODISB	V_{CC}	GND
APO STATE	ENABLE	DISABLE

PAD DIAGRAM


```
IZ1229M  PAD  DIAGRAM
Chip size: 2590 x 2740
Pad size  : 100 x 100
Unit          : μm
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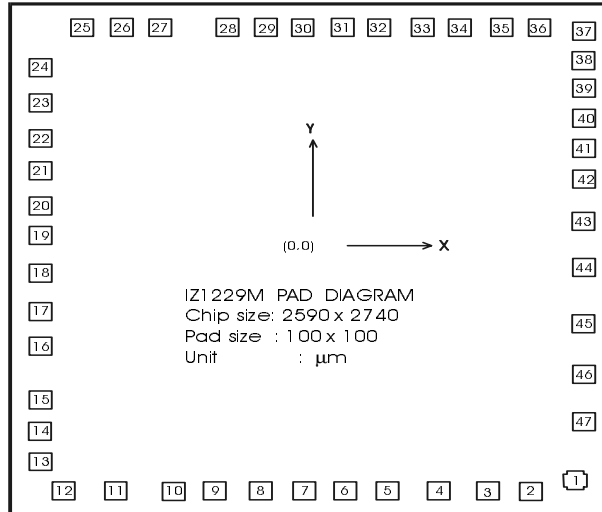
PAD LOCATION

Pad No.	Pad Name	Description	X	Y	Pad No.	Pad Name	Description	X	Y
1	PO	Piezo Output	1124	-1181	25	c5	Display output	-981	1244
2	EXT	External Clock	939	-1236	26	a6	Display output	-816	1244
3	FDIS	F_{OSC} Disable	759	-1236	27	b6	Display output	-646	1244
4	APOD	APO Disable	541	-1236	28	c6	Display output	-361	1244
5	K6	Key input	329	-1236	29	a7	Display output	-196	1244
6	K5	Key input	149	-1236	30	b7	Display output	-36	1244
7	K4	Key input	-31	-1236	31	c7	Display output	134	1244
8	ON/C	Key Input	-211	-1236	32	a8	Display output	294	1244
9	V_{CC}	Power Supply	-411	-1236	33	b8	Display output	474	1244
10	H1	COM1	-591	-1236	34	c8	Display output	639	1244
11	a1	Display output	-841	-1236	35	a9	Display output	819	1244
12	b1	Display output	-1061	-1236	36	b9	Display output	984	1244
13	c1	Display output	-1161	-1076	37	c9	Display output	1149	1224
14	a2	Display output	-1161	-916	38	a10	Display output	1169	1074
15	b2	Display output	-1161	-746	39	b10	Display output	1169	919
16	c2	Display output	-1161	-461	40	c10	Display output	1169	759
17	a3	Display output	-1161	-276	41	a11	Display output	1169	594
18	b3	Display output	-1161	-66	42	H3	COM3	1169	434
19	c3	Display output	-1161	134	43	H2	COM2	1169	209
20	a4	Display output	-1161	294	44	GND	Ground	1169	-36
21	b4	Display output	-1161	484	45	V_C	Capacitor terminal	1169	-306
22	c4	Display output	-1161	654	46	V_A	Capacitor terminal	1169	-611
23	a5	Display output	-1161	844	47	V_B	Capacitor terminal	1169	-866
24	b5	Display output	-1161	1034					

APO: Output Power OFF

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