BASIC FUNCTION 8-DIGITS LCD CALCULATOR WITH TOUCH TONE AND PUNCTUATION FUNCTION

The IZ1225M is a single chip CMOS LSI with 8-digit arithmetic operation, single memory, extraction-of-square-root, percentage calculation and auto power off and punctuation and touch tone function, designed for FEM LCD operation with a 1.5V power supply.

FUNCTIONS

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

FEATURES

- Single chip CMOS construction
- Floating decimal point
- LCD direct drive
- Overflow indication: “E”
- Accumulating memory: M+, M-, RM, CM, RM/CM
- 48 QFP and bare chip available
- Mirror type

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

Characteristic	Symbol	Value	Unit	Note
Terminal Voltage	V_{GG}	- 0.3 ~ + 3.5	V	1
	V_{IN}	- 0.3 ~ V_{GG} + 0.3	V	
Supply Voltage	V_{GG}	2.5 ~ 3.5	V	
Operating Temperature	T_{OPR}	0 ~ + 50	^oC	
Storage Temperature	T_{stg}	- 55 ~ + 125	^oC	

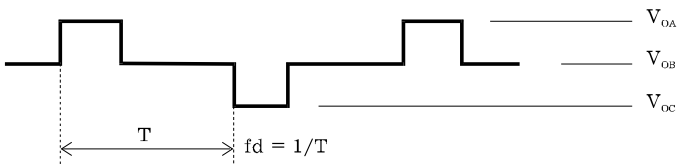
Note: 1. Maximum voltage on any pin with respect to the GND

ELECTRICAL CHARACTERISTICS (T_a = 25°C, V_{GG} = 3.0V, unless otherwise specified)

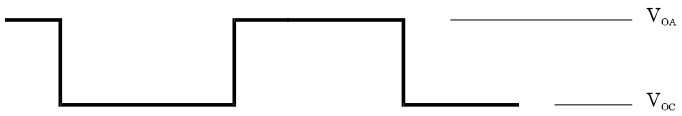
Characteristic	Symbol	Test Condition		Min	Typ	Max	Unit
Input Voltage 1 (K2 ~ K6, TI, S2)	V_{IH1}			V_{GG} - 0.4			V
	V_{IL1}					0.4	
Input Voltage 2 (S1)	V_{IH2}			V_{GG} - 0.4			V
	V_{IL2}					0.2	
Input Current 1 (K2 ~ K6, TI)	I_{IH1}	$V_{IN} = V_{GG}$				1	µA
	I_{IL1}	V_{IN} = 0V			5.5	10	
Input Current 2 (S2)	I_{IH2}	$V_{IN} = V_{GG}$				1	µA
	I_{IL2}	V_{IN} = 0V				1	
Input Current 3 (S1)	I_{IH3}	$V_{IN} = V_{GG}$	S2=GND			1	µA
	I_{IL3}	V_{IN} = 0V		5	10	15	
Input Current 4 (S1)	I_{IH4}	$V_{IN} = V_{GG}$	S2 = V_{GG}	20	30	40	µA
	I_{IL4}	V_{IN} = 0V				1	
Output Voltage 1 (P1, P2, A2~A5)	V_{OH1}	without load		V_{GG} - 0.15			V
	V_{OL1}	I_{OUT} = 15µA				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_{GG} = 1.5V while display is on,		50	75		Hz
Touch Tone (PO)	I_{OL}	V_{GG} = 1.5V, V_{OL} = 0.5V, TI =3V		3			mA
Output Drive Current	I_{OH}	V_{GG} = 1.5V, V_{OL} = 0.5V, TI =3V		-3			
Dissipation	I_{OFF} (1)	Display off, V_{GG} = 3V				0.1	
	I_{dis} (2)	V_{GG} = 1.5V while display is on,			20	30	µA

NOTE: 1) Measured by the next test circuit after power supply automatically turns off.
2) Measured by the next test circuit while “0” is being displayed after auto clear operation and while key is not being depressed.

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



OUTPUT WAVEFORM 2; ai, bi, ci, (i = 1, 2, ... , 8)



FUNCTIONAL DESCRIPTION

Decimal point system

Complete floating decimal point system.

Integral number : 8 digits leading zero suppression. Zero shift.

Symbols : **-** : negative number display
E : error display
M : memory display
, : punctuation comma
♪ : touch tone indicator

Error detections

- **System errors occur when:**

1) The integral part of any memory calculation result exceeds 8 digits.
2) The division by zero.
3) The extraction of square root of a negative number.

- **Rough estimate calculation error**

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 or ON/CE key.

- **Rough estimate calculation error**

A rough estimate calculation error can be released by the ON/C, ON/CE, CE key.
A calculation result is not cleared by ON/CE, CE key but is retained.

Number entry

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

Memory protection

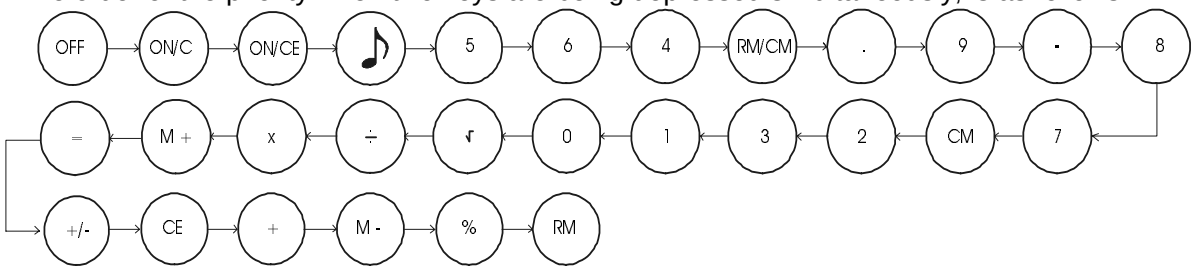
In any error detection, the memory content is retained.

Memory indication

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

Doubler key depression

The order of the priority when two keys are being depressed simultaneously, is as follows:



When the OFF and ON/C key are depressed simultaneously, the OFF key is given priority.

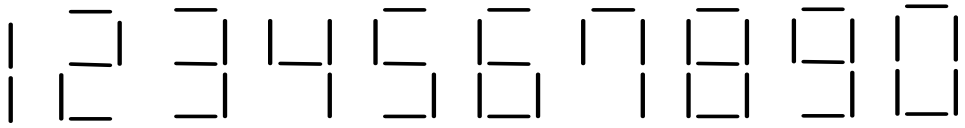
Key bounce protection

Front edge
Down to 1 word and up to about 3 words.

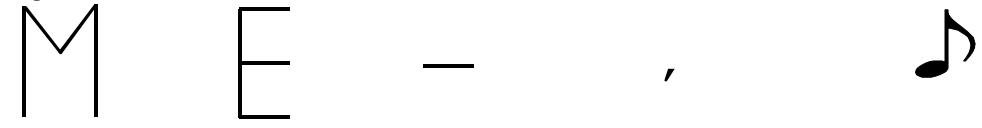
Trailing edge
9 words
1 word is 3.3ms when display frequency is fd = 100Hz.

DISPLAY FONTS

- **Numericals font**



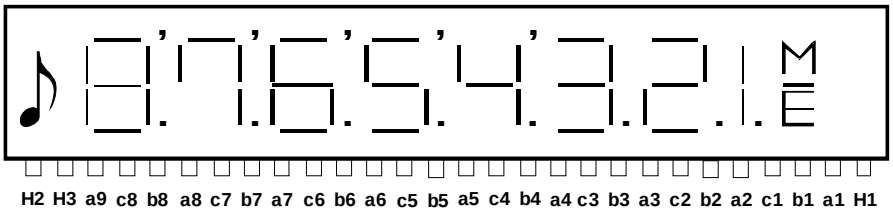
Sigh font

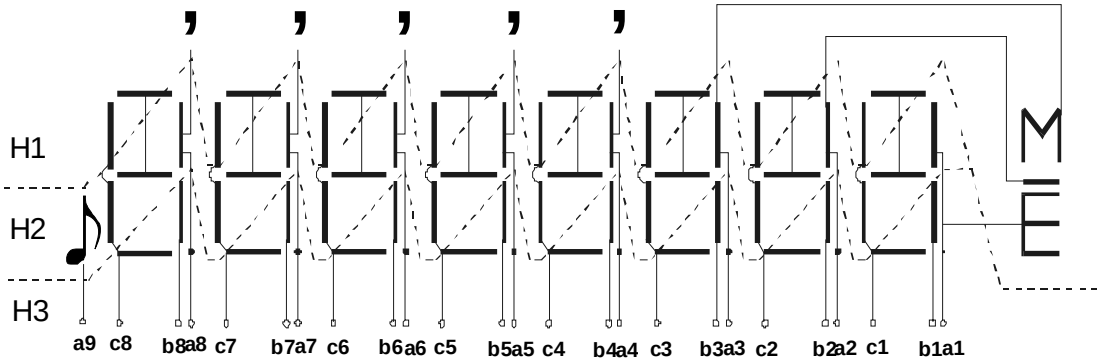


Memory error minus punctuation touch tone indicator

INTEGRAL

LCD connector





AUTO POWER OFF

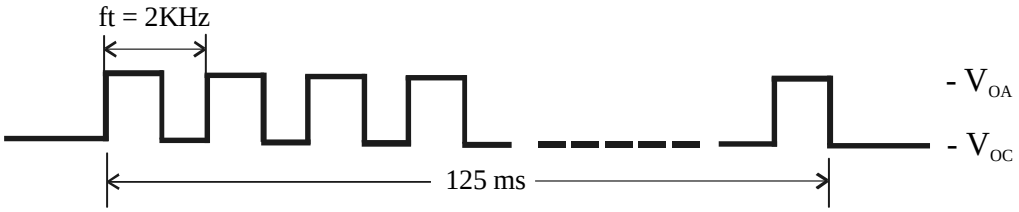
Power automatically turns off after 9 - 11 minutes pass from the last key pressure. (S_1 = Low, S_2 = High)

ON/C KEY

All operations except memory content are cleared by ON/C key.

TOUCH TONE (♪) KEY

- When power is ON, the touch tone function is enable and the beep sound is generated output during 125ms and ♪ sing is displayed on LCD.
- Selection of touch tone function is toggled by touch tone key.
- Output wave form.

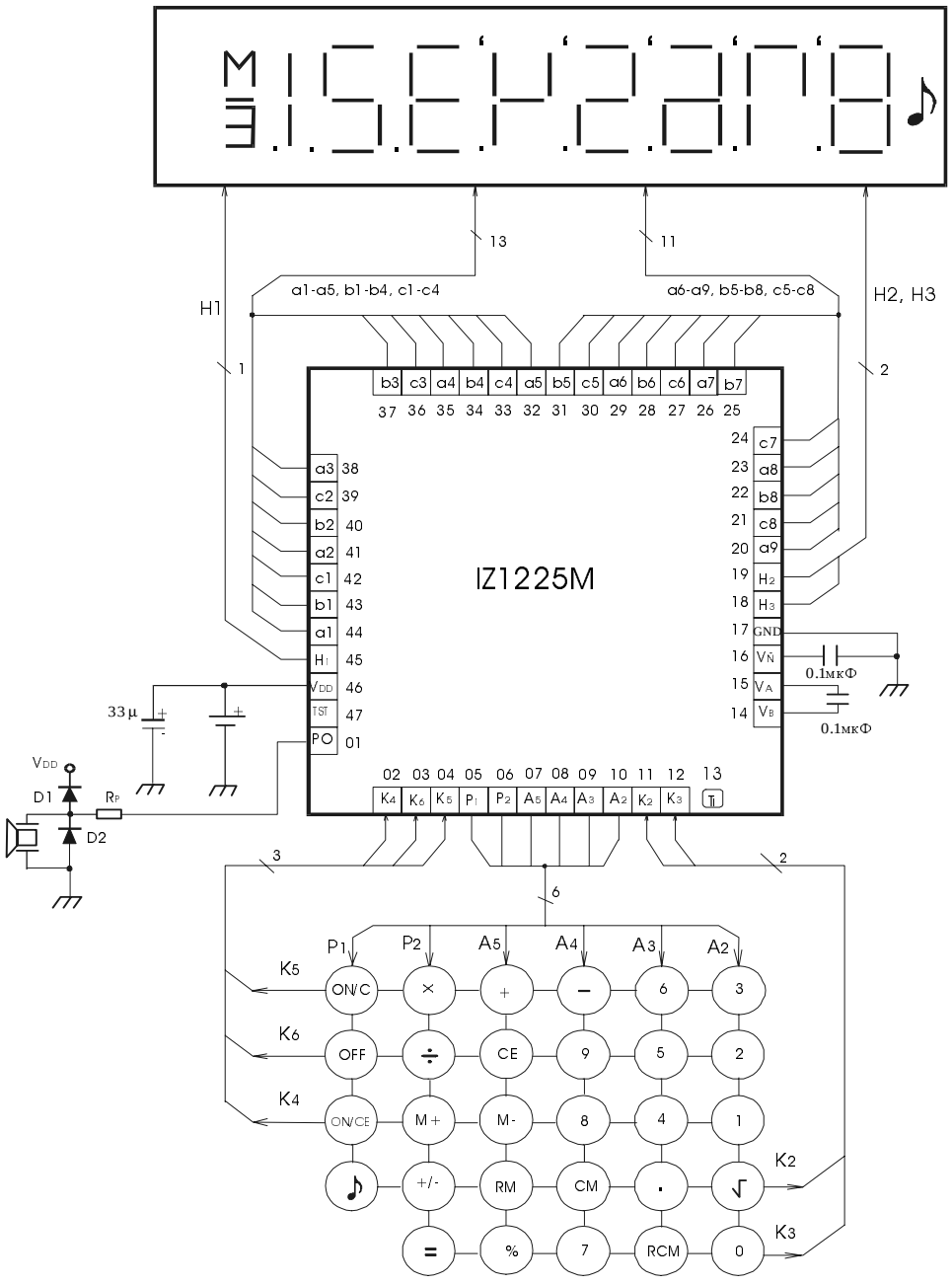


MARK-UP AND MARK-DOWN CALCULATION

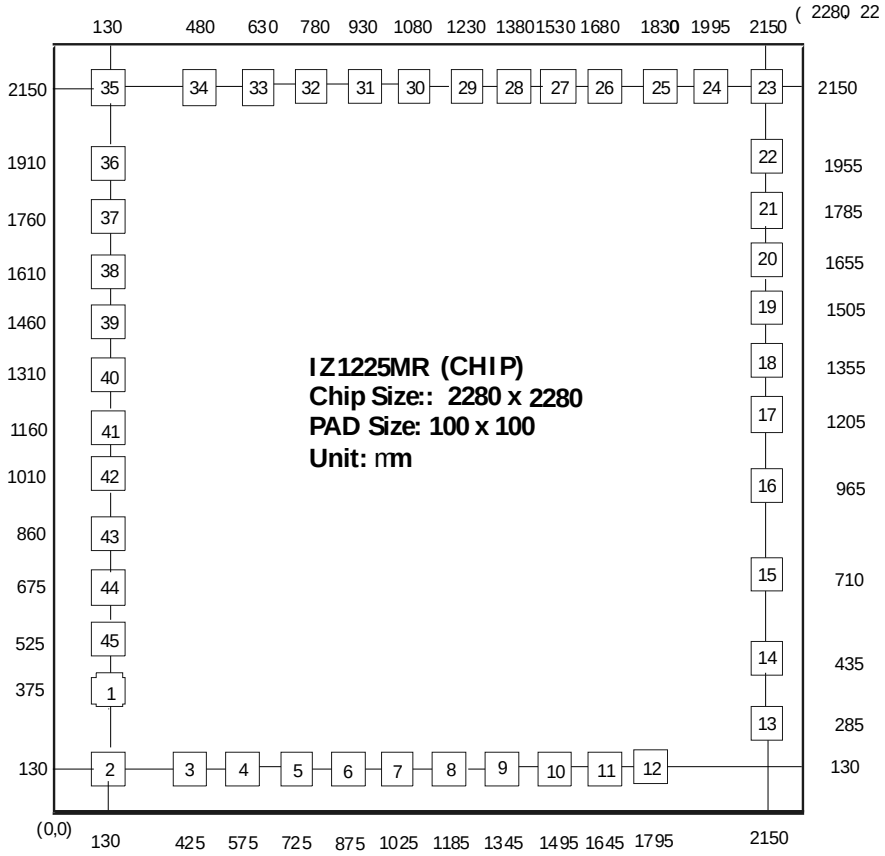
Mark-up and mark-down calculation are performed as follows.

ENTRY		DISPLAY	
A	A	A	A
±	x	A	A
B	B	B	B
%	%	A ± AB/100	AB/100
	+OR-		AB/100
	=		A+AB/100 OR A --AB/100

APPLICATION CIRCUIT



PAD DIAGRAM



PIN DESCRIPTION

Pad	Pad Nam	I/O	Description	Pad No.	Pad Name	I/O	Description
1	PO	O	Piezo output	25	b7	O	Display output
2	K4	I	Key input	26	a7	O	Display output
3	K6	I	Key input	27	c6	O	Display output
4	K5	I	Key input	28	b6	O	Display output
5	P1	O	Strobe output	29	a6	O	Display output
6	P2	O	Strobe output	30	c5	O	Display output
7	A5	O	Strobe output	31	b5	O	Display output
8	A4	O	Strobe output	32	a5	O	Display output
9	A3	O	Strobe output	33	c4	O	Display output
10	A2	O	Strobe output	34	b4	O	Display output
11	K2	I	Key input	35	a4	O	Display output
12	K3	I	Key input	36	c3	O	Display output
13	Ti	I	Test input	37	b3	O	Display output
14	VB			38	a3	O	Display output
15	VA			39	c2	O	Display output
16	VC			40	b2	O	Display output
17	GND		Ground	41	a2	O	Display output
18	H3	O	COMMON 3	42	c1	O	Display output
19	H2	O	COMMON 2	43	b1	O	Display output
20	a9	O	Display output	44	a1	O	Display output
21	c8	O	Display output	45	H1	O	COMMON 1
22	b8	O	Display output	46	V_{GG}		Power supply
23	a8	O	Display output	47	TST	I	Test
24	c7	O	Display output				