

FUNCTIONS

- ◆ Four standard functions (+, -, $\frac{1}{x}$, π)
- ◆ 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 with punctuation comma
- ◆ LCD direct drive
- ◆ Special memory for currency rates
- ◆ Overflow indication: ”
- ◆ Direct (DL3238) or Mirror (DL3238M) LCD
- ◆ Auto Power off
- ◆ Saving special memory contents when auto power off
- ◆ Accumulating memory: M+, M-, MR, MC, MRC
- ◆ Currencies C1, C2 and Rate indication
- ◆ Rounded and formatting function
- ◆ Presetted currency rate (mask option)
- ◆ Bare chip is available

DESCRIPTION

The DL3238/DL3238M are a single chip CMOS LSI with 8-digit arithmetic operation, single memory, percentage calculation and auto power off function. The DL3238/DL3238M 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.

The value of currency rate can be presetted by mask option.

CODING TABLE

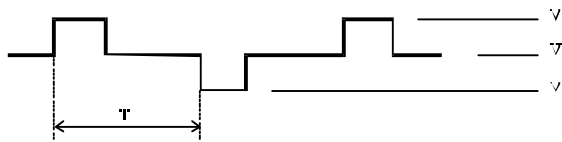
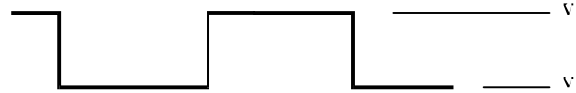
TYPE	RATE	COUNTRY	TYPE	RATE	COUNTRY
DL3238/DL3238M	-	-			
DL3238-01/DL3238M-01	6.55957	FRF/EURO	DL3238-06/DL3238M-06	13.7603	ATS/EURO
DL3238-02/DL3238M-02	1.95583	DEM/EURO	DL3238-07/DL3238M-07	40.3399	LUF/EURO, BEF/EURO
DL3238-03/DL3238M-03	1936.27	ITL/EURO	DL3238-08/DL3238M-08	2.20371	NLG/EURO
DL3238-04/DL3238M-04	166.386	ESP/EURO	DL3238-09/DL3238M-09	5.94573	FIM/EURO
DL3238-05/DL3238M-05	200.482	PTE/EURO	DL3238-10/DL3238M-10	0.787564	IEP/EURO

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

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	$^\circ\text{C}$
Storage Temperature	T_{stg}	- 55 ~ + 125	$^\circ\text{C}$

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	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.
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

Error detections

- **System errors occur when:** The division by zero.
- **Rough estimate calculation error occur when**
The integral part of the result of any standard functions, percentage, reciprocal, or power calculations exceed 8 digits.

Error indication

- **System error**
“0” is indicated in the 1-digit position and ” in the sign -digit position.
- **Rough estimate calculation error**
The high-order 8-digit calculation result is indicated together with ”.
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 $f_d = 100\text{Hz}$.

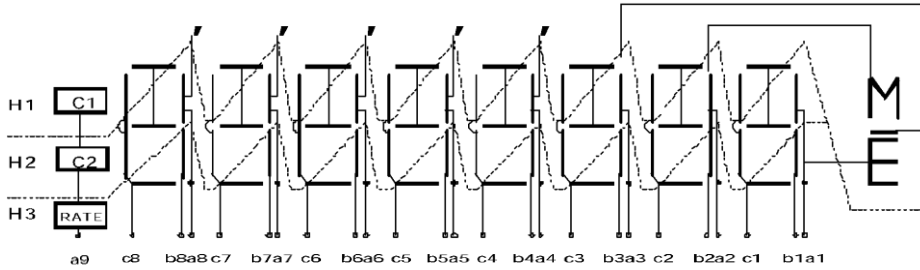
Option

- The value of the currency rate can be presettled by mask option – this value automatically will be written into the special memory when battery install or by RESET function.
- 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 and write the icon RATE only is on if pad F2 is opened or connected to V_{DD} and icons C1, C2 are on if pad F2 is connected to V_{SS} .

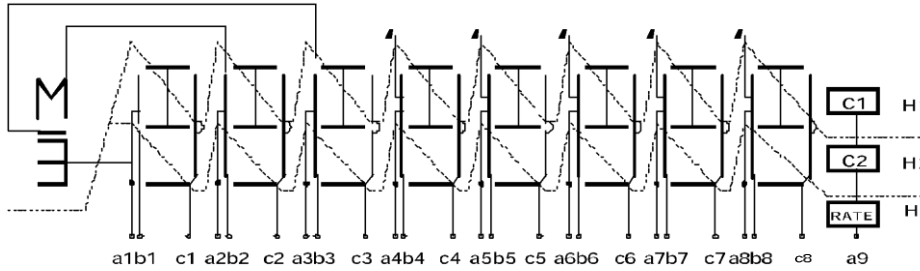
Auto power OFF

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

LCD CONNECTION

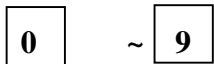


Direct LCD
with DL3238

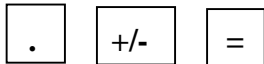


Mirror LCD
with DL3238M

KEY DESCRIPTION



Numerals input keys.

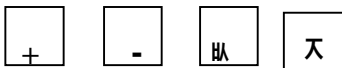


Decimal point key, Sign change key, Enter key.



Clear keys.

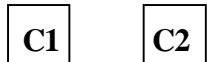
ON/C: Power ON/All clear (system reset) except special memory contents
CE: Entry clear such as only the entered data is cleared



Four standard function keys.



Percent key.



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.



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



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

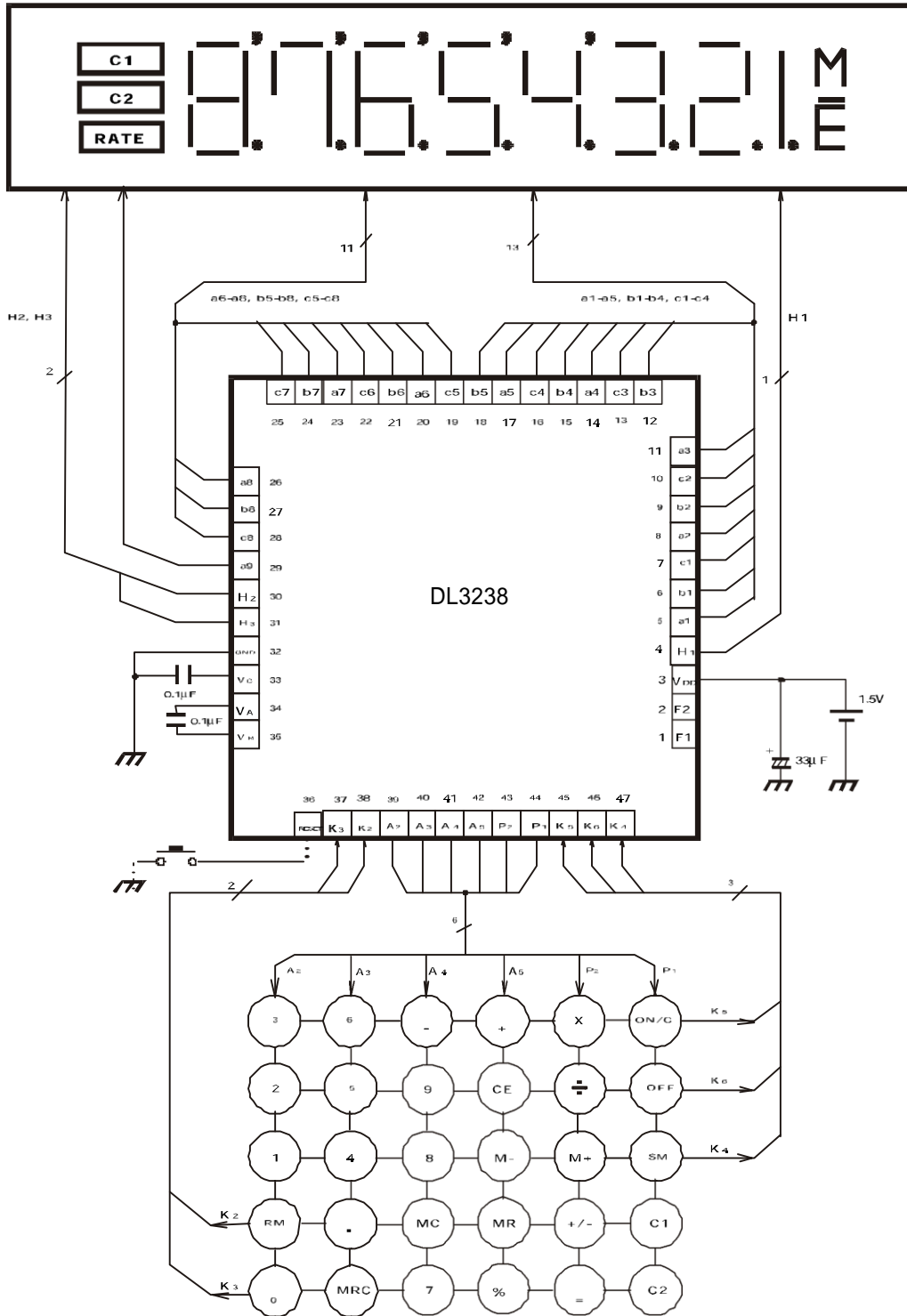


Recall memory, clear memory, recall and clear memory.



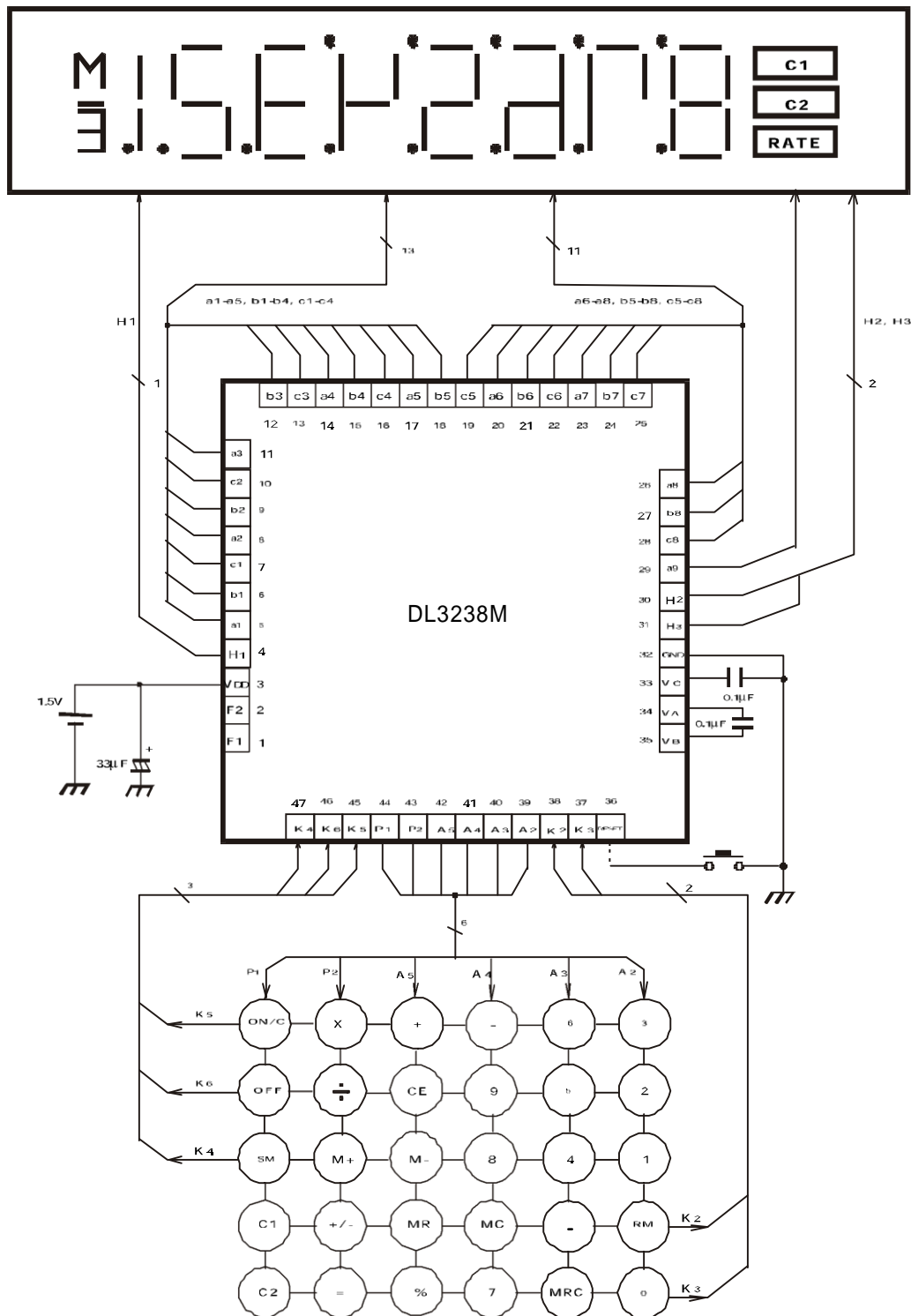
Off key.

APPLICATION CIRCUIT (direct LCD)



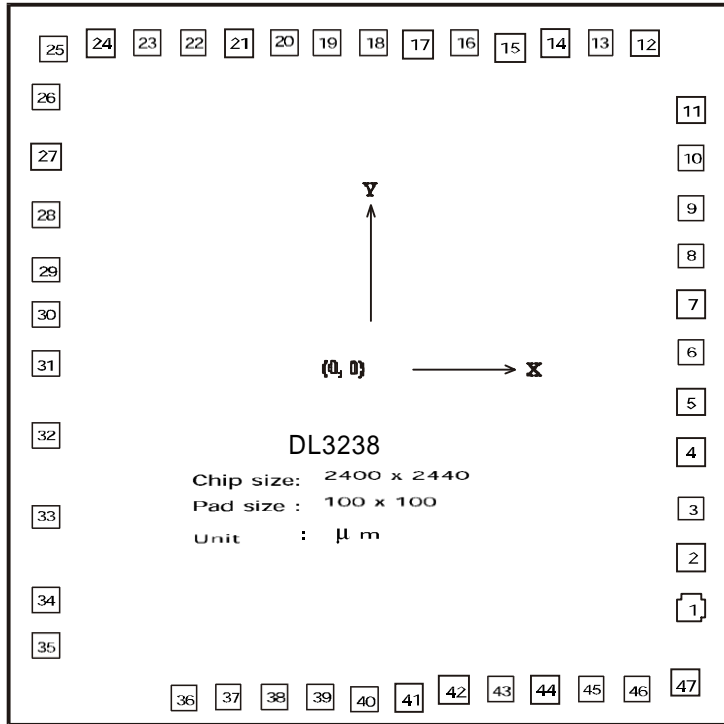
NOTE: Chip substrate must be floating or connected to GND

APPLICATION CIRCUIT (mirror LCD)



NOTE: Chip substrate must be floating or connected to GND

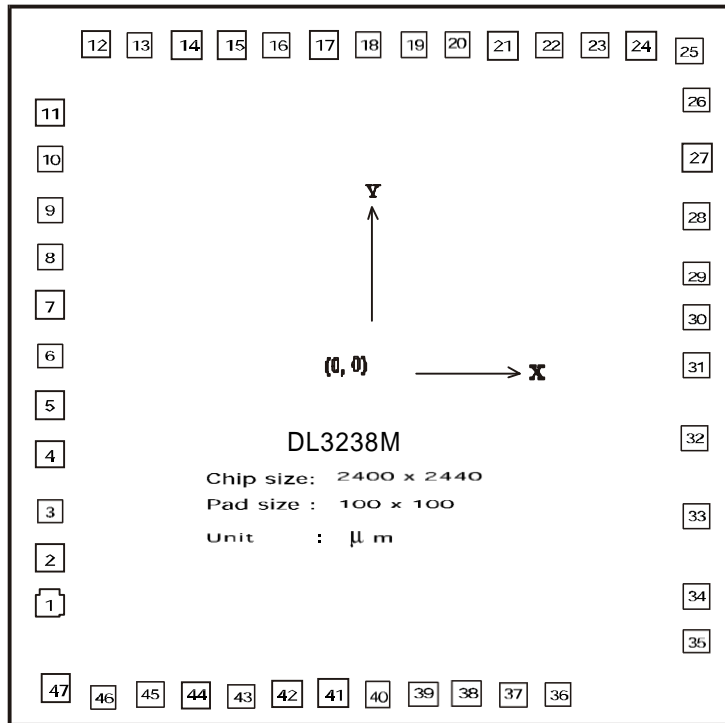
PAD DIAGRAM



PAD LOCATION

Pad No.	Pad Name	Description	X	Y	Pad No.	Pad Name	Description	X	Y
1	F1	Option	1066	-806	25	c7	Display output	-1054	1074
2	F2	Option	1066	-646	26	a8	Display output	-1074	909
3	V _{DD}	Power supply	1066	-466	27	b8	Display output	-1074	709
4	H1	Display output	1066	-296	28	c8	Display output	-1074	519
5	a1	Display output	1066	-126	29	a9	Display output	-1074	334
6	b1	Display output	1066	44	30	H2	Display output	-1074	184
7	c1	Display output	1066	214	31	H3	Display output	-1074	19
8	a2	Display output	1066	374	32	GND	Ground	-1074	-221
9	b2	Display output	1066	534	33	V _C	Capacitor terminal	-1074	-486
10	c2	Display output	1066	704	34	V _A	Capacitor terminal	-1074	-761
11	a3	Display output	1066	864	35	V _B	Capacitor terminal	-1074	-911
12	b3	Display output	911	1094	36	RESET	RESET	-619	-1086
13	c3	Display output	761	1094	37	K3	Key input	-469	-1086
14	a4	Display output	611	1094	38	K2	Key input	-319	-1086
15	b4	Display output	461	1094	39	A2	Strobe output	-169	-1086
16	c4	Display output	311	1094	40	A3	Strobe output	-19	-1086
17	a5	Display output	161	1094	41	A4	Strobe output	131	-1086
18	b5	Display output	11	1094	42	A5	Strobe output	281	-1086
19	c5	Display output	-139	1094	43	P2	Strobe output	431	-1086
20	a6	Display output	-289	1094	44	P1	Strobe output	581	-1086
21	b6	Display output	-439	1094	45	K5	Key input	731	-1086
22	c6	Display output	-589	1094	46	K6	Key input	881	-1086
23	a7	Display output	-739	1094	47	K4	Key input	1046	-1066
24	b7	Display output	-889	1094					

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