GENERAL DESCRIPTION

The DL5518 is a single-chip LSI CMOS calculator for 12-digits 2-memory or 10-digits 2-memory. DL5518 can drive the liquid crystal display (LCD) with single power supply. Single power supply operation, wide operating voltage and lower power consumption make it suitable for 1.5V solar battery operated calculator. Beside EM34014A can be selected as Auto Power OFF or Manual Power OFF with Switch Key. It also can be selected as Memory Hold or Clear at Power OFF.

FEATURES

- Display : 12-digit or 10-digit (selectable with a pin-programmable) of data, 1-digit of sign, error, memory load symbol.
- TAX function available (selectable with a pin-programmable).
- Special LCD icons available (selectable with a pin-programmable).
- Algebraic mode.
- Standard 4 function (addition, subtraction, multiplication, division).
- Memory and Grand total calculation.
- Accumulating GT memory register with count up (down) item counter.
- Automatic percentage operation with add-on discount.
- Automatic delta percentage, mark-up and mark-down operations.
- Square root.
- Constant calculation.
- Chain calculation.
- Change sign.
- Floating point (selectable with a switch).
- Fixed point ("0", "1", "2", "3", "4", or "6" selectable with a switch).
- Adding point mode (selectable with a switch).
- Rounding switch (rounding up, down and off).
- Trailing zero suppression.
- Punctuation on display, commas for thousands.

- Memory and GT memory contents indicator, turned with nonzero in the memory and GT memory.
- Registration overflow, indicating too many digits are entered (the most significant digit are protected).
- Result overflow, indicating during calculation (most function key are locked as it happened).
- Memory overflow indicating.
- Complementary output buffer for direct driving of liquid crystal display.
- Oscillator/clock generator internal to chip.
- Keyboard encoding internal to chip.
- Automatic power on clear.
- Wide supply voltage range (1.2 to 1.8V)
- Very low power consumption.
- Floating minus.
- Key roll over function (2 keys).

PIN DESCRIPTIONS

SYMBOL	I/O	FUNCTION
COM1~3	O	LCD Common signal output.
A1 ~ A3	O	LCD Segment signal output and strobe output for switch status.
A4 ~ A13	O	LCD Segment signal output.
B1 ~ B3	O	LCD Segment signal output and strobe output for switch status.
B4 ~ B13	O	LCD Segment signal output.
C1 ~ C2	O	LCD Segment signal output and strobe output for switch status.
C3 ~ C13	O	LCD Segment signal output.
VDD,VSS	---	Positive and negative power supply pin.
VA,VB	---	Voltage doubler for LCD, connects a capacitor (0.1uF) between both pins.
VEE	---	LCD voltage from voltage doubler, connects a capacitor (0.1uF) to pin VDD.
TS1	I	Test pin input, be opened.
RESET	I	System reset / AC key input. (built-in schmitt trigger for debouncing)
K0 ~ K2	O	Keyboard polling signal output pins.
K3 ~ K7	I/O	Keyboard polling signal output and strobe input pins.
K8 ~ K10	I	Keyboard strobe input pins.
K11~K14	I	Switch status strobe input pins.

FUNCTION DESCRIPTIONS

A) OPERATION CHARACTERISTICS

CONSTANT OPERATION

The DL5518 has implied constant mode on +, -, X, ÷, and % operations. The constant is performed automatically by the "=" key, "%" key, or "%" key without a constant for addition, subtraction and division while the first operand is the constant for multiplication.

NUMBER ENTRY

Numbericals can be entered up to 12-digit.

MEMORY PROTECTION

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

MEMORY INDICATION

If the memory contents are a number other than zero, "M" is indicated in the sign-digit position.

AUTO POWER OFF

If no key is depressed for a specific period of time, the power supply will automatically turn off (pin option). This time interval up to power-off is about 8 minutes.

B) KEYBOARD DESCRIPTION

EQUAL KEY (=)

- Performs Keyed-in operation and maintains that operation for possible use.
- Establishes power/reciprocation calculation.

MULTIPLICATION KEY (×)

- Enters multiplicand.
- Performs previous operation and displays result.

DIVISION KEY (÷)

- Enters dividend.
- Performs previous operation and displays result.

ADDITION KEY (+)

- Conditions machine for an addition.
- Performs previous operation and displays result.

SUBTRACTION KEY (-)

- Conditions machine for a subtraction.
- Performs previous operation and displays result.

PERCENT KEY (%)

The purpose of the percent key is to allow for calculation of add-on and discount. Determination of add-on requires the principal amount to be the first entry followed by the "+" or "X" key, with the percentage being the second entry. Depression of the percent key yields the amount to add on, such as tax or interest. Depression of the "=" key adds this amount to the principal.

CHANGE SIGN KEY (+/-)

Pushing the "+/-" key twice in succession causes the corresponding sign to appear and disappear. During digit entry, this function changes he sign of the entered factor.

CLEAR KEY AND POWER ON KEY (C & ON)

- First push power-on displays "0".
- In the middle of a digit entry, a second push will clear all operating register.

CLEAR ENTRY/CLEAR KEY (CE/C/ON)

- During the digit entry, the first depression will clear the entry register. And display the previous enter number again.
- The second push will clear all registers.

CLEAR ENTRY KEY (CE)

During the digit entry will clear the entry register and display number "0".

NUMBER, DECIMAL KEY ("00", "0 – 9", "•")

The first number key in a sequence will clear the display and enter the digit in the display. Successive entries will shift the display left and enters the data in display register. The first decimal point entered is effective. An attempted entry of more than 12 digits or 11decimal places will be ignored.

SHIFT KEY (⟶)

Delete the rightest digit and others will shift to right.

MEMORY PLUS KEY (M+)

- Adds the current display to the contents of memory.
- It will terminate a number entry.

MEMORY MINUS KEY (M-)

- Subtracts the current display from the contents of memory.
- It will terminate a number entry.

MEMORY RECALL KEY (RM)

Transfers the contents of the memory register into the display register.

MEMORY CLEAR KEY (CM)

clears the memory.

MEMORY RECALL AND CLEAR KEY (RCM)

- First push RCM key, as RM key, transfers the contents of the memory register into the display register.
- Second push RCM key, as CM key, clears the memory.

GRAND TOTAL PLUS KEY (GT+)

Ands the current display to the content of grand total memory.

GRAND TOTAL MINUS KEY (GT-)

Substracts the current display from the content of grand total memory. GT- will terminate a number entry.

GT MEMORY RECALL AND CLEAR KEY (RCGT)

- First push RCGT key, transfers the contents of the GT memory register into the display register.
- Second push RCGT key, clears the GT memory.

SQUARE ROOT KEY (√)

Extracts the square root of a positive number displayed in the entry register.

EXCHANGE KEY (EX)

Exchange two operand between the operator. For example, key in "a-b", and then key in "EX" will change a and b to "b-a".

ITEM COUNTER KEY (IC)

- 0 ~ 99 count up / down by depressing of "+" and "-" key.
- The "+" and "=" key will increase the counter's contents by one.
- The "-" will decrease it by two.
- The others operator key and number key will not change it.

MARK-UP KEY (MU)

- Press [A][+][B][MU], execute $100 \times (A + B) / B$.
- Press [A][−][B][MU], execute $100 \times (A - B) / B$.
- Press [A][×][B][MU], execute $A \times (1 + (B / 100))$.
- Press [A][÷][+/−][B][MU][MU], execute $A / (1 - (B / 100))$ and $| (A / (1 - (B / 100))) - A |$.

TAX RATE SET AND RECALL KEY (RATE)

- Press [RATE][TAX+], store displayed number in TAX memory.
- Press [RATE][TAX−], transfers the contents of the TAX memory register into the display register.

INCLUDED TAX KEY (TAX+)

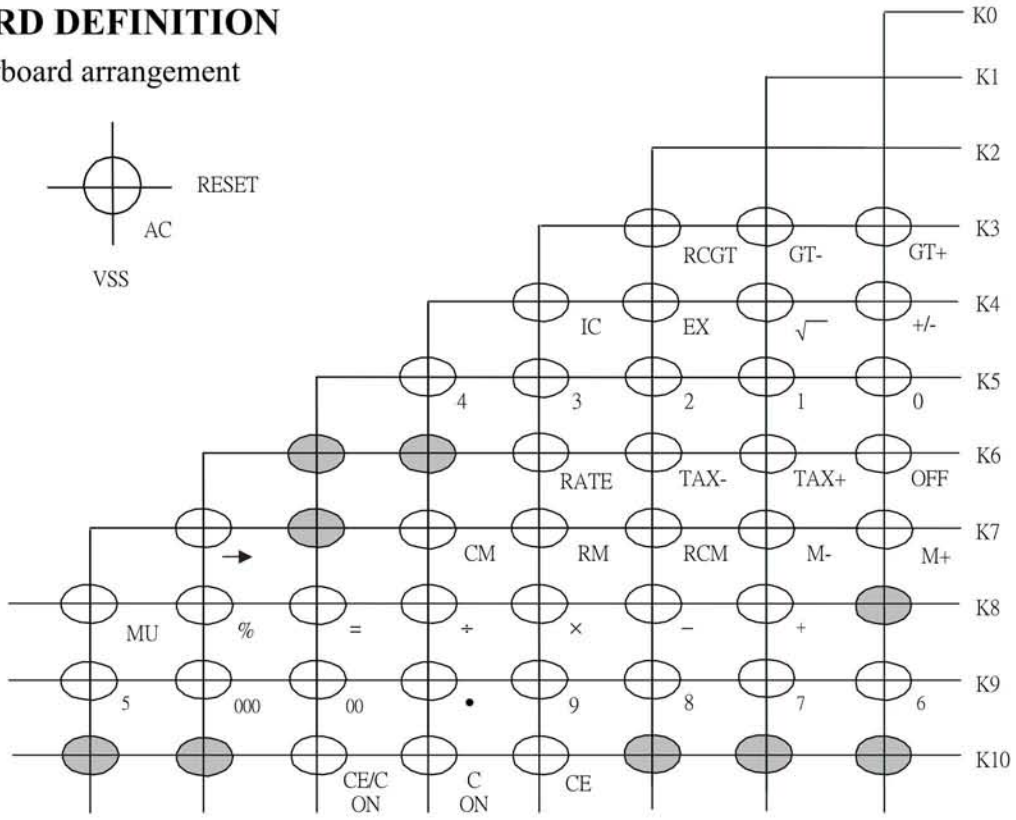
Execute TAX-including calculation of displayed number, TAX rate is in TAX memory.

EXCLUDED TAX KEY (TAX-)

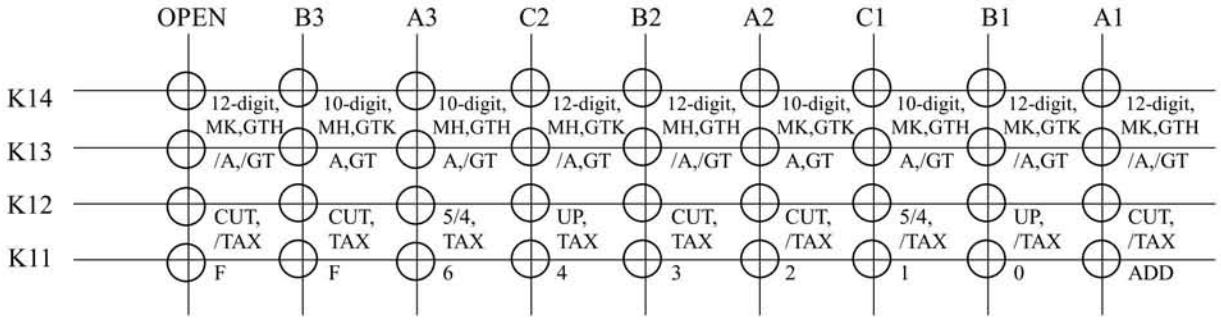
Execute TAX-excluding calculation of displayed number, TAX rate is in TAX memory.

C) KEYBOARD DEFINITION

- Keyboard arrangement



- Connection of switch



K14 : Select with Calculated Digits (12-digit or 10-digit) and Memory Hold Status, MH (Memory Hold), MK (Memory Kill), GTH(GT Memory Hold) and GTX(GT Memory Kill) at Auto Power OFF or OFF key.

K13 : Select with Auto Power OFF mode (A) and Grand total function (GT).

K12 : Select with Rounding switches (CUT, UP, 5/4), TAX function (TAX) and LCD icons.
LCD icons of /TAX option (same as EM34014) : M, –(sign), E, GT
LCD icons of TAX option : (M, –(sign), E), (GT/=, +, –, ×, ÷),
(TAX+, TAX–, TAX%, RATE)

K11 : Select with Fixed point or floating mode.

D) ERROR CONDITIONS

ERROR DETECTION

System errors occur when :

- The integral part of any calculation result exceeds 12 digits.
- The integral part of any memory calculation result exceeds 12-digit or when the integral part of any addend or subtrahend to memory exceeds 12-digit.
- The integral part of a mark-up and mark-down calculation result exceeds 12-digit.
- A division by zero is attempted.
- An extraction of the square root of a negative number is attempted.

ERROR INDICATION

System error :

- "0" is indicated in the first-digit position and "E" in the sign-digit position.
- The high-order 12-digit of a calculation result is indicated together with "E". The location of the decimal point corresponds to the result of calculation times le-12, and no zero shift is performed.

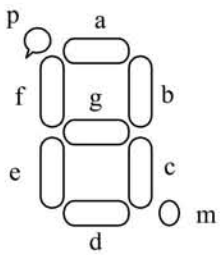
ERROR RELEASE

System error :

A system error can be released by depressing ON/AC key or CE/C key. However the calculation result is not cleared by CE/C key but is retained.

E) LCD DISPLAY

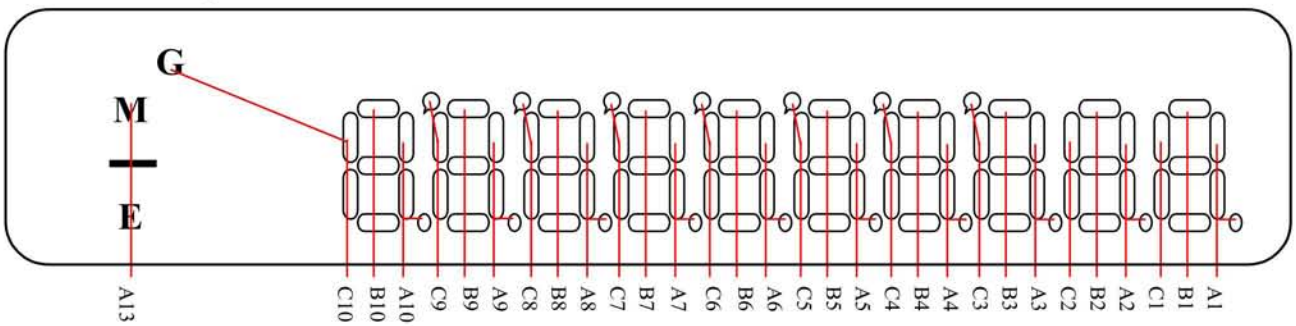
It can directly drive the liquid crystal display (LCD) with 39 segment pins and 3 common pins. The drive method is 1/2 bias and 1/3 duty, built-in BCD to 7-segment decoder for 3V LCD. The following tables exhibit the relationship between the LCD segment, and common pins and corresponding pattern on the display.



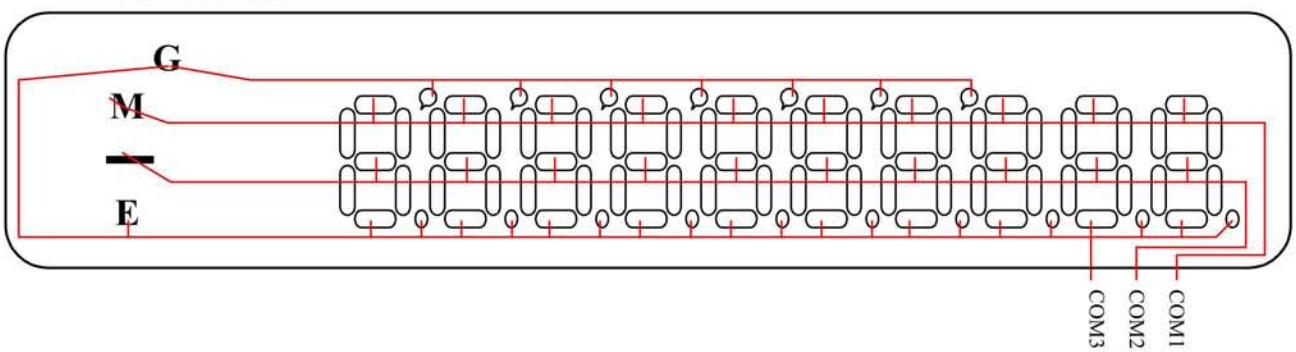
- LCD table for 10D calculator (same as DL5518D calculator)
  K14 select with "10D" and K12 select with "/TAX".

Segment		13	12	11	10	9	8	7	6	5	4	3	2	1
COM1	An	M			b10	b9	b8	b7	b6	b5	b4	b3	b2	b1
	Bn				a10	a9	a8	a7	a6	a5	a4	a3	a2	a1
	Cn				f10	f9	f8	f7	f6	f5	f4	f3	f2	f1
COM2	An	–(sign)			c10	c9	c8	c7	c6	c5	c4	c3	c2	c1
	Bn				g10	g9	g8	g7	g6	g5	g4	g3	g2	g1
	Cn				e10	e9	e8	e7	e6	e5	e4	e3	e2	e1
COM3	An	E			m10	m9	m8	m7	m6	m5	m4	m3	m2	m1
	Bn				d10	d9	d8	d7	d6	d5	d4	d3	d2	d1
	Cn				GT	p9	p8	p7	p6	p5	p4	p3		

LCD Segment



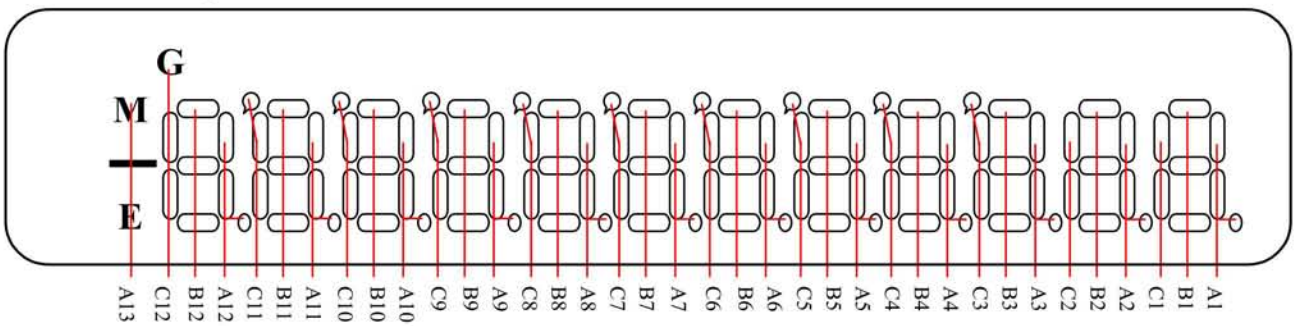
LCD Common



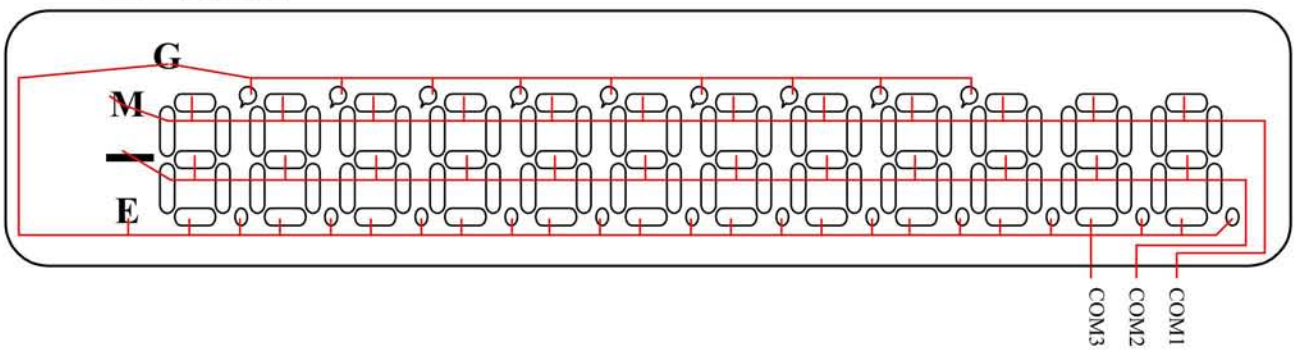
- LCD table for 12D calculator (same as DL5518D calculator)
  K14 select with "12D" and K12 select with "/TAX".

Segment		13	12	11	10	9	8	7	6	5	4	3	2	1
COM1	An	M	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1
	Bn		a12	a11	a10	a9	a8	a7	a6	a5	a4	a3	a2	a1
	Cn		f12	f11	f10	f9	f8	f7	f6	f5	f4	f3	f2	f1
COM2	An	–(sign)	c12	c11	c10	c9	c8	c7	c6	c5	c4	c3	c2	c1
	Bn		g12	g11	g10	g9	g8	g7	g6	g5	g4	g3	g2	g1
	Cn		e12	e11	e10	e9	e8	e7	e6	e5	e4	e3	e2	e1
COM3	An	E	m12	m11	m10	m9	m8	m7	m6	m5	m4	m3	m2	m1
	Bn		d12	d11	d10	d9	d8	d7	d6	d5	d4	d3	d2	d1
	Cn		GT	p11	p10	p9	p8	p7	p6	p5	p4	p3		

LCD Segment



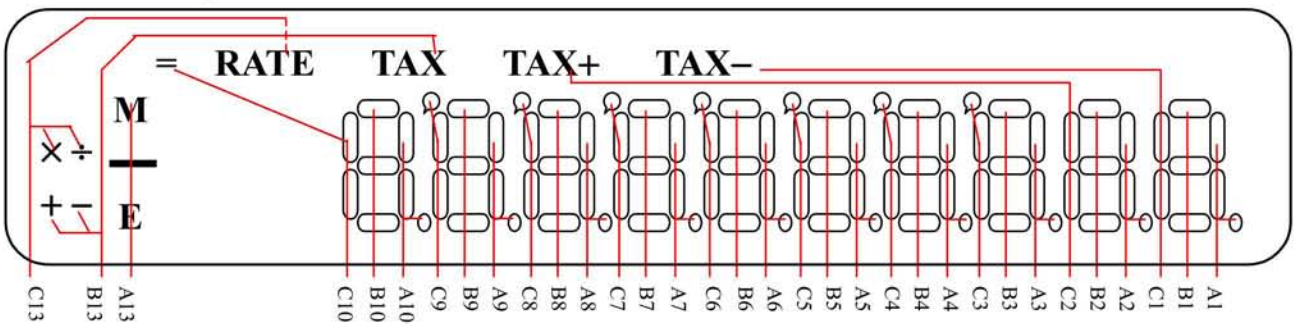
LCD Common



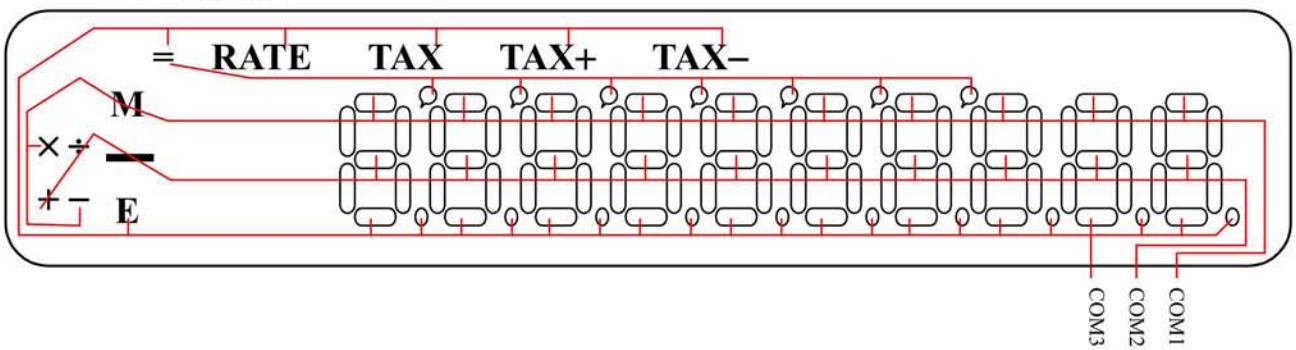
- LCD table for 10D calculator with TAX function
  K14 select with "10D", K13 select with "/GT" and K12 select with "/TAX".

Segment		13	12	11	10	9	8	7	6	5	4	3	2	1
COM1	An	M			b10	b9	b8	b7	b6	b5	b4	b3	b2	b1
	Bn	–			a10	a9	a8	a7	a6	a5	a4	a3	a2	a1
	Cn	×			f10	f9	f8	f7	f6	f5	f4	f3	f2	f1
COM2	An	–(sign)			c10	c9	c8	c7	c6	c5	c4	c3	c2	c1
	Bn	+			g10	g9	g8	g7	g6	g5	g4	g3	g2	g1
	Cn	÷			e10	e9	e8	e7	e6	e5	e4	e3	e2	e1
COM3	An	E			m10	m9	m8	m7	m6	m5	m4	m3	m2	m1
	Bn	TAX			d10	d9	d8	d7	d6	d5	d4	d3	d2	d1
	Cn	RATE			=	p9	p8	p7	p6	p5	p4	p3	TAX+	TAX–

LCD Segment



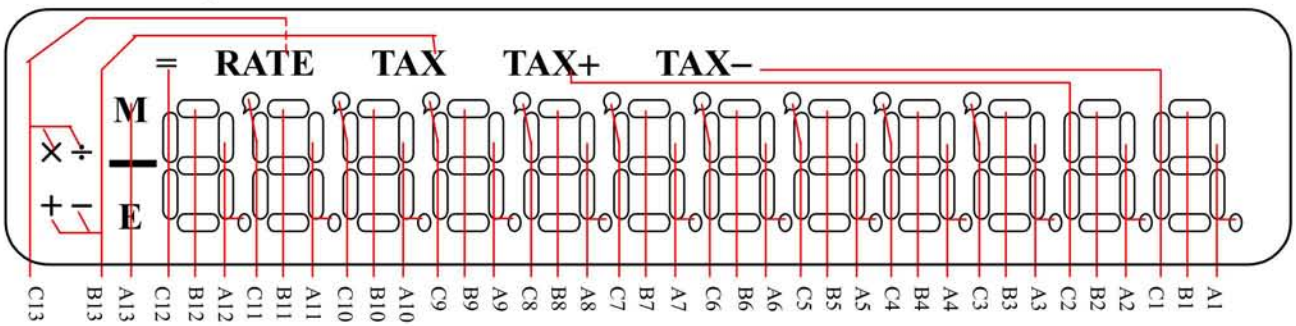
LCD Common



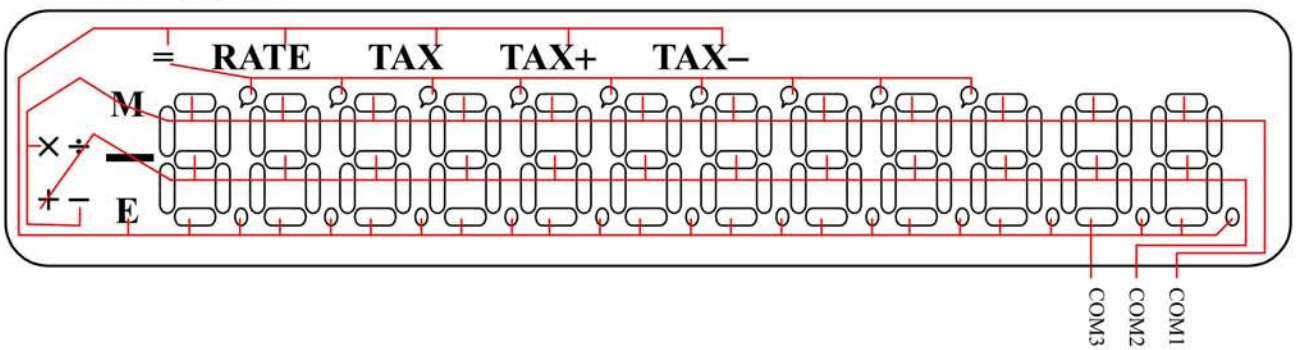
- LCD table for 12D calculator with TAX function
  K14 select with "12D", K13 select with "/GT" and K12 select with "/TAX".

Segment		13	12	11	10	9	8	7	6	5	4	3	2	1
COM1	An	M	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1
	Bn	–	a12	a11	a10	a9	a8	a7	a6	a5	a4	a3	a2	a1
	Cn	×	f12	f11	f10	f9	f8	f7	f6	f5	f4	f3	f2	f1
COM2	An	–(sign)	c12	c11	c10	c9	c8	c7	c6	c5	c4	c3	c2	c1
	Bn	+	g12	g11	g10	g9	g8	g7	g6	g5	g4	g3	g2	g1
	Cn	÷	e12	e11	e10	e9	e8	e7	e6	e5	e4	e3	e2	e1
COM3	An	E	m12	m11	m10	m9	m8	m7	m6	m5	m4	m3	m2	m1
	Bn	TAX	d12	d11	d10	d9	d8	d7	d6	d5	d4	d3	d2	d1
	Cn	RATE	=	p11	p10	p9	p8	p7	p6	p5	p4	p3	TAX+	TAX–

LCD Segment



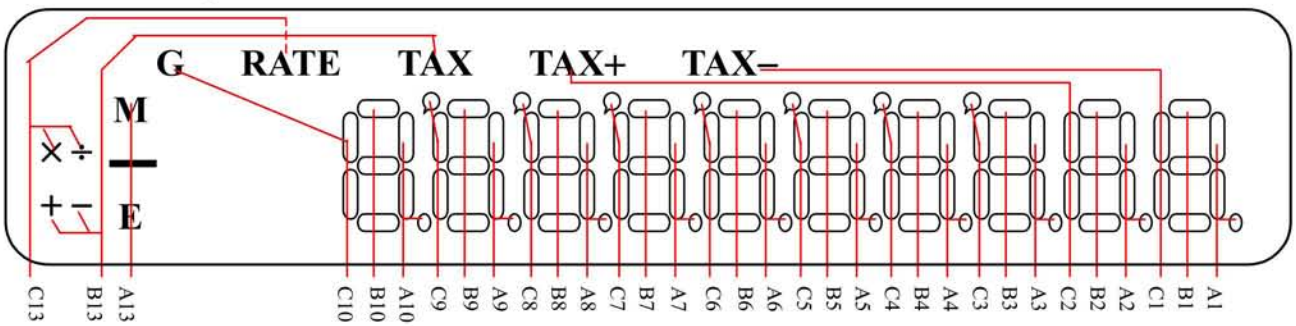
LCD Common



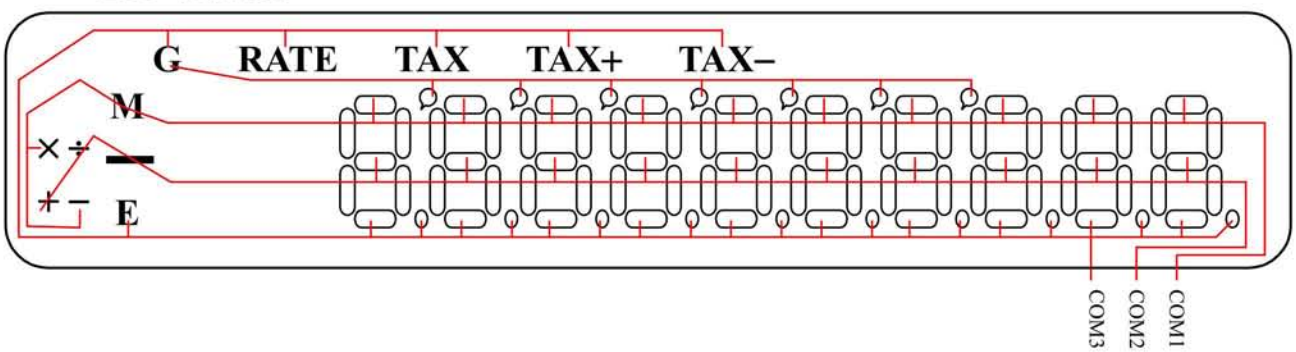
- LCD table for 10D calculator with TAX and GT function
  K14 select with "10D", K13 select with "GT" and K12 select with "/TAX".

Segment		13	12	11	10	9	8	7	6	5	4	3	2	1
COM1	An	M			b10	b9	b8	b7	b6	b5	b4	b3	b2	b1
	Bn	–			a10	a9	a8	a7	a6	a5	a4	a3	a2	a1
	Cn	×			f10	f9	f8	f7	f6	f5	f4	f3	f2	f1
COM2	An	–(sign)			c10	c9	c8	c7	c6	c5	c4	c3	c2	c1
	Bn	+			g10	g9	g8	g7	g6	g5	g4	g3	g2	g1
	Cn	÷			e10	e9	e8	e7	e6	e5	e4	e3	e2	e1
COM3	An	E			m10	m9	m8	m7	m6	m5	m4	m3	m2	m1
	Bn	TAX			d10	d9	d8	d7	d6	d5	d4	d3	d2	d1
	Cn	RATE			GT	p9	p8	p7	p6	p5	p4	p3	TAX+	TAX–

LCD Segment



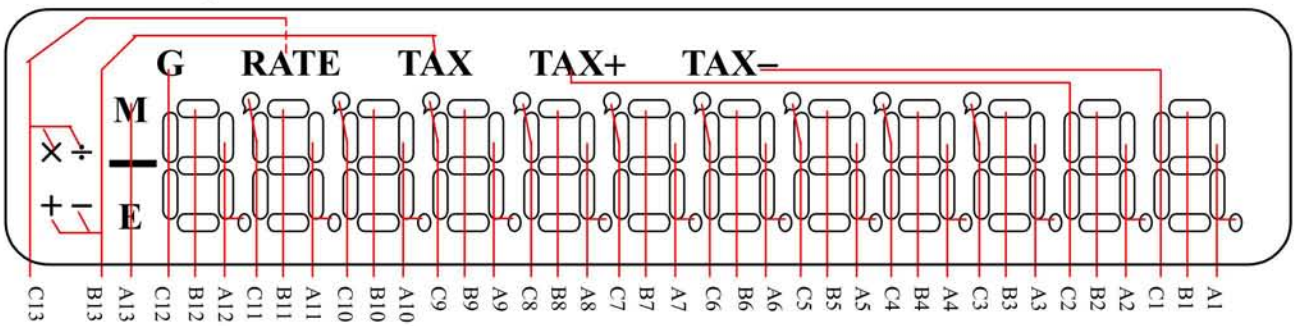
LCD Common



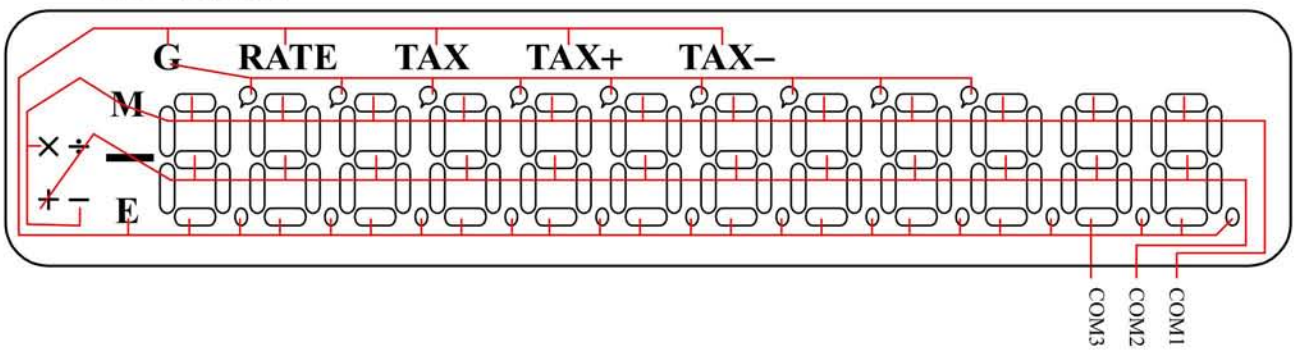
- LCD table for 12D calculator with TAX and GT function
  K14 select with "12D", K13 select with "GT" and K12 select with "/TAX".

Segment		13	12	11	10	9	8	7	6	5	4	3	2	1
COM1	An	M	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1
	Bn	–	a12	a11	a10	a9	a8	a7	a6	a5	a4	a3	a2	a1
	Cn	×	f12	f11	f10	f9	f8	f7	f6	f5	f4	f3	f2	f1
COM2	An	–(sign)	c12	c11	c10	c9	c8	c7	c6	c5	c4	c3	c2	c1
	Bn	+	g12	g11	g10	g9	g8	g7	g6	g5	g4	g3	g2	g1
	Cn	÷	e12	e11	e10	e9	e8	e7	e6	e5	e4	e3	e2	e1
COM3	An	E	m12	m11	m10	m9	m8	m7	m6	m5	m4	m3	m2	m1
	Bn	TAX	d12	d11	d10	d9	d8	d7	d6	d5	d4	d3	d2	d1
	Cn	RATE	GT	p11	p10	p9	p8	p7	p6	p5	p4	p3	TAX+	TAX–

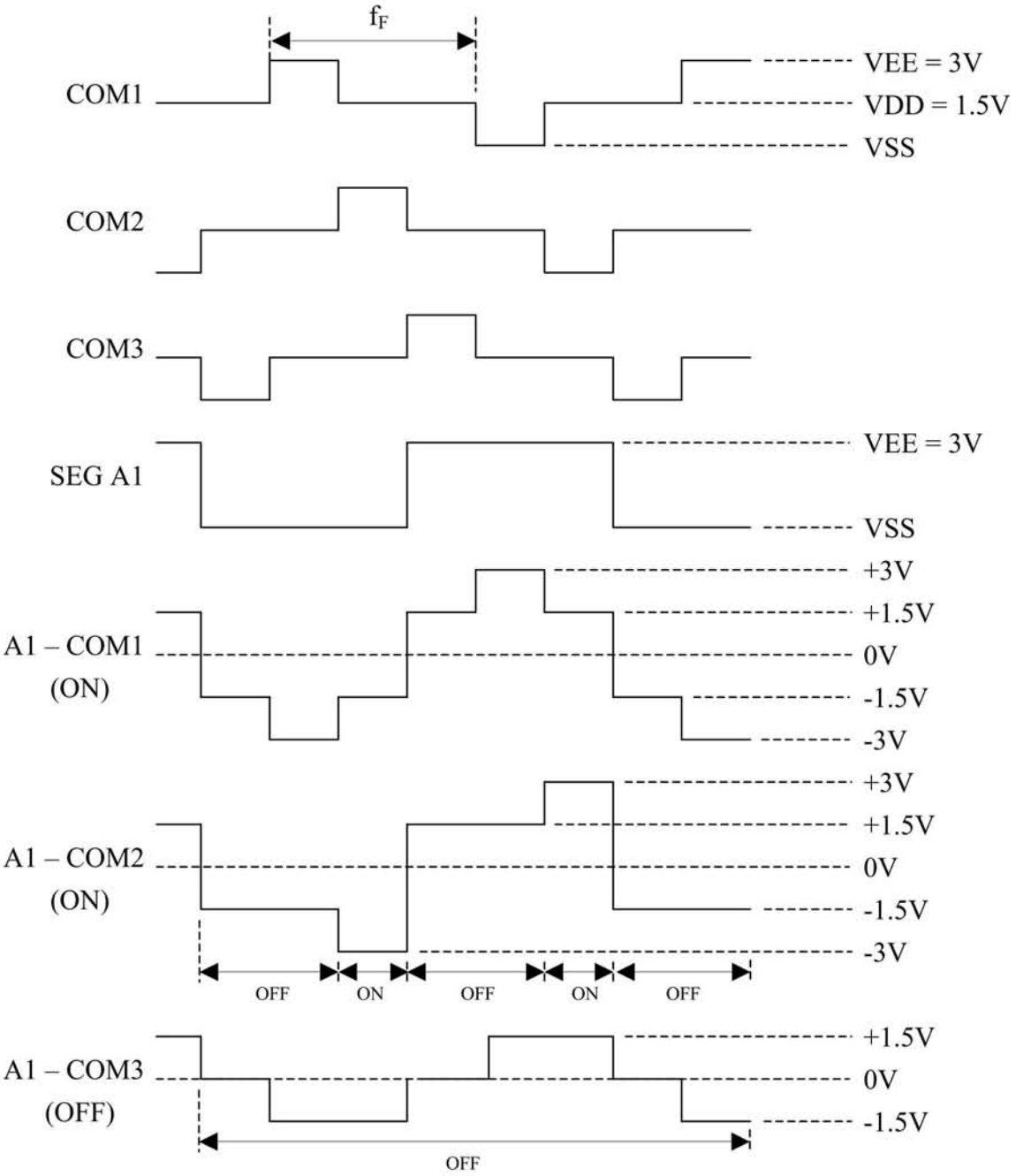
LCD Segment



LCD Common



F) WAVEFORMS FOR DISPLAY



OPERATION EXAMPLES

Type of calculation	Operation	Key-in	Display
Addition and Subtraction calculation	TAB SW: 2, GT SW: Off, Round SW: 5/4, /TAX		
		C	0.
	100 + 200	100 +	100.
	= 300	200 =	300.00
		C	0.
	3 – 5	3 –	3.
	= –2	5 =	–2.00
		C	0.
	10 + 20 – 50	10 +	10.
	= –20	20 –	30.
		50 =	–20.00
	TAB SW: 2, GT SW: Off, Round SW: 5/4, TAX		
		C	0.
	10 + 20 – 50	10 +	+ 10.
	= –20	20 –	– 30.
		50 =	= –20.00
Multiplication and Division calculation	TAB SW: 2, GT SW: Off, Round SW: 5/4, /TAX		
		C	0.
	(–2) x 3	1.	
	= –6	2 +/- x	–2.
		3 =	–6.00
		2.	
		–	
		2 x	–2.
		3 =	–6.00
		C	0.
	(–365) ÷ 7	1.	
	= –52.14	365 +/- ÷	–365.
		7 =	–52.14
		2.	
		–	
		365 ÷	–365.
		7 =	–52.14
	300 x 2,145	C	0.
	= 643,500	300 x	300.
		2145 =	643,500.00
	300 x 4,950.6	4950.6 =	1,485,180.00
	= 1,485,180		
	31,750 ÷ 500	C	0.
	= 63.50	31750 ÷	31,750.
		500 =	63.50
	54,236 ÷ 500	54236 =	108.47
	= 108.47		
	TAB SW: 2, GT SW: Off, Round SW: 5/4, TAX		
		C	0.
	(–2) x 3 ÷ 4	2 +/- x	x –2.
	= –1.5	3 ÷	÷ –6.
		4 =	= –1.50

Type of calculation	Operation	Key-in	Display
Square and Cube calculation	TAB SW: 2, GT SW: Off, Round SW: 5/4, /TAX		
		C	0.
	3^2	3 x	3.
	= 9	=	9.00
		C	0.
	5^3	5 x	5.
	= 125	=	25.00
		=	125.00
Reciprocal calculation	TAB SW: 2, GT SW: Off, Round SW: 5/4, /TAX		
		C	0.
	1 ÷ 4	1.	
	= 0.25	1 ÷	1.
		4 =	0.25
		2.	
		4 ÷	4.
		=	0.25
Percentage calculation	TAB SW: 2, GT SW: Off, Round SW: 5/4, /TAX		
		C	0.
	2,350 x 17 %	2350 x	2,350.
	= 399.50	17 %	399.50
		C	0.
	456 ÷ 789 %	456 ÷	456.
	= 57.79	789 %	57.79
		C	0.
	2,000 + (2,000 x 12 %)	2000 x	2,000.
	= 2,240	12 %	240.00
		+	240.00
		=	2,240.00
		C	0.
	2,000 – (2,000 x 12 %)	2000 x	2,000.
	= 1,760	12 %	240.00
		–	240.00
		=	1,760.00
	TAB SW: 2, GT SW: Off, Round SW: 5/4, TAX		
		C	0.
	2,350 x 17 %	2350 x	x 2,350.
	= 399.50	17 %	= 399.50
"→" key	TAB SW: 2, GT SW: Off, Round SW: 5/4, /TAX		
		C	0.
		122.5	122.5
		→	122.
		3	122.3
		→	122.
		→	12.
		345 +	12,345.
		0.678 =	12,345.68
		→	12,345.6
		x	12,345.6
		10 %	1,234.56
		→	1,234.5

Type of calculation	Operation	Key-in	Display
Reverse (EX)	TAB SW: 2, GT SW: Off, Round SW: 5/4, /TAX		
	3 ÷ (1 + 2 + 3 + 4) = 0.3	C	0.
		1 +	1.
		2 +	3.
		3 +	6.
		4 +	10.
		÷	10.
		3	3.
		EX	10.
		=	0.30
Square root calculation	TAB SW: 2, GT SW: Off, Round SW: 5/4, /TAX		
	$25^{1/2}$ = 5	C	0.
		25	25.
		√	5.
		=	5.00
	10 x $(9^{1/2})$ ÷ 2 =15	C	0.
		10 x	10.
		9 √	3.
		÷	30.
		2 =	15.00
Clear Entry (CE)	TAB SW: 2, GT SW: Off, Round SW: 5/4, /TAX		
		C	0.
		123 x	123.
		756	756.
		CE	0.
		456 =	56,088.00
ADD mode	TAB SW: ADD, GT SW : Off, Round SW: 5/4, /TAX		
		C	0.
In the case of addition and subtraction.	12.55 + 15.75 + 4.20 + 100.00 – 10.45 – 5.30 = 116.75	1255 +	12.55
		1575 +	28.3
		420 +	32.5
		100. –	132.5
		1045 –	122.05
		530 =	116.75
In the case of calculations that are not addition or subtraction.		C	0.
	12 x 20 = 240	12 x	12.
		20 =	240.00
	200 ÷ 3 = 66.67	200 ÷	200
		3 =	66.67
Store memory calculation	TAB SW: 3, GT SW: Off, Round SW: CUT, /TAX		
		C	M 0.
	1,000 M+	1000 M+	M 1,000.000
	100,000,000,000 M-	100000000000 M-	M 100,000,000,000.
	100 x 3 M+	100 x	M 100.
	1500 ÷ 2 M-	3 M+	M 300.000
	M =	1500 ÷	M 1,500.
	–99,999,999,999,450	2 M-	M 750.000
		RM	M –99,999,999,999,450
		CM	–99,999,999,999,450

Type of calculation	Operation	Key-in	Display
		C	0.
	100,000,000,000 M-	100000000000 M-	M 100,000,000,000.
	100,000,000,000 M+	100000000000 M+	100,000,000,000.
	400 x 2 M-	400 x	400.
	300 ÷ 5 M+	2 M-	M 800.000
	M =	300 ÷	M 300.
	–740	5 M+	M 60.000
		RCM	M –740
		RCM	–740
	TAB SW: 3, GT SW: Off,	Round SW: CUT, TAX	
		C	M 0.
	1,000 M+	1000 M+	= M 1,000.000
	100,000,000,000 M-	100000000000 M-	= M 100,000,000,000.
	100 x 3 M+	100 x	x M 100.
	1500 ÷ 2 M-	3 M+	= M 300.000
	M =	1500 ÷	÷ M 1,500.
	–99,999,999,999,450	2 M-	= M 750.000
		RM	M –99,999,999,999,450
		CM	–99,999,999,999,450
GT calculation	TAB SW: 3, GT SW: On,	Round SW: CUT, /TAX	
		C	0.
	10 + 20	10 +	10.
	= 30	20 =	G 30.000
	200 x 20%	200 x	G 200.
	= 40	20 %	G 40.000
	2 x 3	2 x	G 2.
	= 6	3 =	G 6.000
	–200,000,000,000	200000000000 +/–	G –200,000,000,000.
	= –200,000,000,000	=	G –400,000,000,000.
	960 + 4	960 +	G 960.
	=964	4 =	G 964.000
	GT	GT	G –399,999,998,960.
	= –199,999,998,460	GT	–399,999,998,960.
	TAB SW: 3, GT SW: On,	Round SW: CUT, TAX	
		C	0.
	10 + 20	10 +	+ 10.
	= 30	20 =	G 30.000
	200 x 20%	200 x	x G 200.
	= 40	20 %	G 40.000
	2 ÷ 3	2 ÷	÷ G 2.
	= 0.666	3 =	G 0.666

Type of calculation	Operation	Key-in	Display
Store GT memory calculation	TAB SW: 3, GT SW: On,	Round SW: CUT, /TAX	
		C	0.
	1 ÷ 3 GT+	Round SW: CUT	
	100 ÷ 6 GT+	1 ÷	1.
	1,000 ÷ 3 GT-	3 GT+ G	0.333
	GT =		
		100 ÷ G	100.
		6 GT+ G	16.666
		Round SW: UP	
		1000 ÷ G	1,000.
		3 GT- G	333.334
		GT G	–316.335
		GT	–316.335
		GT	–316.335
	TAB SW: 3, GT SW: On,	Round SW: CUT, TAX	
		C	0.
	1 ÷ 3 GT+	1 ÷	1.
	100 x 6 GT-	3 GT+ ÷	0.333
	GT =	G	
		100 x	100.
		6 GT- x G	600.000
		G	
		GT	–599.667
		GT G	–599.667
Mark up calculation	TAB SW: 2, GT SW: Off,	Round SW: 5/4, TAX	
		C	0.
	9,000 ÷ (1 – (20 ÷ 100))	9000 ÷ ÷	9,000.
	=11,250	20 MU	11,250.00
		MU	2,250.00
		C	0.
	2,400 x (1+ (20 ÷ 100))	2400 x x	2,400.
	=2,880	20 MU	2,880.00
		C	0.
	(18,000 – 15,000) ÷	18000 – –	18,000.
	15,000 x 100 = 20	15000 MU	20.00
		C	0.
	(300 + 200) ÷ 200 x 100	300 + +	300.
	= 250	200 MU	250.00
Item counter calculation	TAB SW: 2, GT SW: Off,	Round SW: 5/4, TAX	
		C	0.
	(1 + 2 + 3 + 4 – IC + 8)	1 + +	1.
	= 16	2 + +	3.
	16 ÷ IC = 4	3 + +	6.
		4 + +	10.
		– –	10.
		IC + +	8.
		8 = =	16.00
		÷ ÷	16.00
		IC = =	4.00

Type of calculation	Operation	Key-in	Display
Overflow	TAB SW: 2, GT SW: Off, Round SW: CUT, TAX		
		C	0.
Addition and	– 600,000,000,000 –	600000000000 +/-	–600,000,000,000.
Subtraction	600,000,000,000	–	–600,000,000,000.
calculation	= – 1,200,000,000,000 E	600000000000 =	= E –1.20000000000
		C/CE	–1.20000000000
		C/CE	0.
	400,000,000,000 +	400000000000 +	+ 400,000,000,000.
	400,000,000,000 –	400000000000 –	– 800,000,000,000.
	400,000,000,000 –	400000000000 –	– 400,000,000,000.
	400,000,000,000 +	400000000000 +	+ 0.
	400,000,000,000 +	400000000000 +	+ 400,000,000,000.
	400,000,000,000	400000000000 +	+ 800,000,000,000.
	= 1,200,000,000,000 E	400000000000 =	= E 1.20000000000
		CE	1.20000000000
Multiplication and		C	0.
Division calculation	100,000,000,000 x 200	100000000000 x	x 100,000,000,000.
	= 20,000,000,000,000 E	200 =	= E 20.0000000000
		C	0.
	123,000,000,000 ÷ 0.001	123000000000 ÷	÷ 123,000,000,000.
	= 123,000,000,000,000 E	0.001 =	= E 123.000000000
		C	0.
Division by zero		C	0.
	1 ÷ 0	1 ÷	÷ 1.
	= 0. E	0 =	= E 0.
Store (M, MII &		C	0.
GT) memory	800,000,000,000 M+	800000000000 M+	= M 800,000.000.000.
calculation	M+ E	M+	= E M 1.60000000000
	M	C	M 0.
	= 800,000,000,000	RM	M 800,000,000,000.
		CM	800,000,000,000.
GT memory	TAB SW: 2, GT SW: On, Round SW: CUT, TAX		
calculation	900,000,000,000 =	900000000000 =	G 900,000,000,000.
	900,000,000,000 = E	900000000000 =	E G 1.80000000000
		C	G 0.
		GT	G 900,000,000,000.
		GT	900,000,000,000.

Type of calculation	Operation	Key-in		Display
TAX calculation	TAB SW: 2, GT SW: Off, Round SW: UP			
TAX rate setting	TAX rate: 5%	C		0.
		RATE	RATE	0.
		5 TAX+	RATE	5.
		C		0.
		5 RATE	RATE	5.
		TAX+	RATE	5.
TAX rate recall	TAX rate: 5%	C		0.
		RATE	RATE	0.
		TAX–	RATE	5.
TAX+ calculation	TAX rate: 5%	C		0.
		800		800.
		TAX+	TAX+	840.00
		TAX+	TAX	40.00
		TAX+	TAX+	840.00
TAX– calculation	TAX rate: 5%	C		0.
		840		840.
		TAX–	TAX–	800.00
		TAX–	TAX	40.00
		TAX–	TAX–	800.00
Calculation including TAX+ values	TAX rate: 20%	C		0.
		100 +	+	100.
		1000 TAX+	+ TAX+	1,200.00
		+	+	1,300.
		2000 TAX+	+ TAX+	2,400.00
		TAX+	+ TAX	400.00
		=	=	1,700.00
Calculation including TAX– values	TAX rate: 20%	C		0.
		100 +	+	100.
		2400 TAX–	+ TAX–	2,000.00
		+	+	2,100.
		3600 TAX–	+ TAX–	3,000.00
		TAX–	+ TAX	600.00
		=	=	2,700.00

ABSOLUTE MAXIMUM RATINGS

Item	Sym.	Min.	Max.	Unit
Supply Voltage	VDD – VSS	-0.3	2.0	V
Input Voltage	Vin	-0.3	VDD + 0.3	V
Operating Temperature	Top	0	50	°C
Storage Temperature	Tstg	-55	+ 125	°C

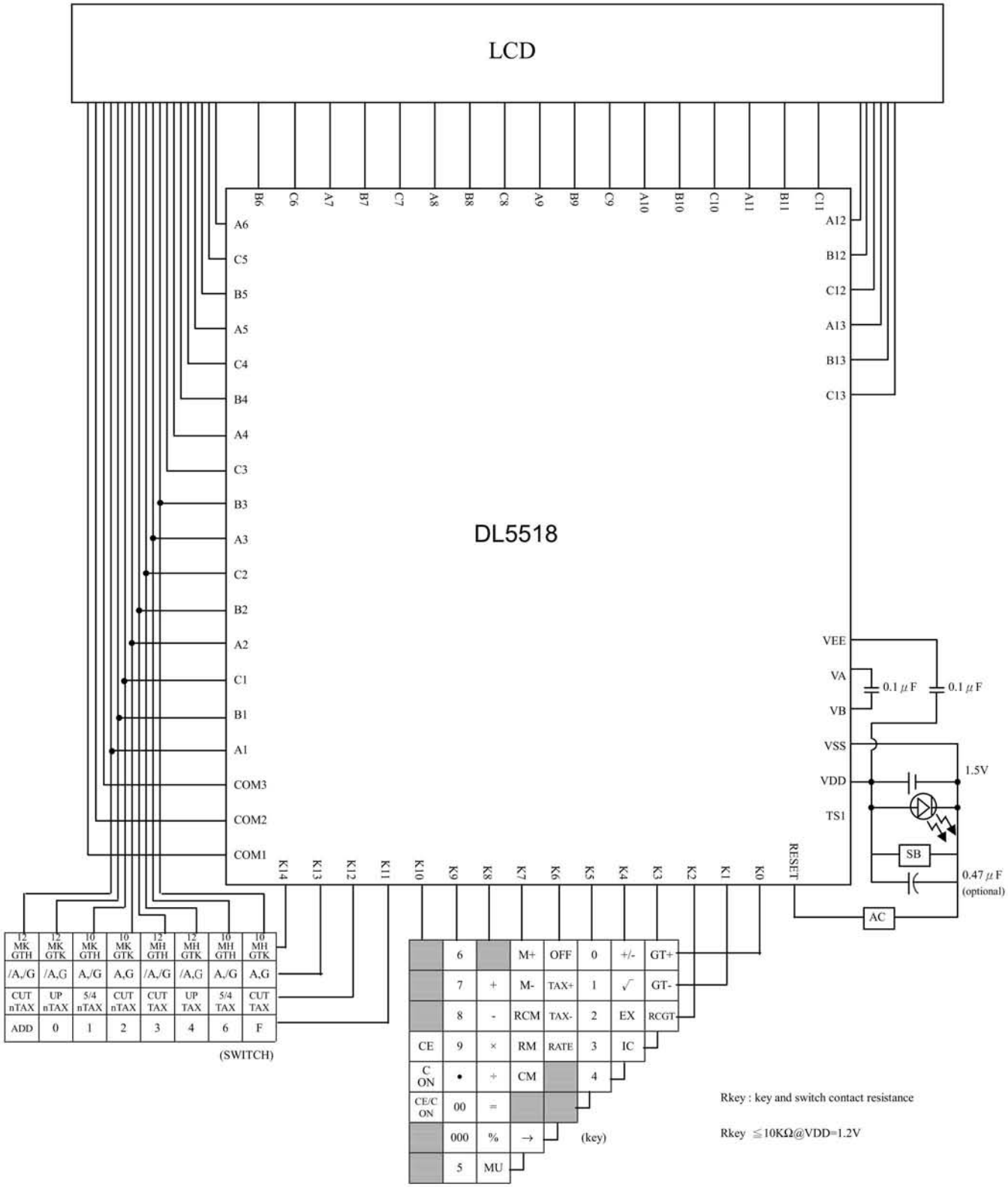
ELECTRICAL CHARACTERISTICS

(VDD=1.5V±0.3V, VSS=0V, TA=25°C, VEE=3.0±0.4V)

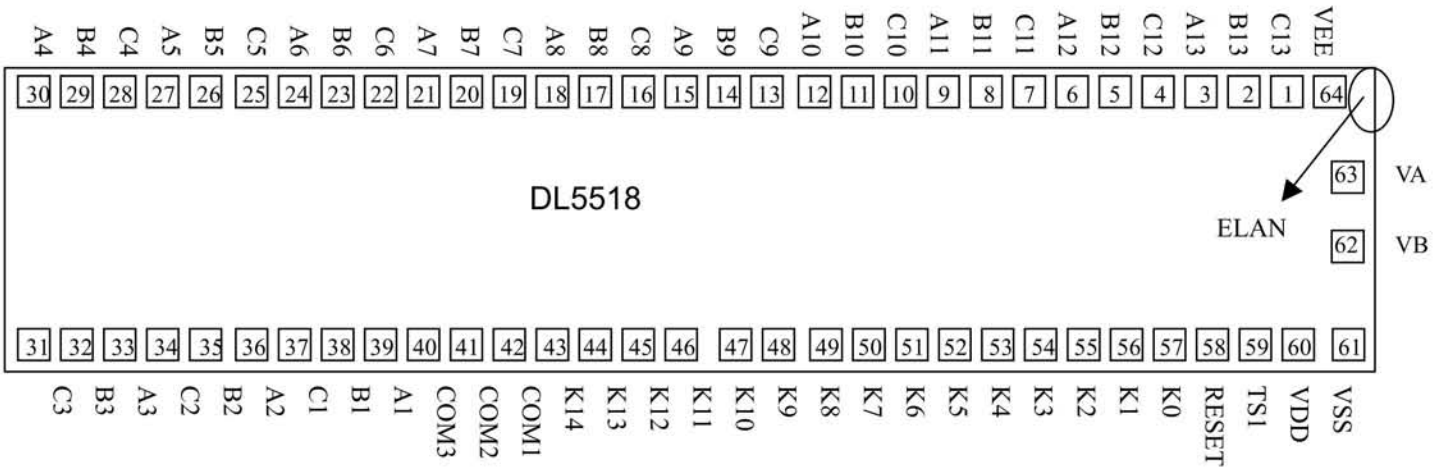
Parameter	Name	Sym.	Min.	Typ.	Max.	Unit	Condition
Operating Voltage	-	V_{DD}	1.1	1.5	1.8	V	
"1" Input Voltage	K3~K10	$V_{IH}(1)$	V_{DD}-0.4	-	V_{DD}	V	
"1" Input Voltage	K11~K14	$V_{IH}(2)$	V_{EE}-0.4	-	V_{EE}	V	
"0" Input Voltage	K3~K14	$V_{IL}(1)$	0	-	0.4 V_{DD}	V	
"1" Input Voltage	RESET	$V_{IH}(3)$	0.6 V_{DD}	-	V_{DD}	V	VDD=1.5V
"0" Input Voltage	RESET	$V_{IL}(2)$	0	-	0.4	V	VDD=1.5V
"1" Output Voltage	SEGMENT COM1~3	$V_{OH}(1)$	V_{EE}-0.2	-	V_{EE}	V	
"O" Output Voltage	SEGMENT COM1~3	$V_{OL}(1)$	0	-	0.2	V	
"M" Output Voltage	COM1~3	V_{OM}	V_{DD}-0.2	-	V_{DD}+0.2	V	
"1" Output Voltage	K0~K7	$V_{OH}(2)$	V_{DD}-0.2	-	V_{DD}	V	
"0" Output Voltage	K0~K7	$V_{OL}(2)$	0	-	0.2	V	
"1" Output Resistance	SEGMENT COM1~3	R_{OH}	-	-	70	KΩ	V_{OUT}= V_{EE}-0.5V
"0" Output Resistance	SEGMENT COM1~3	R_{OL}	-	-	70	KΩ	V_{OUT}= 0.5V

Parameter	Name	Sym.	Min.	Typ.	Max.	Unit	Condition
Key Pull Down Resistance	K0~K10	$R_{KEYL}(1)$	100	180	650	KΩ	$V_{OUT}=V_{DD}$= 1.2~1.8V
Key Pull Up Resistance	K0~K7	$R_{KEYH}(1)$	-	-	10	KΩ	V_{OUT}= 0.5V
	RESET	$R_{KEYH}(2)$	50	-	370	KΩ	
Switch Pull Down Resistance	K11~K14	$R_{SW}(1)$	240	400	800	KΩ	$V_{OUT}=V_{EE}$
Oscillating Frequency	(Wait) TS1	F_{WAIT}	10.8	18	25.2	KHz	V_{DD}=1.2 ~ 1.8V
	(Operate) TS1	F_{OP}	180	300	420	KHz	
Frame Frequency	SEGMENT	f_F	56.3	93.8	131.3	Hz	Wait clock
	COM1~3		62.5	104	145.6	Hz	Fast clock
Supply Current	1 (WAIT)	I_{DDWAIT}	-	3.0	4.5	μA	V_{DD}=1.5V
	2 (OPERATE)	I_{DDOP}	-	22	35	μA	V_{DD}=1.5V, F_{OP}=300KHz
	3 (OFF)	I_{DDOFF}	-	-	1.0	μA	V_{DD}=1.5V
Power off Timer Times		T	350	490	820	SEC	V_{DD}= 1.5V

APPLICATION BLOCK DIAGRAM



PAD DIAGRAM



Pad No.	Symbol	X	Y
1	C13	1510.0	350.0
2	B13	1400.0	350.0
3	A13	1290.0	350.0
4	C12	1180.0	350.0
5	B12	1070.0	350.0
6	A12	960.0	350.0
7	C11	850.0	350.0
8	B11	740.0	350.0
9	A11	630.0	350.0
10	C10	520.0	350.0
11	B10	410.0	350.0
12	A10	300.0	350.0
13	C9	190.0	350.0
14	B9	80.0	350.0
15	A9	-30.0	350.0
16	C8	-140.0	350.0
17	B8	-250.0	350.0
18	A8	-360.0	350.0
19	C7	-470.0	350.0
20	B7	-580.0	350.0
21	A7	-690.0	350.0
22	C6	-800.0	350.0
23	B6	-910.0	350.0
24	A6	-1020.0	350.0
25	C5	-1130.0	350.0

Pad No.	Symbol	X	Y
26	B5	-1240.0	350.0
27	A5	-1350.0	350.0
28	C4	-1460.0	350.0
29	B4	-1570.0	350.0
30	A4	-1680.0	350.0
31	C3	-1680.0	-350.0
32	B3	-1570.0	-350.0
33	A3	-1460.0	-350.0
34	C2	-1350.0	-350.0
35	B2	-1240.0	-350.0
36	A2	-1130.0	-350.0
37	C1	-1020.0	-350.0
38	B1	-910.0	-350.0
39	A1	-800.0	-350.0
40	COM3	-690.0	-350.0
41	COM2	-580.0	-350.0
42	COM1	-470.0	-350.0
43	K14	-360.0	-350.0
44	K13	-250.0	-350.0
45	K12	-140.0	-350.0
46	K11	-30.0	-350.0
47	K10	98.0	-350.0
48	K9	208.0	-350.0
49	K8	318.0	-350.0
50	K7	428.0	-350.0
51	K6	538.0	-350.0
52	K5	648.0	-350.0
53	K4	758.0	-350.0
54	K3	868.0	-350.0
55	K2	978.0	-350.0
56	K1	1088.0	-350.0
57	K0	1198.0	-350.0
58	RESET	1308.0	-350.0
59	TS1	1418.0	-350.0
60	VDD	1540.1	-350.0
61	VSS	1666.7	-350.0
62	VB	1675.0	-59.3
63	VA	1675.0	130.7
64	VEE	1634.0	350.0

Chip size:3620 x 1010 um

Note : For PCB layout, IC substrate must be connected to VSS.