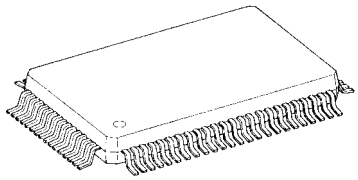
TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC83230-0021,JTC83230-0021S

TC83230-0021, JTC83230-0021S: Single-Chip CMOS LSI for Calculators with Printers (applicable printer heads: M-42V/42TV/41TAV/48T manufactured by EPSON)

The TC83230-0021, JTC83230-0021S LSI is a single-chip CMOS LSI for use in calculators with printers.

It integrates I/O logic circuits necessary to configure a calculator with 10-,12-, or 14-digit display, two-memory function, serial printer used to print calculation results, oscillator, and LCD drivers.



QFP80-P-1420-0.80A

Weight: 1.52 g (typ.)

Features

Operational Features

- Print: 14 digits (numerical value) + 1 digit (decimal point) + 2 digits (symbol) + 1 digit (minus) + 4 digits (commas)
- Display: 10, 12 or 14 digits (numerical value) + 1 digit (sign) with commas for separating thousand, million, billion and trillion units.
- Decimal output: Floating point (F), specified decimal point (0, 1, 2, 3, 4, 5, 6), add mode (A)
- Key-input buffer: 14 words
- Operation methods: Addition and subtraction: By ARITHMETIC operation
  Multiplication and division: By algebraic operation
- Function: Four function, repeat multiplication and division, mixed calculation, square calculation, percentage calculation, percent discount and add-on calculation, memory calculation, delta percent calculation, add-mode calculation, mark-up/down calculation, total calculation, constant calculation, tax calculation, rate conversion.
  Two-key rollover
- Leading zero suppression

Protection

(1) When an error occurs, only the following key inputs are valid: [C], [C/CE], [Feed], [OFF], [ON], [→], and [P/NP].

(2) Key chatter protection (at f = 4 MHz)
  At key read-in: 15 ms
  At key off: 40 ms

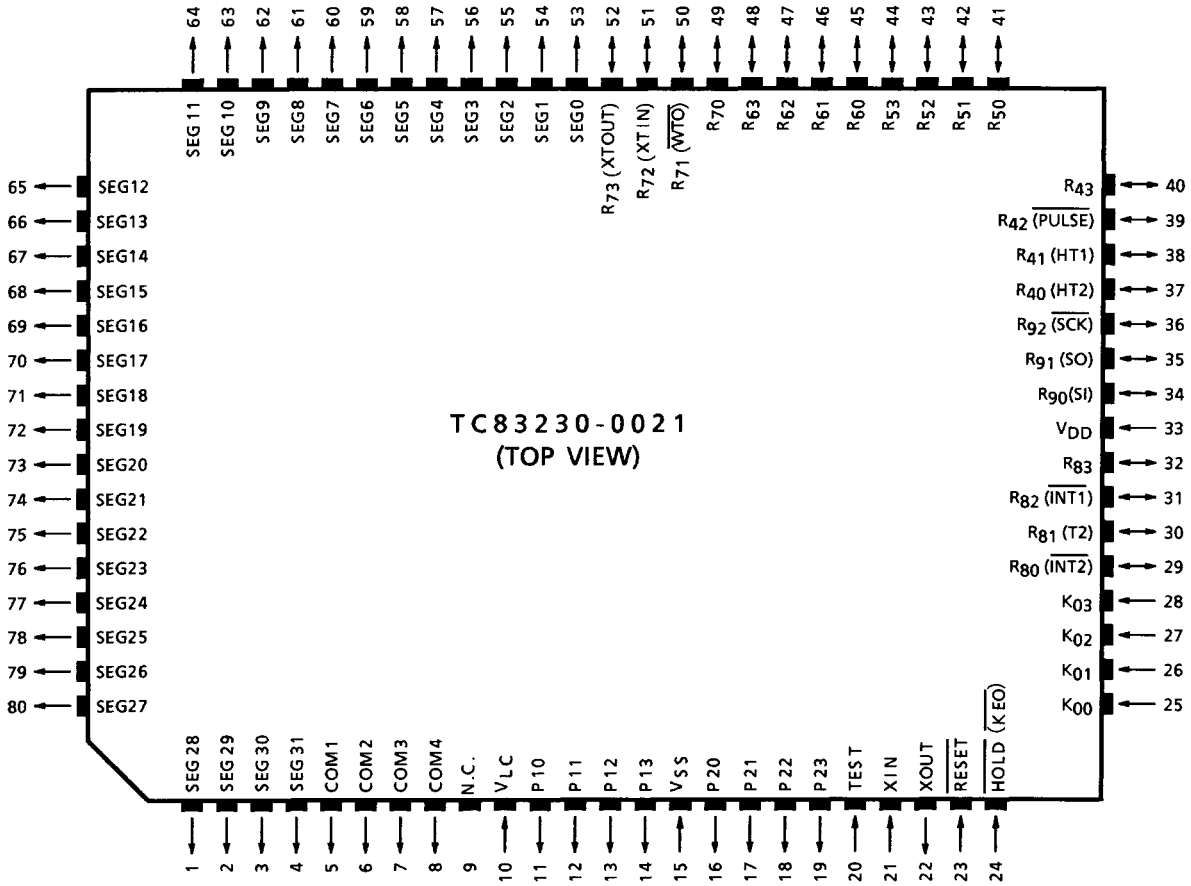
Auto-Clear at Power On

Auto-clear functions by connecting a capacitor to the RESET pin.

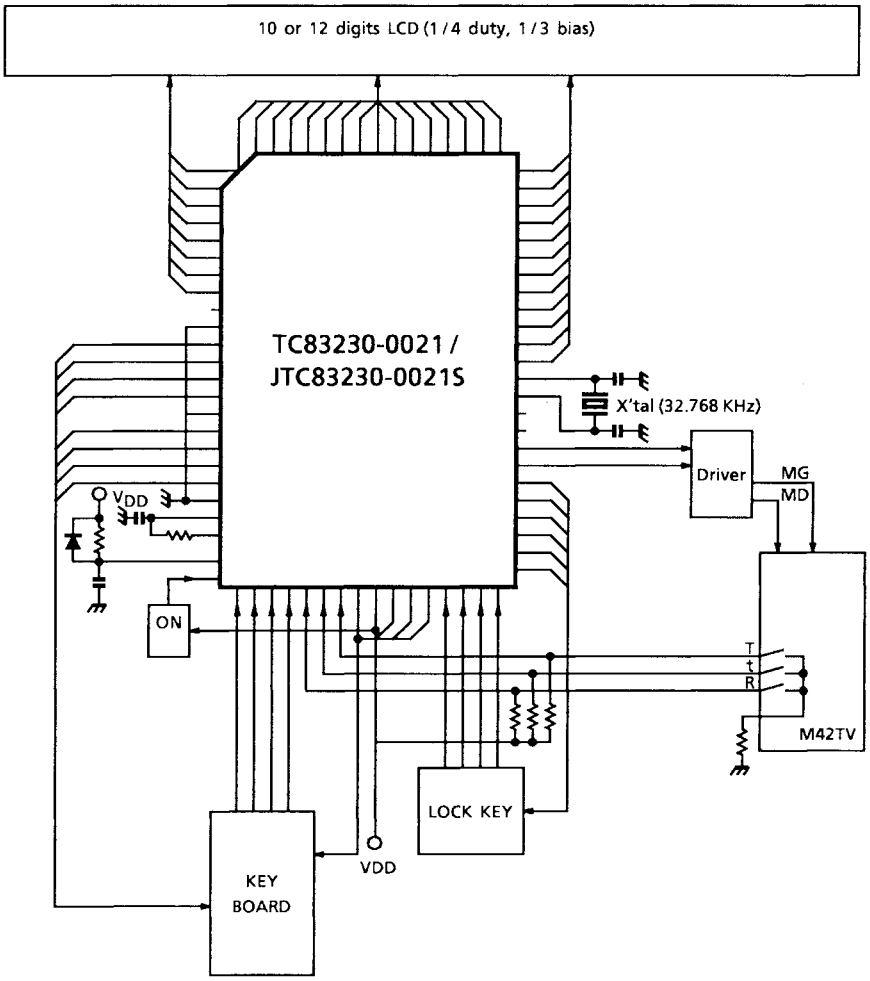
- Conditions for printing in red
  (1) When keys except [–] and [M–] are pressed with print data which is signed negative.
  (2) When the [–] or [M–] key is pressed with print data which is signed positive.
  (3) When the intermediate operation result for MU/D or delta% is negative.

Pin Assignment (top view)

QFP80



System Block Diagram

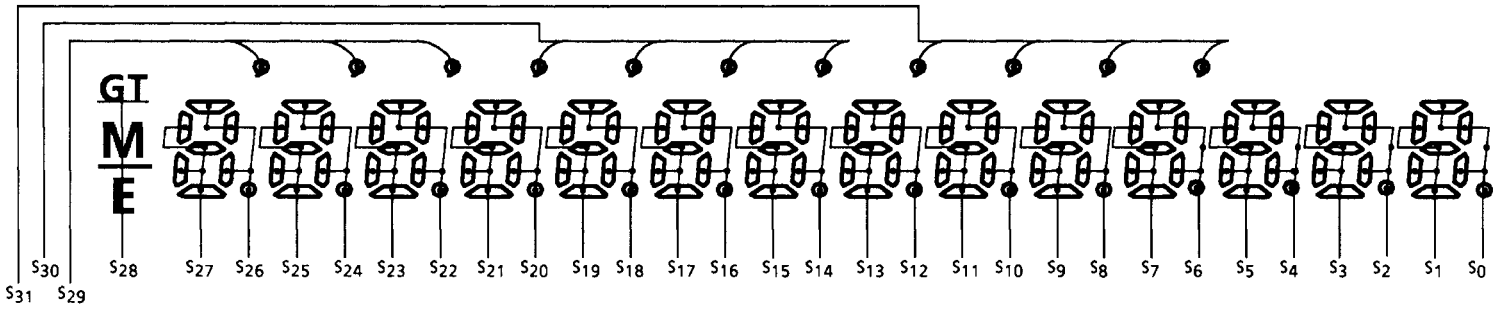


Note 1: VLC: In case of VLC = 0 V

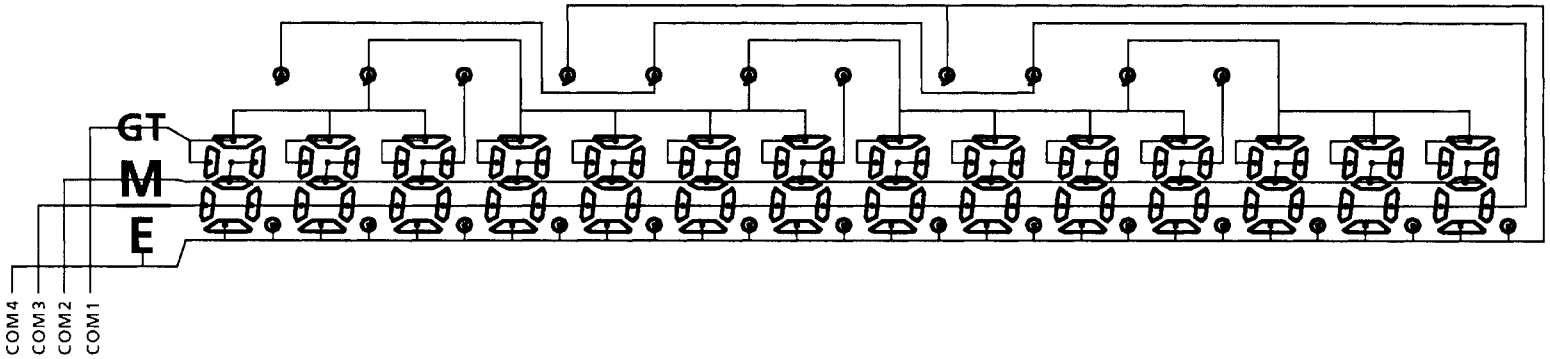
Connection of LCD

(1) 14 digits of LCD

Segment

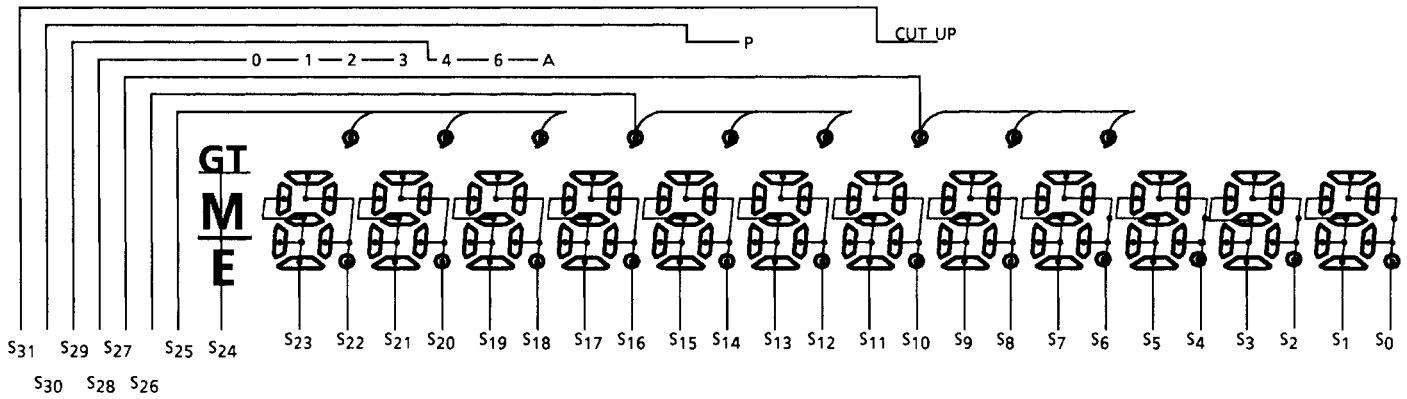


Common

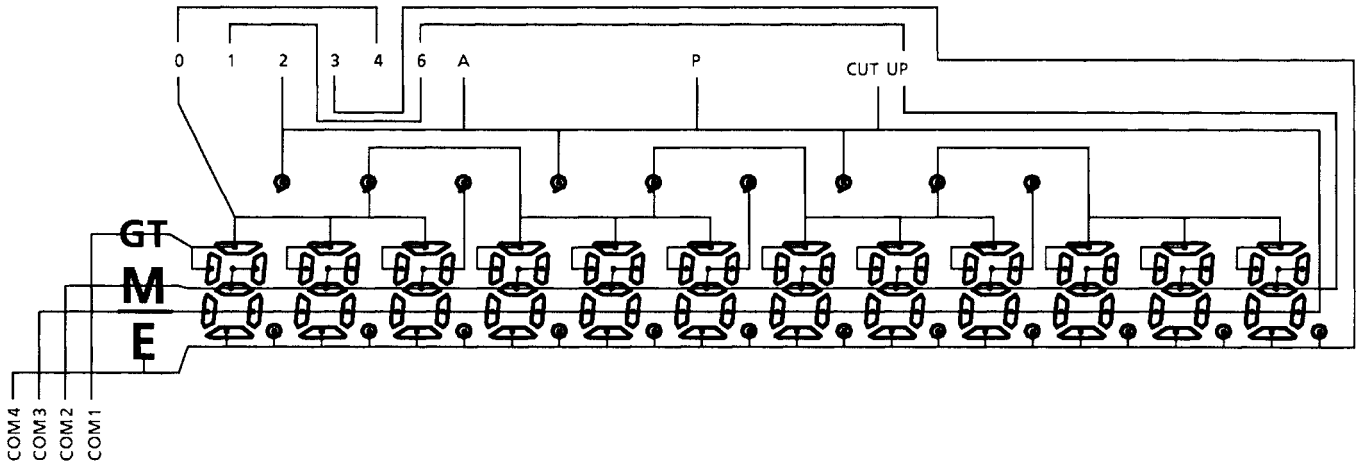


(2) 10 or 12 digits of LCD

Segment



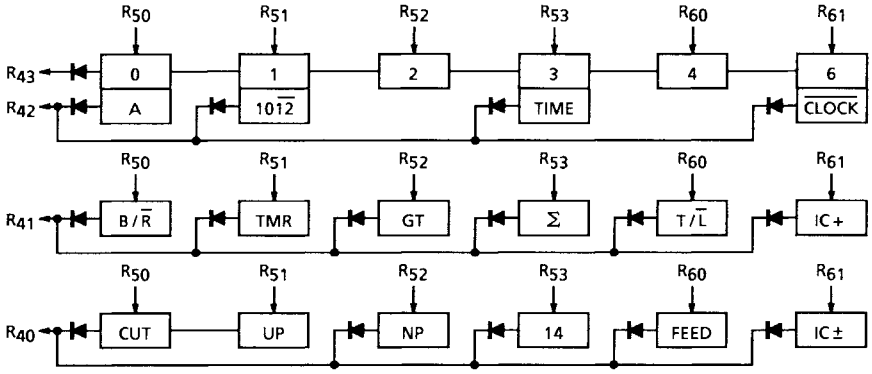
Common



Key Connection (10, 12 or 14 digits M40 series)

	P10	P11	P12	P13	P20	P21	P22	P23	R90	R91	R92	R83
K_{03}	7	8	9	C	*	%	Δ%	IC	M*	M*◇	P / NP	TM·S
K_{02}	4	5	6	C / CE	◇	=	MU / D	# / P	M◇	GT	RND	RT·S
K_{01}	1	2	3	CE	−		÷	→	M −	OFF	DEC	> A→B
K_{00}	0	00	000	·	+		×	+ / −	M +			< B→A

Touch Key



Lock Key



ON Key

Specification of Calculator

(1) Operations depending on key types and modes

Key Name	CAL Mode	CLOCK Mode	
		Time Set	
Mode switch	[CAL] lock key is on	[TIME] lock key is on	
C	Operates as clear key	Cancels set mode and clears input data	Unused
CE	Operates as clear entry key	Unused	Unused
C/CE	Operates as clear or clear entry key	Cancels set mode and clears input data	Unused
OFF	Operates as off key	Unused	Unused
Numeral	Numeral Key-inputs numerals	Inputs numerals	Unused
·	Key-inputs decimal points	Unused	Unused
*, ◊	Operates as total or sub-total key	Unused	Unused
+, − ×, ÷	Operates as four-function key	Unused	Unused
=	Operates as = key	Unused	Unused
GT	Operates as GT key	Unused	Unused
P/NP	Switches print or non-print	Unused	Unused
RND	Switches round-off and round-up	Unused	Unused
DEC	Switches decimal points	Unused	Unused
%	Operates as % key	Unused	Unused
Δ%	Operates as delta percentage calculation key	Unused	Unused
MU/D	Operates as mark-up/down key	Unused	Unused
IC	Operates as item count key	Unused	Unused
#/P	Operates as non-add-print key for left-justified printing	Unused	Prints current date and time
→	Operates as right-shift key	Unused	Unused
+/−	Operates as sign change key	Unused	Unused
M+, M− M*, M◊ M*◊	Operates as memory function key	Unused	Unused
TM·S	Unused	Sets time and date	Moves to TIME SET state
RT·S	Sets rate	Unused	Unused
> A → B	Rate conversion or rate call	Moves cursor to right	Switches between time and date display
< B → A	Rate conversion or rate call	Moves cursor to left	Switches between time and date display

Note 2: CLOCK mode is only available with jumper select of [$\overline{\text{CLOCK}}$] lock key off.

When [$\overline{\text{CLOCK}}$] lock key is on, it is a calculater without CLOCK function.

(2) Explanation of keys

[0~9] [00, 000] ..... Keys in numbers from 0 to 9, 00, and 000. If the number of display digits exceeds 10, 12 or 14, key entry is invalid.

[·] ..... If this key is pressed after a key operation except data entry, the display is cleared and entry of [·] is stored in memory. The decimal point is shifted for subsequent data entry. If the [·] key is pressed during data entry, display does not change.

[+, –] ..... Add or subtract operation data and display the result. The decimal point is floating except when A mode is specified. Addition or subtraction can be performed repeatedly.
If these key are pressed in multiplication/division mode or in constant calculation mode, add or subtract display data to addition/subtraction registers, then display the result. At this time, in the operation mode multiplicand or divisor do not change.
These keys increment or decrement the item counter. In the following operation mode, the operations are executed, and the results are printed and displayed. At that time, addition or subtraction using the addition/subtraction register is not executed.

1) Percent discount/add-on calculation

a × b% +.....a + (ab/100)
c% +.....a + (ac/100)
a × b% –.....a – (ab/100)
c% –.....a – (ac/100)

Percent discount/add-on with constants are calculated as above.

[◊] ..... Prints and displays the intermediate result in addition/subtraction register. In item count mode, prints the contents of the item counter before the calculation result printing.
Contents of data register or stored arithmetic instruction are not changed.

[*] ..... Prints and displays the result in addition/subtraction register. Automatically feeds paper one line. In item count mode, the contents of the item counter are printed before the calculation result printing.
After this key operation, the contents of the addition/subtraction register are cleared. The contents of the item counter are cleared at the first addition/subtraction in next step. The contents of the data register or stored arithmetic instruction are not changed. When GT mode is specified, the result of addition/subtraction is added to the GT memory.

[M+, M–] ..... If the arithmetic instruction is not stored or if the mode is constant calculation mode, first prints the display contents after rounding to the specified number of decimal places, performs addition/subtraction using the data in memory, then stores the result in memory. If the multiplication/division instruction is stored, executes the arithmetic instruction, rounds the result to the specified number of decimal places, prints and display the result, adds/subtracts with the data in memory, then stores the result to memory.
At that time, the multiplicand or divisor is stored together with the mode, constant calculation mode. When this key is pressed immediately after the [×] or [M+, M–] key, operation is the same as that for the [=] key; that is, adds/subtracts using data in memory. This key operation increments or decrements the item counter for memory.

[M◊] ..... Prints or displays the intermediate result of memory calculation. In item count mode, prints the contents of the item counter for memory before the calculation result printing. Contents of the data register or stored arithmetic instruction are not changed.

[M*] ..... Prints and displays the result of memory calculation and automatically feeds paper one line. In item count mode, prints the contents of the item counter for memory before the calculation result printing. After the [M*] key operation, the contents of memory and the contents of the item counter for memory are cleared. Contents of the data register or stored arithmetic instruction are not changed.

[M*◊]..... Operates both [M◊] and [M*] key operations. Pressing this key once is equivalent to pressing the [M◊] key; pressing the key twice is the same as pressing the [M*] key.

[×, ÷]..... If the multiplication or division instruction is stored in memory, prints the operators, performs the operations and displays the results while simultaneously storing a new arithmetic instruction in memory. The decimal point for the result is floating. If the [×] or [÷] key is pressed in constant calculation mode, prints the displayed numeric value without performing an operation and stores a new multiplication/division instruction in memory.

[=]..... Executes a stored multiplication/division instruction, rounds the result to the specified number of decimal places, prints and displays the result, then automatically feeds the paper one line. Stores the multiplicand or divisor together with constant calculation mode in memory. If an instruction is not stored in memory, no operation is performed and the previous state is held. Pressing the [=] key immediately after the [×] or [÷] key performs the following operation.

a × =.....aa
a ÷ =.....1

[%]..... If an arithmetic instruction is stored in memory, performs percentage calculation, rounds the result to the specified number of decimal places, prints and displays the result. Stores the multiplicand/divisor together with constant calculation mode in memory. If a percentage calculation for multiplication is performed, percent discount/add-on calculation can be done by using the [+] or [–] key. At that time, addition/subtraction using the addition/subtraction register is not performed. If an arithmetic instruction is not stored in memory, no operation is performed and the previous state is held. Pressing the [%] key immediately after the [×] or [÷] key performs the following operation.

a × % =...aa/100
a ÷ % =...100

% key operation example: percent discount/add-on calculation

a × b%....ab/100
+.....a + (ab/100)
c% ac/100
+.....a + (ac/100)
a × b%....ab/100
–.....a – (ab/100)
c% ac/100
–.....a – (ac/100)

[MU/D]..... If a multiplication/division instruction is stored in memory, cancels the data. The decimal point for the result is floating.

MU/D key operation example:

aMU/Db =.....	a/(1 – (b/100)) – a	(prints profit)
	a/(1 – (b/100))	(mark-up)
c =.....	a/(1 – (c/100)) – a	(prints profit)
	a/(1 – (c/100))	(mark-up)
aMU/Db +/– =.....	a/(1 + (b/100)) – a	(prints profit)
	a/(1 + (b/100))	(mark-down)
c +/– =.....	a/(1 + (c/100)) – a	(prints profit)
	a/(1 + (c/100))	(mark-down)

[Δ%] ..... If a multiplication/division instruction is memorized, cancels the data.
Δ%key operation example:

aΔ% b =.....	b – a	
	(b – a)/|a|	(prints difference)
c =.....	c – a	(change delta percent)
	(c – a)/|a|	(prints difference)
aΔ% b +/– =.....	–(b + a)	(change delta percent)
	–(b + a)/|a|	(prints difference)
c +/– =.....	–(c + a)	(change delta percent)
	–(c + a)/|a|	(prints difference)

[+/–]..... Inverts sign of the displayed number at key entry.

[→] ..... Shifts the contents of the display to the right by one digit at key entry. For an estimation calculation error, cancels the error.

[IC]..... Calls the contents of the item counter. Does not change current state.

[GT] ..... Calls the contents of GT memory. If the key is pressed once, calls the contents of GT memory, but does not change current state. If the key is pressed twice, calls the contents of GT memory and clears them.

[C] ..... Cancels all arithmetic instructions and errors, clears the contents of all the registers except the memory register, and prints 0.C.

[CE] ..... If pressed at key entry, clears only the contents of the display; does not change the stored arithmetic instruction or the contents of the data register. Invalid if pressed after one of the following keys: [C] [×] [÷] [+] [–] [=] [%] [Δ%] [M+] [M–] [M◊] [M*] [M*◊] [MU/D] [IC].
The result of pressing the [CE] key after the [#/P] key depends on the state before the keys were pressed.

[C/CE]..... If pressed at key entry, operates same as the [CE] key.
If pressed after one of the following keys, operates same as the [C] key: [C/CE] [×] [÷] [+] [–] [=] [%] [Δ%] [M+] [M–] [M◊] [M*] [M*◊] [MU/D] [IC].
The result of pressing the [C/CE] key after the [+/–] or the [#/P] key depends on the state before the keys were pressed.

[#/P] ..... If pressed after the numerical key entry, prints the contents of the key entry data register together with the # symbol, but does not change the current state. If the key is pressed after a key except the numerical keys or [+/–] key, does not change the contents of the displays or the current state. If the key is pressed in clock mode, automatically prints the displayed date and time.

[ON (1)] ..... If pressed in HOLD mode, cancels HOLD. At that time, cancels all arithmetic instructions and errors. The contents of the memory register and the TAX RATE before HOLD mode are retained; all other registers are cleared. While the [ON (1)] key is pressed, the [OFF] key is invalid.

[ON (2)] ..... If pressed in lower frequency (32.768 KHz for CLOCK) operation mode, drives higher frequency (4 MHz) operation mode (normal calculation mode). At the same time, cancels all arithmetic instructions and errors. The contents of memory register and TAX are retained before [OFF] key; all other registers are cleared. While the [ON (2)] key is invalid.

[OFF]..... Forcibly enters HOLD mode or lower frequency (32.768 kHz for CLOCK) mode.

[↑] ..... Feeds paper.

[P/NP]..... Switches between PRINT and NON-PRINT mode. At reset, NON-PRINT mode is set. Switches mode in each time when the [P/NP] key is pressed:
P → NP → P → NP. In PRINT mode, displays "print mode". Valid only when the [T/$\overline{L}$] lock key is set to T.

[RND] ..... Switches between round-up, round-off and half-adjust. At reset, half-adjust is set. Switches the mode in each time when the [RND] key is pressed:
5/4 → ↓ → ↑ → 5/4 → ↓ → ↑. Displays round-up/round-off. Valid only when the [T/$\overline{L}$] lock key is set to T.

[DEC]..... Switches the decimal point. At reset, floating point (F) is set. Switches the mode in each time when the [DEC] key is pressed as follows:
F → 0 → 1 → 2 → 3 → 4 → 6 → A → F → 0 → 1. Displays the specified decimal point or add mode. Valid only when the [T/$\overline{L}$] lock key is set to T.

[TM・S]..... Sets time and date. Pressing the [TM・S] key in clock/date display mode sets time setting mode. Valid only when the [TIME] lock key is set.

[RT・S]..... If pressed after key entry, sets the conversion rate.

>

[A → B]..... When the [TIME] key is on, moves the cursor to the right as the [>] key.
When the [CAL] key is on, executes rate conversion as the [A → B] key.
Example of [A → B] key operation when rate value is 130:
a [A → B]..... a130
Pressing the < [A → B] key after clearing display calls the rate value.

<

[B → A]..... When the [TIME] key is on, moves the cursor to the left as the [<] key.
When the [CAL] key is on, executes rate conversion as [B → A] key.
Example of [B → A] key operation when rate value is 130:
a [B → A]..... a/130
Pressing the < [B → A] key after clearing display calls the rate value.

(3) Explanation of lock keys

[0, 1, 2, 3]..... Sets the specified decimal point. If no specification, floating is set.

[4, 6, A] When processing floating point data, the operation result is zero-shifted. When A mode is specified, key-entered data are multiplied by 1/100 only when the key-entered numerical value is used for addition/subtraction or memory addition/subtraction. If the [·] key is pressed during data entry, A mode is invalid. The operation result is treated the same as the specified decimal point, 2.

[CUT, UP] ..... Rounds-off in CUT mode; rounds-up in UP mode; when no specification is made, half-adjusts. When a decimal point is specified, the digit (s) in the subsequent decimal place is (are) half-adjusted, rounded-off, or rounded-up (??). If floating point is specified, the value of the least significant digits which cannot be displayed is rounded off.

[NP] ..... Switches between print and non print mode. In non-print mode, disables all printing except [↑] or [#/P] key.
When mode changes from non-print to print, feeds the paper one line.

[IC+]..... Selects item count mode.

[IC±] IC+ ..... Counts up by the [+] or [–] key.
IC±..... Counts up by the [+] key, down by the [–] key.

[Σ] ..... If an operation is performed by the [=] or [%] key in auto accumulation calculation mode, adds the operation result to the addition/subtraction register and increments the item counter.

[GT] ..... In grand total mode, adds the total register to the GT register by the [*] key.

[B/$\overline{\text{R}}$]..... Prints in single color when selecting B on is specified for the printer (M-42V); in two colors, when selecting $\overline{\text{R}}$ off is specified (M-42TV, M-41TAV, M-48T).

[TIME]..... When the [TIME] lock key is on, displays the time.

[T/$\overline{\text{L}}$] ..... When the [T/$\overline{\text{L}}$] lock key is on, the [P/NP], [RND], and [DEC] keys are valid. When the [T/$\overline{\text{L}}$] key is off, the [NP], [CUT], [UP], and [0, 1, 2, 3, 4, 6, A] lock keys are valid. In 14-digit mode in display, the [T/$\overline{\text{L}}$] lock key is invalid. The [P/NP], [RND], and [DEC] keys cannot be used.

[TMR] ..... When the [TMR] lock key is on, auto power-off functions. (after approx. 10 minutes).

[14]..... Valid when the [10/$\overline{12}$] lock key is off; selects [14] digits display and (M-48T) printer when the [14] lock key is on.

[10/$\overline{12}$]..... Valid when the [14] lock key is off; selects 10 digits display and printer when the [10/$\overline{12}$] lock key is on; selects 12 digits display and printer when the [10/$\overline{12}$] lock key is off.

[$\overline{\text{CLOCK}}$]..... When [$\overline{\text{CLOCK}}$] lock key is off, CLOCK function is operatable. In this case, [ON (2)] and [OFF] keys are available for ON/OFF function.
When [$\overline{\text{CLOCK}}$] lock key is on, CLOCK function is not operatable. In this case, [ON (1)] and [OFF] keys are available for ON/OFF function.

Explanation of Functions

(1) Auto power-off function

When the [TMR] lock key is on and there is no key input for 10 minutes, automatically enters HOLD state. The [ON] key is used to cancel HOLD mode or to drive higher frequency (4 MHz) mode. When power is turned on by the [ON] key, cancels all arithmetic instructions and errors, stores states before power off in memory and GT memory, and clears all other contents in the RAM. If any key is pressed within 10 minutes, the automatic power-off timer is cleared and resumes counting. Auto power-off functions even though a lock key is kept being pressed (under off-chatter).

(2) Clock function

Time is input and displayed using a 24-hour clock. In clock display mode, a hyphen "–" between hours and minutes blink. In date display, a hyphen "–" between month and day does not blink.

To set or change the time or date, use the [TIME] key to enter clock/date setting mode.

CLOCK function is only available when [CLOCK] lock key is off.

1) How to set or change time and date

a) Enter clock display mode using the [TIME] key. (the current time is displayed.)

b) Press the [TM・S] key to set to clock/date setting mode. (year and data setting when the [TM・S] key is pressed the first time.) At that time, the cursor blinks at the year. In clock/date setting mode, the display is not zero-suppressed.

c) Move the cursor using the cursor keys to the position where the data are to be changed. Input the year, month, day, hour, or minute to be changed using numeric data keys. After a numeral is input, the cursor automatically moves to the next position.

d) After inputting the year and date, pressing the [TM・S] key a second time ends date setting and clock setting mode is entered. Input numerals for time the same way as year or date.

e) Pressing the [TM・S] key a third time sets the hours and minutes, then returns to clock display mode.

2) Clock/date input error

If a value which does not exist is specified for the month, day, hour, or minute, a clock/date setting error occurs. When an error occurs, the cursor returns to the beginning of the position where the error occurred and the system stands by for fresh input. The error mark is not displayed on LCD.

3) Clear or mode key operation during clock/date setting

Pressing the [C] or [C/CE] key cancels clock/date setting mode and returns to clock display mode. While clock function is operative, the [OFF] or auto power-off function cannot be used.

4) Initial values at reset

01 01-01 (YY MM/DD), 00: 00: 00 (HH: MM: SS)

5) Setting example 1: to set data, 15: 34 July 10'93,

a) Press the [TIME] key (12-digit display)

							0	0	-	0	0	Clock display mode

b) Press the [TM·S] key.

0	1		0	1	-	0	1					Inverted display represents blinking.

c) Press the [9], [3], [0], [7], [1], and [0] keys.

9	3		0	7	-	1	0				

d) Press the [TM·S] key.

							0	0	-	0	0	

e) Press the [1], [5], [3], and [4] keys.

							1	5	-	3	4	

f) Press the [TM·S] key.

							1	5	-	3	4	

g) Press the [<] key.

9	3			7	-	1	0				

h) Press the [>] key.

							1	5	-	3	4	Repeat g) and h).

Setting example 2: to change from 15: 34 set in setting example 1 to 04: 09

a) Press the [TM·S] key.

9	3		0	7	-	1	0				

b) Press the [TM·S] key.

							1	5	-	3	4	

c) Press the [0], [4], [0], and [9] keys.

							0	4	-	0	9	

d) Press the [TM·S] key.

								4	-		9	Zero suppression after setting.

Setting example 3: to change from July 10 set in setting example 1 to December 10.

a) Press the [TM·S] key.

9	3		0	7	-	1	0				

b) Press the [>] key twice.

9	3		0	7	-	1	0				

c) Press the [1] and [3] keys.

9	3		1	3	-	1	0				

d) Press the [TM·S] key.

9	3		1	3	-	1	0				

An input error occurs and the cursor returns to the beginning of the position where the error occurred.

e) Press the [1] and [2] keys.

9	3		1	2	-	1	0				

f) Press the [TM·S] key.

							0	4	-	0	9

g) Press the [TM·S] key.

								4	-		9

Clock display mode

(3) Rate conversion function

Conversion can only be performed from one type of currency to another.

1) How to set and change rates

a) Input the numeric value to be set.

b) Pressing the [RT·S] key sets the input numeric value as the rate value.

c) To call the set rate, press the [A → B] or [B → A] key after clear (display data: 0).

2) Example of currency conversion

To set $1 = Y125.45 and converts $1000 to yen:

a) Press [1], [2], [5], [·], [4], and [5] keys.

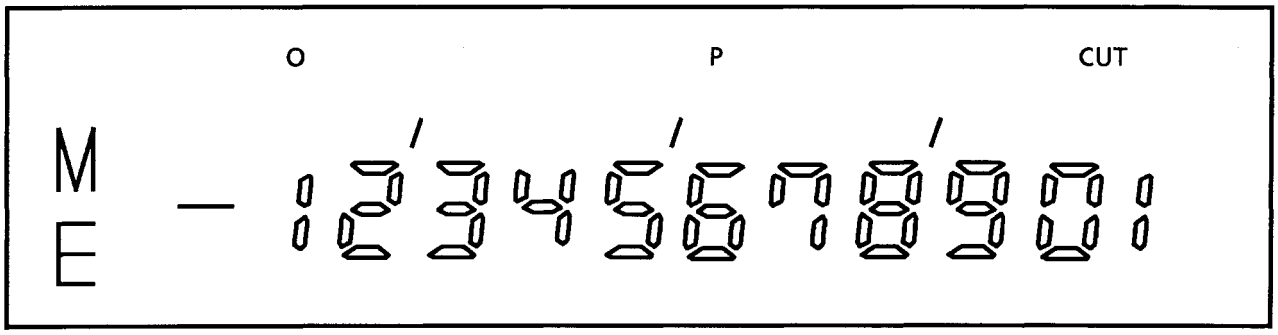
b) Press the [RT·S] key to set the input data.

c) Press the [1], [0], [0], and [0] keys.

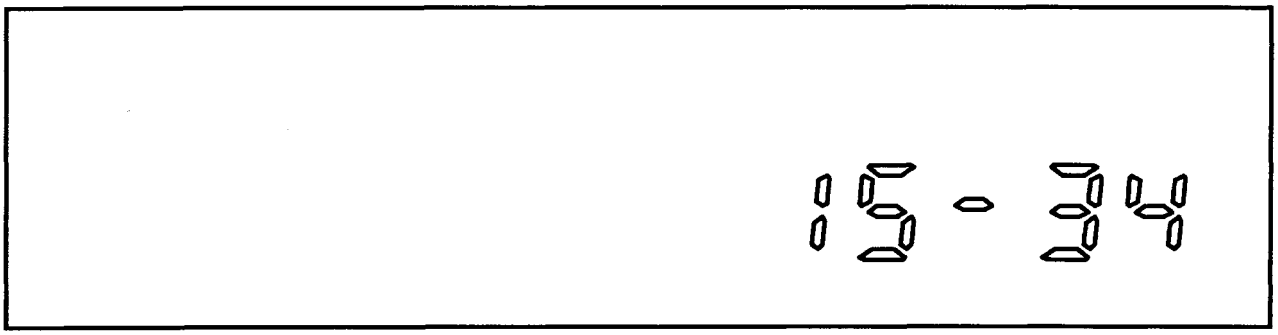
d) Press the [A → B] key for conversion.

Display Examples

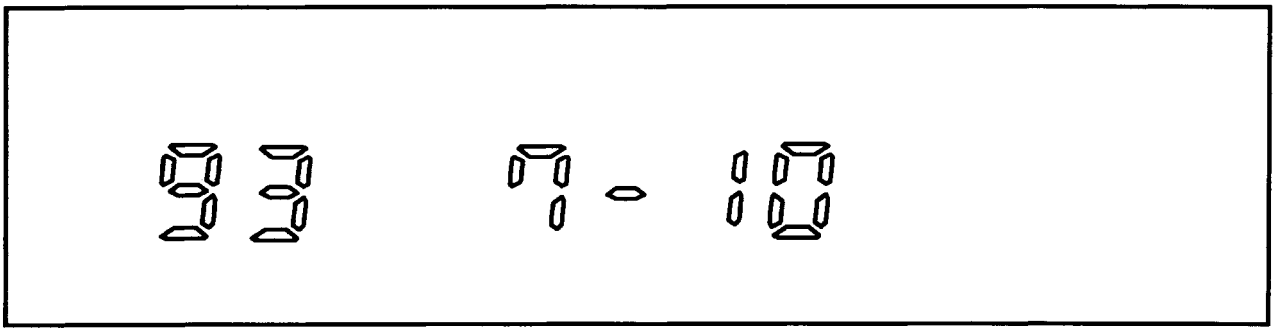
Calculation Mode (12 digits)



Clock Display Mode



Date Display Mode



Operation Example

(the following table shows a example of using 14-digit display and M48T printer.)
Underline is displayed in red print.

Key Operation	Display	Print
Power ON	0.	1 LINE FEED C 1 LINE FEED
[C]	0.	0· C 1 LINE FEED
00.78.09.04.9955[#/P]	0.7809049955	#0·78·09·04·9955····
.1234567890991[+] [◊]	0.1234567890991 0.1234567890991	0·1234567890991 + 001····· 0·1234567890991 ◊
99999999999999[-] [◊]	- 99,999,999,999,999. - 99,999,999,999,999.	99,999,999,999,999· - 001····· -99,999,999,999,999· ◊
11111111111111[M-] [M◊]	M 11,111,111,111,111. M- 11,111,111,111,111.	11,111,111,111,111· M- 001····· -11,111,111,111,111· M◊
11111111111111[M-] [M*]	M 11,111,111,111,111. - 11,111,111,111,111.	11,111,111,111,111· M- 001····· -11,111,111,111,111· M* 1 LINE FEED
1.23456[÷] 789[=] (5/4,TAB3)	1.23456 0.002	1·23456 ÷ 789· = 0·002 * 1 LINE FEED
667.788[+] [#/P]	667.788 667.788	667·788 + 667·788 ◊
99999999999999[+] 0.9999999999999[+]	99,999,999,999,999. 99,999,999,999,999.	99,999,999,999,999· + 0·9999999999999 +
10000000000000[+] 1[-] .0000000000001[-]	10,000,000,000,000. 9,999,999,999,999. 9,999,999,999,999.	10,000,000,000,000· + 1· - 0·0000000000001 -
123456789.8[+] 1.2345678[+]	123,456,789.8 123,456,791.03456	123,456,789·8 + 1·2345678 +
99999999999999[×] 77777777777777[=]	99,999,999,999,999. ← 77,777,777,777,776.	99,999,999,999,999· × 77,777,777,777,777· = ····· 77777777777776· * 1 LINE FEED

Key Operation	Display	Print
99999999000000[+]	99,999,999,000,000.	99,999,999,000,000· +
1234567.8[+]		1,234,567·8 +
		.....
	← 1.0000000023456	1·0000000023456 *
		1 LINE FEED
[CE]	0.	
789012.3[+]	99,999,999,789,012.	789,012·3 +
99999999999999[+]	99,999,999,999,999.	99,999,999,999,999· +
1[M+]	M 1.	1· M+
1[+]		1· +
		.....
	M ← 1.0000000000000	1·0000000000000 *
		1 LINE FEED
[CE]	M 0.	
99999999999999[+]		1 LINE FEED
		99,999,999,999,999· +
		.....
	M ← 1.9999999999999	1·9999999999999 *
		1 LINE FEED
3[×]	3.	3· ×
[÷]	9.	3· ÷
2[÷]	4.5	2· ÷
[×]	2.25	2· ×
4[÷]	9.	4· ÷
[-]	-9.	9· -
11[+]	11.	11· +
345[-]	-334.	345· -
[M-]	M -334.	-334· M-
2[×]	2.	2· ×
3[=] (Σ=ON)		3· =
	6.	6· +
		1 LINE FEED
2[MU/MD]	2.	2· GM
3[=]		3· %
		0·061855670103 Δ*
	2.061855670103	2·061855670103 *
		1 LINE FEED
2[×]	2.	2· ×
3[%]		3· %
	0.06	0·06 *
		1 LINE FEED
[+]	2.06	2·06 +%
		1 LINE FEED

Key Operation	Display	Print
2[Δ%]	2.	2·Δ
3[=]		3· =
		1·Δ*
	50.	50·Δ%
		1 LINE FEED
11111111111111[+/-]	- 11,111,111,111,111.	
[#/P]	- 11,111,111,111,111.	#11111111111111····
2[×]	2.	2· ×
3[%]		3· %
	0.06	0·06 *
		1 LINE FEED
[-]	1.94	1·94 -%
		1 LINE FEED
5[×]	5.	5· ×
[=]		5· =
	25.	25· *
		1 LINE FEED
[+TAX]		25· ◊
		0·75Δ
	25.75	25·75 *
		1 LINE FEED
2[+]	2.	2· +
3[+]	5.	3· +
[*] (GT MODE)	5.	5· G+
		1 LINE FEED
[GT]	5.	5· G◊
[GT]	5.	5· G*
		1 LINE FEED
.1234567890991[+]	0.1234567890991	0·1234567890991 +
[*]		001·····0·1234567890991 *
	0.1234567890991	1 LINE FEED
2[-]	-2.	2· -
5[-]	-7.	5· -
IC (IC+ =ON)	2.	2·
130[RT·S]		
	130.	130· ×%
		1 LINE FEED
20[A→B]		20· ◊
	2,600.	2,600· ×*
		1 LINE FEED
[C/CE]	0.	0· C
		1 LINE FEED
[A→B]	130.	130· ×%
		1 LINE FEED
13000[B→A]		13,000· ◊
	100.	100· ×%
		1 LINE FEED

Maximum Ratings (V_{SS} = 0 V)

Characteristics	Symbol	Rating	Unit
Supply voltage 1	V_{DD}	−0.3~6	V
Supply voltage (LCD drive)	V_{LC}	−0.3~V_{DD} + 0.3	V
Input voltage	V_{IN}	−0.3~V_{DD} + 0.3	V
Output voltage	V_{OUT}	−0.3~V_{DD} + 0.3	V
Output current	I_{OUT}	3.2	mA
Power dissipation	P_D	600	mW
Soldering temperature	T_{sld}	260 (10 s)	°C
Storage temperature	T_{stg}	−55~125	°C
Operating temperature	T_{opr}	0~40	°C

Electrical Characteristics

Recommended Operating Conditions (V_{SS} = 0 V, T_{opr} = 0~40°C)

Characteristics	Symbol	Test Circuit	Test Condition	Min	Max	Unit
Operating temperature	T_{opr}	—	—	0	40	°C
Supply voltage	V_{DD}	—	NORMAL	4.5	5.5	V
		—	SLOW			
		—	HOLD	2.0		
High-level input voltage (non-schmitt circuit)	V_{IH1}	—	$V_{DD} \geqq 4.5$ V	$V_{DD} \times 0.7$	V_{DD}	V
High-level input voltage (schmitt circuit)	V_{IH2}			$V_{DD} \times 0.75$	V_{DD}	V
High-level input voltage	V_{IH3}	—	$V_{DD} < 4.5$ V	$V_{DD} \times 0.9$	V_{DD}	V
Low-level input voltage (non-schmitt circuit)	V_{IL1}	—	$V_{DD} \geqq 4.5$ V	0	$V_{DD} \times 0.3$	V
Low-level input voltage (schmitt circuit)	V_{IL2}			0	$V_{DD} \times 0.25$	V
Low-level input voltage	V_{IL3}	—	$V_{DD} < 4.5$ V	0	$V_{DD} \times 0.1$	V

DC Electrical Characteristics (V_{SS} = 0 V, V_{DD} = 2.7~6.0 V, T_{opr} = 0~40°C)

Characteristics	Symbol	Test Circuit	Terminal	Test Condition	Min	Typ.	Max	Unit
Hysteresis voltage (schmitt circuit)	V_{HS}	—	Hysteresis Input	—	—	0.7	—	V
Input current	I_{IN1}	—	KO port, TEST, $\overline{RESET}$, $\overline{HOLD}$	V_{DD} = 5.5 V V_{IN} = 5.5/0 V	—	—	±2	μA
	I_{IN2}	—	Open Drain R port, P port					
Input resistance	R_{IN1}	—	KO port TEST with Input Resistor	V_{DD} = 5.5 V V_{IN} = 5.5/0 V	30	70	150	kΩ
	R_{IN2}	—	$\overline{RESET}$, $\overline{HOLD}$		100	220	450	
Output leakage current	I_{LO1}	—	Sink Open Drain R port	V_{DD} = 5.5 V V_{OUT} = 5.5 V	—	—	2	μA
	I_{LO2}	—	Source Open Drain R port, P port	V_{DD} = 5.5 V V_{OUT} = −1.5 V	—	—	−2	
High-level output voltage	V_{OH}	—	Source Open Drain R port, P port	V_{DD} = 5.5 V I_{OH} = −1.6 mA	2.4	—	—	V
Low-level output voltage	V_{OL}	—	Sink Open Drain R port	V_{DD} = 5.5 V I_{OL} = 1.6 mA	—	—	0.4	V
Pull-down resistance	R_{OUT}	—	R port, P port	V_{DD} = 5.5 V V_{IN} = 5.5 V	30	70	150	kΩ
Output resistance	R_{OS}	—	SEG	V_{DD} = 5 V $V_{DD} - V_{LC}$ = 3 V	—	—	35	kΩ
	R_{OC}	—	COM					
Output voltage	$V_{O2/3}$	—	SEG/COM		3.8	4.0	4.2	V
	$V_{O1/2}$				3.3	3.5	3.7	
	$V_{O1/3}$				2.8	3.0	3.2	
Output voltage (normal)	I_{DD}	—	—	V_{DD} = 5.5 V, V_{LC} = V_{SS} f_c = 4 MHz	—	3	6	mA
Output voltage (slow)	I_{DDS}	—	—	V_{DD} = 3.0 V, V_{LC} = V_{SS} f_s = 32.768 kHz	—	30	60	μA
Output voltage (hold)	I_{DDH}	—	—	V_{DD} = 5.5 V	—	0.5	10	μA

Note 3: Typ. values are guaranteed at T_{opr} = 25°C, V_{DD} = 5 V.

Note 4: I_{IN1}: Excepts a current through a internal pull up/down resistor.

Note 5: R_{OS}, R_{OC}: Shows on-resistor at level switching.

Note 6: $V_{O2/3}$: Shows 2/3 level output voltage at which 1/4 or 1/3 duty LCD drive.

Note 7: $V_{O1/2}$: Shows 1/2 level output voltage at which 1/2 duty or static LCD drive.

Note 8: $V_{O1/3}$: Shows 1/3 level output voltage at which 1/4 or 1/3 duty LCD drive.

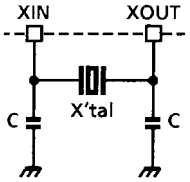
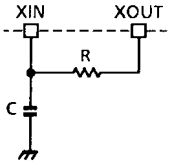
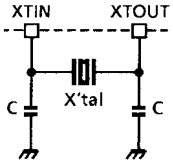
Note 9: I_{DD}, I_{DDH}: Current consumption at V_{IN} = 5.3 V/0.2 V

Should be under that KO port is open and R port voltage level is valid.

I_{DDS}: V_{IN} = 2.8 V/0.2 V

Oscillates only low clock frequency. (connected XTIN, XTOUT)

Oscillation Circuit (T_{opr} = 0~40°C, V_{DD} = 2.7~6.0 V)

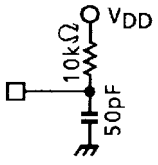
Recommended Circuit	Test Condition	Min	Typ.	Max	Unit
	C = 20 pF X'tal (or ceramic) = 4 MHz	—	4.0	—	MHz
	V_{DD} = 5.0 V C = 100 pF R = 1 kΩ ± 2%	2.4	4.0	5.6	MHz
	C = 10 pF (XIN), 22 pF (XOUT) X'tal = 32.768 kHz	—	32.768	—	kHz

AC Electrical Characteristics (V_{SS} = 0 V, V_{DD} = 4.5~6.0 V, T_{opr} = 0~40°C)

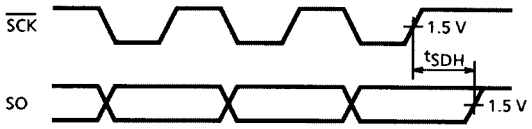
Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Instruction cycle time	t_{CY}	—	NORMAL	1.9	—	20	μs
		—	SLOW	235	—	267	
High-level clock pulse width	t_{WCH}	—	External Clock Operation	80	—	—	ns
Low-level clock pulse width	t_{WCL}	—					ns
Shift data hold time	t_{SDH}	—	—	0.5 tcy − 300	—	—	ns
High speed timer/counter input frequency	f_{HT}	—	—	—	—	f_c	MHz

Note 10: Shift data hold time:

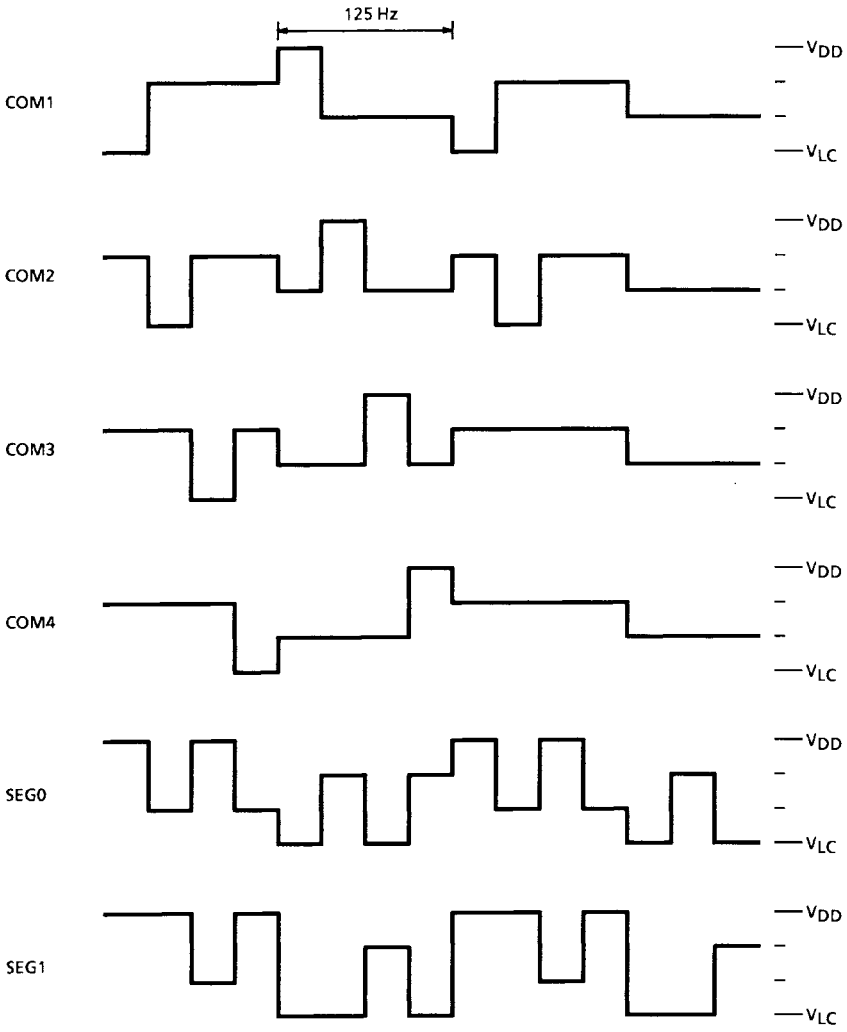
$\overline{SCK}$, SO Terminal External Circuit



Serial Port (the end of transmission)



Waveforms for Display



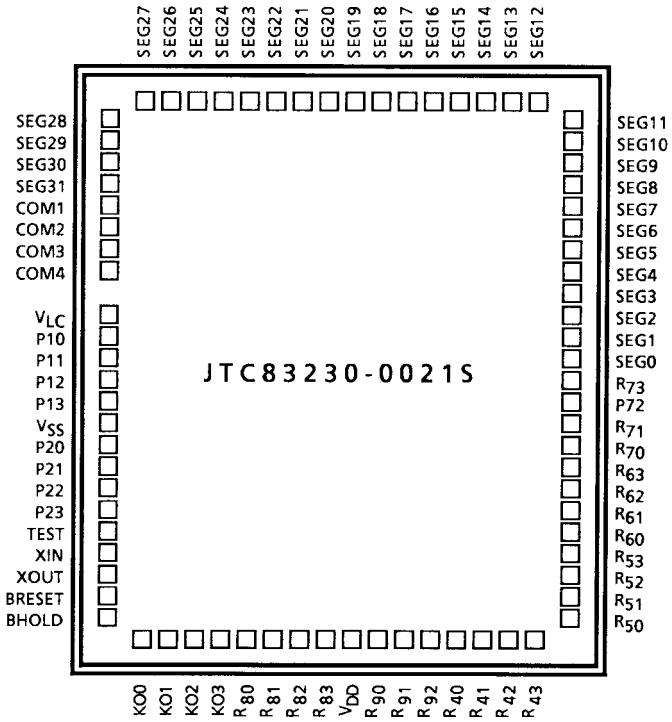
Pad Location Table

(μm)

Name	X Point	Y Point
KO0	−1282	−2074
KO1	−1122	−2074
KO2	−962	−2074
KO3	−802	−2074
R_{80}	−641	−2074
R_{81}	−438	−2074
R_{82}	−278	−2074
R_{83}	−74	−2074
V_{DD}	86	−2074
R_{90}	246	−2074
R_{91}	449	−2074
R_{92}	610	−2074
R_{40}	802	−2074
R_{41}	962	−2074
R_{42}	1122	−2074
R_{43}	1282	−2074
R_{50}	1644	−2011
R_{51}	1644	−1807
R_{52}	1644	−1647
R_{53}	1644	−1444
R_{60}	1644	−1283
R_{61}	1644	−1080
R_{62}	1644	−920
R_{63}	1644	−716
R_{70}	1644	−556
R_{71}	1644	−353
R_{72}	1644	−193
R_{73}	1644	62
SEG0	1644	223
SEG1	1644	383
SEG2	1644	543
SEG3	1644	703
SEG4	1644	863
SEG5	1644	1024
SEG6	1644	1184
SEG7	1644	1344
SEG8	1644	1504
SEG9	1644	1664
SEG10	1644	1825
SEG11	1644	1985

Name	X Point	Y Point
SEG12	1202	2074
SEG13	1042	2074
SEG14	881	2074
SEG15	721	2074
SEG16	561	2074
SEG17	401	2074
SEG18	241	2074
SEG19	80	2074
SEG20	−80	2074
SEG21	−240	2074
SEG22	−400	2074
SEG23	−560	2074
SEG24	−721	2074
SEG25	−881	2074
SEG26	−1041	2074
SEG27	−1201	2074
SEG28	−1644	1961
SEG29	−1644	1801
SEG30	−1644	1641
SEG31	−1644	1481
COM1	−1644	1321
COM2	−1644	1160
COM3	−1644	1000
COM4	−1644	840
V_{LC}	−1644	520
P10	−1644	359
P11	−1644	156
P12	−1644	−4
P13	−1644	−208
V_{SS}	−1644	−368
P20	−1644	−528
P21	−1644	−731
P22	−1644	−892
P23	−1644	−1095
TEST	−1644	−1255
XIN	−1644	−1415
XOUT	−1644	−1651
BRESET	−1644	−1811
BHOLD	−1644	−1971

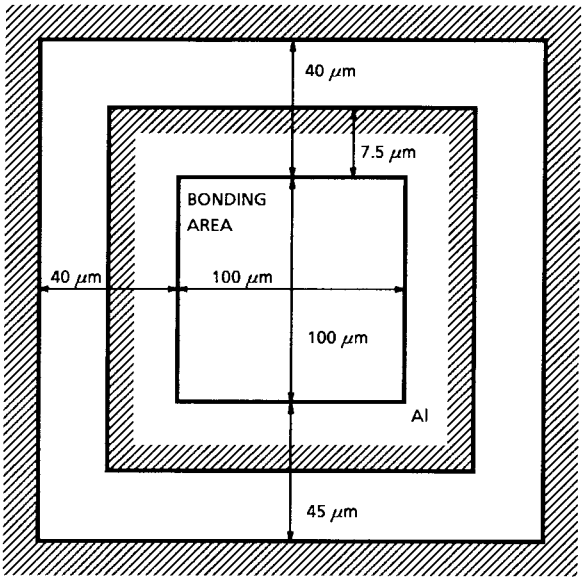
Chip Layout



Chip size : 3.78 × 4.67 (mm)
Chip thickness : 450 ± 30 (μm)
Substrate : V_{SS}
Pad size : 100 ($\mu m^{\square}$)

Pad Layout

Active Element

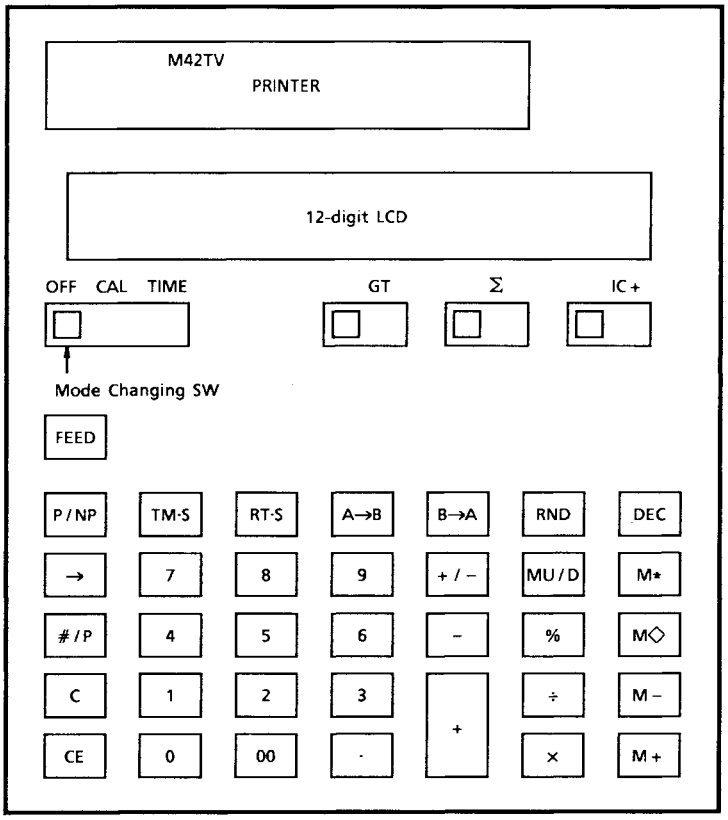


SCRIBE LINE

Pad pitch 160 (μm)

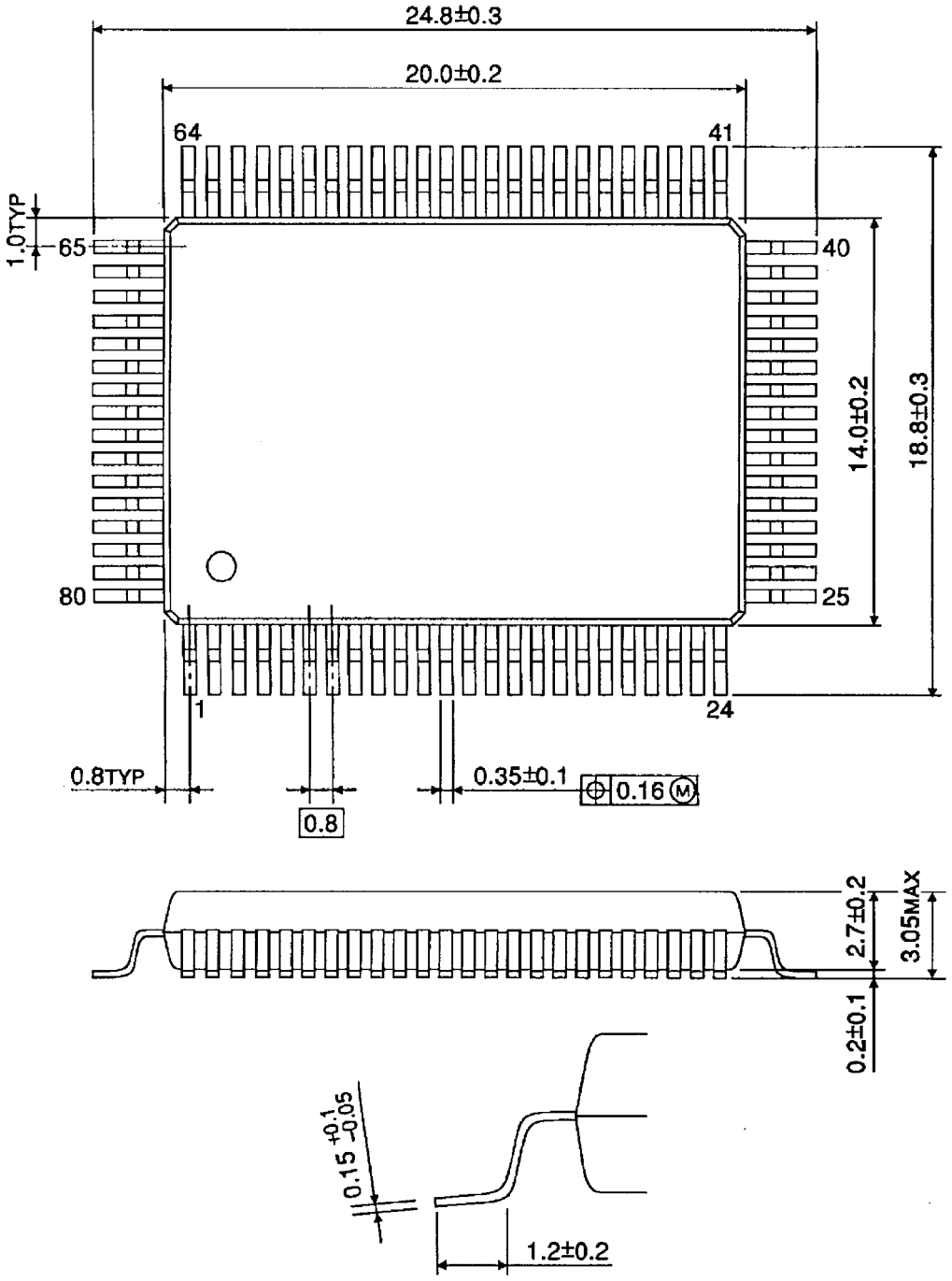
Example of Calculator Figure

12 digits Touch key Mode/Rate mode with clock function and 12-digit display.



Package Dimensions

QFP80-P-1420-0.80A Unit : mm



Weight: 1.52 g (typ.)

RESTRICTIONS ON PRODUCT USE

000707EBA

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