TOSHIBA CMOS Digital Integrated Circuit   Silicon Monolithic

TC83230-0012

TC83230-0012: Single-Chip CMOS LSI for Calculators with Printers

(applicable printer heads: M-80, M-400A, M-400E, M-401A manufactured by EPSON)

The TC83230-0012 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-and 12-digit display, two-memory function, parallel printer used to print calculation results, oscillator, and LCD drivers.

Note 1:   PRINT FONT No.: M400A……001-300

M401A……001-331

M400E……001-310

M80……… Type A (12 digits)

Type C (10 digits)

QFP80-P-1420-0.80A
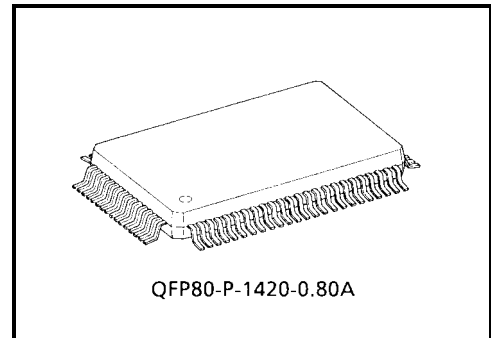
Weight: 1.52 g (typ.)

Features

Operational Features

- Print: 16 digits of data. (including decimal point.) 2 digits of minus sign, operational symbol.
  2-color printing.
- Display: 10 and 12 digits of data. (including punctuation in each digit.)
  1 digit of floating minus sign, memory load, error symbol, grand total memory load, 3 digits of commas.
- Decimal output: Decimal set lock key controls output format. Fixed decimal setting ("0", "1", "2", "3", "4", "6"), full floating decimal, and ADD mode.
- Key-input buffer: 12 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
- Leading zero suppression

Protection
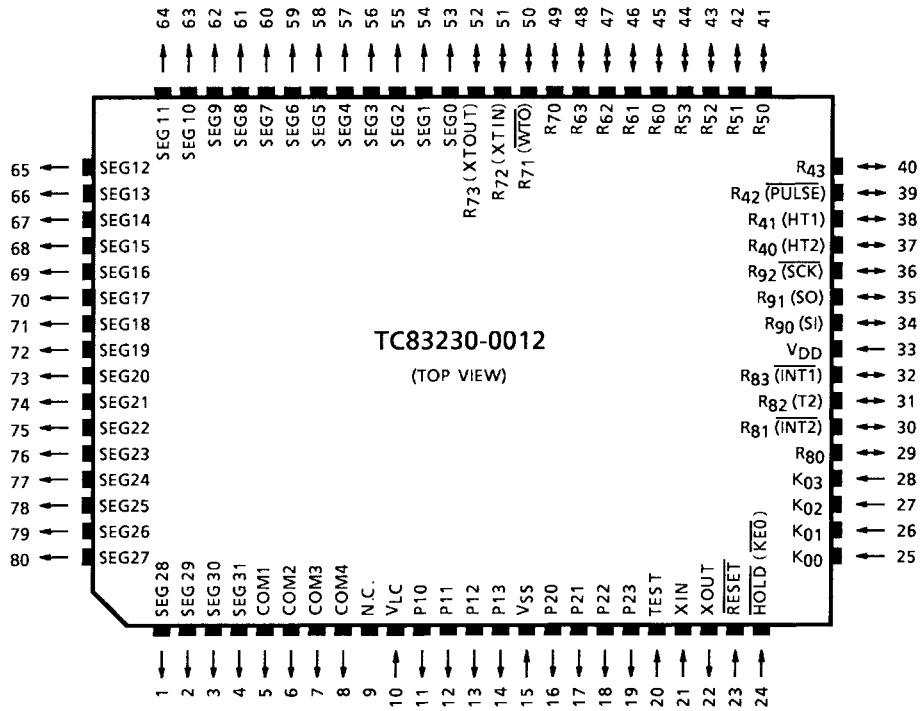
(1)   In the overflow condition, all key except "C", "C/CE", "CE", "Feed", "→" key are inoperative.

(2)   Key chatter protection

Auto-Clear at Power On
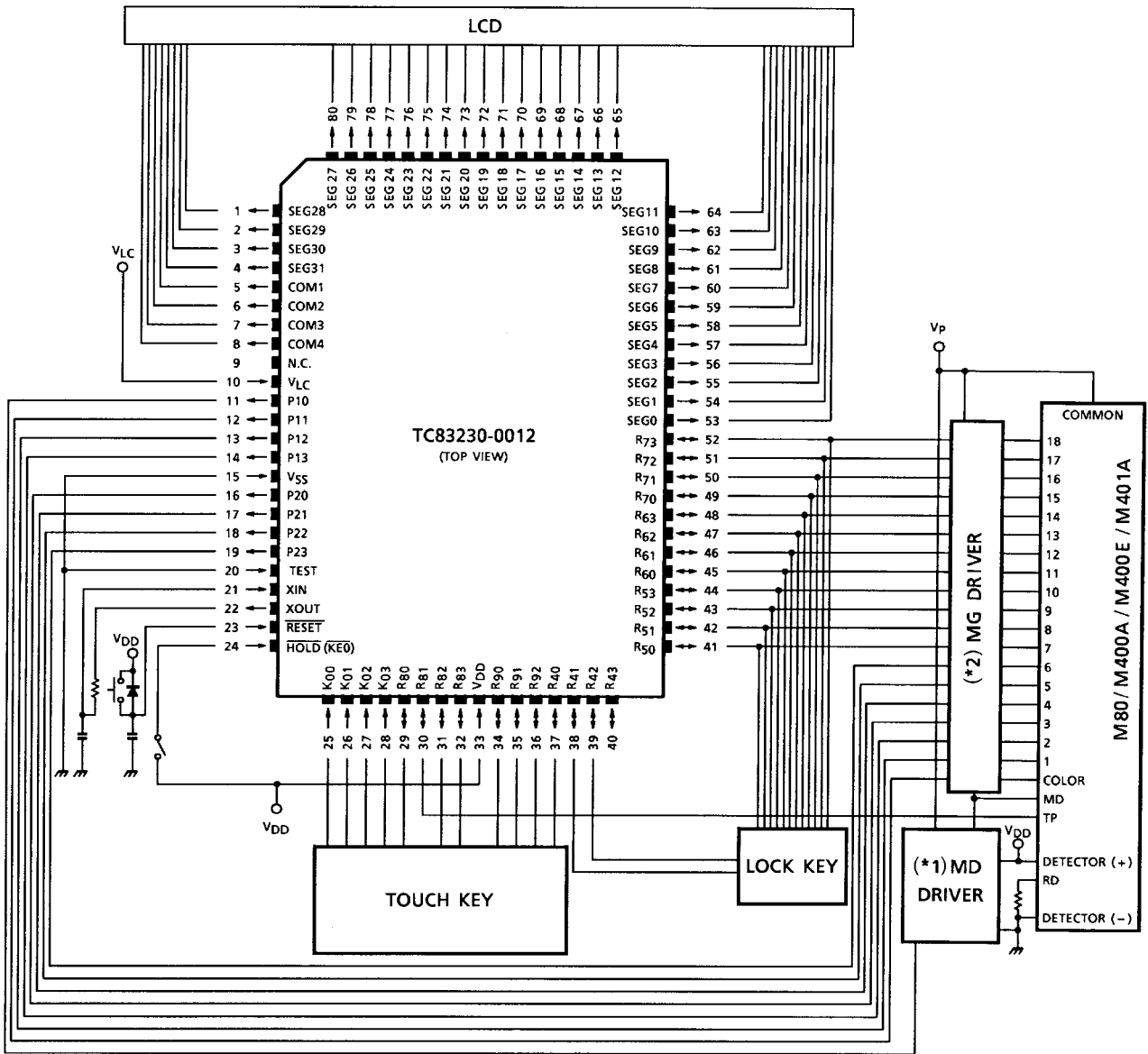
Auto-clear functions by connecting a capacitor to the RESET pin.

Pin Assignment (top view)

QFP80

System Block Diagram

*1: MD driver

*2: MD driver
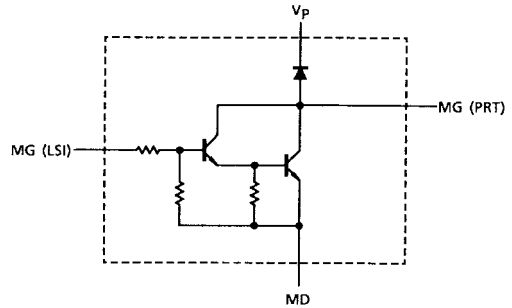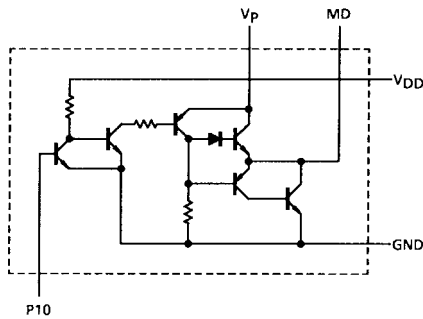
Connection of LCD

Segment

Common

Key Connection

K00	K01	K02	K03	R40	R80	R82	R83	R90	R91	R92
000	4	×	MII+	MI+	+	C	·	IC/AVE	EXC	
00	5	÷	MII−	MI−	−	CE	+/−	√		
0	6	=	MII◇	MI◇	◇	C/CE	#/P			
1	7	%	MII∗	MI∗	∗	→				
2	8	△%	+TAX II	+TAX I	GT◇∗					
3	9	MU/D	−TAX II	−TAX I						

Touch Key

R50	R51	R52	R53	R60	R61	R62	R63	R70	R71	R72	R73
0	1	2	3	4	6	A	AII	400E/ETC		2TAX	2M
CUT	UP	IC+	IC±	Σ	GT	SET I	SETII	P/NP	FEED	10/12	TMR

R42, R41 rows.
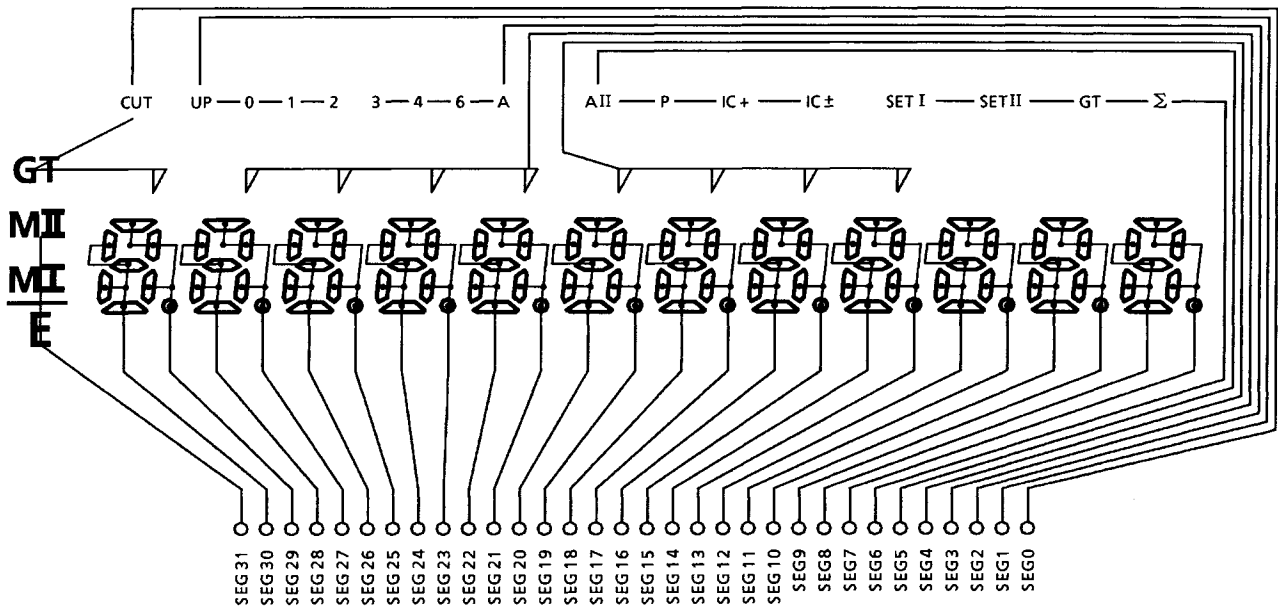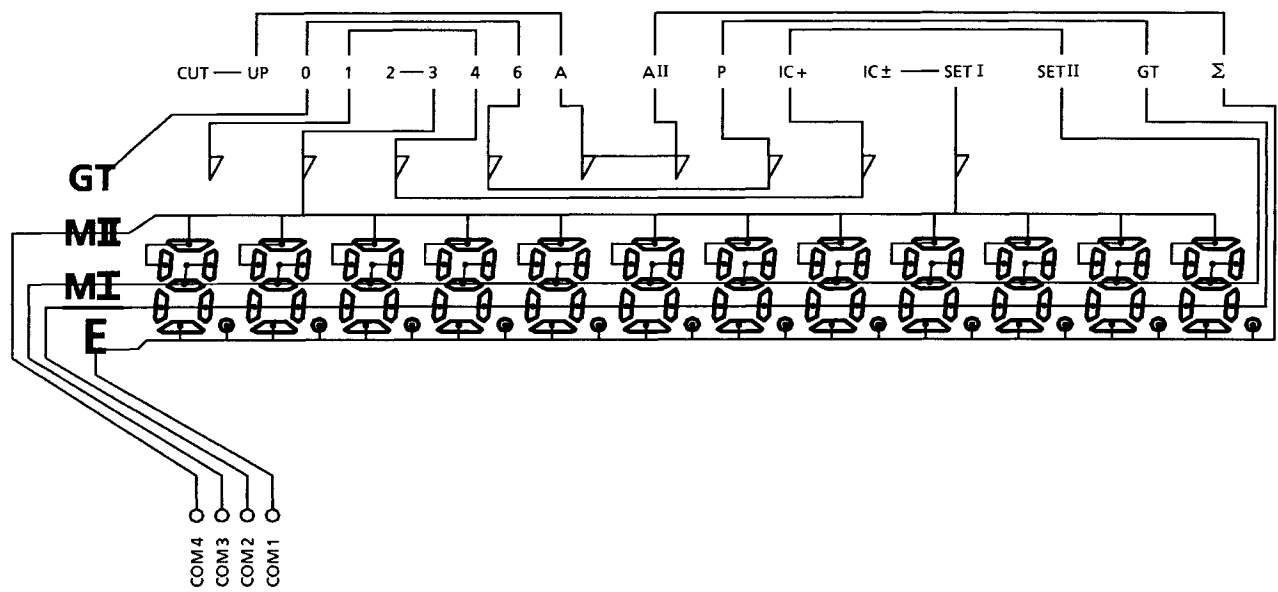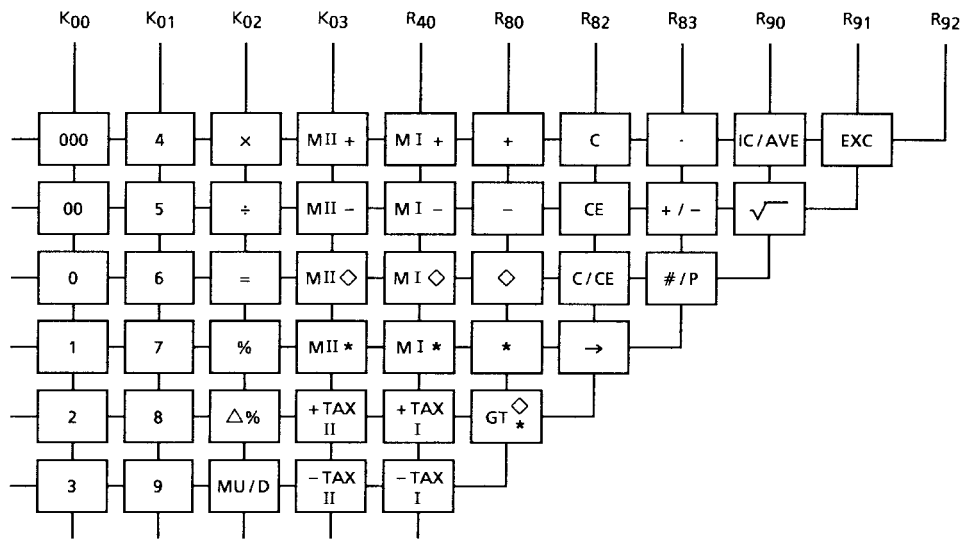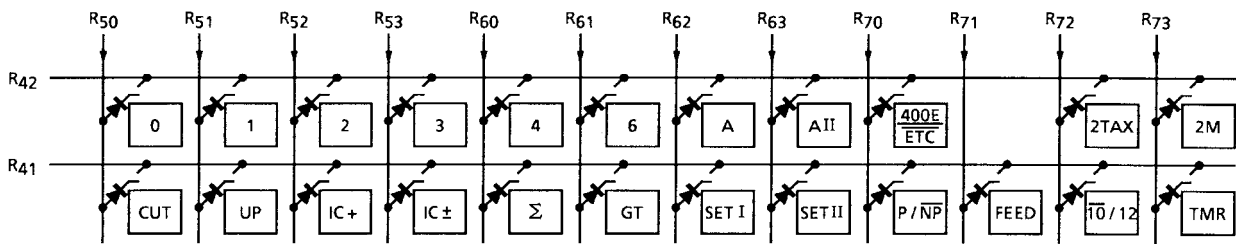
Lock Key

Specification of Calculator

Operation Specifications

    (1)   Operations depending on key types and modes

- Touch key

Key Name	CAL Mode	Tax Set Mode
Mode switch	[SET] lock key is off.	[SET] lock key is on.
C	Operates as clear key	Clears input data
CE	Operates as clear entry key	Clears input data
C/CE	Operates as clear or clear entry key	Clears input data
Numeral	Numerals Key-inputs numerals	Inputs numerals
·	Key-inputs decimal points	Key-inputs decimal points
*, ◊	Operates as total or sub-total key	Unused
+, −, ×, ÷	Operates as four-function key	Unused
=	Operates as = key	Unused
%	Operates as % key	Unused
∆%	Operates as delta percentage calculation key	Unused
MU/D	Operates as mark-up/down key	Unused
IC/AVE	Operates as item count or average key	Unused
#/P	Operates as non-add-print key for left-justified printing	Unused
→	Operates as right-shift key	Unused
+/−	Operates as sign change key	Operates as right-shift key
MI*, MII* MI◊, MII◊, MI−, MII−, MI+, MII+	Operates as memory function key	Unused
−TAXI/II	Operates as −TAXI/II key	Unused
+TAXI/II	Operates as +TAXI/II key	Unused
GT*◊	Operates as GT key	Unused
EXC	Operates as EXC key	Unused
$\sqrt{}$	Operates as $\sqrt{}$ key	Unused

• Lock key

Key Name	CAL Mode	Tax Set Mode
Mode switch	[SET] lock key is off.	[SET] lock key is on.
0, 1, 2, 3, 4, 6, A, AΙΙ	Switches decimal points	Unused
CUT, UP	Switches round-off and round-up	Unused
IC±, IC+	Operates as IC±/IC+ key	Unused
Σ	Operates as Σ key	Unused
GT	Switches GT mode or non-GT mode	Unused
FEED	Operates as paper feed key	Operates as paper feed key
P/$\overline{\text{NP}}$	Switches print or non-print	Unused
$\overline{\overline{10}}$/12 (Note 2)	Selects 10 or 12 digit	
400E $\overline{\text{ECT}}$ (Note 2)	Selects the M400E printer or other printers (M400A, M401A or M80).	
2 TAX (Note 2)	Selects single tax mode or double tax mode.	
2 M (Note 2)	Selects single memory mode or double memory mode.	

Note 2: Can switch modes only with the reset key, operating the same as the [$\overline{\overline{10}}$/12] key.

(2) Explanation of function

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

[·] .... If this key is pressed after a key operation except data entry, the displays 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, displays does
                     not change.

[+, –] .... Add or subtract operation data and displays 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 displays data to addition/subtraction registers, then displays
                     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
          $a \times b\% +$ .....$a + (ab/100)$
              $c\% +$ ......$a + (ac/100)$
          $a \times b\% -$ .....$a - (ab/100)$
              $c\% -$ ......$a - (ac/100)$

    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.

[MI+, MII+] .... If the arithmetic instruction is not stored or if the mode is constant calculation
[MI–, MII–]   mode, first prints the displays 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 displays 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 [MI+, MII+,
                     MI–, MII–] 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.

[MI◊, MII◊]............ 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.

[MI*, MII*]............ 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 [MI*, MII*] 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.

[×, ÷]..................... 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 displays to the right by one digit at key entry. For an estimation calculation error, cancels the error.

[GT$^{\diamond}_{*}$].................. 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 displays; 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%] [MI+, MII+] [MI−, MII−] [MI◊, MII◊] [MI∗, MII∗] [MU/D] [IC/AVE].
The result of pressing the [CE] key after the [#/P] key depends on the state before the keys were pressed.

[IC+]...................... Selects item count mode.
[IC±]   IC+.........Counts up by the [+] or [−] key.
                          IC±.........Counts up by the [+] key, down by the [−] key.

[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%] [MI+, MII+] [MI−, MII−] [MI◊, MII◊] [MI∗, MII∗] [MU/D] [IC/AVE].
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.

$\begin{bmatrix} +\text{TAXI/II} \\ -\text{TAXI/II} \end{bmatrix}$ .... Calculate included tax operation or excluded tax operation. But, only prints and does not express the tax. Prints or displays the result-value. (result-value adjusts decimal-point (TAB) setting.) Feeds the paper one line after prints.

TAXI key operation example: (TAX = 3%)

    a [+TAXI] .... a (3/100)   (prints TAX)

               .... a + (a (3/100))   (included TAX)

    a [−TAXII] .... a/(1 + 3/100) − a   (prints TAX)

               .... a/(1 + 3/100)   (excluded TAX)

If pressed at key entry after number key entry, calculate the tax as a result of calculation.

When multiplication/division instruction is stored in memory.

[EXC] .... If an multiplication or division instruction is not stored in memory, it is invalid. Constant calculation of multiplication or division instruction exchange for the value of displays, and displays it.

[$\sqrt{}$] .... Operates root-instruction and displays result-value with prints. (result-value adjusts decimal-point (TAB) setting.)

After prints feeds the paper one line. If the value is minus, change to the plus value and operate root-instruction. Then produce an estimate calculation-error. But keep the arithmetic instruction and date-register.

[IC/AVE] .... Prints or displays the item counter, when IC/AVE key continuously pressed twice just after pressed [∗] key and [◊] key,

After first, prints or displays the item counter.

The second, the calculation of the mean number are executed, prints or displays the operation result.

After calculation of the mean number, item counter are cleared.

Example

a (+)

b (+)

c (+)

d (+) → Addition to total addition/subtraction register

e (+)

f (+)

g (+)

(∗) → Displays or prints addition/ subtraction register.

(IC/AVE) → Displays the item counter

(IC/AVE) → Displays or prints (a + b + c + d + e + f + g)/7

Then even if IC-value is a negative, the calculation of the mean number.

Example

a (−)

b (−)

c (+) → Addition to total addition/subtraction register

d (−)

(∗) → Displays or prints addition/ subtraction register.

(IC/AVE) → Displays the item counter

(IC/AVE) → Displays or prints

(−a − b + c − d)/$\left|4\right|$ (IC+)

(−a − b + c − d)/$\left|-2\right|$ (IC±)

(3) Explanation of lock keys

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

[4, 6, A, AII] 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. When AII mode is specified, key-entered data are multiplied by 1/100 only when the key-entered numerical value is used for multiplication/division by [=] key. If the [·] key is pressed during data entry, AII 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.

[P/$\overline{NP}$] .... Switches between print and non print mode. When [P/$\overline{NP}$] lock key is off, disables all printing except [PF] 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.

$\begin{bmatrix} \text{SETI} \\ \text{SETII} \end{bmatrix}$ .... When the [SETI/SETII] lock key is on, prints and express the stored tax rate. When the [SETI/SETII] lock key is off, store the expression data to the new tax rate. The result of tax rate is only floating-point, and not concent the decimal-point at this function.

[FEED] .... Feed paper.

[TMR] .... When the [TMR] lock key is on, auto power-off functions.
(after approx. 6 minutes.)

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

$\begin{bmatrix} \text{400E} \\ \text{ECT} \end{bmatrix}$ .... Switches between the M400E printer and other printers (M400A, M401A, or M80) to be used.
When the [400E/ECT] lock key is on, selects the M400E printer.
When the [400E/ECT] lock key is off, selects other printers (M400A, M401A, or M80).

[2 TAX] .... Switches between single tax and double tax mode.
When the [2 TAX] lock key is on, one tax rate can be set. (SETII and TAXII will be disabled.)
When the [2 TAX] lock key is off, two tax rates can be set.

[2 M] .... Selects single memory or double memory mode.
When the [2 M] lock key is on, one memory can be used. (MII will be disabled.)
When the [2 M] lock key is off, two memories can be used.

Operation Example

TAB	4/5	IC	Σ	GT	MOD	$\overline{10}$/12	2 TAX	2 M	Touch	Print		Display
						Key						
F	4/5	OFF	OFF	OFF	CAL	12	OFF	OFF	POWER ON			
										<PF>		
										C		
										<PF>		0.
									1+	1· +		1.
									2−	2· −	R	−1.
									◊	1· − ◊	R	−1.
									*	1· − *	R	
										<PF> −		−1.
									IC/AVE	2·		2.
									IC/AVE	0·5 K *	R	−0.5
									IC/AVE	0·		0.
F	4/5	IC+	OFF	OFF	CAL	12	OFF	OFF	1+	1· +		1.
									2−	2· −	R	−1.
									◊	002		
										1· − ◊	R	−1.
									IC/AVE	2·		2.
									IC/AVE	0·5 K *	R	−0.5
									IC/AVE	2·		2.
									*	002		
										1· − *	R	
										<PF> −		−1.
									IC/AVE	2·		2.
									IC/AVE	0·5 K *	R	−0.5
									IC/AVE	0·		0.
F	4/5	OFF	OFF	OFF	CAL	12	OFF	OFF	3×	3· ×		3.
									4÷	4· ÷		12.
									=	4· =		
										3· *		
										<PF>		3.
									5×	5· ×		5.
									6%	6· %		
										0·3 *		
										<PF>		0.3
									+	5·3 + %		
										<PF>		5.3
									2÷	2· ÷		2.
									3%	3· %		
										66·6666666666 *		
										<PF>		66.6666666666
									2 MU/D	2· M		2.
									3=	3· %		

Note 3: <PF> ....Paper feed
PRINT COLOR.........R: Red
.........No mark: Black

TAB	4/5	IC	Σ	GT	MOD	$\overline{10}$/12	2 TAX 2 M	Touch	Print		Display
									0.0618556701	Δ *	
									2.0618556701	*	
									\<PF\>		2.0618556701
								2Δ%	2·	Δ	2.
								3=	3·	=	
									1·	Δ *	
									50·	Δ %	
									\<PF\>		50.
F	4/5	OFF	Σ	OFF	CAL	12	OFF OFF	3×	3·	×	3.
								4÷	4·	÷	12.
								=	4·	=	
									3·	+	
									\<PF\>		3.
								5×	5·	×	5.
								6%	6·	%	
									0·3	+	
									\<PF\>		0.3
								+	5·3	+ %	
									\<PF\>		5.3
								2÷	2·	÷	2.
								3%	3·	%	
									66.6666666666	+	
									\<PF\>		66.6666666666
								2 MU/D	2·	M	2.
								3=	3·	%	
									0.0618556701	Δ *	
									2.0618556701	+	
									\<PF\>		2.0618556701
								2Δ%	2·	Δ	2.
								3=	3·	=	
									1·	Δ *	
									50·	+	
									\<PF\>		50.
								*	122·028522336	*	
									\<PF\>		122.028522336
F	4/5	OFF	Σ	GT	CAL	12	OFF OFF	2+	2.	+	2.
								3+	3·	+	5.
								*	5·	G +	
									\<PF\>		GT 5.
								3−	3·	− R	GT −3.
								4−	4·	− R	GT −7.
								5−	5·	− R	GT −12.

Note 3: \<PF\> ....Paper feed

       PRINT COLOR.........R: Red

          ....No mark: Black

TAB	4/5	IC	Σ	GT	MOD	$\overline{10}$/12	2 TAX 2 M	Touch	Print		Display
								∗	12· $\overline{G}$ +	R	
									<PF>		GT −12.
								GT$^{◊}_{∗}$	7· $\overline{G}$ ◊	R	GT −7.
								GT$^{◊}_{∗}$	7· $\overline{G}$ ∗	R	
									<PF>		−7.
F	4/5	OFF	Σ	OFF	CAL	12	OFF OFF	MI+	·······1·······		
									7· $\overline{M}$ +	R	MI −7.
								5			MI 5.
								MII+	·······2·······		
									5· M +		MII MI 5.
								MI◊	·······1·······		
									7· $\overline{M}$ ◊	R	MII MI −7.
								MI∗	·······1·······		
									7· $\overline{M}$ ∗	R	
									<PF>		MII −7.
								MII◊	·······2·······		
									5· M ◊		MII 5.
								MII∗	·······2·······		
									5· M ∗		
									<PF>		5.
								#/P	5· ◊		5.
								2 #/P	#2		2.
								#/P	2· ◊		2.
								0÷	0· ÷		0.
								=	0· =		0.
									ERROR		
									0· ∗		
									<PF>		E 0.
								C	0· C		
									<PF>		0.
F	CUT	OFF	OFF	OFF	SETI	12	OFF OFF		·······1·······		
									0· %		
									<PF>		0.
								3			3.
F	CUT	OFF	OFF	OFF	CAL	12	OFF OFF		·······1·······		
									3· %		
									<PF>		0.
								C	0· C		
									<PF>		0.
F	CUT	OFF	OFF	OFF	SETI	12	OFF OFF		·······1·······		
									3· %		
									<PF>		3.

Note 3:   <PF> ....Paper feed
         PRINT COLOR.........R: Red
                 ....No mark: Black

TAB	4/5	IC	Σ	GT	MOD	10/12	2 TAX 2 M	Touch	Print		Display
F	CUT	OFF	OFF	OFF	CAL	12	OFF OFF				0.
F	CUT	OFF	OFF	OFF	SETⅡ	12	OFF OFF		·······2·······		
									0·　　　%		
									<PF>		0.
								5			5.
F	CUT	OFF	OFF	OFF	CAL	12	OFF OFF		·······2·······		
									5·　　　%		
									<PF>		0.
F	CUT	OFF	OFF	OFF	SETⅡ	12	OFF OFF		·······2·······		
									5·　　　%		5.
F	CUT	OFF	OFF	OFF	CAL	12	OFF OFF				0.
								1560			1,560.
								+TAXI	·······1·······		
									1,560·		
									46·8　　Δ		
									1,606·8　　*		
									<PF>		1,606.8
								1560			1,560.
								+TAXII	·······2·······		
									1,560·		
									78·　　Δ		
									1,638·　　*		1,638.
									<PF>		
								+TAXI	·······1·······		
									1,638·　　◊		
									49·14　　Δ		
									1,687·14　　*		
									<PF>		1,687.14
								1560			1,560.
								×	1,560·　　×		1,560.
								78900			78,900.
F	4/5	OFF	OFF	OFF	CAL	12	OFF OFF	+TAXI	·······1·······		
									78,900·　　=		
									123,084,000·　　◊		
									3,692,520·　　Δ		
									126,776,520·　　*		
									<PF>		126,776,520.
								=			126,776,520.
								5			5.
								×	5·　　×		5.
								+TAXI			5.
								=	5·　　=		

Note 3: <PF> ....Paper feed

PRINT COLOR.........R: Red

.........No mark: Black

Key								Touch	Print		Display
TAB	4/5	IC	Σ	GT	MOD	10/12	2 TAX 2 M				
									25· *		
									\<PF\>		25.
								+TAXI	·······1·······		
									25· ◊		
									0·75 Δ		
									25·75 *		
									\<PF\>		25.75
								=			25.75
								C	0· C		
									\<PF\>		0.
2	CUT	OFF	OFF	OFF	CAL	12	OFF OFF	1560			1,560.
								+	1,560·00 +		1,560.00
								1100			1,100.
								+	1,100·00 +		2,660.00
								+TAXII	·······2·······		
									2,660·00 ◊		
									133·00 Δ		
									2,793·00 *		
									\<PF\>		2,793.00
F	CUT	OFF	OFF	OFF	CAL	12	OFF OFF	+TAXI	·······1·······		
									2,793·00 ◊		
									83·79 Δ		
									2,87679 *		
									\<PF\>		2,876.79
								98000000 0000			980,000,000,000.
								+TAXI	·······1·······		
									980,000,000,000·		
									29,400,000,000· Δ		
									ERROR		
									1·00940000000 *		
									\<PF\>		E 1.00940000000
								C	0· C		
									\<PF\>		0.
								1560			1,560.
								+/−			−1,560.
								+TAXI	·······1·······		
									1,560· − R		
									46·8 Δ̄ R		
									1,606·8 − * R		
									\<PF\>		−1,606·8
								1560			1,560.

Note 3: \<PF\> ....Paper feed

PRINT COLOR.........R: Red

.........No mark: Black

Key										Touch	Print			Display
TAB	4/5	IC	Σ	GT	MOD	10̄/12	2 TAX 2 M							
										−TAXI	·······1·······			
											1,560·			
											45·43689321	Δ̄	R	
											1,514·56310679	*		
											\<PF\>			1,514.56310679
										−TAXI	·······1·······			
											1,514·56310679	◊		
											44·11348855	Δ̄	R	
											1,470·44961824	*		
											\<PF\>			1,470.44961824
										1560				1560.
										−TAXII	·······2·······			
											1,560·			
											74·28571429	Δ̄	R	
											1,485·71428571	*		
											\<PF\>			1,485.71428571
										−TAXII	·······2·······			
											1,485·71428571	◊		
											70·74829932	Δ̄	R	
											1,414·96598639	*		
											\<PF\>			1,414.96598639
F	CUT	OFF	OFF	OFF	SETI	12	OFF OFF				·······1·······			
											3·	%		
											\<PF\>			3.
										C				0.
F	CUT	OFF	OFF	OFF	CAL	12	OFF OFF				·······1·······			
											0·	%		
											\<PF\>			0.
F	CUT	OFF	OFF	OFF	SETI	12	OFF OFF				·······1·······			
											0·	%		
											\<PF\>			0.
										1234				1234.
F	CUT	OFF	OFF	OFF	CAL	12	OFF OFF				·······1·······			
											1,234·	%		
											\<PF\>			0.
F	CUT	OFF	OFF	OFF	SETII	12	OFF OFF				·······2·······			
											5·	%		
											\<PF\>			5.
										C				0.
F	CUT	OFF	OFF	OFF	CAL	12	OFF OFF				·······2·······			
											0·	%		
											\<PF\>			0.

Note 3: \<PF\> ....Paper feed

PRINT COLOR.........R: Red

.........No mark: Black

TAB	4/5	IC	Σ	GT	MOD	10/12	2 TAX 2 M	Touch	Print		Display	
								98000000				
								0000			980,000,000,000.	
								+TAX**I**	·······1·······			
F	CUT	OFF	OFF	OFF	CAL	12	OFF OFF		980,000,000,000·			
									ERROR			
									0·	*		
									<PF>		E	0.
								C	0·	C		
									<PF>			0.
								2				2.
								×	2·	×		2.
								3				3.
								×	3·	×		6.
								EXC	3·	↕		3.
								×	6·	×		18.
								EXC	6·	↕		6.
								×	18·	×		108.
								EXC	18·	↕		18.
								×	108·	×		1,944.
								=	108·	=		
									209,952·	*		
									<PF>			209,952.
								9				9.
								√	9·	R		
									3·	*		
									<PF>			3.
								√	3·	R		
									1·73205080756	*		
									<PF>			1,73205080756
								+/−				−1,73205080756
								√	1·73205080756	R	R	
									ERROR			
									1·31607401294	− *	R	
									<PF>		E	−1,31607401294
								C	0·	C		
									<PF>			0.
A	CUT	OFF	OFF	OFF	CAL	12	OFF OFF	123				123.
								+	1·23	+		1.23
								456				456.
								+	4·56	+		5.79
								◊	5·79	◊		5.79
								*	5·79	*		

Note 3:   <PF> ....Paper feed

        PRINT COLOR.........R: Red

                ....No mark: Black

TAB	4/5	IC	Σ	GT	MOD	10̄/12	2 TAX	2 M	Touch	Print	Display
										<PF>	5.79
AII	CUT	OFF	OFF	OFF	CAL	12	OFF	OFF	789		789.
									×	789· ×	789.
									100		100.
									=	1·00 =	
										789·00 *	
										<PF>	789.00
(Don't do it.)									123		123.
									+	123·00 +	123.00
									456		456.
									+	456·00 +	579.00
									*	579·00 *	
										<PF>	579.00
F	4/5	OFF	OFF	OFF	CAL	12	ON	ON	(RESET)	<PF>	
										C	
										<PF>	0.
									7		7.
									+/−		−7.
									MI+	7· M̄ + R MI	−7.
									5	MI	5.
									MII+	MI	5.
									MI◊	7· M̄ ◊ R MI	−7.
									MI*	7· M̄ * R	
										<PF>	−7.
F	4/5	OFF	OFF	OFF	SETI	12	ON	ON		0· %	
										<PF>	0.
									3		3.
F	4/5	OFF	OFF	OFF	CAL	12	ON	ON		3· %	
										<PF>	0.
									C	0· C	
										<PF>	0.
F	4/5	OFF	OFF	OFF	SETI	12	ON	ON		3· %	
										<PF>	3.
F	4/5	OFF	OFF	OFF	CAL	12	ON	ON			0.
F	4/5	OFF	OFF	OFF	SETII	12	ON	ON			0.
									5		5.
F	4/5	OFF	OFF	OFF	CAL	12	ON	ON			5.
F	4/5	OFF	OFF	OFF	SETII	12	ON	ON			5.
F	4/5	OFF	OFF	OFF	CAL	12	ON	ON			5.
									CE		0.

Note 3:   <PF> ....Paper feed

PRINT COLOR.........R: Red

.........No mark: Black

Maximum Ratings ($V_{SS} = 0$ V)

Characteristics	Symbol	Rating	Unit
Supply voltage 1	V_{DD}	$-0.3 \sim 6$	V
Supply voltage (LCD drive)	V_{LC}	$-0.3 \sim V_{DD} + 0.3$	V
Input voltage	V_{IN}	$-0.3 \sim V_{DD} + 0.3$	V
Output voltage	V_{OUT}	$-0.3 \sim V_{DD} + 0.3$	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}	$-55 \sim 125$	°C
Operating temperature	T_{opr}	$0 \sim 40$	°C

Electrical Characteristics

Recommended Operating Conditions ($V_{SS} = 0$ V, $T_{opr} = 0 \sim 40$°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 Characteristics (V$_{SS}$ = 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		—	—	35	kΩ
	R$_{OC}$	—	COM	V$_{DD}$ = 5 V V$_{DD}$ − V$_{LC}$ = 3 V				
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	
Supply current (normal)	I$_{DD}$	—	—	V$_{DD}$ = 5.5 V, V$_{LC}$ = V$_{SS}$ f$_{c}$ = 4 MHz	—	3	6	mA
Supply current (hold)	I$_{DDH}$	—	—	V$_{DD}$ = 5.5 V	—	0.5	10	μA

Note 4: Typ. values are guaranteed at T$_{opr}$ = 25°C, V$_{DD}$ = 5 V.

Note 5: I$_{IN1}$: Excepts a current through a internal pull up/down resistor.

Note 6: R$_{OS}$, R$_{OC}$: Shows on-resistor at level switching.

Note 7: V$_{O2/3}$: Shows 2/3 level output voltage at which 1/4 or 1/3 duty LCD drive.

Note 8: V$_{O1/2}$: Shows 1/2 level output voltage at which 1/2 duty or static LCD drive.

Note 9: V$_{O1/3}$: Shows 1/3 level output voltage at which 1/4 or 1/3 duty LCD drive.

Note 10: 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.

Oscillation Circuit (V_{SS} = 0 V, V_{DD} = 4.5~5.5 V, T_{opr} = 0~40°C)

Recommended Circuit	Test Condition	Min	Typ.	Max	Unit
	V_{DD} = 5.0 V C = 100 pF R = 1 k$\Omega \pm$ 2%	2.4	4.0	5.6	MHz

AC 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

Waveforms for Display
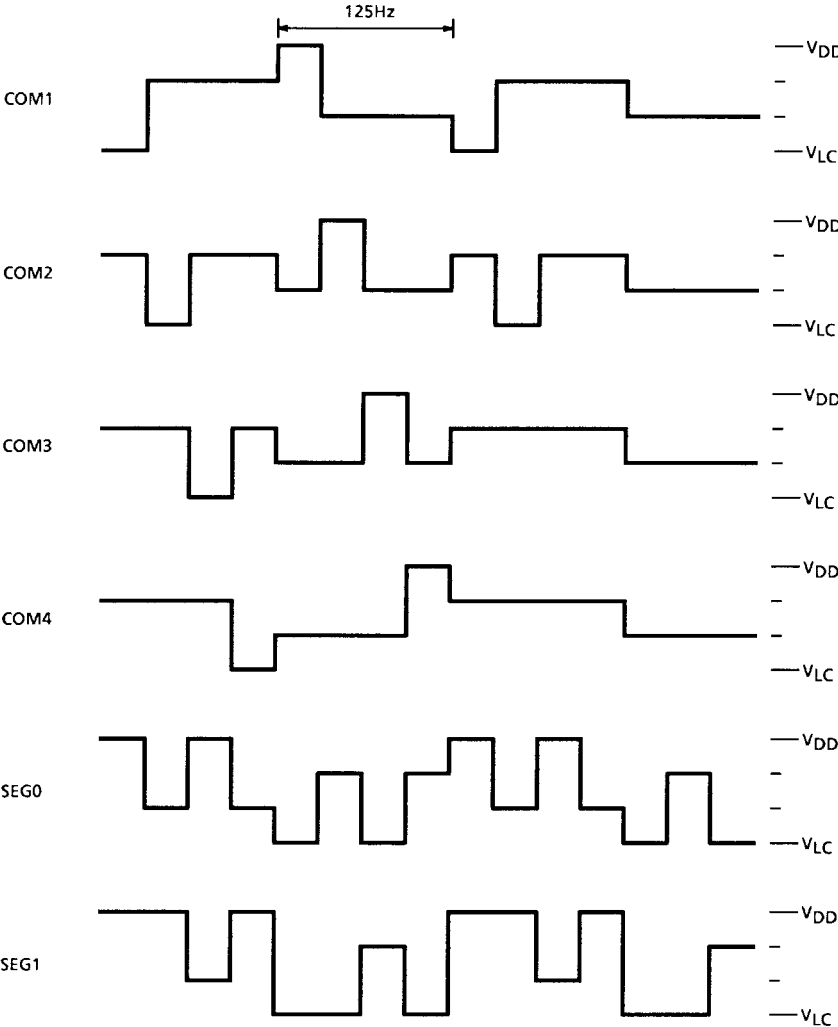
The Proposal of Outer Circuit for Tax Rate Holding with Back-Up Battery.
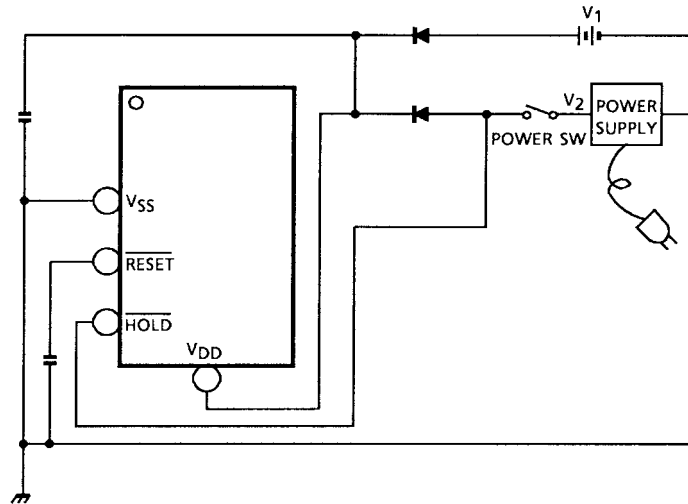
Note 11: $V_1 = +3$ V: Battery supply

$V_2 = +5$ V: DC supply

$\left[\begin{array}{l}\overline{\text{HOLD}} \text{ pin is pulled down in the LSI, but normally pulled up to } V_{DD}. \\ \overline{\text{RESET}} \text{ pin is pulled up to } V_{DD}.\end{array}\right]$
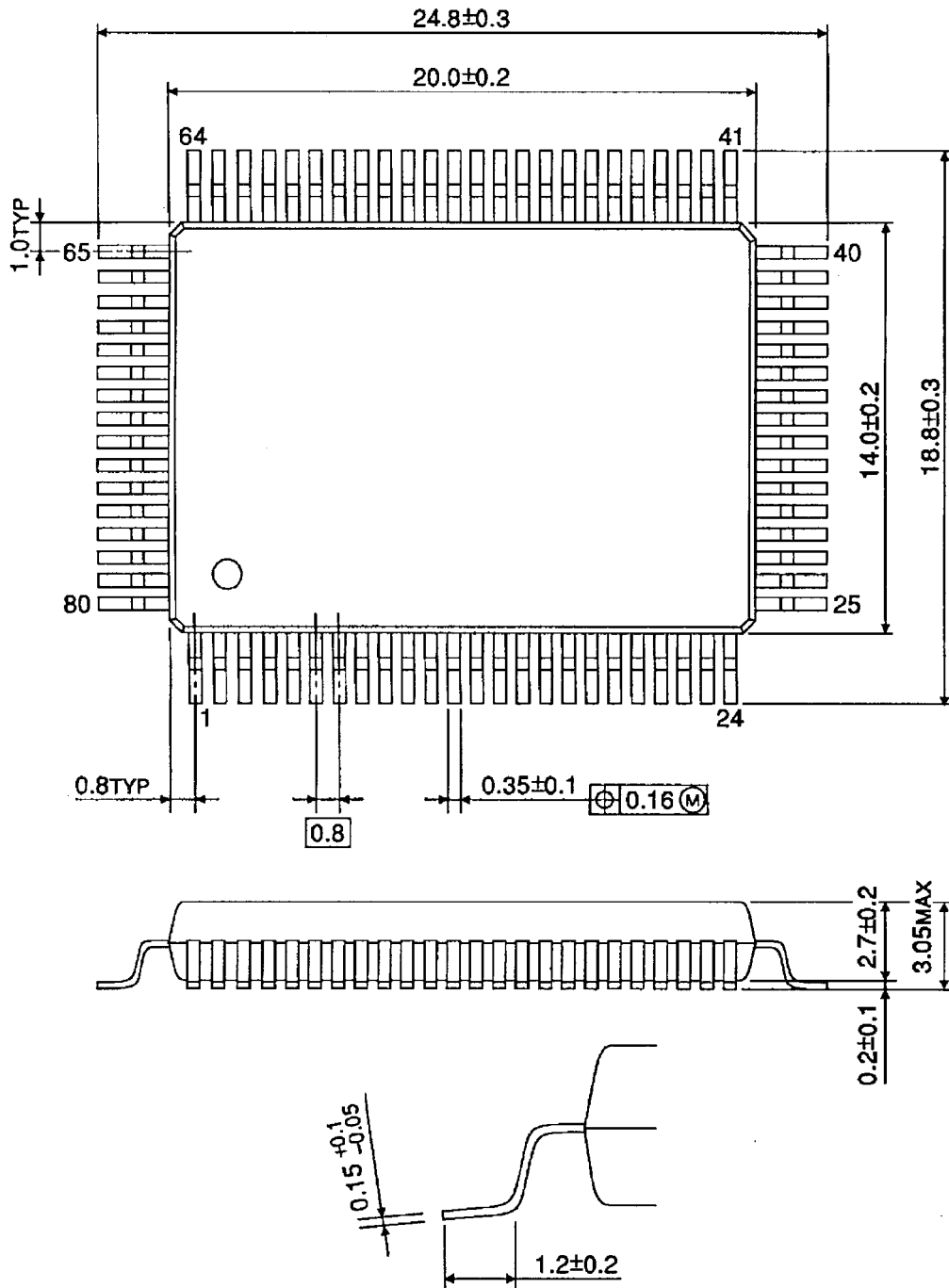
(1) Setting POWER SW to ON, V_2 is supplied to V_{DD} pin, and also to $\overline{\text{HOLD}}$ pin.
Then calculator operates normally.

(2) Setting POWER SW from ON to OFF, V_1 is supplied to V_{DD} pin and V_{SS} is supplied to $\overline{\text{HOLD}}$ pin.
Under this connection, TAX RATE is held.

(3) Setting POWER SW to ON, V_2 is supplied to V_{DD} pin, and also to $\overline{\text{HOLD}}$ pin.
Then calculator operates normally with TAX RATE to be held.

Note 12: V_1 (battery) should be supplied to the circuit after V_2 (DC) supply, because of prevention from exhaustion of battery and abnormal operation.

Package Dimensions

QFP80-P-1420-0.80A   Unit : mm

24.8±0.3

20.0±0.2

64   41

1.0TYP

65   40

14.0±0.2   18.8±0.3

80   25

1   24

0.8TYP

0.8

0.35±0.1   ⊕ 0.16 Ⓜ

2.7±0.2   3.05MAX

0.2±0.1

0.15 +0.1 −0.05

1.2±0.2

Weight: 1.52 g (typ.)

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2003-03-04