TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC83220-0029

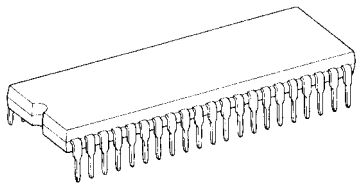
TC83220-0029 CMOS Single-Chip LSI for FL (fluorescent) Calculator

The Toshiba printing/display calculator circuit TC83220-0029 is 10/12-digit calculator on single-chip CMOS LSI.

TC83220-0029 can drive the printing machine (M400A/M401A/M400E/M80*; EPSON) with magnet driver circuit, and can drive the fluorescent display tube with DC-DC converter.

It contains a 4 K-word ROM, a 256 × 4-bit RAM.

Note 1: Print font number: M400A 001-300
M401A 001-330
M400E 001-310



SDIP42-P-600-1.78

Weight: 4.12 g (typ.)

Features

Operational Features

- Print: 11/13 digits of data.
  (including decimal point 2 digit of operational symbol.)
  3 digits of commas.
- Display: 10/12 digits of data. (including punctuation in each digit.)
  1 digit of floating minus sign, memory load, error symbol.
  3 digits of commas.
- Decimal output: Decimal setting lock key controls output format.
  Fixed decimal setting (“0”, “1”, “2”, “3”, “4”, “6”), full floating decimal, and ADD mode.
- Key input buffer: 8 stages
- Function: 4 basic arithmetic functions (+, −, ×, ÷).
  Repeat addition and subtraction.
  Automatic constants in multiplication, division, percent calculation, calculations.
  Automatic percent add-on and percent discount calculation.
  Memory calculation.
  Automatic accumulating calculation.
  Gross margin profit calculation.
  Delta percent calculation.
  Tax calculation.
  Grand total calculation.
  Currency conversion calculation.
  Two-key rollover.
- Item counter: 0~999 count up or −999~0~999 count up/down by depressing of [+] or [+/=], [−] or [−/=] key.
- Punctuation: Commas or space for thousands on display
- Kinds of touch key: [0]~[9], [·], [00], [000], [C], [CE], [C/CE], [+/−], [#/P], [Feed], [+] or [+/=], [−] or [−/=], [◇], [*], [×], [÷], [=], [%], [MU/D], [M+], [M−], [M◇], [M*], [Δ%], [→], [GT], [√], [+TAX], [−TAX], [E to H], [H to E], [SET]

- Kinds of lock key : "NP" printing mode selectable switch.
  "Σ" summation mode selectable switch.
  "5/4" "CUT" "UP" rounding switch.
  Fixed point mode selectable switch.
  "0", "1", "2", "3", "4", "6", "F", "ADD+ ", "ADDX".
  "IC+" "IC±" item counter mode selectable switch.
  "GT" grand total memory selectable switch.
- Duty of display: Duty = 1/16.5
- Leading zero suppression
- Trailing zero suppression
- Tax calculation: [+TAX] key is calculation for included tax.
  [−TAX] key is calculation for excluded tax.
  [SET] key is store the tax rate to memory.
  Depression of [+TAX] or [−TAX] after clear function, recall tax rate and into the setting mode.
  Depression of [SET] stores number of display to memory at the setting mode.
  Depression of [+TAX] following data key performs the calculating included tax.
  Depression of [−TAX] following data key performs the calculating excluded tax.
- Currency conversion
  Calculation: [E to H] key is calculation for home currency.
  [H to E] key is calculation for Euro currency.
  [SET] key is store the currency rate for Euro to memory (ex. 1 Euro = 1.23456).
  Depression of [E to H] or [H to E] after clear function.
  Recall currency rate and into the setting mode.
  Depression of [SET] stores number of display to memory at the setting mode.
  Depression of [E to H] following data key performs the conversion Euro to Home currency.
  Depression of [H to E] following data key performs the conversion Home to Euro currency.

Electrical Features

- P-MOS output buffer with pull down resistor for direct driving of fluorescent display tube.
- Dual in line package.

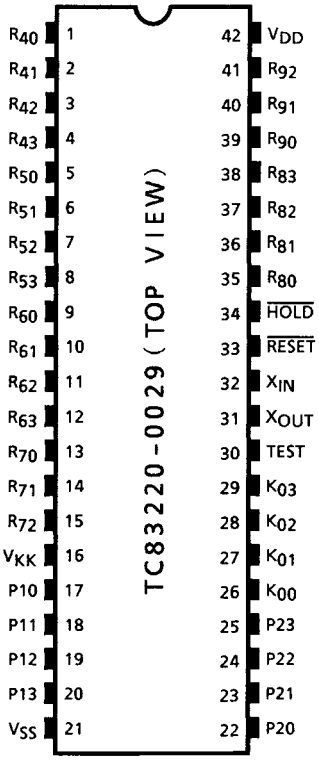
Protection

(1) In the overflow condition, all key except "C", "C/CE", "CE", "Feed", "→" key are inoperative.
(2) Key bouncing protection (at 4 MHz clock)
Key read in: 15 ms
Key off: 40 ms

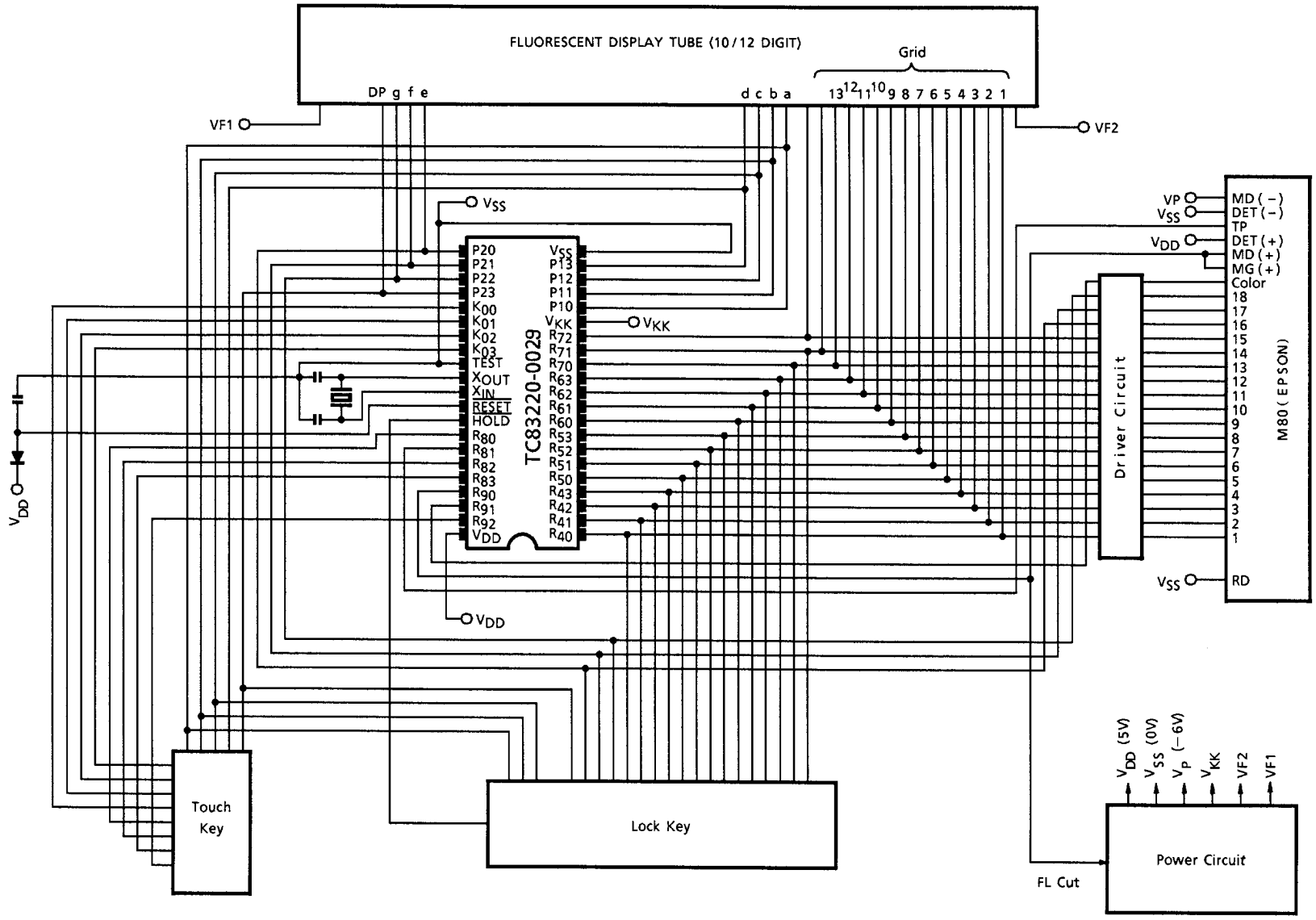
Function Select

(1) "10/12" selectable with auto power off mode
ON.....10-digit calculated
OFF.....12-digit calculated

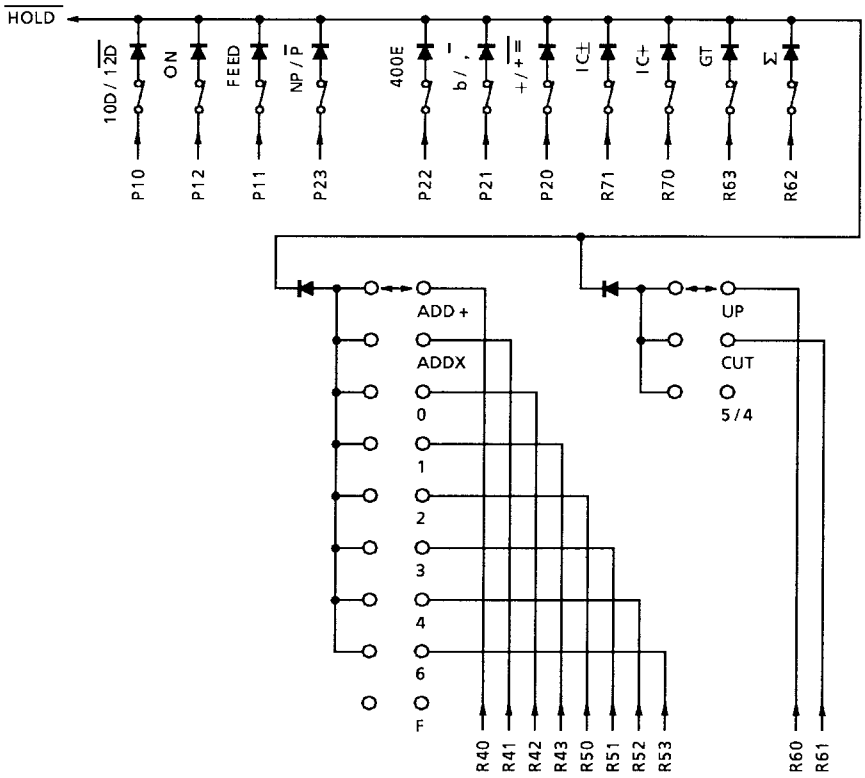
Pin Assignment (top view)



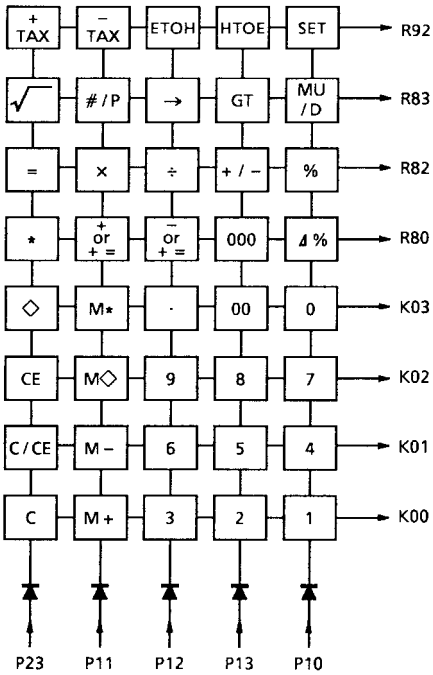
System Diagram



Key Connection

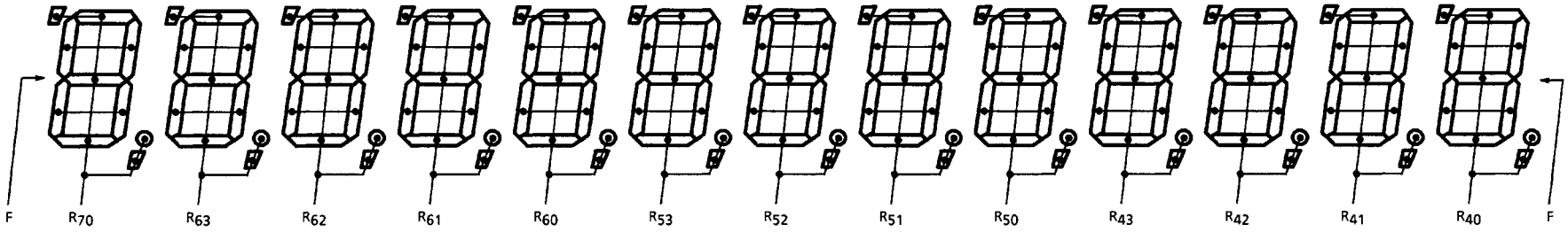


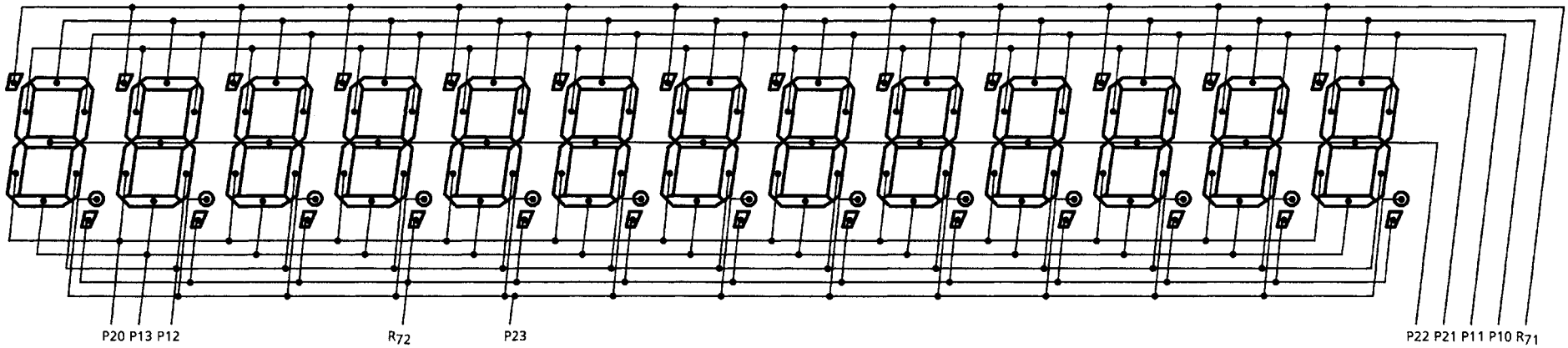
Lock Key



Touch Key

Connection of FL





Note 2: R_{70} digit (P20) of “E” data.

Note 3: R_{70} digit (P22) of “–” data.

Note 4: R_{70} digit (P23) of “M” data.

Note 5: R_{70} digit (P21) of “GT” data.

Operation Example

Key							Print			Display
TAB	4/5		IC	10/12	Σ	GT	Touch			
F	4/5		OFF	10	OFF	OFF	POWER ON			
								<PF>		
								C		
								<PF>		0.
							1+	1. +		1.
							2-	2. -	R	-1.
							◊	1. - ◊	R	-1.
							*	1. - *	R	
								<PF>		-1.
			IC+				1+	1. +		1.
							2-	2. -	R	-1.
							◊	002		
								1. - ◊	R	-1.
							*	002		
								1. - *	R	
								<PF>		-1.
			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. %		
								66.66666666 *		
								<PF>		66.66666666
							2 MU/D	2. M		2.
							3=	3. %		
								0.06185567 Δ *		
								2.06185567 *		
								<PF>		2.06185567
							2Δ%	2. Δ		2.
							3=	3. =		
								1. Δ *		
								50. Δ %		50.
								<PF>		

Note 6: <PF> .....Paper feed

PRINT COLOR.....R: Red

.....No mark: Black

Key						Touch	Print			Display	
TAB	4/5	IC	10/12	Σ	GT						
F	4/5	OFF	10	Σ	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.	%			
							66.66666666	+			
							<PF>				66.66666666
						2 MU/D	2.	M			2.
						3=	3.	%			
							0.06185567	Δ *			
							2.06185567	+			
							<PF>				2.06185567
						2Δ%	2.	Δ			2.
						3=	3.	=			
							1.	Δ *			
							50.	+			
							<PF>				50.
						*	122.0285223	*			
							<PF>				122.0285223
						GT	0.	G ◊			0.
					GT	2+	2.	+			2.
						3+	3.	+			5.
						*	5.	G +			
							<PF>				5.
						3-	3.	-	R		-3.
						4-	4.	-	R		-7.
						5-	5.	-	R		-12.
						*	12.	$\overline{G}$ +	R		
							<PF>				-12.
						GT	7.	$\overline{G}$ ◊	R		-7.
						GT	7.	$\overline{G}$ *	R		
							<PF>				-7.
					OFF	M+	-7.	$\overline{M}$ +	R	M	-7.
						C	0.	C		M	0.

Note 6: <PF> .....Paper feed

PRINT COLOR.....R: Red

.....No mark: Black

Key						Touch	Print			Display	
TAB	4/5	IC	10/12	Σ	GT						
						M◊	<PF>			M	-7.
						M*	7.	M ◊	R		
							7.	M *	R		
F	4/5	OFF	10	Σ	OFF		<PF>				-7.
						#/P	7.	- ◊	R		-7.
						2 #/P	#2				2.
						#/P	2.	◊			2.
						0÷	0.	÷			0.
						=	0.	=			
							ERROR				
							0.	*			
							<PF>			E	0.
						C	0.	C			
							<PF>				0.
F	CUT	OFF	12	OFF	OFF						
						C	0.	C			0.
							<PF>				
						+TAX	0.	%			0.
						5					5.
						SET	5.	%			5.
							<PF>				
						C	0.	C			0.
							<PF>				
						-TAX	5.	%			5.
						3					3.
						SET	3.	%			3.
							<PF>				
						1560					1,560.
						+TAX	1,560.				
							46.8	Δ			
							1,606.8	*			
							<PF>				1,606.8
						+TAX	1,606.8	◊			
							48.204	Δ			
							1,655.004	*			
							<PF>				1,655.004
						1560					1,560.
						×	1,560.	×			1,560.
						78900					78,900.
						+TAX	78,900.	=			
							123,084,000.	◊			
							3,692,520.	Δ			
							126,776,520.	*			

Note 6: <PF> .....Paper feed

PRINT COLOR.....R: Red

.....No mark: Black

Key							Print			Display
TAB	4/5	IC	10/12	Σ	GT	Touch				
							<PF>			126,776,520.
						=				126,776,520.
						5				5.
						×	5.	×		5.
						+TAX				5.
						=	5.	=		
							25.	*		
							<PF>			25.
F	CUT	OFF	12	OFF	OFF	+TAX	25.	◊		
							0.75	Δ		
							25.75	*		
							<PF>			25.75
						=				25.75
						C	0.	C		
							<PF>			0.
2						1560				1,560.
						+	1,560.00	+		1,560.00
						1100				1,100.
						+	1,100.00	+		2,660.00
						+TAX	2,660.00	◊		
							79.80	Δ		
							2,739.80	*		
							<PF>			2,739.80
F						+TAX	2,739.80	◊		
							82.194	Δ		
							2,821.994	*		
							<PF>			2,821.994
						980000000000				980,000,000,000.
						+TAX	980,000,000,000.			
							29,400,000,000.	Δ		
							ERROR			
							1.00940000000	*		
							<PF>			E 1.00940000000
						C	0.	C		
							<PF>			0.
						1560				1560.
						+/-				-1,560.
						+TAX	1,560.	-	R	
							46.8	-Δ	R	
							1,606.8	- *	R	
							<PF>			-1,606.8
						1560				1,560.
						-TAX	1,560.			

Note 6: <PF> .....Paper feed

PRINT COLOR.....R: Red

.....No mark: Black

Key						Touch	Print			Display
TAB	4/5	IC	10/12	Σ	GT					
F	CUT	OFF	12	OFF	OFF		45,43689321	-Δ	R	
							1,514.56310679	*		
							<PF>			1,514.56310679
						-TAX	1,514.56310679	◊		
							-44.11348855	-Δ	R	
							1,470.44961824	*		
							<PF>			1,470.44961824
F						C	0.	C		0.
							<PF>			
						ETOH	1.0000	R		1.00000
						1.92003				1.92003
						SET	1.92003	R *		1.92003
							<PF>			
						C	0.	C		0.
							<PF>			
						1500 HTOE	1,500.	K ÷		781.237793159
							1.92003	R =		
							781.237793159	*		
							<PF>			
A_{DD} + CUT						1500 HTOE	1,500.	K ÷		781.23
							1.92003	R =		
							781.23	*		
							<PF>			
						HTOE				781.23
						ETOH	1,500.	K		1,500.
						+	1,500.00	+		1,500.00
4 CUT						HTOE	1,500.00	K ÷		781.2377
							1.92003	R =		
							781.2377	*		
							<PF>			
						=				781.2377
						HTOE				781.2377
						×	781.2377	×		781.2377
						HTOE	781.2377	K ÷		406.8882
							1.92003	R =		
							406.8882	*		
							<PF>			
						ETOH	781.2377	K		781.2377

Note 6: <PF> .....Paper feed

PRINT COLOR.....R: Red

.....No mark: Black

Key		Print		Display
TAB 4/5 IC 10/12 Σ GT	Touch			
	HTOE	781.2377 K ÷		406.8882
		1.92003 R =		
		406.8882 *		
		<PF>		
	C	0. C		0.
		<PF>		
	HTOE	1.92003 R		1.92003
	23.5308			23.5308
	SET	23.5308 R *		23.5308
		<PF>		
F	200.5001 ETOH	200.5001 K ×		4,717.92775308
		23.5308 R =		
		4,717.92775308 *		
		<PF>		
	200.5001 ETOH	200.5001 K ×		4,718.
0 4/5		23.5308 R =		
		4,718. *		
		<PF>		
	=			4,718.
	ETOH			4,718.
	×	4,718. ×		4,718.
	ETOH	4,718. K ×		111,018.
		23.5308 R =		
		111,018. *		
		<PF>		

Note 6: <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}	−0.5~7	V
Supply voltage 2	V_{KK}	−40~+0.5	V
Input voltage	V_{IN}	−35~V_{DD} + 0.5	V
Output voltage	V_{OUT}	−35~V_{DD} + 0.5	V
Output current	I_{OUT}	−10	mA
Power dissipation (T_{opr} = 70°C)	P_D	600	mW
Soldering temperature, time	T_{sld}	260 (10 s)	°C
Storage temperature	T_{stg}	−55~125	°C
Operating temperature	T_{opr}	0~40	°C

Recommended Operating Conditions (V_{SS} = 0 V)

Characteristics	Symbol	Test Circuit	Test Condition	Min	Max	Unit
Operating temperature	T_{opr}	—	—	0	40	°C
Supply voltage	V_{DD}	—	—	4.5	6	V
Supply voltage (FL)	V_{KK}	—	—	−30	−15	V
Supply voltage (hold)	V_{DDH}	—	—	2	6	V
Input high voltage (except schmitt circuit input)	V_{IH1}	—	$V_{DD} \geqq 4.5$ V	$V_{DD} \times 0.7$	V_{DD}	V
Input high voltage (schmitt circuit input)	V_{IH2}	—		$V_{DD} \times 0.75$	V_{DD}	V
Input high voltage	V_{IH3}	—	$V_{DD} < 4.5$ V	$V_{DD} \times 0.9$	V_{DD}	V
Input low voltage (except schmitt circuit input)	V_{IL1}	—	$V_{DD} \geqq 4.5$ V	V_{KK}	$V_{DD} \times 0.3$	V
Input low voltage (schmitt circuit input)	V_{IL2}	—		V_{KK}	$V_{DD} \times 0.25$	V
Input low voltage	V_{IL3}	—	$V_{DD} < 4.5$ V	V_{KK}	$V_{DD} \times 0.1$	V
Output voltage (source open drain)	V_{OUT}	—	—	V_{DD} − 35	V_{DD}	V
Clock high pulse width (Note 7)	T_{WCH}	—	$V_{IN} = V_{IH}$	80	—	ns
Clock low pulse width (Note 7)	T_{WCL}	—	$V_{IN} = V_{IL}$	80	—	ns

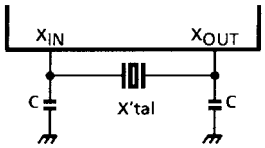
Note 7: In case of the external clock operation.

Electrical Characteristics

DC Characteristics (V_{SS} = 0 V, V_{DD} ± 10%, T_{opr} = 0~40°C)

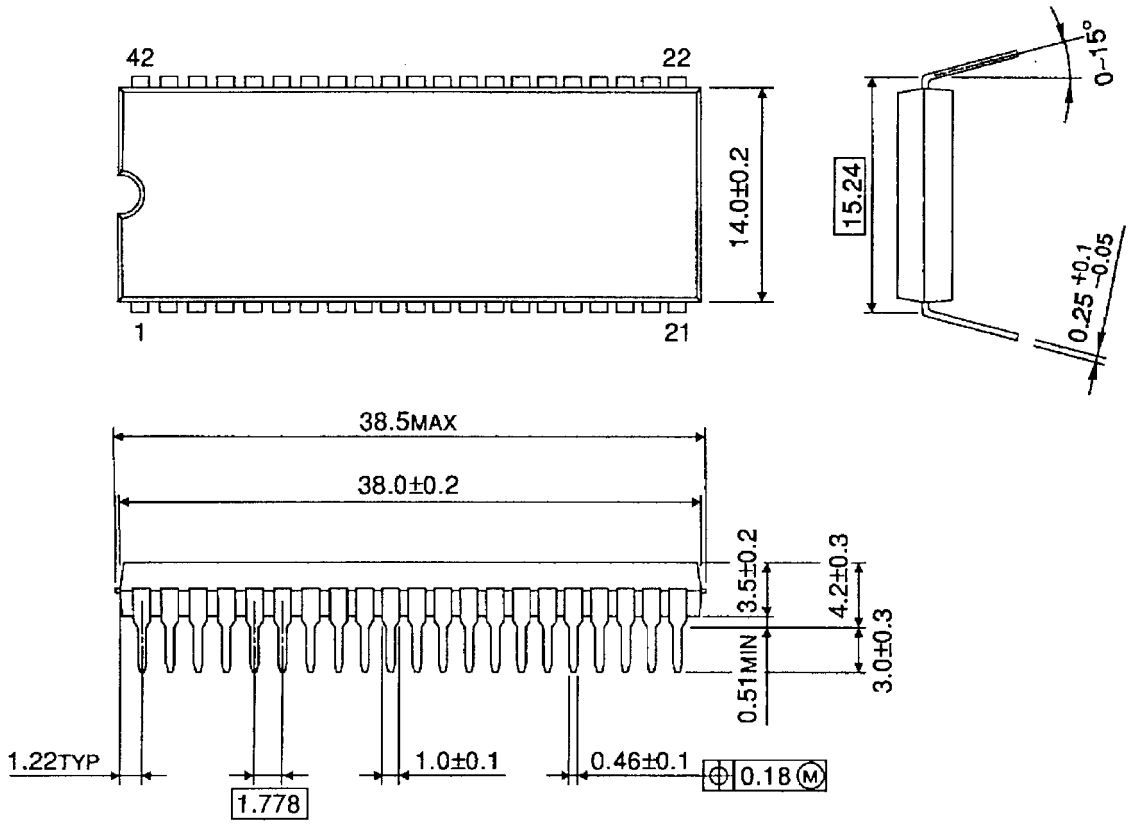
Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Hysteresis voltage (schmitt circuit input)	V_{HS}	—	—	—	0.7	—	V
Input current ($\overline{RESET}$, $\overline{HOLD}$, $\overline{TEST}$)	I_{IN}	—	V_{DD} = 5.5 V, V_{IN} = 5.5/0 V	—	—	±50	μA
Output leak current (source open drain)	I_{LO}	—	V_{DD} = 5.5 V, V_{OUT} = −32 V	—	—	−10	μA
Output high voltage (P1~P2, R_4~R_9)	V_{OH}	—	V_{DD} = 4.5 V, I_{OH} = −6 mA	2.4	—	—	V
Input pull down resistor (K_0, R_7~R_9)	R_{IN}	—	V_{DD} = 5.5 V, V_{KK} = −30 V	—	100	—	kΩ
Pull down resistor (source open drain)	R_{KK}	—		50	80	200	kΩ
Operating supply current	I_{DD} 0	—	V_{DD} (V_{DDH}) 5.5 V, f_c = 4 MHz V_{IN} = 5.3/0.2 V	—	3	6	mA
Supply current (after clear)	I_{KK} 1	—	V_{KK} = −30 V, f_c = 4 MHz	—	0.6	0.9	mA
Supply current (shown full digits)	I_{KK} 2	—		—	3.5	6	mA
Holding supply current	I_{DD} H	—	V_{DD} = 5.5 V	—	0.5	10	μA

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

Circuit	Test Condition	Min	Typ.	Max	Unit
	C = 10 pF X'tal (or ceramic) = 4 MHz	—	4	—	MHz

Package Dimensions

SDIP42-P-600-1.78 Unit : mm



Weight: 4.12 g (typ.)

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000707EBA

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