

TC83220-0029

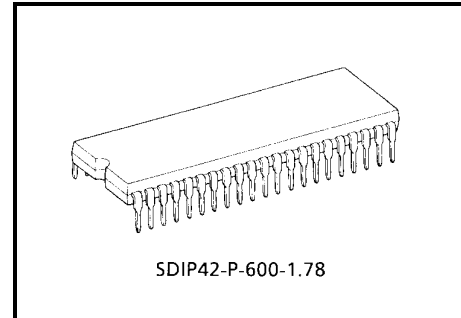
TC83220-0029 CMOS Single-Chip LSI for FL (fluorescent) Calculator

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



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 $\boxed{+}$ or $\boxed{+}$, $\boxed{-}$ or $\boxed{-}$ key.
- Punctuation: Commas or space for thousands on display
- Kinds of touch key: $\boxed{0} \sim \boxed{9}$, $\boxed{\cdot}$, $\boxed{00}$, $\boxed{000}$, \boxed{C} , \boxed{CE} , $\boxed{C/CE}$, $\boxed{+/-}$, $\boxed{\#/P}$, $\boxed{\text{Feed}}$,
 $\boxed{+}$ or $\boxed{+}$, $\boxed{-}$ or $\boxed{-}$, $\boxed{\diamond}$, $\boxed{*}$, $\boxed{\times}$, $\boxed{\div}$, $\boxed{=}$, $\boxed{\%}$, $\boxed{MU/D}$, $\boxed{M+}$,
 $\boxed{M-}$, $\boxed{M\diamond}$, $\boxed{M*}$, $\boxed{\Delta\%}$, $\boxed{\rightarrow}$, \boxed{GT} , $\boxed{\sqrt{\quad}}$, $\boxed{+TAX}$, $\boxed{-TAX}$, $\boxed{E \text{ to } H}$,
 $\boxed{H \text{ to } E}$, \boxed{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.

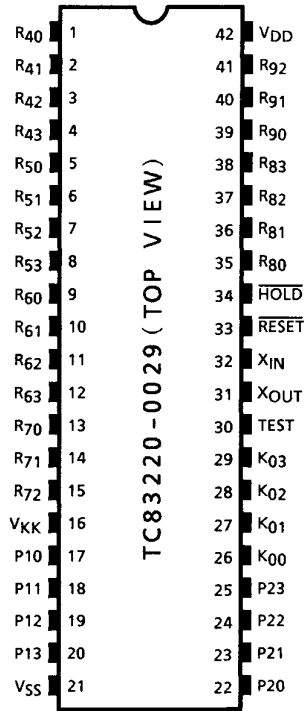
Protection

- (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

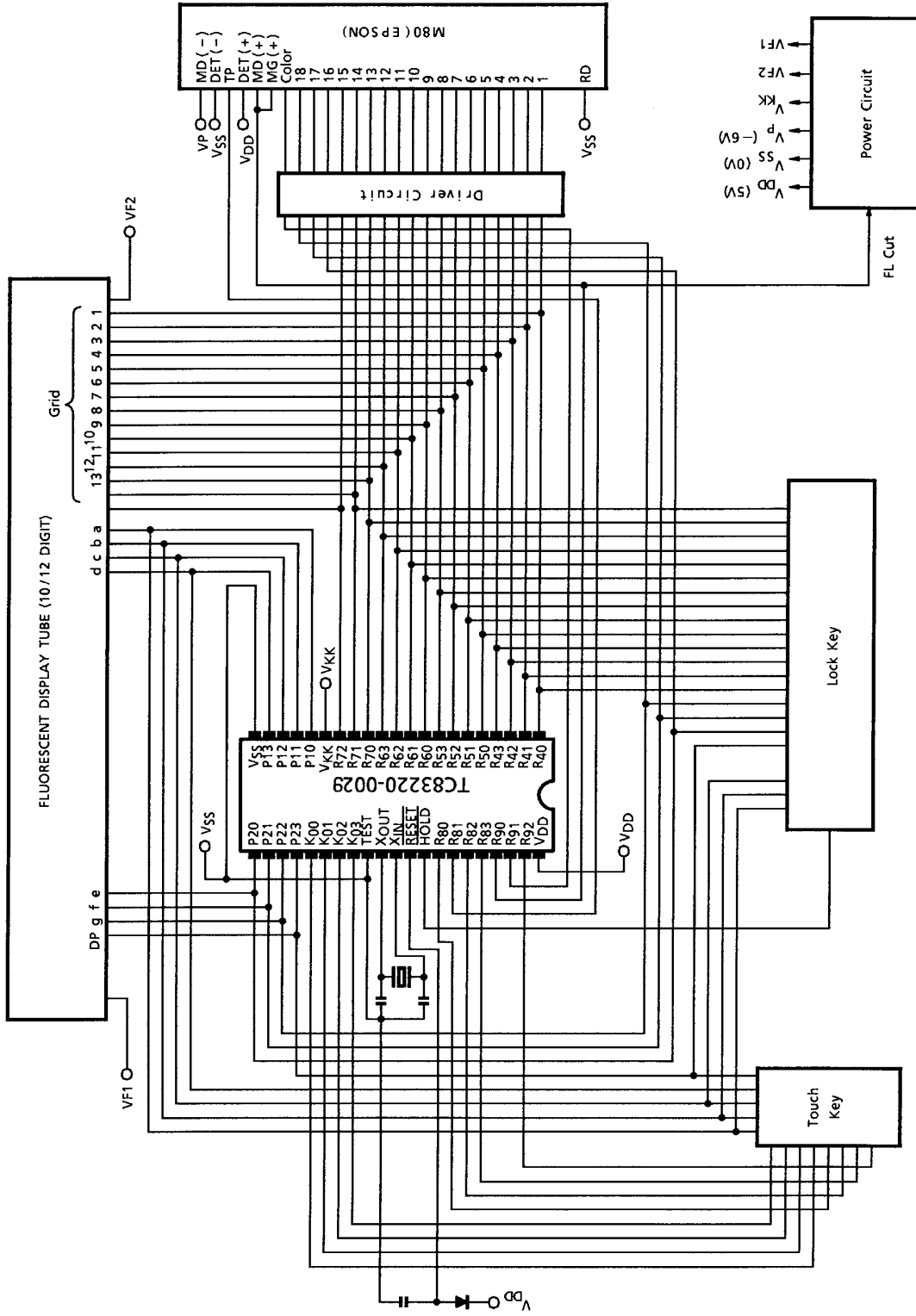
Function Select

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

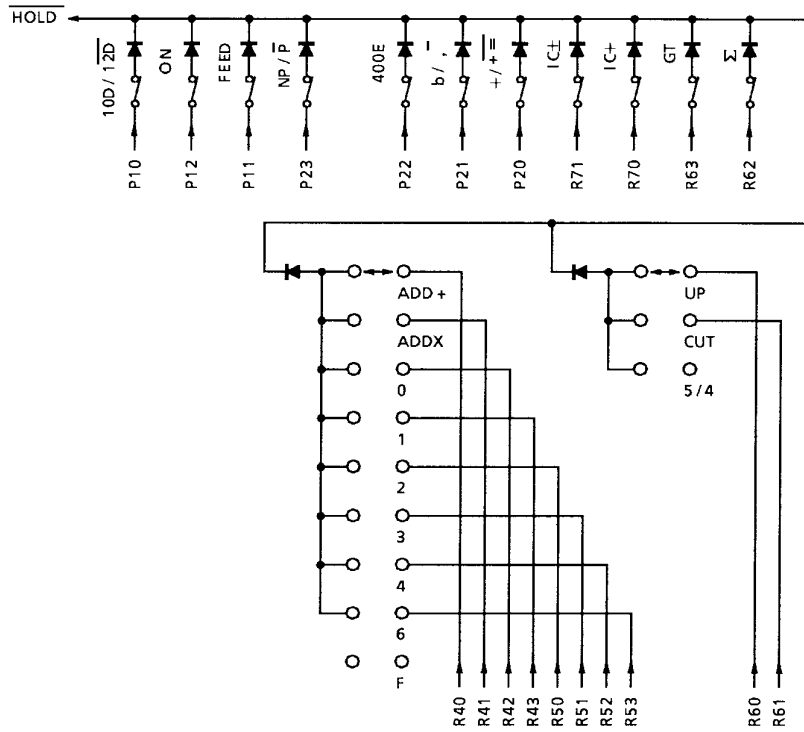
Pin Assignment (top view)



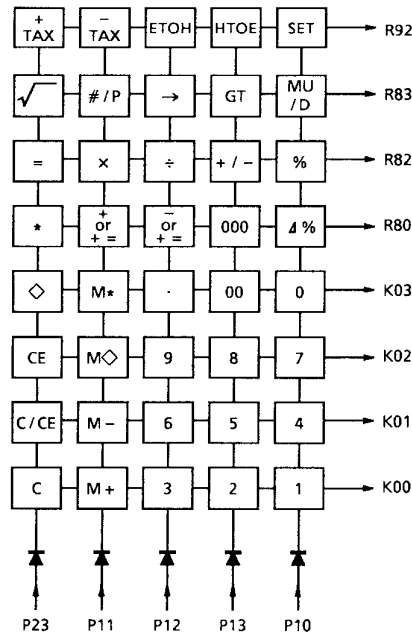
System Diagram



Key Connection

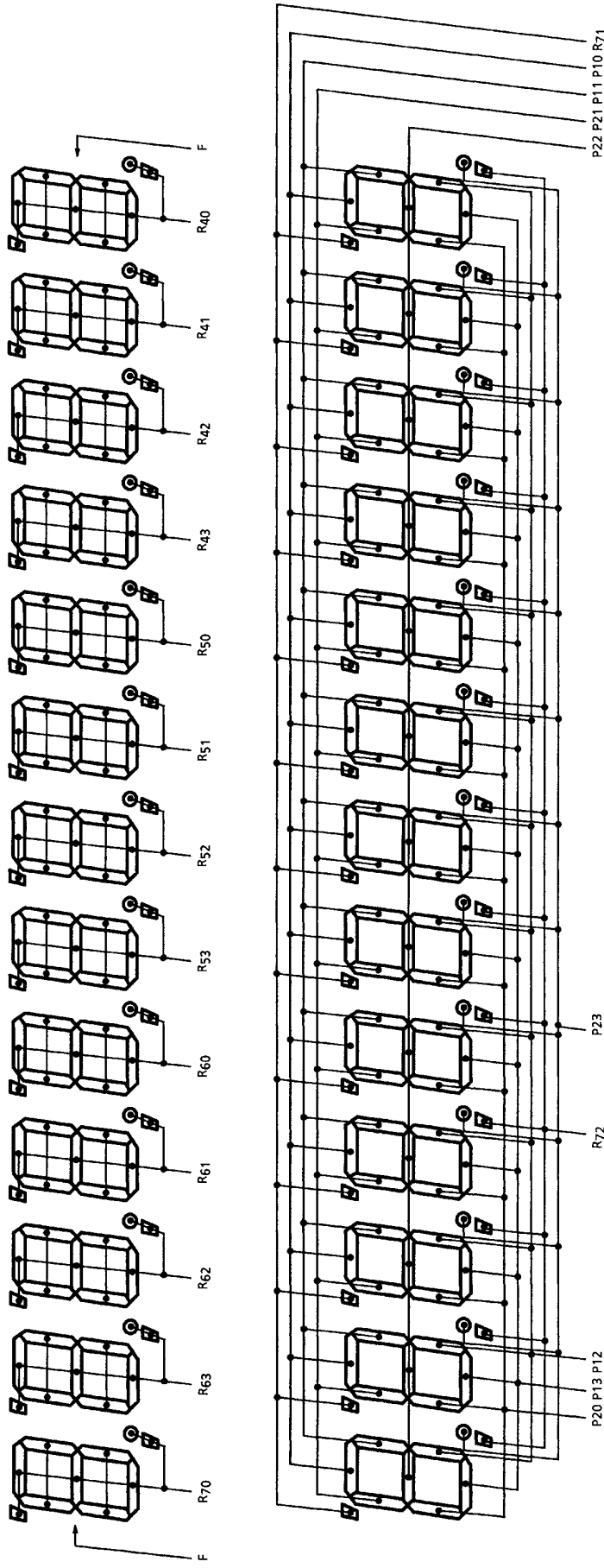


Lock Key



Touch Key

Connection of FL



Note 2: R70 digit (P20) of "E" data.

Note 3: R70 digit (P22) of "-" data.

Note 4: R70 digit (P23) of "M" data.

Note 5: R70 digit (P21) of "GT" data.

Operation Example

Key						Touch	Print	Display
TAB	4/5	IC	10/12	Σ	GT			
F	4/5	OFF	10	OFF	OFF	POWER ON	<PF>	
							C	
						1+	<PF> 1. +	0. 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						Print			Display	
TAB	4/5	IC	10/12	Σ	GT	Touch				
F	4/5	OFF	10	Σ	OFF	3x	3.	x		3.
						4÷	4.	÷		12.
						=	4.	=		
							3.	+		
							<PF>			3.
						5x	5.	x		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.	G + R		
							<PF>			-12.
						GT	7.	G ∅ R		-7.
						GT	7.	G * R		
							<PF>			-7.
		OFF				M+	-7.	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 \diamond		<PF>			M	-7.
						M*		7. $\overline{M} \diamond$	R			
								7. $\overline{M} *$	R			
F	4/5	OFF	10	Σ	OFF			<PF>				-7.
						#/P		7. - \diamond	R			-7.
						2 #/P	#2					2.
						#/P		2. \diamond				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 \diamond				
								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. \diamond				
								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		
							1.009400000000	*	
							<PF>	E	1.009400000000
						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	*		1,514.56310679
							<PF>			
						-TAX	1,514.56310679	◇		
							-44.11348855	-Δ	R	
							1,470.44961824	*		1,470.44961824
							<PF>			
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>			
ADD + 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						Touch	Print			Display
TAB	4/5	IC	10/12	Σ	GT					
						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.
							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 _{slid}	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} ≥ 4.5 V	V _{DD} × 0.7	V _{DD}	V
Input high voltage (schmitt circuit input)	V _{IH2}	—		V _{DD} × 0.75	V _{DD}	V
Input high voltage	V _{IH3}	—	V _{DD} < 4.5 V	V _{DD} × 0.9	V _{DD}	V
Input low voltage (except schmitt circuit input)	V _{IL1}	—	V _{DD} ≥ 4.5 V	V _{KK}	V _{DD} × 0.3	V
Input low voltage (schmitt circuit input)	V _{IL2}	—		V _{KK}	V _{DD} × 0.25	V
Input low voltage	V _{IL3}	—	V _{DD} < 4.5 V	V _{KK}	V _{DD} × 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

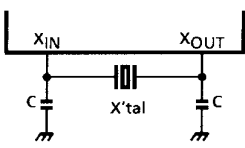
Note 7: In case of the external clock operation.

Electrical Characteristics

DC Characteristics ($V_{SS} = 0\text{ V}$, $V_{DD} \pm 10\%$, $T_{opr} = 0\sim 40^\circ\text{C}$)

Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Hysteresis voltage (schmitt circuit input)	V_{HS}	—	—	—	0.7	—	V
Input current ($\overline{\text{RESET}}$, $\overline{\text{HOLD}}$, $\overline{\text{TEST}}$)	I_{IN}	—	$V_{DD} = 5.5\text{ V}$, $V_{IN} = 5.5/0\text{ V}$	—	—	± 50	μA
Output leak current (source open drain)	I_{LO}	—	$V_{DD} = 5.5\text{ V}$, $V_{OUT} = -32\text{ V}$	—	—	-10	μA
Output high voltage (P1~P2, R4~R9)	V_{OH}	—	$V_{DD} = 4.5\text{ V}$, $I_{OH} = -6\text{ mA}$	2.4	—	—	V
Input pull down resistor (K0, R7~R9)	R_{IN}	—	$V_{DD} = 5.5\text{ V}$, $V_{KK} = -30\text{ V}$	—	100	—	k Ω
Pull down resistor (source open drain)	R_{KK}	—		50	80	200	k Ω
Operating supply current	I_{DD0}	—	V_{DD} (V_{DDH}) 5.5 V, $f_c = 4\text{ MHz}$ $V_{IN} = 5.3/0.2\text{ V}$	—	3	6	mA
Supply current (after clear)	I_{KK1}	—	$V_{KK} = -30\text{ V}$, $f_c = 4\text{ MHz}$	—	0.6	0.9	mA
Supply current (shown full digits)	I_{KK2}	—		—	3.5	6	mA
Holding supply current	I_{DDH}	—	$V_{DD} = 5.5\text{ V}$	—	0.5	10	μA

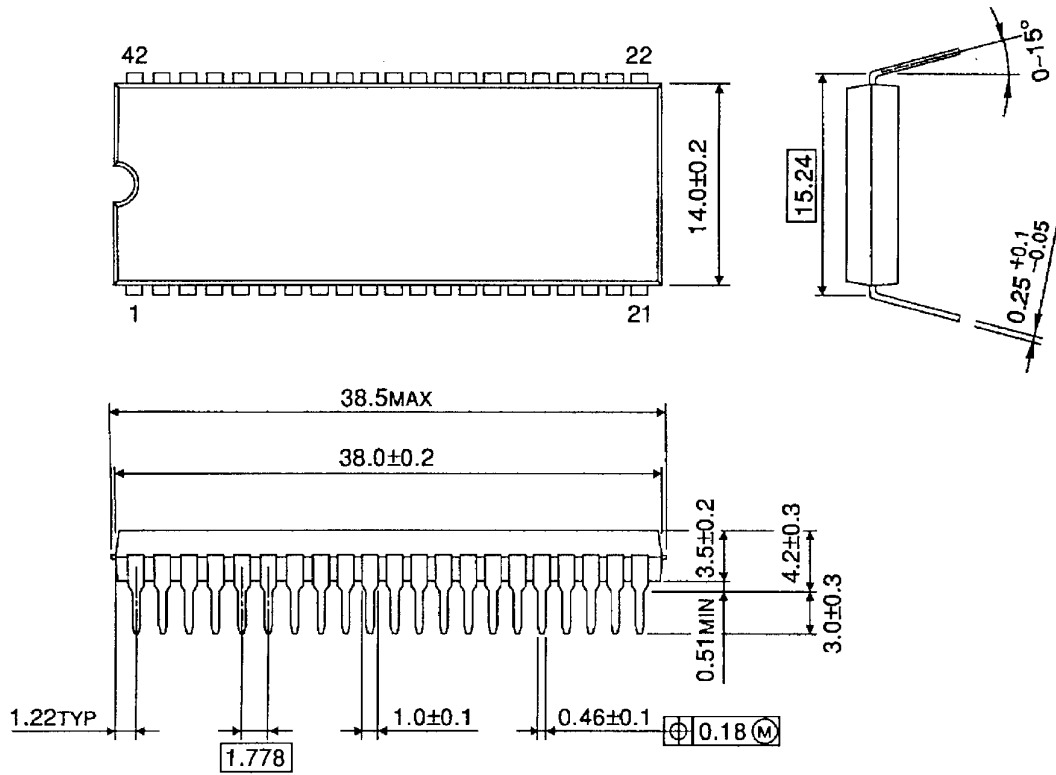
Oscillation Characteristics ($T_{opr} = 0\sim 40^\circ\text{C}$, $V_{DD} = 4.5\sim 6.0\text{ V}$)

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

Package Dimensions

SDIP42-P-600-1.78

Unit : mm



Weight: 4.12 g (typ.)

RESTRICTIONS ON PRODUCT USE

000707EBA

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