

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.

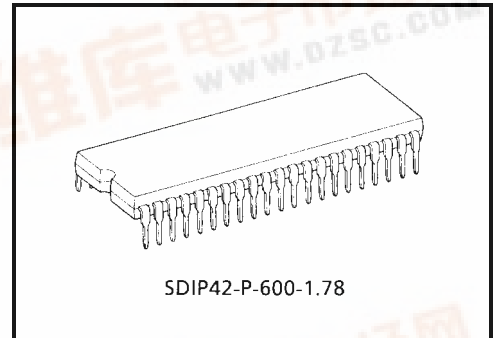
TC83220-0029 can drive the printing machine (M400A/M401A/M400E/M80*; EPSON) with magnet driver circuit, and can drive the fluorescent display tube with DC-DC converter.

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.

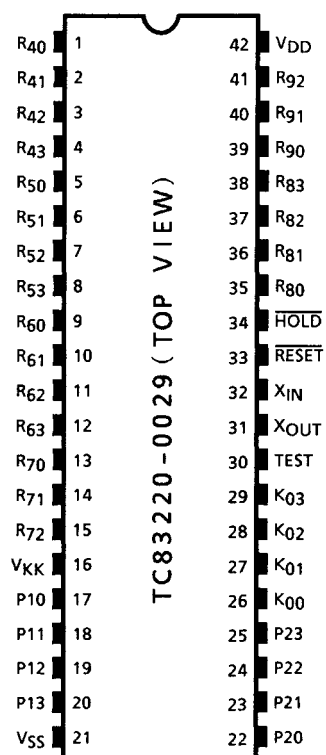
Protection

- (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

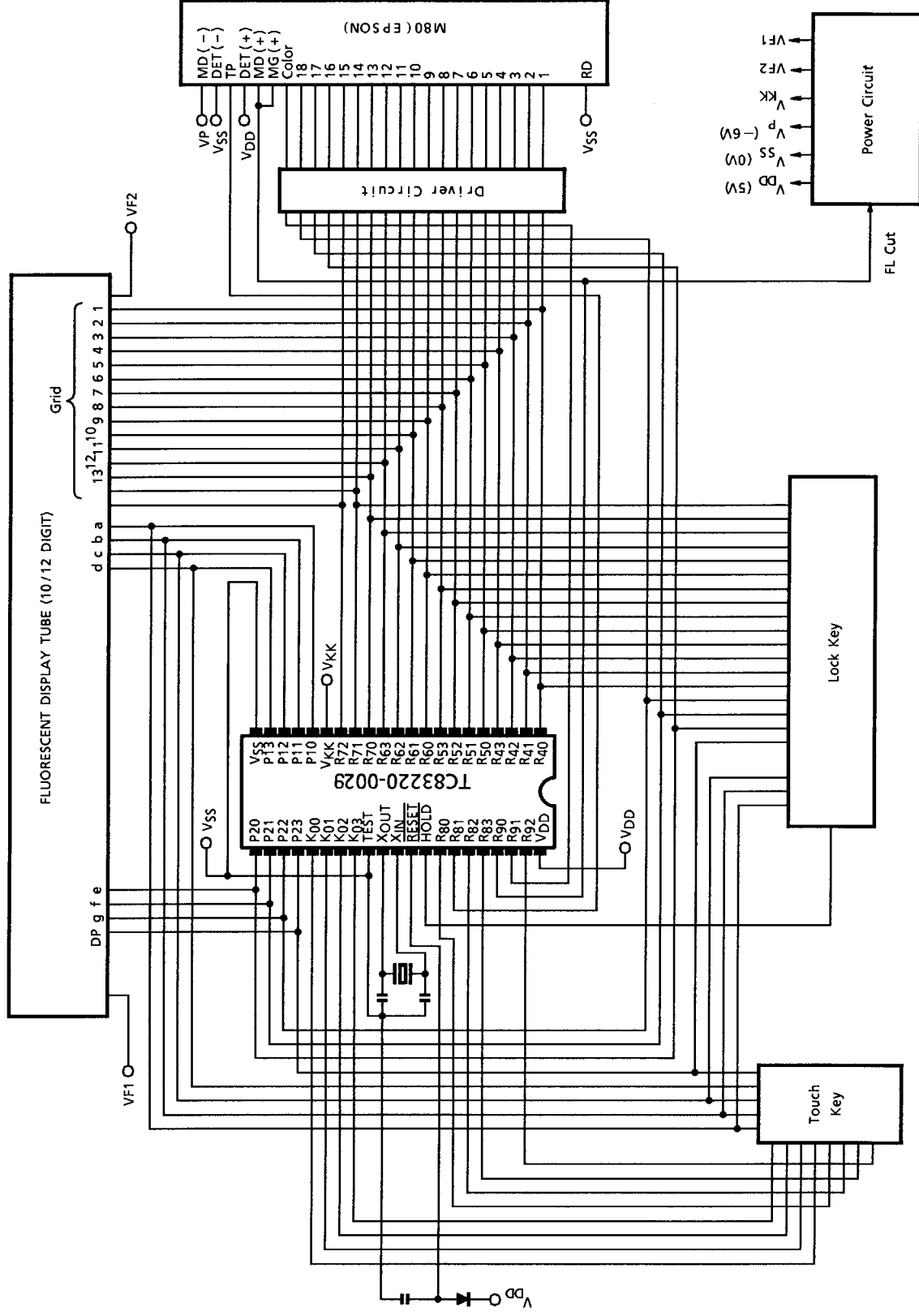
Function Select

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

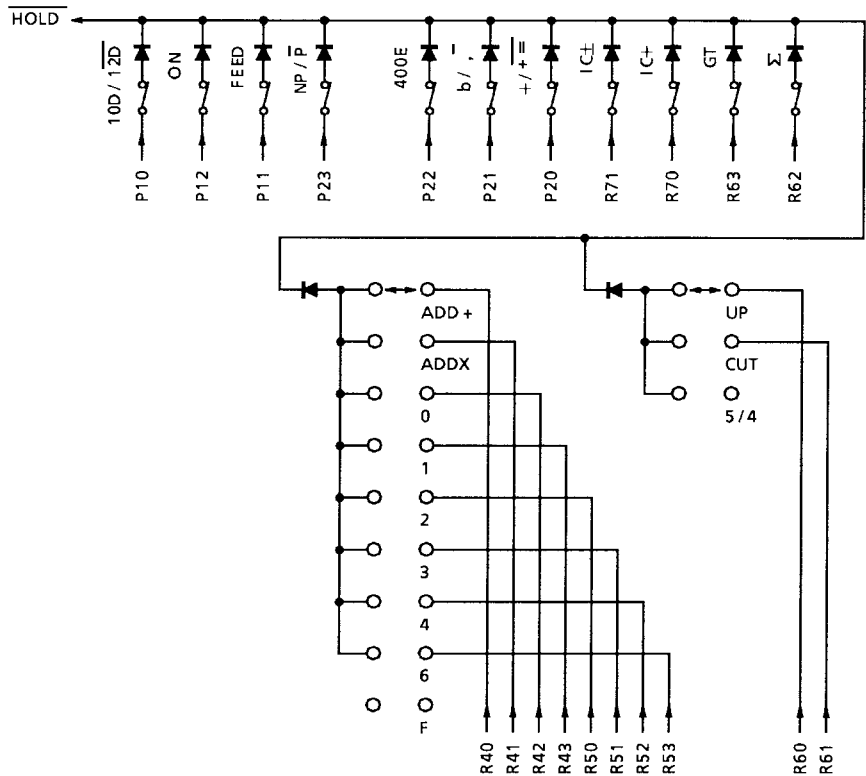
Pin Assignment (top view)



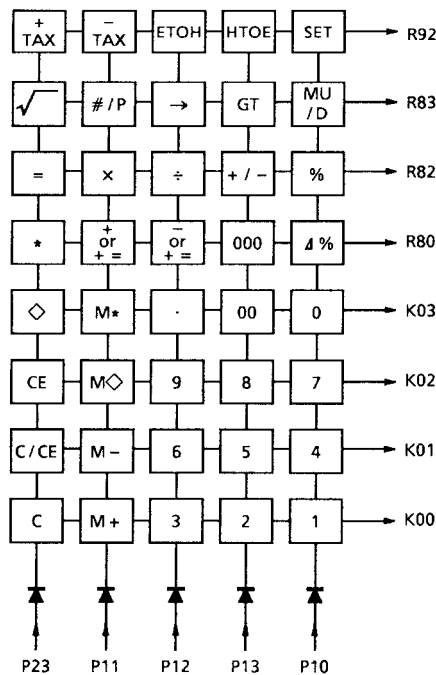
System Diagram



Key Connection

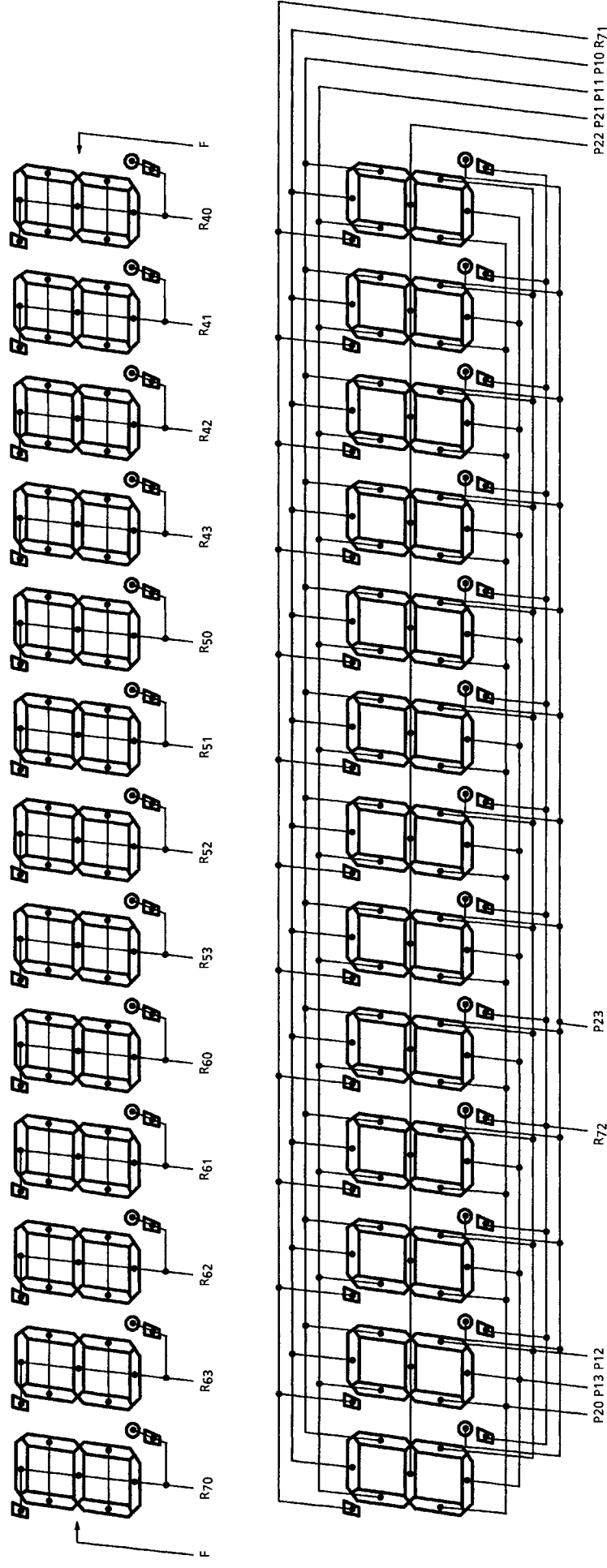


Lock Key



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						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. -	-1.
					◇		1. - ◇	-1.
					*		1. - *	
							<PF>	-1.
		IC+			1+		1. +	1.
					2-		2. -	-1.
					◇	002		
							1. - ◇	-1.
					*	002		
							1. - *	
							<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	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
						2 Δ %	2.	Δ		2.
						3=	3.	=		
							1.	Δ *		
							50.	+		
							<PF>			50.
						*	122.0285223	*		
							<PF>			122.0285223
						GT	0.	G $\Diamond$		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.	$\overline{G}$ $\Diamond$	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						Print		Display
TAB	4/5	IC	10/12	Σ	GT			
						Touch		
						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.
						5			126,776,520.
						×	5.	×	5.
						+TAX			5.
						=	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							Print		Display
TAB	4/5	IC	10/12	Σ	GT	Touch			
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>		
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							Print				Display
TAB	4/5	IC	10/12	Σ	GT	Touch					
F	0	4/5				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>				
						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 ($V_{SS} = 0 \text{ V}$)

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 ($T_{opr} = 70^\circ\text{C}$)	P_D	600	mW
Soldering temperature, time	T_{sld}	260 (10 s)	$^\circ\text{C}$
Storage temperature	T_{stg}	-55~125	$^\circ\text{C}$
Operating temperature	T_{opr}	0~40	$^\circ\text{C}$

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

Characteristics	Symbol	Test Circuit	Test Condition	Min	Max	Unit
Operating temperature	T_{opr}	—	—	0	40	$^\circ\text{C}$
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}	—	$V_{DD} \geq 4.5 \text{ V}$	$V_{DD} \times 0.7$	V_{DD}	V
Input high voltage (schmitt circuit input)	V_{IH2}	—		$V_{DD} \times 0.75$	V_{DD}	V
Input high voltage	V_{IH3}	—	$V_{DD} < 4.5 \text{ V}$	$V_{DD} \times 0.9$	V_{DD}	V
Input low voltage (except schmitt circuit input)	V_{IL1}	—	$V_{DD} \geq 4.5 \text{ V}$	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}	—	$V_{DD} < 4.5 \text{ V}$	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

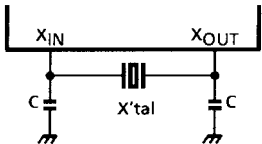
Note 7: In case of the external clock operation.

Electrical Characteristics

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

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	—	$\text{k}\Omega$
Pull down resistor (source open drain)	R_{KK}	—		50	80	200	$\text{k}\Omega$
Operating supply current	$I_{DD\ 0}$	—	$V_{DD} (V_{DDH}) 5.5\text{ V}$, $f_c = 4\text{ MHz}$ $V_{IN} = 5.3/0.2\text{ V}$	—	3	6	mA
Supply current (after clear)	$I_{KK\ 1}$	—	$V_{KK} = -30\text{ V}$, $f_c = 4\text{ MHz}$	—	0.6	0.9	mA
Supply current (shown full digits)	$I_{KK\ 2}$	—		—	3.5	6	mA
Holding supply current	$I_{DD\ H}$	—	$V_{DD} = 5.5\text{ V}$	—	0.5	10	μA

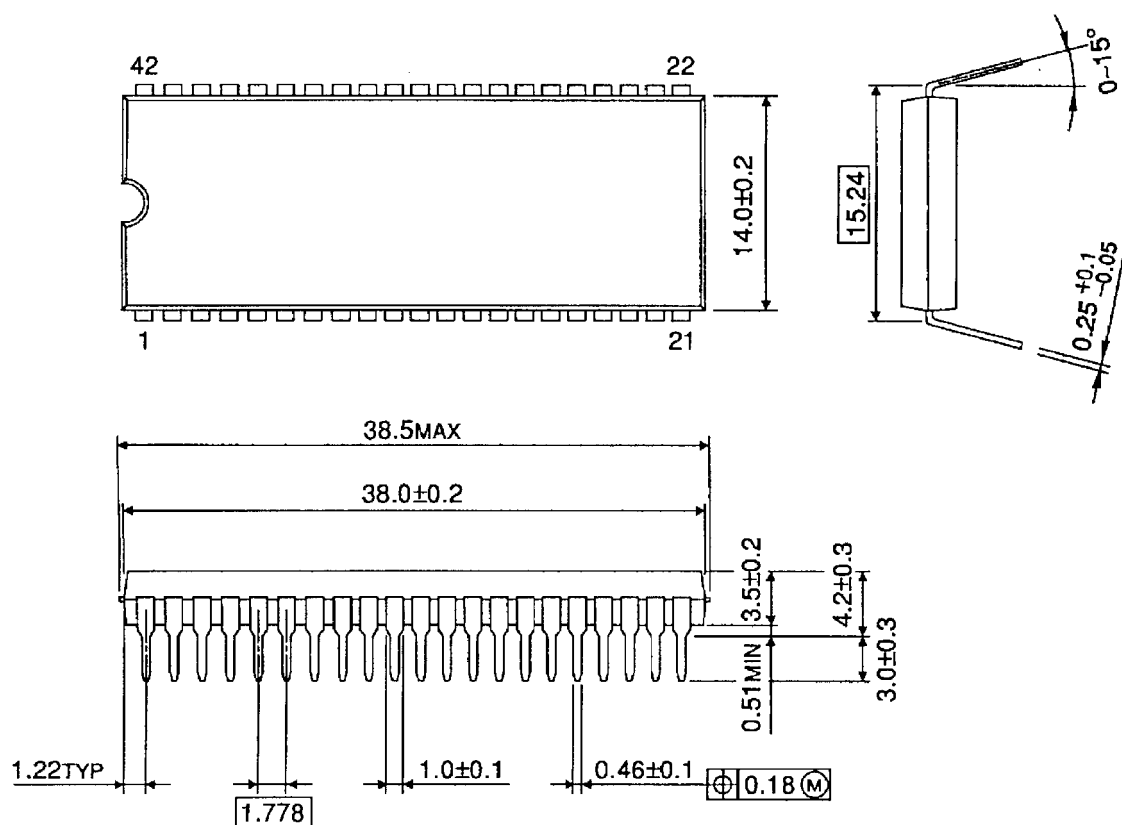
Oscillation Characteristics ($T_{opr} = 0\sim 40^\circ\text{C}$, $V_{DD} = 4.5\sim 6.0\text{ V}$)

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