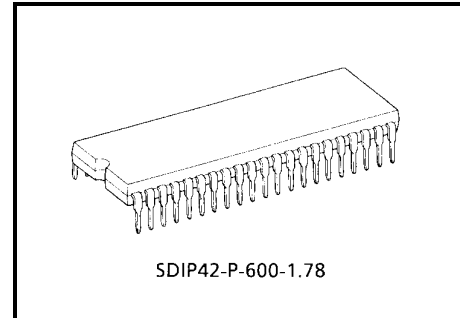


# TC83220-0009

TC83220-0009: Single-Chip CMOS LSI for FL (fluorescent) Calculator with Printers

The TOSHIBA printing/display calculator circuit TC83220-0009 is 10/12-digit calculator on a single-chip CMOS LSI.

TC83220-0009 can drive the printing machine (M-42TV/42V; 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.



Weight: 4.12 g (typ.)

## Features

### Operational Features

- Print: 12/14 digits of data.  
(including decimal point and minus signs.) 2 digits 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 set 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 function (+, -, ×, ÷).  
Repeat addition and subtraction.  
Automatic constants in multiplication, division, percent calculation, calculations.  
Automatic percent add-on and percent discount calculations.  
Memory calculation.  
Automatic accumulating calculation.  
Gross margin profit calculation.  
Delta percent calculation.  
Two-key rollover.
- Item counter: 0~999 count up or -999~0~999 count up/down by depressing of  $\boxed{+}$ ,  $\boxed{-}$ ,  $\boxed{+}$ ,  $\boxed{=}$  key.
- Punctuation: Commas for thousands on display.
- Kinds of touch key:  $\boxed{0} \sim \boxed{9}$ ,  $\boxed{\cdot}$ ,  $\boxed{00}$ ,  $\boxed{000}$ ,  $\boxed{C}$ ,  $\boxed{CE}$ ,  $\boxed{C/CE}$ ,  $\boxed{+/-}$ ,  $\boxed{\#/P}$ ,  $\boxed{\text{Feed}}$ ,  
 $\boxed{+}$ ,  $\boxed{-}$ ,  $\boxed{\diamond}$ ,  $\boxed{*}$ ,  $\boxed{\times}$ ,  $\boxed{\div}$ ,  $\boxed{=}$ ,  $\boxed{\%}$ ,  $\boxed{MU/D}$ ,  $\boxed{M+}$ ,  $\boxed{M-}$ ,  $\boxed{M\diamond}$ ,  
 $\boxed{M*}$ ,  $\boxed{\Delta\%}$ ,  $\boxed{M\diamond}$ ,  $\boxed{IC}$ ,  $\boxed{\rightarrow}$ ,  $\boxed{ON}$ ,  $\boxed{OFF}$ ,  $\boxed{+}$ ,  $\boxed{=}$ ,  $\boxed{GT}$

- Kinds of lock key: “PRINT” 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”, “AM”.  
                           “IC+”, “IC±” item counter mode selectable switch.  
                           “GT” grand total memory selectable switch.
- Duty of display: Duty = 1/14.9
- Leading zero suppression
- Trailing zero suppression

## Electrical Features

- P-MOS output buffer with pull down resistor for direct driving of fluorescent display tube.
- Oscillator/clock generator internal to chip.
- Key board encoding internal to chip.
- Dual in line package.

## Protection

- (1) Double depression of keys will be scan of fast key.
- (2) In the overflow condition, all key except “C”, “CE”, “Feed”, “ON”, “OFF”, “→” key are inoperative.
- (3) Key bouncing protection (at 4 MHz clock)  
           Key read in: 15 ms  
           Key off: 40 ms

## Function Select

- (1) “TMR” selectable with auto power off mode  
     OFF..... Auto power off mode
- (2) “10/12” selectable with auto power off mode  
     ON..... 10 digit calculated  
     OFF..... 12 digit calculated
- (3) “B/R” Selectable with printer heads  
     ON..... M-42V (1 color)  
     OFF..... M-42TV (2 color)

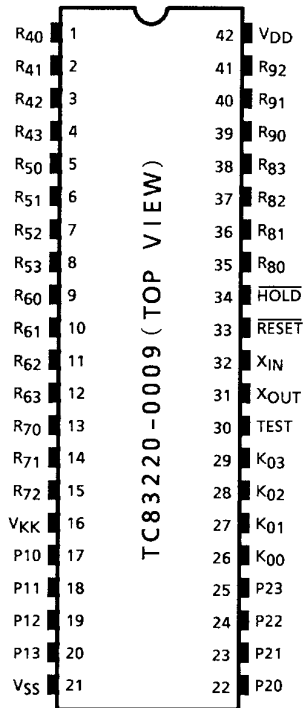
## Speed of Calculation (at 4 MHz clock)

- |                            |                      |          |
|----------------------------|----------------------|----------|
| (1) Addition               | 1 + 1 +              | 31.2 ms  |
| (2) Multiplication         | 1 × 999999999999 =   | 26.8 ms  |
| (3) Division               | 999999999999 ÷ 1 =   | 100.6 ms |
| (4) Memory calculation     | 999999999999 ÷ 1 M + | 108.8 ms |
| (5) Percentage calculation | 1 × 999999999999%    | 35.2 ms  |

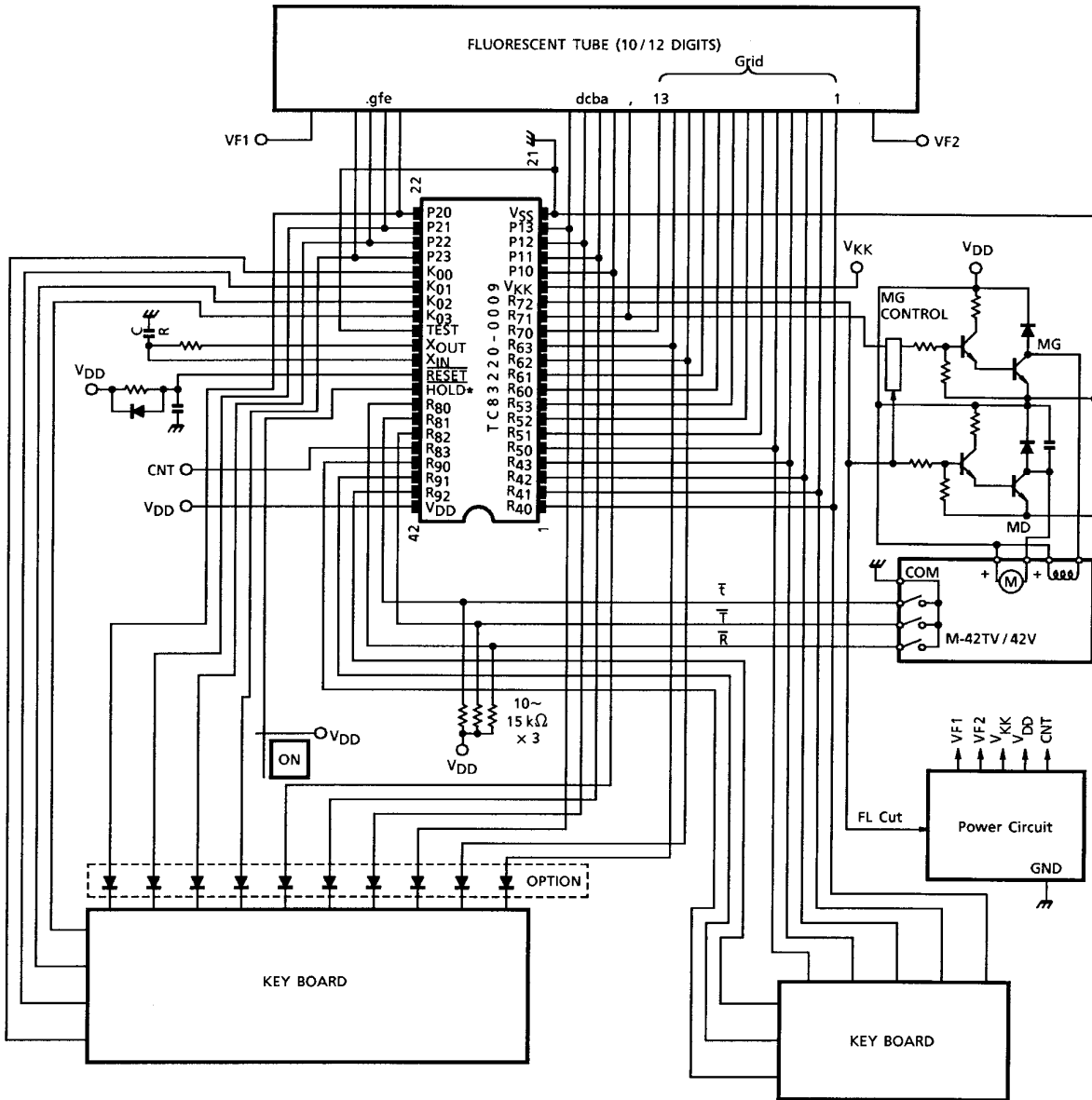
## “CNT (R83)” Function

Operation	On display..... Open
	Printing..... Open
	Off (hold) mode..... V <sub>DD</sub> Level

**Pin Assignment (top view)**

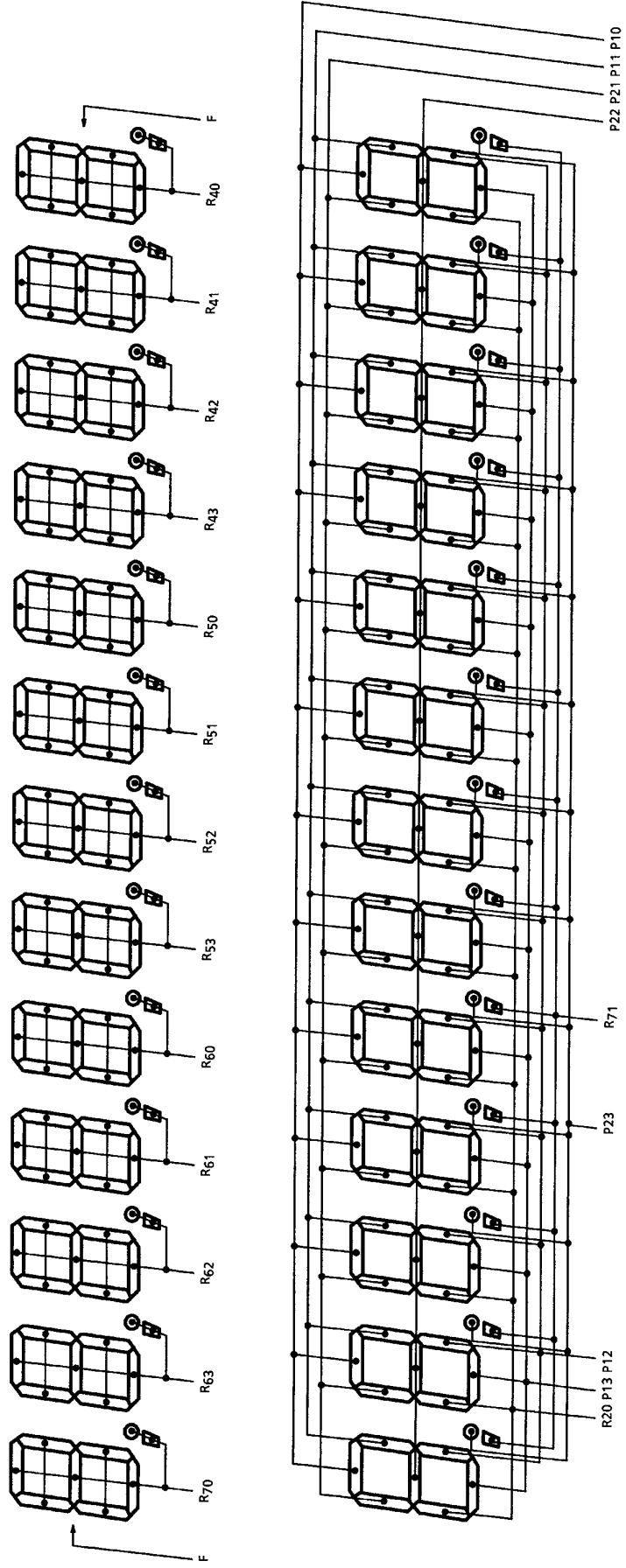


## System Diagram



C = 100 pF

R = 1 kΩ ± 2%

**Connection of FL**

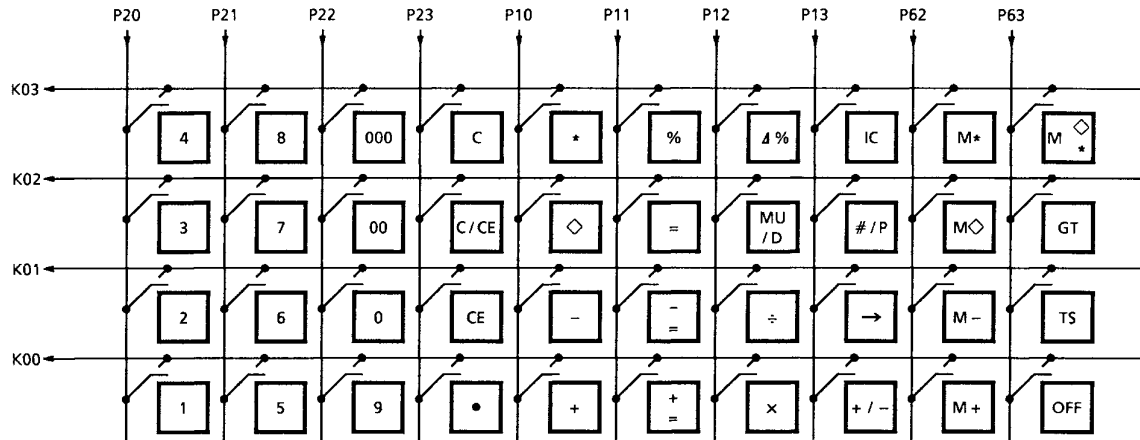
Note 1: R70 digit (P10, P13, P20) of "E" data.

Note 2: R70 digit (P22) of "-" data.

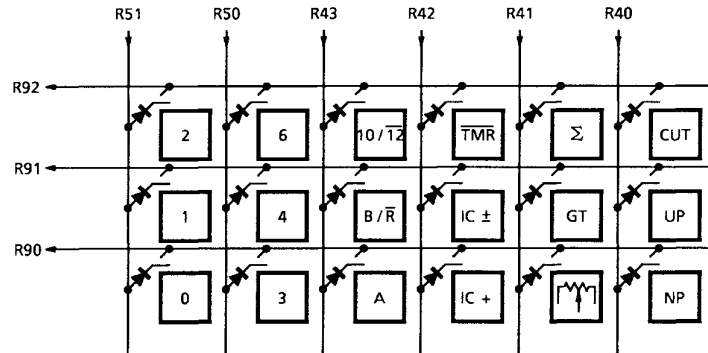
Note 3: R70 digit (P23) of "M" data.

Note 4: R70 digit (P21) of "GT" data.

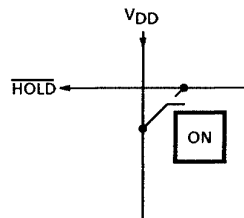
**Key Connection**



**Touch Key**



**Lock Key**





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.	G 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.	+		3.
						*	5.	G +		
							<PF>			G 5.
						3-	3.	- R	G	-3.
						4-	4.	- R	G	-4.
						5-	5.	- R	G	-5.
						*	-12.	G + R		
							<PF>		G	-12.
						GT	-7.	G ∅ R	G	-7.
						GT	-7.	G * R		
							<PF>			-7.
					OFF	M+	-7.	M + R	M	-7.
						OFF				
						ON			M	0.
							<PF>			
						M∅	-7.	M ∅ R	M	-7.
						M*	-7.	M * R		

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



Key						Touch	Print		Display
TAB	4/5	IC	10/12	Σ	GT				
F	4/5	OFF	10	Σ	OFF		<PF>		-7.
						#/P	-7.	R	-7.
						2 #/P	#2 .....		2.
						#/P	2.		2.
						0+	0. ÷		0.
						=	.....		
							0. *		
							<PF>		E 0.
						C	0. C		
							<PF>		0.

Note 7: <PF> .....Paper feed

**Maximum Ratings (V<sub>SS</sub> = 0 V)**

Characteristics	Symbol	Rating	Unit
Supply voltage 1	V <sub>DD</sub>	-0.5~7	V
Supply voltage 2	V <sub>KK</sub>	-40~+0.5	V
Input voltage	V <sub>IN</sub>	-35~V <sub>DD</sub> + 0.5	V
Output voltage	V <sub>OUT</sub>	-35~V <sub>DD</sub> + 0.5	V
Output current	I <sub>OUT</sub>	-10	mA
Power dissipation (T <sub>opr</sub> = 70° C)	P <sub>D</sub>	600	mW
Soldering temperature, time	T <sub>slid</sub>	260 (10 s)	°C
Storage temperature	T <sub>stg</sub>	-55~125	°C
Operating temperature	T <sub>opr</sub>	0~40	°C

**Recommended Operating Conditions (V<sub>SS</sub> = 0 V)**

Characteristics	Symbol	Test Circuit	Test Condition	Min	Max	Unit
Operating temperature	T <sub>opr</sub>	—	—	0	40	°C
Supply voltage	V <sub>DD</sub>	—	—	4.5	6	V
Supply voltage (FL)	V <sub>KK</sub>	—	—	-30	-15	V
Supply voltage (hold)	V <sub>DDH</sub>	—	—	2	6	V
Input high voltage (except schmitt circuit input)	V <sub>IH1</sub>	—	V <sub>DD</sub> ≥ 4.5 V	V <sub>DD</sub> × 0.7	V <sub>DD</sub>	V
Input high voltage (schmitt circuit input)	V <sub>IH2</sub>	—		V <sub>DD</sub> × 0.75	V <sub>DD</sub>	V
Input high voltage	V <sub>IH3</sub>	—	V <sub>DD</sub> < 4.5 V	V <sub>DD</sub> × 0.9	V <sub>DD</sub>	V
Input low voltage (except schmitt circuit input)	V <sub>IL1</sub>	—	V <sub>DD</sub> ≥ 4.5 V	V <sub>KK</sub>	V <sub>DD</sub> × 0.3	V
Input low voltage (schmitt circuit input)	V <sub>IL2</sub>	—		V <sub>KK</sub>	V <sub>DD</sub> × 0.25	V
Input low voltage	V <sub>IL3</sub>	—	V <sub>DD</sub> < 4.5 V	V <sub>KK</sub>	V <sub>DD</sub> × 0.1	V
Output voltage (source open drain)	V <sub>OUT</sub>	—	—	V <sub>DD</sub> - 35	V <sub>DD</sub>	V
Clock high pulse width (Note 5)	T <sub>WCH</sub>	—	V <sub>IN</sub> = V <sub>IH</sub>	80	—	ns
Clock low pulse width (Note 5)	T <sub>WCL</sub>	—	V <sub>IN</sub> = V <sub>IL</sub>	80	—	ns

Note 5: In case of the external clock operation.

## Electrical Characteristics

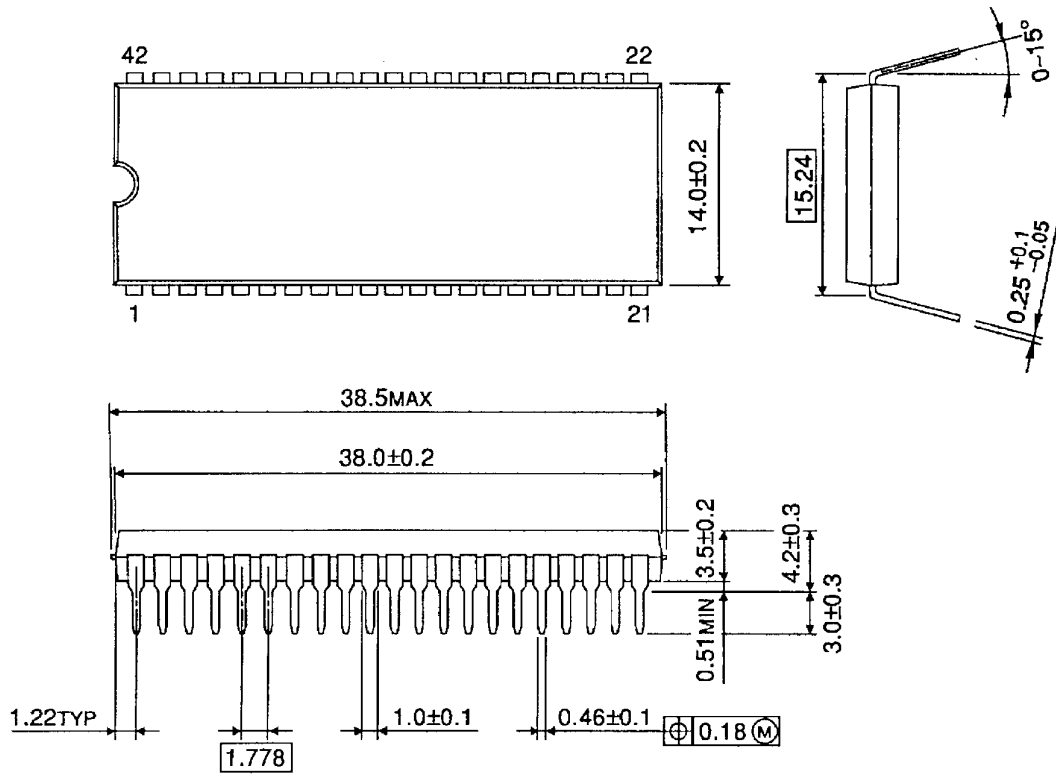
### DC Characteristics ( $V_{SS} = 0\text{ V}$ , $V_{DD} \pm 10\%$ , $T_{opr} = 0\sim 40^\circ\text{C}$ )

Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Hysteresis voltage (schmitt circuit input)	$V_{HS}$	—	—	—	0.7	—	V
Input current ( $\overline{\text{RESET}}$ , $\overline{\text{HOLD}}$ , $\overline{\text{TEST}}$ )	$I_{IN}$	—	$V_{DD} = 5.5\text{ V}$ , $V_{IN} = 5.5/0\text{ V}$	—	—	$\pm 50$	$\mu\text{A}$
Output leak current (source open drain)	$I_{LO}$	—	$V_{DD} = 5.5\text{ V}$ , $V_{OUT} = -32\text{ V}$	—	—	-10	$\mu\text{A}$
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 $\Omega$
Pull down resistor (source open drain)	$R_{KK}$	—		50	80	200	k $\Omega$
Operating supply current	$I_{DD0}$	—	$V_{DD}$ ( $V_{DDH}$ ) $5.5\text{ V}$ , $f_c = 4\text{ MHz}$ , $V_{IN} = 5.3/0.2\text{ V}$	—	3	6	mA
Supply current (after clear)	$I_{KK1}$	—	$V_{KK} = -30\text{ V}$ , $f_c = 4\text{ MHz}$	—	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	$\mu\text{A}$
Oscillating frequency	$F_\phi$	—	$V_{DD} = 5.0\text{ V}$ , $C = 100\text{ pF}$ $R = 1\text{ k}\Omega \pm 2\%$	2.4	4.0	5.6	MHz

## Package Dimensions

SDIP42-P-600-1.78

Unit : mm



Weight: 4.12 g (typ.)

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000707EBA

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