

TC83220-0009

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

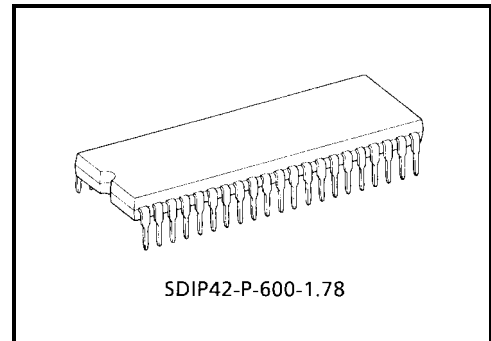
The TOSHIBA printing/display calculator circuit TC83220-0009 is 10/12-digit calculator on a single-chip CMOS LSI.

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.

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}



Weight: 4.12 g (typ.)

- 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)

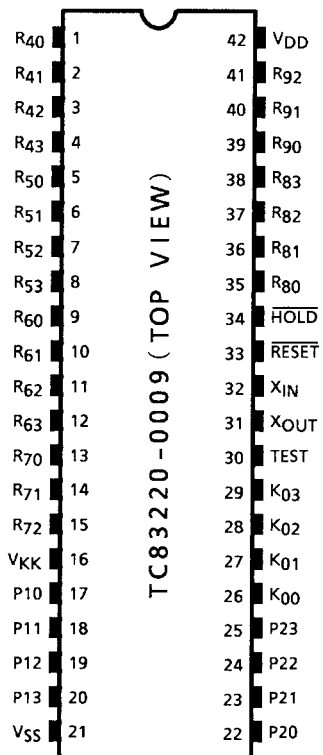
Speed of Calculation (at 4 MHz clock)

- | | | |
|----------------------------|----------------------|----------|
| (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 |

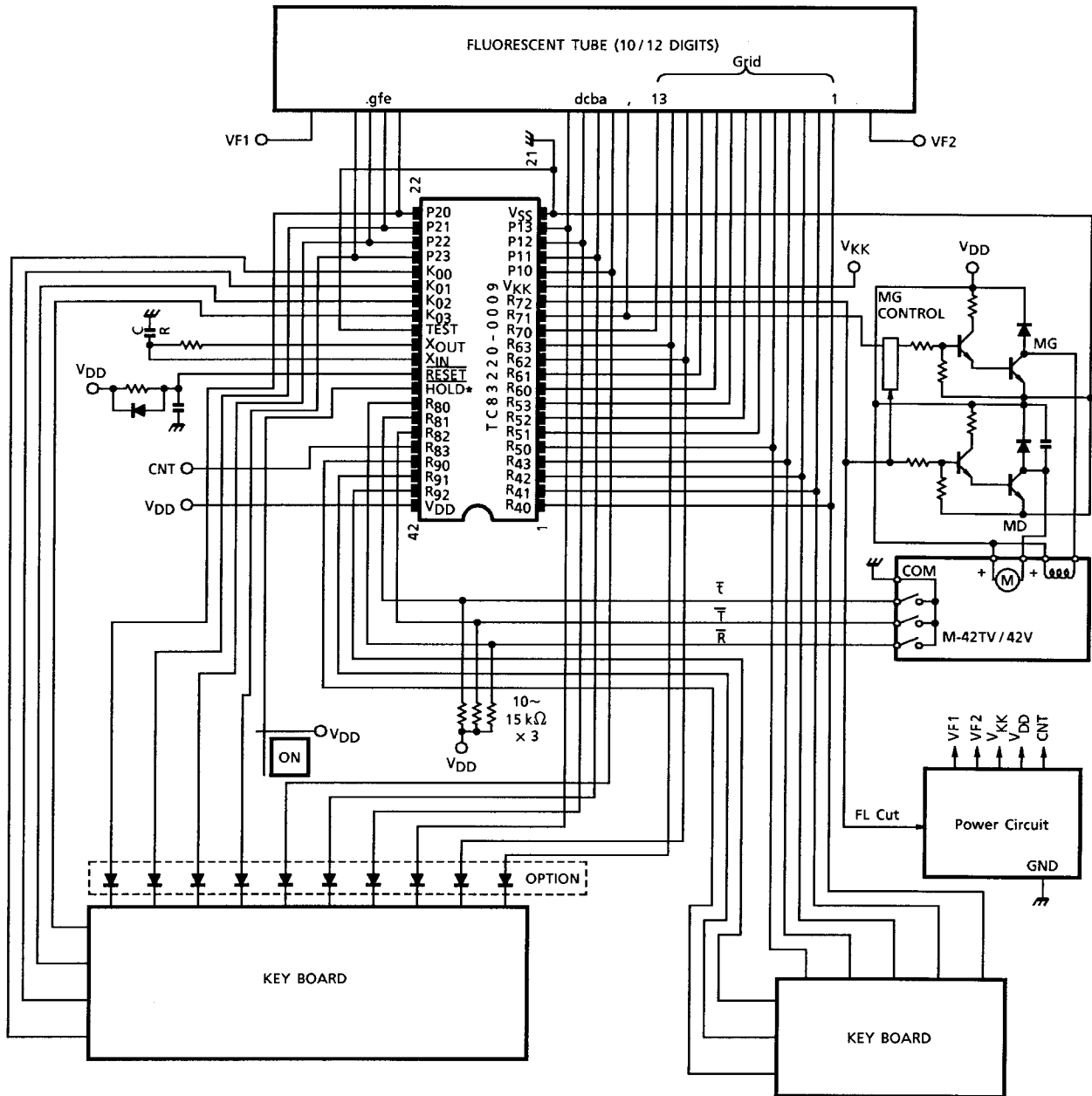
“CNT (R83)” Function

Operation	On display.....Open
	Printing..... Open
	Off (hold) mode..... VDD Level

Pin Assignment (top view)

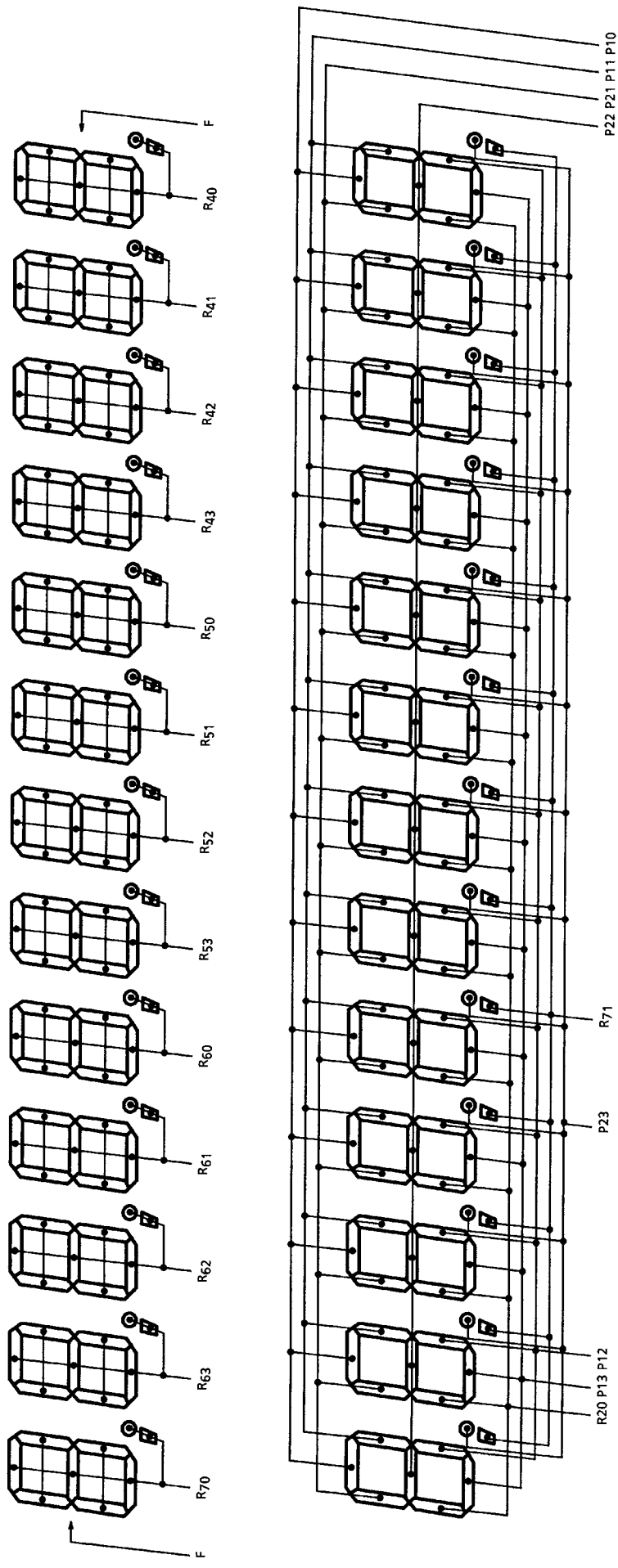


System Diagram



C = 100 pF

R = 1 kΩ ± 2%

Connection of FL

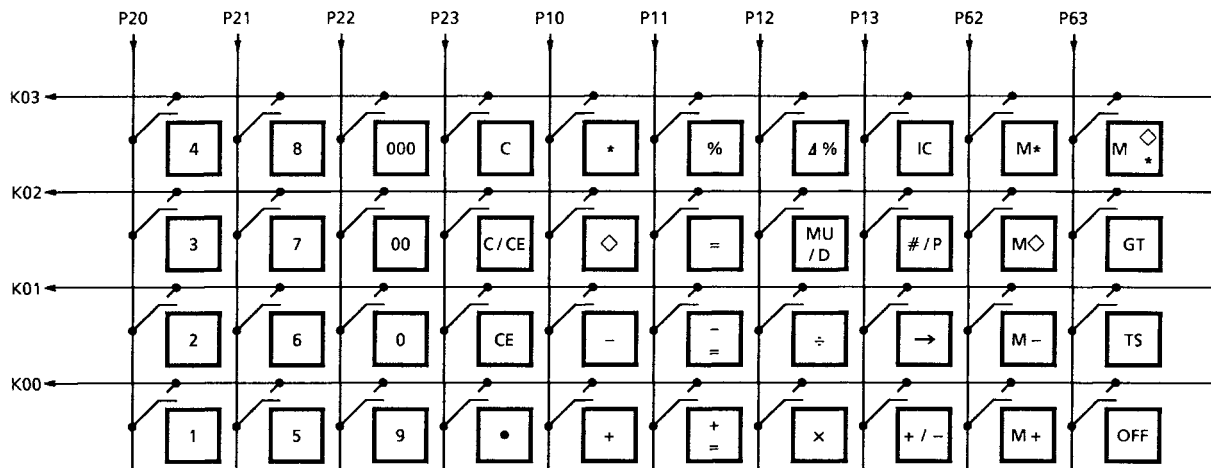
Note 1: R70 digit (P10, P13, P20) of "E" data.

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

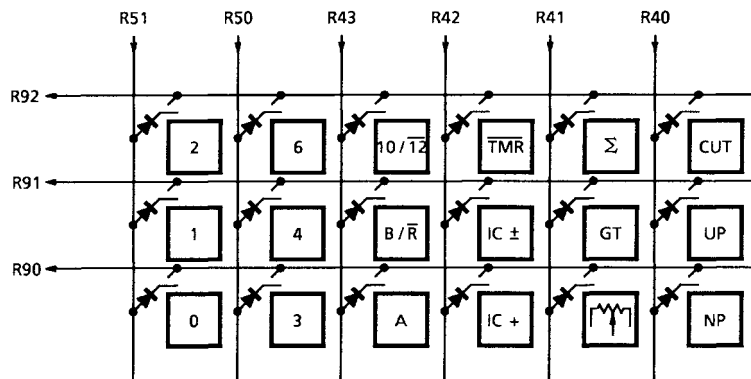
Note 3: R70 digit (P23) of "M" data.

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

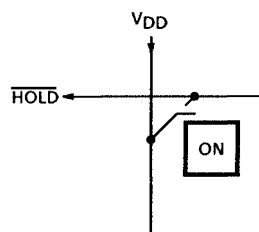
Key Connection



Touch Key



Lock Key



Operation Example

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

Note 5: <PF>Paper feed

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	+ %		5.3
							<PF>			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 ($V_{SS} = 0\text{ V}$)

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 5)	T_{WCH}	—	$V_{IN} = V_{IH}$	80	—	ns
Clock low pulse width (Note 5)	T_{WCL}	—	$V_{IN} = V_{IL}$	80	—	ns

Note 5: In case of the external clock operation.

Electrical Characteristics

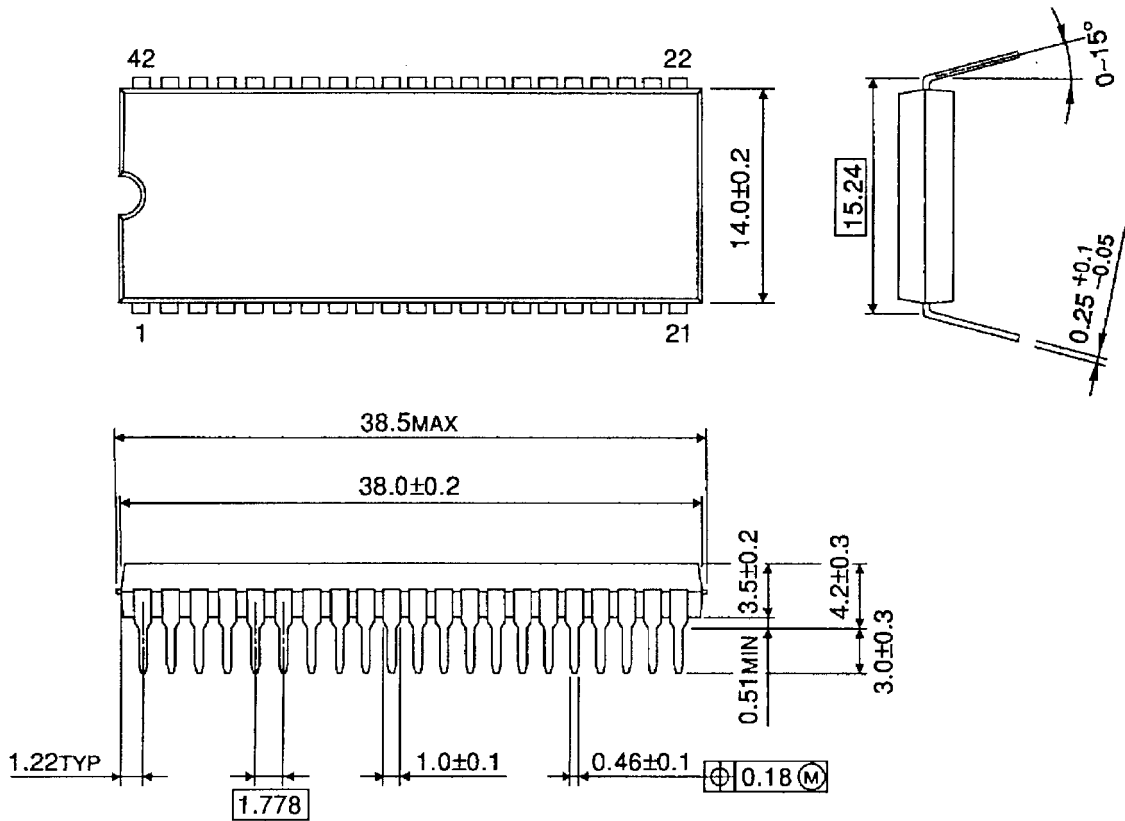
DC Characteristics ($V_{SS} = 0\text{ V}$, $V_{DD} \pm 10\%$, $T_{opr} = 0\sim 40^\circ\text{C}$)

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}	—	$V_{DD} = 5.5\text{ V}$, $V_{IN} = 5.5/0\text{ V}$	—	—	± 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 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
Oscillating frequency	F_ϕ	—	$V_{DD} = 5.0\text{ V}$, $C = 100\text{ pF}$ $R = 1\text{ k}\Omega \pm 2\%$	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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