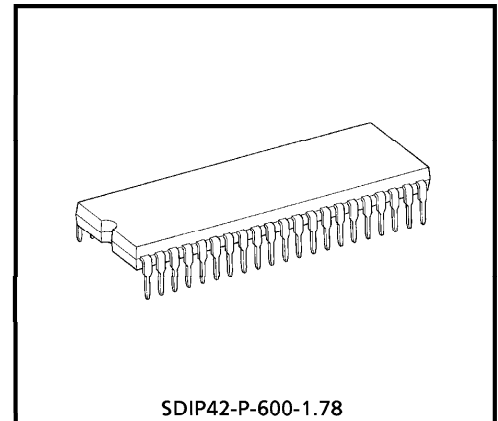


TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

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.



SDIP42-P-600-1.78

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.

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- 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 = $\frac{1}{14.9}$
- 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

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

Function Select

- i) "TMR" Selectable with auto power off mode
 - OFF ... Auto power off mode
- ii) "10/12" Selectable with auto power off mode
 - ON 10 digit calculated
 - OFF ... 12 digit calculated
- iii) "B/R" Selectable with printer heads
 - ON M-42V (1 COLOR)
 - OFF ... M-42TV (2 COLOR)

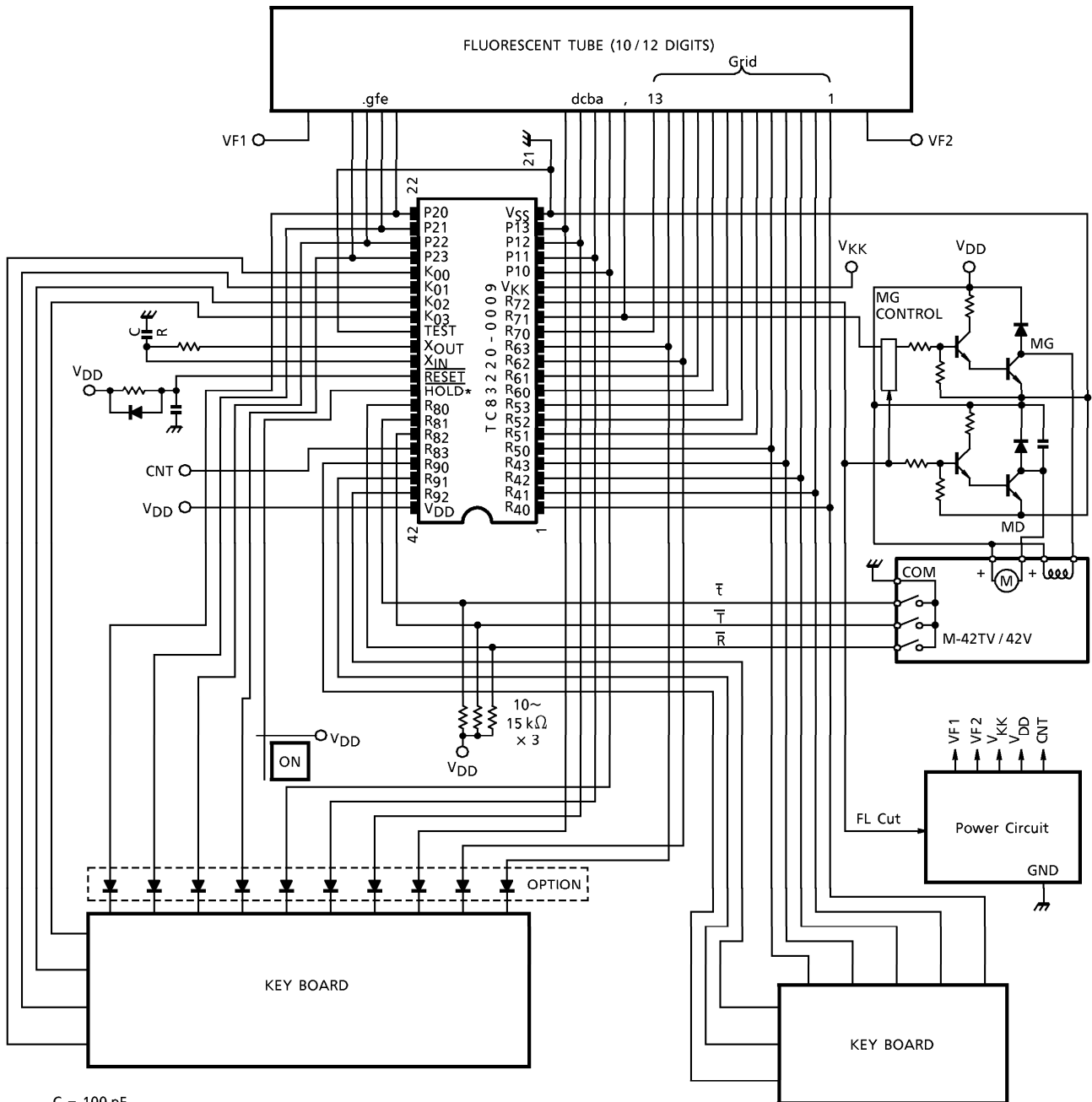
Speed of Calculation (at 4 MHz clock)

- i) Addition 1 + 1 + 31.2 ms
- ii) Multiplication 1 × 99999999999 = 26.8 ms
- iii) Division 99999999999 ÷ 1 = 100.6 ms
- iv) Memory calculation 99999999999 ÷ 1 M + 108.8 ms
- v) Percentage calculation 1 × 99999999999% 35.2 ms

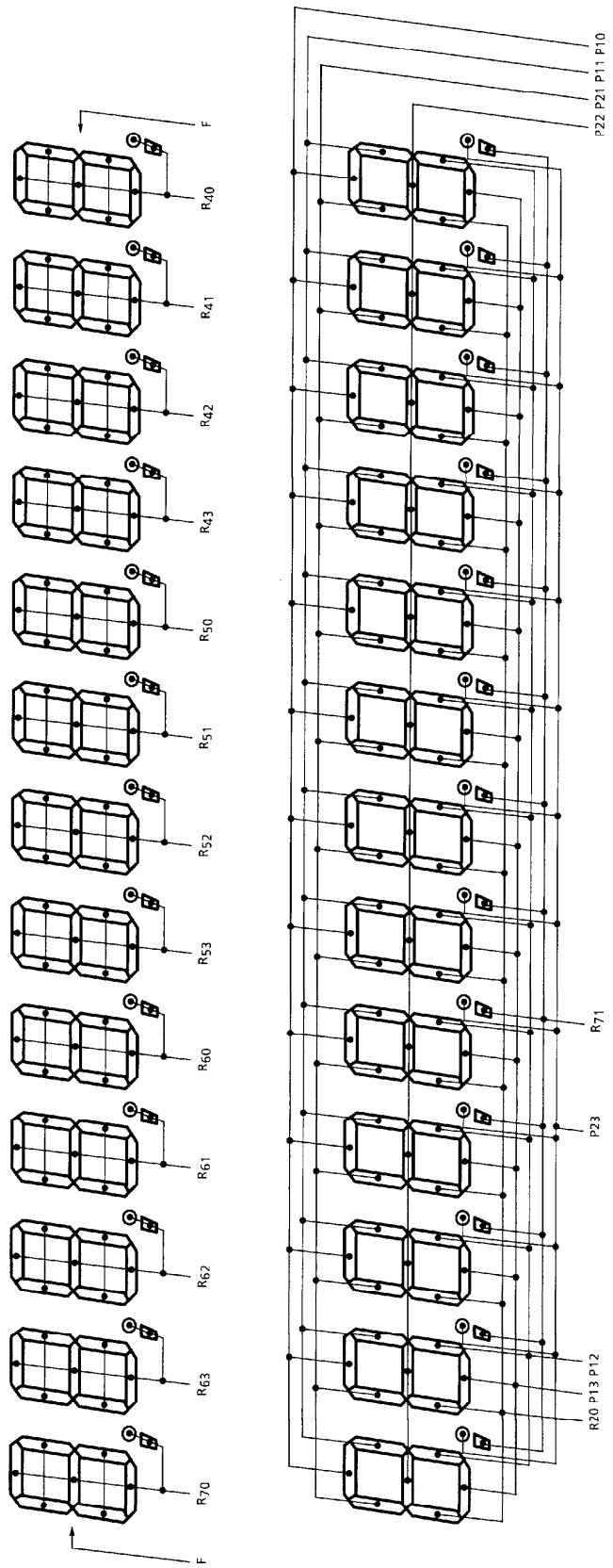
"CNT (R83)" Function

Operation On display } Open
 Printing }
 Off (hold) mode ... V_{DD} Level

SYSTEM DIAGRAM



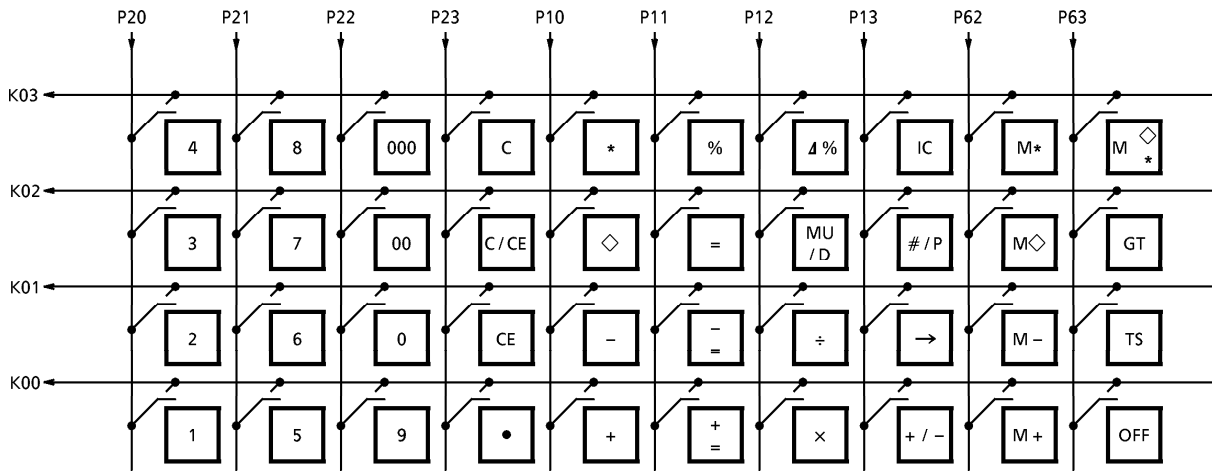
C = 100 pF
 R = 1 kΩ ± 2%



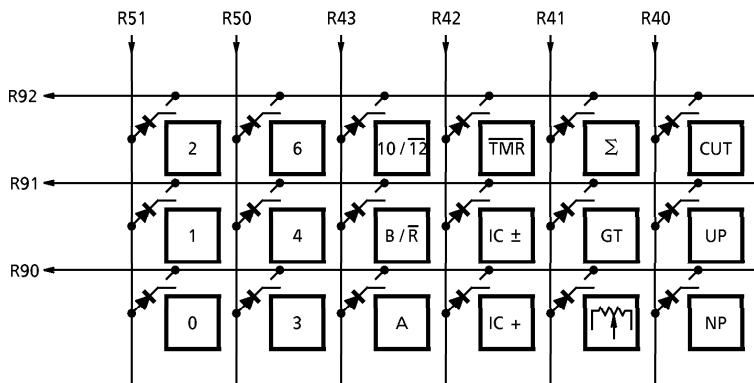
- (Note 1) : R70 digit (P10, P13, P20) of "E" Data.
- (Note 2) : R70 digit (P22) of "-" Data.
- (Note 3) : R70 digit (P23) of "M" Data.
- (Note 4) : R70 digit (P21) of "GT" Data.

TC83220-0009-05

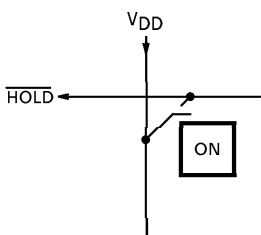
KEY CONNECTION



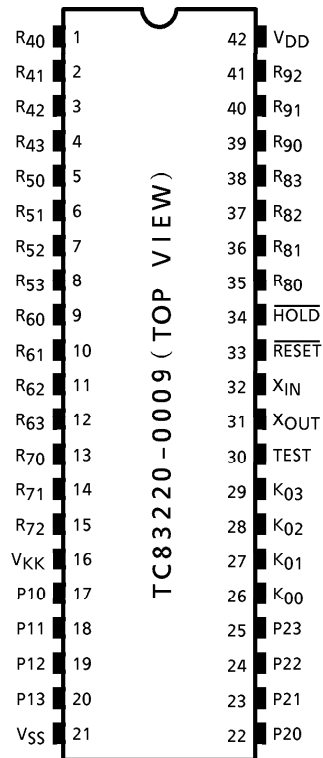
Touch Key



Lock Key



PIN CONNECTION (TOP VIEW)



OPERATION EXAMPLE

KEY		PRINT	DISPLAY
TAB 4/5 IC 10/12 Σ GT	TOUCH		
F 4/5 OFF 10 OFF OFF	<ACL>	<PF>	
		C	0.
	1 +	<PF>	1.
	2 -	1. +	-1.
	◇	2. -	-1.
	*	-1. ◇	-1.
		-1. *	
	IC	<PF>	-1.
IC +	1 +	2.	2.
	2 -	1. +	1.
	◇	2. -	-1.
	*	002	
		-1. ◇	-1.
		-1. *	
	IC	<PF>	-1.
OFF	3 ×	2.	2.
	4 ÷	3. ×	3.
	=	4. ÷	12.
		4. =	
		3. *	
	5 ×	<PF>	3.
	6%	5. ×	5.
		6. %	
		0.3 *	
	+	<PF>	0.3
		5.3 + %	
	2 ÷	<PF>	5.3
	3%	2. ÷	2.
		3. %	
		66.66666666 *	66.66666666
	2 MU/D	<PF>	2.
	3 =	2. G M	
		3. %	
		0.06185567 Δ *	
		2.06185567 *	
	2 Δ%	<PF>	2.06185567
	3 =	2. Δ	2.
		3. =	
		1. Δ *	
		50. Δ %	50.
		<PF>	

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.	G 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 ◇		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		

KEY						PRINT		DISPLAY
TAB	4/5	IC	10/12	Σ	GT	TOUCH		
F	4/5	OFF	10	Σ	OFF			
						# / P	<PF>	-7.
						2 # / P	-7.	-7.
						# / P	#2	2.
						0 ÷	2.	2.
						=	0. ÷	0.
							0.
							0.	*
							<PF>	E 0.
						C	0. C	0.
							<PF>	

MAXIMUM RATINGS ($V_{SS} = 0\text{ V}$)

CHARACTERISTIC	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 ($V_{SS} = 0\text{ V}$)

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	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	
Supply Voltage (Hold)	V_{DDH}	—	—	2	6	
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}	
Input High Voltage	V_{IH3}	—	$V_{DD} < 4.5\text{ V}$	$V_{DD} \times 0.9$	V_{DD}	
Input Low Voltage (Except Schmitt circuit input)	V_{IL1}	—	$V_{DD} \geq 4.5\text{ V}$	V_{KK}	$V_{DD} \times 0.3$	
Input Low Voltage (Schmitt circuit input)	V_{IL2}	—		V_{KK}	$V_{DD} \times 0.25$	
Input Low Voltage	V_{IL3}	—	$V_{DD} < 4.5\text{ V}$	V_{KK}	$V_{DD} \times 0.1$	
Output Voltage (Source open drain)	V_{OUT}	—	—	$V_{DD} - 35$	V_{DD}	V
Clock High Pulse Width (Note 1)	T_{WCH}	—	$V_{IN} = V_{IH}$	80	—	ns
Clock Low Pulse Width (Note 1)	T_{WCL}	—	$V_{IN} = V_{IL}$	80	—	

(Note 1) : In case of the external clock operation.

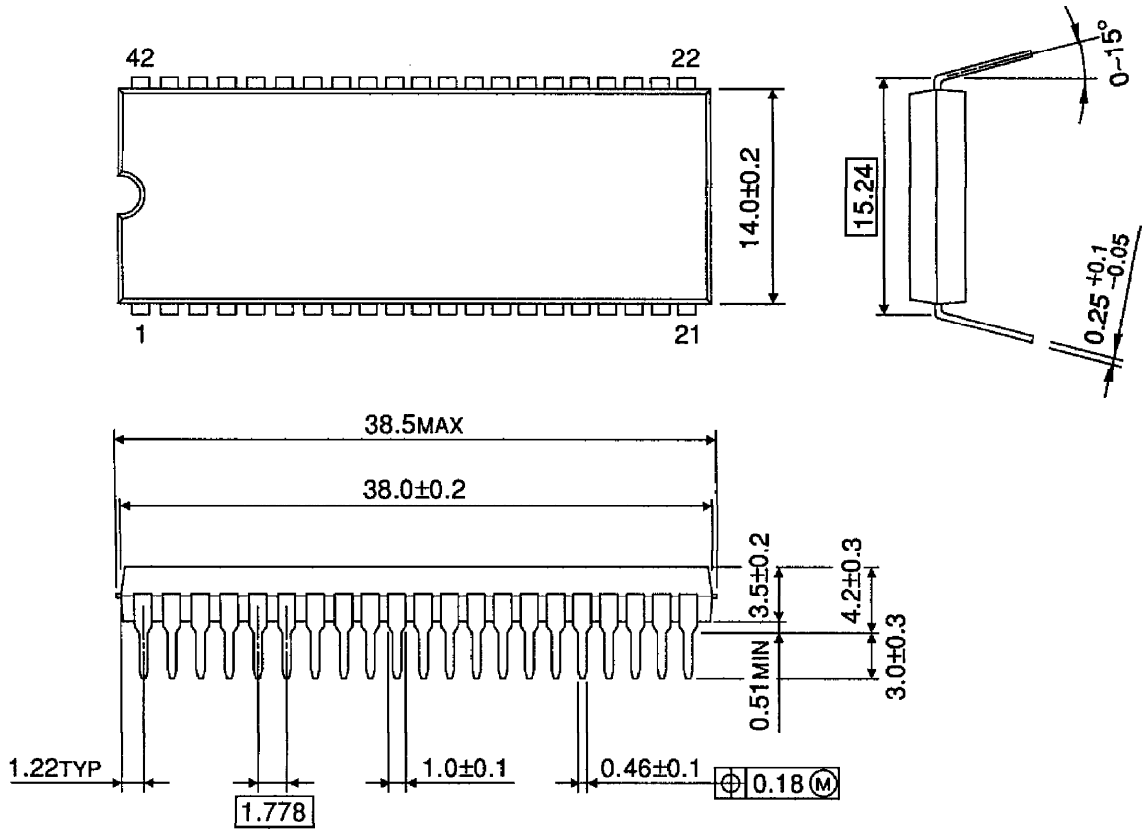
ELECTRICAL CHARACTERISTICS

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

PARAMETER	SYMBOL	TEST CIR-CUIT	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	
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	
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.)