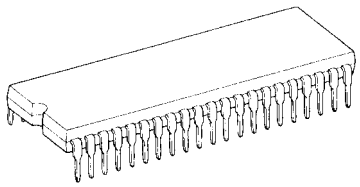
TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

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.
- Item counter: 0~999 count up or −999~0~999 count up/down by depressing of [+], [−], [+/=], [−/=] key.
- Punctuation: Commas for thousands on display.
- Kinds of touch key: [0]~[9], [·], [00], [000], [C], [CE], [C/CE], [+/−], [#/P], [Feed], [+], [−], [◇], [*], [×], [÷], [=], [%], [MU/D], [M+], [M−], [M◇], [M*], [Δ%], [M◇*], [IC], [→], [ON], [OFF], [+/=], [−/=], [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) "$\overline{\text{TMR}}$" 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)

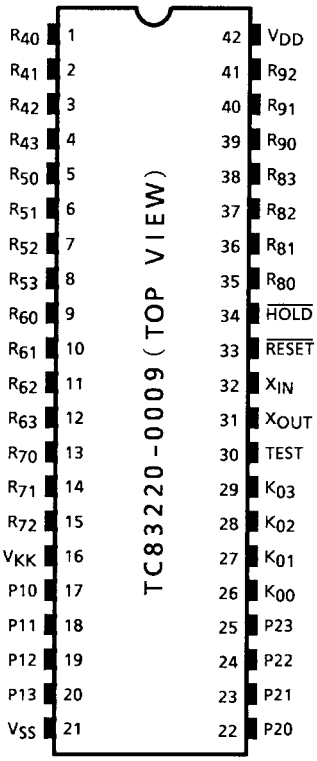
Speed of Calculation (at 4 MHz clock)

(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

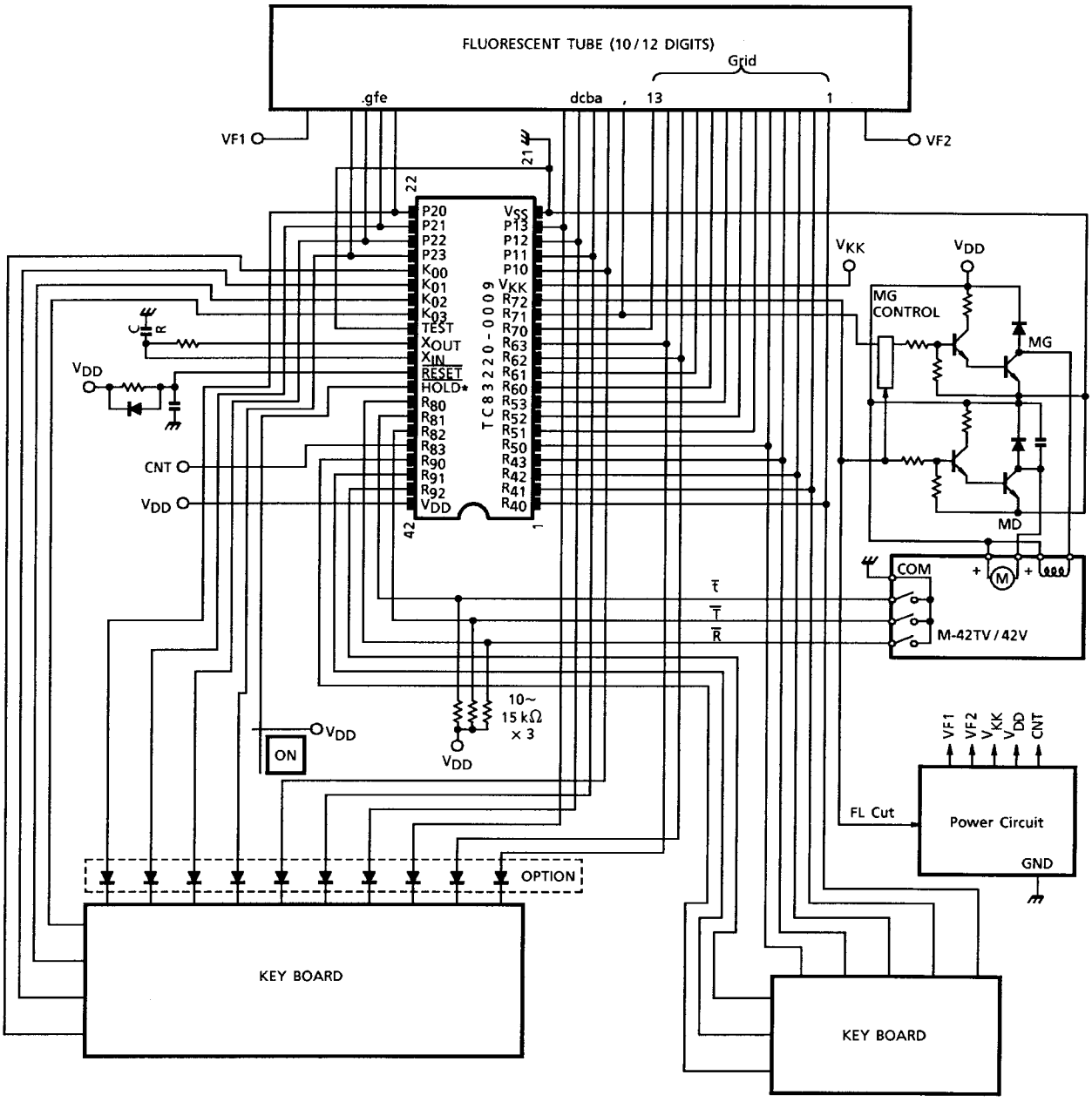
"CNT (R83)" Function

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

Pin Assignment (top view)



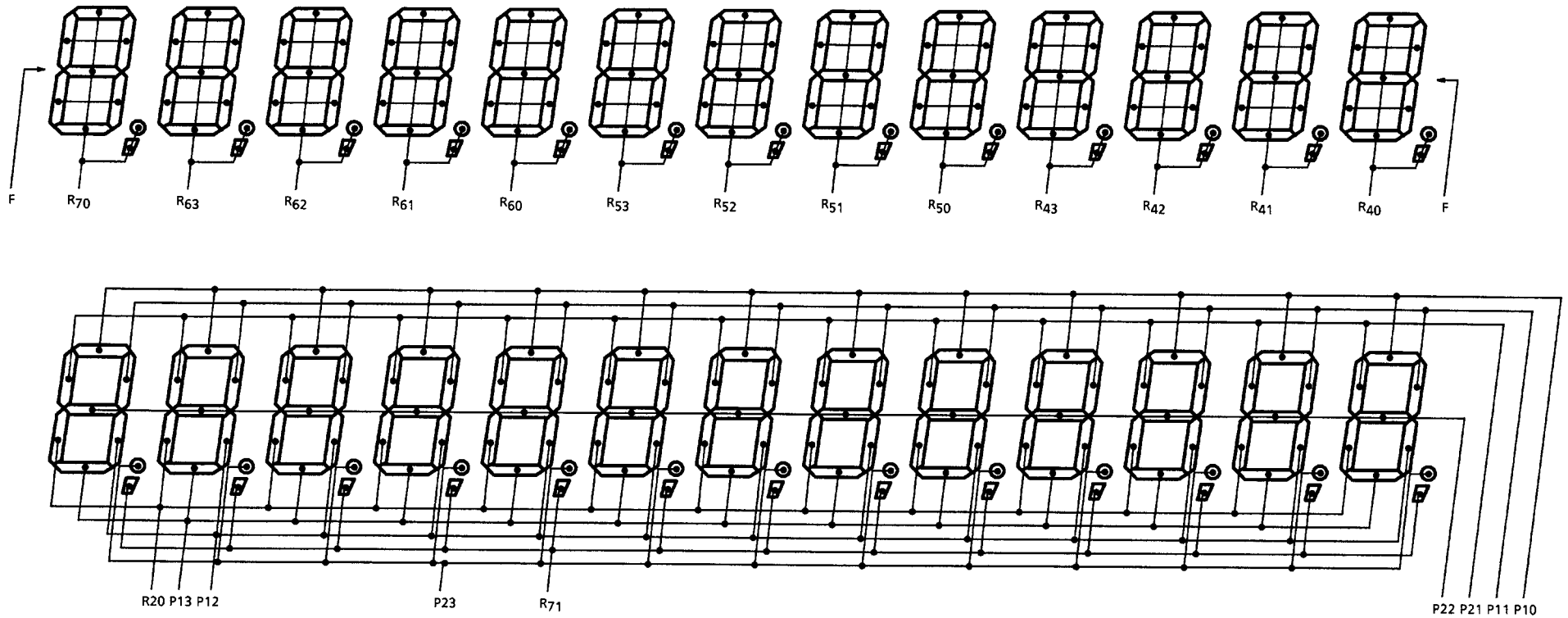
System Diagram



C = 100 pF

R = 1 kΩ ± 2%

Connection of FL



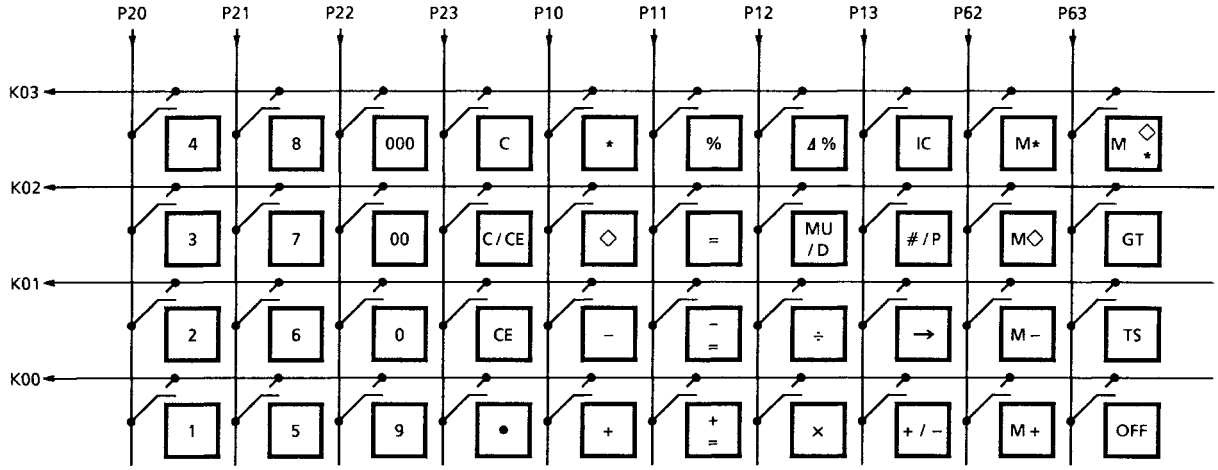
Note 1: R_{70} digit (P10, P13, P20) of “E” data.

Note 2: R_{70} digit (P22) of “–” data.

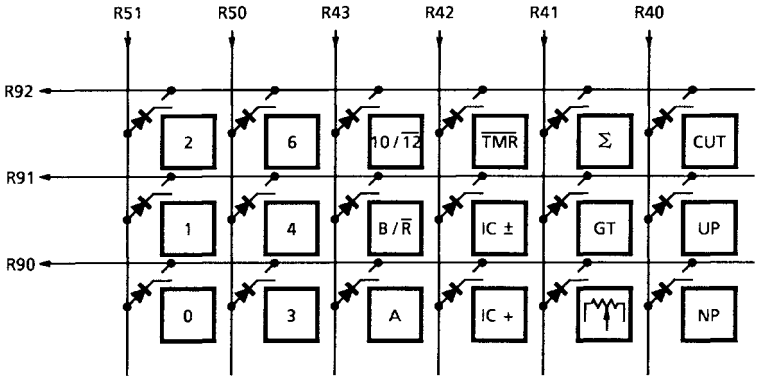
Note 3: R_{70} digit (P23) of “M” data.

Note 4: R_{70} digit (P21) of “GT” data.

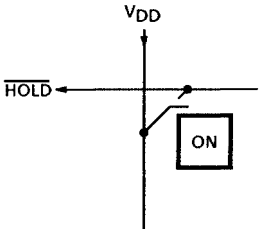
Key Connection



Touch Key



Lock Key



Operation Example

Key							Print			Display
TAB	4/5	IC	10/12	Σ	GT	Touch				
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.
		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 *		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 + %			
							<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							Print		Display
TAB	4/5	IC	10/12	Σ	GT	Touch			
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 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_{sld}	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}	—	$V_{DD} \geqq 4.5$ 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}	—	$V_{DD} < 4.5$ V	$V_{DD} \times 0.9$	V_{DD}	V
Input low voltage (except schmitt circuit input)	V_{IL1}	—	$V_{DD} \geqq 4.5$ 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}	—	$V_{DD} < 4.5$ 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.

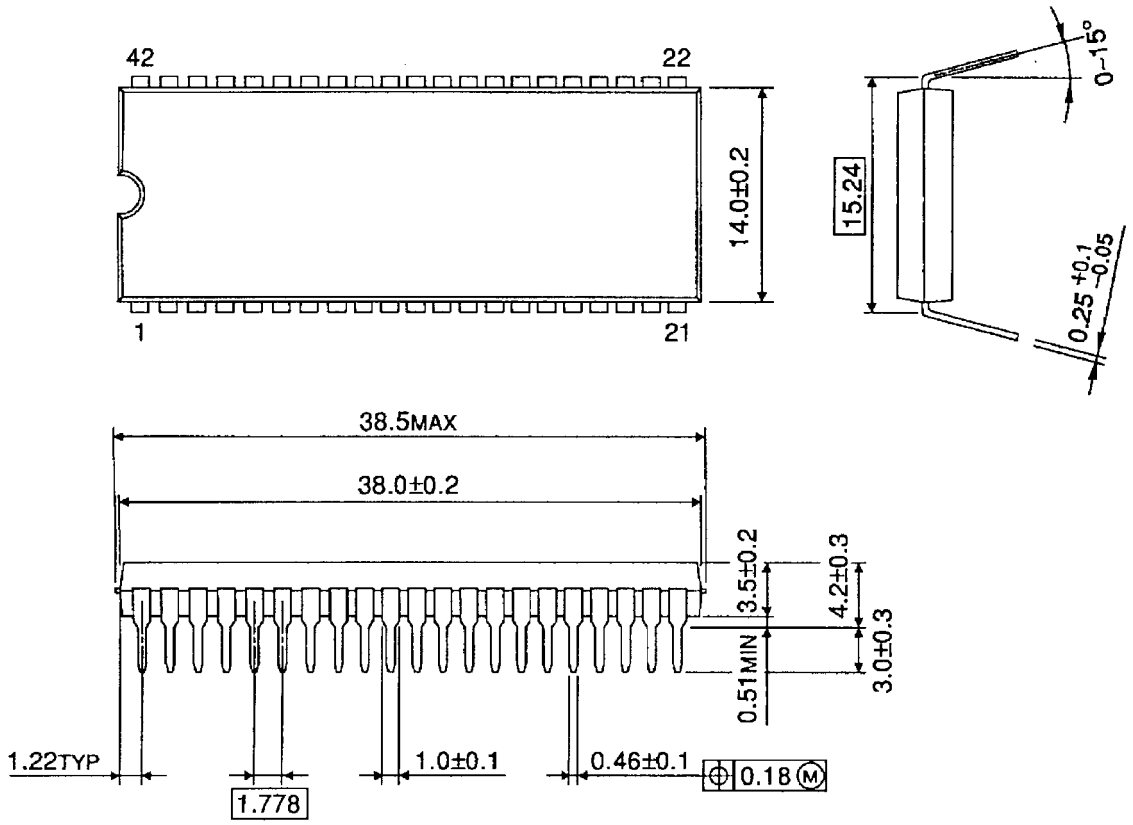
Electrical Characteristics

DC Characteristics (V_{SS} = 0 V, V_{DD} ± 10%, T_{opr} = 0~40°C)

Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Hysteresis voltage (schmitt circuit input)	V_{HS}	—	—	—	0.7	—	V
Input current ($\overline{RESET}$, $\overline{HOLD}$, $\overline{TEST}$)	I_{IN}	—	V_{DD} = 5.5 V, V_{IN} = 5.5/0 V	—	—	±50	μA
Output leak current (source open drain)	I_{LO}	—	V_{DD} = 5.5 V, V_{OUT} = −32 V	—	—	−10	μA
Output high voltage (P1~P2, R_4~R_9)	V_{OH}	—	V_{DD} = 4.5 V, I_{OH} = −6 mA	2.4	—	—	V
Input pull down resistor (K_0, R_7~R_9)	R_{IN}	—	V_{DD} = 5.5 V, V_{KK} = −30 V	—	100	—	kΩ
Pull down resistor (source open drain)	R_{KK}	—		50	80	200	kΩ
Operating supply current	I_{DD} 0	—	V_{DD} (V_{DDH}) 5.5 V, f_c = 4 MHz, V_{IN} = 5.3/0.2 V	—	3	6	mA
Supply current (after clear)	I_{KK} 1	—	V_{KK} = −30 V, f_c = 4 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 V	—	0.5	10	μA
Oscillating frequency	Fϕ	—	V_{DD} = 5.0 V, C = 100 pF R = 1 kΩ ± 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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