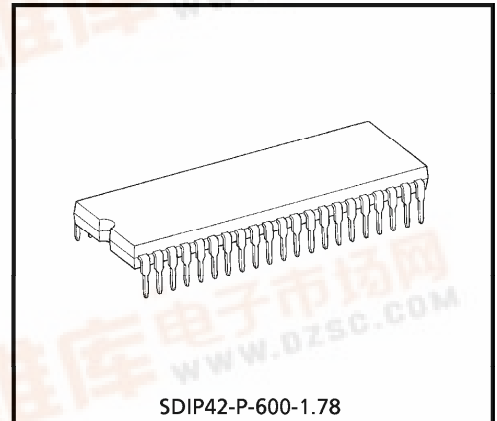


TOSHIBA**TC83220-0006**

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

TC83220-0006**TC83220-0006 SINGLE-CHIP CMOS LSI FOR FL (FLUORESCENT)
CALCULATOR**

The TOSHIBA printing / display calculator circuit TC83220-0006 is 10-digit calculator on single-chip CMOS LSI. TC83220-0006 can drive the printing machine (M-41V; 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.)
1 digit of operational symbol.**FEATURES****Operational Features**

- **Print** : 12 digits of data.
(including decimal point and minus signs.) 1 digit of operational symbol.
3 digits of commas.
- **Display** : 10 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 functions (+, -, ×, ÷).
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.
Tax calculation and grand total calculation are selectable.
Two-key rollover

980910EBA2

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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 : $\boxed{0} \sim \boxed{9}$, $\boxed{\cdot}$, $\boxed{00}$, $\boxed{000}$, $\boxed{C}$, $\boxed{CE}$, $\boxed{C/CE}$, $\boxed{+/-}$, $\boxed{\#/P}$, $\boxed{\text{Feed}}$, $\boxed{+}$, $\boxed{-}$, $\boxed{\diamond}$, $\boxed{*}$, $\boxed{\times}$, $\boxed{\div}$, $\boxed{=}$, $\boxed{\%}$, $\boxed{MU/D}$, $\boxed{M+}$, $\boxed{M-}$, $\boxed{M\diamond}$, $\boxed{M*}$, $\boxed{\Delta\%}$, $\boxed{M\diamond*}$, $\boxed{IC}$, $\boxed{\rightarrow}$, $\boxed{ON}$, $\boxed{OFF}$, $\boxed{+}$, $\boxed{-}$, $\boxed{GT}$, $\boxed{+TAX}$, $\boxed{-TAX}$, $\boxed{SHIFT}$
 - 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", "AM".
 "IC+", "IC±" Item counter mode selectable switch.
 "GT" Grand total memory selectable switch.
 - Duty of display : $\text{Duty} = \frac{1}{14.9}$
 - 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 : 15ms
 - Key off : 40ms

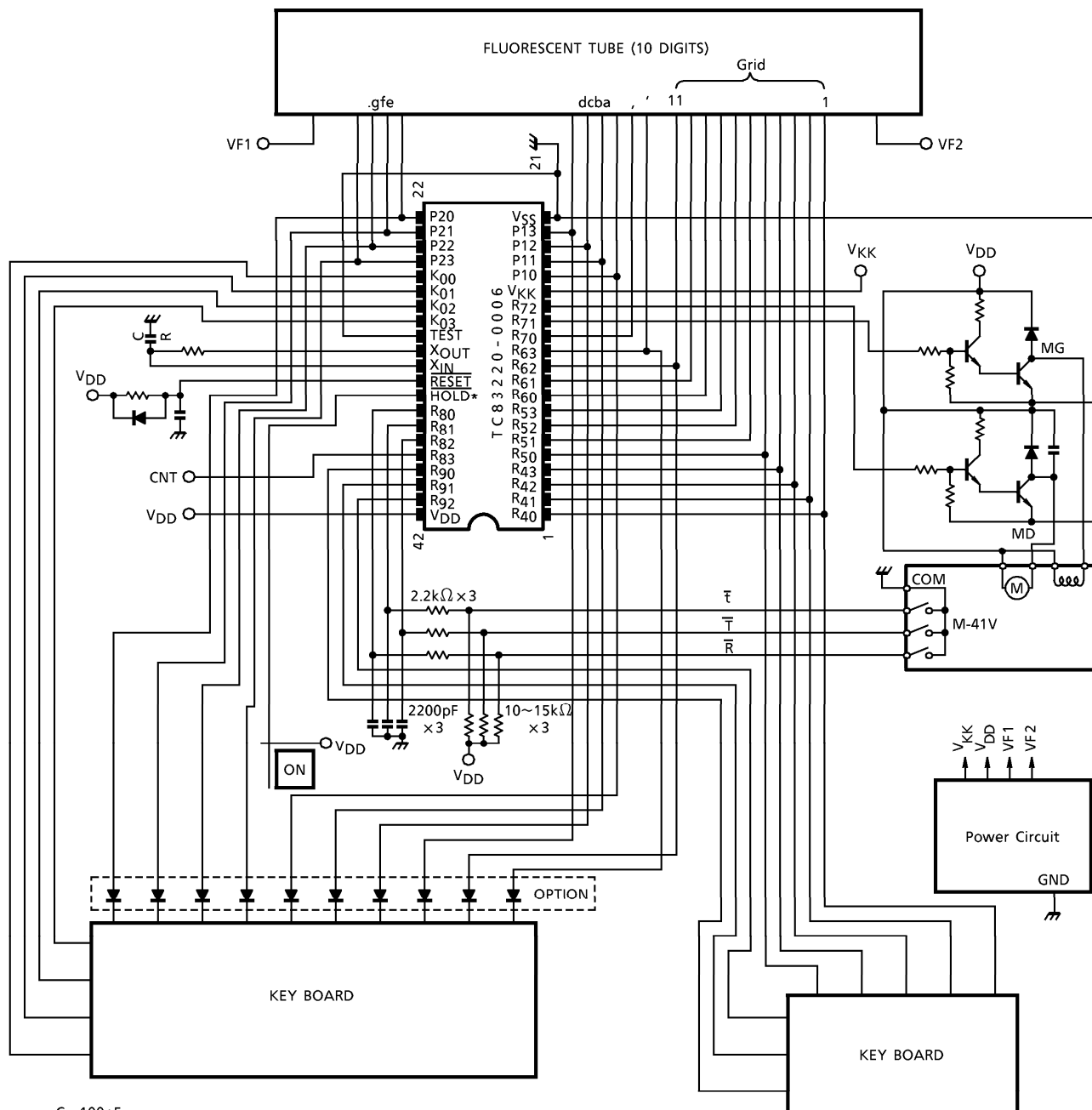
Function Select

- i) "TMR" Selectable with auto power off mode
 - OFF ... Auto power off mode
- ii) "TAX/GT" Selectable with TAX RATE function or GT Mode
 - ON TAX RATE function
 - OFF ... GT function
- iii) "COMP" Selectable with Commas Print
 - OFF ... Commas Print

Speed of Calculation

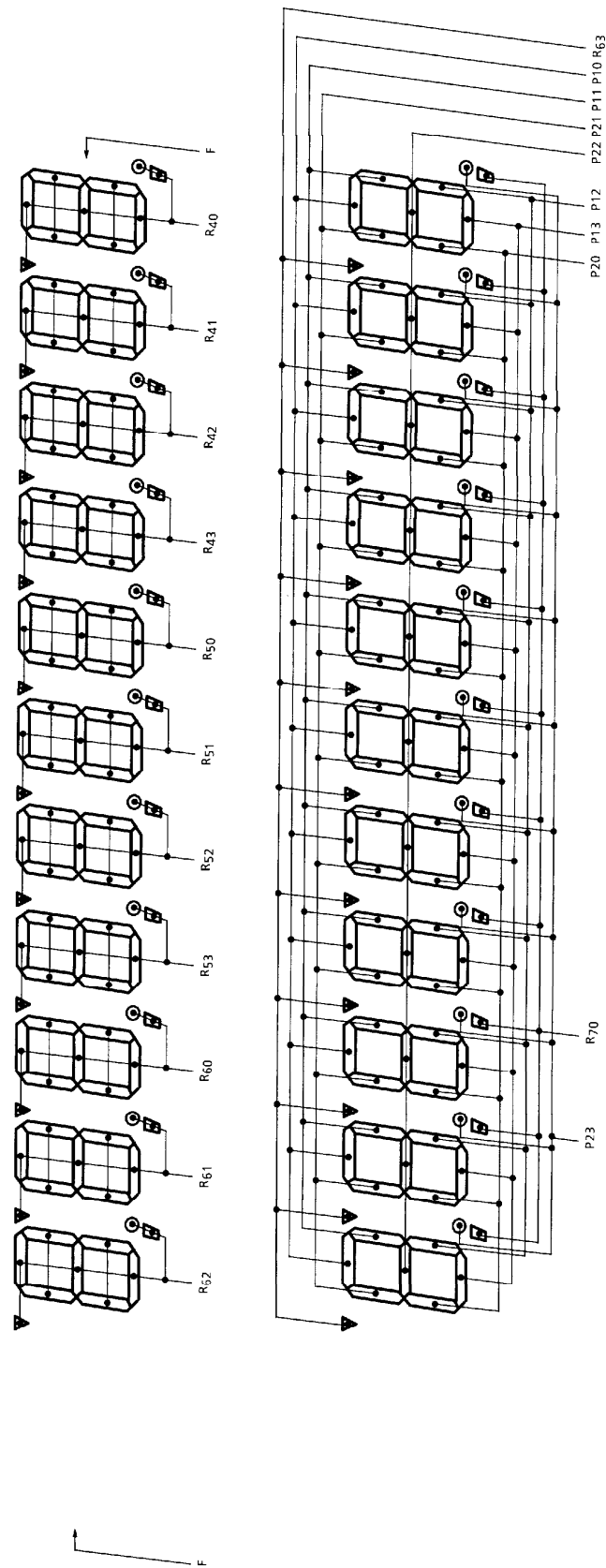
- i) Addition $1 + 1 +$ 31.2ms
- ii) Multiplication $1 \times 999999999999 =$ 26.8ms
- iii) Division $999999999999 \div 1 =$ 100.6ms
- iv) Memory calculation $999999999999 \div 1M +$ 108.8ms
- v) Percentage calculation $1 \times 999999999999\%$ 35.2ms

SYSTEM DIAGRAM



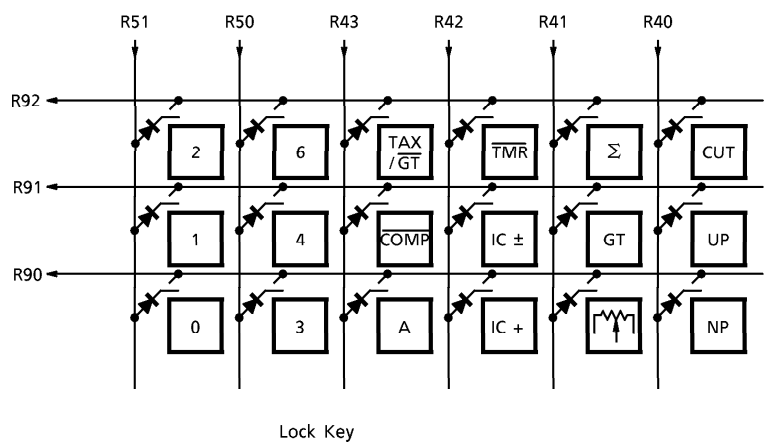
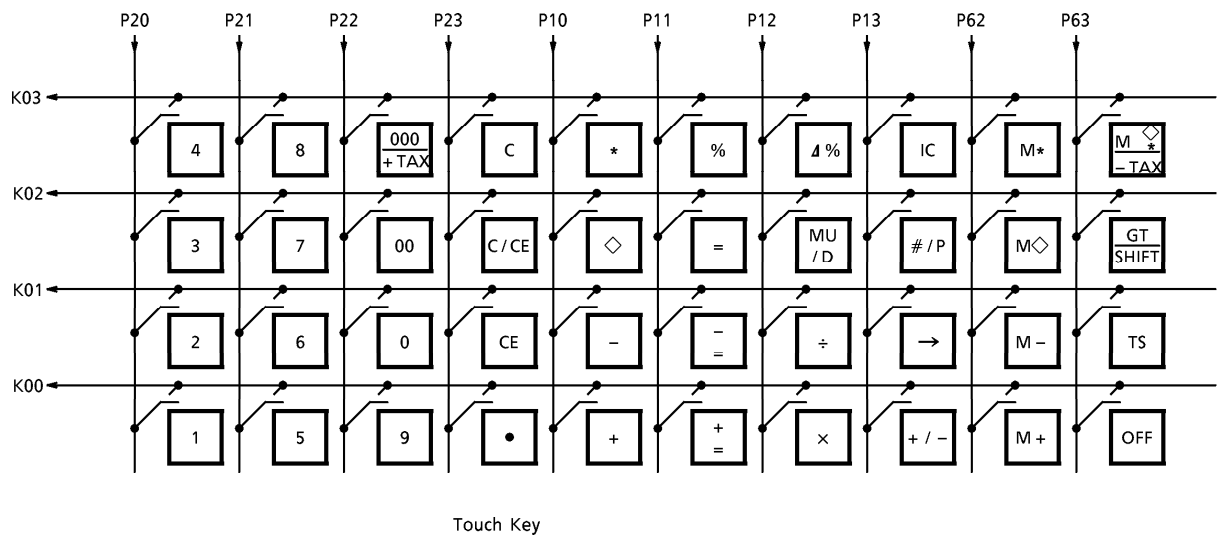
C = 100pF
R = 1k Ω $\pm$ 2%

CONNECTION OF FL



- (Note 1) R62 digit (P10, P13, P20) of "E" Data.
- (Note 2) R62 digit (P22) of "—" Data.
- (Note 3) R62 digit (P23) of "M" Data.
- (Note 4) R62 digit (P21) of "GT" Data.
- (Note 5) R62 digit (P11) of "SHIFT" Flag.

KEY CONNECTION



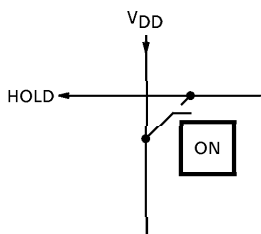
TAX / GT ... SELECTABLE WITH TAX RATE FUN OR GT MODE

ON ... TAX RATE FUNCTION

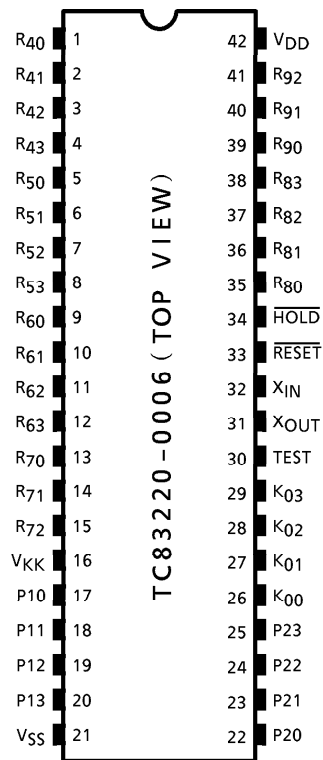
- TOUCH KEY is **+ TAX**
- TAX **SHIFT**

OFF ... GT FUNCTION

- AVAILABLE ON LOCK KEY **GT**
- TOUCH KEY is **M ◇**, **GT**, **000**



PIN ASSIGNMENT (TOP VIEW)



OPERATION EXAMPLE

KEY					PRINT		DISPLAY
TAB	4/5	IC	Σ	GT	TOUCH		
F	4/5	OFF	OFF	OFF	<ACL>	<PF>	
						C	
					1 +	1. +	0.
					2 -	2. -	1.
					◇	- 1.	- 1.
					*	- 1. *	- 1.
						<PF>	- 1.
					IC	2.	2.
		IC +			1 +	1. +	1.
					2 -	2. -	- 1.
					◇		
						002	
					*	- 1. ◇	- 1.
						002	
						- 1. *	
						<PF>	- 1.
					IC	2.	2.
					3 ×	3. ×	3.
		OFF			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	M	
						2. %	2.
					3 =	3. =	
						-	
						0.06185567 *	
						2.06185567 *	2.06185567
						<PF>	
					2 1%	-	
						2. %	2.
					3 =	3. =	
						-	
						1. *	
						50. *	50.
						<PF>	

(Note) <PF> Paper feed

KEY						PRINT			DISPLAY	
TAB	4 / 5	IC	Σ	GT	TOUCH					
F	4 / 5	OFF	Σ	OFF	3 ×	3.	×		3.	X
					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>				
							M			
					2 MU / D	2.	%		2.	
					3 =	3.	=			
							-			
						0.06185567	*			
						2.06185567	+		2.06185567	
						<PF>	-			
					2 1%	2.	%		2.	
					3 =	3.	=			
							-			
						1.	*			
						50.	+			
						<PF>			50.	
					*	122.0285223	*			
						<PF>			122.0285223	
					GT		T			
						0.	◇		0.	
							T			
					*	5.	+			
						<PF>			G	5.
					3 -	3.	-		G	-3.
					4 -	4.	-		G	-4.
					5 -	5.	-		G	-5.
					*		T			
						- 12.	+			
						<PF>			G	- 12.
							T			
					GT	-7.	◇		G	-7.
							T			
					GT	-7.	*			

KEY					PRINT			DISPLAY	
TAB	4 / 5	IC	Σ	GT					
F			Σ	OFF OFF	M + OFF ON	<PF> - 7.	M +		- 7. M - 7. M 0.
					M◇ M*	<PF> - 7. - 7.	M ◇ M *		M - 7.

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

Functional Operation
1 : Set Mode (TAB = F, 5 / 4 = ON)

KEY-IN	DISPLAY	PRINT (M-41V)	COMMENT
3 SHIFT + TAX	3. 3. 3.	S 3. %	SET TAX RATE.

2 : Calculating on + TAX Mode

1560 + TAX	1560.	1560. 46.8 ◇ % 1606.8 + 1 LINE SPACE	TAX CHARGE.
+ TAX	1606.8 1606.8		
1560 SHIFT SHIFT + TAX	1560. 1560. 1560.	1560. 46.8 ◇ % 1606.8 + 1 LINE SPACE	TAX CHARGE.
1560 × 78900 + TAX	1560. 1560. 78900.	1560. × 78900. 2367. ◇ % 81267. + 1 LINE SPACE	
	81267.		

KEY-IN	DISPLAY	PRINT (M-41V)	COMMENT
5 × SHIFT = + TAX = 1560 + 1100 + + TAX	5. 5. 5. 25. 25.75 25.75	5. × 5. = 25. * 1 LINE SPACE 25. 0.75 ◇ % 25.75 + 1 LINE SPACE	 TAX CHARGE. NOP.
9800000000 + TAX	9800000000. E 1.009400000	9800000000. 294000000. 1.009400000 * 1 LINE SPACE	 TAX CHARGE. ERROR.
1560 + / - + TAX	1560. - 1560. - 1606.8	- 1560. - 46.8 ◇ % - 1606.8 + 1 LINE SPACE	 TAX CHARGE.

3 : Check Mode

KEY-IN	DISPLAY	PRINT (M-41V)	COMMENT
1560 SHIFT - TAX	1560. 1560. 3.	 T 3. %	CHECK TAX RATE.
5 × SHIFT - TAX =	5. 5. 5. 3. 15.	5. × T 3. % 3. = 15. * 1 LINE SPACE	CHECK TAX RATE.

4 : Calculating on - TAX Mode

1560 - TAX	1560. 1514.563106 1514.563106	1560. 45.436894 ◇ % 1514.563106 - 1 LINE SPACE	TAX CHARGE. NOP.
1560 SHIFT SHIFT - TAX	1560. 1560. 1560. 1514.563106	1560. 45.436894 ◇ % 1514.563106 - 1 LINE SPACE	TAX CHARGE.
1560 × 78900 - TAX	1560. 1560. 78900. 76601.94174	1560. × 78900. 2298.05826 ◇ % 76601.94174 - 1 LINE SPACE	TAX CHARGE.

KEY-IN	DISPLAY	PRINT (M-41V)	COMMENT
5 × SHIFT = - TAX	5. 5. 5. 25. 24.27184466 24.27184466	5. × 5. = 25. * 1 LINE SPACE 25. 0.72815534 ◇ % 24.27184466 - 1 LINE SPACE	 TAX CHARGE. NOP.
1560 + 1100 + - TAX	1560. 1560. 1100. 2660. 2582.524271	1560. + 1100. + 2660. 77.475729 ◇ % 2582.524271 - 1 LINE SPACE	 TAX CHARGE.
1560 + / - - TAX	1560. - 1560. - 1514.563106	- 1560. - 45.436894 ◇ % - 1514.563106 - 1 LINE SPACE	 TAX CHARGE.

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

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage 1	V_{DD}	$-0.5 \sim 7$	V
Supply Voltage 2	V_{KK}	$-40 \sim +0.5$	V
Input Voltage	V_{IN}	$-35 \sim V_{DD} + 0.5$	V
Output Voltage	V_{OUT}	$-35 \sim V_{DD} + 0.5$	V
Output Current	I_{OUT}	-10	mA
Power Dissipation ($T_{opr} = 70^\circ C$)	P_D	600	mW
Soldering Temperature, Time	T_{sld}	260 (10s)	$^\circ C$
Storage Temperature	T_{stg}	$-55 \sim 125$	$^\circ C$
Operating Temperature	T_{opr}	$0 \sim 40$	$^\circ C$

RECOMMENDED OPERATING CONDITIONS ($V_{SS} = 0V$)

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	CONDITION	MIN	MAX	UNIT
Operating Temperature	T_{opr}	—	—	0	40	$^\circ C$
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}	—	$V_{DD} \geq 4.5V$	$V_{DD} \times 0.7$	V_{DD}	V
Input High Voltage (Schmitt circuit input)	V_{IH2}	—		$V_{DD} \times 0.75$	V_{DD}	
Input High Voltage	V_{IH3}	—	$V_{DD} < 4.5V$	$V_{DD} \times 0.9$	V_{DD}	
Input Low Voltage (Except Schmitt circuit input)	V_{IL1}	—	$V_{DD} \geq 4.5V$	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}	—	$V_{DD} < 4.5V$	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)	T_{WCH}	—	$V_{IN} = V_{IH}$	80	—	ns
Clock Low Pulse Width (Note)	T_{WCL}	—	$V_{IN} = V_{IL}$	80	—	

(Note) In case of the external clock operation.

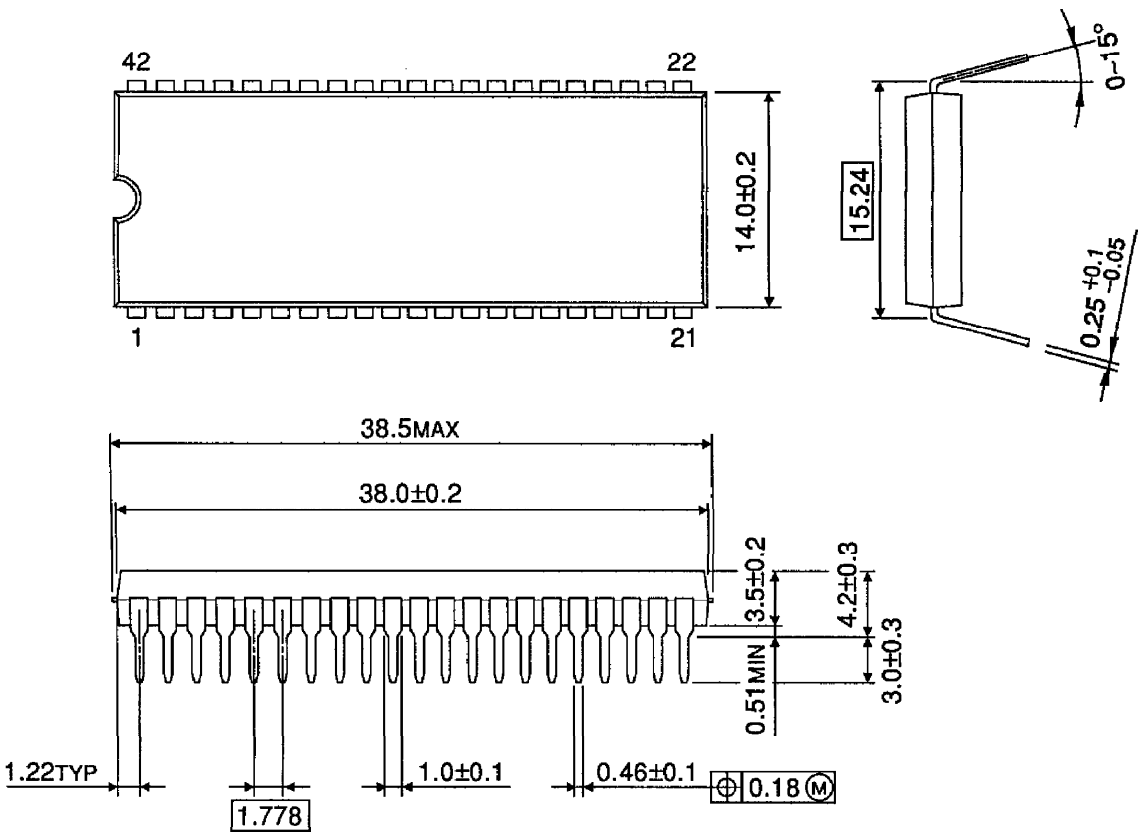
ELECTRICAL CHARACTERISTICS

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 ($\overline{\text{RESET}}$, $\overline{\text{HOLD}}$, $\overline{\text{TEST}}$)	V_{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}	—	$V_{DD} = 4.5\text{ V}$, $V_{OH} = -6\text{ mA}$	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 DEMENSIONS
SDIP42-P-600-1.78

Unit : mm



Weight : 4.12g (Typ.)