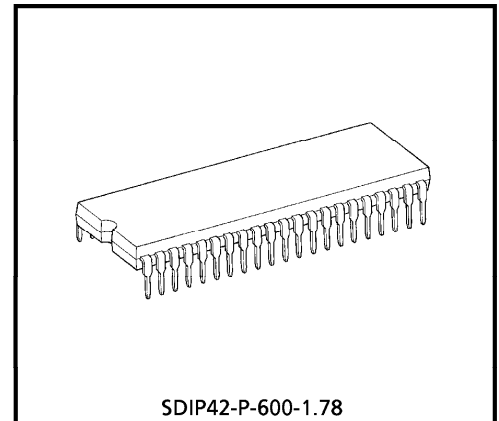


TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

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 : $\boxed{0}$ ~ $\boxed{9}$, $\boxed{\cdot}$, $\boxed{00}$, $\boxed{000}$, \boxed{C} , \boxed{CE} , $\boxed{C/CE}$, $\boxed{+/-}$, $\boxed{\#/P}$, $\boxed{\text{Feed}}$, $\boxed{+}$, $\boxed{-}$, $\boxed{\diamond}$, $\boxed{*}$, $\boxed{\times}$, $\boxed{\div}$, $\boxed{=}$, $\boxed{\%}$, $\boxed{\text{MU/D}}$, $\boxed{\text{M+}}$, $\boxed{\text{M-}}$, $\boxed{\text{M}\diamond}$, $\boxed{\text{M*}}$, $\boxed{\text{1}\%}$, $\boxed{\text{M}\diamond_{*}}$, $\boxed{\text{IC}}$, $\boxed{\rightarrow}$, $\boxed{\text{ON}}$, $\boxed{\text{OFF}}$, $\boxed{+}$, $\boxed{=}$, $\boxed{\text{GT}}$, $\boxed{+TAX}$, $\boxed{-TAX}$, $\boxed{\text{SHIFT}}$
- 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

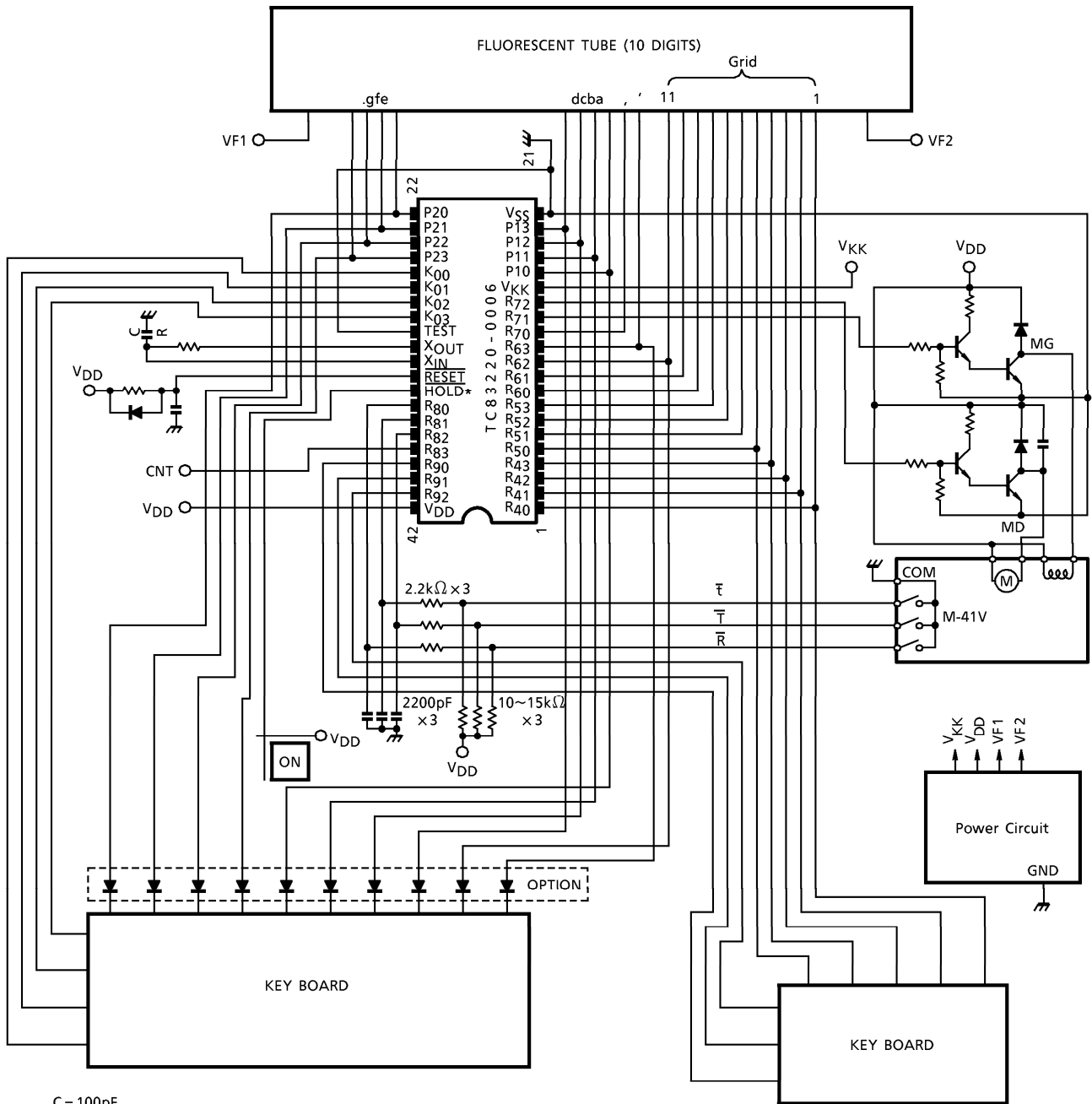
Function Select

- 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

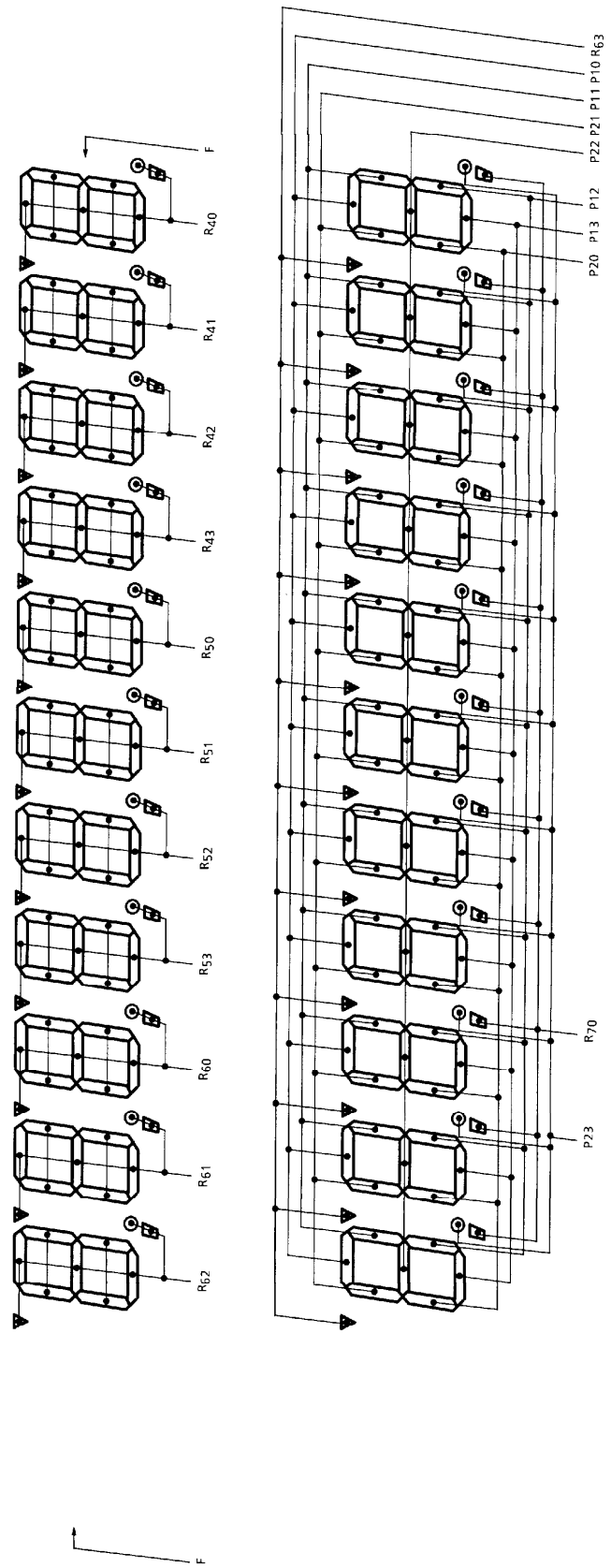
Speed of Calculation

- i) Addition $1 + 1 +$ 31.2ms
- ii) Multiplication $1 \times 999999999999 =$ 26.8ms
- iii) Division $99999999999 \div 1 =$ 100.6ms
- iv) Memory calculation $99999999999 \div 1M +$ 108.8ms
- v) Percentage calculation $1 \times 99999999999\%$ 35.2ms

SYSTEM DIAGRAM



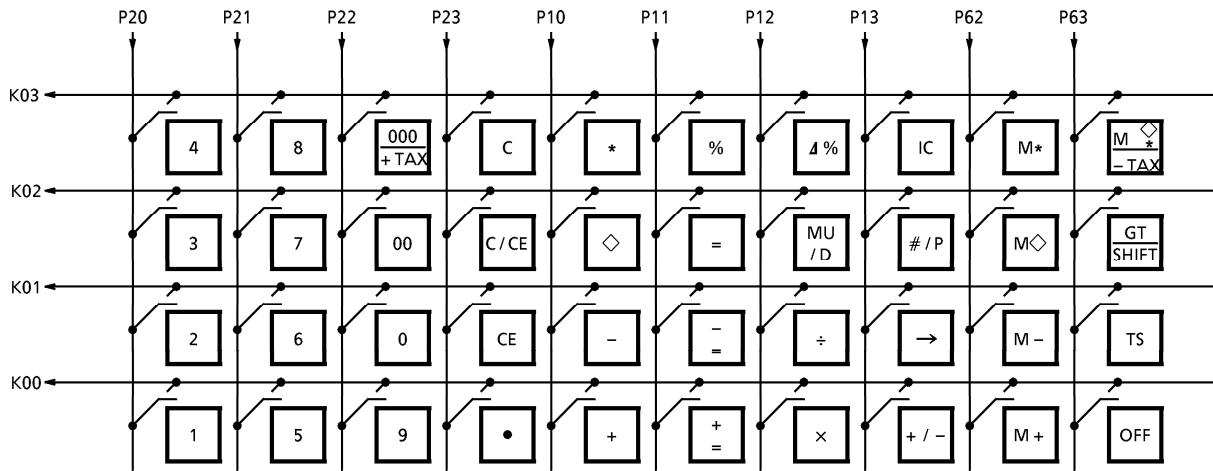
CONNECTION OF FL



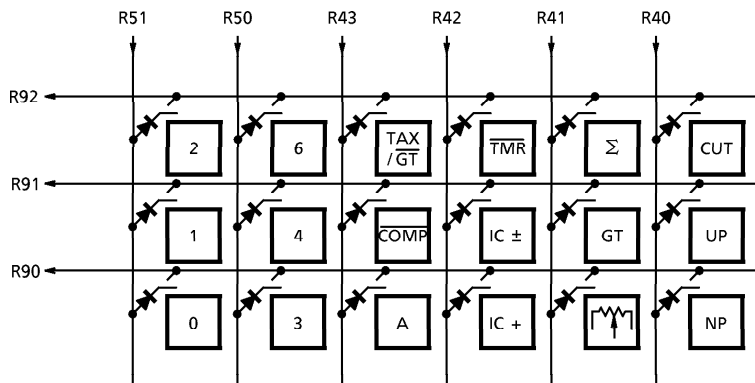
- (Note 1) R62 digit (P10, P13, P20) of "E" Data.
- (Note 2) R62 digit (P22) of "-" Data.
- (Note 3) R62 digit (P23) of "M" Data.
- (Note 4) R62 digit (P21) of "GT" Data.
- (Note 5) R62 digit (P11) of "SHIFT" Flag.

TC83220-0006-05

KEY CONNECTION

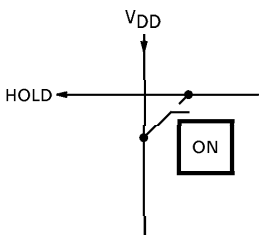


Touch Key

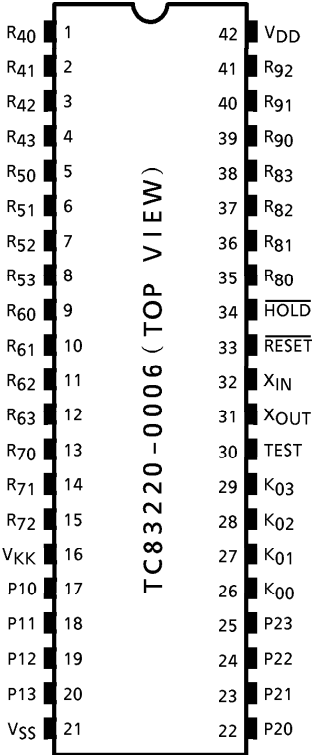


Lock Key

- 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					TOUCH	PRINT			DISPLAY
TAB	4/5	IC	Σ	GT					
F	4/5	OFF	OFF	OFF	<ACL>		<PF>	C	
					1 +		<PF>		0.
					2 -		1.	+	1.
					◇		2.	-	-1.
					*		-1.	*	-1.
					IC		<PF>		-1.
					1 +		2.		2.
		IC +			2 -		1.	+	1.
					◇	002	2.	-	-1.
					*		-1.	◇	-1.
						002	-1.	*	
					IC		<PF>		-1.
					3 ×		2.		2.
		OFF			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	*	
					2 MU / D		<PF>		66.66666666
							2.	M	
					3 =		3.	%	2.
								=	
							0.06185567	*	
							2.06185567	*	2.06185567
							<PF>		
					2 1%		2.	-	
							3.	%	2.
					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	+		
						<PF>			66.66666666
							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.	*		

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

KEY					TOUCH	PRINT		DISPLAY	
TAB	4/5	IC	Σ	GT					
F	4/5	OFF	Σ	OFF					
					# / P	<PF>			-7.
					2 # / P	-7.			-7.
					# / P	#2			2.
					0 ÷	2.			2.
					=	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	3.		
SHIFT	3.		
+ TAX		S	SET TAX RATE.
	3.	3. %	

2 : Calculating on +TAX Mode

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

KEY-IN	DISPLAY	PRINT (M-41V)	COMMENT
5 × SHIFT = + 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.
1560 + 1100 + + TAX	1560. 1560. 1100. 2660. 2739.8	1560. + 1100. + 2660. 79.8 ◇ % 2739.8 + 1 LINE SPACE	TAX CHARGE.
9800000000 + TAX	9800000000. E 1.009400000	9800000000. 294000000. 1.009400000 * 1 LINE SPACE	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 = 15.	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	1560. 45.436894 ◇ % 1514.563106 - 1 LINE SPACE	TAX CHARGE. NOP.
- TAX	1514.563106		
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}	-0.5~7	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 ($T_{opr} = 70^{\circ}C$)	P_D	600	mW
Soldering Temperature, Time	T_{sld}	260 (10s)	$^{\circ}C$
Storage Temperature	T_{stg}	-55~125	$^{\circ}C$
Operating Temperature	T_{opr}	0~40	$^{\circ}C$

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.

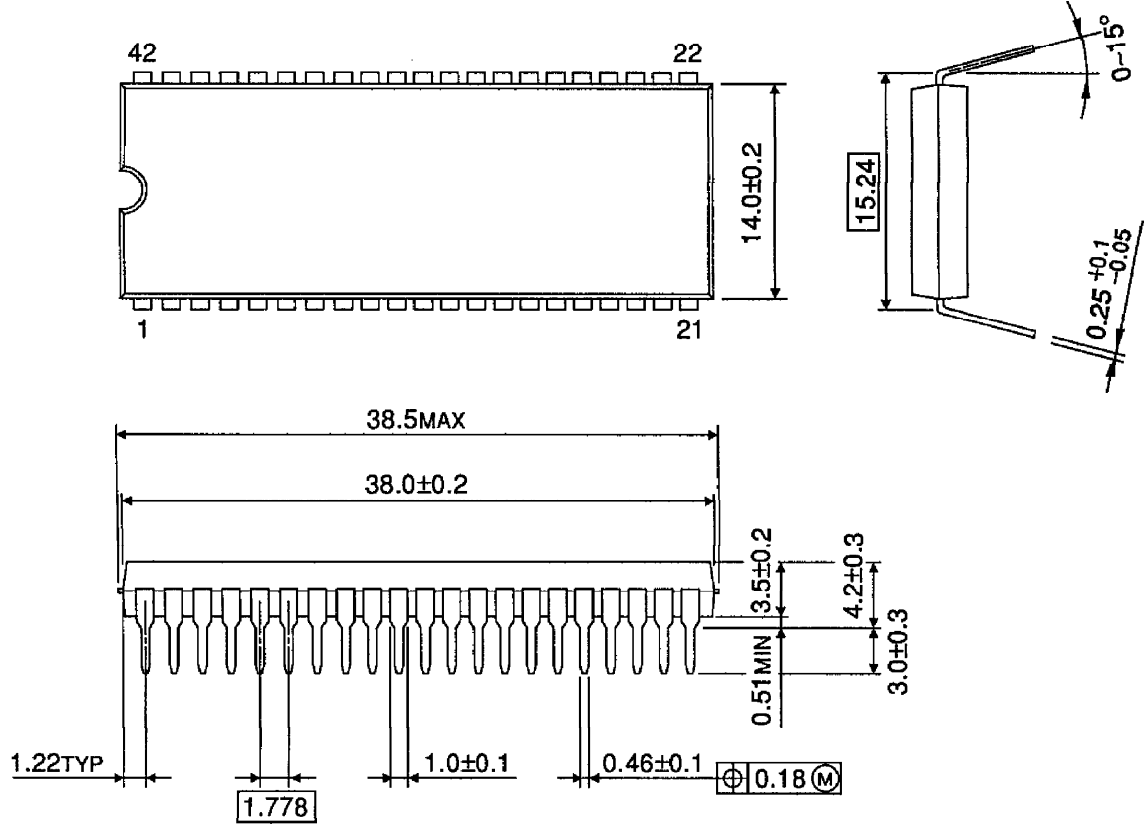
ELECTRICAL CHARACTERISTICS

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

PARAMETER	SYMBOL	TEST CIRCUIT	CONDITION	MIN	TYP.	MAX	UNIT
Hysteresis Voltage (Schmitt circuit input)	V_{HS}	—	—	—	0.7	—	V
Input Current (RESET, HOLD, 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}	—	$V_{DD} = 4.5\text{ V}$, $V_{OH} = -6\text{ mA}$	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 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 : 4.12g (Typ.)