

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.

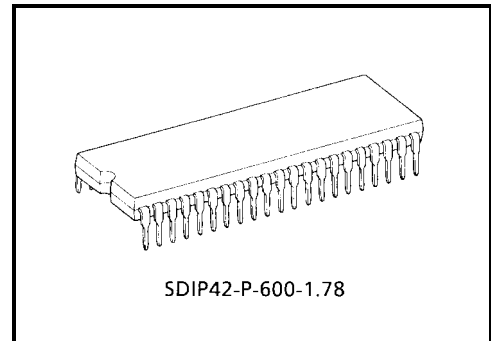
TC83220-0006 can drive the printing machine (M-41V; EPSON) with magnet driver circuit, and can drive the fluorescent display tube with DC-DC converter.

It contains a 4 K-word ROM, a 256 × 4-bit RAM.

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 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.
Tax calculation and grand total calculation are selectable.
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} , $\boxed{+TAX}$,
 $\boxed{-TAX}$, \boxed{SHIFT}



Weight: 4.12 g (typ.)

- 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: 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

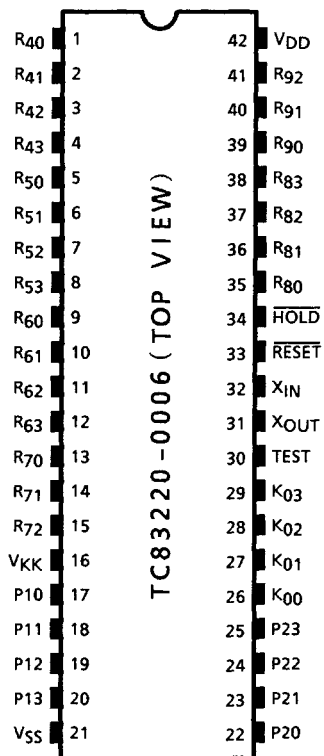
Function Select

- (1) “TMR” selectable with auto power off mode
 OFFAuto power off mode
- (2) “TAX/GT” selectable with TAX RATE function or GT mode
 ONTAX RATE function
 OFFGT function
- (3) “COMP” selectable with commas print
 OFFCommas print

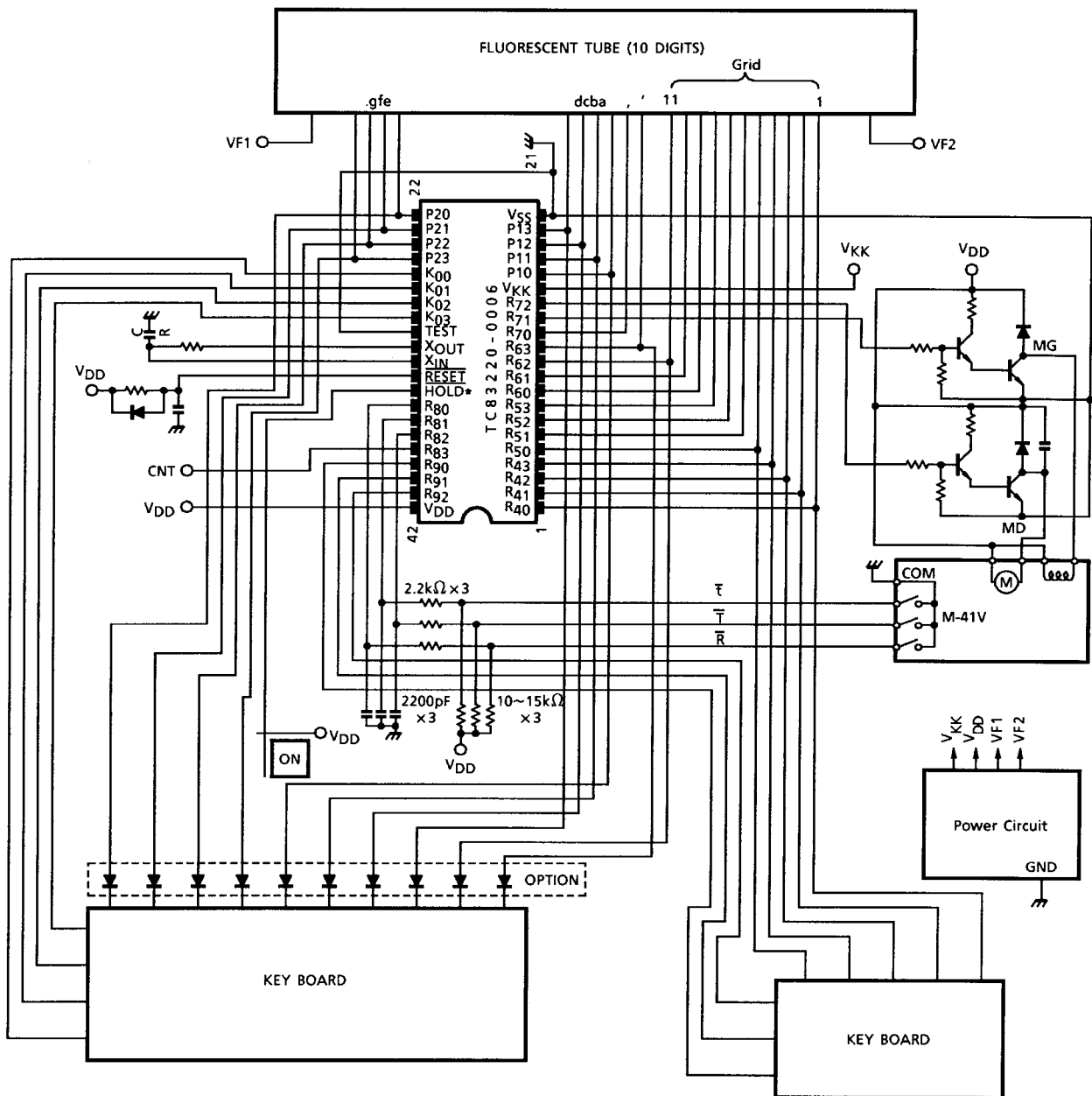
Speed of Calculation

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

Pin Assignment (top view)

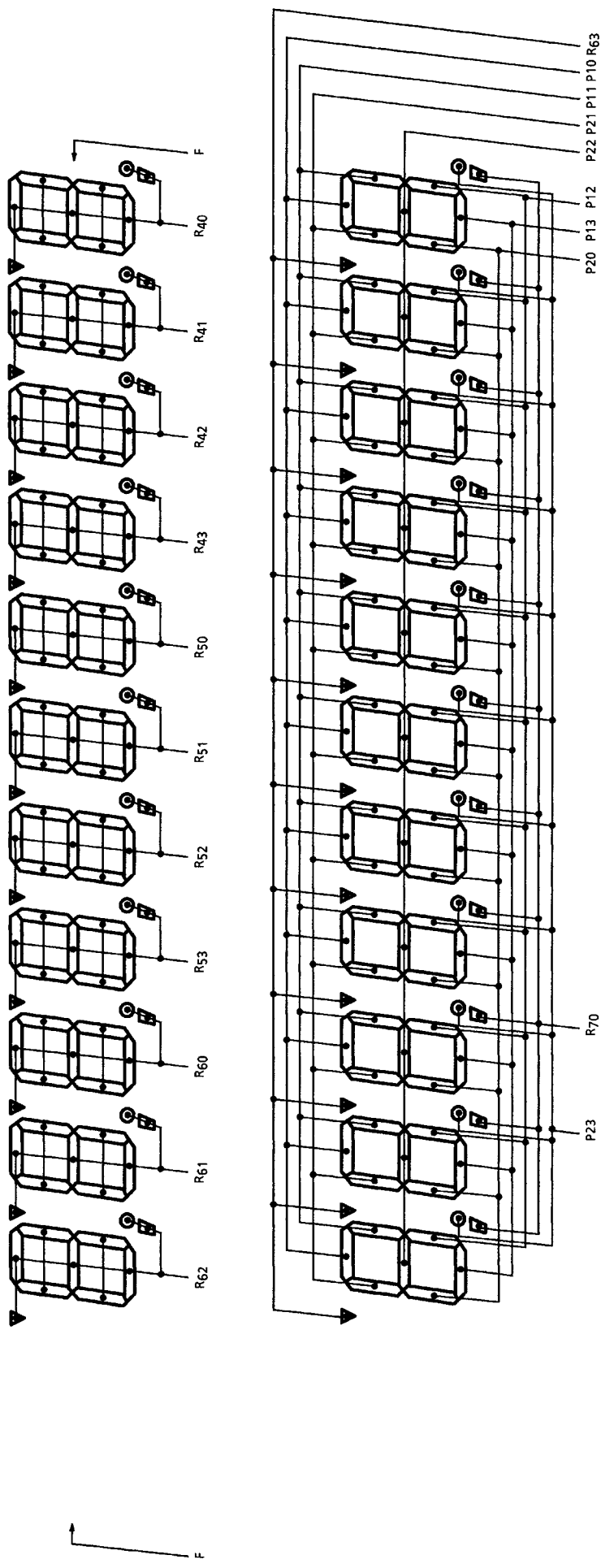


System Diagram



C = 100 pF

R = 1 kΩ ± 2%

Connection of FL

Note 1: R₆₂ digit (P10, P13, P20) of "E" data.

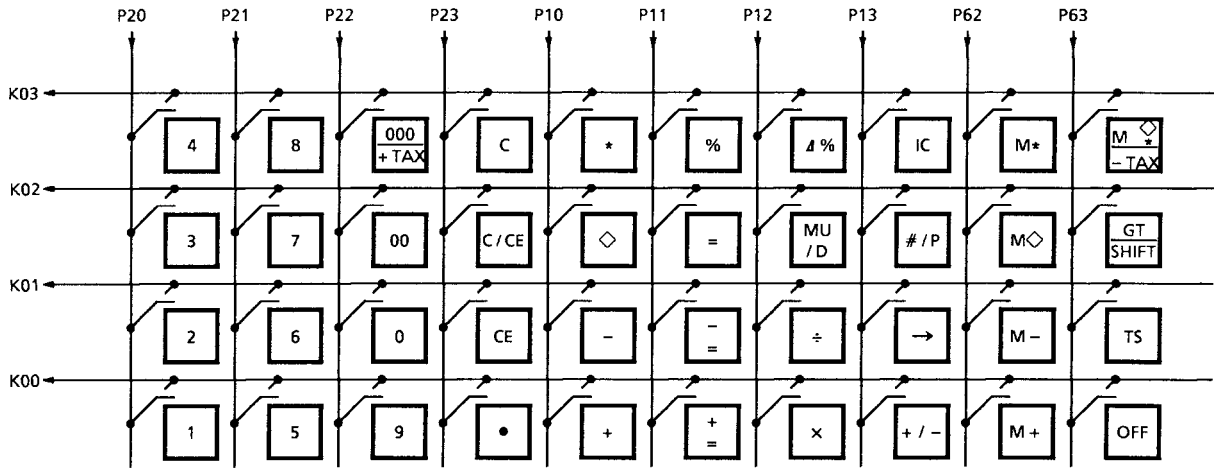
Note 2: R₆₂ digit (P22) of "L" data.

Note 3: R₆₂ digit (P23) of "M" data.

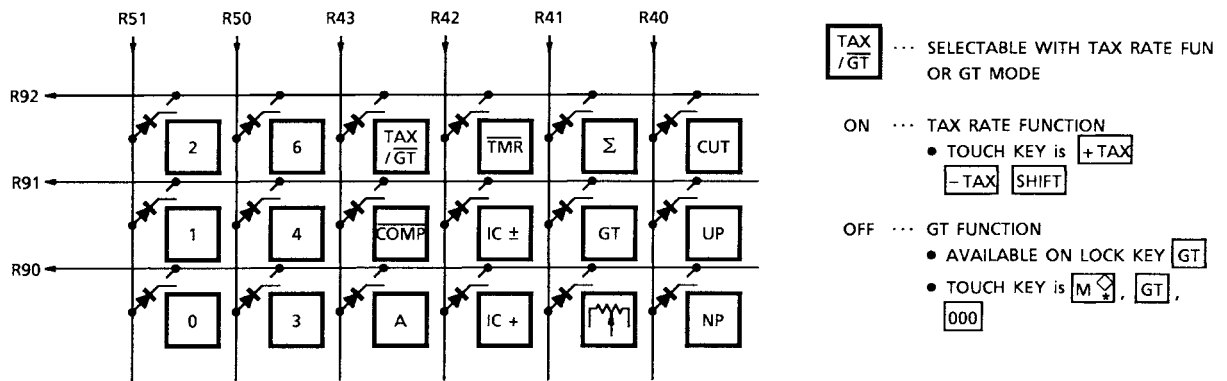
Note 4: R₆₂ digit (P21) of "GT" data.

Note 5: R₆₂ digit (P11) of "SHIFT" flag.

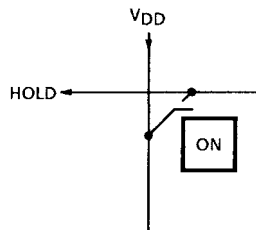
Key Connection



Touch Key



Lock Key



Operation Example

Key					Touch	Print			Display
TAB	4/5	IC	Σ	GT					
F	4/5	OFF	OFF	OFF	<ACL>	<PF>		C	
						<PF>			0.
					1+	1.	+		1.
					2-	2.	-		-1.
					\emptyset	-1.			-1.
					*	-1.	*		
						<PF>			-1.
					IC	2.			2.
		IC+			1+	1.	+		1.
					2-	2.	-		-1.
					\emptyset	002			
					*	-1.	\emptyset		-1.
						-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>			
					2Δ%		-		
						2.	%		2.
					3=	3.	=		
							-		
						1.	*		
						50.	*		50.
						<PF>			

Note 6: <PF>Paper feed

Key					Touch	Print			Display	
TAB	4/5	IC	Σ	GT						
F	4/5	OFF	Σ	OFF	3x	3.	x		3.X	
					4÷	4.	÷		12.	
					=	4.	=			
						3.	+			
						<PF>			3.	
					5x	5.	x		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>	-			
					2Δ%	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.	*			

Note 6: <PF>Paper feed

Key					Print	Display	
TAB	4/5	IC	Σ	GT			Touch
F			Σ	OFF	<PF>	-7.	
				OFF			
					M+	M	
					OFF	-7. +	M -7.
					ON		M 0.
						<PF>	
							M
					M \diamond	-7. \diamond	M -7.
							M
					M*	-7. *	

Note 6: <PF>Paper feed

Key					Touch	Print		Display
TAB	4/5	IC	Σ	GT				
F	4/5	OFF	Σ	OFF				
						<PF>		-7.
					#/P			-7.
					2 #/P	#2		2.
					#/P			2.
					0÷		0.	÷
					=	-----		
							0.	*
						<PF>		E
					C		0.	C
						<PF>		0.

Note 6: <PF>Paper feed

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

Key-In	Display	Print (M-41V)	Comment
1560	1560.		
+TAX		1560.	
		46.8 ◊	TAX CHARGE.
		%	
		1606.8 +	
	1606.8	1 LINE SPACE	
+TAX	1606.8		
1560	1560.		
SHIFT	1560.		
SHIFT	1560.		
+TAX		1560.	
		46.8 ◊	TAX CHARGE.
		%	
		1606.8 +	
	1606.8	1 LINE SPACE	
1560	1560.		
×	1560.	1560. ×	
78900	78900.		
+TAX		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	1560.		
SHIFT	1560.		
-TAX		T	
	3.	3. %	CHECK TAX RATE.
5	5.		
×	5.	5. ×	
SHIFT	5.		
-TAX		T	
	3.	3. %	CHECK TAX RATE.
=		3. =	
		15. *	
	15.	1 LINE SPACE	

4. Calculating on -TAX Mode

Key-In	Display	Print (M-41V)	Comment
1560	1560.		
-TAX		1560.	
		45.436894 ◇	TAX CHARGE.
		%	
		1514.563106 -	
	1514.563106	1 LINE SPACE	
-TAX	1514.563106		NOP.
1560	1560.		
SHIFT	1560.		
SHIFT	1560.		
-TAX		1560.	
		45.436894 ◇	TAX CHARGE.
		%	
		1514.563106 -	
	1514.563106	1 LINE SPACE	
1560	1560.		
×	1560.	1560. ×	
78900	78900.		
-TAX		78900.	
		2298.05826 ◇	TAX CHARGE.
		%	
		76601.94174 -	
	76601.94174	1 LINE SPACE	

Key-In	Display	Print (M-41V)	Comment
5	5.		
×	5.	5. ×	
SHIFT	5.		
=		5. =	
		25. *	
	25.	1 LINE SPACE	
-TAX		25.	
	24.27184466	0.72815534 ◇	TAX CHARGE.
		%	
	24.27184466	24.27184466 -	
		1 LINE SPACE	
	24.27184466		NOF.
1560	1560.		
+	1560.	1560. +	
1100	1100.		
+	2660.	1100. +	
-TAX		2660.	
		77.475729 ◇	TAX CHARGE.
		%	
	2582.524271	2582.524271 -	
	2582.524271	1 LINE SPACE	
1560	1560.		
+/-	-1560.		
-TAX		-1560.	
		-45.436894 ◇	TAX CHARGE.
		%	
		-1514.563106 -	
	-1514.563106	1 LINE SPACE	

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 7)	T_{WCH}	—	$V_{IN} = V_{IH}$	80	—	ns
Clock low pulse width (Note 7)	T_{WCL}	—	$V_{IN} = V_{IL}$	80	—	ns

Note 7: In case of the external clock operation.

Electrical Characteristics

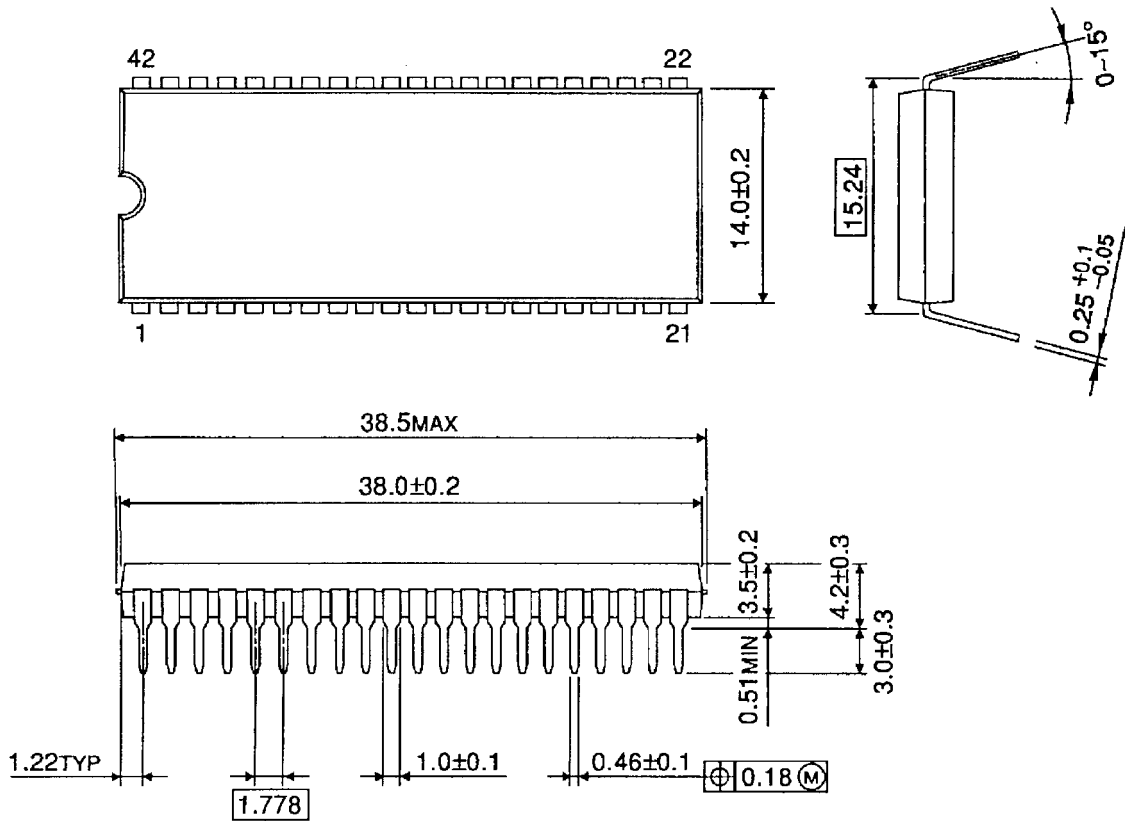
DC Characteristics ($V_{SS} = 0\text{ V}$, $V_{DD} \pm 10\%$, $T_{opr} = 0\text{--}40^\circ\text{C}$)

Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Hysteresis voltage (schmitt circuit input)	V_{HS}	—	—	—	0.7	—	V
Input current ($\overline{\text{RESET}}$, $\overline{\text{HOLD}}$, $\overline{\text{TEST}}$)	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}	—	$V_{DD} = 4.5\text{ V}$, $I_{OH} = -6\text{ mA}$	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	k Ω
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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