

TC83220-0025

TC83220-0025 Single-Chip CMOS LSI for FL (fluorescent) Calculator

The TOSHIBA printing/display calculator circuit TC83220-0025 is 10- or 12-digit calculator on single-chip CMOS LSI.

TC83220-0025 can drive the printing machine (M-72T; EPSON) with magnet driver circuit, and can drive the fluorescent display tube with DC-DC converter.

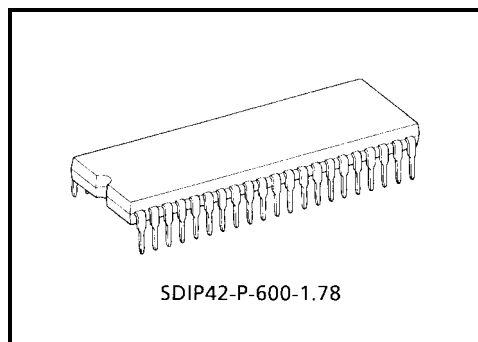
It contains a 4 K-word ROM, a 256 × 4-bit RAM.

Features

Operational Features

- Print: 11 or 13 digits of data.
(including decimal point) 1 digit of minus sign.
2 digits of operational symbol.
3 digits of commas. 2-colors printing. (black and red)
- Display: 10 or 12 digits of data. (including punctuation in each digit.)
1 digit of floating minus sign, memory load, error symbol, grand total memory load.
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 calculation.
Memory calculation.
Automatic accumulating calculation.
Gross margin profit calculation.
Delta percent calculation.
Tax calculation.
Grand total calculation.
Two-key rollover
- Item counter: 0~999 count up by depressing of, $\boxed{+}$, $\boxed{-}$ key.
- Punctuation: Commas for thousands on display.
- Kinds of touch key:

$\boxed{0} \sim \boxed{9}$, $\boxed{\cdot}$, $\boxed{00}$, $\boxed{000}$, $\boxed{C}$, $\boxed{CE}$, $\boxed{C/CE}$, $\boxed{+/-}$, $\boxed{\#/P}$, $\boxed{\text{Feed}}$,
 $\boxed{+}$, $\boxed{-}$, $\boxed{\diamond}$, $\boxed{*}$, $\boxed{\times}$, $\boxed{\div}$, $\boxed{=}$, $\boxed{\%}$, $\boxed{MU/D}$, $\boxed{M+}$, $\boxed{M-}$, $\boxed{M\diamond}$,
 $\boxed{M*}$, $\boxed{\Delta\%}$, $\boxed{M\diamond*}$, $\boxed{\rightarrow}$, $\boxed{GT}$, $\boxed{\pm}$, $\boxed{=}$, $\boxed{+TAX}$, $\boxed{-TAX}$



Weight: 4.12 g (typ.)

- Kinds of lock key (refer to page 5.): “NP” printing mode selectable switch. (“ON”: nonprinting mode. “OFF”: printing mode.)
 “Σ” summation mode selectable switch.
 “5/4” “CUT” “UP” rounding switch. (“5/4”: “CUT” and “UP” lock key off.)
 Fixed point mode selectable switch.
 “0”, “1”, “2”, “3”, “4”, “6”, “F”, “A”. (“A”: ADD mode. “F”: full floating mode, all decimal setting lock key off.)
 “IC+” item counter mode selectable switch.
 “GT” grand total memory selectable switch.
 “SET/CAL” tax memory selectable switch. (ON: set mode. OFF: normal calculation mode.)
 “10/12” display digits selectable switch. (refer to page 3.)
- Duty of display: Duty = 1/17.7
- Leading zero suppression
- Trailing zero suppression
- Tax calculation (refer to page 5.): +TAX key is calculation for included tax.
-TAX key is calculation for excluded tax.
SET/CAL lock key selects set mode or normal calculation mode.
 Changing lock key from set mode to normal calculation mode stores number of display to tax memory.
 Changing lock key from normal calculation mode to set mode recalls tax rate to display from tax memory.
 Depression of +TAX following data key at normal calculation mode performs the calculating included tax.
 Depression of -TAX following data key at normal calculation mode performs the calculating excluded tax.

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.
- Shrink dual in line package.

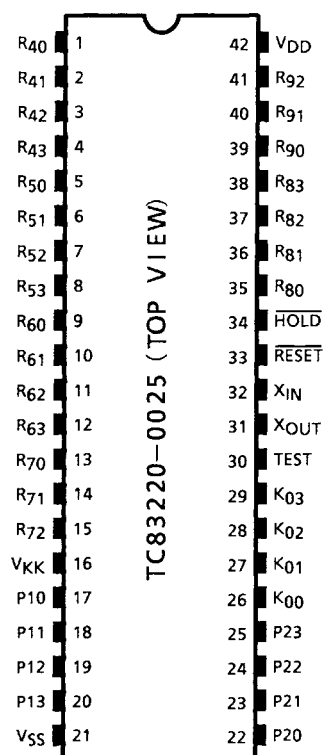
Protection

- (1) Double depression of keys will be inoperative.
- (2) In the overflow condition, all key except “C”, “C/CE”, “CE” “Feed”, “→” key are inoperative.
- (3) Key bouncing protection (at 4 MHz clock)
 Key read in: 15 ms
 Key off: 40 ms

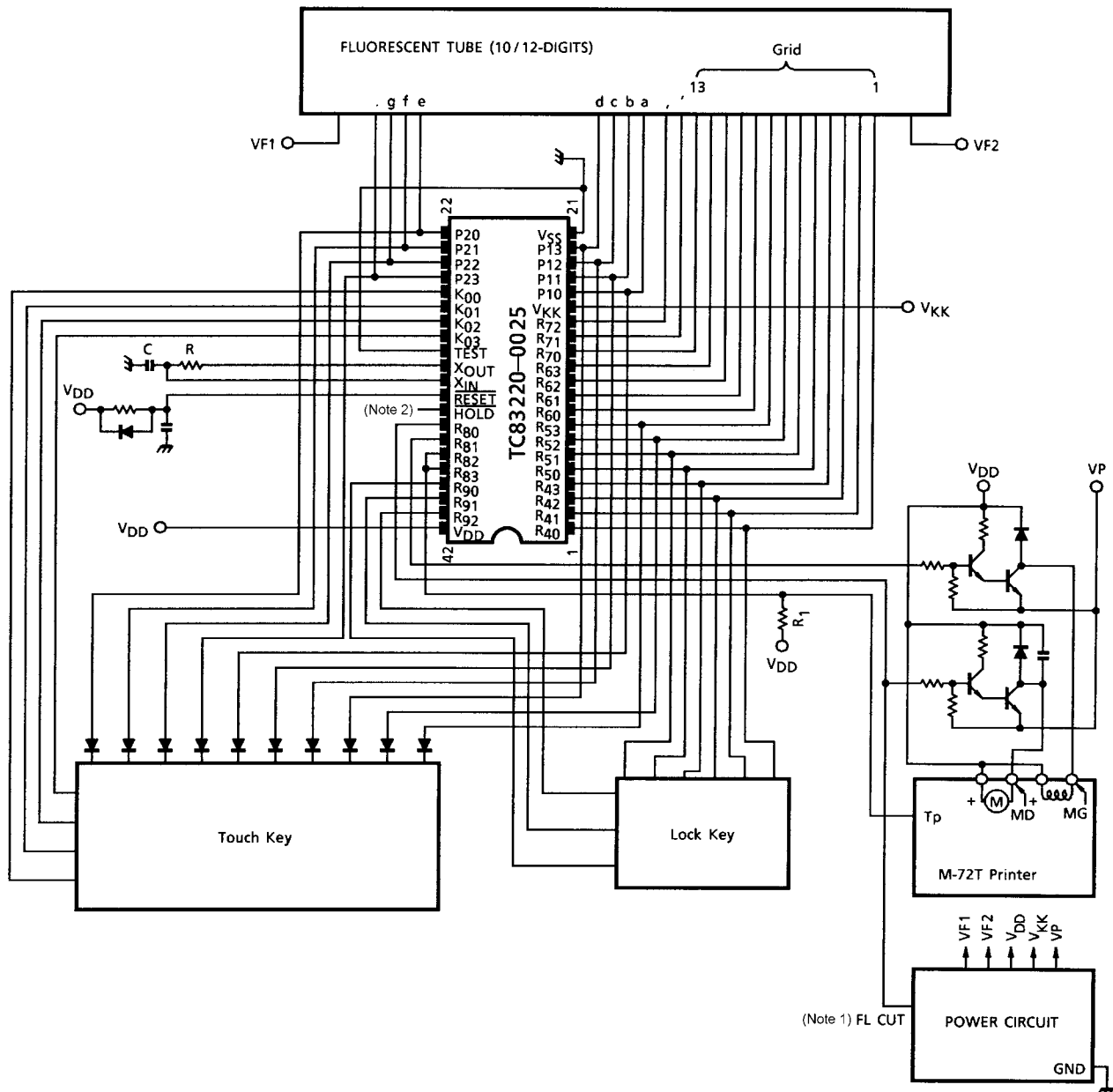
Function Select

- (1) “10/12” selectable with calculated digits (lock key).
 ON..... 10-digit calculation
 OFF..... 12-digit calculation

Pin Assignment (top view)



System Diagram



$C = 100 \text{ pF}$

$R = 1 \text{ k}\Omega \pm 2\%$

$R_1 = 10 \sim 15 \text{ k}\Omega$

VP: Power source to drive printer.

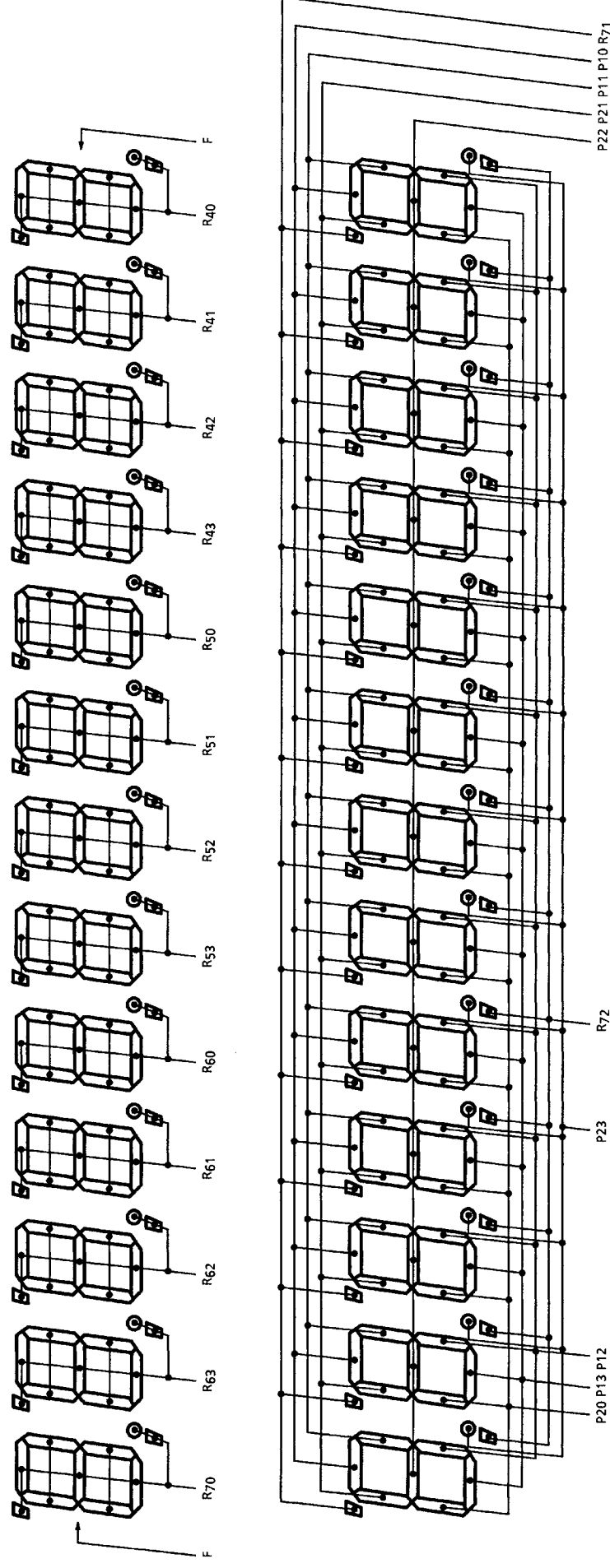
V_{KK}: Power source for display.

Note 1: FL CUT (R₈₀)

(VF1, VF2 cut at printing)

Note 2: Connection to HOLD pin is shown in the following page 15.

Connection of FL



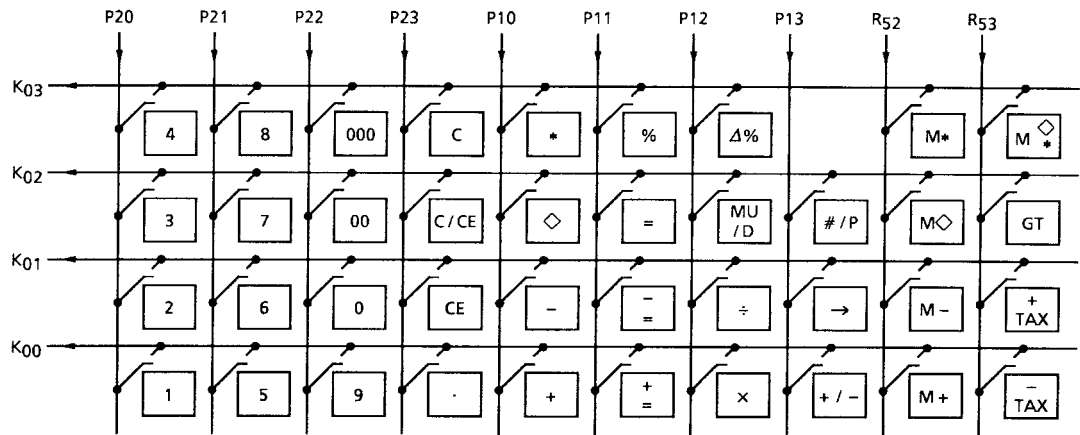
Note 3: R70 digit (P20) of "E" data

Note 4: R70 digit (P22) of "L" data

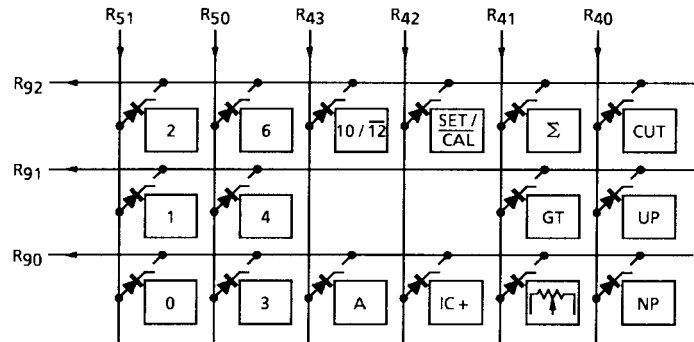
Note 5: R70 digit (P23) of "M" data

Note 6: R70 digit (P21) of "GT" data

Key Connection



Touch Key



Lock Key

Note 7: : Feed

Operation Example

Key		Print	Print Color	Display
TAB 4/5 IC 10/12 Σ GT MOD	Touch			
F 4/5 OFF 10 OFF OFF CAL	POWER ON	<PF>		
		C		
		<PF>		0.
	1+	1. +		1.
	2-	2. -	R	-1.
	$\diamond$	-1. $\diamond$	R	-1.
	*	-1. *	R	
		<PF>		-1.
IC+	1+	1. +		1.
	2-	2. -	R	-1.
	$\diamond$	002.....		
		-1. $\diamond$	R	-1.
	*	002.....		
		-1. *	R	
		<PF>		-1.
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. Δ %		
		<PF>		50.

Note 8: PRINT COLOR.....R: Red

No mark: Black

<PF>Paper feed

Key							Print	Print Color	Display
TAB	4/5	IC	10/12	Σ	GT	MOD			
Touch									
F	4/5	OFF	10	Σ	OFF	CAL	3. ×		3.
							4. ÷		12.
							=		
							3. +		
							<PF>		3.
							5. ×		5.
							6%		
							0.3 +		
							<PF>		0.3
							+ 5.3 + %		
							<PF>		5.3
							2. ÷		2.
							3%		
							66.66666666 +		
							<PF>		66.66666666
	2					MU/D	2. G M		2.
							3. %		
							0.06185567 Δ *		
							2.06185567 +		
							<PF>		2.06185567
							2Δ%		2.
							3=		
							1. Δ *		
							50. +		
							<PF>		50.
							* 122.0285223 *		
							<PF>		122.0285223
							GT 0. G ∅		0.
							2+ 2. +		2.
							3+ 3. +		5.
							* 5. G +		
							<PF>		5.
							3- 3. -	R	-3.
							4- 4. -	R	-7.
							5- 5. -	R	-12.
							* -12. G +	R	
							<PF>		-12.
							GT -7. G ∅	R	-7.
							GT -7. G *	R	
							<PF>		-7.
							M+ -7. M +	R	M
									-7.
							C 0. C		M
									0.

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<PF>Paper feed

Key							Print	Print Color	Display			
TAB	4/5	IC	10/12	Σ	GT	MOD				Touch		
F	4/5	OFF	10	Σ	OFF	CAL		<PF>		M	-7.	
							M ϕ	-7. M ϕ	R			
							M*	-7. M *	R			
							<PF>			-7.		
							#/P	-7. ϕ	R	-7.		
							2 #/P	#2.....		2.		
							#/P	2. ϕ		2.		
							0÷	0. ÷		0.		
							=	0. =				
												
							0. *					
							<PF>		E	0.		
							C	0. C				
							<PF>			0.		
F	CUT	OFF	12	OFF	OFF	CAL	POWER	ON				
								<PF>				
								C				
								<PF>			0.	
							SET	0. %				
								<PF>			0.	
							3			3.		
								3. %				
							CAL				0.	
								<PF>			0.	
							C	0. C				
								<PF>			0.	
							SET	3. %				
								<PF>			3.	
							CAL			0.		
							1560			1,560.		
							+TAX	1,560.				
								46.8 Δ				
								1,606.8 *				
								<PF>			1,606.8	
							+TAX	1,606.8 ϕ				
								48.204 Δ				
								1,655.004 *				
								<PF>			1,655.004	
							1560			1,560.		
							×	1,560. ×			1,560.	
							78900				78,900.	
+TAX	78,900. =											
	123,084,000. ϕ											
	3,692,520. Δ											
	126,776,520. *											

Note 8: PRINT COLOR.....R: Red

No mark: Black

<PF>Paper feed

Key							Print	Print Color	Display		
TAB	4/5	IC	10/12	Σ	GT	MOD				Touch	
									126,776,520.		
							=		126,776,520.		
							5		5.		
							×	5.	×	5.	
							+TAX		5.		
							=	5.	=		
								25.	*		
							<PF>		25.		
							+TAX	25.	◇		
								0.75	Δ		
F	CUT OFF	12	OFF	OFF	CAL				25.		
							+TAX	25.	◇		
								0.75	Δ		
								25.75	*		
							<PF>		25.75		
							=		25.75		
							C	0.	C		
							<PF>		0.		
							2	1560		1,560.	
								+	1,560.00	+	1,560.00
									1,100.		
							1100		1,100.		
							+	1,100.00	+	2,660.00	
							+TAX	2,660.00	◇		
								79.80	Δ		
								2,739.80	*		
							<PF>		2,739.80		
							+TAX	2,739.80	◇		
								82.194	Δ		
								2,821.994	*		
F									2,821.994		
							<PF>		980,000,000,000.		
							980000000000				
							+TAX	980,000,000,000.			
								29,400,000,000.	Δ		
											
								1,00940000000	*		
							<PF>	E	1.00940000000		
							C	0.	C		
							<PF>		0.		
									1,560.		
							1560		1,560.		
							+/-		-1,560.		
							+TAX	-1,560.	R		
								-46.8	Δ	R	
								-1,606.8	*	R	
							<PF>		-1,606.8		
							1560		1,560.		
							-TAX	1,560.			

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<PF>Paper feed

Key							Print	Print Color	Display
TAB	4/5	IC	10/12	Σ	GT	MOD			
Touch									
F	CUT	OFF	12	OFF	OFF	CAL	-45,43689321 Δ	R	
							1,514.56310679 *		
							<PF>		1,514.56310679
						-TAX	1,514.56310679 ◇		
							-44.11348855 Δ	R	
							1,470.44961824 *		
							<PF>		1,470.44961824
						SET	3. %		
							<PF>		3.
						C	0.		0.
						CAL	0. %		
							<PF>		0.
						SET	0. %		
							<PF>		0.
						1234	1,234. %		1,234.
						CAL	<PF>		0.
						980000000000			980,000,000,000.
						+TAX	980,000,000,000.		
									
							0. *		
							<PF>	E	0.
						C	0. C		
							<PF>		0.

Note 8: PRINT COLOR.....R: Red

No mark: Black

<PF> Paper feed

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

Characteristics	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 ($T_{opr} = 70^\circ\text{C}$)	P_D	600	mW
Soldering temperature, time	T_{sld}	260 (10 s)	$^\circ\text{C}$
Storage temperature	T_{stg}	$-55 \sim 125$	$^\circ\text{C}$
Operating temperature	T_{opr}	$0 \sim 40$	$^\circ\text{C}$

Recommended Operating Conditions ($V_{SS} = 0\text{ V}$)

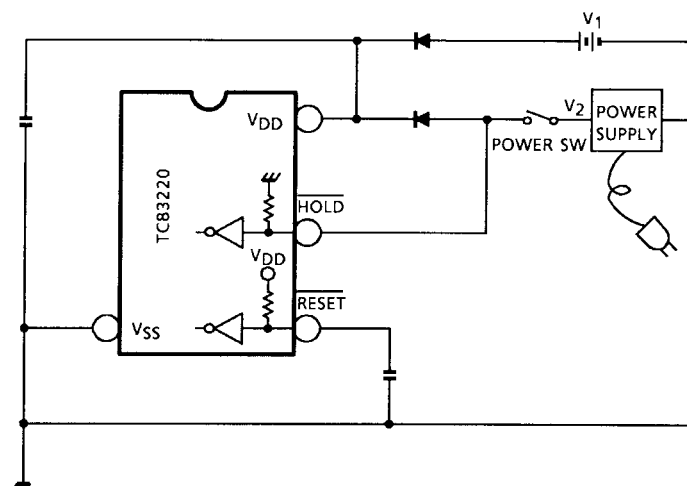
Characteristics	Symbol	Test Circuit	Test Condition	Min	Max	Unit
Operating temperature	T_{opr}	—	—	0	40	$^\circ\text{C}$
Supply voltage	V_{DD}	—	—	4.5	6	V
Supply voltage (FL)	V_{KK}	—	—	-30	-15	V
Supply voltage (hold)	V_{DDH}	—	—	2	6	V
Input high voltage (except schmitt circuit input)	V_{IH1}	—	$V_{DD} \geq 4.5\text{ V}$	$V_{DD} \times 0.7$	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 9)	T_{WCH}	—	$V_{IN} = V_{IH}$	80	—	ns
Clock low pulse width (Note 9)	T_{WCL}	—	$V_{IN} = V_{IL}$	80	—	ns

Note 9: In case of the external clock operation.

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

Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Hysteresis voltage (schmitt circuit input)	V_{HS}	—	—	—	0.7	—	V
Input current ($\overline{\text{RESET}}$, $\overline{\text{HOLD}}$, $\overline{\text{TEST}}$)	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	—	$\text{k}\Omega$
Pull down resistor (source open drain)	R_{KK}	—		50	80	200	$\text{k}\Omega$
Operating supply current	I_{DD0}	—	$V_{DD} (V_{DDH}) = 5.5\text{ V}$, $f_c = 4\text{ MHz}$, $V_{IN} = 5.3/0.2\text{ V}$	—	3	6	mA
Supply current (after clear)	I_{KK1}	—	$V_{KK} = -30\text{ V}$, $f_c = 4\text{ MHz}$	—	0.6	0.9	mA
Supply current (shown full digits)	I_{KK2}	—		—	3.5	6	mA
Holding supply current	I_{DDH}	—	$V_{DD} = 5.5\text{ V}$	—	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

The Proposal of Outer Circuit for Tax Rate Holding with Back-Up Battery.



Note 10: $V_1 = 3\text{ V}$: Battery supply

$V_2 = 5\text{ V}$: DC supply

$\left(\begin{array}{l} \overline{\text{HOLD}} \text{ pin is pulled down in the LSI, but normally pulled up to } V_{DD}. \\ \overline{\text{RESET}} \text{ pin is pulled up to } V_{DD}. \end{array} \right)$

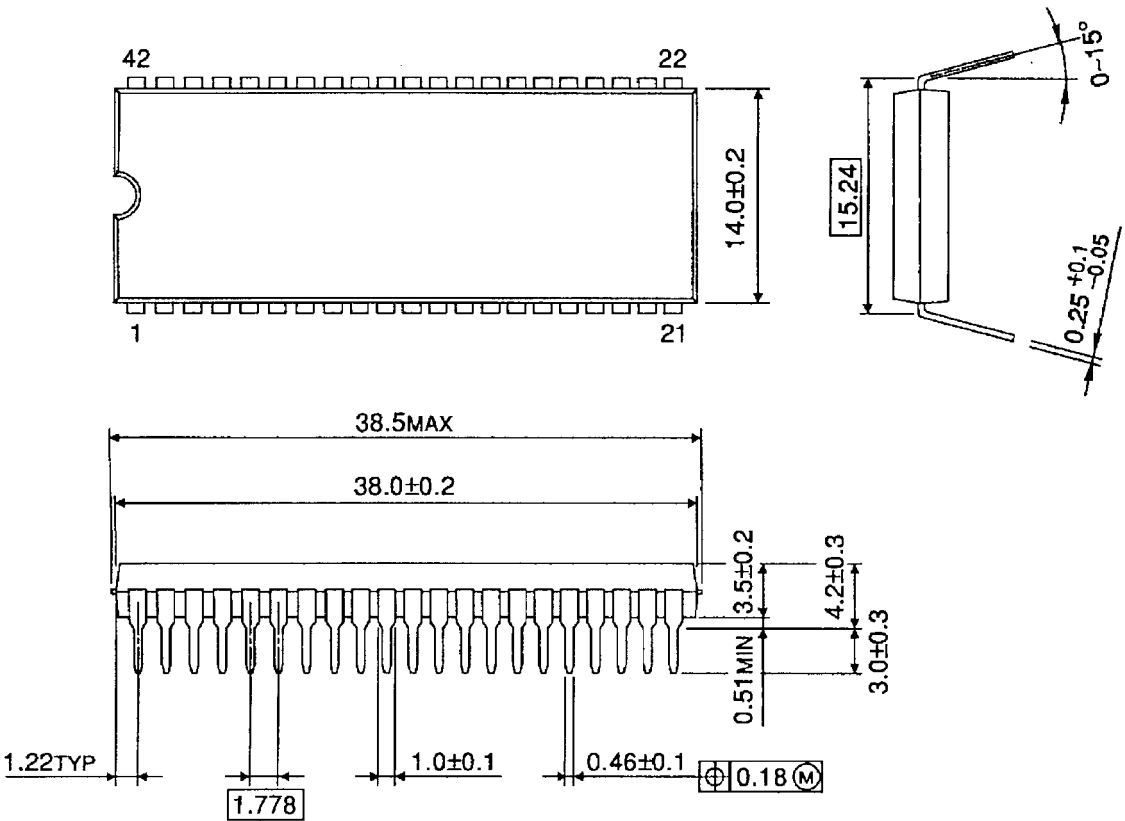
- (1) Setting POWER SW to ON, V_2 is supplied to V_{DD} pin, and also to $\overline{\text{HOLD}}$ pin. Then calculator operates normally.
- (2) Setting POWER SW from ON to OFF, V_1 is supplied to V_{DD} pin and V_{SS} is supplied to $\overline{\text{HOLD}}$ pin. Under this connection, TAX RATE is held.
- (3) Setting POWER SW to ON, V_2 is supplied to V_{DD} pin, and also to $\overline{\text{HOLD}}$ pin. Then calculator operates normally with TAX RATE to be held.

Note 11: V_1 (battery) should be supplied to the circuit after V_2 (DC) supply, because of prevention from exhaustion of battery and abnormal operation.

Package Dimensions

SDIP42-P-600-1.78

Unit : mm



Weight: 4.12 g (typ.)

RESTRICTIONS ON PRODUCT USE

000707EBA

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