

TC83220-0009

TC83220-0009: Single-Chip CMOS LSI for FL (fluorescent) Calculator with Printers

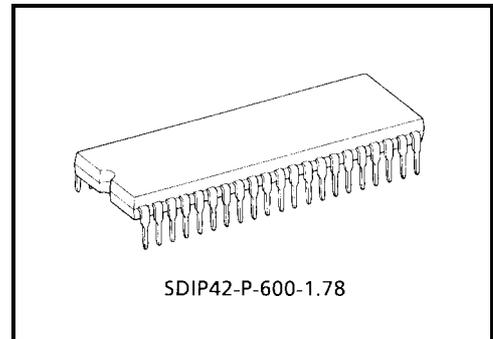
The TOSHIBA printing/display calculator circuit TC83220-0009 is 10/12-digit calculator on a single-chip CMOS LSI.

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.

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 $\boxed{+}$, $\boxed{-}$, $\boxed{+}$, $\boxed{-}$ 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}



Weight: 4.12 g (typ.)

- 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) “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)

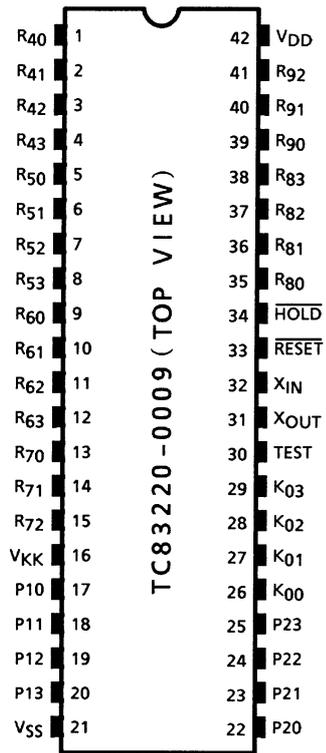
Speed of Calculation (at 4 MHz clock)

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

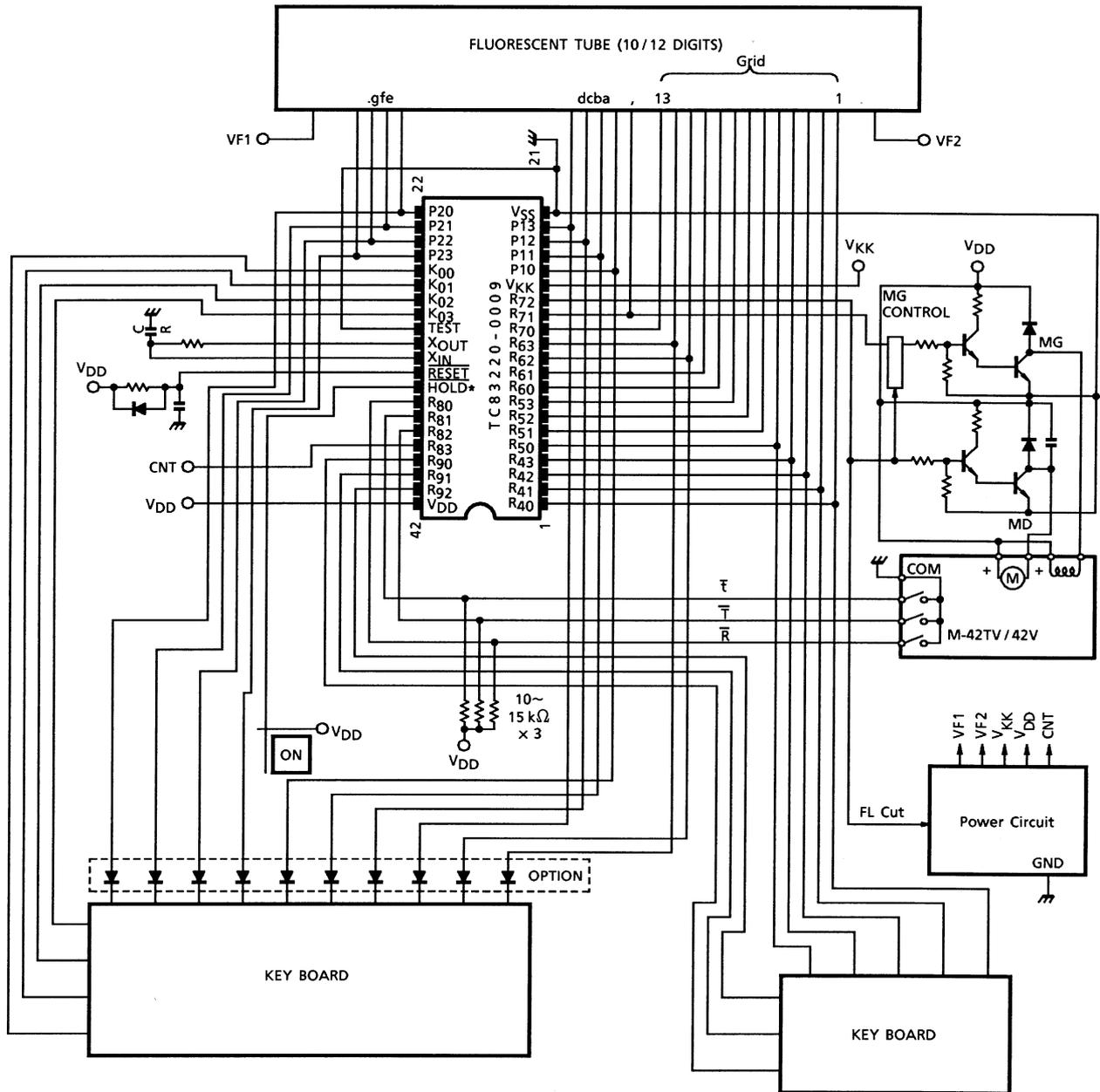
“CNT (R83)” Function

- | | |
|-----------|--------------------------------|
| Operation | On display.....Open |
| | Printing..... Open |
| | Off (hold) mode..... VDD Level |

Pin Assignment (top view)



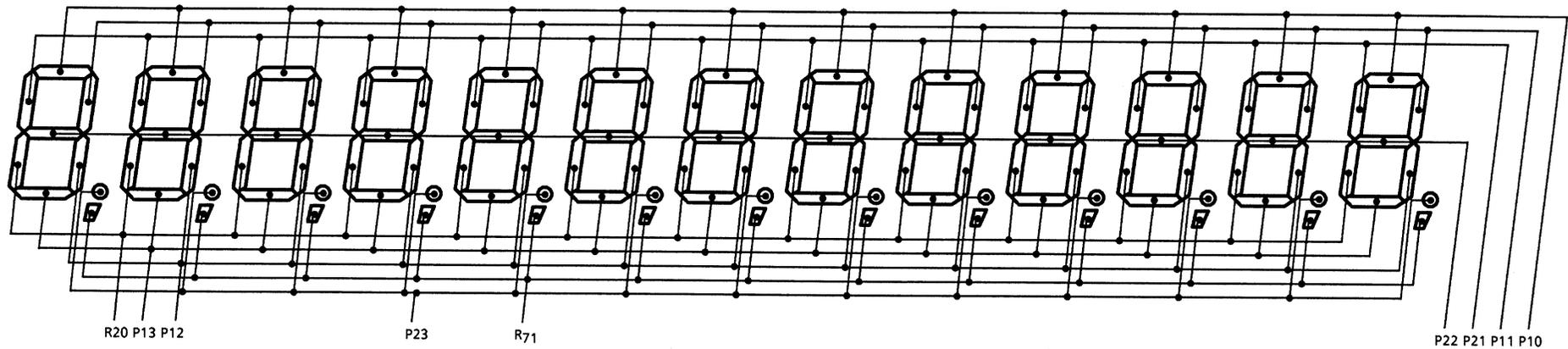
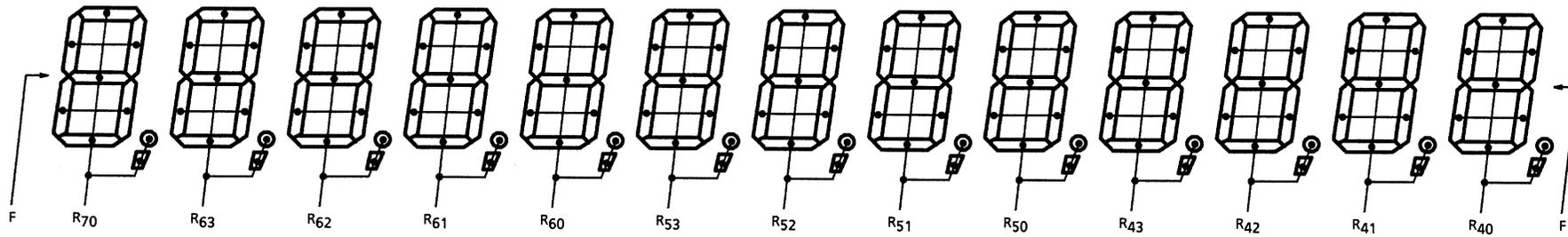
System Diagram



C = 100 pF

R = 1 kΩ ± 2%

Connection of FL



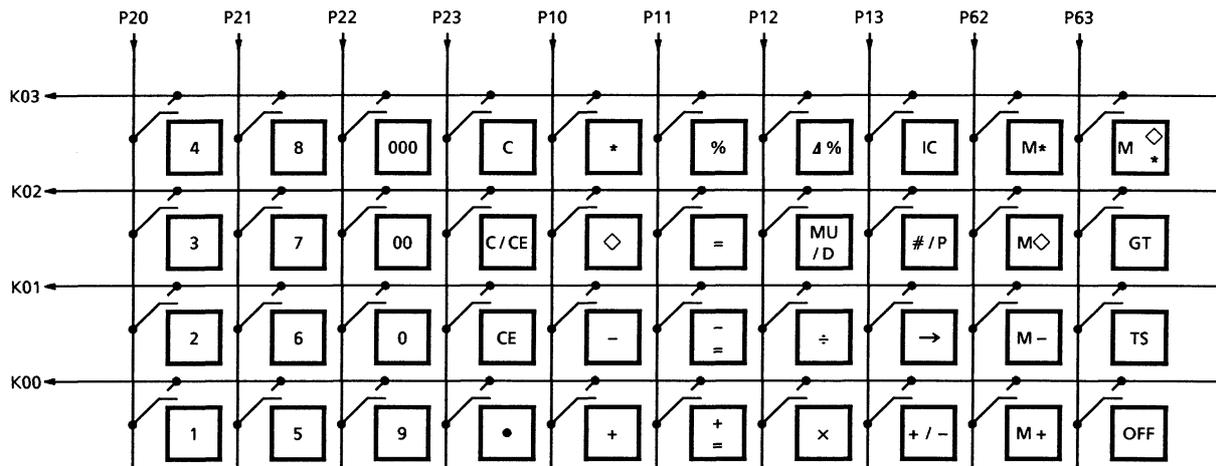
Note 1: R70 digit (P10, P13, P20) of "E" data.

Note 2: R70 digit (P22) of "-" data.

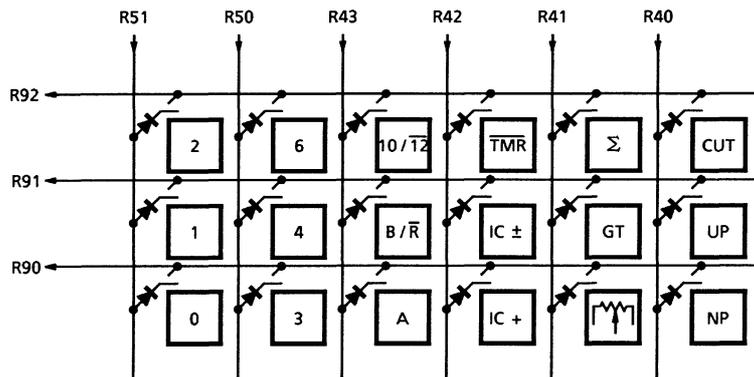
Note 3: R70 digit (P23) of "M" data.

Note 4: R70 digit (P21) of "GT" data.

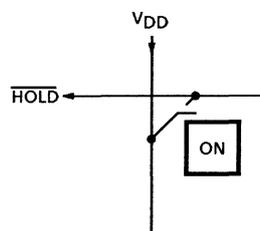
Key Connection



Touch Key



Lock Key



Operation Example

| Key | | | | | | Touch | Print | | | Display | |
|-----|-----|-----|-------|-----|-----|--------|-------|-------------|-----|---------|-------------|
| TAB | 4/5 | IC | 10/12 | Σ | GT | | | | | | |
| 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. |
| | | | | | | 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 | + % | | 5.3 |
| | | | | | | | <PF> | | | 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. |
| | | | | | | ON | | | | M 0. |
| | | | | | | | <PF> | | | |
| | | | | | | M∅ | -7. | M ∅ | R | M -7. |
| | | | | | | M* | -7. | M * | R | |

Note 6: <PF> Paper feed

| Key | | | | | | | Touch | Print | | Display |
|-----|-----|-----|-------|---|-----|-------|-------|-------|---|---------|
| TAB | 4/5 | IC | 10/12 | Σ | GT | | | | | |
| 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 ($V_{SS} = 0\text{ V}$)

| 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 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

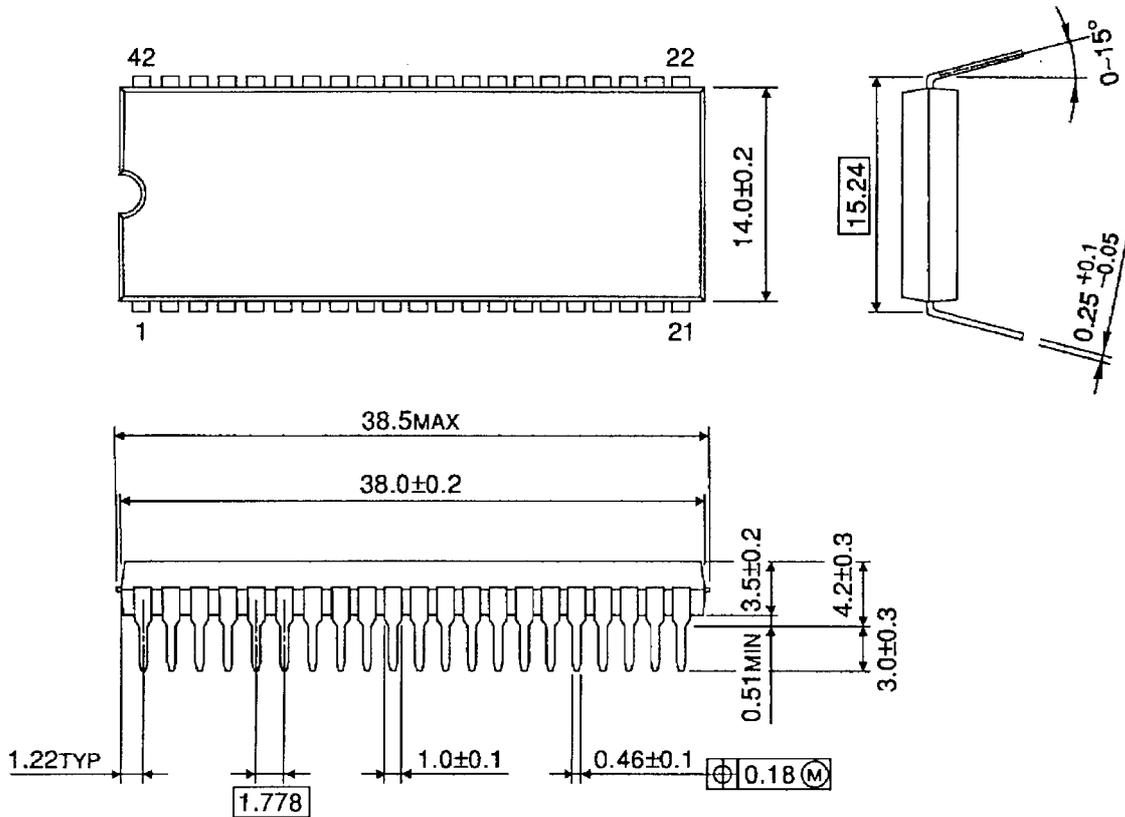
DC Characteristics ($V_{SS} = 0\text{ V}$, $V_{DD} \pm 10\%$, $T_{opr} = 0\sim 40^\circ\text{C}$)

| 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 | $I_{DD\ 0}$ | — | 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.)

RESTRICTIONS ON PRODUCT USE

000707EBA

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