

## OVERVIEW

The C5122 series is a range of CB transceiver ICs fabricated using NPC's original molybdenum-gate CMOS technology. Each IC incorporates a PLL circuit, code ROM applicable to frequencies of various countries, and an UNLOCK signal generator circuit for channel switching. The IC also incorporates a built-in channel UP/DOWN control circuit and CHANNEL/PA display LED driver, thus reducing system cost.

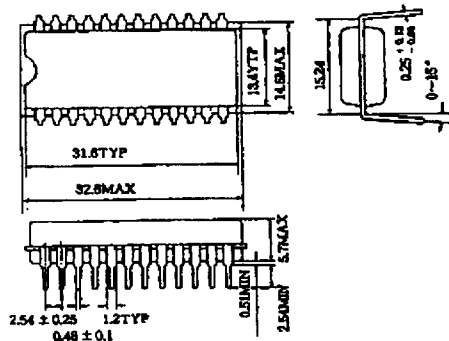
The master slice system will make the ICs compatible with CB frequencies used all over the world, including those specified by US and British standards.

## FEATURES

- Master slice makes IC applicable to CB specifications of various nations.
- Built-in CHANNEL UP/DOWN control circuit
- Built-in UNLOCK signal generator circuit
- Built-in CHANNEL/PA display decoder
- Channel-switching check tone control output pin
- Built-in quartz crystal oscillator circuit (10.24 MHz crystal)
- Last channel backup function
- Master slice makes it possible to select between LED and LCD.
- Built-in LED driver
- Built-in amplifier for active LPF
- One crystal PLL synthesizer
- Emergency channel call function
- Power-on initialize function
- Supply voltage range 5.3 to 6.3 V
- Available in 24-pin plastic DIP or SSOP
- Molybdenum-gate CMOS construction

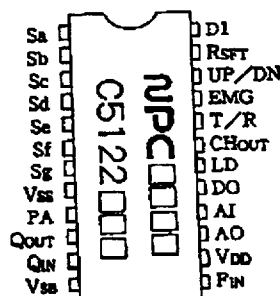
## PACKAGE DIMENSIONS

- 24-pin DIP

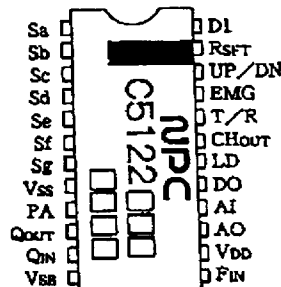


## PINOUT (TOP VIEW)

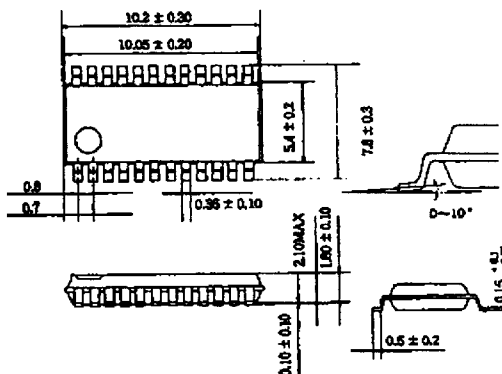
- 24-pin DIP



- 24-pin SSOP



- 24-pin SSOP



# PIN DESCRIPTION

| NAME    | DESCRIPTION                                                                   | NAME  | DESCRIPTION                                                                                                  |
|---------|-------------------------------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------------|
| Sa ~ Sg | LED segment drive outputs. Active "L"                                         | LD    | UNLOCK signal output. When unlocked, it is "L". When locked it goes "H".                                     |
| VSS     | Ground. Should be left "OPEN" during backup.                                  | CHout | Check tone control signal output for channel-switching. Approx. 50 ms pulse is output. Active "H".           |
| PA      | PA display input. Display when H. Internal pull-down resistor                 | T/R   | TX/RX switching input. "H" for TX, and "OPEN" for RX. Internal pull-down resistor.                           |
| QIN     | Quartz crystal oscillator circuit input and output                            | *EMG  | 1 Emergency call pin. "H": Emergency channel. "OPEN": UP/DN input channel.                                   |
| QOUT    |                                                                               |       | 2 Emergency call pin. "H": Emergency CH1. "L": Emergency CH2. "OPEN": UP/DN input CH.                        |
| VSB     | Ground                                                                        | UP/DN | UP/DN Channel UP/DOWN control input. "H": UP. "L": DOWN. "OPEN": NOP.                                        |
| FIN     | Programmable counter input. Internal feedback resistor.                       |       |                                                                                                              |
| VDD     | Power supply 5.3 to 6.3 V                                                     | RSFT  | RX CODE SHIFT input. When "H", RX CODE shifts by +1. Internal pull-down resistor                             |
| AI, AO  | Lowpass filter amplifier input and output. The AI pin goes "H" during standby | DI    | LED digit drive output. When "L", low-order digits are displayed. When "H", high-order digits are displayed. |
| DO      | Phase detector output. Tristate output.                                       |       |                                                                                                              |

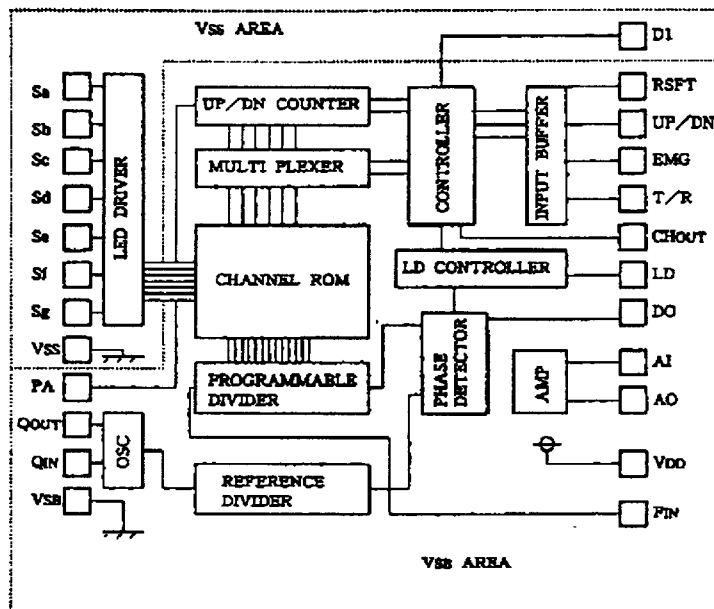
\*EMG: Two versions with different EMG functions are available.

NOP: Non operation

Function 1: C5122 □1□

Function 2: C5122□2□

# BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATING (SSOP)    ■ ABSOLUTE MAXIMUM RATING (DIP)

(V<sub>SS</sub>=0V)

| ITEM                   | SYMBOL                           | RATING                                            | UNIT |
|------------------------|----------------------------------|---------------------------------------------------|------|
| Supply voltage         | V <sub>DD</sub> -V <sub>SS</sub> | -0.3 to +7.0                                      | V    |
| Input voltage          | V <sub>IN</sub>                  | V <sub>SS</sub> ≤V <sub>IN</sub> ≤V <sub>DD</sub> | V    |
| Power dissipation      | P <sub>W</sub>                   | 150                                               | mW   |
| Operating temperature  | T <sub>OPR</sub>                 | -30 to +80                                        | °C   |
| Storage temperature    | T <sub>STG</sub>                 | -40 to +125                                       | °C   |
| Soldering temperature  | T <sub>SLD</sub>                 | 260±5                                             | °C   |
| Soldering time         | t <sub>SLD</sub>                 | 10                                                | Sec  |
| Maximum output current | I <sub>O</sub>                   | 10                                                | mA   |

(V<sub>SS</sub>=0V)

| ITEM                  | SYMBOL                           | RATING                                            | UNIT |
|-----------------------|----------------------------------|---------------------------------------------------|------|
| Supply voltage        | V <sub>DD</sub> -V <sub>SS</sub> | -0.3 to +7.0                                      | V    |
| Input voltage         | V <sub>IN</sub>                  | V <sub>SS</sub> ≤V <sub>IN</sub> ≤V <sub>DD</sub> | V    |
| Power dissipation     | P <sub>W</sub>                   | 250                                               | mW   |
| Operating temperature | T <sub>OPR</sub>                 | -30 to +80                                        | °C   |
| Storage temperature   | T <sub>STG</sub>                 | -40 to +125                                       | °C   |
| Soldering temperature | T <sub>SLD</sub>                 | 260±5                                             | °C   |
| Soldering time        | t <sub>SLD</sub>                 | 10                                                | Sec  |

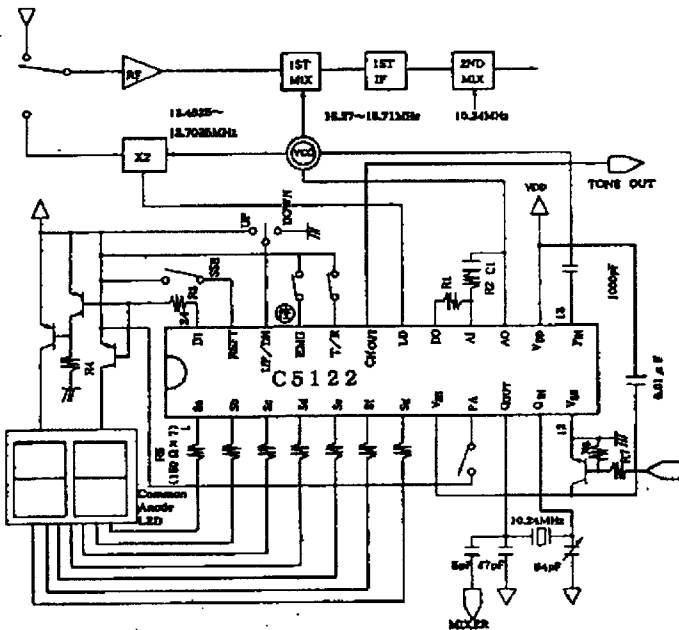
■ ELECTRICAL CHARACTERISTICS

V<sub>SS</sub> = 0 V, V<sub>DD</sub> = 5.3 to 6.3 V and T<sub>a</sub> = -30 to +80 °C unless otherwise specified.

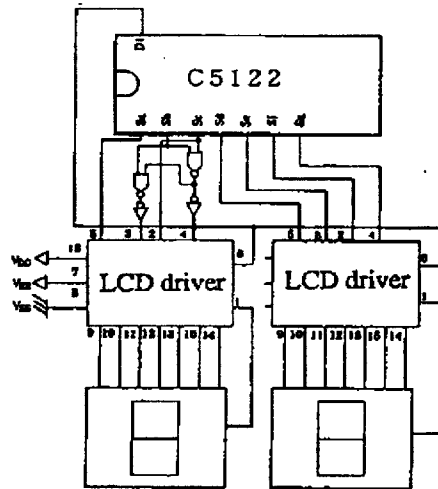
| ITEM                            | SYMBOL            | CONDITIONS                                                                                                         | LIMITS               |     |                 | UNIT            | REMARKS                                                   |
|---------------------------------|-------------------|--------------------------------------------------------------------------------------------------------------------|----------------------|-----|-----------------|-----------------|-----------------------------------------------------------|
|                                 |                   |                                                                                                                    | MIN                  | TYP | MAX             |                 |                                                           |
| Supply voltage                  | V <sub>DD</sub>   | F <sub>IN</sub> = F <sub>MAX</sub> /1V <sub>PP</sub> Q <sub>IN</sub> = 1V <sub>PP</sub>                            | 5.3                  | 5.8 | 6.3             | V               |                                                           |
| Current consumption             | I <sub>DD1</sub>  | F <sub>IN</sub> = F <sub>MAX</sub> Q <sub>IN</sub> = 10.24MHz/1V <sub>PP</sub><br>A <sub>I</sub> = V <sub>DD</sub> |                      |     | 10              | mA              | Max. 15 mA with DIP package                               |
| Maximum operating frequency     | f <sub>MAX1</sub> | F <sub>IN</sub> = 1V <sub>PP</sub> sine wave                                                                       | 18                   |     |                 | MHz             | F <sub>IN</sub>                                           |
|                                 | f <sub>MAX2</sub> | Q <sub>IN</sub> = 1V <sub>PP</sub> sine wave                                                                       | 12                   |     |                 | MHz             | Q <sub>IN</sub>                                           |
| Minimum operating input voltage | V <sub>IN1</sub>  | F <sub>IN</sub> = F <sub>MAX</sub> sine wave                                                                       | 1                    |     |                 | V <sub>PP</sub> | F <sub>IN</sub>                                           |
|                                 | V <sub>IN2</sub>  | Q <sub>IN</sub> = 10.24MHz sine wave                                                                               | 1                    |     |                 | V <sub>PP</sub> | Q <sub>IN</sub>                                           |
| Input voltage                   | V <sub>IL1</sub>  |                                                                                                                    | 0                    |     | 0.4             | V               | T/R, UP/DN, PA                                            |
|                                 | V <sub>IH1</sub>  |                                                                                                                    | V <sub>DD</sub> -0.4 |     | V <sub>DD</sub> | V               | EMG, RSFT                                                 |
| Open state voltage              | V <sub>IO</sub>   | V <sub>DD</sub> = 5.8V T <sub>a</sub> = 25°C                                                                       | 2.3                  | 2.9 | 3.5             | V               | F <sub>IN</sub> , Q <sub>IN</sub>                         |
| Input current                   | I <sub>IL1</sub>  | V <sub>IL1</sub> = 0V V <sub>DD</sub> = 6.3V T <sub>a</sub> = 25°C                                                 |                      |     | 20              | μA              | F <sub>IN</sub> , Q <sub>IN</sub>                         |
|                                 | I <sub>IH1</sub>  | V <sub>IH1</sub> = V <sub>DD</sub> V <sub>DD</sub> = 6.3V T <sub>a</sub> = 25°C                                    |                      |     | 20              | μA              |                                                           |
|                                 | I <sub>IL2</sub>  | V <sub>IH2</sub> = 0V V <sub>DD</sub> = 6.3V T <sub>a</sub> = 25°C                                                 |                      |     | 1               | μA              | T/R, PA                                                   |
|                                 | I <sub>IH2</sub>  | V <sub>IH2</sub> = V <sub>DD</sub> V <sub>DD</sub> = 6.3V T <sub>a</sub> = 25°C                                    |                      | 100 | 200             | μA              | EMG, RSFT                                                 |
|                                 | I <sub>IL3</sub>  | V <sub>IL3</sub> = 0V V <sub>DD</sub> = 6.3V T <sub>a</sub> = 25°C                                                 |                      | 100 | 200             | μA              | UP/DN                                                     |
|                                 | I <sub>IH3</sub>  | V <sub>IH3</sub> = V <sub>DD</sub> V <sub>DD</sub> = 6.3V T <sub>a</sub> = 25°C                                    |                      | 100 | 200             | μA              |                                                           |
| Standby current                 | I <sub>STB</sub>  | Open V <sub>SS</sub>                                                                                               |                      |     | 1               | μA              | V <sub>DD</sub> V <sub>SS</sub> . See typical application |
| Output current                  | I <sub>OL1</sub>  | V <sub>OL</sub> = 2.0V                                                                                             | 15                   |     |                 | mA              | Sa ~ Sg                                                   |
|                                 | I <sub>OH1</sub>  | V <sub>OH</sub> = V <sub>DD</sub> - 0.4V                                                                           | 400                  |     |                 | μA              |                                                           |
|                                 | I <sub>OL2</sub>  | V <sub>OL</sub> = 2.0V                                                                                             | 1.5                  |     |                 | mA              | D1                                                        |
|                                 | I <sub>OH2</sub>  | V <sub>OH</sub> = V <sub>DD</sub> - 0.4V                                                                           | 400                  |     |                 | μA              |                                                           |
|                                 | I <sub>OL3</sub>  | V <sub>OL</sub> = 0.4V A <sub>I</sub> = V <sub>DD</sub>                                                            | 400                  |     |                 | μA              | LD, DO                                                    |
|                                 | I <sub>OH3</sub>  | V <sub>OH</sub> = V <sub>DD</sub> - 0.4V A <sub>J</sub> = V <sub>SS</sub>                                          | 400                  |     |                 | μA              | CH <sub>OUT</sub> , AO                                    |

## ■ TYPICAL APPLICATION

### • LED display



### • LCD display

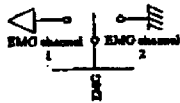


Sa ~ Sc: High-order digit data outputs (BCD)  
 Sd ~ Sg: Low-order digit data outputs (BCD)  
 D1: display drive clock 78 Hz, 50% duty

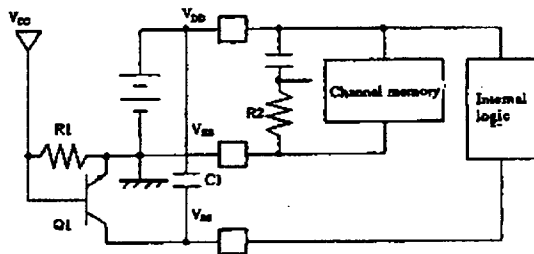
CR values are given for reference.

No values are given where nothing is specified.

Note: The circuit shown below is for the C5122 □ 2 □ version.

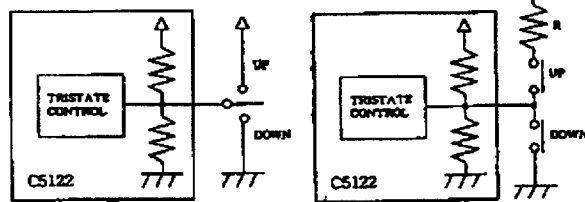


### ■ CHANNEL BACKUP CIRCUIT EXAMPLE



C1 = 0.01  $\mu$ F. R1 and R2 are not specified.  
 A mechanical switch may be used as Q1.

### ■ UP/DOWN SWITCH INTERFACE



(Detent SW interface)

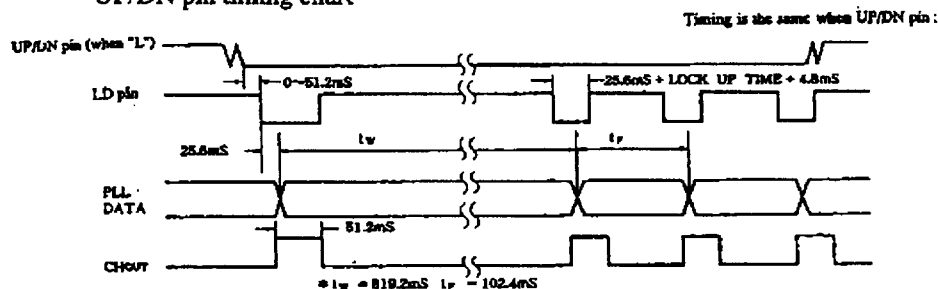
(Push, up/down SW interface)

R is a current limiter resistor when both are pressed simultaneously ( $R \leq 1$  K $\Omega$ ). In this example, the down operation is performed when both switches are pressed simultaneously.

### ■ UP AND DOWN SWITCH TIMING

The UP/DOWN pin is provided for channel up/down control. In addition to step-up and step-down functions, this pin implements the fast-forward function. Holding down the key continually for wait time  $t_w$  or longer starts fast forwarding in  $t_f$  cycles. The up/down operation is disabled when the EMG, PA and T/R pins are "H". The up/down operation is also disabled when the Vss pin is not "L" (during standby).

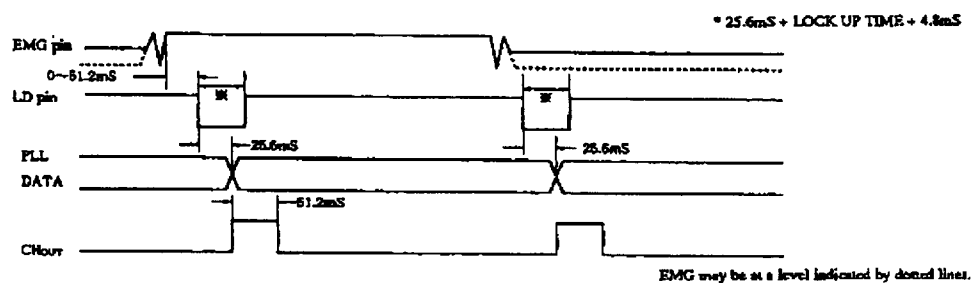
#### • UP/DN pin timing chart



### ■ EMG (C5122 □ 1 □ version)

Taking the EMG pin "H" selects the emergency channel. When "OPEN", the channel returns to what was set by the UP/DN pin.

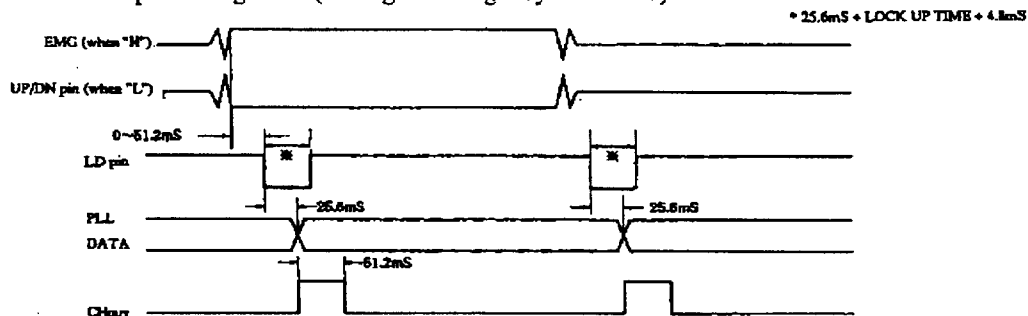
#### • EMG pin timing chart



### ■ EMG (C5122 □ 2 □ version)

Taking the EMG pin "H" selects emergency channel 1, and taking it "L" selects emergency channel 2. When "OPEN", the channel returns to what was set by the UP/DN pin.

#### • EMG pin timing chart (setting to emergency channel 1)

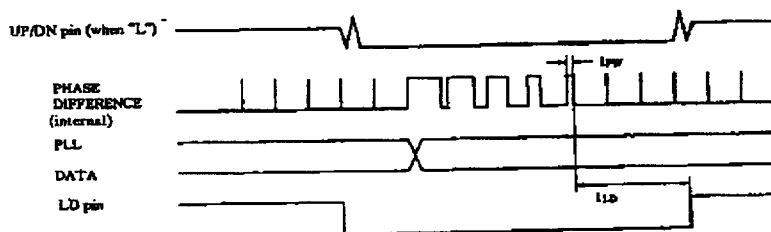


## ■ LD PIN

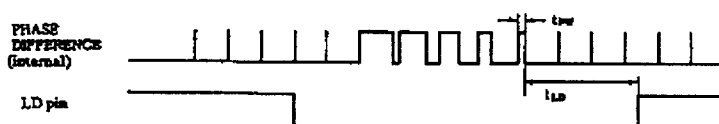
Unlock detector pin

The LD pin goes "H" when the PLL is locked, and goes "L" when the PLL is unlocked. The LD pin may go "L" by the UP/DN, REST, T/R or EMG pin. It may also go "L" when the PLL unlocks due to external instability.

### a. Case of input pin



### b. Unlocking due to external instability



\*t<sub>pw</sub> ..... Phase difference (time difference) for detecting unlocking 16  $\mu$ S (TYP)

\*t<sub>LD</sub> .... From the time the PLL locks to produce the phase difference of 1.6  $\mu$ s until LD is reset 4.8 ms  $\pm$  10%

## ■ PA PIN

Making this pin go "H" enables PA display. Leaving it "OPEN" resumes the previous PLL operation. The PLL operation stops during PA display, and the following state is created.

- \* AI pin: "H" level
- \* CHout pin: "L" level
- \* DO pin and LD pin: High impedance
- \* Channel information is retained.

## ■ T/R pin

Transmission and receiving switching pin. The level of this pin (H/L) does not affect EMG. However, when this pin is "H", the channel up/down operation is disabled. At the time of switching, the LD pin operates in the same manner as the other input pins.

## ■ RSFT pin

Making this pin go "H" increments RX CODE by 1. Leaving it "OPEN" obtains the original CODE. The timing chart is the same as that of the EMG pin.

## ■ CHout pin

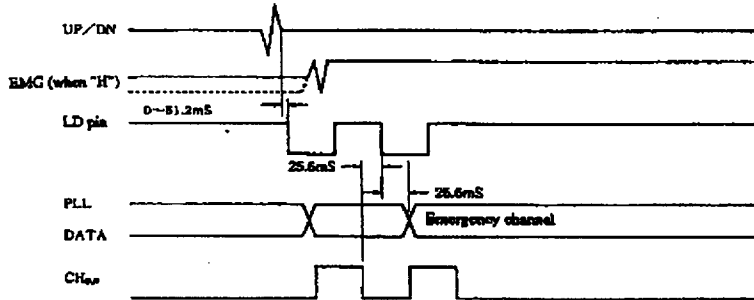
The CHOUT pin outputs signals when the channel UP/DOWN operation is performed by the UP/DN pin, when the EMG pin level changes, or when the RSFT pin level changes.

## ■ PRIORITY OF INPUT PINS

Data is input to UP/DN, EMG and PA pins according to the following priority: PA > EMG > UP/DN

If a high-priority pin goes "L" while a low-priority pin is in operation (e.g., from the time LD changes from H to L until the CHOUT output stops), the high-priority pin operation starts after the low-priority pin operation is finished.

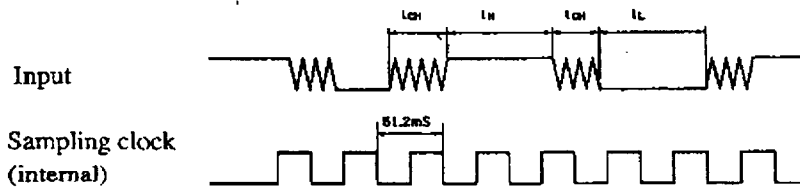
With version C5122 □ 1 □, the EMG pin may be at the level indicated by the dotted line.



## ■ CHATTERING PREVENTION CIRCUIT

A chattering prevention circuit is attached to each of the UP/DN, EMG, RSFT, PA and T/R pins.

| Item                      | Symbol   | MIN | TYP | MAX | UNIT |
|---------------------------|----------|-----|-----|-----|------|
| Allowable chattering time | $t_{CH}$ |     |     | 51  | mS   |
| H-level input time        | $t_H$    | 52  |     |     | mS   |
| L-level input time        | $t_L$    | 52  |     |     | mS   |



## ■ STANDBY MODE

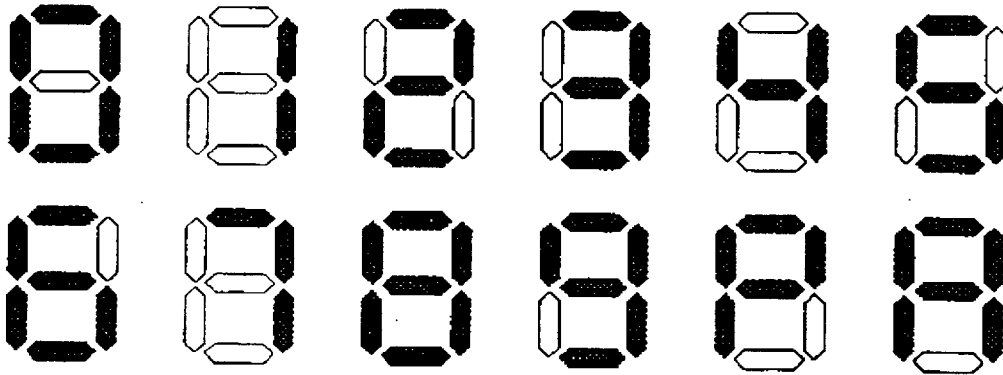
Leaving the Vss pin "OPEN" sets the standby mode and performs the following operation.

- Cut off the pull-up resistor of the UP/DOWN pin.
- FIN, QIN pin: "L" level, AI pin: "H" level
- CHOUT pin: "L" level
- DO, LD pin: High impedance
- Quartz crystal oscillation is stopped.
- Channel information is retained.

- \* The LD pin goes "L" when the standby state returns to the normal operation state. LD goes "H" after the PLL is locked. No signal is output from the CHOUT pin.

# ■ CHANNEL/PA DISPLAY

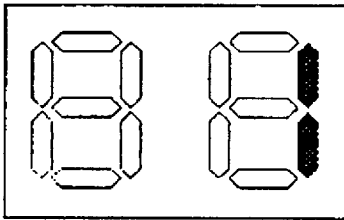
The display signals output from the Sa to Sg, D1 and PA pins display with the following display font.



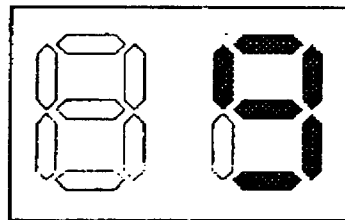
● Channel display example

■ : Lighting segment  
□ : Non-lighting segment

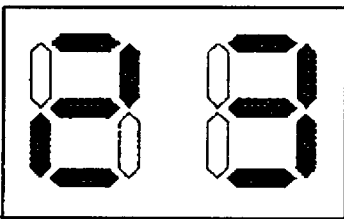
1CH



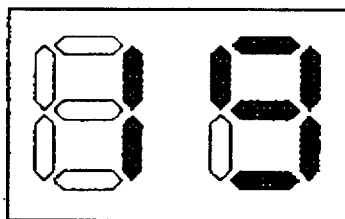
9CH



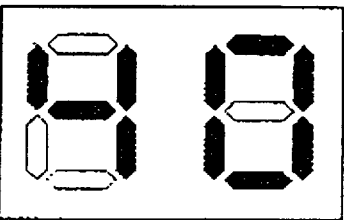
23CH



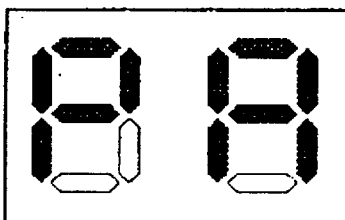
19CH



40CH



PA

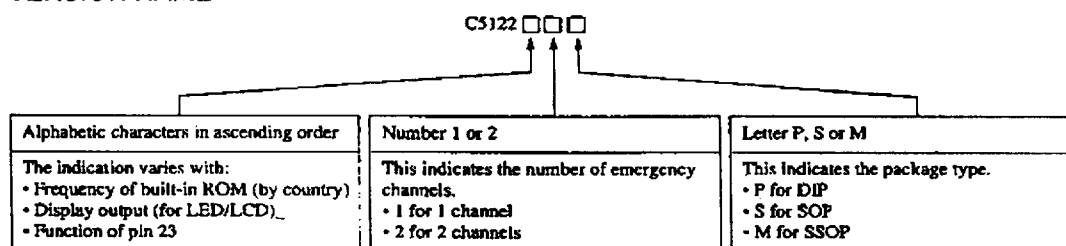




# MASTER SLICES (example)

| Version name | Frequency specification | Emergency channel | 23 pin (RSFT) function | Display |
|--------------|-------------------------|-------------------|------------------------|---------|
| C5122 A1     | USA                     | 9ch               | "H"; N + 1             | LED     |
| A2           | USA                     | 9ch, 19ch         | "H"; N + 1             | LED     |
| B1           | UK                      | 9ch               | NC                     | LED     |
| ⋮            | ⋮                       | ⋮                 | ⋮                      | ⋮       |
| E1           | DENMARK, NORWAY         | 11Ach             | "H"; N + 1             | LED     |
| ⋮            | ⋮                       | ⋮                 | ⋮                      | ⋮       |
| J1           | USA                     | 9ch               | "H"; N + 1             | LCD     |

# VERSION NAME



# FREQUENCY TABLE (reference)

(Unit: MHz)

| CHANNEL | USA    |                          |                          | CHANNEL | USA    |                          |                          |
|---------|--------|--------------------------|--------------------------|---------|--------|--------------------------|--------------------------|
|         | FREQ   | TX VCO FREQ<br>(TX F IN) | TX VCO FREQ<br>(RX F IN) |         | FREQ   | TX VCO FREQ<br>(TX F IN) | RX VCO FREQ<br>(RX F IN) |
| 1       | 26.965 | 13.5825                  | 16.27                    | 21      | 27.215 | 13.6075                  | 16.52                    |
| 2       | 26.975 | 13.4875                  | 16.28                    | 22      | 27.225 | 13.6125                  | 16.53                    |
| 3       | 26.985 | 13.4925                  | 16.29                    | 23      | 27.255 | 13.6275                  | 16.56                    |
| 4       | 27.005 | 13.5025                  | 16.31                    | 24      | 27.235 | 13.6175                  | 16.54                    |
| 5       | 27.015 | 13.5075                  | 16.32                    | 25      | 27.245 | 13.6225                  | 16.55                    |
| 6       | 27.025 | 13.5125                  | 16.33                    | 26      | 27.265 | 13.6325                  | 16.57                    |
| 7       | 27.035 | 13.5175                  | 16.34                    | 27      | 27.275 | 13.6375                  | 16.58                    |
| 8       | 27.055 | 13.5275                  | 16.36                    | 28      | 27.285 | 13.6425                  | 16.59                    |
| 9       | 27.065 | 13.5325                  | 16.37                    | 29      | 27.295 | 13.6475                  | 16.60                    |
| 10      | 27.075 | 13.5375                  | 16.38                    | 30      | 27.305 | 13.6525                  | 16.61                    |
| 11      | 27.085 | 13.5425                  | 16.39                    | 31      | 27.315 | 13.6575                  | 16.62                    |
| 12      | 27.105 | 13.5525                  | 16.41                    | 32      | 27.325 | 13.6625                  | 16.63                    |
| 13      | 27.115 | 13.5575                  | 16.42                    | 33      | 27.335 | 13.6675                  | 16.64                    |
| 14      | 27.125 | 13.5625                  | 16.43                    | 34      | 27.345 | 13.6725                  | 16.65                    |
| 15      | 27.135 | 13.5675                  | 16.44                    | 35      | 27.355 | 13.6775                  | 16.66                    |
| 16      | 27.155 | 13.5775                  | 16.46                    | 36      | 27.365 | 13.6825                  | 16.67                    |
| 17      | 27.165 | 13.5825                  | 16.47                    | 37      | 27.375 | 13.6875                  | 16.68                    |
| 18      | 27.175 | 13.5875                  | 16.48                    | 38      | 27.385 | 13.6925                  | 16.69                    |
| 19      | 27.185 | 13.5925                  | 16.49                    | 39      | 27.395 | 13.6975                  | 16.70                    |
| 20      | 27.205 | 13.6025                  | 16.51                    | 40      | 27.405 | 13.7025                  | 16.71                    |