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It is a document includes overview of 6011N FLEX Pager in digital and RF board.

6011N FLEX PAGER DIGITAL BOARD CIRCUIT DESCRIPTION

A) OVERVIEW

The 6011N Pager is a 4-line alpha-numeric display FLEX pager. It has four keys and 128 x 32 dots LCD display. It is controlled by NEC μPD78054 8-bit MCU. The FLEX signal data is received by the decoder Motorola XC68175 IC (or TI TLV5591) and will store to the external memory (RAM). The user can use the key to read the received message that will be displayed on the LCD glass. When the new user message is arrived, the pager can set the alert signal to user such as buzzing sound or vibration from vibrator.

B) FLEX decoder

The FLEX decoder is Motorola XC68175 IC or TI TLV5591 is used as a FLEXchip signal processor to connect the RF board to MCU of the digital board. The decoder will control the RF board ON & OFF and receive the 2 bits FSK data. The decoder will decode the FSK data and acknowledge the MCU if CAP code (address) is correct. When the new message arrive, the decoder will generate the interrupt to the MCU. The decoder will also acknowledge the MCU about the low battery condition if voltage is below 1.1V. The 76.8K Hz crystal is used to drive the FLEX decoder. FLEXchip will communicate to the MCU by the 32 bits SPI.

C) MCU

The core MCU is 8-bit NEC μPD78054 which will handle all the work of pager. The MCU will has a initial procedure that will read setting from EEPROM and setup the I/O device. The MCU will receive the RF signal through RF board and FLEX decoder. After MCU receive the signal with respect address, it will turn the buzzer on or motor on to acknowledge the user. The user can access the pager by the key input to read the message from the LCD and setup the pager function. The 2 M Hz resonator and 32.768K Hz crystal is used to drive the MCU. The DC/DC convertor step up the 1.5V to 2.7V from battery to supply the MCU, FLEX decoder, EEPROM and LCD module. A 2.2V voltage detector with a RC delay circuit is used as reset circuit to the MCU.

D) I/O device and Support device

LCD -	A 128x32 STN type full dots matrix LCD display is used as the display of 6011N pager. It can display up to 4 line alpha-numeric character. It can check in the test mode.
RAM -	The data is stored in the 256K bit RAM (32K byte).
EEPROM -	S-29430A, 8K bit serial EEPROM by Seiko Instruments Inc., is used to save the configuration information.
Buzzer & Motor -	is used to acknowledge the user when call is arrived.

Lamp - It is used to see the LCD in darkness place.

Key - The key pad is a input device. In 6011N, there are four input key.

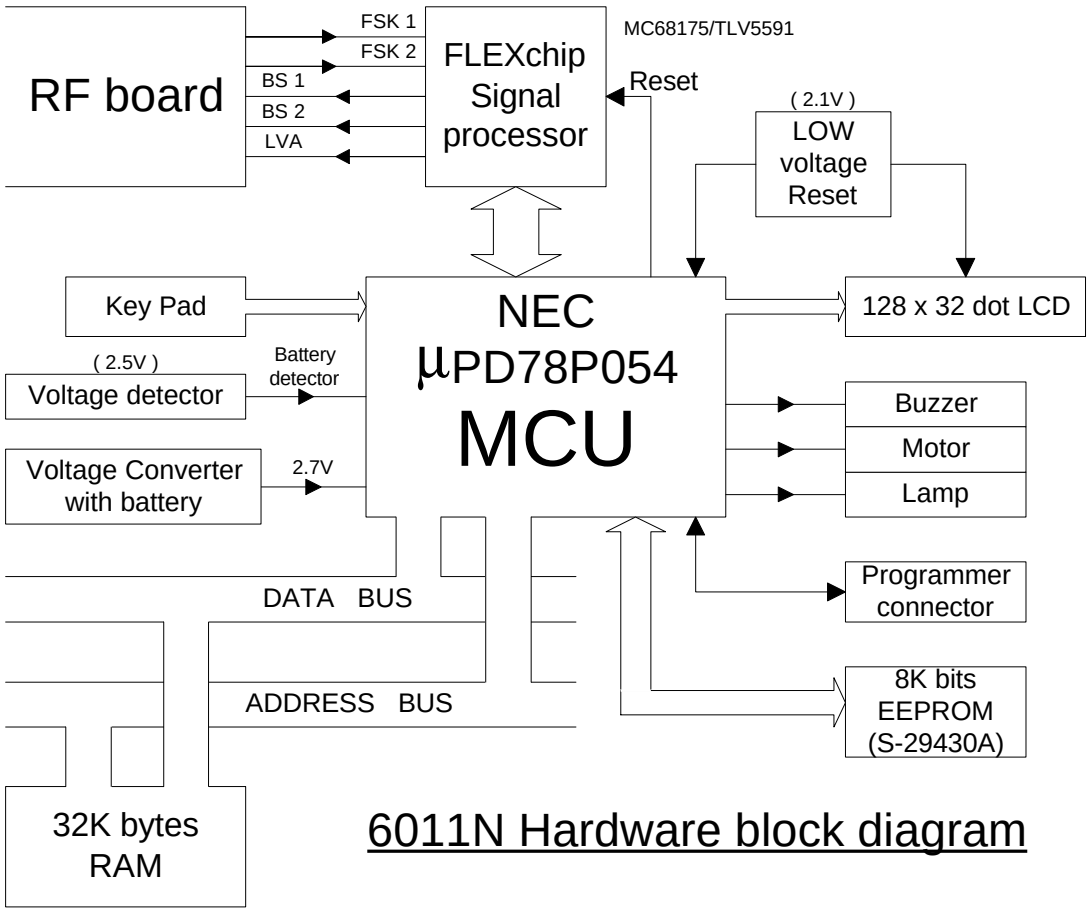
DC/DC converter - The voltage converter provide the necessary voltage level from the 1.5V battery. Current voltage of DC/DC converter output is 2.7V.

Battery detector - A voltage detector (2.5V) is used as a battery remove detector that will let the pager switch to sleep mode after battery is removed.

Backup battery - A backup battery is used to maintain the memory data for a short time after the main 1.5 V battery is removed.

Programmer connector - The programmer connector is used to program the pager address.

The block diagram of the 6011N FLEX Pager Digital board was show as following.



6011N Hardware block diagram

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Technical Description and Block diagram of 6011 Flex pager - RF part

A) Theory of Operation

The RF demodulation process is based on conventional double conversion superheterodyne method. The first IF (intermediate frequency) is selected to be 21.4MHz. The second IF is 455KHz. The demodulation process is done by the FM-IF IC (KA8515) or TA31149. The FM-IF IC includes voltage regulator, low battery detection circuit, mixer, oscillator, FSK comparator and limiting IF amplifier. The operation principles of this paging receiver are depicted in Fig. 1 and the schematics.

B) Antenna Circuit and Amplifier

Antenna of the pager is constructed by silver plated copper loop. By proper tuning a variable capacitor, the loop antenna will be matched to the amplifier and hence the signal picked up would be amplified. The amplified RF signal is then applied to a mixer through a wide-band SAW filter. The SAW filter is mainly used for first image signal suppression.

C) First Local Oscillator and Mixer

The oscillating signal is generated by a crystal oscillator with one stage of frequency multiplier. The LO signal is then mixed with the RF signal by mixer to generate the 21.4MHz IF signal. The 21.4MHz crystal filter is used to filter the 21.4MHz IF signal with second image rejection purpose.

D) FM-IF Circuit

The FM-IF IC converts the 21.4MHz IF signal to 455KHz second IF by the internal second mixer with externally connected crystal of either 20.945MHz. Ceramic filters are used to improve the adjacent channel rejection response. The 455KHz IF signal will then be amplified, limited and discriminated by a ceramic resonator to the base-band analogue signal. Inside the chip there is a level comparator for converting the analogue signal to the 2 bits digital data, i.e. FSK1 and FKS2. Besides, the chip can power up the whole RF front end with a regulated 1Vdc. With the low voltage alarm function, the MCU can detect the battery from running flat.

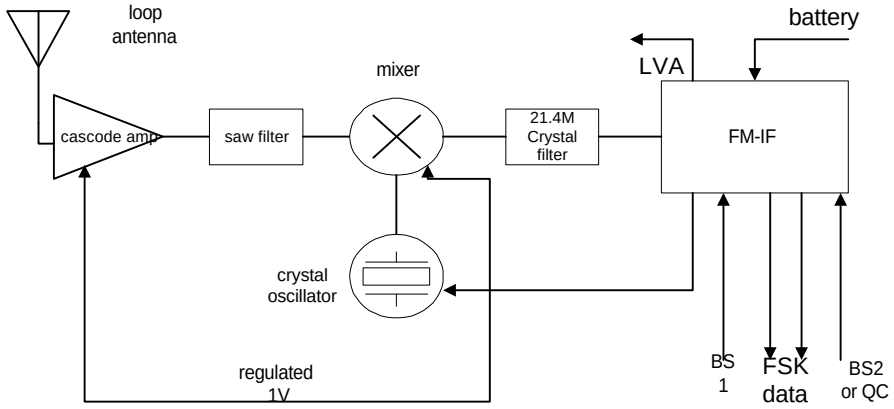

Figure 1: Block diagram of 2-level FSK RF demodulation architecture.

E) Frequency of the first and second local oscillator

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Here attached the frequency of the first local oscillator,

e.g. 1. for 928MHz pager sample, the frequency generated from the local oscillator is 75.550MHz and its harmonic.

2. for 932MHz pager sample, the frequency generated from the local oscillator is 75.883MHz and its harmonic.

The second local oscillator is fixed at 20.945MHz.