

WPM 14.2

SINGLE CHIP RADIO IC INCLUDING SYNCHRONOUS DETECTOR

Taiwa, Okanobu Daisuke, Yamazaki *

Personal Communications Group Sony Corporation 1-7-4 Kohnan, Minato-ku, Tokyo, 108 Japan
* Bipolar Division Semiconductor Group

ABSTRACT

We developed a single chip AM/FM radio IC which can be used for short wave receiver. It includes synchronous detector and PSN as AM and SSB detector. So distortion and interference are decreased by this IC.

INTRODUCTION

At AM broadcast, especially at short wave broadcast, listening condition is often poor by fading or adjacent frequency signal interference. One of the methods to improve it is using synchronous detector. By generating carrier in receiver, over modulation distortion which occurred by carrier suppression caused by fading can be reduced, and at AM broadcast, by selecting upper side band or lower side band, reception becomes better. Therefore, many communication receivers have synchronous detectors, but few consumer receivers have it.

CONVENTIONAL RADIO

At conventional consumer short wave radio, detector circuits are conventional envelope detector by diode and product detector (few radios have it) for SSB decoding. Because another new detector circuit's scale is too large, so radio cannot be small. And local oscillator's stability, IF filter's selectivity should be totally improved for new detector circuits.

Therefore, we need new IC to use synchronous detector at conventional radio.

NEW DETECTING CIRCUITS

Fig. 1 is block diagram of synchronous detector of newly developed IC. Carrier is regenerated by PLL. VCO is 8 times higher than IF (frequency is 3.6MHz or 3.64MHz), using ceramic or lithium tantalum for good stability. VCO varies ± 2 kHz (at IF) to follow frequency drift of radio's local oscillator in long and short time.

To select side band for receiving, PSN which

is 4 order all pass network is included (a few capacitors are needed as external parts). Consequently, side band rejection ratio from 300Hz to 9kHz is about 30dB.

THE RADIO USING NEW IC

Fig. 2 is block diagram of FM/AM radio using this new 30 pins IC. Short wave receiving circuit is double conversion and its 1st local oscillator is synthesized by PLL. The IC includes FM front end, FM IF limiter amplifier, FM detector, AM 2nd mixer, AM 2nd oscillator, AM IF amplifier, and AM synchronous detector.

FM detector is quadrature detector using ceramic discriminator. There are three ways to receive short wave, product detector, synchronous detector, envelope detector. By product detector or synchronous detector, USB or LSB can be selected.

PLL circuits in synchronous detector have a VCO which varies at large frequency range (± 2 kHz as explained before). Until PLL is locked, loop coverage is wide, so PLL can be locked even if frequency difference between input signal and VCO is ± 500 ~ 1000 kHz. After PLL is locked, PLL loop gain is decreased. So selectivity to signal close to carrier frequency becomes better and a purity of regenerated carrier signal becomes better.

Therefore, even if using local oscillator which has stability for consumer radio, we can prevent the states unable to receive when receiving frequency change and PLL is unlocked.

CONCLUSION

Small radio with synchronous detector can be realized by this newly developed IC easily. Many people will have less interference and less distortion receiver. And this IC is not only for better receiving DSB broadcasting, but also for SSB broadcasting which will increase in the future.

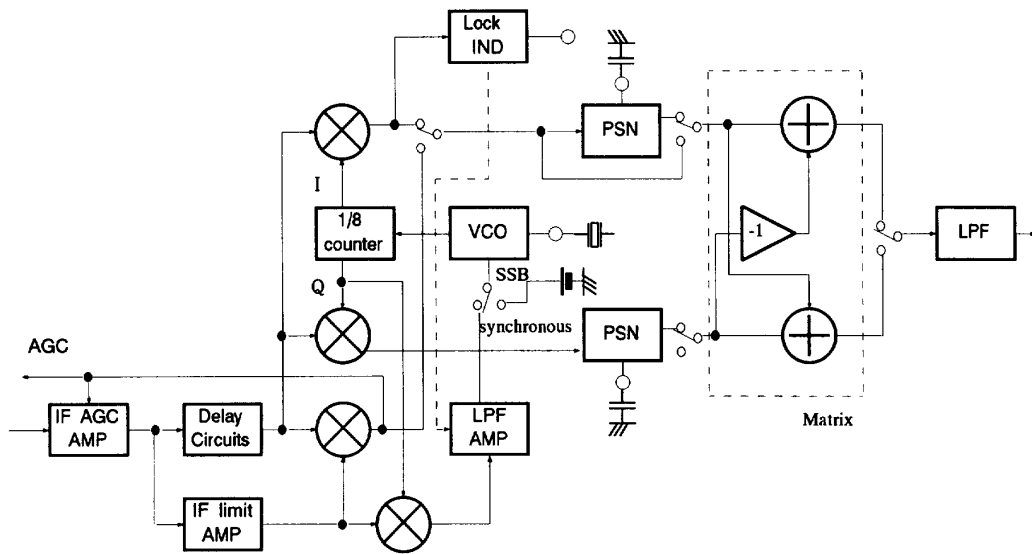


Fig.1

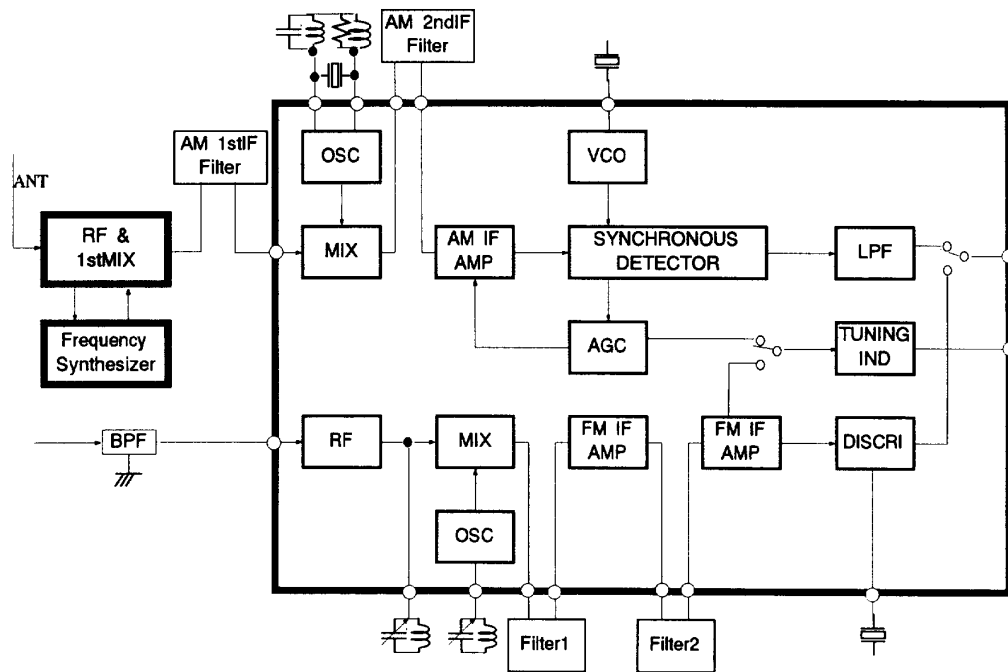


Fig.2