Ordering number : ENN7891A

SANYO Semiconductors
DATA SHEET

LA8677V — Monolithic Linear IC
IF Signal Processor for Cordless Phones

Overview

The LA8677V is IF signal processor for cordless phones.

Features

- Since 2nd-MIX, IF filter, IF amplifier, FM detection, a comparator, etc. are implemented, FM wireless data transmission receiver can easily be composed.
- Since IF ceramic filter and discriminator for FM demodulation are implemented, it is effective on the reduction of external components.

Specifications

Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum power supply voltage	V_{CC} max		7	V
Allowable power dissipation	Pd max	Ta≤70°C	150	mW
Operating temperature	Topr		-20 to +70	°C
Storage temperature	Tstg		-50 to +125	°C

Operating Conditions at Ta = 25°C

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Power supply voltage	V_{CC}	$V_{CC}1$, $V_{CC}2$	1.8	2.0	5.5	V
Mixer input frequency	Fin	MIXIN		21.3		MHz
Local input amplitude	VLO	LOIN	95	100	105	dBμ

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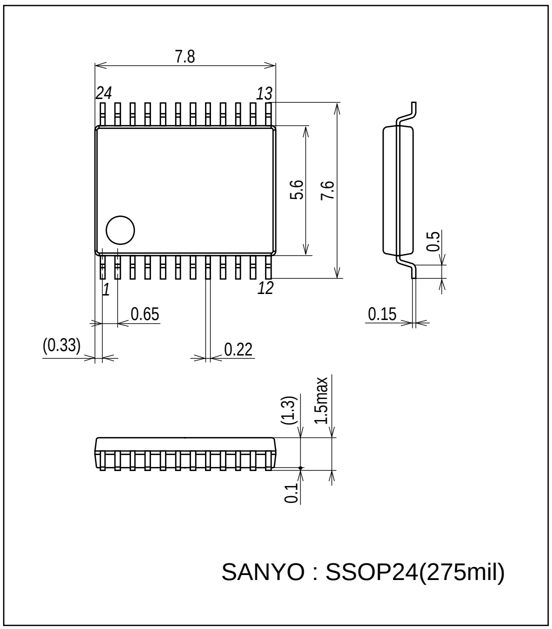
Electrical characteristics at Ta = 25°C, V_{CC} = 2.0V, fin = 21.3MHz, fm = 1kHz, Δf = ±1.5kHz

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Power supply current	I_{CCO}	No signal input	4.3	7	9.0	mA
Mixer image rejection ratio	Irr	V_{IN} = 70dBμEMF 4-pin GND	20	35		dB
Mixer conversion gain	Gc	V_{IN} = 60dBμEMF 4-pin GND	26	30		dB
Mixer input impedance	R_{IN}			5		kΩ
	C_{IN}			3		pF
Input sensitivity	VSN	(S+N) /N = 12dB		20		dBμEMF
Demodulation output	Vdet	V_{IN} = 80dBμEMF	110	140	170	mVrms
SN ratio	SNR	V_{IN} = 80dBμEMF	40	54		dB
AM rejection ratio	AMR	V_{IN} = 80dBμEMF AM = 30%	32	38		dB
Distortion factor	THD	V_{IN} = 80dBμEMF		-38	-30	dB
Demodulation bandwidth	Fc	-3dB		3		kHz
IF filter bandwidth	BW	-3dB bandwidth	6	8		kHz
IF filter attenuation	ATT	f = 50kHz±12.5kHz	50	57		dB
RSSI output voltage	Vrssi1	V_{CC} = 3V, V_{IN} = 20dBμEMF	0.3	0.6	0.9	V
	Vrssi2	V_{CC} = 3V, V_{IN} = 90dBμEMF	1.8	2.2	2.6	V
RSSI comparator reference input range	VREF	10pin input	0.3		V_{CC}-1	V
RSSI comparator hysteresis width	VHYS			30		mV
RSSI comparator output voltage	VRDET	20pin output, VREF<VRSS1, I_S = 0.2mA		0.1	0.5	V
Noise detection output voltage	Vndet	19pin, I_S = 0.2mA		0.1	0.5	V
Noise comparator detection level	VTHH			0.5		V
	VTHL			0.4		V

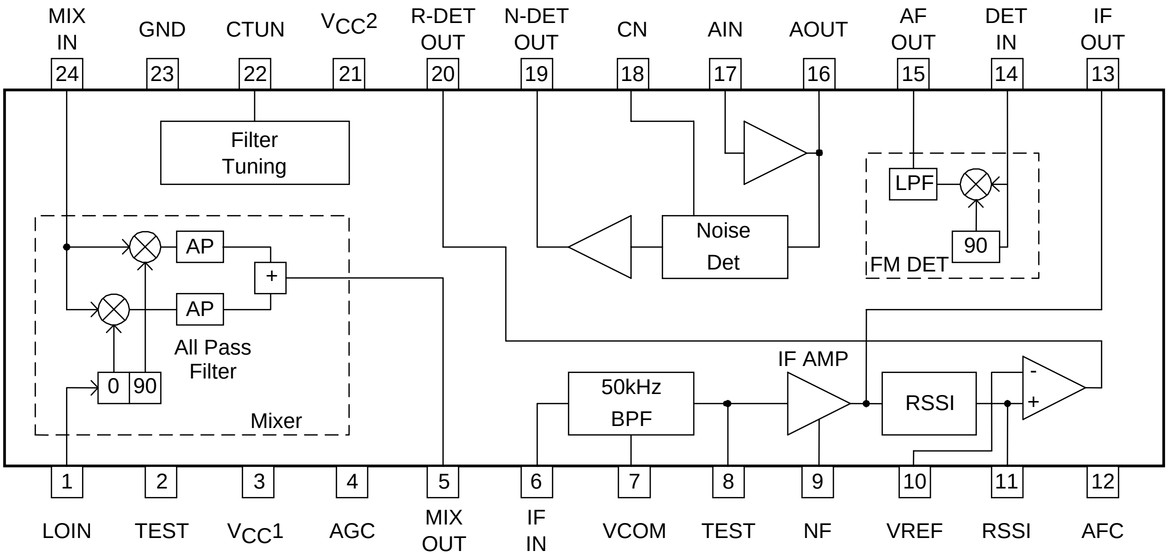
Package Dimensions

unit : mm (typ)

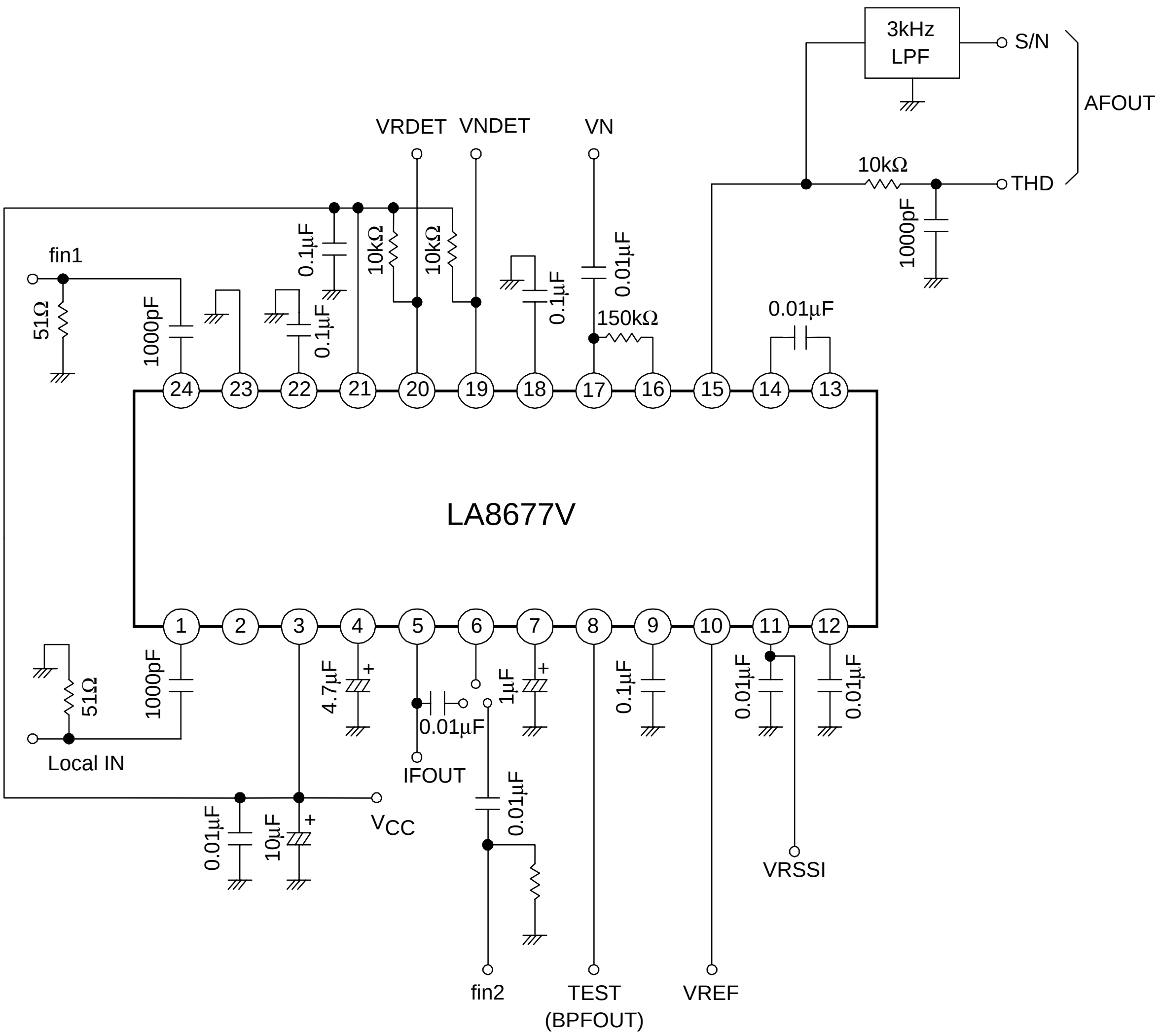
3175C



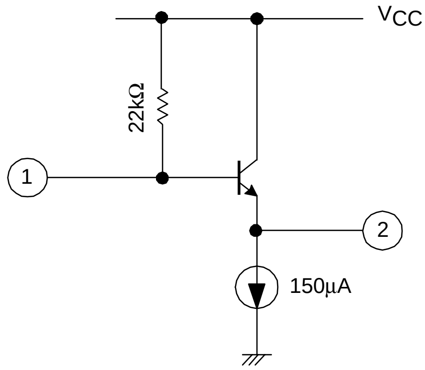
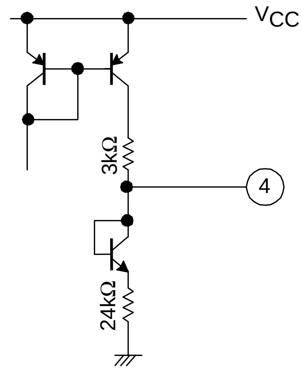
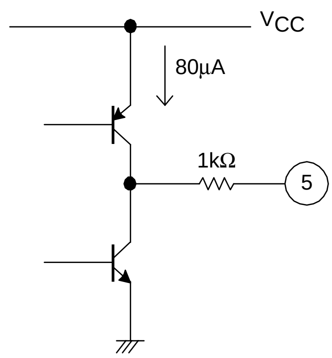
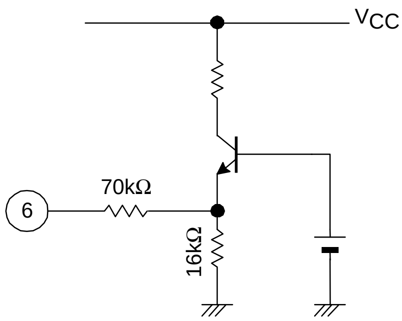
Block Diagram



Test circuit



Pin Functions Description

Pin No.	Pin Name	Function	Internal Equivalent circuit
1	LOIN	Pin for local oscillator Input to internal mixer through emitter follower	
2	TEST		
3	$V_{CC}1$	Power supply pin	
4	AGC	Mixer circuit's AGC pin A smoothing capacitor is connected between this pin and GND.	
5	MIXOUT	Mixer output pin	
6	IFIN	IF filter input	

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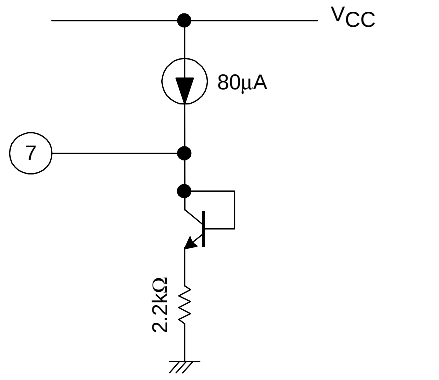
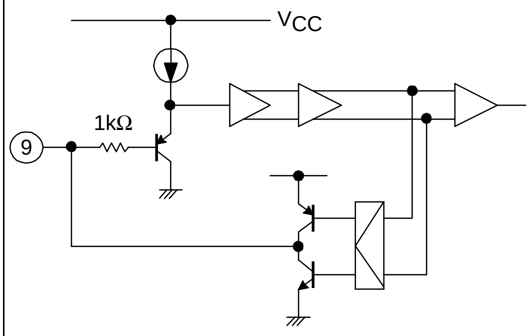
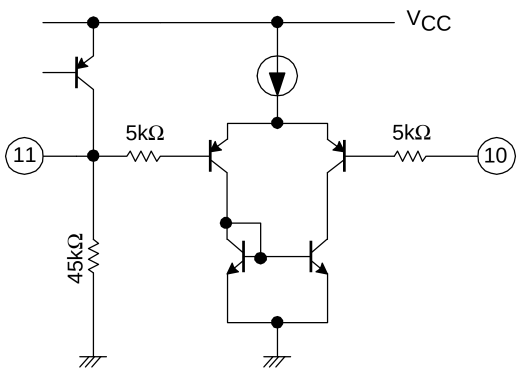
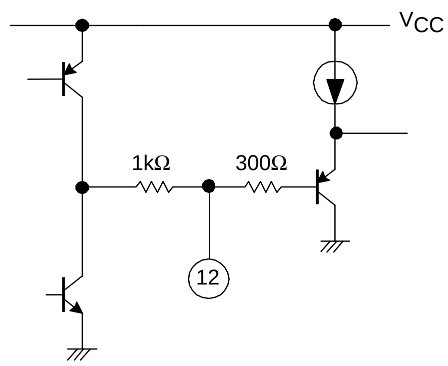
Pin No.	Pin Name	Function	Internal Equivalent circuit
7	VCOM	The built-in filter's common voltage pin A bypass capacitor is connected between this pin and GND.	
8	TEST	Test pin Open in use	
9	NF	IF AMP's DC feedback bias pin A capacitor is connected between this pin and GND.	
10	VREF	RSSI comparator's reference input pin	
11	RSSI	DC voltage output pin proportional (logarithmic proportion) to IF AMP input signal D Range: 80dB(approx.)	
12	AFC	Quadrature detector's AFC pin A capacitor is connected between this pin and GND.	

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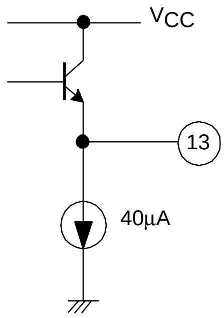
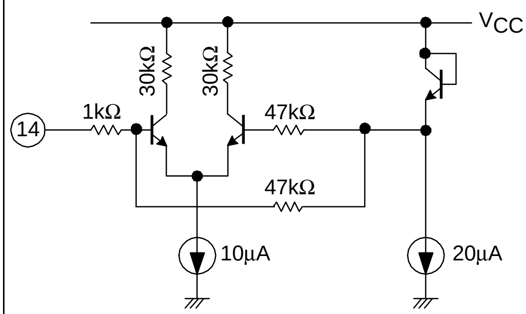
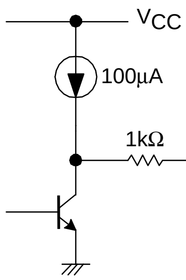
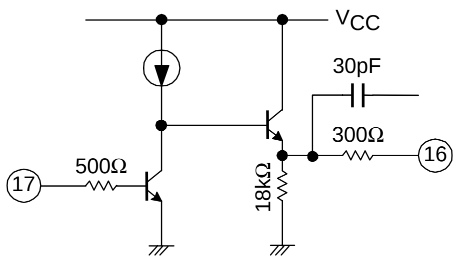
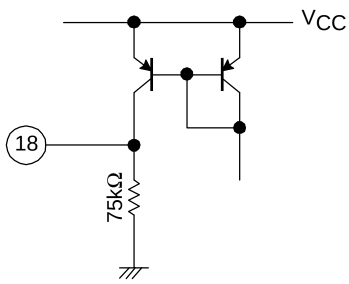
Pin No.	Pin Name	Function	Internal Equivalent circuit
13	IFOUT	IF AMP output pin	
14	DETIN	FM demodulation circuit's input pin	
15	AFOUT	FM demodulation output pin	
16	AOUT	Filter AMP input/output pin The external CR is used to compose BPF. Connected internally to noise detection circuit.	
17	AIN		
18	CN	Noise detection pin Connect a smoothing capacitor and obtain the DC voltage proportional to noise input.	

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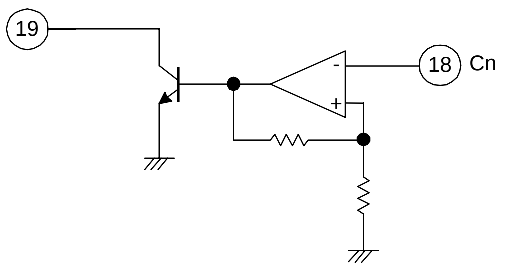
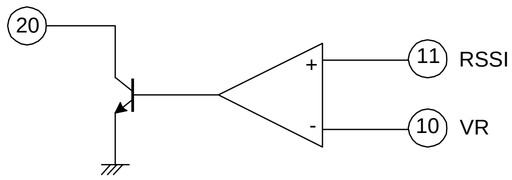
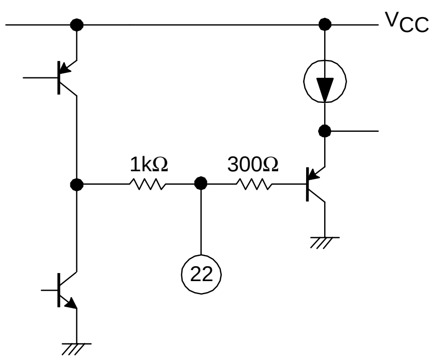
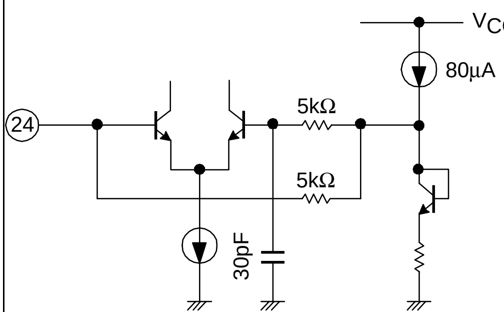
Pin No.	Pin Name	Function	Internal Equivalent circuit
19	N-DETOUT	Comparator circuit output pin for noise detection output (pin 18) Open collector pin with hysteresis at 100mV	
20	R-DETOUT	Comparator circuit pin between VR pin input and RSSI pin output Open collector output “LOW” when VR < RSSI.	
21	$V_{CC}2$	Power pin for filter automatic regulation circuit	
22	CTUN	Filter automatic regulation circuit’s capacitor pin A capacitor is connected between this pin and GND.	
23	GND		
24	MIXIN	Second mixer input pin	

Cautions for Application

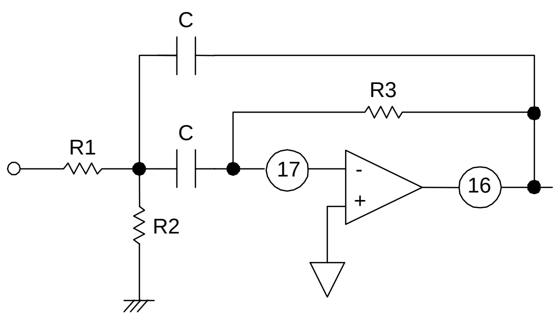
1. IF filter (BPF) and FM demodulation 90° phase converter
   The RF input is converted to 2nd IF 50Hz by the 2nd mixer circuit and enters the IF filter (BPF).
   This IF filter consists of active filters, each with the center frequency of 50kHz, -3dB bandwidth 8kHz, and attenuation of about 55dB at ±12.5kHz.
   The 90° phase converter of quadrature type FM demodulation circuit also consists of active filter.
   Since features of these built-in filters affects substantially the selectivity and demodulation output distortion, these features must be stable not susceptible to device variations and ambient temperature.
   Accordingly, this IC is designed to perform automatic adjustment of the center frequency of built-in filters by means of the reference signal generated from the local signal. It is therefore necessary to use the high-accuracy frequency, such as a crystal oscillator circuit output, for the local signal.

2. Filter composition with noise input OP amplifier
   BPF or LPF can be composed as shown in the figure
   ① BPF
   - Calculation formula
     The constant design equation with the center frequency $\omega = 1$ is shown below.
     In actual design, scaling is made for the device value and frequency.

$$R_{new} = R \bullet K_m$$
$$C_{new} = C / (K_m \bullet K_f)$$

Where

$K_m = R_{min}$: Scaling constant for device value. Select minimum resistance
$K_f = 2\pi f_0$: Frequency scaling constant
f_0 : Center frequency



Original circuit constant

$$R_1 = 2Q^2$$
$$R_2 = 2Q^2 / (2Q^2 - 1)$$
$$R_3 = 4Q^2$$
$$C = 1/2Q$$

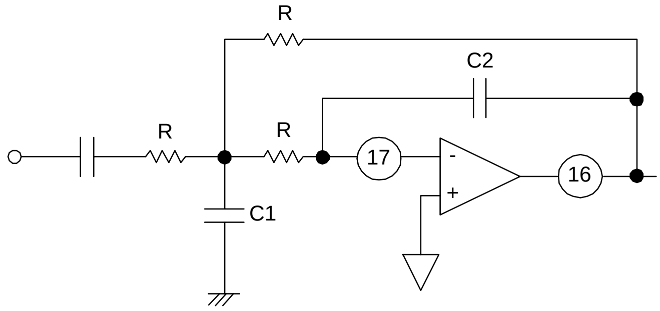
   - Design example
     Target specifications:

$$Q = 3, f_0 = 20\text{kHz}, R_{min} = 5.1\text{k}\Omega$$
$$R_1 = 2 \bullet Q^2 \bullet K_m = 91.8\text{k}\Omega \rightarrow 91\text{k}\Omega$$
$$R_2 = 2Q^2 / (2Q^2 - 1) \bullet K_m = 5.4\text{k}\Omega \rightarrow 5.6\text{k}\Omega$$
$$R_3 = 4Q^2 K_m = 183.6\text{k}\Omega \rightarrow 180\Omega\text{k}\Omega$$
$$C = 1/2Q \bullet 1/K_m \bullet K_f = 260\text{pF} \rightarrow 270\text{pF}$$

② LPF

- Calculation formula

  The design equation with the cut off frequency ω =1 is also shown below.



Original circuit constant

$R_1 = 1$

$C_1 = 3Q$

$C_2 = 1/3Q$

- Design example

  Target specifications:

$f_c = 30\text{kHz}, Q = 1/\sqrt{2}, R_{min} = 10\text{k}\Omega$

$R = K_m = 10\text{k}\Omega$

$C_1 = 3Q \bullet 1/K_m \bullet K_f = 1.13\text{nF} \rightarrow 1.2\text{nF}$

$C_2 = 1/3Q \bullet 1/K_m \bullet K_f = 250\text{pF} \rightarrow 270\text{pF}$

3. Noise detection circuit response time and noise detection output

   The response time is determined from the product of the noise detection capacity (pin 18) and internal resistance (75k).

   Note that decreasing the detection capacity can reduce the response time, but causes malfunction readily. On the other hand, increasing the detection capacity can ensure the reliable operation, but causes longer response time.

   When a malfunction occurs due to the 50kHz carrier leak component overlapping the FM demodulation output, the use of LPF incorporating an OP amplifier to attenuate such leak component ensures stable operation.

   On detection, the noise comparator output (pin 19) becomes “HIGH”.

4. RSSI comparator

   The RSSI comparator output is the result of comparison between the RSSI output and reference voltage.

   With VRSSI > VREF, the comparator output becomes “LOW”.

This catalog provides information as of February, 2007. Specifications and information herein are subject to change without notice.