

### Features

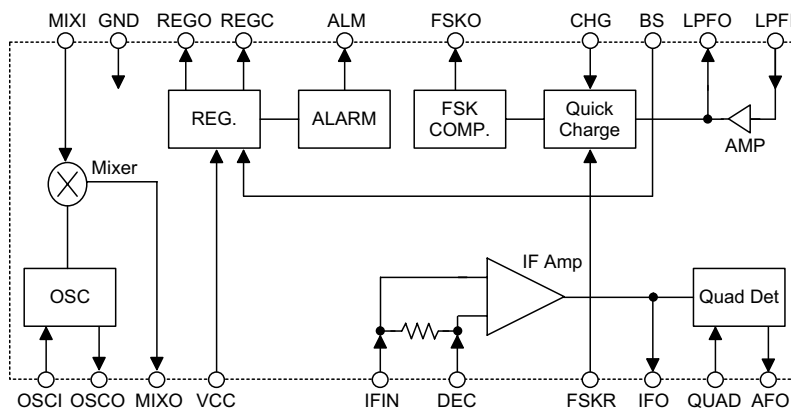
- Operating voltage: 1.1V~3.5V
- Constant power supply voltage can be generated by externally adding a transistor:  $V_{REG}=1.0V$  typ.
- Alarm function sensitivity:  $V_{ALM}=1.1V$  typ.
- Low current consumption:  $I_{CCQ}=1.1mA$  typ.
- Built-in 2nd stage mixer for double conversion method
- Mixer operating frequency: 10MHz~50MHz
- Built-in low-pass filter and waveform shaping circuit enable the extraction of FSK signals from voice signals
- Built-in battery-saving function for longer battery life time
- High transmission rate: 1200 bps
- 20-pin TSSOP package (0.65mm Pitch)

### General Description

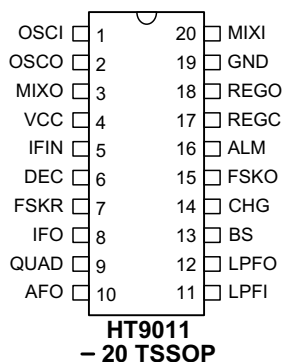
The HT9011 is designed for FM communication system devices. It combines a paging system, mixer, IF limiter, Quadrature detector, operation amplifier, comparator and more. The

HT9011 could provide the customer's PAGER system with total solution along with Holtek's POCSAG Pager Controller series products.

### Block Diagram



## Pin Assignment



## Pin Description

Pin No.	Pin Name	I/O	Description
1	OSCI	I	These pins are connected to the external parts of an oscillating circuit.
2	OSCO	O	
3	MIXO	O	Mixer output pin. Connect a 455kHz ceramic filter between this pin and the IFIN pin.
4	VCC	—	Positive power supply
5	IFIN	I	Input terminal for IF Amp.
6	DEC	I	Bias Decoupling
7	FSKR	I	Reference input of differential amplifier for waveform shaping. Connect the capacitor externally.
8	IFO	O	IF Amplifier Output pin. Connect the discriminator through the coupling capacitor.
9	QUAD	I	FM demodulator phase shift input pin connected to a quadrature detector phase shifter.
10	AFO	O	FM demodulator output pin
11	LPFI	I	Low Pass Filter Input pin
12	LPFO	O	Low Pass Filter Output pin
13	BS	I	Battery-saving Control pin "H" Normal Operation "L" Battery-saving
14	CHG	I	Control pin for quick charge-discharge circuit. "H" turn on quick charge-discharge "L" turn off quick charge-discharge

Pin No.	Pin Name	I/O	Description
15	FSKO	O	FSK NRZ data output
16	ALM	O	Output pin for Low Voltage Alarm At $V_{CC} \cong 1.1V$ , this pin becomes "H" ( $\cong V_{CC}$ ) and can indicate deterioration of battery.
17	REGC	O	Control pin of external transistor for regulator of external power supply. Externally connect the PNP transistor
18	REGO	O	Output voltage monitoring pin of regulator for external power supply.
19	GND	—	Negative power supply, ground
20	MIXI	I	MIXER Input terminal

### Absolute Maximum Ratings

Power Supply Voltage..... $V_{CC}$ —0.3V to 4.0V      Power Dissipation.....730mW  
 Operating Temperature range.....0°C to 45°C      Storage Temperature.....–55°C to 150°C

Note: These are stress ratings only. Stresses exceeding the range specified under "Absolute Maximum Ratings" may cause substantial damage to the device. Functional operation of this device at other conditions beyond those listed in the specification is not implied and prolonged exposure to extreme conditions may affect device reliability.

### Electrical Characteristics

$T_a = 25^\circ\text{C}$ , Unless otherwise specified,  $F_{in}(\text{MIX}) = 21.7\text{MHz}$ ,  $F_{in}(\text{IF}) = 455\text{kHz}$ ,  $F_{dev} = \pm 4\text{kHz}$ ,  $F_{in} = 600\text{Hz}$

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		$V_{DD}$	Conditions				
Iccq	Quiescent Current	1.4V	—	—	1.1	1.6	mA
Icco	Supply Current at Battery Saving	1.4V	—	—	0	5	$\mu\text{A}$
GMV	MIXER Conversion Gain	1.4V	—	9	12.5	16	dB
IP	MIXER 3rd Interception point	1.4V	—	—	–10	—	dBm
R(MIX)in	MIX Input Resistance	1.4V	—	—	5	—	k $\Omega$
R(IF)in	IF Amp Input Resistance	1.4V	—	—	2	—	k $\Omega$
S/N1	Signal to Noise Ration 1	1.4V	MIX IN, $V_{IN}(\text{MIX}) = 60\text{dB}\mu\text{EMF}$	—	63	—	dB

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V <sub>DD</sub>	Conditions				
S/N2	Signal to Noise Ration 2	1.4V	IF IN, V <sub>IN</sub> (IF)=60dBμEMF	—	63	—	dB
S/N3	Signal to Noise Ration 3	1.4V	IF IN, V <sub>IN</sub> (IF)=22dBμEMF	—	25	—	dB
Vi(LIM)1	−3dB Limiting Sensitivity 1	1.4V	MIX input	—	14	—	dBμEMF
Vi(LIM)2	−3dB Limiting Sensitivity 2	1.4V	IF input	—	23	27	dBμEMF
V <sub>OD</sub>	Detected Output Level	1.4V	V <sub>IN</sub> (IF)=60dBμEMF	30	45	60	mVrms
AMR	AM Rejection Ratio	1.4V	V <sub>IN</sub> (IF)=60dBμEMF AM=30%	—	50	—	dB
DR	FSK OUT Duty Ratio	1.4V	V <sub>IN</sub> (IF)=60dBμEMF	40	50	60	%
V <sub>ALM</sub>	Alarm Detected Voltage	1.4V	—	1.05	1.1	1.15	V
V <sub>ALML</sub>	"L" Level Output Voltage (ALM)	1.4V	I=100μA	—	—	0.4	V
I <sub>ALM</sub>	"H" Level Output Current (ALM)	1.4V	—	—	—	2	μA
V <sub>FSKL</sub>	"L" Level Output Voltage (FSK)	1.4V	I=100μA	—	—	0.4	V
I <sub>FSK</sub>	"H" Level Output Current (FSK)	1.4V	—	—	—	2	μA
V <sub>REC</sub>	Constant Voltage Output	1.4V	—	0.95	1.0	1.05	V

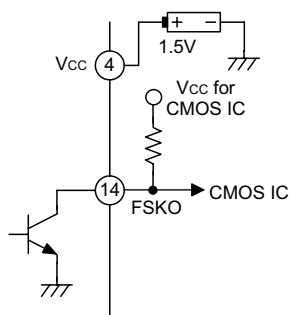
## Functional Description

### Battery-saving function

The battery-saving function is controlled by the pin "BS" and the battery consumption is minimized by reducing the current consumption. If the pin is logic LOW, the HT9011 enters the battery-saving mode, otherwise HT9011 is in normal operation state.

### FSK NRZ output

The HT9011 has two built-in operation amplifiers. One of these operation amplifiers is connected inside the IC to the NRZ comparator. The NRZ comparator can output the input signal waveform as a square wave. The NRZ comparator output is an open collector. If the IC interfaces with CMOS devices, the possible connection is shown below.



### Quick charge-discharge circuit

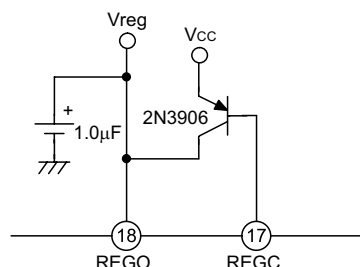
If an FSK signal inputs during the brief transition from battery-saving state to normal operation state, the time that the pin "FSKR" arrives at the reference voltage is delayed by a time constant determined by the capacitor connected to the pin "FSKR" and the internal resistor. Sometimes, the output signal becomes erroneous due to some error in the comparator input voltage. Such a case could be avoided by quickly charging or discharging the capacitor connected to the pin "FSKR". By using the quick charge-discharge circuit, the delay time for the "FSKR" pin to be of the same level with the "LPFO" pin could be minimized, hence, erroneous FSK NRZ output signal is prevented.

### Battery low alarm function

In case the HT9011 is battery powered, when the power supply voltage goes low to about 1.1V, the output of the pin "ALM" rises up to about 1.1V and the battery voltage can be monitored by other devices. The output is an open collector similar to FSK NRZ output.

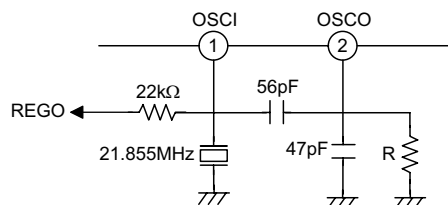
### Constant voltage regulator for external part power supply

Externally connecting the transistor as shown in the figure below, the output "REGO" could be used constantly as 1.0V regulator output. At the battery-saving mode, the regulator is turned OFF.



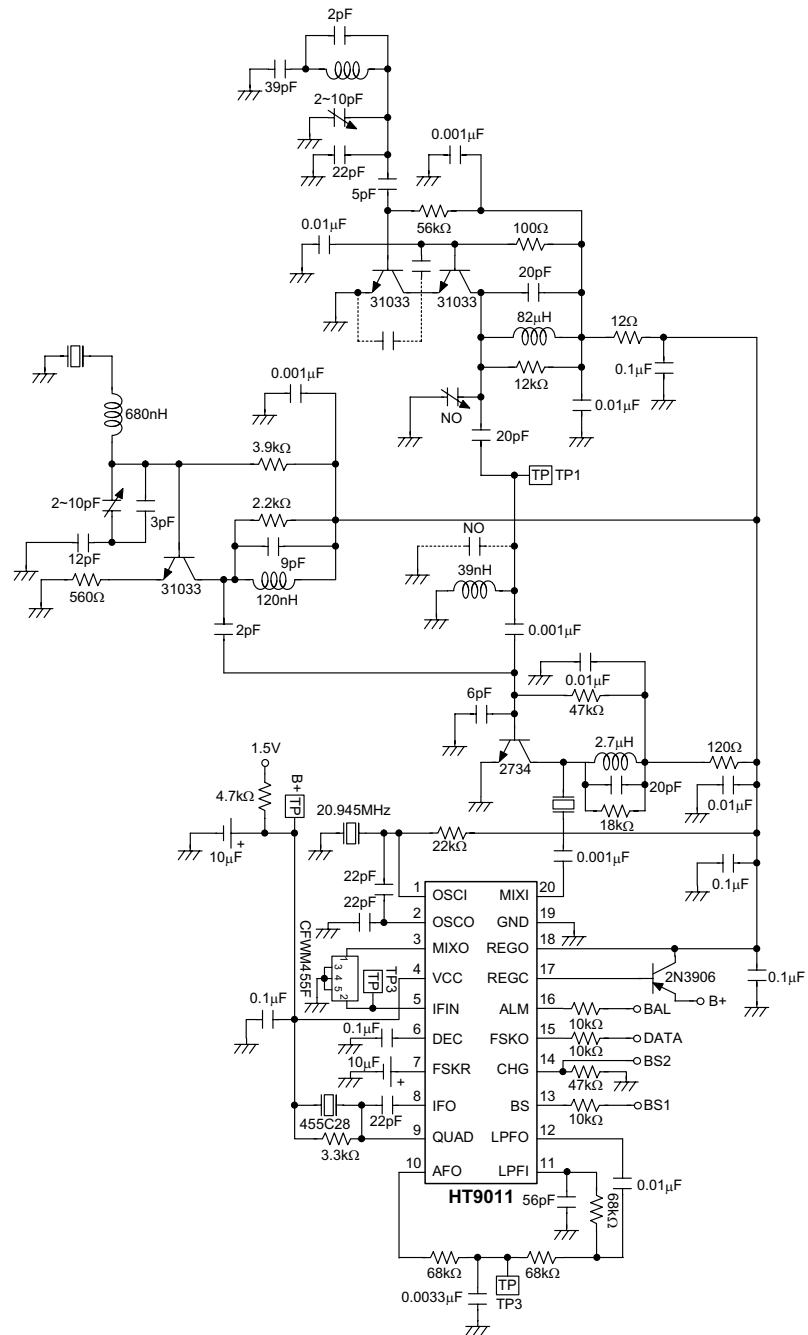
### Local oscillator circuit

The HT9011 local oscillator circuit is of Colpitts type oscillator composed of internal emitter follower circuit and an external X'tal. The transistor is connected externally as shown in the figure below. Resistor "R" may be needed to increase the current of the local oscillator circuit in order to compose the overtone oscillator and improve its stability. It is recommended that the resistor be connected between OSC1 and REGO to provide battery-saving mode.

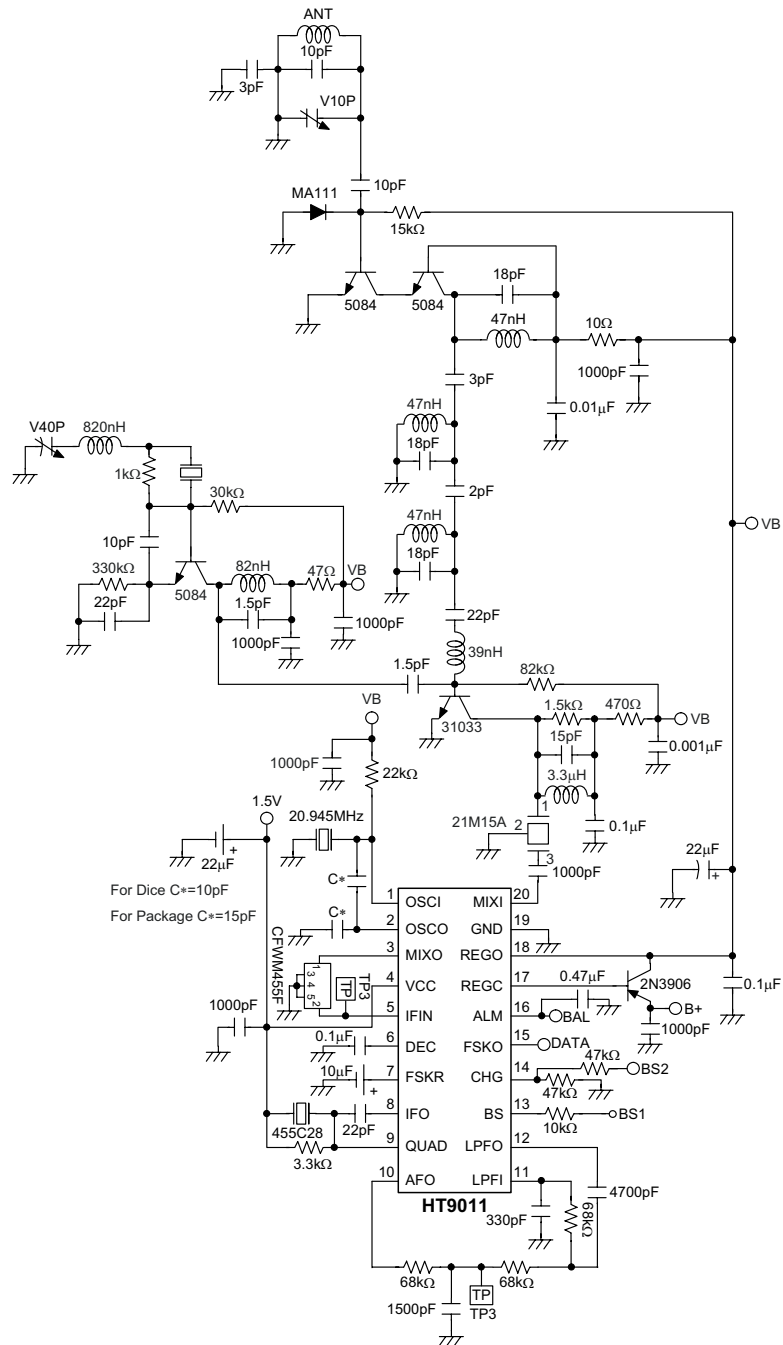


# Application Circuits

## Pager RF board (149.7MHz)



**Pager RF board (151.35MHz)**



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