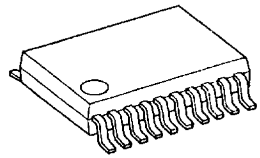
TENTATIVE DATA

FM IF DETECTION IC FOR PAGER (Built-in 2nd MIX)



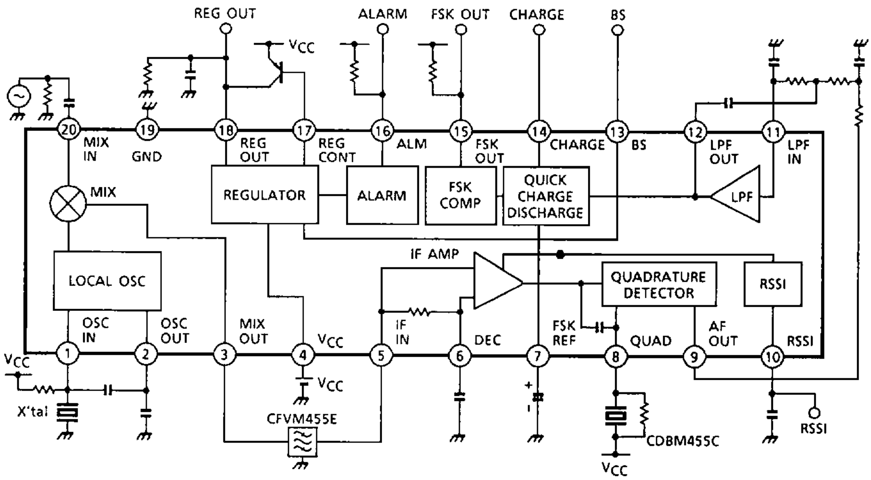
SSOP20-P-225A

Weight : 0.09g (Typ.)

FEATURES

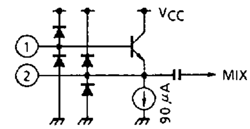
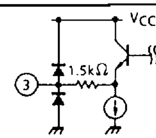
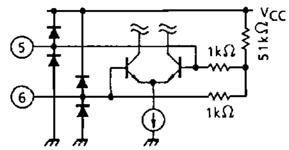
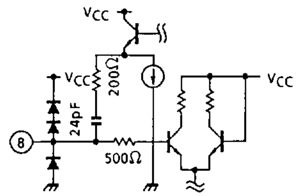
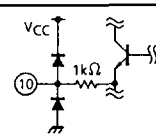
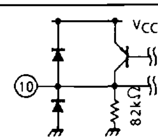
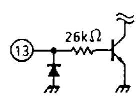
- Built-in RSSI function
  To prevent input overload, RSSI output controls RF attenuator
- Built-in 2nd MIX for double conversion method
  Mix operating frequency: 10~50MHz
- Built-in low pass filter and waveform shaping circuit enable the extraction of FSK signals from voice signal
- High transmit rate : 1200bps (Typ.)
- Built-in battery-saving function
  It is possible to reduce load of the battery which is functioning as power supply
- Battery alarm function (ALM)
  Alarm sensitivity : V_{ALM} = 1.1V (Typ.)
- Constant voltage power supply can be fabricated through externally adding a transistor
  Output voltage : V_{REG} = 1.0V (Typ.)
- Extremely low current consumption : I_{CC} = 1.2mA (Typ.)
- Power supply voltage : V_{CC} = 1.1~3.5V
- Small package : SSOP20PIN (0.65mm pitch)

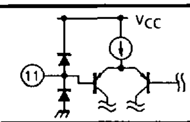
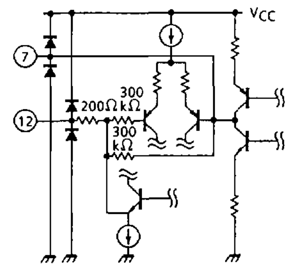
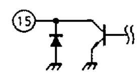
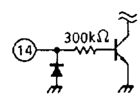
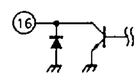
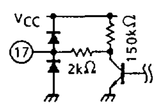
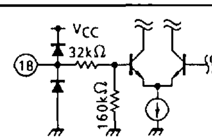
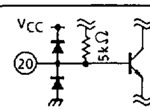
BLOCK DIAGRAM



TA31145FN-1

PIN FUNCTION (The values of resistor and capacitor are typical.)

PIN No.	PIN NAME	FUNCTION	INTERNAL EQUIPMENT CIRCUIT
1	OSC IN	Input terminal for local oscillator. In case of oscillating by X'tal, connect to this terminal.	
2	OSC OUT	Output terminal for local oscillator. In case of input from external circuit, input to this terminal.	
3	MIX OUT	Output terminal for MIX. Output impedance is about 2kΩ.	
4	V_{CC}	Terminal of power supply.	—
5	IF IN	Input terminal for IF AMP (pin 5) and terminal for decoupling of bias (pin 6). IF IN (pin 5) input impedance is about 2kΩ.	
6	DEC		
8	QUAD	Phase-shift input terminal of FM demodulator. Connect the discriminator.	
9	AF OUT	Output terminal for FM demodulator.	
10	RSSI	Output terminal for RSSI. DC electric potential which corespond to input signal level of IF AMP outputs to RSSI terminal.	
13	BS	Control terminal for battery-saving. "H": Battery-saving OFF state "L": Battery-saving state	

PIN No.	PIN NAME	FUNCTION	INTERNAL EQUIPMENT CIRCUIT
11	LPF IN	Input terminal for LPF. Bias is supplied from pin 10 through external resistor.	
12	LPF OUT	Output terminal for LPF. This output is composed by operation amplifier.	
7	FSK REF	Reference input terminal of differential amplifier which is waveform shaping section. Connect the capacitor externally. By the quick charge-discharge circuit of pushpull output, potentials of pin 7 and pin 12 can be made equal.	
15	FSK OUT	Output terminal for waveform shaping. FSK signal, which is input from LPF OUT (pin 12) and of which waveform is shaped, is output as inverted signal. Connect pull up resistor because it is open collector output.	
14	CHARGE	Control terminal for quick charge-discharge circuit. "H": Quick charge-discharge ON "L": Quick charge-discharge OFF	
16	ALM	Output terminal for ALARM. At $V_{CC} \approx 1.1V$, this terminal output becomes "H" ($\approx V_{CC}$) and can indicate deterioration of battery. Connect pull up resistor because it is open collector output.	
17	REG CONT	Control terminal of external transistor for regulator for external power supply. Connect the PNP transistor externally.	
18	REG OUT	Output voltage monitoring terminal of regulator for external power supply.	
19	GND	Terminal for GND.	—
20	MIX IN	Input terminal for MIX. Input impedance is about 5kΩ.	

TA31145FN-3

1. Battery-saving function

   Since the battery-saving function is built-in, this IC can minimize the consumption of battery by means of reducing the current consumption by the battery-saving function when the battery is used as the power supply of the set.
   Since BS terminal (pin 13) is the base of the NPN transistor, this IC can be driven by the CMOS output of the microcomputer because of its high input impedance and the drivability with low power.

STATE OF BS TERMINAL (PIN 13)	BATTERY-SAVING FUNCTION	EACH CIRCUIT OPERATION STATE IN IC	QUIESCENT CURRENT CONSUMPTION OF IC
L	Battery-saving state	Operation-stop state	0μA (Typ.)
H	Battery-saving OFF state	Normal-operation state	1.2mA (Typ.)

2. FSK waveform shaping function

   For extracting the FSK signal from the FSK demodulation signal, the waveform is shaped by the waveform shaping circuit (comparator) in IC and turned into a more correct logic output resulting in reducing the read error of the microcomputer when the FSK signal level is low or the noise is superimposed upon the FSK signal in the weak electric field.

3. Quick charge-discharge circuit

   When operation state turn to the battery-saving OFF state (Normal operation state) from the battery-saving state, if the FSK signal is input, the time that the FSK REF terminal (pin 7) arrives at the reference voltage is delayed by the time constant determined by the capacitor connected to the FSK REF terminal (pin 7) and the internal resistance.
   In this case, sometimes the erroneous waveform-shaping signal is output because of the error of the input voltage of the waveform shaping circuit (comparator).
   In such a case, by means of charging or discharging quickly the capacitor connected to the FSK REF terminal (pin 7) by the quick charge-discharge circuit, the time that the FSK REF terminal (pin 7) becomes the same potential as that of the LPF OUT terminal (pin 12) is shortened, and the FSK output of the erroneous waveform shaping signal is prevented.

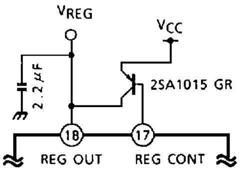
   * When CHARGE terminal (pin 14) is at "H", the quick charge-discharge circuit becomes active state.

4. Alarm function

   In case the battery is used as the power supply of the set, when the power supply voltage is reduced and the voltage of the V_{CC} terminal (pin 4) becomes approximately. 1.1V, the output of the ALM terminal (pin 16) rises up to approximately. 1.1V ($\approx V_{CC}$) and the consumption of the battery power can be detected.

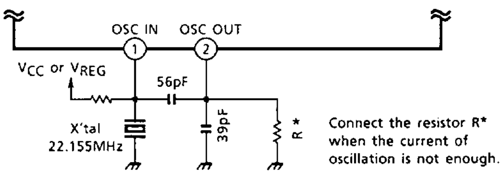
5. Constant voltage regulator for power supply of external part

Connecting the transistor to the REG CONT terminal (pin 17) externally as shown in the figure below, the REG OUT terminal (pin 18) can be used for the constant voltage regulator (V_{REG} = 1.0V (Typ.)) of high-output type.
At the battery-saving state, the constant voltage regulator also becomes OFF.



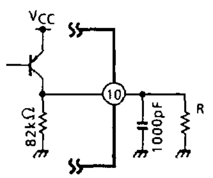
6. Local oscillation circuit

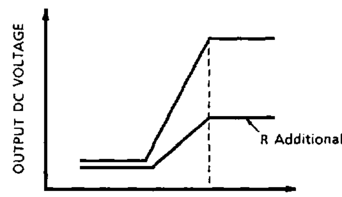
Local oscillation circuit is Colpitts type oscillator composed by internal emitter follow circuit and external X'tal. Connect the parts as shown the figure below.
Connect the resistor of the base bias for internal transistor between the pin 1 and V_{CC}, or pin 1 and REG OUT terminal (pin 18).
In case of need to increase the current of local oscillation circuit in order to compose the overtone oscillation and improve the stability of oscillation, connect the resistor between pin 2 and GND.
In such a case if the resistor for the base bias of internal transistor is connected between pin 1 and V_{CC}, at battery-saving state, the current only flowing at the resistor between pin 2 and GND flow.
Therefore we recommend to connect the resistor for the base bias between pin 1 and pin 18, or pin 1 and external regulator providing the battery-saving mode.



7. RSSI function

DC electric potential which correspond to input level of IF IN terminal (pin 5) output to RSSI terminal (pin 10).
Because RSSI output is changing voltage by internal resistance (82kΩ), it is able to change slope (Refer to figure).
In this case, because of skew temperature coefficient of external resistance and IC internal resistance, it must be careful there is the possibility temperature characteristics for RSSI output changes. The RSSI terminal (pin 9) doesn't directly short GND (the circumstances for internal circuit of IC).





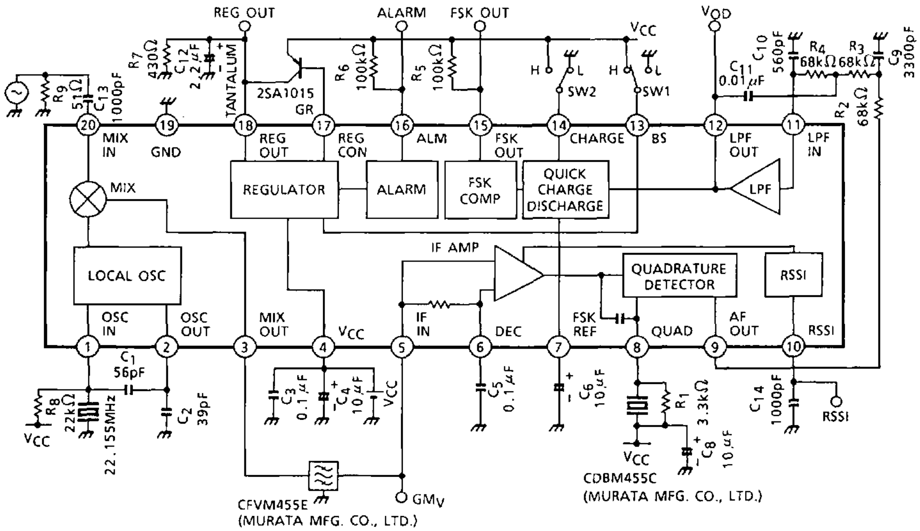
MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Power Supply Voltage	V_{CC}	4	V
Power Dissipation	P_D	710	mW
Operating Temperature	T_{opr}	−30~85	°C
Storage Temperature	T_{stg}	−55~150	°C

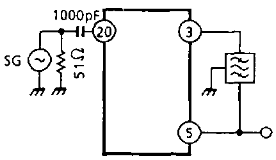
ELECTRICAL CHARACTERISTICS
(Unless otherwise specified, V_{CC} = 1.4V, $f_{IN\ (MIX)}$ = 21.7MHz, $f_{IN\ (IF)}$ = 455kHz, Δf = ±4kHz, f_{MOD} = 600Hz, Ta = 25°C)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Quiescent Current Consumption	I_{CCQ}	—	—	—	1.2	1.7	mA
Current Consumption	I_{CCO}	—	At battery-saving	—	0	5	μA
MIX Conversion Gain	GM_V	—	Measured through ceramic filter	9	12.5	16	dB
MIX 3rd Intercept Point	I_P	—	—	—	−10	—	dBμV
MIX Input Resistance	R (MIX) IN	—	—	—	5	—	kΩ
MIX Output Resistance	R (MIX) OUT	—	—	—	2	—	kΩ
IF AMP Input Resistance	R (IF) IN	—	—	—	2	—	kΩ
SN Ratio 1	SN1	—	MIX IN, $V_{IN\ (MIX)}$ = 60dBμV EMF	—	63	—	dB
SN Ratio 2	SN2	—	IF IN, $V_{IN\ (IF)}$ = 60dBμV EMF	—	63	—	dB
SN Ratio 3	SN3	—	IF IN, $V_{IN\ (IF)}$ = 25dBμV EMF	—	35	—	dB
Limiting Sensitivity 1	$V_{I\ (LIM)\ 1}$	—	MIX IN	—	14	—	dBμV EMF
Limiting Sensitivity 2	$V_{I\ (LIM)\ 2}$	—	IF IN	—	22	27	dBμV EMF
Demodulated Output Level	V_{OD}	—	$V_{IN\ (IF)}$ = 60dBμV EMF	30	45	65	mV_{rms}
AM Rejection Ratio	AMR	—	$V_{IN\ (IF)}$ = 60dBμV EMF, AM = 30%	—	50	—	dB
FSK Output Duty Ratio	DR	—	$V_{IN\ (IF)}$ = 60dBμV EMF	40	50	60	%
Alarm Detected Voltage	V_{ALM}	—	—	1.05	1.1	1.15	V
"L" Level Output Voltage (ALM)	$V_{ALM\ L}$	—	I = 100μA	—	—	0.4	V
"H" Level Leak Current (ALM)	I_{ALM}	—	—	—	—	2	μA
"L" Level Output Voltage (FSK)	$V_{FSK\ L}$	—	I = 100μA	—	—	0.4	V
"H" Level Leak Current (FSK)	I_{FSK}	—	—	—	—	2	μA
Constant Voltage Output	V_{REG}	—	R_L = 430Ω	0.95	1.0	1.05	V
RSSI Output Voltage	VRSSI	—	$V_{IN\ (IF)}$ = 65dBμV EMF	0.45	0.6	0.80	V
RSSI Output Resistance	RRSSI	—	—	—	82	—	kΩ
Quick Charging And Discharging Current	I_{CH}	—	V_7 = 0V, V_{12} = 0.18V	35	70	110	μA
"L" Level Output Voltage (REC CON)	REG L	—	I = 100μA	—	—	0.6	V

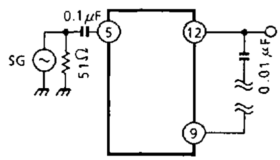
TEST CIRCUIT 1



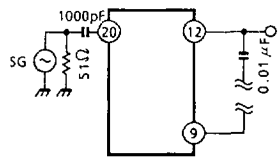
(1) GM_V



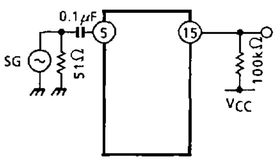
(2) SN2, SN3, $V_{I(LIM)2}$, V_{OD}, AMR



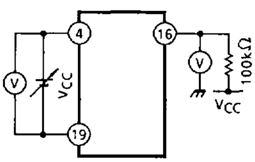
(3) SN1, $V_{I(LIM)1}$



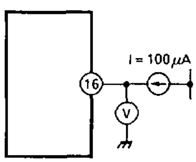
(4) D_R



(5) V_{ALM}

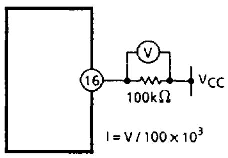


(6) $V_{ALM\ L}$

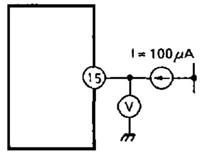


Test condition …… TEST CIRCUIT 1

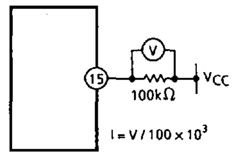
(7) I_{ALM}



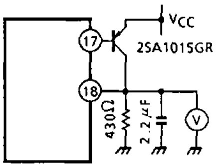
(8) V_{FSK} L



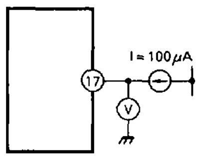
(9) I_{FSK}



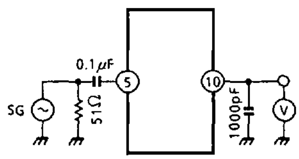
(10) V_{REG}



(11) R_{EG} L



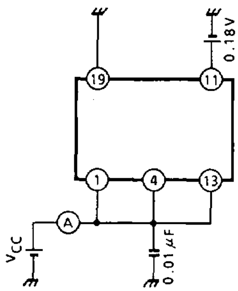
(12) V_{RSSI}



Test condition ······ TEST CIRCUIT 1.

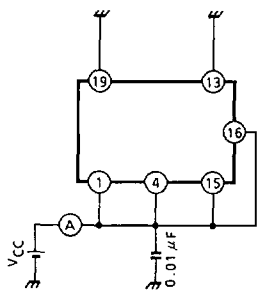
TEST CIRCUIT 2

I_{CCQ}



TEST CIRCUIT 3

I_{CCO}



TEST CIRCUIT 4

I_{CH}