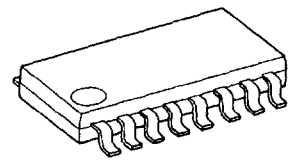
FM IF DETECTION IC FOR PAGER

FEATURES

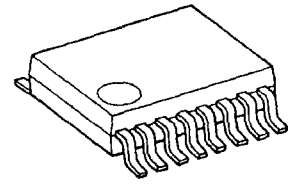
- High sensitive IF limiter amplifier
- Quadrature detection
- Built-in low pass filter (LPF) and waveform shaping circuit enable the extraction of FSK signals from voice signal
- High transmit rate (1200bps (Typ.))
- Built-in battery-saving function can reduce the load upon the battery which is functioning as power supply
- Built-in alarm function
- Alarm function makes possible the observation of battery consumption which is constituting power supply
  Alarm sensitivity is 1.1V (Typ.)
- Constant voltage power supply can be fabricated through externally adding a transistor : $V_{REG} = 1.0V$ (Typ.)
- Extremely low current consumption : $I_{CCQ} = 700\mu A$ (Typ.)

TA31141F



SSOP16-P-225A

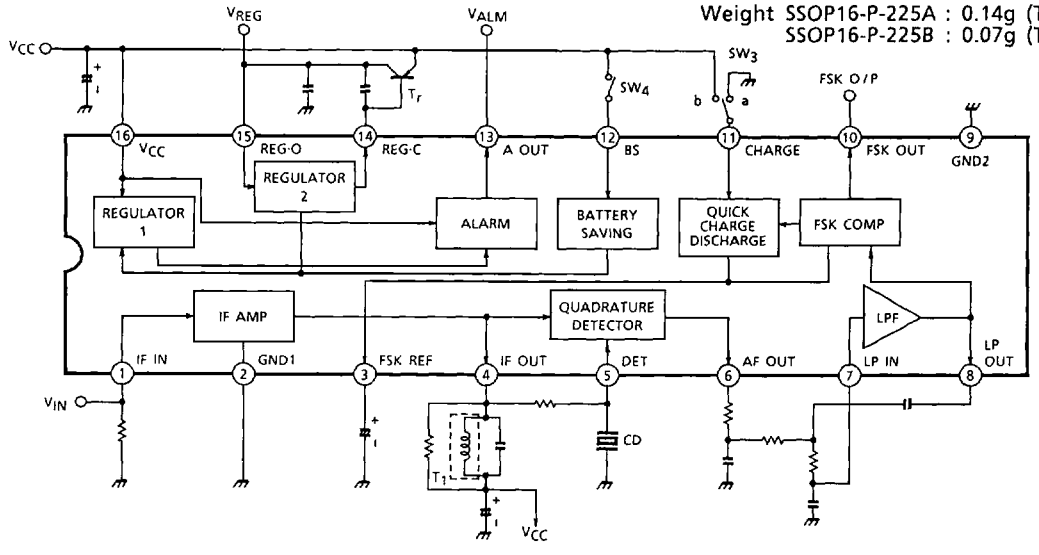
TA31141FN



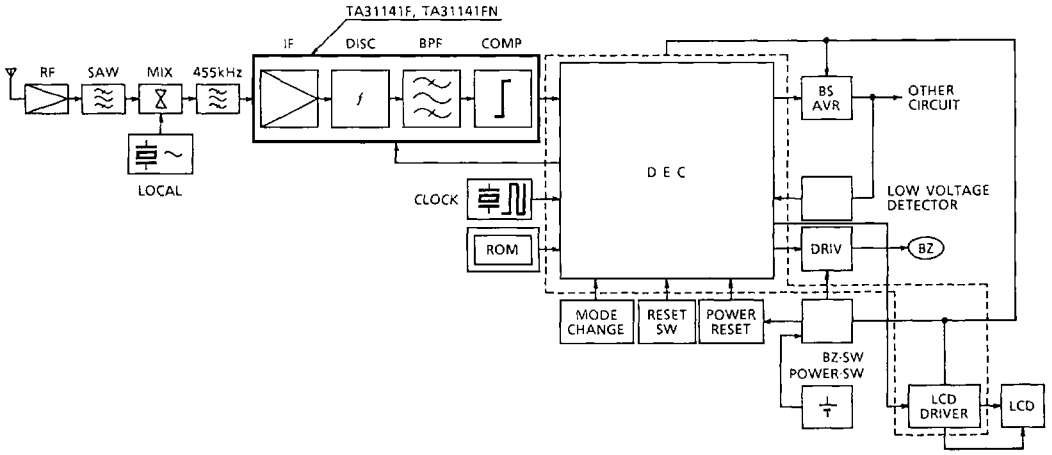
SSOP16-P-225B

Weight SSOP16-P-225A : 0.14g (Typ.)
SSOP16-P-225B : 0.07g (Typ.)

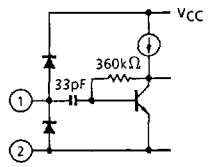
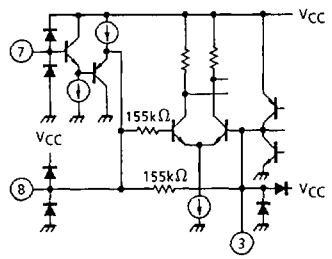
BLOCK DIAGRAM

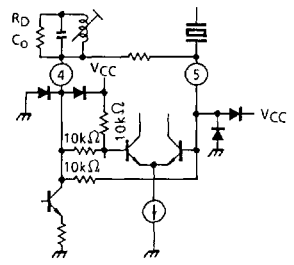
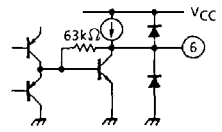
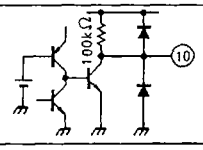
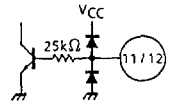
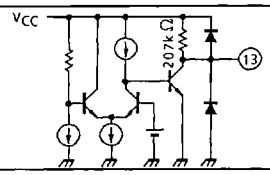
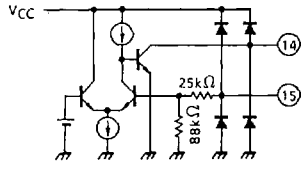


APPLICATION EXAMPLE



PIN FUNCTION (The values of resistor and capacitor are typical.)
(Terminal voltage are the typical values at V_{CC} = 1.4V, Ta = 25°C and quiescent time in test circuit.)

PIN No.	PIN NAME	TERMINAL VOLTAGE (V)	FUNCTION	INTERNAL EQUIVALENT CIRCUIT
1	IF IN	0	Input terminal of IF AMP. This IF AMP is made into BPF AMP. construction of f_O = 455kHz for stably amplifying IF signal.	
2	GND1	0	GND of IF AMP.	
3	FSK REF	0.9	Reference input terminal of differential amplifier which is constituting waveform-shaping section. Externally connect capacitor. By the quick charge and discharge circuit of pushpull output, potentials of pin 3 and pin 8 can be made equal.	
7	LP IN	0.9	Input terminal for LPF. Bias is supplied from pin 6 through external resistor.	
8	LP OUT	0.9	Output terminal for LPF. Construction is of emitter-follower type, however, potential is maintained equal to that of input terminal for LPF.	

PIN No.	PIN NAME	TERMINAL VOLTAGE (V)	FUNCTION	INTERNAL EQUIVALENT CIRCUIT
4	IF OUT	1.4	Output terminal of IF AMP. Externally connect tuning coil. At this time, R_D of 1kΩ is recommendable for stabilizing the IF AMP. If f_o temperature characteristic of whole set can be compensated, C_o of 470pF or over (for example, 10000pF) is advisable for increasing practical sensitivity.	
5	DET	1.4	Phase-shift input terminal of FM demodulator. Externally connect resonator CDBM455C2 made by MURATA MANUFACTURING CO., LTD.	
6	AF OUT	0.9	FM demodulated output.	
9	GND2	0	GND terminal other than IF AMP.	—
10	FSK OUT	0.7	Waveform-shaped output terminal. FSK signal, which is input from LPF OUT pin 8 and of which waveform is shaped, is output as inverted signal.	
11	CHARGE	0	Terminal for controlling the operation of quick charge-and-discharge circuit. Operates at "H".	
12	BS	1.4	Terminal for controlling the operation of battery saving. Operates at "H".	
13	A OUT	0.1	Alarm output terminal. At $V_{CC} \simeq 1.1V$, this terminal output becomes "H" ($\simeq V_{CC}$) and can indicate deterioration of battery.	
14	REG·C	0.7	Becomes terminal for controlling the transistor for external current amplifier at the fabrication of regulator for external power supply. Externally connect PNP transistor.	
15	REG·O	1.0	Output voltage monitoring terminal of regulator for external power supply.	
16	V_{CC}	1.4	Power supply terminal.	—

DESCRIPTION

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 through the battery-saving function when the battery is applied as the power supply of the set.
   Since the BS terminal (pin 12) functions as the base input of the NPN transistor. the 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 12)	BATTERY-SAVING FUNCTION	EACH CIRCUIT OPERATION STATE IN OTHER ICS	QUIESCENT CURRENT CONSUMPTION OF IC
L	Battery-saving stage	Operation-stop state	10μA (Max.) (0μA (Typ.))
H	Battery-saving OFF state	Normal-operation state	700μA (Typ.)

2. FSK waveform shaping function

   For extracting the FSK signal from the FSK modulation signal, the waveform is shaped by the waveform shaping circuit (comparator) in IC and is 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-and-discharge circuit

   At the time when the battery-saving OFF state (Normal operation state) is restored from the battery-saving state, if the FSK signal is input, the time for the FSK REF terminal (pin 3) to arrive at the reference voltage is delayed by the time constant determined by the capacitor connected to the FSK REF terminal (pin 3) and the internal resistance.
   In this case, sometime the erroneous waveform-shaping signal is output due to the error of the input voltage of the waveform-shaping circuit (comparator).
   In such a case, by means of quickly discharging the capacitor connected to the FSK REF terminal (pin 3) through the quick charge-and-discharge circuit, the time for the FSK REF terminal (pin 3) to become the same potential as that of the LP OUT terminal (pin 8) is shortened and the output of the erroneous waveform-shaping signal is prevented.

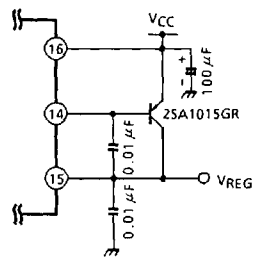
   * The quick charge-and-discharge circuit becomes active when the charge terminal (pin 11) is at "H".

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 16) becomes approx. 1.1V, the output of the A OUT terminal (pin 13) rises approx. up to 1.1V and the consumption of the battery power can be detected.

5. External constant voltage output function

Through externally mounting the transistor on the REG·C terminal (pin 14) as shown in the figure below, the REG·O terminal (pin 15) can be used for the constant voltage output V_{REG} = 1.0V (Typ.) of high-output type.
At the time of the battery-saving function operation, the constant voltage output also becomes OFF.



- Notes for artwork of PCB
  1. Make the pattern to IF IN (pin 1) as short as possible.
  2. Make the pattern between AF OUT (pin 6) and the external resistor 68kΩ as short as possible.

MAXIMUM RATINGS (Ta = 25°C)

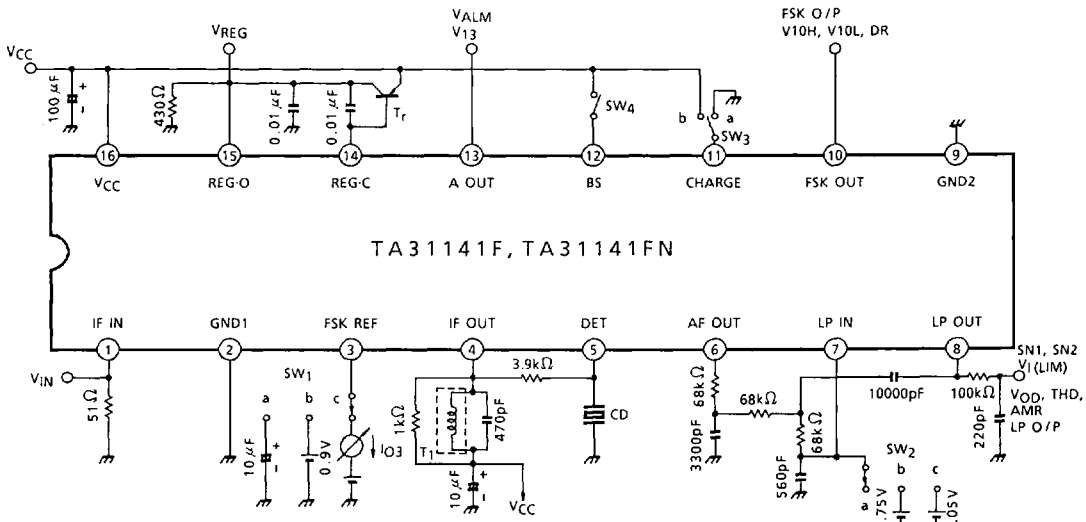
CHARACTERISTIC		SYMBOL	RATING	UNIT
Power Supply Voltage		V_{CC}	5	V
Power Dissipation	TA31141FN	P_D	560	mW
	TA31141F		370	
Operating Temperature		T_{opr}	−30~85	°C
Storage Temperature		T_{stg}	−55~150	°C

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified V_{CC} = 1.4V, f_{IN} = 455kHz, Δf = ±4.0kHz, f_{MOD} = 600Hz, V_{IN} = 60dBμV)
$SW_1 = SW_2 = SW_3$ = a, SW_4 = ON, Ta = 25°C

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Quiescent Current Consumption	I_{CCQ}	—	V_{IN} = 0	0.4	0.7	1.0	mA
Supply Current consumption	I_{CCO}	—	At battery-saving V_{IN} = 0, SW_4 = OFF	—	—	10	μA
SN Ratio	SN1	—	V_{IN} = 21dBμV	6	12	—	dB
	SN2	—	—	40	60	—	
Limiting Sensitivity Level	V_I (LIM)	—	—	—	20	27	dBμV
Demodulation Output Level	V_{OD}	—	—	25	40	50	mV_{rms}
Total Harmonic Distortion Ratio	THD	—	—	—	−30	—	dB
AM Rejection Ratio	AMR	—	AM = 30%	—	40	—	dB
FSK Output Voltage	V10H	—	SW_2 = b, SW_1 = b	1.07	—	—	V
	V10L	—	SW_2 = c, V_{CC} = 1.1V	—	—	0.15	
FSK Output Duty Ratio	DR	—	—	40	50	60	%
Alarm Output Voltage	V13L	—	V_{16} = 1.15V	—	20	150	mV
	V13H	—	V_{16} = 1.05V	0.99	1.05	—	V
Constant Voltage Output	V_{REG}	—	—	0.95	1.0	1.05	V
IF AMP Input Impedance Parallel Resistance	R_{IP}	—	—	—	20	—	kΩ
IF AMP Input Impedance Parallel Capacitance	C_{IP}	—	—	—	8.6	—	pF
Pin 3 Charge Current	I_{O3}	—	V_3 = 0.3V, V_7 = 0.9V, SW_3 = b	70	200	—	μA

TEST CIRCUIT



T_1 : 5102-070 (SUMIDA ELECTRIC CO.,LTD.)
CD : CDBM455C2 (MURATA MFG. CO.,LTD.)
T_r : 2SA1015GR

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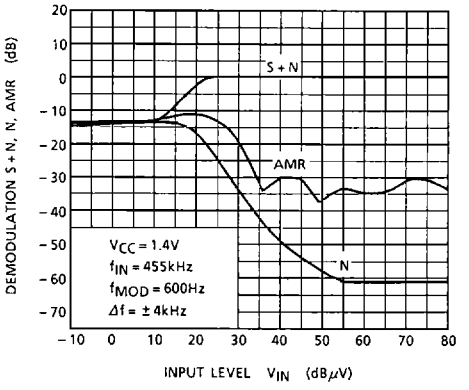
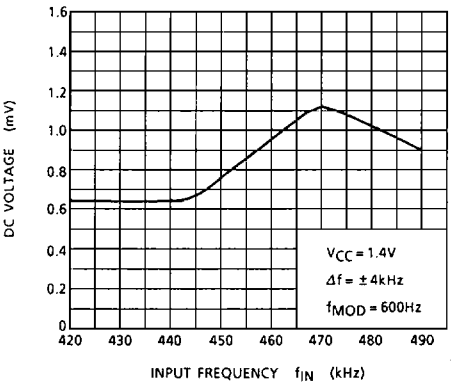
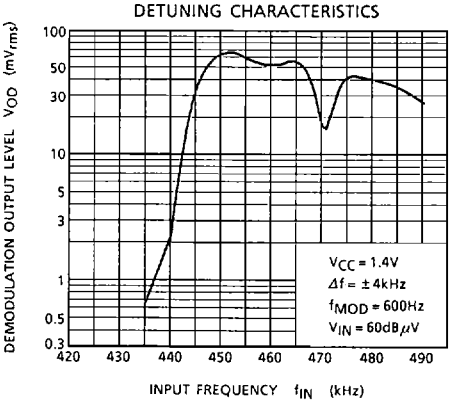
DEMODULATION CHARACTERISTICS



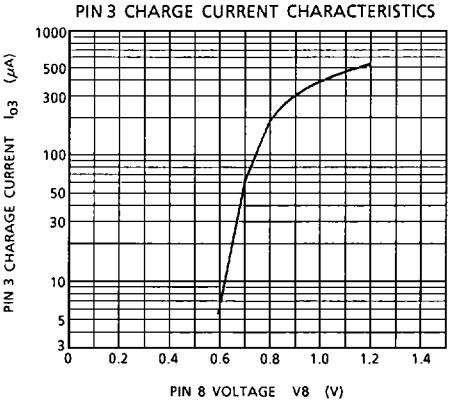
S CURVE CHARACTERISTICS



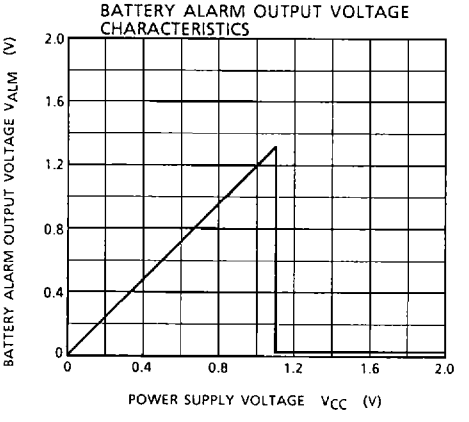
DETUNING CHARACTERISTICS



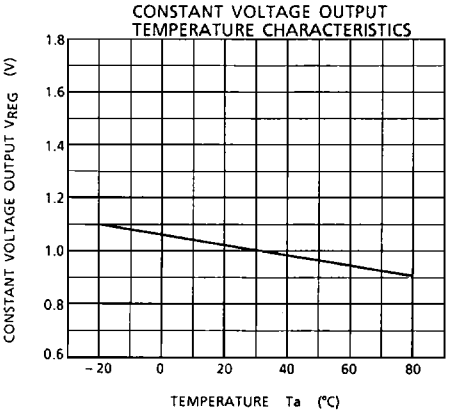
PIN 3 CHARGE CURRENT CHARACTERISTICS



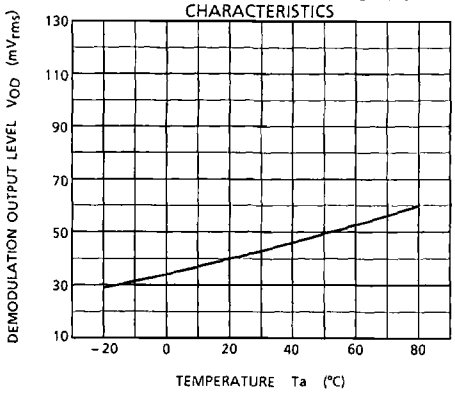
BATTERY ALARM OUTPUT VOLTAGE CHARACTERISTICS



CONSTANT VOLTAGE OUTPUT TEMPERATURE CHARACTERISTICS



DEMODULATION OUTPUT TEMPERATURE CHARACTERISTICS



APPLICATION CIRCUIT