

# AN6400FA

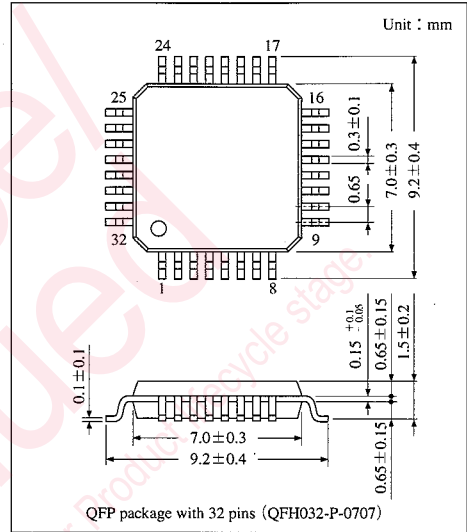
## Pager Direct Conversion FSK Demodulator Base-Band IC

### Overview

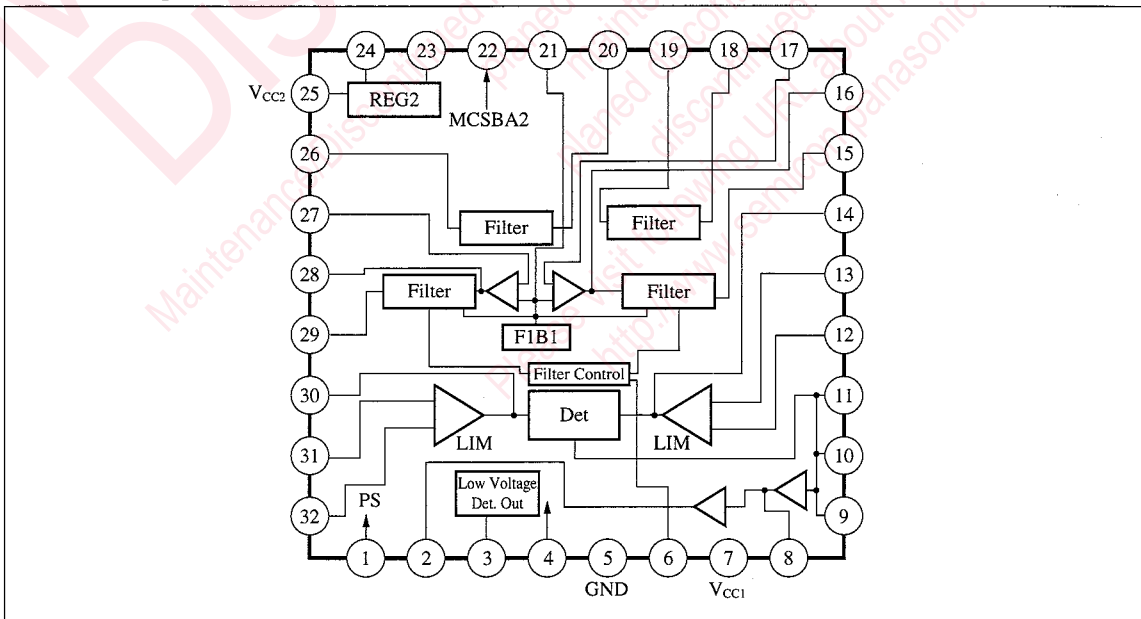
The AN6400FA is a base-band IC supporting direct conversion FSK demodulation for pagers.

### Features

- Low current consumption :  $V_{CC1}$  current consumption  $I_{CC1} = 1 \text{ mA}$  ( $V_{CC1} = 2.0 \text{ V}$ ),  $V_{CC2}$  current consumption  $I_{CC2} = 45 \text{ } \mu\text{A}$  ( $V_{CC2} = 1.4 \text{ V}$ )
- Battery saving function : current consumption is less than  $1 \text{ } \mu\text{A}$  at BS
- Low voltage alarm (LVA)
- Incorporating a regulator circuit (REG2 :  $1.05 \text{ V}$ ).
- Incorporating a regulated current source ( $10 \text{ } \mu\text{A}$ ) for the mixer.



### Block Diagram



### Pin Descriptions

Pin No.	Symbol	Description	Pin No.	Symbol	Description
1	PS	Power saving signal input	17	A1I	Buffer amp. (1) input
2	NRZ	Demodulator data output	18	F1O	Filter (1) output
3	LVA	Low voltage alarm output	19	F1I	Filter (1) input
4	BSV	Battery saving signal input	20	F2I	Filter (2) input
5	GND	Ground	21	FBI	Filter bias
6	FIC	Filter F. characteristics control	22	MCS	Mixer current source
7	V <sub>CC1</sub>	Supply voltage (1)	23	REG2	Regulator (2) voltage detection
8	DFo	Data filter output	24	RC2	Regulator (2) voltage control
9	DF3	Data filter input (3)	25	V <sub>CC2</sub>	Supply voltage (2)
10	DF2	Data filter input (2)	26	F2O	Filter (2) output
11	DF1	Data filter input (1)	27	A2I	Buffer amp. (2) input
12	L1R	Limiter amp. (1) input bias	28	A2O	Buffer amp. (2) output
13	L1I	Limiter amp. (1) input	29	C2O	Channel filter (2) output
14	L1F	Limiter amp. (1) feedback	30	L2F	Limiter amp. (2) feedback
15	C1O	Channel filter. (1) output	31	L2I	Limiter amp. (2) input
16	A1O	Buffer amp. (1) output	32	L2R	Limiter amp. (2) input bias

### Absolute Maximum Ratings (Ta = 25°C)

Parameter	Symbol	Rating	Unit
Supply voltage	V <sub>CC</sub>	4.5	V
Supply current	I <sub>CC</sub>	5.0	mA
Power dissipation (Ta = 75°C)	P <sub>D</sub>	224	mW
Operating ambient temperature	T <sub>opr</sub>	-20 to +70	°C
Storage temperature	T <sub>stg</sub>	-55 to +125	°C

Note) Protect Pin ⑫ from electrostatic discharge.

### Operating Supply Voltage Range

Parameter	Symbol	Range
Operating supply voltage range	V <sub>CC1</sub>	1.8 to 4V
	V <sub>CC2</sub>	0.9 to 1.6V

**Electrical Characteristics** ( $V_{CC1}=2.0V$ ,  $V_{CC2}=1.4V$ ,  $T_a=25\pm 2^\circ C$ )

Parameter	Symbol	Condition	min	typ	max	Unit
$V_{CC1}$ current consumption (operational) : $I_{CC1}$	$I_7$		0.8	1.0	1.2	mA
$V_{CC1}$ current consumption (at BSV)	$I_{7(BSV)}$		—	—	1	$\mu A$
$V_{CC2}$ current consumption (operational) : $I_{CC2}$	$I_{25}$		35	45	55	$\mu A$
$V_{CC2}$ current consumption (at PS)	$I_{25(PS)}$		—	—	1	$\mu A$
Mixer current source	$I_{22}$		8	10	12	$\mu A$
REG2 output voltage	$V_{RG2}$		1.00	1.05	1.10	V
LVA detection voltage	$V_{LVA}$	$V_{CC2}$ at which LVA goes low	1.02	1.07	1.12	V
Filter F. characteristics F1b	$V_{F1b}$	F1I = -30dBs, f=4.5kHz, output=C1O	-34	-31	-28	dBs
Filter F. characteristics F2b	$V_{F2b}$	F1I = -30dBs, f=4.5kHz, output=C2O	-34	-31	-28	dBs
Filter F. characteristics F1c	$V_{F1c}$	F1I = -30dBs, f=25kHz, output=C1O	—	—	-75	dBs
Filter F. characteristics F2c	$V_{F2c}$	F1I = -30dBs, f=25kHz, output=C2O	—	—	-75	dBs
Data demodulator characteristics (High)	$V_{H2}$	F1I=F2I = -40dBs, F1If=F2If=4.5kHz $\theta$ F1I = $\theta$ F2I + $\pi/2$	1.8	—	—	V
Data demodulator characteristics (Low)	$V_{L2}$	F1I=F2I = -40dBs, F1If=F2If=4.5kHz $\theta$ F1I = $\theta$ F2I + $\pi/2$	—	—	0.2	V

**Electrical Characteristics (design values for reference)** ( $V_{CC1}=2.0V$ ,  $V_{CC2}=1.4V$ ,  $T_a=25\pm 2^\circ C$ )  
 The following are design values for reference only (not guaranteed)

Parameter	Symbol	Condition	min	typ	max	Unit
Filter F. characteristics F1a	$V_{F1a}$	F1I = -30dBs, f=1kHz, output=C1O	—	-30	—	dBs
Filter F. characteristics F2a	$V_{F2a}$	F1I = -30dBs, f=1kHz, output=C2O	—	-30	—	dBs
Filter F. characteristics F1d	$V_{F1d}$	F1I = -30dBs, f=50kHz, output=C1O	—	—	-75	dBs
Filter F. characteristics F2d	$V_{F2d}$	F1I = -30dBs, f=50kHz, output=C2O	—	—	-75	dBs

**Pin Descriptions**

Pin No.	Symbol	Description	Equivalent circuit
1	PS	Power save (PS) control for LVA and REG2 H : Power ON L : Power OFF	
2	NRZ	Open collector data output. Use a suitable pull-up resistor connecting to a power supply.	
3	LVA	Low voltage alarm output. Use a suitable pull-up resistor connecting to a power supply. This pin goes low when V <sub>CC2</sub> at Pin 25 gets higher than the internal reference voltage.	
4	BSV	Battery save (BSV) control for other than LIVA and REG2. This function allows battery to last longer. Connect this pin to V <sub>CC2</sub> for battery save, otherwise connect to GND.	
5	GND	Ground	—
6	FIC	Controls the frequency characteristics of the internal gyrator filter. Connect a suitable resistance between this pin and GND.	
7	V <sub>CC1</sub>	Supply voltage (1)	—
8	DF0	Pins 8 to 11 are for connection to a capacitor. External capacitors and the internal resistors (and the operational amp.) form a three-step LPF.	
9	DF3		
10	DF2		
11	DF1		



■ Pin Descriptions (cont.)

Pin No.	Symbol	Description	Equivalent circuit
12	L1R	Limiter amplifier inputs. Pin ⑮ output is input through a capacitor to pin ⑬. Feedback Pins ⑫ and ⑭ should be grounded through a suitable capacitance.	
13	L1I		
14	L1F		
15	C1O	Gyrator filter output for channel 1. This pin connects through a capacitor to pin ⑬.	
16	A1O	Pin ⑯ is the output from the operational amp. as well as the input to the gyrator amp. Pin ⑰ is the input to the operational amp. The operational amp. functions as a filter or an amplifier.	
17	A1I		
18	F1O	Channel filter (1) output. Connects through a capacitor to pin ⑰.	
19	F1I	Channel filter (1) input for directly converted signals.	

Pin Descriptions (cont.)

Pin No.	Symbol	Description	Equivalent circuit
20	F2I	Channel filter (2) input for directly converted signals.	
21	FBI	Provides the reference voltage to channel filters 1 and 2, and gyrator filters 1 and 2. This pin must be grounded through a capacitor.	
22	MCS	Provides a mixer regulated-current source. This pin can be connected to Pin ④ of the AN6454. If not used, this pin must be grounded directly.	
23	REG2	Connect the collector of the PNP transistor to Pin ②, the base to Pin ③, and the emitter to the power supply. Pin ③ is the regulated voltage output, and Pin ④ is the control.	
24	RC2		
25	Vcc2	Supply voltage (2).	



### Pin Descriptions (cont.)

Pin No.	Symbol	Description	Equivalent circuit
26	F2O	Band-pass filter output. Connects through a capacitor to Pin 27.	
27	A2I	Pin 28 is the output from the operational amp. as well as the input to the gyrator amp. Pin 27 is the input to the operational amp. The operational amp. functions as a filter or an amplifier.	
28	A2O		
29	C2O	Channel 2 gyrator filter output. Connects through a capacitor to Pin 31.	
30	L2F	Limiter amplifier inputs. Pin 29 output is input through a capacitor to Pin 31. Feedback Pins 32 and 30 should be grounded through a suitable capacitance.	
31	L2I		
32	L2R		

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