

# AN7293NFBQ

## FM-IF, NC, MPX IC for Car Radio

### Overview

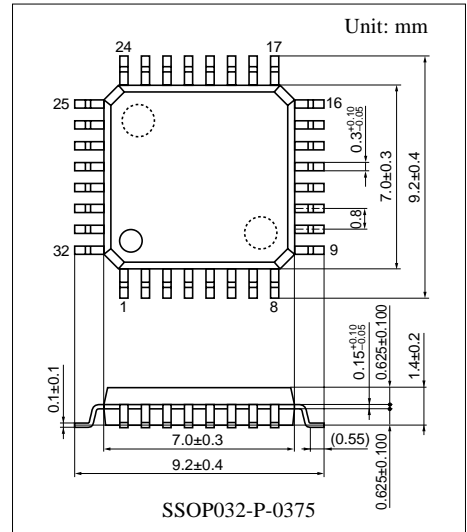
The AN7293NFBQ is an IC having FM-IF, NC and MPX function for car radio. A tuner block of car radio can be constructed by this IC and the AN7289NFBQ/NSC.

### Features

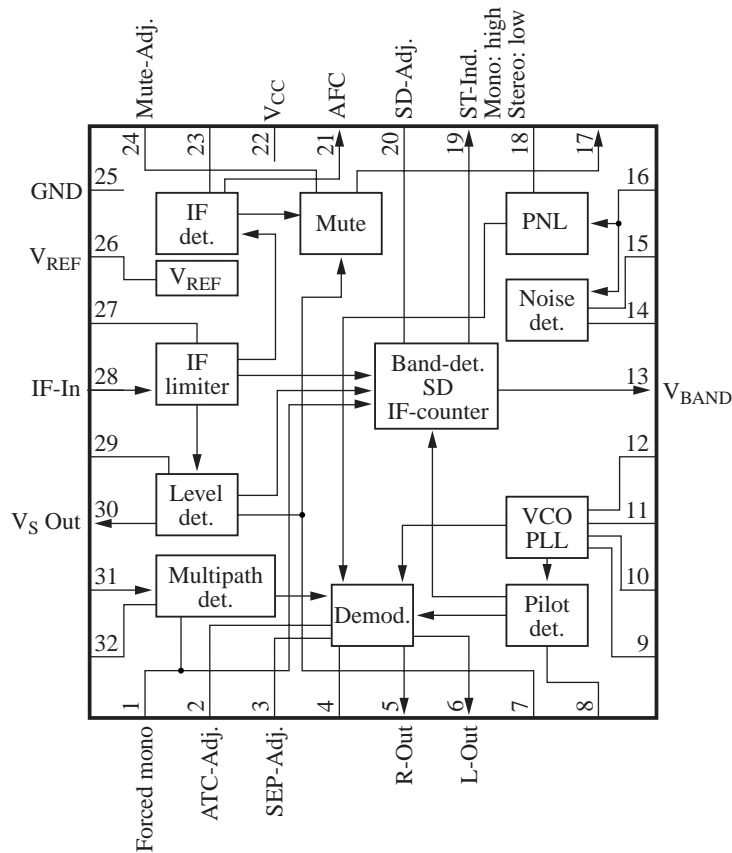
- A less number of external components is required (8 components reduction compared with our conventional IC)
- Neighboring-station interference characteristics improvement by band-ATC function
- Band-mute on/off function
- DIL package product (the AN7293NSC) is also available

### Applications

- Car radios



### Block Diagram



### ■ Pin Description

Pin No.	Description	Pin No.	Description
1	ASC adjustment/forced monaural	17	Detection output
2	ATC adjustment	18	PNL output hold
3	Separation adjustment	19	SD/FM-IF counter output/stereo indicator
4	ATC low-pass filter	20	SD sensitivity adjustment
5	R-ch. output	21	AFC voltage
6	L-ch. output	22	V <sub>CC</sub>
7	Mute voltage	23	FM detection
8	Pilot detection low-pass filter	24	Soft mute adjustment
9	PLL low-pass filter	25	GND
10	PLL low-pass filter	26	V <sub>REF</sub>
11	VCO	27	IF bypass
12	Pilot cancel control low-pass filter	28	IF input
13	Band signal output/band mute SW	29	Control voltage adjustment
14	PNL low-pass filter	30	Control voltage
15	PNL AGC	31	Multi-path noise input
16	PNL input	32	Multi-path detection

### ■ Absolute Maximum Ratings

Parameter	Symbol	Rating	Unit
Supply voltage	V <sub>CC</sub>	9.1	V
Supply current	I <sub>CC</sub>	45	mA
Power dissipation *2	P <sub>D</sub>	343.3	mW
Operating ambient temperature *1	T <sub>opr</sub>	-30 to +80	°C
Storage temperature *1	T <sub>stg</sub>	-55 to +125	°C

Note) \*1: Except for the power dissipation, operating ambient temperature, and storage temperature, all ratings are for T<sub>a</sub> = 25°C.

\*2: T<sub>a</sub> = 80°C

### ■ Recommended Operating Range

Parameter	Symbol	Range	Unit
Supply voltage	V <sub>CC</sub>	7.2 to 9.0	V

### ■ Electrical Characteristics at $T_a = 25^\circ\text{C}$

Unless otherwise specified,  $V_{CC} = 8\text{V}$ ,  $V_{IN1}$  is  $f = 10.70\text{ MHz}$ , Mod. =  $1\text{ kHz}$ , 30%

FM modulation stereo input is  $L + R = 90\%$   $V_P = 10\%$

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Control voltage (1)	$V_{C1}$	Without signal input, pin 30 DC voltage	0.0	0.3	0.9	V
Control voltage (2)	$V_{C2}$	$V_{IN1} = 40\text{ dB}\mu$ , pin 30 DC voltage	0.6	1.3	1.6	V
Control voltage (3)	$V_{C3}$	$V_{IN1} = 70\text{ dB}\mu$ , pin 30 DC voltage	2.4	3.1	3.8	V
Control voltage (4)	$V_{C4}$	$V_{IN1} = 100\text{ dB}\mu$ , pin 30 DC voltage	4.5	5.3	5.8	V
Control voltage (5)	$V_{C5}$	$V_{C5} = V_{C3} - V_{C2}$	1.8	2.0	2.2	V
Control voltage (6)	$V_{C6}$	$V_{C6} = V_{C4} - V_{C3}$	1.85	2.05	2.25	V
Output level L-channel	$V_{OL}$	$V_{IN1} = 70\text{ dB}\mu$ , pin 6 AC voltage	85	105	125	mV[rms]
Output level R-channel	$V_{OR}$	$V_{IN1} = 70\text{ dB}\mu$ , pin 5 AC voltage	85	105	125	mV[rms]
Channel balance	CB	$CB = 20 \cdot \log(V_{OL}/V_{OR})$	-1.0	0	1.0	dB
Residual pilot voltage	$V_{PC}$	$V_P = 10\%$ modulation, $V_{IN1} = 70\text{ dB}\mu$ , pin 18 output voltage	—	4	14	mV[rms]
Stereo lamp light up level	LAMP <sub>ON</sub>	19 kHz modulation, Modulation factor at which pin 19 becomes under 1 V	1.3	4.0	6.3	%
Separation L-channel	Sep <sub>L</sub>	L+R = 90%, $V_P = 10\%$ Larger separation value after changing over pin 3 external resistor	25	33	—	dB
Separation R-channel	Sep <sub>R</sub>		25	33	—	dB
Capture range	CR	Modulation at $V_P = 6.5\%$ Referred to 19 kHz	$\pm 0.4$	$\pm 0.7$	—	%
Counter output level (1)	VIF <sub>1</sub>	$V_{IN1} = 100\text{ dB}\mu$ , $V_{20} = 2\text{ V}$ pin 19 output voltage	135	155	175	mV[rms]
Counter output level (2)	VIF <sub>2</sub>	$V_{IN1} = 100\text{ dB}\mu$ , $V_{20} = 5\text{ V}$ pin 19 output voltage	0	2	5	mV[rms]
Monaural THD (L)	THD <sub>L</sub>	$V_{IN2}$ monaural input, 500 mV[0-p] 1 kHz, L-ch. output distortion factor	—	0.1	0.3	%
Monaural THD (R)	THD <sub>R</sub>	$V_{IN2}$ monaural input, 500 mV[0-p] 1 kHz, R-ch. output distortion factor	—	0.1	0.3	%
Stereo THD (L)	THD <sub>STL</sub>	$V_{IN2}$ stereo input, 500 mV[0-p] 1 kHz, L-ch. output distortion factor	—	0.1	0.3	%
Stereo THD (R)	THD <sub>STR</sub>	$V_{IN2}$ stereo input, 500 mV[0-p] 1 kHz, R-ch. output distortion factor	—	0.1	0.3	%
PNL-AGC voltage (1)	$V_{AGC1}$	$V_{IN2} =$ Without input pin 15 DC voltage	1.2	1.4	1.7	V
PNL-AGC voltage (2)	$V_{AGC2}$	$V_{IN2} = 100\text{ mV}$ , $f = 100\text{ kHz}$ input Difference from $V_{AGC1}$	0.1	0.35	0.60	V
Residual noise voltage	$V_{NR}$	$V_{IN2} =$ (pulse width 10 $\mu\text{s}$ , 1 V[p-p] 1 kHz) L-ch. output	0.0	0.2	0.7	mV[rms]

### ■ Electrical Characteristics at $T_a = 25^\circ\text{C}$ (continued)

Unless otherwise specified,  $V_{CC} = 8\text{V}$ ,  $V_{IN1}$  is  $f = 10.70\text{ MHz}$ , Mod. =  $1\text{ kHz}$ , 30%

FM modulation stereo input is L + R = 90%  $V_p = 10\%$

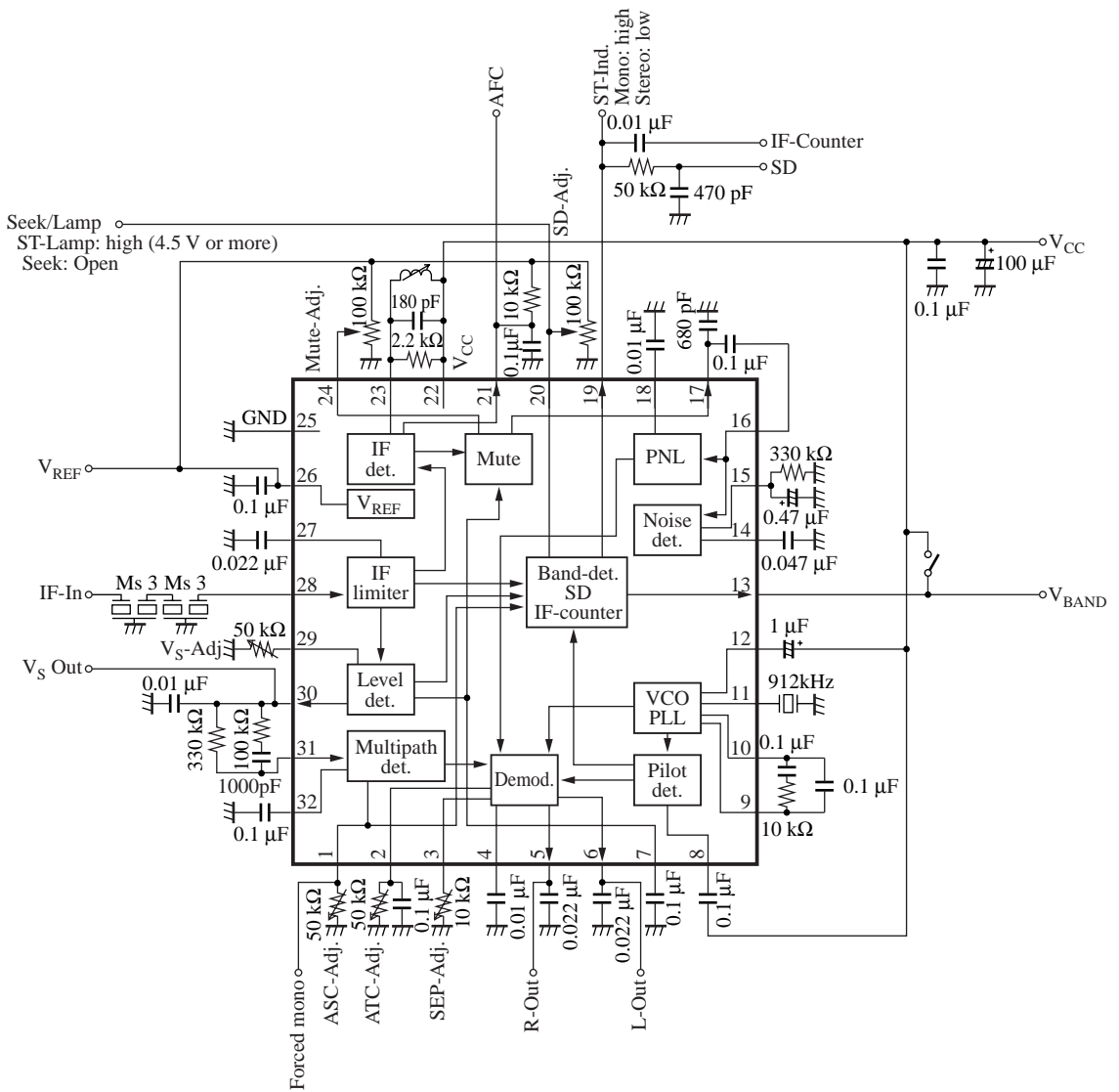
Parameter	Symbol	Conditions	Min	Typ	Max	Unit
SD sensitivity	$SD_S$	$V_{IN1}$ when $V_{20} = 2\text{ V}$ , $V_{19} > 2\text{ V}$	70	80	90	$\text{dB}\mu$
SD bandwidth	$SD_W$	$V_{IN}$ bandwidth when $V_{24} = 2\text{ V}$ , and $V_{19} > 2\text{ V}$ , $V_{IN1} = 100\text{ dB}\mu$	100	130	160	kHz
Supply current	$I_{TOT}$	Without input	30	37	44	mA
Limiting sensitivity	$V_{LIM}$	$V_{IN1}$ input level when pin 5 AC voltage drops by 3 dB	24	32	38	$\text{dB}\mu$
ATC	$V_{ATC}$	L-ch. output ratio when $V_2 = 2\text{ V}$ and $0\text{ V}$	7	11	15	dB
Gate pulse width	PW	$V_{IN2} = (\text{pulse width } 1\ \mu\text{s}, 0.3\text{ V}[\text{p-p}] 1\text{ kHz})$ pin 18 output pulse width	16	23	30	$\mu\text{s}$

### • Design reference data

Note) The following characteristics are the reference values for design and not guaranteed values.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Stereo lamp turn off level	$LAMP_{OFF}$	Ratio between the modulation factor when pin 19 becomes 2 V or more and $LAMP_{ON}$	2.0	6.0	10.0	dB
AFC offset voltage	$V_{AFC}$	Without signal input, DC potential difference between pin 21 and pin 26.	-0.1	0.0	0.1	V

■ Application circuit Example





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