# AN7293NSC

## FM-IF, NC, MPX IC for car radio

#### ■ Overview

The AN7293NSC is an IC having FM-IF, NC and MPX functions for car radio. A tuner block of car radio can be constructed in combination with the AN7289NFBQ/NSC. Small outline package product (the AN7293NFBQ) is also available.

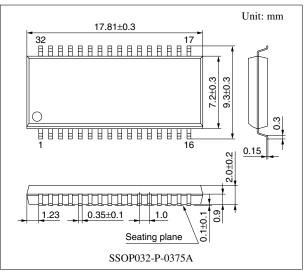
#### ■ Features

- A less number of external components is required (8 components reduction compared with our conventional IC)
- Neighbouring-station interference characteristics improvement by band-ATC function
- Band-mute on/off function

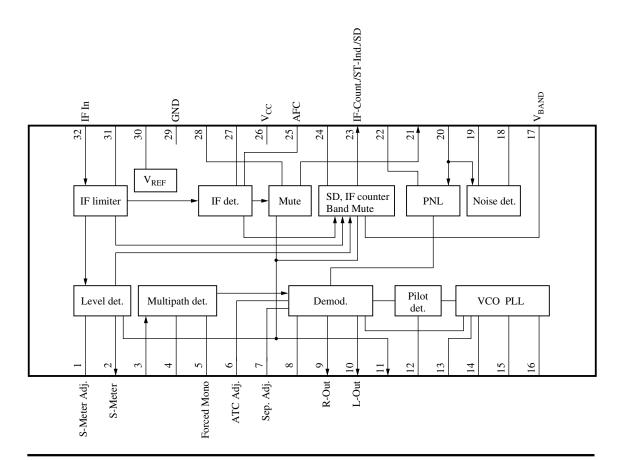
#### ■ Applications

• Car radios

### ■ Block Diagram



Note) The package of this product will be changed to lead-free type (SSOP032-P-0375C). See the new package dimensions section later of this datasheet.



## ■ Pin Description

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

## ■ 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	$P_{\mathrm{D}}$	380.2	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)  $*1: T_a = 25$ °C except power dissipation, operating ambient temperature and storage temperature.

## ■ Recommended Operating Range

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

<sup>\*2:</sup>  $T_a = 80^{\circ}C$ 

## ■ Electrical Characteristics at T<sub>a</sub> = 25°C

Unless otherwise specified,  $V_{CC}$  = 8V,  $V_{IN1}$  is f = 10.70 MHz, Mod. = 1 kHz, 30% FM modulation stereo input is L+R = 90%  $V_P$  = 10%

Parameter	Symbol	Conditions	Min	Тур	Max	Unit
Control voltage (1)	V <sub>C1</sub>	Without signal input, pin 2 DC voltage	0.0	0.3	0.9	V
Control voltage (2)	V <sub>C2</sub>	$V_{IN1} = 40 \text{ dB}\mu$ , pin 2 DC voltage	0.7	1.2	1.7	V
Control voltage (3)	V <sub>C3</sub>	$V_{IN1} = 70 \text{ dB}\mu$ , pin 2 DC voltage	2.5	3.2	3.9	V
Control voltage (4)	V <sub>C4</sub>	$V_{IN1} = 100 \text{ dB}\mu$ , pin 2 DC voltage	4.5	5.3	5.8	V
Control voltage (5)	V <sub>C5</sub>	$V_{C5} = V_{C3} - V_{C2}$	1.8	2.0	2.2	V
Control voltage (6)	V <sub>C6</sub>	$V_{C6} = V_{C4} - V_{C3}$	1.9	2.1	2.3	V
Output level L-channel	V <sub>OL</sub>	$V_{IN1} = 70 \text{ dB}\mu$ , pin 10 AC voltage	85	105	125	mV[rms]
Output level R-channel	V <sub>OR</sub>	$V_{IN1} = 70 \text{ dB}\mu$ , pin 9 AC voltage	85	105	125	mV[rms]
Channel balance	СВ	$CB = 20 \cdot \log (V_{OL}/V_{OR})$	-1.0	0	1.0	dB
Residual pilot voltage	V <sub>PC</sub>	$V_P = 10\% \ modulation, \ V_{INI} = 70 \ dB\mu,$ pin 22 output voltage	_	4	14	mV[rms]
Stereo lamp turn-on level	LAMP <sub>ON</sub>	19 kHz modulation, Modulation factor at which pin 23 becomes under 1 V	1.3	4.0	6.3	%
Separation L-channel	$Sep_L$	L+R = 90%, $V_P = 10\%$ Larger separation value after	25	33	_	dB
Separation R-channel	Sep <sub>R</sub>	changing over pin 7 external resistor	25	33	_	dB
Capture range	CR	Modulation at $V_P = 6.5\%$ Referred to 19 kHz	±0.4	±0.7	_	%
Counter output level (1)	VIF <sub>1</sub>	$V_{IN1} = 100 \text{ dB}\mu$ , $V_{24} = 2 \text{ V}$ pin 23 output voltage	120	140	160	mV[rms]
Counter output level (2)	VIF <sub>2</sub>	$V_{IN1} = 100 \text{ dB}\mu$ , $V_{24} = 5 \text{ V}$ pin 23 output voltage	0	2	5	mV[rms]
Monaural THD (L)	THD <sub>L</sub>	V <sub>IN2</sub> monaural input, 500 mV[0-p] 1 kHz, L-ch. output distortion factor		0.1	0.3	%
Monaural THD (R)	$THD_R$	V <sub>IN2</sub> 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 <sub>IN2</sub> stereo input, 500 mV[0-p] 1 kHz, L-ch. output distortion factor	_	0.1	0.3	%
Stereo THD (R)	$THD_{STR}$	V <sub>IN2</sub> stereo input, 500 mV[0-p] 1 kHz, R-ch. output distortion factor	_	0.1	0.3	%
PNL-AGC voltage (1)	V <sub>AGC1</sub>	V <sub>IN2</sub> = Without input pin 19 DC voltage	1.2	1.4	1.7	V
PNL-AGC voltage (2)	V <sub>AGC2</sub>	Input $V_{IN2} = 100 \text{ mV}$ , $f = 100 \text{ kHz}$ Difference from $V_{AGC1}$	0.1	0.35	0.60	V
Residual noise voltage	V <sub>NR</sub>	$V_{IN2}$ = (pulse width 10 $\mu$ s, 1 V[p-p] 1 kHz), L-ch. output	0.0	0.2	0.7	mV[rms]

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

Unless otherwise specified,  $V_{CC}$  = 8V,  $V_{IN1}$  is f = 10.70 MHz, Mod. = 1 kHz, 30% FM modulation stereo input is L + R = 90%  $V_P$  = 10%

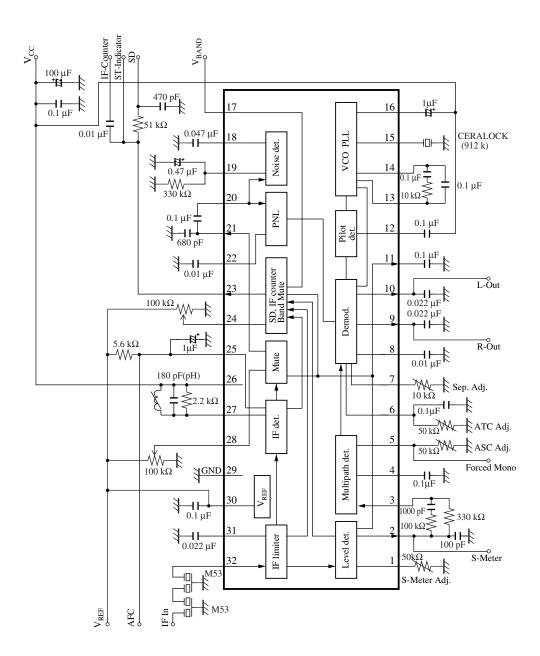
Parameter	Symbol	Conditions	Min	Тур	Max	Unit
SD sensitivity	$SD_S$	$V_{IN1}$ when $V_{24} = 2 V$ , $V_{23} > 2 V$	68	78	88	dΒμ
SD bandwidth	$SD_W$	$V_{IN}$ bandwidth when $V_{24}$ = 2 V, and $V_{23}$ > 2 V, $V_{IN1}$ = 100 dB $\mu$	100	130	160	kHz
Supply current	I <sub>TOT</sub>	Without input	30	37	44	mA
Limiting sensitivity	V <sub>LIM</sub>	V <sub>IN1</sub> input level when pin 9 AC voltage drops by 3 dB	24	32	38	dΒμ
ATC	V <sub>ATC</sub>	L-ch. output ratio when $V_6 = 2 V$ and $0 V$	6	10	14	dB
Gate pulse width	PW	$V_{IN2}$ = (pulse width 1 $\mu$ s, 0.3 V[p-p] 1 kHz) pin 22 output pulse width	16	23	30	μs

#### • Design reference data

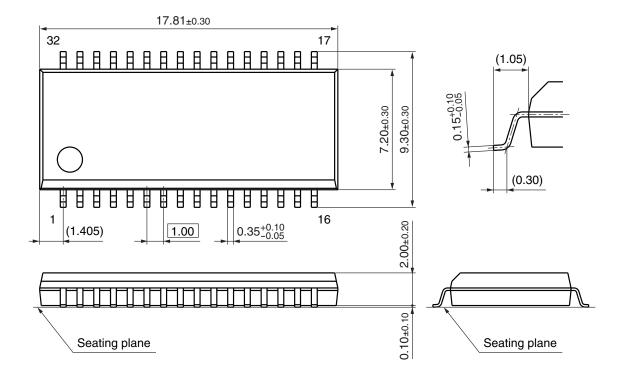
Note) The following characteristics are the reference values for design and not guaranteed values.

Parameter	Symbol	Conditions	Min	Тур	Max	Unit
Stereo lamp turn-off level	LAMP <sub>OFF</sub>	Ratio between the modulation factor when pin 23 becomes 2 V or higher and LAMP <sub>ON</sub>		6.0	10.0	dB
AFC offset voltage	V <sub>AFC</sub>	Without signal input, DC potential difference between pin 25 and pin 30	- 0.1	0.0	0.1	V

### ■ Application circuit Example



- New Package Dimensions (Unit: mm)
- SSOP032-P-0375C (Lead-free package)



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