# 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





Pin Description		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 <sub>REF</sub>
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 <sub>D</sub>	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. \*2:  $T_a$  = 80°C

### Recommended Operating Range

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

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

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	CB	$CB = 20 \cdot \log (V_{OL}/V_{OR})$	-1.0	0	1.0	dB
Residual pilot voltage	V <sub>PC</sub>	$V_P = 10\%$ modulation, $V_{IN1} = 70$ 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 <sub>L</sub>	$L+R = 90\%$ , $V_P = 10\%$ 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>	$V_{IN1} = 100 \text{ dB}\mu, V_{24} = 5 \text{ V}$	0	2	5	mV[rms]
		pin 23 output voltage				
Monaural THD (L)	THDL	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 <sub>R</sub>	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 <sub>STR</sub>	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 kHz Difference from $V_{AGC1}$	0.1	0.35	0.60	V
Residual noise voltage	V <sub>NR</sub>	$V_{IN2} =$ (pulse width 10 µs, 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	SDs	$V_{IN1}$ when $V_{24} = 2 V$ , $V_{23} > 2 V$	68	78	88	dBμ
SD bandwidth	$\mathrm{SD}_{\mathrm{W}}$	$    V_{IN} \text{ bandwidth when } V_{24} = 2 \text{ V}, \\     and V_{23} > 2 \text{ V}, V_{IN1} = 100 \text{ dB} \mu $	100	130	160	kHz
Supply current	I <sub>TOT</sub>	Without input	30	37	44	mA
Limiting sensitivity	V <sub>LIM</sub>	$V_{IN1}$ input level when pin 9 AC voltage drops by 3 dB	24	32	38	dBμ
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 µs, 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 $LAMP_{ON}$	2.0	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



### Request for your special attention and precautions in using the technical information and semiconductors described in this material

- (1) An export permit needs to be obtained from the competent authorities of the Japanese Government if any of the products or technologies described in this material and controlled under the "Foreign Exchange and Foreign Trade Law" is to be exported or taken out of Japan.
- (2) The technical information described in this material is limited to showing representative characteristics and applied circuit examples of the products. It does not constitute the warranting of industrial property, the granting of relative rights, or the granting of any license.
- (3) The products described in this material are intended to be used for standard applications or general electronic equipment (such as office equipment, communications equipment, measuring instruments and household appliances).

Consult our sales staff in advance for information on the following applications:

- Special applications (such as for airplanes, aerospace, automobiles, traffic control equipment, combustion equipment, life support systems and safety devices) in which exceptional quality and reliability are required, or if the failure or malfunction of the products may directly jeopardize life or harm the human body.
- Any applications other than the standard applications intended.
- (4) The products and product specifications described in this material are subject to change without notice for reasons of modification and/or improvement. At the final stage of your design, purchasing, or use of the products, therefore, ask for the most up-to-date Product Standards in advance to make sure that the latest specifications satisfy your requirements.
- (5) When designing your equipment, comply with the guaranteed values, in particular those of maximum rating, the range of operating power supply voltage and heat radiation characteristics. Otherwise, we will not be liable for any defect which may arise later in your equipment. Even when the products are used within the guaranteed values, redundant design is recommended, so that such equipment may not violate relevant laws or regulations because of the function of our products.
- (6) When using products for which dry packing is required, observe the conditions (including shelf life and after-unpacking standby time) agreed upon when specification sheets are individually exchanged.
- (7) No part of this material may be reprinted or reproduced by any means without written permission from our company.

### Please read the following notes before using the datasheets

- A. These materials are intended as a reference to assist customers with the selection of Panasonic semiconductor products best suited to their applications.
  Due to modification or other reasons, any information contained in this material, such as available product types, technical data, and so on, is subject to change without notice.
  Customers are advised to contact our semiconductor sales office and obtain the latest information before starting precise technical research and/or purchasing activities.
- B. Panasonic is endeavoring to continually improve the quality and reliability of these materials but there is always the possibility that further rectifications will be required in the future. Therefore, Panasonic will not assume any liability for any damages arising from any errors etc. that may appear in this material.
- C. These materials are solely intended for a customer's individual use. Therefore, without the prior written approval of Panasonic, any other use such as reproducing, selling, or distributing this material to a third party, via the Internet or in any other way, is prohibited.