

# AN7289NFBQ

## FM-FE+AM IC for car radio

### Overview

The AN7289NFBQ is an IC having FM-FE+AM functions for car radio. A tuner block of car radio can be constructed by using this IC and the AN7293NSC/NFBQ.

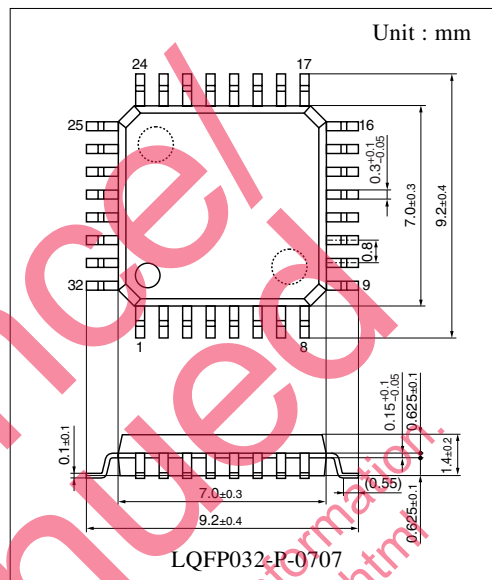
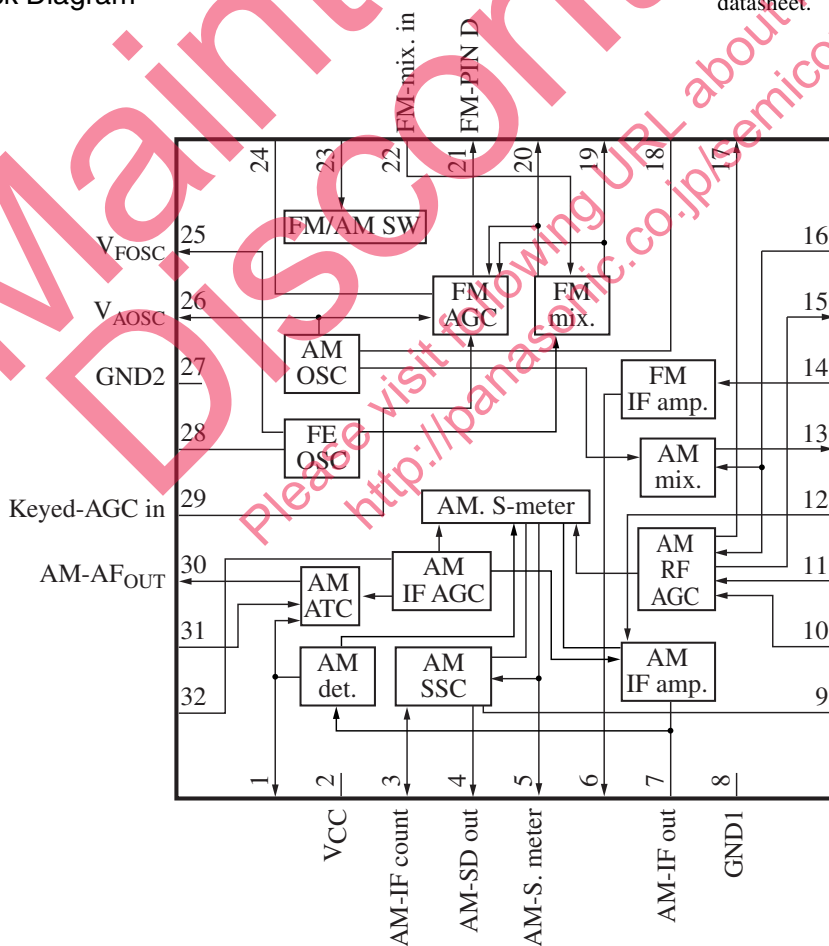
### Features

- A less number of electrolytic capacitors is required (3 capacitors reduction compared with our conventional IC)
- AM: Effective sensitivity is improved by 2 dB through ATC
- AM: Strong-input characteristic is improved by 2-loop-AGC function
- The AN7289NSC of DIL package type is also available

### Applications

- Car radios

### Block Diagram



Note) The package of this product will be changed to lead-free type (LQFP032-P-0707B). See the new package dimensions section later of this datasheet.

### ■ Pin Descriptions

Pin No.	Description	Pin No.	Description
1	AM detection output	17	FM-PIN diode driver
2	V <sub>CC1</sub>	18	AM-OSC coil pin
3	AM-IF counter output/DX/LO SW	19	FM-mix. output 2
4	AM-SD output	20	FM-mix. output 1
5	AM-signal meter output	21	FM-PIN diode driver
6	FM-IF output	22	FM-mix. input
7	AM-IF output	23	V <sub>CC2</sub> /FM/AM SW
8	GND1	24	FM-AGC output
9	SSC	25	FM-OSC buffer output
10	AM-RF level detection	26	AM-OSC buffer output/FE-AGC sensitivity setting
11	AM-WAGC detection/DX setting	27	GND2
12	AM-IF input	28	FM-OSC coil pin
13	AM-mix. output	29	FM-keyed-AGC input
14	FM-IF input	30	AM-AM output/LO setting
15	AM-RF gain control	31	AM-ATC input
16	AM-mix. input	32	AM-IF level detection

### ■ Absolute Maximum Ratings

Parameter	Symbol	Rating	Unit
Supply voltage	V <sub>CC</sub>	9.1	V
Supply current	I <sub>CC</sub>	56	mA
Power dissipation *2	P <sub>D</sub>	343.3	mW
Operating ambient temperature *1	T <sub>opr</sub>	-35 to +80	°C
Storage temperature *1	T <sub>stg</sub>	-55 to +125	°C

Note) \*1: T<sub>a</sub> = 25°C except power dissipation, operating ambient temperature and storage temperature.

\*2: Referring to "■ Technical Information" for power dissipation at T<sub>a</sub> = 80°C, use the circuit under the conditions not exceeding the allowable limit value.

### ■ Recommended Operating Range

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

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

- AM mode at  $V_{CC} = 8.0\text{ V}$ ,  $f_{IN2} = 1\text{ MHz}$

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
AM consumption current 1	amL <sub>T1</sub>	Without input	28	36	44	mA
AM consumption current 2	amL <sub>T2</sub>	$f_{IN2} = 1\text{ MHz}$ , $V_{IN2} = 130\text{ dB}\mu$	33	41	49	mA
AM-AF output	amV <sub>O</sub>	$V_{IN2} = 74\text{ dB}\mu$ , 400 Hz 30%, AM-AF output	105	135	160	mV
AM signal-to-noise ratio	amSN	$V_{IN2} = 74\text{ dB}\mu$ , 400 Hz 30%, AM-AF output S/N	48	52	58	dB
AM-AGC width	amW	$V_{IN2} = 74\text{ dB}\mu$ , 400 Hz 30%, AM-AF output -10 dB input change	56	60	64	dB
AM-ATC operation	amATC	(Output ratio [dB] of 400 Hz and 3 kHz when $V_{IN2} = 18\text{ dB}\mu$ ) - (output ratio [dB] of 400 Hz and 3 kHz when $V_{IN2}$ = 74 dB $\mu$ ) 80%Mod., AM-AF <sub>OUT</sub> output	3.5	6.5	9.5	dB
AM-distortion rate 1	amT1	$V_{IN2} = 74\text{ dB}\mu$ , 400 Hz 80%, AM-AF output distortion	0.01	0.5	1.5	%
AM-distortion rate 2	amT2	$V_{IN2} = 130\text{ dB}\mu$ , 400 Hz 80%, AM-AF output distortion	0.01	0.5	1.5	%
AM wide band AGC on input	amV <sub>W</sub>	$f_{IN2} = 1.4\text{ MHz}$ , input when pin 15 voltage becomes below 3 V	96	102	108	dB $\mu$
AM local oscillation buffer output	amV <sub>OS</sub>	Without input	160	210	260	mV
AM-IF count output 1	amIF1	$V_{IN2} = 40\text{ dB}\mu$	150	210	270	mV
AM-IF count output 2	amIF2	Without input	—	—	10	mV
AM-SD output 1	amSD1	$V_{IN2} = 40\text{ dB}\mu$	4.5	4.9	5.1	V
AM-SD output 2	amSD2	Without input	0.0	0.2	0.5	V
AM signal meter output 1	amV <sub>S1</sub>	Without input, pin 5 voltage	1	50	200	mV
AM signal meter output 2	amV <sub>S2</sub>	$V_{IN2} = 30\text{ dB}\mu$ , pin 5 voltage	0.8	1.05	1.3	V
AM signal meter output 3	amV <sub>S3</sub>	$V_{IN2} = 130\text{ dB}\mu$ , pin 5 voltage	4.1	4.8	5.1	V
AM search sensitivity DX	amDX	AM-IF count output is over 120 mV $V_{IN2}$ when f becomes 450 kHz $\pm$ 2 kHz	23	29	35	dB $\mu$
AM search sensitivity LO	amLO	AM-IF count output is over 120 mV $V_{IN2}$ when f becomes 450 kHz $\pm$ 2 kHz	43	49	55	dB $\mu$

Note) FM tuning condition: Adjust  $V_{ATU}$  voltage so that  $V_{AOSC}$  output frequency becomes 1 450 kHz $\pm$ 500 Hz

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

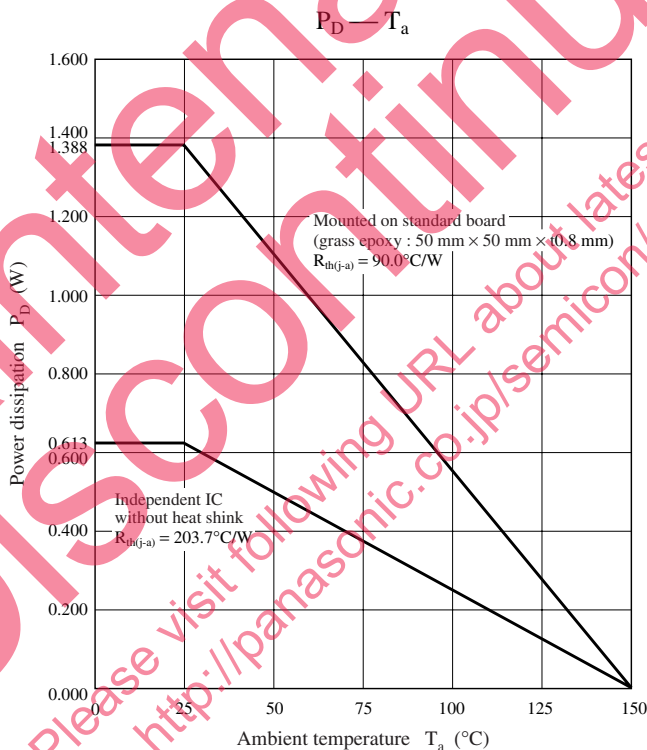
- FM mode at  $V_{CC} = 8.0\text{ V}$ ,  $f_{IN1} = 98\text{ MHz}$

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
FM local oscillation buffer output	fmV <sub>OS</sub>	$f_{OSC} = 108.7\text{ MHz}$ , without input	140	200	260	mV
FM-IF output level	fmIF	$V_{IN1} = 71\text{ dB}\mu$	40	75	110	mV
FM-AGC sensitivity	fmAGC	$V_{IN1}$ level when $V_{24}$ becomes 3 V	60	64	68	dB $\mu$
High-level FM-AGC voltage	fmV <sub>AH</sub>	$V_{IN1} = 70\text{ dB}\mu$	6.0	6.4	6.8	V
Low-level FM-AGC voltage	fmV <sub>AL</sub>	$V_{IN1} = 82\text{ dB}\mu$	—	0.05	0.5	V
FM consumption current	fmI <sub>T</sub>	Without input	26	35	44	mA

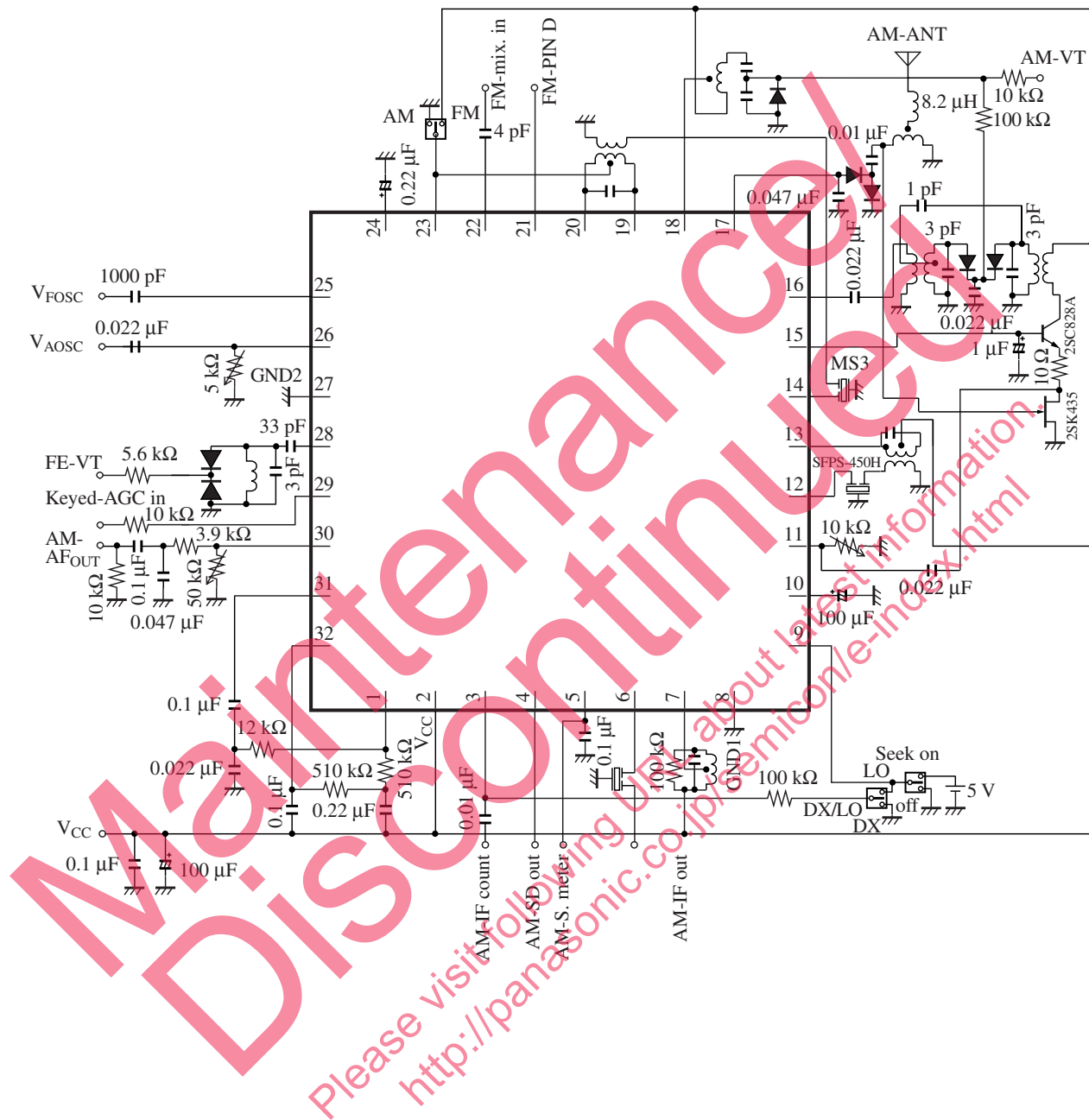
Note) FM tuning condition: Adjust  $V_{FTU}$  voltage so that  $V_{FOSC}$  output frequency becomes  $108.7\text{ MHz} \pm 10\text{ kHz}$ .

### ■ Technical Information

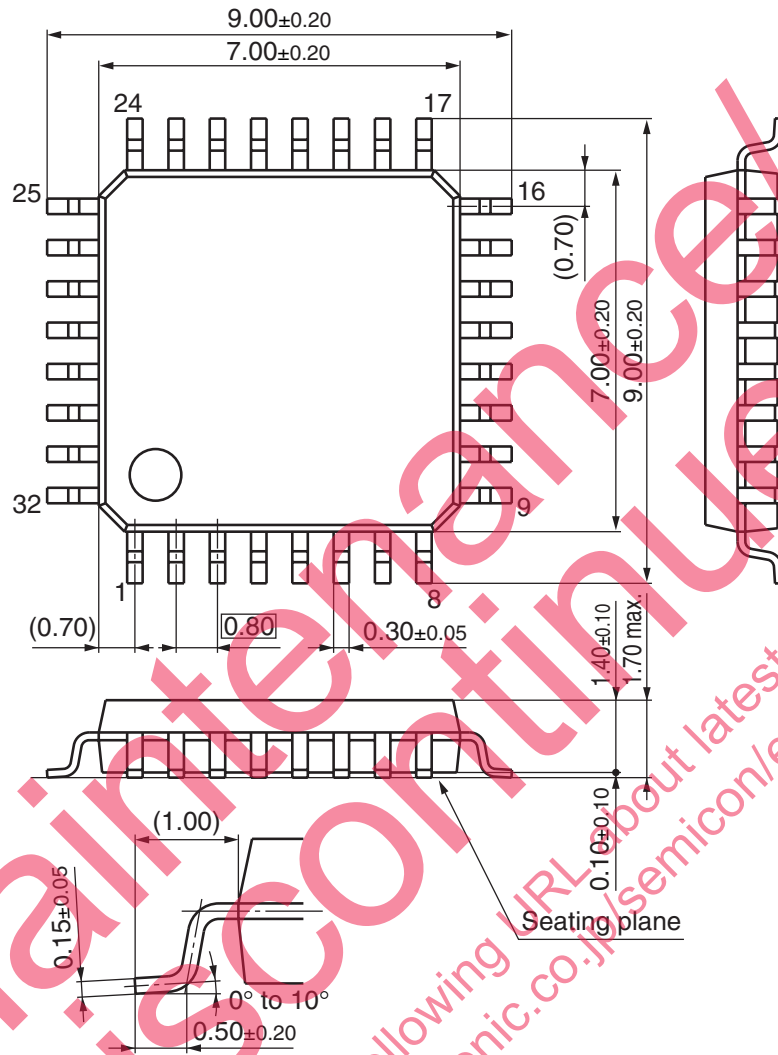
- $P_D$  —  $T_a$  curves of LQFP032-P-0707



■ Application Circuit Example



- New Package Dimensions (Unit: mm)
- LQFP032-P-0707B (Lead-free package)



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

- (1) If any of the products or technical information described in this book is to be exported or provided to non-residents, the laws and regulations of the exporting country, especially, those with regard to security export control, must be observed.
- (2) The technical information described in this book is intended only to show the main characteristics and application circuit examples of the products, and no license is granted under any intellectual property right or other right owned by our company or any other company. Therefore, no responsibility is assumed by our company as to the infringement upon any such right owned by any other company which may arise as a result of the use of technical information described in this book.
- (3) The products described in this book 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 book are subject to change without notice for 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 range of absolute maximum rating and the guaranteed operating conditions (operating power supply voltage and operating environment etc.). Especially, please be careful not to exceed the range of absolute maximum rating on the transient state, such as power-on, power-off and mode-switching. 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, take into the consideration of incidence of break down and failure mode, possible to occur to semiconductor products. Measures on the systems such as redundant design, arresting the spread of fire or preventing glitch are recommended in order to prevent physical injury, fire, social damages, for example, by using the products.
- (6) Comply with the instructions for use in order to prevent breakdown and characteristics change due to external factors (ESD, EOS, thermal stress and mechanical stress) at the time of handling, mounting or at customer's process. When using products for which damp-proof packing is required, satisfy the conditions, such as shelf life and the elapsed time since first opening the packages.
- (7) This book may be not reprinted or reproduced whether wholly or partially, without the prior written permission of Matsushita Electric Industrial Co., Ltd.