TEF668X

Low IF tuner high performance one-chip

Rev. 1 — 30 July 2013 **Product short data sheet**

1. General description

The Low IF Tuner HIgh performance One chips, TEF6686 and TEF6688, are single-chip radio ICs including an AM/FM radio tuner and software-defined radio signal processing. They extend NXP Semiconductors' broad, industry-proven car radio single tuner portfolio, offering outstanding radio performance with the widest range of features and state of the art software algorithms at most optimized system costs.

Both devices are available in HVQFN packages occupying the smallest PCB space and are suitable for dual- and multi-layer PCBs. The radio receiver includes highest feature sets, the FM/AM front-ends, tuning synthesizer, channel filtering, FM Channel Equalization, FM multipath improvement, demodulation, FM stereo decoding, weak signal processing, noise blanking and RDS and provides an interface to a DARC demodulator/decoder.

The TEF6686 and TEF6688 can provide stereo audio in digital format on the I²S outputs and on the audio DAC outputs. The TEF6688 supports the digital radio standards HD Radio and Digital Radio Mondiale (DRM) digital radio when used with NXP Semiconductors' digital radio coprocessors such as SAF356X and SAF360X.

2. Features and benefits

- Alignment free digital receiver including tuner and software-defined radio processing
- Command based high-level user interface combining high control flexibility with ease of control
- Read information with device and tuning status, reception quality and RDS data
- FM receiver with a tuning range of 65 MHz to 108 MHz covering Eastern Europe (OIRT), Japan, Europe and US bands
- AM receiver covering LW, MW and full SW
- Fully integrated tuning system with low phase noise and fast tuning
- FM LNA with AGC
- State-of-the art FM Improved Multipath Suppression
- FM Channel Equalization
- Soft Mute on Modulation
- Stereo High Blend
- FM mixer for frequency conversion to a low IF complex signal (AM SW)
- AM LNA with AGC, matching active and passive antenna applications
- AM mixer for frequency conversion to a low IF complex signal

- High dynamic range Sigma Delta IF ADC
- Digital IF signal processing including decimation, shift to baseband, AGC control, I/Q correction, variable IF bandwidth filtering (PACS) and demodulation
- FM stereo decoding
- TEF6688 baseband I^2S output supporting HD Radio and DRM[1] with external digital radio coprocessor (SAF356X or SAF360X)
- Blending function for HD Radio reception (TEF6688)
- AM and FM noise blanking, Signal quality detection and weak signal processing
- Advanced RDS and RBDS demodulation and decoding
- MPX output supporting DARC demodulator
- One I^2S input and one I^2S output
- Two mono audio DACs
- Single 3.3 V supply voltage
- Fast mode I^2C-bus (400 kHz)
- Configurable GPIO pins for RDS, Quality Status Interrupt and generic I^2C-bus controlled I/O
- Qualified in accordance with AEC-Q100

3. Applications

The TEF668X is a single tuner AM/FM receiver for automotive applications and supports analog AM/FM and HD/DRM reception (HD/DRM is supported in TEF6688 only).

Additionally, due to a common technology platform, the TEF668X can be combined with TEF701X, SAF775X and SAF360X for optimal system application through common crystal oscillator sharing.

4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Supply voltage						
$V_{DDA(RF)(3V3)}$	RF analog supply voltage (3.3 V)	on pin VDDA_RF	3.0	3.3	3.5	V
$V_{DDA(IF)(3V3)}$	IF analog supply voltage (3.3 V)	on pin VDDA_IFADC	3.0	3.3	3.5	V
$V_{DDD(3V3)}$	digital supply voltage (3.3 V)	on pin VDD_DIGITAL	3.0	3.3	3.5	V
Current in FM mode						
$I_{DDA(RF)}$	RF analog supply current	on pin VDDA_RF	33	37	42	mA
$I_{DDA(IFADC)}$	IF ADC analog supply current	on pin VDDA_IFADC	81	94	110	mA
I_{DDD}	digital supply current	on pin VDDD	37	38	48	mA
Current in AM - MW/LW mode						
$I_{DDA(RF)}$	RF analog supply current	on pin VDDA_RF	34	40	48	mA

1. DRM includes DRM30 and DRM+ (band I and II)

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Table 1. Quick reference data *...continued*

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{DDA(IFADC)}$	IF ADC analog supply current	on pin VDDA_IFADC	63	74	86	mA
I_{DDD}	digital supply current	on pin VDDD	33	34	46	mA
Current in Standby mode						
$I_{DDA(RF)}$	RF analog supply current	on pin VDDA_RF	0	0.3	2	mA
$I_{DDA(IFADC)}$	IF ADC analog supply current	on pin VDDA_IFADC	25	37	45	mA
I_{DDD}	digital supply current	on pin VDDD	15	24	35	mA

5. Ordering information

Table 2. Ordering information

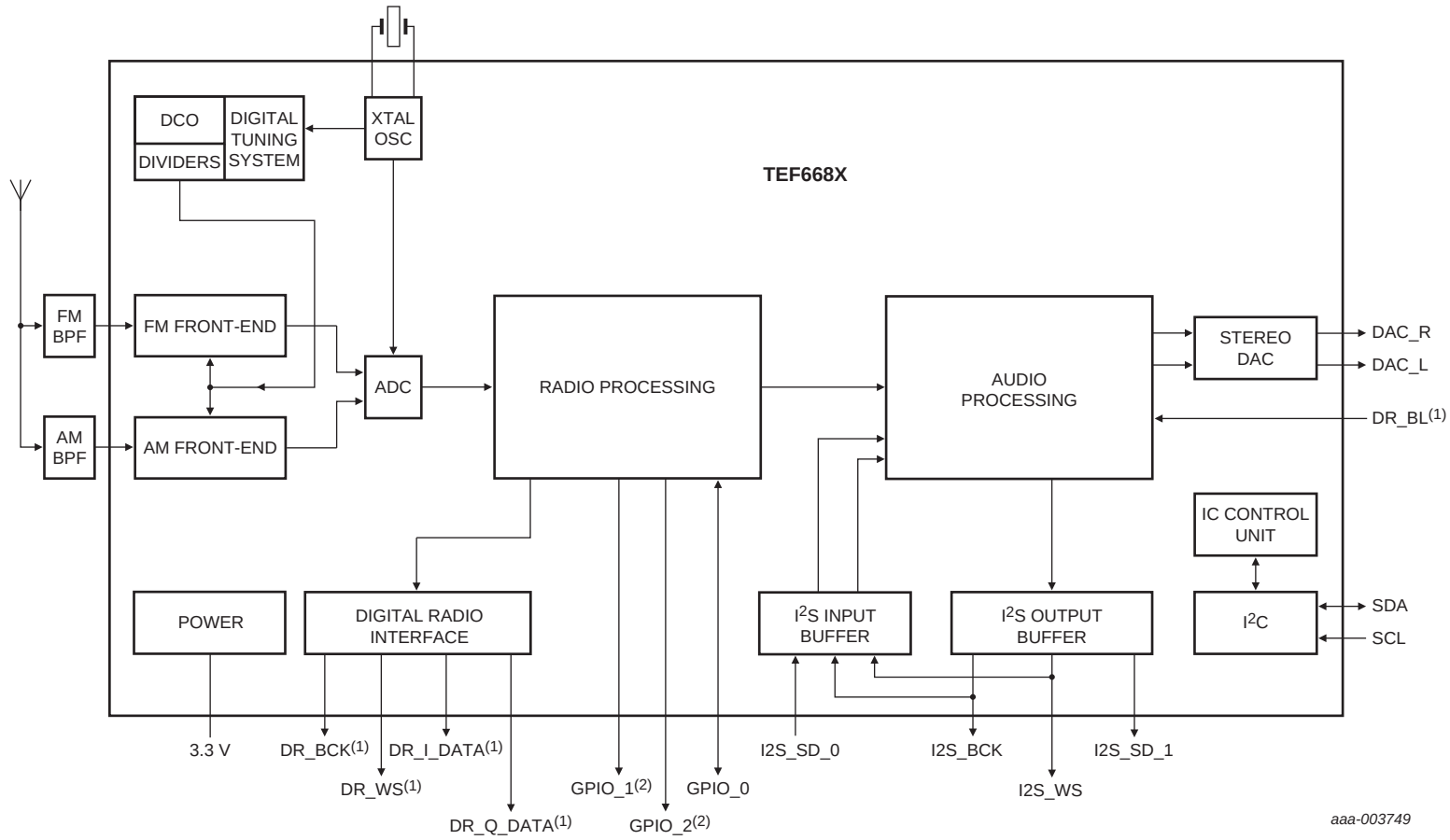
Type number	Package		
	Name	Description	Version
TEF6686HN/V101	HVQFN32	plastic thermal enhanced very thin quad flat package; no leads; 32 terminals; body 5 × 5 × 0.85 mm[1]	SOT617-3
TEF6688HN/V101			

[1] Wettable sides to allow for optical inspection.

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6. Block diagram



(1) TEF6688

(2) GPIO_1 and GPIO_2 are output only.

Fig 1. Block diagram

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7. Limiting values

Table 3. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions		Min	Max	Unit
$V_{DDA(RF)(3V3)}$	RF analog supply voltage (3.3 V)	on pin VDDA_RF		−0.5	+3.9	V
$V_{DDA(IF)(3V3)}$	IF analog supply voltage (3.3 V)	on pin VDDA_IFADC		−0.5	+3.9	V
$V_{DDD(3V3)}$	digital supply voltage (3.3 V)	on pin VDDD		−0.5	+3.9	V
$\Delta V_{DD(3V3-3V3)}$	supply voltage difference between two 3.3 V supplies	between pins VDDA_IFADC and VDDA_RF		−0.3	+0.3	V
V_n	voltage on any other pin			−0.5	$+V_{DDD(3V3)}$ + 0.3	V
I_{lu}	latch-up current	all supply voltages below the maximum value	[1]	−100	+100	mA
V_{lu}	latch-up voltage			-	$1.5 \times V_{DDD(3V3)}$	V
T_{stg}	storage temperature			−55	+150	°C
T_{amb}	ambient temperature			−40	+85	°C
T_j	junction temperature			−40	+125	°C

[1] In accordance with AEC-Q100-004.

8. Revision history

Table 4. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
TEF668X_SDS v.1	20130730	Product short data sheet	-	-

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9.1 Data sheet status

Document status[1][2]	Product status[3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

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