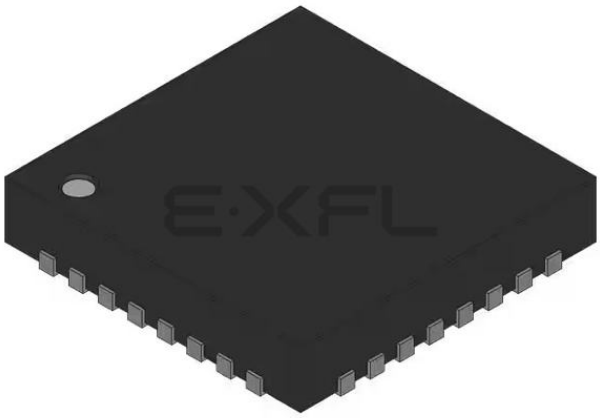

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## Understanding Embedded - DSP (Digital Signal Processors)

Embedded - DSP (Digital Signal Processors) are specialized microprocessors designed to perform complex mathematical computations on digital signals in real-time. Unlike general-purpose processors, DSPs are optimized for high-speed numeric processing tasks, making them ideal for applications that require efficient and precise manipulation of digital data. These processors are fundamental in converting and processing signals in various forms, including audio, video, and communication signals, ensuring that data is accurately interpreted and utilized in embedded systems.

## Applications of Embedded - DSP (Digital Signal Processors)

| Details | |
|---|---|
| Product Status | Active |
| Type | - |
| Interface | - |
| Clock Rate | - |
| Non-Volatile Memory | - |
| On-Chip RAM | - |
| Voltage - I/O | - |
| Voltage - Core | - |
| Operating Temperature | - |
| Mounting Type | - |
| Package / Case | - |
| Supplier Device Package | - |
| Purchase URL | https://www.e-xfl.com/product-detail/nxp-semiconductors/tef6659hn-v102k |

# TEF665X

## DSP-based radio tuner one-chip

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

## 1. General description

The TEF6657 and TEF6659 are single-chip radio ICs including an AM/FM radio tuner and software-defined radio signal processing. These devices are the successors to the industry-proven TEF661X product range, with improved performance and feature set at lower system cost.

Both devices are available in HVQFN packages occupying only smallest PCB real estate and are suitable for multi-layer PCBs.

The radio receiver includes the FM/AM front-ends, tuning synthesizer, channel filtering, FM multipath improvement, demodulation, FM stereo decoding, weak signal processing, noise blanking, RDS and DARC support.

Stereo audio is provided in digital format on the $I^2S$ outputs and on the audio DAC outputs.

The TEF6659 supports the HD Radio and Digital Radio Mondiale (DRM) digital radio standards 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
- FM mixer for frequency conversion to a low IF complex signal
- AM LNA with AGC, matching active and passive antenna applications
- AM mixer for frequency conversion to a low IF complex signal (AM SW)
- High dynamic range 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

- Baseband $I^2S$ output supporting HD Radio and DRM[1] with external digital radio coprocessor (TEF6659)
- Blending function for HD Radio reception (TEF6659)
- AM & 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 TEF665X is a single tuner AM/FM receiver for automotive applications and supports analog AM/FM and HD/DRM reception (HD/DRM is supported in TEF6659 only).

Additionally, due to a common technology platform, the TEF665X 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 |
| $I_{DDA(IFADC)}$ | 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** | | | | | | |

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

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

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $I_{DDA(RF)}$ | 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 |

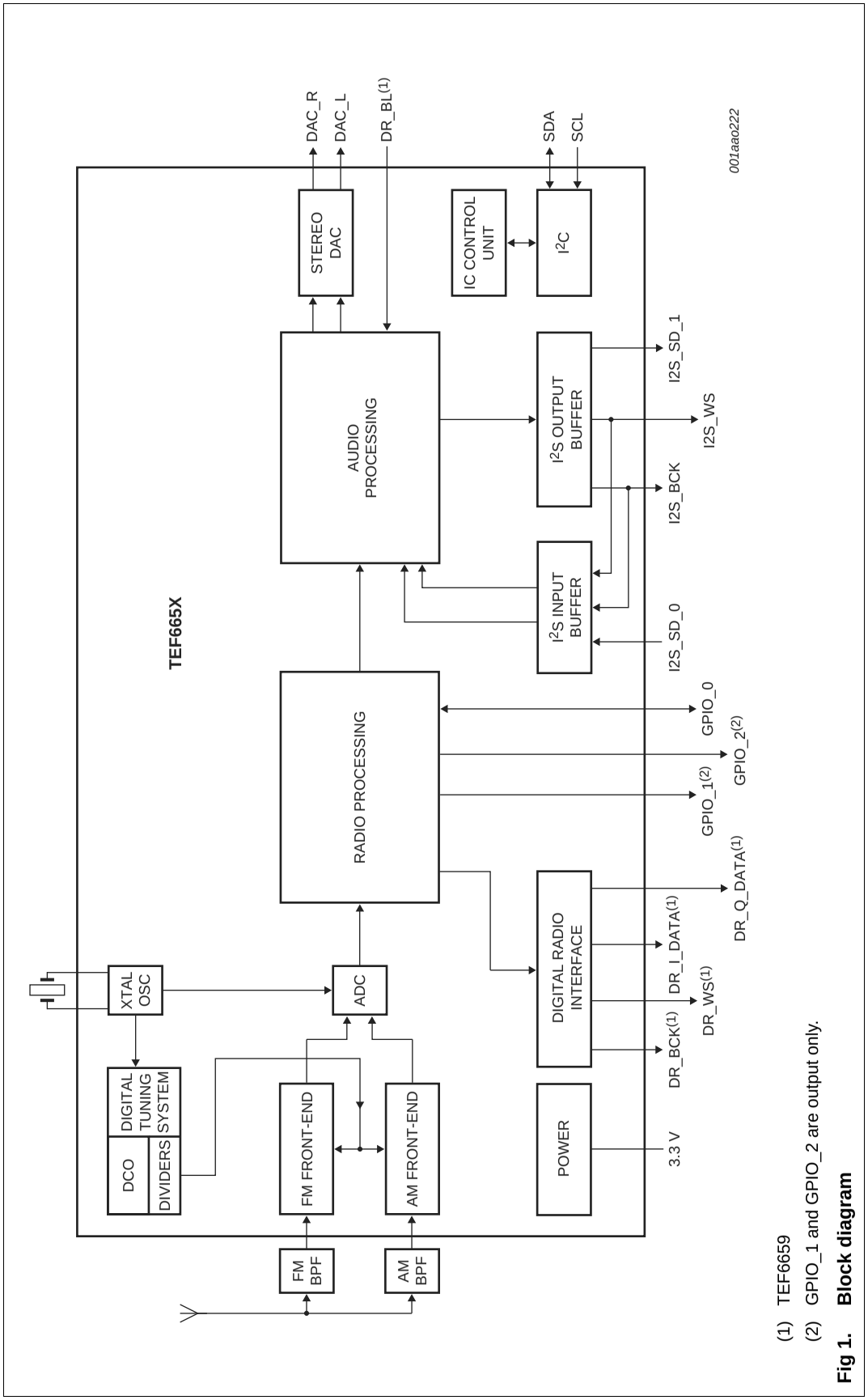
# 5. Ordering information

**Table 2. Ordering information**

| Type number | Package | | |
|---|---|---|---|
| | Name | Description | Version |
| TEF6657HN/V101 | HVQFN32 | plastic thermal enhanced very thin quad flat package; no leads; 32 terminals; body 5 × 5 × 0.85 mm[1] | SOT617-3 |
| TEF6659HN/V101 | | | |

[1] Wettable sides to allow for optical inspection.

## 6. Block diagram




(1) TEF6659

(2) GPIO_1 and GPIO_2 are output only.

**Fig 1. Block diagram**

# 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 |
|---|---|---|---|---|
| TEF665X_SDS v.1 | 20130730 | Product short data sheet | - | - |

# 9. Legal information

## 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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| --- |
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For sales office addresses, please send an email to: **salesaddresses@nxp.com**

# 11. Contents





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