

SIEMENS

FM IF IC with Search Tuning Stop Pulse, Field Strength Indicator, MUTE Setting and Multipath

TDA 4210-3

Bipolar IC

The TDA 4210-3 has been designed as FM IF component with a special demodulator for application in car radios. The sensitivity level of the input amplifier can be adjusted for applications with search tuning mode. In addition, a search tuning stop pulse is generated. Moreover, the included multipath identification circuit activates an interference suppression circuit in case of multipath interference. The TDA 4210-3 is especially suitable for application in car radios and home receivers which require a search tuning stop pulse and include an interference suppression circuit.

Features

- Multipath identification circuit
- 7-stage limiter amplifier
- Product demodulator
- AFC output
- Field strength dependent volume control
- Generation of search tuning stop pulse
- Adjustable limiter threshold
- Adjustable muting depth

| Type | Ordering Code | Package |
|------------|---------------|----------|
| TDA 4210-3 | Q67000-A8008 | P-DIP-18 |

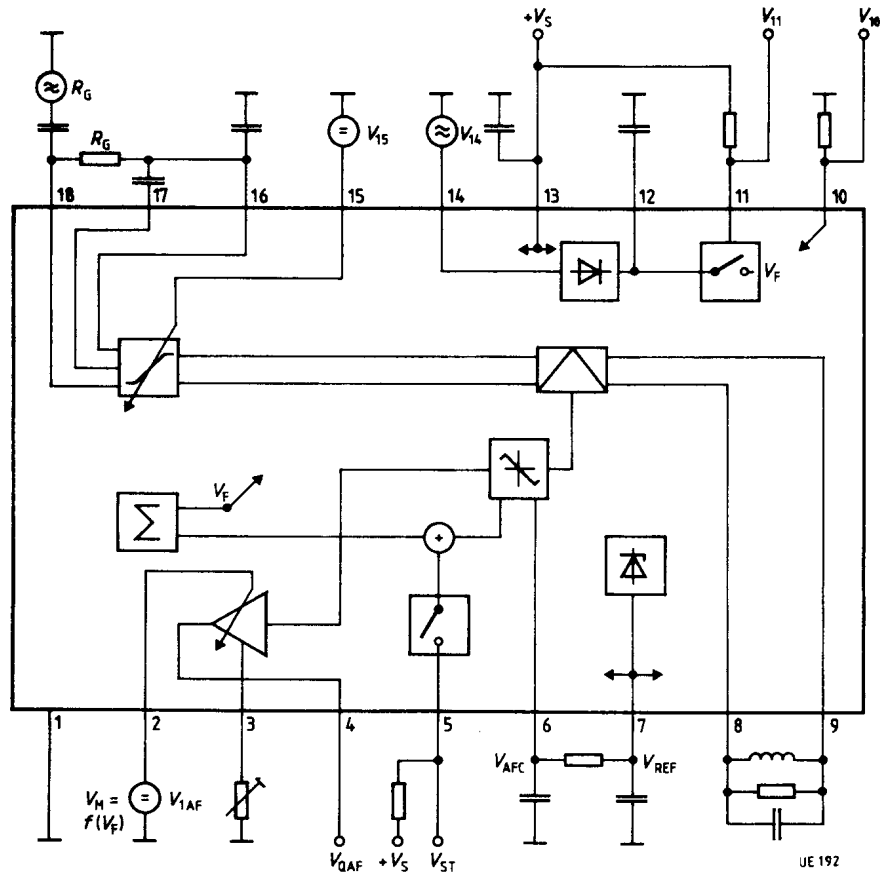
Circuit Description

The integrated circuit includes a 7-stage limiter amplifier with demodulator and non-controlled AF output. The limiter threshold can be raised by approx. 44 dB by means of external circuitry. Within this range the AF output signal can be continuously attenuated by 39 dB typical to eliminate the usually occurring noise products.

To suppress variable interference products, e.g. multipath interference, the TDA 4210-3 includes an identification circuit with an externally adjustable time constant.

Also included are a field strength output, an AFC output, as well as an open collector output. The latter will be activated at zero crossing of the detector S-curve.

Block Diagram



Pin Functions

| Pin No. | Function |
|---------|---|
| 1 | Ground capacitors for operating point feedback, V_S , and V_{REF} decoupling are to be connected directly to pin 1 |
| 2 | MUTE input (usually derived from field strength output voltage) for DC voltage which attenuates the AF output voltage by the set muting depth (pin 4). Max. attenuation when $V_2 = 0$ V, no attenuation when $V_2 \geq 0.75$ V |
| 3 | Muting depth adjustment by connecting a resistor to ground the required muting depth can be set. Maximal attenuation of AF output voltage with $R = 0$ (approx. 46 dB), minimal attenuation with $R = \infty$ (approx. 7 dB) |
| 4 | AF output for demodulated FM-IF |
| 5 | Search tuning stop (ST) output is connected when the input field strength exceeds the search tuning stop pulse threshold and the input frequency lies within the search tuning stop pulse window. |
| 6 | AFC output: push-pull current output, referenced via a resistor connected to a fixed voltage source (e.g. V_{REF}). The voltage generated at the resistor is in proportion to the deviation from the nominal input frequency and can be applied for retuning purposes. |
| 7 | Reference voltage should be RF decoupled to pin 1. The AFC resistor and the potentiometer for the limiter threshold are referenced to V_{REF} . |
| 8/9 | Demodulator tank circuit driven via two integrated capacitors (approx. 40 pF \pm 25%). The circuit voltage should be approx. 200 mV (peak-to-peak) |
| 10 | Field strength output supplies a DC voltage proportional to the input level, which quickly adjusts to changes in the input voltage |
| 11 | Identification output designed as an open NPN collector output, which connects an additional time constant in parallel to pin 2 during multipath interference, or activates another circuit to suppress variable interference. |
| 12 | Demodulator time constant determines the response and hold time of the identification circuit. |
| 13 | Supply voltage to be RF decoupled to pin 1 |
| 14 | Identification input high impedance input ($R_i \sim 10$ k Ω). This input receives variable interference forwarded on the field strength voltage via a high-pass filter. |
| 15 | Input for setting limiter threshold with a potential between V_{REF} and 0 V, the limiter threshold can be varied by approx. 44 dB. |
| 16/17 | Operating point feedback to be RF decoupled. For efficient push-push suppression, pin 16 should be blocked against pin 17 and latter to ground (pin 1). |
| 18 | IF input: frequency modulated IF voltage is injected at pin 18. |

Absolute Maximum Ratings

| Parameter | Symbol | Limit Values | Unit |
|----------------------------------|--------------|--------------|------|
| Ground | V_1 | 0 | V |
| MUTE input | V_2 | V_S | V |
| Muting depth | V_3 | V_7 | V |
| AF output | V_4 | V_S | V |
| Search tuning stop signal output | I_5 | 5 | mA |
| AFC output | V_6 | V_S | V |
| Reference voltage output | I_7 | 5 | mA |
| Phase shift | V_8 | V_S | V |
| Phase shift | V_9 | V_S | V |
| Field strength | I_{10} | 5 | mA |
| Identification output | I_{11} | 5 | mA |
| Demodulator time constant | I_{12} | 1 | mA |
| Supply voltage | V_S | 18 | V |
| Identification input | V_{14} | V_7 | V |
| Limiter threshold | V_{15} | V_7 | V |
| Operating point feedback | $V_{16, 17}$ | V_7 | V |
| IF input | V_{18} | V_7 | V |
| Junction temperature | T_j | 125 | °C |
| Storage temperature range | T_{stg} | - 55 to 125 | °C |

Operating Range

| | | | |
|------------------------|----------|-------------|-----|
| Supply voltage | V_S | 7.5 to 15 | V |
| IF section demodulator | f_{IF} | 0.4 to 15 | MHz |
| Overall frequency | f | 0.4 to 15 | MHz |
| AF ($V_{OAF} = 1$ dB) | f_{AF} | 0.02 to 150 | kHz |
| Ambient temperature | T_A | - 25 to 85 | °C |

Characteristics

$V_S = 8.5 \text{ V}$; $V_{I\text{IF rms}} = 10 \text{ mV}$; $f_{I\text{IF}} = 10.7 \text{ MHz}$; $\Delta f = \pm 75 \text{ kHz}$; $f_{\text{mod}} = 1 \text{ kHz}$; $Q_B = 20$; $T_A = 25 \text{ }^\circ\text{C}$; adjustment when $I_7 = 0$; test circuit 1

| Parameter | Symbol | Limit Values | | | Unit | Test Condition |
|--|-------------------------|--------------|-----------|----------|---------------|---|
| | | min. | typ. | max. | | |
| Current consumption | I_{13} | | 27 | 33 | mA | |
| Field strength output voltage | V_{10} | 3.0 | 3.8 | | V | $V_{I\text{IF rms}} = 50 \text{ mV}$ |
| | V_{10} | | 0 | 0.1 | V | $V_{I\text{IF rms}} = 0 \text{ V}$ |
| AF output voltage | $V_{Q4 \text{ rms}}$ | 270 | 380 | 520 | mV | |
| Total harmonic distortion during FM IF mode | <i>THD</i> | | 0.7 | 1.5 | % | $I_{\text{AFC}} = 0$ |
| Input voltage for limiter threshold | $V_{I\text{IF rms}}$ | | 15 | 30 | μV | $V_{Q4-3 \text{ dB}}$ |
| AM suppression | a_{AM} | 60 | | | dB | $m = 30\%$ |
| Signal-to-noise ratio | $a_{\text{S/N}}$ | 70 | | | dB | |
| Current deviation of AFC output | ΔI_7 | | ± 110 | | μA | $f = f_{I\text{IF}} \pm 50 \text{ kHz}$ |
| AFC offset | Δf_{off} | | | ± 15 | kHz | $V_{I7} = 20 \mu\text{V} \dots 10 \text{ mV}$ |
| Search tuning stop window | Δf_{ST} | | ± 18 | | kHz | $R_{6-7} = 22 \text{ k}\Omega$ |
| Search tuning stop threshold FM | $V_{I\text{ST}}$ | | | 70 | μV | $V_6 = V_{\text{S}2}$ |
| Search tuning stop threshold AM | $V_{I\text{ST}}$ | | | 500 | μV | $V_6 = V_{\text{S}2}$ |
| Stabilized voltage | V_7 | 3.6 | 4.1 | 4.6 | V | |
| Adjustable range of limiter threshold via pin 15 | $V_{I\text{IF}}$ | | 44 | | dB | $V_{15} = 0$; $V_{15} = V_{\text{REF}}$ |
| AF MUTE | a_{AF} | 3 | 7 | 11 | dB | $V_2 = 0$; $R_{3-1} = \infty$ |
| | a_{AF} | 31 | 39 | 47 | dB | $V_2 = 0$; $R_{3-1} = 0$ |
| AF MUTE switch-off voltage | V_2 | | 0.5 | 0.75 | V | |
| MP sensitivity for full drive at pin 1 | $V_{I14 \text{ rms}}$ | | 5 | | mV | $f = 20 \text{ kHz}$ |
| Charge current pin 12 | I_{12} | | 3 | | mA | pin 14 to ground |
| Discharge current pin 12 | I_{12} | | 10 | | μA | pin 14 open, $V_{12} < 1 \text{ V}$ |

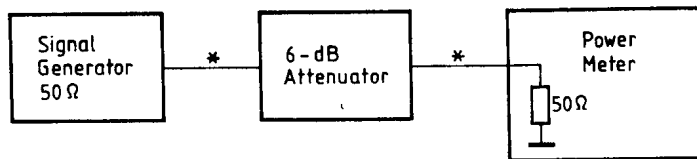
Additional Data with Respect to Application

(data does not apply to series measurement)

| | | | | | | |
|--|------------|------|-----|-----|------------------|--|
| DC voltage AF output | V_{Q5} | 2.8 | 3.8 | 4.8 | V | |
| Internal DC current of emitter follower output | I_4 | 0.75 | 1 | | mA | |
| Input resistance for demodulator circuit | R_{9-10} | 27 | 35 | | $\text{k}\Omega$ | |
| Search tuning stop "LOW" | V_6 | | | 1.3 | V | |
| Search tuning stop "HIGH" | V_6 | 7 | | | V | |

Measurement Circuit

Calibration of signal generator



Measurement of input sensitivity

