

SIEMENS

HL

Application Note



High Frequency Products

CAR RADIO

FM – IF TDA 4321XS

Functional Description:

The FM IF demodulator TDA 4321XS has been designed especially for car radio applications.

The on-chip multipath identification circuit activates an interference suppression circuit in case of multipath interference.

Features:

- 7 stage limiter amplifier
- coincidence demodulator
- counter output with request input
- field strength output
- multipath identification circuit with analog output
- adjustable muting depth
(with full muting ≥ 80 dB)
- STS function

Circuit Description:

The Integrated Circuit includes a 7 stage capacitive coupled limiter amplifier with coincidence demodulator and AF output. The AF output signal can be continuously attenuated to decrease the noise at weak input signals.

In case of multipath interferences the multipath detector of the TDA 4321XS activates an identification circuitry with analog output.

There is a field strength output (with min. 76 dB dynamic range, typ. ± 1 dB non linearity, and max. ± 3 dB temperature drift), an IF counter output and an adjustable muting function (with full muting ≥ 80 dB). An STS output with adjustable threshold and stop window is available.

The IF output supplies via a buffer the input frequency which is necessary for a precise temperature independent search tuning stop. To avoid any interference during normal mode the IF output may be shortened to ground.

Technical Details:

Supply voltage	7.5 V to 11 V
Supply current	33 mA
Ambient temperature	- 40 ... + 85 °C
Reference voltage	4.5 V ... 5.1 V

Measuring condition:

$V_s = 10 \text{ V}$; $f_{IF} = 10.7 \text{ MHz}$; $f_{dev} = \pm 75 \text{ kHz}$; $V_{IF} = 10 \text{ mV}_{rms}$;
 $T_{amb} = + 25 \text{ °C}$

Stabilized voltage	V_8	typ. 4.8 V
Fieldstrength output	V_7	
dynamic range		80 dB
non linearity		$\pm 1 \text{ dB}$
temperature drift		max. $\pm 3 \text{ dB}$
$V_1 = 200 \text{ mV}_{rms}$		5.1 V ... 5.9 V
$V_1 = 1 \text{ mV}_{rms}$		2.3 V ... 3.1 V
$V_1 = 0 \text{ mV}$		0 V ... 1.1 V

Input voltage for limiter threshold		
$V_{17} = - 3 \text{ dB}$	V_1	typ. $20 \mu\text{V}_{rms}$
AF output voltage	V_{17}	460 ... 640 mV_{rms}
Total harmonic distortion		max. 1.2 %
AM suppression $m = 80 \%$		min. 60 dB
Signal to noise ratio		typ. 84 dB

Technical Details (cont.):

Counter output voltage

$C_L = 5 \text{ pF}; R_{i15} = 1.5 \text{ k}\Omega$ typ. $80 \text{ mV}_{\text{rms}}$

Attack current pin 4

$V_{3AC}=1V_{\text{pp}}; V_m=5V$ 800 μA

Recovery current pin 4

$V_{3AC}=0V; V_m=3.6V$ - 9 μA

Start voltage

$V_{5\text{Def}}$ $V_{3AC}=0V$ typ. 4.7 V

Detector characteristic

$V_3=100\text{mV}_{\text{pp}}$ V_5 $V_{5\text{Def}-1.6V}$
 $V_3=350\text{mV}_{\text{pp}}$ V_5 max. 500 mV

AF mute

$V_{19} = 4.8 \text{ V}; V_{18} = 4.8 \text{ V}$ 0 dB
 $V_{19} = 0 \text{ V}; V_{18} = 4.8 \text{ V}$ - 2 dB ... + 2 dB
 $V_{19} = 0V; V_{18} = 2.4 \text{ V}$ 32 dB ... 44 dB
 $V_{19} = 4.8 \text{ V}; V_{18} \leq 1.0 \text{ V}$ min. 80 dB
 $V_{19} = 0 \text{ V}; V_{18} \leq 1.0V$ min. 80 dB

Mute off

V_{19} min. 0.5 V

Mute on

V_{19} max. 0.1 V

Search tuning stop window

f_{ST8} $R_{\text{Window}}=\text{tbf}$ max. $\pm 25 \text{ kHz}$

Search tuning stop threshold

V_{IST1} $V_{12}=\text{tbf}$ 150 μV_{rms}

Demoboard:

The demoboard shows the complete IF stage with the demodulator tank circuit and the multipath detector (optional).

The IF_{in} is matched with 50 Ohm to connect a signal generator with $R_i = 50$ Ohm.

The external demodulator tank circuit is designed as a 120 pF resonant circuit with a damping resistor of $R = 3.6$ kOhm.

Pin 17 delivers the MPX signal according to the IC specification, the adapted RC lowpass filter is matched for a deemphasis of 50 μ s.

To avoid a disturbing noise at weak input signals an adjustment of the mute depth is possible at pin 18 via a dc level. According to the signalstrength signal the mute threshold is adjustable at pin 19. Because of a multipath ac part on the fieldstrength signal a low pass filtering at pin 19 is necessary.

At pin 6 a fieldstrength characteristic adjustment is possible. With an additional resistor from pin 6 to ground the signalstrength characteristic can be shifted parallel, and with an additional resistor between pin 6 and pin 7 the steepness of the characteristic can be changed.

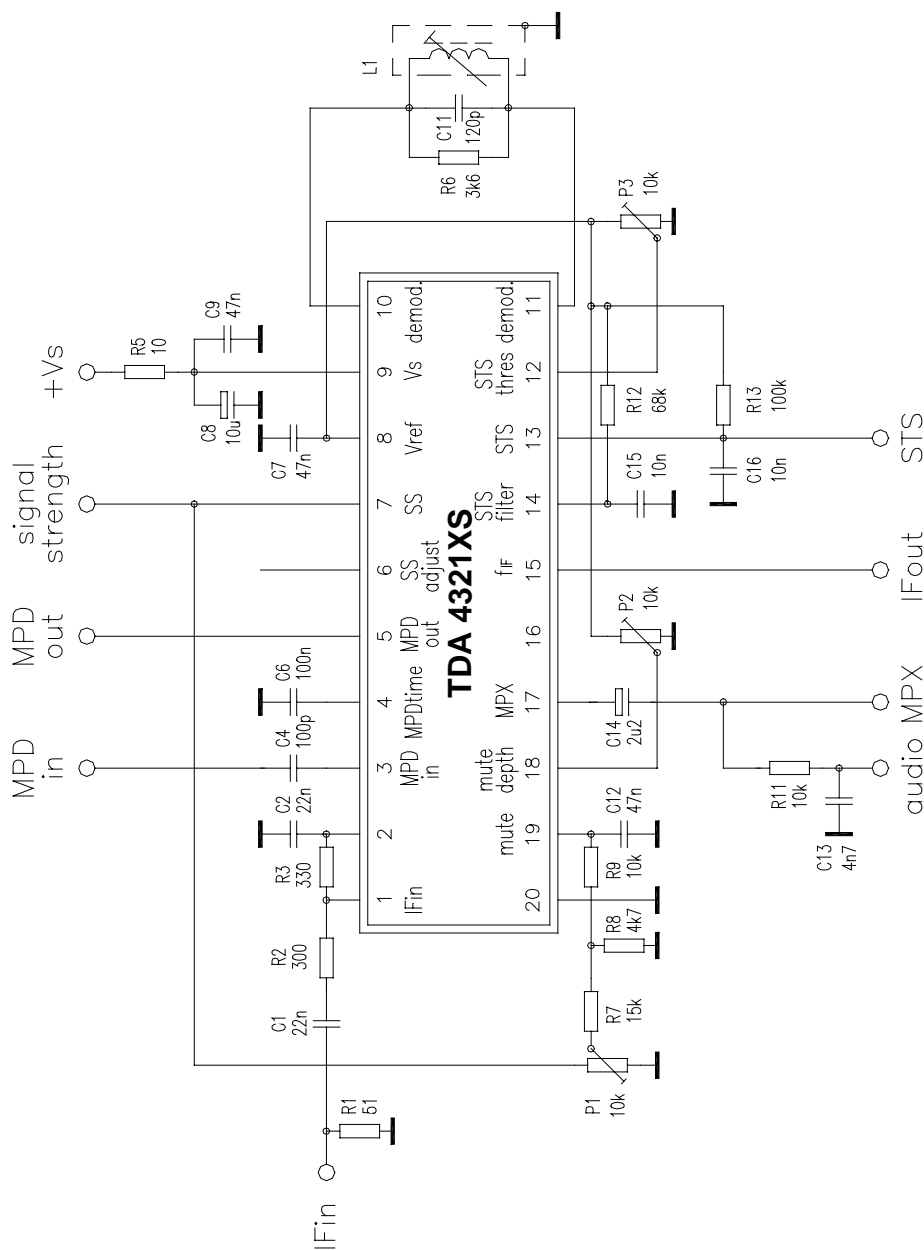
The multipath detector between the pins 3 and 5 is designed as a sensitive prestage, a very fast rectifier, and an analog output. A highpass or bandpass filtered signal from the fieldstrength (and/or MPX signal) signal activates the detector and controls the output transistor. This signal for example can be used to force the Stereodecoder into mono mode, to control the audio deemphasis characteristic, to give an information to the micro controller to select another input frequency, and so on.

Enclosure:

- figure 1 schematic diagram of the demoboard
- figure 2 partlist for the FM IF module
- figure 3 SO-SMD partside of the pcb
- figure 4 partside of the pcb
- figure 5 block circuitry of the IC

measurement diagrams

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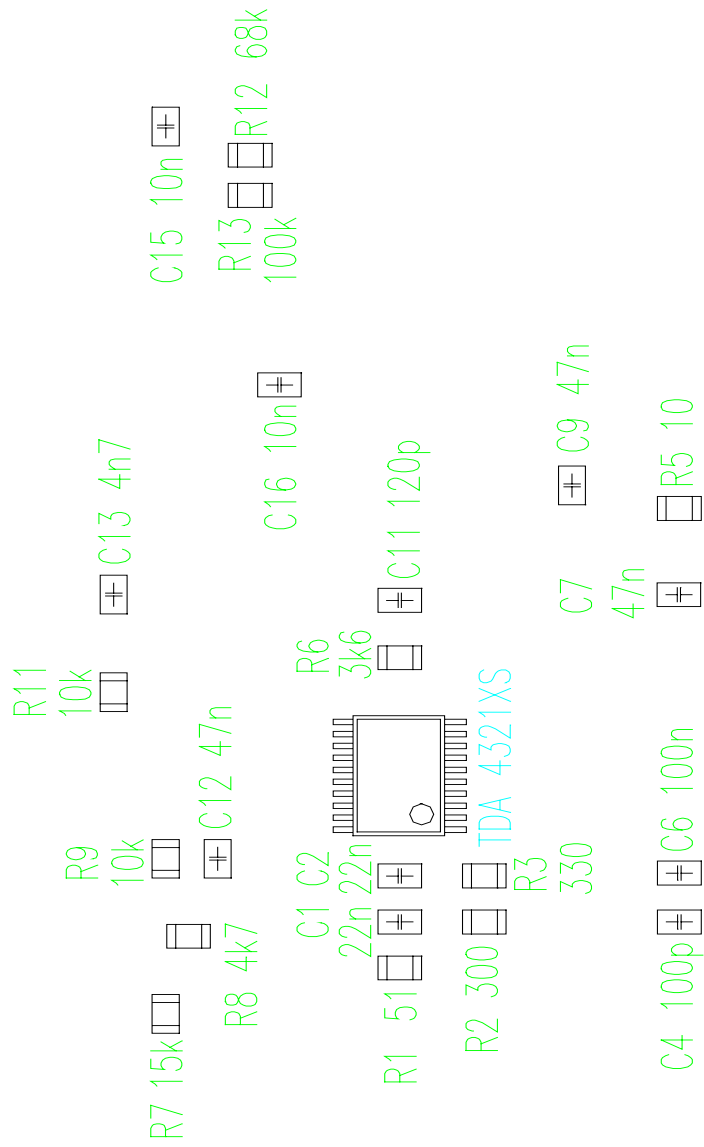
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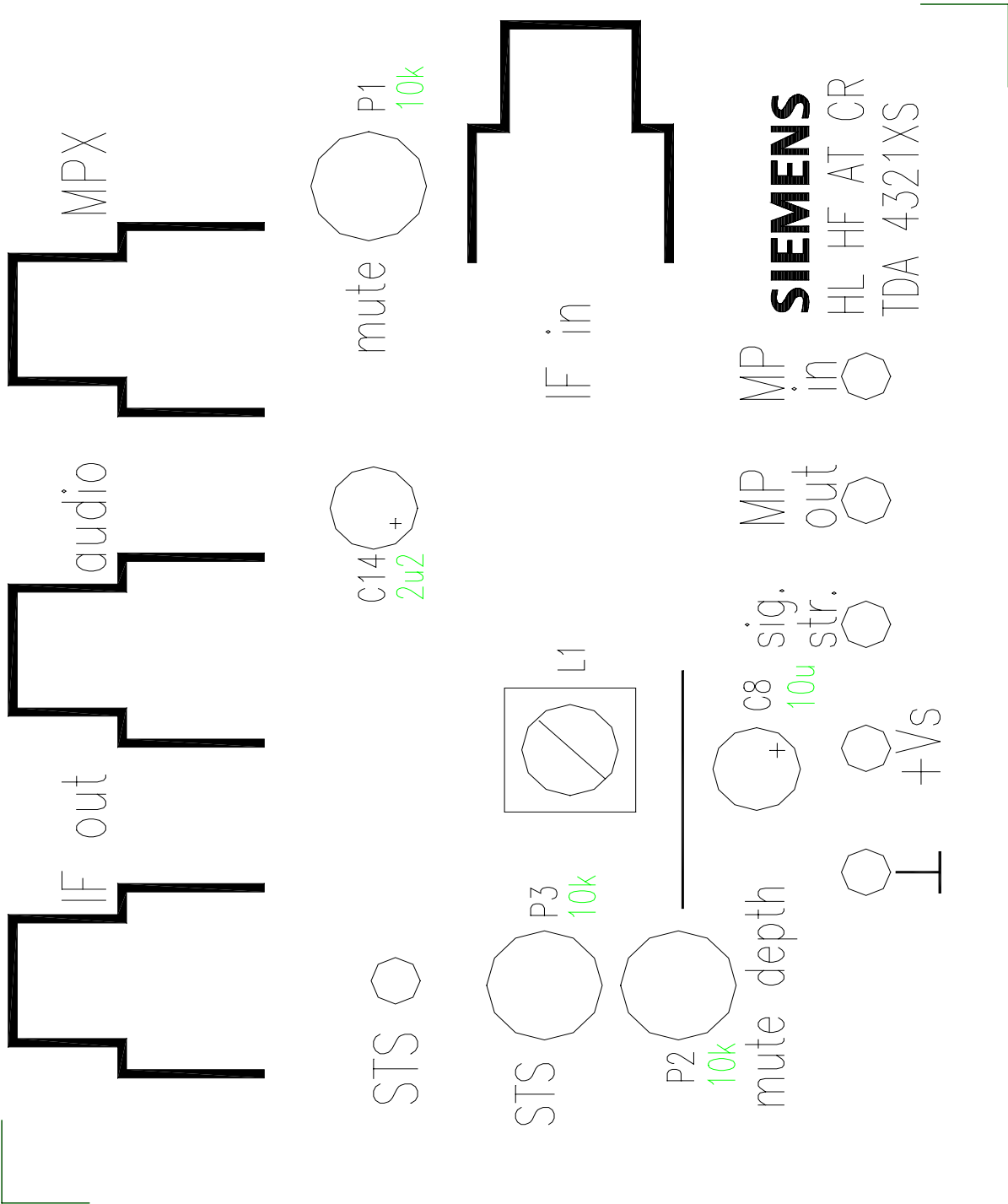
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partlist for the FM IF module

Integrated circuit	IC01	TDA 4321XS	Siemens
chip capacitor	C1	22n	Siemens
chip capacitor	C2	22n	Siemens
chip capacitor	C4	100p	Siemens
chip capacitor	C6	100n	Siemens
chip capacitor	C7	47n	Siemens
chip capacitor	C9	47n	Siemens
chip capacitor	C11	120p	Siemens
chip capacitor	C12	47n	Siemens
chip capacitor	C13	4n7	Siemens
chip capacitor	C15	10n	Siemens
chip capacitor	C16	10n	Siemens
chip resistor	R1	51	Siemens
chip resistor	R2	300	Siemens
chip resistor	R3	330	Siemens
chip resistor	R5	10	Siemens
chip resistor	R6	3k6	Siemens
chip resistor	R7	15k	Siemens
chip resistor	R8	4k7	Siemens
chip resistor	R9	10k	Siemens
chip resistor	R11	10k	Siemens
chip resistor	R12	68k	Siemens
chip resistor	R13	100k	Siemens
elco	C8	10u	
elco	C14	2u2	
variable resistor	P1	10k	
variable resistor	P2	10k	
variable resistor	P3	10k	
tank circuit	L2	1.5uH	Toko 600BNS-A1004HM

S0-SMD





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