DATA SHEET

TEA6822T
In Car Entertainment (ICE) car radio

Preliminary specification
File under Integrated Circuits, IC01

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Philips
Semiconductors

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In Car Entertainment (ICE) car radio TEA6822T

FEATURES

General

- FM mixer for conversion from FM-IF1 = 72.2 MHz to FM-IF2 = 10.7 MHz
- AM mixer for conversion from AM-IF1 = 10.7 MHz to AM-IF2 = 450 kHz
- FM-IF gain stage
- Crystal oscillator providing mixer frequencies and references for IF-count and stereo decoder
- FM quadrature demodulator with automatic centre frequency adjustment and THD compensation
- Level, multi-path and noise detectors
- Soft mute
- Stereo noise cancelling and variable de-emphasis
- PLL stereo decoder
- Noise blanker
- AM IF-amplifier and demodulator
- I^2C-bus transceiver with interface to enable direct data transfer to radio front-end
- IF-count for AM and FM
- Reference frequency generation for PLL synthesizer.

Stereo decoder

- Adjustment-free PLL-VCO
- Pilot depending mono/stereo switching
- Analog control of mono/stereo blend
- Adjacent channel noise suppression (114 kHz)
- Pilot cancelled
- Analog control of de-emphasis
- Integrated low-pass filters for 190 kHz adjacent channel interferences and signal delay for interference absorption circuit.

GENERAL DESCRIPTION

The TEA6822T together with the TEA6810T/TEA6811T forms an AM/FM electronic tuned car radio in a double conversion receiver concept.

ORDERING INFORMATION

TYPE NUMBER	PACKAGE		
	NAME	DESCRIPTION	VERSION
TEA6822T	VSO56	plastic very small outline package; 56 leads	SOT190-1

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{DDA1}	analog supply voltage 1 (+5 V; pin 5)	note 1	4.5	5.0	5.5	V
		operating range	4.75	5.0	5.25	V
I_{DDA1}	analog supply current 1 (pin 5)	FM mode	18	21	25	mA
		AM mode	14	17	21	mA
$I_{19} + I_{20}$	total FM mixer output current		4.8	6.0	7.2	mA
$I_{22} + I_{23}$	total AM mixer output current		10	12	14	mA
V_{DDA2}	analog supply voltage 2 (pin 28)	note 1	7	8.5	10	V
		operating range	8.1	8.5	8.9	V
I_{DDA2}	analog supply current 2 (pin 28)	FM mode	2.4	3.0	3.6	mA
V_{DDA3}	analog supply voltage 3 (+8.5 V; pin 56)	note 1	7	8.5	10	V
		operating range	8.1	8.5	8.9	V
I_{DDA3}	analog supply current 3 (pin 56)	FM mode	19	24	28	mA
		AM mode	9.5	12	15	mA
V_{DDD}	digital supply voltage 1 (+5 V; pin 5)	note 1	4.5	5.0	5.5	V
		operating range	4.75	5.0	5.25	V
I_{DDD}	digital supply current (pin 52)	note 1	8	10	12	mA
$\frac{S+N}{N}$	signal-plus-noise-to-noise ratio	ΔFM mode; f = 22.5 kHz at pins 43 and 47	66	75	–	dB
		AM mode; m = 0.3	54	60	–	dB
THD	total harmonic distortion	FM mode; Δf = 75 kHz	–	0.1	0.35	%
		AM mode	–	1.5	3	%
α_{cs}	channel separation (adjusted)		40	–	–	dB
T_{amb}	operating ambient temperature		–40	–	+85	°C

Note

1. IC is operating; specified parameters may deviate from limits which are valid for operating range.

BLOCK DIAGRAM

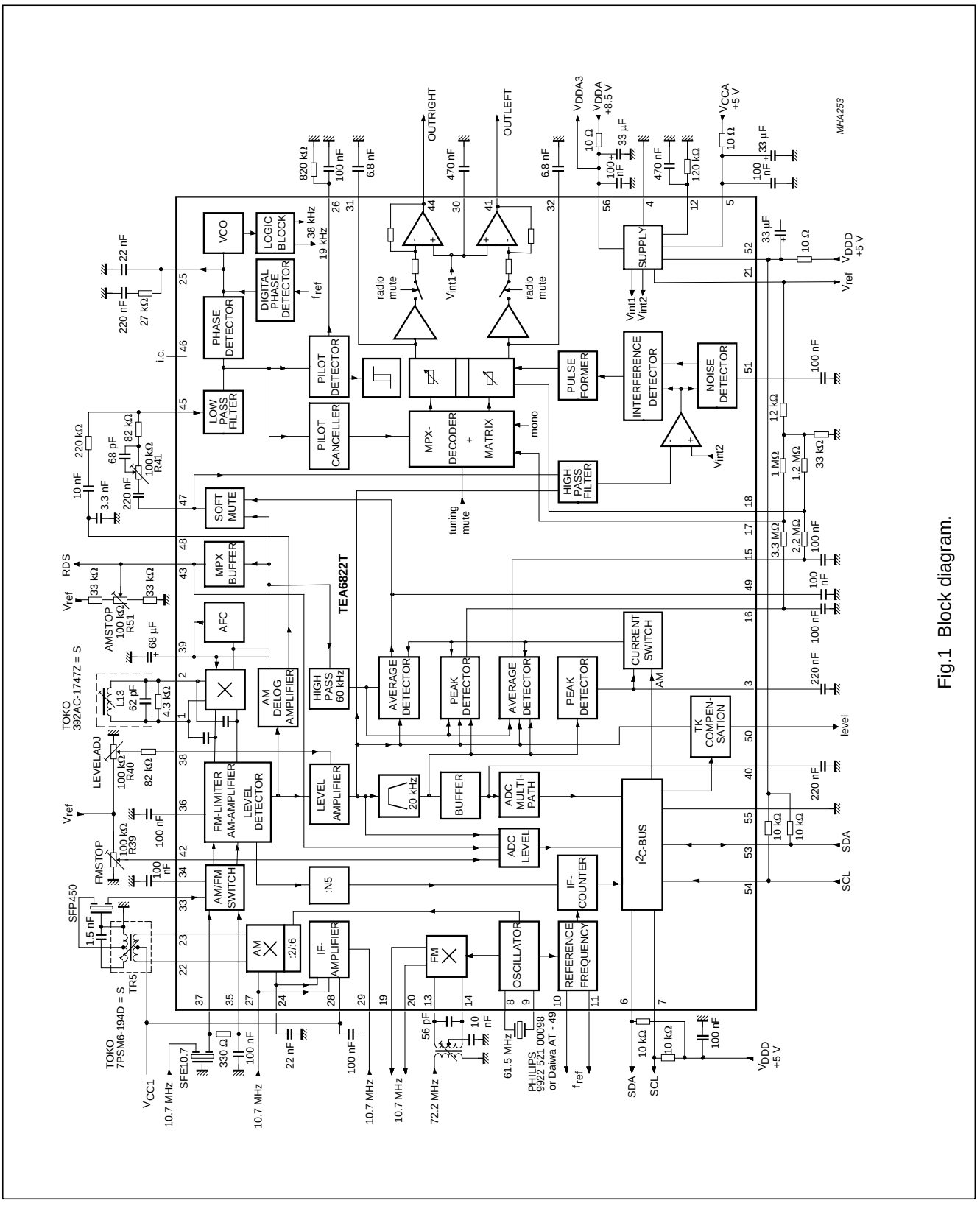

Fig.1 Block diagram.

PINNING

SYMBOL	PIN	DESCRIPTION
QDET1	1	demodulator tank 1
QDET2	2	demodulator tank 2
TSWITCH	3	time switch
AGND	4	analog ground
V_{DDA1}	5	analog supply voltage 1 (+5 V)
HFBUS1	6	HF bus 1; pull-up to 5 V
HFBUS2	7	HF bus 2; pull-up to 5 V
XTAL1	8	crystal oscillator 1
XTAL2	9	crystal oscillator 2
f_{ref1}	10	PLL reference output frequency 1
f_{ref2}	11	PLL reference output frequency 2
I_{ref}	12	reference current
FMIF1IN1	13	72 MHz FM-IF input 1
FMIF1IN2	14	72 MHz FM-IF input 2
TSDR	15	time constant for SDR
TSDS	16	time constant for SDS
V_{SDS}	17	SDS control voltage
V_{SDR}	18	SDR control voltage
FMIF2OUT1	19	FM mixer output 1
FMIF2OUT2	20	FM mixer output 2
V_{ref}	21	reference voltage
AMIF2OUT1	22	AM mixer output 1
AMIF2OUT2	23	AM mixer output 2
FMAMDEC	24	FM/AM 10.7 MHz decoupling
PHASEDET	25	phase detector
PILDET	26	pilot detector
FMAM10.7	27	FM/AM 10.7 MHz input
V_{DDA2}	28	analog supply voltage 2

SYMBOL	PIN	DESCRIPTION
FMIFAMPOUT	29	FM-IF amplifier output
AFGND	30	AF ground
DEEMPHR	31	de-emphasis capacitor right
DEEMPHL	32	de-emphasis capacitor left
AMIF2IN1	33	AM-IF2 input 1
AMIF2IN2	34	AM-IF2 input 2
FMIN2	35	FM limiter input
DCFEED	36	DC feed FM limiter
FMIN1	37	FM limiter input
LEVELADJ	38	level adjustment
C_{AFC}	39	AFC capacitor
MPBUF	40	multi-path buffer time constant
OUTLEFT	41	AF output left
FMSTOP	42	FMSTOP adjustment
RDS/AMSTOP	43	MPX for RDS/AMSTOP adjustment
OUTRIGHT	44	AF output right
MPXIN	45	stereo decoder MPX input
i.c.	46	internally connected
MPXOUT	47	FM demodulator MPX output
AMAFOUT	48	AM demodulator AF output
$V_{mute/AML}$	49	mute voltage/AM level
LEVELUNWEIG	50	level unweighted
IAC_{CONTR}	51	IAC control voltage
V_{DDD}	52	digital supply voltage
SDA	53	SDA; pull-up to 5 V
SCL	54	SCL; pull-up to 5 V
DGND	55	digital ground
V_{DDA3}	56	analog supply voltage 3 (8.5 V)

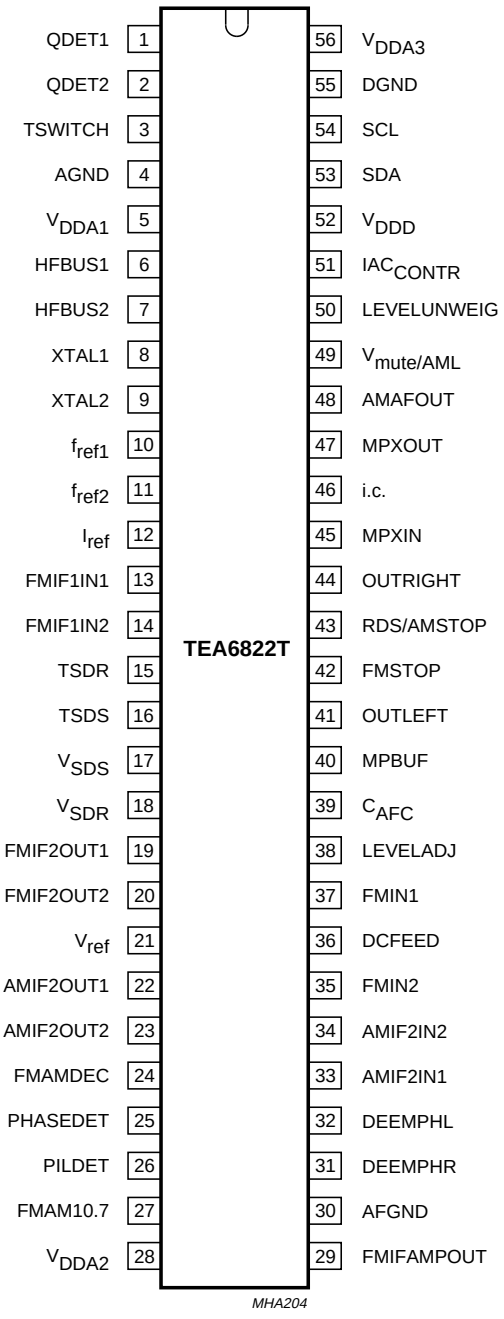

Fig.2 Pin configuration.

FUNCTIONAL DESCRIPTION

Stereo decoder

By changing the value of the input resistor at pin 12 the MPX input can be adapted to the level of the FM demodulator output (see Fig.15).

A 3rd order low-pass filter f_g = 90 kHz at the MPX input provides extra 190 kHz ACI suppression.

For AM the VCO is switched off. Interference gate at MPX demodulator outputs.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{DDA1}	analog supply voltage 1 (pin 5)		–0.3	+6.5	V
V_{DDA2}	analog supply voltage 2 (pin 28)		–0.3	+12	V
V_{DDA3}	analog supply voltage 3 (pin 56)		–0.3	+12	V
V_{DDD}	digital supply voltage (pin 52)		–0.3	+6.5	V
T_{stg}	storage temperature		–55	+150	°C
T_{amb}	operating ambient temperature		–40	+85	°C
V_{es}	electrostatic handling	note 1			
	pins 8 and 9		–100	+100	V
	all other pins		–300	+300	V

Note

1. Charge device model class B: equivalent to discharging a 200 pF capacitor via a 0 Ω series resistor.

CHARACTERISTICS

$V_{56-4} = V_{28-4} = 8.5$ V; $V_{5-4} = V_{52-55} = 5$ V; $T_{amb} = 25$ °C; $f_{mod} = 1$ kHz; deviation = 22.5 kHz; $R_g = 50$ Ω; $V_{37-35} = 10$ mV; with de-emphasis = 50 μs; coil quality = 15; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Current consumption						
I_{DDA1}	analog supply current 1 (pin 5)	FM mode	18	21	25	mA
		AM mode	14	17	21	mA
I_{DDA2}	analog supply current 2 (pin 28)	FM mode	2.4	3.0	3.6	mA
I_{DDA3}	analog supply current 3 (pin 56)	FM mode	19	24	28	mA
		AM mode	9.5	12	15	mA
I_{DDD}	digital supply current (pin 52)		8	10	12	mA
$I_{19} + I_{20}$	total FM mixer output current		4.8	6.0	7.2	mA
$I_{22} + I_{23}$	total AM mixer output current	AM mode	10	12	14	mA
FM-IF path (see Fig.3)						
$V_{19\text{-}20\ max(p\text{-}p)}$	maximum output voltage (peak-to-peak value)		12.0	14.0	–	V
I_{19}; I_{20}	mixer bias current		2.4	3.0	3.6	mA
	mixer leakage current	in AM position	–	–	2	μA
$I_{19F2}/V_{13\text{-}14IF1}$	conversion gain		1.65	1.9	2.2	mS
R_i	input resistance (pins 13 to 14)		5	7	–	kΩ
C_i	input capacitance (pins 13 to 14)		–	3	4.5	pF
R_{opt}	optimum generator resistance		–	1.2	–	kΩ
R_o	output resistance (pins 19 to 20)		15	20	–	kΩ
C_o	output capacitance (pins 19 to 4 and pins 20 to 4)		–	12	14	pF
IP3	third order intermodulation		114	124	–	dBμV

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Oscillator						
f_{osc}	oscillator frequency		–	61.5	–	MHz
Δf_{osc}	oscillator frequency spread		–	–	250	Hz
$\Delta f_{osc}/\Delta T$	temperature dependence of oscillator frequency	crystal type PHILIPS 9922 521 00098	–	30×10^{-6}	–	K
R_1	crystal motional resistance		–	–	70	Ω
C_0	crystal shunt capacitance		–	–	5	pF
FM-IF2 amplifier						
$V_{27\text{-}24\ max(rms)}$	maximum input voltage for 1 dB compression point (RMS value)		80	110	–	mV
$V_{29\text{-}4\ max(rms)}$	maximum output voltage (RMS value)		220	320	–	mV
$V_{29\text{-}4}/V_{27\text{-}24}$	amplifier gain	loaded with 330 Ω; see Fig.4	9	12	15	dB
$\Delta V_{29\text{-}4}/V_{27\text{-}24}$	gain temperature dependence		–	0.05	–	dB/K
R_i	input resistance pins 27 to 4		300	330	360	Ω
C_i	input capacitance pins 27 to 4		–	–	5	pF
R_o	output resistance pins 29 to 4		300	330	360	Ω
C_o	output capacitance pins 29 to 4		–	–	5	pF
FM-IF2 limiter						
$V_{o\ 1\text{-}2(p\text{-}p)}$	limiter output voltage (peak-to-peak value)		500	700	–	mV
$V_{1\text{-}2}/V_{37\text{-}35}$	limiter gain	see Fig.5	–	80	–	dB
C_i	input capacitance pins 37 to 4		–	–	5	pF
R_o	output resistance pins 1 to 2		–	–	1.0	kΩ
C_o	output capacitance pins 1 to 2		10	15	20	pF

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
FM demodulator						
$V_{47\text{-}4(rms)}$	MPX output voltage (RMS value)		160	200	240	mV
$V_{43\text{-}4(rms)}$	MPX output voltage for RDS (RMS value)		160	200	240	mV
$V_{37\text{-}35(rms)}$	start of limiting voltage (RMS value)	α_{AF} = –3 dB	–	25	40	µV
$V_{37\text{-}35(rms)}$	input voltage for signal-plus-noise-to-noise ratio (RMS value)	see Fig.6 for pin 47 (MPXOUT) and Fig.7 for pin 43 (RDS/AMSTOP);				
		$\frac{S+N}{N}$ = 26 dB	–	30	45	µV
		$\frac{S+N}{N}$ = 46 dB	–	70	100	µV
ΔV_{43DC}	residual DC-offset voltage	ΔL_{demod} = typical value;				
		10 µV < $V_{37\text{-}35}$ < 80 µV	–	100	1000	mV
		80 µV < $V_{37\text{-}35}$ < 800 mV	–	10	30	mV
V_{43FM}/V_{43AM}	suppression	Δf = 22.5 kHz; f_{modAM} = 1 kHz; m_{AM} = 30%; $V_{37\text{-}35}$ = 3 to 300 mV	50	60	–	dB
V_{47FM}/V_{47AM}	suppression	$V_{37\text{-}35}$ = 1 to 300 mV	50	60	–	dB
$\Delta V_{43\text{-}44AFCdis}$ /$\Delta V_{43\text{-}44AFCactive}$	demodulator frequency control voltage (AFC) efficiency at 100 kHz detune from exact tuning		28	32	–	dB
R_{o47}	output resistance		–	–	3	kΩ
R_{o43}	output resistance		–	–	1.5	kΩ
B_{o43}	AF bandwidth		200	–	–	kHz
$\frac{S+N}{N}$	signal-plus-noise-to-noise ratio		66	75	–	dB
THD	total harmonic distortion	detuning ≤50 kHz; Δf = 75 kHz; f_{mod} = 1 kHz without de-emphasis; L_{demod} = typical value;				
		pin 43; $V_{37\text{-}35}$ = 300 µV to 800 mV	–	0.1	0.35	%
		pin 47; $V_{37\text{-}35}$ = 1 to 800 mV	–	0.1	0.35	%

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Unweighted voltage level						
V_{50-4}	unweighted voltage level	see Fig.8; V_{38} = 2.52 V;				
		$V_{37-35} \leq 2.5$ μV	1.6	2.2	3.0	V
		V_{37-35} = 1.0 mV	2.7	3.4	4.7	V
$\Delta V_{50-4}/\Delta V_{37-35}$	slope of unweighted voltage level	$V_{37-35} \leq 100$ μV (RMS) < 300 mV				
		temperature compensation **off**	0.75	0.9	1.05	V/20 dB
		temperature compensation **on**	0.6	0.75	0.9	V/20 dB
$\Delta V_{50-4}/VK$	temperature dependence	V_{37-35} = 1 mV;				
		temperature compensation **off**	–	5.0	–	mV/VK
		temperature compensation **on**	–	2.0	–	mV/VK
$I_{50(max)source}$	maximum output source current		0.3	–	–	mA
$I_{50(max)sink}$	maximum output sink current		–50	–	–	μA
R_{o50}	output resistance		–	–	300	Ω
ADJUSTMENT OF UNWEIGHTED VOLTAGE LEVEL AND V_{mutaml}; note 1						
ΔV_{50}	adjusting range voltage	V_{37-35} = 10 mV (RMS)	–1.8	–	+1.8	V
V_{38-4}	internal bias voltage		–	2.6	–	V
V_{50-4}/V_{38-4}	adjusting gain		–	–0.9	–	–
R_{i38}	input resistance		–	80	–	kΩ
MUTING DEPENDENCE ON ADJUST OF LEVEL UNWEIGHTED VOLTAGE; note 2						
$\alpha = V_{43}/V_{47}$	start of mute	V_{49}/V_{21} = 0.625	1	3	7	dB
$\Delta\alpha/\Delta V_{49}$	mute slope	α = –6 dB	–	25	–	dB/V
Soft mute, time constant control, mono/stereo blend and high-cut control (see Fig.22)						
MUTE VOLTAGE; note 3						
V_{49-4}	mute voltage	V_{38} = 2.52 V;				
		V_{37-35} < 2.5 μV	1.8	2.2	3.2	V
		V_{37-35} = 1.0 mV	2.7	3.4	4.7	V
$\Delta V_{49-4}/\Delta V_{37-35}$	slope of mute voltage	$V_{37-35} \leq 100$ μV (RMS) < 300 mV	0.75	0.9	1.05	V/20 dB
$\Delta V_{49-4}/VK$	temperature dependence	V_{37-35} = 1 mV	–	5.0	–	mV/VK

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
ATTACK AND DECAY TIME FOR MUTE VOLTAGE						
I_{49}	charge current	pin 3 connected to GND	–	3.5	–	µA
	discharge current	pin 3 connected to GND	–	–4.0	–	µA
	charge current	pin 3 connected to pin 21	–	150	–	µA
	discharge current	pin 3 connected to pin 21	–	–170	–	µA
Δf	muting activated by 60 kHz FM interference	V_{49} < 3 V; $V_{37\text{-}35}$ = 3 mV; f_{mod} = 60 kHz;				
		pin 3 connected to GND; V_{43}/V_{47} = 9 dB	–	40	–	kHz
		pin 3 connected to pin 21; V_{43}/V_{47} = 6 dB	–	40	–	kHz
V_{43}/V_{47}	maximum mute depth by 60 kHz FM interference	pin 3 connected to GND	–	15	–	dB
		pin 3 connected to pin 21	–	10	–	dB
TIME CONSTANT FOR MONO/STEREO BLEND VOLTAGE; note 4						
I_{16}	charge current	$V_{37\text{-}35}$ = 3 mV; pin 3 connected to GND	–	0.6	–	µA
	discharge current	$V_{37\text{-}35}$ = 3 mV; pin 3 connected to GND	–	–18	–	µA
	charge current	$V_{37\text{-}35}$ = 3 mV; pin 3 connected to pin 21	–	26	–	µA
	discharge current	$V_{37\text{-}35}$ = 3 mV; pin 3 connected to pin 21	–	–800	–	µA
m	mono/stereo blend activated by 20 kHz AM interference	V_{16} < 2 V; $V_{37\text{-}35}$ = 3 mV; R_{L16} > 50 MΩ; f_{mod} = 20 kHz; data byte 2 bit 5 = 0				
		pin 3 connected to GND	–	45	–	%
		pin 3 connected to pin 21	–	45	–	%
		data byte 2 bit 5 = 1				
		pin 3 connected to GND	–	55	–	%
		pin 3 connected to pin 21	–	55	–	%
Δf	mono/stereo blend activated by 60 kHz FM interference	V_{16} < 2 V; $V_{37\text{-}35}$ = 3 mV; R_{L16} > 50 MΩ; f_{mod} = 60 kHz				
		pin 3 connected to GND	–	50	–	kHz
		pin 3 connected to pin 21	–	50	–	kHz

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
TIME CONSTANT FOR HIGH-CUT CONTROL VOLTAGE SDR; note 5						
I_{15}	charge current	V_{37-35} = 3 mV; pin 3 connected to GND	–	0.6	–	µA
	discharge current	V_{37-35} = 3 mV; pin 3 connected to GND	–	–0.7	–	µA
	charge current	V_{37-35} = 3 mV; pin 3 connected to pin 21	–	41	–	µA
	discharge current	V_{37-35} = 3 mV; pin 3 connected to pin 21	–	–44	–	µA
m	high-cut control activated by 20 kHz AM interference	V_{15} < 2 V; V_{37-35} = 3 mV; R_{L15} > 50 MΩ; f_{mod} = 20 kHz				
		pin 3 connected to GND	–	45	–	%
		pin 3 connected to pin 21	–	45	–	%
Δf	high-cut control activated by 60 kHz FM interference	V_{15} < 2 V; V_{37-35} = 3 mV; R_{L15} > 50 MΩ; f_{mod} = 60 kHz				
		pin 3 connected to GND	–	50	–	kHz
		pin 3 connected to pin 21	–	50	–	kHz
MULTI-PATH DETECTOR						
f_{MP}	multi-path detector band-pass centre frequency		–	20	–	kHz
B_{MP}	band-pass bandwidth		7.0	–	–	kHz
Reference voltage						
V_{21-4}	output voltage	I_{21} = –1 mA	4.5	5.1	5.7	V
ΔV_{21-4}	temperature dependence		–	3.3	–	mV/VK
I_{21}	output current		–	–	1	mA
AM-IF path; see Fig.13 and notes 6 and 7						
$V_{22-23\ max(p-p)}$	maximum output voltage (peak-to-peak value)		12	15	–	V
I_{22}, I_{23}	mixer bias current		5.0	6.0	7.0	mA
	mixer leakage current	in FM position	–	–	2	µA
$I_{22IF2}/V_{27-24IF1}$	conversion gain		2.2	2.7	3.4	mS
R_{27-24}	input resistance		300	330	360	Ω
C_{27-24}	input capacitance		–	5	8	pF
R_{22-23}	output resistance		10.0	20.0	–	kΩ
C_{22-23}	output capacitance		–	5	10	pF
IP3	third order intermodulation		–	137	–	dBµV

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
AM DETECTOR; see notes 8 and 9						
$V_{48\text{-}4(rms)}$	AF output level (RMS value)	$R_{L48} > 500\ k\Omega$; $330\ \mu V \leq V_{33\text{-}34} \leq 300\ mV$	190	240	290	mV
$V_{33\text{-}34(rms)}$	sensitivity voltage (RMS value)	$\frac{S+N}{N} = 26\ dB$	–	50	75	µV
		$\frac{S+N}{N} = 46\ dB$	–	200	400	µV
	AM-IF2 minimum input voltage (RMS value)	THD ≤ 5%; m = 0.8	–	–	100	µV
	AM-IF2 maximum input voltage (RMS value)	THD ≤ 5%; m = 0.8	800	–	–	mV
$R_{33\text{-}34(rms)}$	IF_2 input resistance		1.8	2.0	2.2	kΩ
$C_{24\text{-}23(rms)}$	IF_2 input capacitance		–	10	15	pF
R_{o48}	output resistance		27	33	39	kΩ
C_{o48}	output capacitance		–	–	10	pF
$\frac{S+N}{N}$	signal-plus-noise-to-noise ratio		54	60	–	dB
THD	total harmonic distortion	m = 0.8; $300\ \mu V \leq V_{33\text{-}34} \leq 200\ mV$	–	1.5	3.0	%

Notes to Characteristics

1. For typical adjusting range see Figs 9 and 12.
2. For typical curve see Fig.10.
3. The static mute voltage follows the unweighted voltage level as function of FM-IF2 voltage and level adjustment voltage $V_{38\text{-}4}$. It additionally depends on multi-path level, noise (adjacent channel interferences) and the position of TSWITCH (pin 3). For typical curve for mute voltage dependence see Fig.11.
4. The mono/stereo blend voltage is generated as a function of FM-IF2 voltage, multi-path level, noise and position of TSWITCH.
5. The high-cut control voltage is generated as a function of FM-IF2 voltage, multi-path level, noise and position of TSWITCH.
6. f_{IF1} = 10.7 MHz; f_{IF2} = 450 kHz for AM mixer.
7. The AM oscillator signal is generated by division of the 61.5 MHz crystal oscillator. Two divider ratios programmable by the I^2C-bus: division by 6 (AM-IF_1 = 10.7 MHz); division by 2 (AM-IF_1 = 30 MHz).
8. For typical AM level curve see Fig.14.
9. For AM detector; f_{AMIF2} = 450 kHz; f_{mod} = 400 Hz; m = 30%.

STEREO DECODER CHARACTERISTICS

Input signal (Δf = 75 kHz) $V_{MPX(p-p)}$ = 1.7 V; modulation frequency f_{mod} = 1 kHz; de-emphasis time constant t = 50 μs; nominal input resistor (pin 45) R_i = 168 kΩ; T_{amb} = +25 °C; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{44-4;}$ $V_{41-4(rms)}$	AF output voltage (RMS value)		800	900	1000	mV
V_{44-4}; V_{41-4}	DC output voltage		3.3	3.8	4.3	V
I_{44}; $I_{41(max)}$	maximum output current		150	–	–	μA
V_{44-4}/V_{41-4}	difference of output voltage		–1	–	+1	dB
R_{o44}; R_{o41}	output resistor		–	–	600	Ω
R_{Lmin}	minimum load resistor		12	–	–	kΩ
α_{cs}	channel separation (adjusted)		40	–	–	dB
$\frac{S+N}{N}$	signal-plus-noise-to-noise ratio	f = 20 Hz to 15 kHz	74	80	–	dB
THD	total harmonic distortion		–	0.1	0.3	%
	MPX input overdrive margin	THD = 1%	4	–	–	dB
Carrier and harmonic suppression at the output; note 1						
α_{19}	pilot signal	f = 19 kHz	–	50	–	dB
α_{38}	subcarrier	f = 38 kHz	–	50	–	dB
α_{57}		f = 57 kHz	–	50	–	dB
α_{76}		f = 76 kHz	–	60	–	dB
α_2	intermodulation	f_{mod} = 10 kHz; f_{spur} = 1 kHz	–	60	–	dB
α_3		f_{mod} = 13 kHz; f_{spur} = 1 kHz	–	58	–	dB
α_{57}	traffic radio (ARI)	f = 57 kHz	–	70	–	dB
α_{67}	subsidiary communications authorization	f = 67 kHz	70	–	–	dB
α_{114}	adjacent channel frequency	f = 114 kHz	–	80	–	dB
α_{190}		f = 190 kHz	–	70	–	dB
RR	ripple rejection at output	f_r = 100 Hz; V_r = 100 mV_{eff}	–	30	–	dB
Mono/stereo control						
$V_{i(pil)}$	pilot threshold voltage	stereo on	–	24	30	mV
		mono on	8	20	–	mV
$\Delta V_{i(pil)}$	switch hysteresis $V_{i\ on}/V_{i\ off}$		–	2	–	dB
External mono/stereo control; note 2						
$V_{17} - 0.765V_{21}$	control voltage channel separation	see Fig.16;				
		α = 6 dB	–	–110	–	mV
		α = 16 dB	–	–40	–	mV

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Muting functions (mute via I^2C-bus)						
ΔV_{44}, ΔV_{41}	DC offset voltage	tuned mute	–50	–	+50	mV
		radio mute (in combination with tuned mute)	–400	–	+400	mV
α_{mute}	tuned mute		60	–	–	dB
	radio mute (in combination with tuned mute)		80	–	–	dB
High-cut control (see Fig.17)						
$V_{18} - 0.765V_{21}$	control voltage	see note 3;				
		$t_{de\text{-}emph}$ = 50 µs	0	–	–	mV
		$t_{de\text{-}emph}$ = 80 µs	–	–300	–	mV
$t_{de\text{-}emph}$	control range of de-emphasis		50	–	80	µs
Voltage controlled oscillator; note 4						
f_{osc}	oscillator frequency range		225	228	231	kHz
Noise blanker						
INTERFERENCE DETECTION FULLY INTERNAL FROM LEVEL DETECTOR						
t_{sup}	interference suppression time		–	40	50	µs
TRIGGER THRESHOLD CONTROL						
$I_{51\ charge}$	charge current (into 4 V)		–	45	–	µA
$I_{51\ discharge}$	discharge current (from 8.5 V)		–	–900	–	µA
TRIGGER SENSITIVITY MEASUREMENT WITH PULSED MODULATION OF FM-IF2 (see Figs 18 and 19)						
$V_{37\text{-}35(p)}$	trigger sensitivity for test signal 1 (peak value)	V_{38} = 2.52 V; note 5	–	–	1.7	mV
		V_{38} = 2.52 V; note 6	5	–	–	mV
	trigger sensitivity for test signal 2 (peak value)	V_{38} = 2.52 V; note 6	5	–	–	mV
		V_{38} = 2.52 V; note 6	100	–	–	mV
V_{51}	trigger threshold variation with frequency modulation of FM-IF2 and f_{mod} = 15 kHz (pin 51)	$V_{37\text{-}35}$ = 100 mV; Δf = 0 kHz	–	6.4	–	V
ΔV_{51}		$V_{37\text{-}35}$ = 100 mV; Δf = 75 kHz	–	520	–	mV
I_{offset}	gate input offset current at pins 31 and 32 during suppression pulse duration		–	20	50	nA

Notes

1. The following equations give the values for the carrier and harmonic suppression at the output:

$$\alpha_2 = \frac{V_0\,(\text{signal})\,(\text{at 1 kHz})}{V_0\,(\text{spurious})\,(\text{at 1 kHz})}\ f_s = (2 \times 10\ \text{kHz}) - 19\ \text{kHz}$$

$$\alpha_3 = \frac{V_0\,(\text{signal})\,(\text{at 1 kHz})}{V_0\,(\text{spurious})\,(\text{at 1 kHz})}\ f_s = (3 \times 13\ \text{kHz}) - 38\ \text{kHz}$$

$$\alpha_{57}\ (\text{ARI}) = \frac{V_0\,(\text{signal})\,(\text{at 1 kHz})}{V_0\,(\text{spurious})\ (\text{at 1 KHz} \pm 23\ \text{Hz})}$$

$$\alpha_{67} = \frac{V_0\,(\text{signal})\,(\text{at 1 kHz})}{V_0\,(\text{spurious})\,(\text{at 9 kHz})}\ f_s = (2 \times -38\ \text{kHz}) - 67\ \text{kHz}$$

$$\alpha_{114} = \frac{V_0\,(\text{signal})\,(\text{at 1 kHz})}{V_0\,(\text{spurious})\,(\text{at 4 kHz})}\ f_s = 110\ \text{kHz} - (3 \times 38\ \text{kHz})$$

$$\alpha_{190} = \frac{V_0\,(\text{signal})\,(\text{at 1 kHz})}{V_0\,(\text{spurious})\,(\text{at 4 kHz})}\ f_s = 186\ \text{kHz} - (5 \times 38\ \text{kHz})$$

2. The stereo decoder can be set to mono via the I^2C-bus. Pilot presence indication via the I^2C-bus.
3. The nominal de-emphasis value can be changed to 75 µs with C_{31}; C_{32} = 10 nF.
4. The VCO is adjusted by means of a digital auxiliary PLL.
5. Noise blanker does not trigger.
6. Noise blanker triggers.

CHARACTERISTICS FOR ANALOG-TO-DIGITAL CONVERTORS (ADCs) FOR LEVEL AND MULTI-PATH VOLTAGES

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
ADC for FM level information; note 1						
ΔV_{37-35}	analog-to-digital conversion step size		2	4	8	dB/step
ΔV_{37-35}	analog-to-digital conversion level range		43	56	69	dB
FM STOP						
ΔV_{stop}	variation of stop level as function of V_{42-4}		–	16	–	dB/V
ADC for AM level information; note 2						
ΔV_{34-35}	analog-to-digital conversion step size		2	4	8	dB/step
ΔV_{34-35}	analog-to-digital conversion level range		43	56	69	dB
AM STOP						
ΔV_{stop}	variation of stop level as function of V_{43-4}		–	16	–	dB/V
A/D converter for multi-path information; note 3						
m	multi-path conversion	step 0	–	–	5	%
		step 1	–	15	–	%
		step 2	–	22	–	%
		step 3	–	28	–	%
		step 4	–	34	–	%
		step 5	–	40	–	%
		step 6	–	46	–	%
		step 7	–	52	–	%

Notes

1. The FM level information V_{50-3} is analog-to-digital converted with 4 bits.
2. The AM level information V_{49-4} is analog-to-digital converted with 4 bits.
3. The multi-path information V_{40-4} is analog-to-digital converted with 3 bits covering an IF2 amplitude modulation range $0.15 \leq m \leq 0.6$; f_{mod} = 20 kHz.

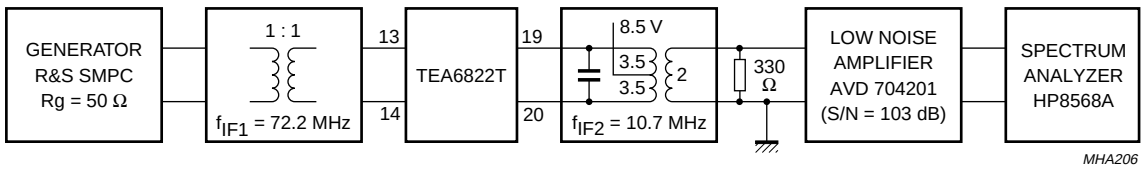

Fig.3 Test circuit FM mixer.

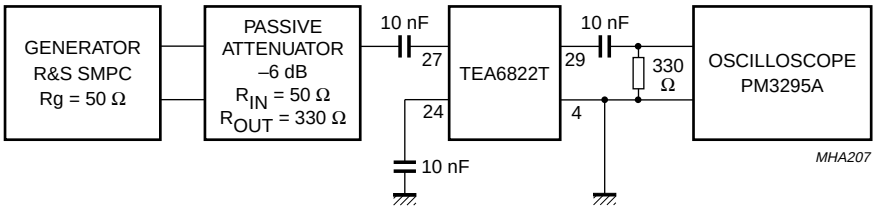

Fig.4 Test circuit IF-amplifier.

Fig.5 Test circuit limiter gain.