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DATA SHEET



TEA6823T; TEA6825T In Car Entertainment (ICE) car radio

Preliminary specification
File under Integrated Circuits, IC01

1998 Mar 24

In Car Entertainment (ICE) car radio**TEA6823T; TEA6825T****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
- I²C-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 TEA6823T together with the TEA6811T and the TEA6825T together with the TEA6810T form an AM/FM electronic tuned car radio in a double conversion receiver concept.

ORDERING INFORMATION

TYPE NUMBER	PACKAGE		
	NAME	DESCRIPTION	VERSION
TEA6823T	VSO56	plastic very small outline package; 56 leads	SOT190-1
TEA6825T	VSO56	plastic very small outline package; 56 leads; face down	SOT190-2

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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	17	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	7.0	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	7.0	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 52)	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	FM mode; $\Delta f = 22.5$ kHz at pins 43 and 47	66	75	–	dB
		AM mode; m = 0.3	54	60	–	dB
THD	total harmonic distortion	FM mode; $\Delta f = 75$ 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.

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BLOCK DIAGRAM

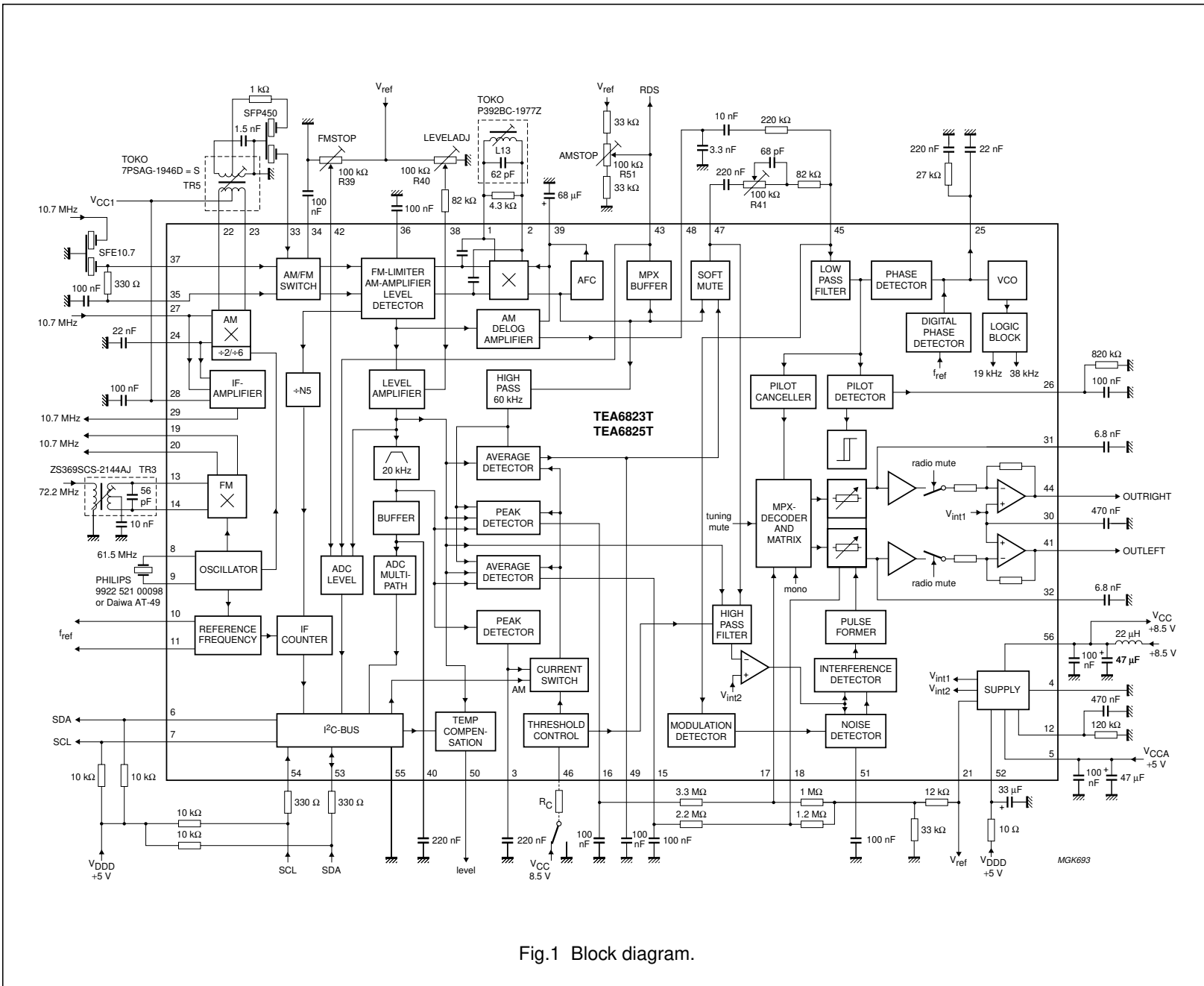


Fig.1 Block diagram.

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PINNING

SYMBOL	PIN	DESCRIPTION
QDET1	1	demodulator tank 1
QDET2	2	demodulator tank 2
TSWITCH	3	time switch input
AGND	4	analog ground
V _{DDA1}	5	analog supply voltage 1 (+5 V)
HFBUS1	6	HF bus 1 output; pull-up to +5 V
HFBUS2	7	HF bus 2 output; pull-up to +5 V
XTAL1	8	crystal oscillator 1
XTAL2	9	crystal oscillator 2
f _{ref(p)}	10	PLL reference frequency output (p)
f _{ref(n)}	11	PLL reference frequency output (n)
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 input
V _{SDR}	18	SDR control voltage input
FMIF2OUT1	19	FM mixer output 1
FMIF2OUT2	20	FM mixer output 2
V _{ref}	21	reference voltage output
AMIF2OUT1	22	AM mixer output 1
AMIF2OUT2	23	AM mixer output 2
FMAMDEC	24	FM/AM 10.7 MHz decoupling
PHASEDET	25	phase detector output
PILDET	26	pilot detector output
FMAM10.7	27	FM/AM 10.7 MHz input
V _{DDA2}	28	analog supply voltage 2

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

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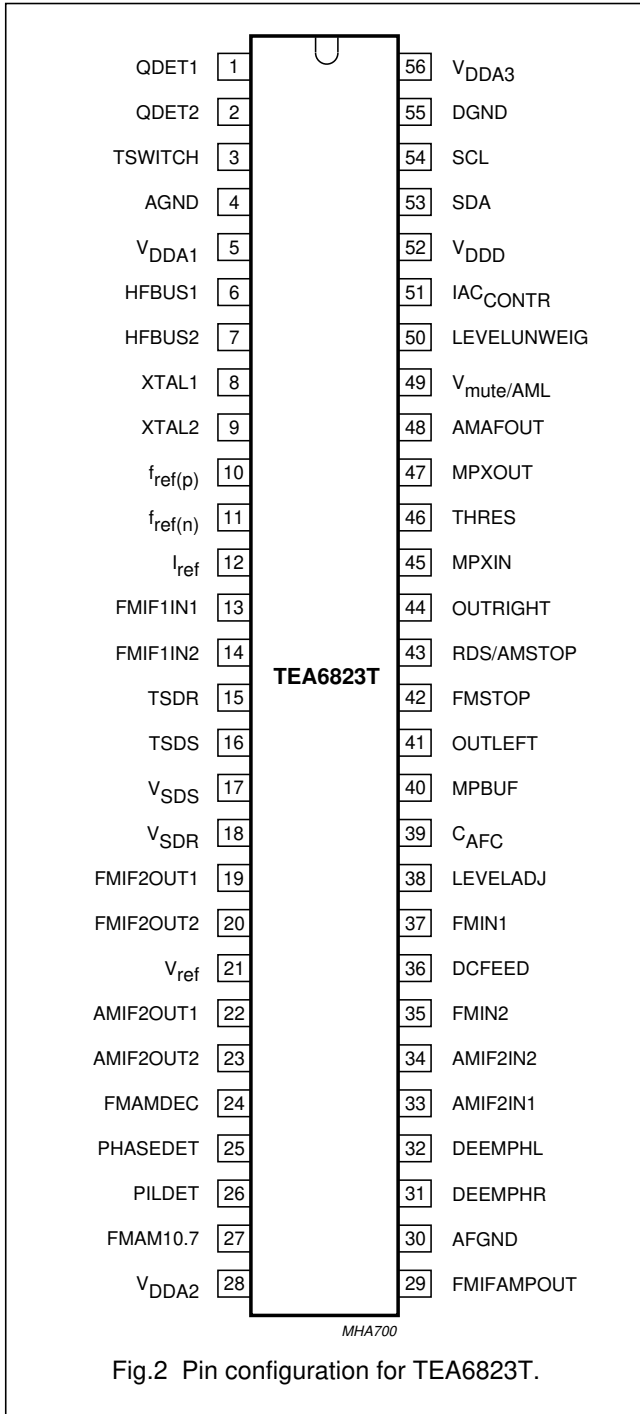


Fig.2 Pin configuration for TEA6823T.

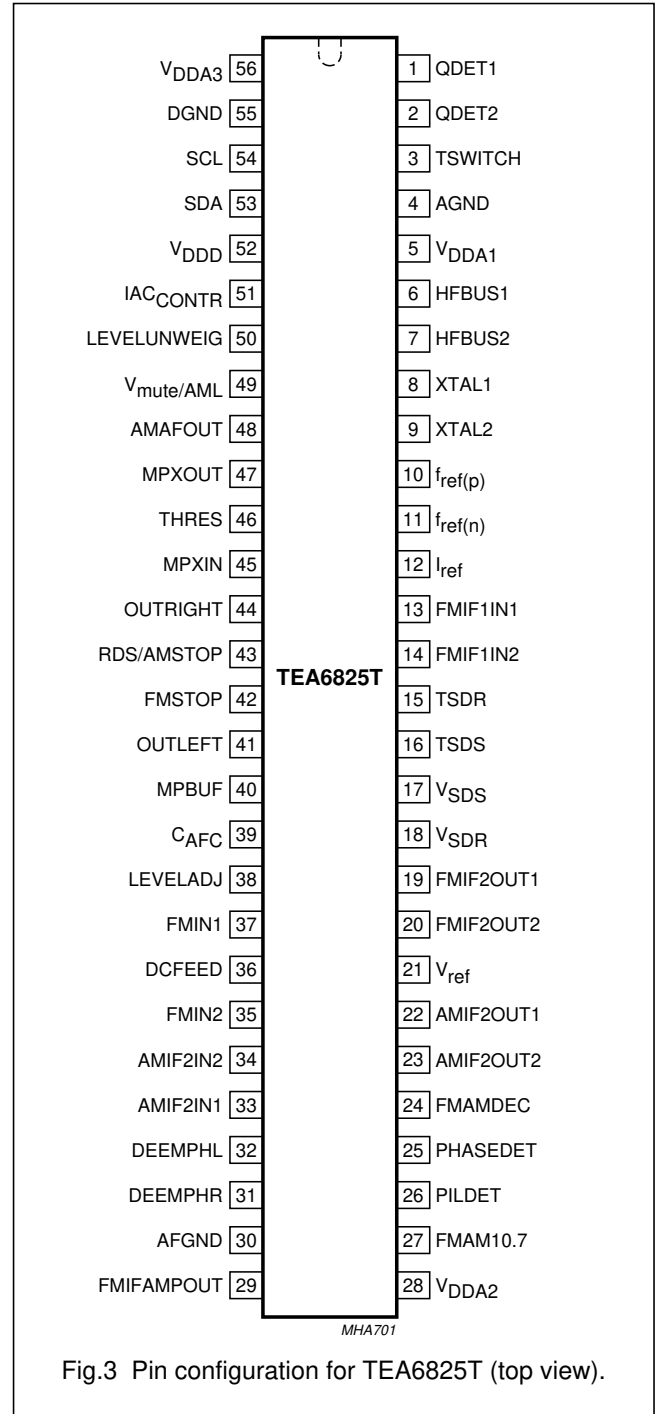


Fig.3 Pin configuration for TEA6825T (top view).

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.16).

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

An interference gate is connected at the MPX demodulator outputs. For AM the VCO is switched off.

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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

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

CHARACTERISTICS

V₅₆₋₄ = V₂₈₋₄ = 8.5 V; V₅₋₄ = V₅₂₋₅₅ = 5 V; T_{amb} = 25 °C; f_{mod} = 1 kHz; deviation = 22.5 kHz; R_g = 50 Ω; V₃₇₋₃₅ = 10 mV; with de-emphasis = 50 μs; coil quality = 15; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Currents						
I _{DDA1}	analog supply current 1 (pin 5)	FM mode	17	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.4						
V _{19-20 max(p-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 _{19IF2} /V _{13-14IF1}	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

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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 ⁻¹
R_1	crystal motional resistance		–	–	70	Ω
C_0	crystal shunt capacitance		–	–	5	pF
FM-IF₂ amplifier						
$V_{27-24 \max(rms)}$	maximum input voltage for 1 dB compression point (RMS value)		80	110	–	mV
$V_{29-4 \max(rms)}$	maximum output voltage (RMS value)		220	320	–	mV
V_{29-4}/V_{27-24}	amplifier gain	$R_L = 330 \Omega$; see Fig.5	9	12	15	dB
$\Delta V_{29-4}/V_{27-24}$	gain temperature dependence	$-25 \text{ }^\circ\text{C} < T_{amb} < +85 \text{ }^\circ\text{C}$	–	0.1	–	dB/K
R_i	input resistance (pins 27 to 24)		300	330	360	Ω
C_i	input capacitance (pins 27 to 4)		–	–	5	pF
R_o	output resistance (pin 29)		300	330	360	Ω
C_o	output capacitance (pins 29 to 4)		–	–	5	pF
FM-IF₂ limiter						
$V_{o \ 1-2(p-p)}$	limiter output voltage (peak-to-peak value)		500	700	–	mV
V_{1-2}/V_{37-35}	limiter gain	see Fig.6	–	80	–	dB
C_i	input capacitance (pins 37 to 4)		–	–	5	pF
R_o	output resistance (pins 1 to 2)		–	–	1.0	k Ω
C_o	output capacitance (pins 1 to 2)		10	15	20	pF

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SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
FM demodulator						
$V_{47-4(rms)}$	MPX output voltage (RMS value)		160	200	240	mV
$V_{43-4(rms)}$	MPX output voltage for RDS (RMS value)		160	200	240	mV
$V_{37-35(rms)}$	start of limiting voltage (RMS value)	$\alpha_{AF} = -3$ dB	–	25	40	μ V
$V_{37-35(rms)}$	input voltage for signal plus noise-to-noise ratio (RMS value)	see Fig.7 for pin 47 (MPXOUT) and Fig.8 for pin 43 (RDS/AMSTOP) $\frac{S+N}{N} = 26$ dB $\frac{S+N}{N} = 46$ dB	–	30	45	μ V
ΔV_{43DC}	residual DC-offset voltage	$\Delta L_{demod} = \text{typical value}$	–	100	1000	mV
		$10 \mu\text{V} < V_{37-35} < 80 \mu\text{V}$ $80 \mu\text{V} < V_{37-35} < 800 \text{mV}$	–	10	30	mV
V_{43FM}/V_{43AM}	AM suppression	$\Delta f = 22.5$ kHz; $f_{modAM} = 1$ kHz; $m_{AM} = 30\%$; $V_{37-35} = 3$ to 300 mV	50	60	–	dB
V_{47FM}/V_{47AM}	AM suppression	$V_{37-35} = 1$ to 300 mV	50	60	–	dB
$\Delta V_{43-44AFCdis} / \Delta V_{43-44AFCactive}$	demodulator frequency control voltage (AFC) efficiency	at 100 kHz detune from exact tuning	28	32	–	dB
R_o	output resistance (pin 47)		–	–	3	k Ω
	output resistance (pin 43)		–	–	1.5	k Ω
	AF bandwidth (pin 43)		200	–	–	kHz
$\frac{S+N}{N}$	signal plus noise-to-noise ratio		66	75	–	dB
THD	total harmonic distortion	detuning ≤ 50 kHz; $\Delta f = 75$ kHz; $f_{mod} = 1$ kHz without de-emphasis; $L_{demod} = \text{typical value}$ pin 43; $V_{37-35} = 300 \mu\text{V}$ to 800 mV	–	0.1	0.35	%
		pin 47; $V_{37-35} = 1$ to 800 mV	–	0.1	0.35	%

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SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Unweighted voltage level						
V_{50-4}	unweighted voltage level	see Fig.9; $V_{38} = 2.52 \text{ V}$ $V_{37-35} \leq 2.5 \mu\text{V}$ $V_{37-35} = 1.0 \text{ mV}$	1.6 2.7	2.2 3.4	3.0 4.7	V V
$\Delta V_{50-4}/\Delta V_{37-35}$	slope of unweighted voltage level	$100 \mu\text{V (RMS)} \leq V_{37-35} < 300 \text{ mV}$ temperature compensation off temperature compensation on	0.75 0.6	0.9 0.75	1.05 0.9	V/20 dB V/20 dB
$\Delta V_{50-4}/\text{VK}$	temperature dependence	$V_{37-35} = 1 \text{ mV}$ temperature compensation off temperature compensation on	– –	5.0 2.0	– –	mV/VK mV/VK
$I_{50(\text{max})\text{source}}$	maximum output source current		0.3	–	–	mA
$I_{50(\text{max})\text{sink}}$	maximum output sink current		–50	–	–	μA
R_{o50}	output resistance		–	–	300	Ω
ADJUSTMENT OF UNWEIGHTED VOLTAGE LEVEL AND $V_{\text{mute/AML}}$; note 1						
ΔV_{50}	adjusting range voltage	$V_{37-35} = 10 \text{ mV (RMS)}$	–1.8	–	+1.8	V
V_{38-4}	internal bias voltage		–	2.6	–	V
$\Delta V_{50-4}/\Delta V_{38-4}$	adjusting gain		–	–0.9	–	–
R_{i38}	input resistance		–	80	–	k Ω
MUTING DEPENDENCE ON ADJUST OF LEVEL UNWEIGHTED VOLTAGE; note 2						
V_{43}/V_{47}	start of mute	$V_{49}/V_{21} = 0.625$	1	3	7	dB
$\frac{\Delta V_{43}/V_{47}}{\Delta V_{49}}$	mute slope	$V_{43}/V_{47} = -6 \text{ dB}$	–	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	$V_{38} = 2.52 \text{ V}$ $V_{37-35} < 2.5 \mu\text{V}$ $V_{37-35} = 1.0 \text{ mV}$	1.8 2.7	2.2 3.4	3.2 4.7	V V
$\Delta V_{49-4}/\Delta V_{37-35}$	slope of mute voltage	$100 \mu\text{V (RMS)} \leq V_{37-35} < 300 \text{ mV}$	0.75	0.9	1.05	V/20 dB
$\Delta V_{49-4}/\text{VK}$	temperature dependency	$V_{37-35} = 1 \text{ mV}$	–	5.0	–	mV/VK

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SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
ATTACK AND DECAY TIME FOR MUTE VOLTAGE						
I_{ch}	charge current	pin 3 connected to GND	–	3.5	–	μA
		pin 3 connected to pin 5	–	150	–	μA
I_{dch}	discharge current	pin 3 connected to GND	–	–4.0	–	μA
		pin 3 connected to pin 5	–	–170	–	μA
Δf	muting activated by 60 kHz FM interference	$V_{49} < 3 \text{ V}$; $V_{37-35} = 3 \text{ mV}$; $f_{mod} = 60 \text{ kHz}$ pin 3 connected to GND; $V_{43}/V_{47} = 9 \text{ dB}$	–	40	–	kHz
		pin 3 connected to pin 5; $V_{43}/V_{47} = 6 \text{ dB}$	–	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 5	–	10	–	dB
TIME CONSTANT FOR MONO/STEREO BLEND VOLTAGE; note 4						
I_{ch}	charge current	$V_{37-35} = 3 \text{ mV}$; pin 3 connected to GND	–	0.6	–	μA
		$V_{37-35} = 3 \text{ mV}$; pin 3 connected to pin 5	–	23	–	μA
I_{dch}	discharge current	$V_{37-35} = 3 \text{ mV}$; pin 3 connected to GND	–	–17	–	μA
		$V_{37-35} = 3 \text{ mV}$; pin 3 connected to pin 5	–	–750	–	μA
m	mono/stereo blend activated by 20 kHz AM interference	$V_{16} < 2 \text{ V}$; $V_{37-35} = 3 \text{ mV}$; $R_{L16} > 50 \text{ M}\Omega$; $f_{mod} = 20 \text{ kHz}$; data byte 2 bit 5 = 0 pin 3 connected to GND	–	45	–	%
		pin 3 connected to pin 5	–	45	–	%
		data byte 2 bit 5 = 1 pin 3 connected to GND	–	55	–	%
		pin 3 connected to pin 5	–	55	–	%
Δf	mono/stereo blend activated by 60 kHz FM interference	$V_{16} < 2 \text{ V}$; $V_{37-35} = 3 \text{ mV}$; $R_{L16} > 50 \text{ M}\Omega$; $f_{mod} = 60 \text{ kHz}$ pin 3 connected to GND	–	50	–	kHz
		pin 3 connected to pin 5	–	50	–	kHz

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SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
TIME CONSTANT FOR HIGH-CUT CONTROL VOLTAGE SDR; note 5						
I_{ch}	charge current	$V_{37-35} = 3 \text{ mV}$; pin 3 connected to GND	–	0.6	–	μA
		$V_{37-35} = 3 \text{ mV}$; pin 3 connected to pin 5	–	41	–	μA
I_{dch}	discharge current	$V_{37-35} = 3 \text{ mV}$; pin 3 connected to GND	–	–0.7	–	μA
		$V_{37-35} = 3 \text{ mV}$; pin 3 connected to pin 5	–	–44	–	μA
m	high-cut control activated by 20 kHz AM interference	$V_{15} < 2 \text{ V}$; $V_{37-35} = 3 \text{ mV}$; $R_{L15} > 50 \text{ M}\Omega$; $f_{mod} = 20 \text{ kHz}$ pin 3 connected to GND	–	45	–	%
		pin 3 connected to pin 5	–	45	–	%
Δf	high-cut control activated by 60 kHz FM interference	$V_{15} < 2 \text{ V}$; $V_{37-35} = 3 \text{ mV}$; $R_{L15} > 50 \text{ M}\Omega$; $f_{mod} = 60 \text{ kHz}$ pin 3 connected to GND	–	50	–	kHz
		pin 3 connected to pin 5	–	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	$I_{21} = -1 \text{ mA}$	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. 14 and notes 6 and 7						
$V_{22-23 \text{ max(p-p)}}$	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 transconductance		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	–	k Ω
C_{22-23}	output capacitance		–	5	10	pF
IP3	third order intermodulation		–	137	–	dB μV

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SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
AM DETECTOR; notes 8 and 9						
$V_{48-4(rms)}$	AF output level (RMS value)	$R_{L48} > 500 \text{ k}\Omega$; $100 \mu\text{V} \leq V_{33-34} \leq 300 \text{ mV}$	190	240	290	mV
$V_{33-34(rms)}$	sensitivity voltage (RMS value)	$\frac{S+N}{N} = 26 \text{ dB}$	–	50	75	μV
		$\frac{S+N}{N} = 46 \text{ dB}$	–	200	400	μV
	AM-IF ₂ minimum input voltage (RMS value)	THD $\leq 5\%$; m = 0.8	–	–	100	μV
	AM-IF ₂ maximum input voltage (RMS value)	THD $\leq 5\%$; m = 0.8	800	–	–	mV
R_{33-34}	IF ₂ input resistance		1.8	2.0	2.2	k Ω
C_{24-23}	IF ₂ input capacitance		–	10	15	pF
R_{048}	output resistance		27	33	39	k Ω
C_{048}	output capacitance		–	–	10	pF
$\frac{S+N}{N}$	signal plus noise-to-noise ratio		54	60	–	dB
THD	total harmonic distortion	m = 0.8; $300 \mu\text{V} \leq V_{33-34} \leq 200 \text{ mV}$	–	1.5	3.0	%

Notes to the characteristics

- For typical adjusting range see Figs 10 and 13.
- For typical curve see Fig.11.
- The static mute voltage follows the unweighted voltage level as function of FM-IF₂ voltage and level adjustment voltage V_{38-4} . 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.12.
- The mono/stereo blend voltage is generated as a function of FM-IF₂ voltage, multi-path level, noise and position of TSWITCH.
- The high-cut control voltage is generated as a function of FM-IF₂ voltage, multi-path level, noise and position of TSWITCH.
- $f_{IF1} = 10.7 \text{ MHz}$; $f_{IF2} = 450 \text{ kHz}$ for AM mixer.
- The AM oscillator signal is generated by division of the 61.5 MHz crystal oscillator. Two divider ratios programmable by the I²C-bus: divide by 6 (AM-IF₁ = 10.7 MHz); divide by 2 (AM-IF₁ = 30 MHz).
- For typical AM level curve see Fig.15.
- For AM detector; $f_{AMIF2} = 450 \text{ kHz}$; $f_{mod} = 400 \text{ Hz}$; m = 30%.

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STEREO DECODER CHARACTERISTICS

Input signal ($\Delta f = 75$ kHz) $V_{MPX(p-p)} = 1.7$ V; $f_{mod} = 1$ kHz; de-emphasis time constant $t = 50$ μ s; nominal input resistor (pin 45) $R_i = 168$ k Ω ; $T_{amb} = 25$ °C; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{44-4(rms)}$; $V_{41-4(rms)}$	AF output voltage (RMS value)		800	900	1 000	mV
V_{44-4} ; V_{41-4}	DC output voltage		3.1	3.6	4.1	V
$I_{44(max)}$; $I_{41(max)}$	maximum output current		150	–	–	μ A
V_{44-4}/V_{41-4}	difference of output voltage		–1	–	+1	dB
$R_{o(44)}$; $R_{o(41)}$	output resistance		–	–	600	Ω
R_{Lmin}	minimum load resistor		12	–	–	k Ω
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	–
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						
$V_{17} - 0.75V_{21}$	control voltage channel separation	see Fig.17 $V_{43}/V_{47} = 6$ dB $V_{43}/V_{47} = 16$ dB	–	–110	–	mV
			–	–40	–	mV

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SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Muting functions (mute via I²C-bus)						
$\Delta V_{44}, \Delta V_{41}$	DC offset voltage	tune mute	-50	-	+50	mV
		radio mute (in combination with tune mute)	-400	-	+400	mV
α_{mute}	tune mute		60	-	-	dB
	radio mute (in combination with tune mute)		80	-	-	dB
High-cut control; see Fig.18						
$V_{18} - 0.75V_{21}$	control voltage	note 3				
		$t_{\text{de-emph}} = 50 \mu\text{s}$	0	-	-	mV
		$t_{\text{de-emph}} = 80 \mu\text{s}$	-300	-	-	mV
$t_{\text{de-emph}}$	control range of de-emphasis		50	-	80	μs
Voltage controlled oscillator; note 4						
f_{osc}	oscillator frequency		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_{ch}	charge current (into +4 V)		-	45	-	μA
I_{dch}	discharge current (from +8.5 V)		-	-900	-	μA
TRIGGER SENSITIVITY MEASUREMENT WITH PULSED MODULATION OF FM-IF ₂ ; see Figs 19 and 20						
$V_{37-35(p)}$	trigger sensitivity for test signal 1 (peak value)	$V_{38} = 2.52 \text{ V}$; note 5	-	-	0.5	mV
		$V_{38} = 2.52 \text{ V}$; note 6	100	-	-	mV
	trigger sensitivity for test signal 2 (peak value)	$V_{38} = 2.52 \text{ V}$; note 6	5.0	-	-	mV
		$V_{38} = 2.52 \text{ V}$; note 6	100	-	-	mV
V_{51}	trigger threshold variation with frequency modulation of FM-IF ₂ and $f_{\text{mod}} = 15 \text{ kHz}$ (pin 51)	$V_{37-35} = 100 \text{ mV}$; $\Delta f = 0 \text{ kHz}$	-	6.4	-	V
ΔV_{51}		$V_{37-35} = 100 \text{ mV}$; $\Delta f = 40 \text{ kHz}$	-	250	-	mV
$V_{37\text{th}}/V_{37(3\text{dB})}$	shift of threshold for triggering from MPX signal	$I_{46} = 0$	14	20	26	dB
$\Delta V_{37\text{th}}/\Delta I_{46}$	shift of threshold as function of I_{46}		-0.32	-0.25	-0.16	dB/ μA
V_{46}	bias voltage (pin 46)	$I_{46} < 0$	4.0	4.3	4.7	V
		$I_{46} > 0$	5.3	5.7	6.1	V
I_{offset}	gate input offset current at pins 31 and 32 during suppression pulse duration		-	20	50	nA

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Notes to the stereo decoder characteristics

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

$$\alpha_{2^7} = \frac{V_0(\text{signal}) (\text{at } 1 \text{ kHz})}{V_0(\text{spurious}) (\text{at } 1 \text{ kHz})} f_s = (2 \times 10 \text{ kHz}) - 19 \text{ kHz}$$

$$\alpha_{3^7} = \frac{V_0(\text{signal}) (\text{at } 1 \text{ kHz})}{V_0(\text{spurious}) (\text{at } 1 \text{ kHz})} f_s = (3 \times 13 \text{ kHz}) - 38 \text{ kHz}$$

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

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

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

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

2. The stereo decoder can be set to mono via the I²C-bus. Pilot presence indication via the I²C-bus.
3. The nominal de-emphasis value can be changed to 75 μ s with C₃₁; C₃₂ = 10 nF.
4. The VCO is adjusted by means of a digital auxiliary PLL.
5. Noise blanker does not trigger.
6. Noise blanker triggers.

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

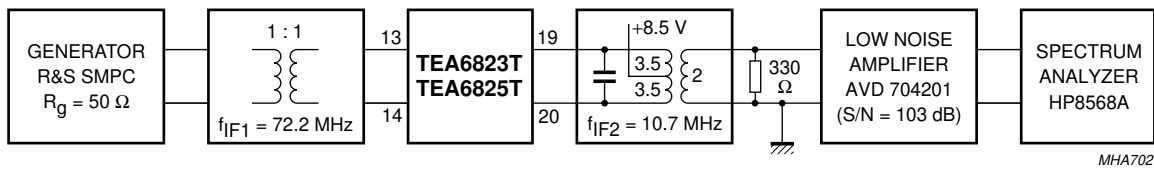
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
ADC for FM level information; note 1						
ΔV_{37-35}	analog-to-digital conversion					
	step size		2	4	8	dB/step
	level range		43	56	69	dB
FM STOP						
ΔV_{stop}	variation of stop level as function of V_{42-4}		–	16	–	dB/V
ADC for AM level information; note 2						
ΔV_{33-34}	analog-to-digital conversion step size		2	4	8	dB/step
ΔV_{33-34}	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
ADC 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	60	%

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 IF_2 amplitude modulation range $m \leq 0.6$; $f_{\text{mod}} = 20$ kHz.

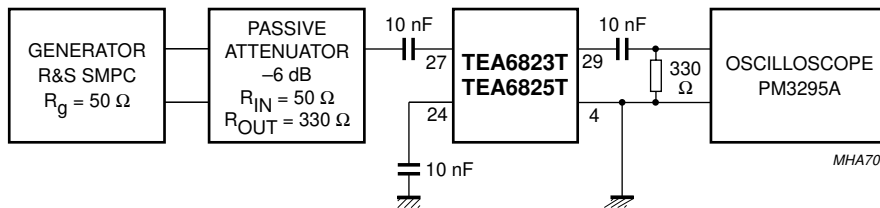
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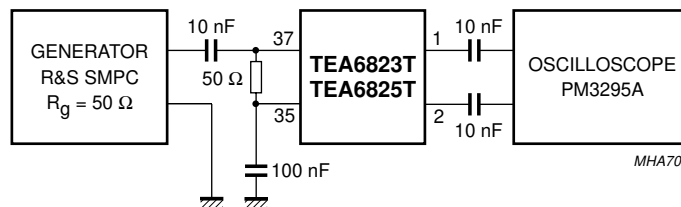
MHA702

Fig.4 Test circuit FM mixer.



MHA703

Fig.5 Test circuit IF-amplifier.

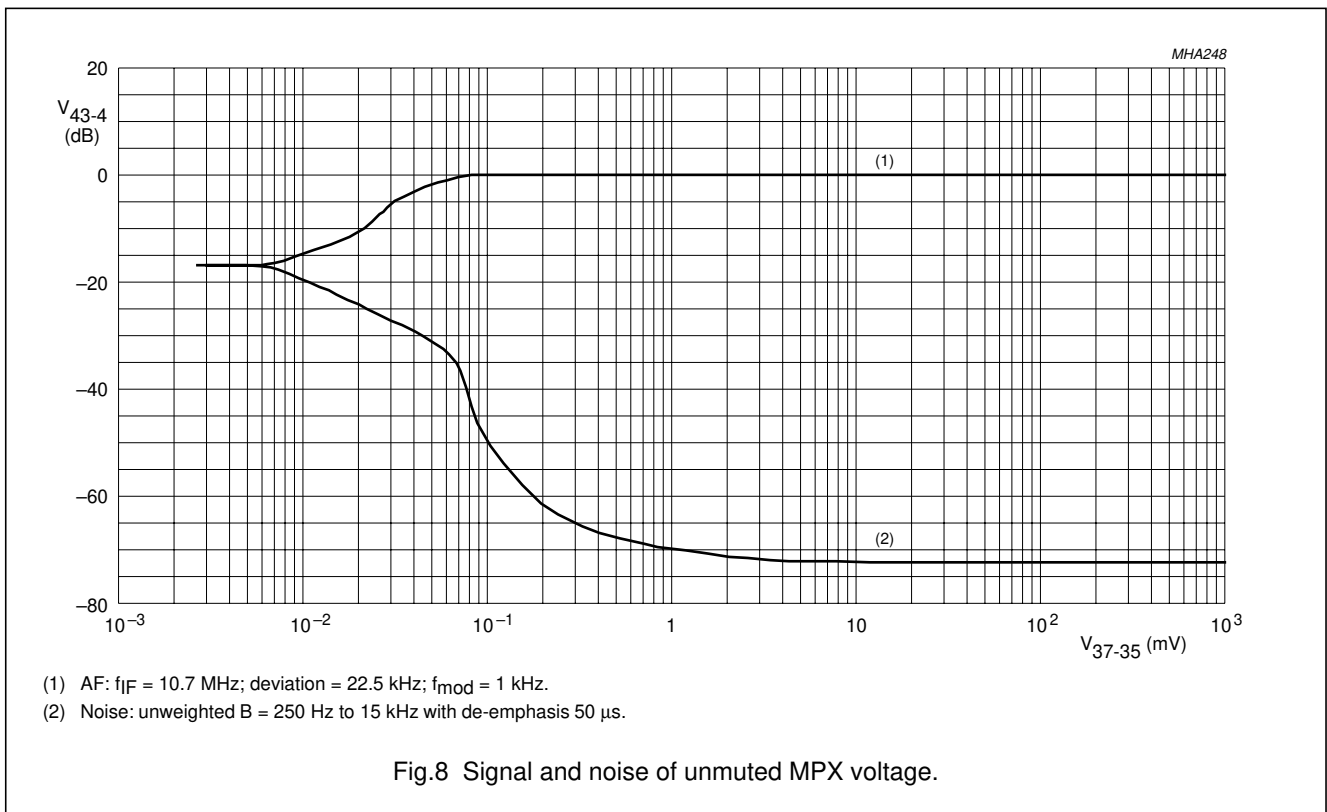
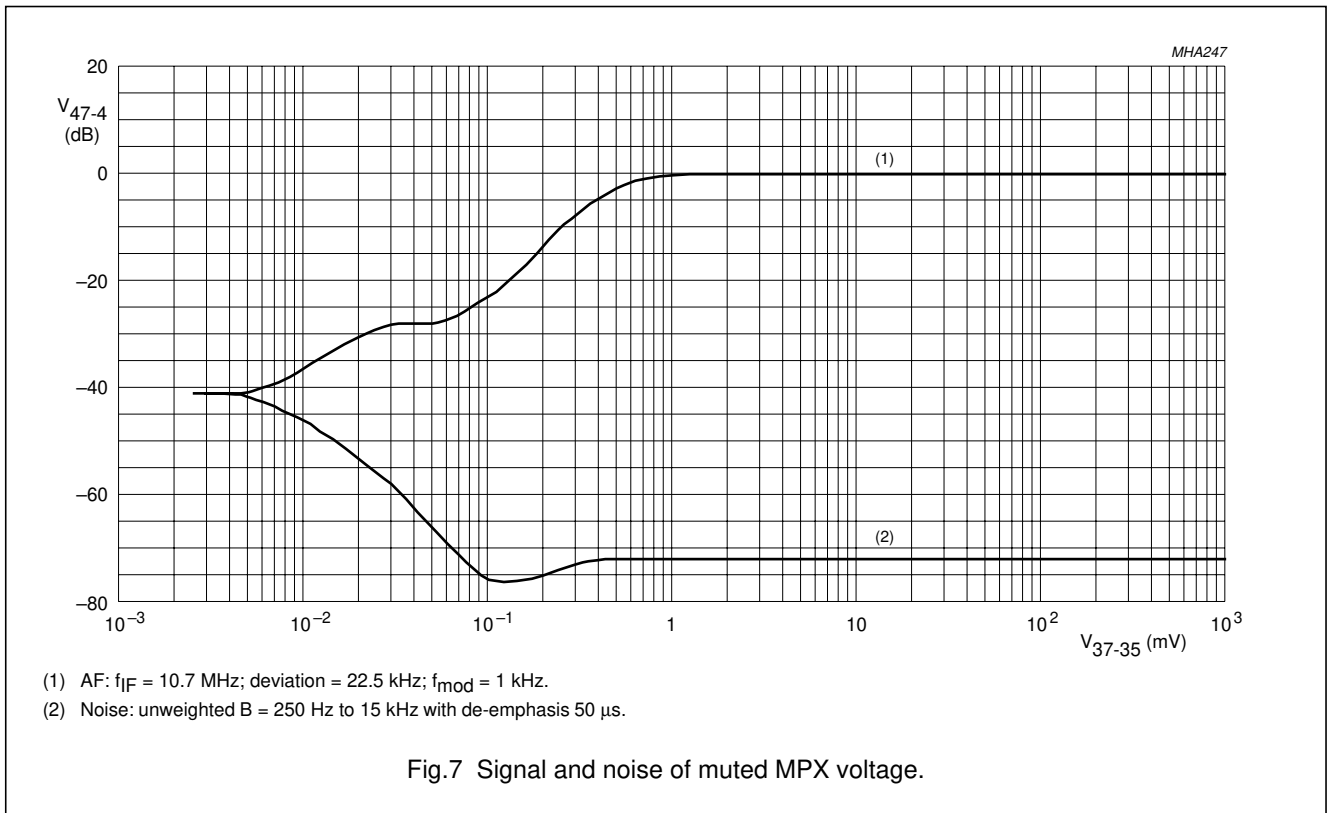


MHA704

Fig.6 Test circuit limiter gain.

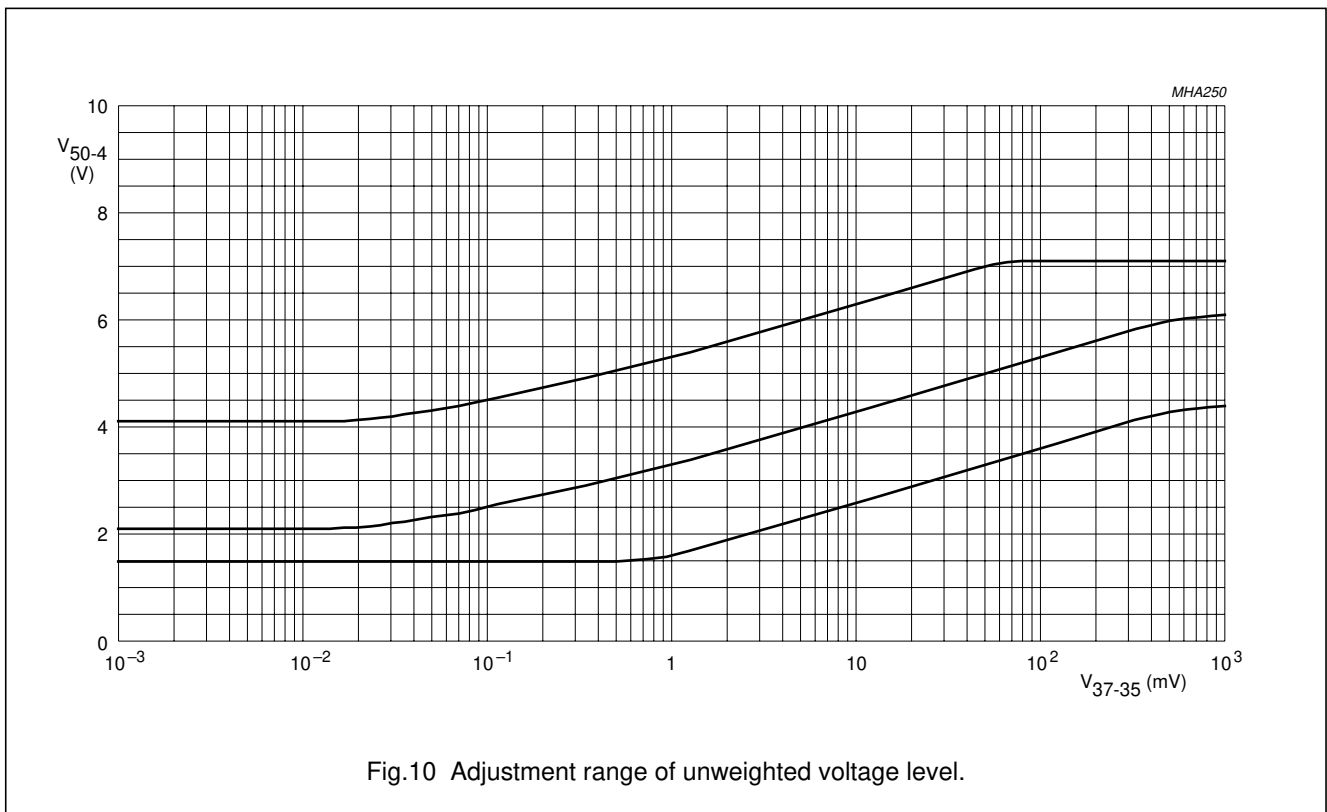
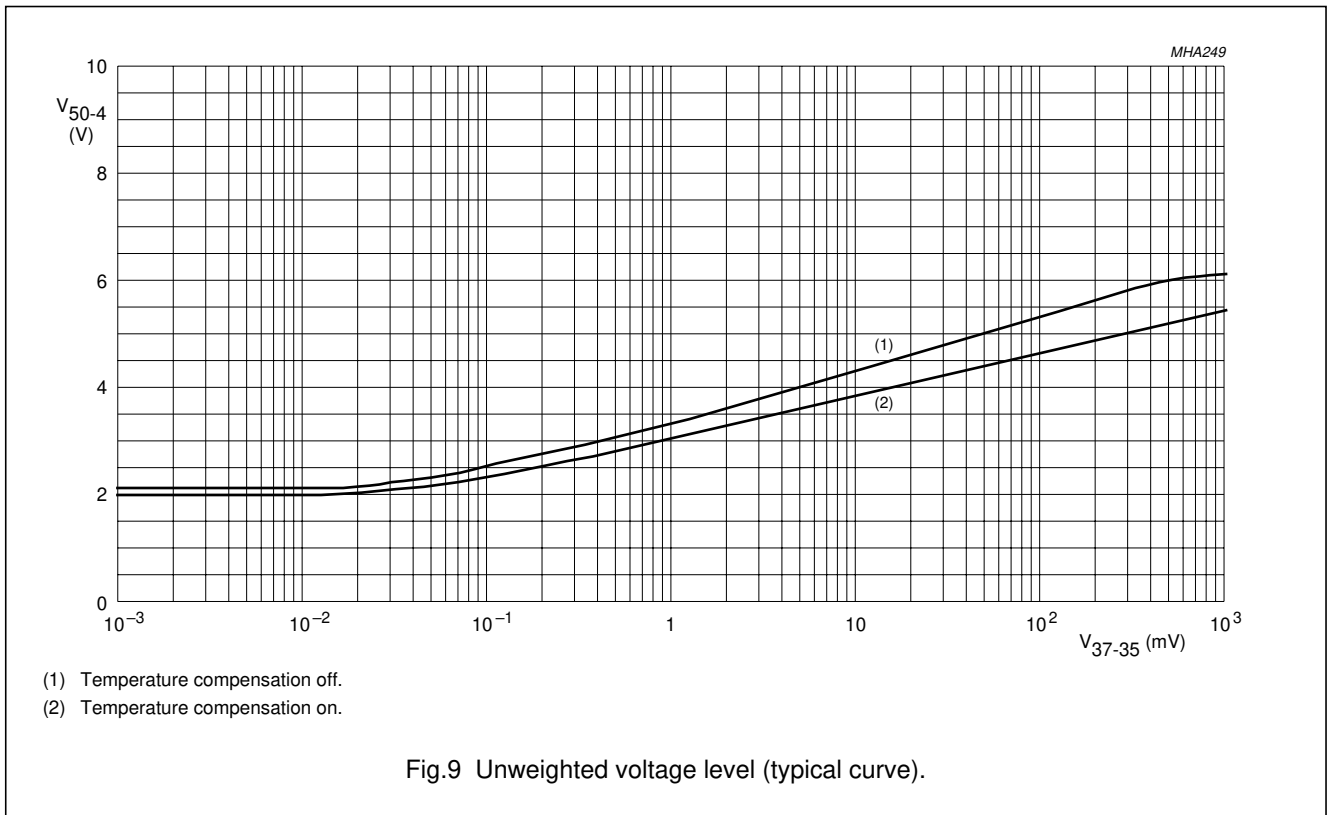
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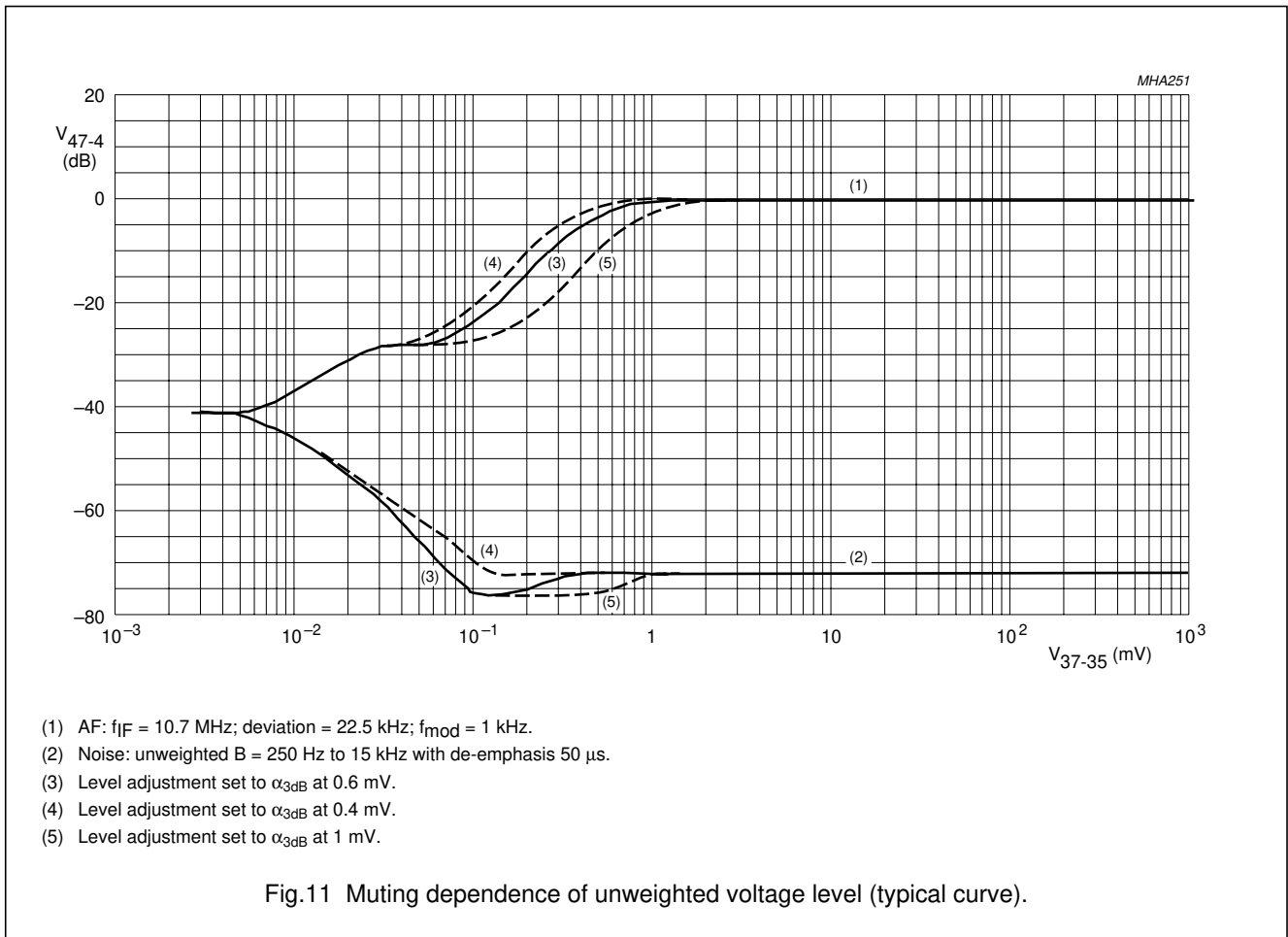
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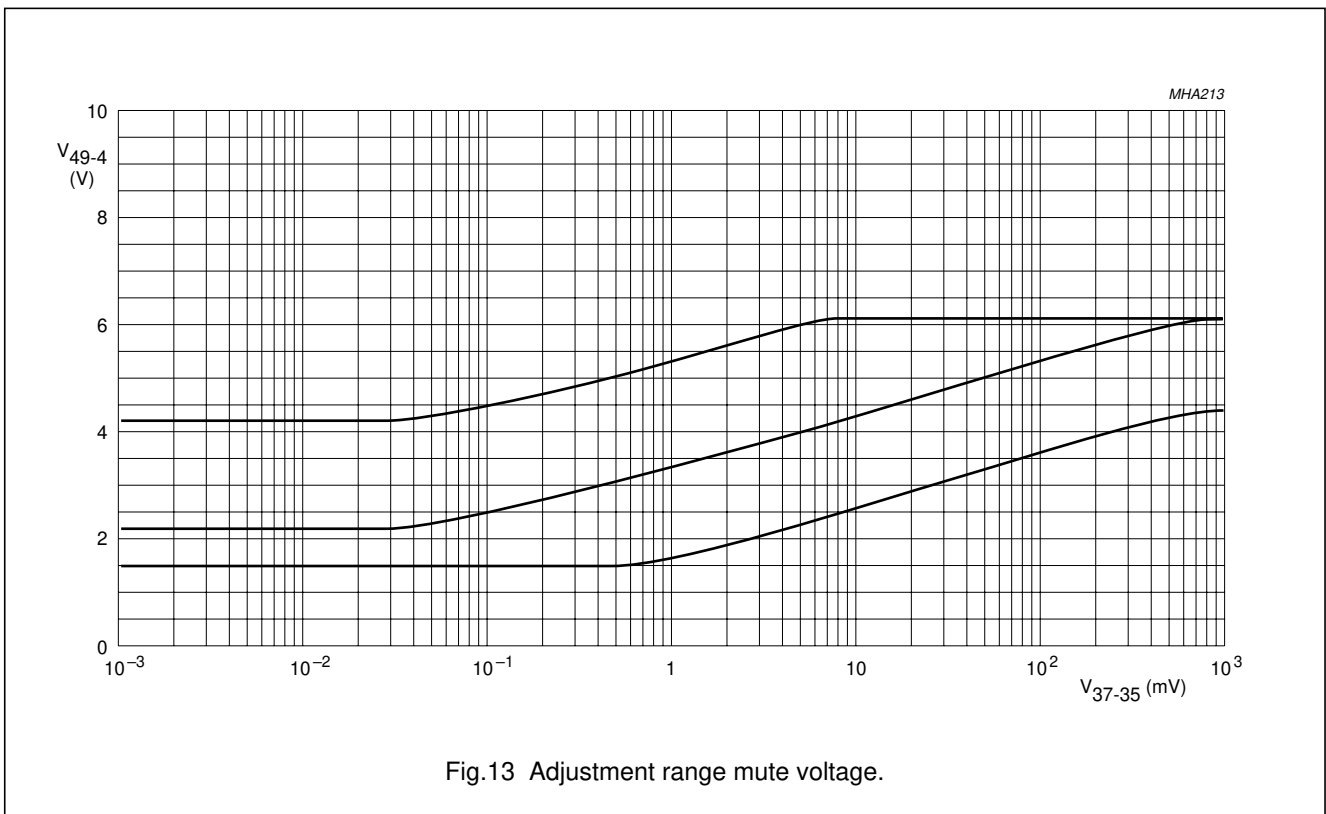
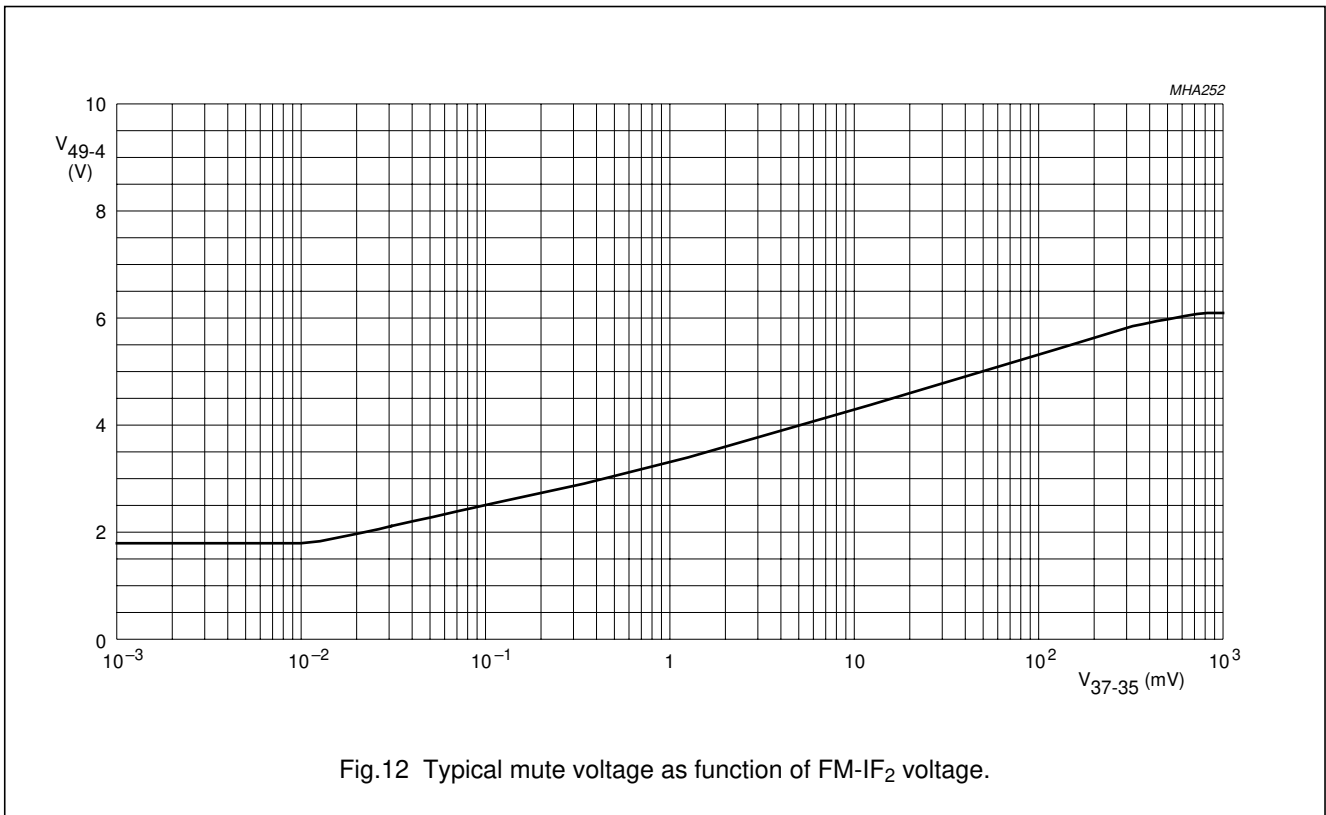
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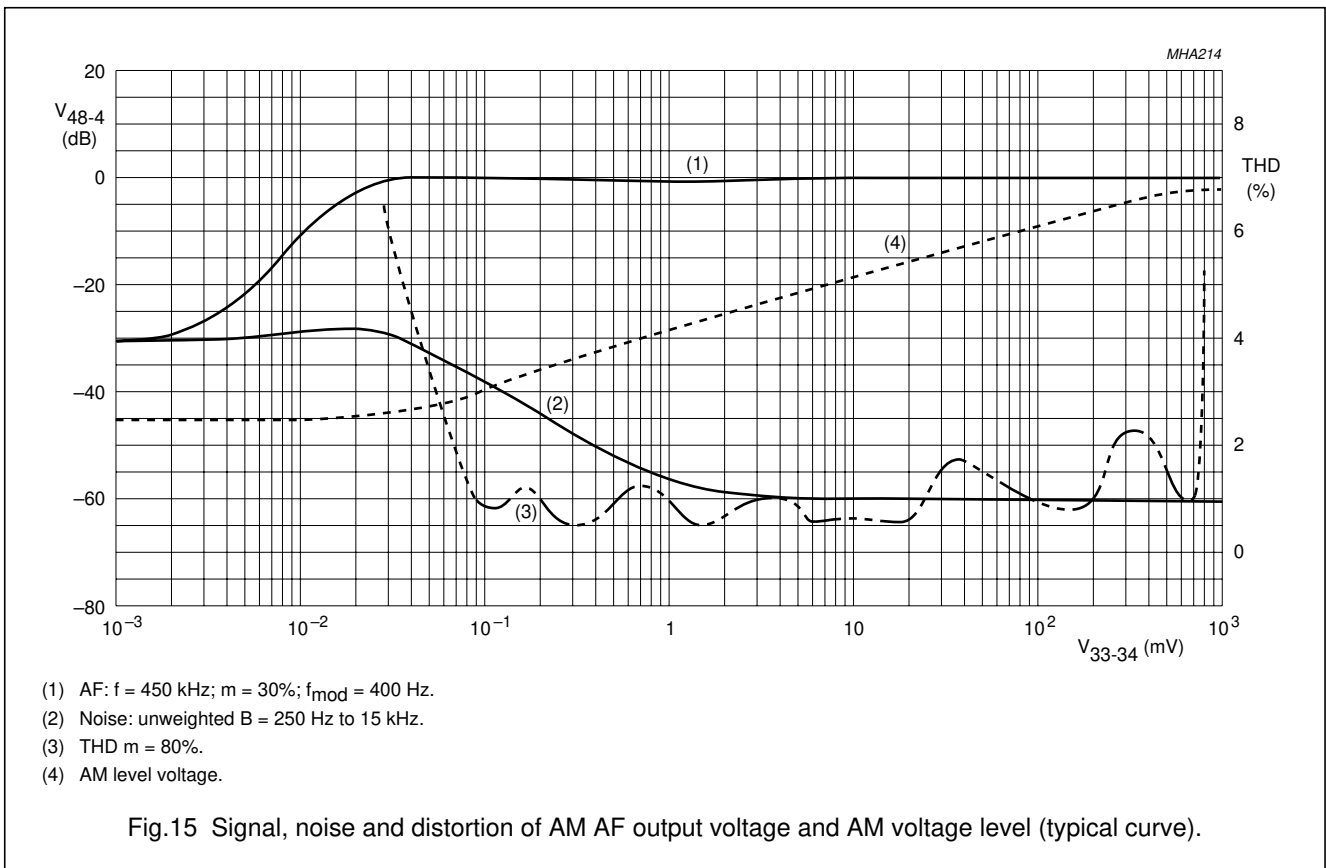
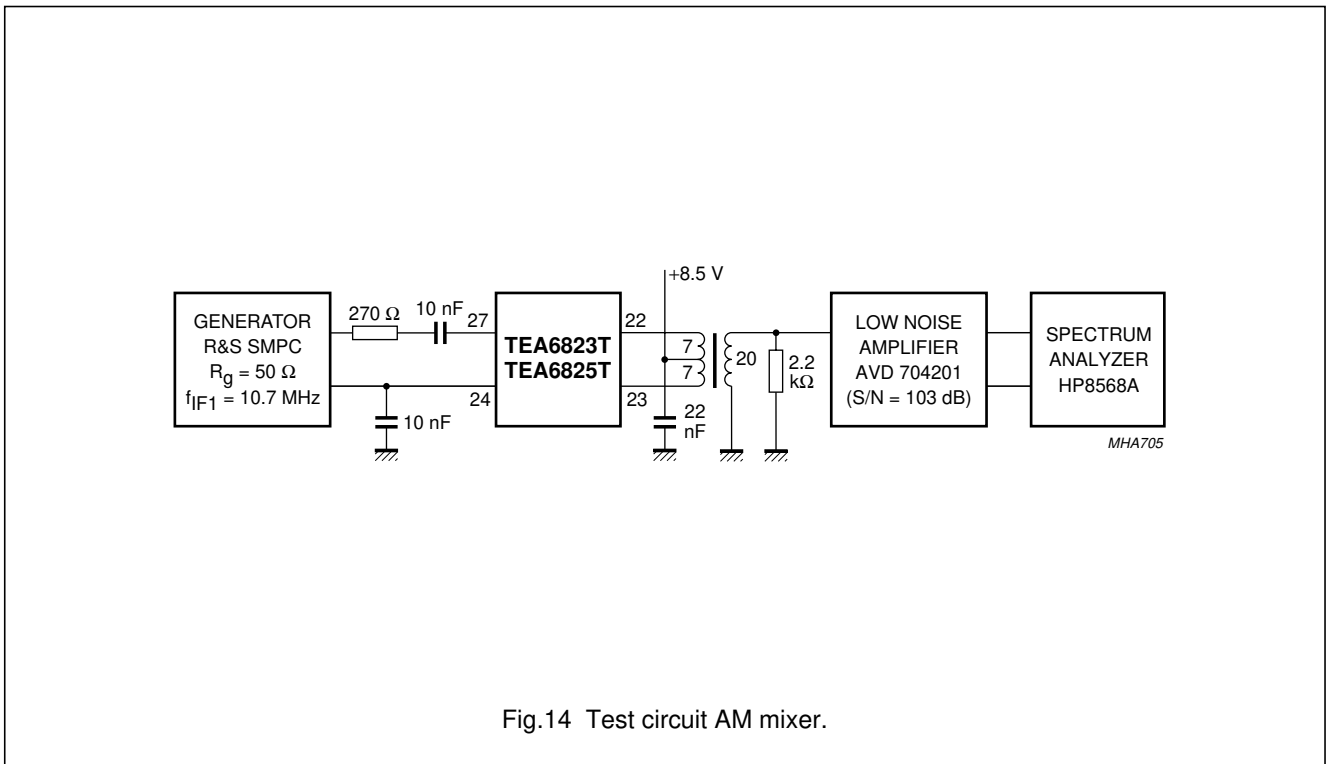
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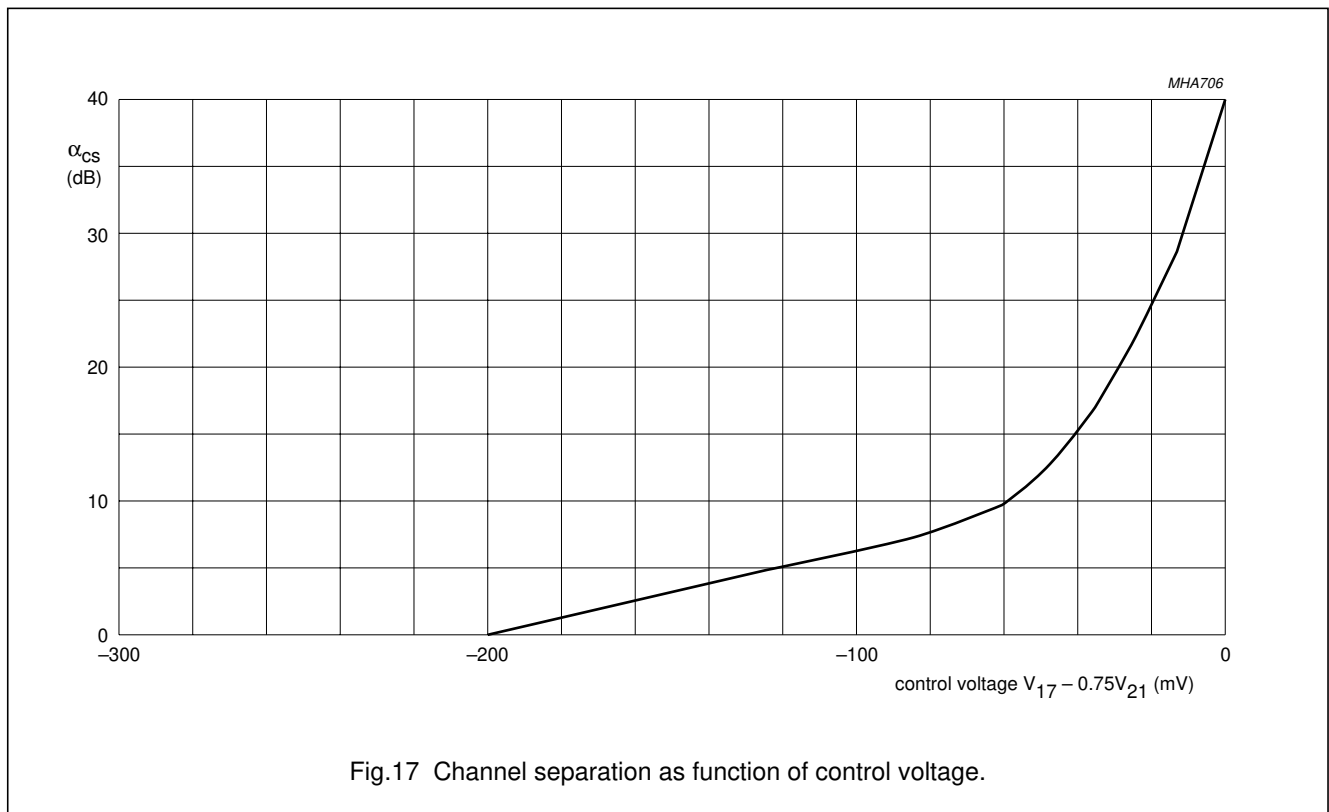
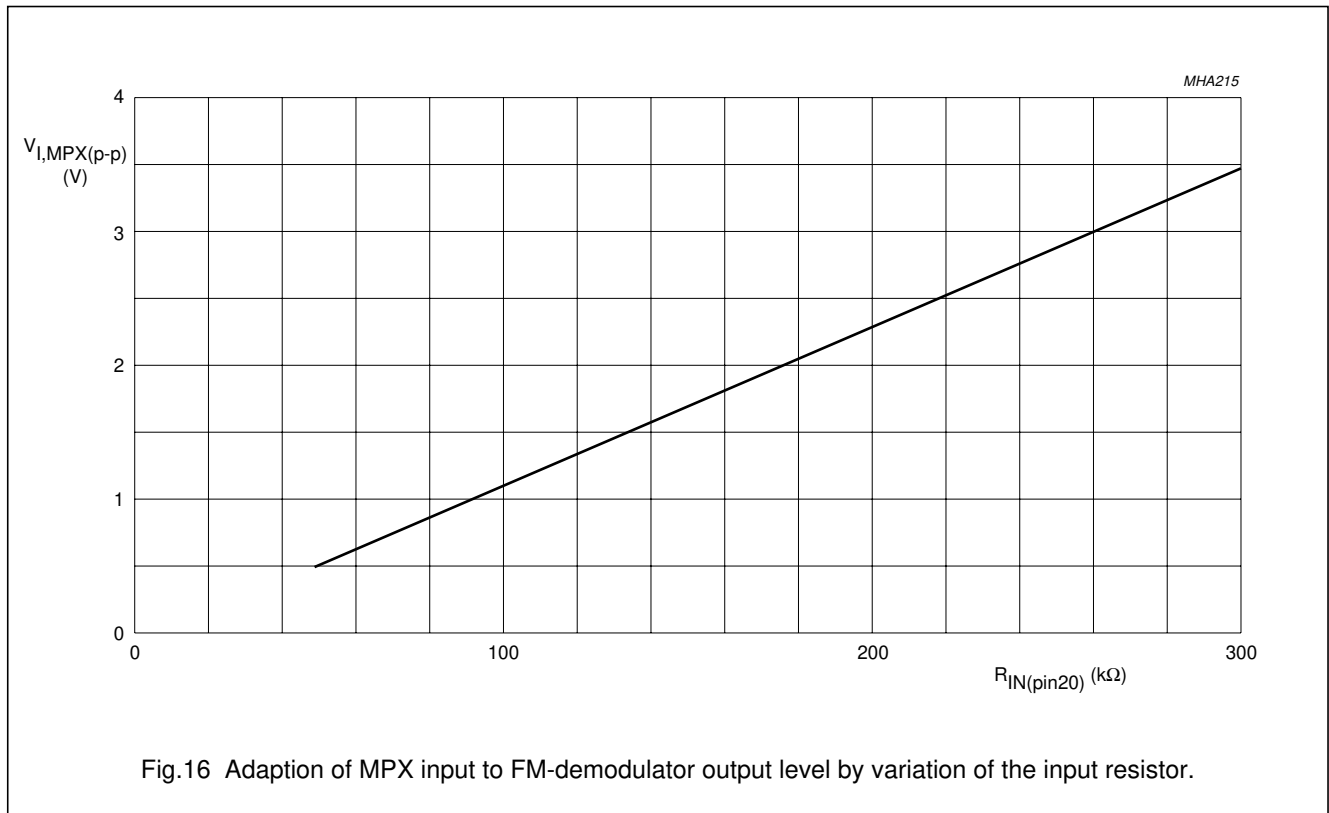
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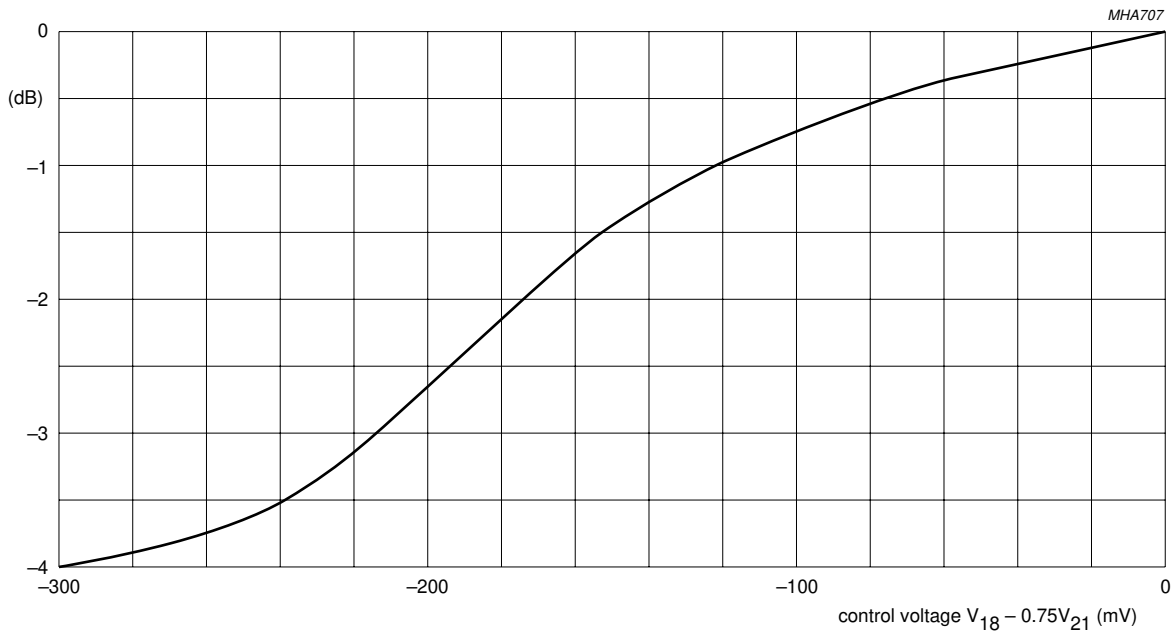


Fig.18 High-cut with $f_{mod} = 10$ kHz as function of control voltage.