DOLBY* B and C TYPE NOISE REDUCTION CIRCUIT

GENERAL DESCRIPTION

The TEA0665 is designed for use in Dolby B and Dolby C type audio Noise Reduction (NR) systems. The device provides the high and low level stages for one channel of a Dolby C-type NR system, including NR ON/OFF switching and all electronic switching necessary for Dolby C-type systems. In addition the TEA0665 includes a preamplifier for the record and playback functions and a multiplex buffer amplifier. The circuit offers two different line-output levels (−6 and 0 dBm) and a low-pass filter, which can be fed into the signal path in playback mode.

Features

- Few external components required
- Included RECORD/PLAY preamplifiers plus multiplex filter buffer amplifier
- Two different line-output levels
- All electronic switching

PACKAGE OUTLINES

TEA0665: 28-lead DIL; plastic (SOT117).
TEA0665T: 28-lead mini-pack; plastic (SO28; SOT136A).

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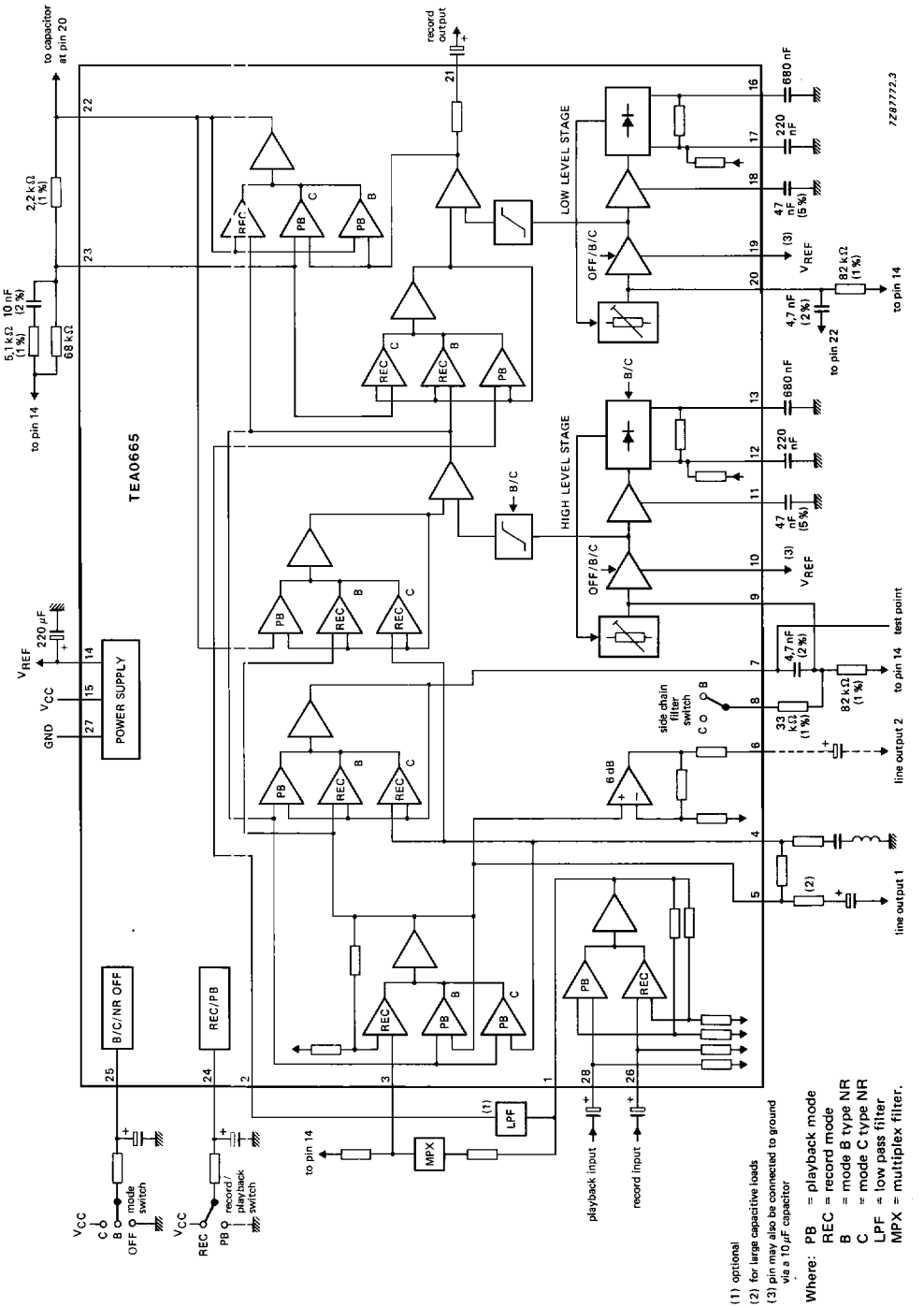


(1) optional
(2) for large capacitive loads
(3) pin may also be connected to ground via a 10 µF capacitor

Where: PB = playback mode
REC = record mode
B = mode B type NR
C = mode C type NR
LPF = low pass filter
MPX = multiplex filter.

Fig. 1 Block diagram and application circuit.

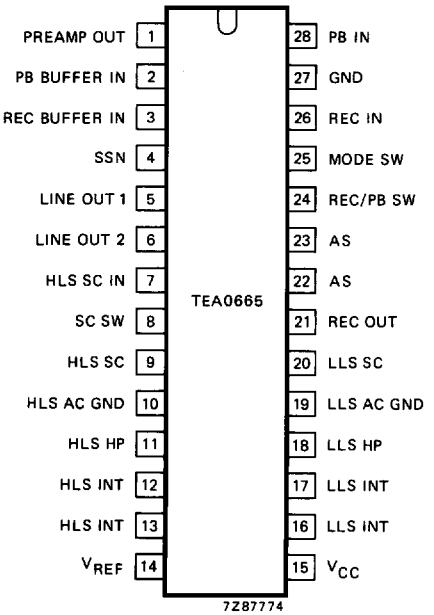


Fig. 2 Pinning diagram.

PINNING

1	PREAMP OUT	record/playback preamplifier output
2	PB BUFFER IN	playback amplifier input buffer
3	REC BUFFER IN	record amplifier input buffer
4	SSN	spectral skewing network
5	LINE OUT 1	line output 1
6	LINE OUT 2	line output 2
7	HLS SC IN	high level stage side chain input
8	SC SW	side chain filter switch
9	HLS SC	high level stage side chain
10	HLS AC GND	high level stage AC ground
11	HLS HP	high level stage high pass filter
12	HLS INT	high level stage integrating filter
13	HLS INT	high level stage integrating filter
14	V_{REF}	reference voltage
15	V_{CC}	positive supply voltage
16	LLS INT	low level stage integrating filter
17	LLS INT	low level stage integrating filter
18	LLS HP	low level stage high pass filter
19	LLS AC GND	low level stage AC ground
20	LLS SC	low level stage side chain
21	REC OUT	record output
22	AS	anti-saturation filter
23	AS	anti-saturation filter
24	REC/PB SW	record/playback switch input
25	MODE SW	mode switch input
26	REC IN	record input
27	GND	ground
28	PB IN	playback input

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage (pin 15)	V_{CC}	max. 18	V
Input voltage (pins 26 and 28)	V_I	max. −0,3 to V_{CC}	V
Total power dissipation	P_{tot}	600	mW
Storage temperature range	T_{stg}	−55 to + 150	°C
Operating ambient temperature range	T_{amb}	−40 to + 85	°C

CHARACTERISTICS

V_{CC} = 14 V; f = 20 Hz to 15 kHz; T_{amb} = 25 °C; all levels with reference to 387,5 mV = 0 dB = −6 dBm at test point pin 7; test circuit Fig. 5; record mode; unless otherwise specified.

parameter	conditions			symbol	min.	typ.	max.	unit
	mode	f (kHz)						
Supply								
Supply voltage range	C	–	note 1					
single				V_{CC}	8	14	16	V
(split)				V_{CC}	(± 4)	(± 7)	(± 8)	V
Supply current	OFF	–	no input signal	I_{CC}	–	17	25	mA
Input sensitivity	C		note 2					
of record amplifier			pin 26	V_i	43	50	57	mV
of playback amplifier			pin 28	V_i	25	30	35	mV
Signal handling of record output (note 3; see Fig. 8)	C	1	V_{CC} = 8 V THD = 1%		12	15	–	dB
		1	V_{CC} = 14 V THD = 1%		–	20	–	dB
Line output 1			note 3		−0,5	0	+ 0,5	dB
Line output 2; amplifier gain V_o/V_i (pin 6 to pin 5)				G_v	+ 5,5	+ 6	+ 6,5	dB
Total harmonic distortion	OFF	1	TPL = 0 dB*	THD	–	0,02	0,1	%
			TPL = + 10 dB	THD	–	0,05	0,3	%
Total harmonic distortion	B	1	TPL = 0 dB	THD	–	0,1	0,15	%
			TPL = + 10 dB	THD	–	0,08	0,3	%
		10	TPL = 0 dB	THD	–	0,06	0,1	%
Total harmonic distortion	C	1	TPL = 0 dB	THD	–	0,15	0,3	%
			TPL = + 10 dB	THD	–	0,13	0,5	%
Signal plus noise-to-noise ratio	C		R_S = 10 kΩ CCIR/ARM weighted	(S+N)/N	62	66	–	dB

* TPL is Test Point Level.

parameter	conditions			symbol	min.	typ.	max.	unit
	mode	f (kHz)						
Frequency response	B	2	TPL = −25 dB		−19,0	−18,0	−17,0	dB
		5	TPL = −40 dB		−30,7	−29,7	−28,7	dB
		10	TPL = −30 dB		−24,5	−23,5	−22,5	dB
	C	0,2	TPL = −40 dB		−33,4	−31,9	−30,4	dB
		1	TPL = −30 dB		−20,1	−18,6	−17,1	dB
		1	TPL = −20 dB		−16,1	−14,1	−12,1	dB
		5	TPL = −0 dB		−3,8	−2,3	−0,8	dB
		5	TPL = −20 dB		−19,1	−17,1	−15,1	dB
		5	TPL = −40 dB		−28,5	−26,5	−24,5	dB
Switching thresholds			note 4; pin 24					
for record				V_{24-27}	8,5	–	14	V
for playback				V_{24-27}	0	–	4	V
Switching thresholds			note 5; pin 25					
	OFF			V_{25-27}	0	–	3,5	V
(switch in open position)	B			V_{25-27}	–	7	–	V
(external voltage)	B			V_{25-27}	6,3	7	7,7	V
	C			V_{25-27}	10,8	–	14	V
Switch input current			pin 25					
	OFF		V_{25-27} = 0 V	$-I_{25}$	–	–	40	μA
	C		$V_{25-27} = V_{CC}$	I_{25}	–	–	40	μA
Frequency response shift as a function of temperature deviation, range −40 to + 85 °C, measured as deviation from 25 °C	C			Δf	–	± 0,5	–	dB
as a function of voltage deviation, range 8 to 16 V, measured as deviation from 14 V				Δf	–	± 0,1		dB
Input resistance								
			pin 26	R_{26-27}	35	50	65	kΩ
			pin 28	R_{28-27}	35	50	65	kΩ
Output resistance								
			pin 6	R_{6-27}	–	160	220	Ω
			pin 21	R_{21-27}	–	60	100	Ω

Notes to the characteristics

1. Operation with minimum of 12 dB headroom; system remains functional to 7 V.
2. Attenuation between pins 1 and 3 is 3,5 dB (MPX-filter).
   Playback input sensitivity is 45 mV if a switchable MPX-low pass filter is used in playback mode (pins 2 and 3 short-circuited).
3. System headroom is determined by the line output channel in use.
   For low supply voltages line output 2 (pin 6) will saturate at high signal levels. Headroom for line output 1 (pin 5) tracks with record output (pin 21).
4. The equation for REC/PB switch input voltage is:

   REC: $V_{24\text{-}27} > 0{,}55\ V_{CC} - V_{BE} + 1{,}5\ V$,

   PB: $V_{24\text{-}27} < 0{,}45\ V_{CC} - V_{BE} - 1{,}5\ V$.
5. The equation for C/B/OFF mode switch input voltage is:

   OFF: $V_{25\text{-}27} < 0{,}38\ V_{CC} - V_{BE} - 1\ V$,

   B: $0{,}45\ V_{CC} < V_{25\text{-}27} < 0{,}55\ V_{CC}$ (external voltage),

   B: $0{,}5\ V_{CC}$ (switch in open position),

   C: $V_{25\text{-}27} > 0{,}75\ V_{CC} - V_{BE} + 1\ V$.

   The voltage drop across the external time constant resistor must be taken in to account.

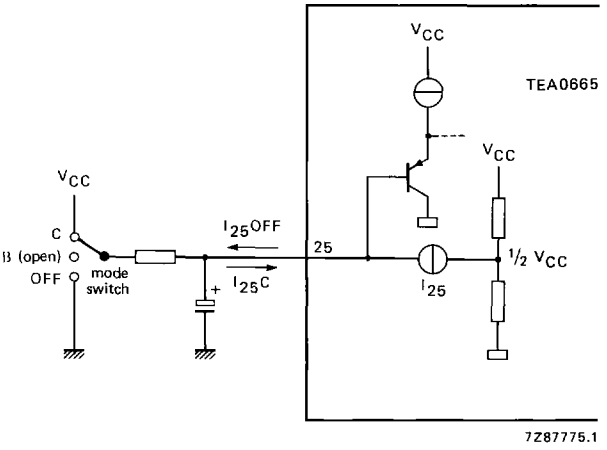


Fig. 3 Mode switch input configuration.

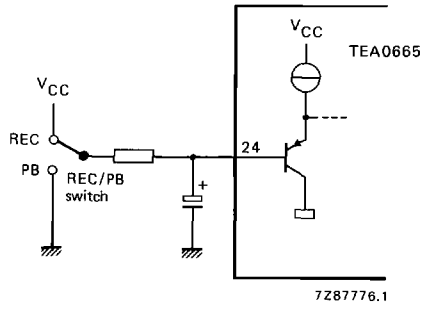
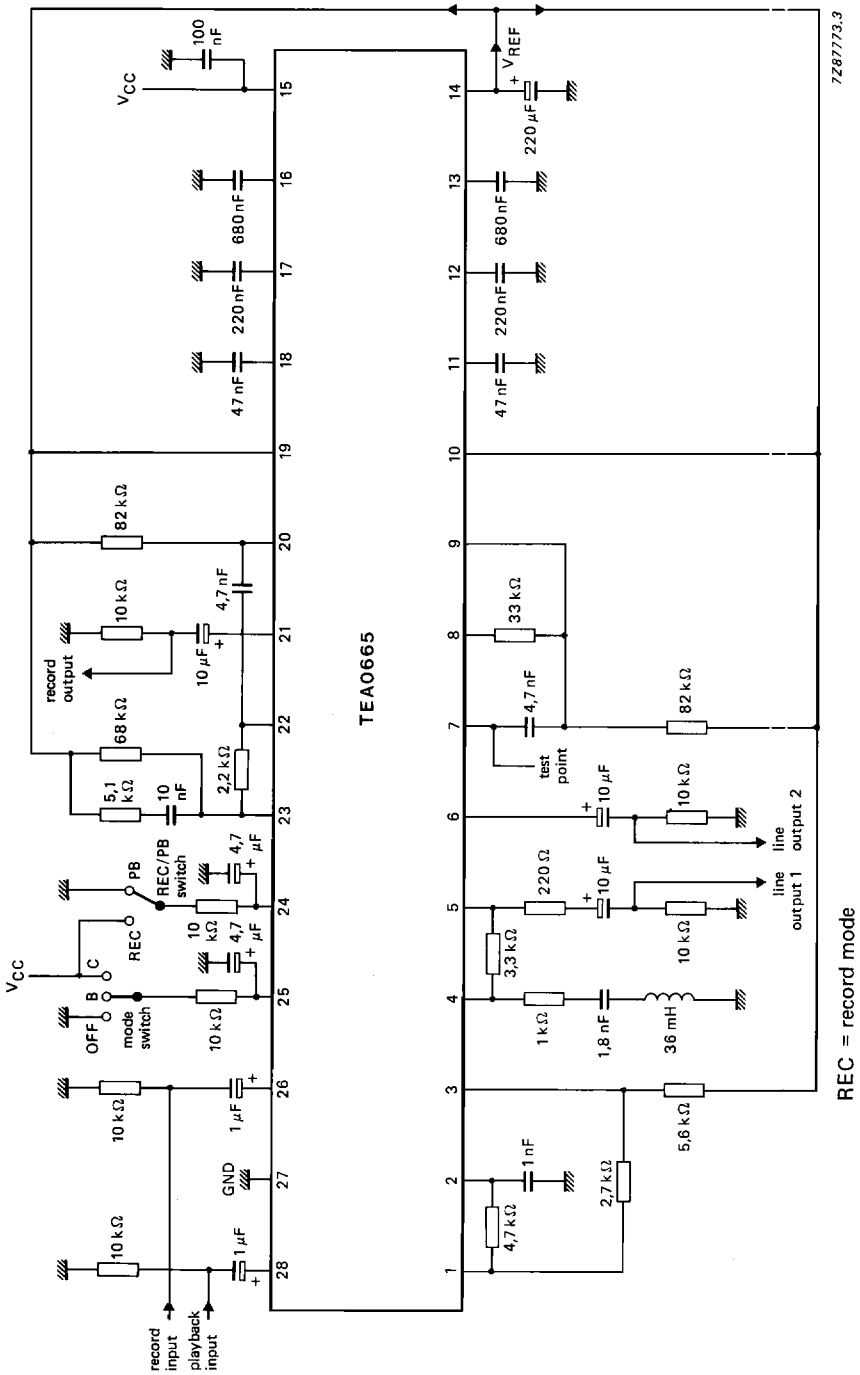


Fig. 4 REC/PB switch input configuration.



REC = record mode
PB = playback mode

Tolerances: resistors 1%
capacitors 1%

Fig. 5 Test circuit.

SYSTEM GRAPHS

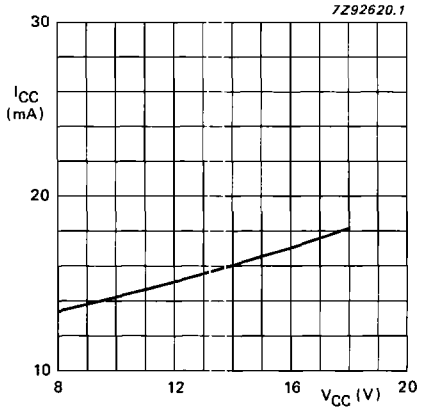


Fig. 6 Supply current as a function of supply voltage; $I_{CC} = f(V_{CC})$; no input signal.

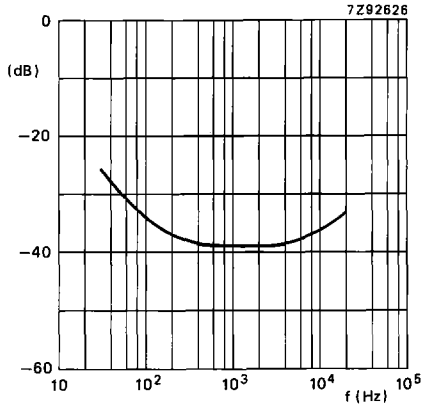


Fig. 7 Power supply ripple rejection measured at REC OUT as a function of frequency; level at pin 15 = 100 mV (rms). R_G = 10 kΩ; record mode; NR OFF.

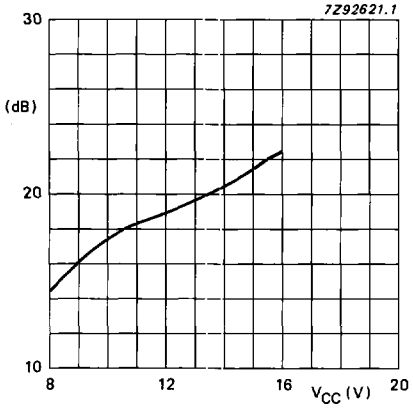


Fig. 8 Signal handling = $f(V_{CC})$ measured at REC OUT as a function of the supply voltage; THD = 1%.

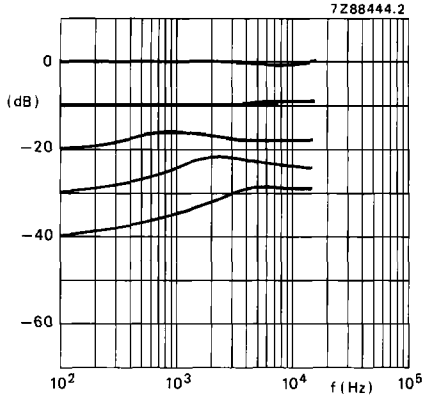


Fig. 9 Encoder frequency response for B-mode.

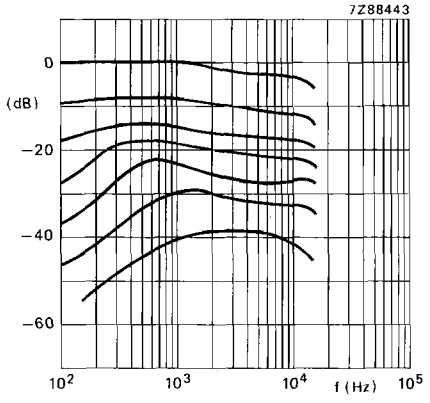


Fig. 10 Encoder frequency response for C-mode.

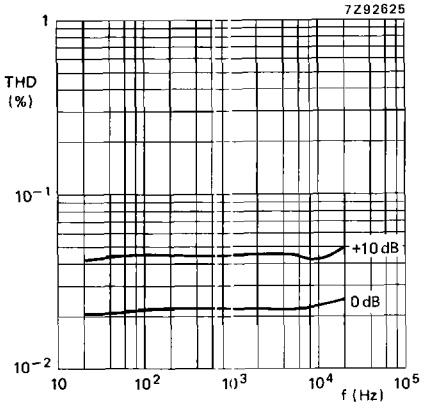


Fig. 11 Total harmonic distortion measured at REC OUT as a function of frequency; for NR OFF mode; V_{CC} = 14 V; LPF 80 kHz.

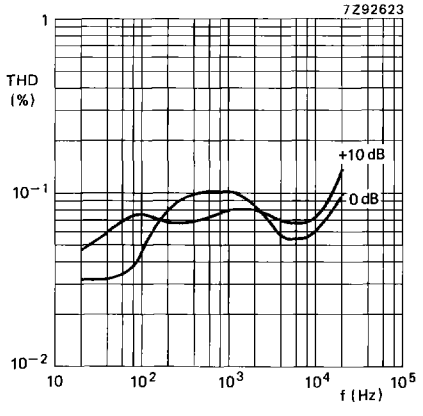


Fig. 12 Total harmonic distortion measured at REC OUT as a function of frequency; for B-mode; V_{CC} = 14 V; LPF 80 kHz.

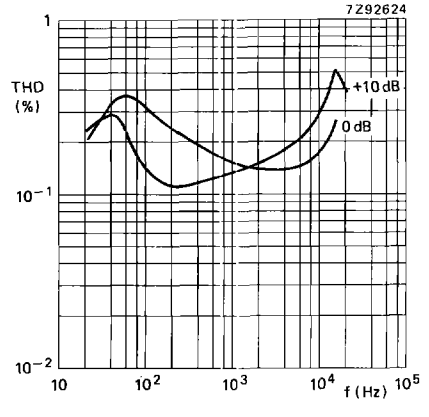


Fig. 13 Total harmonic distortion measured at REC OUT as a function of frequency; for C-mode; V_{CC} = 14 V; LPF 80 kHz.

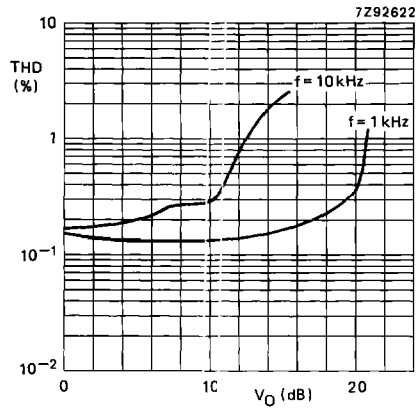


Fig. 14 Total harmonic distortion as a function of the record output level (pin 21); for C-mode; V_{CC} = 14 V; LPF 80 kHz.

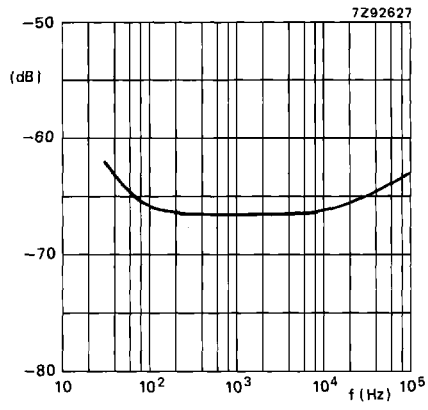


Fig. 15 Crosstalk from record input (pin 26) to line output as a function of frequency in playback mode; record input level is 50 mV; NR OFF; R_G = 10 kΩ.