Quasi split-sound circuit and AM demodulator

TDA3845; TDA3845T

FEATURES

- Power supply from 5 V (200 mW) to 8 V source also an alternative 12 V source (12 V not for TDA3845T)
- Gain controlled wideband IF amplifier (AC coupled with three stages)
- High precision internal 90° phase shifter for quadrature demodulator
- Amplitude detector for gain control which operates as a peak detector for FM sound and as a mean level detector for AM sound (switchable)
- In-phase wideband synchronous demodulator for AM detection
- Stabilizer circuit for ripple rejection and constant output signals
- ESD protection for all pins
- Suitable for all FM standards and L as well as L-accent standard
- NICAM compatible.

GENERAL DESCRIPTION

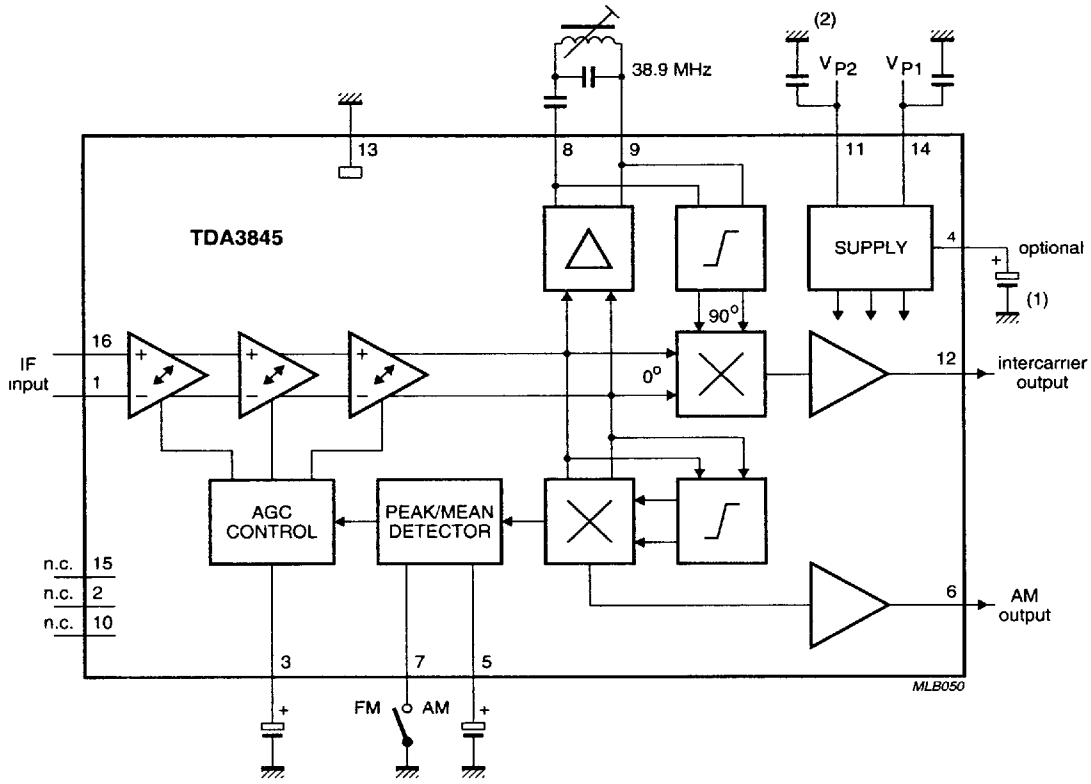
The TDA3845 is a quasi split-sound IF circuit which is designed to provide high performance television FM/AM sound.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT
	positive supply voltage				
V_{P1}	pin 14	4.5	5.0	8.8	V
V_{P2}	pin 11 (not for TDA3845T)	10.8	12.0	13.2	V
I_P	supply current	–	40	–	mA
$V_{1\text{-}16(RMS)}$	minimum IF input voltage (RMS value)	–	70	100	µV
	IF control range	60	63	–	dB
$V_{12\text{-}13(RMS)}$	intercarrier output voltage 5.5 MHz (RMS value)	70	100	–	mV
(S + W)/W	signal-to-weighted-noise ratio (relative to 1 kHz; 50 kHz deviation)				
	at 5.5 MHz for 2T/20T	–	60	–	dB
	at 5.742 MHz for 2T/20T	–	58	–	dB
$V_{6\text{-}13(RMS)}$	AF output votage AM (RMS value)	440	550	660	mV
(S + W)/W	signal-to-weighted-noise ratio; AM mode	–	56	–	dB
THD	total harmonic distortion; AM mode	–	1	2	%
T_{amb}	operating ambient temperature	0	–	+70	°C

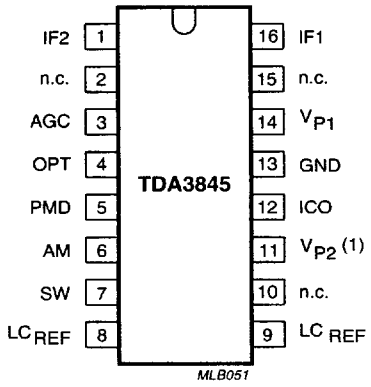
ORDERING INFORMATION

EXTENDED TYPE NUMBER	PACKAGE			
	PINS	PIN POSITION	MATERIAL	CODE
TDA3845	16	DIL	plastic	SOT38
TDA3845T	16	SO16	plastic	SOT109A



(1) See note 10 to the characteristics.
(2) Not for TDA3845T, pin 11 not connected.

Fig.1 Block diagram.



(1) Not for TDA3845T, pin 11 not connected.

Fig.2 Pin configuration.

PINNING

SYMBOL	PIN	DESCRIPTION
IF2	1	IF amplifier input 2
n.c.	2	not connected
AGC	3	AGC control capacitor
OPT	4	optional capacitor (see note 10 to the characteristics
PMD	5	peak/mean detector capacitor
AM	6	AM output
SW	7	FM/AM switch
LC_{REF}	8	LC reference circuit for the picture carrier
LC_{REF}	9	LC reference circuit for the picture carrier
n.c.	10	not connected
V_{P2}	11	positive supply voltage 2 (+12 V); note 1
ICO	12	intercarrier output
GND	13	ground (0 V)
V_{P1}	14	positive supply voltage 1 (+5 V)
n.c.	15	not connected
IF1	16	IF amplifier input 1

Note to Pinning

1. Not for TDA3845T, pin 11 not connected.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC134)

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
	supply voltage			
V_{P1}	pin 14	4.5	8.8	V
V_{P2}	pin 11 (not for TDA3845T)	10.8	13.2	V
T_{amb}	operating ambient temperature	0	+70	°C
T_{stg}	storage temperature	−25	+125	°C

CHARACTERISTICS

V_{P1} = 5 V (note 11); T_{amb} = 25 °C; all measurements are referenced to ground (pin 13); unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Supply						
	supply voltage					
V_{P1}	pin 14		4.5	5.0	8.8	V
V_{P2}	pin 11 (not for TDA3845T)		10.8	12.0	13.2	V
I_{tot}	total supply current		–	40	48	mA
IF amplifier						
R_{1-16}	input resistance		–	2	–	kΩ
C_{1-16}	input capacitance		–	2.5	–	pF
$V_{1-16(RMS)}$	minimum IF input voltage (RMS value)	note 1	–	70	100	μV
$V_{1-16(RMS)}$	maximum IF input voltage (RMS value)	note 2	70	100	–	mV
ΔG	gain control range		60	63	–	dB
G_{v3-16}	gain control voltage range		1.5	–	3.0	V
B_{IF}	IF bandwidth	–3 dB	50	70	–	MHz
V_{1-16}	DC potential		–	1.7	–	V
Intercarrier mode (FM mode; standard B/G) notes 3, 4 and 5						
Reference amplifier						
$V_{8-9(p-p)}$	picture carrier amplitude (peak-to-peak value)		–	270	–	mV
R_{8-9}	operating resistance		–	4	–	kΩ
V_{8-9}	DC potential		–	3.9	–	V
Intercarrier mixer and output stage						
$V_{12(RMS)}$	output signal (RMS value)					
	at 5.5 MHz		70	100	–	mV
	at 5.74 MHz		32	45	–	mV
B_{12}	intercarrier bandwidth					
	at –1 dB		–	8	–	MHz
	at –3 dB		–	9	–	MHz
	residual video AM on intercarrier signal	note 6	–	3	10	%
R_{12}	output resistance		–	30	–	Ω
V_{12}	DC potential		–	1.8	–	V
$I_{12(peak)}$	permissable AC output current (peak value)	note 7	–	–	±0.7	mA
I_{12}	permissable DC output current		–	–	–2	mA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
AF signal performance (note 8)						
(S + W)/W	black picture		60/58	68/64	–	dB
(S + W)/W	2T/20T pulses with white bars		57/55	60/58	–	dB
(S + W)/W	6 kHz sinewave (black-to-white modulation)		53/51	57/55	–	dB
(S + W)/W	250 kHz square wave (black-to-white modulation)		50/44	56/50	–	dB
AM mode (standard L) note 9						
S/N weighted in accordance with CCIR 468-3						
$V_{6(RMS)}$	AF output signal (RMS value)		440	550	660	mV
B_{AF}	AF bandwith	–3 dB; note 12	0.02	–	120	kHz
THD	total harmonic distortion		–	1	2	%
(S + W)/W	signal-to-weighted-noise ratio	note 10	50	56	–	dB
R_6	output resistance		–	200	–	Ω
V_6	DC potential		–	1.8	–	V
$I_{6(peak)}$	permissable AC output current (peak value)	note 7	–	–	±0.3	mA
I_6	permissable DC output current		–	–	–1	mA
Standard switch (note 4)						
V_7	peak signal AGC (FM mode)	V_{P1} used	1.8	–	V_{P1}	V
V_7	or switch open-circuit	V_{P2} used	1.8	–	5.5	V
V_7	mean signal AGC (AM mode)		–	–	0.8	V
I_7	switch current					
	at 0 V		–	–	–200	µA
	at V_{P1}		–	–	10	µA
	at V_{P2}	via a 2.2 kΩ series resistor	–	–	2.5	mA
Ripple rejection (note 13)						
AM/AF signal						
αRR	voltage ripple on V_P/ voltage ripple on output signal		30	40	–	dB
FM phase noise						
Δf(RMS)	intercarrier signal		–	10	20	Hz

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
AM mode (standard L) note 9						
S/N weighted in accordance with CCIR 468-3						
$V_{6(RMS)}$	AF output signal (RMS value)		440	550	660	mV
B_{AF}	AF bandwith	−3 dB; note 12	0.02	–	120	kHz
THD	total harmonic distortion		–	1	2	%
(S + W)/W	signal-to-weighted-noise ratio	note 10	50	56	–	dB
R_6	output resistance		–	200	–	Ω
V_6	DC potential		–	1.8	–	V
$I_{6(peak)}$	permissable AC output current (peak value)	note 7	–	–	±0.3	mA
I_6	permissable DC output current		–	–	−1	mA
Standard switch (note 4)						
V_7	peak signal AGC (FM mode)	V_{P1} used	1.8	–	V_{P1}	V
V_7	or switch open-circuit	V_{P2} used	1.8	–	5.5	V
V_7	mean signal AGC (AM mode)		–	–	0.8	V
I_7	switch current					
	at 0 V		–	–	−200	µA
	at V_{P1}		–	–	10	µA
	at V_{P2}	via a 2.2 kΩ series resistor	–	–	2.5	mA
Ripple rejection (note 13)						
AM/AF signal						
αRR	voltage ripple on V_P/ voltage ripple on output signal		30	40	–	dB
FM phase noise						
Δf(RMS)	intercarrier signal		–	10	20	Hz

Notes to the characteristics

1. Start of gain control (LOW IF input signal) at −3 dB intercarrier signal reduction at pin 12, AGC mode set to FM or −3 dB AF signal reduction at pin 6, AGC mode set to AM.
2. End of gain control (HIGH IF input signal) at +1 dB intercarrier signal expansion at pin 12, AGC mode set to FM or +1 dB AF signal expansion at pin 6, AGC mode set to AM.
3. Picture carrier (38.9 MHz) to sound carriers (33.4 MHz/33.158 MHz) ratio: 13/20 dB.

   IF input signal (picture carrier at sync pulse); $V_{1\text{-}16}$ = 10 mV (RMS). Transmitter mode: DSB.

   Reference for the (S + W)/W ratio (0 dB) corresponds to the sound modulation where f = 1 kHz and frequency deviation $\Delta f = \pm 50$ kHz.

   With reduced frequency deviation $\Delta f = \pm 27$ kHz and the (S + W)/W figures will decrease by 5.4 dB.
4. If the device is used only for the B/G standard (no AM), the capacitor at pin 5 can be omitted (pin 5 has to be disconnected). In this event the AGC will always operate as a peak signal AGC and is independent of the voltage at pin 7.

   The AM mode can also be used for the B/G standard, consequently standard switching is not required. However, the intercarrier level depends on the video modulation and the AF performance may decrease.

   When the IC is operated from a 12 V power supply pin 7 can be connected to a 12 V logic level via a 2.2 kΩ resistor.
5. LC reference circuit for the picture carrier (pins 8 and 9); 68 pF/0.247 µH; in series with 27 pF:

   Q loaded = 40 (Qo = 90); tuned to 38.9 MHz yields quadrature demodulation for the picture carrier which provides optimum video suppression at the intercarrier output (e.g. black-to-white jump of the video modulation.

   The series capacitor provides a notch at the sound carrier frequency in order to produce more attenuation for the sound carrier in the PC reference channel. The ratio of parallel to series capacitance depends on the ratio of picture to sound carrier frequency which has to be adapted to other TV transmission standards, if required, in accordance with the formula:

   $C_S = C_P(f_{PC}/f_{SC})^2 - C_P$

   Where:

   C_S = series capacitor

   C_P = parallel capacitor

   f_{PC} = picture carrier frequency

   f_{SC} = sound carrier frequency

   The result is an improved 'intercarrier buzz' in the stereo system B/G, particularly with 250 kHz video modulation (up to 10 dB improvement in sound Channel 2), or to suppress 350 kHz video modulated beat in the digitally modulated NICAM subcarrier.

   In order to optimize the AF signal performance, fine tuning to the optimum S/W at the sound Channel 2 may be achieved by a 250 kHz video modulated square wave.
6. Residual video AM is defined as:

   m = (A-B)/A

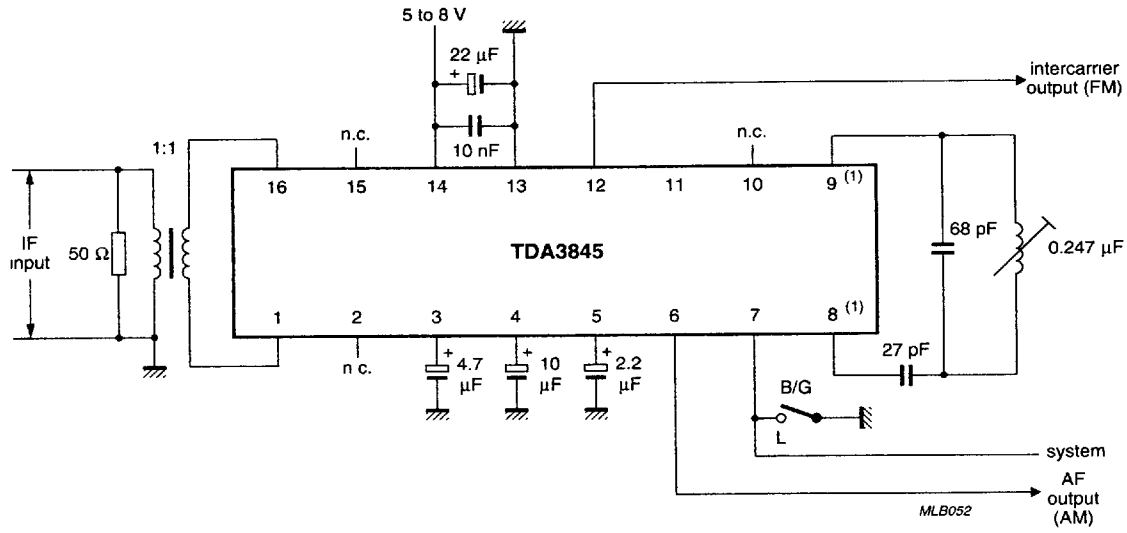
   A = intercarrier level at sync pulse

   B = intercarrier level at 100% white video modulation
7. If higher AC output current is required an external resistor must be be connected between the output pin and ground in order to increase the bias current of the emitter follower. The permissable maximum DC output current must not be exceeded.

8. For all S/N measurements the used vision IF modulator must conform to the following:

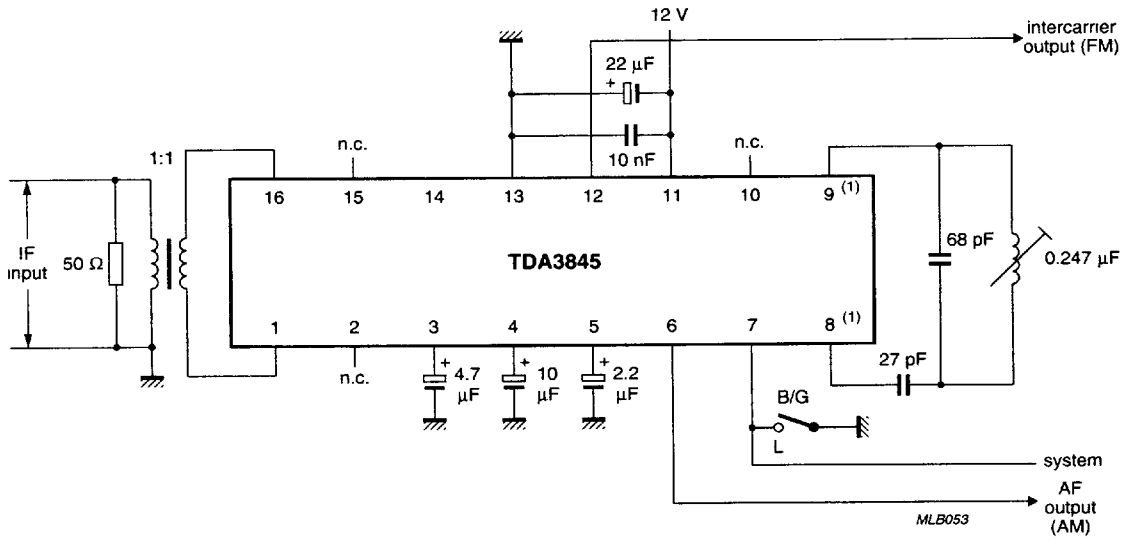
   Incidental phase modulation for black-to-white jump should be less than 0.5 degrees. Intercarrier performance, measured with the television demodulator AMF2 (intercarrier mode weighted S/N ratio) better than 60 dB for 6 kHz sinewave black-to-white video modulation. Weighted S/N ratio of the demodulated intercarrier signals in accordance with CCIR 468-3, measured with de-emphasis of 50 µs.

   The indicated (S + W)/W ratio X/Y concerns the sound channels 1 and 2 that means demodulated intercarrier signals of 5.5 and 5.74 MHz respectively.
9. Sound carrier frequency in the range of 30 to 40 MHz modulated with f = 1 kHz and a modulation depth of 80%. IF input signal (sound carrier) $V_{1\text{-}16}$ = 10 mV (RMS).
10. The capacitor at pin 4 can be omitted, however, the (S + W)/W figure for the AM sound (standard L) will be up to 8 dB worse in the IF voltage range 1 mV to 100 mV.
11. When the supply at V_{P2} = 12 V the performance will be comparable with the performance when V_{P1} = 5 to 8 V. The power supply pin that is not in use should be disconnected.
12. The maximum value given as minimum 120 kHz and typical 700 kHz.
13. Voltage ripple < 200 mV (p-p) at 70 Hz.



(1) See note 5 to the characteristics.

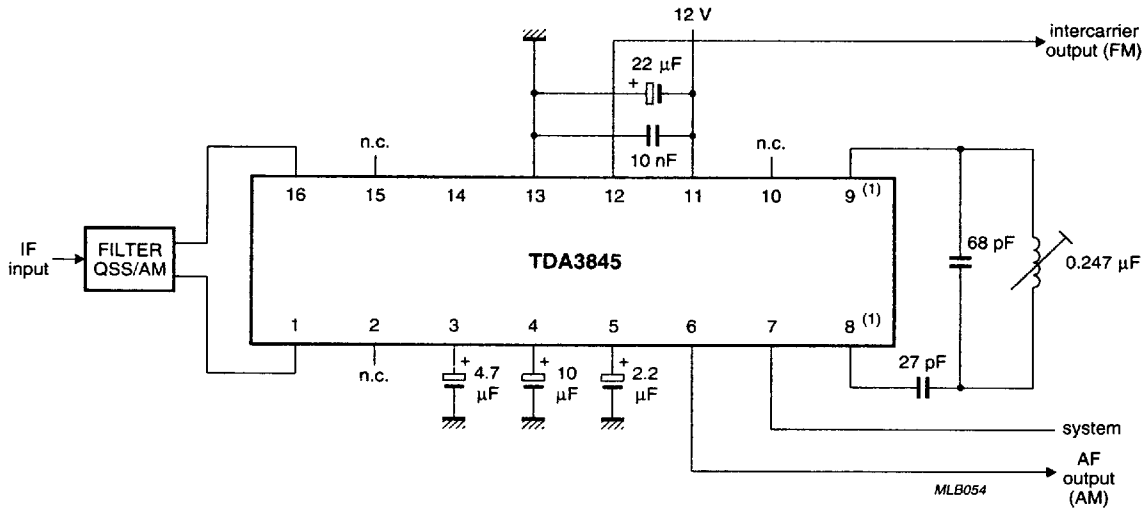
Fig.3 Test circuit for the +5 V supply.



(1) See note 5 to the characteristics.

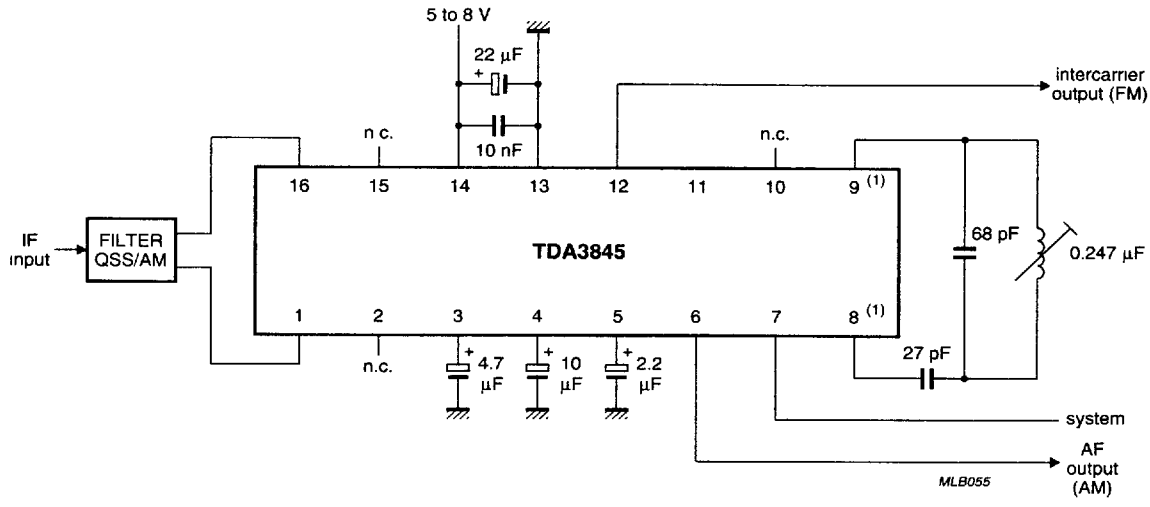
Fig.4 Test circuit for the +12 V supply; not for TDA3845T.

APPLICATION INFORMATION



(1) See note 5 to the characteristics.

Fig.5 Application diagram for the +12 V supply; not for TDA3845T.



(1) See note 5 to the characteristics.

Fig.6 Application diagram for the +5 V supply.

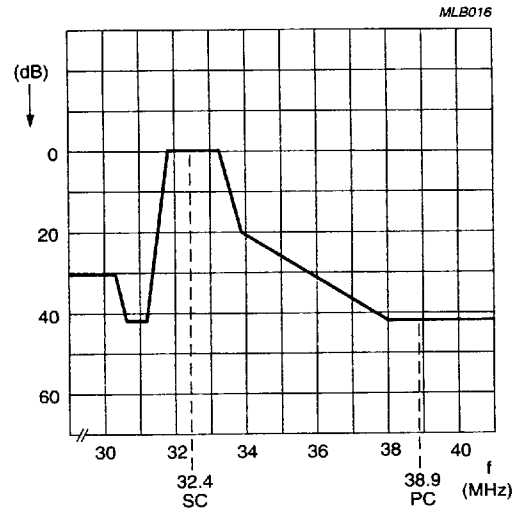


Fig.7 AM IF filter for standard L.

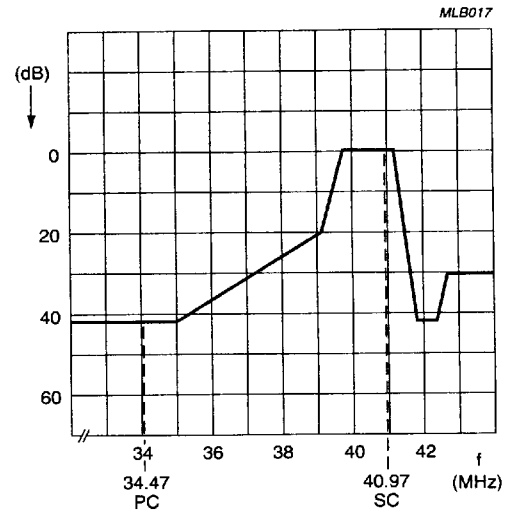


Fig.8 AM IF filter for standard L-accent.

IF filter proposal for AM sound (see Figs 7 and 8)

With an IF filter in accordance with this proposal, the video buzz suppression on the audio output is better than 50 dB (in accordance with CCIR 468-3, m = 54%) for the worst case video modulation with 6 kHz sinewave black-to-white.

Note to figures 7 and 8.

Where SC = sound carrier and PC = picture carrier.

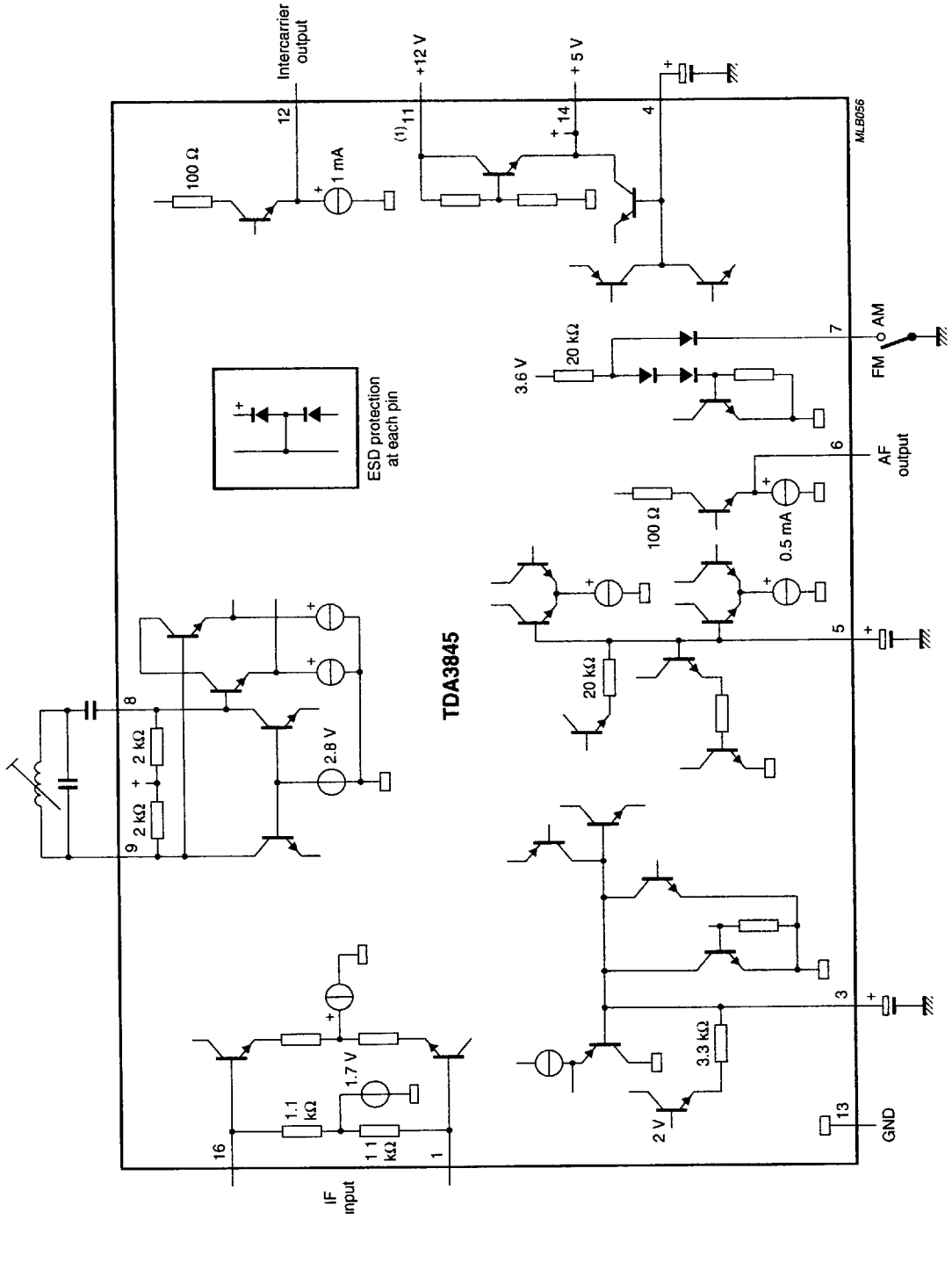
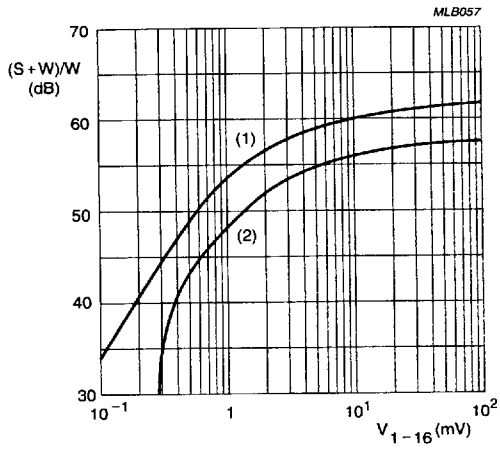


Fig.9 Internal pin circuitry.

(1) Not for TDA3845T, pin 11 not connected.



Picture modulation; 6 kHz sinewave.
Intercarrier signal; sound Channel 1 = 5.5 MHz, sound Channel 2 = 5.74 MHz.

Fig.10 Response curve of the signal-to-weighted noise ratio of the demodulated intercarrier signal.

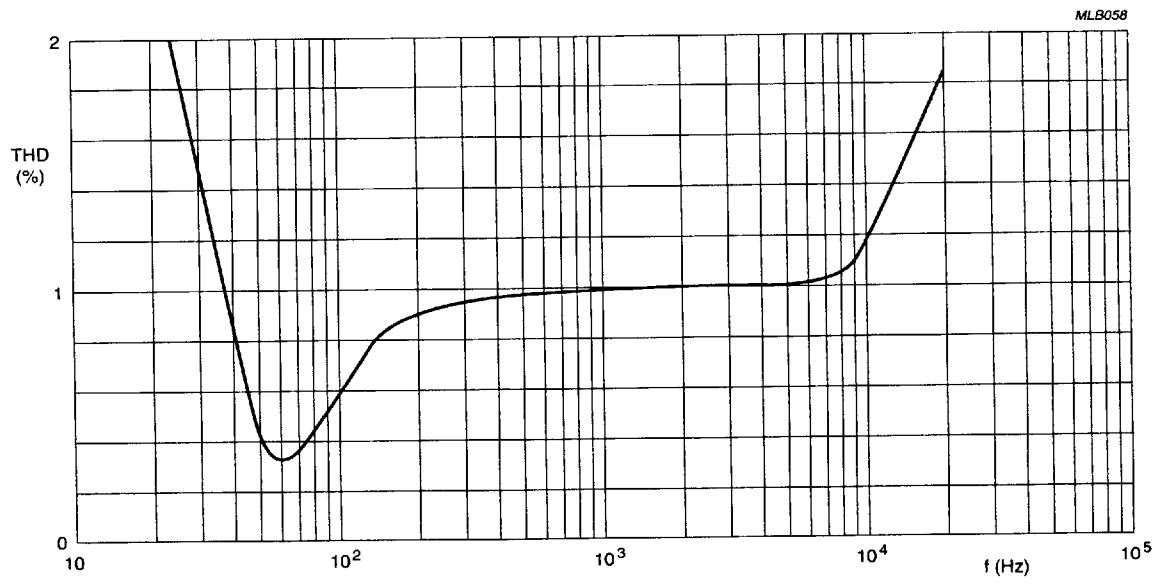
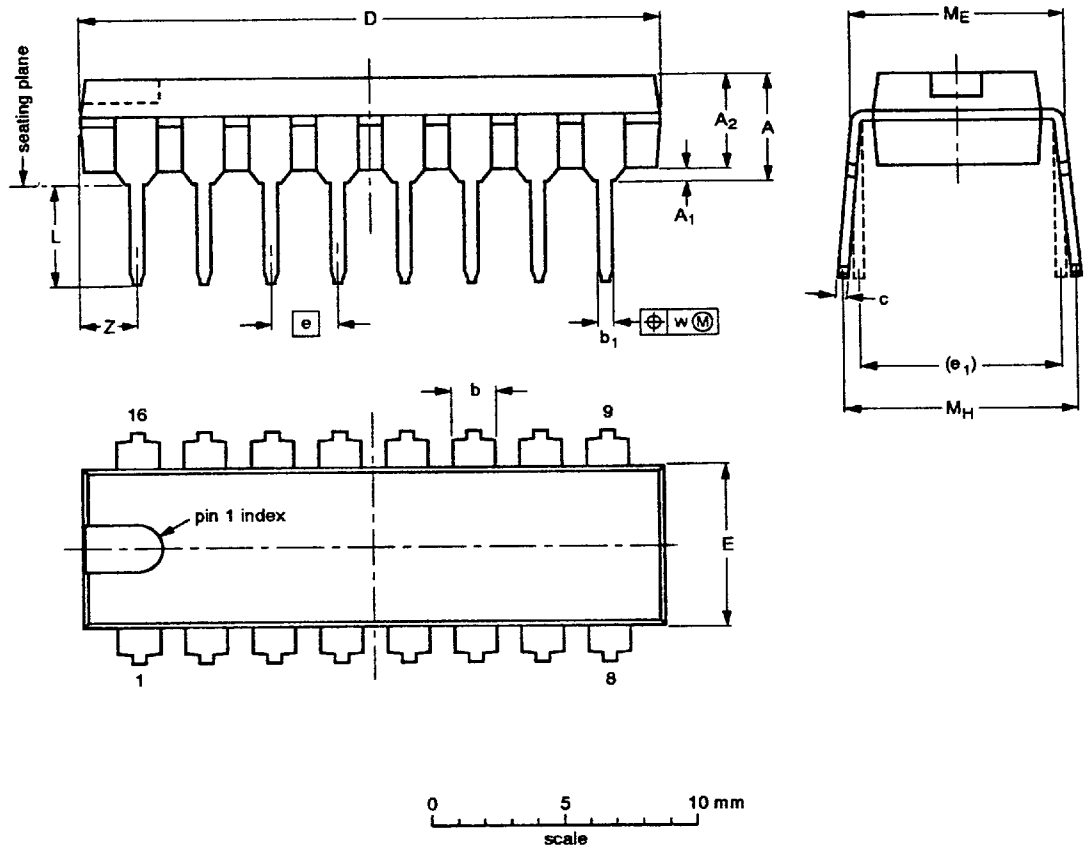


Fig.11 Response curve for the total harmonic distortion of the AM signal.

Package outlines

DIP16: plastic dual in-line package; 16 leads (300 mil); long body — SOT38-1



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A_1 min.	A_2 max.	b	b_1	c	D (1)	E (1)	e	e_1	L	M_E	M_H	w	Z (1) max.
mm	4.7	0.51	3.7	1.40 1.14	0.53 0.38	0.32 0.23	21.8 21.4	6.48 6.20	2.54	7.62	3.9 3.4	8.25 7.80	9.5 8.3	0.254	2.2
inches	0.19	0.020	0.15	0.055 0.045	0.021 0.015	0.013 0.009	0.86 0.84	0.26 0.24	0.10	0.30	0.15 0.13	0.32 0.31	0.37 0.33	0.01	0.087

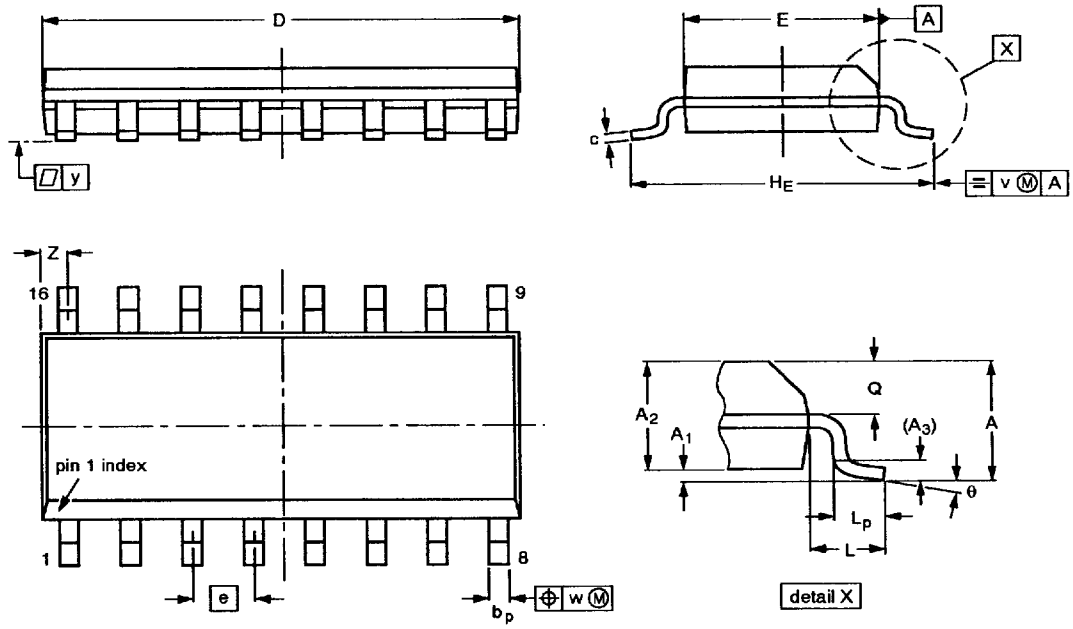
Note

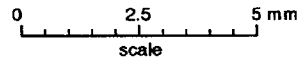
1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT38-1	050G09	MO-001AE				~~92-10-02~~ 95-01-19

Package outlines

SO16: plastic small outline package; 16 leads; body width 3.9 mm — SOT109-1





DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(1)}$	e	H_E	L	L_p	Q	v	w	y	$Z^{(1)}$	θ
mm	1.75	0.25 0.10	1.45 1.25	0.25	0.49 0.36	0.25 0.19	10.0 9.8	4.0 3.8	1.27	6.2 5.8	1.05	1.0 0.4	0.7 0.6	0.25	0.25	0.1	0.7 0.3	8° 0°
inches	0.069	0.0098 0.0039	0.057 0.049	0.01	0.019 0.014	0.0098 0.0075	0.39 0.38	0.16 0.15	0.050	0.24 0.23	0.041	0.039 0.016	0.028 0.020	0.01	0.01	0.004	0.028 0.012	

Note

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT109-1	076E07S	MS-012AC				~~91-08-13~~ 95-01-23