

DATA SHEET

TDA1576

FM/IF amplifier/demodulator circuit

Product specification
Supersedes data of March 1985
File under Integrated Circuits, IC01

1998 Nov 18

FM/IF amplifier/demodulator circuit

TDA1576

FEATURES

- Symmetrical limiting IF amplifier
- Symmetrical quadrature demodulator
- Internal muting circuit
- Symmetrical AFC output
- Field strength indication output
- Detune detector
- Reference voltage output
- Electronic smoothing of the supply voltage
- Standby on/off switching circuit.

GENERAL DESCRIPTION

The TDA1576 is a monolithic integrated FM/IF amplifier circuit for use in mono and stereo FM-receivers of car radios or home sets.

QUICK REFERENCE DATA

$f_o = 10.7$ MHz; $\Delta f = \pm 22.5$ kHz; $f_m = 400$ Hz; $Q_L = 20$; 50 μ s de-emphasis.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_P	supply voltage (pin 1)		7.5	–	20	V
I_P	supply current	$V_P = 8.5$ V	–	16	–	mA
		$V_P = 15$ V	–	18	–	mA
$V_{iIF(rms)}$	input sensitivity (RMS value)	–3 dB before limiting	–	22	–	μ V
		$\frac{S+N}{N} = 26$ dB	–	8	–	μ V
		$\frac{S+N}{N} = 46$ dB	–	35	–	μ V
$V_{oAF(rms)}$	AF output voltage (RMS value)	$V_P = 8.5$ V	–	67	–	mV
		$V_P = 15$ V	–	135	–	mV
THD	total harmonic distortion					
	single tuned circuit		–	0.1	–	%
	two tuned circuits		–	0.02	–	%
$\frac{S+N}{N}$	signal plus noise-to-noise ratio	$V_{iIF} > 1$ mV (RMS); $V_P = 8.5$ V	–	76	–	dB
		$V_{iIF} > 1$ mV (RMS); $V_P = 15$ V	–	80	–	dB
α_{AM}	AM suppression		–	50	–	dB
Δf_i	AFC offset drift		–	± 3	± 6	kHz
ΔV_i	field strength indication		–	90	–	dB
I_L	permissible indicator load current		–	–	2	mA
T_{amb}	operating ambient temperature		–30	–	+80	$^{\circ}$ C

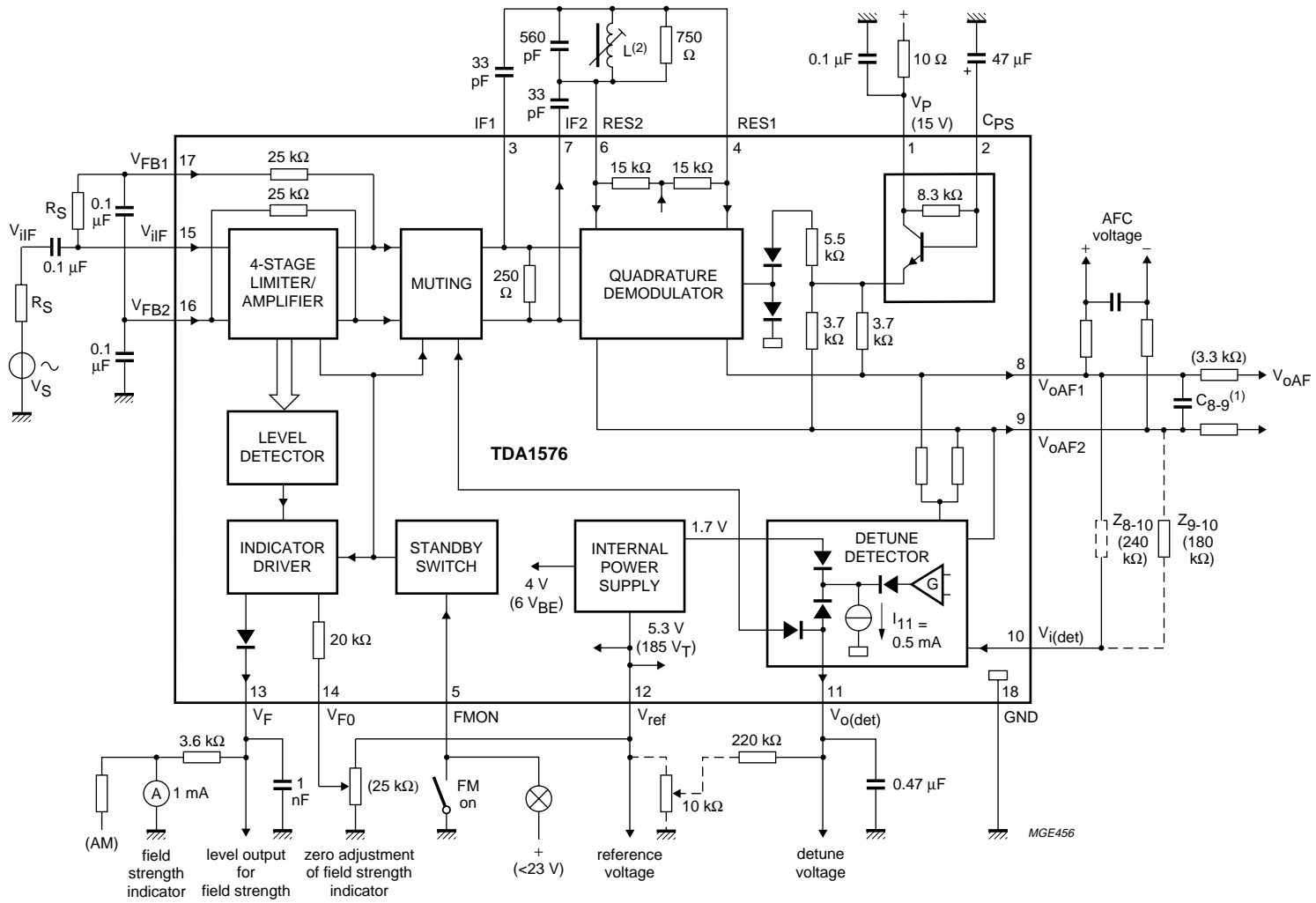
ORDERING INFORMATION

TYPE NUMBER	PACKAGE		
	NAME	DESCRIPTION	VERSION
TDA1576	DIP18	plastic dual in-line package; 18 leads (300 mil)	SOT102-1

FM/IF amplifier/demodulator circuit

TDA1576

BLOCK DIAGRAM



(1) For 50 μs de-emphasis: $C_{8-9} = 6.8 \text{ nF}$; for stereo operation $C_{8-9} = 56 \text{ pF}$.

(2) $L = 0.38 \mu\text{H}$; $Q_o = 70$; $Q_L = 20$; adjusted to minimum 2nd harmonic distortion (d_2); at $V_i = 1 \text{ mV}$; coil: 6 turns CuL (0.25 mm) on coil former KAN (C).

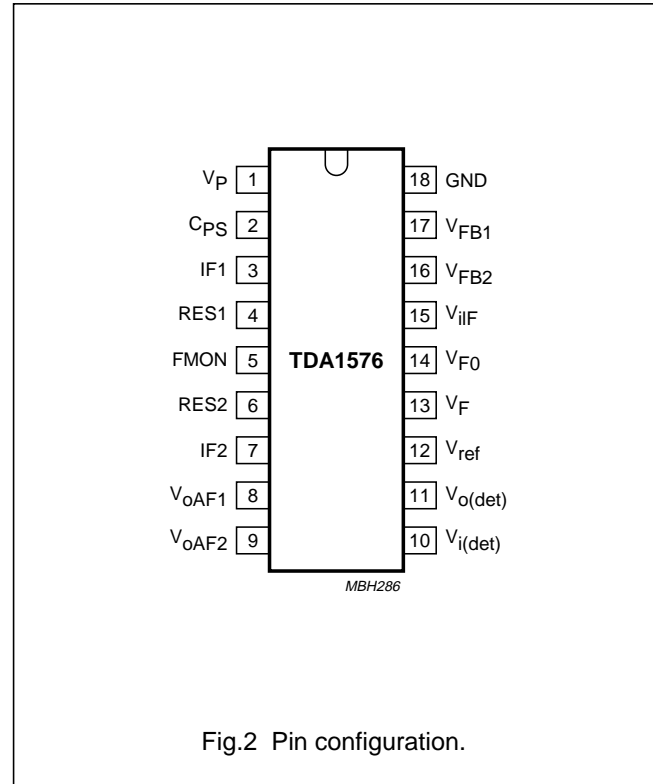
Fig.1 Block diagram and test circuit.

FM/IF amplifier/demodulator circuit

TDA1576

PINNING

SYMBOL	PIN	DESCRIPTION
V_P	1	positive supply voltage
C_{PS}	2	smoothing capacitor of power supply
IF1	3	IF signal to resonant circuit
RES1	4	resonant circuit input 1
FMON	5	FM-ON, standby switch
RES2	6	resonant circuit input 2
IF2	7	IF signal to resonant circuit
V_{oAF1}	8	AF output voltage 1 (0° phase)
V_{oAF2}	9	AF output voltage 2 (180° phase)
$V_{i(det)}$	10	detune detector input voltage for external audio reference
$V_{o(det)}$	11	detune detector output voltage
V_{ref}	12	reference voltage output
V_F	13	level output for field strength
V_{F0}	14	zero adjust voltage for field strength
V_{iIF}	15	FM/IF input signal voltage
V_{FB2}	16	DC feedback 2
V_{FB1}	17	DC feedback 1
GND	18	ground (0 V)



FM/IF amplifier/demodulator circuit

TDA1576

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_P	supply voltage (pin 1)	0	23	V
V_2	voltage on pin 2	0	V_P	V
$V_{5, 14}$	voltage on pins 5 and 14	0	23	V
V_{12}	voltage on pin 12	0	7	V
V_{13}	voltage on pin 13	0	6	V
P_{tot}	total power dissipation	0	800	mW
T_{stg}	storage temperature	-55	+150	°C
T_{amb}	operating ambient temperature	-30	+80	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j-a}$	thermal resistance from junction to ambient in free air	80	K/W

FM/IF amplifier/demodulator circuit

TDA1576

CHARACTERISTICS

$V_P = 7.5$ to 20 V; $f_{IF} = 10.7$ MHz; $R_S = 60$ Ω ; $f_m = 400$ Hz with $\Delta f = \pm 22.5$ kHz; 50 μ s de-emphasis ($C_{8-9} = 6.8$ nF); $T_{amb} = 25$ °C and measurements taken in Fig.1; unless otherwise specified. The demodulator circuit is adjusted at minimum second harmonic distortion for $V_{iIF} = 1$ mV and a deviation $\Delta f = \pm 75$ kHz.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Supply						
I_P	supply current without load	$I_{12} = I_{13} = 0$; $V_P = 8.5$ V	10	16	23	mA
		$I_{12} = I_{13} = 0$; $V_P = 15$ V	12	18	25	mA
IF amplifier/detector						
$V_{iIF(rms)}$	input sensitivity (RMS value; pin 15)	-3 dB before limiting	-	22	30	μ V
		$\frac{S+N}{N} = 26$ dB	-	8	-	μ V
		$\frac{S+N}{N} = 46$ dB	-	35	-	μ V
$V_{oIF(p-p)}$	output voltage at pins 3 and 7 (peak-to-peak value)	$Z_{3,7} = 10$ pF parallel to 1 M Ω	-	680	-	mV
R_{3-7}	output resistance		-	250	-	Ω
Z_{4-6}	input impedance		-	30	-	k Ω
C_{4-6}	input capacitance		-	1	-	pF
$R_{8,9}$	output resistance		-	3.7	-	k Ω
$V_{8,9}$	DC output voltage	$V_P = 8.5$ V	-	5.5	-	V
		$V_P = 15$ V	-	9.8	-	V
$V_{oAF(rms)}$	AF output voltage (RMS value)	$Q_L = 20$; $V_P = 8.5$ V	60	67	75	mV
		$Q_L = 20$; $V_P = 15$ V	120	135	150	mV
THD	total harmonic distortion single tuned circuit two tuned circuits	$Q_L = 20$	-	0.1	-	%
			-	0.02	-	%
$\frac{S+N}{N}$	signal plus noise-to-noise ratio (pins 8 and 9)	$B = 250$ Hz to 15 kHz; $V_i > 1$ mV (RMS); $V_P = 8.5$ V	-	76	-	dB
		$B = 250$ Hz to 15 kHz; $V_i > 1$ mV (RMS); $V_P = 15$ V	-	80	-	dB
α_{AM}	AM suppression	$V_{iIF} = 10$ mV; FM: 70 Hz; $\Delta f = \pm 22.5$ kHz; AM: 1 kHz; $m = 30\%$; note 1	-	54	-	dB
V_{iIF}	IF input voltage	$\alpha > 40$ dB	0.5	-	500	mV
α_{100}	hum suppression at $f = 100$ Hz	$V_P = 100$ mV (RMS); $C_2 = 47$ μ F	43	48	-	dB
$\frac{\Delta V_{8-9}}{\Delta f_0}$	AFC tuning slope at $Q_L = 20$	$V_P = 8.5$ V	-	8.5	-	mV/kHz
		$V_P = 15$ V	-	17	-	mV/kHz

FM/IF amplifier/demodulator circuit

TDA1576

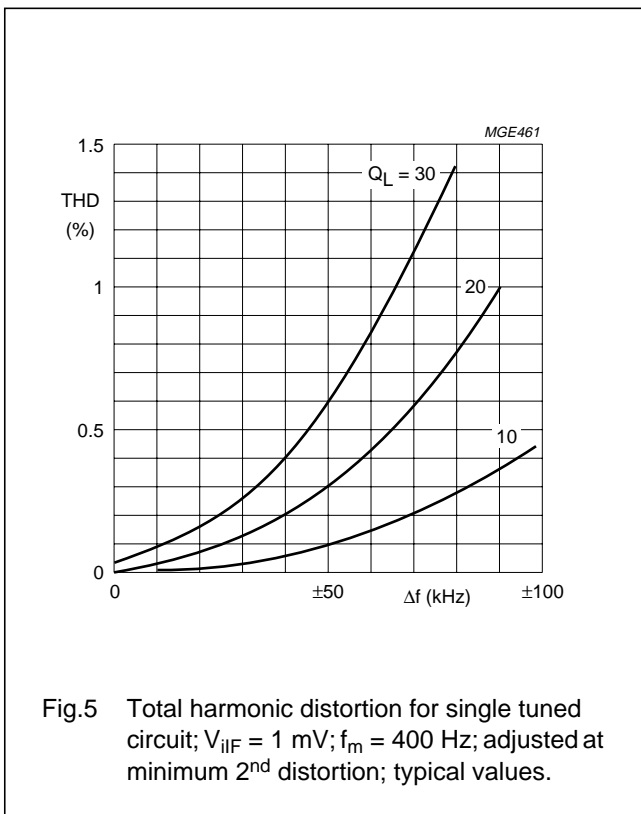
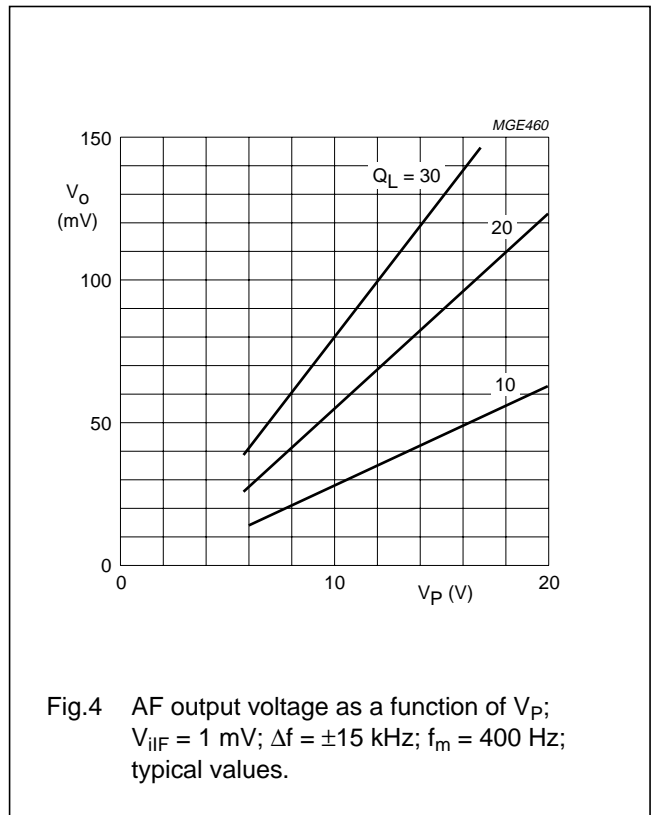
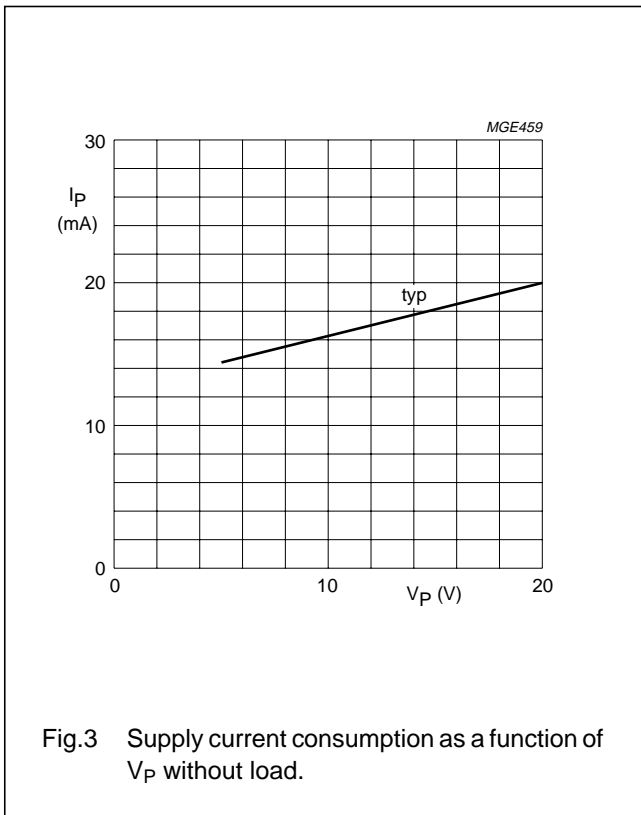
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
ΔV_{8-9}	AFC offset voltages at $Q_L = 20$	$V_i = 1 \text{ mV}; V_P = 8.5 \text{ V}$	–	–	± 100	mV
		$V_i = 1 \text{ mV}; V_P = 15 \text{ V}$	–	–	± 200	mV
		$V_i = 30 \mu\text{V to } 500 \text{ mV}$ ($V_{\text{ref}} = 1 \text{ mV}$ and muting); $V_P = 8.5 \text{ V}$	–	± 25	± 50	mV
		$V_i = 30 \mu\text{V to } 500 \text{ mV}$ ($V_{\text{ref}} = 1 \text{ mV}$ and muting); $V_P = 15 \text{ V}$	–	± 50	± 100	mV
Field strength output; see Fig.7						
V_i	indicator sensitivity	$I_{14} = 0$	0.02	–	600	mV
V_{13}	output voltage	$R_{13} = 3.6 \text{ k}\Omega; I_{14} = 0$ $V_{\text{ilF}} = 0$	–	0	200	mV
		$V_{\text{ilF}} = 250 \text{ mV (RMS)}$	3.2	3.6	4.1	V
I_{13}	available output current		–2	–	–	mA
V_{13}	reverse voltage at output for FM off	$V_5 > 3.5 \text{ V}$	5	–	–	V
Detuning detector						
I_{10}	quiescent input current	$V_{10-9} = 0$	–	20	100	nA
V_{11}	output voltage		1.8	–	5.0	V
I_{11}	maximum output current		0.35	0.5	0.65	mA
G_v	voltage gain	$\Delta V_{11}/\Delta(\pm V_{10-9})$ at $I_{11} = 0.25 \text{ mA}; V_P = 15 \text{ V}$	–	3.3	–	
V_{10-9}	input offset voltage (pin 10)	$V_{11} = 2.5 \text{ V}$	–	20	–	mV
Reference voltage						
V_{ref}	reference voltage (pin 12)	$I_{12} = -1 \text{ mA}; V_P = 8.5 \text{ V}$	–	5.1	–	V
		$I_{12} = -1 \text{ mA}; V_P = 15 \text{ V}$	–	5.3	–	V
I_{12}	available output current		–	–2.5	–	mA
Standby switch						
V_5	input voltage for FM on		–	–	2	V
	input voltage for FM off		3.5	–	–	V
I_5	input current for FM on		–	–	–100	μA

Note

1. Simultaneously measured.

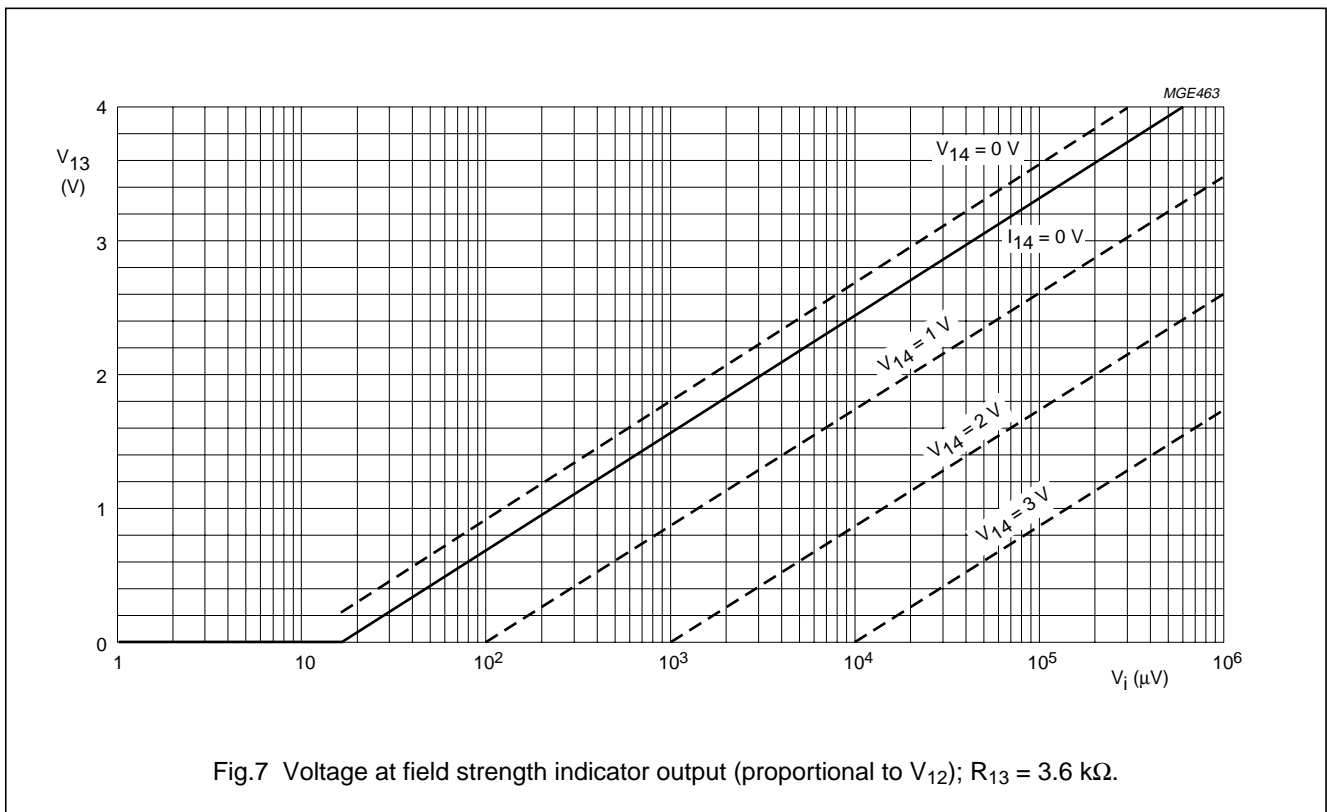
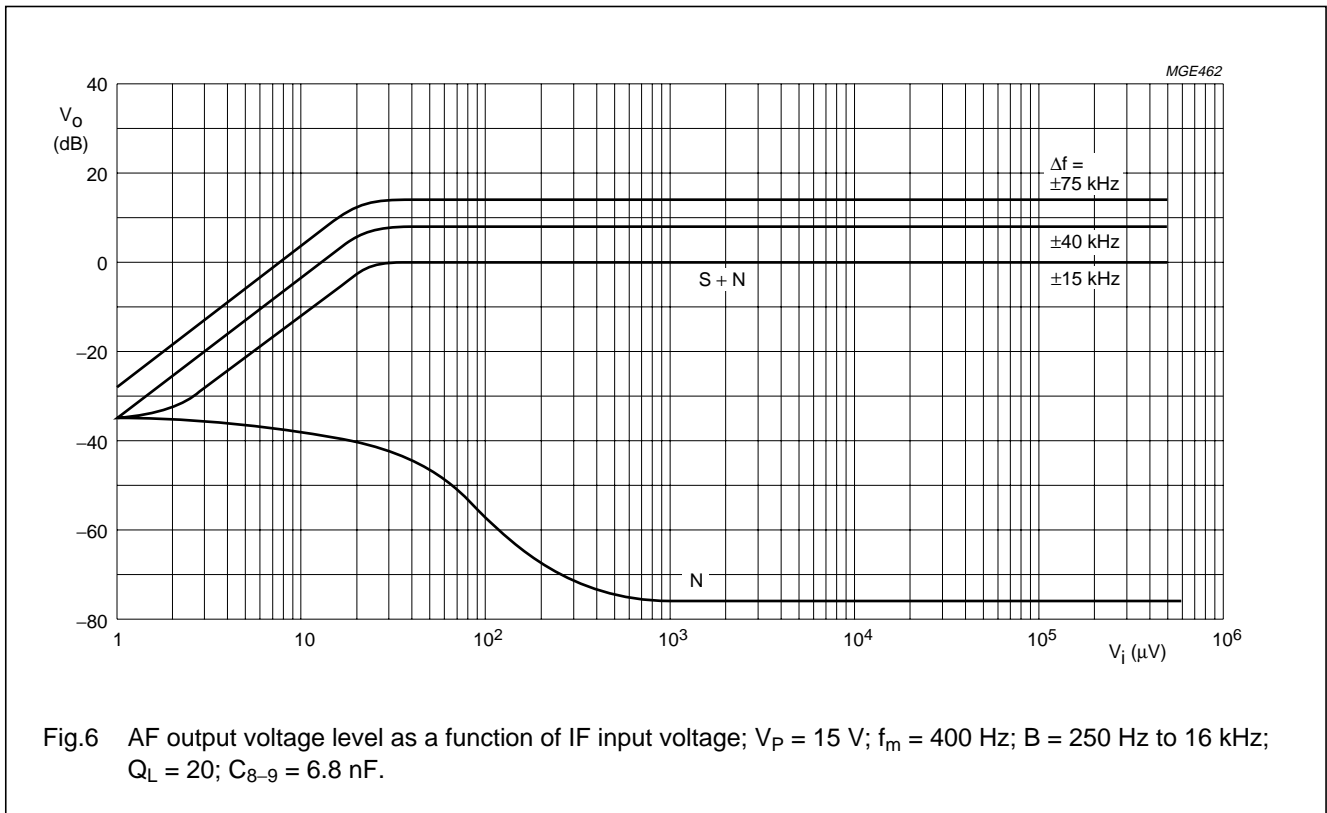
FM/IF amplifier/demodulator circuit

TDA1576



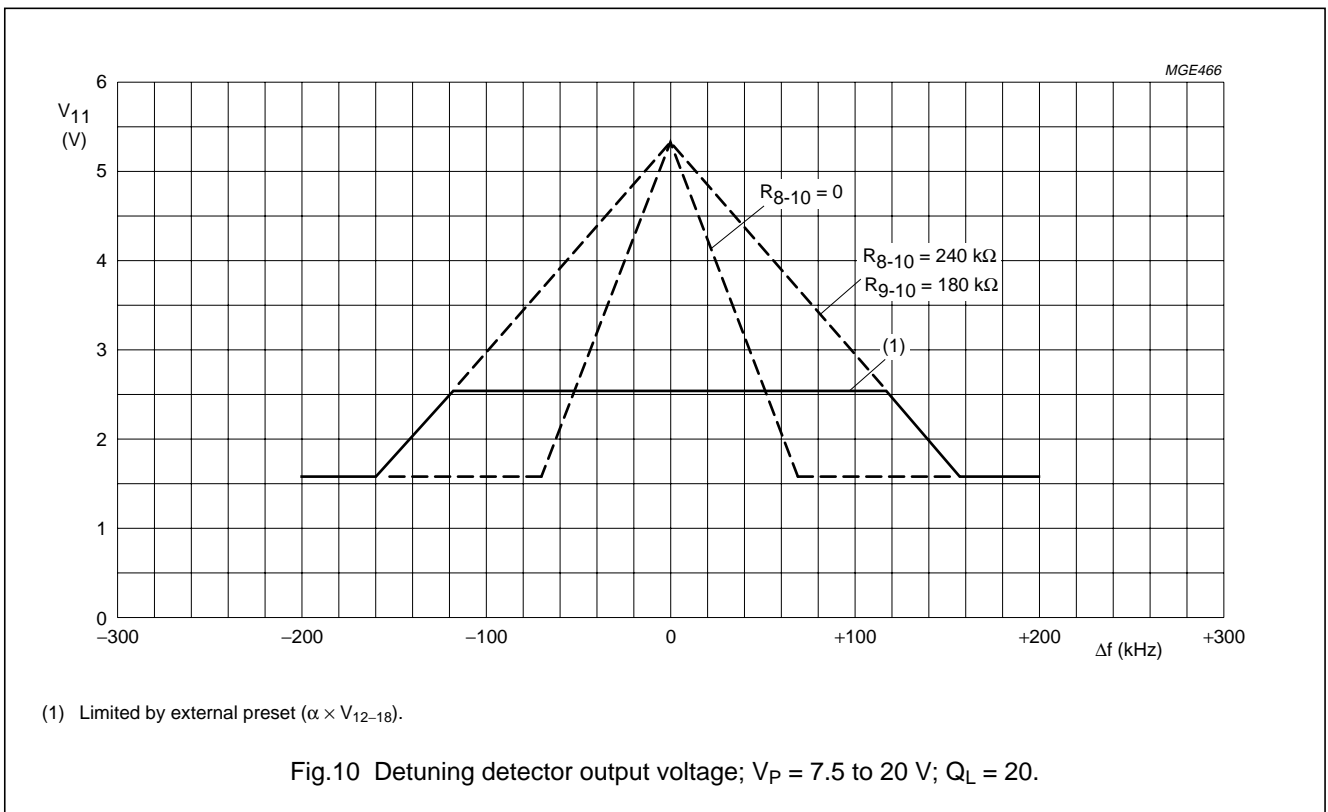
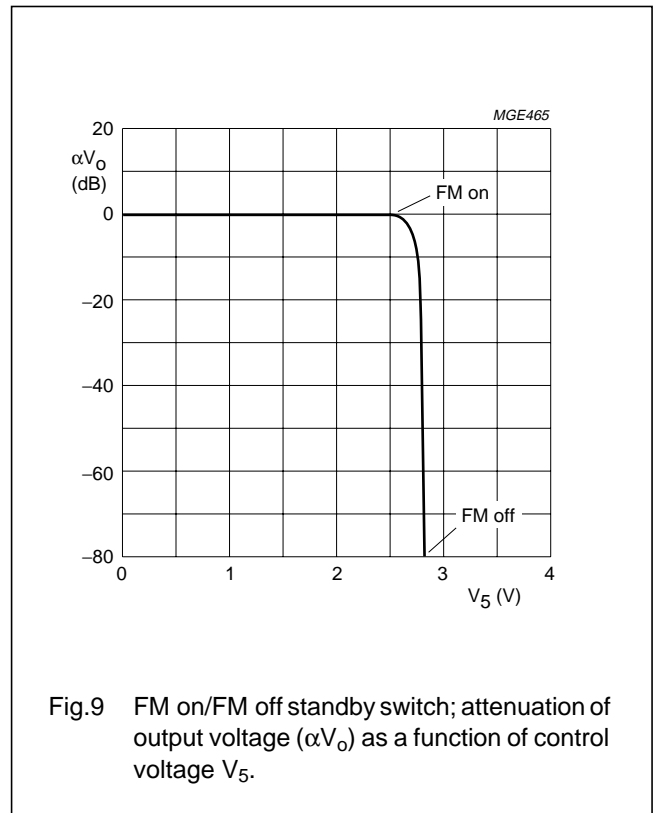
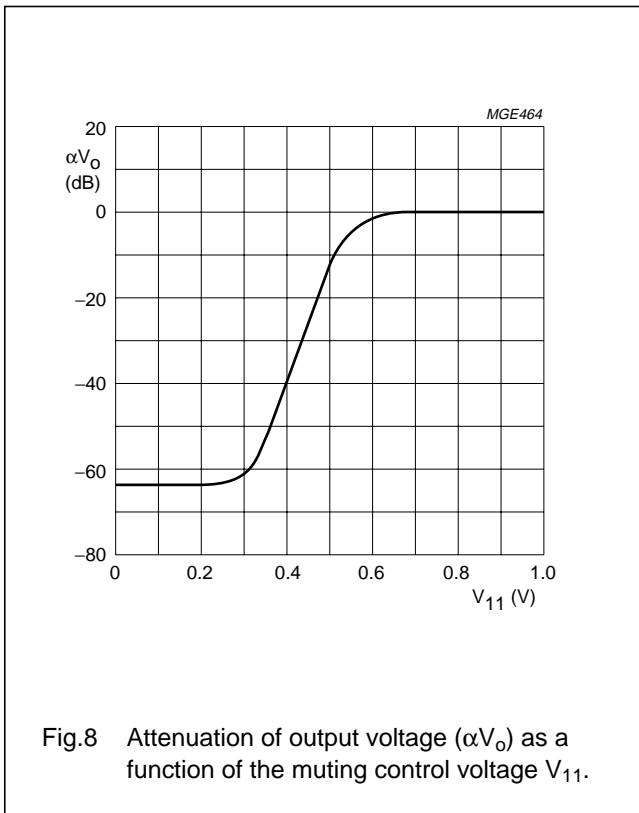
FM/IF amplifier/demodulator circuit

TDA1576



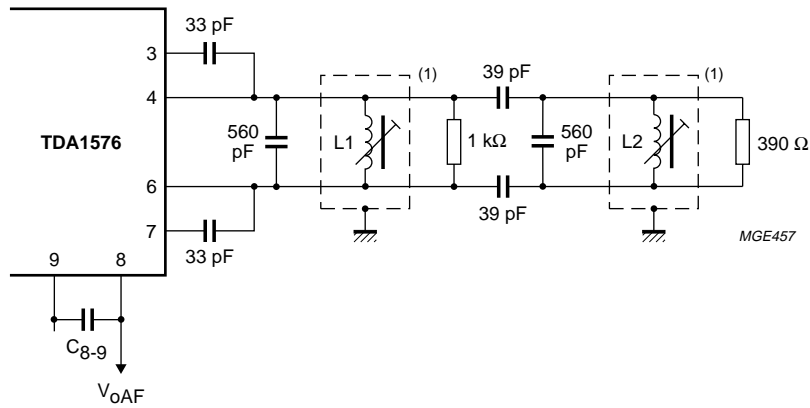
FM/IF amplifier/demodulator circuit

TDA1576



FM/IF amplifier/demodulator circuit

TDA1576



Adjustment of the demodulator circuit is obtained with an IF signal which is higher than the 3 dB limiting level; L2 should be short-circuited or detuned; L1 should be adjusted to minimum d_2 distortion, and then L2 to minimum d_2 distortion.

(1) Coil data: L1 = L2 = 0.38 μ H; Q_o = 70; coil former KAN (C).

Fig.11 An example of the TDA1576 when using a demodulator with two tuned circuits.

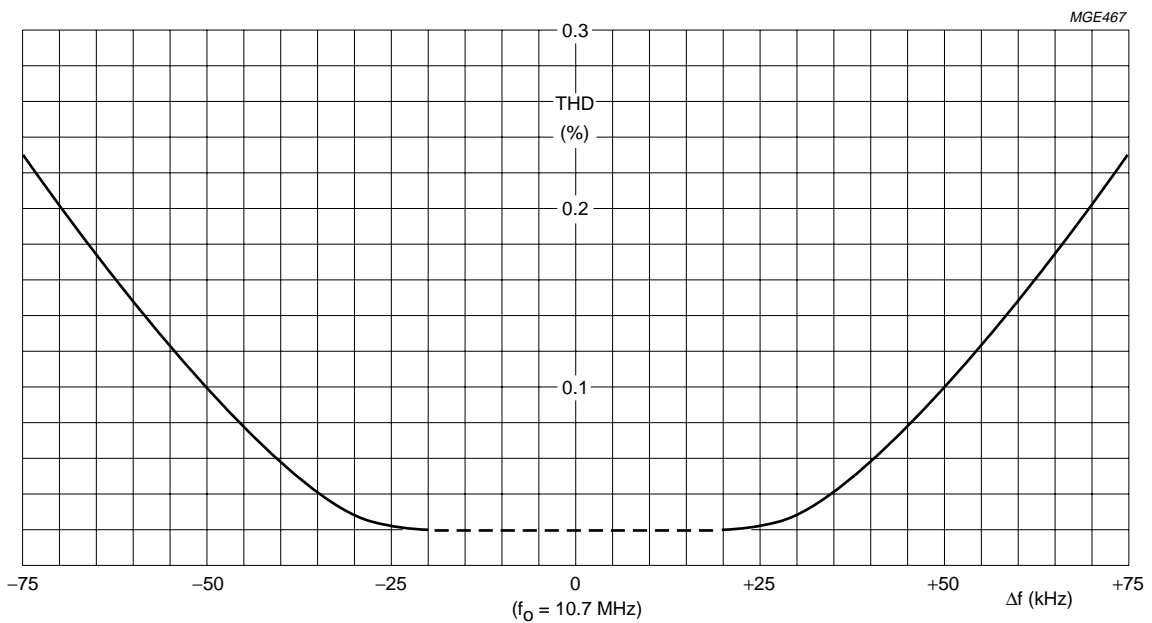
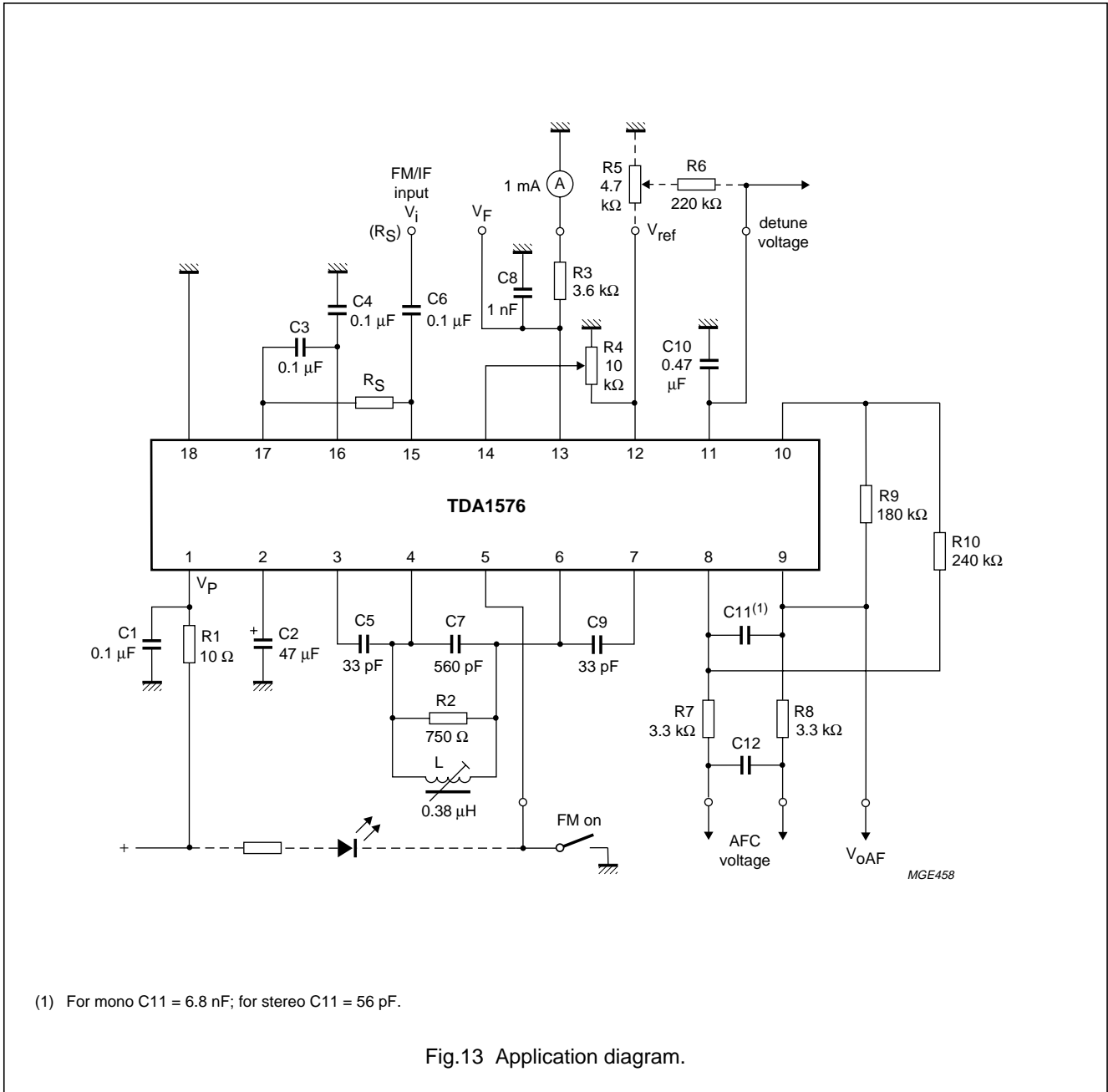


Fig.12 Total harmonic distortion as a function of detuning; $f_m = 400$ Hz; $C_{8-9} = 6.8$ nF; $\Delta f = \pm 75$ kHz; $V_o = 330$ mV for a frequency deviation $\Delta f = \pm 75$ kHz.

FM/IF amplifier/demodulator circuit

TDA1576

APPLICATION INFORMATION



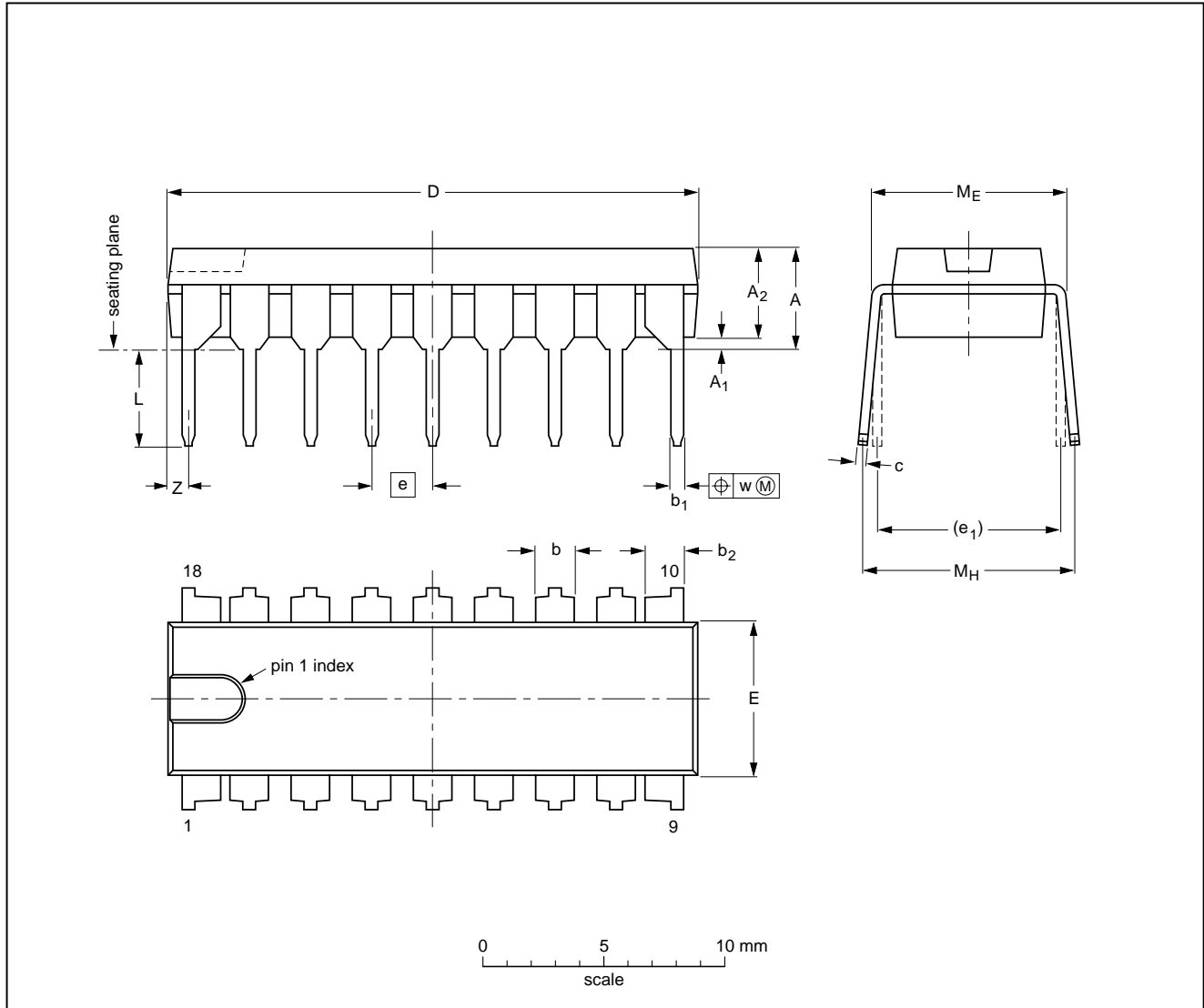
FM/IF amplifier/demodulator circuit

TDA1576

PACKAGE OUTLINE

DIP18: plastic dual in-line package; 18 leads (300 mil)

SOT102-1



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

UNIT	A max.	A ₁ min.	A ₂ max.	b	b ₁	b ₂	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	1.40 1.14	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	0.85
inches	0.19	0.020	0.15	0.055 0.044	0.021 0.015	0.055 0.044	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	0.033

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			
SOT102-1						93-10-14 95-01-23

FM/IF amplifier/demodulator circuit

TDA1576

SOLDERING

Introduction to soldering through-hole mount packages

This text gives a brief insight to wave, dip and manual soldering. A more in-depth account of soldering ICs can be found in our "Data Handbook IC26; Integrated Circuit Packages" (document order number 9398 652 90011).

Wave soldering is the preferred method for mounting of through-hole mount IC packages on a printed-circuit board.

Soldering by dipping or by solder wave

The maximum permissible temperature of the solder is 260 °C; solder at this temperature must not be in contact with the joints for more than 5 seconds.

The total contact time of successive solder waves must not exceed 5 seconds.

The device may be mounted up to the seating plane, but the temperature of the plastic body must not exceed the specified maximum storage temperature ($T_{stg(max)}$). If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature within the permissible limit.

Manual soldering

Apply the soldering iron (24 V or less) to the lead(s) of the package, either below the seating plane or not more than 2 mm above it. If the temperature of the soldering iron bit is less than 300 °C it may remain in contact for up to 10 seconds. If the bit temperature is between 300 and 400 °C, contact may be up to 5 seconds.

Suitability of through-hole mount IC packages for dipping and wave soldering methods

PACKAGE	SOLDERING METHOD	
	DIPPING	WAVE
DBS, DIP, HDIP, SDIP, SIL	suitable	suitable ⁽¹⁾

Note

- 1. For SDIP packages, the longitudinal axis must be parallel to the transport direction of the printed-circuit board.

FM/IF amplifier/demodulator circuit

TDA1576

DEFINITIONS

Data sheet status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

LIFE SUPPORT APPLICATIONS

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips for any damages resulting from such improper use or sale.

Philips Semiconductors – a worldwide company

Argentina: see South America

Australia: 34 Waterloo Road, NORTH RYDE, NSW 2113, Tel. +61 2 9805 4455, Fax. +61 2 9805 4466

Austria: Computerstr. 6, A-1101 WIEN, P.O. Box 213, Tel. +43 160 1010, Fax. +43 160 101 1210

Belarus: Hotel Minsk Business Center, Bld. 3, r. 1211, Volodarski Str. 6, 220050 MINSK, Tel. +375 172 200 733, Fax. +375 172 200 773

Belgium: see The Netherlands

Brazil: see South America

Bulgaria: Philips Bulgaria Ltd., Energoproject, 15th floor, 51 James Bourchier Blvd., 1407 SOFIA, Tel. +359 2 689 211, Fax. +359 2 689 102

Canada: PHILIPS SEMICONDUCTORS/COMPONENTS, Tel. +1 800 234 7381

China/Hong Kong: 501 Hong Kong Industrial Technology Centre, 72 Tat Chee Avenue, Kowloon Tong, HONG KONG, Tel. +852 2319 7888, Fax. +852 2319 7700

Colombia: see South America

Czech Republic: see Austria

Denmark: Prags Boulevard 80, PB 1919, DK-2300 COPENHAGEN S, Tel. +45 32 88 2636, Fax. +45 31 57 0044

Finland: Sinikalliontie 3, FIN-02630 ESPOO, Tel. +358 9 615800, Fax. +358 9 61580920

France: 51 Rue Carnot, BP317, 92156 SURESNES Cedex, Tel. +33 1 40 99 6161, Fax. +33 1 40 99 6427

Germany: Hammerbrookstraße 69, D-20097 HAMBURG, Tel. +49 40 23 53 60, Fax. +49 40 23 536 300

Greece: No. 15, 25th March Street, GR 17778 TAVROS/ATHENS, Tel. +30 1 4894 339/239, Fax. +30 1 4814 240

Hungary: see Austria

India: Philips INDIA Ltd, Band Box Building, 2nd floor, 254-D, Dr. Annie Besant Road, Worli, MUMBAI 400 025, Tel. +91 22 493 8541, Fax. +91 22 493 0966

Indonesia: PT Philips Development Corporation, Semiconductors Division, Gedung Philips, Jl. Buncit Raya Kav.99-100, JAKARTA 12510, Tel. +62 21 794 0040 ext. 2501, Fax. +62 21 794 0080

Ireland: Newstead, Clonskeagh, DUBLIN 14, Tel. +353 1 7640 000, Fax. +353 1 7640 200

Israel: RAPAC Electronics, 7 Kehilat Saloniki St, PO Box 18053, TEL AVIV 61180, Tel. +972 3 645 0444, Fax. +972 3 649 1007

Italy: PHILIPS SEMICONDUCTORS, Piazza IV Novembre 3, 20124 MILANO, Tel. +39 2 6752 2531, Fax. +39 2 6752 2557

Japan: Philips Bldg 13-37, Kohnan 2-chome, Minato-ku, TOKYO 108-8507, Tel. +81 3 3740 5130, Fax. +81 3 3740 5077

Korea: Philips House, 260-199 Itaewon-dong, Yongsan-ku, SEOUL, Tel. +82 2 709 1412, Fax. +82 2 709 1415

Malaysia: No. 76 Jalan Universiti, 46200 PETALING JAYA, SELANGOR, Tel. +60 3 750 5214, Fax. +60 3 757 4880

Mexico: 5900 Gateway East, Suite 200, EL PASO, TEXAS 79905, Tel. +9-5 800 234 7381

Middle East: see Italy

Netherlands: Postbus 90050, 5600 PB EINDHOVEN, Bldg. VB, Tel. +31 40 27 82785, Fax. +31 40 27 88399

New Zealand: 2 Wagener Place, C.P.O. Box 1041, AUCKLAND, Tel. +64 9 849 4160, Fax. +64 9 849 7811

Norway: Box 1, Manglerud 0612, OSLO, Tel. +47 22 74 8000, Fax. +47 22 74 8341

Pakistan: see Singapore

Philippines: Philips Semiconductors Philippines Inc., 106 Valero St. Salcedo Village, P.O. Box 2108 MCC, MAKATI, Metro MANILA, Tel. +63 2 816 6380, Fax. +63 2 817 3474

Poland: Ul. Lukiska 10, PL 04-123 WARSZAWA, Tel. +48 22 612 2831, Fax. +48 22 612 2327

Portugal: see Spain

Romania: see Italy

Russia: Philips Russia, Ul. Usatcheva 35A, 119048 MOSCOW, Tel. +7 095 755 6918, Fax. +7 095 755 6919

Singapore: Lorong 1, Toa Payoh, SINGAPORE 319762, Tel. +65 350 2538, Fax. +65 251 6500

Slovakia: see Austria

Slovenia: see Italy

South Africa: S.A. PHILIPS Pty Ltd., 195-215 Main Road Martindale, 2092 JOHANNESBURG, P.O. Box 7430 Johannesburg 2000, Tel. +27 11 470 5911, Fax. +27 11 470 5494

South America: Al. Vicente Pinzon, 173, 6th floor, 04547-130 SÃO PAULO, SP, Brazil, Tel. +55 11 821 2333, Fax. +55 11 821 2382

Spain: Balmes 22, 08007 BARCELONA, Tel. +34 93 301 6312, Fax. +34 93 301 4107

Sweden: Kottbygatan 7, Akalla, S-16485 STOCKHOLM, Tel. +46 8 5985 2000, Fax. +46 8 5985 2745

Switzerland: Allmendstrasse 140, CH-8027 ZÜRICH, Tel. +41 1 488 2741 Fax. +41 1 488 3263

Taiwan: Philips Semiconductors, 6F, No. 96, Chien Kuo N. Rd., Sec. 1, TAIPEI, Taiwan Tel. +886 2 2134 2865, Fax. +886 2 2134 2874

Thailand: PHILIPS ELECTRONICS (THAILAND) Ltd., 209/2 Sanpavuth-Bangna Road Prakanong, BANGKOK 10260, Tel. +66 2 745 4090, Fax. +66 2 398 0793

Turkey: Talatpasa Cad. No. 5, 80640 GÜLTEPE/ISTANBUL, Tel. +90 212 279 2770, Fax. +90 212 282 6707

Ukraine: PHILIPS UKRAINE, 4 Patrice Lumumba str., Building B, Floor 7, 252042 KIEV, Tel. +380 44 264 2776, Fax. +380 44 268 0461

United Kingdom: Philips Semiconductors Ltd., 276 Bath Road, Hayes, MIDDLESEX UB3 5BX, Tel. +44 181 730 5000, Fax. +44 181 754 8421

United States: 811 East Arques Avenue, SUNNYVALE, CA 94088-3409, Tel. +1 800 234 7381

Uruguay: see South America

Vietnam: see Singapore

Yugoslavia: PHILIPS, Trg N. Pasica 5/v, 11000 BEOGRAD, Tel. +381 11 625 344, Fax. +381 11 635 777

For all other countries apply to: Philips Semiconductors, International Marketing & Sales Communications, Building BE-p, P.O. Box 218, 5600 MD EINDHOVEN, The Netherlands, Fax. +31 40 27 24825

Internet: <http://www.semiconductors.philips.com>

© Philips Electronics N.V. 1998

SCA60

All rights are reserved. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner.

The information presented in this document does not form part of any quotation or contract, is believed to be accurate and reliable and may be changed without notice. No liability will be accepted by the publisher for any consequence of its use. Publication thereof does not convey nor imply any license under patent- or other industrial or intellectual property rights.

Printed in The Netherlands

545102/750/02/pp16

Date of release: 1998 Nov 18

Document order number: 9397 750 04822

Let's make things better.

**Philips
Semiconductors**



PHILIPS