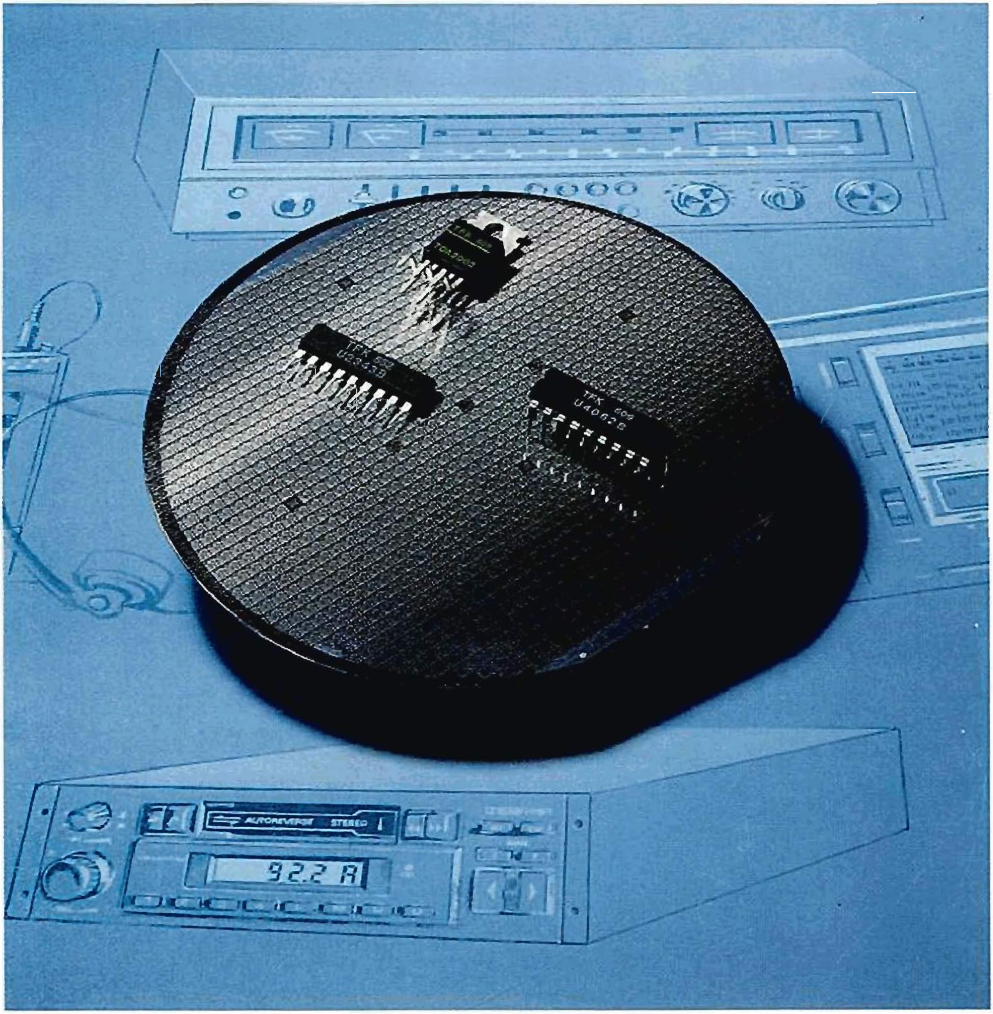
TELEFUNKEN electronic

Creative Technologies

Data Book
1986

Integrated Circuits Radio and Audio Applications



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Contents

A. Summary of the types

alpha-numeric index

A. Summary of the types
according to applications

1. Type Designation

1.1. Pro Electron Type Designation Code for Integrated Circuits[1]

The code consists of

Three letters followed by **a serial number**

TEA 1007
TDA 4437

The first two letters

a. Solitary Circuits

The first letter identifies the circuit as:

S: Solitary digital circuit

T: Analogue circuit

U: Mixed analogue/ digital circuit

The second letter has no special significance,except the letter H which stands for hybrid circuits.

b. Family circuits

These are digital circuits related in their specifications and primarily designed to be mutually connected.

The **first two letters** identify the family.

The **third letter** indicates the operational temperature range or exceptionally, another significant characteristic.

A: No temperature range specified

B: 0 to + 70°C

C: –55 to +125°C

D: –25 to + 70°C

E: –25 to + 85°C

F: –40 to + 85°C

If a circuit is designed for a wider temperature range, but does not qualify for a higher classification, the code letter for the narrower temperature range is used.

The **Serial Number** may be either a 4-figure number (assigned by PRO ELECTRON) or the serial number of minimum 4 digits (combining figures and numbers) of an existing house number. House numbers consisting of less than 4 digits are extended to a 4-digit number by adding zeros (0) before them.

A First Version Letter can be added to indicate a variant of a basic type.

For package variants the following letters are recommended:

C: Cylindrical package

D: Dual in-line

F: Flat pack (incl. so)

Q: Quadruple in-line

For other variants the version letter has no fixed meaning, except the letter Z which stands for types with customised wiring.

A second Version Letter indicates the package material as follows:

C: Metal ceramic

G: Glass ceramic

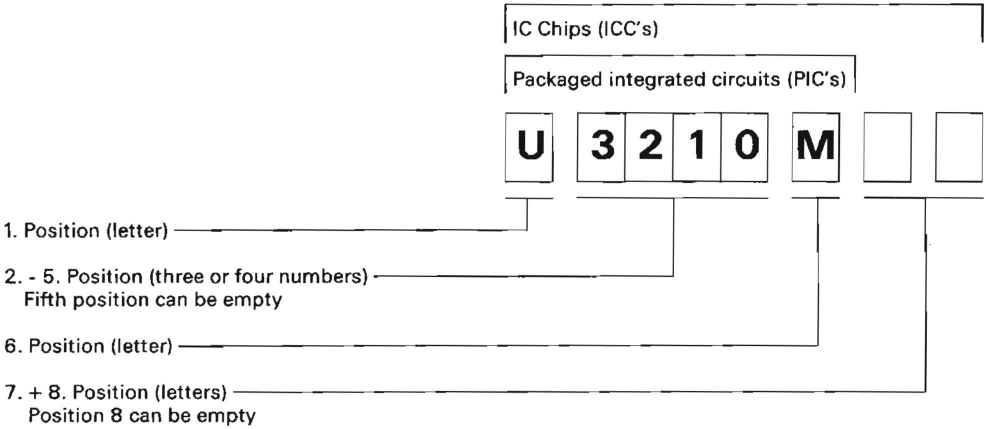
M: Metal

P: Plastic

[1] The type nomenclature for integrated circuits applies to: monolithic, multichip, thin film, thick film and hybrid integrated circuits. (applied since 1973)

1.2 TELEFUNKEN electronic Type Designation Code

TELEFUNKEN electronic type designation code uses five or six digits for packaged integrated circuits and maximum eight digits for IC chips.



1. Position

M = Packaged multichip devices
T = IC chip (without case)
U = Packaged single chip IC

2. - 5. Position

Serial number
Left binding, three or four position serial numbers are written (Position 5 is open)
Same serial number is used for different mechanical versions of an integrated circuits i.e. DIP-case or chip.

6. Position

B = Bipolar integrated circuit
M = MOS (only in connection with T or U at the first position).
M = Mixed devices (only in connection with M at the first position i.e. for combined ICs including one monolithic and additional discrete chips.
U = Integrated elements (only in connection with M at the first position i.e. for combined ICs including more than one IC-chip).

7. Position

Delivery versions for IC-chips
C = Separated and measured chips in carrier box
F = Separated and measured wafer on prolonged foil
M = Separated and measured wafer on unprolonged foil
V = Separated and measured wafer in vacuum envelope
W = Complete unseparated wafer, measured and packed into a plastic box.

8. Position

Back side of the semiconductor device
Empty = Without metallization
A = Aluminium
G = Gold
S = Silver

2. Technologies

At present, TELEFUNKEN electronic has the following silicon technologies running in its production lines for the fabrication of monolithic integrated circuits.

Bipolar Technologies

- Standard:
  Universal manufacturing process for digital and linear circuits of low or medium complexity.
  One or two levels of metallisation.
  Signal frequencies up to approx. 10 MHz

- Low noise:
  For low noise AF and DC circuits.

- Power:
  For linear and digital circuits. Output current approx. 4 A

- I^2L:
  Technology and circuit technique for complex digital circuits with low power requirements and operation down to supply voltages even below 2 V.
  Combination with linear functions e.g. higher power (current, voltage) or higher frequency.

- RF:
  For digital and linear circuits with operational frequencies of approx. 50 MHz

- UHF:
  For very fast digital circuits using unsaturated logic and linear circuits for operating frequencies up to approx. 2 GHz

- Universal:
  High package density process for complex analogue-digital circuits. Operating frequency up to 100 MHz, supply voltage up to 12 V.

Combined Technologies

- BICMOS
  Advanced family of technolgies to combine bipolar and CMOS functions on chip.

MOS Technologies

- PMOS:
  Digital technology for frequencies up to approx. 1 MHz. Al-Gate transistors: Enhancement driver and ion implanted depletion load transistors.

- NMOS 1:
  Technology for digital circuits working up to approx. 5 MHz, also suitable for analog functions. Self aligned Si-gate transistors, enhancement driver and depletion load transistors, LOCOS field range.

  Operating voltage $V_{DD} \leqq 18$ V

- NMOS 3:
  High density NMOS technology for the fabrication of complex circuits such as one-chip microcomputer with clock rates up to 6 MHz.
  Operating voltage $V_{DD} \leqq 8$ V.

- NCMOS/N^2CMOS:
  N-well Si-gate CMOS-technology with optional N-channel depletion load transitors (N^2CMOS) for mixed analog/digital components with clock rates up to 6 MHz.
  Operating voltage $V_{DD} \leqq 8$ V.

2.1. Circuits tailored to customer specifications

- Full custom design:
  Customer specific circuit, layout and chip development i.e.
  - optimized chip size and performance.
  - economic advantages at large quantities and/or long term production.

- Universal Arrays:
  (See data sheets U 4...B, U 6...B)
  Universal Array Circuits are available for customer specific wiring by metal mask option:
  - prefabricated wafers
  - short development and delivery times
  - low development costs
  - economically even for low quantities - such as prototypes for development and market tests.

3. Explanation of Technical Data

3.1 Arrangement of symbols according to DIN 41875 + IEC

For currents, voltages and power basic letter symbols are used. These basic symbols are having either upper-case (capital) or lower-case (small) letters. Capital basic letters are used for the representation of peak, mean, d. c. or root-mean-square values. Small basic letters are used for the representation of instantaneous values which vary with time.
In subscript (index), capital letters are used to represent continuous or total values whereas small letters are used to represent the varying component alone. The following table illustrates the application of the rules given above.

Basic letter	
Lower-case	Upper-case
instantaneous values which vary with time	maximum (peak), average (mean) continuous (d. c.) or root-mean-square (RMS) values
Subscript(s)	
Lower-case	Upper-case
varying component alone, i.e.: instantaneous, root-mean-square, maximum or average values	continuous (without signal) or total (instantaneous, average or maximum) values

Letter symbols for impedance, admittances, four-pole parameters etc.

In case of impedances, admittances, four-pole parameters etc., upper-case basic letters are used for the representation of external circuits and of circuits in which the device forms only a part. Lower-case basic letters are used for the representation of electrical parameters inherent in the device.
These rules are not valid for inductances and capacitances. Both these quantities are denoted with capital basic letters.

In Index, upper-case letters are used for the designation of static (d. c.) values whereas the lower-case letters are meant for the designation of small-signal values.
If more than one subscript is used (h_{FE}, h_{fe}) then the letter symbols are either all upper-case or all lower-case.

If the index has numeric (single, double, etc.) as well as letter symbol(s) such as h_{21E}, or h_{21e}, the differentiation between static or small-signal value is made only by subscript letter symbol.

Other quantities (values) which deviate from the above mentioned rules are given under the list of letter symbols.

The following table illustrates the application of the rules given above.

Basic letter	
Lower-case	Upper-case
electrical parameters inherent in the semiconductor devices except inductances and capacitances	electrical parameters of external circuits and of circuits in which the semiconductor device forms only a part; all inductances + capacitances
Subscript(s)	
Lower-case	Upper-case
small-signal values	static (d. c.) values

Examples:

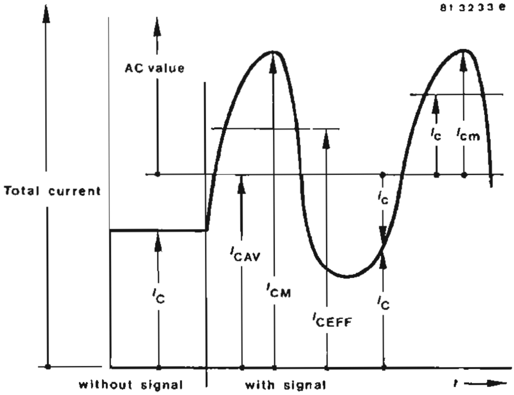
R_G
Generator resistance

G_p
Power gain

h_{FE}
DC forward current transfer ratio in common emitter configuration

r_p
Parallel resistance, damping resistance

3.2 Examples of the application of symbols according to DIN 41 785 and IEC 148



I_C
D. C. value, no signal

I_{CAV}
Average total value

I_{CM}; $\hat{I}_C$
Maximum total value

I_{CRMS}
RMS total value

I_c; I_{cRMS}
RMS varying component

I_{cm}; $\hat{I}_c$
Maximum varying component value

i_C
Instantaneous total value

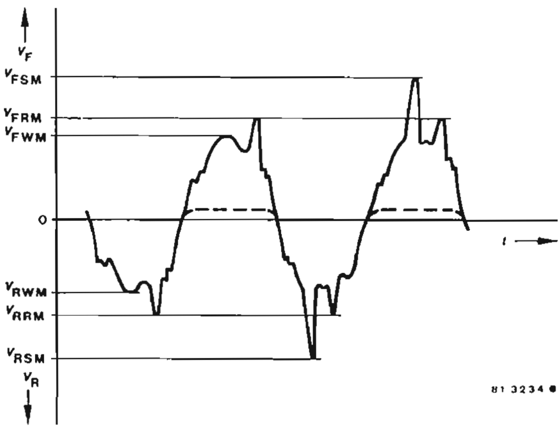
i_c
Instantaneous varying component value

It is valid:

$$I_{CM} = I_{CAV} + I_{cm}$$

$$I_{CRMS} = \sqrt{I^2_{CAV} + I^2_{CRMS}}$$

$$i_C = I_{CAV} + i_c$$



V_F
Forward voltage

V_R
Reverse voltage

V_{FSM}
Surge forward voltage (non-repetitive)

V_{RSM}
Surge reverse voltage (non-repetitive)

V_{FRM}
Repetitive peak forward voltage

V_{RRM}
Repetitive peak reverse voltage

V_{FWM}
Crest working forward voltage

V_{RWM}
Crest working reverse voltage

4. Data Sheet Construction

Data sheet information is described according to International Electrotechnical Commission (IEC), publication 134. It follows the sequence given below:

- Device and block diagram description
- Ratings i.e., absolute maximum ratings, thermal data and electrical characteristics
- Application notes, if available
- Dimensions (mechanical data)

4.1 Device and block diagram description

It includes type number, technology used, short-form information on the typical **applications** and special **features.** Block diagram is added in this section.

4.2 Ratings: Absolute maximum ratings

These values are absolute maximum ratings, which under no operational and environmental conditions should be exceeded, irrespective of allowable maximum or minimum values. If any one of the ratings is exceeded, this could result in irreversible changes in the ratings. Generally the absolute maximum ratings are given under specified conditions and are valid only for these conditions.

Unless otherwise specified an ambient temperature of 25 ±3°C is assumed for all absolute maximum ratings. These ratings are static characteristics, if they are measured by a pulse method then the associated measurement conditions are stated.

4.3 Thermal data - thermal resistances

Some thermal data (e.g. junction temperature, storage temperature range, total power dissipation), are given under the heading „Absolute maximum ratings".

A special section is provided for thermal resistances. The thermal resistance, junction-ambient (R_{thJA}) quoted is that which would be measured without artificial cooling, i.e. under the worst conditions.
Temperature coefficients, on the other hand, are listed together with the associated parameters under "Characteristics".

4.4 Characteristics, switching characteristics

Under this heading are grouped the most important operational, electrical characteristics (minimum, typical and maximum values) together with associated test conditions supplemented with curves.

4.5 Application notes, if available

Here are given application examples including external circuitry recommendation, because the complex nature of the integrated circuit, the limiting values and characteristics are no longer sufficient.

4.6 Dimensions (mechanical data)

It contains important dimensions, sequence of connection supplemented by a circuit diagram. Case outline drawing carry DIN-, JEDEC or commercial designations. Information on weight completes the list of mechanical data.

Note especially:
If the dimensional information does not include any tolerances, then the following applies: Lead length and mounting hole dimensions are minimum values. All other dimensions are maximum.

5. Soldering Instructions

The integrated circuits must be protected against overheating due to soldering. If necessary, adequate measures must be taken for sufficient heat transfer. The following maximum soldering conditions should not be exceeded:

	Iron soldering			Dip or flow soldering		
	Iron temperature	Soldering distance from the case	Max. allowable soldering time	Soldering temperature	Soldering distance from the case	Max. allowable soldering time
Metal case	≦ 245 °C ≦ 245 °C 245...350 °C	1.5...5 mm > 5 mm > 5 mm	5 s 10 s 5 s	≦ 245 °C 245...300 °C	> 1,5 mm > 5 mm	5 s 3 s
Plastic case	≦ 245 °C ≦ 245 °C	2...5 mm > 5 mm	3 s 5 s	≦ 245 °C 245...300 °C	> 2 mm > 5 mm	3 s 3 s
23 A 3 DIN 41 869 (SOT 23)	≦ 250 °C	–	10 s	≦ 250 °C	–	10 s

6. Heat Removal

To keep the thermal equilibrium, the heat generated in the semiconductor junction(s) must be removed to the ambient.

In the case of low-power devices the natural heat-conductive path between case and surrounding air is usually adequate for this purpose.

However, in the case of medium-power devices heat radiation must be improved by the heat dissipators, which increase the heat radiating surface.

Finally, in the case of high-power devices special heat sinks must be provided, the cooling effect of which can be increased further by the use of special coolants or air blowers.

The heat generated in the junction is conveyed to the case or header by conduction rather than convection; a measure of the effectiveness of heat conduction is the inner thermal resistance junction case, R_{thJC}, the value of which is governed by the construction of the device.

Any heat transfer from the case to the surrounding air involves radiation convenction and conduction, the effectiveness of transfer being expressed in terms of an R_{thCA}-value, i.e. the external or case-ambient thermal resistance. The total thermal resistance junction ambient is consequently:

$$R_{thJA} = R_{thJC} + R_{thCA}$$

The total maximum power dissipation, $P_{tot\,max}$, of a semiconductor device can be expressed as follows:

$$P_{tot\,max} = \frac{T_{jmax} - T_{amb}}{R_{thJA}} = \frac{T_{jmax} - T_{amb}}{R_{thJC} + R_{thCA}}$$

whereas

T_{jmax}

is the maximum temperature, of a representative junction area on the silicon chip.

T_{amb}

the highest ambient temperature likely to be reached under the most unfavourable conditions.

R_{thJC}

the thermal resistance, junction-case.

R_{thJA}

the thermal resistance, junction-ambient.

R_{thCA}

the thermal resistance, case-ambient, the value of which depends on cooling conditions.

If a heat dissipator or sink is used, then R_{thCA} depends on the thermal contact between case and heat sink, heat propagation conditions in the sink and the rate at which heat is transferred to the surrounding air.

Therefore, the maximum allowable total power dissipation for a given semiconductor device can be influenced only by changing T_{amb} and R_{thCA}. The value of R_{thCA} could be obtained either from the data of heat sink suppliers or through direct measurements.

In case of cooling plates as heat sink without optimum performance, the following approach holds good.

The curves shown in both figures are given for thermal resistance R_{thCA} by using square plates of aluminium with edge length, *a*, but with different thiknesses. There by, the device case should be mounted direct on the cooling plate.

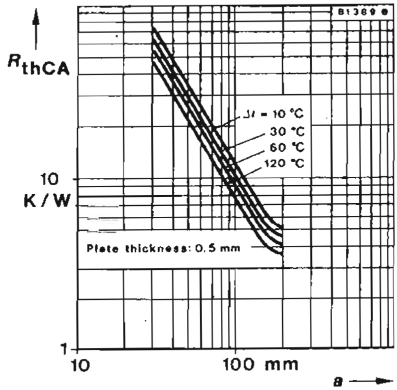


Fig. 6.1

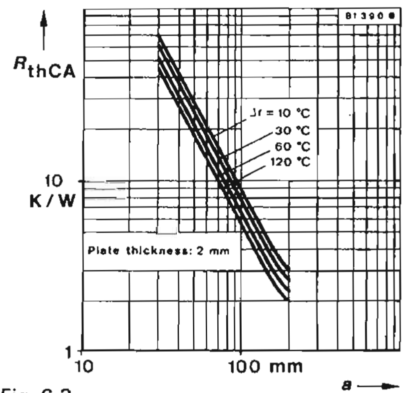


Fig. 6.2

The edge length, α, derived from Fig. 6.1. and 6.2. for a given R_{thCA} value must be multiplied with α and β:

$a' = a \cdot \beta \cdot \alpha$

where

α = 1.00 for vertical arrangement
α = 1.15 for horizontal arrangement
β = 1.00 for bright surface
β = 0.85 for dull black surface

7. Quality Data

With an extensive system consisting of qualification, intermediate and final tests, TELEFUNKEN electronic endeavour to supply the customers with components, which fulfil the specifiactions of the OEM-industry.

If you are interested in detailed informations regarding "TELEFUNKEN Quality Assurance of Semiconductor Components", please request for our booklet **"TELEREL"!**

7.1. Delivery Quality

In order to define a guarantee for the quality of the delivered elements, the data sheets contain maximum and minimum ratings.

If the portion of defect circuits is smaller than the AQL values specified in percent or equal, the delivery must be accepted.

7.2. Description of Defects

The defects are classified in three groups and described as follows:

● Total defect:

Short-circuits and interruptions of connections. Wrong inscriptions and marking, broken packages. If the maximum or minimum ratings in the data sheets are exceeded or are lower by more than 50% and consequently functional use of the circuit is not possible.

● Major defects:

Exceeding of the limits of the electrical characteristics specified in the data sheet, but functional use of circuit is still possible.

● Minor defects:

Insignificant defects, deformed leads, inscription badly legible, manufacturer's name and charges not indicated; brand not wipe-proof, dimensional tolerances exceeded.

7.3. AQL Values

In accordance with the classification of defects the following AQL values are valid on delivery. These values are based on the single sampling plan for quality test DIN 40080 which corresponds mostly to the sampling plan ASQ/AW F1 and MIL-STD 105 D, test stage II.

Quality level defect	IC	Element
total defect	0.15	–
major defect	0.65	–
minor defects	1.0	–
sum of all defects	1.0	1.0*

*optically controlled

Different qualities required by the customer are possible, but need a special agreement.

7.4. Sampling Inspection Plan

List of symbols:

Acceptable Quality Level

Lot size

Sample size

Acceptance number

Average outgoing quality level

8. Qualified Semiconductor Devices

TELEFUNKEN electronic supplies qualified semiconductor devices for highest demands, being qualified according to:

VG 95211

or GfWH 000 sheet 16 (of the German research and test centre for aeronautics and space travel)

or **ESA**/SCC-5000 System of ESA (**E**uropean **S**pace **A**gency)

These devices are designated in contents (summary of types) and data sheets.

Test methods are given in the booklet "Quality Assessed Components" from TELEFUNKEN electronic.

Single sampling plan for attribute testing according to DIN 40080 (MIL-STD 105 D)

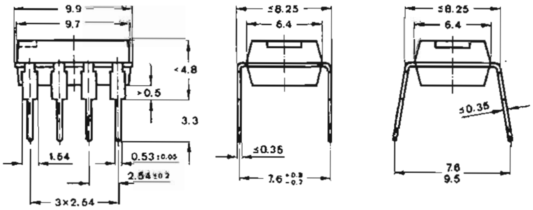
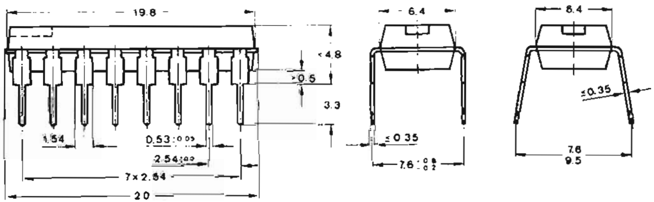
normal inspection N	AQL 0.06	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	reduced inspection N
	n – c (D$_{max}$ in %)											
2- 15								8-0 (3.9)	5-0 (6.7)	3-0 (9.6)	2-0 (15.6)	2- 15
16- 50						20-0 (1.7)	13-0 (2.6)			13-1 (4.8)	8-1 (9.2)	16- 150
51- 150					32-0 (1.1)				20-1 (3.6)	20-2 (6.0)	20-3 (8.4)	151- 280
151- 280		125-0 (0.29)	80-0 (0.45)	50-0 (0.71)				32-1 (2.3)	32-2 (3.8)	32-3 (5.4)	32-5 (8.8)	281- 500
281- 500	200-0 (0.18)						50-1 (1.5)	50-2 (2.4)	50-3 (3.5)	50-5 (5.7)	50-7 (8.1)	501- 1200
501- 1200					125-1 (0.64)	80-1 (1.0)	80-2 (1.6)	80-3 (2.2)	80-5 (3.7)	80-7 (5.2)	80-10 (7.7)	1201- 3200
1201- 3200				200-1 (0.41)		125-2 (1.1)	125-3 (1.5)	125-5 (2.4)	125-7 (3.5)	125-10 (5.0)	125-14 (7.2)	3201-10000
3201-10000			315-1 (0.27)		200-2 (0.68)	200-3 (0.69)	200-5 (1.6)	200-7 (2.2)	200-10 (3.2)	200-14 (4.6)	200-21 (7.3)	10001-35000[1)]
10001-35000[1)]		500-1 (0.17)		315-2 (0.44)	315-3 (0.61)	315-5 (0.99)	315-7 (1.4)	315-10 (2.1)	315-14 (3.0)	315-21 (4.7)		

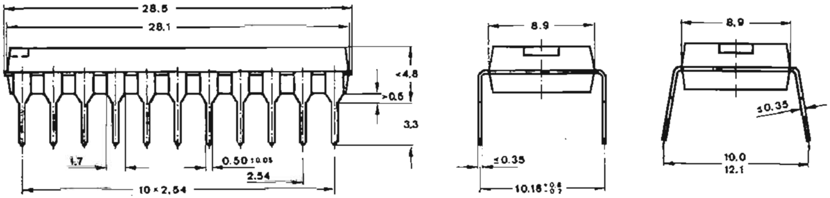
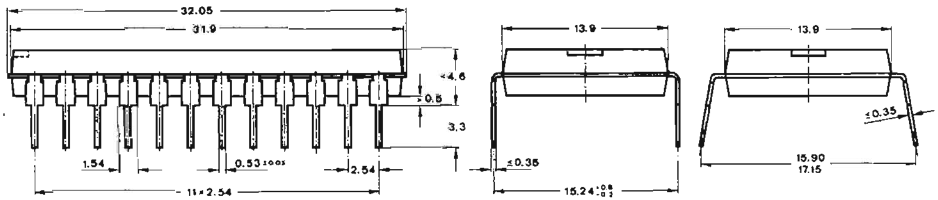
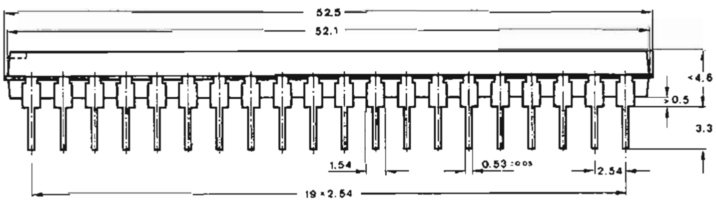
Single sampling plan for destructive or very costly test procedurs according to DIN

Z 1 normal inspection N	AQL 0.06	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	Z 2 reduced inspection N
	n – c (D$_{max}$ in %)											
2- 25										3-0 (11.6)	2-0 (16.6)	2- 50
26- 90									5-0 (7.2)			51- 150
91- 150							13-0 (2.8)	8-0 (4.5)			8-1 (10.8)	151- 500
151- 500	200-0 (0.18)	125-0 (0.29)	80-0 (0.46	50-0 (0.74)	32-0 (1.2)	20-0 (1.8)			20-1 (4.1)	13-1 (6.3)		501- 3200
501- 1200								32-1 (2.6)		20-2 (6.8)	20-3 (9.5)	3201-35000[1)]
1201-10000							50-1 (1.7)		32-2 (4.3)	32-3 (6.1)	32-5 (9.9)	–
10001-35000[1)]						80-1 (1.1)		50-2 (2.7)	50-3 (3.9)	50-5 (6.3)	50-7 (9.0)	–

[1)]Lot size above 35000 must be divided.

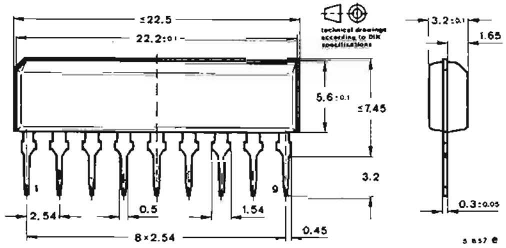
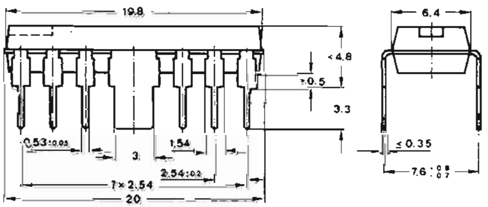
9. Thermal resistance of different cases

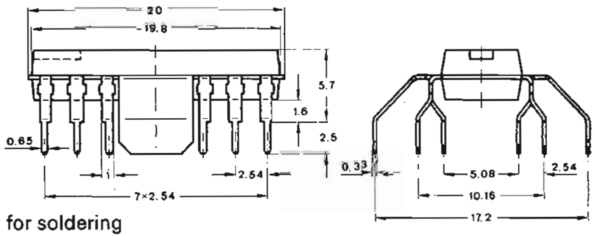
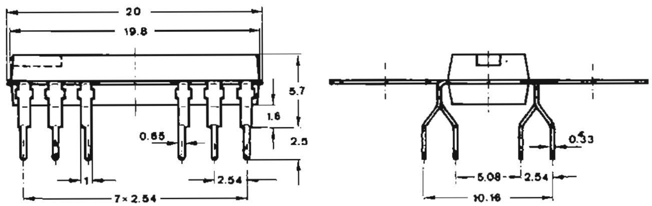
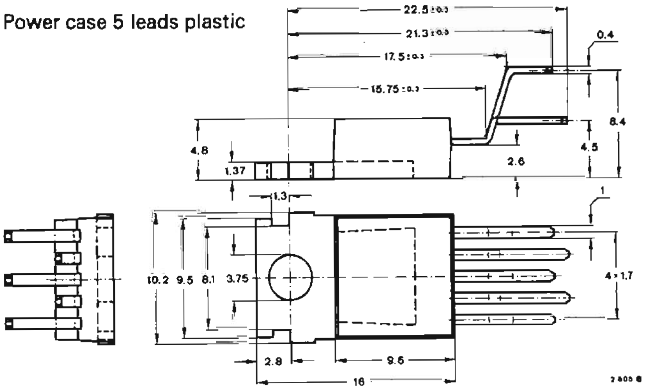
Package outlines	Lead frame material	Lead frame thickness mm	R_{thJC} typ. K/W	R_{thJA} [1] min. K/W	R_{thJA} [1] typ. K/W	R_{thJA} [1] max. K/W
DIP 8 Plastic 	CuFe	0.3		80	110	120
DIP 14…20 Plastic 	CuFe	0.4	9 [2]	65	70	80
	CuFe	0.3	12 [2]	75	90	100
				65	75	85 [3]
	CuFe	0.25			120	
	Vacon	0.25		200	210	220
						90 [5]

DIP 22 Plastic						
	CuFe	0.3			80	
	Vacon	0.25			120	
						70[5]
DIP 24, 28 Plastic						
	CuFe	0.3		38	45	55
	CuSn	0.3		45	53	65
	Vacon	0.25		85	95	105
				50	55	60
DIP 40 Plastic						
	CuFe	0.3		30	43	45
	Vacon	0.25		82	90	100
				38	44[5]	50

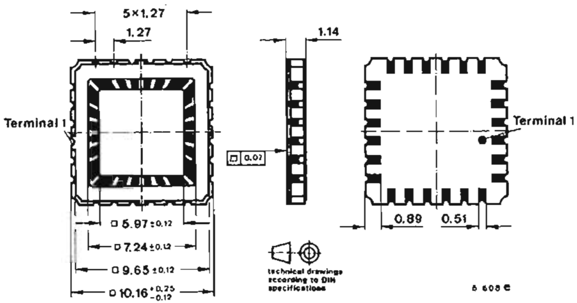
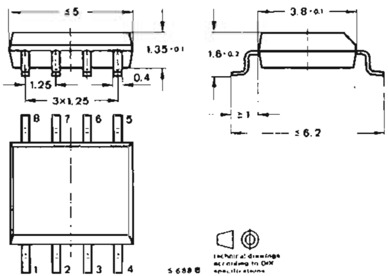
[1] Depends upon chip size, substrate area and plastic material; [2] Pad connected to pin 1; [3] Soldered; [4] Mounted on PC board; [5] Ceramic

Thermal resistance of different cases

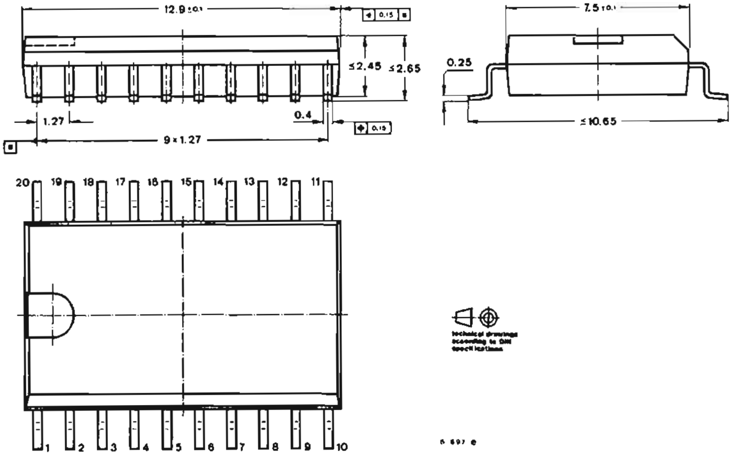
Package outlines	Lead frame material	Lead frame thickness mm	R_{thJC} typ. K/W	R_{thJA} [1] min. K/W	R_{thJA} [1] typ. K/W	R_{thJA} [1] max. K/W
SIP 6…9 Plastic 	CuFe	0.3			95	
DIP 16 Special case Plastic 	CuFe	0.3	14		110	

Power case Quil 12 Plastic  for soldering	CuFe	0.3	11		70	
 for screw mounting	CuFe	1	2.5			
Power case 5 leads plastic 	Cu	1	2.5			

Thermal resistance of different cases

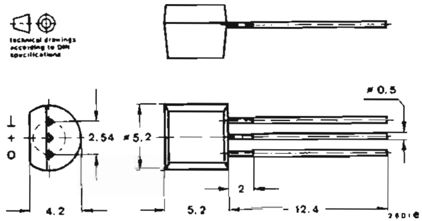
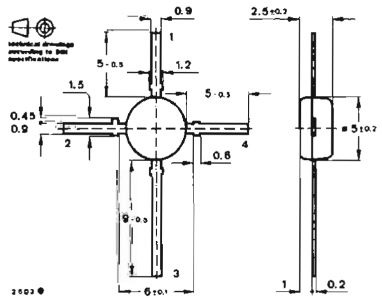
Package outlines	Lead frame material	Lead frame thickness mm	R_{thJC} typ. K/W	R_{thJA} [1] min. K/W	R_{thJA} [1] typ. K/W	R_{thJA} [1] max. K/W
Chip carrier 24, 28, 40 leads ceramic 				60	70	80
Small outline SO 8, 16 Plastic 						
SO 8	CuFe	0.25	160[4]			
SO 16	CuFe	0.25	130[4]			

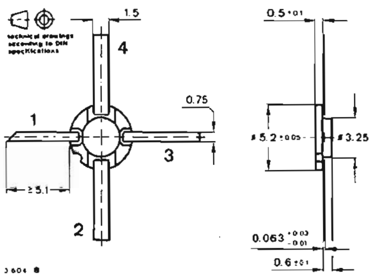
Small outline SO 20, 24 Plastic



SO 20	CuFe	0.25	80[4)]			
SO 24	CuFe	0.25	70[4)]			

Thermal resistance of different cases

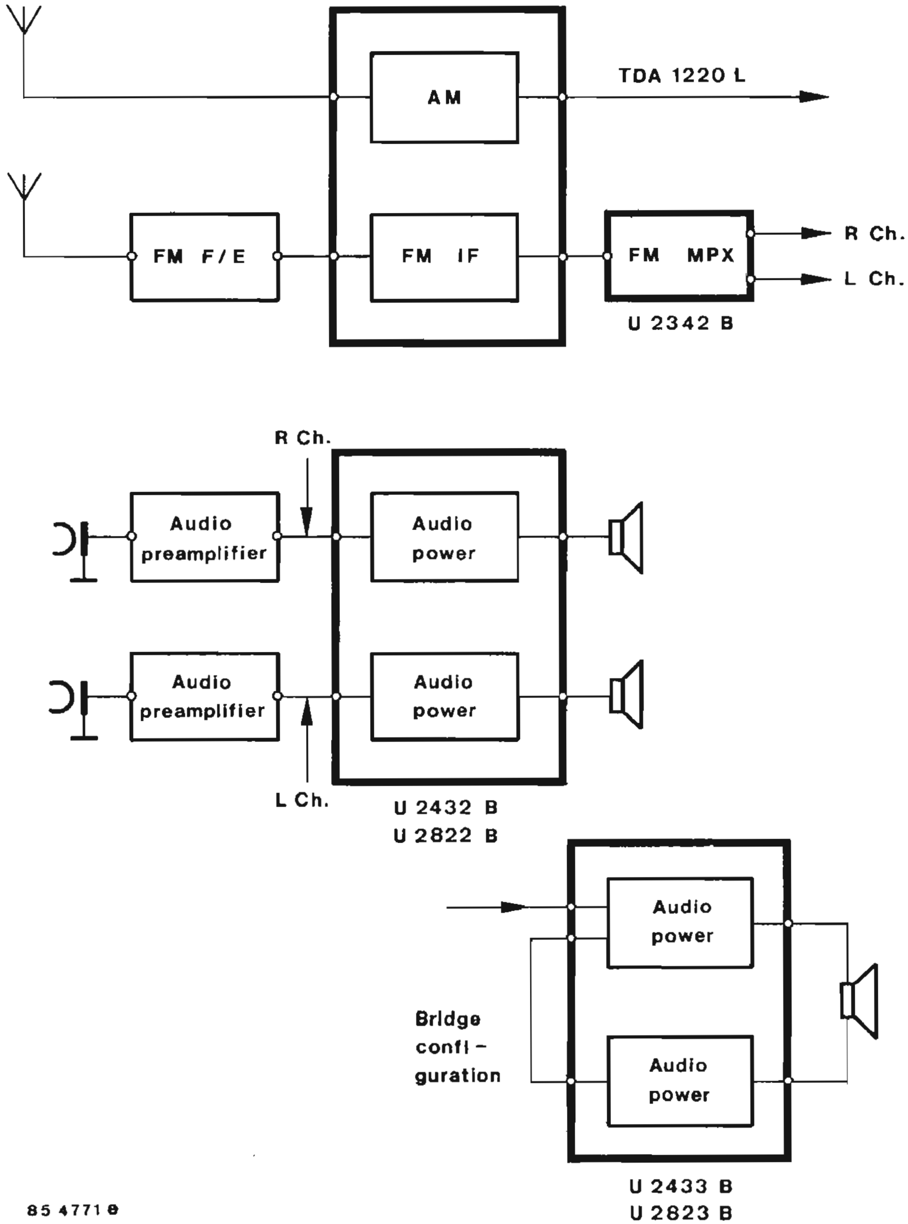
Package outlines	Lead frame material	R_{thJC} typ. K/W	min.	R_{thJA} [1] typ. K/W	max.
TO 92 Plastic 	CuFe	55...150[1]	150	250	500
Terminal length 3 mm			125	150	250
TO 50 Plastic (Chip area = 1 mm^2) 	CuFe			110	

TO 50 Ceramic (Chip area = 1 mm²) 	CuFe			100	

[1] Depends upon chip size, substrate area and plastic material; [2] Pad connected to pin 1; [3] Soldered; [4] Mounted on PC board; [5] Ceramic

Headphone Radio

$V_S = 2 \ldots 7$ V



85 4771 6

Monolithic Integrated Circuit

Application: Low voltage AM/FM-IF Amplifier

Features:

- Large supply voltage range $V_S = 2...9$ V
- High sensitivity and low noise
- Very low tweet
- High signal handling (1 V)
- Low battery drain
- AM sensitivity regulation facility
- High stability of electrical characteristics from 2 V to 9 V
- Very simple DC switching of AM/FM

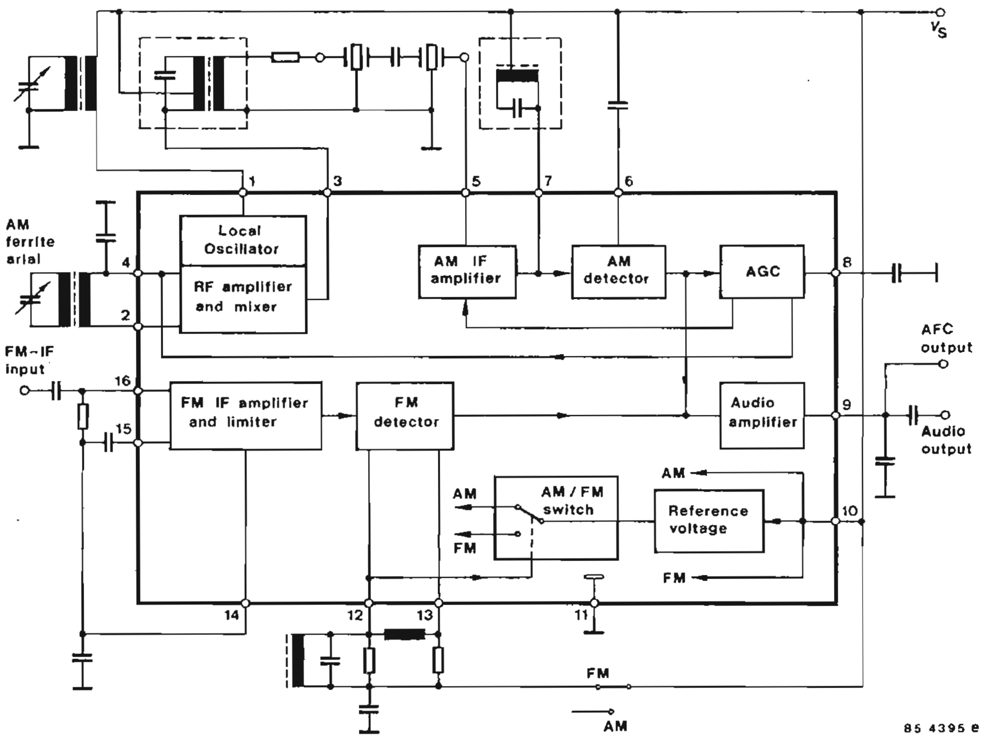
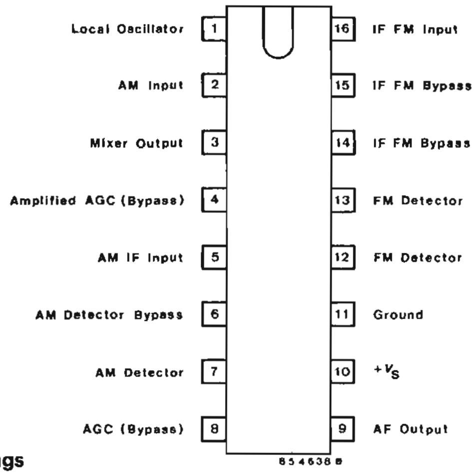


Fig.1 Block diagram and pin connections

T1.2/371.0184 E



Pin connection

Absolute maximum ratings

Reference point Pin 11, unless otherwise specified

Supply voltage	Pin 10	V_S	12	V
Ambient temperature		T_{amb}	85	°C
Junction temperature		T_j	150	°C
Storage temperature range		T_{stg}	−25...+150	°C

Thermal resistance			**Min.**	**Typ.**	**Max.**	
Junction ambient		R_{thJA}			100	K/W

Electrical characteristics

V_S = 4.5 V, reference point Pin 11, T_{amb} = 25°C, unless otherwise specified

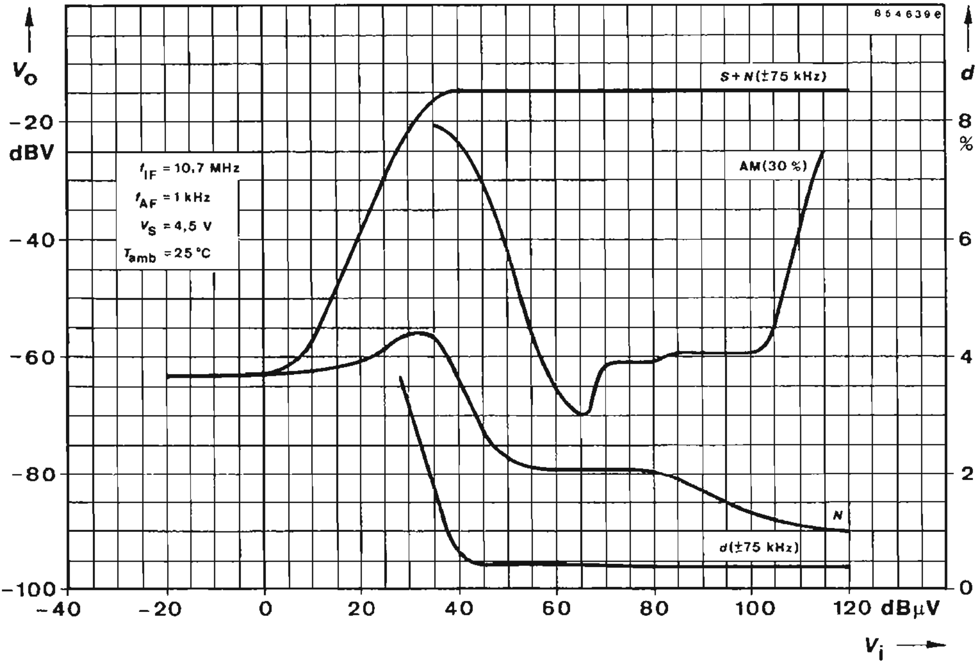
			Min.	Typ.	Max.	
Supply voltage range	Pin 10	V_S	2		9	V
Supply current	Pin 10	I_S		10		mA

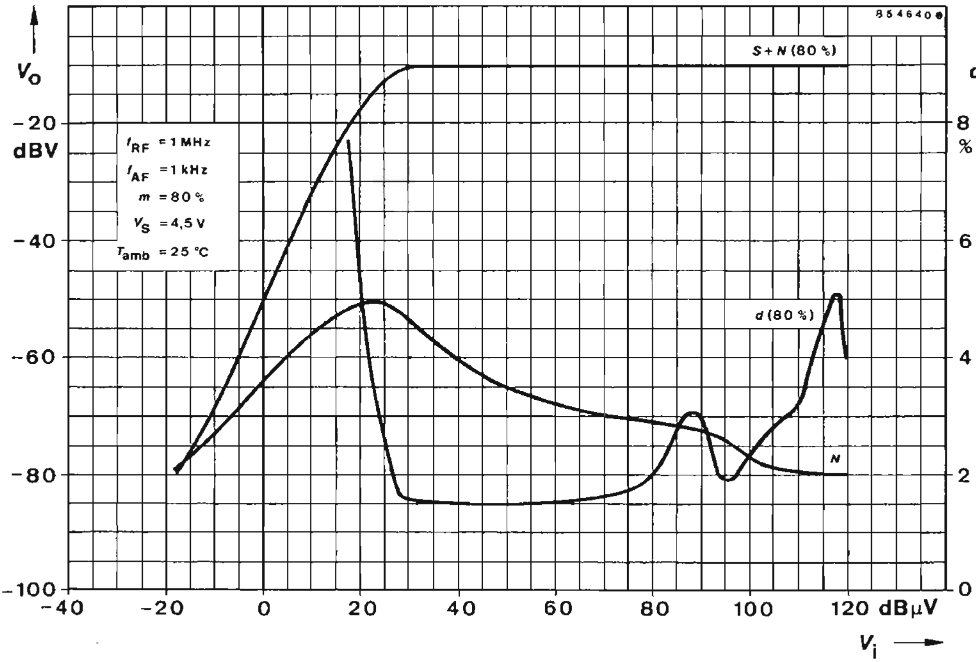
AM-Amplifier

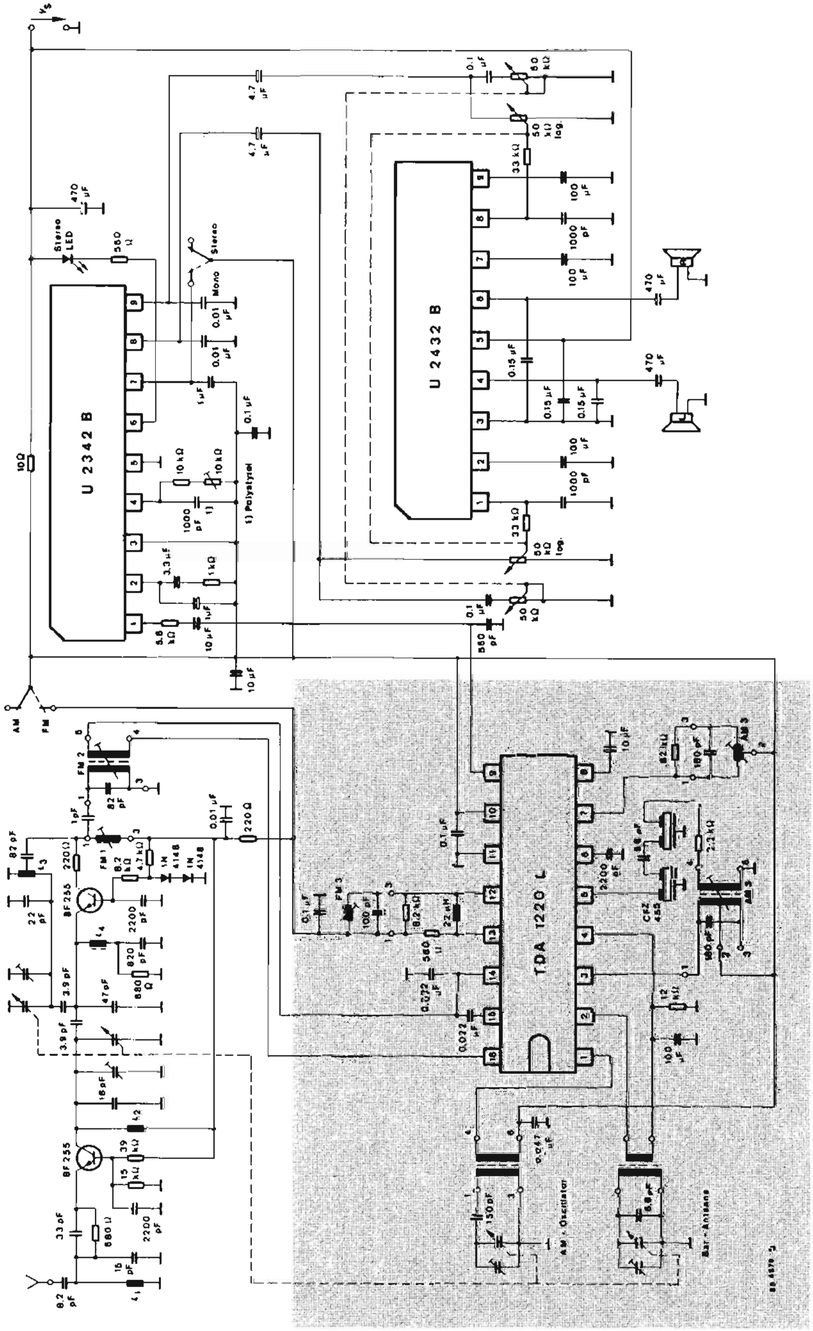
f_i = 1 MHz, f_{IF} = 455 kHz, f_{mod} = 1 kHz, m = 0.3

			Min.	Typ.	Max.	
Input sensitivity S/N = 26 dB	Pin 2	v_i		15		μV
Signal to noise ratio v_i = 10 mV	Pin 9	S/N		52		dB
AGC range $\Delta V_{oAF}/V_{oAF}$ = 10 dB	Pin 2	Δv_i		100		dB
AF voltage at demodulator output v_i = 1 mV	Pin 9	v_{oAF}		80		mV

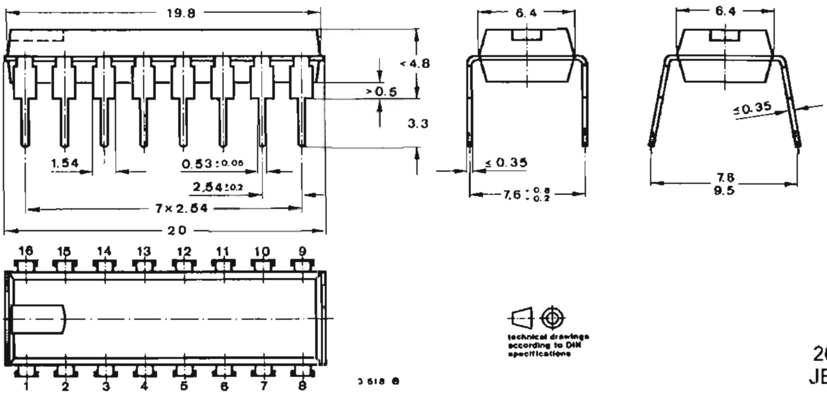
			Min.	Typ.	Max.	
Distortion						
$v_i = 1$ mV	Pin 9	d		0.4		%
Max. input signal handling capability						
m = 0.8, d < 10%	Pin 2	v_H		1		V
Input resistance	Pin 2-4	R_i		7.5		KΩ
Input capacitance	Pin 2-4	C_i		18		pF
Output resistance	Pin 9	R_o		5		KΩ
Tweet 2 IF	Pin 9					
$v_i = 1$ mV				40		dB
Tweet 3 IF	Pin 9					
$v_i = 1$ mV				55		dB
FM-IF-Amplifier						
$f_{IF} = 10.7$ MHz, $\Delta f = \pm 22.5$ kHz, $f_{mod} = 1$ kHz						
Limiting threshold (−3 dB)	Pin 9	v_i		20		μV
AM-rejection						
$v_i = 3$ mV, m = 0.3	Pin 16	AMR		50		dB
Signal to noise ratio						
$v_i = 1$ mV	Pin 9	S/N		70		dB
Distortion						
$v_i = 1$ mV	Pin 9	d		0.3		%
AF voltage at demodulator output						
$v_i = 1$ mV	Pin 9	v_{oAF}		80		mV
Input resistance	Pin 16	R_i		6.5		KΩ
Input capacitance	Pin 16	C_i		14		pF
Output resistance	Pin 9	R_o		5		KΩ


854639e
V_o
d
-20
dBV
-40
-60
-80
-100
8
%
6
4
2
0
$S+N$(±75 kHz)
AM(30 %)
N
d(±75 kHz)
f_{IF} = 10,7 MHz
f_{AF} = 1 kHz
V_S = 4,5 V
T_{amb} = 25 °C
-40
-20
0
20
40
60
80
100
120 dBμV
V_i


854640e
V_o
d
-20
dBV
-40
-60
-80
-100
8
%
6
4
2
0
$S+N$ (80 %)
d (80 %)
N
f_{RF} = 1 MHz
f_{AF} = 1 kHz
m = 80 %
V_S = 4,5 V
T_{amb} = 25 °C
-40
-20
0
20
40
60
80
100
120 dBμV
V_i


U 2342 B
U 2432 B
TDA 1220 L
BF 255
BF 255
1) Polystyrol
AM - Oscillator
Bar - Antenne
AM
FM
Stereo
Mono
Stereo LED

Dimensions in mm



Case
20 A 16 DIN 41866
JEDEC MO 001 AC
DIP 16
Weight max. 1.5 g

Monolithic Integrated Circuit

Application: Phase Locked Loop (PLL) FM Stereo Multiplex for portable and headphone radios (3 V)

Features:

- Small installed area and few external parts
- Excellent pilot sensitivity $v_{P(ON)} = 9\ \mathrm{m}V_{RMS}$ (typ.)
- Operating supply voltage range $V_S = 1.8...5\ \mathrm{V}$
- Suitable for LED driving
- VCO stop capability
  The Voltage Controlled Oscillator (VCO) is stopped when the L.P.F.2 terminal is connected to the power supply line, and then the stereo indicator is turned off
- Easy adjustment
  The monitored free running frequency of VCO is 76 kHz at stereo lamp terminal

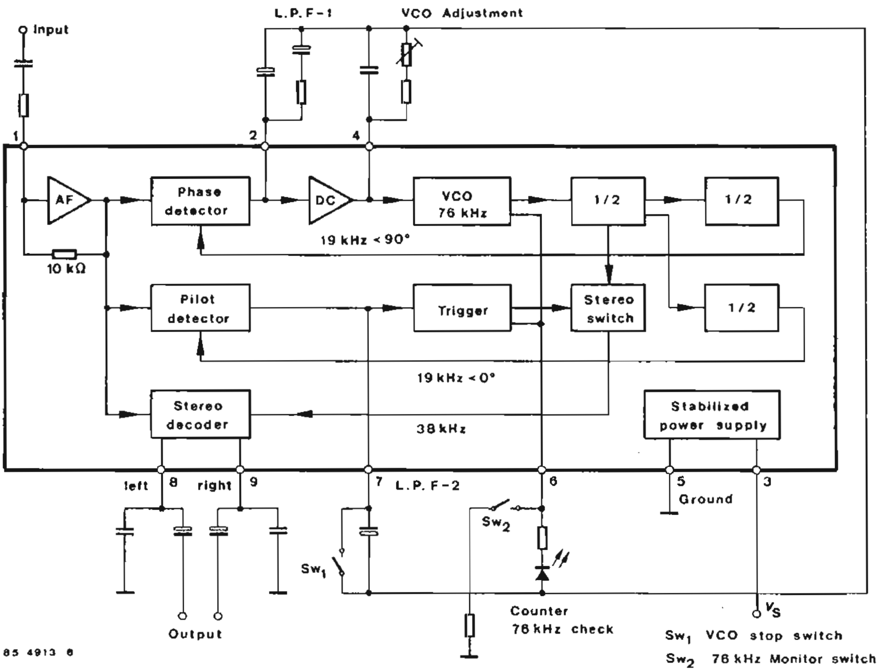


Fig. 1 Block diagram and pin connections

T1.2/377.0184 E

Absolute maximum ratings

Reference point Pin 5, unless otherwise specified

Supply voltage	Pin 3	V_S	6	V
Lamp voltage	Pin 6	V_{Lamp}	8	V
Lamp current		I_{Lamp}	8	mA
Power dissipation		P_{tot}	500	mW
Ambient temperature		T_{amb}	75	°C
Storage temperature range		T_{stg}	−25...+ 150	°C

Thermal resistance

		Min.	Typ.	Max.	
Junction ambient	R_{thJA}			125	K/W

Electrical characteristics

V_S = 3 V, T_{amb} = 25°C, reference point Pin 5, f_{mod} = 1 kHz, unless otherwise specified

				Min.	Typ.	Max.	
Supply voltage range		Pin 3	V_S	1.8		5	V
Supply current, with lamp off		Pin 6	I_S		4.5	8	mA
Stereo input voltage (maximal) L+R = 90%, P = 10%, f_{mod} = 1 kHz, d = 5%		Pin 1	v_i		400		mV_{RMS}
Channel separation		Pin 8, 9					
$v_{(L+R)}$ = 180 mV_{RMS}	f_{mod} = 100 Hz		Ch.Sep.		35		dB
v_p = 20 mV_{RMS}	f_{mod} = 1 kHz		Ch.Sep.	30	35		dB
	f_{mod} = 10 kHz		Ch.Sep.		35		dB
Voltage gain v_i = 200 mV_{RMS}		Pin 8, 9	$-G_V$	6.5	5.0	3.5	dB
Channel balance v_i = 200 mV_{RMS}		Pin 8, 9	Ch.B.		0	1.5	dB
Lamp sensitivity, Pilot input	ON		v_p		9	15	mV_{RMS}
	OFF		v_p	2	6		mV_{RMS}
Stereo lamp hysteresis to turn-on from turn-off					3		mV_{RMS}
Capture range v_p = 20 mV_{RMS}			C.R.		±3		%
Carrier leak							
v_p = 20 mV_{RMS}	19 kHz		C.L.		32		dB
$v_{(L+R)}$ = 180 mV_{RMS}	38 kHz		C.L.		60		dB
Signal to noise ratio v_i = 200 mV_{RMS}, R_G = 620 Ω		Pin 8, 9	S/N		82		dB

			Min.	Typ.	Max.	
Distortion						
Mono						
$v_i = 200\ mV_{RMS}$		d		0.4	1.0	%
Stereo						
$v_{(L+R)} = 180\ mV_{RMS}$						
$v_p = 20\ mV_{RMS}$, $f_{mod} = 1$ kHz		d		0.5		%
Input resistance	Pin 1	R_i		10		kΩ
Output resistance	Pin 8, 9	R_o		5		kΩ

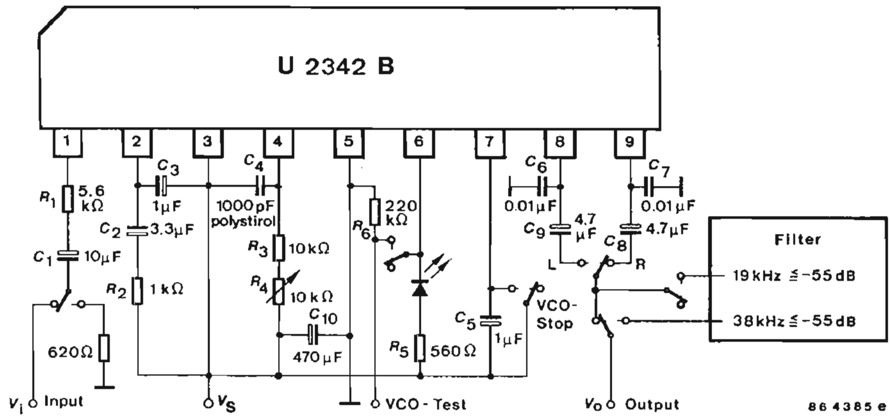
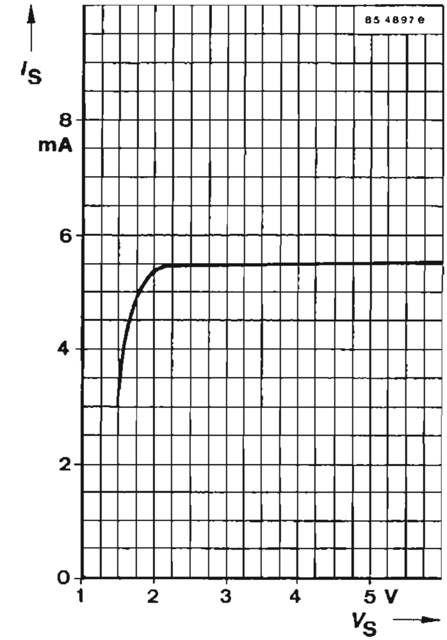
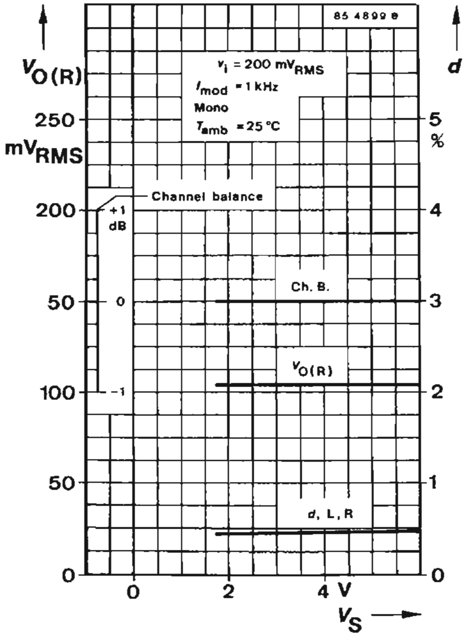
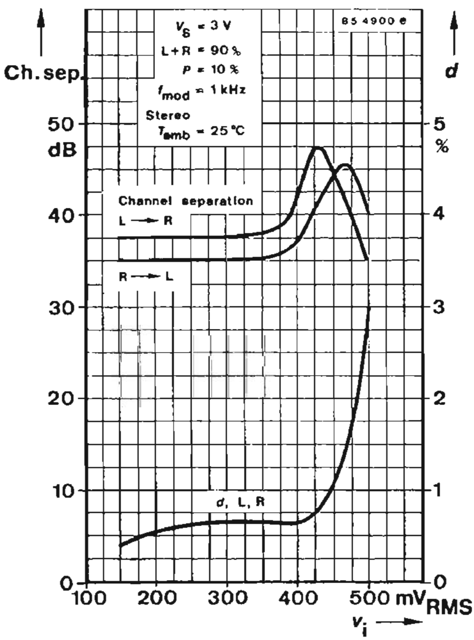
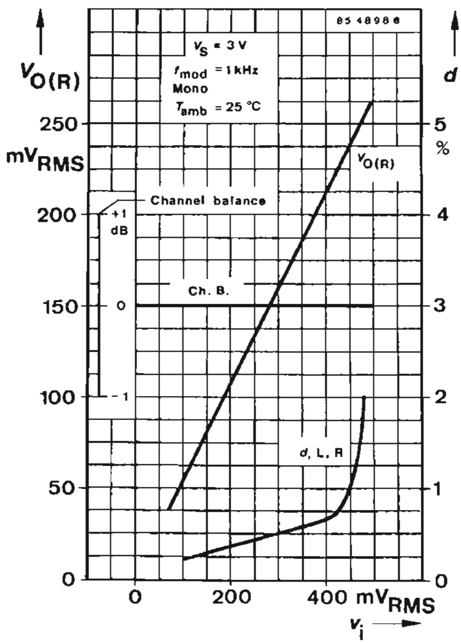


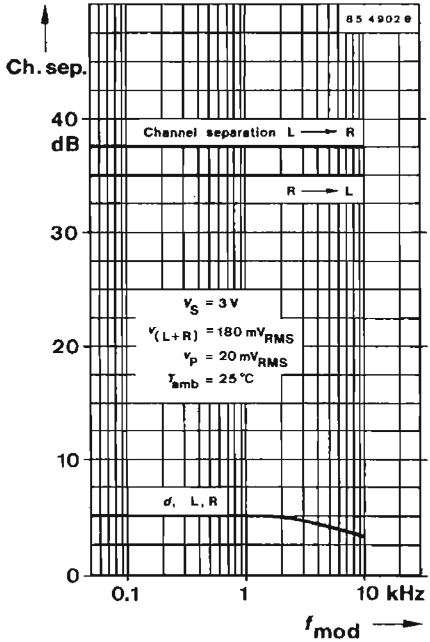
Fig. 2 Test circuit

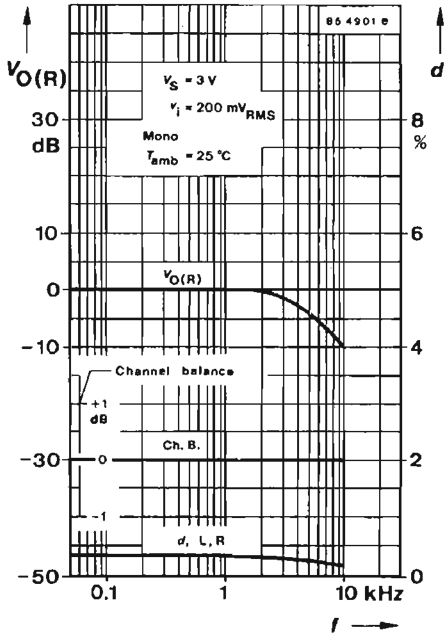

85 4897 e
I_S
8 mA
6
4
2
0
1
2
3
4
5 V
V_S

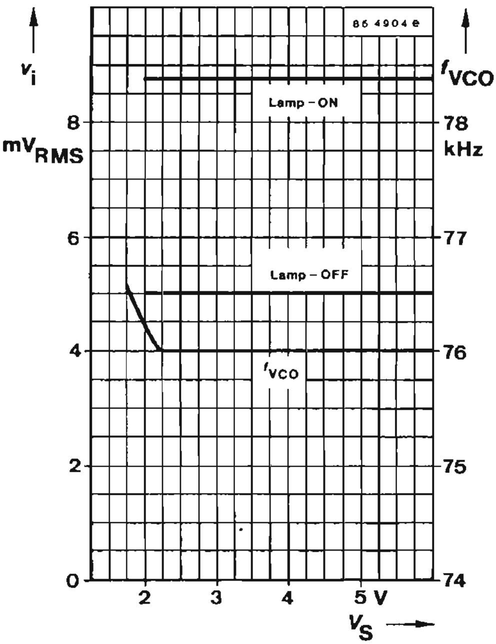

85 4899 e
$V_{O(R)}$
250 mV$_{RMS}$
200
50
100
50
0
d
5 %
4
3
2
1
0
v_i = 200 mV$_{RMS}$
f_{mod} = 1 kHz
Mono
T_{amb} = 25 °C
Channel balance
+1 dB
0
−1
Ch. B.
$V_{O(R)}$
d, L, R
0
2
4 V
V_S

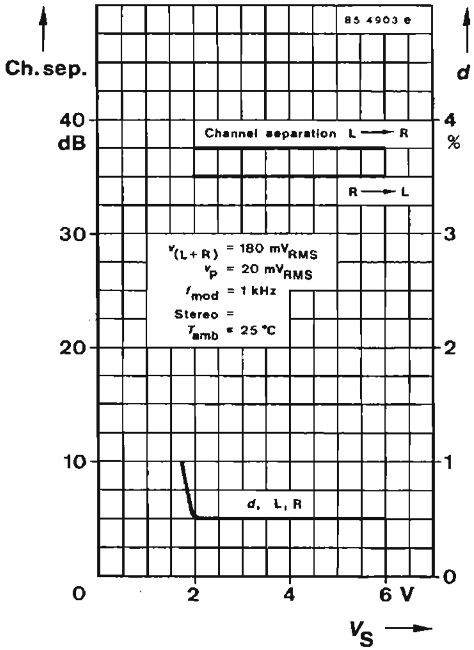

85 4900 e
Ch. sep.
50 dB
40
30
20
10
0
d
5 %
4
3
2
1
0
V_S = 3 V
L+R = 90 %
P = 10 %
f_{mod} = 1 kHz
Stereo
T_{amb} = 25 °C
Channel separation
L → R
R → L
d, L, R
100
200
300
400
500 mV$_{RMS}$
v_i

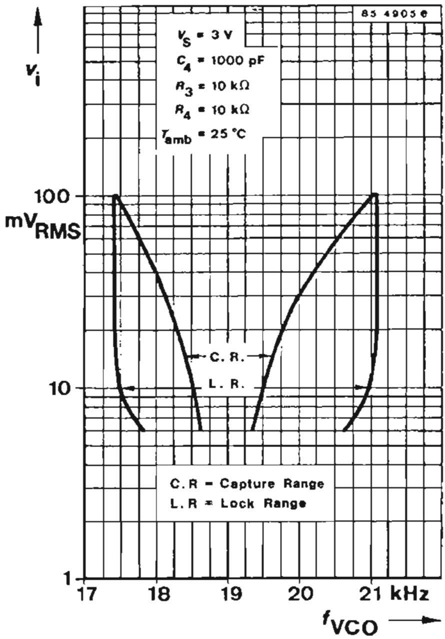

85 4898 e
$V_{O(R)}$
250 mV$_{RMS}$
200
150
100
50
0
d
5 %
4
3
2
1
0
V_S = 3 V
f_{mod} = 1 kHz
Mono
T_{amb} = 25 °C
$V_{O(R)}$
Channel balance
+1 dB
0
−1
Ch. B.
d, L, R
0
200
400 mV$_{RMS}$
v_i

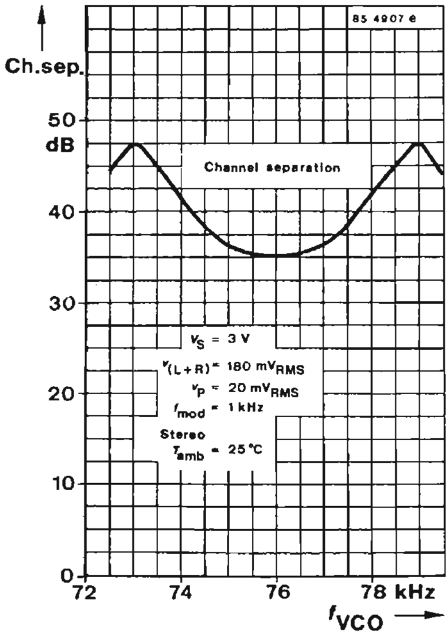

85 4902 e
Ch. sep.
d
40
dB
4
%
Channel separation L → R
R → L
30
3
V_S = 3 V
$V_{(L+R)}$ = 180 mV$_{RMS}$
V_P = 20 mV$_{RMS}$
T_{amb} = 25 °C
20
2
10
1
d, L, R
0
0.1
1
10 kHz
f_{mod} →

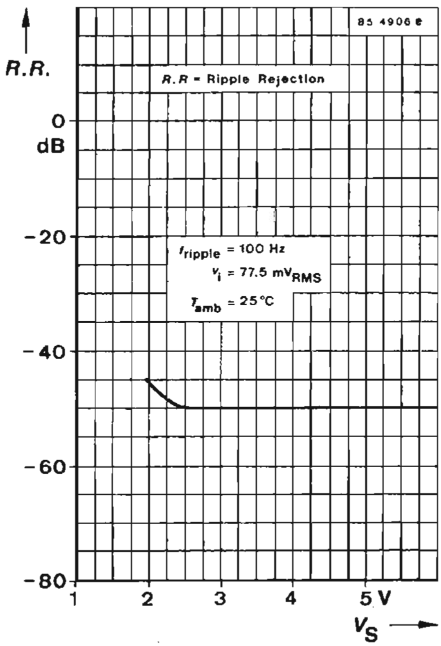

85 4901 e
$V_{O(R)}$
d
V_S = 3 V
V_i = 200 mV$_{RMS}$
Mono
T_{amb} = 25 °C
30
dB
8
%
10
6
$V_{O(R)}$
0
−10
4
Channel balance
+1
dB
Ch. B.
−30
0
2
−1
d, L, R
−50
0
0.1
1
10 kHz
f →


85 4904 e
V_i
f_{VCO}
Lamp – ON
8
mV$_{RMS}$
78
kHz
6
77
Lamp – OFF
4
76
f_{VCO}
2
75
0
74
2
3
4
5 V
V_S →

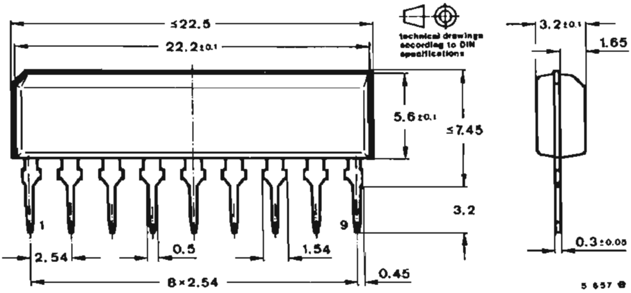

85 4903 e
Ch. sep.
d
40
dB
4
%
Channel separation L → R
R → L
30
3
$V_{(L+R)}$ = 180 mV$_{RMS}$
V_P = 20 mV$_{RMS}$
f_{mod} = 1 kHz
Stereo =
T_{amb} = 25 °C
20
2
10
1
d, L, R
0
0
2
4
6 V
V_S →


85 4905 e
V_S = 3 V
C_4 = 1000 pF
R_3 = 10 kΩ
R_4 = 10 kΩ
T_{amb} = 25 °C
v_i
100
mV_{RMS}
10
1
C. R.
L. R.
C. R = Capture Range
L. R = Lock Range
17
18
19
20
21 kHz
f_{VCO}


85 4907 e
Ch.sep.
50
dB
40
30
20
10
0
Channel separation
V_S = 3 V
$v_{(L+R)}$ = 180 mV_{RMS}
v_p = 20 mV_{RMS}
f_{mod} = 1 kHz
Stereo
T_{amb} = 25 °C
72
74
76
78 kHz
f_{VCO}


85 4906 e
R.R.
R.R = Ripple Rejection
0
dB
-20
-40
-60
-80
f_{ripple} = 100 Hz
v_i = 77.5 mV_{RMS}
T_{amb} = 25 °C
1
2
3
4
5 V
V_S

Dimensions in mm



Case
SIP 9
Weight max. 0.8 g

Monolithic Integrated Circuit

Application: Dual Low voltage Power Amplifier, especially for portable radios and cassette players

Features:

- Supply voltage range 1.8 V to 10 V
- Low crossover distortion
- Very low radiation due to low cut-off frequency
- Low quiescent current
- Stereo configuration
- Audio output power 2x0.7 W

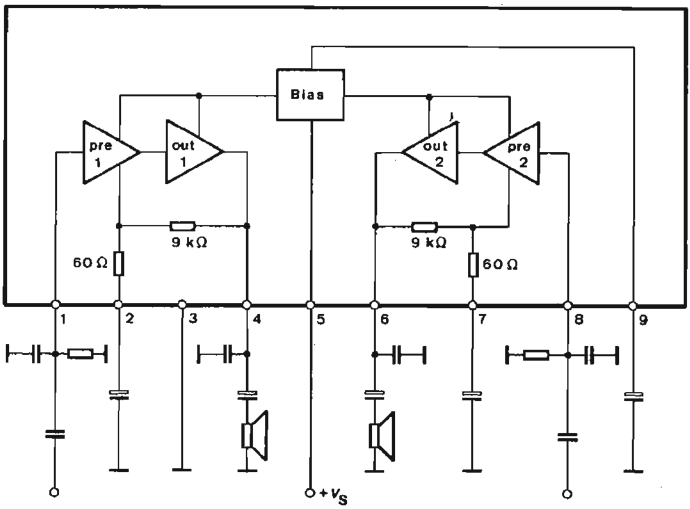


Fig.1 Block diagram and pin connections

Absolute maximum ratings

Reference point Pin 3, unless otherwise specified

Supply voltage	V_S	10	V
Power dissipation			
T_{amb} = 50°C	P_{tot}	1	W
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	–25...+150	°C

Thermal resistance			**Min.**	**Typ.**	**Max.**	
Junction ambient		R_{thJA}			100	K/W

Electrical characteristics

V_S = 4.5 V, T_{amb} = 25°C, reference point Pin 3, unless otherwise specified

			Min.	Typ.	Max.	
Supply voltage range	Pin 5	V_S	1.8		10	V
Quiescent drain current	Pin 5	I_S		12		mA
V_S = 8 V	Pin 5	I_S	5		16	mA
Output power						
d = 10%, f = 1 kHz						
V_S = 2.0 V, R_L = 4 Ω	Pin 4, 6	P_o		25		mW
V_S = 3.0 V, R_L = 8 Ω	Pin 4, 6	P_o		65		mW
V_S = 4.5 V, R_L = 8 Ω	Pin 4, 6	P_o		200		mW
V_S = 9.0 V, R_L = 12 Ω	Pin 4, 6	P_o		650		mW
V_S = 6.0 V, R_L = 16 Ω	Pin 4, 6	P_o		220		mW
V_S = 3.0 V, R_L = 32 Ω	Pin 4, 6	P_o		20		mW
V_S = 4.5 V, R_L = 32 Ω	Pin 4, 6	P_o		60		mW
Distortion						
P_o = 50 mW, R_L = 8 Ω	Pin 4, 6	d		0.5		%
Closed loop voltage gain						
f = 1 kHz	Pin 4, 6	G_{vf}	40	43		dB
Power bandwidth (−3 dB)	Pin 4, 6	B		30		kHz
Input resistance	Pin 1, 8	R_i	800			kΩ
Input noise voltage						
R_S = 0, B = 22 Hz...22 kHz	Pin 1, 8	V_{ni}		2.5		µV
Supply voltage rejection ratio	Pin 4, 6	SVR		26		dB
v_{hum} = 0.2 V, f_{hum} = 100 Hz						
Channel separation						
f = 1 kHz, P_o = 0.25 W						
Channel 1 ⟷ Channel 2	Pin 4 ⟷ 6			46		dB

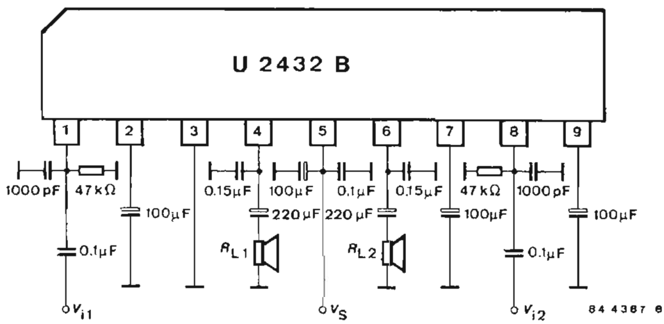
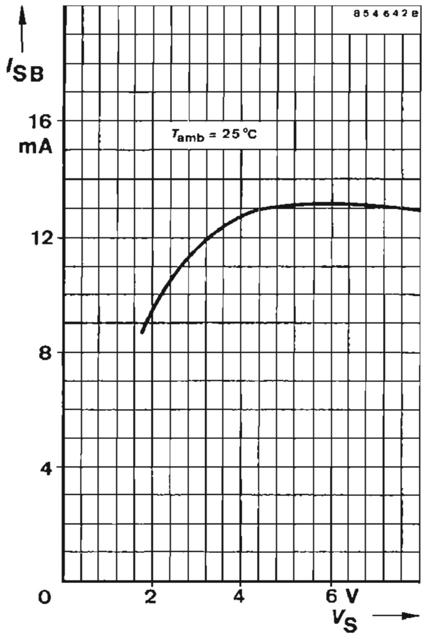
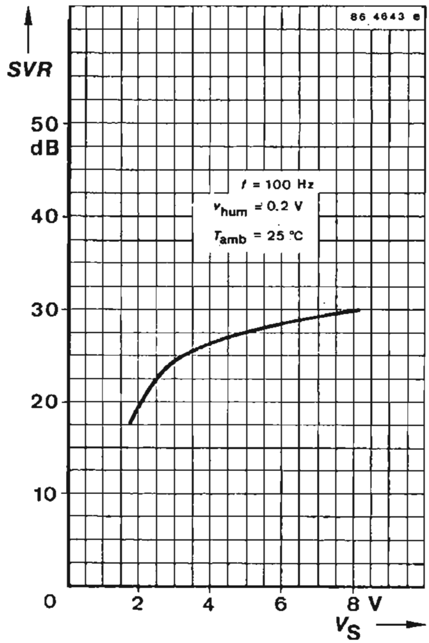
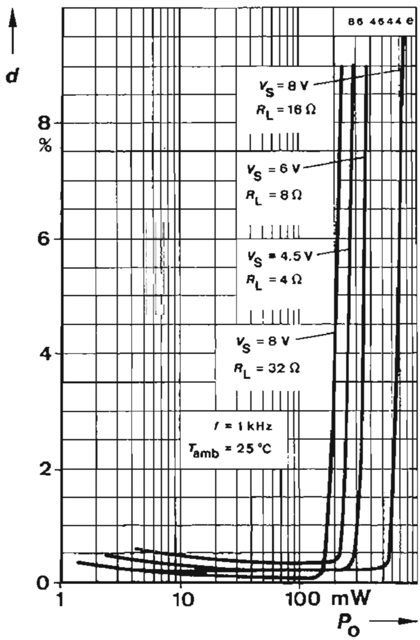
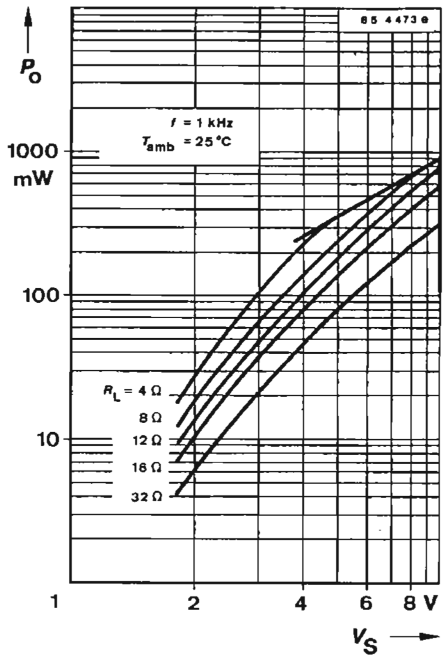


Fig. 2
Test circuit

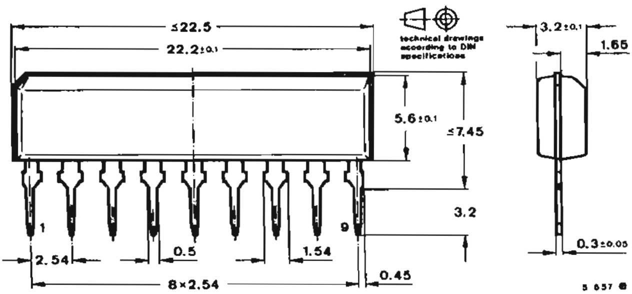

854642e
I_{SB}
16 mA
12
8
4
0
2
4
6 V
V_S
T_{amb} = 25 °C


86 4643 e
SVR
50 dB
40
30
20
10
0
2
4
6
8 V
V_S
f = 100 Hz
v_{hum} = 0.2 V
T_{amb} = 25 °C


86 4644 e
d
8 %
6
4
2
0
1
10
100 mW
P_o
V_S = 8 V
R_L = 16 Ω
V_S = 6 V
R_L = 8 Ω
V_S = 4.5 V
R_L = 4 Ω
V_S = 8 V
R_L = 32 Ω
f = 1 kHz
T_{amb} = 25 °C


85 4473 e
P_o
1000 mW
100
10
1
2
4
6
8 V
V_S
f = 1 kHz
T_{amb} = 25 °C
R_L = 4 Ω
8 Ω
12 Ω
16 Ω
32 Ω

Dimensions in mm



Case
SIP 9
Weight max. 0.8 g

Monolithic Integrated Circuit

Application: Dual Low voltage Power Amplifier, especially for portable radios and cassette players

Features:

- Supply voltage range 1.8 V to 10 V
- Low crossover distortion
- Very low radiation due to low cut-off frequency
- Low quiescent current
- Bridge configuration
- Audio output power 1.4 W

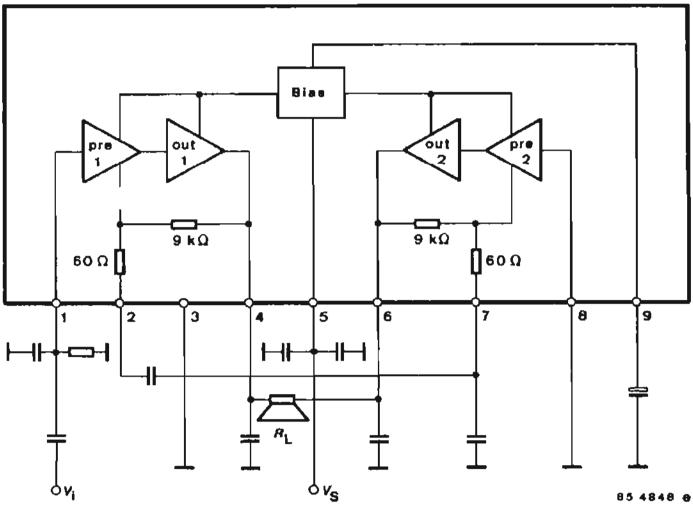


Fig.1 Block diagram and pin connections

Absolute maximum ratings

Reference point Pin 3, unless otherwise specified

Supply voltage	V_S	10	V
Power dissipation T_{amb} = 50°C	P_{tot}	1	W
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	–25...+150	°C

Thermal resistance

			Min.	Typ.	Max.	
Junction ambient		R_{thJA}			100	K/W

Electrical characteristics

V_S = 4.5 V, T_{amb} = 25°C, reference point Pin 3, unless otherwise specified

			Min.	Typ.	Max.	
Supply voltage range	Pin 5	V_S	1.8		10	V
Quiescent drain current						
$R_L = \infty$	Pin 5	I_S	5	12	16	mA
Output offset voltage						
$R_L = 8\ \Omega$	Pin 4 ⟷ 6	$\pm V_{00}$		10	50	mV
Output power						
d = 10%, f = 1 kHz						
V_S = 2.0 V, R_L = 4 Ω	Pin 4-6	P_o		75		mW
V_S = 3.0 V, R_L = 8 Ω	Pin 4-6	P_o		225		mW
V_S = 4.5 V, R_L = 8 Ω	Pin 4-6	P_o		600		mW
V_S = 6.0 V, R_L = 16 Ω	Pin 4-6	P_o		900		mW
V_S = 3.0 V, R_L = 32 Ω	Pin 4-6	P_o		75		mW
V_S = 4.5 V, R_L = 32 Ω	Pin 4-6	P_o		230		mW
Distortion						
P_o = 50 mW, R_L = 16 Ω	Pin 4-6	d		0.5		%
Closed loop voltage gain						
f = 1 kHz	Pin 4-6	G_{vf}	40	43		dB
Power bandwidth (–3 dB)	Pin 4-6	B		30		kHz
Input resistance	Pin 1, 8	R_i	800			kΩ
Input noise voltage						
R_S = 0, B = 22 Hz...22 kHz	Pin 1	V_{ni}		5		µV
Supply voltage rejection ratio	Pin 4-6	SVR		46		dB
V_{hum} = 0.2 V, f_{hum} = 100 Hz						

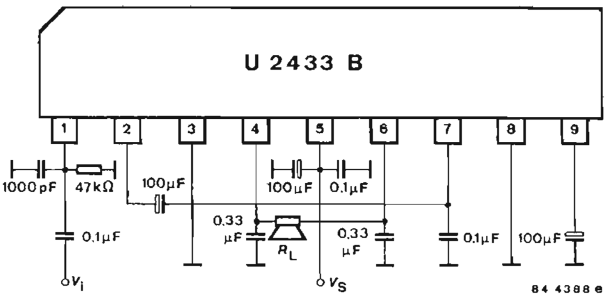
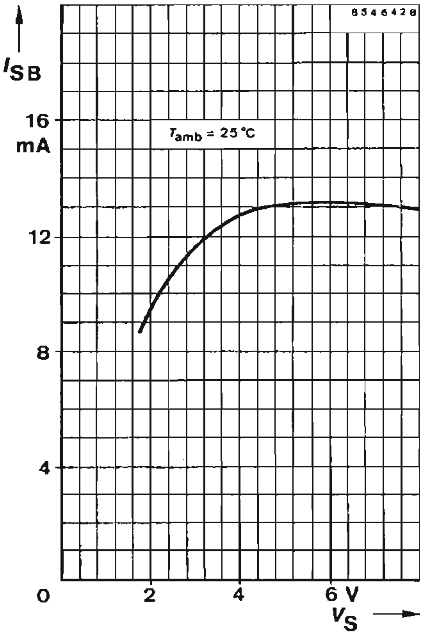
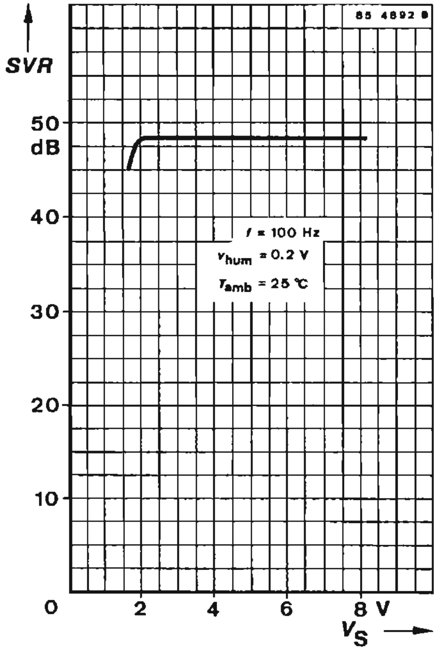


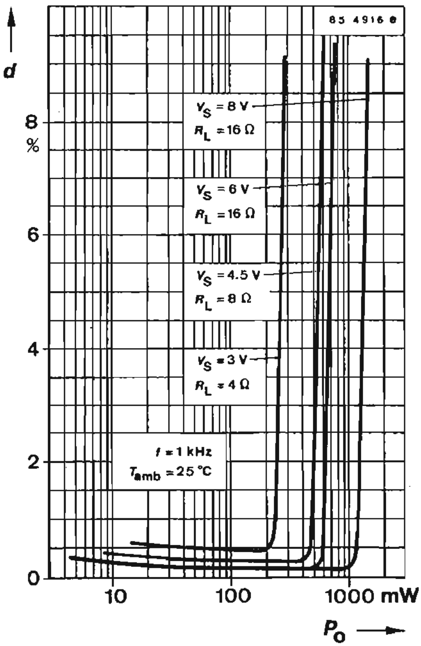
Fig. 2 Test circuit



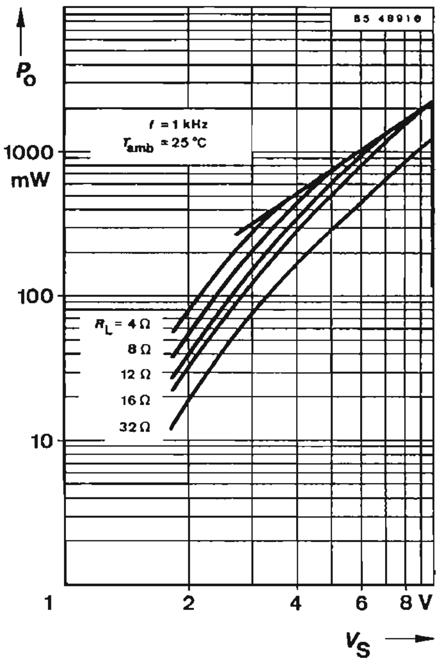
85 4642 B
I_{SB}
16
mA
12
8
4
0
2
4
6 V
V_S
T_{amb} = 25 °C



85 4892 B
SVR
50
dB
40
30
20
10
0
2
4
6
8 V
V_S
f = 100 Hz
v_{hum} = 0.2 V
T_{amb} = 25 °C

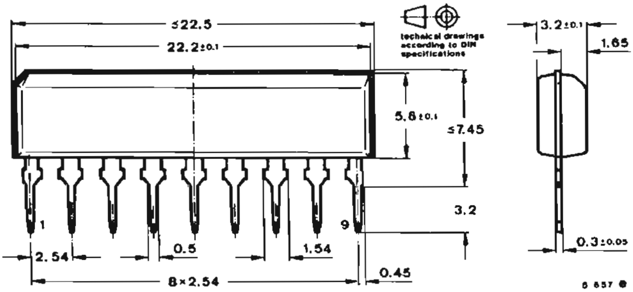


85 4916 B
d
8
%
6
4
2
0
10
100
1000 mW
P_o
V_S = 8 V
R_L = 16 Ω
V_S = 6 V
R_L = 16 Ω
V_S = 4.5 V
R_L = 8 Ω
V_S = 3 V
R_L = 4 Ω
f = 1 kHz
T_{amb} = 25 °C



85 4891 B
P_o
1000
mW
100
10
1
2
4
6
8 V
V_S
f = 1 kHz
T_{amb} = 25 °C
R_L = 4 Ω
8 Ω
12 Ω
16 Ω
32 Ω

Dimensions in mm



Case
SIP 9
Weight max. 0.8 g

Monolithic Integrated Circuit

Application: Dual Low voltage Power Amplifier, especially for portable radios and cassette players

Features:

- Supply voltage range 1.8 V to 10 V
- Low crossover distortion
- Very low radiation due to low cut-off frequency
- Low quiescent current
- Stereo configuration
- Audio output power 2x0.7 W

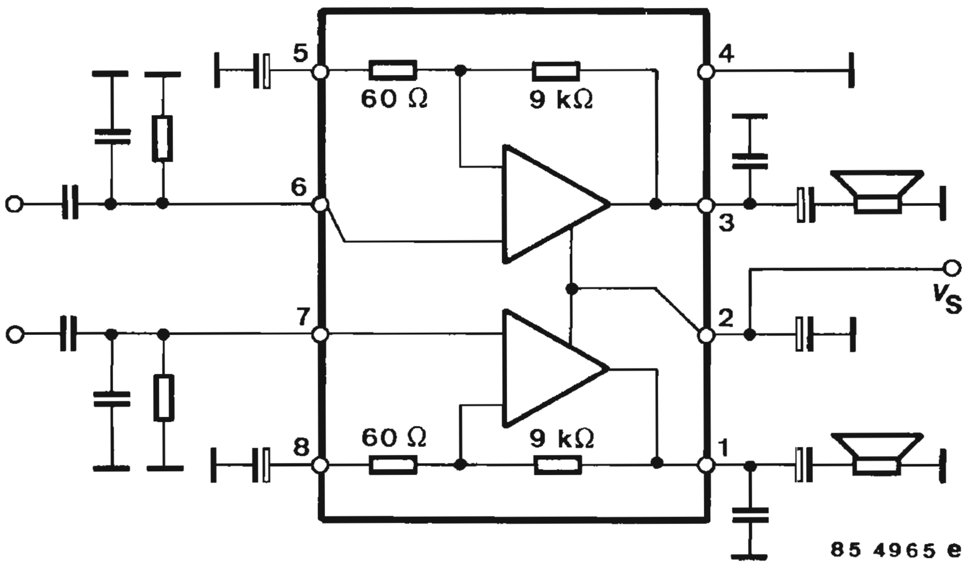


Fig.1 Block diagram and pin connections

Absolute maximum ratings

Reference point Pin 4, unless otherwise specified

Supply voltage	V_S	10	V
Power dissipation			
T_{amb} = 50°C	P_{tot}	1	W
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	−25...+150	°C

Thermal resistance		Min.	Typ.	Max.	
Junction ambient	R_{thJA}			100	K/W

Electrical characteristics

V_S = 4.5 V, T_{amb} = 25°C, reference point Pin 4, unless otherwise specified

			Min.	Typ.	Max.	
Supply voltage range	Pin 2	V_S	1.8		10	V
Quiescent drain current						
$R_L = \infty$	Pin 2	I_S	5	12	16	mA
Output power						
d = 10%, f = 1 kHz						
V_S = 2.0 V, R_L = 4 Ω	Pin 1, 3	P_o		25		mW
V_S = 3.0 V, R_L = 8 Ω	Pin 1, 3	P_o		65		mW
V_S = 4.5 V, R_L = 8 Ω	Pin 1, 3	P_o		200		mW
V_S = 9.0 V, R_L = 12 Ω	Pin 1, 3	P_o		650		mW
V_S = 6.0 V, R_L = 16 Ω	Pin 1, 3	P_o		220		mW
V_S = 3.0 V, R_L = 32 Ω	Pin 1, 3	P_o		20		mW
V_S = 4.5 V, R_L = 32 Ω	Pin 1, 3	P_o		60		mW
Distortion						
P_o = 50 mW, R_L = 8 Ω	Pin 1, 3	d		0.5		%
Closed loop voltage gain						
f = 1 kHz	Pin 1, 3	G_{vf}	40	43		dB
Power bandwidth (−3 dB)	Pin 1, 3	B		30		kHz
Input resistance	Pin 6, 7	R_i	800			kΩ
Input noise voltage						
R_S = 0, B = 22 Hz...22 kHz	Pin 6, 7	V_{ni}		2.5		μV
Supply voltage rejection ratio	Pin 1, 3	SVR		15		dB
v_{hum} = 0.2 V, f_{hum} = 100 Hz						
Channel separation						
f = 1 kHz, P_o = 0.25 W						
Channel 1 ⟷ Channel 2	Pin 1 ⟷ 3			46		dB

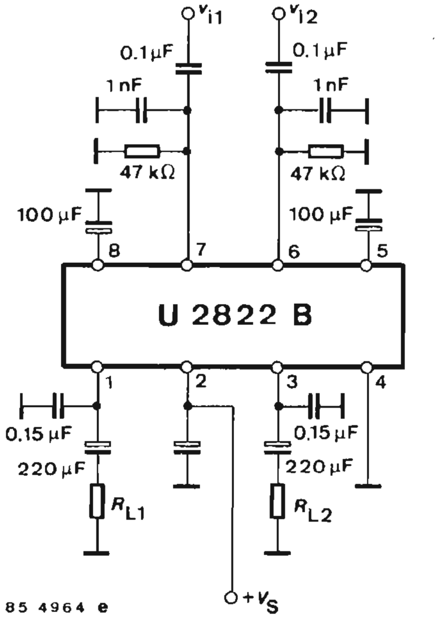
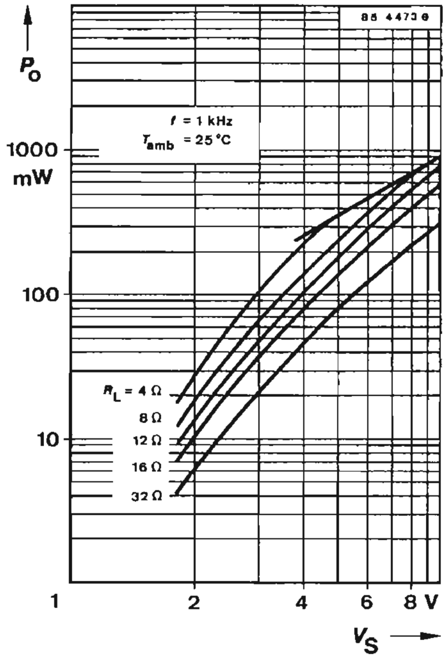
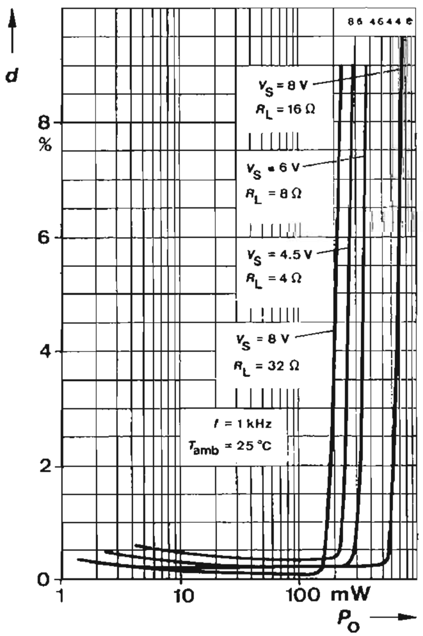
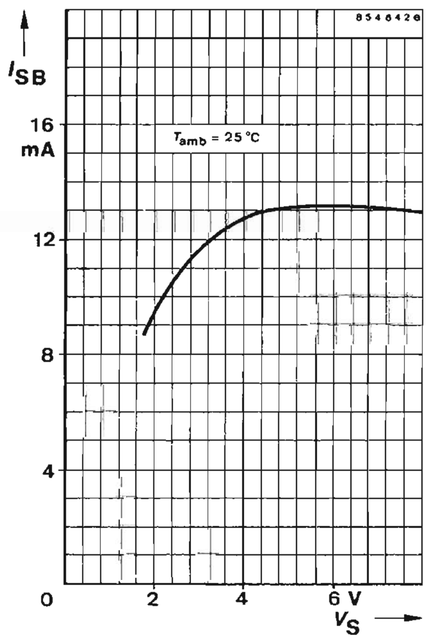


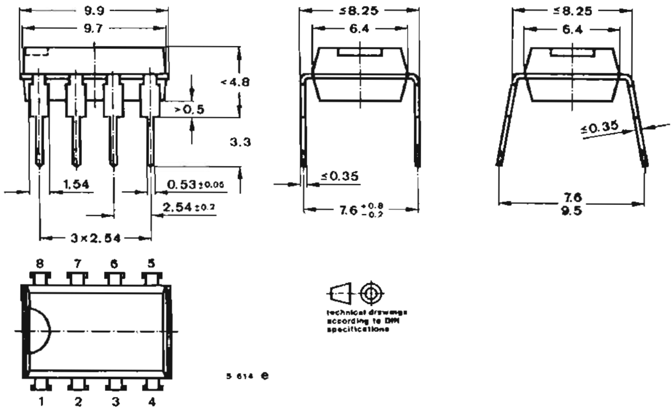
Fig. 2 Test circuit







Dimensions in mm



Case
DIP 8
Weight max. 0.8 g

Monolithic Integrated Circuit

Application: Dual Low voltage Power Amplifier, especially for portable radios and cassette players

Features:

- Supply voltage range 1.8 V to 10 V
- Low crossover distortion
- Very low radiation due to low cut-off frequency
- Low quiescent current
- Stereo configuration
- Audio output power 1.4 W

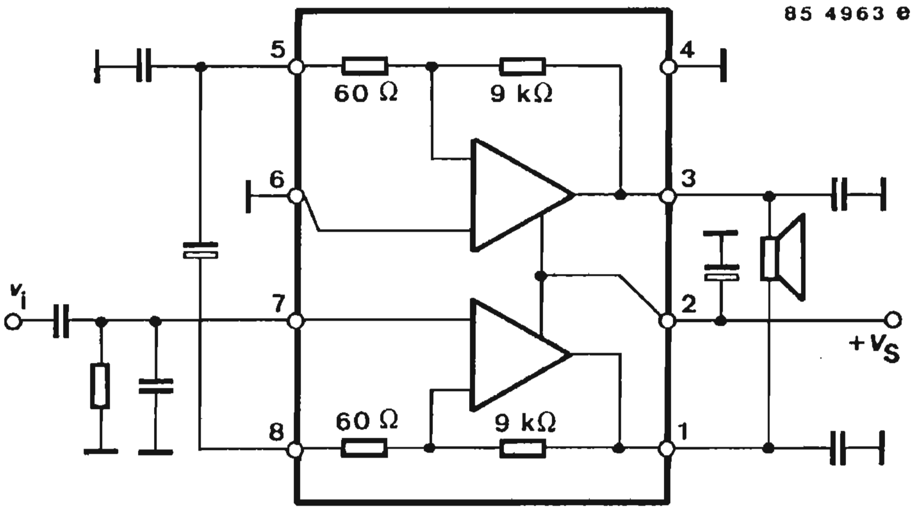


Fig. 1 Block diagram and pin connections

Absolute maximum ratings

Reference point Pin 4, unless otherwise specified

Supply voltage	V_S	10	V
Power dissipation T_{amb} = 50°C	P_{tot}	1	W
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	–25...+150	°C

Thermal resistance		Min.	Typ.	Max.	
Junction ambient	R_{thJA}			100	K/W

Electrical characteristics

V_S = 4.5 V, T_{amb} = 25°C, reference point Pin 4, unless otherwise specified

			Min.	Typ.	Max.	
Supply voltage range	Pin 2	V_S	1.8		10	V
Quiescent drain current $R_L = \infty$	Pin 2	I_S	5	12	16	mA
Output power R_L = 8 Ω	Pin 1 ⟷ 3	$\pm V_{00}$		10	50	mV
Output power d = 10%, f = 1 kHz						
V_S = 2.0 V, R_L = 4 Ω	Pin 1-3	P_o		75		mW
V_S = 3.0 V, R_L = 8 Ω	Pin 1-3	P_o		225		mW
V_S = 4.5 V, R_L = 8 Ω	Pin 1-3	P_o		600		mW
V_S = 6.0 V, R_L = 16 Ω	Pin 1-3	P_o		900		mW
V_S = 3.0 V, R_L = 32 Ω	Pin 1-3	P_o		75		mW
V_S = 4.5 V, R_L = 32 Ω	Pin 1-3	P_o		230		mW
Distortion P_o = 50 mW, R_L = 16 Ω	Pin 1-3	d		0.5		%
Closed loop voltage gain f = 1 kHz	Pin 1-3	G_{vf}	40	43		dB
Power bandwidth (–3 dB)	Pin 1-3	B		30		kHz
Input resistance	Pin 7	R_i	800			kΩ
Input noise voltage R_S = 0, B = 22 Hz...22 kHz	Pin 7	V_{ni}		5		µV
Supply voltage rejection ratio v_{hum} = 0.2 V, f_{hum} = 100 Hz	Pin 1-3	*SVR*		43		dB

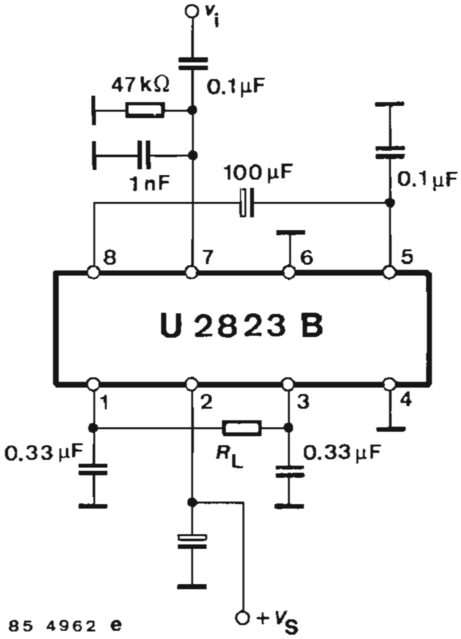
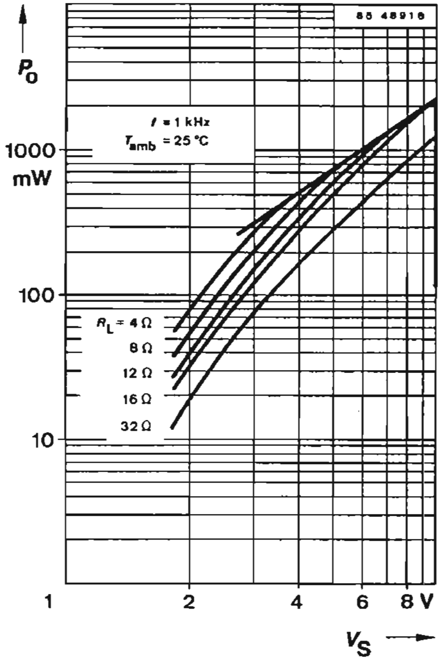
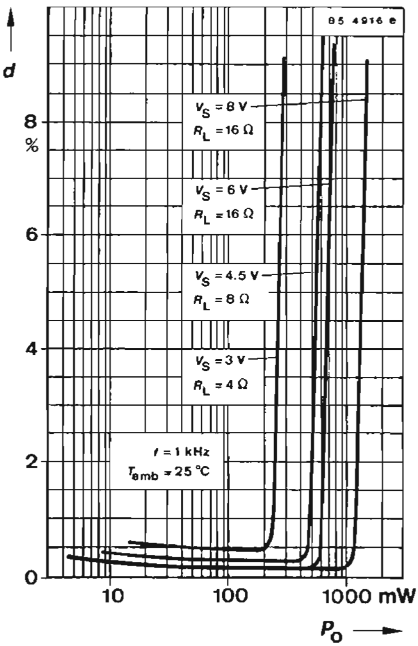
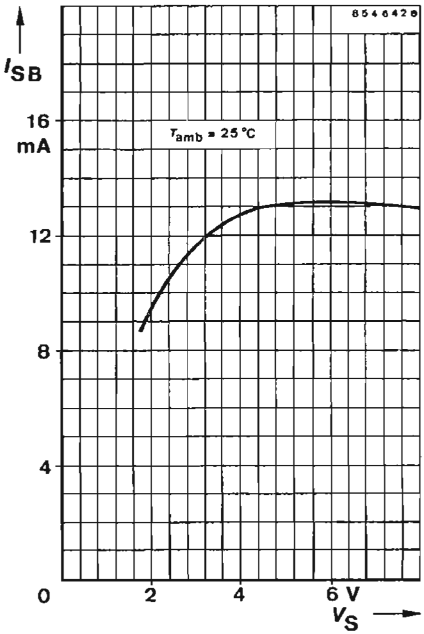


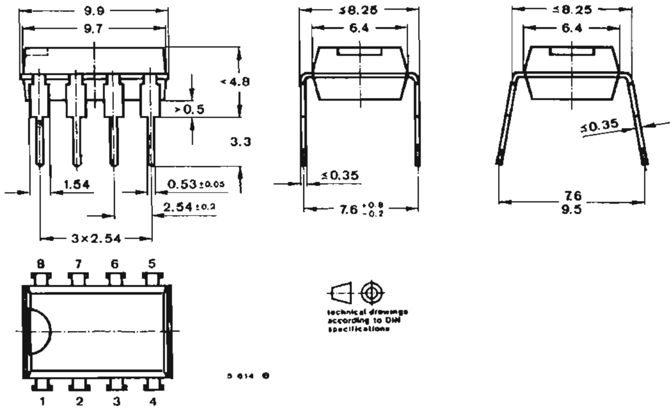
Fig. 2 Test circuit







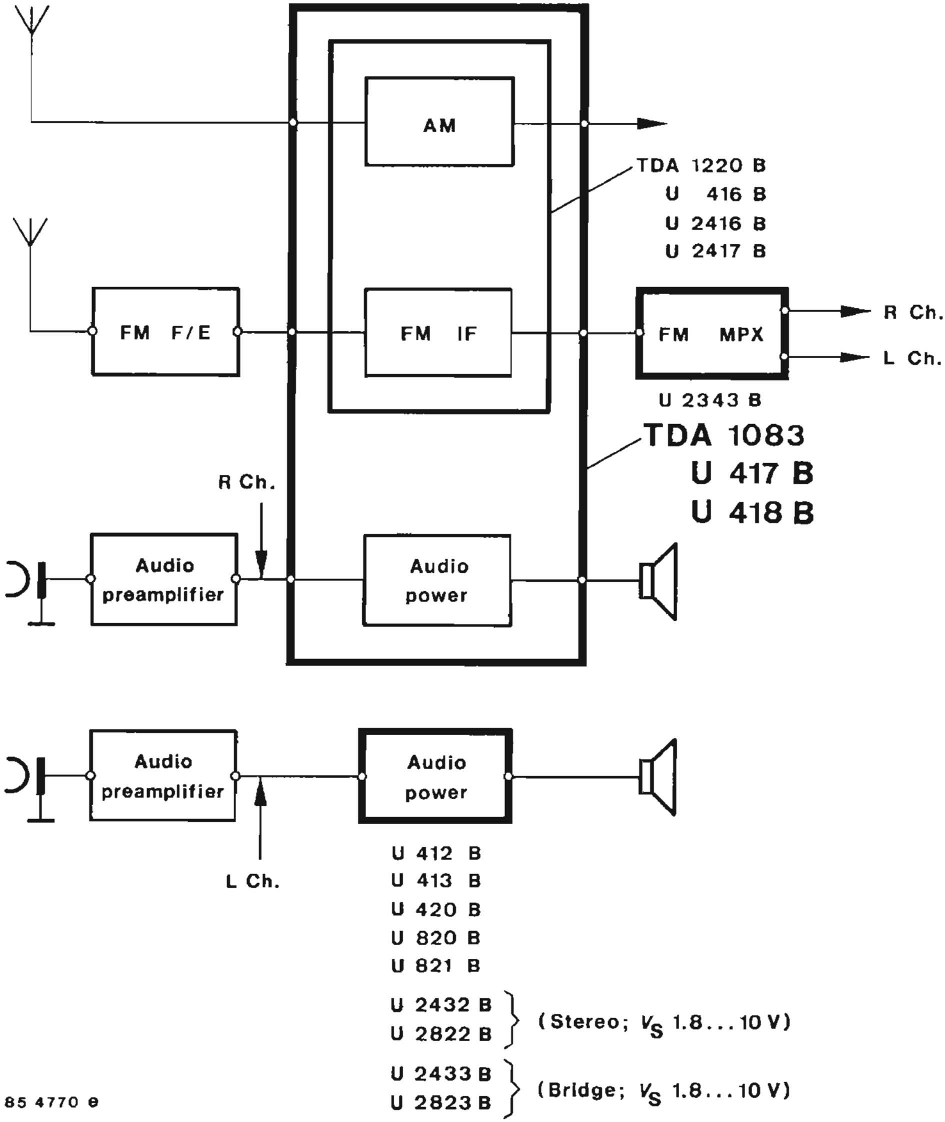
Dimensions in mm



Case
DIP 8
Weight max. 0.8 g

Portable Radio
Clock Radios

$V_S = 3 \ldots 12$ V



Monolithic Integrated Circuit

Application: AM/FM-IF Amplifier for portable radios

Features:

- Large supply voltage range $V_S = 3...16$ V
- High sensitivity and low noise
- Very low tweet
- Very high signal handling (1 V)
- Sensitivity regulation facility
- High recovered audio signal (100 mV) suited for stereo decoders and radio recorders
- Very simple DC switching of AM-FM
- High stability of electrical characteristics from 3 V to 16 V
- Low current drain

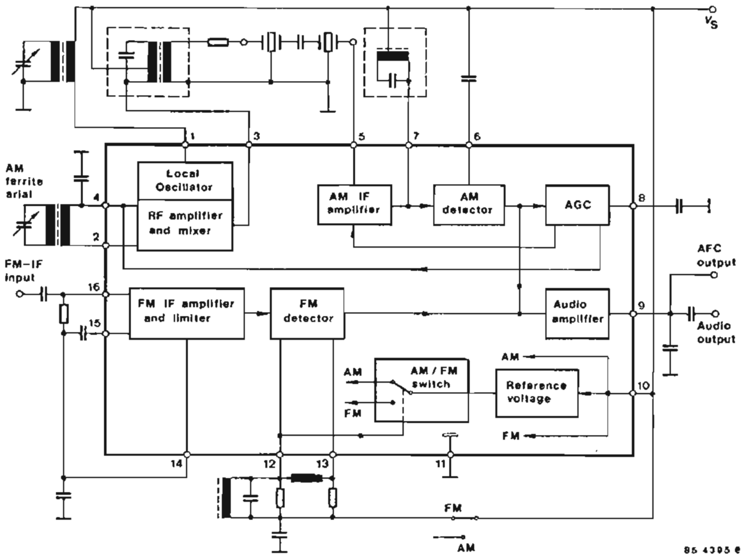
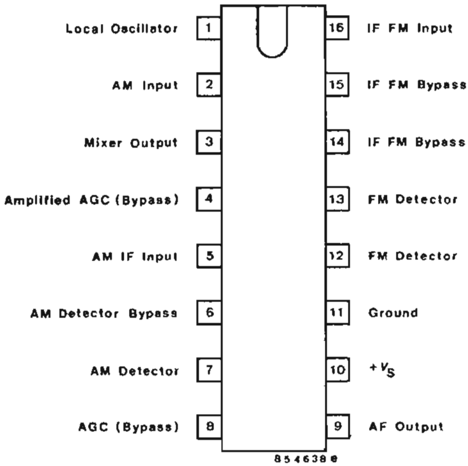


Fig.1 Block diagram and pin connections

T1.2/369.0184 E



Pin connection

Absolute maximum ratings

Reference point Pin 11, unless otherwise specified

Supply voltage	Pin 10	V_S	16	V
Ambient temperature		T_{amb}	85	°C
Junction temperature		T_j	150	°C
Storage temperature range		T_{stg}	−25...+150	°C

Thermal resistance		**Min.**	**Typ.**	**Max.**	
Junction ambient	R_{thJA}			100	K/W

Electrical characteristics

$V_S = 9$ V, reference point Pin 11, $T_{amb} = 25$°C, unless otherwise specified

			Min.	Typ.	Max.	
Supply voltage range	Pin 10	V_S	3		16	V
Supply current	Pin 10	I_S		10		mA

AM-Amplifier

$f_i = 1$ MHz, $f_{IF} = 455$ kHz, $f_{mod} = 1$ kHz, m = 0.3

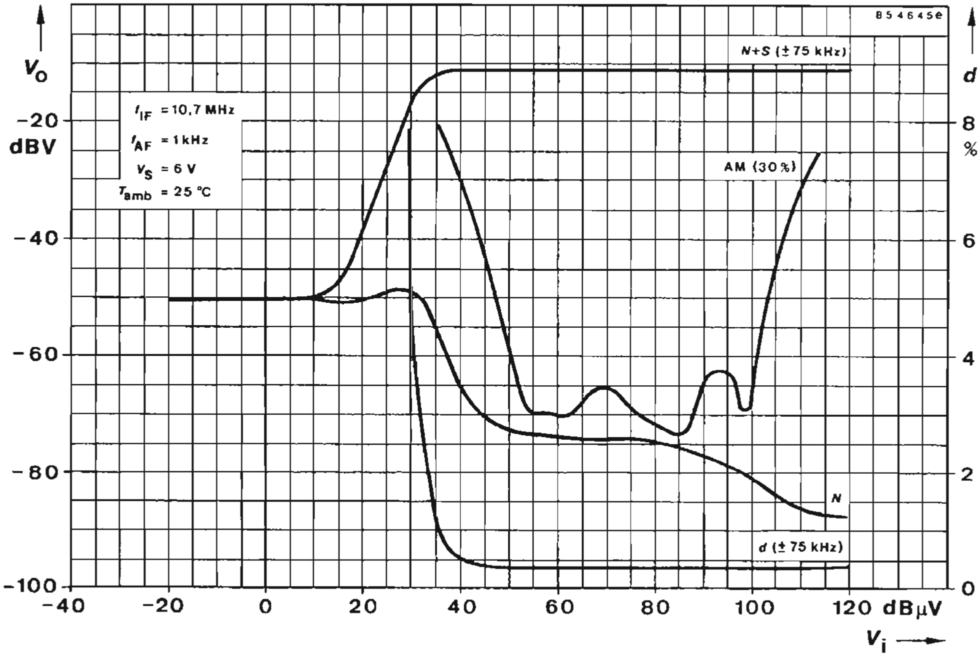
			Min.	Typ.	Max.	
Input sensitivity S/N = 26 dB	Pin 2	v_i		12	25	μV
Signal to noise ratio $v_i = 10$ mV	Pin 9	S/N		52		dB

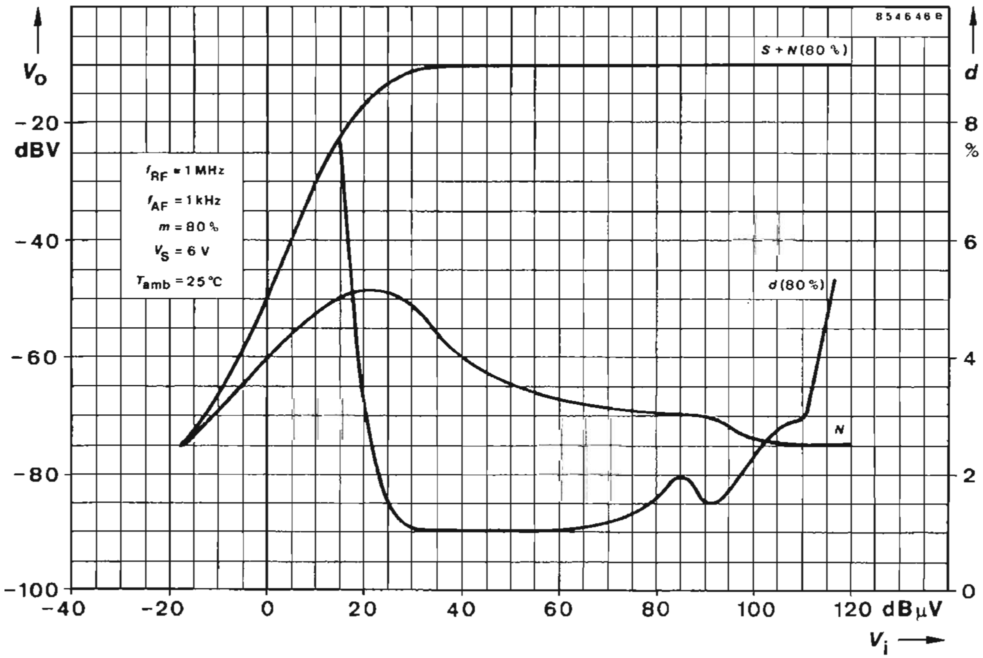
			Min.	Typ.	Max.	
AGC range						
$\Delta V_{oAF}/V_{oAF}$ = 10 dB, m = 0.8	Pin 2	Δv_i		100		dB
AF voltage at demodulator output						
v_i = 1 mV	Pin 9	v_{oAF}		120		mV
Distortion						
v_i = 1 mV	Pin 9	d		0.4		%
Max. input signal handling capability						
m = 0.8, d < 10%	Pin 2	v_H		1		V
Input resistance	Pin 2-4	R_i		7.5		KΩ
Input capacitance	Pin 2-4	C_i		18		pF
Output resistance	Pin 9	R_o		7		KΩ
Tweet 2 IF	Pin 9					
v_i = 1 mV				38		dB
Tweet 3 IF	Pin 9					
v_i = 1 mV				55		dB

FM-IF-Amplifier

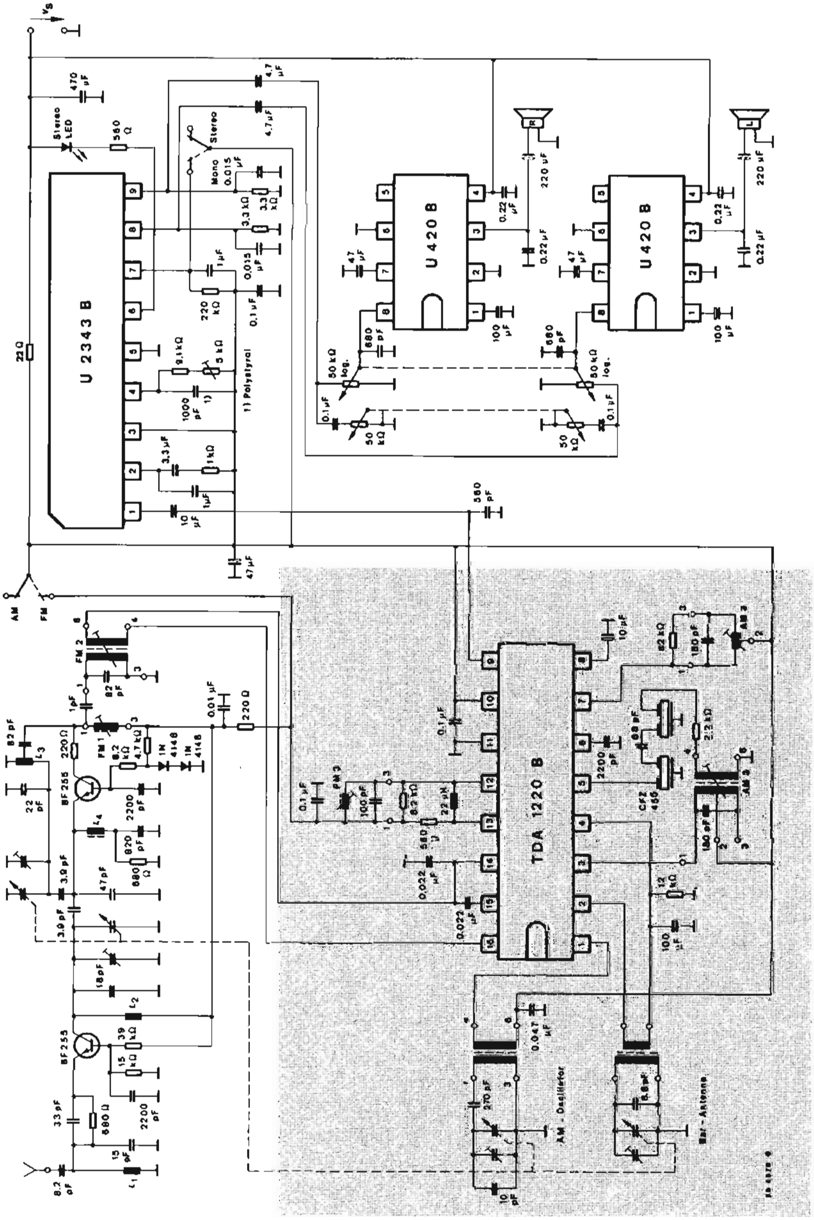
f_{IF} = 10.7 MHz, $\Delta f = \pm 22.5$ kHz, f_{mod} = 1 kHz

			Min.	Typ.	Max.	
Limiting threshold (−3 dB)	Pin 9	v_i		22		μV
AM-rejection						
v_i = 3 mV, m = 0.3	Pin 16	*AMR*		52		dB
Signal to noise ratio						
v_i = 1 mV	Pin 9	S/N		64		dB
Distortion	Pin 9					
v_i = 1 mV $\Delta f = \pm 75$ kHz		d		0.7		%
$\Delta f = \pm 22.5$ kHz		d		0.25		%
(double tuned) $\Delta f = \pm 22.5$ kHz		d		0.1		%
AF voltage at demodulator output						
v_i = 1 mV	Pin 9	v_{oAF}	65	100		mV
Input resistance	Pin 16	R_i		6.5		KΩ
Input capacitance	Pin 16	C_i		14		pF
Output resistance	Pin 9	R_o		7		KΩ

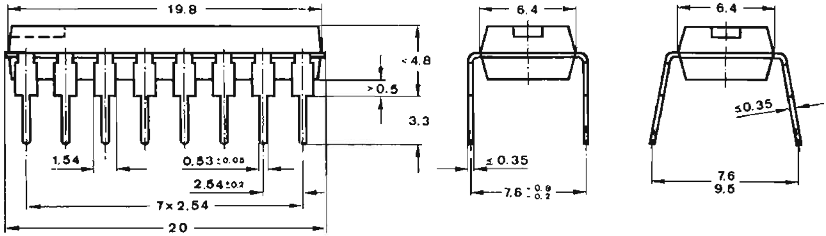

854645e
V_o
dBV
-20
-40
-60
-80
-100
d
8
%
6
4
2
0
-40
-20
0
20
40
60
80
100
120 dBμV
V_i
f_{IF} = 10,7 MHz
f_{AF} = 1 kHz
V_S = 6 V
T_{amb} = 25 °C
N+S (± 75 kHz)
AM (30 %)
N
d (± 75 kHz)

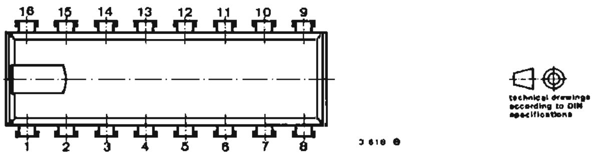

854646e
V_o
dBV
-20
-40
-60
-80
-100
d
8
%
6
4
2
0
-40
-20
0
20
40
60
80
100
120 dBμV
V_i
f_{RF} = 1 MHz
f_{AF} = 1 kHz
m = 80 %
V_S = 6 V
T_{amb} = 25 °C
S + N (80 %)
d (80 %)
N

Application:



Dimensions in mm





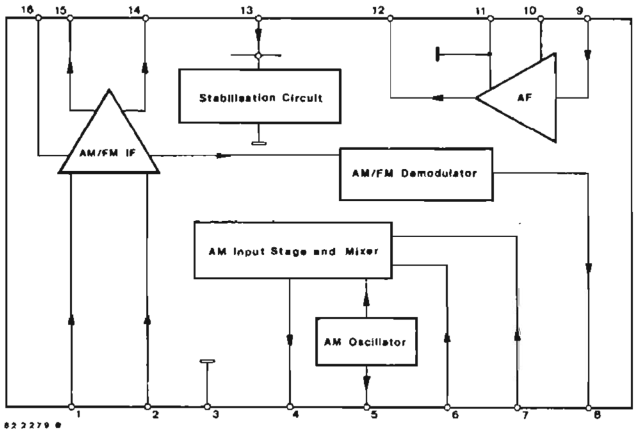
Case
20 A 16 DIN 41866
JEDEC MO 001 AC
DIP 16
Weight max. 1.5 g

Monolithic Integrated Circuit

Applications: AM-/FM- and Audio-Amplifier

Features:

- Large supply voltage range V_S= 3...12 V
- High AM-Sensitivity
- Limiting threshold voltage V_i =50 μV
- Audio output power P_o = 0.7 W
- AFC-connection for VHF-Tuner
- AM-FM switching without high frequency voltages



1 IF-Decoupling
2 IF-Input
3 HF-Ground
4 AM-Mixer output
5 AM-Oscillator circuit
6 AM-Input
7 AM-Decoupling
8 Demodulator-Output
9 Audio-Input
10 Audio-Feedback
11 Audio-Ground
12 Audio-Output
13 + V_S
14 Demodulator circuit
15 Demodulator circuit
16 AGC/AFC-Voltage

Fig. 1 Block diagram and pin connections

Description:

The integrated circuit TDA 1083 includes, with exception of the FM front end, a complete AM-/FM-radio-circuit with audio power amplifier.
An internal Z-diode stabilizes the supply voltage at $V_S \approx$ 13 V, which allows with the aid of a resistor and a rectifier, the circuit to be driven by a higher external supply voltage.

Absolute maximum ratings

Reference points Pin 3 and 11, unless otherwise specified

Supply voltage range	Pin 13	V_S	3...12	V
Supply current when using the integrated stabilisation circuit V_S = 12.5...14.3 V	Pin 13	I_S	50	mA
Power dissipation T_{amb} = 65°C		P_{tot}	600	mW
Junction temperature		T_j	125	°C
Storage temperature range		T_{stg}	–25...+125	°C

			Min.	Typ.	Max.	
Thermal resistance						
Junction ambient		R_{thJA}			100	K/W

Electrical characteristics

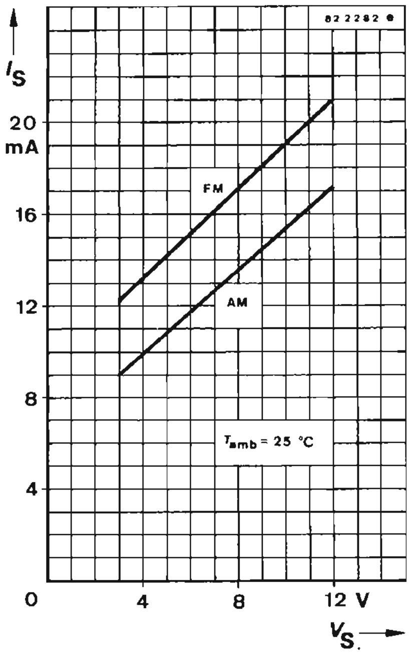
V_S = 9 V, reference points Pin 3 and 11, T_{amb} = 25°C, unless otherwise specified

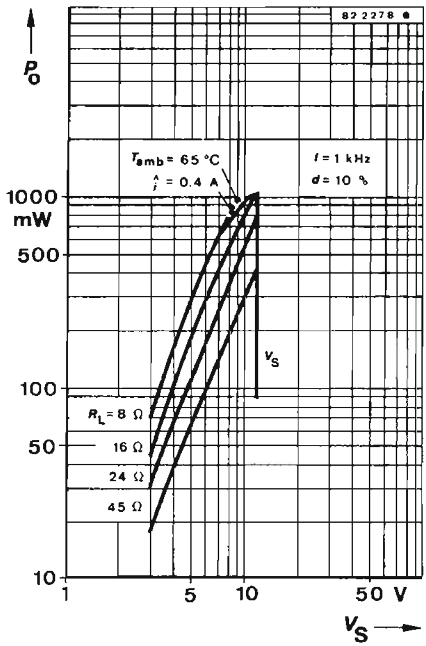
			Min.	Typ.	Max.	
AF Amplifier						
AF voltage amplification f = 1 kHz		G_v		40		dB
Input impedance		R_i		150		kΩ
Output power (Fig. 4, 5) V_S = 5.5 V, R_L = 8 Ω, = 10 %		P_o	300			mW
AM-IF Amplifier f_i = 1 MHz, f_{IF} = 455 kHz, f_{mod} = 1 kHz, m = 0.3						
DC voltages at AM mode without signal at:						
V_S = 3 V	Pin 10	V_{10B}		1.2		V
	Pin 12	V_{12B}	1.0		1.4	V
	Pin 13	V_{13B}	3.0	3.0	3.0	V
	Pin 16	V_{16B}	1.25		2.0	V
I_S = 42 mA (V_S = 12.5...14.3 V)	Pin 10	V_{10B}		1.2		V
	Pin 12	V_{12B}	5.9		7.2	V
	Pin 13	V_{13B}	12.5	13.3	14.3	V
	Pin 16	V_{16B}	1.5		2.0	V
Regulation range for: V_{oAF}/V_{oAF} = –10 dB	Pin 6	ΔV_i		70		dB
AF voltage at demodulator output	Pin 8	V_{oAF}		100		mV
FM-IF Amplifier f_{IF} = 10.7 MHz, Δf = ±22,5 kHz, f_{mod} = 1 kHz						
DC voltages at FM mode without signal at:						
V_S = 3 V	Pin 10	V_{10B}		1.2		V
	Pin 12	V_{12B}	1.0		1.4	V
	Pin 13	V_{13B}	3.0	3.0	3.0	V
	Pin 16	V_{16B}	1.8		2.8	V
I_S = 42 mA (V_S = 12.5...14.3V)	Pin 10	V_{10B}		1.2		V
	Pin 12	V_{12B}	5.9		7.2	V
	Pin 13	V_{13B}	12.5	13.3	14.3	V
	Pin 16	V_{16B}	2.0		3.1	V
Limiting threshold (–3 dB)	Pin 2	V_i		50		µV
AF voltage at demodulator output	Pin 8	V_{oAF}		100		mV

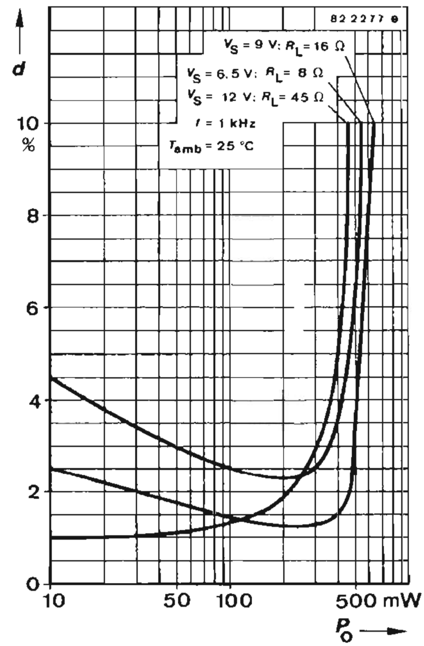
Different dc voltages are developed at Pin 16 due to gain spread of AM-IF-amplifier. To determine the value of parallel resistance R_8, at the output of the demodulator Pin 8 for $V_S = 9$ V, AM mode without signal, dc voltage should be selected at Pin 16.

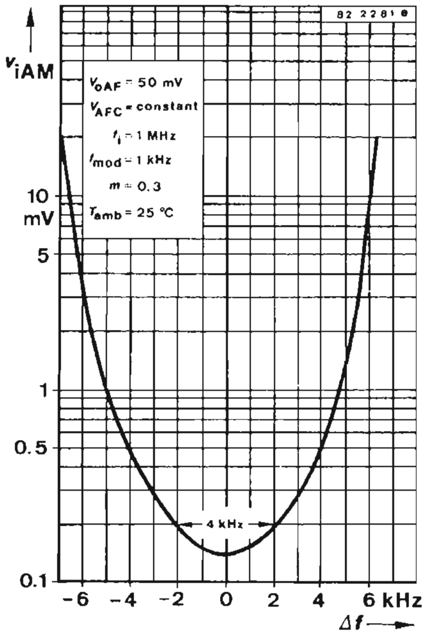
Available in following voltage groups:

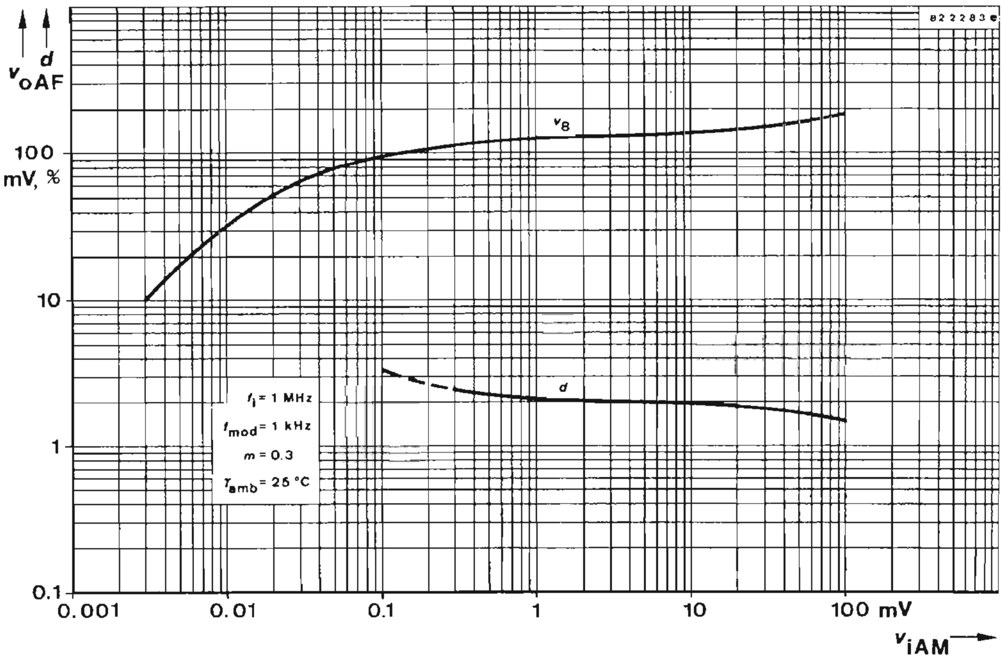
V_{16}	1.4...1.7 V	1.7...1.9 V	1.9...2.1 V
R_8	∞	47 kΩ	33 kΩ
Group	1	2	3

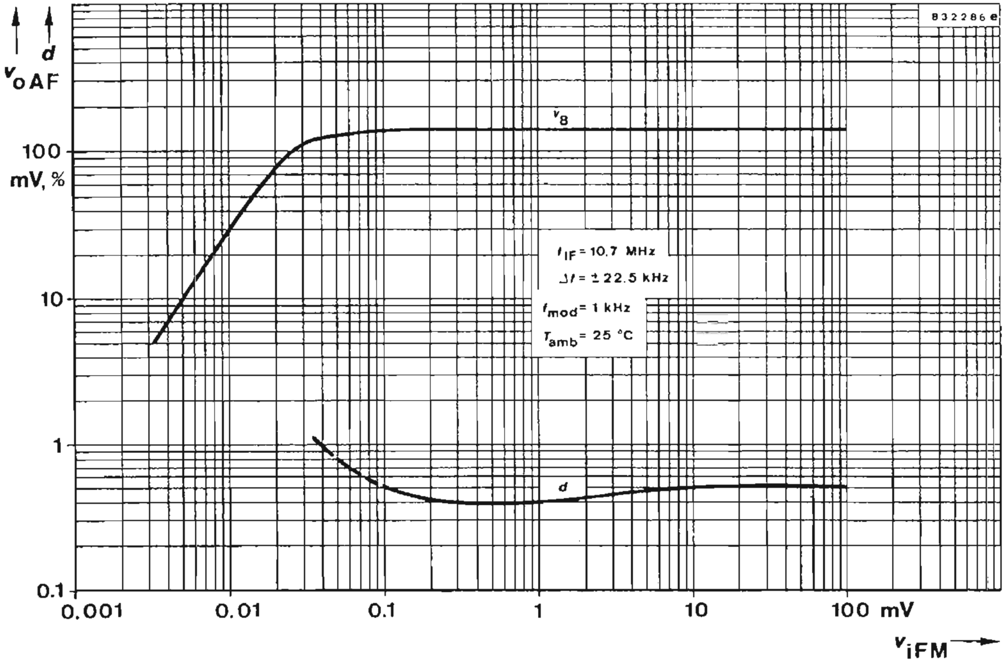


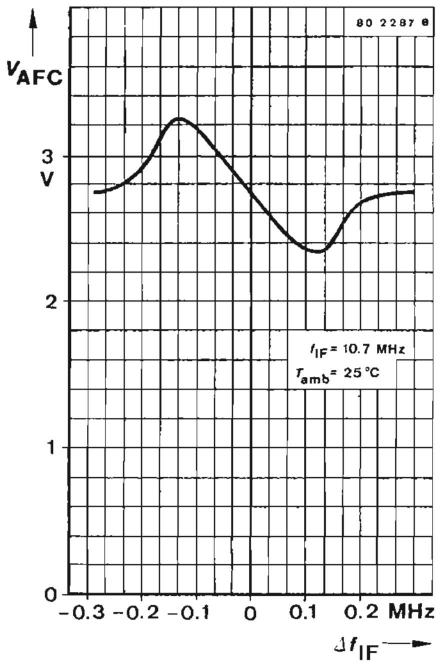



822277 e
d
%
10
8
6
4
2
0
V_S = 9 V; R_L = 16 Ω
V_S = 6.5 V; R_L = 8 Ω
V_S = 12 V; R_L = 45 Ω
f = 1 kHz
T_{amb} = 25 °C
10
50
100
500 mW
P_o


82 2281 e
v_{iAM}
10
mV
5
1
0.5
0.1
V_{oAF} = 50 mV
V_{AFC} = constant
f_i = 1 MHz
f_{mod} = 1 kHz
m = 0.3
T_{amb} = 25 °C
4 kHz
−6
−4
−2
0
2
4
6 kHz
Δf


822283 e
v_{oAF}
d
100
mV, %
10
1
0.1
v_8
d
f_i = 1 MHz
f_{mod} = 1 kHz
m = 0.3
T_{amb} = 25 °C
0.001
0.01
0.1
1
10
100 mV
v_{iAM}


832286 e
v_{oAF}
d
100
mV, %
10
1
0.1
0.001
0.01
0.1
1
10
100 mV
v_{iFM}
v_8
d
f_{IF} = 10.7 MHz
Δf = ± 22.5 kHz
f_{mod} = 1 kHz
T_{amb} = 25 °C


80 2287 e
V_{AFC}
3
V
2
1
0
−0.3
−0.2
−0.1
0
0.1
0.2 MHz
$Δf_{IF}$
f_{IF} = 10.7 MHz
T_{amb} = 25 °C

Components in Fig. 9

L_1	=	4	Wdg Ø 0.45 CuL, Threaded core 7.5x3 material: Fi 01 U8 (Vogt GmbH)
L_2	=	5	Wdg Ø 0.45 CuL
L_3	=	5	Wdg Ø 0.45 CuL, air core Ø 3.5 mm
L_4	=	3+3	Wdg Ø 0.45 CuL, air core Ø 2.7 mm
L_5	=	12	Wdg Ø 0.25 CuL, Pin 3-1, Filter kit 154 AN(C) or 154ANS-7 A6363AO (TOKO, Componex)
L_6	=	2	Wdg Ø 0.25 CuL, Pin 4-6
L_7	=	7	Wdg Ø 0.25 CuL, Pin 6-3, Filter kit 154AN(C) or 154EES-7 A6392FA (TOKO, Componex)
L_8	=	7	Wdg Ø 0.16 CuL, Pin 1-4, Filter kit 154AN(C) or 154EES-7 A6391ABM (TOKO, Componex)
L_9	=	5	Wdg Ø 0.16 CuL, Pin 2-6
L_{10}	=	96	Wdg Ø 0.25 CuLs, Ferrite aerial Ø 8x130 mm, Type 031039-2103-606, (Draloric)
L_{11}	=	6	Wdg Ø 0.25 CuLs
L_{12}	=	78	Wdg Ø 0.09 CuL, Pin 3-4, Filter kit RBR or RWOS-6A7609AAU (TOKO, Componex)
L_{13}	=	7	Wdg Ø 0.09 CuL, Pin 2-1
L_{14}	=	18	Wdg Ø 0.09 CuL, Pin 3-4, Filter kit RHN(C) or RHCS-1A7607AQH (TOKO, Componex)
L_{15}	=	46+100	Wdg Ø 0.09 CuL, Pin 6-2-1
L_{16}	=	72+72	Wdg Ø 0.09 Cul Pin 3-4/6-1, Filter kit RHN(C) or RHNS-1A7608AZP (TOKO, Componex)
455 kHz	=	Ceramic filter LBF 6 (Componex) or CFU 445 H (Stettner)	
10.7 MHz	=	Ceramic filter 10.7 MF-18 (Componex) or SFE 10.7 MA (Stettner)	
D_{r1}, D_{r3}	=	Ferrit bead on the transistor terminal	
D_{r2}	=	16	Wdg Ø 0.25 CuL, Ø 2 air core
D_{r4}	=	6	Wdg Ø 0.15 CuL, Ø 2.1x3 mm Ferrit bead
$C_6 = C_{14}$	=	4.5... 20 pF, Variable capacitor Type CY2-22124-RT02 (TOKO, Componex)	
C_{19}	=	5... 80 pF	
C_{21}	=	5...140 pF	
R_8	=	according to gain groups ∞, 47 kΩ or 33 kΩ	

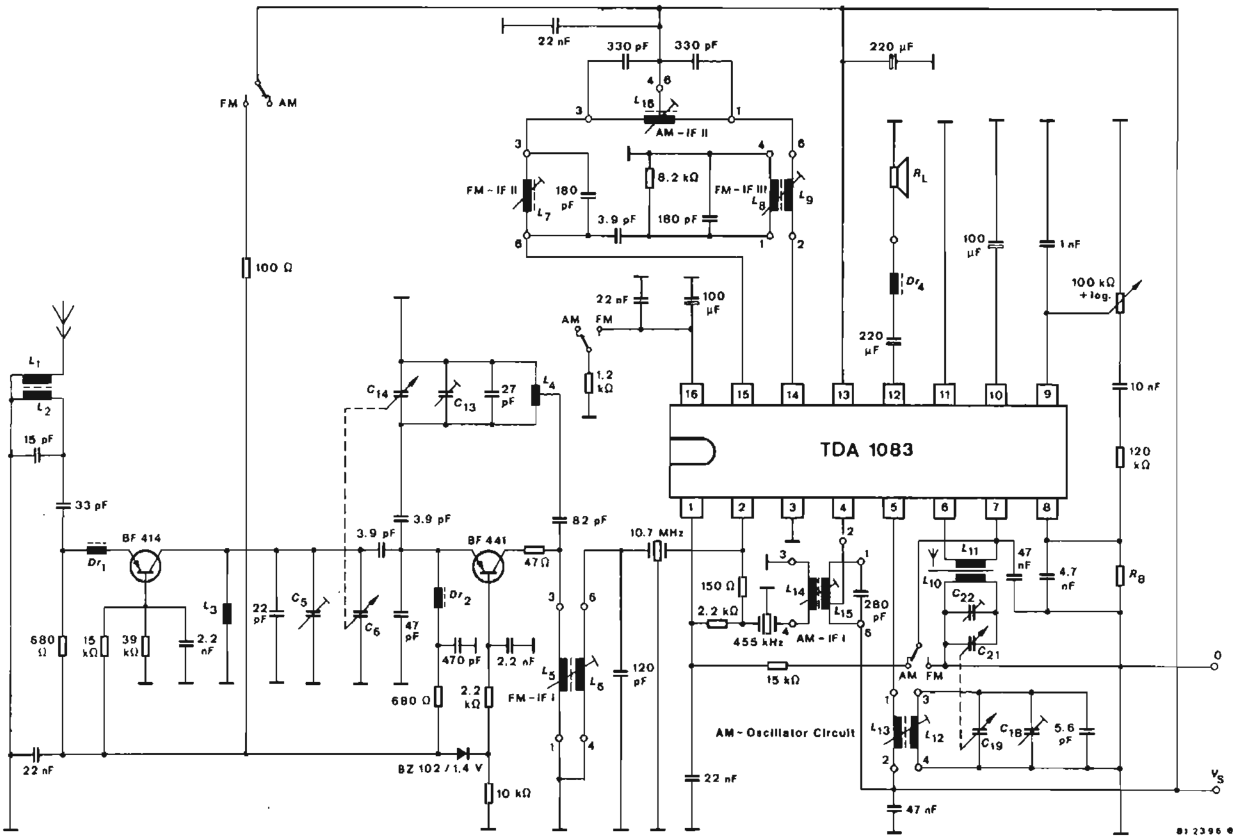


Fig. 9 FM-/AM-receiver circuit

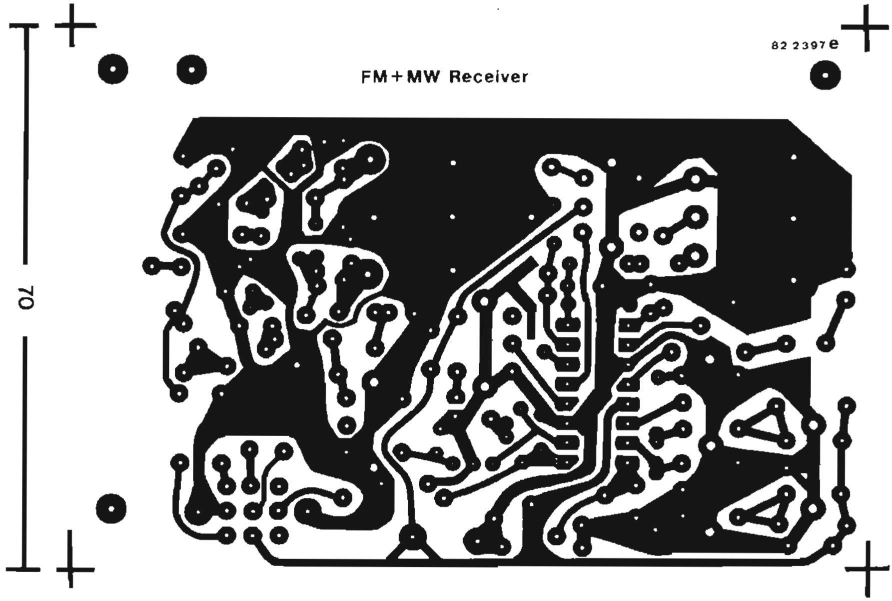


Fig. 10 Layout of circuit board (soldered side) of the FM-/AM-receiver

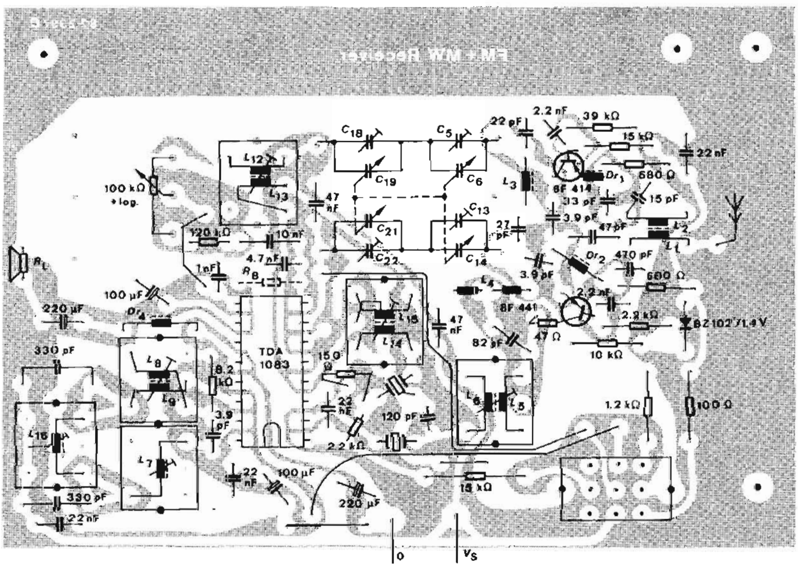
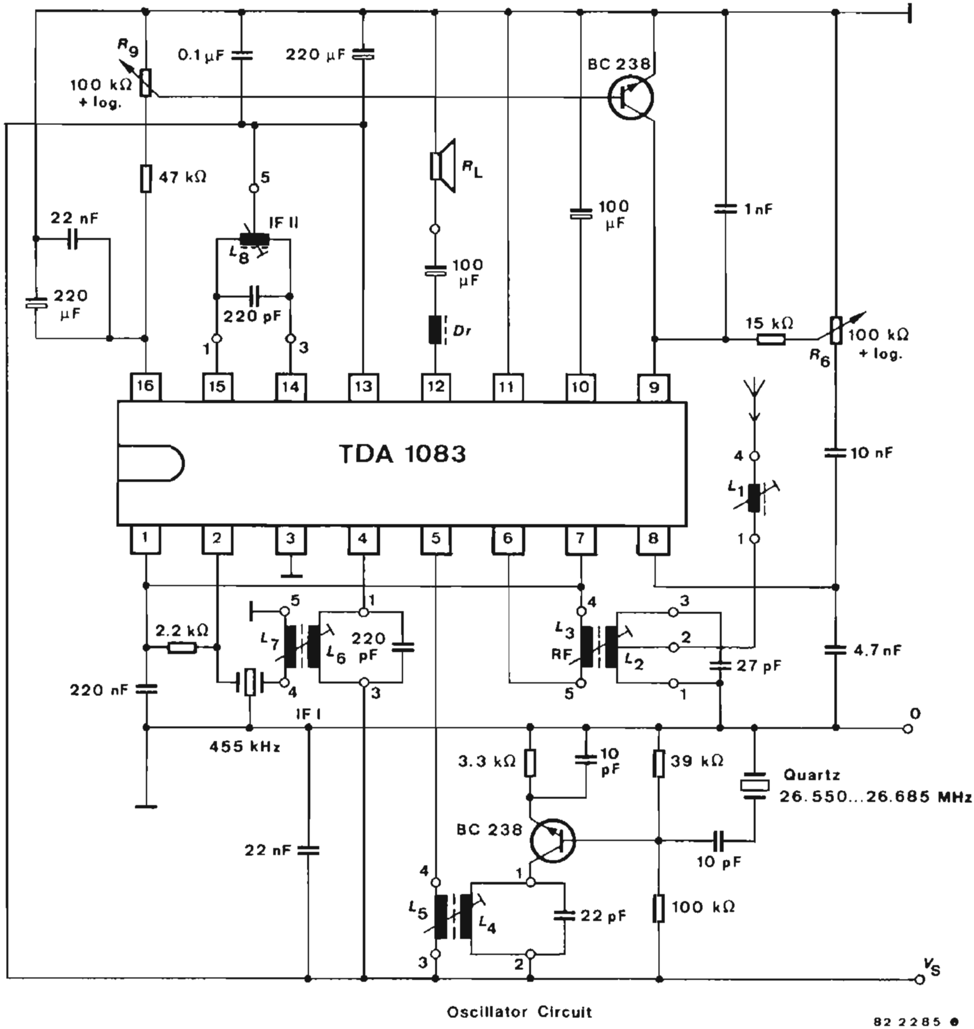


Fig. 11 Printed board with components for FM-/AM-receiver



L_1	= 3	Wdg ⌀ 0.25 CuL Pin 3-4 (Neosid 7F1)
L_2	= 3+4	Wdg ⌀ 0.25 CuL Pin 1-2-3 (Neosid 7F1)
L_3	= 3	Wdg ⌀ 0.25 CuL Pin 4-5
L_4	= 8	Wdg ⌀ 0.45 CuL Pin 1-2 (Neosid 7F1)
L_5	= 1	Wdg ⌀ 0.25 CuL Pin 3-4
L_6	= 154	Wdg ⌀ 0.08 CuL Pin 1-3 (Neosid 7A1)
L_7	= 30	Wdg ⌀ 0.08 CuL Pin 4-5
L_8	= 76+76	Wdg ⌀ 0,08 CuL Pin 1-5-3 (Neosid 7A1)
Dr	= 4	Wdg ⌀ 0,25 CuL Ferrit bead
455 kHz	=	Ceramic filter LFB 6 (Componex) or CFU 455 H (Stettner)
R_6	=	Volume control
R_9	=	Squelch

Fig. 12 27 MHz-receiver circuit

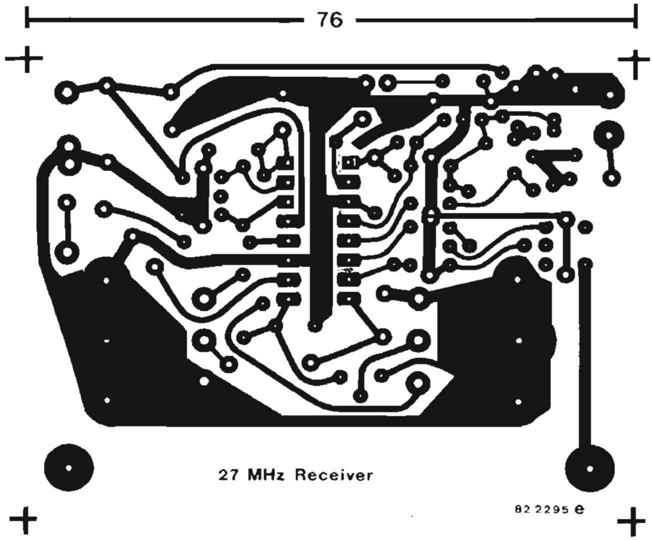


Fig. 13 Layout of circuit board (soldered side) for 27 MHz-receiver

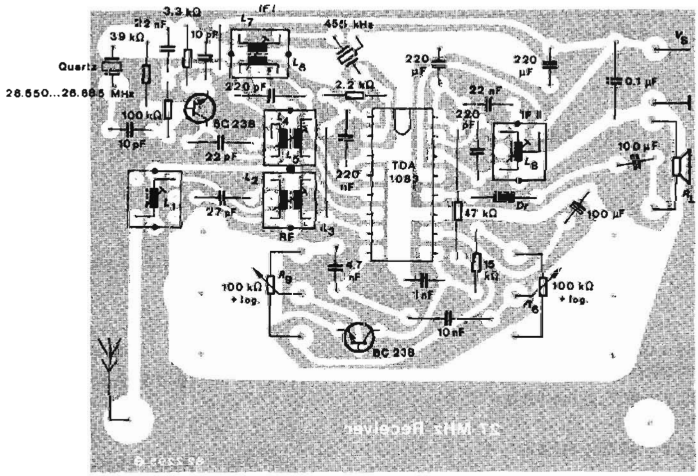
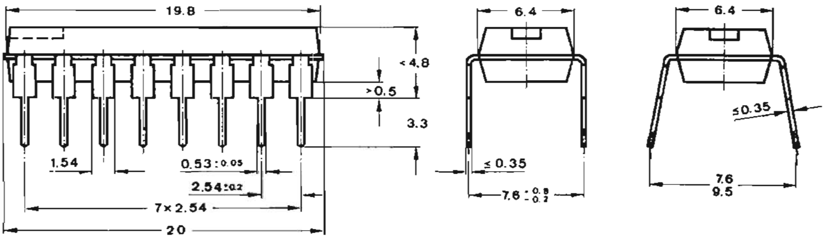
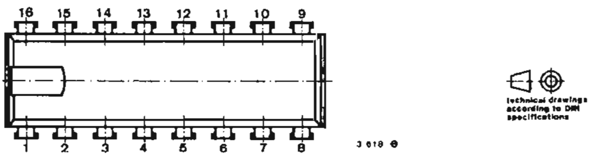


Fig. 14 Printed board with components for 27 MHz-receiver

Dimensions in mm





Case
20 A 16 DIN 41866
JEDEC MO 001
Weight max. 1.5 g

Monolithic Integrated Circuit

Application: Phase Locked Loop (PLL) FM Stereo Multiplex for portable and car radios

Features:

- Excellent pilot sensitivity
  $v_{P(ON)} = 9\ mV_{RMS}$ (typ.)
- Operating supply voltage range
  $V_S = 3.5...12\ V$
- Suitable for LED driving
- VCO stop capability
  The Voltage Controlled Oscillator (VCO) is stopped when the L.P.F.2 terminal is connected to the power supply line, and then the stereo indicator is turned off
- Easy adjustment
  The monitored free running frequency of VCO is 38 kHz at stereo lamp terminal
- Excellent channel separation through entire audio frequency range; 45 dB
- Low distortion 0.08% (typ.)

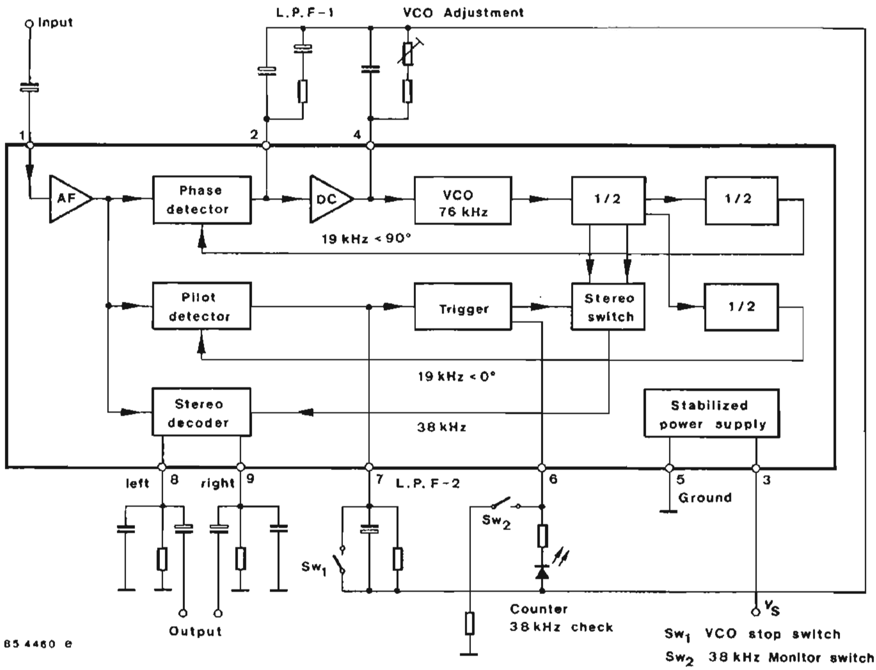


Fig.1 Block diagram and pin connections

T1.2/1175.1185 E1

Absolute maximum ratings

Reference point Pin 5, unless otherwise specified

Supply voltage		Pin 3	V_S	12	V
Lamp voltage		Pin 6	V_{Lamp}	16	V
Lamp current	continuation		I_{Lamp}	20	mA
	Peak		I_{Lamp}	40	mA
Power dissipation			P_{tot}	500	mW
Ambient temperature			T_{amb}	75	°C
Storage temperature range			T_{stg}	−25...+ 150	°C

Thermal resistance

		Min.	Typ.	Max.	
Junction ambient	R_{thJA}			125	K/W

Electrical characteristics

V_S = 8 V, T_{amb} = 25°C, reference point Pin 5, f_{mod} = 1 kHz, unless otherwise specified

			Min.	Typ.	Max.	
Supply voltage range	Pin 3	V_S	3.5		12	V
Supply current, with lamp off	Pin 6	I_S		11	18	mA
Input resistance	Pin 1	R_i		33		kΩ
Stereo input voltage (maximal) L+R = 90%, P[1] = 10%, f_{mod} = 1 kHz	Pin 1	v_i		1.1		V_{RMS}
Channel separation $v_{(L+R)}$ = 180 mV_{RMS}, P = 20 mV_{RMS}	Pin 8, 9	Ch.Sep.	36	45		dB
Voltage gain v_i = 200 mV_{RMS}	Pin 8, 9	G_V	−2	0.5	+2	dB
Channel balance v_i = 200 mV_{RMS}	Pin 8, 9	Ch.B.		0	1.5	dB
Lamp sensitivity, Pilot input ON		v_p		10	15	mV_{RMS}
OFF		v_p	2	6		mV_{RMS}
Stereo lamp hysteresis to turn-on from turn-off				3		mV_{RMS}
Capture range v_p = 20 mV_{RMS}		C.R.		±3		%

[1]) P = Pilot input signal

				Min.	Typ.	Max.	
Carrier leak							
$v_p = 20\ mV_{RMS}$	19 kHz		C.L.		34		dB
$v_{(L+R)} = 180\ mV_{RMS}$	38 kHz		C.L.		42		dB
Signal to noise ratio							
$v_i = 200\ mV_{RMS}$, $R_G = 620\ \Omega$		Pin 8, 9	S/N		74		dB
Distortion							
Mono							
$V_i = 200\ mV_{RMS}$			d		0.08	0.3	%
Stereo							
$v_{(L+R)} = 180\ mV_{RMS}$,							
$v_p = 20\ mV_{RMS}$, $f_{mod} = 1$ kHz			d		0.08		%
Output current		Pin 8, 9					
$R_L = 3.3\ k\Omega$, $V_S = 3.5$ V			I_O		0.3	0.6	mA
$V_S = 8.0$ V			I_O		1.2	1.8	mA
$V_S = 12$ V			I_O		1.4	2.1	mA

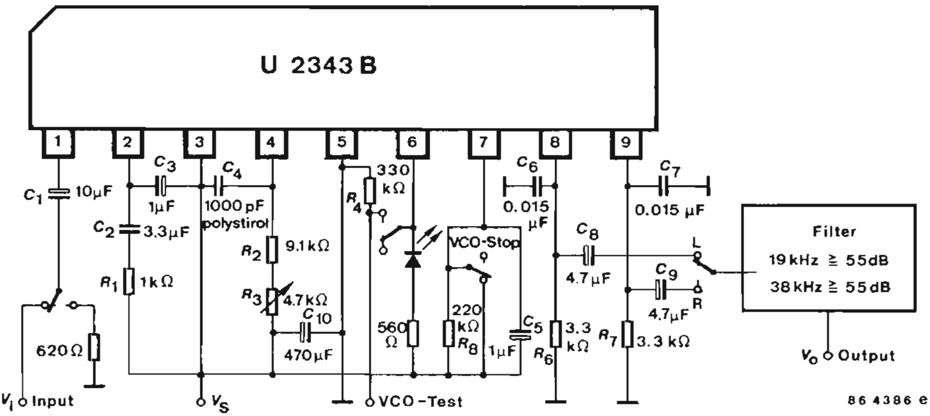
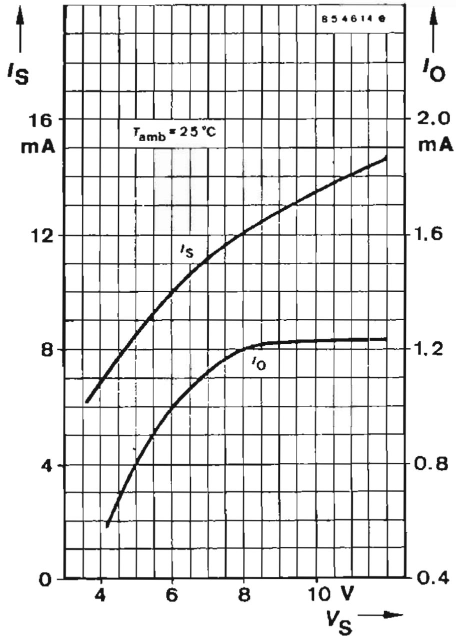
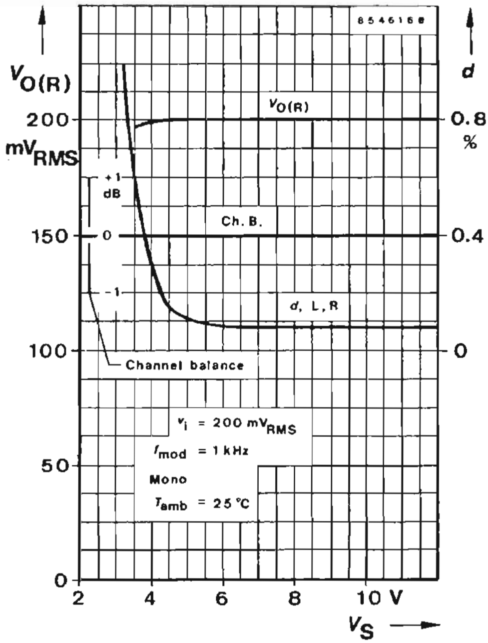
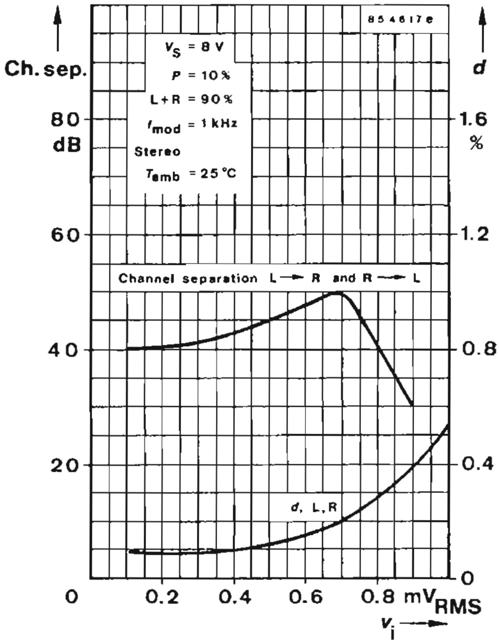
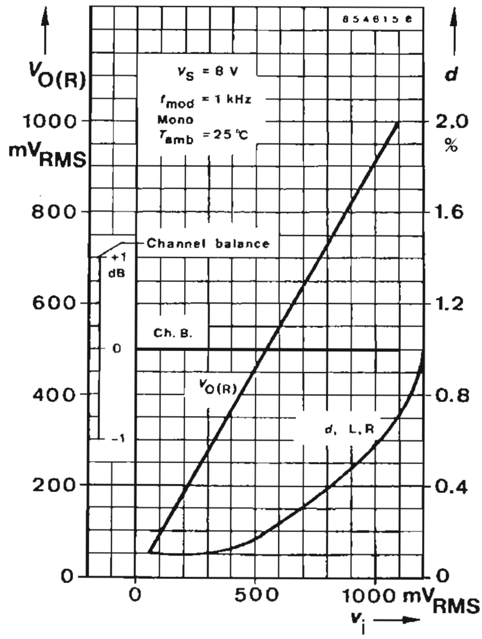


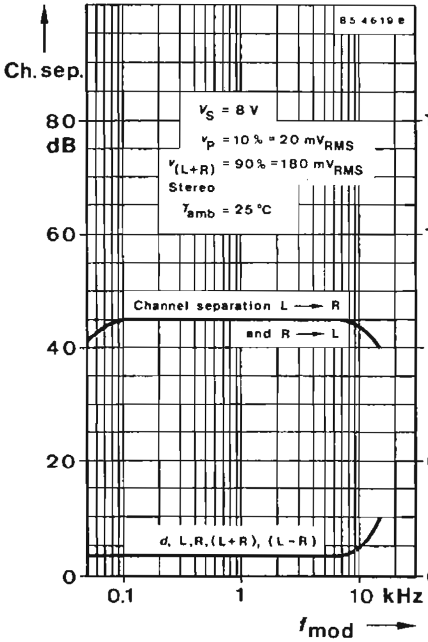
Fig. 2 Test circuit

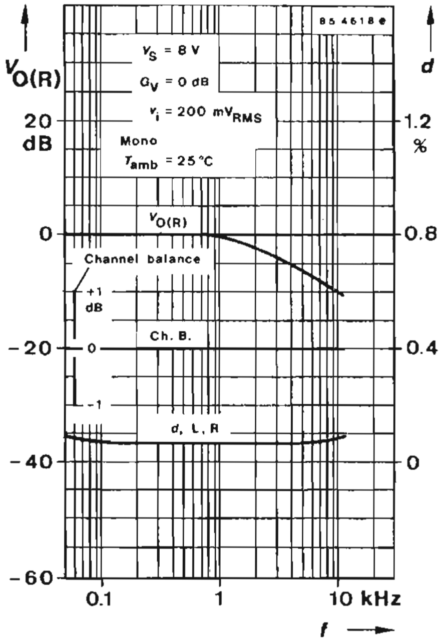

854614 e
I_S
I_O
16 mA
12
8
4
0
2.0 mA
1.6
1.2
0.8
0.4
T_{amb} = 25 °C
I_S
I_O
4
6
8
10 V
V_S

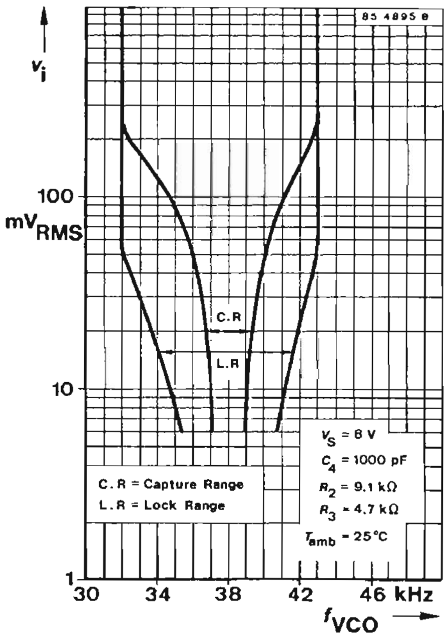

854616 e
$V_{O(R)}$
d
200 mV$_{RMS}$
150
100
50
0
0.8 %
0.4
0
$V_{O(R)}$
+1 dB
0
−1
Ch. B.
d, L, R
Channel balance
v_i = 200 mV$_{RMS}$
f_{mod} = 1 kHz
Mono
T_{amb} = 25 °C
2
4
6
8
10 V
V_S

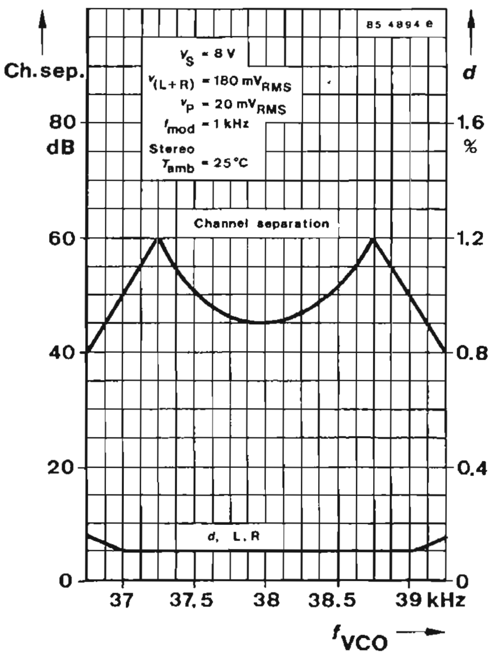

854617 e
Ch. sep.
d
80 dB
60
40
20
0
1.6 %
1.2
0.8
0.4
0
V_S = 8 V
P = 10 %
L+R = 90 %
f_{mod} = 1 kHz
Stereo
T_{amb} = 25 °C
Channel separation L → R and R → L
d, L, R
0.2
0.4
0.6
0.8 mV$_{RMS}$
v_i

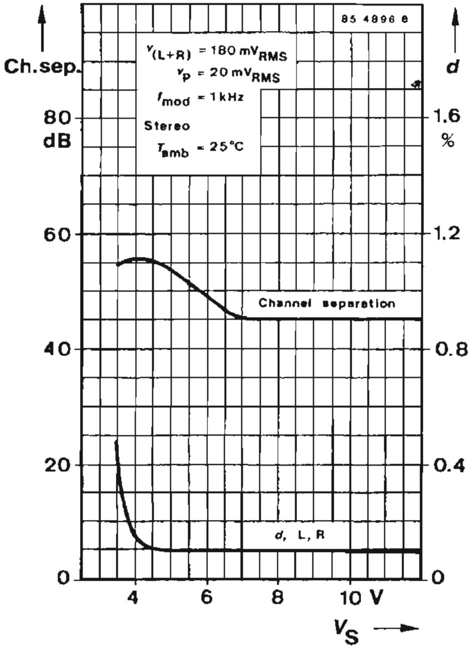

854615 e
$V_{O(R)}$
d
1000 mV$_{RMS}$
800
600
400
200
0
2.0 %
1.6
1.2
0.8
0.4
0
V_S = 8 V
f_{mod} = 1 kHz
Mono
T_{amb} = 25 °C
Channel balance
+1 dB
0
−1
Ch. B.
$V_{O(R)}$
d, L, R
0
500
1000 mV$_{RMS}$
v_i

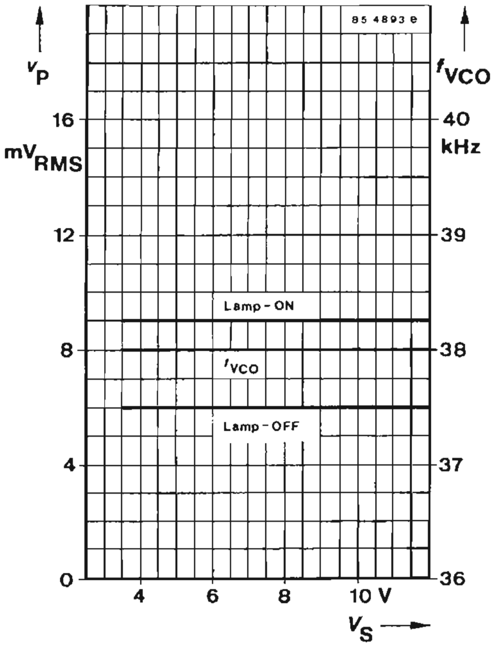

Ch. sep.
80 dB
60
40
20
0
d
1.6 %
1.2
0.8
0.4
0
85 4619 e
V_S = 8 V
v_P = 10 % = 20 mV$_{RMS}$
$v_{(L+R)}$ = 90 % = 180 mV$_{RMS}$
Stereo
T_{amb} = 25 °C
Channel separation L → R
and R → L
d, L, R, (L+R), (L−R)
0.1
1
10 kHz
f_{mod}


$V_{O(R)}$
20 dB
0
−20
−40
−60
d
1.2 %
0.8
0.4
0
85 4618 e
V_S = 8 V
G_V = 0 dB
v_i = 200 mV$_{RMS}$
Mono
T_{amb} = 25 °C
$V_{O(R)}$
Channel balance
+1 dB
0
−1
Ch. B.
d, L, R
0.1
1
10 kHz
f

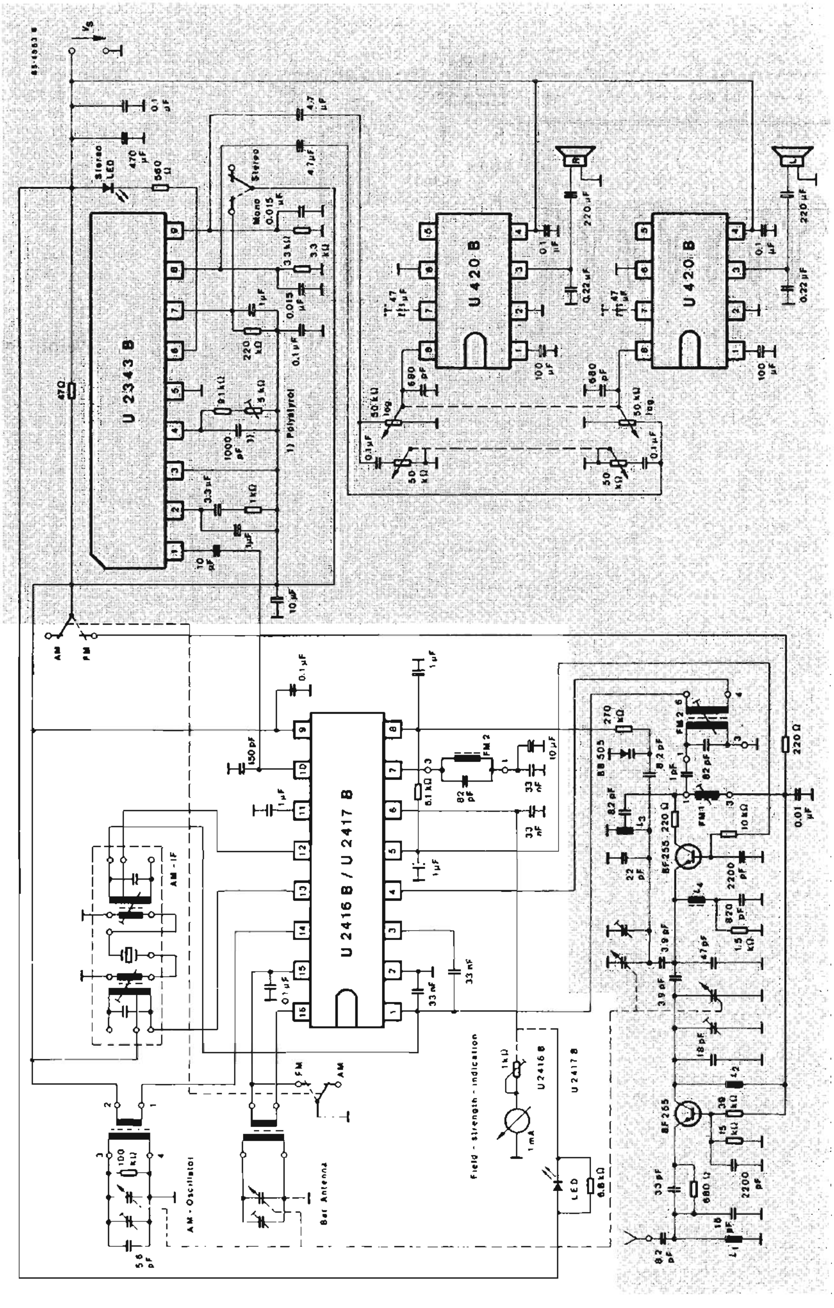

v_i
100 mV$_{RMS}$
10
1
85 4895 e
C.R
L.R
C.R = Capture Range
L.R = Lock Range
V_S = 8 V
C_4 = 1000 pF
R_2 = 9.1 kΩ
R_3 = 4.7 kΩ
T_{amb} = 25 °C
30
34
38
42
46 kHz
f_{VCO}


Ch. sep.
80 dB
60
40
20
0
d
1.6 %
1.2
0.8
0.4
0
85 4894 e
V_S = 8 V
$v_{(L+R)}$ = 180 mV$_{RMS}$
v_P = 20 mV$_{RMS}$
f_{mod} = 1 kHz
Stereo
T_{amb} = 25 °C
Channel separation
d, L, R
37
37.5
38
38.5
39 kHz
f_{VCO}

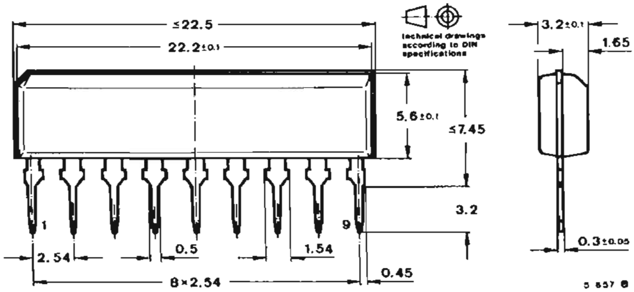

85 4896 e
Ch.sep.
80
dB
60
40
20
0
d
1.6
%
1.2
0.8
0.4
0
v(L+R) = 180 mVRMS
vP = 20 mVRMS
fmod = 1 kHz
Stereo
Tamb = 25°C
Channel separation
d, L, R
4
6
8
10 V
VS


85 4893 e
vP
16
mVRMS
12
8
4
0
fVCO
40
kHz
39
38
37
36
Lamp - ON
fVCO
Lamp - OFF
4
6
8
10 V
VS

Application



Dimensions in mm



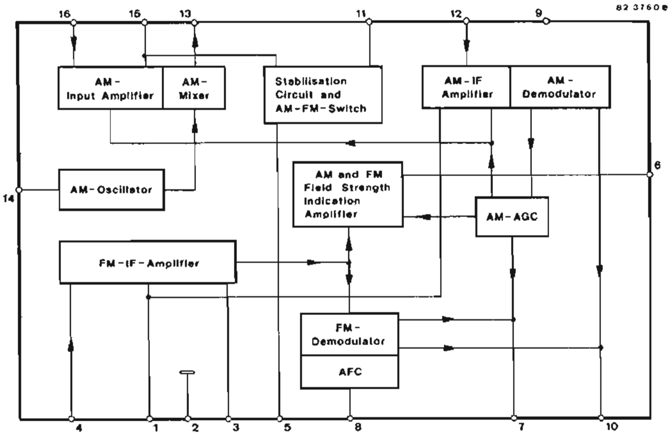
Case
SIP 9
Weight max. 0.8 g

Monolithic Integrated Circuit

Applications: AM/FM-IF-Amplifier for mains and battery operated radios

Features:

- Large supply voltage range $V_S = 3 \ldots 16$ V
- High AM-Sensitivity
- Limiting threshold voltage $V_i = 30$ µV
- AFC-output with reference voltage connection
- AM-Oscillator for LW, MW and SW
- Single output for field strength indication of AM and FM
- Single pole ended AM-FM switch without high frequency voltages



1+3 IF-Decoupling
2 Ground, Reference Point
4 FM-IF-Input
5 FM-Reference Voltage
6 Field Strength Indication
7 FM-Demodulator Circuit and AM-AGC-Capacitance
8 AFC-Output
9 + V_S
10 Demodulator Output
11 AM-Reference Voltage
12 AM-IF-Input
13 AM-Mixer Output
14 AM-Oscillator Circuit
15 AM-Decoupling
16 AM-Input

Fig. 1 Block diagram and pin connections

Description

The integrated circuit U 2416 B includes, with exception of the FM front end, a complete AM/FM-radio-circuit. To drive a tunning diode for FM, there is a possibility of a AFC-connection (current source) and reference voltage terminal.
Field strength for AM and FM can be read on one instrument.

T1.2/032.1182 E1

U 2416 B

Absolute maximum ratings

Reference point Pin 2, unless otherwise specified

Supply voltage range	Pin 9	V_S		16		V
Ambient temperature		T_{amb}		85		°C
Junction temperature		T_j		150		°C
Storage temperature range		T_{stg}		−25...+150		°C
Thermal resistance			**Min.**	**Typ.**	**Max.**	
Junction ambient		R_{thJA}			100	K/W

Electrical characteristics

$V_S = 9$ V, reference point Pin 2, Fig. 2, $T_{amb} = 25$ °C, unless otherwise specified

			Min.	Typ.	Max.	
Supply voltage range	Pin 9	V_S	3		16	V
AM Amplifier $f_i = 1$ MHz, $f_{IF} = 455$ kHz, $f_{mod} = 1$ kHz, m = 0.3						
Supply quiescent current	Pin 9	I_{SB}		14		mA
Signal to noise ratio $v_i = 1.5$ µV	Pin 10	$\frac{S+N}{N}$		6		dB
$v_i = 10$ µV	Pin 10	$\frac{S+N}{N}$		20		dB
$v_i = 15$ µV	Pin 10	$\frac{S+N}{N}$		26		dB
Regulation range $\Delta V_{oAF}/V_{oAF} = -10$ db, $v_i = 100$ mV	Pin 16	ΔV_i		80		dB
AF voltage at demodulator output $v_i = 1$ mV	Pin 10	V_{oAF}		70		mV
Distortion $v_i = 1$ mV	Pin 10	d		0.8		%
Demodulator output voltage	Pin 10	V_o		1.2		V
FM-IF Amplifier $f_{IF} = 10.7$ MHz, $\Delta f = \pm 22.5$ kHz, $f_{mod} = 1$ kHz						
Supply quiescent current	Pin 9	I_{SB}		14		mA
Limiting threshold (−3 dB)	Pin 4	V_i		30		µV
Signal to noise ratio $v_i = 10$ µV	Pin 10	$\frac{S+N}{N}$		6		dB
$v_i = 30$ µV	Pin 10	$\frac{S+N}{N}$		26		dB
$v_i = 10$ mV	Pin 10	$\frac{S+N}{N}$		65		dB
AF voltage at demodulator output $v_i = 10$ mV	Pin 10	V_{oAF}		70		mV

			Min.	Typ.	Max.	
Distortion						
$v_i = 3$ mV	Pin 10	d		0.8		%
AM-rejection						
$V_i = 10$ mV, $m = 0.3$	Pin 10	AMR		40		dB
Demodulator voltage	Pin 10	v_o		1.3		V
Reference voltage FM	Pin 5	V_o		2.45		V
Current from Pin 5		I_o			0.2	mA

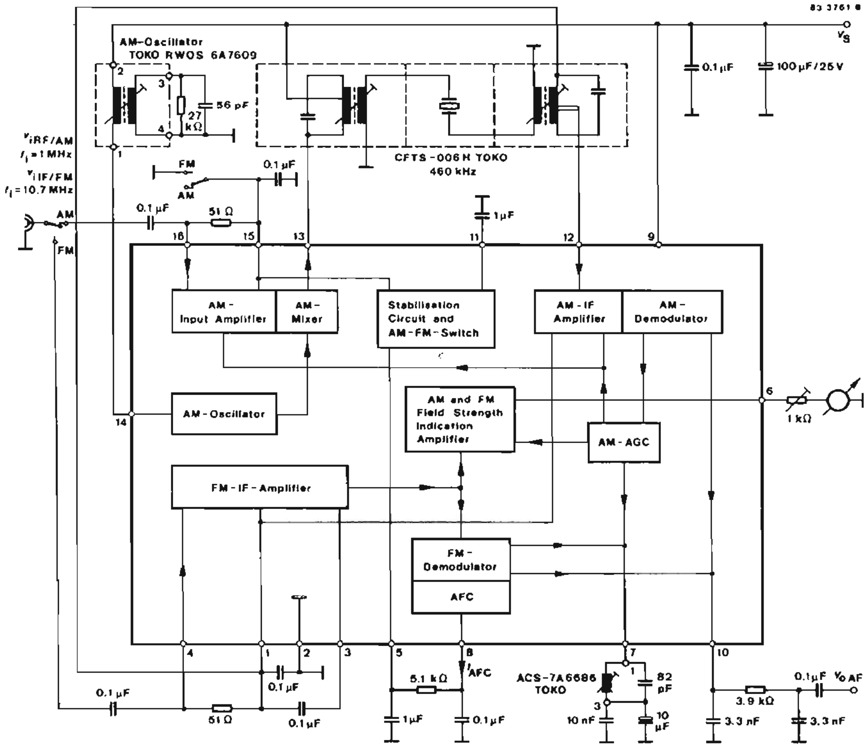
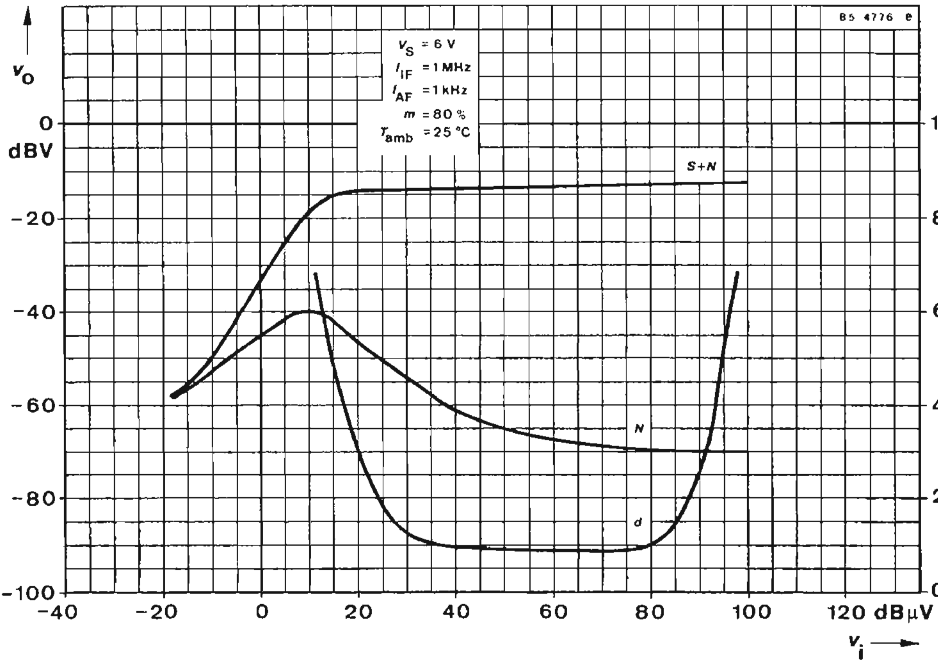
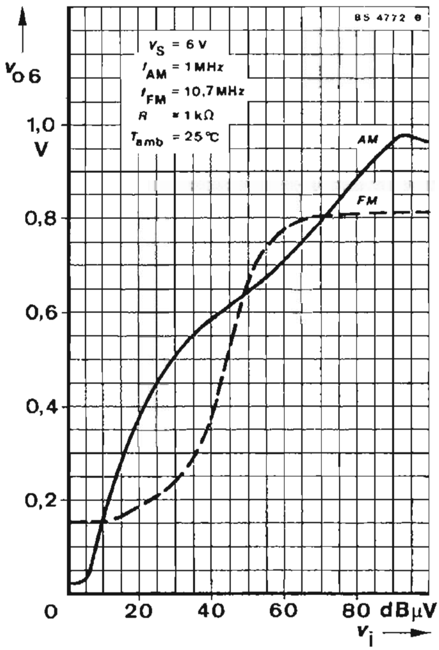
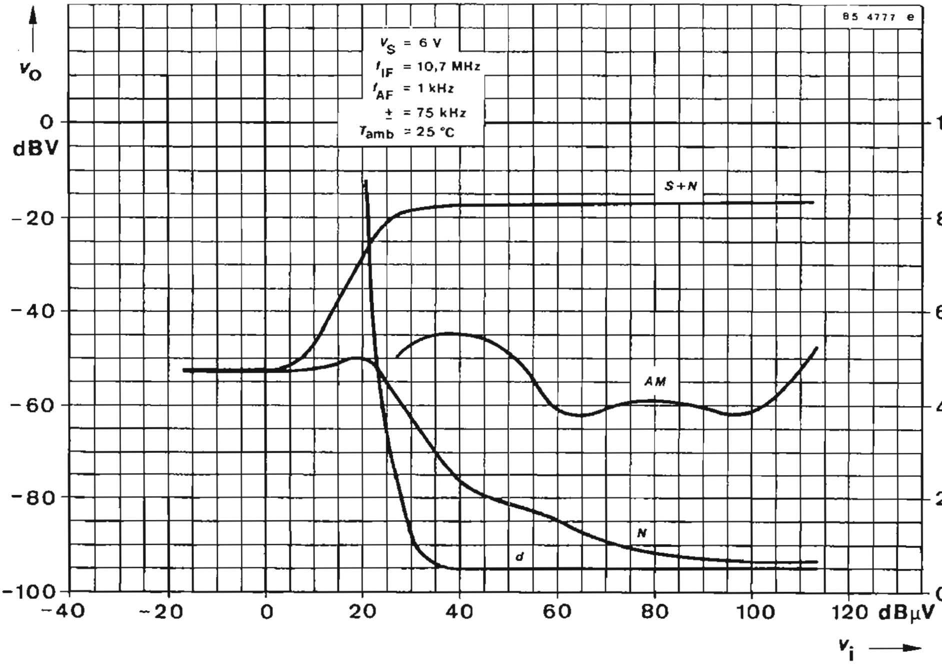
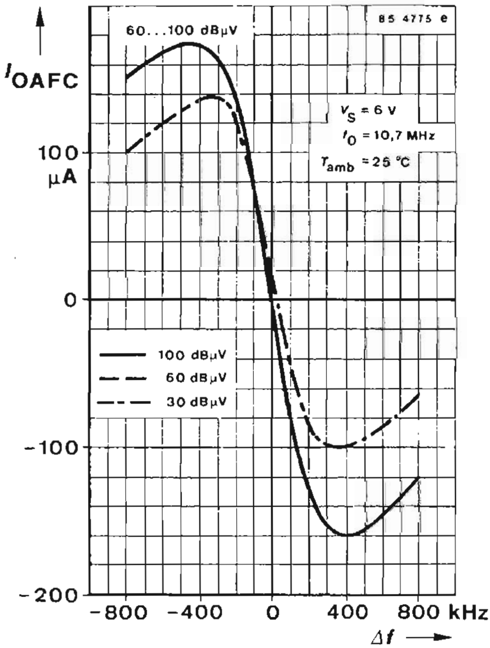


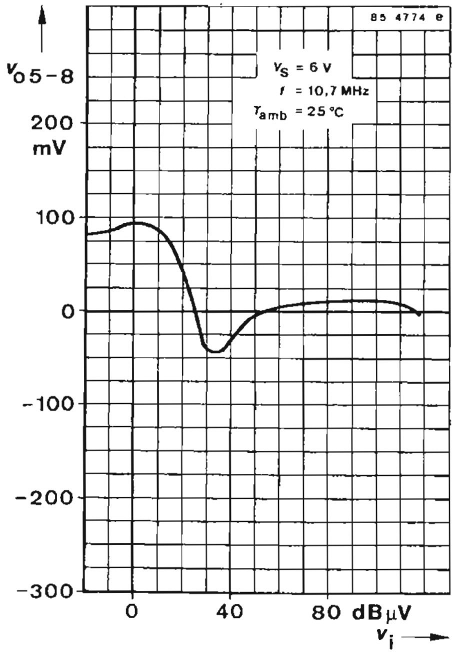
Fig. 2 Test circuit


85 4776 e
V_S = 6 V
f_{IF} = 1 MHz
f_{AF} = 1 kHz
m = 80 %
T_{amb} = 25 °C
v_o
0
dBV
-20
-40
-60
-80
-100
d
10
%
8
6
4
2
0
S+N
N
d
-40
-20
0
20
40
60
80
100
120 dBμV
v_i

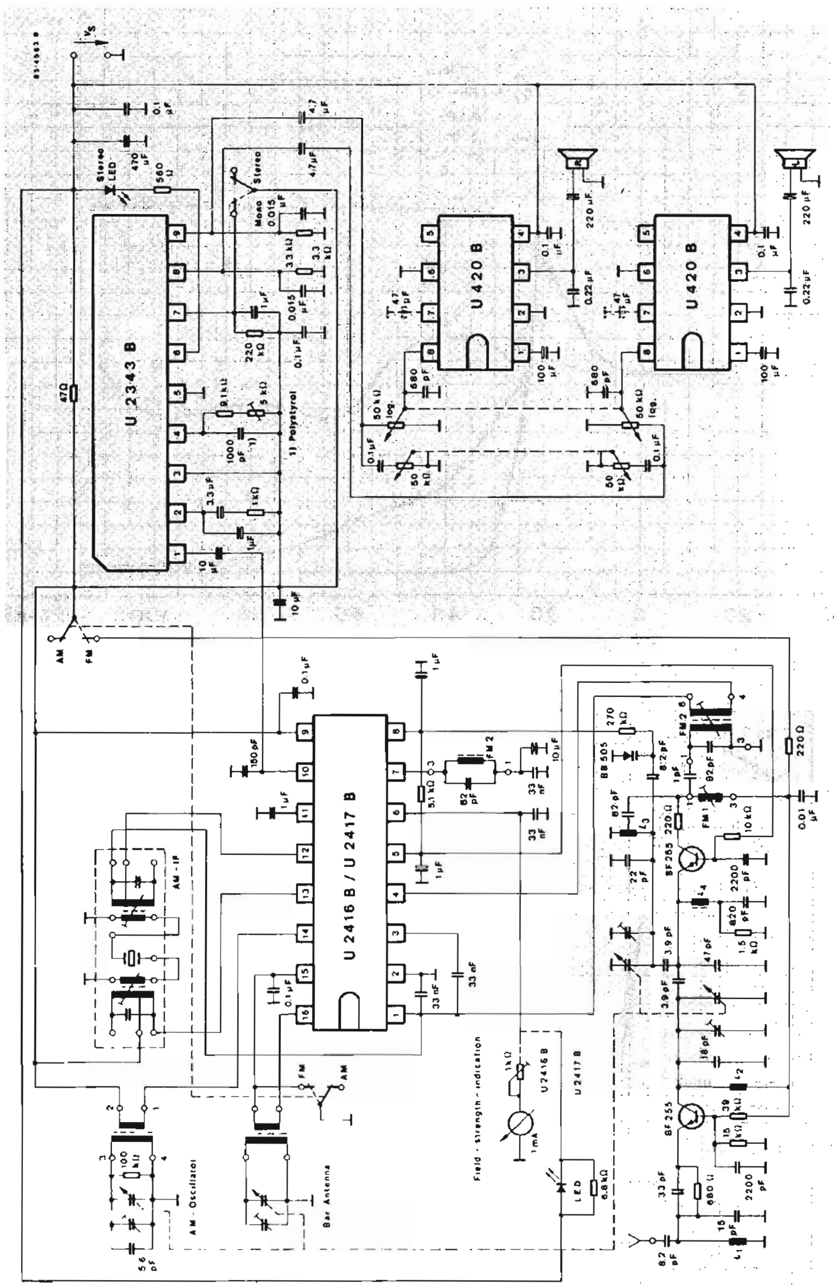

85 4772 e
V_S = 6 V
f_{AM} = 1 MHz
f_{FM} = 10,7 MHz
R = 1 kΩ
T_{amb} = 25 °C
v_{o6}
1,0
V
0,8
0,6
0,4
0,2
0
20
40
60
80 dBμV
v_i
AM
FM


85 4777 e
V_S = 6 V
f_{IF} = 10,7 MHz
f_{AF} = 1 kHz
± = 75 kHz
T_{amb} = 25 °C
V_O
0 dBV
-20
-40
-60
-80
-100
d
10 %
8
6
4
2
0
S+N
AM
N
d
-40
-20
0
20
40
60
80
100
120 dBµV
V_i


85 4775 e
60...100 dBµV
I_{OAFC}
100 µA
0
-100
-200
V_S = 6 V
f_0 = 10,7 MHz
T_{amb} = 25 °C
100 dBµV
60 dBµV
30 dBµV
-800
-400
0
400
800 kHz
Δf

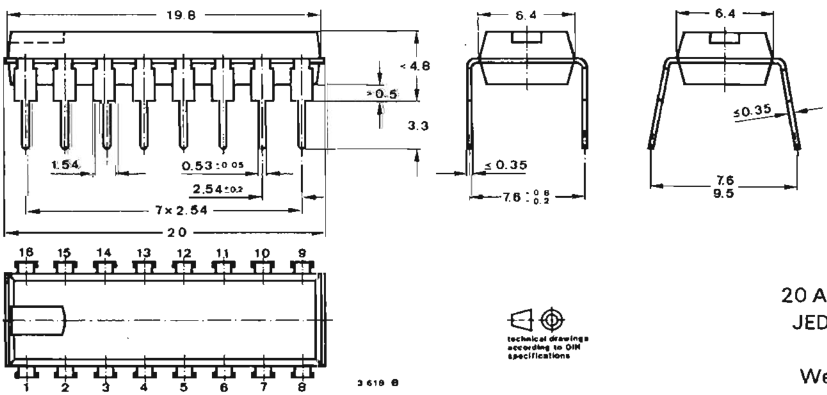

85 4774 e
V_{O5-8}
200 mV
100
0
-100
-200
-300
V_S = 6 V
f = 10,7 MHz
T_{amb} = 25 °C
0
40
80 dBµV
V_i

U 2416 B


U 2343 B
U 420 B
U 420 B
U 2416 B / U 2417 B
Stereo LED
Stereo
Mono
1) Polystyrol
AM-IF
AM-Oscillator
Bar Antenna
Field-strength-indication
LED
BF 255
BF 255
BB 505

Typical		D. C. voltages for $V_S = 6$ V		
Pin No:		AM	FM	Unit
1	IF-input decoupling	1.0	1.4	V
2	Ground	0	0	V
3	IF-input decoupling	1.0	1.4	V
4	FM-IF input	1.0	1.4	V
5	FM stabilised voltage	–	2.45	V
6	Field strength indication	0.15	0.15	V
7	FM-IF/AM-AGC	0.5	0	V
8	FM-AFC	–	2.3	V
9	Supply voltage, $+V_S$	6	6	V
10	Demodulator output	1.7	1.8	V
11	AM-stabilised voltage	2.45	–	V
12	AM-IF input	1.0	1.4	V
13	AM-mixer output	6	6	V
14	AM-oscillator	6	6	V
15	AM input decoupling	1.65	–	V
16	AM input	1.65	–	V

Dimensions in mm



Case
20 A 16 DIN 41 866
JEDEC MO 015 AH
DIP 16
Weight max. 1.5 g

TELEFUNKEN electronic
Creative Technologies

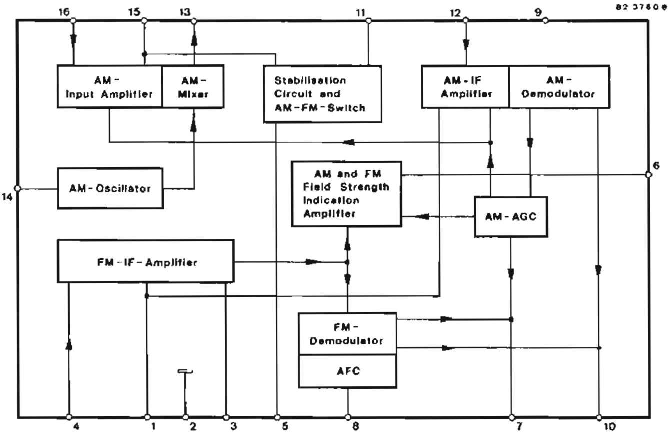
U 2417 B

Monolithic Integrated Circuit

Applications: AM/FM-IF-Amplifier for mains and battery operated radios

Features:

- Large supply voltage range $V_S = 3 \ldots 16$ V
- High AM-Sensitivity
- Limiting threshold voltage $V_i = 30$ µV
- AFC-output with reference voltage connection
- AM-Oscillator for LW, MW and SW
- Single output for field strength indication of AM and FM with LED
- Single pole ended AM-FM switch without high frequency voltages



1+3 IF-Decoupling
2 Ground, Reference Point
4 FM-IF-Input
5 FM-Reference Voltage
6 Field Strength Indication
7 FM-Demodulator Circuit and AM-AGC-Capacitance
8 AFC-Output
9 $+V_S$
10 Demodulator Output
11 AM-Reference Voltage
12 AM-IF-Input
13 AM-Mixer Output
14 AM-Oscillator Circuit
15 AM-Decoupling
16 AM-Input

Fig. 1 Block diagram and pin connections

Description

The integrated circuit U 2417 B includes, with exception of the FM front end, a complete AM/FM-radio-circuit. To drive a tunning diode for FM, there is a possibility of a AFC-connection (current source) and reference voltage terminal.
Field strength for AM and FM can be read on one LED.

T1.2/373.0184 E

Absolute maximum ratings

Reference point Pin 2, unless otherwise specified

Supply voltage range	Pin 9	V_S		16	V
Ambient temperature		T_{amb}		85	°C
Junction temperature		T_j		150	°C
Storage temperature range		T_{stg}		−25...+150	°C

Thermal resistance

			Min.	Typ.	Max.	
Junction ambient		R_{thJA}			100	K/W

Electrical characteristics

$V_S = 9$ V, reference point Pin 2, Fig. 2, $T_{amb} = 25$ °C, unless otherwise specified

			Min.	Typ.	Max.	
Supply voltage range	Pin 9	V_S	3		16	V
AM Amplifier						
$f_i = 1$ MHz, $f_{IF} = 455$ kHz, $f_{mod} = 1$ kHz, m = 0.3						
Supply quiescent current	Pin 9	I_{SB}		14		mA
Signal to noise ratio						
$v_i = 1.5$ µV	Pin 10	$\frac{S+N}{N}$		6		dB
$v_i = 10$ µV	Pin 10	$\frac{S+N}{N}$		20		dB
$v_i = 15$ µV	Pin 10	$\frac{S+N}{N}$		26		dB
Regulation range						
$\Delta V_{oAF}/V_{oAF} = -10$ db, $v_i = 100$ mV	Pin 16	ΔV_i		80		dB
AF voltage at demodulator output						
$v_i = 1$ mV	Pin 10	V_{oAF}		70		mV
Distortion						
$v_i = 1$ mV	Pin 10	d		0.8		%
Demodulator output voltage	Pin 10	V_o		1.2		V
FM-IF Amplifier						
$f_{IF} = 10.7$ MHz, $\Delta f = \pm 22.5$ kHz, $f_{mod} = 1$ kHz						
Supply quiescent current	Pin 9	I_{SB}		14		mA
Limiting threshold (−3 dB)	Pin 4	V_i		30		µV
Signal to noise ratio						
$v_i = 10$ µV	Pin 10	$\frac{S+N}{N}$		6		dB
$v_i = 30$ µV	Pin 10	$\frac{S+N}{N}$		26		dB
$v_i = 10$ mV	Pin 10	$\frac{S+N}{N}$		65		dB

			Min.	Typ.	Max.	
AF voltage at demodulator output						
$v_i = 10$ mV	Pin 10	V_{oAF}		70		mV
AM-rejection						
$V_i = 10$ mV, $m = 0.3$	Pin 10	AMR		40		dB
Reference voltage FM	Pin 5	V_o		2.45		V
Current from Pin 5		I_o			0.2	mA

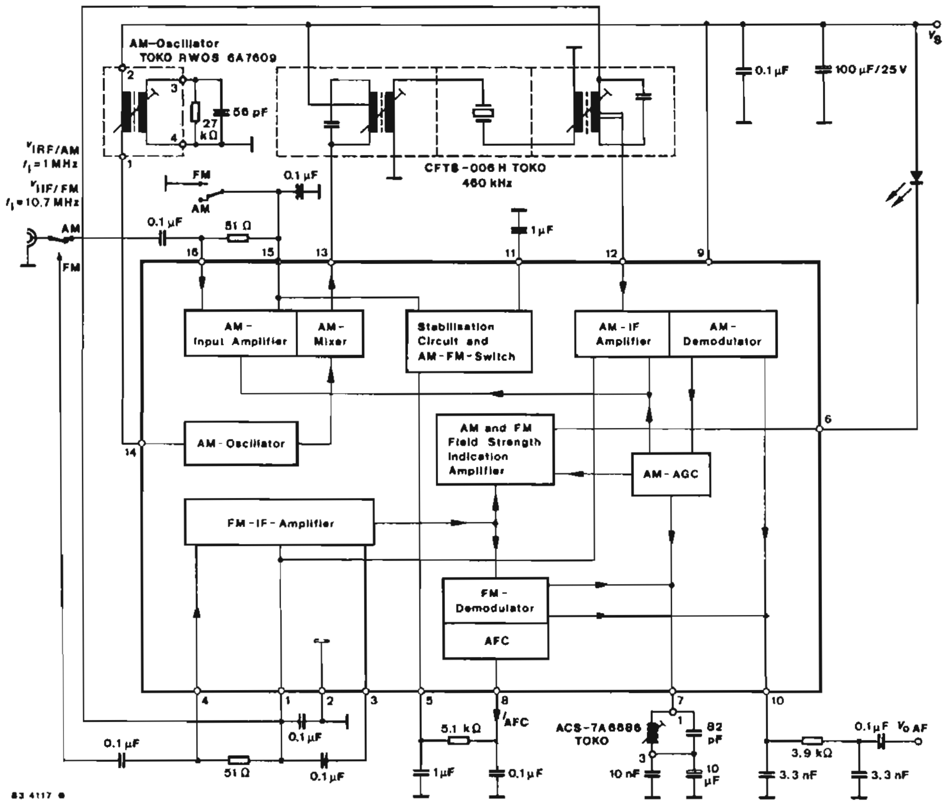
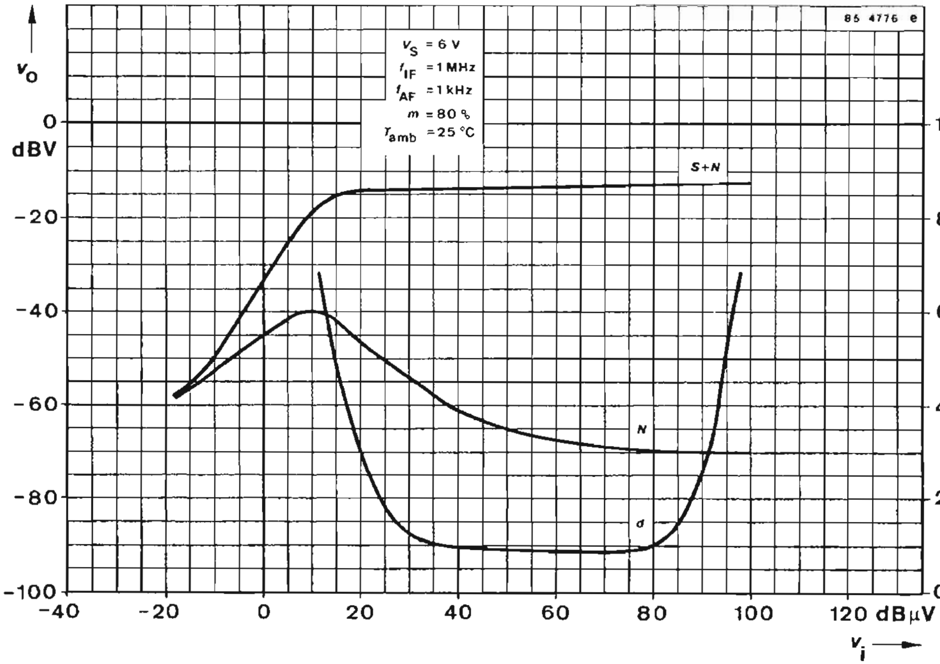
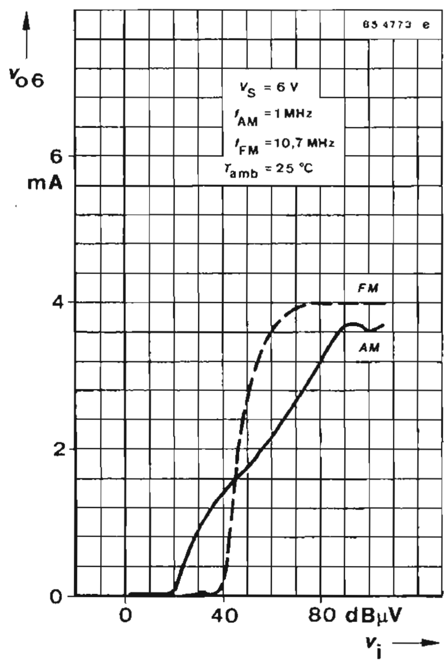
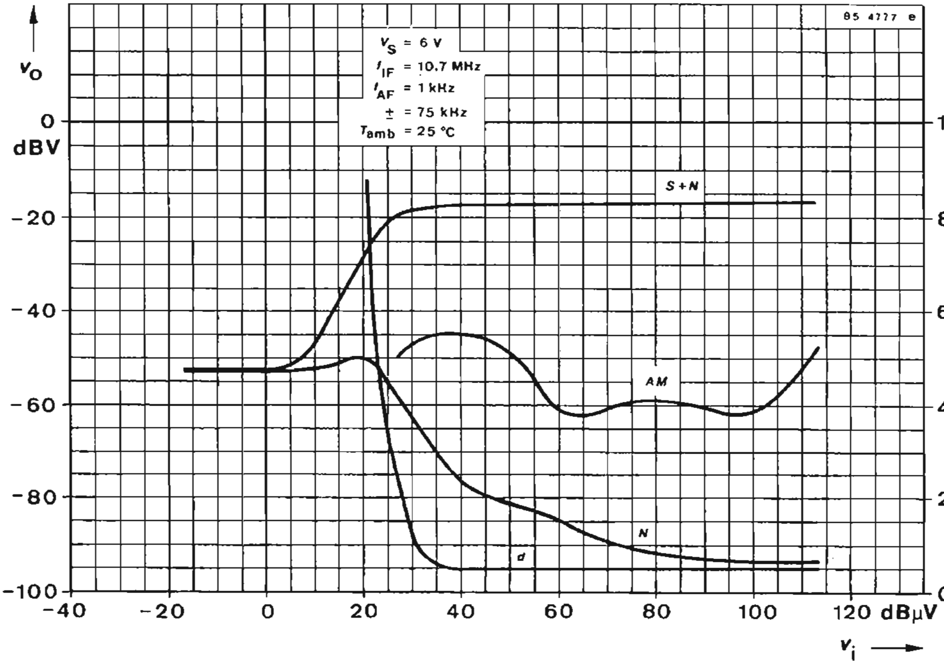
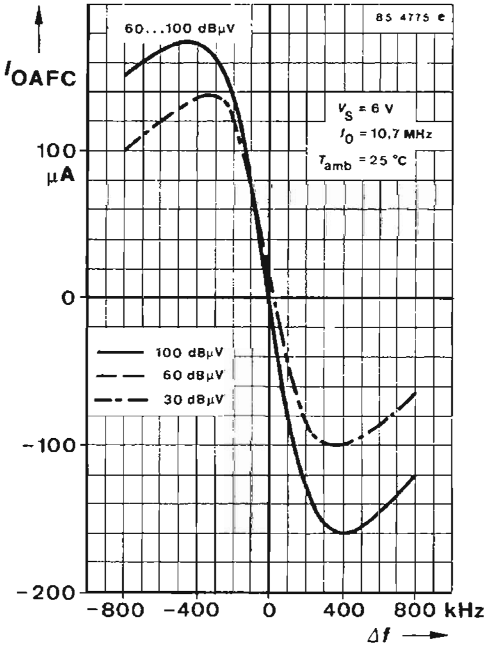


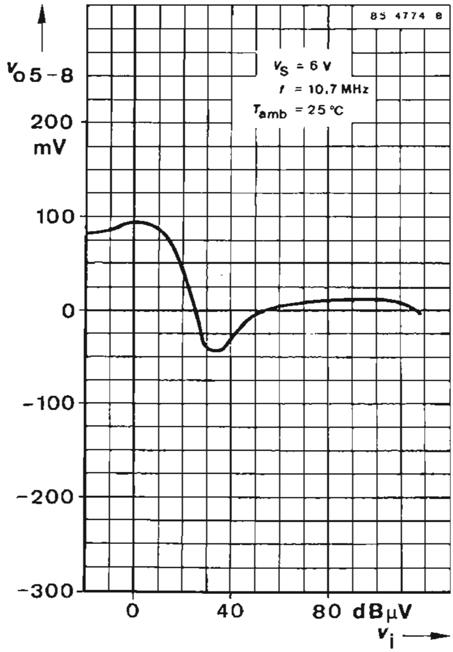
Fig. 2 Test circuit


85 4776 e
V_S = 6 V
f_{IF} = 1 MHz
f_{AF} = 1 kHz
m = 80 %
T_{amb} = 25 °C
V_o
0
dBV
-20
-40
-60
-80
-100
d
10
%
8
6
4
2
0
S+N
N
d
-40
-20
0
20
40
60
80
100
120 dBµV
V_i

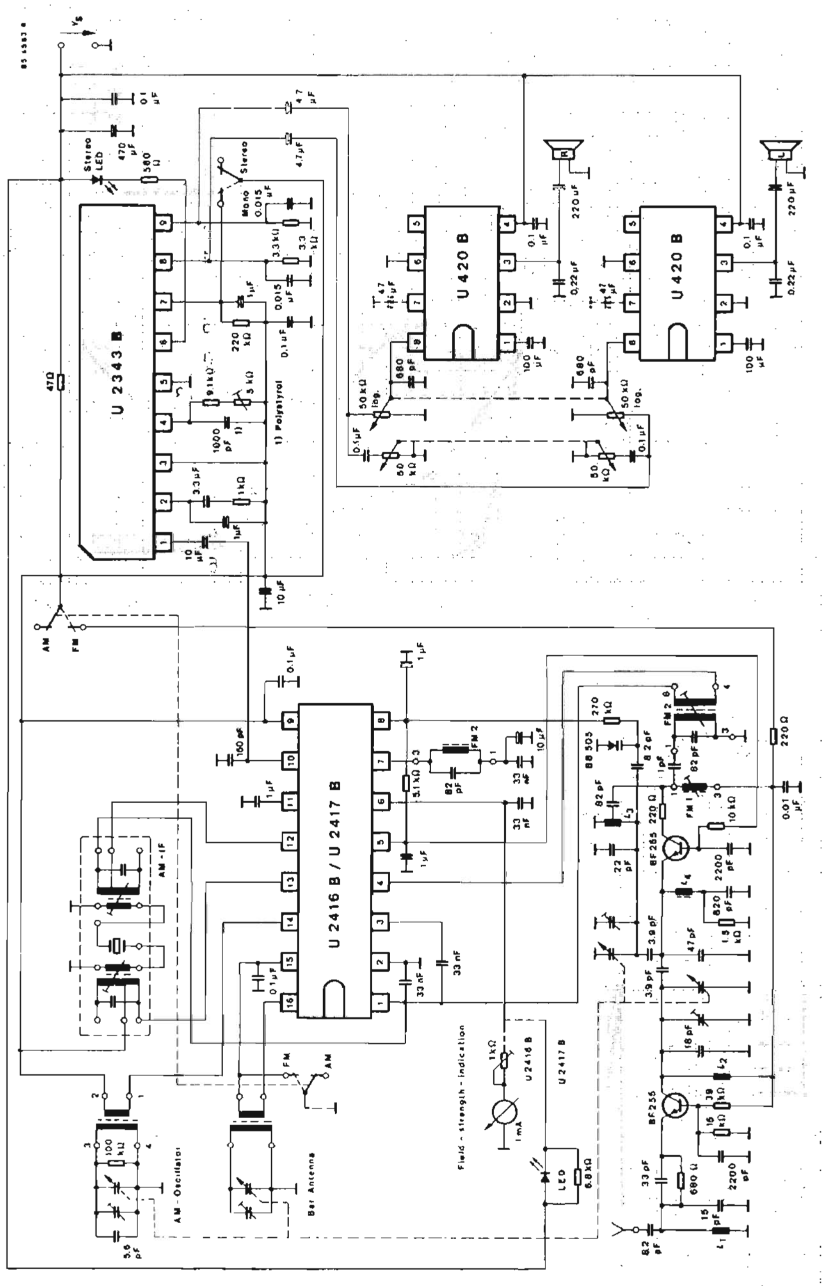

85 4773 e
V_S = 6 V
f_{AM} = 1 MHz
f_{FM} = 10,7 MHz
T_{amb} = 25 °C
V_{o6}
6
mA
4
2
0
FM
AM
0
40
80 dBµV
V_i


85 4777 e
V_S = 6 V
f_{IF} = 10.7 MHz
f_{AF} = 1 kHz
± = 75 kHz
T_{amb} = 25 °C
V_O
0 dBV
−20
−40
−60
−80
−100
d
10 %
8
6
4
2
0
S + N
AM
N
d
−40
−20
0
20
40
60
80
100
120 dBµV
V_i


85 4775 e
60...100 dBµV
I_{OAFC}
100 µA
0
−100
−200
V_S = 6 V
f_0 = 10.7 MHz
T_{amb} = 25 °C
100 dBµV
60 dBµV
30 dBµV
−800
−400
0
400
800 kHz
Δf


85 4774 e
V_{O5-8}
200 mV
100
0
−100
−200
−300
V_S = 6 V
f = 10.7 MHz
T_{amb} = 25 °C
0
40
80 dBµV
V_i

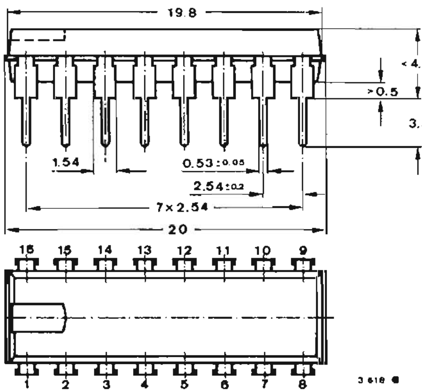
U 2417 B

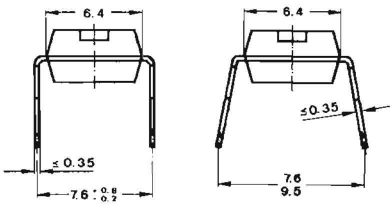


U 2343 B
U 420 B
U 420 B
U 2416 B / U 2417 B
AM - IF
AM - Oscillator
Bar Antenna
Field - strength - indication
U 2416 B
U 2417 B
LED
Stereo LED
Stereo
Mono
AM
FM
1) Polystyrol
BF 255
BF 255
BB 505
FM 1
FM 2
FM 2 B

Typical		D. C. voltages for $V_S = 6$ V		
Pin No:		AM	FM	Unit
1	HF-input decoupling	1.0	1.4	V
2	Ground	0	0	V
3	IF-input decoder	1.0	1.4	V
4	FM-IF input	1.0	1.4	V
5	FM stabilised voltage	–	2.45	V
6	Field strength indication	6	6	V
7	FM-IF/AM-AGC	0.5	0	V
8	FM-AFC	–	2.3	V
9	Supply voltage, $+V_S$	6	6	V
10	Demodulator output	1.7	1.8	V
11	AM-stabilised voltage	2.45	–	V
12	AM-IF input	6	6	V
13	AM-mixer output	6	6	V
14	AM-oscillator	6	6	V
15	AM input decoder	1.65	–	V
16	AM input	1.65	–	V

Dimensions in mm





Case
20 A 16 DIN 41 866
JEDEC MO 015 AH
DIP 16
Weight max. 1.5 g

Monolithic Integrated Circuit

Application: Audio-Amplifier for portable radios, cassette recorders and general purposes.

Features:

- Large supply voltage range V_S = 3...16 V
- Low cross-over distortion
- Low harmonic distortion
- Audio output power P_o = 1.6 W
- High supply voltage rejection ratio
- Bootstrap circuit

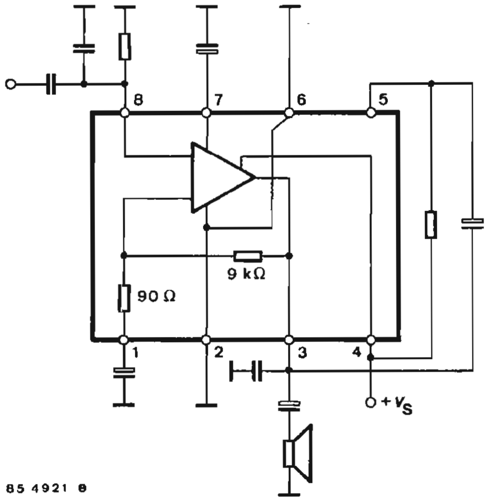


Fig. 1 Block diagramm and pin connections

Absolute maximum ratings

Reference point Pin 2, Pin 6

Supply voltage	Pin 4	V_S	16	V
Peak output current	Pin 3	I_{OM}	850	mA
Power dissipation T_{amb} = 50°C		P_{tot}	1	W
Junction temperature		T_j	150	°C
Storage temperature range		T_{stg}	−25...+150	°C

T2./048.1282 E

Thermal resistance				Min.	Typ.	Max.	
Junction ambient			R_{thJA}			100	K/W

Electrical characteristics
$V_S = 9$ V, reference point: Pin 2, Pin 6, $G_v = 40$ dB, $f = 1$ kHz,
$R_L = 8\ \Omega$, $d = 10\%$, $T_{amb} = 25°C$, unless otherwise specified

				Min.	Typ.	Max.	
Supply voltage range		Pin 4	V_S	3		16	V
Quiescent output voltage		Pin 3	V_{OB}	4.2		5.2	V
Quiescent drain current							
$V_S = 3$ V	Fig. 2	Pin 4	I_{SB}	3	5	8	mA
$V_S = 9$ V			I_{SB}	4.0	7.5	12	mA
$V_S = 16$ V			I_{SB}	4.0	7	10	mA
Output power			P_o	1.0	1.1		W
Supply voltage rejection ratio							
$V_{hum} = 0.35$ V, $C_1 = 100\ \mu F$, $f_{hum} = 100$ Hz			SVR	40	50		dB
Input resistance		Pin 8	R_i	800			kΩ
Band width (–3 dB)	Fig. 2		B		100...28000		Hz
Distortion	Fig. 2						
$P_o = 50$ mW			d			1	%
Voltage gain			G_v	37	40	43	dB
Output noise voltage							
$R_G = 0$, $B = 22...22000$ Hz		Pin 3	V_{no}		250	600	µV

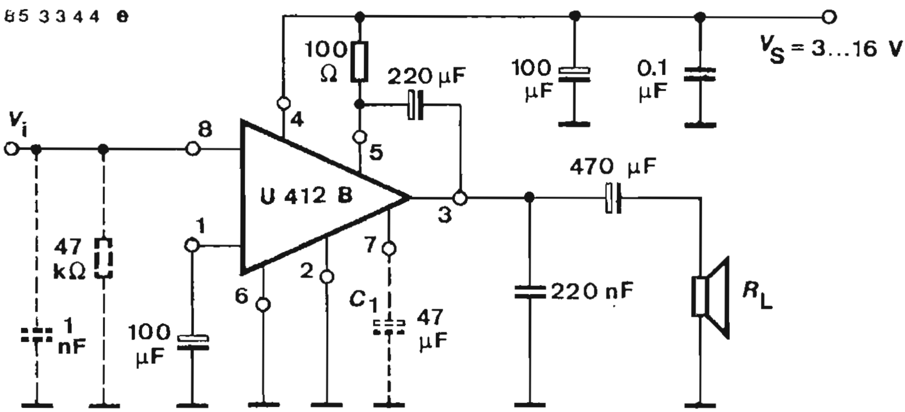
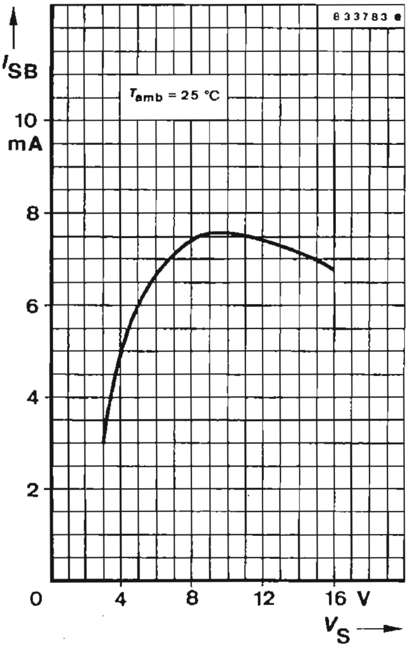
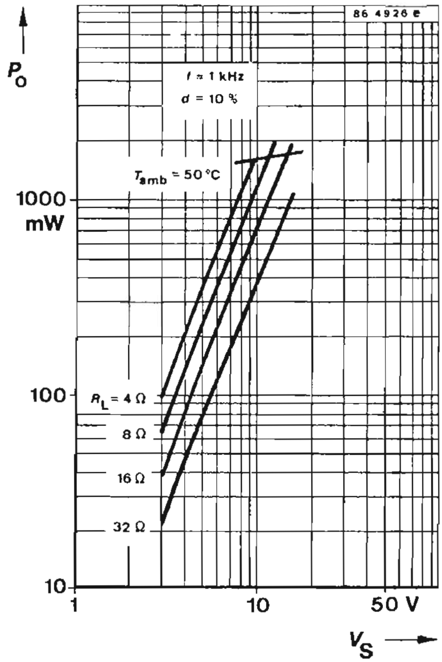
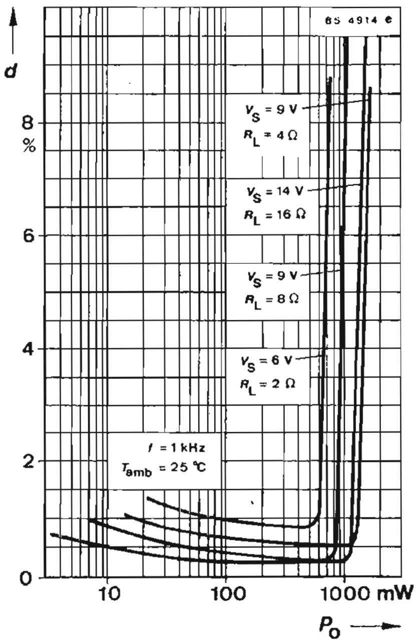


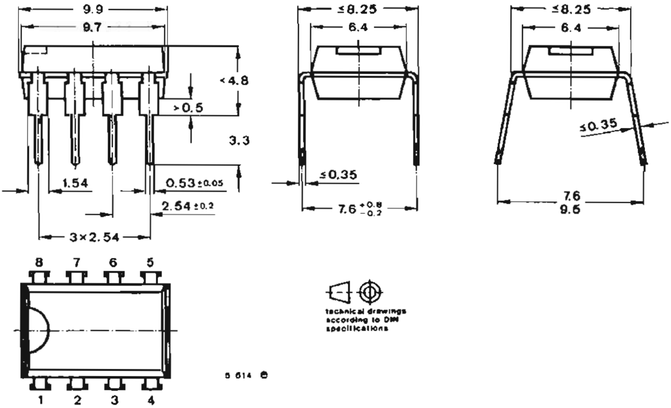
Fig. 2 Test circuit for: P_o, P_{tot}, d, V_{no}, B, G_v and application note


833783 e
I_{SB}
T_{amb} = 25 °C
10 mA
8
6
4
2
0
4
8
12
16 V
V_S


86 4926 e
P_O
f = 1 kHz
d = 10 %
T_{amb} = 50 °C
1000 mW
100
10
R_L = 4 Ω
8 Ω
16 Ω
32 Ω
1
10
50 V
V_S


85 4914 e
d
8 %
6
4
2
0
V_S = 9 V
R_L = 4 Ω
V_S = 14 V
R_L = 16 Ω
V_S = 9 V
R_L = 8 Ω
V_S = 6 V
R_L = 2 Ω
f = 1 kHz
T_{amb} = 25 °C
10
100
1000 mW
P_O

Dimensions in mm



Case
20 A 8 DIN 41866
DIP 8-polig
Weight max. 0.8 g

Monolithic Integrated Circuit

Application: Audio-Amplifier for portable radios, cassette recorders and general purposes.

Features:

- Large supply voltage range $V_S = 3...16$ V
- Low cross-over distortion
- Low harmonic distortion
- Adjustable voltage gain $G_v = 34...54$ dB
- Audio output power $P_o = 1.5$ W
- Connection possibility for an external capacitor to suppress hum voltage
- Bootstrap circuit

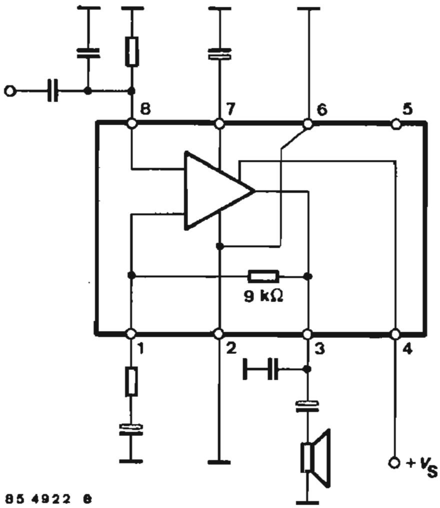


Fig. 1 Block diagramm and pin connections

Absolute maximum ratings

Reference point Pin 2, Pin 6

Supply voltage	Pin 4	V_S	16	V
Peak output current	Pin 3	I_{OM}	850	mA
Power dissipation $T_{amb} = 50°C$		P_{tot}	1	W
Junction temperature		T_j	150	°C
Storage temperature range		T_{stg}	–25...+150	°C

T1.2/349.1183 E

Thermal resistance				**Min.**	**Typ.**	**Max.**	
Junction ambient			R_{thJA}			100	K/W

Electrical characteristics

V_S = 9 V, reference point: Pin 2, Pin 6, G_v = 40 dB, f = 1 kHz,
R_L = 8 Ω, d = 10%, T_{amb} = 25°C, unless otherwise specified

				Min.	Typ.	Max.	
Supply voltage range		Pin 4	V_S	3		16	V
Quiescent output voltage		Pin 3	V_{OB}	3.9		4.7	V
Quiescent drain current							
V_S = 3 V	Fig. 2	Pin 4	I_{SB}	2	3	6	mA
V_S = 9 V			I_{SB}	3.3	7.5	12	mA
V_S = 16 V			I_{SB}	3.3	7	10	mA
Output power			P_o	0.9	1		W
Supply voltage rejection ratio							
V_{hum} = 0.35 V, C_1 = 47 µF, f_{hum} = 100 Hz			SVR		30		dB
Input resistance		Pin 8	R_i	800			kΩ
Band width (–3 dB)	Fig. 2		B		100...28000		Hz
Distortion	Fig. 2						
P_o = 50 mW			d		0.4	1	%
Voltage gain, closed loop							
R_1 = 91 Ω			G_v	37	40	43	dB
Output noise voltage							
R_G = 0, B = 22...22000 Hz		Pin 3	V_{no}		250	600	µV

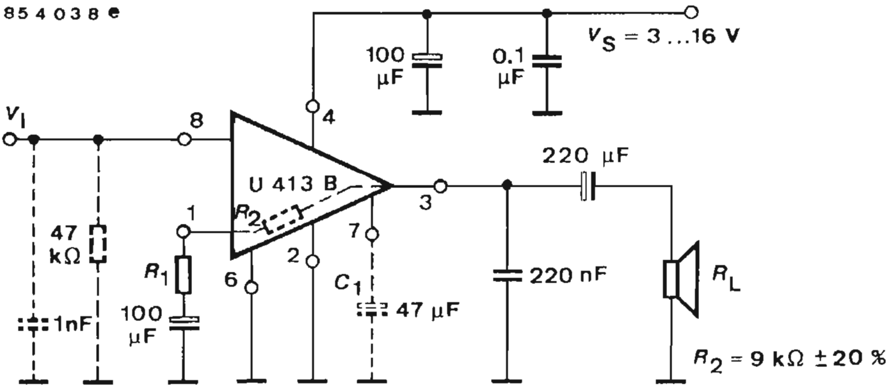
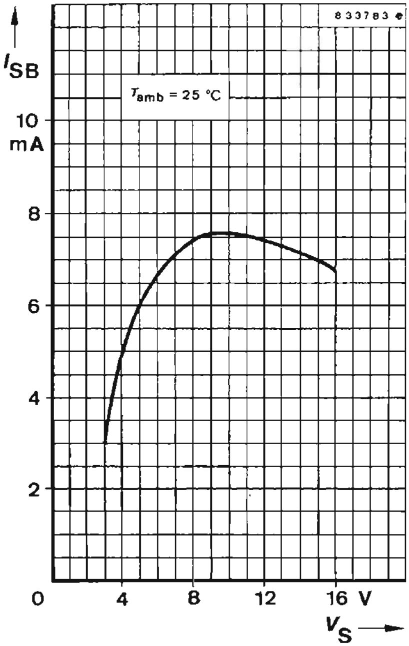
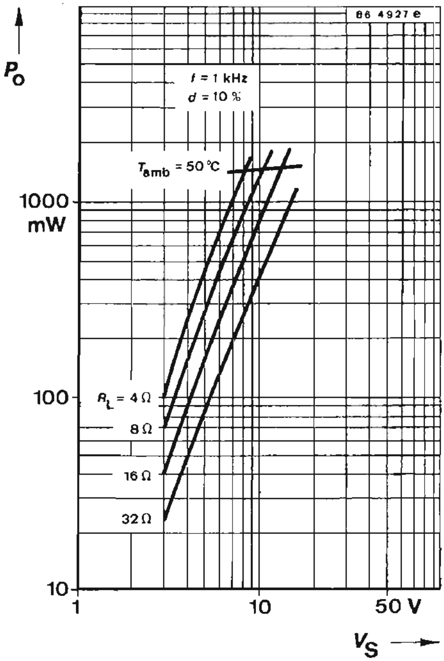
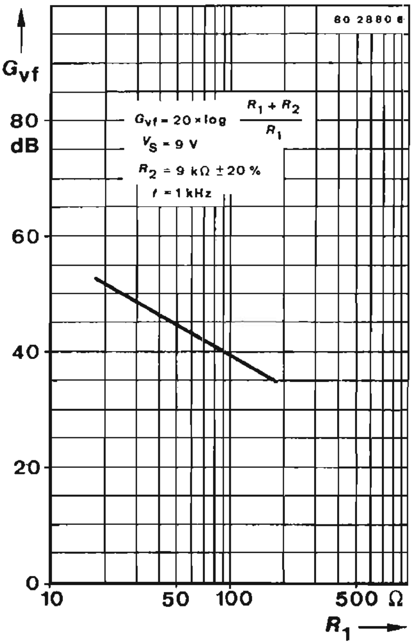
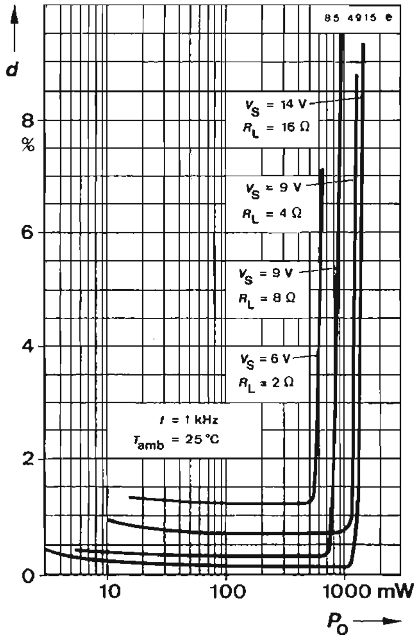


Fig. 2 Test circuit for: P_o, P_{tot}, d, V_{no}, B, G_v and application note

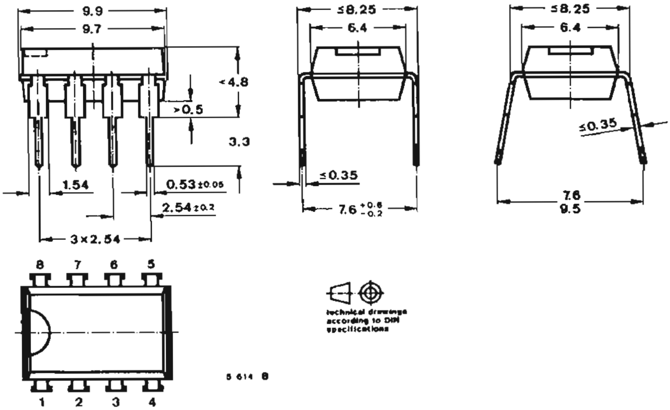

833783 e
I_{SB}
10 mA
8
6
4
2
T_{amb} = 25 °C
0
4
8
12
16 V
V_S


86 4927 e
P_o
f = 1 kHz
d = 10 %
T_{amb} = 50 °C
1000 mW
100
10
R_L = 4 Ω
8 Ω
16 Ω
32 Ω
1
10
50 V
V_S


80 2880 e
G_{vf}
80 dB
60
40
20
0
$G_{vf} = 20 \times \log \frac{R_1 + R_2}{R_1}$
V_S = 9 V
R_2 = 9 kΩ ± 20 %
f = 1 kHz
10
50
100
500 Ω
R_1


85 4915 e
d
8 %
6
4
2
0
V_S = 14 V
R_L = 16 Ω
V_S = 9 V
R_L = 4 Ω
V_S = 9 V
R_L = 8 Ω
V_S = 6 V
R_L = 2 Ω
f = 1 kHz
T_{amb} = 25 °C
10
100
1000 mW
P_o

Dimensions in mm



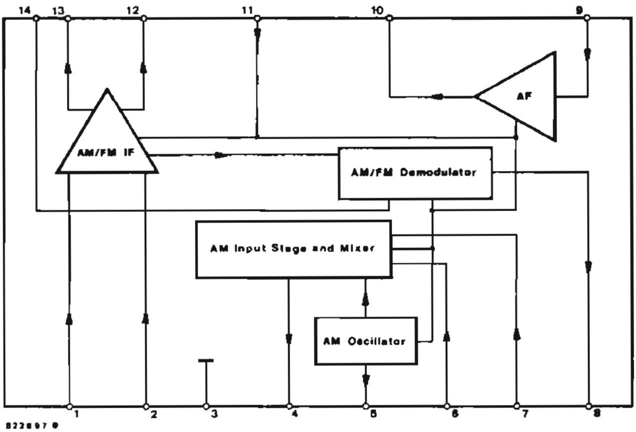
Case
20 A 8 DIN 41866
DIP 8
Weight max. 0.8 g

Monolithic Integrated Circuit

Applications: AM-/FM-/IF-Amplifier for portable radios

Features:

- Large supply voltage range $V_S = 3...15$ V
- High AM-Sensitivity
- Limiting threshold voltage $V_l = 50$ μV
- AM-Oscillator for LW, MW and SW
- AM-FM switching without high frequency voltages
- Additional audio preamplifier $G_v = 10$ dB



1 IF-Decoupling
2 IF-Input
3 Ground
4 AM-Mixer output
5 AM-Oscillator circuit
6 AM-Input
7 AM-Decoupling
8 Demodulator-Output
9 Audio-Input
10 Audio-Output
11 + V_s
12 Demodulator circuit
13 Demodulator circuit
14 AGC-/AFC-Voltage

Fig. 1 Block diagram and pin connections

Description

The integrated circuit U 416 B includes, with exception of the FM front end and audio amplifier, a complete AM-/FM-radio-circuit with additional audio preamplifier with $G_v = 10$ dB.

Absolute maximum ratings

Reference point Pin 3, unless otherwise specified

Supply voltage range	Pin 11	V_S	3...15	V
Power dissipation $T_{amb} = 65°C$		P_{tot}	300	mW
Junction temperature		T_j	125	°C
Storage temperature range		T_{stg}	–25...+125	°C

Thermal resistance			Min.	Typ.	Max.	
Junction ambient		R_{thJA}			200	K/W

Electrical characteristics
$V_S = 9$ V, reference points Pin 3, $T_{amb} = 25°C$, unless otherwise specified

			Min.	Typ.	Max.	
AF Amplifier						
Voltage amplification $f = 1$ kHz	Pin 10	G_v		10		dB
Input resistance	Pin 9		800			kΩ
Load resistance	Pin 10	R_L		3.3		kΩ
AM-Amplifier $f_i = 1$ MHz, $f_{IF} = 455$ kHz, $f_{mod} = 1$ kHz, m = 0.3						
Total supply quiescent current		I_{SB}	6		10	mA
Output quiescent voltage	Pin 8	V_{OB}	1.45		2.1	V
	Pin 10	V_{OB}	6		8	V
AGC-Quiescent voltage	Pin 14	V_{AGCB}	1.4		2.1	V
Regulation range $\Delta V_{oAF}/V_{oAF} = 10$ dB	Pin 6	ΔV_i		70		dB
AF-Voltage at demodulator output	Pin 8	V_{oAF}		100		mV
FM-IF-Amplifier $f_{IF} = 10.7$ MHz, $\Delta f = \pm 22.5$ kHz, $f_{mod} = 1$ kHz						
Total supply quiecent current		I_{SB}	7		15	mA
AF-Output quiescent current	Pin 8	V_{OB}	1.5		3	V
	Pin 10	V_{OB}	6		8	V
AFC-Quiescent current	Pin 14	V_{AFCB}	1.8		2.8	V
Limiting threshold (–3 dB)	Pin 2	V_i		50		µV
AF-Voltage at demodulator output	Pin 8	V_{oAF}		100		mV

Different dc voltages are developed at Pin 14 due to gain spread of AM-IF-Amplifier. To determine the value of parallel resistance R_8 at the output of the demodulator Pin 8 for $V_S = 9$ V, AM mode without signal, dc voltage should be selected at Pin 14.

Voltage groups designation:

Group	1	2	3
V_{14}	1.4...1.7 V	1.7...1.9 V	1.9...2.1 V
R_8	∞	47 kΩ	33 kΩ

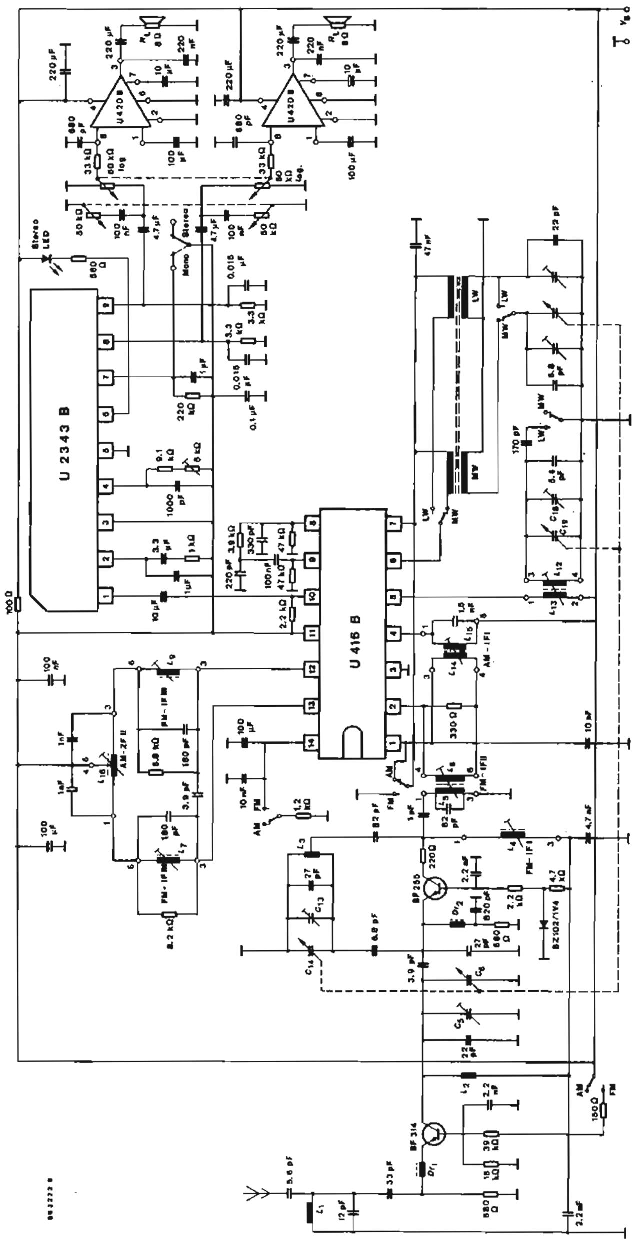
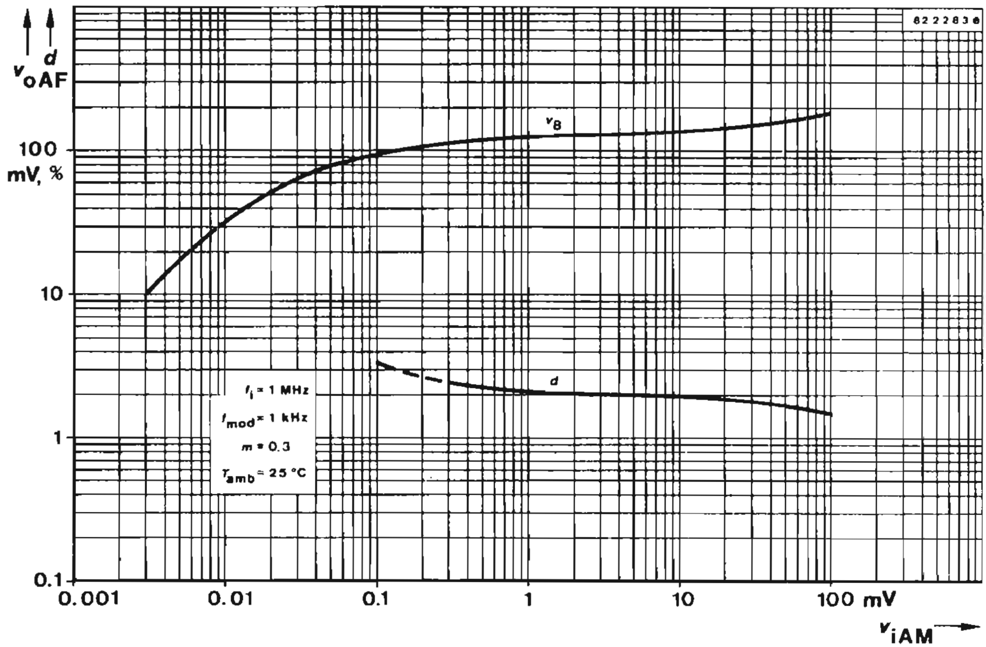
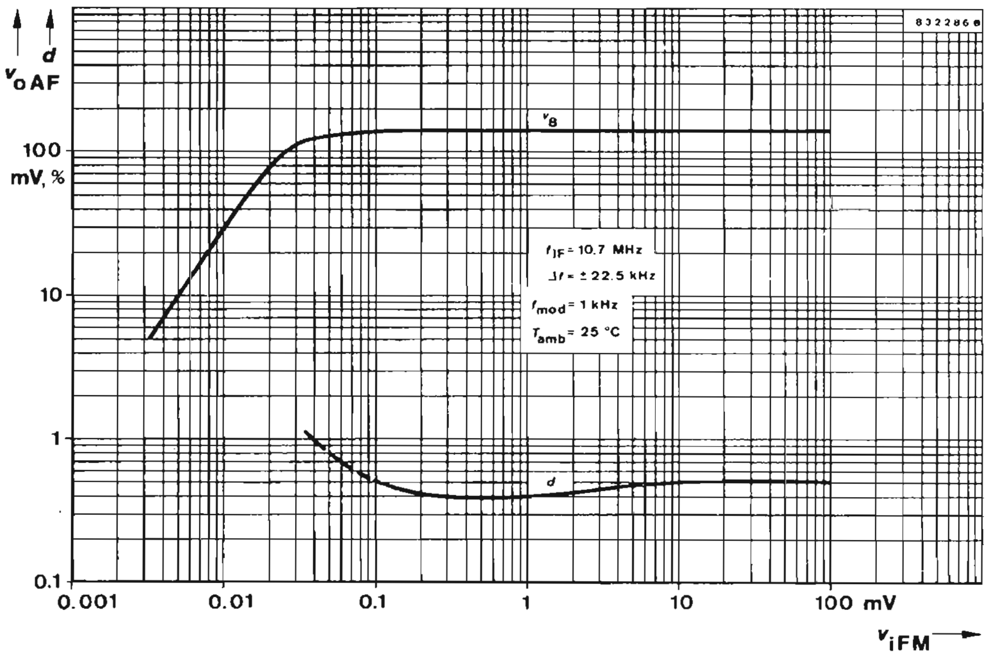
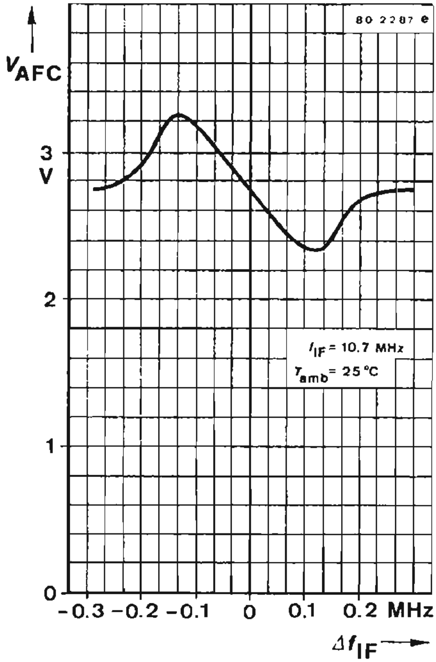


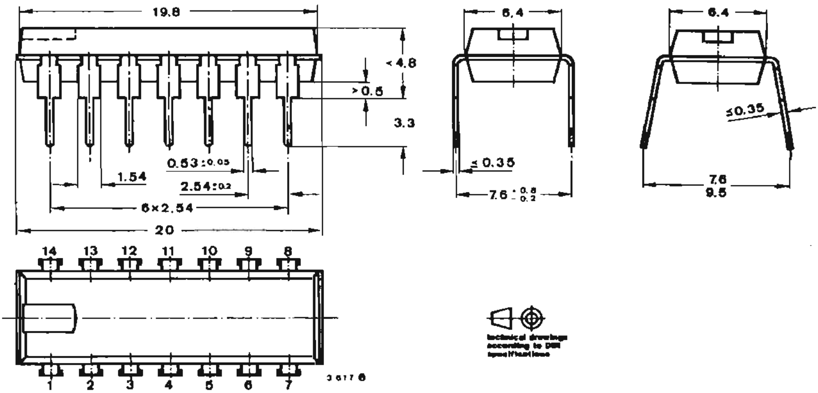
Fig. 2 FM-/AM-Receiver circuit


8222836
v_{oAF}
d
100
mV, %
10
1
0.1
0.001
0.01
0.1
1
10
100 mV
v_{iAM}
v_8
d
f_i = 1 MHz
f_{mod} = 1 kHz
m = 0.3
T_{amb} = 25 °C


8322866
v_{oAF}
d
100
mV, %
10
1
0.1
0.001
0.01
0.1
1
10
100 mV
v_{iFM}
v_8
d
f_{IF} = 10.7 MHz
Δf = ± 22.5 kHz
f_{mod} = 1 kHz
T_{amb} = 25 °C



Dimensions in mm



Case
20 A 14 DIN 41866
JEDEC MO 001 AA
Weight max. 1.5 g

U 417 B

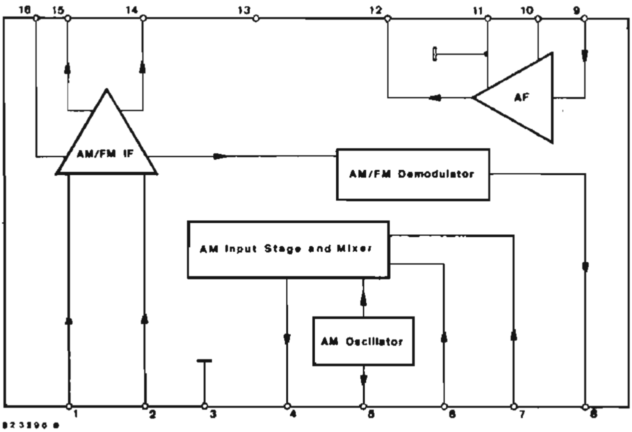
TELEFUNKEN electronic
Creative Technologies

Monolithic Integrated Circuit

Applications: AM-/FM-/ZF- and Audio-Amplifier

Features:

- Large supply voltage range $V_S = 3...15$ V
- High AM-Sensitivity
- Limiting threshold voltage $V_I = 50\ \mu V$
- Audio output power $P_o = 0.7$ W
- AM-Oscillator for LW, MW and SW
- AM-FM switching without high frequency voltages



1 IF-Decoupling
2 IF-Input
3 RF-Ground
4 AM-Mixer output
5 AM-Oscillator circuit
6 AM-Input
7 AM-Decoupling
8 Demodulator-Output
9 Audio-Input
10 Audio-Feedback
11 Audio-Ground
12 Audio-Output
13 $+V_S$
14 Demodulator circuit
15 Demodulator circuit
16 AGC-/IAFC-Voltage

Fig. 1 Block diagram and pin connections

Description

The integrated circuit U 417 B includes, with exception of the FM front end, a complete AM-/FM-radio-circuit with audio power amplifier.

Absolute maximum ratings

Reference points Pin 3, 11, unless otherwise specified

Supply voltage range	Pin 13	V_S	3...15	V
Power dissipation $T_{amb} = 65°C$		P_{tot}	600	mW
Junction temperature		T_j	150	°C
Storage temperature range		T_{stg}	–25...+150	°C

Thermal resistance		**Min.**	**Typ.**	**Max.**	
Junction ambient	R_{thJA}			100	K/W

T1.2/260.0683 E

Electrical characteristics $V_S = 9$ V, reference points Pin 3 and 11, $T_{amb} = 25°C$, unless otherwise specified			**Min.**	**Typ.**	**Max.**	
AF Amplifier $R_l = 16\ \Omega$, $d = 10\%$, Fig. 3, 5						
Output power	Pin 12	P_o		0.7		W
Input resistance	Pin 9	R_i	800			kΩ
Band width (–3 dB)		B		100...80000		Hz
Distortion $P_o =$ mW		d			1	%
Voltage gain, closed loop	Pin 12	G_u	37	40	43	dB
Output noise voltage $R_G = 0$, $B = 22...22000$	Pin 12	V_{no}			600	μV
AM-Amplifier $f_i = 1$ MHz, $f_{IF} = 455$ kHz, $f_{mod} = 1$ kHz, m = 0.3						
Supply quiescent current	Pin 13	I_{SB}	8		19	mA
Output quiescent voltage	Pin 12	V_{OB}	3.9		4.7	V
AGC-Quiescent voltage	Pin 16	V_{AGCB}	1.4		2.1	V
Regulation range $\Delta V_{oAF}/V_{oAF} = -10$ dB	Pin 6	ΔV_i		70		dB
AF voltage at demodulator output	Pin 8	V_{oAF}		100		mV
FM-IF Amplifier $f_{IF} = 10.7$ MHz, $\Delta f = \pm 22.5$ kHz, $f_{mod} = 1$ kHz						
Supply quiescent current	Pin 13	I_{SB}	10		20	mA
Output quiescent voltage	Pin 12	V_{OB}	3.9		4.7	V
AFC-Quiescent voltage	Pin 16	V_{AFCB}	1.8		2.8	V
Limiting threshold (–3 dB)	Pin 2	V_i		50		μV
AF voltage at demodulator output	Pin 8	V_{oAF}		100		mV

Different dc voltages are developed at Pin 16 due to gain spread of AM-IF-amplifier. To determine the value of parallel resistance R_8 at the output of the demodulator Pin 8 for $V_S = 9$ V, AM mode without signal, dc voltage should be selected at Pin 16.

Voltage groups designation:

Group	1	2	3
V_{16}	1.4...1.7 V	1.7...1.9 V	1.9...2.1 V
R_8	∞	47 kΩ	33 kΩ

Example:

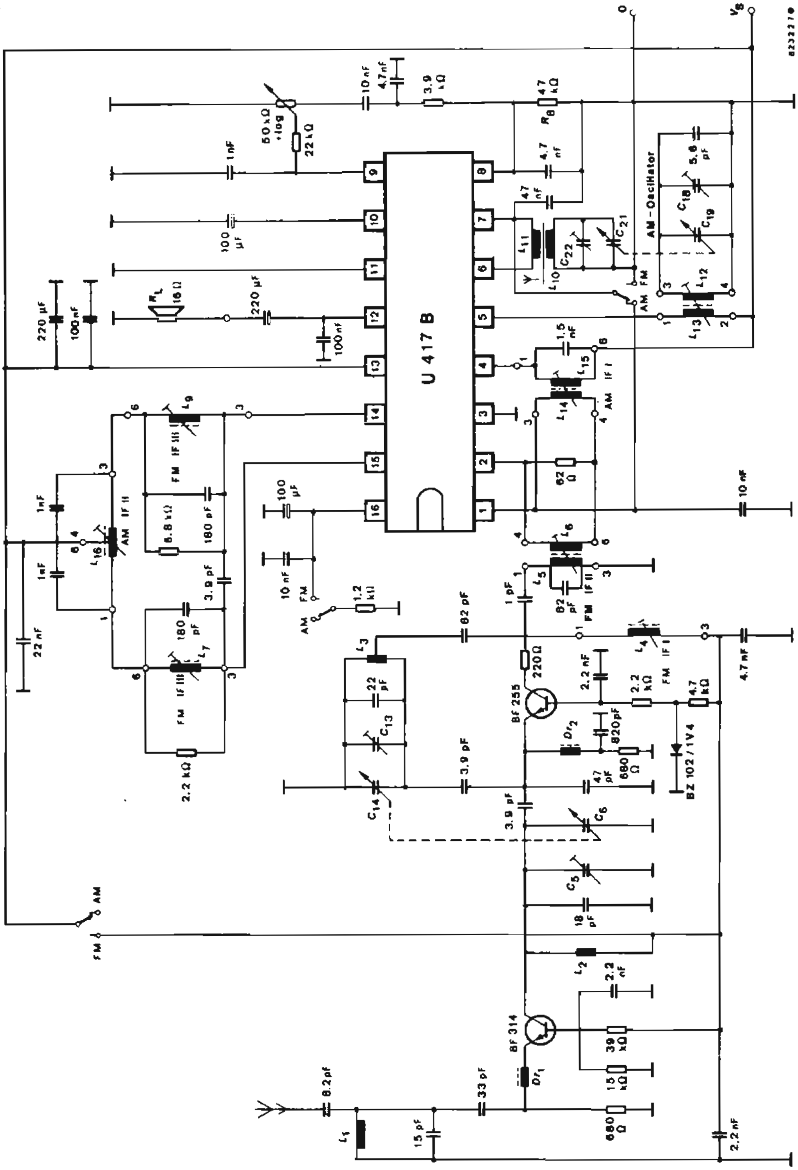
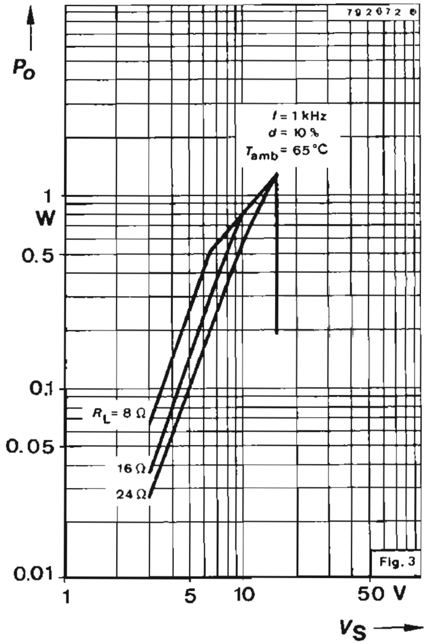
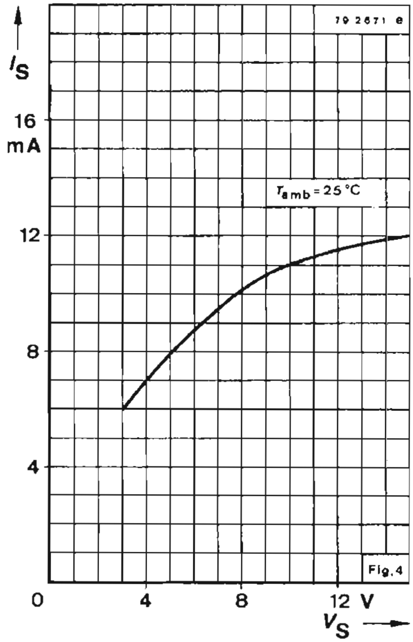
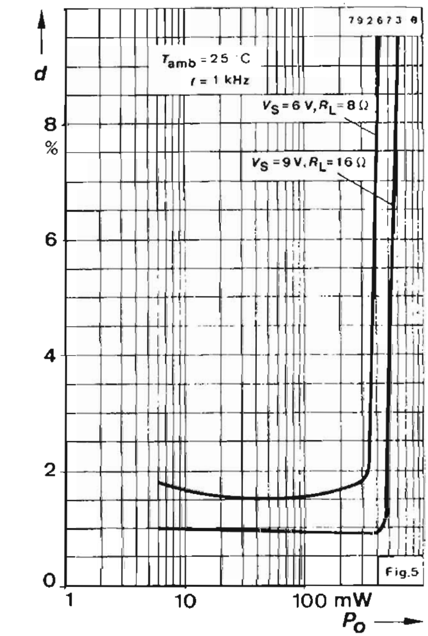
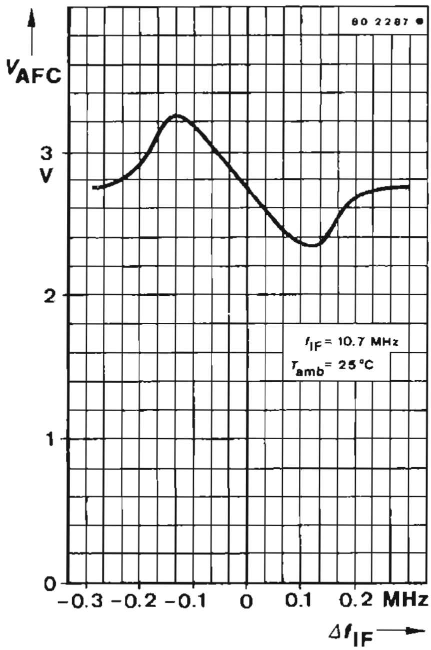


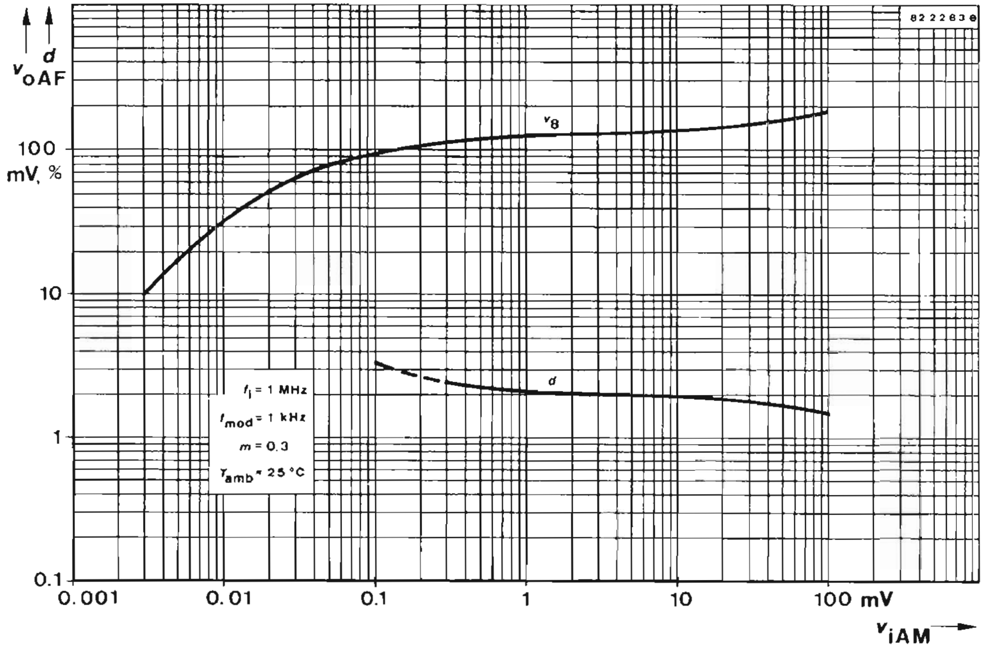
Fig. 2 FM-/AM-receiver circuit


792672 e
P_o
1
W
0.5
0.1
0.05
0.01
f = 1 kHz
d = 10 %
T_{amb} = 65 °C
R_L = 8 Ω
16 Ω
24 Ω
1
5
10
50 V
V_S
Fig. 3

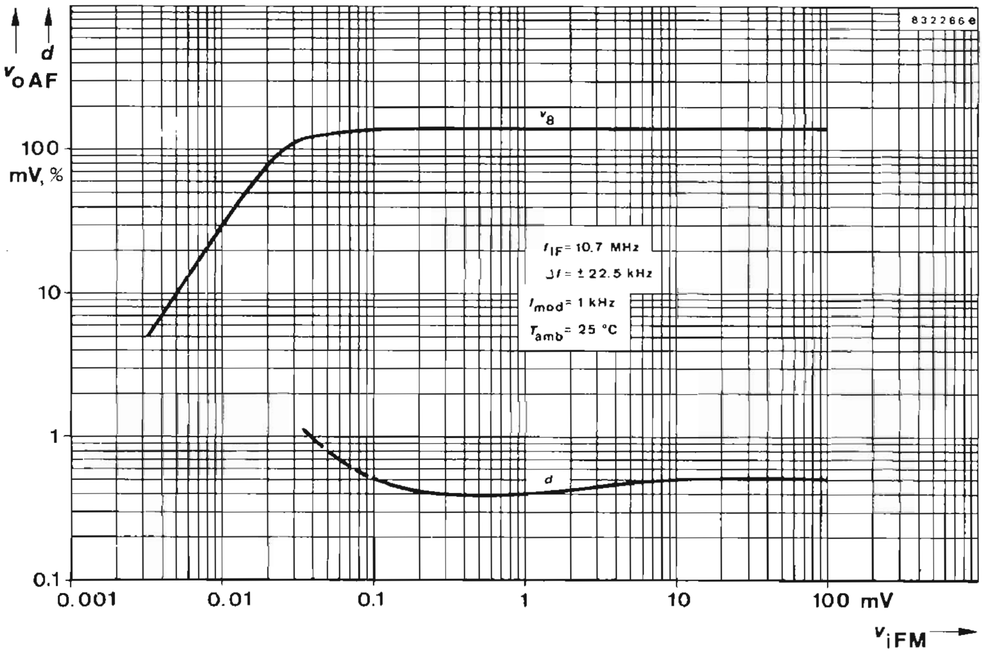

79 2671 e
I_S
16
mA
12
8
4
0
4
8
12 V
V_S
T_{amb} = 25 °C
Fig. 4


792673 e
d
8
%
6
4
2
0
T_{amb} = 25 °C
f = 1 kHz
V_S = 6 V, R_L = 8 Ω
V_S = 9 V, R_L = 16 Ω
1
10
100 mW
P_o
Fig. 5


80 2287 e
V_{AFC}
3
V
2
1
0
f_{IF} = 10.7 MHz
T_{amb} = 25 °C
−0.3 −0.2 −0.1 0 0.1 0.2 MHz
Δf_{IF}

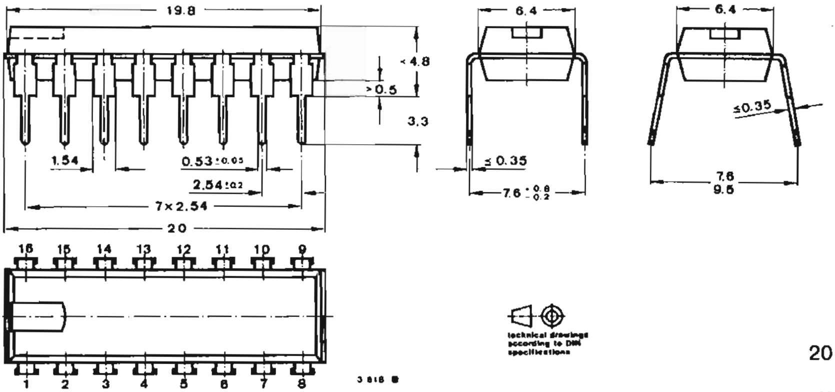


822283 e
d
v_{oAF}
100
mV, %
10
1
0.1
0.001
0.01
0.1
1
10
100 mV
v_{iAM}
v_8
d
f_i = 1 MHz
f_{mod} = 1 kHz
m = 0.3
T_{amb} = 25 °C



832266 e
d
v_{oAF}
100
mV, %
10
1
0.1
0.001
0.01
0.1
1
10
100 mV
v_{iFM}
v_8
d
f_{IF} = 10.7 MHz
Δf = ± 22.5 kHz
f_{mod} = 1 kHz
T_{amb} = 25 °C

Dimensions in mm



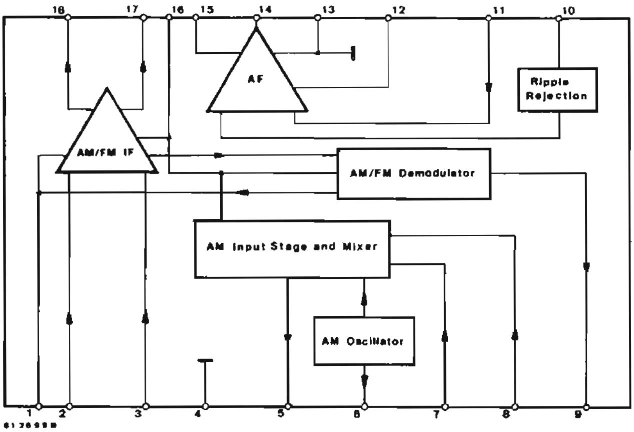
Case
20 A 16 DIN 41 866
JEDEC MO 001
Weight max. 1.5 g

Monolithic Integrated Circuit

Applications: AM-/FM-/IF- and Audio-Amplifier

Features:

- Large supply voltage range $V_S = 3...15$ V
- High AM-Sensitivity
- Limiting threshold voltage $V_i = 50\ \mu V$
- Audio output power $P_o = 1$ W
- AM-Oscillator for LW, MW and SW
- Connection possibility for an external capacitor to suppress hum voltage
- AM-FM switching without high frequency voltages



1 AGC/AFC-Voltage
2 IF-Decoupling
3 IF-Input
4 RF-Ground
5 AM-Mixer output
6 AM-Oscillator circuit
7 AM-Input
8 AM-Decoupling
9 Demodulator-Output
10 Ripple rejection
11 Audio-Input
12 Audio-Feedback
13 Audio-Ground
14 Audio-Output
15 + V_S
16 + V_S
17 Demodulator circuit
18 Demodulator circuit

Fig. 1 Block diagram and pin connections

Description

The integrated circuit U 418 B includes, with exception of the FM front end, a complete AM-/FM-radio-circuit with audio power amplifier.

To avoid interference between AF- and RF-section, there are available two leads for supply voltages. An improvement in hum voltage suppression can be attained by using an external capacitor.

Absolute maximum ratings

Reference points Pin 4, 13, unless otherwise specified

Supply voltage range	Pin 15/16	V_S	3...15	V
Power dissipation $T_{amb} = 65°C$		P_{tot}	600	mW
Junction temperature		T_j	150	°C
Storage temperature range		T_{stg}	–25...+150	°C

Thermal resistance		**Min.**	**Typ.**	**Max.**	
Junction ambient	R_{thJA}			100	K/W

T1.2/262.0683 E

Electrical characteristics **Min. Typ. Max.**

V_S = 9 V, reference points Pin 4 and 13, T_{amb} = 25°C, unless otherwise specified

			Min.	Typ.	Max.	
AF Amplifier						
R_l = 8 Ω, d = 10%, Fig. 3, 5						
Output power	Pin 14	P_o	0.9	1		W
Supply voltage rejection ratio V_{hum} = 0.35 V, C_1 = 47 μF f_{hum} = 100 Hz		SVR		30		dB
Input resistance	Pin 11	R_i	800			kΩ
Band width (–3 dB)		B		100...80000		Hz
Distortion P_o = 50 mW		d			1	%
Voltage gain, closed loop	Pin 14	G_v	37	40	43	dB
Output noise voltage R_G = 0, B = 22...22000	Pin 14	V_{no}			600	μV
AM-Amplifier						
f_i = 1 MHz, f_{IF} = 455 kHz, f_{mod} = 1 kHz, m = 0.3						
Supply quiescent current	Pin 15/16	I_{SB}	8		19	mA
Output quiescent voltage	Pin 14	V_{OB}	3.9		4.7	V
AGC-Quiescent voltage	Pin 1	V_{AGCB}	1.4		2.1	V
Regulation range $\Delta V_{oAF}/V_{oAF}$ = –10 dB	Pin 7	ΔV_i		70		dB
AF voltage at demodulator output	Pin 9	V_{oAF}		100		mV
FM-IF Amplifier						
f_{IF} = 10.7 MHz, Δf = ±22.5 kHz, f_{mod} = 1 kHz						
Supply quiescent current	Pin 15/16	I_{SB}	10		20	mA
Output quiescent voltage	Pin 14	V_{OB}	3.9		4.7	V
AFC-Quiescent voltage	Pin 1	V_{AFCB}	1.8		2.8	V
Limiting threshold (–3 dB)	Pin 3	V_i		50		μV
AF voltage at demodulator output	Pin 9	V_{oAF}		100		mV

Different dc voltages are developed at Pin 1 due to gain spread of AM-IF-amplifier. To determine the value of parallel resistance R_9 at the output of the demodulator Pin 9 for V_S = 9 V, AM mode without signal, dc voltage should be selected at Pin 1.

Voltage groups designation:

Group	1	2	3
V_1	1.4...1.7 V	1.7...1.9 V	1.9...2.1 V
R_9	∞	47 kΩ	33 kΩ

Example:

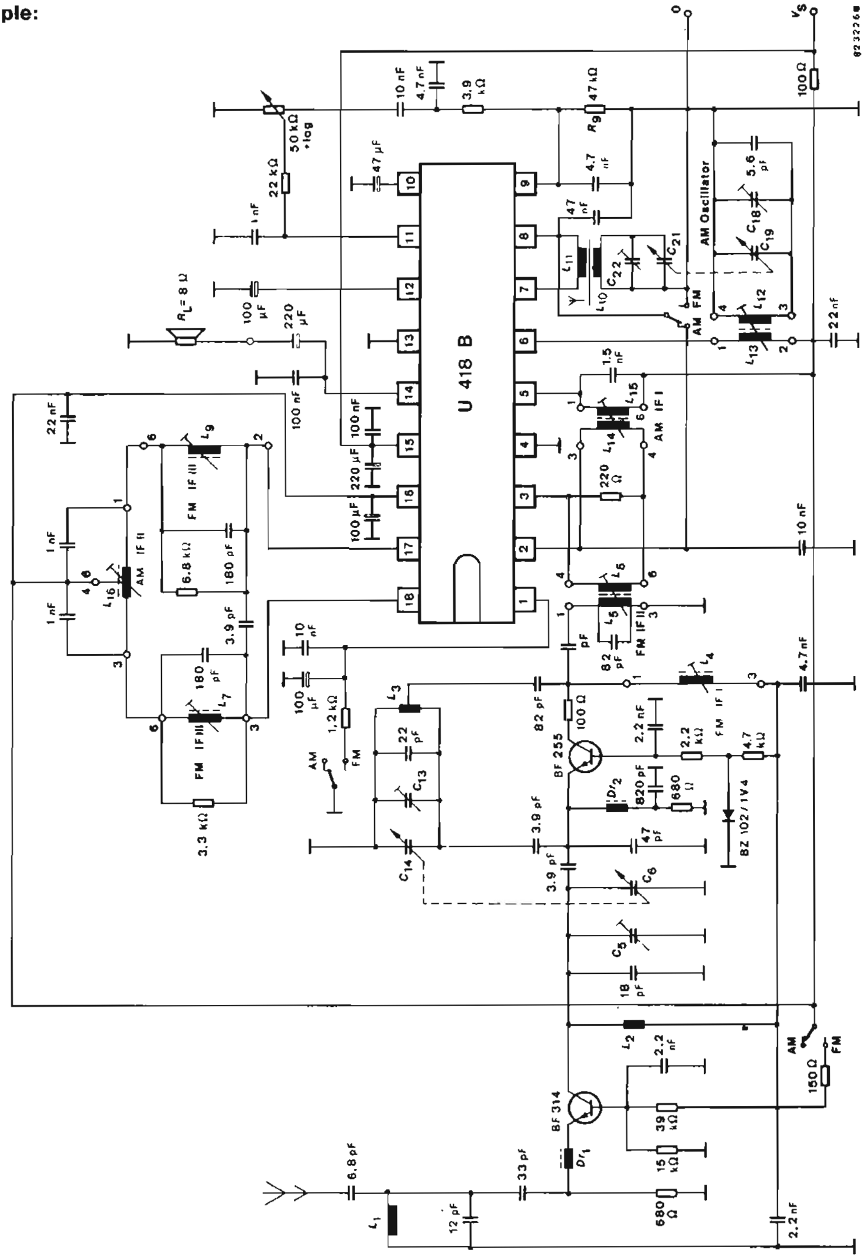
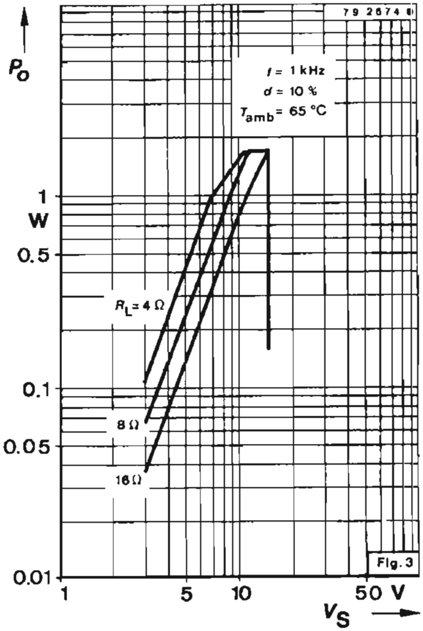
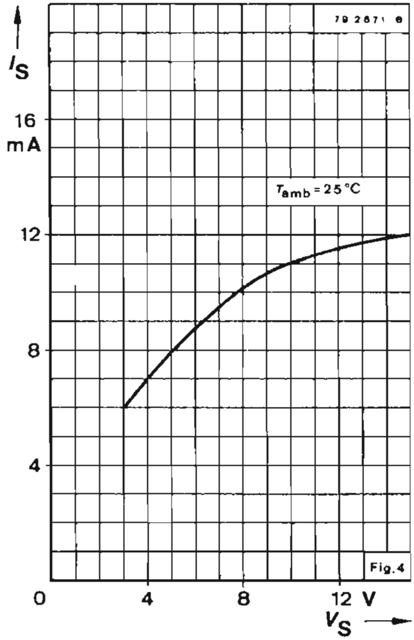
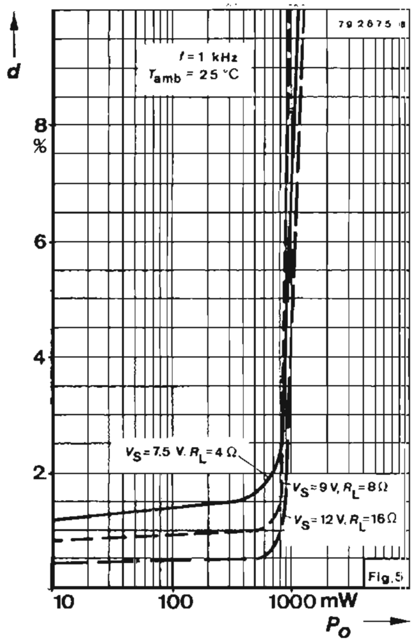
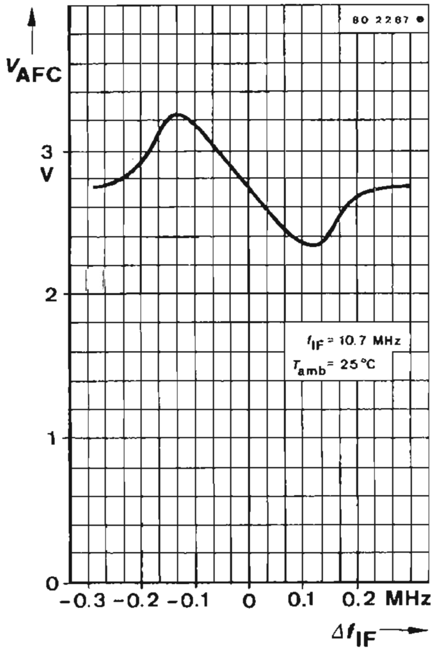


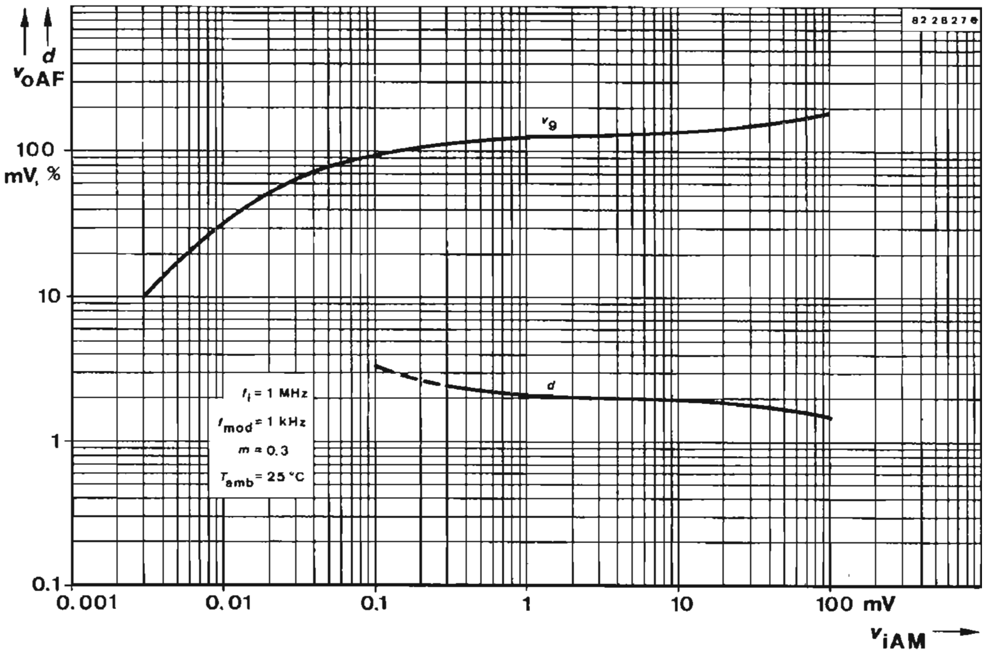
Fig. 2 FM-/AM-receiver circuit


79 2674 e
P_o
f = 1 kHz
d = 10 %
T_{amb} = 65 °C
1
W
0.5
0.1
0.05
0.01
R_L = 4 Ω
8 Ω
16 Ω
1
5
10
50 V
V_S
Fig. 3

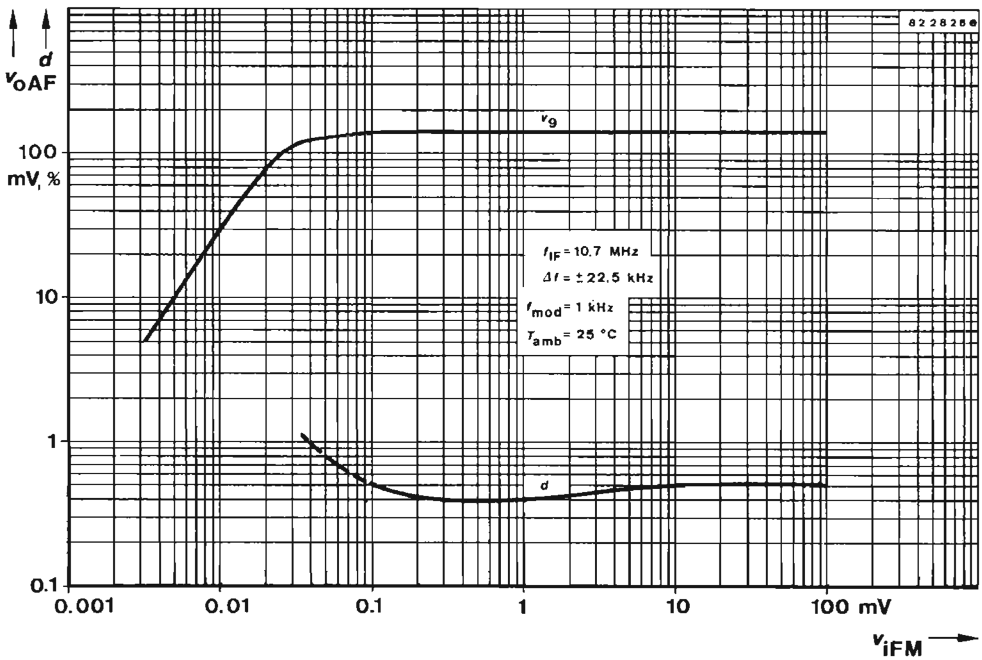

79 2671 e
I_S
16
mA
12
8
4
0
T_{amb} = 25 °C
4
8
12 V
V_S
Fig. 4


79 2675 e
d
f = 1 kHz
T_{amb} = 25 °C
8
%
6
4
2
V_S = 7.5 V, R_L = 4 Ω
V_S = 9 V, R_L = 8 Ω
V_S = 12 V, R_L = 16 Ω
10
100
1000 mW
P_o
Fig. 5


80 2267 e
V_{AFC}
3
V
2
1
0
f_{IF} = 10.7 MHz
T_{amb} = 25 °C
−0.3
−0.2
−0.1
0
0.1
0.2 MHz
Δf_{IF}

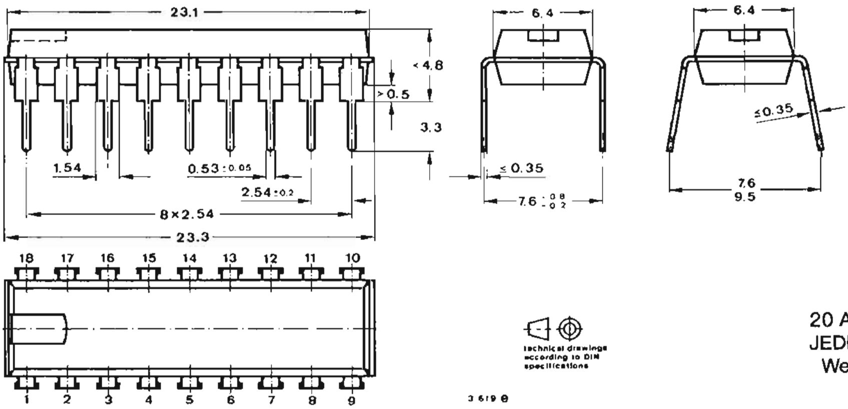


8228276
d
v_{oAF}
100
mV, %
10
1
0.1
v_g
d
f_i = 1 MHz
f_{mod} = 1 kHz
m = 0.3
T_{amb} = 25 °C
0.001
0.01
0.1
1
10
100 mV
v_{iAM}



8228286
d
v_{oAF}
100
mV, %
10
1
0.1
v_g
d
f_{IF} = 10.7 MHz
Δf = ± 22.5 kHz
f_{mod} = 1 kHz
T_{amb} = 25 °C
0.001
0.01
0.1
1
10
100 mV
v_{iFM}

Dimensions in mm



Case
20 A 18 DIN 41 866
JEDEC MO 015 AH
Weight max. 1.5 g

Monolithic Integrated Circuit

Application: Audio-Amplifier for portable radios, cassette recorders and general purposes.

Features:

- Large supply voltage range V_S = 3...16 V
- Low cross-over distortion
- Low harmonic distortion
- Audio output power P_o = 1.5 W
- Connection possibility for an external capacitor to suppress hum voltage
- Minimum number of external components

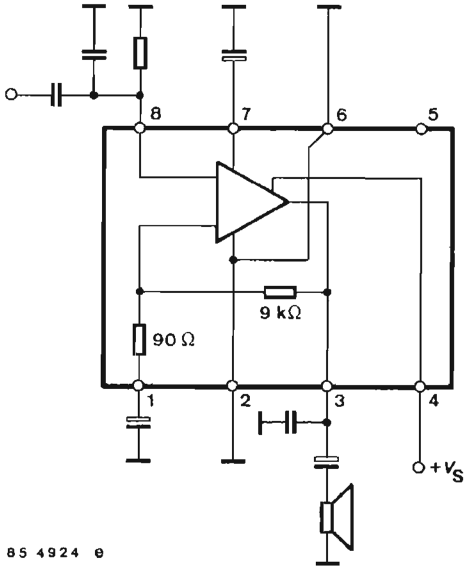


Fig. 1 Block diagram and pin connections

Absolute maximum ratings

Reference point Pin 2, Pin 6

Supply voltage	Pin 4	V_S	16	V
Peak output current	Pin 3	I_{OM}	850	mA
Power dissipation T_{amb} = 50°C		P_{tot}	1	W
Junction temperature		T_j	150	°C
Storage temperature range		T_{stg}	−25...+150	°C

T2./040.12.82 E

				Min.	Typ.	Max.	
Thermal resistance							
Junction ambient			R_{thJA}			100	K/W

Electrical characteristics
V_S = 9 V, reference point Pin 2, Pin 6, G_v = 40 dB, f = 1 kHz,
R_L = 8 Ω, d = 10%, T_{amb} = 25°C, unless otherwise specified

				Min.	Typ.	Max.	
Supply voltage range		Pin 4	V_S	3		16	V
Quiescent output voltage		Pin 3	V_{OB}	3.9		4.7	V
Quiescent drain current							
V_S = 3 V	Fig. 2	Pin 4	I_{SB}	2	3	6	mA
V_S = 9 V			I_{SB}	3.5	7.5	12	mA
V_S = 16 V			I_{SB}	3.5	7	10	mA
Output power			P_o	0.9	1		W
V_S = 6 V, R_L = 4 Ω			P_o	0.6			W
Supply voltage rejection ratio							
V_{hum} = 0.35 V, C_1 = 47 µF, f_{hum} = 100 Hz			SVR		30		dB
Input resistance		Pin 8	R_i	800			kΩ
Band width (–3 dB)	Fig. 2		B		100...28000		Hz
Distortion	Fig. 2						
P_o = 50 mW			d		0.4	1	%
Voltage gain, closed loop			G_v	37	40	43	dB
Output noise voltage							
R_G = 0, B = 22...22000 Hz		Pin 3	V_{no}		250	600	µV

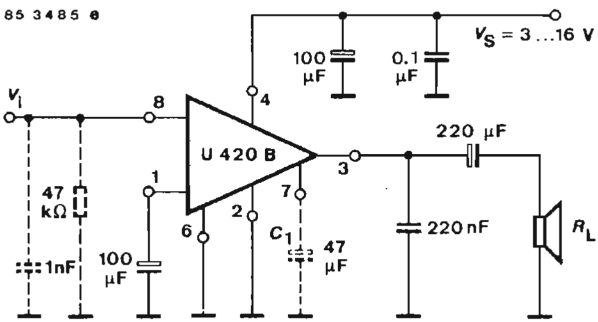
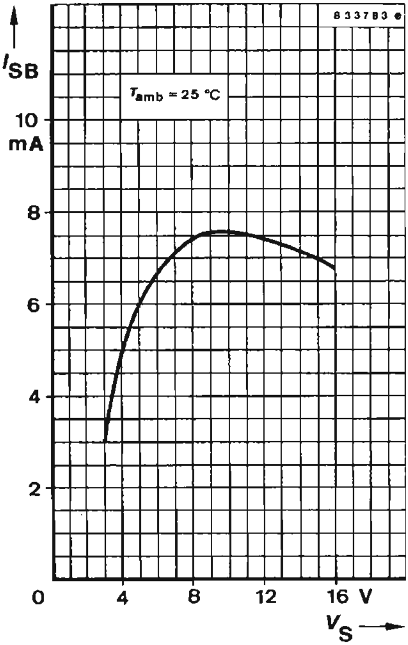
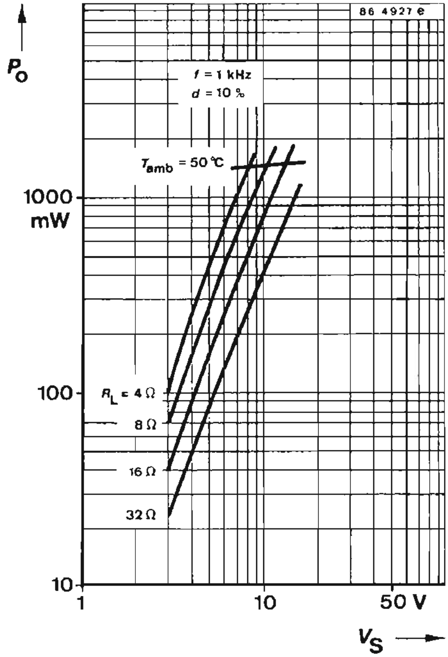
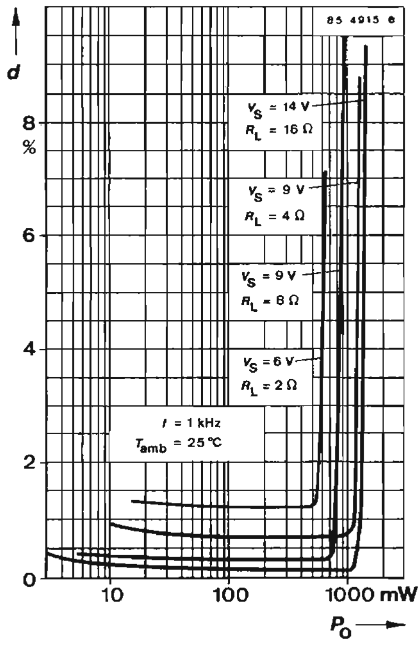


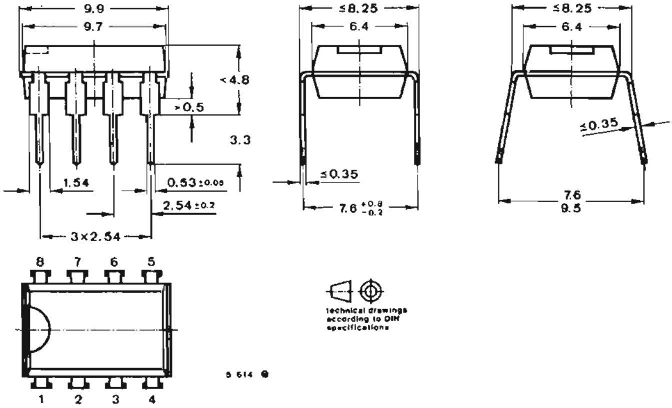
Fig. 2 Test circuit for: P_o, P_{tot}, d, V_{no}, B, G_v and application note


833783 e
I_{SB}
10
mA
8
6
4
2
0
4
8
12
16 V
V_S
T_{amb} = 25 °C


86 4927 e
P_o
1000
mW
100
10
1
10
50 V
V_S
f = 1 kHz
d = 10 %
T_{amb} = 50 °C
R_L = 4 Ω
8 Ω
16 Ω
32 Ω


85 4915 e
d
8
%
6
4
2
0
10
100
1000 mW
P_o
V_S = 14 V
R_L = 16 Ω
V_S = 9 V
R_L = 4 Ω
V_S = 9 V
R_L = 8 Ω
V_S = 6 V
R_L = 2 Ω
f = 1 kHz
T_{amb} = 25 °C

Dimensions in mm



Case
20 A 8 DIN 41866
DIP 8
Weight max. 0.8 g

Monolithic Integrated Circuit

Application: Audio-Amplifier for portable radios, cassette recorders and general purposes.

Features:

- Large supply voltage range V_S = 3...16 V
- Low cross-over distortion
- Low harmonic distortion
- Audio output power P_o = 1.6 W
- High supply voltage rejection ratio
- Bootstrap circuit
- Adjustable voltage gain G_v = 34...54 dB

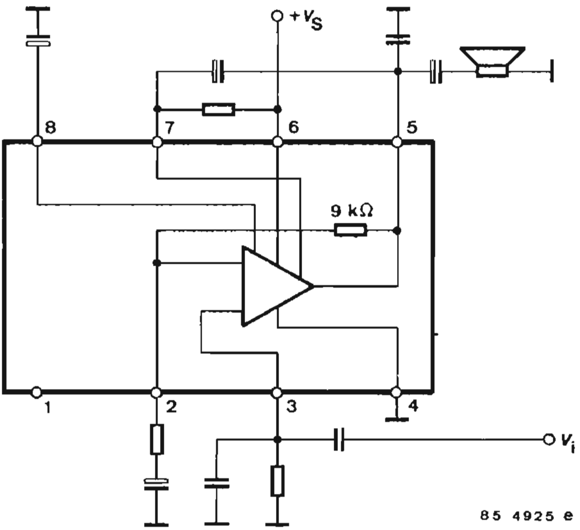


Fig. 1 Block diagram and pin connections

Absolute maximum ratings

Reference point Pin 2, Pin 6

Supply voltage	Pin 4	V_S	16	V
Peak output current	Pin 3	I_{OM}	850	mA
Power dissipation T_{amb} = 50°C		P_{tot}	1	W
Junction temperature		T_j	150	°C
Storage temperature range		T_{stg}	−25...+150	°C

T1.2/407.0184 E

Thermal resistance				Min.	Typ.	Max.	
Junction ambient			R_{thJA}			100	K/W

Electrical characteristics
V_S = 9 V, reference point Pin 2, Pin 6, G_v = 40 dB, f = 1 kHz,
R_L = 8 Ω, d = 10%, T_{amb} = 25°C, unless otherwise specified

				Min.	Typ.	Max.	
Supply voltage range		Pin 4	V_S	3		16	V
Quiescent output voltage		Pin 3	V_{OB}	4.2		5.2	V
Quiescent drain current							
V_S = 3 V	Fig. 2	Pin 4	I_{SB}	3	5	8	mA
V_S = 9 V			I_{SB}	4	7.5	12	mA
V_S = 16 V			I_{SB}	4	7	10	mA
Output power			P_o	1.0	1.1		W
Supply voltage rejection ratio							
V_{hum} = 0.35 V, C_1 = 47 µF, f_{hum} = 100 Hz			SVR	38	42		dB
Input resistance		Pin 8	R_i	800			kΩ
Band width (–3 dB)	Fig. 2		B		100...28000		Hz
Distortion	Fig. 2						
P_o = 50 mW			d			1	%
Voltage gain, closed loop							
R_1 = 91 Ω			G_v	37	40	43	dB
Output noise voltage							
R_G = 0, B = 22...22000 Hz		Pin 3	V_{no}		250	600	µV

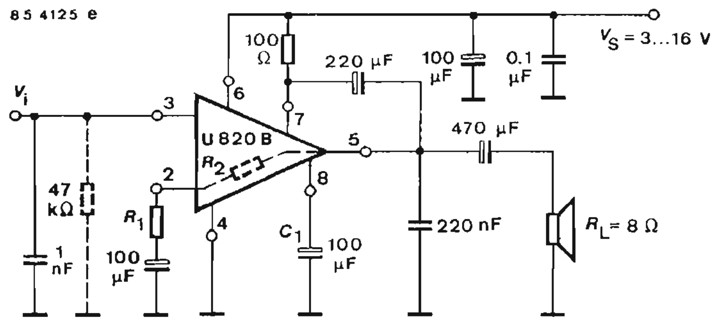
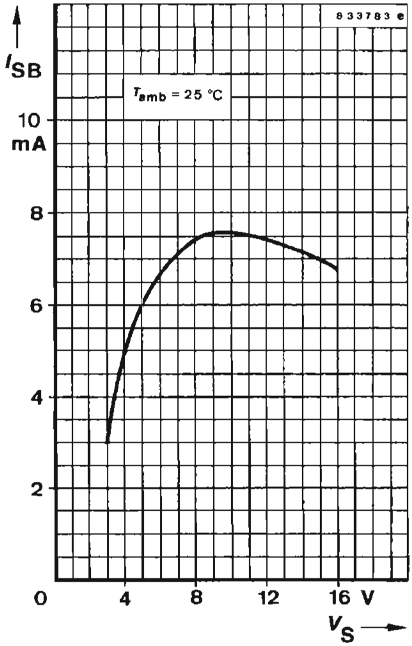
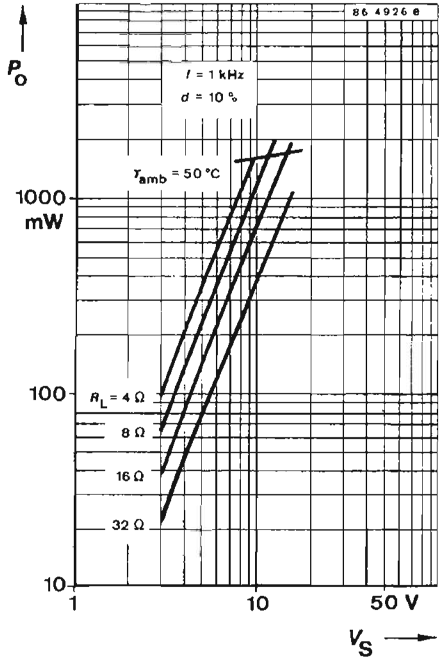
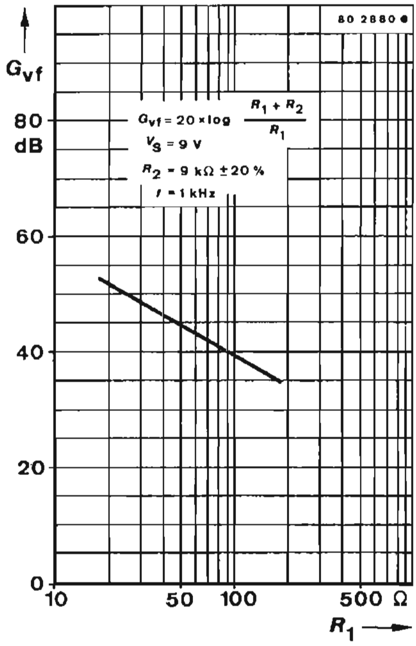
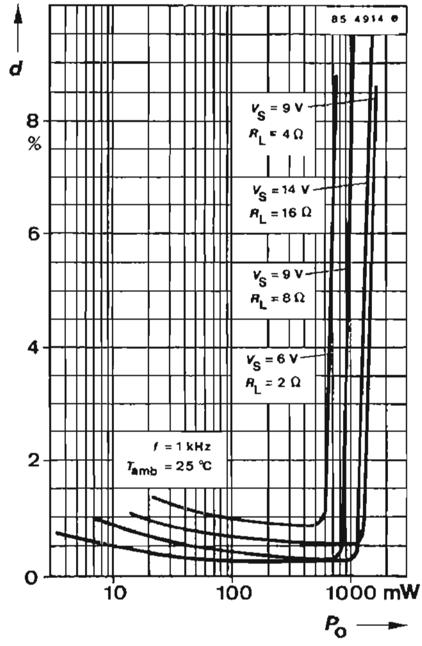


Fig. 2 Test circuit for: P_o, P_{tot}, d, V_{no}, B, G_v and application note

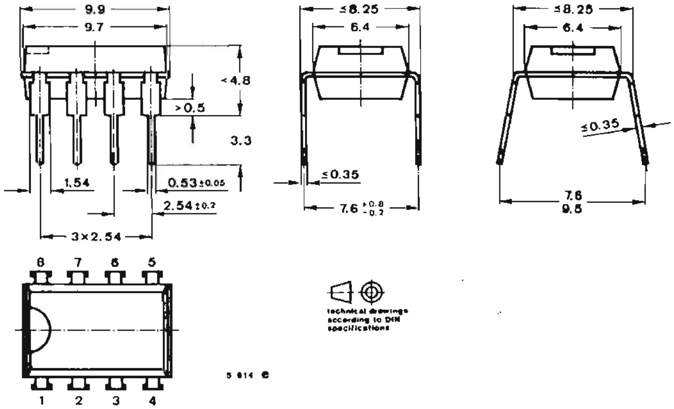

833783 e
I_{SB}
10
mA
8
6
4
2
0
4
8
12
16 V
V_S
T_{amb} = 25 °C


86 4926 e
P_o
f = 1 kHz
d = 10 %
T_{amb} = 50 °C
1000
mW
100
10
R_L = 4 Ω
8 Ω
16 Ω
32 Ω
1
10
50 V
V_S


80 2880 e
G_{vf}
80
dB
60
40
20
0
$G_{vf} = 20 \times \log \frac{R_1 + R_2}{R_1}$
V_S = 9 V
R_2 = 9 kΩ ±20 %
f = 1 kHz
10
50
100
500 Ω
R_1


85 4914 e
d
8
%
6
4
2
0
V_S = 9 V
R_L = 4 Ω
V_S = 14 V
R_L = 16 Ω
V_S = 9 V
R_L = 8 Ω
V_S = 6 V
R_L = 2 Ω
f = 1 kHz
T_{amb} = 25 °C
10
100
1000 mW
P_o

Dimensions in mm



Case
20 A 8 DIN 41866
DIP 8
Weight max. 0.8 g

Monolithic Integrated Circuit

Application: Audio-Amplifier for portable radios, cassette recorders and general purposes.

Features:

- Large supply voltage range V_S = 3...16 V
- Low cross-over distortion
- Low harmonic distortion
- Audio output power P_o = 1.5 W
- Connection possibility for an external capacitor to suppress hum voltage
- Minimum number of external components

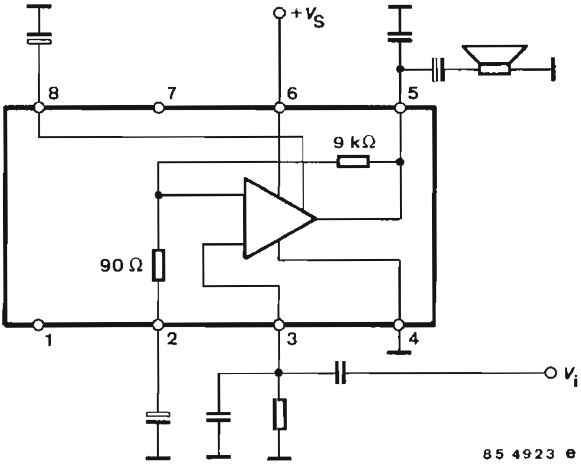


Fig. 1 Block diagram and pin connections

Absolute maximum ratings

Reference point Pin 2, Pin 6

Supply voltage	Pin 4	V_S	16	V
Peak output current	Pin 3	I_{OM}	850	mA
Power dissipation T_{amb} = 50°C		P_{tot}	1	W
Junction temperature		T_j	150	°C
Storage temperature range		T_{stg}	–25...+150	°C

T1.2/408.0184 E

Thermal resistance				Min.	Typ.	Max.	
Junction ambient			R_{thJA}			100	K/W

Electrical characteristics
V_S = 9 V, reference point Pin 2, Pin 6, G_v = 40 dB, f = 1 kHz,
R_L = 8 Ω, d = 10%, T_{amb} = 25°C, unless otherwise specified

				Min.	Typ.	Max.	
Supply voltage range		Pin 4	V_S	3		16	V
Quiescent output voltage		Pin 3	V_{OB}	3.9		4.7	V
Quiescent drain current							
V_S = 3 V	Fig. 2	Pin 4	I_{SB}	3	5	8	mA
V_S = 9 V			I_{SB}	4	7.5	12	mA
V_S = 16 V			I_{SB}	4	7	10	mA
Output power			P_o	0.9	1		W
Supply voltage rejection ratio							
V_{hum} = 0.35 V, C_1 = 47 μF, f_{hum} = 100 Hz			SVR		30		dB
Input resistance		Pin 8	R_i	800			kΩ
Band width (–3 dB)	Fig. 2		B		100...28000		Hz
Distortion	Fig. 2						
P_o = 50 mW			d		0.4	1	%
Voltage gain, closed loop			G_v	37	40	43	dB
Output noise voltage							
R_G = 0, B = 22...22000 Hz		Pin 3	V_{no}		250	600	μV

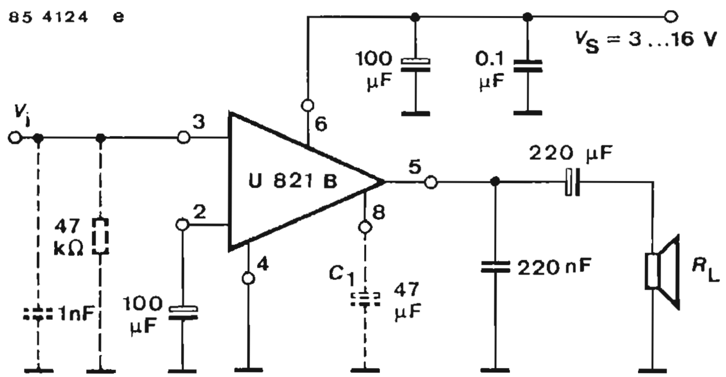
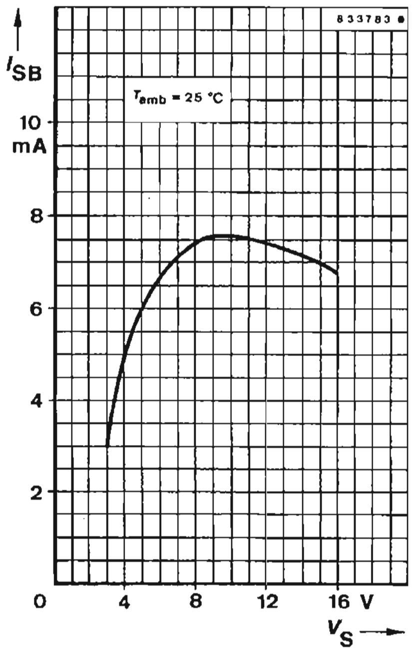
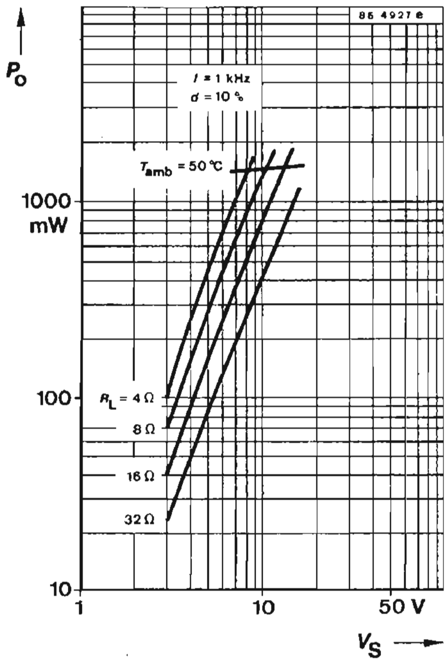
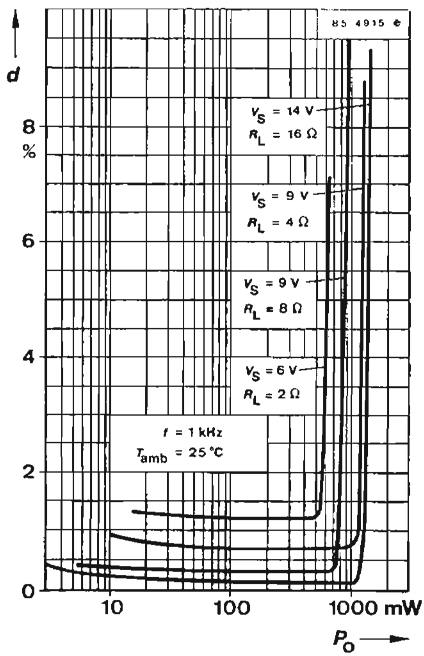


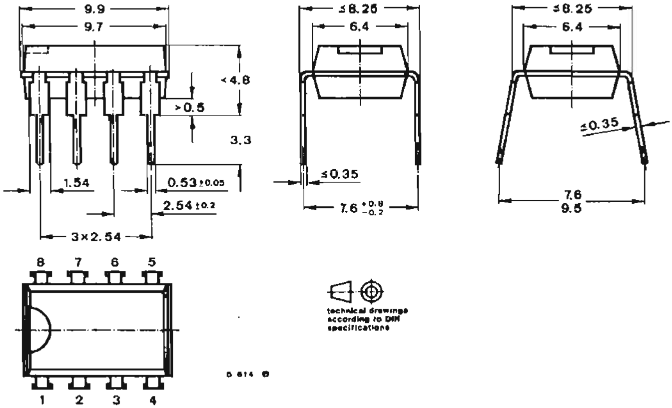
Fig. 2 Test circuit for: P_o, P_{tot}, d, V_{no}, B, G_v and application note


833783 e
I_{SB}
T_{amb} = 25 °C
10 mA
8
6
4
2
0
4
8
12
16 V
V_S


85 4927 e
P_o
f = 1 kHz
d = 10 %
T_{amb} = 50 °C
1000 mW
100
10
R_L = 4 Ω
8 Ω
16 Ω
32 Ω
1
10
50 V
V_S


85 4915 e
d
8 %
6
4
2
0
V_S = 14 V
R_L = 16 Ω
V_S = 9 V
R_L = 4 Ω
V_S = 9 V
R_L = 8 Ω
V_S = 6 V
R_L = 2 Ω
f = 1 kHz
T_{amb} = 25 °C
10
100
1000 mW
P_o

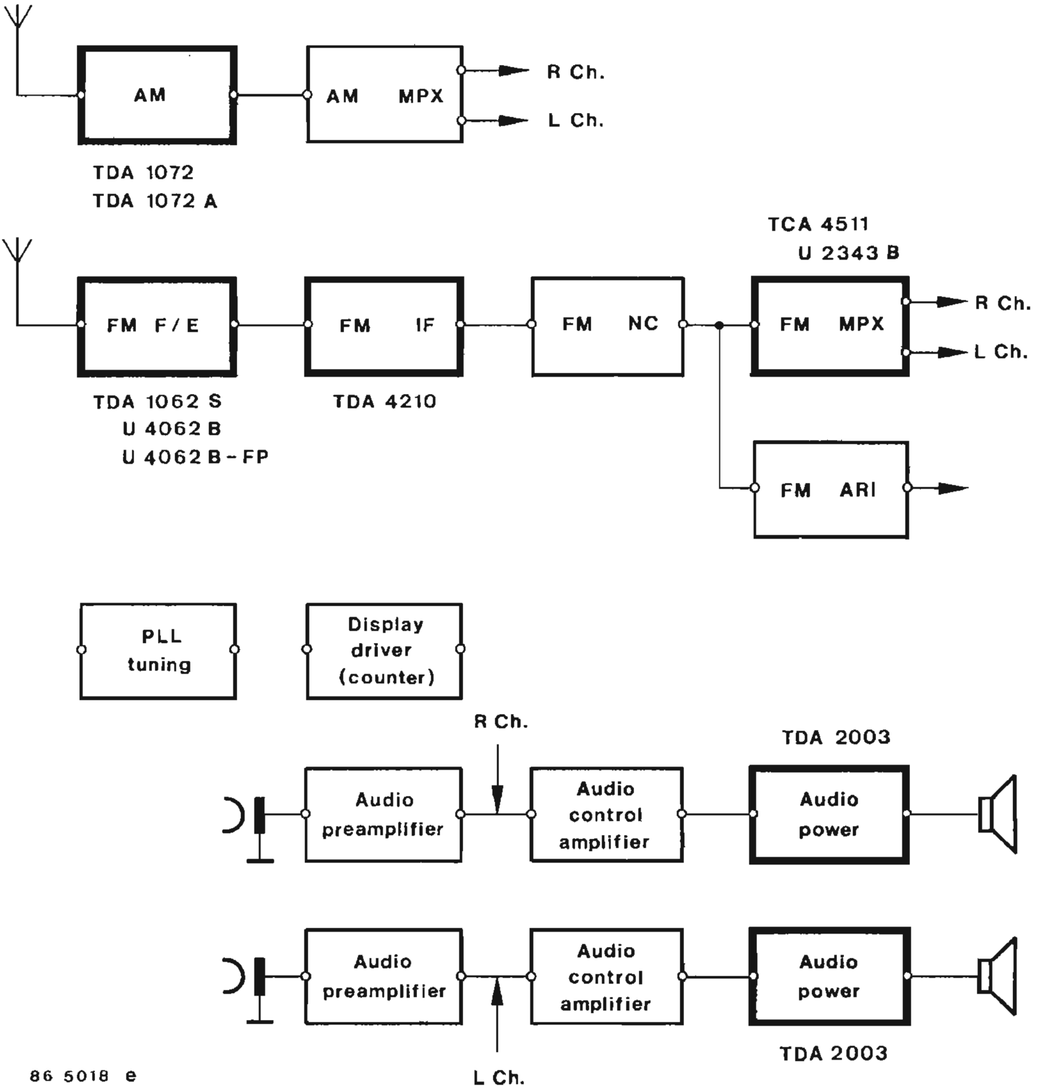
Dimensions in mm



Case
20 A 8 DIN 41866
DIP 8
Weight max. 0.8 g

Car Radio

$V_S = 7 \dots 16\ V$



Monolithic Integrated Circuit

Applications: Stereo demodulator for car- and mains operated radios

Features:

- Supply voltage range $V_S = 8...18$ V
- FM mpx. switch or matrix operation possible
- Excellent rejection of ARI* subcarrier and pilot tone harmonics

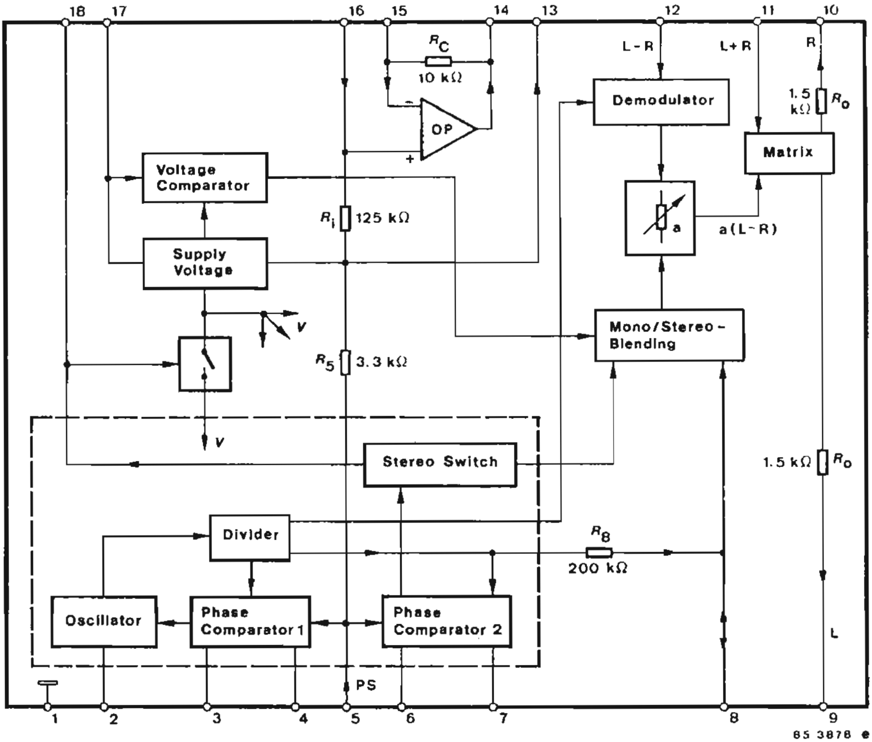


Fig.1 Block diagram and pin connections

*) "Auto Radio Information"

T1.2/224.0583 E1

Pin configuration

1	Ground	10	Output R
2	Oscillator RC	11	(L+R) input
3	TP phase comparison 1	12	(L−R) input
4	TP phase comparison 1	13	Reference voltage
5	Pilot tone (PT) input	14	Output op amp
6	TP phase comparison 2	15	− input op amp
7	TP phase comparison 2	16	+ input op amp
8	f_{osc} output/St-Mo blending V_H	17	Supply voltage
9	Output L	18	Lamp connection/oscillator switch

Description

The TCA 4511 decodes the transmitter side stereo information in both L and R channels. Stereo transmission is shown by means of an indicator lamp. A continual blending of mono and stereo signals is possible. The switching frequencies are controlled by a phase-locked loop. The stereo decoder can be used in time multiplex (switching) or in frequency multiplex (matrix) mode of operation.

Switching operation

The MPX input signal is corrected in amplitude and phase by an operational amplifier. For this purpose an *RC* circuit is connected at Pin 15.

Subsequently, the (L+R) and (L−R) signals are processed in separate stages. The (L−R) signal is demodulated and can be reduced by the factor *a* through mono/stereo blending. In the final matrix circuit the aggregate signal (L+R) is added to the demodulated signal *a* (L−R) according to the following formulae:

$$(L-R) + a\,(L-R) = L(1+a) + R(1-a)$$
$$(L+R) - a\,(L-R) = L(1-a) + R(1+a)$$

$$\underset{\text{Mono}}{0} \leq \underset{\text{Blending}}{a} \leq \underset{\text{Stereo}}{1}$$

The generated output signals are then forwarded to two external *RC* low-passes for deemphasis.

The required frequency to demodulate the L−R signal is obtained by a phase-locked loop (PLL) from the divider. By means of a pilot tone applied to Pin 5, the oscillator is synchronized by phase comparison 1. An additional phase comparison 2 provides mono or stereo information. Based on this information, the indicator lamp is activated and lights up when a sufficiently strong signal is present at the input. Moreover, the (L−R) reduction is eliminated.

If switch S1 is open, the IC switches the oscillator off, whereby the stereo switch and the mono/stereo blending suppress the L−R signal. The supply current is thus reduced. Also, since the oscillator does not resonate when switch S1 is open, AM receiver signals can be forwarded without interference via the IC.

If Pin 8 is not connected, the oscillator frequency can be measured. For normal operating functions, the blending voltage V_H is applied to Pin 8 or Pin 8 must be blocked by a capacitor. Otherwise, cross-talk is affected by the oscillator frequency.

Absolute maximum ratings

Reference point Pin 1

Supply voltage	Pin 17	V_S	18	V
Lamp voltage	Pin 18	V_{LP}	18	V
Current for stereo indicator lamp $V_{18} \cdot I_{LP} \leqq 300$ mW	*Pin 18*	I_{LP}	50	mA
Minimum values at all terminals		V_{ext}	$\geqq 0$	V
Junction temperature		T_j	+ 150	°C
Storage temperature range		T_{stg}	– 40...+ 150	°C
Ambient temperature range		T_{amb}	– 25...+ 85	°C

Thermal resistance

		Min.	Typ.	Max.	
Junction ambient	R_{thJA}			78	K/W

Electrical characteristics for switching operation

$V_S = 8$ V, reference point Pin 1, $T_{amb} = 25$°C, unless otherwise specified

			Min.	Typ.	Max.	
Supply voltage range	Pin 17	V_S	8		18	V
Total supply current (FM-operation) S1 closed	Pin 17	I_S		14	20	mA
Total supply current (AM-operation) S1 open	Pin 17	I_S		10	15	mA
Lamp current control range $V_{18} \cdot I_{LP} \leqq 300$ mW	Pin 18	I_{LP}	10		25	mA
Lamp current short circuited $V_{18} \cdot I_{LP} \leqq 300$ mW	Pin 18	I_{LP}			50	mA

Input amplifier

			Min.	Typ.	Max.	
Input signal	Pin 16	V_I			1.6	V_{pp}
Output signal	Pin 14	V_o [1)]		V_{16}		V
Input resistance	Pin 16	R_I	90	125		kΩ
Feedback resistance	Pin 15-14	R_f		10		kΩ
Reference voltage	Pin 13	V_{Ref}		1.75		V

Stereo-Matrix			Min.	Typ.	Max.	
Output voltage (Stereo) modulated	Pin 9,10	V_{oAF}[1,6]	0.9	1.2	1.6	V_{pp}
Output voltage (Mono) L or R modulated	Pin 9,10	V_{oAF}[2,6]	0.45	0.6	0.8	V_{pp}
Output resistance	Pin 9,10	R_o		1.5	2	kΩ
Separation Fig. 2 f_{AF} = 1 kHz	Pin 9,10	α_v[1]	34	40		dB
Rejection ratio 19 kHz		α_{19}	30	32		dB
38 kHz		α_{38}	30	40		dB
57 kHz		α_{57}	30	45		dB
76 kHz		α_{76}	30	40		dB
Supply voltage rejection ratio	Pin 9,10	V_{ripple}[3]	40	45		dB
Noise voltage	Pin 9,10	V_{on}[4]		30	80	µV
Total harmonic distortion f_{AF} = 1 kHz	Pin 9,10	THD[1,6]			0.5	%
Channel balance	Pin 9,10	B_{al}[2]			0.5	dB
Switching noise mono/stereo S1 closed-open	Pin 9,10	ΔV_o			60	mV
Oscillator						
Output resistance for f_{osc}-measuring	Pin 8	R_o		200		kΩ
Oscillator basic frequency		f_{osc}		19		kHz
Capture and hold range	Pin 2	$f_{C/H}$[1]	±0.4	±1	±2.0	kHz
Balancing resistor f_{osc} = 19 kHz	Pin 2-1	R_{osc}	13		18	kΩ
Oscillator - "ON" S1 closed	Pin 18	V_L	1.0			V
I_o = 10 mA	Pin 18		0.9			V
Oscillator - "OFF" S1 open or $V_{18} \leqq 0.4$ V	Pin 18	V_L			0.4	V
Phase comparison						
Input voltage	Pin 5	V_i[1]	0.5	0.7	0.9	V_{pp}
Input resistance	Pin 5	R_i		3.3		kΩ
Input voltage	Pin 5	V_i			1.6	V_{pp}

			Min.	Typ.	Max.	
Stereo switch						
$f = 19$ kHz, S1 closed						
Switch threshold "ON"	Pin 5	V_{iPT}		30	55	mV_{pp}
"OFF"	Pin 5	V_{iPT}	12	15		mV_{pp}
Hysteresis	Pin 5	H	3	6	9	dB
Mono/stereo blending						
Mono						
$V_H = V_8 = 0.5$ V		$\alpha_{blend.}$ [7]	3	6	9	dB
Stereo						
$V_H = V_8 = 0.9$ V		$\alpha_{blend.}$ [7]	34			dB

[1] $V_i = 1.2\ V_{pp}$ MPX, $V_H \geqq 1$ V, S1 closed, $f_{AF} = 1$ kHz
[2] $V_i = 1.2\ V_{pp}$ MPX, S1 open, $f_{AF} = 1$ kHz
[3] $V_S = 12\ V + V_{St}$, $V_{St} = 200\ mV_{RMS}$, 200 Hz
[4] CCIR DIN 45405, unweighted, S1 open
[5] S1 closed
[6] after LP $f_\alpha = 6.5$ kHz, reduction 36 dB/octave
[7] $V_{16} = 0.75\ V_{pp}$ MPX, S1 closed, $f_{AF} = 1$ kHz

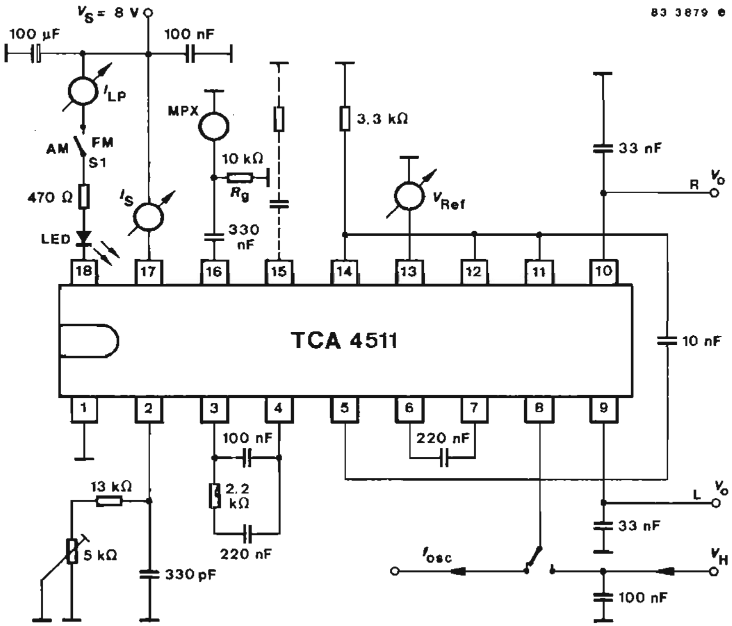
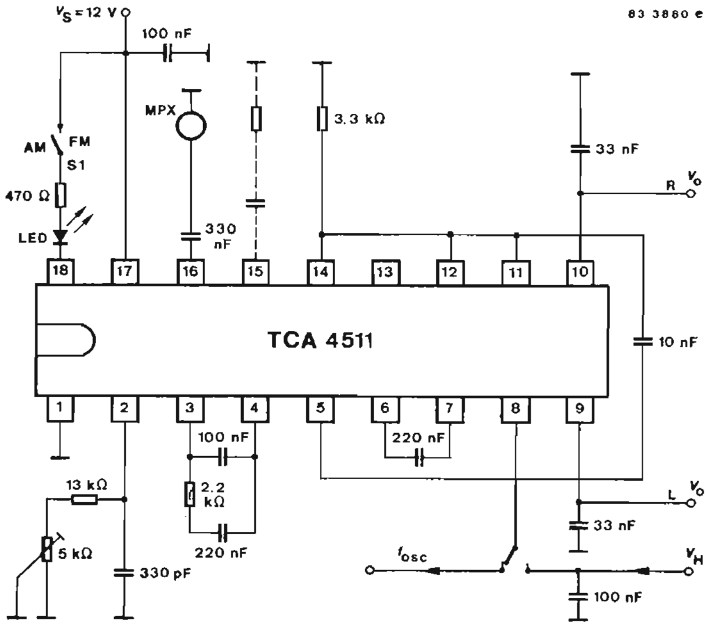
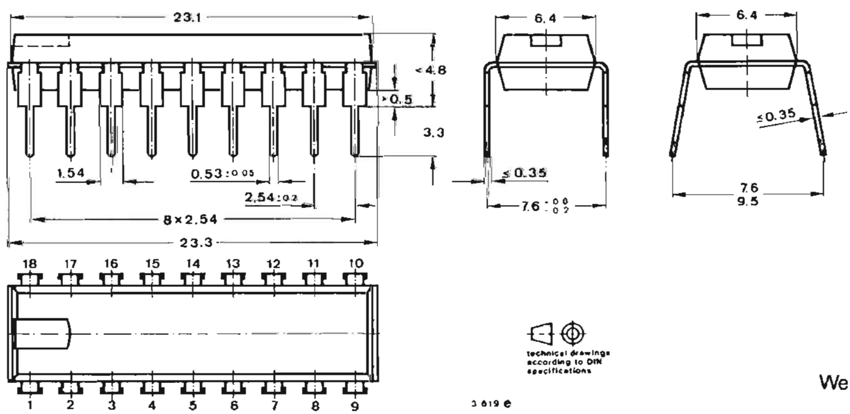


Fig. 2 Test circuit

Fig. 3 Application switching operation



Dimensions in mm



Plastic case
DIP 18
Weight max. 1.5 g

Monolithic Integrated Circuit

Applications: FM-front end for Hi-Fi and car-radios, mixer modulator and phase-sensitive detectors up to 250 MHz.

Features:

- Excellent large signal behavior
- High oscillator frequency stability, even by large input signals
- Low external power level of the oscillator
- Low radiation
- Low noise figure
- Build-in AGC amplifier for external PIN-diode
- High overall amplification
- Specially recommende for varactor tuned front ends
- Buffered oscillator output
  Pinning and function fully compatible with TDA 1062

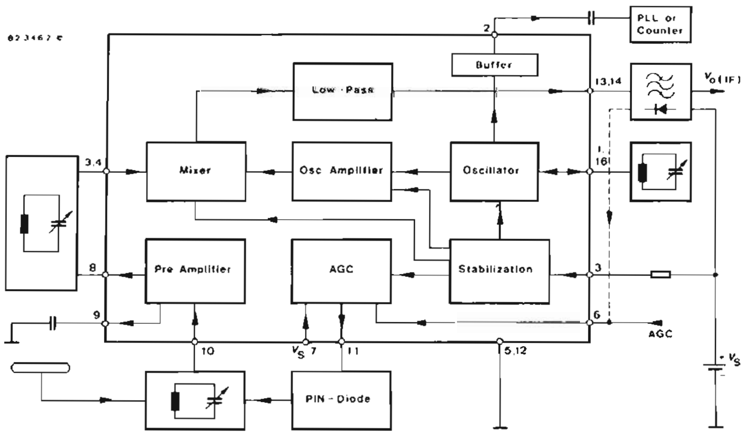


Fig. 1 Block diagram

Absolute maximum ratings

Supply voltage	Pin 6	V_S	16	V
Power dissipation $T_{amb} = 85°C$		P_{tot}	400	mW
Junction temperature		T_j	125	°C
Ambient temperature range		T_{amb}	–25...+85	°C
Storage temperature range		T_{stg}	–55...+125	°C

T1.2/242.0583 E

Thermal resistance			Min.	Typ.	Max.	
Junction ambient		R_{thJA}			100	K/W

Electrical characteristics

$V_S = 10$ V, reference point Pin 5, 12, $f_i = 50.3$ MHz, $f_{osc} = 100$ MHz, $P_i = -40$ dBm, $V_{AGC} = 0$, $R_G = R_L = 50\ \Omega$, $T_{amb} = 25$ °C, see test circuit Fig. 3, unless otherwise specified

				Min.	Typ.	Max.	
Supply voltage range		Pin 6	V_S		8	16	V
Total supply current			I_S		28		mA
Mixer current		Pin 13/14			10	16.5	mA
Stabilized base voltage		Pin 3		3.8	4.2	4.8	V
RF stage collector voltage		Pin 8	V_{CE}	4.4	5	6.6	V
$V_{AGC} = 5$ V		Pin 8	V_{CE}		1.2	1.8	V
RF stage base voltage		Pin 9	V_{BE}		0.7		V
Oscillator stage collector voltage		Pin 1/16	V_{CE}	1.7	2.3	2.6	V
Power gain							
$f_{if} = f_{osc} - f_i$	Fig. 4	Pin 13/14	G_p	13	17	20.5	dB
RF rejection	Fig. 4	Pin 13/14	d_{RF}	17	30		dB
3rd order distortion	Fig. 4	Pin 13/14	d_3rd		48		dB
Oscillator output							
$R_L = 50\ \Omega$		Pin 2	v_{oosc}	25	40		mV

Electrical characteristics

$V_S = 10$ V, $T_{amb} = 25$°C, reference point Pin 5, 12, $f_i = 95$ MHz, $R_G = R_L = 50\ \Omega$, Fig. 5

			Min.	Typ.	Max.	
Total supply current		I_S		30		mA
Tuning range		Δf	88		108	MHz
IF-frequency		f_{IF}		10.7		MHz
Tuning voltage range		V_{tun}	2		7.5	V
Power gain		G_p		30		dB
Noise figure		F		5.5		dB
IF bandwith		B_{IF}		0.5		MHz
RF-bandwith		B_{RF}		1.7		MHz
Image rejection		S_{IR}		80		dB
IF-rejection		IFR	100			dB
Ultimate quieting						
-40 dBm, $\Delta f = \pm 75$ kHz, $f = 1$ kHz						
$B_{AF} = 30$ Hz ... 15 kHz		α_{lor}		70		dB
Oscillator pulling						
$P_i = 0$ dBm		Δf_{osc}		10		kHz
with AGC		Δf_{osc}		2		kHz
AGC threshold		P_{iAGC}		–30		dBm
Radiation at antenna input		P_{ni}		–60		dBm
Gain difference						
$f = 88 ... 108$ MHz		ΔG_p		1.5		dB
Oscillator output						
$R_L = 50\ \Omega$	Pin 2	v_{oosc}		40		mV

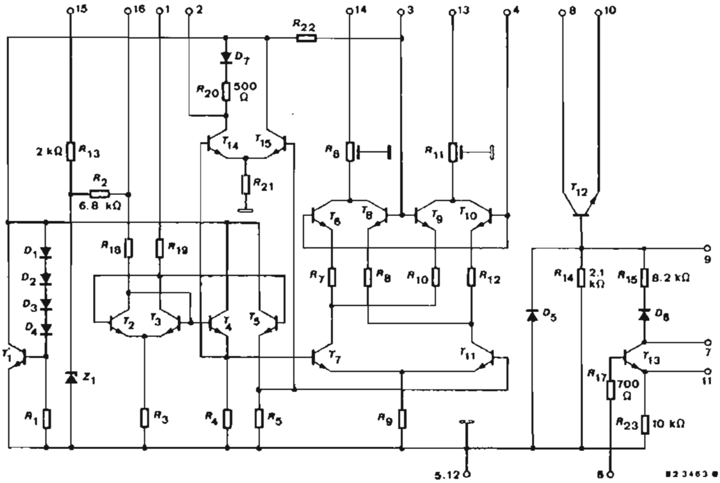
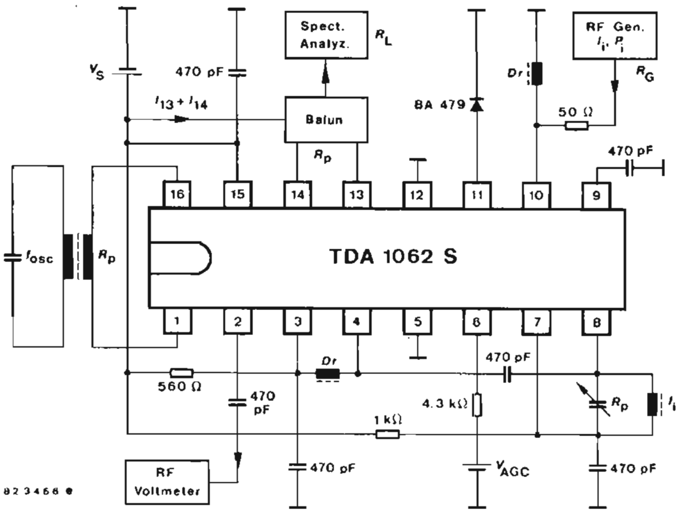


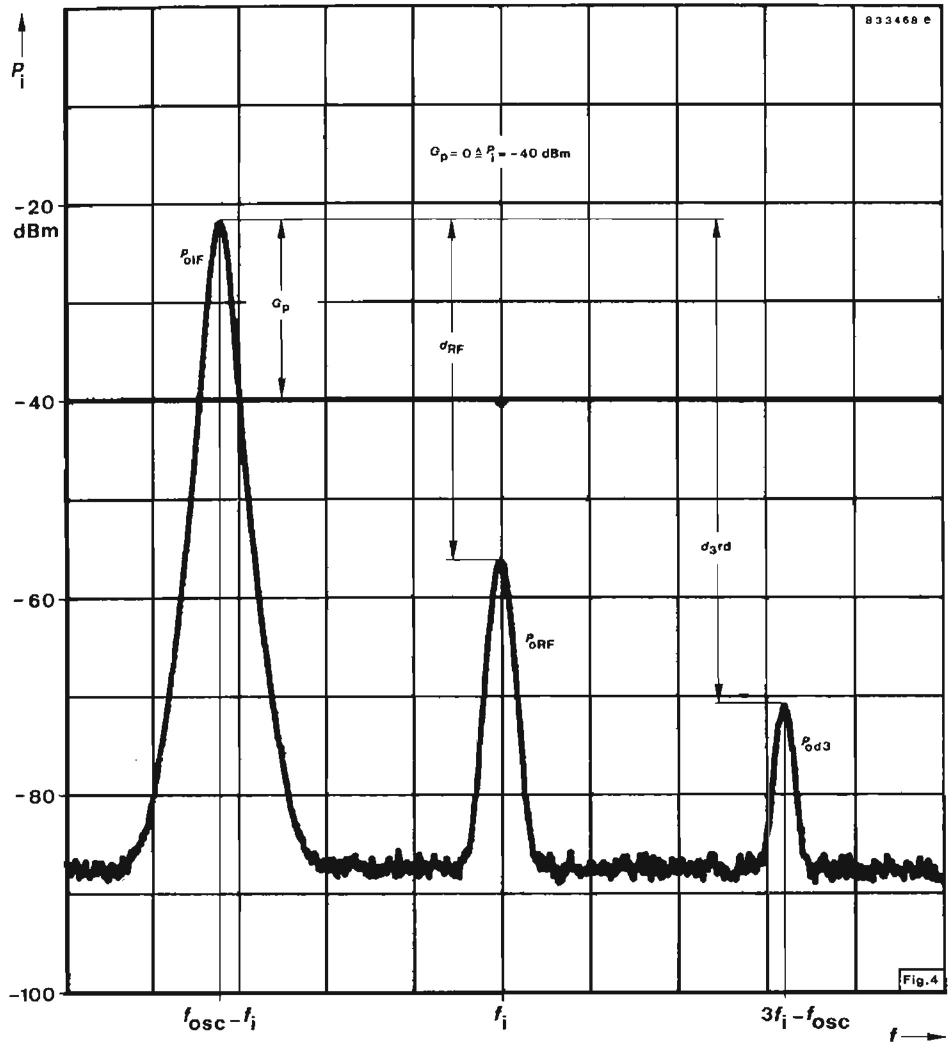
Fig. 2 Diagram and pin connections

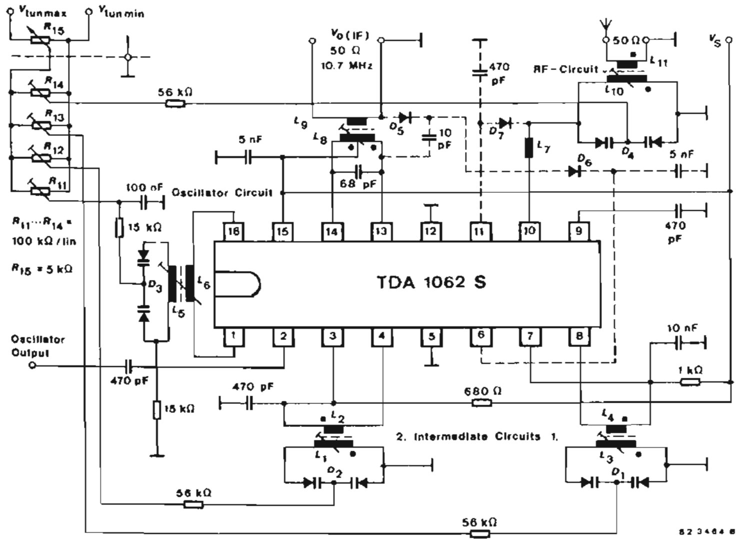


Electrical characteristics of the test circuit without IC in the socket

RF-input Pin 10 with $R_G = 50\ \Omega$ terminated
RF-circuit Pin 8/5 at $f = 50.3$ MHz: $B = 5.6$ MHz, $C_p = 5.5$ pF, $R_p = 1\ \Omega$
IF-circuit Pin 13/14 with $R_L = 50\ \Omega$ terminated: at $f = 50$ MHz, $R_p = 200\ \Omega$
Oscillator circuit Pin 1/16 at $f = 100$ MHz: $B = 2.3$ MHz, $C_p = 3$ pF, $R_p = 800\ \Omega$

Fig. 3 Test circuit


833468 e
P_i
$G_p = 0 \triangleq P_i = -40$ dBm
-20
dBm
-40
-60
-80
-100
P_{oIF}
G_p
d_{RF}
d_{3rd}
P_{oRF}
P_{od3}
$f_{osc} - f_i$
f_i
$3f_i - f_{osc}$
f
Fig.4



D_1, D_2, D_3, D_4 = BB 304 blue (BB 204 blue)

D_5, D_6 = 1 N 4151 — all resistors ±10%

D_7 = PIN Diode BA 479

L_1, L_3, L_5, L_{10} = on 4 mm bobbin Fa. Kaschke, Göttingen, core 3/7.5x0.5 Mat. K 3/12/100

L_6, L_9 = Vogt Filter D 4, core 3/7.5x0.5 Mat. Fi 05 F7

L_1 = 5 3/4	WdG	⌀ 0.8 mm	CuAg at the cold end of L_1
L_2 = 2 3/4	WdG	⌀ 0.4 mm	CuLs
L_3 = 5 3/4	WdG	⌀ 0.8 mm	CuAg at the cold end of L_3
L_4 = 4 3/4	WdG	⌀ 0.4 mm	CuLs
L_5 = 6 3/4	WdG	⌀ 0.8 mm	CuAg wound in L_5
L_6 = 3 3/4	WdG	⌀ 0.4 mm	CuLs
L_7 = 19	WdG	⌀ 0.15 mm	Culs ⌀ 3.5 mm air-core coil
L_8 = 2x15	WdG	⌀ 0.15 mm	CuLs double wound
L_9 = 2	WdG	⌀ 0.2 mm	Culs wound on L_8
L_{10} = 6	WdG	⌀ 0.8 mm	CuAG at the cold end of L_{10}
L_{11} = 1	WdG	⌀ 0.4 mm	CuLs

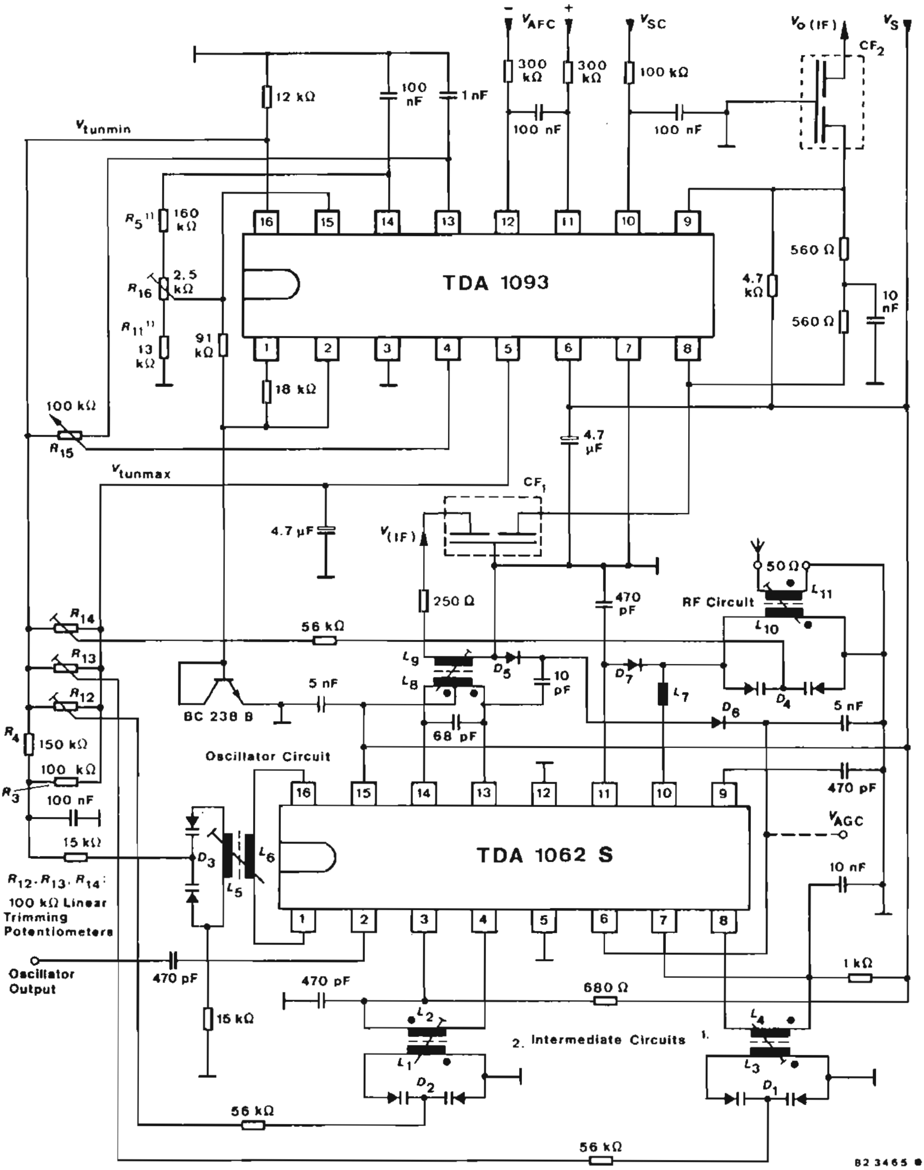
Culs ≙ single-nylon enamalled wire

Alignment: 88 MHz (V_{tunmin}) inductors, 108 MHz (V_{tunmax}) $R_{11} \ldots R_{14}$

No iteration of the alignment is necessary. The dotted line shows the external circuit for the AGC.

Fig. 5 Test circuit and application note

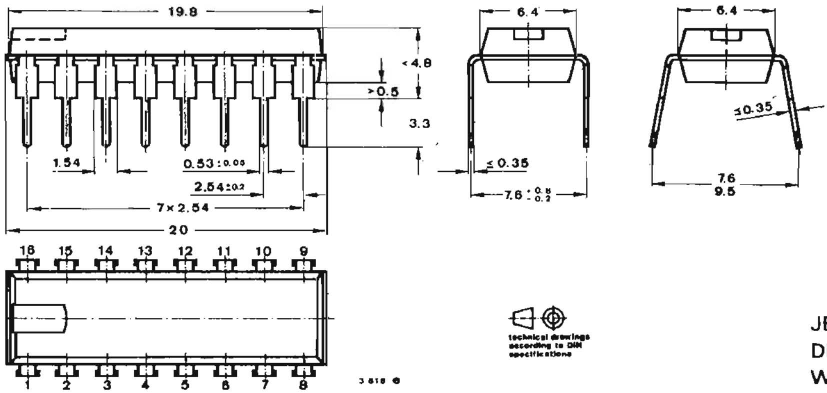
Supply voltage must be disconnected before inserting the integrated circuit in the socket.



1) Metal Film Resistors

Fig. 6 FM-front end with tuning interface integrated circuit TDA 1093

Dimensions in mm



JEDEC MO 001
DIP 16
Weight max. 1.5 g

TELEFUNKEN electronic
Creative Technologies

TDA 1072

Monolithic Integrated Circuit

Application: AM Receiver Circuit

Features:

- Controlled RF-Preamplifier
- Multiplicative balanced mixer
- Separate oscillator with amplitude control
- I.F. amplifier with gain control
- Balanced full-wave detector
- Audio pre-amplifier
- Internal AGC voltage
- Amplifier for field-strength indication
- Electronic stand-by on/off switch

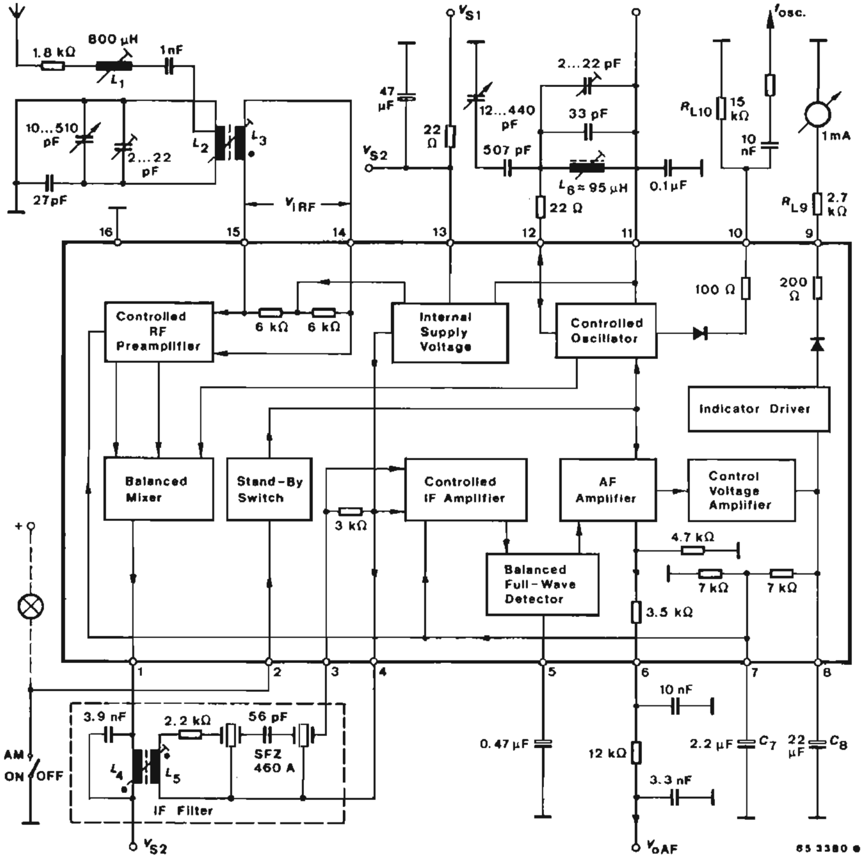


Fig. 1 Block diagram and application circuit

Absolute maximum ratings

Reference point Pin 16, unless otherwise specified

Supply voltage	Pin 13	V_S	23	V
Voltage on pin 2		V_2	0...23	V
RF-Inputs				
Voltages				
Reference point 15	Pin 14	$\pm V_i$	12	V
	Pin 14	V_i	V_S	V
	Pin 14	$-V_i$	6	V
	Pin 15	V_i	V_S	V
	Pin 15	$-V_i$	6	V
RF-Inputs				
Currents	Pin 14	$\pm I_i$	10	mA
	Pin 15	$\pm I_i$	10	mA
Ambient temperature range		T_{amb}	–30...+80	°C
Storage temperature range		T_{stg}	–55...+150	°C

Electrical characteristics

$V_S = 15$ V, reference point Pin 16, $f_{iRF} = 1$ MHz, $R_G = 50\ \Omega$, $f_{mod} = 0.4$ kHz, $m = 30\%$, $f_{IF} = 460$ kHz, $T_{amb} = 25°C$, unless otherwise specified

			Min.	Typ.	Max.	
Supply voltage range	Pin 13	V_S	7.5		18	V
Supply current, without load	Pin 13					
$I_L = 0$ (Pin 11)		I_S	15	25	30	mA

RF-Preamplifier and Mixer

			Min.	Typ.	Max.	
D.C. input voltages	Pin 14, 15	V_i		2.75	($4V_{BE}$)	V
Input impedances						
$V_{iRF} < 300\ \mu V$	Pin 14, 15	R_i		6.0		kΩ
		C_i		6.0		pF
$V_{iRF} > 10$ mV	Pin 14, 15	R_i		9.0		kΩ
		C_i		2.5		pF
Output impedance	Pin 1	R_o	200			kΩ
		C_o		4.0		pF
Maximum conversion conductance						
$I_{o\,1\,IF} / V_{iRF}$		s_M			5.5	mA/V
Maximum I.F. output voltage	Pin 1	V_{oIF}			2.8	V_{pp}
Output current	Pin 1	I_o		1		mA
Preamplifier control range		Δs_M		30		dB
Max. RF-input voltage	Pin 14-15	V_i			2.8	V_{pp}

Oscillator			**Min.**	**Typ.**	**Max.**	
Frequency range	Pin 12	$f_{osc.}$	0.6		31	MHz
Oscillator circuit impedance range	Pin 12	$Z_{LOSC.}$	1		200	kΩ
Controlled oscillator amplitude	Pin 12	$V_{osc.}$		140	200	mV
D.C. output voltage	Pin 11					
$I_L = 0$		V_O		$(V_S-1.3)$		V
Output load current range	Pin 11	$-I_L$			15	mA
Output resistance	Pin 11					
$I_L = 5 \pm 0.5$ mA		R_O		7		Ω
Oscillator frequency output	Pin 10					
Output voltage						
$R_{L10} = 15$ kΩ		V_o		200		mV_{pp}
Output resistance		R_o		150		Ω
Allowable output current		I_o			2	mA_p
I.F. amplifier and A.F. stage						
D.C. input voltages	Pin 3, 4	V_i		2		V
Input impedance	Pin 3	R_i	2.4	3	3.9	kΩ
		C_i		4.0		pF
Max. i.f. input voltage	Pin 3					
$m = 80\%$, $d = 3\%$		V_i		75		mV
Control range						
$V_{oAF} = -6$ dB		ΔV_i		62		dB
Audio output voltage	Pin 6					
$V_i = 2$ mV (Pin 3), without load		V_o		350		mV
Audio output resistance	Pin 6	R_o		3.5		kΩ
Field-strength indication						
D.C. indicator voltages						
$R_{L9} = 2.7$ kΩ, $V_i = 0$	Pin 9	V_O	0		140	mV
$V_i = 500$ mV	Pin 9	V_O	2.5	2.8	3.1	V
Output current capability	Pin 9	$-I_O$	1.2			mA
Output resistance						
$I_o = 0.5$ mA	Pin 9	R_o		250		Ω
Reverse voltage at the output						
AM switch-OFF, $\pm I_o \leq 1$ µA	Pin 9	V_O		6		V

Stand-by switch			**Min.**	**Typ.**	**Max.**	
Switching voltage	Pin 2	V_I		2.6		V
Required control voltage						
AM ON	Pin 2	V_I			2	V
AM OFF	Pin 2	V_I[1])	3.5			V
Input current						
AM on, switching current	Pin 2	$-I_I$			100	μA
AM off, reverse current ($V_2 = V_3$)	Pin 2	$\pm I_I$			1	μA

Operating conditions

$V_S = 15$ V, $f_{iRF} = 1$ MHz, $f_{mod} = 0.4$ kHz, $m = 30\%$, $T_{amb} = 25°C$, reference point Pin 16, see Fig. 2, unless otherwise specified

RF input voltages					
$(S+N)/N =$ 6 dB	V_{iRF}		2.2		μV
10 dB	V_{iRF}		3.5		μV
26 dB	V_{iRF}		30		μV
46 dB	V_{iRF}		550		μV
RF input for a.g.c. operation	V_{iRF}		14		μV
Control range for $\Delta V_o = 6$ dB (Reference value $V_i = 500$ mV)	ΔV_{iRF}		91		dB
Maximum RF input voltage					
$d = 3\%$, $m = 80\%$	V_{iRF}		0.65		V
$d = 3\%$, $m = 30\%$	V_{iRF}		0.9		V
$d = 10\%$, $m = 30\%$	V_{iRF}		1.3		V
Audio output voltage					
$V_i = 2$ mV	V_{oAF}		340		mV
Change of audio output voltage					
$V_i = 2$ mV	$\pm\Delta V_{oAF}$		2		dB
RF input voltage					
$V_{oAF} = 60$ mV	V_{iRF}		4		μV
Total distortion of audio output voltage					
$m = 80\%$, $V_i = 2$ mV	d		0.5		%
$V_i = 500$ mV	d		1.8	3	%
Signal plus noise-to-noise ratio of audio output voltage					
$V_i = 2$ mV	$\frac{(S+N)}{N}$		50		dB
I.F. bandwith (–3 dB)	B_{IF}		4.6		kHz
I.F. selectivity					
$\Delta f = \pm$ 9 kHz	S_{IF}		30		dB
$\Delta f = \pm 36$ kHz	S_{IF}		60		dB

[1]) or open input

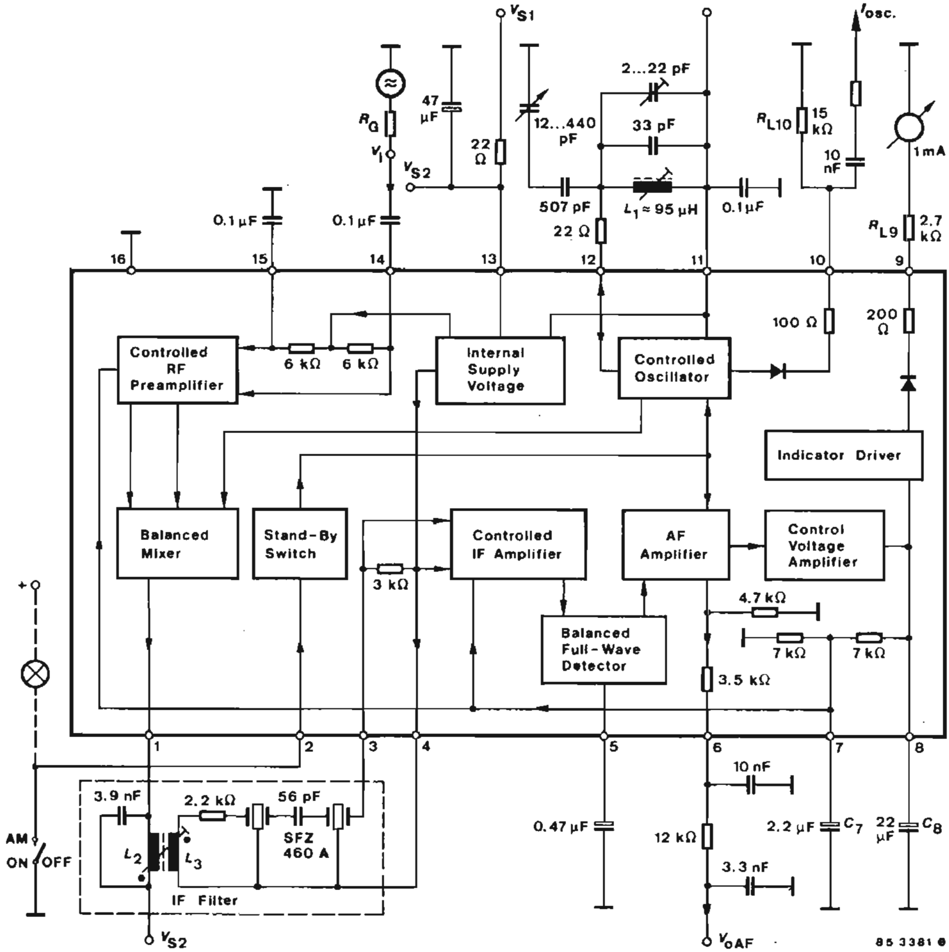
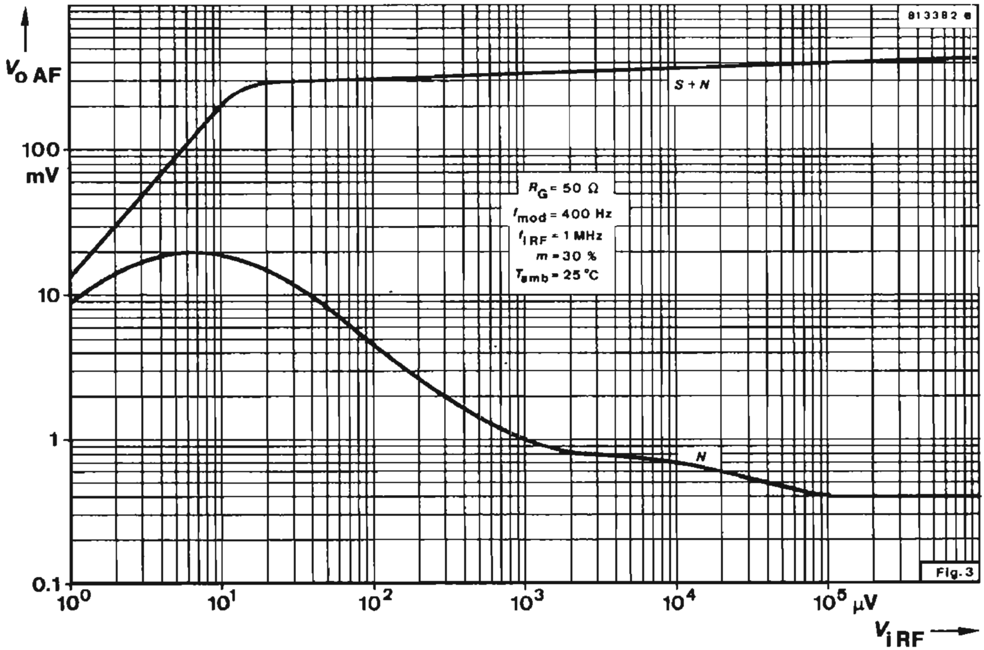
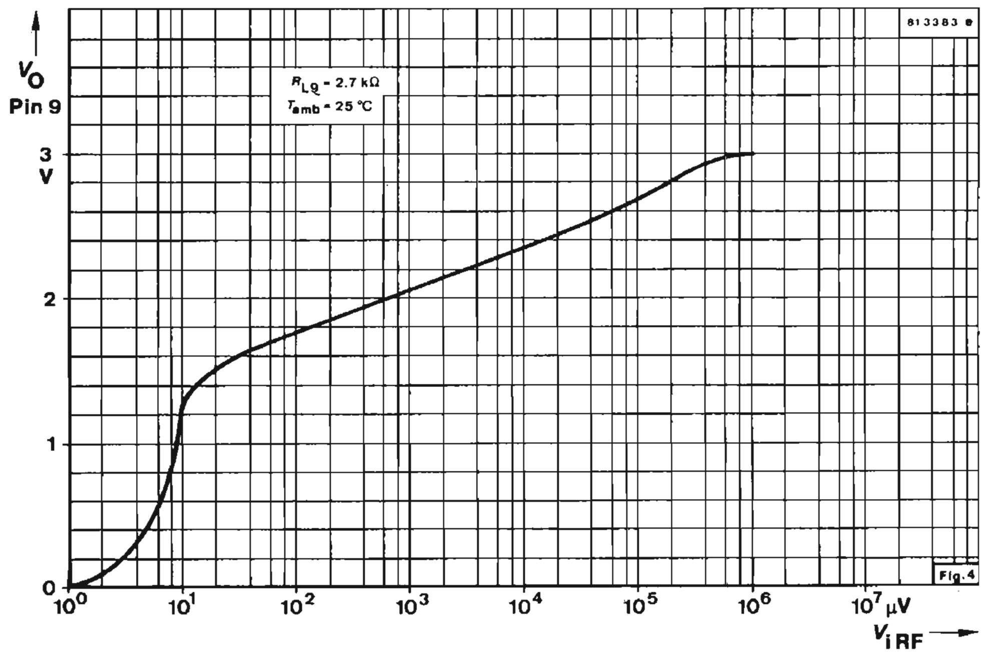
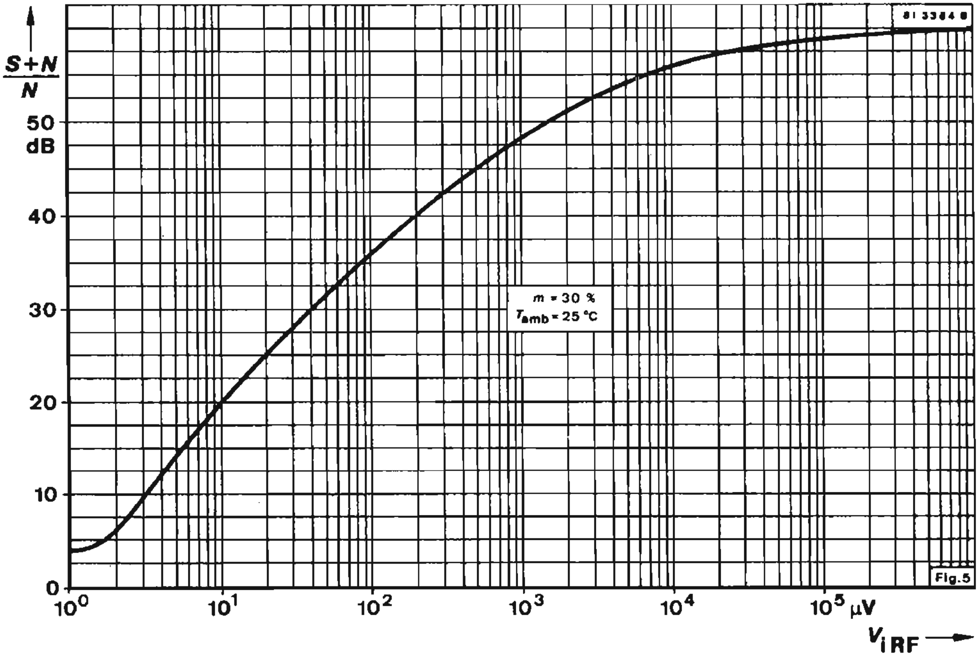


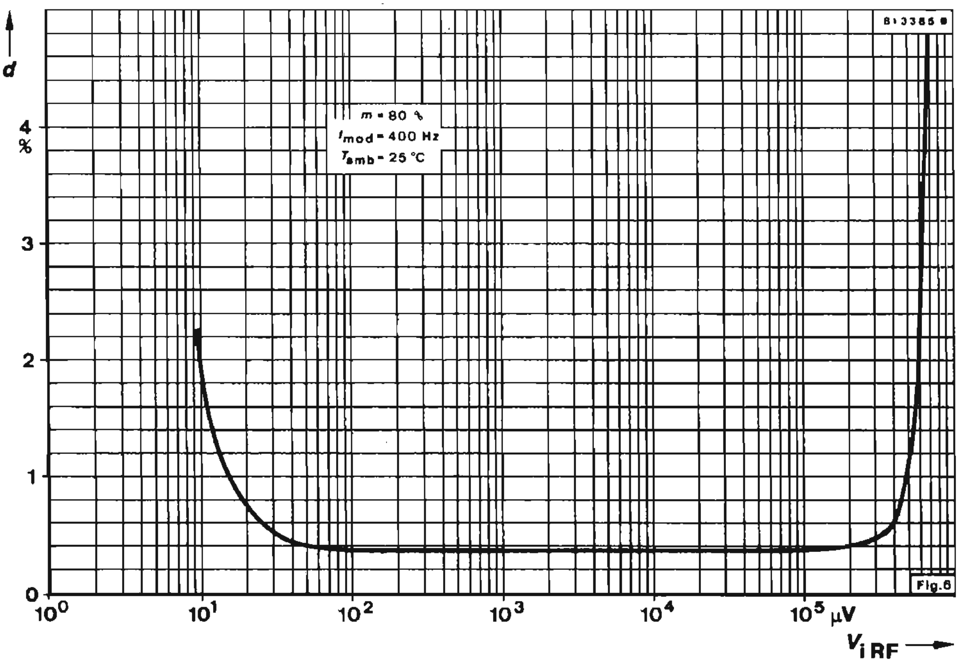
Fig. 2 Test circuit


813382 e
$V_{o\,AF}$
100
mV
10
1
0.1
R_G = 50 Ω
f_{mod} = 400 Hz
$f_{i\,RF}$ = 1 MHz
m = 30 %
T_{amb} = 25 °C
S + N
N
Fig. 3
10^0
10^1
10^2
10^3
10^4
10^5 μV
$V_{i\,RF}$

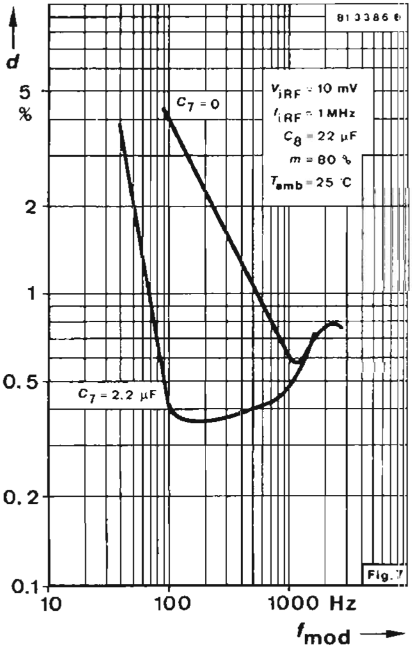

813383 e
V_O
Pin 9
3
V
2
1
0
R_{L9} = 2.7 kΩ
T_{amb} = 25 °C
Fig. 4
10^0
10^1
10^2
10^3
10^4
10^5
10^6
10^7 μV
$V_{i\,RF}$

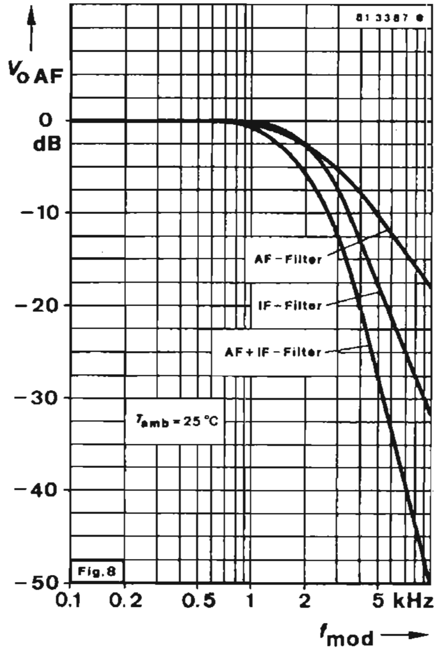


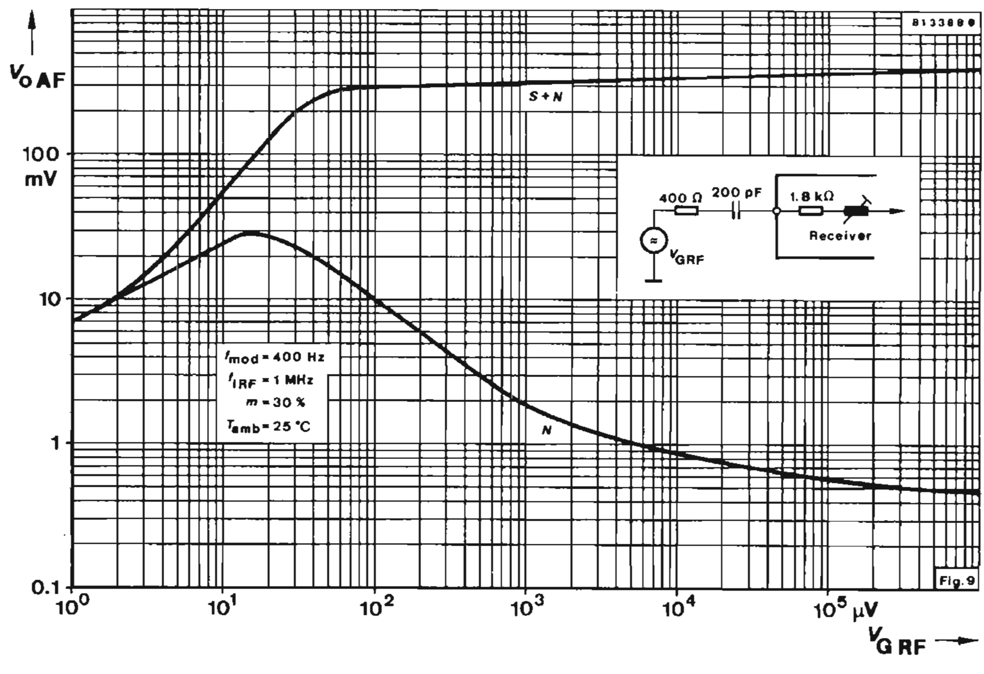
81 3384 8
$\frac{S+N}{N}$
50
dB
40
30
20
10
0
m = 30 %
T_{amb} = 25 °C
Fig.5
10^0
10^1
10^2
10^3
10^4
10^5 μV
$V_{i\,RF}$

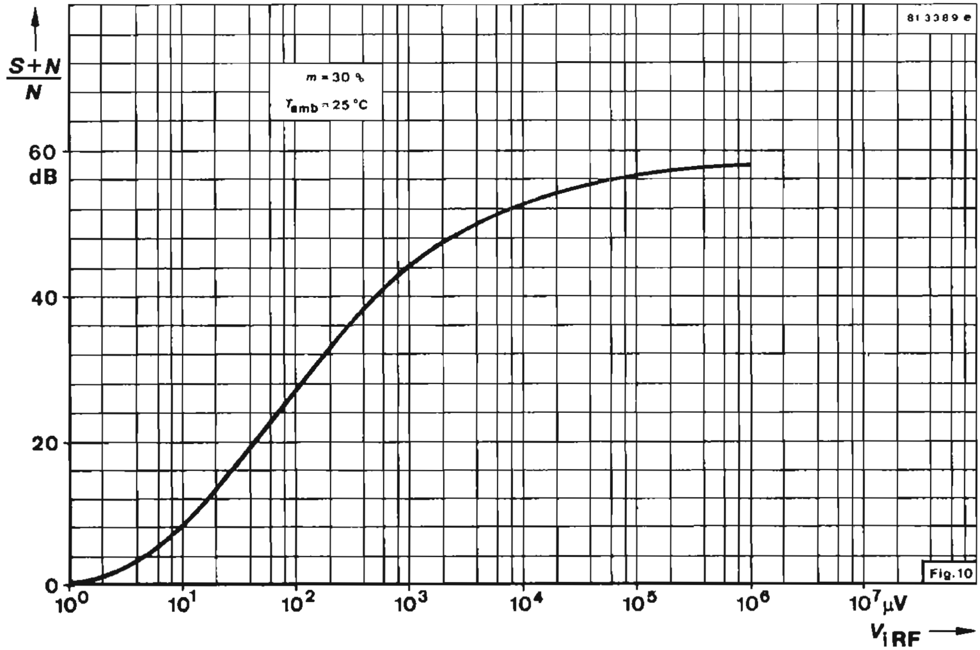


81 3385 8
d
4
%
3
2
1
0
m = 80 %
f_{mod} = 400 Hz
T_{amb} = 25 °C
Fig.6
10^0
10^1
10^2
10^3
10^4
10^5 μV
$V_{i\,RF}$


813386 6
d
5
%
2
1
0.5
0.2
0.1
10
100
1000 Hz
f mod
C7 = 0
C7 = 2.2 µF
ViRF = 10 mV
fiRF = 1 MHz
C8 = 22 µF
m = 80 %
Tamb = 25 °C
Fig.7

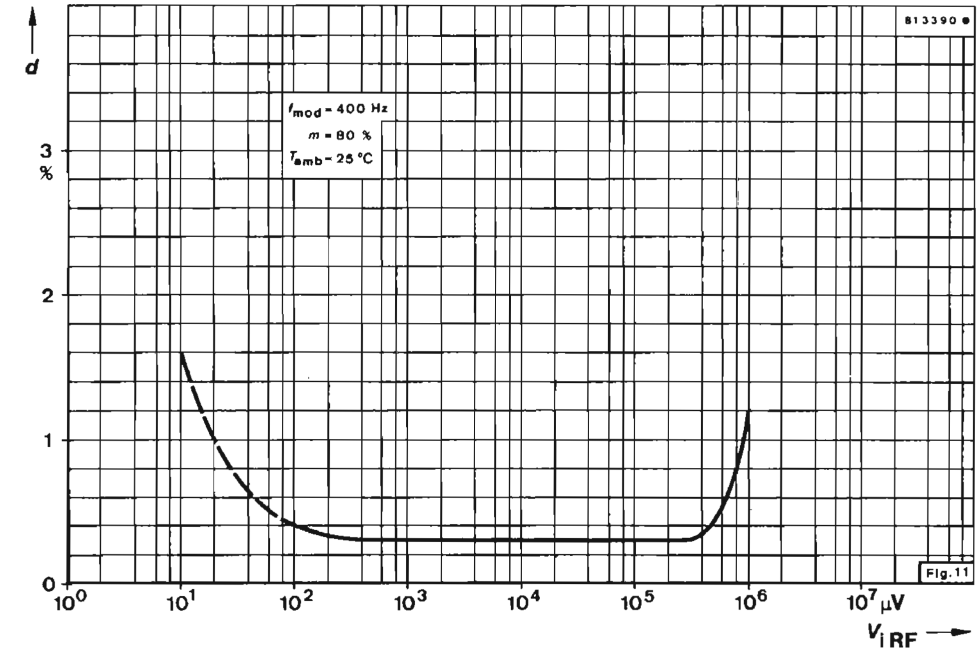

813387 6
VO AF
0
dB
−10
−20
−30
−40
−50
0.1
0.2
0.5
1
2
5 kHz
f mod
AF − Filter
IF − Filter
AF + IF − Filter
Tamb = 25 °C
Fig.8


813388 6
VO AF
100
mV
10
1
0.1
10^0
10^1
10^2
10^3
10^4
10^5 µV
VG RF
S + N
N
fmod = 400 Hz
fiRF = 1 MHz
m = 30 %
Tamb = 25 °C
400 Ω
200 pF
1.8 kΩ
Receiver
VGRF
Fig.9



813389 e
$\frac{S+N}{N}$
60
dB
40
20
0
m = 30 %
T_{amb} = 25 °C
10^0
10^1
10^2
10^3
10^4
10^5
10^6
10^7 µV
$V_{i\,RF}$

Fig.10

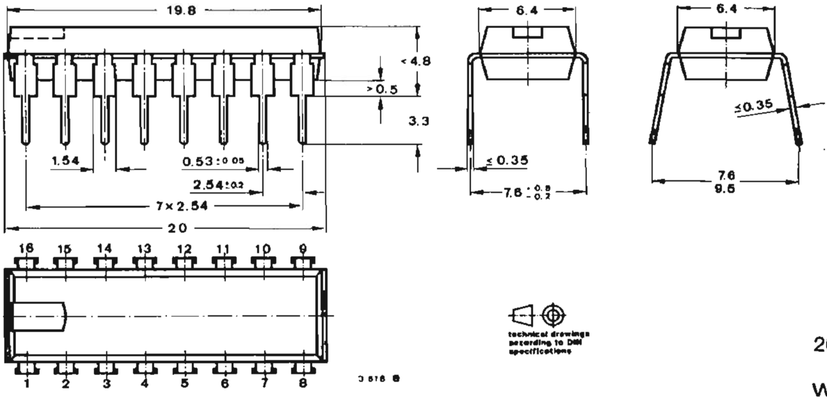


813390 e
d
3
%
2
1
0
f_{mod} = 400 Hz
m = 80 %
T_{amb} = 25 °C
10^0
10^1
10^2
10^3
10^4
10^5
10^6
10^7 µV
$V_{i\,RF}$

Fig.11

TDA 1072

Dimensions in mm



Case
20 A 16 DIN 41866
JEDEC MO 001
Weight max. 1.5 g

Monolithic Integrated Circuit

Application: AM Receiver Circuit

Features:

- Controlled RF-Preamplifier
- Multiplicative balanced mixer
- Separate oscillator with amplitude control
- I.F. amplifier with gain control
- Balanced full-wave detector
- Audio pre-amplifier
- Internal AGC voltage
- Amplifier for field-strength indication
- Electronic stand-by on/off switch

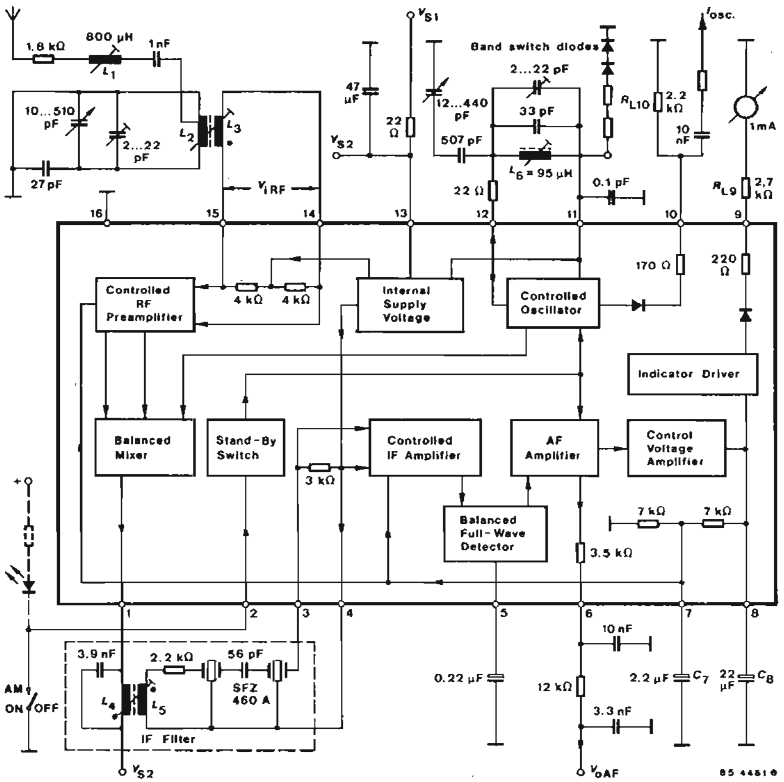


Fig. 1 Block diagram and application circuit

Absolute maximum ratings

Reference point Pin 16, unless otherwise specified

Supply voltage	Pin 13	V_S	20	V
Voltage on Pin 2		V_2	0...20	V
RF-Inputs				
Voltages				
Reference point 15	Pin 14	$\pm V_i$	12	V
	Pin 14	V_i	V_S	V
	Pin 14	$-V_i$	0.6	V
	Pin 15	V_i	V_S	V
	Pin 15	$-V_i$	0.6	V
RF-Inputs				
Currents	Pin 14	$\pm I_i$	200	mA
	Pin 15	$\pm I_i$	200	mA
Ambient temperature range		T_{amb}	– 30...+ 80	°C
Storage temperature range		T_{stg}	– 55...+ 150	°C

Electrical characteristics

$V_S = 8.5$ V, reference point Pin 16, $f_{IRF} = 1$ MHz, $R_G = 50\ \Omega$, $f_{mod} = 0.4$ KHz, $m = 30\%$, $f_{IF} = 460$ KHz, $T_{amb} = 25\,°C$, unless otherwise specified

			Min.	Typ.	Max.	
Supply voltage range	Pin 13	V_S	7.5		18	V
Supply current, without load	Pin 13					
$I_L = 0$ (Pin 11)		I_S		23	30	mA
RF-Preamplifier and Mixer						
D. C. input voltages	Pin 14, 15	V_i		$V_{S/2}$		V
Input impedances						
$V_{iRF} < 300\ \mu V$	Pin 14, 15	R_i		5.5		kΩ
		C_i		25		pF
$V_{iRF} > 10$ mV	Pin 14, 15	R_i		8.0		kΩ
		C_i		22		pF
Output impedance	Pin 1	R_o	500			kΩ
		C_o		6.0		pF
Maximum conversion conductance						
I_{o1IF}/V_{iRF}		S_M			6.5	mA/V
Maximum I.F. output voltage	Pin 1	V_{oIF}			5.0	V_{pp}
Output current	Pin 1	I_o		1.2		mA
Preamplifier control range		ΔS_M		30		dB
Max. RF-input voltage	Pin 14 - 15	V_i			2.5	V_{pp}

			Min.	Typ.	Max.	
Oscillator						
Frequency range	Pin 12	f_{OBC}	0.6		60	MHz
Oscillator circuit impedance range	Pin 12	Z_{LOSC}	0.5		200	kΩ
Controlled oscillator amplitude	Pin 12	V_{OSC}		130	150	mV
D. C. output voltage	Pin 11					
$I_L = 0$		V_O		6 $V_{BE(4V)}$		V
Output load current range	Pin 11	$-I_L$			20	mA
Output resistance	Pin 11					
$I_L = 5 \pm 0.5$ mA		R_O		25		Ω
Oscillator fequency output	Pin 10					
Output voltage						
$R_{L\,10} = 4.7$ kΩ		V_o		320		mV_{pp}
Output resistance		R_o		170		Ω
Allowable output current		I_o			3	mA_p
I.F. amplifier and A.F. stage						
D. C. input voltages	Pin 3, 4	V_i		2		V
Input impedance	Pin 3	R_i	2.4	3	3.9	kΩ
		C_i		7.0		pF
Max. i.f. input voltage	Pin 3					
$m = 80\%$, $d = 3\%$		V_i		90		mV
Control range						
$V_{oAF} = -6$ dB		ΔV_i		61		dB
Audio output voltage	Pin 6					
$V_i = 1$ mV (Pin 3), without load		V_o		310		mV
Audio output resistance	Pin 6	R_o		3.5		kΩ
Field-strength Indication						
D. C. indicator voltages						
$R_{L\,9} = 2.7$ kΩ, $V_i = 0$	Pin 9	V_O	0		140	mV
$V_i = 500$ mV	Pin 9	V_O	2.5	2.8	3.1	V
Output current capability	Pin 9	$-I_O$	2.0			mA
Output resistance						
$-I_o = 0.5$ mA	Pin 9	R_o		220		Ω
Reverse voltage at the output						
AM switch-OFF, $\pm I_o \leq 1$ μA	Pin 9	V_O		6		V

Stand-by switch			Min.	Typ.	Max.	
Switching voltage	Pin 2	V_i		2.75		V
Required control voltage						
AM ON	Pin 2	V_{i_1}			2	V
AM OFF	Pin 2	V_i [1]	3.5			V
Input current						
AM on, switching current	Pin 2	$-I_i$			200	μA
AM off, reverse current ($V_2 = V_3$)	Pin 2	$\pm I_i$			10	μA

Operating conditions

$V_S = 8.5$ V, $f_{iRF} = 1$ MHz, $f_{mod} = 0.4$ KHz, $m = 30\%$, $T_{amb} = 25$ °C, reference point Pin 16, see Fig. 2, unless otherwise specified

			Min.	Typ.	Max.	
RF input voltages						
$(S+N)/N =$ 6 dB		V_{iRF}		1.5		μV
= 26 dB		V_{iRF}		15		μV
= 46 dB		V_{iRF}		150		μV
RF input for a.g.c. operation		V_{iRF}		30		μV
Control range for	$\Delta V_o = 6$ bB	ΔV_{iRF}		91		dB
(Reference value $V_i = 500$ mV)	$\Delta V_o = 1$ dB	ΔV_{iRF}		86		dB
Maximum RF input voltage						
$d = 3\%$, $m = 80\%$		V_{iRF}		0.5		V
$d = 3\%$, $m = 30\%$		V_{iRF}		0.7		V
$d = 10\%$, $m = 30\%$		V_{iRF}		0.9		V
Audio output voltage						
$V_1 = 1$ mV		V_{oAF}		310 (±2 dB)		mV
$V_2 = 4$ μV, $m = 0.8$		V_{oAF}		130 (±3.5 dB)		mV
RF input voltage						
$V_{oAF} = 60$ mV		V_{iRF}		5.5		μV
Total distortion of audio output voltage						
$M = 80\%$, $V_i = 1$ mV		d		0.5		%
$V_i = 500$ mV		d		3.0		%
Signal plus noise-to-noise ratio of audio output voltage						
$V_i = 1$ mV		$\frac{(S+N)}{N}$		50		dB
I.F. bandwidth (−3 dB)		B_{iF}		4.6		KHz
I.F. selectivity						
$\Delta f = \pm 9$ kHz		S_{iF}		30		dB
$\Delta f = \pm 36$ kHz		S_{iF}		60		dB

[1] or open input

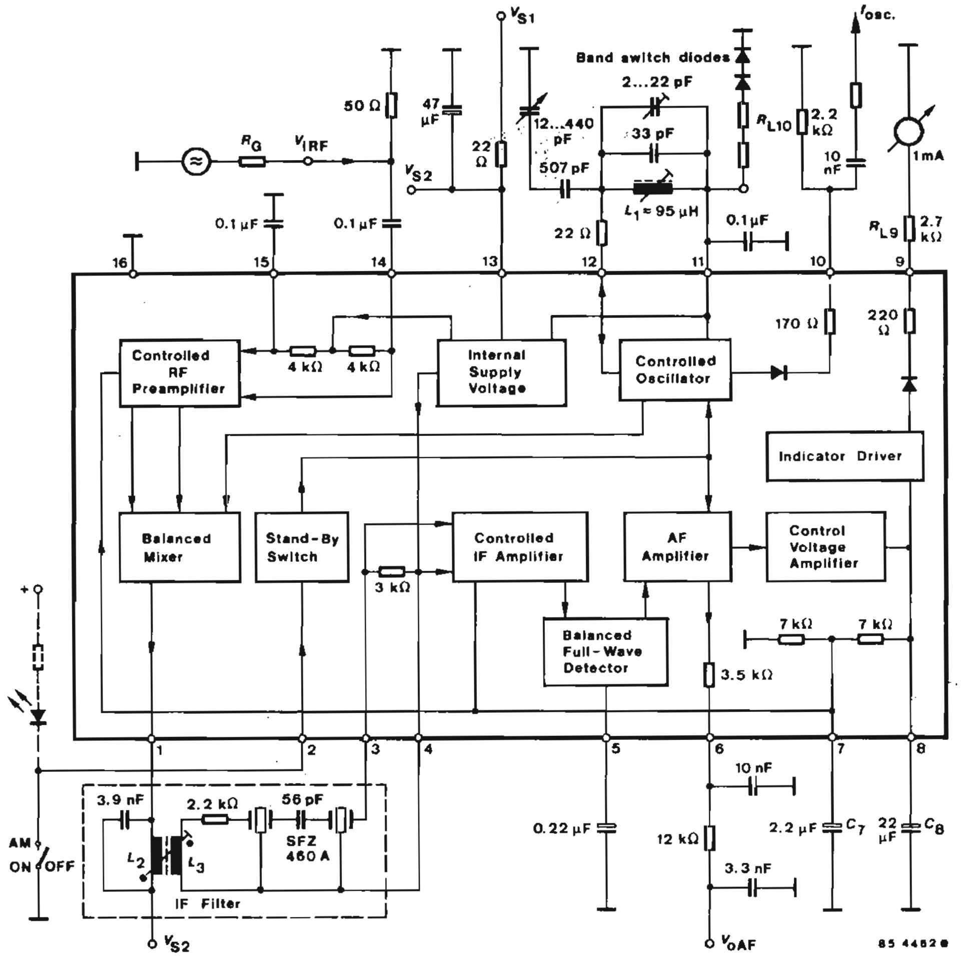
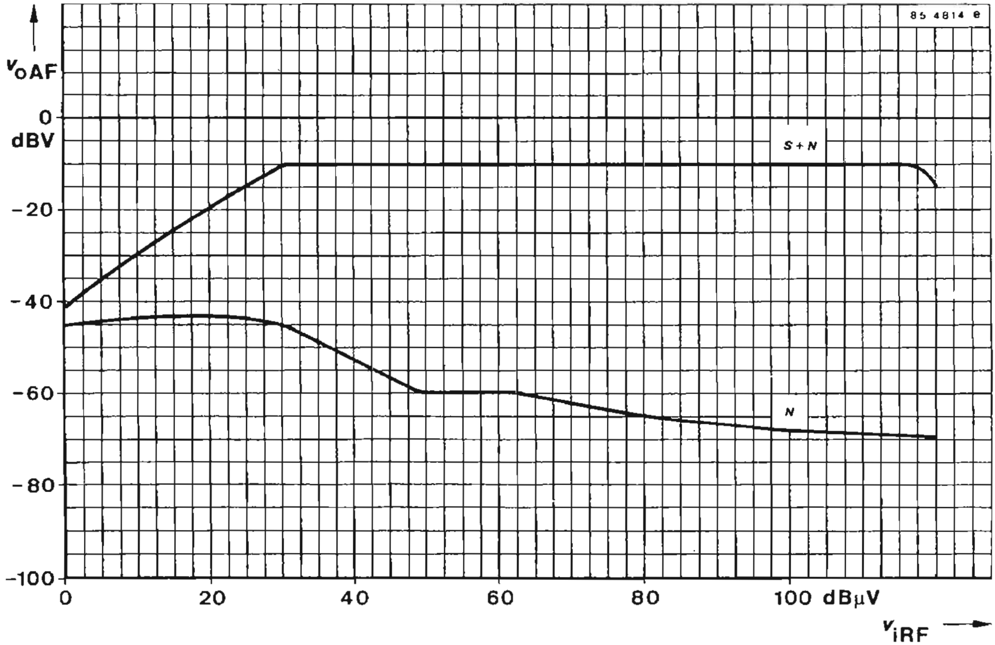
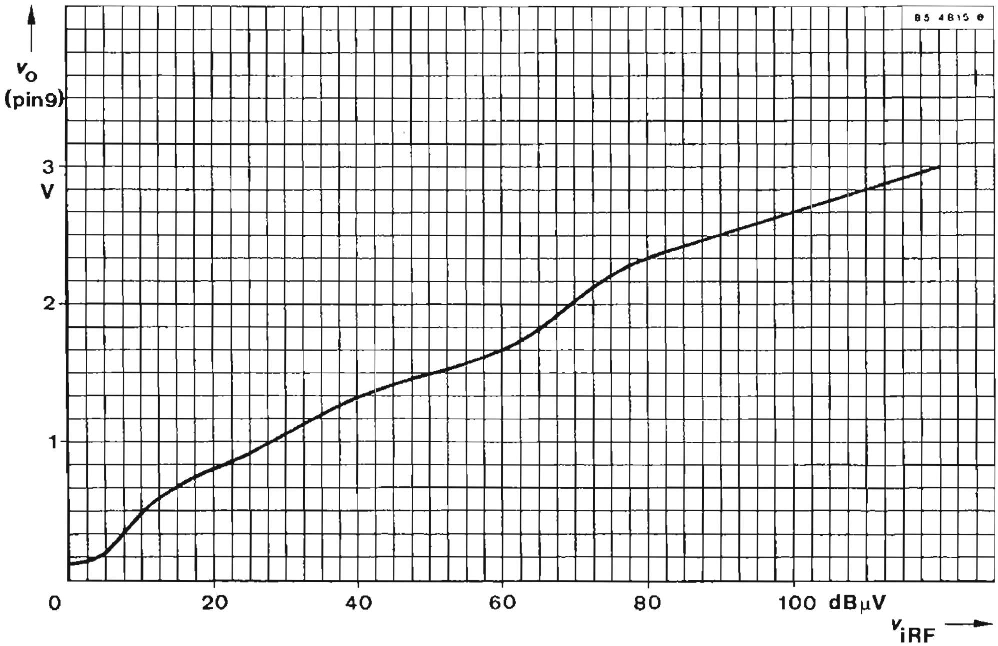
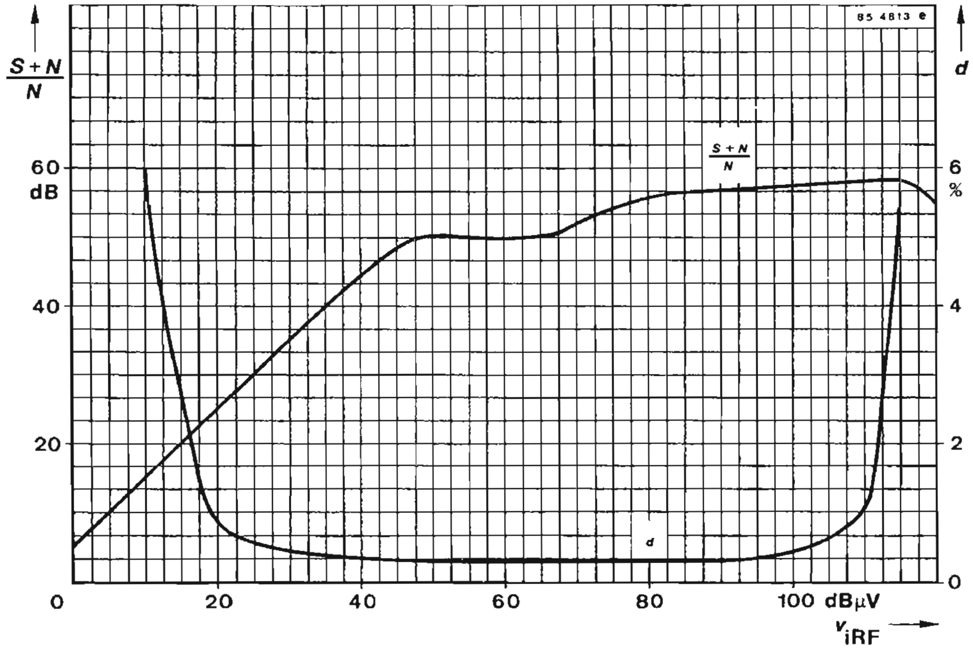


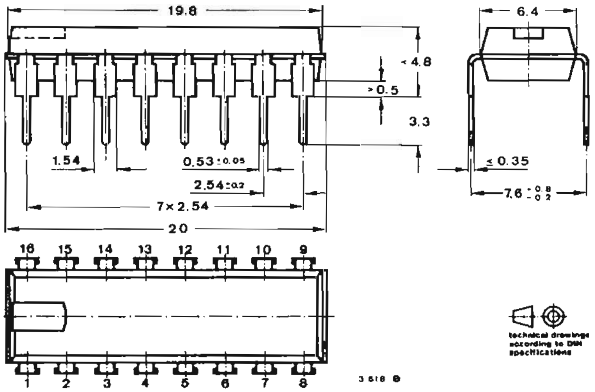
Fig. 2 Test circuit


85 4814 e
V_{oAF}
0
dBV
−20
−40
−60
−80
−100
S + N
N
0
20
40
60
80
100 dBμV
V_{iRF}


85 4815 e
V_o
(pin9)
3
V
2
1
0
20
40
60
80
100 dBμV
V_{iRF}


85 4813 e
S + N / N
d
60 dB
40
20
6 %
4
2
0
S + N / N
d
0
20
40
60
80
100 dBμV
V_{iRF}

Dimensions in mm



Case
20 A 16 DIN 41866
JEDEC MO 001
Weight max. 1.5 g

Monolithic Integrated Circuit

Application: Audio Power amplifier for car radio

Features:

- Improved performance compared with TDA 2002
- Mounting on cooling plate without insulation with minus polarity at ground
- Wide supply voltage range 8...18 V
- Designed for low impedance load 4 Ω as well as 2 Ω
- Protected against polarity inversion till 12 V
- Load dump surge up to 40 V

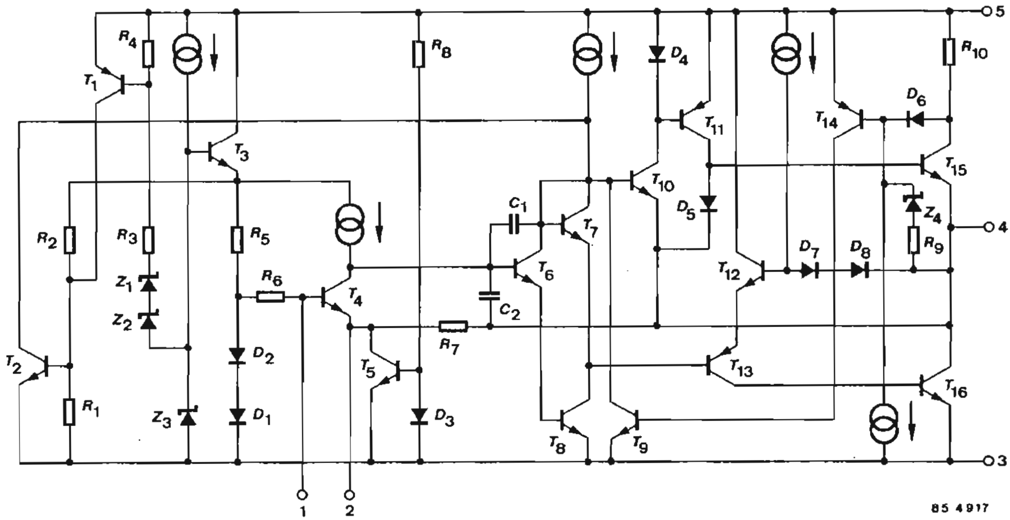


Fig. 1 Diagram and pin connections

Absolute maximum ratings

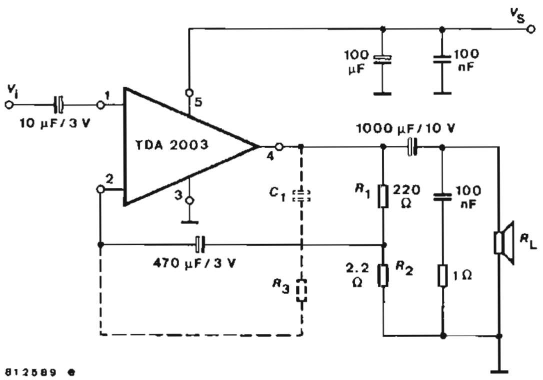
Peak supply voltage Fig. 2				
$t_p \leqq 50$ ms	Pin 5	V_{SP}	40	V
Supply voltage	Pin 5	V_S	28	V
Output peak current (non-repetitive)	Pin 4	I_o	4.5	A
Output peak current repetitive		I_o	3.5	A
Power dissipation				
$T_{case} = 90°C$		P_{tot}	20	W
Junction temperature		T_j	+150	°C
Storage temperature range		T_{stg}	−40...+150	°C

Thermal resistance			Min.	Typ.	Max.	
Junction case		R_{thJC}			3	K/W

Electrical characteristics

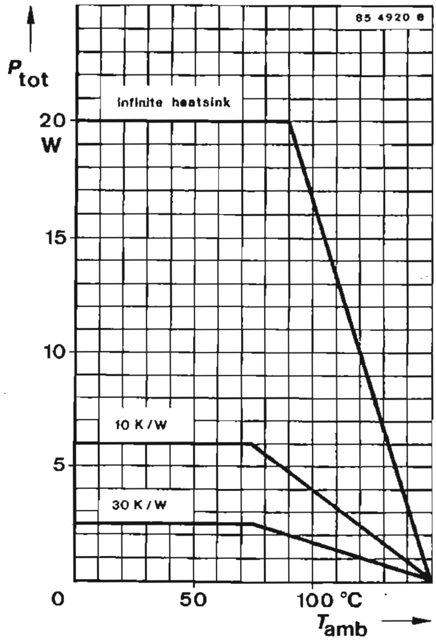
V_S = 14.4 V, Fig. 2 reference point Pin 3, G_V = 40 dB,
f = 1 kHz, T_{amb} = 25°C, unless otherwise specified

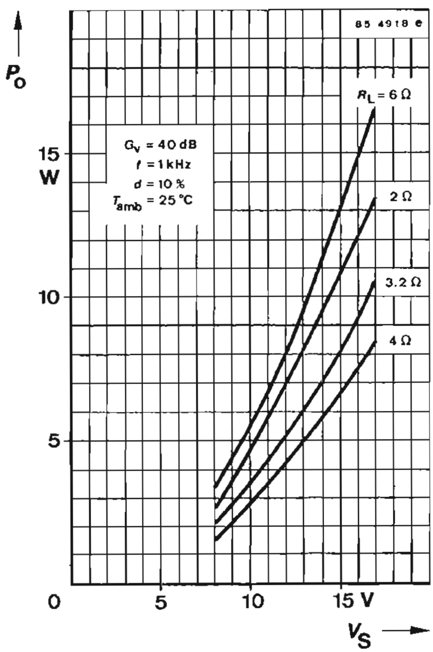
			Min.	Typ.	Max.	
Supply voltage range	Pin 5	V_S	8		18	V
Quiescent output voltage	Pin 5	V_{OB}	6.1	6.9	7.7	V
Quiescent drain current without current of: (R_1 + R_2)	Pin 5	I_{SB}		45	80	mA
Output power	Pin 4					
d = 10%, R_L = 4 Ω		P_o	5.5	6		W
R_L = 2 Ω		P_o		10		W
R_L = 3.2 Ω		P_o		7.5		W
R_L = 1.6 Ω		P_o		12		W
Input saturation voltage	Pin 1	V_i	300			mV
Supply voltage rejection ratio V_{hum} = 0.5 V, R_L = 4 Ω, f_{hum} = 100 Hz R_g = 10 KΩ		SVR	30	36		dB
Input resistance	Pin 1	R_i	70	150		kΩ
Input voltage G_v = 40 dB						
P_o = 0.5 W, R_L = 4 Ω		V_i		14		mV
P_o = 0.5 W, R_L = 2 Ω		V_i		10		mV
P_o = 6 W, R_L = 4 Ω		V_i		55		mV
P_o = 10 W, R_L = 2 Ω		V_i		50		mV
Band width (–3 dB) C_1 = 39 nF, R_3 = 39 Ω		B		40...15 000		Hz
Distortion						
P_o = 0.05 to 4.5 W, R_L = 4 Ω		d		0.15		%
P_o = 0.05 to 7.5 W, R_L = 2 Ω		d		0.15		%
Voltage gains						
R_L = 4 Ω open loop		G_{vg}		80		dB
closed loop		G_{vf}	39.5	40	40.5	dB
Input noise voltage B (–3 dB) = 40...15 000 Hz	Pin 1	V_{ni}		1	5	µV
Input noise current B (–3 dB) = 40...15 000 Hz	Pin 1	I_{ni}		60	200	pA
Efficiency						
P_o = 6 W, R_L = 4 Ω		n		69		%
P_o = 10 W, R_L = 2 Ω		n		65		%

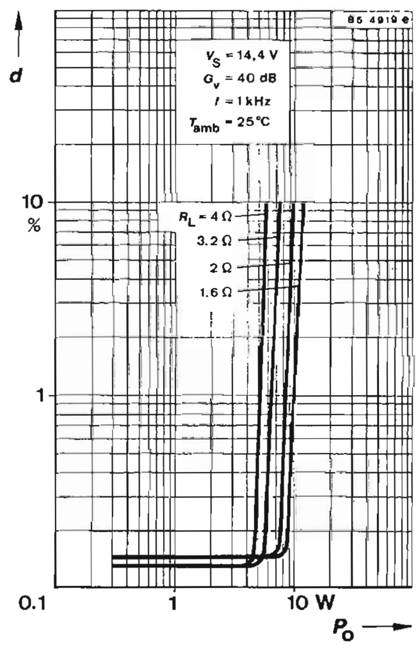


$$R_3 = 20 \cdot R_2;\ C_1 = \frac{1}{2\pi \cdot B \cdot R_1}$$

Fig. 2 Test circuit and application note

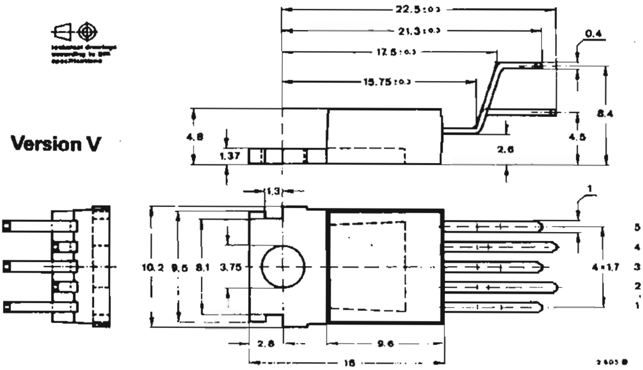






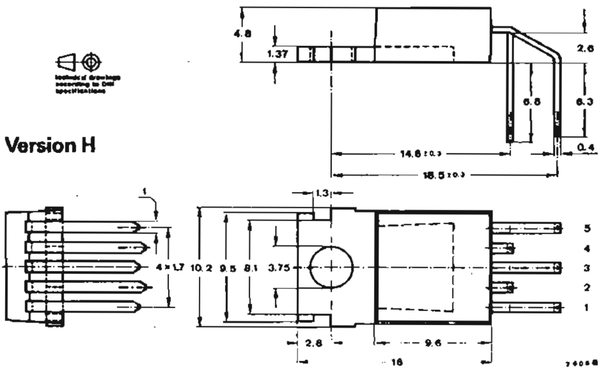
Dimensions in mm

Version V



Supply voltage + V_S	Pin 5
Output	Pin 4
Supply voltage − V_S	Pin 3
Inverting input	Pin 2
Non-inverting input	Pin 1

Version H



Special case
plastic
≈ TO 220
5-leads
Weight max. 1.8 g

Monolithic Integrated Circuit

Application: FM – IF limiter amplifier and detector for HiFi and car radios

Features:

- 7 stage limiter amplifier
- Multi-path signal detector
- Controllable limiting sense and stop pulse threshold
- Controllable mute function
- High S + N/N ratio and low signal distortion
- Signal strength output

Preliminary specifications

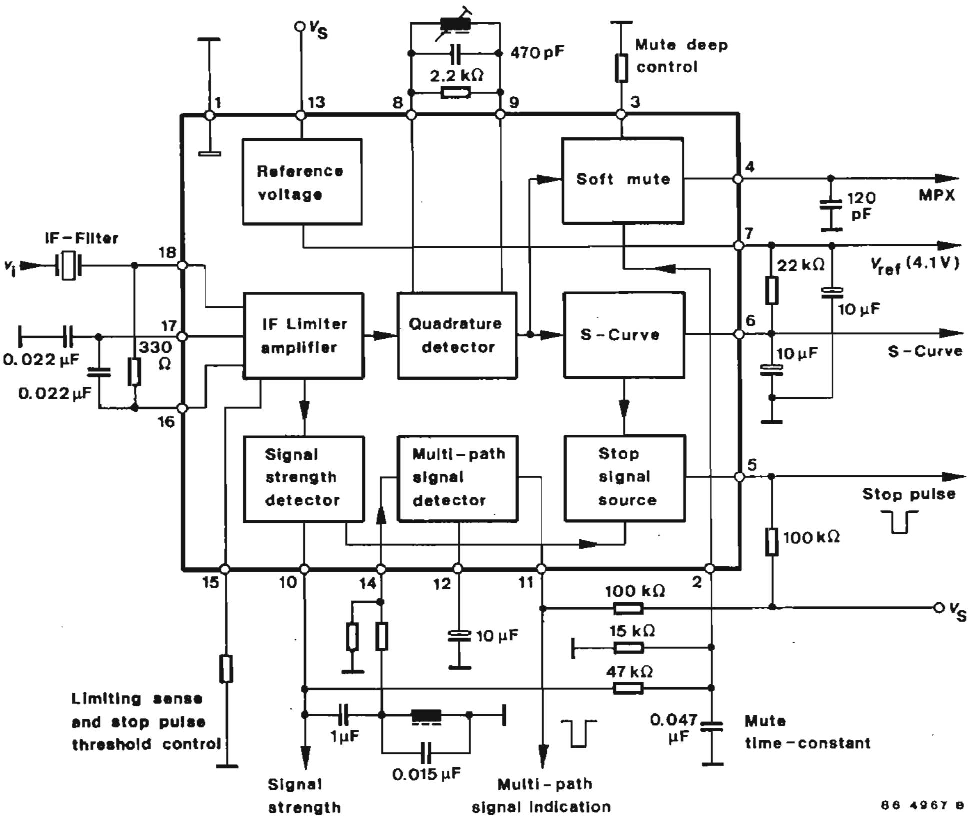


Fig. 1 Block diagram and application circuit

Absolute maximum ratings

Reference point Pin 1, unless otherwise specified

Supply voltage	Pin 13	V_S	18	V
Junction temperature		T_j	150	°C
Storage temperature range		T_{stg}	–40…+ 150	°C
Ambient temperature range		T_{amb}	–25…+ 85	°C

Thermal resistance

		Min.	Typ.	Max.	
Junction ambient	R_{thJA}			100	K/W

Electrical characteristics

$V_S = 8.5$ V, reference point Pin 1, $f_i = 10.7$ MHz,
$V_i = 10$ mV, FM = ± 75 KHz
$f_{mod} = 1$ KHz, $Q_o \approx 20$, $T_{amb} = 25$ °C, unless otherwise specified

			Min.	Typ.	Max.	
Supply voltage range	Pin 13		7.5		15	V
Supply current	Pin 13			24	29	mA
IF-limiter amplifier, Pin 18						
Limitimg threshold (–3 dB),						
Pin 15 open circuit		V_i		15	40	µV
Pin 15 connected to ground		V_i		500		µV
Audio signal, Pin 4						
Audio output voltage level		V_o		420 (± 2 dB)		mV_{RMS}
Frequency response (–1 dB)		f_r		0.02…150		KHz
Distortion		d		0.7		%
S + N/N ratio		$\frac{S+N}{N}$	70	78		dB
AFC current signal, Pin 6						
$\Delta f_i = \pm 50$ KHz		$\pm\Delta I_o$	70	110	160	µA
$\Delta f_i = \pm 300$ KHz		$\pm\Delta I_o$	120	170	250	µA
Stop signal generation, Pin 5						
Frequency window, $R_{6\text{-}7} = 22$ KΩ	Pin 5	Δf_{st}		± 18	± 30	KHz
Input voltage threshold,						
Pin 15 open circuit	Pin 18	V_{imin}		35	50	µV
Pin 15 connected to ground	Pin 18	V_{imax}		500		µV
Saturation voltage, $I_5 = 0.5$ mA	Pin 5	V_{sat}			1	V

			Min.	Typ.	Max.	
Signal strength output, Pin 10						
$V_i = 0\ \mu V$		V_O			0.1	V
$V_i = 50\ \mu V$		V_O	0.8			V
$V_i = 500 \mu V$		V_O	1.7		2.9	V
$V_i = 100$ mV		V_O	3.5			V
Mute function						
Mute "off" voltage,	Pin 2	V_{off}		0.5	0.75	V
Minimum mute range, $R_{3\text{-}1} = \infty$			4	7	10	dB
Maximum mute range, $R_{3\text{-}2} = 0$			32	39	46	dB
Multi-path signal detector, Pin 11						
Input voltage for full output swing $f = 20$ KHz	Pin 14	V_i		5		mV_{RMS}
Charge current Pin 14 connected to ground	Pin 12	I		3		mA
Discharge current Pin 14 open circuit or $V_{12} < 1$ V	Pin 12	I		10		μA
Saturation voltage, $I_{11} = 0.5$ mA	Pin 11	V_{sat}			1	V
Reference voltage supply						
Reference voltage $I_o = 500\ \mu A$	Pin 7	V_{Ref}	3.6	4.1	4.6	V
Load current	Pin 7	I_{load}		3	5	mA

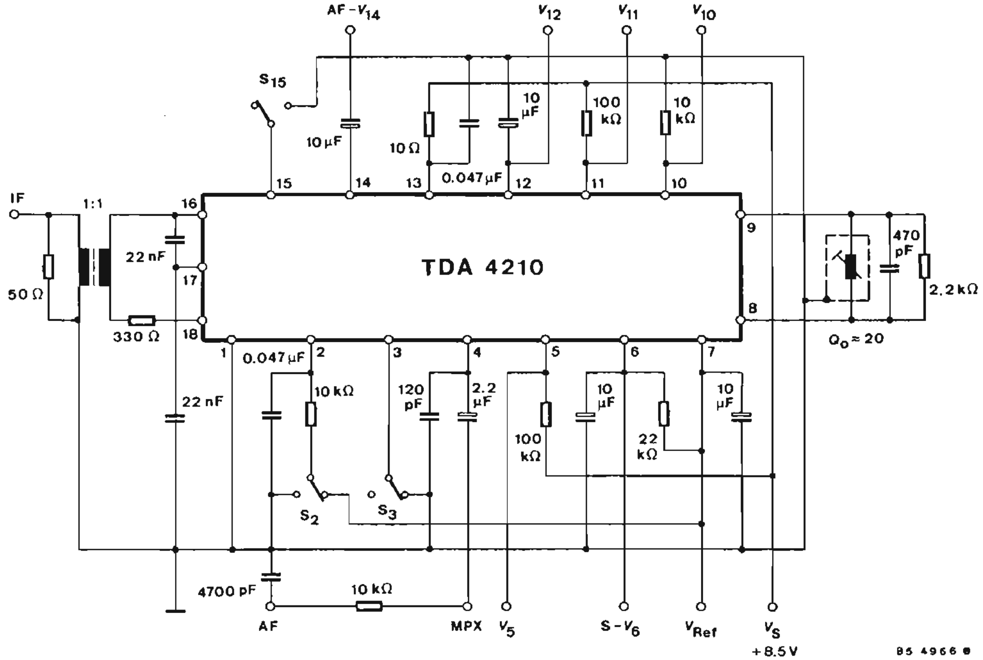
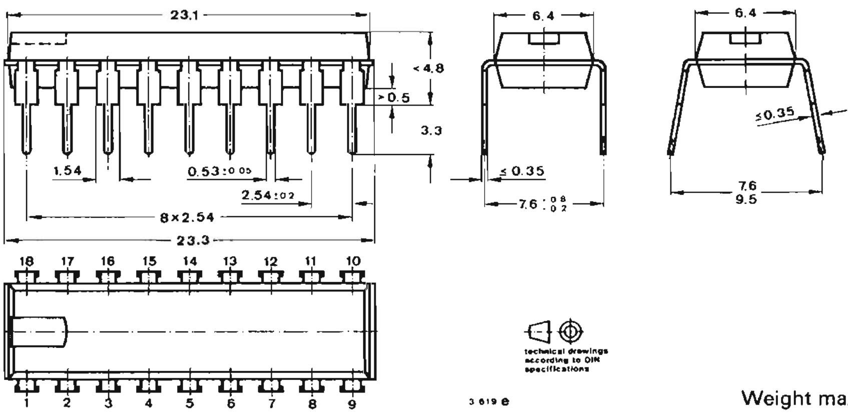


Fig. 2 Test circuit

Dimensions in mm



technical drawings according to DIN specifications

3 619 e

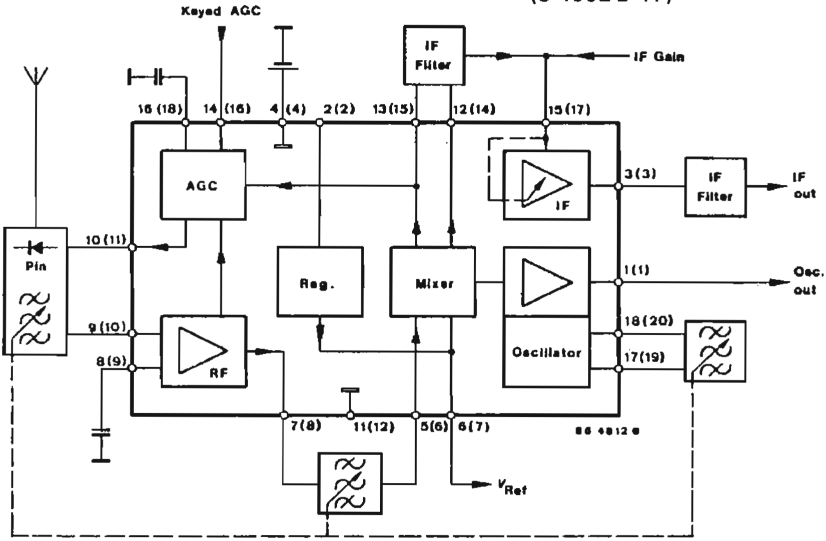
Case
DIP 18
Weight max. 1.5 g

Monolithic Integrated Circuit

Application: VHF-Front-End for car radios and Hi-Fi receivers, communication and navigation receivers up to 300 MHz, signal converters, demodulators and modulators up to 500 MHz.

Features:

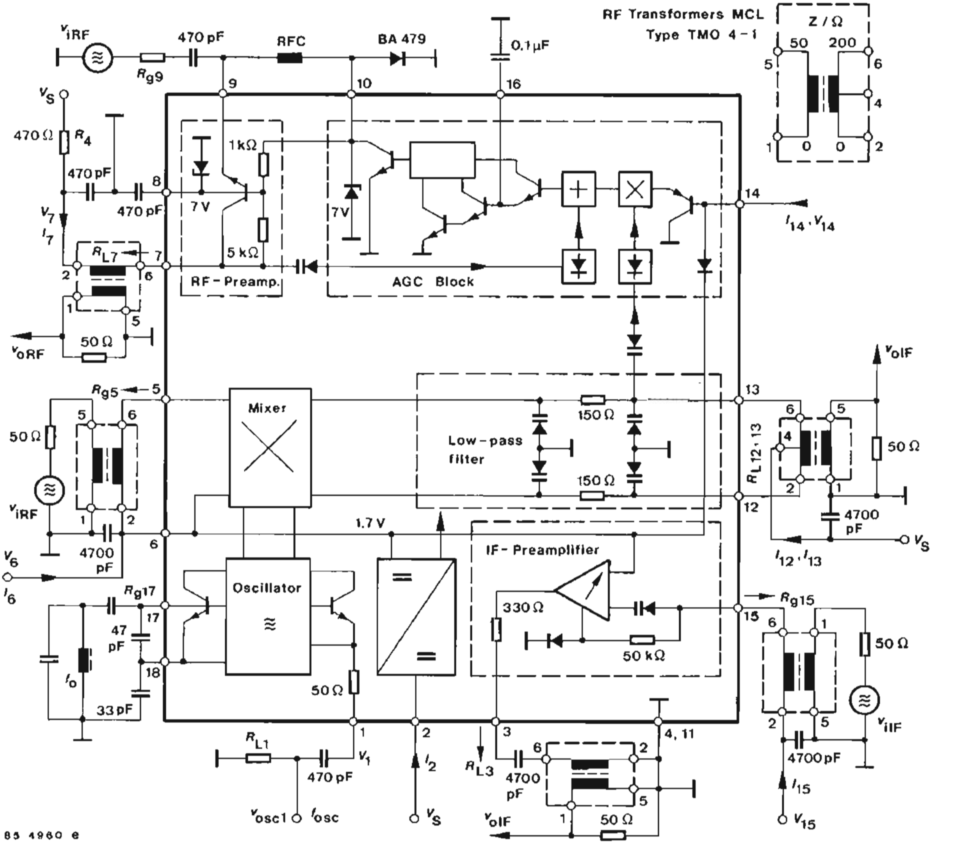
- Completely integrated FM-Front-End increases quality level and reliability
- High performance due to three AGC loops allow extreme large signal handling
- Fulfils latest FTZ-rules
- Double-balanced high linear mixer with low noise figure
- Oscillator with low phase noise and excellent frequency stability
- IF-preamplifier with dB-linear gain control
- Low noise and high stability of the reference voltage circuit for internal and auxiliary functions
- Available on request as SO-20 case (U 4062 B - FP)



1 (1)	Oscillator output	10 (11)	AGC output
2 (2)	Supply voltage (V_S)	11 (12)	Ground
3 (3)	IF output	12 (14)	Mixer output
4 (4)	Ground	13 (15)	Mixer output
5 (6)	Mixer Input	14 (16)	AGC input (IF Strip)
6 (7)	Reference voltage output	15 (17)	IF input / IF gain control
7 (8)	Collector — RF preamplifier	16 (18)	AGC time constant
8 (9)	Base — RF preamplifier	17 (19)	Base — Oscillator
9 (10)	Emitter — RF preamplifier	18 (20)	Emitter — Oscillator

Pin connections for U 4062 B FP in brackets

Pin connections and block diagram



Test circuit

Absolute maximum ratings

Reference point ground, Pin 4 and 11

Supply voltage	Pin 2,12,13	V_S	18	V
Power dissipation $T_{amb} = 85°C$		P_{tot}	450	mW
Junction temperature		T_j	125	°C
Storage temperature range		T_{stg}	–50...+ 125	°C
Ambient temperature range		T_{amb}	–25...+ 85	°C

Thermal resistance		**Min.**	**Typ.**	**Max.**	
Junction ambient	R_{thJA}			90	K/W

Electrical characteristics, see test circuit

$V_S = 10$ V, $f_{iRF} = 50.3$ MHz, $F_{osc} \approx 100$ MHz,
$f_{IF} = f_{osc} - f_{iRF} \approx 49.7$ MHz,
reference point Pin 4 and 11, $T_{amb} = 25$ °C, unless otherwise specified

			Min.	Typ.	Max.	
Supply voltage range		V_S	7		16	V
Supply currents						
Pin 2		I_S		11.5		mA
Mixer	Pin 12, 13	$I_{12}+I_{13}$		9		mA
RF-stage ($R_4 = 470\ \Omega$)	Pin 7	I_7		9		mA
RF - Preamplifier ($R_{g9} = 50\ \Omega$, $R_{L7} = 200\ \Omega$)						
DC voltage	Pin 7	V_7		5.7		V
DC voltage	Pin 8	V_8		0.77		V
Power gain		G_{RF}		10.5		dB
3rd order intercept		IP_3		+12		dBm
Dynamic characteristics $f = 100$ MHz						
Input impedance		Z_9			5	Ω
Forward current gain $\lvert i_7/i_9 \rvert$		h_{fb}		1		A/A
Parallel output resistance		R_7		3		kΩ
Parallel output capacitance		C_1		3.8		pF
Noise figure		NF_{RF}		2		dB

			Min.	Typ.	Max.	
Oscillator (f_{osc} = 100 MHz, unloaded Q = 80, resonance resistance R_{g17} = 250 Ω)						
DC voltage	Pin 17	V_{17}		3.2		V
DC voltage	Pin 18	V_{18}		2.5		V
Oscillator voltage	Pin 17	V_{osc17}	100	130		mV_{RMS}
Frequency drift						
– by supply voltage change d_{fo}/dV_S		$\Delta f_{osc}(V_S)$		1.3		kHz/V
– by temperature change d_{fo}/d_K		$\Delta f_{osc}(T_j)$		2		kHz/K
FM noise (equivalent deviation) (Ripple voltage < 0.5 mV)		Δf_{noise}				
– frequency band 300 Hz to 20 kHz, unweighted				5		Hz
– peak CCIR				10.5		Hz
– peak CCIR, weighted with 75 μs de-emphasis				4.2		Hz
FM by AM-Signal at mixer input (f_{iRF} = 90 MHz, m = 0.8, f_M = 1 kHz) V_{iRF} = 106 dBμV		$\Delta f_{osc}(V_{iRF})$		160		Hz
Oscillator output buffer (R_{L1} = 520 Ω)						
DC current load limitation	Pin 1	I_1			0.2	mA
DC voltage	Pin 1	V_1		1.7		V
Voltage gain ($V_{OSC17} \leqq$ 200 mV) V_{osc1}/V_{osc17}	Pin 1	G_{buffer}		0.86		
Harmonics				<−30		dBC
Output impedance	Pin 1	Z_1		80		Ω
Mixer (R_{g5} = 200 Ω, R_{L12-13} = 200 Ω)						
Conversion power gain		G_C		7.5		dB
3rd order intercept		IP_3		+3.5		dBm
Parallel input resistance f = 100 MHz	Pin 5	R_5		5		kΩ
Parallel input capacitance f = 100 MHz	Pin 5	C_5		3		pF
Parallel output resistance f = 10.7 MHz, Pin 12 and Pin 13 parallel connected		R_{12+13}		55		kΩ
Effective output capacitance between Pin 12 and Pin 13, f = 10.7 MHz						
$V_{12,13}$ = 10 V		C_{12-13}	2.9	3.1	3.3	pF
$V_{12,13}$ = 7 V		C_{12-13}	3.25	3.5	3.75	pF
$V_{12,13}$ = 16 V		C_{12-13}	2.5	2.7	2.9	pF

			Min.	Typ.	Max.	
Conversion transconductance $\left\|i_{12}/u_5\right\|, \left\|i_{13}/u_6\right\|$		g_c		5.8		m-mho
Maximum available conversion power gain $f_{iRF} = 100$ MHz, $f_{IF} = 10.7$ MHz		MACG		43		dB
Noise figure (f_{IF} = 10.7 MHz) Single side band $R_{g5}(f_{iRF}) = 450\ \Omega$, $f_{iRF} = f_{osc} - f_{IF}$		NF_{CSSB}		5.6		dB

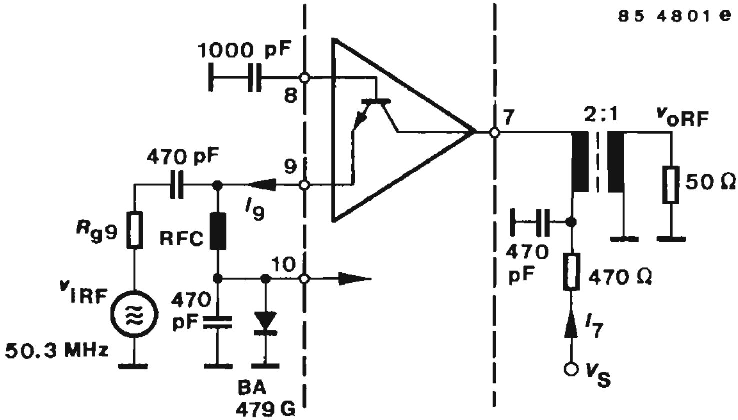
IF-Preamplifier

(f = 10.7 MHz, $R_{L3} = R_{g15} = 200\ \Omega$)

			Min.	Typ.	Max.	
DC voltage	Pin 3	V_3		7.6		V
Power gain						
Maximum control voltage of $V_{15} = 1.6$ V is recommended						
$V_{15} = 1.6$ V		G_{maxIF}		24		dB
$V_{15} < 0.8$ V		G_{minIF}		−4		dB
Gain control deviation by V_{15}		ΔG_{IF}		28		dB
External control current						
at G_{maxIF}	Pin 15	I_{15max}		20		μA
at G_{minIF}	Pin 15	I_{15min}		0		μA
Gain control slope						
dG_{IF}/dI_{15}	Pin 15	S_{I15}		1.3		dB/μA
dG_{IF}/dV_{15}	Pin 15	S_{V15}		35		dB/V
Temperature coefficient of voltage gain dG_{IF}/d_{Tj} at		TCG				
$V_{15} = 1.6$ V				0		dB/K
$V_{15} < 0.8$ V				0.04		dB/K
I_{15} = constant				−0.02		dB/K
Parallel input resistance	Pin 15	R_{15}		2.4		kΩ
Parallel input capacitance	Pin 15	C_{15}		5.9		pF
Parallel output resistance	Pin 3	R_3		350		Ω
Parallel output capacitance	Pin 3	C_3		4.1		pF
Noise figure ($V_{15} = 1.6$ V)		NF_{IF}		11		dB

			Min.	Typ.	Max.	
AGC-Circuit						
(No signal at Pin 5 and Pin 9)						
DC voltage	Pin 16	V_{16}		1.0		V
Saturation voltage	Pin 10	V_{10min}		0.08	0.2	V
Input current $V_{14} \leqq V_6$	Pin 14	$-I_{14}$		0.01	0.1	μA
Maximum allowable current	Pin 14	$\left\|\pm I_{14}\right\|_{max}$			50	μA
Maximum control current for external PIN-diode ($I_{10} = 0$)		I_{diode}			I_7	
AGC threshold voltages (respecting $V_{10} = 0.25$ V)						
RF stage output	Pin 7	V_{RF7}		450		mV_{RMS}
Mixer-stage output $V_{14} = V_6$	Pin 13	V_{IF13}		300		mV_{RMS}
External AGC voltage $V_{IF13} = 1\ V_{eff}$	Pin 14	V_{14min}		0.9		V
Internal AGC voltage	Pin 16	V_{16min}		1.4		V
Reference voltage source						
Output voltage, without load ($I_6 = 0$)	Pin 6	V_6	1.6	1.7	1.8	V
Temperature dependence of V_6 $\left\|V_6\right\|_{T_{amb}} = -25 \ldots 85$ °C		$\Delta V_6(T)$		20		mV
Internal differential resistance dV_6/dI_6 when $I_6 = 0$ mA		r_{d6}		50		Ω
Ripple rejection $20 \log \left\|\frac{d_{Vs}}{d_{V6}}\right\|$ when $I_6 = 0$ mA		α_6		65		dB
Noise voltage / $\sqrt{Hz}$ when $I_6 = 0$ and						
$f =$ 25 Hz				0.6		μV
$f =$ 125 Hz				0.37		μV
$f =$ 1 kHz				0.1		μV
$f =$ 10 kHz				0.1		μV

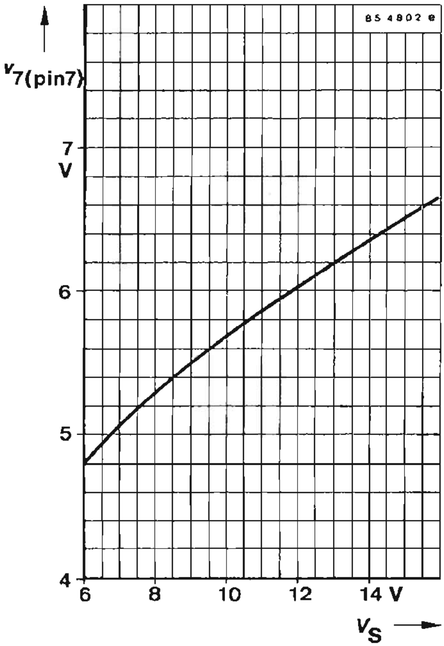
RF-Preamplifier

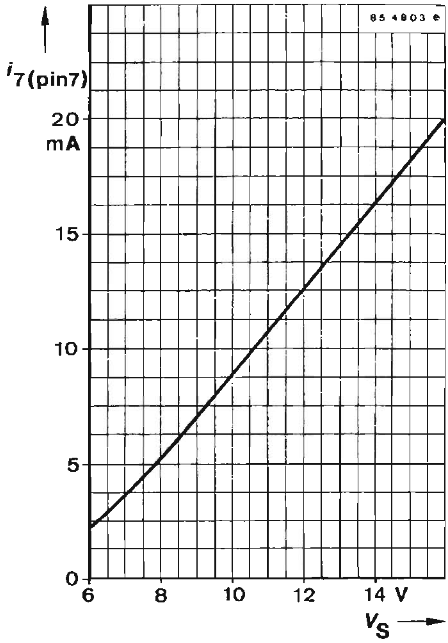


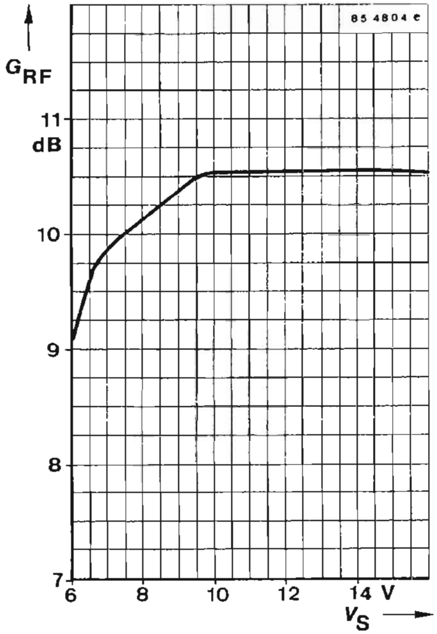
Test circuit

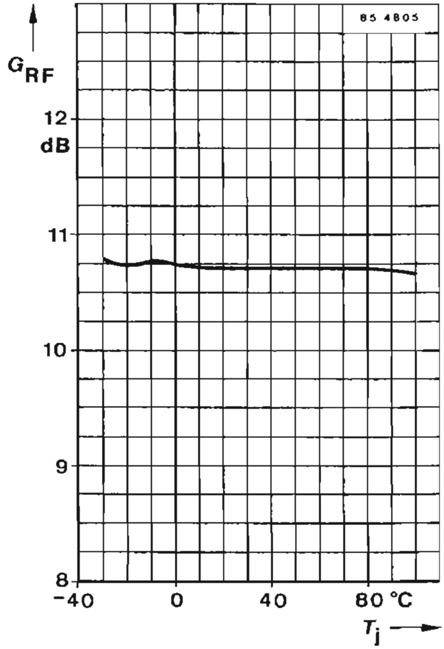
Power gain $G_{RF} = 20 \log (2\ V_{oRF}/V_{iRF}) + I_L$ (dB)

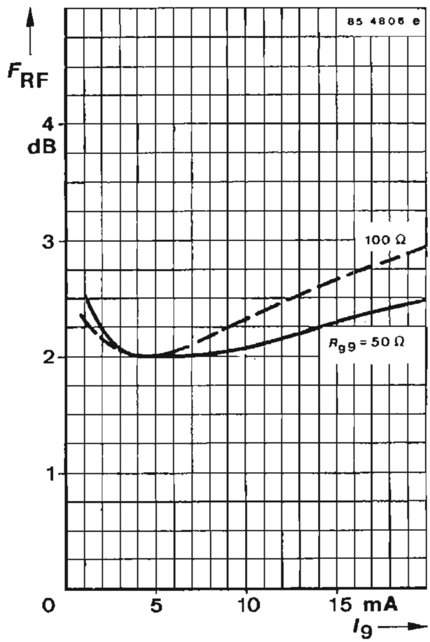
I_L = Insertion loss of the RF transformer



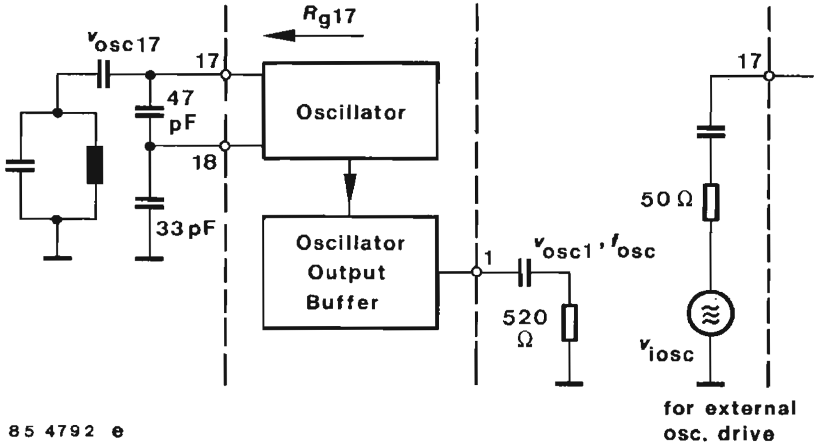



85 4804 e
G_{RF}
11
dB
10
9
8
7
6
8
10
12
14 V
V_S


85 4805
G_{RF}
12
dB
11
10
9
8
−40
0
40
80 °C
T_j

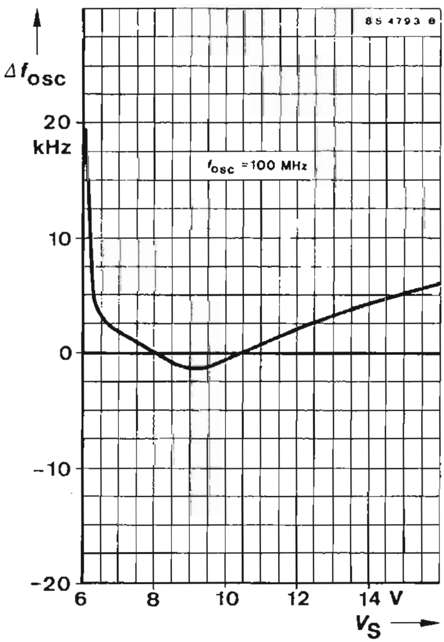

85 4806 e
F_{RF}
4
dB
3
2
1
0
5
10
15 mA
I_g
100 Ω
R_{gg} = 50 Ω

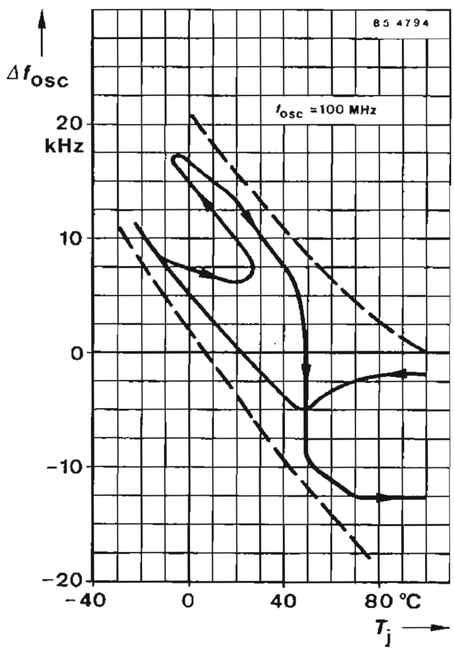
Oscillator / Oscillator output buffer

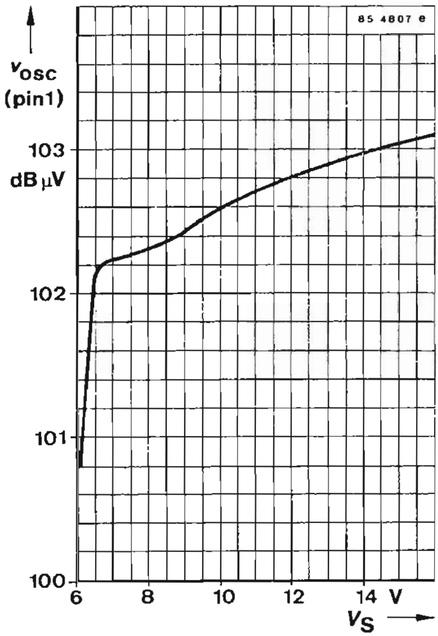


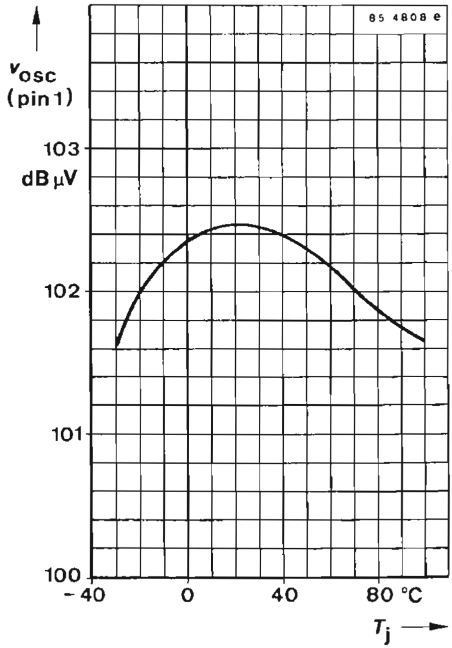
Test circuit

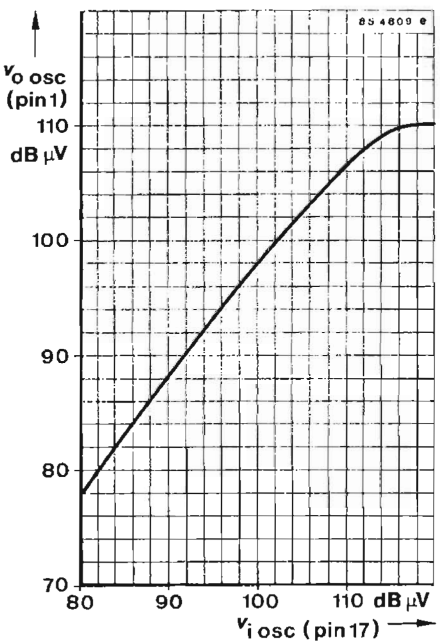
Free running oscillator frequency $f_{osc} \approx 100$ MHz

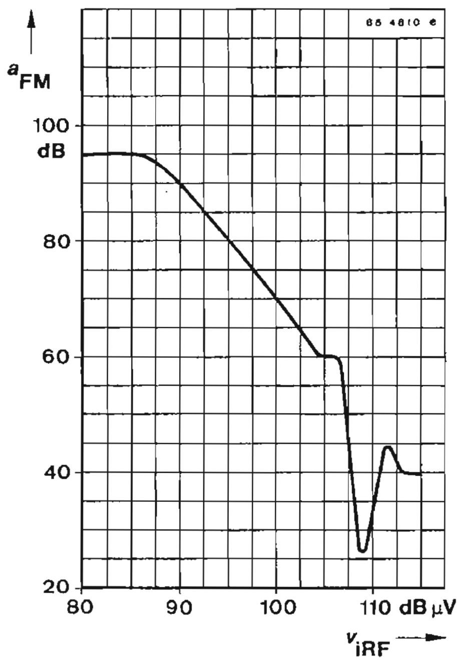




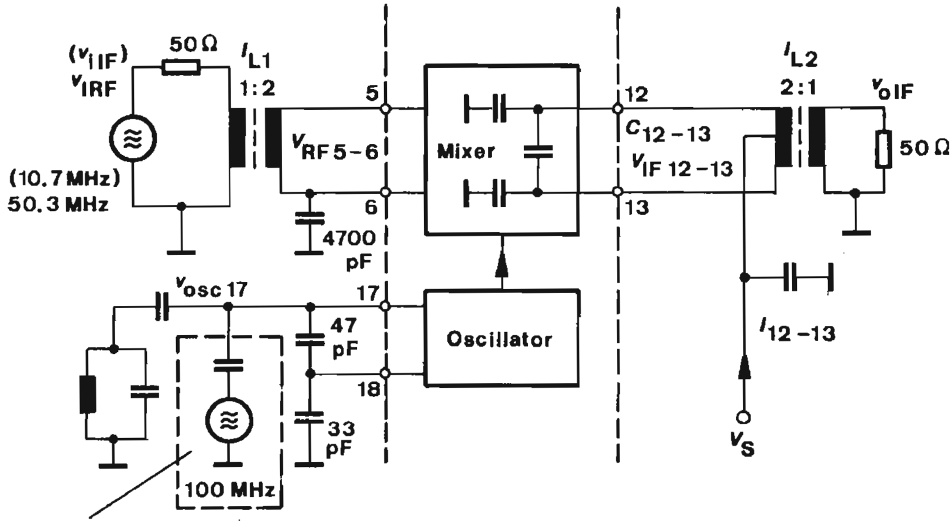

85 4807 e
v_{osc} (pin1)
103 dB µV
102
101
100
6
8
10
12
14 V
V_S


85 4808 e
v_{osc} (pin 1)
103 dB µV
102
101
100
− 40
0
40
80 °C
T_j


85 4809 e
$v_{o\ osc}$ (pin 1)
110 dB µV
100
90
80
70
80
90
100
110 dB µV
$v_{i\ osc}$ (pin 17)


85 4810 e
a_{FM}
100 dB
80
60
40
20
80
90
100
110 dB µV
v_{iRF}

Mixer



Test circuit

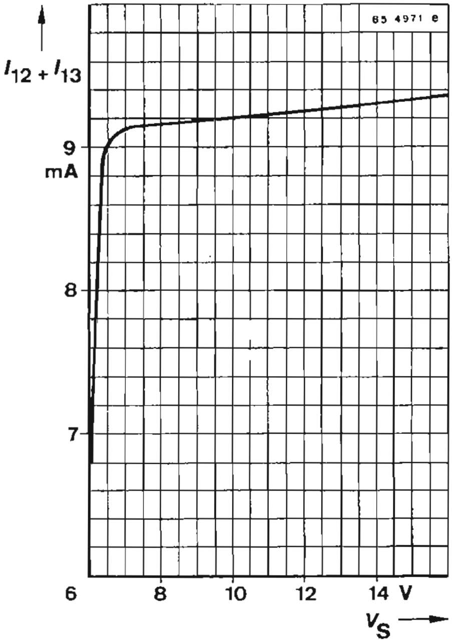
I_{L1}, I_{L2} = Insertion loss of the RF transformers
Conversion power gain $G_C = 20 \log (2\ V_{oIF}/V_{iRF}) + I_{L1}\,(dB) + I_{L2}\,(dB)$
$V_{RF5\text{-}6}\,(dB\mu V) = V_{iRF}\,(dB\mu V) - I_{L1}\,(dB) + 6$
$V_{IF12\text{-}13}\,(dB\mu V) = V_{oIF}\,(dB\mu V) - I_{L2}\,(dB) + 6$
$\Delta G_C = G_C\,(V_{OSC17}) - G_C$ (nominal)
Input to output I.F. isolation
$a_{IF} = 20 \log (2\ V_{oIF}/V_{iIF}) + I_{L1}\,(dB) + I_{L2}\,(dB) - G_C$ (nominal)

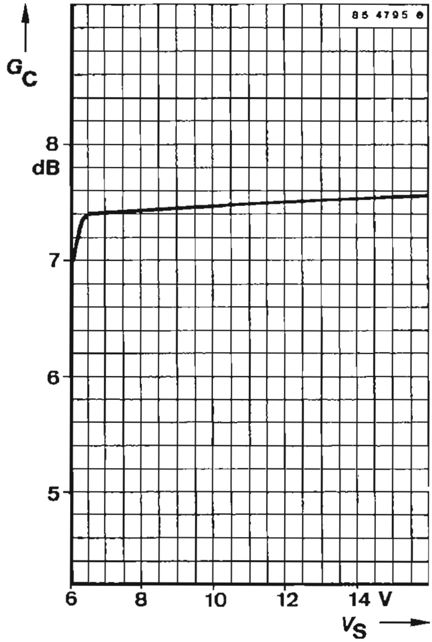
Characteristics α_{FM} versus v_{iRF}, see previous page

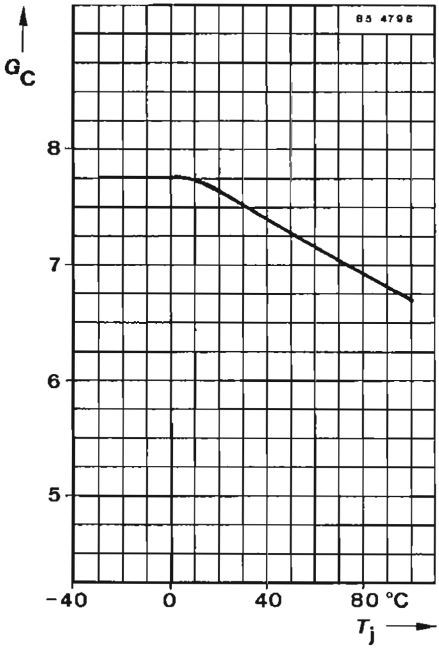
Oscillator frequency immunity against amplitude modulated signal at mixer input (Pin 5-6) related to FM standard modulation:

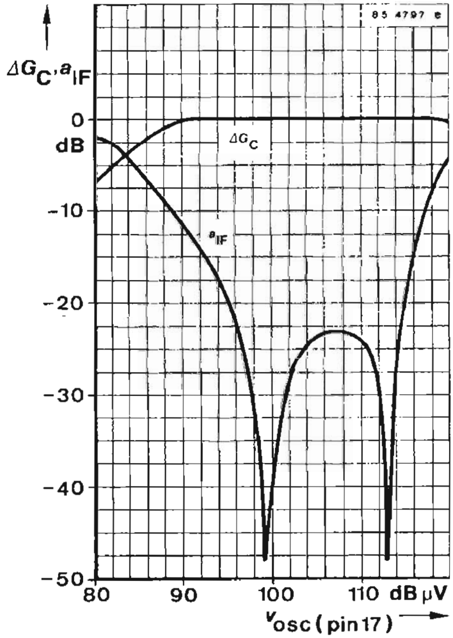
$\alpha_{FM} = 20 \log [\,75\ kHz/\Delta f_{osc}\,(v_{iRF})\,]$ whereas

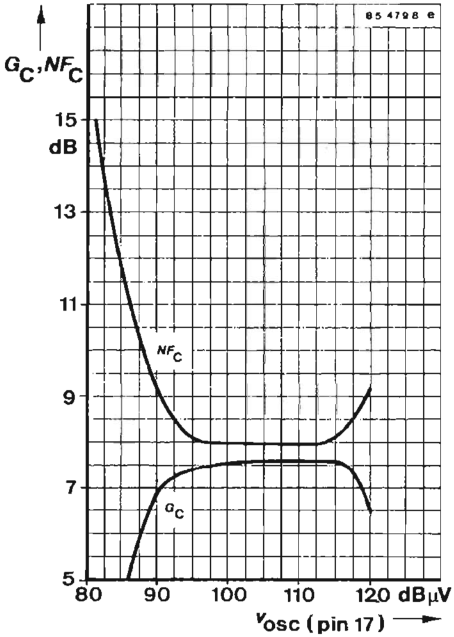
v_{iRF} = mixer input signal (f_{iRF} = 89.3 MHz, m = 0.8, f_M = 1 kHz)

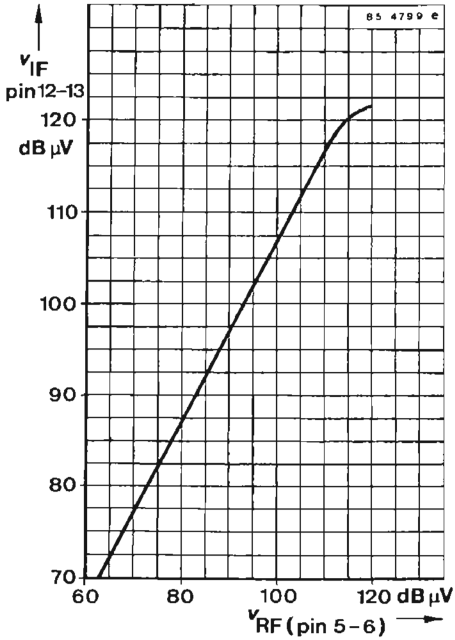

85 4971 e
$I_{12} + I_{13}$
9
mA
8
7
6
8
10
12
14 V
V_S

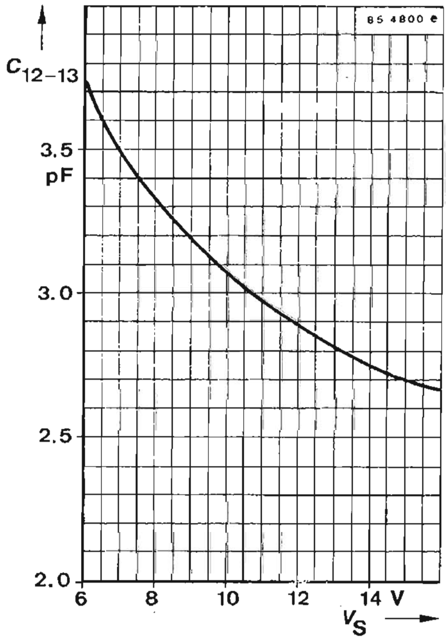

85 4795 e
G_C
8
dB
7
6
5
6
8
10
12
14 V
V_S

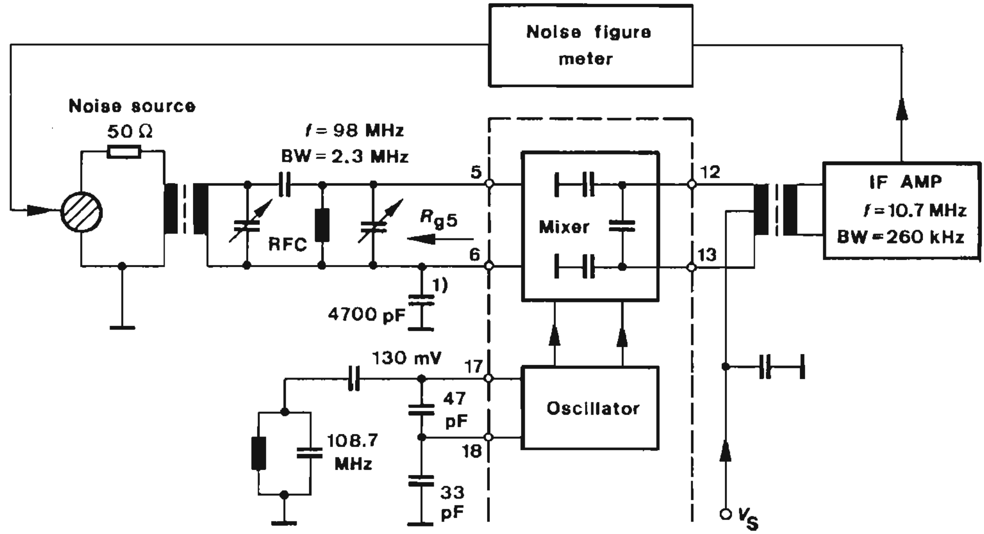

85 4796
G_C
8
7
6
5
−40
0
40
80 °C
T_j


85 4797 e
$\Delta G_C, a_{IF}$
0
dB
−10
−20
−30
−40
−50
ΔG_C
a_{IF}
80
90
100
110 dBμV
V_{osc} (pin 17)


85 4798 e
G_C, NF_C
15
dB
13
11
9
7
5
NF_C
G_C
80
90
100
110
120 dBµV
V_{osc} (pin 17)


85 4799 e
V_{IF}
pin 12–13
120
dBµV
110
100
90
80
70
60
80
100
120 dBµV
V_{RF} (pin 5–6)


85 4800 e
C_{12-13}
3.5
pF
3.0
2.5
2.0
6
8
10
12
14 V
V_S

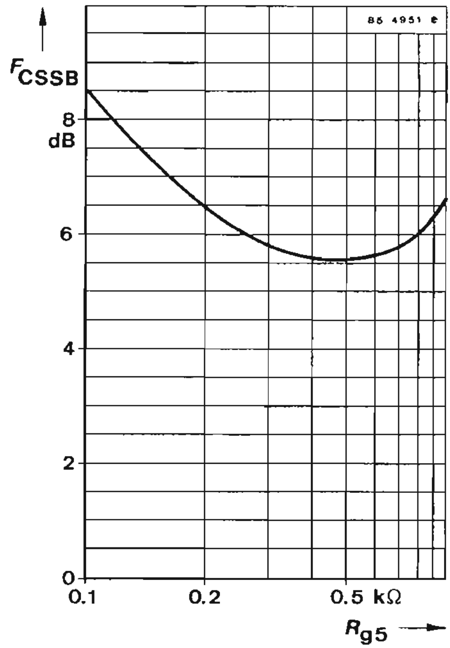


1) Mounted as close as possible between pin 6 and Ground

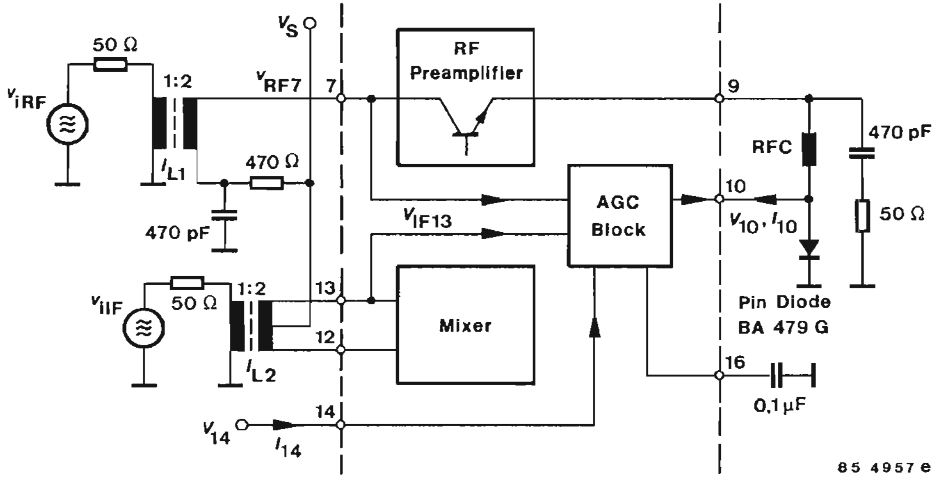
Test circuit for single sideband noise (F_{CSSB})

F_{CSSB} = Noise figure reading/dB – I_L/dB

I_L = Insertion loss of the tuned transformer network



AGC Circuit

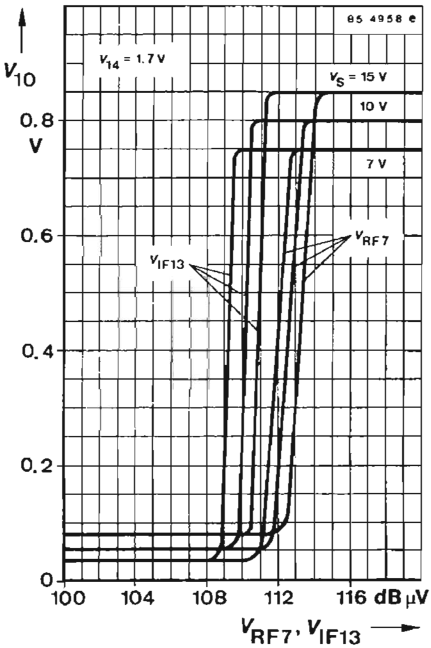


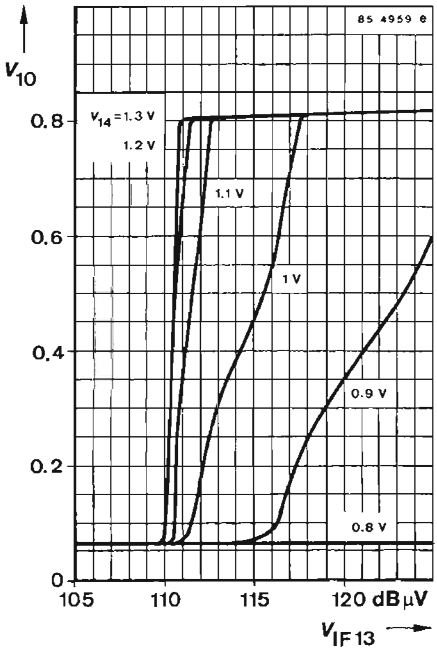
Test circuit

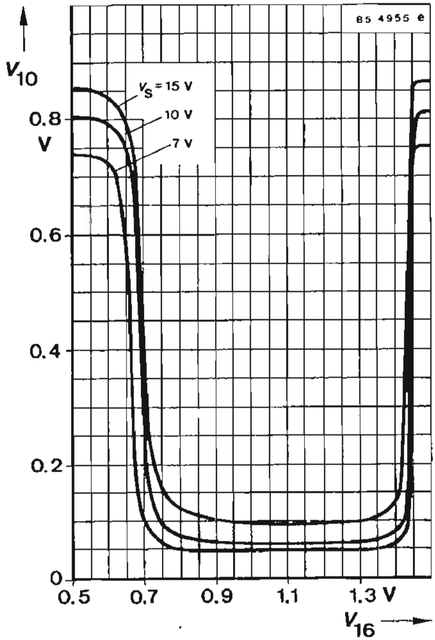
I_{L1}, I_{L2} = Insertion loss of the RF transformers

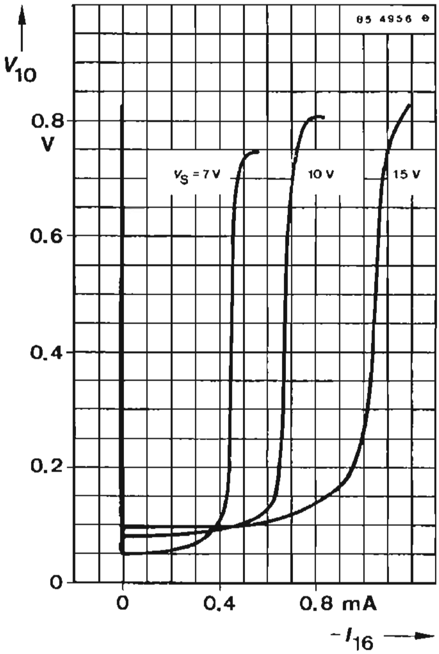
V_{RF7}(dBμV) = V_{iRF} (dBμV) - I_{L1} (dB) + 6

V_{IF13}(dBμV) = V_{iIF} (dBμV) - I_{L2} (dB)

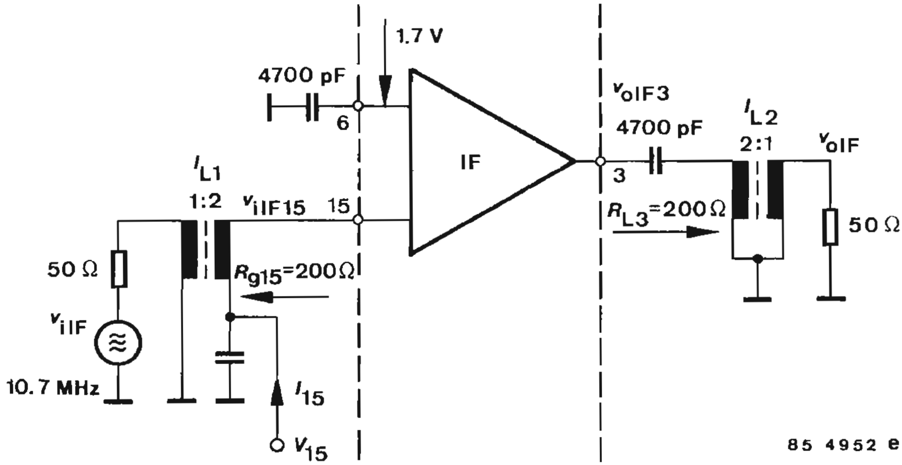





85 4955 e
V_{10}
0.8 V
0.6
0.4
0.2
0
V_S = 15 V
10 V
7 V
0.5
0.7
0.9
1.1
1.3 V
V_{16}


85 4956 e
V_{10}
0.8 V
0.6
0.4
0.2
0
V_S = 7 V
10 V
15 V
0
0.4
0.8 mA
$-I_{16}$

IF Preamplifier



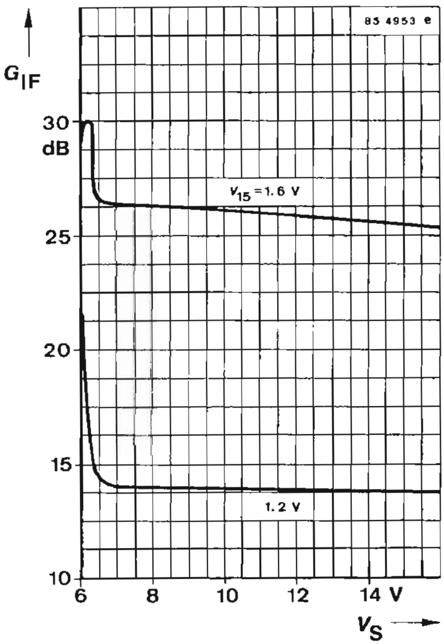
Test circuit

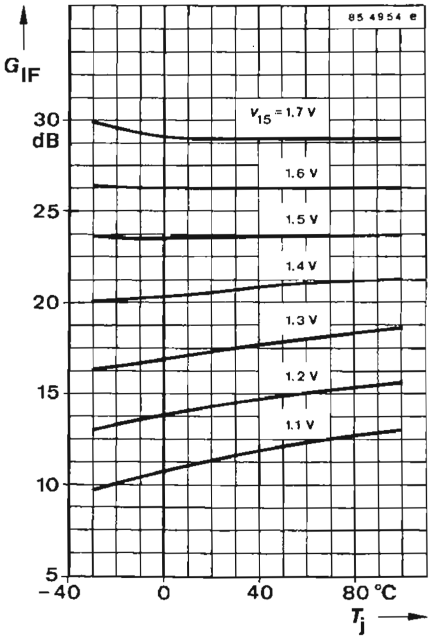
I_{L1}, I_{L2} = Insertion loss of the RF transformers

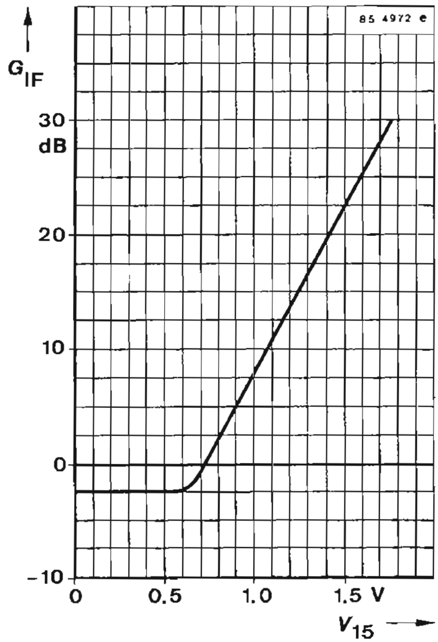
Power gain $G_{IF} = 20 \log (2\ V_{oIF}/V_{iIF}) + I_{L1}\ (dB) + I_{L2}\ (dB)$

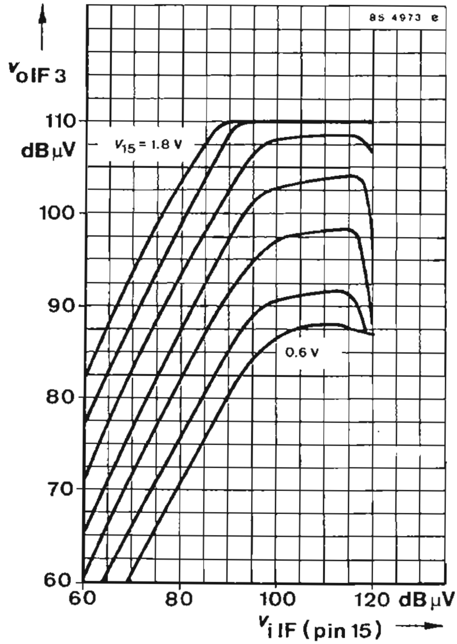
$V_{iIF15}\ (dB\mu V) = V_{iIF}\ (dB\mu V) - I_{L1}\ (dB) + 6$

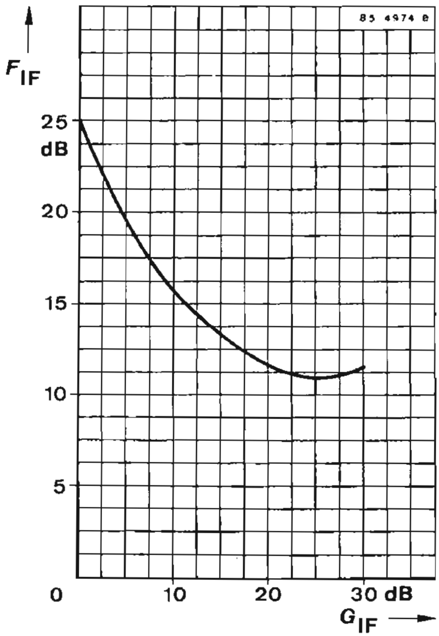
$V_{oIF3}\ (dB\mu V) = V_{oIF}\ (dB\mu V) - I_{L2}\ (dB) + 6$



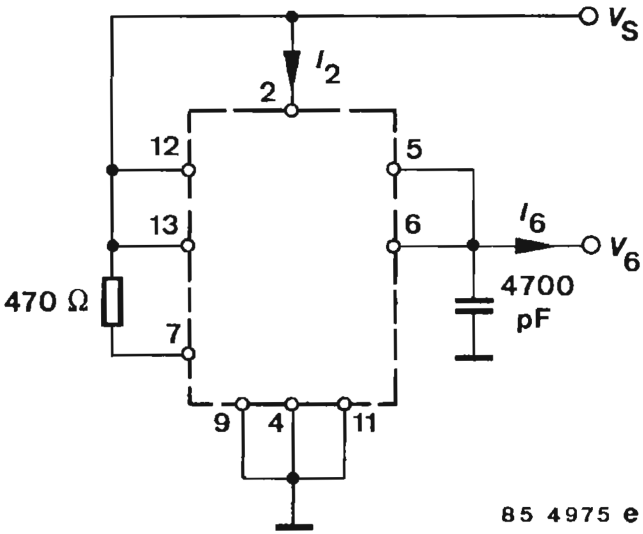



85 4972 e
G_{IF}
30
dB
20
10
0
−10
0
0.5
1.0
1.5 V
V_{15}

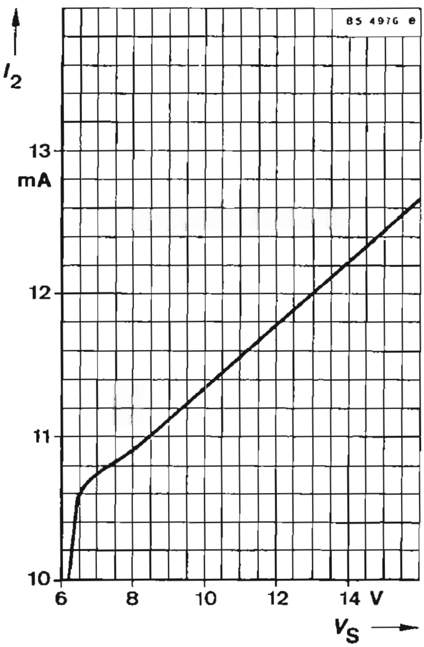

85 4973 e
v_{oIF3}
110
dBμV
100
90
80
70
60
V_{15} = 1.8 V
0.6 V
60
80
100
120 dBμV
v_{iIF} (pin 15)

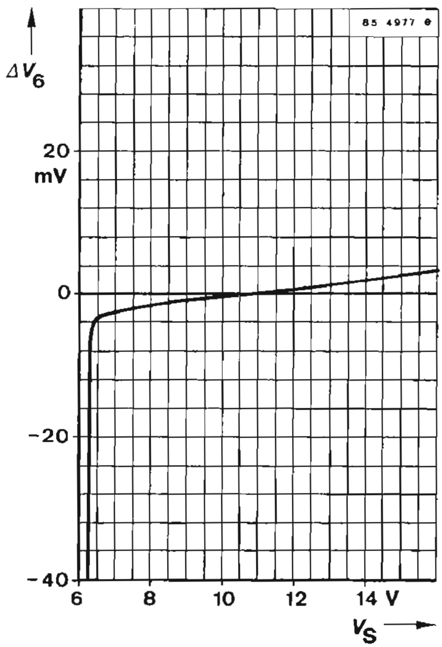

85 4974 e
F_{IF}
25
dB
20
15
10
5
0
10
20
30 dB
G_{IF}

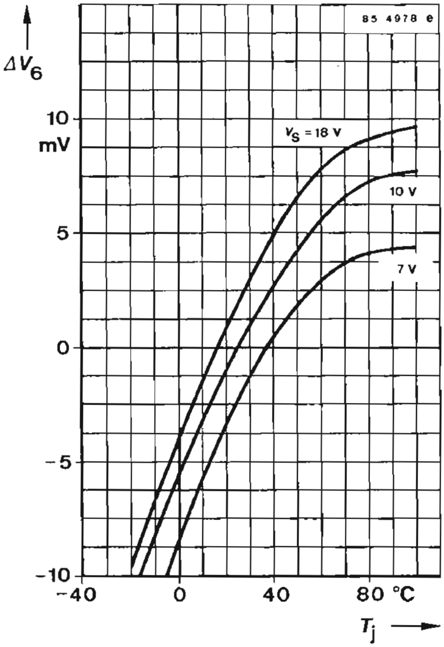
Reference voltage

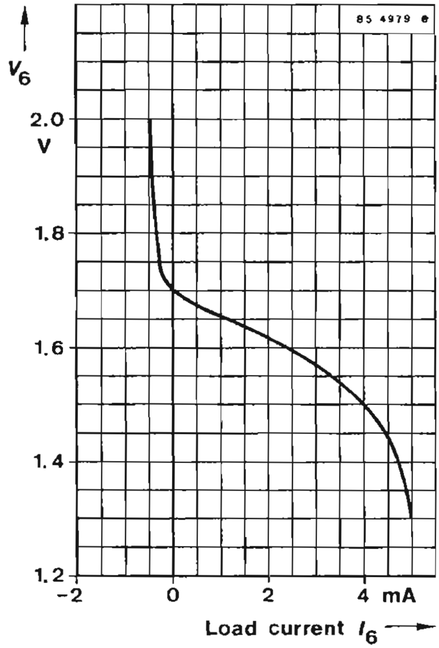


Test circuit

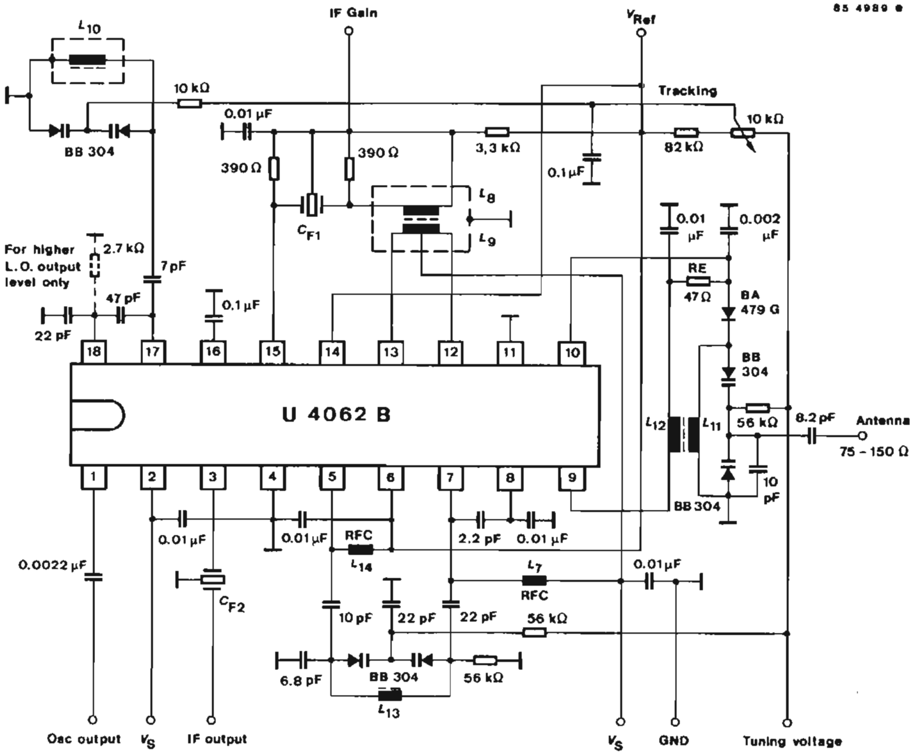


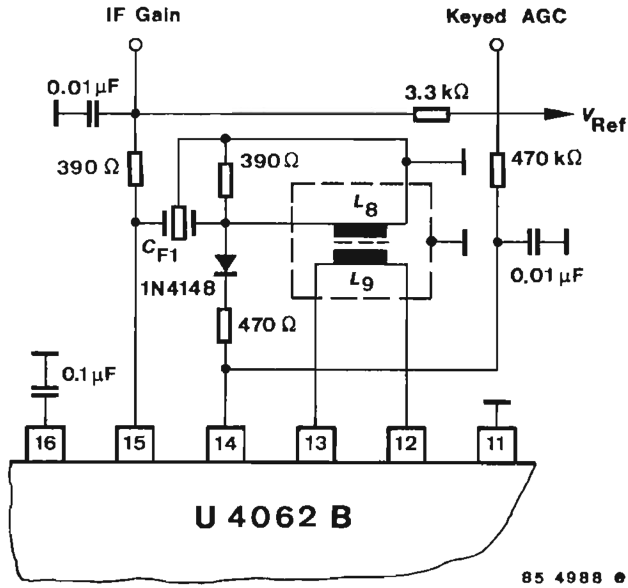



85 4978 e
ΔV6
10
mV
5
0
−5
−10
−40
0
40
80 °C
Tj
VS = 18 V
10 V
7 V


85 4979 e
V6
2.0
V
1.8
1.6
1.4
1.2
−2
0
2
4 mA
Load current I6

Typical application circuit for high performance FM-Front-End using non-repetitive alignment concept





Circuit (section) from above diagram with keyed AGC

Coils Specifications

L_8/L_9 Toko 7 PL 9/ (18+18) turns
Nr. 218 ANS - 788 N

L_{10} Toko 7 KI 3 turns
Nr. 291 ENS – 2054 IB or
Toko MC 122
Nr. E528 SNAS – 100075

L_{11}/L_{12} Toko 7 KI without case
4/8 turns
Nr. 291 ENF – 2342 x

L_{13} Toko 7 KI 4 turns
Nr. 291 ENS – 2341 IB or Toko MC 122
Nr. E528 SNAS – 100076

L_{14}/L_{17} Choke 1.5 μH
Toko 348 LS – 1R5 or similar

CF1; CF2
Toko CFSK – 107 M3 or similar

$V_S = 8.5$ V, $T_{amb} = 25$ °C

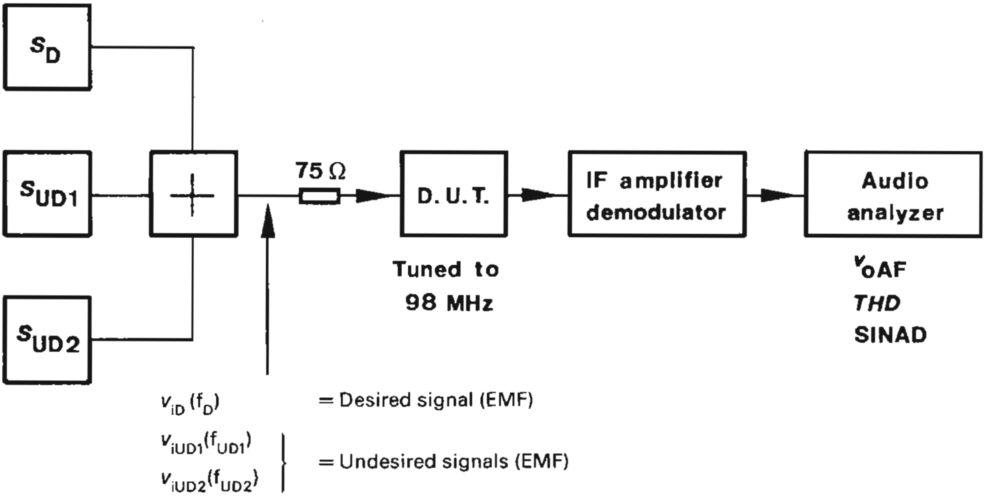
Electrical connections	Pin	Voltage (D.C) in V
L.O. output	1	1.73
V_S	2	8.5
I. F. output	3	6.1
Ground	4	0
Mixer input	5	1.7
Reference output voltage	6	1.7
RF preamplifier (collector)	7	8.5
RF preamplifier (base)	8	1.3
RF preamplifier (emitter)	9	0.53
AGC output	10	0.07
Ground	11	0
Mixer output	12	8.5
Mixer output	13	8.5
AGC input	14	1.7
I.F. input, I. F. gain control	15	1.54
AGC time constant	16	1.06
L.O. (base)	17	3.2
L.O. (emitter)	18	2.51

FM-Front-End- data using application circuit

Antenna impedance 75 Ω, $Z_{load\ IF}$ = 330 Ω, V_S = 8.5 V, T_{amb} = 25°C

Characteristics		Min.	Typ.	Max.	
Supply current	I_S		32		mA
Tuning range	f	88		108	MHz
Tuning voltage – at 88 MHz (equal IC's reference voltage) – at 108 MHz	 V_{tune} V_{tune}		 1.7 6.5		 V V
Center I. F.	f		10.7*		MHz
I. F. output bandwidth at – 3 dB	B_{IF}		130*		kHz
Power gain	G		46*		dB
Gain variation versus the band	ΔG		1		dB
Noise figure	NF		6		dB
Image rejection		57	70		dB
RF intermodulation			70		dB
½ I. F. rejection			90		dB
Spurious response, 2nd osc. harmonic			90		dB
I. F. rejection		85			dB
Osc. output voltage at 520 Ω load	V_{osc}		200		mV_{rms}

* Depending on ceramic I. F. filters to be used



Block diagram of the test set up

Test conditions:

- De-emphasis – 75 µs
- AF bandwidth 30 Hz – 20 kHz
- RMS, unweighted

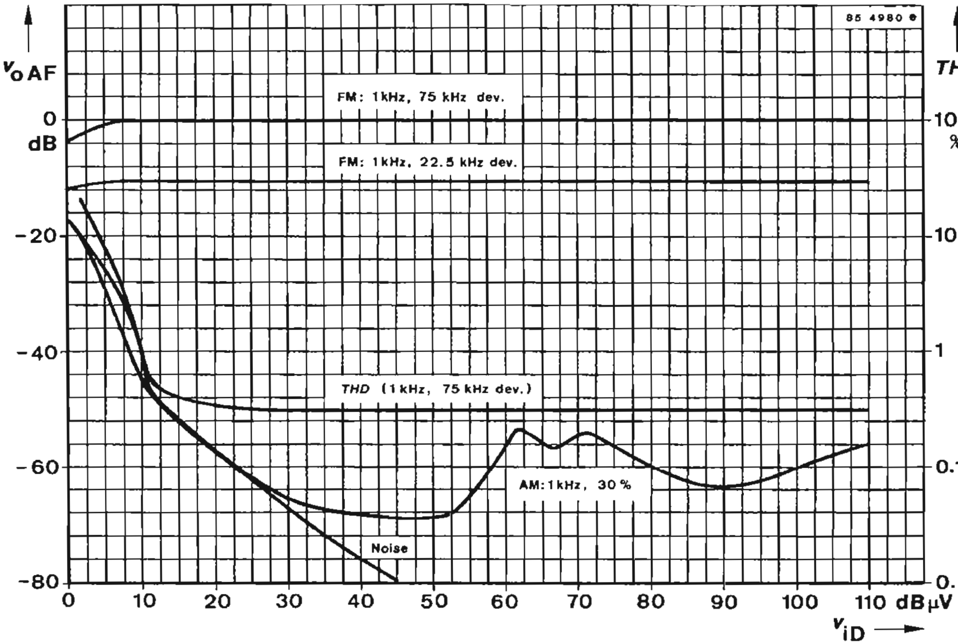
Set up for one signal measurement:

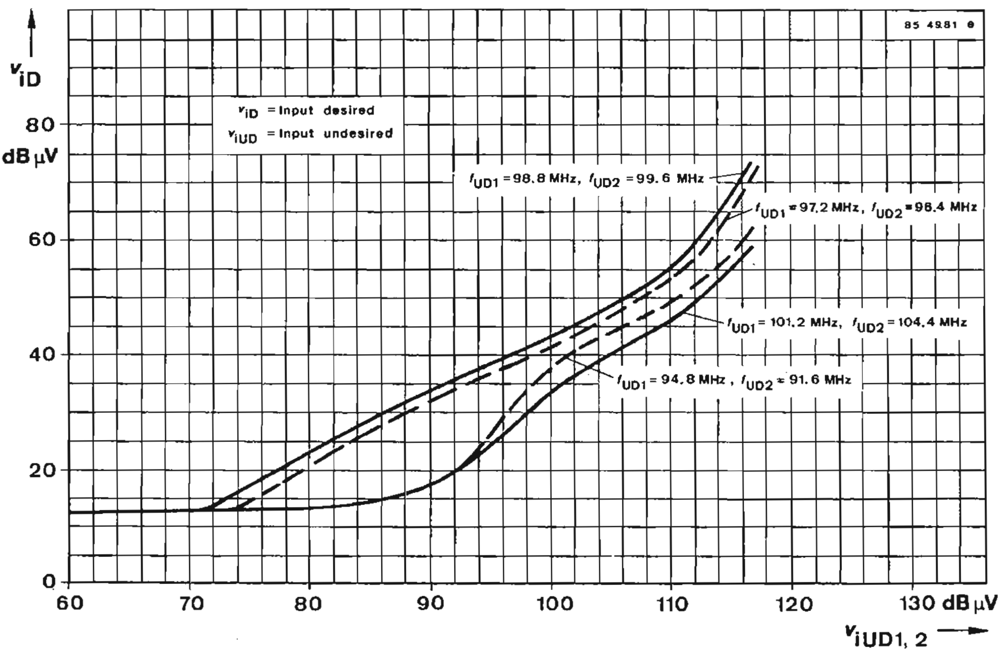
- f_D = 98 MHz

Note: v_{oAF} related to 75 kHz dev., 1 kHz, v_{iD} = 66 dB µV

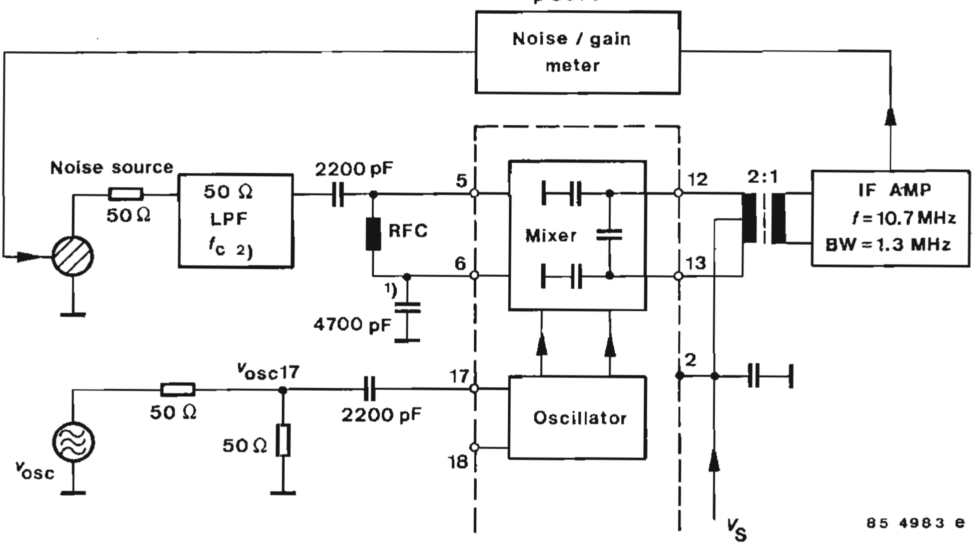
Set up for three signals intermodulation measurement:

- S_D: f_D = 98 MHz, FM: 1 kHz, 22.5 kHz dev.
- S_{UD1}: FM: 0.15 kHz, 22.5 kHz dev.
- S_{UD2}: Unmodulated
- v_{iD} for 35 dB SINAD


85 4980 e
v_o AF
0 dB
-20
-40
-60
-80
THD
100 %
10
1
0.1
0.01
FM: 1kHz, 75 kHz dev.
FM: 1kHz, 22.5 kHz dev.
THD (1kHz, 75 kHz dev.)
AM: 1kHz, 30 %
Noise
0 10 20 30 40 50 60 70 80 90 100 110 dBµV
v_{iD}


85 4981 e
v_{iD}
80 dBµV
60
40
20
0
v_{iD} = Input desired
v_{iUD} = Input undesired
f_{UD1} = 98.8 MHz, f_{UD2} = 99.6 MHz
f_{UD1} = 97.2 MHz, f_{UD2} = 96.4 MHz
f_{UD1} = 101.2 MHz, f_{UD2} = 104.4 MHz
f_{UD1} = 94.8 MHz, f_{UD2} = 91.6 MHz
60 70 80 90 100 110 120 130 dBµV
$v_{iUD1, 2}$

VHF/UHF – application



[1] Mounted as close as possible between Pin 6 and Ground

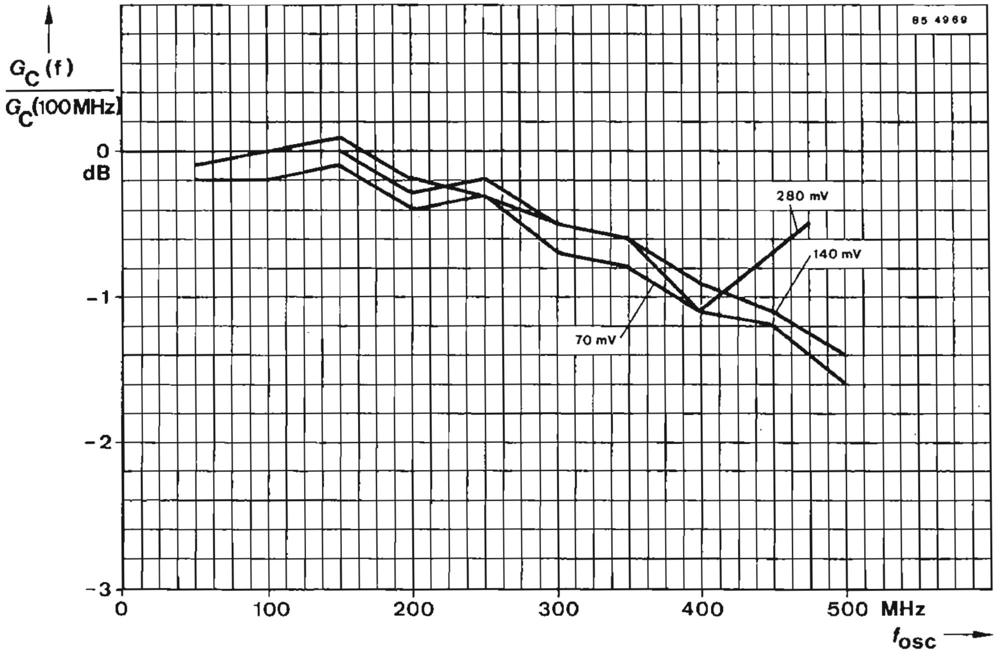
[2] Cut off frequency, f_c adjustment: $(f_{osc}+f_{IF})<f_c<(2\ f_{osc}-f_{IF})$

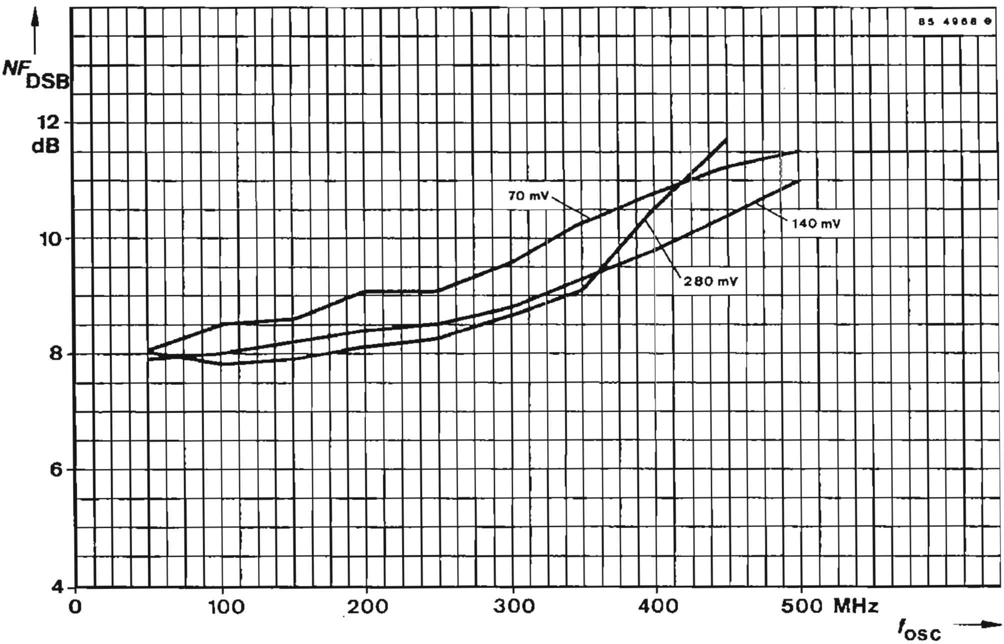
Test circuit for conversion gain and noise measurement

Mixer, VHF characteristics

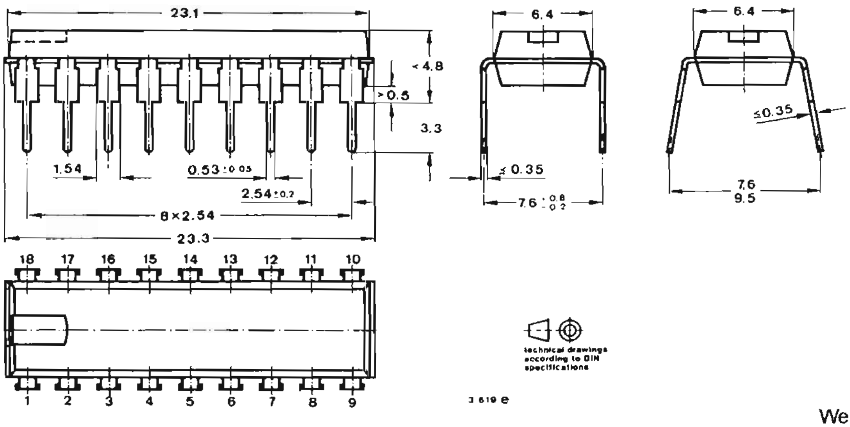
Test conditions: $R_{g5}=50\ \Omega$, $R_{L12\text{-}13}=200\ \Omega$, $V_S=10$ V
$f_{IF}=10.7$ MHz, $f_{iRF}=200$ MHz, $f_{osc}=f_{iRF}+f_{IF}$, $V_{osc\ 17}=140\ mV_{RMS}$

Test parameter	Symbol	Typ	Unit
Conversion power gain,			
f_{IF} = 10.7 MHz	G_c	2.5	dB
f_{IF} = 70 MHz	G_c	2.3	dB
Double side band noise figure,			
f_{osc} = 200 MHz	NF_{DSB}	8.2	dB
3rd order intercept input signal level	IP_3	5.5	dBm
Parallel input resistance Pin 5, f = 200 MHz	Rp_5	1500	Ω
Parallel input capacitance Pin 5, f = 200 MHz	Cp_5	3.3	pF
Parallel input resistance Pin 17, f = 200 MHz	Rp_{17}	4000	Ω
Parallel input capacitance Pin 17, f = 200 MHz	Cp_{17}	2.7	pF
Conversion transconductance	G_c	6.4	m-mho


85 4969
G_C (f) / G_C(100MHz)
0 dB
−1
−2
−3
0
100
200
300
400
500 MHz
f_{osc}
280 mV
140 mV
70 mV

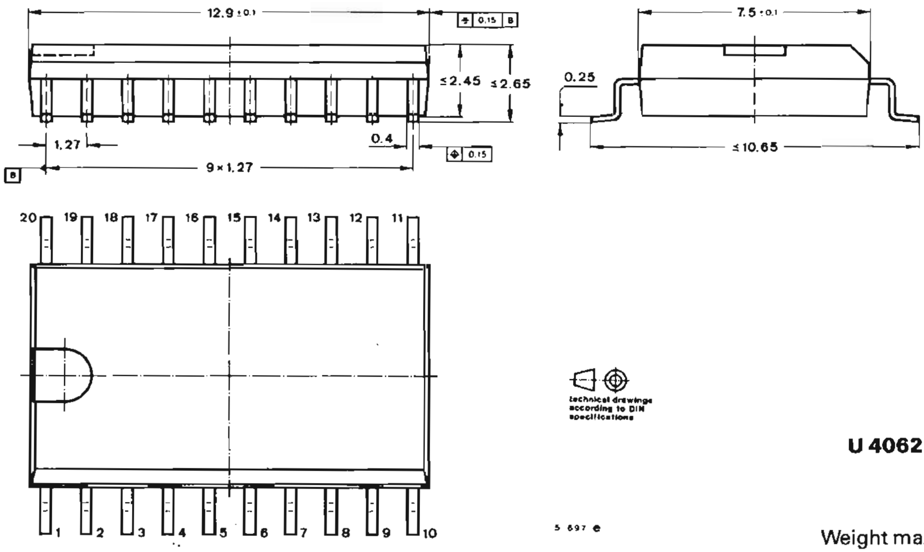

85 4968 9
NF_{DSB}
12 dB
10
8
6
4
0
100
200
300
400
500 MHz
f_{osc}
70 mV
140 mV
280 mV

Dimensions in mm



U 4062 B

Case
DIP 18
Weight max. 1.5 g



U 4062 B – FP

Case
SO 20
Weight max. 1.5 g

DIVERSE AUDIO APPLICATIONS

Audio power amplifier	● TBA 800
	● TBA 810 S/TBA 810 AS
	● TBA 810 T/TBA 810 AT
	● TDA 2006
	● TDA 2030
	● TDA 2040
LED – display driver	● U 237 BG · U 247 BG U 257 BG · U 267 BG
	● U 244 B · U 254 B
	● U 2066 B · U 2067 B
	● U 2068 B

Monolithic Integrated Circuit

Application: Audio power amplifier, especially for TV-receivers

Features:

- High output current, up to 1.5 A
- Wide range of supply voltage, 5 to 30 V
- High output power
  - without heat sink 2.5 W
  - with heat sink 5.0 W
- Very high efficiency 70%

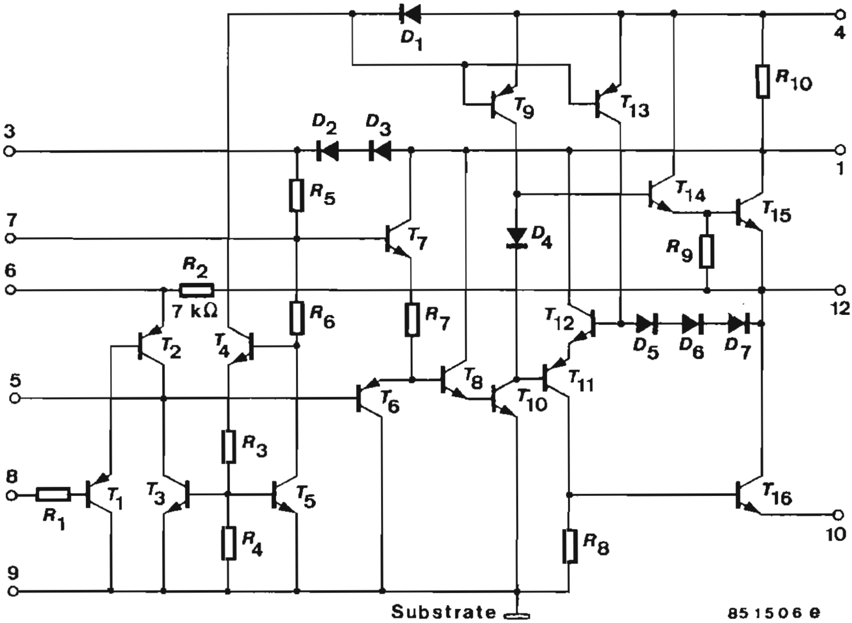


Fig.1 Diagram and pin connections

Absolute maximum ratings

Reference point Pin 9, 10

Supply voltage	Pin 1, 3	V_S	30	V
Surge output current (non repetitive)	Pin 12	I_{OP}	2	A
Peak output current (repetitive)		I_{OM}	1.5	A
Power dissipation	Fig. 2, 3			
$T_{amb} = 80$		P_{tot}	1	W
$T_{case} = 90°C$		P_{tot}	5	W
Junction temperature		T_j	+150	°C
Storage temperature range		T_{stg}	−40...+150	°C

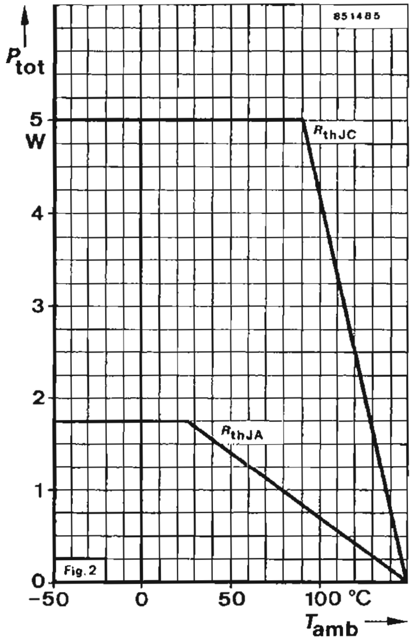
Thermal resistance

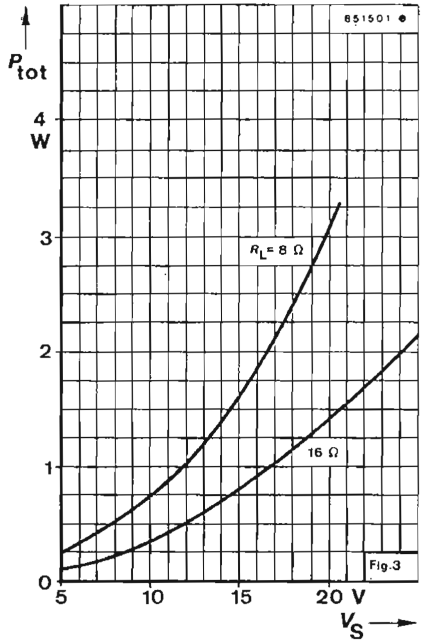
			Min.	Typ.	Max.	
Junction ambient		R_{thJA}			70	K/W
Junction case		R_{thJC}			12	K/W

Electrical characteristics

V_S = 24 V, R_f = 56 Ω, reference points Pin 9, 10, T_{amb} = 25°C, unless otherwise specified

			Min.	Typ.	Max.	
Supply voltage range	Pin 1, 3	V_S	5		30	V
Quiescent output voltage	Pin 12	V_{QB}	11	12	13	V
Quiescent drain current	Pin 1, 3	I_{SB}		9	20	mA
Input current	Pin 8	I_I		1	5	µA
Output power R_L = 16 Ω, f = 1 kHz, d = 10%		P_o	4.4	5		W
Input voltage	Pin 8	V_i			220	mV
Input voltage P_o = 5 W, f = 1 kHz, R_L = 16 Ω	Pin 8	V_i		80		mV
Input resistance	Pin 8	R_i		5		MΩ
Band width (–3 dB) R_L = 16 Ω, C_3 = 330 pF		B		40...20 000		Hz
Distortion Fig. 4, 6, 7 R_L = 16 Ω, f = 1 kHz, P_o = 50 mW to 2.5 W		d		0.5		%
Voltage gain Fig. 4 R_L = 16 Ω, f = 1 kHz						
Open loop		G_{vog}		80		dB
Closed loop		G_{vof}	39	42	45	dB
Input noise voltage B = 40...20000 Hz	Pin 8	V_{ni}		5		µV
Input noise current B = 40...20000 HZ	Pin 8	I_{ni}		0.2		nA
Efficiency P_o = 4 W, R_L = 16 Ω, f = 1 kHz		η		70		%





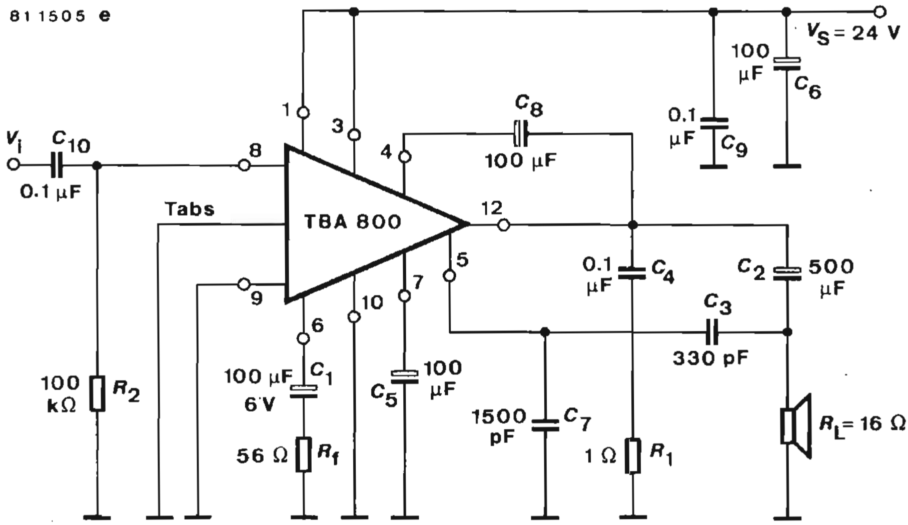
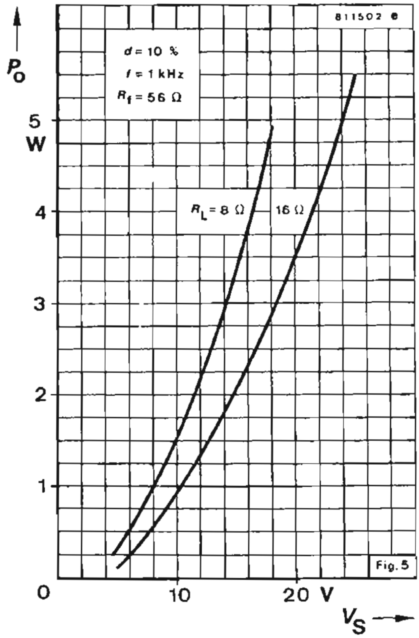
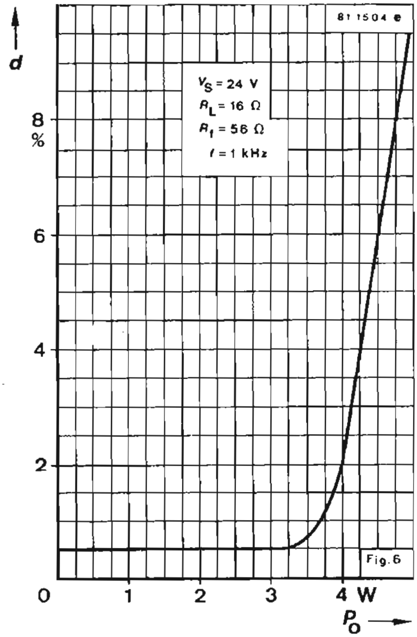


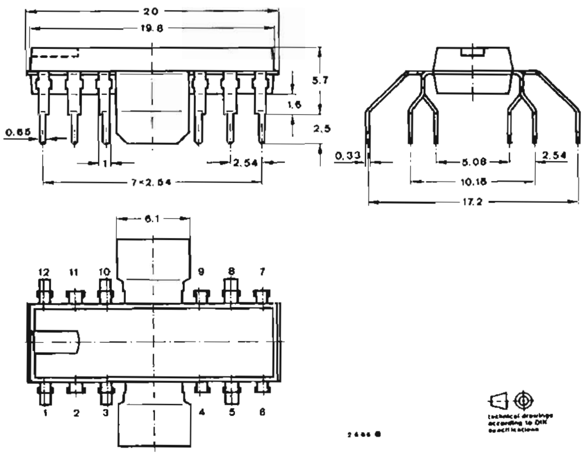
Fig. 4 Test circuit for: P_o, P_{tot}, d, η

Supply voltage must be disconnected before inserting the integrated circuit in the socket.





Dimensions in mm



QIP-Special
Weight max. 1.5 g

Monolithic Integrated Circuit

Application: Audio power amplifier

Features:

- Thermal shut-down
- High output current, up to 2.5 A
- Wide range of supply voltage, 4 to 20 V
- High output power 7 W
- Low cross-over distortion
- Low harmonic distortion
- Very high efficiency 70%

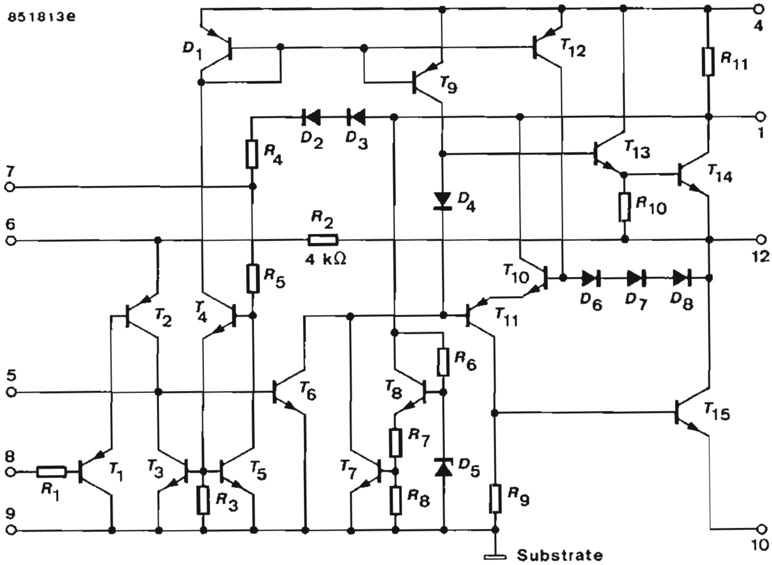


Fig. 1 Diagram and pin connections

Absolute maximum ratings

Reference point Pin 9, 10

Supply voltage	Pin 1	V_S	20	V
Surge output current	Pin 12	I_{OS}	3.5	A
Peak output current (repetitive)	Pin 12	I_{OM}	2.5	A
Power dissipation	Fig. 2, 3, 3, 4, 5, 6			
T_{amb} = 80°C	**TBA 810 S**	P_{tot}	1	W
T_{case} = 100°C	**TBA 810 AS**	P_{tot}	5	W
Junction temperature		T_j	+150	°C
Storage temperature range		T_{stg}	−40...+150	°C

B2/V.2.571/1174 A2

Thermal resistances

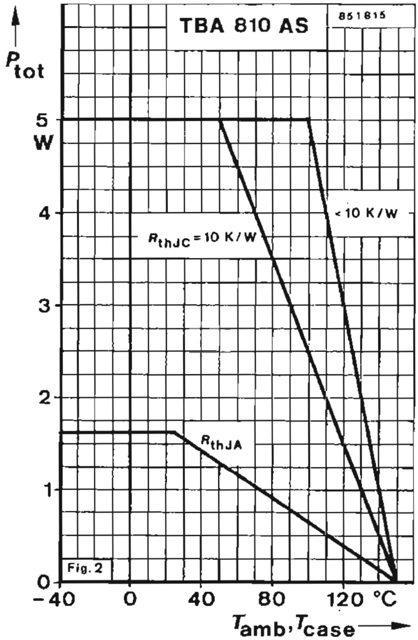
				Min.	Typ.	Max.	
Junction ambient		**TBA 810 S**	R_{thJA}			70	K/W
		TBA 810 AS	R_{thJA}			80	K/W
Junction case	Fig. 3, 4, 5	**TBA 810 S**	R_{thJC} [1]			12	K/W
	Fig. 2	**TBA 810 AS**	R_{thJC} [1]			10	K/W

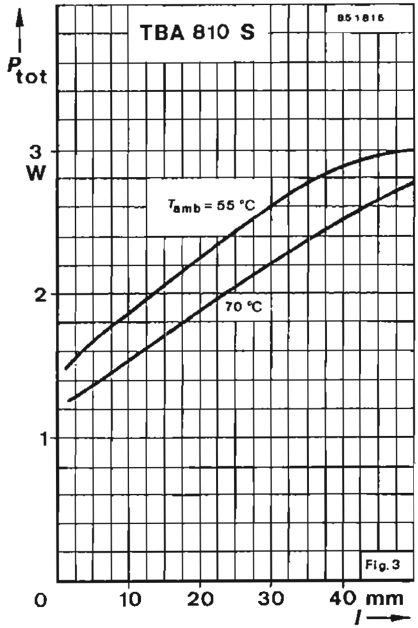
Electrical characteristics

T_{amb} = 25°C, R_f = 56 Ω, reference point: Pin 9,10, unless otherwise specified

				Min.	Typ.	Max.	
Supply voltage range		Pin 1	V_S	4		20	V
Quiescent output voltage V_S = 14.4 V	Fig.13	Pin 12	V_{OB}	6.4	7.2	8	V
Quiescent drain current V_S = 14.4 V	Fig.12	Pin 1	I_{SB}		12	20	mA
Total supply current P_o = 6 W, V_S = 14.4 V, R_L = 4 Ω		Pin 1	I_{Stot}		600		mA
Thermal shut-down temperature P_{tot} = 2.8 W	Fig.11		T_{case}		120		°C
Supply voltage rejection ratio V_S = 14.4 V, R_L = 4 Ω, f_{hum} = 100 Hz	Fig.14,15		SVR		48		dB
Input current V_S = 14.4 V		Pin 8	I_{IB}		0.4	4	μA
Output power R_L = 4 Ω, f = 1 kHz, d = 10%	Fig. 6, 8, 9, 10, 11 V_S = 16.0 V		P_o		7		W
	V_S = 14.4 V		P_o	4.6	6		W
	V_S = 9.0 V		P_o		2.5		W
	V_S = 6.0 V		P_o		1		W
Input voltage		Pin 8	V_i			220	mV
Input voltage V_S = 14.4 V, P_o = 6 W, f = 1 kHz, R_L = 4 Ω,	Fig.18	Pin 8 R_f = 56 Ω	V_i		80		mV
		R_f = 22 Ω	V_i		35		mV
Input resistance		Pin 8	R_i		5		MΩ
Band width (–3 dB) V_S = 14.4 V, R_L = 4 Ω,	Fig.16 C_3 = 820 pF		B		40...20 000		Hz
	C_3 = 1500 pF		B		40...10 000		Hz

[1] with cooling plate R_{thCA} = 10 K/W





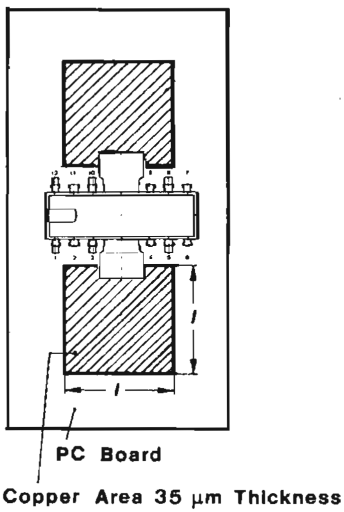


Fig. 4

81 2603 e

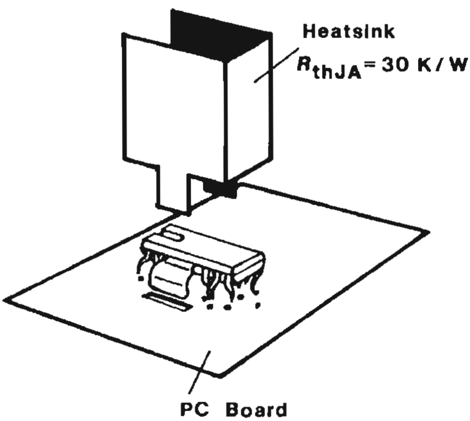


Fig. 5

				Min.	Typ.	Max.	
Distortion	Fig. 6, 19, 20						
V_S = 14.4 V, R_L = 4 Ω, f = 1 kHz, P_o = 50 mW to 3 W			d		0.3		%
Voltage gains V_S = 14.4 V, R_L = 4 Ω, f = 1 kHz							
Open loop			G_{vg}		80		dB
Closed loop	Fig. 17		G_{vf}	34	37	40	dB
Input noise voltage V_S = 14.4 V, B = 20...20000 Hz		Pin 8	V_{ni}		2		µV
Input noise current V_S = 14.4 V, B = 20...20000 Hz		Pin 8	I_{ni}		0.1		nA
Efficiency	Fig. 6, 9						
P_o = 5 W, V_S = 14.4 V, R_L = 4 Ω, f = 1 kHz			η		70		%

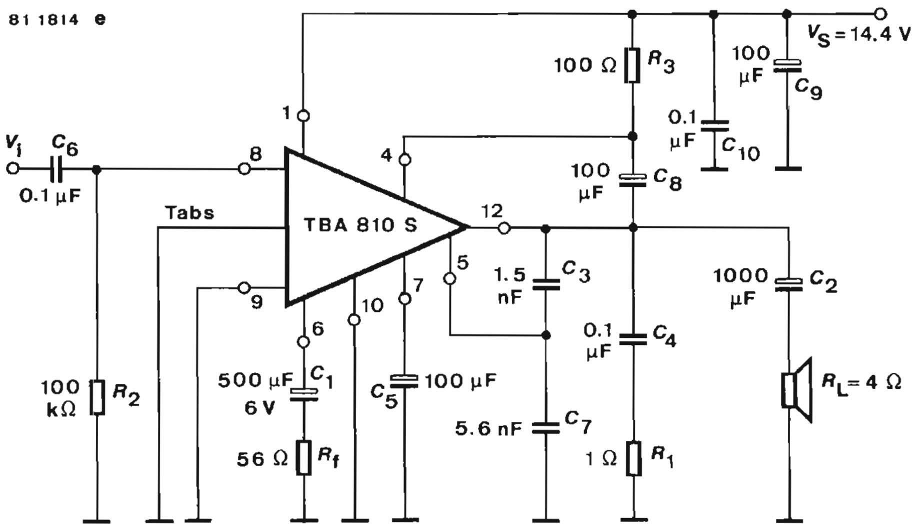
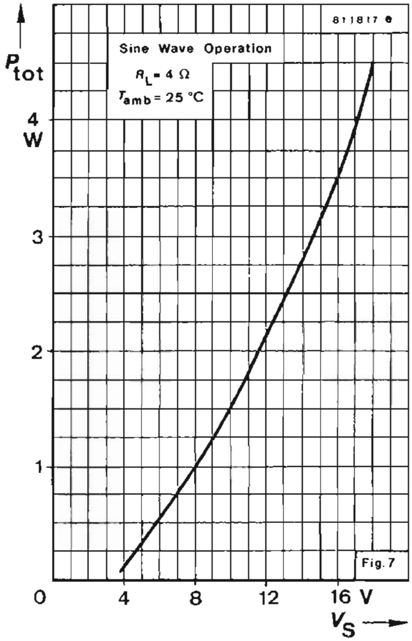


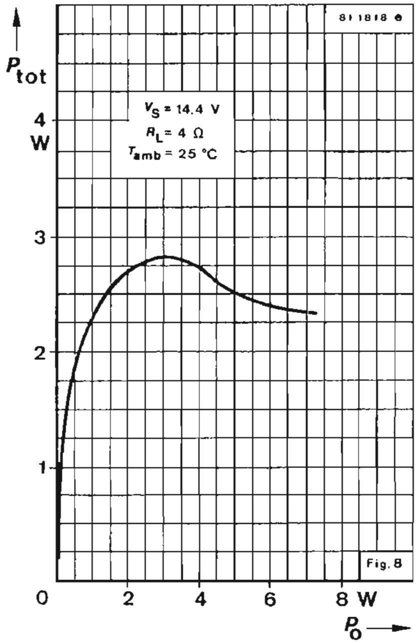
Fig. 6 Test circuit for: P_o, P_{tot}, d, η and application note

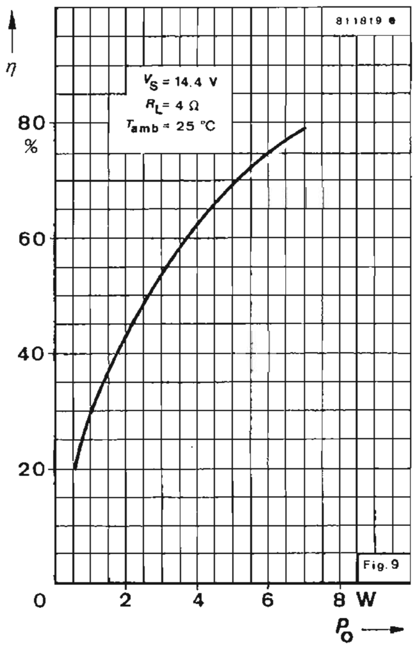
Thermal shut-down

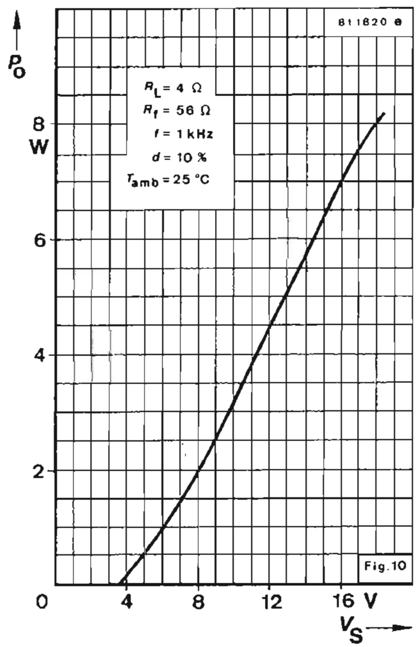
The presence of a thermal limiting circuit offers the following advantages:

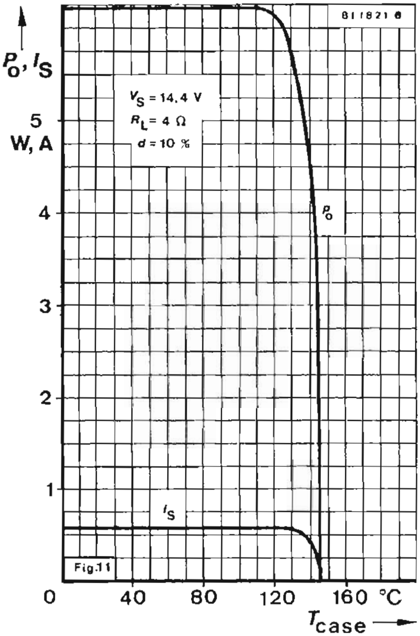
1. An overload on the output (even if it is permanent), or an above-limit ambient temperature can be easily supported.
2. The heat sink can have a smaller factor of safety compared with that of a conventional circuit. There is no device damage in the case of too high a junction temperature: all that happens is that P_O (and therefor P_{tot}) and I_S are reduced (Fig. 11).


811817 e
Sine Wave Operation
R_L = 4 Ω
T_{amb} = 25 °C
P_{tot}
4 W
3
2
1
0
4
8
12
16 V
V_S
Fig. 7

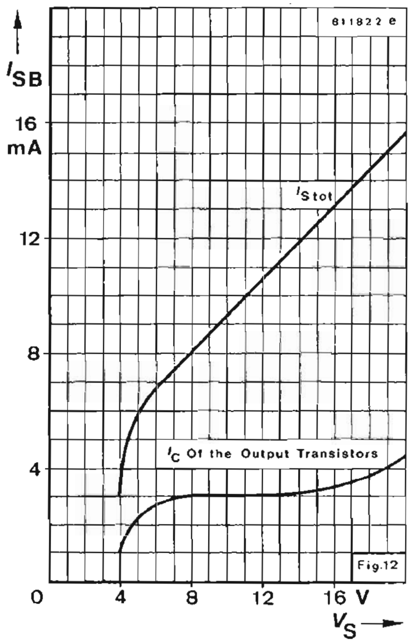

811818 e
V_S = 14.4 V
R_L = 4 Ω
T_{amb} = 25 °C
P_{tot}
4 W
3
2
1
0
2
4
6
8 W
P_o
Fig. 8


811819 e
V_S = 14.4 V
R_L = 4 Ω
T_{amb} = 25 °C
η
80 %
60
40
20
0
2
4
6
8 W
P_o
Fig. 9

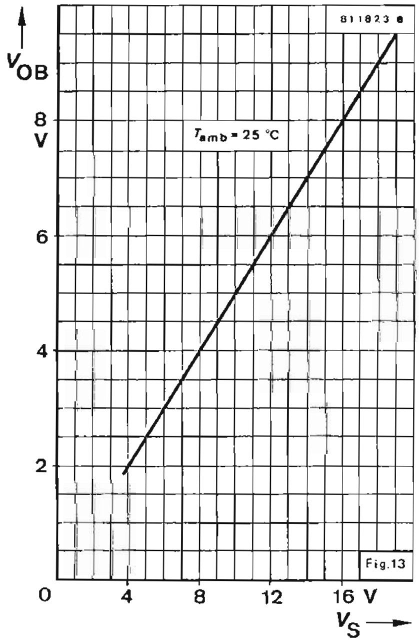

811820 e
R_L = 4 Ω
R_f = 56 Ω
f = 1 kHz
d = 10 %
T_{amb} = 25 °C
P_o
8 W
6
4
2
0
4
8
12
16 V
V_S
Fig. 10



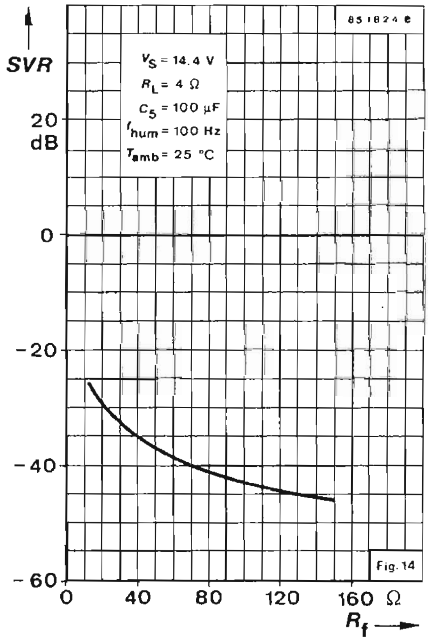
811821 e
P_o, I_S
5
W, A
4
3
2
1
0
V_S = 14.4 V
R_L = 4 Ω
d = 10 %
P_o
I_S
Fig.11
40
80
120
160 °C
T_{case}



811822 e
I_{SB}
16
mA
12
8
4
0
$I_{S\,tot}$
I_C Of the Output Transistors
Fig.12
4
8
12
16 V
V_S



811823 e
V_{OB}
8
V
6
4
2
0
T_{amb} = 25 °C
Fig.13
4
8
12
16 V
V_S



851824 e
SVR
20
dB
0
-20
-40
-60
V_S = 14.4 V
R_L = 4 Ω
C_5 = 100 μF
f_{hum} = 100 Hz
T_{amb} = 25 °C
Fig.14
0
40
80
120
160 Ω
R_f

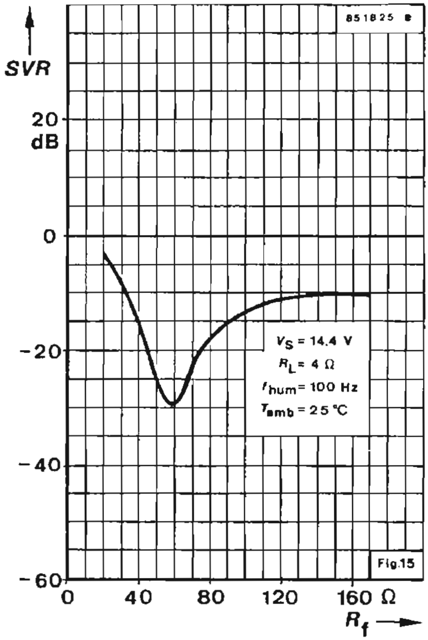


Fig.15

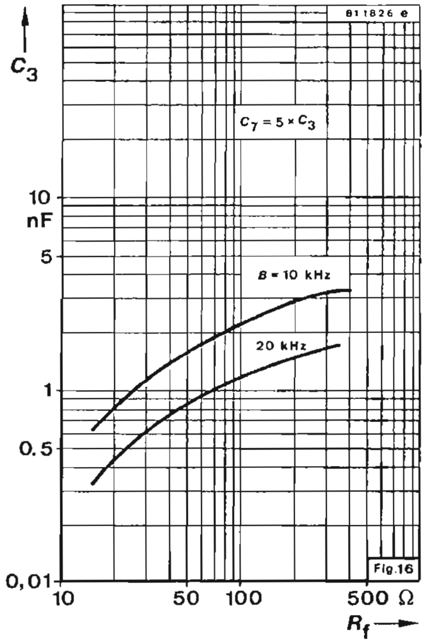


Fig.16

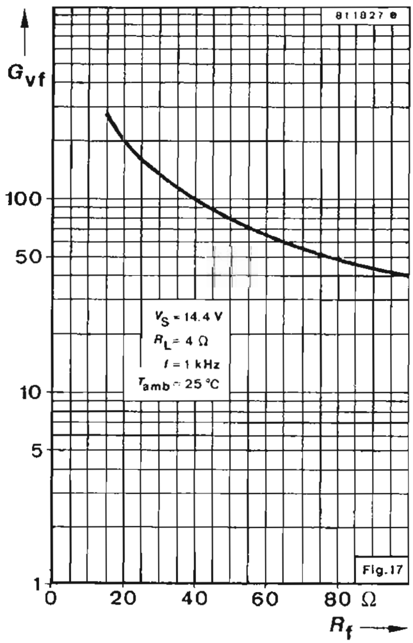


Fig.17

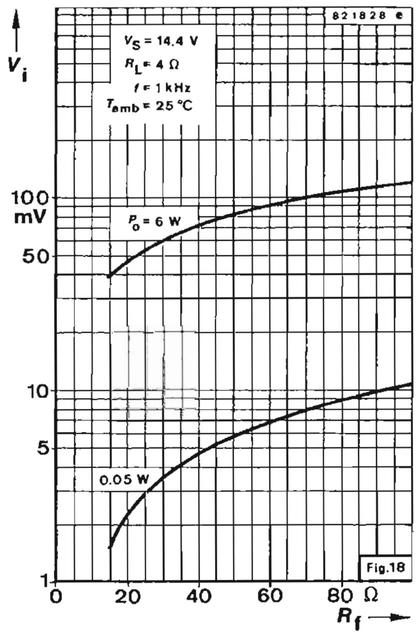


Fig.18

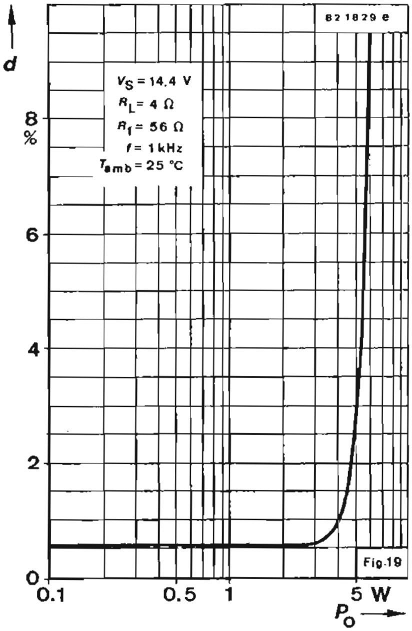


Fig. 19

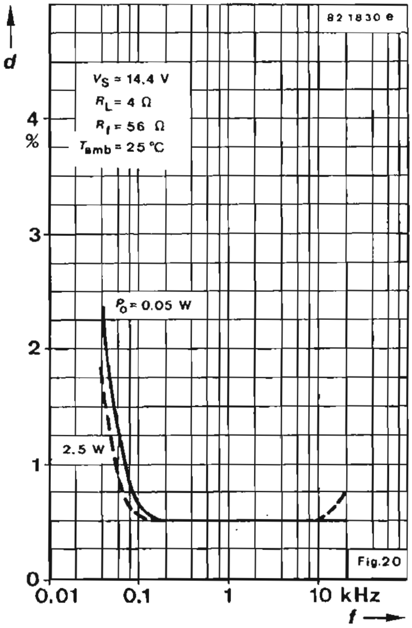
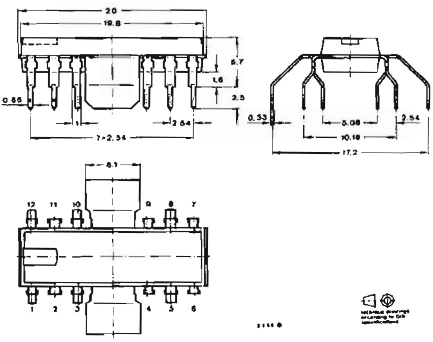
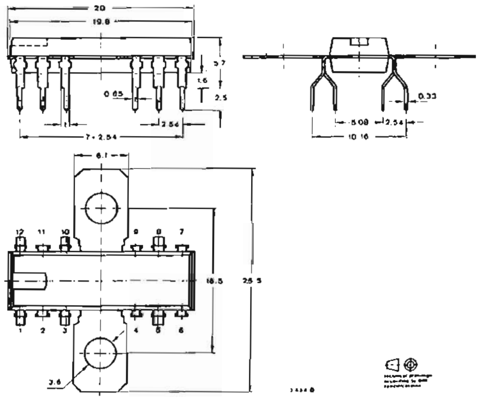


Fig. 20

Dimensions in mm





TBA 810 S

TBA 810 AS

QIP-Special
Weight max. 1.5 g

Monolithic Integrated Circuit

Application: Audio power amplifier

Features:

- Thermal shut-down
- High output current, up to 3 A
- Wide range of supply voltage, 4 to 25 V
- High output power 7 W
- Low cross-over distortion
- Low harmonic distortion
- Very high efficiency 70%

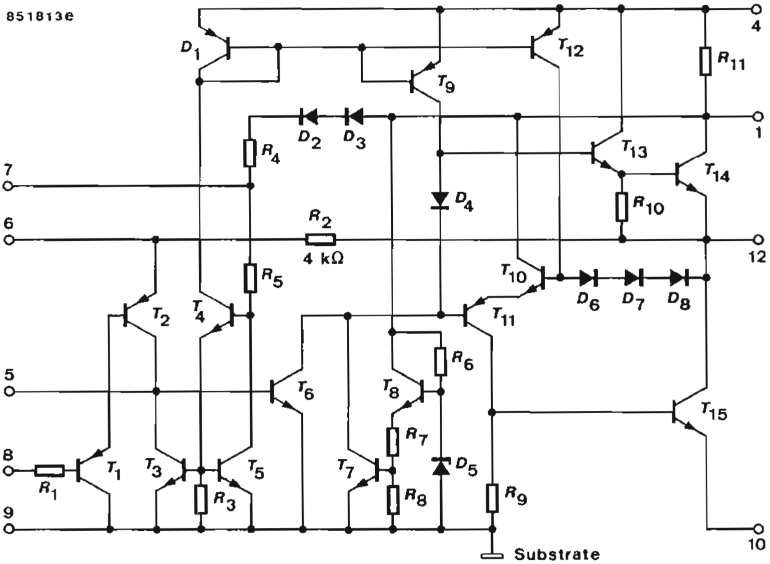


Fig. 1 Diagram and pin connections

Absolute maximum ratings

Reference point Pin 9,10

Supply voltage	Pin 1	V_S	25	V
Surge output current	Pin 12	I_{OS}	3.5	A
Peak output current (repetitive)	Pin 12	I_{OM}	3	A
Power dissipation	Fig. 2, 3, 4, 5, 6			
T_{amb} = 80°C	**TBA 810 T**	P_{tot}	1	W
T_{case} = 100°C	**TBA 810 AT**	P_{tot}	5	W
Junction temperature		T_j	+150	°C
Storage temperature range		T_{stg}	−40...+150	°C

TBA 810 T · TBA 810 AT

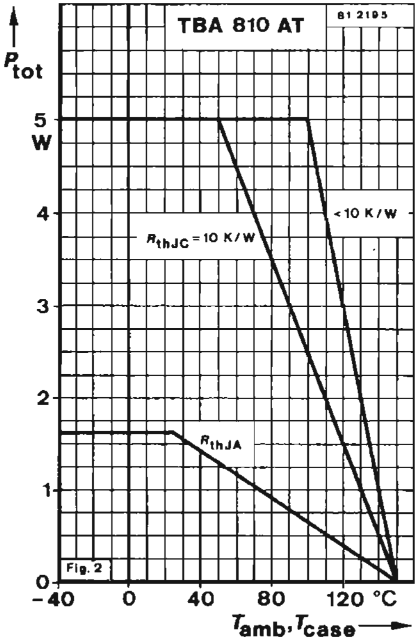
Thermal resistances				Min.	Typ.	Max.	
Junction ambient		TBA 810 T	R_{thJA}			70	K/W
		TBA 810 AT	R_{thJA}			80	K/W
Junction case	Fig. 3, 4, 5	TBA 810 T	R_{thJC}[1]			12	K/W
	Fig. 2	TBA 810 AT	R_{thJC}[1]			10	K/W

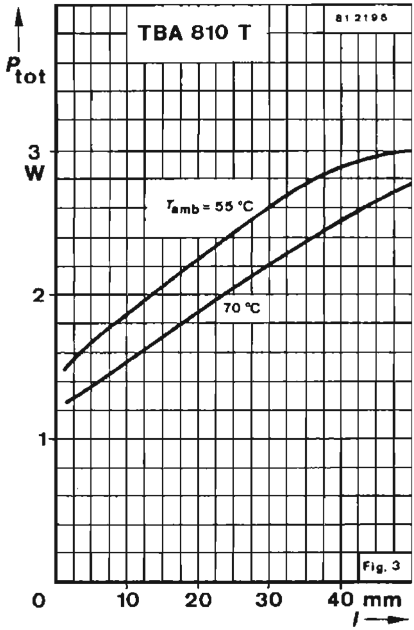
Electrical characteristics

T_{amb} = 25°C, R_f = 56 Ω, reference point: Pin 9,10, unless otherwise specified

				Min.	Typ.	Max.	
Supply voltage range		Pin 1	V_S	4		25	V
Quiescent output voltage V_S = 14.4 V	Fig.13	Pin 12	V_{OB}	6.4	7.2	8	V
Quiescent drain current V_S = 14.4 V	Fig.12	Pin 1	I_{SB}		12	20	mA
Total supply current P_o = 6 W, V_S = 14.4 V, R_L = 4 Ω		Pin 1	I_{Stot}		600		mA
Thermal shut-down temperature P_{tot} = 2.8 W	Fig.11		T_{case}		120		°C
Supply voltage rejection ratio V_S = 14.4 V, R_L = 4 Ω, f_{hum} = 100 Hz	Fig.14,15		*SVR*		48		dB
Input current V_S = 14.4 V		Pin 8	I_{IB}		0.4	4	μA
Output power, R_L = 4 Ω, f = 1 kHz, d = 10%	Fig. 6, 8, 9,10,11 V_S = 16.0 V		P_o		7		W
	V_S = 14.4 V		P_o	4.6	6		W
	V_S = 9.0 V		P_o		2.5		W
	V_S = 6.0 V		P_o		1		W
Input voltage		Pin 8	V_i			220	mV
Input voltage V_S = 14.4 V, P_o = 6 W, f = 1 kHz, R_L = 4 Ω	Fig.18	Pin 8 R_f = 56 Ω	V_i		80		mV
		R_f = 22 Ω	V_i		35		mV
Input resistance		Pin 8	R_i		5		MΩ
Band width (–3 dB) V_S = 14.4 V, R_L = 4 Ω, C_3 = 820 pF	Fig.16		*B*		40...20 000		Hz
C_3 = 1500 pF			*B*		40...10 000		Hz

[1] with cooling plate R_{thCA} = 10 K/W


TBA 810 AT
81 2195
P_{tot}
5
W
4
3
2
1
0
-40
0
40
80
120 °C
T_{amb}, T_{case}
<10 K/W
R_{thJC} = 10 K/W
R_{thJA}
Fig. 2


TBA 810 T
81 2196
P_{tot}
3
W
2
1
0
10
20
30
40 mm
l
T_{amb} = 55 °C
70 °C
Fig. 3

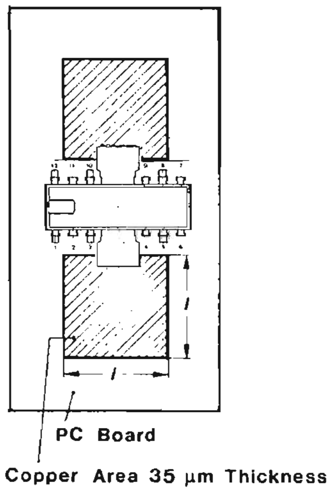

l
l
PC Board
Copper Area 35 µm Thickness

Fig. 4

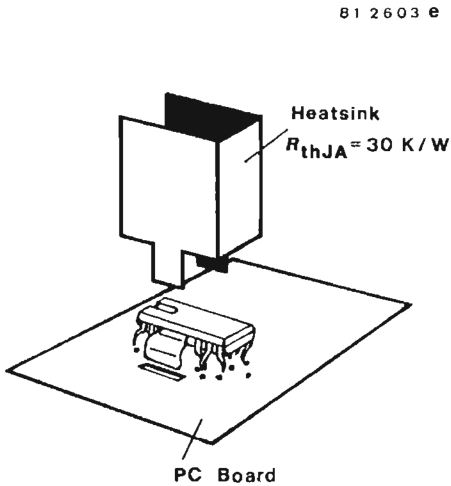

81 2603 e
Heatsink
R_{thJA} = 30 K/W
PC Board

Fig. 5

				Min.	Typ.	Max.	
Distortion V_S = 14.4 V, R_L = 4 Ω, f = 1 kHz, P_o = 50 mW to 3 W			d		0.3		%
Voltage gains V_S = 14.4 V, R_L = 4 Ω, f = 1 kHz							
Open loop			G_{vg}		80		dB
Closed loop	Fig. 17		G_{vf}	34	37	40	dB
Input noise voltage V_S = 14.4 V, B = 20...20000 Hz		Pin 8	V_{ni}		2		μV
Input noise current V_S = 14.4 V, B = 20...20000 Hz		Pin 8	I_{ni}		0.1		nA
Efficiency P_o = 5 W, V_S = 14.4 V, R_L = 4 Ω, f = 1 kHz	Fig. 6, 9		η		70		%

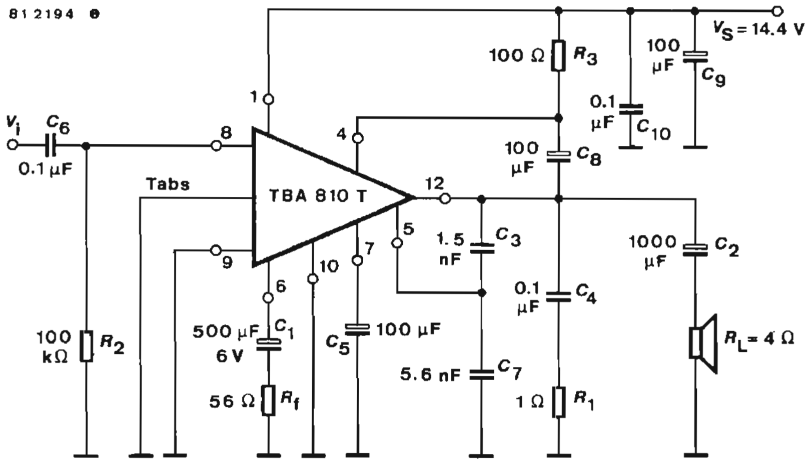
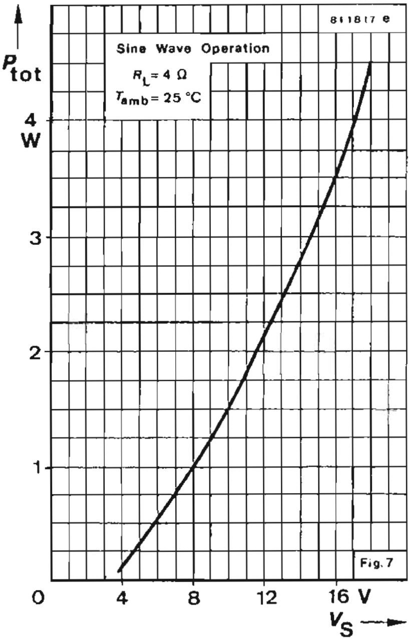


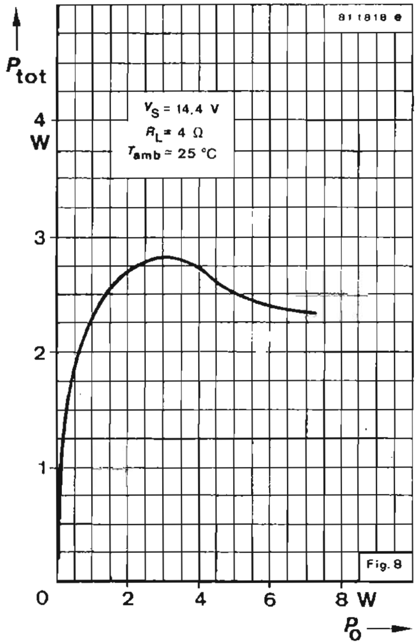
Fig. 6 Test circuit for: P_o, P_{tot}, d, η and application note

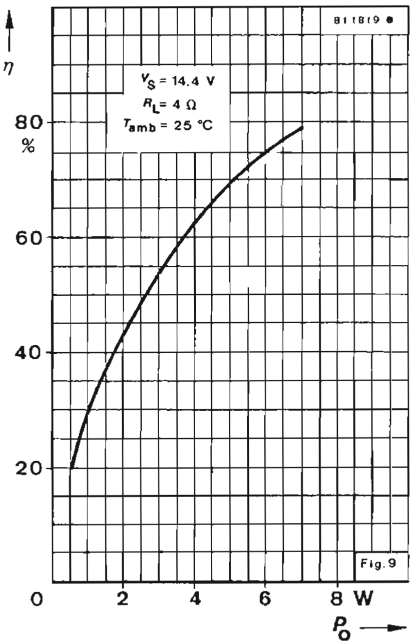
Thermal shut-down

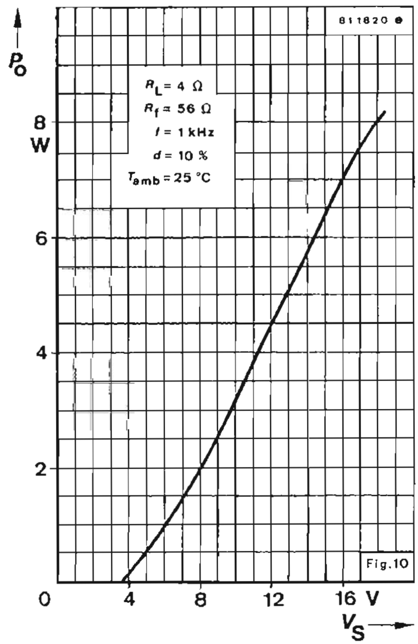
The presence of a thermal limiting circuit offers the following advantages:

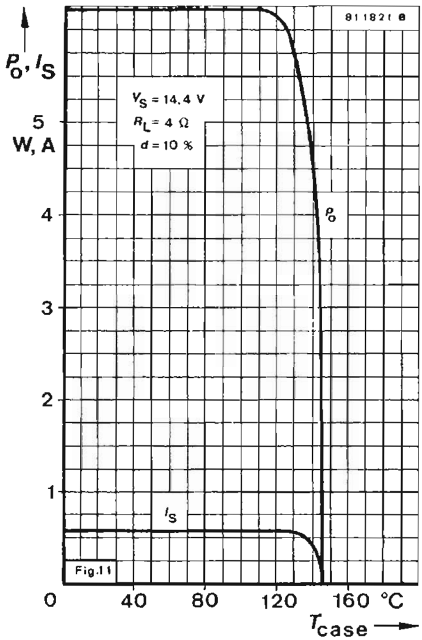
1. An overload on the output (even if it is permanent), or an above-limit ambient temperature can be easily supported.
2. The heat sink can have a smaller factor of safety compared with that of a conventional circuit. There is no device damage in the case of too high a junction temperature: all that happens is that P_O (and therefore P_{tot}) and I_S are reduced (Fig. 11).

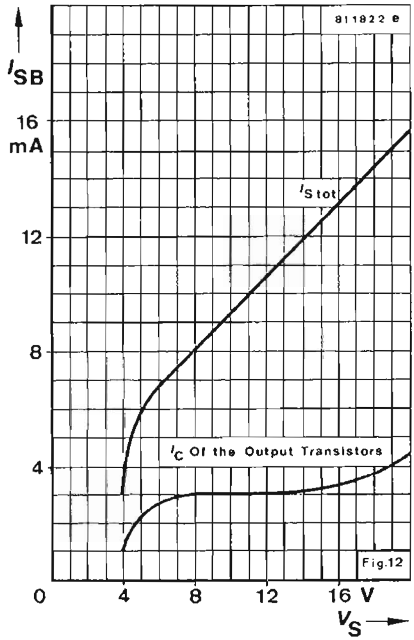

811817 e
Sine Wave Operation
R_L = 4 Ω
T_{amb} = 25 °C
P_{tot}
4 W
3
2
1
0
4
8
12
16 V
V_S
Fig. 7

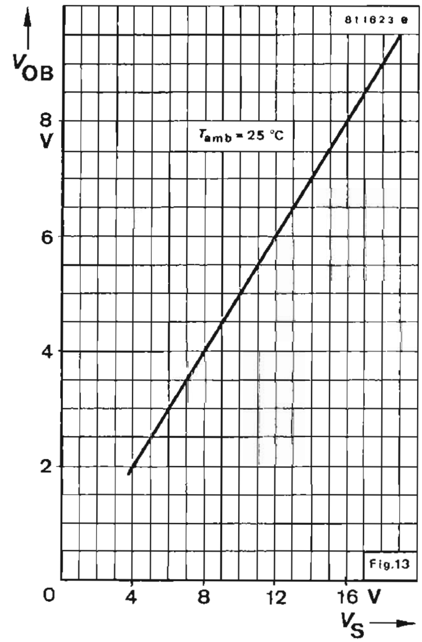

811818 e
V_S = 14.4 V
R_L = 4 Ω
T_{amb} = 25 °C
P_{tot}
4 W
3
2
1
0
2
4
6
8 W
P_o
Fig. 8

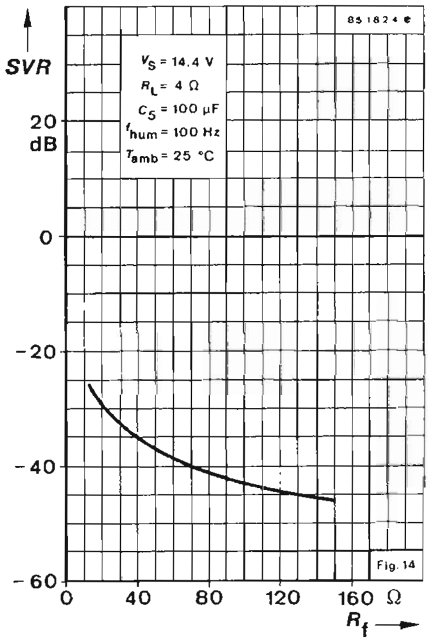

811819 e
V_S = 14.4 V
R_L = 4 Ω
T_{amb} = 25 °C
η
80 %
60
40
20
0
2
4
6
8 W
P_o
Fig. 9


811820 e
R_L = 4 Ω
R_f = 56 Ω
f = 1 kHz
d = 10 %
T_{amb} = 25 °C
P_o
8 W
6
4
2
0
4
8
12
16 V
V_S
Fig. 10


811821 e
P_o, I_S
5
W, A
4
3
2
1
0
V_S = 14.4 V
R_L = 4 Ω
d = 10 %
P_o
I_S
Fig.11
40
80
120
160 °C
T_{case}


811822 e
I_{SB}
16
mA
12
8
4
0
$I_{S tot}$
I_C Of the Output Transistors
Fig.12
4
8
12
16 V
V_S


811823 e
V_{OB}
8
V
6
4
2
0
T_{amb} = 25 °C
Fig.13
4
8
12
16 V
V_S


851824 e
SVR
20
dB
0
-20
-40
-60
V_S = 14.4 V
R_L = 4 Ω
C_5 = 100 μF
f_{hum} = 100 Hz
T_{amb} = 25 °C
Fig.14
0
40
80
120
160 Ω
R_f

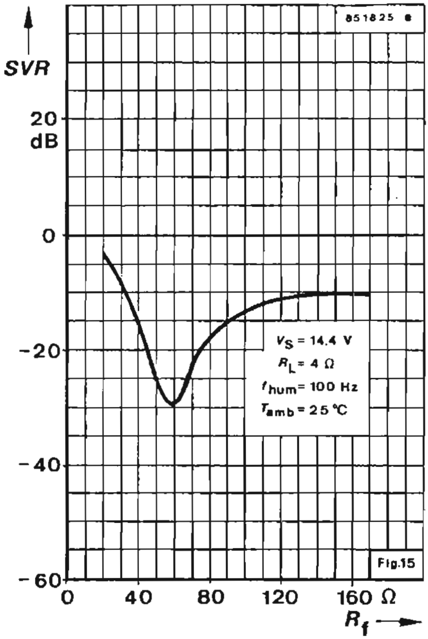


Fig.15

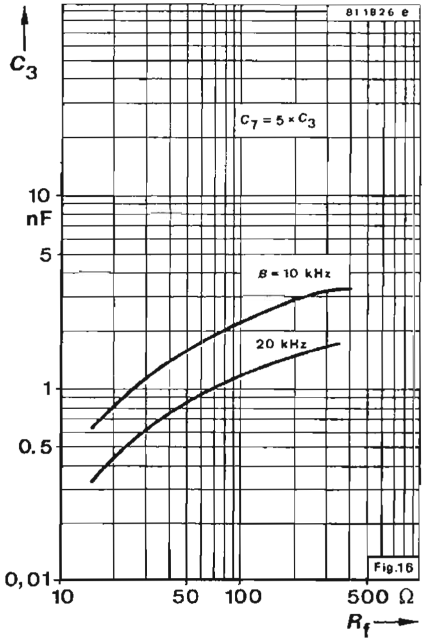


Fig.16

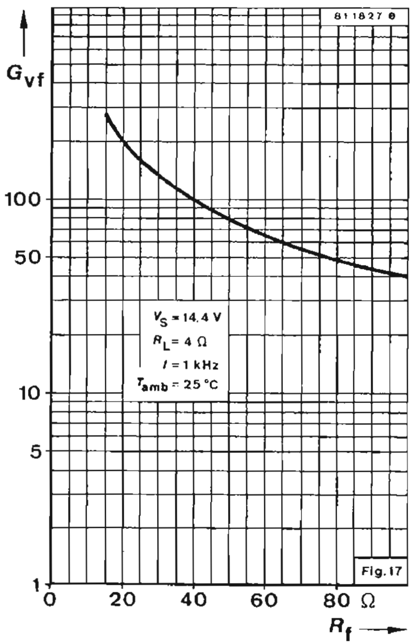


Fig.17

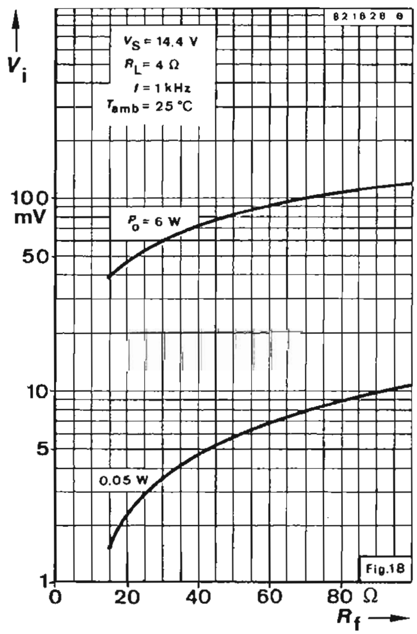
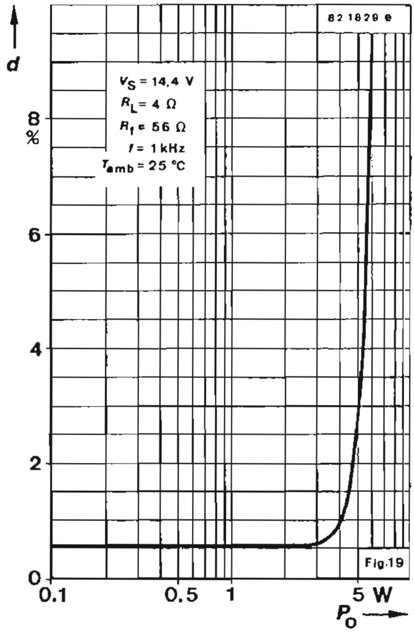
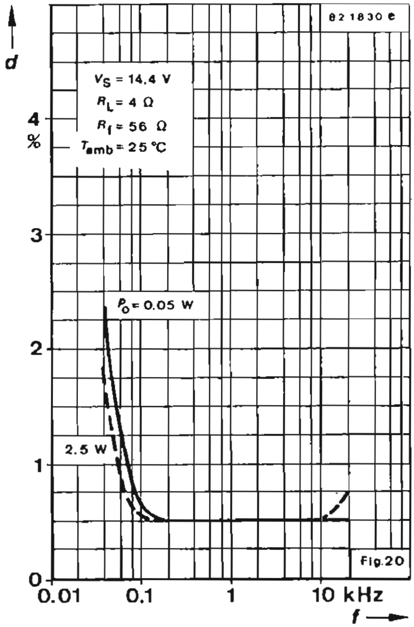
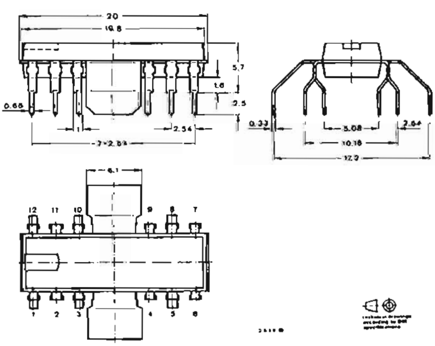


Fig.18



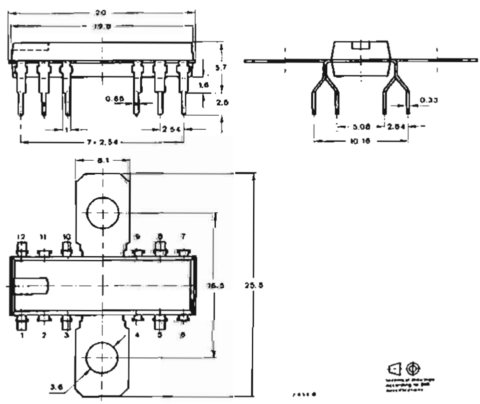


Dimensions in mm



TBA 810 T

QIP-Special
Weight max. 1.5 g



TBA 810 AT

Monolithic Integrated Circuit

Application: Audio power amplifier for radios and television receivers

Features:

- Output stage short circuit protected
- Thermal shut down protected
- Characteristic specification according to DIN 45000
- Simple mounting due to ≈ TO-220 casing

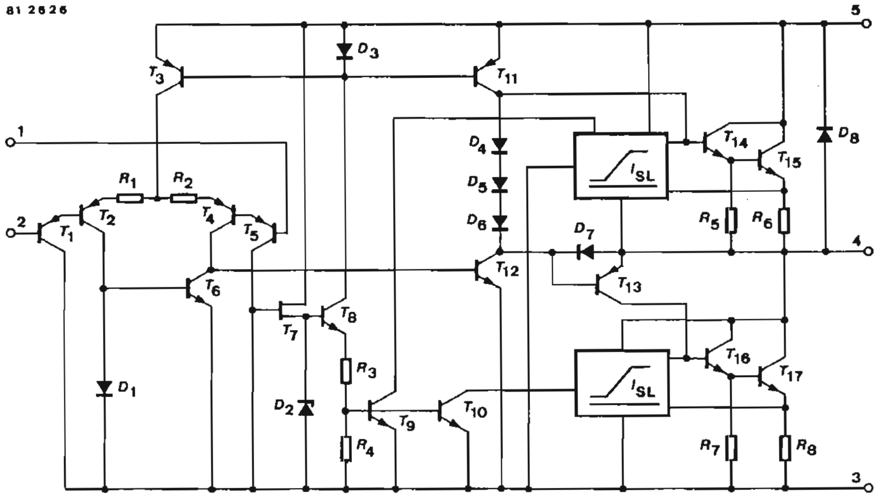


Fig. 1 Diagram and pin connections, Pin 3 connected with metallic surface

Absolute maximum ratings

Reference point: Common power supply

Supply voltage		Pin 5−3	$\pm V_S$	15	V
Input voltage		Pin 1+2	V_i	V_S	V
Differential input voltage		Pin1−2	$\pm V_{ID}$	12	V
Peak output current (repetitive)		Pin 4	I_{OM}	3	A
Power dissipation	Fig. 2				
T_{case} = 90°C			P_{tot}	20	W
Junction temperature			T_j	+150	°C
Storage temperature range			T_{stg}	−40...+150	°C

Thermal resistance

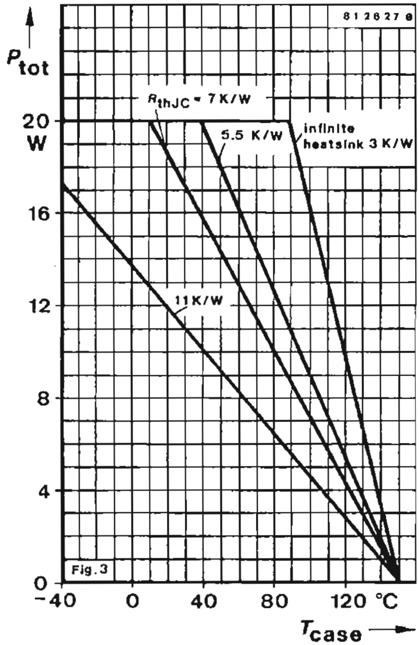
				Min.	Typ.	Max.	
Junction case			R_{thJC}			3	K/W

Electrical characteristics

$\pm V_S = 12$ V, $G_v = 30$ dB, $f = 1$ kHz, $T_{amb} = 25°C$
Reference point: Common power supply, unless otherwise specified

				Min.	Typ.	Max.	
Supply voltage		Pin 5–3	$\pm V_S$	6		15	V
Quiescent drain current							
$\pm V_S = 15$ V, $R_L = 4\ \Omega$	Fig. 4	Pin 5	I_{SB}		40	80	mA
Total supply current							
$P_o = 12$ W, $R_L = 4\ \Omega$		Pin 5	I_{Stot}		845		mA
$P_o = 8$ W, $R_L = 8\ \Omega$		Pin 5	I_{Stot}		500		mA
Thermal shut down							
$P_{tot} = 9$ W			T_{case}	110			°C
Supply voltage rejection ratio							
$R_L = 4\ \Omega$, $V_{hum} = 0.5$ V,							
$f_{hum} = 100$ Hz, $R_G = 22$ kΩ		Fig. 5	SVR	40	50		dB
Input offset voltage							
$\pm V_S = 15$ V		Pin 1-2	$\pm V_{IO}$		8		mV
Input offset current							
$\pm V_S = 15$ V		Pin 1, 2	$\pm I_{IO}$		80		nA
Input current							
$\pm V_S = 15$ V		Pin 1, 2	I_I		0.2	3	µA
Output offset voltage							
$\pm V_S = 15$ V		Pin 4	$\pm V_{OO}$		10	100	mV
Output power		Fig. 8, 9					
$f = 1$ kHz, $d = 10\%$, $R_L = 4\ \Omega$			P_o		12		W
$R_L = 8\ \Omega$			P_o	6	8		W
Input voltage	Fig. 10, 11	Pin 1					
$P_o = 10$ W, $R_L = 4\ \Omega$			V_i		200		mV
$P_o = 6$ W, $R_L = 8\ \Omega$			V_i		220		mV
Input resistance		Pin 1	R_i	0.5	5		MΩ
Band width (–3 dB)	Fig. 6, 7						
$\pm V_S = 15$ V, $R_L = 4\ \Omega$, $P_o = 8$ W			B		10...140 000		Hz
Distortion	Fig. 12, 13						
$P_o = 0.1...8$ W, $R_L = 4\ \Omega$			d		0.2	0.5	%
$P_o = 0.1...4$ W, $R_L = 8\ \Omega$			d		0.1	1	%

			Min.	Typ.	Max.	
Voltage gains						
Open loop		G_{vg}		75		dB
Closed loop	Fig. 3	G_{vf}	29.5	30	30.5	dB
Input noise voltage						
B = 22...22000 Hz, R_L = 4 Ω		V_{ni}		3	10	μV
Input noise current						
B = 22...22000 Hz, R_L = 4 Ω		I_{ni}		80	200	pA



Thermal Switching off

The protective circuit will be effective against thermal overload of the IC; therefore, the heat sink should be dimensioned only for normal operating conditions.

Short circuit protection

The output stage of the integrated circuit is protected against overload due to short circuit of the load resistance.

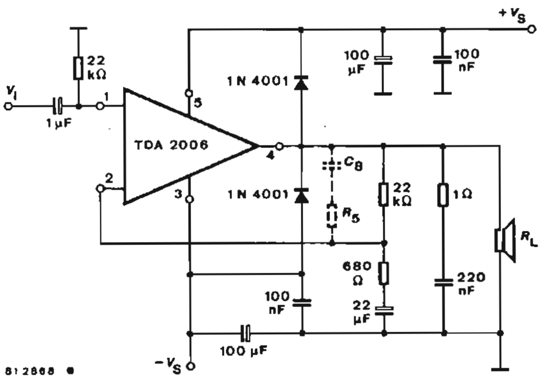
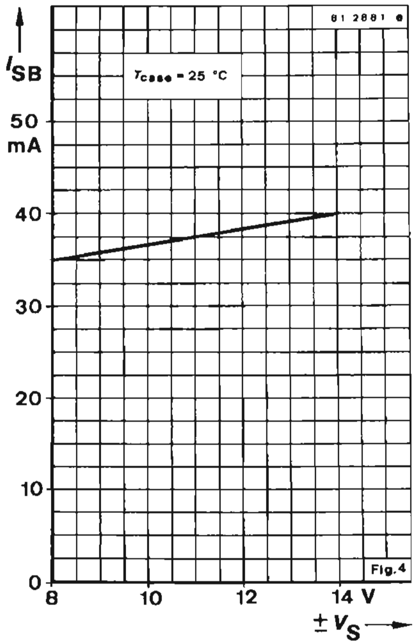
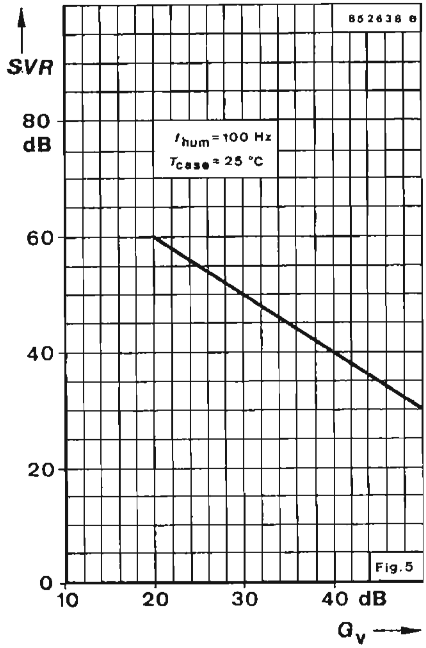
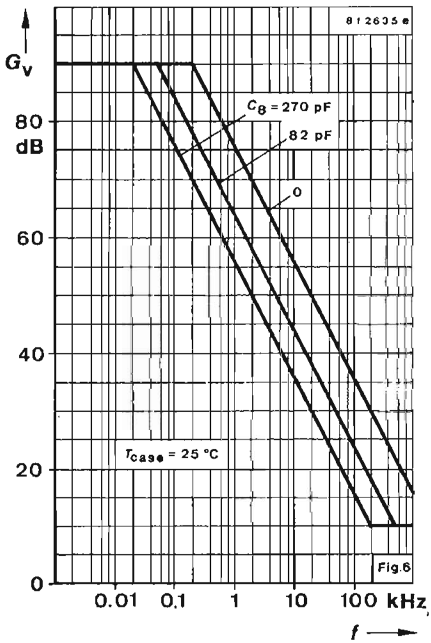


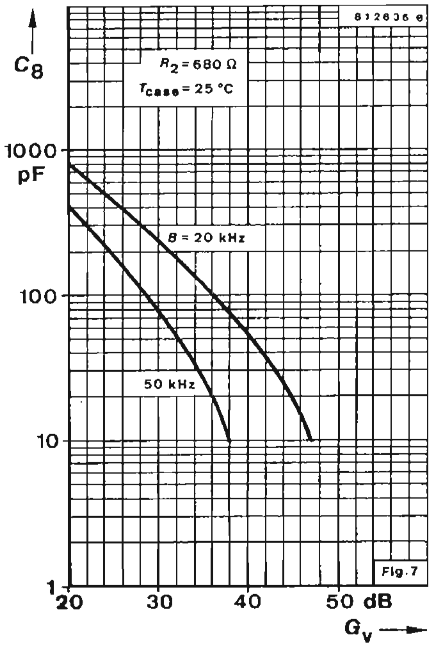
Fig. 3 Test circuit

812868


81 2881 e
I_{SB}
T_{case} = 25 °C
50 mA
40
30
20
10
0
8
10
12
14 V
$\pm V_S$
Fig.4


852638 e
SVR
f_{hum} = 100 Hz
T_{case} = 25 °C
80 dB
60
40
20
0
10
20
30
40 dB
G_v
Fig.5


812635 e
G_v
C_8 = 270 pF
82 pF
0
80 dB
60
40
20
0
T_{case} = 25 °C
0.01
0.1
1
10
100 kHz
f
Fig.6


812636 e
C_8
R_2 = 680 Ω
T_{case} = 25 °C
1000 pF
100
10
1
B = 20 kHz
50 kHz
20
30
40
50 dB
G_v
Fig.7

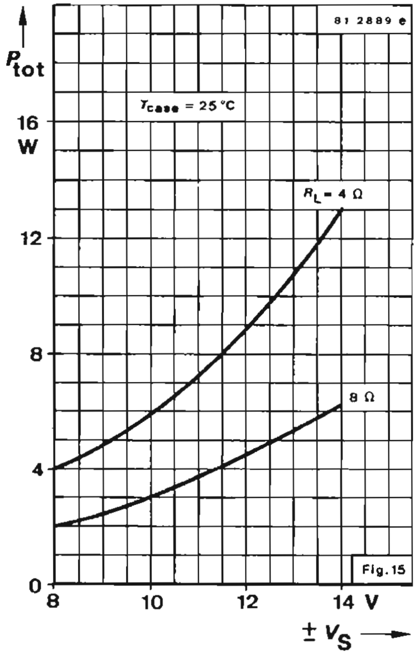


Fig.15

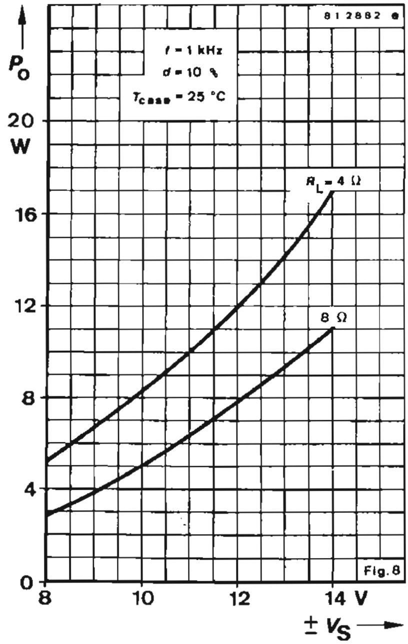


Fig.8

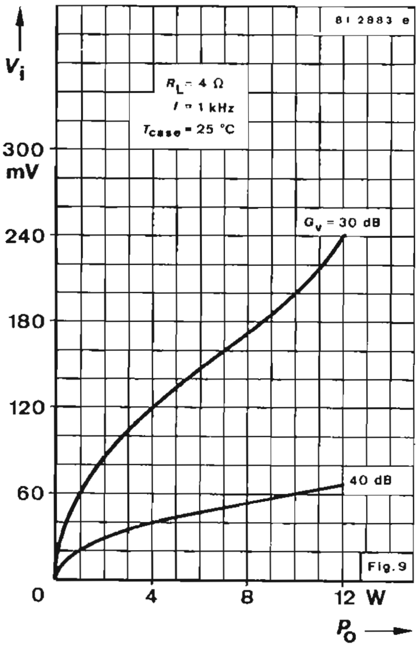


Fig.9

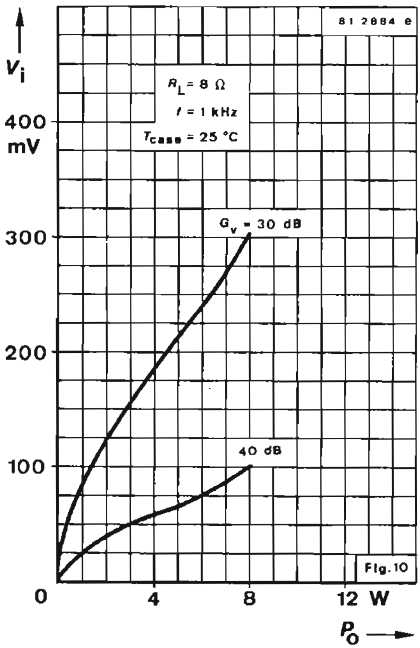
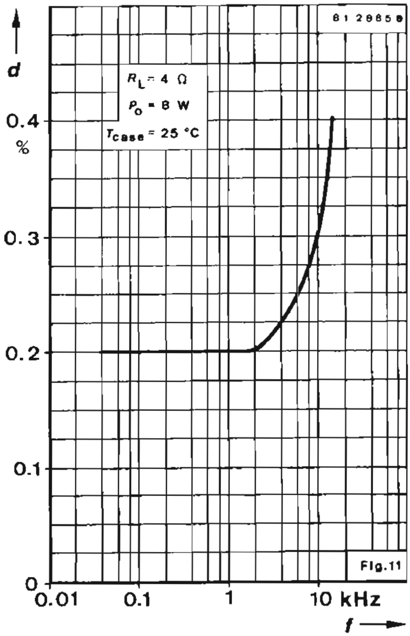
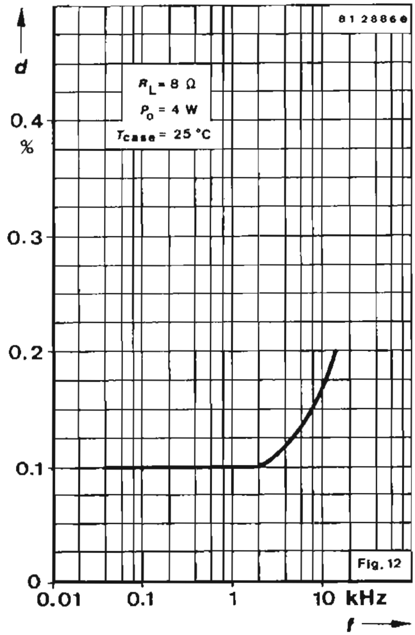
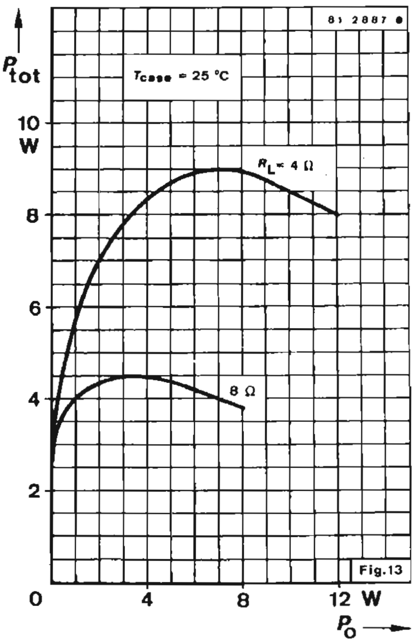
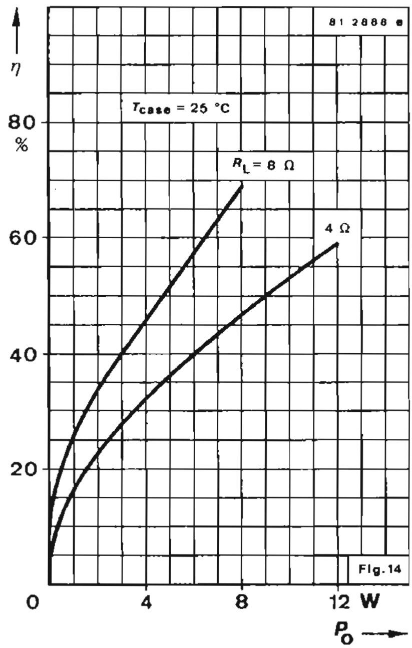


Fig.10


81 28850
d
0.4
%
0.3
0.2
0.1
0
R_L = 4 Ω
P_o = 8 W
T_{case} = 25 °C
Fig.11
0.01
0.1
1
10 kHz
f


81 28860
d
0.4
%
0.3
0.2
0.1
0
R_L = 8 Ω
P_o = 4 W
T_{case} = 25 °C
Fig.12
0.01
0.1
1
10 kHz
f


81 2887 e
P_{tot}
10
W
8
6
4
2
0
T_{case} = 25 °C
R_L = 4 Ω
8 Ω
Fig.13
4
8
12 W
P_o


81 2888 e
η
80
%
60
40
20
0
T_{case} = 25 °C
R_L = 8 Ω
4 Ω
Fig.14
4
8
12 W
P_o

Applications

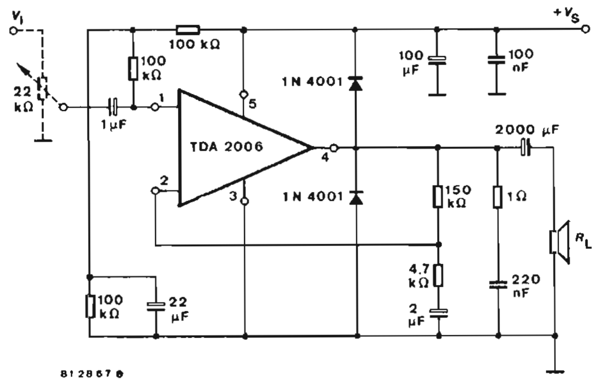


Fig.16 AF amplifier with single power supply

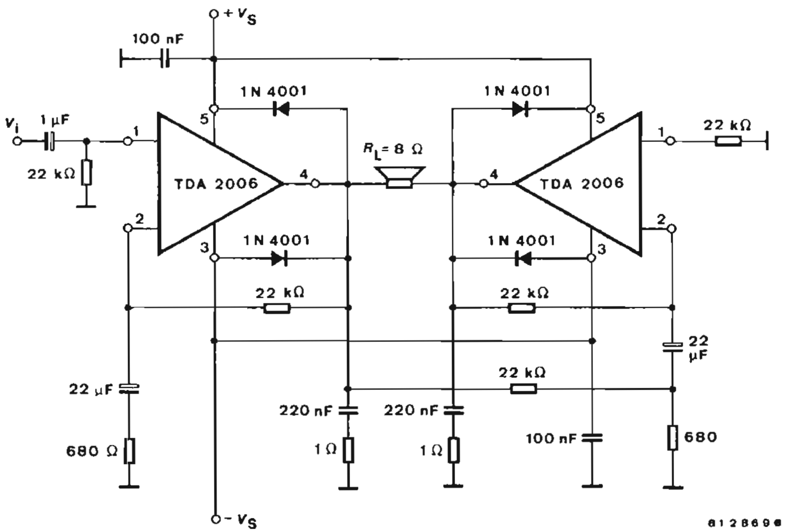


Fig.17 Bridge amplifier with split power supply

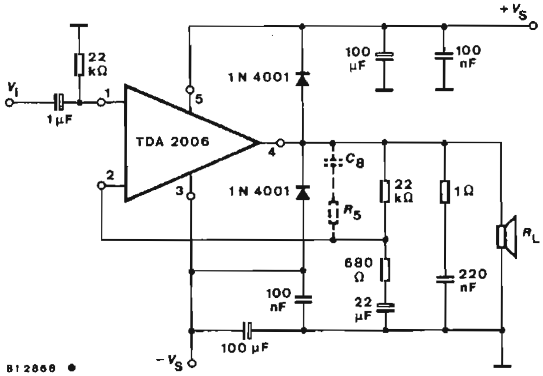
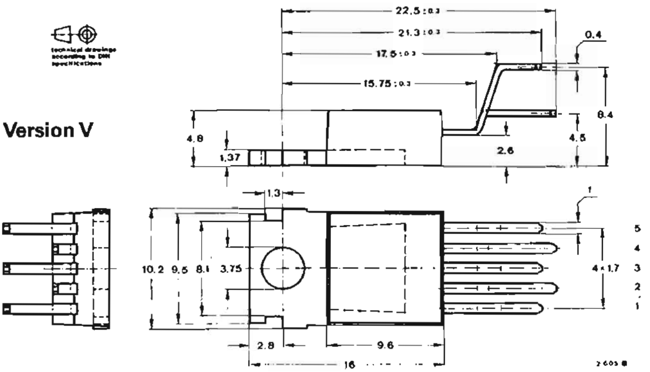


Fig.18 AF amplifier with split power supply

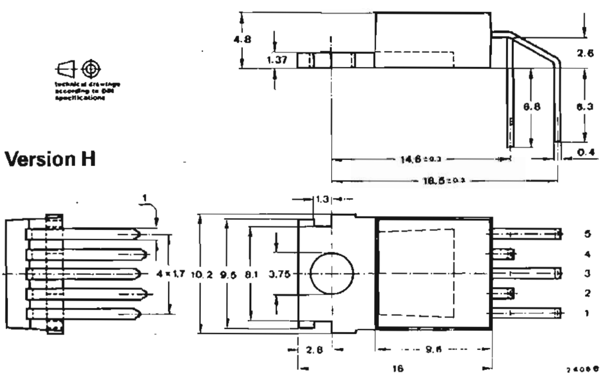
Dimensions in mm

Version V



Supply voltage + V_S	Pin 5
Output	Pin 4
Supply voltage − V_S	Pin 3
Inverting input	Pin 2
Non-inverting input	Pin 1

Version H



Special case
Plastic
≈ TO 220
5-leads
Weight max. 1.8 g

Monolithic Integrated Circuit

Application: Audio power amplifier for radios and television receivers

Features:

- Output stage short circuit protected
- Thermal shut down protected
- Characteristic specification according to DIN 45500
- Simple mounting due to ≈ TO-220 casing

81 2626

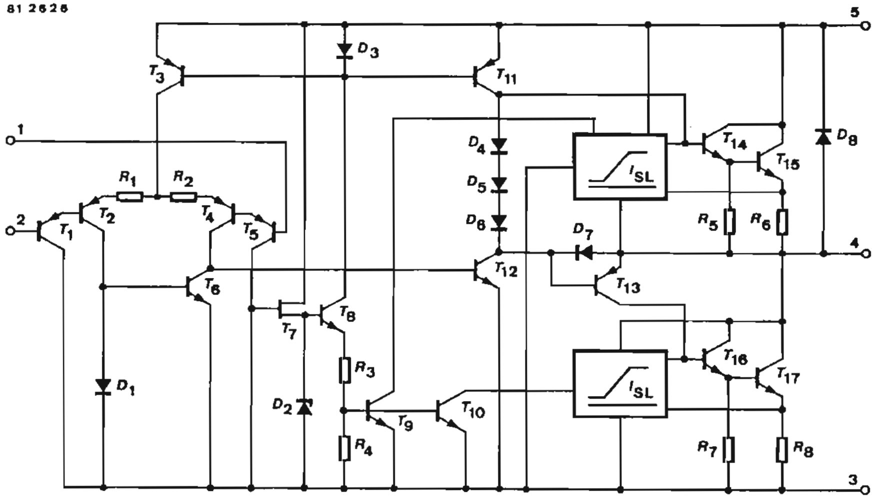


Fig. 1 Diagram and pin connections, Pin 3 connected with metallic surface

Absolute maximum ratings

Reference point: Common power supply

Supply voltage	Pin 5−3	$\pm V_S$	18	V
Input voltage	Pin 1+2	V_i	V_S	V
Differential input voltage	Pin1−2	$\pm V_{ID}$	15	V
Peak output current (repetitive)	Pin 4	I_{OM}	3.5	A
Power dissipation	Fig. 2			
T_{case} = 90°C		P_{tot}	20	W
Junction temperature		T_j	+150	°C
Storage temperature range		T_{stg}	−40...+150	°C

T1.2/1327.0586 E1

Thermal resistance				Min.	Typ.	Max.	
Junction case			R_{thJC}			3	K/W

Electrical characteristics

$\pm V_S$ = 14 V, G_v = 30 dB, f = 1 kHz, T_{amb} = 25°C
Reference point: Common power supply, unless otherwise specified

				Min.	Typ.	Max.	
Supply voltage		Pin 5–3	$\pm V_S$	6		18	V
Quiescent drain current							
$\pm V_S$ = 18 V, R_L = 4 Ω	Fig. 4	Pin 5	I_{SB}		40	60	mA
Total supply current							
P_o = 14 W, R_L = 4 Ω		Pin 5	I_{Stot}		900		mA
P_o = 9 W, R_L = 8 Ω		Pin 5	I_{Stot}		515		mA
Thermal shut down							
P_{tot} = 12 W			T_{case}	110			°C
Supply voltage rejection ratio							
R_L = 4 Ω, V_{hum} = 0.5 V, f_{hum} = 100 Hz, R_G = 22 kΩ	Fig. 5		SVR	40	50		dB
Input offset voltage							
$\pm V_S$ = 18 V		Pin 1-2	$\pm V_{IO}$		2	20	mV
Input offset current							
$\pm V_S$ = 18 V		Pin 1, 2	$\pm I_{IO}$		20	200	nA
Input current							
$\pm V_S$ = 18 V		Pin 1, 2	I_I		0.2	1	μA
Output offset voltage							
$\pm V_S$ = 18 V		Pin 4	$\pm V_{OO}$		2.5	22	mV
Output power	Fig. 8, 9						
f = 1 kHz, d = 0.5%, R_L = 4 Ω			P_o	12	14		W
R_L = 8 Ω			P_o	8	9		W
d = 10%, R_L = 4 Ω			P_o		18		W
R_L = 8 Ω			P_o		11		W
Input voltage	Fig.10,11	Pin 1					
P_o = 12 W, R_L = 4 Ω			V_i		215		mV
P_o = 8 W, R_L = 8 Ω			V_i		250		mV
Input resistance		Pin 1	R_i	0.5	5		MΩ
Band width (–3 dB)	Fig. 6, 7						
V_S = 18 V, R_L = 4 Ω, C_3 = 1000 pF			B		10...140000		Hz
Distortion	Fig.12,13						
P_o = 0.1...12 W, R_L = 4 Ω			d		0.2	0.5	%
P_o = 0.1... 8 W, R_L = 8 Ω			d		0.1	0.5	%

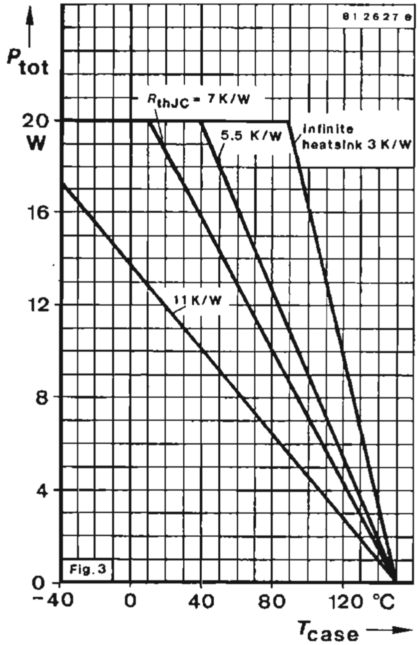
			Min.	Typ.	Max.	
Voltage gain						
Open loop		G_{vg}		90		dB
Closed loop	Fig. 3	G_{vf}		30		dB
Input noise voltage						
B = 10...25000 Hz, R_L = 4 Ω		V_{nI}		3	10	μV
Input noise current						
B = 10...25000 Hz, R_L = 4 Ω		I_{ni}		80	200	pA

Thermal Switching off

The protective circuit will be effective against thermal overload of the IC; therefore, the heat sink should be dimensioned only for normal operating conditions.

Short circuit protection

The output stage of the integrated circuit is protected against overload due to short circuit of the load resistance.



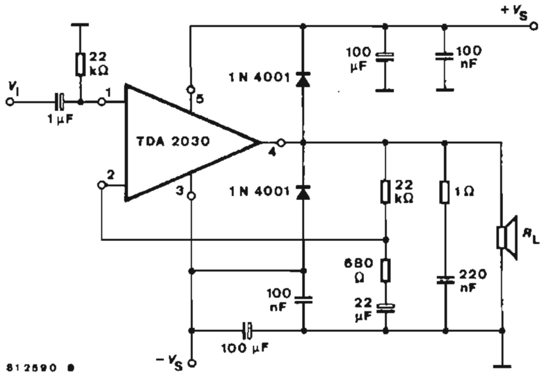
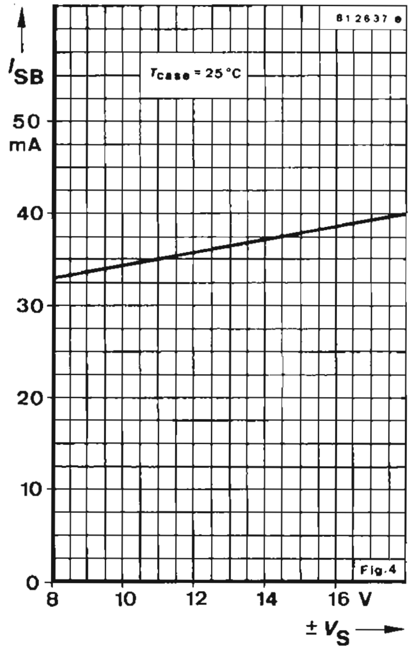
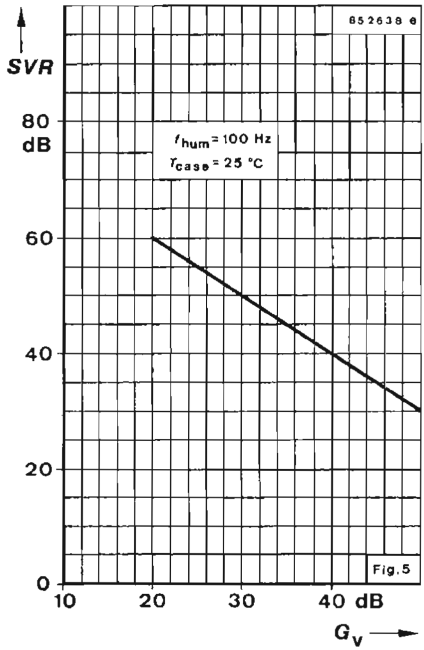
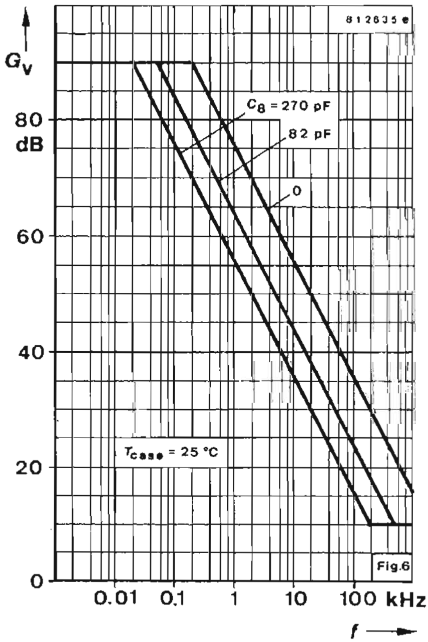
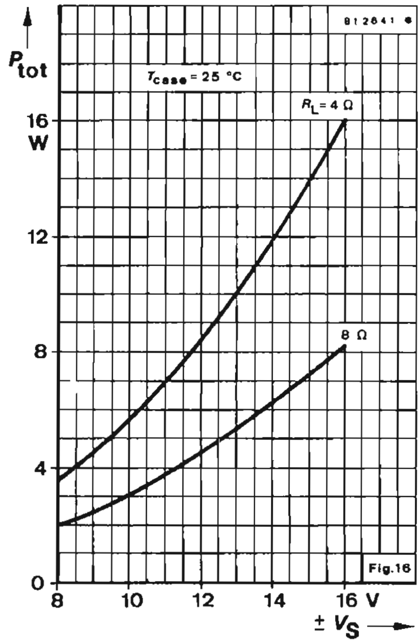


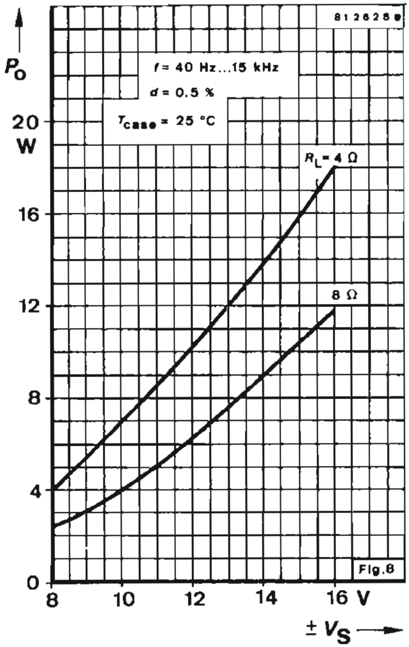
Fig. 3 Test circuit

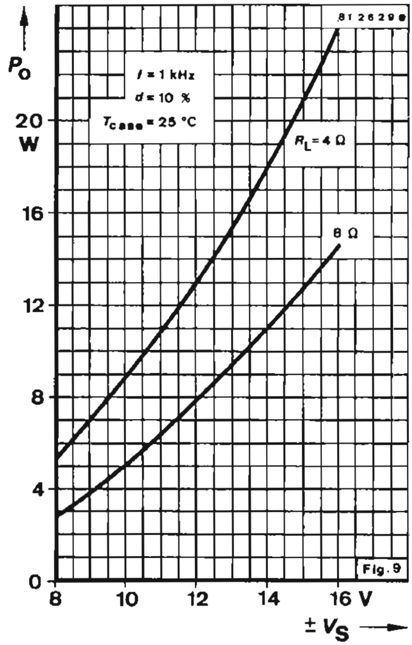

812637 e
I_{SB}
T_{case} = 25 °C
50
mA
40
30
20
10
0
8
10
12
14
16 V
± V_S
Fig.4

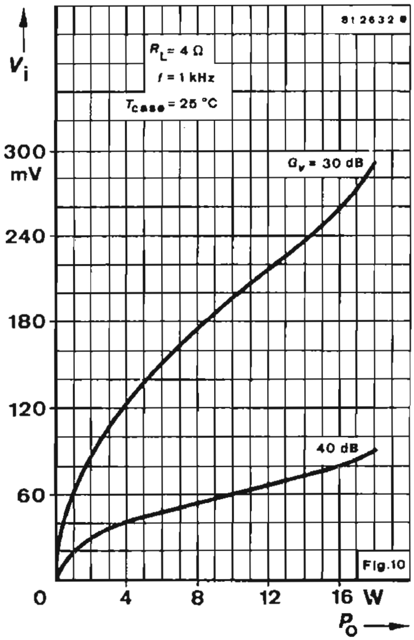

852638 e
SVR
80
dB
f_{hum} = 100 Hz
T_{case} = 25 °C
60
40
20
0
10
20
30
40 dB
G_v
Fig.5

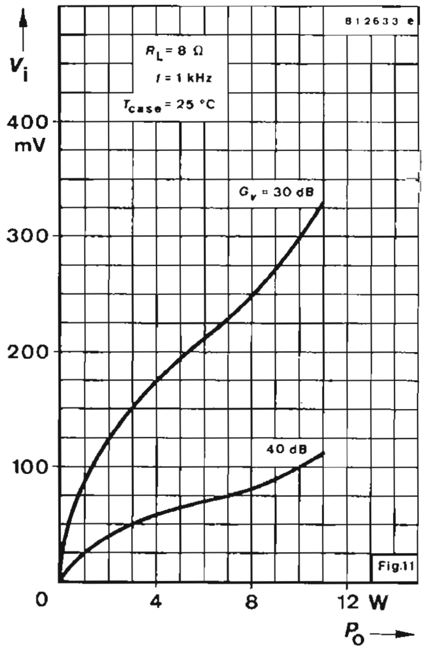

812635 e
G_v
C_8 = 270 pF
82 pF
0
80
dB
60
40
20
0
T_{case} = 25 °C
0.01
0.1
1
10
100 kHz
f
Fig.6


812641 e
P_{tot}
T_{case} = 25 °C
R_L = 4 Ω
16
W
12
8 Ω
8
4
0
8
10
12
14
16 V
± V_S
Fig.16


812628 e
P_o
f = 40 Hz...15 kHz
d = 0.5 %
T_{case} = 25 °C
20 W
16
12
8
4
0
R_L = 4 Ω
8 Ω
Fig.8
8
10
12
14
16 V
± V_S


812629 e
P_o
f = 1 kHz
d = 10 %
T_{case} = 25 °C
20 W
16
12
8
4
0
R_L = 4 Ω
8 Ω
Fig.9
8
10
12
14
16 V
± V_S


812632 e
V_i
R_L = 4 Ω
f = 1 kHz
T_{case} = 25 °C
300 mV
240
180
120
60
0
G_v = 30 dB
40 dB
Fig.10
4
8
12
16 W
P_o


812633 e
V_i
R_L = 8 Ω
f = 1 kHz
T_{case} = 25 °C
400 mV
300
200
100
0
G_v = 30 dB
40 dB
Fig.11
4
8
12 W
P_o

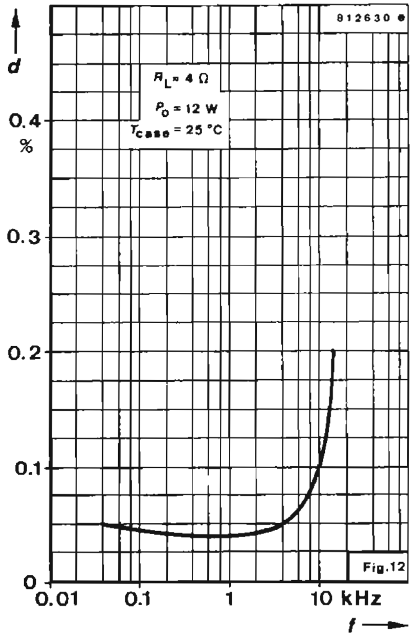


Fig.12

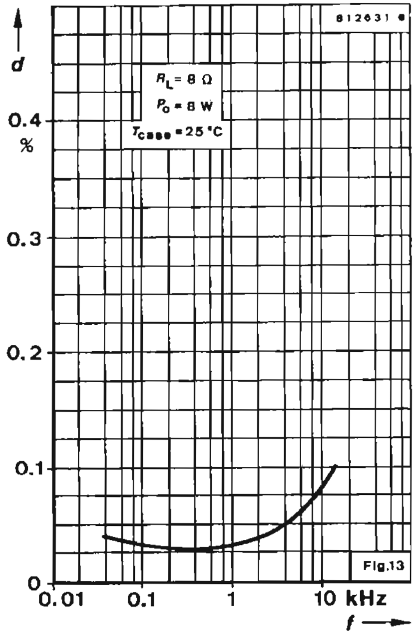


Fig.13

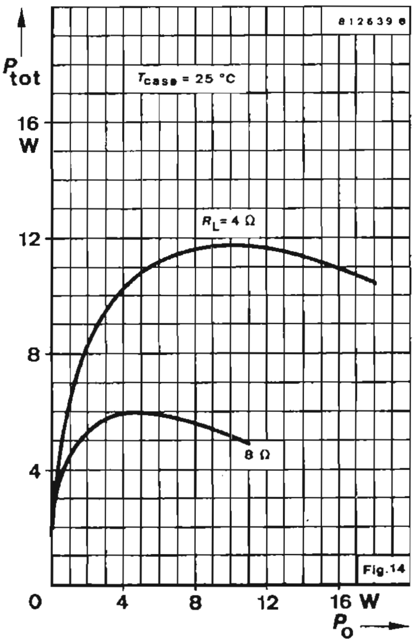


Fig.14

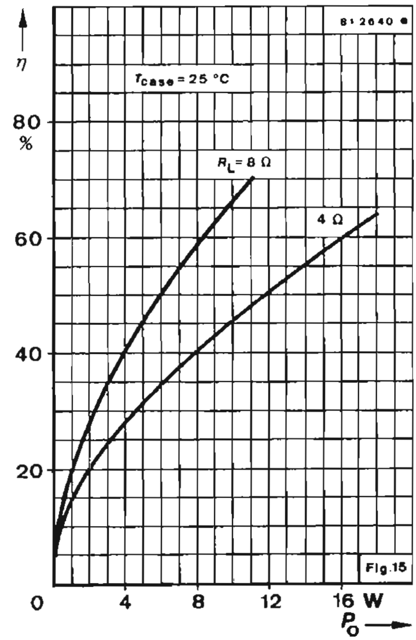


Fig.15

Applications

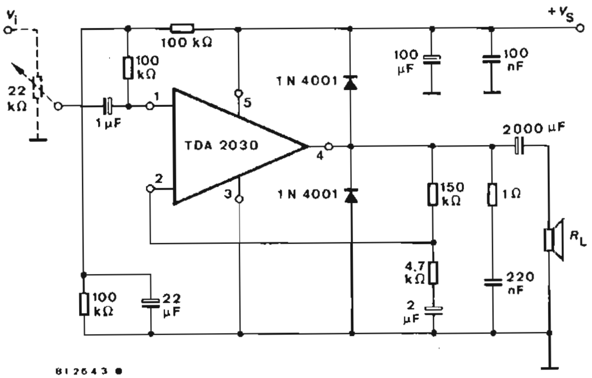


Fig.16 AF amplifier with single power supply

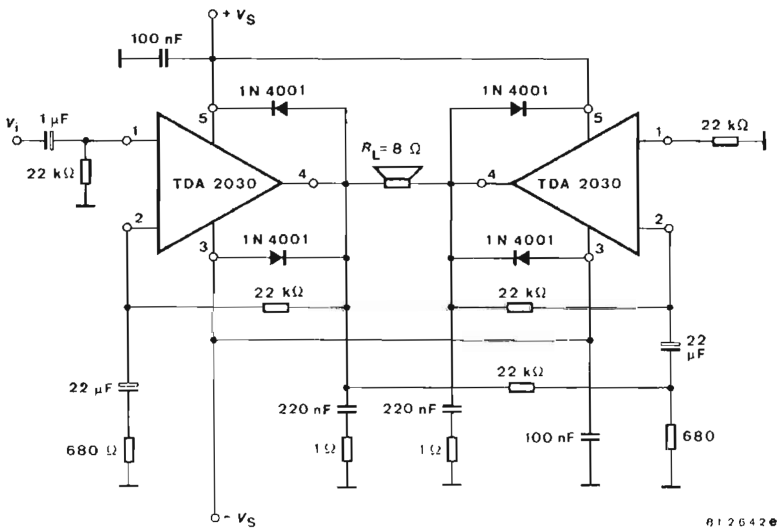


Fig. 17 AF amplifier with split power supply

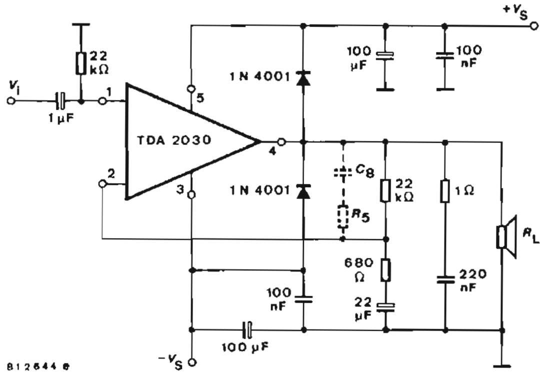
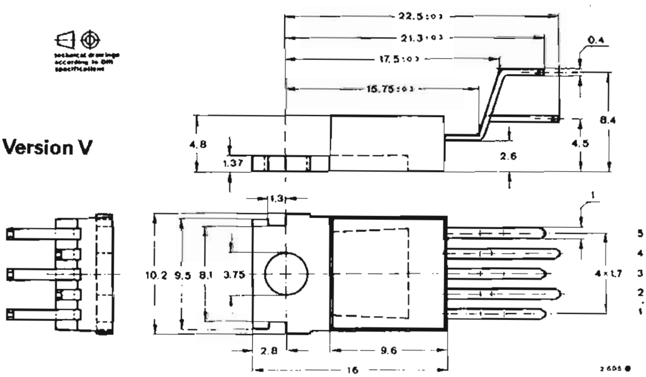


Fig. 18 Bridge amplifier with split power supply

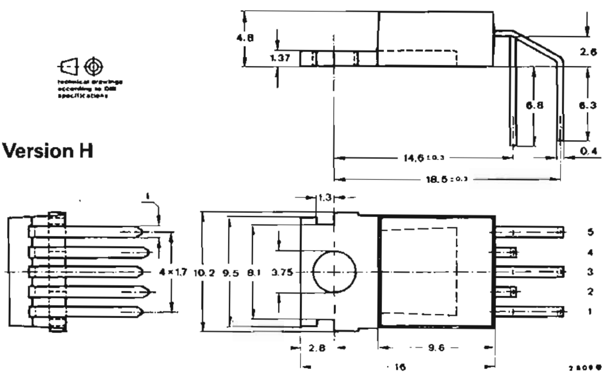
Dimensions in mm

Version V



Supply voltage + V_S	Pin 5
Output	Pin 4
Supply voltage − V_S	Pin 3
Inverting input	Pin 2
Non-inverting input	Pin 1

Version H



Special case
Plastic
≈ TO 220
5-leads
Weight max. 1.8 g

TELEFUNKEN electronic
Creative Technologies

TDA 2040

Monolithic Integrated Circuit

Application: Audio power amplifier for radios and television receivers

Features:

- Very low harmonic and cross-over distortion
- Output stage short circuit protected
- Thermal shut down protected
- Simple mounting

Preliminary specifications

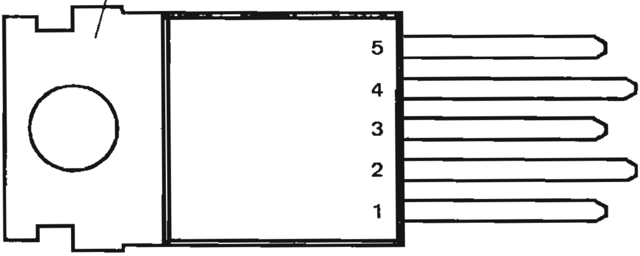


Fig. 1 Connection diagram (top view)

Absolute maximum ratings

Reference point: Common power supply

Supply voltage	Pin 5–3	$\pm V_S$	20	V
Input voltages	Pin 1+2	V_i	V_S	V
Differential input voltage	Pin 1–2	$\pm V_{ID}$	15	V
Peak output current (internally limited)	Pin 4	I_{OM}	4	A
Power dissipation $T_{case} = 75$ °C		P_{tot}	25	W
Junction temperature		T_j	+150	°C
Storage temperature range		T_{stg}	−40...+150	°C

T1.2/1308.0386 E1

Thermal resistance			Min.	Typ.	Max.	
Junction case		R_{thJC}			3	K/W

Electrical characteristics

$\pm V_S = 16$ V, $G_v = 30$ dB, $T_{amb} = 25$ °C, Test circuit Fig. 2
Reference point: Common power supply, unless otherwise specified

			Min.	Typ.	Max.	
Supply voltage range	Pin 5–3	$\pm V_S$	2.5		20	V
Quiescent drain current						
$V_S = \pm 4.5$ V	Pin 5	I_{SB}		30		mA
$V_S = \pm 20$ V	Pin 5	I_{SB}	45	100		mA
Thermal shut down		T_j		145		°C
Supply voltage rejection ratio $R_L = 4\ \Omega$, $V_{humeff} = 0.5$ V, $f_{hum} = 100$ Hz, $R_G = 22$ kΩ		SVR	40	48		dB
Input offset voltage						
$\pm V_S = 20$ V	Pin 1-2	$\pm V_{IO}$		2	20	mV
Input offset current	Pin 1, 2	$\pm I_{IO}$			200	nA
Input current						
$\pm V_S = 20$ V	Pin 1,2	I_I		0.3	1	µA
Output power $T_{case} = 60$ °C						
$f = 1$ kHz, $d = 0.5\%$, $R_L = 4\ \Omega$		P_o	20	22		W
$R_L = 8\ \Omega$		P_o		12		W
$f = 15$ kHz $R_L = 4\ \Omega$		P_o	15	18		W
Input resistance	Pin 1	R_i	0.5	5		MΩ
Bandwidth (−3 dB)						
$P_o = 1$ W, $R_L = 4\ \Omega$		B		100		kHz
Distortion						
$P_o = 0.1...10$ W, $R_L = 4\ \Omega$		d		0.03		%
$f = 40..15000$ Hz		d		0.08		%
Voltage gain						
Open loop		G_{vg}		80		dB
Closed loop		G_{vg}	29.5	30	30.5	dB
Input noise voltage						
B = A-weighted		V_{ni}		2		µV
$B = 22..22000$ Hz		V_{ni}		3		µV
Input noise current						
B = A-weighted		I_{ni}		50		pA
$B = 22..22000$ Hz		I_{ni}		80		pA
Efficiency						
$R_L = 8\ \Omega$, $P_o = 12$ W		n		66		%
$R_L = 4\ \Omega$, $P_o = 22$ W		n		63		%

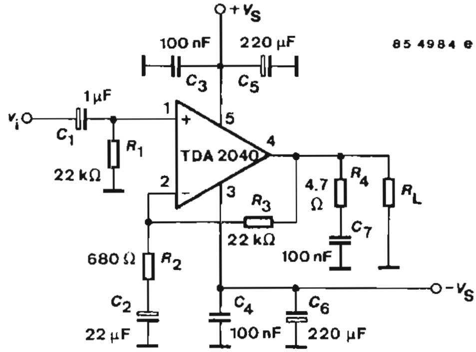
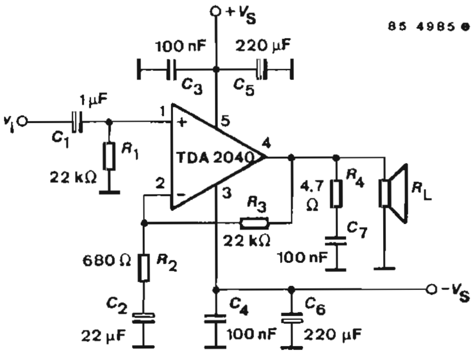
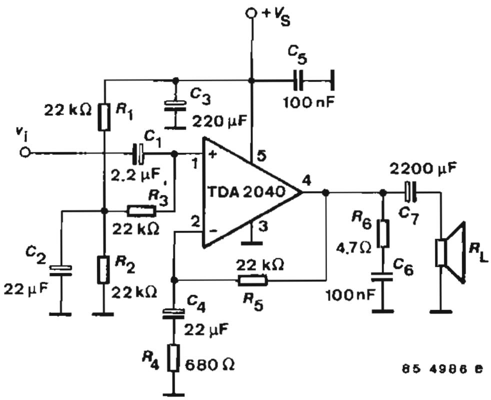


Fig. 2 Test circuit

Applications:





$V_S = \pm 16$ V
$R_L = 4\ \Omega$
$P_o \geqq 15$ W ($d = 0.5\%$)

Fig. 3 Amplifier with split power supply (*)

Fig. 4 Amplifier with single supply (*)

* In the case of highly inductive loads protection diodes may be necessary

$V_S = \pm 16$ V
$R_L = 8\ \Omega$
$P_o \geqq 30$ W ($d = 0.5\%$)

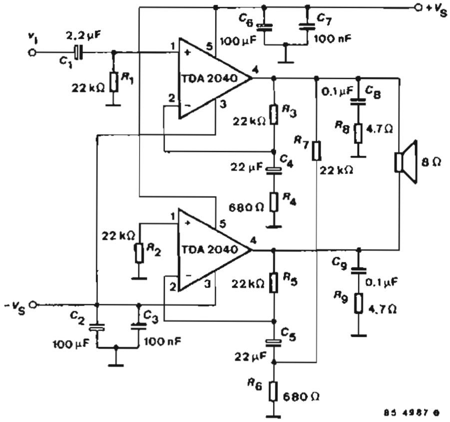
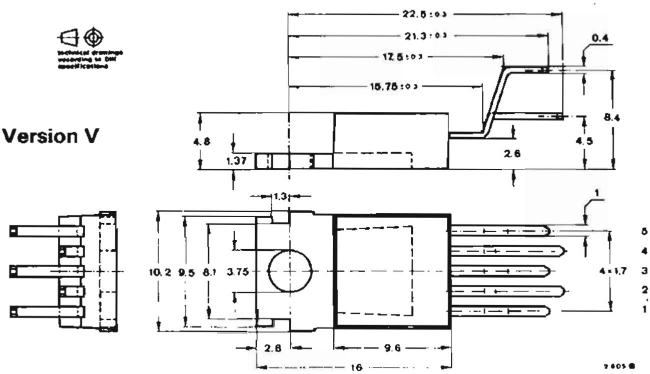


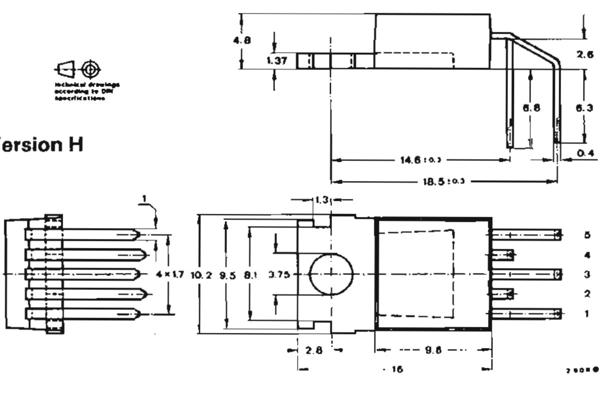
Fig. 5 30 W Bridge amplifier with split power supply

Dimensions in mm

Version V



Version H



Special case plastic
5-leads
Weight max. 1.8 g

U 237 BG · U 247 BG
U 257 BG · U 267 BG

Monolithic Integrated Circuits

Application: To drive LED-displays with 5 or 10 diodes

Features:

- Wide supply voltage range
- High LED current
- Low power dissipation due to series connection of LED's
- Different colour LED's can be connected arbitrary
- No peripheral components are necessary
- High input resistance
- Eligible between:
  5 LED's line with linear scale division with U 237 BG or U 247 BG
  5 LED's line with logarithmic scale division with U 257 BG or U 267 BG
  10 LED's line with linear scale division with U 237 BG and U 247 BG
  10 LED's line with logarithmic scale division with U 257 BG and 267 BG

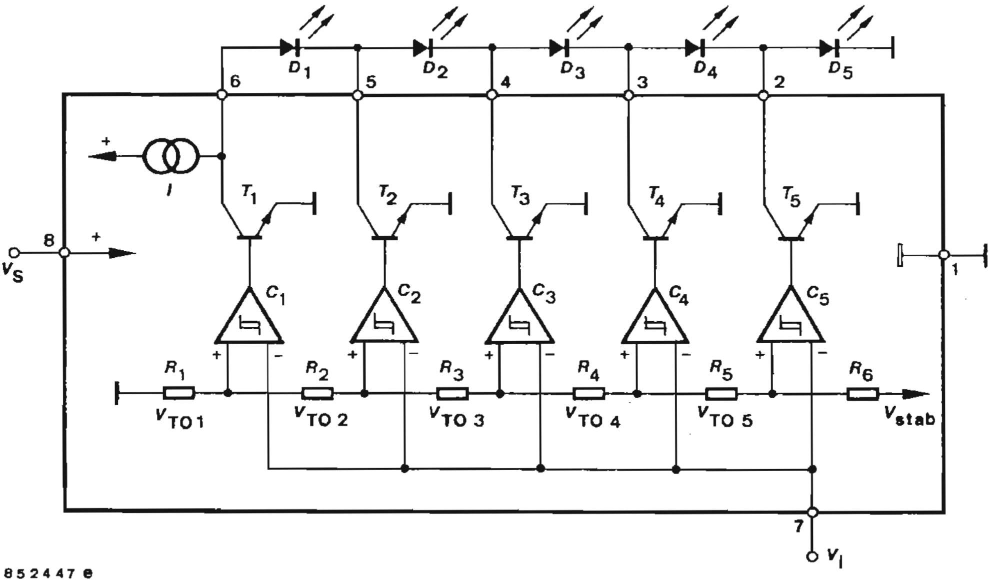


Fig. 1 Block diagram LED scale IC

Absolute maximum ratings

Supply voltage	V_S	25	V
Input voltage	V_I	5	V
Input current	I_I	0.5	mA
Output current, maximum	$I_{O1...5}$	30	mA
Output reverse voltage	V_O	V_S	
Power dissipation $T_{amb} = 60°C$	P_{tot}	690	mW
Ambient temperature range $V_S = 25$ V	T_{amb}	−10...+ 60	°C
$V_S = 18$ V	T_{amb}	−10...+ 85	°C
Storage temperature range	T_{stg}	−15...+ 125	°C
Junction temperature	T_j	150	°C

Thermal resistance

		Min.	Typ.	Max.	
Junction ambient	R_{thJA}			130	K/W

Optical and electrical characteristics

$V_S = 16$ V, $T_{amb} = 25°C$, Reference point: Ground

		Min.	Typ.	Max.	
Total current (incl. LED current)	I_S		25		mA
Supply voltage	V_S	12		25	V
Step tolerance	ΔV_I			±30	mV
Switching threshold hysteresis	ΔV_{IH}		10		mV
Input current	$-I_I$		1		µA
Output saturation voltage $I_{O1...5} = 20$ mA	$V_{O1...5sat}$			1.1	V
Output current	$-I_{O5}$		20		mA

Circuit description

The IC's are driving circuits for a 5 or 10 LED bar display having an integrated current generator whose current is adjusted to 20 mA.

Light emitting diodes are connected in series in order to reduce power dissipation and to have the same current flow to the supply in every operating condition, Fig. 2

For red LED's (i.e. TLSR 5100) the supply voltage is 12 V whereas in case of green or yellow diodes (i.e. TLSY 5100, TLSG 5100) the voltage is 16 V.

The input thresholds are:

- **U 237 BG:** 0.2 V, 0.4 V, 0.6 V, 0.8 V, 1.0 V
- **U 247 BG:** 0.1 V, 0.3 V, 0.5 V, 0.7 V, 0.9 V
- **U 257 BG:** 0.18 V/–15 dB, 0.5 V/–6 dB, 0.84 V/–1.5 dB, 1.19 V/+1.5 dB, 2.0 V/+6 dB
- **U 267 BG:** 0.1 V/–20 dB, 0.3 V/–10 dB, 0.71 V/–3 dB, 1.0 V/0 dB, 1.41 V/+3 dB

If a voltage greater than the first threshold but less than the second threshold is applied one LED is lighted, if the input voltage is between the second and the third threshold, then two LED's are in operation and so on.

Fig. 2 shows the circuit diagram of a bar display with 5 LED's.

By choosing a parallel connection of the inputs of an U 237 BG and an U 247 BG it is possible to get a 10 LED bar display with thresholds 0.1 V, 0.2 V, 0.3...1.0 V.

By choosing a parallel connection of the inputs of an U 257 BG and an U 267 BG it is possible to get a 10 LED bar display with thresholds: –20 dB, –15 dB, –10 dB...+6 dB.

Fig. 3 shows the circuit diagram of a bar display with 10 LED's.

Applications:

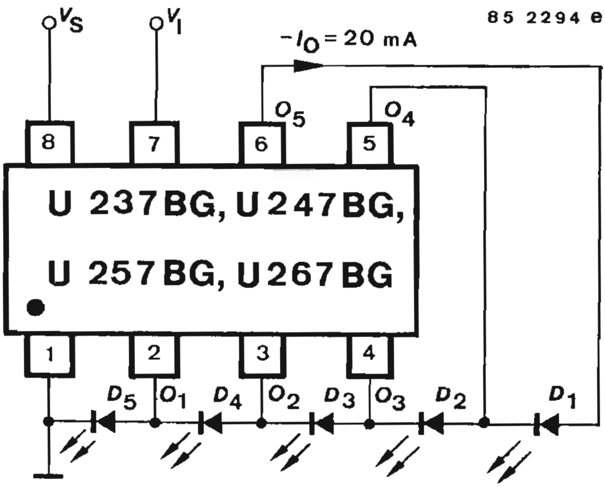


Fig. 2 Bar display with 5 LED's

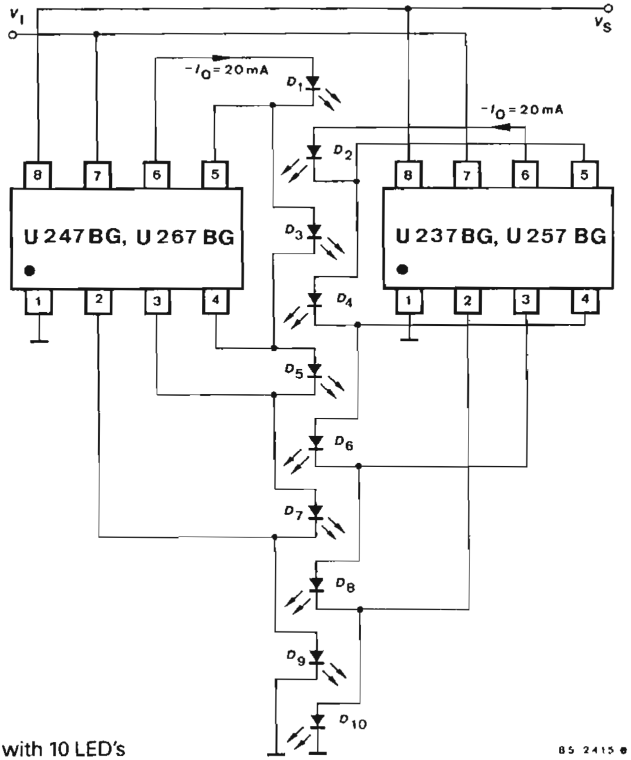


Fig. 3 Bar display with 10 LED's

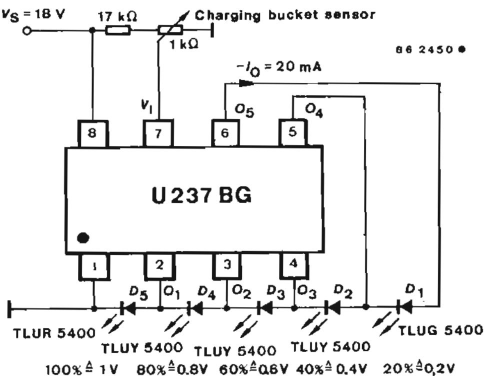


Fig. 4 Liquid level display with linear resistance pickup

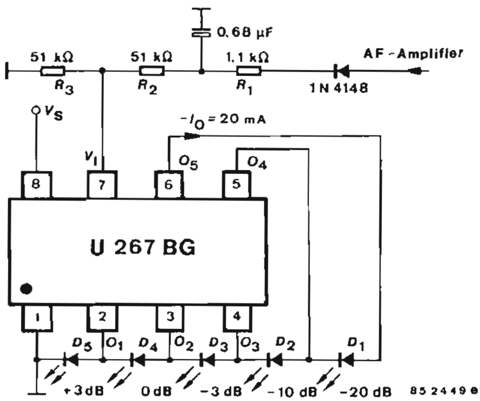


Fig. 5 Logarithmic AF recording level display with 5 LED's

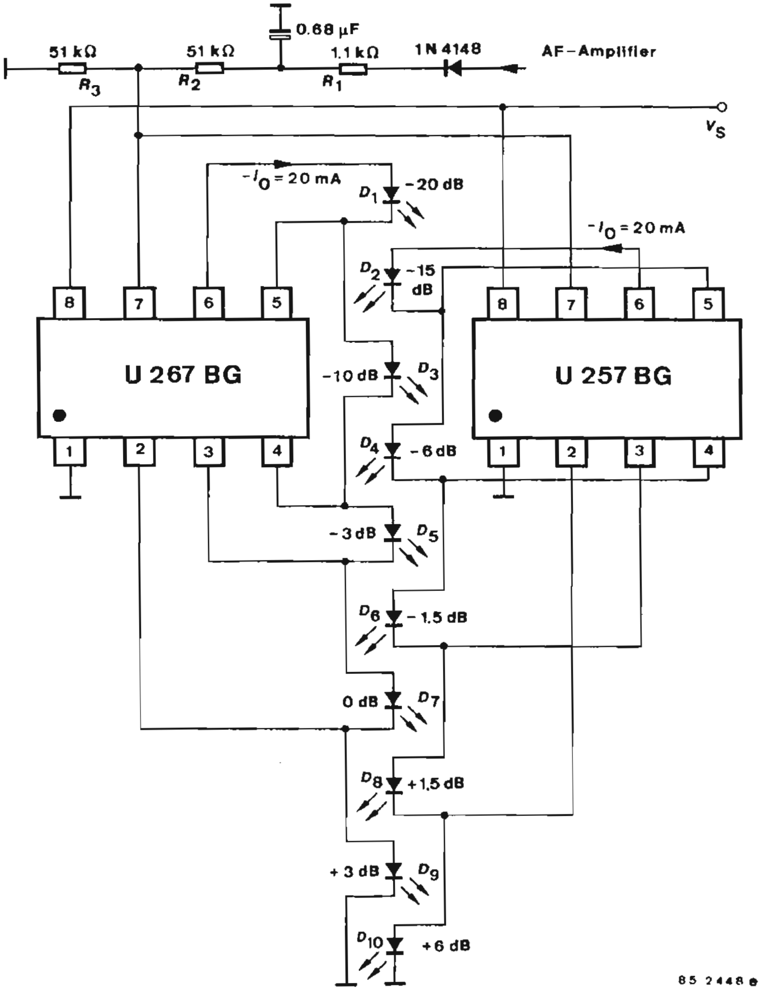


Fig. 6 Logarithmic AF recording level display with 10 LED's

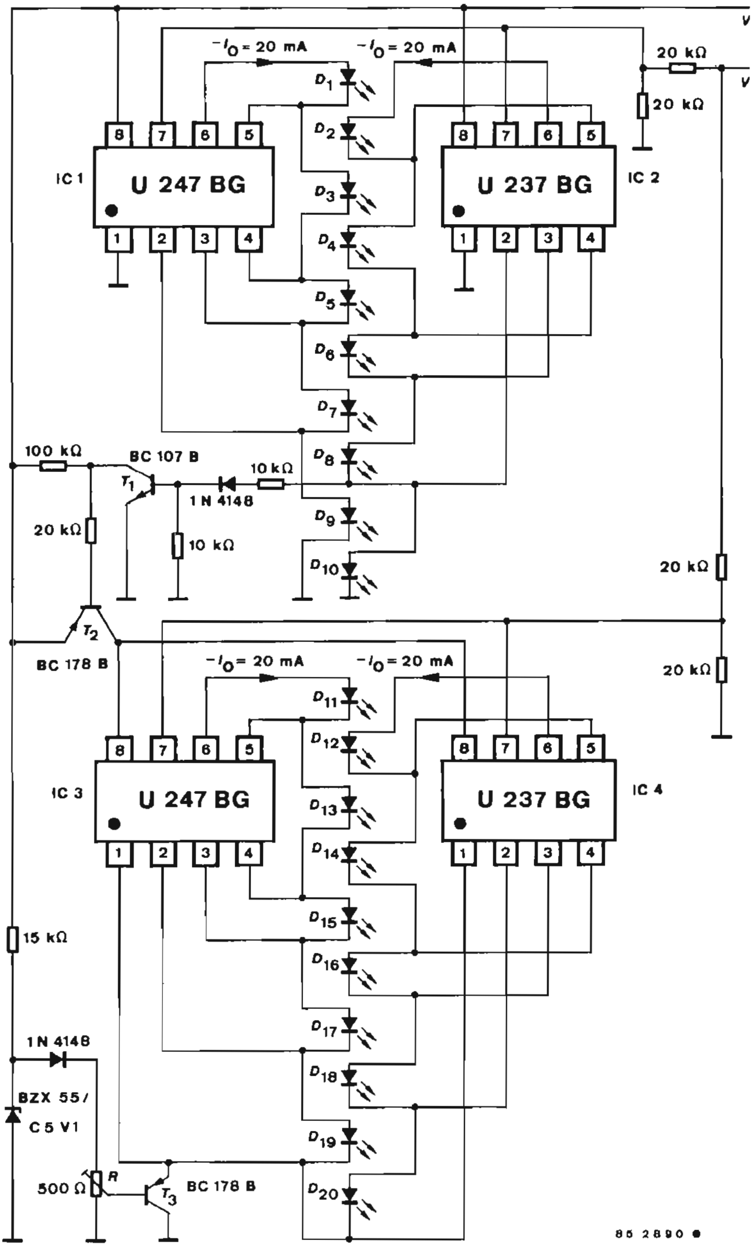
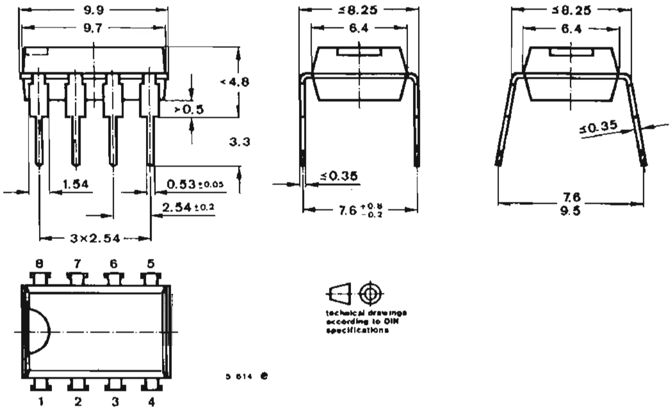


Fig. 7 Driver for 20 LED's

Dimensions in mm



Plastic case
DIP 8
Weight max. 1 g

Monolithic Integrated Circuits

Application: To drive LED-displays with 5 or 10 diodes with flowing transition

Features:

- Wide supply voltage range
- High LED current
- Low power dissipation due to series connection of LED's
- Different colour LED's can be connected arbitrary
- No peripheral components are necessary
- High input resistance
- Eligible between:
  5 LED's line with linear scale division with U 244 B or U 254 B
  10 LED's line with linear scale division with U 244 B and U 254 B

Preliminary specifications

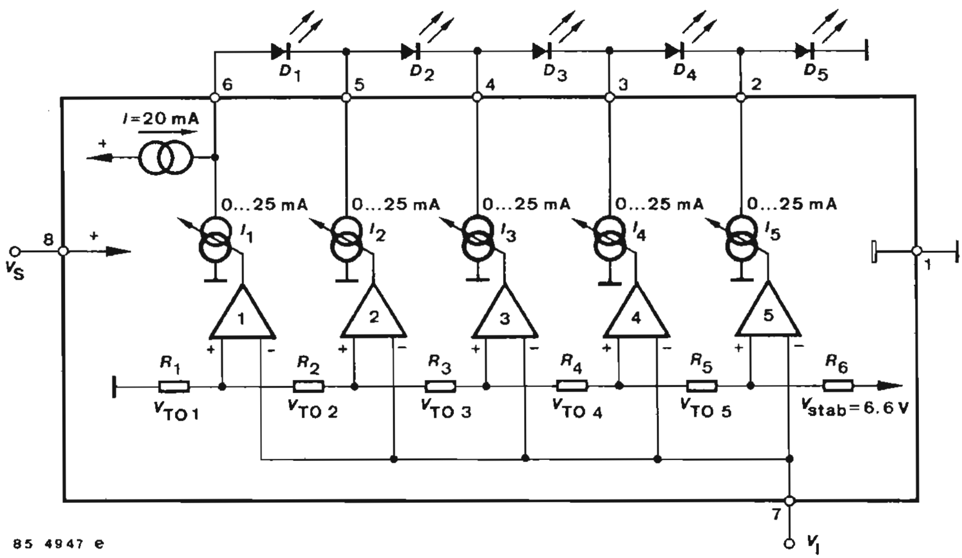


Fig. 1 Block diagram

Absolute maximum ratings

Supply voltage	V_S	25	V
Input voltage	V_I	5	V
Input current	I_I	0.5	mA
Output reverse voltage	V_O	V_S	
Power dissipation T_{amb} = 60°C	P_{tot}	690	mW
Junction temperature	T_j	150	°C
Ambient temperature range V_S = 25 V	T_{amb}	−10...+ 60	°C
V_S = 18 V	T_{amb}	−10...+ 85	°C
Storage temperature range	T_{stg}	−15...+125	°C

Thermal resistance

		Min.	Typ.	Max.	
Junction ambient	R_{thJA}			130	K/W

Optical and electrical characteristics

V_S = 16 V, T_{amb} = 25°C, reference point: Pin 1 Ground

		Min.	Typ.	Max.	
Total current (incl. LED current)	I_S		25		mA
Supply voltage	V_S	12		25	V
Input current	$-I_I$		1		µA
Output current at maximum brightness	$-I_{O5}$		20		mA

Circuit description

The IC's are driving circuits for a 5 or 10 LED bar display having an integrated current generator whose current is adjusted to 20 mA.

Light emitting diodes are connected in series in order to reduce power dissipation and to have the same current flow to the supply in every operating condition, Fig. 2.
For red LED's (i.e. TLSR 5100) the supply voltage is 12 V whereas in case of green or yellow diodes (i.e. TLSY 5100, TLSG 5100) the voltage is 16 V.

Range of flowing transition:

U 244 B
1. Threshold 200...280 mV
2. Threshold 380...460 mV
3. Threshold 560...640 mV
4. Threshold 740...820 mV
5. Threshold 920...1000 mV

U 254 B
1. Threshold 110...190 mV
2. Threshold 290...370 mV
3. Threshold 470...550 mV
4. Threshold 650...730 mV
5. Threshold 830...910 mV

Application

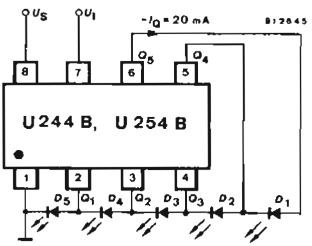


Fig. 2 Bar display with 5 LEDs

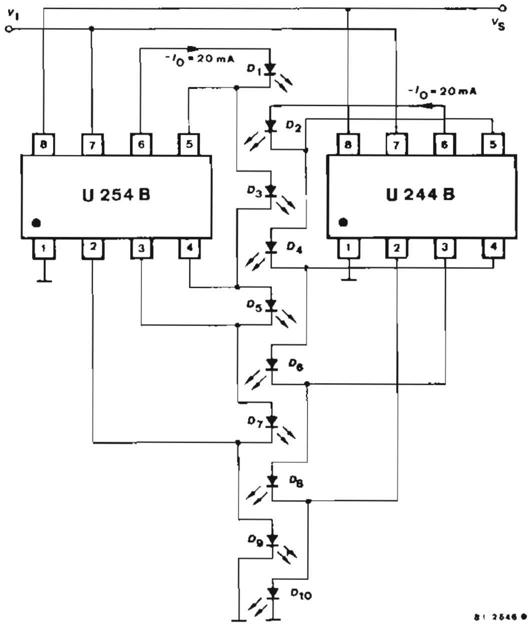
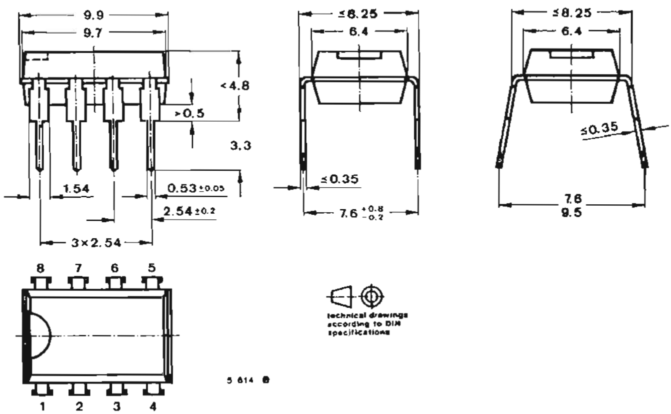


Fig. 3 Bar displays with 10 LEDs

Dimensions in mm



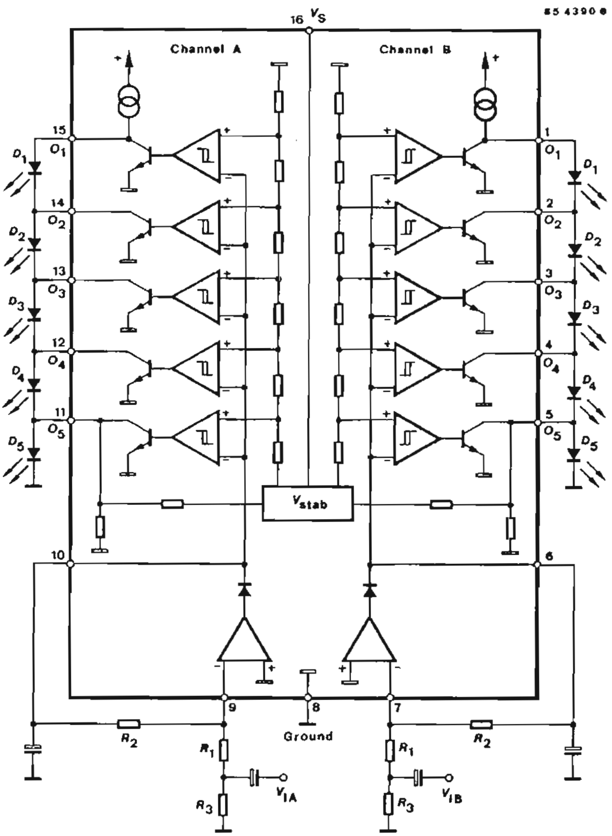
Plastic case
DIP 8-leads
Weight max. 1 g

Monolithic Integrated Circuits

Application: Low cost stereo LEDs scale controller for radio, amplifier or cassette recorder

Features:

- Wide supply voltage range
- Constant LED current
- Low power dissipation due to series connection of LEDs
- Different colour LEDs can be mixed easily
- One operational amplifier per channel
- Logarithmic scale division
- Dual 10 LEDs scale controller possible by series connection of U 2066 B and U 2067 B
- Turn-on intervals:
  5 dB – 5 dB – 3 dB – 3 dB – U 2066 B
  2 dB – 2 dB – 2 dB – 2 dB – U 2067 B



Channel B

1 LED-Output 0_1
2 LED-Output 0_2
3 LED-Output 0_3
4 LED-Output 0_4
5 LED-Output 0_5
6 Rectifier output
7 OP AMP "negative"-Input
8 Ground (GND)

Channel A

9 OP AMP "negative"-Input
10 Rectifier output
11 LED-Output 0_5
12 LED-Output 0_4
13 LED-Output 0_3
14 LED-Output 0_2
15 LED-Output 0_1
16 Supply voltage V_S

Fig. 1 Block diagram and Pin connections

U 2066 B · U 2067 B

Absolute maximum ratings

Reference point Pin 8

Supply current	Pin 16	V_S	20	V
Input voltages	Pin 6, 7, 9, 10	V_I	V_S-1.5	V
Input currents	Pin 6, 7, 9, 10	I_I	0.5	mA
Maximum currents	Pin 1…5, 11…15	I_O	25	mA
Output reverse voltage	Pin 1…5, 11…15	V_O	V_S	
Power dissipation $T_{amb} = 85$ °C		P_{tot}	810	mW
Ambient temperature range		T_{amb}	−10…+85	°C
Junction temperature		T_j	150	°C

Thermal resistance

		Min.	Typ.	Max.	
Junction ambient	R_{thJA}			80	K/W

Electrical characteristics

$V_S = 16$ V, T_{amb} 25 °C, reference point Pin 8, unless otherwise specified

			Min.	Typ.	Max.	
Supply voltage range	Pin 16	V_S [1]	7		18	V
Total supply current	Pin 16	I_S		35		mA
LED current source	Pin 1, 15	I_O		15		mA

Comparator turn-on thresholds and tolerances (LEDs display input)

LEDs No.	U 2066 B V_i mV	U 2066 B ΔV_i mV	U 2067 B V_i mV	U 2067 B ΔV_i mV
1	206	± 30	510	± 30
2	364	± 40	644	± 40
3	644	± 50	814	± 50
4	912	± 60	1021	± 60
5	1289	± 80	1289	± 80

			Min.	Typ.	Max.	
Switching threshold hysteresis (LED-Display input)	Pin 1…5, 11…15	ΔV_{IH}		10		mV
Output saturation voltage	Pin 1…5, 11…15	V_{Osat}			1.1	V
Input currents $V_i = 0$ V	Pin 7, 9	I_I			1	µA
Pull up resistance	Pin 5, 11	$R_{5,\,11}$		10		kΩ
Pull down resistance	Pin 5, 11	$R_{5,\,11}$		5		kΩ
Operational amplifier						
Input offset voltage		V_{IO}			10	mV
Input offset current		I_{IO}			0.5	µA
Input bias current		I_{IB}			1	µA

[1] Series circuit connection of 5 LEDs is not possible if the supply voltage is below 12 V for red LEDs and below 17 V for green LEDs. LED should be connected then separately through external resistance. The basic function of the integrated circuit is guaranteed down to $V_S = 4.5$ V, however without compliance of data sheet values.

			Min.	Typ.	Max.	
Open loop gain		G_{VO}	80			dB
Common mode rejection ratio		*CMR*		80		dB
Common mode input voltage range		V_{IC}	0		V_S–1.5	V
Output voltage swing		V_O	0		V_S–1.5	V
Output current limitation $V_{6,10} = 0$ V	Pin 6, 10	I_O			30	mA
Frequency compensation				internal		

Applications

LED basic circuit

When sufficient supply voltage is available, LEDs are connected in series and supplied with constant current source of 15 mA. Output transistors are "turned-on" (conducting stage) if the input voltage is zero (V_i=0 V), they are "turned-off" (non-conducting) if the input voltage is greater than the 5th turned-on threshold.

Minimum supply voltage requirement depends upon the colour and V_F of the LED, i. e.:

$$V_{Smin} = \sum V_F + 2\ \text{V}$$

whereas V_F is worst case value of the LEDs forward voltage

with red colour $V_F = 2$ V
green, yellow, orange $V_F = 3$ V

For different colour LEDs supply voltage requirements, please refer to table 1.

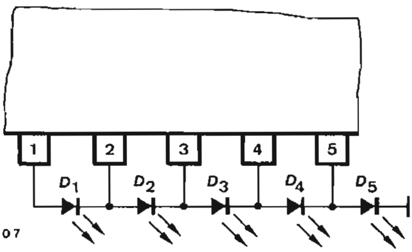


Fig. 2 Series circuit for 5 LEDs

LEDs colour	S P 5 0	S P 4 1	S P 3 2	S P 2 3	S P 1 4
5 green	17 V	14 V	11 V	8 V	5 V
5 red	12 V	10 V	8 V	6 V	4 V
4 green/1 red	16 V	14 V	11 V	8 V	5 V
3 green/2 red	15 V	13 V	11 V	8 V	5 V
Fig. No.	2	3	4	5	6

Table 1: Supply voltage requirement for different configurations; S = Serie, P = Parallel

If the supply voltage is lower than above mentioned, then some of the LEDs must be connected to supply voltage V_S with external resistance *R* as shown in Figs. 3...6.

The resistance value *R* is calculated as follows:

$$R = \frac{V_S - V_F}{15\ \text{mA}}$$

Different connection possibilities are shown in table 1 together with appropriate diags. 2...6.

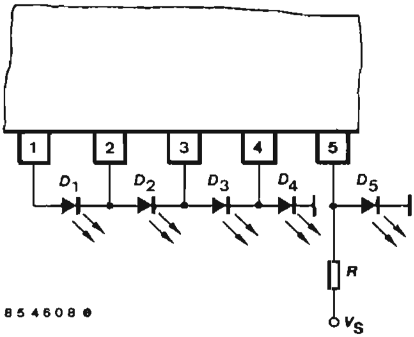


Fig. 3 4 LEDs in series
1 LED in parallel

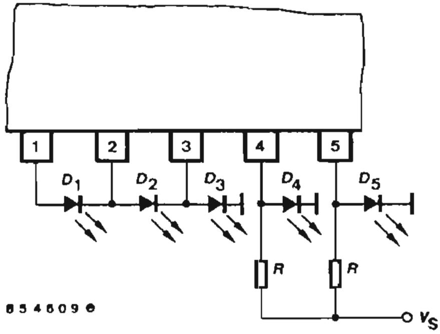


Fig 4. 3 LEDs in series
2 LEDs in parallel

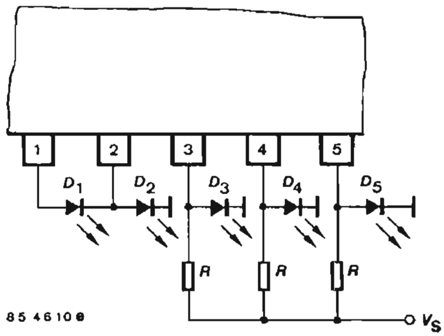


Fig. 5 2 LEDs in series
3 LEDs in parallel

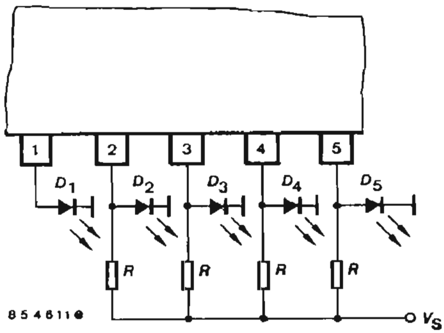


Fig. 6 1 LED in serie
4 LEDs in parallel

LEDs turn-on threshold level settings

Switching thresholds are dependent on the gain of the inverting amplifier. Voltage gain, G_v is realised mainly with resistance ratios (R_1 and R_2).

$$G_v = \frac{1289 \text{ mV}}{V_i \sqrt{2}}$$, whereas V_i in mV_{rms} for the 5th LED.

Example: 5th LED shall be turned-on when input voltage, V_i is 212 mV_{rms}, (see table 2).

$$\text{Therefore } G_v = \frac{1289}{212\sqrt{2}} = \frac{R_2}{R_1} = 4.3$$

$$\text{when } R_1 = 100 \text{ k}\Omega\text{, then } R_2 = \frac{1289 \times 100 \text{ k}\Omega}{212\sqrt{2}} = \underline{430 \text{ k}\Omega}$$

For exact dimensioning use a potentiometer (R_2) of value 400…500 kΩ

Therefore the following input voltages with $G_v = 4.3$ is given in table 2 and its application is shown in Fig. 7

LEDs No.	U 2066 B	U 2067 B	V_i
1	34	84	mVrms
2	60	106	mVrms
3	106	134	mVrms
4	150	168	mVrms
5	212	212	mVrms

Table 2: Different input voltages, V_i in mVrms

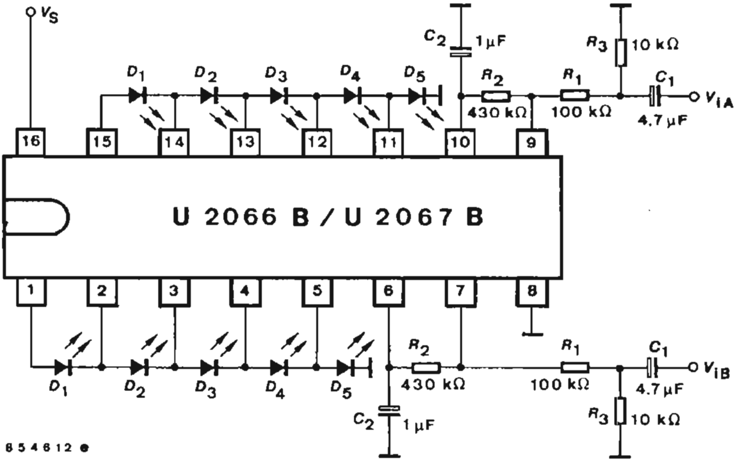


Fig. 7 Circuit with $G_v = 4.3$

10 LEDs scale controller circuit

It is possible to build a dual 10 LEDs scale controller indicator by series connection of U 2066 B and U 2067 B with appropriate gain factors.

Example: Calculation of gain factor G_2 for U 2067 B:

$$G_2 = \frac{1289\ \text{mV}}{V_i\sqrt{2}}$$

The fifth turn-on level of U 2066 B always lies 10 dB lower than the fifth turn-on level of U 2067 B i.e. a factor 3.16; therefore:

$$\frac{G_1}{G_2} = 3.16 \text{ or } G_1 = 3.16\ G_2$$

Gain factor of U 2066 B should be 3.16 greater than the gain factor of U 2067 B.

From the table 3 of comparator turn-on threshold and its specified input voltages in dB, one can obtain:

$V_{imax} = 911\ mV \triangleq +6\ dB$ and $R_1 = 100\ k\Omega$; then $G_2 = \frac{1289}{911 \times \sqrt{2}} = 1$

when $G_2 = 1$ and $R_2 = 100\ k\Omega$, $G_1 = 3.16 \times G_2 = 3.16$

then $R'_2 = 3.16 \times R_2 = \underline{316\ k\Omega}$

LED 1	LED 2	LED 3	LED 4	LED 5	LED 6	LED 7	LED 8	LED 9	LED 10	
–20	–15	–10	–7	–4	–2	0	+2	+4	+6	dB
46	81	144	204	288	363	456	574	723	911	mV

Table 3: Comparator turn-on thresholds for 10 LEDs

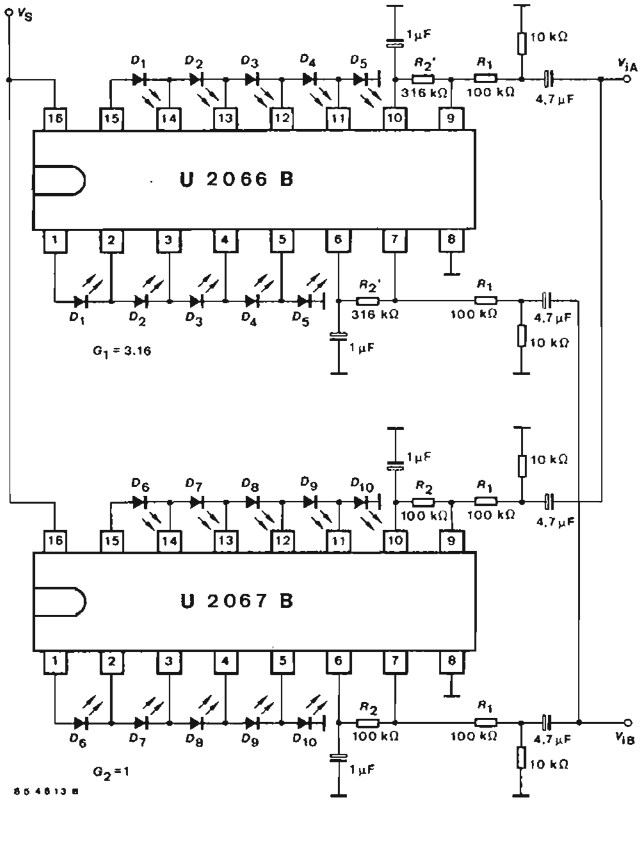
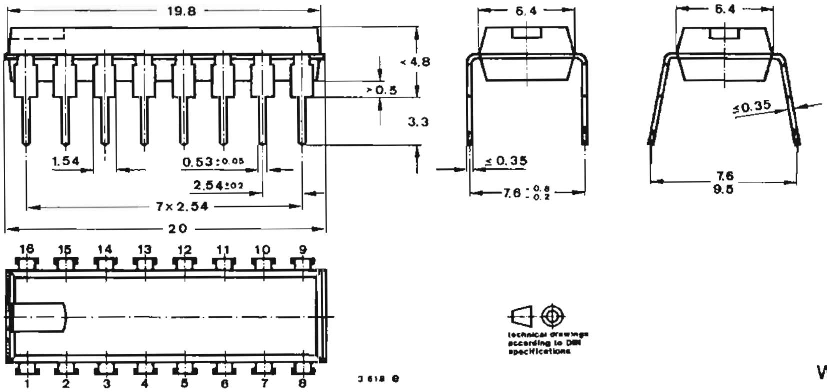


Fig. 8 Dual 10 LED control circuit
$V_{i\,max} = 911$ Vrms

Dimensions in mm



Case
DIP 16
Weight max. 1.5 g

TELEFUNKEN electronic
Creative Technologies

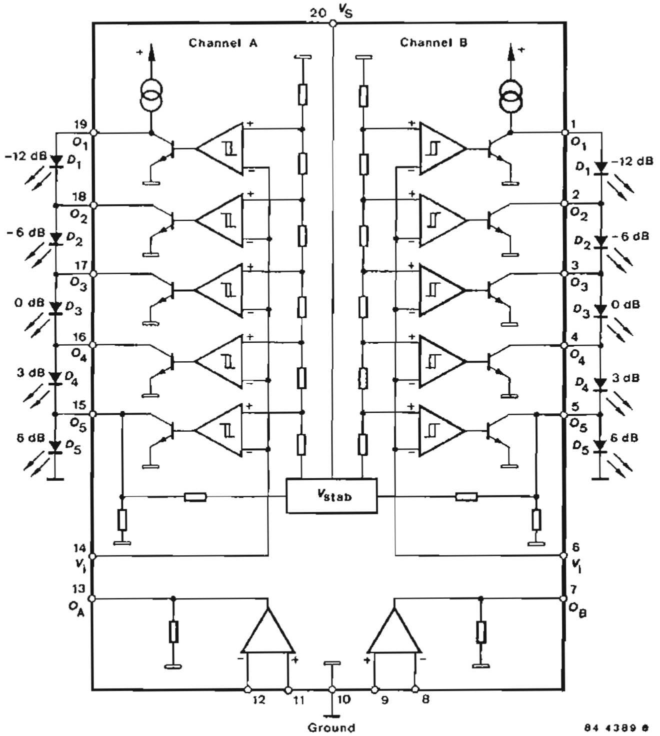
U 2068 B

Monolithic Integrated Circuit

Application: Stereo control indicator with 5 LED's and one operational amplifier per channel for radio, amplifier and cassette recorder.

Features:

- Large supply voltage range
- Constant LED current
- Low power dissipation due to series connection of LED's
- Different colour LED's can be mixed easily
- One independent connectable operational amplifier per channel
- Turn-on intervals: 6 dB – 6 dB – 3 dB – 3 dB



Channel B

1: LED-Output O_1
2: LED-Output O_2
3: LED-Output O_3
4: LED-Output O_4
5: LED-Output O_5
6: Comparator input V_i
7: OP AMP-Output OUT
8: OP AMP "negative"-Input
9: OP AMP "positive"-Input
10: Ground (GD)

Channel A

11: OP AMP "positive"-Input
12: OP AMP "negative"-Input
13: OP AMP-Output OUT
14: Comparator input V_i
15: LED-Output O_5
16: LED-Output O_4
17: LED-Output O_3
18: LED-Output O_2
19: LED-Output O_1
20: Supply voltage V_S

Fig. 1 Block diagram and Pin connections

T1.2/361.0184 E1

Absolute maximum ratings

Supply voltage	Pin 20	V_S		20		V
Input voltages	Pin 6, 8, 9, 11, 12, 14	V_I		$V_S-1.5$		V
Input currents	Pin 6, 8, 9, 11, 12, 14	I_I		0.5		mA
Maximum currents	Pin 1...5, 15...19	I_O		30		mA
Output reverse voltage	Pin 1...5, 15...19	V_O		V_S		
Power dissipation $T_{amb} = 85$ °C		P_{tot}		810		mW
Ambient temperature range		T_{amb}		– 10...+ 85		°C
Junction temperature		T_j		150		°C
Thermal resistance			**Min.**	**Typ.**	**Max.**	
Junction ambient		R_{thJA}			80	K/W

Electrical characteristics

$V_S = 16$ V, $T_{amb} = 25$ °C, reference point Pin 10

			Min.	Typ.	Max.	
Supply voltage range	Pin 20	V_S [1]	7		18	V
Total supply current	Pin 20	I_S		40		mA
LED current source	Pin 1, 19	I_O		15		mA

Comparator turn-on thresholds and tolerances (LED-Display input)

	V_I mV	ΔV_I mV
−12 dB	216	±30
−6 dB	560	±30
0 dB	1260	±30
+3 dB	1860	±60
+6 dB	2710	±80

			Min.	Typ.	Max.	
Switching threshold hysteresis (LED-Display input)	Pin 1...5, 15...19	ΔV_{IH}		10		mV
Output saturation voltage	Pin 1...5, 15...19	V_{Osat}			1.1	V
Input currents $V_i = 0$ V	Pin 6, 14	$-I_i$			1	µA
Pull up resistance	Pin 5, 15	$R_{5, 15}$		10		kΩ
Pull down resistance	Pin 5, 15	$R_{5, 15}$		5		kΩ

[1] Series circuit connection of 5 LED's is not possible if the supply voltage is below 12 V for red LED's and below 17 V for green LED's. LED should be connected then separately through external resistances.
The basic function of the integrated circuit is guaranteed down to $V_S = 4.5$ V, however without compliance of data sheet values.

		Min.	Typ.	Max.	
Operational amplifier					
Input offset voltage	V_{10}			10	mV
Input offset current	I_{10}			0.5	μA
Input bias current	I_{IB}			1	μA
Open loop gain	G_{VO}	80			dB
Common mode rejection ratio	CMR		80		dB
Common mode input range	V_{IC}	0		V_S-1.5	V
Output voltage swing	V_O	1		V_S-1.5	V
Output current limitation $V_{7.13} = 0$ V	I_O			30	mA
Load resistance	$R_{7.13}$		10		kΩ
Channel separation Channel A – Channel B	Ch. Sep.	60			dB
Frequency compensation			internal		
Slew rate	SR		0.5		V/μs

Applications

LED basic circuit

When sufficient supply voltage is available, LEDs are connected in series and supplied with constant current source of 15 mA. Output transistors are "turned-on" (conducting stage) if the input voltage is zero ($V_i = 0$ V), they are "turned-off" (non-conducting) if the input voltage is greater than the 5th turned-on threshold.

Minimum supply voltage requirement depends upon the colour and V_F of the LED, i. e.:

$$V_{Smin} = \sum V_F + 2\text{ V}$$

whereas V_F is worst case value of the LEDs forward voltage

with red colour $V_F = 2$ V
green, yellow, orange $V_F = 3$ V

For different colour LEDs supply voltage requirements, please refer to table 1.

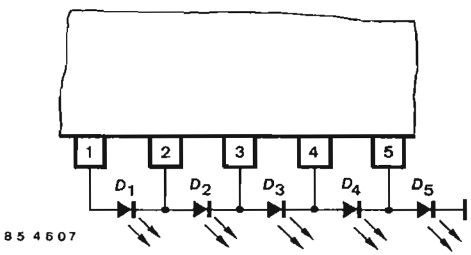


Fig. 2 Series circuit for 5 LEDs

LEDs colour	S 5 P 0	S 4 P 1	S 3 P 2	S 2 P 3	S 1 P 4
5 green	17 V	14 V	11 V	8 V	5 V
5 red	12 V	10 V	8 V	6 V	4 V
4 green/1 red	16 V	14 V	11 V	8 V	5 V
3 green/2 red	15 V	13 V	11 V	8 V	5 V
Fig. No.	2	3	4	5	6

Table 1: Supply voltage requirement for different configurations; S = Series, P = Parallel

If the supply voltage is lower than above mentioned, then some of the LEDs must be connected to supply voltage V_S with external resistance R as shown in Figs. 3...6.

The resistance value R is calculated as follows:

$$R = \frac{V_S - V_F}{15\ \text{mA}}$$

Different connection possibilities are shown in table 1 together with appropriate diags. 2...6.

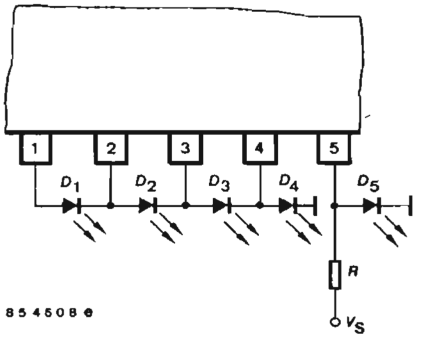


Fig. 3 4 LEDs in series
1 LED in parallel

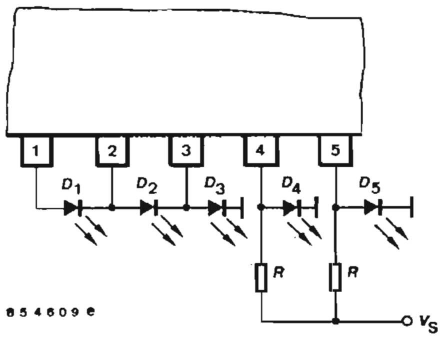


Fig. 4 3 LEDs in series
2 LEDs in parallel

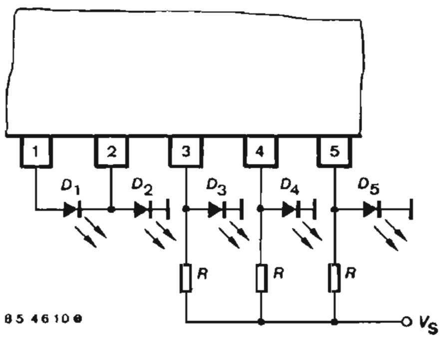


Fig. 5 2 LEDs in series
3 LEDs in parallel

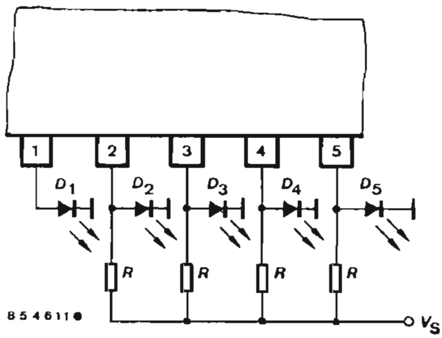
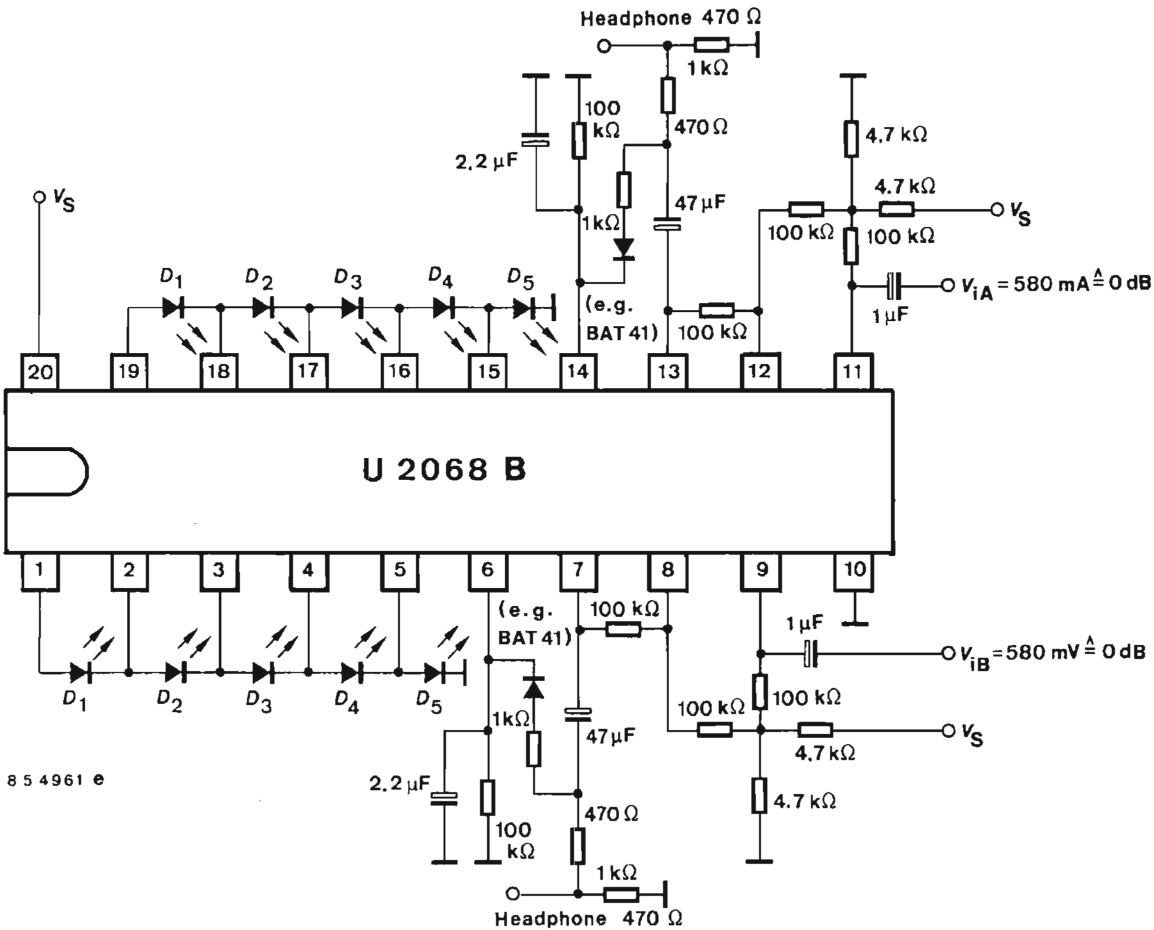


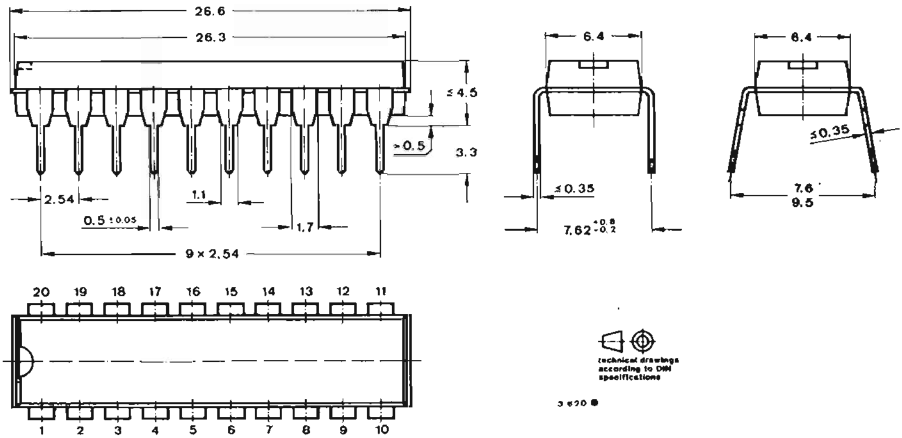
Fig. 6 1 LED in series
4 LEDs in parallel

Application

Display control and headphone amplifier



Dimensions in mm



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