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%

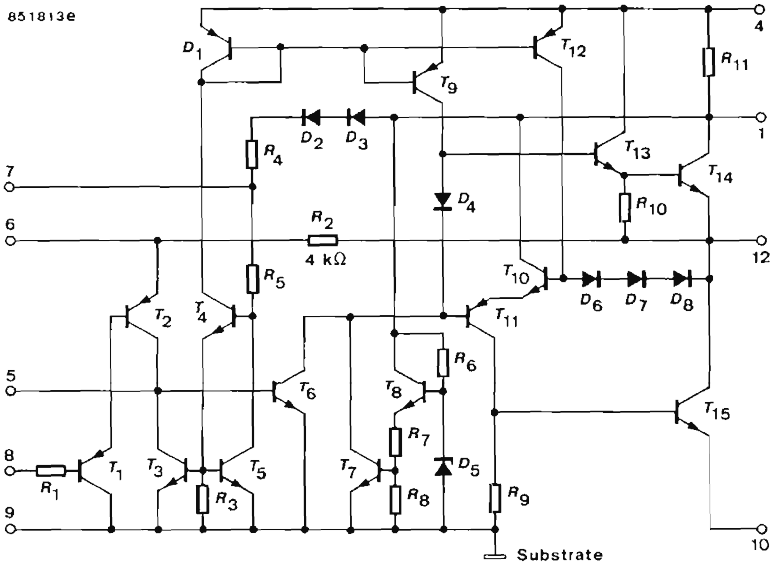

Fig. 1 Diagram and pin connections

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

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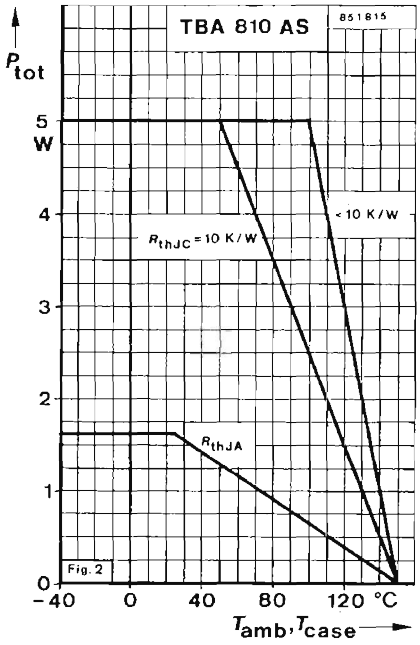
Thermal resistances				Min.	Typ.	Max.	
Junction ambient		**TBA 810 S**	R_{thJA}			70	K/W
		TBA 810 AS	R_{thJA}			80	K/W
Junction case	Fig. 3, 4, 5	**TBA 810 S**	R_{thJC} [1]			12	K/W
	Fig. 2	**TBA 810 AS**	R_{thJC} [1]			10	K/W

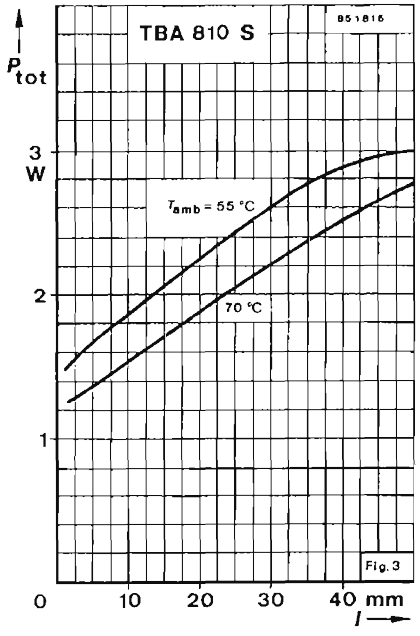
Electrical characteristics

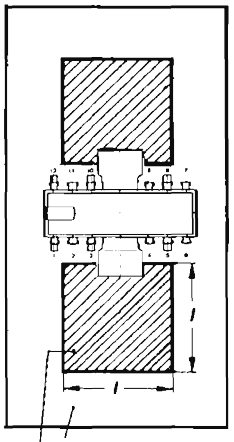
T_{amb} = 25°C, R_f = 56 Ω, reference point: Pin 9,10, unless otherwise specified

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	Fig. 6, 8, 9, 10, 11						
R_L = 4 Ω, f = 1 kHz, d = 10%	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	Fig.18	Pin 8					
V_S = 14.4 V, P_o = 6 W,							
f = 1 kHz, R_L = 4 Ω,		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)	Fig.16						
V_S = 14.4 V, R_L = 4 Ω, 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





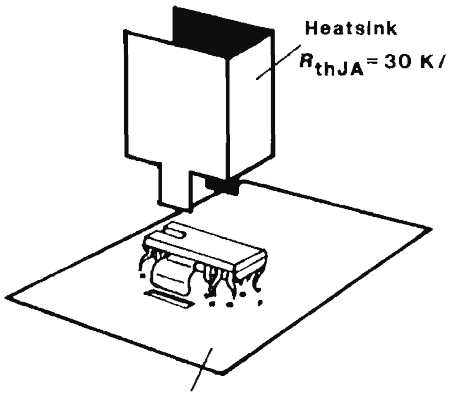


PC Board

Copper Area 35 µm Thickness

Fig. 4

81 2603 e



PC Board

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		%

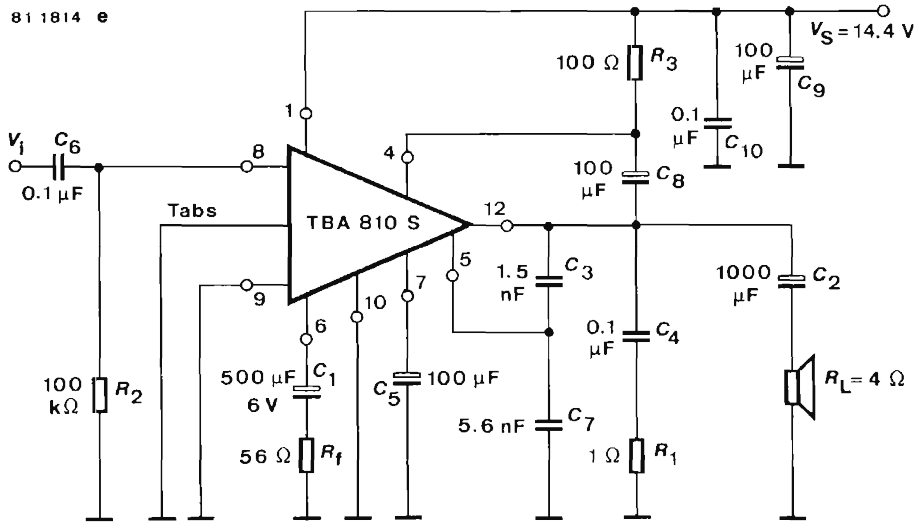
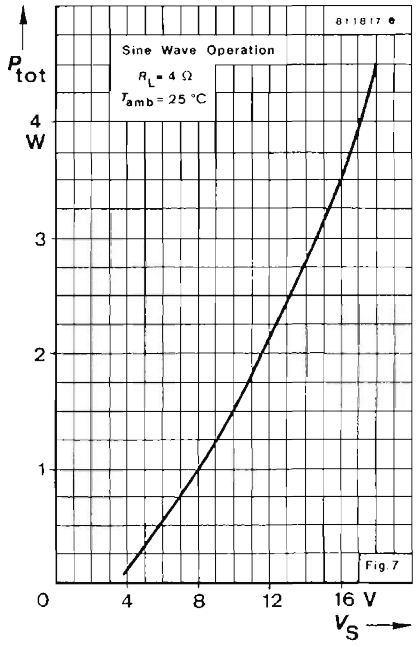


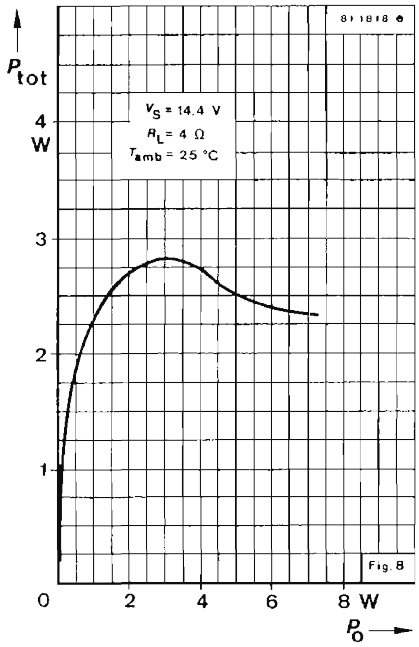
Fig. 6 Test circuit for: P_o, P_{tot}, d, η and application note

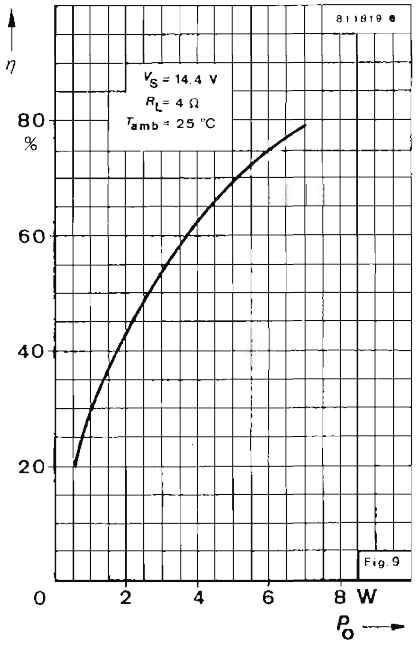
Thermal shut-down

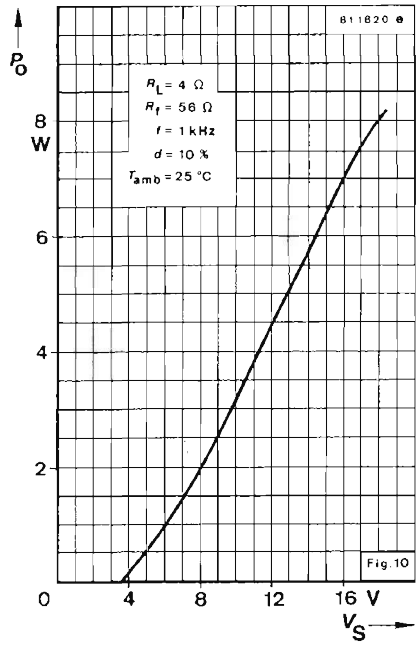
The presence of a thermal limiting circuit offers the following advantages:

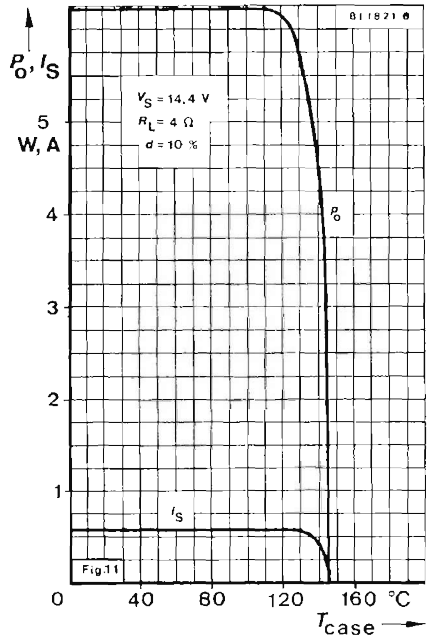
1. An overload on the output (even if it is permanent), or an above-limit ambient temperature can be easily supported.
2. The heat sink can have a smaller factor of safety compared with that of a conventional circuit. There is no device damage in the case of too high a junction temperature: all that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

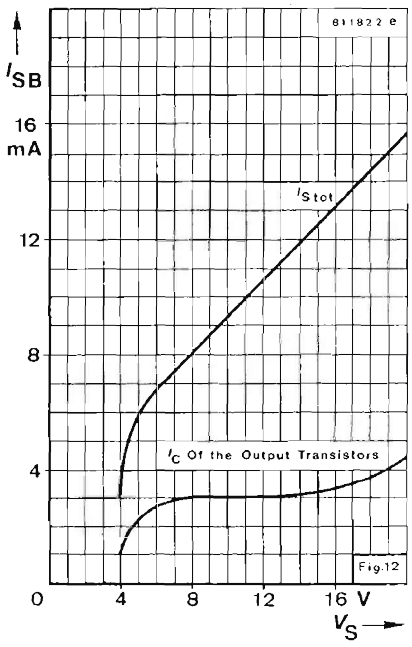

8 11817 e
Sine Wave Operation
R_L = 4 Ω
T_{amb} = 25 °C
P_{tot}
4 W
3
2
1
0
4
8
12
16 V
V_S
Fig. 7

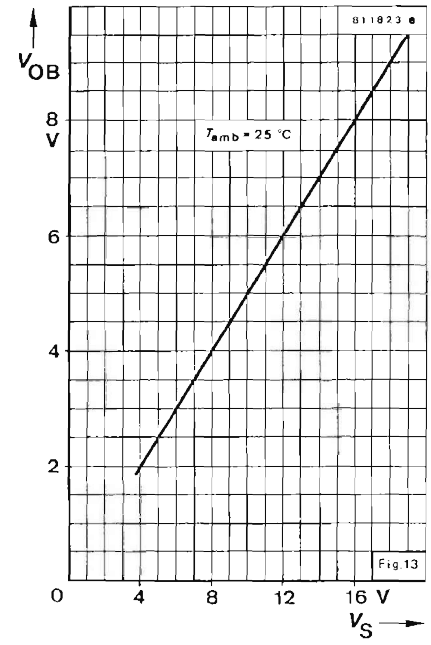

8 11818 e
P_{tot}
V_S = 14.4 V
R_L = 4 Ω
T_{amb} = 25 °C
4 W
3
2
1
0
2
4
6
8 W
P_o
Fig. 8

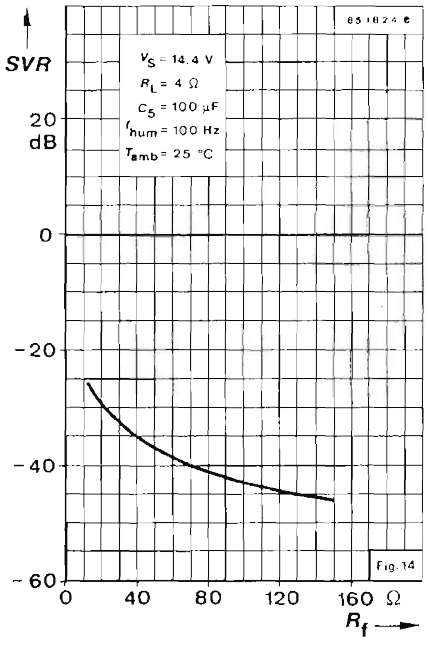

8 11819 e
η
V_S = 14.4 V
R_L = 4 Ω
T_{amb} = 25 °C
80 %
60
40
20
0
2
4
6
8 W
P_o
Fig. 9

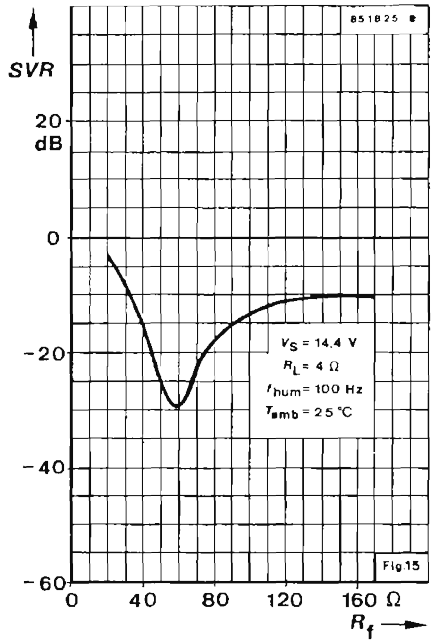

8 11820 e
P_o
R_L = 4 Ω
R_f = 56 Ω
f = 1 kHz
d = 10 %
T_{amb} = 25 °C
8 W
6
4
2
0
4
8
12
16 V
V_S
Fig. 10

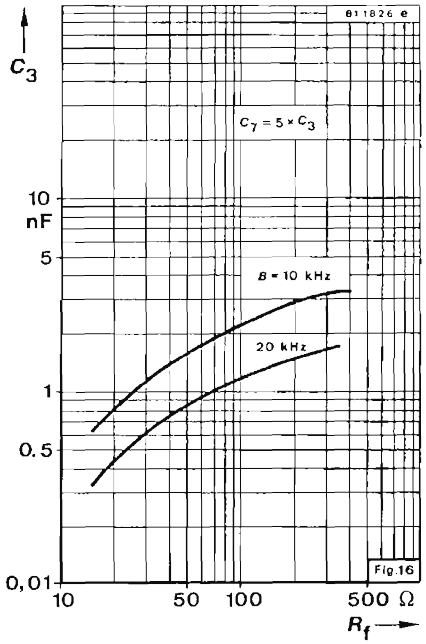

P_o, I_S
W, A
V_S = 14.4 V
R_L = 4 Ω
d = 10 %
P_o
I_S
Fig.11
T_{case}

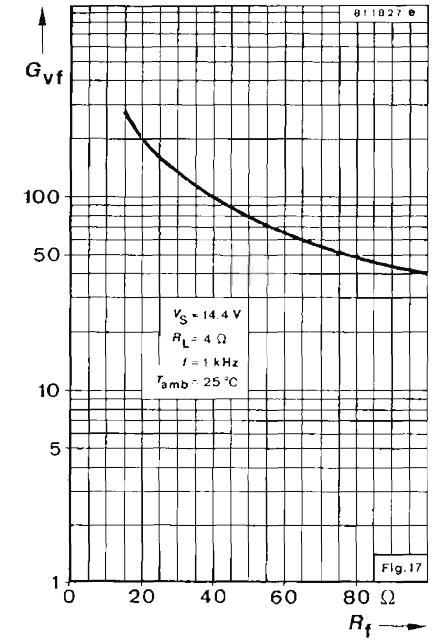

I_{SB}
mA
I_{Stot}
I_C Of the Output Transistors
Fig.12
V_S

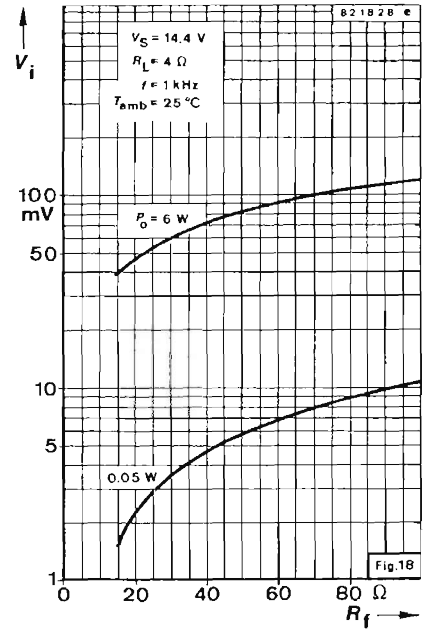

V_{OB}
V
T_{amb} = 25 °C
Fig.13
V_S


SVR
dB
V_S = 14.4 V
R_L = 4 Ω
C_5 = 100 µF
f_{hum} = 100 Hz
T_{amb} = 25 °C
Fig.14
R_f

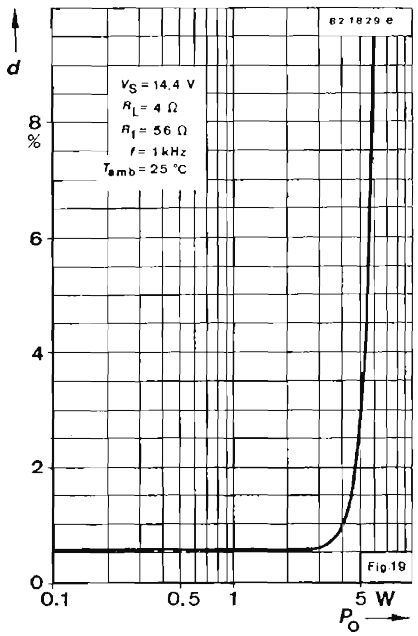

SVR
20
dB
0
-20
-40
-60
0
40
80
120
160 Ω
R_f
V_S = 14.4 V
R_L = 4 Ω
f_{hum} = 100 Hz
T_{amb} = 25 °C
Fig.15

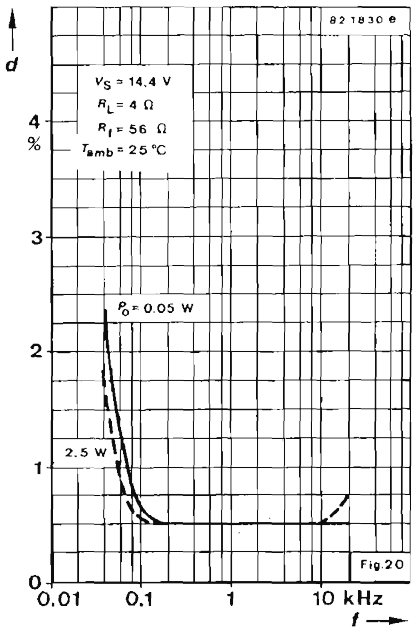

C_3
$C_7 = 5 \times C_3$
10
nF
5
1
0.5
0,01
10
50
100
500 Ω
R_f
B = 10 kHz
20 kHz
Fig.16


G_{vf}
100
50
10
5
1
0
20
40
60
80 Ω
R_f
V_S = 14.4 V
R_L = 4 Ω
f = 1 kHz
T_{amb} = 25 °C
Fig.17

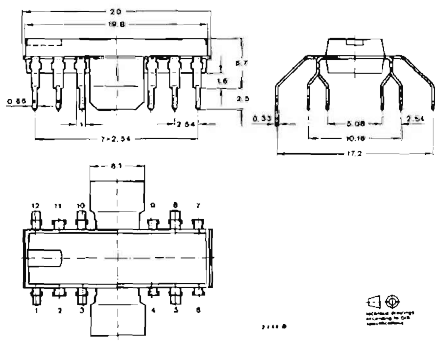

V_i
V_S = 14.4 V
R_L = 4 Ω
f = 1 kHz
T_{amb} = 25 °C
100
mV
50
10
5
1
P_o = 6 W
0.05 W
0
20
40
60
80 Ω
R_f
Fig.18

TBA 810 S · TBA 810 AS

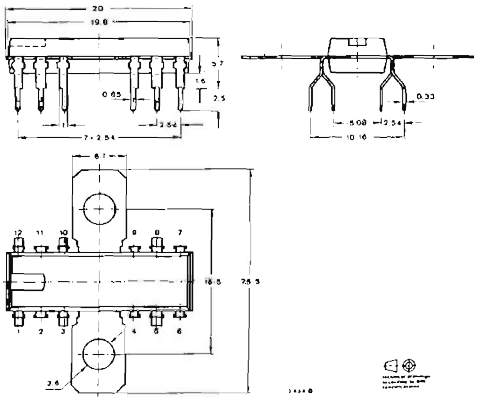




Dimensions in mm



TBA 810 S



TBA 810 AS

QIP-Special
Weight max. 1.5 g

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- 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%

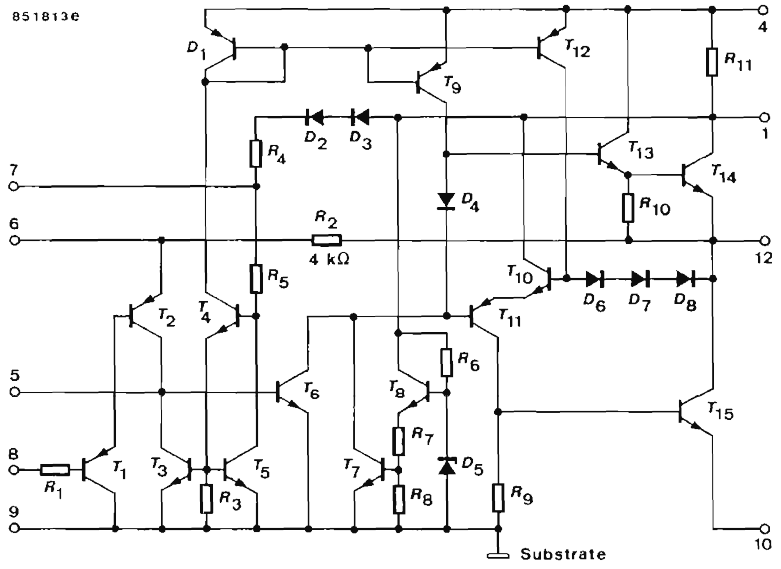


Fig. 1 Diagram and pin connections

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

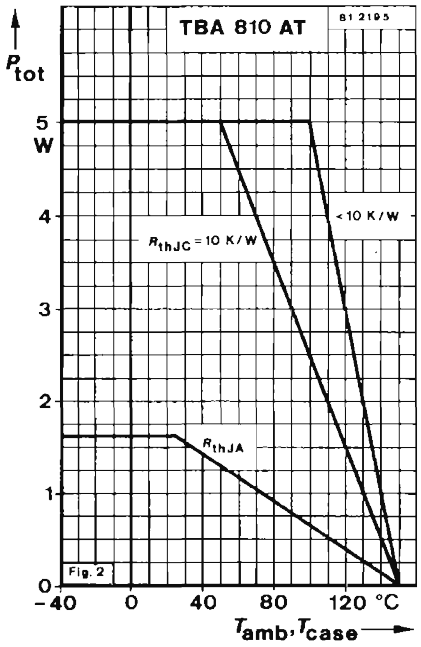
Thermal resistances				Min.	Typ.	Max.	
Junction ambient		**TBA 810 T**	R_{thJA}			70	K/W
		TBA 810 AT	R_{thJA}			80	K/W
Junction case	Fig. 3, 4, 5	**TBA 810 T**	R_{thJC} [1]			12	K/W
	Fig. 2	**TBA 810 AT**	R_{thJC} [1]			10	K/W

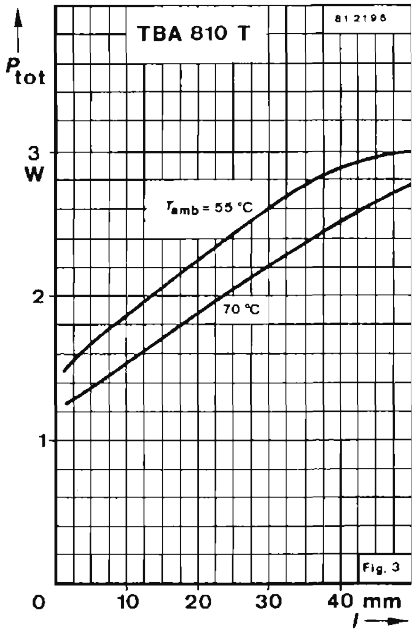
Electrical characteristics

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

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,							
$R_L = 4\ \Omega$		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, $R_L = 4\ \Omega$,							
$f_{hum} = 100$ Hz	Fig.14,15		SVR		48		dB
Input current							
$V_S = 14.4$ V		Pin 8	I_{IB}		0.4	4	μA
Output power,	Fig. 6, 8, 9,10,11						
$R_L = 4\ \Omega$, $f = 1$ kHz, $d = 10\%$	$V_S = 16.0$ 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	Fig.18	Pin 8					
$V_S = 14.4$ V, $P_o = 6$ W,							
$f = 1$ kHz, $R_L = 4\ \Omega$	$R_f = 56\ \Omega$		V_i		80		mV
	$R_f = 22\ \Omega$		V_i		35		mV
Input resistance		Pin 8	R_i		5		MΩ
Band width (–3 dB)	Fig.16						
$V_S = 14.4$ V, $R_L = 4\ \Omega$, $C_3 =$	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





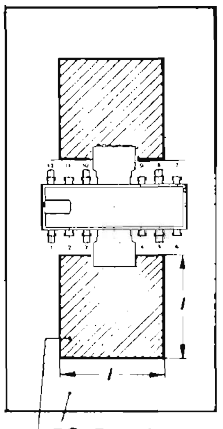


Fig. 4

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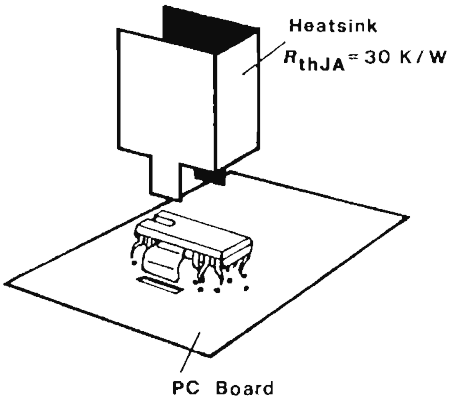

Fig. 5

				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		%

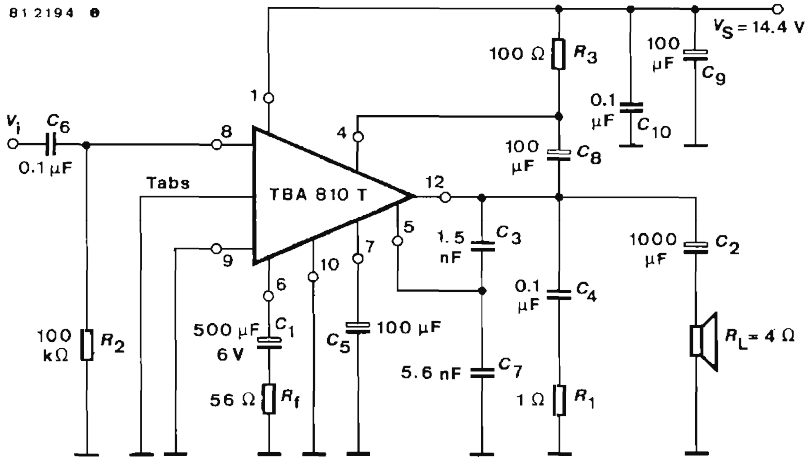

Fig. 6 Test circuit for: P_o, P_{tot}, d, η and application note

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.
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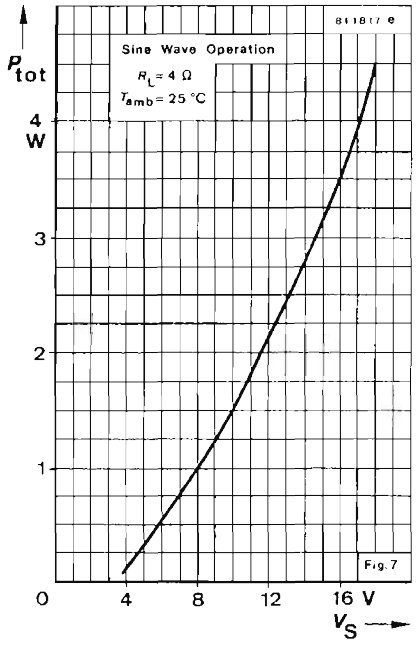
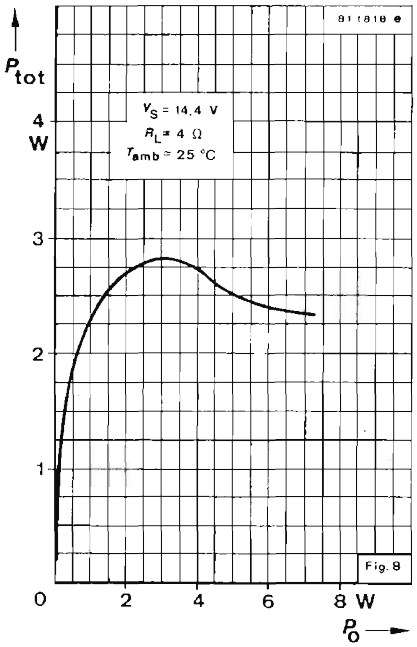
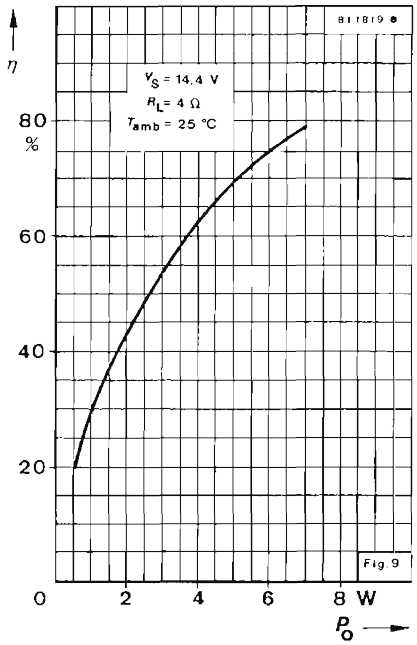
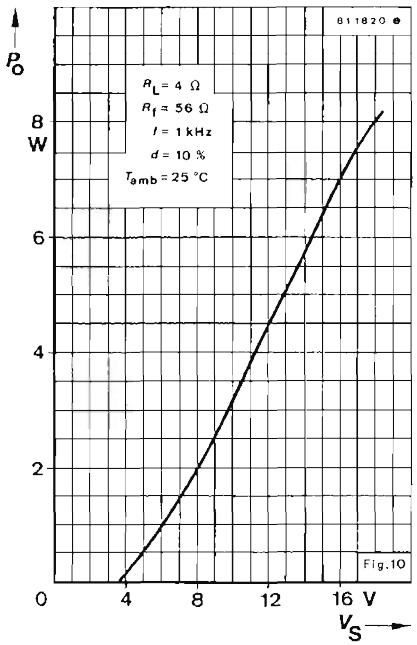
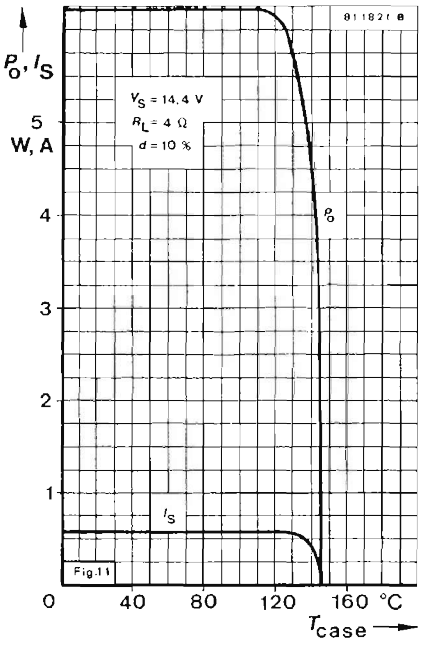
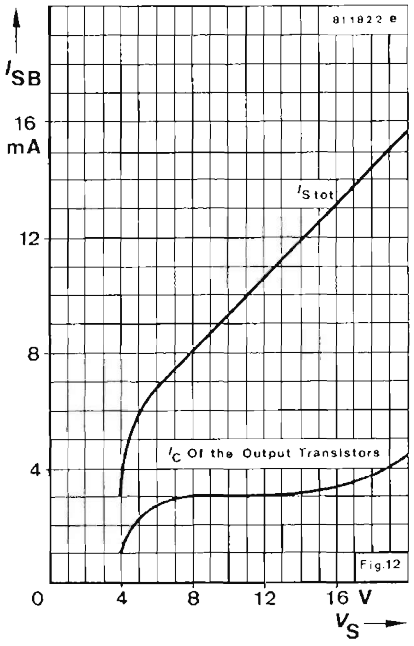

811817 e
Sine Wave Operation
R_L = 4 Ω
T_{amb} = 25 °C
P_{tot}
4 W
3
2
1
0
4
8
12
16 V
V_S
Fig. 7

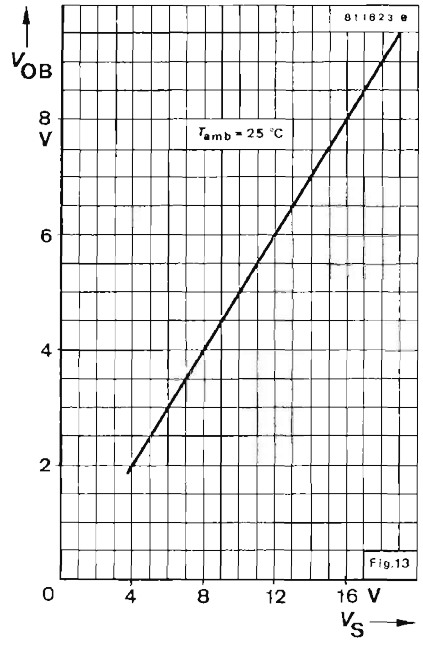

811818 e
P_{tot}
V_S = 14,4 V
R_L = 4 Ω
T_{amb} = 25 °C
4 W
3
2
1
0
2
4
6
8 W
P_O
Fig. 8

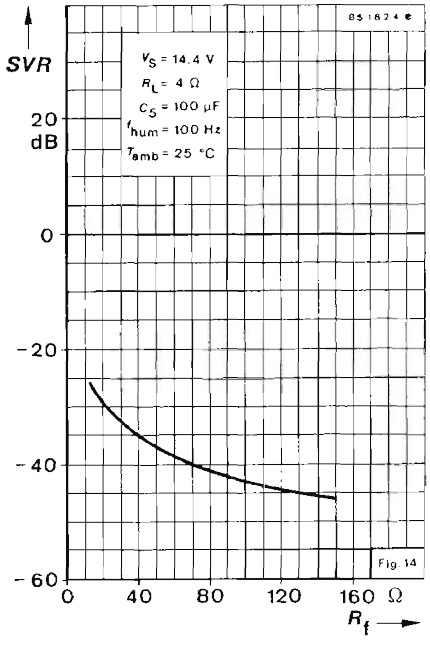

811819 e
η
V_S = 14,4 V
R_L = 4 Ω
T_{amb} = 25 °C
80 %
60
40
20
0
2
4
6
8 W
P_O
Fig. 9

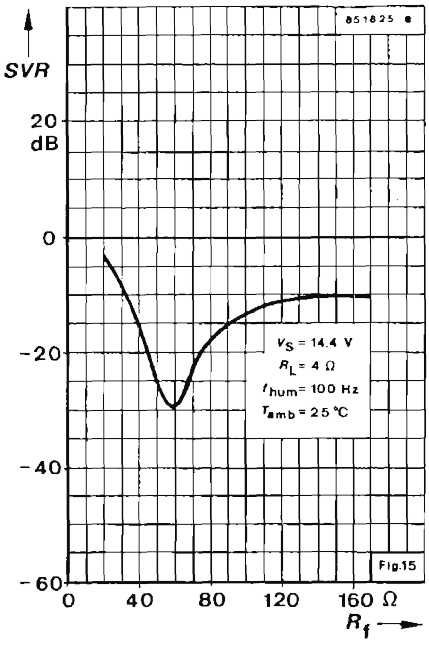

811820 e
P_O
R_L = 4 Ω
R_f = 56 Ω
f = 1 kHz
d = 10 %
T_{amb} = 25 °C
8 W
6
4
2
0
4
8
12
16 V
V_S
Fig. 10

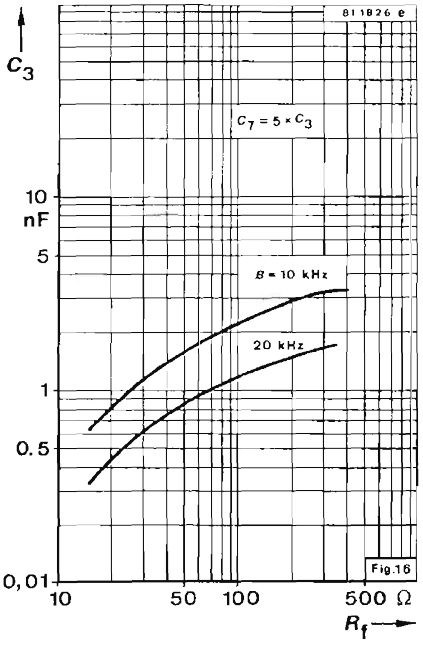

811821 e
P_o, I_S
5
W, A
4
3
2
1
0
40
80
120
160 °C
T_{case}
V_S = 14.4 V
R_L = 4 Ω
d = 10 %
P_o
I_S
Fig.11

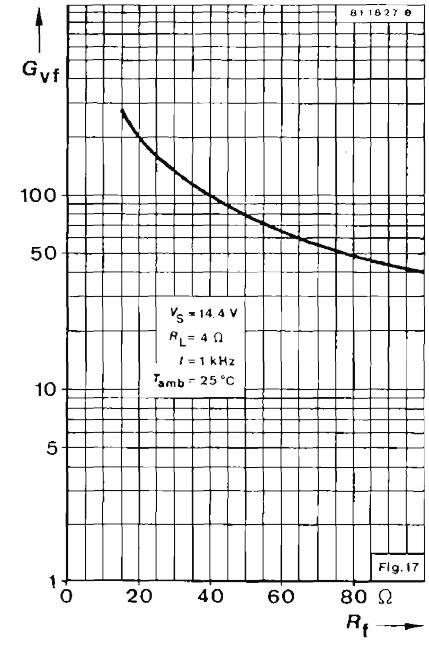

811822 e
I_{SB}
16
mA
12
8
4
0
4
8
12
16 V
V_S
$I_{S\,tot}$
I_C Of the Output Transistors
Fig.12

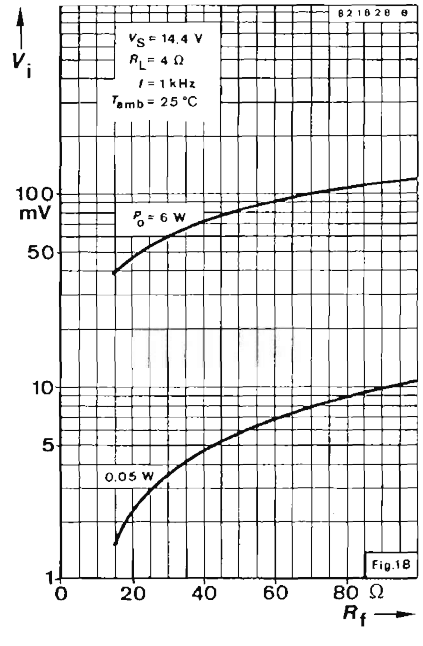

811823 e
V_{OB}
8
V
6
4
2
0
4
8
12
16 V
V_S
T_{amb} = 25 °C
Fig.13

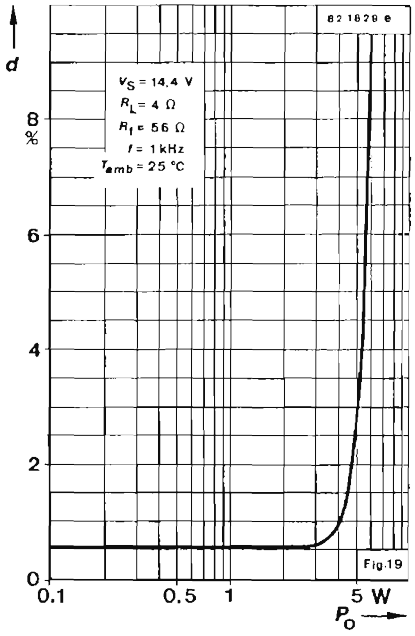

851824 e
SVR
20
dB
0
-20
-40
-60
0
40
80
120
160 Ω
R_f
V_S = 14.4 V
R_L = 4 Ω
C_S = 100 µF
f_{hum} = 100 Hz
T_{amb} = 25 °C
Fig. 14

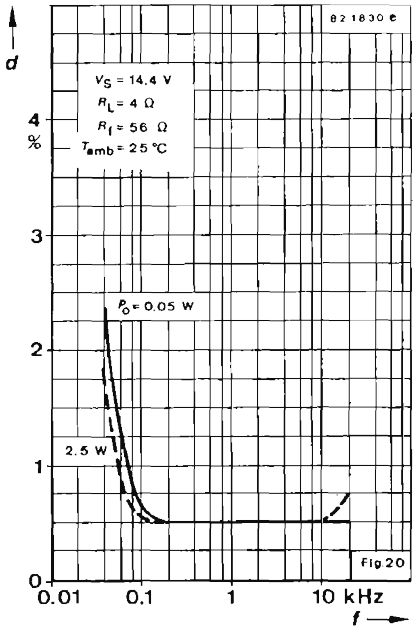

851825 e
SVR
20
dB
0
-20
-40
-60
0
40
80
120
160 Ω
R_f
V_S = 14.4 V
R_L = 4 Ω
f_{hum} = 100 Hz
T_{amb} = 25 °C
Fig.15


811826 e
C_3
$C_T = 5 \times C_3$
10
nF
5
1
0.5
0,01
10
50
100
500 Ω
R_f
B = 10 kHz
20 kHz
Fig.16

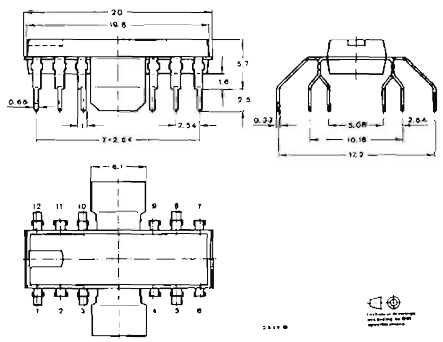

811827 e
G_{vf}
100
50
10
5
1
0
20
40
60
80 Ω
R_f
V_S = 14.4 V
R_L = 4 Ω
f = 1 kHz
T_{amb} = 25 °C
Fig.17


821828 e
V_i
100
mV
50
10
5
1
0
20
40
60
80 Ω
R_f
V_S = 14.4 V
R_L = 4 Ω
f = 1 kHz
T_{amb} = 25 °C
P_o = 6 W
0.05 W
Fig.18



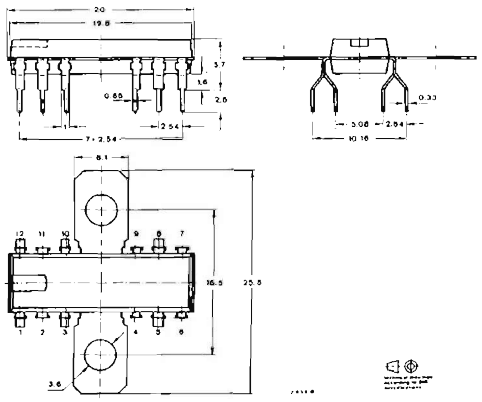


Dimensions in mm



TBA 810 T

DIP-Special
Weight max. 1.5 g



TBA 810 AT