DISCRETE SEMICONDUCTORS

RF Power Modules

BOOK SC09 1991

Philips Semiconductors

PHILIPS

RF power modules

Contents

page

SELECTION GUIDE

VHF modules for mobile transmitters 4

UHF modules for portable transmitters 4

SHF modules for portable transmitters 5

TYPE NUMBER SURVEY (alpha-numeric) 6

GENERAL

Pro-electron type designation code for semiconductor devices 9

Rating systems 11

Letter symbols for transistors and signal diodes 13

Scattering parameters 19

Mounting recommendations 21

MODULE DATA (in alpha-numeric sequence) 25

SELECTION GUIDE

INTRODUCTION

The following tables represent our complete range of RF power modules.

VHF modules for mobile transmitters

P_L (W)	V_S (V)	f (MHz)	G_p (dB)	ENVELOPE	TYPE NUMBER	PAGE
18	12.5	68 to 88	22.6	SOT132B	BGY32	25
18	12.5	80 to 108	22.6	SOT132B	BGY33	25
18	12.5	132 to 156	20.8	SOT132B	BGY35	25
18	12.5	148 to 174	20.8	SOT132B	BGY36	25
13	12.5	148 to 174	19.4	SOT132B	BGY43	35
7	7.5	68 to 88	38.5	SOT288C	BGY112A	97
7	7.5	132 to 156	38.5	SOT288C	BGY112B	97
7	7.5	146 to 174	38.5	SOT288C	BGY112C	97
29	12.5	68 to 88	22.9	SOT183A	BGY145A	105
28	12.5	148 to 174	19.7	SOT183A	BGY145B	113
40	12.5	174 to 200	19.5	SOT183A	BGY145C	121

UHF modules for portable transmitters

P_L (W)	V_S (V)	f (MHz)	G_p (dB)	ENVELOPE	TYPE NUMBER	PAGE
1.4	9.6	400 to 440	15	SOT181	BGY46A	43
1.4	9.6	430 to 470	15	SOT181	BGY46B	49
3.2	9.6	400 to 440	18	SOT181	BGY47A	55
7	7.5	400 to 440	38.5	SOT288D	BGY113A	101
7	7.5	430 to 470	38.5	SOT288D	BGY113B	101

SHF modules for portable transmitters

P_L (W)	V_S (V)	f (MHz)	G_p (dB)	ENVELOPE	TYPE NUMBER	PAGE
2.2	7.5	824 to 849	20.4	SOT200	BGY95A	63
2.2	7.5	890 to 915	20.4	SOT200	BGY95B	63
2.5	9.6	824 to 849	21	SOT200	BGY96A	73
2.5	9.6	890 to 915	21	SOT200	BGY96B	73
1.2	6	824 to 849	30.8	SOT246	BGY110A	81
1.2	6	872 to 905	30.8	SOT246	BGY110B	83
1.7	7.2	824 to 849	32.3	SOT246	BGY110D	85
1.7	7.2	872 to 905	32.3	SOT246	BGY110E	85
1.7	7.2	890 to 915	32.3	SOT246	BGY110F	85

TYPE NUMBER SURVEY

RF power modules

Type number survey

INTRODUCTION

In this alphanumeric list we present all RF power modules mentioned in this handbook, together with the most important data.

TYPE NUMBER	ENVELOPE	V_S (V)	f (MHz)	P_L (W)	G_p (dB)	PAGE
BGY32	SOT132	12.5	68 to 88	> 18	22.6	25
BGY33	SOT132	12.5	80 to 108	> 18	22.6	25
BGY35	SOT132	12.5	132 to 156	> 18	20.6	25
BGY36	SOT132	12.5	148 to 174	> 18	20.8	25
BGY43	SOT132	12.5	148 to 174	> 13	19.4	35
BGY46A	SOT181	9.6	400 to 440	> 1.4	15	43
BGY46B	SOT181	9.6	430 to 470	> 1.4	15	49
BGY47A	SOT181	9.6	400 to 470	> 3.2	18	55
BGY95A	SOT200	7.5	824 to 849	> 2.2	20.4	63
BGY95B	SOT200	7.5	890 to 915	> 2.2	20.4	63
BGY96A	SOT200	9.6	824 to 849	> 2.5	21	73
BGY96B	SOT200	9.6	890 to 915	> 2.5	21	73
BGY110A	SOT246	6	824 to 849	> 1.2	30.8	81
BGY110B	SOT246	6	872 to 905	> 1.2	30.8	83
BGY110D	SOT246	7.2	824 to 849	> 1.7	32.3	85
BGY110E	SOT246	7.2	872 to 905	> 1.7	32.3	85
BGY110F	SOT246	7.2	890 to 915	> 1.7	32.3	85
BGY112A	SOT288C	7.5	68 to 88	> 7	38.5	97
BGY112B	SOT288C	7.5	132 to 156	> 7	38.5	97
BGY112C	SOT288C	7.5	146 to 174	> 7	38.5	97
BGY113A	SOT288D	7.5	400 to 440	> 7	38.5	101
BGY113B	SOT288D	7.5	430 to 470	> 7	38.5	101
BGY145A	SOT183A	12.5	68 to 88	> 29	22.9	105
BGY145B	SOT183A	12.5	146 to 174	> 28	19.7	113
BGY145C	SOT183A	12.5	174 to 200	> 27	19.5	121

GENERAL

Type designation
Rating systems
Letter symbols
s-parameters
Mounting recommendations

PRO ELECTRON TYPE DESIGNATION CODE FOR SEMICONDUCTOR DEVICES

This type designation code applies to discrete semiconductor devices – as opposed to integrated circuits –, multiples of such devices and semiconductor chips.

"Although not all type numbers accord with the Pro Electron system, the following explanation is given for the ones that do."

A basic type number consists of:

TWO LETTERS FOLLOWED BY A SERIAL NUMBER

FIRST LETTER

The first letter gives information about the material used for the active part of the devices.

A. GERMANIUM or other material with band gap of 0,6 to 1,0 eV.
B. SILICON or other material with band gap of 1,0 to 1,3 eV.
C. GALLIUM-ARSENIDE or other material with band gap of 1,3 eV or more.
R. COMPOUND MATERIALS (e.g. Cadmium-Sulphide).

SECOND LETTER

The second letter indicates the function for which the device is primarily designed.

A. DIODE; signal, low power
B. DIODE; variable capacitance
C. TRANSISTOR; low power, audio frequency ($R_{th\ j\text{-}mb} > 15$ K/W)
D. TRANSISTOR; power, audio frequency ($R_{th\ j\text{-}mb} \leq 15$ K/W)
E. DIODE; tunnel
F. TRANSISTOR; low power, high frequency ($R_{th\ j\text{-}mb} > 15$ K/W)
G. MULTIPLE OF DISSIMILAR DEVICES – MISCELLANEOUS; e.g. oscillator
H. DIODE; magnetic sensitive
L. TRANSISTOR; power, high frequency ($R_{th\ j\text{-}mb} \leq 15$ K/W)
N. PHOTO-COUPLER
P. RADIATION DETECTOR; e.g. high sensitivity phototransistor
Q. RADIATION GENERATOR; e.g. light-emitting diode (LED)
R. CONTROL AND SWITCHING DEVICE; e.g. thyristor, low power ($R_{th\ j\text{-}mb} > 15$ K/W)
S. TRANSISTOR; low power, switching ($R_{th\ j\text{-}mb} > 15$ K/W)
T. CONTROL AND SWITCHING DEVICE; e.g. thyristor, power ($R_{th\ j\text{-}mb} \leq 15$ K/W)
U. TRANSISTOR; power, switching ($R_{th\ j\text{-}mb} \leq 15$ K/W)
X. DIODE: multiplier, e.g. varactor, step recovery
Y. DIODE; rectifying, booster
Z. DIODE; voltage reference or regulator (transient suppressor diode, with third letter **W**)

SERIAL NUMBER

Three figures, running from 100 to 999, for devices primarily intended for consumer equipment.*
One letter (Z, Y, X, etc.) and two figures, running from 10 to 99, for devices primarily intended for industrial/professional equipment.*
This letter has no fixed meaning except W, which is used for transient suppressor diodes.

VERSION LETTER

It indicates a minor variant of the basic type either electrically or mechanically. The letter never has a fixed meaning, except letter R, indicating reverse voltage, e.g. collector to case or anode to stud.

SUFFIX

Sub-classification can be used for devices supplied in a wide range of variants called associated types. Following sub-coding suffixes are in use:

1. VOLTAGE REFERENCE and VOLTAGE REGULATOR DIODES: *ONE LETTER and ONE NUMBER*
   The LETTER indicates the nominal tolerance of the Zener (regulation, working or reference) voltage
   A. 1% (according to IEC 63: series E96)
   B. 2% (according to IEC 63: series E48)
   C. 5% (according to IEC 63: series E24)
   D. 10% (according to IEC 63: series E12)
   E. 20% (according to IEC 63: series E6)
   The number denotes the typical operating (Zener) voltage related to the nominal current rating for the whole range.
   The letter 'V' is used instead of the decimal point.

2. TRANSIENT SUPPRESSOR DIODES: *ONE NUMBER*
   The NUMBER indicates the maximum recommended continuous reversed (stand-off) voltage V_R. The letter 'V' is used as above.

3. CONVENTIONAL and CONTROLLED AVALANCHE RECTIFIER DIODES and THYRISTORS: *ONE NUMBER*
   The NUMBER indicates the rated maximum repetitive peak reverse voltage (V_{RRM}) or the rated repetitive peak off-state voltage (V_{DRM}), whichever is the lower. Reversed polarity is indicated by letter R, immediately after the number.

4. RADIATION DETECTORS: *ONE NUMBER,* preceded by a hyphen (–)
   The NUMBER indicates the depletion layer in μm. The resolution is indicated by a version LETTER.

5. ARRAY OF RADIATION DETECTORS and GENERATORS: *ONE NUMBER,* preceded by a stroke (/).
   The NUMBER indicates how many basic devices are assembled into the array.

* When these serial numbers are exhausted the serial number for consumer types may be extended to four figures, and that for industrial types to three figures.

RATING SYSTEMS

The rating systems described are those recommended by the International Electrotechnical Commission (IEC) in its Publication 134.

DEFINITIONS OF TERMS USED

Electronic device. An electronic tube or valve, transistor or other semiconductor device.

Note
This definition excludes inductors, capacitors, resistors and similar components.

Characteristic. A characteristic is an inherent and measurable property of a device. Such a property may be electrical, mechanical, thermal, hydraulic, electro-magnetic, or nuclear, and can be expressed as a value for stated or recognized conditions. A characteristic may also be a set of related values, usually shown in graphical form.

Bogey electronic device. An electronic device whose characteristics have the published nominal values for the type. A bogey electronic device for any particular application can be obtained by considering only those characteristics which are directly related to the application.

Rating. A value which establishes either a limiting capability or a limiting condition for an electronic device. It is determined for specified values of environment and operation, and may be stated in any suitable terms.

Note
Limiting conditions may be either maxima or minima.

Rating system. The set of principles upon which ratings are established and which determine their interpretation.

Note
The rating system indicates the division of responsibility between the device manufacturer and the circuit designer, with the object of ensuring that the working conditions do not exceed the ratings.

ABSOLUTE MAXIMUM RATING SYSTEM

Absolute maximum ratings are limiting values of operating and environmental conditions applicable to any electronic device of a specified type as defined by its published data, which should not be exceeded under the worst probable conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking no responsibility for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the device under consideration and of all other electronic devices in the equipment.

The equipment manufacturer should design so that, initially and throughout life, no absolute maximum value for the intended service is exceeded with any device under the worst probable operating conditions with respect to supply voltage variation, equipment component variation, equipment control adjustment, load variations, signal variation, environmental conditions, and variations in characteristics of the device under consideration and of all other electronic devices in the equipment.

DESIGN MAXIMUM RATING SYSTEM

Design maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electronic device of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking responsibility for the effects of changes in operating conditions due to variations in the characteristics of the electronic device under consideration.

The equipment manufacturer should design so that, initially and throughout life, no design maximum value for the intended service is exceeded with a bogey device under the worst probable operating conditions with respect to supply voltage variation, equipment component variation, variation in characteristics of all other devices in the equipment, equipment control adjustment, load variation, signal variation and environmental conditions.

DESIGN CENTRE RATING SYSTEM

Design centre ratings are limiting values of operating and environmental conditions applicable to a bogey electronic device of a specified type as defined by its published data, and should not be exceeded under normal conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device in average applications, taking responsibility for normal changes in operating conditions due to rated supply voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all electronic devices.

The equipment manufacturer should design so that, initially, no design centre value for the intended service is exceeded with a bogey electronic device in equipment operating at the stated normal supply voltage.

LETTER SYMBOLS FOR TRANSISTORS AND SIGNAL DIODES

based on IEC Publication 148

LETTER SYMBOLS FOR CURRENTS, VOLTAGES AND POWERS

Basic letters

The basic letters to be used are:

I, i = current
V, v = voltage
P, p = power.

Lower-case basic letters shall be used for the representation of instantaneous values which vary with time.
In all other instances upper-case basic letters shall be used.

Subscripts

A, a	Anode terminal
(AV), (av)	Average value
B, b	Base terminal, for MOS devices: Substrate
(BR)	Breakdown
C, c	Collector terminal
D, d	Drain terminal
E, e	Emitter terminal
F, f	Forward
G, g	Gate terminal
K, k	Cathode terminal
M, m	Peak value
O, o	As third subscript: The terminal not mentioned is open circuited
R, r	As first subscript: Reverse. As second subscript: Repetitive. As third subscript: With a specified resistance between the terminal not mentioned and the reference terminal.
(RMS), (rms)	Root-mean-square value
S, s	As first or second subscript: Source terminal (for FETS only) As second subscript: Non-repetitive (not for FETS) As third subscript: Short circuit between the terminal not mentioned and the reference terminal
X, x	Specified circuit
Z, z	Replaces R to indicate the actual working voltage, current or power of voltage reference and voltage regulator diodes.

Note: No additional subscript is used for DC values.

Upper-case subscripts shall be used for the indication of:

a) continuous (DC) values (without signal)

Example I_B

b) instantaneous total values

Example i_B

c) average total values

Example $I_{B(AV)}$

d) peak total values

Example I_{BM}

e) root-mean-square total values

Example $I_{B(RMS)}$

Lower-case subscripts shall be used for the indication of values applying to the varying component alone:

a) instantaneous values

Example i_b

b) root-mean-square values

Example $I_{b(rms)}$

c) peak values

Example I_{bm}

d) average values

Example $I_{b(av)}$

Note: If more than one subscript is used, subscript for which both styles exist shall either be all upper-case or all lower-case.

Additional rules for subscripts

Subscripts for currents

Transistors: If it is necessary to indicate the terminal carrying the current, this should be done by the first subscript (conventional current flow from the external circuit into the terminal is positive).

Examples: I_B, i_B, i_b, I_{bm}

Diodes: To indicate a forward current (conventional current flow into the anode terminal) the subscript F or f should be used; for a reverse current (conventional current flow out of the anode terminal) the subscript R or r should be used.

Examples: I_F, I_R, i_F, $I_{f(rms)}$

Subscripts for voltages

Transistors: If it is necessary to indicate the points between which a voltage is measured, this should be done by the first two subscripts. The first subscript indicates the terminal at which the voltage is measured and the second the reference terminal or the circuit node. Where there is no possibility of confusion, the second subscript may be omitted.

Examples: V_{BE}, v_{BE}, v_{be}, V_{bem}

Diodes: To indicate a forward voltage (anode positive with respect to cathode), the subscript F or f should be used; for a reverse voltage (anode negative with respect to cathode) the subscript R or r should be used.

Examples: V_F, V_R, v_F, V_{rm}

Subscripts for supply voltages or supply currents

Supply voltages or supply currents shall be indicated by repeating the appropriate terminal subscript.

Examples: V_{CC}, I_{EE}

Note: If it is necessary to indicate a reference terminal, this should be done by a third subscript

Example : V_{CCE}

Subscripts for devices having more than one terminal of the same kind

If a device has more than one terminal of the same kind, the subscript is formed by the appropriate letter for the terminal followed by a number; in the case of multiple subscripts, hyphens may be necessary to avoid misunderstanding.

Examples: I_{B2} = continuous (DC) current flowing into the second base terminal

V_{B2-E} = continuous (DC) voltage between the terminals of second base and emitter

Subscripts for multiple devices

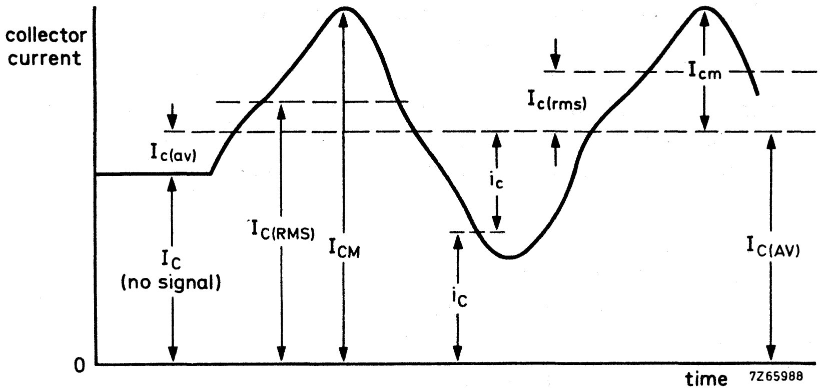
For multiple unit devices, the subscripts are modified by a number preceding the letter subscript; in the case of multiple subscripts, hyphens may be necessary to avoid misunderstanding.

Examples: I_{2C} = continuous (DC) current flowing into the collector terminal of the second unit

V_{1C-2C} = continuous (DC) voltage between the collector terminals of the first and the second unit.

Application of the rules

The figure below represents a transistor collector current as a function of time. It consists of a continuous (DC) current and a varying component.



LETTER SYMBOLS FOR ELECTRICAL PARAMETERS

Defenition

For the purpose of this Publication, the term "electrical parameter" applies to four-pole matrix parameters, elements of electrical equivalent circuits, electrical impedances and admittances, inductances and capacitances.

Basic letters

The following is a list of the most important basic letters used for electrical parameters of semiconductor devices.

B, b = susceptance; imaginary part of an admittance

C = capacitance

G, g = conductance; real part of an admittance

H, h = hybrid parameter

L = inductance

R, r = resistance; real part of an impedance

X, x = reactance; imaginary part of an impedance

Y, y = admittance;

Z, z = impedance;

Upper-case letters shall be used for the representation of:

a) electrical parameters of external circuits and of circuits in which the device forms only a part;

b) all inductances and capacitances.

Lower-case letters shall be used for the representation of electrical parameters inherent in the device (with the exception of inductances and capacitances).

Subscripts

General subscripts

The following is a list of the most important general subscripts used for electrical parameters of semiconductor devices:

F, f	=	forward; forward transfer
I, i (or 1)	=	input
L, l	=	load
O, o (or 2)	=	output
R, r	=	reverse; reverse transfer
S, s	=	source

Examples: Z_S, h_f, h_F

The upper-case variant of a subscript shall be used for the designation of static (d.c.) values.

Examples : h_{FE} = static value of forward current transfer ratio in common-emitter configuration (DC current gain)

R_E = DC value of the external emitter resistance

Note: The static value is the slope of the line from the origin to the operating point on the appropriate characteristic curve, i.e. the quotient of the appropriate electrical quantities at the operating point.

The lower-case variant of a subscript shall be used for the designation of small-signal values.

Examples: h_{fe} = small-signal value of the short-circuit forward current transfer ratio in common-emitter configuration

$Z_e = R_e + jX_e$ = small-signal value of the external impedance

Note: If more than one subscript is used, subscripts for which both styles exist shall either be all upper-case or all lower-case

Examples: h_{FE}, y_{RE}, h_{fe}

Subscripts for four-pole matrix parameters

The first letter subscript (or double numeric subscript) indicates input, output, forward transfer or reverse transfer

Examples: h_i (or h_{11})
h_o (or h_{22})
h_f (or h_{21})
h_r (or h_{12})

A further subscript is used for the identification of the circuit configuration. When no confusion is possible, this further subscript may be omitted.

Examples: h_{fe} (or h_{21e}), h_{FE} (or h_{21E})

Distinction between real and imaginary parts

If it is necessary to distinguish between real and imaginary parts of electrical parameters, no additional subscripts should be used. If basic symbols for the real and imaginary parts exist, these may be used.

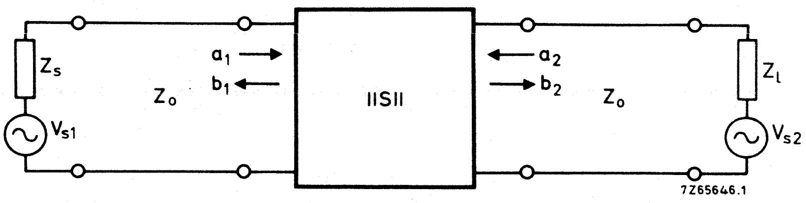
Examples: $Z_i = R_i + jX_i$
$y_{fe} = g_{fe} + jb_{fe}$

If such symbols do not exist or if they are not suitable, the following notation shall be used:

Examples: Re (h_{ib}) etc. for the real part of h_{ib}
Im (h_{ib}) etc. for the imaginary part of h_{ib}

SCATTERING PARAMETERS

In distinction to the conventional h, y and z-parameters, s-parameters relate to travelling wave conditions. The figure below shows a two-port network with the incident and reflected waves a_1, b_1, a_2 and b_2.



$$a_1 = \frac{V_{i1}}{\sqrt{Z_o}} \qquad a_2 = \frac{V_{i2}}{\sqrt{Z_o}} \qquad ^{1)}$$

$$b_1 = \frac{V_{r1}}{\sqrt{Z_o}} \qquad b_2 = \frac{V_{r2}}{\sqrt{Z_o}}$$

Z_o = characteristic impedance of the transmission line in which the two-port is connected.

V_i = incident voltage

V_r = reflected (generated) voltage

The four-pole equations for s-parameters are:

$$b_1 = s_{11}a_1 + s_{12}a_2$$

$$b_2 = s_{21}a_1 + s_{22}a_2$$

Using the subscripts i for 11, r for 12, f for 21 and o for 22, it follows that:

$$s_i = s_{11} = \left.\frac{b_1}{a_1}\right| a_2 = 0$$

$$s_r = s_{12} = \left.\frac{b_1}{a_2}\right| a_1 = 0$$

$$s_f = s_{21} = \left.\frac{b_2}{a_1}\right| a_2 = 0$$

$$s_o = s_{22} = \left.\frac{b_2}{a_2}\right| a_1 = 0$$

1) The squares of these quantities have the dimension of power.

The s-parameters can be named and expressed as follows:

$s_i = s_{11}$ = Input reflection coefficient.
The complex ratio of the reflected wave and the incident wave at the input, under the conditions $Z_l = Z_o = 50\ \Omega$ and $V_{s2} = 0$.

$s_r = s_{12}$ = Reverse transmission coefficient.
The complex ratio of the generated wave at the input and the incident wave at the output, under the conditions $Z_s = Z_o = 50\ \Omega$ and $V_{s1} = 0$.

$s_f = s_{21}$ = Forward transmission coefficient.
The complex ratio of the generated wave at the output and the incident wave at the input, under the conditions $Z_l = Z_o = 50\ \Omega$ and $V_{s2} = 0$.

$s_o = s_{22}$ = Output reflection coefficient.
The complex ratio of the reflected wave and the incident wave at the output, under the conditions $Z_s = Z_o = 50\ \Omega$ and $V_{s1} = 0$.

RECOMMENDATIONS FOR MOUNTING OF RF POWER MODULES

The modules are manufactured using a ceramic substrate soldered to a copper flange; this causes a small thermal mismatch between these two components. A further thermal mismatch will exist between the module flange and the heatsink to which it is mounted. Because of these mismatches, precautions must be taken to avoid unnecessary mechanical stresses being applied to the ceramic substrate and other components within the module resulting from variations in temperature during operating cycles.

Design of heatsink

To ensure that the maximum specified flange temperature will not be exceeded under maximum fault conditions, the module should always be mounted on a heatsink of suitable thermal resistance.

The mounting area of the heatsink should be flat and free from burrs. Particular attention should be paid to the mounting hole areas. The maximum amount of bowing along the plane of the module should not exceed 0.1 mm. Where anodizing is used, the area under the module should be milled clean as the presence of anodizing under the module can result in high resistance earth paths, leading to oscillation and early failure, in addition to poor thermal contact.

The heatsink should be rigid and not prone to bowing under thermal cycling conditions. The thickness of a solid heatsink should not be less than 5 mm, to ensure a rigid assembly. On finned heatsinks, the module should be mounted along a plane parallel to the fins.

Mounting of module

To ensure a good thermal contact and to prevent mechanical stresses when bolted down, the flatness of the module flange is designed to be typically better than 0.02 mm.

The module should be mounted to the heatsink using 3 mm bolts with flat washers, tightened to a maximum torque of 0.5 Nm. Over-tightening can result in bowing of the flange. Locking washers should not be used.

A thin, even layer of thermal compound should be used between the module and the heatsink to achieve the best possible contact thermal resistance, which should be in the order of 0.2 K/W. Excessive use of thermal compound will result in an increase in thermal resistance and possible bowing of the flange; too little will result in poor thermal resistance.

Electrical connections

The main earth return path of all modules is via the flange; it is therefore important that the heatsink is well earthed and that return paths are kept as short as possible. Failure to ensure this may result in loss of output power or oscillation, which in turn will have a detrimental effect on the module life.

The RF output connection should be to correctly designed 50 Ω terminations. Failure to do this will result in a mismatch being presented to the module, with a resulting reduction in module life.

CAUTION

Under no circumstances must the maximum specified operating or storage temperatures be exceeded, even for short periods.

MODULE DATA

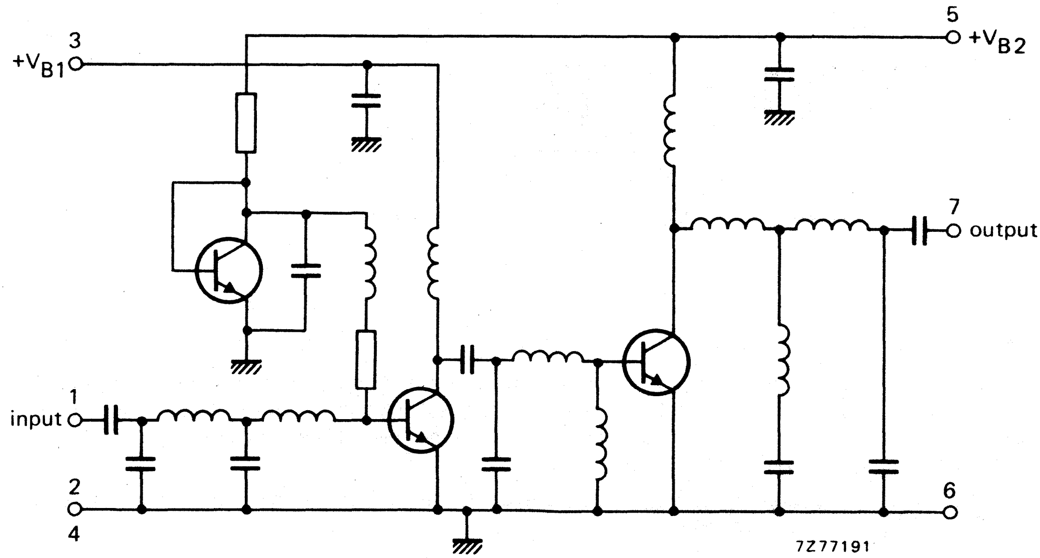
VHF POWER AMPLIFIER MODULES

A range of broadband amplifier modules designed for mobile communications equipments, operating directly from 12 V vehicle electrical systems. The devices will produce 18 W output into a 50 Ω load. The modules consist of a two stage RF amplifier using npn transistor chips, together with lumped-element matching components.

QUICK REFERENCE DATA

type number	mode of operation	frequency range f (MHz)	nominal supply voltages $V_{B1} = V_{B2}$ (V)	drive power P_D (mW)	load power P_L (W)	nominal input impedance z_i (Ω)	nominal load impedance Z_L (Ω)
BGY32	cw	68 to 88	12.5	100	> 18 typ 23	50	50
BGY33	cw	80 to 108	12.5	100	> 18 typ 22	50	50
BGY35	cw	132 to 156	12.5	150	> 18 typ 22	50	50
BGY36	cw	148 to 174	12.5	150	> 18 typ 21	50	50

CIRCUIT DIAGRAM

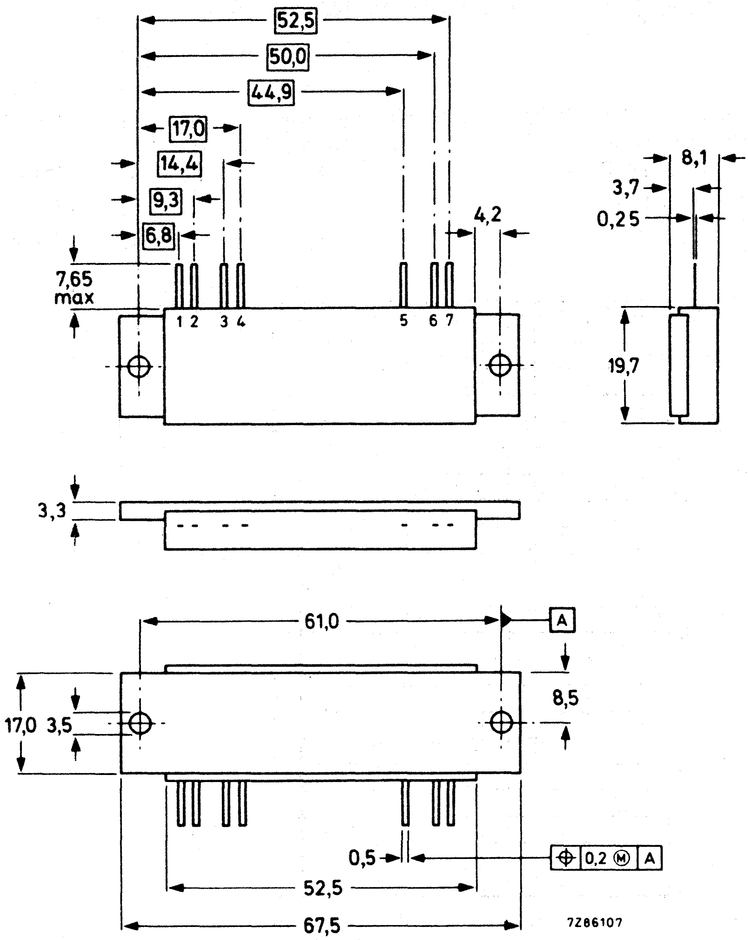


PRODUCT SAFETY This device incorporates beryllium oxide, the dust of wich is toxic. The device is entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT132B.



Lead reference

1 = Input
2 = Earth
3 = Supply $+V_{B1}$
4 = Earth
5 = Supply $+V_{B2}$
6 = Earth
7 = Output

Mounting and soldering recommendations

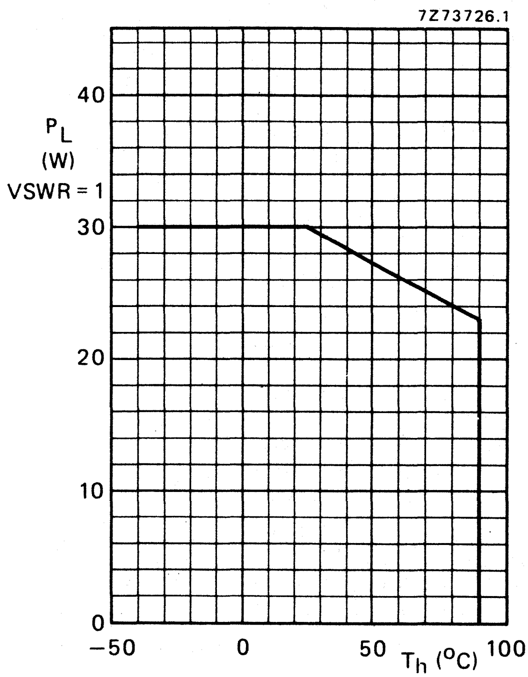
To ensure good thermal transfer the module should be mounted using heatsink compound onto a heatsink with a flat surface; if an isolation washer is used heatsink compound should be used on both sides of the insulator. Burrs and thickening of the holes in the heatsink should be removed and 3 mm bolts tightened to torques of 0,5 Nm minimum.

Devices may be soldered directly into a circuit with a soldering iron at maximum iron temperature of 245 ^{o}C for 10 seconds at least 1 mm from the plastic.

RATINGS

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

DC voltages (with respect to flange)				
DC supply terminals	V_{B1} and V_{B2}	max	15	V
RF input terminal	$\pm V_I$	max	25	V
RF output terminal	$\pm V_O$	max	25	V
Input drive power BGY32 and BGY33	P_D	max	200	mW
Input drive power BGY35 and BGY36	P_D	max	300	mW
Load power	P_L	max	30	W



Storage temperature range	T_{stg}		−40 to 100	°C
Operating heatsink temperature	T_h	max	90	°C

CHARACTERISTICS

T_h = 25 °C

			BGY32	BGY33	BGY35	BGY36	
Quiescent current $V_{B1} = V_{B2}$ = 12,5 V; P_D = 0; $R_S = R_L$ = 50 Ω	I_{BQ1}	typ	6	6	6	6	mA
	I_{BQ2}	typ	13	13	13	13	mA
Frequency range	f	>	68	80	132	148	MHz
		<	88	108	156	174	MHz
Load power $V_{B1} = V_{B2}$ = 12.5 V; $R_S = R_L$ = 50 Ω; **BGY32** and **BGY33**; P_D = 100 mW	P_L	>	18	18	–	–	W
		typ	23	22			W
	η	>	40	40	–	–	%
		typ	50	50			%
BGY35 and **BGY36**; P_D = 150 mW	P_L	>	–	–	18	18	W
		typ			22	21	W
	η	>	–	–	40	40	%
		typ			50	50	%

Harmonic output — Any single harmonic will be at least 25 dB down relative to carrier

Input VSWR with respect to 50 Ω — typ 1,5

Stability

The module is stable with a load VSWR up to 3 : 1 (all phases) when operated within the following conditions: V_{S1} = 6 to 15 V; V_{S2} = 10 to 15 V; $V_{S1} \leqslant V_{S2}$; P_D = 50 to 200 mW; frequency within operating frequency range, provided the maximum ratings of the module are not exceeded.

Ruggedness

The modules are capable of withstanding load mismatch of up to 50 VSWR for short period overload conditions, with P_D, V_{B1} and V_{B2} at maximum values providing the combination does not result in the matched RF output power rating being exceeded.

APPLICATION INFORMATION

Supply

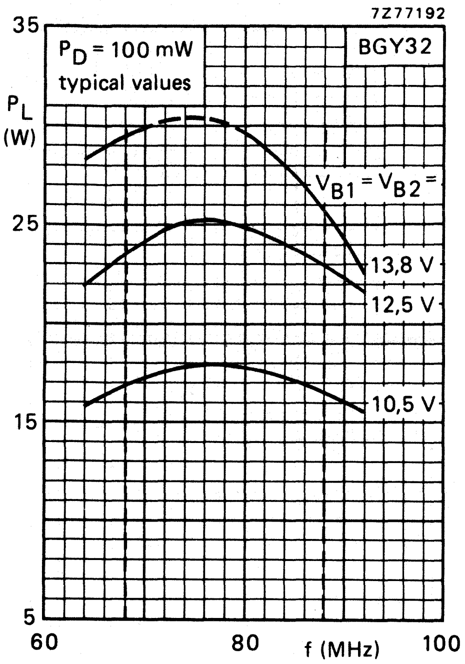
An electrolytic capacitor of 10 μF (25 V), in parallel with a polyester capacitor of 100 nF to earth, is recommended as decoupling arrangement for each power supply pin.

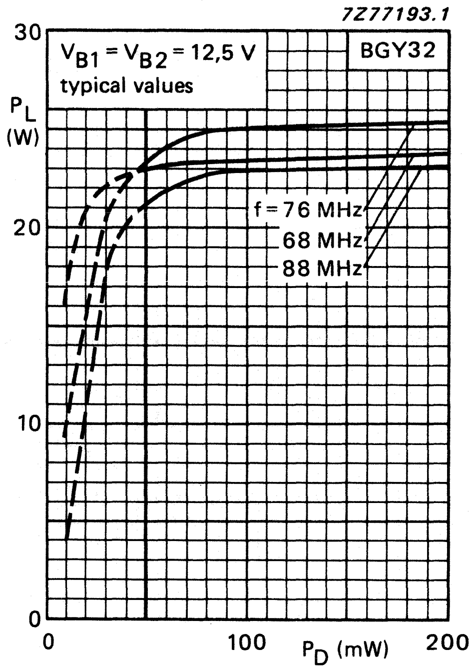
Power rating

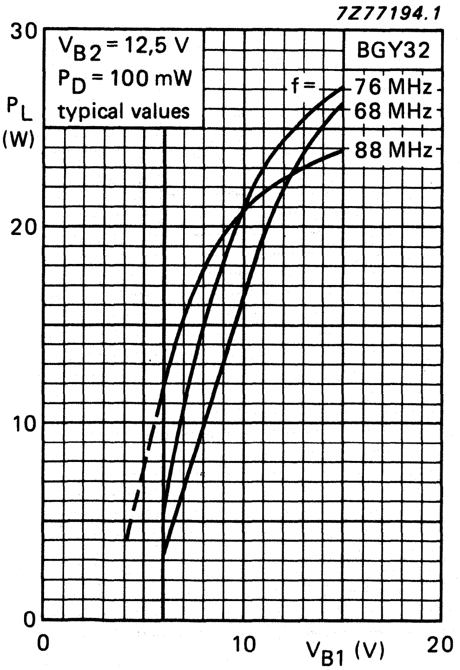
In general it is recommended that the output power from the module under nominal design conditions should not exceed 23 W in order to provide adequate safety margin under fault conditions.

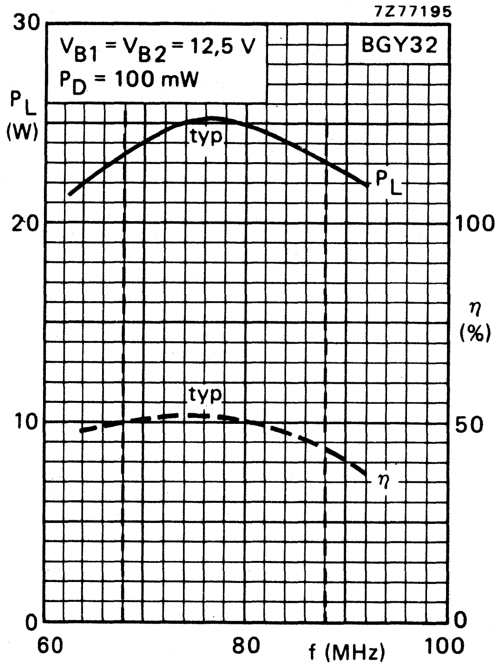
Output power control

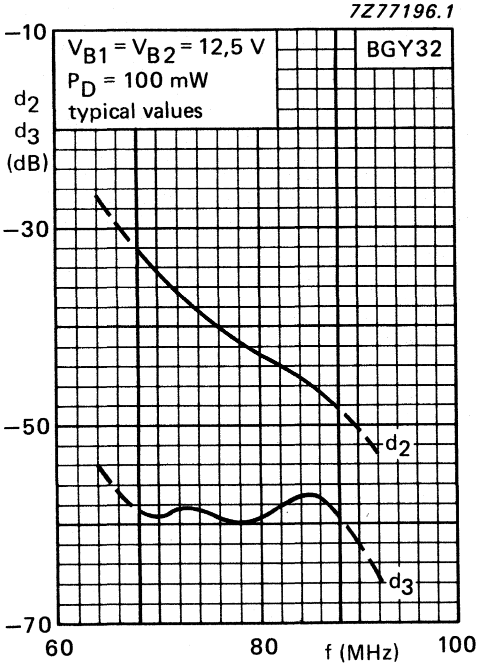
The module is not designed to be operated over a large range of output power levels. The purpose of the output power control is to set the nominal output power level. The preferred method of output power control is by varying the drive power between 50 and 200 mW. The next option is by varying V_{S1} between 6 and 12.5 V.

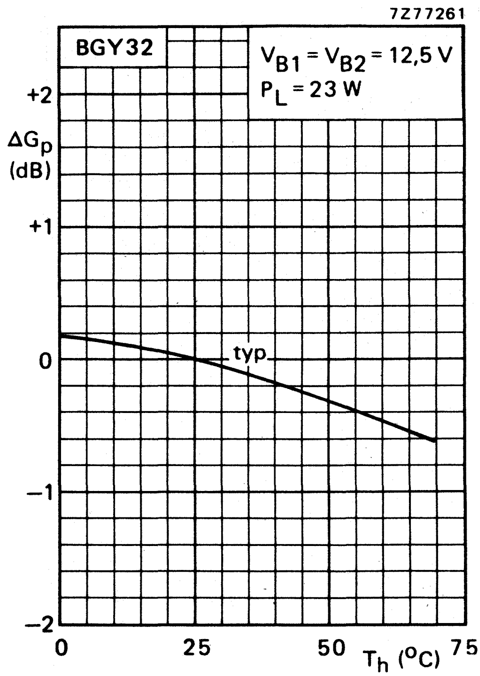

7Z77192
P_D = 100 mW
typical values
BGY32
P_L (W)
$V_{B1} = V_{B2} =$
13,8 V
12,5 V
10,5 V
35
25
15
5
60
80
f (MHz)
100

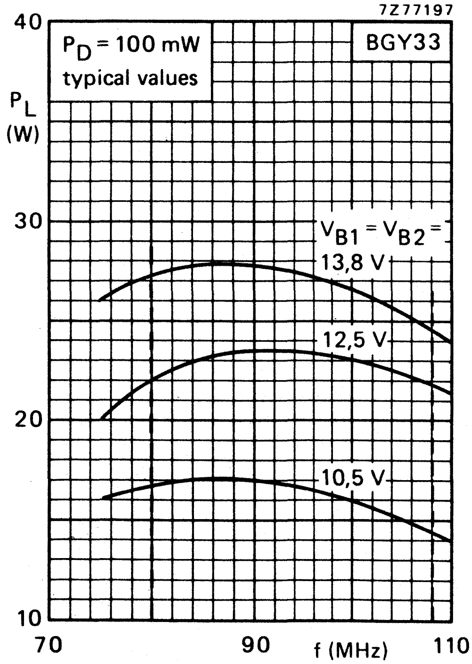

7Z77193.1
$V_{B1} = V_{B2}$ = 12,5 V
typical values
BGY32
P_L (W)
f = 76 MHz
68 MHz
88 MHz
30
20
10
0
100
P_D (mW)
200

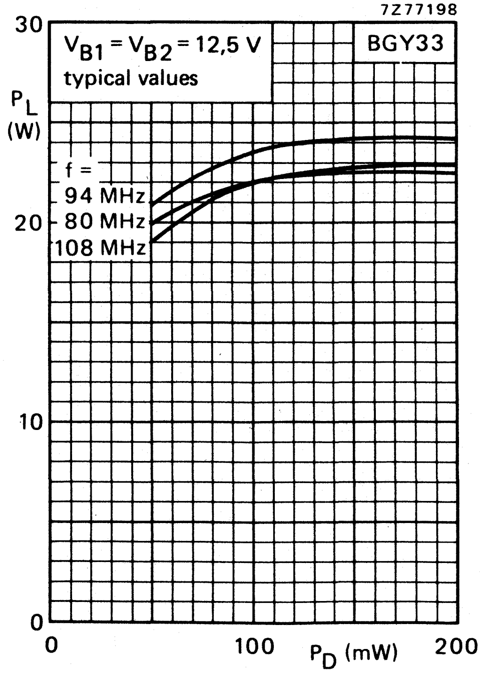

7Z77194.1
V_{B2} = 12,5 V
P_D = 100 mW
typical values
BGY32
P_L (W)
f =
76 MHz
68 MHz
88 MHz
30
20
10
0
10
V_{B1} (V)
20

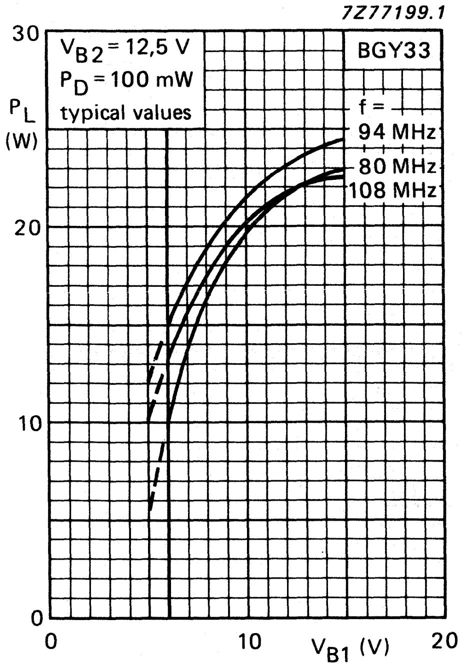

7Z77195
$V_{B1} = V_{B2}$ = 12,5 V
P_D = 100 mW
BGY32
P_L (W)
typ
P_L
typ
η
η (%)
30
20
10
0
100
50
0
60
80
f (MHz)
100

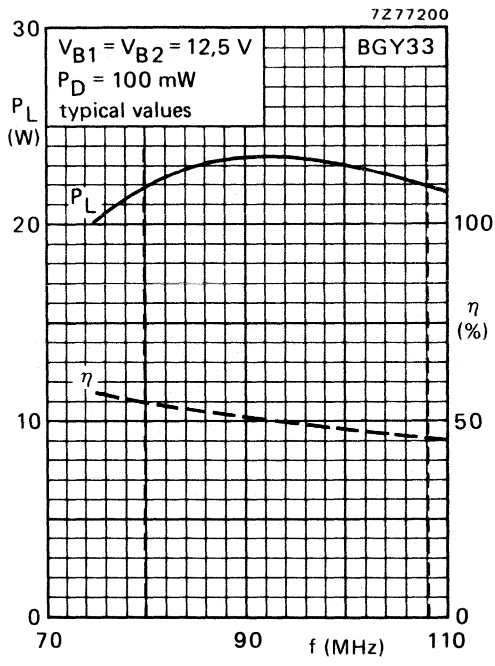

7Z77196.1
$V_{B1} = V_{B2} = 12,5$ V
P_D = 100 mW
typical values
BGY32
d_2
d_3
(dB)
−10
−30
−50
−70
60
80
100
f (MHz)
d_2
d_3

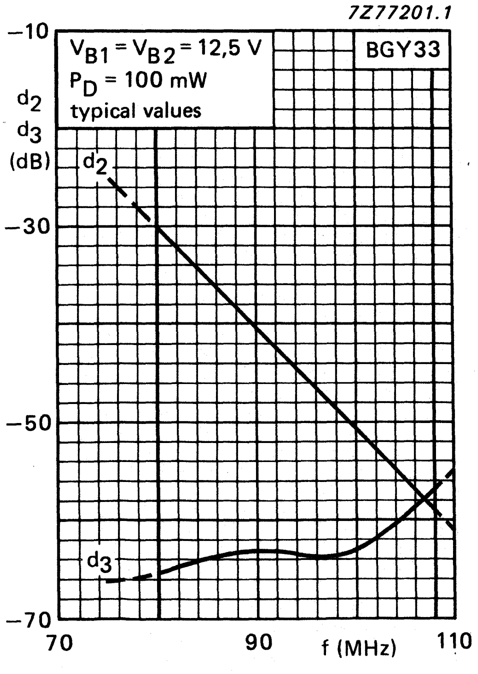

7Z77261
BGY32
$V_{B1} = V_{B2} = 12,5$ V
P_L = 23 W
ΔG_p
(dB)
+2
+1
0
−1
−2
typ
0
25
50
75
T_h (°C)

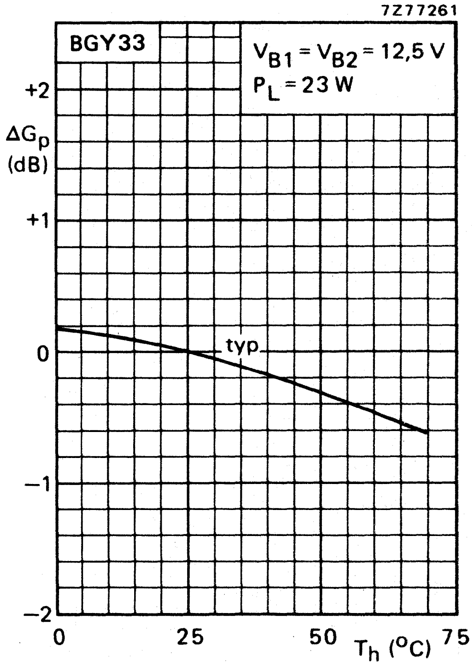

7Z77197
P_D = 100 mW
typical values
BGY33
P_L
(W)
40
30
20
10
$V_{B1} = V_{B2} =$
13,8 V
12,5 V
10,5 V
70
90
110
f (MHz)

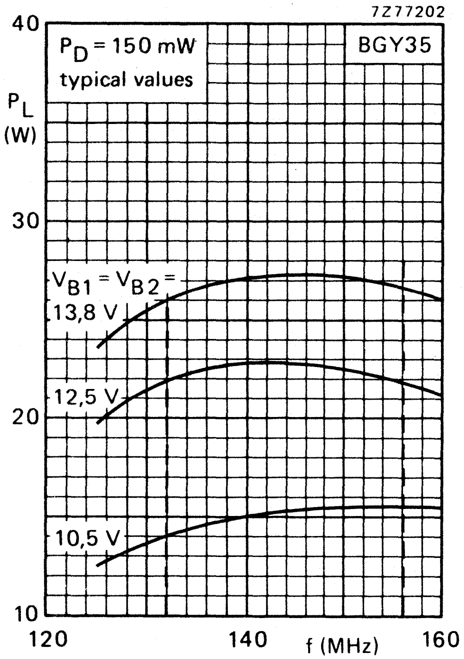

7Z77198
$V_{B1} = V_{B2} = 12,5$ V
typical values
BGY33
P_L
(W)
30
20
10
0
f =
94 MHz
80 MHz
108 MHz
0
100
200
P_D (mW)

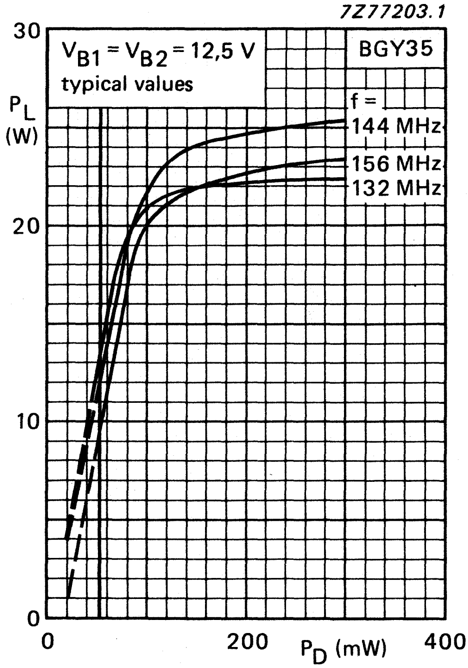

7Z77199.1
BGY33
V_{B2} = 12,5 V
P_D = 100 mW
typical values
P_L
(W)
f =
94 MHz
80 MHz
108 MHz
30
20
10
0
0
10
20
V_{B1} (V)

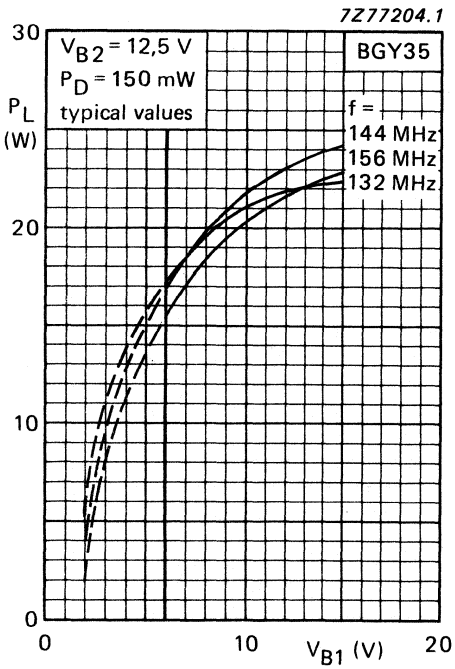

7Z77200
BGY33
V_{B1} = V_{B2} = 12,5 V
P_D = 100 mW
typical values
P_L
(W)
P_L
η
η
(%)
30
20
10
0
100
50
0
70
90
110
f (MHz)

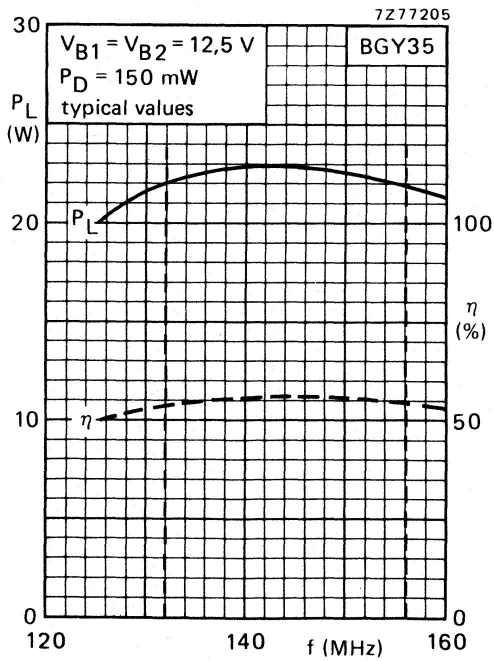

7Z77201.1
BGY33
V_{B1} = V_{B2} = 12,5 V
P_D = 100 mW
typical values
d_2
d_3
(dB)
d_2
d_3
−10
−30
−50
−70
70
90
110
f (MHz)

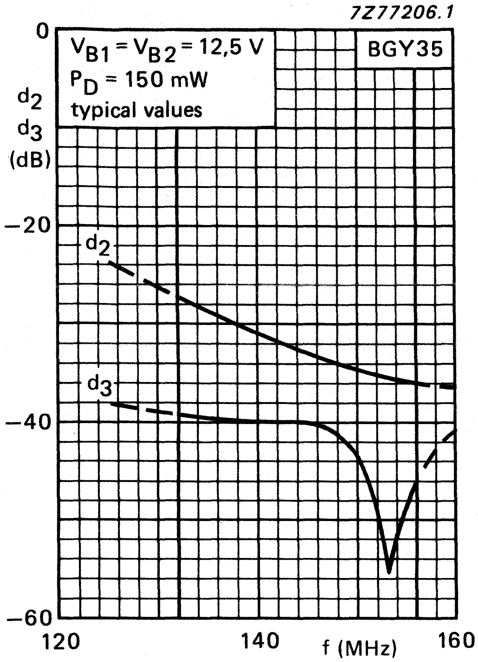

7Z77261
BGY33
V_{B1} = V_{B2} = 12,5 V
P_L = 23 W
ΔG_p
(dB)
typ
+2
+1
0
−1
−2
0
25
50
75
T_h (°C)

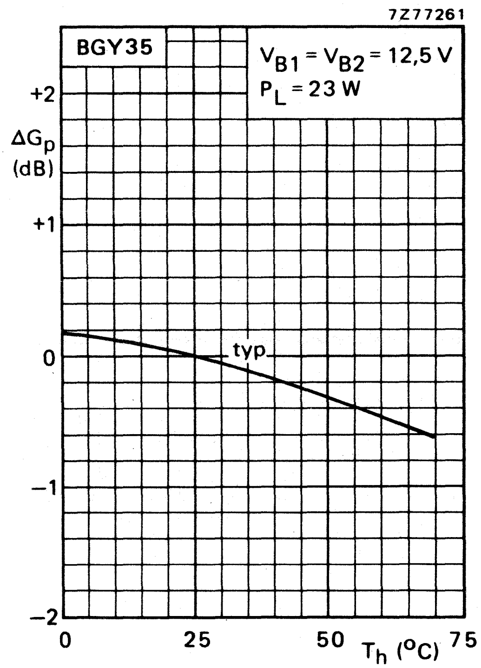

7Z77202
P_D = 150 mW
typical values
BGY35
P_L
(W)
V_B1 = V_B2 =
13,8 V
12,5 V
10,5 V
40
30
20
10
120
140
160
f (MHz)

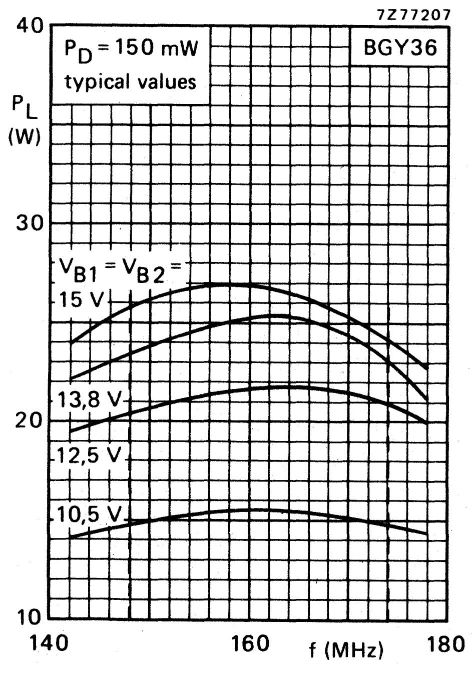

7Z77203.1
V_B1 = V_B2 = 12,5 V
typical values
BGY35
P_L
(W)
f =
144 MHz
156 MHz
132 MHz
30
20
10
0
200
400
P_D (mW)

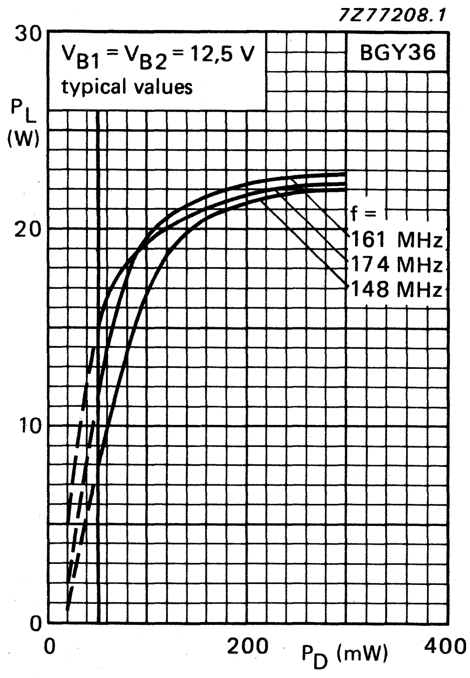

7Z77204.1
V_B2 = 12,5 V
P_D = 150 mW
typical values
BGY35
P_L
(W)
f =
144 MHz
156 MHz
132 MHz
30
20
10
0
10
20
V_B1 (V)

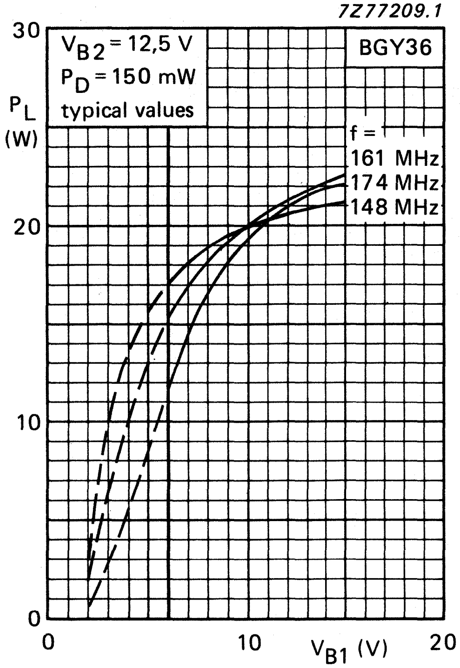

7Z77205
V_B1 = V_B2 = 12,5 V
P_D = 150 mW
typical values
BGY35
P_L
(W)
P_L
η
η
(%)
30
20
10
0
100
50
0
120
140
160
f (MHz)

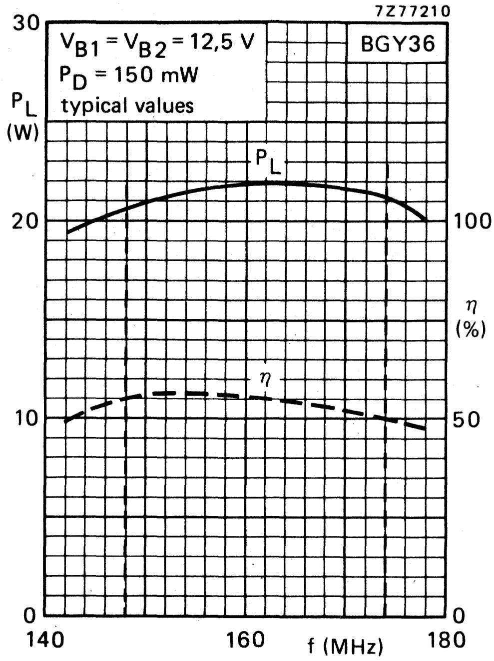

7Z77206.1
$V_{B1} = V_{B2} = 12,5$ V
$P_D = 150$ mW
typical values
BGY35
d_2
d_3
(dB)
0
−20
−40
−60
d_2
d_3
120
140
160
f (MHz)

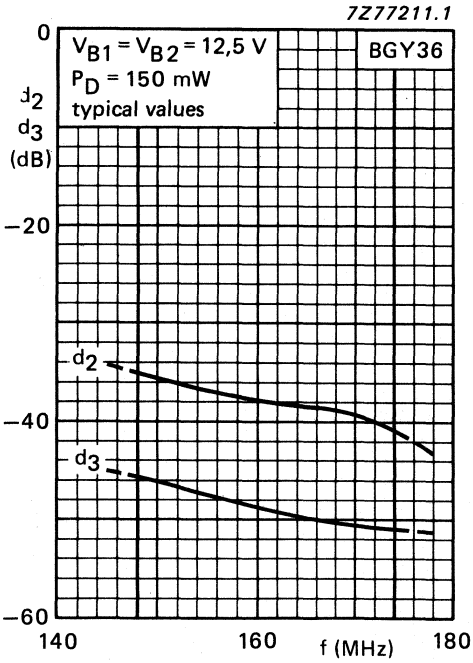

7Z77261
BGY35
$V_{B1} = V_{B2} = 12,5$ V
$P_L = 23$ W
ΔG_p
(dB)
+2
+1
0
−1
−2
typ
0
25
50
75
T_h (°C)

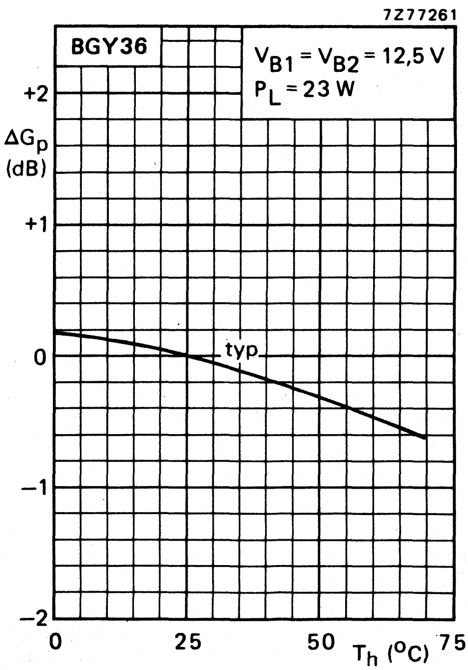

7Z77207
$P_D = 150$ mW
typical values
BGY36
P_L
(W)
40
30
20
10
$V_{B1} = V_{B2} =$
15 V
13,8 V
12,5 V
10,5 V
140
160
180
f (MHz)


7Z77208.1
$V_{B1} = V_{B2} = 12,5$ V
typical values
BGY36
P_L
(W)
30
20
10
0
f =
161 MHz
174 MHz
148 MHz
0
200
400
P_D (mW)


7Z77209.1
V_{B2} = 12,5 V
P_D = 150 mW
typical values
BGY36
P_L
(W)
f =
161 MHz
174 MHz
148 MHz
30
20
10
0
0
10
V_{B1} (V)
20


7Z77210
$V_{B1} = V_{B2}$ = 12,5 V
P_D = 150 mW
typical values
BGY36
P_L
(W)
P_L
η
(%)
η
30
20
10
0
100
50
0
140
160
f (MHz)
180


7Z77211.1
$V_{B1} = V_{B2}$ = 12,5 V
P_D = 150 mW
typical values
BGY36
d_2
d_3
(dB)
d_2
d_3
0
−20
−40
−60
140
160
f (MHz)
180


7Z77261
BGY36
$V_{B1} = V_{B2}$ = 12,5 V
P_L = 23 W
ΔG_p
(dB)
typ
+2
+1
0
−1
−2
0
25
50
T_h (°C)
75

VHF POWER AMPLIFIER MODULE

A broadband VHF amplifier module primarily designed for mobile communications equipment, operating directly from 12 V electrical systems. The module will produce a minimum output of 13 W into a 50 Ω load over the frequency range 148 to 174 MHz.
The module consists of a two stage RF amplifier using npn transistor chips with lumped-element matching components in a plastic stripline encapsulation. The negative supply is internally connected to the flange.

QUICK REFERENCE DATA

Mode of operation			c.w.	
Frequency range	f		148 to 174	MHz
Drive power	P_D	max.	150	mW
	P_D	typ.	80	mW
Load power	P_L	>	13	W
Supply voltages	V_{S1} and V_{S2}	nom.	12.5	V
Input impedance	z_i	nom.	50	Ω
Output load impedance	Z_L	nom.	50	Ω

MECHANICAL DATA (see Fig. 10)

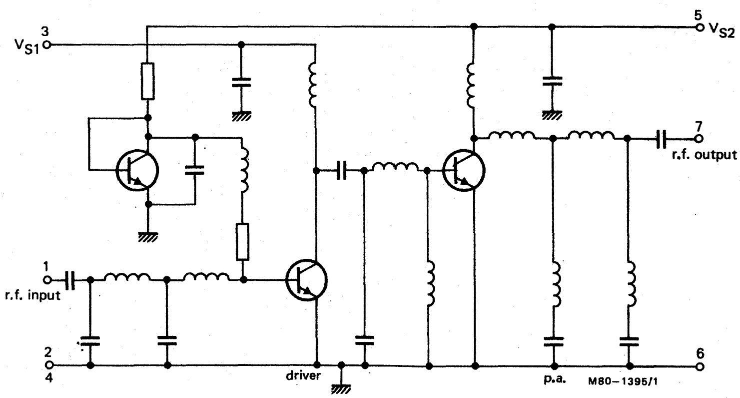


Fig. 1 Circuit of the VHF module.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages (with respect to flange)

DC supply terminals	V_{S1} and V_{S2}	max.	16.5	V
RF input terminal	$\pm V_i$	max.	25	V
RF output terminal	$\pm V_o$	max.	25	V
Load power (see below)	P_L	max.	18	W
Input drive power	P_D	max.	300	mW
Storage temperature range	T_{stg}		−40 to +100	°C
Operating heatsink temperature	T_h	max.	90	°C

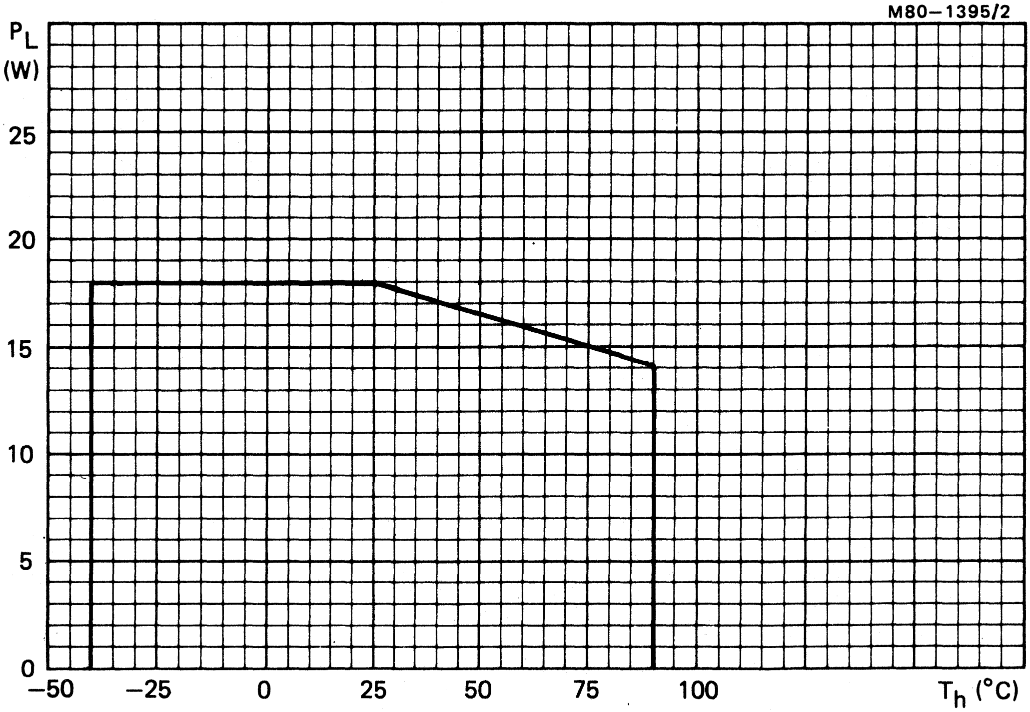


Fig.2 Load power derating; VSWR = 1

CHARACTERISTICS

T_h = 25 °C unless otherwise specified

$V_{S1} = V_{S2}$ = 12.5 V; R_S = 50 Ω; frequency range 148 to 174 MHz; R_L = 50 Ω

Quiescent currents				
$P_D = 0$	I_{Q1}	typ.	5	mA
	I_{Q2}	typ.	15	mA
RF drive power				
P_L = 13 W	P_D	<	150	mW
	P_D	typ.	80	mW
Efficiency				
P_L = 13 W	η	>	40	%
	η	typ.	48	%
Harmonic output	Any single harmonic will be at least 25 dB down from the carrier, with typical rejection of 34 dB.			
Input VSWR (with respect to 50 Ω)		typ.	1.5	

Stability

The module is stable with load VSWR up to 3 (all phases) when operated with:

$V_{S1} = V_{S2}$ = 10 to 16.5 V; f = 148 to 174 MHz; P_D = 30 to 300 mW; $P_L \leqslant$ 18 W (matched)

Ruggedness

The modules will withstand load VSWR of 50 for short period overload conditions, with P_D, V_{S1} and V_{S2} at maximum values, providing the combination does not result in the matched RF output power rating being exceeded.

Mounting

To ensure good thermal transfer the module should be mounted onto a heatsink with a flat surface, with heat conducting compound between module and heatsink. If an isolation washer is used, heatsink compound should be applied to both sides of the washer. Burrs and thickening of the holes in the heatsink should be removed and 3 mm bolts tightened to a torque of 0.5 Nm.
Devices may be soldered directly into a circuit using a soldering iron with a maximum temperature of 245 °C for not more than 10 seconds at a distance of at least 1 mm from the plastic.

APPLICATION INFORMATION

A technical publication (M80–0056) entitled 'Transmitter design using VHF broadband amplifier modules' is available on request.

Power rating

In general it is recommended that the output power from the module under nominal conditions should not exceed 16 W in order to provide adequate safety margin under fault conditions.

Output power control

The module is not designed to be operated over a large range of output power levels.
The purpose of the output power control is to set the nominal output power level.
The preferred method of output power control is by varying the drive power between 30 and 200 mW. The next option is by varying V_{S1} between 6 and 12.5 V.

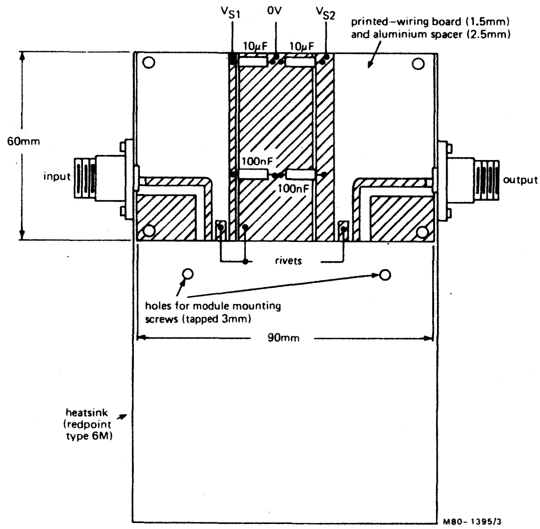


Fig.3 Test jig for VHF modules

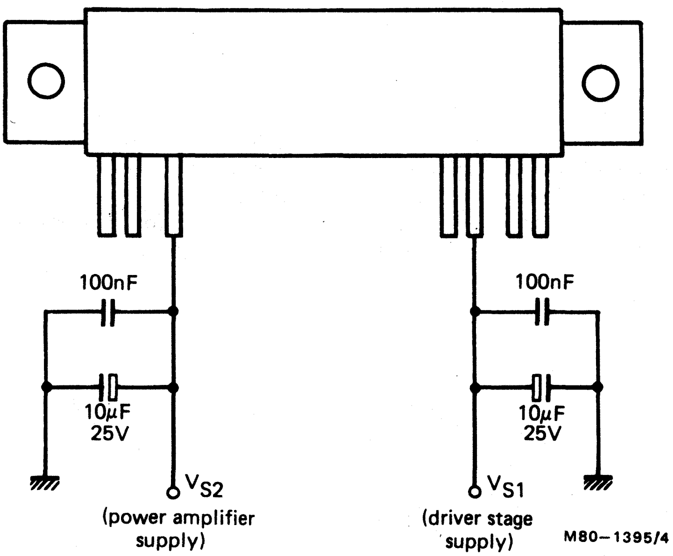


Fig.4 Recommended decoupling arrangement

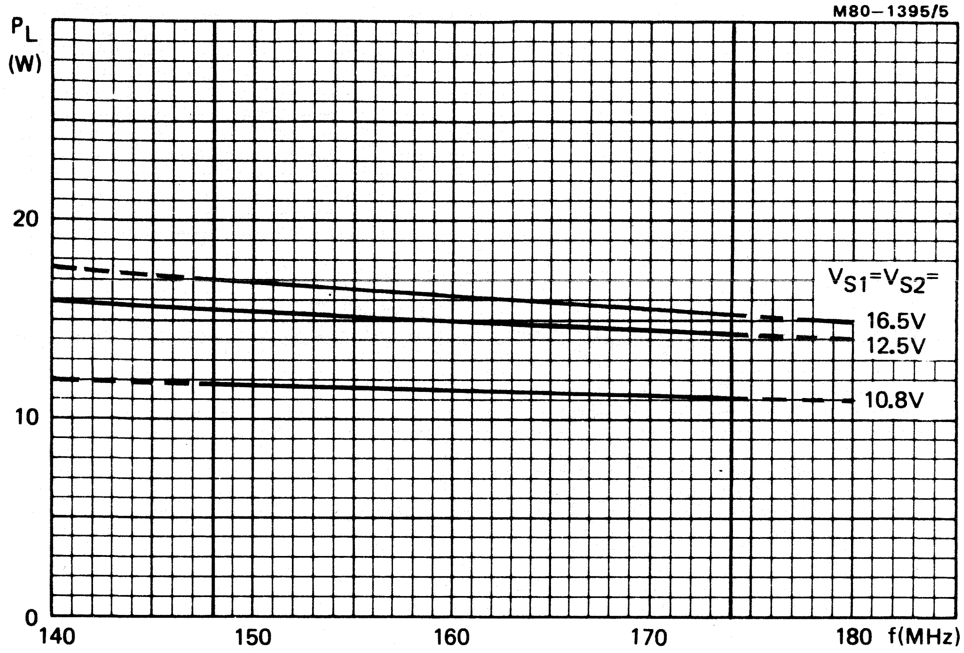


Fig.5 Typical values; P_D = 150 mW

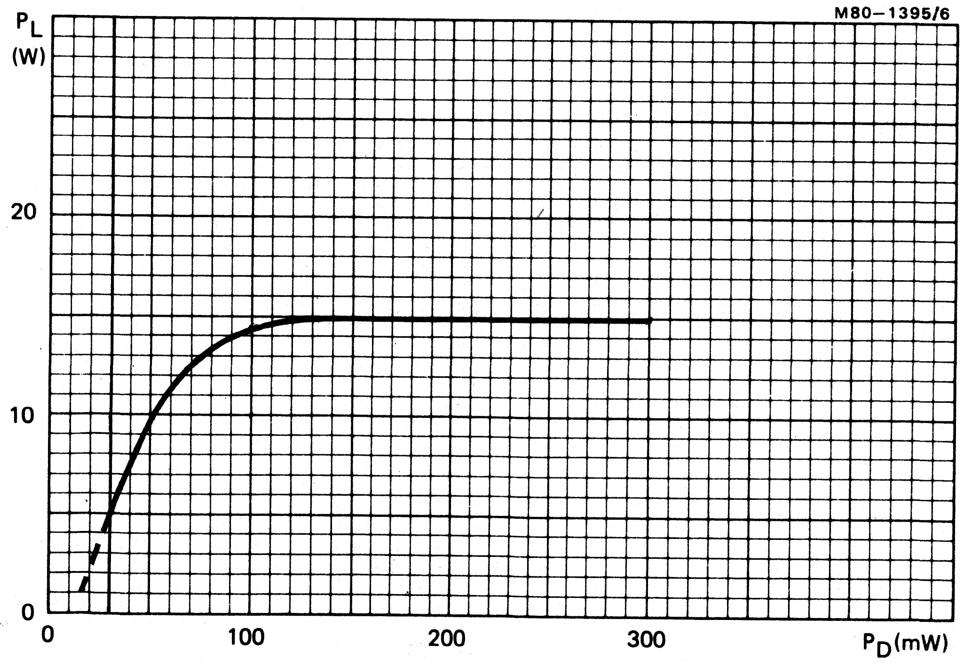


Fig.6 Typical values; V_{S1} = V_{S2} = 12.5 V; f = 160 MHz

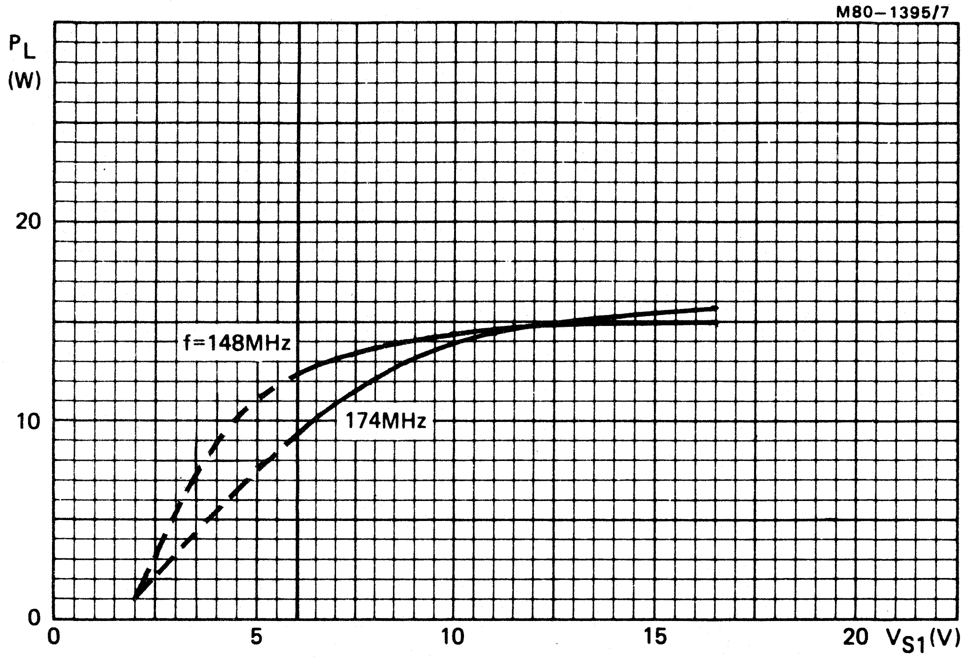


Fig.7 Typical values; V_{S2} = 12.5 V; P_D = 150 mW

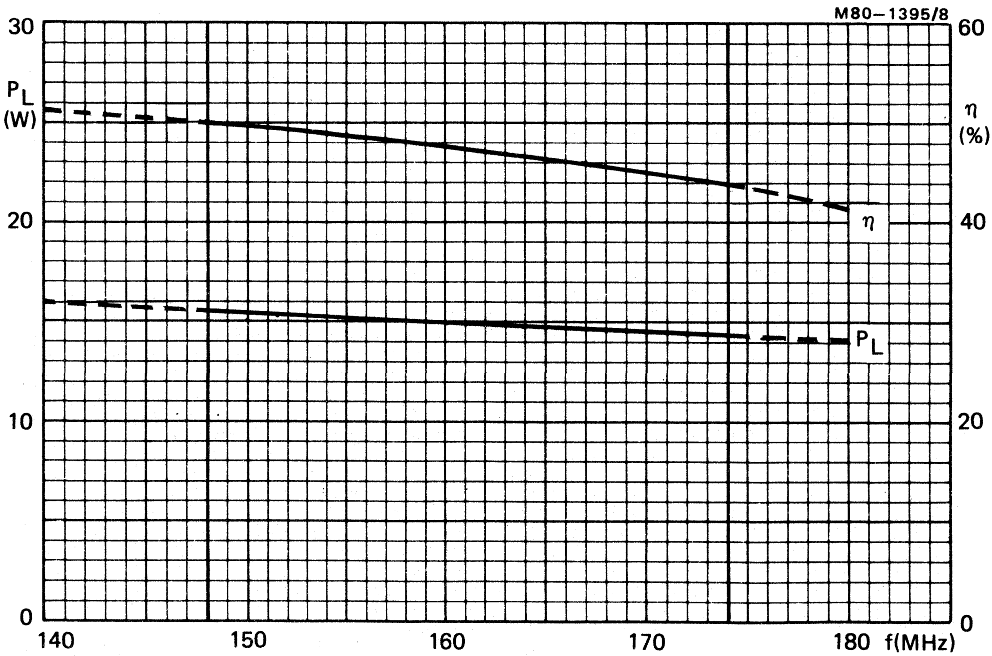


Fig.8 Typical values; V_{S1} = V_{S2} = 12.5 V; P_D = 150 mW

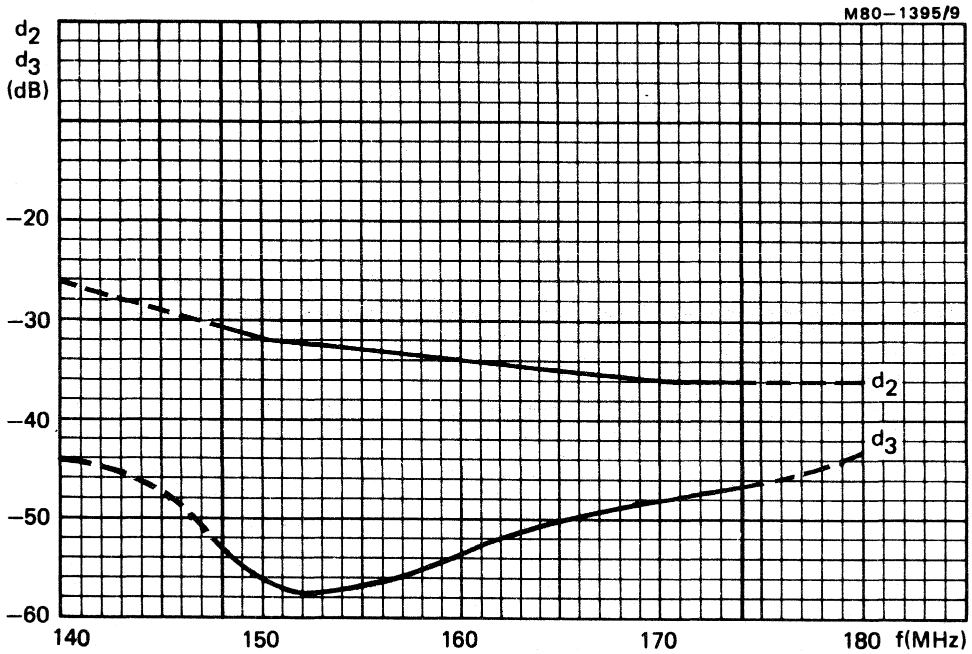
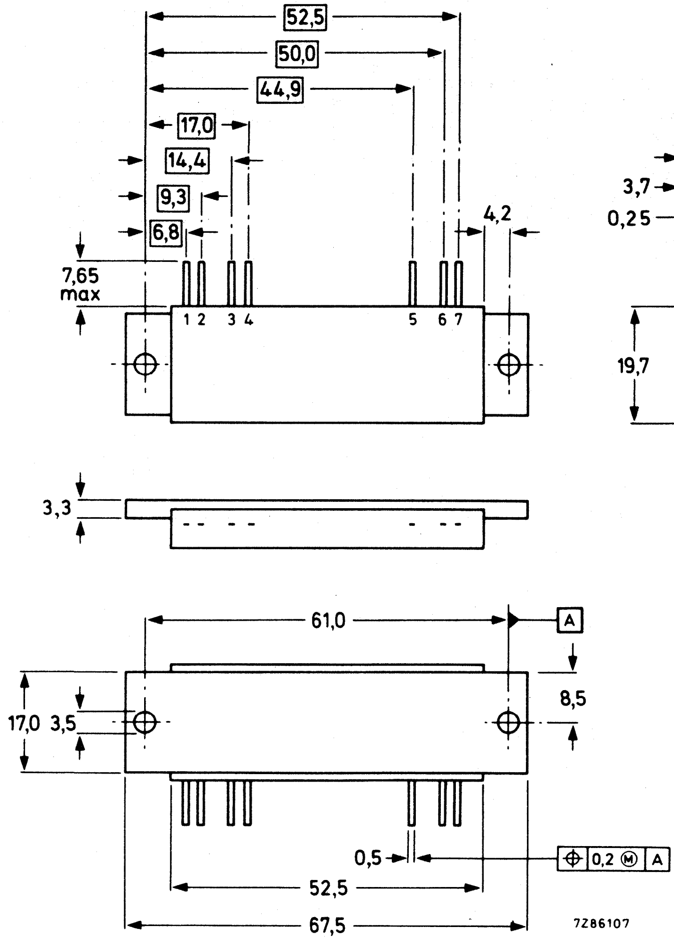


Fig.9 Typical values; $V_{S1} = V_{S2} = 12.5$ V; $P_D = 150$ mW

MECHANICAL DATA

Dimensions in mm

Fig. 10 SOT-132B.



Lead reference

1 = Input
2 = Earth
3 = V_{S1}
4 = Earth
5 = V_{S2}
6 = Earth
7 = Output

UHF POWER AMPLIFIER MODULE

UHF broadband amplifier module designed for use in mobile communication equipment operating directly from a 9.6 V electrical supply. The module will produce a minimum of 1.4 W into a 50 Ω load over the frequency range 400 to 440 MHz.

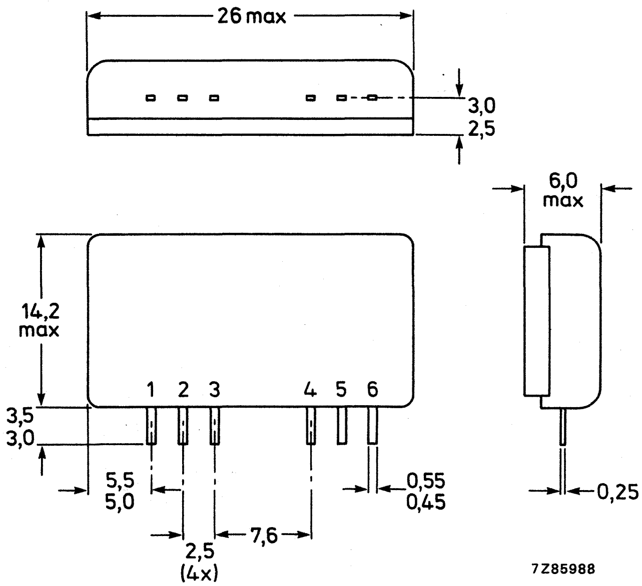
The module consists of a two-stage RF amplifier using npn transistor chips with lumped element matching components in a SOT-181 plastic encapsulation. The negative supply is internally connected to the flange.

QUICK REFERENCE DATA

Mode of operation		continuous wave		
Frequency range		400 to 440		MHz
DC supply voltage (terminal 3)	V_{S1}	nom.	7.5	V
DC supply voltage (terminal 4)	V_{S2}	nom.	9.6	V
RF drive power	P_D	<	45	mW
RF load power	P_L	min.	1.4	W
Efficiency	η	typ.	42	%

MECHANICAL DATA

Dimensions in mm



Lead reference

1. RF input
2. Earth
3. V_{S1}
4. V_{S2}
5. Earth
6. RF output

Flange connected to earth.

Fig. 1 SOT-181.

RATINGS

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

DC supply terminal voltages*	V_{S1}, V_{S2}	max.	12	V*
RF input terminal voltage*	$\pm V_i$	max.	25	V*
RF output terminal voltage*	$\pm V_o$	max.	25	V*
Load power (see Fig. 2)	P_L	max.	2.5	W
Drive power	P_D	max.	90	mW
Storage temperature range	T_{stg}		−40 to 100	°C
Operating heatsink temperature range	T_h		−30 to 90	°C

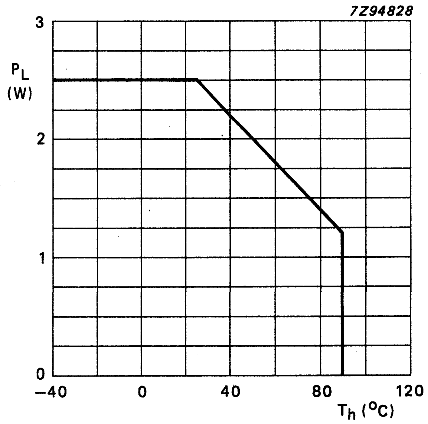


Fig. 2 Load power derating.

CHARACTERISTICS

V_{S1} = 7.5 V; V_{S2} = 9.6 V; R_S = R_L = 50 Ω; f = 400 to 440 MHz; T_h = 25 °C

Quiescent currents P_D = 0	I_{Q1} I_{Q2}	< <	7.0 0.1	mA mA
RF drive power P_L = 1.4 W	P_D	<	45	mW
Efficiency P_L = 1.4 W	η	> typ.	40 42	% %
Harmonic output	any harmonic	min. typ.	30 40	dB dB
Input VSWR with respect to 50 Ω		<	2 : 1	

* With respect to earth pins.

Stability

The module is stable with a load VSWR up to 5 : 1 (all phases) when operated within the following conditions:

$V_{S1} = V_{S2} = 5.0$ V to 11.2 V; $P_D = 17$ to 90 mW; f = 400 to 440 MHz; $P_L < 2.5$ W (matched).

Ruggedness

The module will withstand a load mismatch VSWR of 50 : 1 (all phases) for short period overload conditions, with $P_D \leqslant 90$ mW, $V_{S1} \leqslant V_{S2} \leqslant 12$ V, $P_L < 2.5$ W (matched), $T_h \leqslant 90$ °C.

APPLICATION INFORMATION

Mounting

To ensure good thermal transfer the module should be mounted onto a heatsink with a flat surface with heat-conducting compound applied between module and heatsink. The module is designed to be pressed against the heatsink by a sheet spring applying up to 50 N to the top surface of the module encapsulation. The leads of the devices may be soldered directly into a circuit using a soldering iron with a maximum temperature of 245 °C for not more than 10 seconds at a distance of at least 1 mm from the plastic.

Power rating

In general, it is recommended that the output power from the module under nominal conditions should not exceed 1.5 W in order to provide an adequate safety margin under fault conditions.

Output power control

The module is designed to be operated at a constant output power of 1.4 W. The module is adjusted to produce nominal output by reducing the first stage supply voltage V_{S1}. If the module is to be used over a range of output power levels below 1.4 W, the first stage supply voltage should not be reduced below 5 V. If further reductions in power are needed, this may be achieved by varying the drive power P_D. For stable operation however, care must be taken to avoid operating the module outside the published stability conditions.

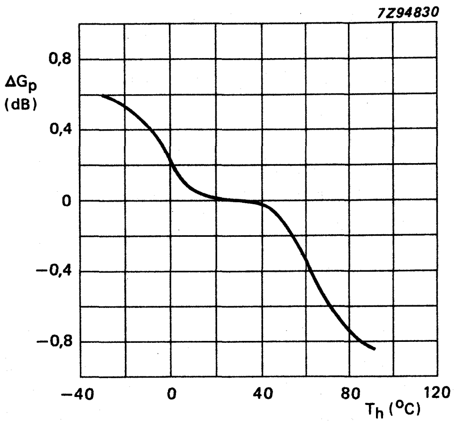


Fig. 3 Power gain as a function of temperature; V_{S1} = 7.5 V; V_{S2} = 9.6 V; P_D = 45 mW; typical values.

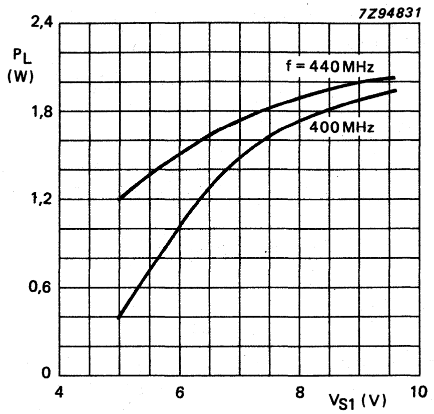


Fig. 4 Load power as a function of supply voltage V_{S1}; V_{S2} = 9.6 V; P_D = 45 mW; typical values.

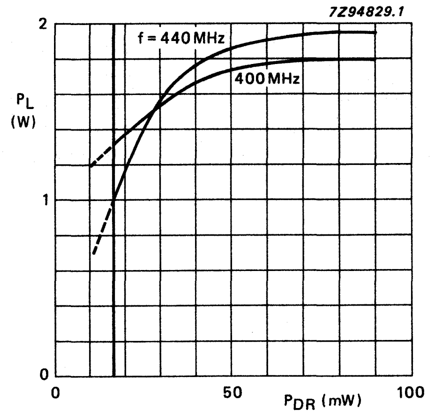


Fig. 5 Load power as a function of drive power; V_{S1} = 7.5 V; V_{S2} = 9.6 V; typical values.

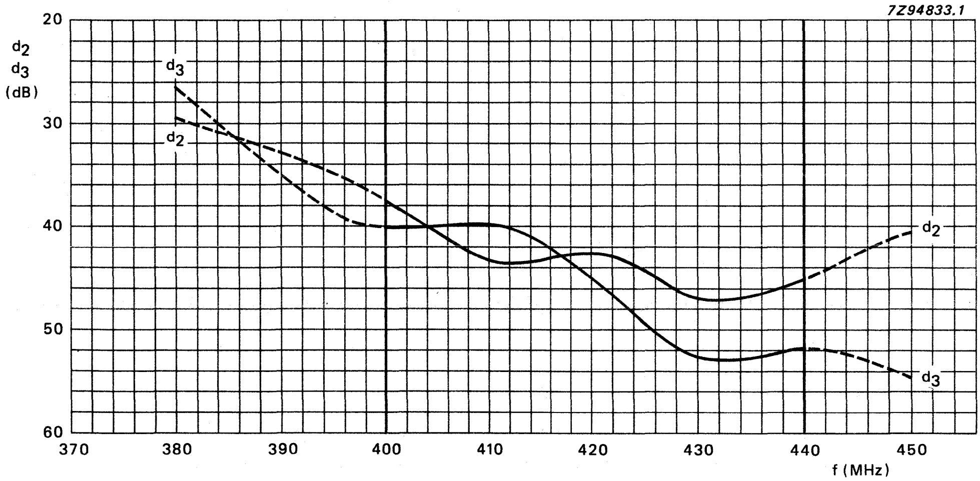


Fig. 6 Second and third harmonic distortions as a function of frequency; V_{S1} = 7.5 V; V_{S2} = 9.6 V; P_D = 45 mW; typical values.

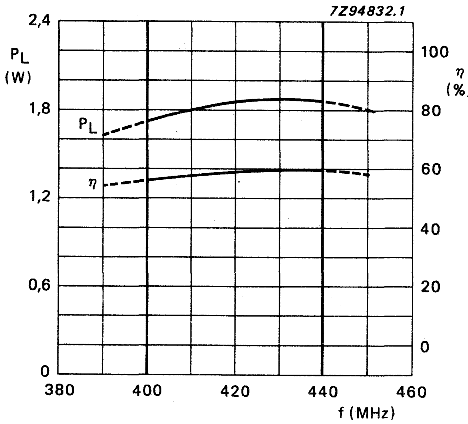


Fig. 7 Load power and efficiency as functions of frequency; V_{S1} = 7.5 V; V_{S2} = 9.6 V; P_D = 45 mW; typical values.

UHF POWER AMPLIFIER MODULE

UHF broadband amplifier module designed for use in mobile communication equipment operating directly from a 9.6 V electrical supply. The module will produce a minimum of 1.4 W into a 50 Ω load over the frequency range of 430 to 470 MHz.

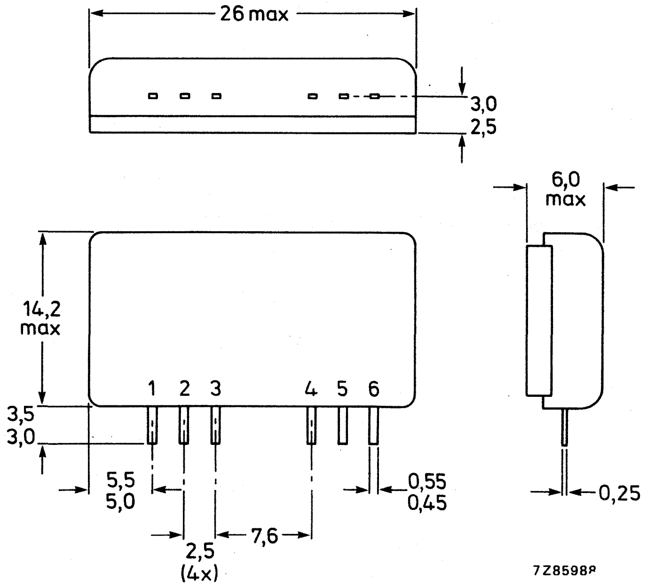
The module consists of a two-stage RF amplifier using npn transistor chips with lumped element matching components in a SOT-181 plastic encapsulation. The negative supply is internally connected to the flange.

QUICK REFERENCE DATA

Mode of operation		continuous wave		
Frequency range			430 to 470	MHz
DC supply voltage (terminal 3)	V_{S1}	nom.	7.5	V
DC supply voltage (terminal 4)	V_{S2}	nom.	9.6	V
RF drive power	P_D	<	45	mW
RF load power	P_L	min.	1.4	W
Efficiency	η	typ.	45	%

MECHANICAL DATA

Dimensions in mm



Lead reference

1. RF input
2. Earth
3. V_{S1}
4. V_{S2}
5. Earth
6. RF output

Flange connected to earth.

Fig. 1 SOT-181.

RATINGS

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

DC supply terminal voltages*	V_{S1}, V_{S2}	max.	12	V*
RF input terminal voltage*	$\pm V_i$	max.	25	V*
RF output terminal voltage*	$\pm V_o$	max.	25	V*
Load power (see Fig. 2)	P_L	max.	2.5	W
Drive power	P_D	max.	90	mW
Storage temperature range	T_{stg}		−40 to + 100	°C
Operating heatsink temperature	T_h	max.	90	°C

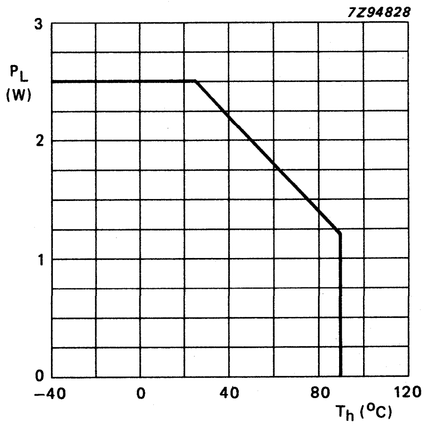


Fig. 2 Load power derating; VSWR = 1 : 1.

CHARACTERISTICS

V_{S1} = 7.5 V; V_{S2} = 9.6 V; $R_S = R_L$ = 50 Ω; f = 430 to 470 MHz; T_h = 25 °C

Quiescent currents				
$P_D = 0$	I_{Q1}	<	7.0	mA
	I_{Q2}	<	0.1	mA
RF drive power				
P_L = 1.4 W	P_D	<	45	mW
Efficiency				
P_L = 1.4 W	η	>	40	%
		typ.	45	%
Harmonic output	any harmonic	min.	30	dB
		typ.	40	dB
Input VSWR				
with respect to 50 Ω		<	2 : 1	

* With respect to the earth pins.

Stability

The module is stable with a load VSWR up to 5 : 1 (all phases) when operated within the following conditions:

$V_{S1} \leqslant V_{S2}$ = 5.0 V to 11.2 V; P_D = 17 to 90 mW; f = 430 to 470 MHz; $P_L < 2.5$ W (matched).

Ruggedness

The module will withstand a load mismatch VSWR of 50 : 1 (all phases) for short period overload conditions, with $P_D \leqslant 90$ mW, $V_{S1} \leqslant V_{S2} \leqslant 12$ V, $P_L < 2.5$ V (matched), $T_h < 90$ °C.

APPLICATION INFORMATION

Mounting

To ensure good thermal transfer the module should be mounted onto a heatsink with a flat surface with heat-conducting compound applied between module and heatsink. The module is designed to be pressed against the heatsink by a sheet spring applying up to 50 N to the top surface of the module encapsulation. The leads of the devices may be soldered directly into a circuit using a soldering iron with a maximum temperature of 245 °C for not more than 10 seconds at a distance of at least 1 mm from the plastic.

Power rating

In general, it is recommended that the output power from the module under nominal conditions should not exceed 1.5 W in order to provide an adequate safety margin under fault conditions.

Output power control

The module is designed to be operated at a constant output power of 1.4 W. The module is adjusted to produce nominal output by reducing the first stage supply voltage V_{S1}. If the module is to be used over a range of output power levels below 1.4 W, the first stage supply voltage should not be reduced below 5 V. If further reductions in power are needed, this may be achieved by varying the drive power P_D. For stable operation however, care must be taken to avoid operating the module outside the published stability conditions.

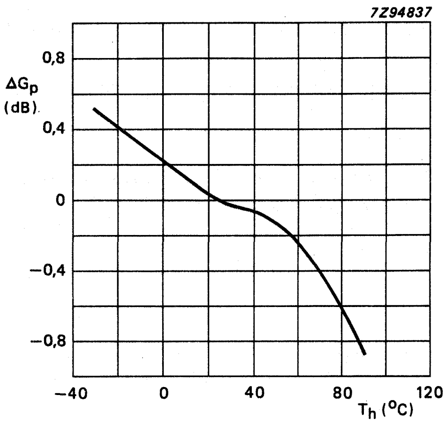


Fig. 3 Power gain as a function of temperature; V_{S1} = 7.5 V; V_{S2} = 9.6 V; P_D = 45 mW; typical values.

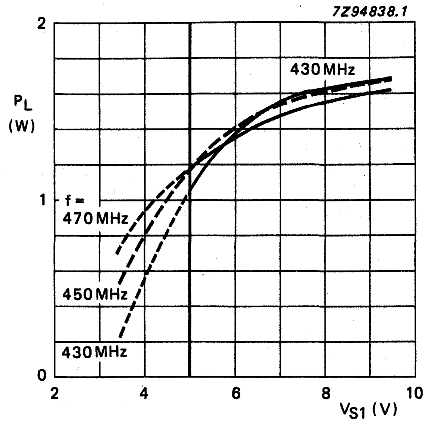


Fig. 4 Load power as a function of supply voltage V_{S1}; V_{S2} = 9.6 V; P_D = 45 mW; typical values.

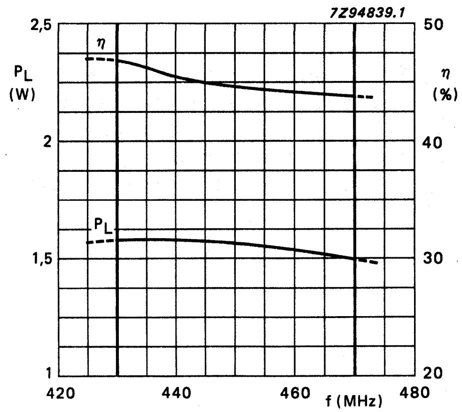


Fig. 5 Load power and efficiency as functions of frequency; V_{S1} = 7.5 V; V_{S2} = 9.6 V; P_D = 45 mW; typical values.

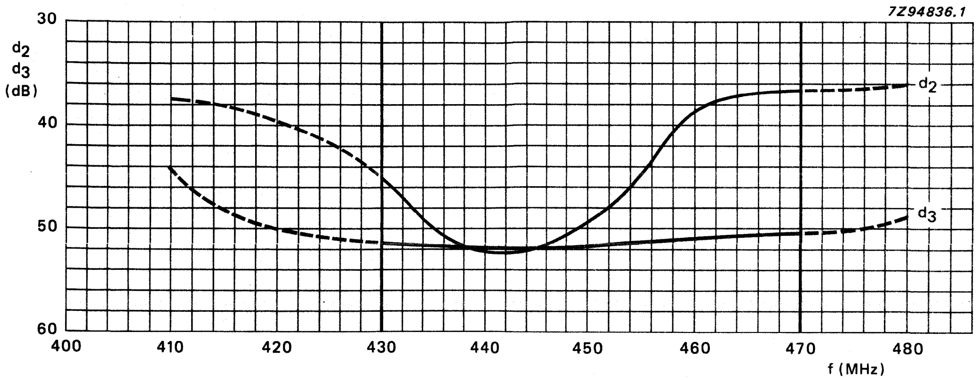


Fig. 6 Second and third harmonic distortions as a function of frequency; V_{S1} = 7.5 V; V_{S2} = 9.6 V; P_D = 45 mW; typical values.

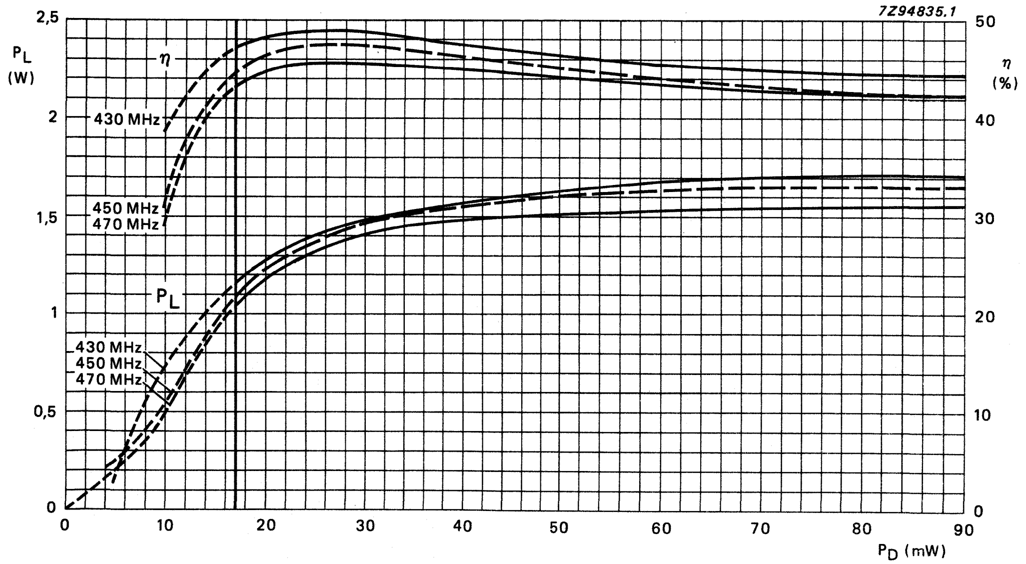


Fig. 7 Load power and efficiency as functions of drive power; V_{S1} = 7.5 V; V_{S2} = 9.6 V; typical values.

UHF POWER AMPLIFIER MODULE

A broadband UHF amplifier module primarily designed for mobile communications equipment, operating directly from 7.5 V or 9.6 V electrical systems. The module will produce a minimum output of 2.0 W or 3.2 W into a 50 Ω load over the frequency range 400 to 470 MHz.

The module consists of a two-stage RF amplifier, using npn transistor chips with lumped-element matching components in a plastic stripline encapsulation (SOT181). The negative supply is internally connected to the flange.

QUICK REFERENCE DATA

Mode of operation			CW	
Frequency range			400 to 470	MHz
DC supply voltage (terminal 3)	V_{S1}		7.5 or 9.6	V
DC supply voltage (terminal 4)	V_{S2}		7.5 or 9.6	V
RF drive power	P_D	max.	50	mW
RF load power	P_L	min.	2.0 or 3.2	W
Efficiency	η	typ.	44	%

MECHANICAL DATA

Dimensions in mm

Lead reference

1 = RF input
2 = Earth
3 = V_{S1}
4 = V_{S2}
5 = Earth
6 = RF output
Flange = earth

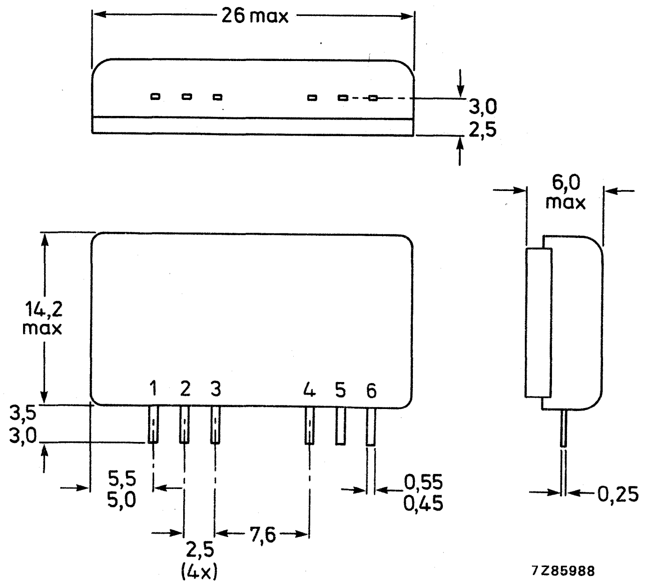


Fig.1 SOT181.

RATINGS

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

DC supply terminal voltages*	V_{S1}, V_{S2}	max.	12	V
RF input terminal voltage*	$\pm V_i$	max.	25	V
RF output terminal voltage*	$\pm V_o$	max.	25	V
Load power	P_L	max.	5.0	W
Drive power	P_D	max.	90	mW
Storage temperature range	T_{stg}		−40 to 100	°C
Operating heatsink temperature	T_h	max.	90	°C

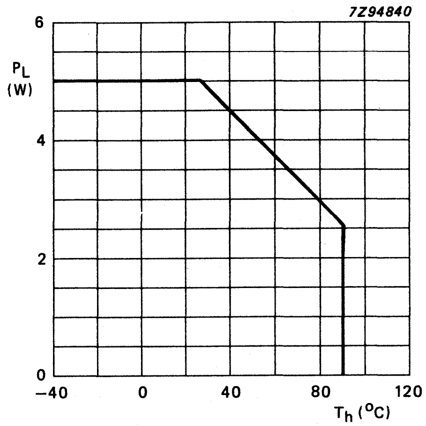


Fig.2 Load power derating; VSWR = 1 : 1.

* With respect to the earth pins.

CHARACTERISTICS

$Z_S = Z_L = 50\ \Omega$; frequency range = 400 to 470 MHz; T_h = 25 °C unless otherwise specified.

Quiescent currents			
$V_{S1} = V_{S2}$ = 7.5 V or 9.6 V;	I_{Q1}	max.	7.0 mA
$P_D = 0$	I_{Q2}	max.	0.1 mA
Efficiency			
P_L = 2.0 W or P_L = 3.2 W	η	min.	40 %
	η	typ.	44 %
RF drive power			
P_L = 2.0 W; $V_{S1} = V_{S2}$ = 7.5 V	P_D	max.	50 mW
P_L = 3.2 W; $V_{S1} = V_{S2}$ = 9.6 V	P_D	max.	50 mW
Harmonic output	any harmonic	min.	−30 dB
		typ.	−40 dB
Input VSWR			
with respect to 50 Ω	VSWR	max.	2:1

Stability

The module is stable with a load VSWR up to 5:1 (all phases) when operated within the following conditions:

$V_{S1} \leqslant V_{S2}$ = 5.0 V to 11.2 V; P_D = 25 to 90 mW; f = 400 to 470 MHz; $P_L < 5.0$ W (matched)

Ruggedness

The module will withstand a load mismatch VSWR of 50:1 (all phases) for short period overload conditions, with P_D, V_{S1} and V_{S2} at maximum values, providing the combination does not cause the matched RF output power rating to be exceeded.

Mounting

To ensure good thermal transfer the module should be mounted onto a heatsink with a flat surface with heat-conducting compound applied between module and heatsink. The leads of the devices may be soldered directly into a circuit using a soldering iron with a maximum temperature of 245 °C for not more than 10 seconds at a distance of a least 1 mm from the plastic.

Power rating

In general it is recommended that the output power from the module under nominal conditions should not exceed 4 W in order to provide an adequate safety margin under fault conditions.

Output power control

The module is not designed to be operated over a large range of output power levels. The aim of the output power control is to set the nominal output power level. The preferred method of output power control is by varying the drive power between 25 and 50 mW. The next option is by varying V_{S1} between 5.0 and 9.6 V.

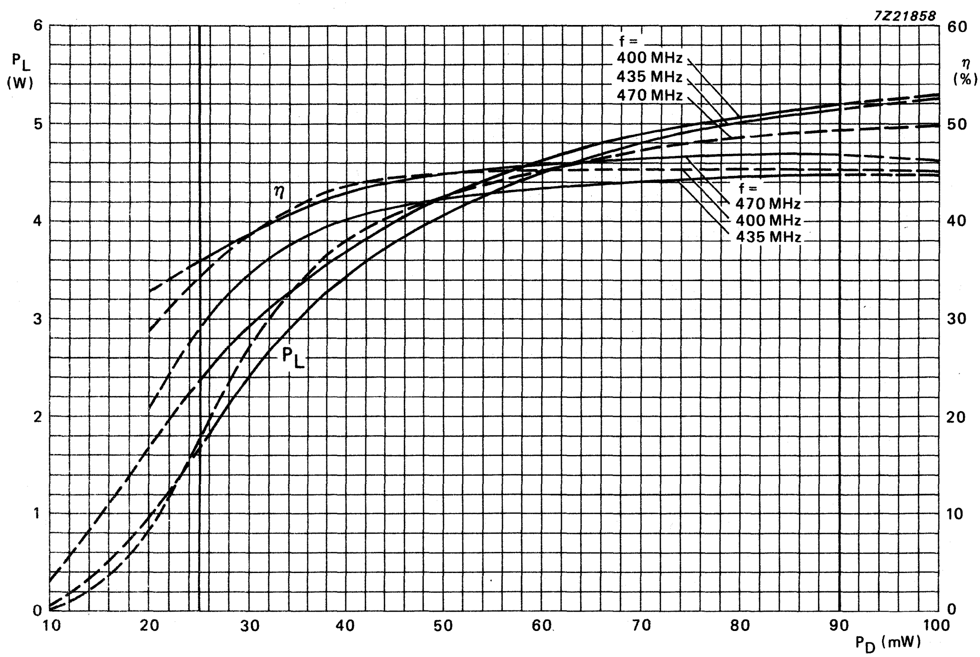


Fig.3 Load power and efficiency as functions of drive power; $V_{S1} = V_{S2} = 9.6$ V; typical values.

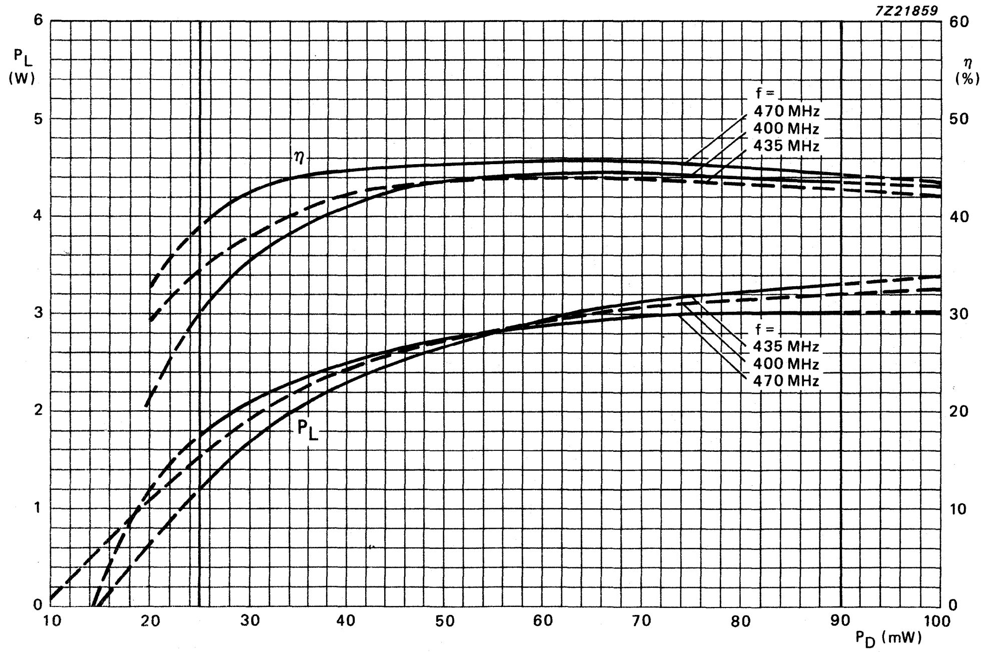


Fig.4 Load power and efficiency as functions of drive power; $V_{S1} = V_{S2} = 7.5$ V; typical values.

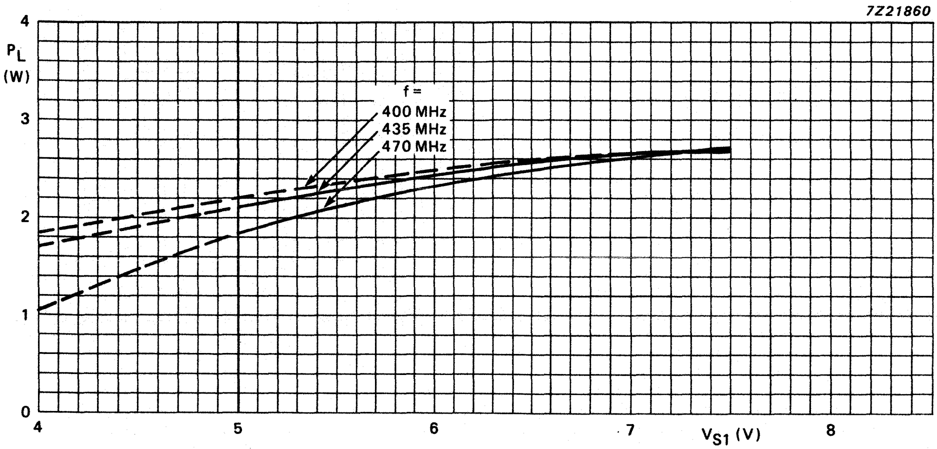


Fig.5 Load power as a function of V_{S1}; V_{S2} = 7.5 V; P_D = 50 mW; typical values.

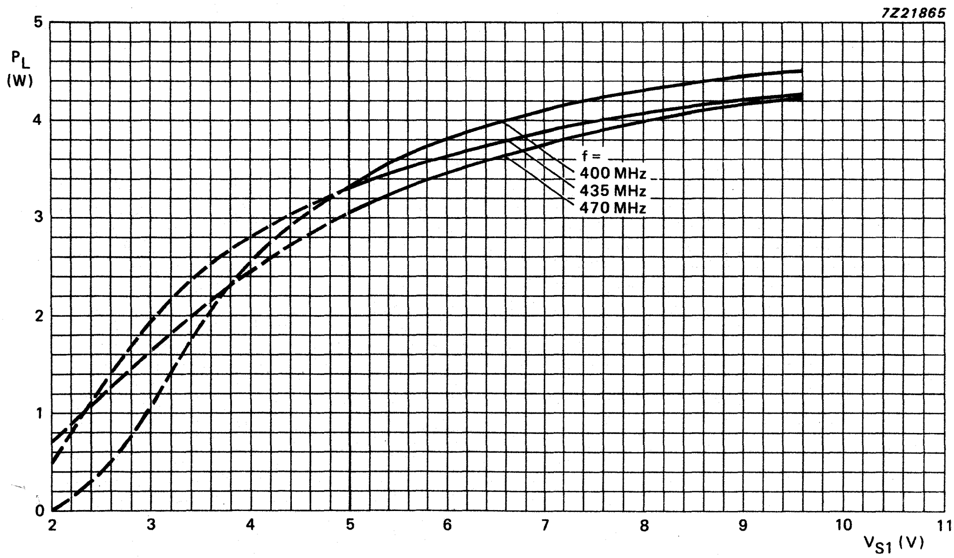


Fig.6 Load power as a function of V_{S1}; V_{S2} = 9.6 V; P_D = 50 mW; typical values.

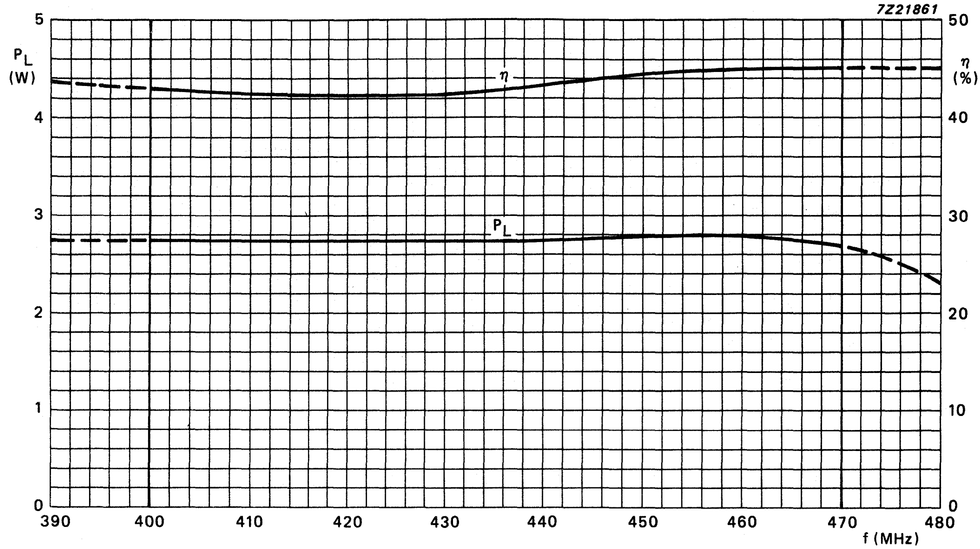


Fig.7 Load power and efficiency as functions of frequency; $V_{S1} = V_{S2} = 7.5$ V; $P_D = 50$ mW; typical values.

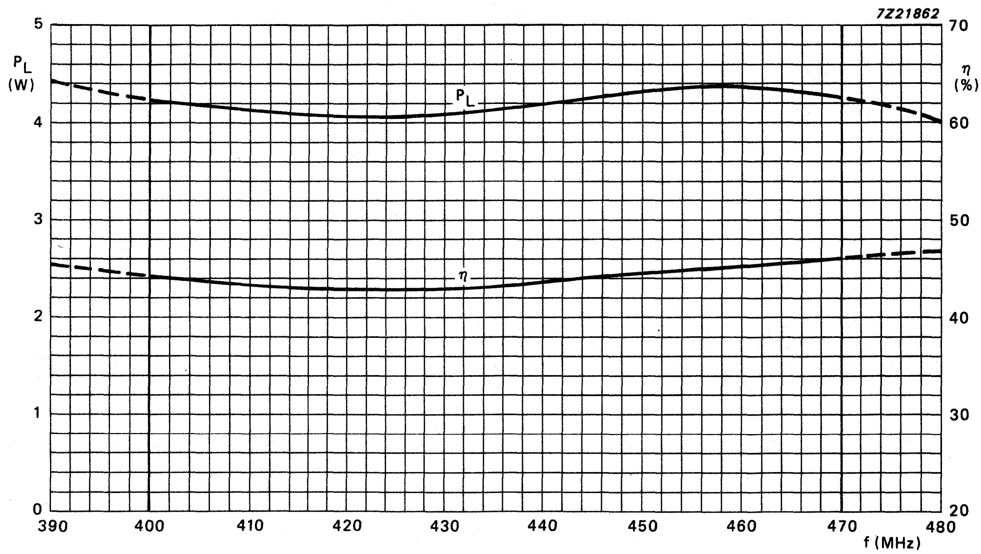


Fig.8 Load power and efficiency as functions of frequency; $V_{S1} = V_{S2} = 9.6$ V; $P_D = 50$ mW; typical values.

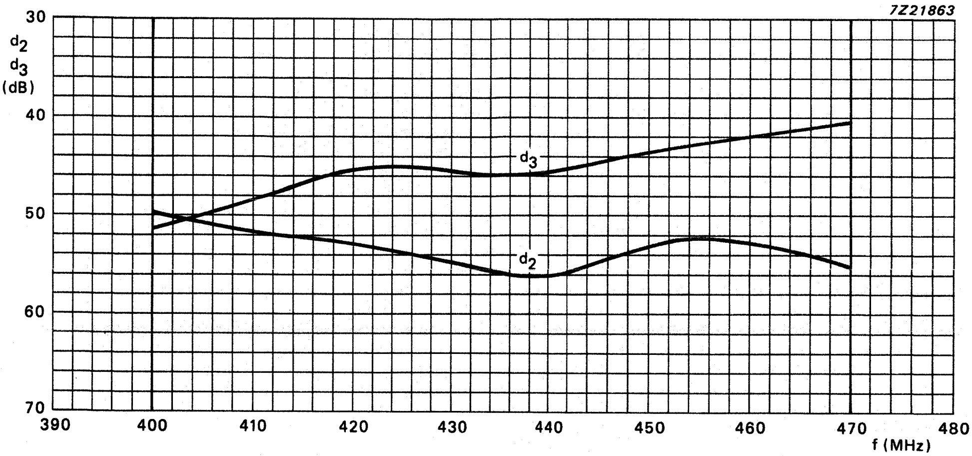


Fig.9 Second and third harmonic distortions as functions of frequency; $V_{S1} = V_{S2} = 7.5$ V; $P_D = 50$ mW; typical values.

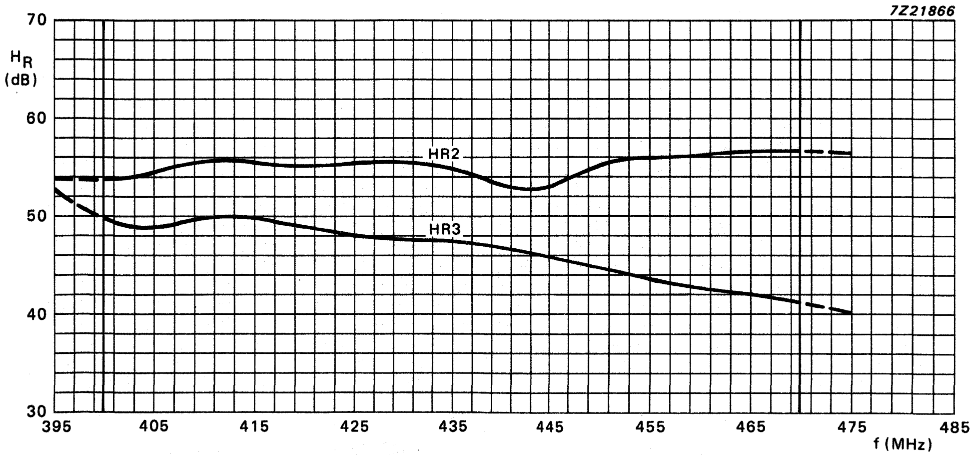


Fig.10 Second and third harmonic distortions as functions of frequency; $V_{S1} = V_{S2} = 9.6$ V; $P_D = 50$ mW; typical values.

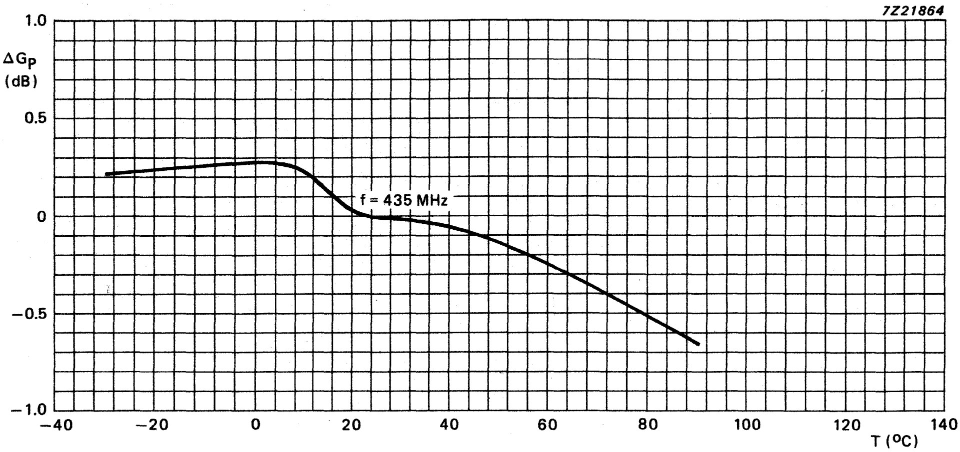


Fig.11 Power gain as a function of temperature; P_D = 50 mW; V_{S1} = V_{S2} = 7.5 V; typical values.

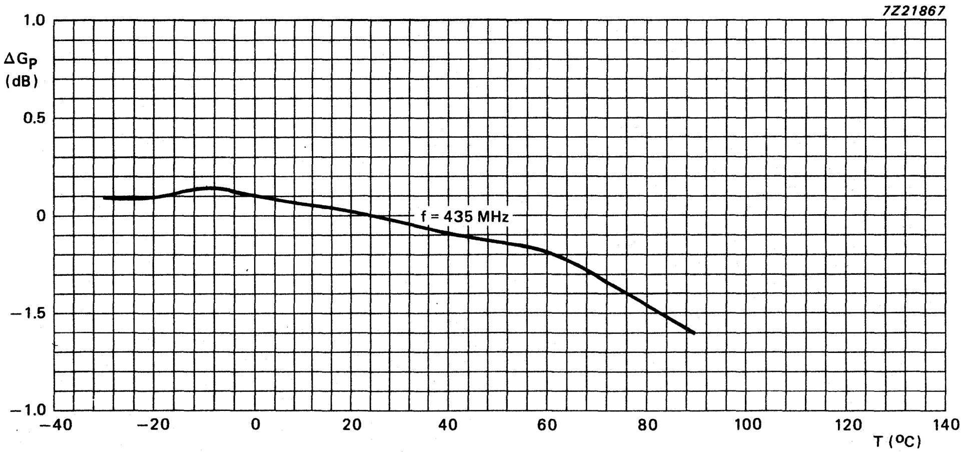


Fig.12 Power gain as a function of temperature; P_D = 50 mW; V_{S1} = V_{S2} = 9.6 V; typical values.

UHF AMPLIFIER MODULE

The BGY95 is a three-stage UHF amplifier module designed primarily for mobile transmitting equipment operating from a nominal 7.5 V power supply.

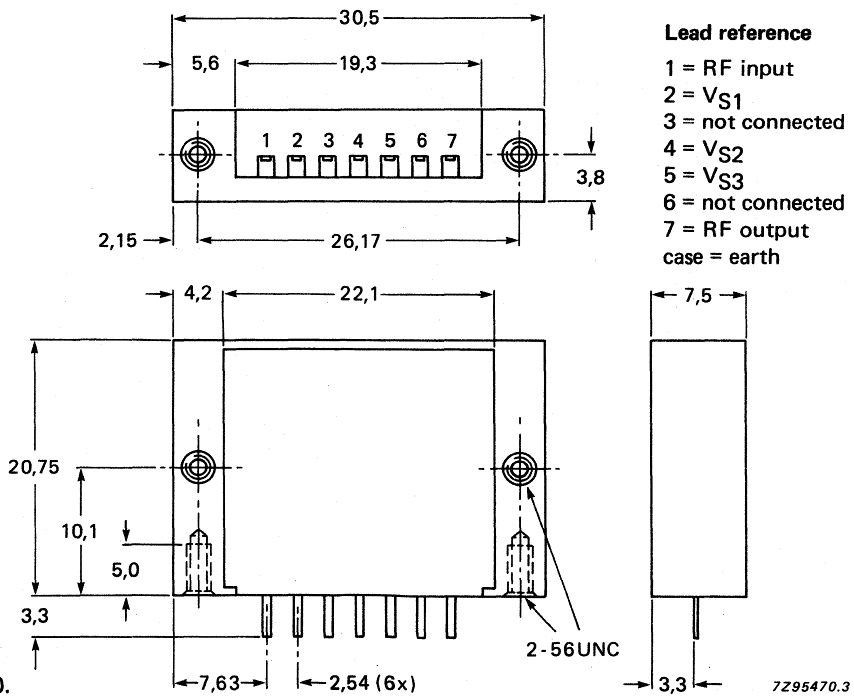
The module consists of three npn silicon planar transistors mounted on a metallized ceramic substrate, together with matching and bias circuitry. The BGY95A and BGY95B produce an output power of 2.2 W into a 50 Ω load over the frequency band of 824-851 MHz and 890-915 MHz respectively. The output power can be controlled by means of a DC voltage (V_{S1}).

QUICK REFERENCE DATA

Mode of operation				CW	
Frequency range	BGY95A	f		824 to 851	MHz
	BGY95B	f		890 to 915	MHz
RF load power V_{S1} = 6 V; V_{S2} = V_{S3} = 7.5 V; P_D = 20 mW		P_L	min.	2.2	W
RF drive power V_{S1} = 6 V; V_{S2} = V_{S3} = 7.5 V; P_L = 2.2 W		P_D	≤	20	mW
Output load impedance		Z_L	nom.	50	Ω

MECHANICAL DATA

Dimensions in mm



Lead reference

1 = RF input
2 = V_{S1}
3 = not connected
4 = V_{S2}
5 = V_{S3}
6 = not connected
7 = RF output
case = earth

Fig.1 SOT200.

RATINGS

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

RF input terminal voltage*	V_{in}	max.	± 25	V
RF output terminal voltage*	V_{out}	max.	± 25	V
DC supply terminal voltages*	V_{S1}	max.	8.0	V
	V_{S2}, V_{S3}	max.	9.0	V
RF load power (see Fig.2)	P_L	max.	3.5	W
RF drive power	P_D	max.	40	mW
Storage temperature range	T_{stg}		−40 to + 100	°C
Operating heatsink temperature range	T_h		−30 to + 90	°C

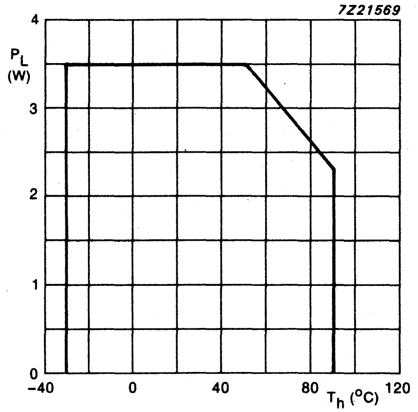


Fig.2 Load power derating; VSWR = 1:1.

* With respect to case.

CHARACTERISTICS

$V_{S2} = V_{S3} = 7.5$ V; $P_D = 20$ mW; $T_h = 25\ ^oC$; $R_S = R_L = 50\ \Omega$; unless otherwise specified

Frequency range	BGY95A	f		824 to 851 MHz
	BGY95B	f		890 to 915 MHz
RF output power $V_{S1} = 6$ V		P_L	min.	2.2 W
Efficiency $P_L = 2.2$ W		η	min.	35 %
Harmonic rejection $P_L = 2.2$ W		H_R2	min.	30 dB
		H_R3	min.	40 dB
Input VSWR with respect to 50 Ω		VSWR	max.	2 : 1
Noise power 25 kHz. Bandwidth 45 MHz above f_o. $P_{out} = 2.2$ W		Noise	max.	–88 dBm

Stability

The module will produce no spurious signals > –60 dB below the carrier signal when operated with a load mismatch VSWR < 3 : 1 (all phases) and $V_{S1} = 0.5$ to 6.0 V, $V_{S2} = V_{S3} = 6$ to 9 V. $P_D = 10$ to 40 mW and $T_h \leqslant 90\ ^oC$, provided maximum ratings are not exceeded. $V_{S1} \leqslant V_{S2}$ and V_{S3}.

Ruggedness

The module will withstand a load mismatch of 50 : 1 (all phases) for short periods when operated with $V_{S1} < 8$ V, $V_{S2} = V_{S3} \leqslant 9$ V, $P_D \leqslant 40$ mW and $T_h \leqslant 90\ ^oC$, provided maximum ratings are not exceeded.

Mounting

To ensure good thermal transfer the module should be mounted onto a heatsink with a flat surface with heat-conducting compound applied between module and the heatsink. The leads may be soldered directly into a circuit using a soldering iron with a maximum temperature of 245 °C for not more than 10 seconds at a distance of at least 1 mm from the plastic.

Power rating

In general, it is recommended that the output power from the module under nominal conditions should not exceed 3.0 W in order to provide an adequate safety margin under fault conditions.

Gain control

The module is designed to be operated at a nominal output power of 2.2 W. The module is adjusted to produce nominal output power by reducing the first stage supply voltage V_{S1}. The output power may be varied from 6 mW to 2.2 W by varying V_{S1} from 0.5 V to 6 V.

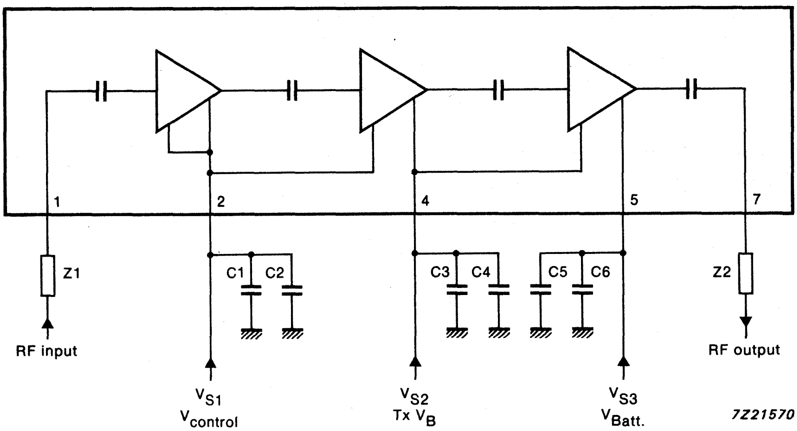
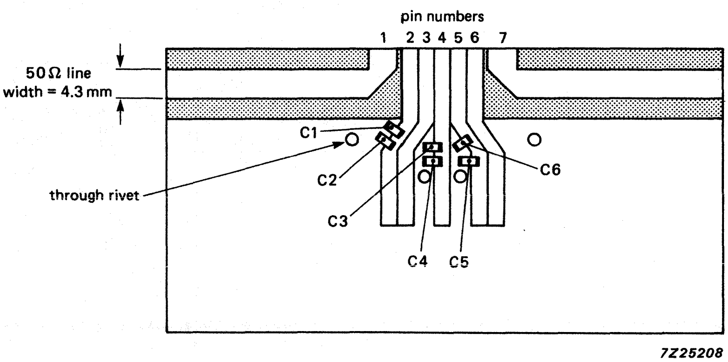


Fig. 3 Internal diagram.

Z1 = Z2 = 50 Ω stripline
C1 = C3 = C6 = 0.01 μF ceramic chip capacitor
C2 = C4 = C5 = 1.0 μF tantalum capacitor



Teflon glass board 1/16"; ϵ_r = 2.55. Decouple DC supplies with 0.01 μF chip and 1 μF tantalum capacitors.

Fig.4 Printed circuit board layout.

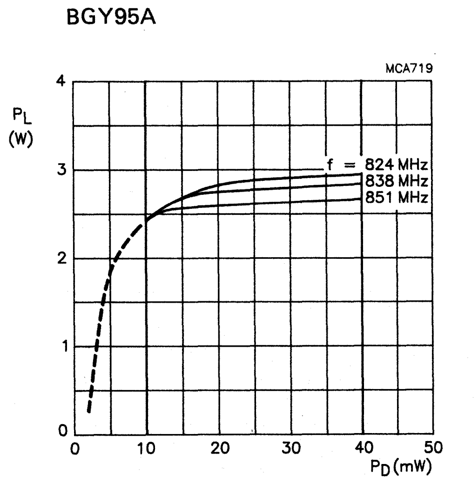


Fig.5 Load power as a function of drive power; V_{S1} = 6 V; V_{S2} = V_{S3} = 7.5 V.

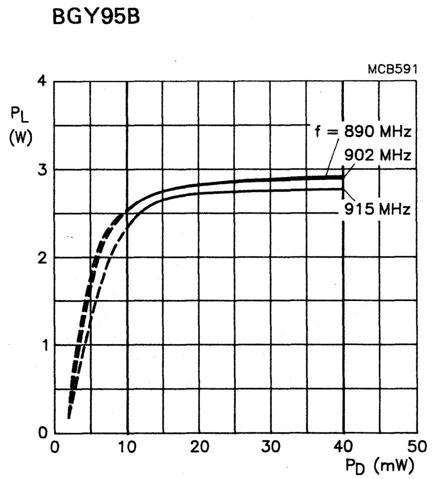


Fig.6 Load power as a function of drive power; V_{S1} = 6 V; V_{S2} = V_{S3} = 7.5 V.

BGY95A

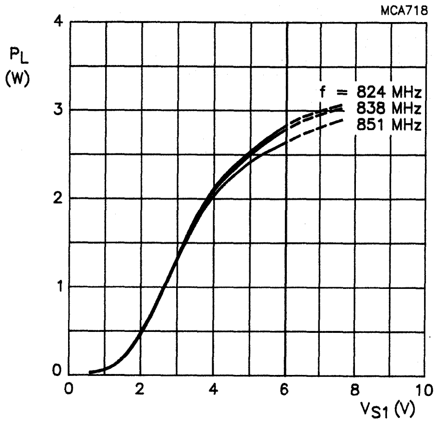


Fig. 7 Load power as a function of supply voltage V_{S1}; P_D = 20 mW; $V_{S2} = V_{S3}$ = 7.5 V.

BGY95B

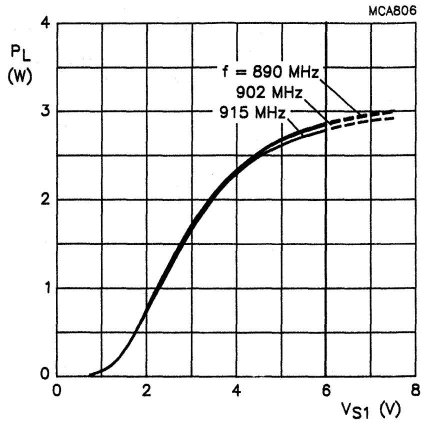


Fig. 8 Load power as a function of supply voltage V_{S1}; P_D = 20 mW; $V_{S2} = V_{S3}$ = 7.5 V.

BGY95A

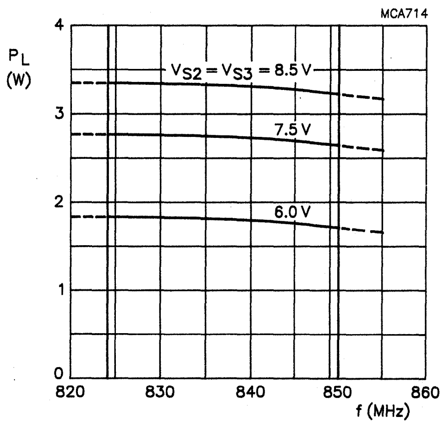


Fig. 9 Load power as a function of frequency; P_D = 20 mW; V_{S1} = 6 V.

BGY95B

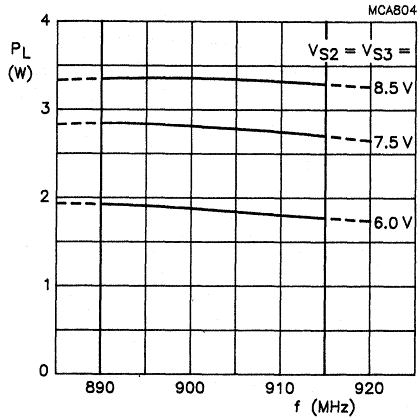


Fig. 10 Load power as a function of frequency; P_D = 20 mW; V_{S1} = 6 V.

BGY95A

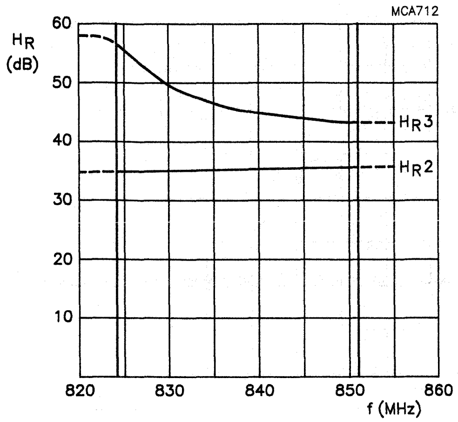


Fig. 11 Second and third harmonic rejections as functions of frequency; P_D = 20 mW; V_{S1} = 6 V; V_{S2} = V_{S3} = 7.5 V.

BGY95B

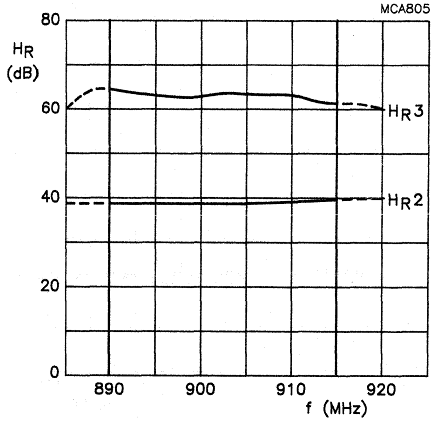


Fig. 12 Second and third harmonic rejections as functions of frequency; P_D = 20 mW; V_{S1} = 6 V; V_{S2} = V_{S3} = 7.5 V.

BGY95A

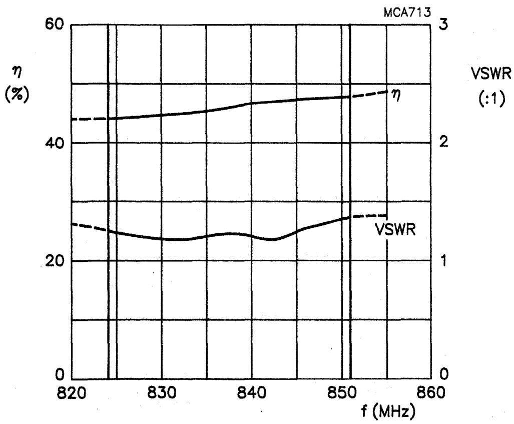


Fig. 13 Efficiency and VSWR as functions of frequency; P_D = 20 mW; V_{S2} = V_{S3} = 7.5 V; P_L = 2.2 W.

BGY95B

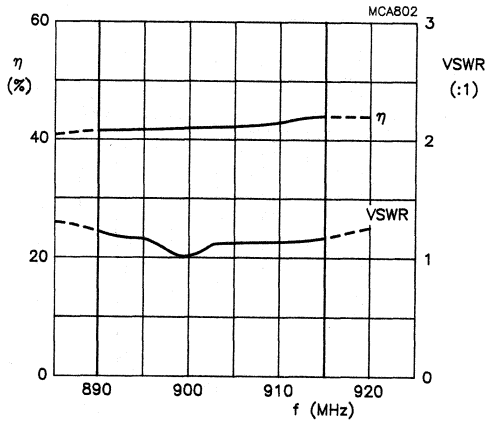


Fig. 14 Efficiency and VSWR as functions of frequency; P_D = 20 mW; V_{S2} = V_{S3} = 7.5 V; P_L = 2.2 W.

BGY95A

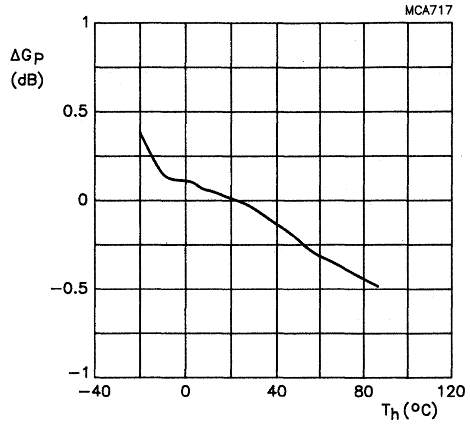


Fig. 15 Change in power gain as a function of heatsink temperature; P_D = 20 mW; V_{S1} = 6 V; V_{S2} = V_{S3} = 7.5 V; f = 838 MHz.

BGY95B

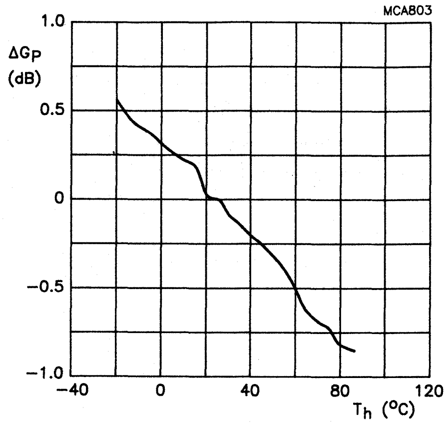


Fig. 16 Change in power gain as a function of heatsink temperature; P_D = 20 mW; V_{S1} = 6 V; V_{S2} = V_{S3} = 7.5 V; f = 902 MHz.

BGY95A

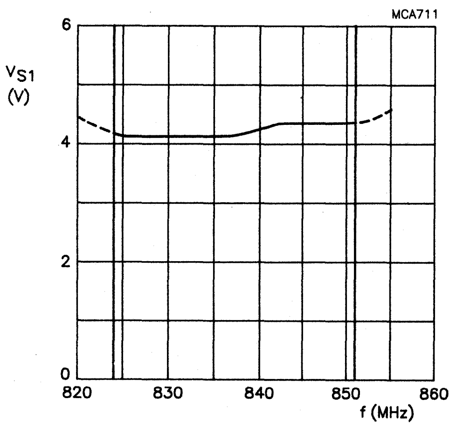


Fig. 17 Supply voltage V_{S1} as a function of frequency; P_D = 20 mW; P_L = 2.2 W; V_{S2} = V_{S3} = 7.5 V.

BGY95B

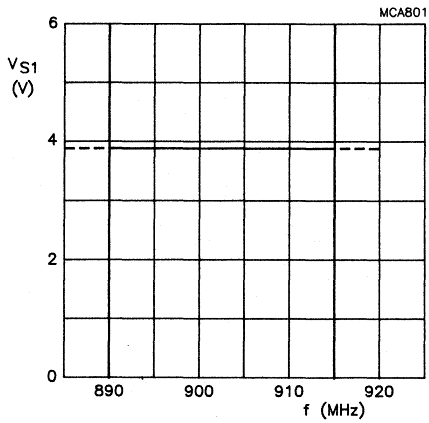


Fig. 18 Supply voltage V_{S1} as a function of frequency; P_D = 20 mW; P_L = 2.2 W; V_{S2} = V_{S3} = 7.5 V.

BGY95A

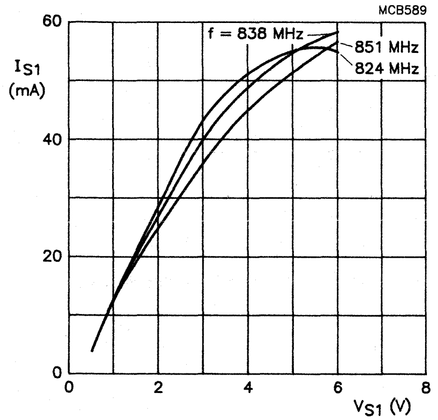


Fig.19 Supply current I_{S1} as a function of supply voltage V_{S1}; P_D = 20 mW; $V_{S2} = V_{S3}$ = 7.5 V.

BGY95B

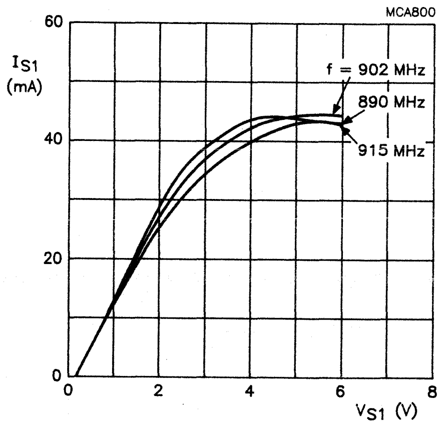


Fig.20 Supply current I_{S1} as a function of supply voltage V_{S1}; P_D = 20 mW; $V_{S2} = V_{S3}$ = 7.5 V.

BGY95A

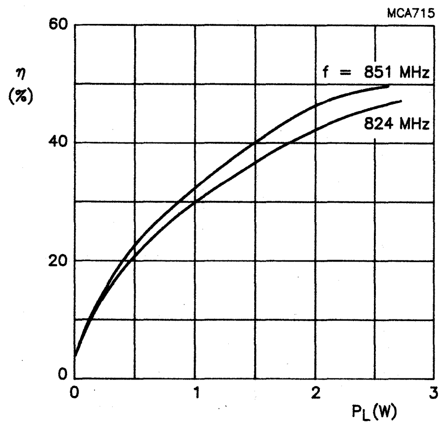


Fig.21 Efficiency as a function of load power; P_D = 20 mW; $V_{S2} = V_{S3}$ = 7.5 V.

BGY95B

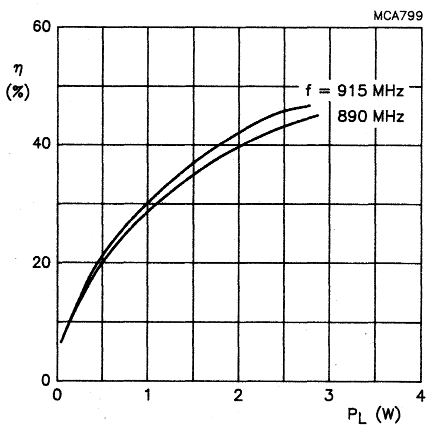


Fig.22 Efficiency as a function of load power; P_D = 20 mW; $V_{S2} = V_{S3}$ = 7.5 V.

UHF AMPLIFIER MODULE

The BGY96 is a three-stage UHF amplifier module designed primarily for mobile transmitting equipment operating from a nominal 9.6 V power supply.

The module consists of three npn silicon planar transistors mounted on a metallized ceramic substrate, together with matching and bias circuitry. The BGY96A and BGY96B produce an output power of 2.5 W into a 50 Ω load over the frequency band of 824-851 MHz and 890-915 MHz respectively. The output power can be controlled by means of a DC voltage (V_{S1}).

QUICK REFERENCE DATA

Mode of operation				CW	
Frequency range	BGY96A	f		824 to 851	MHz
	BGY96B	f		890 to 915	MHz
RF power output V_{S1} = 6 V; V_{S2} = V_{S3} = 9.6 V; P_D = 20 mW		P_L	min.	2.5	W
RF input drive power P_L = 2.5 W		P_D	⩽	20	mW
Output load impedance		Z_L	nom.	50	Ω

MECHANICAL DATA

Dimensions in mm

Lead reference

1 = RF input
2 = V_{S1}
3 = not connected
4 = V_{S2}
5 = V_{S3}
6 = not connected
7 = RF output
case = earth

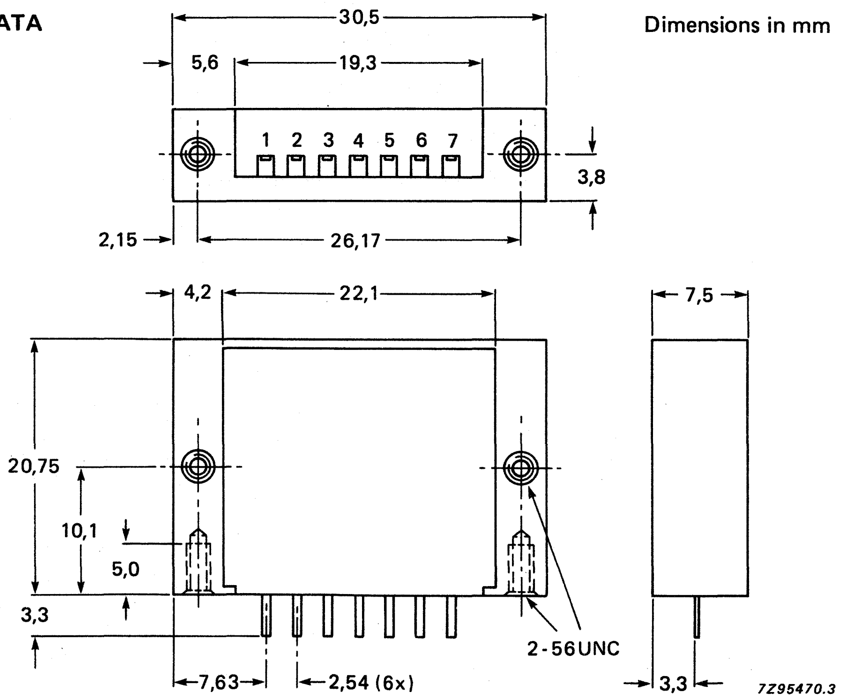


Fig. 1 SOT-200.

RATINGS

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

DC supply terminal voltages*	V_{S1}	max.	8.0 V
	V_{S2}, V_{S3}	max.	13 V
RF input terminal voltage*	V_{in}	max.	± 25 V
RF output terminal voltage*	V_{out}	max.	± 25 V
RF load power (see Fig. 2)	P_L	max.	3.5 W
RF drive power	P_D	max.	50 mW
Storage temperature range	T_{stg}		−40 to + 100 °C
Operating heatsink temperature range	T_h	max.	−30 to + 90 °C

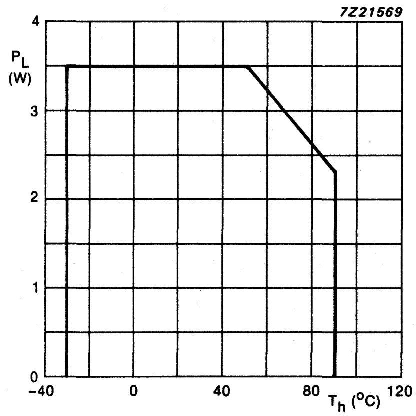


Fig. 2 Load power derating; VSWR = 1 : 1.

* With respect to case.

CHARACTERISTICS

$V_{S2} = V_{S3} = 9.6$ V; $P_D = 20$ mW; $T_h = 25$ °C; $R_S = R_L = 50\ \Omega$; unless otherwise specified

Frequency range	BGY96A	f		824 to 851 MHz
	BGY96B	f		890 to 915 MHz
RF output power				
$V_{S1} = 6$ V		P_L	min.	2.5 W
Efficiency				
$P_L = 2.5$ W		η	min.	35 %
Harmonic rejection				
$P_L = 2.5$ W		d2	min.	30 dB
		d3	min.	40 dB
Input VSWR				
with respect to 50 Ω		VSWR	max.	2 : 1
Noise power 25 kHz, bandwidth 45 MHz above f_o;				
$P_{out} = 2.5$ W by adjustment of $V_{control}$		Noise power	max.	−88 dBm

Stability

The module will produce no spurious signals > −60 dB below the carrier signal when operated with a load mismatch VSWR < 3 : 1 (all phases) and $V_{S1} = 0.5$ to 6.0 V, $V_{S2} = V_{S3} = 7.9$ to 12 V. $P_D = 10$ to 40 mW and $T_h \leqslant 90$ °C, provided maximum ratings are not exceeded. $V_{S1} \leqslant V_{S2}$ and V_{S3}.

Ruggedness

The module will withstand a load mismatch of 50 : 1 (all phases) for short periods when operated with $V_{S1} = < 8$ V, $V_{S2} = V_{S3} = \leqslant 13$ V, $P_D = \leqslant 50$ mW and $T_h \leqslant 90$ °C, provided maximum ratings are not exceeded.

Mounting

To ensure good thermal transfer the module should be mounted onto a heatsink with a flat surface with heat-conducting compound applied between module and the heatsink. The leads of the devices may be soldered directly into a circuit using a soldering iron with a maximum temperature of 245 °C for not more than 10 seconds at a distance of at least 1 mm from the plastic.

Power rating

In general, it is recommended that the output power from the module under nominal conditions should not exceed 3.0 W in order to provide an adequate safety margin under fault conditions.

Gain control

The module is designed to be operated at a nominal output power of 2.5 W. The module is adjusted to produced nominal output power by reducing the first stage supply voltage V_{S1}. The output power may be varied from 6 mW to 2.5 W by varrying V_{S1} from 0.5 V to 6 V.

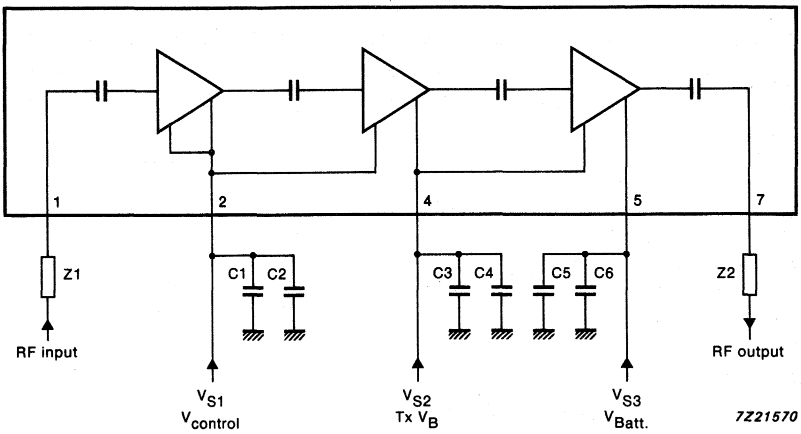
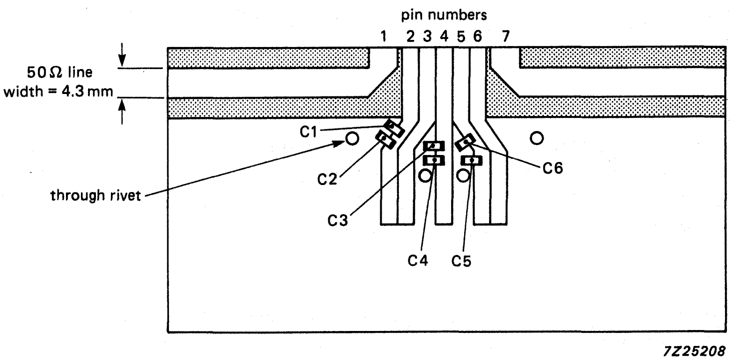


Fig.3 Internal diagram.

Z1 = Z2 = 50 Ω stripline
C1 = C3 = C6 = 0.01 μF ceramic chip capacitor
C2 = C4 = C5 = 1.0 μF tantalum capacitor



Teflon glass board 1/16"; ϵ_r = 2.55.

Fig.4 Printed-circuit board layout.

BGY96A

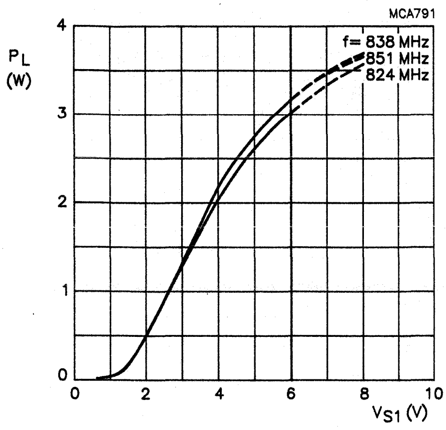


Fig.5 Load power as a function of supply voltage V_{S1}; P_D = 20 mW; $V_{S2} = V_{S3}$ = 9.6 V.

BGY96B

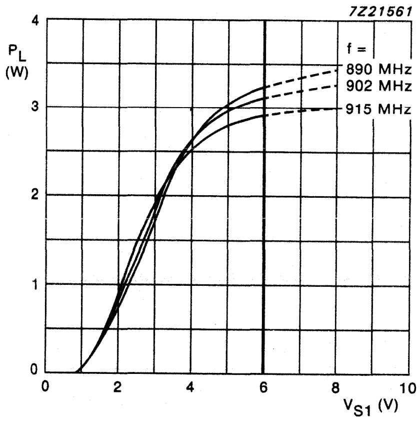


Fig.6 Load power as a function of supply voltage V_{S1}; P_D = 20 mW; $V_{S2} = V_{S3}$ = 9.6 V.

BGY96A

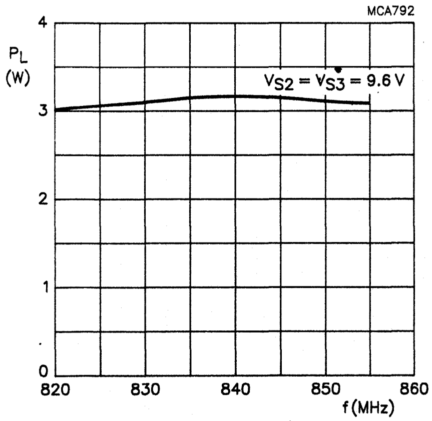


Fig.7 Load power as a function of frequency; P_D = 20 mW; V_{S1} = 6 V; $V_{S2} = V_{S3}$ = 9.6 V.

BGY96B

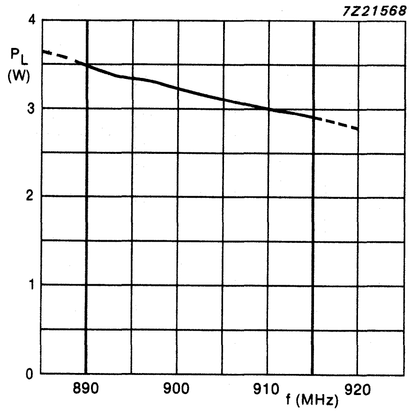


Fig.8 Load power as a function of frequency; P_D = 20 mW; V_{S1} = 6 V; $V_{S2} = V_{S3}$ = 9.6 V.

BGY96A

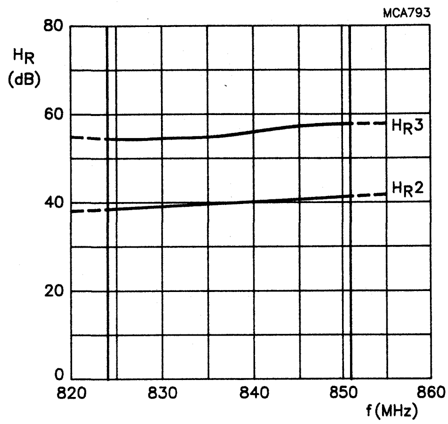


Fig.9 Second and third harmonic rejections as functions of frequency; P_D = 20 mW; V_{S1} = 6 V; V_{S2} = V_{S3} = 9.6 V.

BGY96B

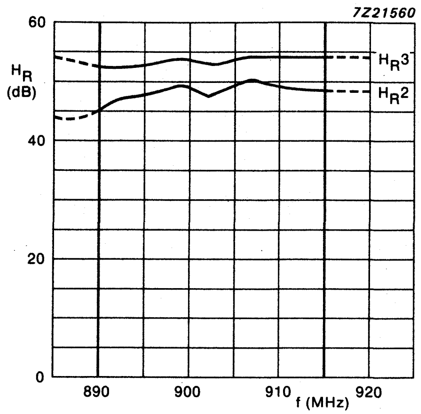


Fig.10 Second and third harmonic rejections as functions of frequency; P_D = 20 mW; V_{S1} = 6 V; V_{S2} = V_{S3} = 9.6 V.

BGY96A

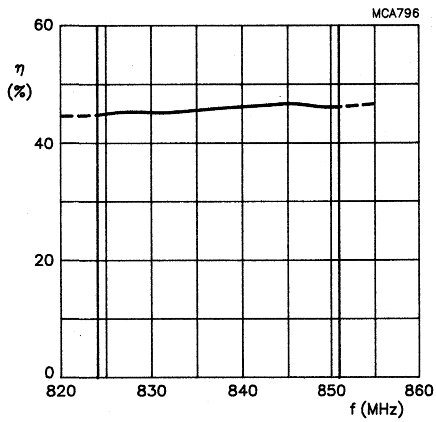


Fig.11 Efficiency as a function of frequency; P_D = 20 mW; P_L = 2.5 W V_{S2} = V_{S3} = 9.6 V.

BGY96B

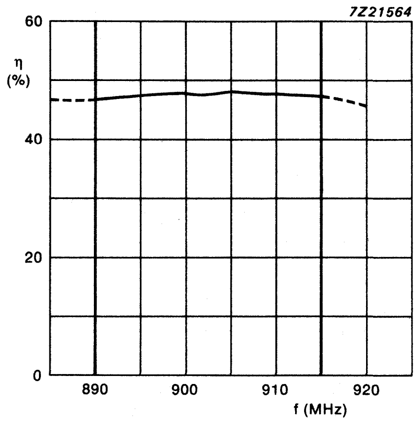


Fig.12 Efficiency as a function of frequency; P_D = 20 mW; P_L = 2.5 W; V_{S2} = V_{S3} = 9.6 V.

BGY96A

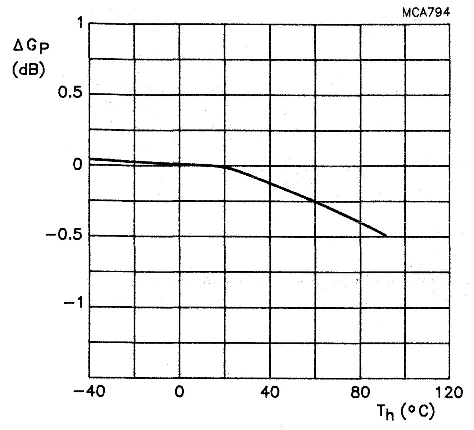


Fig.13 Change in power gain as a function of heatsink temperature; P_D = 20 mW; V_{S1} = 6 V; V_{S2} = V_{S3} = 9.6 V; f = 838 MHz.

BGY96B

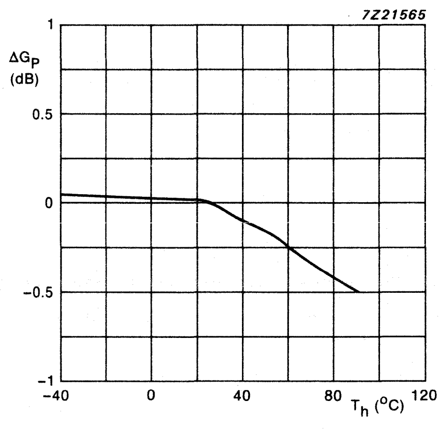


Fig.14 Change in power gain as a function of heatsink temperature; P_D = 20 mW; V_{S1} = 6 V; V_{S2} = V_{S3} = 9.6 V; f = 915 MHz.

BGY96A

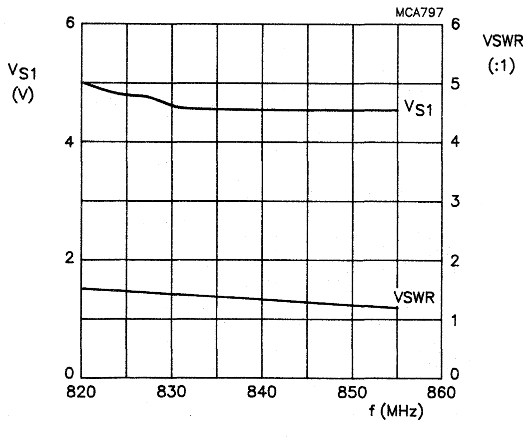


Fig.15 Supply voltage V_{S1} and VSWR as functions of frequency; P_D = 20 mW; P_L = 2.5 W; V_{S2} = V_{S3} = 9.6 V.

BGY96B

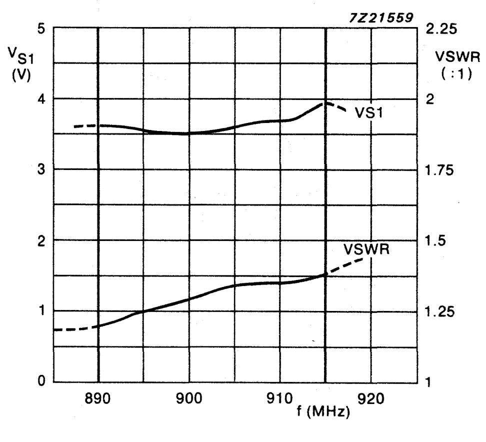


Fig.16 Supply voltage V_{S1} and VSWR as functions of frequency; P_D = 20 mW; P_L = 2.5 W; V_{S2} = V_{S3} = 9.6 V.

BGY96A

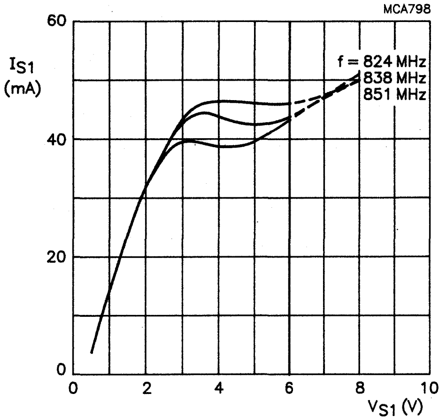


Fig.17 Supply current I_{S1} as a function of supply voltage V_{S1}; $P_D = 20$ mW; $V_{S2} = V_{S3} = 9.6$ V.

BGY96B

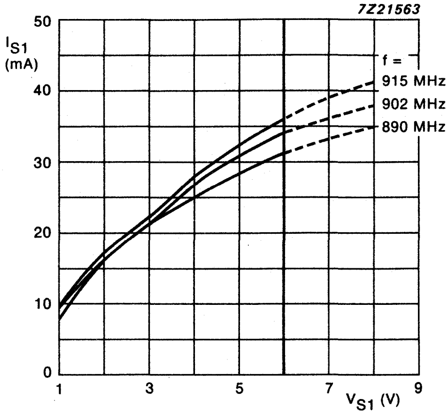


Fig.18 Supply current I_{S1} as a function of supply voltage V_{S1}; $P_D = 20$ mW; $V_{S2} = V_{S3} = 9.6$ V.

BGY96A

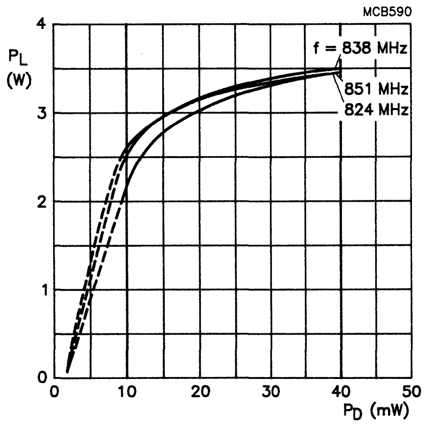


Fig.19 Load power as a function of drive power; $V_{S1} = 6$ V; $V_{S2} = V_{S3} = 9.6$ V.

BGY96B

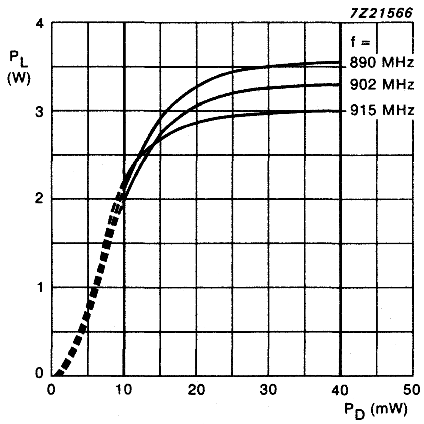


Fig.20 Load power as a function of drive power; $V_{S1} = 6$ V; $V_{S2} = V_{S3} = 9.6$ V.

UHF AMPLIFIER MODULE

The BGY110A is a four-stage UHF amplifier module designed primarily for hand-held transmitting equipment, operating from a nominal 6 V power supply.

The module consists of four npn silicon planar transistor chips mounted on a metallized ceramic substrate, together with matching and bias circuitry. The module produces an output power of 1.2 W into a 50 Ω load over the frequency band of 824 - 849 MHz. The output power can be controlled by means of a DC voltage (V_{S2}).

QUICK REFERENCE DATA

Mode of operation			CW	
Frequency range	f		824 to 849	MHz
Supply voltage	V_S		6.0	V
Load power	P_L	min.	1.2	W
Gain	G	min.	30.8	dB
Load impedance	Z_L	nom.	50	Ω

MECHANICAL DATA

Dimensions in mm

Lead reference

1 = RF input
2 = V_{S1}
3 = V_{S2}
4 = V_{S3}
5 = RF output
Flange = earth

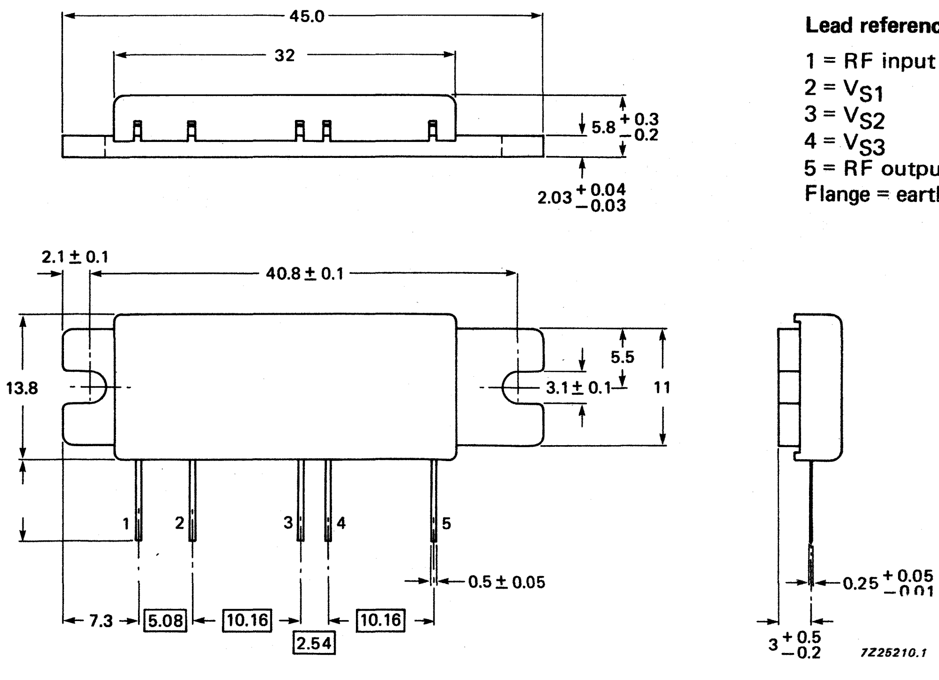


Fig. 1 SOT-246.

RATINGS

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

DC supply terminal voltages*	V_{S1}, V_{S2}, V_{S3}	max.	8.0 V
RF input terminal voltage*	$+V_{in}$	max.	25 V
RF output terminal voltage*	$+V_{out}$	max.	25 V
RF load power	P_L	max.	1.6 W
RF drive power	P_D	max.	2.0 mW
Storage temperature range	T_{stg}	−40 to + 100 °C	
Operating heatsink temperature	T_h	max.	90 °C

CHARACTERISTICS

$V_{S1} = V_{S2} = V_{S3} = 6$ V; $T_h = 25$ °C; f = 824 - 849 MHz; $R_S = R_L = 50\ \Omega$ unless otherwise specified

Load power			
$P_D = 1$ mW	P_L	min.	1.2 W
Efficiency			
$P_L = 1.2$ W	η	min.	40 %
Harmonic rejection			
$P_L = 1.2$ W	d2	min.	40 dB
	d3	min.	45 dB
Input VSWR			
$P_L = 1.2$ W	VSWR	max.	2 : 1
Gain control			
$P_D = 1$ mW	ΔG_P	min.	30 dB
Power switching			
$V_{S1} = 0$ V; $P_D = 1$ mW	P_L	max.	−20 dBm

Stability

All spurious signals will be at least 60 dB below the desired output signal level with a load mismatch VSWR $<$ 3 : 1 when operated with V_{S1}, $V_{S3} = 4$ to 8 V and $V_{S2} = 0$ to 8 V; $P_D = 0.5$ to 2 mW, providing maximum ratings are not exceeded.

Ruggedness

The module will withstand a load mismatch of 50 : 1 under the following conditions: $P_D = 1$ mW; V_{S1}, $V_{S3} = 8$ V; $P_L = 1.6$ W (matched).

UHF AMPLIFIER MODULE

The BGY110B is a four-stage UHF amplifier module designed primarily for hand-held transmitting equipment, operating from a nominal 6 V power supply.

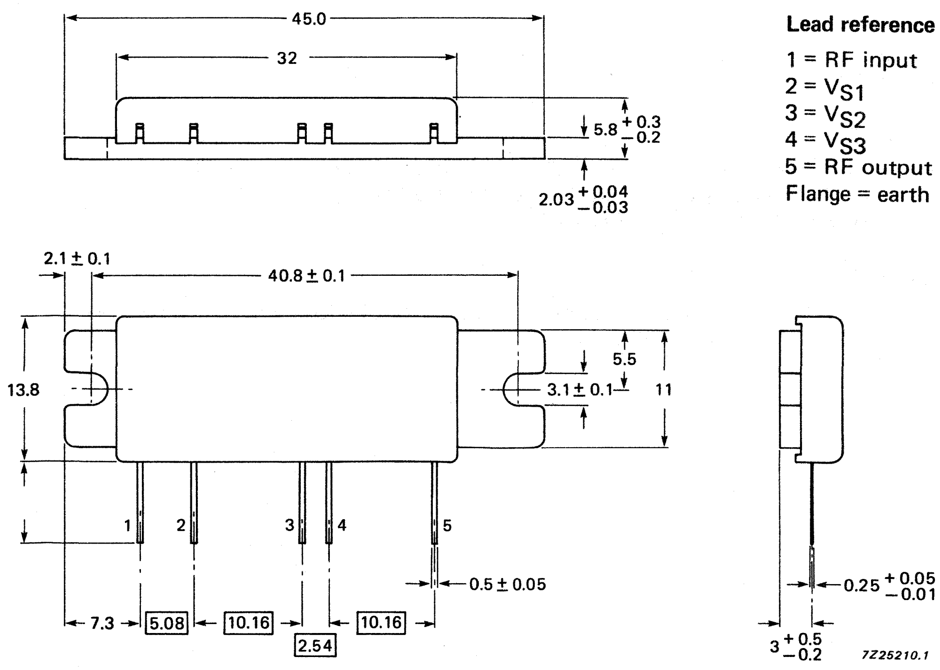
The module consists of four npn silicon planar transistor chips mounted on a metallized ceramic substrate, together with matching and bias circuitry. The module produces an output power of 1.2 W into a 50 Ω load over the frequency band of 872 - 905 MHz. The output power can be controlled by means of a DC voltage (V_{S2}).

QUICK REFERENCE DATA

Mode of operation			CW	
Frequency range	f		872 to 905	MHz
Supply voltage	V_S		6.0	V
Load power	P_L	min.	1.2	W
Gain	G	min.	30.8	dB
Load impedance	Z_L	nom.	50	Ω

MECHANICAL DATA

Dimensions in mm



Lead reference

1 = RF input
2 = V_{S1}
3 = V_{S2}
4 = V_{S3}
5 = RF output
Flange = earth

Fig. 1 SOT-246.

RATINGS

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

DC supply terminal voltages*	V_{S1}, V_{S2}, V_{S3}	max.	8.0 V
RF input terminal voltage*	$+V_{in}$	max.	25 V
RF output terminal voltage*	$+V_{out}$	max.	25 V
RF load power	P_L	max.	1.6 W
RF drive power	P_D	max.	2.0 mW
Storage temperature range	T_{stg}		−40 to + 100 °C
Operating heatsink temperature	T_h	max.	90 °C

CHARACTERISTICS

$V_{S1} = V_{S2} = V_{S3} = 6$ V; $T_h = 25$ °C; f = 872 - 905 MHz; $R_S = R_L = 50\ \Omega$ unless otherwise specified

Load power			
$P_D = 1$ mW	P_L	min.	1.2 W
Efficiency			
$P_L = 1.2$ W	η	min.	40 %
Harmonic rejection			
$P_L = 1.2$ W	d2	min.	40 dB
	d3	min.	45 dB
Input VSWR			
$P_L = 1.2$ W	VSWR	max.	2 : 1
Gain control			
$P_D = 1$ mW	ΔG_P	min.	30 dB
Power switching			
$V_{S1} = 0$ V; $P_D = 1$ mW	P_L	max.	−20 dBm

Stability

All spurious signals will be at least 60 dB below the desired output signal level with a load mismatch VSWR < 3 : 1 when operated with V_{S1}, $V_{S3} = 4$ to 8 V and $V_{S2} = 0$ to 8 V; $P_D = 0.5$ to 2 mW, providing maximum ratings are not exceeded.

Ruggedness

The module will withstand a load mismatch of 50 : 1 under the following conditions: $P_D = 1$ mW; V_{S1}, $V_{S3} = 8$ V; $P_L = 1.6$ W (matched).

Philips Components

Data sheet	
status	Product specification
date of issue	May 1991

BGY110D/BGY110E/BGY110F
UHF amplifier modules

DESCRIPTION

The BGY110 is a four-stage UHF amplifier module, primarily designed for hand-held transmitting equipment operating from a nominal 7.2 V power supply.

The module consists of four npn silicon planar transistor chips, mounted on a metallized ceramic substrate, together with matching and bias circuitry. The BGY110D, 110E and 110F produce an output power of 1.7 W into a 50 Ω load over the frequency band 824 to 849 MHz, 872 to 905 MHz and 890 to 915 MHz respectively. The output power can be controlled by means of a DC voltage (V_C).

MECHANICAL DATA

SOT246 - see Fig.1.

QUICK REFERENCE DATA

RF performance at T_{mb} = 25 °C.

TYPE NUMBER	MODE OF OPERATION	f (MHz)	V_S (V)	V_C (V)	P_L (W)	G_P (dB)	η (%)	Z_i/Z_L (Ω)
BGY110D	c.w.	824 - 849	7.2	4.5	1.7	> 32.3	> 39	50
BGY110E	c.w.	872 - 905	7.2	4.5	1.7	> 32.3	> 39	50
BGY110F	c.w.	890 - 915	7.2	4.5	1.7	> 32.3	> 39	50

MECHANICAL DATA

Dimensions in mm

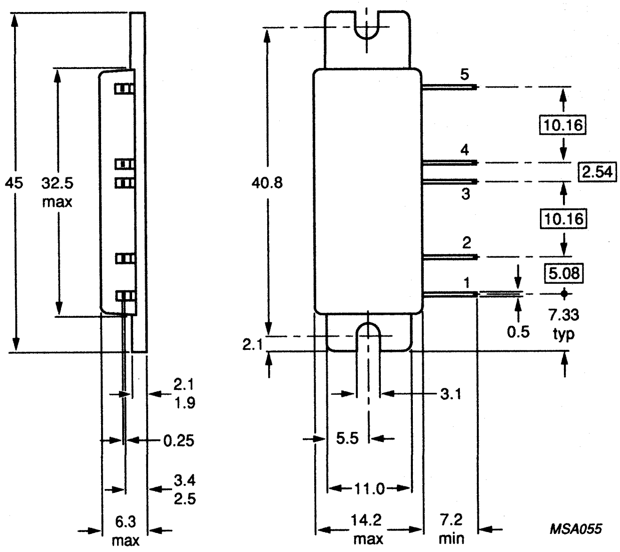


Fig.1 SOT246.

PINNING

PIN	DESCRIPTION
1	RF input/V_C
2	V_{S1}
3	V_{S2}
4	V_{S3}
5	RF output
flange	earth

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_{S1}; V_{S2}; V_{S3}	DC supply voltage	–	10	V
V_C	DC control voltage	–	4.5	V
$+V_o$	RF output terminal	–	25	V
P_L	load power	–	2.25	W
P_D	input drive power	–	3	mW
T_{stg}	storage temperature range	–40	100	°C
T_{mb}	operating mounting base temperature	–	90	°C

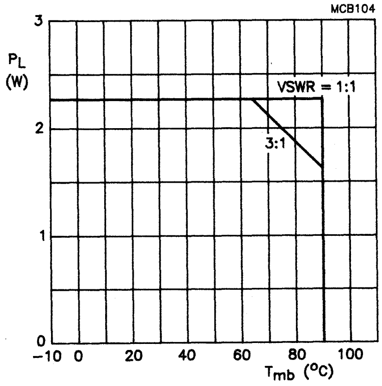


Fig.2 Load power derating; V_{S1}; V_{S2}; V_{S3} = max. 9 V.

CHARACTERISTICS

T_{mb} = 25 °C, Z_i = Z_L = 50 Ω, V_{S1} = V_{S2} = V_{S3} = 7.2 V, V_C = 4.5 V, unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
f	frequency range BGY110D		824	–	849	MHz
f	frequency range BGY110E		872	–	905	MHz
f	frequency range BGY110F		890	–	915	MHz
$I_{C2} + I_{C3}$	leakage current	V_{S1} = V_C = 0	-	–	200	μA
P_L	load power	P_D = 1 mW	1.7	–	–	W
η	efficiency	P_L = 1.7 W	39	–	–	%
H_2	second harmonic rejection	P_L = 1.7 W	40	–	–	dB
H_3	third harmonic rejection	P_L = 1.7 W	45	–	–	dB
	input VSWR	P_L = 1.7 W	-	–	2:1	
ΔG_p	gain control	V_C = 0 - 4.5 V P_D = 1.0 mW	30	–	–	dB
P_L	output power switching	V_{S1} = V_C = 0 P_D = 1 mW	-	–	–20	dBm
	noise power	30 kHz bandwidth P_L = 1.7 W 45 MHz above f_O	-	–84	–80	dBm

STABILITY

All non-harmonically related outputs shall be at least 60 dB down when the module is operated with a load mismatch up to VSWR = 6:1 under the conditions $V_{S1\text{-}2\text{-}3}$ = 6 to 9 V, V_C = 0 to 4.5 V, P_D = 0.5 to 2 mW and P_L < 2 W.

Ruggedness

The BGY110 is capable of withstanding a load mismatch corresponding to VSWR = 10:1 through all phases, under the following conditions: P_D = 1 mW, $V_{S1\text{-}2\text{-}3}$ = 9 V and P_L = 1.8 W.

UHF amplifier modules BGY110D/BGY110E/BGY110F

APPLICATION INFORMATION

Conditions: T_{mb} = 25 °C, P_D = 1 mW, P_L = 1.7 W,
V_{S1} = V_{S2} = V_{S3} = 7.2 V, unless otherwise specified; typical values.

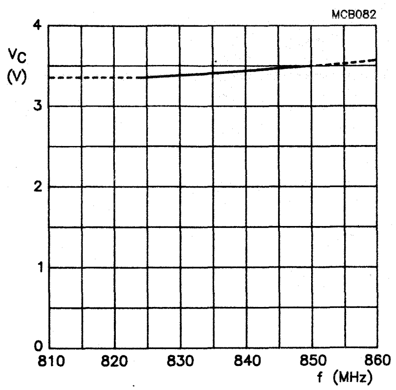


Fig.3 Control voltage as a function of frequency, BGY110D.

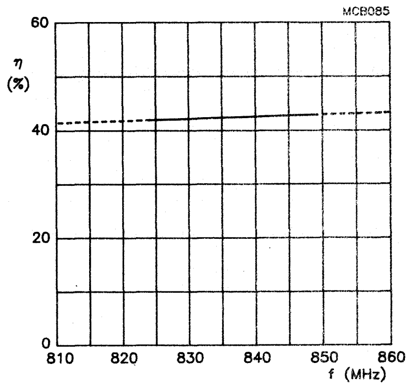


Fig.4 Efficiency as a function of frequency, BGY110D.

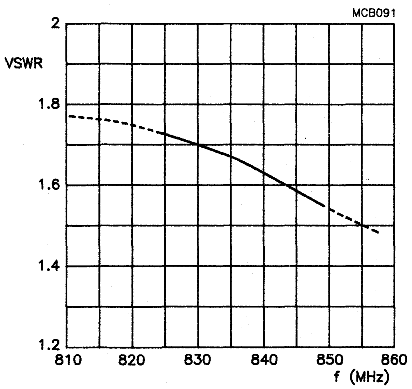


Fig.5 VSWR input as a function of frequency, BGY110D.

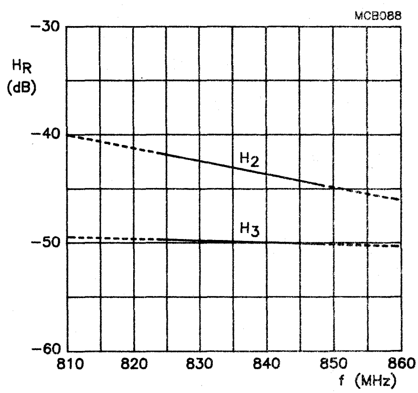


Fig.6 Harmonics as a function of frequency, BGY110D.

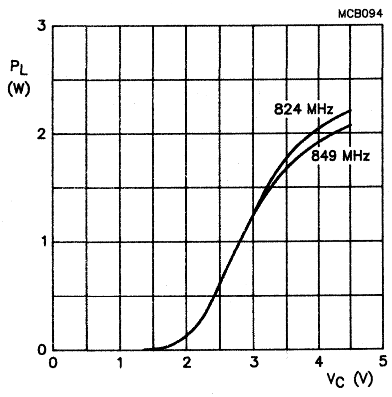


Fig.7 Load power as a function of control voltage, BGY110D.

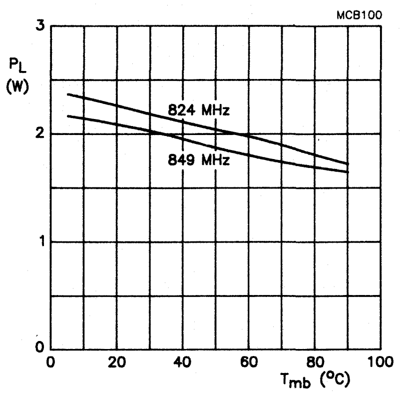


Fig.8 Load power as a function of temperature, V_C = 4.5 V; BGY110D.

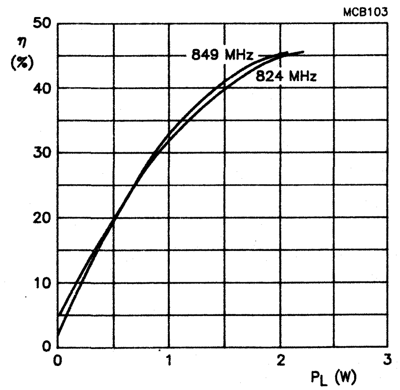


Fig.9 Efficiency as a function of load power, BGY110D.

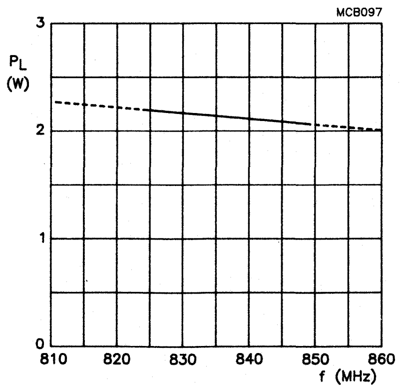


Fig.10 Load power as a function of frequency, V_C = 4.5 V; BGY110D.

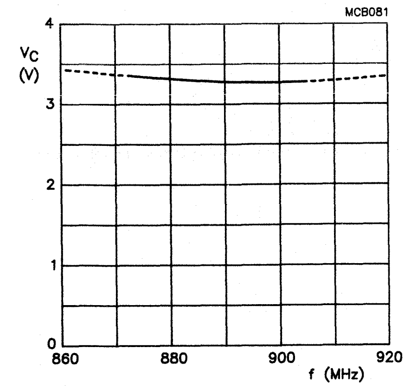


Fig.11 Control voltage as a function of frequency, BGY110E.

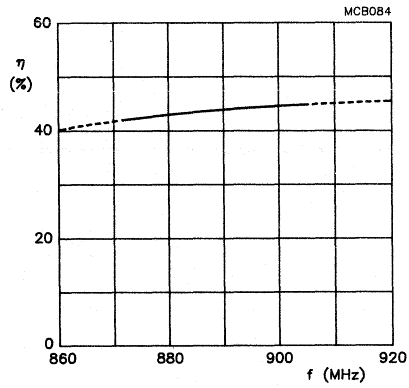


Fig.12 Efficiency as a function of frequency, BGY110E.

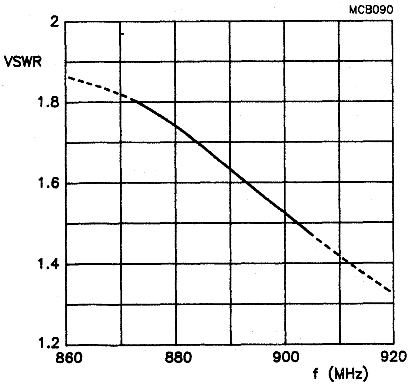


Fig.13 VSWR input as a function of frequency, BGY110E.

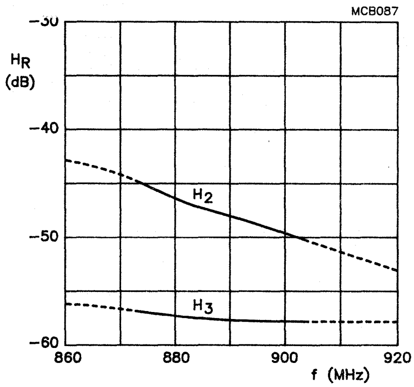


Fig.14 Harmonics as a function of frequency, BGY110E.

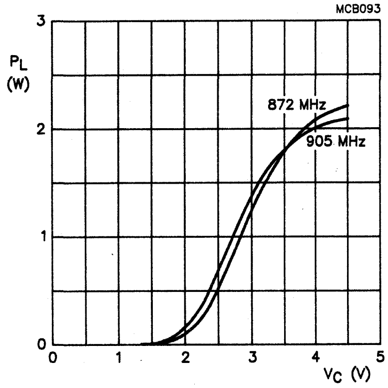


Fig.15 Load power as a function of control voltage, BGY110E.

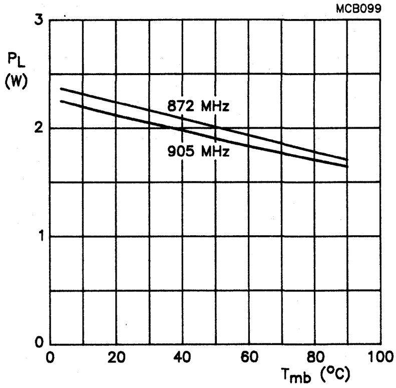


Fig.16 Load power as a function of temperature, V_C = 4.5 V; BGY110E.

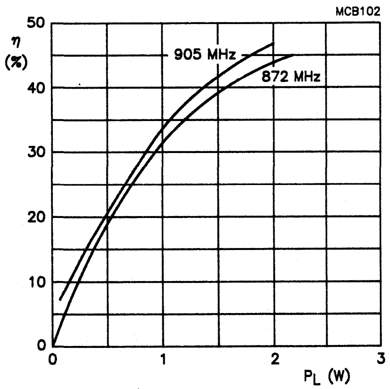


Fig.17 Efficiency as a function of load power, BGY110E.

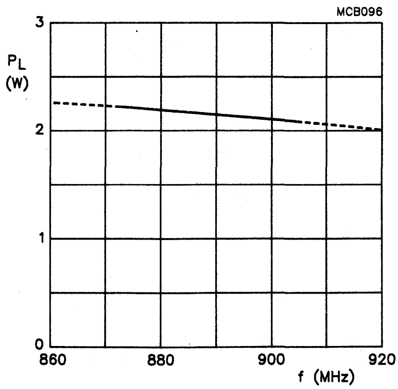


Fig.18 Load power as a function of frequency, V_C = 4.5 V; BGY110E.

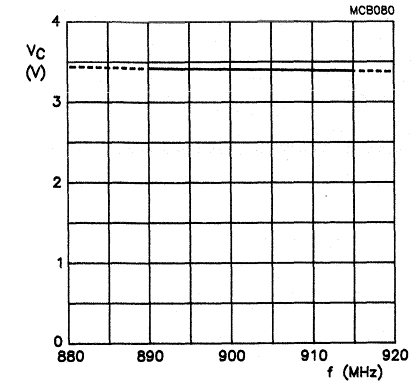


Fig.19 Control voltage as a function of frequency, BGY110F.

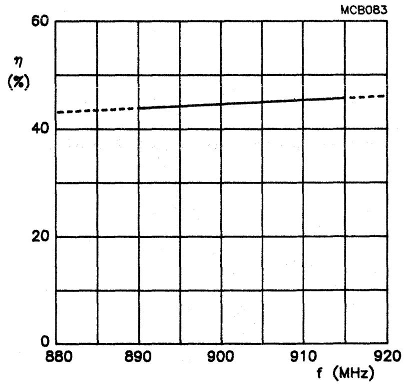


Fig.20 Efficiency as a function of frequency, BGY110F.

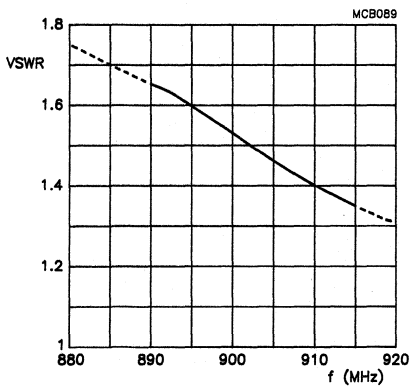


Fig.21 VSWR input as a function of frequency, BGY110F.

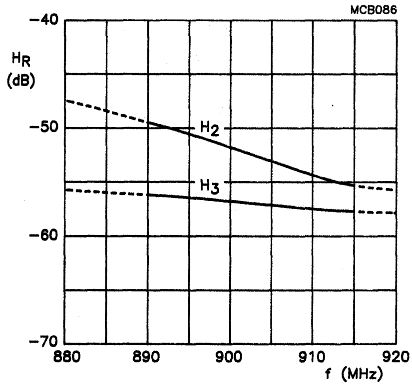


Fig.22 Harmonics as a function of frequency, BGY110F.

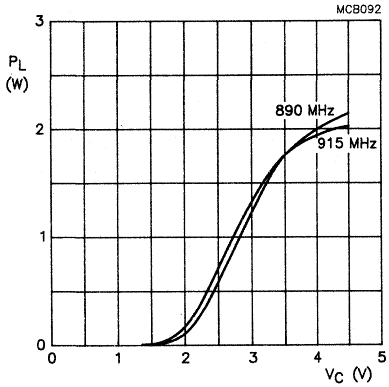


Fig.23 Load power as a function of control voltage, BGY110F.

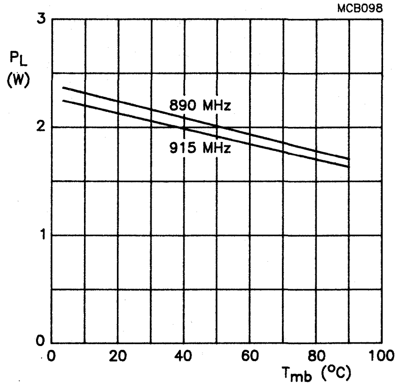


Fig.24 Load power as a function of temperature, V_C = 4.5 V; BGY110F.

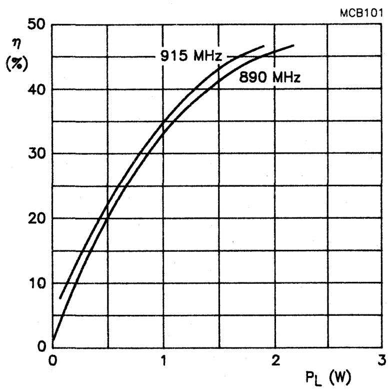


Fig.25 Efficiency as a function of load power, BGY110F.

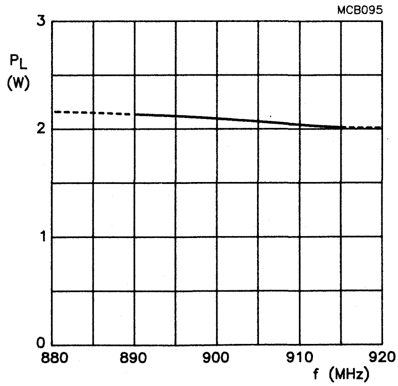


Fig.26 Load power as a function of frequency, V_C = 4.5 V; BGY110F.

List of components (Fig.27)

DESIGNATION	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C4, C7	multilayer chip capacitor	100 nF		
C2, C5, C8	tantalum capacitor	2.2 μF		
C3, C6, C9	multilayer chip capacitor	33 pF		
C10, C11	multilayer chip capacitor	1 nF		
C12	tantalum capacitor	1 μF		
L1, L2, L3	RF choke, 1 turn copper wire on grade 3B core	2.2 μH	0.4 mm	4330 030 32221
L4	Ferroxcube coil	5 μH		3122 108 20153
Z1, Z2	stripline note 1	50 Ω		

Notes

1. Z1 and Z2 striplines are on a double copper-clad printed-circuit board with PTFE (ε_r = 2.2), thickness 1/16 inch.

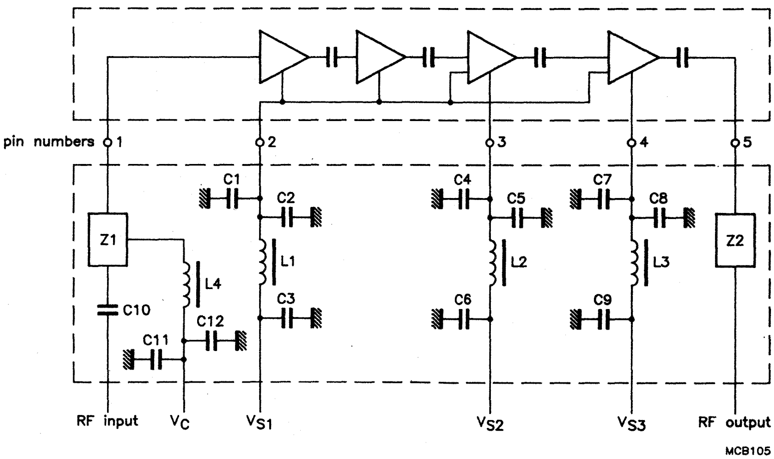


Fig.27 Test circuit BGY110D, BGY110E, BGY110F.

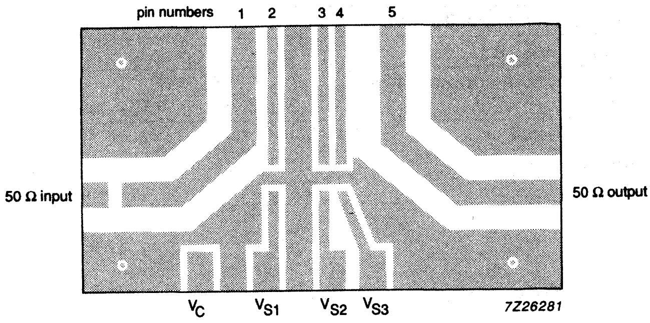


Fig.28 Printed-circuit board layout.

Philips Components

Data sheet	
status	Preliminary specification
date of issue	May 1991

BGY112A/112B/112C
VHF amplifier modules

DESCRIPTION

A range of RF power amplifier modules designed for use in portable communications equipment with nominal 7.5 V electrical battery supplies.

The devices are four stage RF amplifiers, consisting of npn bipolar transistors mounted on a single ceramic thick film metallized substrate, together with lumped elements that make up the matching and biasing circuits.

The module will produce a minimum output of 7 W into a 50 Ω load with a minimum power gain of 38.5 dB.

PINNING - SOT288C

PIN	DESCRIPTION
1	RF input
2	V_{S1}
3	$V_{control}$
4	V_{S2}
5	V_{S3}
6	RF output
flange	ground

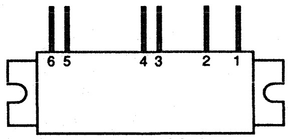


Fig.1 Simplified outline.

QUICK REFERENCE DATA

Mode of operation: continuous wave.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
f	frequency range					
	BGY112A		68	–	88	MHz
	BGY112B		132	–	156	MHz
	BGY112C		146	–	174	MHz
P_L	RF output power	P_D = 1 mW	7	–	–	W
G_p	RF power gain	P_L = 7 W	38.5	–	–	dB
η	efficiency	P_L = 7 W	40	–	–	%
V_S	DC supply voltage		–	7.5	–	V
Z_i	input impedance		–	50	–	Ω
Z_L	output load impedance		–	50	–	Ω

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_S	DC supply voltage	–	9	V
$\pm V_i$	RF input terminal voltage	–	25	V
$\pm V_o$	RF output terminal voltage	–	25	V
P_D	RF input power	–	2	mW
P_L	RF output power	–	9	W
T_{stg}	storage temperature range	–40	100	°C
T_h	heatsink operating temperature	–	90	°C

CHARACTERISTICS

T_h = 25 °C; V_S = 7.5 V; $R_S = R_L$ = 50 Ω; frequency ranges as stated in 'Quick Reference Data'.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{Q3}	quiescent current	$V_{S1} = V_{S2} = V_{control} = 0$ $V_{S3} = 7.5$ V	–	–	0.1	mA
P_D	RF input power	P_L = 7 W	–	–	1	mW
G_p	RF power gain	P_L = 7 W	38.5	–	–	dB
η	efficiency	P_L = 7 W	40	45	–	%
H_{R2}, H_{R3}	harmonic output	P_L = 7 W	–	–	–40	dBc
	input VSWR with respect to 50 Ω	P_L = 7 W	–	–	2:1	

STABILITY

The module is stable when operated into a load of 6:1 at all phases, providing the operating conditions are as follows:

P_D = 0 to 2 mW; P_L < 9 W; $V_{S1} = V_{S2} = V_{S3}$ = 5 to 9 V; $V_{control}$ adjusted for required P_L; source impedance VSWR max 3:1.

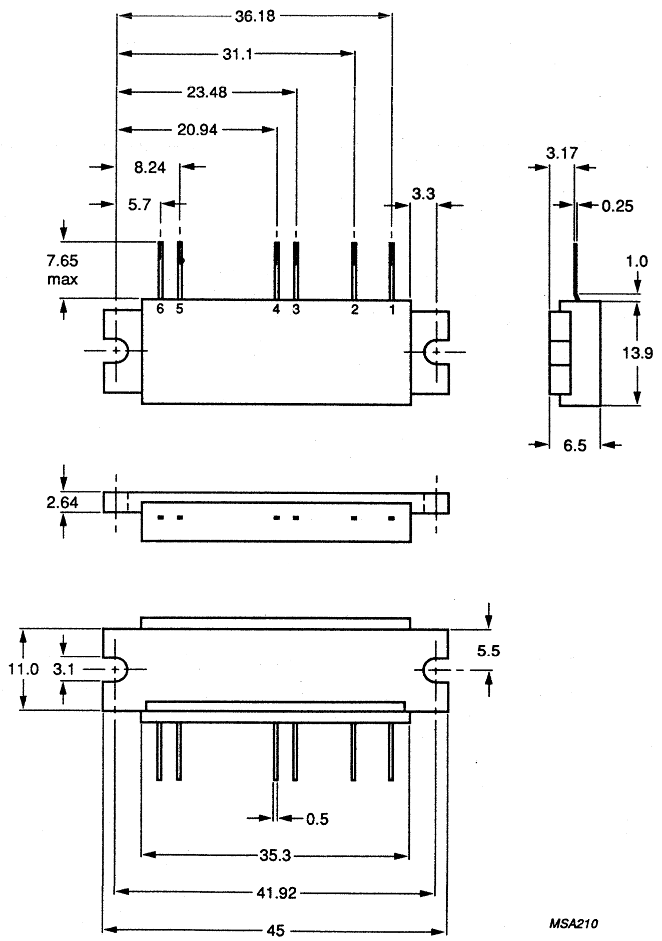
OUTPUT POWER CONTROL

The module output should be limited to 7 W. The preferred method of output power control is to fix $V_{S1} = V_{S2} = V_{S3}$ = 7.5 V, P_D at 1 mW and vary $V_{control}$.

RUGGEDNESS

The module will withstand a load of 50:1 for short period overload conditions, with P_D, V_{S1} and V_{S2} at maximum values.

PACKAGE OUTLINE



Dimensions in mm.

Fig.2 SOT288C.

Philips Components

Data sheet	
status	Preliminary specification
date of issue	May 1991

BGY113A/113B
UHF amplifier modules

DESCRIPTION

A range of RF power amplifier modules designed for use in portable communications equipment with nominal 7.5 V electrical battery supplies.

The devices are four stage RF amplifiers, consisting of npn bipolar transistors mounted on a single ceramic thick film metallized substrate, together with lumped elements that make up the matching and biasing circuits.

The module will produce a minimum output of 7 W into a 50 Ω load with a minimum power gain of 38.5 dB.

PINNING - SOT288D

PIN	DESCRIPTION
1	RF input
2	V_{S1}
3	$V_{control}$
4	V_{S2}
5	V_{S3}
6	V_{S4}
7	RF output
flange	ground

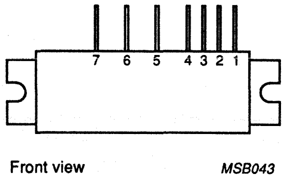


Fig.1 Simplified outline.

QUICK REFERENCE DATA

Mode of operation: continuous wave.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
f	frequency range					
	BGY113A		400	–	440	MHz
	BGY113B		430	–	470	MHz
P_L	RF output power	P_D = 1 mW	7	–	–	W
G_p	RF power gain	P_L = 7 W	38.5	–	–	dB
η	efficiency	P_L = 7 W	40	–	–	%
V_S	DC supply voltage		–	7.5	–	V
Z_i	input impedance		–	50	–	Ω
Z_L	output load impedance		–	50	–	Ω

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_S	DC supply voltage	–	9	V
$\pm V_i$	RF input terminal voltage	–	25	V
$\pm V_o$	RF output terminal voltage	–	25	V
P_D	RF input power	–	2	mW
P_L	RF output power	–	9	W
T_{stg}	storage temperature range	–40	100	°C
T_h	heatsink operating temperature	–	90	°C

CHARACTERISTICS

T_h = 25 °C; V_S = 7.5 V; $R_S = R_L$ = 50 Ω; frequency ranges as stated in 'Quick Reference Data'.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{Q3}, I_{Q4}	quiescent current	$V_{S1} = V_{S2} = V_{control} = 0$ $V_{S3} = V_{S4}$ = 7.5 V	–	–	0.1	mA
P_D	RF output power	P_D = 1 mW	7	–	–	W
G_p	RF power gain	P_L = 7 W	38.5	–	–	dB
η	efficiency	P_L = 7 W	40	45	–	%
H_{R2}, H_{R3}	harmonic output	P_L = 7 W	–	–	–40	dBc
	input VSWR with respect to 50 Ω	P_L = 7 W	–	–	2:1	

STABILITY

The module is stable when operated into a load of 6:1 at all phases, providing the operating conditions are as follows:

P_D = 0 to 2 mW; P_L < 9 W;
$V_{S1} = V_{S2} = V_{S3} = V_{S4}$ = 5 to 9 V;
$V_{control}$ adjusted for required P_L;
source impedance VSWR max 3:1.

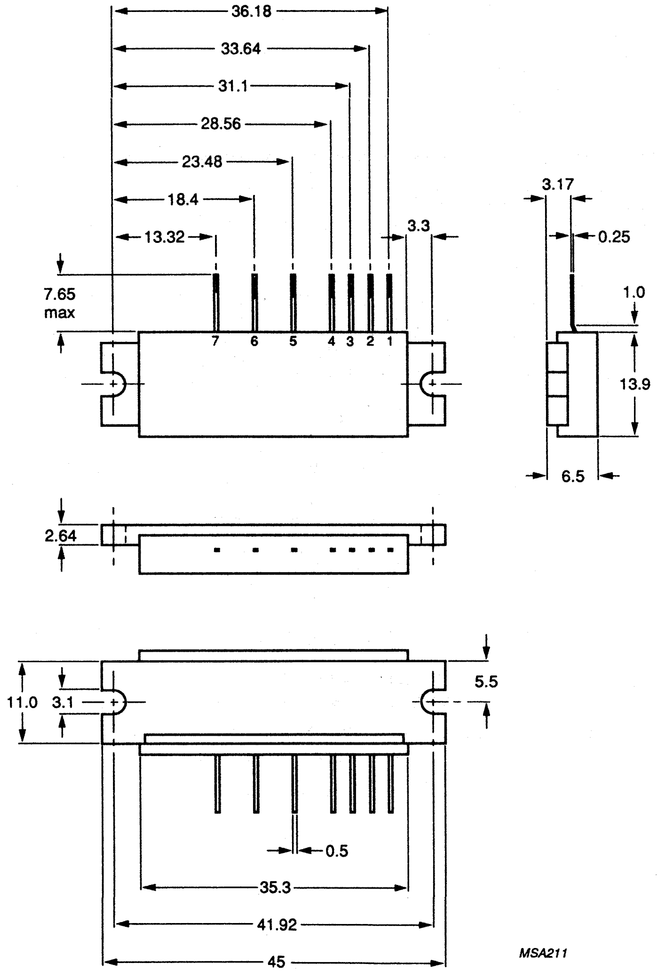
OUTPUT POWER CONTROL

The module output should be limited to 7 W. The preferred method of output power control is to fix $V_{S1} = V_{S2} = V_{S3} = V_{S4}$ = 7.5 V, P_D at 1 mW and vary $V_{control}$.

RUGGEDNESS

The module will withstand a load of 50:1 for short period overload conditions, with P_D, V_{S1} and V_{S2} at maximum values.

PACKAGE OUTLINE



Dimensions in mm.

Fig.2 SOT288D.

DESCRIPTION

The BGY145A is a RF amplifier module, designed for use in transmitters of mobile communications equipment powered by vehicles with 12.5 V battery supplies.

The module is a two-stage transistor amplifier and consists of two RF npn transistors mounted on a ceramic substrate, together with surface mounted components that make up the matching and bias circuits.

The module will provide 29 W RF power into a 50 Ω load, when operated at nominal conditions within the frequency range of 68 to 88 MHz.

PINNING - SOT183A

PIN	DESCRIPTION
1	output
2	V_{S2}
3	V_{S1}
4	input
flange	ground

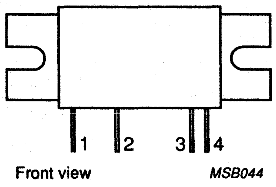


Fig.1 Simplified outline.

QUICK REFERENCE DATA

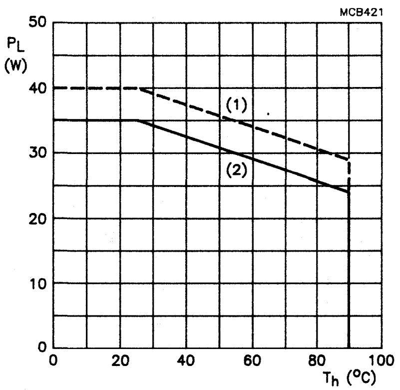
Mode of operation: continuous wave.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
f	frequency range		68	–	88	MHz
P_D	RF output power	P_D = 150 mW	29	–	–	W
G_p	RF power gain	P_L = 29 W	22.9	–	–	dB
η	efficiency	P_L = 29 W	37	–	–	%
V_{S1}, V_{S2}	DC supply voltage		–	12.5	–	V
Z_i	input impedance		–	50	–	Ω
Z_L	output load impedance		–	50	–	Ω

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_{S1}, V_{S2}	DC supply voltage	–	15	V
$\pm V_i$	RF input terminal voltage	–	25	V
$\pm V_o$	RF output terminal voltage	–	25	V
P_D	RF input power	–	300	mW
P_L	RF output power (see Fig.2)	–	40	W
T_{stg}	storage temperature range	–30	100	°C
T_h	heatsink operating temperature	–	90	°C



(1) Matched.

(2) 3:1 mismatch.

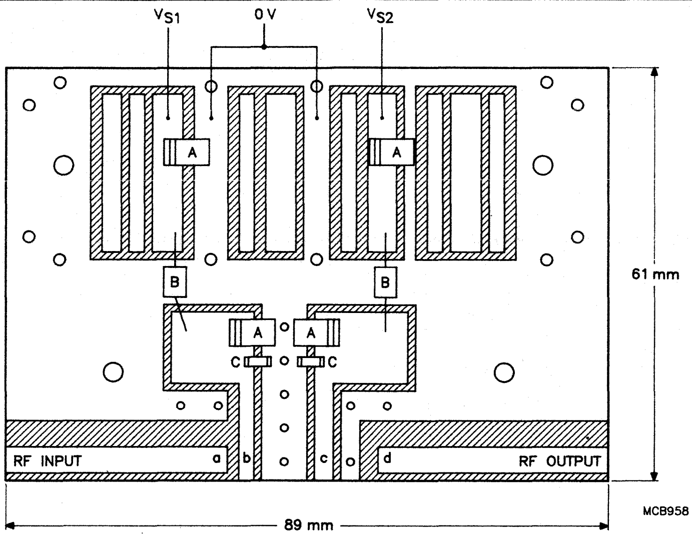
Fig.2 Load power derating.

CHARACTERISTICS

T_h = 25 °C; V_{S1} = V_{S2} = 12.5 V; R_S = R_L = 50 Ω; frequency range = 68 to 88 MHz.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{Q1}	quiescent current	P_D = 0	–	10	25	mA
I_{Q2}	quiescent current	P_D = 0	–	–	35	mA
P_L	RF output power	P_D = 150 mW	29	–	–	W
G_p	RF power gain	P_L = 29 W	22.9	–	–	dB
η	efficiency	P_L = 29 W	37	–	–	%
H_{R2}	2nd harmonic output	P_L = 29 W	–	–	–30	dBc
	input VSWR with respect to 50 Ω	P_L = 29 W	–	–	2:1	

APPLICATION INFORMATION



Epoxy fibre-glass board, 1/16 inch thick, $\varepsilon_r = 4.5$.

A: 10 µF, 16 V, tantalum chip capacitor.

B: 2 turns FX1115 Ferroxcube bead.

C: 0.1 µF, 60 V, ceramic multilayer chip capacitor.

Track widths 'a' and 'd' (50 Ω) = 4 mm.

Track width 'b' = 2.5 mm.

Track width 'c' = 3 mm.

Circles indicate the positions of through rivets.

Fig.3 Test jig.

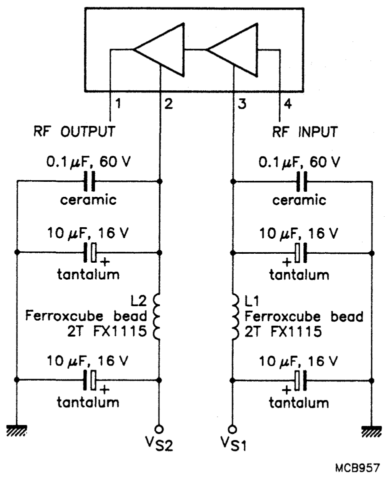


Fig.4 Decoupling arrangement.

STABILITY

The module is stable when operated into a load of 3:1 at all phases, under the following conditions, providing maximum ratings are not exceeded:

P_D 30 to 300 mW; $P_L \leq 40$ W;
V_{S1} = 6 to 15 V; V_{S2} = 10 to 15 V and $V_{S1} < V_{S2}$.

RUGGEDNESS

The output power of the module into a 50 Ω load will be unchanged after one minute of operation into a load mismatch of 20:1 (any phase), providing maximum ratings are not exceeded.

V_{S1}, $V_{S2} \leq 15$ V; $T_h \leq 90$ °C;
$P_L \leq 40$ W; $P_D < 300$ mW.

RF POWER CONTROL

The module is not designed to be operated over a wide range of output levels. The aim of the output power control is to set the nominal output level. The preferred method of output power control is by varying the drive power between 30 and 200 mW. Another option is to vary V_{S1} between 6 and 12.5 V.

CAUTIONS

The main earth return path for this module is via the flange. Therefore, it is important that the heatsink is well earthed and that the return paths are kept as short as possible. Failure to do this may result in loss of output power or oscillation, which will have a detrimental effect upon the life of the module.

The RF output connection should be made to correctly designed 50 Ω terminals. Failure to do so will result in a mismatch being presented to the module, with a resultant reduction in module life.

The leads of the devices may be soldered directly into a circuit using a soldering iron with a maximum temperature of 245 °C, for not more than 10 seconds at a distance of at least 1 mm from the plastic.

Under no circumstances must the maximum specified operating or storage temperatures be exceeded, even for short periods.

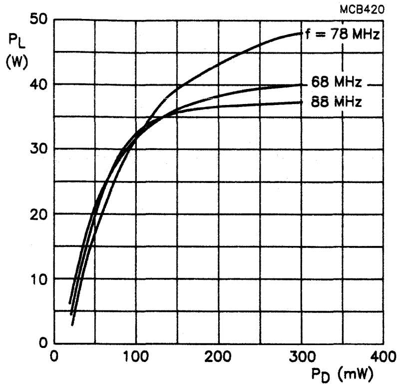


Fig.5 Load power as a function of drive power; $V_{S1} = V_{S2} = 12.5$ V; typical values.

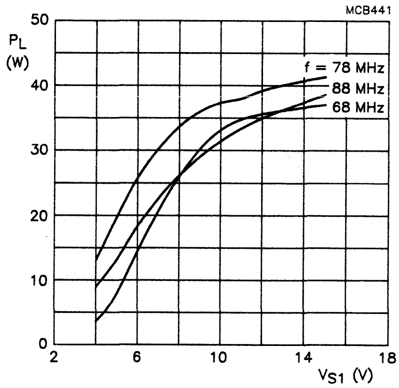


Fig.6 Load power as a function of supply voltage V_{S1}; $P_D = 150$ mW; typical values.

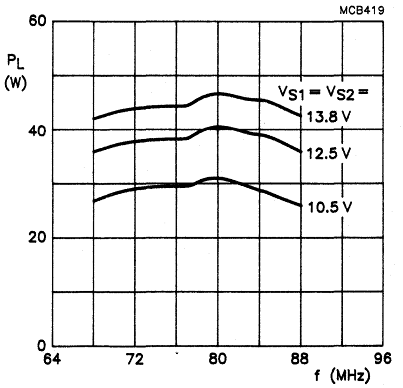


Fig.7 Load power as a function of frequency; $P_D = 150$ mW; typical values.

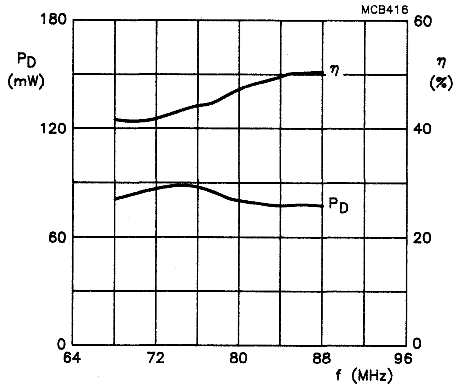


Fig.8 Efficiency and drive power as functions of frequency; $P_L = 29$ W; $V_{S1} = V_{S2} = 12.5$ V; typical values.

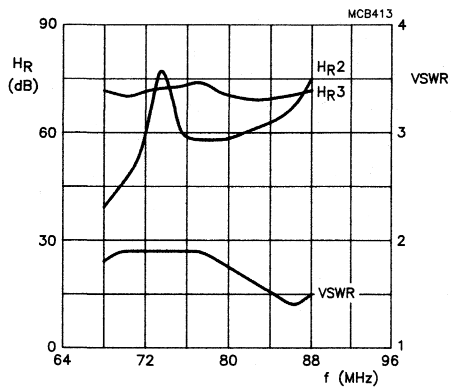
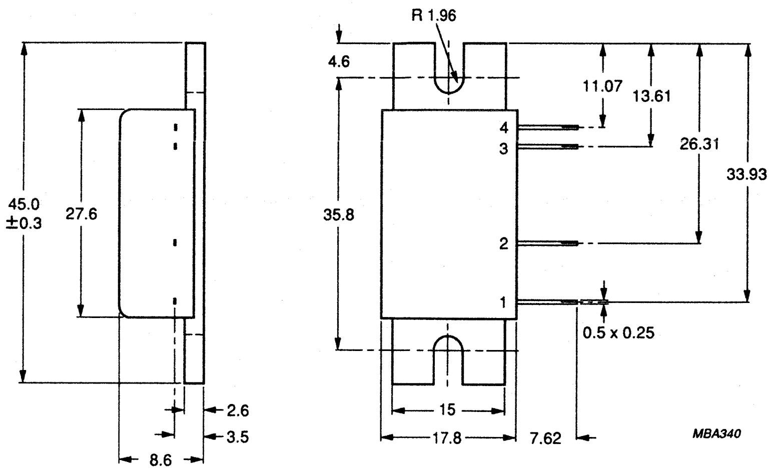


Fig.9 Second and third harmonic rejection as a function of frequency; P_L = 29 W; V_{S1} = V_{S2} = 12.5 V; typical values.

PACKAGE OUTLINE



Dimensions in mm.

Fig.10 SOT183A.

VHF amplifier module BGY145B

DESCRIPTION

The BGY145B is a RF amplifier module, designed for use in transmitters of mobile communications equipment powered by vehicles with 12.5 V battery supplies.

The module is a two-stage transistor amplifier and consists of two RF npn transistors mounted on a ceramic substrate, together with surface mounted components that make up the matching and bias circuits.

The module will provide 28 W RF power into a 50 Ω load, when operated at nominal conditions within the frequency range of 146 to 174 MHz.

PINNING - SOT183A

PIN	DESCRIPTION
1	output
2	V_{S2}
3	V_{S1}
4	input
flange	ground

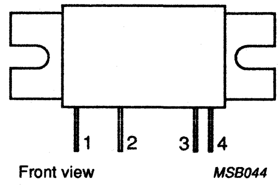


Fig.1 Simplified outline.

QUICK REFERENCE DATA

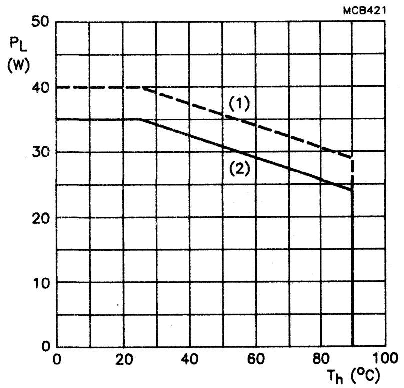
Mode of operation: continuous wave.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
f	frequency range		146	–	174	MHz
P_D	RF output power	P_D = 300 mW	28	–	–	W
G_p	RF power gain	P_L = 28 W	19.7	–	–	dB
η	efficiency	P_L = 28 W	40	–	–	%
V_{S1}, V_{S2}	DC supply voltage		–	12.5	–	V
Z_i	input impedance		–	50	–	Ω
Z_L	output load impedance		–	50	–	Ω

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_{S1}, V_{S2}	DC supply voltage	–	15.5	V
$\pm V_i$	RF input terminal voltage	–	25	V
$\pm V_o$	RF output terminal voltage	–	25	V
P_D	RF input power	–	450	mW
P_L	RF output power (see Fig.2)	–	40	W
T_{stg}	storage temperature range	–30	100	°C
T_h	heatsink operating temperature	–	90	°C



(1) Matched.

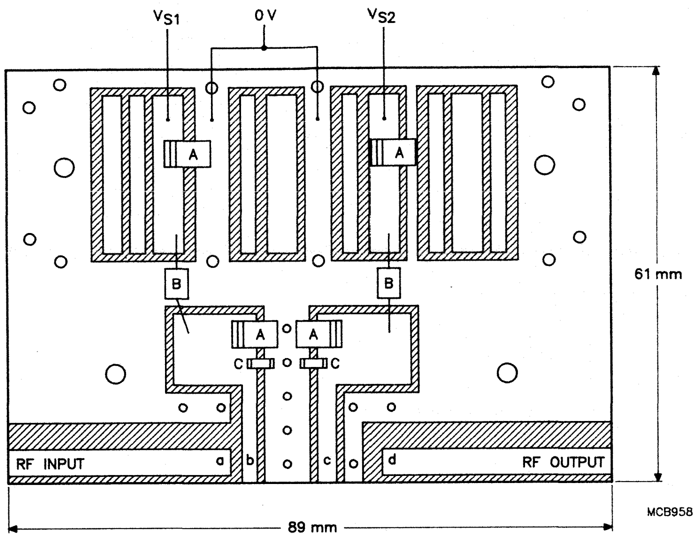
(2) 3:1 mismatch.

Fig.2 Load power derating.

CHARACTERISTICS

T_h = 25 °C; V_{S1} = V_{S2} = 12.5 V; R_S = R_L = 50 Ω; frequency range = 146 to 174 MHz.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{Q1}	quiescent current	P_D = 0	–	10	25	mA
I_{Q2}	quiescent current	P_D = 0	–	–	35	mA
P_L	RF output power	P_D = 300 mW	28	–	–	W
G_p	RF power gain	P_L = 28 W	19.7	–	–	dB
η	efficiency	P_L = 28 W	40	–	–	%
H_{R2}, H_{R3}	2nd & 3rd harmonic outputs	P_L = 28 W	–	–	–30	dBc
	input VSWR with respect to 50 Ω	P_L = 28 W	–	–	2:1	



Epoxy fibre-glass board, 1/16 inch thick, ε_r = 4.5.

A: 10 µF, 16 V, tantalum chip capacitor.

B: 2 turns FX1115 Ferroxcube bead.

C: 0.1 µF, 60 V, ceramic multilayer chip capacitor.

Track widths 'a' and 'd' (50 Ω) = 4 mm.

Track width 'b' = 2.5 mm.

Track width 'c' = 3 mm.

Circles indicate the positions of through rivets.

Fig.3 Test jig.

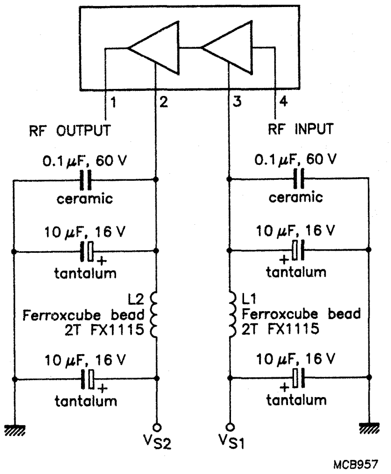


Fig.4 Decoupling arrangement.

STABILITY

The module is stable when operated into a load of 3:1 at all phases, providing the operating conditions are as follows:

P_D 30 to 450 mW; $P_L \geq 3$ to ≤ 40 W;
V_{S1} = 3 to 15.5 V;
V_{S2} = 10.5 to 15.5 V and $V_{S1} < V_{S2}$.

RUGGEDNESS

The output power of the module into a 50 Ω load will be unchanged after one minute of operation into a load mismatch of 20:1 (any phase), providing maximum ratings are not exceeded.

V_{S1}, $V_{S2} \leq 15.5$ V; $T_h \leq 90$ °C;
$P_L \leq 40$ W; $P_D < 450$ mW.

RF POWER CONTROL

The module is not designed to be operated at constant output power. However, the module may be operated over a range of output power levels by varying the input drive power level, P_{IN}. For stable operation, care must be taken to maintain conditions within the specified range:

P_D 30 to 450 mW; V_{S1} = 3 V to V_{S2};
P_L = 3 to 28 W.

CAUTIONS

The main earth return path for this module is via the flange. Therefore, it is important that the heatsink is well earthed and that the return paths are kept as short as possible. Failure to do this may result in loss of output power or oscillation, which will have a detrimental effect upon the life of the module.

The RF output connection should be made to correctly designed 50 Ω terminals. Failure to do so will result in a mismatch being presented to the module, with a resultant reduction in module life.

The leads of the devices may be soldered directly into a circuit using a soldering iron with a maximum temperature of 245 °C, for not more than 10 seconds at a distance of at least 1 mm from the plastic.

Under no circumstances must the maximum specified operating or storage temperatures be exceeded, even for short periods.

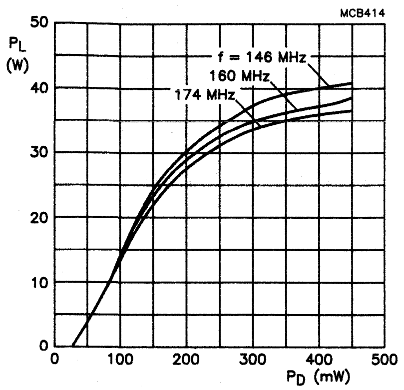


Fig.5 Load power as a function of drive power; $V_{S1} = V_{S2} = 12.5$ V; typical values.

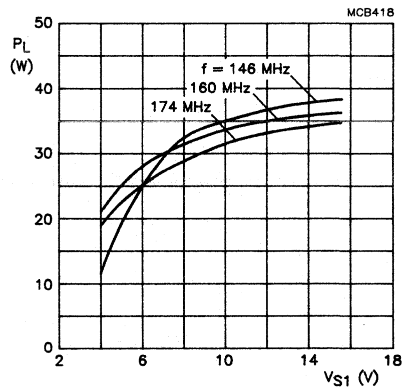


Fig.6 Load power as a function of supply voltage V_{S1}; $P_D = 300$ mW; $V_{S2} = 12.5$ V; typical values.

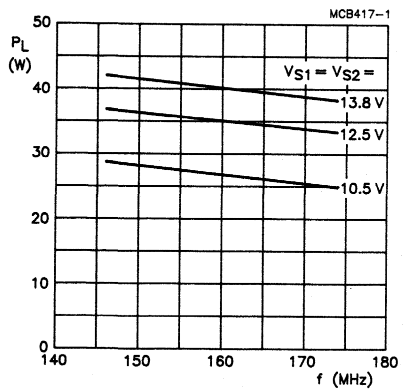


Fig.7 Load power as a function of frequency; $P_D = 300$ mW; typical values.

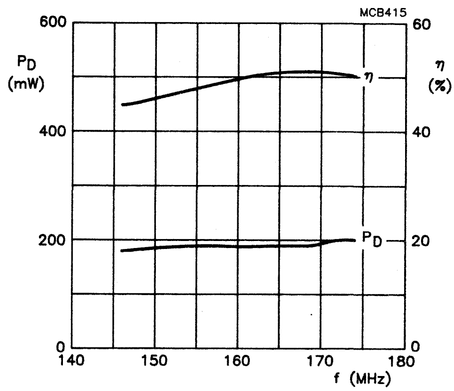


Fig.8 Efficiency and drive power as functions of frequency; $P_L = 28$ W; $V_{S1} = V_{S2} = 12.5$ V; typical values.

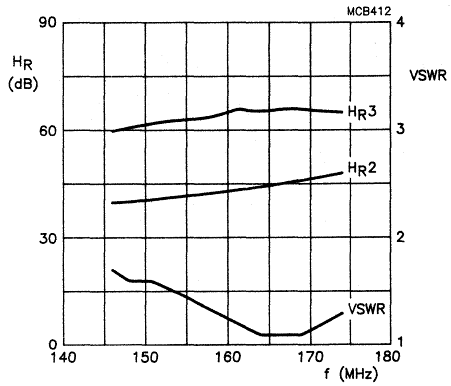
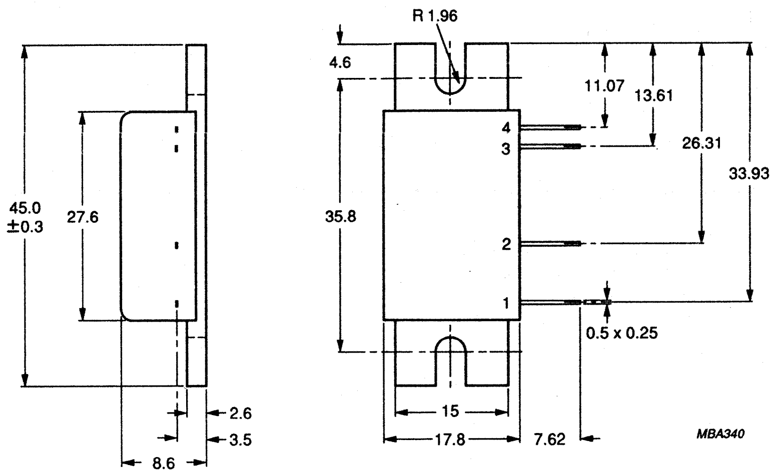


Fig.9 Second and third harmonic rejection as a function of frequency; P_L = 28 W; V_{S1} = V_{S2} = 12.5 V; typical values.

PACKAGE OUTLINE



Dimensions in mm.

Fig.10 SOT183A.

VHF amplifier module BGY145C

DESCRIPTION

An RF amplifier module designed for use in transmitters of mobile communications equipment powered by a 12.5 V battery supply.

The module is a two stage transistor amplifier and consists of two RF npn transistors mounted on a ceramic substrate, together with surface mounted components that make up the matching and bias circuits.

The module will provide 27 W RF power into a 50 Ω load, when operated at nominal conditions within the frequency range of 174 to 200 MHz.

PINNING - SOT183A

PIN	DESCRIPTION
1	output
2	V_{S2}
3	V_{S1}
4	input
flange	ground

PIN CONGIGURATION

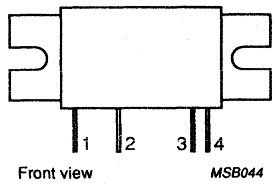


Fig.1 Simplified outline.

QUICK REFERENCE DATA

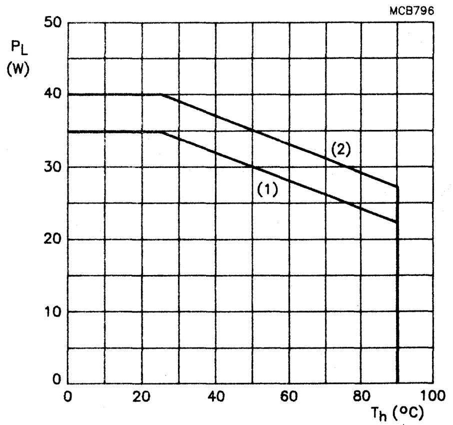
Mode of operation: continuous wave.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
f	frequency range		174	–	200	MHz
P_L	RF output power	P_D = 300 mW	27	–	–	W
G_p	RF power gain	P_L = 27 W	19.5	–	–	dB
η	efficiency	P_L = 27 W	35	–	–	%
V_{S1}, V_{S2}	DC supply voltage		–	12.5	–	V
Z_i	input impedance		–	50	–	Ω
Z_L	output load impedance		–	50	–	Ω

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_{S1}, V_{S2}	DC supply voltage	–	15.5	V
$\pm V_i$	RF input terminal voltage	–	25	V
$\pm V_o$	RF output terminal voltage	–	25	V
P_D	RF input power	–	450	mW
P_L	RF output power (see Fig.2)	–	40	W
T_{stg}	storage temperature range	–30	100	°C
T_h	heatsink operating temperature	–	90	°C



(1) 3:1 mismatch.

(2) Matched.

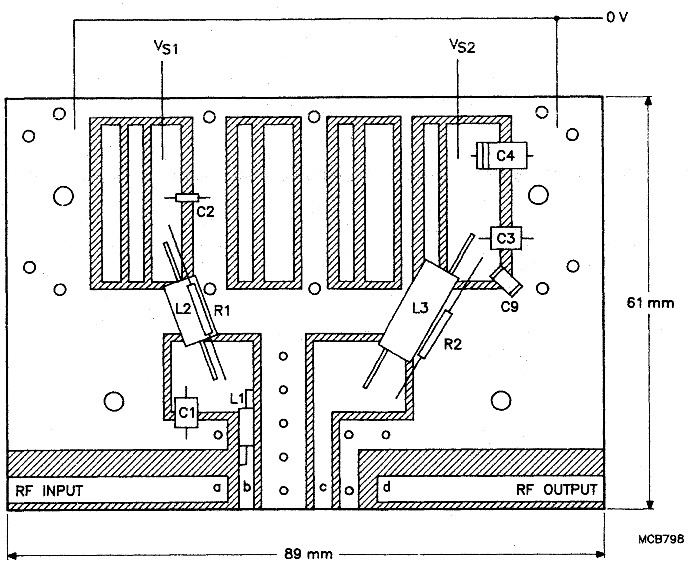
Fig.2 Load power derating.

CHARACTERISTICS

T_h = 25 °C; V_{S1} = V_{S2} = 12.5 V; R_S = R_L = 50 Ω; frequency range = 174 to 200 MHz.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{Q1}	quiescent current	P_D = 0	–	25	mA
I_{Q2}	quiescent current	P_D = 0	–	55	mA
P_L	RF output power	P_D = 300 mW	27	–	W
G_p	RF power gain	P_L = 27 W	19.5	–	dB
η	efficiency	P_L = 27 W	35	–	%
H_{R2}	2nd harmonic output	P_L = 27 W	–	–30	dBc
H_{R3}	3rd harmonic output	P_L = 27 W	–	–40	dBc
	input VSWR with respect to 50 Ω	P_L = 27 W	–	2:1	

APPLICATION INFORMATION



Epoxy fibre-glass board, 1/16 inch thick, $\varepsilon_r = 4.5$.

L2 to be 90 degrees to L3.

Track widths 'a' and 'd' (50 Ω) = 4 mm.

Track width 'b' = 2.5 mm.

Track width 'c' = 3 mm.

Circles indicate the positions of through rivets.

Fig.3 Test jig.

LIST OF COMPONENTS (Fig.3)

DESIGNATION	DESCRIPTION	VALUE	DIMENSIONS
C1, C3	63 V miniature polyester film capacitor	470 nF	
C2	35 V tantalum bead capacitor	4.7 µF	
C4	35 V tantalum capacitor	1 µF	
C9	50 V multilayer ceramic capacitor	47 nF	
L1	4 turns 0.45 mm diameter copper wire		int. dia. 2.5 mm
L2	4 turns 1 mm diameter copper wire		int. dia. 9 mm
L3	12 turns 1 mm diameter copper wire		int. dia. 9 mm
R1, R2	0.5 W resistor	12 Ω	

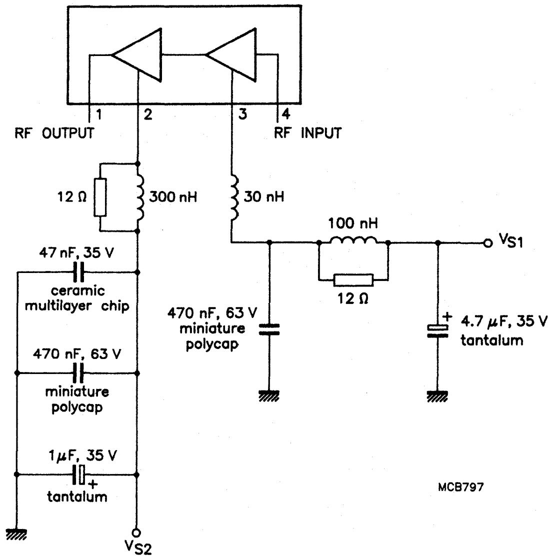


Fig.4 Decoupling arrangement.

STABILITY

The module is stable when operated with a load of up to 3:1 at all phases, providing the operating conditions are as follows:

P_D 15 to 450 mW; $P_L \geq 3$ to ≤ 40 W;
V_{S1} = 1.5 to 15.5 V;
V_{S2} = 10.5 to 15.5 V and $V_{S1} < V_{S2}$.

RUGGEDNESS

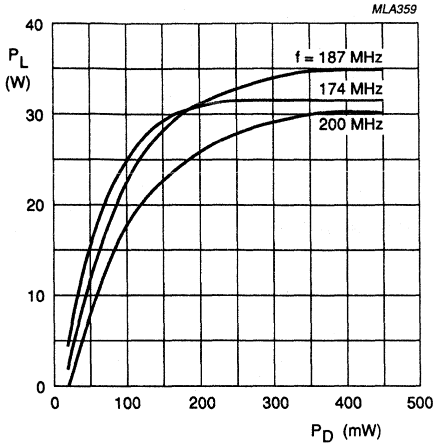
The output power of the module into a 50 Ω load will be unchanged after one minute of operation into a load mismatch of 20:1 (any phase), providing maximum ratings are not exceeded.

V_{S1}, $V_{S2} \leq 15.5$ V; $T_h \leq 90$ °C;
$P_L \leq 40$ W; $P_D < 450$ mW.

RF POWER CONTROL

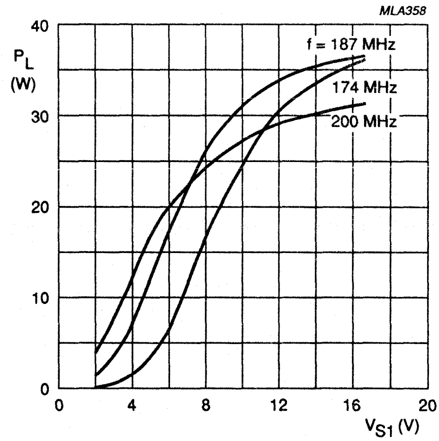
The module is designed to be operated over a power range up to 27 W, under nominal conditions. The output power may be controlled by adjusting the input power, P_D, or the first stage supply voltage, V_{S1}.

P_D = 15 to 450 mW;
V_{S1} = 1.5 V to V_{S2}.



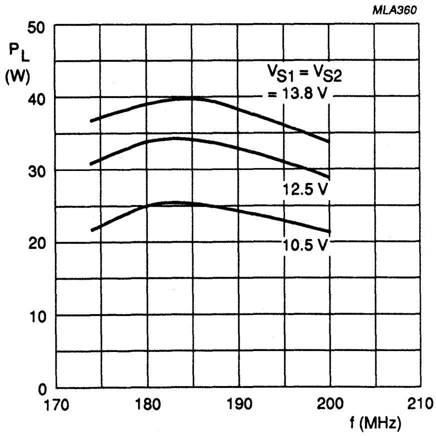
$V_{S1} = V_{S2} = 12.5$ V.

Fig.5 Load power as a function of drive power.



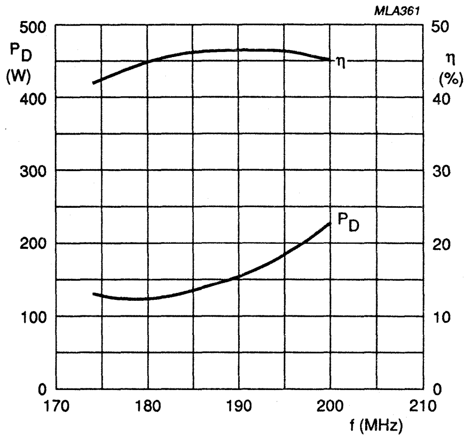
$P_D = 300$ mW; $V_{S2} = 12.5$ V.

Fig.6 Load power as a function of first stage supply voltage.



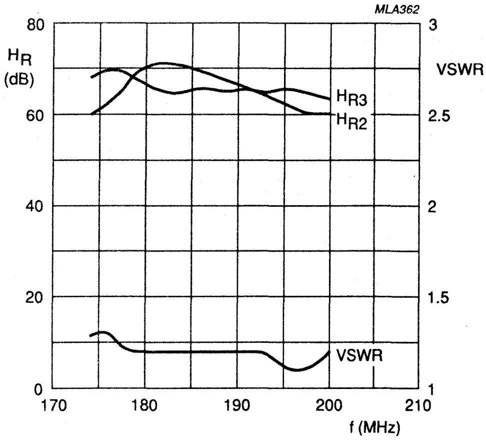
$P_D = 300$ mW.

Fig.7 Load power as a function of frequency.



$P_L = 27$ W; $V_{S1} = V_{S2} = 12.5$ V.

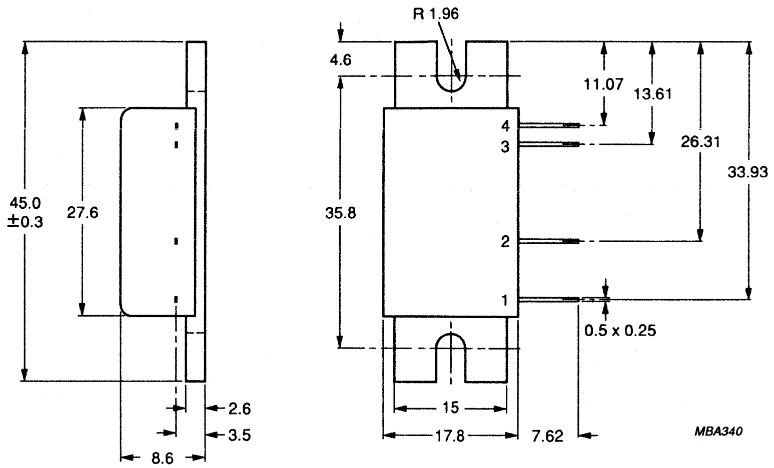
Fig.8 Drive power as a function of frequency.



P_L = 27 W; V_{S1} = V_{S2} = 12.5 V.

Fig.9 Harmonics as a function of frequency.

PACKAGE OUTLINE



Dimensions in mm.

Fig.10 SOT183A.

DATA HANDBOOK SYSTEM

Data handbook system

INTRODUCTION

Our data handbook system comprises more than 65 books with subjects including electronic components, subassemblies and magnetic products. The handbooks are classified into seven series:

- INTEGRATED CIRCUITS;
- DISCRETE SEMICONDUCTORS;
- DISPLAY COMPONENTS;
- PASSIVE COMPONENTS;
- PROFESSIONAL COMPONENTS;
- MAGNETIC PRODUCTS;
- LIQUID CRYSTAL DISPLAYS.

Data handbooks contain all pertinent data available at the time of publication and each is revised and reissued regularly.

Loose data sheeets are sent to subscribers to keep them up-to-date on additions or alterations made during the lifetime of a data handbook.

Catalogues are available for selected product ranges (some catalogues are also on floppy discs).

For more information about data handbooks, catalogues and subscriptions, contact one of the organizations listed on the back cover of this handbook. Product specialists are at your service and enquiries are answered promptly.

INTEGRATED CIRCUITS

IC01	Radio, Audio and Associated Systems Bipolar, MOS
IC02a/b	Video and Associated Systems Bipolar, MOS
IC03	ICs for Telecom Subscriber Sets, Cordless, Mobile and Cellular Telephones, Radio Pagers
IC04	HE4000B Logic Family CMOS
IC05	Advanced Low-power Schottky (ALS) Logic Series
IC06	High-speed CMOS; 74HC/HCT/HCU Logic Family
IC07	Advanced CMOS Logic (ACL)

IC07 supplement: Additional ACL data

INTEGRATED CIRCUITS (continued)

IC08	10/100k ECL Logic/Memory/PLD
IC09	TTL Logic Series
IC10	Memories MOS, TTL, ECL
IC11	Linear Products
IC12	I²C-bus-compatable ICs
IC13	Programmable Logic Devices (PLD)
IC14	8048-based 8-bit Microcontrollers
IC15	FAST TTL Logic Series

IC15 supplement: Additional FAST data

IC16	CMOS Integrated Circuits for Clocks and Watches
IC17	ICs for Telecom ISDN
IC18	Microprocessors and Peripherals
IC19	Data Communication Products
IC20	8051-based 8-bit Microcontrollers
IC23	Advanced BiCMOS Interface Logic

DISCRETE SEMICONDUCTORS

SC01	Diodes
SC02	Power Diodes
SC03	Thyristors and Triacs
SC04	Small Signal Transistors
SC05	Low-frequency Power Transistors and Hybrid IC Power Modules
SC06	High-voltage and Switching Power Transistors
SC07	Small-signal Field-effect Transistors
SC08a	RF Power Bipolar Transistors
SC08b	RF Power MOS Transistors
SC09	RF Power Modules
SC10	Surface Mounted Semiconductors
SC12	Optocouplers
SC13	PowerMOS Transistors
SC14	Wideband Transistors and Wideband Hybrid IC Modules
SC15	Microwave Transistors
SC17	Semiconductor Sensors

Data handbook system

DISPLAY COMPONENTS

DC01	Colour Display Components Colour TV Picture Tubes and Assemblies Colour Monitor Tube Assemblies
DC02	Monochrome Monitor Tubes and Deflection Units
DC03	Television Tuners, Coaxial Aerial Input Assemblies
DC04	Loudspeakers
DC05	Flyback Transformers, Mains Transformers and General-purpose FXC Assemblies

PASSIVE COMPONENTS

PA01	Electrolytic Capacitors; Solid and Non-solid
PA02	Varistors, Thermistors and Sensors
PA03	Potentiometers and Switches
PA04	Variable Capacitors
PA05	Film Capacitors
PA06	Ceramic Capacitors
PA07	Piezoelectric Quartz Devices
PA08	Fixed Resistors
PA11	Quartz Oscillators

PROFESSIONAL COMPONENTS

PC01	High-power Klystrons and Accessories
PC02	Cathode-ray Tubes
PC03	Geiger-Müller Tubes
PC04	Photo Multipliers
PC05	Plumbicon Camera Tubes and Accessories
PC06	Circulators and Isolators
PC07	Vidicon and Newvicon Camera Tubes and Deflection Units
PC08	Image Intensifiers
PC09	Dry-reed Switches
PC11	Solid-state Image Sensors and Peripheral Integrated Circuits
PC12	Electron Multipliers

MAGNETIC PRODUCTS

MA01	Soft Ferrites
MA02	Permanent Magnet Materials
MA03	Piezoelectric Ceramics

LIQUID CRYSTAL DISPLAYS

LCD01	Liquid Crystal Displays and Driver ICs for LCDs

Philips – a worldwide company

Argentina: PHILIPS ARGENTINA S.A., Div. Philips Components, Vedia 3892, 1430 BUENOS AIRES, Tel. (01) 541-4261.
Australia: PHILIPS COMPONENTS PTY Ltd, 34 Waterloo Road, NORTH RYDE NSW 2113, Tel. (02) 805 4455. Fax. (02) 805 4466.
Austria: ÖSTERREICHISCHE PHILIPS INDUSTRIE G.m.b.H., UB Bauelemente, Triester Str. 64, 1101 WIEN, Tel. (0222) 60 101-820.
Belgium: N.V PHILIPS PROF. SYSTEMS – Components Div., 80 Rue Des Deux Gares, B-1070 BRUXELLES, Tel. (02) 52 56 111.
Brazil: PHILIPS COMPONENTS (Active Devices & LCD) Rua do Rocia 220, SAO PAULO-SP, CEP 4552, P.O. Box 7383, CEP 01051, Tel. (011) 829-1166. Fax. (011) 459-8282. PHILIPS COMPONENTS (Passive Devices & Materials) Av. Francisco Monteiro 702, RIBEIRAO PIRES-SP, CEP 09400, Tel. (011) 459-8211.
Canada: PHILIPS ELECTRONICS LTD., Philips Components, 601 Milner Ave., SCARBOROUGH, Ontario, M1B 1M8, Tel. (416) 292-5161. (IC Products) PHILIPS COMPONENTS – Signetics Canada LTD., 1 Eva Road, Suite 411, ETOBICOKE, Ontario, M9C 4Z5, Tel. (416) 626-6676.
Chile: PHILIPS CHILENA S.A., Av. Santa Maria 0760, SANTIAGO, Tel. (02) 77 38 16.
Colombia: IPRELENSO LTDA., Carrera 21 No. 56-17, BOGOTA, D.E., P.O. Box 77621, Tel. (01) 2 49 76 24.
Denmark: PHILIPS COMPONENTS A/S, Prags Boulevard 80, PB1919, DK-2300 COPENHAGEN S, Tel. 32-88 33 33.
Finland: PHILIPS COMPONENTS, Sinikalliontie 3, SF-2630 ESPOO, Tel. 358-0-50 261.
France: PHILIPS COMPOSANTS, 117 Quai du Président Roosevelt, 92134 ISSY-LES-MOULINEAUX Cedex, Tel. (01) 40 93 80 00, Fax. 01 40 93 86 92.
Germany: PHILIPS COMPONENTS UB der Philips G.m.b.H., Burchardstrasse 19, D-2 HAMBURG 1, Tel. (040) 3296-0, Fax. 040 329 69 12.
Greece: PHILIPS HELLENIQUE S.A., Components Division, No. 15, 25th March Street, GR 17778 TAVROS, Tel. (01) 48 94 339/48 94 911.
Hong Kong: PHILIPS HONG KONG LTD., Components Div., 15/F Philips Ind. Bldg., 24-28 Kung Yip St., KWAI CHUNG, Tel. (0)-42 45 121. Fax. 0 480 69 60.
India: PEICO ELECTRONICS & ELECTRICALS LTD., Components Dept., Shivsagar Estate 'A' Block, P.O. Box 6598, 254-D Dr. Annie Besant Rd., BOMBAY – 40018, Tel. (022) 49 21 500-49 21 515. Fax. 022 494 190 63.
Indonesia: P.T. PHILIPS-RALIN ELECTRONICS, Components Div., Setiabudi II Building, 6th Fl., Jalan H.R. Rasuna Said (P.O. Box 223/KBY) Kuningan, JAKARTA 12910, Tel. (021) 51 79 95.
Ireland: PHILIPS ELECTRONICS (IRELAND) LTD., Components Division, Newstead, Clonskeagh, DUBLIN 14, Tel. (01) 69 33 55.
Italy: PHILIPS S.p.A., Philips Components, Piazza IV Novembre 3, I-20124 MILANO, Tel. (02) 6752.1, Fax. 02 675 226 42.
Japan: PHILIPS JAPAN LTD., Components Division, Philips Bldg 13-37, Kohnan 2-chome, Minato-ku, TOKYO 108, Tel. (03) 813-3740-5030. Fax. 03 813 374 00570.
Korea (Republic of): PHILIPS ELECTRONICS (KOREA) LTD. Components Division, Philips House, 260-199 Itaewon-dong, Yongsan-ku, SEOUL, Tel. (02) 794-5011.
Malaysia: PHILIPS MALAYSIA SDN BHD, Components Div., 3 Jalan SS15/2A SUBANG, 47500 PETALING JAYA, Tel. (03) 73 45 511.
Mexico: PHILIPS COMPONENTS, Paseo Triunfo de la Republica, No 215 Local 5, Cd Juarez CHI HUA HUA 32340 MEXICO Tel. (16) 18-67-01/02.
Netherlands: PHILIPS NEDERLAND B.V., Marktgroep Philips Components, Postbus 90050, 5600 PB EINDHOVEN, Tel. (040) 78 37 49.
New Zealand: PHILIPS NEW ZEALAND LTD., Components Division, 110 Mt. Eden Road, C.P.O. Box 1041, AUCKLAND, Tel. (09) 605-914.
Norway: NORSK A/S PHILIPS, Philips Components, Box 1, Manglerud 0612, OSLO, Tel. (02) 74 10 10.
Pakistan: PHILIPS ELECTRICAL CO. OF PAKISTAN LTD., Philips Markaz, M.A. Jinnah Rd., KARACHI-3, Tel. (021) 72 57 72.
Peru: CADESA, Carretera Central 6.500, LIMA 3, Apartado 5612, Tel. 51-14-35 00 59.
Philippines: PHILIPS ELECTRICAL LAMPS INC. Components Div., 106 Valero St. Salcedo Village, P.O. Box 911, MAKATI, Metro MANILA, Tel. (63-2) 810-0161. Fax. 63 2 817 3474.
Portugal: PHILIPS PORTUGUESA S.A.R.L., Av. Eng. Duarte Pacheco 6, 1009 LISBOA Codex, Tel. (019) 68 31 21.
Singapore: PHILIPS SINGAPORE, PTE LTD., Components Div., Lorong 1, Toa Payoh, SINGAPORE 1231, Tel. 35 02 000.
South Africa: S.A. PHILIPS PTY LTD., Components Division, 195-215 Main Road, JOHANNESBURG 2000, P.O. Box 7430, Tel. (011) 470-5434. Fax. (011) 470 54 94.
Spain: PHILIPS COMPONENTS, Balmes 22, 08007 BARCELONA, Tel. (03) 301 63 12. Fax. 03 301 42 43.
Sweden: PHILIPS COMPONENTS, A.B., Tegeluddsvägen 1, S-11584 STOCKHOLM, Tel. (0)8-78 21 000.
Switzerland: PHILIPS A.G., Components Dept., Allmendstrasse 140-142, CH-8027 ZÜRICH, Tel. (01) 488 22 11.
Taiwan: PHILIPS TAIWAN LTD., 581 Min Sheng East Road, P.O. Box 22978, TAIPEI 10446, Taiwan, Tel. 886-2-509 76 66. Fax. 886 2 500 58 99.
Thailand: PHILIPS ELECTRICAL CO. OF THAILAND LTD., 283 Silom Road, P.O. Box 961, BANGKOK, Tel. (02) 233-6330-9.
Turkey: TÜRK PHILIPS TICARET A.S., Philips Components, Talatpasa Cad. No. 5, 80640 LEVENT/ISTANBUL, Tel. (01) 179 27 70.
United Kingdom: PHILIPS COMPONENTS LTD., Mullard House, Torrington Place, LONDON WC1E 7HD.
United States: (Colour picture tubes – Monochrome & Colour Display Tubes) PHILIPS DISPLAY COMPONENTS COMPANY, 1600 Huron Parkway, P.O. Box 963, ANN ARBOR, Michigan 48106, Tel. 313/996-9400. Fax. 313 761 2886. (IC Products) PHILIPS COMPONENTS – Signetics, 811 East Arques Avenue, SUNNYVALE, CA 94088-3409, Tel. (800) 227-1817. (Passive Components, Discrete Semiconductors, Materials and Professional Components & LCD) PHILIPS COMPONENTS, Discrete Products Division, 2001 West Blue Heron Blvd., P.O. Box 10330, RIVIERA BEACH, Florida 33404, Tel. (407) 881-3200.
Uruguay: PHILIPS COMPONENTS, Coronel Mora 433, MONTEVIDEO, Tel. (02) 70-40 44.
Venezuela: MAGNETICA S.A., Calle 6, Ed. Las Tres Jotas, CARACAS 1074A, App. Post. 78117, Tel. (02) 241 75 09.
Zimbabwe: PHILIPS ELECTRICAL (PVT) LTD., 62 Mutare Road, HARARE, P.O. Box 994, Tel. 47211.

For all other countries apply to: Philips Components, Strategic Accounts and International Sales, P.O. Box 218, 5600 MD EINDHOVEN, The Netherlands, Telex 35000 phtcnl, Fax. +31-40-724825

Printed in The Netherlands 9398 174 10011

Philips Semiconductors

PHILIPS

PHILIPS