

RF Power Modules

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Philips Components



PHILIPS

RF POWER MODULES

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SELECTION GUIDE

VHF modules for portable transmitters

P _L W	V _S V	f MHz	G _p dB	envelope	type number	page
2	9.5	68-88	17.5	SOT182	BGY93A	147
2	9.6	136-156	17.5	SOT182	BGY93B	153
2	9.6	148-174	17.5	SOT182	BGY93C	159
5	9.6	68-88	21.5	SOT182	BGY94A	165
5	9.6	132-156	21.5	SOT182	BGY94B	171
5	9.6	148-174	21.5	SOT182	BGY94C	177

VHF modules for mobile transmitters

13	12.5	148-174	19.4	SOT132B	BGY43	63
18	12.5	68-88	22.6	SOT132B	BGY32	45
18	12.5	80-108	22.6	SOT132B	BGY33	45
18	12.5	132-156	20.8	SOT132B	BGY35	45
18	12.5	148-174	20.8	SOT132B	BGY36	45
29	12.5	68-88	22.8	SOT183	BGY45A	71
28	12.5	148-174	19.7	SOT183	BGY45B	77
18	12.5	170-210	20.8	SOT183	BGY45C	83

UHF modules for portable transmitters

1.4	9.6	400-440	15.0	SOT181	BGY46A	89
1.4	9.6	430-470	15.0	SOT181	BGY46B	95
3.2	9.6	400-440	18.0	SOT181	BGY47A	101
3.2	9.6	460-512	18.0	SOT181	BGY47F	109
5.0	9.6	400-440	21.5	SOT182	BGY48A	111
5.0	9.6	430-470	21.5	SOT182	BGY48B	115
5.0	9.6	460-512	21.5	SOT182	BGY48C	121

UHF modules for mobile transmitters

2.5	13.5	380-512	17.0	SOT75A	BGY22	29
7.0	13.5	380-480	4.5	SOT75A	BGY23	37
7.5	12.5	400-440	18.8	SOT132C	BGY40A	55
7.5	12.5	400-470	18.8	SOT132C	BGY40B	55
13	12.5	400-440	19.4	SOT132C	BGY41A	55
13	12.5	440-470	19.4	SOT132C	BGY41B	55
20	12.5	400-440	21.2	SOT132D	BGY49A	127
20	12.5	440-470	21.2	SOT132D	BGY49B	131

SHF modules for portable transmitters

2.2	7.5	825-845	21.0	SOT200	BGY95A	183
2.2	7.5	890-915	21.0	SOT200	BGY95B	183
2.5	9.6	825-845	21.0	SOT200	BGY96A	185
2.5	9.6	890-915	21.0	SOT200	BGY96B	187
1.2	6.0	824-849	30.8	SOT246	BGY110A	195
1.2	6.0	872-905	30.8	SOT246	BGY110B	197

SELECTION GUIDE

SHF modules for mobile transmitters

P_L W	V_S V	f MHz	G_p dB	envelope	type number	page
6.0	12.5	806-890	14.8	SOT197	BGY90A	135
6.0	12.5	870-950	14.8	SOT197	BGY90B	137
6.0	12.5	809-890	14.8	SOT233	BGY91A	139
6.0	12.5	870-950	14.8	SOT233	BGY91B	143

TYPE NUMBER SURVEY

TYPE NUMBER SURVEY

type (modules)	envelope	V _S	frequency MHz	output power W	power gain dB	page
BGY22	SOT75A	13.5	380-512	> 2.5	17	29
BGY23	SOT75A	13.5	380-480	> 7.0	4.5	37
BGY32	SOT132	12.5	68-88	> 18	22.6	45
BGY33	SOT132	12.5	80-108	> 18	22.6	45
BGY35	SOT132	12.5	132-156	> 18	20.6	45
BGY36	SOT132	12.5	148-174	> 18	20.8	45
BGY40A	SOT132	12.5	400-440	> 11.5	18.8	55
BGY40B	SOT132	12.5	440-470	> 10	18.8	55
BGY41A	SOT132	12.5	400-440	> 15.6	19.4	55
BGY41B	SOT132	12.5	440-470	> 15	19.4	55
BGY43	SOT132	12.5	148-174	> 13	19.4	63
BGY45A	SOT183	12.5	68-88	> 29	22.9	71
BGY45B	SOT183	12.5	148-174	> 28	19.2	77
BGY45C	SOT183	12.5	170-210	> 18	20.8	83
BGY46A	SOT181	9.6	400-440	> 1.4	15.0	89
BGY46B	SOT181	9.6	430-470	> 1.4	15.0	95
BGY47A	SOT181	9.6	400-470	> 3.2	18.0	101
BGY47F	SOT181	9.6	460-512	> 3.2	18.0	109
BGY48A	SOT182	9.6	400-440	> 5.0	21.5	111
BGY48B	SOT182	9.6	430-470	> 5.0	21.5	115
BGY48C	SOT182	9.6	460-512	> 5.0	21.5	121
BGY49A	SOT132	12.5	400-440	> 20.0	21.2	127
BGY49B	SOT132	12.5	440-470	> 20.0	21.2	131
BGY90A	SOT197	12.5	806-890	> 6.0	14.8	135
BGY90B	SOT197	12.5	870-950	> 6.0	14.8	137
BGY91A	SOT233	12.5	809-890	> 6.0	23.0	139
BGY91B	SOT233	12.5	870-950	> 6.0	23.0	143
BGY93A	SOT182	9.6	68-88	> 2.0	17.5	147
BGY93B	SOT182	9.6	136-156	> 2.0	17.5	153
BGY93C	SOT182	9.6	148-174	> 2.0	17.5	159
BGY94A	SOT182	9.6	68-88	> 5.0	21.5	165
BGY94B	SOT182	9.6	132-156	> 5.0	21.5	171
BGY94C	SOT182	9.6	148-174	> 5.0	21.5	177
BGY95A	SOT200	7.5	825-845	> 2.2	20.4	183
BGY95B	SOT200	7.5	890-915	> 2.2	20.4	183
BGY96A	SOT200	9.6	825-845	> 2.5	21.0	185
BGY96B	SOT200	9.6	890-915	> 2.5	21.0	187
BGY110A	SOT246	6.0	824-849	> 1.2	30.8	195
BGY110B	SOT246	6.0	872-905	> 1.2	30.8	197

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 ($R_{th j-mb} > 15 K/W$)
- D. TRANSISTOR; power, audio frequency ($R_{th j-mb} \leq 15 K/W$)
- E. DIODE; tunnel
- F. TRANSISTOR; low power, high frequency ($R_{th j-mb} > 15 K/W$)
- G. MULTIPLE OF DISSIMILAR DEVICES — MISCELLANEOUS; e.g. oscillator
- H. DIODE; magnetic sensitive
- L. TRANSISTOR; power, high frequency ($R_{th j-mb} \leq 15 K/W$)
- 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 ($R_{th j-mb} > 15 K/W$)
- S. TRANSISTOR; low power, switching ($R_{th j-mb} > 15 K/W$)
- T. CONTROL AND SWITCHING DEVICE; e.g. thyristor, power ($R_{th j-mb} \leq 15 K/W$)
- U. TRANSISTOR; power, switching ($R_{th j-mb} \leq 15 K/W$)
- 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)

TYPE DESIGNATION

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

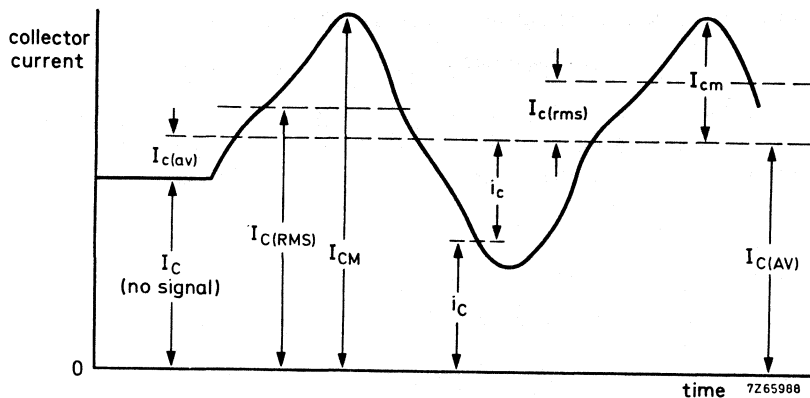
For multiple unit devices, the subscripts are modified by a number preceding the letter subscript; in the case of multiple subscripts, hyphens may be necessary to avoid misunderstanding.

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

Definition

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
l, 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.

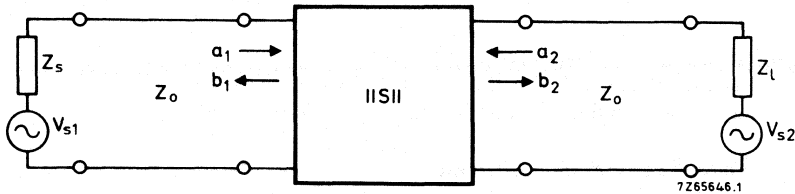
Examples: $Z_i = R_i + jX_i$
 $y_{fe} = g_{fe} + jb_{fe}$

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

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

SCATTERING PARAMETERS

In distinction to the conventional h, y and z-parameters, s-parameters relate to traveling 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 .



$$a_1 = \frac{V_{i1}}{\sqrt{Z_0}} \qquad a_2 = \frac{V_{i2}}{\sqrt{Z_0}} \qquad 1)$$

$$b_1 = \frac{V_{r1}}{\sqrt{Z_0}} \qquad b_2 = \frac{V_{r2}}{\sqrt{Z_0}}$$

Z_0 = 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.

S-PARAMETERS

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 $Z_1 = Z_o = 50 \Omega$ 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 $Z_1 = Z_o = 50 \Omega$ 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 FLANGE R.F. POWER TRANSISTORS

Flange r.f. transistors are easy to mount but for optimum performance we offer the following recommendations:

- Holes or tapped holes in the heatsink should be free from burrs and spaced at 18,42 mm (+ 0,05; -0,05) between centres. They must have a depth of at least 6 mm.
Recommended screw: for SOT-119, SOT-121 and SOT-161 cheese-head 4-40 UNC/2A, for SOT-123 and SOT-160 also M3. A washer to spread the joint pressure is also recommended.
- For transistors dissipating up to 80 W the heatsink thickness should be at least 3 mm copper (> 99,9%, ETP-Cu) or 5 mm aluminium (> 99,0% Al). For transistors dissipating more power, the thickness should be increased proportionally.
- The flatness of the heatsink mounting surface must be > 0,02 mm with a surface roughness $R_a < 0,5 \mu\text{m}$ (preferably by grinding or lapping).
- The sparing use of evenly distributed heatsink compound on the transistor flange is recommended. Suitable heatsink compound brands are: Dow Corning 340, Eccotherm TC-5 (E&C), Wakefield 120.
- The screws through the flange holes should first both be tightened to 0,05 Nm (finger tight), and then tightened to 0,6 to 0,75 Nm, to achieve the published thermal resistance between the mounting base and heatsink.
- When a transistor is removed from the heatsink, the flange will almost certainly have been distorted by the joint pressure. Grinding or lapping of the flange according to the information above is necessary if the transistor is remounted.

RECOMMENDATIONS FOR MOUNTING 1/4", 3/8" AND 1/2" CAPSTAN HEADERS AS USED FOR R.F. POWER TRANSISTORS

A nickel plated brass nut is supplied with each transistor for securing it to a heatsink.

Screw threads, diameter and nuts:

mounting base diameter	thread	maximum diameter of threaded stud	nut thickness
1/4"	8-32UNC-2A(B)	4,14 mm	3,5 and 5 mm
3/8"	10-32UNF-2A(B)	4,80 mm	5 mm
1/2"	1/4" x 28UNF-2A(B)	6,33 mm	5,5 mm

To ensure optimum heat transfer and to avoid damage to the threaded stud of the transistor the following recommendations should be observed.

– Diameter of the mounting hole in the heatsink:

1/4" stud	diameter 4,15 +0,05; –0 mm
3/8" stud	diameter 4,85 +0,05; –0 mm
1/2" stud	diameter 6,35 +0,05; –0 mm

Heatsink surfaces at the mounting hole to be flat, parallel, and free of burrs or oxidation.

– Mounting nut torque:

1/4" nut	minimum 0,75 Nm (7,5 kg cm) maximum 0,85 Nm (8,5 kg cm)
3/8" nut	minimum 1,5 Nm (15 kg cm) maximum 1,7 Nm (17 kg cm)
1/2" nut	minimum 2,3 Nm (23 kg cm) maximum 2,7 Nm (27 kg cm)

– Recommended distance from the surface of the heatsink to the top surface of the printed-circuit board:

1/4" capstan header	2,9 + 0; –0,2 mm
3/8" capstan header	3,8 + 0; –0,2 mm
1/2" capstan header	4,8 + 0; –0,2 mm

It is important that the above maximum printed-circuit board mounting heights are not exceeded in order to prevent stress being applied to the encapsulation. Upward lead bending, in particular, can damage the encapsulation and impair the sealing of the header.

- Experience indicates that flux or flux solutions can penetrate even hermetically sealed ceramic-capped transistors. To prevent this, tin and wash the printed-circuit boards before mounting the power transistors, then solder the transistors in place without using flux.
- The leads may be tinned by dipping them, full length, into a solder bath at about 230 °C. Note, no flux should be used during tinning.
- The full mounting-nut torque (specified above) should be applied only once during the life of the transistor. For pre-assembly testing, apply no more than two thirds of the specified torque.
- Since locking washers are much harder than most heatsink materials, their locking action might deteriorate during the life of the transistor. The use of locking washers is therefore not recommended. Instead, tighten the nuts to their specified torque, allow about 30 minutes for them to bed down, then re-tighten. After this, apply locking paint.

MODULE DATA

U.H.F. POWER AMPLIFIER MODULES

Broadband amplifier modules primarily designed for mobile applications operating directly from 12 V vehicle electrical systems. The module will produce 2,5 W output into a 50 Ω load over the bands 380 to 512 MHz for the BGY22, and 420 to 480 MHz for the BGY22A.

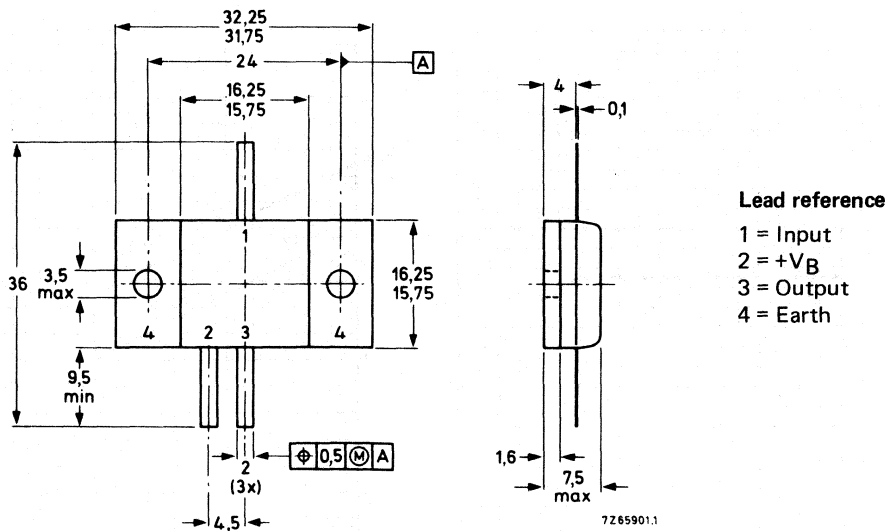
QUICK REFERENCE DATA

type number	mode of operation	freq. range MHz	V _B V	P _D mW	P _L W	η %	Z _S = Z _L Ω
BGY22	c.w.	380 to 512	13,5	50	> 2,5 typ. 2,9	> 40 typ. 50	50
BGY22A	c.w.	420 to 480	12,5	50	> 2,5	> 40	50

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-75A.



To ensure good thermal contact between mounting base and heatsink, burrs or thickening at the edges of the heatsink holes should be removed and the package bolted down onto a flat surface.

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

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.

BGY22 BGY22A

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

D. C. voltages (with respect to flange)

Supply terminal	V_B	max.	18	V
Input terminal	$\pm V_I$	max.	25	V
Output terminal	$\pm V_O$	max.	25	V

Current

Supply current (d. c.)	I_{tot}	max.	800	mA
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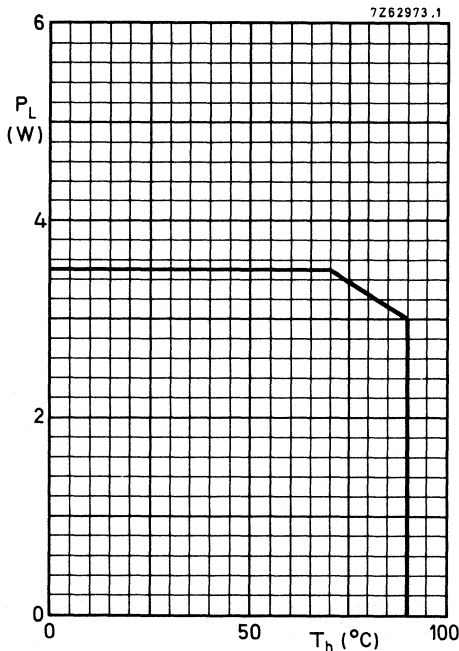
Drive power

$V_B = 13,5 \text{ V}; Z_L = 50 \Omega$	P_D	max.	150	mW
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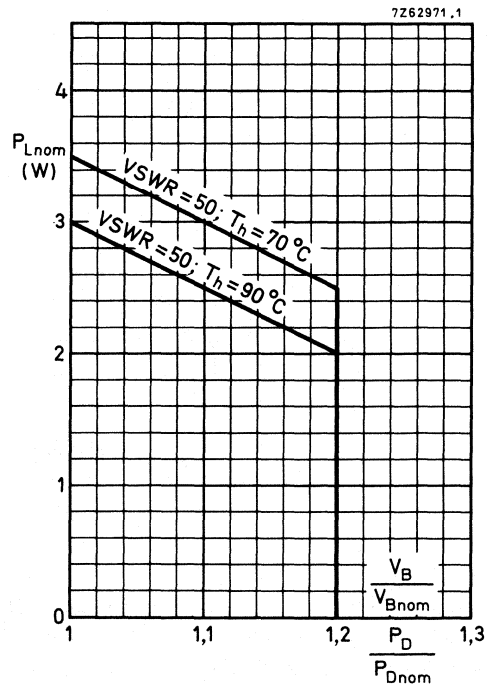
Temperatures

Storage temperature	T_{stg}	-40 to +100	$^{\circ}\text{C}$
Operating heatsink temperature	T_h	max.	90 $^{\circ}\text{C}$

P_L for normal operation



P_L for fault condition



Where $P_{Lnom} = P_L$ at $V_B = 13,5 \text{ V}; Z_L = 50 \Omega$ (BGY22)
and $P_{Lnom} = P_L$ at $V_B = 12,5 \text{ V}; Z_L = 50 \Omega$ (BGY22A)

CHARACTERISTICS $T_h = 25\text{ }^\circ\text{C}$ unless otherwise specified

Reference planes at r. f. input and output terminals are 1 mm from the plastic encapsulation.

Frequency range 380-512 MHz; $V_B = 13,5\text{ V}$ (BGY22)Frequency range 420-480 MHz; $V_B = 12,5\text{ V}$ (BGY22A)

Quiescent current

 $P_D = 0$ I_{BQ} 4,0 to 12,0 mA

Load power

 $P_D = 50\text{ mW}$ P_L 2,5 to 3,5 W

Efficiency

 $P_D = 50\text{ mW}$ η > 40 %

Supply current

 $P_D = 50\text{ mW}$ I_{tot} typ. 475 mA

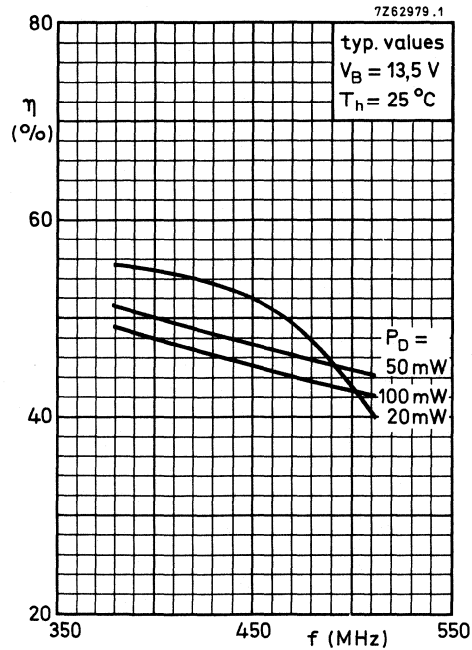
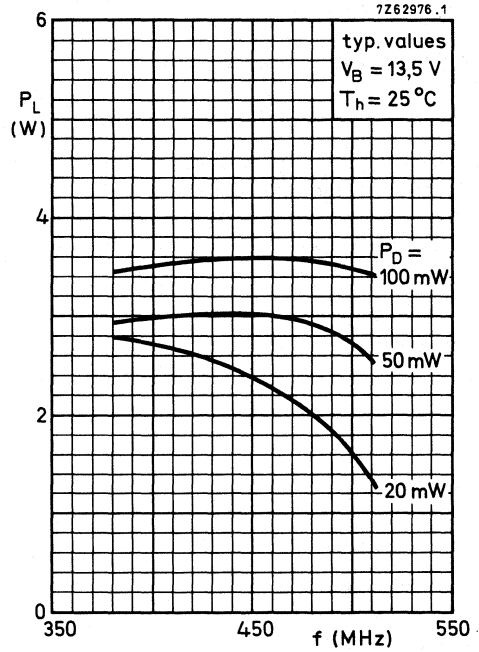
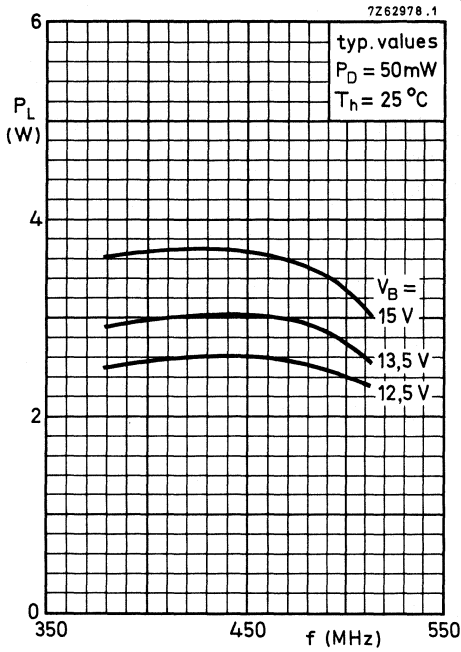
Harmonic content

 $P_D = 50\text{ mW}$ Any harmonic is at least 20 dB down relative to carrierInput VSWR with respect to $50\ \Omega$ $P_D = 50\text{ mW}$ VSWR < 2Temperature coefficient of P_L $P_D = 50\text{ mW}$; $T_h = 25\text{ to }70\text{ }^\circ\text{C}$ typ. -10 mW/ $^\circ\text{C}$

Stability

 $V_B = 10,5\text{ to }15\text{ V}$; $P_D = 10\text{ mW to }100\text{ mW}$ $T_h = -40\text{ to }+90\text{ }^\circ\text{C}$ Output load VSWR ≤ 3 , all phasesOutput load VSWR ≤ 10 , all phasesNo instabilities
No appreciable
instabilities

BGY22
BGY22A



APPLICATION INFORMATION

R.F. performance in c.w. operation; $T_h = 25\text{ }^\circ\text{C}$ Drive source and load impedance $Z_S = Z_L = 50\ \Omega$

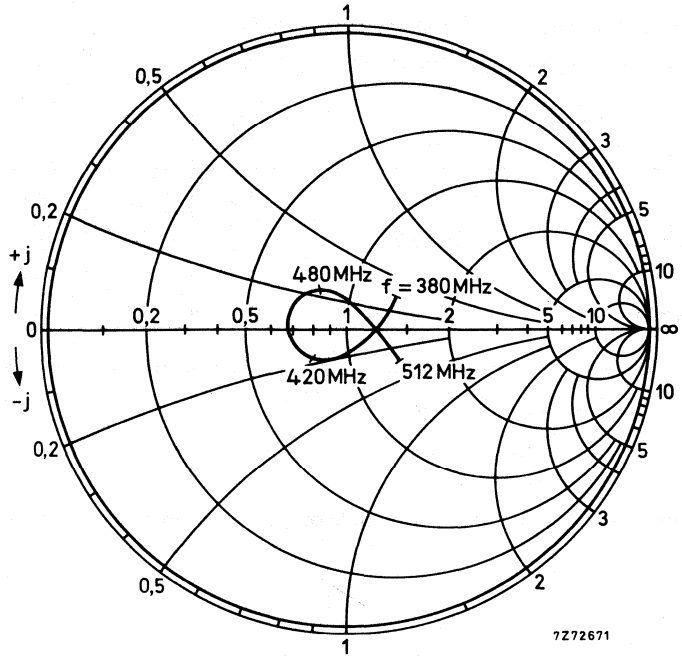
type number	f MHz	V_B V	P_D mW	P_L W	η %
BGY22	380 to 512	15,0	50	typ. 3,5	typ. 47
		13,5		> 2,5	> 40
		13,5		typ. 2,9	typ. 47
		12,5		typ. 2,5	typ. 47
BGY22A	420 to 480	12,5	50	> 2,5	> 40

The modules are designed to withstand full load mismatch under the following conditions:

 $P_D = P_{Dnom} + 20\%$; $T_h = 70\text{ }^\circ\text{C}$ $V_B = 16,5\text{ V}$ (BGY22) $V_B = 15,0\text{ V}$ (BGY22A)

VSWR = 50 at any phase

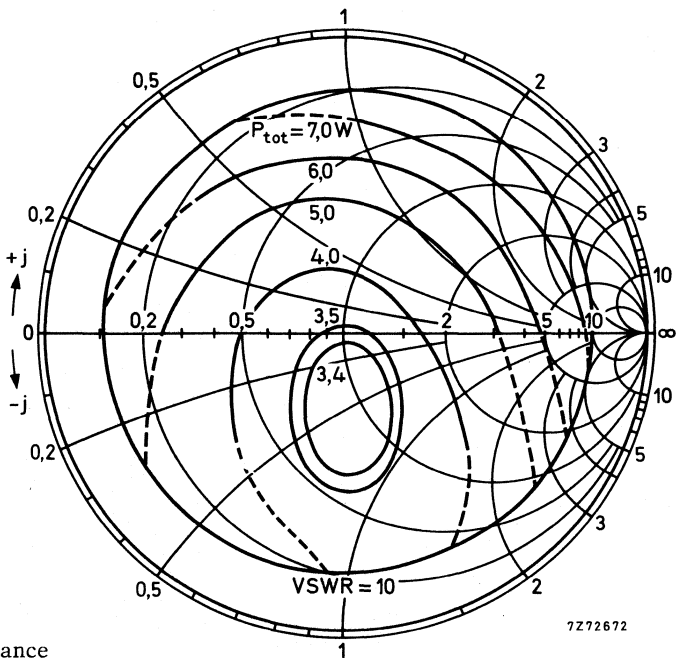
where $P_{Dnom} = P_D$ for 2,5 W module output under nominal conditions.



Typical variation of input impedance with frequency

$V_B = 13,5 \text{ V}$

$f = 470 \text{ MHz}$

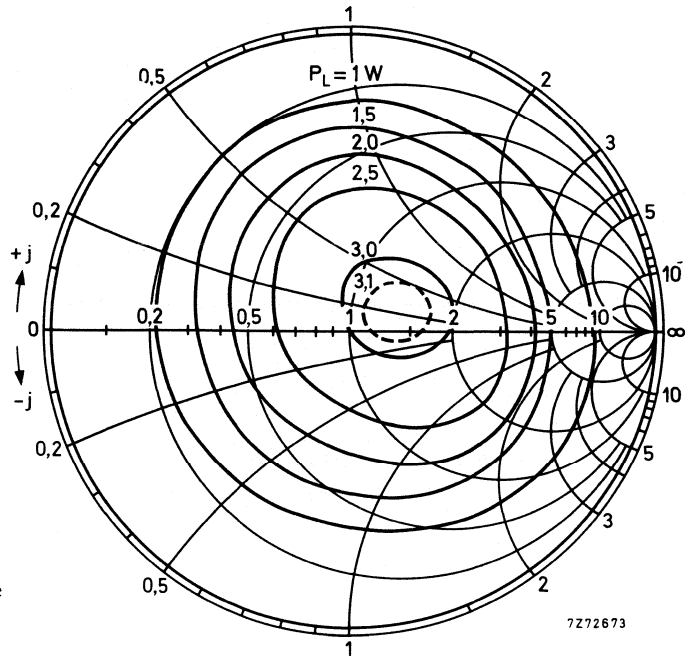


Typical variation of power dissipation with load impedance

$V_B = 13,5 \text{ V}$

$P_D = 50 \text{ mW}$

$f = 470 \text{ MHz}$

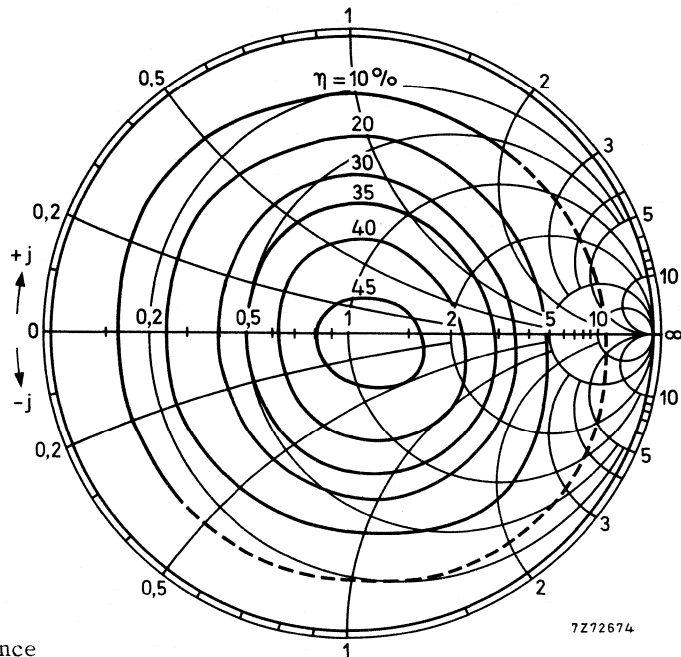


Typical variation of load power with load impedance

$V_B = 13,5 \text{ V}$

$P_D = 50 \text{ mW}$

$f = 470 \text{ MHz}$



Typical variation of efficiency with load impedance

U.H.F. POWER AMPLIFIER MODULES

Broadband amplifier modules primarily designed for mobile applications operating directly from 12 V vehicle electrical systems. The modules are suitable for driving directly from the BGY22 and BGY22A respectively, and when so driven will produce 7 W output into a 50 Ω load over the band 380 to 480 MHz for the BGY23, and 7 W over the band 420 to 480 MHz for the BGY23A.

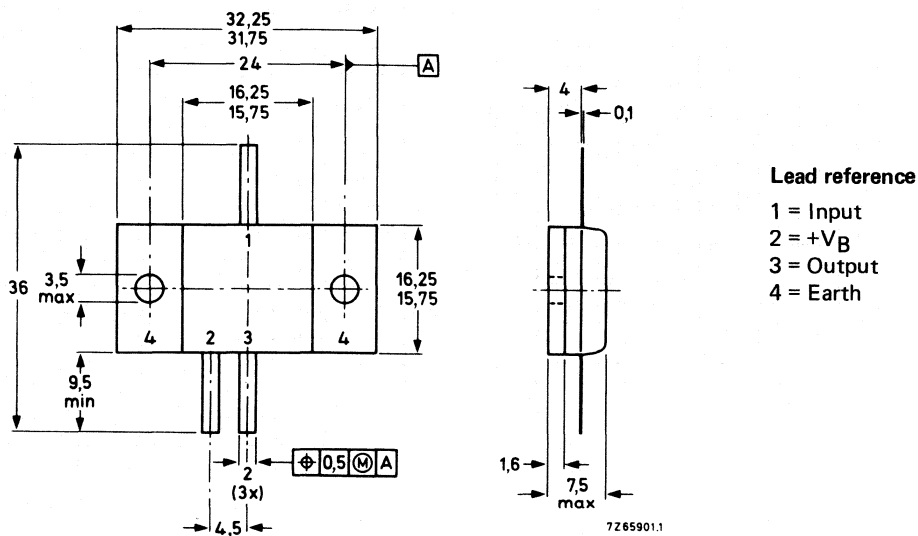
QUICK REFERENCE DATA

type number	mode of operation	freq. range MHz	V _B V	P _D W	P _L W	η %	Z _S = Z _L Ω
BGY23	c.w.	380 to 480	13,5	2,5	> 7,0	> 60	50
		380 to 480			typ. 8,3	typ. 71	
		480 to 512			typ. 7,5	typ. 69	
BGY23A	c.w.	420 to 480	12,5	2,5	> 7,0	> 60	50

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-75A.



To ensure good thermal contact between mounting base and heatsink, burrs or thickening at the edges of the heatsink holes should be removed and the package bolted down onto a flat surface.

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

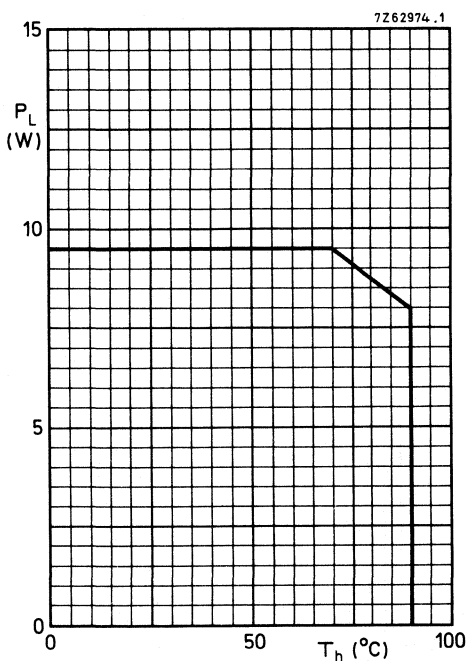
PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

BGY23 BGY23A

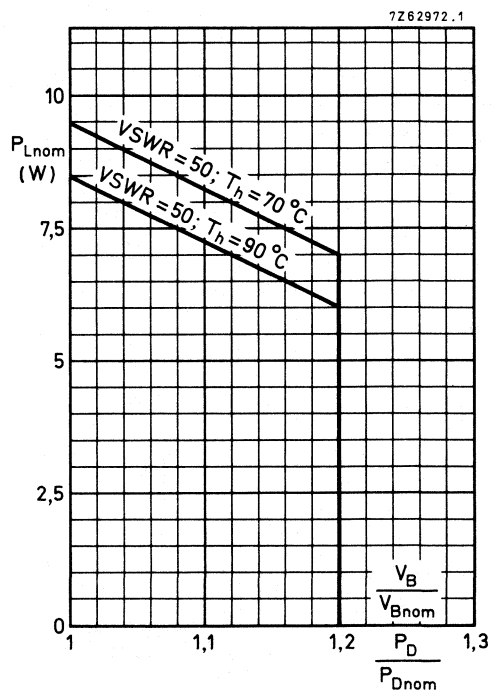
RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)
(with respect to flange)

Supply terminal	V_B	max.	18	V
Input terminal (no external d. c. connection)	$\pm V_I$	max.	0,5	V
Output terminal	$\pm V_O$	max.	25	V
Supply current (d. c.)	I_{tot}	max.	1,7	A
$V_B = 13,5$ V; $Z_L = 50 \Omega$	P_D	max.	3,5	W
Storage temperature	T_{stg}	-40 to +100		$^{\circ}\text{C}$
Operating heatsink temperature	T_h	max.	90	$^{\circ}\text{C}$

P_L for normal operation



P_L for fault condition



Where $P_{Lnom} = P_L$ at $V_B = 13,5$ V; $Z_L = 50 \Omega$ (BGY23)
and $P_{Lnom} = P_L$ at $V_B = 12,5$ V; $Z_L = 50 \Omega$ (BGY23A)

CHARACTERISTICS

$T_h = 25\text{ }^\circ\text{C}$ unless otherwise specified.

Reference planes at r. f. input and output terminals are 1 mm from the plastic encapsulation.

Frequency range 380-512 MHz; $V_B = 13,5\text{ V}$ (BGY23)

Frequency range 420-480 MHz; $V_B = 12,5\text{ V}$ (BGY23A)

Quiescent current

$P_D = 0$ $I_{BQ} < 5,0\text{ mA}$

Load power

$P_D = 2,5\text{ W}$; $f = 380\text{-}480\text{ MHz}$ BGY23 P_L 7,0 to 9,5 W

$P_D = 2,5\text{ W}$; $f = 480\text{-}512\text{ MHz}$ BGY23 P_L typ. 7,5 W

$P_D = 2,5\text{ W}$; $f = 420\text{-}480\text{ MHz}$ BGY23A P_L 7,0 to 9,5 W

Efficiency

$P_D = 2,5\text{ W}$ $\eta > 60\%$

Supply current

$P_D = 2,5\text{ W}$ I_{tot} typ. 900 mA

Harmonic content

$P_D = 2,5\text{ W}$ Any harmonic is at least 20 dB down relative to carrier

Input VSWR with respect to $50\ \Omega$

$P_D = 2,5\text{ W}$ VSWR < 2

Temperature coefficient of P_L

$P_D = 2,5\text{ W}$; $T_h = 25\text{ to }70\text{ }^\circ\text{C}$ typ. $-20\text{ mW}/^\circ\text{C}$

Stability

$V_B = 10,5\text{ V to }15\text{ V}$; $P_D = 1\text{ W to }3,5\text{ W}$

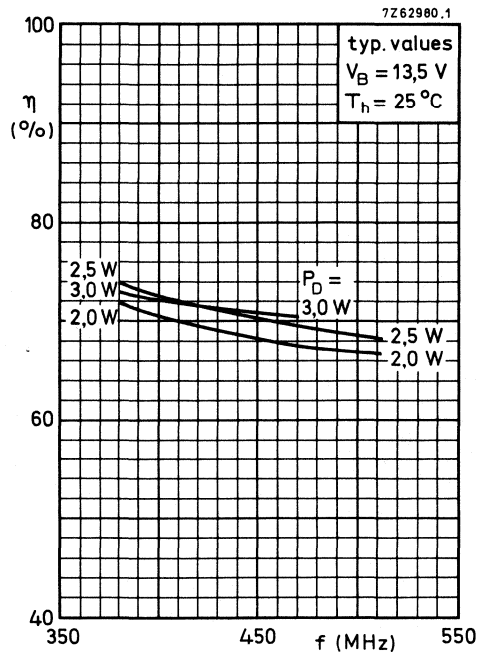
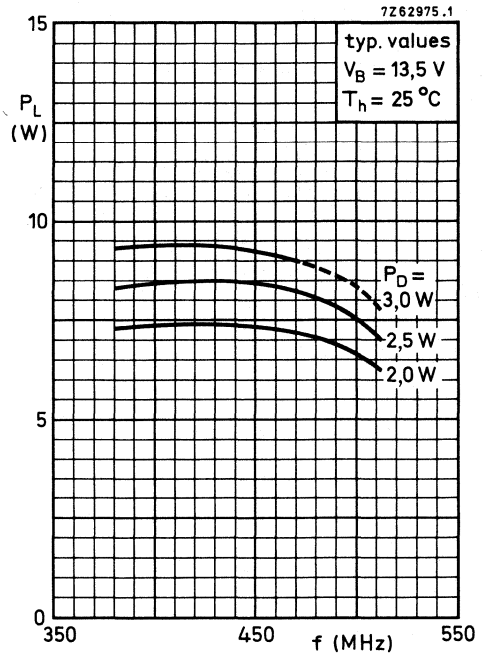
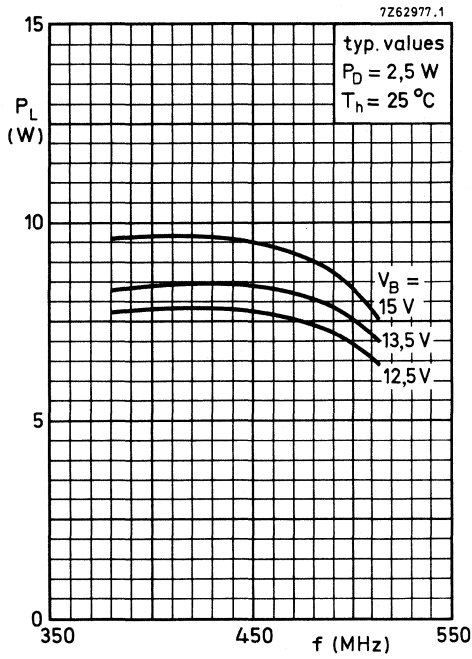
$T_h = -40\text{ }^\circ\text{C to }+90\text{ }^\circ\text{C}$

Output load VSWR ≤ 3 , all phases

Output load VSWR ≤ 10 , all phases

No instabilities
No appreciable
instabilities

**BGY23
BGY23A**



APPLICATION INFORMATION

R.F. performance in c.w. operation; $T_h = 25\text{ }^\circ\text{C}$

Drive source and load impedance $Z_S = Z_L = 50\ \Omega$

Type number	f (MHz)	V_B (V)	P_D (W)	P_L (W)	η (%)
BGY23	380 to 512	15,0	2,5	typ. 9,0	typ. 65
BGY23	380 to 480	13,5	2,5	> 7,0	> 60
BGY23	380 to 480	13,5	2,5	typ. 8,3	typ. 71
BGY23	480 to 512	13,5	2,5	typ. 7,5	typ. 69
BGY23	380 to 512	12,5	2,5	typ. 7,4	typ. 70
BGY23A	420 to 480	12,5	2,5	> 7,0	> 60

Connection of the BGY22/BGY22A to the BGY23/BGY23A respectively can be either by $50\ \Omega$ transmission line or directly with a total lead length not greater than 2 mm.

The modules are designed to withstand full load mismatch under the following conditions:

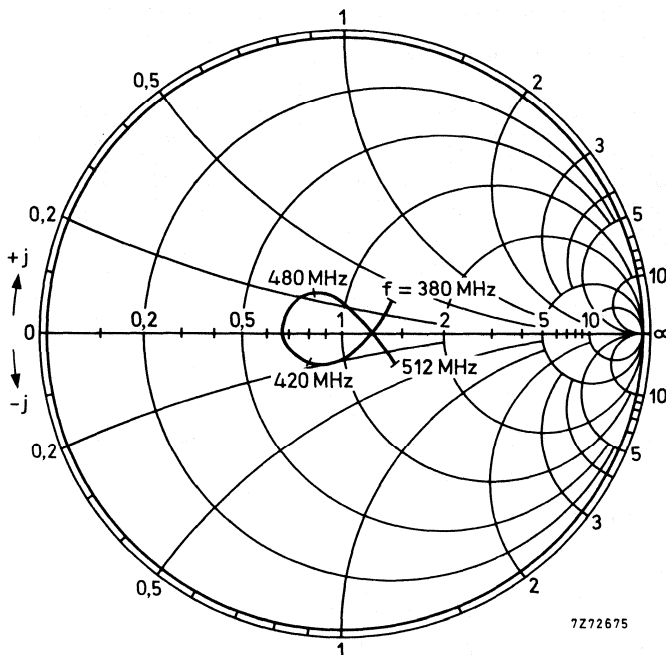
$$P_D = P_{Dnom} + 20\%; T_h = 70\text{ }^\circ\text{C}$$

$$V_B = 16,5\text{ V (BGY23)}$$

$$V_B = 15,0\text{ V (BGY23A)}$$

$$VSWR = 50\text{ at any phase}$$

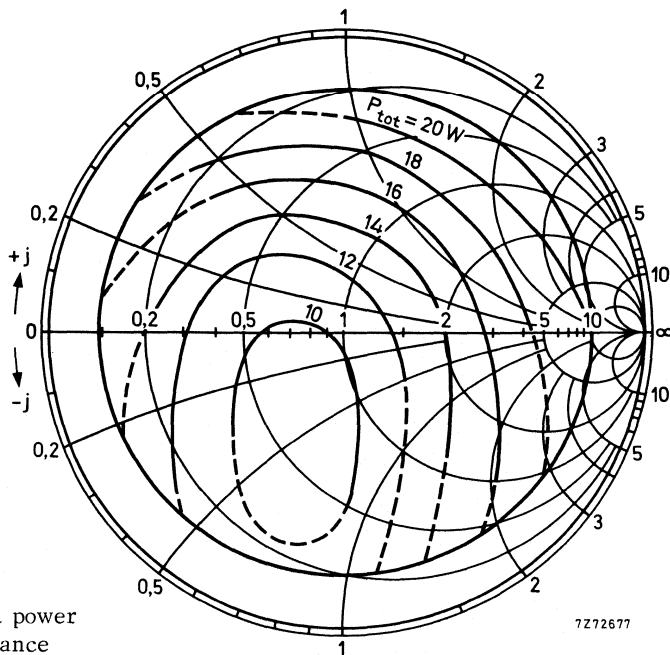
where $P_{Dnom} = P_D$ for 7,0 W module output under nominal conditions.



Typical variation of input impedance with frequency

7Z72675

$V_B = 13,5 \text{ V}$
 $f = 470 \text{ MHz}$



BGY22/23 or
BGY22A/23A
cascaded amplifier

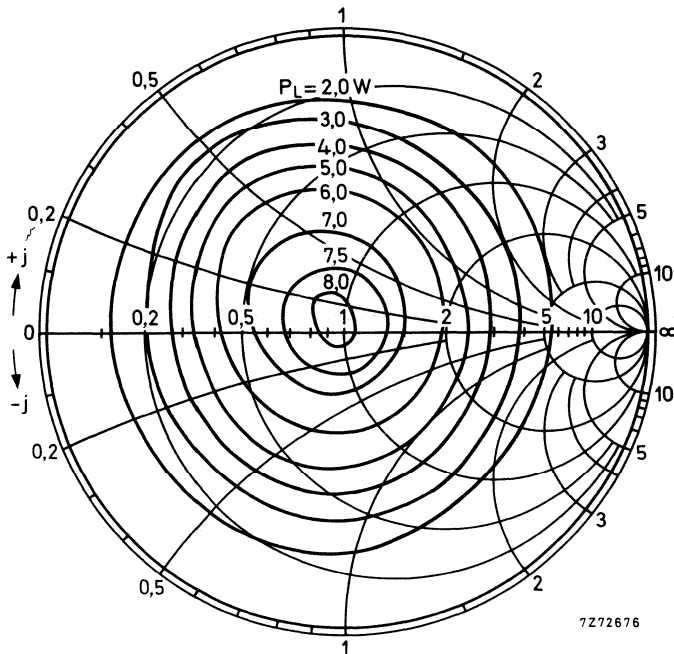
Typical variation of overall power dissipation with load impedance

7Z72677

$V_B = 13,5 \text{ V}$

$f = 470 \text{ MHz}$

BGY22/23 or
BGY22A/23A
cascaded amplifier

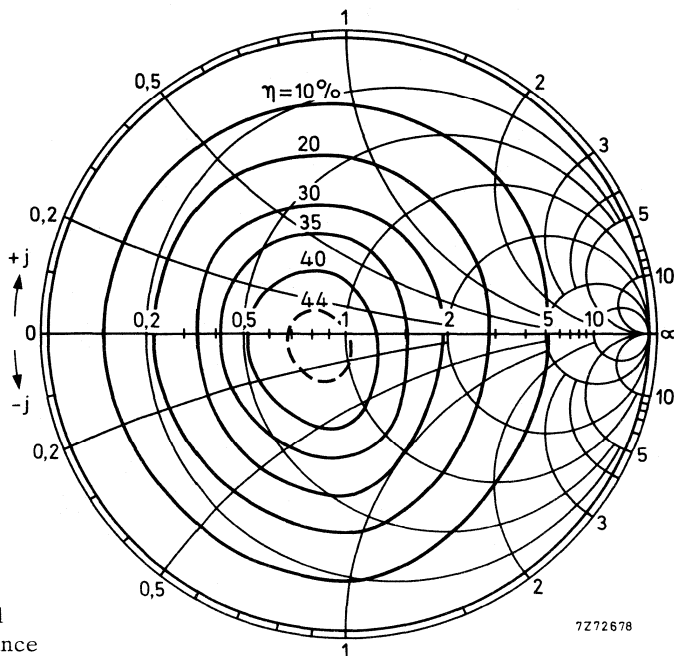


Typical variation of load power with load impedance

$V_B = 13,5 \text{ V}$

$f = 470 \text{ MHz}$

BGY22/23 or
BGY22A/23A
cascaded amplifier



Typical variation of overall efficiency with load impedance

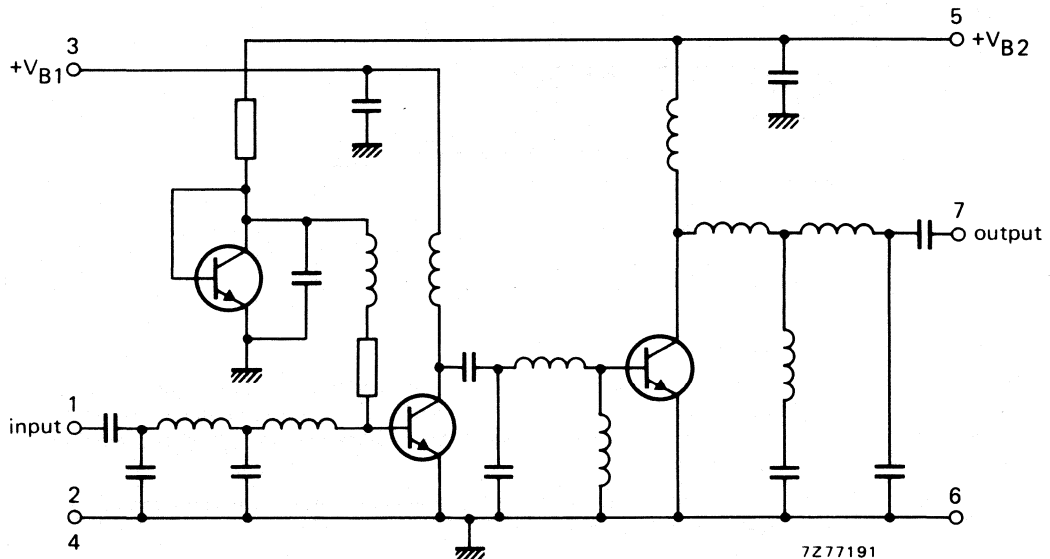
VHF POWER AMPLIFIER MODULES

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

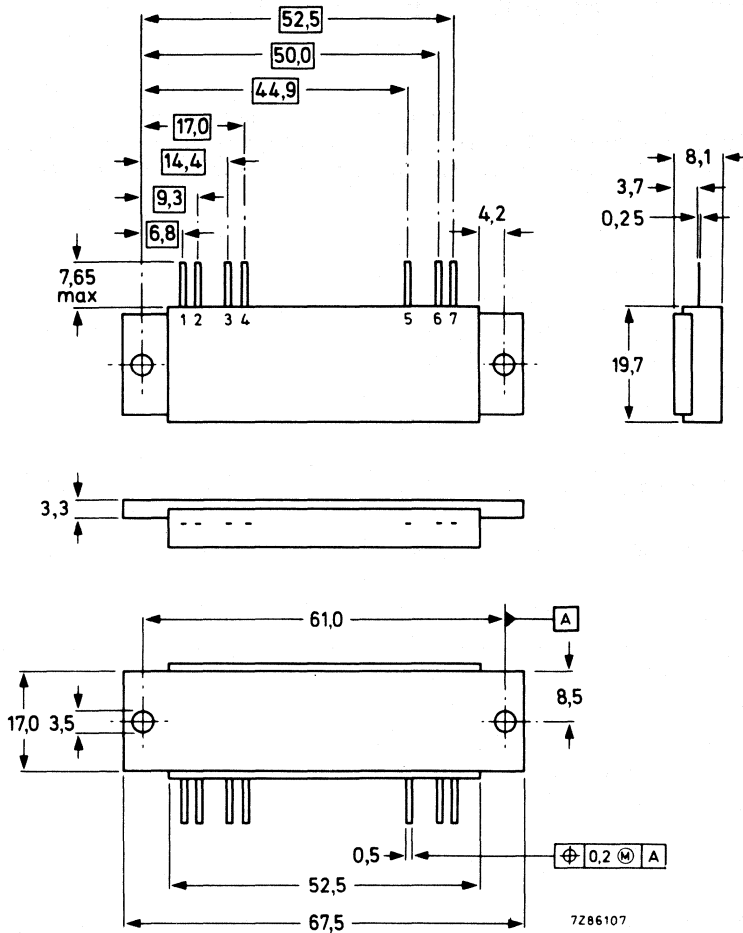


PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA

Fig. 1 SOT132B.

Dimensions in mm



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.

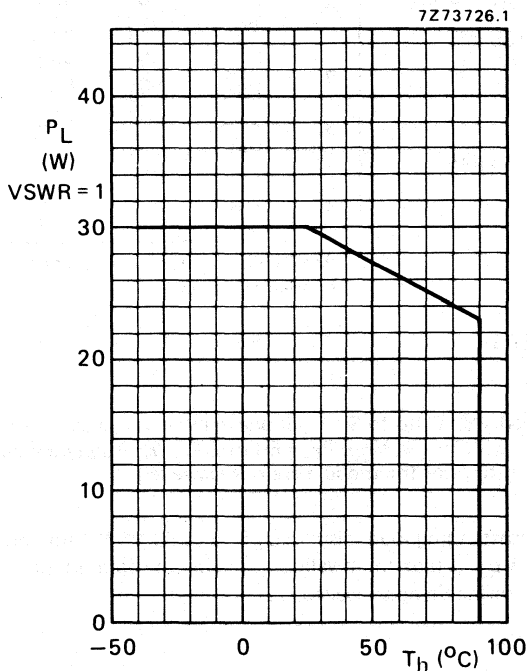
Devices may be soldered directly into a circuit with a soldering iron at maximum iron temperature of 245 °C for 10 seconds at least 1 mm from the plastic.

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

BGY32 BGY33
BGY35 BGY36

CHARACTERISTICS

$T_h = 25\text{ }^\circ\text{C}$

Quiescent current

$V_{B1} = V_{B2} = 12,5\text{ V}; P_D = 0;$

$R_S = R_L = 50\ \Omega$

		BGY32	BGY33	BGY35	BGY36
I_{BQ1}	typ	6	6	6	6 mA
I_{BQ2}	typ	13	13	13	13 mA
Frequency range	$f >$	68	80	132	148 MHz
	$f <$	88	108	156	174 MHz
Load power	$P_L >$	18	18	—	— W
		typ 23	22	—	— W
	$\eta >$	40	40	—	— %
		typ 50	50	—	— %
BGY35 and BGY36; $P_D = 150\text{ mW}$	$P_L >$	—	—	18	18 W
		typ —	—	22	21 W
	$\eta >$	—	—	40	40 %
		typ —	—	50	50 %

Frequency range

Load power

$V_{B1} = V_{B2} = 12.5\text{ V}; R_S = R_L = 50\ \Omega$

BGY32 and BGY33; $P_D = 100\text{ mW}$

BGY35 and BGY36; $P_D = 150\text{ mW}$

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: $V_{S1} = 6\text{ to }15\text{ V}; V_{S2} = 10\text{ to }15\text{ V}; V_{S1} \leq V_{S2}; P_D = 50\text{ to }200\text{ mW};$ 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

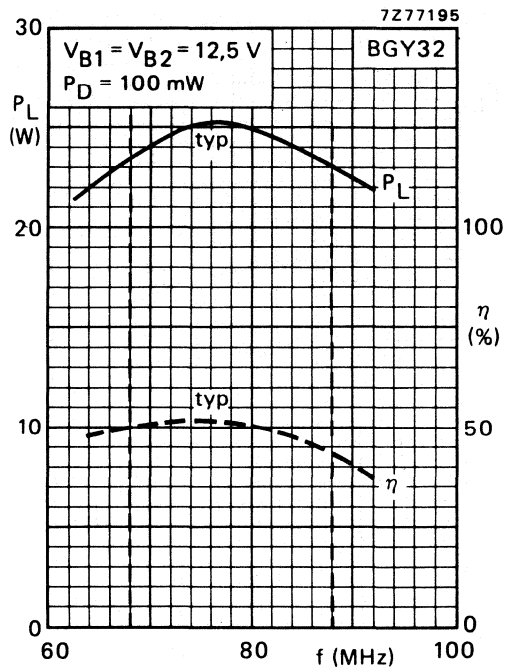
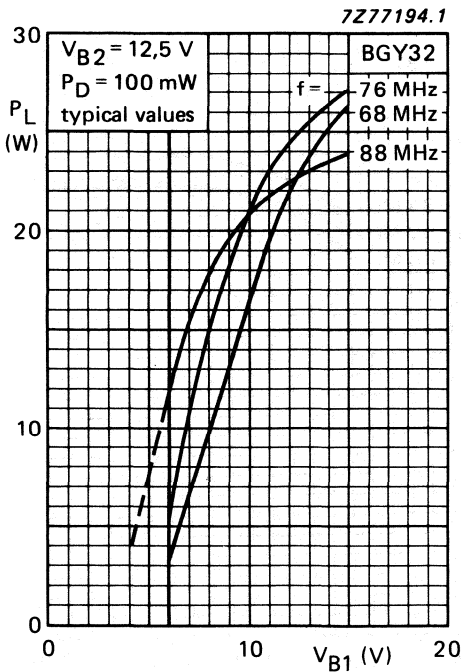
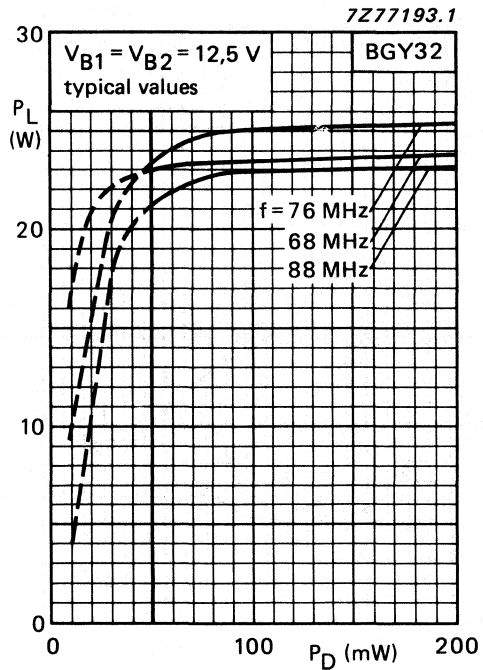
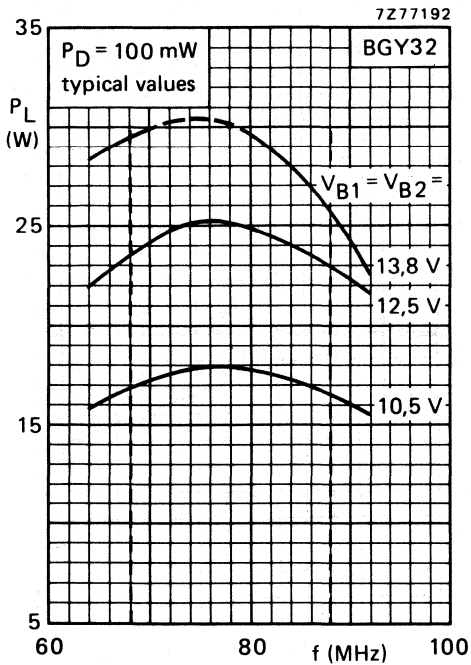
An electrolytic capacitor of 10 μF (25 V), in parallel with a polyester capacitor of 100 nF to earth, is recommended as decoupling arrangement for each power supply pin.

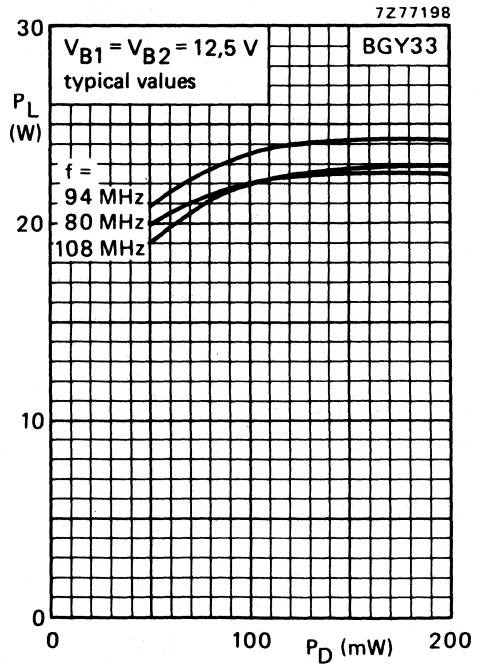
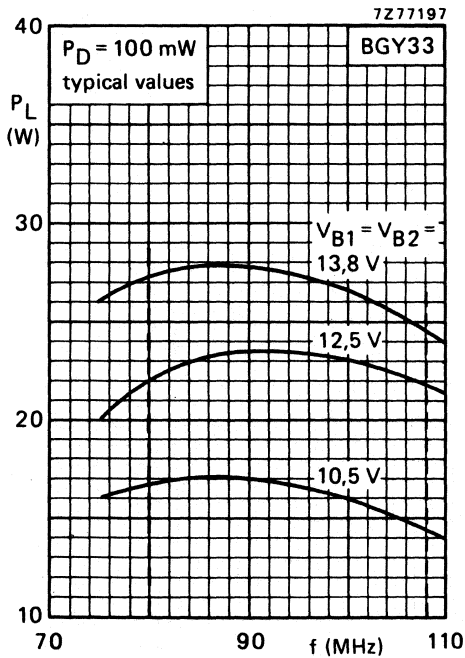
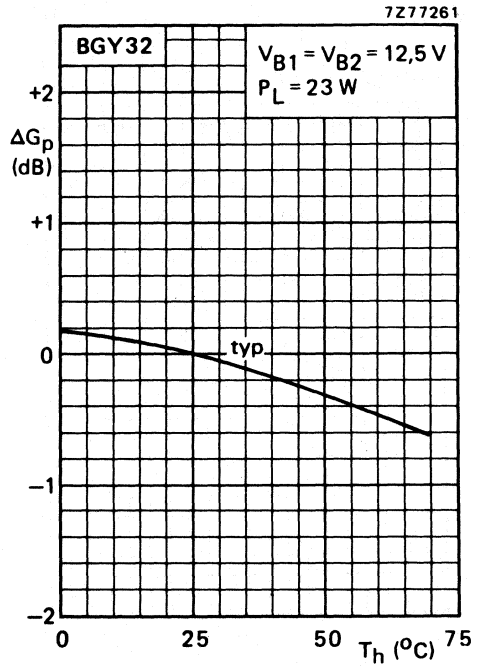
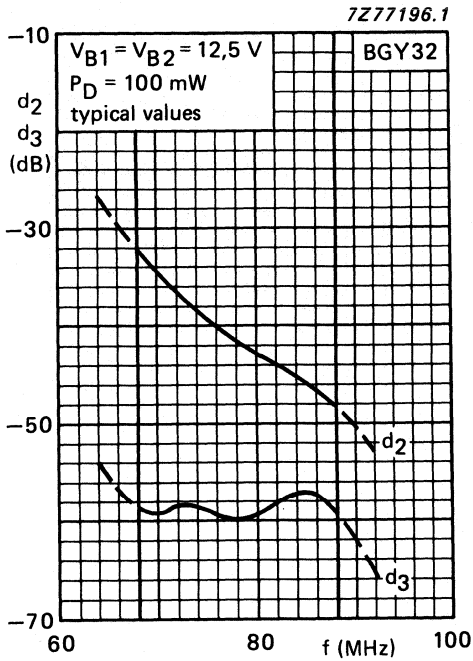
Power rating

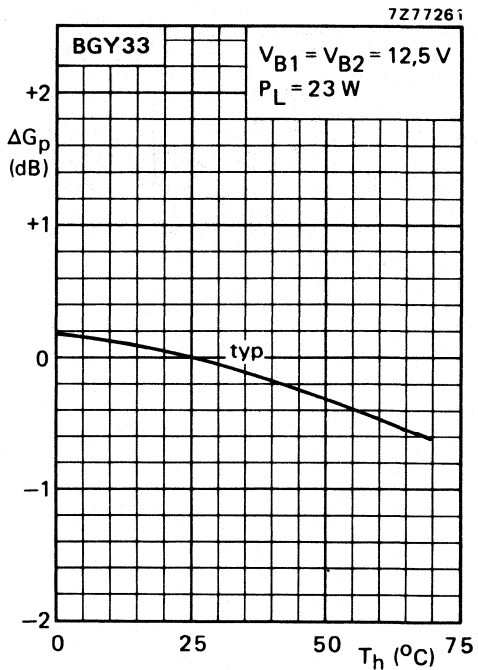
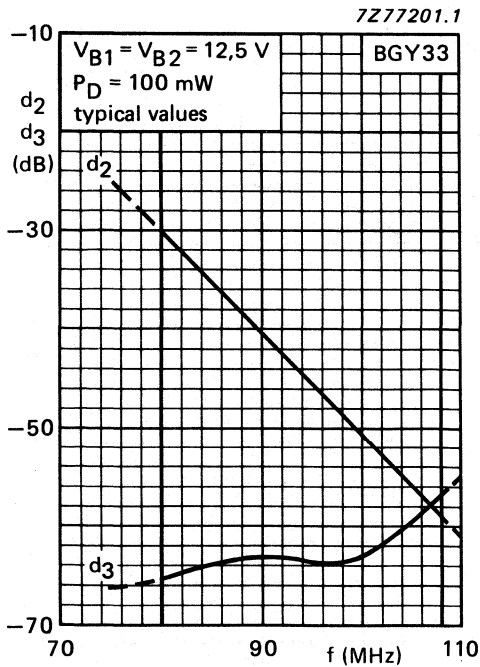
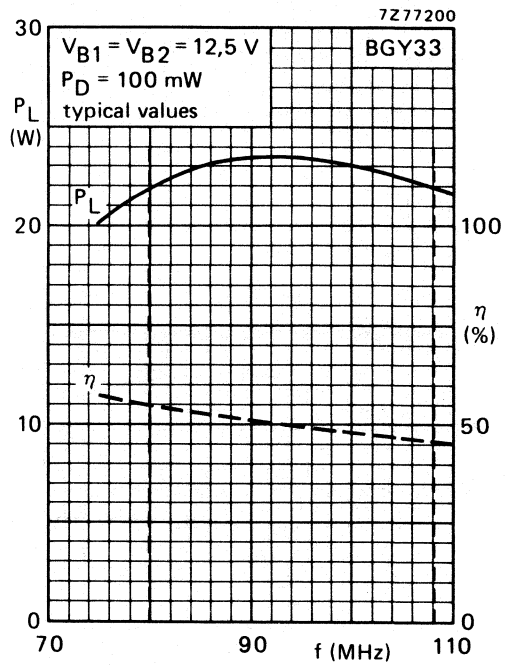
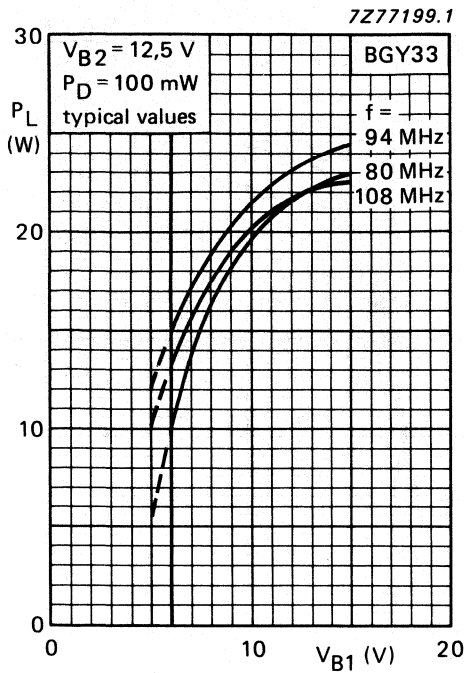
In general it is recommended that the output power from the module under nominal design conditions should not exceed 23 W in order to provide adequate safety margin under fault conditions.

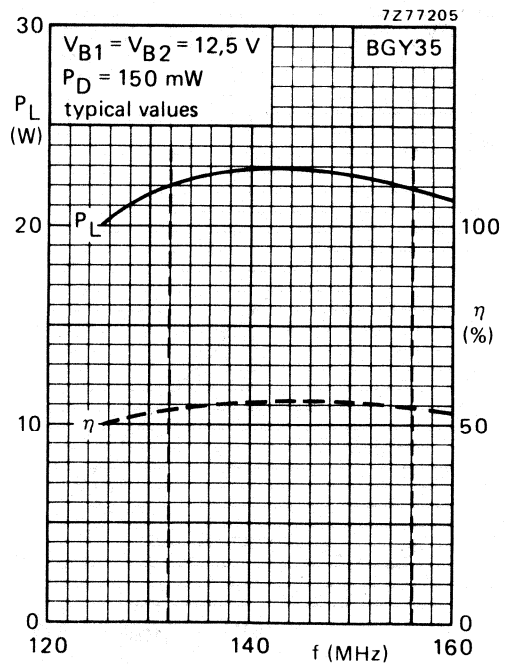
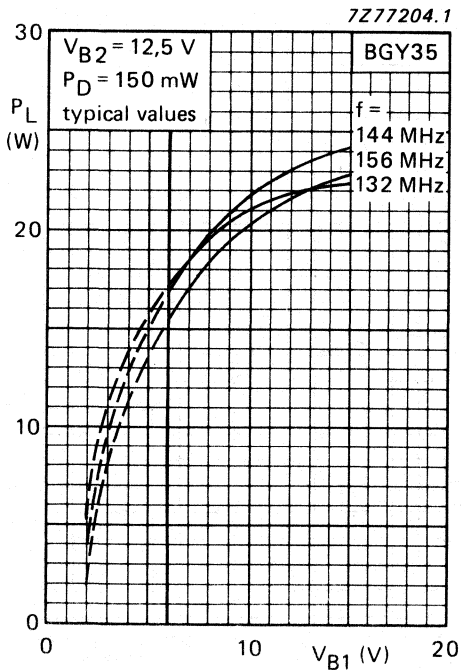
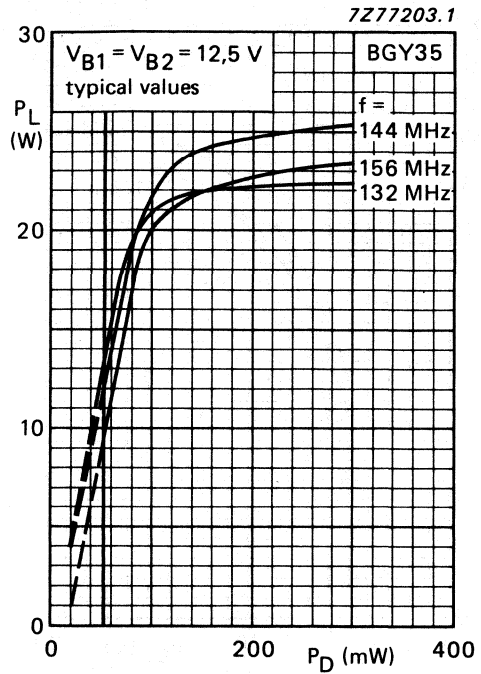
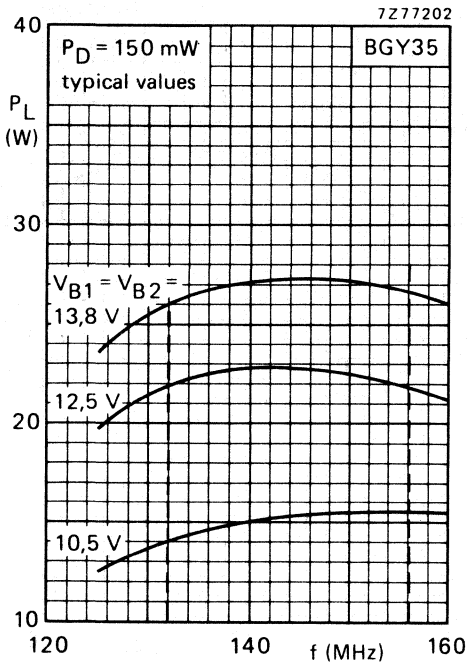
Output power control

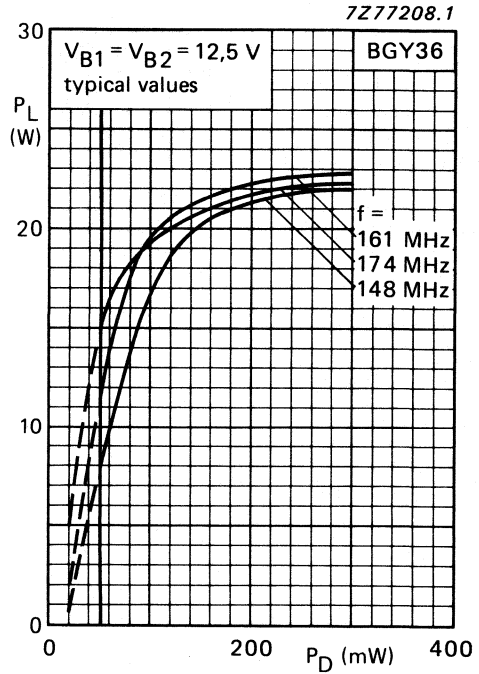
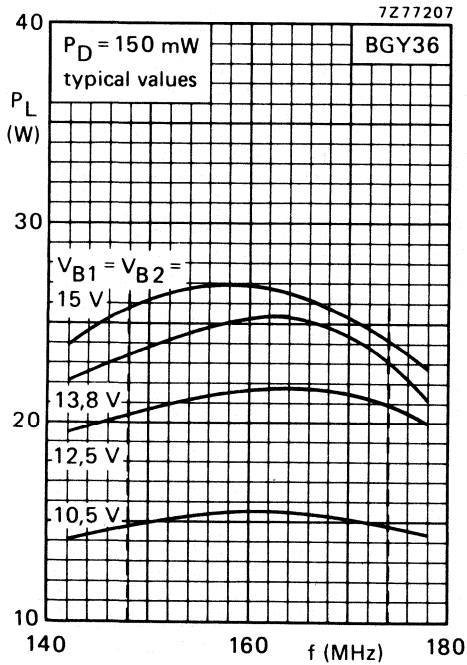
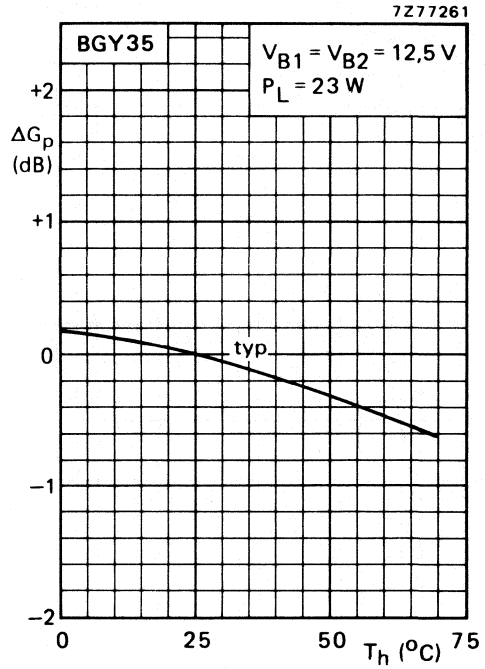
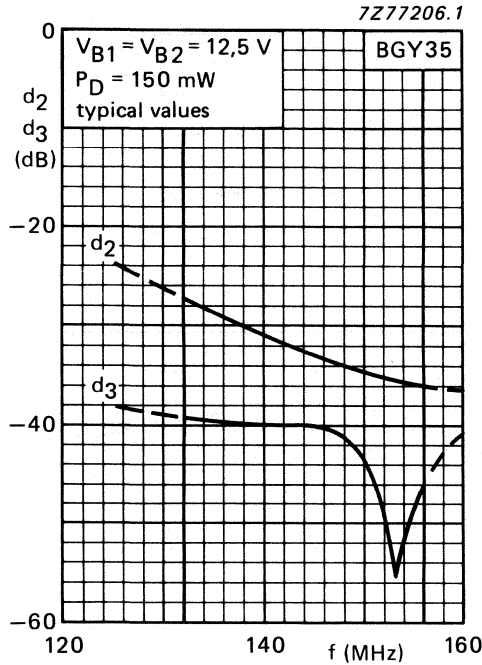
The module is not designed to be operated over a large range of output power levels. The purpose of the output power control is to set the nominal output power level. The preferred method of output power control is by varying the drive power between 50 and 200 mW. The next option is by varying V_{S1}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



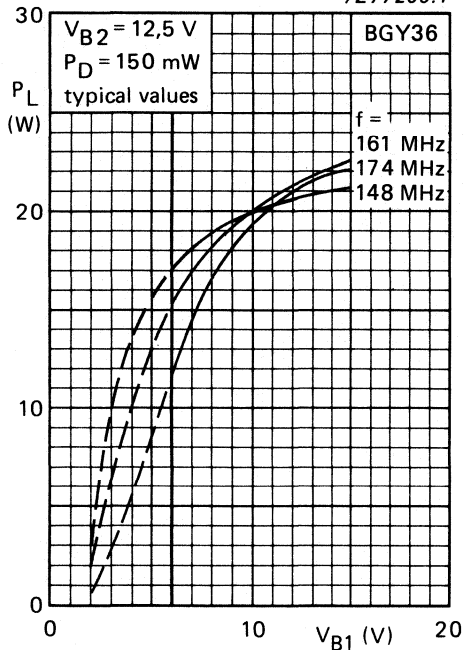




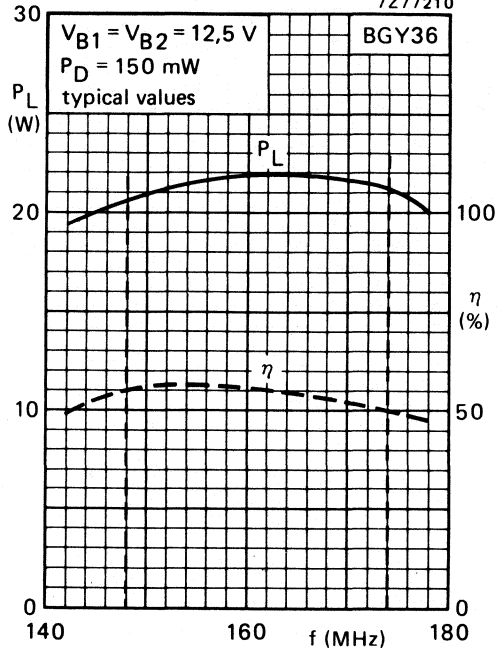




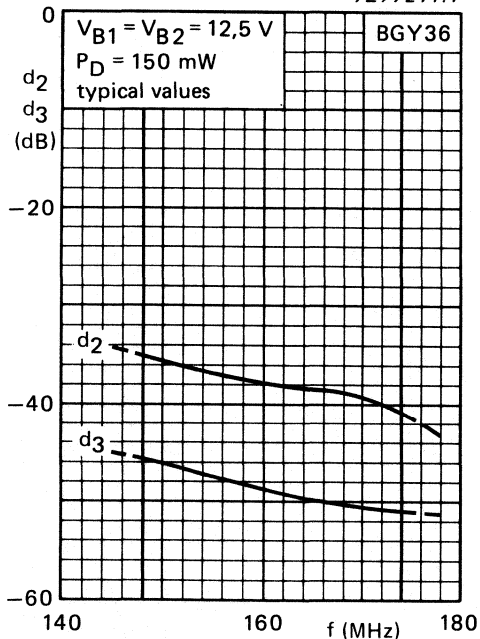
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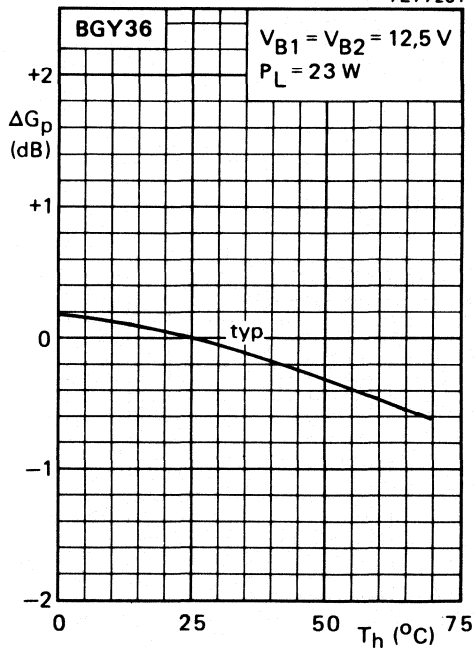
7277210



7277211.1



7277261



UHF POWER AMPLIFIER MODULES

A range of broadband UHF modules, primarily designed for mobile communication equipment, operating directly from 12 V electrical systems.

The BGY40,41 series produce minimum output powers of 7.5 W and 13 W respectively in the UHF communications bands, the 'A' types covering 400 to 440 MHz and the 'B' types covering 440 to 470 MHz.

The modules consist of a three-stage RF amplifier using n-p-n 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			cw	
Supply voltages	V_{S1}, V_{S2}	nom.	12.5	V
Input impedance	Z_i	nom.	50	Ω
Output load impedance	Z_L	nom.	50	Ω

RF performance

		BGY40A	BGY41A	BGY40B	BGY41B	
Frequency of operation	f	400 to 440		440 to 470		MHz
Typical drive power	P_D	75	150	100	150	mW
Typical load power	P_L	11.5	15.6	10	15	W
Typical efficiency	η	40	40	40	40	%

MECHANICAL DATA (see Fig. 15)

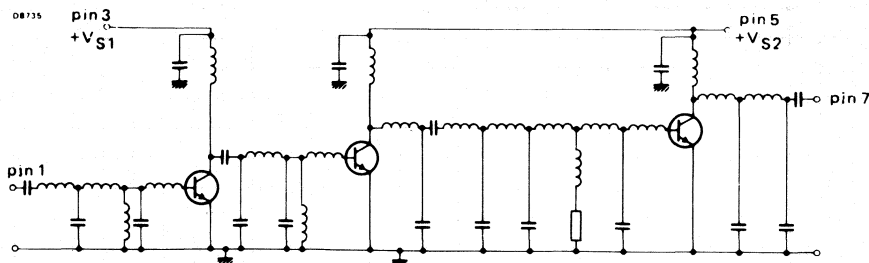


Fig. 1 Circuit of the UHF modules.

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	$\pm V_{in}$	max.	25	V
RF output terminal	$\pm V_{out}$	max.	25	V

Load power (see Fig.2)	BGY40A, 40B	P_L	max.	12	W
	BGY41A, 41B	P_L	max.	16.5	W
Input drive power	BGY40A, 40B	P_D	max.	150	mW
	BGY41A, 41B	P_D	max.	200	mW

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

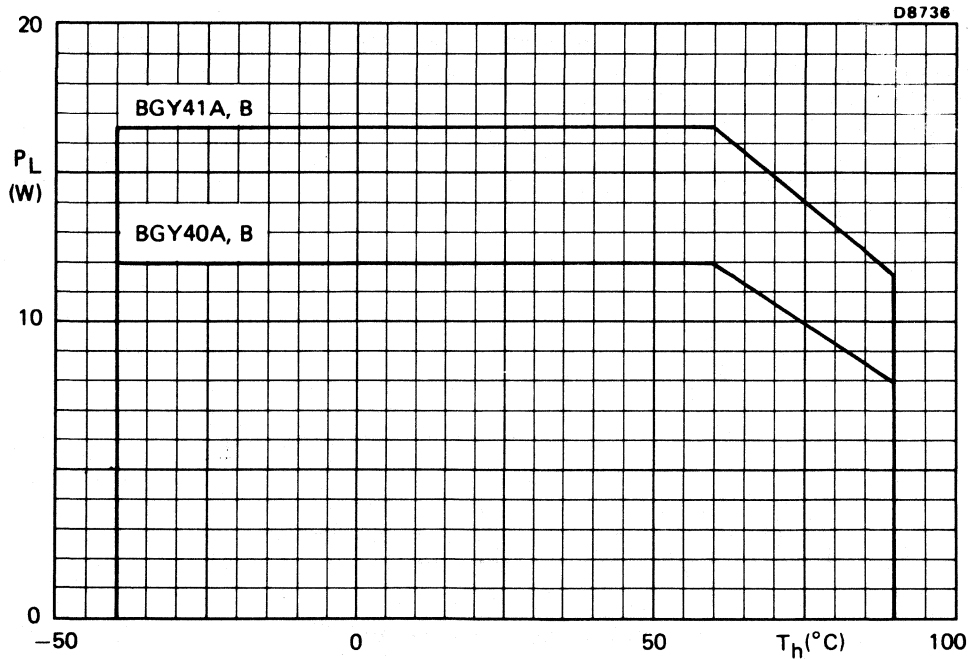


Fig.2 Load power derating; VSWR = 1

CHARACTERISTICS

$T_h = 25\text{ }^\circ\text{C}$ unless otherwise specified;

$V_{S1} = V_{S2} = 12.5\text{ V}$; $R_S = 50\ \Omega$; $R_L = 50\ \Omega$

		BGY40A	BGY41A	BGY40B	BGY41B	
Frequency of operation	f	400 to 440		440 to 470		MHz
Minimum load power	P_L	7.5	13	7.5	13	W
Nominal drive power	P_D	100	150	100	150	mW
Minimum efficiency	η	35	35	35	35	%
Typical load power	P_L	11.5	15.6	10	15	W
Typical drive power	P_D	75	150	100	150	mW
Typical efficiency	η	40	40	40	40	%

Harmonic output Any single harmonic will be at least 40 dB down from the carrier.

Input VSWR (with respect to 50 Ω) typ. 1.5

Stability

The modules are stable with load VSWR up to 3 (all phases) when operated within the following limits:

BGY40A, BGY40B	BGY41A, BGY41B
$P_D = 30$ to 150 mW	$P_D = 30$ to 200 mW
$V_{S1} = V_{S2} = 8$ to 16.5 V	$V_{S1} = V_{S2} = 8$ to 16.5 V
$P_L = 5$ to 12 W	$P_L = 5$ to 16.5 W

Ruggedness

The modules will withstand load VSWR of 50 (all phases) 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 $^\circ\text{C}$ for not more than 10 seconds at a distance of at least 1 mm from the plastic.

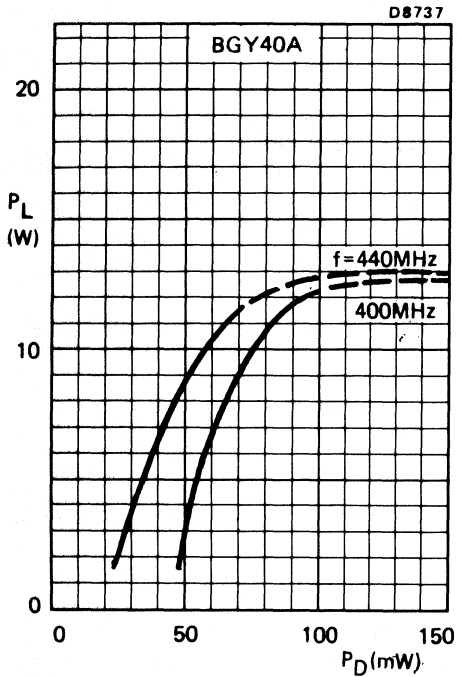


Fig.3 Typical values; $V_{S1} = V_{S2} = 12.5\text{ V}$

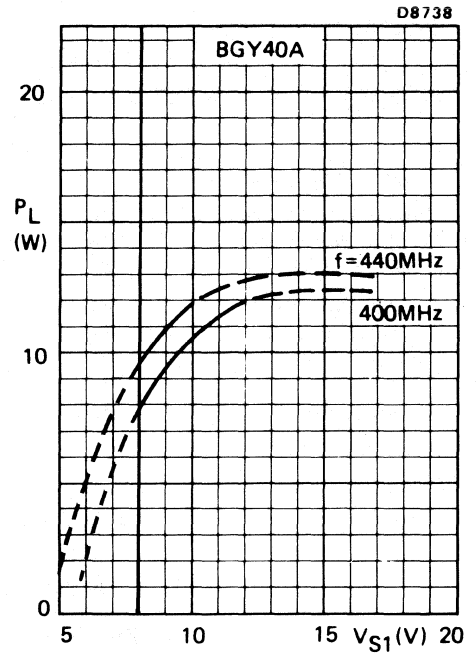


Fig.4 Typical values; $V_{S2} = 12.5\text{ V}$; $P_D = 100\text{ mW}$

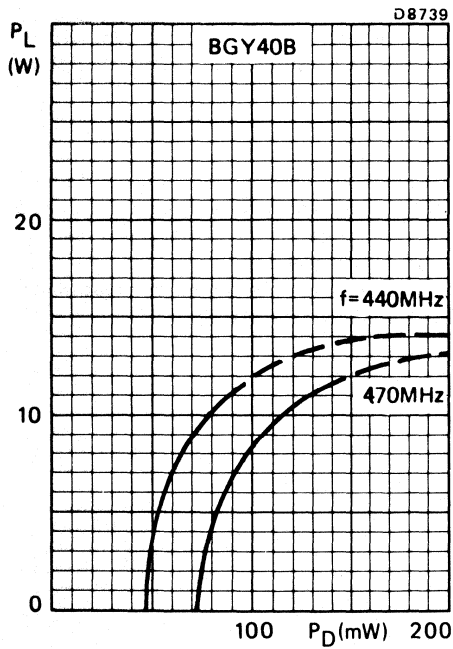


Fig.5 Typical values; $V_{S1} = V_{S2} = 12.5\text{ V}$

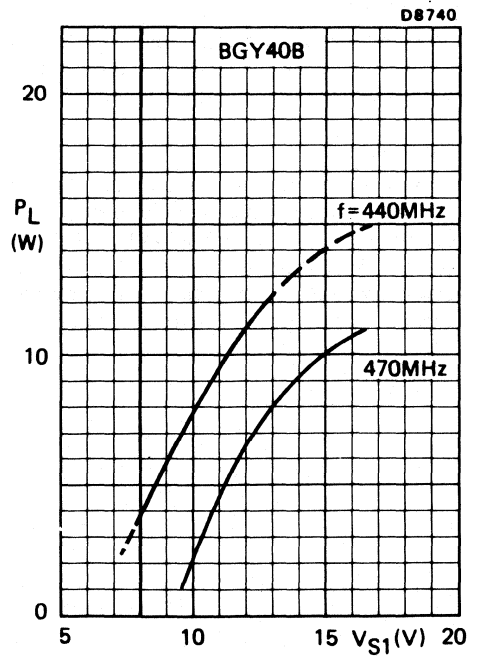


Fig.6 Typical values; $V_{S2} = 12.5\text{ V}$; $P_D = 100\text{ mW}$

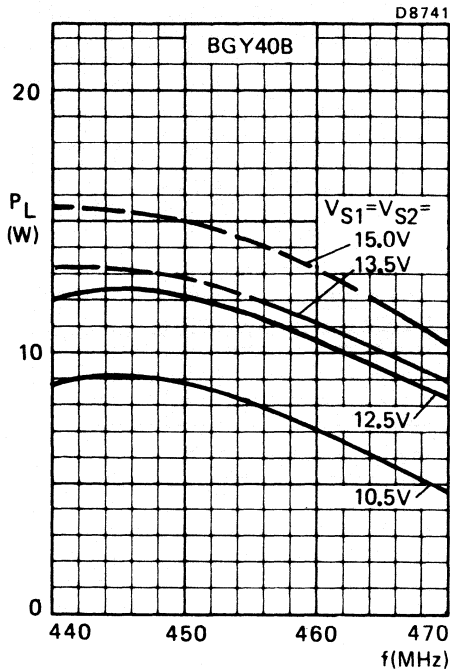


Fig.7 Typical values; $P_D = 100$ mW

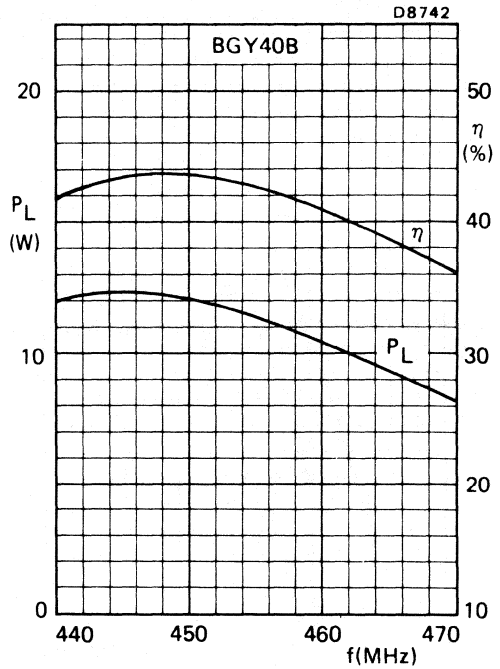


Fig.8 Typical values; $V_{S1} = V_{S2} = 12.5$ V;
 $P_D = 100$ mW

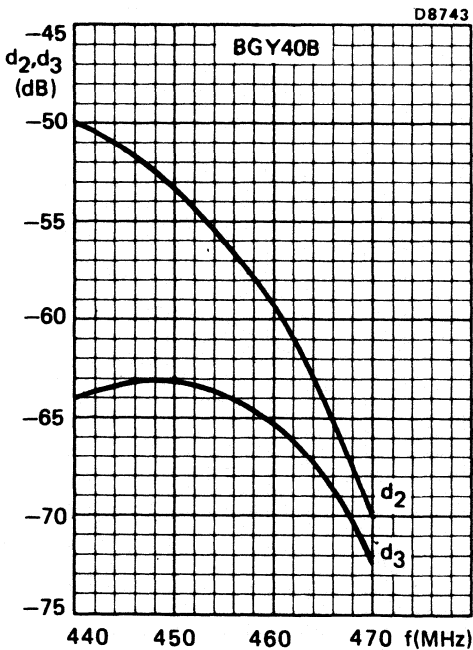


Fig.9 Typical values; $V_{S1} = V_{S2} = 12.5$ V;
 $P_D = 100$ mW

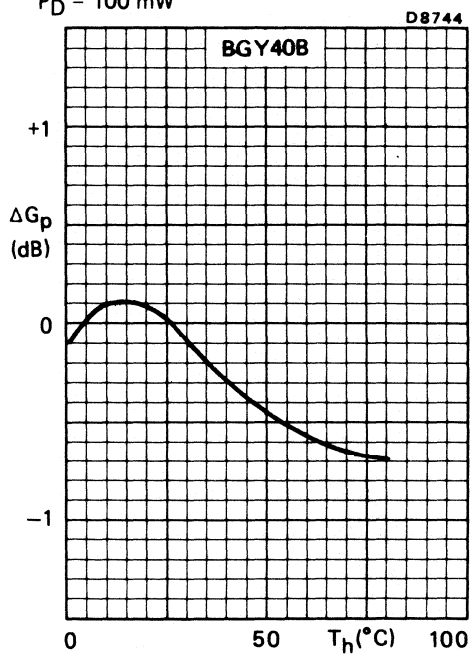


Fig.10 Typical values; $V_{S1} = V_{S2} = 12.5$ V;
 $P_D = 100$ mW

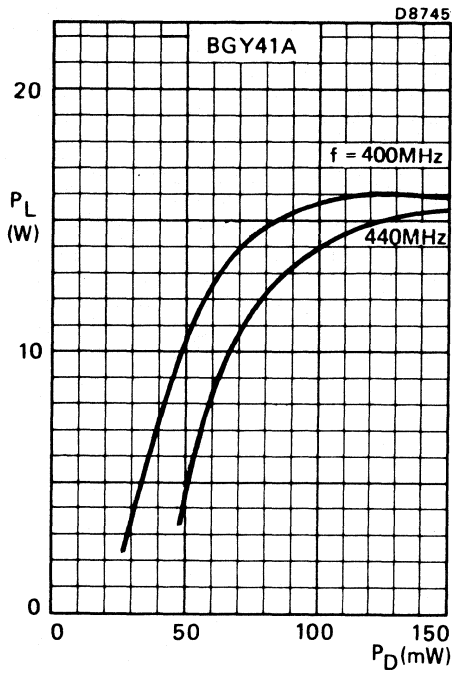


Fig.11 Typical values; $V_{S1} = V_{S2} = 12.5$ V

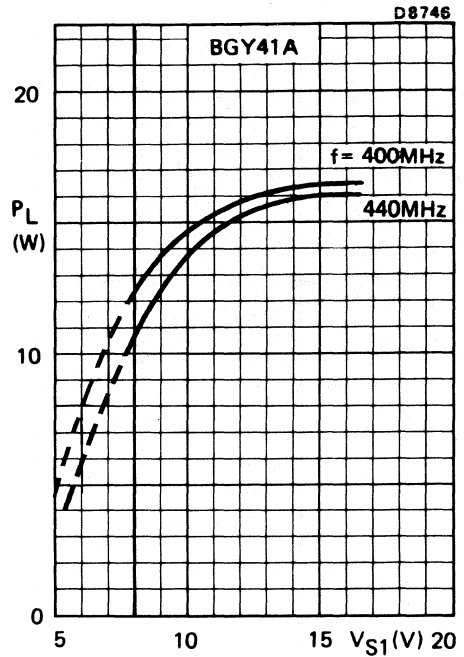


Fig.12 Typical values; $V_{S2} = 12.5$ V; $P_D = 150$ mW

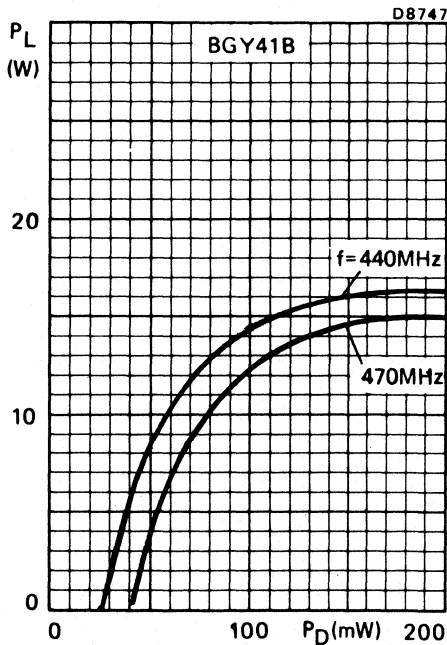


Fig.13 Typical values; $V_{S1} = V_{S2} = 12.5$ V

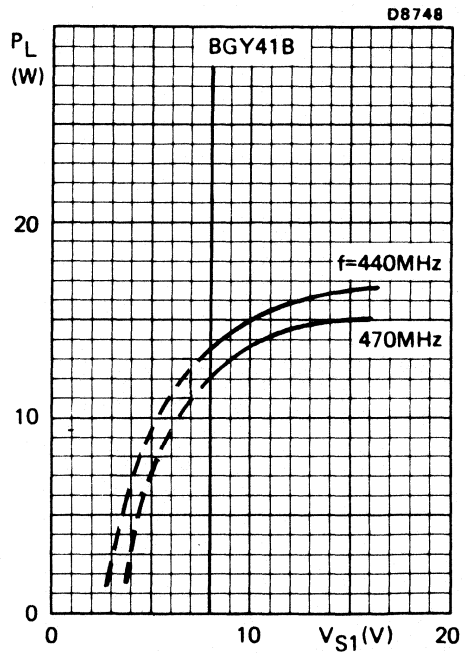
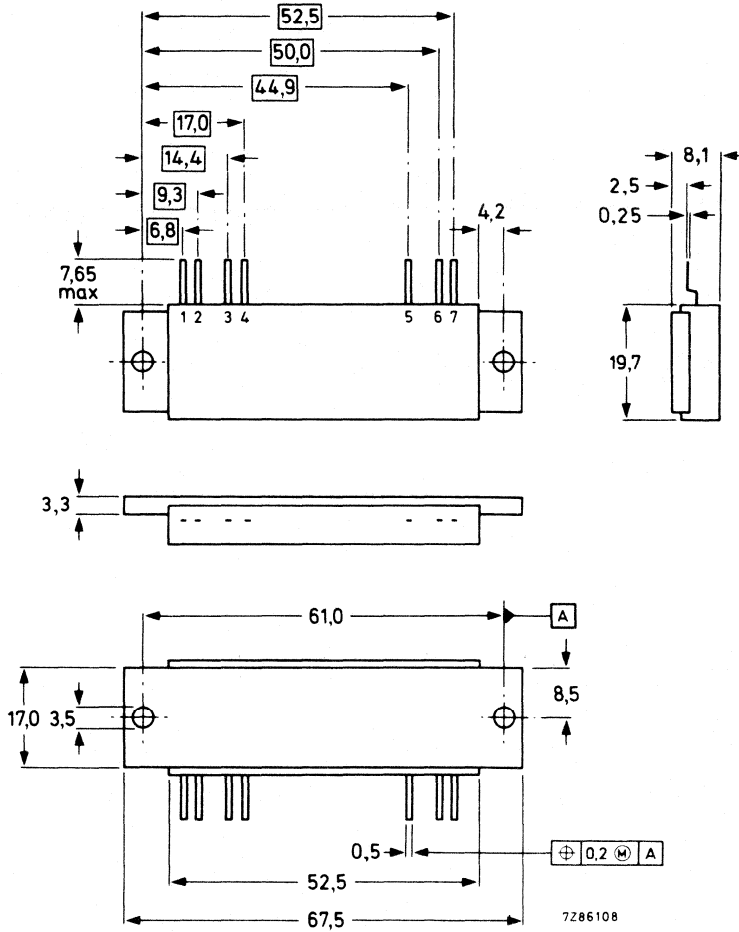


Fig.14 Typical values; $V_{S2} = 12.5$ V; $P_D = 150$ mW

MECHANICAL DATA

Fig. 15 SOT-132C.

Dimensions in mm



Lead reference

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

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)

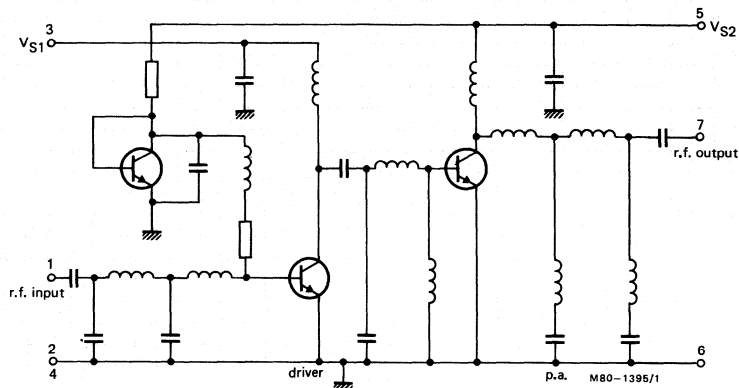


Fig. 1 Circuit of the VHF module.

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

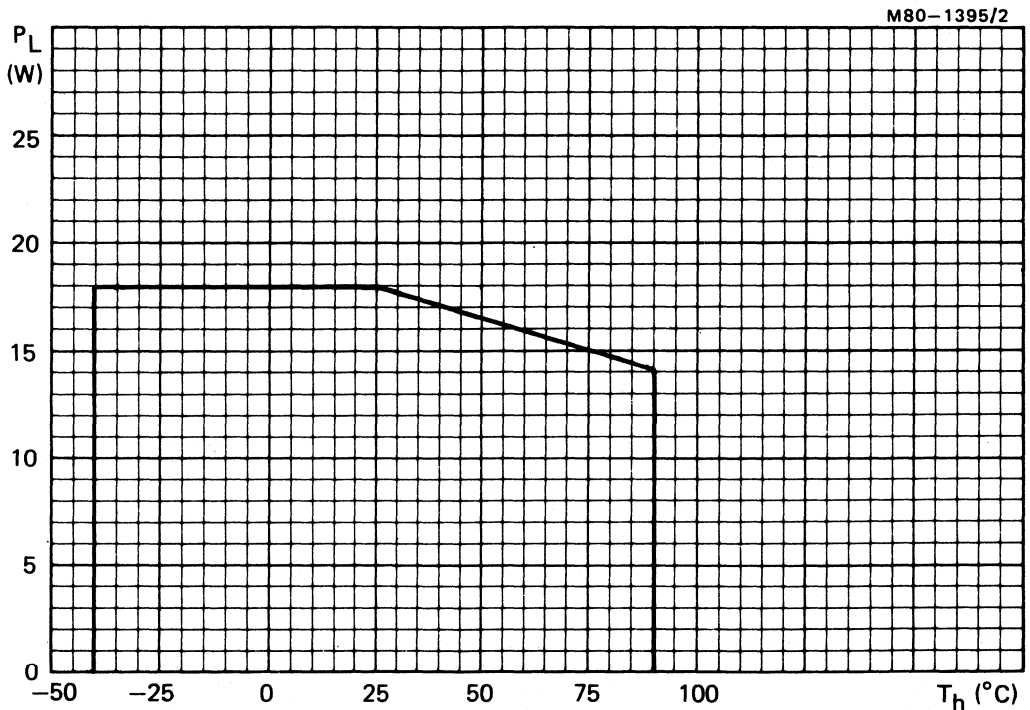


Fig.2 Load power derating; VSWR = 1

CHARACTERISTICS

$T_h = 25\text{ }^\circ\text{C}$ unless otherwise specified

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

Quiescent currents

$P_D = 0$	I_{Q1}	typ.	5	mA
	I_{Q2}	typ.	15	mA

RF drive power

$P_L = 13\text{ W}$	P_D	<	150	mW
	P_D	typ.	80	mW

Efficiency

$P_L = 13\text{ W}$	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
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Stability

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

$V_{S1} = V_{S2} = 10\text{ to }16.5\text{ V}$; $f = 148\text{ to }174\text{ MHz}$; $P_D = 30\text{ to }300\text{ mW}$; $P_L \leq 18\text{ W}$ (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 $^\circ\text{C}$ 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.

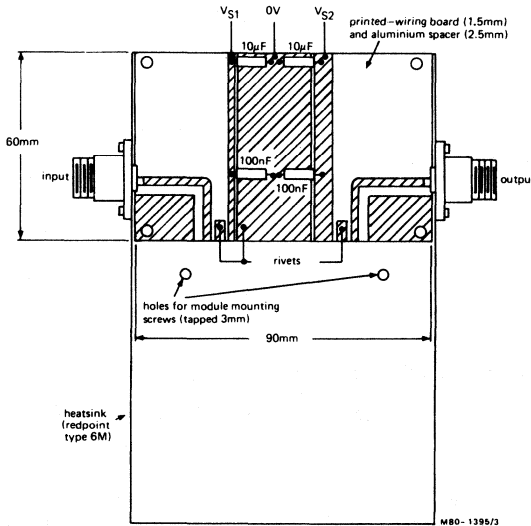


Fig.3 Test jig for VHF modules

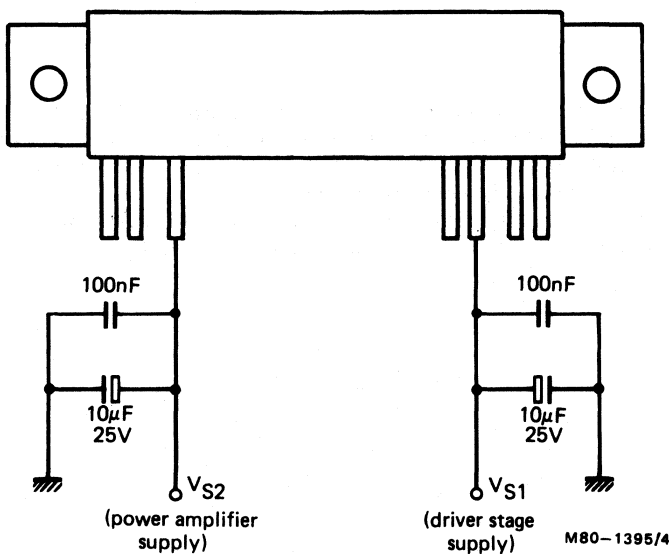


Fig.4 Recommended decoupling arrangement

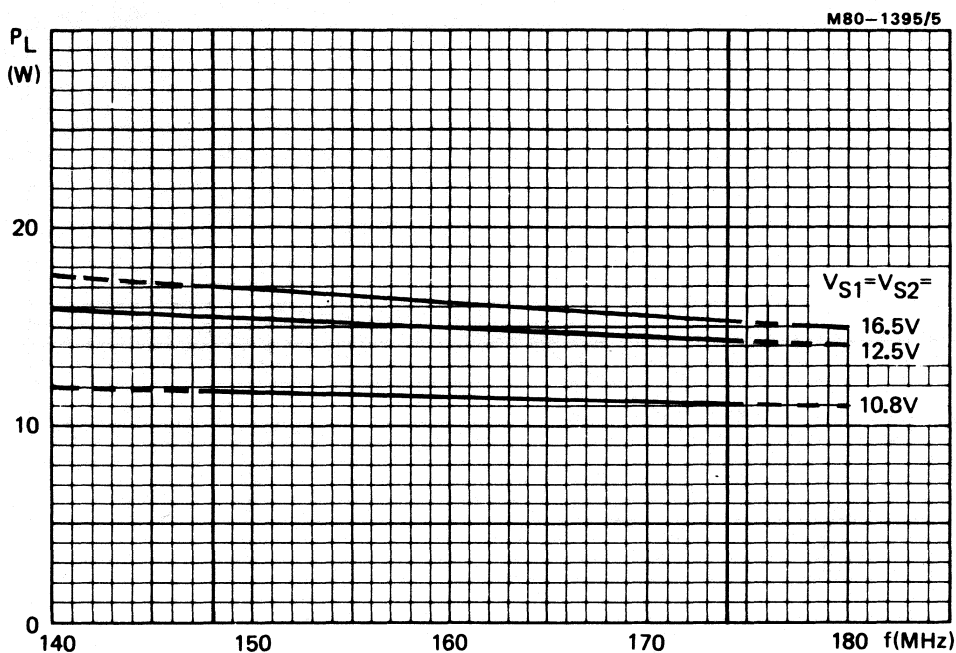


Fig.5 Typical values; $P_D = 150 \text{ mW}$

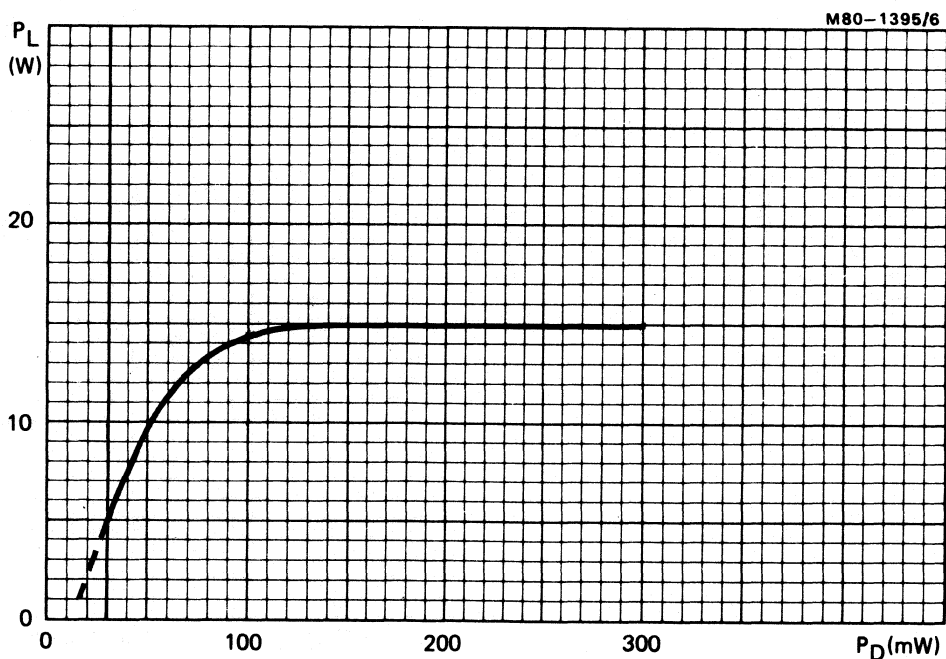


Fig.6 Typical values; $V_{S1} = V_{S2} = 12.5 \text{ V}$; $f = 160 \text{ MHz}$

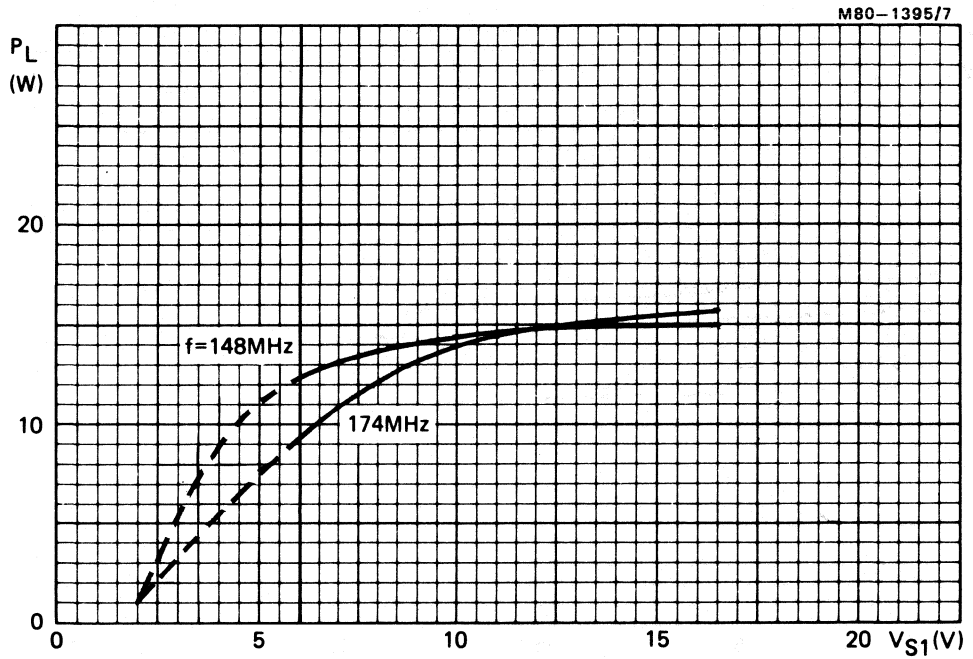


Fig.7 Typical values; $V_{S2} = 12.5$ V; $P_D = 150$ mW

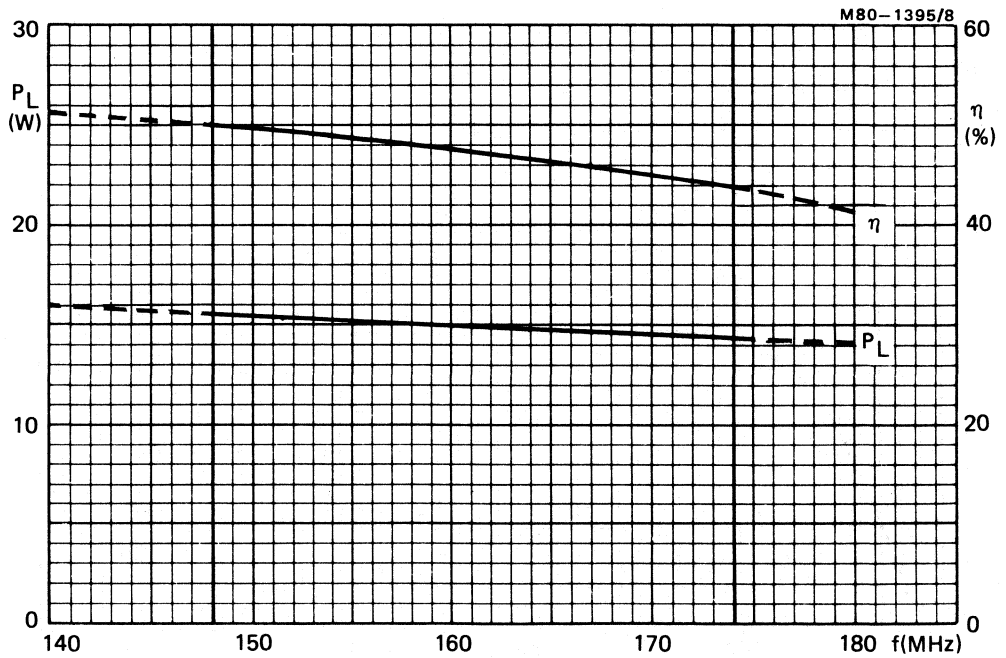


Fig.8 Typical values; $V_{S1} = V_{S2} = 12.5$ V; $P_D = 150$ mW

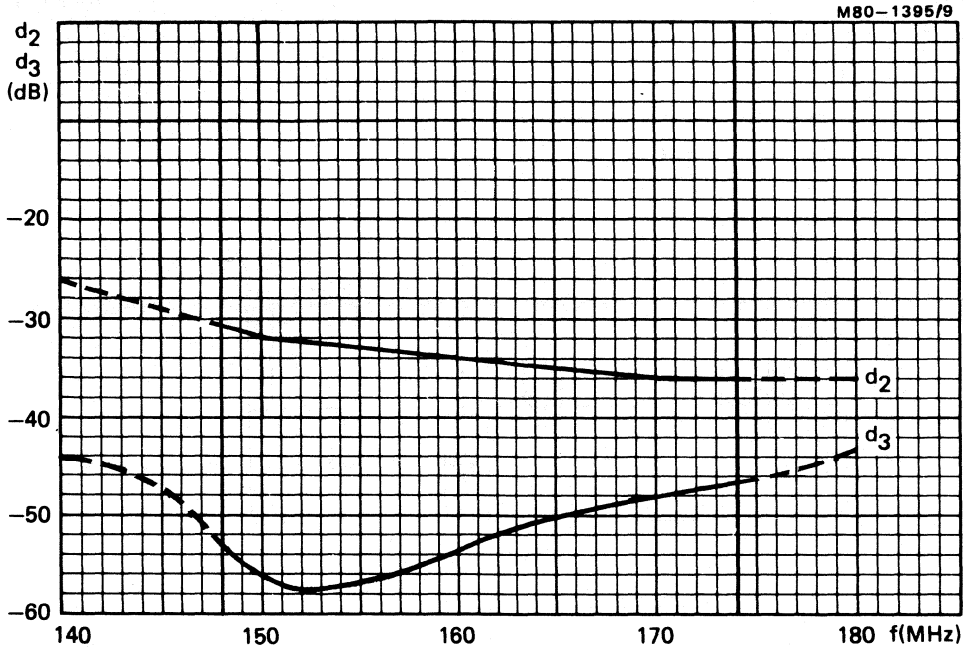
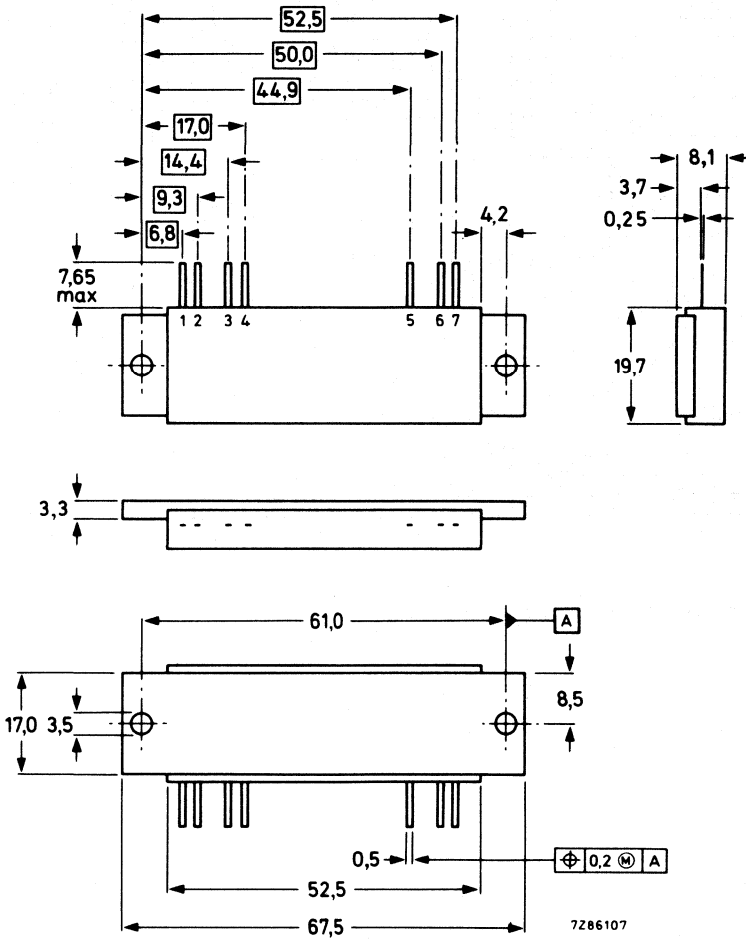


Fig.9 Typical values; $V_{S1} = V_{S2} = 12.5 \text{ V}$; $P_D = 150 \text{ mW}$

MECHANICAL DATA

Fig. 10 SOT-132B.

Dimensions in mm



Lead reference

- 1 = Input
- 2 = Earth
- 3 = VS1
- 4 = Earth
- 5 = VS2
- 6 = Earth
- 7 = Output

VHF BROADBAND POWER MODULE

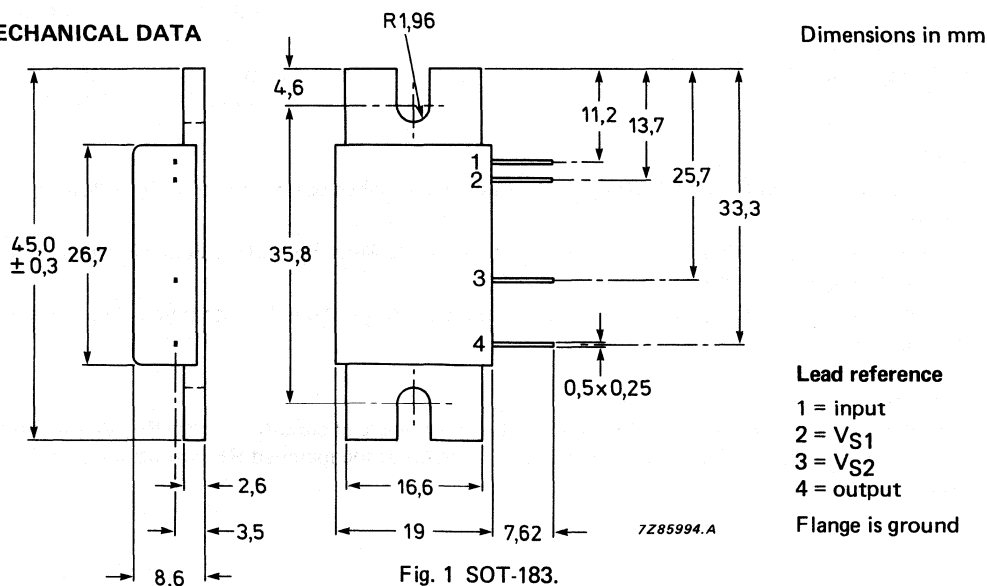
VHF broadband power amplifier module primarily designed for mobile communications equipment, operating directly from 12.5 V systems. The module will produce a minimum output of 29 W into a 50 Ω load over the frequency range of 68 to 88 MHz.

The module consists of a two-stage 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		CW	
Frequency range			68 to 88 MHz
DC supply voltage (terminal 1)	V _{S1}		12.5 V
DC supply voltage (terminal 2)	V _{S2}		12.5 V
Drive power	P _D	typ.	50 mW
		max.	150 mW
Load power	P _L		29 W
Efficiency	η	typ.	40 %
Operating heatsink temperature	T _h	max.	90 °C

MECHANICAL DATA



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

RATINGS

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

DC supply voltages*	V_{S1}, V_{S2}	max.	15 V*
Input terminal voltage*	$\pm V_i$	max.	25 V*
Output terminal voltage*	$\pm V_o$	max.	25 V*
Load power	P_L	max.	40 W**
Drive power	P_D	max.	300 mW
Storage temperature range	T_{stg}		-40 to + 100 °C
Operating temperature	T_h	max.	90 °C

CHARACTERISTICS

$V_{S1} = V_{S2} = 12.5 \text{ V}; Z_S = Z_L = 50 \Omega; T_h = 25 \text{ °C}$

Quiescent currents

$P_{DR} = 0$	I_{Q1}	typ.	10 mA
	I_{Q2}	typ.	25 mA
		max.	35 mA
Frequency range	f		68 to 88 MHz
Efficiency $P_L = 29 \text{ W}$	η	min.	37 %
		typ.	40 %
RF drive power $P_L = 29 \text{ W}$	P_D	typ.	50 mW
		max.	150 mW
Second harmonic rejection $P_L = 29 \text{ W}$		typ.	45 dB
		min.	30 dB
Input VSWR with respect to 50 Ω		typ.	1.5 : 1
		max.	2.0 : 1

Stability

The module is stable with load VSWR up to 3 : 1 (all phases) when operated within the following conditions:

$V_{S1} = 6 \text{ to } 15 \text{ V}; V_{S2} = 10 \text{ to } 15 \text{ V}; V_{S1} \leq V_{S2}; f = 68 \text{ to } 88 \text{ MHz}; P_D = 30 \text{ to } 300 \text{ mW}$ provided the maximum ratings of the module are not exceeded.

The module should also be stable under no-drive conditions ($P_D = 0.0 \text{ mW}$) with nominal source and load impedance.

Ruggedness

The module will withstand load VSWR of 20 : 1 for short 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.

* With respect to the flange.

** See Fig. 2.

Mounting

To ensure good thermal transfer the module should be mounted onto a heatsink with a flat surface with heat-conducting compound sparingly applied between module and heatsink. Any burrs on the heatsink should be removed. The connectors may be soldered directly onto 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 35 W in order to provide adequate safety margins under fault conditions.

Output power control

The module is not designed to be operated over a large range of output power level. 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 30 and 200 mW. The next option is by varying V_{S1} between 6.0 and 12.5 V.

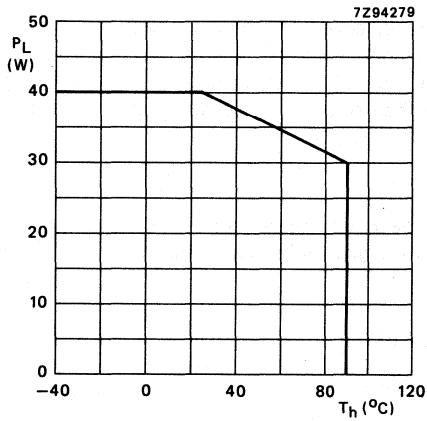


Fig. 2 Load power derating; VSWR = 1 : 1.

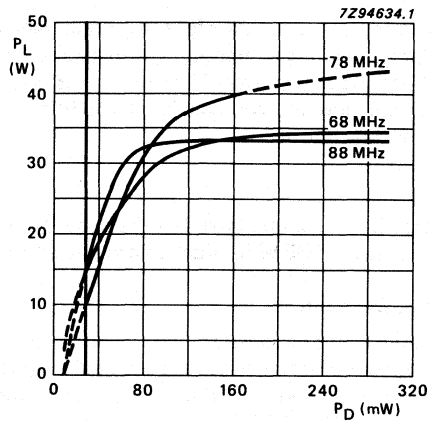


Fig. 3 Load power as a function of drive power; $V_{S1} = V_{S2} = 12.5$ V; $T_h = 25$ °C; typical values.

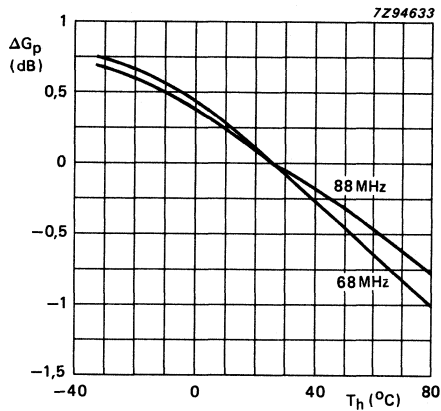


Fig. 4 Power gain as a function of temperature; $P_D = 150$ mW; $V_{S1} = V_{S2} = 12.5$ V; typical values.

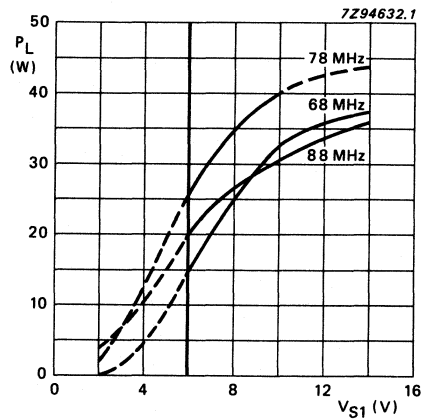


Fig. 5 Load power as a function of supply voltage V_{S1} ; $P_D = 150$ mW; $V_{S2} = 12.5$ V; typical values.

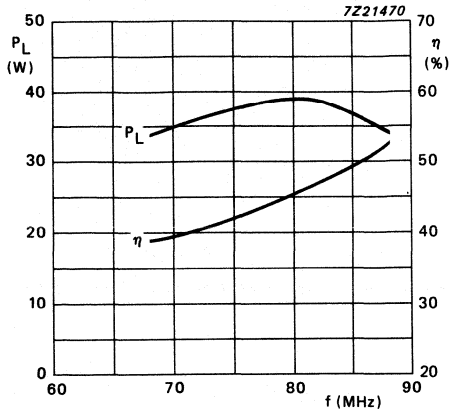


Fig. 6 Load power as a function of frequency; $V_{S1} = V_{S2} = 12.5$ V; $P_D = 150$ mW; typical values.

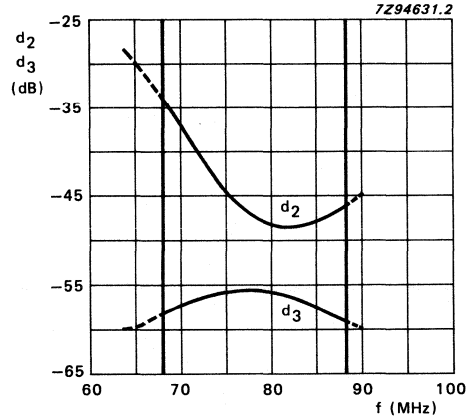


Fig. 7 Second and third harmonic distortions as a function of frequency; $V_{S1} = V_{S2} = 12.5$ V; $P_D = 150$ mW; typical values.

VHF BROADBAND POWER MODULE

VHF broadband power amplifier module primarily designed for mobile communications equipment, operating directly from 12.5 V systems. The module will produce a minimum output of 28 W into a 50 Ω load over the frequency range of 148 to 174 MHz.

The module consists of a two stage 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		CW
Frequency range		148 to 174 MHz
DC supply voltage (terminal 1)	V _{S1}	12.5 V
DC supply voltage (terminal 2)	V _{S2}	12.5 V
Drive power	P _D	typ. 150 mW
		max. 300 mW
Load power	P _L	28 W
Efficiency	η	typ. 45 %
Operating heatsink temperature	T _h	max. 90 °C

MECHANICAL DATA

Dimensions in mm

Lead reference

- 1 = Input
- 2 = V_{S1}
- 3 = V_{S2}
- 4 = Output

Flange is ground

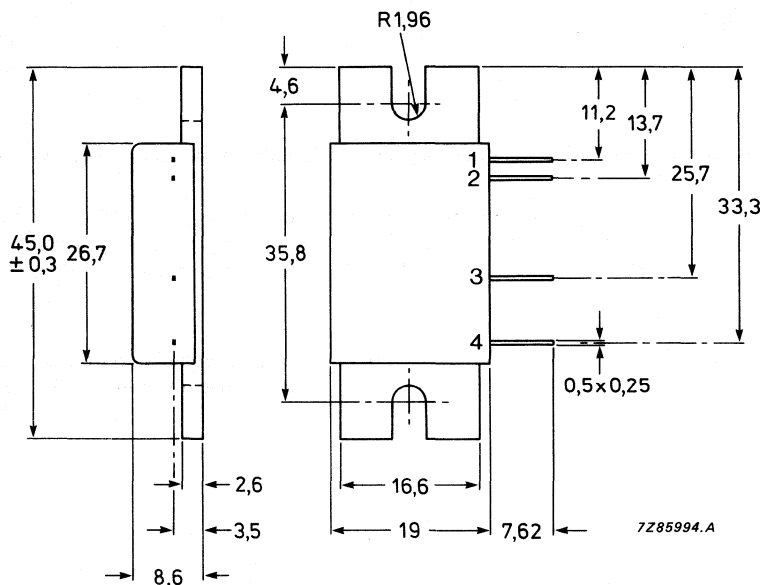


Fig. 1 SOT-183.

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

RATINGS

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

DC supply terminal voltages *	V_{S1}, V_{S2}	max.	15.5 V*
RF input voltage *	$\pm V_i$	max.	25 V*
RF output voltage*	$\pm V_o$	max.	25 V*
Load power	P_L	max.	40 W**
Drive power	P_D	max.	400 mW
Storage temperature range	T_{stg}		-40 to + 100 °C
Operating temperature	T_h	max.	90 °C

CHARACTERISTICS

$V_{S1} = V_{S2} = 12.5 \text{ V}; Z_S = Z_L = 50 \Omega; T_h = 25 \text{ °C}$

Quiescent currents

$P_D = 0$	I_{Q1}	typ.	10 mA
	I_{Q2}	typ.	25 mA
		max.	35 mA
Frequency range	f		148 – 174 MHz
Efficiency			
$P_L = 28 \text{ W}$	η	min.	40 %
		typ.	45 %
RF drive power			
$P_L = 28 \text{ W}$	P_D	max.	300 mW
		typ.	150 mW
Second harmonic rejection			
$P_L = 28 \text{ W}$		typ.	35 dB
		min.	30 dB
Input VSWR			
with respect to 50 Ω	VSWR	typ.	1.5 : 1
		max.	2.0 : 1

Stability

The module is stable with load VSWR up to 3 : 1 (all phases) when operated within the following conditions:

$V_{S1} = 6 \text{ to } 15.5 \text{ V}; V_{S2} = 10 \text{ to } 15.5 \text{ V}; V_{S1}$ not to exceed $V_{S2}; f = 148 - 174 \text{ MHz};$

$P_D = 50 \text{ to } 400 \text{ mW}$ provided the maximum ratings of the module are not exceeded. The module should be stable also under no-drive conditions ($P_D = 0.0 \text{ mW}$) with nominal source and load impedance.

Ruggedness

The module will withstand load VSWR of 20 : 1 for short 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.

* With respect to the flange.

** See Fig. 2.

Mounting

To ensure good thermal transfer the module should be mounted onto a heatsink with a flat surface with heat-conducting compound sparingly applied between module and heatsink. Any burrs on the heatsink should be removed. The connectors may be soldered directly onto 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 35 W in order to provide adequate safety margins 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 50 and 300 mW. The next option is by varying V_{S1} between 6.0 and 12.5 V.

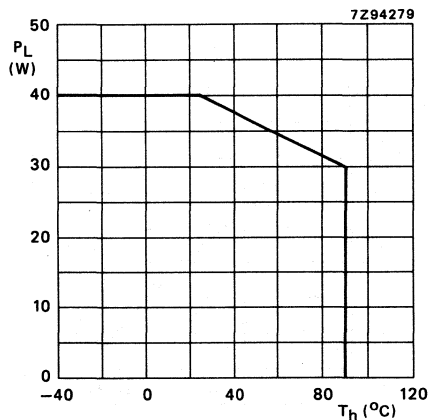


Fig. 2 Load power derating; VSWR = 1 : 1.

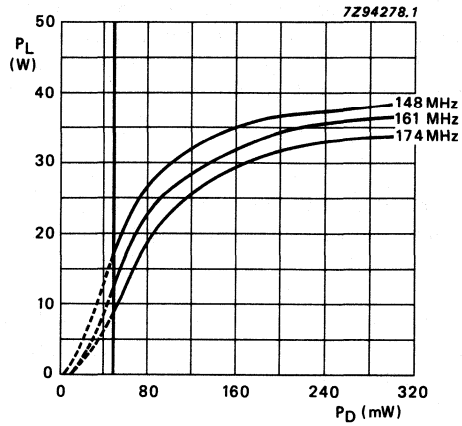


Fig. 3 Load power as a function of drive power; $V_{S1} = V_{S2} = 12.5 \text{ V}$; $T_h = 25 \text{ }^\circ\text{C}$; typical values.

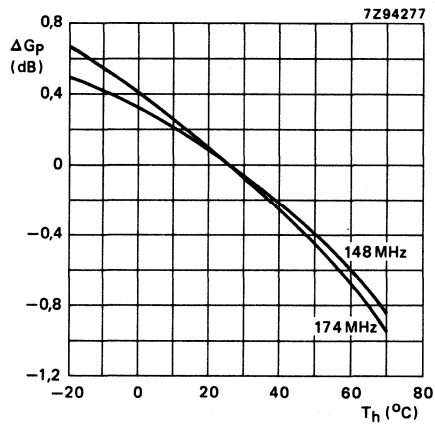


Fig. 4 Power gain as a function of heatsink temperature; $P_D = 300 \text{ mW}$; $V_{S1} = V_{S2} = 12.5 \text{ V}$; typical values.

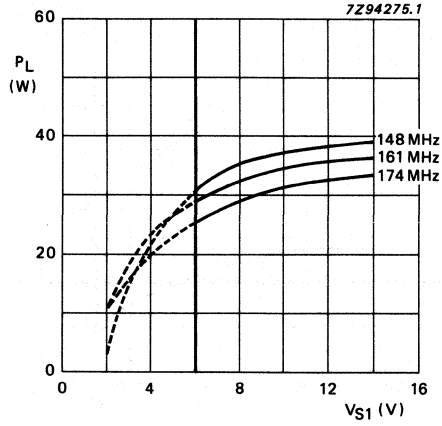


Fig. 5 Load power as a function of supply voltage V_{S1} ; $P_D = 300$ mW; $V_{S2} = 12.5$ V; typical values.

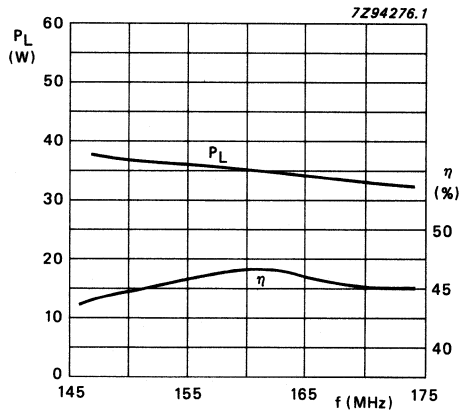


Fig. 6 Load power and efficiency as functions of frequency; $V_{S1} = V_{S2} = 12.5$ V; $P_D = 300$ mW; typical values.

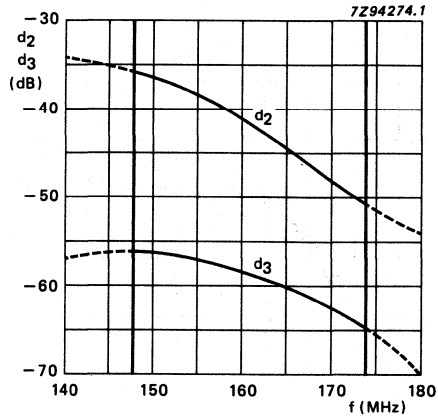


Fig. 7 Second and third harmonic distortions as a function of frequency; $V_{S1} = V_{S2} = 12.5$ V; $P_D = 300$ mW; typical values.

VHF BROADBAND POWER MODULE

VHF broadband power amplifier module primarily designed for mobile communications equipment, operating directly from 12.5 V systems. The module will produce a minimum output of 18 W into a 50 Ω load over the frequency range 170 to 210 MHz.

The module consists of a two-stage 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		CW	
Frequency range		170 to 210 MHz	
DC supply voltage (terminal 2)	V _{S1}	12.5 V	
DC supply voltage (terminal 3)	V _{S2}	12.5 V	
Drive power	P _D	typ. 80 mW max. 150 mW	
Load power	P _L	min. 18 W	
Efficiency	η	min. 40 %	
Operating heatsink temperature	T _h	max. 90 °C	

MECHANICAL DATA

Dimensions in mm

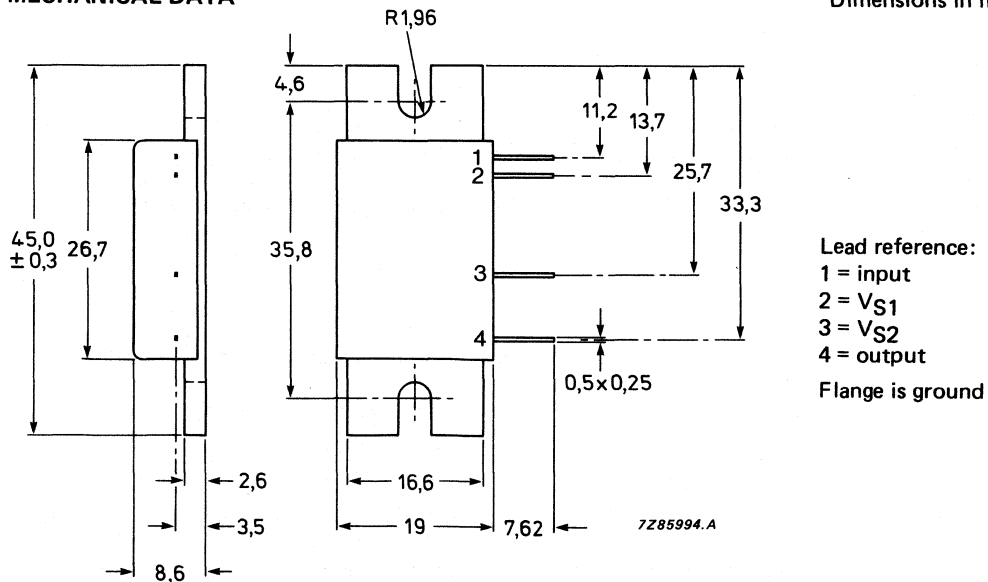


Fig. 1 SOT-183.

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

RATINGS

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

DC supply terminal voltages	V_{S1}, V_{S2}	max. 16.5 V
input terminal voltage*	$\pm V_i$	max. 25 V
output terminal voltage*	$\pm V_o$	max. 25 V
Load power (See Fig. 2)	P_L	max. 35 W
Drive power	P_D	max. 300 mW
Storage temperature	T_{stg}	-40 to 100 °C
Operating temperature	T_h	max. 90 °C

CHARACTERISTICS

$V_{S1} = V_{S2} = 12.5 \text{ V}; Z_S = Z_L = 50 \Omega; T_h = 25 \text{ }^\circ\text{C}.$

Quiescent currents	I_{Q1}	typ. 10 mA
$P_D = 0$	I_{Q2}	typ. 25 mA max. 35 mA
Frequency range	f	170 to 210 MHz
Efficiency	η	min. 40 % typ. 45 %
$P_L = 18 \text{ W}$		
RF drive power	P_D	typ. 80 W max. 150 W
$P_L = 18 \text{ W}$		
Second harmonic rejection		min. 30 dB
$P_L = 18 \text{ W}$		
Input VSWR		typ. 1.5:1 max. 2.0:1

Stability

The module is stable with load VSWR up to 3:1 (all phases) when operated within the following conditions:

$V_{S1} = 6 \text{ to } 16.5 \text{ V}; V_{S2} = 10 \text{ to } 16.5 \text{ V}; f = 170 \text{ to } 210 \text{ MHz}; P_D = 30 \text{ to } 300 \text{ mW}$ provided the maximum ratings of the module are not exceeded.

Note: V_{S1} not to exceed V_{S2}

Ruggedness

The modules will withstand load VSWR of 20:1 (all phases) when operated within the following conditions:

$V_{S1} \leq V_{S2} \leq 16.5 \text{ V}; f = 170 \text{ to } 210 \text{ MHz}; P_D \leq 300 \text{ mW}; T_h \leq 90 \text{ }^\circ\text{C}$, provided the maximum ratings are not exceeded.

Mounting

To ensure good thermal transfer the module should be mounted onto a heatsink with a flat surface and heat-conducting compound sparingly applied between module and heatsink. Any burrs on the heatsink should be removed. The connectors may be soldered directly onto 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.

* With respect to the flange.

Power rating

In general, it is recommended that the output power from the module under normal conditions should not exceed 25 W in order to provide adequate safety margins 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 30 and 150 mW. The next option is by varying V_{S1} between 6 and 12.5 V.

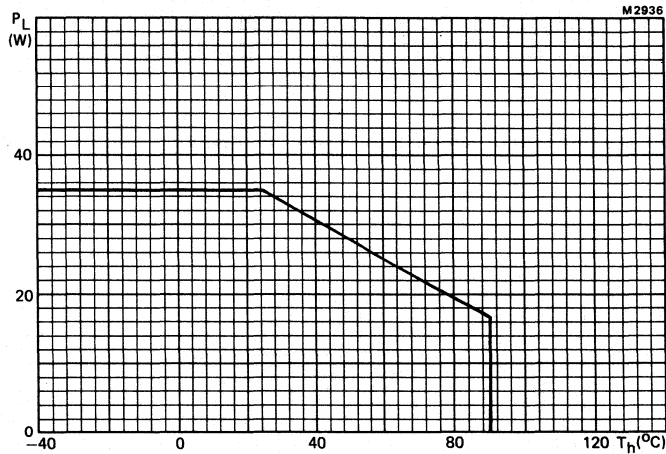


Fig. 2 Load power derating; VSWR = 1:1.

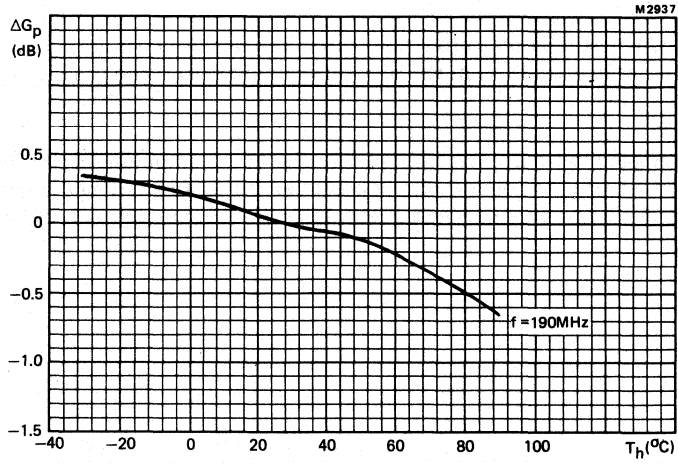


Fig. 3 Power gain as a function of temperature; $P_D = 150$ mW; $V_{S1} = V_{S2} = 12.5$ V; typical values.

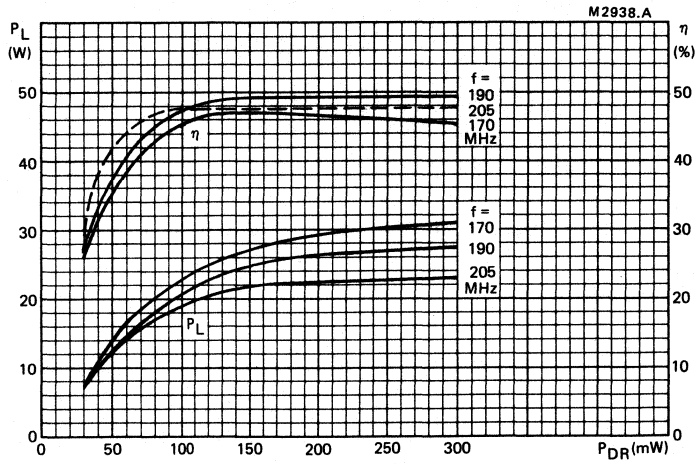


Fig. 4 Load power as a function of drive power; $V_{S1} = V_{S2} = 12.5$ V; typical values.

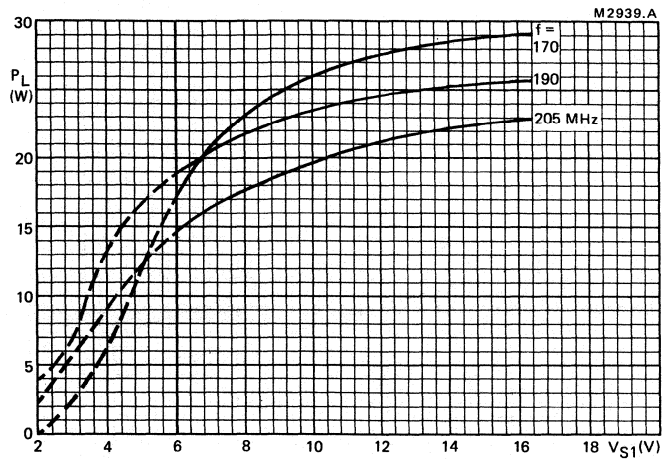


Fig. 5 Load power as a function of supply voltage V_{S1} ; $P_D = 150$ mW; $V_{S2} = 12.5$ V; typical values.

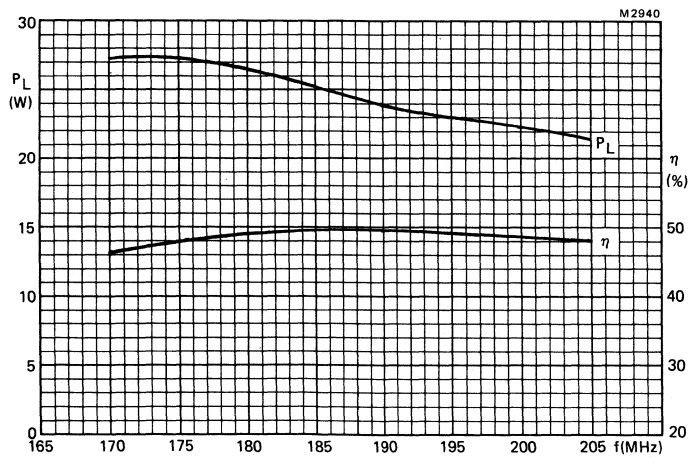


Fig. 6 Load power as a function of frequency; $V_{S1} = V_{S2} = 12.5$ V; $P_D = 150$ mW; typical values.

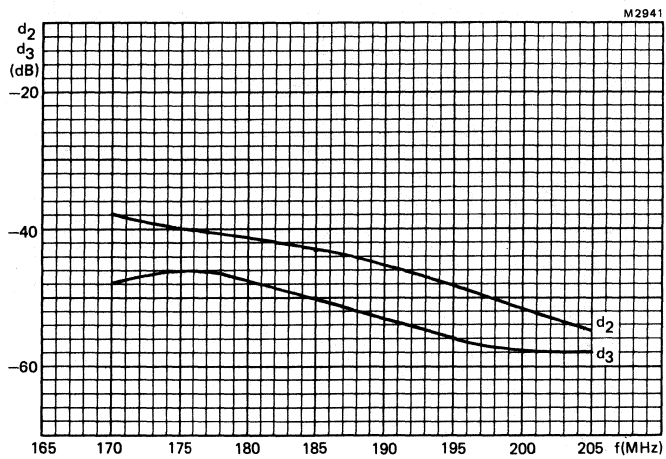


Fig. 7 Second and third harmonic distortions as a function of frequency; $V_{S1} = V_{S2} = 12.5$ V; $P_D = 150$ mW; typical values.

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 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

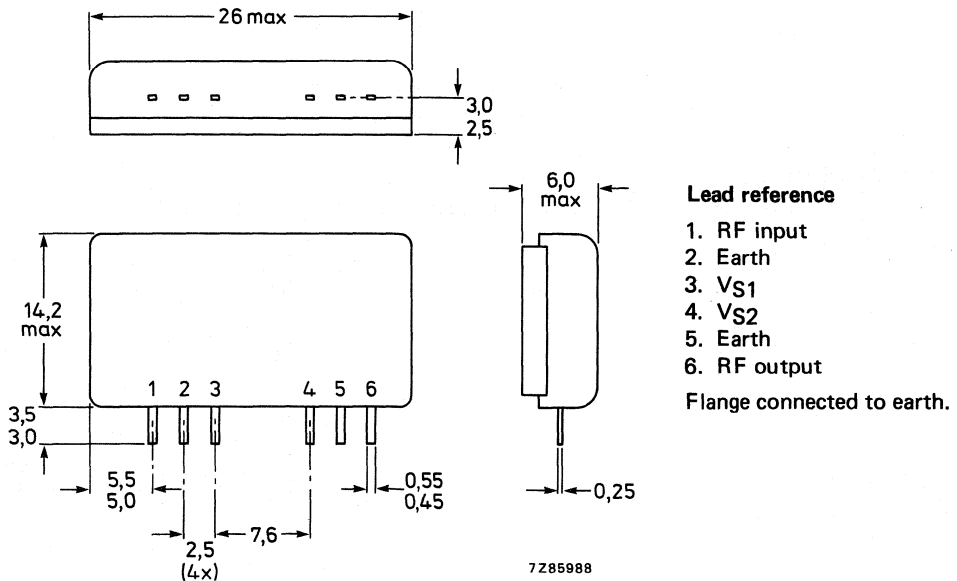


Fig. 1 SOT-181.

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

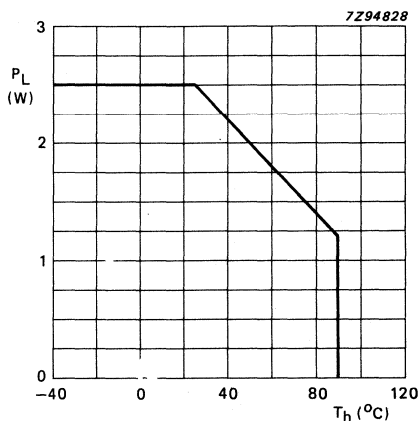


Fig. 2 Load power derating.

CHARACTERISTICS

$V_{S1} = 7.5$ V; $V_{S2} = 9.6$ V; $R_S = R_L = 50 \Omega$; $f = 400$ to 440 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.	42 %
Harmonic output	any harmonic	min.	30 dB
		typ.	40 dB
Input VSWR with respect to 50Ω		<	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:

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

Ruggedness

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

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.

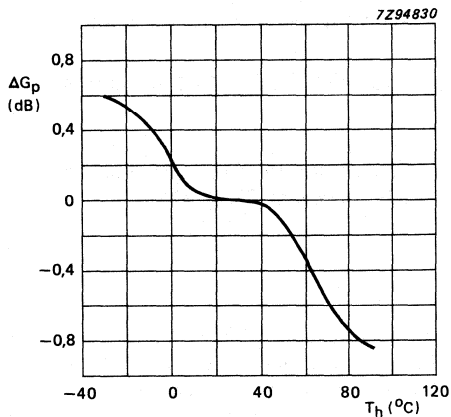


Fig. 3 Power gain as a function of temperature; $V_{S1} = 7.5$ V; $V_{S2} = 9.6$ V; $P_D = 45$ mW; typical values.

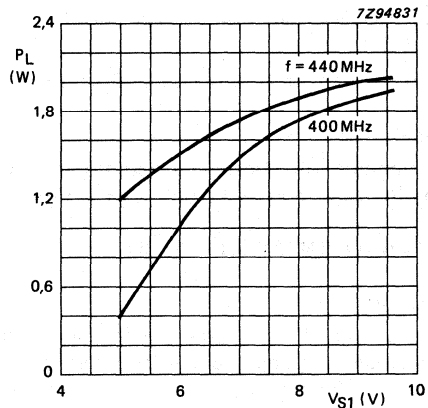


Fig. 4 Load power as a function of supply voltage V_{S1} ; $V_{S2} = 9.6$ V; $P_D = 45$ mW; typical values.

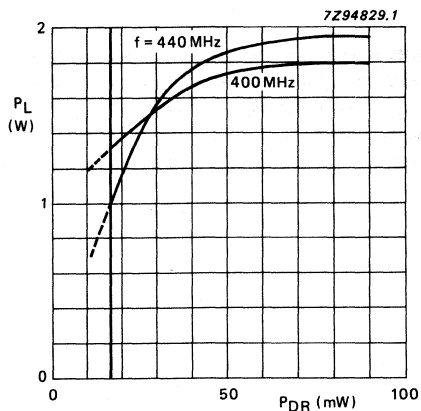


Fig. 5 Load power as a function of drive power; $V_{S1} = 7.5$ V; $V_{S2} = 9.6$ V; typical values.

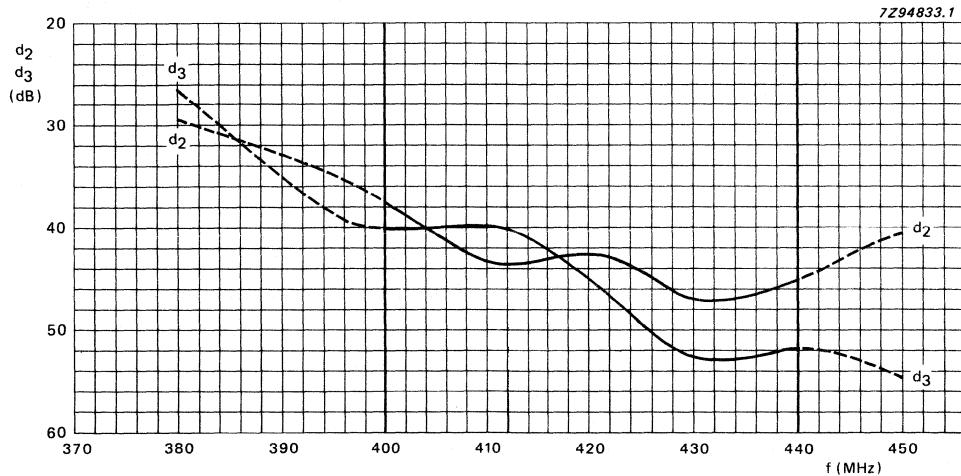


Fig. 6 Second and third harmonic distortions as a function of frequency; $V_{S1} = 7.5$ V; $V_{S2} = 9.6$ V; $P_D = 45$ mW; typical values.

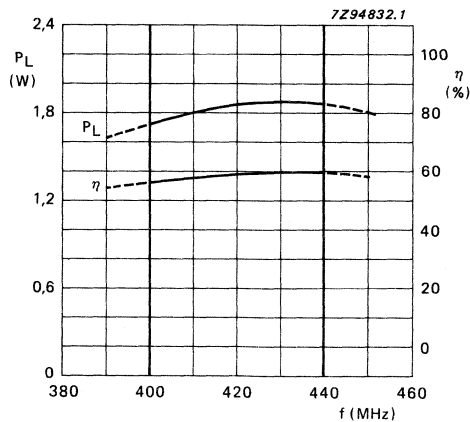


Fig. 7 Load power and efficiency as functions of frequency; $V_{S1} = 7.5$ V; $V_{S2} = 9.6$ V; $P_D = 45$ mW; typical values.

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

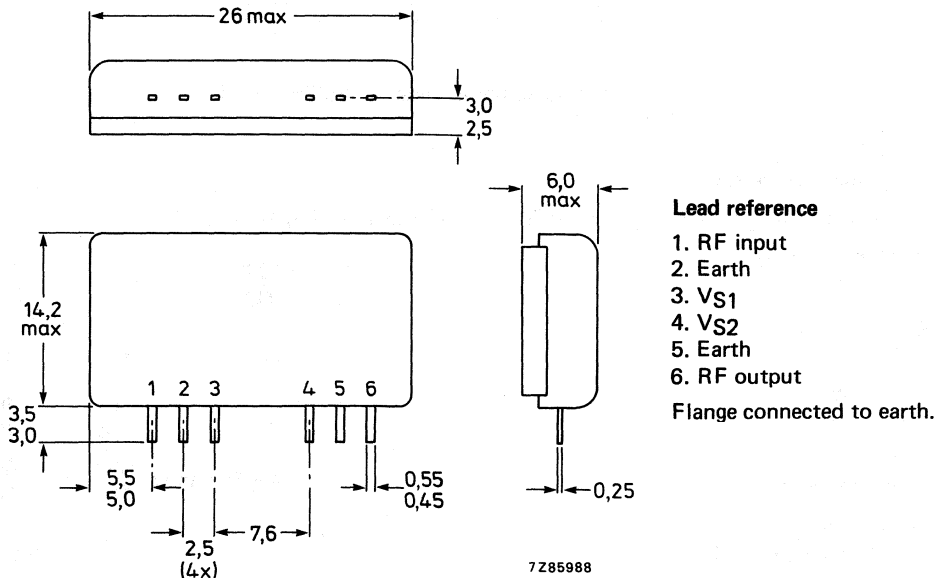


Fig. 1 SOT-181.

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

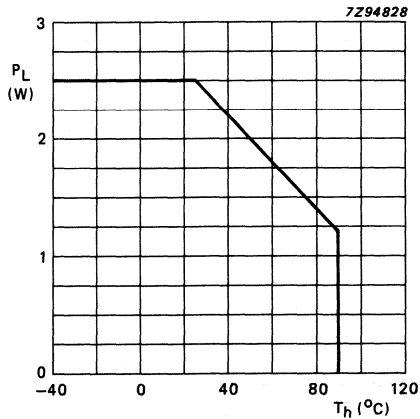


Fig. 2 Load power derating; VSWR = 1 : 1.

CHARACTERISTICS

$V_{S1} = 7.5$ V; $V_{S2} = 9.6$ V; $R_S = R_L = 50 \Omega$; $f = 430$ 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 50Ω		<	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:

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

Ruggedness

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

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.

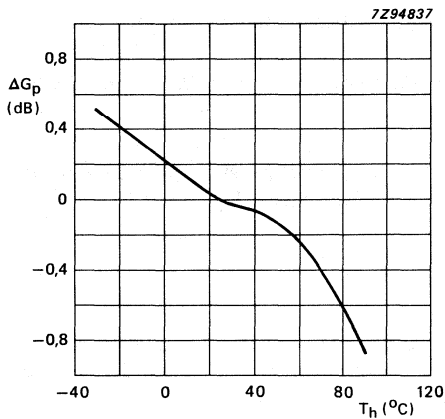


Fig. 3 Power gain as a function of temperature; $V_{S1} = 7.5$ V; $V_{S2} = 9.6$ V; $P_D = 45$ mW; typical values.

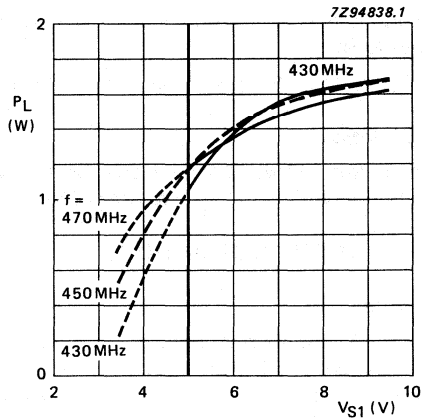


Fig. 4 Load power as a function of supply voltage V_{S1} ; $V_{S2} = 9.6$ V; $P_D = 45$ mW; typical values.

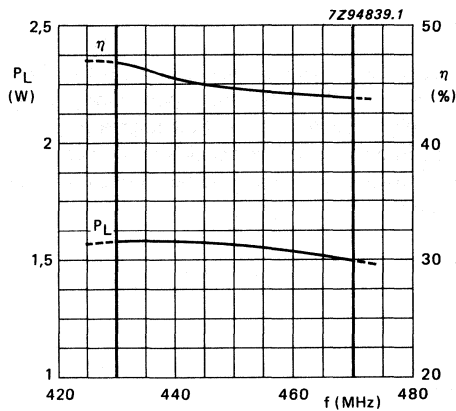


Fig. 5 Load power and efficiency as functions of frequency; $V_{S1} = 7.5$ V; $V_{S2} = 9.6$ V; $P_D = 45$ mW; typical values.

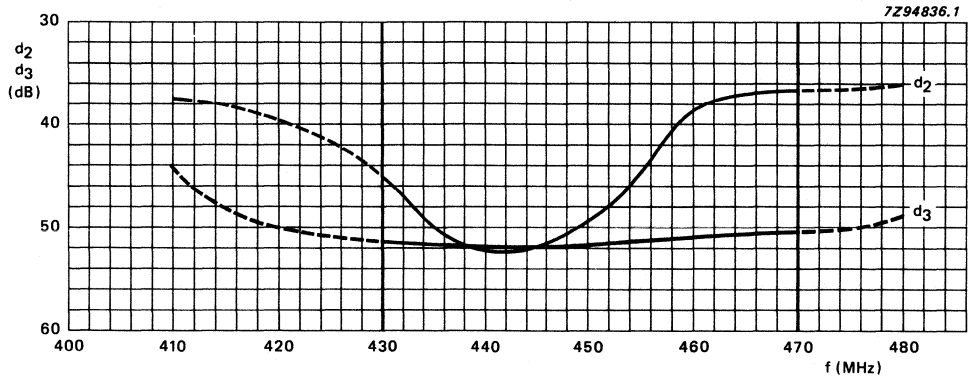


Fig. 6 Second and third harmonic distortions as a function of frequency; $V_{S1} = 7.5$ V; $V_{S2} = 9.6$ V; $P_D = 45$ mW; typical values.

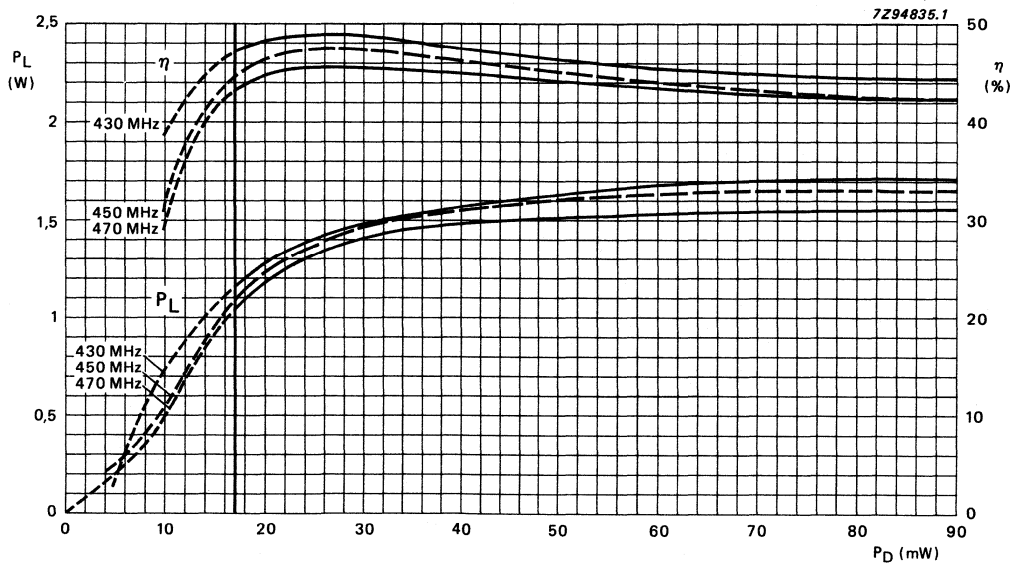


Fig. 7 Load power and efficiency as functions of drive power; $V_{S1} = 7.5$ V; $V_{S2} = 9.6$ V; typical values.

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

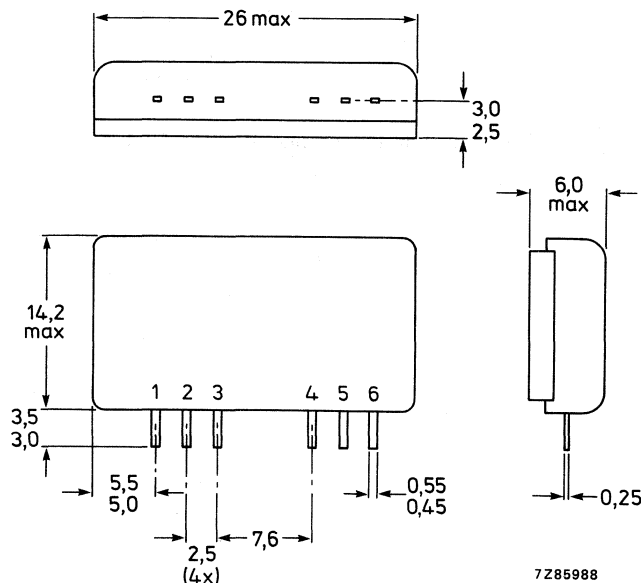


Fig.1 SOT181.

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

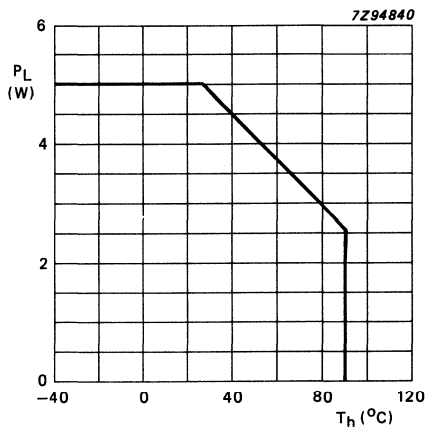


Fig.2 Load power derating; VSWR = 1 : 1.

* With respect to the earth pins.

CHARACTERISTICS

$Z_S = Z_L = 50 \Omega$; frequency range = 400 to 470 MHz; $T_h = 25 \text{ }^\circ\text{C}$ unless otherwise specified.

Quiescent currents

$V_{S1} = V_{S2} = 7.5 \text{ V}$ or 9.6 V ;
 $P_D = 0$

I_{Q1}	max.	7.0 mA
I_{Q2}	max.	0.1 mA

Efficiency

$P_L = 2.0 \text{ W}$ or $P_L = 3.2 \text{ W}$

η	min.	40 %
η	typ.	44 %

RF drive power

$P_L = 2.0 \text{ W}$; $V_{S1} = V_{S2} = 7.5 \text{ V}$
 $P_L = 3.2 \text{ W}$; $V_{S1} = V_{S2} = 9.6 \text{ V}$

P_D	max.	50 mW
P_D	max.	50 mW

Harmonic output

any harmonic	min.	-30 dB
	typ.	-40 dB

Input VSWR

with respect to 50Ω

VSWR	max.	2:1
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Stability

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

$V_{S1} \leq V_{S2} = 5.0 \text{ V}$ to 11.2 V ; $P_D = 25$ to 90 mW ; $f = 400$ to 470 MHz ; $P_L < 5.0 \text{ W}$ (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 $245 \text{ }^\circ\text{C}$ 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 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.

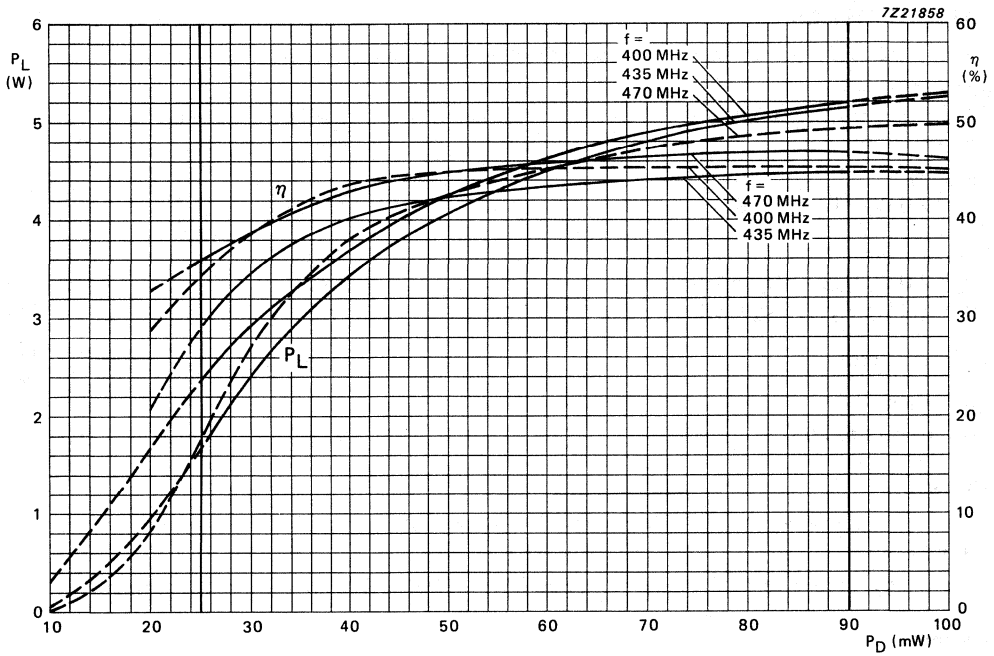


Fig.3 Load power and efficiency as functions of drive power; $V_{S1} = V_{S2} = 9.6$ V; typical values.

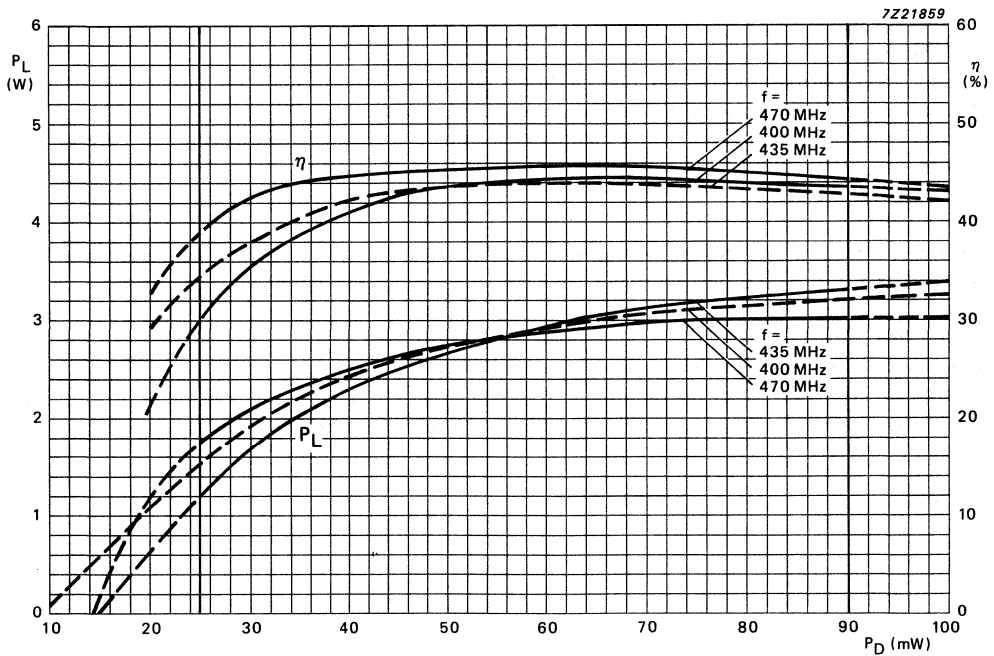


Fig.4 Load power and efficiency as functions of drive power; $V_{S1} = V_{S2} = 7.5$ V; typical values.

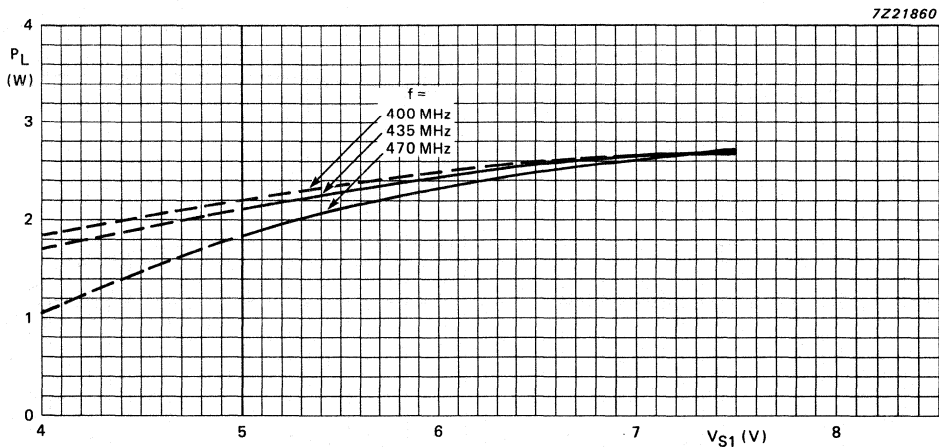


Fig.5 Load power as a function of V_{S1} ; $V_{S2} = 7.5$ V; $P_D = 50$ mW; typical values.

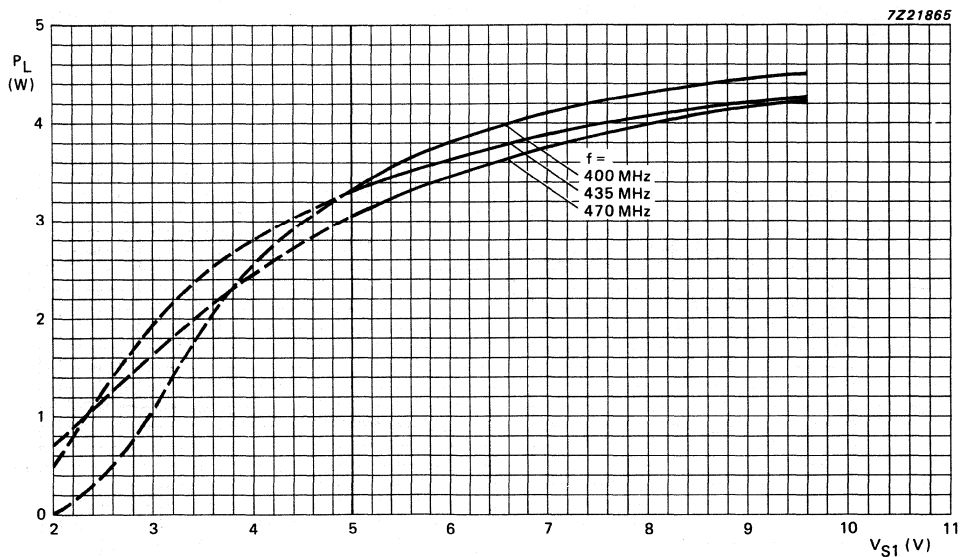


Fig.6 Load power as a function of V_{S1} ; $V_{S2} = 9.6$ V; $P_D = 50$ mW; typical values.

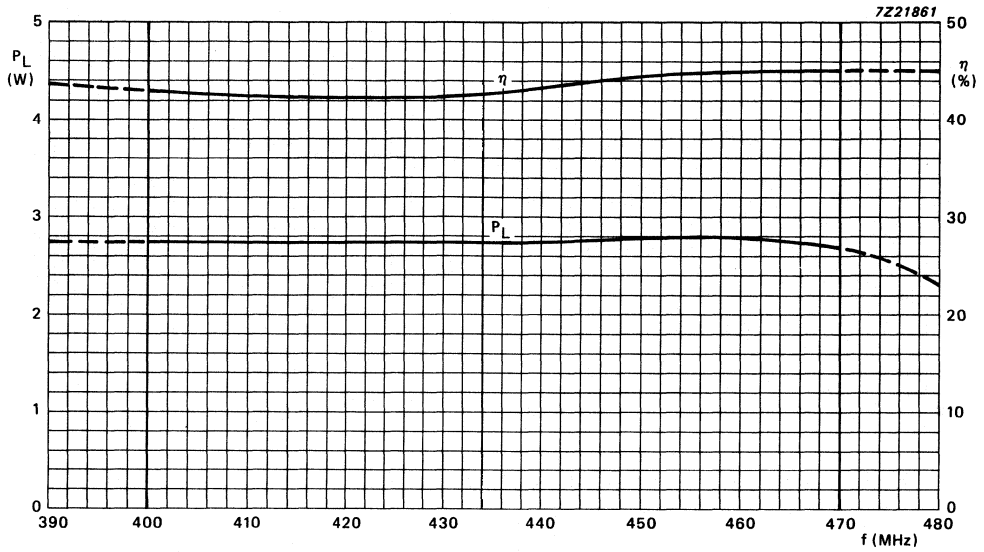


Fig.7 Load power and efficiency as functions of frequency; $V_{S1} = V_{S2} = 7.5$ V; $P_D = 50$ mW; typical values.

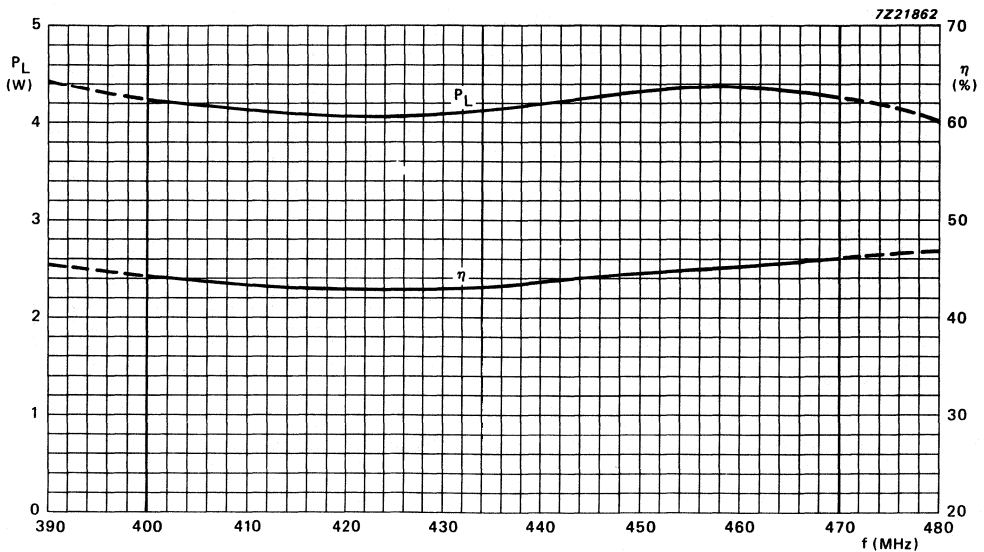


Fig.8 Load power and efficiency as functions of frequency; $V_{S1} = V_{S2} = 9.6$ V; $P_D = 50$ mW; typical values.

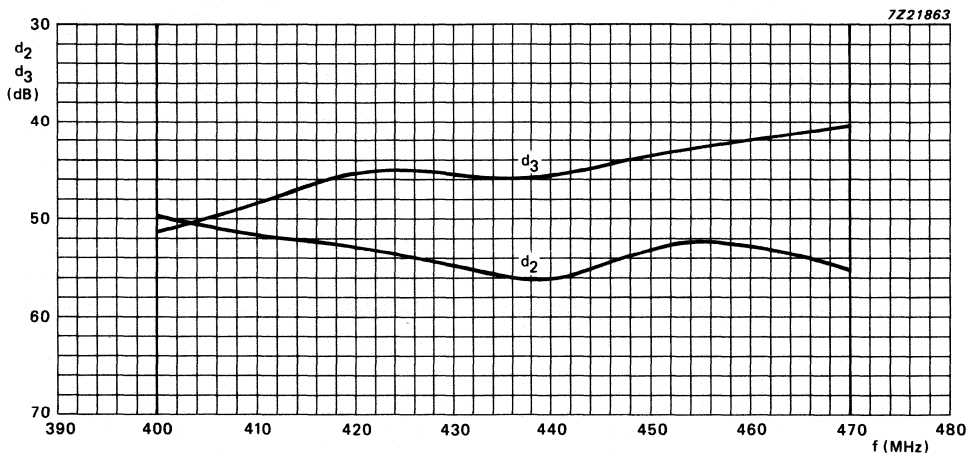


Fig.9 Second and third harmonic distortions as functions of frequency; $V_{S1} = V_{S2} = 7.5 \text{ V}$; $P_D = 50 \text{ mW}$; typical values.

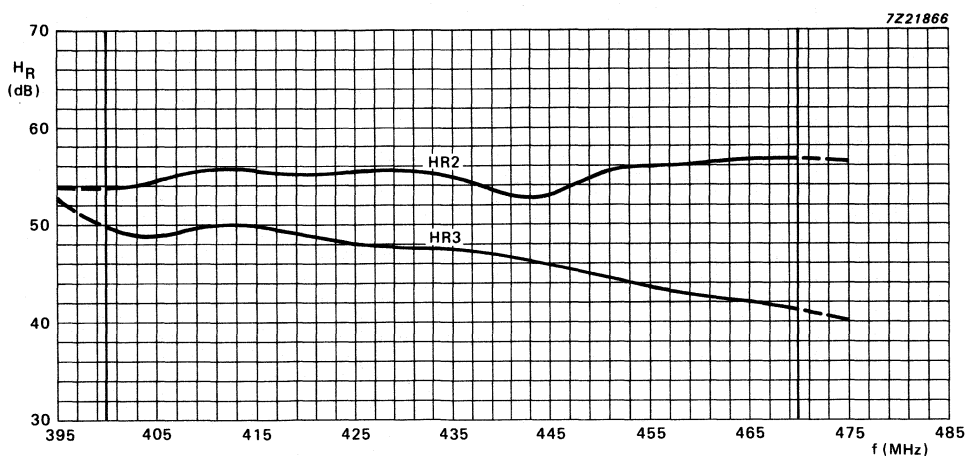


Fig.10 Second and third harmonic distortions as functions of frequency; $V_{S1} = V_{S2} = 9.6 \text{ V}$; $P_D = 50 \text{ mW}$; typical values.

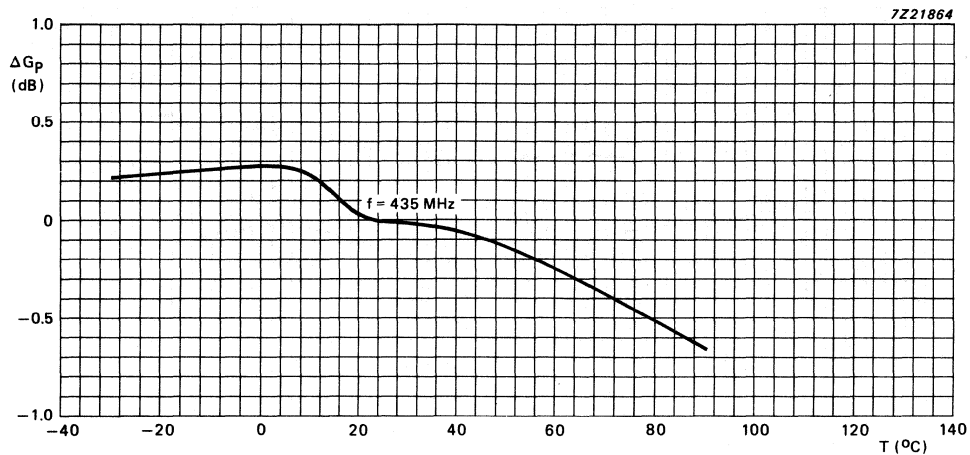


Fig.11 Power gain as a function of temperature; $P_D = 50$ mW; $V_{S1} = V_{S2} = 7.5$ V; typical values.

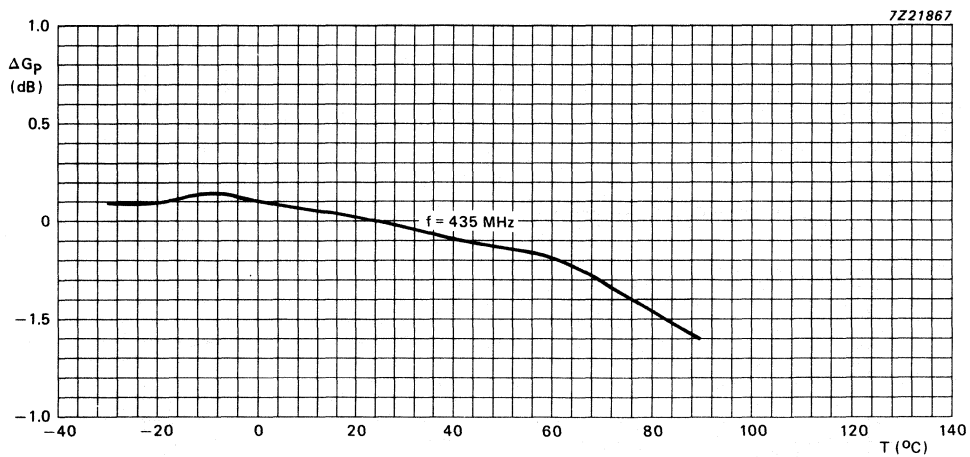


Fig.12 Power gain as a function of temperature; $P_D = 50$ mW; $V_{S1} = V_{S2} = 9.6$ V; typical values.

DEVELOPMENT DATA

This data sheet contains advance information and specifications are subject to change without notice.

BGY47F

UHF AMPLIFIER MODULE

A UHF amplifier module designed for use in portable transmitters operating from a 9.6 V supply. The module is a two-stage amplifier using npn transistors mounted on a thin-film metallized alumina substrate with a stripline matching circuit.

QUICK REFERENCE DATA

Mode of operation	frequency modulation				
RF performance	f MHz	V _{S1} V	V _{S2} V	P _D mW	P _L W
	460 to 512	7.5	9.6	< 50	> 3.2

MECHANICAL DATA

Dimensions in mm

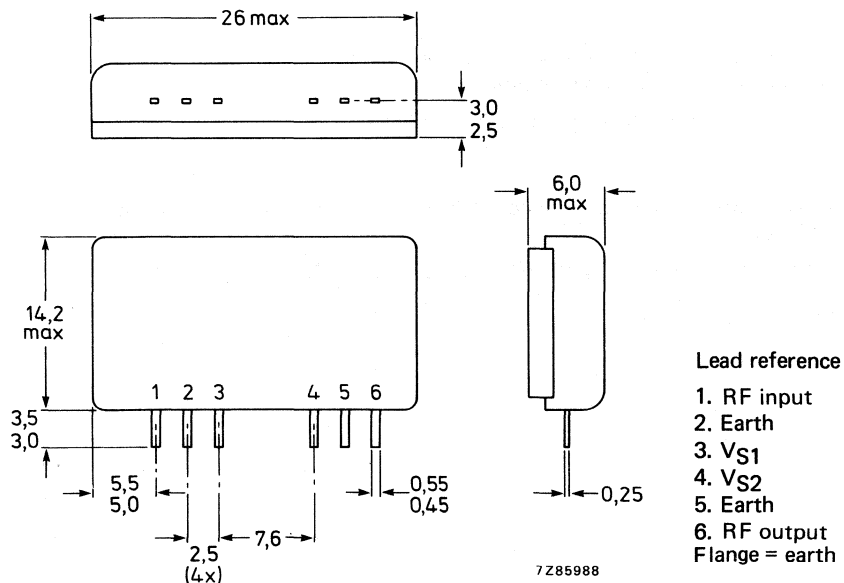


Fig. 1 SOT181.

RATINGS

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

DC supply terminal voltages*	V_{S1}/V_{S2}	max.	12 V*
RF input voltage*	$\pm V_i$	max.	25 V*
RF output voltage*	$\pm V_o$	max.	25 V*
Load power	P_L	max.	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

CHARACTERISTICS

Quiescent currents

$V_{S1} = 7.5 \text{ V}; V_{S2} = 9.6 \text{ V};$
 $P_D = 0; T_h = 25 \text{ °C}$

I_{Q1}	<	7 mA
I_{Q2}	<	0.1 mA

Efficiency

when operated under nominal conditions

η	>	36 %
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Harmonic output

$V_{S1} = 7.5 \text{ V}; V_{S2} = 9.6 \text{ V}; P_D = 50 \text{ mW}$

any harmonic	<	-30 dB
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Stability

The module will produce no spurious signals with a load mismatch of up to 5 VSWR (all phases) when operated within the following conditions:

$V_{S1} = 6 \text{ to } 12 \text{ V}; V_{S2} = 8 \text{ to } 12 \text{ V}; P_D = 25 \text{ to } 90 \text{ mW}.$

Ruggedness

The module will withstand a load mismatch VSWR of 50 (all phases) when operated within the following conditions:

$V_{S1} < 12 \text{ V}; V_{S2} < 12 \text{ V}; P_D < 90 \text{ mW}; P_L < 5 \text{ W}; T_h < 90 \text{ °C}$

* With respect to flange.

UHF AMPLIFIER MODULE

UHF amplifier module designed for use in portable transmitters operating from a 9.6 V electrical supply. The module is a three-stage amplifier consisting of bipolar silicon npn transistors and lumped element matching circuits.

The BGY48A will produce a minimum of 5 W into a 50 Ω load over the 400 to 440 MHz frequency range.

QUICK REFERENCE DATA

Mode of operation	continuous wave
Frequency range	400 to 440 MHz
RF load power $V_{S1} = V_{S2} = 9.6 \text{ V}; P_D = 50 \text{ mW}$	> 5.0 W
RF drive power $V_{S1} = V_{S2} = 9.6 \text{ V}; P_L = 5.0 \text{ W}$	< 35 mW
Input and output impedances	nom. 50 Ω

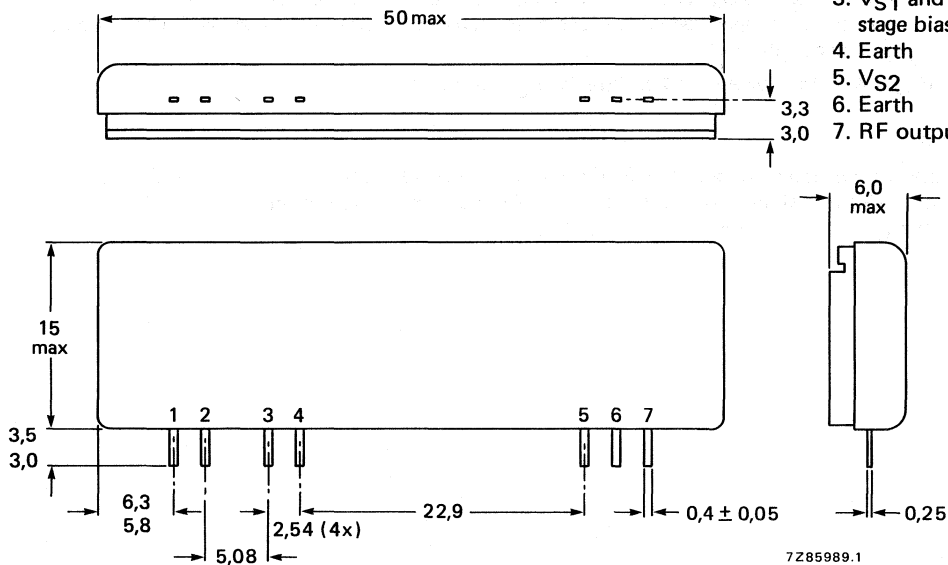
MECHANICAL DATA

Fig. 1 SOT182.

Dimensions in mm

Lead reference

1. RF input
2. Earth
3. V_{S1} and second stage bias
4. Earth
5. V_{S2}
6. Earth
7. RF output



RATINGS

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

DC supply terminal voltages*	V_{S1}/V_{S2}	max.	13.5 V*
RF input voltage*	$\pm V_i$	max.	25 V*
RF output voltage*	$\pm V_o$	max.	25 V*
Load power	P_L	max.	9 W
Drive power	P_D	max.	70 mW
Storage temperature range	T_{stg}		-40 to 100 °C
Operating heatsink temperature	T_h	max.	90 °C

CHARACTERISTICS

Quiescent currents

second stage current with first stage open circuit
 $V_{S2} = 9.6 \text{ V}; P_D = 0; R_S = R_L = 50 \Omega; I_{S1} = 0$

I_{Q2}	<	0.5 mA
I_{Q2}	typ.	0.1 mA

first stage current

$V_{S1} = 7.1 \text{ V}; V_{S2} = 9.6 \text{ V}; P_D = 0; R_S = R_L = 50 \Omega$

I_{Q1}	typ.	2 mA
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Efficiency

$V_{S1} = V_{S2} = 9.6 \text{ V}; P_L = 5.0 \text{ W}; R_S = R_L = 50 \Omega$

η	>	40 %
	typ.	42 %

Harmonic output

$V_{S1} = V_{S2} = 9.6 \text{ V}; P_D = 35 \text{ mW}; R_S = R_L = 50 \Omega$

any harmonic (relative to carrier)	<	-40 dB
	typ.	-50 dB

Input VSWR

$V_{S1} = V_{S2} = 9.6 \text{ V}; P_D = 35 \text{ mW}; R_S = R_L = 50 \Omega$

VSWR	max.	2
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Stability

The module will produce no signals at frequencies other than that of the carrier and harmonics of the carrier frequency when operated with a load mismatch of 5 VSWR (all phases) and when operated within the following conditions:

$$V_{S1} \leq V_{S2} = 4 \text{ to } 11.2 \text{ V}; P_D = 17 \text{ to } 70 \text{ mW}; P_L < 9.0 \text{ W.}$$

Ruggedness

The module will withstand a 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 derating curve being exceeded. $T_h = 90 \text{ °C}$.

* With respect to earth pins.

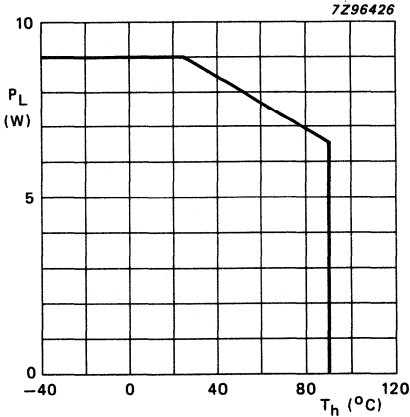


Fig. 2 Load power derating; VSWR = 1 : 1.

U H F 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 5 W into a 50 Ω load over the frequency range 430 to 470 MHz.

The module consists of a two-stage RF amplifier using npn transistor chips with lumped element matching components in a SOT182 plastic encapsulation.

QUICK REFERENCE DATA

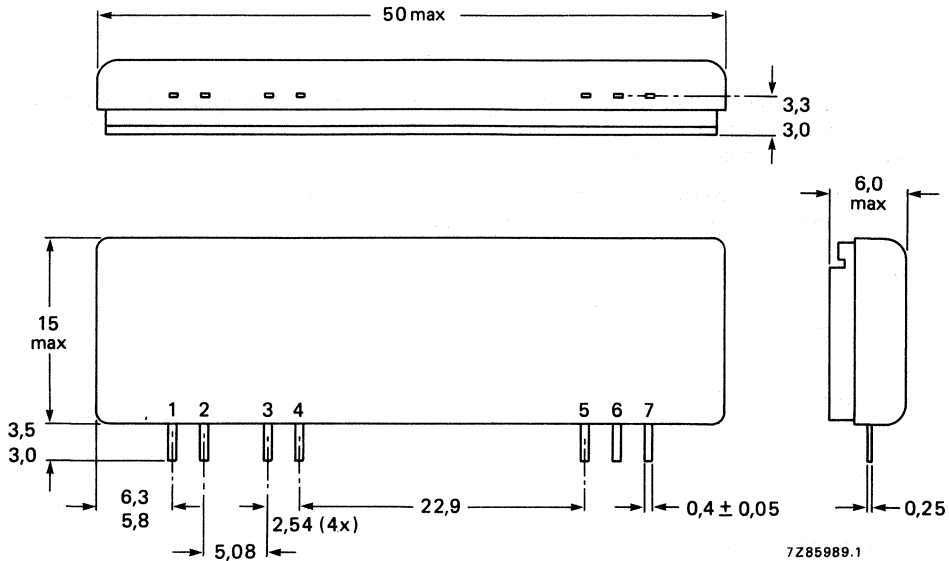
Mode of operation		continuous wave	
Frequency range		430 to 470 MHz	
DC supply terminal voltages	$V_{S1}; V_{S2}$	nom.	9.6 V
RF drive power	P_D	max.	35 mW
RF load power	P_L	min.	5.0 W
Efficiency	n	min.	40 %
Input and output impedance	$z_i; Z_l$	nom.	50 Ω

MECHANICAL DATA

See Fig.1 next page.

MECHANICAL DATA

Dimensions in mm



Lead reference

- | | |
|---|---------------------|
| 1 = RF input | 5 = VS ₂ |
| 2 = Earth | 6 = Earth |
| 3 = VS ₁ and second stage bias | 7 = RF output |
| 4 = Earth | |

Flange connected to earth

Fig.1 SOT182.

RATINGS

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

DC supply terminal voltages*	VS ₁ ; VS ₂	max.	13.5 V
RF input terminal voltage*	± V _i	max.	25 V
RF output terminal voltage*	± V _o	max.	25 V
Load power	P _L	max.	9.0 W
Drive power	P _D	max.	70 mW
Storage temperature range	T _{stg}		-40 to 100 °C
Operating heatsink temperature	T _h	max.	90 °C

* With respect to the earth pins.

CHARACTERISTICS

$T_h = 25\text{ }^\circ\text{C}$ unless otherwise stated

Conditions: $V_{S1} = V_{S2} = 9.6\text{ V}$; $R_S = R_L = 50\ \Omega$; $f = 430\text{ to }470\text{ MHz}$

Quiescent currents

first stage current

$P_D = 0$ I_{Q1} typ. 10 mA

second stage current with
first stage open circuit

$I_{Q2} < 0.5\text{ mA}$

RF drive power

$P_L = 5.0\text{ W}$ $P_D < 35\text{ mW}$

Efficiency

$P_L = 5.0\text{ W}$ η min. 40 %
typ. 44 %

Harmonic output

$R_S = R_L = 50\ \Omega$ any harmonic min. -40 dB
typ. -50 dB

Input VSWR

with respect to $50\ \Omega$ VSWR $< 2.0 : 1$

Stability

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

$V_{S1} = V_{S2} = 4.0\text{ V to }11.2\text{ V}$; $P_D = 17\text{ to }70\text{ mW}$; $f = 430\text{ to }470\text{ MHz}$; $P_L = < 9.0\text{ W}$ (matched)

Ruggedness

The module will withstand a load mismatch VSWR of 50 (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 ($T_h < 90\text{ }^\circ\text{C}$).

Output power control

The module is designed to be operated at a constant output power of 5.0 W. The module is adjusted to produce nominal output power by reducing the first stage supply voltage V_{S1} . If the module is to be used over a range of output power levels below 5.0 W, the first stage supply voltage should not be reduced below 4.0 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.

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 $245\text{ }^\circ\text{C}$ for not more than 10 s 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 7 W in order to provide an adequate safety margin under fault conditions.

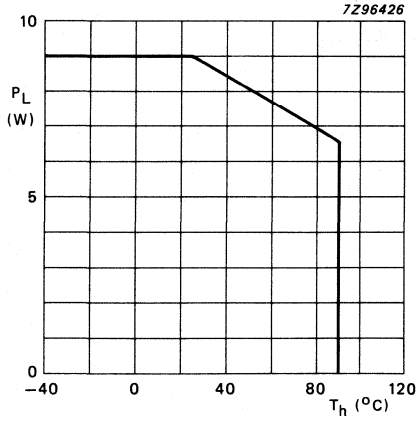


Fig.2 Load power derating; VSWR = 1 : 1.

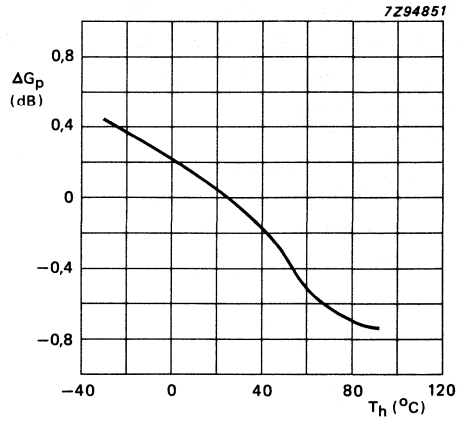


Fig.3 Change in power gain as a function of heatsink temperature; VS1 = VS2 = 9.6 V; typical values.

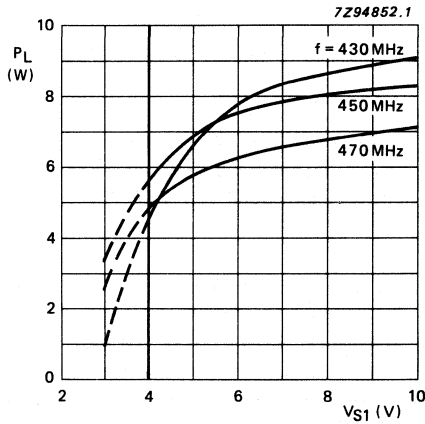


Fig.4 Load power as a function of VS1; VS2 = 9.6 V; PD = 35 mW; typical values.

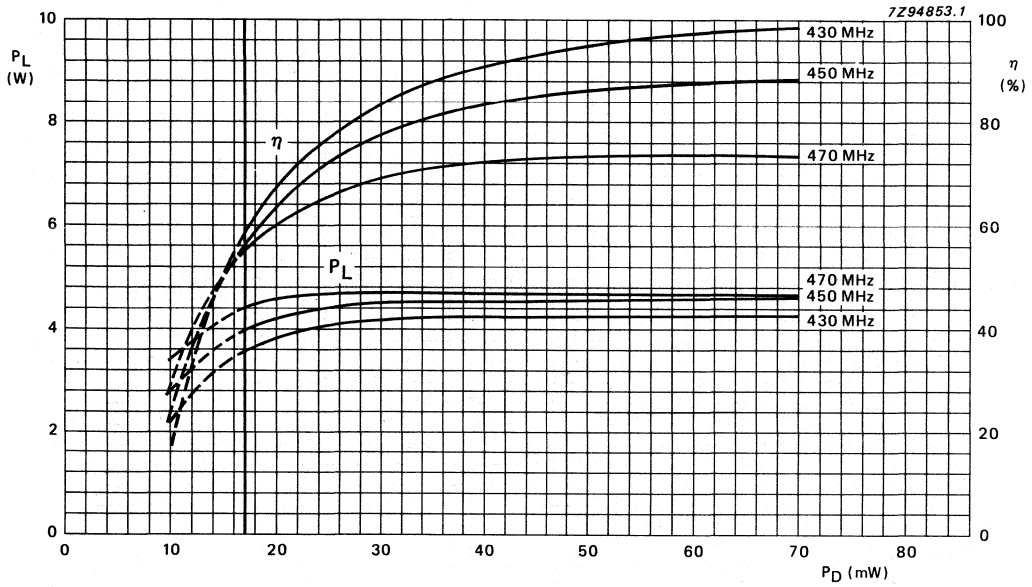


Fig.5 Load power and efficiency as functions of drive power; $V_{S1} = V_{S2} = 9.6$ V; typical values.

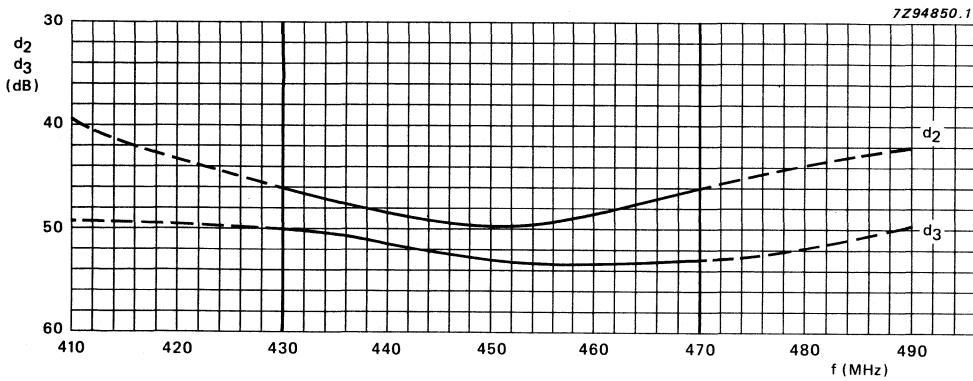


Fig.6 Second and third harmonic distortions as functions of frequency; $V_{S1} = V_{S2} = 9.6$ V; $P_D = 35$ mW; typical values.

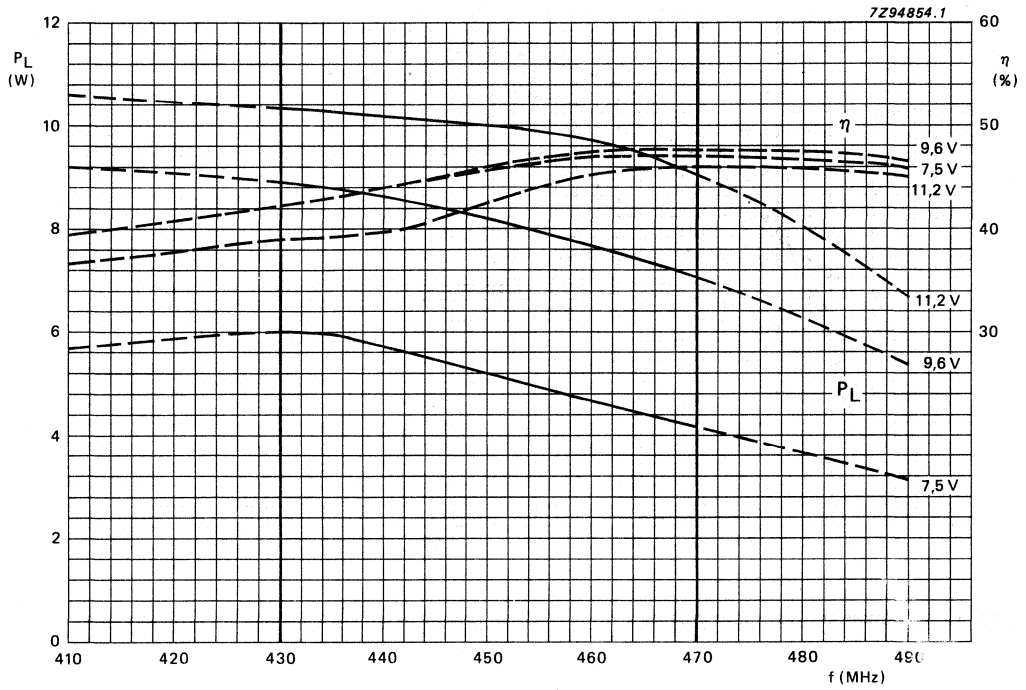


Fig.7 Load power and efficiency as functions of frequency; $V_{S1} = V_{S2}$; $P_D = 35$ mW; typical values.

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 5 W into a 50Ω load over the frequency range 460 to 512 MHz.

The module consists of a two-stage RF amplifier using npn transistor chips with lumped element matching components in a SOT182 plastic encapsulation.

QUICK REFERENCE DATA

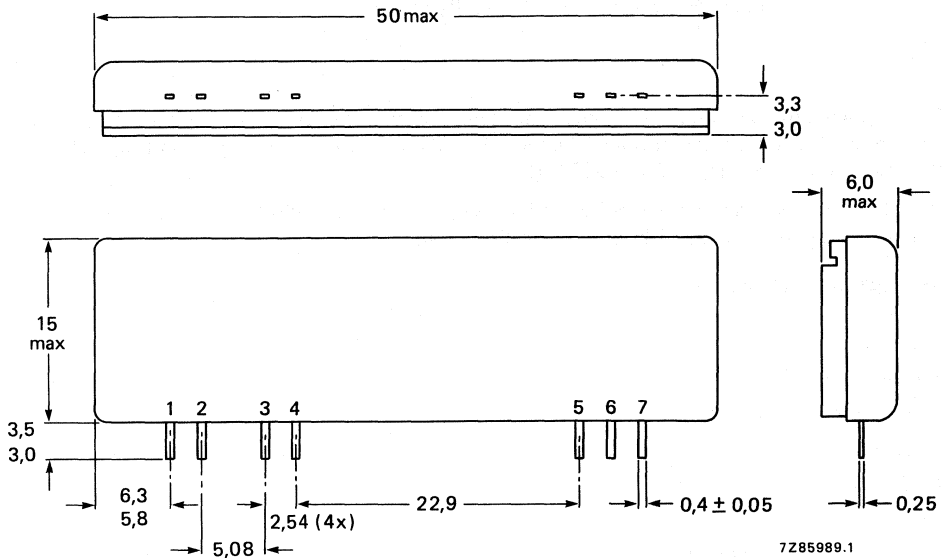
Mode of operation		continuous wave	
Frequency range		460 to 512 MHz	
DC supply terminal voltages	$V_{S1}; V_{S2}$	nom.	9.6 V
RF drive power	P_D	max.	35 mW
RF load power	P_L	min.	5.0 W
Efficiency	η	min.	40 %
Input and output impedances	$z_i; Z_l$	nom.	50Ω

MECHANICAL DATA

See Fig.1 next page.

MECHANICAL DATA

Dimensions in mm



Lead reference

- | | |
|-------------------------------|---------------|
| 1 = RF input | 5 = VS2 |
| 2 = Earth | 6 = Earth |
| 3 = VS1 and second stage bias | 7 = RF output |
| 4 = Earth | |

Flange connected to earth

Fig.1 SOT182.

RATINGS

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

DC supply terminal voltages*	VS1; VS2	max.	13.5 V
RF input terminal voltage*	$\pm V_i$	max.	25 V
RF output terminal voltage*	$\pm V_o$	max.	25 V
Load power	PL	max.	9.0 W
Drive power	PD	max.	70 mW
Storage temperature range	Tstg		-40 to 100 °C
Operating heatsink temperature range	Th		-30 to 90 °C

* With respect to the earth pins.

CHARACTERISTICS

$T_h = 25\text{ }^\circ\text{C}$ unless otherwise stated

Conditions: $V_{S1} = V_{S2} = 9.6\text{ V}$; $R_S = R_L = 50\ \Omega$; $f = 460\text{ to }512\text{ MHz}$

Quiescent currents

first stage current

$P_D = 0$ I_{Q1} typ. 10 mA

second stage current with
first stage open circuit

I_{Q2} < 0.5 mA

RF drive power

$P_L = 5.0\text{ W}$ P_D < 35 mW

Efficiency

$P_L = 5.0\text{ W}$ η min. 40 %
typ. 42 %

Harmonic output

$R_S = R_L = 50\ \Omega$ any harmonic min. -40 dB
typ. -50 dB

Input VSWR

with respect to $50\ \Omega$ VSWR < 2.0 : 1

Stability

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

$V_{S1} = V_{S2} = 4.0\text{ V to }11.2\text{ V}$; $P_D = 17\text{ to }70\text{ mW}$; $f = 460\text{ to }512\text{ MHz}$; $P_L = < 9.0\text{ W}$ (matched)

Ruggedness

The module will withstand a load mismatch VSWR of 50 (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 ($T_h < 90\text{ }^\circ\text{C}$).

Output power control

The module is designed to be operated at a constant output power of 5.0 W. The module is adjusted to produce nominal output power by reducing the first stage supply voltage V_{S1} . If the module is to be used over a range of output power levels below 5.0 W, the first stage supply voltage should not be reduced below 4.0 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.

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 $245\text{ }^\circ\text{C}$ for not more than 10 s 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 7 W in order to provide an adequate safety margin under fault conditions.

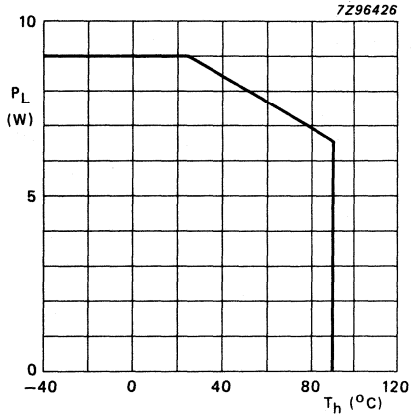


Fig.2 Load power derating; VSWR = 1 : 1.

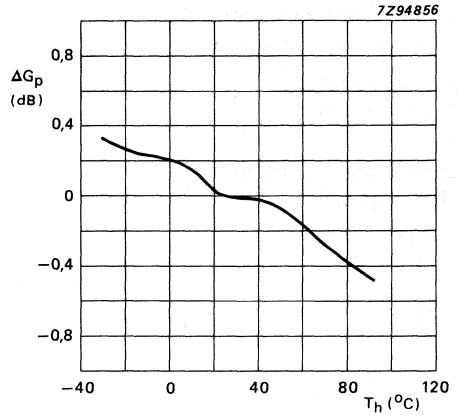


Fig.3 Change in power gain as a function of heatsink temperature;
 $V_{S1} = V_{S2} = 9.6 \text{ V}$; $P_D = 35 \text{ mW}$;
 typical values.

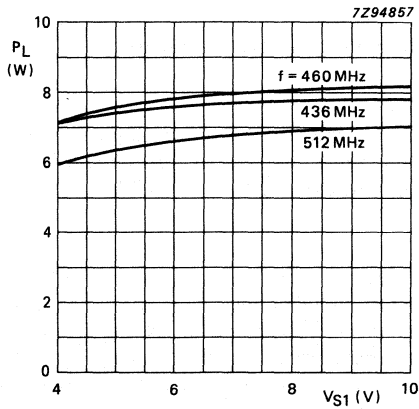


Fig.4 Load power as a function of V_{S1} ; $V_{S2} = 9.6 \text{ V}$; $P_D = 35 \text{ mW}$; typical values.

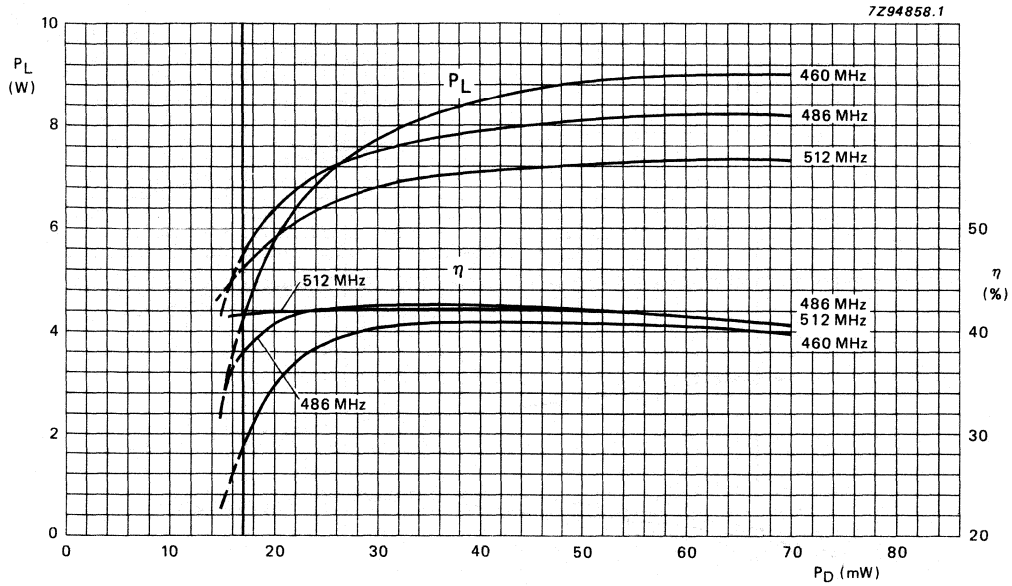


Fig.5 Load power and efficiency as functions of drive power; $V_{S1} = V_{S2} = 9.6$ V; typical values.

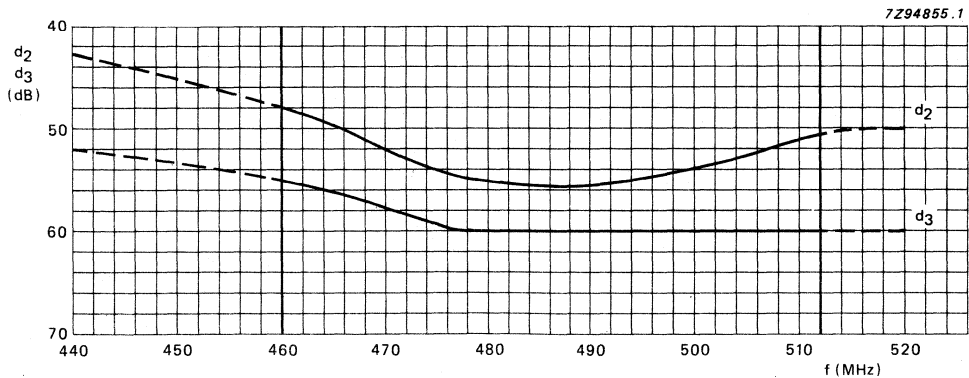


Fig.6 Second and third harmonic distortions as functions of frequency; $V_{S1} = V_{S2} = 9.6$ V; $P_D = 35$ mW; typical values.

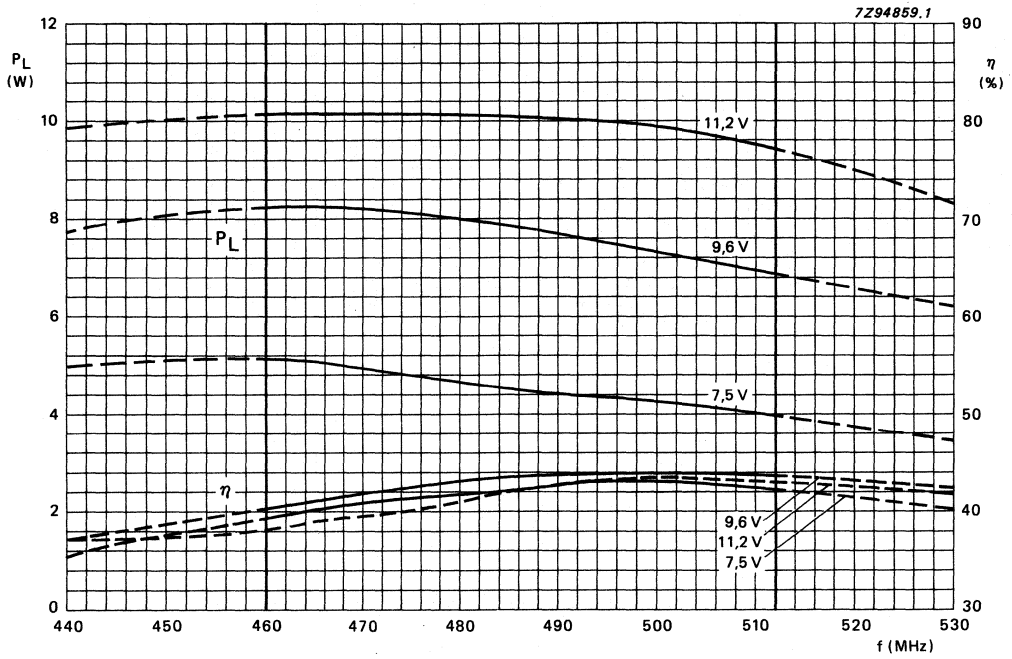


Fig.7 Load power and efficiency as functions of frequency; $V_{S1} = V_{S2}$; $P_D = 35 \text{ mW}$; typical values.

DEVELOPMENT DATA

This data sheet contains advance information and specifications are subject to change without notice.

BGY49A

UHF POWER AMPLIFIER MODULE

A UHF amplifier module primarily designed for mobile communications equipment, operating directly from 12.5 V electrical systems. The module will produce a minimum output of 20 W into a 50 Ω load over the frequency range of 400 to 440 MHz.

The module consists of a three-stage RF amplifier using npn transistor chips with stripline and surface mount matching elements. The negative supply is internally connected to the flange in a plastic strip-line encapsulation.

QUICK REFERENCE DATA

Mode of operation		CW
Frequency range		400 to 440 MHz
Drive power $P_L = 20$ W	P_D	max. 150 mW
Load power	P_L	> 20 W
Supply voltages	V_{S1}, 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. 1 next page

MECHANICAL DATA

Lead reference

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

Dimensions in mm

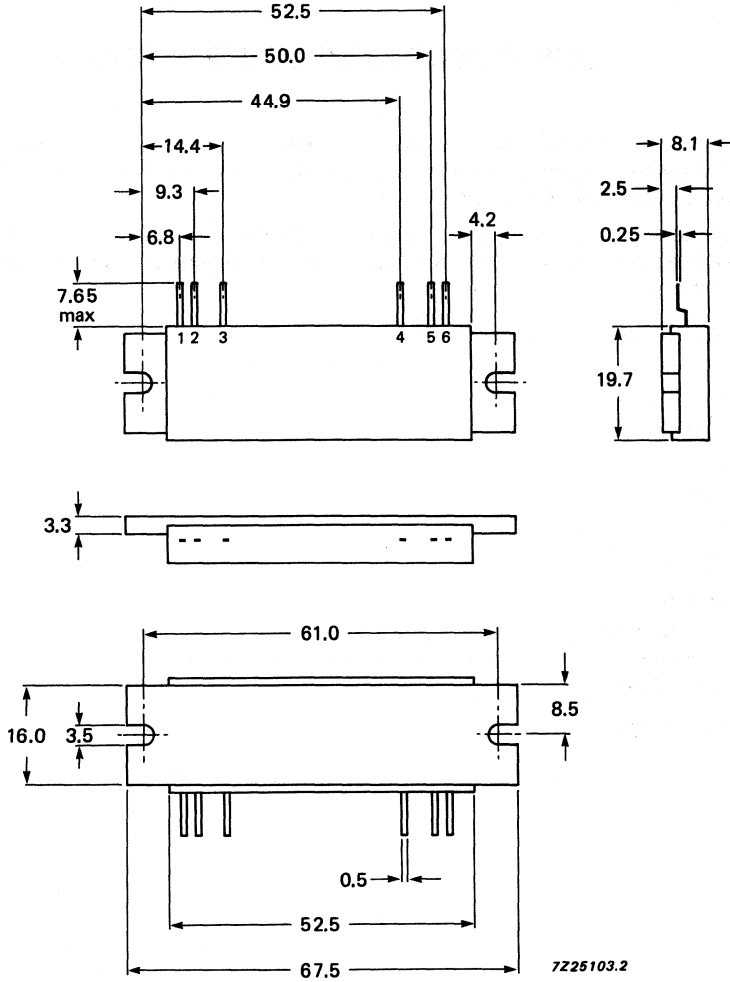


Fig. 1 SOT-132D.

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

RATINGS

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

DC supply terminal voltages*	V_{S1}, V_{S2}	max.	15.5 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.	30 W
Drive power	P_D	max.	300 mW
Storage temperature range	T_{stg}		-30 to + 100 °C
Operating heatsink temperature range	T_h		-30 to + 90 °C

CHARACTERISTICS

$T_h = 25\text{ °C}; V_{S1} = V_{S2} = 12.5\text{ V}; R_S = R_L = 50\text{ }\Omega; f = 400\text{ to }440\text{ MHz}$, unless otherwise stated

Quiescent currents

$P_D = 0$	I_{Q1}	max.	200 mA
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RF load power

$P_D = 150\text{ mW}$	P_L	min.	20 W
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Efficiency

$P_L = 20\text{ W}$	η	>	35 %
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Harmonic output

$P_L = 20\text{ W}$ (any harmonic relative to carrier)		<	35 dB
		typ.	-40 dB

Input VSWR

with respect to 50 Ω	VSWR	max.	2:1
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Stability

The module will produce no spurious signals when operated with a load mismatch < 4:1 VSWR, and $P_D = 0$ to 300 mW, $V_{S1} = 6$ to 15.5 V, $V_{S2} = 10$ to 15.5 V, and $V_{S2} \geq V_{S1}$ at all times.

Ruggedness

The module will withstand a load VSWR of 50:1 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 derating curve being exceeded ($T_h < 90\text{ °C}$).

DEVELOPMENT DATA

* with respect to the earth pins

Mounting

To ensure good thermal transfer the module should be mounted onto a heatsink with a flat surface and heat-conducting compound applied between module and heatsink. Burrs and tickening of the heatsink should be removed and 3 mm bolts tightened to a torque of 0.5 Nm. 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 25 W in order to provide an adequate safety margin under fault conditions.

Output power control

The module is designed to be operated over a wide range of output power levels. The preferred method of output power control is to fix V_{S1} and V_{S2} at 12.5 V and vary the drive power. Another method of output power control is to fix V_{S2} at 12.5 V, the drive power at 150 mW and vary V_{S1} , provided V_{S1} is not outside the stability criteria.

DEVELOPMENT DATA

This data sheet contains advance information and specifications are subject to change without notice.

BGY49B

UHF POWER AMPLIFIER MODULE

A UHF amplifier module primarily designed for mobile communications equipment, operating directly from 12.5 V electrical systems. The module will produce a minimum output of 20 W into a 50 Ω load over the frequency range of 440 to 470 MHz.

The module consists of a three-stage RF amplifier using npn transistor chips with stripline and surface mounted matching elements. The negative supply is internally connected to the flange in a plastic stripline encapsulation.

QUICK REFERENCE DATA

Mode of operation		CW
Frequency range		440 to 470 MHz
Drive power		
$P_L = 20$ W	P_D	max. 150 mW
Load power	P_L	> 20 W
Supply voltages	V_{S1}, 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. 1 next page

MECHANICAL DATA

Dimensions in mm

Lead reference

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

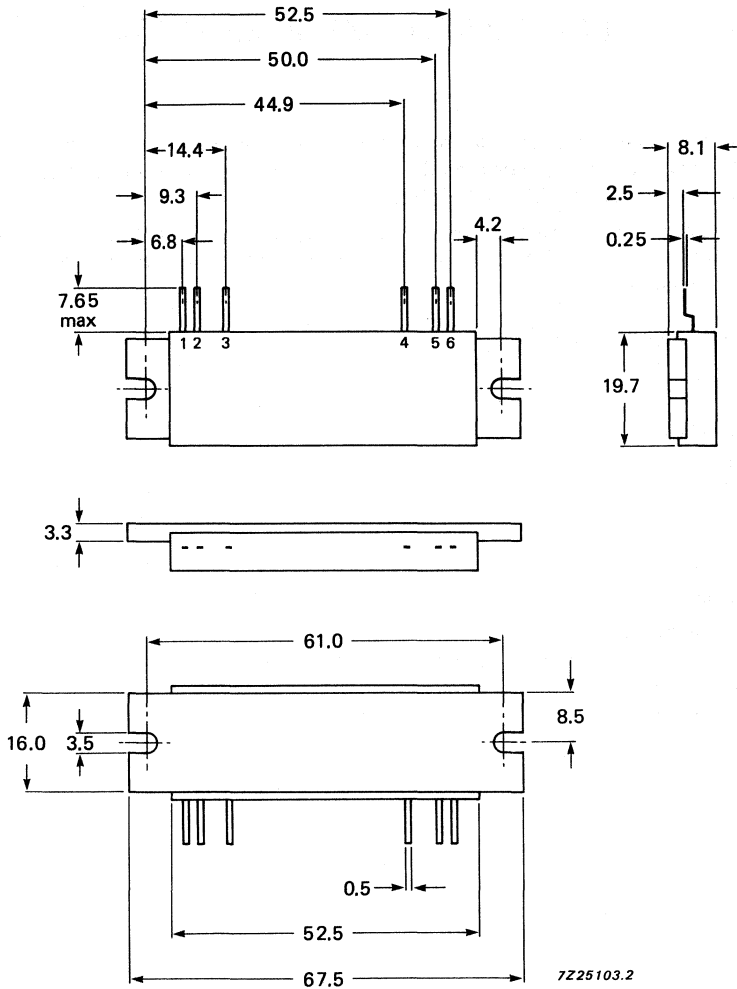


Fig.1 SOT-132D.

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

RATINGS

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

DC supply terminal voltages*	V_{S1}, V_{S2}	max.	15.5 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.	30 W
Drive power	P_D	max.	300 mW
Storage temperature range	T_{stg}		-30 to + 100 °C
Operating heatsink temperature range	T_h		-30 to + 90 °C

CHARACTERISTICS

$T_h = 25\text{ °C}; V_{S1} = V_{S2} = 12.5\text{ V}; R_S = R_L = 50\ \Omega; f = 400\text{ to }440\text{ MHz}$, unless otherwise stated

Quiescent currents

$P_D = 0$	I_{Q1}	max.	200 mA
RF load power $P_D = 150\text{ mW}$	P_L	min.	20 W
Efficiency $P_L = 20\text{ W}$	η	>	35 %
Harmonic output $P_L = 20\text{ W}$ (any harmonic relative to carrier)		< typ.	35 dB -40 dB
Input VSWR with respect to 50 Ω	VSWR	max.	2:1

DEVELOPMENT DATA

Stability

The module will produce no spurious signals when operated with a load mismatch < 4:1 VSWR, and $P_D = 0$ to 300 mW, $V_{S1} = 6$ to 15.5 V, $V_{S2} = 10$ to 15.5 V, and $V_{S2} \geq V_{S1}$ at all times.

Ruggedness

The module will withstand a load VSWR of 50:1 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 derating curve being exceeded ($T_h < 90\text{ °C}$).

* with respect to the earth pins

Mounting

To ensure good thermal transfer the module should be mounted onto a heatsink with a flat surface and heat-conducting compound applied between module and heatsink. Burrs and tickening of the heatsink should be removed and 3 mm bolts tightened to a torque of 0.5 Nm. 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 25 W in order to provide an adequate safety margin under fault conditions.

Output power control

The module is designed to be operated over a wide range of output power levels. The preferred method of output power control is to fix V_{S1} and V_{S2} at 12.5 V and vary the drive power. Another method of output power control is to fix V_{S2} at 12.5 V, the drive power at 150 mW and vary V_{S1} , provided V_{S1} is not outside the stability criteria.

DEVELOPMENT DATA

This data sheet contains advance information and specifications are subject to change without notice.

BGY90A

UHF POWER MODULE

The BGY90A is a two stage UHF power module designed for use in mobile transmitting equipment operating from a 12 V power supply.

The module consists of two npn silicon planar transistors mounted on a metallized ceramic substrate together with matching and bias circuitry. The module produces an output of 6.0 W into a 50 Ω load over the frequency range of 806 to 890 MHz when operated under nominal conditions.

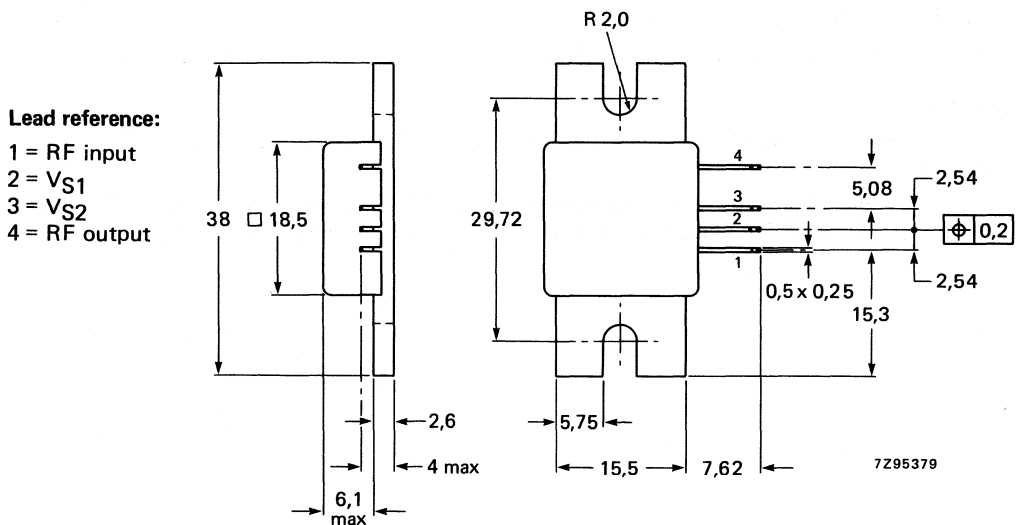
QUICK REFERENCE DATA

DC supply terminal voltages	$V_{S1}; V_{S2}$	nom. 12.5 V
Frequency	f	806 to 890 MHz
RF load power at $P_D = 200$ mW	P_L	> 6.0 W
RF input drive power at $P_L = 6.0$ W	P_D	< 200 mW
Input and output impedance	$Z_S; Z_L$	nom. 50 Ω

MECHANICAL DATA

Dimensions in mm

Fig.1 SOT197.



RATINGS

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

DC terminal supply voltages	$V_{S1}; V_{S2}$	max.	16.5 V
DC voltage on RF input	$\pm V_i$	max.	25 V
DC voltage on RF output	$\pm V_o$	max.	25 V
Load power (RF)	P_L	max.	8 W
Drive power (RF)	P_D	max.	400 mW
Storage temperature range	T_{stg}		-40 to +100 °C
Operating heatsink temperature	T_h	max.	90 °C

CHARACTERISTICS

$V_{S1} = V_{S2} = 12,5 \text{ V}$; $f = 806 - 890 \text{ MHz}$; $Z_S = Z_L = 50 \Omega$ unless otherwise specified

Quiescent currents $P_D = 0$	I_{Q1}	typ.	40 mA
	I_{Q2}	typ.	25 mA
RF input drive power at $P_L = 6.0 \text{ W}$	P_D	<	200 mW
RF output power at $P_D = 200 \text{ mW}$	P_L	>	6.0 W
Efficiency at $P_L = 6.0 \text{ W}$	η	>	35 %
Harmonic rejection at $P_L = 6.0 \text{ W}$		>	35 dB

Stability

The module will produce no spurious signals with a load mismatch of up to 3 VSWR when operated within the following conditions:

$V_{S1} = 0 \text{ to } 15 \text{ V}$; $V_{S2} = 6 \text{ to } 15 \text{ V}$; $P_D = 0 \text{ to } 400 \text{ mW}$; $T_h < 90 \text{ °C}$; $P_L \text{ (into } 50 \Omega) \leq 9 \text{ W}$.

Ruggedness

The module will withstand a load mismatch VSWR of 50 when operated within the following conditions:

$V_{S1} = 15 \text{ V max.}$; $V_{S2} = 15 \text{ V}$; $P_D = 400 \text{ mW max.}$; $T_h < 90 \text{ °C}$; providing the module is adjusted for $P_L < 8 \text{ W (into } 50 \Omega)$. This adjustment may be performed by control of either P_D or V_{S1} .

DEVELOPMENT DATA

This data sheet contains advance information and specifications are subject to change without notice.

BGY90B

UHF POWER MODULE

The BGY90B is a two stage UHF power module designed for use in mobile transmitting equipment operating from a 12 V power supply.

The module consists of two npn silicon planar transistors mounted on a metallized ceramic substrate together with matching and bias circuitry. The module produces an output power of 6.0 W into a 50 Ω load over the frequency range of 870 to 950 MHz when operated under nominal conditions.

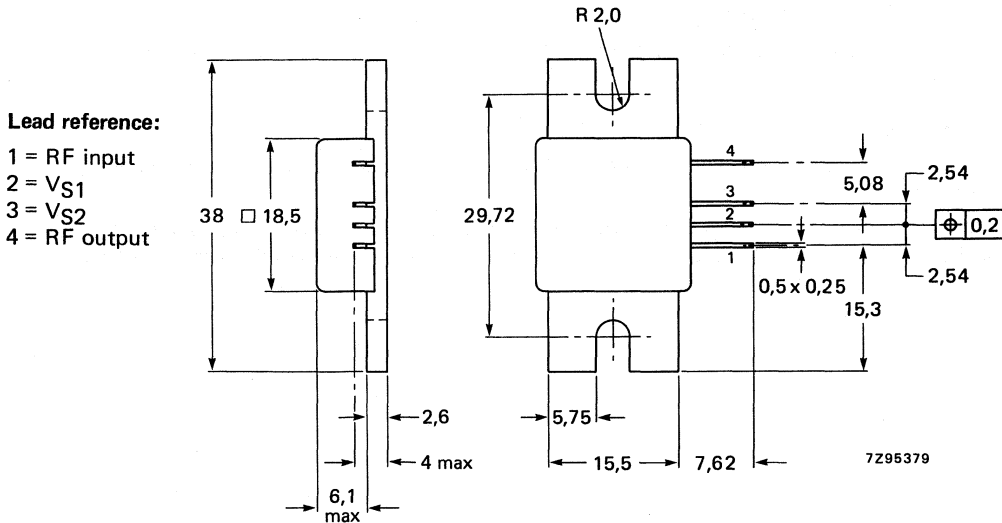
QUICK REFERENCE DATA

DC supply terminal voltages	$V_{S1}; V_{S2}$	nom. 12.5 V
Frequency	f	870 to 950 MHz
RF load power at $P_D = 200$ mW	P_L	> 6.0 W
RF input drive power at $P_L = 6.0$ W	P_D	< 200 mW
Input and output impedances	$Z_S; Z_L$	nom. 50 Ω

MECHANICAL DATA

Dimensions in mm

Fig.1 SOT197.



RATINGS

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

DC terminal supply voltages	$V_{S1}; V_{S2}$	max.	16,5 V
DC voltage on RF input	$\pm V_i$	max.	25 V
DC voltage on RF output	$\pm V_o$	max.	25 V
Load power (RF)	P_L	max.	8 W
Drive power (RF)	P_D	max.	400 mW
Storage temperature range	T_{stg}		-40 to +100 °C
Operating heatsink temperature	T_h	max.	90 °C

CHARACTERISTICS

$V_{S1} = V_{S2} = 12,5$ V; $f = 870 - 950$ MHz; $Z_S = Z_L = 50 \Omega$ unless otherwise specified

Quiescent currents			
$P_D = 0$	I_{Q1}	typ.	15 mA
	I_{Q2}	typ.	25 mA
RF input drive power at $P_L = 6.0$ W	P_D	<	200 mW
RF output power at $P_D = 200$ mW	P_L	>	6.0 W
Efficiency at $P_L = 6.0$ W	η	>	35 %
Harmonic rejection at $P_L = 6.0$ W		>	35 dB

Stability

The module will produce no spurious signals with a load mismatch of up to 3 VSWR when operated within the following conditions:

$V_{S1} < V_{S2} = 0$ to 15 V; $P_D = 0$ to 400 mW; $T_h < 90$ °C; providing maximum ratings are not exceeded.

Ruggedness

The module will withstand a load mismatch VSWR of 50 when operated within the following conditions:

$V_{S1} = 15$ V max.; $V_{S2} = 15$ V; $P_D = 400$ mW max.; $T_h < 90$ °C; providing the module is adjusted for $P_L < 8$ W (into 50Ω). This adjustment may be performed by control of either P_D or V_{S1} .

DEVELOPMENT DATA

This data sheet contains advance information and specifications are subject to change without notice.

BGY91A

UHF POWER AMPLIFIER MODULE

A UHF amplifier module primarily designed for mobile communications equipment, operating directly from 12.5 V electrical systems. The module will produce a minimum output of 6 W into a 50 Ω load over the frequency range of 806 to 890 MHz.

The module consists of a three-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	CW		
Frequency range	806 to 890 MHz		
DC supply voltage	VS1, VS2, VS3	nom.	12.5 V
Drive power	PD	max.	30 mW
Load power	PL	>	6.0 W
Input, output impedance	zi, ZL	nom.	50 Ω

MECHANICAL DATA

Dimensions in mm

Pinning:

- 1 = RF input
- 2 = VS1
- 3 = VS2
- 4 = VS3
- 5 = RF output

Flange connected to earth.

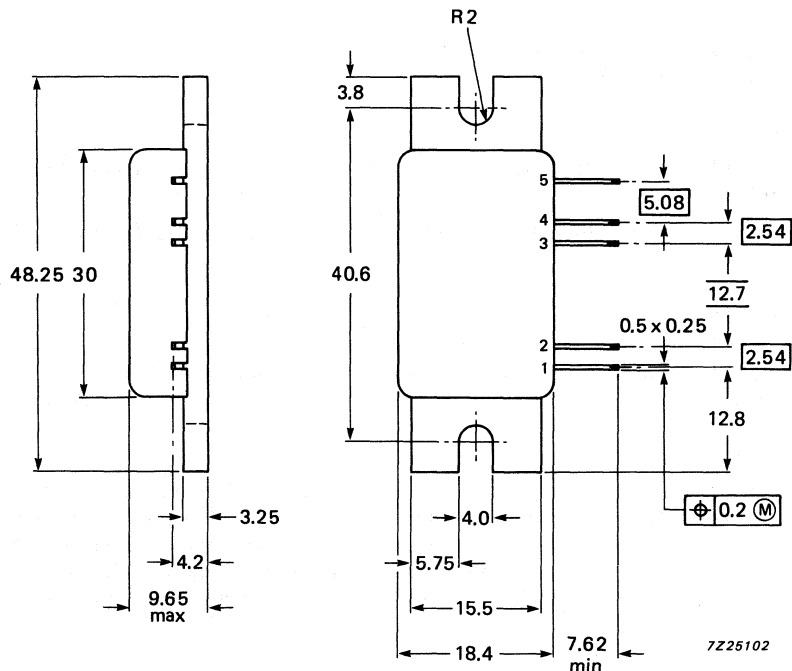


Fig. 1 SOT-233.

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

RATINGS

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

DC supply terminal voltages *	V_{S1}, V_{S2}, V_{S3}	max.	16 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.	8.0 W
Drive power	P_D	max.	80 mW
Storage temperature range	T_{stg}		-40 to + 100 °C
Operating heatsink temperature range	T_h		-30 to + 90 °C

CHARACTERISTICS

$T_h = 25$ °C; $V_{S1} = V_{S2} = V_{S3} = 12.5$ V; $R_S = R_L = 50$ Ω ; $f = 806$ to 890 MHz unless otherwise stated.

Quiescent currents

$P_D = 0$	I_{Q1}	typ.	10 mA
	I_{Q2}	typ.	80 mA

RF drive power

$P_L = 6$ W	P_D	<	30 mW
		typ.	20 mW

Efficiency

$P_L = 6$ W	η	>	30 %
		typ.	35 %

Harmonic output

any harmonic (relative to carrier); $P_L = 6$ W		<	-35 dB
		typ.	-40 dB

Input VSWR

with respect to 50 Ω	VSWR	max.	2.0 : 1
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Stability

The module is stable with load VSWR up to 4 (all phases) when operated within the following conditions:

$V_{S2} = V_{S3} = 10$ to 16 V; $f = 806$ to 890 MHz; $P_D = 0$ to 40 mW; $V_{S1} = 0$ to 12.5 V; $P_L < 8$ W (matched).

Ruggedness

The module will withstand a load VSWR of 50 : 1 for short period overload conditions, with P_D , V_{S1} , V_{S2} and V_{S3} at maximum values, providing the combination does not result in the matched RF output power derating curve being exceeded ($T_h < 90$ °C).

Mounting

To ensure good thermal transfer the module should be mounted onto a heatsink with a flat surface and heat-conducting compound applied between module and heatsink. Burrs and thickening of the heatsink should be removed and 3 mm bolts tightened to a torque of 0.5 Nm. 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.

* With respect to flange.

Power rating

In general it is recommended that the output power from the module under nominal conditions should not exceed 7 W in order to provide an adequate safety margin under fault conditions.

Gain control

Power output can be controlled by variation of the driver stage supply voltage V_{S1} from 0.5 V to 12.5 V.

DEVELOPMENT DATA

DEVELOPMENT DATA

This data sheet contains advance information and specifications are subject to change without notice.

BGY91B

UHF POWER AMPLIFIER MODULE

A UHF amplifier module primarily designed for mobile communications equipment, operating directly from 12.5 V electrical systems. The module will produce a minimum output of 6 W into a 50 Ω load over the frequency range of 870 to 950 MHz.

The module consists of a three-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		CW
Frequency range		870 to 950 MHz
DC supply voltage	V _{S1} , V _{S2} , V _{S3}	nom. 12.5 V
Drive power	P _D	max. 30 mW
Load power	P _L	> 6.0 W
Input, output impedance	Z _i , Z _L	nom. 50 Ω

MECHANICAL DATA

Dimensions in mm

Pinning:

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

Flange connected to earth.

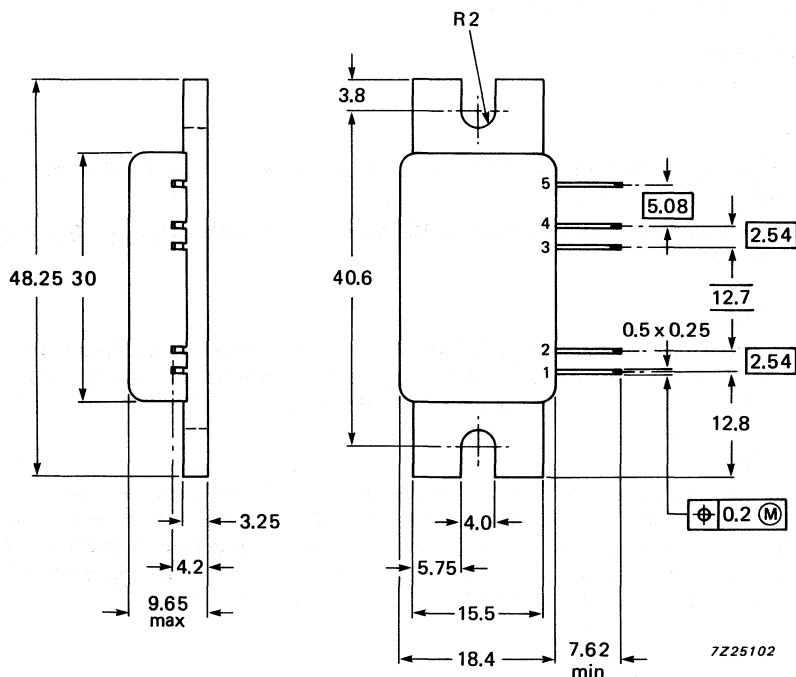


Fig. 1 SOT-233.

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

RATINGS

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

DC supply terminal voltages *	V_{S1}, V_{S2}, V_{S3}	max.	16 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.	8.0 W
Drive power	P_D	max.	80 mW
Storage temperature range	T_{stg}		-40 to + 100 °C
Operating heatsink temperature	T_h		-30 to + 90 °C

CHARACTERISTICS

$T_h = 25\text{ °C}$; $V_{S1} = V_{S2} = V_{S3} = 12.5\text{ V}$; $R_S = R_L = 50\ \Omega$; $f = 870\text{ to }950\text{ MHz}$ unless otherwise stated.

Quiescent currents			
$P_D = 0$	I_{Q1}	typ.	10 mA
	I_{Q2}	typ.	80 mA
RF drive power			
$P_L = 6\text{ W}$	P_D	<	30 mW
		typ.	20 mW
Efficiency			
$P_L = 6\text{ W}$	η	>	30 %
		typ.	35 %
Harmonic output			
any harmonic (relative to carrier); $P_L = 6\text{ W}$		<	-35 dB
		typ.	-40 dB
Input VSWR			
with respect to $50\ \Omega$	VSWR	max.	2.0 : 1

Stability

The module is stable with load VSWR up to 4 (all phases) when operated within the following conditions:

$V_{S2} = V_{S3} = 10\text{ to }16\text{ V}$; $f = 806\text{ to }890\text{ MHz}$; $P_D = 0\text{ to }40\text{ mW}$; $V_{S1} = 0\text{ to }12.5\text{ V}$; $P_L < 8\text{ W}$ (matched).

Ruggedness

The module will withstand a load VSWR of 50 : 1 for short period overload conditions, with P_D , V_{S1} , V_{S2} and V_{S3} at maximum values, providing the combination does not result in the matched RF output power derating curve being exceeded ($T_h < 90\text{ °C}$).

Mounting

To ensure good thermal transfer the module should be mounted onto a heatsink with a flat surface and heat-conducting compound applied between module and heatsink. Burrs and thickening of the heatsink should be removed and 3 mm bolts tightened to a torque of 0.5 Nm. 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.

* With respect to flange.

Power rating

In general it is recommended that the output power from the module under nominal conditions should not exceed 7 W in order to provide an adequate safety margin under fault conditions.

Gain control

Power output can be controlled by variation of the driver stage supply voltage V_{S1} from 0.5 V to 12.5 V.

DEVELOPMENT DATA

VHF POWER AMPLIFIER MODULE

VHF 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 2 W into a 50 Ω load over the frequency range 68 to 88 MHz.

The module consists of a two-stage RF amplifier using n-channel FETs with lumped element matching components in a SOT-182 plastic encapsulation.

QUICK REFERENCE DATA

Mode of operation		CW
Frequency range		68 to 88 MHz
DC supply voltage (terminal 3)	V _{S1}	nom. 9.6 V
DC supply voltage (terminal 5)	V _{S2}	nom. 9.6 V
Drive power	P _D	max. 35 mW
Load power	P _L	> 2.0 W
Input impedance	z _i	nom. 50 Ω
Output load impedance	Z _L	nom. 50 Ω

MECHANICAL DATA

Dimensions in mm

Lead reference

- 1 = RF input
- 2 = Earth
- 3 = V_{S1} and second stage bias
- 4 = Earth
- 5 = V_{S2}
- 6 = Earth
- 7 = RF output

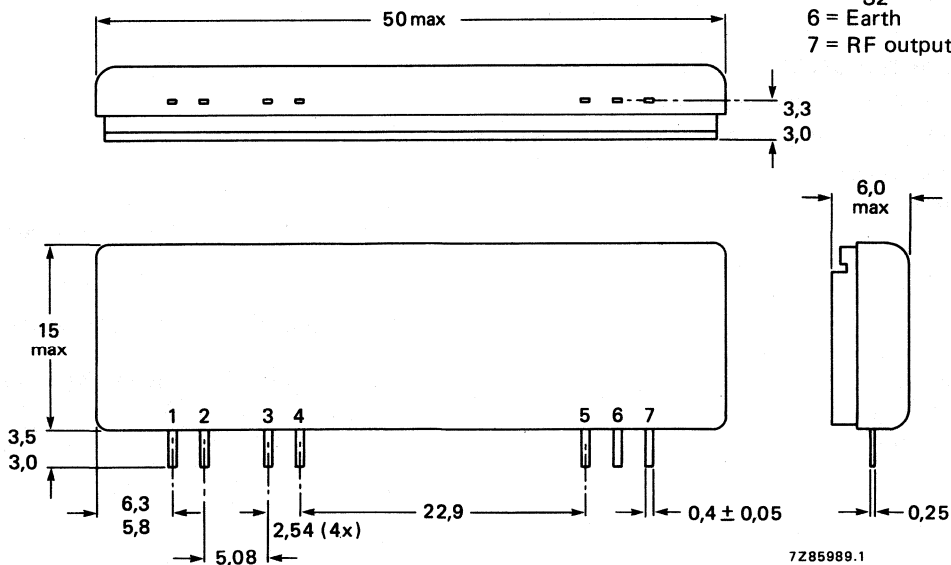


Fig. 1 SOT-182.

RATINGS

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

DC supply terminal voltages*	V_{S1}/V_{S2}	max.	13.5 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.	4.0 W
Drive power	P_D	max.	70 mW
Storage temperature range	T_{stg}		-40 to 100 °C
Operating heatsink temperature	T_h	max.	90 °C

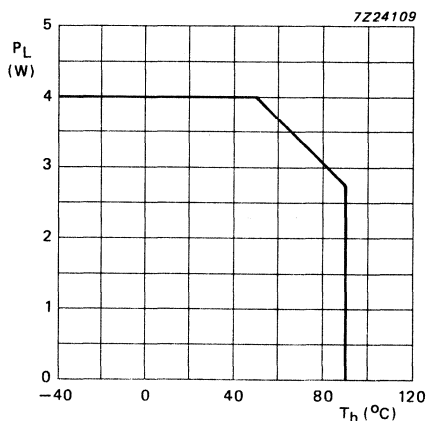


Fig. 2 Load power derating; VSWR = 1:1.

CHARACTERISTICS

$T_h = 25$ °C unless otherwise stated

$V_{S1} = V_{S2} = 9.6$ V; $R_S = R_L = 50$ Ω ; $f = 68$ to 88 MHz.

Quiescent currents

first stage current

$P_D = 0$

I_{Q1} typ. 70 mA

second stage current with

first stage open circuit

$P_D = 0$; $I_{S1} = 0$

$I_{Q2} < 0.5$ mA

second stage current with

first stage supply connected

I_{Q2} typ. 250 mA

RF drive power

$P_L = 2.0$ W

$P_D < 35$ mW

* With respect to flange.

CHARACTERISTICS (continued)

Efficiency $P_L = 2.0 \text{ W}$	η	>	40 % typ. 55 %
Harmonic output	d_2, d_3	max.	-35 dB
Input VSWR with respect to 50Ω	VSWR	<	2.0:1

Stability

The module is stable with a load VSWR up to 8 (all phases) when operated within the following conditions:

$$V_{S1} \leq V_{S2} = 4.0 \text{ V to } 11.2 \text{ V}; P_D = 17 \text{ to } 70 \text{ mW}; f = 68 \text{ to } 88 \text{ MHz}; P_L = < 4 \text{ W (matched)}.$$

Ruggedness

The module will withstand a load mismatch VSWR of 50 (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 ($T_h < 90 \text{ }^\circ\text{C}$).

Mounting

To ensure good thermal transfer the module should be mounted onto a heatsink with a flat surface and 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 $245 \text{ }^\circ\text{C}$ for not more than 10 s 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 W in order to provide an adequate safety margin under fault conditions.

Gain control

Power output can be controlled by variation of the driver stage supply voltage V_{S1} . The supply required is a voltage regulator with a current rating of 0.15 A and an output voltage range of 4 V to 9.6 V. V_{S1} must not exceed V_{S2} .

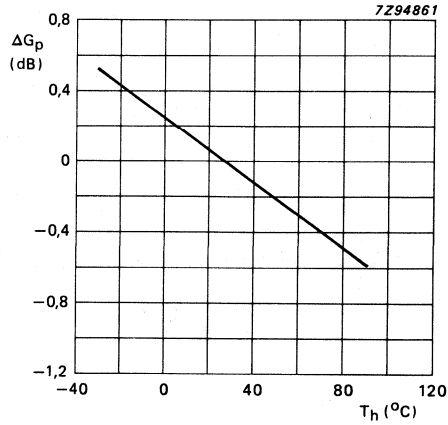


Fig. 3 Power gain as a function of temperature; $P_D = 35$ mW; $V_{S1} = V_{S2} = 9.6$ V; $f = 78$ MHz; typical values.

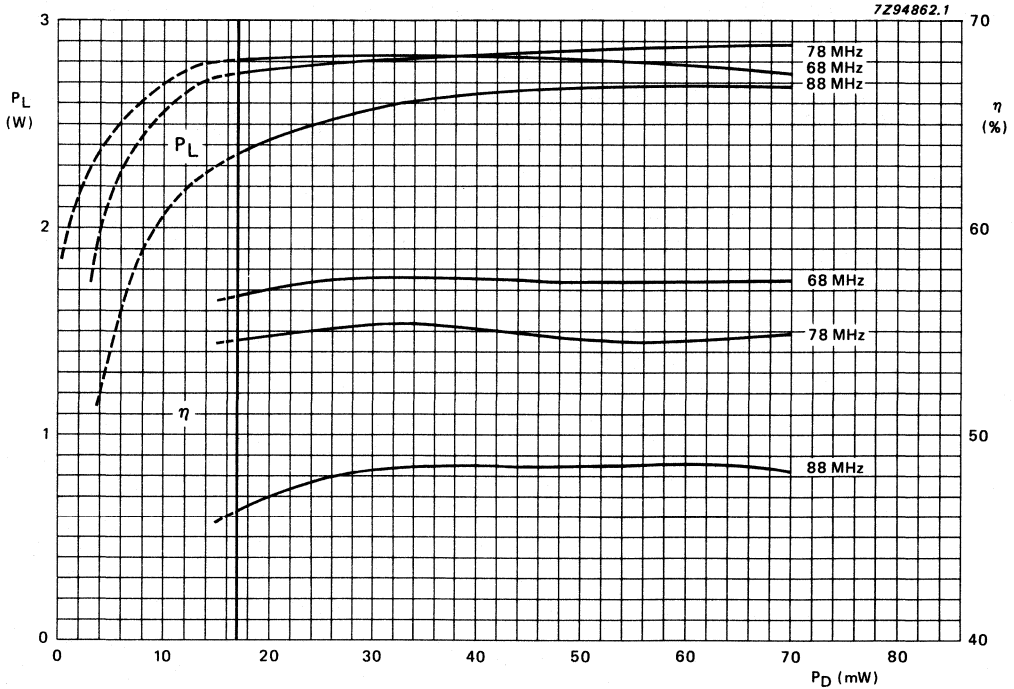


Fig. 4 Load power as a function of drive power; $V_{S1} = V_{S2} = 9.6$ V; typical values.

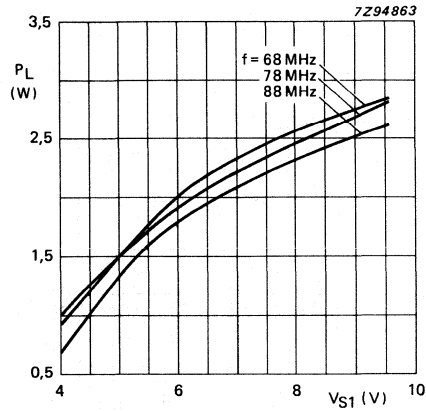


Fig. 5 Load power as a function of supply voltage V_{S1} ;
 $P_D = 35 \text{ mW}$; $V_{S2} = 9.6 \text{ V}$; typical values.

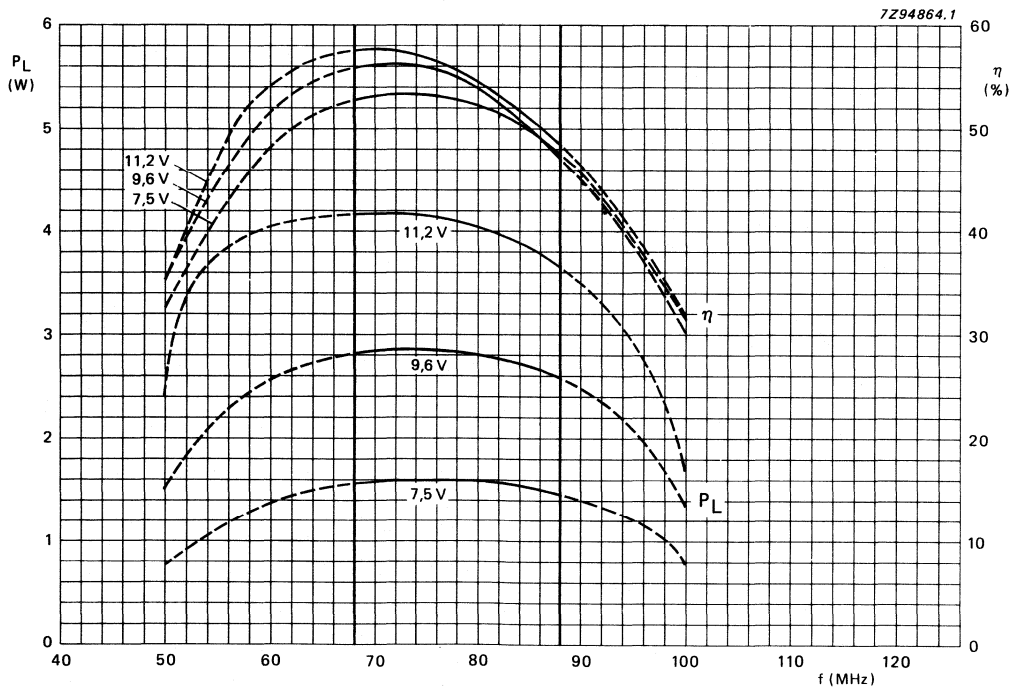


Fig. 6 Load power as a function of frequency;
 $P_D = 35 \text{ mW}$; typical values.

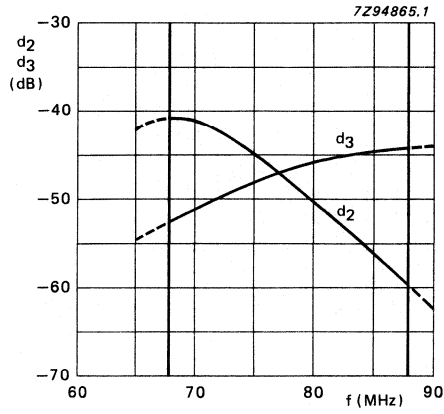


Fig. 7 Second and third harmonic distortions as a function of frequency;
 $V_{S1} = V_{S2} = 9.6 \text{ V}$; $P_D = 35 \text{ mW}$; $P_L = 2.0 \text{ W}$; typical values.

VHF POWER AMPLIFIER MODULE

VHF 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 2 W into a 50 Ω load over the frequency range 132 to 156 MHz.

The module consists of a two-stage RF amplifier using n-channel FETs with lumped element matching components in a SOT-182 plastic encapsulation.

QUICK REFERENCE DATA

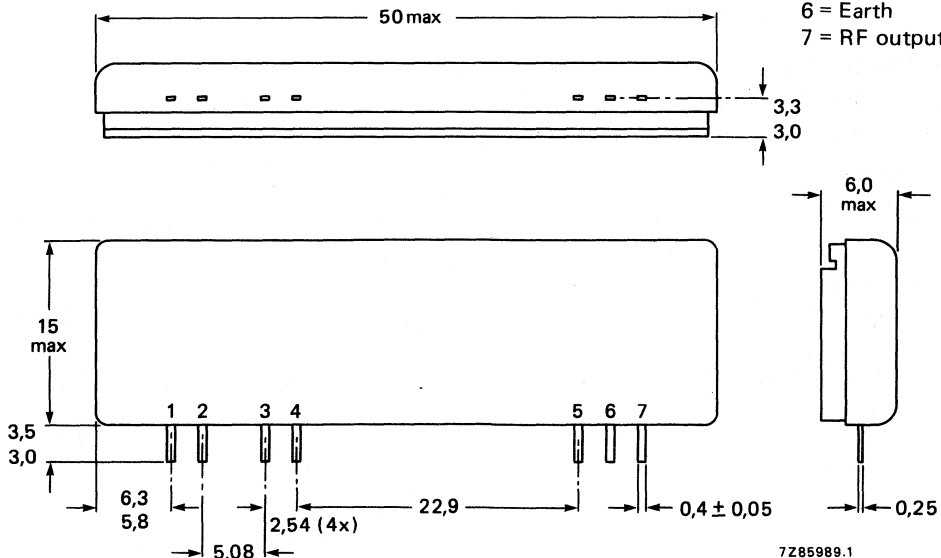
Mode of operation		CW
Frequency range		132 to 156 MHz
DC supply voltage (terminal 3)	VS1	nom. 9.6 V
DC supply voltage (terminal 5)	VS2	nom. 9.6 V
Drive power	PD	max. 35 mW
Load power	PL	> 2.0 W
Input impedance	zi	nom. 50 Ω
Output load impedance	ZL	nom. 50 Ω

MECHANICAL DATA

Dimensions in mm

Lead reference

- 1 = RF input
- 2 = Earth
- 3 = VS1 and second stage bias
- 4 = Earth
- 5 = VS2
- 6 = Earth
- 7 = RF output



7Z85989.1

Fig. 1 SOT-182.

RATINGS

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

DC supply terminal voltages*	V_{S1}, V_{S2}	max.	13.5 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.	4.0 W
Drive power	P_D	max.	70 mW
Storage temperature range	T_{stg}		-40 to 100 °C
Operating heatsink temperature	T_h	max.	90 °C

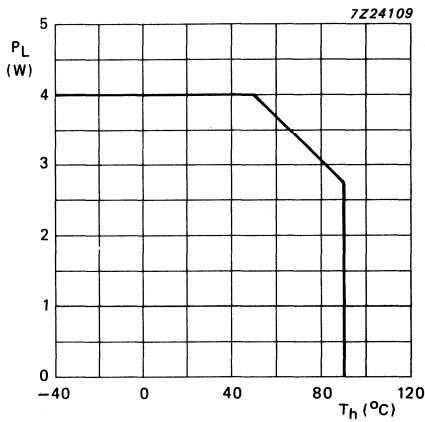


Fig. 2 Load power derating; VSWR = 1:1.

CHARACTERISTICS

$T_h = 25$ °C unless otherwise stated

$V_{S1} = V_{S2} = 9.6$ V; $R_S = R_L = 50$ Ω ; $f = 132$ to 156 MHz.

Quiescent currents

first stage current			
$P_D = 0$	I_{Q1}	typ.	70 mA
second stage current with first stage open circuit			
$P_D = 0; V_{S1} = 0$	I_{Q2}	<	0.5 mA
second stage current with first stage supply connected	I_{Q2}	typ.	250 mA
RF drive power			
$P_L = 2.0$ W	P_D	<	35 mW

* With respect to flange.

CHARACTERISTICS (continued)

Efficiency			
$P_L = 2.0 \text{ W}$	η	>	40 %
		typ.	42 %
Harmonic output	d_2, d_3	max.	-35 dB
Input VSWR			
with respect to 50Ω	VSWR	<	2.0:1

Stability

The module is stable with a load VSWR up to 8 (all phases) when operated within the following conditions:

$$V_{S1} \leq V_{S2} = 4.0 \text{ V to } 11.2 \text{ V}; P_D = 17 \text{ to } 70 \text{ mW}; f = 132 \text{ to } 156 \text{ MHz}; P_L = < 4 \text{ W (matched)}.$$

Ruggedness

The module will withstand a load mismatch VSWR of 50 (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 ($T_h < 90 \text{ }^\circ\text{C}$).

Mounting

To ensure good thermal transfer the module should be mounted onto a heatsink with a flat surface and 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 $245 \text{ }^\circ\text{C}$ for not more than 10s 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 W in order to provide an adequate safety margin under fault conditions.

Gain control

Power output can be controlled by variation of the driver stage supply voltage V_{S1} . The supply required is a voltage regulator with a current rating of 0.15 A and an output voltage range of 4 V to 9.6 V. V_{S1} must not exceed V_{S2} .

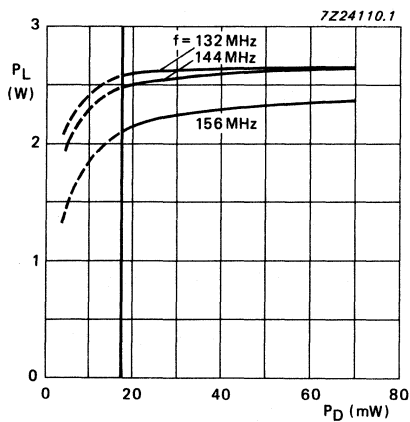


Fig. 3 Load power as a function of drive power; $V_{S1} = V_{S2} = 9.6$ V; typical values.

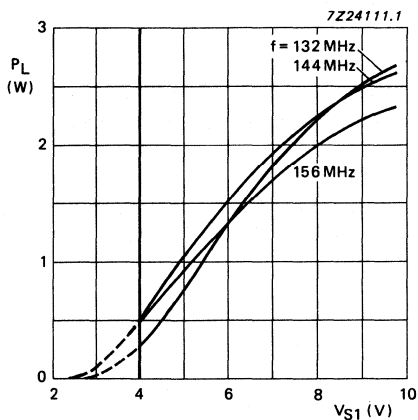


Fig. 4 Load power as a function of supply voltage V_{S1} ; $P_D = 35$ mW; $V_{S2} = 9.6$ V; typical values.

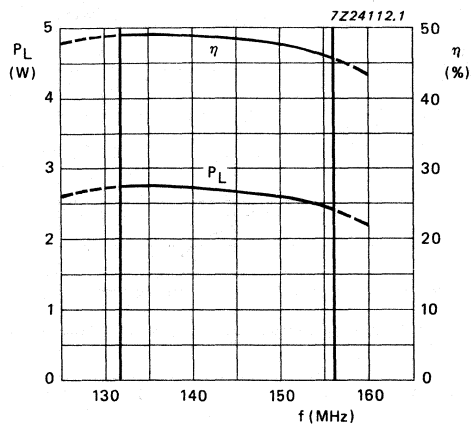


Fig. 5 Load power and efficiency as functions of frequency; $V_{S1} = V_{S2} = 9.6$ V; $P_D = 35$ mW; typical values.

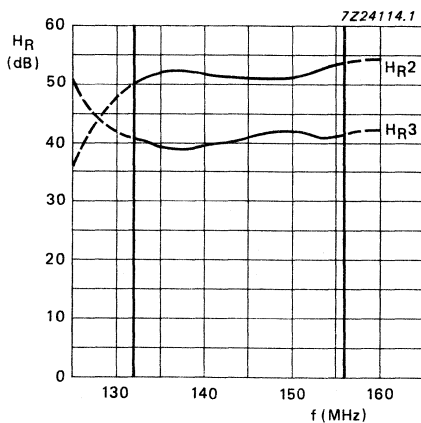


Fig. 6 Second and third harmonic rejection as a function of frequency; $V_{S1} = V_{S2} = 9.6$ V; $P_D = 35$ mW; $P_L = 2.0$ W; typical values.

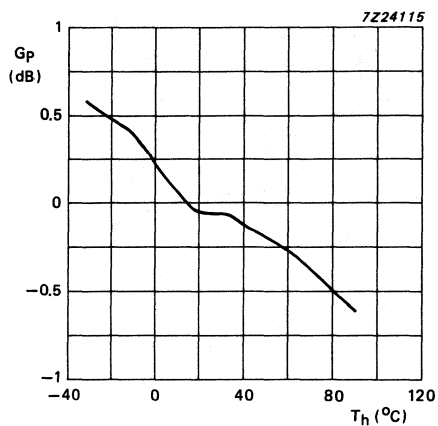


Fig. 7 Power gain as a function of temperature;
 $V_{S1} = V_{S2} = 9.6$ V; $P_D = 35$ mW; $f = 144$ MHz.

V H F POWER AMPLIFIER MODULE

A broadband VHF amplifier module primarily designed for use in portable transmitters operating from 9.6 V electrical battery supply.

The module is a two-stage RF amplifier consisting of n-channel FETs, with lumped-element matching and bias circuits.

The module will produce a minimum output of 2 W into a 50 Ω load over the frequency range of 148 to 174 MHz.

QUICK REFERENCE DATA

Mode of operation		CW
Frequency range	f	148 to 174 MHz
Drive power	P _D	max. 35 mW
Load power	P _L	min. 2.0 W
Supply voltages	V _{S1} , V _{S2}	nom. 9.6 V
Input and output impedances	Z _S , Z _L	nom. 50 Ω

MECHANICAL DATA

Dimensions in mm

Lead reference

- 1 = RF input
- 2 = Earth
- 3 = V_{S1} and second stage bias
- 4 = Earth
- 5 = V_{S2}
- 6 = Earth
- 7 = RF output

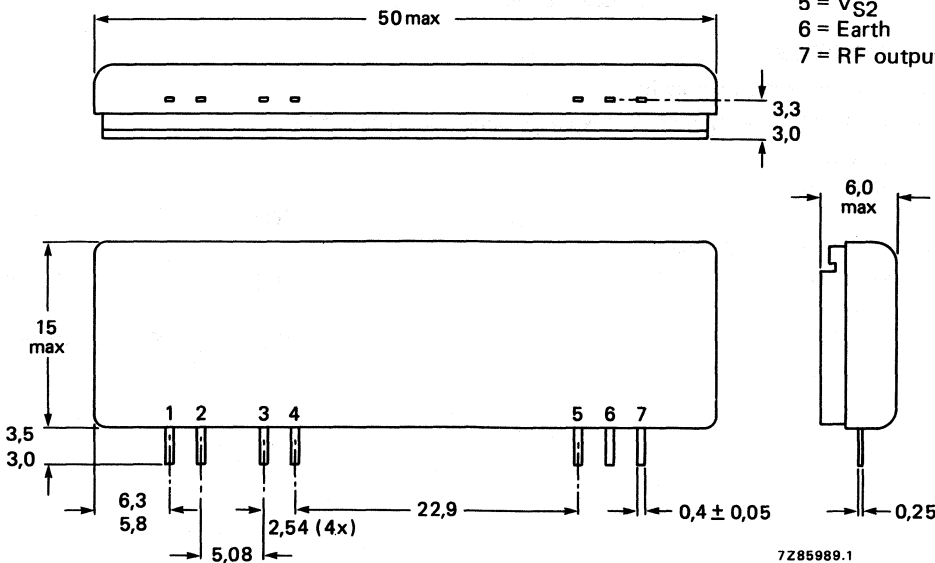


Fig. 1 SOT-182.

RATINGS

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

DC supply terminal voltages*	V_{S1}, V_{S2}	max.	13.5 V*
RF input voltage*	$\pm V_i$	max.	25 V*
RF output voltage*	$\pm V_o$	max.	25 V*
Load power (see Fig. 2)	P_L	max.	4.0 W
Drive power	P_D	max.	70 mW
Storage temperature range	T_{stg}		-40 to 100 °C
Operating heatsink temperature	T_h	max.	90 °C

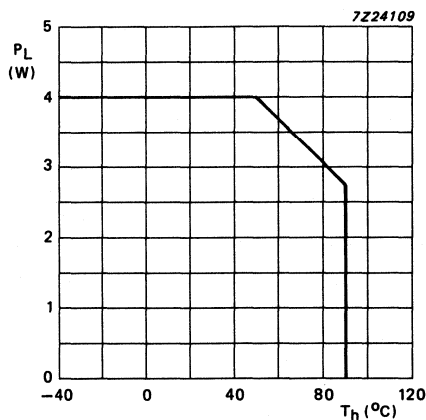


Fig. 2 Load power derating; VSWR = 1:1.

CHARACTERISTICS

$T_h = 25$ °C unless otherwise specified

$V_{S1} = V_{S2} = 9.6$ V; $R_S = R_L = 50$ Ω ; frequency range 148 to 174 MHz.

Quiescent currents

first stage current

$P_D = 0$

I_{Q1} typ. 70 mA

second stage current with first

stage open circuit; $P_D = 0$; $I_{S1} = 0$

$I_{Q2} < 0.5$ mA

RF drive power

$P_L = 2$ W

$P_D < 35$ mW

* With respect to flange.

CHARACTERISTICS (continued)

Efficiency $P_L = 2 \text{ W}$	η	>	40 % typ. 43 %
Harmonic output	any harmonic	<	-35 dB
Input VSWR with respect to 50 Ω	VSWR	max.	2:1

Stability

The module is stable with load VSWR up to 8 (all phases) when operated with:

$$V_{S1} \leq V_{S2} = 4 \text{ to } 11.2 \text{ V}; f = 148 \text{ to } 174 \text{ MHz}; P_D = 17 \text{ to } 70 \text{ mW}; P_L < 4.0 \text{ W (matched)}.$$

Ruggedness

The modules will withstand a load mismatch VSWR of 50 for short 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 ($T_h < 90 \text{ }^\circ\text{C}$).

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. 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 $^\circ\text{C}$ 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 W in order to provide an adequate safety margin under fault conditions.

Gain control

Power output can be controlled by variation of the driver stage supply voltage V_{S1} . The supply required is a voltage regulator with a current rating of 0.15 A, and an output voltage range of 4 V to 9.6 V.

V_{S1} must not exceed V_{S2} .

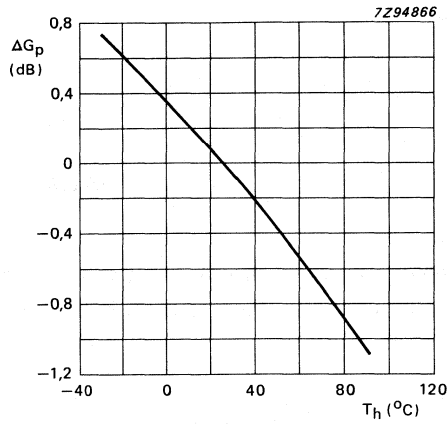


Fig. 3 Power gain as a function of temperature; $P_D = 35$ mW; $V_{S1} = V_{S2} = 9.6$ V; $f = 161$ MHz; typical values.

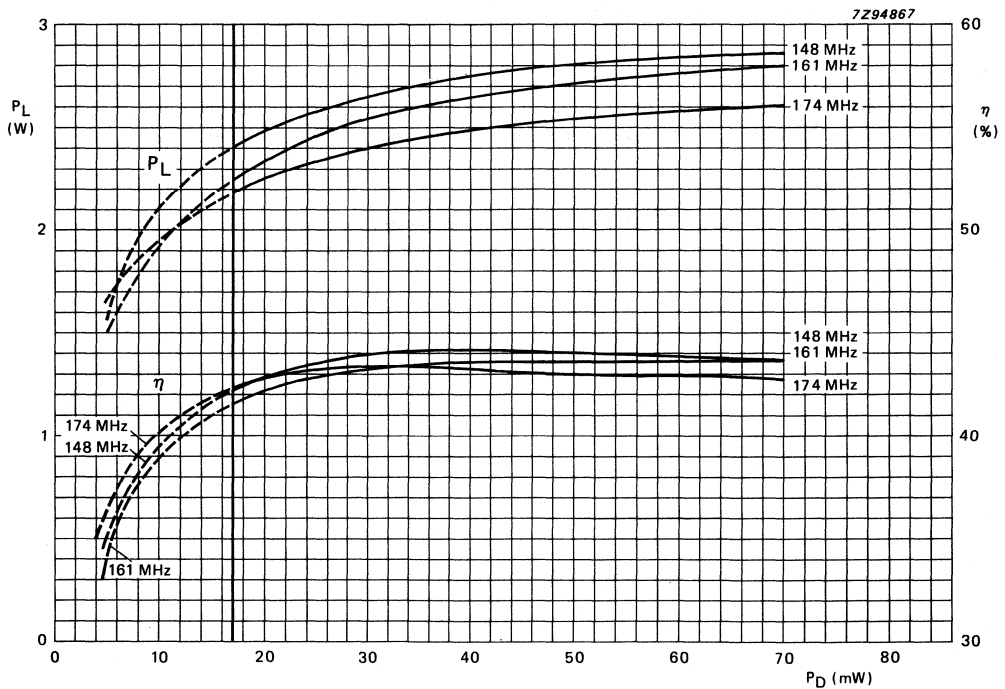


Fig. 4 Load power as a function of drive power; $V_{S1} = V_{S2} = 9.6$ V; typical values.

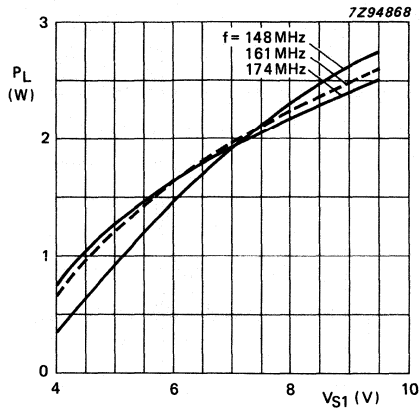


Fig. 5 Load power as a function of supply voltage V_{S1} ; $V_{S2} = 9.6 \text{ V}$; $P_D = 35 \text{ mW}$; typical values.

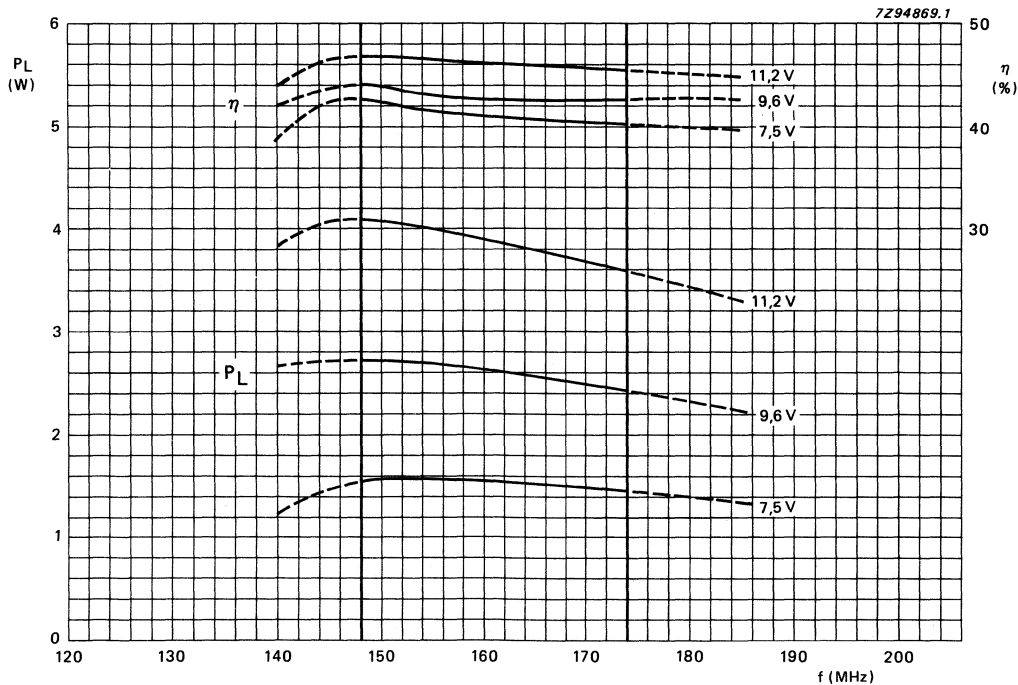


Fig. 6 Load power as a function of frequency; $P_D = 35 \text{ mW}$; typical values.

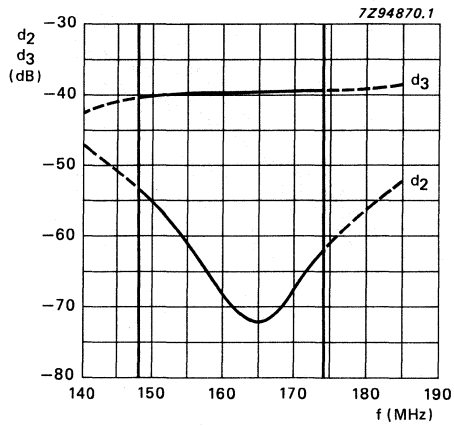


Fig. 7 Second and third harmonic distortion as a function of frequency; $V_{S1} = V_{S2} = 9.6$ V; $P_D = 35$ mW; typical values.

VHF AMPLIFIER MODULE

VHF amplifier module designed for use in portable transmitters operating from a 9.6 V supply. The module is a two-stage amplifier consisting of n-channel FET crystals and lumped-element matching circuits.

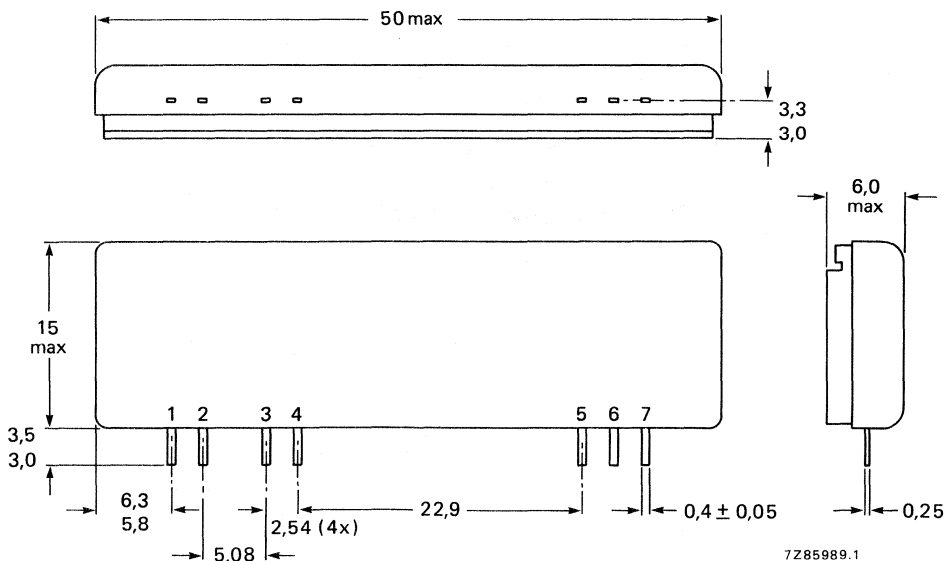
The BGY94A will produce a minimum of 5 W into a 50 Ω load over the 68 to 88 MHz frequency range.

QUICK REFERENCE DATA

Mode of operation			CW
Frequency range			68 to 88 MHz
DC supply voltages	V_{S1}, V_{S2}	nom.	9.6 V
Drive power	P_D	max.	35 mW
Load power	P_L	>	5.0 W
Input, output impedance	z_i, z_L	nom.	50 Ω

MECHANICAL DATA

Dimensions in mm



Lead reference
 1 = RF input
 2 = Earth

3 = V_{S1} and second stage bias
 4 = Earth

5 = V_{S2}
 6 = Earth
 7 = RF output
 flange = earth

Fig. 1 SOT-182.

RATINGS

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

DC supply terminal voltages*	V_{S1}, V_{S2}	max.	13.5 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.	9.0 W
Drive power	P_D	max.	70 mW
Storage temperature range	T_{stg}		-40 to + 100 °C
Operating heatsink temperature	T_h	max.	90 °C

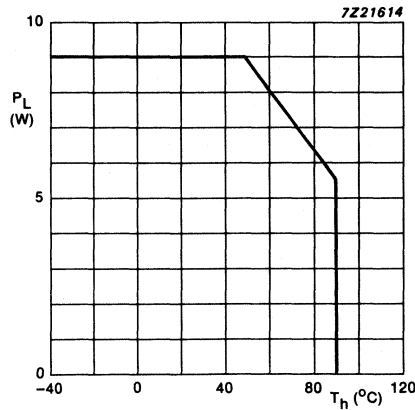


Fig. 2 Load power derating; VSWR = 1 : 1.

* With respect to earth.

CHARACTERISTICS

$T_h = 25\text{ }^\circ\text{C}$ unless otherwise stated

$V_{S1} = V_{S2} = 9.6\text{ V}$; $R_S = R_L = 50\text{ }\Omega$; $f = 68\text{ to }88\text{ MHz}$.

Quiescent currents

first stage current

$P_D = 0$

I_{Q1} typ. 125 mA

second stage current with

first stage open circuit

$P_D = 0$; $I_{S1} = 0$

$I_{Q2} < 0.5\text{ mA}$

RF drive power

$P_L = 5.0\text{ W}$

$P_D < 35\text{ mW}$
typ. 10 mW

Efficiency

$P_L = 5.0\text{ W}$

$\eta > 40\%$
typ. 48%

Harmonic output

any harmonic
(relative to
carrier) $<$

-35 dB

Input VSWR

with respect to $50\text{ }\Omega$

VSWR max. 2 : 1

Stability

The module is stable with load VSWR up to 8 (all phases) when operated within the following conditions:

$V_{S1} \leq V_{S2} = 4\text{ to }11.2\text{ V}$; $f = 68\text{ to }88\text{ MHz}$; $P_D = 17\text{ to }70\text{ mW}$; $P_L < 9\text{ W}$ (matched).

Ruggedness

The module will withstand a 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 derating curve being exceeded ($T_h < 90\text{ }^\circ\text{C}$).

Mounting

To ensure good thermal transfer the module should be mounted onto a heatsink with a flat surface and 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 s 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 7 W in order to provide an adequate safety margin under fault conditions.

Gain control

The module is designed to be operated at a constant output power of 5 W. The module is adjusted to produce nominal output power by reducing the first stage supply voltage (V_{S1}). If the module is to be used over a range of output power levels below 5 W the first stage supply voltage should not be reduced below 4 V. If further reductions in power are needed this may be achieved by varying the drive power (P_D), however for stable operation care must be taken to avoid operating the module outside the published stability conditions.

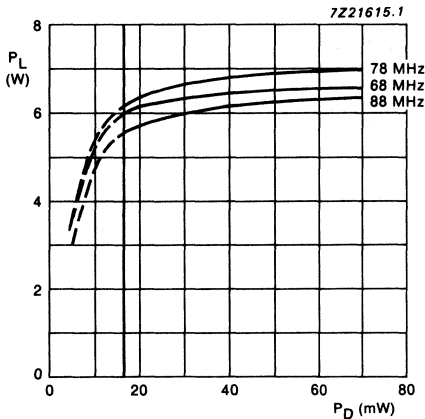


Fig. 3 Load power as a function of drive power; $V_{S1} = V_{S2} = 9.6$ V.

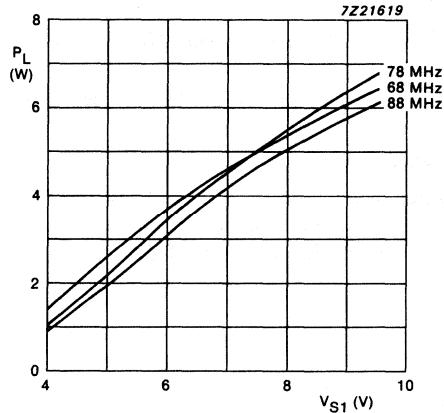


Fig. 4 Load power as a function of supply voltage V_{S1} ; $P_D = 35$ mW; $V_{S2} = 9.6$ V.

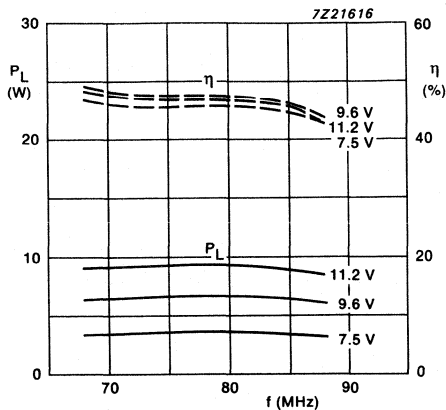


Fig. 5 Load power and efficiency as functions of frequency; $P_D = 35$ mW.

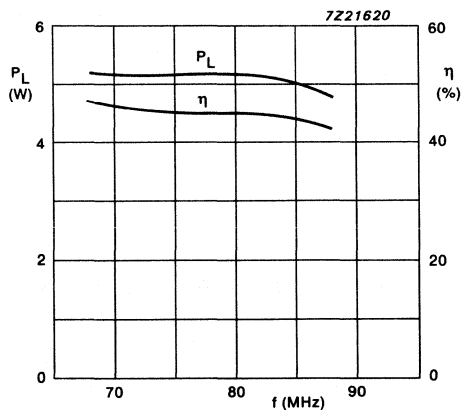


Fig. 6 Load power and efficiency as functions of frequency; $P_D = 35$ mW; $V_{S1} = 7.5$ V; $V_{S2} = 9.6$ V.

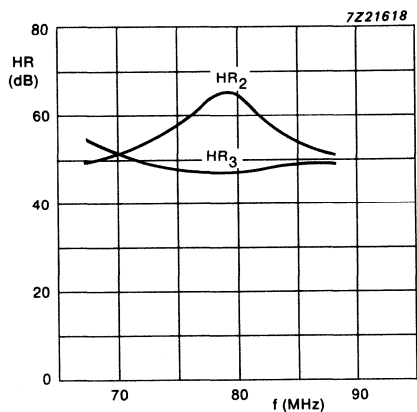


Fig. 7 Second and third harmonic rejection as a function of frequency; $P_D = 35$ mW; $V_{S1} = V_{S2} = 9.6$ V.

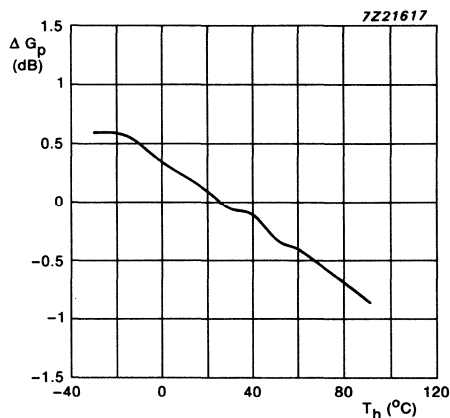


Fig. 8 Change in power gain as a function of heatsink temperature; $f = 78$ MHz; $P_D = 35$ mW; $V_{S1} = V_{S2} = 9.6$ V.

VHF POWER AMPLIFIER MODULE

A broadband VHF amplifier module primarily designed for use in portable transmitters operating from 9.6 V electrical battery supply.

The module is a two-stage RF amplifier consisting of n-channel FETs, with lumped-element matching and bias circuits.

The module will produce a minimum of 5 W into a 50 Ω load over the frequency range of 132 to 156 MHz.

QUICK REFERENCE DATA

Mode of operation		CW	
Frequency range		132 to 156 MHz	
DC supply voltages	V_{S1}, V_{S2}	nom.	9.6 V
Drive power	P_D	max.	35 mW
Load power	P_L	>	5.0 W
Input, output impedance	Z_i, Z_L	nom.	50 Ω

MECHANICAL DATA

Dimensions in mm

Lead reference

- 1 = RF input
- 2 = Earth
- 3 = V_{S1} and second stage bias
- 4 = Earth
- 5 = V_{S2}
- 6 = Earth
- 7 = RF output
- Flange = earth

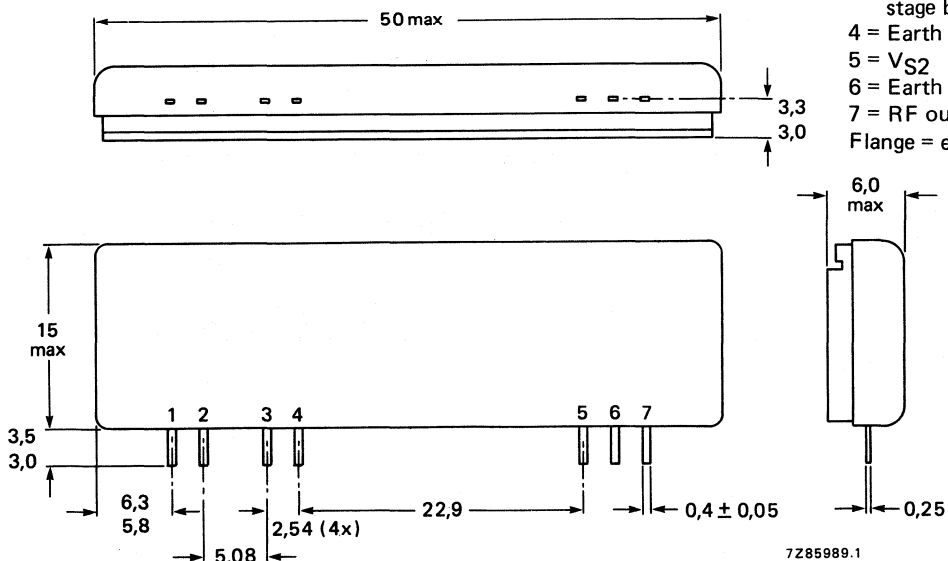


Fig. 1 SOT-182.

RATINGS

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

DC supply terminal voltages*	V_{S1}, V_{S2}	max.	13.5 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.	9.0 W
Drive power	P_D	max.	70 mW
Storage temperature range	T_{stg}		-40 to + 100 °C
Operating heatsink temperature	T_h	max.	90 °C

CHARACTERISTICS

$T_h = 25$ °C unless otherwise stated

$V_{S1} = V_{S2} = 9.6$ V; $R_S = R_L = 50$ Ω ; $f = 132$ to 156 MHz

Quiescent currents

first stage current
 $P_D = 0$ I_{Q1} typ. 125 mA

second stage current with
 first stage open circuit
 $P_D = 0$; $I_{S1} = 0$ I_{Q2} < 0.5 mA

RF drive power
 $P_L = 5.0$ W P_D < 35 mW

Efficiency
 $P_L = 5.0$ W η > 40 %
 typ. 42 %

Harmonic output
 any harmonic
 (relative to carrier) < -35 dB

Input VSWR
 with respect to 50 Ω VSWR max. 2:1

Stability

The module is stable with load VSWR up to 8 (all phases) when operated within the following conditions:

$V_{S1} \leq V_{S2} = 4$ to 11.2 V; $f = 132$ to 156 MHz; $P_D = 17$ to 70 mW; $P_L < 9$ W (matched).

Ruggedness

The module will withstand a 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 derating curve being exceeded ($T_h < 90$ °C).

* With respect to flange.

Mounting

To ensure good thermal transfer the module should be mounted onto a heatsink with a flat surface and 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 s 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 7 W in order to provide an adequate safety margin under fault conditions.

Gain control

The module is designed to be operated at a constant output power of 5 W. The module is adjusted to produce nominal output power by reducing the first stage supply voltage (V_{S1}). If the module is to be used over a range of output power levels below 5 W the first stage supply voltage should not be reduced below 4 V. If further reductions in power are needed this may be achieved by varying the drive power (P_D), however for stable operation care must be taken to avoid operating the module outside the published stability conditions.

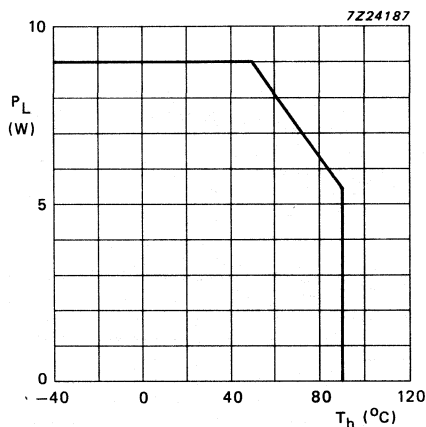


Fig. 2 Load power derating; VSWR = 1:1.

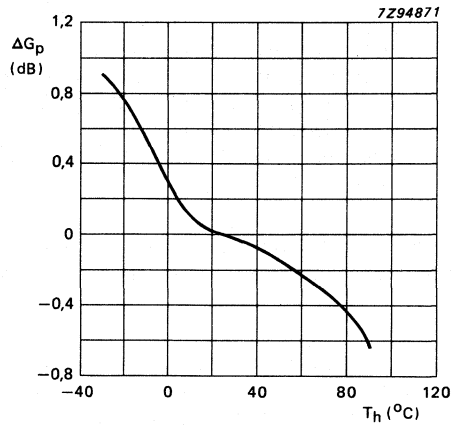


Fig. 3 Power gain as a function of temperature;
 $V_{S1} = V_{S2} = 9.6 \text{ V}$; $P_D = 35 \text{ mW}$; $f = 144 \text{ MHz}$.

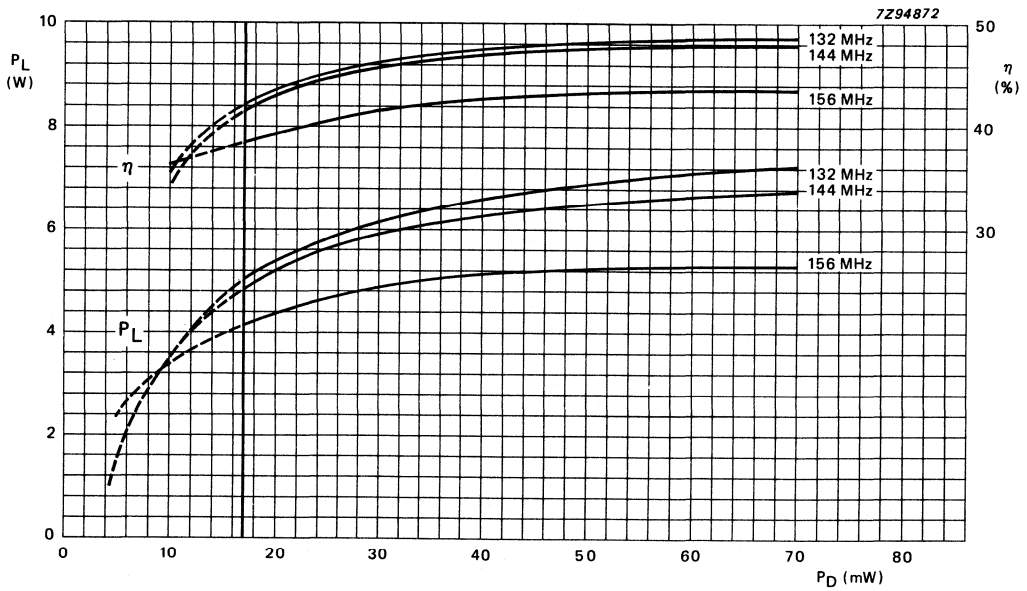


Fig. 4 Load power and efficiency as functions of drive power;
 $V_{S1} = V_{S2} = 9.6 \text{ V}$; typical values.

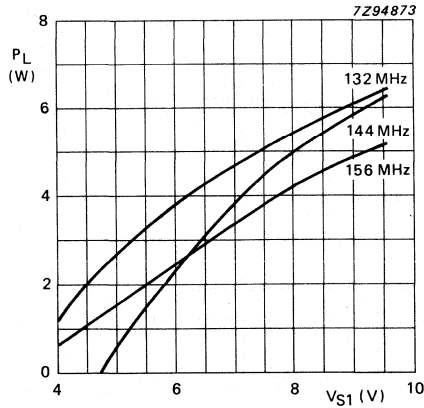


Fig. 5 Load power as a function of supply voltage V_{S1} ; $P_D = 35$ mW; $V_{S2} = 9.6$ V; typical values.

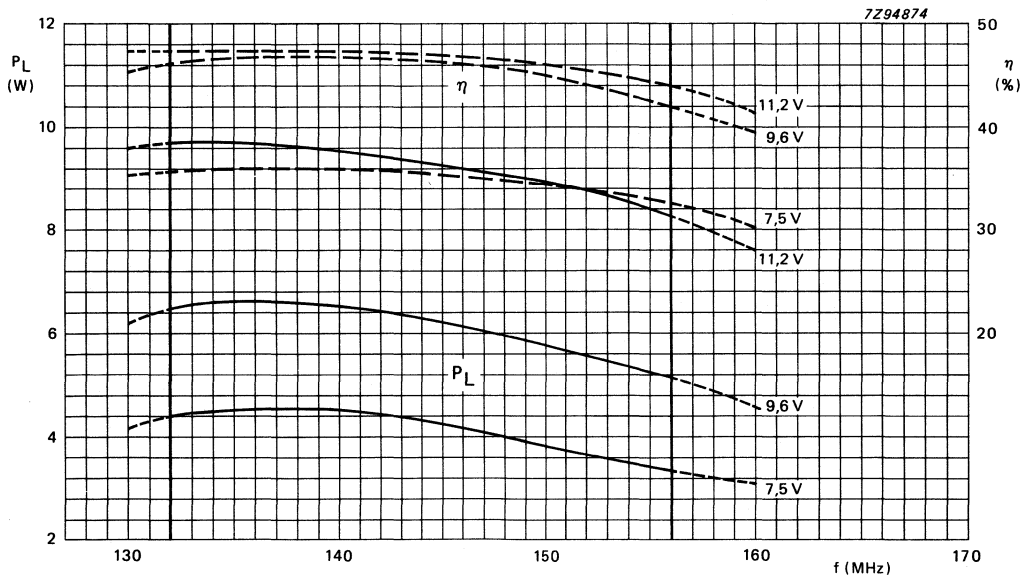


Fig. 6 Load power and efficiency as functions of frequency; $V_{S1} = V_{S2}$; $P_D = 35$ mW; typical values.

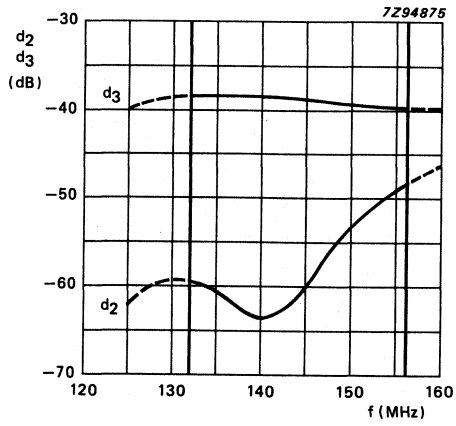


Fig. 7 Second and third harmonic distortion as a function of frequency; $V_{S1} = V_{S2} = 9.6$ V; $P_D = 35$ mW; typical values.

VHF AMPLIFIER MODULE

A broadband VHF amplifier module primarily designed for use in portable transmitters operating from 9.6 V electrical battery supply.

The module is a two-stage RF amplifier consisting of n-channel FETs, with lumped-element matching and bias circuits.

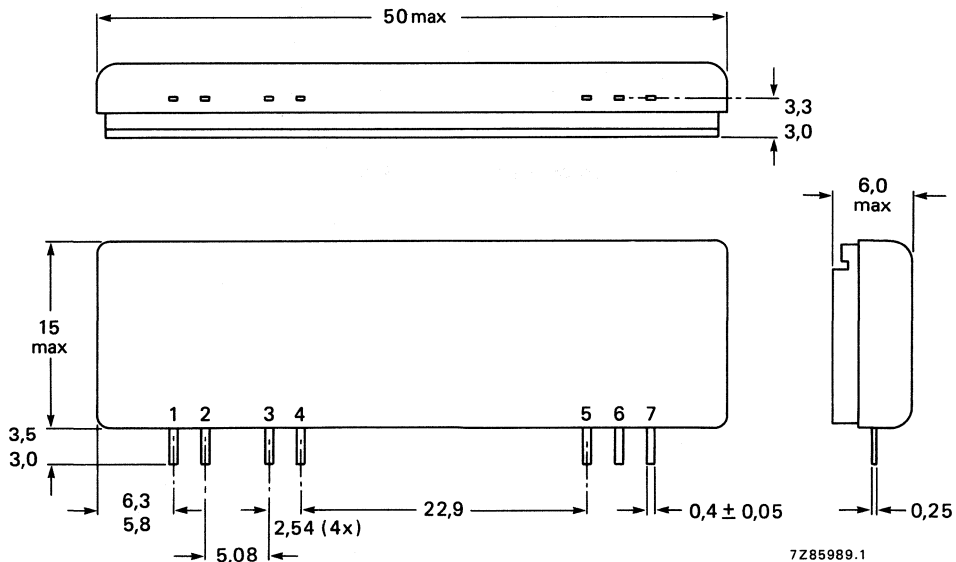
The module will produce a minimum of 5 W into a 50 Ω load over the frequency range of 148 to 174 MHz.

QUICK REFERENCE DATA

Mode of operation			CW
Frequency range			148 to 174 MHz
DC supply voltages	V_{S1}, V_{S2}	nom.	9.6 V
Drive power	P_D	max.	35 mW
Load power	P_L	>	5.0 W
Input, output impedance	z_i, z_L	nom.	50 Ω

MECHANICAL DATA

Dimensions in mm



Lead reference

1 = RF input
2 = Earth

3 = V_{S1} and second stage bias

4 = Earth
Fig. 1 SOT-182.

5 = V_{S2}

6 = Earth
7 = RF output
Flange = Earth

RATINGS

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

DC supply terminal voltages*	V_{S1}, V_{S2}	max.	13.5 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.	9.0 W
Drive power	P_D	max.	70 mW
Storage temperature range	T_{stg}		-40 to + 100 °C
Operating heatsink temperature	T_h	max.	90 °C

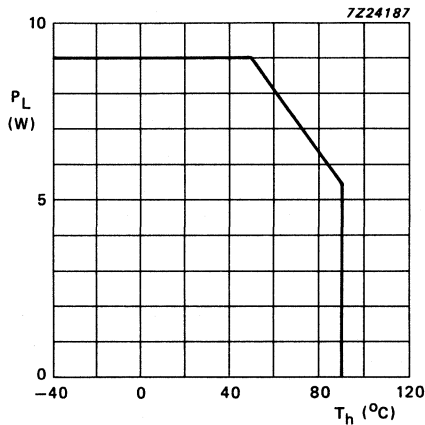


Fig. 2 Load power derating; VSWR = 1 : 1.

* With respect to earth.

CHARACTERISTICS

$T_h = 25\text{ }^\circ\text{C}$ unless otherwise stated

$V_{S1} = V_{S2} = 9.6\text{ V}$; $R_S = R_L = 50\ \Omega$; $f = 148\text{ to }174\text{ MHz}$.

Quiescent currents

first stage current

$P_D = 0$

I_{Q1} typ. 125 mA

second stage current with

first stage open circuit

$P_D = 0$; $I_{S1} = 0$

$I_{Q2} < 0.5\text{ mA}$

RF drive power

$P_L = 5.0\text{ W}$

$P_D < 35\text{ mW}$

Efficiency

$P_L = 5.0\text{ W}$

$\eta > 40\%$
typ. 46%

Harmonic output

any harmonic

(relative to

carrier)

$< -35\text{ dB}$

Input VSWR

with respect to $50\ \Omega$

VSWR max. 2 : 1

Stability

The module is stable with load VSWR up to 8 (all phases) when operated within the following conditions:

$V_{S1} \leq V_{S2} = 4\text{ to }11.2\text{ V}$; $f = 148\text{ to }174\text{ MHz}$; $P_D = 17\text{ to }70\text{ mW}$; $P_L < 9\text{ W}$ (matched).

Ruggedness

The module will withstand a 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 derating curve being exceeded ($T_h < 90\text{ }^\circ\text{C}$).

Mounting

To ensure good thermal transfer the module should be mounted onto a heatsink with a flat surface and 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 s 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 7 W in order to provide an adequate safety margin under fault conditions.

Gain control

The module is designed to be operated at a constant output power of 5 W. The module is adjusted to produce nominal output power by reducing the first stage supply voltage (V_{S1}). If the module is to be used over a range of output power levels below 5 W the first stage supply voltage should not be reduced below 4 V. If further reductions in power are needed this may be achieved by varying the drive power (P_D), however for stable operation care must be taken to avoid operating the module outside the published stability conditions.

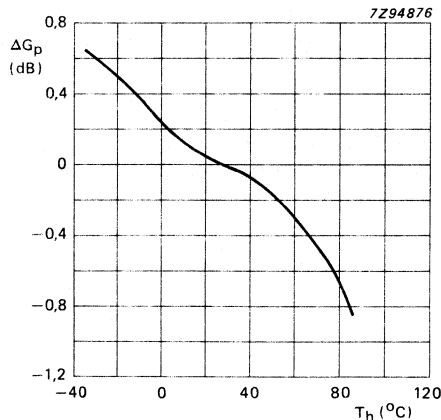


Fig. 3 Power gain as a function of temperature; $V_{S1} = V_{S2} = 9.6$ V; $P_D = 35$ mW; $f = 161$ MHz.

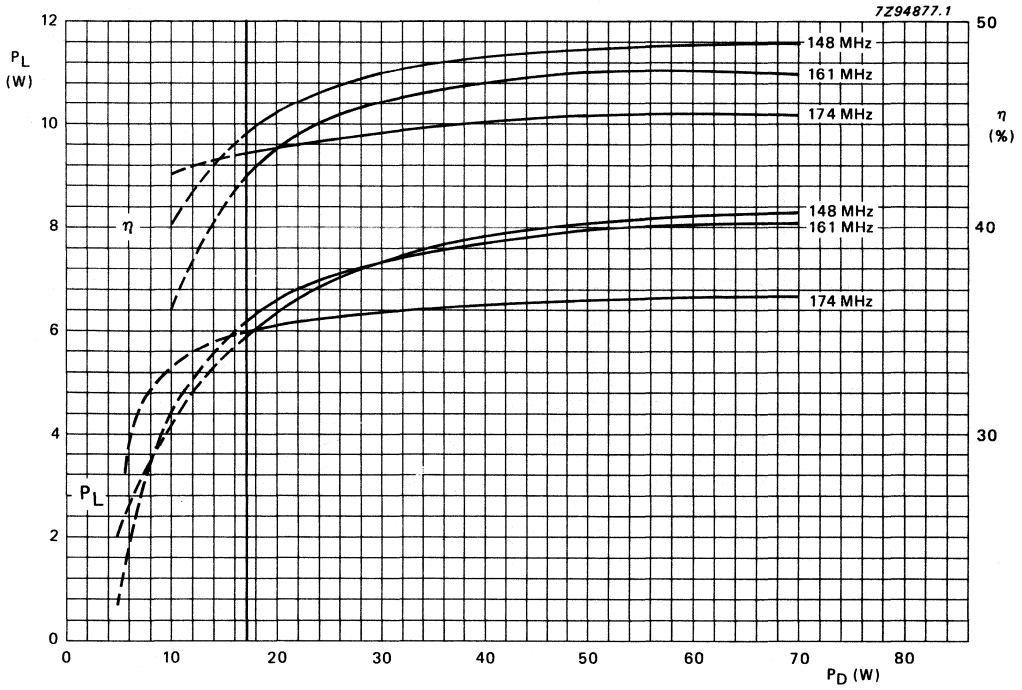


Fig. 4 Load power and efficiency as functions of drive power; $V_{S1} = V_{S2} = 9.6$ V; typical values.

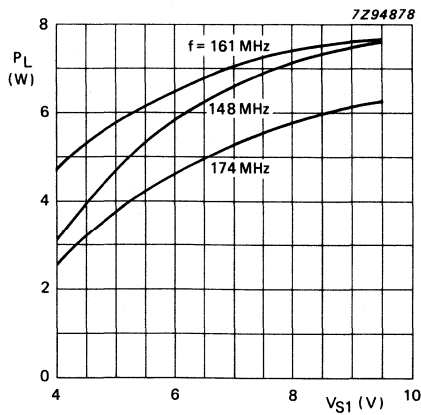


Fig. 5 Load power as a function of supply voltage V_{S1} ; $P_D = 35$ mW; $V_{S2} = 9.6$ V; typical values.

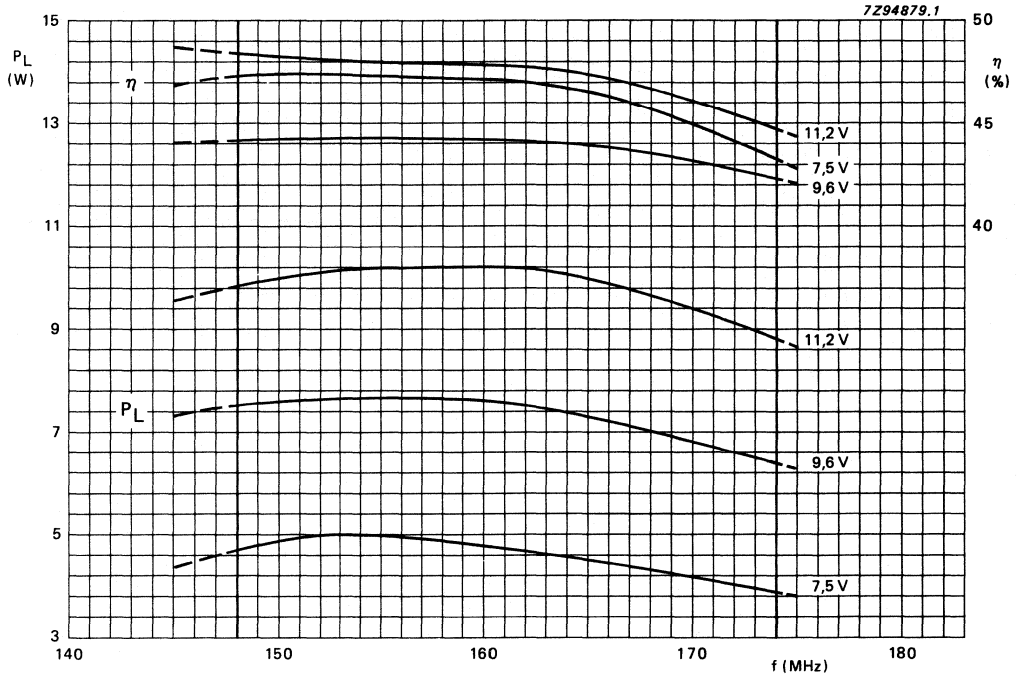


Fig. 6 Load power and efficiency as functions of frequency;
 $V_{S1} = V_{S2}$; $P_D = 35$ mW; typical values.

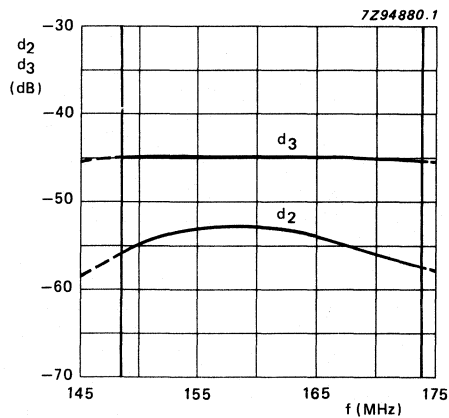


Fig. 7 Second and third harmonic distortion as a function of frequency;
 $V_{S1} = V_{S2} = 9.6$ V; $P_D = 35$ mW; typical values.

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.

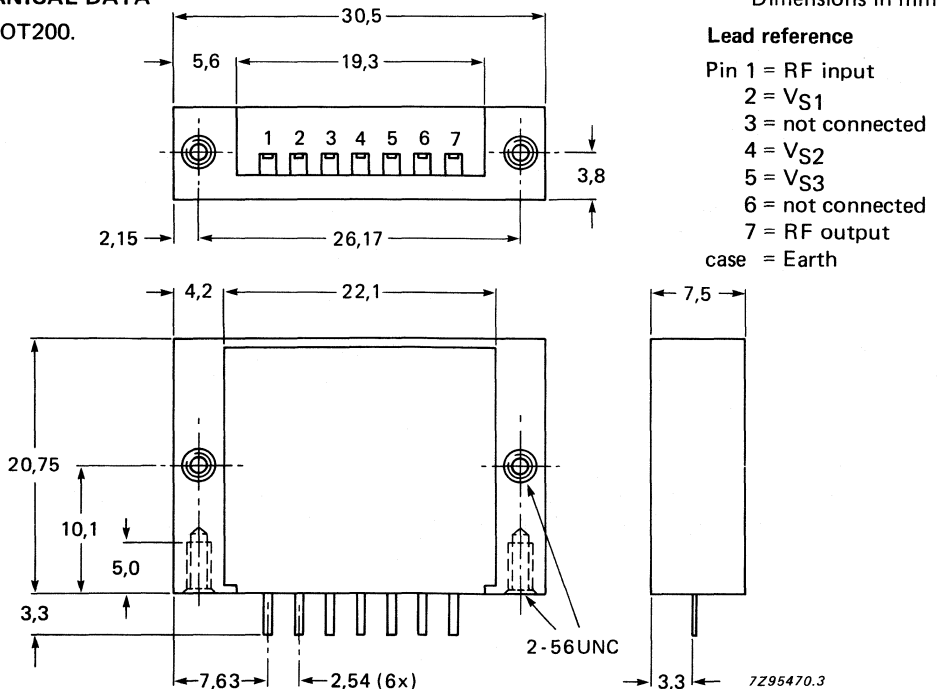
The module consists of three npn silicon planar transistors mounted on a metallized ceramic substrate, together with matching and bias circuitry. The BGY95A and BGY95B produce an output power of 2.2 W into a 50 Ω load over the frequency band 824-849 MHz and 890-915 MHz respectively. The output power can be controlled by means of a DC voltage (V_{S1}).

QUICK REFERENCE DATA

Mode of operation				CW
Frequency range	BGY95A	f		824-849 MHz
	BGY95B	f		890-915 MHz
RF power output				
$V_{S1} = V_{S2} = V_{S3} = 7.5 \text{ V}; P_D = 20 \text{ mW}$		P_L	min.	2.2 W
RF input drive power				
$V_{S1} = V_{S2} = V_{S3} = 7.5 \text{ V}; P_L = 2.2 \text{ W}$		P_D	≤	20 mW
Output load impedance		Z_L	nom.	50 Ω

MECHANICAL DATA

Fig.1 SOT200.



RATINGS

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

Voltages with respect to case			
RF input pin	V_{in}	max.	± 25 V
RF output pin	V_{out}	max.	± 25 V
Supply pins			
	V_{S1}	max.	8 V
	V_{S2}	max.	9 V
	V_{S3}	max.	9 V
RF output power	P_L	max.	3.5 W
RF input drive power	P_D	max.	40 mW
Storage temperature range	T_{stg}		-40 to + 100 °C
Operating heatsink temperature	T_h	max.	90 °C

CHARACTERISTICS

Performance

BGY95A: $f = 824\text{-}849$ MHz; $R_S = R_L = 50 \Omega$; $V_{S1} = V_{S2} = V_{S3} = 7.5$ V

BGY95B: $f = 890\text{-}915$ MHz; $R_S = R_L = 50 \Omega$; $V_{S1} = V_{S2} = V_{S3} = 7.5$ V

RF output power			
$P_D = 20$ mW	P_L	min.	2.2 W
RF input drive power			
$P_L = 2.2$ W	P_D	\leq	20 mW
Efficiency			
$P_L = 2.2$ W	η	min.	35 %
Harmonic rejection			
$P_L = 2.2$ W		min.	30 dB
Input VSWR			
with respect to 50Ω ;		typ.	1.5
$P_D = 20$ mW	VSWR	max.	2.0
Gain control: $P_D = 20$ mW;			
at $V_{S1} = 0.5$ V	P_L	max.	6 mW
at $V_{S1} = 6.0$ V	P_L	min.	2.2 W

Stability

The module will produce no spurious signals with a load mismatch $VSWR < 3 : 1$ when operated with $V_{S1} = 0.5$ to 7.5 V, $V_{S2} = V_{S3} = 6$ to 9 V, $P_D = 10$ to 40 mW and $T_h \leq 90$ °C, provided maximum ratings are not exceeded.

Ruggedness

The module will withstand a load mismatch of $50 : 1$ when operated with $V_{S1} = 0$ to 8 V, $V_{S2} = V_{S3} = 0$ to 9 V, $P_D = 0$ to 40 mW and $T_h = 90$ °C, provided maximum ratings are not exceeded.

RATINGS

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

Voltages with respect to case

RF input pin	V_{in}	max.	± 25 V
RF output pin	V_{out}	max.	± 25 V
Supply pins	V_{S1}	max.	8 V
	V_{S2}	max.	13 V
	V_{S3}	max.	13 V
RF output power	P_L	max.	3.55 W
RF input drive power	P_D	max.	50 mW
Storage temperature range	T_{stg}		-40 to +100 °C
Operating heatsink temperature	T_h	max.	90 °C

CHARACTERISTICS

Performance:

$f = 824\text{-}849$ MHz; $R_S = R_L = 50 \Omega$; $V_{S1} = 6$ V; $V_{S2} = V_{S3} = 9.6$ V

RF output power $P_D = 20$ mW	P_L	min.	2.5 W
RF input drive power $P_L = 2.5$ W	P_D	\leq	20 mW
Efficiency $P_L = 2.5$ W	η	min.	35 %
Harmonic rejection $P_L = 2.5$ W		min.	30 dB
Input VSWR with respect to 50 Ω ; $P_D = 20$ mW	VSWR	typ. max.	1.5 2.0
Gain control: $P_D = 20$ mW; at $V_{S1} = 0.5$ V at $V_{S1} = 6.0$ V	P_L	max.	6 mW
	P_L	min.	2.5 W

Stability:

The module will produce no spurious signals with a load mismatch $VSWR < 3 : 1$ when operated with $V_{S1} = 0.5$ to 6 V, $V_{S2} = V_{S3} = 7.9$ to 12 V, $P_D = 10$ to 40 mW and $T_h \leq 90$ °C, provided maximum ratings are not exceeded.

Ruggedness:

The module will withstand a load mismatch of 50 : 1 when operated with $V_{S1} = 0$ to 8 V, $V_{S2} = V_{S3} = 0$ to 13 V, $P_D = 0$ to 50 mW and $T_h = 90$ °C, provided maximum ratings are not exceeded.

UHF AMPLIFIER MODULE

The BGY96B 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 BGY96B produces an output power of 2.5 W into a 50 Ω load over the frequency band of 890 – 915 MHz. The output power can be controlled by means of a DC voltage (V_{S1}).

QUICK REFERENCE DATA

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

MECHANICAL DATA

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

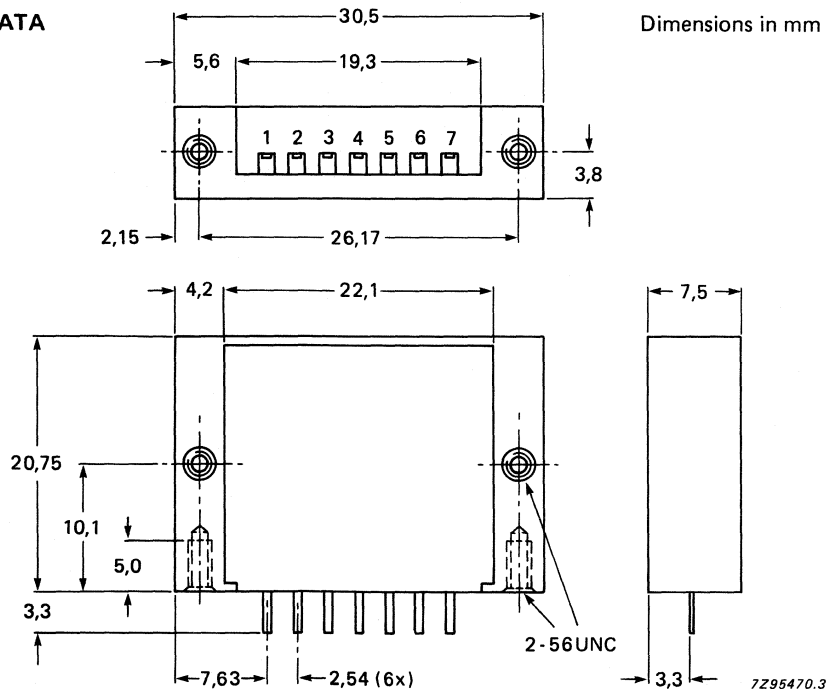


Fig. 1 SOT-200.

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

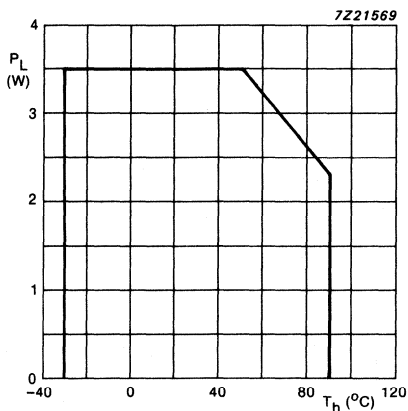


Fig. 2 Load power derating; VSWR = 1 : 1.

* With respect to case.

CHARACTERISTICS

$V_{S1} = 6 \text{ V}$; $V_{S2} = V_{S3} = 9.6 \text{ V}$; $T_h = 25 \text{ }^\circ\text{C}$; $f = 890 - 915 \text{ MHz}$; $R_S = R_L = 50 \text{ } \Omega$
unless otherwise specified.

RF output power $P_D = 20 \text{ mW}$	P_L	min.	2.5 W
RF input drive power $P_L = 2.5 \text{ W}$	P_D	\leq	20 mW
Efficiency $P_L = 2.5 \text{ W}$	η	min.	35 %
Harmonic rejection $P_L = 2.5 \text{ W}$	d2	min.	30 dB
	d3	min.	40 dB
Input VSWR with respect to $50 \text{ } \Omega$ $P_D = 20 \text{ mW}$	VSWR	max.	2 : 1
Gain control: $P_D = 20 \text{ mW}$ at $V_{S1} = 0.5 \text{ V}$ to 6.0 V	ΔG_p		6 mW to 2.5 W
Noise power 25 kHz. bandwidth 45 MHz above f_0 ; $P_{out} = 2.5 \text{ W}$ by adjustment of $V_{control}$; $P_i = 20 \text{ mW}$	Noise power max.		-85 dBm

Stability

The module will produce no spurious signals $> -70 \text{ dB}$ 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 $T_h \leq 90 \text{ }^\circ\text{C}$, provided maximum ratings are not exceeded. $V_{S1} \leq V_{S2}$ and V_{S3} .

Ruggedness

The module will withstand a load mismatch of $50 : 1$ (all phases) for short periods when operated with $V_{S1} = < 8 \text{ V}$, $V_{S2} = V_{S3} = \leq 13 \text{ V}$, $P_D = \leq 50 \text{ mW}$ and $T_h \leq 90 \text{ }^\circ\text{C}$, 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 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 produce 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 varying V_{S1} from 0.5 V to 6 V.

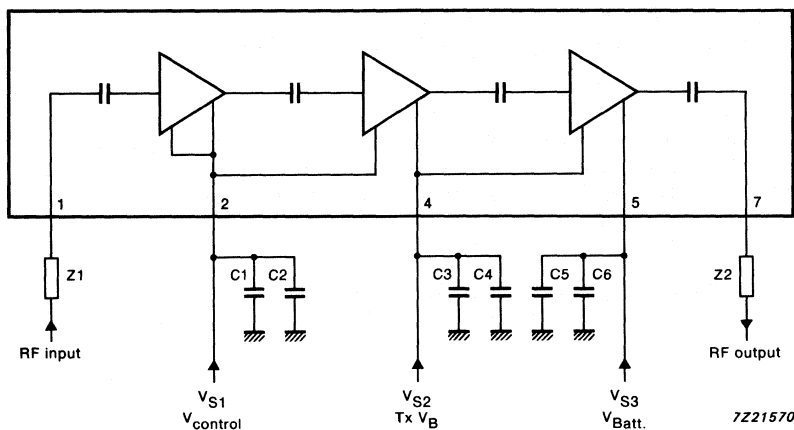
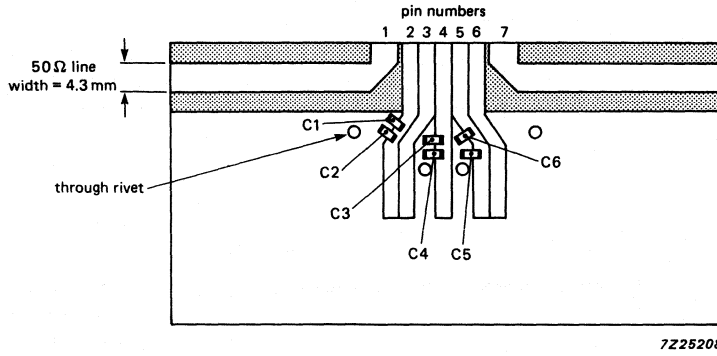


Fig. 3 Internal diagram.

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



Teflon glass board 1/16"; $\epsilon_r = 2.55$.

Fig. 4 Printed circuit board layout.

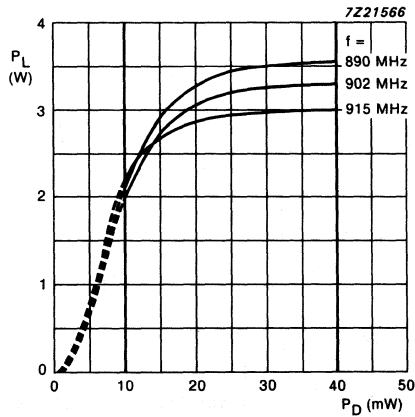


Fig. 5 Load power as a function of drive power; $V_{S1} = 6$ V; $V_{S2} = V_{S3} = 9.6$ V.

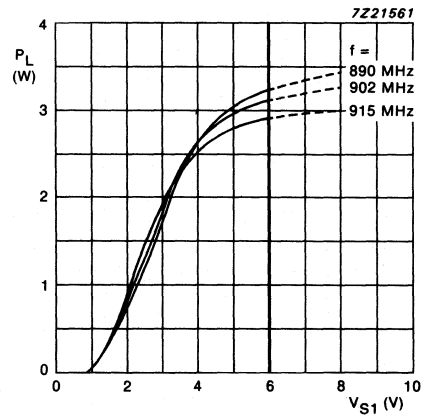


Fig. 6 Load power as a function of supply voltage V_{S1} ; $P_D = 20$ mW; $V_{S2} = V_{S3} = 9.6$ V.

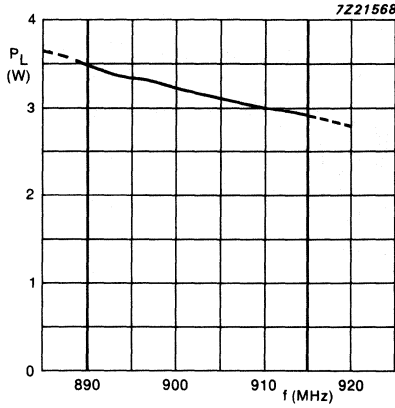


Fig. 7 Load power as a function of frequency; $P_D = 20 \text{ mW}$; $V_{S1} = 6 \text{ V}$; $V_{S2} = V_{S3} = 9.6 \text{ V}$.

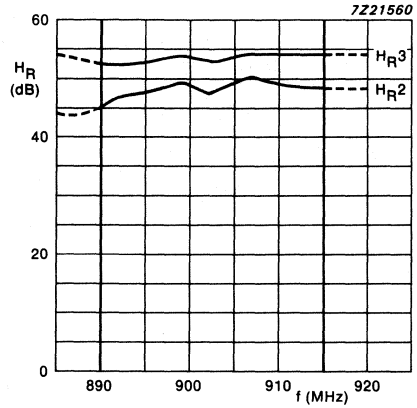


Fig. 8 Second and third harmonic rejections as functions of frequency; $P_D = 20 \text{ mW}$; $V_{S1} = 6 \text{ V}$; $V_{S2} = V_{S3} = 9.6 \text{ V}$.

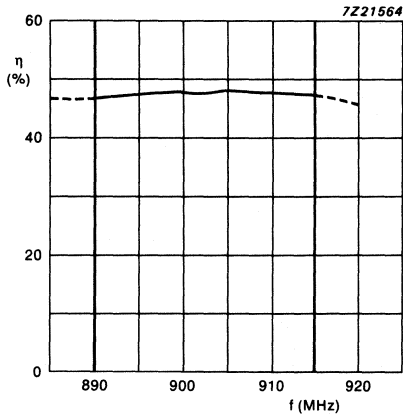


Fig. 9 Efficiency as a function of frequency; $P_L = 2.5 \text{ W}$; $P_D = 20 \text{ mW}$; $V_{S2} = V_{S3} = 9.6 \text{ V}$.

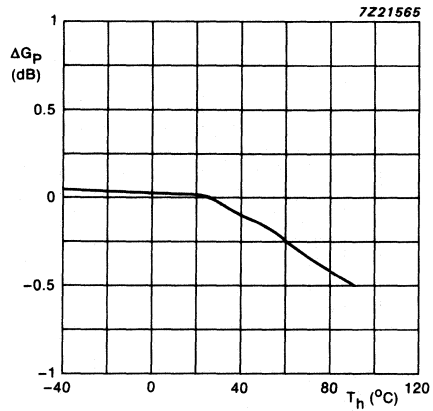


Fig. 10 Change in power gain as a function of heatsink temperature; $P_D = 20 \text{ mW}$; $V_{S1} = 6 \text{ V}$; $V_{S2} = V_{S3} = 9.6 \text{ V}$; $f = 915 \text{ MHz}$.

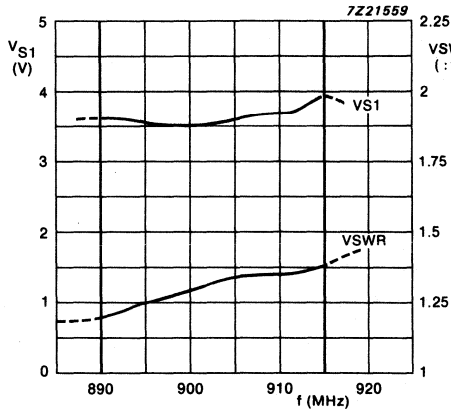


Fig. 11 Supply voltage V_{S1} and VSWR as functions of frequency; $P_D = 20$ mW; $P_L = 2.5$ W; $V_{S2} = V_{S3} = 9.6$ V.

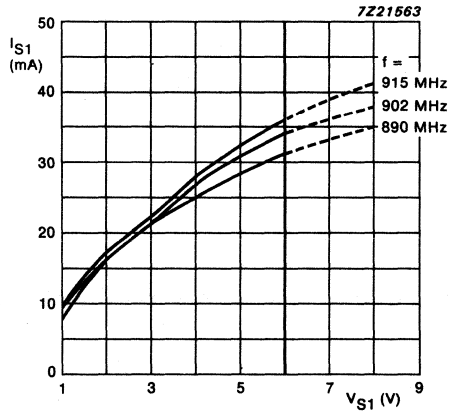


Fig. 12 Supply current I_{S1} as a function of supply voltage V_{S1} ; $P_D = 20$ mW; $V_{S2} = V_{S3} = 9.6$ V.



DEVELOPMENT DATA

This data sheet contains advance information and specifications are subject to change without notice.

BGY110A

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.

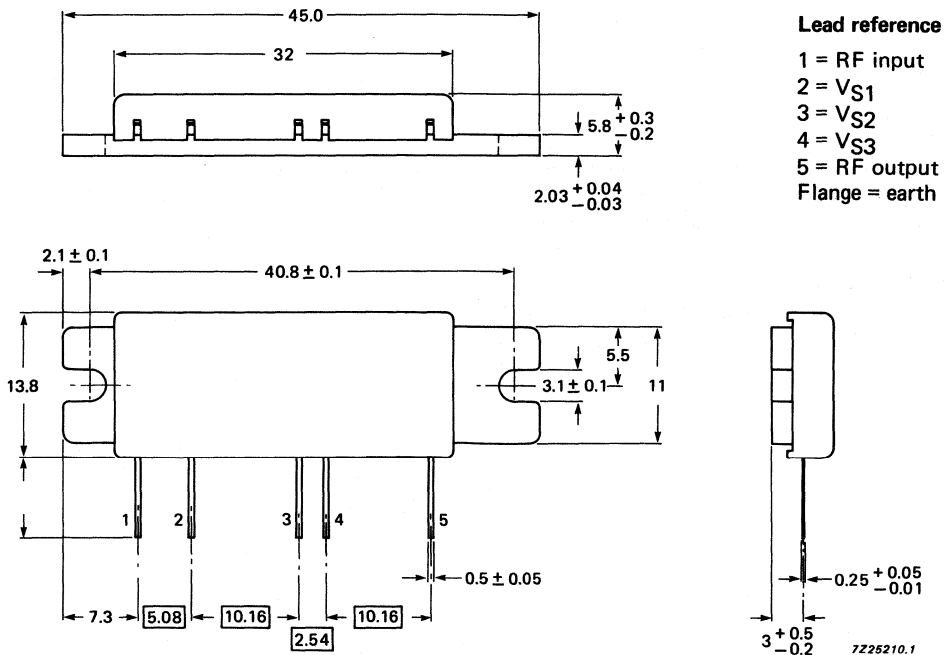
The module consists of four npn silicon planar transistor chips mounted on a metallized ceramic substrate, together with matching and bias circuitry. The module produces an output power of 1.2 W into a 50 Ω load over the frequency band of 824 - 849 MHz. The output power can be controlled by means of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



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

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

Load power			
$P_D = 1 \text{ mW}$	P_L	min.	1.2 W
Efficiency			
$P_L = 1.2 \text{ W}$	η	min.	40 %
Harmonic rejection			
$P_L = 1.2 \text{ W}$	d2	min.	40 dB
	d3	min.	45 dB
Input VSWR			
$P_L = 1.2 \text{ W}$	VSWR	max.	2 : 1
Gain control			
$P_D = 1 \text{ mW}$	ΔG_p	min.	30 dB
Power switching			
$V_{S1} = 0 \text{ V}$; $P_D = 1 \text{ mW}$	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 $V_{S1}, V_{S3} = 4 \text{ to } 8 \text{ V}$ and $V_{S2} = 0 \text{ to } 8 \text{ V}$; $P_D = 0.5 \text{ to } 2 \text{ mW}$, providing maximum ratings are not exceeded.

Ruggedness

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

DEVELOPMENT DATA

This data sheet contains advance information and specifications are subject to change without notice.

BGY110B

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.

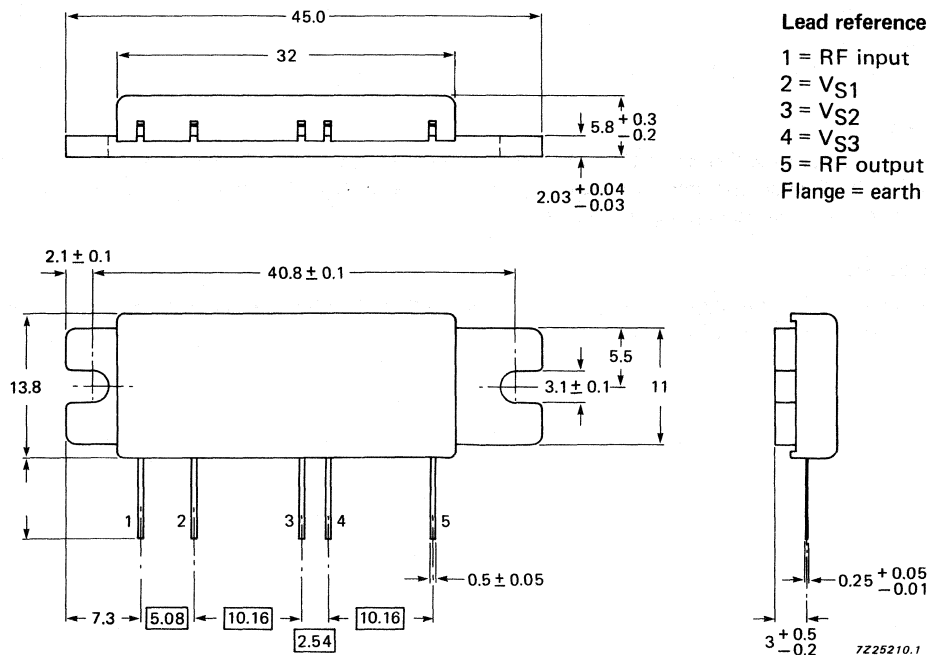
The module consists of four npn silicon planar transistor chips mounted on a metallized ceramic substrate, together with matching and bias circuitry. The module produces an output power of 1.2 W into a 50Ω load over the frequency band of 872 - 905 MHz. The output power can be controlled by means of a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

MECHANICAL DATA

Dimensions in mm



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

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

Load power $P_D = 1 \text{ mW}$	P_L	min.	1.2 W
Efficiency $P_L = 1.2 \text{ W}$	η	min.	40 %
Harmonic rejection $P_L = 1.2 \text{ W}$	d2	min.	40 dB
	d3	min.	45 dB
Input VSWR $P_L = 1.2 \text{ W}$	VSWR	max.	2 : 1
Gain control $P_D = 1 \text{ mW}$	ΔG_p	min.	30 dB
Power switching $V_{S1} = 0 \text{ V}$; $P_D = 1 \text{ mW}$	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 $V_{S1}, V_{S3} = 4 \text{ to } 8 \text{ V}$ and $V_{S2} = 0 \text{ to } 8 \text{ V}$; $P_D = 0.5 \text{ to } 2 \text{ mW}$, providing maximum ratings are not exceeded.

Ruggedness

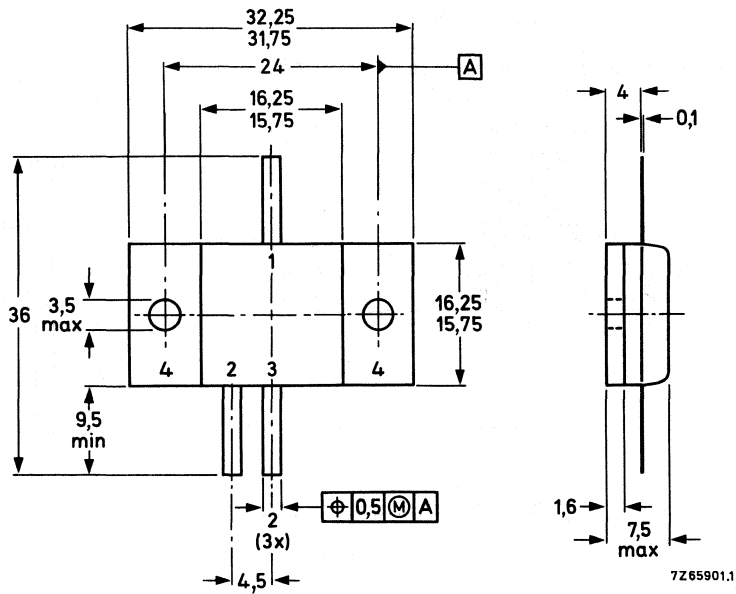
The module will withstand a load mismatch of 50 : 1 under the following conditions: $P_D = 1 \text{ mW}$; $V_{S1}, V_{S3} = 8 \text{ V}$; $P_L = 1.6 \text{ W}$ (matched).

ENVELOPE SPECIFICATIONS

SOT75A

MECHANICAL DATA

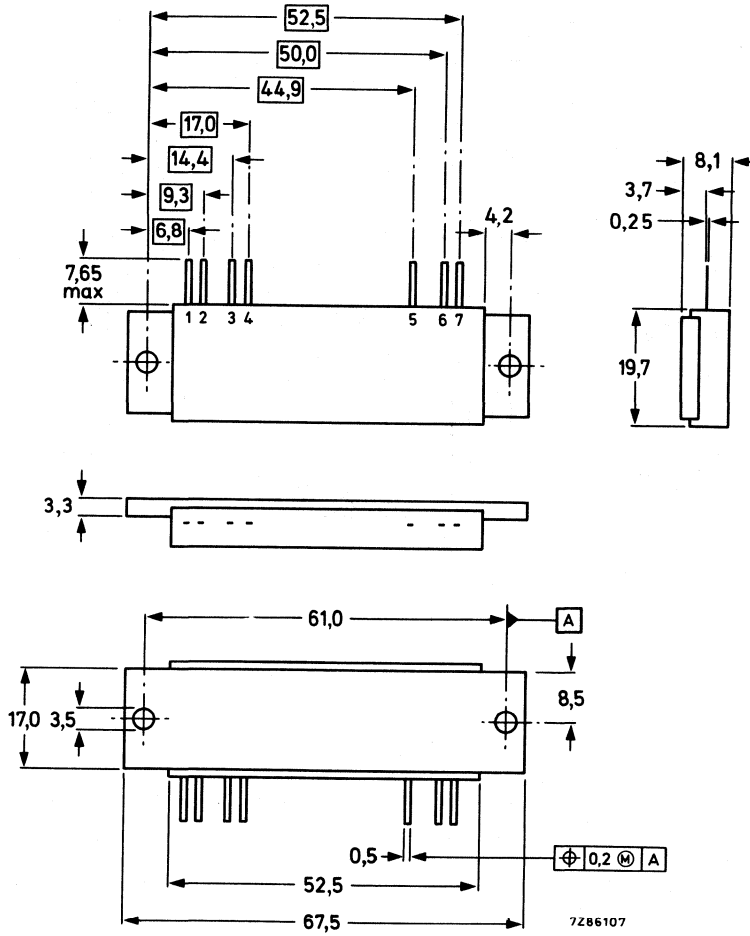
Dimensions in mm



SOT132B

MECHANICAL DATA

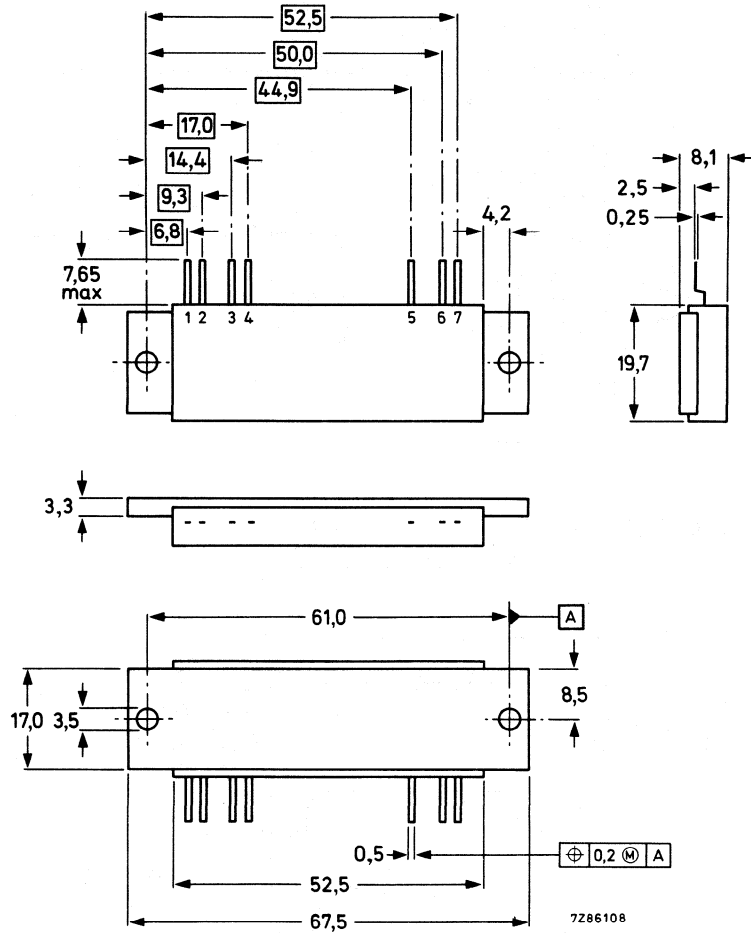
Dimensions in mm



SOT132C

MECHANICAL DATA

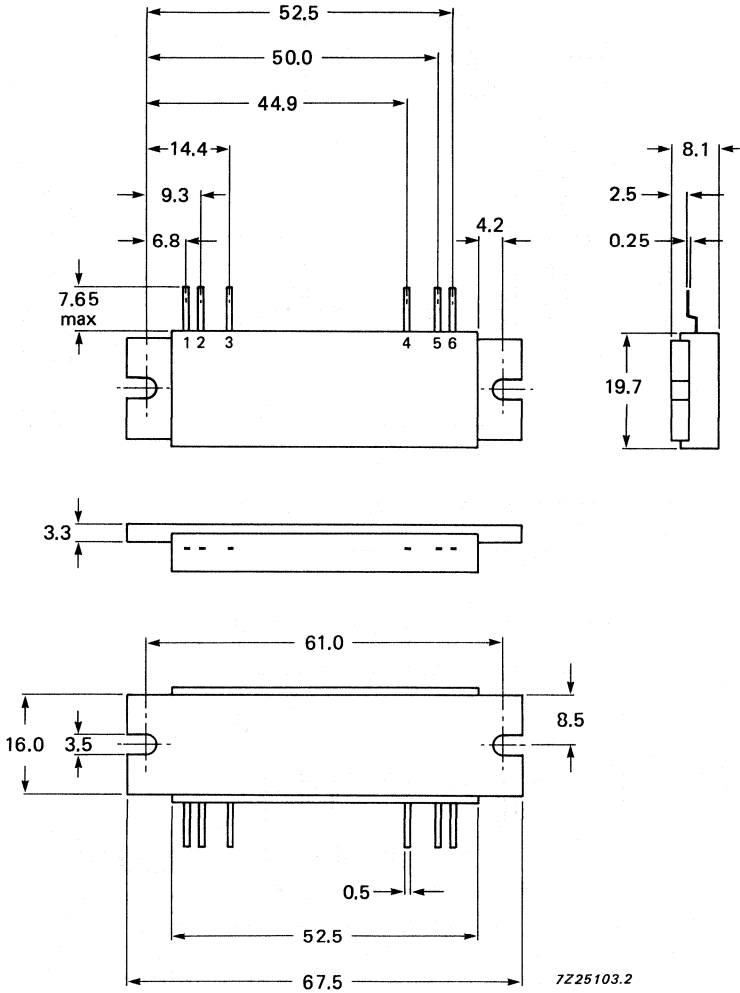
Dimensions in mm



SOT132D

MECHANICAL DATA

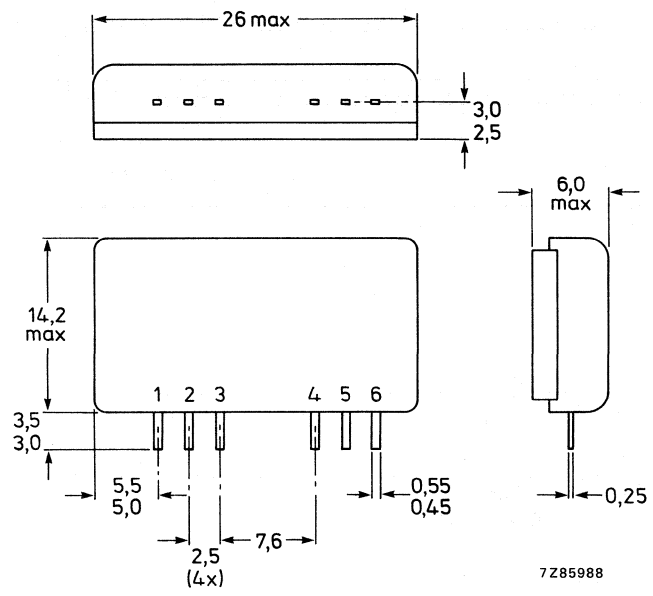
Dimensions in mm



SOT181

MECHANICAL DATA

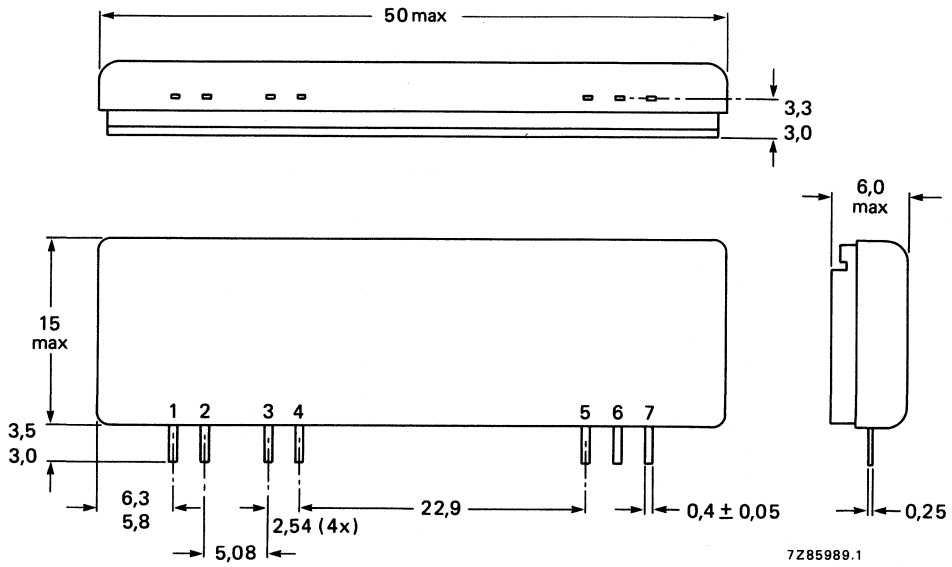
Dimensions in mm



SOT182

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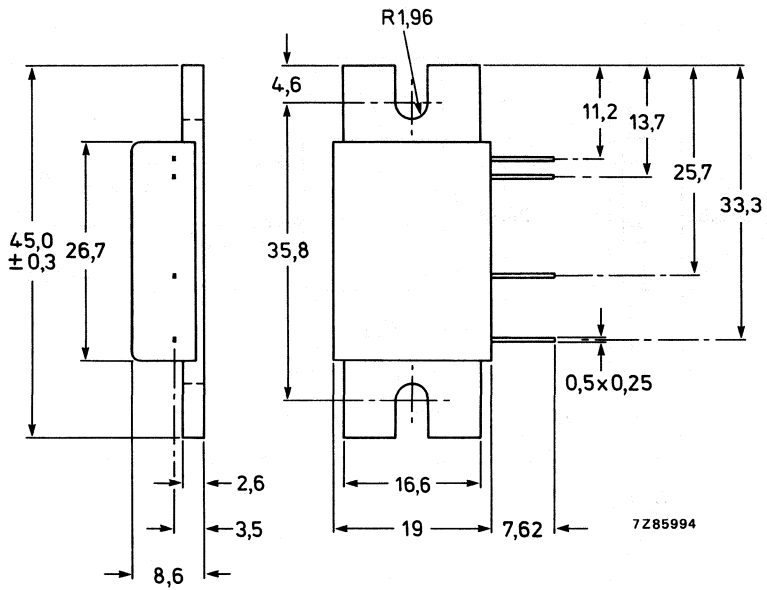
Dimensions in mm



SOT183

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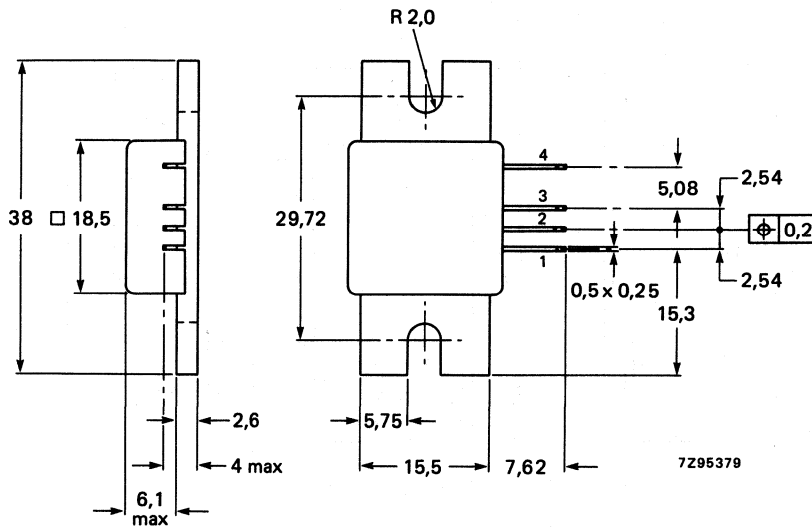
Dimensions in mm



SOT197

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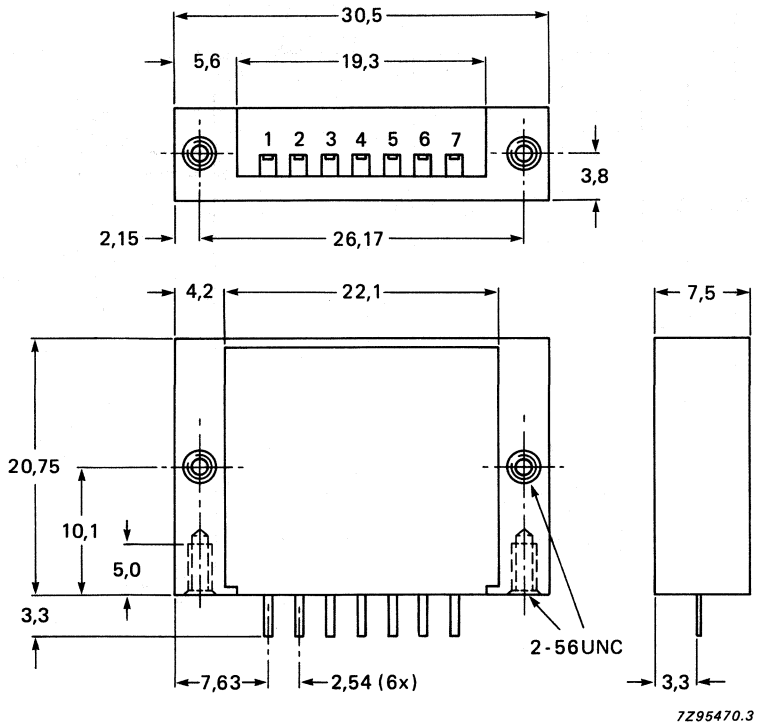
Dimensions in mm



SOT200

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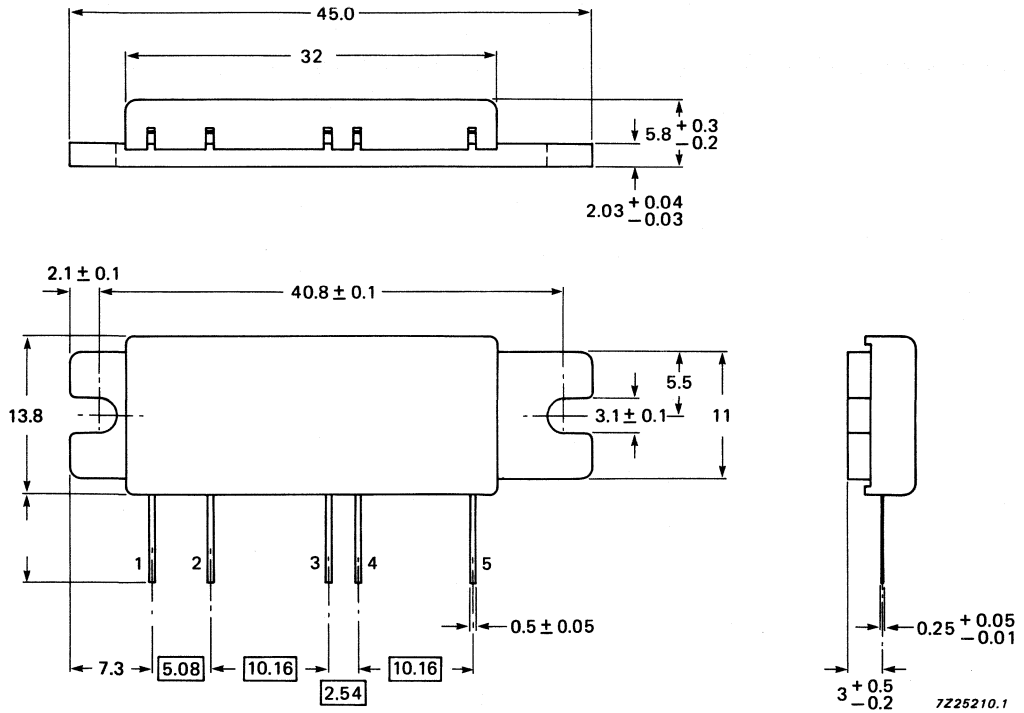
Dimensions in mm



SOT246

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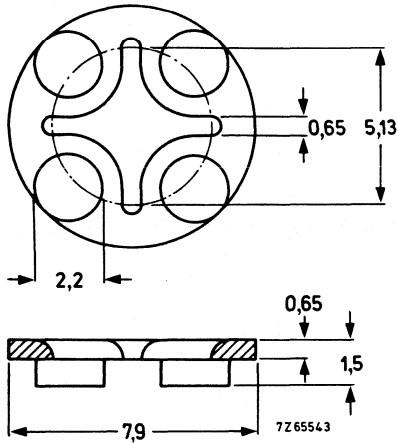
Dimensions in mm



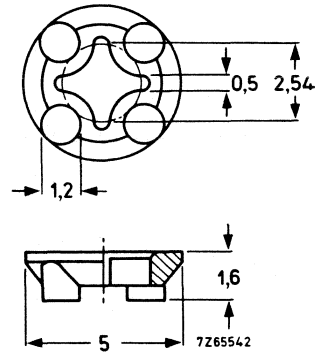
ACCESSORIES

MECHANICAL DATA

Dimensions in mm



Distance disc 56245 for TO-5 or TO-39;
insulating material.

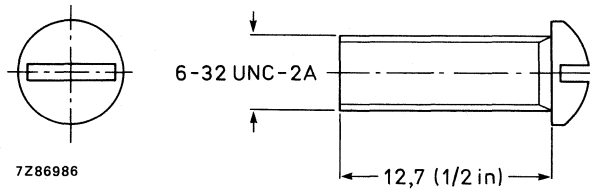


Distance disc 56246 for TO-18 or TO-72;
insulating material.

Maximum permissible temperature: 100 °C.

ROUND HEAD SCREW 6-32 UNC-2A

Available, upon request, under type number 56396 or 12 NC code number 9390 298 10xx0.



INDEX OF TYPE NUMBERS

The inclusion of a type number in this publication does not necessarily imply its availability.

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BA223	SC01	T	BAS31	SC01/10	SD/Mm	BAV74	SC01	SD
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BAS15	SC01	SD	BAV10	SC01	SD	BB204G	SC01	T
BAS16	SC01/10	SD/Mm	BAV18	SC01	SD	BB212	SC01	T
BAS17	SC01/10	Vrg/Mm	BAV19	SC01	SD	BB215	SC01/10	SD/Mm
BAS19	SC01/10	SD/Mm	BAV20	SC01	SD	BB219	SC01/10	SD/Mm
BAS20	SC01/10	SD/Mm	BAV21	SC01	SD	BB240	SC01/10	T/Mm
BAS21	SC01/10	SD/Mm	BAV23	SC01/10	SD/Mm	BB241	SC01/10	T/Mm

Key to handbook sections

A = Accessories
 FET = Field-effect transistors
 I = Infrared devices
 LED = Light-emitting diodes
 LCD = Liquid crystal displays
 Mm = Surface-mounted devices
 M = Microwave transistors
 P = Low-frequency power transistors and modules
 PDT = Photodiodes or transistors
 Ph = Photoconductive devices
 PhC = Photocouplers
 PM = PowerMOS transistors
 R = Rectifier diodes
 RFP = RF power transistors and modules
 RT = Triplers

* series.

SEN = Semiconductor sensors
 SD = Small-signal diodes
 Sm = Small-signal transistors
 Sp = Special diodes
 SP = Low-frequency switching power diodes
 St = Rectifier stacks
 T = Tuner diodes
 Th = Thyristors
 Tri = Triacs
 TS = Transient suppressor diodes
 Vrf = Voltage reference diodes
 Vrg = Voltage regulator diodes
 WBT = Wideband hybrid IC transistors
 WBM = Wideband hybrid IC modules

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BB809	SC01	T	BC636	SC04	Sm	BCV63	SC10	Mm
BB909A	SC01	T	BC637	SC04	Sm	BCV64	SC10	Mm
BB909B	SC01	T	BC638	SC04	Sm	BCV65	SC10	Mm
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BB911	SC01	T	BC640	SC04	Sm	BCV72;R	SC10	Mm
BBY31	SC01/10	T/Mm	BC807	SC10	Mm	BCW29;R	SC10	Mm
BBY39	SC01	T	BC808	SC10	Mm	BCW30;R	SC10	Mm
BBY40	SC01/10	T/Mm	BC817	SC10	Mm	BCW31;R	SC10	Mm
BBY42	SC01	T	BC818	SC10	Mm	BCW32;R	SC10	Mm
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BC107	SC04	Sm	BC847	SC10	Mm	BCW60*	SC10	Mm
BC108	SC04	Sm	BC848	SC10	Mm	BCW61*	SC10	Mm
BC109	SC04	Sm	BC849	SC10	Mm	BCW69;R	SC10	Mm
BC140	SC04	Sm	BC850	SC10	Mm	BCW70;R	SC10	Mm
BC141	SC04	Sm	BC856	SC10	Mm	BCW71;R	SC10	Mm
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BC161	SC04	Sm	BC858	SC10	Mm	BCW81;R	SC10	Mm
BC177	SC04	Sm	BC859	SC10	Mm	BCW89;R	SC10	Mm
BC178	SC04	Sm	BC860	SC10	Mm	BCX17;R	SC10	Mm
BC179	SC04	Sm	BC868	SC10	Mm	BCX18;R	SC10	Mm
BC264A	SC07	FET	BC869	SC10	Mm	BCX19;R	SC10	Mm
BC264B	SC07	FET	BCF29;R	SC10	Mm	BCX20;R	SC10	Mm
BC264C	SC07	FET	BCF30;R	SC10	Mm	BCX51	SC10	Mm
BC264D	SC07	FET	BCF32;R	SC10	Mm	BCX52	SC10	Mm
BC327;A	SC04	Sm	BCF33;R	SC10	Mm	BCX53	SC10	Mm
BC328	SC04	Sm	BCF70;R	SC10	Mm	BCX54	SC10	Mm
BC337;A	SC04	Sm	BCF81;R	SC10	Mm	BCX55	SC10	Mm
BC338	SC04	Sm	BCP51	SC10	Mm	BCX56	SC10	Mm
BC368	SC04	Sm	BCP52	SC10	Mm	BCX58	SC04	Sm
BC369	SC04	Sm	BCP53	SC10	Mm	BCX59	SC04	Sm
BC375	SC04	Sm	BCP54	SC10	Mm	BCX70*	SC10	Mm
BC376	SC04	Sm	BCP55	SC10	Mm	BCX71*	SC10	Mm
BC516	SC04	Sm	BCP56	SC10	Mm	BCX78	SC04	Sm
BC517	SC04	Sm	BCP68	SC10	Mm	BCX79	SC04	Sm
BC546	SC04	Sm	BCP69	SC10	Mm	BCY56	SC04	Sm
BC547	SC04	Sm	BCV26	SC10	Mm	BCY57	SC04	Sm
BC548	SC04	Sm	BCV27	SC10	Mm	BCY58	SC04	Sm
BC549	SC04	Sm	BCV28	SC10	Mm	BCY59	SC04	Sm
BC550	SC04	Sm	BCV29	SC10	Mm	BCY65	SC04	Sm
BC556	SC04	Sm	BCV46	SC10	Mm	BCY70	SC04	Sm
BC557	SC04	Sm	BCV47	SC10	Mm	BCY71	SC04	Sm
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BD204;F	SC05	P	BD337	SC05	P	BD842	SC05	P
BD226	SC05	P	BD338	SC05	P	BD843	SC05	P
BD227	SC05	P	BD433	SC05	P	BD844	SC05	P
BD228	SC05	P	BD434	SC05	P	BD933;F	SC05	P
BD229	SC05	P	BD435	SC05	P	BD934;F	SC05	P
BD230	SC05	P	BD436	SC05	P	BD935;F	SC05	P
BD231	SC05	P	BD437	SC05	P	BD936;F	SC05	P
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BD236	SC05	P	BD645;F	SC05	P	BD940;F	SC05	P
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BD238	SC05	P	BD647;F	SC05	P	BD942;F	SC05	P
BD239	SC05	P	BD648;F	SC05	P	BD943;F	SC05	P
BD239A	SC05	P	BD649;F	SC05	P	BD944;F	SC05	P
BD239B	SC05	P	BD650;F	SC05	P	BD945;F	SC05	P
BD239C	SC05	P	BD651;F	SC05	P	BD946;F	SC05	P
BD240	SC05	P	BD652;F	SC05	P	BD947;F	SC05	P
BD240A	SC05	P	BD675	SC05	P	BD948;F	SC05	P
BD240B	SC05	P	BD676	SC05	P	BD949;F	SC05	P
BD240C	SC05	P	BD677	SC05	P	BD950;F	SC05	P
BD241	SC05	P	BD678	SC05	P	BD951;F	SC05	P
BD241A	SC05	P	BD679	SC05	P	BD952;F	SC05	P
BD241B	SC05	P	BD680	SC05	P	BD953;F	SC05	P
BD241C	SC05	P	BD681	SC05	P	BD954;F	SC05	P
BD242	SC05	P	BD682	SC05	P	BD955;F	SC05	P
BD242A	SC05	P	BD683	SC05	P	BD956;F	SC05	P
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BDT29B;F	SC05	P	BDT65B;F	SC05	P	BDX46	SC05	P
BDT29C;F	SC05	P	BDT65C;F	SC05	P	BDX47	SC05	P
BDT30;F	SC05	P	BDT81;F	SC05	P	BDX62	SC05	P
BDT30A;F	SC05	P	BDT82;F	SC05	P	BDX62A	SC05	P
BDT30B;F	SC05	P	BDT83;F	SC05	P	BDX62B	SC05	P
BDT30C;F	SC05	P	BDT84;F	SC05	P	BDX62C	SC05	P
BDT31;F	SC05	P	BDT85;F	SC05	P	BDX63	SC05	P
BDT31A;F	SC05	P	BDT86;F	SC05	P	BDX63A	SC05	P
BDT31B;F	SC05	P	BDT87;F	SC05	P	BDX63B	SC05	P
BDT31C;F	SC05	P	BDT88;F	SC05	P	BDX63C	SC05	P
BDT31DF	SC05	P	BDT91;F	SC05	P	BDX64	SC05	P
BDT32;F	SC05	P	BDT92;F	SC05	P	BDX64A	SC05	P
BDT32A;F	SC05	P	BDT93;F	SC05	P	BDX64B	SC05	P
BDT32B;F	SC05	P	BDT94;F	SC05	P	BDX64C	SC05	P
BDT32C;F	SC05	P	BDT95;F	SC05	P	BDX65	SC05	P
BDT32DF	SC05	P	BDT96;F	SC05	P	BDX65A	SC05	P
BDT41A;F	SC05	P	BDV64	SC05	P	BDX65B	SC05	P
BDT41B;F	SC05	P	BDV64A	SC05	P	BDX65C	SC05	P
BDT41C;F	SC05	P	BDV64B	SC05	P	BDX66	SC05	P
BDT42;F	SC05	P	BDV64C	SC05	P	BDX66A	SC05	P
BDT42A;F	SC05	P	BDV65	SC05	P	BDX66B	SC05	P
BDT42B;F	SC05	P	BDV65A	SC05	P	BDX66C	SC05	P
BDT42C;F	SC05	P	BDV65B	SC05	P	BDX67	SC05	P
BDT60;F	SC05	P	BDV65C	SC05	P	BDX67A	SC05	P
BDT60A;F	SC05	P	BDV66A	SC05	P	BDX67B	SC05	P
BDT60B;F	SC05	P	BDV66B	SC05	P	BDX67C	SC05	P
BDT60C;F	SC05	P	BDV66C	SC05	P	BDX68	SC05	P
BDT61;F	SC05	P	BDV66D	SC05	P	BDX68A	SC05	P
BDT61A;F	SC05	P	BDV67A	SC05	P	BDX68B	SC05	P
BDT61B;F	SC05	P	BDV67B	SC05	P	BDX68C	SC05	P
BDT61C;F	SC05	P	BDV67C	SC05	P	BDX69	SC05	P
BDT62;F	SC05	P	BDV67D	SC05	P	BDX69A	SC05	P
BDT62A;F	SC05	P	BDV91	SC05	P	BDX69B	SC05	P
BDT62B;F	SC05	P	BDV92	SC05	P	BDX69C	SC05	P
BDT62C;F	SC05	P	BDV93	SC05	P	BDX77;F	SC05	P
BDT63;F	SC05	P	BDV94	SC05	P	BDX78;F	SC05	P
BDT63A;F	SC05	P	BDV95	SC05	P	BDX91	SC05	P
BDT63B;F	SC05	P	BDV96	SC05	P	BDX92	SC05	P
BDT63C;F	SC05	P	BDX35	SC05	P	BDX93	SC05	P
BDT64;F	SC05	P	BDX36	SC05	P	BDX94	SC05	P
BDT64A;F	SC05	P	BDX37	SC05	P	BDX95	SC05	P
BDT64B;F	SC05	P	BDX42	SC05	P	BDX96	SC05	P
BDT64C;F	SC05	P	BDX43	SC05	P	BDY90	SC05	P
BDT65;F	SC05	P	BDX44	SC05	P	BDY91	SC05	P
BDT65A;F	SC05	P	BDX45	SC05	P	BDY92	SC05	P

type no.	book	section	type no.	book	section	type no.	book	section
BF198	SC04	Sm	BF720	SC10	Mm	BFG90A	SC14	WBT
BF199	SC04	Sm	BF721	SC10	Mm	BFG91A	SC14	WBT
BF240	SC04	Sm	BF722	SC10	Mm	BFG92A	SC14	WBT
BF241	SC04	Sm	BF723	SC10	Mm	BFG93A	SC14	WBT
BF245A	SC07	FET	BF763	SC14	WBT	BFG96	SC14	WBT
BF245B	SC07	FET	BF820	SC10	Mm	BFG97	SC14/10	WBT/Mm
BF245C	SC07	FET	BF821	SC10	Mm	BFG135	SC14/10	WBT/Mm
BF247A	SC07	FET	BF822	SC10	Mm	BFG195	SC14	WBT
BF247B	SC07	FET	BF823	SC10	Mm	BFG198	SC14/10	WBT/Mm
BF247C	SC07	FET	BF824	SC10	Mm	BFP90A	SC14	WBT
BF256A	SC07	FET	BF840	SC10	Mm	BFP91A	SC14	WBT
BF256B	SC07	FET	BF841	SC10	Mm	BFP96	SC14	WBT
BF256C	SC07	FET	BF926	SC04	Sm	BFQ10	SC07	FET
BF324	SC04	Sm	BF936	SC04	Sm	BFQ11	SC07	FET
BF370	SC04	Sm	BF939	SC04	Sm	BFQ12	SC07	FET
BF410A	SC07	FET	BF960	SC07	FET	BFQ13	SC07	FET
BF410B	SC07	FET	BF964S	SC07	FET	BFQ14	SC07	FET
BF410C	SC07	FET	BF965	SC07	FET	BFQ15	SC07	FET
BF410D	SC07	FET	BF966S	SC07	FET	BFQ16	SC07	FET
BF420	SC04	Sm	BF967	SC04	Sm	BFQ17	SC14/10	WBT/Mm
BF421	SC04	Sm	BF970	SC04	Sm	BFQ18A	SC14/10	WBT/Mm
BF422	SC04	Sm	BF970A	SC04	Sm	BFQ19	SC14/10	WBT/Mm
BF423	SC04	Sm	BF979	SC04	Sm	BFQ22S	SC14	WBT
BF450	SC04	Sm	BF980	SC07	FET	BFQ23	SC14	WBT
BF451	SC04	Sm	BF980A	SC07	FET	BFQ23C	SC14	WBT
BF483	SC04	Sm	BF981	SC07	FET	BFQ24	SC14	WBT
BF485	SC04	Sm	BF982	SC07	FET	BFQ32	SC14	WBT
BF487	SC04	Sm	BF989	SC07/10	FET/Mm	BFQ32C	SC14	WBT
BF494	SC04	Sm	BF990A	SC07/10	FET/Mm	BFQ32M	SC14	WBT
BF495	SC04	Sm	BF990AR	SC07/10	FET/Mm	BFQ32S	SC14	WBT
BF496	SC04	Sm	BF991	SC07/10	FET/Mm	BFQ33	SC14	WBT
BF510	SC07/10	FET/Mm	BF992	SC07/10	FET/Mm	BFQ33C	SC14	WBT
BF511	SC07/10	FET/Mm	BF992R	SC07/10	FET/Mm	BFQ34	SC14	WBT
BF512	SC07/10	FET/Mm	BF994S	SC07/10	FET/Mm	BFQ34T	SC14	WBT
BF513	SC07/10	FET/Mm	BF994SR	SC07/10	FET/Mm	BFQ42	SC08	RFP
BF550;R	SC10	Mm	BF996S	SC07/10	FET/Mm	BFQ43	SC08	RFP
BF569	SC10	Mm	BF996SR	SC07/10	FET/Mm	BFQ43S	SC08	RFP
BF570	SC10	Mm	BF997	SC07/10	FET/Mm	BFQ51	SC14	WBT
BF579	SC10	Mm	BFG23	SC14	WBT	BFQ51C	SC14	WBT
BF620	SC10	Mm	BFG32	SC14	WBT	BFQ52	SC14	WBT
BF621	SC10	Mm	BFG34	SC14	WBT	BFQ53	SC14	WBT
BF622	SC10	Mm	BFG35	SC14/10	WBT/Mm	BFQ63	SC14	WBT
BF623	SC10	Mm	BFG51	SC14	WBT	BFQ65	SC14	WBT
BF660;R	SC10	Mm	BFG65	SC14	WBT	BFQ66	SC14	WBT
BF689K	SC14	WBT	BFG67	SC14/10	WBT/Mm	BFQ67	SC14/10	WBT/Mm

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BFQ68	SC14	WBT	BFW17A	SC14	WBT	BGY49A	SC09	RFP
BFQ136	SC14	WBT	BFW30	SC14	WBT	BGY49B	SC09	RFP
BFR29	SC07	FET	BFW61	SC07	FET	BGY50	SC14	WBM
BFR30	SC07/10	FET/Mm	BFW92	SC14	WBT	BGY51	SC14	WBM
BFR31	SC07/10	FET/Mm	BFW92A	SC14	WBT	BGY52	SC14	WBM
BFR49	SC14	WBT	BFW93	SC14	WBT	BGY53	SC14	WBM
BFR53	SC14/10	WBT/Mm	BFX34	SC04	Sm	BGY54	SC14	WBM
BFR54	SC04	Sm	BFX89	SC14	WBT	BGY55	SC14	WBM
BFR64	SC14	WBT	BFY50	SC04	Sm	BGY56	SC14	WBM
BFR65	SC14	WBT	BFY51	SC04	Sm	BGY57	SC14	WBM
BFR84	SC07	FET	BFY52	SC04	Sm	BGY58	SC14	WBM
BFR90	SC14	WBT	BFY55	SC04	Sm	BGY58A	SC14	WBM
BFR90A	SC14	WBT	BFY90	SC14	WBT	BGY59	SC14	WBM
BFR91	SC14	WBT	BG2000	SC01	RT	BGY60	SC14	WBM
BFR91A	SC14	WBT	BG2097	SC01	RT	BGY61	SC14	WBM
BFR92	SC14/10	WBT/Mm	BGD102	SC14	WBM	BGY65	SC14	WBM
BFR92A	SC14/10	WBT/Mm	BGD102E	SC14	WBM	BGY67	SC14	WBM
BFR93	SC14/10	WBT/Mm	BGD104	SC14	WBM	BGY67A	SC14	WBM
BFR93A	SC14/10	WBT/Mm	BGD104E	SC14	WBM	BGY70	SC14	WBM
BFR94	SC14	WBT	BGD502	SC14	WBM	BGY71	SC14	WBM
BFR95	SC14	WBT	BGD504	SC14	WBM	BGY74	SC14	WBM
BFR96	SC14	WBT	BGX885	SC14	WBM	BGY75	SC14	WBM
BFR96S	SC14	WBT	BGY22	SC09	RFP	BGY78	SC14	WBM
BFR101A;B	SC07/10	FET/Mm	BGY22A	SC09	RFP	BGY84	SC14	WBM
BFS17	SC14/10	WBT/Mm	BGY23	SC09	RFP	BGY84A	SC14	WBM
BFS17A	SC14	WBT	BGY23A	SC09	RFP	BGY85	SC14	WBM
BFS18;R	SC10	Mm	BGY32	SC09	RFP	BGY85A	SC14	WBM
BFS19;R	SC10	Mm	BGY33	SC09	RFP	BGY86	SC14	WBM
BFS20;R	SC10	Mm	BGY35	SC09	RFP	BGY87	SC14	WBM
BFS21	SC07	FET	BGY36	SC09	RFP	BGY88	SC14	WBM
BFS21A	SC07	FET	BGY40A	SC09	RFP	BGY90A	SC09	RFP
BFS22A	SC08	RFP	BGY40B	SC09	RFP	BGY90B	SC09	RFP
BFS23A	SC08	RFP	BGY41A	SC09	RFP	BGY91A	SC09	RFP
BFT24	SC14	WBT	BGY41B	SC09	RFP	BGY91B	SC09	RFP
BFT25	SC14/10	WBT/Mm	BGY43	SC09	RFP	BGY93A	SC09	RFP
BFT44	SC04	Sm	BGY45A	SC09	RFP	BGY93B	SC09	RFP
BFT45	SC04	Sm	BGY45B	SC09	RFP	BGY93C	SC09	RFP
BFT46	SC07/10	FET/Mm	BGY45C	SC09	RFP	BGY94A	SC09	RFP
BFT92	SC14/10	WBT/Mm	BGY46A	SC09	RFP	BGY94B	SC09	RFP
BFT93	SC14/10	WBT/Mm	BGY46B	SC09	RFP	BGY94C	SC09	RFP
BFW10	SC07	FET	BGY47A	SC09	RFP	BGY95A	SC09	RFP
BFW11	SC07	FET	BGY47F	SC09	RFP	BGY95B	SC09	RFP
BFW12	SC07	FET	BGY48A	SC09	RFP	BGY96A	SC09	RFP
BFW13	SC07	FET	BGY48B	SC09	RFP	BGY96B	SC09	RFP
BFW16A	SC14	WBT	BGY48C	SC09	RFP	BGY110A	SC09	RFP

type no.	book	section	type no.	book	section	type no.	book	section
BGY110B	SC09	RFP	BLV94	SC08	RFP	BLX92A	SC08	RFP
BGY584A	SC14	WBM	BLV95	SC08	RFP	BLX93A	SC08	RFP
BGY585A	SC14	WBM	BLV97	SC08	RFP	BLX94A	SC08	RFP
BGY586	SC14	WBM	BLV98	SC08	RFP	BLX94C	SC08	RFP
BGY587	SC14	WBM	BLV99	SC08	RFP	BLX95	SC08	RFP
BLF242	SC08	RFP/FET	BLW29	SC08	RFP	BLX96	SC08	RFP
BLF244	SC08	RFP/FET	BLW31	SC08	RFP	BLX97	SC08	RFP
BLF245	SC08	RFP/FET	BLW32	SC08	RFP	BLX98	SC08	RFP
BLT90/SL	SC08	RFP	BLW33	SC08	RFP	BLY87A	SC08	RFP
BLT91/SL	SC08	RFP	BLW34	SC08	RFP	BLY87C	SC08	RFP
BLT92/SL	SC08	RFP	BLW50F	SC08	RFP	BLY88A	SC08	RFP
BLU20/12	SC08	RFP	BLW60	SC08	RFP	BLY88C	SC08	RFP
BLU30/12	SC08	RFP	BLW60C	SC08	RFP	BLY89A	SC08	RFP
BLU45/12	SC08	RFP	BLW76	SC08	RFP	BLY89C	SC08	RFP
BLU50	SC08	RFP	BLW77	SC08	RFP	BLY90	SC08	RFP
BLU51	SC08	RFP	BLW78	SC08	RFP	BLY91A	SC08	RFP
BLU52	SC08	RFP	BLW79	SC08	RFP	BLY91C	SC08	RFP
BLU53	SC08	RFP	BLW80	SC08	RFP	BLY92A	SC08	RFP
BLU60/12	SC08	RFP	BLW81	SC08	RFP	BLY92C	SC08	RFP
BLU97	SC08	RFP	BLW83	SC08	RFP	BLY93A	SC08	RFP
BLU98	SC08	RFP	BLW84	SC08	RFP	BLY93C	SC08	RFP
BLU99	SC08	RFP	BLW85	SC08	RFP	BLY94	SC08	RFP
BLV10	SC08	RFP	BLW86	SC08	RFP	BPF24	SC12	PDT
BLV11	SC08	RFP	BLW87	SC08	RFP	BPW22A	S8a/b	PDT
BLV20	SC08	RFP	BLW89	SC08	RFP	BPW50	S8a/b	PDT
BLV21	SC08	RFP	BLW90	SC08	RFP	BPW71	SC12	PDT
BLV25	SC08	RFP	BLW91	SC08	RFP	BPX25	SC12	PDT
BLV30	SC08	RFP	BLW95	SC08	RFP	BPX29	SC12	PDT
BLV30/12	SC08	RFP	BLW96	SC08	RFP	BPX40	SC12	PDT
BLV31	SC08	RFP	BLW97	SC08	RFP	BPX41	SC12	PDT
BLV32F	SC08	RFP	BLW98	SC08	RFP	BPX42	SC12	PDT
BLV33	SC08	RFP	BLW99	SC08	RFP	BPX61	SC12	PDT
BLV33F	SC08	RFP	BLX13	SC08	RFP	BPX61P	SC12	PDT
BLV36	SC08	RFP	BLX13C	SC08	RFP	BPX71	SC12	PDT
BLV45/12	SC08	RFP	BLX14	SC08	RFP	BPX72	SC12	PDT
BLV57	SC08	RFP	BLX15	SC08	RFP	BR100/03	S2b	Th
BLV59	SC08	RFP	BLX39	SC08	RFP	BR101	SC04	Sm
BLV75/12	SC08	RFP	BLX65	SC08	RFP	BR210*	S2a	Th
BLV80/28	SC08	RFP	BLX65E	SC08	RFP	BR216*	S2a	Th
BLV90	SC08	RFP	BLX65ES	SC08	RFP	BR220*	S2a	Th
BLV90/SL	SC08	RFP	BLX67	SC08	RFP	BRY39	SC04	Sm
BLV91	SC08	RFP	BLX68	SC08	RFP	BRY56	SC04	Sm
BLV91/SL	SC08	RFP	BLX69A	SC08	RFP	BRY61	SC10	Mm
BLV92	SC08	RFP	BLX91A	SC08	RFP	BRY62	SC10	Mm
BLV93	SC08	RFP	BLX91CB	SC08	RFP	BS107	SC07	FET

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BS 107A	SC07	FET	BSR 15;R	SC10	Mm	BSS87	SC07	FET
BS 170	SC07	FET	BSR 16;R	SC10	Mm	BSS89	SC07	FET
BS250	SC07	FET	BSR 17;R	SC10	Mm	BSS91	SC07	FET
BSD10	SC07	FET	BSR 17A;R	SC10	Mm	BSS92	SC07	FET
BSD12	SC07	FET	BSR 18;R	SC10	Mm	BST15	SC10	Mm
BSD20	SC07/10	FET/Mm	BSR 18A;R	SC10	Mm	BST16	SC10	Mm
BSD22	SC07/10	FET/Mm	BSR 19	SC10	Mm	BST39	SC10	Mm
BSD212	SC07	FET	BSR19A	SC10	Mm	BST40	SC10	Mm
BSD213	SC07	FET	BSR20	SC10	Mm	BST50	SC10	Mm
BSD214	SC07	FET	BSR20A	SC10	Mm	BST51	SC10	Mm
BSD215	SC07	FET	BSR30	SC10	Mm	BST52	SC10	Mm
BSJ111	SC07	FET	BSR31	SC10	Mm	BST60	SC10	Mm
BSJ112	SC07	FET	BSR32	SC10	Mm	BST61	SC10	Mm
BSJ113	SC07	FET	BSR33	SC10	Mm	BST62	SC10	Mm
BSJ174	SC07	FET	BSR40	SC10	Mm	BST70A	SC07	FET
BSJ175	SC07	FET	BSR41	SC10	Mm	BST72A	SC07	FET
BSJ176	SC07	FET	BSR42	SC10	Mm	BST74A	SC07	FET
BSJ177	SC07	FET	BSR43	SC10	Mm	BST76A	SC07	FET
BSN205	SC07	FET	BSR50	SC04	Sm	BST78	SC07	FET
BSN205A	SC07	FET	BSR51	SC04	Sm	BST80	SC07/10	FET/Mm
BSN254	SC07	FET	BSR52	SC04	Sm	BST82	SC07/10	FET/Mm
BSN254A	SC07	FET	BSR56	SC07/10	FET/Mm	BST84	SC07/10	FET/Mm
BSP15	SC10	Mm	BSR57	SC07/10	FET/Mm	BST86	SC07/10	FET/Mm
BSP16	SC10	Mm	BSR58	SC07/10	FET/Mm	BST95	SC07	FET
BSP19	SC10	Mm	BSR60	SC04	Sm	BST97	SC07	FET
BSP20	SC10	Mm	BSR61	SC04	Sm	BST100	SC07	FET
BSP30	SC10	Mm	BSR62	SC04	Sm	BST110	SC07	FET
BSP31	SC10	Mm	BSR111	SC07/10	FET/Mm	BST120	SC07/10	FET/Mm
BSP32	SC10	Mm	BSR112	SC07/10	FET/Mm	BST122	SC07/10	FET/Mm
BSP33	SC10	Mm	BSR113	SC07/10	FET/Mm	BSV15	SC04	Sm
BSP40	SC10	Mm	BSR174	SC07/10	FET/Mm	BSV16	SC04	Sm
BSP41	SC10	Mm	BSR175	SC07/10	FET/Mm	BSV17	SC04	Sm
BSP42	SC10	Mm	BSR176	SC07/10	FET/Mm	BSV52;R	SC10	Mm
BSP43	SC10	Mm	BSR177	SC07/10	FET/Mm	BSV64	SC04	Sm
BSP50	SC10	Mm	BSS38	SC04	Sm	BSV78	SC07	FET
BSP51	SC10	Mm	BSS50	SC04	Sm	BSV79	SC07	FET
BSP52	SC10	Mm	BSS51	SC04	Sm	BSV80	SC07	FET
BSP60	SC10	Mm	BSS52	SC04	Sm	BSV81	SC07	FET
BSP61	SC10	Mm	BSS60	SC04	Sm	BSW66A	SC04	Sm
BSP62	SC10	Mm	BSS61	SC04	Sm	BSW67A	SC04	Sm
BSP204	SC07	FET	BSS62	SC04	Sm	BSW68A	SC04	Sm
BSP204A	SC07	FET	BSS63;R	SC10	Mm	BSX19	SC04	Sm
BSR 12;R	SC10	Mm	BSS64;R	SC10	Mm	BSX20	SC04	Sm
BSR 13;R	SC10	Mm	BSS68	SC04	Sm	BSX30	SC04	Sm
BSR 14;R	SC10	Mm	BSS83	SC07/10	FET/Mm	BSX45	SC04	Sm

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type no.	book	section	type no.	book	section	type no.	book	section
BSX46	SC04	Sm	BU306F	SC06	SP	BUV48;A	SC06	SP
BSX47	SC04	Sm	BU505	SC06	SP	BUV82	SC06	SP
BSX59	SC04	Sm	BU506	SC06	SP	BUV83	SC06	SP
BSX60	SC04	Sm	BU506D	SC06	SP	BUV89	SC06	SP
BSX61	SC04	Sm	BU508A	SC06	SP	BUV90	SC06	SP
BT136*	S2b	Tri	BU508D	SC06	SP	BUV90F	SC06	SP
BT136F*	S2b	Tri	BU705	SC06	SP	BUV98(V);A	SC06	SP
BT137*	S2b	Tri	BU706	SC06	SP	BUV298(V);A	SC06	SP
BT137F*	S2b	Tri	BU706D	SC06	SP	BUW11;A	SC06	SP
BT138*	S2b	Tri	BU806	SC06	SP	BUW12;A	SC06	SP
BT138F*	S2b	Tri	BU807	SC06	SP	BUW12F;AF	SC06	SP
BT139*	S2b	Tri	BU808	SC06	SP	BUW13;A	SC06	SP
BT139F*	S2b	Tri	BU824	SC06	SP	BUW13F;AF	SC06	SP
BT145*	S2b	Tri	BU826	SC06	SP	BUW84	SC06	SP
BT149*	S2b	Th	BUP22*	SC06	SP	BUW85	SC06	SP
BT150	S2b	Th	BUP23*	SC06	SP	BUW86	SC06	SP
BT151*	S2b	Th	BUS11;A	SC06	SP	BUW87;A	SC06	SP
BT151F*	S2b	Th	BUS12;A	SC06	SP	BUW131*	SC06	SP
BT152*	S2b	Th	BUS13;A	SC06	SP	BUW132*	SC06	SP
BT153	S2b	Th	BUS14;A	SC06	SP	BUW133*	SC06	SP
BT157*	S2b	Th	BUS21*	SC06	SP	BUX46;A	SC06	SP
BT169*	S2b	Th	BUS22*	SC06	SP	BUX47;A	SC06	SP
BTA140*	S2b	Tri	BUS23*	SC06	SP	BUX48;A	SC06	SP
BTR59*	S2b	Tri	BUS24*	SC06	SP	BUX84	SC06	SP
BTS59*	S2b	Tri	BUS131*	SC06	SP	BUX84F	SC06	SP
BTV58*	S2b	Th	BUS132*	SC06	SP	BUX85	SC06	SP
BTV59*	S2b	Th	BUS133*	SC06	SP	BUX85F	SC06	SP
BTV59D*	S2b	Th	BUT11;A	SC06	SP	BUX86	SC06	SP
BTV60*	S2b	Th	BUT11F;AF	SC06	SP	BUX87	SC06	SP
BTV60D*	S2b	Th	BUT12;A	SC06	SP	BUX88	SC06	SP
BTV70*	S2b	Th	BUT12F;AF	SC06	SP	BUX98;A	SC06	SP
BTV70D*	S2b	Th	BUT18;A	SC06	SP	BUX99	SC06	SP
BTW23*	S2b	Th	BUT18F;AF	SC06	SP	BUY89	SC06	SP
BTW38*	S2b	Th	BUT21B;C	SC06	SP	BUZ10	S9	PM
BTW40*	S2b	Th	BUT21BF;CF	SC06	SP	BUZ11	S9	PM
BTW42*	S2b	Th	BUT22B;C	SC06	SP	BUZ11A	S9	PM
BTW43*	S2b	Tri	BUT22BF;CF	SC06	SP	BUZ14	S9	PM
BTW45*	S2b	Th	BUT131	SC06	SP	BUZ15	S9	PM
BTW58*	S2b	Th	BUV26;A	SC06	SP	BUZ20	S9	PM
BTW62*	S2b	Th	BUV26F;AF	SC06	SP	BUZ21	S9	PM
BTW62D*	S2b	Th	BUV27;A	SC06	SP	BUZ23	S9	PM
BTW63*	S2b	Th	BUV27F;AF	SC06	SP	BUZ24	S9	PM
BTY79*	S2b	Th	BUV28;A	SC06	SP	BUZ25	S9	PM
BTY91*	S2b	Th	BUV28F;AF	SC06	SP	BUZ31	S9	PM
BU306	SC06	SP	BUV47;A	SC06	SP	BUZ32	S9	PM

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BUZ34	S9	PM	BUZ347	S9	PM	BY714	SC01	R
BUZ35	S9	PM	BUZ348	S9	PM	BY715	SC01	R
BUZ36	S9	PM	BUZ349	S9	PM	BY716	SC01	R
BUZ41A	S9	PM	BUZ350	S9	PM	BY717	SC01	R
BUZ42	S9	PM	BUZ351	S9	PM	BY718	SC01	R
BUZ45	S9	PM	BUZ355	S9	PM	BY719	SC01	R
BUZ45A	S9	PM	BUZ356	S9	PM	BY720	SC01	R
BUZ45B	S9	PM	BUZ357	S9	PM	BY721	SC01	R
BUZ50A	S9	PM	BUZ358	S9	PM	BY722	SC01	R
BUZ50B	S9	PM	BUZ384	S9	PM	BY723	SC01	R
BUZ50C	S9	PM	BUZ385	S9	PM	BY724	SC01	R
BUZ53A	S9	PM	BY224*	S2a	R	BYD11 *	SC01	R
BUZ54	S9	PM	BY225*	S2a	R	BYD13 *	SC01	R
BUZ54A	S9	PM	BY228	SC01	R	BYD14 *	SC01	R
BUZ60	S9	PM	BY229*	S2a	R	BYD17 *	SC01/10	R/Mm
BUZ63	S9	PM	BY229F*	S2a	R	BYD31 *	SC01	R
BUZ64	S9	PM	BY249*	S2a	R	BYD33 *	SC01	R
BUZ71	S9	PM	BY260*	S2a	R	BYD34 *	SC01	R
BUZ71A	S9	PM	BY261*	S2a	R	BYD37 *	SC01/10	R/Mm
BUZ72	S9	PM	BY328	SC01	SD	BYD73 *	SC01	R
BUZ72A	S9	PM	BY329*	S2a	R	BYD74 *	SC01	R
BUZ73	S9	PM	BY359*	S2a	R	BYD77 *	SC01	R
BUZ73A	S9	PM	BY438	SC01	R	BYM26 *	SC01	R
BUZ74	S9	PM	BY448	SC01	R	BYM36 *	SC01	R
BUZ74A	S9	PM	BY458	SC01	R	BYM56 *	SC01	R
BUZ76	S9	PM	BY505	SC01	R	BYP21*	S2a	R
BUZ76A	S9	PM	BY509	SC01	R	BYP22*	S2a	R
BUZ78	S9	PM	BY527	SC01	R	BYP59*	S2a	R
BUZ80	S9	PM	BY584	SC01	R	BYQ27*	SC01	R
BUZ80A	S9	PM	BY588	SC01	R	BYQ28*	S2a	R
BUZ83	S9	PM	BY609	SC01	R	BYR29*	S2a	R
BUZ83A	S9	PM	BY610	SC01	R	BYR29F*	S2a	R
BUZ84	S9	PM	BY614	SC01	R	BYR30*	SC01	R
BUZ84A	S9	PM	BY619	SC01	R	BYR79*	SC01	R
BUZ90	S9	PM	BY620	SC01	R	BYT28*	S2a	R
BUZ90A	S9	PM	BY627	SC01	R	BYT79*	S2a	R
BUZ94	S9	PM	BY705	SC01	R	BYT230PIV	SC01	R
BUZ211	S9	PM	BY706	SC01	R	BYV10*	SC01	R
BUZ307	S9	PM	BY707	SC01	R	BYV18*	S2a	R
BUZ308	S9	PM	BY708	SC01	R	BYV19*	S2a	R
BUZ310	S9	PM	BY709	SC01	R	BYV20*	S2a	R
BUZ311	S9	PM	BY710	SC01	R	BYV21*	S2a	R
BUZ326	S9	PM	BY711	SC01	R	BYV22*	S2a	R
BUZ330	S9	PM	BY712	SC01	R	BYV23*	S2a	R
BUZ331	S9	PM	BY713	SC01	R	BYV24*	S2a	R

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BYV26 *	SC01/S2a	R	BYX10G	SC01	R	CNX21	SC12	PhC
BYV27*	SC01/S2a	R	BYX25*	S2a	R	CNX35	SC12	PhC
BYV28*	SC01/S2a	R	BYX30*	S2a	R	CNX35U	SC12	PhC
BYV29*	S2a	R	BYX32*	S2a	R	CNX36	SC12	PhC
BYV29F*	S2a	R	BYX38*	S2a	R	CNX36U	SC12	PhC
BYV30*	S2a	R	BYX39*	S2a	R	CNX38	SC12	PhC
BYV31*	S2a	R	BYX42*	S2a	R	CNX38U	SC12	PhC
BYV32*	S2a	R	BYX46*	S2a	R	CNX39	SC12	PhC
BYV32F*	S2a	R	BYX50*	S2a	R	CNX39U	SC12	PhC
BYV33*	S2a	R	BYX52*	S2a	R	CNX44	SC12	PhC
BYV33F*	S2a	R	BYX56*	S2a	R	CNX44A	SC12	PhC
BYV34*	S2a	R	BYX90G	SC01	R	CNX46	SC12	PhC
BYV36 *	SC01	R	BYX96*	S2a	R	CNX48	SC12	PhC
BYV39*	S2a	R	BYX97*	S2a	R	CNX48U	SC12	PhC
BYV42*	S2a	R	BYX98*	S2a	R	CNX62	SC12	PhC
BYV43*	S2a	R	BYX99*	S2a	R	CNX72	SC12	PhC
BYV43F*	S2a	R	BZD23	SC01	Vrg	CNX82	SC12	PhC
BYV44*	S2a	R	BZD27	SC01/10	Vrg/Mm	CNX83	SC12	PhC
BYV54V	SC01	R	BZT03	SC01	Vrg	CNX91	SC12	PhC
BYV60*	S2a	R	BZV10	SC01	Vrf	CNX92	SC12	PhC
BYV72*	S2a	R	BZV11	SC01	Vrf	CNY17-1	SC12	PhC
BYV73*	S2a	R	BZV12	SC01	Vrf	CNY17-2	SC12	PhC
BYV74*	S2a	R	BZV13	SC01	Vrf	CNY17-3	SC12	PhC
BYV79*	S2a	R	BZV14	SC01	Vrf	CNY50	SC12	PhC
BYV92*	S2a	R	BZV37	SC01	Vrf	CNY57	SC12	PhC
BYV95A	SC01	R	BZV49*	SC01/10	Vrg/Mm	CNY57A	SC12	PhC
BYV95B	SC01	R	BZV55*	SC10	Mm	CNY57AU	SC12	PhC
BYV95C	SC01	R	BZV60	SC01	Vrg	CNY57U	SC12	PhC
BYV96D	SC01	R	BZV80	SC01	Vrf	CNY62	SC12	PhC
BYV96E	SC01	R	BZV81	SC01	Vrf	CNY63	SC12	PhC
BYW25*	S2a	R	BZV85*	SC01	Vrg	CQF24	SC12	Ph
BYW29*	S2a	R	BZV86	SC01	SD	CQL10A	SC12	Ph
BYW29F*	S2a	R	BZW03*	SC01	Vrg	CQL13A	SC12	Ph
BYW30*	S2a	R	BZW14	SC01	Vrg	CQL16	SC12	Ph
BYW31*	S2a	R	BZW86*	S2a	TS	CQW58A	S8a	I
BYW54	SC01	R	BZX55*	SC01	Vrg	CQW89A	S8a	I
BYW55	SC01	R	BZX70*	S2a	Vrg	CQW89B	S8a	I
BYW56	SC01	R	BZX75*	SC01	Vrg	CQY58A	S8a	I
BYW92*	S2a	R	BZX79*	SC01	Vrg	CQY89A	S8a	I
BYW93*	S2a	R	BZX84*	SC01/10	Vrg/Mm	CQY89F	S8a	I
BYW95A	SC01	R	BZY91*	S2a	Vrg	ESM3045A(V)	SC06	SP
BYW95B	SC01	R	BZY93*	S2a	Vrg	ESM3045D(V)	SC06	SP
BYW95C	SC01	R	CNG35	SC12	PhC	ESM4045A(V)	SC06	SP
BYW96D	SC01	R	CNG36	SC12	PhC	ESM4045D(V)	SC06	SP
BYW96E	SC01	R	CNR36	SC12	PhC	ESM5045D(V)	SC06	SP

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ESM6045A(V)	SC06	SP	LKE2015T	SC15	M	MPS6515	SC04	Sm
ESM6045D(V)	SC06	SP	LKE21004R	SC15	M	MPS6517	SC04	Sm
Fresnel-lens	SC12	A	LKE21015T	SC15	M	MPS6518	SC04	Sm
H11A1	SC12	PhC	LKE21050T	SC15	M	MPS6519	SC04	Sm
H11A2	SC12	PhC	LKE27010R	SC15	M	MPS6520	SC04	Sm
H11A3	SC12	PhC	LKE27025R	SC15	M	MPS6521	SC04	Sm
H11A4	SC12	PhC	LKE32002T	SC15	M	MPS6522	SC04	Sm
H11A5	SC12	PhC	LKE32004T	SC15	M	MPS6523	SC04	Sm
H11B1	SC12	PhC	LTE21009R	SC15	M	MPSA05	SC04	Sm
H11B2	SC12	PhC	LTE21015R	SC15	M	MPSA06	SC04	Sm
H11B3	SC12	PhC	LTE21025R	SC15	M	MPSA13	SC04	Sm
H11B255	SC12	PhC	LTE4002S	SC15	M	MPSA14	SC04	Sm
KMZ10A	SC13	SEN	LTE42005S	SC15	M	MPSA42	SC04	Sm
KMZ10B	SC13	SEN	LTE42008R	SC15	M	MPSA43	SC04	Sm
KMZ10C	SC13	SEN	LTE42012R	SC15	M	MPSA55	SC04	Sm
KP100A	SC13	SEN	LUE2003S	SC15	M	MPSA56	SC04	Sm
KP101A	SC13	SEN	LUE2009S	SC15	M	MPSA63	SC04	Sm
KPZ20G	SC13	SEN	LV1721E50R	SC15	M	MPSA64	SC04	Sm
KPZ21G	SC13	SEN	LV2024E45R	SC15	M	MPSA92	SC04	Sm
KTY81-100*	SC13	SEN	LV2327E40R	SC15	M	MPSA93	SC04	Sm
KTY81-200*	SC13	SEN	LV2931E50S	SC15	M	MRB11080Y	SC15	M
KTY83-100*	SC13	SEN	LV3742E16R	SC15	M	MRB11175Y	SC15	M
KTY84-100*	SC13	SEN	LV3742E24R	SC15	M	MRB11350Y	SC15	M
KTY85-100*	SC10	SEN	LVE21050R	SC15	M	MRB12175YR	SC15	M
LAE2001R	SC15	M	LWE2015R	SC15	M	MRB12350YR	SC15	M
LAE4000Q	SC15	M	LWE2025R	SC15	M	MS1011B700Y	SC15	M
LAE4001R	SC15	M	LZ1418E100R	SC15	M	MS6075B800Z	SC15	M
LAE4002S	SC15	M	MCA230	SC12	PhC	MSB11900Y	SC15	M
LAE6000Q	SC15	M	MCA231	SC12	PhC	MSB12900Y	SC15	M
LBE1004R	SC15	M	MCA255	SC12	PhC	MZ0912B75Y	SC15	M
LBE1010R	SC15	M	MCT2	SC12	PhC	MZ0912B150Y	SC15	M
LBE2003S	SC15	M	MCT26	SC12	PhC	OM286; M	SC13	SEN
LBE2005Q	SC15	M	MJE13004	SC06	SP	OM287; M	SC13	SEN
LBE2008T	SC15	M	MJE13005	SC06	SP	OM320	SC14	WBM
LBE2009S	SC15	M	MJE13006	SC06	SP	OM321	SC14	WBM
LCE1004R	SC15	M	MJE13007	SC06	SP	OM322	SC14	WBM
LCE1010R	SC15	M	MJE13008	SC06	SP	OM323	SC14	WBM
LCE2003S	SC15	M	MJE13009	SC06	SP	OM323A	SC14	WBM
LCE2005Q	SC15	M	MKB12040WS	SC15	M	OM335	SC14	WBM
LCE2008T	SC15	M	MKB12100WS	SC15	M	OM336	SC14	WBM
LCE2009S	SC15	M	MKB12140W	SC15	M	OM337	SC14	WBM
LJE42002T	SC15	M	M06075B200Z	SC15	M	OM337A	SC14	WBM
LKE1004R	SC15	M	M06075B400Z	SC15	M	OM339	SC14	WBM
LKE2002T	SC15	M	MPS6513	SC04	Sm	OM345	SC14	WBM
LKE2004T	SC15	M	MPS6514	SC04	Sm	OM350	SC14	WBM

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OM360	SC14	WBM	PKB3003U	SC15	M	PLED-TR12E	S8a	LED
OM361	SC14	WBM	PKB3005U	SC15	M	PLED-TR12F	S8a	LED
OM370	SC14	WBM	PKB12005U	SC15	M	PLED-TR12G	S8a	LED
OM386B	SC13	SEN	PKB20010U	SC15	M	PLED-TR42DL	S8a	LED
OM386M	SC13	SEN	PKB23001U	SC15	M	PLED-Y313A	S8a	LED
OM387B	SC13	SEN	PKB23003U	SC15	M	PLED-Y313N	S8a	LED
OM387M	SC13	SEN	PKB23005U	SC15	M	PLED-Y314A	S8a	LED
OM388B	SC13	SEN	PKB25006T	SC15	M	PLED-Y314N	S8a	LED
OM389B	SC13	SEN	PKB32001U	SC15	M	PLED-Y511C	S8a	LED
OM931	SC05	P	PKB32003U	SC15	M	PLED-Y513C	S8a	LED
OM961	SC05	P	PKB32005U	SC15	M	PLED-Y513M	S8a	LED
OSB9115	S2a	St	PLED-G313A	S8a	LED	PLED-Y514B	S8a	LED
OSB9215	S2a	St	PLED-G313N	S8a	LED	PLED-Y514M	S8a	LED
OSB9415	S2a	St	PLED-G314A	S8a	LED	PLED-Y544KL	S8a	LED
OSM9115	S2a	St	PLED-G314N	S8a	LED	PLED-Y544LL	S8a	LED
OSM9215	S2a	St	PLED-G511C	S8a	LED	PLED-YR14E	S8a	LED
OSM9415	S2a	St	PLED-G513C	S8a	LED	PLED-YR14F	S8a	LED
OSM9510	S2a	St	PLED-G513M	S8a	LED	PLED-YR14G	S8a	LED
OSM9511	S2a	St	PLED-G514B	S8a	LED	PLED-YR44DL	S8a	LED
OSM9512	S2a	St	PLED-G514M	S8a	LED	PMBD914	SC01	SD
OSS9115	S2a	St	PLED-G544KL	S8a	LED	PMBD2835	SC01	SD
OSS9215	S2a	St	PLED-G544LL	S8a	LED	PMBD2836	SC01	SD
OSS9415	S2a	St	PLED-GR14E	S8a	LED	PMBD2837	SC01	SD
P2105	SC12	I	PLED-GR14F	S8a	LED	PMBD2838	SC01	SD
PDE1001U	SC15	M	PLED-GR14G	S8a	LED	PMBD6050	SC01	SD
PDE1003U	SC15	M	PLED-GR44DL	S8a	LED	PMBD6100	SC01	SD
PDE1005U	SC15	M	PLED-H313A	S8a	LED	PMBD7000	SC01	SD
PDE1010U	SC15	M	PLED-H314A	S8a	LED	PMBF170	SC07/10	FET/Mm
PEE1001U	SC15	M	PLED-H511C	S8a	LED	PMBF4391	SC07/10	FET/Mm
PEE1003U	SC15	M	PLED-H514B	S8a	LED	PMBF4392	SC07/10	FET/Mm
PEE1005U	SC15	M	PLED-H544KL	S8a	LED	PMBF4393	SC07/10	FET/Mm
PEE1010U	SC15	M	PLED-H544LL	S8a	LED	PMBFJ174	SC07/10	FET/Mm
PH2222/A	SC04	Sm	PLED-HR14E	S8a	LED	PMBFJ175	SC07/10	FET/Mm
PH2369	SC04	Sm	PLED-HR14F	S8a	LED	PMBFJ176	SC07/10	FET/Mm
PH2907	SC04	Sm	PLED-HR14G	S8a	LED	PMBFJ177	SC07/10	FET/Mm
PH2907A	SC04	Sm	PLED-HR44DL	S8a	LED	PMBT2222	SC10	Mm
PH5415	SC04	Sm	PLED-O313N	S8a	LED	PMBT2222A	SC10	Mm
PH5416	SC04	Sm	PLED-O314N	S8a	LED	PMBT2369	SC10	Mm
PH6659	SC07	FET	PLED-O513M	S8a	LED	PMBT2907	SC10	Mm
PH6660	SC07	FET	PLED-O514M	S8a	LED	PMBT2907A	SC10	Mm
PH6661	SC07	FET	PLED-P313N	S8a	LED	PMBT3903	SC10	Mm
PH13002	SC06	SP	PLED-P314N	S8a	LED	PMBT3904	SC10	Mm
PH13003	SC06	SP	PLED-P513M	S8a	LED	PMBT3906	SC10	Mm
PHSD51	S2a	R	PLED-P514M	S8a	LED	PMBT4401	SC10	Mm
PKB3001U	SC15	M	PLED-T512B	S8a	LED	PMBT4403	SC10	Mm

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PMBT5088	SC10	Mm	PTB23003X	SC15	M	PZTA93	SC10	Mm
PMBT5401	SC10	Mm	PTB23005X	SC15	M	RPY97	SC12	I
PMBT5550	SC10	Mm	PTB32001X	SC15	M	RPY100	SC12	I
PMBT5551	SC10	Mm	PTB32003X	SC15	M	RPY101	SC12	I
PMBT6428	SC10	Mm	PTB32005X	SC15	M	RPY102	SC12	I
PMBT6429	SC10	Mm	PTB42001X	SC15	M	RPY103	SC12	I
PMBTA05	SC10	Mm	PTB42002X	SC15	M	RPY107	SC12	I
PMBTA06	SC10	Mm	PTB42003X	SC15	M	RPY109	SC12	I
PMBTA13	SC10	Mm	PV3742B4X	SC15	M	RV2833B5X	SC15	M
PMBTA14	SC10	Mm	PVB42004X	SC15	M	RV3135B5X	SC15	M
PMBTA42	SC10	Mm	PXT2222	SC10	Mm	RX1011B250Y	SC15	M
PMBTA43	SC10	Mm	PXT2222A	SC10	Mm	RX1011B350Y	SC15	M
PMBTA55	SC10	Mm	PXT2907	SC10	Mm	RX1214B150Y	SC15	M
PMBTA56	SC10	Mm	PXT2907A	SC10	Mm	RX1214B300Y	SC15	M
PMBTA63	SC10	Mm	PXT3904	SC10	Mm	RX2731B90W	SC15	M
PMBTA64	SC10	Mm	PXT3906	SC10	Mm	RX3034B70W	SC15	M
PMBTA92	SC10	Mm	PXT4401	SC10	Mm	RXB12350Y	SC15	M
PMBTA93	SC10	Mm	PXT4403	SC10	Mm	RZ1214B35Y	SC15	M
PMB25226	SC01	SD	PXTA14	SC10	Mm	RZ1214B65Y	SC15	M
PMLL4148	SC01/10	SD/Mm	PXTA27	SC10	Mm	RZ1214B125Y	SC15	M
PMLL4150	SC01/10	SD/Mm	PXTA64	SC10	Mm	RZ1214B150Y	SC15	M
PMLL4151	SC01/10	SD/Mm	PXTA77	SC10	Mm	RZ2731B45W	SC15	M
PMLL4153	SC01/10	SD/Mm	PZ1418B15U	SC15	M	RZ2731B60W	SC15	M
PMLL4446	SC01/10	SD/Mm	PZ1418B30U	SC15	M	RZ2833B15W	SC15	M
PMLL4448	SC01/10	SD/Mm	PZ1721B12U	SC15	M	RZ2833B30W	SC15	M
PMLL5225B to			PZ1721B25U	SC15	M	RZ2833B45W	SC15	M
PMLL5267B	SC01/10	SD/Mm	PZ2024B10U	SC15	M	RZ2833B60W	SC15	M
PN2222	SC04	Sm	PZ2024B20U	SC15	M	RZ3135B15W	SC15	M
PN2222A	SC04	Sm	PZ2327B15U	SC15	M	RZ3135B30W	SC15	M
PN2369	SC04	Sm	PZB16035U	SC15	M	RZ3135B40W	SC15	M
PN2369A	SC04	Sm	PZB16040U	SC15	M	RZ3135B50W	SC15	M
PN2907	SC04	Sm	PZB27020U	SC15	M	RZB12050Y	SC15	M
PN2907A	SC04	Sm	PZT2222	SC10	Mm	RZB12100Y	SC15	M
PN3439	SC04	Sm	PZT2222A	SC10	Mm	RZB12250Y	SC15	M
PN3440	SC04	Sm	PZT2907	SC10	Mm	SL5500	SC12	PhC
PN4391	SC07	FET	PZT2907A	SC10	Mm	SL5501	SC12	PhC
PN4392	SC07	FET	PZT3904	SC10	Mm	SL5502R	SC12	PhC
PN4393	SC07	FET	PZT3906	SC10	Mm	SL5504	SC12	PhC
PN5415	SC04	Sm	PZTA13	SC10	Mm	SL5504S	SC12	PhC
PN5416	SC04	Sm	PZTA14	SC10	Mm	SL5505S	SC12	PhC
PO44	SC12	PhC	PZTA42	SC10	Mm	SL5511	SC12	PhC
PO44A	SC12	PhC	PZTA43	SC10	Mm	TIP29*	SC05	P
PPC5001T	SC15	M	PZTA63	SC10	Mm	TIP30*	SC05	P
PQC5001T	SC15	M	PZTA64	SC10	Mm	TIP31*	SC05	P
PTB23001X	SC15	M	PZTA92	SC10	Mm	TIP32*	SC05	P

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TIP33*	SC05	P	1N3883	S2a	R	2N2219	SC04	Sm
TIP34*	SC05	P	1N3889	S2a	R	2N2219A	SC04	Sm
TIP41*	SC05	P	1N3890	S2a	R	2N2222	SC04	Sm
TIP42*	SC05	P	1N3891	S2a	R	2N2222A	SC04	Sm
TIP47	SC06	P	1N3892	S2a	R	2N2297	SC04	Sm
TIP48	SC06	P	1N3893	S2a	R	2N2369	SC04	Sm
TIP49	SC06	P	1N3909	S2a	R	2N2369A	SC04	Sm
TIP50	SC06	P	1N3910	S2a	R	2N2483	SC04	Sm
TIP110	SC05	P	1N3911	S2a	R	2N2484	SC04	Sm
TIP111	SC05	P	1N3912	S2a	R	2N2904	SC04	Sm
TIP112	SC05	P	1N3913	S2a	R	2N2904A	SC04	Sm
TIP115	SC05	P	1N4001D	SC01	R	2N2905	SC04	Sm
TIP116	SC05	P	1N4002D	SC01	R	2N2905A	SC04	Sm
TIP117	SC05	P	1N4003D	SC01	R	2N2906	SC04	Sm
TIP120	SC05	P	1N4004D	SC01	R	2N2906A	SC04	Sm
TIP121	SC05	P	1N4005D	SC01	R	2N2907	SC04	Sm
TIP122	SC05	P	1N4006D	SC01	R	2N2907A	SC04	Sm
TIP125	SC05	P	1N4007D	SC01	R	2N3019	SC04	Sm
TIP126	SC05	P	1N4001G	SC01	R	2N3020	SC04	Sm
TIP127	SC05	P	1N4002G	SC01	R	2N3053	SC04	Sm
TIP130	SC05	P	1N4003G	SC01	R	2N3375	SC08	RFP
TIP131	SC05	P	1N4004G	SC01	R	2N3553	SC08	RFP
TIP132	SC05	P	1N4005G	SC01	R	2N3632	SC08	RFP
TIP135	SC05	P	1N4006G	SC01	R	2N3822	SC07	FET
TIP136	SC05	P	1N4007G	SC01	R	2N3823	SC07	FET
TIP137	SC05	P	1N4148	SC01	SD	2N3866	SC08	RFP
TIP140	SC05	P	1N4150	SC01	SD	2N3903	SC04	Sm
TIP141	SC05	P	1N4151	SC01	SD	2N3904	SC04	Sm
TIP142	SC05	P	1N4153	SC01	SD	2N3905	SC04	Sm
TIP145	SC05	P	1N4446	SC01	SD	2N3906	SC04	Sm
TIP146	SC05	P	1N4448	SC01	SD	2N3924	SC08	RFP
TIP147	SC05	P	1N4531	SC01	SD	2N3926	SC08	RFP
TIP2955;T	SC05	P	1N4532	SC01	SD	2N3927	SC08	RFP
TIP3055;T	SC05	P	1N4933	SC01	R	2N3966	SC07	FET
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1N3881	S2a	R	2N1711	SC04	Sm	2N4125	SC04	Sm
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T4	*	Magnetrons for microwave heating
T5	PC02**	Cathode-ray tubes
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T11	PC06**	Microwave diodes and sub-assemblies
T12	PC07	Vidicon and Newvicon camera tubes and deflection units
T13	PC08	Image intensifiers
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