

and materials

Electron tubes

Part 2b May 1978

Microwave semiconductors

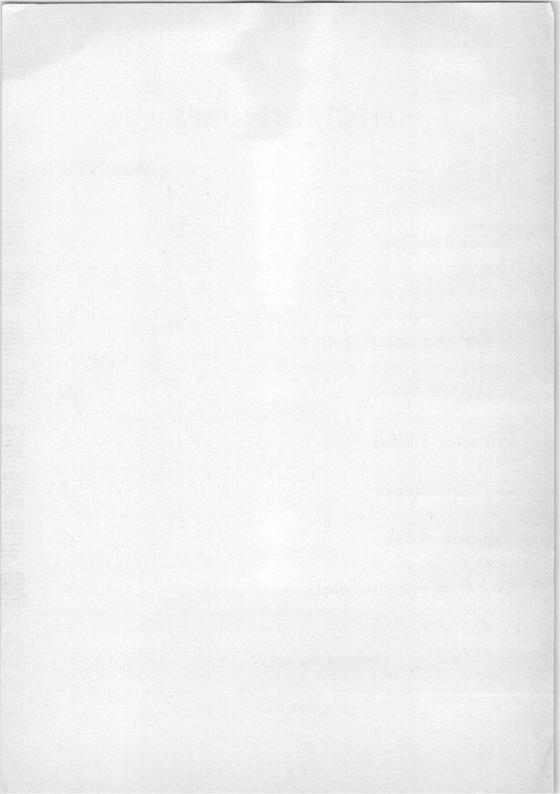
and components



ELECTRON TUBES

Part 2b	May 1978		
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DATA HANDBOOK SYSTEM

Our Data Handbook System is a comprehensive source of information on electronic components, sub-assemblies and materials; it is made up of three series of handbooks each comprising several parts.

ELECTRON TUBES

BLUE

SEMICONDUCTORS AND INTEGRATED CIRCUITS

RED

COMPONENTS AND MATERIALS

GREEN

The several parts contain all pertinent data available at the time of publication, and each is revised and reissued periodically.

Where ratings or specifications differ from those published in the preceding edition they are pointed out by arrows. Where application information is given it is advisory and does not form part of the product specification.

If you need confirmation that the published data about any of our products are the latest available, please contact our representative. He is at your service and will be glad to answer your inquiries.

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ELECTRON TUBES (BLUE SERIES)

Part 1a December 1975	ET1a 12-75	Transmitting tubes for communication, tubes for r.f. heating Types PE05/25 to TBW15/25
Part 1b August 1977	ET1b 08-77	Transmitting tubes for communication, tubes for r.f. heating, amplifier circuit assemblies
Part 2a November 1977	ET2a 11-77	Microwave tubes Communication magnetrons, magnetrons for microwave heating, klystrons, travelling-wave tubes, diodes, triodes T-R switches
Part 2b May 1978	ET2b 05-78	Microwave semiconductors and components Gunn, Impatt and noise diodes, mixer and detector diodes, backward diodes, varactor diodes, Gunn oscillators, sub- assemblies, circulators and isolators
Part 3 January 1975	ET3 01-75	Special Quality tubes, miscellaneous devices
Part 4 March 1975	ET4 03-75	Receiving tubes
Part 5a March 1978	ET5a 03-78	Cathode-ray tubes Instrument tubes, monitor and display tubes, C.R. tubes for special applications
Part 5b May 1975	ET5b 05-75	Camera tubes, image intensifier tubes
Part 6 January 1977	ET6 01-77	Products for nuclear technology Channel electron multipliers, neutron tubes, Geiger-Müller tubes
Part 7a March 1977	ET7a 03-77	Gas-filled tubes Thyratrons, industrial rectifying tubes, ignitrons, high-voltage rectifying tubes
Part 7b March 1977	ET7b 03-77	Gas-filled tubes Segment indicator tubes, indicator tubes, switching diodes, dry reed contact units
Part 8 May 1977	ET8 05-77	TV picture tubes
Part 9 March 1978	ET9 03-78	Photomultiplier tubes; phototubes

SEMICONDUCTORS AND INTEGRATED CIRCUITS (RED SERIES)

Part 1a March 1976	SC1a 03-76	Rectifier diodes, thyristors, triacs Rectifier diodes, voltage regulator diodes (> 1,5 W), transient suppressor diodes, rectifier stacks, thyristors, triacs
Part 1b May 1977	SC1b 05-77	Diodes Small signal germanium diodes, small signal silicon diodes, special diodes, voltage regulator diodes (< 1,5 W), voltage reference diodes, tuner diodes
Part 2 November 1977	SC2 11-77	Low-frequency and dual transistors
Part 3 January 1978	SC3 01-78	High-frequency, switching and field-effect transistors
Part 4a June 1976	SC4a 06-76	Special semiconductors Transmitting transistors, field-effect transistors, dual transistors, microminiature devices for thick and thin-film circuits
Part 4b July 1976	SC4b 07-76	Devices for optoelectronics Photosensitive diodes and transistors, light emitting diodes, displays, photocouplers, infrared sensitive devices, photoconductive devices
Part 5a November 1976	SC5a 11-76	Professional analogue integrated circuits
Part 5b March 1977	SC5b 03-77	Consumer integrated circuits Radio-audio, television
Part 6 October 1977	SC6 10-77	Digital integrated circuits LOCMOS HE4000B family
Signetics integrated circuits	1976	Logic, Memories, Interface, Analogue, Microprocessor, Milrel

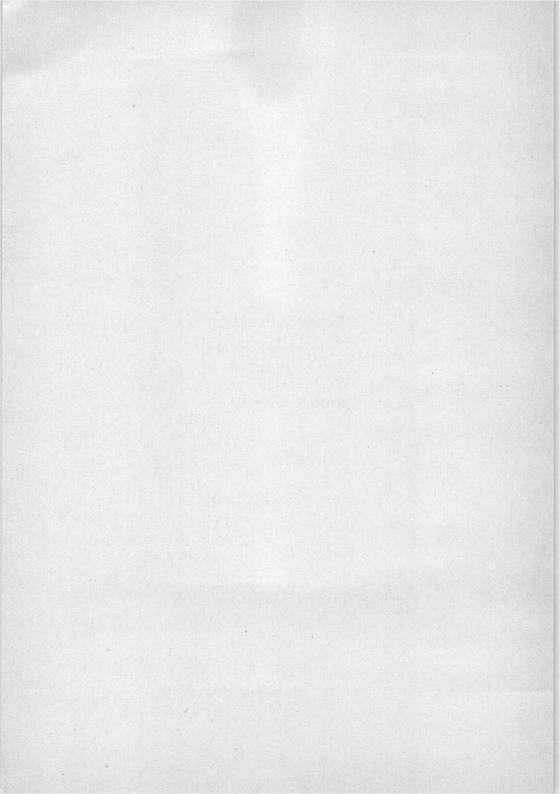
COMPONENTS AND MATERIALS (GREEN SERIES)

Part 1 June '	1977 CM1 06-77	Assemblies for industrial use High noise immunity logic FZ/30-series, counter modules 50-series, NORbits 60-series, 61-series, circuit blocks 90-series, circuit block CSA70(L), PLC modules, input/ output devices, hybrid circuits, peripheral devices, ferrite core memory products
Part 2a Octob	er 1977 CM2a 10-7	Proceedings of the Resistors of Resistors (VDR), light dependent resistors (LDR), negative temperature coefficient thermistors (NTC), positive temperature coefficient thermistors (PTC), test switches
Part 2b Febru	ary 1978 CM2b 02-7	Capacitors Electrolytic and solid capacitors, film capacitors, ceramic capacitors, variable capacitors
Part 3 Janua	ry 1977 CM3 01-77	Radio, audio, television FM tuners, loudspeakers, television tuners and aerial input assemblies, components for black and white television, components for colour television
Part 4a Octob	er 1976 CM4a 10-7	Ferrites Ferrites for radio, audio and television, beads and chokes, Ferroxcube potcores and square cores, Ferroxcube transformer cores
Part 4b Decen	nber 1976 CM4b 12-7	76 Piezoelectric ceramics, permanent magnet materials
Part 5 July 1	975 CM5 07-75	Ferrite core memory products Ferroxcube memory cores, matrix planes and stacks, core memory systems
Part 6 April	1977 CM6 04-77	Electric motors and accessories Small synchronous motors, stepper motors, miniature direct current motors
Part 7 Septer	mber 1971 CM7 09-71	Circuit blocks Circuit blocks 100 kHz-series, circuit blocks 1-series, circuit blocks 10-series, circuit blocks for ferrite core memory drive
Part 8 Febru	ary 1977 CM8 02-77	Variable mains transformers
Part 9 March	1976 CM9 03-76	Piezoelectric quartz devices
Part 10 April	1978 CM10 04-7	78 Connectors



General section
Type nomenclature
List of symbols
Explanation
Rating system

Α



Section 1

TYPE NOMENCLATURE

The type nomenclature of a discrete device or, in certain cases, of a range of devices, consists of two letters followed by a serial number. The serial number may consist of three figures or of one letter and two figures depending on the main application of the device.

The first letter indicates the semiconductor material used:

- A germanium
- B silicon
- C compound materials such as gallium arsenide
- D compound materials such as indium antimonide
- R compound materials such as cadmium sulphide

The second letter indicates the general function of the device:

- A detection diode, high speed diode, mixer diode.
- B variable capacitance diode
- C transistor for a.f. applications (not power types)
- D power transistor for a.f. applications
- E tunnel diode
- F transistor for r.f. applications (not power types)
- G multiple of dissimilar devices; miscellaneous devices
- L power transistor for r.f. applications
- N photo-coupler
- P radiation sensitive device such as photodiode, phototransistor, photoconductive cell, or radiation detector diode
- Q radiation generating device such as light-emitting diode
- R controlling and switching device (e.g. thyristor) having a specified breakdown characteristic (not power types)
- S transistor for switching applications (not power types)
- T controlling and switching power device (e.g. thyristor) having a specified breakdown characteristic
- U power transistor for switching applications
- X multiplier diode such as varactor or step recovery diode
- Y rectifier diode, booster diode, efficiency diode
- Z voltage reference or voltage regulator diode, transient suppressor diode

The remainder of the type number is a **serial number** indicating a particular design or development and is in one of the following two groups:

- (a) Devices intended primarily for use in consumer applications (radio and television receivers, audio amplifiers, tape recorders, domestic appliances, etc.).
 - The serial number consists of three figures.
- (b) Devices intended mainly for applications other than (a), e.g. industrial, professional and transmitting equipments.
 The serial number consists of one letter (Z, Y, X, W, etc.) followed by two figures.

DEVICES

Range Numbers

Where there is a range of variants of a basic type of rectifier diode, thyristor or voltage regulator diode the type number as defined above is often used to identify the range; further letters and figures are added after a hyphen to identify individual types within the range. These additions are as follows:

Rectifier Diodes and Thyristors

The group of figures indicates the rated repetitive peak reverse voltage, VRRM, or the rated repetitive peak off-state voltage, VDRM, whichever value is lower, in volts for each type.

The final letter R is used to denote a reverse polarity version (stud-anode) where applicable. The normal polarity version (stud cathode) has no special final letter.

Voltage Regulator Diodes, Transient Suppression Diodes

The first letter indicates the nominal percentage tolerance in the operating voltage Vz.

A — ±1% B — ±2% C — ±5%

The letter is omitted on transient suppressor diodes.

The group of figures indicates the typical operating voltage Vz for each type at the nominal operating current Iz rating of the range. For transient suppressor diodes the figure indicates the maximum recommended standoff voltage VR.

The letter V is used to denote a decimal sign.

The final letter R is used to denote a reverse polarity version (stud anode) where applicable. The normal polarity version (stud cathode) has no special final letter.

Examples:

BF362 Silicon r.f. transistor intended primarily for 'consumer' applications.

Germanium a.f. transistor primarily for 'industrial' applications. ACY17

BTW24-800R Silicon thyristor for 'industrial' applications. In BTW24 range with 800V maximum repetitive peak voltage, reverse polarity, stud connected to anode.

BZY88-C5V6 Silicon voltage regulator diode for 'industrial' applications. In BZY88 range with 5.6V operating voltage +5% tolerance.

RPY71 Photoconductive cell for 'industrial' applications.

OLD SYSTEM

Some earlier semiconductor diodes and transistors have type numbers consisting of two or three letters followed by a group of one, two or three figures.

The first letter is always 'O', indicating a semiconductor device.

The second (and third) letter(s) indicate the general class of device:

A — diode or rectifier
AP — photodiode
A'Z — voltage regulator diode C — transistor CP — phototransistor

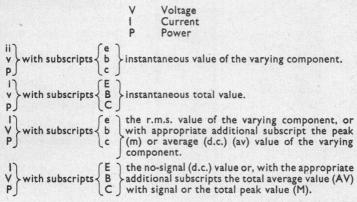
The group of figures is a serial number indicating a particular design or development.

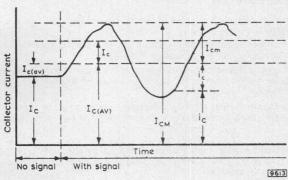
Section II

LIST OF SYMBOLS FOR SEMICONDUCTOR DEVICES

These symbols are based on British Standard Specification No. 3363: "Letter Symbols for Semiconductor Devices." A full description of the system is contained in this publication.

QUANTITY SYMBOLS





Examples:

d.c. emitter current no signal.

1E r.m.s. value of varying component of emitter current. le

Instantaneous value of varying component of emitter current. ie

Instantaneous value of total emitter current. IE

IE(AV) Average (d.c.) value of total emitter current with signal applied. le(av) Average (d.c.) value of the varying component of the emitter current.

Peak value of the varying component of the emitter current. lem

Peak value of the total emitter current. IEM

/e

Subscripts for quantity sumbols

A, a	Anode terminal	l, i	Input
AV, av	Average	J, j	Junction
B, b	Base terminal	K, k	Cathode terminal
ВО	Breakover	M, m	Peak value
BR	Breakdown	0,0	Open-circuit, output
C, c	Collector terminal, conversion, capacitive	OV R, r	Average value of overload Resistive, reverse, repetitiv
D, d	Delay, Off-state (i.e. non trigger) drain terminal	S, s	Short-circuit, series, shield, source
E, e	Emitter terminal	T, t	On-state (i.e. triggered)
F, f	Forward	W, w X, x	Working Specified circuit, reactive
G, g	Gate terminal	Z, z	Reference or regulator
H, h	Holding	-, -	(i.e. Zener), impedance

The letter O is used with three terminal devices as a third subscript only to denote that the terminal not indicated in the subscript is open-circuited.

The letter S is also used with three terminal devices as a third subscript to denote that the terminal not indicated in the subscript is shorted to the reference terminal.

Sequence of subscripts

The first subscript denotes the terminal at which the current or terminal voltage is measured.

The second subscript denotes the reference terminal or circuit mode that the current or terminal voltage is measured.

Where the reference terminal or circuit is understood the second subscript may be omitted where its use is not required to preserve the meaning of the symbol.

The supply voltage shall be indicated by repeating the terminal subscript. The reference terminal may then be designated by the third subscript. Examples $V_{\rm EE}$, $V_{\rm CC}$, $V_{\rm BB}$, $V_{\rm EEB}$

In devices having more than one terminal of the same type, the terminal subscripts shall be modified by adding a number following the subscript and on the same line.

Example B2

In multiple unit devices the terminal subscripts shall be modified by a number preceding the terminal subscript.

Example 2B

GENERAL EXPLANATORY NOTES

Where ambiguity might arise the complete terminal designations shall be separated by hyphens or commas.

Example V_{1C1-2C1}

the voltage at the first collector of the first unit referred to the voltage at the first collector of the second unit.

The first subscript in the matrix notation shall identify the element of the four pole matrix.

input

o output

forward transfer

r reverse transfer

A second subscript may be used to identify the circuit configuration.

e common emitter

b common base

c common collector

Example $V_{ie} = h_{ie}$, $I_{ie} + h_{re}$, V_{oe}

When the common terminal is understood the second subscript may be omitted.

Static value of parameters shall be indicated by the upper case (capital) subscripts.

Example hIE, hIB

The four pole matrix parameters of the device are represented by lower case symbols with the appropriate subscripts

hib

The four pole matrix parameters of external circuits and of circuits in which the device forms only a small part are represented by upper case symbols with the appropriate subscripts.

Hi, Zo

Symbols for the components of small-signal equivalent circuits used to represent devices are qualified by lower case symbols.

rb, re, rbb'

ELECTRICAL PARAMETERS	Associate	d
	Device circuit	
Resistance	r R	
Reactance	x X	
Impedance	z Z	
Admittance	x X Z Z Y Y	
Conductance		
Susceptance	g G b B	
Mutual inductance	m M	
Inductance	l L	
Capacitance	c C	
Distortion	c C	
Frequency limits	f max.	
	f min.	
Bandwidth	Δf	
Bandwidth (for associated circu	its) B	
Noise factor	N N	

GENERAL EXPLANATORY NOTES

List of Symbols for Semiconductor Devices

List of Symbols	of bettied actor befrees
C_d	diode capacitance (reverse bias)
Cf	diode capacitance (forward bias)
C _{ib}	transistor input capacitance (grounded base)
C _{ie}	transistor input capacitance (grounded emitter)
C_j	junction capacitance (of the intrinsic diode)
Cmin	diode capacitance (at breakdown voltage)
Co	diode capacitance (zero bias)
Cob	transistor output capacitance (grounded base)
Coe	transistor output capacitance (grounded emitter)
C _p	parasitic (parallel) capacitance
[10] [4] [3] [4] [4] [4] [4] [4] [4] [4] [4] [4] [4	를 받는데 하는데 보다 보는데 보고 있다면 보다 되었다. 그는 사람들은 사람들은 보다 되었다면 되었다면 보다 되었다면 보다 되었다면 보다는데 보다 되었다면 되었다면 되었다. 그 사람들은 사람들은 사람들은 사람들은 사람들은 사람들은 사람들은 사람들은
Cs	stray capacitance
C_{Te}	capacitance of the emitter depletion layer
C_{Te}	capacitance of the collector depletion layer
fco	varactor diode cut-off frequency
()	transistor cut-off frequency (the frequency at which the
f _{hfb} }	parameter indicated by the subscript is 0.7 times its low
f _{hfe} \int	frequency value)
f ₁	frequency of unity current transfer ratio modulus
f _{max}	maximum frequency of oscillations
	tunnel diode resistive cut-off frequency
fr	
$f_{\mathbf{T}}$	transition frequency (common emitter gain-bandwidth product)
gj	tunnel diode negative conductance (of the intrinsic diode)
8 p	small signal power gain
Gp	large signal power gain
h _{IB})	
h _{IE} }	the static value of the input resistance with the output voltage.
h _{IC}	held constant
h _{ib} (h ₁₁)	The small-signal value of the input impedance with the output
h _{ie} (h ₁₁)	short-circuited to alternating current
h _{ie}	
h _{RB}	The static value of the reverse voltage transfer ratio with the
h _{RE} }	input current held constant
h _{RC}	
h_{rb} (h_{12})	The small-signal value of the reverse voltage transfer ratio
h _{re} (h ₁₂) }	with the output voltage held constant
h _{re}	
h _{FB}	The static value of the forward current transfer ratio with the
h _{FE} }	output voltage held constant
h _{FC} J	
h _{fb} (h ₂₁)	The small-signal forward current transfer ratio with the
h _{fe} (h ₂₁) }	output short-circuited to alternating current
h _{fe}	output direction to altornating current
h _{OB})	The static value of the output conductance with the input
hoE >	current held constant
hoc	The state of the s
hob (h22)	The small-signal value of the output admittance with the
hoe (h22) }	input open-circuited to alternating current
hoc	
$h_{FE(sat)}$	transient forward current transfer ratio in saturation
h	inherent forward current transfer ratio = $\frac{I_{C}-I_{CBO}}{I_{CBO}}$
h _{FEL}	innerent forward current transfer ratio = $I_{B} + I_{CBO}$

SEMICONDUCTOR DEVICES

GENERAL EXPLANATORY NOTES

IB, IC, IE total d.c. current

 $I_{B(AV)}I_{C(AV)}I_{E(AV)}$ average (d.c.) value of total current

IBBX base current (with both junctions reverse biased)

IBEX, ICEX base (respectively collector) cut off current in a specified

circuit

IBM, ICM, IEM peak value of total current

iB, iC, iE instantaneous total value of current

ib, ic, ie instantaneous value of varying component of current

I(BO) thyristor breakover current (d.c.)

I_{CBO} collector cut-off current (emitter open-circuited)

 $I_{\rm CBS}$, $I_{\rm CES}$ collector cut-off current (emitter short-circuited to base) collector current with both junctions reverse biased with

respect to base

ICEO collector cut-off current (base open-circuit)

ICER collector cut-off current (with specified resistance between

base and emitter)

ID thyristor continuous (d.c.) off-state current, field effect

transistor drain current

1_{EBO} emitter cut-off current (collector open-circuit)

IEBX emitter current with both junctions reverse biased with

respect to base

I_F D.C. forward current

i_F instantaneous forward current
 l_{F(AV)} average forward current
 l_{FG} thyristor forward gate current
 thyristor peak forward gate current

JEM peak forward current

 I_{F(OV)} , I_{FOM}
 overload mean forward current

 I_{FRM}
 repetitive peak forward current

 I_{FSM}
 surge (non-repetitive) forward current

 I_{GD}
 thyristor gate non-trigger current

 I_{GQ}
 thyristor gate trigger current

 I_H
 thyristor folding current (d.c.)

 I_T
 thyristor latching current

 IL
 thyristor latching current

 IO
 average output current

 IORM
 repetitive peak output current

 IP
 tunnel diode peak point current

 I_p/I_V
 tunnel diode peak to valley point current ratio

 I_R
 continuous (d.c.) reverse leakage current

 i_R
 instantaneous reverse leakage current

 $\begin{array}{ll} I_{RG} & \text{thyristor reverse gate current} \\ I_{RRM} & \text{repetitive peak reverse current} \\ I_{RSM} & \text{non-repetitive peak reverse current} \end{array}$

ls source current

 $\begin{array}{ll} I_{\rm T} & \text{thyristor continuous (d.c.) on-state current} \\ I_{\rm T(OV)} & \text{thyristor overload mean on-state current} \\ I_{\rm T(AV)} & \text{thyristor average on-state current} \\ I_{\rm TRM} & \text{thyristor repetitive peak on-state current} \end{array}$

I_{TRM} thyristor repetitive peak on-state current thyristor non-repetitive peak on-state current

GENERAL EXPLANATORY NOTES

SEMICONDUCTOR DEVICES

lv	tunnel diode valley point current
Iz	voltage regulator (zener) diode continuous (d.c.) operating current
$I_{Z(AV)}$	voltage regulator (zener) diode average operating current
I _{ZM}	voltage regulator (zener) diode peak current
Le	conversion loss
Ls	series inductance
Nr	flicker noise
Nir	noise figure at intermediate frequency
N _o	overall noise figure
Nr	noise temperature ratio
PG	thyristor average gate power
Ром	thyristor peak gate power
P _{tot}	total power dissipated within the device
Q _s	recovered (stored) charge
rbb'	extrinsic base resistance
Rs	source resistance
rs	series resistance
Rth	thermal resistance
rz	voltage regulator (zener) diode differential resistance
Sts	tangential signal sensitivity
Sz	voltage regulator (zener) diode temperature coefficient of the
	operating voltage
Tamb	ambient temperature
T _{case}	case temperature
Ti	junction temperature
Tmb	mounting base temperature
T _{stg}	storage temperature
td	delay time
tr	fall time
tfr	forward recovery time
tgt	thyristor gate controlled turn-on time
tgq	thyristor gate controlled turn-off time
tp	pulse duration
tq	thyristor circuit-commutated turn-off time
ton	turn-on time
toff	turn-off time
tr	rise time
trr	reverse recovery time
ts	storage time
$\theta_{\mathtt{h}}$	thermal resistance of heat sink
$\theta_{\mathbf{i}}$	contact thermal resistance
θ_{j-amb}	thermal resistance junction to ambient
θ_{j-case}	thermal resistance junction to case
θ_{j-mb}	thermal resistance junction to mounting base
τc	collector time coefficient of a switching transistor
$ au_{ m S}$	carrier storage time coefficient of a switching transistor
$ au_{ extbf{F}}$	fall time factor
$ au_{ m R}$	rise time factor

SEMICONDUCTOR **DEVICES**

GENERAL EXPLANATORY NOTES

base-emitter saturation voltage V_{BE(sat)} V(BO) thyristor breakover voltage

V(BR) breakdown voltage

V_{(BR)CBO} breakdown voltage collector to base (emitter open-circuited) breakdown voltage collector to base (emitter and base short-V_{(BR)CBS} circuited)

V(BR)CEO breakdown voltage collector to emitter (base open circuited) breakdown voltage collector to emitter (with specified V(BR)CER resistance between base and emitter)

V_{(BR)CES} breakdown voltage collector to emitter (emitter and base-

short-circuited)

V_{(BR)CEX} breakdown voltage collector to emitter (with specified

circuit between base and emitter)

V(BR)EBO breakdown voltage emitter to base (collector open-circuited)

reverse breakdown voltage V(BR)R V_{CB} collector-base voltage (d.c.)

 V_{CBO} collector-base voltage (with emitter open-circuited)

VCBn collector-base floating potential Vcc collector supply voltage (d.c.) VCE collector to emitter voltage (d.c.)

VCEO collector to emitter voltage (with base open-circuited)

Vce collector to emitter r.m.s. voltage

V_{CE(knee)} collector knee voltage.

collector to emitter saturation voltage V_{CE(sat)} V_{CE(sust)} collector to emitter sustaining voltage V_D thyristor continuous (d.c.) off-state voltage

V_{DG} drain to gate voltage

V_{DM} thyristor peak off-state voltage

VDRM thyristor repetitive peak off-state voltage

V_{DS} drain to source voltage

 $V_{\rm DSM}$ thyristor non-repetitive off-state voltage V_{DWM} thyristor crest (peak) working off-state voltage

VEB emitter-base voltage (d.c.)

emitter-base voltage (with collector open circuited) VERO

Veb emitter-base r.m.s. voltage emitter-base floating potential VEBI emitter-collector floating potential VECT

D.C. forward voltage $V_{\rm F}$

instantaneous total value of the forward voltage VF

 V_{FG} thyristor forward gate voltage V_{FGM} thyristor peak forward gate voltage Vfr signal diode forward recovery voltage

VGB gate to substrate voltage

 V_{GD} thyristor gate non-trigger voltage

VGS gate to source voltage VGT thyristor gate trigger voltage

VI input voltage

VIRM repetitive peak input voltage non-repetitive peak input voltage VISM VIWM crest working input voltage

output voltage Vo

GENERAL EXPLANATORY NOTES

SEMICONDUCTOR DEVICES

V_{P}	peak point voltage
V_{PP}	projected peak point voltage
V_{R}	D.C. reverse voltage
V _R	instantaneous total value of the reverse voltage
V_{RG}	thyristor reverse gate voltage
V_{RGM}	thyristor peak reverse gate voltage
V_{RM}	peak reverse voltage
V _{RRM}	repetitive peak reverse voltage
V_{RSM}	non-repetitive peak reverse voltage
V_{RWM}	crest (peak) working reverse voltage
V _T	thyristor continuous (d.c.) on-state voltage
$V_{T(TO)}$	thyristor threshold voltage
$V_{\rm V}$	valley point voltage
$V_{\rm Z}$	voltage regulator (zener) diode operating voltage
Zit	intermediate frequency impedance
Z _v	video impedance

y-parameters

Common base yib (y11) gib (g11) cib (c11) φib	Common emitter yie (y'11) gie (g'11) cie (c'11) φie	Input admittance Input conductance Input capacitance Phase angle of input admittance	Output short-circuited
y _{ob} (y ₂₂) g _{ob} (g ₂₂) c _{obs} (c ₂₂) φ _{ob}	yoe (y'22) goe (g'22) coes (c'22) φoe	Output admittance Output conductance Output capacitance Phase angle of output admittance	Input short-circuited
y _{fb} (y ₂₁) g _{fb} c _{fb} φ _{fb} (φ ₂₁)	yfe (y'21) gfe cfe cfe (cf'21)	Transfer admittance Transfer conductance Transfer capacitance Phase angle of transfer admittance	Output short-circuited
y _{rb} (y ₁₂) g _{rb} c _{rb} φ _{rb} (φ ₁₂)	yre (y'12) gre Cre \$\phi\$re (\$\phi'_{12}\$)	Feedback admittance Feedback conductance Feedback capacitance Phase angle of feedback admittance	Input short-circuited

GENERAL EXPLANATORY NOTES

Section III. Explanation of Handbook Data

1. FORM OF ISSUE

The semiconductor data published in the Handbook follows the same pattern, as much as possible, concerning, (a) the forms of issue, (b) the ratings system and (c) the ratings presentation.

1.1 Types of Data

The Handbook data is published either as tentative or final data.

Tentative Data

Tentative data aims at providing information on new devices as early as possible to allow the customer to proceed with circuit design. The tentative data may not include all the characteristics or ratings which will be incorporated later in the final data and some of the numerical values quoted may be slightly adjusted later on.

Final Data

The transfer from tentative data to final data involves the addition of those numerical values and curves which were not available at tentative data stage and small adjustments to those values already quoted in tentative data. Reissue of final data may be made from time to time to incorporate additional information resulting from prolonged production experience or to meet new applications.

1.2 Presentation of Data

The information on the published data sheets is presented in the following form:

- —description of basic application and physical characteristics of the device.
- —quick reference data giving the most important ratings and characteristics.
- outline and dimensions. Reference to standard outline nomenclature if applicable and lead connections.
- -Ratings. Voltage, current, power and thermal ratings.
- -Characteristics.
- -Application information or operating conditions.
- -Mechanical and environmental data if applicable.
- -Charts showing ratings and characteristics.

2. RATINGS

A rating is a limiting condition of usage specified for a device by the manufacturer, beyond which the serviceability may be impaired.

A rating system is a set of principles upon which ratings are established and which determines their interpretation. There are three systems which have been internationally accepted and which allocate responsibility between the device manufacturer and the circuit designer differently.

2.1 Rating Systems

Unless otherwise stated the ratings given in semiconductor data sheets follow the absolute maximum rating system.

The definitions of the three systems accepted by the International Electrotechnical Commission are as follows:

ABSOLUTE MAXIMUM RATING SYSTEM

Absolute maximum ratings are limiting values of operating and environmental conditions applicable to any device of a specified type as defined by the 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 no responsibility for variations in equipment or environment, and the effects of changes in operating conditions due to variations in the characteristics of the device under consideration and of all other 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 variations in supply voltage, environment, equipment components, equipment control adjustment, load, signal or characteristics of the device under consideration and of all other devices in the equipment.

DESIGN-CENTRE RATING SYSTEM

Design-centre ratings are limiting values of operating and environmental conditions applicable to a bogey 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 variations in supply voltage, environment, equipment components, equipment control adjustment, load, signal or characteristics of all other devices in the equipment. The equipment manufacturer should design so that initially no design-centre value for the intended service is exceeded with a bogey device in equipment operating at the stated normal supply voltage.

DESIGN-MAXIMUM RATING SYSTEM

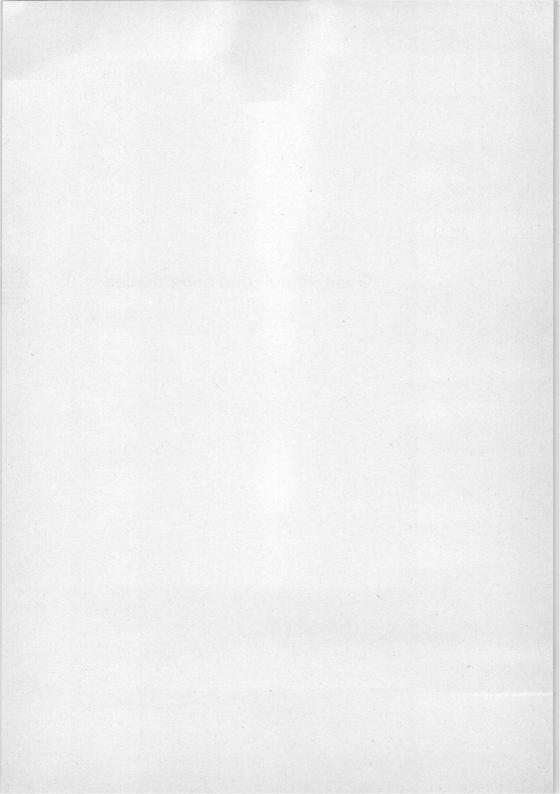
Design-maximum ratings are limiting values of operating and environmental conditions applicable to a bogey device of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

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 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 variations in supply voltage, environment, equipment components, equipment control adjustment, load, signal or characteristics of the device under consideration and of all other devices in the equipment.

Gunn, Impatt and noise diodes B





Epitaxial, silicon planar, broadband noise generator. This is a current controlled device operated at avalanche breakdown and is effective from less than 10 Hz to above J-band. Applications include built-in test equipment (BITE) for surveillance, tracking and weather radars, microwave links, direction finding, p.c.m. systems and noise modulators for electronic countermeasures.

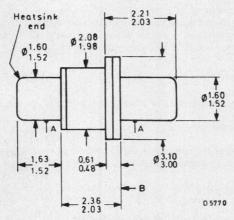
It conforms to the environmental requirements of BS9300 where applicable.

QUICK REFERENCE DATA			
Frequency range	<10 Hz to	>18	GHz
Avalanche voltage	min. max.	17 22	v v
Recommended operating current range	0.5 to 40		mA
Broadband excess noise ratio (fig. 3)	typ.	34	dB

OUTLINE AND DIMENSIONS

Dimensions in mm

Conforms to B.S. 3934 SO-86



A = concentricity tolerance = ± 0.13



Normal operation with reverse bias, i.e. heatsink end positive.

LIMITING VALUES (Absolute max. rating system)

$I_{\mathbf{R}}$	max.	40	mA
P _{tot}	max.	1.0	W
T _{mb}	max.	80	°C
T _{stg} range	-55	to +150	°C
CHARACTERISTICS (T _{mb} = 25 °C)			
$V_{BR(R)}$ at $I_R = 5 \text{ mA}$	min.	17	V
C_j at V_R = 6 V, f = 1 MHz	min.	0.4	pF
	max.	0.8	pF
I_R at $V_R = 6 V$	max.	0.1	μΑ
R_{slope} at $I_R = 40$ mA, $f = 1$ kHz 1)	max.	60	Ω
$\frac{R_1}{R_{40}}$ at I_R = 1 mA and 40 mA, f = 1 kHz 1)	max.	2,5	
$C_{\mathbf{s}}$	typ.	0.2	pF
L _S	typ.	650	pН

1) R_{slope} is the reverse slope resistance and $\frac{R_1}{R_{40}}$ is the ratio of reverse slope resistance at 1 mA and 40 mA, measured at 1 kHz. This ratio is included in the characteristics to eliminate spurious effects in the noise output/current characteristic. The reverse slope resistance consists of the space charge resistance R_{sc} , the spreading resistance R_{sp} and the 'thermal resistance' R_{th} , i.e.

$$R_{slope} = R_{sc} + R_{sp} + R_{th}$$

where: R_{SC} is approximately 10 Ω at 10 to 40 mA and 19 Ω at 1 mA

 R_{SD} is approximately 1 Ω

 R_{th} is the effective resistance due to isothermal heating in the device when operated with an infinite heatsink. Above 10 MHz, R_{th} may be neglected.

²⁾ The location of the top cap should be a hole of diameter 1.8 to 2.2 mm, bearing on flange with a force not exceeding 10 N.

³⁾ Other encapsulations may be made available on request.

SILICON AVALANCHE NOISE DIODE

APPLICATION INFORMATION

The device, as characterized, is operated in a 50 Ω characteristic impedance measurement system. When used as a noise source in an on-off mode, the device, when off, should appear to be 50 Ω . Since it has a large reflection coefficient when zero biased or biased just below avalanche breakdown, sufficient attenuation is required to provide a reasonable match to 50 Ω . For the broadest operating frequency range, an attenuator of approximately 14 dB with a v.s.w.r. of <1.2:1 is recommended. This will reduce the available excess noise by 14 dB. Higher excess noise may be obtained, but over a reduced operating frequency range, in a balanced configuration with low noise directional couplers (e.g. a 3 dB quadrature coupler), or fed into a broadband ferrite isolator (or terminated circulator) which would reduce the available excess noise by approximately 1 dB.

Temperature and excess noise relationship

Excess noise dB	Noise temperature OK	1 Hz bandwidth dBm	1 MHz bandwidth dBm
+100	2.9 × 10 ¹²	- 74	- 14
+ 90	2.9×10^{11}	- 84	- 24
+ 80	2.9 × 10 ¹⁰	- 94	- 34
+ 70	2.9×10^9	-104	- 44
+ 60	2.9 × 108	-114	- 54
+ 50	2.9 × 10 ⁷	-124	- 64
+ 40	2.9 × 106	-134	- 74
+ 30	2.9 × 105	-144	- 84
+ 20	2.9 × 10 ⁴	-154	- 94
+ 10	2.9×10^{3}	-164	-104
0	2.9×10^{2}	-174	-114

The device may be pulse operated with a rise time of $<<0.5 \mu s$

The device should be operated from a constant current source, however, good results may be achieved using a 28 V supply and typically a metal film or wirewound 1.6 k Ω resistor in series with the noise diode, with suitable power supply decoupling.

In some applications, current profiling with time may be useful, i.e. linear excess noise ratio as a function of \log bias current as shown in fig. 1. This may be used for receiver sensitivity measurement on a P.P.I. display.

Recommended bias range for broadband operation up to 12.4GHz

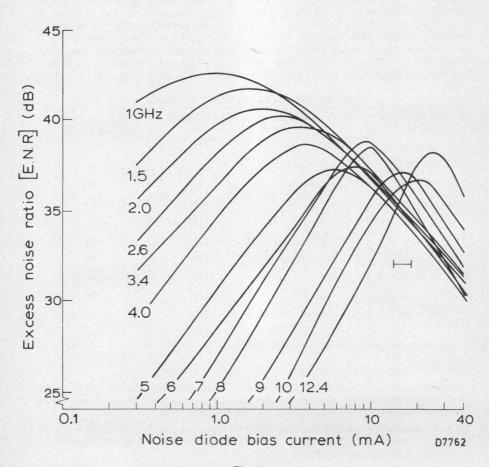
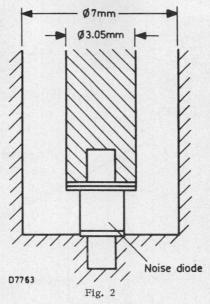
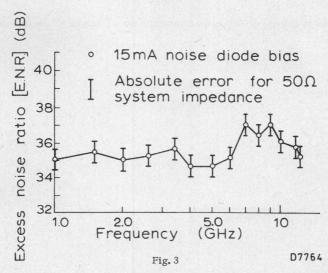


Fig. 1

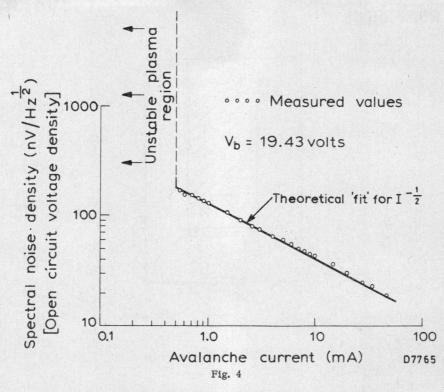
Typical excess noise ratio as a function of avalanche current with frequency as a parameter. Device mounted in a 50 Ω 7 mm coaxial line as shown in Fig. 2



Device mounted in a 50 Ω 7 mm coaxial line



Typical broadband noise performance for an avalanche current of 15 mA with device mounted as shown in Fig. 2

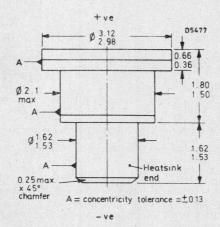


Typical broadband noise density measured over a 1 kHz to 10 kHz bandwidth.

A high efficiency silicon Impatt diode for the generation of c.w. power at microwave frequencies. It conforms to the environmental requirements of BS 9300 where applicable.

QUICK REFEREN	CE DATA	
Operating frequency	8.0 to 10	GHz
P_{out} (typ.) ($T_{hs} = 35^{\circ}C$)	600	mW
Operating current (typ.)	135	mA
Operating voltage (typ.)	91	v

OUTLINE AND DIMENSIONS



All dimensions in mm

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

P _{tot} m	ax. (see note 1)		200 - T _j R _{th} (j -		W
R _{th} (j	-hs) max.		15		°C/W
T _i - T	hs max.		165		°C
T stg			-55 to -	+175	°C
ELECTRICA	L CHARACTERISTICS (T _{hs} = 25°C)				
		Min.	Тур.	Max.	
V _(BR) I	Reverse breakdown voltage (at I _R = 1.0mA)	65	75	85	V
IR	Reverse current (at $V_R = 50V$)	-	-	10	μΑ
$^{\mathrm{C}}\mathrm{_{T}}$	Total capacitance (at V _{(BR)R} =5V)	-	0.9	-	pF
TYPICAL OS	CILLATOR PERFORMANCE				
Opera	ting current (see note 2)		135		mA
Operat	ing voltage		91		V
Freque	ency (see note 3)	8.0	-	10	GHz
Output	power (see notes 2,4,5 and 6)	500	600	-	mW
Efficie	ency	-	5.0	-	%

OPERATING NOTES

1. The maximum junction temperature is $200^{\circ}\mathrm{C}$, therefore care must be taken to ensure that P_{tot} max. $\leq \frac{200 - T_{hs}}{R.~(i-hs)}$ W,

where $P_{tot} = P_{in} - P_{out}$

 T_{hs} = temperature of heatsink at interface with device

 \mathbf{R}_{th} (j - hs) =thermal resistance from junction to heatsink in which device is clamped.

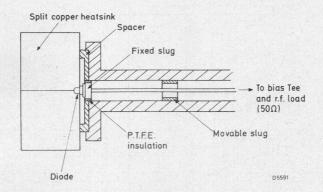
- 2. The bias supply should be current regulated to within 1% and care should be taken to avoid transient current surges which could cause burnout. The bias circuit should be arranged to present a high impedance at d.c. to v.h.f. frequencies. This will help to prevent oscillation in the bias circuit and noisy operation. The maximum power supply requirements are 115V and 160mA.
- 3. The frequency is governed by the choice of cavity to which the device is coupled.
- The polarity of the device must be strictly observed when applying bias, (see outline drawing).
- The output power is normally measured in a coaxial cavity near to centre band frequency.

SILICON IMPATT DIODE

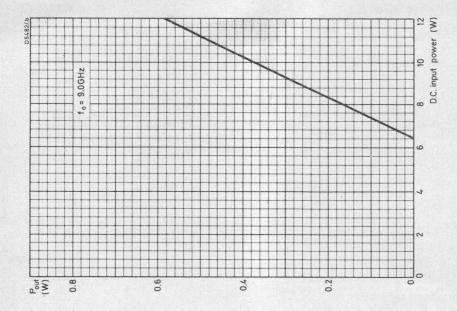
OPERATING NOTES (contd.)

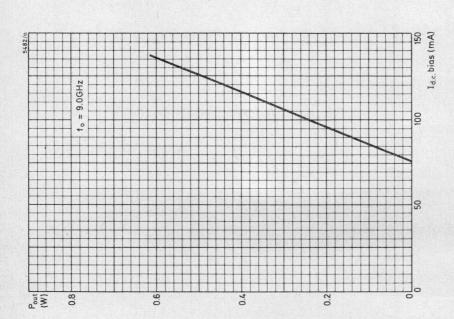
- 6. The heatsink end of the device should be held in a collet or equivalent clamping system to ensure minimum thermal resistance in the path to the mounting base. This in turn must be coupled to an adequate heatsink. Alternatively, direct soldering, using a low melting point solder, or an electrically conductive single loaded epoxy, such as Epotek H40, may be used.
- 7. This device may be used as a negative resistance amplifier.

Devices may be selected to suit customers' specific requirements



COAXIAL TEST OSCILLATOR CAVITY



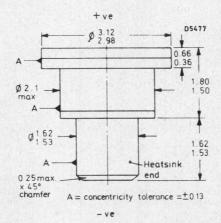


TYPICAL OUTPUT POWER AS A FUNCTION OF BIAS CURRENT TYPICAL OUTPUT POWER AS A FUNCTION OF D.C. INPUT POWER

A high efficiency silicon Impatt diode for the generation of c.w. power at microwave frequencies. It conforms to the environmental requirements of BS 9300 where applicable.

10 to 12	GHz
450	mW
120	mA
80	v
	450 120

OUTLINE AND DIMENSIONS



All dimensions in mm

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

P _{tot} max. (see note 1)	$\frac{200 - T_{hs}}{R_{th} (j - hs)}$	W
R _{th} (j - hs) max.	19	°C/W
T _j - T _{hs} max.	165	°C
T stg range	-55 to +175	°C
CCTRICAL CHARACTERISTICS (T _{hs} = 25°C)		
	Min. Typ. Ma	x.

		Min.	Тур.	Max.	
V _{(BR)R}	Reverse breakdown voltage				
	Reverse breakdown voltage (at I _R = 1.0mA)	55	65	75	V
IR	Reverse current (at $V_R = 45V$)	-	-	10	μΑ
$^{\rm C}_{ m T}$	Total capacitance (at V _{(BR)R} - 5V)	-	0.85	-	pF

TYPICAL OSCILLATOR PERFORMANCE

Operating current (see note 2)		120		mA
Operating voltage		80		V
Frequency (see note 3)	10	-	12	GHz
Output power (see notes 2, 4, 5 and 6)	400	450	-	mW
Efficiency		5.0	-	%

OPERATING NOTES

ELE

1. The maximum junction temperature is $200^{\circ} C$, therefore care must be taken to ensure that P_{tot} max. $\leq \frac{200 - T_{hs}}{R_{th} (j - hs)}$ W,

where
$$P_{tot} = P_{in} - P_{out}$$

T_{hs} = temperature of heatsink at interface with device

 $\mathbf{R}_{th} \; (\text{j - hs}) \; \text{-thermal resistance from junction to heatsink in which device} \\ \text{is clamped.}$

- 2. The bias supply should be current regulated to within 1% and care should be taken to avoid transient current surges which could cause burnout. The bias circuit should be arranged to present a high impedance at d.c. to v.h.f. frequencies. This will help to prevent oscillation in the bias circuit and noisy operation. Particular care should be taken to minimise stray capacitances across the diode. The maximum power supply requirements are 105V and 170mA.
- 3. The frequency is governed by the choice of cavity to which the device is coupled.
- The polarity of the device must be strictly observed when applying bias, (see outline drawing).
- The output power is normally measured in a coaxial cavity near to centre band frequency.

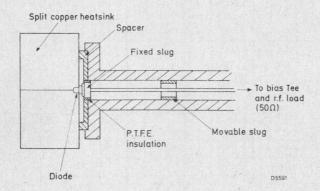
SILICON IMPATT DIODE

BXY51

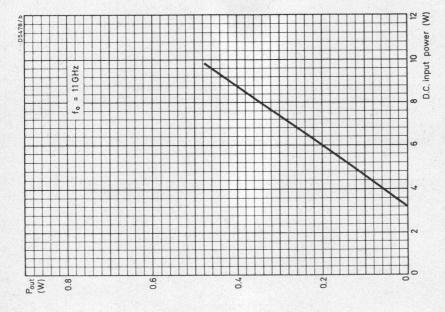
OPERATING NOTES (contd.)

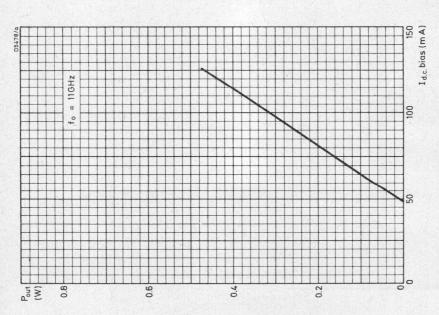
- 6. The heatsink end of the device should be held in a collet or equivalent clamping system to ensure minimum thermal resistance in the path to the mounting base. This in turn must be coupled to an adequate heatsink. Alternatively, direct soldering, using a low melting point solder, or an electrically conductive single loaded epoxy, such as Epotek H40, may be used.
- 7. This device may be used as a negative resistance amplifier.

Devices may be selected to suit customers' specific requirements



COAXIAL TEST OSCILLATOR CAVITY



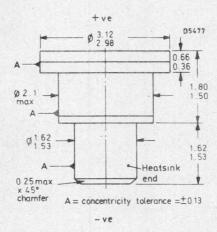


TYPICAL OUTPUT POWER AS A FUNCTION OF BIAS CURRENT TYPICAL OUTPUT POWER AS A FUNCTION OF D. C. INPUT POWER

A high efficiency silicon Impatt diode for the generation of c.w. power at microwave frequencies. It conforms to the environmental requirements of BS 9300 where applicable.

QUICK REFEREI	NCE DATA	
Operating frequency	12 to 14	GHz
P_{out} (typ.) ($T_{hs} = 35^{\circ}C$)	370	mW
Operating current (typ.)	120	mA
Operating voltage (typ.)	70	V

OUTLINE AND DIMENSIONS



All dimensions in mm

	P _{tot} ma	x. (see note 1)	200 - ' R _{th} (j			W
	R _{th} (j-h	as) max.		24		°C/W
	T _i - T _h		. 1	65		°C
	T ra		-55 t	o +175		°C
ELI	ECTRICAL	CHARACTERISTICS ($T_{hs} = 25^{\circ}C$)				
			Min.	Тур.	Max.	
	V _{(BR)R}	Reverse breakdown voltage (at I _R = 1.0mA)	50	55	60	v
	I_R	Reverse current (at V _R = 40V)		-	10	μА
	C _T	Total capacitance (at V _{(BR)R} -5V)		0.75	-	pF
TYI	PICAL OSC	CILLATOR PERFORMANCE				
	Operati	ng current (see note 2)		120		mA
	Operati	ng voltage		70		v
	Freque	ncy (see note 3)	12		. 14	GHz
	Output 1	power (see notes 2, 4, 5 and 6)	300	370	-	mW

OPERATING NOTES

Efficiency

1. The maximum junction temperature is $200^{\circ}C$, therefore care must be taken to ensure than P_{tot} max. $\leq \frac{200 - T_{hs}}{R_{th} (j - hs)}$ W,

where
$$P_{tot} = P_{in} - P_{out}$$

The = temperature of heatsink at interface with device

 $R_{\mbox{th}}$ (j - hs)=thermal resistance from junction to heatsink in which device is clamped.

4.5

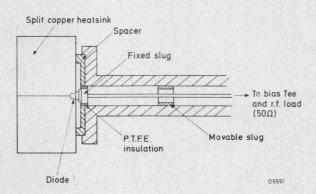
%

- 2. The bias supply should be current regulated to within 1% and care should be taken to avoid transient current surges which could cause burnout. The bias circuit should be arranged to present a high impedance at d.c. to v.h.f. frequencies. This will help to prevent oscillation in the bias circuit and noisy operation. Particular care should be taken to minimise stray capacitance across the diode. The maximum power supply requirements are 90V and 150mA.
- 3. The frequency is governed by the choice of cavity to which the device is coupled.
- The polarity of the device must be strictly observed when applying bias, (see outline drawing).
- The output power is normally measured in a coaxial cavity near to centre band frequency.

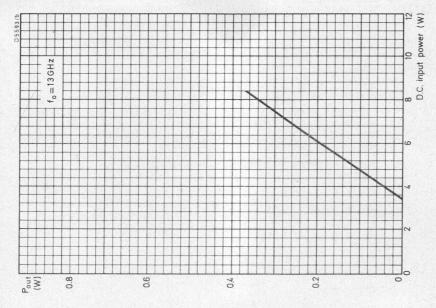
OPERATING NOTES (contd.)

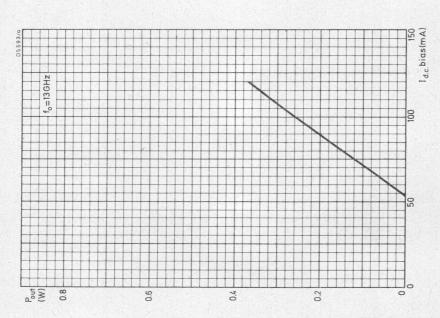
- 6. The heatsink end of the device should be held in a collet or equivalent clamping system to ensure minimum thermal resistance in the path to the mounting base. This in turn must be coupled to an adequate heatsink. Alternatively, direct soldering, using a low melting point solder, or an electrically conductive single loaded epoxy, such as Epotek H40, may be used.
- 7. This device may be used as a negative resistance amplifier.

Devices may be selected to suit customers' specific requirements



COAXIAL TEST OSCILLATOR CAVITY



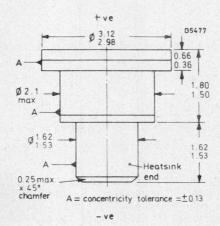


TYPICAL OUTPUT POWER AS A FUNCTION OF BLAS CURRENT TYPICAL OUTPUT POWER AS A FUNCTION OF D.C. INPUT POWER

A high efficiency silicon Impatt diode for the generation of c.w. power at microwave frequencies. It conforms to the environmental requirements of BS 9300 where applicable.

QUICK REFERENCE	DATA		
Operating frequency	6.0 to 8.0	GHz	
P_{out} (typ.) ($T_{hs} = 35^{\circ}C$)	750	mW	
Operating current (typ.)	125	mA	
Operating voltage (typ.)	120	V	

OUTLINE AND DIMENSIONS



All dimensions in mm

	P _{tot} max	c. (see note 1)	200 - R _{th} (j			W
	R _{th} (j -	hs) max.	1	4		°C/W
	T _i - T _{hs}	max.	16	5		°C
	Ti max.		20	0		°C
	T _{stg} rar		-55 to	+175		°C
ELE	CTRICAL	CHARACTERISTICS (T _{hs} = 25°C)	Min.	Тур.	Max.	
	V _{(BR)R}	Reverse breakdown voltage (at I _R = 5.0mA)	85	100	115	v
	I_R	Reverse current (at V _R = 70V)		- 199	10	μΑ
	$C_{\mathbf{T}}$	Total capacitance (at $V_{(BR)R} = 75V$)	•	0.97	7 3 -19	pF
	Operatin	ng current (see note 2)		125		mA
	Operatin	ng voltage		120		v
	Frequen	cy (see note 3)	6.0		8.0	GHz
	Output p	ower (see notes 2, 4, 5 and 6)	650	750	- 2	mW
	Efficien	су	-	5.0	-	%

OPERATING NOTES

1. The maximum junction temperature is 200°C, therefore care must be taken to

ensure that
$$P_{tot}$$
 max. $\leq \frac{200 - T_{hs}}{R_{th} (j - hs)}$ W,

where
$$P_{tot} = P_{in} - P_{out}$$

T_{hs} = temperature of heatsink at interface with device

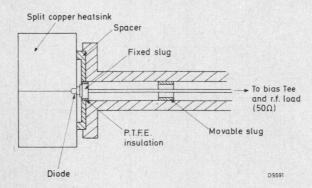
 $R_{\mbox{th}}$ (j - hs) = thermal resistance from junction to heatsink in which device is clamped.

- 2. The bias supply should be current regulated to within 1% and care should be taken to avoid transient current surges which could cause burnout. The bias circuit should be arranged to present a high impedance at d.c. to v.h.f. frequencies. This will help to prevent oscillation in the bias circuit and noisy operation. Particular care should be taken to minimise stray capacitances across the diode. The maximum power supply requirements are 140V and 180mA.
- 3. The frequency is governed by the choice of cavity to which the device is coupled.
- The polarity of the device must be strictly observed when applying bias (see outline drawing).
- The output power is normally measured in a coaxial cavity near to centre band frequency.

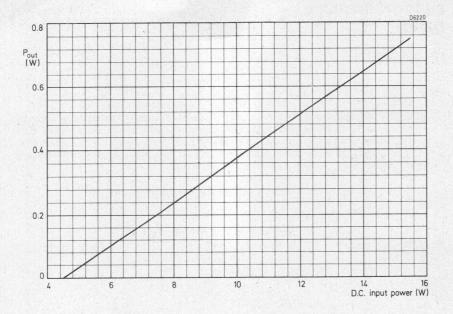
OPERATING NOTES (contd.)

- 6. The heatsink end of the device should be held in a collet or equivalent clamping system to ensure minimum thermal resistance in the path to the mounting base. This in turn must be coupled to an adequate heatsink. Alternatively, direct soldering, using a low melting point solder, or an electrically conductive single loaded epoxy, such as Epotek H40, may be used.
- 7. This device may be used as a negative resistance amplifier.

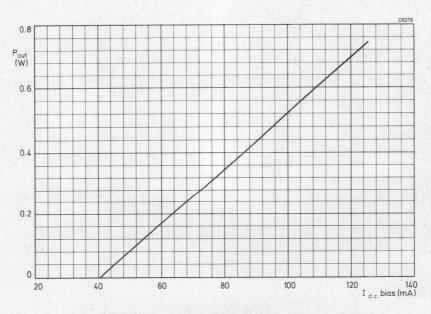
Devices may be selected to suit customers' specific requirements



COAXIAL TEST OSCILLATOR CAVITY



TYPICAL OUTPUT POWER AS A FUNCTION OF D.C. INPUT POWER



TYPICAL OUTPUT POWER AS A FUNCTION OF BIAS CURRENT

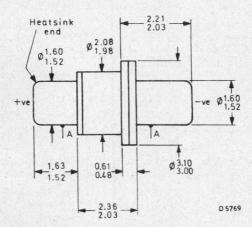
Gallium arsenide bulk effect devices employing the Gunn effect to produce c.w. oscillations at microwave frequencies. Each device is encapsulated in a standard microwave package and conforms to the environmental requirements of BS9300 where applicable.

	QUICK REFERENCE D	ATA	
Operating voltage (typ.	.)	7.0	V
P_{tot} max. $(T_{mb} = 70)$	C)	1.0	W
Operating frequency		8.0 to 12	GHz
Pout min.	CXY11A	5.0	mW
	CXY11B	10	mW
	CXY11C	15	mW

Unless otherwise stated, data is applicable to all types

OUTLINE AND DIMENSIONS

Conforms to B.S. 3934 SO-86



A = concentricity tolerance = ± 0.13

V max. 1)			7.5		V
V max (for less than 1 ms)			9.0		V
P_{tot} max. $(T_{mb} = 70 {}^{\circ}C)$			1.0		W
Temperature					
T _{mb} range		-40	to +70		oC
T _{stg} range		-55 to	o +150		°C
ELECTRICAL CHARACTERISTICS	$S(T_{amb} = 25 \text{ °C})$				
		Min.	Тур.	Max.	
I_{dc} (at V = 7.0 V) 1)			120	150	mA
Frequency ²)		8.0	9.5	12	GHz
P_{out} (at V = 7.0 V) ³)	CXY11A	5.0	8.0		mW
Out	CXY11B	10	12	-	mW
	CXY11C	15	20	-	mW
A.M. noise to output power ratio	4)	-90	-100	-	dB

OPERATING NOTES

- Bias must be applied in such a way that the mounting base (heatsink end) of the device is always positive. Reversing the polarity may cause permanent damage. Care should be taken to protect the device from transients. An 8.2 V voltage regulator diode to shunt the power supply is recommended for this purpose.
- 2) The frequency is governed by the choice of cavity to which the device is coupled.
- 3) The output power is normally measured in a coaxial cavity at a frequency of 9.5 GHz. Other centre frequencies may be supplied at 8.5, 10.5 and 11.5 GHz by suffixing the type number e.g. CXY11B/10.5 specifies a diode giving 10 mW min. at 10.5 GHz. See the table below.

Diodes with these other centre frequencies will not necessarily oscillate over the whole $8\ {\rm to}\ 12\ {\rm GHz}$ range.

The bias may be optimized to give maximum output power within the V max. and $P_{\mbox{tot}}$ max. ratings.

- 4) A.M. noise is measured in a 1 Hz to 1 kHz bandwidth with the diode mounted in a CL8630 oscillator.
- 5) It is important to ensure good thermal contact between the device and the mounting base, which in turn should be coupled to an adequate heatsink.
- 6) The power supply should be low impedance voltage regulated and capable of supplying approximately 1.5 times the normal current, to initiate oscillation.

Minimum output	Test Frequency (GHz)			
power (mW)	8.5	9.5	10.5	11.5
5	CXY11A/8.5	CXY11A	CXY11A/10.5	CXY11A/11.5
10	CXY11B/8,5	CXY11B	CXY11B/10.5	CXY11B/11.5
15	CXY11C/8.5	CXY11C	CXY11C/10.5	CXY11C/11.5

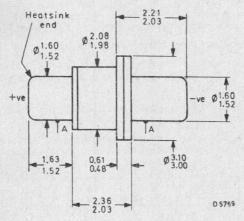
Gallium arsenide bulk effect device employing the Gunn effect to produce c.w. oscillations at microwave frequencies. Each device is encapsulated in a standard microwave package and conforms to the environmental requirements of BS9300 where applicable.

QUIC	K REFERENCE DATA		
Operating voltage		7.0	v
P_{tot} max. $(T_{mb} = 70 {}^{\circ}\text{C})$		1.0	W
Operating frequency		12 to 18	GHz
Pout min.	CXY14A CXY14B CXY14C	5.0 10.0 15.0	mW mW

Unless otherwise stated, data is applicable to all types

OUTLINE AND DIMENSIONS

Conforms to B.S. 3934 SO-86



A = concentricity tolerance = ± 0.13

V max. (d.c.)	7.5	V
V max. (for less than 1 ms)	9.0	V
P_{tot} max. $(T_{mb} = 70 {}^{\circ}C)$	1.0	W
Temperature		
T _{mb} range	-40 to +70	°C
T _{stg} range	-55 to +150	°C

ELECTRICAL CHARACTERISTICS (Tamb = 25 °C)

		Min.	Тур.	Max.	
I_{dc} (at V = 7.0 V) 1)		-	120	145	mA
Frequency 2)		12	14	18	GHz
P_{out} (at V = 7.0 V) 3)	CXY14A	5.0	8.0	-	mW
	CXY14B	10	12	-	mW
	CXY14C	15	20	-	mW

OPERATING NOTES

- 1) Bias must be applied in such a way that the mounting base (heatsink end) of the device is always positive. Reversing the polarity may cause permanent damage. Care should be taken to protect the device from transients. An 8.2 V voltage regulator diode to shunt the power supply is recommended for this purpose.
- 2) The frequency is governed by the choice of cavity to which the device is coupled.
- 3) The output power is normally measured in a coaxial cavity at approximately centreband frequency. The bias may be optimized to give maximum output power within the V max. and P_{tot} max. ratings.
- 4) It is important to ensure good thermal contact between the device and the mounting base, which in turn should be coupled to an adequate heatsink.
- 5) The power supply should be low impedance voltage regulated and capable of supplying approximately 1.5 times the normal current, to initiate oscillation.

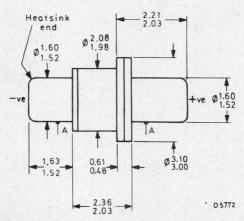
Devices may be selected to suit customers' specific requirements

Gallium arsenide bulk effect device employing the Gunn effect to produce c.w. oscillations at microwave frequencies. Each device is encapsulated in a standard microwave package and conforms to the environmental requirements of BS9300 where applicable.

QUICK REFERENCE	EDATA	
Operating voltage (note 2)	8 to 15	V
P_{tot} max. $(T_{mb} = 70 {}^{\circ}\text{C})$	6.0	W
Operating frequency	8 to 12	GHz
$P_{out} min. (f = 9.5 GHz)$	100	mW

OUTLINE AND DIMENSIONS

Conforms to B.S. 3934 SO-86



A = concentricity tolerance = ± 0.13

V max. (see note 1)

P_{tot}^{max} . $(T_{mb} = 70^{\circ}C)$		6	.0	w
Temperature				
T _{mb} range		-40 to	0 +70	°C
T. range		-55 to	0 +150	°C
ELECTRICAL CHARACTERISTICS (T _{amb} = 25°C)				
	Min.	Тур.	Max.	
I_{dc} (at V = 12V)(see notes 1 and 2)	-	450	-	mA
Frequency (see note 3)	8.0	9.5	12	GHz

OPERATING NOTES

Pout (see note 2)

 Bias must be applied in such a way that the mounting base (heatsink end) of the device is always negative. Reversing the polarity may cause permanent damage. Care should be taken to protect the device from transients.

100

150

mW

- 2. Each device is measured for maximum output power at 9.5GHz in a coaxial test cavity. The bias is optimized for this maximum within the V max, and P max. ratings. The operating voltage and corresponding current are quoted for this condition on a test record supplied with each device.
- 3. The frequency is governed by the choice of cavity to which the device is coupled.
- 4. The heatsink end of the device should be held in a collet or equivalent clamping system to ensure minimum thermal resistance in the path to the mounting base. This in turn must be coupled to an adequate heatsink. Alternatively, direct soldering, using a low melting point solder, or an electrically conductive single loaded epoxy, such as Epotek H40, may be used.
- The power supply should be low impedance voltage regulated and capable of supplying approximately 1.5 times the normal current, to initiate oscillation.

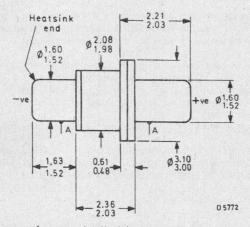
Devices may be selected to suit customers' specific requirements

Gallium arsenide bulk effect device employing the Gunn effect to produce c.w. oscillations at microwave frequencies. Each device is encapsulated in a standard microwave package and conforms to the environmental requirements of BS9300 where applicable.

QUICK REFERENC	E DATA	
Operating voltage (note 2)	8 to 15	v
P_{tot} max. $(T_{mb} = 70^{\circ}C)$	6.0	W
Operating frequency	8 to 12	GHz
P_{out} min. (f = 9.5GHz)	200	mW

OUTLINE AND DIMENSIONS

Conforms to B.S. 3934 SO-86



A = concentricity tolerance = ± 0.13

V max. (see note 1)		15		V
P_{tot} max. $(T_{mb} = 70^{\circ}C)$		6	.0	W
Temperature				
T _{mb} range		-40 to	+70	°C
T _{stg} range		-55 to	+150	°C
ELECTRICAL CHARACTERISTICS (T _{amb} = 25°C)			
	Min.	Тур.	Max.	
$I_{\mbox{dc}}$ (at V = 12V) (see notes 1 and 2)	-	450	-	mA
Frequency (see note 3)	8.0	9.5	12	GHz
Pout (see note 2)	200	250	667 - 10	mW

OPERATING NOTES

- Bias must be applied in such a way that the mounting base (heatsink end) of the device is always negative. Reversing the polarity may cause permanent damage. Care should be taken to protect the device from transients.
- 2. Each device is measured for maximum output power at 9.5GHz in a coaxial test cavity. The bias is optimized for this maximum within the V max. and P_{tot} max. ratings. The operating voltage and corresponding current are quoted for this condition on a test record supplied with each device.
- 3. The frequency is governed by the choice of cavity to which the device is coupled.
- 4. The heatsink end of the device should be held in a collet or equivalent clamping system to ensure minimum thermal resistance in the path to the mounting base. This in turn must be coupled to an adequate heatsink. Alternatively, direct soldering, using a low melting point solder, or an electrically conductive single loaded epoxy, such as Epotek H40, may be used.
- The power supply should be low impedance voltage regulated and capable of supplying approximately 1.5 times the normal current, to initiate oscillation.

Devices may be selected to suit customers' specific requirements

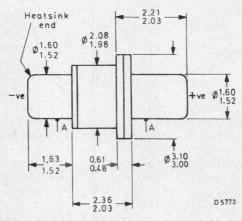
Gallium arsenide bulk effect n^+ sandwich device employing the Gunn effect to produce c.w. oscillations at microwave frequencies. Each device is encapsulated in a standard microwave package and conforms to the environmental requirements of BS9 300 where applicable.

QUICK REFERENCE D	ATA	
Operating voltage ²)	8 to 15	v
P_{tot} max. $(T_{mb} = 70 {}^{\circ}C)$	7.5	W
Operating frequency	8 to 12	GHz
P_{out} min. (f = 9.5 GHz)	300	mW

OUTLINE AND DIMENSIONS

Dimensions in mm

Conforms to B.S. 3934 SO-86



A = concentricity tolerance = ± 0.13

V max. 1) 2)		15		v
P_{tot} max. $(T_{mb} = 70 {}^{\circ}C)$		7.5		w
Temperature				
T _{mb} range	-4	0 to +70		°C
T _{stg} range	-55	to +150		°C
ELECTRICAL CHARACTERISTICS (T _{amb} = 25 °C)				
	Min.	Тур.	Max.	
I _{dc} 1) 2)	-	650	900	mA
Frequency 3)	8.0	9.5	12	GHz
Pout 2)	300	325	•	mW

Devices may be selected to suit customers' specific requirements

¹⁾ Bias must be applied in such a way that the mounting base (heatsink end) of the device is always negative. Reversing the polarity may cause permanent damage. Care should be taken to protect the device from transients.

²⁾ Each device is measured for maximum output power at 9.5 GHz in a coaxial test cavity. The bias is optimized for this maximum within the V max. and P_{tot} max. ratings. The operating voltage and corresponding current are quoted for this condition on a test record supplied with each device.

³⁾ The frequency is governed by the choice of cavity to which the device is coupled.

⁴⁾ The heatsink end of the device should be held in a collet or equivalent clamping system to ensure minimum thermal resistance in the path to the mounting base. This in turn must be coupled to an adequate heatsink. Alternatively, direct soldering, using a low melting point solder, or an electrically conductive single loaded epoxy, such as Epotek H40, may be used.

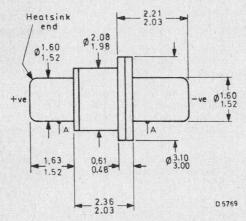
⁵⁾ The power supply should be low impedance voltage regulated and capable of supplying approximately 1.5 times the normal current, to initiate oscillation.

Gallium arsenide bulk effect device employing the Gunn effect to produce c.w. oscillations at microwave frequencies. It is encapsulated in a standard microwave package and conforms to the environmental requirements of BS9300 where applicable.

QUICK REFEREN	ICE DATA	
Operating voltage	9.5	v
P_{tot} max. $(T_{mb} = 70 {}^{\circ}\text{C})$	2.5	w
Operating frequency range	8.0 to 12	GHz
P_{out} typ. (at $f_o = 9.5$ GHz)	60	mW

OUTLINE AND DIMENSIONS

Conforms to B.S. 3934 SO-86



A = concentricity tolerance = ± 0.13

V max. 1)	10	V
V max. (for less than 1 ms.)	12	v
P_{tot} max. $(T_{mb} = 70 {}^{\circ}C)$	2.5	W
T _{mb} range	-40 to +70	°C
T _{stg} range	-55 to +150	°C

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C)

	Min.	Тур.	Max.	
Frequency range 2)	8.0	-	12	GHz
D.C. operating current (at V = 9.5 V)	-	210	265	mA
Power output 3)	50	60	-	mW

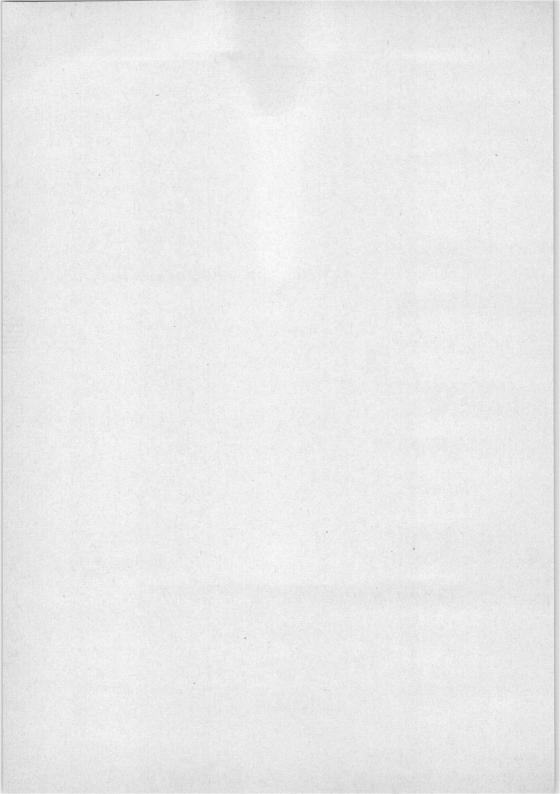
OPERATING NOTES

- 1) The heatsink end is positive. Bias must be applied in such a way that the mounting base end of the device is always positive. Reversal of the bias will cause permanent damage. Care should be taken to prevent the device from transients. An 11 V voltage regulator diode to shunt the power supply is recommended for this purpose.
- 2) The frequency is governed by the choice of cavity to which the device is coupled.
- 3) The power output is normally measured in a coaxial cavity at approximately mid-band frequency. The bias may be optimized to give maximum power output within the limits of V max. and P_{tot} max.
- 4) The heatsink end of the device should be held in a collet or similar clamping system to ensure minimum thermal resistance in the path to the mounting base. This in turn must be coupled to an adequate heatsink. Alternatively, direct soldering, using a low melting point solder, or an electrically conductive single loaded epoxy such as Epotek H40, may be used.
- 5) The power supply should be low impedance voltage regulated and be capable of supplying 1.5 times the normal current, to initiate oscillation.

Devices may be selected to suit customers' specific requirements.

Mixer and detector diodes



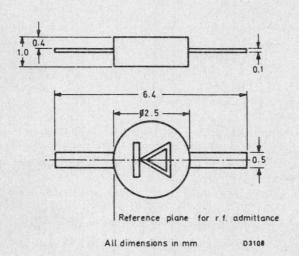


MICROWAVE MIXER/DETECTOR DIODE

Silicon Schottky barrier diode for use as a low level detector or as a low noise mixer at microwave frequencies. The diode is plastic encapsulated with ribbon leads suitable for mounting in stripline circuitry and conforms to the environmental requirements of BS9300 where applicable. Available as a matched pair 2/BAT10 M.

QUICK REFERENCE DATA		
Frequency range	1.0 to 12	GHz
Mixer: Typical noise figure in X-band	7.0	dB
Detector: Typical tangential sensitivity in X-band with 100 μA bias	-50	dBm
Typical current sensitivity in X-band with 50 μA bias	5.0	μΑ/μ\

OUTLINE AND DIMENSIONS



LIMITING VALUES (Absolute max. rating system)

Maximum pook pulged a f input power at 0 275 CUR

Tangential sensitivity 4)

Current sensitivity 5)

v.s.w.r. Voltage standing wave ratio

Noise

Video impedance 7)

Electrical

0.5 μs pulse length	1.0	w
Maximum burn out (multiple r.f. spike, $\Delta N_0 = 1$ dB)	20 0.2	nJ erg
Temperature		
T _{stg} range	-55 to +150	°C
T _{amb} range	-55 to +150	°C
ELECTRICAL CHARACTERISTICS (T _{amb} = 25 °C)		
	Тур. Ма	х.
Mixer		
N _o Noise figure 1)	7.0 7.5	dB
v.s.w.r. Voltage standing wave ratio 2)	- 2:1	
Z _{if} Intermediate frequency impedance ³)	- 500	Ω

$\frac{Z_{\mathbf{v}}}{\frac{1}{f}}$

NOTES

Detector

Sts

Si

1. Measured in a 50 Ω test mount at f = 9.375 GHz, rectified current = 2.0 mA, load resistance = 20 Ω , i.f. = 45 MHz and i.f. noise figure = 1.5 dB. BS9300.

-50

5.0

600

12

dBm

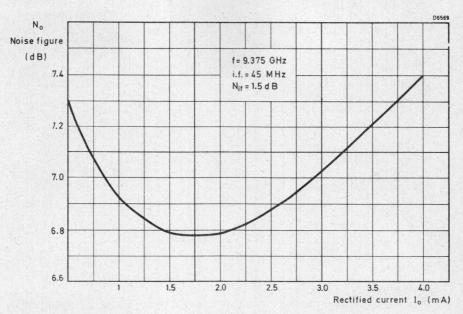
Ω

17 dB

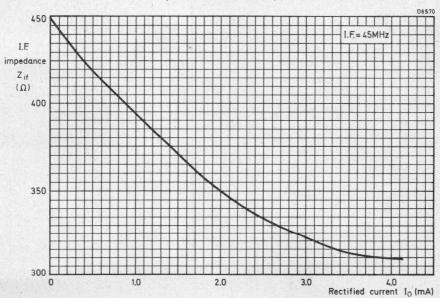
5:1

μA/μW

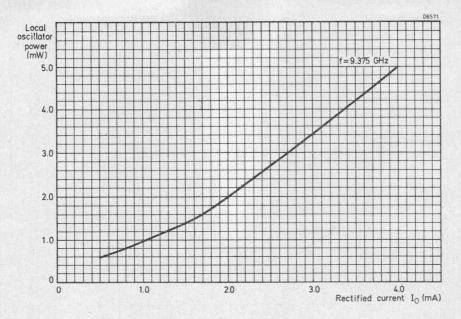
- 2. Measured with respect to 50 Ω at f = 9.375 GHz, rectified current = 2.0 mA, and load resistance = 10 Ω . BS9300.
- 3. Measured in a 50 Ω test mount at f = 9.375 GHz, rectified current = 2.0 mA, load resistance = 20 Ω and i.f. = 45 MHz. BS9300.
- 4. Measured at f = 9.375 GHz with 2.0 MHz bandwidth and 100 μ A bias.
- 5. Measured at f = 9.375 GHz at an input power of 1.0 μ W and 50 μ A bias.
- 6. Measured with respect to 50 Ω at f = 9.375 GHz, 100 μ A bias and c.w. input less than 2.0 μ W. BS 9300.
- 7. D.C. measurement with 1.0 mV max. and 50 µA bias.



TYPICAL NOISE FIGURE AS A FUNCTION OF RECTIFIED CURRENT (MIXER APPLICATION)



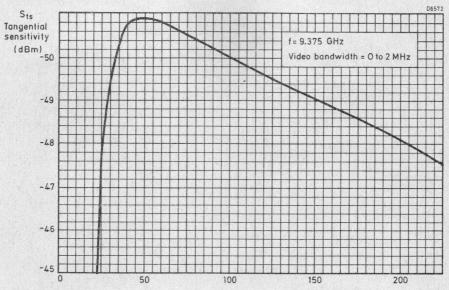
TYPICAL I.F. IMPEDANCE AS A FUNCTION OF RECTIFIED CURRENT (MIXER APPLICATION)



TYPICAL LOCAL OSCILLATOR POWER AS A FUNCTION OF RECTIFIED CURRENT (MIXER APPLICATION)

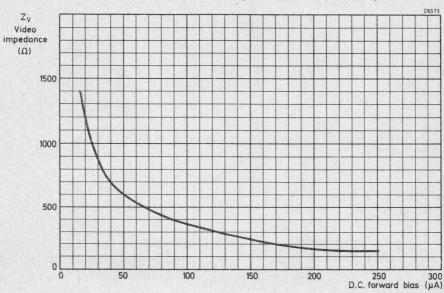
MICROWAVE MIXER/DETECTOR DIODE

BAT10

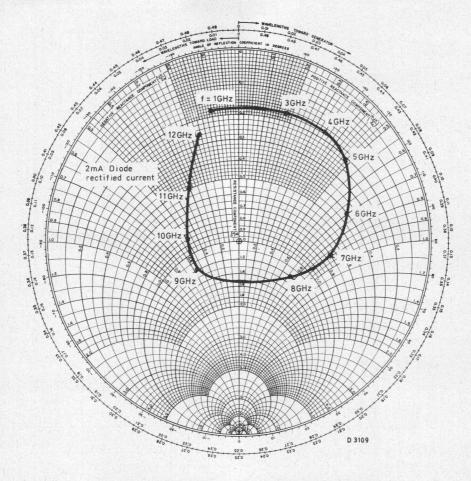


D.C. forward bias (µA)

TYPICAL TANGENTIAL SENSITIVITY AS A FUNCTION OF D.C. FORWARD BIAS CURRENT (DETECTOR APPLICATION)



TYPICAL VIDEO IMPEDANCE AS A FUNCTION OF D.C. FORWARD BIAS CURRENT. (DETECTOR APPLICATION)



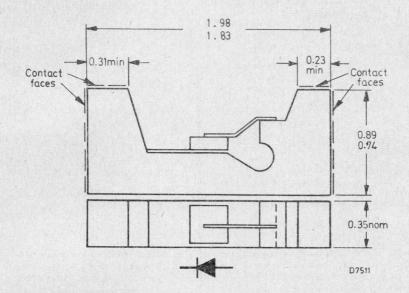
TYPICAL ADMITTANCE AS A FUNCTION OF FREQUENCY

Silicon Schottky barrier low noise mixer diode mounted in a L.I.D. type envelope. Primarily intended for hybrid integrated circuit applications in X-band. It conforms to the environmental requirements of BS9300 where applicable. Available as a matched pair 2/BAT11 M.

QUICK REFERENCE	E DATA
Typical noise figure in X-band	6.5 dB
Frequency range	up to 12 GHz

MECHANICAL DATA

Dimensions in mm



Contact faces are gold plated, 5 µm over 1.27 µm of nickel.

Blectrical

Max.	burn-out (r.f. spike)		20 0.2		nJ erg
Max.	burn-out (multiple d.c. spike)		30 0.3		nJ erg
Tempera	ture				
T _{stg} 1	range		-55 to +1	50	°C
Tamb			-55 to +1	50	°C
ELECTRICAL	CHARACTERISTICS $(T_{amb} = 25^{\circ}C)$				
		Min.	Тур.	Max.	
Dynamic					
No	Noise figure (see note 1)		6.5	7.0	dB
$z_{\rm rf}$	R.F. impedance spread referred to 50Ω bounded by co-ordinates (see note 2).		0.6 - j0.3 0.6 + j0.3		
Z _{if}	Intermediate frequency impedance (see note 3)	280	320	380	Ω

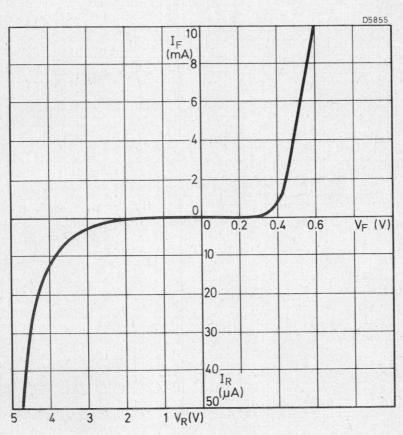
NOTES

- 1. Measured at 9.375GHz \pm 0.1GHz, 1.5mA rectified current, R_L = 15 Ω . N_0 includes N_{if} = 1.5dB with 45MHz intermediate frequency. BS9321/1406.
- 2. Measured at 9.375GHz \pm 0.1GHz, 1.5mA rectified current, $R_{\rm L}$ = 150. BS9321/ 1409.
- 3. Measured at 9.375GHz \pm 0.1GHz, 1.5mA rectified current, R_L = 15 Ω , intermediate frequency 45MHz, BS9321/1405.
- 4. Maximum out of balance condition for a matched pair:

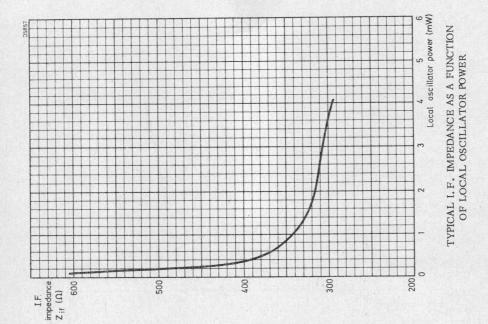
Operating frequency range

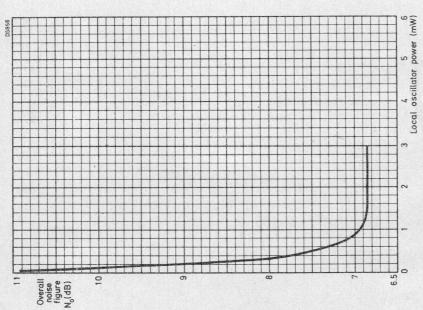
- a) 0.1mA rectified current.
- b) R.F. admittance 1.15:1 with other diode normalized to 50Ω .
- 5. The diode may be mounted on microstrip, using conventional thermocompression or micro-gap bonding techniques. Alternatively, the application of a single loaded epoxy, such as Epotek H40, may be used, followed by polymerisation at 150°C for 15 minutes. The force applied to the L.I.D. must not exceed 147mN (15gf).
- Devices may be specially selected with the r.f. impedance measured at a customer's specific frequency in the range 8.4 to 12GHz.

GHz



TYPICAL D.C. CHARACTERISTIC





TYPICAL OVERALL NOISE FIGURE AS A FUNCTION OF LOCAL OSCILLATOR POWER

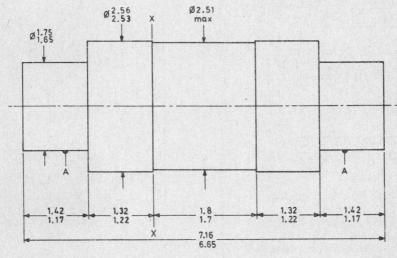
Subminiature silicon reversible Schottky barrier diodes primarily intended for low noise mixer applications in X-band. They are intended as retrofits for AAY39 and AAY39A. Available in a matched pair as 2/BAT39M.

	QUICK REFEREN	NCE DATA		
Operating frequency			1.0 to 18	GHz
Noise figure at X-band	BAT39	typ.	6.0	dB
	BAT39A	typ.	7.0	dB

Unless otherwise stated, data is applicable to both types.

MECHANICAL DATA

Dimensions in mm



XX = reference plane

All dimensions in mm

D2527a

AA = concentricity tolerance = + 0.15

Terminal identification

The positive end (cathode) is marked red.

The positive end indicates the electrode which becomes positive in an a.c. rectifier circuit.

ACCESSORIES

WG16 holders to fit these diodes are available from Marconi Instruments Ltd., (Sanders Division), Gunnels Wood Road, Stevenage, Herts.

RATINGS In accordance with the Absolute Maximum Ratings System (IEC134)						
Burn-out f = 9.375 GHz						
Multiple d.c. spike			max.		0.1	erg
Multiple r.f. spike (spike width a half peak power = $2 \mu s$)	t ·		max.		0.05	erg
Peak pulse power						
$f = 9.375 \text{ GHz}, t_p = 1.0 \mu s$			max.		0.5	W
Temperatures						
Storage temperature		T _{stg}		-55	to +100	°C
Ambient temperature		T _{amb}		-55	5 to +100	°C
CHARACTERISTICS					$T_{amb} = 2$	25 °C
			Min.	Тур.	Max.	
Reverse current V _R = 0.5 V		I_{R}	-	-	2.0	μΑ
Forward current V _F = 0.5 V		I_{F}	-	7.0	-	mA
Overall noise figure						
f = 9.375 GHz, R_L = 15 Ω , rectified current = 1.0 mA N_o includes N_{if} = 1.5 dB (BS9300/1406 Method B)	BAT39 BAT39A	N _o N _o	5.5	6.0 7.0	6.5 7.5	dB dB
Conversion loss	BAT39 BAT39A	L _C L _C	-	4.2 5.0))) <u>-</u> () () () ()	dB dB
Noise temperature ratio						
I.F. = 45 MHz (BS9300/1407)	BAT39 BAT39A	N _r N _r	-	1.1:1 1.2:1	-	
Voltage standing wave ratio						
f = 9.375 GHz, R_L = 15 Ω , rectified current = 1.0 mA (BS300/1409) Measured in standard test holder		v.s.w.r.	300 0. 1	- 10	1.43:1	
Intermediate frequency impedance	2					
f = 9.375 GHz, R_L = 15 Ω rectified current = 1.0 mA (BS9300/1405)		z _{if}	250		450	Ω
Operating frequency range		f	1.0	-	18	GHz

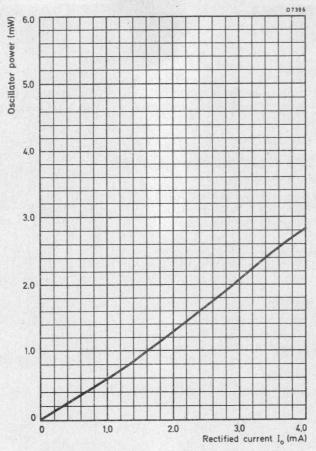
OPERATING NOTE

Optimum performance is obtained with BAT39 and BAT39A when the local oscillator drive is adjusted to give a diode rectified current of 1.0 mA and the load resistance is restricted to $100~\Omega$ max.

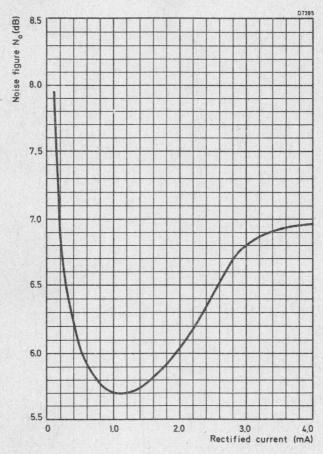
APPLICATION INFORMATION

Mixer performance at other than Test Radio Frequency

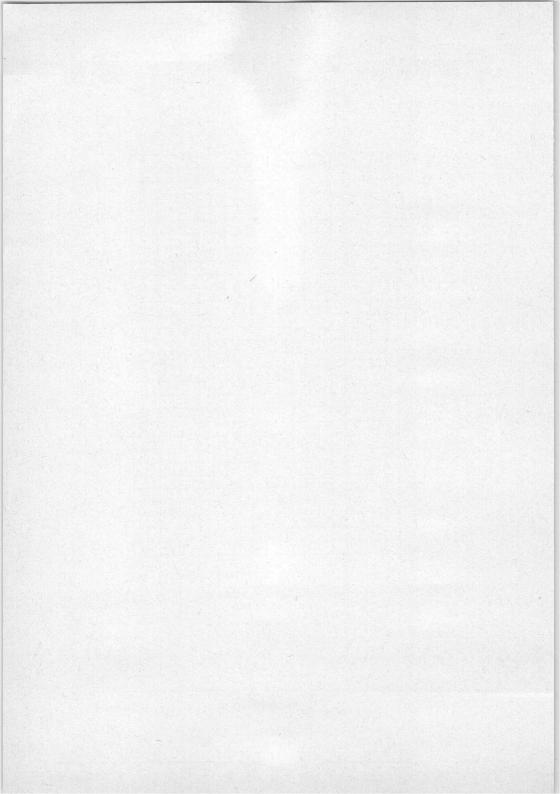
No	typ.	7.0	dB
No	typ.	5.5	dB
N _O	typ.	29	dB
	typ.	131	dB
S _{ts}	typ.	-52	dbm
z_r	typ.	800	Ω
	No No S _{ts}	$N_{ m o}$ typ. $N_{ m o}$ typ. $N_{ m o}$	No typ. 5.5 No typ. 29 typ. 131



Typical rectified current as a function of local oscillator power



Typical noise figure as a function of rectified current



MICROWAVE MIXER DIODES

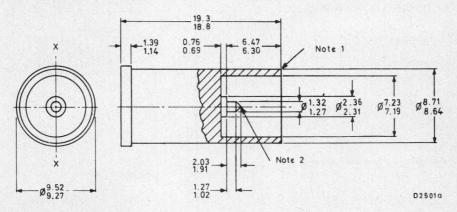
Coaxial silicon Schottky barrier diodes for use in pre-tuned X-band low noise mixer circuits. They are intended for use as low noise retrofits at X-band frequencies for coaxial mixer diodes types AAY50, AAY50R etc. The two types have identical dimensions and characteristics but the polarity is reversed. The pair are intended for use in balanced mixer circuits and conform to the environmental requirements of BS9300 where applicable.

QUICK REF	ERENCE DATA		
Operating frequency	max.	12	GHz
Noise figure	typ.	6. 2	dB

MECHANICAL DATA

Dimensions in mm

Conforms to BS3934 SO-26



Terminal identification

BAT50	Pin	cathode	BAT50R	Pin	anode
	Body (red spot)	anode		Body (green spot)	cathode

ACCESSORIES

Holders to fit these coaxial diodes are available in the U.K. from Marconi Instruments (Sanders Division) Gunnels Wood Rd., Stevenage, Herts.

Note 1. The device is designed to make contact on this open face.

Note 2. Cone tapers to a radius of 0.13 mm nominal.

RATINGS In accordance with the Absolute Maximum Rating System (IEC134)

Burn-out				
R.F. spike		max.	0.2	erg
Peak pulse power				
$t_p = 0.5 \mu s$		max.	1.0	W
Temperatures				
Storage temperature	T _{stg}		-55 to +100	°C
Ambient temperature	Tamb		-55 to +100	°C
CHARACTERISTICS			$T_{amb} = 25$	5°C
Reverse current V _R = 0,5 V	I_R		3.0	μΑ
Forward current V _F = 0.5 V	IF		7.0	mA
Overall noise figure 1)				
f = 9.375 GHz, rectified current = 1.0 mA, R_L = 15 $\Omega,\ N_o$ includes N_{if} = 1.5 dB	N _o	typ. max.	6. 2 6. 8	dB dB
Conversion loss	L _c		4.4	dB
Noise temperature ratio				
I. F. = 45 MHz	N _r		1.1:1	
Voltage standing wave ratio 1) 2)				
f = 9375 ± 10% MHz, rectified current 1.0 mA R_L = 15 $\Omega,\ N_o$ includes N_{if} = 1.5 dB	v.s.w.r.	max.	1. 43: 1	
Intermediate frequency impedance	z _{if}	min. max.	300 500	Ω
Operating frequency range	f	max.	12	GHz

$$\frac{1}{83.5} + \frac{j}{350}$$
 mho.

¹⁾ Measured in standard holder (K1007, Issue 3, Section 8B3. 3.1/2.)

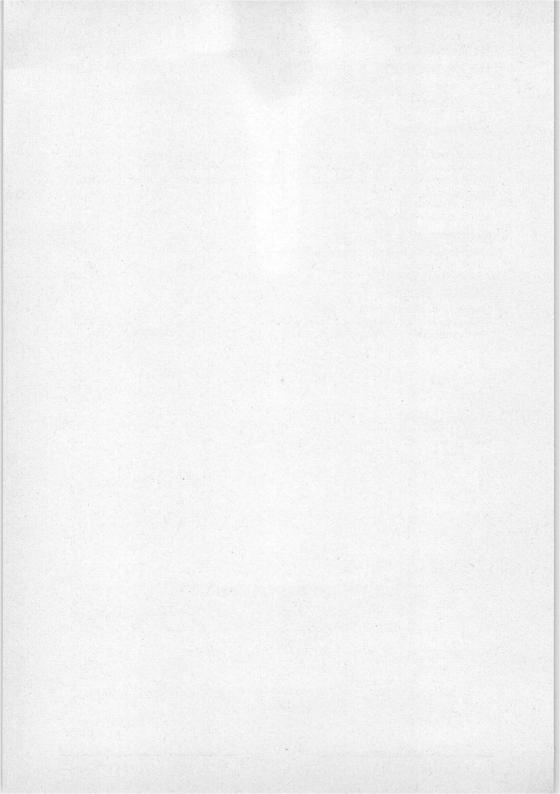
²⁾ The nominal rectifier admittance at a plane 7.01 mm inside the body from the open end is

OPERATING NOTE

These devices will exhibit their inherent improved noise figure performance over the frequency range $1.0\ \text{to}\ 12\ \text{GHz}$, but are not recommended for use as direct replacements in pre-tuned mounts designed for the AAY50 type coaxial diode, at other than X-band frequencies.

APPLICATION INFORMATION

Signal/Flicker noise ratio				
f = 9.5 GHz. Measured at 2 kHz from carrier in 70 Hz bandwidth		typ.	131	dB
Detector performance				
Tangential sensitivity, f = 9.375 GHz, video bandwidth = 1.0 MHz, I_F (bias) = 50 μ A video impedance, I_F (bias) = 50 μ A	S _t	typ.	-52 800	dBm Ω



The BAT51 and BAT51R form a reverse pair of mixer diodes for use in balanced mixer circuits at J-band (Ku band). The diodes are of silicon Schottky barrier construction and are intended as retrofits for AAY51 and AAY51R. They are packaged in the standard coaxial outline for this band, similar to 1N78 types. The encapsulation is hermetically sealed and the diodes conform to the environmental requirements of BS9300 where applicable. Available as a matched pair as 2/BAT51 MR.

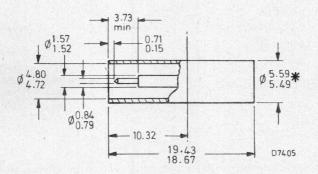
QU	JICK REFE	ERENCE DATA		
Frequency range	4		12 to 18	GHz
Noise figure		typ.	7.0	dB

Unless otherwise stated, data is applicable to both types.

MECHANICAL DATA

Dimensions in mm

DO-37



*These limits apply only over 10.32 dimension

Terminal identification

BAT51 Pin cathode Body (red) anode BAT51R Pin anode
Body (green) cathode

RATINGS In accordance with the Absolute Maximum System (IEC134)

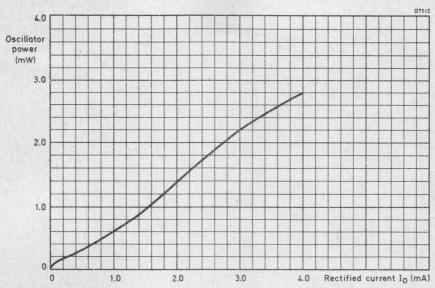
Burn-out				
f = 9.375 GHz, multiple r.f. spike, spike width at half peak power = 2 ns		max.	0.05	erg
Peak pulse power				
$f = 9.375 \text{ GHz}, t_p = 1.0 \mu s$		max.	0.5	W
Temperatures				
Storage temperature	T _{stg}	-55 t	o +100	°C
Ambient temperature	Tamb	-55 t	o +100	°C
CHARACTERISTICS		Г	amb = 2	5 °C
Reverse current $V_R = 0.5 V$	I_R	max.	0.2	μΑ
Forward current $V_F = 0.5 \text{ V}$	$I_{\mathbf{F}}$	typ.	7.0	mA
Overall noise figure				
f = 13.5 GHz, N _o includes N _{if} = 1.5 dB Measured in JAN 201 holder (BS9300/1406 Method A)	No	typ.	7.0 7.5	dB dB
Conversion loss	L_{C}		5.2	dB
Noise temperature ratio				
I.F. = 45 MHz (BS9300/1407)	Nr		1.1:1	
Voltage standing wave ratio				
f = 13.5 GHz, rectified current = 0.9 mA			1.5:1	
Intermediate frequency impedance	z _{if}	min. typ. max.	250 350 450	Ω
Operating frequency range	f	1	2 to 18	GHz

FINISH

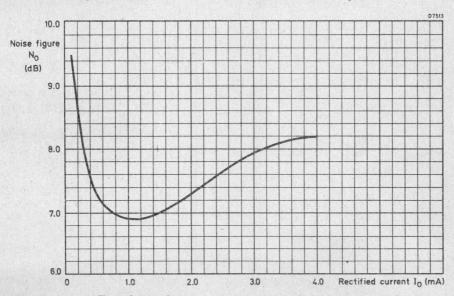
The bodies are cadmium plated in order to be compatible with an aluminium holder

MATCHED PAIR

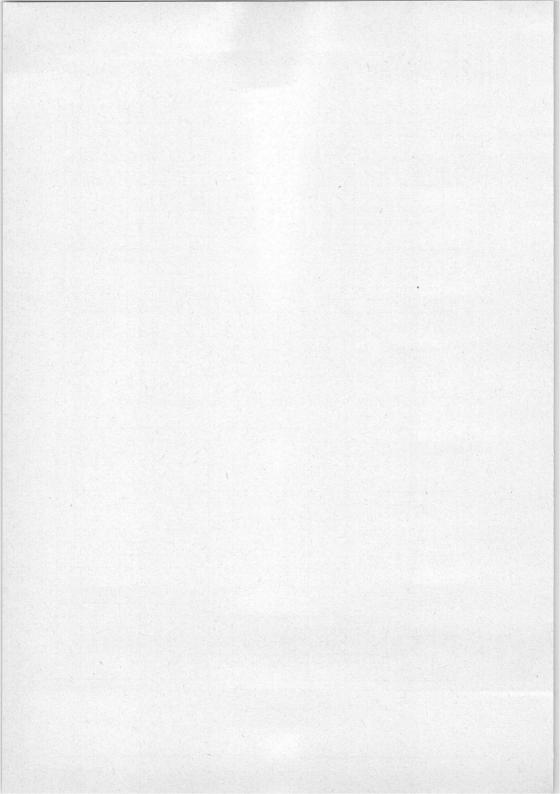
Maximum unbalance conditions, Z_{if} = 25 Ω , rectified current 0.1 mA.



Typical rectified current as a function of local oscillator power



Typical noise figure as a function of rectified current



The BAT52 and BAT52R form a reverse pair of mixer diodes for use in balanced mixer circuits at J-band (Ku band). The diodes are of silicon Schottky barrier construction and are intended as retrofits for AAY52 and AAY52R. They are packaged in the standard coaxial outline for this band, similar to IN78 types. The encapsulation is hermetically sealed and the devices conform to the environmental requirements of BS9300 where applicable. Available as a matched pair as 2/BAT52MR.

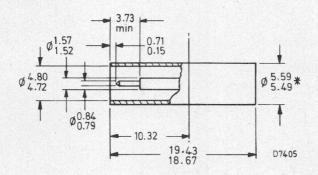
QUICE	K REFERENCE DATA		
Frequency range		12 to 18	GHz
Noise figure	typ.	8.0	dB

Unless otherwise stated, data is applicable to both types.

MECHANICAL DATA

Dimensions in mm

DO-37



*These limits apply only over 10.32 dimension

Terminal identification

BAT52 Pin cathode Body (red) anode BAT52R Pin anode Body (green) cathode

RATINGS In accordance with the Absolute Maximum System (IEC134)

Burn-out				
f = 9.375 GHz, multiple r.f. spike, spike width at half peak power = 2 ns		max.	0.05	erg
Peak pulse power				
$f = 9.375 \text{ GHz}, t_p = 1.0 \mu s$		max.	0.5	W
Temperatures				
Storage temperature	T _{stg}	-55 to	+100	°C
Ambient temperature	Tamb	-55 to	+100	°C
CHARACTERISTICS		Ta	mb = 2	5 °C
Reverse current V _R = 0.5 V	I_R	max.	0.2	μΑ
Forward current V _F = 0.5 V	I_{F}	typ.	7.0	mA
Overall noise figure				
f = 13.5 GHz, $$N_{\rm o}$$ includes $N_{\rm if}$ = 1.5 dB Measured in JAN 201 holder (BS9300/1406 Method A)	N _o	typ.	8.0 8.5	dB dB
Conversion loss	L _C		5.2	dB
Noise temperature ratio				
I.F. = 45 MHz (BS9300/1407)	Nr		1.1:1	
Voltage standing wave ratio				
f = 13.5 GHz, rectified current = 0.9 mA			1.5:1	
Intermediate frequency impedance	z _{if}	min. typ. max.	250 350 450	Ω Ω Ω

FINISH

The bodies are cadmium plated in order to be compatible with an aluminium holder

f

MATCHED PAIR

Operating frequency range

Maximum unbalance conditions, Z_{if} = 25 Ω , rectified current 0.1 mA.

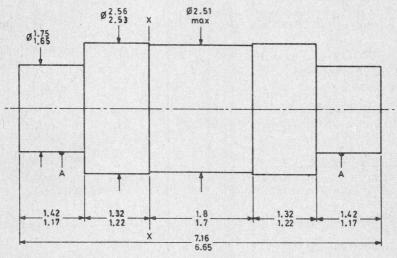
12 to 18 GHz

Subminiature silicon Schottky barrier mixer diode for use at Q-band (Ka-band). Where applicable, this device conforms to the environmental requirements of BS9300.

QUIC	K REFERENCE DATA		
Frequency range		26 to 40	GHz
Noise figure	typ.	8.5	dB

MECHANICAL DATA

Dimensions in mm



XX = reference plane
AA = concentricity tolerance = + 0.15

D2527a

The cathode (positive) is marked red.

The cathode indicates the electrode which becomes positive in an a.c. rectifier circuit.

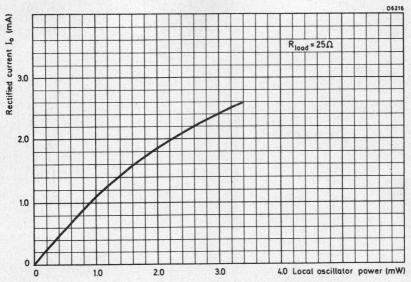
RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Burn-out				
R.F. spike		max.	0.04	erg
Peak pulse power ($t_p = 0.2 \mu s$)		max.	0.5	W
Temperature				
Storage temperature	T _{stg}		-55 to +100	°C
Ambient temperature	T _{amb}		-55 to +100	°C
CHARACTERISTICS			T _{amb} =	25 °C
Reverse current $V_R = 0.5 V$	I_R	typ.	2.0	μΑ
Forward current $V_F = 0.5 V$	$I_{\mathbf{F}}$	typ.	2.0	mA
Overall noise figure				
f = 34.86 GHz, rectified current = 0.5 mA N_0 includes N_{if} of 1.5 dB (BS9321/1406)	N _o	typ.	8.5 10	dB dB
Conversion loss	L _c	typ.	5.5	dB`
Noise temperature ratio				
I.F. = 45 MHz	N_r		1.6:1	
Voltage standing wave ratio 1)				
f = 34.86 GHz, rectified current = 0.5 mA R_L = 15 Ω (BS9321/1409)	v.s.w.r.	typ.	1.4: 1 1.8: 1	
Intermediate frequency impedance				
f = 34.86 GHz, rectified current = 0.5 mA R_L = 15 $\Omega,$ i.f. = 45 MHz (BS9321/1405)	z_{if}	typ.	1000 700 to 1400	Ω
Operating frequency range	f		26 to 40	GHz

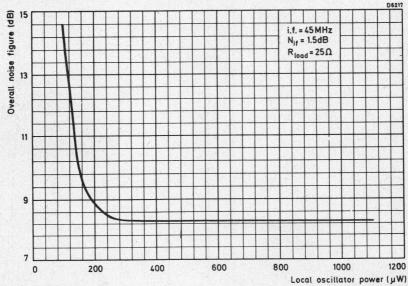
MATCHED PAIRS

The diodes can be supplied in matched pairs under the type number 2/BAT59M. The diodes are matched to $\pm 10\%$ on rectified current and within 150 Ω i.f. impedance.

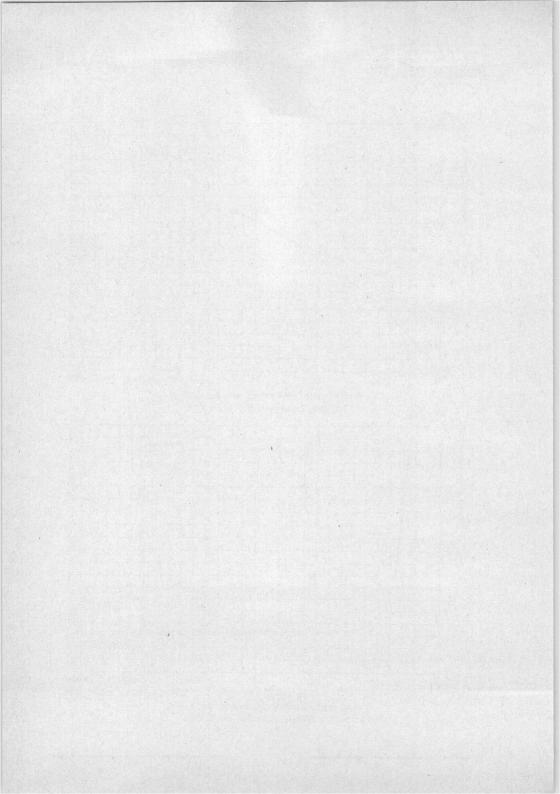
¹⁾ Standard test holder.



Typical rectified current as a function of local oscillator power at 34.86 GHz



Typical overall noise figure as a function of local oscillator power at 34.86 GHz



Coaxial Schottky barrier diodes for use in pre-tuned X- and S-band low noise mixer circuits. The diodes are suitable as replacements for most British coaxial point contact types in these bands, for example, GEM3, GEM4, CV7108, CV7109, CV2154 and CV2155. They conform to the environmental requirements of BS9300 where applicable. Available as a matched pair as 2/BAV22MR.

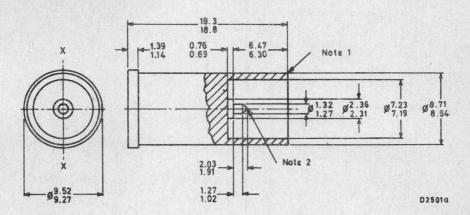
QUICK REFERI	ENCE DATA		
Operating frequency	max.	12	GHz
Noise figure at X-band	týp.	7.0	dB
at S-band	typ.	6.0	dB

Unless otherwise stated, data is applicable to both types.

MECHANICAL DATA

Dimensions in mm

Conforms to BS3934 SO-26



Terminal identification

BAV22	Pin	cathode	BAV22R	Pin	anode
	Body (red	spot) anode		Body (green spot)	cathode

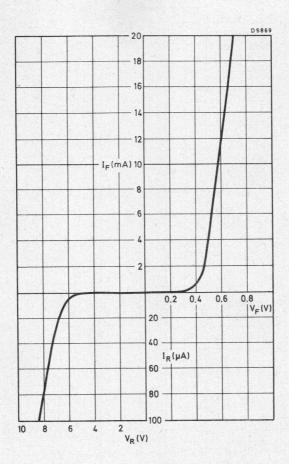
Note 1. The device is designed to make contact on this open face

Note 2. Cone tapers to a radius 0.13 mm nominal

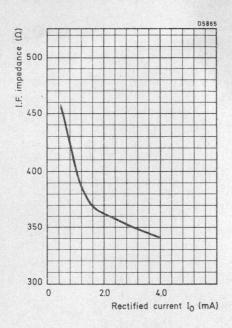
Electrical

peak pulse power z, 0.5µs pulse length)		1.0)	W
burn-out				
e r.f. spikes, $\Delta N_0 = 1$ dB		20 0.:	2	nJ erg
.c. spikes, $\Delta N_0 = 1 dB$		35 0.3	35	nJ erg
e .	-55	to +100		°C
T _{stg} range T _{amb} range		-55 to +100		°C
RACTERISTICS ($T_{amb} = 25^{\circ}C$)	Min.	Тур.	Max.	
Noise figure (see note 1)	-	7.0	7.5	dB
Noise figure (at 3GHz)	-	6.0	-	dB
Voltage standing wave ratio (see note 2)		2.4	1.43:1	
Voltage standing wave ratio (at 3GHz)	· · ·	1.2:1	-	
Intermediate frequency impedance (see note 3)	300	- 2	550	Ω
	burn out the r.f. spikes, $\Delta N_0 = 1 dB$ to	z, $0.5\mu s$ pulse length) burn-out le r.f. spikes, $\Delta N_0 = 1 dB$ c. spikes, $\Delta N_0 = 1 dB$ le e -55 ge -55 ARACTERISTICS ($T_{amb} = 25^{\circ}C$) Min. Noise figure (see note 1) Noise figure (at 3GHz) Voltage standing wave ratio (see note 2) Voltage standing wave ratio (at 3GHz) Intermediate frequency	z , 0.5 μ s pulse length) burn-out le r.f. spikes, $\Delta N_0 = 1 dB$ c. spikes, $\Delta N_0 = 1 dB$ 20 0.2 c. spikes, $\Delta N_0 = 1 dB$ 35 0.3 e e ARACTERISTICS ($T_{amb} = 25^{\circ}C$) Min. Typ. Noise figure (see note 1) Noise figure (at 3GHz) Voltage standing wave ratio (see note 2) Voltage standing wave ratio (at 3GHz) Intermediate frequency	burn out the r.f. spikes, $\Delta N_0 = 1 dB$ c. spikes, $\Delta N_0 = 1 dB$ c. spikes, $\Delta N_0 = 1 dB$ de r.f. spikes, $\Delta N_0 = 1 dB$ c. spikes, $\Delta N_0 = 1 dB$ de r.f. spikes, $\Delta N_0 = 1 dB$ d

- 1. Measured at 9.375GHz, 1mA rectified current, $\rm R_L$ = 15 Ω , $\rm N_0$ includes $\rm N_{if}$ =1.5dB with 45MHz intermediate frequency. BS9321/1406.
- 2. With respect to CV2154 holder at 9.375GHz and 1mA rectified current, $\rm R_L$ =150. BS9321/1409.
- 3. Measured at 9.375GHz, 1mA rectified current, $R_{\rm L}$ = 150, i.f. = 45MHz. BS9321/ 1405



TYPICAL D.C. CHARACTERISTIC

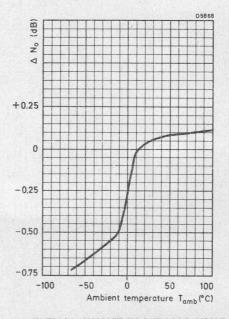


7.2
7.0
6.8
0
2
4
Rectified current I₀ (mA)

TYPICAL I.F. IMPEDANCE
AGAINST RECTIFIED CURRENT

2.0 2.0 Rectified current l₀ (mA)

TYPICAL OVERALL NOISE FIGURE AGAINST RECTIFIED CURRENT



TYPICAL LOCAL OSCILLATOR POWER AGAINST RECTIFIED CURRENT

TYPICAL CHANGE IN OVERALL NOISE FIGURE AGAINST TEMPERATURE

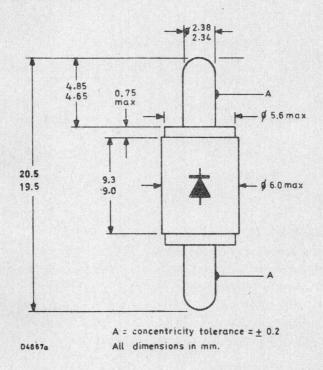
MICROWAVE DETECTOR DIODE

Silicon Schottky barrier diode in DO-23 (1N23) outline specially designed for use in doppler radar systems and intruder alarms where low 1/f noise and high detector sensitivity is required.

QUICK REFERENCE DATA	1	
Sensitivity at X-band (typ.)	5.0	$\mu A/\mu W$
1/f noise at 1kHz (typ.)	10	dB

OUTLINE AND DIMENSIONS

Compatible with J. E. D. E. C. DO-23



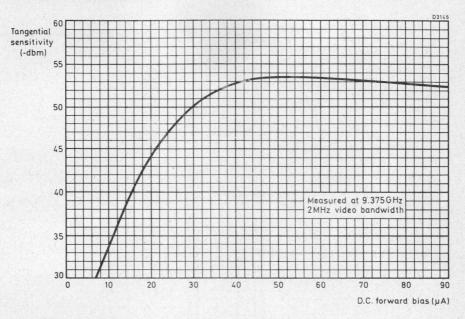
Terminal identification: Diode symbol indicates polarity

Accessory: Collet type 56321 (see page 4) converts BAV46 to DO-22 outline

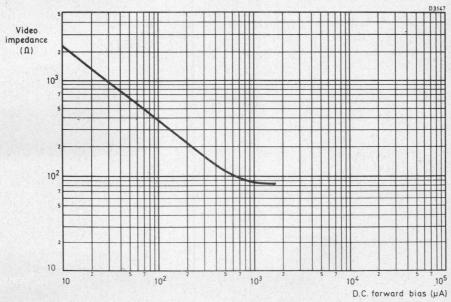
Electrical

		peak pulse power 75GHz, 0.5µs pulse length)		1. 0	W
	Maximum (multip	burn out ble r.f. spike)	2	0	nJ
				0.2	erg
7	Γemperature				
	T rang	e	-20 to +15	0	°C
	T _{amb} ran	ge	-20 to +15	0	°C
ELECT	TRICAL CHA	ARACTERISTICS (T _{amb} = 25°C)			
			Typ.	Max.	
		1/f Noise figure (see notes 1 and 2)	10	15	dB
	Si	Sensitivity (see notes 3 and 4)	5.0		μΑ
	v. s. w. r.	Voltage standing wave ratio (see notes 3 and 5)	3:1	5:1	
	z _v	Video impedance (see note 2)	850		Ω
	S _{ts} ,	Tangential sensitivity (see note 6)	-52		dbm
		(see note 7)	-54		dbm

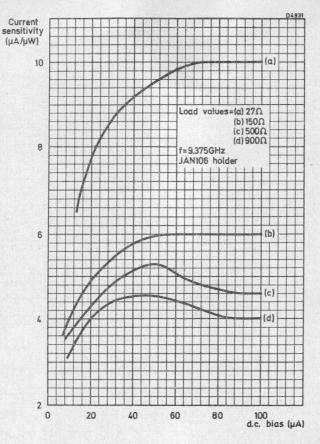
- 1. Measured at i.f. of 1kHz, bandwidth 50Hz.
- 2. Measured with forward bias of $30\mu A$.
- 3. Measured with $30\mu A$ forward bias and $1\mu W$ local oscillator drive at 9.375GHz.
- 4. Measured in a JAN106 holder.
- 5. $R_L = 15\Omega$, JAN106 holder.
- 6. Measured with 0 to 2MHz bandwidth.
- 7. Measured with 1kHz to 1MHz bandwidth.



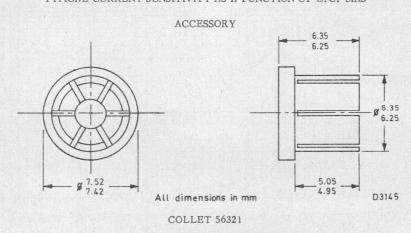
TYPICAL TANGENTIAL SENSITIVITY AS A FUNCTION OF D.C. FORWARD BIAS



TYPICAL VIDEO IMPEDANCE AS A FUNCTION OF D.C. FORWARD BIAS



TYPICAL CURRENT SENSITIVITY AS A FUNCTION OF D.C. BIAS

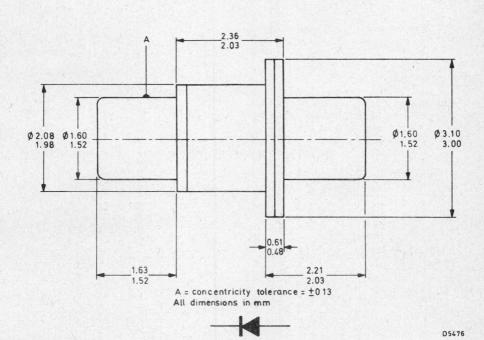


Silicon Schottky barrier diode in SO-86 outline, specially designed for use in doppler radars where high detector sensitivity is required.

QUICK REFER	RENCE DATA	
Frequency range	8.0 to 12	GHz
Tangential sensitivity (typ.) with		
100μA bias	-50	dbm

OUTLINE AND DIMENSIONS

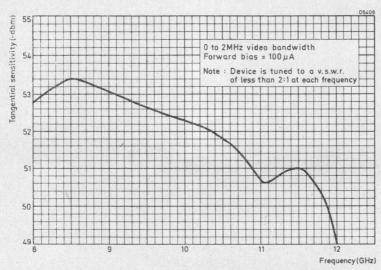
Conforms to B.S. 3934 SO -86



Electrical

Peak pulse 0.5 μs puls	power (max.) at 9.375 GHz e length		0.75		W
Temperatur	re				
T range		-55 to	+150		°C
T range	•	-55 to	+150		°C
ELECTRICAL CH	HARACTERISTICS (at $T_{amb} = 25^{\circ}C$)				
		min.	typ.	max.	
v.s.w.r.	Voltage standing wave ratio (see notes 1,2, and 3)		2:1		
z _v	Video impedance (see notes 4 and 5)		310		Ω
S _{ts}	Tangential sensitivity (see notes 1 and 2)	-49	-50		dbm
1/f	Flicker noise (see notes 4 and 6)		10	15	dB

- 1. Measured at 10.687 GHz with 100 µA forward bias.
- 2. Measured in a reduced height waveguide mount, (Sanders 6521, modified).
- 3. R.F. input power less than $5.0 \mu W$.
- 4. Measured with 100 μA forward bias.
- 5. Maximum d.c. input voltage = 1.0mV.
- 6. a) Measured at an i.f. of 1kHz with 50Hz bandwidth.
 - b) 1/f noise remains constant with a forward bias not exceeding 250 μA.



TANGENTIAL SENSITIVITY AS A FUNCTION OF FREQUENCY

D5404

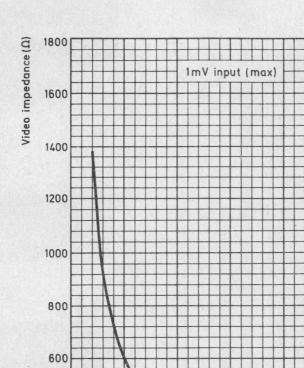
400

200

OL

50

460



VIDEO IMPEDANCE AS A FUNCTION OF D.C. FORWARD BIAS

150

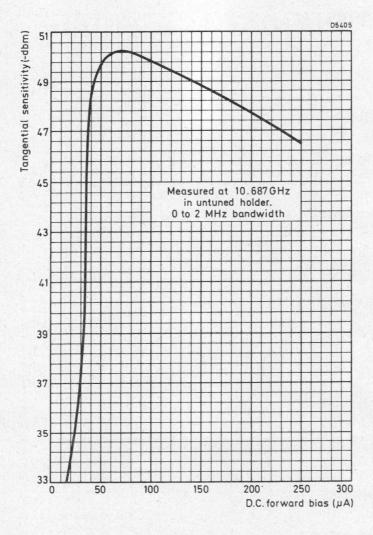
200

250

D.C. forward bias (µA)

100

300



TANGENTIAL SENSITIVITY AS A FUNCTION OF D.C. FORWARD BIAS

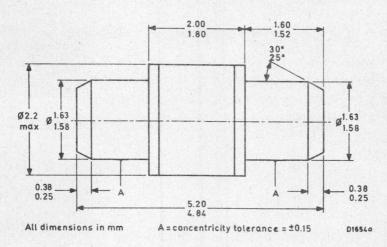
A range of sub-miniature reversible low noise Schottky barrier mixer diodes. The planar technology employed imparts a high degree of reliability and reproducability. The metal-ceramic case is hermetically sealed and the devices conform to the environmental requirements of BS9 300 where applicable.

QUICK REFE	ERENCE DATA	
Maximum noise figure in X-band		
BAV96A	7.5	dB
BAV96B	7.0	dB
BAV96C	6.5	dB
BAV96D	6.0	dB

Unless otherwise stated, data is applicable to all types

OUTLINE AND DIMENSIONS

M.Q.M.



Terminal identification: red end indicates cathode

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

Electrical

Maximum burn out (see note 1) 15 nJ 0.15 erg

RATINGS (ABSOLUTE MAXIMUM SYSTEM) (Contd.)

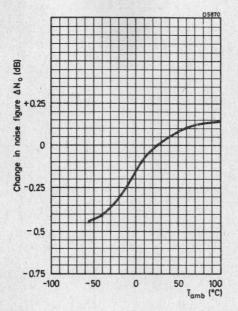
Temperature

T range	-55 to +150	°C
T range	-55 to +150	°C

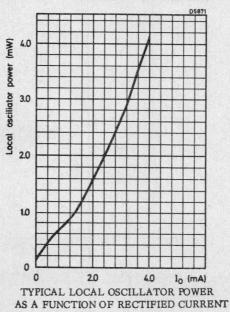
ELECTRICAL CHARACTERISTICS (Tamb = 25°C)

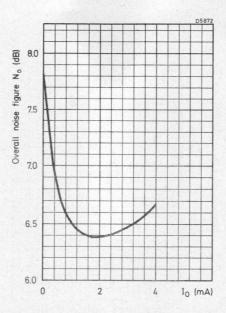
Max.	
7.5	dB
7.0	dB
6.5	dB
6.0	dB
1.43:1	
450	Ω
- db	bm
db	bm
	450 - d

- 1. Burn out is defined as the r.f. pulse energy necessary to cause 1dB degradation in noise figure when the diode is subjected to 2×10^8 pulses of 2ns width.
- 2. Measured at 9.375 \pm 0.1GHz. The noise figure includes i.f. amplifier contribution of 1.5dB, i.f. 45MHz, d.c. return for diode 15 Ω max., rectified current 1mA. BS9321/1406.
- Measured in a reduced height waveguide mount under the same test conditions as in note 2. BS9321/1409.
- 4. I. F. = 45MHz, $R_I = 15\Omega$, $f = 9.375 \pm 0.1$ GHz, $I_0 = 1$ mA. BS 9321/1405.
- 5. Video bandwidth 0 to 2MHz, 30µA bias. BS 9322/1411.
- 6. Video bandwidth 1kHz to 1MHz, 30µA bias. BS9322/1411.
- 7. A suitable holder for this diode is a modified version of Sanders type 6521.

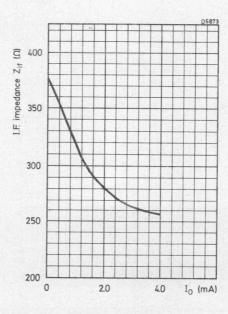


TYPICAL CHANGE IN OVERALL NOISE FIGURE AS A FUNCTION OF TEMPERATURE





TYPICAL OVERALL NOISE FIGURE AS A FUNCTION OF RECTIFIED CURRENT



TYPICAL I, F. IMPEDANCE AS A FUNCTION OF RECTIFIED CURRENT

MICROWAVE DETECTOR DIODE

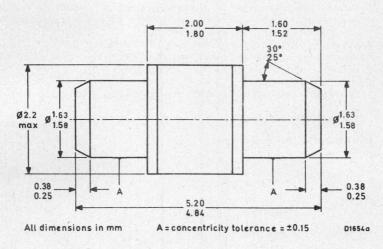
A reversible silicon Schottky barrier diode with excellent sensitivity and very low $\frac{1}{f}$ noise. It conforms to the environmental requirements of BS9300 where applicable.

The metal ceramic case is hermetically sealed.

	QUICK REFERENCE DATA	A	
Sts	Tangential sensitivity (typ.)	-54	dBm
$\frac{1}{6}$	noise (typ.)	10	dB

OUTLINE AND DIMENSIONS

M.Q.M.

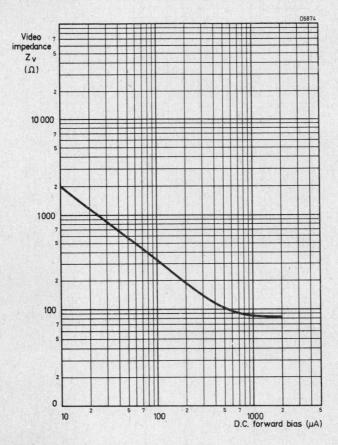


Terminal identification: red end indicates cathode

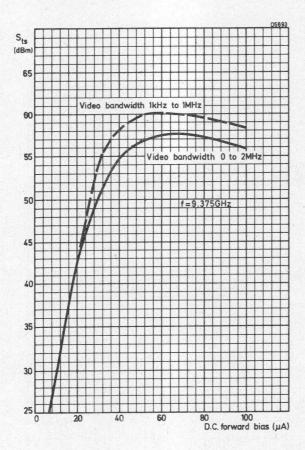
Electrical

Ma	eximum burn out (see note 1)		18 0.	18	nJ erg
Temp	erature				
T.	tg range		-55 to -	+150	°C
	mb range	~-55 to +150		°C	
ELECTRICA	AL CHARACTERISTICS $(T_{amb} = 25^{\circ}C)$				
		Min.	Тур.	Max.	
Sts	tangential sensitivity (see note 2)	-52	-54	-58	dBm
$\frac{1}{f}$	noise (see note 3)		10	15	dB
z _v	video impedance (see note 4)	- 1	500		Ω

- 1. Burn out is defined as the r.f. pulse energy necessary to cause 1dB degradation in noise figure when the diode is subjected to 2×10^8 pulses of 2ns width.
- 2. Video bandwidth 0 to 2MHz, $50\mu A$ bias, f = 9.375GHz. BS9322/1411. (A2dBm improvement in tangential sensitivity may be obtained by limiting the bandwidth to 1kHz to 1MHz).
- 3. Measured at 30 μ A bias, f = 1kHz, 50Hz bandwidth. $\frac{1}{f}$ noise is unchanged with values of bias up to 150 μ A.
- 4. Measured at 50μA forward bias.



VIDEO IMPEDANCE AS A FUNCTION OF D.C. FORWARD BIAS



TANGENTIAL SENSITIVITY AS A FUNCTION OF D.C. FORWARD BIAS

MICROWAVE MIXER DIODES

BAW95D BAW95E BAW95F BAW95G

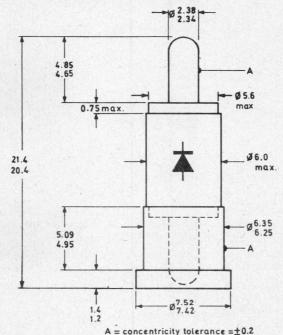
A range of silicon Schottky barrier mixer diodes in reversible cartridge outline. The diodes are suitable as replacements for the 1N23 and 1N415 series and conform to the environmental requirements of BS9300 where applicable.

QUICK REFE	ERENCE DATA	
Maximum noise figure at X-band		
BAW95D	8. 2	dE
BAW95E	7.5	dE
BAW95F	7.0	dE
BAW95G	6.5	dE

Unless otherwise stated, data is applicable to all types

OUTLINE AND DIMENSIONS

Compatible with J.E.D.E.C. DO-22 with collet Compatible with J.E.D.E.C. DO-23 without collet



All dimensions in mm.

D4868

Terminal identification: Diode symbol indicates polarity.

LIMITING VALUES (Absolute max. rating system)

Electrical

Maximum peak pulse power (at 9.37	5 GHz, 0.5 μs pulse lengt	th)	1.0	W
Maximum burn out 1)			20 0.2	nJ erg
Temperature				
T _{stg} range		-55 to	+150	°C
T _{amb} range		-55 to	+150	°C
ELECTRICAL CHARACTERISTICS	$T_{amb} = 25$ °C			
	Min.	Тур.	Max.	
No Noise figure 2)				
BAW95D		7.8	8.2	dB
BAW95E		7.2	7.5	dB
RAW95F		6.8	7.0	dB

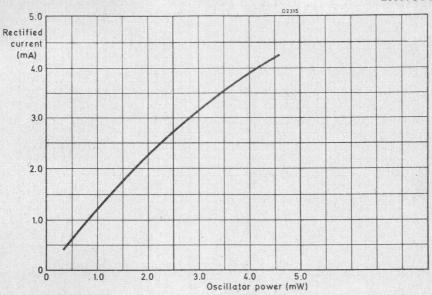
BAW 95F
BAW 95G
BAW 9

 $^{^1)}$ Burn out is defined as the r.f. pulse energy necessary to cause 1 dB degradation in noise figure when the diode is subjected to 2 $\times\,10^8$ pulses of 2 ns width

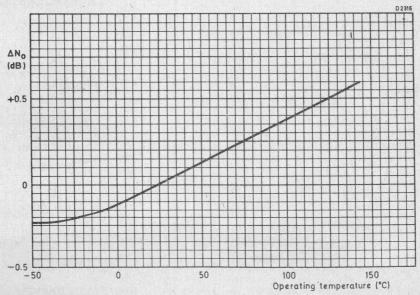
²) Measured at 9.375 GHz, 1 mA rectified current, R $_{\rm L}$ = 15 $_{\rm N}$. N $_{\rm O}$ includes N $_{\rm if}$ = 1.5 dB with 45 MHz intermediate frequency. BS9321/1406

³⁾ With respect to JAN-106 holder measured at 9.375 GHz, 1 mA rectified current, R $_{\rm L}=15~\Omega_{\star}$ BS9321/1409

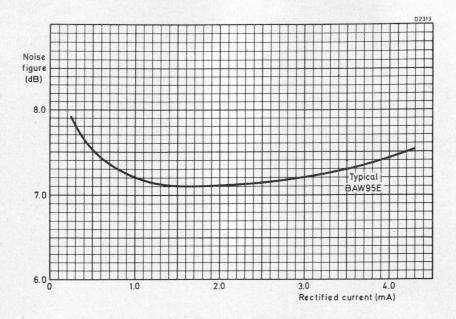
 $^{^4)}$ Measured at 9.375 GHz. 1 mA rectified current, R $_{\rm L}$ = 15 Ω with 45 MHz intermediate frequency. BS9321/1405



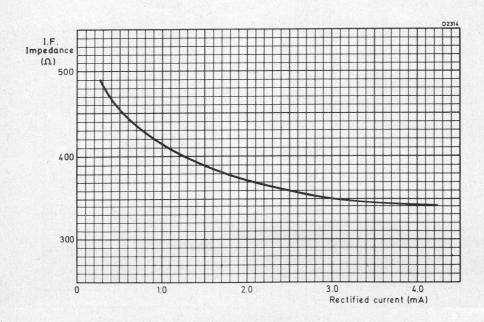
TYPICAL RECTIFIED CURRENT AS A FUNCTION OF LOCAL OSCILLATOR POWER



TYPICAL CHANGE IN NOISE FIGURE WITH TEMPERATURE



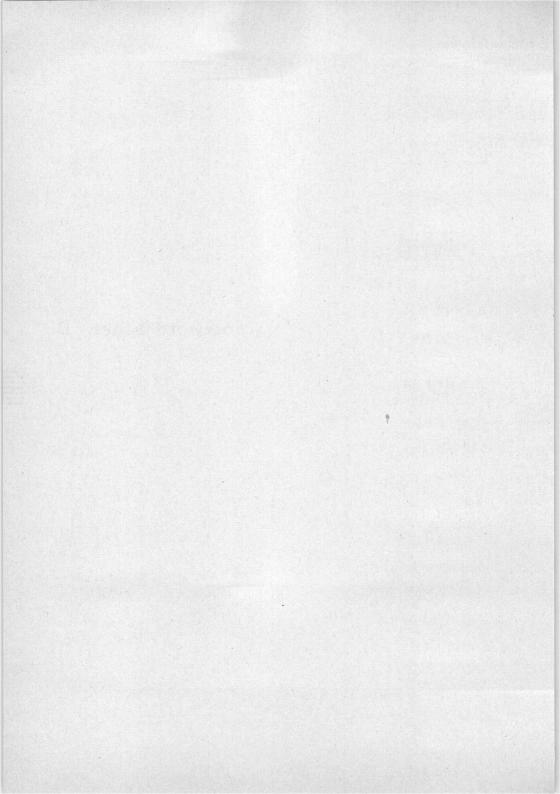
TYPICAL NOISE FIGURE AS A FUNCTION OF RECTIFIED CURRENT



TYPICAL DEPENDENCE OF I, F. IMPEDANCE ON RECTIFIED CURRENT

Backward diodes D



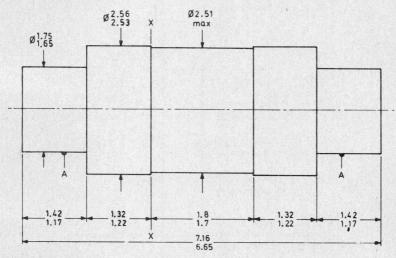


MICROWAVE DETECTOR DIODE

Sub-miniature germanium bonded backward diode primarily intended for broadband low level detector applications at X-band. It conforms to the environmental requirements of BS9 300 where applicable.

QUICK REFEREN	CE DATA	
Frequency range	1 to 18	GHz
Typ. zero bias tangential		
sensitivity in X-band	-53	dBm

OUTLINE AND DIMENSIONS



XX = reference plane

All dimensions in mm

D2527a

 $AA = concentricity tolerance = \pm 0.15$

TERMINAL IDENTIFICATION

The AEY17 is colour coded according to K1007 Issue 3, Section 1.3.4.4.

That is: the positive end (cathode) is marked red and the negative end (anode is marked blue.

The positive end indicates the electrode which becomes positive in an a.c. rectifier circuit.

JUNE 1977 AEY17 Page 1

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

Temperature

T _{stg} max.	150	°C
T _{stg} min.	-55	°C
Tamb max.	150	°C
Tamb min.	-55	$^{\rm o}{}_{\rm C}$

ELEC

(see note 4)

CTRICAL CH	ARACTERISTICS $(T_{amb} = 25^{\circ}C)$				
		Min.	Typ.	Max.	
Static					
I_{R}	Reverse current				
	$V_R = 0.3V$, y .	100	i -	μΑ
I	Forward current				
	$V_F = 0.3V$		12	-	mA
Dynamic					
S _{ts}	Tangential sensitivity (see note 1)	-	-53	-	dBm
M	Figure of merit				
	(see note 2)	120	-	, -	
z	Video impedance				
. '	(see note 3)	-	300	-	Ω
v.s.w.r.	Voltage standing wave ratio	-		5:1	

Notes:

- 1. Measured at 9.375GHz, zero bias, video bandwidth = 1.0MHz. K1007 Issue 3, Section 8B.4.3.
- 2. Measured at 9.375GHz, M is taken as the product of current sensitivity expressed in μA per μW , and the square root of video impedance in ohms. K1007 Issue 3, Section 8B.4.2.
- 3. Zero bias, input 1.0mV max. (d.c. or a.c. r.m.s.). K1007 Issue 3, Section 8B.4.8.
- 4. With respect to 50Ω , measured at f = 9.375 GHz, zero bias and c.w. input power less than 1.0 µW. The nominal rectifier admittance at a reference plane X-Xtaken at the end faces of the ceramic insulator (see outline drawing on page 1) is:

$$(2.0 - j 2.0) \frac{1}{50}$$
 mho

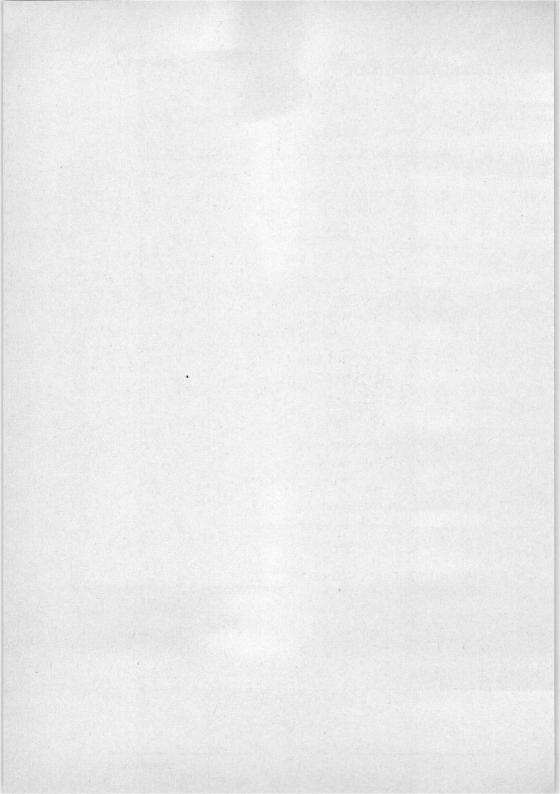
MICROWAVE DETECTOR DIODE

AEY17

APPLICATION INFORMATION FOR AEY17

1.	Detector	performance	at	other	than	Test	Radio	Frequency	
----	----------	-------------	----	-------	------	------	-------	-----------	--

			Min.	Typ.	Max.	
	Sts	Tangential sensitity				
	LO	f=1.0 to 18GHz, $B=1.0$ MHz	-	-53	-	dBm
	v.s.w.r.	Voltage standing wave ratio				
		$f=1.0 \text{ to } 18\text{GHz}, Z_0=50\Omega$		-	5:1	
2.	Mixer per	rformance (I.F.=45MHz)				
	No	Measured overall noise figure				
		$f = 9.375 \text{GHz}, N_{if} = 1.5 \text{dB}$				
		$P_{L.O.} = 200 \mu W, I_{out} = 1.0 \text{mA}$	- /	9.0	-	dB
		$f = 16.5 GHz, N_{if} = 1.5 dB$				
		$P_{L.O.} = 200 \mu W, I_{out} = 1.0 \text{mA}$	-	9.5	- 11	dB
	z _{if}	I.F. impedance				
		I _{out} =1.0mA	-	130	-	Ω
	v.s.w.r.	Voltage standing wave ratio				
		$f=1 \text{ to } 18\text{GHz}, Z_0 = 50\Omega$				
		I _{out} =1.0mA	-	-	2.5:1	
3.	Doppler n	mixer performance (I.F. = 3kHz)				
	No	Measured overall noise figure				
		$f = 9.375 \text{GHz}, N_{if} = 2.0 \text{dB}$		18	-	dB

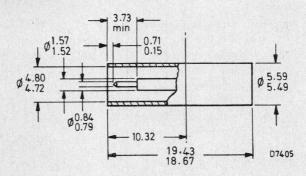


Germanium bonded backward diodes primarily intended for low level detector applications at J-band (Ku band). The AEY29 and AEY29R are packaged in the standard coaxial outline for this frequency band, similar to 1N78 types. The encapsulation is hermetically sealed and the devices conform to the environmental requirements of BS9300 where applicable.

QUICK REFERENCE DATA		
Frequency range	12 to 18	GHz
Typ. zero bias tangential sensitivity at J-band	-53	dBm

Unless otherwise stated, data is applicable to both types

OUTLINE AND DIMENSIONS



Dimensions in mm

TERMINAL IDENTIFICATION

AEY29	Pin	cathode
	Body (red)	anode

AEY29R Pin anode Body (green) cathode

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

Temperature

T _{stg} min.	-55	oC
T _{stg} max.	100	°C
T _{amb} min.	-55	°C
Tamb max.	100	oC

ELECTRICAL CHARACTERISTICS $(T_{amb} = 25^{\circ}C)$

Static		Min.	Тур.	Max.	
$^{\mathrm{I}}\mathrm{_{R}}$	Reverse current V _R =0.3V	_	100	-	μΑ
$^{\mathrm{I}}\mathrm{_{F}}$	Forward current $V_F = 0.3V$		12		mA
Dynamic					
S _{ts}	Tangential sensitivity (see note 1)	-	-53	-	dBm
M	Figure of merit (see note 2)	50	-		
z _v	Video impedance (see note 3)	- 1	300	-	Ω
v.s.w.r.	Voltage standing wave ratio (see note 4)	-	-,	5:1	

Notes:

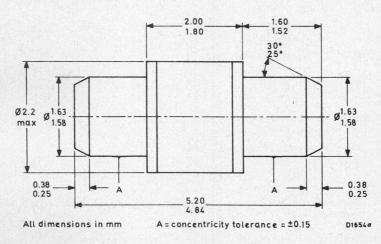
- Measured at 16.5GHz in JAN201 holder, zero bias, 1.0MHz video bandwidth. (K1007 Issue 3, Section 8B.4.3.).
- 2. Measured at 16.5GHz in JAN201 holder, M is taken as the product of current sensitivity expressed in μ A per μ W, and the square root of video impedance in ohms. (K1007 Issue 3, Section 8B.4.2.).
- Zero bias, input 1.0mV max. (d.c. or a.c. r.m.s.). (K1007 Issue 3, Section 8B.4.8.).
- 4. With respect to JAN201 holder, measured at f = 16.5GHz, zero bias and c.w. input power less than 1.0 μ W.

Sub-miniature germanium bonded backward diodes primarily intended for broadband low level detector applications at X-band. It conforms to the environmental requirements of BS9300 where applicable.

QUICK REFER	ENCE DATA	
Frequency range	1 to 18	GHz
Typ. zero bias tangential sensitivity at X-band		
AEY31	-53	dBm
AEY31A	-50	dBm

Unless otherwise stated, data is applicable to both types

OUTLINE AND DIMENSIONS



TERMINAL IDENTIFICATION

The AEY31 and AEY31A are colour coded according to K1007 Issue 3, Section 1. 3. 4. 4. That is: the positive end (cathode) is marked red and the negative end (anode) is marked blue.

The positive end indicates the electrode which becomes positive in an a.c. rectifier circuit.

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

Temperature

T _{stg} max.	150	°C
T _{stg} max. T _{stg} min. T _{amb} max.	-55	°c
T max.	150	°c
Tamb min.	-55	°C

ELECT

T _{amb} ma	ix.		15	50	°C
T _{amb} mi		-55		55	°c
CTRICAL CH	ARACTERISTICS (T _{amb} = 25°C)				
		Min.	Typ.	Max.	
Static					
IR	Reverse current				
	$V_R = 0.3V$	- 1	100	2	μΑ
I _F	Forward current				
	$V_{F} = 0.3V$	-	12	-	mA
Dynamic					
Sts	Tangential sensitivity (see note 1)				
	AEY31 AEY31A		-53 -50	-	dBm dBm
M	Figure of merit (see note 2)				
	AEY31	120	-	-	
	AEY31A	50	- 5	- 1	
z_v	Video impedance (see note 3)	_	300	_	Ω
v.s.w.r.	Voltage standing wave ratio				
	(see note 4)	-		5:1	

Notes:

- 1. Measured at 9.375GHz, zero bias, video bandwidth = 1.0MHz. K1007 Issue 3, Section 8B.4.3.
- 2. Measured at 9.375GHz, M is taken as the product of current sensitivity expressed in μA per μW , and the square root of video impedance in ohms. K1007 Issue 3, Section 8B.4.2.
- 3. Zero bias, input 1.0mV max. (d.c. or a.c. r.m.s.). K1007 Issue 3, Section 8B.4.8.
- 4. With respect to 50Ω , measured at f = 9.375GHz, zero bias and c.w. input power less than 1.0 µW. The nominal rectifier admittance at a reference plane X-X taken at the end faces of the ceramic insulator (see outline drawing on page 1) is:

$$(2.0 - j 2.0) \frac{1}{50}$$
 mho

MICROWAVE DETECTOR DIODES

AEY31A

APPLICATION INFORMATION FOR AEY31 AND AEY31A

1. Detector performance at other than Test Radio Frequency

Sts	Tangential sensitivity				
	f = 1.0 to 18GHz, B = 1.0 MHz				
	AEY31	-	-53	- 1	dBm
	AEY31A	-	-50	-	dBm
v.s.w	.r. Voltage standing wave ratio				
	$f=1.0$ to 18GHz, $Z_0 = 50\Omega$	-	-	5:1	
2. Mixer	performance (I.F.=45MHz)				
N _o	Measured overall noise figure				
	$f = 9.375GHz$, $N_{if} = 1.5dB$				

Min.

Typ.

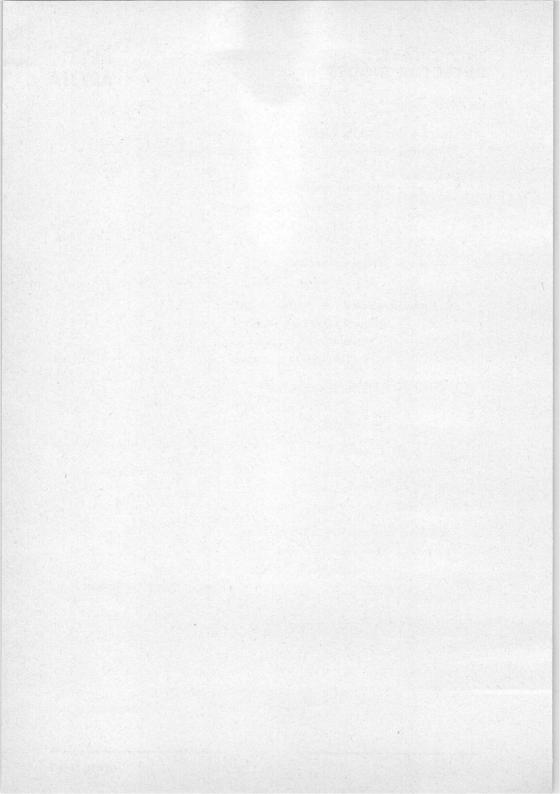
Max.

$f = 9.375GHz$, $N_{if} = 1.5dB$				
$P_{L.O.} = 200 \mu W, I_{out} = 1.0 \text{mA}$	-	9.0	-	dB
$f=16.5GHz$, $N_{if}=1.5dB$				
$P_{L.O.} = 200 \mu A, I_{out} = 1.0 mA$	-	9.5	-	dB
I.F. impedance				
$I_{out} = 1.0 \text{mA}$	-	130	-	Ω
	$P_{L.O.} = 200 \mu W, I_{out} = 1.0 mA$ $f = 16.5 GHz, N_{if} = 1.5 dB$ $P_{L.O.} = 200 \mu A, I_{out} = 1.0 mA$ I.F. impedance	$P_{L.O.} = 200 \mu W, I_{out} = 1.0 mA$ - $f = 16.5 GHz, N_{if} = 1.5 dB$ $P_{L.O.} = 200 \mu A, I_{out} = 1.0 mA$ - I.F. impedance	$P_{L.O.} = 200 \mu W, I_{out} = 1.0 mA$ - 9.0 $f = 16.5 GHz, N_{if} = 1.5 dB$ $P_{L.O.} = 200 \mu A, I_{out} = 1.0 mA$ - 9.5 I.F. impedance	$P_{L.O.} = 200 \mu W$, $I_{out} = 1.0 mA$ - 9.0 - $f = 16.5 GHz$, $N_{if} = 1.5 dB$ $P_{L.O.} = 200 \mu A$, $I_{out} = 1.0 mA$ - 9.5 - I.F. impedance

out			
v.s.w.r. Voltage standing wave ratio			
$f=1 \text{ to } 18\text{GHz}, Z_0 = 50\Omega$			
I _{out} =1.0mA	-	-	2.5:1

3. Doppler mixer performance (I.F. = 3kHz)

N	Measured overall noise figure				
	$f = 9.375GHz$, $N_{cs} = 2.0dB$	-	18	-	dB



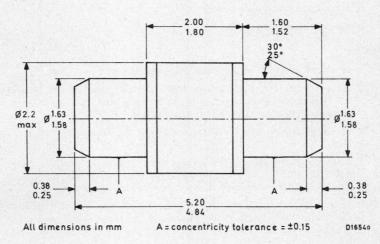
MICROWAVE DETECTOR DIODE

Sub-miniature germanium bonded backward diode primarily intended for broadband low level detector applications in K-band and in Q-band (Ka-band). It conforms to the environmental requirements of BS9300 where applicable.

QUICK REFERE	ENCE DATA	
Frequency range	18 to 40	GHz
Zero bias current sensitivity		
in the band 18 to 40 GHz (typ.)	2.0	$\mu A/\mu W$

OUTLINE AND DIMENSIONS

M.Q.M.



Terminal identification: red end indicates Cathode

JUNE 1977 AEY 32 Page 1

POLARITY IDENTIFICATION

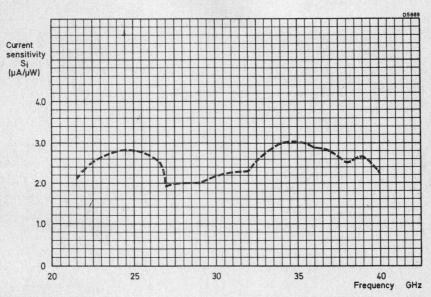
The positive end (cathode) is marked red and the negative end (anode) is marked blue. The positive end indicates the electrode which becomes positive in an a.c. rectifier circuit.

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

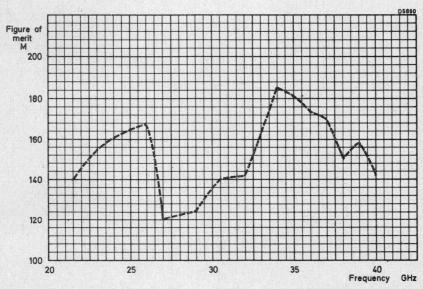
0 p.p.s.)		40	mW
	-55 to	+100	°C
	-55 to	+100	°C
Min.	Тур.	Max.	
-	-	7.0	dB
	-	5: 1	
3.0	- 4	5.0	kΩ
-	2.0	-	$\mu A/\mu W$
50	-	-	
	Min 3.0 -	-55 to -55 to Min. Typ 3.0 - 2.0	-55 to +100 -55 to +100 Min. Typ. Max. 7.0 5: 1 3.0 - 5: 0 - 2.0 -

NOTES

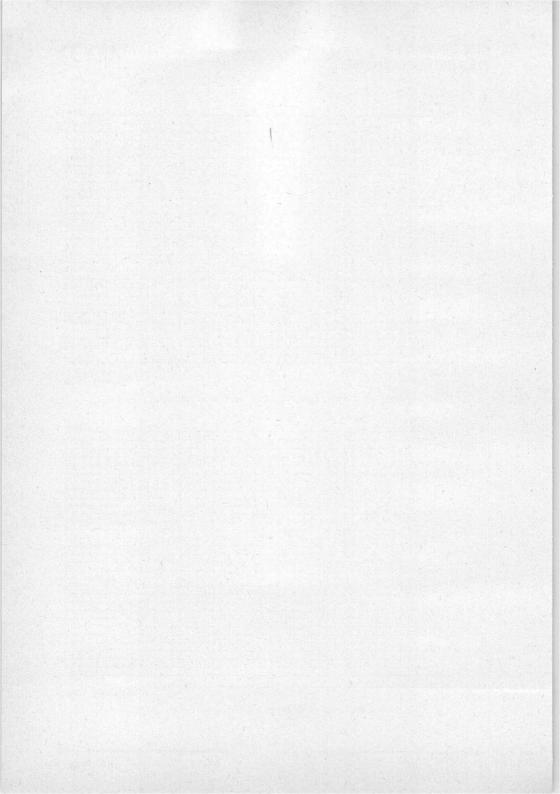
- 1. Measured at an i.f. of 1kHz with 50Hz bandwidth and zero bias.
- 2. Measured in a Q-band broadband mount (Mullard specification 7313-731-0091). The v.s.w.r. measurement is swept over the band 26.5 to 40GHz at a power level not exceeding $100\mu W$ and with zero bias.
- Measured at an i.f. of 1.6kHz with an input not exceeding 1mV and with zero bias.
- 4. Measured in the same mount as described in note 2 at frequencies of 27GHz, 34GHz and 40GHz, with an input power not exceeding $1\mu W$ and with zero bias. Rectified current measured by a microammeter of resistance less than 10Ω .
- 5. Measured at frequencies of 27GHz, 34GHz and 40GHz. M is the product of current sensitivity expressed in $\mu A/\mu W$ and square root of the video impedance expressed in ohms.



Typical current sensitivity as a function of frequency



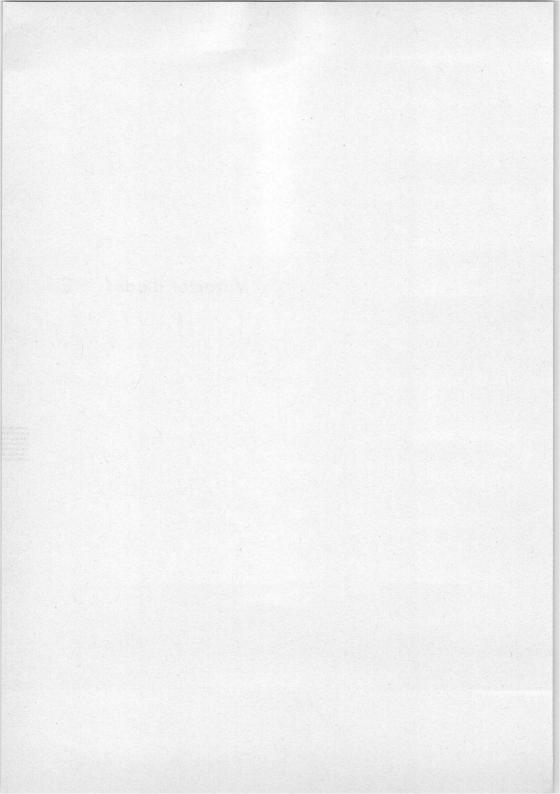
Typical figure of merit as a function of frequency



Varactor diodes



E



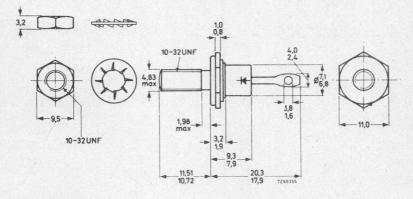
Silicon planar epitaxial varactor diode for use as a high efficiency frequency multiplier in the v.h.f. and u.h.f. bands. As a tripler from 150 to 450 MHz it has a typical efficiency of 64% and can handle inputs up to 40 W. The BAY96 has a very low series resistance and is packaged in a low inductance, hermetically sealed, welded ceramic-metal envelope, DO-4 with stud cathode. It conforms to the environmental requirements of BS9 300 where applicable.

QUICK REFERENCE	E DATA	
V _R max.	120	V
Ptot max.	20	W
T _j max.	175	°C
$C_T(V_R = 6.0 \text{ V, } f = 1.0 \text{ MHz})$	28 to 39	pF
R_{S} max. (V_{R} = 6.0 V, f = 400 MHz)	1.2	Ω
$f_{co} = \frac{1}{2\pi R_s \cdot C_T}$ at $V_R = 120 \text{ V typ.}$	25	GHz

MECHANICAL DATA

Dimensions in mm

Conforming to J. E.D. E.C. DO-4



RATINGS

Limiting values of	operation	according to the	e absolute	maximum	system.
--------------------	-----------	------------------	------------	---------	---------

Electrical

V _R max.	120	v
P_{tot} max. $(T_{mb} = 25$ °C)	20	w

Temperature

T _{stg} min.	-65	°C
T _{stg} max.	175	°C
T _j max. (operating)	175	°C

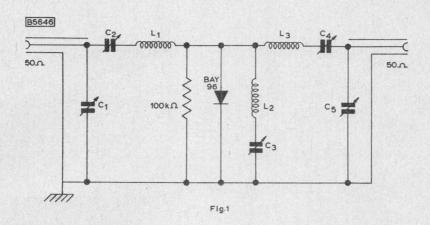
THERMAL CHARACTERISTIC

R _{th j-mb}	7.5	°C/W
Ath j-mb		

ELECTRICAL CHARACTERISTICS

		Min.	Тур.	Max.	
$C_{\mathbf{T}}$	Total capacitance				
	$V_{R} = 6.0 \text{ V}, f = 1.0 \text{ MHz}$	28	•	39	pF
Rs	Series resistance				
	V_R = 6.0 V, f = 400 MHz		0.9	1.2	Ω
fco	Cut-off frequency				
	$V_R = 120 V$				
	1		25	-	GHz
	$2\pi R_{c} \cdot C_{T}$				

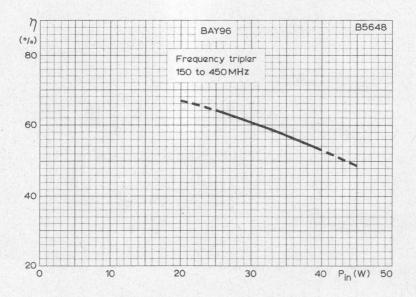
APPLICATION INFORMATION
TYPICAL OPERATING CHARACTERISTICS AS A FREQUENCY TRIPLER



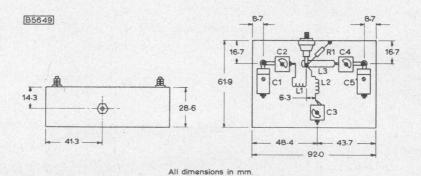
Frequency tripler circuit - 150 to 450 MHz

$$\begin{split} &\mathbf{L_1} = 6.5 \text{ turns } 18 \text{ s.w.g. wire } 0.297 \text{"I.D. } 0.562 \text{"long} \\ &\mathbf{L_2} = 2 \text{ turns } 14 \text{ s.w.g. wire } 0.266 \text{"I.D. } 0.312 \text{"long} \\ &\mathbf{L_3} = 1 \text{"} \times 0.25 \text{"} \times 0.020 \text{"copper strip } 0.562 \text{"from chassis} \\ &\mathbf{C_1} = 7.0 - 100 \text{pF variable} \\ &\mathbf{C_2} \ , \mathbf{C_3} \ , \mathbf{C_4} = 2.0 - 13 \text{pF variable} \\ &\mathbf{C_5} = 2.0 - 25 \text{pF variable} \end{split}$$

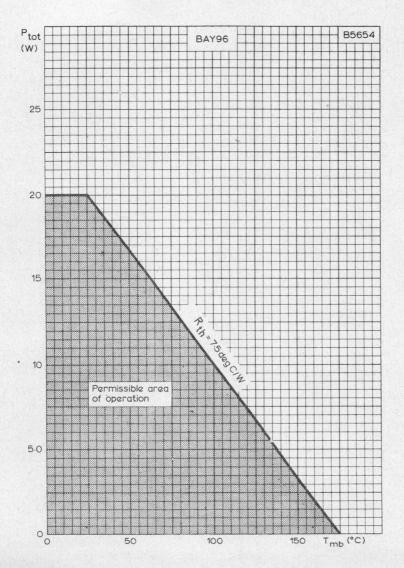
		Min.	Тур.	
η	Efficiency			
	$P_{in} = 25W, f_{in} = 150 \text{ MHz}$	60	64	%



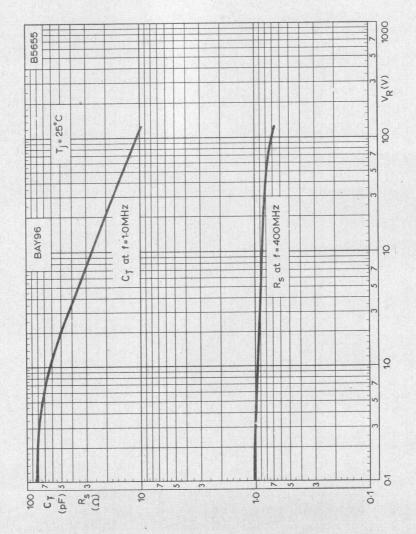
TYPICAL TRIPLER EFFICIENCY PLOTTED AGAINST INPUT POWER See circuit on page 3



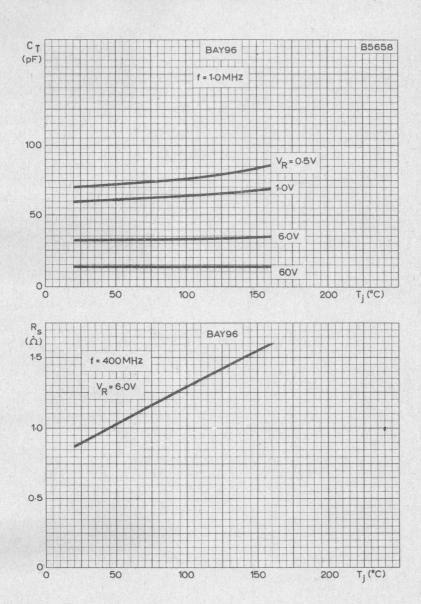
COMPONENT LAYOUT OF TRIPLER CIRCUIT



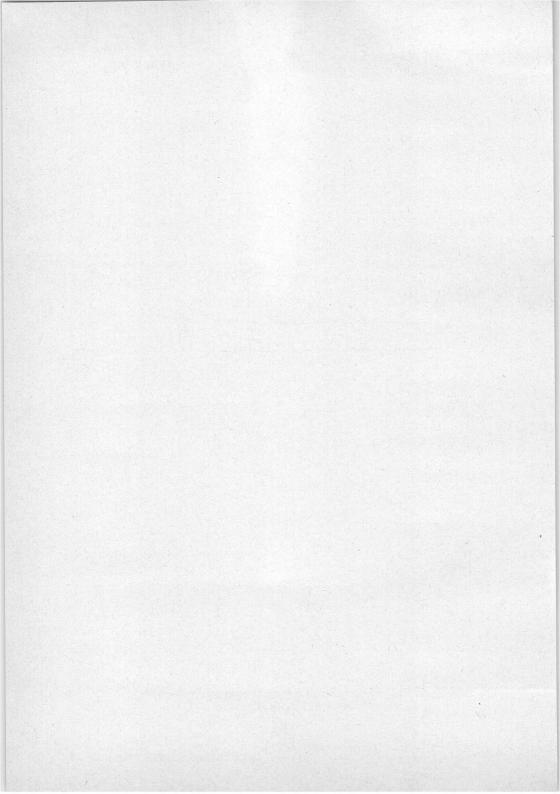
TOTAL DISSIPATION PLOTTED AGAINST MOUNTING BASE TEMPERATURE



TYPICAL DIODE CAPACITANCE AND SERIES RESISTANCE PLOTTED AGAINST REVERSE VOLTAGE



TYPICAL DIODE CAPACITANCE AND SERIES RESISTANCE PLOTTED AGAINST JUNCTION TEMPERATURE



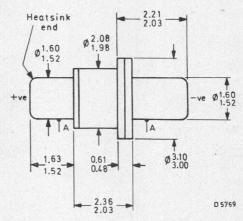
SILICON PLANAR EPITAXIAL VARACTOR DIODE

Silicon planar epitaxial varactor diode exhibiting step recovery characteristics, especially suitable for use in frequency multiplier circuits up to 'S' band output frequency.

It is a diffused silicon device and is mounted in a small double-ended ceramic-metal case with hermetic seal and conforms to the environmental requirements of BS9 300 where applicable.

QUICK REFERENCE DAT	A	
Operation as a frequency doubler 1 to 2 GHz in a ty	pical circuit.	
P _{in}	10	w
Pout	5.0	W
Resistive cut-off frequency typ. $(V_R = 6.0 V)$	100	GHz
Total capacitance typ. $(V_R = 6.0 \text{ V})$	4.5	pF
T _i max.	150	°C

OUTLINE AND DIMENSIONS

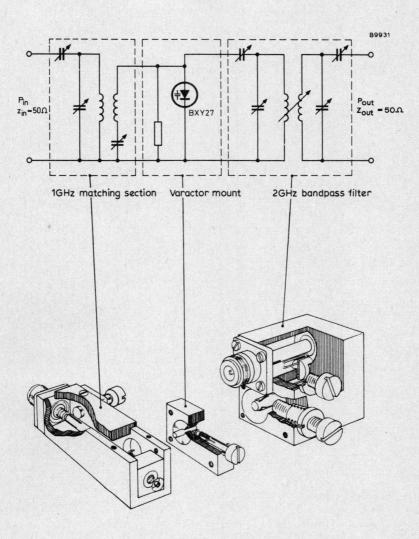


A = concentricity tolerance = ± 0.13

All dimensions in mm

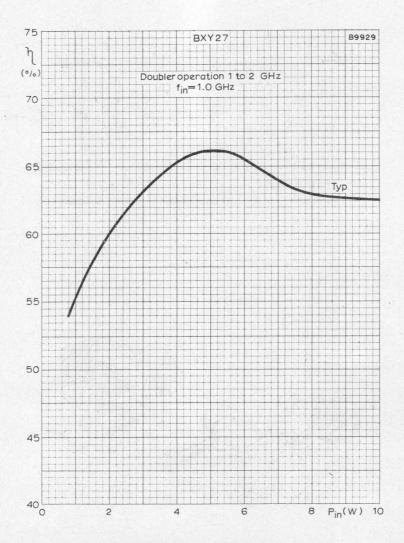
RATINGS (ABSOLUTE MAXIMUM SYSTEM)

I	Electrical					
	V _R max.				55	V
	P _{tot} max.	R.F., T _{pin} ≤70°C			4.0	W
		T _{pin} > 70°C, derating fa	ctor		50	mW/degC
7	Cemperature					
	Tstg min.				-55	°C
	T max				150	°C
	T max.				150	°C
THER	MAL CHARA	CTERISTIC				
I	th j-pin ma	ax.			20	degC/W
ELECT	TRICAL CHA	ARACTERISTICS (T _{amb} = 25°C)				
			Min.	Typ.	Max.	
7	(BR)R	Reverse breakdown voltage	55	70	-	v
I	R	Reverse current V _R =6.0V	-	0.001	1.0	μΑ
f	co	Cut-off frequency $\frac{1}{2\pi r_s C_i}$				
		V _R =6.0V	50	100	- \	GHz
(Т	Total capacitance (C _i + C _s)				
		$V_{R} = 6.0V, f = 1.0MHz$	3.0	4.5	6.0	pF
(s	Stray capacitance	-	0.25	-	pF
I	s	Series inductance	-	650	-	pH
r	s	Series resistance $V_R = 6.0V$	-	0.4	-2	Ω
η	1	Overall efficiency P _{in} = 10W, f _{in} = 1.0GHz				
		frequency doubler	50	60	-	'%
		frequency trebler	-	40	-	%



APPLICATION INFORMATION
FREQUENCY DOUBLER CIRCUIT (1 to 2GHz)

TIVE



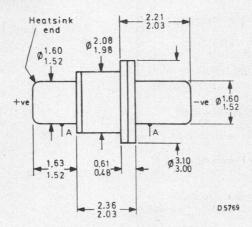
OVERALL EFFICIENCY PLOTTED AGAINST INPUT POWER FOR DOUBLER OPERATION

Silicon planar epitaxial varactor diode exhibiting step recovery characteristics, especially suitable for use in frequency multiplier circuits up to C-band output frequency.

It is a diffused silicon device and is mounted in a small double-ended ceramic-metal case with hermetic seal and conforms to the environmental requirements of BS9300 where applicable.

QUICK REFERENCE DAT	ГА	
Operation as a frequency doubler 2 to 4 GHz in a t	ypical circuit.	
P _{in}	7.0	W
Pout	3.5	W
Resistive cut-off frequency typ. $(V_R = 6.0 \text{ V})$	120	GHz
Total capacitance typ. $(V_R = 6.0 \text{ V})$	1.5	pF
T _i max.	150	°C

OUTLINE AND DIMENSIONS

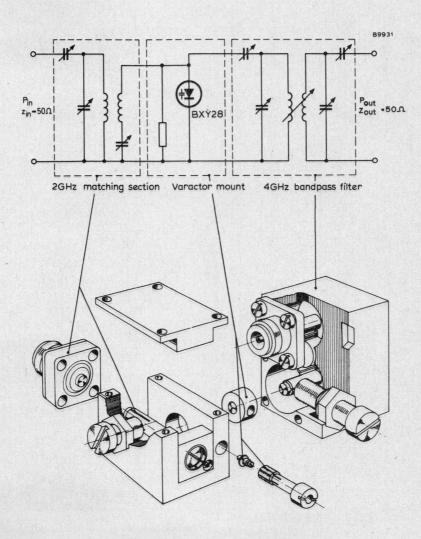


A = concentricity tolerance = ± 0.13

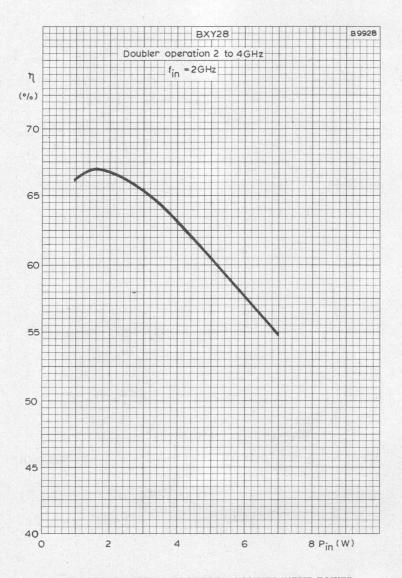
All dimensions in mm .

25.00				
701	ec	4	00	٠1
-			CZ	11

Electrical					
V _R max.				45	v
	$R.F.,T_{pin} \le 70^{\circ}C$			2.7	w
	T _{pin} > 70°C, derating fa	ctor		34	mW/degC
Temperatur	·e				
T _{stg} min				-55	°C
T _{stg} max				150	°C
T max.				150	°C
THERMAL CHAR	ACTERISTIC				
R _{th j-pin} n	nax.			30	degC/W
ELECTRICAL CH	(ARACTERISTICS ($T_{amb} = 25^{\circ}C$)				
		Min.	Typ.	Max.	
V _{(BR)R}	Reverse breakdown voltage	45	60	-	v
$I_{\mathbf{R}}$	Reverse current		0.001	1.0	
	$V_R = 6.0V$		0.001	1.0	μΑ
fco	Cut-off frequency $\frac{1}{2\pi r_s C_j}$				
	$V_R = 6.0V$	80	120	-	GHz
c _T	Total capacitance (C _i + C _s)				
	$V_{R} = 6.0V, f = 1.0MHz$	1.0	1.5	2.5	pF
Cs	Stray capacitance	-	0.25	-	pF
Ls	Series inductance	-	650	-	pH
rs	Series resistance		1.0		Ω
	$V_R = 6.0V$		1.0		
η	Overall efficiency P = 7 0W f = 2 0GHz				
	P _{in} = 7.0W, f _{in} = 2.0GHz frequency doubler	50	Sec.		. %
	riequency doubter	00			70



APPLICATION INFORMATION FREQUENCY DOUBLER CIRCUIT (2 to 4GHz)



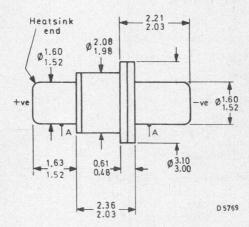
OVERALL EFFICIENCY PLOTTED AGAINST INPUT POWER FOR DOUBLER OPERATION

Silicon planar epitaxial varactor diode exhibiting step recovery characteristics, especially suitable for high order frequency multiplier circuits up to X-band output frequency.

It is a diffused silicon device and is mounted in a small double-ended ceramic-metal case with hermetic seal and conforms to the environmental requirements of BS9300 where applicable.

QUICK REFERENCE DAT	'A	
Operation as a frequency quadrupler 2.25 GHz to	0.0 GHz in a typi	cal circuit:
P _{in}	1.0	W
Pout	0.3	W
Resistive cut-off frequency typ. $(V_R = 6.0 \text{ V})$	120	GHz
Total capacitance typ. $(V_R = 6.0 \text{ V})$	1.0	pF
T _j max.	150	°C

OUTLINE AND DIMENSIONS



A = concentricity tolerance = ± 0.13

All dimensions in mm

El	ec	tri	cal
131	.00	PTT	Cal

V _R max.	25	V
P_{tot} max. R.F. $(T_{pin} \le 70^{\circ}C)$	2.0	w
Temperature		
T _{stg} min.	-55	°C
T _{stg} max.	+150	°C
T, max.	+150	°C

THERMAL CHARACTERISTIC

R _{th j-pin max.}	. 40	degC/W
th j-pin max.	40	,

ELECTRICAL CHARACTERISTICS $(T_{amb} = 25^{\circ}C)$

		Min.	Typ.	Max.	
V _{(BR)R}	Reverse breakdown voltage $(I_R = 1.0 \text{mA})$	25	- 1 - 1	-	v
I _R	Reverse current (V _R =6.0V)	-	0.001	1.0	μА
fco	Cut-off frequency (V _R =6.0V) (see note)	90	120	190	GHz
CT	Total capacitance (C _i + C _s)				
	$(V_R = 6.0V, f = 1.0MHz)$	0.8	1.0	1.5	pF
Cs	Stray capacitance	-	0.25	-	pF
Ls	Series inductance	-	650		pН
η	Overall efficiency P _{in} =1.0W, f _{in} =2.25GHz				
	frequency quadrupler	30	-	-	%

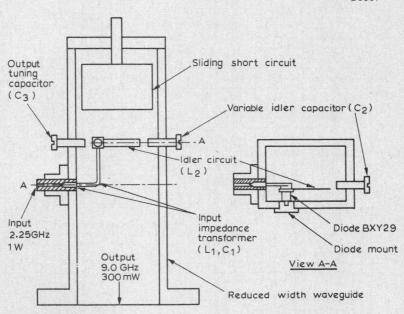
Note. The cut-off frequency f_{co} is defined as:

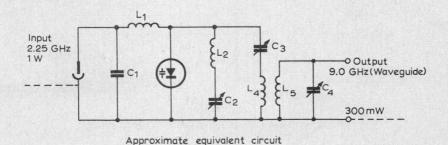
$$f_{co} = \frac{1}{2\pi r_s C_j}$$

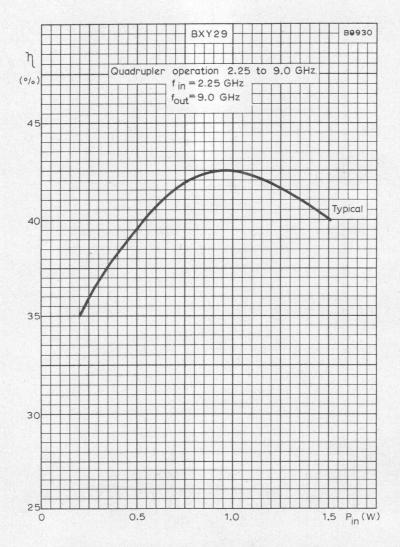
Where, \mathbf{C}_j is the junction capacitance and is measured at 1.0MHz \mathbf{r}_S is measured on a slotted line at 2.0GHz.

S-X BAND QUADRUPLER

B9937







OVERALL EFFICIENCY PLOTTED AGAINST INPUT POWER FOR QUADRUPLER OPERATION

SILICON PLANAR EPITAXIAL VARACTOR DIODE

Silicon planar epitaxial varactor diode exhibiting step recovery characteristics, especially suitable for high order frequency multiplier circuits up to X-band output frequency.

It is a diffused silicon device and is mounted in a small double-ended ceramic-metal case with hermetic seal and conforms to the environmental requirements of BS9300 where applicable.

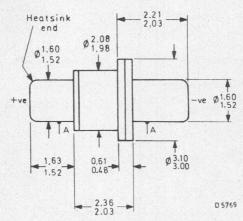
QUICK REFERENCE DATA

Operation as a high order frequency multiplier 1.0 GHz to 10 GHz in a typical circuit: -

500	mW
20	mW
150	GHz
0.75	pF
150	°C
	20 150 0.75

OUTLINE AND DIMENSIONS

RT



A = concentricity tolerance = ± 0.13

All dimensions in mm

Electrical

V_R max.	20	V
P_{tot} max. R.F. $(T_{pin} \le 70^{\circ}C)$	1.6	W
Temperature		
T _{stg} min.	-55	°C
T max.	+150	°C
508		

+150

THERMAL CHARACTERISTIC

T max.

R _{th j-pin}	max.			50	degC/W
tii j-piii					

ELECTRICAL CHARACTERISTICS ($T_{amb} = 25^{\circ}C$)

		Min.	Typ.	Max.	
V _{(BR)R}	Reverse breakdown voltage $(I_R = 1.0 \mathrm{mA})$	20	- '	-	v.
IR	Reverse current (V _R =6.0V)	11 () 1 2 1 1 1 2 1 1 1 1	0.001	1.0	μΑ
fco	Cut-off frequency (V _R =6.0V) (see note)	100	150	-	GHz
$C_{\mathbf{T}}$	Total capacitance (C _i + C _s)				
	$(V_R = 6.0V, f = 1.0 MHz)$	0.5	0.75	1.0	pF
C	Stray capacitance	-	0.25	-	pF
L	Series inductance		650	-	pH
t _t	Transition time	-	-	150	ps
τ_	Life time		50	-	ns

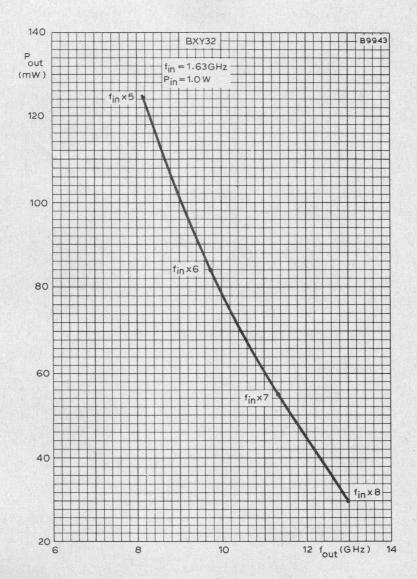
Note. The cut-off frequency $\boldsymbol{f}_{\text{co}}$ is defined as:

$$f_{co} = \frac{1}{2\pi r_s C_j}$$

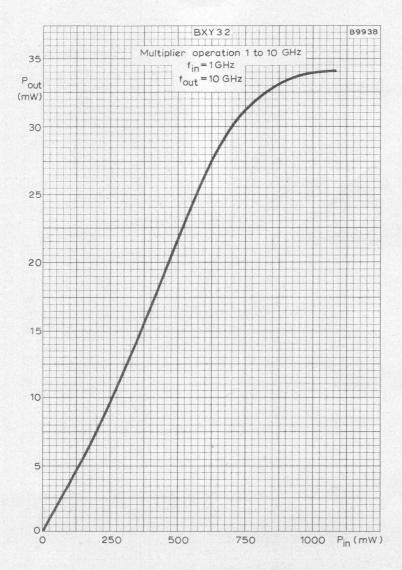
Where, C_j is the junction capacitance and is measured at 1.0MHz r_{S} is measured on a slotted line at 8.0GHz

MULTIPLIER PERFORMANCE

Pout	f _{in} =1.0GHz, P _{in} =500mW,	Min.	Typ.	Max.	
	f out = 10GHz	15	20	-	mW



TYPICAL PERFORMANCE IN HIGH ORDER MULTIPLIERS



TYPICAL PERFORMANCE AS A FREQUENCY MULTIPLIER

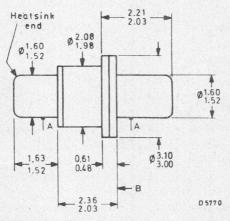
Epitaxial silicon varactor tuning diodes supplied in a standard microwave package. They conform to the environmental requirements of BS9300 where applicable.

	QUICK REFERE	NCE DATA		
V _R max.	BXY53	60 BXY54	BXY55	v
C _T at -4V typ.	1.0	4.7	15	pF
$\frac{C_{TO}}{C_{T60V}}$ min.	4.0	6. 5	7.0	pF

Unless otherwise shown, data is applicable to all types

OUTLINE AND DIMENSIONS

Conforms to B.S. 3934 SO-86



A = concentricity tolerance = ± 0.13

All dimensions in mm



Normal operation with reverse bias, i.e. heatsink end positive.

V _R	max. (see	note 1)				60)		V
T range						-55 t	o +175	C	C
Tcase	max.					125		C	°C
CTRICAL CHAR	ACTERISTIC	S (at T	amb = 25	5°C)					
			BXY53		XY54	I	BXY55		
V _{(BR)R} (10μΑ	min.)		60		60		60		V
I _R at 55V	max.		1.0		1.0		1.0	Ļ	LA.
C _T at -4V	min.		0.8		3.7		12	ŗ	F
(see note 2)	typ.		1.0		4.7		15	F	F
	max.		1.2		5.7		18	p	F
Total capacitan	ce ratio								
C _{TO}	min.		4.0		6.5		7.0		
C _{T60V}	111111.		4.0		0,3		7.0		
Insertion loss (zero bias)								
(see notes 3, 4	and 5)	max.	0.8		0.5		0.25	(dB
Phase swing	min.		80		85		63	degree	es
(0 to 60V) (see notes	typ.		72		74		57*	degree	es
3, 4 and 5)									

NOTES

E

- 1. At $25^{\circ}C$; below $25^{\circ}C$ this figure must be derated at $7 \times 10^{-2} \text{V/}^{\circ}C$. Diodes with different values of $V_{(BR)R}$ are available on request.
- 2. Capacitance tolerances of ±10% and lower are available on request.
- 3. Measurements made with the diode at the end of a 50Ω transmission line and with small signal conditions.
- 4. Measured at 2.0GHz for BXY53 and BXY54; at 1.0GHz for BXY55. For values at other frequencies see graphs on page 4.
- 5. The heatsink pin should be located in a hole of 1.6 to 1.65mm dia. The location of the other end should be a hole of 1.8 to 2.2mm dia., bearing on flange B with a force not exceeding 10 N.

APPLICATION NOTE

When designing tuning circuits at high frequencies it is not sufficient to specify a capacitance swing and loss resistance in the tuning varactor. The parasitic reactances of the microwave package have a significant effect on the terminal impedance of the device. Although strictly speaking one must consider the entire circuit when quoting impedance values the method of measurement adopted here has been found to give values of useful accuracy in a variety of coaxial and waveguide test mounts.

SILICON VARACTOR TUNING DIODES

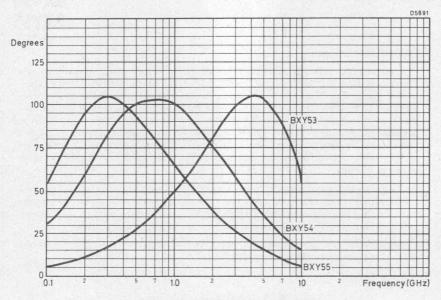
BXY53 BXY54 BXY55

APPLICATION NOTE (contd.)

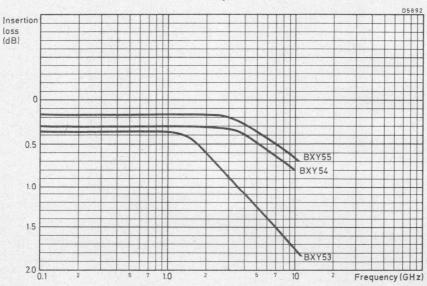
One may simply take the measurements as giving values of r.f. impedance as a function of bias for small signal conditions or they can be used as a more fundamental design aid. This is because the significant factors for the design of a microwave varactor tuned circuit are the available phase swing in the circuit and the loss incurred by the varactor. Both these quantities can be increased or decreased by lowering or raising respectively the characteristic impedance of the circuit. Both these quantities are also invariant under transformation down a uniform loss less transmission line and apply whatever impedance is required to be presented by the varactor circuit.

At large signal levels the r.f. swing may drive the varactor into forward conduction for part of the cycle. This has two effects, firstly there is a rectified voltage built up on the varactor terminal and secondly the effective insertion loss rides at low bias voltages. These effects are fundamental to any varactor diode.

Under forward d.c. bias conditions, the maximum bias current must not exceed $100\mathrm{mA}$ or permanent damage may occur.



TYPICAL PHASE SWING AS A FUNCTION OF FREQUENCY



TYPICAL INSERTION LOSS AS A FUNCTION OF FREQUENCY

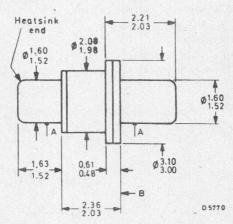
High efficiency silicon varactor diodes suitable for operation in low and high order multiplier circuits with output frequencies in the range 3 to 8 GHz. These diodes are of the diffused epitaxial type, having mesa construction for optimum performance and conform to the environmental requirements of BS9300 where applicable.

QUICK REFER	RENCE DATA		
$V_{BR(R)}$ min. ($I_R = 10 \mu A min.$)		60	v
	BXY56	BXY57	
$C_j (V_R = 6 V)$ min.	1.5	2.5	pF
max.	2.5	3.5	pF
$f_{\rm C}$ ($V_{\rm R}$ = 6 V min.)	160	140	GHz

Unless otherwise shown, data is applicable to both types

OUTLINE AND DIMENSIONS

Conforms to BS3934 SO-86



A = concentricity tolerance = ± 0.13

All dimensions in mm

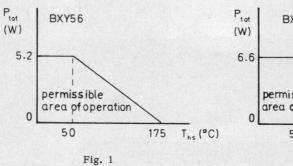


Normal operation with reverse bias, i.e. heatsink end positive.

		BXY56	BXY57	
V _R max.		60	60	V
P _{tot} max. (T _{hs} max. 50°	C) (see note 1)	5.2	6.6	w
R _{th} (j-hs) max.		24	19	°C/W
T range		-55 to +175	-55 to +1	
T _j max.		+175	+175	°C
CHARACTERISTICS (T _{pin} = 25	5°C)			
$V_{(BR)R}$ min. $(I_R = 10\mu A)$		60	60	v
$C_j (V_R = 6V, f = 1MHz)$ (see note 2)				
(see note 2)	min.	1.5	2.5	pF
	max.	2.5	3.5	pF
f_{co} min. $(V_R = 6V)$				
(see note 3)		160	140	GHz
t _t typ. (transition time)		150	200	ps
τ typ. (lifetime)		60	150	ns
C _s typ.		0.25	0.25	pF
L _S typ.		650	650	pН
MULTIPLIER PERFORMANCE	(see note 4)			
Low order multiplier eff 2.1 to 4.2GHz double:			60	%
High order multiplier eff 0.45 to 3.6GHz 8 × m			20	%

NOTES

1. $P_{tot} = P_{in} - P_{out}$. Derating curves are used for value of T_{hs} greater than $50^{\circ}C$:



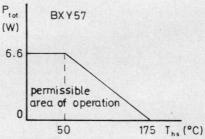


Fig. 2

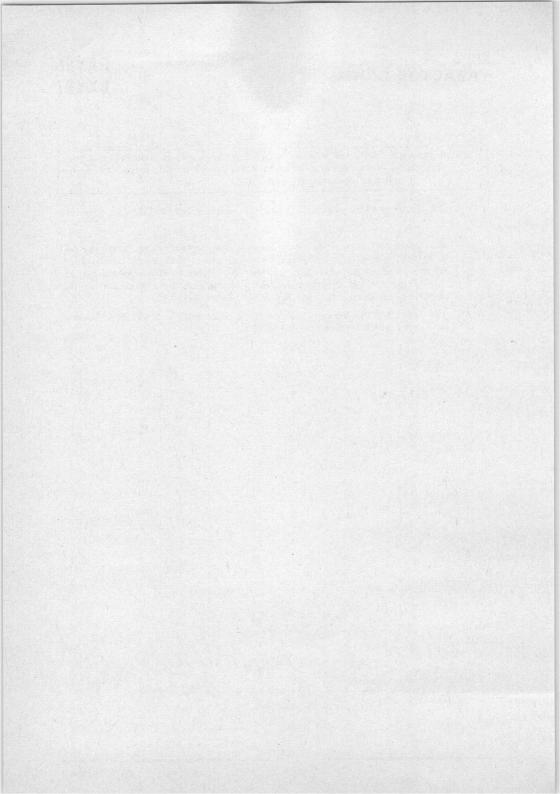
SILICON VARACTOR DIODES

BXY56 BXY57

NOTES (contd.)

- A particular diode specification within this range may be selected to suit the application. Furthermore, it is recommended that devices are functionally tested by the supplier in the customer's circuit.
- 3. Cut-off frequency is measured using a slotted line system at 2GHz. $f_{co} = \frac{1}{2\pi R_s C_j}$
- 4. For high power applications it is essential that the heatsink end of the devices is gripped by a collet or equivalent clamping system to ensure the best possible thermal conductivity, this in turn should be coupled to an adequate heatsink. Care must be taken to avoid unnecessary deformation of this diode pin, as this may cause cracking of the metal-ceramic hermetic seal.

The location of the top cap should be a hole of diameter 1.8 to 2.2mm. bearing on flange B with a force not exceeding 10 N.

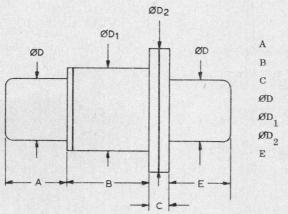


TENTATIVE DATA

Gallium arsenide varactor diode with a high cut-off frequency for use in parametric amplifiers, frequency multipliers and switches. The diodes are of the diffused mesa type and are mounted in a small ceramic-metal case with a welded hermetic seal.

QUICK REFERE	ENCE DATA	
V _R max.	6.0	v
I _{F(AV)} max.	70	mA
Ptot max. Tstud up to 107°C	50	mW
for higher temperatures s	see derating curve	
Operating temperature range	-196 to +150	°C
$f_{c} \text{ typ. } (V_{R} = 6.0V)$	240	GHz

OUTLINE AND DIMENSIONS



	Millimetres	
	Min.	Max.
A	1.52	1.63
В	1.70	nom.
C	0.48	0.61
ØD	1.52	1.60
ØD ₁	1.98	2.03
$ØD_2$	3.00	3.10
E	1.55	1.60

RATINGS

Limiting values of operation according to the absolute maximum system.

Electrical

V _R max.	6.0	v
I _{F(AV)} max.	70	mA
$P_{tot}^{(AV)}$ max. $(T_{stud} \le 107^{\circ}C)$	50	mW
remperature		
	100	00

T _{stg} min.	-196	°C
T max.	+150	°C
T _j (operating range)	-196 to +150	°C

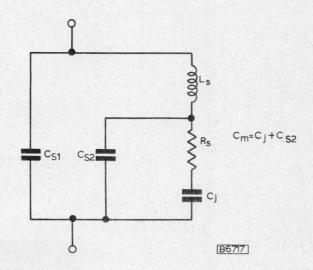
ELEC

CTRICAL	CHARACTERISTICS (T _{amb} = 25°C)				
		Min.	Typ.	Max.	
Static					
I _R	Reverse current V _R =6.0V	-	0.1	1.0	μΑ
v _F	Forward voltage drop $I_F = 1.0 \mu A$ (see note 3.)	-	0.9	-,	v
Dynamic					
f _o	Series resonant frequency Zero bias (see notes 1,2.)	8.9	10	11.6	GHz
fco	Cut-off frequency Zero bias (see note 2.)	125	150	-	GHz
f _c	Cut-off frequency V _R =6.0V (see note 2.)	-	240	-	GHz
C _{mo}	Effective diode capacitance at X band frequency Zero bias (see notes 1,2.)	0.3	0.4	0.5	pF
X	Capacitance variation coefficient (see note 3.)	0.12	0.15	-	
C _{S1}	Stray capacitance (see note 1.)	-	0.10	4	pF
C _{S2}	Stray capacitance (see note 1.)	- 4	0.15	-	pF
Ls	Series inductance (see note 1.)	-	625	-	pН

GALLIUM ARSENIDE VARACTOR DIODE

Notes

 A suitable lumped circuit equivalent for the device may be drawn as follows:



2. Measurements at and about the series resonant frequency, in a suitable waveguide holder, enable the values of $f_{\rm O}$ and the diode Q factor to be determined. The effective diode capacitance and the cut-off frequency can be calculated taking $L_{\rm S}$ to be the typical value.

 $f_{CO} = Q_{OO}^{f}$ where f_{OO}^{f} is the series resonant frequency and Q_{OO}^{f} is the Q factor at zero bias

and
$$C_{\text{mo}} = \frac{1}{4\pi^2 f_0^2 L_S}$$

3. The capacitance variation coefficient δ is defined as

$$= \frac{C_{m} \max. -C_{m} \min.}{2(C_{m} \max. + C_{m} \min.)}$$

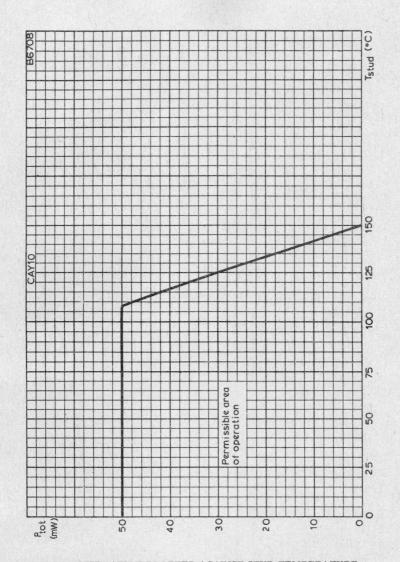
where C min. = effective capacitance at V $_{R}$ = 1.0V C max. = effective capacitance at I $_{F}$ = 1.0 μ A

This can be re-written in the form

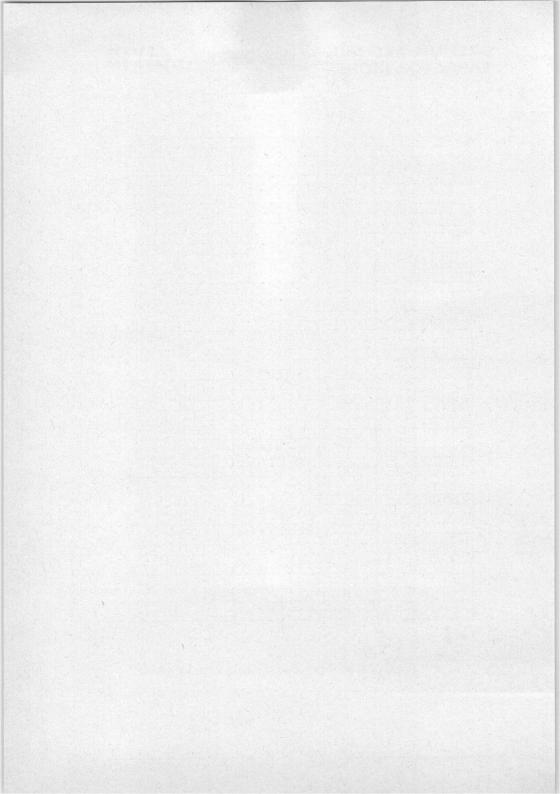
n be re-written in the form
$$\begin{cases} = \frac{(1-V)^{-\frac{1}{3}} - 2^{-\frac{1}{3}}}{2\left\{(1-V)^{-\frac{1}{3}} + 2^{-\frac{1}{3}}\right\} + \frac{4C_{S2}}{C_{jo}}} \end{cases}$$

where
$$V = V_F$$
 at 1.0 μ A

$$C_{jo} = C_{mo} - C_{S2}$$



TOTAL DISSIPATION PLOTTED AGAINST STUD TEMPERATURE

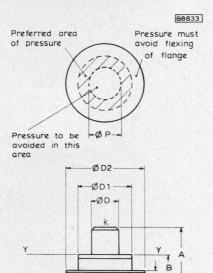


TENTATIVE DATA

Gallium arsenide varactor diode with a high cut-off frequency for use in parametric amplifiers, frequency multipliers and switches. The diodes are of the diffused mesa type and are mounted in a small ceramic-metal case with a hermetic welded seal.

QUICK REFER	ENCE DATA	
V _R max.	6.0	v
P_{tot} max. $T_{pin} \le 25^{\circ}C$	50	mW
Operating temperature range	-196 to +135	°C
f_{co} typ. $(V_R = 0V)$	350	GHz

OUTLINE AND DIMENSIONS



	Millimetres	
	Min.	Max.
A	1.15	1.60
В	0.56	0.87
C	0.19	0.32
ØD	0.61	0.66
ØD1	1.19	1.35
ØD2	1.75	1.80
ØР	0.71	0.81

Compression force on mounting surfaces X-X and Y-Y must not exceed 2.45N.

121	-	_		ica	1
Et.		C	LI	LUd	1

V _R max.	6.0	V
P _{tot} max. T _{pin} ≤25°C	50	mW
'emperature		
T _{stg} min.	-196	°C
T max.	+175	°C
T. (operating range)	-196 to +135	°C.

THERMAL CHARACTERISTIC

R _{th(j-pin)} max.	0.9	degC/mW
tii(j-piii)		

ELECTRICAL CHARACTERISTICS ($T_{amb} = 25^{\circ}C$ unless otherwise stated)

	amo	Min.	Typ.	Max.	
I_R	Reverse current V _R =6.0V		0.1	1.0	μΑ
fres	Series resonant frequency $V_{R}^{=0}$ (see note 1)	27	30	34	GHz
fco	Cut-off frequency V _R =0 (see note 1)	200	350	-	GHz
δf _{co}	Product of capacitance variation coefficient and cut-off frequency at $V_{\rm R}$ =0V (see note 2)	35	40	_	GHz
R _m	Microwave value of effective device series resistance (see notes 1, 4)	1.0	2.25	3.0	Ω
C _m	Microwave value of effective device capacitance V _R = 0V (see notes 3, 4)		0.2	-	pF
C _s	Stray capacitance (L.F. measurement)	2.0	0.3	-	pF
Ls	Microwave value of effective device series inductance		140		»W
	(see note 3)		140		pH

Notes

1. Measurements on semiconductor devices at microwave frequencies are very much dependent upon the kind of holder used. The above dynamic parameters are quoted using a holder which takes the form of a double four-section, wide band, low v.s.w.r.Q-band (ka-band) 26 to 40GHz waveguide transformer to a reduced height of 0.25mm. The transformer is step down followed by step up in order to use standard Q-band components on either side. A d.c. isolated coaxial choke system allows the diode to be inserted across the 0.25mm reduced height section and to be biased.

Using a sweep frequency transmission loss measuring system the series resonant frequency can be measured, the Q of the diode/holder system (hence the frequency cut-off Q \times fres), the effective capacitance variation coefficient, and separately, by measuring the transmission loss past the diode at resonance, the effective diode series resistance.

2. The capacitance variation coefficient, χ , is defined as follows:-

where C
$$_{\rm m}$$
 (min) = capacitance at V $_{\rm R}$ = 1.0V $_{\rm C}$ (max) = capacitance at I $_{\rm F}$ = 1.0 μ A

- and $$f_{\rm res}$$ (max) and $f_{\rm res}$ (min) are the corresponding resonant frequencies, assuming a constant inductance. Hence it is directly measurable in the transmission loss system.
- 3. C_m is calculated using the frequency cut-off and the series resistance:-

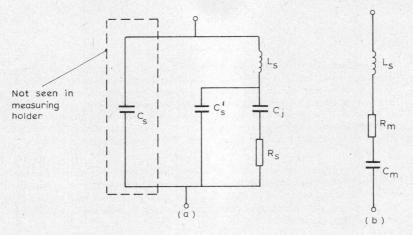
$$C_{m} = \frac{1}{2\pi R_{m}f_{co}}$$

L is also calculated using f and C :-

$$L_{s} = \frac{1}{4\pi^{2} f^{2} C_{m}}$$

4. (a) Diode circuit model.

(b) Equivalent circuit in measuring holder.



Operating note

The CXY10 varactor diode will give excellent noise performance in a parametric amplifier of suitable design.

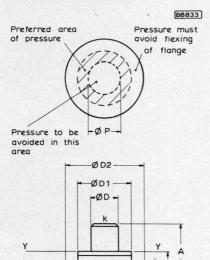
For instance, at a signal frequency of $8.5 \mathrm{GHz}$ in an amplifier having an overcoupled ratio of $4 \mathrm{dB}$ to $5 \mathrm{dB}$ with a pump frequency at $35 \mathrm{GHz}$ and an idler frequency of $26.5 \mathrm{GHz}$, the effective input noise temperature of the amplifier less the contribution due to the circulator would be typically $200^{\mathrm{o}}\mathrm{K}$ and a maximum of $250^{\mathrm{o}}\mathrm{K}$ with the amplifier at room temperature. In cooled paramps, due to its low temperature working capability, the device would give appropriately lower effective input noise temperatures.

TENTATIVE DATA

Gallium arsenide varactor diode suitable for use in frequency multiplier circuits up to Q-band output frequency. The diodes are of the diffused mesa type and are mounted in a small ceramic-metal case with hermetic welded seal.

QUICK REFERENCE DATA Operation as a frequency quadrupler 9.0GHz to 36GHz in a typical circuit:- P_{in} max. 500 mW P_{out} min. 50 mW Resistive cut-off frequency typ. $(V_R = 6.0V)$ 500 GHz T_j max. 175 °C

OUTLINE AND DIMENSIONS



B

	Millimetres	
	Min.	Max.
A	1.15	1.60
В	0.56	0.87
C	0.19	0.32
ØD	0.61	0.66
ØD1	1.19	1.35
ØD2	1.75	1.80
ØP	0.71	0.81

Compression force on mounting surfaces X-X and Y-Y must not exceed 2.45N.

RATINGS (ADS	OLOTE MAXIMUM SISTEM)				
Electrica	1				
V _R ma		10		. V	
P _{tot} n	nax. $(T_{pin} = 25^{\circ}C)$ (see note 1)		300		n.W
	.F. max.		500		mW
Tempera	ture				
T _{stg} r	nin.		-55		°C
T stg			+175		°C
T ma			+175		°C
THERMAL CHA	ARACTERISTIC				
R _{th(j-pin}) max.		0.5	de	gC/mW
ELECTRICAL	CHARACTERISTICS (T _{amb} = 25°C				
		Min.	Typ.	Max.	
V _{(BR)R}	Breakdown voltage $I_R = 100 \mu A$	10	15		v
IR	Reverse current V _R =6.0V		0.001	1.0	μΑ
fres	Series resonance frequency $V_R = 6.0V$ (see note 2)	27	29	35	GHz
fco	Cut-off frequency V _R =6.0V (see note 2)	300	500	74 -0 10 4 4 4 1	GHz
C _m	Microwave value of effective device capacitance $V_{ m R}$ =6.0V (see note 3)	-	0.25		pF
R _m	Microwave value of effective device series resistance $V_R = 6.0V$ (see notes 2 and 4)	- 111	1.3	-	Ω
C _s	Stray case capacitance (L.F. measurement)		0.3	-	pF

Microwave value of effective device series inductance (see note 3)

Ls

рН

120

Notes

- 1. The maximum value of P_{tot} is based on a d.c. dissipation life test. The R.F. power may well exceed this figure in a practical circuit.
- 2. Measurements on semiconductor devices at microwave frequencies are very much dependent upon the kind of holder used. The dynamic parameters are quoted using a holder which takes the form of a double four section Q-band (Ka-band) 26 to 40GHz waveguide wide band low v.s.w.r. transformer to a reduced height of 0.25mm. The transformer is step down followed by step up in order to use standard Q-band components on either side. A d.c. isolated coaxial choke system allows the diode to be inserted across the 0.25mm reduced height section and to be biased.

Using a swept frequency transmission loss measurement system, the series resonant frequency and the Q of the diode holder system can be measured. Hence the resistive cut-off frequency which is defined as $Q\times f_{\mbox{res}}$.

Separately, by measuring the transmission loss past the diode at resonance, the effective diode series resistance can be found.

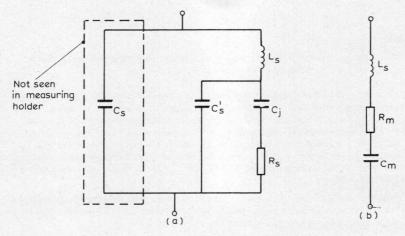
3. $C_{\rm m}$ is calculated using the frequency cut-off and the series resistance

$$C_{m} = \frac{1}{2\pi R_{m}^{f} co}$$

 \boldsymbol{L}_{s} is also calculated using \boldsymbol{f}_{res} and \boldsymbol{C}_{m}

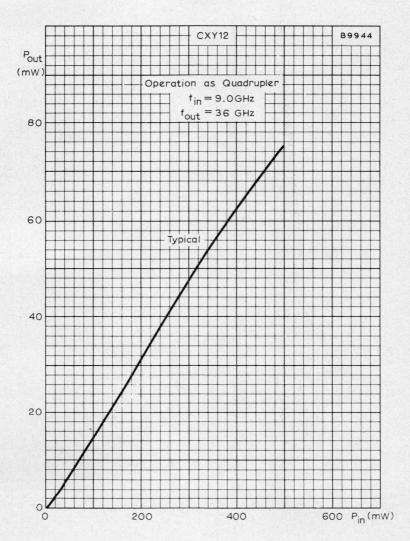
$$L_{s} = \frac{1}{4\pi^{2} f_{res}^{2} C_{m}}$$

- 4. (a) Diode circuit model.
 - (b) Equivalent circuit in measuring holder.

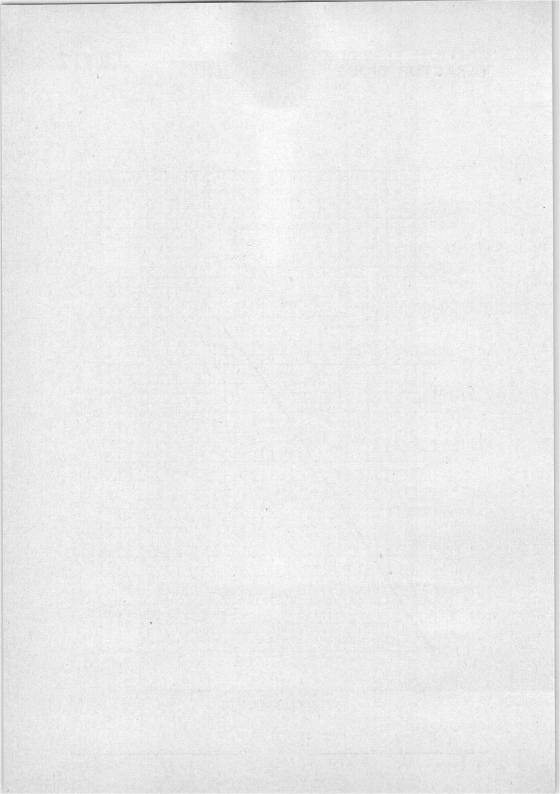


Application note

In a suitable frequency quadrupler CL8700 this device is capable of producing 50 mW at 36 GHz for an input power of 500 mW at 9.0 GHz.



OUTPUT POWER AGAINST INPUT POWER QUADRUPLER OPERATION



DEVELOPMENT SAMPLE DATA

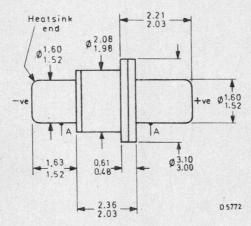
Gallium arsenide varactor diodes for limiter applications from C to X-band. Very low insertion loss and high isolation characteristics may be obtained. The diodes are of the diffused mesa type and are mounted in standard microwave packages.

QUICK RI	EFERENCE DATA		
	CXY22A	CXY22B	
Operating frequency range	2.0 to 7.0	7.0 to 12	GHz
C _T at 0V (typ.)	0. 85	0.55	pF
Insertion loss (typ.)	0.2	0.3	dB
High power attenuation (typ.)	30	16	dB

Unless otherwise shown, data is applicable to both types.

OUTLINE AND DIMENSIONS

Dimensions in mm



A = concentricity tolerance = ± 0.13

LIMITING VALUES (Absolute max. rating system)

v_R	max. 6.0	V
T _{stg} range	-55 to +150	°C
T _{amb} range	-55 to +100	°C

CHARACTERISTICS

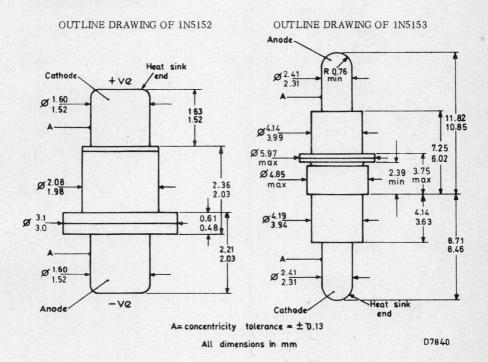
	CILLELL	Online	
max.	1.0	1.0	μΑ
typ.	0.85	0.55	pF
max.	1.45	1.45	V
typ.	1.0	1. 2	Ω
	max. typ. max.	max. 1.0 typ. 0.85 max. 1.45	max. 1.0 1.0 typ. 0.85 0.55 max. 1.45 1.45 typ. 1.0 1.2

Silicon planar epitaxial varactor diodes exhibiting step recovery characteristics, especially suitable for use in frequency multiplier circuits up to S-band output frequency. They conform to the environmental requirements of BS9 300 where applicable.

QUICK REFERENCE DATA		
Operation as a frequency doubler 1.0 to 2.0 GHz in a	typical circuit.	
P _{in}	12	W
Pout	6.0	W
Typical resistive cut-off frequency ($V_R = 6.0 \text{ V}$)	100	GHz
Typical total capacitance ($V_R = 6.0 \text{ V}$)	6.0	pF

Unless otherwise stated, data is applicable to both types

OUTLINE AND DIMENSIONS



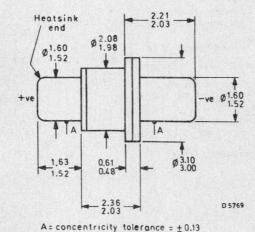
RATINGS (ABSOLUTE MAXIMUM SYSTEM)

Electrical					
V _R max	.		75		V
P _{tot} ma	$x. R.F. (T_{pin} \le 70^{\circ}C)$		5	.0	W
Temperatu	ire				
T _{stg} m	in.		-55		°C
T m			+175		°C
T max			+175		°C
THERMAL CHA					
R _{th(j-pin)}	max.		20	d	egC/W
ELECTRICAL C	HARACTERISTICS (T _{amb} = 25°C)			×.	
		Min.	Typ.	Max.	
V _{BR(R)}	Reverse breakdown voltage $(I_R = 10 \mu A)$. 75	-	-	v
I_R	Reverse current (V _R =60V)	-	0.001	1.0	μΑ
$v_{_{ m F}}$	Forward voltage (I _F =10mA)	_		1.0	v
fco	Cut-off frequency (V _R =6.0V, f _{measured} =2.0GHz)	55	100	-	GHz
C _T	Total capacitance (V _R =6.0V, f=1.0MHz)	5.0	-	7.5	pF
η	Overall efficiency P _{in} = 12W, f _{in} = 1.0GHz				
	frequency doubler	50	60	-	%

Silicon planar epitaxial varactor diode exhibiting step recovery characteristics, especially suitable for use in frequency multiplier circuits up to C-band output frequency. It conforms to the environmental requirements of BS9300 where applicable.

QUICK REFERENCE DATA		
Operating as a frequency tripler 2.0 to 6.0 GHz in a	typical circuit.	
P _{in}	5.0	W
Pout	2.0	W
Typical resistive cut-off frequency ($V_R = 6.0 \text{ V}$)	120	GHz
Typical total capacitance (V _R = 6.0 V)	2.0	pF

OUTLINE AND DIMENSIONS



All dimensions in mm

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

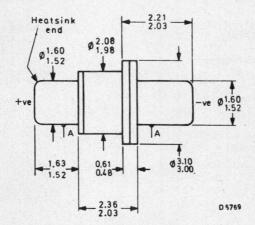
Electrical		
V _R max.	35	v
P_{tot} max. R.F. $(T_{pin} \le 70^{\circ}C)$	3.0	w
Temperature		
T _{stg} min.	-55	°c
T max.	+175	°c
T _j max.	+175	°c
THERMAL CHARACTERISTIC		
R _{th(j-pin)} max.	35	degC/W
ELECTRICAL CHARACTERISTICS (T = 25°C)		

ECTRICAL CH	ARACTERISTICS (Tamb=25°C)				
		Min.	Typ.	Max.	
V _{BR(R)}	Reverse breakdown voltage ($I_R = 10\mu A$)	35		-	v
$^{\mathrm{I}}\mathrm{_{R}}$	Reverse current (V _R =26V)	-	0.001	1.0	μΑ
v _F	Forward voltage (I _F =10mA)	-	-	1.0	v
fco	Cut-off frequency (V _R =6.0V, f _{measured} =2.0GHz)	100	120	-	GHz
C _T	Total capacitance (V _R =6.0V, f=1.0MHz)	1.0	-	3.0	pF
η	Overall efficiency P _{in} =5.0W, f _{in} =2.0GHz				
	frequency tripler	40		-	%

Silicon planar epitaxial varactor diode exhibiting step recovery characteristics, especially suitable for use in frequency multiplier circuits up to X-band output frequency. It conforms to the environmental requirements of BS9300 where applicable.

QUICK REFERENCE DATA		
Operation as a frequency doubler 5.0 to 10 GHz in a ty	pical circuit.	
P _{in}	2.6	w
Pout	1.0	W
Typical resistive cut-off frequency ($V_R = 6.0 \text{ V}$)	200	GHz
Typical total capacitance (V _R = 6.0 V)	0.8	pF

OUTLINE AND DIMENSIONS



A = concentricity tolerance = ± 0.13

All dimensions in mm

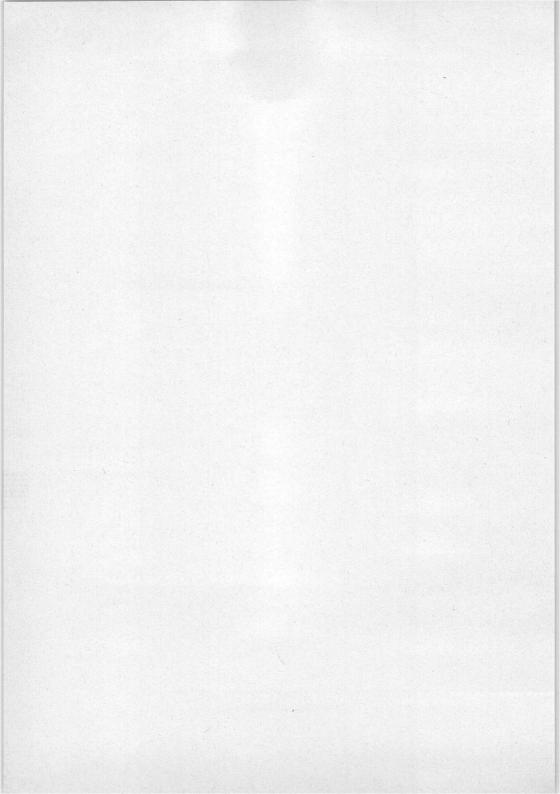
RATINGS (ABSOLUTE MAXIMUM SYSTEM)

El		

Electrical					
V _R max	.			20	V
P _{tot} ma	$x. R.F. (T_{pin} \le 70^{\circ}C)$			2.5	W
Temperatu	ire				
T _{stg} m	in.		-	55	°c
T ma			+1	75	°c
T max			+1	75	°C
THERMAL CHA	RACTERISTIC				
R _{th(j-pin)}	max.			38.5 de	egC/W
ELECTRICAL C	HARACTERISTICS (T _{amb} =25°C)				
		Min.	Typ.	Max.	
V _{BR(R)}	Reverse breakdown voltage $(I_R = 10\mu A)$	20	-		v
I_R	Reverse current (V _R =16V)	-	-	0.1	μΑ
v _F	Forward voltage (I _F =10mA)	-		1.0	V.
fco	Cut-off frequency (V _R =6.0V, f _{measured} =8.0GHz)	180	200		GHz
c _T ,	Total capacitance $(V_R = 6.0V, f = 1.0MHz)$	0.6	-11	1.0	pF
η	Overall efficiency P _{in} =2.6W, f _{in} =5.0GHz frequency doubler	38	-		%

Gunn oscillators F





X-BAND GUNN OSCILLATOR

QUICK REFERENCE DATA

Fixed frequency Gunn oscillator for operation in the 10,7 GHz band. Applications include all forms of miniature radar systems.

Centre frequency			10,687	GHz
Output power			8	mW
Supply voltage			7	V
Output flange	154 II	EC-UBR 10	00 (WG16/V	VR 90)
OPERATING CONDITIONS 1)2)				
Supply voltage			7	V
Supply current			≤ 160	mA
Output power			8	mW
CHARACTERISTICS at 25 °C				
Centre frequency	min.	10,687 typ.	max.	GHz
Output power	5	8		mW
Frequency (fixed)	10,675	10,687	10,700	GHz
Temperature coefficient of frequency		-0,25	-0,40	MHz/K
Pushing figure		1,5		MHz/V
A.M. noise to carrier ratio (1 Hz to 100 Hz bandwidth)		-94		dB
Second harmonic		-35		dBm ³)
LIMITING VALUES (Absolute max. ratio	ng system)			
Supply voltage		max. min.	7,5 6,5	V V
Supply current, running starting		max.	160 200	mA mA
Voltage standing wave ratio		max.	1,5	

Notes see page 2.

Data based on pre-production devices.

November 1976

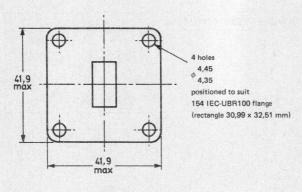
TEMPERATURE LIMITS

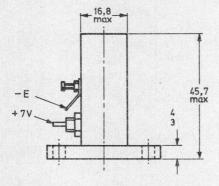
Ambient temperature

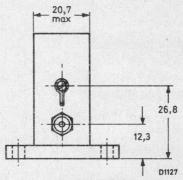
max. +40 °C min. 0 °C

DIMENSIONS AND CONNECTIONS

Dimensions in mm







Soldering: The use of low melting point solder is recommended.

NOTES

- 1) The active element will be damaged if the supply voltage is reversed. Care should be taken to avoid transients in excess of 8 V. A voltage regulator diode to shunt the power supply is recommended for this purpose.
- $^2)$ A 10 nF capacitor between the +V $_{\rm G}$ terminal and earth (E) is recommended to suppress any tendency to low frequency oscillations in the supply leads.
- 3) Modulation of the supply voltage within the 1 to 100 Hz bandwidth will degrade the a.m. noise to carrier ratio as a result of direct conversion by the Gunn device to both a.m. and f.m. noise components. The f.m. component may be demodulated by the non-linear response characteristic of the associated detecting element.

X-BAND GUNN OSCILLATOR/DETECTOR

Fixed frequency Gunn oscillator for operation in the $10.7~\mathrm{GHz}$ band as a self-oscillating mixer (auto detector).

QUICK REFERENCE DATA

		VIII COMPANIE DE LA C	
Frequency		10,687	GHz
Output power at supply voltage = 7 V		8	mW
Frequency temperature coefficient		-0,25	MHz/K
Supply voltage, d.c.		7	V
Output flange	154 IEC-UBR	.100 (WG1	6/WR90)
OPERATING CONDITIONS			
Supply voltage, d.c. (see operating notes)		7	v
Voltage standing wave ratio of the load	max.	1,5	
Threshold current	<	200	mA
Operating current	<	160	mA
CHARACTERISTICS at 25 °C			
Centre frequency		10,687	GHz
Output power	>	8 5	mW mW
requency, fixed	> <	10, 687 10, 700	GHz GHz
requency temperature coefficient	<	-0, 25 -0, 40	
Frequency pushing		4	MHz/V
Output voltage for an input power 66 dB down on out	tput power		
$at \frac{signal + noise}{noise} = 6 dB$	>	40 24	μV μV
Second harmonic		-35	dBm
Threshold current	<	200	mA
perating current	<	120 160	mA mA

Data based on pre-production devices.

CL8630S

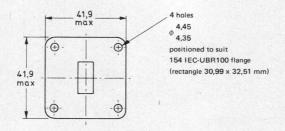
LIMITING VALUES (absolute max. rating system) at 25 °C

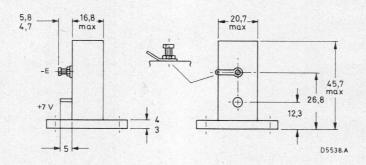
Cupply valtage	4.0			max.	7,5	V
Supply voltage,	u.c.			min.	6,5	V
	transient,	$T_{imp} = max.$	1 ms	max.	9,0	V

Temperature, operating
$$\begin{array}{cccc} max. & +40 & ^{O}C \\ min. & 0 & ^{O}C \end{array}$$

DIMENSIONS AND CONNECTIONS

Dimensions in mm



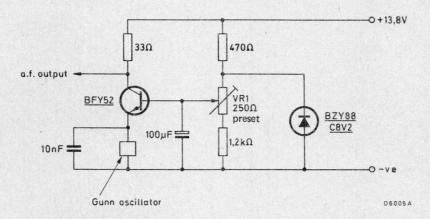


Soldering: The use of low melting point solder is recommended.

3

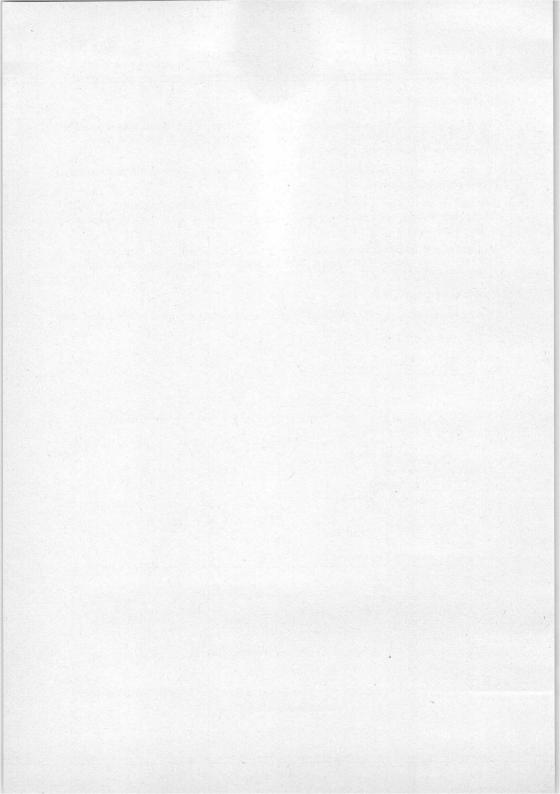
OPERATING NOTES

- 1) The active element will be damaged if the supply voltage is reversed. Care should be taken to limit transients. An 8, 2 V 5% voltage regulator diode to shunt the power supply is recommended for this purpose.
- 2) The minimum supply voltage is 6,5 V for the frequency of oscillation to remain within the characteristic limits.
- 3) It is recommended that a small capacitor (e.g. 10 nF) is connected across the oscillator supply voltage terminals to suppress low frequency oscillation which may occur in the power supply.
- 4) A return signal 66 dB down on radiated power will be achieved from a man target of radar cross-section 1 m² at a range of 12 m, when operating with an antenna gain of 20 dB.
- 5) System bandwidth 1 Hz to 1 kHz.
- Power supply ripple in the amplifier passband will degrade to signal to noise performance.



VR₁ is used to set voltage at 7 V across Gunn oscillator.

Circuit for sensitivity measurements



X-BAND GUNN OSCILLATOR

Fixed frequency Gunn oscillator for operation in the $9,35~\mathrm{GHz}$ band.

QUICK REFERENCE	EDATA		
Frequency		9, 35	GHz
Output power at supply voltage = 7 V		8	mW
Frequency temperature coefficient		-0, 25	MHz/K
Supply voltage, d.c.		7	V
Output flange	154 IEC-UBR	.100 (WG1	6/WR90)
OPERATING CONDITIONS			
Supply voltage, d.c. (see operating notes)		7	V
Voltage standing wave ratio of the load	max.	1,5	
Threshold current	€	200	mA
Operating current	<	160	mA
CHARACTERISTICS at 25 °C			
Centre frequency		9, 35	GHz
Output power	>	8 5	mW mW
Frequency, fixed	> <	9, 33 9, 37	GHz GHz
Frequency temperature coefficient	<	-0, 25 -0, 40	MHz/K MHz/K
Frequency pushing		1,5	MHz/V
A.M. noise to carrier ratio (1 Hz to 100 Hz bandwidth)		-94	dB
Second harmonic		-25	dBm
Threshold current	<	200	mA
Operating current	<	120 160	mA mA

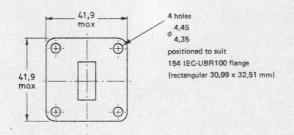
LIMITING VALUES (absolute max. rating system) at 25 °C

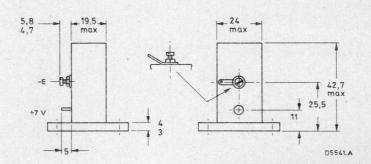
Supply voltage, d.c. max. 7,5 V min. 6,5 V min. max. 8 V max. 40 max.

Temperature, operating $\begin{array}{cccc} \text{max.} & 40 & ^{0}\text{C} \\ \text{min.} & 0 & ^{0}\text{C} \end{array}$

DIMENSIONS AND CONNECTIONS

Dimensions in mm



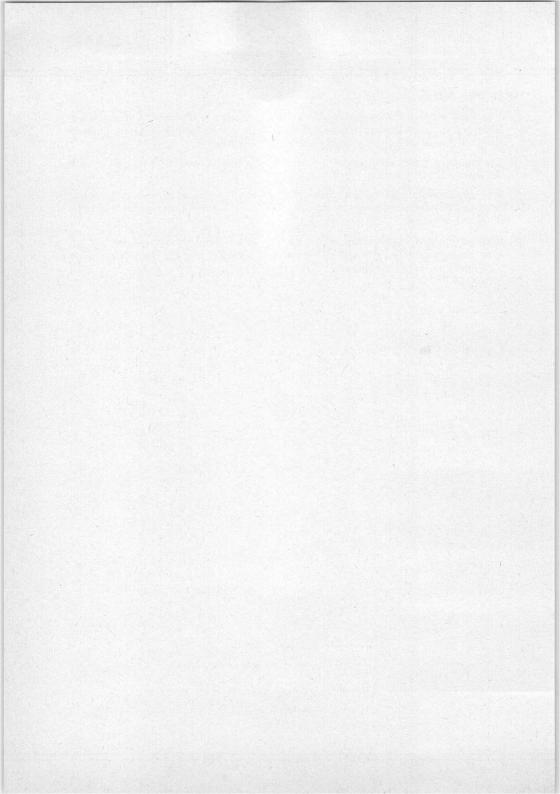


Soldering: The use of low melting point solder is recommended.

OPERATING NOTES

- 1) The active element will be damaged if the supply voltage is reversed. Care should be taken to avoid transients in excess of 8 volts. An 8,2 V 5% voltage regulator diode to shunt the power supply is recommended for this purpose.
- 2) The minimum supply voltage is 6,5 V for the frequency of oscillation to remain within the characteristic limits.
- 3) It is recommended that a small capacitor (e.g. 10 nF) is connected across the oscillator supply voltage terminals to suppress low frequency oscillation which may occur in the power supply.
- 4) Modulation of the supply voltage within the 1 Hz to 100 Hz bandwidth will degrade the a.m. noise to carrier ratio as a result of direct conversion by the Gunn device to both a.m. and f.m. noise components.

November 1976



X-BAND GUNN OSCILLATOR/DETECTOR

Fixed frequency Gunn oscillator for operation in the 9,35 GHz band as a self-oscillating mixer (auto detector).

QUICK REFERENCE DATA			
Frequency		9, 35	GHz
Output power at supply voltage = 7 V		8	mW
Frequency temperature coefficient		-0,25	MHz/K
Supply voltage, d.c.		7	V
Output flange	54 IEC-UBR	.100 (WG1	6/WR90)
OPERATING CONDITIONS			
Supply voltage, d.c. (see operating notes)		7	V
Voltage standing wave ratio of the load	max.	1,5	
Threshold current	<	200	mA
Operating current	<	160	mA
CHARACTERISTICS at 25 °C			
Centre frequency		9, 35	GHz
Output power	>	8 5	mW mW
Frequency, fixed	> <	9, 33 9, 37	GHz GHz
Frequency temperature coefficient	<	-0, 25 -0, 40	MHz/K MHz/K
Frequency pushing		4	MHz/V
Output voltage for an input power 66 dB down on output power at $\frac{\text{signal} + \text{noise}}{\text{noise}} = 6 \text{ dB}$	ver >	40 24	μV μV
Second harmonic		-25	dBm
Threshold current	<	200	mA
Operating current	<	120 160	mA mA

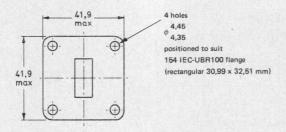
Data based on pre-production devices.

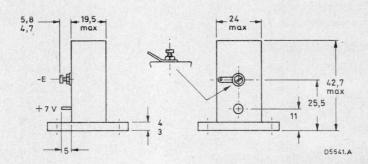
LIMITING VALUES (absolute max. rating system) at 25 °C

		min.	6,5	V
Supply voltage, d.c.		max.	7,5	V
trans	sient, T _{imp} = max. 1 ms	max.	9,0	V
		min.	0	°C
Temperature, opera	ting	max.	40	oC

DIMENSIONS AND CONNECTIONS

Dimensions in mm

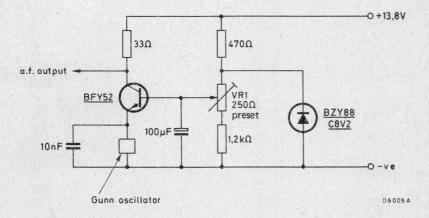




Soldering: The use of low melting point solder is recommended.

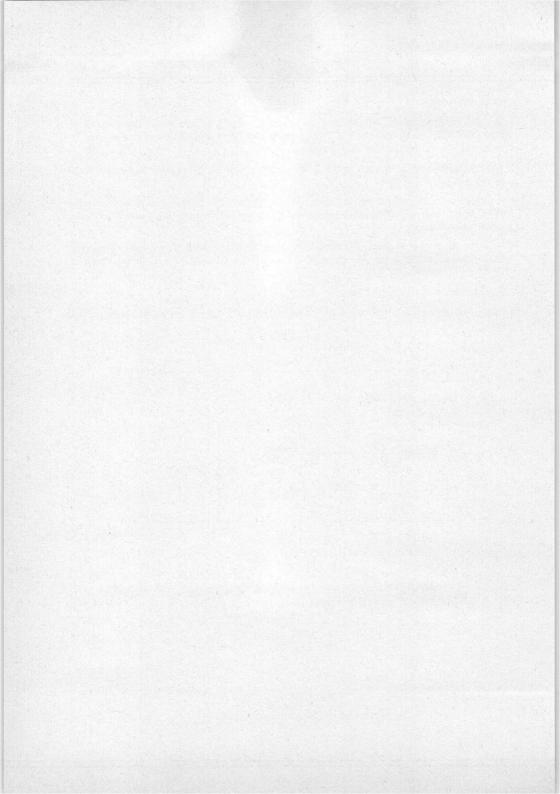
OPERATING NOTES

- 1) The active element will be damaged if the supply voltage is reversed. Care should be taken to limit transients. An 8,2 V 5% voltage regulator diode to shunt the power supply is recommended for this purpose.
- 2) The minimum supply voltage is 6,5 V for the frequency of oscillation to remain within the characteristic limits.
- 3) It is recommended that a small capacitor (e.g. 10 nF) is connected across the oscillator supply voltage terminals to suppress low frequency oscillation which may occur in the power supply.
- 4) A return signal 66 dB down on radiated power will be achieved from a man target of radar cross-section 1 m² at a range of 12 m, when operating with an antenna gain of 20 dB.
- 5) System bandwidth 1 Hz to 1 kHz.
- 6) Power supply ripple in the amplifier passband will degrade the signal to noise performance.



VR₁ is used to set voltage at 7 V across Gunn oscillator.

Circuit for sensitivity measurements



X-BAND GUNN OSCILLATOR

Fixed frequency Gunn oscillator in the $10,5~\mathrm{GHz}$ band. Applications include all forms of miniature radar systems.

QUICK REFERENCE	DATA		
Frequency		10, 525	GHz
Output power at supply voltage = 7 V		8	mW
Frequency temperature coefficient		-0, 25	MHz/K
Supply voltage, d.c.		7	V
Output flange	154 IEC-UBI	R100 (WG1	6/WR90)
OPERATING CONDITIONS			
Supply voltage, d.c. (see operating notes)		7	V
Voltage standing wave ratio of the load	max.	1,5	
Threshold current	< 1	200	mA
Operating current	<i>,</i>	160	mA
CHARACTERISTICS at 25 °C			
Centre frequency		10,525	GHz
Output power	>	8 5	mW mW
Frequency, fixed	> <	10,500 10,550	GHz GHz
Frequency temperature coefficient	<	-0, 25 -0, 40	MHz/K MHz/K
Frequency pushing		4	MHz/V
A.M. noise to carrier ratio (1 Hz to 100 Hz bandwidth)		-94	dB
Second harmonic		-35	dBm
Threshold current	<	200	mA
Operating current	≤	160	mA

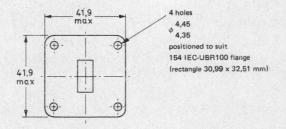
LIMITING VALUES (absolute max. rating system) at 25 $^{\rm o}{\rm C}$

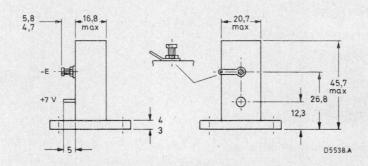
Supply voltage, d.c. $\begin{array}{cccc} & \text{min.} & 6,5 & V \\ & \text{max.} & 7,5 & V \\ & \text{transient, } T_{\mbox{imp}} = \text{max. 1 ms} & \text{max.} & 9,0 & V \\ \end{array}$

Temperature, operating $\begin{array}{ccc} & \text{min.} & 0 & ^{\text{O}}\text{C} \\ & \text{max.} & 40 & ^{\text{O}}\text{C} \end{array}$

DIMENSIONS AND CONNECTIONS

Dimensions in mm



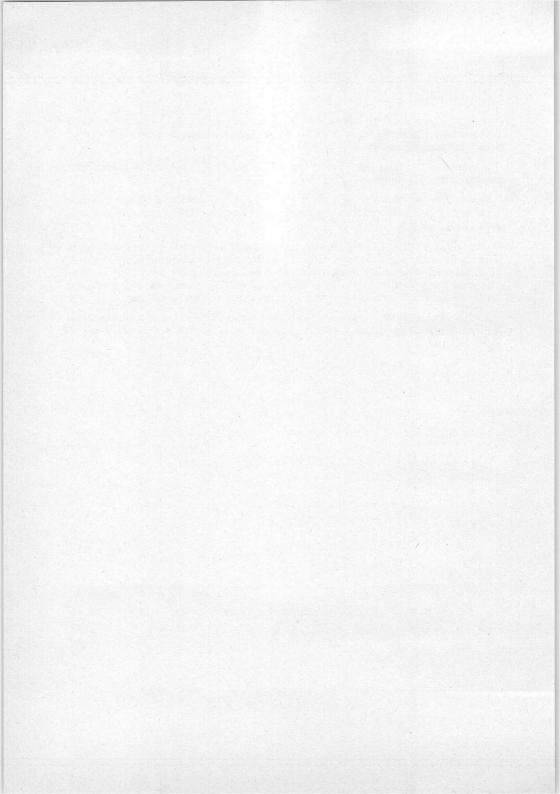


Soldering: The use of low melting point solder is recommended.

OPERATING NOTES

- 1) The active element will be damaged if the supply voltage is reversed. Care should be taken to limit transients. An 8, 2 V 5% voltage regulator diode to shunt the power supply is recommended for this purpose.
- 2) The minimum supply voltage is 6,5 V for the frequency of oscillation to remain within the characteristic limits.
- 3) It is recommended that a small capacitor (e.g. 10 nF) is connected across the oscillator supply voltage terminals to suppress low frequency oscillation which may occur in the power supply.
- 4) When used in a Doppler radar system, modulation of the oscillator supply voltage will degrade the a.m. signal to noise ratio at the output of the associated mixer, as a result of direct conversion by the Gunn device to a.m. and f.m. noise components. The a.m. component will contribute directly and the f.m. component may contribute from demodulation by the slope of the bandpass characteristic of the mixer.
- 5) Second harmonic level is measured into a load with a VSWR < 1, 1 at fundamental frequency. The level is equivalent to that radiated from a low VSWR X-band antenna, for example, ACX-01.</p>

3



X-BAND GUNN OSCILLATOR/DETECTOR

Fixed frequency Gunn oscillator for operation in the $10,525~\mathrm{GHz}$ band as a self-oscillating mixer (auto detector).

QUICK REFERENCE DATA

Frequency		10,525	GHz
Output power at supply voltage = 7 V		8	mW
Frequency temperature coefficient		-0, 25	MHz/K
Supply voltage, d.c.		7	V
Output flange	154 IEC-UBR	.100 (WG1	6/WR90)
OPERATING CONDITIONS			
Supply voltage, d.c. (see operating notes)		7	V
Voltage standing wave ratio of the load	max.	1,5	
Threshold current	<	200	mA
Operating current	<	160	mA
CHARACTERISTICS at 25 °C			
Centre frequency		10, 525	GHz
Output power	>	. 8 5	mW mW
Frequency, fixed	> <	10,500 10,550	GHz GHz
Frequency temperature coefficient	<	0, 25 0, 40	MHz/K MHz/K
Frequency pushing		1,5	MHz/V
Output voltage for an input power 66 dB down on output at $\frac{\text{signal} + \text{noise}}{\text{noise}} = 6 \text{ dB}$	power >	40 24	μV μV
Second harmonic		-35	dBm
Threshold current	<	200	mA
Operating current	<	120 160	mA mA

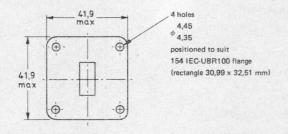
Data based on pre-production devices.

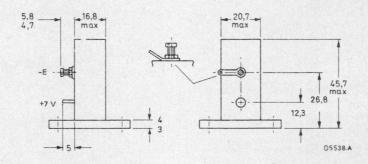
LIMITING VALUES (absolute max. rating system) at 25 °C

0 1 1 1	min	. 6,5	V
Supply voltage, d.c.	max	7,5	V
transient, T _{imp} = max. 1 ms	max	c. 9,0	V
	min	. 0	°C
Temperature, operating	max	40	°C

DIMENSIONS AND CONNECTIONS

Dimensions in mm

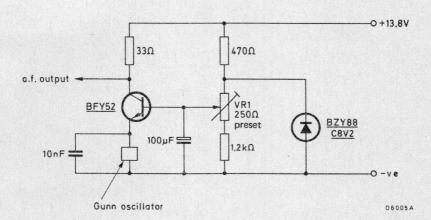




Soldering: The use of low melting point solder is recommended.

OPERATING NOTES

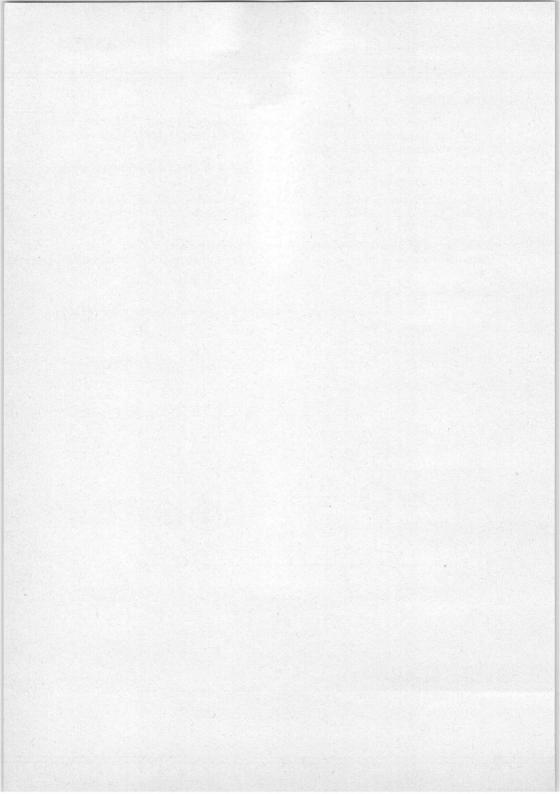
- 1) The active element will be damaged if the supply voltage is reversed. Care should be taken to limit transients. An 8,2 V 5% voltage regulator diode to shunt the power supply is recommended for this purpose.
- 2) The minimum supply voltage is 6,5 V for the frequency of oscillation to remain within the characteristic limits.
- 3) It is recommended that a small capacitor (e.g. 10 nF) is connected across the oscillator supply voltage terminals to suppress low frequency oscillation which may occur in the power supply.
- 4) A return signal 66 dB down on radiated power will be achieved from a man target of radar cross-section 1 m 2 at a range of 12 m, when operating with an antenna gain of 20 dB.
- 5) System bandwidth 1 Hz to 1 kHz.
- 6) Power supply ripple in the amplifier passband will degrade the signal to noise performance.



VR₁ is used to set voltage at 7 V across Gunn oscillator.

Circuit for sensitivity measurements

November 1976



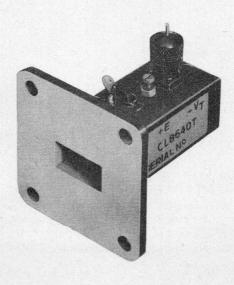
TENTATIVE DATA

Mechanically and electronically tuned Gunn-effect oscillators in the 10.5GHz band. The high Q cavity offers frequency stability compatible with application as the transmitter (CL8640T) and receiver local oscillator (CL8640R) in short range data link systems.

QUICK REFEREN	ICE DATA		
	CL8640R	CL8640T	
Centre frequency	10.49	10.56	GHz
Mechanical tuning range min.	120	120	MHz
Electronic tuning range min.	30	8.0	MHz
Power output typ.	6.0	6.0	mW
Operating voltage	-7.0	-7.0	v
Output via square plain flange WG. 16.WR	90. 5985-99-08	3-0052	

CL8640R - receiver local oscillator

CL8640T - transmitter

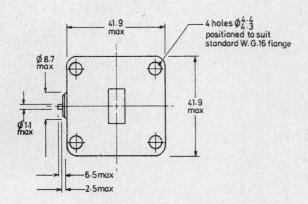


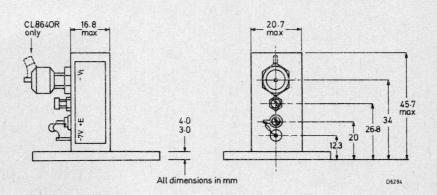
TYPICAL OPERATING CONDITIONS

Supply voltage (note 1)				-7.0	V
Starting current			2	50	mA
Running current			1	70	mA
Tuning voltage (modulation) (notes 1 and 2)		R -0.5 to -7 T -0.5 to -1		v v
RATINGS (ABSOLUTE MAXIMUM	M SYSTEM)				
Supply voltage max.				-7.2	у
Supply voltage (transient)	max.			-8.0	v
Tuning voltage max.				12	v
Tuning current max.			1	00	μΑ
Load v.s.w.r. max.			1.5	:1	
CHARACTERISTICS (at 25°C)					
Centre frequency	CL8640R CL8640T			10.49 10.56	GHz GHz
		Min.	Тур.	Max.	
Mechanical tuning range		±60	-	-	MHz
Electronic tuning range	CL8640R	±15	- 1	-	MHz
(notes 2 and 3)	CL8640T	±4.0	10.	-	MHz
Power output at -7.0V		4.0	6.0		mW
Frequency pushing		-	3.0	- 1	MHz/V
Frequency pulling (note 4)		-	1.5	-	MHz
Frequency temperature coe	efficient	-	-0.25	-0.3	MHz/°C
Tuning current		-		10	μΑ
TEMPERATURE			CL8640R	CL8640	Т
Operating range			-15 to +70	+25 to +	70 °C
Storage range			-30 to +100	-30 to +	100 °C

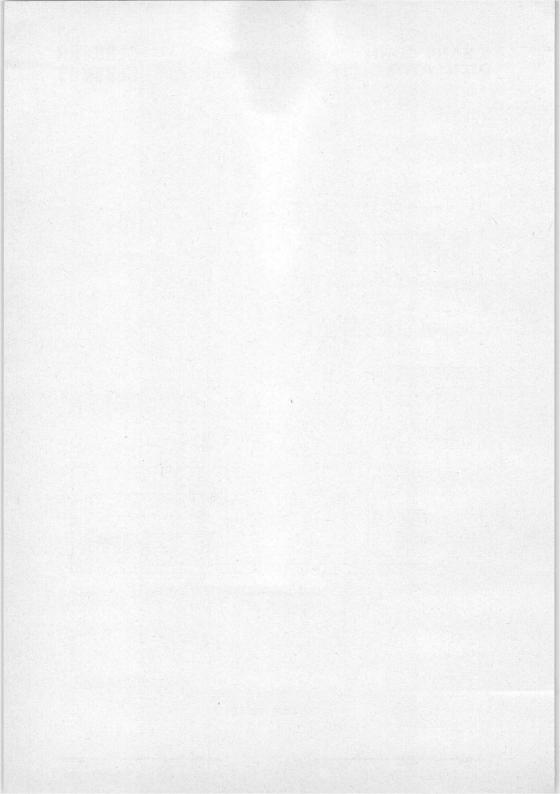
OPERATING NOTES

- The active element will be damaged if the supply voltage is reversed. Care should be taken to avoid transients in the supply voltage.
- The electronic tuning provided by the varactor diode circuit is non-linear, following an approximately exponential rate of change of capacitance at low tuning voltages.
- 3. For CL8640R the tuning voltage range is -0.5V to -7.5V with the electronic centre at -2.5V.
- 4. V.S.W.R. = 1.5:1



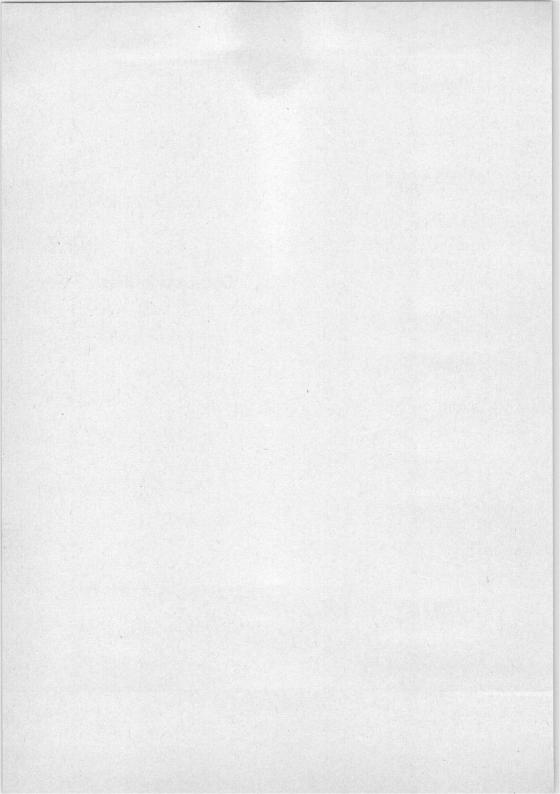


OUTLINE DRAWING



Sub-assemblies G





ACX-01

This information is derived from development samples made available for evaluation. It does not form part of our data handbook system and does not necessarily imply that the device will go into production

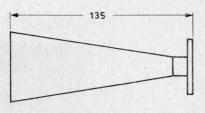
MICROWAVE HORN ANTENNA

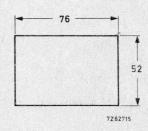
A general purpose X-band antenna for miniature radar systems. The unit gives a low VSWR and is of a strong cast construction.

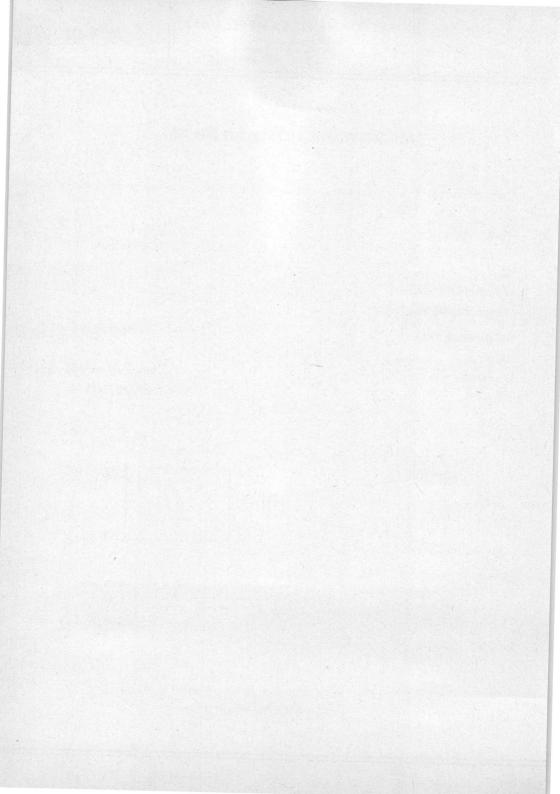
CHARACTERISTICS

9 to 11 GHz Frequency range 16 dB Gain Beam angle (both planes) 30 deg Voltage standing wave ratio 1,2 max. Dimensions in mm MECHANICAL DATA

Weight 160 Dimensions See outline drawing UBR100 (UG135/U) Flange







GHz

μV

10,687

15

X-BAND MIXER/DETECTOR

Waveguide single-ended mixer designed for use in the 10,7 GHz band. It is primarily intended for Doppler control systems, e.g. intruder alarms deriving local oscillator drive from the transmitter output of a Gumn-effect device such as the CL8630. The CL7500 can be used as a microwave detector. Two examples of this are sensing deliberate beam obstruction in a microwave-protected area, and as receiver in a microwave barrier.

QUICK REFERENCE DATA

Typical noise level (32 μA d.c. bias, 1 Hz to 1 kHz bandwidth)				1	μV
TYPICAL OPERATING CONDITIONS					
Ambient temperature				-10 to +50	°C
Local oscillator level				-18	dBm
D.C. bias 3), 4)				32	μΑ
Total load (d.c. and i.f.)				10	kΩ
CHARACTERISTICS at 25 °C					
Centre frequency				10,687	GHz
		min.	typ.	max.	
Mixer					
Sensitivity for -95 dBm input		10	15		μV
Noise level (32 µA d.c. bias, 1 Hz to 1 kHz bandwidth) ¹)			1	2	μV
Detector					
Tangential sensitivity at centre frequency	2)		-50		dBm
Tangential sensitivity from 10,1 to 11,0 GHz	2)		- 49		dBm

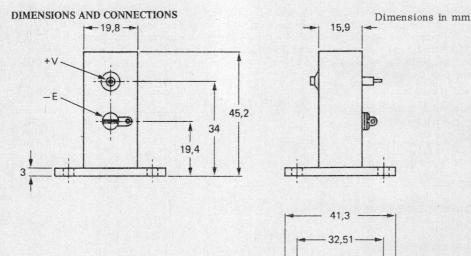
Notes see page 2.

Centre frequency

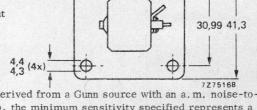
Typical sensitivity for -95 dBm-input

LIMITING VALUES (Absolute max. rating system)

Reverse current	max.	5	mA
Forward current, peak	max.	10	mA
Storage temperature	max. min.	+100 -10	



Soldering: The use of low melting point solder is recommended.



When the local oscillator power is derived from a Gunn source with an a.m. noise-to-carrier ratio of 94 dB (e.g. CL8630), the minimum sensitivity specified represents a signal-to-noise ratio at the mixer output of 10 dB (typically 17 dB).

 $^{^2}$) When operated as a detector with 32 μA d.c. bias, measured in a 0 to 2 MHz bandwidth.

³⁾ The diode may be damaged if the bias supply is reversed.

⁴⁾ The mixer diode will be damaged by forward current in excess of 10 mA. The module is supplied with a shorting strap connected between the mixer a.f. and earth terminals. The mixer has a low junction capacitance and may be damaged by transients of very short duration. It is therefore recommended that soldering irons are isolated from mains supplies and that the shorting strap is not removed until all wiring has been completed.

9.35

15 μV

GHz

X-BAND MIXER/DETECTOR

Waveguide single-ended mixer designed for use in the 9,35 GHz band. It is primarily intended for Doppler control systems, e.g. intruder alarms deriving local oscillator drive from the transmitter output of a Gunn-effect device such as the CL8632. The CL7520 can be used as a microwave detector. Two examples of this are sensing deliberate beam obstruction in a microwave-protected area, and as receiver in a microwave-protected area, and as receiver in a microwave barrier or fence.

QUICK REFERENCE DATA

Typical noise level (32 μA d.c 1 Hz to 1 kHz bandwidth)	. bias,			1	μV
TYPICAL OPERATING CONDITION	NS				
Ambient temperature range				-10 to +50	°C
Local oscillator level				-18	dBm
D.C. bias 3), 4)				32	μA
Total load (d.c. and i.f.)				10	kΩ
CHARACTERISTICS at 25 °C Centre frequency				9,35	GHz
		min.	typ.	max.	
Mixer					
Sensitivity for -95 dBm input		10	15		μV
Noise level (32 µA d.c. bias, 1 Hz to 1 kHz bandwidth)	1)		1	2	μV
Detector					
Tangential sensitivity	2)		-50		dBm

Notes see page 2.

Centre frequency

Typical sensitivity for -95 dBm input

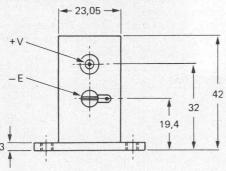
LIMITING VALUES (Absolute max. rating system)

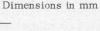
Reverse current max. 5 mA

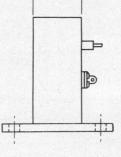
Forward current, peak max.

Ambient temperature, storage $\begin{array}{ccc} \text{max.} & +100 & \text{oC} \\ \text{min.} & -10 & \text{oC} \end{array}$

DIMENSIONS AND CONNECTIONS



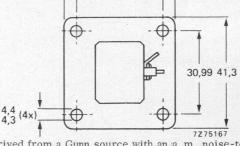




41,3 32,51

18,52

Soldering: The use of low melting point solder is recommended.



¹⁾ When the local oscillator power is derived from a Gunn source with an a.m. noise-to-carrier ratio of 94 dB (e.g. CL8632), the minimum sensitivity specified represents a signal-to-noise ratio at the mixer output of 10 dB (typically 14 dB).

 $^{^2}$) When operated as a detector with 32 μA d.c. bias, measured in a 0 to 2 MHz bandwidth.

³⁾ The diode may be damaged if the bias supply is reversed.

⁴⁾ The mixer diode will be damaged by forward current in excess of 10 mA. the module is supplied with a shorting strap connected between the mixer a.f. and earth terminals. The mixer has a low junction capacitance and may be damaged by transients of very short duration. It is therefore recommended that soldering irons are isolated from main supplies and that the shorting strap is not removed until all wiring has been completed.

X-BAND DOPPLER RADAR MODULE

Fixed frequency Gunn oscillator and mixer cavity for operation in the X-band (approx. 3 cm wavelength) intended for use in all forms of Doppler radar systems.

QUICK REFERENCE	CE DATA		
Frequency		10,687	GHz
Output power at supply voltage = 7 V		8	mW
Output voltage for an input power 100 dB dow	n on input power		
at $\frac{\text{signal + noise}}{\text{noise}} = 18 \text{ dB}$		40	μV
Supply voltage, d.c.		7	V
OPERATING CONDITIONS			
Supply voltage	2)	$7,0 \pm 0,1$	V
Supply current	3)	140	mA
O.C. mixer bias current (into a.f. terminal with respect to earth)		30 to 35	μA
A.F. load	see page		kΩ
CHARACTERISTICS at 25 °C			
Centre frequency		10,687	GHz
Output voltage for an input power 100 dB down	on input power		
at $\frac{\text{signal + noise}}{\text{noise}} = 18 \text{ dB}$ 1), 4)	, and page 5	> 20	μV μV
Output power at supply voltage = 7 V		8	mW
Frequency, fixed		> 10,675 < 10,700	GHz GHz
Frequency temperature coefficient		-0, 2 < -0, 3	MHz/k
Frequency pushing	· 基本 (1) (1) (1)	4	MHz/\
Second harmonic		-35	dBm
Diode current	3)	130 < 165	mA mA
Polar diagram		see page	5
Notes see page 3.			

LIMITING VALUES (Absolute max. rating system)

Supply voltage, d.c.

transient, T_{imp} = max. 1 ms

Temperature, storage

operating ambient

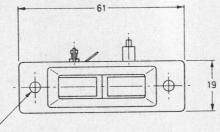
max.	7,5	7
max.	9	7
max.	+70	C

min. -10 °C max. +40 °C

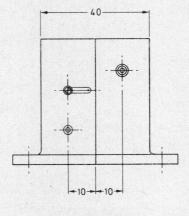
max. +40 °C min. 0 °C

Dimensions in mm

DIMENSIONS AND CONNECTIONS



2 holes \$4,2/4,0 51,5/51,0 centres



A.F.

A.F.

-E

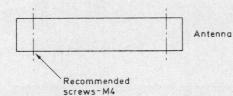
-E

-17 V 26,8

12,3

-25

2 max --



12,3

D6007A

 $\underline{\underline{Soldering}} : The use of low melting point solder is recommended.$

OPERATING NOTES

 $^{
m l}$) A return signal 100 dB down on radiated power will be achieved from a man target of radar cross-section 1 m² at a range of 15 m, when operating with the antenna supplied (antenna gain = 5 dB typ.).

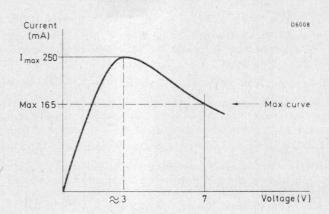
Extended range may be obtained for a reduced signal + noise and this may be

acceptable if the environment in which the system operates is stable, i.e., free from extraneous moving or vibrating objects. For example, 110 dB path loss is obtained from a man target of radar cross-section 1 m² at a range of 25 m and the $\underline{\text{signal} + \text{noise}}$ is reduced to 15 dB with an output voltage of 16 μV min.

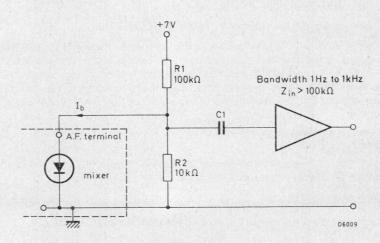
Alternatively, the range may be increased by an increase in target radar crosssection or by the use of a high gain antenna. The performance may then be calculated from the radar range equation. Further related information may be obtained on application to the supplier.

- 2) It is essential that the earth terminal is used as the common return for the Gunn voltage (+7 V) and the d.c. bias applied to the a.f. terminal.
- 3) The Gunn effect device has a voltage/current characteristic as shown on page 4. The power supply should have a low source impedance and be capable of supplying up to 250 mA at approximately 3 V during the switch-on phase.
- 4) Noise measured in a 1 Hz to 1 kHz bandwidth.
- 5) The Gunn device will be damaged if the supply is reversed.
- 6) The mixer diode will be damaged by forward current in excess of 10 mA. The module is supplied with a shorting strap connected between the mixer a.f. and earth terminals. The mixer has a low junction capacitance and may be damaged by transients of very short duration. It is therefore recommended that soldering irons are isolated from mains supplies and that the shorting strap is not removed until all wiring has been completed.
- 7) The above conditions apply when operated into the antenna supplied with the CL8960 module.
- 8) A 10 nF capacitor should be connected across and close to the +7 V and earth terminals to suppress parasitic oscillations in the power supply.
- 9) Signal + noise performance may be degraded if the antenna is covered by a radome of unsuitable construction. Page 6 describes the preferred arrangement.

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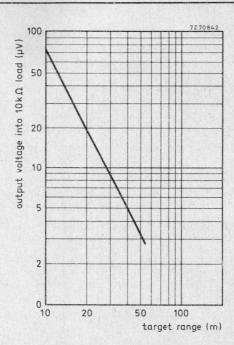
Gunn device characteristic



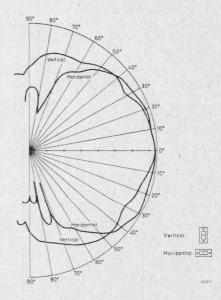
Circuit used to measure a.f. performance

 $^{^1)}$ The current I_b should be approximately 35 μA with the Gunn device disconnected and approximately 42 μA with the Gunn device operational and the antenna operating into free space.

 $^{^{2}}$) The impedance of the coupling capacitor should be low compared with \mathbf{Z}_{in} .



Minimum output for a man target



Polar diagram for antenna supplied

MOUNTING

For optimum signal to noise ratio it is recommended that the module and antenna are mounted, using M4 screws, to a 1,6 mm thick metal plate with aperture dimensions as shown on page 7.

In this configuration, the metal plate forms the front panel of the equipment, and the antenna radiates into free space. If the equipment housing is all metal, any back radiation will be completely contained. Alternatively a metal based adhesive tape may be used to seal the joint between antenna and mounting plate.

The total mixer bias under the optimum operating conditions is approximately 42 μA ($35~\mu A$ d.c. bias + $7~\mu A$ from-19 dBm of coupled 1.o.power.)

If, however, for environmental reasons, it is considered desirable to cover the antenna aperture, then it is recommended that a thin plastic meterial (approximately 0, 25 mm thick) is fixed to the metal plate with adhesive.

In this case, the l.o. power coupled to the mixer will be 11 dBm, and the total mixer bias current will now be approximately 60 μ A.

Increase in 1.o. power will, in general, give rise to an increase in a.f. output voltage for a given target, but this will be accompanied by a degradation in signal to noise ratio. For -11 dBm of 1.o. power, the degradation in signal to noise ratio should be acceptable for most applications.

However, further increase in the level of coupled l.o. power, arising from the use of thick or microwave reflective covering materials, will:

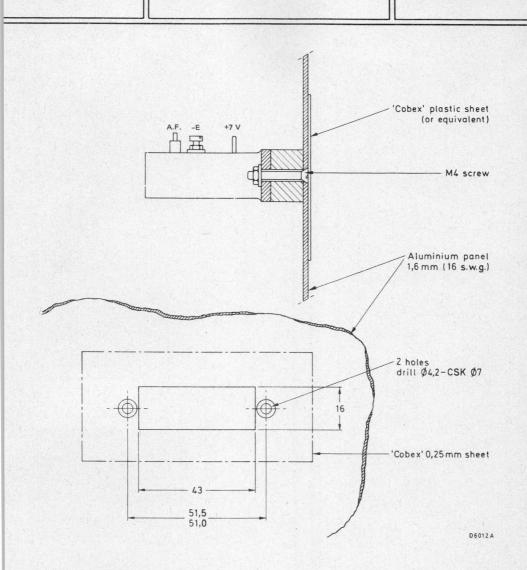
- a. continue to increase the a.f. power output voltage from the mixer but, at the same time, degrade the signal to noise ratio. Note that the increase in a.f. output voltage will not be the same for each module.
- b. present a mismatch to the Gunn oscillator which may impair the switching and running performance and may "pull" the frequency outside the allocated operating frequency band.

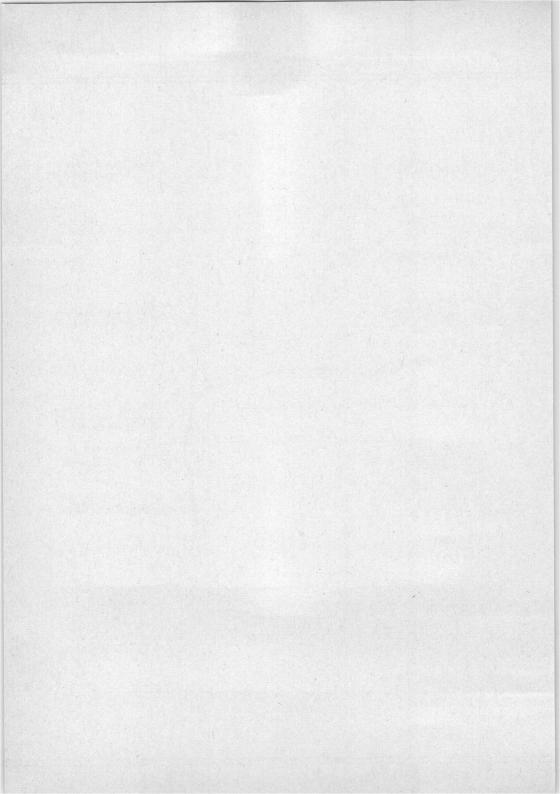
The following table compares the 1.o. coupling level obtained for different covering materials at the antenna.

L.O. coupling	Mixer total bias	Antenna covering
(dBm)	(µA)	material
-	35 (d.c. only)	
-19	42	No covering
-15	50	1 to 2 cm expanded
		polythene or
		polystyrene
-11	61	0,25 mm Cobex plastic
-6	70	0,5 mm Cobex plastic

Cobex is a product of British Industrial Plastics.

T





10,525 GHz

X-BAND DOPPLER RADAR MODULE

Fixed frequency Gunn oscillator and mixer cavity for operation in the X-band (approx. 3 cm wavelength) intended for use in all forms of Doppler radar systems.

QUICK REFERENCE DATA

Output power at supply voltage = 7 V			8	mW
Output voltage for an input power 100 dB down on output power				
$at \frac{\text{signal} + \text{noise}}{\text{noise}} = 18 \text{ dB}$			40	μV
Supply voltage, d.c.			7	V
OPERATING CONDITIONS				
Supply voltage	2)		$7,0\pm 0,1$	V
Supply current	3)	h .	140	mA
D.C. mixer bias current (into a.f. terminal with respect to earth)	3		30 to 50	μА
A.F. load	see page	4	. 10	kΩ
CHARACTERISTICS at 25 °C				
Centre frequency			10,525	GHz
Output voltage for an input power 100 dB down of	on output power			
at $\frac{\text{signal} + \text{noise}}{\text{noise}} = 18 \text{ dB}$	1), 4), page 5	>	40 20	μV μV
Output power at supply voltage = 7 V			8	mW
Output power at suppry voltage - 7 v				
Frequency, fixed		> <	10,500 10,550	GHz GHz
Frequency temperature coefficient		<	-0,2 -0,3	MHz/K MHz/K
Frequency pushing			4	MHz/V
Second harmonic			-35	dBm
Diode current	3)	<	130 165	mA mA
Polar diagram			see page 5	
Notes see page 3. Data based on pre-production devices.				

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Frequency

LIMITING VALUES (Absolute max. rating system)

Supply voltage, d.c.

transient, T_{imp} = max. 1 ms

Temperature, storage

operating

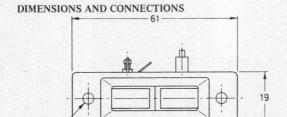
max. 7,5 V max. 9,0 V

min. -10 °C

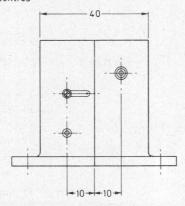
max. +70 $^{\circ}$ C

min. 0 °C max. +40 °C

Dimensions in mm



2 holes Ø 4,2 / 4,0 51,5 / 51,0 centres



25 A.F.

46 +7 V 26,8 12,3 12,3 12,3



12,3

D6007A

Soldering: The use of low melting point solder is recommended.

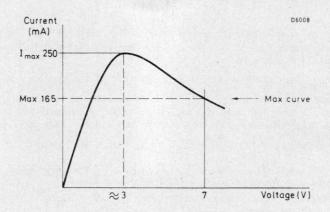
OPERATING NOTES

 1) A return signal 100 dB down on radiated power will be achieved from a man target of radar cross-section 1 m² at a range of 15 m, when operating with the antenna supplied (antenna gain is 5 dB typ.).

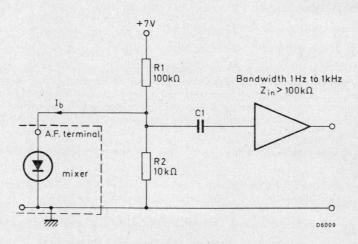
Extended range may be obtained for a reduced $\frac{\text{signal} + \text{noise}}{\text{noise}}$ and this may be acceptable if the environment in which the system operates is stable, i.e., free from extraneous moving or vibrating objects. For example, 110 dB path loss is obtained from a man target of radar cross-section 1 m² at a range of 25 m and the $\frac{\text{signal} + \text{noise}}{\text{noise}}$ is reduced to 15 dB with an output voltage of 16 μ V min.

Alternatively, the range may be increased by an increase in target radar crosssection or by the use of a high gain antenna. The performance may then be calculated from the radar range equation. Further related information may be obtained on application to the supplier.

- 2) It is essential that the earth terminal is used as the common return for the Gunn voltage (+7 V) and the d.c. bias applied to the a.f. terminal.
- 3) The Gunn effect device has a voltage/current characteristic as shown on page 4. The power supply should have a low source impedance and be capable of supplying up to 250 mA at approximately 3 V during the switch-on phase.
- 4) Noise measured in a 1 Hz to 1 kHz bandwidth.
- 5) The Gunn device will be damaged if the supply is reversed.
- 6) The mixer diode will be damaged by forward current in excess of 10 mA. The module is supplied with a shorting strap connected between the mixer a.f. and earth terminals. The mixer has a low junction capacitance and may be damaged by transients of very short duration. It is therefore recommended that soldering irons are isolated from main supplies and that the shorting strap is not removed until all wiring has been completed.
- 7) The above conditions apply when operated into the antenna supplied with the CL8963 module.
- $^8)$ A 10 nF capacitor should be connected across and close to the $+\,7$ V and earth terminals to suppress parasitic oscillations in the power supply.
- 9) Signal + noise performance may be degraded if the antenna is covered by a radome of unsuitable construction. Page 6 describes the preferred arrangement.



Gunn device characteristic

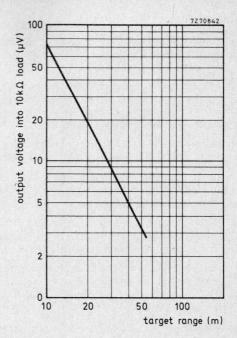


Circuit used to measure a.f. performance

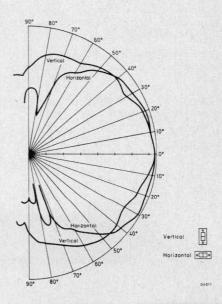
November 1976

 $^{^1\!\!}$) The current I_b should be approximately 35 $\mu\! A$ with the Gunn device disconnected and approximately 42 $\mu\! A$ with the Gunn device operational and the antenna operating into free space.

 $^{^{2}}$) The coupling capacitor should have a small impedance compared with $Z_{\mbox{in}}$.



Minimum output for a man target



Polar diagram for antenna supplied

MOUNTING

For optimum signal to noise ratio, it is recommended that the module and antenna are mounted, using M4 screws, to a 1,6 mm thick metal plate with aperture dimensions as shown on page 7.

In this configuration, the metal plate forms the front panel of the equipment, and the antenna radiates into free space. If the equipment housing is all metal, any back radiation will be totally contained. Alternatively a metal based adhesive tape may be used to seal the joint between and mounting plate.

The total mixer bias under the optimum operating conditions is approximately 42 μA . (35 μA d.c. bias + 7 V from -19 dBm of coupled l.o. power.)

If, however, for environmental reasons, it is considered desirable to cover the antenna aperture, then it is recommended that a thin plastic material (approximately 0,25 mm thick) is fixed to the metal plate with adhesive. A suitable plastic material is detailed on page 7.

In this case, the l.o. power coupled to the mixer will be -11 dBm, and the total mixer bias current will now be approximately 60 μ A.

The increase in 1.0. power will, in general, give rise to an increase in a.f. output voltage for a given target, but this will be accompanied by a degradation in signal to noise ratio. For -11 dBm of 1.0. power, the degradation in signal to noise ratio should be acceptable for most applications.

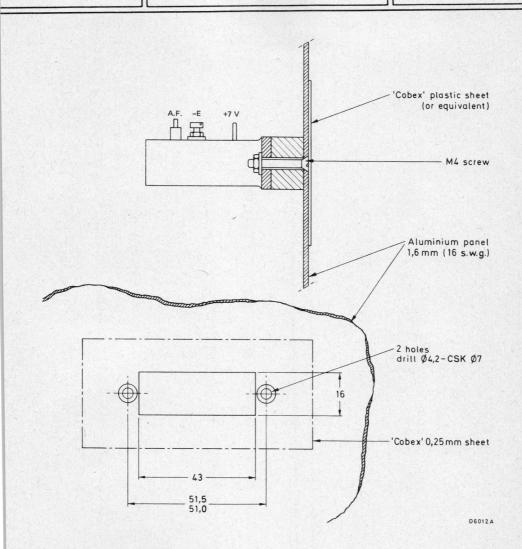
However, further increase in the level of coupled l.o. power, arising from the use of thick or microwave reflective covering materials, will:

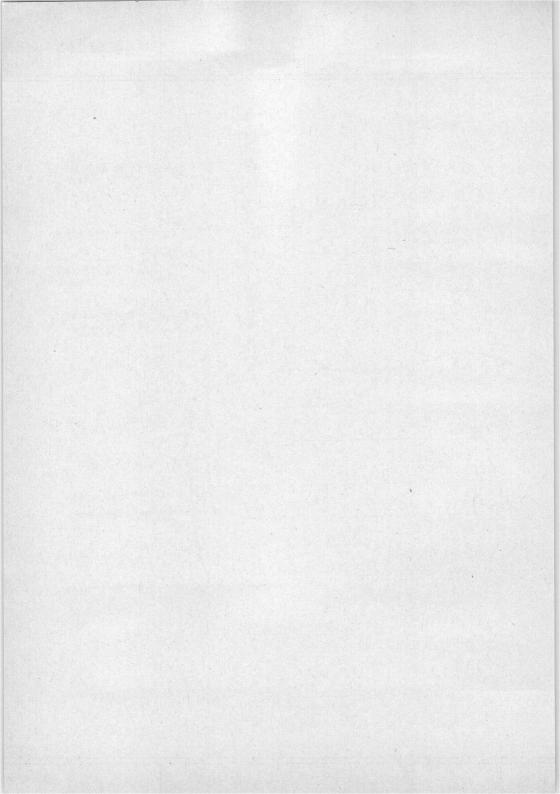
- a. continue to increase the a.f. output voltage from the mixer but, at the same time, degrade the signal to noise ratio. Note that the increase in a.f. output voltage will not be the same for each module.
- b. present a mismatch to the Gunn oscillator which may impair the switching and running performance and may 'pull' the frequency outside the allocated operating frequency band.

The following table compares the l.o. coupling level obtained for different covering materials at the antenna.

L.O. coupling (dBm)	Mixer total bias (μA)	Antenna covering material
1	35 (d.c. only)	
-19	42	No covering
-15	50	1 to 2 cm expanded
		polythene or
		polystyrene
-11	61	0,25 mm Cobex plastic
-6	70	0,5 mm Cobex plastic

Cobex is a product of British Industrial Plastics.





This information is derived from development samples made available for evaluation. It does not form part of our data handbook system and does not necessarily imply that the device will go into production

MICROWAVE ANTENNA

The MAC0102 is a general purpose X-band antenna with SMA socket, for use with 50 Ω coaxial cables provided with a 50 Ω plug. The MAC0103 is fitted with an SMA plug for use with 50 Ω socket.

CHARACTERISTICS

Frequency range
Gain at 9,35 GHz
Beam angle, both planes, 3 dB at 9,35 GHz
VSWR

30 deg max. 1,2

9 to 10 GHz

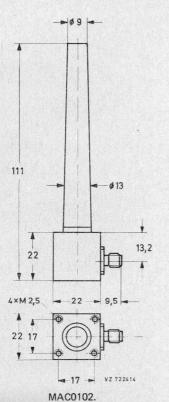
12 to 13 dB

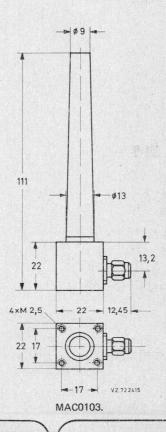
Dimensions in mm

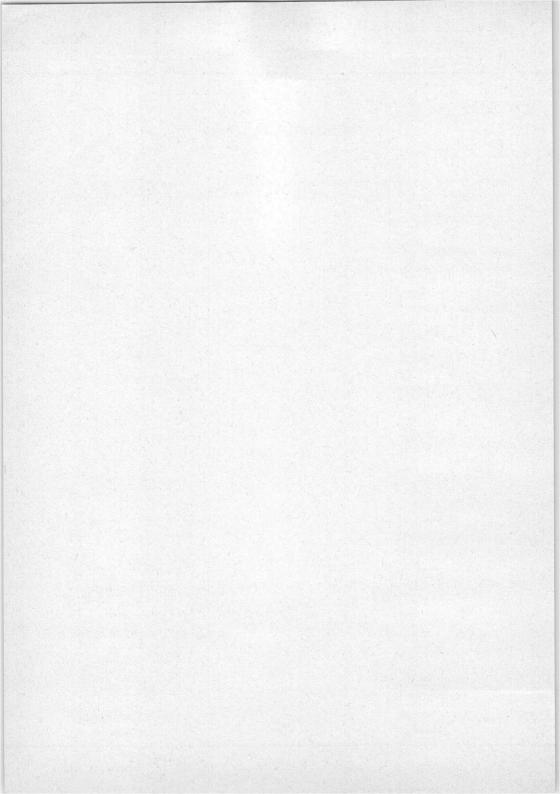
MECHANICAL DATA

Conical body made in polypropylene

Mass 35 g nominal







X-BAND DOPPLER RADAR MODULE

The MDX0520 is a compact oscillator/detector type Doppler radar module comprising a cavity stabilized Gunn-oscillator as transmitter, a diode mixer, and a planar transmitter and receiver antenna; it is intended for use in motion detectors. (Application information on request.)

The oscillator, the diode mixer and antenna are one unit.

QUICK REFERENCE DATA

Frequency	9,350 GH
Detection range (human target)	≈ 15 m
Antenna beam angle horizontal vertical	≈ 50 deg ≈ 30 deg
Supply voltage, d.c.	10,5 to 14,0 V
Dimensions	70 dia x 25 mm
Mass	≈ 80 g

CHARACTERISTICS AND LIMITING VALUES

Detection range (human target); see page 3	≈ 15 m*
Antenna beam angle (-3 dB) horizontal vertical	≈ 50 deg ≈ 30 deg
Antenna gain	≈ 9 dB
Operating frequency	9,350 GHz**
Temperature coefficient of frequency	-0,5 MHz/K
Radiated power	≈ 10 mW
Second harmonic radiated power	<10 ⁻² mW

^{*} For detection of a human target (target gain 40 dB, or radar cross-section 1 m²). Noise voltage (5 to 100 Hz) \leq 3 μ V. The range depends on the electrical characteristics of the low frequency amplifier and the signal processing system connected to the unit.

^{**} Other frequencies in the X-band on request.

CHARACTERISTICS AND LIMITING VALUES (continued)

Power supply requirements

Caution: Negative to case - reversal of polarity will destroy module

voltage d.c., operating	max.	14,0	٧
	min.	10,5	٧
ripple voltage (peak-to-peak)		1	V*
absolute maximum	max.	15	V
current	≈	150	mA
Temperature ·	max.	+70	oC
operating	min.	-30	oC
	max.	+80	oC
storage	min.	-30	oC

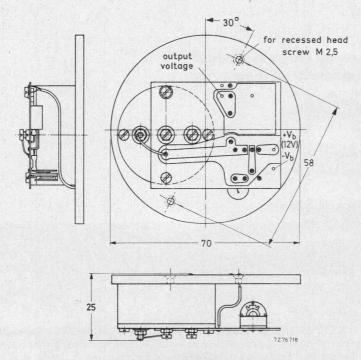
CONNECTIONS

Soldering terminals

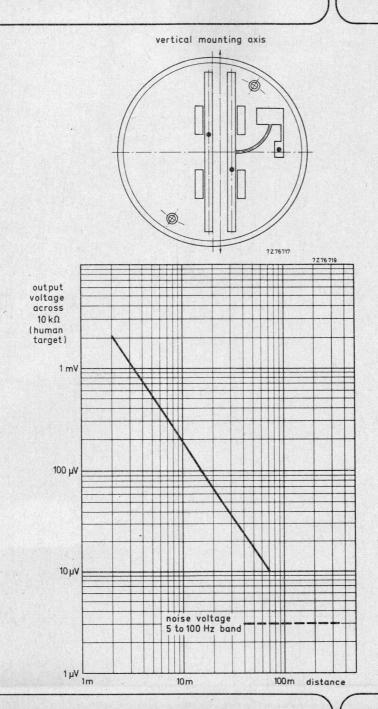
The signal processing circuitry (or, at least, the signal amplifier) shall be connected directly to the module.

MECHANICAL DATA

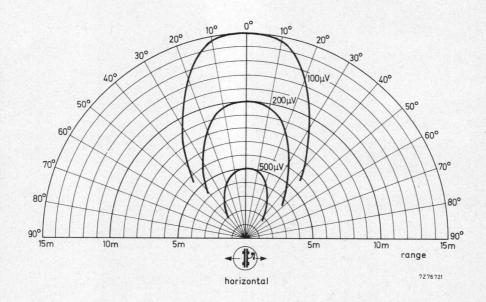
Dimensions in mm

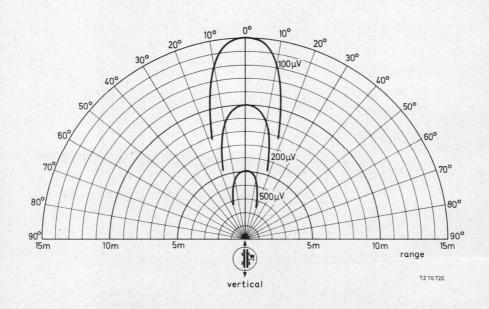


^{*} The instantaneous value of the supply voltage shall not be below 10,5 V.



Output voltage across 10 $k\Omega$ (human target)





DEVELOPMENT SAMPLE DATA

This information is derived from development samples made available for evaluation. It does not form part of our data handbook system and does not necessarily imply that the device will go into production

MDX1021 (DMOA21)

MICROWAVE DOPPLER RADAR MODULE

The MDX1021 is an oscillator/detector type Doppler radar module operating in the X-band (approximately 3 cm wavelength). It has been designed for slow-motion detection and its main application is in intruder alarm systems. The module features a built-in self-testing circuit that detects certain fault conditions such as improper functioning or attempts to sabotage the module.

QUICK REFERENCE	DATA	
Detection range, adjustable (human target)	≥ 1 to ≥ 12	m
Velocity range	0,25 to 3,5	km/h
Antenna beam angle (horizontal and vertical)	≈ 150	deg
Supply voltage, d.c.	12	V
Overall dimensions	max. 195 x 180 x 162	mm
Mass	≈ 2	kg

DESCRIPTION

The MDX1021 contains a special waveguide cavity Gunn oscillator and a Schottky diode mixer cavity (twin cavity module). Both use the same antenna, which forms an integral part of the cavities. Microwave energy is transmitted and received via this antenna. When the transmitted energy is reflected by a moving object the frequency will be changed due to the Doppler effect. In the receiving part of the module only those signals are amplified and processed that differ in frequency from that of the radiated frequency.

When Doppler signals of sufficient strength (e.g. from intruders) are detected, a positive security relay is operated - normally closed relay contacts are opened - and an alarm can be initiated via these contacts.

A separate built-in self-testing circuit continuously checks the proper functioning of both transmitter and receiver. When the module is at fault this will result in the operation of a relay with normally closed contacts that can be incorporated in a monitoring circuit. Furthermore, when an attempt is made to sabotage the module by placing a metal screen in front of the antenna to make the MDX1021 "blind" the same relay is operated to indicate that the module is not functioning properly.

In the module and in the wall bracket three normally closed microswitches protect the module against tampering.

The only adjustment to be made after mounting the module is the setting of the range by means of a variable potentiometer, situated behind a microswitch-protected panel.

To avoid unnecessary alarms the MDX1021 has three circuits:

- -1 A low-pass filter to ensure that only slow movements are detected, and interference signals with frequencies of 100 Hz and higher are suppressed.
- -2 An A.G.C.: Automatic Gain Control. A circuit in the amplifier section ensures that repetitive interference signals will be inversely and proportionally amplified so that only those Doppler signals will lead to an alarm whose nature and level differ from repetitive interference signals. As soon as the interference signals have disappeared the gain of the amplifier is progressively restored to the originally set nominal value.
- -3 A signal analyser. As soon as Doppler signals are received they are stored in a memory. After approximately one second they are compared with the output signals of the amplifier. If these are still present the alarm circuit is triggered.

CHARACTERISTICS AND LIMITING VALUES

Detection range, adjustable (human target) ≥ 1 to ≥ 12					
Antenna beam angle (horizontal and vertical) ≈ 150					
Operating frequency 10,670					
	15	mW			
>	-20	dBm			
≤ 5	0 000				
5 1	to 70	Hz			
nom.	12	V			
min.	11	V			
max.	15	Ŋ			
max.	50	mV			
nom.	180	mA			
≤	250	mA			
	<pre></pre>	≈ 150 10,670 15 > -20 ≤ 50000 5 to 70 nom. 12 min. 11 max. 15 max. 50 nom. 180			

¹⁾ Modules with operating frequencies of 9,350 GHz or 9,900 GHz can be supplied.

Output terminals:

Alarm Self-test circuit

Self-test circuit Tamper

Temperature range

Overall dimensions

Mass

relay 1)
microswitches

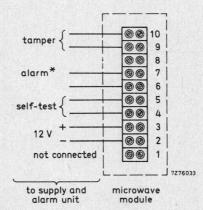
max. 200 mA max. 200 V max. 10 VA

-10 to +55 °C

max. 195 x 180 x 162 mm

2 kg

CONNECTIONS



* Terminals 6 and 7 "normally closed" with power on.

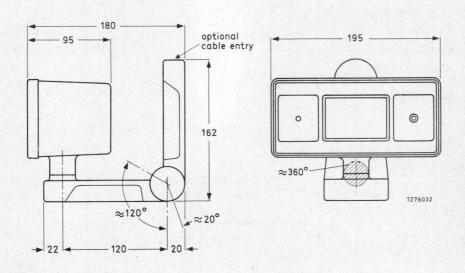
¹⁾ To protect the relay contacts:

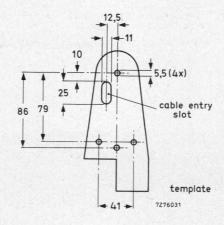
a) for inductive d.c. load (relay) connect a diode (BYX36/400 or equivalent) across the load coil (cathode connected to +supply):

b) for a.c. load connect a 0, 1 μ F (400 V) capacitor across the load.

MECHANICAL DATA

Dimensions in mm





DEVELOPMENT SAMPLE DATA

This information is derived from development samples made available for evaluation. It does not form part of our data handbook system and does not necessarily imply that the device will go into production

MDX1033 (DOP23)

MICROWAVE DOPPLER RADAR MODULE

The MDX1033 is an oscillator/detector type Doppler radar module operating in the X-band (approximately 3 cm wavelength). It has been designed for slow-motion detection (0,25 to 4 km/h) and its main application is in automatic door openers.

The module is built in a sturdy, drip-proof housing, with a mounting bracket which can be orientated.

QUICK REFERENCE DATA

Detection range, adjustable (human target)	≤ 1 to ≥ 12	m
Velocity range	0,25 to 4	km/h
Antenna beam angle (horizontal and vertical) at maximum gain	≈ 150	deg
Supply voltage, d.c.	12	V
Overall dimensions	max 195 x 180 x 162	mm
Mass	≈ 2	kg

DESCRIPTION

The MDX1033 contains a special twin cavity with separate Gunn oscillator and Schottky diode mixer cavity, and an integral common antenna. When the transmitted microwave energy is reflected by a moving object the frequency will be changed due to the Doppler effect. In the mixer this frequency shift is detected. The "difference frequency signal" is amplified and filtered to avoid parasitic operation of the positive security output relay (in case of failure the contacts are closed). The only adjustment to be made is the setting of the range by means of a potentiometer situated behind a small front panel. Operation is monitored by a small LED indicator ("on" during standby).

The electronic subassembly is separately available. Please ask your supplier.

CHARACTERISTICS AND LIMITING VALUES

Detection range, adjustable (human target)	≤ 1 to ≥ '	12 m	
Antenna beam angle (horizontal and vertical) at maximum gain	≈ 19	50 deg	
Operating frequency	10 6	70 MHz †	
Radiated power (Gunn diode)		15 mW	
Second harmonic radiation	< -:	20 dBm	
Amplifier pass band	5 to	80 Hz	
Power supply requirements			
Voltage, d.c.	nom	12 V	
	min	11 V	
	max	15 V	
Ripple voltage, peak to peak	max	30 mV	
Current	nom 1	80 mA	
	max 2	20 mA	
Output relay	S.P.D.T. (f	S.P.D.T. (form C)	
Switched power	max 5	50 VA	
Switched voltage	max	V	
Switched current	max	mA	
Overall dimensions	max 195 x 180 x 1	62 mm	
Mass	≈	2 kg	

CONNECTIONS

terminal	colour	connection	function		
10	_	_			
9					
8	yellow	normally closed			
7	blue	normally open	output relay		
6	green	common	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		
5	*white	_			
4	grey	-			
3	red	+12 V	supply		
2	black	mass			
1	-				

[†] Other frequencies such as 9350 MHz and 9900 MHz can be supplied.

INSTALLATION AND POSITIONING

All connections are hidden inside the mounting bracket and accessible after taking off its front cover.

Direction setting

a) Elevation (in steps of 100)

The elevation is set by means of the hinge in the mounting bracket. The hinge can be unlocked and locked in position with the screw in it (use no.5 Allen key).

b) Azimuth (in steps of 100)

The housing may be turned around the vertical axis. The locking screw is accessible after removing the bottom plate of the mounting bracket.

Position the module so that the lobe of the radiation pattern (see below) skims the door to be opened.

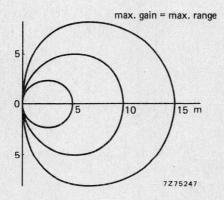
Range setting (see radiation pattern below)

The range (= gain) setting potentiometer is accessible after removing the small front panel of the module.

After switching on the power, set the range (gain) at minimum by turning the potentiometer clockwise and allow a few minutes for the detector to become active: LED indicator lights up (in absence of moving bodies at close range). Any detection of movement within the set range activates the output relay (hold position maintained for about 1 s) and de-activates the LED indicator. If necessary increase the range (gain) by turning the potentiometer anti-clockwise. Do not set the gain higher than strictly necessary to avoid unwanted activation: the range is a function of the cross-section of the moving body. Microwave radiation can "see" through thin walls as well as being reflected by thicker walls or metal surfaces.

Note that the beam width is reduced with lower gain.

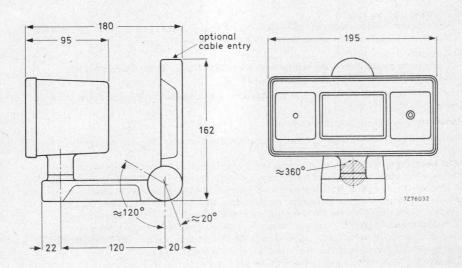
The complete electronic subassembly can be removed from the housing for servicing without affecting the direction setting. Unscrew the 4 corner screws in the front panel, take out the subassembly and disconnect the internal connector.

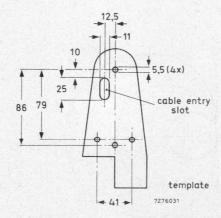


Radiation pattern

MECHANICAL DATA

Dimensions in mm





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BALANCED MIXER

Balanced mixer in microstrip technique with integrated Schottky-barrier diodes intended for transformation of signals from the X-band to intermediate frequencies up to 2 GHz, e.g. TV converter band VI to band IV/V.

OPERATING CONDITIONS AND CHARACTERISTICS (at 25 °C)

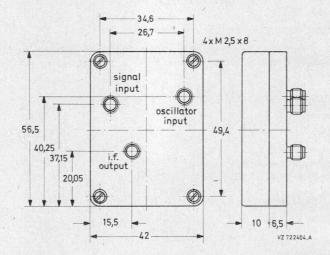
o()			
	11,4 to	12,2	GHz*
	11,33 to	11,41	GHz
		6	mW
		8	dB
		4	dB
min.	typ.	max.	
15	20		dB
	2 2	3	
	max.	100	mW
	max.	100	mW
	max.	75	oC
	min.	11,4 to 11,33 to 11,33 to 20 2 2 2 max. max.	11,4 to 12,2 11,33 to 11,41 6 8 4 min. typ. max. 15 20 2 3 2 3 2 3

^{*} Other frequency ranges within the X-band on request.

MECHANICAL DATA

Terminals SMA 50 Ω

Dimensions in mm



The SHF inputs may be interchanged without damaging the mixer and without significant changes in performance. The values given in these data are based on the connections indicated in the drawing.

DEVELOPMENT SAMPLE DATA

This information is derived from development samples made available for evaluation. It does not form part of our data handbook system and does not necessarily imply that the device will go into production

MMX0111

BALANCED MIXER

Balanced mixer in microstrip technique with integrated Schottky-barrier diodes, intended for transformation of signals from the X-band to intermediate frequencies of 10 to 70 MHz.

OPERATING CONDITIONS AND CHARACTERISTICS (at 25 °C)

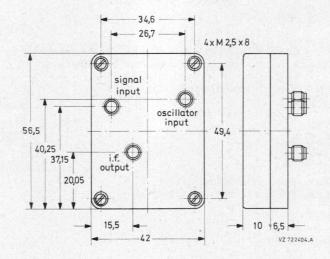
OPENATING CONDITIONS AND CHARACTERISTICS (at 25	C)				
Signal frequency range		8,5	to 9,6	GHz*	
Oscillator frequency		8,4	to 9,7	GHz	
Intermediate frequency		10	to 70	MHz	
Local oscillator power			10	mW	
	min.	typ.	max.		
Noise figure, measured with broad-band amplifier with a noise contribution of 1,5 dB; i.f. frequency 30 and 70 MHz		8	9	dB	
Conversion loss			6,5	dB	
L.O. isolation	15			dB	
VSWR (with respect to 50 Ω) at the signal input terminal at the oscillator input terminal		max. max.	3		
LIMITING VALUES (Absolute maximum rating system)					
Input power at signal terminal		max.	100	mW	
Input power at oscillator terminal		max.	100	mW	
Ambient temperature		max.	75	oC	

^{*} Other frequency ranges within the X-band on request.

MECHANICAL DATA

Terminals SMA 50 Ω

Dimensions in mm



The SHF inputs may be interchanged without damaging the mixer and without significant changes in performance. The values given in these data are based on the connections indicated in the drawing.

MMX0112

This information is derived from development samples made available for evaluation. It does not form part of our data handbook system and does not necessarily imply that the device will go into production

BROAD-BAND BALANCED MIXER

Broad-band balanced mixer in microstrip and microslot technique with integrated Schottky-barrier diodes intended for transformation of signals from the X-band to the intermediate frequencies from 10 to 70 MHz.

OPERATING CONDITIONS AND CHARACTERISTICS (at 25 °C)

Signal frequency range	8,13 to	12,47 GHz
Oscillator frequency	8,2 to	12,4 GHz
Intermediate frequency	10 to	70 MHz
Local oscillator power		8 mW
	typ.	max.
Noise figure*	8,5	10 dB
VSWR (with respect to 50 Ω)		
at the signal input terminal	. 2	3
at the oscillator input terminal	2	3

LIMITING VALUES (Absolute maximum rating system)

Input power signal terminal	max.	100 mW
Input power oscillator terminal	max.	100 mW
Ambient temperature	max.	75 °C

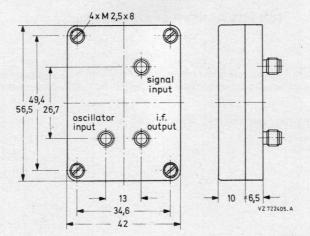
MECHANICAL DATA

Terminals: SMA 50 Ω female

^{*} Measured with an i.f. amplifier with a noise contribution of 1,8 dB.

MECHANICAL DATA (continued)

Dimensions in mm



The SHF inputs may be interchanged without damaging the mixer and without significant changes in performance. The values given in these data are based on the connections indicated in the drawing.

Circulators and isolators H



GENERAL

Contents	page
Isolators and circulators, general section	3
Coaxial circulator series, bands IV $-$ V, 100 W, u.h.f., TV	10
Coaxial circulator series, 300 W, u.h.f., TV	12
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Coaxial circulator/isolator series, octave bandwidth	18
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Industrial heating isolators	30
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ISOLATORS AND CIRCULATORS

INTRODUCTION

Only a brief general description of isolators and circulators is given here: those readers seeking fuller information are referred to our Application Book 'Isolators and Circulators'.

Isolators

An isolator is a passive non-reciprocal device which permits microwave energy to pass through it in one direction whilst absorbing energy in the reverse direction. In the forward direction, that is the direction in which the energy is passed, the insertion loss is usually 0,3 to 0,5 dB in the frequency range for which the isolator has been designed. In the opposite direction the isolation is normally 30 dB but for certain applications isolation can be made as high as 55 to 60 dB.

In the field displacement type of isolator, which is described later, a ferrite bar is mounted in a waveguide and biased by a magnetic field. The non-reciprocal behaviour of this type of isolator is produced by gyromagnetic effects which occur between the high frequency magnetic field and the electrons in the ferrite.

Circulators

A circulator is a passive non-reciprocal device with three or more ports. It contains a core of ferrite material in which energy introduced into one port is transferred to an adjacent port, the other ports being isolated.

Although circulators can be made with any number of ports, the most commonly used are 3-port and 4-port, the symbols for which are given in Figs 1 and 2.

Fig. 1 Symbol for 3-port circulator.

Fig. 2 Symbol for 4-port circulator.

Energy entering port 1 emerges from port 2; energy entering port 2 emerges from port 3, and so on in cyclic order. In this direction of circulation an ideal circulator would have no losses, but in practical constructions there are some losses.

In an ideal circulator no energy would flow in the direction opposite to the circulation direction. Again in practice this isolation is in the order of 20 to 30 dB; in very narrow bands it is even higher. The non-reciprocal behaviour of circulators is the result of gyromagnetic effects in the ferrite when this is biased with a magnetic field.

APPLICATIONS

Isolators

The main application of an isolator is to improve the behaviour of klystrons, magnetrons or travelling-wave tubes by isolating the source from the load. The main factor is that an antenna or amplifier cannot be matched ideally to the preceding function over the required frequency range, so that energy would be reflected back into the tube and upset the frequency stability. The isolator will absorb this reflected energy so that the tube is effectively protected from these disturbing influences.

The isolators are provided with adjusting screws that enable them to be matched so that the v.s.w.r. is minimum over a certain frequency range. It is therefore possible to optimize the efficiency of waveguide runs by matching the isolator to minimum reflection. This means that long line effects can be drastically reduced.

Circulators

The main application of circulators is the duplexing of systems for simultaneous transmission and reception in low and medium-power telecommunication equipment; this is illustrated in Figs 3 and 4.

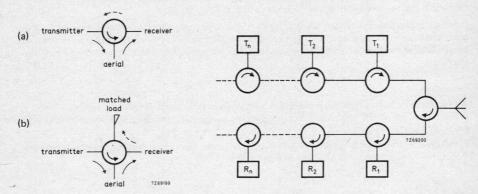


Fig. 3 Duplexing one receiver and one transmitter with (a) a 3-port circulator and (b) a 4-port.

Fig. 4 Duplexing of a number of transmitters (T) and receivers (R).

The reasons that both 3-port and 4-port circulators are used are:

- a 3-port circulator usually has a wider bandwidth than a 4-port circulator;
- a 4-port circulator (of which the fourth port is provided with a matched load, Fig. 3(b)), however, does not require a very accurately matched receiver, so that a much simpler filter can be used on the receiver input.

A 3-port circulator can also be used as an isolator by putting a matched load on one port; Fig. 5. The characteristics of a circulator performing a decoupling function are superior to those of an isolator, particularly at the lower frequencies. Decoupling can be increased by cascading circulators. Decoupling and insertion loss are directly proportional to the number of circulators. For additional information refer to our Application Book 'Isolators and Circulators'.

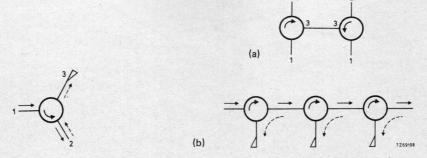


Fig. 5 A 3-port circulator used as an isolator.

Fig. 6 Cascaded circulators (a) in H-configuration, (b) π -configuration.

CONSTRUCTION

Waveguide isolators

A field displacement isolator is shown in Fig. 7. The ferrite bar (1) can be seen inside the waveguide, flanked by two sets of magnets (2) outside the waveguide. These magnets bias the ferrite bar. The adjusting screws (3) protruding into the waveguide are used to match the isolator for minimum voltage standing wave ratio.

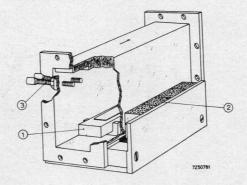


Fig. 7 Field displacement isolator.

Waveguide circulators

Three or four waveguides intersect at angles of 120° or 90° respectively in this type of circulator. A 4-port waveguide circulator of the junction type is shown in Fig. 8. A piece of ferrite (1) is located between two magnets (2) exactly in the centre of the intersection. Posts (3) are placed in the waveguide to achieve a good match.

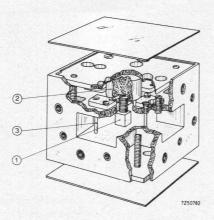


Fig. 8 Construction of a junction type waveguide circulator.

Coaxial circulators

A coaxial circulator of the junction type is shown in Fig. 9. Three copper strips (1) intersect at 120° in the centre of the circulator. The strips are mounted between two earth plates (2) to form a matched high-frequency conductor. Two ferrite discs (3) and magnets (4) are mounted in the exact centre of the circulator.

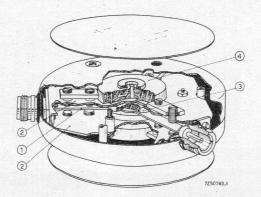


Fig. 9 Construction of a junction type coaxial circulator.

TERMS AND DEFINITIONS

Frequency range

This is the range within which the isolator or circulator meets the guaranteed specification. Outside of this range the electrical properties deteriorate rapidly. Circulators, however, will not be damaged if erroneously subjected to frequencies outside the range.

Isolation

In an isolator, isolation is the ratio of the input power to the output power in the reverse direction, expressed in dB. The power measurements are made with matched source and matched load.

In a circulator, isolation is the ratio of the energy entering a port to the energy scattered into the adjacent port in the reverse direction to normal circulation, expressed in dB. Measurements are made with a matched source and all other ports correctly terminated. The isolation between ports 1 and 3, α_{1-3} , is equal to α_{3-2} and α_{2-1} (Fig. 1).

Insertion loss

This is the attenuation which results from including an isolator or circulator in the transmission system. Insertion loss is the proportion of power lost between the ports of the device when energy is travelling in the forward direction, expressed in dB. Measurements are made with the input and output matched.

Voltage standing wave ratio

The v.s.w.r. is the ratio of the maximum voltage to the minimum voltage along a lossless line. In circulators the v.s.w.r. is measured with all unused ports terminated by a matched load. Coaxial circulators are designed with a characteristic impedance of 50 ohms.

Maximum power

Under no circumstances should the maximum power value for isolators and circulators be exceeded. In an *isolator*, the maximum power is the largest power that may be passed through it in the forward direction into a load with a v.s.w.r. of 2.

In a *circulator*, the maximum power is the largest power that it can handle at sea level and maximum ambient temperature — and with cooling applied if specified in the data — when one port is terminated with a mismatch having a v.s.w.r. of 2, and the next port is matched having a v.s.w.r. $\leq 1,2$.

The maximum power for coaxial circulators is the maximum continuous-wave power unless a maximum peak power is separately stated. These power levels should not be exceeded.

The peak power is the maximum peak sync power as defined by the CCIR signal standard. This value is given for isolators and circulators at the v.h.f. and u.h.f. television frequencies. If this value is exceeded the isolator or circulator can be damaged by arcing in its internal transmission structure.

Peak power values are valid for one signal passage only.

Since the sound power P_S passes through the circulator twice in a signal-combining circulator, the average power when P_S = 0,2 P_{SVDC} is given by $P \approx 1,17P_{SVDC}$.

Under worst-case conditions, the peak power produced for the same signal is given by

$$P_{M} = \sqrt{P_{sync} + 2\sqrt{P_{s}}} = P_{sync} (1 + 2\sqrt{0.2})^{2} = 3.6P_{sync}$$

Temperature range

The ambient temperature range within which isolators and circulators function to specification. (When necessary, special temperature compensation is built in for circulators.) Circulators still function outside the temperature range but their electrical behaviour may be far outside the guaranteed specifications. However, no permanent damage can be expected unless a large temperature rise is caused by excessive power handling.

The storage temperature of isolators may be from -40 to +125 $^{\circ}\text{C}$ unless otherwise specified in the data.

CAUTIONARY NOTES

- Isolators and circulators have internal magnetic fields that are carefully adjusted for optimum
 operation.
- 2. Isolators and circulators are not to be subjected to strong external magnetic fields.

QUALITY GUARANTEE

Subject to the Conditions of Guarantee the Manufacturer guarantees the isolators/circulators supplied to the purchaser to meet the specifications as published in the Manufacturer's Data Handbook and to be free from defects in material and workmanship.

Under this guarantee the Manufacturer will within one year after shipment to the original purchaser repair or replace at the Manufacturer's option, free of charge, any isolator/circulator proved by the Manufacturer's inspection to be thus defective.

STANDARD TEST SPECIFICATIONS

Initial measurements

These measurements have been carried out at room temperature and at the extreme temperatures, with a power level not exceeding 10 mW.

Tropical test

This test has been carried out completely in accordance with IEC 68 test D, accelerated damp heat. This test begins with the temperature at 55 + 2 °C and R.H. at 95 to 100% for a period of 16 hours, followed by a period of 8 hours with the temperature at +25 °C and R.H. 80 to 100% to complete the 24-hour cycle: the test consists of 6 uninterrupted cycles.

Vibration test

This test has been carried out completely in accordance with MIL-STD-202D, method 201A: frequency range 10 to 55 to 10 Hz for 2 hours in each of the X, Y and Z directions, with a total excursion of 1,5 mm.

Thermal shock test

This test has been carried out completely in accordance with MIL-STD-202D, method 107C under condition A: 5 cycles with extreme temperatures of -55 °C and +85 °C; duration of one cycle is 1 hour.

Mechanical shock test

This test has been carried out in accordance with MIL-STD-202D, method 213A under condition G: peak value 100 g, duration 6 ms, and also with extreme peak values up to 800 g, duration approximately 1 ms for each device, referring to the results of the drop test.

Drop test

This test has been carried out in accordance with ISO 2248, part IV: packaging complete, filled transport packages, vertical impact.

R.F. power test

The devices have been tested in accordance with the definition of maximum power in the Data Handbook (v.s.w.r.= 2). The ambient temperature of 25 °C was increased to the maximum operating temperature and the duration of the test was 1 hour for each device.

Final measurements

On completion of the above tests final measurements were carried out at a temperature of ± 25 °C and with a power level not exceeding 10 mW. The results of these tests should be within the guaranteed values.

Dimensions and visual appearance

These have been checked in accordance with the published data.

Note

On request, different tests and/or additional tests to those above can be carried out.

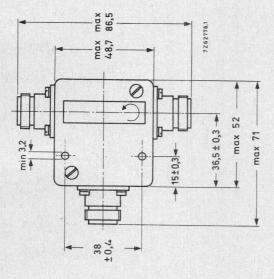
COAXIAL CIRCULATOR SERIES, BANDS IV-V, 100 W, U.H.F., TV

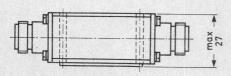
frequency	isolation dB	uo	insertion loss dB	ssol	V.S.W.F.	r.	max.	max. power W	temperature range	connector	mass	catalogue
MHz	guaran- teed	typ	guaran- teed	typ	guaran- teed	typ	c.w.	peak	၁၀	*	ð	
400-470	> 20	25	< 0,5	0,35	<1,25 1,15		100	200	-10 to +60	N-female	400	2722 162 03411
470-600	> 20	25	< 0,5	0,35	<1,25	1,15	100	200	-10 to +60	N-female	400	2722 162 01551
008-009	> 20	25	< 0,5	0,35	<1,25	1,15	100	200	-10 to +60	N-female	400	2722 162 01561
790-1000	> 20	25	<0,5	6,0	<1,25	1,14	100	200	-10 to +60	N-female	400	2722 162 03261

Notes

Combinations to form 4-port versions (π or H configurations) can be made to special order. Isolator versions of these circulators are available.

* These circulators can be made available with different connector types.





COAXIAL CIRCULATOR SERIES, 300 W, U.H.F., TV

	isolation dB	uc	insertion loss dB	loss	V.S.W.F.	r.	max.	max. power W	temperature range	connector	mass	catalogue number
gua	guaran- teed	typ	guaran- teed	typ	guaran- teed	typ	c.w.	peak	0	*	g	
Λ.	20	25	< 0,35	0,20	<1,25	1,15	300	200	-10 to + 60	N-female	1200	2722 162 01572
^	20	25	<0,35	0,20	<1,25	1,15	300	200	-10 to +60	HF 7/16	1200	2722 162 01622
٨	20	25	<0,35	0,20	<1,25	1,15	300	200	-10 to +60	N-female	1200	2722 162 01582
٨	20	25	<0,35	0,20	<1,25	1,15	300	200	-10 to +60	HF 7/16	1200	2722 162 01632
> 20	50	25	<0,35	0,20	<1,25	1,15	300	200	-10 to +60	N-female	1200	2722 162 01592
> 20	20	25	<0,35	0,20	<1,25	1,15	300	200	-10 to +60	HF 7/16	1200	2722 162 01642
< 098-	. 50	25	<0,35	0,20	<1,25	1,15	300	200	-10 to +60	N-female	1200	2722 162 01612
710-860 >2	>20	25	<0,35	0,20	<1,25	1,15	300	200	-10 to +60	HF 7/16	1200	2722 162 01662

Note

Isolator versions of these circulators are available.

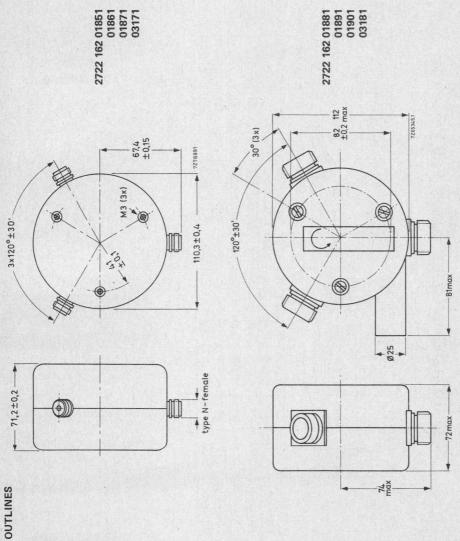
13

64,5 110,5 max max Dimensions in mm -- 50,5±0,3 -- 71,5 max--- 94,5 max 4,2 +0,2 2722 162 01622 01632 01642 01662 ▼ 18±0,3 ▲ 52 ±0,3 → 37,5 max → 64,5 98 max max 7262778.1 50,5±0,3 - 71,5 max 88,5 max 4,2 +0,2 2722 162 01572 01582 01592 01612 ₹ 18±0,3 52 ±0,3 OUTLINES → 37,5 max →

COAXIAL CIRCULATOR SERIES, 500 W/I kW, V.H.F., TV

	-										
solation inse	inse	nsertion loss dB	ssol	V.S.W.F.	ن	max. power W	ower	temperature range	connector	mass	catalogue number
typ guaran- teed	guara	<u>-</u>	typ	guaran- teed	typ	c.w.	peak	၁၀		б	
24 <0,35	<0,38	10	6,0	< 1,25	1,15	200	850	-10 to +60	N-female	2100	2722 162 01871
24 <0,35	<0,35	September 1	0,3	< 1,25	1,15	1000	1800	-10 to +40*	HF 7/16	2150	2722 162 01901
24 < 0,35	<0,35		0,3	<1,25	1,15	200	850	-10 to +60	N-female	2100	2722 162 01861
24 <0,35	<0,35	527.50	0,3	<1,25	1,15	1000	1800	-10 to +40*	HF 7/16	2150	2722 162 01891
24 < 0,35	<0,35	N. Carlo	0,3	<1,25	1,15	200	850	-10 to +60	N-female	2100	2722 162 01851
24 < 0,35	<0,35	1000	0,3	<1,25	1,15	1000	1800	-10 to +40*	HF 7/16	2150	2722 162 01881
24 < 0,35	<0,35		0,3	<1,25	1,15	200	850	-10 to +60	N-female	2100	2722 162 03171
24 <0,35	<0,35	la de la	6,0	<1,25	1,15	1000	1800	-10 to +40*	HF 7/16	2150	2722 162 03181

* With air cooling (filtered) at a pressure of 25 mm water column and maximum 40 °C intake temperature, the permissible connector temperature is + 55 °C.

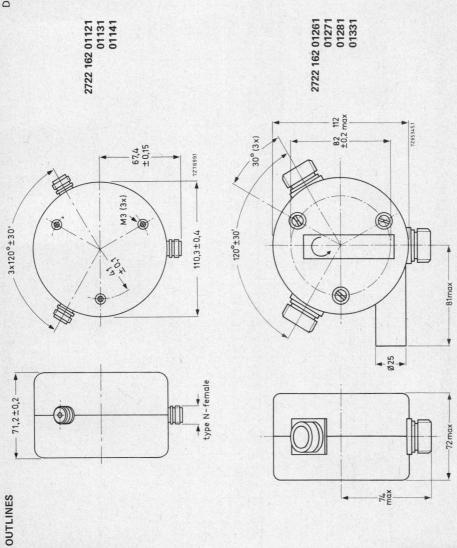


COAXIAL CIRCULATOR SERIES, BANDS IV-V, 500 W/2 kW, U.H.F., TV

range	isolation dB	ation	insertion loss dB	SSO	V.S.W.F.	4	max. p	max. power W	temperature range	connector	approx	catalogue number
MHz	guaran- teed	typ	guaran- teed	typ	guaran- teed	typ	c.w.	c.w.+ peak sync	20		б	
470-600	> 22	24	< 0,35	0,25	< 1,2	1,15	200	006	-10 to + 70 N-female**	N-female**	2080	2722 162 01121
470-600	> 20	24	< 0,35	0,17	< 1,25	1,12	2000	2000	-10 to + 40* HF 7/16	HF 7/16	2000	2722 162 01261
590-720	> 22	24	< 0,35	0,25	< 1,2	1,15	200	006	-10 to + 70 N-female** 2080	N-female**	2080	2722 162 01131
590-720	> 22	27	< 0,35	0,15	< 1,2	1,1	2000	2000	-10 to + 40* HF 7/16	HF 7/16	2000	2722 162 01281
008-009	> 20	24	< 0,35	0,17	< 1,25	1,13	2000	2000	-10 to + 40* HF 7/16	HF 7/16	2000	2722 162 01331
710-860	> 22	24	< 0,35	0,25	<1,2	1,15	200	006	-10 to + 70 N-female** 2080	N-female**	2080	2722 162 01141
710-860	> 22	26	< 0,35	0,16	< 1,2	1,15	2000	2000	-10 to + 40* HF 7/16 2000	HF 7/16	2000	2722 162 01271

With air cooling (filtered) at a pressure of 25 mm water colomn and maximum 40 °C intake temperature, the permissible connector temperature is + 60 °C.

Dimensions in mm



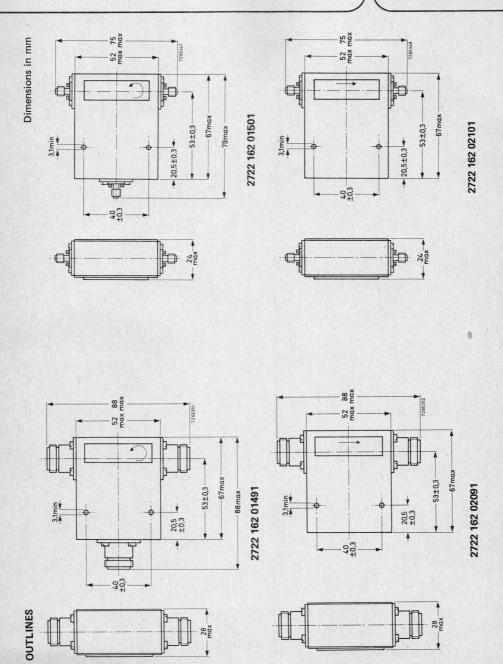
COAXIAL CIRCULATOR/ISOLATOR SERIES, OCTAVE BANDWIDTH

isolation dB	ion	insertion loss dB	ssol n	v.s.w.r.	٠	max. power W	ower	temperature range	connector	mass	catalogue
guaran- teed	typ	guaran- teed	typ	guaran- teed	typ	forward	reverse	၁၀		6	
> 20	24	< 0,5	0,35	0,35 < 1,25	1,15	50	.1	-10 to + 70	N-female	300	2722 162 01491
> 20	24	< 0,5	0,35	0,35 < 1,25	1,15	20	1	-10 to + 70	SMA	300	2722 162 01501
> 20	24	< 0,5	0,35	0,35 < 1,25	1,1	20	Ŋ	-10 to + 70	N-female	300	2722 162 02091
> 20	24	< 0,5	0,35	0,35 < 1,25	1,1	20	2	-10 to + 70	SMA	300	2722 162 02101
> 20	27	< 0,5	0,3	< 1,25	1,1	20	1	-10 to + 70	SMA	120	2722 162 01511
> 20	27	< 0,5	0,3	< 1,25	1,1	20	Ω	-10 to + 70	SMA	120	2722 162 02071
> 20	23	< 0,5	0,3	< 1,25	1,15	10	1	-10 to + 70	SMA	100	2722 162 01811
> 20	27	< 0,5	0,3	< 1,25	1,15	10	10	-10 to + 70	SMA	100	2722 162 02111
> 20	23	9'0>	0,4	< 1,25	1,15	10	1	-10 to + 70	SMA	09	2722 162 01821
> 20	25	9'0>	0,35	0,35 < 1,25	1,12	10	1	-10 to + 70	SMA	100	2722 162 02121
> 18	22	9'0>	0,35	0,35 < 1,30	1,2	2	1	-10 to + 70	SMA	20	2722 162 03301
> 18	22	9'0 >	0,35	0,35 < 1,25	1,2	2	-	-10 to + 70	SMA	20	2722 162 02221

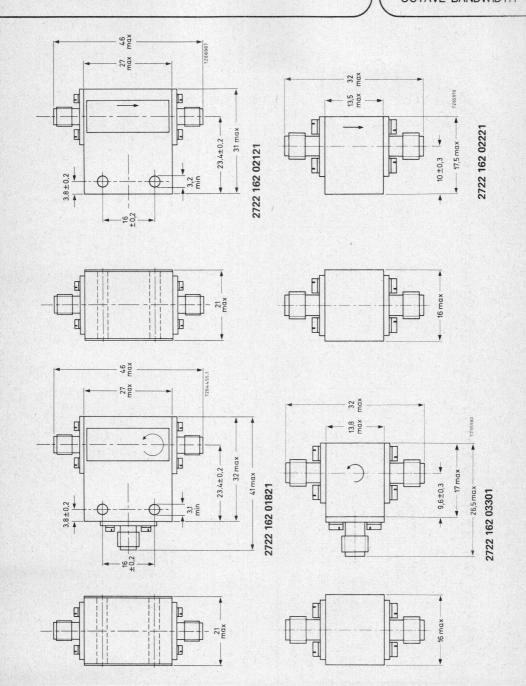
Note

Combinations to form 4-port versions (π or H configurations) can be made to special order.

COAXIAL
CIRCULATORS/ISOLATORS,
OCTAVE BANDWIDTH



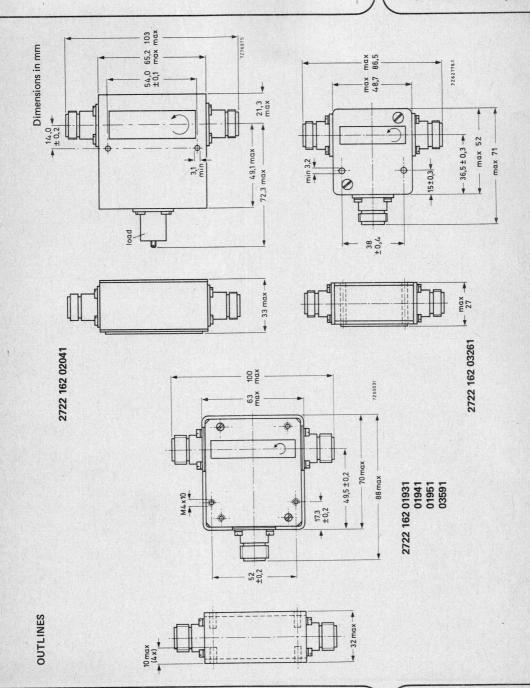
COAXIAL
CIRCULATORS/ISOLATORS,
OCTAVE BANDWIDTH

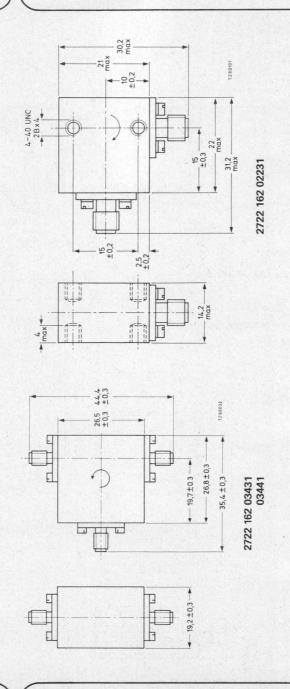


COAXIAL CIRCULATOR/ISOLATOR SERIES (3-PORT VERSIONS), STANDARD BANDS

frequency	isolation dB	uo	insertion loss dB	ssol r	V.S.W.F.		max. power W	ower	temperature range	connector	mass	catalogue number
GHz	guaran- teed	typ	typ guaran- teed	typ	typ guaran- teed	typ	forward reverse	reverse	၁ွ		g	
0,225-0,27	> 18	21	<0,35		0,2 < 1,35	1,25	150	1	0 to + 70	N-female	725	2722 162 01931
0,27 -0,33	> 18	21	<0,35	0,2	<1,35	1,25	150	-1	0 to + 70	N-female	725	2722 162 01941
0,33 -0,40	> 18	21	<0,35	0,3	<1,35	1,25	150	1	0 to + 70	N-female	725	2722 162 01951
0,79 -1	> 20	25	<0,5	0,3	<1,25	1,14	100	ı	-10 to +60	N-female	400	2722 162 03261
0,96 -1,225 > 20	> 20	22	<0,5	0,35	0,35 < 1,25	1,20	100	1	-10 to +60	N-female	460	2722 162 03591
1,48 -1,95 > 20	> 20	28	<0,3	0,3	0,3 <1,2	1,08	20	2	0 to + 70	N-female	200	2722 162 02041
3,8 -4,2	> 25	27	<0,25		0,2 <1,12	1,10	10	ı	-10 to +70	SMA	110	2722 162 03431
4,4 -5	> 25	27	<0,25	0,2	0,2 <1,12	1,10	10	ı	-10 to + 70	SMA	110	2722 162 03441
7,9 -10,4	> 20	22		0,35	<0,4 0,35 <1,25	1,23	2	-	-10 to +70	SMA	30	2722 162 02231

COAXIAL CIRCULATORS/ISOLATORS, STANDARD BANDS





COAXIAL CIRCULATOR SERIES (4-PORT VERSIONS), STANDARD BANDS

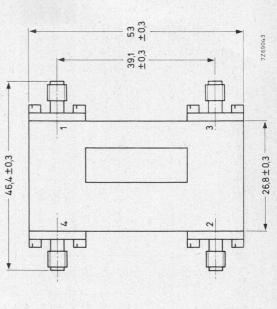
frequency		isolatic	isolation (dB)		ins	ertion	insertion loss (dB)	_	V.S.W.F.	٠.	max.	ter	connector	catalogue
range	guara	guaranteed		typical	guarar	guaranteed	typical	ical	guaran- typ power	typ	(c.w.) power	range	type	number
	α1-4	α2-1	α_{1-4} α_{2-1} α_{1-4} α_{2-1} α_{4-1} α_{1-2} α_{4-1} α_{1-2}	α2-1	α4-1	α_{1-2}	α_{4-1}	α_{1-2}	133					
GHz	α3–2	04-2	α_{3-2} α_{4-2} α_{3-2} α_{4-3} α_{2-3} α_{3-4} α_{2-3} α_{3-4}	0.4-3	α 2 -3	03-4	α2–3	03-4			8	၁၀		
3,8-4,2 > 25 > 50	> 25	> 50	27	52	<0,25	<0,5	0,2	0,4	<1,12	1,1	10	<0,25 <0,5 <0,6 <0,7 <0,4 <1,12 1,1 10 <0.10 to +70 SMA	SMA	2722 162 04031
4,4-5 > 25 > 50	> 25	> 50	27	52	<0,25	<0,5	0,2	0,4	<1,12	1,1	10	<0,25 <0,5 0,2 0,4 <1,12 1,1 10 -10 to +70	SMA	2722 162 04041

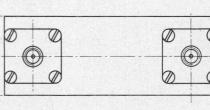
Mass of circulators: 220 g approx.

 $-19,2\pm0,3$

OUTLINES

Dimensions in mm



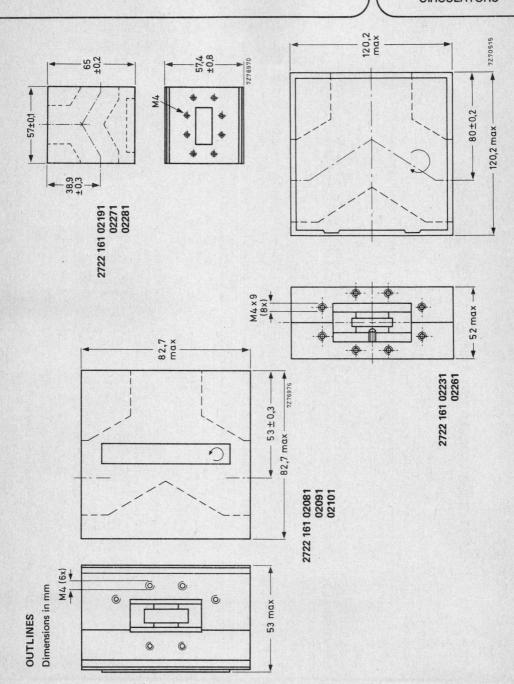


WAVEGUIDE CIRCULATOR SERIES (3-PORT VERSIONS)

frequency	isolation (dB)	1B)	insertion loss (dB)	s (dB)	v.s.w.r.		max.	temperature	flange	mass	catalogue
GHZ	guaranteed	typ	guaranteed	typ	guaranteed	typ	M	O _O	*	applox	
3,4 -3,8	> 28	35	<0,4	0,15	< 1,08	1,04	20	0 to + 50	UER40	1500	2722 161 02261
3,8 -4,2	> 28	35	<0,2	0,15	<1,08	1,04	20	0 to + 50	UER40	1500	2722 161 02231
5,925-6,425	> 30	35	<0,2	0,15	<1,06	1,04	100	-10 to +70	UER70	950	2722 161 02101
6,425-7,125	> 30	33	<0,15	0,13	<1,07	1,04	100	-10 to +70	UER70	950	2722 161 02081
7,125-7,750	> 30	33	<0,2	0,13	<1,06	1,04	100	-10 to +70	UER70	950	2722 161 02091
7,7 -8,5	> 25	32	<0,5	0,2	<1,1	1,05	20	+10 to +40	UER84	825	2722 161 02191
7,7 -8,5	>25	28	<0,5	0,3	<1,1	1,08	20	+10 to +40	UER84	825	2722 161 02281
7,9 -8,4	> 30	33	< 0,3	0,15	<1,06	1,04	20	+ 10 to + 40	UER84	825	2722 161 02271

Note

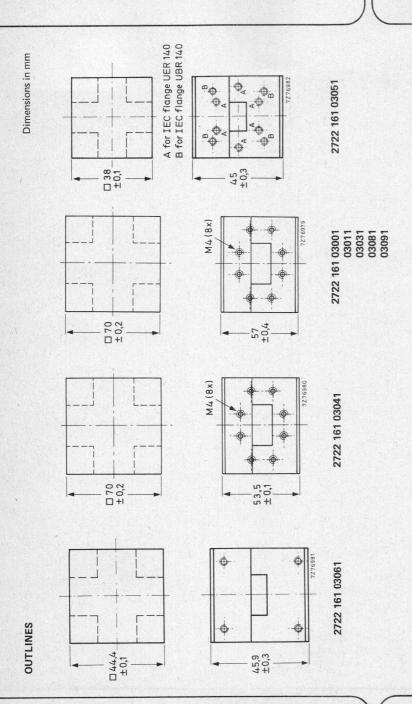
On request, 3-port versions can be coupled to form n-ports.



WAVEGUIDE CIRCULATOR SERIES (4-PORT VERSIONS)

		Company Contract		The state of the s							
frequency	isolati	on (dB)	isolation (dB) insertion loss (dB)	s (dB)	V.S.W.F.	w.r.	nominal	temperature	flange	mass	catalogue
GHz	α_{1-3}	$\alpha_{1-3} \alpha_{1-4}$	guaranteed typ	typ	α1–3	α1–4	W (C.W.)	OC OC	**************************************	appi ox g	Jaguinu.
5,925-6,175 > 33 > 20	> 33	> 20	<0,1	0,10	< 1,05	<1,04	150	+ 10 to + 60	UER70	920	2722 161 03081
6,125-6,425 > 30	> 30	> 20	<0,1	1,10	<1,06	< 1,06	150	+ 10 to + 60	UER70	920	2722 161 03091
6,575-6,875 > 25 > 20	> 25	> 20	<0,4	0,35	<1,10	<1,10	100	+ 10 to + 60	UER70	920	2722 161 03031
6,825-7,125 > 25 > 18	> 25	> 18	<0,4	0,35	< 1,08	< 1,08	100	+ 10 to + 60	UER70	920	2722 161 03011
7,125–7,425 > 25 > 18	> 25	> 18	<0,3	0,25	<1,10	<1,10	100	+ 10 to + 60	UER70	920	2722 161 03001
7,425–7,725 > 30 > 20	> 30	> 20	<0,4	0,35	<1,10	<1,10	100	+ 10 to + 60	UER70	920	2722 161 03041
10,7 -11,7 >30 >18	> 30	> 18	<0,3	0,25	<1,10	<1,10	25	+ 10 to + 60	UER100	390	2722 161 03061
12,5 -13,5	> 25	> 20	<0,3	0,25	<1,10	<1,10	25	+ 10 to + 60	UER140/	320	2722 161 03051
									UBR140		

* Material of flange: brass, Finish of flange: gold on silver plate.

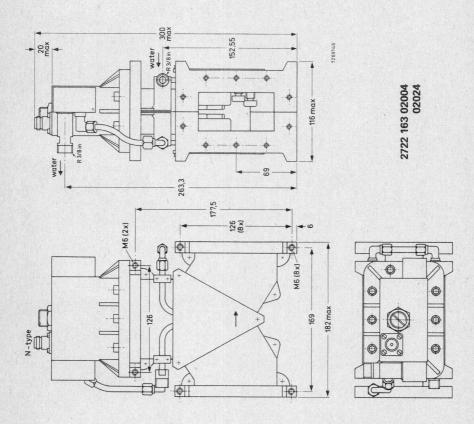


INDUSTRIAL HEATING ISOLATORS

requency	isolation dB	uo	insertion loss dB	loss	v.s.w.r.	ن	max. c.w. power	cooling temp.	cooling water temp. (°C)	flange	h.f. mass monitoring approx	mass	catalogue number
GHz	guaran- teed	typ	typ guaran- typ guaran- teed typ guaran-	typ	guaran- teed	ţ	reverse W	(water pressure 600 kPa abs)	600 kPa abs)	* (JEC)	terminal	kg	
2,425-2,475 > 20 26 < 0,3 0,2 < 1,2 1,1 6500	> 20	26	<0,3	0,2	<1,2	1,1	6500	40	20	PDR26	N-female	4.7	2722 163 02004

Note Minimum storage temperature, -10 °C.

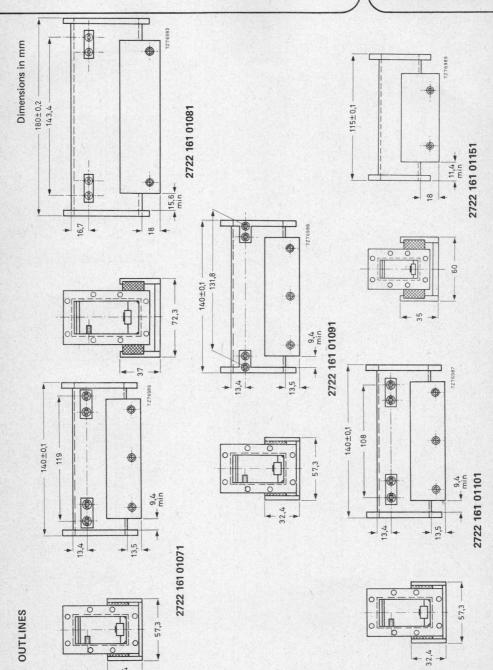
* Finish of flange/housing: alodine.

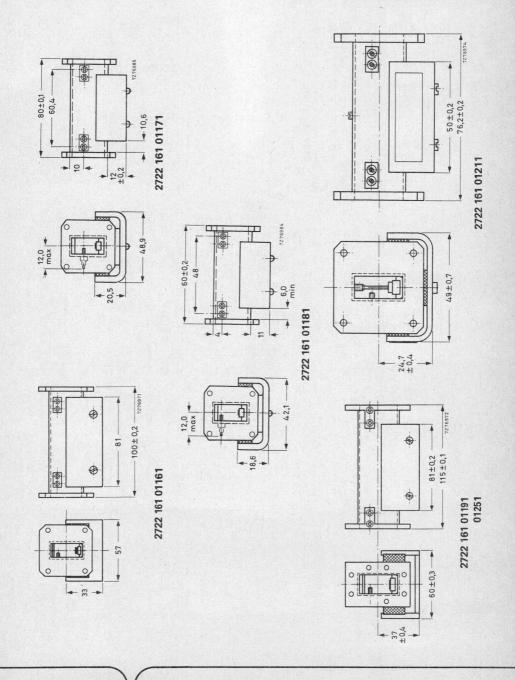


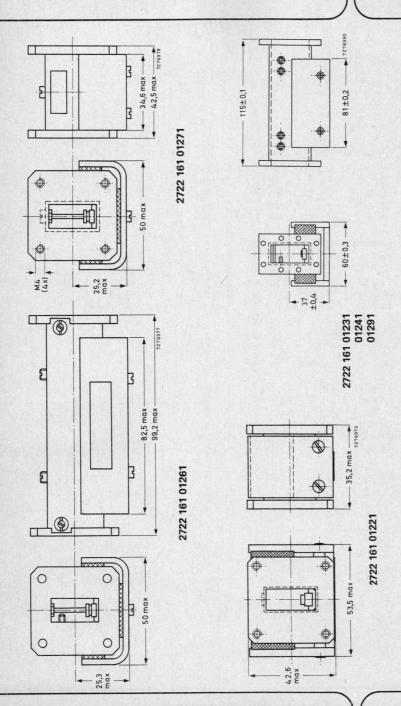
WAVEGUIDE ISOLATOR SERIES

frequency range GHz	isolation	insertion loss dB	v.s.w.r.	power (c.w.)	temperature range oC	waveguide type (IEC)	flange type (IEC)	mass approx g	catalogue number
3,8 -4,2	> 30	8′0>	< 1,05	10	+ 10 to + 40	R48	UER48	1700	2722 161 01071
3,8 -4,2	> 30	<0,5	< 1,05	10	+ 10 to + 80	R40	UER40	2450	2722 161 01081
4,2 -4,6	> 30	<0,5	< 1,05	10	+ 10 to + 40	R48	UER48	1680	2722 161 01091
4,6 -5,0	> 30	8'0>	< 1,05	10	+ 10 to + 40	R48	UER48	1680	2722 161 01101
5,925-6,425	> 30	<0,3	< 1,05	20	-10 to +70	R70	UER70	1450	2722 161 01191
6,425-7,150	> 30	<0,3	< 1,05	20	-10 to +70	R70	UER70	1450	2722 161 01251
6,825-7,425	> 30	<0,3	< 1,05	20	-10 to +70	R70	UER70	1450	2722 161 01231
7,125-7,750	> 30	<0,3	< 1,05	20	-10 to +70	R70	UER70	1450	2722 161 01291
7,250-7,750	> 30	<0,3	< 1,05	20	-10 to +70	R70	UER70	1450	2722 161 01241
7,4 -8,025	> 30	<0,5	<1,05	10	-10 to +70	R70	UER70	1450	2722 161 01151
7,7 -8,5	> 30	<0,5	<1,05	10	+ 10 to + 70	R84	UBR84	1260	2722 161 01161
9,6- 2,8	> 30	<0,5	<1,05	10	-10 to +70	R100	UBR100	420	2722 161 01211
9'6- 9'8	> 15	9'0>	<1,15	-	+ 10 to + 70	R100	UBR100	400	2722 161 01221
9'6- 5'8	> 55	<1,2	<1,2	10	-10 to $+70$	R100	154-UER100**	009	2722 161 01261
9'6- 5'8	> 20	\ \ \	<1,15	10	-10 to +70	R100	154-UBR100**	300	2722 161 01271
10,7 -11,7	> 30	<0,8	< 1,05	5	+ 10 to + 70	R100	UBR100	430	2722 161 01171
12,5 -13,5	> 30	<0,5	< 1.05	10	+ 10 to + 70	R140	IIBRIO	000	7722 161 01181

* Other flanges to order. Finish of waveguide and flanges: gold plate. ** Finish of flanges: nickel plate.







CONTENTS

Section A	General section				
Section B	Gunn, Impatt ar	nd noise diodes			
	BAT31 BXY50 BXY51 BXY52 BXY60	CXY11A CXY11B CXY11C CXY14A CXY14B	CXY14C CXY19 CXY19A CXY19B CXY21		
Section C	Mixer and detec	tor diodes			
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Section D	Backward diodes	3			
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Section E	Varactor diodes				
	BAY96 BXY27 BXY28 BXY29 BXY32	BXY53 BXY54 BXY55 BXY56 BXY57	CAY10 CXY10 CXY12 CXY22A CXY22B	1N5152 1N5153 1N5155 1N5157	
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Section G	Sub-assemblies				
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Section H	Circulators and i	solators			
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INDEX OF TYPE NUMBERS

type no.	section	type no.	section	type no.	section
ACX-01	G	BAW95F	С	CXY11A	В
AEY17	D	BAW95G	C	CXY11B	В
AEY29	D	BAY96	E	CXY11C	В
AEY29R	D	BXY27	E	CXY12	E
AEY31	D	BXY28	E	CXY14A	В
AEY31A	D	BXY29	E	CXY14B	В
AEY32	D	BXY32	E	CXY14C	В
BAT10	C	BXY50	В	CXY19	В
BAT11	C	BXY51	В	CXY19A	В
BAT31	В	BXY52	В /	CXY19B	В
ВАТ39	С	BXY53	E	CXY21	В
ВАТЗ9А	C	BXY54	E	CXY22A	E
BAT50	C	BXY55	E	CXY22B	E
BAT50R	C	BXY56	E	MAC0102	G
BAT51	C	BXY57	E	MAC0103	G
BAT51R	С	BXY60	В	MDX0520	G
BAT52	C	CAY10	E	MDX1021	G
BAT52R	C	CL7500	G	MDX1033	G
BAT59	C	CL.7520	G	MMX0109	G
BAV22	С	CL8630	F	MMX0111	G
BAV22R	С	CL8630S	F	MMX0112	G
BAV46	C	CL8632	F	1N5152	E
BAV75	C	CL8632S	F	1N5153	E
BAV96A	C	CL8633	F	1N5155	E
BAV96B	C	CL8633S	F	1N5157	E
BAV96C	С	CL8640R	F	2722 161	Н
BAV96D	C	CL8640T	F	2722 162	Н
BAV97	C	CL8960	G	2722 163	Н
BAW95D	C	CL8963	G		
BAW95E	C	CXY10	E		

A = General

B = Gunn, Impatt and noise diodes

C = Mixer and detector diodes

D = Backward diodes

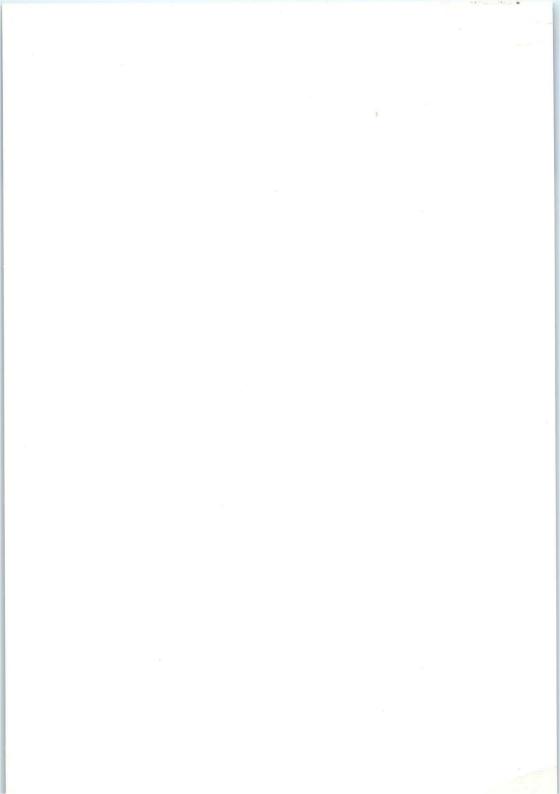
E = Varactor diodes

F = Gunn oscillators

G = Sub-assemblies

H = Circulators and isolators.

Α	General section
В	Gunn, Impatt and noise diodes
С	Mixer and detector diodes
WINDS TO BE STORY	Backward diodes
E	Varactor diodes
F	Gunn oscillators
G	Sub-assemblies
Н	Circulators and isolators



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