DISCRETE SEMICONDUCTORS

Wideband Hybrid Amplifier Modules for CATV

Data Handbook SC16
2000

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QUALITY ASSURED

Our quality system focuses on the continuing high quality of our components and the best possible service for our customers. We have a three-sided quality strategy: we apply a system of total quality control and assurance; we operate customer-oriented dynamic improvement programmes; and we promote a partnering relationship with our customers and suppliers.

PRODUCT SAFETY

In striving for state-of-the-art perfection, we continuously improve components and processes with respect to environmental demands. Our components offer no hazard to the environment in normal use when operated or stored within the limits specified in the data sheet.

Some components unavoidably contain substances that, if exposed by accident or misuse, are potentially hazardous to health. Users of these components are informed of the danger by warning notices in the data sheets supporting the components. Where necessary the warning notices also indicate safety precautions to be taken and disposal instructions to be followed. Obviously users of these components, in general the set-making industry, assume responsibility towards the consumer with respect to safety matters and environmental demands.

All used or obsolete components should be disposed of according to the regulations applying at the disposal location. Depending on the location, electronic components are considered to be ‘chemical’, ‘special’ or sometimes ‘industrial’ waste. Disposal as domestic waste is usually not permitted.

Wideband Hybrid Amplifier Modules for CATV

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DATA SHEET STATUS

DATA SHEET STATUS	PRODUCT STATUS	DEFINITIONS [1]
Objective specification	Development	This data sheet contains the design target or goal specifications for product development. Specification may change in any manner without notice.
Preliminary specification	Qualification	This data sheet contains preliminary data, and supplementary data will be published at a later date. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.
Product specification	Production	This data sheet contains final specifications. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.

Note

1. Please consult the most recently issued data sheet before initiating or completing a design.

DEFINITIONS

Short-form specification — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

Limiting values definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

Application information — Applications that are described herein for any of these products are for illustrative purposes only. Philips Semiconductors make no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

DISCLAIMERS

Life support applications — These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips Semiconductors customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips Semiconductors for any damages resulting from such application.

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CAUTION
This product is supplied in anti-static packing to prevent damage caused by electrostatic discharge during transport and handling. For further information, refer to Philips specs.: SNW-EQ-608, SNW-FQ-302A, and SNW-FQ-302B.

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SELECTION GUIDE

WIDEBAND HYBRID AMPLIFIER MODULES FOR CATV

f_{min}(2) (MHz)	f_{max}(2) (MHz)	G_p@ f_{min}(3)	G_p@ f_{max}(3)	SL(4) (dB)	FL(5) (dB)	s_{11}@ f_{max} (dB)	s_{22}@ f_{max} (dB)	CTB (dB)	X_{mod} (dB)	CSO (dB)	@ Ch (6)	@ V_o (7)	F(8) (dB)	I_{tot} (mA)	PACKAGES	
															SOT115D	SOT115J
Reverse amplifiers(1)																
5	75	30 ±0.8	–	–0.2 to 0.5	±0.2	20	18	–68	–60	–	4	50	3.5	135		BGY68
5	120	25 ±0.5	–	–0.2 to 0.5	±0.2	20	20	–66	–54	–	14	48	5	135		BGY66B
5	200	22 ±0.5	–	–0.2 to 0.5	±0.2	20	20	–67	–60	–	22	50	5.5	230		BGY67
5	200	24 ±0.5	–	–0.2 to 0.5	±0.2	20	20	–67	–59	–	22	50	5.5	230		BGY67A
Forward amplifiers(1)																
40	450	17 ±0.5	17.3 to 18.8	0.5 to 1.5	±0.2	18	18	–58	–60	–	60	46	7	240		BGY85
40	450	18.4 ±0.4	18.7 to 20.2	0.3 to 1.5	±0.2	18	18	–55	–58	–	60	46	6.5	200		BGY84A
40	450	18.4 ±0.4	18.7 to 20.2	0.3 to 1.5	±0.2	18	18	–59	–61	–	60	46	7	240		BGY85A
40	450	22 ±0.5	21.7 to 23.5	0 to 1.5	±0.2	18	18	–54	–51	–53	60	46	6	200		BGY86
40	450	22 ±0.5	21.7 to 23.5	0 to 1.5	±0.2	18	18	–58	–55	–57	60	46	6.5	240		BGY87
40	450	27 ±0.8	>27.5	0.5 to 2.5	±0.2	18	18	–58	–58	–60	60	46	6	340		BGY87B
40	550	18.2 ±0.5	18.8 to 20	0.5 to 2	±0.2	18	18	–59	–62	–59	77	44	8	240		BGY585A
40	550	22 ±0.5	>22	0.2 to 1.5	±0.2	18	18	–53	–55	–50	77	44	6.5	200		BGY586
40	550	22 ±0.5	22 to 24	0.2 to 1.5	±0.2	18	18	–57	–58	–54	77	44	7	240		BGY587
40	550	27 ±0.8	>27.5	0.5 to 2.5	±0.4	18	18	–57	–60	–57	77	44	6.5	340		BGY587B
40	550	34.5 ±1	35 to 36	0.5 to 1.5	±0.4	18	18	–57	–59	–62	77	44	6	340		BGY588N
40	600	18.2 ±0.5	>19	0.5 to 2.2	±0.2	18	18	–55	–60	–56	85	44	8.5	240		BGY685A
40	600	18.5 ±0.5	>19	0.2 to 2.2	±0.3	18	18	–62	–58	–60	85	44	8	250		BGY685AD
40	600	18.5 ±0.5	>18.5	0.5 to 2	±0.3	18	18	–56	–55	–56	85	44	5	250		BGY685AL
40	600	21.5 ±0.5	>22	0.8 to 2.2	±0.2	18	18	–54	–54	–52	85	44	6.5	240		BGY687
40	600	27 ±0.8	>27.8	0.8 to 2.8	±0.4	18	18	–53	–58	–54	85	44	7	340		BGY687B
40	750	18.5 ±0.5	>18.5	0 to 2	±0.3	14	14	–53	–56	–53	110	44	7	240		BGY785A
40	750	18.5 ±0.5	>18.5	0.2 to 2	±0.5	14	14	–58	–56	–58	110	44	6	265		BGY785AD
40	750	21.5 ±0.5	>21.5	0 to 1.5	±0.5	14	14	–53	–52	–53	110	44	6.5	240		BGY787
40	750	34 ±0.5	>34	0.5 to 2.5	±0.5	14	14	–49	–51	–52	110	44	7	320		BGE788
40	860	15 ±0.5	>15	0 to 2	±0.3	14	14	–61	–61	–61	49	44	8.5	235		BGY883
40	860	18.5 ±0.5	>18.5	0 to 2	±0.3	14	14	–61	–61	–61	49	44	8	240		BGY885A

f_{min}(2) (MHz)	f_{max}(2) (MHz)	G_p@ f_{min}(3)	G_p@ f_{max}(3)	SL(4) (dB)	FL(5) (dB)	s_{11}@ f_{max} (dB)	s_{22}@ f_{max} (dB)	CTB (dB)	X_{mod} (dB)	CSO (dB)	@ Ch (6)	@ V_o (7)	F(8) (dB)	I_{tot} (mA)	PACKAGES	
															SOT115D	SOT115J
40	860	18.5 ±0.5	>18.5	0.2 to 2	±0.5	14	14	−58	−56	−58	110	44	6	265		BGY785AD/ 8M
40	860	20 ±0.5	>20	0 to 2	±0.3	14	14	−60	−60	−60	49	44	7.5	235		BGY885B
40	860	21.5 ±0.5	>21.5	0.2 to 2	±0.3	14	14	−62	−61	−61	49	44	6.5	235		BGY887
40	860	25.5 ±0.3	25.6 to 26.6	0.2 to 1	±0.5	17	16	−62	−55	−57	129	40	5	240		CGY887A
40	860	29 ±0.5	>29	0.5 to 2.5	±0.5	14	14	−60	−60	−60	49	44	6.5	340		BGY887B
40	860	34 ±0.5	>34	0.5 to 2.5	±0.5	14	14	−60	−59	−55	49	44	7	340		BGY888
40	1000	18.5 ±0.5	>18.5	0 to 2	±0.3	14	14	−53	−54	−56	150	44	7.5	240		BGY1085A
Power doublers(1)																
40	550	18.5 ±0.5	18.8 to 20.8	0.2 to 2.2	±0.3	18	18	−65	−68	−62	77	44	8	435		BGD502
40	550	20 ±0.5	20.2 to 22.2	0.2 to 2.2	±0.3	18	18	−64	−67	−60	77	44	8	435		BGD504
40	600	18 ±0.5	>18.5	0.2 to 2.2	±0.3	18	18	−68	−61	−64	85	44	7	440		BGD602D
40	600	18.5 ±0.5	>19	0.2 to 2.2	±0.3	18	18	−62	−66	−60	85	44	8	435		BGD602
40	750	18.5 ±0.5	>18.5	0.2 to 2	±0.5	16	16	−58	−62	−58	110	44	8.5	435		BGD702
40	750	18.5 ±0.5	>20	2 to 4	±0.5	14	14	−62	−59	−62	110	44	7	435		BGD702D
40	750	18.5 ±0.5	>18.5	0.2 to 2	±0.25	16	16	−58	−62	−58	110	44	8.5	435		BGD702N
40	750	18.5 ±0.3	19 to 20	0.5 to 1.5	±0.35	17	17	−62	−63	−63	112	44	7	410		BGD712
40	750	20 ±0.5	>20	0 to 2	±0.5	16	16	−57	−61	−56	110	44	8.5	435		BGD704
40	750	20.3 ±0.3	20.8 to 21.8	0.5 to 1.5	±0.35	17	17	−61	−62	−62	112	44	7	410		BGD714
40	860	17 ±0.5		0.2 to 1.6	±0.5	10	10	–	–	–	129	59	8	450	BGD885	
40	860	18.5 ±0.5	>18.5	0.2 to 2	±0.5	14	14	−54	−59	−56	129	44	9	410		BGD802
40	860	18.5 ±0.5	>18.5	0.2 to 2	±0.25	14	14	−54	−59	−56	129	44	9	410		BGD802N
40	860	18.5 ±0.5	>18.5	0.2 to 2	±0.5	14	14	−54	−59	−56	129	44	9	410		BGD802MI
40	860	18.5 ±0.3	19 to 20	0.4 to 1.4	±0.5	18	17	−58	−62	−60	132	44	7.5	410		BGD812
40	860	18.5 ±0.3	19 to 20	0.4 to 1.4	±0.3	18	19	−58	−62	−58	129	44	8	435		BGD902
40	860	18.5 ±0.5	19 to 20	0.4 to 1.4	±0.3	18	19	−56	−60	−59	129	44	7.5	380		BGD902L
40	860	18.5 ±0.3	19 to 20	0.4 to 1.4	±0.3	18	19	−58	−62	−58	129	44	8	435		BGD902MI
40	860	20 ±0.5	>20	0.2 to 2	±0.5	14	14	−53	−61	−54	129	44	7.5	410		BGD804
40	860	20 ±0.5	>20	0.2 to 2	±0.25	14	14	−53	−58	−54	129	44	8	410		BGD804N
40	860	20 ±0.3	20.5 to 21.5	0.4 to 1.4	±0.5	15	16	−57.5	−62	−59	132	44	7.5	410		BGD814

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Selection guide

f_{min}(2) (MHz)	f_{max}(2) (MHz)	G_p@ f_{min}(3)	G_p@ f_{max}(3)	SL(4) (dB)	FL(5) (dB)	s_{11}@ f_{max} (dB)	s_{22}@ f_{max} (dB)	CTB (dB)	X_{mod} (dB)	CSO (dB)	@ Ch (6)	@ V_o (7)	F(8) (dB)	I_{tot} (mA)	PACKAGES	
															SOT115D	SOT115J
40	860	20 ±0.3	20.5 to 21.5	0.4 to 1.4	±0.3	16	17	−57.5	−61	−58	129	44	7.5	435		BGD904
40	860	20 ±0.3	20.5 to 21.5	0.4 to 1.4	±0.3	16	17	−55	−59	−59	129	44	7.5	380		BGD904L
40	860	20 ±0.3	20.5 to 21.5	0.4 to 1.4	±0.3	16	17	−57.5	−61	−58	129	44	7.5	435		BGD904MI
40	860	20 ±0.25	20.2 to 21.5	0.2 to 1.5	±0.45	14	16	−59.5	−64	−50	132	44	4	375		CGD914
40	860	20 ±0.25	20.2 to 21.5	0.2 to 1.5	±0.45	14	16	−59.5	−64	−50	132	44	4	375		CGD914MI
40	860	21.5 ±0.3	22 to 23	0.5 to 1.5	±0.35	16	16	−57	−60	−54	129	44	7.5	435		BGD906
40	860	21.5 ±0.3	22 to 23	0.5 to 1.5	±0.35	15	16	−54	−57	−56	129	44	7.5	380		BGD906L
40	860	21.5 ±0.3	22 to 23	0.5 to 1.5	±0.35	16	16	−57	−60	−54	129	44	7.5	435		BGD906MI
Cascade amplifiers(1)																
40	860	12.5 ±0.5		0.2 to 1.2	±0.3	10	10	–	–	–	129	59	9	240	BGX881	
40	860	17 ±0.5		0.2 to 1.2	±0.5	10	10	–	–	–	129	59	8	240	BGE885	
40	860	17 ±0.5	>17.3	0.2 to 1.4	±0.3	10	10	–	–	–	129	59	8	240	BGX885N	

Notes

1. This table is for reference only. It contains some calculated values that are not guaranteed. For full data please refer to the data sheet.
2. Frequencies at which data are characterized (not necessarily the minimum and maximum operating frequencies).
3. Power gain in dB.
4. Slope.
5. Flatness.
6. The number of channels and the output voltage at which composite triple beat (CTB), cross modulation (X_{mod}), composite second order distortion (CSO) and second order distortion (d_2) are characterized.
7. Output voltage measured in dBmV.
8. Noise figure at F_{max}.

f_{min} (MHz)	f_{max} (MHz)	S_{min} @ 50M (2)	SL (dB)	FL (dB)	OIL (3) (dB)	s_{22} (dB)	d_3(4) (dB)	d_2(5) (dB)	@ fm(6) (MHz)	F(7) (dB)	I_{tot} (mA)	PACKAGES			
												SOT115T	SOT115U	SOT115X	SOT115Y
Optical receivers(1)															
5	300	800		±0.3	45	15	−80	−70	100	7	190		BGE67BO		
5	400	800		±0.3	45	14	−80	−70	300	7	180		BGE67BO/4M		
40	870	400		±0.5	45	17	−92	−76	324	13	205		BGE883BO		
40	870	800		±0.5	45	11	−80	−70	324	11	205		BGE887BO		
40	870	800		±0.5	45	11	−75	−57	853	11	205	BGE847BO			
40	870	750		±0.5	45	11	−75	−57	853	11	205			BGE847BO /FC0	BGE847BO /SC0
40	870	800	0 to 2	1	45	11	−73	−63	853	8	205	BGO847			
40	870	750	0 to 2	1	45	11	−73	−63	853	8	205			BGO847 /FC0	BGO847 /SC0

Notes

1. This table is for reference only. It contains some extrapolated values that are not guaranteed. For full data please refer to the data sheet.
2. Minimum responsivity (V/W).
3. Optical input return losses.
4. Third order distortion.
5. Second order distortion.
6. Measurement frequency.
7. Noise in pA/√Hz.

GENERAL

1 QUALITY

1.1 Total Quality Management

Philips Semiconductors is a Quality Company, aiming towards one ultimate standard, that of Business Excellence. The tool we use in striving towards this goal is our Total Quality Management (TQM) system. The TQM is described in our Quality manuals, and is summarized in the following paragraphs. The Philips Business Excellence Programme as part of TQM follows the European Foundation for Quality Management (EFQM) model. The EFQM award is on the level of the Malcolm Baldridge award.

1.1.1 QUALITY ASSURANCE

Quality Assurance (QA) is based on ISO 9000 standards and customer standards such as QS-9000. Our factories are certified to ISO 9000 and QS-9000 by external inspectorates. Sales organizations and headquarters are also certified to ISO 9000. The products of Philips Semiconductors are in conformance with the requirements of international standards.

1.1.2 PARTNERSHIPS WITH CUSTOMERS

Partnerships with customers include Process Quality measurement co-operation (using PPM), design-in agreements, ship-to-stock, just-in-time, sharing technology roadmaps, a change notification programme, self-qualification programmes and application support.

1.1.3 PARTNERSHIPS WITH SUPPLIERS

Our suppliers are certified to ISO 9000 and participate in ship-to-stock programmes. Key-suppliers receive support and feedback through our Supplier Quality System (SQS) audits.

1.1.4 CONTINUOUS IMPROVEMENT PROGRAMME

The continuous improvement programme incorporates continuous process and system improvement, design improvement, complete use of statistical process control, and logistics improvement, driven by key performance indicators. To encourage improvement in teamwork a very popular Quality Improvement Competition is held yearly. With a large number of improvement teams participating, opportunities arise for the sharing of successful improvement ideas.

1.2 Advanced quality planning

During the design and development of new products and processes, quality is built-in by advanced quality planning. By means of failure-mode-and-effect analysis the critical parameters of a process are identified. Procedures are then laid down to ensure the highest level of performance for these parameters. The capability of process steps is also planned in this phase in preparation for production under statistical process control.

1.3 Quality network

Product quality is the responsibility of the Business Lines, with their Quality and Reliability (Q&R) departments operating in a supportive and controlling manner. The sales organization has Quality Managers who respond to any quality matters raised by customers. Customer complaints are then handled by direct contact between Sales Quality and the relevant Q&R department. General quality requirements are covered by a divisional Quality department.

1.4 Product conformance

The assurance of product conformance is an integral part of our Quality Assurance practice. This is achieved by:

- In-line Quality Assurance to monitor process reproducibility during manufacture. Equipment performance and process steps are under statistical process control.
- Acceptance tests on finished products to verify conformance with the device specification. The test results are used for Quality feedback and corrective actions. Periodic sample inspections to monitor and measure the conformance of products are increasingly being replaced by continuous in-line monitoring.
- Qualification tests.

The inspection and test requirements are detailed in the General Quality Specifications in the SNW-FQ-611 series.

1.5 Product reliability

Highly accelerated tests are implemented to evaluate and monitor product reliability. Rejects from reliability tests are subjected to failure analysis, so that improvements may be made. This analysis also extends to product related customer complaints.

1.6 Customer response

Our quality improvement depends on working together with our customer. We need our customer's input, and we therefore invite constructive comments on all aspects of our performance. For all such matters, please contact your local Philips Semiconductors sales representative.

Pro Electron type numbering system for Discrete Semiconductors

1 BASIC TYPE NUMBER

This type designation code applies to discrete semiconductor devices (not integrated circuits), multiples of such devices, semiconductor chips and Darlington transistors.

A basic type number consists of:

two letters followed by a serial number

1.1 First letter

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

Table 1 First letter

LETTER	DESCRIPTION
A	Germanium or other material with a band gap of 0.6 to 1 eV
B	Silicon or other material with a band gap of 1 to 1.3 eV
C	Gallium arsenide (GaAs) or other material with a band gap of 1.3 eV or more
R	Compound materials, e.g. cadmium sulphide

1.2 Second letter

The second letter indicates the function for which the device is primarily designed. The same letter can be used for multi-chip devices with similar elements.

In Table 2 low power types are defined by $R_{th(j\text{-}c)} > 15$ K/W and power types by $R_{th(j\text{-}c)} \leq 15$ K/W.

Table 2 Second letter

LETTER	DESCRIPTION
A	Diode; signal, low power
B	Diode; variable capacitance
C	Transistor; low power, audio frequency
D	Transistor; power, audio frequency
F	Transistor; low power, high frequency
G	Multiple of dissimilar devices/miscellaneous devices; e.g. amplifier modules; with special third letter, see Section 1.3
H	Diode; magnetic sensitive
L	Transistor; power, high frequency
N	Photocoupler
Q	Radiation generator; e.g. LED, laser; with special third letter; see Section 1.3
R	Control or switching device; low power, e.g. thyristors, diacs, triacs; with special third letter, see Section 1.3
S	Transistor; low power, switching
T	Control or switching device; power, e.g. thyristors, triacs; with special third letter, see Section 1.3
U	Transistor; power, switching
W	Surface acoustic wave device
X	Diode; multiplier, e.g. varactor, step recovery
Y	Diode; rectifying, booster
Z	Diode; voltage reference or regulator, transient voltage suppressor diode; with special third letter, see Section 1.3

1.3 Serial number or special third letter

The number comprises:

three figures running from 100 to 999 for devices primarily intended for consumer equipment,

or one letter (Z, Y, X, etc.) and two figures running from 10 to 99 for devices primarily intended for industrial or professional equipment (see Table 3, note 1).

The letter has no fixed meaning, except as described in Table 3.

Table 3 Serial number or special third letter

LETTER	DESCRIPTION
A	For triacs, after second letter 'R' or 'T'
F	For emitters and receivers in fibre-optic communication, after second letter 'G' or 'Q'. When, the second letter is 'G', the first letter should be defined in accordance with the material of the main optical device
L	For lasers in non-fibre-optic applications, after second letter 'G' or 'Q' (1)
M	For transistor drivers, after second letter 'R'
O	For opto-triacs after second letter 'R'
R	For SC resistor network, after second letter 'C'

LETTER	DESCRIPTION
T	For 3-state bicolour LEDs, after second letter 'Q'
W	For transient voltage suppressor diodes, after second letter 'Z'

Note

1. When the supply of these serial numbers is exhausted, the serial number may be expanded to three figures for industrial types and four figures for consumer types.

2 VERSION LETTER(S)

One or two letters may be added to the basic type number to indicate minor electrical or mechanical variants of the basic type. The letters never have a fixed meaning, except that the letter 'R' indicates reverse polarity and the letter 'W' indicates a surface mounted device (SMD).

3 SUFFIX

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

3.1 Voltage reference and voltage regulator diodes

One letter and one number, preceded by a hyphen (-).

The letter, if required, indicates the nominal tolerance of the Zener voltage.

Table 4 Nominal tolerance indication

LETTER	TOLERANCE (1)	according to IEC 63
A	1%	series E96
B	2%	series E48
C	5%	series E24
D	10%	series E12
E	20%	series E6

Note

1. In the case of a 3% nominal tolerance, the letter 'F' is used.

The number denotes the typical operating (Zener) voltage, related to the nominal current rating for the entire range. The letter 'V' is used in place of the decimal point.

3.2 Transient voltage suppressor diodes

One number, preceded by a hyphen (-).

The number indicates the maximum recommended continuous reversed (stand-off) voltage, V_R. The letter 'V' is used in place of the decimal point.

The letter 'B' may be used immediately after the last number, to indicate a bidirectional suppressor diode.

3.3 Conventional and controlled avalanche rectifier diodes and thyristors

One number, preceded by a hyphen (-).

The number indicates the rated maximum repetitive peak reverse voltage, V_{RRM}, or the rated repetitive peak off-state voltage, V_{DRM}, whichever is the lower. Reversed polarity with respect to the case is indicated by the letter 'R' immediately after the number.

3.4 Radiation detectors

One number, preceded by a hyphen (-).

The number indicates the depletion layer in micrometres (μm). The resolution is indicated by a version letter.

3.5 Array of radiation detectors and generators

One number, preceded by a hyphen (-).

The number indicates the number of basic devices assembled into the array.

3.6 Radiation generators

One number, preceded by a hyphen (-).

The number indicates the luminous intensity range in milli-candela (mcd).

3.7 High frequency power transistors

One number, preceded by a hyphen (-).

The number indicates the supply voltage.

1 RATING SYSTEMS

The rating systems described are those recommended by the IEC in its publication number 60134.

Remark: It is common practice to use the Absolute Maximum Rating System in published semiconductor data sheets.

1.1 Definitions of terms used

1.1.1 ELECTRONIC DEVICE

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

Remark: This definition excludes inductors, capacitors, resistors and similar components.

1.1.2 CHARACTERISTIC

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

1.1.3 BOGEY ELECTRONIC DEVICE

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

1.1.4 RATING

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

Remark: Limiting conditions may be either maxima or minima.

1.1.5 RATING SYSTEM

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

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

1.2 Absolute maximum rating system

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

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

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

1.3 Design maximum rating system

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

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

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

1.4 Design centre rating system

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

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

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

1 LETTER SYMBOLS

1.1 Introduction

The general standards given in *IEC Publication 60027, Letter Symbols to be Used in Electrical Technology,* are applicable, except where this Chapter 1, "Letter Symbols" (1), based on *IEC publications 60747 and 60748,* gives different standards, in which case the latter should be followed.

1.2 Letter symbols for currents, voltages and powers

1.2.1 BASIC LETTERS

Table 1 Recommended basic letters

SYMBOL	DESCRIPTION
I, i	current
V, v	voltage
P, p	power

1.2.1.1 Use of upper-case basic letters

Upper-case basic letters are used for the indication of a constant value of the quantity or of values that are derived from the periodic waveform of a quantity:

- Direct (DC) values
- Maximum (peak) values
- Average (mean) values
- Root-mean-square values
- Peak-to-peak (swing) values.

1.2.1.2 Use of lower-case basic letters

Lower-case basic letters are used for the indication of instantaneous values of the periodic waveform of the quantity.

(1) See for detailed information: IEC 60747-1, Chapter V, Letter symbols, general.

1.3 Subscripts

Table 2 Recommended general subscripts

SYMBOL	DESCRIPTION
First subscript	
F, f	forward
n	noise
R, r	reverse
Additional subscripts	
(AV)	average value
(BR)	breakdown
(cr), cr	critical
(D)	direct
F, f	forward
M, m	maximum (peak) value with respect to time
MIN, min	minimum (peak) value with respect to time
O, o	open circuit
(OV)	overload
(P-P), (p-p)	peak-to-peak (swing)
R, r	repetitive; recovery; reverse
(RMS), (rms)	root-mean-square value
S, s	short-circuit; surge
(tot), tot	total value

1.3.1 CHOICE BETWEEN UPPER-CASE AND LOWER-CASE SUBSCRIPTS

Where Section 1.7.3.1 lists both upper-case and lower-case letters, the choice between these two styles shall be made according to Section 1.7.3.3 hereafter. If more than one subscript is used, subscripts for which both styles exist shall either be **all** upper-case or **all** lower case.

Examples: h_{FE}, y_{RE}, h_{fe}, but C_{Te} (T has no lower-case variant)

1.3.2 USE OF UPPER-CASE SUBSCRIPTS

Upper-case subscripts are used for the indication of values that refer to the total value of the quantity:

- Direct (DC) values (without signal), e.g. I_B
- Instantaneous total values, e.g. i_B
- Average total values, e.g. $I_{B(AV)}$
- Maximum (peak) total values, e.g. I_{BM}
- Root-mean-square total values, e.g. $I_{B(RMS)}$
- Peak-to-peak total values, e.g. $V_{O(P-P)}$

1.3.3 USE OF LOWER-CASE SUBSCRIPTS

Lower-case subscripts are used for the indication of values that refer to the alternating component of the quantity, including small-signal modulations:

- Instantaneous alternating values, e.g. i_b
- maximum (peak) alternating values, e.g. I_{bm}
- Root-mean-square alternating values, e.g. $I_{b(rms)}$ (or I_b, the use of $I_{b(rms)}$ is recommended)
- Peak-to-peak alternating values, e.g. $V_{o(p-p)}$.

Lower-case subscripts are also used in combination with upper-case subscripts to save otherwise necessary parentheses, e.g. V_{CEsat}.

1.3.4 ADDITIONAL RULES FOR SUBSCRIPTS

1.3.4.1 Subscripts for currents

If it is necessary to indicate the terminal carrying the current and after which the current is named, this shall be done by the first subscript with only the exceptions indicated below. The other terminal through which this is flowing may be indicated in the subscript immediately following the first terminal-designation subscript.

Examples of usual indication:

base current of a transistor: I_B, i_B, i_b, I_b

collector current of a transistor for $V_{BE} = 0$: I_{CES}

forward gate current of a field-effect transistor: I_{GF}

Exceptions: In letter symbols for forward or reverse gate currents of thyristors, the letter ‘F’ or ‘R’, respectively, precedes the terminal-designation subscript, which then becomes the second subscript, that is:

forward gate current of a thyristor: I_{FG}

reverse gate current of a thyristor: I_{RG}

1.3.4.2 Subscripts for voltages

If it is necessary to indicate the terminals between which a voltage exists, this shall be done by the first two subscripts with only the exceptions indicated below. The first subscript indicates one terminal and the second subscript indicates the reference terminal or circuit node. Where no ambiguity is likely to occur, the letter indicating the reference terminal may be omitted.

Examples of usual indication:

base-emitter voltage of a transistor:
V_{BE}, v_{BE}, v_{be}, V_{be} or V_B

collector-emitter voltage of a transistor for $V_{BE} = 0$: V_{CES}

forward gate-source voltage of a field-effect transistor:
V_{GSF}

Exceptions:

1. Forward gate-cathode voltage of a p-type thyristor:
   V_{FGK}

   Reverse gate-cathode voltage of a p-type thyristor:
   V_{RGK}

   Forward gate-anode voltage of an n-type thyristor:
   V_{FGA}

   Reverse gate-anode voltage of an n-type thyristor:
   V_{RGA}
2. In letter symbols for breakdown voltage, the subscript (BR) is placed before the terminal subscripts:

   collector-emitter breakdown voltage for $I_B = 0$:
   $V_{(BR)CEO}$

1.3.4.3 Subscripts for supply voltages or currents

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

Examples: V_{CC}, I_{EE}.

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

Example: V_{CCE}.

1.3.4.4 Subscripts for devices with more than one terminal of the same kind

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

Examples:

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

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

1.3.4.5 *Subscripts for multiple devices*

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

Examples:

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

$V_{1C\text{-}2C}$ (continuous (DC) voltage between the collector terminals of the first and second units).

1.4 Summary chart for current, voltage and power letter symbols

Table 3 demonstrates the applications of the rules given in Sections 1.2 and 1.3 and can be used to identify letter symbols that are composed in accordance with these rules.

Table 3 Basic letter chart

<table>
<tr><th colspan="2">BASIC LETTERS</th></tr>
<tr><th>LOWER CASE
(i, v, p)</th><th>UPPER CASE
(I, V, P)</th></tr>
<tr><td colspan="2">Lower case electrode or terminal subscript(s)</td></tr>
<tr><td rowspan="2">With terminal subscript(s) only:
• Instantaneous values of the varying component</td><td>With terminal subscript(s) only:
• Root-mean-square value of alternating component (use of additional subscript (rms) is recommended</td></tr>
<tr><td>With terminal subscript(s) and one of the following additional subscripts:
• m: maximum instantaneous value of alternating component
• min: minimum instantaneous value of alternating component
• (rms): root-mean-square value of alternating component
• (p-p): peak-to-peak value of alternating component</td></tr>
<tr><td colspan="2">Upper case electrode or terminal subscript(s)</td></tr>
<tr><td rowspan="2">With terminal subscript(s) only:
• Instantaneous total value</td><td>With terminal subscript(s) only:
• Value of a direct current or voltage (use of additional subscript (D) is recommended)</td></tr>
<tr><td>With terminal subscript(s) and one of the following additional subscripts:
• D: value of direct current or voltage
• (AV): average total value
• M: maximum instantaneous total value
• MIN: minimum instantaneous total value
• (RMS): root-mean-square total value
• (P-P): peak-to-peak value of total value</td></tr>
</table>

1.5 Application of the rules

Figure 1 represents a transistor collector current as a function of time. It comprises a direct (DC) component (the average value) and an alternating component.

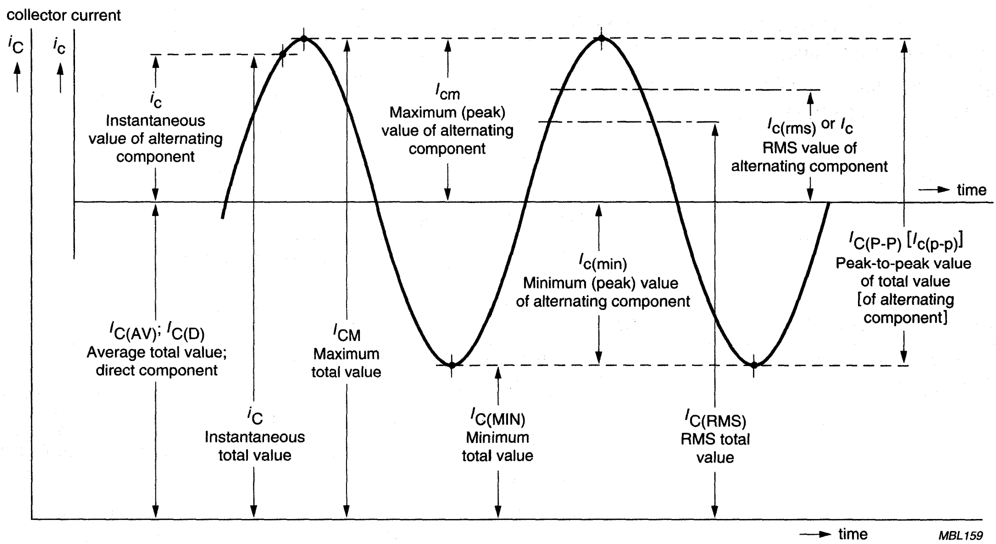

Fig.1 Example of the application of the rules to a periodic quantity

1.6 Indication of the polarity of currents and voltages

1.6.1 CURRENTS (THROUGH A TERMINAL)

1.6.1.1 Basic letter symbol

The basic letter symbol, when composed as detailed as in this document (Section 1.3.4.1), e.g. I_X denotes a conventional current that is considered to have a positive value if it flows from the external circuit into terminal X, or a negative value if it flows out of terminal X into the external circuit.

1.6.1.2 Negated letter symbol

The negated letter symbol, e.g. $-I_X$, denotes a conventional current that is considered to have a positive value if it flows out of terminal X into the external circuit, or a negative value if it flows from the external circuit into terminal X.

Remark: It follows by the application of algebraic rules that: $-I_X = 5$ A can be expressed as $I_X = -5$ A.

1.6.2 VOLTAGES (ACROSS TWO TERMINALS)

1.6.2.1 Basic letter symbol

The basic letter symbol, when composed as detailed in this document (Section 1.3.4.2), e.g. V_{XY} denotes a voltage that is considered to have a positive value if terminal X is at a positive potential with respect to terminal Y, or a negative value if terminal X is at a negative potential with respect to terminal Y.

1.6.2.2 Negated letter symbol

The negated letter symbol, e.g. $-V_{XY}$ denotes a voltage that is considered to have a positive value if terminal X is at a negative potential with respect to terminal Y, or a negative value if terminal X is at a positive potential with respect to terminal Y.

Remark: It follows by the application of algebraic rules that: $-V_{XY} = 5$ V can be expressed as $V_{XY} = -5$ V.

1.7 Letter symbols for electrical parameters

1.7.1 Definition

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

1.7.2 Basic letters

Table 4 comprises the most important basic letters used for electrical parameters of semiconductor devices.

Table 4 Recommended basic letters

SYMBOL	DESCRIPTION
B, b	susceptance; imaginary part of an admittance (y) four-pole matrix parameter
C	capacitance
G, g	conductance; real part of an admittance (y) four-pole matrix parameter
H, h	hybrid (h) four-pole matrix parameter
L	inductance
R, r	resistance; real part of an impedance (z) four-pole matrix parameter
X, x	reactance; imaginary part of an impedance (z) four-pole matrix parameter
Y, y	admittance; admittance (y) four-pole matrix parameter
Z, z	impedance; impedance (z) four-pole matrix parameter

1.7.2.1 Use of upper and lower-case letters

Upper-case letters are used for the representation of:

- Electrical parameters of external circuits and of circuits in which the device forms only a part
- All inductances and capacitances.

Lower-case letters are used for the representation of electrical parameters inherent in the device, with the exception of inductances and capacitances.

1.7.3 Subscripts

1.7.3.1 General subscripts

Table 5 comprises the most important general subscripts used for electrical parameters of semiconductor devices.

Table 5 Recommended general subscripts

SUBSCRIPT	DESCRIPTION
F, f	forward; forward transfer
I, i	input
O, o	output
R, r	reverse; reverse transfer; rise; reference point
T	depletion layer
11	input (1)
22	output (1)
12	reverse transfer (1)
21	forward transfer (1)
1	input (2)
2	output (2)

Notes

1. Applicable to four-pole matrix parameters only.
2. Applicable to all electrical parameters except four-pole matrix parameters.

Examples: Z_i, h_f, h_F.

1.7.3.2 Choice between upper-case and lower-case subscripts

Where Section 1.7.3.1 lists both upper-case and lower-case letters, the choice between these two styles shall be made according to Section 1.7.3.3 hereafter.
If more than one subscript is used, subscripts for which both styles exist shall either be **all** upper-case or **all** lower case.

Examples: h_{FE}, y_{RE}, h_{fe}, but C_{Te} (T has no lower-case variant).

1.7.3.3 Use of upper and lower-case subscripts

The upper-case variant of a subscript is used for the designation of static (DC) values.

Examples:

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

R_E (DC value of the external emitter resistance)

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

Examples:

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

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

1.7.3.4 Subscripts for four-pole matrix parameters

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

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

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

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

If only h_f is written, the circuit configuration must be understood. If only h_{21} is written, the circuit configuration must be understood as well as the kind of parameter (small-signal or static value).

1.7.3.5 Distinction between real and imaginary parts

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

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

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

Re (h_{ib}) etc. for the real part of h_{ib}

Im (h_{ib}) etc. for the imaginary part of h_{ib}.

1.8 Letter symbols for other quantities

1.8.1 GENERAL

Where the following Sections do not give recommendations for a letter symbol, the general recommendations (see IEC Publication 60027) should be followed. If there are no IEC recommendations, the appropriate ISO recommendations should be followed.

1.8.2 TIMES, DURATIONS

The basic letter symbol is:

t

example: t_r (rise time)

1.8.3 THERMAL CHARACTERISTICS AND RELATED TEMPERATURES

1.8.3.1 Basic letter symbol for temperature

The basic letter symbol is:

T , indicating either Celsius or Kelvin temperature.

example: T_{amb} = 25 °C, T_{op} = 295 K.

Remark: The use of the lower-case letter '**t**' is strongly deprecated.

1.8.3.2 General subscripts

Table 6 Recommended general subscripts

SUBSCRIPT	DESCRIPTION
a, A	ambient (1)
c, C	case (1)
f, F	cooling fluid, other than air
j, J	junction (2)
op	operating (3)
r, R	reference point (1)
h	heatsink
mb	mounting base
sb	substrate
sld	soldering
stg	storage
tp	tie-point
th	thermal

Notes

1. The use of longer subscripts as '**case**', '**ref**' and '**amb** is deprecated. If they are used for thermal resistances or impedances, the subscripts shall be separated by hyphens and put in brackets (parenthesis) as shown in the following example: $R_{th(j\text{-}a)}$.
2. In data sheets, specifications **always** refer to the **virtual** junction (channel) temperature. Therefore, the letter '**v**' in the subscript may be **omitted**.
3. In letter symbols for operating temperatures, e.g. as in $T_{amb(op)}$ for 'operating ambient temperature', the subscript '(op)' is usually omitted in data sheets if no ambiguity is likely to occur.

1.8.3.3 Composed letter symbols for thermal resistances and impedances

In the letter symbols below, the letters x, y, or X, Y stand for the subscripts that denote the points or regions between which the terminal resistance or impedance extends. These subscripts should be taken from Table 6.

Thermal resistance basic forms:

$R_{th(x\text{-}y)}$ or $R_{th(X\text{-}Y)}$

examples: $R_{th(j\text{-}a)}$, $R_{th(j\text{-}mb)}$, $R_{th(h\text{-}a)}$

Transient thermal impedance basic forms:

$Z_{th(x\text{-}y)}$ or $Z_{th(X\text{-}Y)}$

example: $Z_{th(j\text{-}mb)}$, $Z_{th(j\text{-}a)}$

Transient thermal impedance under pulsed conditions basic forms:

$Z_{thp(x\text{-}y)}$ or $Z_{thp(X\text{-}Y)}$

example: $Z_{thp(j\text{-}mb)}$, $Z_{thp(j\text{-}a)}$

1.8.4 FREQUENCIES

The basic letter symbol is:

f

example: f_{osc} (oscillator frequency)

1.8.5 SUNDRY QUANTITIES

Table 7 Recommended quantities and their letter symbols

DESCRIPTION	SYMBOL
Thermal derating factor	K_t
Average noise figure, average noise factor	$\overline{F}$, $F_{(AV)}$
Spot noise figure, spot noise factor	F
Output noise ratio	N_r
Equivalent input noise voltage (of a two-port)	V_n
Equivalent input noise current (of a two-port)	I_n
Noise temperature	T_n
Reference noise temperature	T_o/T_{no}

1.9 Letter symbols for logarithmic scale units for signal ratios expressed in dB

1.9.1 POWER RATIO

The letter symbol (unit) 'dB' is used for the logarithmic scale unit when the logarithm to the base of ten of the ratio of two amounts of power is expressed in decibels using the expression:

$n = 10 \log (P_1/P_2)$ dB

Remark: In principle, the unit 'dB' shall only be used for a ratio of powers, but see also the remark in Section 1.9.2.

1.9.2 VOLTAGE RATIO (OR CURRENT RATIO)

The letter symbol 'dB(V)' (or 'dB(I)') is used for the logarithmic scale unit when the logarithm to the base of ten of the ratio of two amounts of voltage (or current) is expressed in decibels using the expressions:

$n = 20 \log (V_1/V_2)$ dB(V)

or $n = 20 \log (I_1/I_2)$ dB(I)

Remark: When, and only when, the resistances appertaining to V_1 and V_2 (or I_1 and I_2) are equal or negligible difference, the numerical value calculated from the expressions may be labelled with dB because application of the power ratio expression in Section 1.9.1 to the corresponding powers results in the same value of 'n'.

1 CATV PARAMETERS

1.1 Power gain (G_p)

1.1.1 DEFINITION

The power gain, expressed in dB, is the ratio of output and input power of a module, operating in a 75 Ω (Z_0) system.

1.1.2 MEASUREMENT

The power gain is measured at several frequencies throughout the band, although the gain performances are mostly given only at the start and stop frequencies.
The gain is measured by applying a single tone signal to the module and measur2000 Apr 28ing the output power. The input power is measured before connecting the module using a thru-line and feeding the system with exactly the same signals.

1.1.3 EQUIPMENT

Input and output power levels are measured with a power meter.

1.2 Flatness of frequency response (FL)

1.2.1 DEFINITION

The flatness of gain of a CATV amplifier module is defined as the maximum deviation from an absolute flat gain over a given frequency range, after the slope of the amplifier over this frequency range has been optimized and equalized by means of a certain cable length to give the best result for flatness (see Figs 1 and 2). This means that an 'ideal gain curve' for the module is calculated and the flatness is the maximum deviation of this 'ideal gain' curve.

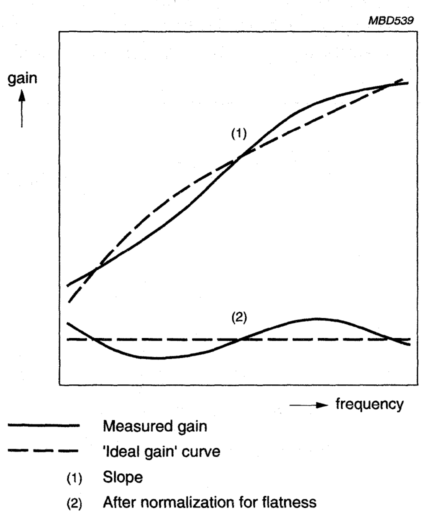

Fig.1 Gain curve before optimizing.

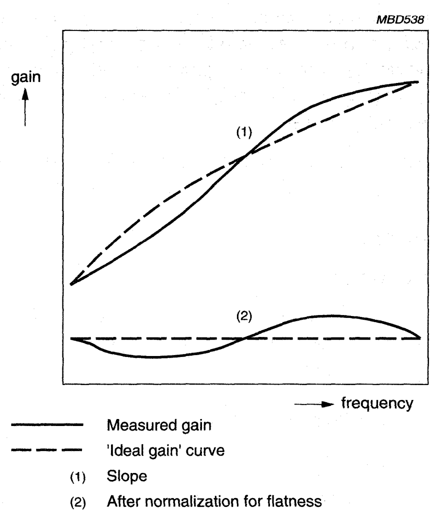

Fig.2 Gain curve after optimizing.

1.2.2 CALCULATION

To determine the flatness, the measured gain values are compared with an 'ideal gain' curve derived from a mathematical model. The formula used is as follows:

$$\text{Gain} = G + C\sqrt{\frac{f_x}{f_1}}$$

where

G = constant gain (frequency independent)

C = cable constant

f_x = desired frequency

f_1 = start frequency.

The cable constant (C) must be optimized during the flatness determination so that the gain curve best fits the measured gain figures. The start value for C is calculated using the formula:

$$C_{start} = \frac{G_n - G_1}{\sqrt{\frac{f_n}{f_1}} - 1}$$

where

G_n = the measured gain at stop frequency

G_1 = the measured gain at start frequency

f_n = stop frequency.

The value of G is chosen so that the maximum positive deviation of the measured gain from the 'ideal gain' curve is the same as the maximum negative deviation. The value of C is adapted by ±0.001 until the 'ideal gain' curve best fits the measured curve.

The flatness of the module gain is the maximum deviation in measured gain from the optimized gain formula.

1.3 Slope (SL)

1.3.1 DEFINITION

The slope of a module is the difference between the 'ideal gain' at the start frequency and the 'ideal gain' at the stop frequency (see Section 1.2).

1.4 Flatness (S-curve method)

1.4.1 DEFINITION

For some high-slope modules the flatness is calculated according to the 'S-curve' method. The ideal S-curve is defined as:

$$G_f = G_{f_1} + \delta G \times a \times (f - f_1) + \delta G \times b \times (f - f_1)^2 + \delta G \times c \times (f - f_1)^3$$

where:

$$\delta G = G_{f_n} - G_{f_1}$$

f_1 = start frequency

f_n = stop frequency

$a = 3.1224 \times 10^{-3}$

$b = 1.9932 \times 10^{-6}$

$c = -8.934 \times 10^{-9}$.

The flatness is the maximum deviation between the measured gain and the 'ideal gain' curve.

1.5 Delta gain

1.5.1 DEFINITION

Delta gain is the difference in gain between two given frequencies (mostly the start and stop frequencies).

1.6 Intermodulation distortion (d_{im})

In accordance with DIN 45004-B 6.3, 3-tone.

1.6.1 DEFINITION

The intermodulation distortion product is the difference in dB between the peak of the RF signal in the measuring channel and the peak of the distortion signal caused by the influence of a signal in a neighbouring channel (see Fig.3).

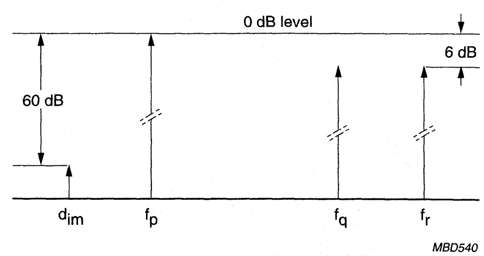

Fig.3 Intermodulation distortion.

To measure 3-tone d_{im}, three CW signals are applied to the module:

Table 1 CW signals

CW SIGNAL	FREQUENCY	LEVEL
f_p	f	0 dB
f_q	f + 7 MHz	−6 dB
f_r	f + 9 MHz	−6 dB

The distortion product is measured at f − 2 MHz. This distortion product consists of the $(f_p + f_q - f_r)$ beats and is expressed in dB referenced to the 0 dB level (the f_p signal level).

This 0 dB level should be chosen so that the distortion product (d_{im}) is −60 dB. For practical reasons the given output level (V_o) for 3-tone distortion is defined as the 0 dB level and the modules are rejected if the distortion level is worse than −60 dB.

1.6.2 EQUIPMENT

Table 2 Spectrum analyzer settings

SETTINGS	VALUE	UNIT
Internal attenuator	40	dB
Resolution bandwidth	3	kHz
Video bandwidth	100	Hz
Span	50	kHz

The three CW-signals are obtained from three different generators (see Chapter 2, *Appendix A*).

1.7 Composite third order distortion: composite triple beat (CTB) in CW carriers

In accordance with National Cable Television Association recommendations.

1.7.1 DEFINITION

Composite third order modulation is the amplitude distortion of desired signals, caused by third order curvature of non-linear transfer characteristics in system equipment. It is the ratio, expressed in dB, of the peak level of the RF signal to the peak level of the cluster of distortion components centred around the carrier.

1.7.2 MEASUREMENT

To measure the CTB, a signal at the measuring frequency is set to the specified V_o level. This output level is defined as the 0 dB level. During the measurement (1) all channels in the band are set to the specified V_o level, see Chapter 6, *Appendix E*. Now, at the measuring frequency, the distortion product is measured with a spectrum analyzer or distortion analyzer.

The CTB distortion is measured high in the band because here the distortion products have most amplitude (although the greatest number of beats ($f_1 \pm f_2 \pm f_3$ and $2 \times f_1 \pm f_2$) are found in the centre of the band).

1.7.3 EQUIPMENT

Table 3 Spectrum analyzer settings

SETTINGS	VALUE	UNIT
Resolution bandwidth	30	kHz
Video bandwidth	100	Hz
Span	500	kHz

A bandpass filter is used to eliminate the distortion products caused by the spectrum analyzer itself.
If desired, a distortion analyzer can be used instead of the spectrum analyzer.

The carrier signals are obtained from a multi-channel generator. The frequency deviation of each channel must be less than 5 kHz.

(1) In the USA, an equally spaced frequency raster is used with a space of 6 MHz between the channels. In Germany frequency distribution of the space between the channels is 7 MHz up to 300 MHz, and 8 MHz above 300 MHz. In general, the Philips measurements are made in accordance with the American frequency raster. For the German market, measurements can be made with a set-up which is as closely as possible to the German raster.
A list of both rasters is given in Chapter 5, *Appendix D*.

1.8 Composite third order distortion: cross modulation (X_{mod}) in modulated carriers

1.8.1 DEFINITION

Cross modulation distortion is a form of distortion where modulation of interfering stations appears as a modulation of the desired station, caused by third order curvature of non-linear transfer characteristics in system equipment. It is the ratio, expressed in dB, of the peak level of the modulated RF signal to the peak level of the distortion components centred around the carrier (Figs 4, 5 and 6).

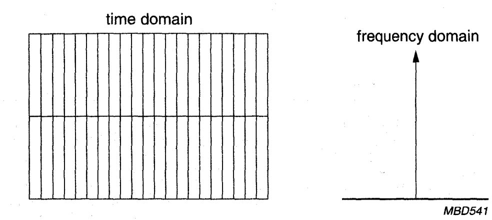

Fig.4 CW signal (sine-wave), no other signals switched on.

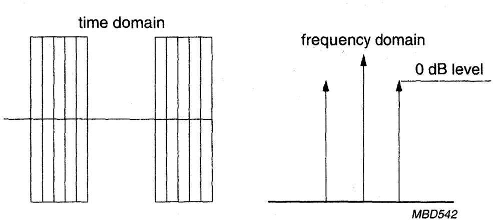

Fig.5 One signal switched on 100% modulated.

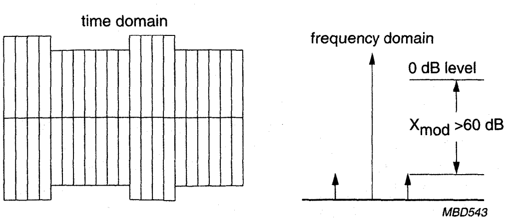

Fig.6 CW signal with X_{mod} distortion caused by other modulated signals.

1.8.2 MEASUREMENT

To measure X_{mod}, the carrier of the desired channel is set to the specified V_o level. This channel is then 100% modulated with a 15.75 kHz square wave(1). The peak level of this modulation signal (15.75 kHz on the carrier) is defined as the 0 dB level. The distortion product is now measured by setting each individual CW channel to the specified V_o level and switching them on in modulated mode, see Chapter 6, *Appendix E*. Only the carrier in the channel where the X_{mod} distortion is to be measured, is not modulated. The X_{mod} distortion peak now appears as 15.75 kHz on the carrier.

The X_{mod} distortion is most easily measured at the low end of the frequency band.

1.8.3 EQUIPMENT

Bandpass filter:

Tuned to the channel in which the distortion product is to be measured.

Table 4 Spectrum analyzer settings (for most types)

SETTINGS	VALUE	UNIT
Resolution bandwidth	300	kHz
Video bandwidth	30	Hz
Span	5	kHz

A multi-channel generator is required for the test signals.

A distortion analyzer will be required if the X_{mod} is to be measured at a high frequency in the band. This is because phase noise will make spectrum analyzer measurements inaccurate.

(1) The 15.75 kHz square wave modulation signal, used with X_{mod} measurements, found its origin in the American broadcasting method. Using the NTSC system, the 15.75 kHz is defined by the 60 Hz mains frequency and the number of 525 TV lines, i.e. (NTSC) = 60 × 525 ÷ 2 = 15.75 KHz.
The modulation frequency for PAL (one of the European methods) is 15.625 kHz. This is because in Europe the mains frequency is 50 Hz and the number of TV lines using PAL is 625.

1.9 Second order distortion (d_2)

In accordance with DIN 45004-A1.

1.9.1 DEFINITION

The second order distortion product is the difference in dB between the peak level of an RF signal at the measuring frequency, and the peak level of the signal at the measuring frequency caused by two CW signals with their second order modulation product ($f_1 \pm f_2$) at the measuring frequency (see Fig.7).

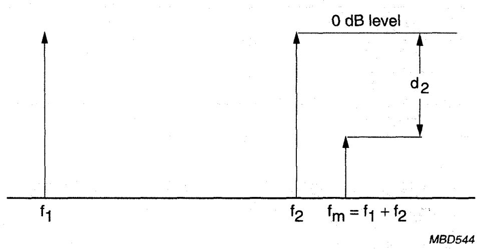

Fig.7 Second order distortion (d_2).

1.9.2 MEASUREMENT

Second order modulation is measured at the frequency in the band where the distortion product is found to be worst. In general this will be at the high end of the band.

In most cases the measuring procedure will be as follows:

Signals f_1 and f_2 are chosen so that f_1 is the lowest channel in the band and f_2 is the highest. This means that $f_1 + f_2$ lays within the band.

The peak levels of f_1 and f_2 are equal and are defined as the 0 dB level. For frequency sets, see Chapter 3, *Appendix B*.

1.9.3 EQUIPMENT

Table 5 Spectrum analyzer settings

SETTINGS	VALUE	UNIT
Resolution bandwidth	3	kHz
Video bandwidth	100	Hz
Span	50	kHz

A tunable bandpass filter is used to eliminate the distortion caused by the spectrum analyzer.

1.10 Composite second order (CSO) distortion

1.10.1 DEFINITION

Composite second order distortion is the ratio, expressed in dB, of the peak level of the RF signal to the peak level of the cluster of distortion components centred around the desired signal. This distortion is caused by a compilation of components of second order intermodulation products of interfering signals with frequencies f_1 and f_2, so that

$f_m = f_1 \pm f_2$ or,

$f_m = 2 \times f_1$ or,

$f_m = 2 \times f_2$.

1.10.2 MEASUREMENT

Measurement is made by setting a signal with the desired frequency to the specified level for V_o. This V_o level is defined as the 0 dB level.

During the measurement, all channels in the band are levelled to the specified V_o. Now at the measurement frequency, the distortion product is measured by use of a spectrum analyzer.

The CSO distortion is measured high in the band because it is here that this distortion product has most influence, see Chapter 6, *Appendix E*.

1.10.3 EQUIPMENT

Table 6 Spectrum analyzer settings

SETTINGS	VALUE	UNIT
Resolution bandwidth	30	kHz
Video bandwidth	100	Hz
Span	400	kHz

A bandpass filter is used at the input of the spectrum analyzer.

2 APPENDIX A - COMMON FREQUENCY SETS FOR d_{dim} MEASUREMENTS

Table 7 Common frequency sets for d_{dim} measurements

f_m (MHz)	f_p (MHz)	f_q (MHz)	f_r (MHz)
33.25	35.25	42.25	44.25
163.25	165.25	172.25	174.25
185.25	187.25	194.25	196.25
285.25	287.25	294.25	296.25
335.25	337.25	344.25	346.25
339.25	341.25	348.25	350.25
385.25	387.25	394.25	396.25
438.25	440.25	447.25	449.25
481.25	483.25	490.25	492.25
538.25	540.25	547.25	549.25
849.25	851.25	858.25	860.25

3 APPENDIX B - COMMON FREQUENCY SETS FOR d_2 MEASUREMENTS

Table 8 Common frequency sets for d_2 measurements

f_p (MHz)	f_q (MHz)	f_m (MHz)
83.25	109.25	192.50
66.00	144.00	210.00
55.25	211.25	266.50
55.25	343.25	398.50
55.25	391.25	446.50
55.25	493.25	548.50
300.00	450.00	750.00

4 APPENDIX C - DISTORTION RESULTS USING THE CENELEC FREQUENCY RASTER

The CENELEC Frequency Raster is increasingly being used in Europe. This raster has less channels and these are no longer equally spaced as with the USA Frequency Raster. This results generally in much better distortion readings.

The distortion figures of the CATV hybrids are measured using the standard USA Frequency Raster. A different number of channels is used, however, depending on the frequency range.

The following table based on calculations and correlation measurements using several different hybrid types provides a means of converting the standard measured distortion figures (USA Frequency Raster) into CENELEC Frequency Raster readings (see Table 9).

Table 9 Distortion results using the CENELEC frequency raster

FREQUENCY RANGE (MHz)	CHANNELS		CTB (dB)	X_{mod} (dB)	CSO (dB)
	USA	CENELEC			
40 - 600	85	29	−11.00	−8.00	−6.00
40 - 750	110	35	−12.00	−9.00	−9.00
40 - 860	49	42	+2.00	−1.00	+1.00

5 APPENDIX D - LISTS OF FREQUENCY RASTERS FOR USA AND GERMANY

Table 10 Frequency rasters for USA

USA	
CHANNEL	FREQUENCY (MHz)
2	55.25
3	61.25
4	67.25
5	77.25
6	83.25
A2	109.25
A1	115.25
A	121.25
B	127.25
C	133.25
D	139.25
E3	145.25
F	151.25
G	157.25
H	163.25
I	169.25
7	175.25
8	181.25
9	187.25
10	193.25
11	199.25
12	205.25
13	211.25
J	217.25
K	223.25
L	229.25
M	235.25
N	241.25
O	247.25
P	253.25
Q	259.25
R	265.25
S	271.25
T	277.25
U	283.25
V	289.25
W	295.25

USA (CONTINUED)	
CHANNEL	FREQUENCY (MHz)
X	301.25
Y	307.25
Z	313.25
H1	319.25
H2	325.25
H3	331.25
H4	337.25
H5	343.25
H6	349.25
H7	355.25
H8	361.25
H9	367.25
H10	373.25
H11	379.25
H12	385.25
H13	391.25
H14	397.25
H15	403.25
H16	409.25
H17	415.25
H18	421.25
H19	427.25
H20	433.25
H21	439.25
H22	445.25
H23	451.25
H24	457.25
H25	463.25
14	469.25
15	475.25
16	481.25
17	487.25
18	493.25
19	499.25
20	505.25
21	511.25
22	517.25
23	523.25

USA (CONTINUED)	
CHANNEL	FREQUENCY (MHz)
24	529.25
25	535.25
26	541.25
27	547.25
28	553.25
29	559.25
30	565.25
31	571.25
32	577.25
33	583.25
34	589.25
35	595.25
36	601.25
37	607.25
38	613.25
39	619.25
40	625.25
41	631.25
42	637.25
43	643.25
44	649.25
45	655.25
46	661.25
47	667.25
48	673.25
49	679.25
50	685.25
51	691.25
52	697.25
53	703.25
54	709.25
55	715.25
56	721.25
57	727.25
58	733.25
59	739.25
60	745.25
61	751.25
62	757.25

USA (CONTINUED)	
CHANNEL	FREQUENCY (MHz)
63	763.25
64	769.25
65	775.25
66	781.25
67	787.25
68	793.25
69	799.25
70	805.25
71	811.25
72	817.25
73	823.25
74	829.25
75	835.25
76	841.25
77	847.25
78	853.25
79	859.25
80	865.25
81	871.25
82	877.25
83	883.25
84	889.25
85	895.25

Table 11 Frequency rasters for Germany

GERMANY	
CHANNEL	FREQUENCY (MHz)
K2	48.25
K3	55.25
K4	62.25
–	69.25
–	76.25
S2	112.25
S3	119.25
S4	126.25
S5	133.25
S6	140.25
S7	147.25
S8	154.25

GERMANY (CONTINUED)	
CHANNEL	FREQUENCY (MHz)
S10	168.25
K5	175.25
K6	182.25
K7	189.25
K8	196.25
K9	203.25
K10	210.25
K11	217.25
K12	224.25
S11	231.25
S12	238.25
S13	245.25
S14	252.25
S15	259.25
S16	266.25
S17	273.25
S18	280.25
S19	287.25
S20	294.25
S21	303.25
S22	311.25
S23	319.25
S24	327.25
S25	335.25
S26	343.25
S27	351.25
S28	359.25
S29	367.25
S30	375.25
S31	383.25
S32	391.25
S33	399.25
S34	407.25
S35	415.25
S36	423.25
S37	431.25
S38	439.25
S39	445.25

6 APPENDIX E - TEST CHANNELS

Table 12 Channels used during CTB, X_{mod} and CSO measurements

RANGE	NAMES	FREQUENCIES (MHz)	CHANNELS
5 - 200 MHz 22 channels	T7 - T13 2 - 4 5 - 6 A - 7	7.00 - 43.00 55.25 - 67.25 77.25 - 83.25 121.25 - 175.25	7 3 2 10
40 - 300 MHz 32 channels	2 - 4 5 - 6 A2 A - F H - S W	55.25 - 67.25 77.25 - 83.25 109.25 121.25 - 151.25 163.25 - 271.25 295.25	3 2 1 6 19 1
40 - 450 MHz 52 channels	2 - 4 5 - 6 A2 A - F H - H14	55.25 - 67.25 77.25 - 83.25 109.25 121.25 - 151.25 163.25 - 397.25	3 2 1 6 40
40 - 450 MHz 60 channels	2 - 4 5 - 6 A - H22	55.25 - 67.25 77.25 - 83.25 121.25 - 445.25	3 2 55
40 - 550 MHz 77 channels	2 - 4 5 - 6 A - 27	55.25 - 67.25 77.25 - 83.25 121.25 - 547.25	3 2 72
40 - 600 MHz 85 channels	2 - 4 5 - 6 A - 35	55.25 - 67.25 77.25 - 83.25 121.25 - 595.25	3 2 80
40 - 750 MHz 110 channels	2 - 4 5 - 6 A - 60	55.25 - 67.25 77.25 - 83.25 121.25 - 745.25	3 2 105
Continued on next page			

CATV parameters General

RANGE	NAMES	FREQUENCIES (MHz)	CHANNELS
40 - 860 MHz 49 channels	2	55.25	1
	4	67.25	1
	6	83.25	1
	7	175.25	1
	9	187.25	1
	12	205.25	1
	J	217.25	1
	M	235.25	1
	O	247.25	1
	R	265.25	1
	T	277.25	1
	W	295.25	1
	Y	307.25	1
	H2	325.25	1
	H4	337.25	1
	H7	355.25	1
	H9	367.25	1
	H12	385.25	1
	H14	397.25	1
	H17	415.25	1
	H19	427.25	1
	H22	445.25	1
	H24	457.25	1
	15	475.25	1
	17	487.25	1
	20	505.25	1
	22	517.25	1
	25	535.25	1
	27	547.25	1
	30	565.25	1
	32	577.25	1
	35	595.25	1
	37	607.25	1
	40	625.25	1
	42	637.25	1
	45	655.25	1
	47	667.25	1
	50	685.25	1
	52	697.25	1
	55	715.25	1
	57	727.25	1
	60	745.25	1
	62	757.25	1
	65	775.25	1
	67	787.25	1
	70	805.25	1
	73	823.25	1
	76	841.25	1
	79	859.25	1

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RANGE	NAMES	FREQUENCIES (MHz)	CHANNELS
40 - 860 MHz 129 channels	2 - 4 5 - 6 A - 79	55.25 - 67.25 77.25 - 83.25 121.25 - 859.25	3 2 124
40 - 450 MHz 36 channels German raster (For test purposes, USA frequency rasters are used to emulate the German raster)	2 - 3 C - F H 7 9 12 J L - M O - S U - X Z - H2 H4 H6 H8 - H10 H12 - H13 H16 - H18 H20	55.25 - 61.25 133.25 - 151.25 163.25 175.25 187.25 205.25 217.25 229.25 - 235.25 247.25 - 271.25 283.25 - 301.25 313.25 - 325.25 337.25 349.25 361.25 - 373.25 385.25 - 391.25 409.25 - 421.25 433.25	2 4 1 1 1 1 1 2 5 4 3 1 1 3 2 3 1

1 SCATTERING PARAMETERS

The scattering or s-parameters described in this document are in accordance with IEC 60747-7, Chapter II, Section 5.

1.1 s-parameters

In distinction to the conventional h-, y- and z-parameters, scattering parameters (s-parameters) relate to travelling wave conditions. Fig.1 shows a four-pole network with the incident and reflected waves a_1, b_1, a_2 and b_2.

1.1.1 General introduction

The s-parameters are defined by the following two equations:

$$b_1 = s_{11}a_1 + s_{12}a_2 \quad (1)$$

$$b_2 = s_{21}a_1 + s_{22}a_2 \quad (2)$$

where a_1 and a_2 are the incident wave quantities, b_1 and b_2 the reflected wave quantities, all having the dimension $W^{1/2}$ or the squares of these quantities have the dimension of power (W).

They can be used for general two-port networks, including the special case of a four-pole network. In this latter case, a_i and b_i are defined as:

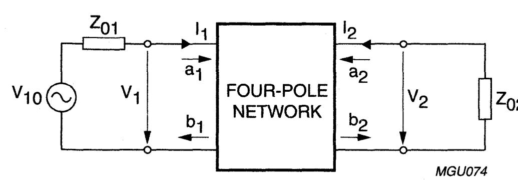
$$a_i = \frac{V_i + Z_{0i}I_i}{2\sqrt{|R_{0i}|}} \quad (3)$$

$$b_i = \frac{V_i - Z_{0i}^{*}I_i}{2\sqrt{|R_{0i}|}} \quad (4)$$

where: i = 1 or 2 and $R_{0i} \neq 0$

and: $Z_{0i} = R_{0i} + jX_{0i}$ and $Z_{0i}^{*} = R_{0i} - jX_{0i}$

In the general case, they are complex quantities.



Z_{01} and Z_{02} are reference impedances at the input and output, respectively.

Fig.1 Four-pole network.

For the use of s-parameters for the specification of transistors mainly at VHF and UHF, $Z_{01} = Z_{02} = R_0$ (which in most cases will equal 50 Ω).

The equations (1) and (2) can then be written in the following form:

$$V_1 - R_0I_1 = s_{11}(V_1 + R_0I_1) + s_{12}(V_2 + R_0I_2) \quad (5)$$

$$V_2 - R_0I_2 = s_{21}(V_1 + R_0I_1) + s_{22}(V_2 + R_0I_2) \quad (6)$$

Both sets of equations (1), (2) and (5), (6) can now be used to show the meaning of the s-parameters:

$$s_{11} = \frac{b_1}{a_1} \quad \text{with } a_2 = 0 \quad (7)$$

$$s_{11} = \frac{V_1 - R_0I_1}{V_1 + R_0I_1} \quad \text{with } V_2 = -R_0I_2 \quad (8)$$

$$s_{11} = \frac{Z_1 - R_0}{Z_1 + R_0} \quad \text{with } -\frac{V_2}{I_2} = R_0 \quad (9)$$

$\mathbf{s_{11}}$ = reflection factor of the input impedance referred to R_0, the output being terminated by R_0.

Definition of $\mathbf{s_{11}}$: ratio of the complex value of the reflected wave at the input to that of the incident wave at the input; the output terminating resistance and the source resistance each having the value R_0.

Analogously for $\mathbf{s_{22}}$: ratio of the complex value of the reflected wave at the output to that of the incident wave at the output; the input terminating resistance and the source resistance each having the value R_0.

$\mathbf{s_{22}}$ = reflection factor of the output impedance referred to R_0, the input being terminated by R_0.

In addition:

$$s_{21} = \left(\frac{b_2}{a_1}\right) \quad \text{with } a_2 = 0 \quad (10)$$

$$s_{21} = \left(\frac{V_2 - R_0I_2}{V_1 + R_0I_1}\right) \quad \text{with } V_2 = -R_0I_2 \quad (11)$$

$$s_{21} = \left(\frac{V_2}{\frac{1}{2}V_{10}}\right) \quad \text{with } -\frac{V_2}{I_2} = R_0 \quad (12)$$

$\mathbf{s_{21}}$ = ratio of the output voltage V_2 to half the open-circuit source voltage V_{10}, with source and load resistances each having the value R_0.

Analogously for $\mathbf{s_{12}}$: ratio of the complex value of the transmitted wave at the input to that of the incident wave at the output; the input terminating resistance and the source resistance each having the value R_0.

$\mathbf{s_{12}}$ = ratio of the input voltage V_1 to half the open-circuit source voltage V_{20}, with source and load resistances each having the value R_0.

1.1.2 DEFINITIONS

The following definitions are given for the general case. For transistors, different values of these parameters may be obtained according to the configuration used, and for small and large-signal conditions.

1.1.2.1 Input reflection coefficient (s_{11})

The ratio of the complex value of the reflected wave at the input to that of the incident wave at the input, under small-signal conditions; the output terminating resistance and the source resistance each having the value R_0.

Remark: This is equivalent to the reflection factor of the input impedance Z_1 of the transistor with respect to the source resistance R_0, the output being terminated by R_0.

1.1.2.2 Output reflection coefficient (s_{22})

The ratio of the complex value of the reflected wave at the output to that of the incident wave at the output, under small-signal conditions; the input terminating resistance and the source resistance each having the value R_0.

Remark: This is equivalent to the reflection factor of the output impedance Z_2 of the transistor with respect to a resistance R_0, the input being terminated by R_0.

1.1.2.3 Forward transmission (transfer) coefficient (s_{21})

The ratio of the complex value of the transmitted wave at the output to that of the incident wave at the input, under small-signal conditions; the output terminating resistance and the source resistance each having the value R_0.

Remark: This is equivalent to the ratio of the complex value of the output voltage to that of half the open-circuit source voltage when the transistor is terminated at the output by a resistance R_0 and fed at the input from a source having a resistance R_0.

1.1.2.4 Reverse transmission (transfer) coefficient (s_{12})

The ratio of the complex value of the transmitted wave at the input to that of the incident wave at the output, under small-signal conditions; the input terminating resistance and the source resistance each having the value R_0.

Remark: This is equivalent to the ratio of the complex value of the input voltage to that of half the open-circuit source voltage when the transistor is terminated at the input by a resistance R_0 and fed at the output from a source having a resistance R_0.

1.1.2.5 General remark

The resistance R_0 shall be the same for all four s-parameters and usually will have the value of 50 Ω.

The above definitions, which infer-ohmic source and terminating resistances, may not be practical for some classes of transistors (e.g. MOS field-effect transistors).

1.1.2.6 Frequency of unity forward transmission coefficient (f_s, f_{1s})

The frequency at which the modulus of the forward transmission coefficient $\mathbf{s_{21}}$ has decreased to unity.

1.1.3 APPLICATION OF S-PARAMETERS

The s-parameters as defined in Section 1.1.2 can be used as follows.

1.1.3.1 Relation of s-parameters with other parameters (y, z, h)

The following matrix equivalencies hold:

$$(y) = \frac{1}{R_0(1+s_{11}+s_{22}+\det s)}\begin{bmatrix}(1-s_{11}+s_{22}-\det s) & -2s_{12}\\ -2s_{21} & (1+s_{11}-s_{22}-\det s)\end{bmatrix} \quad (13)$$

$$(z) = \frac{R_0}{1-s_{11}-s_{22}+\det s}\begin{bmatrix}(1+s_{11}-s_{22}-\det s) & 2s_{12}\\ 2s_{21} & (1-s_{11}+s_{22}-\det s)\end{bmatrix} \quad (14)$$

$$(h) = \frac{1}{1-s_{11}+s_{22}-\det s}\begin{bmatrix}(1+s_{11}+s_{22}+\det s)R_0 & 2s_{12}\\ -2s_{21} & \frac{1}{R_0}(1-s_{11}-s_{22}+\det s)\end{bmatrix} \quad (15)$$

$$\det y = \frac{1}{R_0^2}\times\frac{1-s_{11}-s_{22}+\det s}{1+s_{11}+s_{22}+\det s} \quad (16)$$

$$\det z = R_0^2\times\frac{1+s_{11}+s_{22}+\det s}{1-s_{11}-s_{22}+\det s} \quad (17)$$

$$\det h = \frac{1+s_{11}-s_{22}-\det s}{1-s_{11}+s_{22}-\det s} \quad (18)$$

1.1.3.2 Conversion of s-parameters to other parameters (y, z, h)

The following equivalencies hold:

$$y_{11} = \frac{s_{12}s_{21}+(1-s_{11})(1+s_{22})}{(1+s_{11})(1+s_{22})-s_{12}s_{21}}\times\frac{1}{R_0} \quad (19)$$

$$y_{12} = \frac{-2s_{12}}{(1+s_{11})(1+s_{22})-s_{12}s_{21}}\times\frac{1}{R_0} \quad (20)$$

$$y_{21} = \frac{-2s_{21}}{(1+s_{11})(1+s_{22})-s_{12}s_{21}}\times\frac{1}{R_0} \quad (21)$$

$$y_{22} = \frac{s_{12}s_{21}+(1+s_{11})(1-s_{22})}{(1+s_{11})(1+s_{22})-s_{12}s_{21}}\times\frac{1}{R_0} \quad (22)$$

$$h_{11} = \frac{(1+s_{11})(1+s_{22})-s_{12}s_{21}}{s_{12}s_{21}+(1-s_{11})(1+s_{22})}\times R_0 \quad (23)$$

$$h_{12} = \frac{2s_{12}}{s_{12}s_{21}+(1-s_{11})(1+s_{22})} \quad (24)$$

$$h_{21} = \frac{-2s_{21}}{s_{12}s_{21}+(1-s_{11})(1+s_{22})} \quad (25)$$

$$h_{22} = \frac{(1-s_{11})(1-s_{22})-s_{12}s_{21}}{s_{12}s_{21}+(1-s_{11})(1+s_{22})}\times\frac{1}{R_0} \quad (26)$$

$$z_{11} = \frac{(1+s_{11})(1-s_{22})+s_{12}s_{21}}{(1-s_{11})(1-s_{22})-s_{12}s_{21}}\times R_0 \quad (27)$$

$$z_{12} = \frac{2s_{12}}{(1-s_{11})(1-s_{22})-s_{12}s_{21}}\times R_0 \quad (28)$$

$$z_{21} = \frac{2s_{21}}{(1-s_{11})(1-s_{22})-s_{12}s_{21}}\times R_0 \quad (29)$$

$$z_{22} = \frac{(1+s_{22})(1-s_{11})+s_{12}s_{21}}{(1-s_{11})(1-s_{22})-s_{12}s_{21}}\times R_0 \quad (30)$$

1.1.3.3 Use of s-parameters for the direct computation of transistor amplifier characteristics

Input reflection factor: r_1

The input reflection factor (r_1) referred to R_0, for a load impedance Z_L defined by the load reflection factor r_L.

$$r_1 = s_{11} + \frac{r_L s_{12} s_{21}}{1 - r_L s_{22}} \quad (31)$$

$$r_1 = \frac{Z_1 - R_0}{Z_1 + R_0} \quad (32)$$

$$r_L = \frac{Z_L - R_0}{Z_L + R_0} \quad (33)$$

Output reflection factor: r_2

The output reflection factor (r_2) referred to R_0, for a source impedance Z_G defined by the source reflection factor r_G.

$$r_2 = s_{22} + \frac{r_G s_{12} s_{21}}{1 - r_G s_{11}} \quad (34)$$

$$r_2 = \frac{Z_2 - R_0}{Z_2 + R_0} \quad (35)$$

$$r_G = \frac{Z_G - R_0}{Z_G + R_0} \quad (36)$$

Current amplification: A_i

$$A_i = \frac{-I_2}{I_1} = \frac{s_{21}(1 - r_L)}{(1 - s_{11}) - r_L(s_{22} - \det s)} \quad (37)$$

Voltage amplification: A_v

$$A_v = \frac{-V_2}{V_1} = \frac{s_{21}(1 + r_L)}{(1 + s_{11}) - r_L(s_{22} + \det s)} \quad (38)$$

Power gain: G_p

$$G_p = \frac{P_2}{P_1} = |A_v|^2 \times \frac{1 - |r_L|^2}{1 - |r_1|^2} \frac{|1 - r_1|^2}{|1 - r_L|^2} = |s_{21}|^2 \times \frac{1 - |r_L|^2}{|1 - r_L s_{22}|^2 - |s_{11} - r_L \det s|^2} \quad (39)$$

Transducer g2000 Apr 28ain: G_T

$$G_T = |s_{21}|^2 \times \frac{(1 - |r_G|^2)(1 - |r_L|^2)}{[(1 - r_G s_{11})(1 - r_L s_{22}) - r_G r_L s_{12} s_{21}]^2} \quad (40)$$

Conditions for unconditional stability:

$$\frac{1 - |s_{11}|^2 - |s_{22}|^2 + |\det s|^2}{2|s_{12}s_{21}|} > 1 \quad (41)$$

$$1 - |s_{11}|^2 - |s_{12}s_{21}| > 0 \quad (42)$$

$$1 - |s_{22}|^2 - |s_{12}s_{21}| > 0 \quad (43)$$

1 ELECTROSTATIC CHARGES

Electrostatic charges can be stored in many things; for example, man-made fibre clothing, moving machinery, objects with air blowing across them, plastic storage bins, sheets of paper stored in plastic envelopes, paper from electrostatic copying machines, and people (see Fig.1). The charges are caused by friction between two surfaces, at least one of which is non-conductive. The magnitude and polarity of the charges depend on the different affinities for electrons of the two materials rubbing together, the friction force and the humidity of surrounding air.

Electrostatic discharge (ESD) is the transfer of an electrostatic charge between bodies at different potentials and occurs with direct contact or when induced by an electrostatic field. All pins of Philips Semiconductors' devices are protected against electrostatic discharge. However we recommend that the following ESD precautions are complied with when handling such components.

2 WORKSTATION FOR HANDLING ELECTROSTATIC-SENSITIVE DEVICES

Figure 2 shows a working area suitable for safely handling electrostatic-sensitive devices. It has a workbench, the surface of which is conductive and anti-static. The floor should also be covered with anti-static material.

The following precautions should be observed:

- Persons at a workbench should be earthed via a wrist strap and a resistor.
- All mains-powered equipment should be connected to the mains via an earth-leakage switch.
- Equipment cases should be grounded.
- Relative humidity should be maintained between 40% and 50%.
- An ionizer should be used to neutralize objects with immobile static charges in case other solutions fail.
- Keep static materials, such as plastic envelopes and plastic trays etc., away from the workbench. If there are any such static materials on the workbench, remove them before handling the semiconductor devices.
- Refer to the current version of the handbook EN 100015 (CECC 00015) *"Protection of Electrostatic Sensitive Devices"*, which explains in more detail how to arrange an ESD protective area for handling ESD sensitive devices.

3 RECEIPT AND STORAGE OF COMPONENTS

Electrostatic-sensitive devices are packed for despatch in anti-static/conductive containers, usually boxes, tubes or blister tape. Warning labels on both primary and secondary packing show that the contents are sensitive to electrostatic discharge.

Such devices should be kept in their original packing whilst in storage. If a bulk container is partially unpacked, the unpacking should be done at a protected workstation. Any components that are stored temporarily should be packed in conductive or anti-static packing or carriers.

4 PCB ASSEMBLY

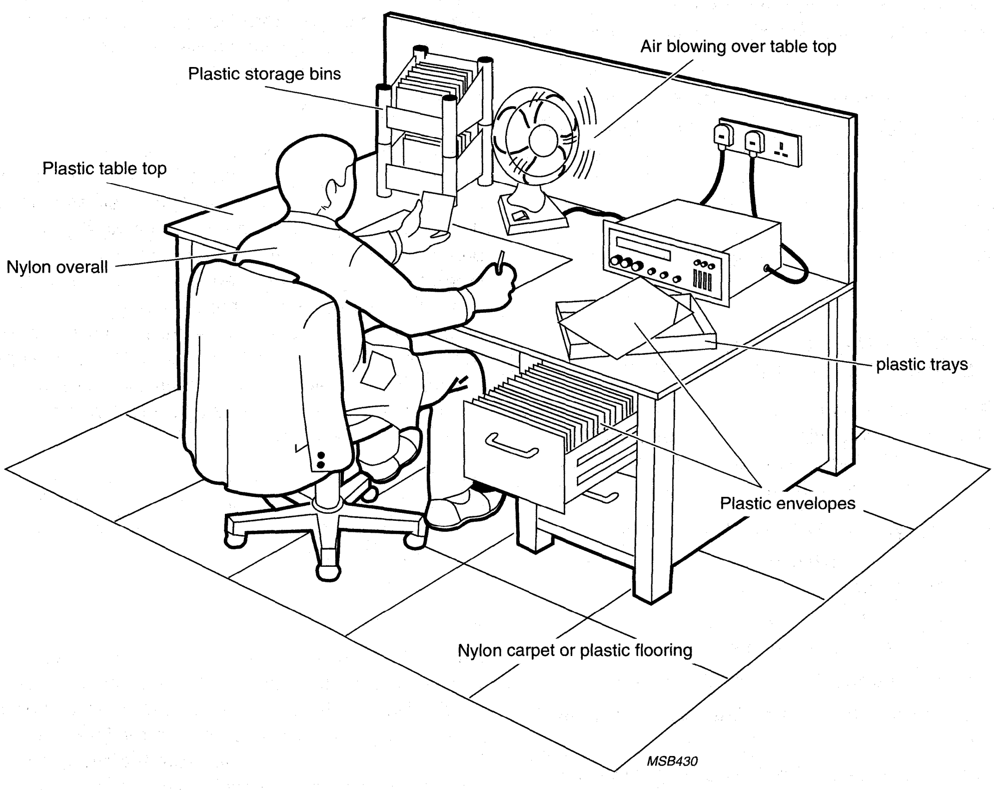
Electrostatic-sensitive devices must be removed from their protective packing with grounded component-pincers or short-circuit clips. Short-circuit clips must remain in place during mounting, soldering and cleansing/drying processes. Don't remove more components from the storage packing than are needed at any one time. Production/assembly documents should state that the product contains electrostatic sensitive devices and that special precautions need to be taken. During assembly, ensure that the electrostatic-sensitive devices are the last of the components to be mounted and that this is done at a protected workstation.

All tools used during assembly, including soldering tools and solder baths, must be grounded. All hand-tools should be of conductive or anti-static material and, where possible, should not be insulated.

5 TESTING PCBs

Completed PCBs must be tested at a protected workstation. Place the soldered side of the circuit board on conductive or anti-static foam and remove the short-circuit clips. Remove the circuit board from the foam, holding the board only at the edges. Make sure the circuit board doesn't touch the conductive surface of the workbench. After testing, replace the PCB on the conductive foam to await packing.

Assembled circuit boards containing electrostatic-sensitive devices should always be handled in the same way as unmounted components. They should also carry warning labels and be packed in conductive or anti-static packing.



This is a dangerous situation!

Fig.1 Typical working environment for electronic component handling showing potential ESD hazards.

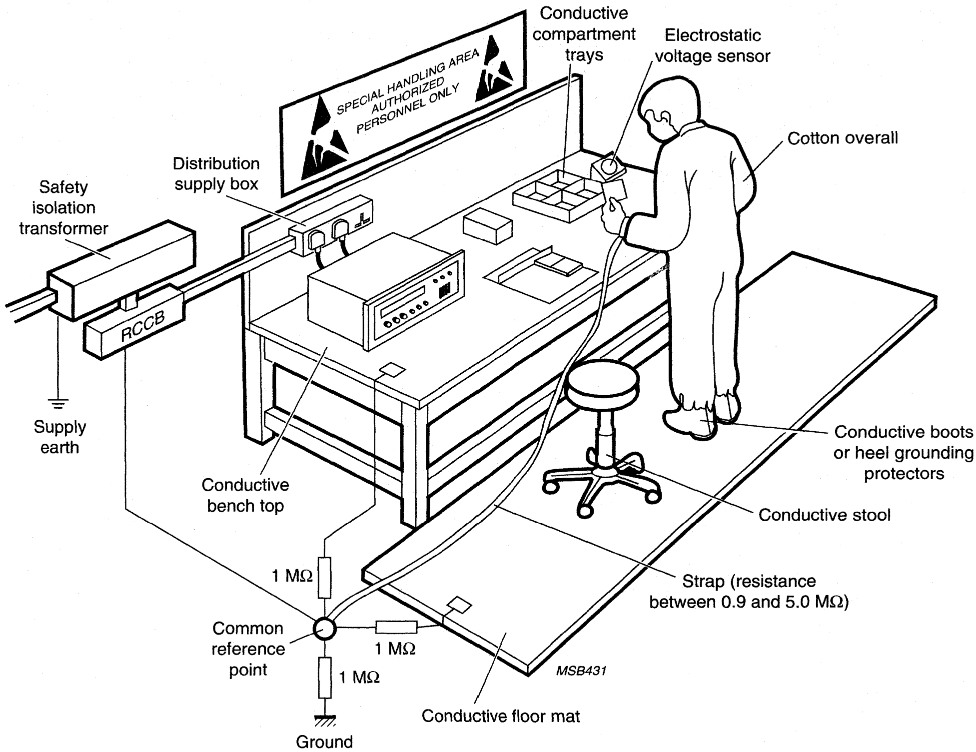


Fig.2 Essential features of an ESD-protected workstation.

APPLICATION INFORMATION

Using a Philips Optical Receiver in CATV Applications

Application note AN98060

CONTENTS

Using a Philips Optical Receiver in CATV Applications

Application note
AN98060

1 INTRODUCTION

For many years, Philips wideband hybrid modules have been used in CATV amplifiers. All these modules have a 75 Ω input and output impedance. Since 1994, Philips Semiconductors also offers wideband amplifier modules with an optical input and an electrical 75 Ω output. These modules have type numbers that end with the letters 'BO' or start with the letters 'BGO', sometimes followed by an extension (e.g./FC0), indicating that the optical input is connectorized. These modules are sensitive for modulated laser light with a wavelength between 1290 and 1600 nm.

Since 1998, Philips Semiconductors offers the low cost versions of their optical receiver modules, i.e. BGE883BO and BGE887BO.

An increasing amount of systems use redundancy in the network, which is reached by designing double ring-networks. Because of the redundancy in the optical path, it became necessary to monitor the optical input signal continuously. Based on the presence of an optical input signal, it is decided to switch the amplifier part of the module on or off. This is possible with modules with external biasing of the pin-diode (via pin 4). The amplifier part of the module can be switched on or off via pin 5, dependent on the presence of an optical input signal. The modules with external photodiode biasing are the BGE847BO and the BGO847.

Since 2000, Philips Semiconductors offers an improved module on distortion, Equivalent Input Noise (EIN) and flatness, the BGO847. Above mentioned modules are intended for the forward path. For the return path, Philips offers the BGE67BO and the BGE67BO/4M.

This application note describes how to use these optical receiver modules. In this document, when we speak of an 'optical receiver', we refer to an optical receiver module intended for CATV applications.

2 MECHANICAL OUTLINES, PINNING AND GLASS FIBRE OF THE MODULE

2.1 Mechanical outlines

Unconnectorized optical receivers are encapsulated in a SOT115T (with pin 4 for external photodiode biasing) or SOT115U outline. Connectorized optical receivers are encapsulated in a SOT115X (FC0) or SOT115Y (SC0) outline. For detailed information of the connectors, see Chapter 12.

2.2 Pinning

The pinning of the BGE883BO and the BGE887BO is:

PIN	DESCRIPTION
1	voltage output to monitor the photodiode current (typ. 0.85 V/mW)
2	common
3	common
5	$+V_B$
7	common
8	common
9	75 Ω electrical output

The pinning of the BGE847BO and the BGO847 is:

PIN	DESCRIPTION
1	voltage output to monitor the photodiode current (typ. 0.85 V/mW)
2	common
3	common
4	$+V_B$ of the photodiode
5	$+V_B$ of the amplifier
7	common
8	common
9	75 Ω electrical output

2.3 Glass fibre

2.3.1 DIMENSIONS OF THE SIECOR GLASS FIBRE

The optical input of the presently produced Philips optical receivers is a single mode glass fibre of Siecor (Corning SMF-28, type 1R41-31131-24). This glass fibre is double coated.

The dimensions of this glass fibre are

Nominal mode field diameter	9.3 μm ± 5 μm
Cladding diameter	125 μm ± 1 μm
Primary coating diameter	245 μm ± 10 μm
Secondary coating diameter	900 μm

The mechanical characteristics are:

Bending radius	min. 32 mm
Pulling force	max. 6 Newton

2.3.2 STRIPPING OF GLASS FIBRE

The glass fibres used for optical receivers are double coated, so stripping of this glass fibre is a double activity. Stripping can be done mechanically:

1. Strip the secondary coating with a mechanical stripper. The diameter of the closed stripper must be 0.40 mm. Do not strip more then a length of ±1.5 cm at once.
2. Strip the primary coating with a mechanical stripper. The diameter of this stripper must be 0.18 mm. The primary coating of the NKF glass fibre can also be removed by dissolving the coating with di-chlorine-methylene (CH_2Cl_2).

Many strippers are available on the market, both manually as automatically. We want to mention one of the several possibilities here.

Two mechanical strippers that can be used are:

1. Radikor fibre stripper, article no. 650952, type 3756, 0.40 mm red
2. Radikor fibre stripper, article no. 650956, type 3755, 0.18 mm blue.

These strippers can be ordered at:

Radikor Electronics B.V.
De Steiger 131
1351 AM Almere
The Netherlands
tel. +31 (0)36 5312554
fax +31 (0)36 5312465
www.radikor.nl

3 SPECIFICATION:

The specification of optical receivers contains a table with the main parameters of the device. In this chapter, these parameters are explained.

3.1 Responsivity

The responsivity of an optical receiver is defined as:

$$\text{responsivity} = \frac{\text{output voltage [V]}}{\text{input power of modulated light [W]}}$$

The responsivity is given in V/W and can be calculated to A/W as follows:

$$\text{Responsivity}\left[\frac{A}{W}\right] = \frac{\text{Responsivity}\left[\frac{V}{W}\right]}{\text{load impedance}[\Omega]}$$

and can be the calculated to W/W:

$$\text{Responsivity}\left[\frac{W}{W}\right] = \frac{\text{Responsivity}\left[\frac{V}{W}\right]^2}{\text{load impedance}[\Omega]}$$

The responsivity of an optical receiver is determined with a network analyzer. First this analyzer is calibrated with a calibrated optical reference receiver, the HP83411C. This reference receiver has one optical input and two electrical outputs; a 50 Ω RF output and a DC output. The responsivity of the two outputs is given. The RF output responsivity is given in A/W and as a function of the frequency. The DC output at pin 1 has a responsivity of 2 V/W of the unmodulated light. After the calibration, the responsivity of an optical receiver is measured compared to the reference receiver.

The output impedance of an optical receiver is 75 Ω and the output of a calibrated reference receiver is 50 Ω. For calibration, an additional minimum loss pad is needed to convert the 50 Ω output impedance into a 75 Ω output. This minimum loss pad has an attenuation of 5.7 dB for power. When the calibration is done with a calibrated reference receiver, the calibration data has to be adapted for this minimum loss pad. The calibration data is given in A/W, so the current attenuation of the minimum loss pad has to be calculated:

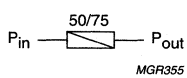


Fig.1 Minimum loss pad.

$$P_{in} = I_{in}^2 \times Z_{in}$$

$$P_{out} = I_{out}^2 \times Z_{out}$$

$$P_{out} = P_{in} - 5.7\text{ dB} = 0.269 \times P_{in} = 0.269 \times I_{in}^2 \times Z_{in}$$

$I_{out}^2 \times Z_{out} = 0.269 \times I_{in}^2 \times Z_{in}$

$$\frac{I_{out}}{I_{in}} = \sqrt{\left(\frac{0.269 \times Z_{in}}{Z_{out}}\right)} = \sqrt{\left(\frac{0.269 \times 50}{75}\right)} = 0.4236 \text{ and } \frac{I_{out}}{I_{in}} = \sqrt{\left(\frac{0.269 \times Z_{in}}{Z_{out}}\right)} = \sqrt{\left(\frac{0.269 \times 75}{50}\right)} = 0.6353$$

The current attenuation of a minimum loss pad from 50 to 75 Ω is 20 × log(0.4236) = −7.46 dB.

The current attenuation of a minimum loss pad from 75 to 50 Ω is 20 × log(0.6353) = −3.94 dB.

The responsivity measurement of an optical receiver has to be corrected for the Calibrated Reference Receiver (Cal.Ref.Rec.) and the minimum loss pad.

Example:

Current attenuation minimum loss pad = −7.46 dB
50 MHz $\text{Cal.Ref.Rec.}_{(responsivity)}$ = 0.44659 A/W = −7.00 dB
50 MHz measured responsivity DUT = 36 dB.

The network analyzer is calibrated as ‘thru-line’, with the calibrated reference receiver and minimum loss pad as thru-line. The measured 50 MHz responsivity has to be corrected for this ‘thru-line’:

Responsivity DUT	= measured resp.	+	current att	+	$\text{Cal.Ref.Rec.}_{(responsivity)}$
	= +36 dB	+	−7.46 dB	+	−7.00 dB
	= 21.54 dB				
	= 11.93 A/W				
	= 895.5 V/W (in 75 Ω)				

3.2 Flatness of the frequency response

The flatness of the frequency response can be calculated in different ways. The two most important methods are the cable curve method and the straight line method. The cable curve method has been used mostly in the past, while the straight line method gains acceptance and becomes more and more important at the present. Both methods will be discussed in Sections 3.2.1 and 3.2.2, respectively, since the preferred method depends on the module type.

3.2.1 CABLE CURVE METHOD

The flatness of the response of an optical receiver is defined as the maximum deviation from an absolute flat response over a given frequency range, after the slope of the receiver over this frequency range has been optimized and equalized by means of a certain cable length to give the best result for flatness. This means that an ‘ideal response curve’ for the receiver is calculated and the flatness is the maximum deviation of this ‘ideal response curve’.

Calculation:
To determine the flatness, the measured response curve values are compared with an ‘ideal response curve’ derived from a mathematical model. The formula used is as follows:

$$\text{Responsivity} = R + C\sqrt{\left(\frac{f_x}{f_1}\right)}$$

where
R is a constant
C is a cable constant
f_x is the desired frequency
f_1 is the start frequency

The Cable constant (C) must be optimized during the flatness determination so that the response curve best fits the measured response curve figures. The start value for C is calculated using the formula:

$$C_{start} = \frac{R_n - R_1}{\sqrt{\left(\frac{f_n}{f_1} - 1\right)}}$$

where
R_n is the measured response at the stop frequency
R_1 is the measured response at the start frequency
f_n is stop frequency
f_1 is start frequency.

The value of R is chosen in such a way that the maximum positive deviation of the measured response from the 'ideal response curve' is the same as the maximum negative deviation. The value of C is adapted by ±0.001 dB until the 'ideal response curve' best fits the measured curve.

The flatness of the module response is the maximum deviation in measured response from the optimized response formula.

3.2.2 STRAIGHT LINE METHOD

For some module types, the flatness of the frequency response is calculated according to the straight line method. This means, that the responsivity of the optical receiver is measured at 40 and 870 MHz. The deviation from the interpolated line between 40 and 870 MHz is called the flatness. It is measured according peak-to-valley, so a peak of 0.7 dB and a valley of 0.2 dB will result in a flatness of 0.7 + 0.2 = 0.9 dB.

3.3 Slope of the frequency response

Equal to flatness, the slope of the frequency response can be calculated in different ways. The two most important methods are the cable curve method and the straight line method. The cable curve method has been used mostly in the past, while the straight line method gains acceptance and becomes more and more important at present. Both methods will be discussed in Sections 3.3.1 and 3.3.2 respectively, since the preferred method depends on the used module type.

3.3.1 CABLE CURVE METHOD

The slope of a module is the difference between the 'ideal gain' at the start frequency and the' ideal gain' at the stop frequency. See Section 3.2.1, "Cable curve method" of the section "Flatness of the frequency response".

3.3.2 STRAIGHT LINE METHOD

The slope of a module is the difference between the gain at the start frequency and the gain at the stop frequency. See Section 3.2.2, "Straight line method" of the section "Flatness of the frequency response".

3.4 Input and output return losses

The output return loss of an optical receiver is the measured $-s_{22}$ of the output of this module in dB. This s_{22} is the $20\log_{10}$ of the reflection coefficient, which indicates the matching between the output impedance and the characteristic impedance of 75 Ω.

The input return loss of an optical receiver is the optical back reflection of the photodiode, measured at the fibre. The Optical Back Reflection is $10\log_{10}(P_{refl}/P_{in})$, in which P_{in} is the optical input power and P_{refl} is the reflected power back into the fibre. At a level of –45 dB input reflection, 0.0032% of the total optical input power is reflected back into the fibre.

3.5 Second order distortion

The second order distortion product is the difference in dB between the peak level of an RF signal at the measurement frequency and the peak level of the signal at the measurement frequency caused by two Continuous Wave (CW) signals with their second order modulation product ($f_1 \pm f_2$) at the measurement frequency.

The second order distortion of an optical receiver is measured with two lasers. Both lasers are modulated with a CW carrier, which together cause a distortion product at the measurement frequency. For the second order measurement of an optical receiver, the settings are related to the optical input signal; the optical un-modulated input power and the modulation index. The measurement starts with a calibration. First one laser is modulated with a CW signal at the measurement frequency. The optical power level and modulation index are equal to the ones used for the distortion frequencies. The output power at the measurement frequency is set as 0 dB level.

During measurement, the two lasers are modulated by a CW carrier. The distortion is measured by measuring the distance between the 0 dB level and the power level at the measurement.

Example:

$P_{optical}$	= 0.5 mW per laser
$m_{modulation\ index}$	= 40%
f_1	= 133.25 MHz
f_2	= 721.25 MHz
$f_{measurement}$	= 854.50 MHz

- Two lasers are set at an (DC) optical output power level of 0.5 mW each
- One laser is modulated for 40% at 854.5 MHz
- The output power measured at 854.5 MHz is set as 0 dB level.

After this calibration:

- Two lasers are modulated for 40% with 133.25 and 721.25 MHz
- The distortion power is measured at the frequency $f_1 + f_2$ = 854.5 MHz compared to the 0 dB level. This distance is the second order distortion.

3.6 Third order distortion

The third order distortion product is the difference in dB between the peak level of an RF signal at the measurement frequency and the peak level of the signal at the measurement frequency caused by three CW signals with their third order modulation product ($f_1 + f_2 - f_3$) at the measurement frequency.

The third order distortion of an optical receiver is measured with three lasers. These lasers are modulated with a CW carrier, which together cause a distortion product at the measurement frequency. For the third order measurement of an optical receiver, the settings are related to the optical input signal; the optical un-modulated input power and the modulation index. The measurement starts with a calibration. First one laser is modulated with a CW signal at the measurement frequency. The optical power level and modulation index are equal to the ones used for the distortion frequencies. The output power at the measurement frequency is set as 0 dB level. During measurement, the three lasers are modulated by a CW carrier. The distortion is measured by measuring the distance between the 0 dB level and the power level at the measurement frequency.

Example:

$P_{optical}$	= 0.33 mW per laser
$m_{modulation\ index}$	= 60%
f_1	= 133.25 MHz
f_2	= 265.25 MHz
f_3	= 721.25 MHz
$f_{measurement}$	= 853.25 MHz

- Three lasers are set at a (DC) optical output power level of 0.33 mW each
- One laser is modulated for 60% at 853.25 MHz
- The output power measured at 853.25 MHz is set as 0 dB level.

After this calibration:

- Three lasers are modulated for 60% at 133.25, 265.25 and 721.25 MHz
- The distortion power is measured at the frequency $-f_1 + f_2 + f_3$ = 853.25 MHz compared to the 0 dB level. This distance is the third order distortion.

3.7 Total current consumption

The total current consumption I_{tot} is the total DC current consumption of an optical receiver when a DC voltage supply of 24 V is applied to pins 4 and 5.

3.8 Photodiode bias current

The photodiode bias current I_{pin4} is the DC-current consumption of the photodiode bias circuit of an optical receiver when a DC voltage supply of 24 Volts is applied to pin 4.

3.9 Equivalent input noise

The diagram of the measurement set-up to measure the equivalent input noise of the optical receiver is shown in Fig.2.

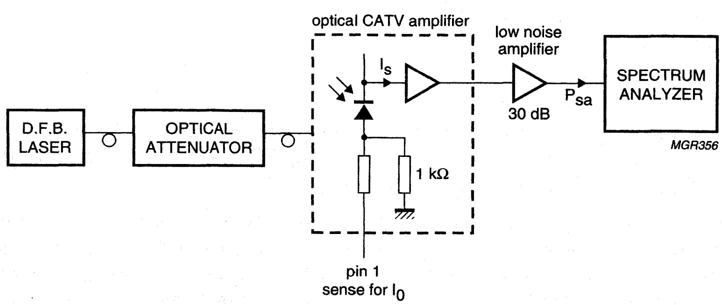


Fig.2 Equivalent input noise measurement set-up.

The total noise power measured at the spectrum analyzer (P_{sa}) consists of three parts:

P_{sa} = laser noise + photodiode shot noise + optical receiver noise (thermal)

The noise power at the spectrum analyzer is frequency dependent. This noise power can be calculated with:

$$P_{sa} = (RIN \times I_0^2 + 2 \times I_0 \times e + I_n^2) \times (B \times Rd)[W] \quad (1)$$

where:

P_{sa}	is the noise power measured at the spectrum analyzer	[W]
RIN	is the relative intensity noise of the laser source	[dB/Hz]
I_0	is the DC detector current (= $V_{pin\ 1}$/1 kΩ)	[A]
e	$= 1.6 \times 10^{-19}$	[Coulomb = A/Hz]
I_n	is the receiver equivalent noise current	[A/√Hz]
B	is the resolution bandwidth of spectrum analyzer	[Hz]
Rd	is the responsivity of the optical CATV ampl. = $\frac{P_{sa}}{I_s^2}$	[Ω]

The receiver equivalent input noise (I_n), which is also frequency dependent, can be calculated out of this noise power measurement. For this calculation, a few assumptions are made:

- Relative Intensity Noise (RIN) of the used laser is more than 160 dB/Hz (DFB laser)
- The responsivity of the DUT is constant over the used optical input span
- No optical reflections in the used measurement equipment (< –60 dB)
- The noise floor of the used spectrum analyzer is much lower than the receiver noise. If necessary, use a good pre-amplifier as given in the diagram of Fig.2.

3.9.1 MEASUREMENT

1. Measure the P_{sa} with no optical input signal (I_0 = 0 mA, $V_{pin\ 1}$ = 0 V). The measured power is the receiver noise power.
2. Adjust the optical power of the laser to the maximum value which will be used (e.g. 2 mW), at this level the RIN of the laser source should be better than 160 dB/Hz.
3. Set the optical attenuator at 0 dB loss.
4. Measure the P_{sa} for at least four different optical input powers by adjusting the optical attenuator (e.g. 0.2, 1, 1.5 or 2 mW) and measure the corresponding I_0 given with the formula $I_0 = \frac{V_{pin1}}{1k\Omega}$. The RIN of the laser stays constant in this measurement because the laser current has not been changed. The measurement results in the P_{sa} as a function of I_0.

3.9.2 CALCULATION

To calculate the receiver equivalent input noise, a help function has been defined:

$$Y(I_0) = \left(\frac{P_{sa}(I_0) - P_{sa}(0)}{I_0}\right) = (RIN \times I_0 + 2 \times e) \times B \times Rd \qquad (2)$$

$Y(I_0)$ can be calculated for the measured P_{sa} values and plotted as function of I_0 (dotted points in Fig.3):

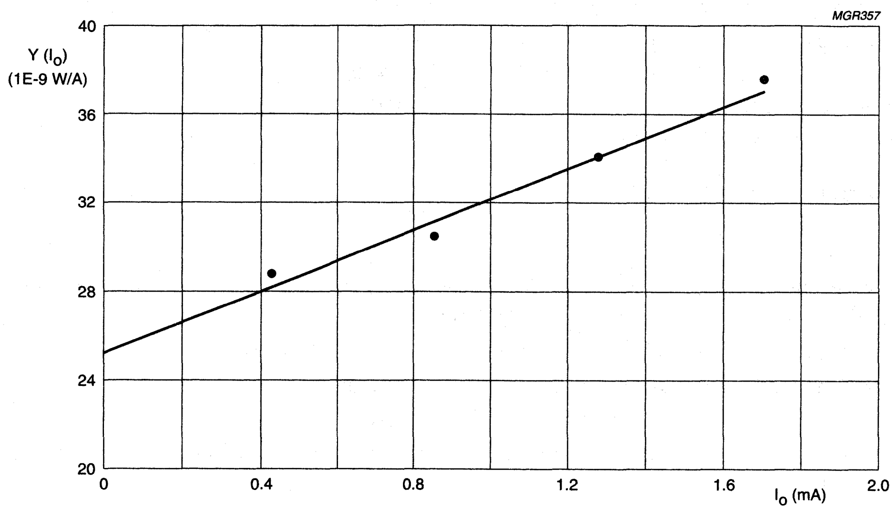


Fig.3 $Y(I_0)$ versus I_0.

With this graph, the value for Y(0) (I_0 = 0) can be found.

For I_0 = 0 (no optical input signal):

$P_{sa}(0) = I_n^2 \times B \times Rd$ (see formula (1)) and $Y(0) = 2 \times e \times B \times Rd$ (see formula (2))

These two formulas combined give the formula to calculate the receiver Equivalent Input Noise (EIN)

$$I_n = \sqrt{\left(\frac{2 \times e \times P_{sa}(0)}{Y(0)}\right)} \text{ [A/}\sqrt{\text{Hz}}\text{]}$$

where:

$P_{sa}(0)$ is the measured noise power at the spectrum analyzer without an optical input signal

Y(0) is the I_0 value out of the graph $Y(I_0)$ versus I_0

I_n is the receiver equivalent noise current

4 PHOTODIODE CURRENT MONITOR PIN

An optical signal which is applied to a reverse biased photodiode will generate electron-hole pairs, resulting in a current. The ratio between the optical input signal and the output current of the photodiodes is the responsivity of a photodiode. This responsivity depends on the used wavelength, the so-called spectral sensitivity.

The photodiodes used in the Philips optical receivers have a minimum responsivity of 0.85 A/W at 1310 nm. Pin 1 of the Philips optical receivers can be used to monitor the un-modulated optical input power (DC). The design of these receivers is such that the DC output current of the photodiode flows into a 1 kΩ transfer resistor. Via a 10 kΩ resistor the voltage drop over the transfer resistor can be measured with a high ohmic voltmeter with an input resistance which is greater than 10 MΩ. A low ohmic voltmeter will influence the voltage drop. Because of the use of a 1 kΩ transfer resistor, the current monitor pin will have a typical output voltage of 0.85 V/mW.

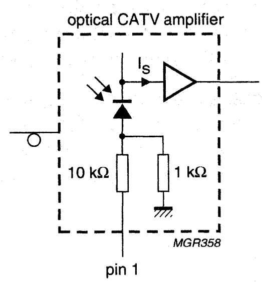


Fig.4 The diode current monitor pin.

The pin 1 output voltage depends on several items:

P_{opt}	is the optical input power at the receiver
R_{esp}	is the responsivity of the used photodiode
$R_{transfer}$	is the value of the transfer resistor

The optical input power can be measured with an optical power meter at a surface where the optical link can be separated and connected to this meter. The loss after this point (connector loss), has to be subtracted of the measured optical power. The loss of a connector is maximal 0.5 dB. The responsivity of the used photodiodes is specified as >0.85 A/W. The transfer resistor is developed for 1 kΩ. The accuracy of this substrate resistor is ±1%. After the assembly of the total receiver, this accuracy is decreased to 1000 Ω ±10% due to some temperature steps during the assembly process.

The pin 1 accuracy is:

$V_{pin\ 1}$	$= (P_{opt} - \text{Connector loss}) \times R_{esp} \times R_{transfer}$	
$V_{pin\ 1\ (min)}$	$= P_{opt} \times 0.891 \times 0.85 \times 900 = 0.68$ V/mW	0.77 V/mW without any connector loss
$V_{pin1\ (max)}$	$= P_{opt} \times 1 \times 0.95 \times 1100 = 1.05$ V/mW	0,93 V/mW with 0.5 dB connector loss

All Philips optical receivers are checked on pin 1 voltage between 0.75 and 1 V/mW.

5 OPTICAL RECEIVER TEST SETUP

For the diagram of the optical receiver test set-up which is used by Philips, seeFig.5. At the left side of this diagram, three lasers are placed, biased via three laser power supplies.

In order to measure d2 and d3, these three lasers have to be modulated by three RF-generators. The input of one laser can be switched to either the output of the RF-generator or to port one of the s-parameter test set. This allows the measurement of the responsivity.

The light of the lasers is combined by two 'splitter/combiners' and applied to the input of the adjustable optical attenuator. After the optical attenuator, the light is split into a 5% and a 95% part. The 5% part is used to adjust and monitor the optical (DC) light, available at the 95% output of the splitter. The ratio between the 5% and 95% output of the splitter is measured and added as correction factor in the optical power meter. The 95% output of the splitter is connectorized and can be connected to the Calibrated Optical Reference Receiver (CORR) or to the Device Under Test (DUT).

The output of the CORR can be connected to a power meter to adjust the optical modulated light for the d2 and d3 measurement. The output of the CORR can also be connected to port 2 of the s-parameter test-set to calibrate for the responsivity measurement. After calibration, the 95% output of the splitter is connected to the DUT.

For the EIN measurement the voltage at pin 1 of the DUT can be measured with a multimeter. To measure the responsivity and s_{22}, the output of the DUT can be switched to port 2 of the s-parameter test-set. The output of the DUT can also be connected to the input of a spectrum analyzer to measure d2 and d3. When a 30 dB amplifier is connected between the output of the DUT and input of the spectrum analyzer, the EIN can be measured.

The equipment used in the test setup:

- 3 lasers CQF94/D from Philips
- 3 RF-generators HP8657A from Hewlett-Packard
- 3 laser power supplies PLPS2000 from Philips
- 3 splitter/combiners from Gould (with a 50/50%, 30/70% and 5/95% ratio respectively)
- An adjustable optical attenuator HP8156A from Hewlett-Packard
- An optical power meter HP8153A from Hewlett-Packard
- A calibrated optical reference receiver HP83411C from Hewlett-Packard
- A spectrum/network analyzer HP4396A from Hewlett-Packard
- A 75 Ω s-parameter test-set HP85046B from Hewlett-Packard
- A 30 dB low noise amplifier, several 50 and 75 Ω switches, 50/75 Ω minimum loss pads, multimeters, a power supply, relay actuator and a computer for automated measurement
- Powermeter HP473B.

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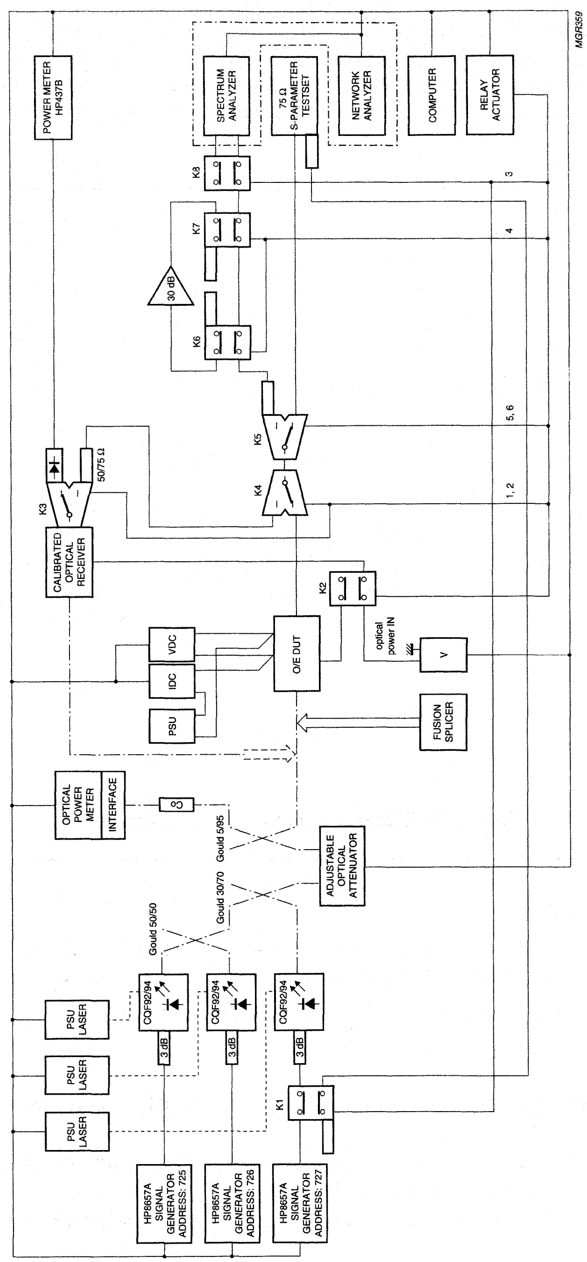


Fig.5 Optical receiver test setup.

6 CIRCUIT DIAGRAM OF AN OPTICAL RECEIVER

The circuit diagram of an optical receiver is shown in Fig.6.

The photodiode at the input of an optical receiver converts light into electrical current. The matching networks matches the photodiode to the push-pull amplifiers. The transformers used in this matching network amplify the photodiode current. This matching network has been patented by Philips Semiconductors, number PHN 14.489. The push-pull amplifiers are standard CATV amplifiers with a standard output transformer. The total gain of the push-pull amplifier, including the matching network, is ±21.5 dB.

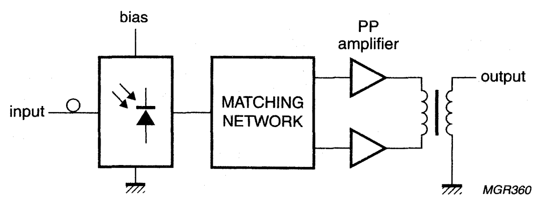


Fig.6 Circuit diagram of the an optical receiver.

7 OUTPUT VOLTAGE CALCULATION

An optical receiver converts an amplitude modulated (AM) optical signal into an electrical RF signal. This chapter describes the calculation of this conversion. The output voltage of an optical receiver can be calculated with the formula:

Output Voltage (peak) = Responsivity × Optical Input Power × Modulation Index

where:

Output voltage	is the electrical output voltage in 75 Ω, at the output of the optical receiver module, given in mV
Responsivity	is the conversion ratio of an optical receiver module, given as electrical output voltage per optical input power given in V/W
Optical input power	is the unmodulated optical power at the input of the optical receiver module, given in mW
Modulation index	is the amplitude modulation index of the optical input signal, given in percentage (%).

Example:

A practical situation is:
Optical input power is 1 mW (0 dBm).
Modulation index m = 3.7%.
Responsivity = 900 V/W (the typical responsivity of the BGE887BO/BGE847BO and BGO847).

Output Voltage (peak) = Responsivity × Optical Input Power × Modulation Index

Vout(peak)	= Rresp × Pi(opt) × m	mV
Vout(peak)	$= 900 \times (1 . \times 10^{-3}) \times 0.037$	mV
Vout(peak)	= 33.3	mV
Vout(average)	$= \text{Vout(peak)} / \sqrt{2}$	mV
Vout(average)	$= 33.3/\sqrt{2} = 23.5$ mV	mV
Vout(dBmV)	= 20 × log(23.5) = 27.4	dBmV

For any other input power and/or modulation index the output voltage can be calculated similarly.

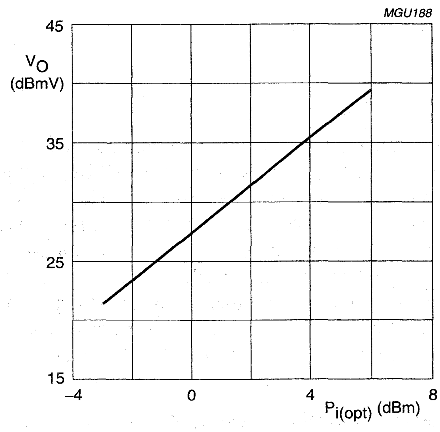
The calculation of the responsivity from V/W into A/W and W/W is given below:

Responsivity [A/W] = Responsivity [V/W]/Load impedance (75 Ω)

Responsivity [W/W] = Responsivity $[V/W]^2$/Load Impedance (75 Ω).

An important property of the optical receiver is the relation between the optical input signal level and the electrical output signal level. An increase of the optical input signal with 1 dB results in an increase of 2 dB electrical output signal. See Fig.7.

The explanation of this 1:2 ratio is as follows: The optical input power is linearly converted into an electrical current by the photodiode. The electrical input power of the amplifier, is equal to $I_{in}^2 \times Z_{in}$. The fact that $P_{in} = I_{in}^2 \times Z_{in}$ leads to the 1 dB optical = 2 dB electrical relationship. See Fig.7.



Modulation index = 3.7%; Responsivity = 900 V/W.

Fig.7 Output voltage as a function of the optical input power $P_{i(opt)}$.

8 CARRIER TO NOISE RATIO CALCULATION

The Carrier (C) to Noise ratio (N) of an optical link (from laser to the output of the receiver) can be determined by the following equation: $\frac{C}{N} = \frac{0.5 \times m^2 \times I_{pd}^2}{2 \times e \times I_{pd} \times B + RIN \times I_{pd}^2 \times B + I_n^2 \times B}$

where:

m	is the modulation index optical input signal	[%]
I_{pd}	is the photodiode current (= V_{pin1}/1 kΩ)	[A]
e	is the 1.6×10^{-19}	[Coulomb = A/Hz]
B	is the bandwidth (= 5 MHz)	[Hz]
RIN	is the relative intensity noise of the laser	[1/Hz]
I_n	is the equivalent input noise optical receiver	[A/√Hz]

Example:

m	= 5%
I_{pd}	= 1 mA ($V_{pin\ 1}$ = 1 V)
e	= 1.6×10^{-19} (C)
B	= 5×10^6 Hz
RIN	= 3.2×10^{-16} (1/Hz) (= −155 dB/Hz)
I_n	= 7 pA/√Hz

$$\frac{C}{N} = \frac{0.5 \times (0.05)^2 \times (1 \times 10^{-3})^2}{2(1.6 \times 10^{-19}) \times (1 \times 10^{-3}) \times (5 \times 10^6) + (3.2 \times 10^{-16}) \times (1 \times 10^{-3})^2 \times (5 \times 10^6) + (7 \times 10^{-12})^2 \times (5 \times 10^6)}$$

$$\frac{C}{N} = -55.6\ \text{dBc}$$

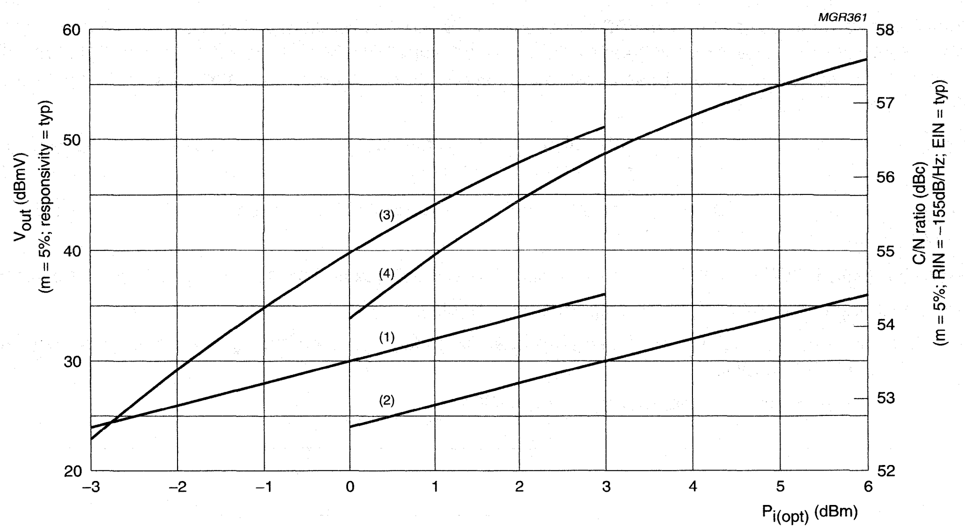
9 APPLICATION CONSIDERATIONS

9.1 BGE887BO and BGE883BO

The BGE887BO has been designed for an optical input power of approximately 0 dBm. Because higher optical input powers are sometimes used in optical systems, Philips designed the BGE883BO. In this chapter the differences between the BGE883BO and BGE887BO are explained. The BGE887BO has been designed for an optical input power range between −3 and +3 dBm. At higher input powers, the second and third order intermodulation of the BGE887BO is limiting for normal use. The BGE883BO has been designed for an optical input power range between 0 and 6 dBm (3 dB higher than the BGE887BO). Compared to the BGE887BO the intermodulation behaviour of this module is better.
The equivalent input noise of this module is higher, but at these levels not limiting. The BGE883BO has 6 dB less responsivity, 400 V/W instead of 800 V/W. The output return-loss of this module has been improved significantly. For the optical input range between 0 and 3 dBm both modules can be used. It depends on the application, which one is preferred.

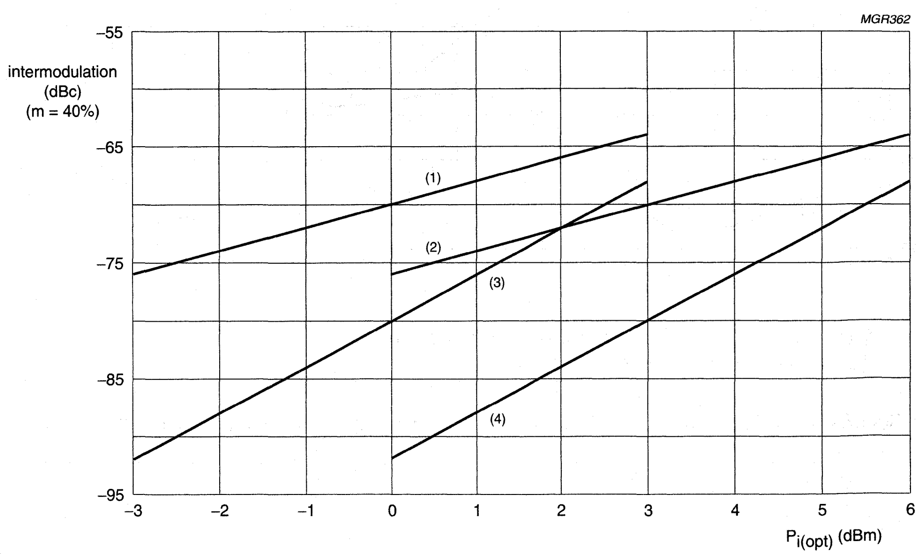
Fig.8 shows the output voltage of the module versus the optical input power and also the carrier to noise ratio versus the optical input power. The output voltage of the two different modules differ with 3 dB of input power. The C/N ratios of the two different modules also differ and have another shape in addition.

Fig.9 shows the d2 and d3 intermodulation versus the optical input power. The d2 and d3 curves of the two different modules differ with 3 dB of input power.



(1) V_{out} BGE887BO.
(2) V_{out} BGE883BO.
(3) C/N BGE887BO.
(4) C/N BGE883BO.

Fig.8 V_{out} and C/N ratio as a function of the optical input power $P_{i(opt)}$.



(1) d2 BGY887BO.
(2) d2 BGY883BO.
(3) d3 BGY887BO.
(4) d3 BGY883BO.

Fig.9 d2 and d3 as a function of the optical input power $P_{i(opt)}$.

9.2 BGE847BO and BGO847

The BGE847BO has been used mainly in 750 MHz systems. Since bandwidth of present CATV systems has been increasing up to 870 MHz bandwidth, the need for an improved optical receiver appeared. This improved optical receiver is the BGO847. The improvement has been achieved at second order distortion (d2) and equivalent input noise, especially between 750 and 870 MHz.

In the graph, shown in Fig.10, the second order distortion d2 as a function of the frequency of the BGE847BO and the BGO847 is given. The BGO847 gives an improvement through the whole frequency range, especially above 650 MHz.

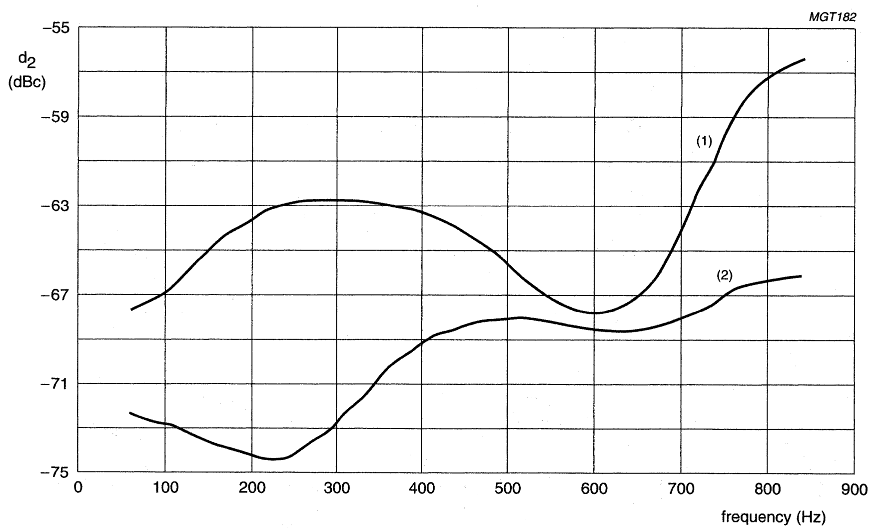
The equivalent input noise as a function of the frequency of the BGE847BO and the BGO847 is shown in Fig.11. The BGO847 gives an improvement above 400 MHz.

Compared to the BGE847BO specification, the specification of the BGO847 has been extended on three parameters:

First one is the addition of d2 and d3 distortion measurements

Second, the equivalent input noise specification has been extended, specified through the whole frequency range from 40 up to and including 870 MHz

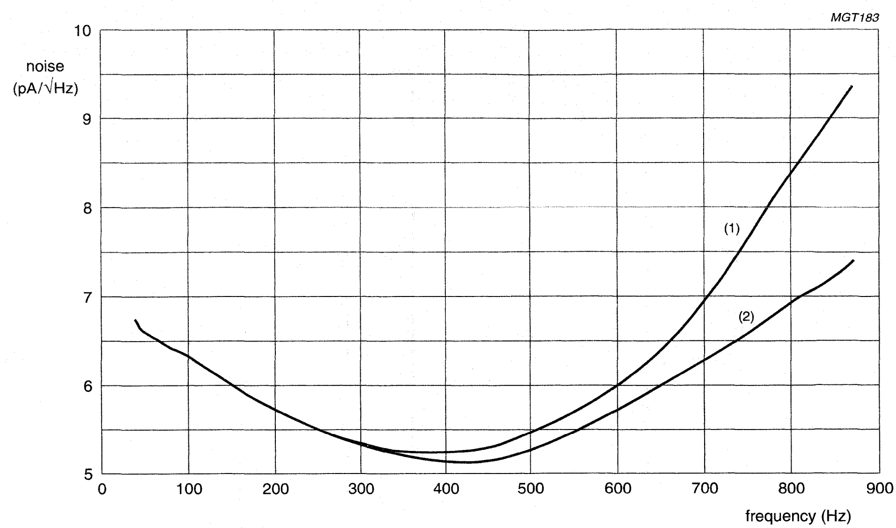
Third, a slope specification has been added for the BGO847.



(1) BGE847BO. f_p = 50 MHz + x(50); f_q = 89.25 MHz + y(50) for x = 0 to 16 and y = 0 to 16.

(2) BGO847. $P_{opt(total)}$ = 1 mW; modulation index = 20% per CW.

Fig.10 Second order distortion as a function of the frequency of the BGE847BO and the BGO847.



(1) BGE847BO.
(2) BGO847.

Fig.11 Equivalent input noise as a function of the frequency of the BGE847BO and BGO847.

10 MULTI CHANNEL DISTORTION MEASUREMENTS

CATV amplifiers are specified on multichannel behaviour. The number of channels used for the measurements depends on the application. Measurements are done with multichannel equipment which has a generator for each channel. Doing multichannel measurements on optical receivers requires a big number of lasers. One laser for each channel is needed to prevent from distortion of the laser being added to the measurement results. This is a very expensive measurement method. Another option is using one linear laser and doing two multi channel measurements with one setting of the laser by using an optical attenuator. After these two measurements, the total voltage of the measured multichannel measurement can be split up in the distortion voltage of the laser and the distortion voltage of the optical receiver. With this type of measurement, it is important that the distortion of the laser is low compared to the distortion of the optical receiver. An example of this measurement method and calculation of distortion is given in Section 10.1.

10.1 Calculation of the CTB Figure of optical receivers

The Composite Triple Beat (CTB) is the distance, expressed in dB or dBc, between the carrier and the CTB distortion voltage. Since the CTB is a third order distortion product, the relation between the output voltage V_o and the CTB voltage V_{CTB} is 1 to 3. This means, that the relation between output voltage and CTB, which is always expressed relative to the carrier, is 1 to 2 and V_{CTB} increases three times faster than the output power. So, an increase of 1 dB optical input power leads to an increase of 2 dB electrical output voltage, which leads to an increase of 6 dB of V_{CTB}. This is illustrated in Fig.12.

As shown on the left side of Fig.12, the output voltage V_o is 35 dBmV, and the CTB voltage V_{CTB} is −35 dBmV, resulting in a CTB of −70 dBc. On the right side of the figure, an output voltage increase of 5 dB is shown. Increasing the output voltage V_o with 5 dB to 40 dBmV results in a CTB voltage V_{CTB} increase of 15 dB to −20 dBmV. This results in a CTB of −60 dBc. In the following discussion, CTB is the relative difference between carrier signal and distortion, and is expressed in dB or dBc. The absolute CTB distortion voltage is denoted by V_{CTB} and is expressed in dBmV or mV.

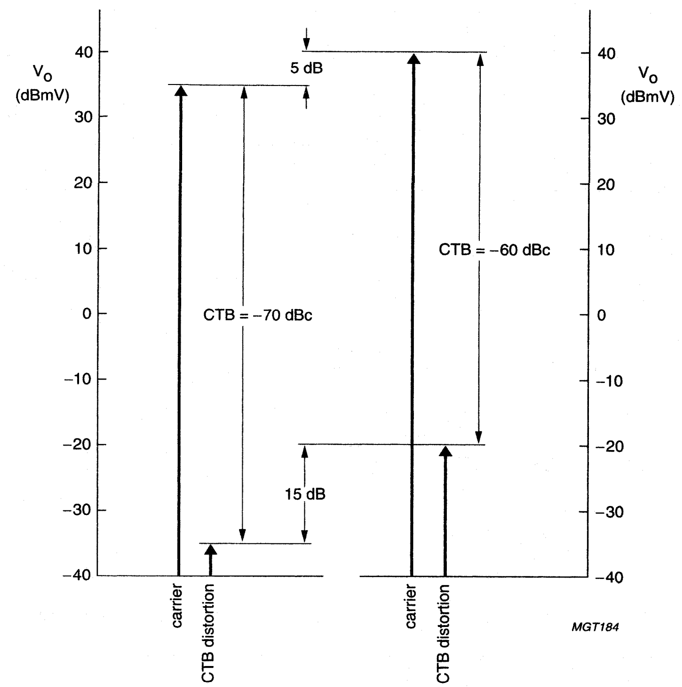


Fig.12 Output voltage of carrier V_o, CTB distortion V_{CTB} and CTB.

For the calculation of the CTB of the optical receiver, we also make use of the 1:2 relationship between optical in and electrical out, as already discussed in Chapter 7, "Output Voltage Calculation". With these relations in mind, we can now focus on the measurement and calculation of the CTB itself.

The method of calculating the CTB figure of an optical receiver is explained with the help of an example. The CTB of the total optical system, is measured twice: test 1 and test 2, each test at a different optical input power by means of an optical attenuator. Because the CTB of the laser is kept constant, we have two equations with two unknowns, which can be solved with linear algebra.

If the optical input power, the responsivity of the optical receiver and the CTB of the total optical system are known, the total CTB voltage V_{CTB} at the output can be calculated:

Overview of the test values of the CTB measuring

SYMBOL	CONDITION	TEST 1	TEST 2
Optical Input Power: • $P_{optical}$ • modulation index		6 dBm 4 mW 3.7%	3 dBm 2 mW 3.7%
• $P_{optical(average)}$	one carrier	$4.0 \times 10^{-3} \times 0.037 \times (1/\sqrt{2})$ = 104.6×10^{-6} W = 104.6 µW	$2.0 \times 10^{-3} \times 0.037 \times (1/\sqrt{2})$ = 52.3×10^{-6} W = 52.3 µW
Output Voltage: responsivity = 900 V/W V_{out}	one carrier	$104.6 \times 10^{-6} \times 900$ = 94.2 mV = 39.5 dBmV	$52.3 \times 10^{-6} \times 900$ = 47.1 mV = 33.5 dBmV
CTB Voltage CTB_{total} [dBc]		–63.15 dBc	–66.52 dBc
$V_{CTB(total)}$		39.5 – 63.15 dBmV = –23.65 dBmV = 0.0655 mV	33.5 – 66.52 dBmV = –33.0 dBmV = 0.0222 mV

The CTB voltage $V_{CTB(total)}$ at the output of the receiver is the addition of the amplified input $V_{CTB(tx)resp}$ and the $V_{CTB(rx)opt}$ of the optical receiver. At test 1, the total CTB voltage at the output of the optical receiver is:

$$V_{CTB(total1)} = V_{CTB(tx)resp} + V_{CTB(rx)opt} \qquad (3)$$

When the input signal is attenuated optically, the CTB distance of the optical input signal stays the same. The amplified input CTB will also be the same in distance but the absolute voltage of this signal is lower; –6 dB at test 2 compared to test 1. The added CTB of the optical receiver is 12 dB lower in distance. The added $V_{CTB(rx)opt}$ is 18 dB lower in absolute output voltage (when an output signal is attenuated with × dB, the third order distortion level is 3 × dB lower).

Using the numbers and voltages of the formulas of test 1, the total output CTB voltage of test 2 is:

$$V_{CTB(total2)} = (V_{CTB(tx)resp} - 6dB) + (V_{CTB(rx)opt} - 18\ dB) \qquad (4)$$

$$V_{CTB(total2)} = (V_{CTB(tx)resp} \times 0.5012) + (V_{CTB(rx))opt} \times 0.1259) \qquad (5)$$

Equations (3) and (5) form two equations with two unknowns, and can be solved with linear algebra:

$$\begin{bmatrix} V_{CTB(total1)} \\ V_{CTB(total2)} \end{bmatrix} = \begin{bmatrix} 1 & 1 \\ 0.5012 & 0.1259 \end{bmatrix} \times \begin{bmatrix} V_{CTB(tx))resp} \\ V_{CTB(rx)opt} \end{bmatrix}$$

in which:

$V_{CTB(total1)}$	measured CTB voltage at high optical input power
$V_{CTB(total2)}$	measured CTB voltage at low optical input power
$V_{CTB(tx)resp}$	amplified CTB voltage of laser
$V_{CTB(rx)opt}$	CTB voltage of optical receiver

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In numbers, this is as follows:

$$\begin{bmatrix} 0.0655 \\ 0.0222 \end{bmatrix} = \begin{bmatrix} 1 & 1 \\ 0.5012 & 0.1259 \end{bmatrix} \times \begin{bmatrix} V_{CTB(tx))resp} \\ V_{CTB(rx)opt} \end{bmatrix}$$

With deriving the inverse of the 2 × 2 matrix, we get the following result, expressed in mV:

$$\begin{bmatrix} V_{CTB(tx)resp} \\ V_{CTB(rx)opt} \end{bmatrix} = \frac{1}{0.1259 - 0.5012} \times \begin{bmatrix} 0.1259 & -1 \\ -0.5012 & 1 \end{bmatrix} \times \begin{bmatrix} 0.0655 \\ 0.0222 \end{bmatrix} = \begin{bmatrix} 0.037 \\ 0.028 \end{bmatrix}$$

which can also be expressed in dBmV's:

$$\begin{bmatrix} V_{CTB(tx)resp} \\ V_{CTB(rx)opt} \end{bmatrix} = \begin{bmatrix} -28.5 \\ -31 \end{bmatrix}$$

Since the 0 dB level is at 39.5 dBmV, the CTB values (in dBc) are as follows:

$$\begin{bmatrix} CTB_{(tx)resp} \\ CTB_{(rx)opt} \end{bmatrix} = \begin{bmatrix} -28.5 \\ -31 \end{bmatrix} - \begin{bmatrix} 39.5 \\ 39.5 \end{bmatrix} = \begin{bmatrix} -68 \\ -70.5 \end{bmatrix}$$

This procedure leads to the CTB of both the laser and the optical receiver. As shown, the input CTB (CTB of the laser) is relatively high compared to the CTB of the optical receiver. Nevertheless, the optical receiver also has a contribution in the CTB. Especially in the case when $CTB_{(tx)resp} \approx CTB_{(rx)opt}$, it can be valuable to perform some extra calculations, considering measurement accuracy of the measured CTB values, and the consequences on the resulting calculated values of $CTB_{(tx)resp}$ and $CTB_{(rx)opt}$. If the measurement accuracy causes significant differences in the results, more measurements have to be done in order to achieve higher accuracy.

Another way to reduce the distortion of the laser can be done by:

- Decreasing the number of channels
- Using a more linear laser
- Using a laser with an optical isolator
- Using a laser with pre-distortion.

Remark: take care that the optical connections don't have a bad optical back reflection (reflections into the laser!).

To consider measurements at other optical input power levels as well, the general form of the matrix equation is shown below:

$$\begin{bmatrix} V_{CTB(total1)} \\ V_{CTB(total2)} \end{bmatrix} = \begin{bmatrix} 1 & 1 \\ 10^{\left(\frac{-2 \times (P_{opt(high)} - P_{opt(low)})}{20}\right)} & 10^{\left(\frac{-6 \times (P_{opt(high)} - P_{opt(low)})}{20}\right)} \end{bmatrix} \times \begin{bmatrix} V_{CTB(tx)resp} \\ V_{CTB(rx)opt} \end{bmatrix}$$

in which:

$P_{opt(high)}$	the optical input power without attenuation expressed in dBm
$P_{opt(low)}$	the optical input power with attenuation expressed in dBm

This can be rewritten into the following form by using the inverse matrix:

$$\begin{bmatrix} V_{CTB(tx)resp} \\ V_{CTB(rx)opt} \end{bmatrix} = \text{InverseMatrix} \times \begin{bmatrix} V_{CTB(total1)} \\ V_{CTB(total2)} \end{bmatrix}$$ in which:

$$\text{InverseMatrix} = \frac{1}{10^{\left(\frac{-6 \times (P_{opt(high)} - P_{opt(low)})}{20}\right)} - 10^{\left(\frac{-2 \times (P_{opt(high)} - P_{opt(low)})}{20}\right)}} \times \begin{bmatrix} 10^{\left(\frac{-6 \times (P_{opt(high)} - P_{opt(low)})}{20}\right)} & -1 \\ -10^{\left(\frac{-2 \times (P_{opt(high)} - P_{opt(low)})}{20}\right)} & 1 \end{bmatrix}$$

10.2 Calculation of the CSO figure of optical receivers

The Composite Second Order (CSO) is the difference in dB or dBc between the carrier signal and the CSO distortion voltage. Since the CSO is a second order distortion product, the relation between the output voltage V_o and the CSO voltage V_{CSO} is 1 to 2, so the V_{CSO} increases two times faster than the output power. This means, that the relation between output voltage and CSO, which is always expressed as a distance, relative to the carrier, is 1 to 1. see Fig.13. So, an increase of 1 dB optical input power leads to an increase of 2 dB electrical output voltage, which leads to an increase of 4 dB of V_{CSO}.

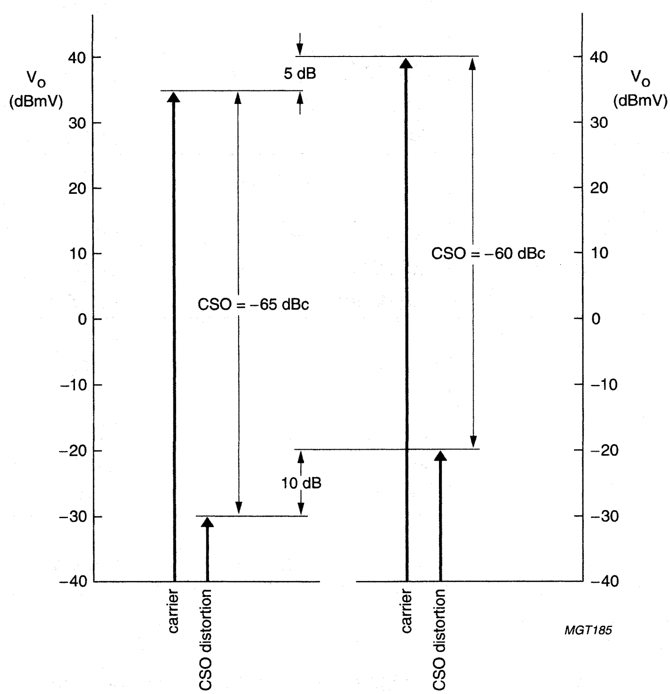


Fig.13 Output voltage of carrier V_o, CSO distortion V_{CSO} and CSO.

As shown on the left side of Fig.13, the output voltage V_o is 35 dBmV, and the CSO voltage V_{CSO} is –30 dBmV, resulting in a CSO of –65 dBc. On the right side of the figure, an output voltage increase of 5 dB is shown. Increasing the output voltage V_o with 5 dB to 40 dBmV results in a CSO voltage V_{CSO} increase of 10 dB to –20 dBmV. This results in a CSO of –60 dBc. In the following discussion, CSO is the relative difference between carrier signal and distortion, and is expressed in dB or dBc. The absolute CSO distortion voltage is denoted by V_{CSO} and is expressed in dBmV or mV.

For the calculation of the CSO of the optical receiver, we also make use of the 1:2 relationship between optical in and electrical out, as already discussed in Chapter 7, “Output Voltage Calculation”. With these relations in mind, we can now focus on the measurement and calculation of the CSO itself.

The method of calculating the CSO figure of an optical receiver is explained with the help of the same example as is used for the calculation of CTB. The CSO of the total optical system, is measured twice: test 1 and test 2, each test at a different optical input power by means of an optical attenuator. Because the CSO of the laser is kept constant, we have two equations with two unknowns, which can be solved with linear algebra.

When the optical input power, the responsivity of the optical receiver and the CSO of the total optical system are known, the total CSO voltage V_{CSO} at the output can be calculated:

Overview of the test values of the CSO measuring

	CONDITIONS	TEST 1	TEST 2
Optical Input Power: • $P_{optical}$ • Modulation index		6 dBm 4 mW 3.7%	3 dBm 2 mW 3.7%
• $P_{optical}$ (average)	one carrier	$4.0 \times 10^{-3} \times 0.037 \times (1/\sqrt{2}) =$ 104.6×10^{-6} W = 104.6 μW	$2.0 \times 10^{-3} \times 0.037 \times (1/\sqrt{2}) =$ 52.3×10^{-6} W = 52.3 μW
Output Voltage: responsivity = 900 V/W V_{out}	one carrier	$104.6 \times 10^{-6} \times 900 =$ 94.2 mV = 39.5 dBmV	$52.3 \times 10^{-6} \times 900 =$ 47.1 mV = 33.5 dBmV
CSO Voltage: CSO_{total} [dBc] $V_{CSOtotal}$		–64.8 dBc 39.5 – 64.8 dBmV = –25.3 dBmV = 0.0543 mV	–65.5 dBc 33.5 – 65.5 dBmV = –32.0 dBmV = 0.0251 mV

The CSO voltage $V_{CSO(total)}$ at the output of the receiver is the addition of the amplified input $V_{CSO(tx)resp}$ and the $V_{CSO(rx)opt}$ of the optical receiver. At test 1, the total CSO voltage at the output of the optical receiver is:

$$V_{CSO(total1)} = (V_{CSO(tx)resp}) + (V_{CSO(rx)opt}) \qquad (6)$$

When the input signal is attenuated optically, the CSO distance of the optical input signal stays the same. The amplified input CSO will also be the same in distance but the absolute voltage of this signal is lower; –6 dB at test 2 compared to test 1. The added CSO of the optical receiver is 6 dB lower in distance. The added $V_{CSO(rx)opt}$ is 12 dB lower in absolute output voltage. When an output signal is attenuated with x dB, the second order distortion level is 2 × x dB lower.

Using the numbers and voltages of the formulas of test 1, the total output CSO voltage $V_{CSO(total2)}$ of test 2 is:

$$V_{CSO(total2)} = (V_{CSO(tx)resp} - 6\ dB) + (V_{CSO(rx)opt} - 12\ dB) \quad (7)$$

$$V_{CSO(total2)} = (V_{CSO(tx)resp} \times 0.5012) + (V_{CSO(rx)opt} \times 0.2519) \quad (8)$$

Equations (6) and (8) form two equations with two unknowns, and can be solved with linear algebra:

$$\begin{bmatrix} V_{CSO(total1)} \\ V_{CSO(total2)} \end{bmatrix} = \begin{bmatrix} 1 & 1 \\ 0.5012 & 0.2519 \end{bmatrix} \times \begin{bmatrix} V_{CSO(tx)resp} \\ V_{CSO(rx)opt} \end{bmatrix}$$

in which

$V_{CSO(total1)}$	measured CSO voltage at high optical input power
$V_{CSO(total2)}$	measured CSO voltage at low optical input power
$V_{CSO(tx)resp}$	amplified CSO voltage of laser
$V_{CSO(rx)opt}$	CSO voltage of optical receiver

In numbers, this is as follows:

$$\begin{bmatrix} 0.0543 \\ 0.0251 \end{bmatrix} = \begin{bmatrix} 1 & 1 \\ 0.5012 & 0.2519 \end{bmatrix} \times \begin{bmatrix} V_{CSO(tx)resp} \\ V_{CSO(rx)opt} \end{bmatrix}$$

With deriving the inverse of the 2 x 2 matrix, we get the following result, expressed in mV:

$$\begin{bmatrix} V_{CSO(tx)resp} \\ V_{CSO(rx)opt} \end{bmatrix} = \frac{1}{0.2519 - 0.5012} \times \begin{bmatrix} 0.2519 & -1 \\ -0.5012 & 1 \end{bmatrix} \times \begin{bmatrix} 0.0543 \\ 0.0251 \end{bmatrix} = \begin{bmatrix} 0.0459 \\ 0.0084 \end{bmatrix}$$

which can also be expressed in dBmV's:

$$\begin{bmatrix} V_{CSO(tx)resp} \\ V_{CSO(rx)opt} \end{bmatrix} = \begin{bmatrix} -26.8 \\ -41.5 \end{bmatrix}$$

Since the 0 dB level is at 39.5 dBmV, the CSO values (in dBc) are as follows:

$$\begin{bmatrix} CSO_{(tx)resp} \\ CSO_{(rx)opt} \end{bmatrix} = \begin{bmatrix} -26.8 \\ -41.5 \end{bmatrix} - \begin{bmatrix} 39.5 \\ 39.5 \end{bmatrix} = \begin{bmatrix} -66.3 \\ -81 \end{bmatrix}$$

This procedure leads to the CSO of both the laser and the optical receiver. As shown, the input CSO (CSO of the laser) is high compared to the CSO of the optical receiver. Especially in this case, when $CSO_{(tx)resp} >> CSO_{(rx)opt}$, it is essential to perform some extra calculations, considering measurement accuracy of the measured CSO values, and the consequences on the resulting calculated values of $CSO_{(tx)resp}$ and $CSO_{(rx)opt}$. It shows, that a measurement accuracy of $\pm$ 0.1dB of the two CSO measurements, results in a –78.8 to –83.9 dB window for the $CSO_{(rx)opt}$, and a –65.9 to –66.6 dB window for $CSO_{(tx)resp}$. If the measurement accuracy causes significant differences in the results, more measurements have to be done in order to achieve higher accuracy.

Another way to reduce the distortion of the laser can be done by:

- Decreasing the number of channels
- Using a more linear laser
- Using a laser with an optical isolator
- Using a laser with pre-distortion.

Remark: take care that the optical connections don't have a bad optical back reflection (reflections into the laser!).

To consider measurements at other optical input power levels as well, the general form of the matrix equation is shown below:

$$\begin{bmatrix} V_{CSO(total1)} \\ V_{CSO(total2)} \end{bmatrix} = \begin{bmatrix} 1 & 1 \\ 10^{\left(\frac{-2 \times (P_{opt(high)} - P_{opt(low)})}{20}\right)} & 10^{\left(\frac{-4 \times (P_{opt(high)} - P_{opt(low)})}{20}\right)} \end{bmatrix} \times \begin{bmatrix} V_{CSO(tx)resp} \\ V_{CSO(rx)opt} \end{bmatrix}$$

In which:

$P_{opt(high)}$ the optical input power without attenuation; in dBm

$P_{opt(low)}$ the optical input power with attenuation; in dBm

This can be rewritten into the following form by using the inverse matrix:

$$\begin{bmatrix} V_{CSO(tx)resp} \\ V_{CSO(rx)opt} \end{bmatrix} = \text{InverseMatrix} \times \begin{bmatrix} V_{CSO(total1)} \\ V_{CSO(total2)} \end{bmatrix}$$

in which:

$$\text{InverseMatrix} = \frac{1}{10^{\left(\frac{-4 \times (P_{opt(high)} - P_{opt(low)})}{20}\right)} - 10^{\left(\frac{-2 \times (P_{opt(high)} - P_{opt(low)})}{20}\right)}} \times \begin{bmatrix} 10^{\left(\frac{-4 \times (P_{opt(high)} - P_{opt(low)})}{20}\right)} & -1 \\ -10^{\left(\frac{-2 \times (P_{opt(high)} - P_{opt(low)})}{20}\right)} & 1 \end{bmatrix}$$

11 INPUT DYNAMIC RANGE

The photodiodes used in the Philips optical receivers can handle a maximum input power of 5 mW = 7 dBm, without any damage or degradation of the photodiode.

11.1 $V_{pin\ 1}$ versus input power

In Fig.14, the current monitor voltage at pin 1 is given as a function of the optical input power. Note, that the optical input power is expressed in mW.

This voltage at pin 1, expressed in Volts, is linear related to the optical input power, expressed in mW, when ranging between 1 and 5 mW.

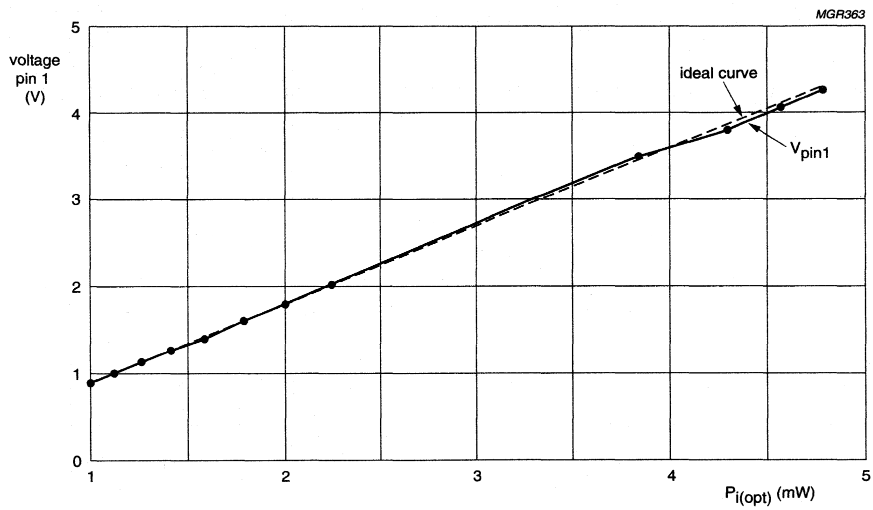
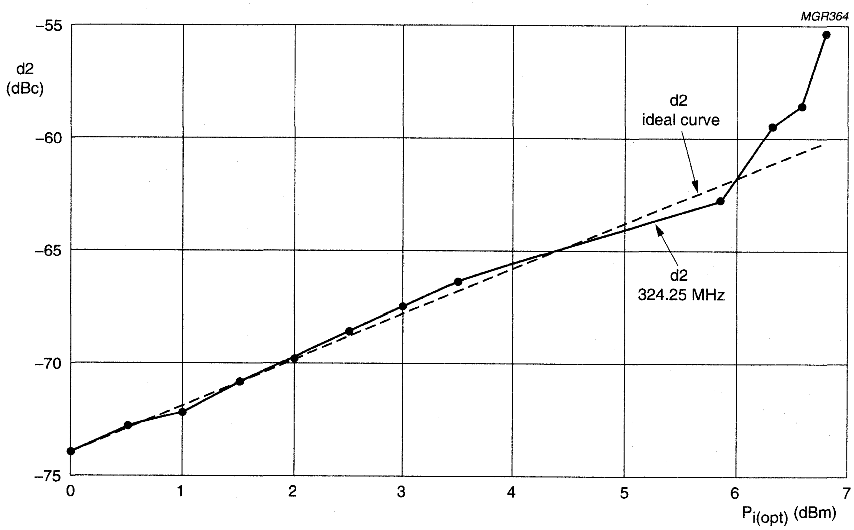


Fig.14 The current monitor voltage at pin1 as a function of the optical input power $P_{i(opt)}$.

11.2 d2 versus input power

In Fig.15, the second order distortion is given as function of optical input power. Note, that the optical input power is expressed in dBm.

The second order distortion, expressed in dBc, is linear related to the optical input power, expressed in dBm, when ranging between 0 and 6. Above 6 dBm, the optical receiver becomes non-linear because the reverse voltage decreases too much. The reverse biasing of the photodiode is done via two 1 kΩ resistors. 6 dBm optical input power gives a voltage decrease of 8 V (6 dBm = 4 mW, causing a pin-diode current ≈ 4 mA), which brings the photodiode in the non-linear region.



m = 40% each laser.

Fig.15 d2 as a function of the optical input power $P_{i(opt)}$.

12 OPTICAL CONNECTORS

Optical connectors are used to couple the light from one glass fibre into another glass fibre. For CATV applications, single mode glass fibre is used. The nominal mode field diameter of these fibres (that part of the glass fibre which is used to transport the light) is 9 to 10 μm. Because of this small diameter, a precise mating of the two glass fibre end faces is needed to couple all the light from one glass fibre into the other glass fibre.

Another problem with glass fibre is reflection of light when the transport medium changes, e.g. from glass into air. Reflection means losses and also a chance exists that light gets back into the laser. The last effect influence the proper functioning of the laser. To solve these problems as much as possible, specific high quality connectors are used. Philips supplies FC0/APC and SC0/APC connectors.

12.1 APC-Ferrules

In an optical connector, the end of the glass fibre is placed in a ferrule, a ceramic or glass bush to fix the glass fibre within the mechanical outline. The last three characters of the optical connector names are used to specify the end face of this ferrule of the connector. The characters APC stand for Angled Physical Contact. The end of the ferrule used in the FC0/APC and SC0/APC connectors is angled; 8° ± 0.5°. Because of this angle, less light is reflected into the glass fibre when the glass fibre is open-ended (optical return loss is minimally 60 dB).

By using a physical contact between the end of two ferrules, the light goes directly from glass fibre into glass fibre. This means less reflections and also less losses (optical insertion loss maximal 0.5 dB). When light goes from one glass fibre via air into another glass fibre, the optical losses are 8% (an interface between glass fibre and air gives 4% loss). The end faces of APC ferrules are also polished to get a very flat plane which makes a better physical contact.
The repeatability of APC connectors is 0.2 dB. Two mated APC ferrules are drawn in Fig.16.

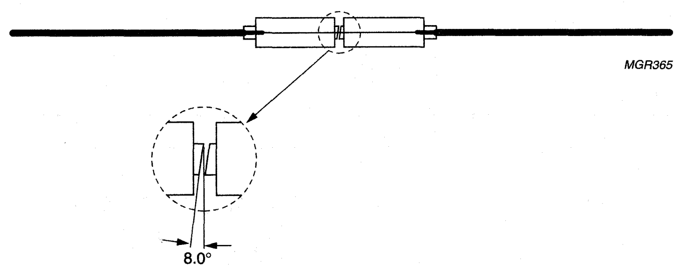
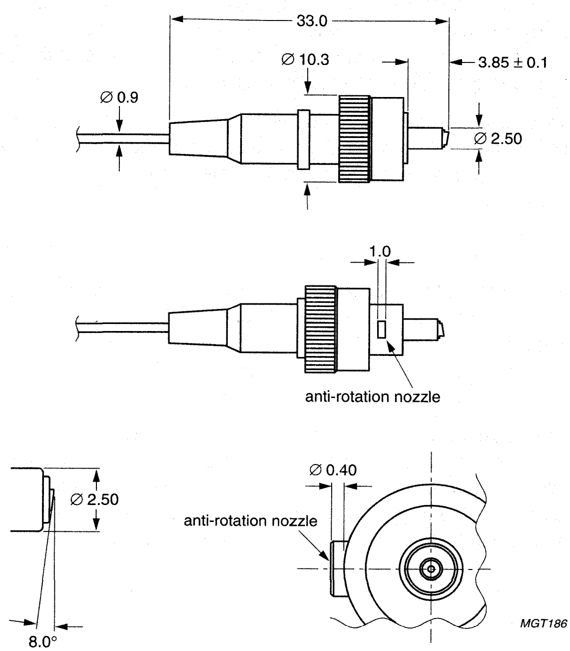


Fig.16 Two mated APC ferrules.

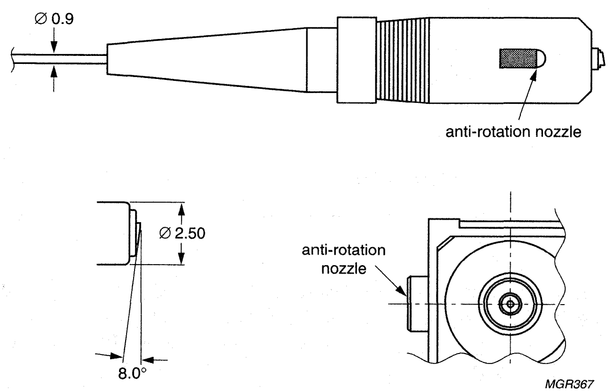
12.2 FC and SC Connectors

The first two characters of the connector names are used to specify the mechanical outline of the connector. The outlines FC and SC have a very tight mechanical specification to get the ferrules exactly in front of each other and with a specified pressure pushed to each other by a spring (7.85 to 11.8 Newton). The outlines of the FC0/APC and SC0/APC connectorized are shown in Figs 17 and 18.



Dimensions in millimetre.

Fig.17 FC0/APC connector.



Dimensions in millimetre.

Fig.18 SC0/APC connector.

A hybrid wideband amplifier module for digital CATV networks with the BGD902

Application Note AN98109

INTRODUCTION

Today's wideband CATV networks transform into a huge information highway system, including analog and digital TV channels, telemetric signals, telephone and multimedia services and Internet access.

The trend is to use higher frequencies and incorporating digital transfer. The trends for increasing information density and higher bandwidth for information transport demand higher performed CATV semiconductor devices.

Therefore, Philips Semiconductors developed a new CATV hybrid module - the BGD902. This BGD902 CATV module (a 900 MHz module) delivers the performance that is demanded by the future multimedia coaxial networks. It is equipped with silicon bipolar transistors, virtually always used in broadband applications such as CATV amplifiers. This technology enables excellent modules with extremely good characteristics, especially for the demands of the future digital CATV networks.

WIDEBAND HYBRID MODULES

A simplified version of a typical wideband amplifier is given in Fig.1.

The first transformer balances the input signal V_i and takes care of impedance matching for maximum power transfer to the inputs of the transistors. The output of the push-pull amplifier, yielding low second order distortion, is fed to the output via the output transformer.

A biasing circuit sets the DC current of the transistors which is normally rather high to minimize the third order distortion d3. The emitter resistors linearize the behaviour of the device by which the distortion has been improved, while some feedback via a RC network is applied to reduce distortion even further.

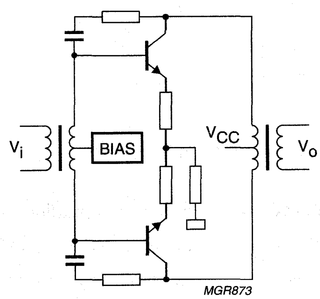


Fig.1 Simplified wideband module.

Many improvements are applied such as applying darlingtons or transistors in a cascade configuration or using a two-stage cascade configuration to obtain higher gains.

Although the basic circuit looks relatively simple the final design in all its details is rather complex with tuned correction networks, carefully designed transformers and the very fine geometric bipolar transistors, optimized for use in CATV amplifier modules.

The most important characteristics of wideband amplifier modules are the following:

- Gain, frequency range, flatness (linearity of the frequency characteristic) and slope
- Second order distortion d2 or CSO
- Third order distortion d3 or CTB
- Cross modulation (X_{MOD}) at a given output voltage V_O
- Input and output reflections (return losses S_{11} and S_{22})
- Noise figure
- Current consumption.

Normally trade-off exist between many of these parameters. Improving one of them may effect another one negatively, so carefully designing these modules is an art in itself.

THE DEMANDS FOR FUTURE MULTIMEDIA NETWORKS

Especially for the multimedia CATV networks of tomorrow, it is very important to invest into the right solutions. For such systems, the planned lifetime is about 15 to 20 years. Therefore, it is necessary to choose high quality components that will survive the environment hazards that reduce the performance of a CATV hybrid both long-term and short-term. The most important influences are:

- Temperature (decreases CTB values at high output levels)
- Surge pulses (may damage, the transistor dies in milliseconds)
- Overvoltage (may damage, the transistor dies instantaneously)
- Quality aspects of the hybrids.

Other important parameters that have a major influence in the performance of future digital transmission in CATV networks are:

- CTB performance, especially at high temperatures, high channel loading and sloped conditions
- Flatness; very important for transmission of linear signals and to decrease failure rate of digital signals
- S_{11} and S_{22}; especially for digital signal transmission one of the parameters that could have big influence on the signal quality.

Philips Semiconductors, as a major player in the CATV hybrid market, has a long experience in designing circuits for highest technical performance and for longest lifetimes. By deciding for the right mix of quality and technical performance of a CATV module we developed the BGD902, the module for future multimedia CATV networks.

COMPARISON OF MAIN PARAMETERS FROM SEVERAL EXISTING WIDEBAND MODULES FOR CATV APPLICATION

This section compares some commercially available state-of-the-art wideband modules using different technologies. Philips Semiconductors' BGD902, the new high performance 900 MHz power doubler is compared to a US made bipolar competitor (called Si. 2) and to a GaAs using MESFETs of Japanese origin.

For reference, a specification summary with all essential characteristics is shown in the Table 1.

Table 1

PARAMETER	CONDITIONS	BGD902	Si. 2	GaAs	UNIT
Frequency range	$f_{MIN} - f_{MAX}$	40 to 900	40 to 860	50 to 860	MHz
Gain	f_{MAX}	19 to 20	19 to 20.5	18.5 to 20.0	dB
Slope	$f_{MIN} - f_{MAX}$	0.4 to 1.4	0 to 1.5	0 to 2.0	dB
Flatness		0.6	1.0	1.0	dB
CSO	110 channels; V_O = 44 dBmV	−61.0	−62.0	−59.0; note 1	dB
CTB	110 channels; V_O = 44 dBmV	−62.0	−62.0	−59.0; note 1	dB
X_{MOD}	110 channels; V_O = 44 dBmV	−63.5	−63.0	−59.0; note 1	dB
Noise	$f = f_{MAX}$	8.0	8.0	7.0	dB
I_{DC}	typical	420	400	355	mA

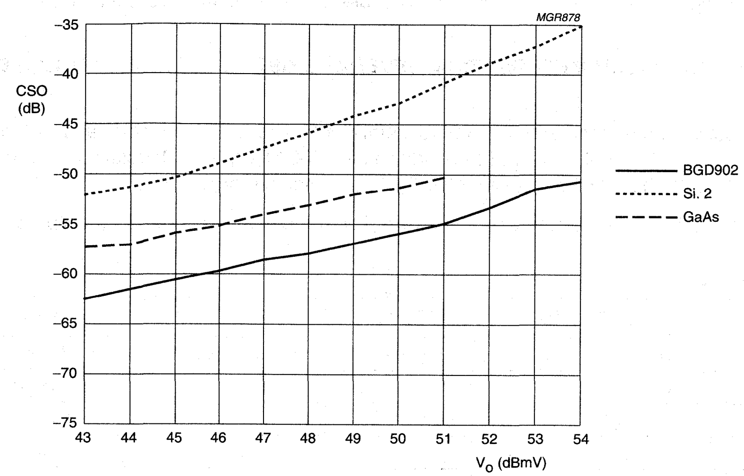
Note

1. Not specified, calculated back from tilted conditions.

Measurement results

Figures 2 to 8 show the test results of extensive measurements on a multitude of products, set up in our development laboratories.

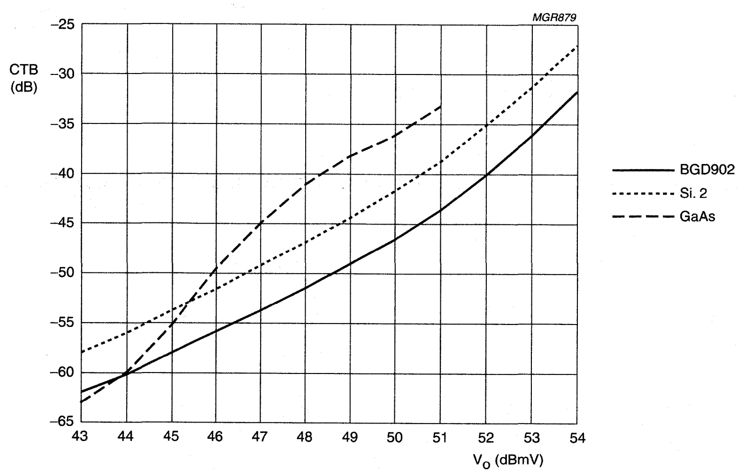
Distortion at various levels of the output voltage



Average value at 860.5 MHz.

Tested with 129 channels, it appears that at high output voltages BGD902 is unbeatable for CSO. One competitor is around 2 dB worse, the other around 4 to 5 dB.

Fig.2 CSO/129 channels (dB) as function of V_O (dBmV).



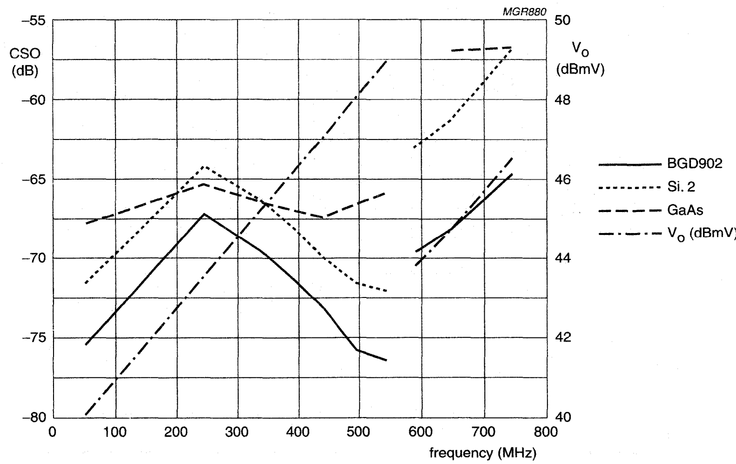
Average value at 859.25 MHz

CTB for 129 channels is best for BGD902 especially at higher output voltages.

Fig.3 CTB (dB) as function of V_O (dBmV).

CTB, XMOD and CSO as function of frequency under tilted conditions

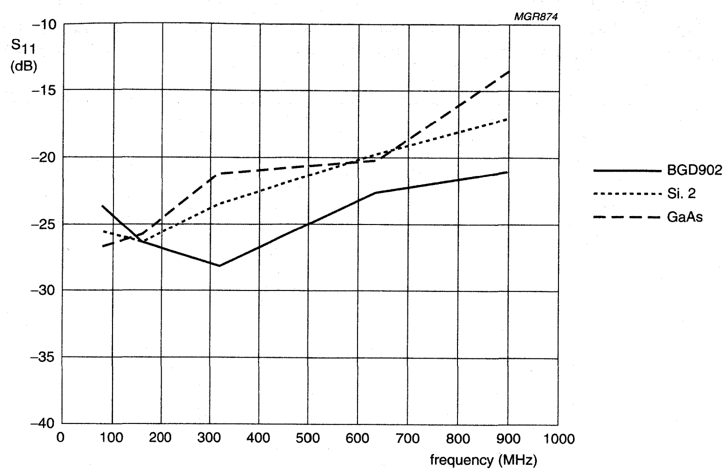
Figure 4 shows the performance for a channel distribution which is partly analogue (f < 750 MHz), partly digital (750 to 870 MHz). Due to the built-in cable loss correction, the input voltage, given as a thin black line in Fig.4, rises as a function of the frequency ('sloped' or 'tilted' conditions). The required output voltage for digital is less as is shown in Fig.4. Clearly, the BGD902 outperforms the competition; the silicon devices are in this case better than the GaAs one.



Mean values at 9 dB tilt.

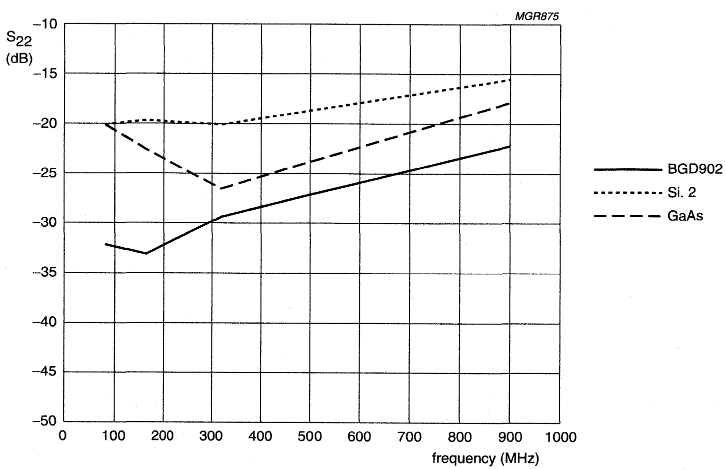
Fig.4 CSO (dB) and V_O (dBmV) as a function of frequency.

S_{11}/S_{22} as function of frequency



The input reflection S_{11} underlines the excellent performance of BGD902.

Fig.5 S_{11} as function of frequency, mean values.

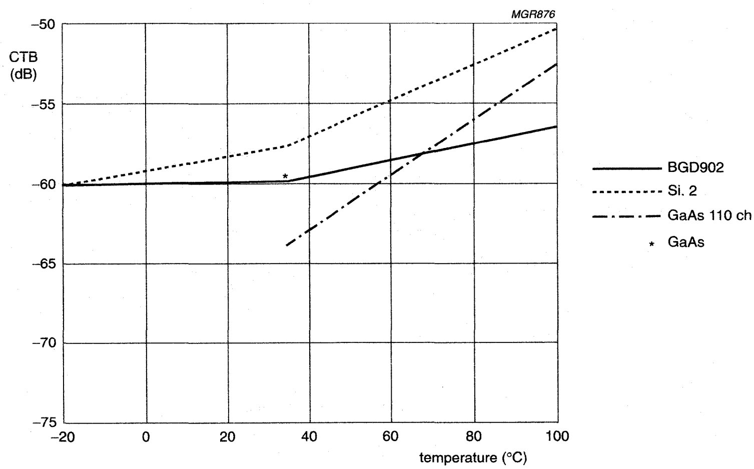


Clearly, the BGD902 is the leader in output reflection.

Fig.6 S_{22} as function of frequency, mean values.

Temperature dependency

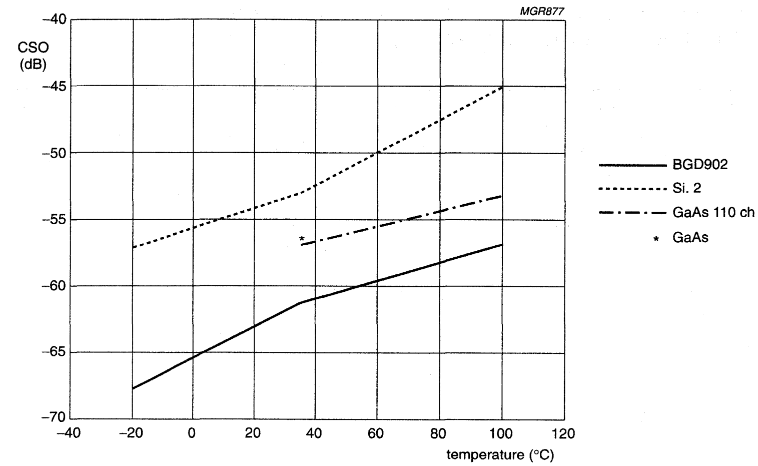
Figure 7 shows the temperature dependency of CTB. It shows a very big effect on GaAs distortion by temperature changes. Its 35 °C behaviour may be OK, at higher temperatures it degrades seriously. Both its high temperature behaviour and its temperature dependency are doubtful.



The temperature graphs show the performance of GaAs at 110 channels (only one test point is available for 129 channels). Silicon devices were all tested at 129 channels.

Mean values V_o = 44 dBmV.

Fig.7 CTB (dB) as function of temperature.



Mean values (V_O = 44dBmV).

This figure shows the excellent behaviour of the BGD902 over temperature on CSO.

Fig.8 CSO (dB) as function of temperature.

SUMMARY

The advantages of the BGD902 - achieved by the properties of state-of-the-art silicon devices - are clearly given and show the big improvements in overall performance of this new developed CATV hybrid amplifier when compared to some other state-of-the-art hybrid modules. The BGD902 is the basis for the entree into the digital millennium, a time with higher channel loading and more coaxial bandwidth that will let multimedia become a 'virtual reality'.

DEVICE DATA

CATV power doubler amplifier modules — BGD502; BGD504

FEATURES

- Excellent linearity
- Extremely low noise
- Silicon nitride passivation
- Rugged construction
- TiPtAu metallized crystals ensure optimal reliability.

DESCRIPTION

Hybrid amplifier modules for CATV systems operating over a frequency range of 40 to 550 MHz at a voltage supply of 24 V (DC).

PINNING - SOT115J

PIN	DESCRIPTION
1	input
2	common
3	common
5	$+V_B$
7	common
8	common
9	output

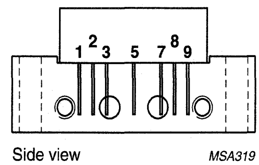


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz			
	BGD502		18	19	dB
	BGD504		19.5	20.5	dB
	power gain	f = 550 MHz			
	BGD502		18.8	20.8	dB
	BGD504		20.2	22.2	dB
I_{tot}	total current consumption (DC)	V_B = 24 V	–	435	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_i	RF input voltage	–	65	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	operating mounting base temperature	–20	+100	°C

CHARACTERISTICS

Bandwidth 40 to 550 MHz; V_B = 24 V; T_{mb} = 35 °C; Z_S = Z_L = 75 Ω.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz				
	BGD502		18	–	19	dB
	BGD504		19.5	–	20.5	dB
	power gain	f = 550 MHz				
	BGD502		18.8	–	20.8	dB
	BGD504		20.2	–	22.2	dB
SL	slope cable equivalent	f = 40 to 550 MHz	0.2	–	2.2	dB
FL	flatness of frequency response	f = 40 to 550 MHz	–	–	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	–	dB
		f = 80 to 160 MHz	19	–	–	dB
		f = 160 to 550 MHz	18	–	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	–	–	dB
		f = 80 to 160 MHz	19	–	–	dB
		f = 160 to 550 MHz	18	–	–	dB
S_{21}	phase response	f = 50 MHz	+135	–	+225	deg
CTB	composite triple beat	77 channels flat; V_o = 44 dBmV; measured at 547.25 MHz				
	BGD502		–	–	–65	dB
	BGD504		–	–	–64	dB
X_{mod}	cross modulation	77 channels flat; V_o = 44 dBmV; measured at 55.25 MHz				
	BGD502		–	–	–68	dB
	BGD504		–	–	–67	dB
CSO	composite second order distortion	77 channels flat; V_o = 44 dBmV; measured at 548.5 MHz				
	BGD502		–	–	–62	dB
	BGD504		–	–	–60	dB
d_2	second order distortion	note 1				
	BGD502		–	–	–72	dB
	BGD504		–	–	–70	dB
V_o	output voltage	d_{im} = –60 dB; note 2				
	BGD502		64	–	–	dBmV
	BGD504		63.5	–	–	dBmV
F	noise figure	f = 550 MHz	–	–	8	dB
I_{tot}	total current consumption (DC)	note 3	–	415	435	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV; f_q = 493.25 MHz; V_q = 44 dBmV; measured at $f_p + f_q$ = 548.5 MHz.
2. Measured according to DIN45004B: f_p = 540.25 MHz; $V_p = V_o$; f_q = 547.25 MHz; $V_q = V_o$ –6 dB; f_r = 549.25 MHz; $V_r = V_o$ –6 dB; measured at $f_p + f_q - f_r$ = 538.25 MHz.
3. The modules normally operate at V_B = 24 V, but are able to withstand supply transients up to 30 V.

CHARACTERISTICS

Bandwidth 40 to 450 MHz; V_B = 24 V; T_{mb} = 35 °C; Z_S = Z_L = 75 Ω.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz				
	BGD502		18	–	19	dB
	BGD504		19.5	–	20.5	dB
	power gain	f = 450 MHz				
	BGD502		18.6	–	20.6	dB
	BGD504		20	–	22	dB
SL	slope cable equivalent	f = 40 to 450 MHz				
	BGD502		0.2	–	1.8	dB
	BGD504		0	–	1.65	dB
FL	flatness of frequency response	f = 40 to 450 MHz	–	–	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	–	dB
		f = 80 to 160 MHz	19	–	–	dB
		f = 160 to 450 MHz	18	–	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	–	–	dB
		f = 80 to 160 MHz	19	–	–	dB
		f = 160 to 450 MHz	18	–	–	dB
S_{21}	phase response	f = 50 MHz	+135	–	+225	deg
CTB	composite triple beat	60 channels flat; V_o = 46 dBmV; measured at 445.25 MHz				
	BGD502		–	–	–67	dB
	BGD504		–	–	–66	dB
CSO	composite second order distortion	60 channels flat; V_o = 46 dBmV; measured at 548.5 MHz				
	BGD502		–	–	t.b.f.	dB
	BGD504		–	–	t.b.f.	dB
X_{mod}	cross modulation	60 channels flat; V_o = 46 dBmV; measured at 55.25 MHz				
	BGD502		–	–	–67	dB
	BGD504		–	–	–66	dB
d_2	second order distortion	note 1				
	BGD502		–	–	–75	dB
	BGD504		–	–	–73	dB
V_o	output voltage	d_{im} = –60 dB; note 2				
	BGD502		67	–	–	dBmV
	BGD504		66.5	–	–	dBmV
F	noise figure	f = 450 MHz	–	–	7	dB
I_{tot}	total current consumption (DC)	note 3	–	415	435	mA

Notes

1. f_p = 55.25 MHz; V_p = 46 dBmV; f_q = 391.25 MHz; V_q = 46 dBmV; measured at $f_p + f_q$ = 446.5 MHz.
2. Measured according to DIN45004B: f_p = 440.25 MHz; $V_p = V_o$; f_q = 447.25 MHz; $V_q = V_o$ –6 dB; f_r = 449.25 MHz; $V_r = V_o$ –6 dB; measured at $f_p + f_q - f_r$ = 438.25 MHz.
3. The modules normally operate at V_B = 24 V, but are able to withstand supply transients up to 30 V.

CATV amplifier module — BGD602

FEATURES

Excellent linearity

- Extremely low noise
- Silicon nitride passivation
- Rugged construction
- Gold metallization ensures excellent reliability.

DESCRIPTION

Hybrid high dynamic range amplifier module designed for applications in CATV systems with a bandwidth of 40 to 600 MHz operating with a voltage supply of 24 V (DC).

PINNING - SOT115J

PIN	DESCRIPTION
1	input
2	common
3	common
5	$+V_B$
7	common
8	common
9	output

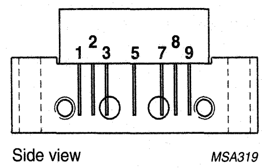


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	19	dB
		f = 600 MHz	19	–	dB
I_{tot}	total current consumption (DC)	V_B = 24 V	–	435	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_i	RF input voltage	–	65	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	operating mounting base temperature	–20	+100	°C

CHARACTERISTICS

Bandwidth 40 to 600 MHz; V_B = 24 V; T_{mb} = 35 °C; Z_S = Z_L = 75 Ω.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	19	dB
		f = 600 MHz	19	–	dB
SL	slope cable equivalent	f = 40 to 600 MHz	0.2	2.2	dB
FL	flatness of frequency response	f = 40 to 600 MHz	–	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	19	–	dB
		f = 160 to 600 MHz	18	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	19	–	dB
		f = 160 to 600 MHz	18	–	dB
S_{21}	phase response	f = 50 MHz	–45	+45	deg
CTB	composite triple beat	85 channels flat; V_o = 44 dBmV; measured at 595.25 MHz	–	–62	dB
X_{mod}	cross modulation	85 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–66	dB
CSO	composite second order distortion	85 channels flat; V_o = 44 dBmV; measured at 596.5 MHz	–	–60	dB
d_2	second order distortion	note 1	–	–70	dB
V_o	output voltage	d_{im} = –60 dB; note 2	63	–	dBmV
F	noise figure	f = 600 MHz	–	8	dB
I_{tot}	total current consumption (DC)	note 3	–	435	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 541.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 596.5 MHz.
2. Measured according to DIN45004B:
   f_p = 590.25 MHz; $V_p = V_o$;
   f_q = 597.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 599.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 588.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

CHARACTERISTICS

Bandwidth 40 to 550 MHz; V_B = 24 V; T_{mb} = 35 °C; Z_S = Z_L = 75 Ω.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	19	dB
		f = 550 MHz	18.8	–	dB
SL	slope cable equivalent	f = 40 to 550 MHz	0.2	2.2	dB
FL	flatness of frequency response	f = 40 to 550 MHz	–	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	19	–	dB
		f = 160 to 550 MHz	18	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	19	–	dB
		f = 160 to 550 MHz	18	–	dB
S_{21}	phase response	f = 50 MHz	–45	+45	deg
CTB	composite triple beat	77 channels flat; V_o = 44 dBmV; measured at 547.25 MHz	–	–66	dB
X_{mod}	cross modulation	77 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–68	dB
CSO	composite second order distortion	77 channels flat; V_o = 44 dBmV; measured at 548.5 MHz	–	–62	dB
d_2	second order distortion	note 1	–	–72	dB
V_o	output voltage	d_{im} = –60 dB; note 2	64	–	dBmV
F	noise figure	f = 550 MHz	–	7.5	dB
I_{tot}	total current consumption (DC)	note 3	–	435	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 493.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 548.5 MHz.
2. Measured according to DIN45004B:
   f_p = 540.25 MHz; $V_p = V_o$;
   f_q = 547.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 549.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 538.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

CHARACTERISTICS

Bandwidth 40 to 450 MHz; V_B = 24 V; T_{mb} = 35 °C; $Z_S = Z_L$ = 75 Ω.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	19	dB
		f = 450 MHz	18.6	–	dB
SL	slope cable equivalent	f = 40 to 450 MHz	0.2	1.8	dB
FL	flatness of frequency response	f = 40 to 450 MHz	–	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	19	–	dB
		f = 160 to 450 MHz	18	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	19	–	dB
		f = 160 to 450 MHz	18	–	dB
S_{21}	phase response	f = 50 MHz	–45	+45	deg
CTB	composite triple beat	60 channels flat; V_o = 46 dBmV; measured at 445.25 MHz	–	–67	dB
X_{mod}	cross modulation	60 channels flat; V_o = 46 dBmV; measured at 55.25 MHz	–	–66	dB
CSO	composite second order distortion	60 channels flat; V_o = 46 dBmV measured at 446.5 MHz	–	–60	dB
d_2	second order distortion	note 1	–	–75	dB
V_o	output voltage	d_{im} = –60 dB; note 2	67	–	dBmV
F	noise figure	f = 450 MHz	–	7	dB
I_{tot}	total current consumption (DC)	note 3	–	435	mA

Notes

1. f_p = 55.25 MHz; V_p = 46 dBmV;
   f_q = 391.25 MHz; V_q = 46 dBmV;
   measured at $f_p + f_q$ = 446.5 MHz.
2. Measured according to DIN45004B:
   f_p = 440.25 MHz; $V_p = V_o$;
   f_q = 447.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 449.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 438.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

CATV amplifier module | BGD602D

FEATURES

- Excellent linearity
- Extremely low noise
- Silicon nitride passivation
- Rugged construction
- Gold metallization ensures excellent reliability.

DESCRIPTION

Hybrid high dynamic range cascode amplifier module with darlington configuration for CATV systems operating over a frequency range of 40 to 600 MHz at a supply voltage of +24 V (DC).

PINNING - SOT115J

PIN	DESCRIPTION
1	input
2	common
3	common
5	$+V_B$
7	common
8	common
9	output

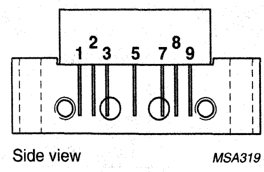


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	17.5	18.5	dB
		f = 600 MHz	18.5	–	dB
I_{tot}	total current consumption (DC)	V_B = 24 V	–	440	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_i	RF input voltage	–	65	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	operating mounting base temperature	–20	+100	°C

CHARACTERISTICS

Bandwidth 40 to 600 MHz; $V_B = 24$ V; $T_{case} = 35$ °C; $Z_S = Z_L = 75\ \Omega$.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	17.5	18.5	dB
		f = 600 MHz	18.5	–	dB
SL	slope cable equivalent	f = 40 to 600 MHz	0.2	2.2	dB
FL	flatness of frequency response	f = 40 to 600 MHz	–	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	19	–	dB
		f = 160 to 600 MHz	18	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	19	–	dB
		f = 160 to 600 MHz	18	–	dB
S_{21}	phase response	f = 50 MHz	–45	+45	deg
CTB	composite triple beat	85 channels flat; $V_o = 44$ dBmV; measured at 595.25 MHz	–	–68	dB
X_{mod}	cross modulation	85 channels flat; $V_o = 44$ dBmV; measured at 55.25 MHz	–	–61	dB
CSO	composite second order distortion	85 channels flat; $V_o = 44$ dBmV; measured at 596.5 MHz	–	–64	dB
d_2	second order distortion	note 1	–	–76	dB
V_o	output voltage	$d_{im} = -60$ dB; note 2	66	–	dBmV
F	noise figure	f = 50 MHz	–	5.5	dB
		f = 600 MHz	–	7	dB
I_{tot}	total current consumption (DC)	note 3	–	440	mA

Notes

1. $f_p = 55.25$ MHz; $V_p = 44$ dBmV;
   $f_q = 541.25$ MHz; $V_q = 44$ dBmV;
   measured at $f_p + f_q = 596.5$ MHz.
2. $f_p = 590.25$ MHz; $V_p = V_o$;
   $f_q = 597.25$ MHz; $V_q = V_o -6$ dB;
   $f_r = 599.25$ MHz; $V_r = V_o -6$ dB;
   measured at $f_p + f_q - f_r = 588.25$ MHz.
3. The module normally operates at $V_B = 24$ V, but is able to withstand supply transients up to 30 V.

CHARACTERISTICS

Bandwidth 40 to 550 MHz; V_B = 24 V; T_{case} = 35 °C; $Z_S = Z_L$ = 75 Ω.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	17.5	18.5	dB
		f = 550 MHz	18.3	–	dB
SL	slope cable equivalent	f = 40 to 550 MHz	0.2	2.2	dB
FL	flatness of frequency response	f = 40 to 550 MHz	–	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	19	–	dB
		f = 160 to 550 MHz	18	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	19	–	dB
		f = 160 to 550 MHz	18	–	dB
S_{21}	phase response	f = 50 MHz	−45	+45	deg
CTB	composite triple beat	77 channels flat; V_o = 44 dBmV; measured at 547.25 MHz	–	−69	dB
X_{mod}	cross modulation	77 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	−62	dB
CSO	composite second order distortion	77 channels flat; V_o = 44 dBmV; measured at 548.5 MHz	–	−66	dB
d_2	second order distortion	note 1	–	−78	dB
V_o	output voltage	d_{im} = −60 dB; note 2	67	–	dBmV
F	noise figure	f = 50 MHz	–	5.5	dB
		f = 550 MHz	–	7	dB
I_{tot}	total current consumption (DC)	note 3	–	440	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 493.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 548.5 MHz.
2. f_p = 540.25 MHz; $V_p = V_o$;
   f_q = 547.25 MHz; $V_q = V_o$ −6 dB;
   f_r = 549.25 MHz; $V_r = V_o$ −6 dB;
   measured at $f_p + f_q - f_r$ = 538.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

CHARACTERISTICS

Bandwidth 40 to 450 MHz; V_B = 24 V; T_{case} = 35 °C; Z_S = Z_L = 75 Ω.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	17.5	18.5	dB
		f = 450 MHz	18.1	–	dB
SL	slope cable equivalent	f = 40 to 450 MHz	0.2	1.8	dB
FL	flatness of frequency response	f = 40 to 450 MHz	–	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	19	–	dB
		f = 160 to 450 MHz	18	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	19	–	dB
		f = 160 to 450 MHz	18	–	dB
S_{21}	phase response	f = 50 MHz	–45	+45	deg
CTB	composite triple beat	60 channels flat; V_o = 46 dBmV; measured at 445.25 MHz	–	–68	dB
X_{mod}	cross modulation	60 channels flat; V_o = 46 dBmV; measured at 55.25 MHz	–	–59	dB
CSO	composite second order distortion	60 channels flat; V_o = 46 dBmV measured at 446.5 MHz	–	–66	dB
d_2	second order distortion	note 1	–	–80	dB
V_o	output voltage	d_{im} = –60 dB; note 2	67	–	dBmV
F	noise figure	f = 50 MHz	–	5.5	dB
		f = 450 MHz	–	6.5	dB
I_{tot}	total current consumption (DC)	note 3	–	440	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 391.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 446.5 MHz.
2. f_p = 440.25 MHz; $V_p = V_o$;
   f_q = 447.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 449.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 438.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

CATV amplifier modules | BGD702; BGD702MI

FEATURES

- Excellent linearity
- Extremely low noise
- Silicon nitride passivation
- Rugged construction
- Gold metallization ensures excellent reliability.

DESCRIPTION

Hybrid amplifier modules designed for CATV systems operating over a frequency range of 40 to 750 MHz at a voltage supply of 24 V (DC). Both modules are electrically identical, only the pinning is different.

PINNING - SOT115J

PIN	DESCRIPTION	
	BGD702	BGD702MI
1	input	output
2	common	common
3	common	common
5	$+V_B$	$+V_B$
7	common	common
8	common	common
9	output	input

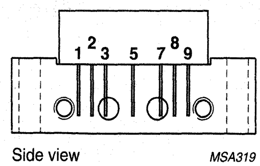


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	19	dB
		f = 750 MHz	18.5	–	dB
I_{tot}	total current consumption (DC)	V_B = 24 V	–	435	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_i	RF input voltage	–	65	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	operating mounting base temperature	–20	+100	°C

CHARACTERISTICS

Table 1 Bandwidth 40 to 750 MHz; V_B = 24 V; T_{mb} = 35 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	18.5	19	dB
		f = 750 MHz	18.5	19.7	–	dB
SL	slope cable equivalent	f = 40 to 750 MHz	0.2	1.3	2	dB
FL	flatness of frequency response	f = 40 to 750 MHz	–	±0.2	±0.5	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	27	–	dB
		f = 80 to 160 MHz	19	30	–	dB
		f = 160 to 320 MHz	18	29	–	dB
		f = 320 to 640 MHz	17	22	–	dB
		f = 640 to 750 MHz	16	21	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	23	–	dB
		f = 80 to 160 MHz	19	24	–	dB
		f = 160 to 320 MHz	18	23	–	dB
		f = 320 to 640 MHz	17	21	–	dB
		f = 640 to 750 MHz	16	21	–	dB
S_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	110 channels flat; V_o = 44 dBmV; measured at 745.25 MHz	–	–59	–58	dB
X_{mod}	cross modulation	110 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–64	–62	dB
CSO	composite second order distortion	110 channels flat; V_o = 44 dBmV; measured at 746.5 MHz	–	–63	–58	dB
d_2	second order distortion	note 1	–	–78	–68	dB
V_o	output voltage	d_{im} = –60 dB; note 2	61	64	–	dBmV
F	noise figure	f = 50 MHz	–	4.5	5.5	dB
		f = 450 MHz	–	–	6.5	dB
		f = 550 MHz	–	–	6.5	dB
		f = 600 MHz	–	–	7	dB
		f = 750 MHz	–	6.5	8.5	dB
I_{tot}	total current consumption (DC)	note 3	–	425	435	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 691.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 746.5 MHz.
2. Measured according to DIN45004B:
   f_p = 740.25 MHz; $V_p = V_o$;
   f_q = 747.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 749.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 738.25 MHz.
3. The modules normally operate at V_B = 24 V, but are able to withstand supply transients up to 30 V.

Table 2 Bandwidth 40 to 600 MHz; V_B = 24 V; T_{mb} = 35 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	18.5	19	dB
		f = 600 MHz	18.5	19.4	–	dB
SL	slope cable equivalent	f = 40 to 600 MHz	0.2	–	2	dB
FL	flatness of frequency response	f = 40 to 600 MHz	–	–	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	27	–	dB
		f = 80 to 160 MHz	19	30	–	dB
		f = 160 to 320 MHz	18	29	–	dB
		f = 320 to 600 MHz	17	22	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	23	–	dB
		f = 80 to 160 MHz	19	24	–	dB
		f = 160 to 320 MHz	18	23	–	dB
		f = 320 to 600 MHz	17	21	–	dB
S_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	85 channels flat; V_o = 44 dBmV; measured at 595.25 MHz	–	–66	–65	dB
X_{mod}	cross modulation	85 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–66	–65	dB
CSO	composite second order distortion	85 channels flat; V_o = 44 dBmV; measured at 596.5 MHz	–	–68	–60	dB
d_2	second order distortion	note 1	–	–80	–70	dB
V_o	output voltage	d_{im} = –60 dB; note 2	64	67	–	dBmV
F	noise figure	see Table 1	–	–	–	dB
I_{tot}	total current consumption (DC)	note 3	–	425	435	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 541.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 596.5 MHz.
2. Measured according to DIN45004B:
   f_p = 590.25 MHz; $V_p = V_o$;
   f_q = 597.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 599.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 588.25 MHz.
3. The modules normally operate at V_B = 24 V, but are able to withstand supply transients up to 30 V.

Table 3 Bandwidth 40 to 550 MHz; V_B = 24 V; T_{mb} = 35 °C; Z_S = Z_L = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	18.5	19	dB
		f = 550 MHz	18.5	19.3	–	dB
SL	slope cable equivalent	f = 40 to 550 MHz	0.2	–	2	dB
FL	flatness of frequency response	f = 40 to 550 MHz	–	–	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	27	–	dB
		f = 80 to 160 MHz	19	30	–	dB
		f = 160 to 320 MHz	18	29	–	dB
		f = 320 to 550 MHz	17	22	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	23	–	dB
		f = 80 to 160 MHz	19	24	–	dB
		f = 160 to 320 MHz	18	23	–	dB
		f = 320 to 550 MHz	17	21	–	dB
S_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	77 channels flat; V_o = 44 dBmV; measured at 547.25 MHz	–	–68	–67	dB
X_{mod}	cross modulation	77 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–68	–67	dB
CSO	composite second order distortion	77 channels flat; V_o = 44 dBmV; measured at 548.5 MHz	–	–68	–62	dB
d_2	second order distortion	note 1	–	–81	–72	dB
V_o	output voltage	d_{im} = –60 dB; note 2	64.5	68	–	dBmV
F	noise figure	see Table 1	–	–	–	dB
I_{tot}	total current consumption (DC)	note 3	–	425	435	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 493.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 548.5 MHz.
2. Measured according to DIN45004B:
   f_p = 540.25 MHz; $V_p = V_o$;
   f_q = 547.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 549.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 538.25 MHz.
3. The modules normally operate at V_B = 24 V, but are able to withstand supply transients up to 30 V.

Table 4 Bandwidth 40 to 450 MHz; V_B = 24 V; T_{mb} = 35 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	18.5	19	dB
		f = 450 MHz	18.5	19.2	–	dB
SL	slope cable equivalent	f = 40 to 450 MHz	0.2	–	2	dB
FL	flatness of frequency response	f = 40 to 450 MHz	–	–	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	27	–	dB
		f = 80 to 160 MHz	19	30	–	dB
		f = 160 to 320 MHz	18	29	–	dB
		f = 320 to 450 MHz	17	22	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	23	–	dB
		f = 80 to 160 MHz	19	24	–	dB
		f = 160 to 320 MHz	18	23	–	dB
		f = 320 to 450 MHz	17	21	–	dB
S_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	60 channels flat; V_o = 46 dBmV; measured at 445.25 MHz	–	–	–68	dB
X_{mod}	cross modulation	60 channels flat; V_o = 46 dBmV; measured at 55.25 MHz	–	–	–65	dB
CSO	composite second order distortion	60 channels flat; V_o = 46 dBmV measured at 446.5 MHz	–	–	–65	dB
d_2	second order distortion	note 1	–	–	–75	dB
V_o	output voltage	d_{im} = –60 dB; note 2	67	–	–	dBmV
F	noise figure	see Table 1	–	–	–	dB
I_{tot}	total current consumption (DC)	note 3	–	425	435	mA

Notes

1. f_p = 55.25 MHz; V_p = 46 dBmV;
   f_q = 391.25 MHz; V_q = 46 dBmV;
   measured at $f_p + f_q$ = 446.5 MHz.
2. Measured according to DIN45004B:
   f_p = 440.25 MHz; $V_p = V_o$;
   f_q = 447.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 449.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 438.25 MHz.
3. The modules normally operate at V_B = 24 V, but are able to withstand supply transients up to 30 V.

CATV amplifier module BGD702D

FEATURES

- Excellent linearity
- Extremely low noise
- Silicon nitride passivation
- Rugged construction
- Gold metallization ensures excellent reliability.

APPLICATIONS

CATV systems in the 40 to 750 MHz frequency range.

DESCRIPTION

Hybrid high dynamic range cascode amplifier module with darlington pre-stage dies operating at a voltage supply of 24 V (DC).

PINNING - SOT115J

PIN	DESCRIPTION
1	input
2	common
3	common
5	$+V_B$
7	common
8	common
9	output

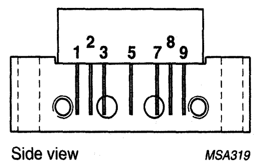


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	19	dB
		f = 750 MHz	20	–	dB
I_{tot}	total current consumption (DC)	V_B = 24 V	400	435	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_B	supply voltage	–	25	V
V_i	RF input voltage	–	65	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	operating mounting base temperature	–20	+100	°C

CHARACTERISTICS

Table 1 Bandwidth 40 to 750 MHz; V_B = 24 V; T_{case} = 35 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	19	dB
		f = 750 MHz	20	–	dB
SL	slope cable equivalent	f = 40 to 750 MHz	2	4	dB
FL	flatness of frequency response	f = 40 to 750 MHz	–	±0.5	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	18.5	–	dB
		f = 160 to 320 MHz	17	–	dB
		f = 320 to 640 MHz	15.5	–	dB
		f = 640 to 750 MHz	14	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	18.5	–	dB
		f = 160 to 320 MHz	17	–	dB
		f = 320 to 640 MHz	15.5	–	dB
		f = 640 to 750 MHz	14	–	dB
S_{21}	phase response	f = 50 MHz	–45	+45	deg
CTB	composite triple beat	110 channels flat; V_o = 44 dBmV; measured at 745.25 MHz	–	–62	dB
X_{mod}	cross modulation	110 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–59	dB
CSO	composite second order distortion	110 channels flat; V_o = 44 dBmV; measured at 746.5 MHz	–	–62	dB
d_2	second order distortion	note 1	–	–72	dB
V_o	output voltage	d_{im} = –60 dB; note 2	64	–	dBmV
F	noise figure	f = 50 MHz	–	5.5	dB
		f = 750 MHz	–	7	dB
I_{tot}	total current consumption (DC)	note 3	400	435	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 691.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 746.5 MHz.
2. Measured according to DIN45004B:
   f_p = 740.25 MHz; $V_p = V_o$;
   f_q = 747.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 749.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 738.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 2 Bandwidth 40 to 600 MHz; V_B = 24 V; T_{case} = 35 °C; Z_S = Z_L = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	19	dB
		f = 600 MHz	19.5	–	dB
SL	slope cable equivalent	f = 40 to 600 MHz	1.5	3.5	dB
FL	flatness of frequency response	f = 40 to 600 MHz	–	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	18.5	–	dB
		f = 160 to 320 MHz	17	–	dB
		f = 320 to 600 MHz	16	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	18.5	–	dB
		f = 160 to 320 MHz	17	–	dB
		f = 320 to 600 MHz	16	–	dB
S_{21}	phase response	f = 50 MHz	–45	+45	deg
CTB	composite triple beat	85 channels flat; V_o = 44 dBmV; measured at 595.25 MHz	–	–68	dB
X_{mod}	cross modulation	85 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–61	dB
CSO	composite second order distortion	85 channels flat; V_o = 44 dBmV; measured at 596.5 MHz	–	–62	dB
d_2	second order distortion	note 1	–	–74	dB
V_o	output voltage	d_{im} = –60 dB; note 2	68	–	dBmV
F	noise figure	f = 50 MHz	–	5.5	dB
		f = 600 MHz	–	6	dB
I_{tot}	total current consumption (DC)	note 3	400	435	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 541.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 596.5 MHz.
2. Measured according to DIN45004B:
   f_p = 590.25 MHz; $V_p = V_o$;
   f_q = 597.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 599.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 588.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 3 Bandwidth 40 to 550 MHz; V_B = 24 V; T_{case} = 35 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	19	dB
		f = 550 MHz	19	–	dB
SL	slope cable equivalent	f = 40 to 550 MHz	1	3	dB
FL	flatness of frequency response	f = 40 to 550 MHz	–	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	18.5	–	dB
		f = 160 to 320 MHz	17	–	dB
		f = 320 to 550 MHz	16	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	18.5	–	dB
		f = 160 to 320 MHz	17	–	dB
		f = 320 to 550 MHz	16	–	dB
S_{21}	phase response	f = 50 MHz	–45	+45	deg
CTB	composite triple beat	77 channels flat; V_o = 44 dBmV; measured at 547.25 MHz	–	–69	dB
X_{mod}	cross modulation	77 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–62	dB
CSO	composite second order distortion	77 channels flat; V_o = 44 dBmV; measured at 548.5 MHz	–	–66	dB
d_2	second order distortion	note 1	–	–78	dB
V_o	output voltage	d_{im} = –60 dB; note 2	69	–	dBmV
F	noise figure	f = 50 MHz	–	5.5	dB
		f = 550 MHz	–	5.5	dB
I_{tot}	total current consumption (DC)	note 3	400	435	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 493.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 548.5 MHz.
2. Measured according to DIN45004B:
   f_p = 540.25 MHz; $V_p = V_o$;
   f_q = 547.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 549.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 538.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

CATV amplifier module BGD704

FEATURES

- Excellent linearity
- Extremely low noise
- Silicon nitride passivation
- Rugged construction
- Gold metallization ensures excellent reliability.

APPLICATIONS

- CATV systems in the frequency range of 40 to 750 MHz.

DESCRIPTION

Hybrid amplifier module operating at a voltage supply of 24 V (DC) encapsulated in a SOT115J package.

PINNING - SOT115J

PIN	DESCRIPTION
1	input
2	common
3	common
5	$+V_B$
7	common
8	common
9	output

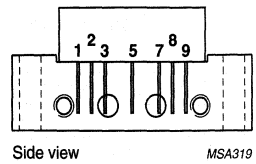


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	19.5	20.5	dB
		f = 750 MHz	20	–	dB
I_{tot}	total current consumption (DC)	V_B = 24 V	–	435	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_i	RF input voltage	–	65	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	operating mounting base temperature	–20	+100	°C

CHARACTERISTICS

Table 1 Bandwidth 40 to 750 MHz; V_B = 24 V; T_{mb} = 35 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	19.5	20	20.5	dB
		f = 750 MHz	20	21	–	dB
SL	slope cable equivalent	f = 40 to 750 MHz	0	1	2	dB
FL	flatness of frequency response	f = 40 to 750 MHz	–	±0.2	±0.5	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	31	–	dB
		f = 80 to 160 MHz	19	29	–	dB
		f = 160 to 320 MHz	18	25	–	dB
		f = 320 to 640 MHz	17	21	–	dB
		f = 640 to 750 MHz	16	21	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	26	–	dB
		f = 80 to 160 MHz	19	27	–	dB
		f = 160 to 320 MHz	18	26	–	dB
		f = 320 to 640 MHz	17	24	–	dB
		f = 640 to 750 MHz	16	23	–	dB
S_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	110 channels flat; V_o = 44 dBmV; measured at 745.25 MHz	–	–58	–57	dB
X_{mod}	cross modulation	110 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–63	–61	dB
CSO	composite second order distortion	110 channels flat; V_o = 44 dBmV; measured at 746.5 MHz	–	–61	–56	dB
d_2	second order distortion	note 1	–	–75	–66	dB
V_o	output voltage	d_{im} = –60 dB; note 2	60.5	63.5	–	dBmV
F	noise figure	f = 50 MHz	–	4.5	5	dB
		f = 450 MHz	–	–	6.5	dB
		f = 550 MHz	–	–	7	dB
		f = 600 MHz	–	–	7	dB
		f = 750 MHz	–	6.5	8.5	dB
I_{tot}	total current consumption (DC)	note 3	–	425	435	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 691.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 746.5 MHz.
2. Measured according to DIN45004B:
   f_p = 740.25 MHz; $V_p = V_o$;
   f_q = 747.25 MHz; $V_q = V_o$ –6 dB;

f_r = 749.25 MHz; V_r = V_o –6 dB;
measured at $f_p + f_q - f_r$ = 738.25 MHz.

3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 2 Bandwidth 40 to 600 MHz; V_B = 24 V; T_{mb} = 35 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	19.5	20	20.5	dB
		f = 600 MHz	20	20.7	–	dB
SL	slope cable equivalent	f = 40 to 600 MHz	0	–	2	dB
FL	flatness of frequency response	f = 40 to 600 MHz	–	–	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	31	–	dB
		f = 80 to 160 MHz	19	29	–	dB
		f = 160 to 320 MHz	18	25	–	dB
		f = 320 to 600 MHz	17	21	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	26	–	dB
		f = 80 to 160 MHz	19	27	–	dB
		f = 160 to 320 MHz	18	26	–	dB
		f = 320 to 600 MHz	17	24	–	dB
S_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	85 channels flat; V_o = 44 dBmV; measured at 595.25 MHz	–	–65	–64	dB
X_{mod}	cross modulation	85 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–65	–64	dB
CSO	composite second order distortion	85 channels flat; V_o = 44 dBmV; measured at 596.5 MHz	–	–66	–58	dB
d_2	second order distortion	note 1	–	–	–68	dB
V_o	output voltage	d_{im} = –60 dB; note 2	63	–	–	dBmV
F	noise figure	see Table 1	–	–	–	dB
I_{tot}	total current consumption (DC)	note 3	–	425	435	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
f_q = 541.25 MHz; V_q = 44 dBmV;
measured at $f_p + f_q$ = 596.5 MHz.
2. Measured according to DIN45004B:
f_p = 590.25 MHz; $V_p = V_o$;
f_q = 597.25 MHz; V_q = V_o –6 dB;
f_r = 599.25 MHz; V_r = V_o –6 dB;
measured at $f_p + f_q - f_r$ = 588.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 3 Bandwidth 40 to 550 MHz; V_B = 24 V; T_{mb} = 35 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	19.5	20	20.5	dB
		f = 550 MHz	20	20.6	–	dB
SL	slope cable equivalent	f = 40 to 550 MHz	0	–	2	dB
FL	flatness of frequency response	f = 40 to 550 MHz	–	–	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	31	–	dB
		f = 80 to 160 MHz	19	29	–	dB
		f = 160 to 320 MHz	18	25	–	dB
		f = 320 to 550 MHz	17	21	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	26	–	dB
		f = 80 to 160 MHz	19	27	–	dB
		f = 160 to 320 MHz	18	26	–	dB
		f = 320 to 550 MHz	17	24	–	dB
S_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	77 channels flat; V_o = 44 dBmV; measured at 547.25 MHz	–	–67	–66	dB
X_{mod}	cross modulation	77 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–67	–66	dB
CSO	composite second order distortion	77 channels flat; V_o = 44 dBmV; measured at 548.5 MHz	–	–67	–60	dB
d_2	second order distortion	note 1	–	–	–70	dB
V_o	output voltage	d_{im} = –60 dB; note 2	63.5	–	–	dBmV
F	noise figure	see Table 1	–	–	–	dB
I_{tot}	total current consumption (DC)	note 3	–	425	435	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 493.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 548.5 MHz.
2. Measured according to DIN45004B:
   f_p = 540.25 MHz; $V_p = V_o$;
   f_q = 547.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 549.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 538.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 4 Bandwidth 40 to 450 MHz; V_B = 24 V; T_{mb} = 35 °C; Z_S = Z_L = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	19.5	20	20.5	dB
		f = 450 MHz	20	20.6	–	dB
SL	slope cable equivalent	f = 40 to 450 MHz	0	–	2	dB
FL	flatness of frequency response	f = 40 to 450 MHz	–	–	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	31	–	dB
		f = 80 to 160 MHz	19	29	–	dB
		f = 160 to 320 MHz	18	25	–	dB
		f = 320 to 450 MHz	17	21	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	26	–	dB
		f = 80 to 160 MHz	19	27	–	dB
		f = 160 to 320 MHz	18	26	–	dB
		f = 320 to 450 MHz	17	25	–	dB
S_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	60 channels flat; V_o = 46 dBmV; measured at 445.25 MHz	–	–	–67	dB
X_{mod}	cross modulation	60 channels flat; V_o = 46 dBmV; measured at 55.25 MHz	–	–	–64	dB
CSO	composite second order distortion	60 channels flat; V_o = 46 dBmV measured at 446.5 MHz	–	–	–63	dB
d_2	second order distortion	note 1	–	–	–73	dB
V_o	output voltage	d_{im} = –60 dB; note 2	66	–	–	dBmV
F	noise figure	see Table 1	–	–	–	dB
I_{tot}	total current consumption (DC)	note 3	–	425	435	mA

Notes

1. f_p = 55.25 MHz; V_p = 46 dBmV;
   f_q = 391.25 MHz; V_q = 46 dBmV;
   measured at $f_p + f_q$ = 446.5 MHz.
2. Measured according to DIN45004B:
   f_p = 440.25 MHz; $V_p = V_o$;
   f_q = 447.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 449.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 438.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

CATV amplifier module BGD712

FEATURES

- Excellent linearity
- Extremely low noise
- Excellent return loss properties
- Silicon nitride passivation
- Rugged construction
- Gold metallization ensures excellent reliability.

APPLICATIONS

- CATV systems operating in the 40 to 750 MHz frequency range.

DESCRIPTION

Hybrid amplifier module in a SOT115J package operating with a voltage supply of 24 V (DC).

PINNING - SOT115J

PIN	DESCRIPTION
1	input
2, 3	common
5	$+V_B$
7, 8	common
9	output

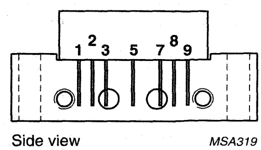


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 45 MHz	18.2	18.8	dB
		f = 750 MHz	19	20	dB
I_{tot}	total current consumption (DC)	V_B = 24 V	380	410	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_B	supply voltage	–	30	V
V_i	RF input voltage	–	70	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	operating mounting base temperature	–20	+100	°C

CHARACTERISTICS

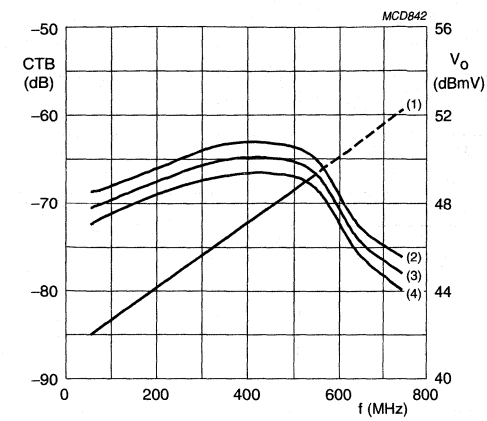
Bandwidth 40 to 750 MHz; V_B = 24 V; T_{mb} = 35 °C; Z_S = Z_L = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 45 MHz	18.2	18.5	18.8	dB
		f = 750 MHz	19	19.5	20	dB
SL	slope straight line	f = 45 to 750 MHz; note 1	0.5	1	1.5	dB
FL	flatness straight line	f = 45 to 100 MHz	–	–	±0.35	dB
		f = 100 to 700 MHz	–	–	±0.5	dB
		f = 700 to 750 MHz	–	–	±0.15	dB
S_{11}	input return losses	f = 45 to 80 MHz	23	–	–	dB
		f = 80 to 160 MHz	23	–	–	dB
		f = 160 to 320 MHz	21	–	–	dB
		f = 320 to 550 MHz	20	–	–	dB
		f = 550 to 650 MHz	20	–	–	dB
		f = 650 to 750 MHz	19	–	–	dB
		f = 750 to 790 MHz	17	–	–	dB
S_{22}	output return losses	f = 45 to 80 MHz	23	–	–	dB
		f = 80 to 160 MHz	23	–	–	dB
		f = 160 to 320 MHz	20	–	–	dB
		f = 320 to 550 MHz	20	–	–	dB
		f = 550 to 650 MHz	19	–	–	dB
		f = 650 to 750 MHz	19	–	–	dB
		f = 750 to 790 MHz	17	–	–	dB
S_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	112 channels flat; V_o = 44 dBmV; f_m = 745.25 MHz	–	–	–62	dB
		79 channels flat; V_o = 44 dBmV; f_m = 547.25 MHz	–	–	–68	dB
		79 channels; f_m = 445.25 MHz; V_o = 49.3 dBmV at 547 MHz; note 2	–	–	–63	dB
X_{mod}	cross modulation	112 channels flat; V_o = 44 dBmV; f_m = 55.25 MHz	–	–	–63	dB
		79 channels flat; V_o = 44 dBmV; f_m = 55.25 MHz	–	–	–69	dB
		79 channels; f_m = 745.25 MHz; V_o = 49.3 dBmV at 547 MHz; note 2	–	–	–60	dB

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
CSO	composite second order distortion	112 channels flat; V_o = 44 dBmV; f_m = 746.5 MHz	–	–	−63	dB
		79 channels flat; V_o = 44 dBmV; f_m = 548.5 MHz	–	–	−68	dB
		79 channels; f_m = 746.5 MHz; V_o = 49.3 dBmV at 547 MHz; note 2	–	–	−62	dB
d_2	second order distortion	note 3	–	–	−74	dB
V_o	output voltage	d_{im} = −60 dB; note 4	64	–	–	dBmV
NF	noise figure	f = 50 MHz	–	–	5.5	dB
		f = 550 MHz	–	–	5.5	dB
		f = 750 MHz	–	–	7	dB
I_{tot}	total current consumption (DC)	note 5	380	395	410	mA

Notes

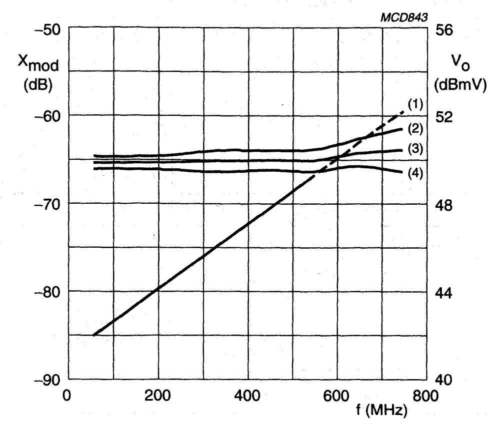
1. Slope straight line is defined as gain at 750 MHz – gain at 45 MHz.
2. Tilt = 7.3 dB (55 to 547 MHz).
3. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 691.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 746.5 MHz.
4. Measured according to DIN45004B:
   f_p = 740.25 MHz; $V_p = V_o$;
   f_q = 747.25 MHz; $V_q = V_o$ −6 dB;
   f_r = 749.25 MHz; $V_r = V_o$ −6 dB;
   measured at $f_p + f_q - f_r$ = 738.25 MHz.
5. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 79 channels;
tilt = 7.3 dB (50 to 550 MHz).

(1) V_o.
(2) Typ. +3 σ.
(3) Typ.
(4) Typ. −3 σ.

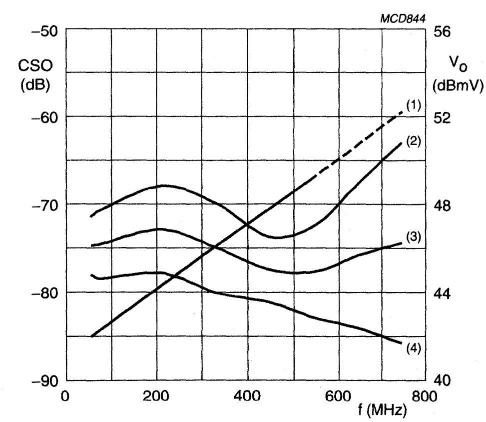
Fig.2 Composite triple beat as a function of frequency under tilted conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 79 channels;
tilt = 7.3 dB (50 to 550 MHz).

(1) V_o.
(2) Typ. +3 σ.
(3) Typ.
(4) Typ. −3 σ.

Fig.3 Cross modulation as a function of frequency under tilted conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 79 channels;
tilt = 7.3 dB (50 to 550 MHz).

(1) V_o.
(2) Typ. +3 σ.
(3) Typ.
(4) Typ. −3 σ.

Fig.4 Composite second order distortion as a function of frequency under tilted conditions.

CATV amplifier module BGD714

FEATURES

- Excellent linearity
- Extremely low noise
- Excellent return loss properties
- Silicon nitride passivation
- Rugged construction
- Gold metallization ensures excellent reliability.

APPLICATIONS

- CATV systems operating in the 40 to 750 MHz frequency range.

DESCRIPTION

Hybrid amplifier module in a SOT115J package operating with a voltage supply of 24 V (DC).

PINNING - SOT115J

PIN	DESCRIPTION
1	input
2, 3	common
5	$+V_B$
7, 8	common
9	output

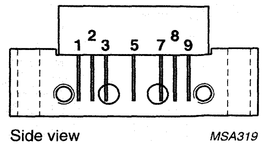


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 45 MHz	20	20.6	dB
		f = 750 MHz	20.8	21.8	dB
I_{tot}	total current consumption (DC)	V_B = 24 V	380	410	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_B	supply voltage	–	30	V
V_i	RF input voltage	–	70	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	operating mounting base temperature	–20	+100	°C

CATV amplifier module BGD714

CHARACTERISTICS

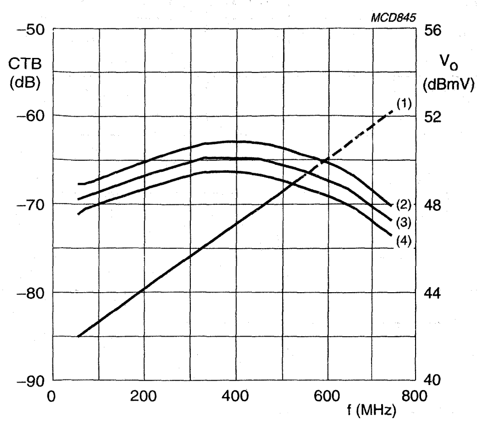
Bandwidth 40 to 750 MHz; V_B = 24 V; T_{mb} = 35 °C; Z_S = Z_L = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 45 MHz	20	20.3	20.6	dB
		f = 750 MHz	20.8	21.3	21.8	dB
SL	slope straight line	f = 45 to 100 MHz; note 1	0.5	1	1.5	dB
FL	flatness straight line	f = 45 to 100 MHz	–	–	±0.35	dB
		f = 100 to 700 MHz	–	–	±0.5	dB
		f = 700 to 750 MHz	–	–	±0.15	dB
S_{11}	input return losses	f = 45 to 80 MHz	23	–	–	dB
		f = 80 to 160 MHz	23	–	–	dB
		f = 160 to 320 MHz	21	–	–	dB
		f = 320 to 550 MHz	20	–	–	dB
		f = 550 to 650 MHz	20	–	–	dB
		f = 650 to 750 MHz	19	–	–	dB
		f = 750 to 790 MHz	17	–	–	dB
S_{22}	output return losses	f = 45 to 80 MHz	23	–	–	dB
		f = 80 to 160 MHz	23	–	–	dB
		f = 160 to 320 MHz	20	–	–	dB
		f = 320 to 550 MHz	20	–	–	dB
		f = 550 to 650 MHz	20	–	–	dB
		f = 650 to 750 MHz	19	–	–	dB
		f = 750 to 790 MHz	17	–	–	dB
S_{21}	phase response	f = 50 MHz	−45	–	+45	deg
CTB	composite triple beat	112 channels flat; V_o = 44 dBmV; f_m = 745.25 MHz	–	–	−61	dB
		79 chs channels; V_o = 44 dBmV; f_m = 547.25 MHz	–	–	−67	dB
		79 channels; f_m = 445.25 MHz; V_o = 49.3 dBmV at 547 MHz; note 2	–	–	−62	dB
X_{mod}	cross modulation	112 channels flat; V_o = 44 dBmV; f_m = 55.25 MHz	–	–	−62	dB
		79 channels flat; V_o = 44 dBmV; f_m = 55.25 MHz	–	–	−66	dB
		79 channels; f_m = 745.25 MHz; V_o = 49.3 dBmV at 547 MHz; note 2	–	–	−58	dB

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
CSO	composite second order distortion	112 channels flat; V_o = 44 dBmV; f_m = 746.5 MHz	–	–	–62	dB
		79 channels flat; V_o = 44 dBmV; f_m = 548.5 MHz	–	–	–67	dB
		79 channels; f_m = 746.5 MHz; V_o = 49.3 dBmV at 547 MHz; note 2	–	–	–60	dB
d_2	second order distortion	note 3	–	–	–74	dB
V_o	output voltage	d_{im} = –60 dB; note 4	64	–	–	dBmV
NF	noise figure	f = 50 MHz	–	–	5.5	dB
		f = 550 MHz	–	–	5.5	dB
		f = 750 MHz	–	–	7	dB
I_{tot}	total current consumption (DC)	note 5	380	395	410	mA

Notes

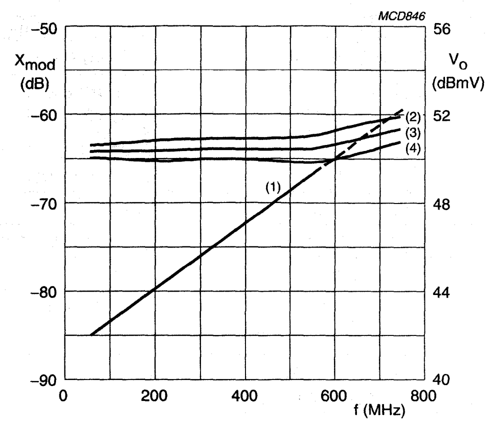
1. Slope straight line is defined as gain at 750 MHz – gain at 45 MHz.
2. Tilt = 7.3 dB (55 to 547 MHz).
3. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 691.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 746.5 MHz.
4. Measured according to DIN45004B:
   f_p = 740.25 MHz; $V_p = V_o$;
   f_q = 747.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 749.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 738.25 MHz.
5. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 79 channels;
tilt = 7.3 dB (50 to 550 MHz).

(1) V_o. (3) Typ.
(2) Typ. +3 σ. (4) Typ. −3 σ.

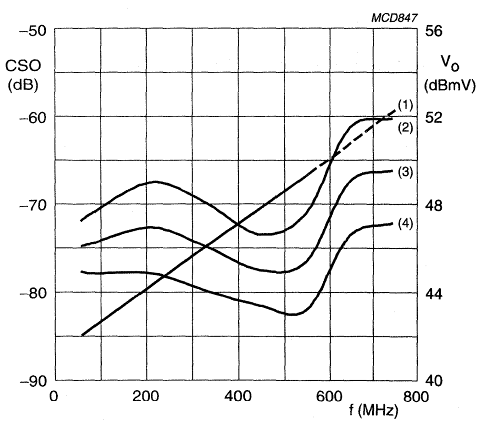
Fig.2 Composite triple beat as a function of frequency under tilted conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 79 channels;
tilt = 7.3 dB (50 to 550 MHz).

(1) V_o. (3) Typ.
(2) Typ. +3 σ. (4) Typ. −3 σ.

Fig.3 Cross modulation as a function of frequency under tilted conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 79 channels;
tilt = 7.3 dB (50 to 550 MHz).

(1) V_o. (3) Typ.
(2) Typ. +3 σ. (4) Typ. −3 σ.

Fig.4 Composite second order distortion as a function of frequency under tilted conditions.

CATV amplifier modules BGD802; BGD802MI

FEATURES

- Excellent linearity
- Extremely low noise
- Excellent return loss properties
- Silicon nitride passivation
- Rugged construction
- Gold metallization ensures excellent reliability.

APPLICATIONS

- CATV systems operating in the 40 to 860 MHz frequency range.

DESCRIPTION

Hybrid amplifier modules in a SOT115J package operating with a voltage supply of 24 V (DC).
Both modules are electrically identical, only the pinning is different.

PINNING - SOT115J

PIN	DESCRIPTION	
	BGD802	BGD802MI
1	input	output
2	common	common
3	common	common
5	$+V_B$	$+V_B$
7	common	common
8	common	common
9	output	input

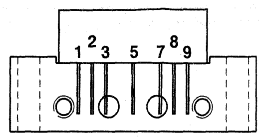


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	19	dB
		f = 860 MHz	18.5	–	dB
I_{tot}	total current consumption (DC)	V_B = 24 V	–	410	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_B	supply voltage	–	25	V
V_i	RF input voltage	–	65	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	operating mounting base temperature	–20	+100	°C

CHARACTERISTICS

Table 1 Bandwidth 40 to 860 MHz; V_B = 24 V; T_{case} = 35 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	18.5	19	dB
		f = 860 MHz	18.5	19.5	–	dB
SL	slope cable equivalent	f = 40 to 860 MHz	0.2	1.1	2	dB
FL	flatness of frequency response	f = 40 to 860 MHz	–	±0.2	±0.5	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	35	–	dB
		f = 80 to 160 MHz	18.5	31	–	dB
		f = 160 to 320 MHz	17	27	–	dB
		f = 320 to 640 MHz	15.5	22	–	dB
		f = 640 to 860 MHz	14	20	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	29.5	–	dB
		f = 80 to 160 MHz	18.5	29	–	dB
		f = 160 to 320 MHz	17	25.5	–	dB
		f = 320 to 640 MHz	15.5	23	–	dB
		f = 640 to 860 MHz	14	22	–	dB
S_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	49 channels flat; V_o = 47 dBmV; measured at 859.25 MHz	–	–66	–63	dB
X_{mod}	cross modulation	49 channels flat; V_o = 47 dBmV; measured at 55.25 MHz	–	–65	–62	dB
CSO	composite second order distortion	49 channels flat; V_o = 47 dBmV; measured at 860.5 MHz	–	–67.5	–60	dB
d_2	second order distortion	note 1	–	–75	–69	dB
V_o	output voltage	d_{im} = –60 dB; note 2	61.5	63.5	–	dBmV
F	noise figure	f = 50 MHz	–	4.5	5.5	dB
		f = 550 MHz	–	–	6	dB
		f = 650 MHz	–	–	7	dB
		f = 750 MHz	–	–	7.5	dB
		f = 860 MHz	–	6.5	9	dB
I_{tot}	total current consumption (DC)	note 3	–	395	410	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 805.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 860.5 MHz.
2. Measured according to DIN45004B:
   f_p = 851.25 MHz; $V_p = V_o$;
   f_q = 858.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 860.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 849.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 2 Bandwidth 40 to 860 MHz; V_B = 24 V; T_{case} = 30 °C; Z_S = Z_L = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	18.5	19	dB
		f = 860 MHz	18.5	19.5	–	dB
SL	slope cable equivalent	f = 40 to 860 MHz	0.2	1.1	2	dB
FL	flatness of frequency response	f = 40 to 860 MHz	–	±0.2	±0.5	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	35	–	dB
		f = 80 to 160 MHz	18.5	31	–	dB
		f = 160 to 320 MHz	17	27	–	dB
		f = 320 to 640 MHz	15.5	22	–	dB
		f = 640 to 860 MHz	14	20	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	29.5	–	dB
		f = 80 to 160 MHz	18.5	29	–	dB
		f = 160 to 320 MHz	17	25.5	–	dB
		f = 320 to 640 MHz	15.5	23	–	dB
		f = 640 to 860 MHz	14	22	–	dB
S_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	129 channels flat; V_o = 44 dBmV; measured at 859.25 MHz	–	–56.5	–54	dB
X_{mod}	cross modulation	129 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–61	–59	dB
CSO	composite second order distortion	129 channels flat; V_o = 44 dBmV; measured at 860.5 MHz	–	–64.5	–56	dB
d_2	second order distortion	note 1	–	–75	–69	dB
V_o	output voltage	d_{im} = –60 dB; note 2	61.5	63	–	dBmV
F	noise figure	see Table 1	–	–	–	dB
I_{tot}	total current consumption (DC)	note 3	–	395	410	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 805.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 860.5 MHz.
2. Measured according to DIN45004B:
   f_p = 851.25 MHz; $V_p = V_o$;
   f_q = 858.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 860.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 849.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 3 Bandwidth 40 to 750 MHz; V_B = 24 V; T_{case} = 30 °C; Z_S = Z_L = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	18.5	19	dB
		f = 750 MHz	18.5	19.4	–	dB
SL	slope cable equivalent	f = 40 to 750 MHz	0.2	–	2	dB
FL	flatness of frequency response	f = 40 to 750 MHz	–	–	±0.5	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	35	–	dB
		f = 80 to 160 MHz	18.5	31	–	dB
		f = 160 to 320 MHz	17	27	–	dB
		f = 320 to 640 MHz	15.5	22	–	dB
		f = 640 to 750 MHz	14	20	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	29.5	–	dB
		f = 80 to 160 MHz	18.5	29	–	dB
		f = 160 to 320 MHz	17	25.5	–	dB
		f = 320 to 640 MHz	15.5	23	–	dB
		f = 640 to 750 MHz	14	22	–	dB
S_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	110 channels flat; V_o = 44 dBmV; measured at 745.25 MHz	–	–60.5	–58	dB
X_{mod}	cross modulation	110 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–62.5	–60	dB
CSO	composite second order distortion	110 channels flat; V_o = 44 dBmV; measured at 746.5 MHz	–	–66	–60	dB
d_2	second order distortion	note 1	–	–	–72	dB
V_o	output voltage	d_{im} = –60 dB; note 2	64	–	–	dBmV
F	noise figure	see Table 1	–	–	–	dB
I_{tot}	total current consumption (DC)	note 3	–	395	410	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 691.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 746.5 MHz.
2. Measured according to DIN45004B:
   f_p = 740.25 MHz; $V_p = V_o$;
   f_q = 747.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 749.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 738.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 4 Bandwidth 40 to 550 MHz; V_B = 24 V; T_{case} = 30 °C; Z_S = Z_L = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	18.5	19	dB
		f = 550 MHz	18.5	19.3	–	dB
SL	slope cable equivalent	f = 40 to 550 MHz	0.2	–	2	dB
FL	flatness of frequency response	f = 40 to 550 MHz	–	–	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	35	–	dB
		f = 80 to 160 MHz	18.5	31	–	dB
		f = 160 to 320 MHz	17	27	–	dB
		f = 320 to 550 MHz	16	22	–	dB
S_{22}	input return losses	f = 40 to 80 MHz	20	29.5	–	dB
		f = 80 to 160 MHz	18.5	29	–	dB
		f = 160 to 320 MHz	17	25.5	–	dB
		f = 320 to 550 MHz	16	23	–	dB
S_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	77 channels flat; V_o = 44 dBmV; measured at 547.25 MHz	–	–67	–65	dB
X_{mod}	cross modulation	77 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–66	–63	dB
CSO	composite second order distortion	77 channels flat; V_o = 44 dBmV; measured at 548.5 MHz	–	–67	–63	dB
d_2	second order distortion	note 1	–	–	–72	dB
V_o	output voltage	d_{im} = –60 dB; note 2	65	–	–	dBmV
F	noise figure	see Table 1	–	–	–	dB
I_{tot}	total current consumption (DC)	note 3	–	395	410	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 493.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 548.5 MHz.
2. Measured according to DIN45004B:
   f_p = 540.25 MHz; $V_p = V_o$;
   f_q = 547.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 549.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 538.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

CATV amplifier module | BGD802N

FEATURES

- Extremely flat gain response
- Excellent linearity
- Extremely low noise
- Excellent return loss properties
- Silicon nitride passivation
- Rugged construction
- Gold metallization ensures excellent reliability.

APPLICATIONS

- CATV systems operating in the 40 to 860 MHz frequency range.

DESCRIPTION

Hybrid amplifier module in a SOT115J package operating at a supply voltage of 24 V (DC).

PINNING - SOT115J

PIN	DESCRIPTION
1	input
2	common
3	common
5	$+V_B$
7	common
8	common
9	output

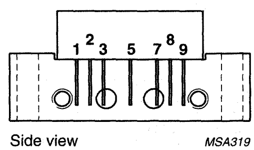


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	19	dB
		f = 860 MHz	18.5	–	dB
I_{tot}	total current consumption (DC)	V_B = 24 V	–	410	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_B	supply voltage	–	25	V
V_i	RF input voltage	–	65	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	operating mounting base temperature	–20	+100	°C

CHARACTERISTICS

Table 1 Bandwidth 40 to 860 MHz; V_B = 24 V; T_{case} = 35 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	18.5	19	dB
		f = 860 MHz	18.5	19.5	–	dB
SL	slope cable equivalent	f = 40 to 860 MHz	0.2	0.9	2	dB
FL	flatness of frequency response	f = 40 to 860 MHz	–	±0.1	±0.25	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	32	–	dB
		f = 80 to 160 MHz	18.5	27	–	dB
		f = 160 to 320 MHz	17	24	–	dB
		f = 320 to 640 MHz	15.5	22	–	dB
		f = 640 to 860 MHz	14	20.5	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	33	–	dB
		f = 80 to 160 MHz	18.5	29	–	dB
		f = 160 to 860 MHz	17	22	–	dB
S_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	49 channels flat; V_o = 47 dBmV; measured at 859.25 MHz	–	–65	–63	dB
X_{mod}	cross modulation	49 channels flat; V_o = 47 dBmV; measured at 55.25 MHz	–	–64	–62	dB
CSO	composite second order distortion	49 channels flat; V_o = 47 dBmV; measured at 860.5 MHz	–	–68	–60	dB
d_2	second order distortion	note 1	–	–75	–69	dB
V_o	output voltage	d_{im} = –60 dB; note 2	61.5	63.5	–	dBmV
F	noise figure	f = 50 MHz	–	4.5	5.5	dB
		f = 550 MHz	–	–	6	dB
		f = 650 MHz	–	–	7	dB
		f = 750 MHz	–	–	7.5	dB
		f = 860 MHz	–	6.5	9	dB
I_{tot}	total current consumption (DC)	note 3	–	395	410	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 805.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 860.5 MHz.
2. Measured according to DIN45004B:
   f_p = 851.25 MHz; $V_p = V_o$;
   f_q = 858.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 860.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 849.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 2 Bandwidth 40 to 860 MHz; V_B = 24 V; T_{case} = 30 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	18.5	19	dB
		f = 860 MHz	18.5	19.5	–	dB
SL	slope cable equivalent	f = 40 to 860 MHz	0.2	0.9	2	dB
FL	flatness of frequency response	f = 40 to 860 MHz	–	±0.1	±0.25	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	32	–	dB
		f = 80 to 160 MHz	18.5	27	–	dB
		f = 160 to 320 MHz	17	24	–	dB
		f = 320 to 640 MHz	15.5	22	–	dB
		f = 640 to 860 MHz	14	20.5	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	33	–	dB
		f = 80 to 160 MHz	18.5	29	–	dB
		f = 160 to 860 MHz	17	22	–	dB
S_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	129 channels flat; V_o = 44 dBmV; measured at 859.25 MHz	–	–	–54	dB
X_{mod}	cross modulation	129 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–	–59	dB
CSO	composite second order distortion	129 channels flat; V_o = 44 dBmV; measured at 860.5 MHz	–	–	–56	dB
d_2	second order distortion	note 1	–	–75	–69	dB
V_o	output voltage	d_{im} = –60 dB; note 2	61.5	63.5	–	dBmV
F	noise figure	see Table 1	–	–	–	dB
I_{tot}	total current consumption (DC)	note 3	–	395	410	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 805.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 860.5 MHz.
2. Measured according to DIN45004B:
   f_p = 851.25 MHz; $V_p = V_o$;
   f_q = 858.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 860.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 849.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 3 Bandwidth 40 to 750 MHz; V_B = 24 V; T_{case} = 30 °C; Z_S = Z_L = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	18.5	19	dB
		f = 750 MHz	18.5	–	–	dB
SL	slope cable equivalent	f = 40 to 750 MHz	0.2	–	2	dB
FL	flatness of frequency response	f = 40 to 750 MHz	–	–	±0.25	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	32	–	dB
		f = 80 to 160 MHz	18.5	27	–	dB
		f = 160 to 320 MHz	17	24	–	dB
		f = 320 to 640 MHz	15.5	22	–	dB
		f = 640 to 750 MHz	14	20.5	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	33	–	dB
		f = 80 to 160 MHz	18.5	29	–	dB
		f = 160 to 750 MHz	17	22	–	dB
S_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	110 channels flat; V_o = 44 dBmV; measured at 745.25 MHz	–	–	–59	dB
X_{mod}	cross modulation	110 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–	–60	dB
CSO	composite second order distortion	110 channels flat; V_o = 44 dBmV; measured at 746.5 MHz	–	–	–60	dB
d_2	second order distortion	note 1	–	–	–72	dB
V_o	output voltage	d_{im} = –60 dB; note 2	64	–	–	dBmV
F	noise figure	see Table 1	–	–	–	dB
I_{tot}	total current consumption (DC)	note 3	–	395	410	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 691.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 746.5 MHz.
2. Measured according to DIN45004B:
   f_p = 740.25 MHz; $V_p = V_o$;
   f_q = 747.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 749.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 738.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 4 Bandwidth 40 to 650 MHz; V_B = 24 V; T_{case} = 30 °C; Z_S = Z_L = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	18.5	19	dB
		f = 650 MHz	18.5	–	–	dB
SL	slope cable equivalent	f = 40 to 650 MHz	0.2	–	2	dB
FL	flatness of frequency response	f = 40 to 650 MHz	–	–	±0.2	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	32	–	dB
		f = 80 to 160 MHz	18.5	27	–	dB
		f = 160 to 320 MHz	17	24	–	dB
		f = 320 to 650 MHz	15	22	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	33	–	dB
		f = 80 to 160 MHz	18.5	29	–	dB
		f = 160 to 650 MHz	17	22	–	dB
S_{21}	phase response	f = 50 MHz	−45	–	+45	deg
CTB	composite triple beat	94 channels flat; V_o = 44 dBmV; measured at 649.25 MHz	–	–	−61	dB
X_{mod}	cross modulation	94 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–	−61	dB
CSO	composite second order distortion	94 channels flat; V_o = 44 dBmV; measured at 650.5 MHz	–	–	−62	dB
d_2	second order distortion	note 1	–	–	−72	dB
V_o	output voltage	d_{im} = −60 dB; note 2	65	–	–	dBmV
F	noise figure	see Table 1	–	–	–	dB
I_{tot}	total current consumption (DC)	note 3	–	395	410	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 595.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 650.5 MHz.
2. Measured according to DIN45004B:
   f_p = 640.25 MHz; $V_p = V_o$;
   f_q = 647.25 MHz; $V_q = V_o$ −6 dB;
   f_r = 649.25 MHz; $V_r = V_o$ −6 dB;
   measured at $f_p + f_q - f_r$ = 638.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 5 Bandwidth 40 to 550 MHz; V_B = 24 V; T_{case} = 30 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	18.5	19	dB
		f = 550 MHz	18.5	–	–	dB
SL	slope cable equivalent	f = 40 to 550 MHz	0.2	–	2	dB
FL	flatness of frequency response	f = 40 to 550 MHz	–	–	±0.2	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	32	–	dB
		f = 80 to 160 MHz	18.5	27	–	dB
		f = 160 to 320 MHz	17	24	–	dB
		f = 320 to 550 MHz	16	22	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	33	–	dB
		f = 80 to 160 MHz	18.5	29	–	dB
		f = 160 to 550 MHz	17	22	–	dB
S_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	77 channels flat; V_o = 44 dBmV; measured at 547.25 MHz	–	–	–65	dB
X_{mod}	cross modulation	77 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–	–63	dB
CSO	composite second order distortion	77 channels flat; V_o = 44 dBmV; measured at 548.5 MHz	–	–	–65	dB
d_2	second order distortion	note 1	–	–	–74	dB
V_o	output voltage	d_{im} = –60 dB; note 2	66	–	–	dBmV
F	noise figure	see Table 1	–	–	–	dB
I_{tot}	total current consumption (DC)	note 3	–	395	410	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 493.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 548.5 MHz.
2. Measured according to DIN45004B:
   f_p = 540.25 MHz; $V_p = V_o$;
   f_q = 547.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 549.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 538.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

CATV amplifier module BGD804

FEATURES

- Excellent linearity
- Extremely low noise
- Silicon nitride passivation
- Rugged construction
- Gold metallization ensures excellent reliability.

APPLICATIONS

CATV systems in the 40 to 860 MHz frequency range.

DESCRIPTION

Hybrid amplifier module in a SOT115J package operating at a voltage supply of 24 V (DC).

PINNING - SOT115J

PIN	DESCRIPTION
1	input
2	common
3	common
5	$+V_B$
7	common
8	common
9	output

PIN CONFIGURATION

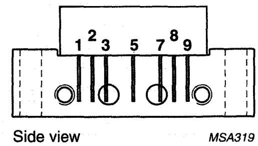


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	19.5	20.5	dB
		f = 860 MHz	20	–	dB
I_{tot}	total current consumption (DC)	V_B = 24 V	–	410	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_i	RF input voltage	–	65	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	mounting base operating temperature	–20	+100	°C
V_B	supply voltage	–	25	V

CHARACTERISTICS

Table 1 Bandwidth 40 to 860 MHz; V_B = 24 V; T_{case} = 35 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	19.5	20	20.5	dB
		f = 860 MHz	20	21	–	dB
SL	slope cable equivalent	f = 40 to 860 MHz	0.2	1.1	2	dB
FL	flatness of frequency response	f = 40 to 860 MHz	–	±0.2	±0.5	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	28	–	dB
		f = 80 to 160 MHz	18.5	23	–	dB
		f = 160 to 320 MHz	17	20	–	dB
		f = 320 to 640 MHz	15.5	20	–	dB
		f = 640 to 860 MHz	14	20	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	28.5	–	dB
		f = 80 to 160 MHz	18.5	28	–	dB
		f = 160 to 320 MHz	17	24	–	dB
		f = 320 to 640 MHz	15.5	19	–	dB
		f = 640 to 860 MHz	14	19	–	dB
S_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	49 channels flat; V_o = 47 dBmV; measured at 859.25 MHz	–	–64	–61	dB
X_{mod}	cross modulation	49 channels flat; V_o = 47 dBmV; measured at 55.25 MHz	–	–65.5	–62	dB
CSO	composite second order distortion	49 channels flat; V_o = 47 dBmV; measured at 860.5 MHz	–	–63	–58	dB
d_2	second order distortion	note 1	–	–73	–67	dB
V_o	output voltage	d_{im} = –60 dB; note 2	+60	–61.5	–	dBmV
F	noise figure	f = 50 MHz	–	4.5	5	dB
		f = 550 MHz	–	–	6	dB
		f = 650 MHz	–	–	6	dB
		f = 750 MHz	–	–	6.5	dB
		f = 860 MHz	–	6.5	7.5	dB
I_{tot}	total current consumption (DC)	note 3	–	395	410	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 805.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 860.5 MHz.
2. Measured according to DIN45004B;
   f_p = 851.25 MHz; $V_p = V_o$;
   f_q = 858.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 860.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 849.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 2 Bandwidth 40 to 860 MHz; V_B = 24 V; T_{case} = 35 °C; Z_S = Z_L = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	19.5	20	20.5	dB
		f = 860 MHz	20	21	–	dB
SL	slope cable equivalent	f = 40 to 860 MHz	0.2	1.1	2	dB
FL	flatness of frequency response	f = 40 to 860 MHz	–	±0.2	±0.5	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	28	–	dB
		f = 80 to 160 MHz	18.5	23	–	dB
		f = 160 to 320 MHz	17	20	–	dB
		f = 320 to 640 MHz	15.5	20	–	dB
		f = 640 to 860 MHz	14	20	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	28.5	–	dB
		f = 80 to 160 MHz	18.5	28	–	dB
		f = 160 to 320 MHz	17	24	–	dB
		f = 320 to 640 MHz	15.5	19	–	dB
		f = 640 to 860 MHz	14	19	–	dB
S_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	129 channels flat; V_o = 44 dBmV; measured at 859.25 MHz	–	–54	–53	dB
X_{mod}	cross modulation	129 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–62	–61	dB
CSO	composite second order distortion	129 channels flat; V_o = 44 dBmV; measured at 860.5 MHz	–	–60.5	–54	dB
d_2	second order distortion	note 1	–	–73	–67	dB
V_o	output voltage	d_{im} = –60 dB; note 2	+60	–61.5	–	dBmV
F	noise figure	see Table 1	–	–	–	dB
I_{tot}	total current consumption (DC)	note 3	–	395	410	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 805.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 860.5 MHz.
2. Measured according to DIN45004B;
   f_p = 851.25 MHz; $V_p = V_o$;
   f_q = 858.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 860.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 849.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 3 Bandwidth 40 to 750 MHz; V_B = 24 V; T_{case} = 35 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	19.5	20	20.5	dB
		f = 750 MHz	20	20.8	–	dB
SL	slope cable equivalent	f = 40 to 750 MHz	0.2	–	2	dB
FL	flatness of frequency response	f = 40 to 750 MHz	–	–	±0.45	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	28	–	dB
		f = 80 to 160 MHz	18.5	23	–	dB
		f = 160 to 320 MHz	17	20	–	dB
		f = 320 to 640 MHz	15.5	20	–	dB
		f = 640 to 750 MHz	14	20	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	28.5	–	dB
		f = 80 to 160 MHz	18.5	28	–	dB
		f = 160 to 320 MHz	17	24	–	dB
		f = 320 to 640 MHz	15.5	19	–	dB
		f = 640 to 750 MHz	14	19	–	dB
S_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	110 channels flat; V_o = 44 dBmV; measured at 745.25 MHz	–	–59	–57	dB
X_{mod}	cross modulation	110 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–64	–62	dB
CSO	composite second order distortion	110 channels flat; V_o = 44 dBmV; measured at 746.5 MHz	–	–62	–56	dB
d_2	second order distortion	note 1	–	–	–68	dB
V_o	output voltage	d_{im} = –60 dB; note 2	63	–	–	dBmV
F	noise figure	see Table 1	–	–	–	dB
I_{tot}	total current consumption (DC)	note 3	–	395	410	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 691.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 746.5 MHz.
2. Measured according to DIN45004B;
   f_p = 740.25 MHz; $V_p = V_o$;
   f_q = 747.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 749.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 738.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 4 Bandwidth 40 to 650 MHz; V_B = 24 V; T_{case} = 35 °C; Z_S = Z_L = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	19.5	20	20.5	dB
		f = 650 MHz	20	20.7	–	dB
SL	slope cable equivalent	f = 40 to 650 MHz	0.2	–	2	dB
FL	flatness of frequency response	f = 40 to 650 MHz	–	–	±0.35	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	28	–	dB
		f = 80 to 160 MHz	18.5	23	–	dB
		f = 160 to 320 MHz	17	20	–	dB
		f = 320 to 650 MHz	15	20	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	28.5	–	dB
		f = 80 to 160 MHz	18.5	28	–	dB
		f = 160 to 320 MHz	17	24	–	dB
		f = 320 to 650 MHz	15	19	–	dB
S_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	94 channels flat; V_o = 44 dBmV; measured at 649.25 MHz	–	–	–60	dB
X_{mod}	cross modulation	94 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–	–62	dB
CSO	composite second order distortion	94 channels flat; V_o = 44 dBmV; measured at 650.5 MHz	–	–	–58	dB
d_2	second order distortion	note 1	–	–	–69	dB
V_o	output voltage	d_{im} = –60 dB; note 2	65	–	–	dBmV
F	noise figure	see Table 1	–	–	–	dB
I_{tot}	total current consumption (DC)	note 3	–	395	410	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 595.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 650.5 MHz.
2. Measured according to DIN45004B;
   f_p = 640.25 MHz; $V_p = V_o$;
   f_q = 647.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 649.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 638.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 5 Bandwidth 40 to 550 MHz; V_B = 24 V; T_{case} = 35 °C; Z_S = Z_L = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	19.5	20	20.5	dB
		f = 550 MHz	20	20.6	–	dB
SL	slope cable equivalent	f = 40 to 550 MHz	0.2	–	2	dB
FL	flatness of frequency response	f = 40 to 550 MHz	–	–	±0.35	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	28	–	dB
		f = 80 to 160 MHz	18.5	23	–	dB
		f = 160 to 320 MHz	17	20	–	dB
		f = 320 to 550 MHz	16	20	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	28.5	–	dB
		f = 80 to 160 MHz	18.5	28	–	dB
		f = 160 to 320 MHz	17	24	–	dB
		f = 320 to 550 MHz	16	19	–	dB
S_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	77 channels flat; V_o = 44 dBmV; measured at 547.25 MHz	–	–66	–64	dB
X_{mod}	cross modulation	77 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–67	–64	dB
CSO	composite second order distortion	77 channels flat; V_o = 44 dBmV; measured at 548.5 MHz	–	–67	–62	dB
d_2	second order distortion	note 1	–	–	–72	dB
V_o	output voltage	d_{im} = –60 dB; note 2	66	–	–	dBmV
F	noise figure	see Table 1	–	–	–	dB
I_{tot}	total current consumption (DC)	note 3	–	395	410	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 493.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 548.5 MHz.
2. Measured according to DIN45004B;
   f_p = 540.25 MHz; $V_p = V_o$;
   f_q = 547.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 549.25 MHz; $V_r = V_o$– 6 dB;
   measured at $f_p + f_q - f_r$ = 538.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

CATV amplifier module | BGD804N

FEATURES

- Extremely flat gain response
- Excellent linearity
- Extremely low noise
- Silicon nitride passivation
- Excellent return loss properties
- Rugged construction
- Gold metallization ensures excellent reliability.

APPLICATIONS

CATV systems operating in the 40 to 860 MHz frequency range.

DESCRIPTION

Hybrid amplifier module in a SOT115J package operating at a voltage supply of 24 V (DC).

PINNING - SOT115J

PIN	DESCRIPTION
1	input
2	common
3	common
5	$+V_B$
7	common
8	common
9	output

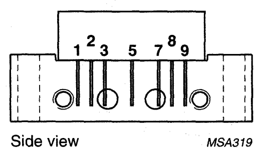


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	19.5	20.5	dB
		f = 860 MHz	20	–	dB
I_{tot}	total current consumption (DC)	V_B = 24 V	–	410	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_B	supply voltage	–	25	V
V_i	RF input voltage	–	65	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	mounting base operating temperature	–20	+100	°C

CHARACTERISTICS

Table 1 Bandwidth 40 to 860 MHz; V_B = 24 V; T_{case} = 35 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	19.5	20	20.5	dB
		f = 860 MHz	20	21	–	dB
SL	slope cable equivalent	f = 40 to 860 MHz	0.2	0.9	2	dB
FL	flatness of frequency response	f = 40 to 860 MHz	–	±0.1	±0.25	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	29.5	–	dB
		f = 80 to 160 MHz	18.5	23.5	–	dB
		f = 160 to 320 MHz	17	20.5	–	dB
		f = 320 to 640 MHz	15.5	19.5	–	dB
		f = 640 to 860 MHz	14	17.5	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	30	–	dB
		f = 80 to 160 MHz	18.5	31	–	dB
		f = 160 to 860 MHz	17	21	–	dB
S_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	49 channels flat; V_o = 47 dBmV; measured at 859.25 MHz	–	–65	–62	dB
X_{mod}	cross modulation	49 channels flat; V_o = 47 dBmV; measured at 55.25 MHz	–	–64	–61	dB
CSO	composite second order distortion	49 channels flat; V_o = 47 dBmV; measured at 860.5 MHz	–	–66	–58	dB
d_2	second order distortion	note 1	–	–77.5	–67	dB
V_o	output voltage	d_{im} = –60 dB; note 2	61	63	–	dBmV
F	noise figure	f = 50 MHz	–	4.5	5	dB
		f = 550 MHz	–	–	5.5	dB
		f = 650 MHz	–	–	6.5	dB
		f = 750 MHz	–	–	7	dB
		f = 860 MHz	–	6.5	8	dB
I_{tot}	total current consumption (DC)	note 3	–	395	410	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 805.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 860.5 MHz.
2. Measured according to DIN45004B;
   f_p = 851.25 MHz; $V_p = V_o$;
   f_q = 858.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 860.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 849.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 2 Bandwidth 40 to 860 MHz; V_B = 24 V; T_{case} = 30 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	19.5	20	20.5	dB
		f = 860 MHz	20	21	–	dB
SL	slope cable equivalent	f = 40 to 860 MHz	0.2	0.9	2	dB
FL	flatness of frequency response	f = 40 to 860 MHz	–	±0.1	±0.25	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	29.5	–	dB
		f = 80 to 160 MHz	18.5	23.5	–	dB
		f = 160 to 320 MHz	17	20.5	–	dB
		f = 320 to 640 MHz	15.5	19.5	–	dB
		f = 640 to 860 MHz	14	17.5	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	30	–	dB
		f = 80 to 160 MHz	18.5	31	–	dB
		f = 160 to 860 MHz	17	21	–	dB
S_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	129 channels flat; V_o = 44 dBmV; measured at 859.25 MHz	–	–	–53	dB
X_{mod}	cross modulation	129 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–	–58	dB
CSO	composite second order distortion	129 channels flat; V_o = 44 dBmV; measured at 860.5 MHz	–	–	–54	dB
d_2	second order distortion	note 1	–	–77.5	–67	dB
V_o	output voltage	d_{im} = –60 dB; note 2	61	63	–	dBmV
F	noise figure	see Table 1	–	–	–	dB
I_{tot}	total current consumption (DC)	note 3	–	395	410	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 805.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 860.5 MHz.
2. Measured according to DIN45004B;
   f_p = 851.25 MHz; $V_p = V_o$;
   f_q = 858.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 860.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 849.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 3 Bandwidth 40 to 750 MHz; V_B = 24 V; T_{case} = 30 °C; Z_S = Z_L = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	19.5	20	20.5	dB
		f = 750 MHz	20	–	–	dB
SL	slope cable equivalent	f = 40 to 750 MHz	0.2	–	2	dB
FL	flatness of frequency response	f = 40 to 750 MHz	–	–	±0.25	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	29.5	–	dB
		f = 80 to 160 MHz	18.5	23.5	–	dB
		f = 160 to 320 MHz	17	20.5	–	dB
		f = 320 to 640 MHz	15.5	19.5	–	dB
		f = 640 to 750 MHz	14	17.5	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	30	–	dB
		f = 80 to 160 MHz	18.5	31	–	dB
		f = 160 to 750 MHz	17	21	–	dB
S_{21}	phase response	f = 50 MHz	−45	–	+45	deg
CTB	composite triple beat	110 channels flat; V_o = 44 dBmV; measured at 745.25 MHz	–	–	−58	dB
X_{mod}	cross modulation	110 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–	−59	dB
CSO	composite second order distortion	110 channels flat; V_o = 44 dBmV; measured at 746.5 MHz	–	–	−58	dB
d_2	second order distortion	note 1	–	–	−70	dB
V_o	output voltage	d_{im} = −60 dB; note 2	63	–	–	dBmV
F	noise figure	see Table 1	–	–	–	dB
I_{tot}	total current consumption (DC)	note 3	–	395	410	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 691.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 746.5 MHz.
2. Measured according to DIN45004B;
   f_p = 740.25 MHz; $V_p = V_o$;
   f_q = 747.25 MHz; $V_q = V_o$ −6 dB;
   f_r = 749.25 MHz; $V_r = V_o$ −6 dB;
   measured at $f_p + f_q - f_r$ = 738.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 4 Bandwidth 40 to 650 MHz; V_B = 24 V; T_{case} = 30 °C; Z_S = Z_L = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	19.5	20	20.5	dB
		f = 650 MHz	20	–	–	dB
SL	slope cable equivalent	f = 40 to 650 MHz	0.2	–	2	dB
FL	flatness of frequency response	f = 40 to 650 MHz	–	–	±0.2	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	29.5	–	dB
		f = 80 to 160 MHz	18.5	23.5	–	dB
		f = 160 to 320 MHz	17	20.5	–	dB
		f = 320 to 650 MHz	15	19.5	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	30	–	dB
		f = 80 to 160 MHz	18.5	31	–	dB
		f = 160 to 650 MHz	17	21	–	dB
S_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	94 channels flat; V_o = 44 dBmV; measured at 649.25 MHz	–	–	–60	dB
X_{mod}	cross modulation	94 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–	–60	dB
CSO	composite second order distortion	94 channels flat; V_o = 44 dBmV; measured at 650.5 MHz	–	–	–60	dB
d_2	second order distortion	note 1	–	–	–70	dB
V_o	output voltage	d_{im} = –60 dB; note 2	64	–	–	dBmV
F	noise figure	see Table 1	–	–	–	dB
I_{tot}	total current consumption (DC)	note 3	–	395	410	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 595.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 650.5 MHz.
2. Measured according to DIN45004B;
   f_p = 640.25 MHz; $V_p = V_o$;
   f_q = 647.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 649.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 638.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 5 Bandwidth 40 to 550 MHz; V_B = 24 V; T_{case} = 30 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	19.5	20	20.5	dB
		f = 550 MHz	20	–	–	dB
SL	slope cable equivalent	f = 40 to 550 MHz	0.2	–	2	dB
FL	flatness of frequency response	f = 40 to 550 MHz	–	–	±0.2	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	29.5	–	dB
		f = 80 to 160 MHz	18.5	23.5	–	dB
		f = 160 to 320 MHz	17	20.5	–	dB
		f = 320 to 550 MHz	16	19.5	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	30	–	dB
		f = 80 to 160 MHz	18.5	31	–	dB
		f = 160 to 550 MHz	17	21	–	dB
S_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	77 channels flat; V_o = 44 dBmV; measured at 547.25 MHz	–	–	–64	dB
X_{mod}	cross modulation	77 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–	–62	dB
CSO	composite second order distortion	77 channels flat; V_o = 44 dBmV; measured at 548.5 MHz	–	–	–63	dB
d_2	second order distortion	note 1	–	–	–72	dB
V_o	output voltage	d_{im} = –60 dB; note 2	65	–	–	dBmV
F	noise figure	see Table 1	–	–	–	dB
I_{tot}	total current consumption (DC)	note 3	–	395	410	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 493.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 548.5 MHz.
2. Measured according to DIN45004B;
   f_p = 540.25 MHz; $V_p = V_o$;
   f_q = 547.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 549.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 538.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

FEATURES

- Excellent linearity
- Extremely low noise
- Excellent return loss properties
- Silicon nitride passivation
- Rugged construction
- Gold metallization ensures excellent reliability.

APPLICATIONS

- CATV systems operating in the 40 to 870 MHz frequency range.

DESCRIPTION

Hybrid amplifier module in a SOT115J package operating with a voltage supply of 24 V (DC).

PINNING - SOT115J

PIN	DESCRIPTION
1	input
2 and 3	common
5	$+V_B$
7 and 8	common
9	output

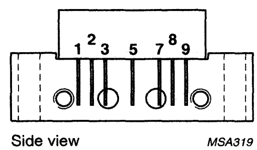


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 45 MHz	18.2	18.8	dB
		f = 870 MHz	19	20	dB
I_{tot}	total current consumption (DC)	V_B = 24 V	380	410	mA

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 60134).

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_B	supply voltage	–	30	V
V_i	RF input voltage	–	70	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	operating mounting base temperature	–20	+100	°C

CHARACTERISTICS

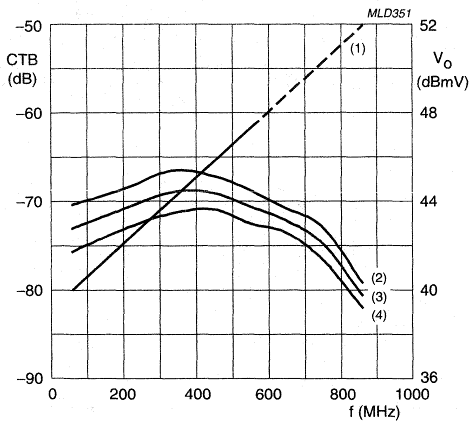
Bandwidth 40 to 870 MHz; V_B = 24 V; T_{mb} = 35 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 45 MHz	18.2	–	18.8	dB
		f = 870 MHz	19	–	20	dB
SL	slope straight line	f = 45 to 870 MHz; note 1	0.4	0.9	1.4	dB
FL	flatness straight line	f = 45 to 100 MHz	–	–	±0.25	dB
		f = 100 to 800 MHz	–	–	±0.5	dB
		f = 800 to 870 MHz	–0.3	–	+0.1	dB
s_{11}	input return losses	f = 45 to 80 MHz	25	–	–	dB
		f = 80 to 160 MHz	23	–	–	dB
		f = 160 to 320 MHz	20	–	–	dB
		f = 320 to 550 MHz	18	–	–	dB
		f = 550 to 650 MHz	18	–	–	dB
		f = 650 to 750 MHz	17	–	–	dB
		f = 750 to 870 MHz	17	–	–	dB
		f = 870 to 914 MHz	14	–	–	dB
s_{22}	output return losses	f = 45 to 80 MHz	23	–	–	dB
		f = 80 to 160 MHz	22	–	–	dB
		f = 160 to 320 MHz	18	–	–	dB
		f = 320 to 550 MHz	18	–	–	dB
		f = 550 to 650 MHz	17	–	–	dB
		f = 650 to 750 MHz	16	–	–	dB
		f = 750 to 870 MHz	16	–	–	dB
		f = 870 to 914 MHz	14	–	–	dB
s_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	79 chs flat; V_o = 44 dBmV; f_m = 547.25 MHz	–	–	–67	dB
		112 chs flat; V_o = 44 dBmV; f_m = 745.25 MHz	–	–	–62	dB
		132 chs flat; V_o = 44 dBmV; f_m = 859.25 MHz	–	–	–58	dB
		112 chs; f_m = 547.25 MHz; V_o = 50.2 dBmV at 745 MHz; note 2	–	–	–56.5	dB
		79 chs; f_m = 331.25 MHz; V_o = 47.3 dBmV at 547 MHz; note 3	–	–	–66	dB
X_{mod}	cross modulation	79 chs flat; V_o = 44 dBmV; f_m = 55.25 MHz	–	–	–68	dB
		112 chs flat; V_o = 44 dBmV; f_m = 55.25 MHz	–	–	–64	dB
		132 chs flat; V_o = 44 dBmV; f_m = 55.25 MHz	–	–	–62	dB
		112 chs; f_m = 745.25 MHz; V_o = 50.2 dBmV at 745 MHz; note 2	–	–	–59	dB
		79 chs; f_m = 331.25 MHz; V_o = 47.3 dBmV at 547 MHz; note 3	–	–	–67	dB

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
CSO	composite second order distortion	79 chs flat; V_o = 44 dBmV; f_m = 548.5 MHz	–	–	–67	dB
		112 chs flat; V_o = 44 dBmV; f_m = 746.5 MHz	–	–	–60	dB
		132 chs flat; V_o = 44 dBmV; f_m = 860.5 MHz	–	–	–58	dB
		112 chs; f_m = 210 MHz; V_o = 50.2 dBmV at 745 MHz; note 2	–	–	–57	dB
		79 chs; f_m = 210 MHz; V_o = 47.3 dBmV at 547 MHz; note 3	–	–	–65	dB
d_2	second order distortion	note 4	–	–	–73	dB
V_o	output voltage	d_{im} = –60 dB; note 5	64.5	–	–	dBmV
		CTB compression = 1 dB; 132 chs flat; f = 859.25 MHz	48	–	–	dBmV
		CSO compression = 1 dB; 132 chs flat; f = 860.5 MHz	51	–	–	dBmV
F	noise figure	f = 50 MHz	–	–	5.5	dB
		f = 550 MHz	–	–	5.5	dB
		f = 750 MHz	–	–	6.5	dB
		f = 870 MHz	–	–	7.5	dB
I_{tot}	total current consumption (DC)	note 6	380	395	410	mA

Notes

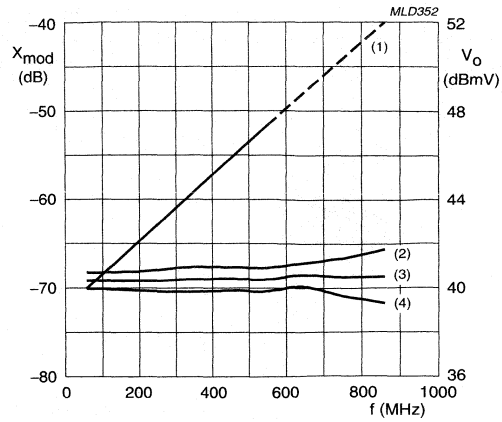
1. Slope straight line is defined as gain at 870 MHz against gain at 45 MHz.
2. Tilt = 10.2 dB (55 to 745 MHz).
3. Tilt = 7.3 dB (55 to 547 MHz).
4. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 805.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 860.5 MHz.
5. Measured according to DIN45004B:
   f_p = 851.25 MHz; $V_p = V_o$;
   f_q = 858.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 860.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 849.25 MHz.
6. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 35 V.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 79 chs; tilt = 7.3 dB (50 to 550 MHz).

(1) V_o.
(2) Typ. +3 σ.
(3) Typ.
(4) Typ. −3 σ.

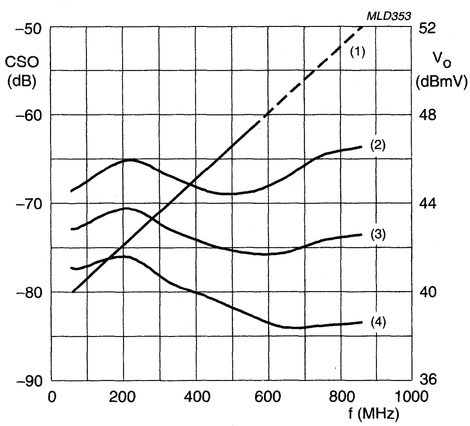
Fig.2 Composite triple beat as a function of frequency under tilted conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 79 chs; tilt = 7.3 dB (50 to 550 MHz).

(1) V_o.
(2) Typ. +3 σ.
(3) Typ.
(4) Typ. −3 σ.

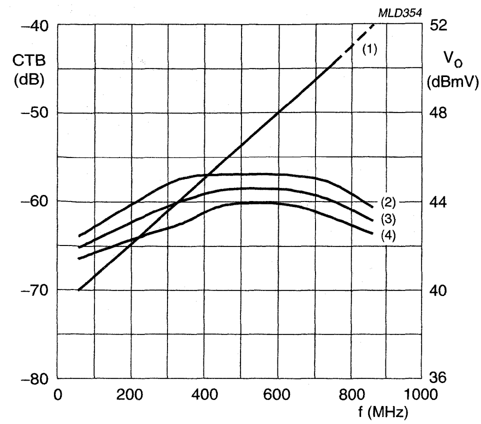
Fig.3 Cross modulation as a function of frequency under tilted conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 79 chs; tilt = 7.3 dB (50 to 550 MHz).

(1) V_o.
(2) Typ. +3 σ.
(3) Typ.
(4) Typ. −3 σ.

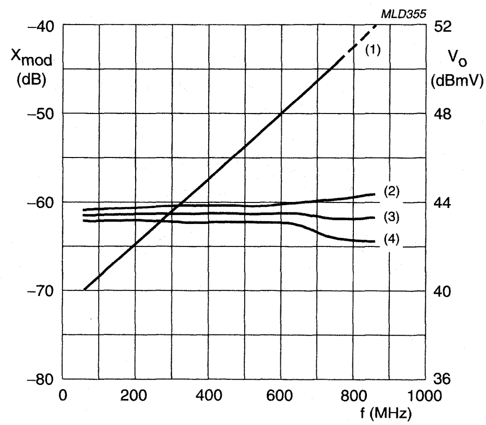
Fig.4 Composite second order distortion as a function of frequency under tilted conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 112 chs; tilt = 10.3 dB (50 to 750 MHz).

(1) V_o. (3) Typ.
(2) Typ. +3 σ. (4) Typ. −3 σ.

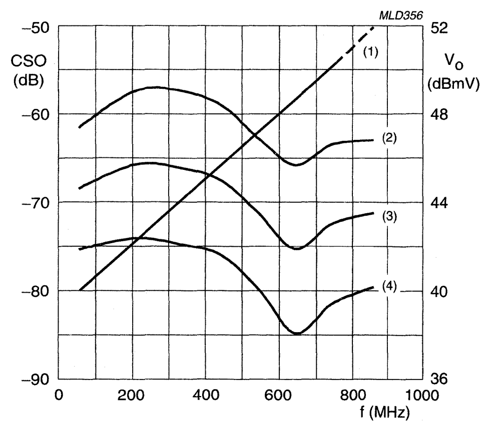
Fig.5 Composite triple beat as a function of frequency under tilted conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 112 chs; tilt = 10.3 dB (50 to 750 MHz).

(1) V_o. (3) Typ.
(2) Typ. +3 σ. (4) Typ. −3 σ.

Fig.6 Cross modulation as a function of frequency under tilted conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 112 chs; tilt = 10.3 dB (50 to 750 MHz).

(1) V_o. (3) Typ.
(2) Typ. +3 σ. (4) Typ. −3 σ.

Fig.7 Composite second order distortion as a function of frequency under tilted conditions.

FEATURES

- Excellent linearity
- Extremely low noise
- Excellent return loss properties
- Silicon nitride passivation
- Rugged construction
- Gold metallization ensures excellent reliability.

APPLICATIONS

- CATV systems operating in the 40 to 870 MHz frequency range.

DESCRIPTION

Hybrid amplifier module in a SOT115J package operating with a voltage supply of 24 V (DC).

PINNING - SOT115J

PIN	DESCRIPTION
1	input
2 and 3	common
5	$+V_B$
7 and 8	common
9	output

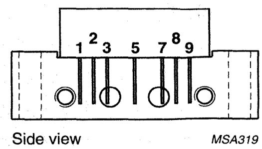


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 45 MHz	19.7	20.3	dB
		f = 870 MHz	20.5	21.5	dB
I_{tot}	total current consumption (DC)	V_B = 24 V	380	410	mA

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 60134).

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_B	supply voltage	–	30	V
V_i	RF input voltage	–	70	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	operating mounting base temperature	–20	+100	°C

CHARACTERISTICS

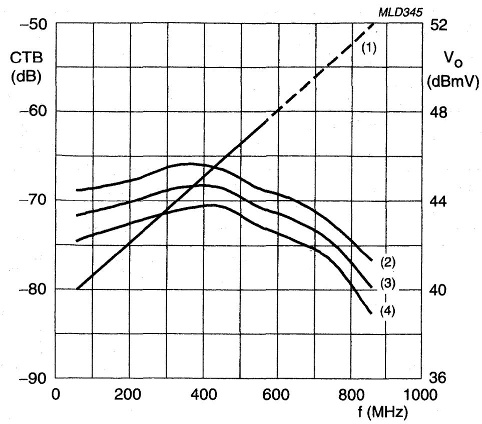
Bandwidth 40 to 870 MHz; V_B = 24 V; T_{mb} = 35 °C; $Z_S = Z_L$ = 75 Ω.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 45 MHz	19.7	–	20.3	dB
		f = 870 MHz	20.5	–	21.5	dB
SL	slope straight line	f = 45 to 870 MHz; note 1	0.5	–	1.5	dB
FL	flatness straight line	f = 45 to 100 MHz	–	–	±0.25	dB
		f = 100 to 800 MHz	–0.7	–	+0.3	dB
		f = 800 to 870 MHz	–0.4	–	0.0	dB
s_{11}	input return losses	f = 45 to 80 MHz	25	–	–	dB
		f = 80 to 160 MHz	22	–	–	dB
		f = 160 to 320 MHz	19	–	–	dB
		f = 320 to 550 MHz	17	–	–	dB
		f = 550 to 650 MHz	17	–	–	dB
		f = 650 to 750 MHz	16	–	–	dB
		f = 750 to 870 MHz	15	–	–	dB
		f = 870 to 914 MHz	12	–	–	dB
s_{22}	output return losses	f = 45 to 80 MHz	24	–	–	dB
		f = 80 to 160 MHz	23	–	–	dB
		f = 160 to 320 MHz	18	–	–	dB
		f = 320 to 550 MHz	18	–	–	dB
		f = 550 to 650 MHz	17	–	–	dB
		f = 650 to 750 MHz	16	–	–	dB
		f = 750 to 870 MHz	16	–	–	dB
		f = 870 to 914 MHz	13	–	–	dB
s_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	79 chs flat; V_o = 44 dBmV; f_m = 547.25 MHz	–	–	–67	dB
		112 chs flat; V_o = 44 dBmV; f_m = 745.25 MHz	–	–	–61	dB
		132 chs flat; V_o = 44 dBmV; f_m = 859.25 MHz	–	–	–57	dB
		112 chs; f_m = 547.25 MHz; V_o = 50.2 dBmV at 745 MHz; note 2	–	–	–56	dB
		79 chs; f_m = 331.25 MHz; V_o = 47.3 dBmV at 547 MHz; note 3	–	–	–65	dB
X_{mod}	cross modulation	79 chs flat; V_o = 44 dBmV; f_m = 55.25 MHz	–	–	–66	dB
		112 chs flat; V_o = 44 dBmV; f_m = 55.25 MHz	–	–	–62.5	dB
		132 chs flat; V_o = 44 dBmV; f_m = 55.25 MHz	–	–	–61	dB
		112 chs; f_m = 745.25 MHz; V_o = 50.2 dBmV at 745 MHz; note 2	–	–	–57	dB
		79 chs; f_m = 445.25 MHz; V_o = 47.3 dBmV at 547 MHz; note 3	–	–	–66	dB

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
CSO	composite second order distortion	79 chs flat; V_o = 44 dBmV; f_m = 548.5 MHz	–	–	−68	dB
		112 chs flat; V_o = 44 dBmV; f_m = 746.5 MHz	–	–	−63	dB
		132 chs flat; V_o = 44 dBmV; f_m = 860.5 MHz	–	–	−59	dB
		112 chs; f_m = 210 MHz; V_o = 50.2 dBmV at 745 MHz; note 2	–	–	−56	dB
		79 chs; f_m = 210 MHz; V_o = 47.3 dBmV at 547 MHz; note 3	–	–	−64	dB
d_2	second order distortion	note 4	–	–	−70	dB
V_o	output voltage	d_{im} = −60 dB; note 5	64	–	–	dBmV
		CTB compression = 1 dB; 132 chs flat; f = 859.25 MHz	48	–	–	dBmV
		CSO compression = 1 dB; 132 chs flat; f = 860.5 MHz	50	–	–	dBmV
F	noise figure	f = 50 MHz	–	–	5.5	dB
		f = 550 MHz	–	–	5.5	dB
		f = 750 MHz	–	–	6.5	dB
		f = 870 MHz	–	–	7.5	dB
I_{tot}	total current consumption (DC)	note 6	380	395	410	mA

Notes

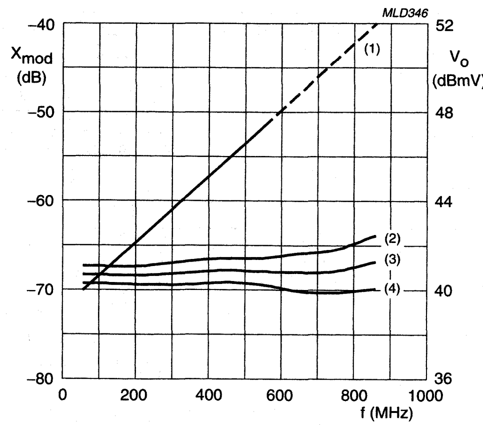
1. Slope straight line is defined as gain at 870 MHz against gain at 45 MHz.
2. Tilt = 10.2 dB (55 to 745 MHz).
3. Tilt = 7.3 dB (55 to 547 MHz).
4. f_p = 55.25 MHz; V_p = 44 dBmV; f_q = 805.25 MHz; V_q = 44 dBmV; measured at $f_p + f_q$ = 860.5 MHz.
5. Measured according to DIN45004B: f_p = 851.25 MHz; $V_p = V_o$; f_q = 858.25 MHz; $V_q = V_o - 6$ dB; f_r = 860.25 MHz; $V_r = V_o - 6$ dB; measured at $f_p + f_q - f_r$ = 849.25 MHz.
6. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 35 V.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 79 chs; tilt = 7.3 dB (50 to 550 MHz).

(1) V_o.
(2) Typ. 3 σ.
(3) Typ.
(4) Typ. −3 σ.

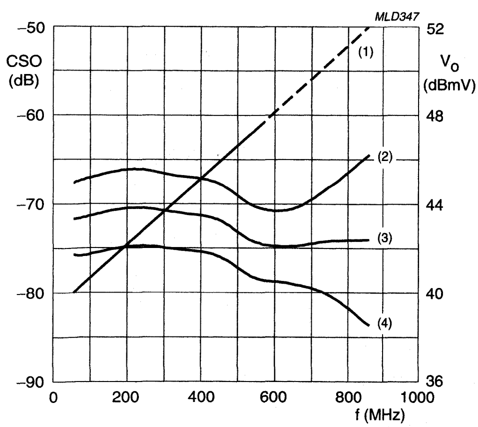
Fig.2 Composite triple beat as a function of frequency under tilted conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 79 chs; tilt = 7.3 dB (50 to 550 MHz).

(1) V_o.
(2) Typ. 3 σ.
(3) Typ.
(4) Typ. −3 σ.

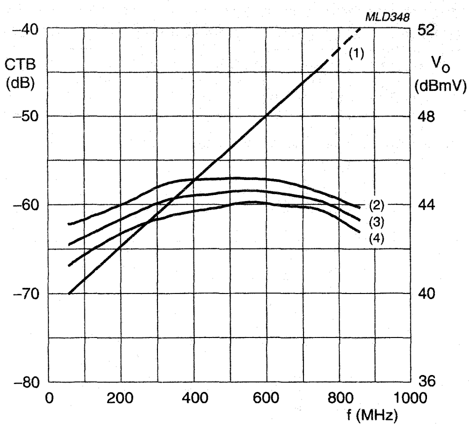
Fig.3 Cross modulation as a function of frequency under tilted conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 79 chs; tilt = 7.3 dB (50 to 550 MHz).

(1) V_o.
(2) Typ. 3 σ.
(3) Typ.
(4) Typ. −3 σ.

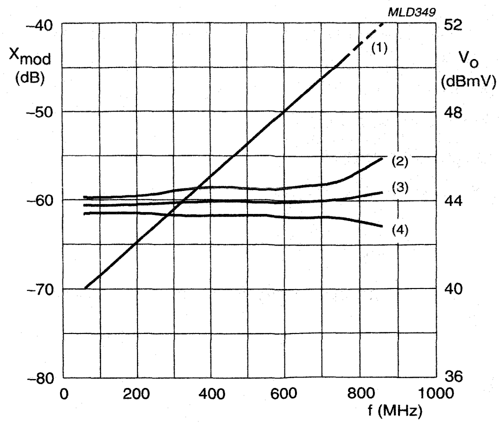
Fig.4 Composite second order distortion as a function of frequency under tilted conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 112 chs; tilt = 10.3 dB (50 to 750 MHz).

(1) V_o.
(2) Typ. 3 σ.
(3) Typ.
(4) Typ. −3 σ.

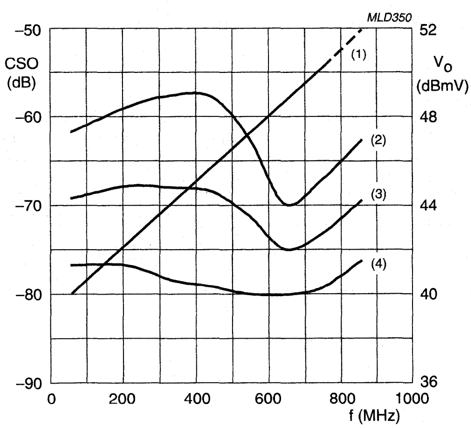
Fig.5 Composite triple beat as a function of frequency under tilted conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 112 chs; tilt = 10.3 dB (50 to 750 MHz).

(1) V_o.
(2) Typ. 3 σ.
(3) Typ.
(4) Typ. −3 σ.

Fig.6 Cross modulation as a function of frequency under tilted conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 112 chs; tilt = 10.3 dB (50 to 750 MHz).

(1) V_o.
(2) Typ. 3 σ.
(3) Typ.
(4) Typ. −3 σ.

Fig.7 Composite second order distortion as a function of frequency under tilted conditions.

CATV amplifier module | BGD816

FEATURES

- Excellent linearity
- Extremely low noise
- Excellent return loss properties
- Silicon nitride passivation
- Rugged construction
- Gold metallization ensures excellent reliability.

APPLICATIONS

- CATV systems operating in the 40 to 870 MHz frequency range.

DESCRIPTION

Hybrid amplifier module in a SOT115J package operating with a voltage supply of 24 V (DC).

PINNING - SOT115J

PIN	DESCRIPTION
1	input
2 and 3	common
5	$+V_B$
7 and 8	common
9	output

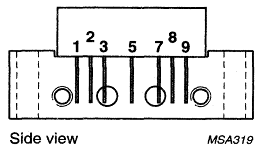


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 45 MHz	21.2	21.8	dB
		f = 870 MHz	22	23	dB
I_{tot}	total current consumption (DC)	V_B = 24 V	380	410	mA

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 60134).

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_B	supply voltage	–	30	V
V_i	RF input voltage	–	70	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	operating mounting base temperature	–20	+100	°C

CHARACTERISTICS

Bandwidth 40 to 870 MHz; V_B = 24 V; T_{mb} = 35 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 45 MHz	21.2	–	21.8	dB
		f = 870 MHz	22	–	23	dB
SL	slope straight line	f = 45 to 870 MHz; note 1	0.5	1	1.5	dB
FL	flatness straight line	f = 45 to 100 MHz	–	–	±0.35	dB
		f = 100 to 800 MHz	–	–	±0.5	dB
		f = 800 to 870 MHz	–	–	±0.15	dB
s_{11}	input return losses	f = 45 to 80 MHz	21	–	–	dB
		f = 80 to 160 MHz	20	–	–	dB
		f = 160 to 320 MHz	19	–	–	dB
		f = 320 to 550 MHz	18	–	–	dB
		f = 550 to 650 MHz	17	–	–	dB
		f = 650 to 750 MHz	16	–	–	dB
		f = 750 to 870 MHz	15	–	–	dB
		f = 870 to 914 MHz	14	–	–	dB
s_{22}	output return losses	f = 45 to 80 MHz	21	–	–	dB
		f = 80 to 160 MHz	20	–	–	dB
		f = 160 to 320 MHz	19	–	–	dB
		f = 320 to 550 MHz	18	–	–	dB
		f = 550 to 650 MHz	17	–	–	dB
		f = 650 to 750 MHz	16	–	–	dB
		f = 750 to 870 MHz	15	–	–	dB
		f = 870 to 914 MHz	14	–	–	dB
s_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	79 chs flat; V_o = 44 dBmV; f_m = 547.25 MHz	–	–	–66	dB
		112 chs flat; V_o = 44 dBmV; f_m = 745.25 MHz	–	–	–60	dB
		132 chs flat; V_o = 44 dBmV; f_m = 859.25 MHz	–	–	–56	dB
		112 chs; f_m = tbd MHz; V_o = 48.2 dBmV at 745 MHz; note 2	–	–	–59	dB
		79 chs; f_m = tbd MHz; V_o = 45.3 dBmV at 547 MHz; note 3	–	–	–67	dB
X_{mod}	cross modulation	79 chs flat; V_o = 44 dBmV; f_m = 55.25 MHz	–	–	–65	dB
		112 chs flat; V_o = 44 dBmV; f_m = 55.25 MHz	–	–	–61	dB
		132 chs flat; V_o = 44 dBmV; f_m = 55.25 MHz	–	–	–60	dB
		112 chs; f_m = tbd MHz; V_o = 48.2 dBmV at 745 MHz; note 2	–	–	–56	dB
		79 chs; f_m = tbd MHz; V_o = 45.3 dBmV at 547 MHz; note 3	–	–	–65	dB

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
CSO	composite second order distortion	79 chs flat; V_o = 44 dBmV; f_m = 548.5 MHz	–	–	−65	dB
		112 chs flat; V_o = 44 dBmV; f_m = 746.5 MHz	–	–	−58	dB
		132 chs flat; V_o = 44 dBmV; f_m = 860.5 MHz	–	–	−54	dB
		112 chs; f_m = tbd MHz; V_o = 48.2 dBmV at 745 MHz; note 2	–	–	−56	dB
		79 chs; f_m = tbd MHz; V_o = 45.3 dBmV at 547 MHz; note 3	–	–	−63	dB
d_2	second order distortion	note 4	–	–	−74	dB
V_o	output voltage	d_{im} = −60 dB; note 5	64.5	–	–	dBmV
		CTB compression = 1 dB; 132 chs flat; f = tbd MHz	tbd	–	–	dBmV
		CSO compression = 1 dB; 132 chs flat; f = tbd MHz	tbd	–	–	dBmV
F	noise figure	f = 50 MHz	–	–	5.5	dB
		f = 550 MHz	–	–	5.5	dB
		f = 750 MHz	–	–	6.5	dB
		f = 870 MHz	–	–	7.5	dB
I_{tot}	total current consumption (DC)	note 6	380	395	410	mA

Notes

1. Slope straight line is defined as gain at 870 MHz against gain at 45 MHz.
2. Tilt = 10.2 dB (55 to 745 MHz).
3. Tilt = 7.3 dB (55 to 547 MHz).
4. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 805.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 860.5 MHz.
5. Measured according to DIN45004B:
   f_p = 851.25 MHz; $V_p = V_o$;
   f_q = 858.25 MHz; $V_q = V_o - 6$ dB;
   f_r = 860.25 MHz; $V_r = V_o - 6$ dB;
   measured at $f_p + f_q - f_r$ = 849.25 MHz.
6. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 35 V.

FEATURES

- Excellent linearity
- Extremely low noise
- Excellent return loss properties
- Silicon nitride passivation
- Rugged construction
- Gold metallization ensures excellent reliability.

APPLICATIONS

- CATV systems operating in the 40 to 870 MHz frequency range.

DESCRIPTION

Hybrid amplifier module in a SOT115J package operating with a voltage supply of 24 V (DC).

PINNING - SOT115J

PIN	DESCRIPTION
1	input
2 and 3	common
5	$+V_B$
7 and 8	common
9	output

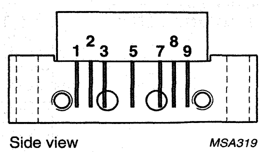


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 45 MHz	21.2	21.8	dB
		f = 870 MHz	22	23	dB
I_{tot}	total current consumption (DC)	V_B = 24 V	345	375	mA

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 60134).

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_B	supply voltage	–	30	V
V_i	RF input voltage	–	70	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	operating mounting base temperature	–20	+100	°C

CHARACTERISTICS

Bandwidth 40 to 870 MHz; V_B = 24 V; T_{mb} = 35 °C; Z_S = Z_L = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 45 MHz	21.2	–	21.8	dB
		f = 870 MHz	22	–	23	dB
SL	slope straight line	f = 45 to 870 MHz; note 1	0.5	1	1.5	dB
FL	flatness straight line	f = 45 to 100 MHz	–	–	±0.35	dB
		f = 100 to 800 MHz	–	–	±0.5	dB
		f = 800 to 870 MHz	–	–	±0.15	dB
s_{11}	input return losses	f = 45 to 80 MHz	21	–	–	dB
		f = 80 to 160 MHz	20	–	–	dB
		f = 160 to 320 MHz	19	–	–	dB
		f = 320 to 550 MHz	18	–	–	dB
		f = 550 to 650 MHz	17	–	–	dB
		f = 650 to 750 MHz	16	–	–	dB
		f = 750 to 870 MHz	15	–	–	dB
		f = 870 to 914 MHz	14	–	–	dB
s_{22}	output return losses	f = 45 to 80 MHz	21	–	–	dB
		f = 80 to 160 MHz	20	–	–	dB
		f = 160 to 320 MHz	19	–	–	dB
		f = 320 to 550 MHz	18	–	–	dB
		f = 550 to 650 MHz	17	–	–	dB
		f = 650 to 750 MHz	16	–	–	dB
		f = 750 to 870 MHz	15	–	–	dB
		f = 870 to 914 MHz	14	–	–	dB
s_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	79 chs flat; V_o = 44 dBmV; f_m = 547.25 MHz	–	–	–64	dB
		112 chs flat; V_o = 44 dBmV; f_m = 745.25 MHz	–	–	–58	dB
		132 chs flat; V_o = 44 dBmV; f_m = 859.25 MHz	–	–	–54	dB
		112 chs; f_m = tbd MHz; V_o = 48.2 dBmV at 745 MHz; note 2	–	–	–57	dB
		79 chs; f_m = tbd MHz; V_o = 45.3 dBmV at 547 MHz; note 3	–	–	–65	dB
X_{mod}	cross modulation	79 chs flat; V_o = 44 dBmV; f_m = 55.25 MHz	–	–	–63	dB
		112 chs flat; V_o = 44 dBmV; f_m = 55.25 MHz	–	–	–59	dB
		132 chs flat; V_o = 44 dBmV; f_m = 55.25 MHz	–	–	–58	dB
		112 chs; f_m = tbd MHz; V_o = 48.2 dBmV at 745 MHz; note 2	–	–	–54.5	dB
		79 chs; f_m = tbd MHz; V_o = 45.3 dBmV at 547 MHz; note 3	–	–	–63.5	dB

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
CSO	composite second order distortion	79 chs flat; V_o = 44 dBmV; f_m = 548.5 MHz	–	–	–64	dB
		112 chs flat; V_o = 44 dBmV; f_m = 746.5 MHz	–	–	–58	dB
		132 chs flat; V_o = 44 dBmV; f_m = 860.5 MHz	–	–	–56	dB
		112 chs; f_m = tbd MHz; V_o = 48.2 dBmV at 745 MHz; note 2	–	–	–57	dB
		79 chs; f_m = tbd MHz; V_o = 45.3 dBmV at 547 MHz; note 3	–	–	–64	dB
d_2	second order distortion	note 4	–	–	–74	dB
V_o	output voltage	d_{im} = –60 dB; note 5	64.5	–	–	dBmV
		CTB compression = 1 dB; 132 chs flat; f = tbd MHz	tbd	–	–	dBmV
		CSO compression = 1 dB; 132 chs flat; f = tbd MHz	tbd	–	–	dBmV
F	noise figure	f = 50 MHz	–	–	5.5	dB
		f = 550 MHz	–	–	5.5	dB
		f = 750 MHz	–	–	6.5	dB
		f = 870 MHz	–	–	7.5	dB
I_{tot}	total current consumption (DC)	note 6	345	360	375	mA

Notes

1. Slope straight line is defined as gain at 870 MHz against gain at 45 MHz.
2. Tilt = 10.2 dB (55 to 745 MHz).
3. Tilt = 7.3 dB (55 to 547 MHz).
4. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 805.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 860.5 MHz.
5. Measured according to DIN45004B:
   f_p = 851.25 MHz; $V_p = V_o$;
   f_q = 858.25 MHz; $V_q = V_o - 6$ dB;
   f_r = 860.25 MHz; $V_r = V_o - 6$ dB;
   measured at $f_p + f_q - f_r$ = 849.25 MHz.
6. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 35 V.

FEATURES

- Excellent linearity
- Extremely low noise
- Silicon nitride passivation
- Rugged construction
- Gold metallization ensures excellent reliability.

DESCRIPTION

Hybrid amplifier module for CATV/MATV systems operating over a frequency range of 40 to 860 MHz at a voltage supply of 24 V (DC).

PINNING - SOT115D

PIN	DESCRIPTION
1	input
2, 3, 5, 6, 7	common
4	10 V, 200 mA supply terminal
8	$+V_B$
9	output

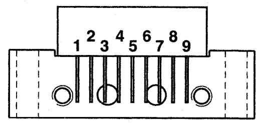


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	16.5	17.5	dB
I_{tot}	total current consumption (DC)	V_B = 24 V	–	450	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_B	DC supply voltage	–	26	V
V_i	RF input voltage	–	65	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	operating mounting base temperature	–20	+100	°C

CHARACTERISTICS

Table 1 Bandwidth 40 to 860 MHz; V_B = 24 V; T_{mb} = 35 °C; Z_S = Z_L = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	16.5	17.5	dB
SL	slope cable equivalent	f = 40 to 860 MHz	0.2	1.6	dB
FL	flatness of frequency response	f = 40 to 860 MHz	–	±0.5	dB
S_{11}	input return losses	f = 40 MHz; note 1	20	–	dB
		f = 800 to 860 MHz	10	–	dB
S_{22}	output return losses	f = 40 MHz; note 1	20	–	dB
		f = 800 to 860 MHz	10	–	dB
d_2	second order distortion	note 2	–	−53	dB
V_o	output voltage	d_{im} = −60 dB; note 3	64	–	dBmV
		d_{im} = −60 dB; note 4	63	–	dBmV
F	noise figure	f = 50 MHz	–	8	dB
		f = 550 MHz	–	8	dB
		f = 650 MHz	–	8	dB
		f = 750 MHz	–	8	dB
		f = 860 MHz	–	8	dB
I_{tot}	total current consumption (DC)	note 5	–	450	mA

Notes

1. Decrease per octave of 1.5 dB.
2. V_p = 59 dBmV at f_p = 349.25 MHz;
   V_q = 59 dBmV at f_q = 403.25 MHz;
   measured at $f_p + f_q$ = 752.5 MHz.
3. Measured according to DIN45004B:
   f_p = 341.25 MHz; $V_p = V_o$;
   f_q = 348.25 MHz; $V_q = V_o$ −6 dB;
   f_r = 350.25 MHz; $V_r = V_o$ −6 dB;
   measured at $f_p + f_q - f_r$ = 339.25 MHz.
4. Measured according to DIN45004B:
   f_p = 851.25 MHz; $V_p = V_o$;
   f_q = 858.25 MHz; $V_q = V_o$ −6 dB;
   f_r = 860.25 MHz; $V_r = V_o$ −6 dB;
   measured at $f_p + f_q - f_r$ = 849.25 MHz.
5. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

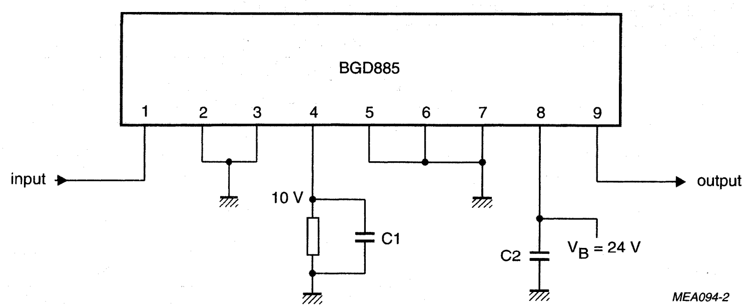


Fig.2 Test circuit.

List of components (see Fig.2)

COMPONENT	DESCRIPTION	VALUE
C1	ceramic multilayer capacitor	1 nF (max.)
C2	ceramic multilayer capacitor	1 nF
R	resistor	56 Ω, 2 W

FEATURES

- Excellent linearity
- Extremely low noise
- Excellent return loss properties
- Silicon nitride passivation
- Rugged construction
- Gold metallization ensures excellent reliability.

APPLICATIONS

- CATV systems operating in the 40 to 900 MHz frequency range.

DESCRIPTION

Hybrid amplifier modules in a SOT115J package operating with a voltage supply of 24 V (DC).
Both modules are electrically identical only the pinning is different.

PINNING - SOT115J

PIN	DESCRIPTION	
	BGD902	BGD902MI
1	input	output
2, 3	common	common
5	$+V_B$	$+V_B$
7, 8	common	common
9	output	input

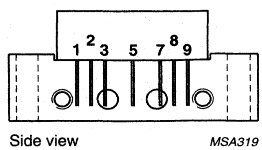


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18.2	18.8	dB
		f = 900 MHz	19	20	dB
I_{tot}	total current consumption (DC)	V_B = 24 V	405	435	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_B	supply voltage	–	30	V
V_i	RF input voltage	–	70	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	operating mounting base temperature	–20	+100	°C

CHARACTERISTICS

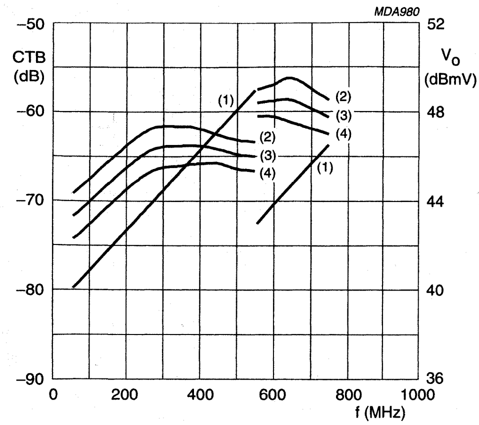
Bandwidth 40 to 900 MHz; V_B = 24 V; T_{mb} = 35 °C; Z_S = Z_L = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18.2	18.5	18.8	dB
		f = 900 MHz	19	19.5	20	dB
SL	slope cable equivalent	f = 40 to 900 MHz	0.4	0.9	1.4	dB
FL	flatness of frequency response	f = 40 to 900 MHz	–	±0.15	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	21	24	–	dB
		f = 80 to 160 MHz	22	26	–	dB
		f = 160 to 320 MHz	22	28	–	dB
		f = 320 to 640 MHz	19	22	–	dB
		f = 640 to 900 MHz	18	21	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	25	32	–	dB
		f = 80 to 160 MHz	25	33	–	dB
		f = 160 to 320 MHz	21	29	–	dB
		f = 320 to 750 MHz	20	25	–	dB
		f = 750 to 900 MHz	19	22	–	dB
S_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	49 chs flat; V_o = 47 dBmV; f_m = 859.25 MHz	–	–68.5	–67	dB
		77 chs flat; V_o = 44 dBmV; f_m = 547.25 MHz	–	–70	–68	dB
		110 chs flat; V_o = 44 dBmV; f_m = 745.25 MHz	–	–63.5	–62	dB
		129 chs flat; V_o = 44 dBmV; f_m = 859.25 MHz	–	–60	–58	dB
		110 chs; f_m = 400 MHz; V_o = 49 dBmV at 550 MHz; note 1	–	–64	–62	dB
		129 chs; f_m = 650 MHz; V_o = 49.5 dBmV at 860 MHz; note 2	–	–58.5	–56.5	dB
X_{mod}	cross modulation	49 chs flat; V_o = 47 dBmV; f_m = 55.25 MHz	–	–66.5	–64	dB
		77 chs flat; V_o = 44 dBmV; f_m = 55.25 MHz	–	–69.5	–67	dB
		110 chs flat; V_o = 44 dBmV; f_m = 55.25 MHz	–	–66	–63.5	dB
		129 chs flat; V_o = 44 dBmV; f_m = 55.25 MHz	–	–64.5	–62	dB
		110 chs; f_m = 400 MHz; V_o = 49 dBmV at 550 MHz; note 1	–	–63	–60	dB
		129 chs; f_m = 860 MHz; V_o = 49.5 dBmV at 860 MHz; note 2	–	–61	–58	dB
CSO	composite second order distortion	49 chs flat; V_o = 47 dBmV; f_m = 860.5 MHz	–	–65	–62	dB
		77 chs flat; V_o = 44 dBmV; f_m = 548.5 MHz	–	–72	–67	dB
		110 chs flat; V_o = 44 dBmV; f_m = 746.5 MHz	–	–65	–60	dB
		129 chs flat; V_o = 44 dBmV; f_m = 860.5 MHz	–	–61	–58	dB
		110 chs; f_m = 250 MHz; V_o = 49 dBmV at 550 MHz; note 1	–	–67	–63	dB
		129 chs; f_m = 250 MHz; V_o = 49.5 dBmV at 860 MHz; note 2	–	–62	–58	dB

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
d_2	second order distortion	note 3	–	−80	−74	dB
		note 4	–	−83	−77	dB
		note 5	–	−84	−78	dB
V_o	output voltage	d_{im} = −60 dB; note 6	64.5	66	–	dBmV
		d_{im} = −60 dB; note 7	65.5	67	–	dBmV
		d_{im} = −60 dB; note 8	67.5	69	–	dBmV
		CTB compression = 1 dB; 129 chs flat; f = 859.25 MHz	48.5	49.5	–	dBmV
		CSO compression = 1 dB; 129 chs flat; f = 860.5 MHz	50	53	–	dBmV
F	noise figure	f = 50 MHz	–	4.5	5	dB
		f = 550 MHz	–	5	5.5	dB
		f = 750 MHz	–	5.5	6.5	dB
		f = 900 MHz	–	6.5	8	dB
I_{tot}	total current consumption (DC)	note 9	405	420	435	mA

Notes

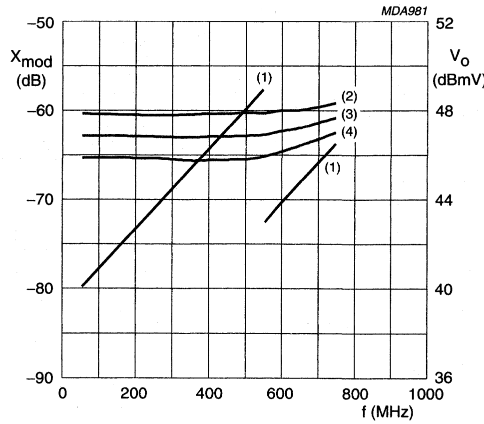
1. Tilt = 9 dB (50 to 550 MHz); tilt = 3.5 dB at −6 dB offset (550 to 750 MHz).
2. Tilt = 12.5 dB (50 to 860 MHz).
3. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 805.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 860.5 MHz.
4. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 691.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 746.5 MHz.
5. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 493.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 548.5 MHz.
6. Measured according to DIN45004B:
   f_p = 851.25 MHz; $V_p = V_o$;
   f_q = 858.25 MHz; $V_q = V_o$ −6 dB;
   f_r = 860.25 MHz; $V_r = V_o$ −6 dB;
   measured at $f_p + f_q - f_r$ = 849.25 MHz.
7. Measured according to DIN45004B:
   f_p = 740.25 MHz; $V_p = V_o$;
   f_q = 747.25 MHz; $V_q = V_o$ −6 dB;
   f_r = 749.25 MHz; $V_r = V_o$ −6 dB;
   measured at $f_p + f_q - f_r$ = 738.25 MHz.
8. Measured according to DIN45004B:
   f_p = 540.25 MHz; $V_p = V_o$;
   f_q = 547.25 MHz; $V_q = V_o$ −6 dB;
   f_r = 549.25 MHz; $V_r = V_o$ −6 dB;
   measured at $f_p + f_q - f_r$ = 538.25 MHz.
9. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 35 V.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 110 chs; tilt = 9 dB (50 to 550 MHz); tilt = 3.5 dB at −6 dB offset (550 to 750 MHz).

(1) V_o. (3) Typ.
(2) Typ. +3 σ. (4) Typ. −3 σ.

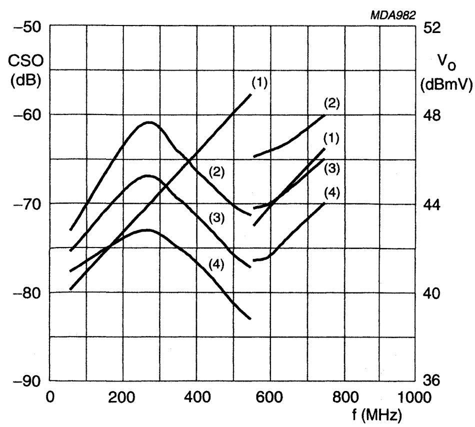
Fig.2 Composite triple beat as function of frequency under tilted conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 110 chs; tilt = 9 dB (50 to 550 MHz); tilt = 3.5 dB at −6 dB offset (550 to 750 MHz).

(1) V_o. (3) Typ.
(2) Typ. +3 σ. (4) Typ. −3 σ.

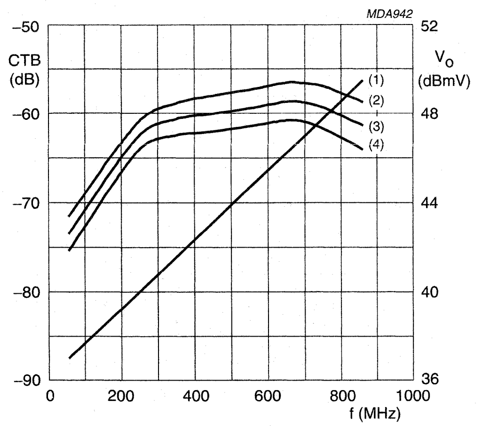
Fig.3 Cross modulation as function of frequency under tilted conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 110 chs; tilt = 9 dB (50 to 550 MHz); tilt = 3.5 dB at −6 dB offset (550 to 750 MHz).

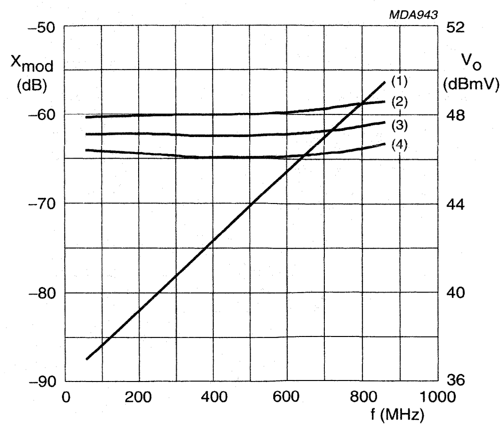
(1) V_o. (3) Typ.
(2) Typ. +3 σ. (4) Typ. −3 σ.

Fig.4 Composite second order distortion as function of frequency under tilted conditions.



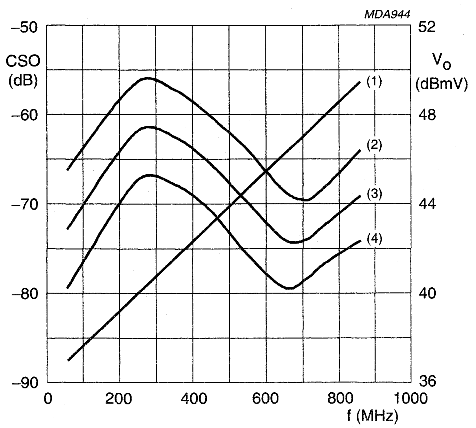
$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 129 chs;
tilt = 12.5 dB; (50 to 860 MHz).
(1) V_o. (3) Typ.
(2) Typ. +3 σ. (4) Typ. −3 σ.

Fig.5 Composite triple beat as function of frequency under tilted conditions.



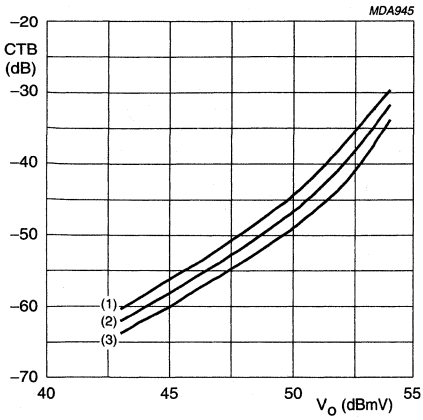
$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 129 chs;
tilt = 12.5 dB; (50 to 860 MHz).
(1) V_o. (3) Typ.
(2) Typ. +3 σ. (4) Typ. −3 σ.

Fig.6 Cross modulation as function of frequency under tilted conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 129 chs;
tilt = 12.5 dB; (50 to 860 MHz).
(1) V_o. (3) Typ.
(2) Typ. +3 σ. (4) Typ. −3 σ.

Fig.7 Composite second order distortion as function of frequency under tilted conditions.



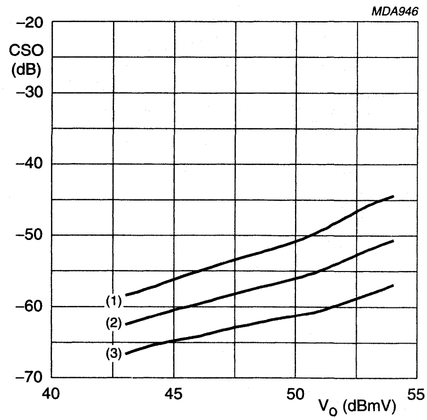
$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 129 chs; $f_m = 859.25$ MHz.

(1) Typ. +3 σ.

(2) Typ.

(3) Typ. −3 σ.

Fig.8 Composite triple beat as function of output voltage.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 129 chs; $f_m = 860.5$ MHz.

(1) Typ. +3 σ.

(2) Typ.

(3) Typ. −3 σ.

Fig.9 Composite second order distortion as function of output voltage.

CATV amplifier module | BGD902L

FEATURES

- Excellent linearity
- Extremely low noise
- Excellent return loss properties
- Silicon nitride passivation
- Rugged construction
- Gold metallization ensures excellent reliability
- Low DC current consumption.

APPLICATIONS

- CATV systems operating in the 40 to 900 MHz frequency range.

DESCRIPTION

Hybrid amplifier module in a SOT115J package operating with a supply voltage of 24 V.

PINNING - SOT115J

PIN	DESCRIPTION
1	input
2	common
3	common
5	$+V_B$
7	common
8	common
9	output

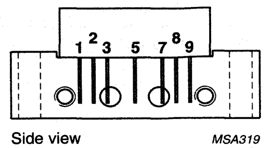


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18.2	18.8	dB
		f = 900 MHz	19	20	dB
I_{tot}	total current consumption (DC)	V_B = 24 V	350	380	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_B	supply voltage	–	30	V
V_i	RF input voltage	–	70	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	operating mounting base temperature	–20	+100	°C

CHARACTERISTICS

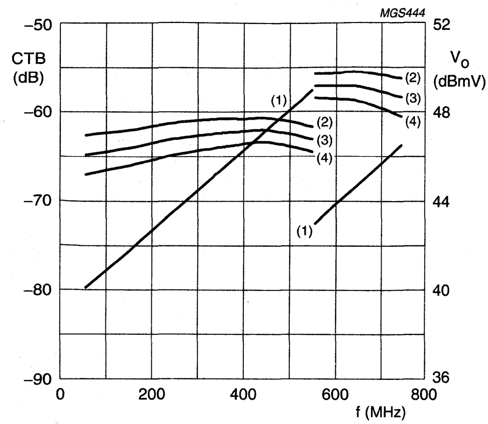
Bandwidth 40 to 900 MHz; V_B = 24 V; T_{mb} = 35 °C; Z_S = Z_L = 75 Ω.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18.2	18.5	18.8	dB
		f = 900 MHz	19	19.5	20	dB
SL	slope straight line	f = 40 to 900 MHz	0.4	0.9	1.4	dB
FL	flatness straight line	f = 40 to 900 MHz	–	±0.15	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	21	24	–	dB
		f = 80 to 160 MHz	22	26	–	dB
		f = 160 to 320 MHz	22	28	–	dB
		f = 320 to 650 MHz	19	22	–	dB
		f = 650 to 900 MHz	18	21	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	25	32	–	dB
		f = 80 to 160 MHz	25	33	–	dB
		f = 160 to 320 MHz	21	29	–	dB
		f = 320 to 750 MHz	20	22	–	dB
		f = 750 to 900 MHz	19	22	–	dB
S_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	49 channels flat; V_o = 47 dBmV; f_m = 859.25 MHz	–	–66.5	–65	dB
		77 channels flat; V_o = 44 dBmV; f_m = 547.25 MHz	–	–68	–66	dB
		110 channels flat; V_o = 44 dBmV; f_m = 745.25 MHz	–	–61.5	–60	dB
		129 channels flat; V_o = 44 dBmV; f_m = 859.25 MHz	–	–58	–56	dB
		110 channels; f_m = 445.25 MHz; V_o = 49 dBmV at 550 MHz; note 1	–	–62	–60	dB
		129 channels; f_m = 697.25 MHz; V_o = 49.5 dBmV at 860 MHz; note 2	–	–56	–53.5	dB
X_{mod}	cross modulation	49 channels flat; V_o = 47 dBmV; f_m = 55.25 MHz	–	–64.5	–62	dB
		77 channels flat; V_o = 44 dBmV; f_m = 55.25 MHz	–	–67.5	–65	dB
		110 channels flat; V_o = 44 dBmV; f_m = 55.25 MHz	–	–64	–61.5	dB
		129 channels flat; V_o = 44 dBmV; f_m = 55.25 MHz	–	–62.5	–60	dB
		110 channels; f_m = 55.25 MHz; V_o = 49 dBmV at 550 MHz; note 1	–	–60.5	–58	dB
		129 channels; f_m = 859.25 MHz; V_o = 49.5 dBmV at 860 MHz; note 2	–	–58	–55	dB

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
CSO	composite second order distortion	49 channels flat; V_o = 47 dBmV; f_m = 860.5 MHz	–	–66	–63	dB
		77 channels flat; V_o = 44 dBmV; f_m = 548.5 MHz	–	–71	–66	dB
		110 channels flat; V_o = 44 dBmV; f_m = 746.5 MHz	–	–65	–60	dB
		129 channels flat; V_o = 44 dBmV; f_m = 860.5 MHz	–	–62	–59	dB
		110 channels; f_m = 246 MHz; V_o = 49 dBmV at 550 MHz; note 1	–	–69	–64	dB
		129 channels; f_m = 246 MHz; V_o = 49.5 dBmV at 860 MHz; note 2	–	–64	–59	dB
d_2	second order distortion	note 3	–	–80	–74	dB
		note 4	–	–83	–77	dB
		note 5	–	–84	–78	dB
V_o	output voltage	d_{im} = –60 dB; note 6	63	64.5	–	dBmV
		d_{im} = –60 dB; note 7	64	65.5	–	dBmV
		d_{im} = –60 dB; note 8	66	67.5	–	dBmV
		CTB compression = 1 dB; 129 channels flat; f = 859.25 MHz	47	48	–	dBmV
		CSO compression = 1 dB; 129 channels flat; f = 860.5 MHz	49.5	51.5	–	dBmV
NF	noise figure	f = 50 MHz	–	4	5	dB
		f = 550 MHz	–	4.3	5.5	dB
		f = 750 MHz	–	5	6.5	dB
		f = 900 MHz	–	6	7.5	dB
I_{tot}	total current consumption (DC)	note 9	350	365	380	mA

Notes

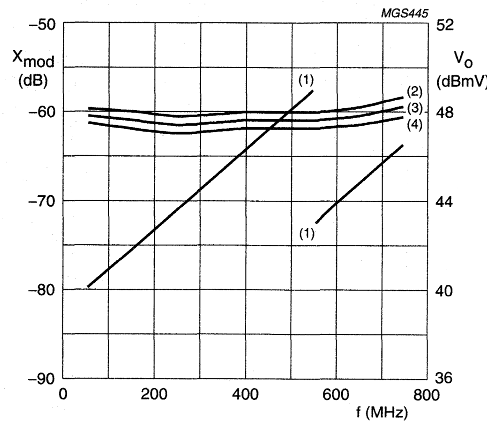
1. Tilt = 9 dB (50 to 550 MHz); tilt = 3.5 dB at –6 dB offset (550 to 750 MHz).
2. Tilt = 12.5 dB (50 to 860 MHz).
3. f_p = 55.25 MHz; V_p = 44 dBmV; f_q = 805.25 MHz; V_q = 44 dBmV; measured at $f_p + f_q$ = 860.5 MHz.
4. f_p = 55.25 MHz; V_p = 44 dBmV; f_q = 691.25 MHz; V_q = 44 dBmV; measured at $f_p + f_q$ = 746.5 MHz.
5. f_p = 55.25 MHz; V_p = 44 dBmV; f_q = 493.25 MHz; V_q = 44 dBmV; measured at $f_p + f_q$ = 548.5 MHz.
6. Measured according to DIN45004B:
   f_p = 851.25 MHz; $V_p = V_o$; f_q = 858.25 MHz; $V_q = V_o$ –6 dB; f_r = 860.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 849.25 MHz.
7. Measured according to DIN45004B:
   f_p = 740.25 MHz; $V_p = V_o$; f_q = 747.25 MHz; $V_q = V_o$ –6 dB; f_r = 749.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 738.25 MHz.
8. Measured according to DIN45004B:
   f_p = 540.25 MHz; $V_p = V_o$; f_q = 547.25 MHz; $V_q = V_o$ –6 dB; f_r = 549.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 538.25 MHz.
9. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 35 V.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 110 chs; tilt = 9 dB (50 to 550 MHz); tilt = 3.5 dB at −6 dB offset (550 to 750 MHz).

(1) V_o.
(2) Typ. +3 σ.
(3) Typ.
(4) Typ. −3 σ.

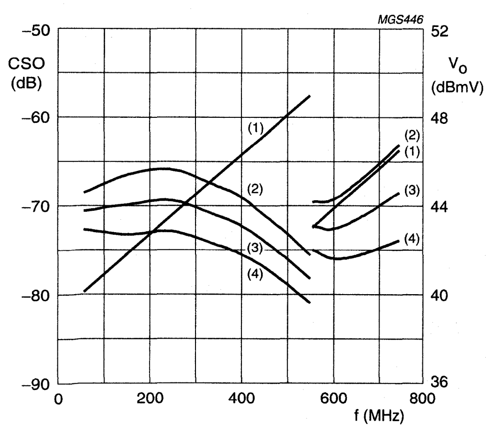
Fig.2 Composite triple beat as a function of frequency under tilted conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 110 chs; tilt = 9 dB (50 to 550 MHz); tilt = 3.5 dB at −6 dB offset (550 to 750 MHz).

(1) V_o.
(2) Typ. +3 σ.
(3) Typ.
(4) Typ. −3 σ.

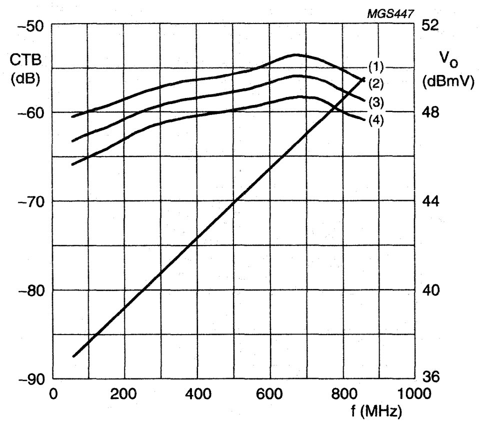
Fig.3 Cross modulation as a function of frequency under tilted conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 110 chs; tilt = 9 dB (50 to 550 MHz); tilt = 3.5 dB at −6 dB offset (550 to 750 MHz).

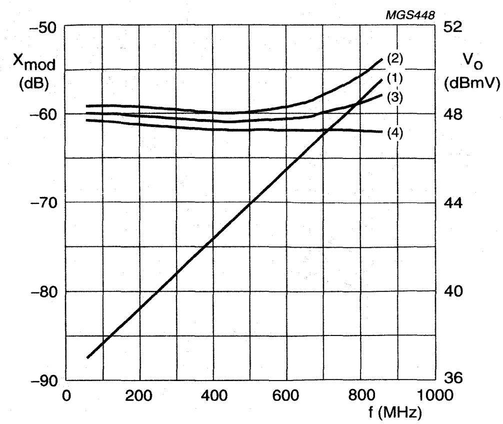
(1) V_o.
(2) Typ. +3 σ.
(3) Typ.
(4) Typ. −3 σ.

Fig.4 Composite second order distortion as a function of frequency under tilted conditions.



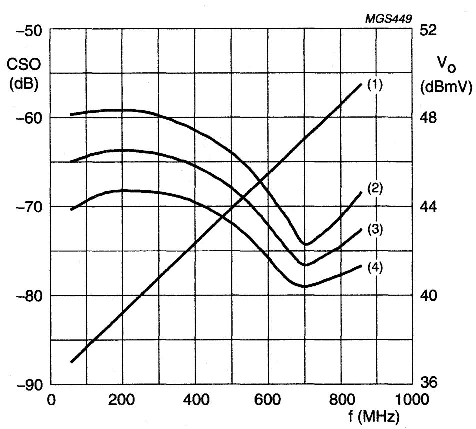
$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 129 chs;
tilt = 12.5 dB; (50 to 860 MHz).
(1) V_o. (3) Typ.
(2) Typ. +3 σ. (4) Typ. −3 σ.

Fig.5 Composite triple beat as a function of frequency under tilted conditions.



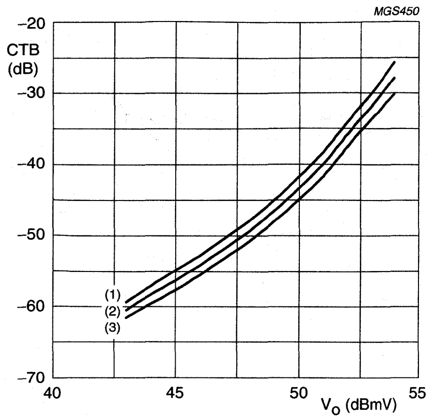
$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 129 chs;
tilt = 12.5 dB; (50 to 860 MHz).
(1) V_o. (3) Typ.
(2) Typ. +3 σ. (4) Typ. −3 σ.

Fig.6 Cross modulation as a function of frequency under tilted conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 129 chs;
tilt = 12.5 dB; (50 to 860 MHz).
(1) V_o. (3) Typ.
(2) Typ. +3 σ. (4) Typ. −3 σ.

Fig.7 Composite second order distortion as a function of frequency under tilted conditions.



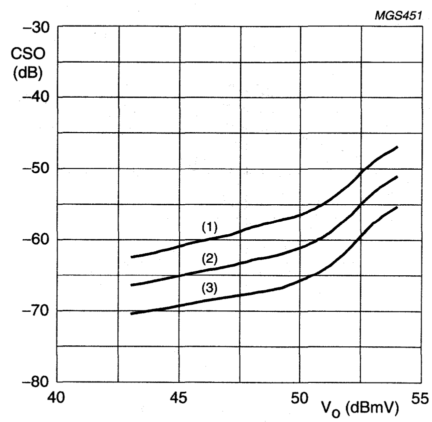
$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 129 chs; $f_m = 859.25$ MHz.

(1) Typ. +3 σ.

(2) Typ.

(3) Typ. −3 σ.

Fig.8 Composite triple beat as a function of output voltage.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 129 chs; $f_m = 860.5$ MHz.

(1) Typ. +3 σ.

(2) Typ.

(3) Typ. −3 σ.

Fig.9 Composite second order distortion as a function of output voltage.

CATV amplifier modules | BGD904; BGD904MI

FEATURES

- Excellent linearity
- Extremely low noise
- Excellent return loss properties
- Silicon nitride passivation
- Rugged construction
- Gold metallization ensures excellent reliability.

APPLICATIONS

- CATV systems operating in the 40 to 900 MHz frequency range.

DESCRIPTION

Hybrid amplifier modules in a SOT115J package operating with a voltage supply of 24 V (DC).
Both modules are electrically identical only the pinning is different.

PINNING - SOT115J

PIN	DESCRIPTION	
	BGD904	BGD904MI
1	input	output
2, 3	common	common
5	$+V_B$	$+V_B$
7, 8	common	common
9	output	input

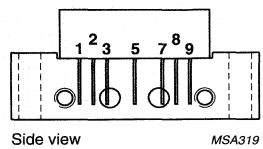


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	19.7	20.3	dB
		f = 900 MHz	20.5	21.5	dB
I_{tot}	total current consumption (DC)	V_B = 24 V	405	435	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_B	supply voltage	–	30	V
V_i	RF input voltage	–	70	dBmV
T_{stg}	storage temperature	−40	+100	°C
T_{mb}	operating mounting base temperature	−20	+100	°C

CHARACTERISTICS

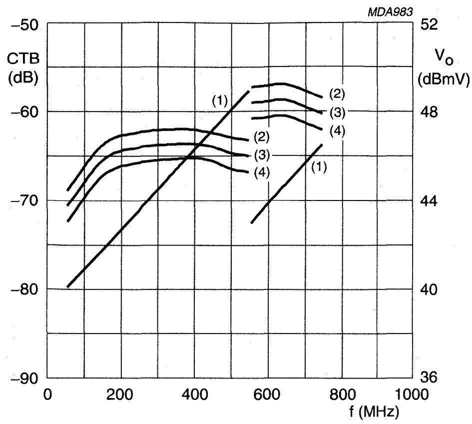
Bandwidth 40 to 900 MHz; V_B = 24 V; T_{mb} = 35 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	19.7	20	20.3	dB
		f = 900 MHz	20.5	21	21.5	dB
SL	slope straight line	f = 40 to 900 MHz	0.4	0.9	1.4	dB
FL	flatness straight line	f = 40 to 900 MHz	–	±0.15	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	21	25	–	dB
		f = 80 to 160 MHz	22	30	–	dB
		f = 160 to 320 MHz	21	29	–	dB
		f = 320 to 550 MHz	18	24	–	dB
		f = 550 to 650 MHz	17	22	–	dB
		f = 650 to 750 MHz	16	21	–	dB
		f = 750 to 900 MHz	16	21	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	25	29	–	dB
		f = 80 to 160 MHz	23	28	–	dB
		f = 160 to 320 MHz	20	25	–	dB
		f = 320 to 550 MHz	20	24	–	dB
		f = 550 to 650 MHz	19	24	–	dB
		f = 650 to 750 MHz	18	24	–	dB
		f = 750 to 900 MHz	17	23	–	dB
S_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	49 chs flat; V_o = 47 dBmV; f_m = 859.25 MHz	–	–68	–66.5	dB
		77 chs flat; V_o = 44 dBmV; f_m = 547.25 MHz	–	–69.5	–67.5	dB
		110 chs flat; V_o = 44 dBmV; f_m = 745.25 MHz	–	–63	–61.5	dB
		129 chs flat; V_o = 44 dBmV; f_m = 859.25 MHz	–	–59.5	–57.5	dB
		110 chs; f_m = 400 MHz; V_o = 49 dBmV at 550 MHz; note 1	–	–63.5	–61.5	dB
		129 chs; f_m = 650 MHz; V_o = 49.5 dBmV at 860 MHz; note 2	–	–58.5	–56	dB
X_{mod}	cross modulation	49 chs flat; V_o = 47 dBmV; f_m = 55.25 MHz	–	–66	–63	dB
		77 chs flat; V_o = 44 dBmV; f_m = 55.25 MHz	–	–68.5	–66	dB
		110 chs flat; V_o = 44 dBmV; f_m = 55.25 MHz	–	–65.5	–62.5	dB
		129 chs flat; V_o = 44 dBmV; f_m = 55.25 MHz	–	–64	–61	dB
		110 chs; f_m = 400 MHz; V_o = 49 dBmV at 550 MHz; note 1	–	–61.5	–59	dB
		129 chs; f_m = 860 MHz; V_o = 49.5 dBmV at 860 MHz; note 2	–	–60	–57	dB

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
CSO	composite second order distortion	49 chs flat; V_o = 47 dBmV; $_m$ = 860.5 MHz	–	–68	–62	dB
		77 chs flat; V_o = 44 dBmV; f_m = 548.5 MHz	–	–72	–67	dB
		110 chs flat; V_o = 44 dBmV; f_m = 746.5 MHz	–	–68	–62	dB
		129 chs flat; V_o = 44 dBmV; f_m = 860.5 MHz	–	–64	–58	dB
		110 chs; f_m = 250 MHz; V_o = 49 dBmV at 550 MHz; note 1	–	–67	–62	dB
		129 chs; f_m = 250 MHz; V_o = 49.5 dBmV at 860 MHz; note 2	–	–62	–58	dB
d_2	second order distortion	note 3	–	–82	–75	dB
		note 4	–	–82	–76	dB
		note 5	–	–83	–77	dB
V_o	output voltage	d_{im} = –60 dB; note 6	64	65.5	–	dBmV
		d_{im} = –60 dB; note 7	65	67	–	dBmV
		d_{im} = –60 dB; note 8	67	69	–	dBmV
		CTB compression = 1 dB; 129 chs flat; f = 859.25 MHz	48.5	49	–	dBmV
		CSO compression = 1 dB; 129 chs flat; f = 860.5 MHz	50	52	–	dBmV
F	noise figure	f = 50 MHz	–	4	5	dB
		f = 550 MHz	–	4.5	5.5	dB
		f = 750 MHz	–	5.1	6.5	dB
		f = 900 MHz	–	6.2	7.5	dB
I_{tot}	total current consumption (DC)	note 9	405	420	435	mA

Notes

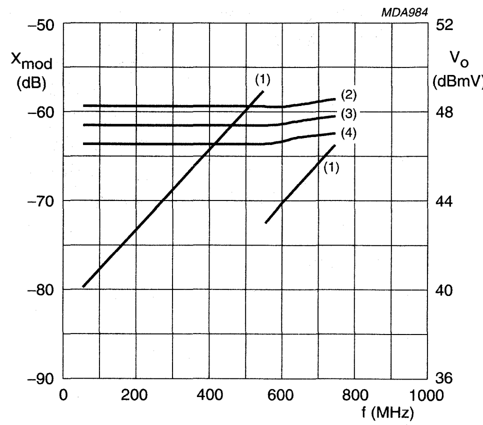
1. Tilt = 9 dB (50 to 550 MHz); tilt = 3.5 dB at –6 dB offset (550 to 750 MHz).
2. Tilt = 12.5 dB (50 to 860 MHz).
3. f_p = 55.25 MHz; V_p = 44 dBmV; f_q = 805.25 MHz; V_q = 44 dBmV; measured at $f_p + f_q$ = 860.5 MHz.
4. f_p = 55.25 MHz; V_p = 44 dBmV; f_q = 691.25 MHz; V_q = 44 dBmV; measured at $f_p + f_q$ = 746.5 MHz.
5. f_p = 55.25 MHz; V_p = 44 dBmV; f_q = 493.25 MHz; V_q = 44 dBmV; measured at $f_p + f_q$ = 548.5 MHz.
6. Measured according to DIN45004B:
   f_p = 851.25 MHz; $V_p = V_o$; f_q = 858.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 860.25 MHz; $V_r = V_o$ –6 dB; measured at $f_p + f_q - f_r$ = 849.25 MHz.
7. Measured according to DIN45004B:
   f_p = 740.25 MHz; $V_p = V_o$; f_q = 747.25 MHz; $V_q = V_o$ –6 dB; f_r = 749.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 738.25 MHz.
8. Measured according to DIN45004B:
   f_p = 540.25 MHz; $V_p = V_o$; f_q = 547.25 MHz; $V_q = V_o$ –6 dB; f_r = 549.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 538.25 MHz.
9. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 35 V.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 110 chs; tilt = 9 dB (50 to 550 MHz); tilt = 3.5 dB at −6 dB offset (550 to 750 MHz).

(1) V_o.
(2) Typ. +3 σ.
(3) Typ.
(4) Typ. −3 σ.

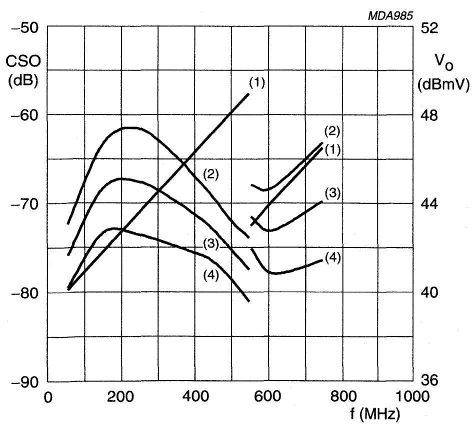
Fig.2 Composite triple beat as a function of frequency under tilted conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 110 chs; tilt = 9 dB (50 to 550 MHz); tilt = 3.5 dB at −6 dB offset (550 to 750 MHz).

(1) V_o.
(2) Typ. +3 σ.
(3) Typ.
(4) Typ. −3 σ.

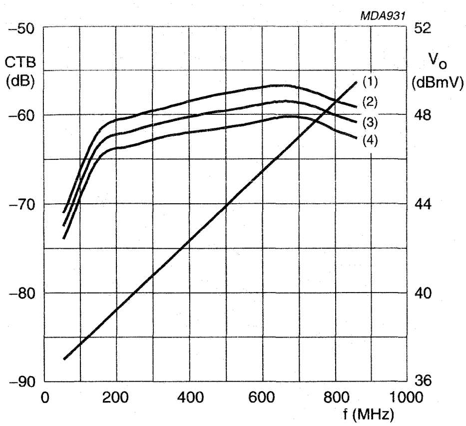
Fig.3 Cross modulation as a function of frequency under tilted conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 110 chs; tilt = 9 dB (50 to 550 MHz); tilt = 3.5 dB at −6 dB offset (550 to 750 MHz).

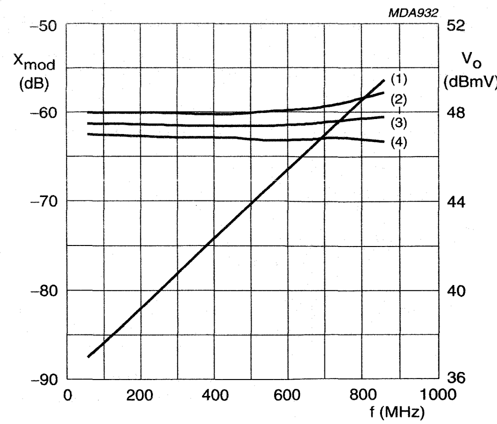
(1) V_o.
(2) Typ. +3 σ.
(3) Typ.
(4) Typ. −3 σ.

Fig.4 Composite second order distortion as a function of frequency under tilted conditions.



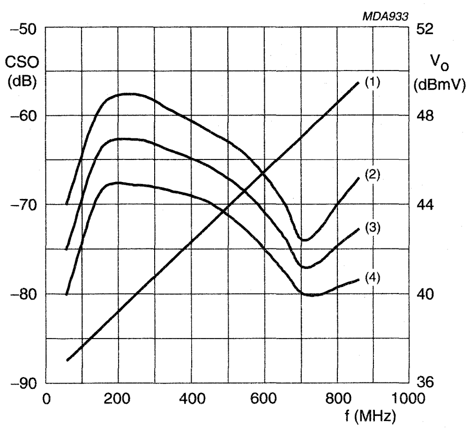
$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 129 chs;
tilt = 12.5 dB; (50 to 860 MHz).
(1) V_o. (3) Typ.
(2) Typ. +3 σ. (4) Typ. −3 σ.

Fig.5 Composite triple beat as a function of frequency under tilted conditions.



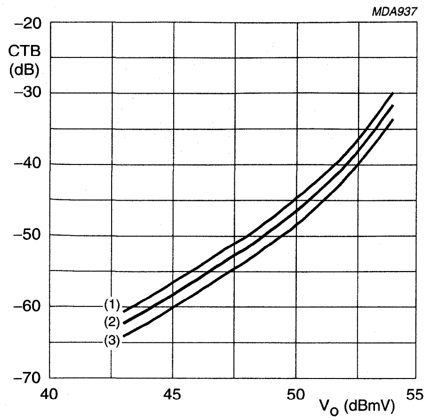
$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 129 chs;
tilt = 12.5 dB; (50 to 860 MHz).
(1) V_o. (3) Typ.
(2) Typ. +3 σ. (4) Typ. −3 σ.

Fig.6 Cross modulation as a function of frequency under tilted conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 129 chs;
tilt = 12.5 dB; (50 to 860 MHz).
(1) V_o. (3) Typ.
(2) Typ. +3 σ. (4) Typ. −3 σ.

Fig.7 Composite second order distortion as a function of frequency under tilted conditions.



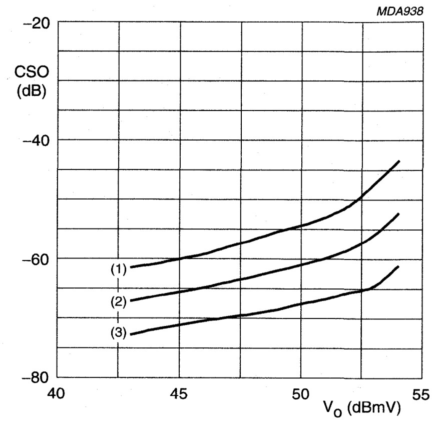
$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 129 chs; $f_m = 859.25$ MHz.

(1) Typ. +3 σ.

(2) Typ.

(3) Typ. −3 σ.

Fig.8 Composite triple beat as a function of output voltage.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 129 chs; $f_m = 860.5$ MHz.

(1) Typ. +3 σ.

(2) Typ.

(3) Typ. −3 σ.

Fig.9 Composite second order distortion as a function of output voltage.

FEATURES

- Excellent linearity
- Extremely low noise
- Excellent return loss properties
- Silicon nitride passivation
- Rugged construction
- Gold metallization ensures excellent reliability
- Low DC current consumption.

APPLICATIONS

- CATV systems operating in the 40 to 900 MHz frequency range.

DESCRIPTION

Hybrid amplifier module in a SOT115J package operating with a supply voltage of 24 V.

PINNING - SOT115J

PIN	DESCRIPTION
1	input
2	common
3	common
5	$+V_B$
7	common
8	common
9	output

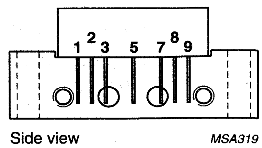


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	19.7	20.3	dB
		f = 900 MHz	20.5	21.5	dB
I_{tot}	total current consumption (DC)	V_B = 24 V	350	380	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_B	supply voltage	–	30	V
V_i	RF input voltage	–	70	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	operating mounting base temperature	–20	+100	°C

CHARACTERISTICS

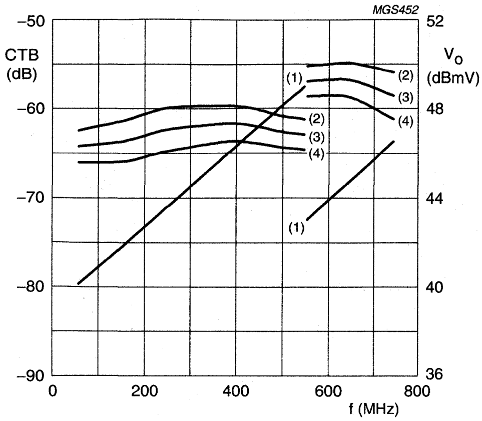
Bandwidth 40 to 900 MHz; V_B = 24 V; T_{mb} = 35 °C; Z_S = Z_L = 75 Ω.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	19.7	20	20.3	dB
		f = 900 MHz	20.5	21	21.5	dB
SL	slope straight line	f = 40 to 900 MHz	0.4	0.9	1.4	dB
FL	flatness straight line	f = 40 to 900 MHz	–	±0.15	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	21	25	–	dB
		f = 80 to 160 MHz	22	30	–	dB
		f = 160 to 320 MHz	21	29	–	dB
		f = 320 to 550 MHz	18	24	–	dB
		f = 550 to 650 MHz	17	22	–	dB
		f = 650 to 900 MHz	16	21	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	25	29	–	dB
		f = 80 to 160 MHz	23	28	–	dB
		f = 160 to 320 MHz	19	25	–	dB
		f = 320 to 750 MHz	18	24	–	dB
		f = 750 to 900 MHz	17	23	–	dB
S_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	49 channels flat; V_o = 47 dBmV; f_m = 859.25 MHz	–	–65.5	–64	dB
		77 channels flat; V_o = 44 dBmV; f_m = 547.25 MHz	–	–67.5	–65.5	dB
		110 channels flat; V_o = 44 dBmV; f_m = 745.25 MHz	–	–61	–59.5	dB
		129 channels flat; V_o = 44 dBmV; f_m = 859.25 MHz	–	–57	–55	dB
		110 channels; f_m = 397.25 MHz; V_o = 49 dBmV at 550 MHz; note 1	–	–61.5	–59.5	dB
		129 channels; f_m = 649.25 MHz; V_o = 49.5 dBmV at 860 MHz; note 2	–	–56	–54	dB
X_{mod}	cross modulation	49 channels flat; V_o = 47 dBmV; f_m = 55.25 MHz	–	–64	–61	dB
		77 channels flat; V_o = 44 dBmV; f_m = 55.25 MHz	–	–66.5	–64	dB
		110 channels flat; V_o = 44 dBmV; f_m = 55.25 MHz	–	–63	–60.5	dB
		129 channels flat; V_o = 44 dBmV; f_m = 55.25 MHz	–	–61.5	–59	dB
		110 channels; f_m = 397.25 MHz; V_o = 49 dBmV at 550 MHz; note 1	–	–60	–57.5	dB
		129 channels; f_m = 859.25 MHz; V_o = 49.5 dBmV at 860 MHz; note 2	–	–56	–53.5	dB

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
CSO	composite second order distortion	49 channels flat; V_o = 47 dBmV; f_m = 860.5 MHz	–	–69	–63	dB
		77 channels flat; V_o = 44 dBmV; f_m = 548.5 MHz	–	–73	–68	dB
		110 channels flat; V_o = 44 dBmV; f_m = 746.5 MHz	–	–69	–63	dB
		129 channels flat; V_o = 44 dBmV; f_m = 860.5 MHz	–	–65	–59	dB
		110 channels; f_m = 150 MHz; V_o = 49 dBmV at 550 MHz; note 1	–	–68	–63	dB
		129 channels; f_m = 150 MHz; V_o = 49.5 dBmV at 860 MHz; note 2	–	–63	–58	dB
d_2	second order distortion	note 3	–	–82	–75	dB
		note 4	–	–83	–76	dB
		note 5	–	–83	–77	dB
V_o	output voltage	d_{im} = –60 dB; note 6	62.5	64	–	dBmV
		d_{im} = –60 dB; note 7	63.5	65.5	–	dBmV
		d_{im} = –60 dB; note 8	65.5	67.5	–	dBmV
		CTB compression = 1 dB; 129 channels flat; f = 859.25 MHz	47.5	48.5	–	dBmV
		CSO compression = 1 dB; 129 channels flat; f = 860.5 MHz	50	52	–	dBmV
NF	noise figure	f = 50 MHz	–	3.8	5	dB
		f = 550 MHz	–	4.1	5.5	dB
		f = 750 MHz	–	4.8	6.5	dB
		f = 900 MHz	–	5.9	7.5	dB
I_{tot}	total current consumption (DC)	note 9	350	365	380	mA

Notes

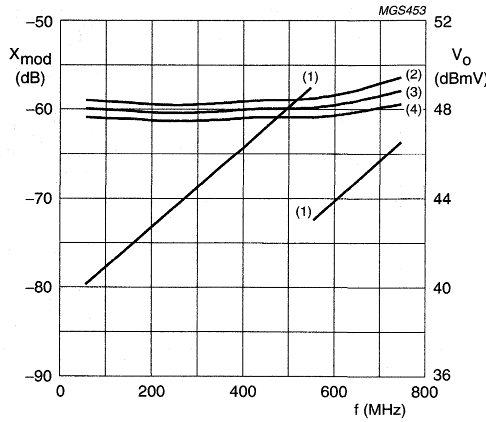
1. Tilt = 9 dB (50 to 550 MHz); tilt = 3.5 dB at –6 dB offset (550 to 750 MHz).
2. Tilt = 12.5 dB (50 to 860 MHz).
3. f_p = 55.25 MHz; V_p = 44 dBmV; f_q = 805.25 MHz; V_q = 44 dBmV; measured at $f_p + f_q$ = 860.5 MHz.
4. f_p = 55.25 MHz; V_p = 44 dBmV; f_q = 691.25 MHz; V_q = 44 dBmV; measured at $f_p + f_q$ = 746.5 MHz.
5. f_p = 55.25 MHz; V_p = 44 dBmV; f_q = 493.25 MHz; V_q = 44 dBmV; measured at $f_p + f_q$ = 548.5 MHz.
6. Measured according to DIN45004B:
   f_p = 851.25 MHz; $V_p = V_o$; f_q = 858.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 860.25 MHz; $V_r = V_o$ –6 dB; measured at $f_p + f_q - f_r$ = 849.25 MHz.
7. Measured according to DIN45004B:
   f_p = 740.25 MHz; $V_p = V_o$; f_q = 747.25 MHz; $V_q = V_o$ –6 dB; f_r = 749.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 738.25 MHz.
8. Measured according to DIN45004B:
   f_p = 540.25 MHz; $V_p = V_o$; f_q = 547.25 MHz; $V_q = V_o$ –6 dB; f_r = 549.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 538.25 MHz.
9. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 35 V.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 110 chs; tilt = 9 dB (50 to 550 MHz); tilt = 3.5 dB at −6 dB offset (550 to 750 MHz).

(1) V_o.
(2) Typ. +3 σ.
(3) Typ.
(4) Typ. −3 σ.

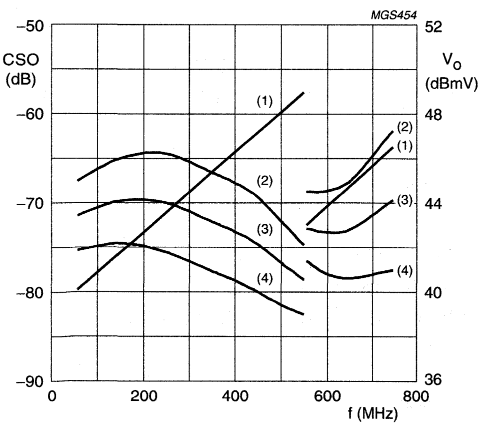
Fig.2 Composite triple beat as a function of frequency under tilted conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 110 chs; tilt = 9 dB (50 to 550 MHz); tilt = 3.5 dB at −6 dB offset (550 to 750 MHz).

(1) V_o.
(2) Typ. +3 σ.
(3) Typ.
(4) Typ. −3 σ.

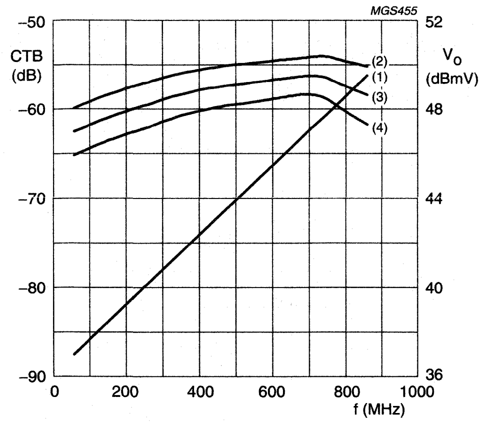
Fig.3 Cross modulation as a function of frequency under tilted conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 110 chs; tilt = 9 dB (50 to 550 MHz); tilt = 3.5 dB at −6 dB offset (550 to 750 MHz).

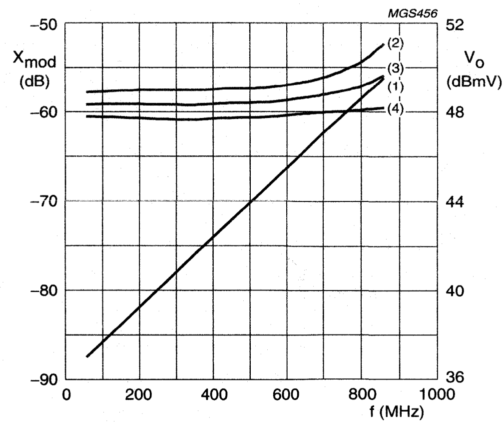
(1) V_o.
(2) Typ. +3 σ.
(3) Typ.
(4) Typ. −3 σ.

Fig.4 Composite second order distortion as a function of frequency under tilted conditions.



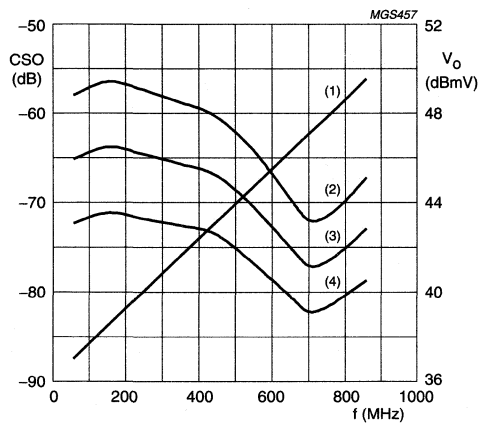
$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 129 chs;
tilt = 12.5 dB; (50 to 860 MHz).
(1) V_o. (3) Typ.
(2) Typ. +3 σ. (4) Typ. −3 σ.

Fig.5 Composite triple beat as a function of frequency under tilted conditions.



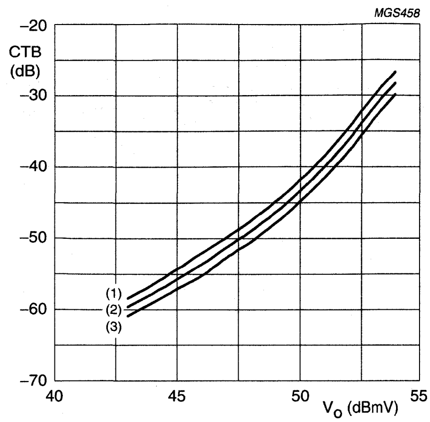
$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 129 chs;
tilt = 12.5 dB; (50 to 860 MHz).
(1) V_o. (3) Typ.
(2) Typ. +3 σ. (4) Typ. −3 σ.

Fig.6 Cross modulation as a function of frequency under tilted conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 129 chs;
tilt = 12.5 dB; (50 to 860 MHz).
(1) V_o. (3) Typ.
(2) Typ. +3 σ. (4) Typ. −3 σ.

Fig.7 Composite second order distortion as a function of frequency under tilted conditions.



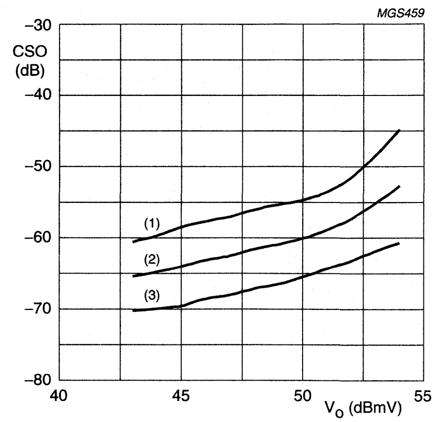
$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 129 chs; $f_m = 859.25$ MHz.

(1) Typ. +3 σ.

(2) Typ.

(3) Typ. −3 σ.

Fig.8 Composite triple beat as a function of output voltage.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 129 chs; $f_m = 860.5$ MHz.

(1) Typ. +3 σ.

(2) Typ.

(3) Typ. −3 σ.

Fig.9 Composite second order distortion as a function of output voltage.

CATV amplifier modules | BGD906; BGD906MI

FEATURES

- Excellent linearity
- Extremely low noise
- Excellent return loss properties
- Silicon nitride passivation
- Rugged construction
- Gold metallization ensures excellent reliability.

APPLICATIONS

- CATV systems operating in the 40 to 900 MHz frequency range.

DESCRIPTION

Hybrid amplifier modules in a SOT115J package operating with a voltage supply of 24 V (DC).
Both modules are electrically identical, only the pinning is different.

PINNING - SOT115J

PIN	DESCRIPTION	
	BGD906	BGD906MI
1	input	output
2, 3	common	common
5	$+V_B$	$+V_B$
7, 8	common	common
9	output	input

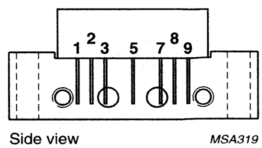


Fig.1 Simplified outline SOT115J.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	21.2	21.8	dB
		f = 900 MHz	22	23	dB
I_{tot}	total current consumption (DC)	V_B = 24 V; T_{mb} = 35 °C	405	435	mA

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 60134).

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_B	supply voltage	–	30	V
V_i	RF input voltage	–	70	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	operating mounting base temperature	–20	+100	°C

CHARACTERISTICS

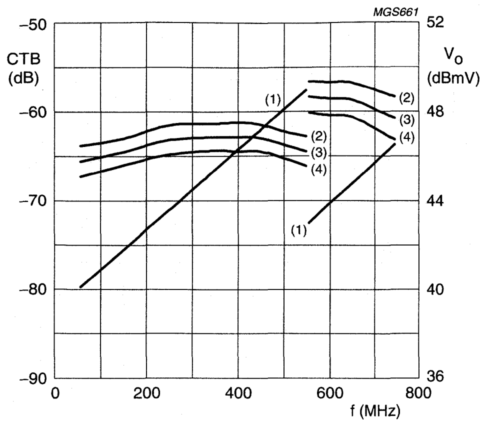
Bandwidth 40 to 900 MHz; V_B = 24 V; T_{mb} = 35 °C; Z_S = Z_L = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	21.2	21.5	21.8	dB
		f = 900 MHz	22	22.5	23	dB
SL	slope straight line	f = 40 to 900 MHz	0.5	1	1.5	dB
FL	flatness straight line	f = 40 to 900 MHz	–	–	±0.35	dB
s_{11}	input return losses	f = 40 to 80 MHz	22	25	–	dB
		f = 80 to 160 MHz	21	24	–	dB
		f = 160 to 320 MHz	18	23	–	dB
		f = 320 to 550 MHz	17	23	–	dB
		f = 550 to 900 MHz	16	20	–	dB
s_{22}	output return losses	f = 40 to 80 MHz	22	25	–	dB
		f = 80 to 160 MHz	21	25	–	dB
		f = 160 to 320 MHz	20	23	–	dB
		f = 320 to 550 MHz	19	22	–	dB
		f = 550 to 650 MHz	18	24	–	dB
		f = 650 to 750 MHz	17	23	–	dB
		f = 750 to 900 MHz	16	21	–	dB
s_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	49 chs flat; V_o = 47 dBmV; f_m = 859.25 MHz	–	–68.5	–66	dB
		77 chs flat; V_o = 44 dBmV; f_m = 547.25 MHz	–	–70	–67	dB
		110 chs flat; V_o = 44 dBmV; f_m = 745.25 MHz	–	–63	–61	dB
		129 chs flat; V_o = 44 dBmV; f_m = 859.25 MHz	–	–59	–57	dB
		110 chs; f_m = 397.25 MHz; V_o = 49 dBmV at 550 MHz; note 1	–	–62.5	–60.5	dB
		129 chs; f_m = 697.25 MHz; V_o = 49.5 dBmV at 860 MHz; note 2	–	–57	–54.5	dB
X_{mod}	cross modulation	49 chs flat; V_o = 47 dBmV; f_m = 55.25 MHz	–	–64	–62	dB
		77 chs flat; V_o = 44 dBmV; f_m = 55.25 MHz	–	–67.5	–65	dB
		110 chs flat; V_o = 44 dBmV; f_m = 55.25 MHz	–	–64	–61.5	dB
		129 chs flat; V_o = 44 dBmV; f_m = 55.25 MHz	–	–61	–60	dB
		110 chs; f_m = 397.25 MHz; V_o = 49 dBmV at 550 MHz; note 1	–	–60	–58	dB
		129 chs; f_m = 859.25 MHz; V_o = 49.5 dBmV at 860 MHz; note 2	–	–56.5	–55	dB

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
CSO	composite second order distortion	49 chs flat; V_o = 47 dBmV; f_m = 860.5 MHz	–	−63	−59	dB
		77 chs flat; V_o = 44 dBmV; f_m = 548.5 MHz	–	−74	−65	dB
		110 chs flat; V_o = 44 dBmV; f_m = 746.5 MHz	–	−66	−58	dB
		129 chs flat; V_o = 44 dBmV; f_m = 860.5 MHz	–	−59	−54	dB
		110 chs; f_m = 150 MHz; V_o = 49 dBmV at 550 MHz; note 1	–	−64	−60	dB
		129 chs; f_m = 150 MHz; V_o = 49.5 dBmV at 860 MHz; note 2	–	−60	−54	dB
d_2	second order distortion	note 3	–	−83	−70	dB
		note 4	–	−81.5	−73	dB
		note 5	–	−79	−76	dB
V_o	output voltage	d_{im} = −60 dB; note 6	63.5	64.5	–	dBmV
		d_{im} = −60 dB; note 7	64.5	66.5	–	dBmV
		d_{im} = −60 dB; note 8	66.5	69	–	dBmV
		CTB compression = 1 dB; 129 chs flat; f = 859.25 MHz	48.5	49	–	dBmV
		CSO compression = 1 dB; 129 chs flat; f = 860.5 MHz	51	54	–	dBmV
NF	noise figure	f = 50 MHz	–	5	5.5	dB
		f = 550 MHz	–	4.5	5	dB
		f = 750 MHz	–	5	6	dB
		f = 900 MHz	–	6	7.5	dB
I_{tot}	total current consumption (DC)	note 9	405	420	435	mA

Notes

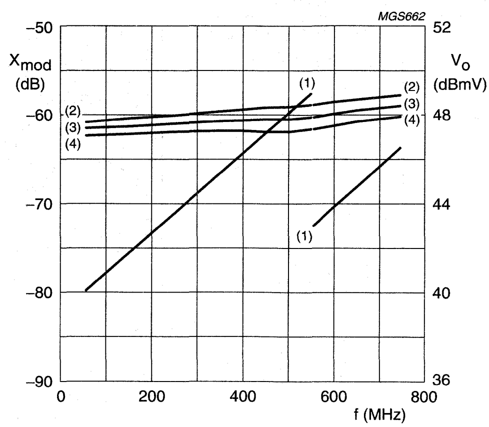
1. Tilt = 9 dB (50 to 550 MHz)
   tilt = 3.5 dB at −6 dB offset (550 to 750 MHz).
2. Tilt = 12.5 dB (50 to 860 MHz).
3. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 805.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 860.5 MHz.
4. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 691.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 746.5 MHz.
5. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 493.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 548.5 MHz.
6. Measured according to DIN45004B:
   f_p = 851.25 MHz; $V_p = V_o$;
   f_q = 858.25 MHz; $V_q = V_o$ −6 dB;
   f_r = 860.25 MHz; $V_r = V_o$ −6 dB;
   measured at $f_p + f_q - f_r$ = 849.25 MHz.
7. Measured according to DIN45004B:
   f_p = 740.25 MHz; $V_p = V_o$;
   f_q = 747.25 MHz; $V_q = V_o$ −6 dB;
   f_r = 749.25 MHz; $V_r = V_o$ −6 dB;
   measured at $f_p + f_q - f_r$ = 738.25 MHz.
8. Measured according to DIN45004B:
   f_p = 540.25 MHz; $V_p = V_o$;
   f_q = 547.25 MHz; $V_q = V_o$ −6 dB;
   f_r = 549.25 MHz; $V_r = V_o$ −6 dB;
   measured at $f_p + f_q - f_r$ = 538.25 MHz.
9. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 35 V.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 110 chs; tilt = 9 dB (50 to 550 MHz);
tilt = 3.5 dB at −6 dB offset (550 to 750 MHz).

(1) V_o. (3) Typ.
(2) Typ. +3 σ. (4) Typ. −3 σ.

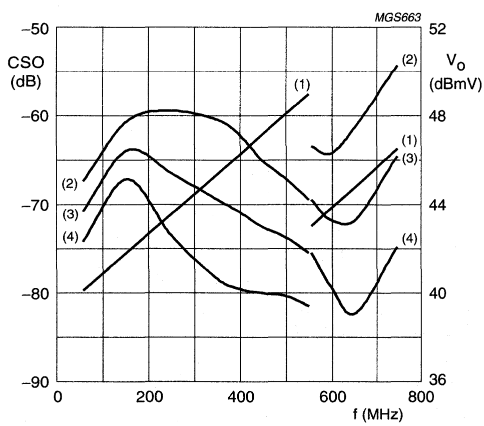
Fig.2 Composite triple beat as a function of frequency under tilted conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 110 chs; tilt = 9 dB (50 to 550 MHz);
tilt = 3.5 dB at −6 dB offset (550 to 750 MHz).

(1) V_o. (3) Typ.
(2) Typ. +3 σ. (4) Typ. −3 σ.

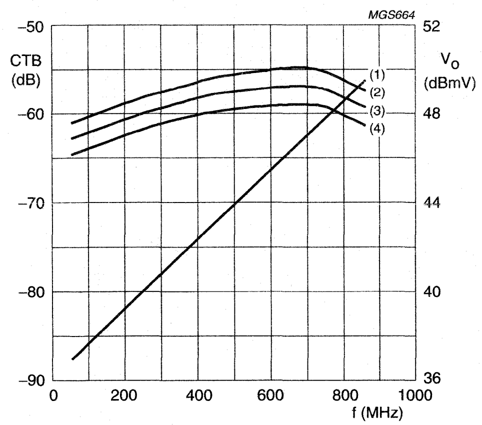
Fig.3 Cross modulation as a function of frequency under tilted conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 110 chs; tilt = 9 dB (50 to 550 MHz);
tilt = 3.5 dB at −6 dB offset (550 to 750 MHz).

(1) V_o. (3) Typ.
(2) Typ. +3 σ. (4) Typ. −3 σ.

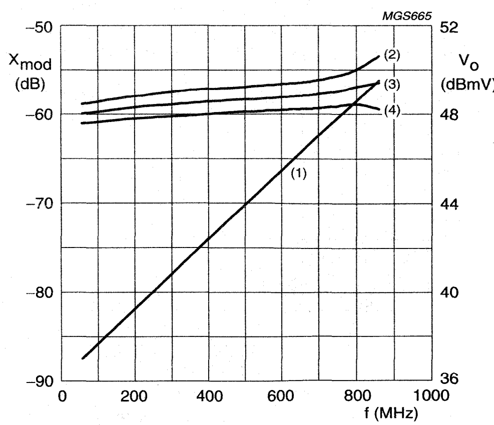
Fig.4 Composite second order distortion as a function of frequency under tilted conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 129 chs;
tilt = 12.5 dB (50 to 860 MHz).

(1) V_o.
(2) Typ. +3 σ.
(3) Typ.
(4) Typ. −3 σ.

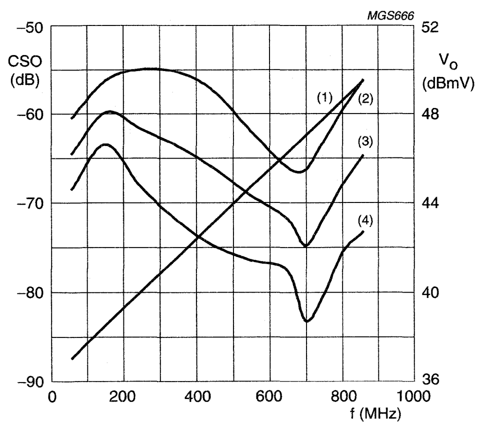
Fig.5 Composite triple beat as a function of frequency under tilted conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 129 chs;
tilt = 12.5 dB (50 to 860 MHz).

(1) V_o.
(2) Typ. +3 σ.
(3) Typ.
(4) Typ. −3 σ.

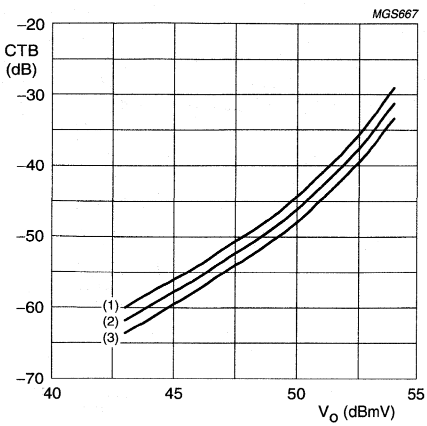
Fig.6 Cross modulation as a function of frequency under tilted conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 129 chs;
tilt = 12.5 dB (50 to 860 MHz).

(1) V_o.
(2) Typ. +3 σ.
(3) Typ.
(4) Typ. −3 σ.

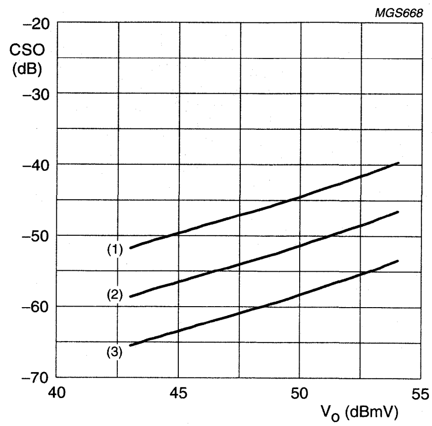
Fig.7 Composite second order distortion as a function of frequency under tilted conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 129 chs; $f_m = 859.25$ MHz.

(1) Typ. +3 σ.
(2) Typ.
(3) Typ. −3 σ.

Fig.8 Composite triple beat as a function of output voltage.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 129 chs; $f_m = 860.5$ MHz.

(1) Typ. +3 σ.
(2) Typ.
(3) Typ. −3 σ.

Fig.9 Composite second order distortion as a function of output voltage.

FEATURES

- Excellent linearity
- Extremely low noise
- Excellent flatness
- Standard CATV outline
- Rugged construction
- Gold metallization ensures excellent reliability.

APPLICATIONS

- Reverse receiver amplifiers in two-way CATV systems in the 5 to 300 MHz frequency range.

DESCRIPTION

Hybrid high dynamic range optical receiver amplifier module in a SOT115U package operating at a voltage supply of 24 V (DC). The module contains a monomode optical input suitable for wavelengths from 1290 to 1600 nm, a terminal to monitor the pin diode current and an electrical output with an impedance of 75 Ω.

PINNING - SOT115U

PIN	DESCRIPTION
1	monitor current
2	common
3	common
5	$+V_B$
7	common
8	common
9	output

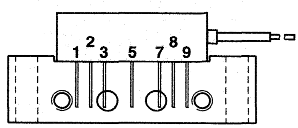


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
f	frequency range		5	300	MHz
S_{22}	output return losses	f = 5 to 300 MHz	15	–	dB
	optical input return losses		45	–	dB
d_2	second order distortion		–	–70	dBc
F	equivalent noise input	f = 10 to 300 MHz	–	7	pA/√Hz
I_{tot}	total current consumption (DC)	V_B = 24 V	160	190	mA

HANDLING

Fibreglass optical coupling: maximum tensile strength = 5 N; minimum bending radius = 35 mm.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
f	frequency range		5	300	MHz
T_{stg}	storage temperature		–40	+85	°C
T_{mb}	operating mounting base temperature		–20	+85	°C
P_{in}	optical input power	continuous	–	5	mW
ESD	ESD sensitivity	human body model; R = 1.5 kΩ; C = 100 pF	500	–	V

CHARACTERISTICS

Table 1 Bandwidth 5 to 300 MHz; V_B = 24 V; T_{mb} = 30 °C; Z_L = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
S	responsivity	λ = 1300 nm	800	–	V/W
FL	flatness of frequency response		–	±0.3	dB
S_{22}	output return losses	f = 5 to 300 MHz	15	–	dB
	optical input return losses		45	–	dB
d_2	second order distortion	note 1	–	–70	dB
d_3	third order distortion	note 2	–	–80	dB
F	equivalent noise input	f = 10 to 300 MHz	–	7	pA/√Hz
s_λ	spectral sensitivity	λ = 1310 ±20 nm	0.85	–	A/W
		λ = 1550 ±20 nm	0.9	–	A/W
λ	optical wavelength		1290	1600	nm
L	length of optical fibre	fibre; SM type; 9/125 µm	1	–	m
I_{tot}	total current consumption (DC)	note 3	160	190	mA

Notes

1. Two laser test; each laser with 40% modulation index;
   f_p = 20.25 MHz; P_p = 0.5 mW;
   f_q = 34 MHz; P_q = 0.5 mW;
   measured at $f_p + f_q$ = 54.25 MHz.
2. Three laser test; each laser with 40% modulation index;
   f_p = 125.25 MHz; P_p = 0.33 mW;
   f_q = 110.25 MHz; P_q = 0.33 mW;
   f_r = 135.25 MHz; P_r = 0.33 mW;
   measured at $f_p + f_q - f_r$ = 100.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

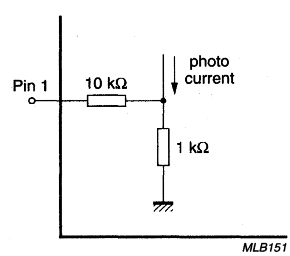


Fig.2 Monitor current pin.

Optical receiver module BGE67BO/4M

FEATURES

- Excellent linearity
- Extremely low noise
- Excellent flatness
- Standard CATV outline
- Rugged construction
- Gold metallization ensures excellent reliability.

APPLICATIONS

- Reverse receiver amplifiers in two-way CATV systems in the 5 to 400 MHz frequency range.

DESCRIPTION

Hybrid high dynamic range optical receiver amplifier module in a SOT115U package operating at a voltage supply of 24 V (DC). The module contains a monomode optical input suitable for wavelengths from 1290 to 1600 nm, a terminal to monitor the pin diode current and an electrical output with an impedance of 75 Ω.

PINNING - SOT115U

PIN	DESCRIPTION
1	monitor current
2	common
3	common
5	$+V_B$
7	common
8	common
9	output

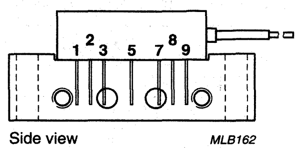


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
f	frequency range		5	400	MHz
S_{22}	output return losses	f = 5 to 400 MHz	14	–	dB
	optical input return losses		45	–	dB
d_2	second order distortion		–	–70	dBc
F	equivalent noise input	f = 5 to 400 MHz	–	7	pA/√Hz
I_{tot}	total current consumption (DC)	V_B = 24 V	150	180	mA

HANDLING

Fibreglass optical coupling: maximum tensile strength = 5 N; minimum bending radius = 35 mm.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
f	frequency range		5	400	MHz
T_{stg}	storage temperature		−40	+85	°C
T_{mb}	operating mounting base temperature		−20	+85	°C
P_{in}	optical input power	continuous	−	5	mW
ESD	ESD sensitivity	human body model; R = 1.5 kΩ; C = 100 pF	500	−	V

CHARACTERISTICS

Table 1 Bandwidth 5 to 400 MHz; V_B = 24 V; T_{mb} = 30 °C; Z_L = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
S	responsivity	λ = 1300 nm	800	−	V/W
FL	flatness of frequency response		−	±0.3	dB
S_{22}	output return losses	f = 5 to 400 MHz	14	−	dB
	optical input return losses		45	−	dB
d_2	second order distortion	note 1	−	−70	dB
		note 2	−	−70	dB
d_3	third order distortion	note 3	−	−80	dB
F	equivalent noise input	f = 5 to 400 MHz	−	7	pA/√Hz
s_λ	spectral sensitivity	λ = 1310 ±20 nm	0.85	−	A/W
		λ = 1550 ±20 nm	0.9	−	A/W
λ	optical wavelength		1290	1600	nm
L	length of optical fibre	fibre; SM type; 9/125 μm	1	−	m
I_{tot}	total current consumption (DC)	note 4	150	180	mA

Notes

1. Two laser test; each laser with 40% modulation index; f_p = 30.25 MHz; P_p = 0.5 mW; f_q = 70 MHz; P_q = 0.5 mW; measured at $f_p + f_q$ = 100.25 MHz.
2. Two laser test; each laser with 40% modulation index; f_p = 200.25 MHz; P_p = 0.5 mW; f_q = 100 MHz; P_q = 0.5 mW; measured at $f_p + f_q$ = 300.25 MHz.
3. Three laser test; each laser with 40% modulation index; f_p = 325.25 MHz; P_p = 0.33 mW; f_q = 210.25 MHz; P_q = 0.33 mW; f_r = 135.25 MHz; P_r = 0.33 mW; measured at $f_p + f_q - f_r$ = 400.25 MHz.
4. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

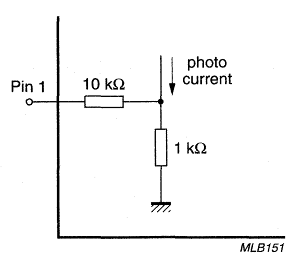


Fig.2 Monitor current pin.

CATV amplifier module BGE787B

FEATURES

- Excellent linearity
- Extremely low noise
- High gain
- Excellent return loss properties.

APPLICATIONS

- Single module line extender in CATV systems operating in the 40 to 750 MHz frequency range.

DESCRIPTION

Hybrid high dynamic range amplifier module operating at a supply voltage of 24 V (DC) in a SOT115J package. The module consists of two cascaded stages both in cascode configuration.

PINNING - SOT115J

PIN	DESCRIPTION
1	input
2, 3, 7, 8	common
5	$+V_B$
9	output

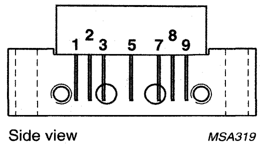


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	28.5	29.5	dB
		f = 750 MHz	29	–	dB
I_{tot}	total current consumption (DC)	V_B = 24 V	290	320	mA

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 60134).

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_B	supply voltage	–	25	V
V_i	RF input voltage	–	55	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	mounting base operating temperature	–20	+100	°C

CHARACTERISTICS

Bandwidth 40 to 750 MHz; V_B = 24 V; T_{case} = 30 °C; Z_S = Z_L = 75 Ω.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	28.5	29.5	dB
		f = 750 MHz	29	–	dB
SL	slope cable equivalent	f = 40 to 750 MHz	0.2	2.2	dB
FL	flatness of frequency response	f = 40 to 750 MHz	–	±0.5	dB
s_{11}	input return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	18.5	–	dB
		f = 160 to 320 MHz	17	–	dB
		f = 320 to 640 MHz	15.5	–	dB
		f = 640 to 750 MHz	14	–	dB
s_{22}	output return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	18.5	–	dB
		f = 160 to 320 MHz	17	–	dB
		f = 320 to 640 MHz	15.5	–	dB
		f = 640 to 750 MHz	14	–	dB
s_{21}	phase response	f = 50 MHz	135	225	deg
CTB	composite triple beat	110 channels flat; V_o = 44 dBmV; measured at 745.25 MHz	–	–50	dB
X_{mod}	cross modulation	110 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–54	dB
CSO	composite second order distortion	110 channels flat; V_o = 44 dBmV; measured at 746.5 MHz	–	–56	dB
d_2	second order distortion	note 1	–	–70	dB
V_o	output voltage	d_{im} = –60 dB; note 2	59	–	dBmV
F	noise figure	f = 750 MHz	–	7	dB
PM	positive match	f = 40 MHz to 2 GHz	–	3	dB
I_{tot}	total current consumption (DC)	note 3	290	320	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 691.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 746.5 MHz.
2. Measured according to DIN45004B;
   f_p = 740.25 MHz; $V_p = V_o$;
   f_q = 747.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 749.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 738.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

CATV amplifier module | BGE788

FEATURES

- Excellent linearity
- Extremely low noise
- High gain
- Excellent return loss properties.

APPLICATIONS

- Single module line extender in CATV systems operating in the 40 to 750 MHz frequency range.

DESCRIPTION

Hybrid high dynamic range amplifier module operating at a supply voltage of 24 V (DC) in a SOT115J package. The module consists of two cascaded stages both in cascode configuration.

PINNING - SOT115J

PIN	DESCRIPTION
1	input
2	common
3	common
5	$+V_B$
7	common
8	common
9	output

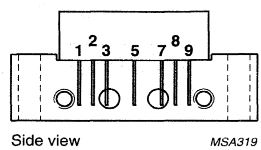


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	33.5	34.5	dB
		f = 750 MHz	34	–	dB
I_{tot}	total current consumption (DC)	V_B = 24 V	290	320	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_B	supply voltage	–	25	V
V_i	RF input voltage	–	55	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	mounting base operating temperature	–20	+100	°C

CHARACTERISTICS

Bandwidth 40 to 750 MHz; V_B = 24 V; T_{case} = 30 °C; $Z_S = Z_L$ = 75 Ω.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	33.5	34.5	dB
		f = 750 MHz	34	–	dB
SL	slope cable equivalent	f = 40 to 750 MHz	0.5	2.5	dB
FL	flatness of frequency response	f = 40 to 750 MHz	–	±0.5	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	18.5	–	dB
		f = 160 to 320 MHz	17	–	dB
		f = 320 to 640 MHz	15.5	–	dB
		f = 640 to 750 MHz	14	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	18.5	–	dB
		f = 160 to 320 MHz	17	–	dB
		f = 320 to 640 MHz	15.5	–	dB
		f = 640 to 750 MHz	14	–	dB
S_{21}	phase response	f = 50 MHz	135	225	deg
CTB	composite triple beat	110 channels flat; V_o = 44 dBmV; measured at 745.25 MHz	–	–49	dB
X_{mod}	cross modulation	110 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–51	dB
CSO	composite second order distortion	110 channels flat; V_o = 44 dBmV; measured at 746.5 MHz	–	–52	dB
d_2	second order distortion	note 1	–	–64	dB
V_o	output voltage	d_{im} = –60 dB; note 2	58	–	dBmV
F	noise figure	f = 750 MHz	–	7	dB
PM	positive match	f = 40 MHz to 2 GHz	–	3	dB
I_{tot}	total current consumption (DC)	note 3	290	320	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 691.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 746.5 MHz.
2. Measured according to DIN45004B;
   f_p = 740.25 MHz; $V_p = V_o$;
   f_q = 747.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 749.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 738.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Optical receiver module BGE847BO/FC

FEATURES

- Excellent linearity
- Extremely low noise
- Excellent flatness
- Standard CATV outline
- Rugged construction
- Gold metallization ensures excellent reliability
- FC/APC connector (JDS version).

APPLICATIONS

- CATV systems operating in the 40 to 870 MHz frequency range.

DESCRIPTION

Hybrid high dynamic range optical receiver module in a SOT115W package. Two of the module pins are for connection to 24 V (DC); one for amplifier supply voltage and the other for the pin diode bias.

The module contains a monomode optical input suitable for wavelengths from 1290 to 1600 nm, a terminal to monitor the pin diode current and an electrical output with an impedance of 75 Ω. The optical fibre is terminated by an FC/APC connector (JDS version) and partly reinforced by a 3 mm diameter Kevlar buffer.

PINNING - SOT115W

PIN	DESCRIPTION
1	monitor current
2	common
3	common
4	$+V_B$ of the pin diode
5	$+V_B$ of the amplifier
7	common
8	common
9	output

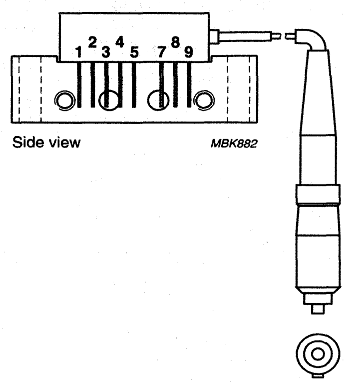


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
f	frequency range		40	870	MHz
S_{22}	output return losses	f = 40 to 870 MHz	11	–	dB
	optical input return losses		45	–	dB
d_2	second order distortion	f = 324.25 MHz	–	−70	dBc
F	equivalent noise input	f = 40 MHz	–	7	pA/√Hz
I_{tot}	total current consumption (DC)	V_B = 24 V	175	205	mA

HANDLING

Fibreglass optical coupling: maximum tensile strength = 5 N; minimum bending radius = 35 mm.

Optical receiver module | BGE847BO/FC

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
f	frequency range		40	870	MHz
T_{stg}	storage temperature		−40	+85	°C
T_{mb}	operating mounting base temperature		−20	+85	°C
P_{in}	optical input power	continuous	–	5	mW
ESD	ESD sensitivity	human body model; R = 1.5 kΩ; C = 100 pF	500	–	V

CHARACTERISTICS

Table 1 Bandwidth 40 to 870 MHz; V_B = 24 V; T_{mb} = 30 °C; Z_L = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
S	responsivity	λ = 1300 nm	750	–	V/W
FL	flatness of frequency response	f_1 = 40 to 870 MHz	–	±0.5	dB
S_{22}	output return losses	f_1 = 40 to 870 MHz	11	–	dB
	optical input return losses		45	–	dB
OBR_C	connector optical return losses		60	–	dB
IL_C	connector optical insertion losses		–	0.5	dB
d_2	second order distortion	note 1	–	−70	dB
d_3	third order distortion	note 2	–	−80	dB
F	equivalent noise input	f_1 = 40 MHz	–	7	pA/√Hz
$s_λ$	spectral sensitivity	λ = 1310 ±20 nm	0.85	–	A/W
		λ = 1550 ±20 nm	0.9	–	A/W
λ	optical wavelength		1290	1600	nm
L	length of optical fibre	buffered fibre; SM type; 9/125 μm; Kevlar buffer: 3 mm	577	627	mm
I_{tot}	total current consumption (DC)	note 3	175	205	mA
$I_{pin\ 4}$	pin diode bias current (DC)		–	25	mA

Notes

1. Two laser test; each laser with 40% modulation index: f_p = 135 MHz; P_p = 0.5 mW; f_q = 189.25 MHz; P_q = 0.5 mW; measured at $f_p + f_q$ = 324.25 MHz.
2. Three laser test; each laser with 40% modulation index: f_p = 326.25 MHz; P_p = 0.33 mW; f_q = 333.25 MHz; P_q = 0.33 mW; f_r = 335.25 MHz; P_r = 0.33 mW; measured at $f_p + f_q - f_r$ = 324.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

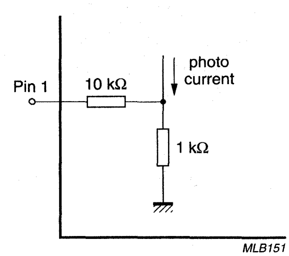


Fig.2 Monitor current pin.

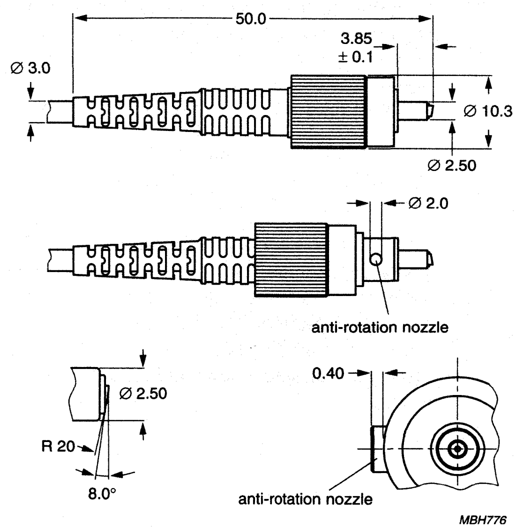


Fig.3 FC/APC connector.

Optical receiver modules

BGE847BO; BGE847BO/FC0; BGE847BO/SC0

FEATURES

- Excellent linearity
- Low noise
- Excellent flatness
- Standard CATV outline
- Rugged construction
- Gold metallization ensures excellent reliability
- High optical input power range.

APPLICATIONS

CATV optical node systems operating in the 40 to 870 MHz frequency range.

DESCRIPTION

High dynamic range optical receiver amplifier modules in a standard SOT115 package where the non-jacketed fibre has either no connector or has an FC/APC or SC/APC connector.

The amplifier supply voltage pin and the photo diode bias voltage pin both connect to 24 V (DC).

The modules have a monomode optical input suitable for 1290 to 1600 nm wavelengths, a terminal to monitor the photo diode current and an electrical output having a characteristic impedance of 75 Ω.

PINNING

PIN	DESCRIPTION
1	monitor current
2	common
3	common
4	$+V_B$ of the photo diode
5	$+V_B$ of the amplifier
7	common
8	common
9	output

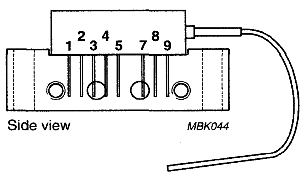


Fig.1 Simplified outline SOT115T (BGE847BO).

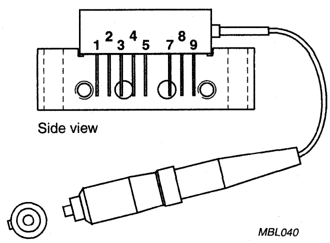


Fig.2 Simplified outline SOT115X (BGE847BO/FC0).

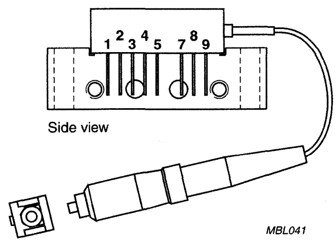


Fig.3 Simplified outline SOT115Y (BGE847BO/SC0).

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
f	frequency range		40	870	MHz
S_{22}	output return losses	f = 40 to 870 MHz	11	–	dB
	optical input return losses		45	–	dB
d_2	second order distortion	f = 854.5 MHz	–	−57	dBc
F	equivalent noise input	f = 40 to 450 MHz	–	7	pA/√Hz
I_{tot}	total current consumption (DC)	V_B = 24 V	175	205	mA

HANDLING

Fibreglass optical coupling: maximum tensile strength = 5 N; minimum bending radius = 35 mm.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 60134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
f	frequency range		40	870	MHz
T_{stg}	storage temperature		−40	+85	°C
T_{mb}	operating mounting base temperature		−20	+85	°C
P_{in}	optical input power	continuous	−	5	mW
ESD	ESD sensitivity	human body model; R = 1.5 kΩ; C = 100 pF	500	−	V

CHARACTERISTICS

Bandwidth 40 to 870 MHz; V_B = 24 V; T_{mb} = 30 °C; Z_S = Z_L = 75 Ω.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
S	responsivity	λ = 1300 nm			
	BGE847BO		800	−	V/W
	BGE847BO/FC0, BGE847BO/SC0		750	−	V/W
FL	flatness straight line (peak to valley)	f = 40 to 870 MHz	−	1	dB
S_{22}	output return losses	f = 40 to 870 MHz	11	−	dB
	optical input return losses		45	−	dB
d_2	second order distortion	f_m = 446.5 MHz; notes 1 and 3	−	−68	dB
		f_m = 746.5 MHz; notes 1 and 4		−63	dB
		f_m = 854.5 MHz; notes 1 and 5		−57	dB
d_3	third order distortion	f_m = 853.25 MHz; notes 2 and 6	−	−75	dB
F	equivalent noise input	f = 40 to 450 MHz	−	7	pA/√Hz
		f = 450 to 750 MHz	−	9	pA/√Hz
		f = 750 to 870 MHz	−	10.5	pA/√Hz
s_λ	spectral sensitivity	λ = 1310 ±20 nm	0.85	−	A/W
		λ = 1550 ±20 nm	0.9	−	A/W
λ	optical wavelength		1290	1600	nm
L	length of optical fibre	fibre; SM type; 9/125 μm			
	BGE847BO		1	−	m
	BGE847BO/FC0, BGE847BO/SC0		746	861	mm
I_{tot}	total current consumption (DC)		175	205	mA
$I_{pin\ 4}$	photo diode bias current (DC)		−	25	mA

Notes

1. Two laser test; each laser with a modulation index of 40%; P_{opt} = 1 mW (total).
2. Three laser test; each laser with a modulation index of 60%; P_{opt} = 1 mW (total).
3. f_m = 446.5 MHz; f_p = 97.25 MHz; f_q = 349.25 MHz.
4. f_m = 746.5 MHz; f_p = 133.25 MHz; f_q = 613.25 MHz.
5. f_m = 854.5 MHz; f_p = 133.25 MHz; f_q = 721.25 MHz.
6. f_m = 853.25 MHz; f_p = 133.25 MHz; f_q = 265.25 MHz; f_r = 721.25 MHz.

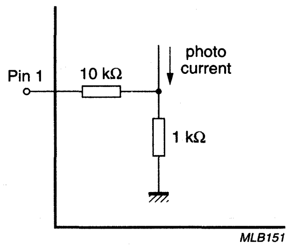


Fig.4 Monitor current pin.

FEATURES

- Excellent linearity
- Low noise
- Excellent flatness
- Standard CATV outline
- Rugged construction
- Gold metallization ensures excellent reliability.

APPLICATIONS

- CATV systems operating in the 40 to 860 MHz frequency range.

DESCRIPTION

Hybrid high dynamic range optical receiver module in a SOT115U package operating at a voltage supply of 24 V (DC). The module contains a monomode optical input suitable for wavelengths from 1 290 to 1 600 nm, a terminal to monitor the pin diode current and an electrical output with an impedance of 75 Ω.

PINNING - SOT115U

PIN	DESCRIPTION
1	monitor current
2	common
3	common
5	$+V_B$
7	common
8	common
9	output

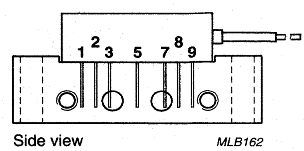


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
f	frequency range		40	860	MHz
S_{22}	output return losses	f = 40 to 860 MHz	17	–	dB
	optical input return losses		45	–	dB
d_2	second order distortion	f = 324.25 MHz	–	−76	dBc
F	equivalent noise input	f = 40 to 860 MHz	–	13	pA/√Hz
I_{tot}	total current consumption (DC)	V_B = 24 V	175	205	mA

HANDLING

Fibreglass optical coupling: maximum tensile strength = 5 N; minimum bending radius = 35 mm.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
f	frequency range		40	860	MHz
T_{stg}	storage temperature		−40	+85	°C
T_{mb}	operating mounting base temperature		−20	+85	°C
P_{in}	optical input power	continuous	−	5	mW
ESD	ESD sensitivity	human body model; R = 1.5 kΩ; C = 100 pF	500	−	V

CHARACTERISTICS

Table 1 Bandwidth 40 to 860 MHz; V_B = 24 V; T_{mb} = 30 °C; Z_L = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
S	responsivity	λ = 1300 nm	400	−	V/W
FL	flatness of frequency response		−	±0.5	dB
S_{22}	output return losses	f = 40 to 860 MHz	17	−	dB
	optical input return losses		45	−	dB
d_2	second order distortion	note 1	−	−76	dB
d_3	third order distortion	note 2	−	−92	dB
		note 3	−	−80	dB
F	equivalent noise input	f = 40 MHz to 860 MHz	−	13	pA/√Hz
s_λ	spectral sensitivity	λ = 1310 ±20 nm	0.85	−	A/W
		λ = 1550 ±20 nm	0.9	−	A/W
λ	optical wavelength		1290	1600	nm
L	length of optical fibre	fibre; SM type; 9/125 μm	1	−	m
I_{tot}	total current consumption (DC)	V_B = 24 V	175	205	mA

Notes

1. Two laser test; each laser with 40% modulation index;
   f_p = 135 MHz; P_p = 0.5 mW;
   f_q = 189.25 MHz; P_q = 0.5 mW;
   measured at $f_p + f_q$ = 324.25 MHz.
2. Three laser test; each laser with 40% modulation index;
   f_p = 326.25 MHz; P_p = 0.33 mW;
   f_q = 333.25 MHz; P_q = 0.33 mW;
   f_r = 335.25 MHz; P_r = 0.33 mW;
   measured at $f_p + f_q - f_r$ = 324.25 MHz.
3. Three laser test; each laser with 50% modulation index;
   f_p = 326.25 MHz; P_p = 0.53 mW;
   f_q = 333.25 MHz; P_q = 0.53 mW;
   f_r = 335.25 MHz; P_r = 0.53 mW;
   measured at $f_p + f_q - f_r$ = 324.25 MHz.

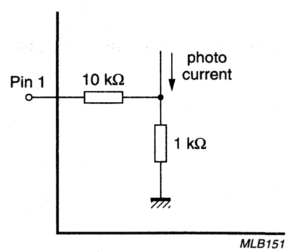


Fig.2 Monitor current pin.

CATV amplifier module BGE885

FEATURES

- Excellent linearity
- Extremely low noise
- Rugged construction
- TiPtAu metallized crystals ensure optimal reliability.

DESCRIPTION

Hybrid amplifier module for use in CATV systems operating over a frequency range of 40 to 860 MHz with a voltage supply of 24 V (DC).

PINNING - SOT115D

PIN	DESCRIPTION
1	input; note 1
2	common
3	common
4	12 V, 60 mA supply terminal
5	common
6	common
7	common
8	$+V_B$
9	output; note 1

Note

1. Pins 1 and 9 carry DC voltages.

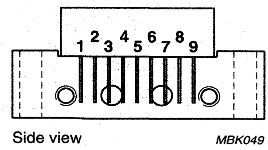


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	16.5	17.5	dB
I_{tot}	total current consumption (DC)	$V_B = 24$ V	–	240	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_B	DC supply voltage	–	28	V
V_i	RF input voltage	–	65	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	operating mounting base temperature	–20	+100	°C

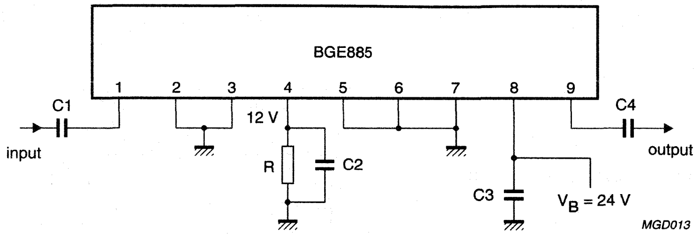
CHARACTERISTICS

Bandwidth 40 to 860 MHz; V_B = 24 V; T_{mb} = 30 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	16.5	17.5	dB
SL	slope cable equivalent	f = 40 to 860 MHz	0.2	1.2	dB
FL	flatness of frequency response	f = 40 to 860 MHz	–	±0.5	dB
S_{11}	input return losses	f = 40 to 450 MHz	14	–	dB
		f = 450 to 860 MHz	10	–	dB
S_{22}	output return losses	f = 40 to 450 MHz	14	–	dB
		f = 450 to 860 MHz	10	–	dB
d_2	second order distortion	note 1	–	–53	dB
V_o	output voltage	d_{im} = –60 dB; note 2	59	–	dBmV
F	noise figure	f = 350 MHz	–	7.5	dB
		f = 860 MHz	–	8	dB
I_{tot}	total current consumption (DC)	note 3	–	240	mA

Notes

1. f_p = 349.25 MHz; V_p = 59 dBmV;
   f_q = 403.25 MHz; V_q = 59 dBmV;
   measured at $f_p + f_q$ = 752.5 MHz.
2. Measured according to DIN45004B:
   f_p = 851.25 MHz; $V_p = V_o$ = 59 dBmV;
   f_q = 858.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 860.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 849.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.



Pins 1 and 9 carry DC voltages.

Fig.2 Test circuit.

List of components (see Fig.2)

COMPONENT	DESCRIPTION	VALUE
C1, C3, C4	ceramic multilayer capacitor	1 nF
C2	ceramic multilayer capacitor	1 nF (max.)
R	resistor	200 Ω,1 W

Optical receiver module — BGE887BO

FEATURES

- Excellent linearity
- Extremely low noise
- Excellent flatness
- Standard CATV outline
- Rugged construction
- Gold metallization ensures excellent reliability.

APPLICATIONS

- CATV systems operating in the 40 to 860 MHz frequency range.

DESCRIPTION

Hybrid high dynamic range optical receiver module in a SOT115U package operating at a voltage supply of +24 V (DC). The module contains a monomode optical input suitable for wavelengths from 1290 to 1600 nm, a terminal to monitor the pin diode current and an electrical output with an impedance of 75 Ω.

PINNING - SOT115U

PIN	DESCRIPTION
1	monitor current
2	common
3	common
5	$+V_B$
7	common
8	common
9	output

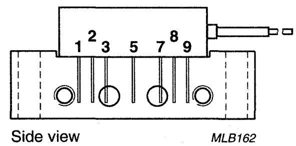


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
f	frequency range		40	860	MHz
S_{22}	output return losses	f = 40 to 860 MHz	11	–	dB
	optical input return losses		45	–	dB
d_2	second order distortion	f = 324.25 MHz	–	–70	dBc
F	equivalent noise input	f = 40 MHz	–	7	pA/√Hz
I_{tot}	total current consumption (DC)	V_B = 24 V	175	205	mA

HANDLING

Fibreglass optical coupling: maximum tensile strength = 5 N; minimum bending radius = 35 mm.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
f	frequency range		40	860	MHz
T_{stg}	storage temperature		−40	+85	°C
T_{mb}	operating mounting base temperature		−20	+85	°C
P_{in}	optical input power	continuous	−	5	mW
ESD	ESD sensitivity	human body model; R = 1.5 kΩ; C = 100 pF	500	−	V

CHARACTERISTICS

Table 1 Bandwidth 40 to 860 MHz; V_B = 24 V; T_{mb} = 30 °C; Z_S = Z_L = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
S	responsivity	λ = 1300 nm	800	−	V/W
$V_{pin\ 1}$	pin 1 monitor voltage	λ = 1300 nm	0.75	1	V/mW
FL	flatness of frequency response		−	±0.5	dB
S_{22}	output return losses	f = 40 to 860 MHz	11	−	dB
	optical input return losses		45	−	dB
d_2	second order distortion	note 1	−	−70	dB
d_3	third order distortion	note 2	−	−80	dB
F	equivalent noise input	f = 40 MHz	−	7	pA/√Hz
s_λ	spectral sensitivity	λ = 1310 ±20 nm	0.85	−	A/W
		λ = 1550 ±20 nm	0.9	−	A/W
λ	optical wavelength		1290	1600	nm
L	length of optical fibre	fibre; SM type; 9/125 μm	1	−	m
I_{tot}	total current consumption (DC)	note 3	175	205	mA

Notes

1. Two laser test; each laser with 40% modulation index;
   f_p = 135 MHz; P_p = 0.5 mW;
   f_q = 189.25 MHz; P_q = 0.5 mW;
   measured at $f_p + f_q$ = 324.25 MHz.
2. Three laser test; each laser with 40% modulation index;
   f_p = 326.25 MHz; P_p = 0.33 mW;
   f_q = 333.25 MHz; P_q = 0.33 mW;
   f_r = 335.25 MHz; P_r = 0.33 mW;
   measured at $f_p + f_q - f_r$ = 324.25 MHz.
3. The module normally operates at V_B = 24 V but is able to withstand supply transients up to 30 V.

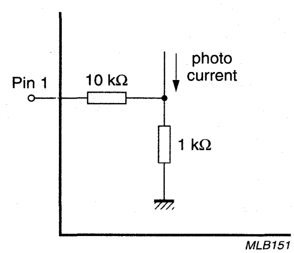


Fig.2 Monitor current pin.

Optical receiver module BGE887BO/FC

FEATURES

- Excellent linearity
- Extremely low noise
- Excellent flatness
- Standard CATV outline
- Rugged construction
- Gold metallization ensures excellent reliability
- FC/APC connector (JDS version).

APPLICATIONS

- CATV systems operating in the 40 to 860 MHz frequency range.

DESCRIPTION

Hybrid high dynamic range optical receiver module in a SOT115N package operating at a voltage supply of 24 V (DC). The module contains a monomode optical input suitable for wavelengths from 1290 to 1600 nm, a terminal to monitor the pin diode current and an electrical output with an impedance of 75 Ω. The optical fibre is terminated by an FC/APC connector (JDS version) and partly reinforced by a 3 mm diameter Kevlar buffer.

PINNING - SOT115N

PIN	DESCRIPTION
1	monitor current
2	common
3	common
5	$+V_B$
7	common
8	common
9	output

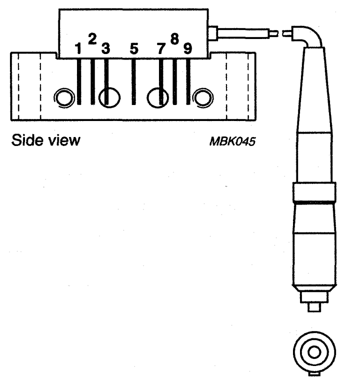


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
f	frequency range		40	860	MHz
S_{22}	output return losses	f = 40 to 860 MHz	11	–	dB
	optical input return losses		40	–	dB
d_2	second order distortion	f = 324.25 MHz	–	−70	dBc
F	equivalent noise input	f = 40 MHz	–	7	pA/√Hz
I_{tot}	total current consumption (DC)	V_B = 24 V	175	205	mA

HANDLING

Fibreglass optical coupling: maximum tensile strength = 5 N; minimum bending radius = 35 mm.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
f	frequency range		40	860	MHz
T_{stg}	storage temperature		–40	+85	°C
T_{mb}	operating mounting base temperature		–20	+85	°C
P_{in}	optical input power	continuous	–	5	mW
ESD	ESD sensitivity	human body model; R = 1.5 kΩ; C = 100 pF	500	–	V

CHARACTERISTICS

Bandwidth 40 to 860 MHz; V_B = 24 V; T_{mb} = 30 °C; Z_L = 75 Ω.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
S	responsivity	λ = 1300 nm	750	–	V/W
FL	flatness of frequency response		–	±0.5	dB
S_{22}	output return losses	f_1 = 40 to 860 MHz	11	–	dB
	optical input return losses		45	–	dB
OBR_C	connector optical return losses		70	–	dB
IL_C	connector optical insertion losses		–	0.5	dB
d_2	second order distortion	note 1	–	–70	dB
d_3	third order distortion	note 2	–	–80	dB
F	equivalent noise input	f_1 = 40 MHz	–	7	pA/√Hz
S_λ	spectral sensitivity	λ = 1310 ±20 nm	0.85	–	A/W
		λ = 1550 ±20 nm	0.9	–	A/W
λ	optical wavelength		1290	1600	nm
L	length of optical fibre	buffered fibre; SM type; 9/125 μm; Kevlar buffer: 3 mm	577	627	mm
I_{tot}	total current consumption (DC)	note 3	175	205	mA

Notes

1. Two laser test; each laser with 40% modulation index:
   f_p = 135 MHz; P_p = 0.5 mW;
   f_q = 189.25 MHz; P_q = 0.5 mW;
   measured at $f_p + f_q$ = 324.25 MHz.
2. Three laser test; each laser with 40% modulation index:
   f_p = 326.25 MHz; P_p = 0.33 mW;
   f_q = 333.25 MHz; P_q = 0.33 mW;
   f_r = 335.25 MHz; P_r = 0.33 mW;
   measured at $f_p + f_q - f_r$ = 324.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

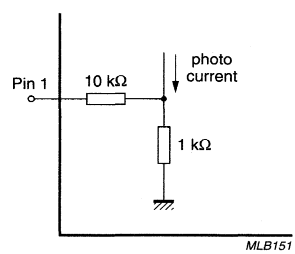


Fig.2 Monitor current pin.

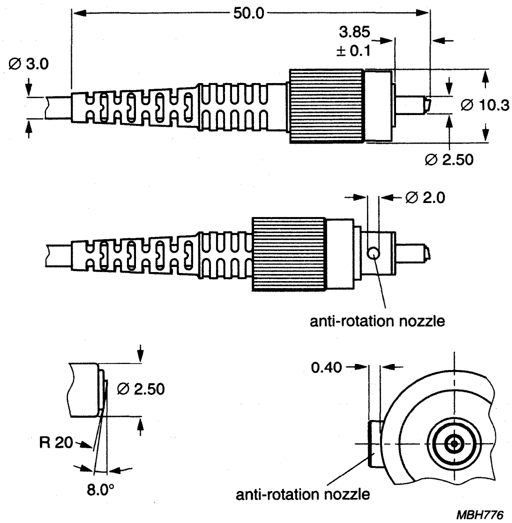


Fig.3 FC/APC connector.

Optical receiver modules

BGO847; BGO847/FC0; BGO847/SC0

FEATURES

- Improved BGE847BO
- Excellent linearity
- Extremely low noise up to 870 MHz
- Excellent flatness (straight line)
- Standard CATV outline
- Rugged construction
- Gold metallization ensures excellent reliability
- High optical input power range.

APPLICATIONS

- CATV optical node systems operating in the 40 to 870 MHz frequency range.

DESCRIPTION

High dynamic range optical receiver amplifier modules in a standard SOT115 package where the non-jacketed fibre has either no connector or an FC/APC or an SC/APC connector.

The amplifier supply voltage pin and the photo diode bias voltage pin both connect to 24 V (DC).

The modules have a monomode optical input suitable for 1290 to 1600 nm wavelengths, a terminal to monitor the photo diode current and an electrical output having a characteristic impedance of 75 Ω.

PINNING

PIN	DESCRIPTION
1	monitor current
2	common
3	common
4	$+V_B$ of the photo diode
5	$+V_B$ of the amplifier
7	common
8	common
9	output

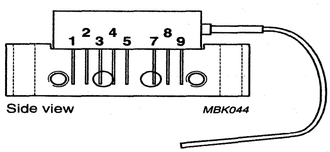


Fig.1 Simplified outline SOT115T (BGO847).

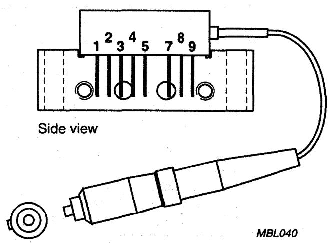


Fig.2 Simplified outline SOT115X (BGO847/FC0).

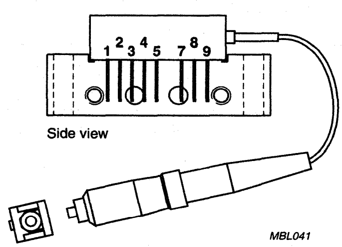


Fig.3 Simplified outline SOT115Y (BGO847/SC0).

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
f	frequency range		40	870	MHz
s_{22}	output return losses	f = 40 to 870 MHz	11	–	dB
	optical input return losses		45	–	dB
d_2	second order distortion	f = 854.5 MHz	–	–63	dBc
F	equivalent noise input	f = 40 to 750 MHz	–	7	pA/√Hz
I_{tot}	total current consumption (DC)	V_B = 24 V	175	205	mA

HANDLING

Fibreglass optical coupling: maximum tensile strength = 5 N; minimum bending radius = 35 mm.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
f	frequency range		40	870	MHz
T_{stg}	storage temperature		−40	+85	°C
T_{mb}	operating mounting base temperature		−20	+85	°C
P_{in}	optical input power	continuous	–	5	mW
ESD	ESD sensitivity	human body model; R = 1.5 kΩ; C = 100 pF	500	–	V

CHARACTERISTICS

Bandwidth 40 to 870 MHz; V_B = 24 V; T_{mb} = 30 °C; Z_L = 75 Ω.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
S	responsivity				
	BGO847	λ = 1300 nm	800	–	V/W
	BGO847/FC0, BGO847/SC0	λ = 1300 nm	750	–	V/W
FL	flatness straight line	peak to valley; f = 40 to 870 MHz	–	1	dB
SL	slope straight line	f = 40 to 870 MHz	0	2	dB
s_{22}	output return losses	f = 40 to 870 MHz	11	–	dB
	optical input return losses		45	–	dB
d_2	second order distortion	f_m = 54 MHz; notes 1 and 3	–	−73	dB
		f_m = 446.5 MHz; notes 1 and 4	–	−68	dB
		f_m = 548.5 MHz; notes 1 and 5	–	−67	dB
		f_m = 746.5 MHz; notes 1 and 6	–	−63	dB
		f_m = 854.5 MHz; notes 1 and 7	–	−63	dB
d_3	third order distortion	f_m = 55.25 MHz; notes 2 and 8	–	−80	dB
		f_m = 445.25 MHz; notes 2 and 9	–	−75	dB
		f_m = 547.25 MHz; notes 2 and 10	–	−75	dB
		f_m = 745.25 MHz; notes 2 and 11	–	−75	dB
		f_m = 853.25 MHz; notes 2 and 12	–	−73	dB
F	equivalent input noise	f = 40 to 750 MHz	–	7	pA/√Hz
		f = 750 to 870 MHz	–	8	pA/√Hz
s_λ	spectral sensitivity	λ = 1310 ±20 nm	0.85	–	A/W
		λ = 1550 ±20 nm	0.9	–	A/W
λ	optical wavelength		1290	1600	nm
L	length of optical fibre				
	BGO847	fibre; SM type; 9/125 μm	1	–	m
	BGO847/FC0, BGO847/SC0	fibre; SM type; 9/125 μm	746	861	mm
I_{tot}	total current consumption (DC)		175	205	mA
$I_{pin\ 4}$	pin diode bias current (DC)		–	25	mA

Notes

1. Two laser test; each laser with 40% modulation index; P_{opt} = 1 mW (total).
2. Three laser test; each laser with 60% modulation index; P_{opt} = 1 mW (total).
3. f_m = 54 MHz; f_p = 187.25 MHz; f_q = 133.25 MHz.
4. f_m = 446.5 MHz; f_p = 97.25 MHz; f_q = 349.25 MHz.
5. f_m = 548 .5MHz; f_p = 109.25 MHz; f_q = 439.25 MHz.
6. f_m = 746.5 MHz; f_p = 133.25 MHz; f_q = 613.25 MHz.
7. f_m = 854.5 MHz; f_p = 133.25 MHz; f_q = 721.25 MHz.
8. f_m = 55.25 MHz; f_p = 109.25 MHz; f_q = 133.25 MHz f_r = 187.25 MHz.
9. f_m = 445.25 MHz; f_p = 193.25 MHz; f_q = 349.25 MHz f_r = 97.25 MHz.
10. f_m = 547.25 MHz; f_p = 217.25 MHz; f_q = 439.25 MHz f_r = 109.25 MHz.
11. f_m = 745.25 MHz; f_p = 133.25 MHz; f_q = 265.25 MHz f_r = 613.25 MHz.
12. f_m = 853.25 MHz; f_p = 133.25 MHz; f_q = 265.25 MHz f_r = 721.25 MHz.

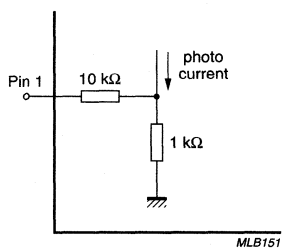


Fig.4 Monitor current pin.

Hybrid CATV amplifier module BGR269

FEATURES

- Extremely low noise
- Excellent linearity
- Silicon nitride passivation
- Rugged construction
- Gold metallization ensures excellent reliability.

APPLICATIONS

- Reverse amplifier in two-way CATV systems operating in the 5 to 200 MHz frequency range.

DESCRIPTION

High performance amplifier operating at a voltage supply of 24 V DC in a SOT115J package.

PINNING SOT115J

PIN	DESCRIPTION
1	input
2	common
3	common
5	$+V_B$
7	common
8	common
9	output

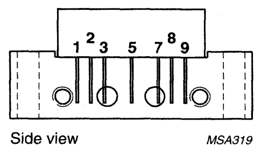


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 5 MHz	34.5	35	35.5	dB
I_{tot}	total current consumption (DC)	$V_B = 24$ V	–	–	330	mA

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 60134).

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_i	RF input voltage	–	65	dBmV
T_{mb}	operating mounting base temperature	–20	+100	°C
T_{stg}	storage temperature range	–40	+100	°C

CHARACTERISTICS

Bandwidth 5 to 200 MHz; V_B = 24 V; T_{mb} = 30 °C; Z_S = Z_L = 75 Ω.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 5 MHz	34.5	35	35.5	dB
SL	slope straight line	f = 5 to 200 MHz	0	–	0.5	dB
FL	flatness of frequency response	f = 5 to 200 MHz	–	–	±0.2	dB
s_{11}	input return losses	f = 5 to 200 MHz	20	–	–	dB
s_{22}	output return losses	f = 5 to 200 MHz	20	–	–	dB
CTB	composite triple beat	6 chs flat; V_o = 50 dBmV; measured at 37.25 MHz	–	–	−73	dB
		10 chs flat; V_o = 50 dBmV; measured at 61.25 MHz	–	–	−62	dB
		28 chs flat; V_o = 50 dBmV; measured at 199.25 MHz	–	–	−58	dB
X_{mod}	cross modulation	6 chs flat; V_o = 50 dBmV; measured at 37.25 MHz	–	–	−66	dB
		10 chs flat; V_o = 50 dBmV; measured at 61.25 MHz	–	–	−57	dB
		28 chs flat; V_o = 50 dBmV; measured at 61.25 MHz	–	–	−51	dB
CSO	composite second order distortion	6 chs flat; V_o = 50 dBmV; measured at 24 or 38.5 MHz	–	–	−68	dB
		10 chs flat; V_o = 50 dBmV; measured at 24 or 62.5 MHz	–	–	−65	dB
		28 chs flat; V_o = 50 dBmV; measured at 24 or 200.5 MHz	–	–	−56	dB
d_2	second order distortion	note 1	–	–	−70	dB
d_3	third order distortion	note 2	–	–	−80	dB
F	noise figure	f = 65 MHz	–	–	4	dB
		f = 200 MHz	–	–	4.5	dB
I_{tot}	total current consumption	note 3	–	–	330	mA

Notes

1. f_p = 25.25 MHz; V_p = 50 dBmV;
   f_q = 37.25 MHz; V_q = 50 dBmV;
   measured at $f_p + f_q$ = 62.5 MHz.
2. f_p = 7.25 MHz; V_p = 50 dBmV;
   f_q = 19.25 MHz; V_q = 50 dBmV;
   f_r = 37.25 MHz; V_r = 50 dBmV;
   measured at $f_p + f_q + f_r$ = 63.75 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Hybrid CATV amplifier module BGR69

FEATURES

- Extremely low noise
- Excellent linearity
- Silicon nitride passivation
- Rugged construction
- Gold metallization ensures excellent reliability.

APPLICATIONS

- Reverse amplifier in two-way CATV systems operating in the frequency range of 5 to 65 MHz.

DESCRIPTION

The BGR69 is a high performance amplifier operating at a voltage supply of 24 V in a SOT115J package.

PINNING SOT115J

PIN	DESCRIPTION
1	input
2	common
3	common
5	$+V_B$
7	common
8	common
9	output

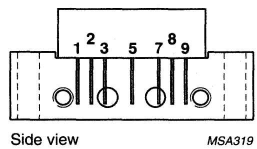


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 5 MHz	34.5	35	35.5	dB
I_{tot}	total current consumption	DC value; V_B = 24 V	–	–	220	mA

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 60134).

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_i	RF input voltage	–	65	dBmV
T_{mb}	operating mounting base temperature	–20	+100	°C
T_{stg}	storage temperature	–40	+100	°C

CHARACTERISTICS

Bandwidth 5 to 65 MHz; V_B = 24 V; T_{mb} = 30 °C; Z_S = Z_L = 75 Ω.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 5 MHz	34.5	35	35.5	dB
SL	slope straight line	f = 5 to 65 MHz	0	–	0.5	dB
FL	flatness of frequency response	f = 5 to 65 MHz	–	–	±0.2	dB
s_{11}	input return losses	f = 5 to 65 MHz	20	–	–	dB
s_{22}	output return losses	f = 5 to 65 MHz	20	–	–	dB
CTB	composite triple beat	6 chs flat; V_o = 50 dBmV; measured at 37.25 MHz	–	–	−73	dB
		10 chs flat; V_o = 50 dBmV; measured at 61.25 MHz	–	–	−57	dB
X_{mod}	cross modulation	6 chs flat; V_o = 50 dBmV; measured at 37.25 MHz	–	–	−66	dB
		10 chs flat; V_o = 50 dBmV; measured at 61.25 MHz	–	–	−57	dB
CSO	composite second order distortion	6 chs flat; V_o = 50 dBmV; measured at 24 or 38.5 MHz	–	–	−68	dB
		10 chs flat; V_o = 50 dBmV; measured at 24 or 62.5 MHz	–	–	−65	dB
d_2	second order distortion	note 1	–	–	−70	dB
d_3	third order distortion	note 2	–	–	−80	dB
F	noise figure	f = 65 MHz	–	–	4	dB
I_{tot}	total current consumption	note 3	–	–	220	mA

Notes

1. f_p = 25.25 MHz; V_p = 50 dBmV; f_q = 37.25 MHz; V_q = 50 dBmV; measured at $f_{(p+q)}$ = 62.5 MHz.
2. f_p = 7.25 MHz; V_p = 50 dBmV; f_q = 19.25 MHz; V_q = 50 dBmV; f_r = 37.25 MHz; V_r = 50 dBmV; measured at $f_p + f_q + f_r$ = 63.75 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

FEATURES

Excellent linearity

- Extremely low noise
- Silicon nitride passivation
- Rugged construction
- Gold metallization ensures excellent reliability.

DESCRIPTION

Hybrid amplifier module for CATV/MATV systems operating over a frequency range of 40 to 860 MHz at a voltage supply of 24 V (DC).

PINNING - SOT115D

PIN	DESCRIPTION
1	input; note1
2	common
3	common
4	12 V, 60 mA supply terminal
5	common
6	common
7	common
8	$+V_B$
9	output; note1

Note

1. Pins 1 and 9 carry DC voltages.

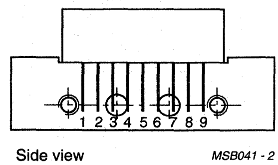


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	12	13	dB
I_{tot}	total current consumption (DC)	V_B = 24 V	–	240	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_B	DC supply voltage	–	26	V
V_i	RF input voltage	–	65	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	operating mounting base temperature	–20	+100	°C

CHARACTERISTICS

Bandwidth 40 to 860 MHz; V_B = 24 V; T_{mb} = 30 °C; $Z_S = Z_L$ = 75 Ω.

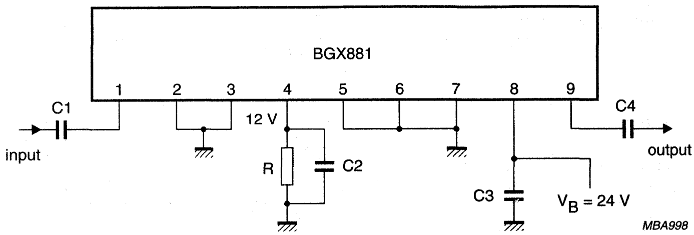
SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	12	13	dB
SL	slope cable equivalent	f = 40 to 860 MHz	0.2	1.2	dB
FL	flatness of frequency response	f = 40 to 860 MHz	–	±0.3	dB
S_{11}	input return losses	f = 40 MHz; note 1	20	–	dB
		f = 800 to 860 MHz	10	–	dB
S_{22}	output return losses	f = 40 MHz; note 1	20	–	dB
		f = 640 to 860 MHz	15	–	dB
d_2	second order distortion	note 2	–	–53	dB
V_o	output voltage	d_{im} = –60 dB; note 3	60.5	–	dBmV
		d_{im} = –60 dB; note 4	59.5	–	dBmV
F	noise figure	f = 350 MHz	–	8.5	dB
		f = 860 MHz	–	9	dB
I_{tot}	total current consumption (DC)	note 5	–	240	mA

Notes

1. Decreases 1.5 dB per octave.
2. f_p = 349.25 MHz; V_p = 59 dBmV;
   f_q = 403.25 MHz; V_q = 59 dBmV;
   measured at $f_p + f_q$ = 752.5 MHz.
3. Measured according to DIN45004B:
   f_p = 341.25 MHz; $V_p = V_o$;
   f_q = 348.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 350.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 339.25 MHz.
4. Measured according to DIN45004B:
   f_p = 851.25 MHz; $V_p = V_o$;
   f_q = 858.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 860.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 849.25 MHz.
5. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

List of components (see Fig.2)

COMPONENT	DESCRIPTION	VALUE
C1, C3, C4	ceramic multilayer capacitor	1 nF
C2	ceramic multilayer capacitor	1 nF (max.)
R	resistor	200 Ω, 1 W



Pins 1 and 9 carry DC voltages.

Fig.2 Test circuit.

CATV amplifier module BGX885N

FEATURES

- Excellent linearity
- Extremely low noise
- Silicon nitride passivation
- Rugged construction
- Gold metallization ensures excellent reliability.

DESCRIPTION

Hybrid amplifier module for CATV/MATV systems operating over a frequency range of 40 to 860 MHz at a voltage supply of 24 V (DC).

PINNING - SOT115D

PIN	DESCRIPTION
1	input (note 1)
2	common
3	common
4	60 mA supply terminal
5	common
6	common
7	common
8	$+V_B$
9	output (note 1)

Note

1. Pins 1 and 9 carry DC voltages.

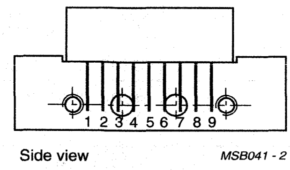


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	16.5	17.5	dB
		f = 750 MHz	17.3	–	dB
I_{tot}	total current consumption (DC)	$V_B = 24$ V	–	240	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_B	DC supply voltage	–	26	V
V_i	RF input voltage	–	65	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	operating mounting base temperature	–20	+100	°C

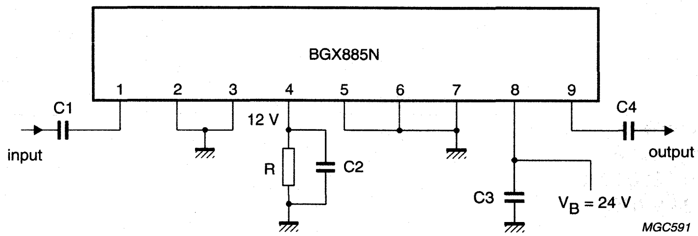
CHARACTERISTICS

Table 1 Bandwidth 40 to 860 MHz; $V_B = 24$ V; $T_{mb} = 30$ °C; $Z_S = Z_L = 75\ \Omega$

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	16.5	17.5	dB
		f = 750 MHz	17.3	–	dB
SL	slope cable equivalent	f = 40 to 860 MHz	0.2	1.4	dB
FL	flatness of frequency response	f = 40 to 860 MHz	–	±0.3	dB
S_{11}	input return losses	f = 40 MHz; note 1	20	–	dB
		f = 800 to 860 MHz	10	–	dB
S_{22}	output return losses	f = 40 MHz; note 1	20	–	dB
		f = 640 to 860 MHz	15	–	dB
d_2	second order distortion	note 2	–	–53	dB
V_o	output voltage	d_{im} = –60 dB; note 3	61	–	dBmV
		d_{im} = –60 dB; note 4	60	–	dBmV
F	noise figure	f = 50 MHz	–	7.5	dB
		f = 350 MHz	–	7.5	dB
		f = 550 MHz	–	7.5	dB
		f = 650 MHz	–	7.5	dB
		f = 750 MHz	–	8	dB
		f = 860 MHz	–	8	dB
I_{tot}	total current consumption (DC)	note 5	–	240	mA

Notes

1. Decrease per octave of 1.5 dB.
2. $f_p = 349.25$ MHz; $V_p = V_o = 59$ dBmV;
   $f_q = 403.25$ MHz; $V_q = V_o$;
   measured at $f_p + f_q = 752.5$ MHz.
3. Measured according to DIN45004B:
   $f_p = 341.25$ MHz; $V_p = V_o$;
   $f_q = 348.25$ MHz; $V_q = V_o - 6$ dB;
   $f_r = 350.25$ MHz; $V_r = V_o - 6$ dB;
   measured at $f_p + f_q - f_r = 339.25$ MHz.
4. Measured according to DIN45004B:
   $f_p = 851.25$ MHz; $V_p = V_o$;
   $f_q = 858.25$ MHz; $V_q = V_o - 6$ dB;
   $f_r = 860.25$ MHz; $V_r = V_o - 6$ dB;
   measured at $f_p + f_q - f_r = 849.25$ MHz.
5. The module normally operates at $V_B = 24$ V, but is able to withstand supply transients up to 30 V.



Pins 1 and 9 carry DC voltages.

Fig.2 Test circuit.

List of components (see Fig.2)

COMPONENT	DESCRIPTION	VALUE
C1, C3, C4	ceramic multilayer capacitor	1 nF (max.)
C2	ceramic multilayer capacitor	1 nF
R	resistor	200 Ω, 1 W

CATV amplifier module | BGY1085A

FEATURES

- Excellent linearity
- Extremely low noise
- Silicon nitride passivation
- Rugged construction
- Gold metallization ensures excellent reliability.

DESCRIPTION

Hybrid high amplifier module for CATV systems operating over a frequency range of 40 to 1 000 MHz at a supply voltage of +24 V (DC).

PINNING - SOT115J

PIN	DESCRIPTION
1	input
2	common
3	common
5	$+V_B$
7	common
8	common
9	output

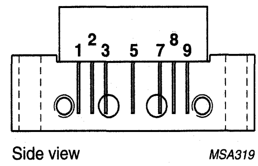


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	19	dB
		f = 1 000 MHz	18.5	–	dB
I_{tot}	total current consumption (DC)	V_B = 24 V	–	240	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_i	RF input voltage	–	65	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	operating mounting base temperature	–20	+100	°C

CHARACTERISTICS

Table 1 Bandwidth 40 to 1000 MHz; T_{case} = 30 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	–	19	dB
		f = 1000 MHz	18.5	–	–	dB
SL	slope cable equivalent	f = 40 to 1000 MHz	0	–	2	dB
FL	flatness of frequency response	f = 40 to 1000 MHz	–	–	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	–	dB
		f = 80 to 160 MHz	18.5	–	–	dB
		f = 160 to 320 MHz	17	–	–	dB
		f = 320 to 640 MHz	15.5	–	–	dB
		f = 640 to 1000 MHz	14	–	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	–	–	dB
		f = 80 to 160 MHz	18.5	–	–	dB
		f = 160 to 320 MHz	17	–	–	dB
		f = 320 to 640 MHz	15.5	–	–	dB
		f = 640 to 1000 MHz	14	–	–	dB
CTB	composite triple beat	85 channels flat; V_o = 44 dBmV; measured at 595.25 MHz	–	–	–58	dB
		110 channels flat; V_o = 44 dBmV; measured at 745.25 MHz	–	–	–53	dB
		150 channels flat; V_o = 40 dBmV; measured at 985.25 MHz	–	–53	–	dB
X_{mod}	cross modulation	85 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–	–58	dB
		110 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–	–54	dB
		150 channels flat; V_o = 40 dBmV; measured at 55.25 MHz	–	–54	–	dB
CSO	composite second order distortion	85 channels flat; V_o = 44 dBmV; measured at 596.5 MHz	–	–	–60	dB
		110 channels flat; V_o = 44 dBmV; measured at 746.5 MHz	–	–	–56	dB
		150 channels flat; V_o = 40 dBmV; measured at 986.5 MHz	–	–56	–	dB

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
d_2	second order distortion	note 1	–	–	−72	dB
		note 2	–	–	−65	dB
		note 3	–	−68	–	dB
V_o	output voltage	d_{im} = −60 dB				
		note 4	61	–	–	dBmV
		note 5	60	–	–	dBmV
		note 6	57	–	–	dBmV
F	noise figure	f = 50 MHz	–	–	5.5	dB
		f = 550 MHz	–	–	6	dB
		f = 600 MHz	–	–	6	dB
		f = 650 MHz	–	–	6.5	dB
		f = 750 MHz	–	–	7	dB
		f = 860 MHz	–	–	7.5	dB
		f = 1000 MHz	–	–	7.5	dB
I_{tot}	total current consumption (DC)	note 7	–	–	240	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 541.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 596.5 MHz.
2. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 691.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 746.5 MHz.
3. f_p = 55.25 MHz; V_p = 40 dBmV;
   f_q = 931.25 MHz; V_q = 40 dBmV;
   measured at $f_p + f_q$ = 986.5 MHz.
4. f_p = 590.25 MHz; $V_p = V_o$;
   f_q = 597.25 MHz; $V_q = V_o$ −6 dB;
   f_r = 599.25 MHz; $V_r = V_o$ −6 dB;
   measured at $f_p + f_q - f_r$ = 588.25 MHz.
5. f_p = 740.25 MHz; $V_p = V_o$;
   f_q = 747.25 MHz; $V_q = V_o$ −6 dB;
   f_r = 749.25 MHz; $V_r = V_o$ −6 dB;
   measured at $f_p + f_q - f_r$ = 738.25 MHz.
6. f_p = 980.25 MHz; $V_p = V_o$;
   f_q = 987.25 MHz; $V_q = V_o$ −6 dB;
   f_r = 989.25 MHz; $V_r = V_o$ −6 dB;
   measured at $f_p + f_q - f_r$ = 978.25 MHz.
7. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

CATV amplifier module | BGY585A

FEATURES

- Excellent linearity
- Extremely low noise
- Silicon nitride passivation
- Rugged construction
- Optimal reliability ensured by TiPtAu metallized crystals.

DESCRIPTION

Hybrid amplifier module for CATV systems operating over a frequency range of 40 to 550 MHz at a voltage supply of 24 V (DC). Intended for use as a final amplifier.

PINNING - SOT115J

PIN	DESCRIPTION
1	input
2	common
3	common
5	$+V_B$
7	common
8	common
9	output

PIN CONFIGURATION

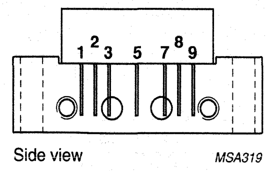


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	17.7	–	18.7	dB
		f = 550 MHz	18.8	–	20	dB
I_{tot}	total current consumption (DC)	V_B = 24 V	–	220	240	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_i	RF input voltage	–	65	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{case}	case operating temperature	–20	+100	°C

CHARACTERISTICS

Table 1 Bandwidth 40 to 550 MHz; T_{case} = 30 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	17.7	–	18.7	dB
		f = 550 MHz	18.8	–	20	dB
SL	slope cable equivalent	f = 40 to 550 MHz	0.5	–	2	dB
FL	flatness of frequency response	f = 40 to 550 MHz	–	–	±0.2	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	–	dB
		f = 80 to 160 MHz	19	–	–	dB
		f = 160 to 550 MHz	18	–	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	–	–	dB
		f = 80 to 160 MHz	19	–	–	dB
		f = 160 to 550 MHz	18	–	–	dB
CTB	composite triple beat	77 channels flat; V_o = 44 dBmV; measured at 547.25 MHz	–	–	–59	dB
X_{mod}	cross modulation	77 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–	–62	dB
CSO	composite second order distortion	77 channels flat; V_o = 44 dBmV; measured at 548.5 MHz	–	–	–59	dB
d_2	second order distortion	note 1	–	–	–72	dB
V_o	output voltage	d_{im} = –60 dB; note 2	61.5	–	–	dBmV
F	noise figure	f = 550 MHz	–	–	8	dB
I_{tot}	total current consumption (DC)	V_B = 24 V; note 3	–	220	240	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 493.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 548.5 MHz.
2. Measured according to DIN45004B;
   f_p = 540.25 MHz; $V_p = V_o$;
   f_q = 547.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 549.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 538.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 2 Bandwidth 40 to 450 MHz; T_{case} = 30 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	17.7	–	18.7	dB
		f = 450 MHz	18.6	–	19.8	dB
SL	slope cable equivalent	f = 40 to 450 MHz	0.5	–	1.8	dB
FL	flatness of frequency response	f = 40 to 450 MHz	–	–	±0.2	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	–	dB
		f = 80 to 160 MHz	19	–	–	dB
		f = 160 to 450 MHz	18	–	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	–	–	dB
		f = 80 to 160 MHz	19	–	–	dB
		f = 160 to 450 MHz	18	–	–	dB
CTB	composite triple beat	60 channels flat; V_o = 46 dBmV; measured at 445.25 MHz	–	–	−61	dB
X_{mod}	cross modulation	60 channels flat; V_o = 46 dBmV; measured at 55.25 MHz	–	–	−61	dB
CSO	composite second order distortion	60 channels flat; V_o = 46 dBmV; measured at 446.5 MHz	–	–	−61	dB
d_2	second order distortion	note 1	–	–	−75	dB
V_o	output voltage	d_{im} = −60 dB; note 2	64	–	–	dBmV
F	noise figure	f = 450 MHz	–	–	7	dB
I_{tot}	total current consumption (DC)	V_B = 24 V; note 3	–	220	240	mA

Notes

1. f_p = 55.25 MHz; V_p = 46 dBmV;
   f_q = 391.25 MHz; V_q = 46 dBmV;
   measured at $f_p + f_q$ = 446.5 MHz.
2. Measured according to DIN45004B;
   f_p = 440.25 MHz; $V_p = V_o$;
   f_q = 447.25 MHz; $V_q = V_o$ −6 dB;
   f_r = 449.25 MHz; $V_r = V_o$ −6 dB; measured at $f_p + f_q - f_r$ = 438.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

CATV amplifier modules BGY586; BGY587

FEATURES

Excellent linearity

- Extremely low noise
- Silicon nitride passivation
- Rugged construction
- TiPtAu metallized crystals ensure optimal reliability.

DESCRIPTION

Hybrid amplifier modules for CATV systems operating over a frequency range of 40 to 550 MHz at a voltage supply of 24 V (DC). The BGY586 is intended for use as a pre-amplifier and BGY587 as a final amplifier.

PINNING - SOT115J

PIN	DESCRIPTION
1	input
2	common
3	common
5	$+V_B$
7	common
8	common
9	output

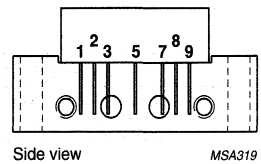


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	21.5	–	22.5	dB
		f = 550 MHz	22	–	–	dB
I_{tot}	total current consumption (DC)	V_B = 24 V				
	BGY586		–	180	200	mA
	BGY587		–	220	240	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_i	RF input voltage	–	65	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	operating mounting base temperature	–20	+100	°C

CHARACTERISTICS

Bandwidth 40 to 550 MHz; V_B = 24 V; T_{mb} = 30 °C; $Z_S = Z_L$ = 75 Ω.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	21.5	–	22.5	dB
		f = 550 MHz	22	–	–	dB
SL	slope cable equivalent	f = 40 to 550 MHz	0.2	–	1.5	dB
FL	flatness of frequency response	f = 40 to 550 MHz	–	–	±0.2	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	–	dB
		f = 80 to 160 MHz	19	–	–	dB
		f = 160 to 550 MHz	18	–	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	–	–	dB
		f = 80 to 160 MHz	19	–	–	dB
		f = 160 to 550 MHz	18	–	–	dB
S_{21}	phase response	f = 50 MHz	+135	–	+225	deg
CTB	composite triple beat	77 channels flat; V_o = 44 dBmV; measured at 547.25 MHz				
	BGY586		–	–	–53	dB
	BGY587		–	–	–57	dB
X_{mod}	cross modulation	77 channels flat; V_o = 44 dBmV; measured at 55.25 MHz				
	BGY586		–	–	–55	dB
	BGY587		–	–	–58	dB
CSO	composite second order distortion	77 channels flat; V_o = 44 dBmV; measured at 548.5 MHz				
	BGY586		–	–	–50	dB
	BGY587		–	–	–54	dB
d_2	second order distortion	note 1				
	BGY586		–	–	–62	dB
	BGY587		–	–	–66	dB
V_o	output voltage	d_{im} = –60 dB; note 2				
	BGY586		58.5	–	–	dBmV
	BGY587		61	–	–	dBmV
F	noise figure	f = 550 MHz				
	BGY586		–	–	6.5	dB
	BGY587		–	–	7	dB
I_{tot}	total current consumption (DC)	note 3				
	BGY586		–	180	200	mA
	BGY587		–	220	240	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV; f_q = 493.25 MHz; V_q = 44 dBmV; measured at $f_p + f_q$ = 548.5 MHz.
2. Measured according to DIN45004B: f_p = 540.25 MHz; $V_p = V_o$; f_q = 547.25 MHz; $V_q = V_o$ –6 dB; f_r = 549.25 MHz; $V_r = V_o$ –6 dB; measured at $f_p + f_q - f_r$ = 538.25 MHz.
3. The modules normally operate at V_B = 24 V, but are able to withstand supply transients up to 30 V.

CATV amplifier module | BGY587B

FEATURES

- Excellent linearity
- Extremely low noise
- Silicon nitride passivation
- Rugged construction
- TiPtAu metallized crystals ensure optimal reliability.

DESCRIPTION

Hybrid amplifier module for CATV systems operating over a frequency range of 40 to 550 MHz at a voltage supply of +24 V (DC).

PINNING - SOT115J

PIN	DESCRIPTION
1	input
2	common
3	common
5	$+V_B$
7	common
8	common
9	output

PIN CONFIGURATION

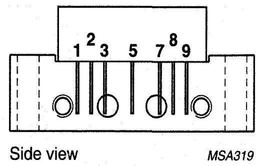


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	26.2	27.8	dB
		f = 550 MHz	27.5	–	dB
I_{tot}	total current consumption (DC)	$V_B = +24$ V	–	340	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_i	RF input voltage	–	55	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	mounting base operating temperature	–20	+100	°C
V_B	DC supply voltage	–	+28	V

CHARACTERISTICS

Table 1 Bandwidth 40 to 550 MHz; T_{case} = 30 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	26.2	27.8	dB
		f = 550 MHz	27.5		dB
SL	slope cable equivalent	f = 40 to 550 MHz	0.5	2.5	dB
FL	flatness of frequency response	f = 40 to 550 MHz	–	±0.4	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	19	–	dB
		f = 160 to 550 MHz	18	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	19	–	dB
		f = 160 to 550 MHz	18	–	dB
CTB	composite triple beat	77 channels flat; V_o = 44 dBmV; measured at 547.25 MHz	–	–57	dB
X_{mod}	cross modulation	77 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–60	dB
CSO	composite second order distortion	77 channels flat; V_o = 44 dBmV; measured at 548.5 MHz	–	–57	dB
d_2	second order distortion	note 1	–	–68	dB
V_o	output voltage	d_{im} = –60 dB; note 2	61	–	dBmV
F	noise figure	f = 550 MHz	–	6.5	dB
I_{tot}	total current consumption	DC value; V_B = +24 V; note 3	–	340	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 493.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 548.5 MHz.
2. Measured according to DIN45004B;
   f_p = 540.25 MHz; $V_p = V_o$ = 66.5 dBmV;
   f_q = 547.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 549.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 538.25 MHz.
3. The module normally operates at V_B = +24 V, but is able to withstand supply transients up to +30 V.

CATV amplifier module | BGY588N

FEATURES

- Excellent linearity
- Extremely low noise
- Silicon nitride passivation
- Rugged construction
- TiPtAu metallized crystals ensure optimal reliability.

APPLICATIONS

CATV systems in the 40 to 550 MHz frequency range and intended for use as a line-extender.

DESCRIPTION

Hybrid amplifier module in a SOT115J package operating with a voltage supply of 24 V (DC).

PINNING - SOT115J

PIN	DESCRIPTION
1	input
2	common
3	common
5	$+V_B$
7	common
8	common
9	output

PIN CONFIGURATION

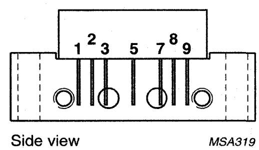


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	34	34.5	35	dB
		f = 550 MHz	35	35.5	36	dB
I_{tot}	total current consumption (DC)	V_B = 24 V	310	325	340	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_i	RF input voltage	–	55	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	mounting base operating temperature	–20	+100	°C

CHARACTERISTICS

Bandwidth 40 to 550 MHz; V_B = 24 V; T_{case} = 35 °C; Z_S = Z_L = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	34	34.5	35	dB
		f = 550 MHz	35	35.5	36	dB
SL	slope cable equivalent	f = 40 to 550 MHz	0.5	1	1.5	dB
FL	flatness of frequency response	f = 40 to 550 MHz	–	–	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	–	dB
		f = 80 to 160 MHz	19	–	–	dB
		f = 160 to 550 MHz	18	–	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	–	–	dB
		f = 80 to 160 MHz	19	–	–	dB
		f = 160 to 550 MHz	18	–	–	dB
CTB	composite triple beat	77 channels flat; V_o = 44 dBmV; measured at 547.25 MHz	–	–	–57	dB
X_{mod}	cross modulation	77 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–	–59	dB
CSO	composite second order distortion	77 channels flat; V_o = 44 dBmV; measured at 548.5 MHz	–	–	–62	dB
d_2	second order distortion	note 1	–	–	–74	dB
V_o	output voltage	d_{im} = –60 dB; note 2	61	–	–	dBmV
F	noise figure	f = 50 MHz	–	–	5	dB
		f = 550 MHz	–	–	6	dB
I_{tot}	total current consumption (DC)	value; V_B = 24 V; note 3	310	325	340	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 493.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 548.5 MHz.
2. Measured according to DIN45004B;
   f_p = 540.25 MHz; $V_p = V_o$;
   f_q = 547.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 549.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 538.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

CATV amplifier module | BGY66B

FEATURES

- Excellent linearity
- Extremely low noise
- Silicon nitride passivation
- Rugged construction
- Gold metallization ensures excellent reliability.

APPLICATIONS

- Intended as a reverse amplifier for use in two-way systems.

DESCRIPTION

Hybrid high dynamic range amplifier module designed for applications in CATV systems with a bandwidth of 5 to 120 MHz operating with a voltage supply of 24 V (DC).

PINNING - SOT115J

PIN	DESCRIPTION
1	input
2	common
3	common
5	$+V_B$
7	common
8	common
9	output

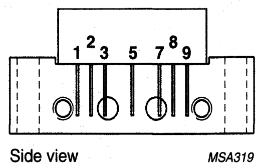


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 10 MHz	24.5	25.5	dB
I_{tot}	total current consumption (DC)	V_B = 24 V	115	135	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_i	RF input voltage	–	65	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	operating mounting base temperature	–20	+100	°C

CHARACTERISTICS

Table 1 Bandwidth 5 to 120 MHz; V_B = 24 V; T_{mb} = 30 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 10 MHz	24.5	25.5	dB
SL	slope cable equivalent		−0.2	+0.5	dB
FL	flatness of frequency response		−	±0.2	dB
S_{11}	input return losses		20	−	dB
S_{22}	output return losses		20	−	dB
CTB	composite triple beat	14 channels flat; V_o = 48 dBmV; measured at 67.25 MHz	−	−66	dB
X_{mod}	cross modulation	14 channels flat; V_o = 48 dBmV; measured at 67.25 MHz	−	−54	dB
d_2	second order distortion	note 1	−	−70	dB
V_o	output voltage	d_{im} = −60 dB; note 2	60	−	dBmV
F	noise figure	f = 120 MHz	−	5	dB
I_{tot}	total current consumption (DC)	note 3	115	135	mA

Notes

1. f_p = 55.25 MHz; V_p = 48 dBmV;
   f_q = 61.25 MHz; V_q = 48 dBmV;
   measured at $f_p + f_q$ = 116.5 MHz.
2. Measured according to DIN45004B:
   f_p = 111.25 MHz; $V_p = V_o$;
   f_q = 118.25 MHz; $V_q = V_o$ −6 dB;
   f_r = 120.25 MHz; $V_r = V_o$ −6 dB;
   measured at $f_p + f_q - f_r$ = 109.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

CATV amplifier module — BGY67

FEATURES

- Excellent linearity
- Extremely low noise
- Silicon nitride passivation
- Rugged construction
- TiPtAu metallized crystals ensure optimal reliability.

DESCRIPTION

Hybrid amplifier module for CATV systems operating over a frequency range of 5 to 200 MHz at a voltage supply of +24 V (DC). The device is intended as a reverse amplifier for use in two way systems.

PINNING - SOT115J

PIN	DESCRIPTION
1	input
2	common
3	common
5	$+V_B$
7	common
8	common
9	output

PIN CONFIGURATION

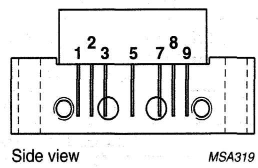


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 10 MHz	21.5	–	22.5	dB
I_{tot}	total current consumption (DC)	V_B = +24 V	–	215	230	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_i	RF input voltage	–	65	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	mounting base operating temperature	–20	+90	°C

CHARACTERISTICS

Table 1 Bandwidth 5 to 200 MHz; T_{mb} = 30 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 10 MHz	21.5	–	22.5	dB
SL	slope cable equivalent	f = 5 to 200 MHz	−0.2	–	+0.5	dB
FL	flatness of frequency response	f = 5 to 200 MHz	–	–	±0.2	dB
S_{11}	input return losses	f = 5 to 200 MHz	20	–	–	dB
S_{22}	output return losses	f = 5 to 200 MHz	20	–	–	dB
CTB	composite triple beat	22 channels flat; V_o = 50 dBmV; measured at 175.25 MHz	–	–	−67	dB
X_{mod}	cross modulation	22 channels flat; V_o = 50 dBmV; measured at 55.25 MHz	–	–	−60	dB
d_2	second order distortion	V_o = 50 dBmV; note 1	–	–	−67	dB
V_o	output voltage	d_{im} = −60 dB; note 2	67	–	–	dBmV
		d_{im} = −60 dB; note 3	64	–	–	dBmV
F	noise figure	f = 200 MHz	–	–	5.5	dB
I_{tot}	total current consumption	DC value; V_B = +24 V; note 4	–	215	230	mA

Notes

1. f_p = 83.25 MHz; V_p = 50 dBmV;
   f_q = 109.25 MHz; V_q = 50 dBmV;
   measured at $f_p + f_q$ = 192.5 MHz.
2. Measured according to DIN45004B;
   f_p = 35.25 MHz; $V_o = V_p$;
   f_q = 42.25 MHz; $V_q = V_o$ −6 dB;
   f_r = 44.25 MHz; $V_r = V_o$ −6 dB;
   measured at $f_p + f_q - f_r$ = 33.25 MHz.
3. Measured according to DIN45004B;
   f_p = 187.25 MHz; $V_o = V_p$;
   f_q = 194.25 MHz; $V_q = V_o$ −6 dB;
   f_r = 196.25 MHz; $V_r = V_o$ −6 dB;
   measured at $f_p + f_q - f_r$ = 185.25 MHz.
4. The module normally operates at V_B = +24 V, but is able to withstand supply transients up to +30 V.

CATV amplifier module BGY67A

FEATURES

- Excellent linearity
- Extremely low noise
- Silicon nitride passivation
- Rugged construction
- TiPtAu metallized crystals ensure optimal reliability.

DESCRIPTION

Hybrid amplifier module for CATV systems operating over a frequency range of 5 to 200 MHz at a voltage supply of +24 V (DC). The device is intended as a reverse amplifier for use in two way systems.

PINNING - SOT115J

PIN	DESCRIPTION
1	input
2	common
3	common
5	$+V_B$
7	common
8	common
9	output

PIN CONFIGURATION

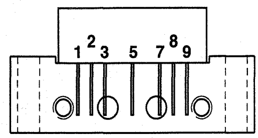


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 10 MHz	23.5	–	24.5	dB
I_{tot}	total current consumption (DC)	$V_B = +24$ V	–	215	230	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_i	RF input voltage	–	65	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	mounting base operating temperature	–20	+90	°C

CHARACTERISTICS

Table 1 Bandwidth 5 to 200 MHz; T_{mb} = 30 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 10 MHz	23.5	–	24.5	dB
SL	slope cable equivalent	f = 5 to 200 MHz	−0.2	–	+0.5	dB
FL	flatness of frequency response	f = 5 to 200 MHz	–	–	±0.2	dB
S_{11}	input return losses	f = 5 to 200 MHz	20	–	–	dB
S_{22}	output return losses	f = 5 to 200 MHz	20	–	–	dB
CTB	composite triple beat	22 channels flat; V_o = 50 dBmV; measured at 175.25 MHz	–	–	−67	dB
X_{mod}	cross modulation	22 channels flat; V_o = 50 dBmV; measured at 55.25 MHz	–	–	−59	dB
d_2	second order distortion	V_o = 50 dBmV; note 1	–	–	−67	dB
V_o	output voltage	d_{im} = −60 dB; note 2	67	–	–	dBmV
		d_{im} = −60 dB; note 3	64	–	–	dBmV
F	noise figure	f = 200 MHz	–	–	5.5	dB
I_{tot}	total current consumption	DC value; V_B = +24 V; note 4	–	215	230	mA

Notes

1. f_p = 83.25 MHz; V_p = 50 dBmV;
   f_q = 109.25 MHz; V_q = 50 dBmV;
   measured at $f_p + f_q$ = 192.5 MHz.
2. Measured according to DIN45004B;
   f_p = 35.25 MHz; $V_o = V_p$;
   f_q = 42.25 MHz; $V_q = V_o$ −6 dB;
   f_r = 44.25 MHz; $V_r = V_o$ −6 dB;
   measured at $f_p + f_q - f_r$ = 33.25 MHz.
3. Measured according to DIN45004B;
   f_p = 187.25 MHz; $V_o = V_p$;
   f_q = 194.25 MHz; $V_q = V_o$ −6 dB;
   f_r = 196.25 MHz; $V_r = V_o$ −6 dB;
   measured at $f_p + f_q - f_r$ = 185.25 MHz.
4. The module normally operates at V_B = +24 V, but is able to withstand supply transients up to +30 V.

CATV amplifier module BGY685A

FEATURES

- Excellent linearity
- Extremely low noise
- Silicon nitride passivation
- Rugged construction
- Gold metallization ensures excellent reliability.

DESCRIPTION

Special super-high dynamic range amplifier module designed for applications in CATV systems with a bandwidth of 40 to 600 MHz operating at a voltage supply of 24 V (DC).

PINNING - SOT115J

PIN	DESCRIPTION
1	input
2	common
3	common
5	$+V_B$
7	common
8	common
9	output

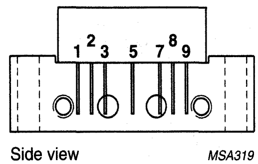


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	17.7	–	18.7	dB
		f = 600 MHz	19	–	–	dB
I_{tot}	total current consumption (DC)	V_B = 24 V	–	220	240	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_i	RF input voltage	–	65	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	mounting base operating temperature	–20	+100	°C

CHARACTERISTICS

Table 1 Bandwidth 40 to 600 MHz; T_{case} = 30 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	17.7	18.7	dB
		f = 600 MHz	19	–	dB
SL	slope cable equivalent	f = 40 to 600 MHz	0.5	2.2	dB
FL	flatness of frequency response	f = 40 to 600 MHz	–	±0.2	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	19	–	dB
		f = 160 to 600 MHz	18	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	19	–	dB
		f = 160 to 600 MHz	18	–	dB
S_{21}	phase response	f = 50 MHz	–45	+45	deg
CTB	composite triple beat	85 channels flat; V_o = 44 dBmV; measured at 595.25 MHz	–	–55	dB
X_{mod}	cross modulation	85 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–60	dB
CSO	composite second order distortion	85 channels flat; V_o = 44 dBmV; measured at 596.5 MHz	–	–56	dB
d_2	second order distortion	note 1	–	–70	dB
V_o	output voltage	d_{im} = –60 dB; note 2	60	–	dBmV
F	noise figure	f = 600 MHz	–	8.5	dB
I_{tot}	total current consumption (DC)	note 3	–	240	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 541.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 596.5 MHz.
2. f_p = 590.25 MHz; $V_p = V_o$;
   f_q = 597.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 599.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 588.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 2 Bandwidth 40 to 550 MHz; T_{case} = 30 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	17.7	–	18.7	dB
		f = 550 MHz	18.8	–	20	dB
SL	slope cable equivalent	f = 40 to 550 MHz	0.5	–	2	dB
FL	flatness of frequency response	f = 40 to 550 MHz	–	–	±0.2	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	–	dB
		f = 80 to 160 MHz	19	–	–	dB
		f = 160 to 550 MHz	18	–	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	–	–	dB
		f = 80 to 160 MHz	19	–	–	dB
		f = 160 to 550 MHz	18	–	–	dB
S_{21}	phase response	f = 50 MHz	−45	–	+45	deg
CTB	composite triple beat	77 channels flat; V_o = 44 dBmV; measured at 547.25 MHz	–	–	−59	dB
X_{mod}	cross modulation	77 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–	−62	dB
CSO	composite second order distortion	77 channels flat; V_o = 44 dBmV; measured at 548.5 MHz	–	–	−59	dB
d_2	second order distortion	note 1	–	–	−72	dB
V_o	output voltage	d_{im} = −60 dB; note 2	61.5	–	–	dBmV
F	noise figure	f = 550 MHz	–	–	8	dB
I_{tot}	total current consumption (DC)	note 3	–	220	240	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 493.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 548.5 MHz.
2. f_p = 540.25 MHz; $V_p = V_o$;
   f_q = 547.25 MHz; $V_q = V_o$ −6 dB;
   f_r = 549.25 MHz; $V_r = V_o$ −6 dB;
   measured at $f_p + f_q - f_r$ = 538.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 3 Bandwidth 40 to 450 MHz; T_{case} = 30 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	17.7	–	18.7	dB
		f = 450 MHz	18.6	–	19.8	dB
SL	slope cable equivalent	f = 40 to 450 MHz	0.5	–	1.8	dB
FL	flatness of frequency response	f = 40 to 450 MHz	–	–	±0.2	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	–	dB
		f = 80 to 160 MHz	19	–	–	dB
		f = 160 to 450 MHz	18	–	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	–	–	dB
		f = 80 to 160 MHz	19	–	–	dB
		f = 160 to 450 MHz	18	–	–	dB
S_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	60 channels flat; V_o = 46 dBmV; measured at 445.25 MHz	–	–	–61	dB
X_{mod}	cross modulation	60 channels flat; V_o = 46 dBmV; measured at 55.25 MHz	–	–	–61	dB
CSO	composite second order distortion	60 channels flat; V_o = 46 dBmV; measured at 446.5 MHz	–	–	–61	dB
d_2	second order distortion	note 1	–	–	–75	dB
V_o	output voltage	d_{im} = –60 dB; note 2	64	–	–	dBmV
F	noise figure	f = 450 MHz	–	–	7	dB
I_{tot}	total current consumption (DC)	note 3	–	220	240	mA

Notes

1. f_p = 55.25 MHz; V_p = 46 dBmV;
   f_q = 391.25 MHz; V_q = 46 dBmV;
   measured at $f_p + f_q$ = 446.5 MHz.
2. f_p = 440.25 MHz; $V_p = V_o$;
   f_q = 447.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 449.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 438.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Hybrid CATV amplifier module BGY685AD

FEATURES

- Excellent linearity
- Extremely low noise
- Silicon nitride passivation
- Rugged construction
- Gold metallization ensures excellent reliability.

APPLICATIONS

- CATV systems operating over a 40 to 600 MHz frequency range.

DESCRIPTION

Hybrid high dynamic range cascode amplifier module with Darlington pre-stage dies operating at a voltage supply of +24 V in a SOT115J package.

PINNING - SOT115J

PIN	DESCRIPTION
1	input
2	common
3	common
5	$+V_B$
7	common
8	common
9	output

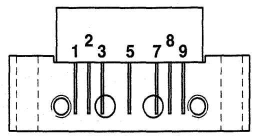


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	19	dB
		f = 600 MHz	18.75	–	dB
I_{tot}	total current consumption (DC)	$V_B = 24$ V	–	250	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_i	RF input voltage	–	60	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	operating mounting base temperature	–20	+100	°C

CHARACTERISTICS

Table 1 Bandwidth 40 to 600 MHz; V_B = 24 V; T_{case} = 30 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	19	dB
		f = 600 MHz	18.75	–	dB
SL	slope cable equivalent	f = 40 to 600 MHz	0.2	2.2	dB
FL	flatness of frequency response	f = 40 to 600 MHz	–	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	19	–	dB
		f = 160 to 600 MHz	18	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	19	–	dB
		f = 160 to 600 MHz	18	–	dB
S_{21}	phase response	f = 50 MHz	–45	+45	deg
CTB	composite triple beat	85 channels flat; V_o = 44 dBmV; measured at 595.25 MHz	–	–62	dB
X_{mod}	cross modulation	85 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–58	dB
CSO	composite second order distortion	85 channels flat; V_o = 44 dBmV; measured at 596.5 MHz	–	–60	dB
d_2	second order distortion	note 1	–	–70	dB
V_o	output voltage	d_{im} = –60 dB; note 2	62	–	dBmV
F	noise figure	f = 50 MHz	–	6	dB
		f = 600 MHz	–	8	dB
I_{tot}	total current consumption (DC)	note 3	–	250	mA

Notes

1. $V_p = V_q$ = 44 dBmV;
   f_p = 55.25 MHz; f_q = 541.25 MHz;
   measured at $f_p + f_q$ = 596.5 MHz.
2. Measured according to DIN45004B:
   f_p = 590.25 MHz; $V_p = V_o$;
   f_q = 597.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 599.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 588.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 2 Bandwidth 40 to 550 MHz; V_B = 24 V; T_{case} = 30 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	19	dB
		f = 550 MHz	18.8	–	dB
SL	slope cable equivalent	f = 40 to 550 MHz	0.2	2.2	dB
FL	flatness of frequency response	f = 40 to 550 MHz	–	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	19	–	dB
		f = 160 to 550 MHz	18	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	19	–	dB
		f = 160 to 550 MHz	18	–	dB
S_{21}	phase response	f = 50 MHz	–45	+45	deg
CTB	composite triple beat	77 channels flat; V_o = 44 dBmV; measured at 547.25 MHz	–	–65	dB
X_{mod}	cross modulation	77 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–60	dB
CSO	composite second order distortion	77 channels flat; V_o = 44 dBmV; measured at 548.5 MHz	–	–62	dB
d_2	second order distortion	note 1	–	–72	dB
V_o	output voltage	d_{im} = –60 dB; note 2	63	–	dBmV
F	noise figure	f = 50 MHz	–	6	dB
		f = 550 MHz	–	7.5	dB
I_{tot}	total current consumption (DC)	note 3	–	250	mA

Notes

1. $V_p = V_q$ = 44 dBmV;
   f_p = 55.25 MHz; f_q = 493.25 MHz;
   measured at $f_p + f_q$ = 548.5 MHz.
2. Measured according to DIN45004B:
   f_p = 540.25 MHz; $V_p = V_o$;
   f_q = 547.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 549.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 538.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 3 Bandwidth 40 to 450 MHz; V_B = 24 V; T_{case} = 30 °C; Z_S = Z_L = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	19	dB
		f = 450 MHz	18.6	–	dB
SL	slope cable equivalent	f = 40 to 450 MHz	0.2	1.8	dB
FL	flatness of frequency response	f = 40 to 450 MHz	–	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	19	–	dB
		f = 160 to 450 MHz	18	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	19	–	dB
		f = 160 to 450 MHz	18	–	dB
S_{21}	phase response	f = 50 MHz	–45	+45	deg
CTB	composite triple beat	60 channels flat; V_o = 46 dBmV; measured at 445.25 MHz	–	–66	dB
X_{mod}	cross modulation	60 channels flat; V_o = 46 dBmV; measured at 55.25 MHz	–	–58	dB
CSO	composite second order distortion	60 channels flat; V_o = 46 dBmV; measured at 446.5 MHz	–	–67	dB
d_2	second order distortion	note 1	–	–75	dB
V_o	output voltage	d_{im} = –60 dB; note 2	65	–	dBmV
F	noise figure	f = 50 MHz	–	6	dB
		f = 450 MHz	–	7	dB
I_{tot}	total current consumption (DC)	note 3	–	250	mA

Notes

1. V_p = V_q = 46 dBmV;
   f_p = 55.25 MHz; f_q = 391.25 MHz;
   measured at $f_p + f_q$ = 446.5 MHz.
2. Measured according to DIN45004B:
   f_p = 440.25 MHz; V_p = V_o;
   f_q = 447.25 MHz; V_q = V_o –6 dB;
   f_r = 449.25 MHz; V_r = V_o –6 dB;
   measured at $f_p + f_q - f_r$ = 438.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

CATV amplifier module BGY685AL

FEATURES

- Excellent linearity
- Extremely low noise
- Silicon nitride passivation
- Rugged construction
- Gold metallization ensures excellent reliability.

DESCRIPTION

Hybrid high dynamic range amplifier module designed for applications in CATV systems operating over a frequency range of 40 MHz to 600 MHz operating with a voltage supply of +24 V (DC).

PINNING - SOT115J

PIN	DESCRIPTION
1	input
2	common
3	common
5	$+V_B$
7	common
8	common
9	output

PIN CONFIGURATION

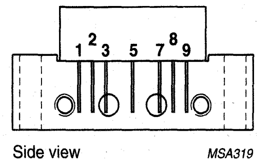


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	19	dB
		f = 600 MHz	18.5	–	dB
I_{tot}	total current consumption (DC)	V_B = +24 V	–	250	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_i	RF input voltage	–	65	dBmV
T_{stg}	storage temperature	−40	+100	°C
T_{mb}	mounting base operating temperature	−20	+100	°C

CHARACTERISTICS

Table 1 Bandwidth 40 to 600 MHz; T_{case} = 30 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	19	dB
		f = 600 MHz	18.5	–	dB
SL	slope cable equivalent	f = 40 to 600 MHz	0.5	2.0	dB
FL	flatness of frequency response	f = 40 to 600 MHz	–	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	19	–	dB
		f = 160 to 600 MHz	18	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	19	–	dB
		f = 160 to 600 MHz	18	–	dB
CTB	composite triple beat	85 channels flat; V_o = 44 dBmV; measured at 595.25 MHz	–	−56	dB
X_{mod}	cross modulation	85 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	−55	dB
CSO	composite second order distortion	85 channels flat; V_o = 44 dBmV; measured at 596.5 MHz	–	−56	dB
d_2	second order distortion	note 1	–	−70	dB
V_o	output voltage	d_{im} = −60 dB; note 2	60	–	dBmV
F	noise figure	f = 600 MHz	–	5	dB
I_{tot}	total current consumption	DC value; V_B = +24 V; note 3	–	250	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 541.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 596.5 MHz.
2. f_p = 590.25 MHz; $V_p = V_o$;
   f_q = 597.25 MHz; $V_q = V_o$ −6 dB;
   f_r = 599.25 MHz; $V_r = V_o$ −6 dB;
   measured at $f_p + f_q - f_r$ = 588.25 MHz.
3. The module normally operates at V_B = +24 V, but is able to withstand supply transients up to +30 V.

Table 2 Bandwidth 40 to 550 MHz; T_{case} = 30 °C; Z_S = Z_L = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	19	dB
		f = 550 MHz	18.5	–	dB
SL	slope cable equivalent	f = 40 to 550 MHz	0.5	2	dB
FL	flatness of frequency response	f = 40 to 550 MHz	–	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	19	–	dB
		f = 160 to 550 MHz	18	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	19	–	dB
		f = 160 to 550 MHz	18	–	dB
CTB	composite triple beat	77 channels flat; V_o = 44 dBmV; measured at 547.25 MHz	–	–58	dB
X_{mod}	cross modulation	77 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–56	dB
CSO	composite second order distortion	77 channels flat; V_o = 44 dBmV; measured at 548.5 MHz	–	–58	dB
d_2	second order distortion	note 1	–	–72	dB
V_o	output voltage	d_{im} = –60 dB; note 2	61.5	–	dBmV
F	noise figure	f = 550 MHz	–	4.5	dB
I_{tot}	total current consumption	DC value; V_B = +24 V; note 3	–	250	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 493.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 548.5 MHz.
2. f_p = 540.25 MHz; $V_p = V_o$;
   f_q = 547.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 549.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 538.25 MHz.
3. The module normally operates at V_B = +24 V, but is able to withstand supply transients up to +30 V.

Table 3 Bandwidth 40 to 450 MHz; T_{case} = 30 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	19	dB
		f = 450 MHz	18.3	–	dB
SL	slope cable equivalent	f = 40 to 450 MHz	0.3	1.5	dB
FL	flatness of frequency response	f = 40 to 450 MHz	–	±0.2	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	19	–	dB
		f = 160 to 450 MHz	18	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	19	–	dB
		f = 160 to 450 MHz	18	–	dB
CTB	composite triple beat	60 channels flat; V_o = 46 dBmV; measured at 445.25 MHz	–	–58	dB
X_{mod}	cross modulation	60 channels flat; V_o = 46 dBmV; measured at 55.25 MHz	–	–54	dB
CSO	composite second order distortion	60 channels flat; V_o = 46 dBmV; measured at 446.5 MHz	–	–58	dB
d_2	second order distortion	note 1	–	–70	dB
V_o	output voltage	d_{im} = –60 dB; note 2	62.5	–	dBmV
F	noise figure	f = 450 MHz	–	4.5	dB
I_{tot}	total current consumption	DC value; V_B = +24 V; note 3	–	250	mA

Notes

1. f_p = 55.25 MHz; V_p = 46 dBmV;
   f_q = 391.25 MHz; V_q = 46 dBmV;
   measured at $f_p + f_q$ = 446.5 MHz.
2. f_p = 440.25 MHz; $V_p = V_o$;
   f_q = 447.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 449.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 438.25 MHz.
3. The module normally operates at V_B = +24 V, but is able to withstand supply transients up to +30 V.

FEATURES

- Excellent linearity
- Extremely low noise
- Silicon nitride passivation
- Rugged construction
- Gold metallization ensures excellent reliability.

DESCRIPTION

Hybrid high dynamic range amplifier module designed for CATV systems operating over a frequency range of 40 to 600 MHz at a voltage supply of 24 V (DC).

PINNING - SOT115J

PIN	DESCRIPTION
1	input
2	common
3	common
5	$+V_B$
7	common
8	common
9	output

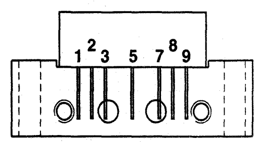


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	21	22	dB
		f = 600 MHz	22	–	dB
I_{tot}	total current consumption (DC)	V_B = 24 V	–	240	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_i	RF input voltage	–	65	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	operating mounting base temperature	–20	+100	°C

CHARACTERISTICS

Bandwidth 40 to 600 MHz; T_{case} = 30 °C; $Z_S = Z_L$ = 75 Ω.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f =50 MHz	21	22	dB
		f = 600 MHz	22	–	dB
SL	slope cable equivalent	f = 40 to 600 MHz	0.8	2.2	dB
FL	flatness of frequency response	f = 40 to 600 MHz	–	±0.2	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	19	–	dB
		f = 160 to 600 MHz	18	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	19	–	dB
		f = 160 to 550 MHz	18	–	dB
		f = 550 to 600 MHz	16	–	dB
S_{21}	phase response	f = 50 MHz	−45	+45	deg
CTB	composite triple beat	85 channels flat; V_o = 44 dBmV; measured at 595.25 MHz	–	−54	dB
X_{mod}	cross modulation	85 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	−54	dB
CSO	composite second order distortion	85 channels flat; V_o = 44 dBmV; measured at 596.5 MHz	–	−52	dB
d_2	second order distortion	note 1	–	−66	dB
V_o	output voltage	d_{im} = −60 dB; note 2	58	–	dBmV
F	noise figure	f = 600 MHz	–	6.5	dB
I_{tot}	total current consumption (DC)	note 3	–	240	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 541.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 596.5 MHz.
2. f_p = 590.25 MHz; $V_p = V_o$;
   f_q = 597.25 MHz; $V_q = V_o$ −6 dB;
   f_r = 599.25 MHz; $V_r = V_o$ −6 dB;
   measured at $f_p + f_q - f_r$ = 588.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

CATV amplifier module | BGY687B

FEATURES

- Excellent linearity
- Extremely low noise
- Silicon nitride passivation
- Rugged construction
- Gold metallization ensures excellent reliability.

DESCRIPTION

Hybrid high dynamic range amplifier module designed for CATV systems operating over a frequency range of 40 to 600 MHz at a voltage supply of 24 V (DC).

PINNING - SOT115J

PIN	DESCRIPTION
1	input
2	common
3	common
5	$+V_B$
7	common
8	common
9	output

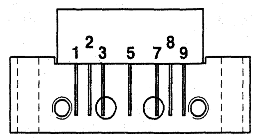


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	26.2	27.8	dB
		f = 600 MHz	27.8	–	dB
I_{tot}	total current consumption (DC)	V_B = 24 V	–	340	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_i	RF input voltage	–	55	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	operating mounting base temperature	–20	+100	°C

CHARACTERISTICS

Bandwidth 40 to 600 MHz; V_B = 24 V; T_{mb} = 35 °C; Z_S = Z_L = 75 Ω.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	26.2	27.8	dB
		f = 600 MHz	27.8	–	dB
SL	slope cable equivalent	f = 40 to 600 MHz	0.8	2.8	dB
FL	flatness of frequency response	f = 40 to 600 MHz	–	±0.4	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	19	–	dB
		f = 160 to 600 MHz	18	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	19	–	dB
		f = 160 to 600 MHz	18	–	dB
S_{21}	phase response	f = 50 MHz	–45	+45	deg
CTB	composite triple beat	85 channels flat; V_o = 44 dBmV; measured at 595.25 MHz	–	–53	dB
X_{mod}	cross modulation	85 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–58	dB
CSO	composite second order distortion	85 channels flat; V_o = 44 dBmV; measured at 596.5 MHz	–	–54	dB
d_2	second order distortion	note 1	–	–66	dB
V_o	output voltage	d_{im} = –60 dB; note 2	60	–	dBmV
F	noise figure	f = 600 MHz	–	7	dB
I_{tot}	total current consumption (DC)	note 3	–	340	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 541.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 596.5 MHz.
2. Measured according to DIN45004B:
   f_p = 590.25 MHz; $V_p = V_o$;
   f_q = 597.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 599.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 588.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

CHARACTERISTICS

Bandwidth 40 to 550 MHz; V_B = 24 V; T_{mb} = 35 °C; Z_S = Z_L = 75 Ω.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	26.2	27.8	dB
		f = 550 MHz	27.5	–	dB
SL	slope cable equivalent	f = 40 to 550 MHz	0.5	2.5	dB
FL	flatness of frequency response	f = 40 to 550 MHz	–	±0.4	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	19	–	dB
		f = 160 to 550 MHz	18	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	19	–	dB
		f = 160 to 550 MHz	18	–	dB
S_{21}	phase response	f = 50 MHz	–45	+45	deg
CTB	composite triple beat	77 channels flat; V_o = 44 dBmV; measured at 547.25 MHz	–	–57	dB
X_{mod}	cross modulation	77 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–60	dB
CSO	composite second order distortion	77 channels flat; V_o = 44 dBmV; measured at 548.5 MHz	–	–57	dB
d_2	second order distortion	note 1	–	–68	dB
V_o	output voltage	d_{im} = –60 dB; note 2	61	–	dBmV
F	noise figure	f = 550 MHz	–	6.5	dB
I_{tot}	total current consumption (DC)	note 3	–	340	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 493.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 548.5 MHz.
2. Measured according to DIN45004B:
   f_p = 540.25 MHz; $V_p = V_o$;
   f_q = 547.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 549.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 538.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

CHARACTERISTICS

Bandwidth 40 to 450 MHz; V_B = 24 V; T_{mb} = 35 °C; Z_S = Z_L = 75 Ω.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	26.2	27.8	dB
		f = 450 MHz	27.5	–	dB
SL	slope cable equivalent	f = 40 to 450 MHz	0.5	2.5	dB
FL	flatness of frequency response	f = 40 to 450 MHz	–	±0.2	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	19	–	dB
		f = 160 to 450 MHz	18	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	19	–	dB
		f = 160 to 450 MHz	18	–	dB
S_{21}	phase response	f = 50 MHz	–45	+45	deg
CTB	composite triple beat	60 channels flat; V_o = 46 dBmV; measured at 445.25 MHz	–	–58	dB
X_{mod}	cross modulation	60 channels flat; V_o = 46 dBmV; measured at 55.25 MHz	–	–58	dB
CSO	composite second order distortion	60 channels flat; V_o = 46 dBmV; measured at 446.5 MHz	–	–60	dB
d_2	second order distortion	note 1	–	–70	dB
V_o	output voltage	d_{im} = –60 dB; note 2	64	–	dBmV
F	noise figure	f = 450 MHz	–	6	dB
I_{tot}	total current consumption (DC)	note 3	–	340	mA

Notes

1. f_p = 55.25 MHz; V_p = 46 dBmV;
   f_q = 391.25 MHz; V_q = 46 dBmV;
   measured at $f_p + f_q$ = 446.5 MHz.
2. Measured according to DIN45004B:
   f_p = 440.25 MHz; $V_p = V_o$;
   f_q = 447.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 449.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 438.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

CATV amplifier module | BGY68

FEATURES

- Excellent linearity
- Extremely low noise
- Silicon nitride passivation
- Rugged construction
- Gold metallization ensures excellent reliability.

APPLICATIONS

Reverse amplifier in two-way CATV systems in the 5 to 75 MHz frequency range.

DESCRIPTION

Hybrid high dynamic range amplifier module in a SOT115J package operating at a voltage supply of 24 V (DC).

PINNING - SOT115J

PIN	DESCRIPTION
1	input
2	common
3	common
5	$+V_B$
7	common
8	common
9	output

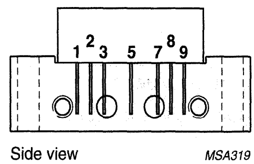


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 10 MHz	29.2	30.8	dB
I_{tot}	total current consumption (DC)	V_B = 24 V	–	135	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_i	RF input voltage	–	55	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	operating mounting base temperature	–20	+100	°C

CHARACTERISTICS

Table 1 Bandwidth 5 to 75 MHz; V_B = +24 V; T_{mb} = 30 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 10 MHz	29.2	30.8	dB
SL	slope cable equivalent	f = 5 to 75 MHz	−0.2	+0.5	dB
FL	flatness of frequency response	f = 5 to 75 MHz	−	±0.2	dB
S_{11}	input return losses	f = 5 to 75 MHz	20	−	dB
S_{22}	output return losses	f = 5 to 50 MHz	20	−	dB
		f = 50 to 75 MHz	18	−	dB
CTB	composite triple beat	4 channels flat; V_o = 50 dBmV; measured at 25 MHz	−	−68	dB
X_{mod}	cross modulation	4 channels flat; V_o = 50 dBmV; measured at 25 MHz	−	−60	dB
d_2	second order distortion	note 1	−	−70	dB
F	noise figure	f = 75 MHz	−	3.5	dB
I_{tot}	total current consumption (DC)	note 2	−	135	mA

Notes

1. f_p = 19 MHz; V_p = 50 dBmV;
   f_q = 31 MHz; V_q = 50 dBmV;
   measured at $f_p + f_q$ = 50 MHz.
2. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

CATV amplifier module BGY785A

FEATURES

- Excellent linearity
- Extremely low noise
- Silicon nitride passivation
- Rugged construction
- Gold metallization ensures excellent reliability.

APPLICATIONS

- CATV systems operating in the 40 to 750 MHz frequency range.

DESCRIPTION

Hybrid high dynamic range cascode amplifier module in a SOT115J package operating with a voltage supply of 24 V (DC).

PINNING - SOT115J

PIN	DESCRIPTION
1	input
2	common
3	common
5	$+V_B$
7	common
8	common
9	output

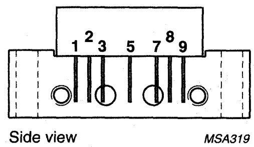


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	19	dB
		f = 750 MHz	18.5	–	dB
I_{tot}	total current consumption (DC)	V_B = 24 V	–	240	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_i	RF input voltage	–	65	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	operating mounting base temperature	–20	+100	°C

CHARACTERISTICS

Table 1 Bandwidth 40 to 750 MHz; V_B = 24 V; T_{case} = 30 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	18.5	19	dB
		f = 750 MHz	18.5	19.5	–	dB
SL	slope cable equivalent	f = 40 to 750 MHz	0	0.9	2	dB
FL	flatness of frequency response	f = 40 to 750 MHz	–	±0.1	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	30	–	dB
		f = 80 to 160 MHz	18.5	29.5	–	dB
		f = 160 to 320 MHz	17	28	–	dB
		f = 320 to 640 MHz	15.5	26	–	dB
		f = 640 to 750 MHz	14	21	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	29	–	dB
		f = 80 to 160 MHz	18.5	26	–	dB
		f = 160 to 320 MHz	17	23.5	–	dB
		f = 320 to 640 MHz	15.5	22	–	dB
		f = 640 to 750 MHz	14	24	–	dB
CTB	composite triple beat	110 channels flat; V_o = 44 dBmV; measured at 745.25 MHz	–	–54.5	–53	dB
X_{mod}	cross modulation	110 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–57.5	–56	dB
CSO	composite second order distortion	110 channels flat; V_o = 44 dBmV; measured at 746.5 MHz	–	–62	–53	dB
d_2	second order distortion	note 1	–	–77	–65	dB
V_o	output voltage	d_{im} = –60 dB; note 2	59	62	–	dBmV
F	noise figure	f = 50 MHz	–	4.5	5.5	dB
		f = 450 MHz	–	–	5.5	dB
		f = 550 MHz	–	–	5.5	dB
		f = 600 MHz	–	–	6	dB
		f = 750 MHz	–	6	7	dB
I_{tot}	total current consumption (DC)	note 3	–	225	240	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 691.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 746.5 MHz.
2. Measured according to DIN45004B:
   f_p = 740.25 MHz; $V_p = V_o$;
   f_q = 747.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 749.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 738.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 2 Bandwidth 40 to 600 MHz; V_B = 24 V; T_{case} = 30 °C; Z_S = Z_L = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	18.5	19	dB
		f = 600 MHz	18.5	–	–	dB
SL	slope cable equivalent	f = 40 to 600 MHz	0	–	1.5	dB
FL	flatness of frequency response	f = 40 to 600 MHz	–	–	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	30	–	dB
		f = 80 to 160 MHz	18.5	29.5	–	dB
		f = 160 to 320 MHz	17	28	–	dB
		f = 320 to 600 MHz	16	26	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	29	–	dB
		f = 80 to 160 MHz	18.5	26	–	dB
		f = 160 to 320 MHz	17	23.5	–	dB
		f = 320 to 600 MHz	16	22	–	dB
CTB	composite triple beat	85 channels flat; V_o = 44 dBmV; measured at 595.25 MHz	–	–	−57	dB
X_{mod}	cross modulation	85 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–	−59	dB
CSO	composite second order distortion	85 channels flat; V_o = 44 dBmV; measured at 596.5 MHz	–	–	−58	dB
d_2	second order distortion	note 1	–	–	−70	dB
V_o	output voltage	d_{im} = −60 dB; note 2	61	–	–	dBmV
F	noise figure	see Table 1	–	–	–	dB
I_{tot}	total current consumption (DC)	note 3	–	225	240	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 541.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 596.5 MHz.
2. Measured according to DIN45004B:
   f_p = 590.25 MHz; $V_p = V_o$;
   f_q = 597.25 MHz; $V_q = V_o$ −6 dB;
   f_r = 599.25 MHz; $V_r = V_o$ −6 dB;
   measured at $f_p + f_q - f_r$ = 588.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 3 Bandwidth 40 to 550 MHz; V_B = 24 V; T_{case} = 30 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	18.5	19	dB
		f = 550 MHz	18.5	–	–	dB
SL	slope cable equivalent	f = 40 to 550 MHz	0	–	1.5	dB
FL	flatness of frequency response	f = 40 to 550 MHz	–	–	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	30	–	dB
		f = 80 to 160 MHz	18.5	29.5	–	dB
		f = 160 to 320 MHz	17	28	–	dB
		f = 320 to 550 MHz	16	26	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	29	–	dB
		f = 80 to 160 MHz	18.5	26	–	dB
		f = 160 to 320 MHz	17	23.5	–	dB
		f = 320 to 550 MHz	16	22	–	dB
CTB	composite triple beat	77 channels flat; V_o = 44 dBmV; measured at 547.25 MHz	–	–61	–60	dB
X_{mod}	cross modulation	77 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–61	–60	dB
CSO	composite second order distortion	77 channels flat; V_o = 44 dBmV; measured at 548.5 MHz	–	–67.5	–60	dB
d_2	second order distortion	note 1	–	–	–72	dB
V_o	output voltage	d_{im} = –60 dB; note 2	62	–	–	dBmV
F	noise figure	see Table 1	–	–	–	dB
I_{tot}	total current consumption (DC)	note 3	–	225	240	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 493.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 548.5 MHz.
2. Measured according to DIN45004B:
   f_p = 540.25 MHz; $V_p = V_o$;
   f_q = 547.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 549.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 538.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 4 Bandwidth 40 to 450 MHz; V_B = 24 V; T_{case} = 30 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	18.5	19	dB
		f = 450 MHz	18.5	–	–	dB
SL	slope cable equivalent	f = 40 to 450 MHz	0	–	1.5	dB
FL	flatness of frequency response	f = 40 to 450 MHz	–	–	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	30	–	dB
		f = 80 to 160 MHz	18.5	29.5	–	dB
		f = 160 to 320 MHz	17	28	–	dB
		f = 320 to 450 MHz	16	26	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	29	–	dB
		f = 80 to 160 MHz	18.5	26	–	dB
		f = 160 to 320 MHz	17	23.5	–	dB
		f = 320 to 450 MHz	16	22	–	dB
CTB	composite triple beat	60 channels flat; V_o = 46 dBmV; measured at 445.25 MHz	–	–	−61	dB
X_{mod}	cross modulation	60 channels flat; V_o = 46 dBmV; measured at 55.25 MHz	–	–	−60	dB
CSO	composite second order distortion	60 channels flat; V_o = 46 dBmV; measured at 446.5 MHz	–	–	−61	dB
d_2	second order distortion	note 1	–	–	−75	dB
V_o	output voltage	d_{im} = −60 dB; note 2	64	–	–	dBmV
F	noise figure	see Table 1	–	–	–	dB
I_{tot}	total current consumption (DC)	note 3	–	225	240	mA

Notes

1. f_p = 55.25 MHz; V_p = 46 dBmV;
   f_q = 391.25 MHz; V_q = 46 dBmV;
   measured at $f_p + f_q$ = 446.5 MHz.
2. Measured according to DIN45004B:
   f_p = 440.25 MHz; $V_p = V_o$;
   f_q = 447.25 MHz; $V_q = V_o$ −6 dB;
   f_r = 449.25 MHz; $V_r = V_o$ −6 dB;
   measured at $f_p + f_q - f_r$ = 438.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

CATV amplifier module | BGY785AD

FEATURES

- Excellent linearity
- Extremely low noise
- Silicon nitride passivation
- Rugged construction
- Gold metallization ensures excellent reliability.

APPLICATIONS

CATV systems operating in the 40 to 750 MHz frequency range.

DESCRIPTION

Hybrid high dynamic range cascode amplifier module with darlington pre-stage dies in a SOT115J package operating at a voltage supply of 24 V (DC).

PINNING - SOT115J

PIN	DESCRIPTION
1	input
2	common
3	common
5	$+V_B$
7	common
8	common
9	output

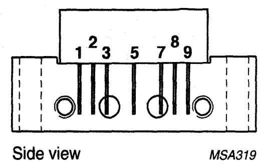


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	19	dB
		f = 750 MHz	18.5	–	dB
I_{tot}	total current consumption (DC)	V_B = 24 V	–	265	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_i	RF input voltage	–	60	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	operating mounting base temperature	–20	+100	°C

CHARACTERISTICS

Table 1 Bandwidth 40 to 750 MHz; V_B = 24 V; T_{case} = 30 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	19	dB
		f = 750 MHz	18.5	–	dB
SL	slope cable equivalent	f = 40 to 750 MHz	0.2	2	dB
FL	flatness of frequency response	f = 40 to 750 MHz	–	±0.5	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	18.5	–	dB
		f = 160 to 320 MHz	17	–	dB
		f = 320 to 640 MHz	15.5	–	dB
		f = 640 to 750 MHz	14	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	18.5	–	dB
		f = 160 to 320 MHz	17	–	dB
		f = 320 to 640 MHz	15.5	–	dB
		f = 640 to 750 MHz	14	–	dB
S_{21}	phase response	f = 50 MHz	135	225	deg
CTB	composite triple beat	110 channels flat; V_o = 44 dBmV; measured at 745.25 MHz	–	–58	dB
X_{mod}	cross modulation	110 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–56	dB
CSO	composite second order distortion	110 channels flat; V_o = 44 dBmV; measured at 746.5 MHz	–	–58	dB
d_2	second order distortion	note 1	–	–68	dB
V_o	output voltage	d_{im} = –60 dB; note 2	61	–	dBmV
F	noise figure	f = 50 MHz	–	5.5	dB
		f = 450 MHz	–	5	dB
		f = 550 MHz	–	5.5	dB
		f = 600 MHz	–	5.5	dB
		f = 750 MHz	–	6	dB
I_{tot}	total current consumption (DC)	note 3	–	265	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 691.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 746.5 MHz.
2. Measured according to DIN45004B:
   f_p = 740.25 MHz; $V_p = V_o$;
   f_q = 747.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 749.25 MHz = ; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 738.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 2 Bandwidth 40 to 600 MHz; V_B = 24 V; T_{case} = 30 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	19	dB
		f = 600 MHz	18.5	–	dB
SL	slope cable equivalent	f = 40 to 600 MHz	0.2	2	dB
FL	flatness of frequency response	f = 40 to 600 MHz	–	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	18.5	–	dB
		f = 160 to 320 MHz	17	–	dB
		f = 320 to 600 MHz	16	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	18.5	–	dB
		f = 160 to 320 MHz	17	–	dB
		f = 320 to 600 MHz	16	–	dB
S_{21}	phase response	f = 50 MHz	135	225	deg
CTB	composite triple beat	85 channels flat; V_o = 44 dBmV; measured at 595.25 MHz	–	−64	dB
X_{mod}	cross modulation	85 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	−59	dB
CSO	composite second order distortion	85 channels flat; V_o = 44 dBmV; measured at 596.5 MHz	–	−60	dB
d_2	second order distortion	note 1	–	−70	dB
V_o	output voltage	d_{im} = −60 dB; note 2	64	–	dBmV
F	noise figure	see Table 1	–	–	dB
I_{tot}	total current consumption (DC)	note 3	–	265	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 541.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 596.5 MHz.
2. Measured according to DIN45004B:
   f_p = 590.25; $V_p = V_o$;
   f_q = 597.25; $V_q = V_o$ −6 dB;
   f_r = 599.25; $V_r = V_o$ −6 dB;
   measured at $f_p + f_q - f_r$ = 588.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 3 Bandwidth 40 to 550 MHz; V_B = 24 V; T_{case} = 30 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	19	dB
		f = 550 MHz	18.5	–	dB
SL	slope cable equivalent	f = 40 to 550 MHz	0.2	2	dB
FL	flatness of frequency response	f = 40 to 550 MHz	–	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	18.5	–	dB
		f = 160 to 320 MHz	17	–	dB
		f = 320 to 550 MHz	16	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	18.5	–	dB
		f = 160 to 320 MHz	17	–	dB
		f = 320 to 550 MHz	16	–	dB
S_{21}	phase response	f = 50 MHz	135	225	deg
CTB	composite triple beat	77 channels flat; V_o = 44 dBmV; measured at 547.25 MHz	–	–66	dB
X_{mod}	cross modulation	77 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–61	dB
CSO	composite second order distortion	77 channels flat; V_o = 44 dBmV; measured at 548.5 MHz	–	–62	dB
d_2	second order distortion	note 1	–	–72	dB
V_o	output voltage	d_{im} = –60 dB; note 2	64.5	–	dBmV
F	noise figure	see Table 1	–	–	dB
I_{tot}	total current consumption (DC)	note 3	–	265	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 493.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 548.5 MHz.
2. Measured according to DIN45004B:
   f_p = 540.25 MHz; $V_p = V_o$;
   f_q = 547.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 549.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 538.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 4 Bandwidth 40 to 450 MHz; V_B = 24 V; T_{case} = 30 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	19	dB
		f = 450 MHz	18.5	–	dB
SL	slope cable equivalent	f = 40 to 450 MHz	0.2	2	dB
FL	flatness of frequency response	f = 40 to 450 MHz	–	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	18.5	–	dB
		f = 160 to 320 MHz	17	–	dB
		f = 320 to 450 MHz	16	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	18.5	–	dB
		f = 160 to 320 MHz	17	–	dB
		f = 320 to 450 MHz	16	–	dB
S_{21}	phase response	f = 50 MHz	135	225	deg
CTB	composite triple beat	60 channels flat; V_o = 46 dBmV; measured at 445.25 MHz	–	−66	dB
X_{mod}	cross modulation	60 channels flat; V_o = 46 dBmV; measured at 55.25 MHz	–	−59	dB
CSO	composite second order distortion	60 channels flat; V_o = 46 dBmV; measured at 446.5 MHz	–	−65	dB
d_2	second order distortion	note 1	–	−75	dB
V_o	output voltage	d_{im} = −60 dB; note 2	66	–	dBmV
F	noise figure	see Table 1	–	–	dB
I_{tot}	total current consumption (DC)	note 3	–	265	mA

Notes

1. f_p = 55.25 MHz; V_p = 46 dBmV;
   f_q = 391.25 MHz; V_q = 46 dBmV;
   measured at $f_p + f_q$ = 446.5 MHz.
2. Measured according to DIN45004B:
   f_p = 440.25 MHz; $V_p = V_o$;
   f_q = 447.25 MHz; $V_q = V_o -6$ dB;
   f_r = 449.25 MHz; $V_r = V_o -6$ dB;
   measured at $f_p + f_q - f_r$ = 438.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

CATV amplifier module | BGY785AD/8M

FEATURES

- Excellent linearity
- Extremely low noise
- Silicon nitride passivation
- Rugged construction
- Gold metallization ensures excellent reliability.

APPLICATIONS

CATV systems operating in the 40 to 870 MHz frequency range.

DESCRIPTION

Hybrid high dynamic range cascode amplifier module with Darlington pre-stage dies in a SOT115J package, operating at a voltage supply of 24 V (DC).

PINNING - SOT115J

PIN	DESCRIPTION
1	input
2	common
3	common
5	$+V_B$
7	common
8	common
9	output

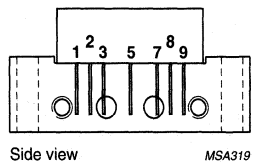


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	19	dB
		f = 870 MHz	18.5	–	dB
I_{tot}	total current consumption (DC)	V_B = 24 V	–	265	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_i	RF input voltage	–	60	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	operating mounting base temperature	–20	+100	°C

CHARACTERISTICS

Table 1 Bandwidth 40 to 870 MHz; V_B = 24 V; T_{case} = 30 °C; Z_S = Z_L = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	19	dB
		f = 870 MHz	18.5	–	dB
SL	slope cable equivalent	f = 40 to 870 MHz	0.2	2	dB
FL	flatness of frequency response	f = 40 to 870 MHz	–	±0.5	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	18.5	–	dB
		f = 160 to 320 MHz	17	–	dB
		f = 320 to 640 MHz	15.5	–	dB
		f = 640 to 870 MHz	14	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	18.5	–	dB
		f = 160 to 320 MHz	17	–	dB
		f = 320 to 640 MHz	15.5	–	dB
		f = 640 to 870 MHz	14	–	dB
S_{21}	phase response	f = 50 MHz	135	225	deg
CTB	composite triple beat	110 channels flat, note 1; V_o = 44 dBmV; measured at 745.25 MHz	–	–58	dB
X_{mod}	cross modulation	110 channels flat, note 1; V_o = 44 dBmV; measured at 55.25 MHz	–	–56	dB
CSO	composite second order distortion	110 channels flat, note 1 V_o = 44 dBmV; measured at 746.5 MHz	–	–58	dB
d_2	second order distortion	notes 1 and 2	–	–68	dB
V_o	output voltage	d_{im} = –60 dB; notes 1 and 3	61	–	dBmV
F	noise figure	f = 50 MHz	–	5.5	dB
		f = 550 MHz	–	5.5	dB
		f = 650 MHz	–	5.5	dB
		f = 750 MHz	–	6	dB
		f = 870 MHz	–	6.5	dB
I_{tot}	total current consumption (DC)	note 4	–	265	mA

Notes

1. Linearity guaranteed up to 750 MHz.
2. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 691.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 746.5 MHz.
3. Measured according to DIN45004B:
   f_p = 740.25 MHz; $V_p = V_o$;
   f_q = 747.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 749.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 738.25 MHz.
4. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 2 Bandwidth 40 to 650 MHz; V_B = 24 V; T_{case} = 30 °C; Z_S = Z_L = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	19	dB
		f = 650 MHz	18.5	–	dB
SL	slope cable equivalent	f = 40 to 650 MHz	0.2	2	dB
FL	flatness of frequency response	f = 40 to 650 MHz	–	±0.4	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	18.5	–	dB
		f = 160 to 320 MHz	17	–	dB
		f = 320 to 650 MHz	16	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	18.5	–	dB
		f = 160 to 320 MHz	17	–	dB
		f = 320 to 650 MHz	16	–	dB
S_{21}	phase response	f = 50 MHz	135	225	deg
CTB	composite triple beat	94 channels flat, note 1; V_o = 44 dBmV; measured at 649.25 MHz	–	–62	dB
X_{mod}	cross modulation	94 channels flat, note 1; V_o = 44 dBmV; measured at 55.25 MHz	–	–57	dB
CSO	composite second order distortion	94 channels flat, note 1; V_o = 44 dBmV; measured at 650.5 MHz	–	–60	dB
d_2	second order distortion	notes 1 and 2	–	–70	dB
V_o	output voltage	d_{im} = –60 dB; notes 1 and 3	63	–	dBmV
F	noise figure	see Table 1	–	–	dB
I_{tot}	total current consumption (DC)	note 4	–	265	mA

Notes

1. Linearity guaranteed up to 750 MHz.
2. f_p = 55.25 MHz; V_p = 44 dBmV; f_q = 595.25 MHz; V_q = 44 dBmV; measured at $f_p + f_q$ = 650.5 MHz.
3. Measured according to DIN45004B:
   f_p = 640.25 MHz; $V_p = V_o$; f_q = 647.25 MHz; $V_q = V_o$ –6 dB; f_r = 649.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 638.25 MHz.
4. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 3 Bandwidth 40 to 550 MHz; V_B = 24 V; T_{case} = 30 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	19	dB
		f = 550 MHz	18.5	–	dB
SL	slope cable equivalent	f = 40 to 550 MHz	0.2	2	dB
FL	flatness of frequency response	f = 40 to 550 MHz	–	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	18.5	–	dB
		f = 160 to 320 MHz	17	–	dB
		f = 320 to 550 MHz	16	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	18.5	–	dB
		f = 160 to 320 MHz	17	–	dB
		f = 320 to 550 MHz	16	–	dB
S_{21}	phase response	f = 50 MHz	135	225	deg
CTB	composite triple beat	77 channels flat, note 1; V_o = 44 dBmV; measured at 547.25 MHz	–	−65	dB
X_{mod}	cross modulation	77 channels flat, note 1; V_o = 44 dBmV; measured at 55.25 MHz	–	−59	dB
CSO	composite second order distortion	77 channels flat, note 1; V_o = 44 dBmV; measured at 548.5 MHz	–	−62	dB
d_2	second order distortion	notes 1 and 2	–	−72	dB
V_o	output voltage	d_{im} = −60 dB; notes 1 and 3	64.5	–	dBmV
F	noise figure	see Table 1	–	–	dB
I_{tot}	total current consumption (DC)	note 4	–	265	mA

Notes

1. Linearity guaranteed up to 750 MHz.
2. f_p = 55.25 MHz; V_p = 44 dBmV; f_q = 493.25 MHz; V_q = 44 dBmV; measured at $f_p + f_q$ = 548.5 MHz.
3. Measured according to DIN45004B:
   f_p = 540.25 MHz; $V_p = V_o$; f_q = 547.25 MHz; $V_q = V_o$ −6 dB; f_r = 549.25 MHz; $V_r = V_o$ −6 dB;
   measured at $f_p + f_q - f_r$ = 538.25 MHz.
4. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

CATV amplifier module BGY787

FEATURES

- Excellent linearity
- Extremely low noise
- Silicon nitride passivation
- Rugged construction
- Gold metallization ensures excellent reliability.

APPLICATIONS

CATV systems operating over a 40 to 750 MHz frequency range.

DESCRIPTION

Hybrid amplifier module in a SOT115J package operating with a voltage supply of 24 V (DC).

PINNING - SOT115J

PIN	DESCRIPTION
1	input
2	common
3	common
5	$+V_B$
7	common
8	common
9	output

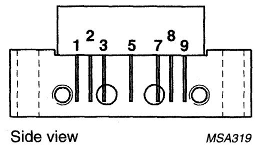


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	21	22	dB
		f = 750 MHz	21.5	–	dB
I_{tot}	total current consumption (DC)	V_B = 24 V	–	240	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_i	RF input voltage	–	60	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	mounting base operating temperature	–20	+100	°C

CHARACTERISTICS

Table 1 Bandwidth 40 to 750 MHz; V_B = 24 V; T_{case} = 30 °C; Z_S = Z_L = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	21	21.5	22	dB
		f = 750 MHz	21.5	22.5	–	dB
SL	slope cable equivalent	f = 40 to 750 MHz	0	1	1.5	dB
FL	flatness of frequency response	f = 40 to 750 MHz	–	±0.2	±0.5	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	33	–	dB
		f = 80 to 160 MHz	18.5	30	–	dB
		f = 160 to 320 MHz	17	25	–	dB
		f = 320 to 640 MHz	15.5	22.5	–	dB
		f = 640 to 750 MHz	14	20.5	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	28.5	–	dB
		f = 80 to 160 MHz	18.5	27.5	–	dB
		f = 160 to 320 MHz	17	25	–	dB
		f = 320 to 640 MHz	15.5	22	–	dB
		f = 640 to 750 MHz	14	20	–	dB
S_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	110 channels flat; V_o = 44 dBmV; measured at 745.25 MHz	–	–54.5	–53	dB
X_{mod}	cross modulation	110 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–54	–52	dB
CSO	composite second order distortion	110 channels flat; V_o = 44 dBmV; measured at 746.5 MHz	–	–57.5	–53	dB
d_2	second order distortion	note 1	–	–75	–63	dB
V_o	output voltage	d_{im} = –60 dB; note 2	61	63	–	dBmV
F	noise figure	f = 50 MHz	–	4	5	dB
		f = 450 MHz	–	–	5.5	dB
		f = 550 MHz	–	–	5.5	dB
		f = 600 MHz	–	–	6	dB
		f = 750 MHz	–	5	6.5	dB
I_{tot}	total current consumption (DC)	note 3	–	220	240	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 691.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 746.5 MHz.
2. Measure according to DIN45004B;
   f_p = 740.25 MHz; $V_p = V_o$;
   f_q = 747.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 749.25 MHz; $V_r = V_o$–6 dB;
   measured at $f_p + f_q - f_r$ = 738.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 2 Bandwidth 40 to 600 MHz; V_B = 24 V; T_{case} = 30 °C; Z_S = Z_L = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	21	21.5	22	dB
		f = 600 MHz	21.5	–	–	dB
SL	slope cable equivalent	f = 40 to 600 MHz	0	–	1.5	dB
FL	flatness of frequency response	f = 40 to 600 MHz	–	–	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	33	–	dB
		f = 80 to 160 MHz	18.5	30	–	dB
		f = 160 to 320 MHz	17	25	–	dB
		f = 320 to 600 MHz	16	22.5	–	dB
S_{22}	output return losses	f = 40 to 80 MHz;	20	28.5	–	dB
		f = 80 to 160 MHz	18.5	27.5	–	dB
		f = 160 to 320 MHz	17	25	–	dB
		f = 320 to 600 MHz	16	22	–	dB
S_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	85 channels flat; V_o = 44 dBmV; measured at 595.25 MHz	–	–59.5	–58	dB
X_{mod}	cross modulation	85 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–55.5	–53	dB
CSO	composite second order distortion	85 channels flat; V_o = 44 dBmV; measured at 596.5 MHz	–	–64	–56	dB
d_2	second order distortion	note 1	–	–	–68	dB
V_o	output voltage	d_{im} = –60 dB; note 2	62.5	–	–	dBmV
F	noise figure	see Table 1	–	–	–	dB
I_{tot}	total current consumption (DC)	note 3	–	220	240	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 541.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 596.5 MHz.
2. Measure according to DIN45004B;
   f_p = 590.25 MHz; $V_p = V_o$;
   f_q = 597.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 599.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 588.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 3 Bandwidth 40 to 550 MHz; V_B = 24 V; T_{case} = 30 °C; Z_S = Z_L = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	21	21.5	22	dB
		f = 550 MHz	21.5	–	–	dB
SL	slope cable equivalent	f = 40 to 550 MHz	0	–	1.5	dB
FL	flatness of frequency response	f = 40 to 550 MHz	–	–	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	33	–	dB
		f = 80 to 160 MHz	18.5	30	–	dB
		f = 160 to 320 MHz	17	25	–	dB
		f = 320 to 550 MHz	16	22.5	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	28.5	–	dB
		f = 80 to 160 MHz	18.5	27.5	–	dB
		f = 160 to 320 MHz	17	25	–	dB
		f = 320 to 550 MHz	16	22	–	dB
S_{21}	phase response	f = 50 MHz	−45	–	+45	deg
CTB	composite triple beat	77 channels flat; V_o = 44 dBmV; measured at 547.25 MHz	–	−61	−60	dB
X_{mod}	cross modulation	77 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	−56.5	−55	dB
CSO	composite second order distortion	77 channels flat; V_o = 44 dBmV; measured at 548.5 MHz	–	−65.5	−58	dB
d_2	second order distortion	note 1	–	–	−70	dB
V_o	output voltage	d_{im} = −60 dB; note 2	63	–	–	dBmV
F	noise figure	see Table 1	–	–	–	dB
I_{tot}	total current consumption (DC)	note 3	–	220	240	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 493.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 548.5 MHz.
2. Measure according to DIN45004B;
   f_p = 540.25 MHz; $V_p = V_o$;
   f_q = 547.25 MHz; $V_q = V_o$ −6 dB;
   f_r = 549.25 MHz; $V_r = V_o$ −6 dB;
   measured at $f_p + f_q - f_r$ = 538.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 4 Bandwidth 40 to 450 MHz; V_B = 24 V; T_{case} = 30 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	21	21.5	22	dB
		f = 450 MHz	21.5	–	–	dB
SL	slope cable equivalent	f = 40 to 450 MHz	0	–	1.5	dB
FL	flatness of frequency response	f = 40 to 450 MHz	–	–	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	33	–	dB
		f = 80 to 160 MHz	18.5	30	–	dB
		f = 160 to 320 MHz	17	25	–	dB
		f = 320 to 450 MHz	16	22.5	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	28.5	–	dB
		f = 80 to 160 MHz	18.5	27.5	–	dB
		f = 160 to 320 MHz	17	25	–	dB
		f = 320 to 450 MHz	16	22	–	dB
S_{21}	phase response	f = 50 MHz	−45	–	+45	deg
CTB	composite triple beat	60 channels flat; V_o = 46 dBmV; measured at 445.25 MHz	–	–	−59	dB
X_{mod}	cross modulation	60 channels flat; V_o = 46 dBmV; measured at 55.25 MHz	–	–	−54	dB
CSO	composite second order distortion	60 channels flat; V_o = 46 dBmV; measured at 446.5 MHz	–	–	−60	dB
d_2	second order distortion	note 1	–	–	−73	dB
V_o	output voltage	d_{im} = −60 dB; note 2	64	–	–	dBmV
F	noise figure	see Table 1	–	–	–	dB
I_{tot}	total current consumption (DC)	note 3	–	220	240	mA

Notes

1. f_p = 55.25 MHz; V_p = 46 dBmV;
   f_q = 391.25 MHz; V_q = 46 dBmV;
   measured at $f_p + f_q$ = 446.5 MHz.
2. Measure according to DIN45004B;
   f_p = 440.25 MHz; $V_p = V_o$;
   f_q = 447.25 MHz; $V_q = V_o$ −6 dB;
   f_r = 449.25 MHz; $V_r = V_o$ −6 dB;
   measured at $f_p + f_q - f_r$ = 438.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

CATV amplifier modules BGY84A; BGY85A

FEATURES

- Excellent linearity
- Extremely low noise
- Silicon nitride passivation
- Rugged construction
- Optimal reliability ensured by TiPtAu metallized crystals.

DESCRIPTION

Hybrid amplifier modules for CATV systems operating over a frequency range of 40 to 450 MHz at a voltage supply of +24 V (DC). BGY84A is intended for use as an input amplifier module and BGY85A as an output amplifier module.

PINNING - SOT115J

PIN	DESCRIPTION
1	input
2	common
3	common
5	$+V_B$
7	common
8	common
9	output

PIN CONFIGURATION

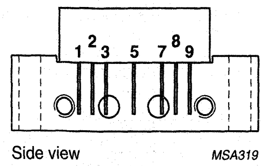


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	–	18.8	dB
		f = 450 MHz	18.7	–	20.2	dB
I_{tot}	total current consumption (DC)	V_B = +24 V				
	BGY84A		–	180	200	mA
	BGY85A		–	220	240	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_i	RF input voltage	–	65	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	mounting base operating temperature	–20	+100	°C

CHARACTERISTICS

Table 1 Bandwidth 40 to 450 MHz; T_{mb} = 30 °C; $Z_S = Z_L = 75\ \Omega$

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	–	18.8	dB
		f = 450 MHz	18.7	–	20.2	dB
SL	slope cable equivalent	f = 40 to 450 MHz	0.3	–	1.5	dB
FL	flatness of frequency response	f = 40 to 450 MHz	–	–	±0.2	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	–	dB
		f = 80 to 160 MHz	19	–	–	dB
		f = 160 to 450 MHz	18	–	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	–	–	dB
		f = 80 to 160 MHz	19	–	–	dB
		f = 160 to 450 MHz	18	–	–	dB
CTB	composite triple beat	60 channels flat; V_o = 46 dBmV; measured at 445.25 MHz				
	BGY84A		–	–	−55	dB
	BGY85A		–	–	−59	dB
X_{mod}	cross modulation	60 channels flat; V_o = 46 dBmV; measured at 55.25 MHz				
	BGY84A		–	–	−58	dB
	BGY85A		–	–	−61	dB
d_2	second order distortion	note 1	–	–	−72	dB
V_o	output voltage	d_{im} = −60 dB; note 2				
	BGY84A		60	–	–	dBmV
	BGY85A		62.5	–	–	dBmV
F	noise figure	f = 40 to 450 MHz				
	BGY84A		–	–	6.5	dB
	BGY85A		–	–	7	dB
I_{tot}	total current consumption	DC value; V_B = +24 V; note 3				
	BGY84A		–	180	200	mA
	BGY85A		–	220	240	mA

Notes

1. f_p = 55.25 MHz; V_p = 46 dBmV;
   f_q = 343.25 MHz; V_q = 46 dBmV;
   measured at $f_p + f_q$ = 398.5 MHz.
2. Measured according to DIN45004B;
   f_p = 440.25 MHz; $V_p = V_o$;
   f_q = 447.25 MHz; $V_q = V_o$ −6 dB;
   f_r = 449.25 MHz; $V_r = V_o$ −6 dB;
   measured at $f_p + f_q - f_r$ = 438.25 MHz.
3. The modules normally operate at V_B = +24 V, but are able to withstand supply transients up to +30 V.

CATV amplifier modules

BGY86; BGY87

FEATURES

- Excellent linearity
- Extremely low noise
- Silicon nitride passivation
- Rugged construction
- TiPtAu metallized crystals ensure optimal reliability.

DESCRIPTION

Hybrid amplifier modules for CATV systems operating over a frequency range of 40 to 450 Mhz at a voltage supply of 24 V (DC). The BGY86 is intended for use as a pre-amplifier and the BGY87 as a final amplifier.

PINNING - SOT115J

PIN	DESCRIPTION
1	input
2	common
3	common
5	$+V_B$
7	common
8	common
9	output

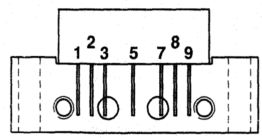


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	21.5	–	22.5	dB
		f = 450 MHz	21.7	–	23.5	dB
I_{tot}	total current consumption (DC)	V_B = 24 V				
	BGY86		–	180	200	mA
	BGY87		–	220	240	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_i	RF input voltage	–	65	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	operating mounting base temperature	–20	+100	°C

CHARACTERISTICS

Bandwidth 40 to 450 MHz; V_B = 24 V; T_{mb} = 30 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	21.5	–	22.5	dB
		f = 450 MHz	21.7	–	23.5	dB
SL	slope cable equivalent	f = 40 to 450 MHz	0	–	1.5	dB
FL	flatness of frequency response	f = 40 to 450 MHz	–	–	±0.2	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	–	dB
		f = 80 to 160 MHz	19	–	–	dB
		f = 160 to 450 MHz	18	–	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	–	–	dB
		f = 80 to 160 MHz	19	–	–	dB
		f = 160 to 450 MHz	18	–	–	dB
S_{21}	phase response	f = 50 MHz	+135	–	+225	deg
CTB	composite triple beat	60 channels flat; V_o = 46 dBmV; measured at 445.25 MHz				
	BGY86		–	–	–54	dB
	BGY87		–	–	–58	dB
X_{mod}	cross modulation	60 channels flat; V_o = 46 dBmV; measured at 55.25 MHz				
	BGY86		–	–	–51	dB
	BGY87		–	–	–55	dB
CSO	composite second order distortion	60 channels flat; V_o = 46 dBmV; measured at 446.5 MHz	–	–	–	–
	BGY86		–	–	–53	dB
	BGY87		–	–	–57	dB
d_2	second order distortion	note 1				
	BGY86		–	–	–68	dB
	BGY87		–	–	–72	dB
V_o	output voltage	d_{im} = –60 dB; note 2				
	BGY86		61.5	–	–	dBmV
	BGY87		64	–	–	dBmV
F	noise figure	f = 450 MHz				
	BGY86		–	–	6	dB
	BGY87		–	–	6.5	dB
I_{tot}	total current consumption (DC)	note 3				
	BGY86		–	180	200	mA
	BGY87		–	220	240	mA

Notes

1. f_p = 55.25 MHz; V_p = 46 dBmV; f_q = 391.25 MHz; V_q = 46 dBmV; measured at $f_p + f_q$ = 446.5 MHz.
2. Measured according to DIN45004B: f_p = 440.25 MHz; $V_p = V_o$; f_q = 447.25 MHz; $V_q = V_o$ –6 dB; f_r = 449.25 MHz; $V_r = V_o$ –6 dB; measured at $f_p + f_q - f_r$ = 438.25 MHz.
3. The modules normally operate at V_B = 24 V, but are able to withstand supply transients up to 30 V.

CATV amplifier module — BGY87B

FEATURES

- Excellent linearity
- Extremely low noise
- Silicon nitride passivation
- Rugged construction
- TiPtAu metallized crystals ensure optimal reliability.

DESCRIPTION

Hybrid amplifier module for CATV systems operating over a frequency range of 40 to 450 MHz at a voltage supply of +24 V.

PINNING - SOT115J

PIN	DESCRIPTION
1	input
2	common
3	common
5	$+V_B$
7	common
8	common
9	output

PIN CONFIGURATION

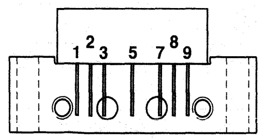


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	26.2	27.8	dB
I_{tot}	total current consumption (DC)	V_B = +24 V; note 1	–	340	mA

Note

1. The module normally operates at V_B = +24 V, but is able to withstand supply transients up to +30 V.

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_i	RF input voltage	–	55	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	mounting base operating temperature	–20	+100	°C

CHARACTERISTICS

Table 1 Bandwidth 40 to 450 MHz; T_{case} = 35 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	26.2	27.8	dB
		f = 450 MHz	27.5	–	dB
SL	slope cable equivalent	f = 40 to 450 MHz	0.5	2.5	dB
FL	flatness of frequency response	f = 40 to 450 MHz	–	±0.2	dB
S_{11}	input return losses	f = 40 to 80 MHz	–	20	dB
		f = 80 to 160 MHz	–	19	dB
		f = 160 to 450 MHz	–	18	dB
S_{22}	output return losses	f = 40 to 80 MHz	–	20	dB
		f = 80 to 160 MHz	–	19	dB
		f = 160 to 450 MHz	–	18	dB
CTB	composite triple beat	60 channels flat; V_o = 46 dBmV; measured at 445.25 MHz	–	−58	dB
X_{mod}	cross modulation	60 channels flat; V_o = 46 dBmV; measured at 55.25 MHz	–	−58	dB
CSO	composite second order distortion	60 channels flat; V_o = 46 dBmV; measured at 446.5 MHz	–	−60	dB
d_2	second order beat	V_o = 46 dBmV; note 1	–	−70	dB
V_o	output voltage	d_{im} = −60 dB; note 2	64	–	dBmV
F	noise figure	f = 450 MHz	–	6	dB
I_{tot}	total current consumption	DC value; V_B = +24 V	–	340	mA

Notes

1. f_p = 55.25 MHz; V_p = 46 dBmV;
   f_q = 391.25 MHz; V_q = 46 dBmV;
   measured at $f_p + f_q$ = 446.5 MHz.
2. Measured according to DIN45004B;
   f_p = 440.25 MHz; $V_p = V_o$;
   f_q = 447.25 MHz; $V_q = V_o$ −6 dB;
   f_r = 449.25 MHz; $V_r = V_o$ −6 dB;
   measured at $f_p + f_q - f_r$ = 438.25 MHz.

CATV amplifier module | BGY883

FEATURES

- Excellent linearity
- Extremely low noise
- Silicon nitride passivation
- Rugged construction
- Gold metallization ensures excellent reliability.

DESCRIPTION

Hybrid amplifier module designed for CATV systems operating over a frequency range of 40 to 860 MHz at a voltage supply of 24 V (DC).

PINNING - SOT115J

PIN	DESCRIPTION
1	input
2	common
3	common
5	$+V_B$
7	common
8	common
9	output

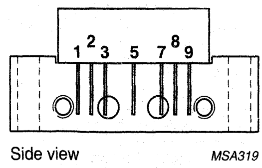


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	14.5	15.5	dB
		f = 860 MHz	15	–	dB
I_{tot}	total current consumption (DC)	V_B = 24 V	–	235	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_i	RF input voltage	–	65	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	operating mounting base temperature	–20	+100	°C

CHARACTERISTICS

Table 1 Bandwidth 40 to 860 MHz; V_B = 24 V; T_{case} = 30 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	14.5	–	15.5	dB
		f = 860 MHz	15	–	–	dB
SL	slope cable equivalent	f = 40 to 860 MHz	0	–	2	dB
FL	flatness of frequency response	f = 40 to 860 MHz	–	–	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	–	dB
		f = 80 to 160 MHz	18.5	–	–	dB
		f = 160 to 320 MHz	17	–	–	dB
		f = 320 to 640 MHz	15.5	–	–	dB
		f = 640 to 860 MHz	14	–	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	–	–	dB
		f = 80 to 160 MHz	18.5	–	–	dB
		f = 160 to 320 MHz	17	–	–	dB
		f = 320 to 640 MHz	15.5	–	–	dB
		f = 640 to 860 MHz	14	–	–	dB
S_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	49 channels flat; V_o = 44 dBmV; measured at 859.25 MHz	–	–	–61	dB
X_{mod}	cross modulation	49 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–	–61	dB
CSO	composite second order distortion	49 channels flat; V_o = 44 dBmV; measured at 860.5 MHz	–	–	–61	dB
d_2	second order distortion	note 1	–	–	–68	dB
V_o	output voltage	d_{im} = –60 dB; note 2	58.5	60	–	dBmV
F	noise figure	f = 50 MHz	–	–	6	dB
		f = 550 MHz	–	–	7	dB
		f = 650 MHz	–	–	7.5	dB
		f = 750 MHz	–	–	8	dB
		f = 860 MHz	–	–	8.5	dB
I_{tot}	total current consumption (DC)	note 3	–	–	235	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 805.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 860.5 MHz.
2. Measured according to DIN45004B:
   f_p = 851.25 MHz; $V_p = V_o$;
   f_q = 858.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 860.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 849.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

CATV amplifier module — BGY885A

FEATURES

- Excellent linearity
- Extremely low noise
- Silicon nitride passivation
- Rugged construction
- Gold metallization ensures excellent reliability.

DESCRIPTION

Hybrid amplifier module for CATV systems operating over a frequency range of 40 to 860 MHz with a voltage supply of 24 V (DC).

PINNING - SOT115J

PIN	DESCRIPTION
1	input
2, 3	common
5	$+V_B$
7, 8	common
9	output

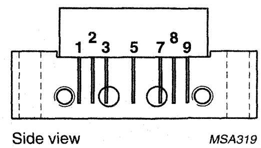


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	19	dB
		f = 860 MHz	18.5	–	dB
I_{tot}	total current consumption (DC)	V_B = 24 V	–	240	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_i	RF input voltage	–	65	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	operating mounting base temperature	–20	+100	°C

CHARACTERISTICS

Table 1 Bandwidth 40 to 860 MHz; V_B = 24 V; T_{mb} = 30 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	18.5	19	dB
		f = 860 MHz	18.5	19.5	–	dB
SL	slope cable equivalent	f = 40 to 860 MHz	0	0.8	2	dB
FL	flatness of frequency response	f = 40 to 860 MHz	–	±0.2	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	31	–	dB
		f = 80 to 160 MHz	18.5	30	–	dB
		f = 160 to 320 MHz	17	27.5	–	dB
		f = 320 to 640 MHz	15.5	25	–	dB
		f = 640 to 860 MHz	14	20.5	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	29	–	dB
		f = 80 to 160 MHz	18.5	27.5	–	dB
		f = 160 to 320 MHz	17	24	–	dB
		f = 320 to 640 MHz	15.5	21	–	dB
		f = 640 to 860 MHz	14	21	–	dB
S_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	49 channels flat; V_o = 44 dBmV; measured at 859.25 MHz	–	–65	–61	dB
X_{mod}	cross modulation	49 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–65	–61	dB
CSO	composite second order distortion	49 channels flat; V_o = 44 dBmV; measured at 860.5 MHz	–	–67	–61	dB
d_2	second order distortion	note 1	–	–78	–70	dB
V_o	output voltage	d_{im} = –60 dB; note 2	58	60	–	dBmV
F	noise figure	f = 50 MHz	–	4.5	5	dB
		f = 450 MHz	–	–	5.5	dB
		f = 550 MHz	–	–	5.5	dB
		f = 600 MHz	–	–	6	dB
		f = 650 MHz	–	–	6	dB
		f = 750 MHz	–	–	7	dB
		f = 860 MHz	–	6	8	dB
I_{tot}	total current consumption (DC)	note 3	–	225	240	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV; f_q = 805.25 MHz; V_q = 44 dBmV; measured at $f_p + f_q$ = 860.5 MHz.
2. Measured according to DIN45004B: f_p = 851.25 MHz; $V_p = V_o$; f_q = 858.25 MHz; $V_q = V_o$ –6 dB; f_r = 860.25 MHz; $V_r = V_o$ –6 dB; measured at $f_p + f_q - f_r$ = 849.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 2 Bandwidth 40 to 750 MHz; V_B = 24 V; T_{mb} = 30 °C; Z_S = Z_L = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	18.5	19	dB
		f = 750 MHz	18.5	–	–	dB
SL	slope cable equivalent	f = 40 to 750 MHz	0	–	1.5	dB
FL	flatness of frequency response	f = 40 to 750 MHz	–	–	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	31	–	dB
		f = 80 to 160 MHz	18.5	30	–	dB
		f = 160 to 320 MHz	17	27.5	–	dB
		f = 320 to 640 MHz	15.5	25	–	dB
		f = 640 to 750 MHz	14	20.5	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	29	–	dB
		f = 80 to 160 MHz	18.5	27.5	–	dB
		f = 160 to 320 MHz	17	24	–	dB
		f = 320 to 640 MHz	15.5	21	–	dB
		f = 640 to 750 MHz	14	21	–	dB
S_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	110 channels flat; V_o = 44 dBmV; measured at 745.25 MHz	–	–55	–53	dB
X_{mod}	cross modulation	110 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–58	–57	dB
CSO	composite second order distortion	110 channels flat; V_o = 44 dBmV; measured at 746.5 MHz	–	–65	–53	dB
d_2	second order distortion	note 1	–	–	–65	dB
V_o	output voltage	d_{im} = –60 dB; note 2	59	–	–	dBmV
F	noise figure	see Table 1	–	–	–	dB
I_{tot}	total current consumption (DC)	note 3	–	225	240	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 691.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 746.5 MHz.
2. Measured according to DIN45004B:
   f_p = 740.25 MHz; $V_p = V_o$;
   f_q = 747.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 749.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 738.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 3 Bandwidth 40 to 600 MHz; V_B = 24 V; T_{mb} = 30 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	18.5	19	dB
		f = 600 MHz	18.5	–	–	dB
SL	slope cable equivalent	f = 40 to 600 MHz	0	–	1.5	dB
FL	flatness of frequency response	f = 40 to 600 MHz	–	–	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	31	–	dB
		f = 80 to 160 MHz	18.5	30	–	dB
		f = 160 to 320 MHz	17	27.5	–	dB
		f = 320 to 600 MHz	16	25	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	29	–	dB
		f = 80 to 160 MHz	18.5	27.5	–	dB
		f = 160 to 320 MHz	17	24	–	dB
		f = 320 to 600 MHz	16	21	–	dB
S_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	85 channels flat; V_o = 44 dBmV; measured at 595.25 MHz	–	–60	–57	dB
X_{mod}	cross modulation	85 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–60.5	–59	dB
CSO	composite second order distortion	85 channels flat; V_o = 44 dBmV; measured at 596.5 MHz	–	–64.5	–58	dB
d_2	second order distortion	note 1	–	–79	–70	dB
V_o	output voltage	d_{im} = –60 dB; note 2	61	64.5	–	dBmV
F	noise figure	see Table 1	–	–	–	dB
I_{tot}	total current consumption (DC)	note 3	–	225	240	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 541.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 596.5 MHz.
2. Measured according to DIN45004B:
   f_p = 590.25 MHz; $V_p = V_o$;
   f_q = 597.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 599.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 588.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 4 Bandwidth 40 to 550 MHz; V_B = 24 V; T_{mb} = 30 °C; Z_S = Z_L = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	18.5	19	dB
		f = 550 MHz	18.5	–	–	dB
SL	slope cable equivalent	f = 40 to 550 MHz	0	–	1.5	dB
FL	flatness of frequency response	f = 40 to 550 MHz	–	–	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	31	–	dB
		f = 80 to 160 MHz	18.5	30	–	dB
		f = 160 to 320 MHz	17	27.5	–	dB
		f = 320 to 550 MHz	16	25	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	29	–	dB
		f = 80 to 160 MHz	18.5	27.5	–	dB
		f = 160 to 320 MHz	17	24	–	dB
		f = 320 to 550 MHz	16	21	–	dB
S_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	77 channels flat; V_o = 44 dBmV; measured at 547.25 MHz	–	–61	–60	dB
X_{mod}	cross modulation	77 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–61	–60	dB
CSO	composite second order distortion	77 channels flat; V_o = 44 dBmV; measured at 548.5 MHz	–	–69	–60	dB
d_2	second order distortion	note 1	–	–	–72	dB
V_o	output voltage	d_{im} = –60 dB; note 2	62	–	–	dBmV
F	noise figure	see Table 1	–	–	–	dB
I_{tot}	total current consumption (DC)	note 3	–	225	240	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 493.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 548.5 MHz.
2. Measured according to DIN45004B:
   f_p = 540.25 MHz; $V_p = V_o$;
   f_q = 547.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 549.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 538.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 5 Bandwidth 40 to 450 MHz; V_B = 24 V; T_{mb} = 30 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	18	18.5	19	dB
		f = 450 MHz	18.5	–	–	dB
SL	slope cable equivalent	f = 40 to 450 MHz	0	–	1.5	dB
FL	flatness of frequency response	f = 40 to 450 MHz	–	–	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	31	–	dB
		f = 80 to 160 MHz	18.5	30	–	dB
		f = 160 to 320 MHz	17	27.5	–	dB
		f = 320 to 450 MHz	16	25	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	29	–	dB
		f = 80 to 160 MHz	18.5	27.5	–	dB
		f = 160 to 320 MHz	17	24	–	dB
		f = 320 to 450 MHz	16	21	–	dB
S_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	60 channels flat; V_o = 46 dBmV; measured at 445.25 MHz	–	–	–61	dB
X_{mod}	cross modulation	60 channels flat; V_o = 46 dBmV; measured at 55.25 MHz	–	–	–60	dB
CSO	composite second order distortion	60 channels flat; V_o = 46 dBmV; measured at 446.5 MHz	–	–	–61	dB
d_2	second order distortion	note 1	–	–	–75	dB
V_o	output voltage	d_{im} = –60 dB; note 2	64	–	–	dBmV
F	noise figure	see Table 1	–	–	–	dB
I_{tot}	total current consumption (DC)	note 3	–	225	240	mA

Notes

1. f_p = 55.25 MHz; V_p = 46 dBmV;
   f_q = 391.25 MHz; V_q = 46 dBmV;
   measured at $f_p + f_q$ = 446.5 MHz.
2. Measured according to DIN45004B:
   f_p = 440.25 MHz; $V_p = V_o$;
   f_q = 447.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 449.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 438.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

CATV amplifier module BGY885B

FEATURES

- Excellent linearity
- Extremely low noise
- Silicon nitride passivation
- Rugged construction
- Gold metallization ensures excellent reliability.

DESCRIPTION

The BGY885B is a hybrid amplifier module designed for CATV systems operating over a frequency range of 40 to 860 MHz at a voltage supply of 24 V (DC).

PINNING - SOT115J

PIN	DESCRIPTION
1	input
2	common
3	common
5	$+V_B$
7	common
8	common
9	output

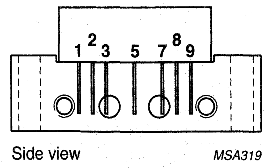


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	19.5	20.5	dB
		f = 860 MHz	20	–	dB
I_{tot}	total current consumption (DC)	V_B = 24 V	–	235	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_i	RF input voltage	–	65	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	operating mounting base temperature	–20	+100	°C

CHARACTERISTICS

Table 1 Bandwidth 40 to 860 MHz; V_B = 24 V; T_{mb} = 30 °C; Z_S = Z_L = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	19.5	–	20.5	dB
		f = 860 MHz	20	–	–	dB
SL	slope cable equivalent	f = 40 to 860 MHz	0	–	2	dB
FL	flatness of frequency response	f = 40 to 860 MHz	–	–	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	–	dB
		f = 80 to 160 MHz	18.5	–	–	dB
		f = 160 to 320 MHz	17	–	–	dB
		f = 320 to 640 MHz	15.5	–	–	dB
		f = 640 to 860 MHz	14	–	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	–	–	dB
		f = 80 to 160 MHz	18.5	–	–	dB
		f = 160 to 320 MHz	17	–	–	dB
		f = 320 to 640 MHz	15.5	–	–	dB
		f = 640 to 860 MHz	14	–	–	dB
S_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	49 channels flat; V_o = 44 dBmV; measured at 859.25 MHz	–	–	–60	dB
CSO	composite second order distortion	49 channels flat; V_o = 44 dBmV; measured at 860.5 MHz	–	–	–60	dB
d_2	second order distortion	note 1	–	–	–68	dB
V_o	output voltage	d_{im} = –60 dB; note 2	57.5	59	–	dBmV
F	noise figure	f = 50 MHz	–	–	5	dB
		f = 550 MHz	–	–	5.5	dB
		f = 650 MHz	–	–	6.5	dB
		f = 750 MHz	–	–	6.5	dB
		f = 860 MHz	–	–	7.5	dB
I_{tot}	total current consumption (DC)	note 3	–	–	235	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 805.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 860.5 MHz.
2. Measured according to DIN45004B:
   f_p = 851.25 MHz; $V_p = V_o$;
   f_q = 858.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 860.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 849.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

CATV amplifier module BGY887

FEATURES

- Excellent linearity
- Extremely low noise
- Excellent return loss properties
- Silicon nitride passivation
- Rugged construction
- Gold metallization ensures excellent reliability.

APPLICATIONS

- CATV systems operating in the 40 to 860 MHz frequency range.

DESCRIPTION

Hybrid dynamic range amplifier module in a SOT115J package operating with a voltage supply of 24 V (DC).

PINNING - SOT115J

PIN	DESCRIPTION
1	input
2	common
3	common
5	$+V_B$
7	common
8	common
9	output

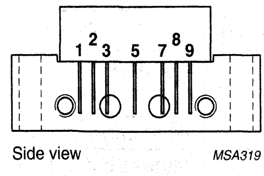


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	21	22	dB
		f = 860 MHz	21.5	–	dB
I_{tot}	total current consumption (DC)	V_B = 24 V	–	235	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_i	RF input voltage	–	65	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	operating mounting base temperature	–20	+100	°C

CHARACTERISTICS

Table 1 Bandwidth 40 to 860 MHz; V_B = 24 V; T_{case} = 30 °C; Z_S = Z_L = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	21	21.5	22	dB
		f = 860 MHz	21.5	22.5	–	dB
SL	slope cable equivalent	f = 40 to 860 MHz	0.2	1	2	dB
FL	flatness of frequency response	f = 40 to 860 MHz	–	±0.2	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	29.5	–	dB
		f = 80 to 160 MHz	18.5	27.5	–	dB
		f = 160 to 320 MHz	17	23	–	dB
		f = 320 to 640 MHz	15.5	22	–	dB
		f = 640 to 860 MHz	14	20	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	27	–	dB
		f = 80 to 160 MHz	18.5	25	–	dB
		f = 160 to 320 MHz	17	20.5	–	dB
		f = 320 to 640 MHz	15.5	19	–	dB
		f = 640 to 860 MHz	14	19	–	dB
S_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	49 channels flat; V_o = 44 dBmV; measured at 859.25 MHz	–	–64.5	–62	dB
X_{mod}	cross modulation	49 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–64.5	–61	dB
CSO	composite second order distortion	49 channels flat; V_o = 44 dBmV; measured at 860.5 MHz	–	–67.5	–61	dB
d_2	second order distortion	note 1	–	–77	–70	dB
V_o	output voltage	d_{im} = –60 dB; note 2	59	60.5	–	dBmV
F	noise figure	f = 50 MHz	–	4	4.5	dB
		f = 550 MHz	–	–	5	dB
		f = 600 MHz	–	–	5	dB
		f = 650 MHz	–	–	5	dB
		f = 750 MHz	–	–	5.5	dB
		f = 860 MHz	–	5	6.5	dB
I_{tot}	total current consumption (DC)	note 3	–	220	235	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 805.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 860.5 MHz.
2. Measured according to DIN45004B:
   f_p = 851.25 MHz; $V_p = V_o$;
   f_q = 858.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 860.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 849.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 2 Bandwidth 40 to 860 MHz; V_B = 24 V; T_{case} = 30 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	21	21.5	22	dB
		f = 860 MHz	21.5	22.5	–	dB
SL	slope cable equivalent	f = 40 to 860 MHz	0.2	1	2	dB
FL	flatness of frequency response	f = 40 to 860 MHz	–	±0.2	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	29.5	–	dB
		f = 80 to 160 MHz	18.5	27.5	–	dB
		f = 160 to 320 MHz	17	23	–	dB
		f = 320 to 640 MHz	15.5	22	–	dB
		f = 640 to 860 MHz	14	20	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	27	–	dB
		f = 80 to 160 MHz	18.5	25	–	dB
		f = 160 to 320 MHz	17	20.5	–	dB
		f = 320 to 640 MHz	15.5	19	–	dB
		f = 640 to 860 MHz	14	19	–	dB
S_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	129 channels flat; V_o = 42 dBmV; measured at 859.25 MHz	–	–54	–51	dB
X_{mod}	cross modulation	129 channels flat; V_o = 42 dBmV; measured at 55.25 MHz	–	–60	–57	dB
CSO	composite second order distortion	129 channels flat; V_o = 42 dBmV; measured at 860.5 MHz	–	–605	–55	dB
d_2	second order distortion	note 1	–	–77	–70	dB
V_o	output voltage	d_{im} = –60 dB; note 2	59	60.5	–	dBmV
F	noise figure	see Table 1	–	–	–	dB
I_{tot}	total current consumption (DC)	note 3	–	220	235	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 805.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 860.5 MHz.
2. Measured according to DIN45004B:
   f_p = 851.25 MHz; $V_p = V_o$;
   f_q = 858.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 860.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 849.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 3 Bandwidth 40 to 750 MHz; V_B = 24 V; T_{case} = 30 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	21	21.5	22	dB
		f = 750 MHz	21.5	22.3	–	dB
SL	slope cable equivalent	f = 40 to 750 MHz	0.2	–	2	dB
FL	flatness of frequency response	f = 40 to 750 MHz	–	–	±0.3	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	29.5	–	dB
		f = 80 to 160 MHz	18.5	27.5	–	dB
		f = 160 to 320 MHz	17	23	–	dB
		f = 320 to 640 MHz	15.5	22	–	dB
		f = 640 to 750 MHz	14	20	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	27	–	dB
		f = 80 to 160 MHz	18.5	25	–	dB
		f = 160 to 320 MHz	17	20.5	–	dB
		f = 320 to 640 MHz	15.5	19	–	dB
		f = 640 to 750 MHz	14	19	–	dB
S_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	110 channels flat; V_o = 44 dBmV; measured at 745.25 MHz	–	–53	–51	dB
X_{mod}	cross modulation	110 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–57	–54	dB
CSO	composite second order distortion	110 channels flat; V_o = 44 dBmV; measured at 746.5 MHz	–	–62	–56	dB
d_2	second order distortion	note 1	–	–78	–70	dB
V_o	output voltage	d_{im} = –60 dB; note 2	60	62	–	dBmV
F	noise figure	see Table 1	–	–	–	dB
I_{tot}	total current consumption (DC)	note 3	–	220	235	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 691.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 746.5 MHz.
2. Measured according to DIN45004B:
   f_p = 740.25 MHz; $V_p = V_o$;
   f_q = 747.25 MHz; $V_q = V_o$–6 dB;
   f_r = 749.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 738.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 4 Bandwidth 40 to 600 MHz; V_B = 24 V; T_{case} = 30 °C; Z_S = Z_L = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	21	21.5	22	dB
		f = 600 MHz	21.5	22.1	–	dB
SL	slope cable equivalent	f = 40 to 600 MHz	0.2	–	2	dB
FL	flatness of frequency response	f = 40 to 600 MHz	–	–	±0.2	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	29.5	–	dB
		f = 80 to 160 MHz	18.5	27.5	–	dB
		f = 160 to 320 MHz	17	23	–	dB
		f = 320 to 600 MHz	16	22	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	27	–	dB
		f = 80 to 160 MHz	18.5	25	–	dB
		f = 160 to 320 MHz	17	20.5	–	dB
		f = 320 to 600 MHz	16	19	–	dB
S_{21}	phase response	f = 50 MHz	–45	–	+45	deg
CTB	composite triple beat	85 channels flat; V_o = 44 dBmV; measured at 595.25 MHz	–	–	–56	dB
X_{mod}	cross modulation	85 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–	–57	dB
CSO	composite second order distortion	85 channels flat; V_o = 44 dBmV; measured at 596.5 MHz	–	–	–58	dB
d_2	second order distortion	note 1	–	–	–70	dB
V_o	output voltage	d_{im} = –60 dB; note 2	61	–	–	dBmV
F	noise figure	see Table 1	–	–	–	dB
I_{tot}	total current consumption (DC)	note 3	–	220	235	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 541.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 596.5 MHz.
2. Measured according to DIN45004B:
   f_p = 590.25 MHz; $V_p = V_o$;
   f_q = 597.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 599.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 588.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

CATV amplifier module | BGY887B

FEATURES

- Excellent linearity
- Extremely low noise
- High gain
- Excellent return loss properties.

APPLICATIONS

- Single-module line extender in CATV systems operating in the 40 to 860 MHz frequency range.

PINNING - SOT115J

PIN	DESCRIPTION
1	input
2	common
3	common
5	$+V_B$
7	common
8	common
9	output

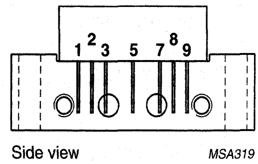


Fig.1 Simplified outline.

DESCRIPTION

Hybrid amplifier module in a SOT115J package operating with a voltage supply of 24 V (DC). This high gain module consists of two cascaded stages, both in cascode configuration.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	28.5	29.5	dB
		f = 860 MHz	29	–	dB
I_{tot}	total current consumption (DC)	V_B = 24 V	–	340	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_i	RF input voltage	–	55	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	operating mounting base temperature	–20	+100	°C

CHARACTERISTICS

Table 1 Bandwidth 40 to 860 MHz; V_B = 24 V; T_{mb} = 30 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	28.5	29.5	dB
		f = 860 MHz	29	–	dB
SL	slope cable equivalent	f = 40 to 860 MHz	0.5	2.5	dB
FL	flatness of frequency response	f = 40 to 860 MHz	–	±0.5	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	18.5	–	dB
		f = 160 to 320 MHz	17	–	dB
		f = 320 to 640 MHz	15.5	–	dB
		f = 640 to 860 MHz	14	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	18.5	–	dB
		f = 160 to 320 MHz	17	–	dB
		f = 320 to 640 MHz	15.5	–	dB
		f = 640 to 860 MHz	14	–	dB
CTB	composite triple beat	49 channels flat; V_o = 44 dBmV; measured at 859.25 MHz	–	–60	dB
X_{mod}	cross modulation	49 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–60	dB
CSO	composite second order distortion	49 channels flat; V_o = 44 dBmV; measured at 860.5 MHz	–	–60	dB
d_2	second order distortion	note 1	–	–70	dB
V_o	output voltage	d_{im} = –60 dB; note 2	58.5	–	dBmV
F	noise figure	f = 50 MHz	–	5	dB
		f = 550 MHz	–	5.5	dB
		f = 600 MHz	–	5.5	dB
		f = 650 MHz	–	5.5	dB
		f = 750 MHz	–	6	dB
		f = 860 MHz	–	6.5	dB
I_{tot}	total current consumption (DC)	note 3	–	340	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 805.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 860.5 MHz.
2. Measured according to DIN45004B:
   f_p = 851.25 MHz; $V_p = V_o$;
   f_q = 858.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 860.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 849.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 2 Bandwidth 40 to 860 MHz; V_B = 24 V; T_{mb} = 30 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	28.5	29.5	dB
		f = 860 MHz	29	–	dB
SL	slope cable equivalent	f = 40 to 860 MHz	0.5	2.5	dB
FL	flatness of frequency response	f = 40 to 860 MHz	–	±0.5	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	18.5	–	dB
		f = 160 to 320 MHz	17	–	dB
		f = 320 to 640 MHz	15.5	–	dB
		f = 640 to 860 MHz	14	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	18.5	–	dB
		f = 160 to 320 MHz	17	–	dB
		f = 320 to 640 MHz	15.5	–	dB
		f = 640 to 860 MHz	14	–	dB
CTB	composite triple beat	129 channels flat; V_o = 44 dBmV; measured at 859.25 MHz	–	−46	dB
X_{mod}	cross modulation	129 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	−52	dB
CSO	composite second order distortion	129 channels flat; V_o = 44 dBmV; measured at 860.5 MHz	–	−53	dB
d_2	second order distortion	note 1	–	−70	dB
V_o	output voltage	d_{im} = −60 dB; note 2	58.5	–	dBmV
F	noise figure	see Table 1	–	–	dB
I_{tot}	total current consumption (DC)	note 3	–	340	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 805.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 860.5 MHz.
2. Measured according to DIN45004B:
   f_p = 851.25 MHz; $V_p = V_o$;
   f_q = 858.25 MHz; $V_q = V_o$ −6 dB;
   f_r = 860.25 MHz; $V_r = V_o$ −6 dB;
   measured at $f_p + f_q - f_r$ = 849.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

CATV amplifier module BGY887B

Table 3 Bandwidth 40 to 750 MHz; V_B = 24 V; T_{mb} = 30 °C; Z_S = Z_L = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	28.5	29.5	dB
		f = 750 MHz	29	–	dB
SL	slope cable equivalent	f = 40 to 750 MHz	0.2	2.2	dB
FL	flatness of frequency response	f = 40 to 750 MHz	–	±0.45	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	18.5	–	dB
		f = 160 to 320 MHz	17	–	dB
		f = 320 to 640 MHz	15.5	–	dB
		f = 640 to 750 MHz	14	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	18.5	–	dB
		f = 160 to 320 MHz	17	–	dB
		f = 320 to 640 MHz	15.5	–	dB
		f = 640 to 750 MHz	14	–	dB
CTB	composite triple beat	110 channels flat; V_o = 44 dBmV; measured at 745.25 MHz	–	–50	dB
X_{mod}	cross modulation	110 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–54	dB
CSO	composite second order distortion	110 channels flat; V_o = 44 dBmV; measured at 746.5 MHz	–	–56	dB
d_2	second order distortion	note 1	–	–70	dB
V_o	output voltage	d_{im} = –60 dB; note 2	59	–	dBmV
F	noise figure	see Table 1	–	–	dB
I_{tot}	total current consumption (DC)	note 3	–	340	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 691.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 746.5 MHz.
2. Measured according to DIN45004B:
   f_p = 740.25 MHz; $V_p = V_o$;
   f_q = 747.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 749.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 738.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 4 Bandwidth 40 to 600 MHz; V_B = 24 V; T_{mb} = 30 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	28.5	29.5	dB
		f = 600 MHz	29	–	dB
SL	slope cable equivalent	f = 40 to 600 MHz	–	2	dB
FL	flatness of frequency response	f = 40 to 600 MHz	–	±0.35	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	18.5	–	dB
		f = 160 to 320 MHz	17	–	dB
		f = 320 to 600 MHz	16	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	18.5	–	dB
		f = 160 to 320 MHz	17	–	dB
		f = 320 to 600 MHz	16	–	dB
CTB	composite triple beat	85 channels flat; V_o = 44 dBmV; measured at 595.25 MHz	–	–55	dB
X_{mod}	cross modulation	85 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–56	dB
CSO	composite second order distortion	85 channels flat; V_o = 44 dBmV; measured at 596.5 MHz	–	–60	dB
d_2	second order distortion	note 1	–	–72	dB
V_o	output voltage	d_{im} = –60 dB; note 2	61	–	dBmV
F	noise figure	see Table 1	–	–	dB
I_{tot}	total current consumption (DC)	note 3	–	340	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 541.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 596.5 MHz.
2. Measured according to DIN45004B:
   f_p = 590.25 MHz; $V_p = V_o$;
   f_q = 597.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 599.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 588.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

FEATURES

- Excellent linearity
- Extremely low noise
- High gain
- Excellent return loss properties.

APPLICATIONS

- Single module line extender in CATV systems operating over a frequency range of 40 to 860 MHz.

DESCRIPTION

Hybrid high dynamic range amplifier module operating with a voltage supply of 24 V in a SOT115J package. The high gain module consists of two cascaded stages both in cascode configuration.

PINNING SOT115J

PIN	DESCRIPTION
1	input
2, 3	common
5	$+V_B$
7, 8	common
9	output

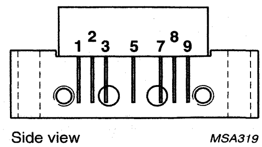


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	33.5	34.5	dB
		f = 860 MHz	34	–	dB
I_{tot}	total current consumption (DC)	V_B = 24 V	–	340	mA

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_i	RF input voltage	–	55	dBmV
T_{mb}	operating mounting base temperature	–20	+100	°C
T_{stg}	storage temperature	–40	+100	°C

CHARACTERISTICS

Table 1 Bandwidth 40 to 860 MHz; V_B = 24 V; T_{case} = 30 °C; Z_S = Z_L = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	33.5	34	34.5	dB
		f = 860 MHz	34	35	–	dB
SL	slope cable equivalent	f = 40 to 860 MHz	0.5	1.1	2.5	dB
FL	flatness of frequency response	f = 40 to 860 MHz	–	±0.2	±0.5	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	25	–	dB
		f = 80 to 160 MHz	18.5	28	–	dB
		f = 160 to 320 MHz	17	28	–	dB
		f = 320 to 640 MHz	15.5	21	–	dB
		f = 640 to 860 MHz	14	18.5	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	25.5	–	dB
		f = 80 to 160 MHz	18.5	28.5	–	dB
		f = 160 to 320 MHz	17	26.5	–	dB
		f = 320 to 640 MHz	15.5	20.5	–	dB
		f = 640 to 860 MHz	14	21	–	dB
S_{21}	phase response	f = 50 MHz	135	–	225	deg
CTB	composite triple beat	49 channels flat; V_o = 44 dBmV; measured at 859.25 MHz	–	–63.5	–60	dB
X_{mod}	cross modulation	49 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–63	–59	dB
CSO	composite second order distortion	49 channels flat; V_o = 44 dBmV; measured at 860.5 MHz	–	–64	–55	dB
d_2	second order distortion	note 1	–	–74	–65	dB
V_o	output voltage	d_{im} = –60 dB; note 2	58	60	–	dBmV
F	noise figure	f = 50 MHz	–	4	4.5	dB
		f = 550 MHz	–	–	5	dB
		f = 600 MHz	–	–	5	dB
		f = 650 MHz	–	–	5.5	dB
		f = 750 MHz	–	–	6	dB
		f = 860 MHz	–	5.5	7	dB
I_{tot}	total current consumption (DC)	note 3	–	325	340	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 805.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 860.5 MHz.
2. Measured according to DIN45004B:
   f_p = 851.25 MHz; $V_p = V_o$;
   f_q = 858.25 MHz; $V_q = V_o$–6 dB;
   f_r = 860.25 MHz; $V_r = V_o$–6 dB;
   measured at $f_p + f_q - f_r$ = 849.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 2 Bandwidth 40 to 860 MHz; V_B = 24 V; T_{case} = 30 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	33.5	34	34.5	dB
		f = 860 MHz	34	35	–	dB
SL	slope cable equivalent	f = 40 to 860 MHz	0.5	1.1	2.5	dB
FL	flatness of frequency response	f = 40 to 860 MHz	–	±0.2	±0.5	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	25	–	dB
		f = 80 to 160 MHz	18.5	28	–	dB
		f = 160 to 320 MHz	17	28	–	dB
		f = 320 to 640 MHz	15.5	21	–	dB
		f = 640 to 860 MHz	14	18.5	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	25.5	–	dB
		f = 80 to 160 MHz	18.5	28.5	–	dB
		f = 160 to 320 MHz	17	26.5	–	dB
		f = 320 to 640 MHz	15.5	20.5	–	dB
		f = 640 to 860 MHz	14	21	–	dB
S_{21}	phase response	f = 50 MHz	135	–	225	deg
CTB	composite triple beat	129 channels flat; V_o = 44 dBmV; measured at 859.25 MHz	–	−47.5	−46	dB
X_{mod}	cross modulation	129 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	−53.5	−50	dB
CSO	composite second order distortion	129 channels flat; V_o = 44 dBmV; measured at 860.5 MHz	–	−56	−48	dB
d_2	second order distortion	note 1	–	−74	−65	dB
V_o	output voltage	d_{im} = −60 dB; note 2	58	60	–	dBmV
F	noise figure	see Table 1	–	–	–	dB
I_{tot}	total current consumption (DC)	note 3	–	325	340	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 805.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 860.5 MHz.
2. Measured according to DIN45004B:
   f_p = 851.25 MHz; $V_p = V_o$;
   f_q = 858.25 MHz; $V_q = V_o$ −6 dB;
   f_r = 860.25 MHz; $V_r = V_o$ −6 dB;
   measured at $f_p + f_q - f_r$ = 849.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 3 Bandwidth 40 to 750 MHz; V_B = 24 V; T_{case} = 30 °C; $Z_S = Z_L$ = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	33.5	34	34.5	dB
		f = 750 MHz	34	–	–	dB
SL	slope cable equivalent	f = 40 to 750 MHz	0.2	–	2.2	dB
FL	flatness of frequency response	f = 40 to 750 MHz	–	–	±0.45	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	25	–	dB
		f = 80 to 160 MHz	18.5	28	–	dB
		f = 160 to 320 MHz	17	28	–	dB
		f = 320 to 640 MHz	15.5	21	–	dB
		f = 640 to 750 MHz	14	18.5	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	25.5	–	dB
		f = 80 to 160 MHz	18.5	28.5	–	dB
		f = 160 to 320 MHz	17	26.5	–	dB
		f = 320 to 640 MHz	15.5	20.5	–	dB
		f = 640 to 750 MHz	14	21	–	dB
S_{21}	phase response	f = 50 MHz	135	–	225	deg
CTB	composite triple beat	110 channels flat; V_o = 44 dBmV; measured at 745.25 MHz	–	–52.5	–50	dB
X_{mod}	cross modulation	110 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	–55.5	–51	dB
CSO	composite second order distortion	110 channels flat; V_o = 44 dBmV; measured at 746.5 MHz	–	–61.5	–53	dB
d_2	second order distortion	note 1	–	–	–65	dB
V_o	output voltage	d_{im} = –60 dB; note 2	59	–	–	dBmV
F	noise figure	see Table 1	–	–	–	dB
I_{tot}	total current consumption (DC)	note 3	–	325	340	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 691.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 746.5 MHz.
2. Measured according to DIN45004B:
   f_p = 740.25 MHz; $V_p = V_o$;
   f_q = 747.25 MHz; $V_q = V_o$–6 dB;
   f_r = 749.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 738.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

Table 4 Bandwidth 40 to 600 MHz; V_B = 24 V; T_{case} = 30 °C; Z_S = Z_L = 75 Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 50 MHz	33.5	34	34.5	dB
		f = 600 MHz	34	–	–	dB
SL	slope cable equivalent	f = 40 to 600 MHz	0	–	2	dB
FL	flatness of frequency response	f = 40 to 600 MHz	–	–	±0.35	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	25	–	dB
		f = 80 to 160 MHz	18.5	28	–	dB
		f = 160 to 320 MHz	17	28	–	dB
		f = 320 to 600 MHz	16	21	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	20	25.5	–	dB
		f = 80 to 160 MHz	18.5	28.5	–	dB
		f = 160 to 320 MHz	17	26.5	–	dB
		f = 320 to 600 MHz	16	20.5	–	dB
S_{21}	phase response	f = 50MHz	135	–	225	deg
CTB	composite triple beat	85 channels flat; V_o = 44 dBmV; measured at 595.25 MHz	–	−56.5	−55	dB
X_{mod}	cross modulation	85 channels flat; V_o = 44 dBmV; measured at 55.25 MHz	–	−58	−54	dB
CSO	composite second order distortion	85 channels flat; V_o = 44 dBmV; measured at 596.5 MHz	–	−69.5	−56	dB
d_2	second order distortion	note 1	–	–	−68	dB
V_o	output voltage	d_{im} = −60 dB; note 2	61	–	–	dBmV
F	noise figure (DC)	see Table 1	–	–	–	dB
I_{tot}	total current consumption	note 3	–	325	340	mA

Notes

1. f_p = 55.25 MHz; V_p = 44 dBmV;
   f_q = 541.25 MHz; V_q = 44 dBmV;
   measured at $f_p + f_q$ = 596.5 MHz.
2. Measured according to DIN45004B:
   f_p = 590.25 MHz; $V_p = V_o$;
   f_q = 597.25 MHz; $V_q = V_o$ −6 dB;
   f_r = 599.25 MHz; $V_r = V_o$ −6 dB;
   measured at $f_p + f_q - f_r$ = 588.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

CATV amplifier module | CGD914

FEATURES

- Excellent linearity
- Extremely low noise
- Excellent return loss properties
- Rugged construction
- Gold metallization ensures excellent reliability.

APPLICATIONS

- CATV systems operating in the 40 to 870 MHz frequency range.

DESCRIPTION

Hybrid amplifier module in a SOT115J package operating with a voltage supply of 24 V (DC), employing both GaAs and Si dies.

PINNING - SOT115J

Pin	DESCRIPTION
1	input
2 and 3	common
5	$+V_B$
7 and 8	common
9	output

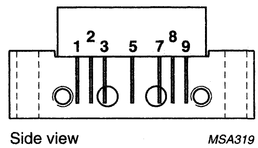


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 45 MHz	19.75	20.25	dB
		f = 870 MHz	20.2	21.5	dB
I_{tot}	total current consumption (DC)	V_B = 24 V	345	375	mA

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 60134).

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_B	supply voltage	–	30	V
V_i	RF input voltage	–	–	
	single tone	–	70	dBmV
	132 channels flat	–	45	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	operating mounting base temperature	–20	+100	°C

CHARACTERISTICS

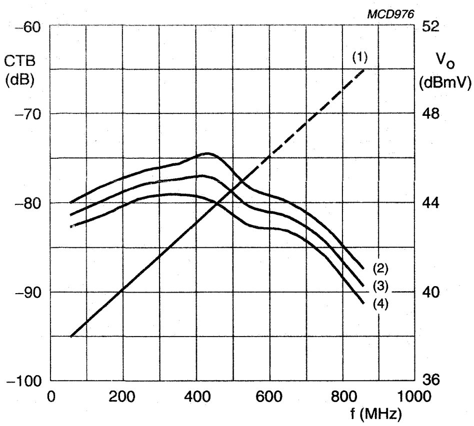
Bandwidth 45 to 870 MHz; V_B = 24 V; T_{mb} = 35 °C; $Z_S = Z_L$ = 75 Ω.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_p	power gain	f = 45 MHz	19.75	20	20.25	dB
		f = 870 MHz	20.2	21	21.5	dB
SL	slope straight line	f = 45 to 870 MHz	0.2	1	1.5	dB
FL	flatness straight line	f = 45 to 100 MHz	−0.25	–	+0.25	dB
		f = 100 to 800 MHz	−0.6	–	+0.4	dB
		f = 800 to 870 MHz	−0.45	–	+0.2	dB
	flatness narrow band	in each 6 MHz segment	–	–	±0.1	dB
s_{11}	input return losses	f = 40 to 80 MHz	20	–	–	dB
		f = 80 to 160 MHz	20	–	–	dB
		f = 160 to 320 MHz	18	–	–	dB
		f = 320 to 550 MHz	16	–	–	dB
		f = 550 to 650 MHz	15	–	–	dB
		f = 650 to 750 MHz	14	–	–	dB
		f = 750 to 870 MHz	14	–	–	dB
		f = 870 to 914 MHz	10	–	–	dB
s_{22}	output return losses	f = 40 to 80 MHz	21	–	–	dB
		f = 80 to 160 MHz	21	–	–	dB
		f = 160 to 320 MHz	20	–	–	dB
		f = 320 to 550 MHz	19	–	–	dB
		f = 550 to 650 MHz	18	–	–	dB
		f = 650 to 750 MHz	17	–	–	dB
		f = 750 to 870 MHz	16	–	–	dB
		f = 870 to 914 MHz	14	–	–	dB
s_{21}	phase response	f = 50 MHz	−45	–	+45	deg
s_{12}	reverse isolation	RF_{out} to RF_{in}	–	–	22	dB
CTB	composite triple beat	79 chs; f_m = 445.25 MHz; note 1	–	–	−76	dB
		112 chs; f_m = 649.25 MHz; note 2	–	–	−64	dB
		132 chs; f_m = 745.25 MHz; note 3	–	–	−55	dB
		79 chs flat; V_o = 44 dBmV; f_m = 547.25 MHz	–	–	−73	dB
		112 chs flat; V_o = 44 dBmV; f_m = 745.25 MHz	–	–	−64	dB
		132 chs flat; V_o = 44 dBmV; f_m = 745.25 MHz	–	–	−60	dB
X_{mod}	cross modulation	79 chs; f_m = 55.25 MHz; note 1	–	–	−70	dB
		112 chs; f_m = 55.25 MHz; note 2	–	–	−62	dB
		132 chs; f_m = 55.25 MHz; note 3	–	–	−57	dB
		79 chs flat; V_o = 44 dBmV; f_m = 55.25 MHz	–	–	−69	dB
		112 chs flat; V_o = 44 dBmV; f_m = 55.25 MHz	–	–	−65	dB
		132 chs flat; V_o = 44 dBmV; f_m = 55.25 MHz	–	–	−63	dB

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
CSO Sum	composite second order distortion (sum)	79 chs; f_m = 446.5 MHz; note 1	–	–	–71	dB
		112 chs; f_m = 746.5 MHz; note 2	–	–	–60	dB
		132 chs; f_m = 860.5 MHz; note 3	–	–	–56	dB
		79 chs flat; V_o = 44 dBmV; f_m = 548.5 MHz	–	–	–63	dB
		112 chs flat; V_o = 44 dBmV; f_m = 746.5 MHz	–	–	–54	dB
		132 chs flat; V_o = 44 dBmV; f_m = 860.5 MHz	–	–	–49	dB
CSO Diff	composite second order distortion (diff)	79 chs; f_m = 150 MHz; note 1	–	–	–59	dB
		112 chs; f_m = 150 MHz; note 2	–	–	–53	dB
		132 chs; f_m = 150 MHz; note 3	–	–	–48	dB
		79 chs flat; V_o = 44 dBmV; f_m = 150 MHz	–	–	–60	dB
		112 chs flat; V_o = 44 dBmV; f_m = 150 MHz	–	–	–59	dB
		132 chs flat; V_o = 44 dBmV; f_m = 150 MHz	–	–	–57	dB
NF	noise figure	f = 50 MHz	–	2.5	3	dB
		f = 550 MHz	–	2.5	3	dB
		f = 750 MHz	–	2.6	3.5	dB
		f = 870 MHz	–	3	3.5	dB
d_2	second order distortion	note 4	–	–	–60	dB
		note 5	–	–	–54	dB
		note 6	–	–	–50	dB
V_o	output voltage	d_{im} = –60 dB; note 7	69	–	–	dBmV
		d_{im} = –60 dB; note 8	66	–	–	dBmV
		d_{im} = –60 dB; note 9	63	–	–	dBmV
I_{tot}	total current consumption (DC)	note 10	345	360	375	mA

Notes

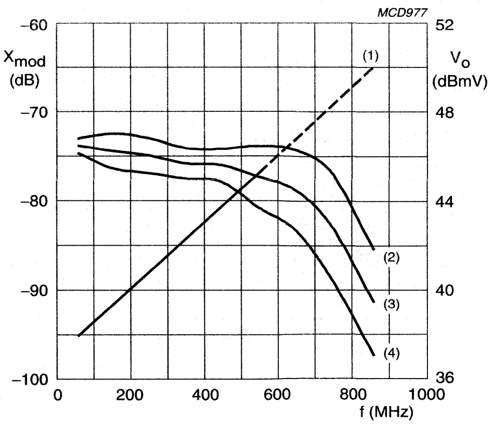
1. V_o = 38 dBmV at 54 MHz; Tilt = 7.3 dB (55 to 547 MHz) extrapolated to 12 dB at 870 MHz.
2. V_o = 38 dBmV at 54 MHz; Tilt = 10.2 dB (55 to 745 MHz) extrapolated to 12 dB at 870 MHz.
3. V_o = 38 dBmV at 54 MHz; Tilt = 12 dB (55 to 865 MHz).
4. f_p = 55.25 MHz; V_p = 60 dBmV; f_q = 493.25 MHz; V_q = 60 dBmV; measured at $f_p + f_q$ = 548.5 MHz.
5. f_p = 55.25 MHz; V_p = 60 dBmV; f_q = 691.25 MHz; V_q = 60 dBmV; measured at $f_p + f_q$ = 746.5 MHz.
6. f_p = 55.25 MHz; V_p = 60 dBmV; f_q = 805.25 MHz; V_q = 60 dBmV; measured at $f_p + f_q$ = 860.5 MHz.
7. Measured according to DIN45004B: f_p = 540.25 MHz; $V_p = V_o$; f_q = 547.25 MHz; $V_q = V_o$ –6 dB; f_r = 549.25 MHz; $V_r = V_o$ –6 dB; measured at $f_p + f_q - f_r$ = 538.25 MHz.
8. Measured according to DIN45004B: f_p = 740.25 MHz; $V_p = V_o$; f_q = 747.25 MHz; $V_q = V_o$ –6 dB; f_r = 749.25 MHz; $V_r = V_o$ –6 dB; measured at $f_p + f_q - f_r$ = 738.25 MHz.
9. Measured according to DIN45004B: f_p = 851.25 MHz; $V_p = V_o$; f_q = 858.25 MHz; $V_q = V_o$ –6 dB; f_r = 860.25 MHz; $V_r = V_o$ –6 dB; measured at $f_p + f_q - f_r$ = 849.25 MHz.
10. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 79 chs; tilt = 7.3 dB (50 to 550 MHz).

(1) V_o.
(2) Typ. +3 σ.
(3) Typ.
(4) Typ. −3 σ.

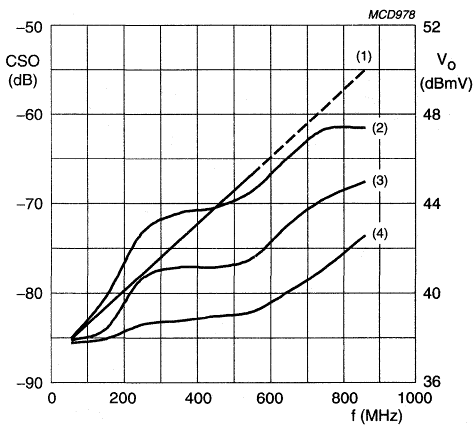
Fig.2 Composite triple beat as a function of frequency under tilted conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 79 chs; tilt = 7.3 dB (50 to 550 MHz).

(1) V_o.
(2) Typ. +3 σ.
(3) Typ.
(4) Typ. −3 σ.

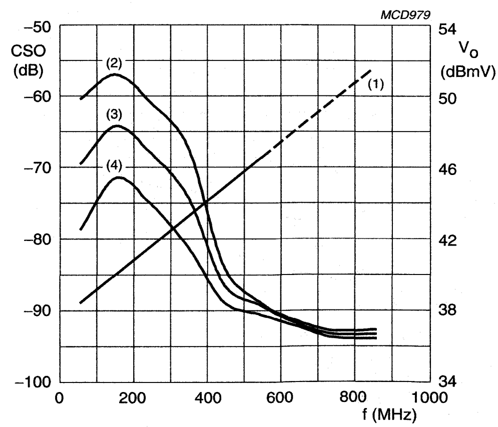
Fig.3 Cross modulation as a function of frequency under tilted conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 79 chs; tilt = 7.3 dB (50 to 550 MHz).

(1) V_o.
(2) Typ. +3 σ.
(3) Typ.
(4) Typ. −3 σ.

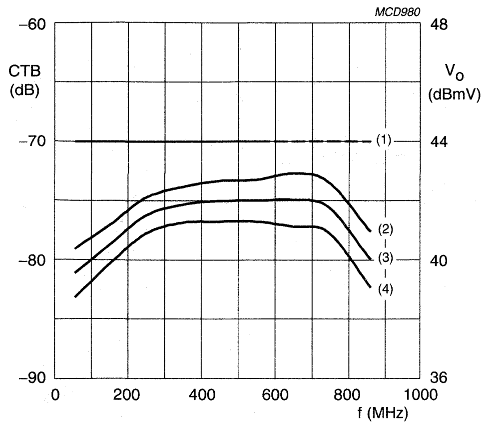
Fig.4 Composite second order distortion (sum) as a function of frequency under tilted conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 79 chs; tilt = 7.3 dB (50 to 550 MHz).

(1) V_o.
(2) Typ. +3 σ.
(3) Typ.
(4) Typ. −3 σ.

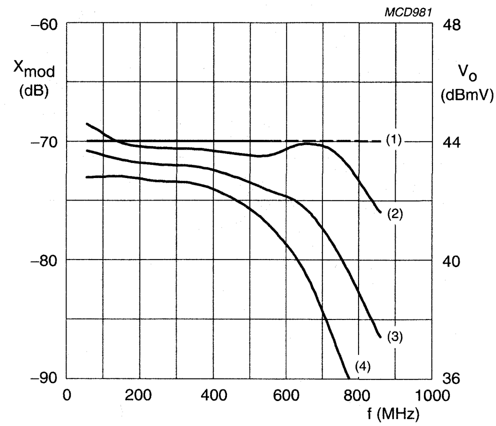
Fig.5 Composite second order distortion (diff) as a function of frequency under tilted conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 79 chs flat (50 to 550 MHz).

(1) V_o.
(2) Typ. +3 σ.
(3) Typ.
(4) Typ. −3 σ.

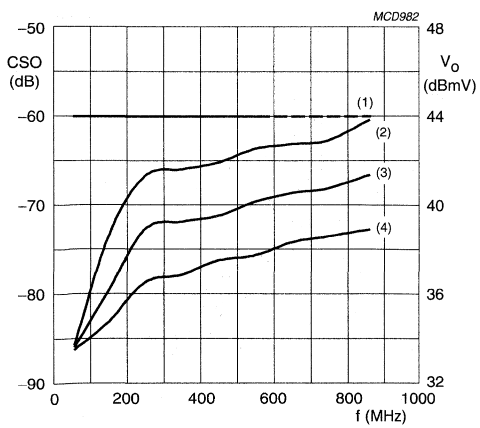
Fig.6 Composite triple beat as a function of frequency under flat conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 79 chs flat (50 to 550 MHz).

(1) V_o.
(2) Typ. +3 σ.
(3) Typ.
(4) Typ. −3 σ.

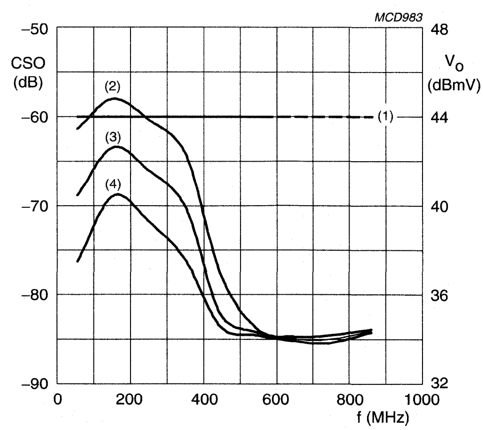
Fig.7 Cross modulation as a function of frequency under flat conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 79 chs flat (50 to 550 MHz).

(1) V_o.
(2) Typ. +3 σ.
(3) Typ.
(4) Typ. −3 σ.

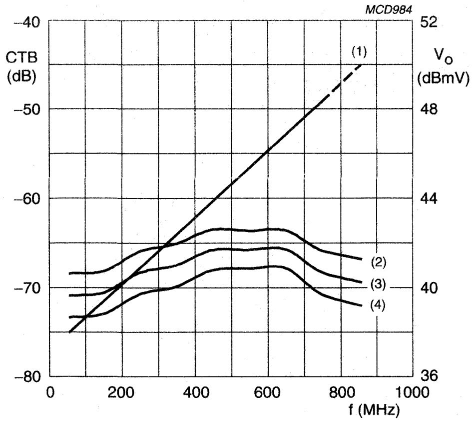
Fig.8 Composite second order distortion (sum) as a function of frequency under flat conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 79 chs flat (50 to 550 MHz).

(1) V_o.
(2) Typ. +3 σ.
(3) Typ.
(4) Typ. −3 σ.

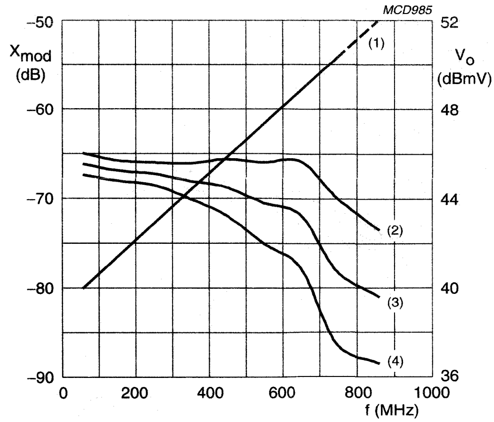
Fig.9 Composite second order distortion (diff) as a function of frequency under flat conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 112 chs; tilt = 10.2 dB (50 to 750 MHz).

(1) V_o.
(2) Typ. +3 σ.
(3) Typ.
(4) Typ. −3 σ.

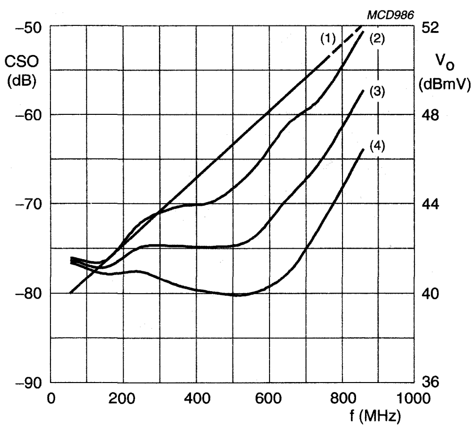
Fig.10 Composite triple beat as a function of frequency under tilted conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 112 chs; tilt = 10.2 dB (50 to 750 MHz).

(1) V_o.
(2) Typ. +3 σ.
(3) Typ.
(4) Typ. −3 σ.

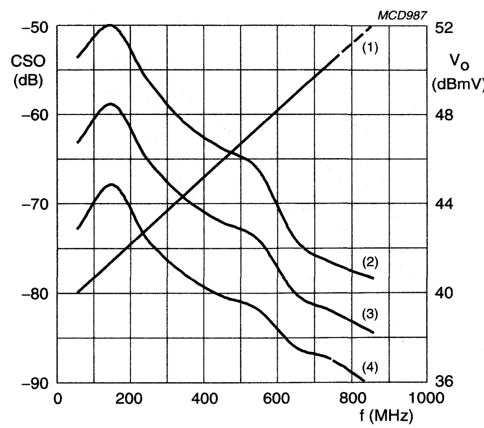
Fig.11 Cross modulation as a function of frequency under tilted conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 112 chs; tilt = 10.2 dB (50 to 750 MHz).

(1) V_o.
(2) Typ. +3 σ.
(3) Typ.
(4) Typ. −3 σ.

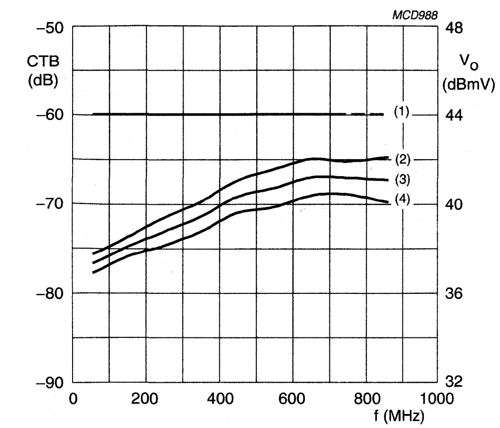
Fig.12 Composite second order distortion (sum) as a function of frequency under tilted conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 112 chs; tilt = 10.2 dB (50 to 750 MHz).

(1) V_o.
(2) Typ. +3 σ.
(3) Typ.
(4) Typ. −3 σ.

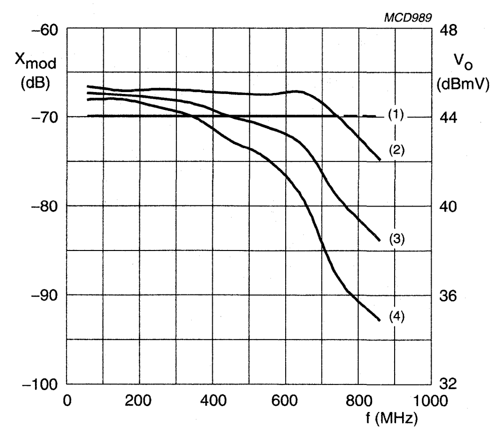
Fig.13 Composite second order distortion (diff) as a function of frequency under tilted conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 112 chs flat (50 to 750 MHz).

(1) V_o.
(2) Typ. +3 σ.
(3) Typ.
(4) Typ. −3 σ.

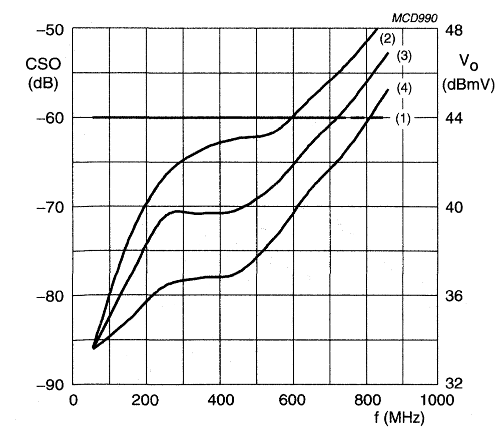
Fig.14 Composite triple beat as a function of frequency under flat conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 112 chs flat (50 to 750 MHz).

(1) V_o.
(2) Typ. +3 σ.
(3) Typ.
(4) Typ. −3 σ.

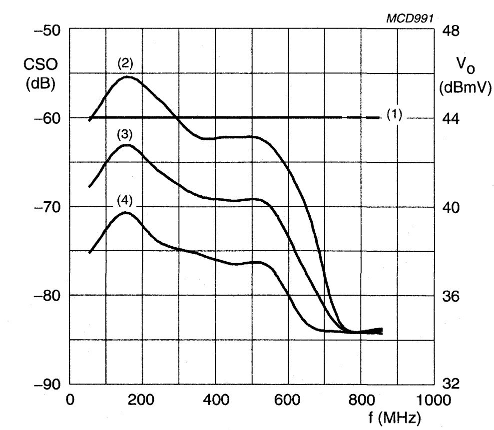
Fig.15 Cross modulation as a function of frequency under flat conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 112 chs flat (50 to 750 MHz).

(1) V_o.
(2) Typ. +3 σ.
(3) Typ.
(4) Typ. −3 σ.

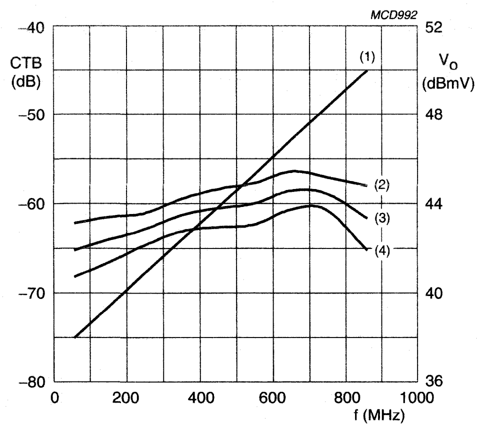
Fig.16 Composite second order distortion (sum) as a function of frequency under flat conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 112 chs; flat (50 to 750 MHz).

(1) V_o.
(2) Typ. +3 σ.
(3) Typ.
(4) Typ. −3 σ.

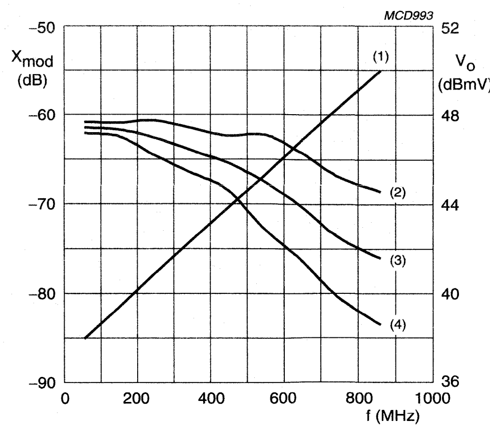
Fig.17 Composite second order distortion (diff) as a function of frequency under flat conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 132 chs; tilt = 12 dB (50 to 870 MHz).

(1) V_o.
(2) Typ. +3 σ.
(3) Typ.
(4) Typ. −3 σ.

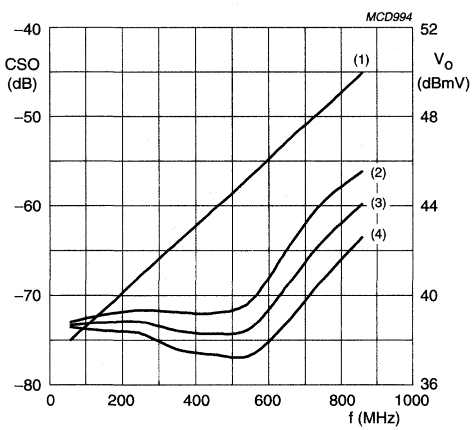
Fig.18 Composite triple beat as a function of frequency under tilted conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 132 chs; tilt = 12 dB (50 to 870 MHz).

(1) V_o.
(2) Typ. +3 σ.
(3) Typ.
(4) Typ. −3 σ.

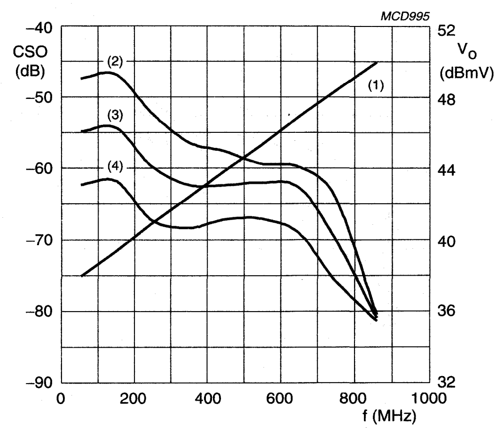
Fig.19 Cross modulation as a function of frequency under tilted conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 132 chs; tilt = 12 dB (50 to 870 MHz).

(1) V_o.
(2) Typ. +3 σ.
(3) Typ.
(4) Typ. −3 σ.

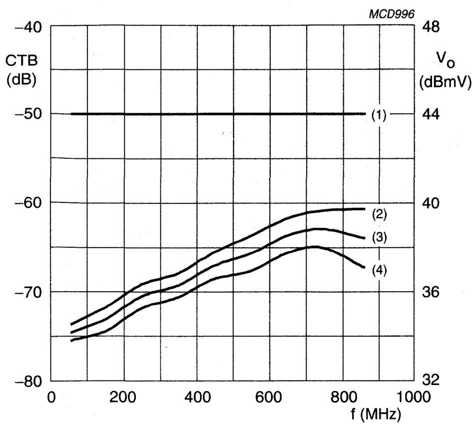
Fig.20 Composite second order distortion (sum) as a function of frequency under tilted conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 132 chs; tilt = 12 dB (50 to 870 MHz).

(1) V_o.
(2) Typ. +3 σ.
(3) Typ.
(4) Typ. −3 σ.

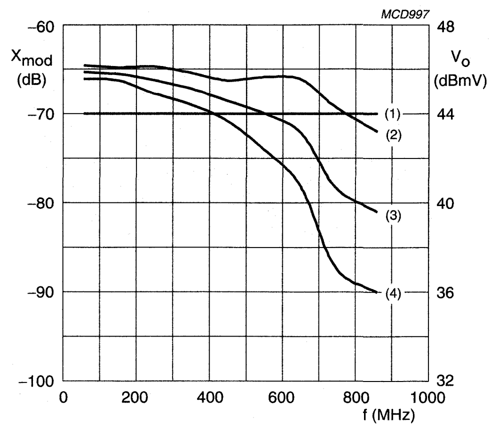
Fig.21 Composite second order distortion (diff) as a function of frequency under tilted conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 132 chs flat (50 to 870 MHz).

(1) V_o.
(2) Typ. +3 σ.
(3) Typ.
(4) Typ. −3 σ.

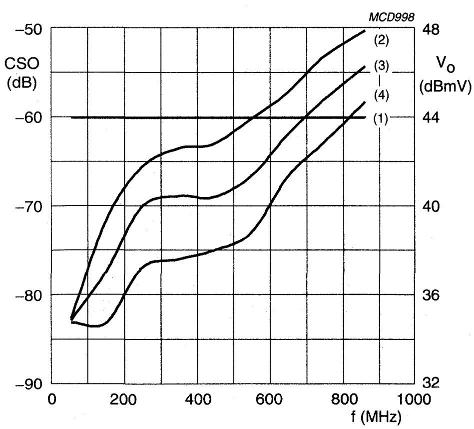
Fig.22 Composite triple beat as a function of frequency under flat conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 132 chs flat (50 to 870 MHz).

(1) V_o.
(2) Typ. +3 σ.
(3) Typ.
(4) Typ. −3 σ.

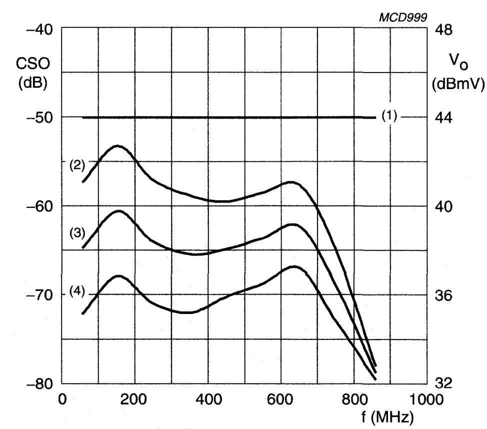
Fig.23 Cross modulation as a function of frequency under flat conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 132 chs flat (50 to 870 MHz).

(1) V_o.
(2) Typ. +3 σ.
(3) Typ.
(4) Typ. −3 σ.

Fig.24 Composite second order distortion (sum) as a function of frequency under flat conditions.



$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 132 chs flat (50 to 870 MHz).

(1) V_o.
(2) Typ. +3 σ.
(3) Typ.
(4) Typ. −3 σ.

Fig.25 Composite second order distortion (diff) as a function of frequency under flat conditions.

FEATURES

- High gain
- Superior linearity
- Extremely low noise
- Rugged construction
- Gold metallization ensures excellent reliability.

APPLICATIONS

- CATV systems operating in the 40 to 870 MHz frequency range.

DESCRIPTION

Hybrid dynamic range amplifier module in a SOT115J package operating with a voltage supply of 24 V (DC), employing both GaAs and Si dies.

PINNING - SOT115J

PIN	DESCRIPTION
1	input
2	common
3	common
5	$+V_B$
7	common
8	common
9	output

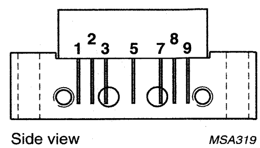


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	25.2	25.8	dB
		f = 870 MHz	25.6	26.6	dB
I_{tot}	total current consumption (DC)	V_B = 24 V	–	240	mA

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 60134).

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_i	RF input voltage	–	75	dBmV
T_{stg}	storage temperature	–40	+100	°C
T_{mb}	operating mounting base temperature	–20	+100	°C

CHARACTERISTICS

Bandwidth 40 to 870 MHz; V_B = 24 V; T_{case} = 30 °C; Z_S = Z_L = 75 Ω.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	f = 50 MHz	25.2	25.8	dB
		f = 870 MHz	25.6	26.6	dB
SL	straight line	f = 40 to 870 MHz	0.2	1	dB
FL	flatness of frequency response	f = 40 to 870 MHz	–	±0.5	dB
S_{11}	input return losses	f = 40 to 80 MHz	20	–	dB
		f = 80 to 160 MHz	20	–	dB
		f = 160 to 320 MHz	20	–	dB
		f = 320 to 550 MHz	20	–	dB
		f = 550 to 640 MHz	19	–	dB
		f = 640 to 750 MHz	17	–	dB
		f = 750 to 870 MHz	17	–	dB
S_{22}	output return losses	f = 40 to 80 MHz	21	–	dB
		f = 80 to 160 MHz	19	–	dB
		f = 160 to 320 MHz	17	–	dB
		f = 320 to 550 MHz	16	–	dB
		f = 550 to 640 MHz	16	–	dB
		f = 640 to 750 MHz	16	–	dB
		f = 750 to 870 MHz	16	–	dB
S_{21}	phase response	f = 50 MHz	–45	+45	deg
CTB	composite triple beat	129 channels flat; V_o = 40 dBmV; measured at 745.25 MHz	–	–62	dB
X_{mod}	cross modulation	129 channels flat; V_o = 40 dBmV; measured at 55.25 MHz	–	–55	dB
CSO	composite second order distortion	129 channels flat; V_o = 40 dBmV; measured at 860.5 MHz	–	–57	dB
d_2	second order distortion	note 1	–	–67	dB
V_o	output voltage	d_{im} = –60 dB; note 2	62	–	dBmV
F	noise figure	f = 50 MHz	–	5.5	dB
		f = 100 to 870MHz	–	5	dB
I_{tot}	total current consumption (DC)	note 3	–	240	mA

Notes

1. f_p = 55.25 MHz; V_p = 50 dBmV;
   f_q = 805.25 MHz; V_q = 50 dBmV;
   measured at $f_p + f_q$ = 860.5 MHz.
2. Measured according DIN45004B:
   f_p = 851.25 MHz; $V_p = V_o$;
   f_q = 858.25 MHz; $V_q = V_o$ –6 dB;
   f_r = 860.25 MHz; $V_r = V_o$ –6 dB;
   measured at $f_p + f_q - f_r$ = 849.25 MHz.
3. The module normally operates at V_B = 24 V, but is able to withstand supply transients up to 30 V.

PACKAGE INFORMATION

MOUNTING AND SOLDERING RECOMMENDATIONS

Mounting

The heatsink surface must be flat, free of burrs and oxidation and be parallel to the mounting surface.

The heatsink, mounting base and ground leads should be properly RF-grounded.

Heatsink compound should be applied sparingly and evenly on the mounting base. Suitable heatsink compounds are Dow Corning 340, Eccotherm TC-5 (E&C) and Wakefield 120.

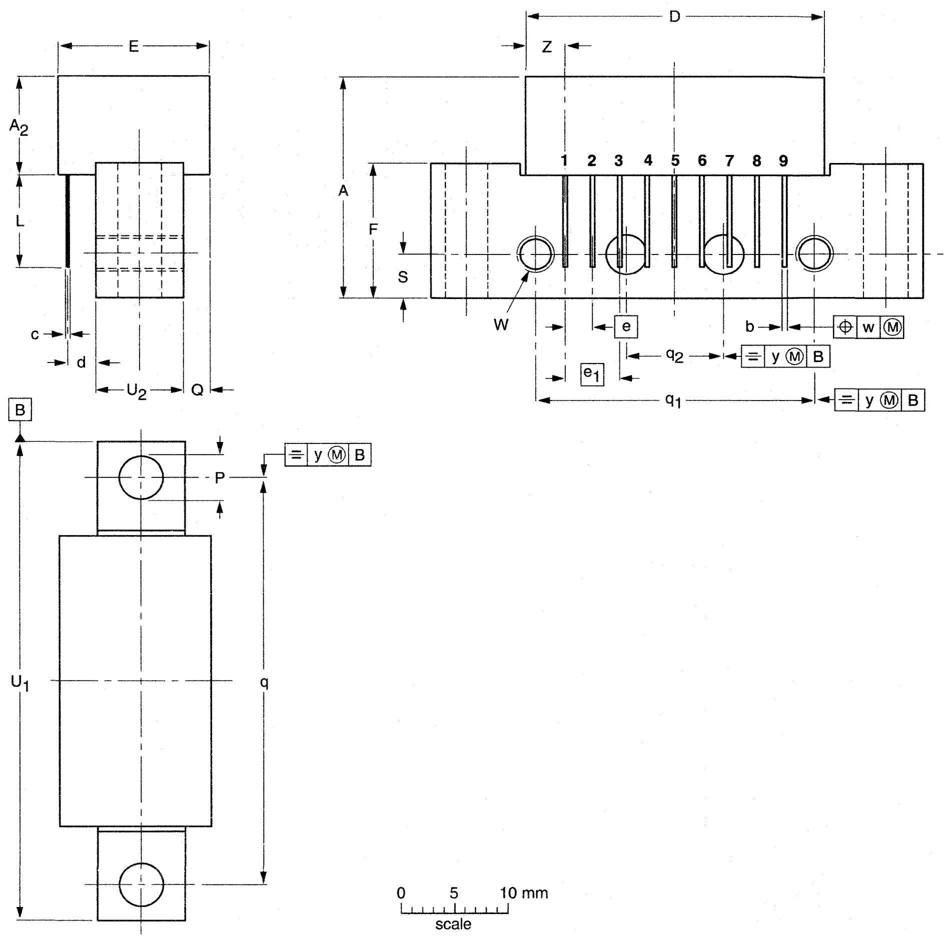
When mounting CATV hybrid modules, the UNC screws must first be turned finger-tight. The screws should then be tightened to within the tolerance 0.5 Nm minimum and 0.7 Nm maximum.

Soldering

Modules may be soldered directly into a circuit using a soldering iron with a maximum temperature of 260 °C for not more than 3 seconds when the soldered joints are a minimum of 3 mm from the module.

PACKAGE OUTLINES

Rectangular single-ended package; aluminium flange; 2 vertical mounting holes; 2 x 6-32 UNC and 2 extra horizontal mounting holes; 9 gold-plated in-line leads **SOT115D**

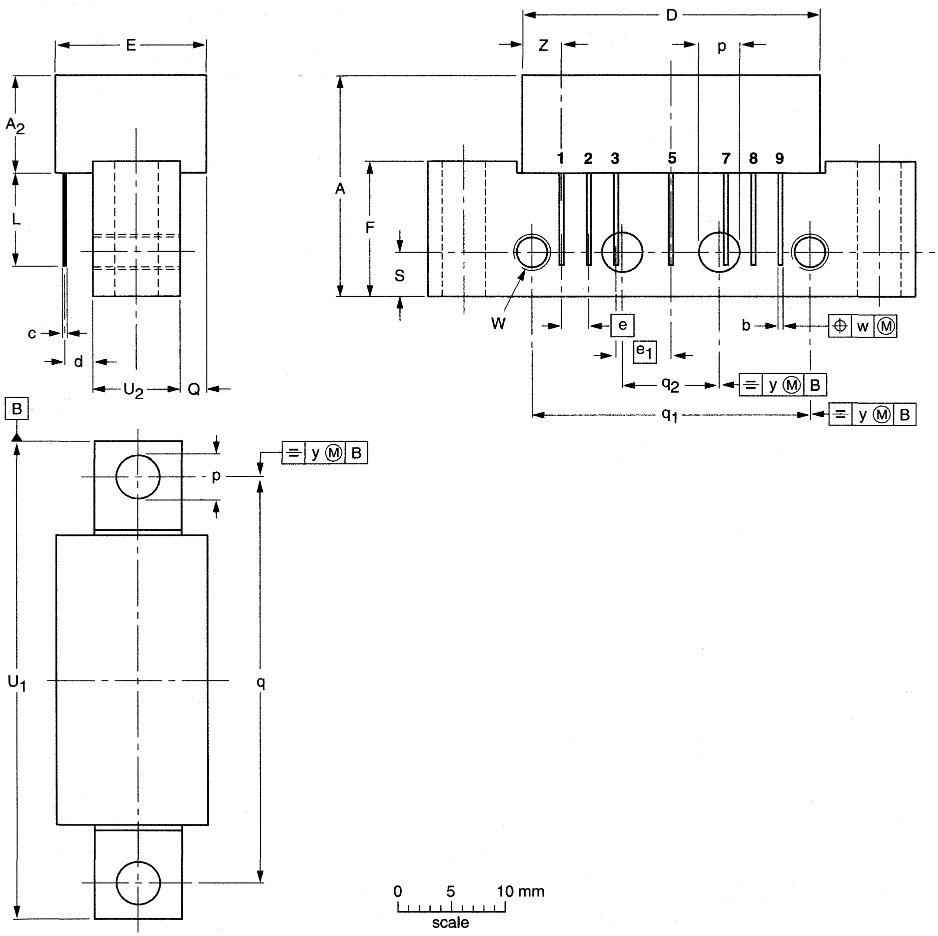


DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A_2 max.	b	c	D max.	d max.	E max.	e	e_1	F	L min.	∅P	Q max.	q	q_1	q_2	S	U_1 max.	U_2	W	w	y	Z max.
mm	20.8	9.1	0.51 0.38	0.25	27.2	2.54	13.75	2.54	5.08	12.7	8.8	4.15 3.85	2.4	38.1	25.4	10.2	4.2	44.75	8	6-32 UNC	0.25	0.1	3.8

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT115D						97-04-10

Rectangular single-ended package; aluminium flange; 2 vertical mounting holes; 2 x 6-32 UNC and 2 extra horizontal mounting holes; 7 gold-plated in-line leads **SOT115J**

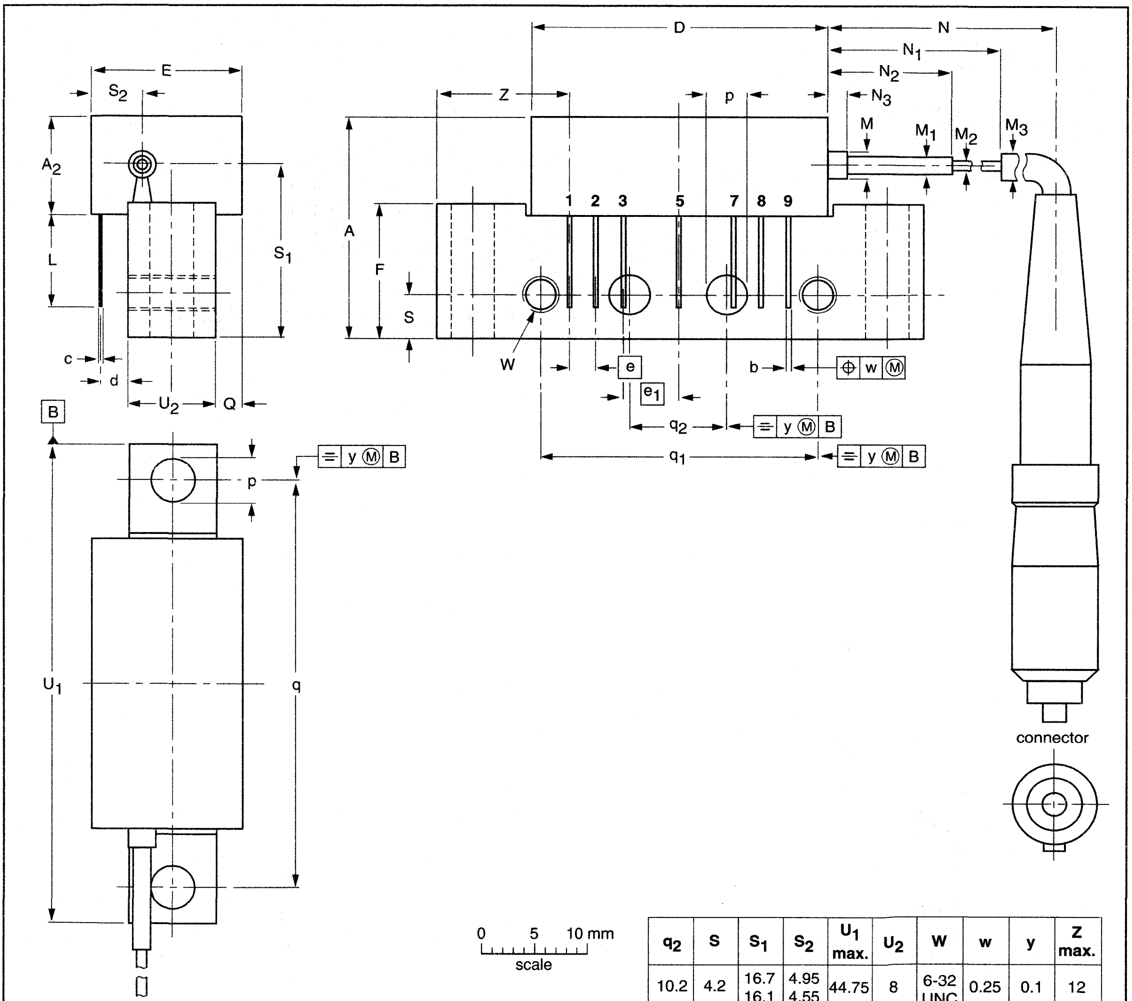


DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A2 max.	b	c	D max.	d max.	E max.	e	e1	F	L min.	p	Q max.	q	q1	q2	S	U1 max.	U2	W	w	y	Z max.
mm	20.8	9.1	0.51 0.38	0.25	27.2	2.54	13.75	2.54	5.08	12.7	8.8	4.15 3.85	2.4	38.1	25.4	10.2	4.2	44.75	8	6-32 UNC	0.25	0.1	3.8

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT115J						99-02-06

Rectangular single-ended package; aluminium flange;
2 vertical mounting holes; 2 x 6-32 UNC and 2 extra horizontal mounting holes;
optical input with connector; 7 gold-plated in-line leads **SOT115N**



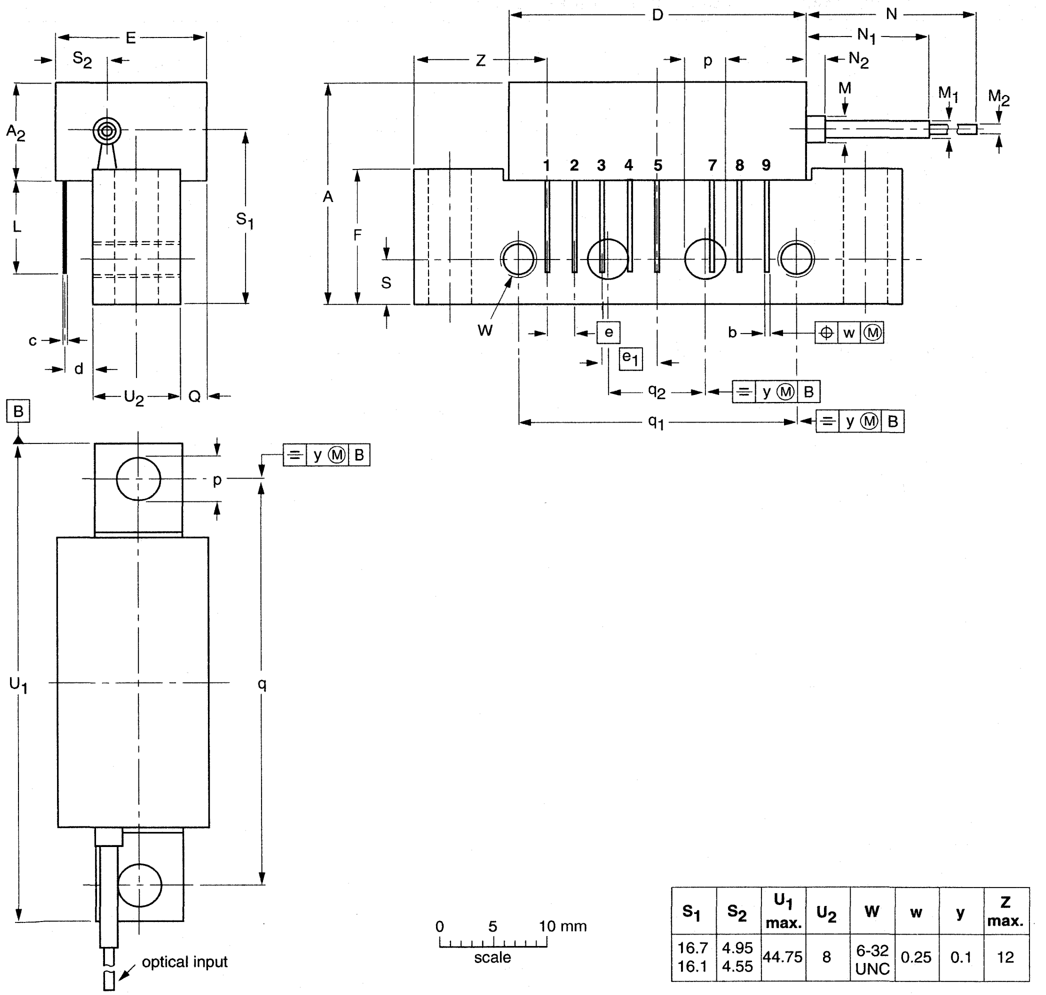
q_2	S	S_1	S_2	U_1 max.	U_2	W	w	y	Z max.
10.2	4.2	16.7 16.1	4.95 4.55	44.75	8	6-32 UNC	0.25	0.1	12

DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A_2 max.	b	c	D max.	d max.	E max.	e	e_1	F	L min.	M	M_1	M_2	M_3	N	N_1	N_2	N_3	p	Q max.	q	q_1
mm	20.8	9.1	0.51 0.38	0.25	27.2	2.54	13.75	2.54	5.08	12.7	8.8	2.5	1.6	0.9	3	627 577	127 77	10.7 8.7	5 1	4.15 3.85	2.4	38.1	25.4

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT115N						99-04-28

Rectangular single-ended package; aluminium flange; 2 vertical mounting holes; 2 x 6-32 UNC and 2 extra horizontal mounting holes; optical input; 8 gold-plated in-line leads **SOT115T**



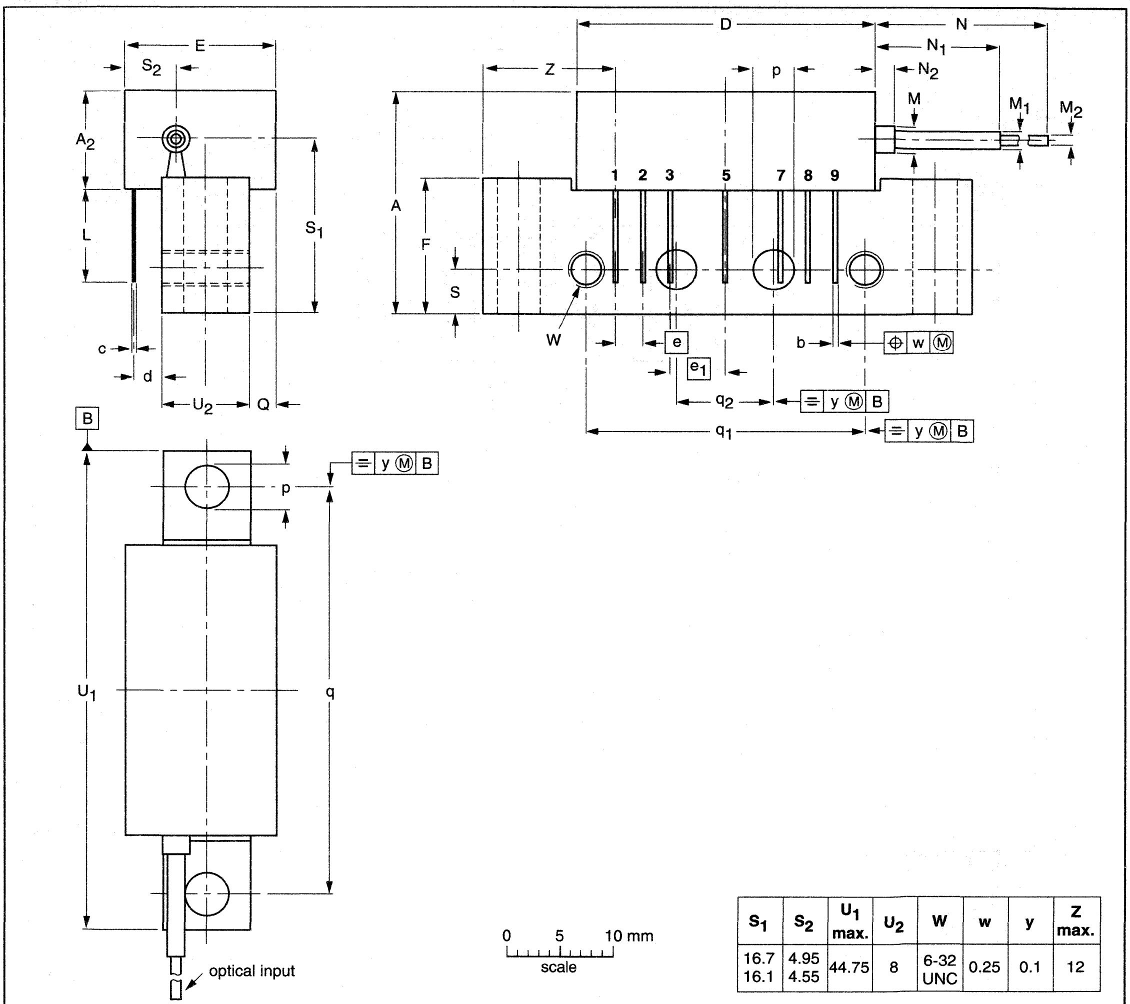
S_1	S_2	U_1 max.	U_2	W	w	y	Z max.
16.7 16.1	4.95 4.55	44.75	8	6-32 UNC	0.25	0.1	12

DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A_2 max.	b	c	D max.	d max.	E max.	e	e_1	F	L min.	M	M_1	M_2	N min.	N_1	N_2	p	Q max.	q	q_1	q_2	S
mm	20.8	9.1	0.51 0.38	0.25	27.2	2.54	13.75	2.54	5.08	12.7	8.8	2.5	1.6	0.9	1000	10.7 8.7	5 1	4.15 3.85	2.4	38.1	25.4	10.2	4.2

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT115T						99-04-13

Rectangular single-ended package; aluminium flange; 2 vertical mounting holes; 2 x 6-32 UNC and 2 extra horizontal mounting holes; optical input; 7 gold-plated in-line leads **SOT115U**



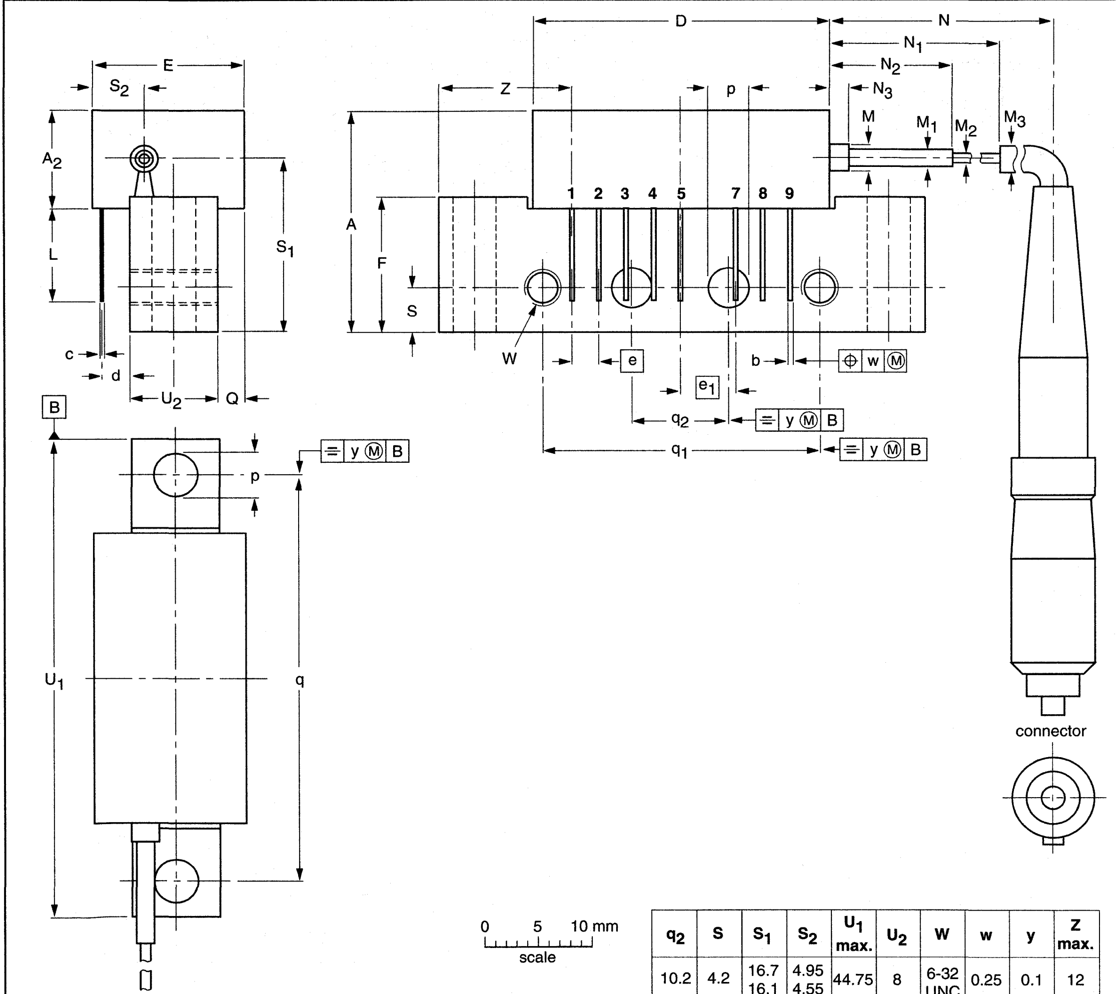
S_1	S_2	U_1 max.	U_2	W	w	y	Z max.
16.7 16.1	4.95 4.55	44.75	8	6-32 UNC	0.25	0.1	12

DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A_2 max.	b	c	D max.	d max.	E max.	e	e_1	F	L min.	M	M_1	M_2	N min.	N_1	N_2	p	Q max.	q	q_1	q_2	S
mm	20.8	9.1	0.51 0.38	0.25	27.2	2.54	13.75	2.54	5.08	12.7	8.8	2.5	1.6	0.9	1000	10.7 8.7	5 1	4.15 3.85	2.4	38.1	25.4	10.2	4.2

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT115U						99-04-13

Rectangular single-ended package; aluminium flange;
2 vertical mounting holes; 2 x 6-32 UNC and 2 extra horizontal mounting holes;
optical input with connector; 8 gold-plated in-line leads **SOT115W**



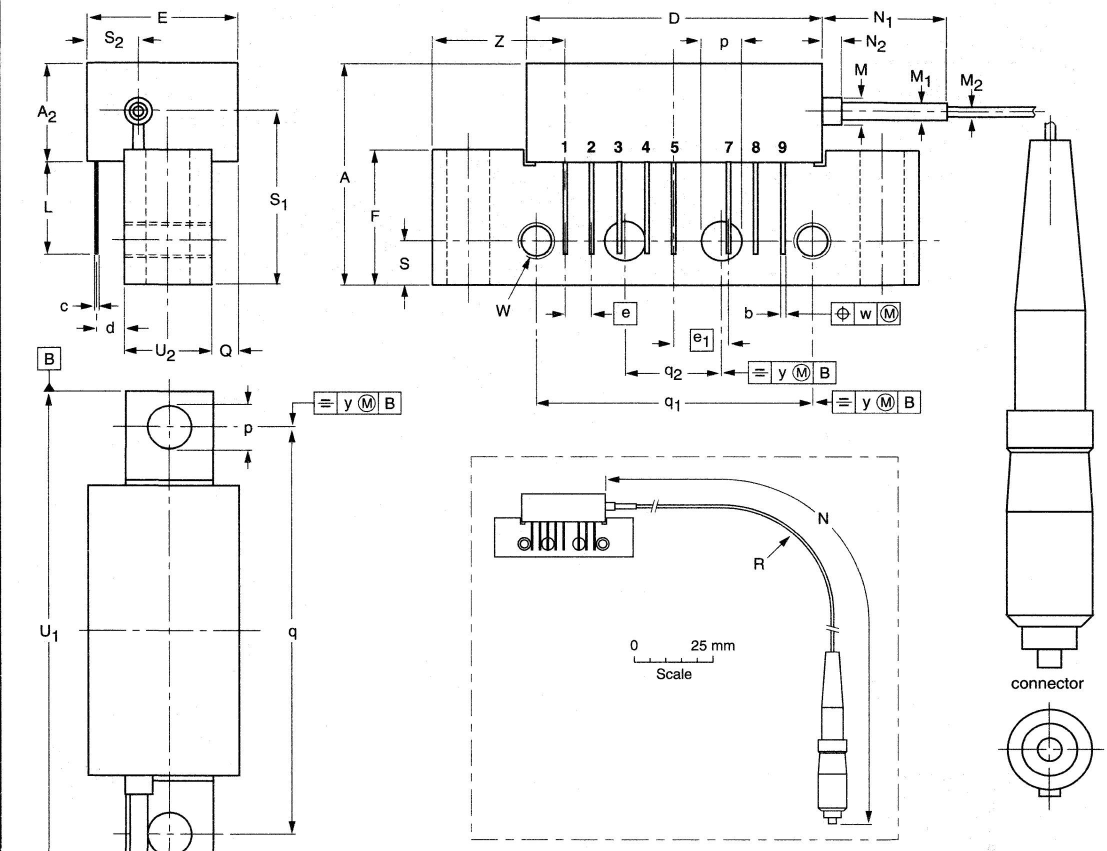
q_2	S	S_1	S_2	U_1 max.	U_2	W	w	y	Z max.
10.2	4.2	16.7 16.1	4.95 4.55	44.75	8	6-32 UNC	0.25	0.1	12

DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A_2 max.	b	c	D max.	d max.	E max.	e	e_1	F	L min.	M	M_1	M_2	M_3	N	N_1	N_2	N_3	p	Q max.	q	q_1
mm	20.8	9.1	0.51 0.38	0.25	27.2	2.54	13.75	2.54	5.08	12.7	8.8	2.5	1.6	0.9	3	627 577	127 77	10.7 8.7	5 1	4.15 3.85	2.4	38.1	25.4

OUTLINE VERSION	REFERENCES: IEC	REFERENCES: JEDEC	REFERENCES: EIAJ		EUROPEAN PROJECTION	ISSUE DATE
SOT115W						99-04-13

Rectangular single-ended package; aluminium flange;
2 vertical mounting holes; 2 x 6-32 UNC and 2 extra horizontal mounting holes;
optical input with connector; 8 gold-plated in-line leads **SOT115X**



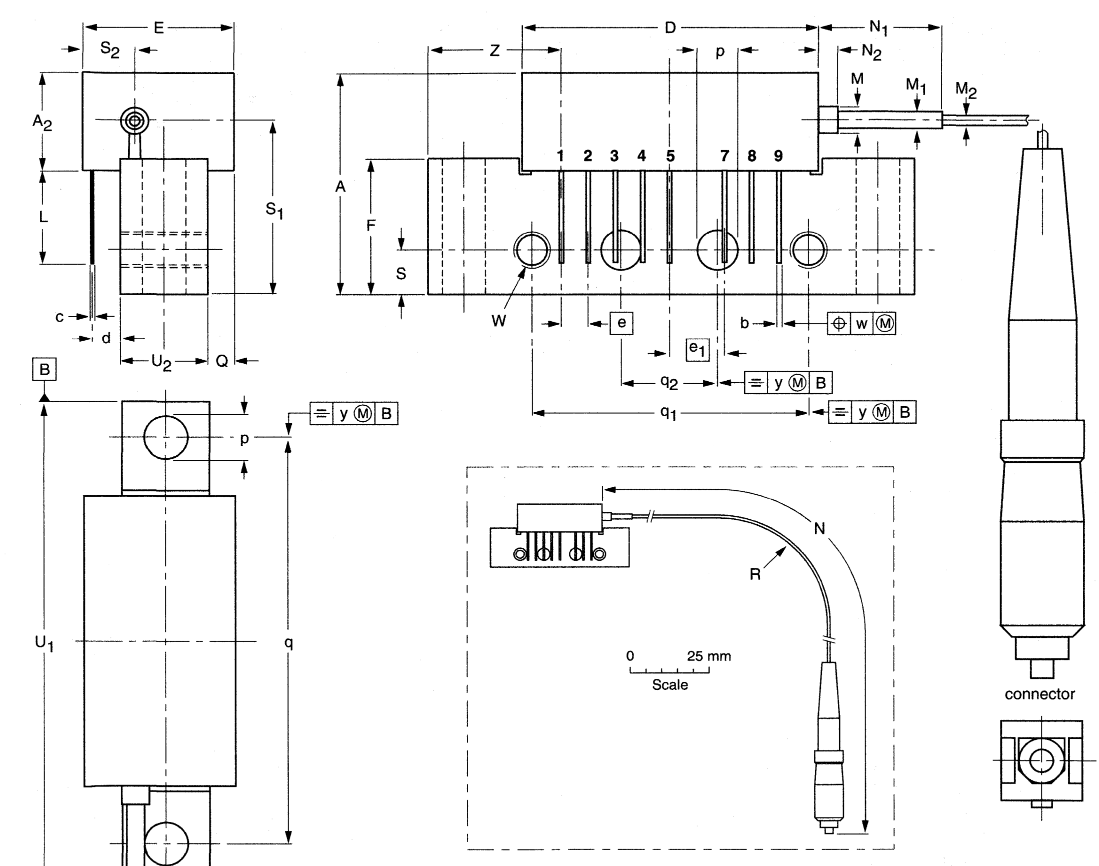
S	S_1	S_2	U_1 max.	U_2	W	w	y	Z max.
4.2	16.7 16.1	4.95 4.55	44.75	8	6-32 UNC	0.25	0.1	12

DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A_2 max.	b	c	D max.	d max.	E max.	e	e_1	F	L min.	M	M_1	M_2	N	N_1	N_2	p	Q max.	q	q_1	q_2	R min.
mm	20.8	9.1	0.51 0.38	0.25	27.2	2.54	13.75	2.54	5.08	12.7	8.8	2.5	1.6	0.9	861 746	10.7 8.7	5 1	4.15 3.85	2.4	38.1	25.4	10.2	35

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT115X						~~99-06-03~~ 00-01-06

Rectangular single-ended package; aluminium flange;
2 vertical mounting holes; 2 x 6-32 UNC and 2 extra horizontal mounting holes;
optical input with connector; 8 gold-plated in-line leads **SOT115Y**



S	S_1	S_2	U_1 max.	U_2	W	w	y	Z max.
4.2	16.7 16.1	4.95 4.55	44.75	8	6-32 UNC	0.25	0.1	12

DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A_2 max.	b	c	D max.	d max.	E max.	e	e_1	F	L min.	M	M_1	M_2	N	N_1	N_2	p	Q max.	q	q_1	q_2	R min.
mm	20.8	9.1	0.51 0.38	0.25	27.2	2.54	13.75	2.54	5.08	12.7	8.8	2.5	1.6	0.9	861 746	10.7 8.7	5 1	4.15 3.85	2.4	38.1	25.4	10.2	35

OUTLINE VERSION	REFERENCES: IEC	REFERENCES: JEDEC	REFERENCES: EIAJ		EUROPEAN PROJECTION	ISSUE DATE
SOT115Y						~~99-06-03~~ 00-01-06

STANDARD CATV TEST FIXTURE

PARAMETER	CONDITIONS	VALUE
Frequency		5 to 1000 MHz
Suitability	suitable for devices with switchable positive and negative power supplies	
Impedance		75 Ω
Return loss	measured with thru-line system; other port terminated with 75 Ω	
<600 MHz		<−40 dB
<860 MHz		<−32 dB
<1000 MHz		<−28 dB
Cross talk		<−80 dB
Insertion loss	measured with thru-line system	<0.1 dB
DC current		<1 A
DC voltage	automatically switched to the device by means of a microswitch after closing the pressing system	<50 V
Operating temperature		−25 to +75 °C
RF connectors		N-type female; 75 Ω
DC connectors		banana type
Dimensions	length × breadth × height; note 1	110 × 60 × 55 mm
Cooling		water cooling connections available on test fixture
Ordering	order the CATV test fixture via your regional sales office. Type number: ON5045/test jig 12NC: 9340 554 04114	

Note

1. Dimensions without pressing system, RF connectors and cooling connections. Distance between the centre contact of the RF connectors is 35.2 mm.

DATA HANDBOOK SYSTEM

DATA HANDBOOK SYSTEM

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Integrated circuits

Book	*Title*
IC03	Semiconductors for Wired Telecom Systems
IC04	HE4000B Logic Family CMOS
IC05	Advanced Low-power Schottky (ALS) Logic
IC06	High-speed CMOS Logic Family
IC11	General-purpose/Linear ICs
IC12	I^2C Peripherals
IC14	8048-based 8-bit Microcontrollers
IC15	FAST TTL Logic Series
IC16	CMOS ICs for Clocks, Watches and Real Time Clocks
IC17	Semiconductors for Wireless Communications
IC19	ICs for Data Communications
IC23	BiCMOS Bus Interface Logic
IC24	Low Voltage CMOS & BiCMOS Logic
IC26	Integrated Circuit Packages
IC28	80C51 and XA Microcontrollers

Discrete semiconductors

Book	*Title*
SC03	Power Thyristors and Triacs
SC06	Power Bipolar Transistors
SC07	Small-signal Field-effect Transistors and Diodes
SC10	Small-signal Transistors and Diodes
SC11	Power Diodes
SC13	PowerMOS Transistors
SC14	RF Wideband Transistors
SC16	Wideband Hybrid Amplifier Modules for CATV
SC17	Semiconductor Sensors
SC18	Discrete Semiconductor Packages
SC19	RF & Microwave Power Transistors and RF Power Modules

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Data handbook system

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Display Components

Book	*Title*
DC01	Colour Television and Multimedia Tubes
DC02	Monochrome Monitor Tubes and Deflection Units
DC03	Television Tuners, Coaxial Aerial Input Assemblies
DC04	Colour Monitor and Multimedia Tubes
DC05	Wire Wound Components

Advanced Ceramics & Modules

ACM1 (MA01)	Soft Ferrites
ACM2	Discrete Ceramics
ACM3 (MA03)	Piezoelectric Ceramics and Specialty Ferrites

BC Components

BC01	Electrolytic Capacitors
BC02	Varistors, Thermistors and Sensors
BC03	Potentiometers
PA04	Variable Capacitors
PA05	Film Capacitors
BC06	Leaded Ceramic Capacitors
PA06a	Surface Mounted Ceramic Multilayer Capacitors
PA06b	Leaded Ceramic Capacitors
PA08	Fixed Resistors
PA10	Quartz Crystals
PA11	Quartz Oscillators

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