



# CGD987HC

1 GHz, 27 dB gain GaAs high output power doubler

Rev. 1 — 26 May 2014

Product data sheet

## 1. Product profile

### 1.1 General description

Hybrid amplifier module in a SOT115J package, operating at a supply voltage of 24 V Direct Current (DC), employing Hetero junction Field Effect Transistor (HFET) GaAs dies.

### 1.2 Features and benefits

- Excellent linearity
- Optimized for flat PAL D and flat NTSC loading
- Extremely low noise
- Excellent return loss properties
- Gain compensation over temperature
- Rugged construction
- Unconditionally stable
- Thermally optimized design
- Compliant to Directive 2002/95/EC, regarding Restriction of Hazardous Substances (RoHS)

### 1.3 Applications

- CATV systems operating in the 40 MHz to 862 MHz / 1003 MHz frequency range using PAL D or NTSC channel conditions.

### 1.4 Quick reference data

**Table 1. Quick reference data**

Bandwidth 40 MHz to 1003 MHz;  $V_B = 24$  V (DC);  $Z_S = Z_L = 75 \Omega$ ;  $T_{mb} = 35$  °C; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$G_p$	power gain	$f = 50$ MHz	-	25.5	-	dB
		$f = 1003$ MHz	26	27	28	dB
CTB	composite triple beat	$V_o = 48$ dBmV at 862 MHz <a href="#">[1]</a>	-	-66	-62	dBc
CSO	composite second-order distortion	$V_o = 48$ dBmV at 862 MHz <a href="#">[1]</a>	-	-66	-60	dBc
$I_{tot}$	total current	<a href="#">[2]</a>	-	440	460	mA

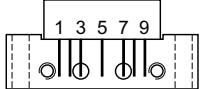
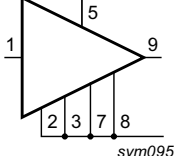
[1] 98 PAL D channels with 8 MHz bandwidth per channel; [ $f = 47$  MHz to 862 MHz]; flat  $V_o$  till 862 MHz.

[2] Direct Current (DC).



## 2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Graphic symbol
1	input		
2, 3	common		
5	+V <sub>B</sub>		
7, 8	common		
9	output		

## 3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
CGD987HC	-	rectangular single-ended package; aluminium flange; 2 vertical mounting holes; 2 × 6-32 UNC and 2 extra horizontal mounting holes; 7 gold-plated in-line leads	SOT115J

## 4. Limiting values

Table 4. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
V <sub>B</sub>	supply voltage		-	30	V
V <sub>i(RF)</sub>	RF input voltage	single tone	-	75	dBmV
T <sub>stg</sub>	storage temperature		-40	+100	°C
T <sub>mb</sub>	mounting base temperature		-20	+100	°C

## 5. Characteristics

Table 5. Characteristics

Bandwidth 40 MHz to 1003 MHz; V<sub>B</sub> = 24 V (DC); Z<sub>S</sub> = Z<sub>L</sub> = 75 Ω; T<sub>mb</sub> = 35 °C; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
G <sub>p</sub>	power gain	f = 50 MHz	-	25.5	-	dB
		f = 870 MHz	-	26.5	-	dB
		f = 1003 MHz	26	27	28	dB
SL <sub>sl</sub>	slope straight line	f = 40 MHz to 1003 MHz	[1] 0.7	-	2.2	dB
FL	flatness of frequency response	f = 40 MHz to 1003 MHz	[2] -	-	1	dB

**Table 5. Characteristics ...continued**

Bandwidth 40 MHz to 1003 MHz;  $V_B = 24$  V (DC);  $Z_S = Z_L = 75 \Omega$ ;  $T_{mb} = 35$  °C; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
RL <sub>in</sub>	input return loss	f = 40 MHz to 160 MHz	20	-	-	dB
		f = 160 MHz to 320 MHz	19	-	-	dB
		f = 320 MHz to 640 MHz	18	-	-	dB
		f = 640 MHz to 870 MHz	17	-	-	dB
		f = 870 MHz to 1003 MHz	16	-	-	dB
RL <sub>out</sub>	output return loss	f = 40 MHz to 160 MHz	20	-	-	dB
		f = 160 MHz to 320 MHz	18	-	-	dB
		f = 320 MHz to 640 MHz	17	-	-	dB
		f = 640 MHz to 870 MHz	16	-	-	dB
		f = 870 MHz to 1003 MHz	16	-	-	dB
NF	noise figure	f = 50 MHz	-	4.5	5.5	dB
		f = 1003 MHz	-	5	6	dB
I <sub>tot</sub>	total current	[3]	-	440	460	mA

- [1] G<sub>p</sub> at 1003 MHz minus G<sub>p</sub> at 40 MHz.
- [2] Flatness is defined as peak deviation to straight line.
- [3] Direct Current (DC).

**Table 6. Distortion characteristics**

Bandwidth 40 MHz to 1003 MHz;  $V_B = 24$  V (DC);  $Z_S = Z_L = 75 \Omega$ ;  $T_{mb} = 35$  °C; unless otherwise specified.

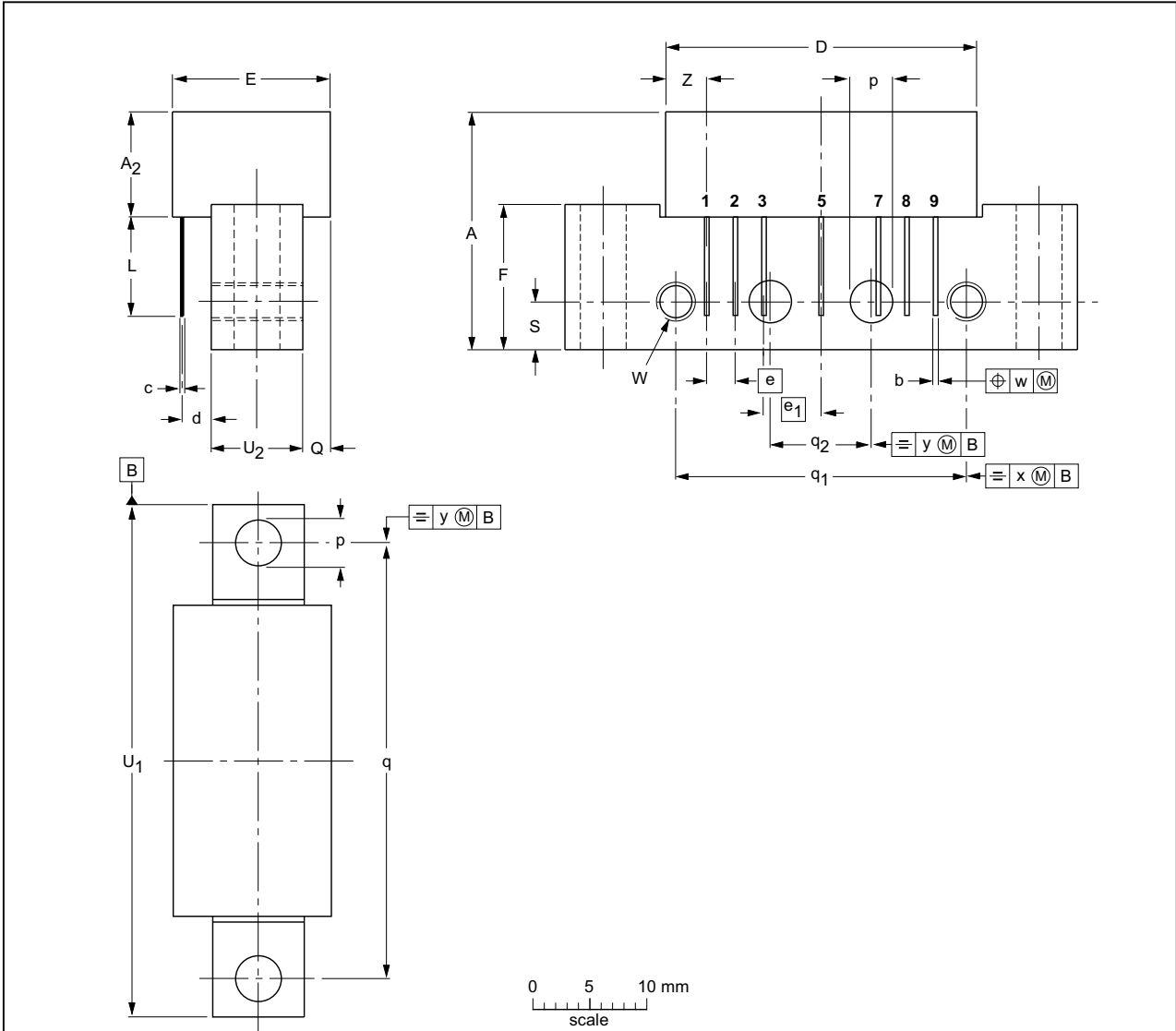
Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
<b>98 PAL D channels</b>							
CTB	composite triple beat	V <sub>o</sub> = 48 dBmV at 862 MHz	[1]	-	-66	-62	dBc
		V <sub>o</sub> = 50 dBmV at 862 MHz	[1]	-	-62	-	dBc
CSO	composite second-order distortion	V <sub>o</sub> = 48 dBmV at 862 MHz	[1]	-	-66	-60	dBc
		V <sub>o</sub> = 50 dBmV at 862 MHz	[1]	-	-63	-	dBc
Xmod	cross modulation	V <sub>o</sub> = 48 dBmV at 862 MHz	[1]	-	-68	-	dB
		V <sub>o</sub> = 50 dBmV at 862 MHz	[1]	-	-60	-	dB
<b>112 NTSC channels</b>							
CTB	composite triple beat	V <sub>o</sub> = 48 dBmV at 750 MHz	[2]	-	-63	-	dBc
CSO	composite second-order distortion	V <sub>o</sub> = 48 dBmV at 750 MHz	[2]	-	-64	-	dBc
Xmod	cross modulation	V <sub>o</sub> = 48 dBmV at 750 MHz	[2]	-	-66	-	dB
<b>79 NTSC channels + 75 digital channels</b>							
CTB	composite triple beat	V <sub>o</sub> = 56.4 dBmV at 1003 MHz	[3]	-	-75	-	dBc
CSO	composite second-order distortion	V <sub>o</sub> = 56.4 dBmV at 1003 MHz	[3]	-	-70	-	dBc
Xmod	cross modulation	V <sub>o</sub> = 56.4 dBmV at 1003 MHz	[3]	-	-68	-	dB
CCN	carrier-to-composite noise	V <sub>o</sub> = 56.4 dBmV at 1003 MHz	[3]	-	57	-	dBc

- [1] 98 PAL D channels with 8 MHz bandwidth per channel; [f = 47 MHz to 862 MHz]; flat V<sub>o</sub> till 862 MHz.
- [2] 112 NTSC channels; [f = 45 MHz to 750 MHz]; flat V<sub>o</sub> till 750 MHz.
- [3] 79 NTSC channels [f = 54 MHz to 550 MHz] + 75 digital channels [f = 550 MHz to 1003 MHz] (-6 dB offset); tilt extrapolated to 13.5 dB at 1003 MHz.

6. Package outline

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.	A <sub>2</sub> max.	b	c	D max.	d	E max.	e	e <sub>1</sub>	F	L min.	p	Q max.	q	q <sub>1</sub>	q <sub>2</sub>	S	U <sub>1</sub>	U <sub>2</sub>	W	w	x	y	Z max.
mm	20.8	9.5	0.51 0.38	0.25	27.2	2.04 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 44.25	8.2 7.8	6-32 UNC	0.25	0.7	0.1	3.8

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT115J						04-02-04 10-06-18

Fig 1. Package outline SOT115J

## 7. Abbreviations

Table 7. Abbreviations

Acronym	Description
CATV	Community Antenna TeleVision
GaAs	Gallium-Arsenide
NTSC	National Television Standard Committee
PAL	Phase Alternate Line
UNC	UNified Coarse

## 8. Revision history

Table 8. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
CGD987HC v.1	20140526	Product data sheet	-	-

## 9. Legal information

### 9.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nxp.com>.

### 9.2 Definitions

**Draft** — The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. NXP Semiconductors does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

**Short data sheet** — A short data sheet is an extract from a full data sheet with the same product type number(s) and title. A short data sheet is intended for quick reference only and should not be relied upon to contain detailed and full information. For detailed and full information see the relevant full data sheet, which is available on request via the local NXP Semiconductors sales office. In case of any inconsistency or conflict with the short data sheet, the full data sheet shall prevail.

**Product specification** — The information and data provided in a Product data sheet shall define the specification of the product as agreed between NXP Semiconductors and its customer, unless NXP Semiconductors and customer have explicitly agreed otherwise in writing. In no event however, shall an agreement be valid in which the NXP Semiconductors product is deemed to offer functions and qualities beyond those described in the Product data sheet.

### 9.3 Disclaimers

**Limited warranty and liability** — Information in this document is believed to be accurate and reliable. However, NXP Semiconductors does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information. NXP Semiconductors takes no responsibility for the content in this document if provided by an information source outside of NXP Semiconductors.

In no event shall NXP Semiconductors be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory.

Notwithstanding any damages that customer might incur for any reason whatsoever, NXP Semiconductors' aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the *Terms and conditions of commercial sale* of NXP Semiconductors.

**Right to make changes** — NXP Semiconductors reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

**Suitability for use** — NXP Semiconductors products are not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or equipment, nor in applications where failure or malfunction of an NXP Semiconductors product can reasonably be expected to result in personal injury, death or severe property or environmental damage. NXP Semiconductors and its suppliers accept no liability for inclusion and/or use of NXP Semiconductors products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

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

Customers are responsible for the design and operation of their applications and products using NXP Semiconductors products, and NXP Semiconductors accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the NXP Semiconductors product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

NXP Semiconductors does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using NXP Semiconductors products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). NXP does not accept any liability in this respect.

**Limiting values** — Stress above one or more limiting values (as defined in the Absolute Maximum Ratings System of IEC 60134) will cause permanent damage to the device. Limiting values are stress ratings only and (proper) operation of the device at these or any other conditions above those given in the Recommended operating conditions section (if present) or the Characteristics sections of this document is not warranted. Constant or repeated exposure to limiting values will permanently and irreversibly affect the quality and reliability of the device.

**Terms and conditions of commercial sale** — NXP Semiconductors products are sold subject to the general terms and conditions of commercial sale, as published at <http://www.nxp.com/profile/terms>, unless otherwise agreed in a valid written individual agreement. In case an individual agreement is concluded only the terms and conditions of the respective agreement shall apply. NXP Semiconductors hereby expressly objects to applying the customer's general terms and conditions with regard to the purchase of NXP Semiconductors products by customer.

**No offer to sell or license** — Nothing in this document may be interpreted or construed as an offer to sell products that is open for acceptance or the grant, conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights.

**Export control** — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from competent authorities.

**Non-automotive qualified products** — Unless this data sheet expressly states that this specific NXP Semiconductors product is automotive qualified, the product is not suitable for automotive use. It is neither qualified nor tested in accordance with automotive testing or application requirements. NXP Semiconductors accepts no liability for inclusion and/or use of non-automotive qualified products in automotive equipment or applications.

In the event that customer uses the product for design-in and use in automotive applications to automotive specifications and standards, customer (a) shall use the product without NXP Semiconductors' warranty of the product for such automotive applications, use and specifications, and (b) whenever customer uses the product for automotive applications beyond NXP Semiconductors' specifications such use shall be solely at customer's own risk, and (c) customer fully indemnifies NXP Semiconductors for any

liability, damages or failed product claims resulting from customer design and use of the product for automotive applications beyond NXP Semiconductors' standard warranty and NXP Semiconductors' product specifications.

**Quick reference data** — The Quick reference data is an extract of the product data given in the Limiting values and Characteristics sections of this document, and as such is not complete, exhaustive or legally binding.

**Translations** — A non-English (translated) version of a document is for reference only. The English version shall prevail in case of any discrepancy between the translated and English versions.

## 9.4 Trademarks

Notice: All referenced brands, product names, service names and trademarks are the property of their respective owners.

## 10. Contact information

For more information, please visit: <http://www.nxp.com>

For sales office addresses, please send an email to: [salesaddresses@nxp.com](mailto:salesaddresses@nxp.com)

## 11. Contents

<b>1</b>	<b>Product profile</b> . . . . .	<b>1</b>
1.1	General description . . . . .	1
1.2	Features and benefits . . . . .	1
1.3	Applications . . . . .	1
1.4	Quick reference data . . . . .	1
<b>2</b>	<b>Pinning information</b> . . . . .	<b>2</b>
<b>3</b>	<b>Ordering information</b> . . . . .	<b>2</b>
<b>4</b>	<b>Limiting values</b> . . . . .	<b>2</b>
<b>5</b>	<b>Characteristics</b> . . . . .	<b>2</b>
<b>6</b>	<b>Package outline</b> . . . . .	<b>4</b>
<b>7</b>	<b>Abbreviations</b> . . . . .	<b>5</b>
<b>8</b>	<b>Revision history</b> . . . . .	<b>5</b>
<b>9</b>	<b>Legal information</b> . . . . .	<b>6</b>
9.1	Data sheet status . . . . .	6
9.2	Definitions . . . . .	6
9.3	Disclaimers . . . . .	6
9.4	Trademarks . . . . .	7
<b>10</b>	<b>Contact information</b> . . . . .	<b>7</b>
<b>11</b>	<b>Contents</b> . . . . .	<b>8</b>

Please be aware that important notices concerning this document and the product(s) described herein, have been included in section 'Legal information'.

© NXP Semiconductors N.V. 2014. All rights reserved.

For more information, please visit: <http://www.nxp.com>  
 For sales office addresses, please send an email to: [salesaddresses@nxp.com](mailto:salesaddresses@nxp.com)

Date of release: 26 May 2014  
 Document identifier: CGD987HC