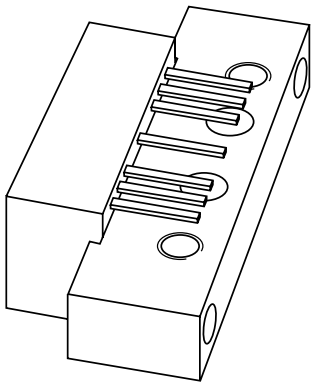
# DATA SHEET



# BGD902; BGD902MI
## CATV amplifier modules

Product specification
Supersedes data of 1998 Aug 31

1999 Mar 29

Philips
Semiconductors

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# CATV amplifier modules BGD902; BGD902MI

## 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 |

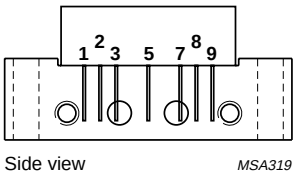



Fig.1 Simplified outline.

## 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**

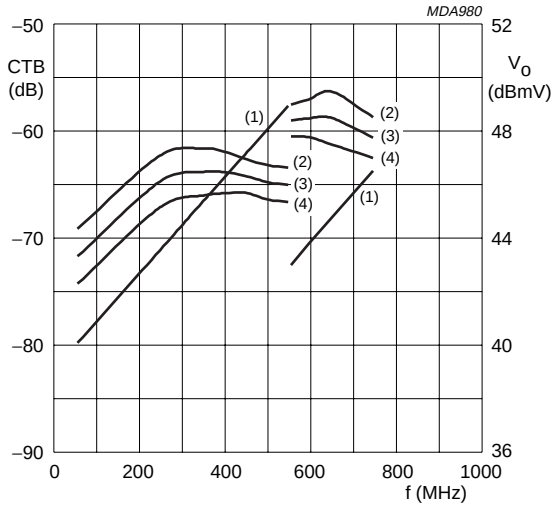
Bandwidth 40 to 900 MHz; $V_B$ = 24 V; $T_{mb}$ = 35 °C; $Z_S = Z_L$ = 75 Ω

| 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**

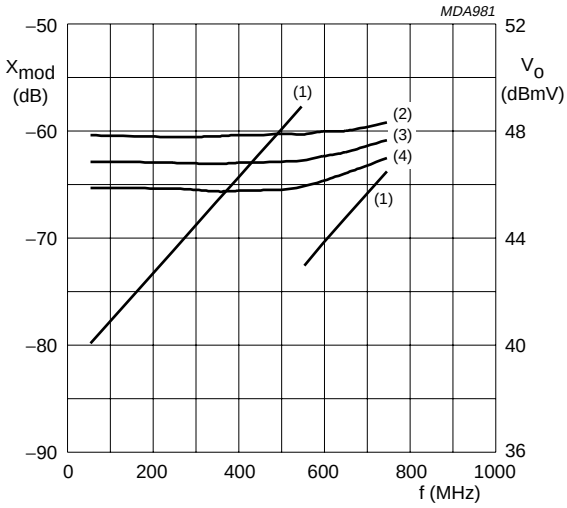
1. Tilt = 9 dB (50 to 550 MHz); tilt = 3.5 dB at –6 dB offset (550 to 750 MHz).
2. Tilt = 12.5 dB (50 to 860 MHz).
3. $f_p$ = 55.25 MHz; $V_p$ = 44 dBmV;
   $f_q$ = 805.25 MHz; $V_q$ = 44 dBmV;
   measured at $f_p + f_q$ = 860.5 MHz.
4. $f_p$ = 55.25 MHz; $V_p$ = 44 dBmV;
   $f_q$ = 691.25 MHz; $V_q$ = 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.

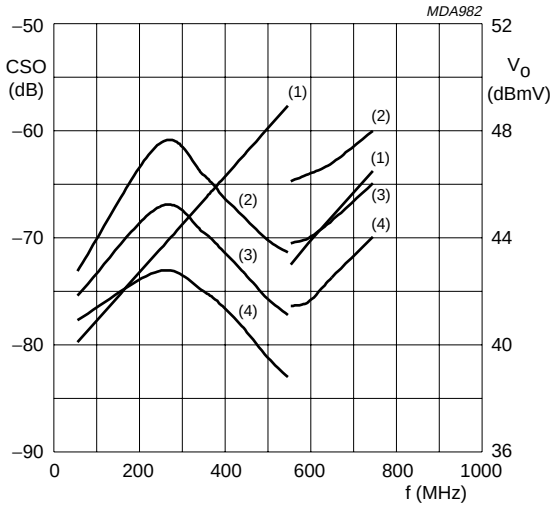
Fig.2 Composite triple beat as function of frequency under tilted conditions.




$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ 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.

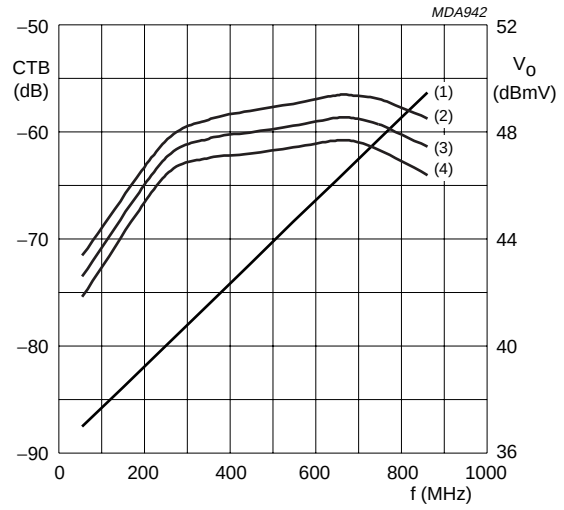
Fig.3 Cross modulation as function of frequency under tilted conditions.




$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 110 chs; tilt = 9 dB (50 to 550 MHz); tilt = 3.5 dB at −6 dB offset (550 to 750 MHz).

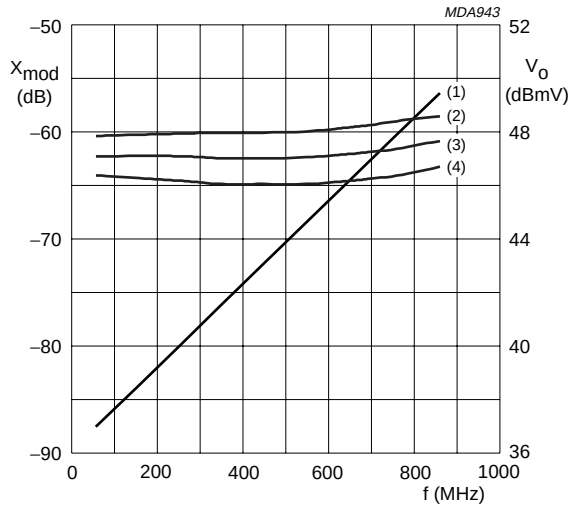
(1) $V_o$. (3) Typ.
(2) Typ. +3 σ. (4) Typ. −3 σ.

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



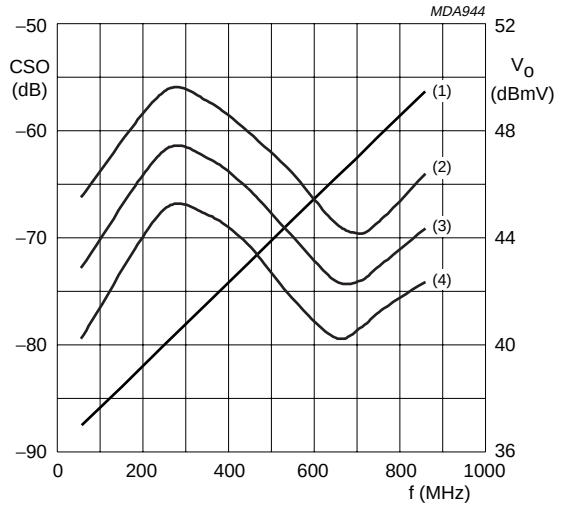

$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 129 chs;
tilt = 12.5 dB; (50 to 860 MHz).
(1) $V_o$. (3) Typ.
(2) Typ. +3 σ. (4) Typ. −3 σ.

Fig.5 Composite triple beat as function of frequency under tilted conditions.



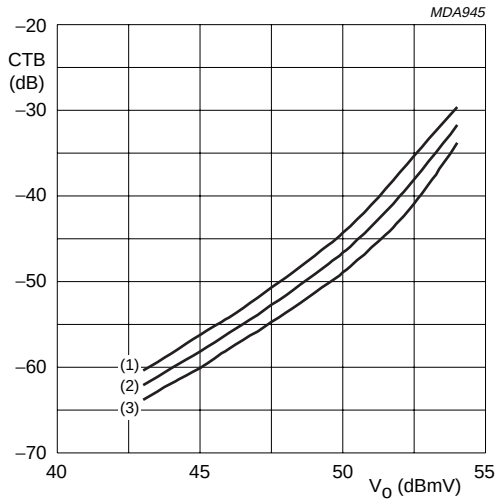

$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 129 chs;
tilt = 12.5 dB; (50 to 860 MHz).
(1) $V_o$. (3) Typ.
(2) Typ. +3 σ. (4) Typ. −3 σ.

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.



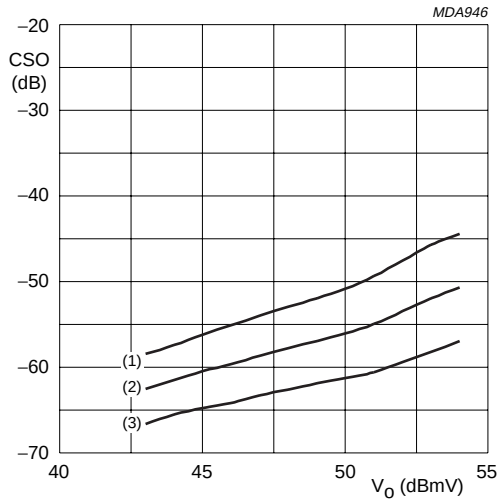

$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 129 chs; $f_m = 859.25$ MHz.

(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.

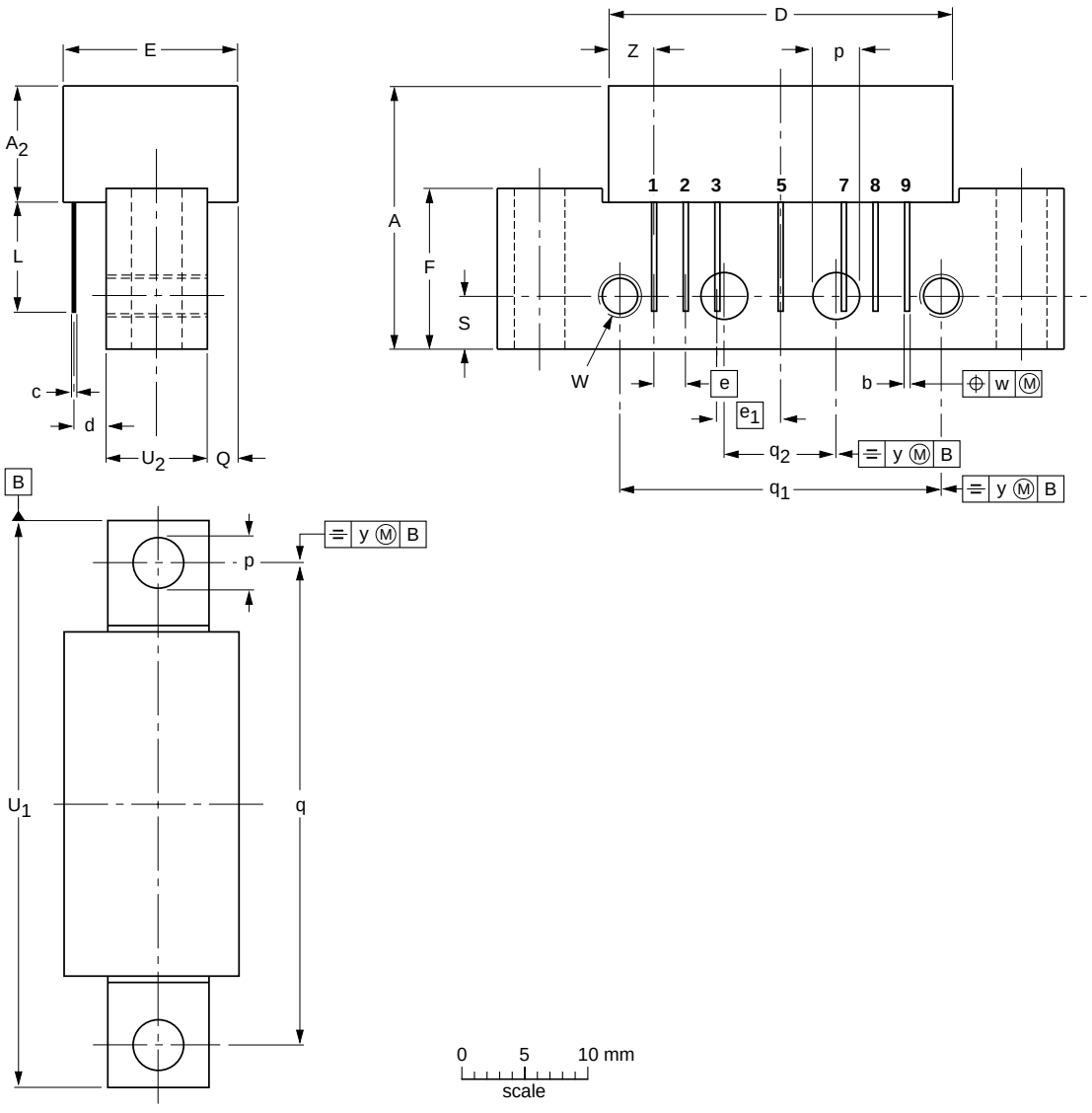
(2) Typ.

(3) Typ. –3 σ.

Fig.9 Composite second order distortion as function of output voltage.

## 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. | $A_2$ 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<br>0.38 | 0.25 | 27.2 | 2.54 | 13.75 | 2.54 | 5.08 | 12.7 | 8.8 | 4.15<br>3.85 | 2.4 | 38.1 | 25.4 | 10.2 | 4.2 | 44.75 | 8 | 6-32<br>UNC | 0.25 | 0.1 | 3.8 |

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | EIAJ | | | |
| SOT115J | | | | | | 99-02-06 |

## DEFINITIONS

| **Data Sheet Status** | |
|---|---|
| Objective specification | This data sheet contains target or goal specifications for product development. |
| Preliminary specification | This data sheet contains preliminary data; supplementary data may be published later. |
| Product specification | This data sheet contains final product specifications. |
| **Limiting values** | |
| Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). 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** | |
| Where application information is given, it is advisory and does not form part of the specification. | |

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**NOTES**

**NOTES**

# *Philips Semiconductors – a worldwide company*


**Argentina:** see South America

**Australia:** 34 Waterloo Road, NORTH RYDE, NSW 2113,
Tel. +61 2 9805 4455, Fax. +61 2 9805 4466

**Austria:** Computerstr. 6, A-1101 WIEN, P.O. Box 213,
Tel. +43 1 60 101 1248, Fax. +43 1 60 101 1210

**Belarus:** Hotel Minsk Business Center, Bld. 3, r. 1211, Volodarski Str. 6,
220050 MINSK, Tel. +375 172 20 0733, Fax. +375 172 20 0773

**Belgium:** see The Netherlands

**Brazil:** see South America

**Bulgaria:** Philips Bulgaria Ltd., Energoproject, 15th floor,
51 James Bourchier Blvd., 1407 SOFIA,
Tel. +359 2 68 9211, Fax. +359 2 68 9102

**Canada:** PHILIPS SEMICONDUCTORS/COMPONENTS,
Tel. +1 800 234 7381, Fax. +1 800 943 0087

**China/Hong Kong:** 501 Hong Kong Industrial Technology Centre,
72 Tat Chee Avenue, Kowloon Tong, HONG KONG,
Tel. +852 2319 7888, Fax. +852 2319 7700

**Colombia:** see South America

**Czech Republic:** see Austria

**Denmark:** Sydhavnsgade 23, 1780 COPENHAGEN V,
Tel. +45 33 29 3333, Fax. +45 33 29 3905

**Finland:** Sinikalliontie 3, FIN-02630 ESPOO,
Tel. +358 9 615 800, Fax. +358 9 6158 0920

**France:** 51 Rue Carnot, BP317, 92156 SURESNES Cedex,
Tel. +33 1 4099 6161, Fax. +33 1 4099 6427

**Germany:** Hammerbrookstraße 69, D-20097 HAMBURG,
Tel. +49 40 2353 60, Fax. +49 40 2353 6300

**Hungary:** see Austria

**India:** Philips INDIA Ltd, Band Box Building, 2nd floor,
254-D, Dr. Annie Besant Road, Worli, MUMBAI 400 025,
Tel. +91 22 493 8541, Fax. +91 22 493 0966

**Indonesia:** PT Philips Development Corporation, Semiconductors Division,
Gedung Philips, Jl. Buncit Raya Kav.99-100, JAKARTA 12510,
Tel. +62 21 794 0040 ext. 2501, Fax. +62 21 794 0080

**Ireland:** Newstead, Clonskeagh, DUBLIN 14,
Tel. +353 1 7640 000, Fax. +353 1 7640 200

**Israel:** RAPAC Electronics, 7 Kehilat Saloniki St, PO Box 18053,
TEL AVIV 61180, Tel. +972 3 645 0444, Fax. +972 3 649 1007

**Italy:** PHILIPS SEMICONDUCTORS, Piazza IV Novembre 3,
20124 MILANO, Tel. +39 2 6752 2531, Fax. +39 2 6752 2557

**Japan:** Philips Bldg 13-37, Kohnan 2-chome, Minato-ku,
TOKYO 108-8507, Tel. +81 3 3740 5130, Fax. +81 3 3740 5077

**Korea:** Philips House, 260-199 Itaewon-dong, Yongsan-ku, SEOUL,
Tel. +82 2 709 1412, Fax. +82 2 709 1415

**Malaysia:** No. 76 Jalan Universiti, 46200 PETALING JAYA, SELANGOR,
Tel. +60 3 750 5214, Fax. +60 3 757 4880

**Mexico:** 5900 Gateway East, Suite 200, EL PASO, TEXAS 79905,
Tel. +9-5 800 234 7381, Fax +9-5 800 943 0087

**Middle East:** see Italy

**Netherlands:** Postbus 90050, 5600 PB EINDHOVEN, Bldg. VB,
Tel. +31 40 27 82785, Fax. +31 40 27 88399

**New Zealand:** 2 Wagener Place, C.P.O. Box 1041, AUCKLAND,
Tel. +64 9 849 4160, Fax. +64 9 849 7811

**Norway:** Box 1, Manglerud 0612, OSLO,
Tel. +47 22 74 8000, Fax. +47 22 74 8341

**Pakistan:** see Singapore

**Philippines:** Philips Semiconductors Philippines Inc.,
106 Valero St. Salcedo Village, P.O. Box 2108 MCC, MAKATI,
Metro MANILA, Tel. +63 2 816 6380, Fax. +63 2 817 3474

**Poland:** Ul. Lukiska 10, PL 04-123 WARSZAWA,
Tel. +48 22 612 2831, Fax. +48 22 612 2327

**Portugal:** see Spain

**Romania:** see Italy

**Russia:** Philips Russia, Ul. Usatcheva 35A, 119048 MOSCOW,
Tel. +7 095 755 6918, Fax. +7 095 755 6919

**Singapore:** Lorong 1, Toa Payoh, SINGAPORE 319762,
Tel. +65 350 2538, Fax. +65 251 6500

**Slovakia:** see Austria

**Slovenia:** see Italy

**South Africa:** S.A. PHILIPS Pty Ltd., 195-215 Main Road Martindale,
2092 JOHANNESBURG, P.O. Box 7430 Johannesburg 2000,
Tel. +27 11 470 5911, Fax. +27 11 470 5494

**South America:** Al. Vicente Pinzon, 173, 6th floor,
04547-130 SÃO PAULO, SP, Brazil,
Tel. +55 11 821 2333, Fax. +55 11 821 2382

**Spain:** Balmes 22, 08007 BARCELONA,
Tel. +34 93 301 6312, Fax. +34 93 301 4107

**Sweden:** Kottbygatan 7, Akalla, S-16485 STOCKHOLM,
Tel. +46 8 5985 2000, Fax. +46 8 5985 2745

**Switzerland:** Allmendstrasse 140, CH-8027 ZÜRICH,
Tel. +41 1 488 2741 Fax. +41 1 488 3263

**Taiwan:** Philips Semiconductors, 6F, No. 96, Chien Kuo N. Rd., Sec. 1,
TAIPEI, Taiwan Tel. +886 2 2134 2886, Fax. +886 2 2134 2874

**Thailand:** PHILIPS ELECTRONICS (THAILAND) Ltd.,
209/2 Sanpavuth-Bangna Road Prakanong, BANGKOK 10260,
Tel. +66 2 745 4090, Fax. +66 2 398 0793

**Turkey:** Talatpasa Cad. No. 5, 80640 GÜLTEPE/ISTANBUL,
Tel. +90 212 279 2770, Fax. +90 212 282 6707

**Ukraine**: PHILIPS UKRAINE, 4 Patrice Lumumba str., Building B, Floor 7,
252042 KIEV, Tel. +380 44 264 2776, Fax. +380 44 268 0461

**United Kingdom:** Philips Semiconductors Ltd., 276 Bath Road, Hayes,
MIDDLESEX UB3 5BX, Tel. +44 181 730 5000, Fax. +44 181 754 8421

**United States:** 811 East Arques Avenue, SUNNYVALE, CA 94088-3409,
Tel. +1 800 234 7381, Fax. +1 800 943 0087

**Uruguay:** see South America

**Vietnam:** see Singapore

**Yugoslavia:** PHILIPS, Trg N. Pasica 5/v, 11000 BEOGRAD,
Tel. +381 11 62 5344, Fax.+381 11 63 5777

**For all other countries apply to:** Philips Semiconductors,
International Marketing & Sales Communications, Building BE-p, P.O. Box 218,
5600 MD EINDHOVEN, The Netherlands, Fax. +31 40 27 24825

**Internet:** http://www.semiconductors.philips.com





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