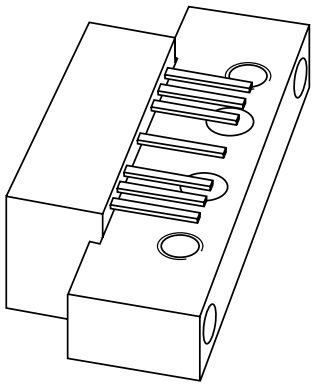
# DATA SHEET



# BGD904; BGD904MI
## CATV amplifier modules

Product specification
Supersedes data of 1999 May 26

2000 Jan 10

Philips
Semiconductors

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# 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 |

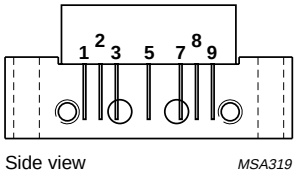



Fig.1 Simplified outline.

## 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**

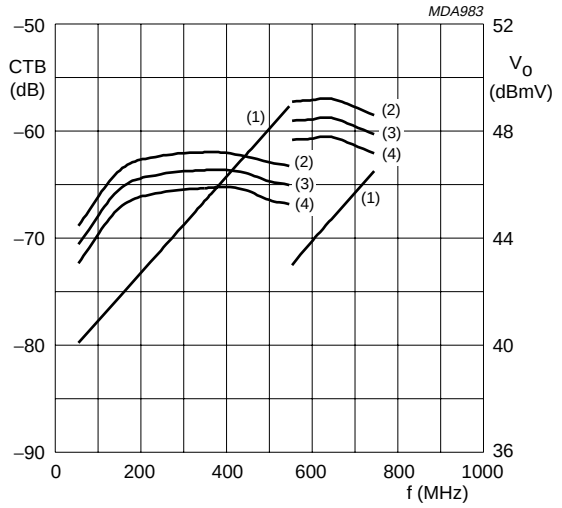
Bandwidth 40 to 900 MHz; $V_B$ = 24 V; $T_{mb}$ = 35 °C; $Z_S = Z_L$ = 75 Ω

| 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**

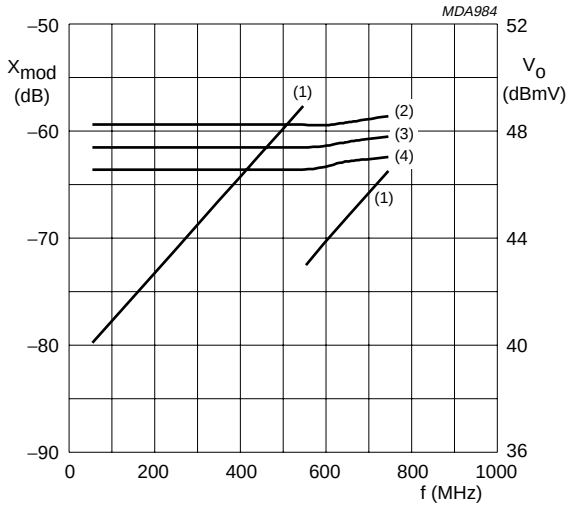
1. Tilt = 9 dB (50 to 550 MHz); tilt = 3.5 dB at –6 dB offset (550 to 750 MHz).
2. Tilt = 12.5 dB (50 to 860 MHz).
3. $f_p$ = 55.25 MHz; $V_p$ = 44 dBmV; $f_q$ = 805.25 MHz; $V_q$ = 44 dBmV; measured at $f_p + f_q$ = 860.5 MHz.
4. $f_p$ = 55.25 MHz; $V_p$ = 44 dBmV; $f_q$ = 691.25 MHz; $V_q$ = 44 dBmV;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

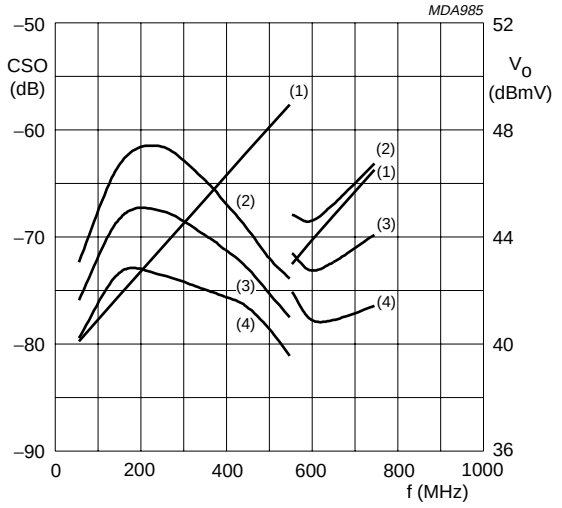
Fig.2 Composite triple beat as a function of frequency under tilted conditions.




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

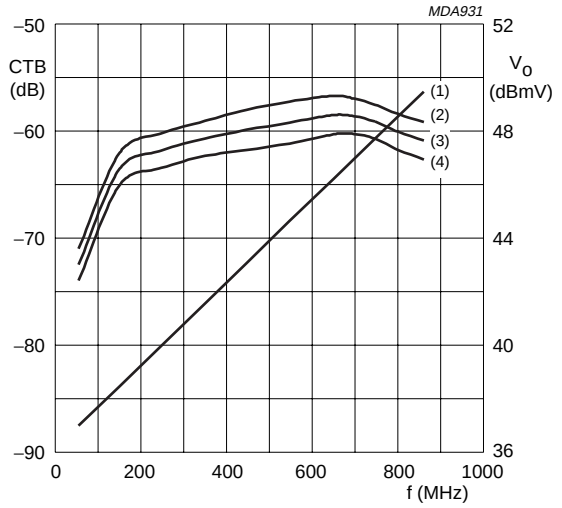
Fig.3 Cross modulation as a function of frequency under tilted conditions.




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

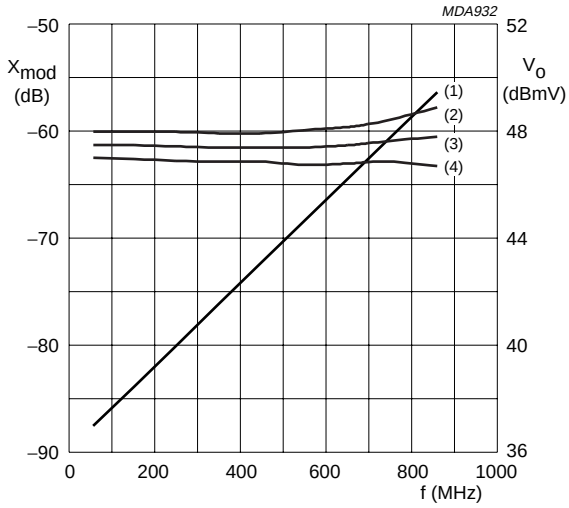
(1) $V_o$. (3) Typ.
(2) Typ. +3 σ. (4) Typ. −3 σ.

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



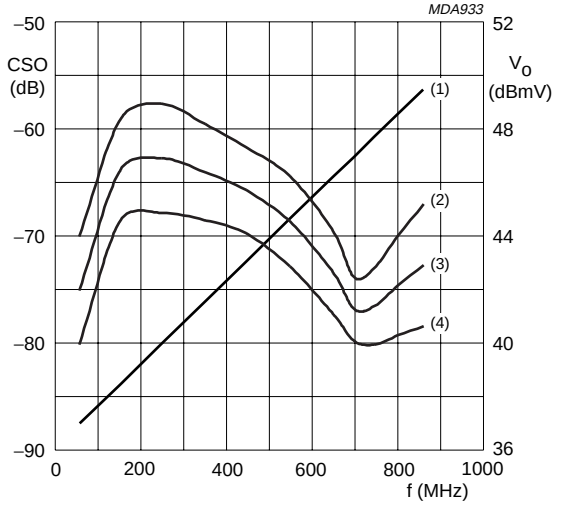

$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 129 chs;
tilt = 12.5 dB; (50 to 860 MHz).
(1) $V_o$. (3) Typ.
(2) Typ. +3 σ. (4) Typ. –3 σ.

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



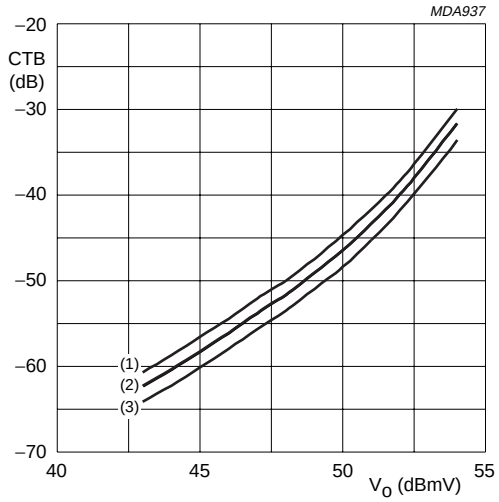

$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 129 chs;
tilt = 12.5 dB; (50 to 860 MHz).
(1) $V_o$. (3) Typ.
(2) Typ. +3 σ. (4) Typ. –3 σ.

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.



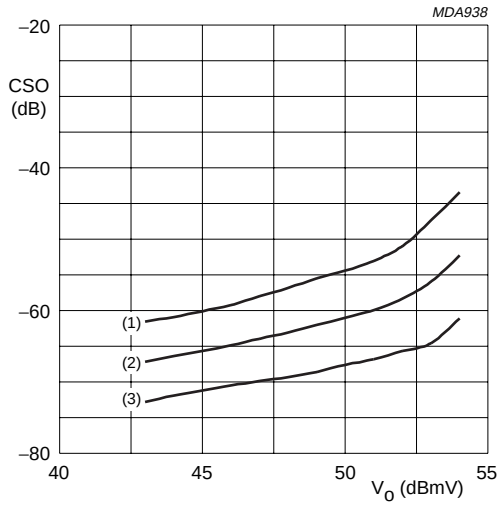

$Z_S = Z_L = 75\ \Omega$; $V_B = 24$ V; 129 chs; $f_m = 859.25$ MHz.

(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.

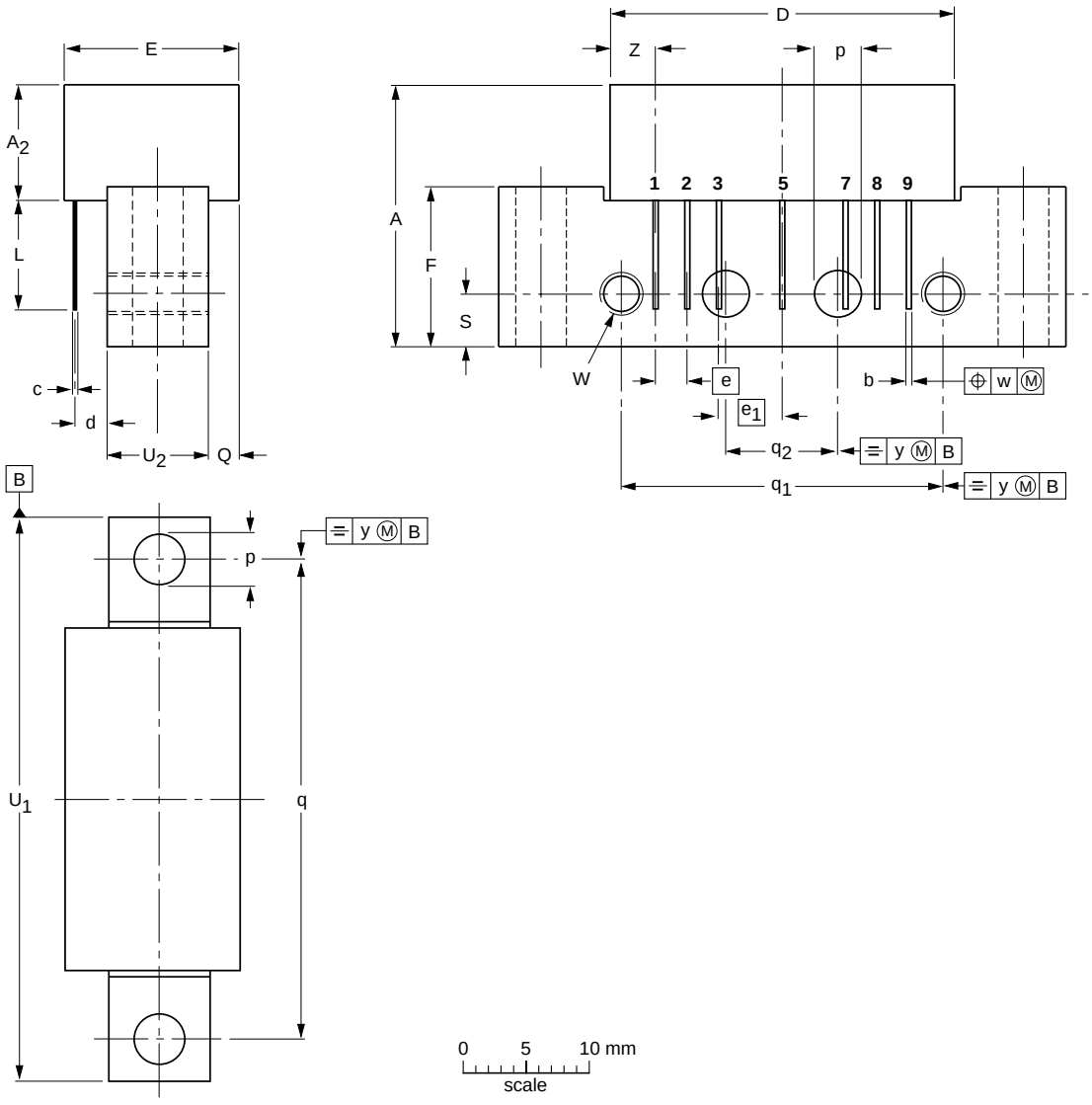
(2) Typ.

(3) Typ. –3 σ.

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

## 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**

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