

# BLS6G3135-20; BLS6G3135S-20

LDMOS S-Band radar power transistor

Rev. 03 — 3 March 2009

Product data sheet

## 1. Product profile

### 1.1 General description

20 W LDMOS power transistor intended for radar applications in the 3.1 GHz to 3.5 GHz range.

**Table 1. Typical performance**

Typical RF performance at  $T_{case} = 25\text{ }^{\circ}\text{C}$ ;  $t_p = 300\text{ }\mu\text{s}$ ;  $\delta = 10\text{ }\%$ ;  $I_{Dq} = 50\text{ mA}$ ; in a class-AB production test circuit.

| Mode of operation | f<br>(GHz) | V <sub>DS</sub><br>(V) | P <sub>L</sub><br>(W) | G <sub>p</sub><br>(dB) | $\eta_D$<br>(%) | t <sub>r</sub><br>(ns) | t <sub>f</sub><br>(ns) |
|-------------------|------------|------------------------|-----------------------|------------------------|-----------------|------------------------|------------------------|
| Pulsed RF         | 3.1 to 3.5 | 32                     | 20                    | 15.5                   | 45              | 20                     | 10                     |

#### CAUTION



This device is sensitive to ElectroStatic Discharge (ESD). Therefore care should be taken during transport and handling.

### 1.2 Features

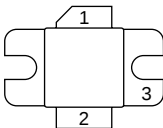
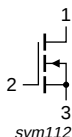
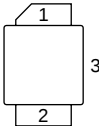
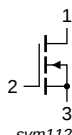
- Typical pulsed RF performance at a frequency of 3.1 GHz to 3.5 GHz, a supply voltage of 32 V, an  $I_{Dq}$  of 50 mA, a  $t_p$  of 300  $\mu\text{s}$  and a  $\delta$  of 10 %:
  - ◆ Output power = 20 W
  - ◆ Power gain = 15.5 dB
  - ◆ Efficiency = 45 %
- Integrated ESD protection
- Excellent ruggedness
- High efficiency
- Excellent thermal stability
- Designed for broadband operation (3.1 GHz to 3.5 GHz)
- Internally matched for ease of use
- Compliant to Directive 2002/95/EC, regarding Restriction of Hazardous Substances (RoHS)

### 1.3 Applications

- S-Band power amplifiers for radar applications in the 3.1 GHz to 3.5 GHz frequency range

## 2. Pinning information

**Table 2. Pinning**

| Pin                     | Description | Simplified outline                                                                   | Graphic symbol                                                                       |
|-------------------------|-------------|--------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| BLS6G3135-20 (SOT608A)  |             |                                                                                      |                                                                                      |
| 1                       | drain       |   |   |
| 2                       | gate        |                                                                                      |                                                                                      |
| 3                       | source      |                                                                                      |                                                                                      |
| BLS6G3135S-20 (SOT608B) |             |                                                                                      |                                                                                      |
| 1                       | drain       |  |  |
| 2                       | gate        |                                                                                      |                                                                                      |
| 3                       | source      |                                                                                      |                                                                                      |

[1] Connected to flange.

## 3. Ordering information

**Table 3. Ordering information**

| Type number   | Package |                                                    |         |
|---------------|---------|----------------------------------------------------|---------|
|               | Name    | Description                                        | Version |
| BLS6G3135-20  | -       | flanged ceramic package; 2 mounting holes; 2 leads | SOT608A |
| BLS6G3135S-20 | -       | ceramic earless flanged package; 2 leads           | SOT608B |

## 4. Limiting values

**Table 4. Limiting values**

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

| Symbol    | Parameter            | Conditions | Min  | Max  | Unit |
|-----------|----------------------|------------|------|------|------|
| $V_{DS}$  | drain-source voltage |            | -    | 60   | V    |
| $V_{GS}$  | gate-source voltage  |            | -0.5 | +13  | V    |
| $I_D$     | drain current        |            | -    | 2.1  | A    |
| $T_{stg}$ | storage temperature  |            | -65  | +150 | °C   |
| $T_j$     | junction temperature |            | -    | 225  | °C   |

## 5. Thermal characteristics

**Table 5. Thermal characteristics**

| Symbol           | Parameter                                | Conditions                                            | Typ  | Max  | Unit |
|------------------|------------------------------------------|-------------------------------------------------------|------|------|------|
| $R_{th(j-case)}$ | thermal resistance from junction to case | $T_{case} = 80\text{ °C}; P_L = 20\text{ W}$          |      |      |      |
|                  |                                          | $t_p = 100\text{ }\mu\text{s}; \delta = 20\text{ }\%$ | 0.76 | 0.92 | K/W  |
|                  |                                          | $t_p = 300\text{ }\mu\text{s}; \delta = 10\text{ }\%$ | 0.79 | 0.95 | K/W  |

## 6. Characteristics

**Table 6. Characteristics**

$T_j = 25\text{ °C}$  unless otherwise specified.

| Symbol        | Parameter                        | Conditions                                                  | Min | Typ  | Max  | Unit          |
|---------------|----------------------------------|-------------------------------------------------------------|-----|------|------|---------------|
| $V_{(BR)DSS}$ | drain-source breakdown voltage   | $V_{GS} = 0\text{ V}; I_D = 0.5\text{ mA}$                  | 60  | -    | -    | V             |
| $V_{GS(th)}$  | gate-source threshold voltage    | $V_{DS} = 10\text{ V}; I_D = 40\text{ mA}$                  | 1.4 | 2    | 2.4  | V             |
| $I_{DSS}$     | drain leakage current            | $V_{GS} = 0\text{ V}; V_{DS} = 28\text{ V}$                 | -   | -    | 1.5  | $\mu\text{A}$ |
| $I_{DSX}$     | drain cut-off current            | $V_{GS} = V_{GS(th)} + 3.75\text{ V}; V_{DS} = 10\text{ V}$ | 6   | 8.2  | -    | A             |
| $I_{GSS}$     | gate leakage current             | $V_{GS} = 8.3\text{ V}; V_{DS} = 0\text{ V}$                | -   | -    | 150  | nA            |
| $g_{fs}$      | forward transconductance         | $V_{DS} = 10\text{ V}; I_D = 1.4\text{ A}$                  | -   | 2.8  | -    | S             |
| $R_{DS(on)}$  | drain-source on-state resistance | $V_{GS} = V_{GS(th)} + 3.75\text{ V}; I_D = 1.4\text{ A}$   | -   | 0.37 | 0.58 | $\Omega$      |

## 7. Application information

**Table 7. Application information**

Mode of operation: pulsed RF;  $t_p = 300\text{ }\mu\text{s}; \delta = 10\text{ }\%$ ; RF performance at  $V_{DS} = 32\text{ V}; I_{Dq} = 50\text{ mA}; T_{case} = 25\text{ °C}$ ; unless otherwise specified; in a class-AB production circuit.

| Symbol   | Parameter        | Conditions          | Min | Typ  | Max | Unit |
|----------|------------------|---------------------|-----|------|-----|------|
| $P_L$    | output power     |                     | -   | 20   | -   | W    |
| $V_{CC}$ | supply voltage   | $P_L = 20\text{ W}$ | -   | -    | 32  | V    |
| $G_p$    | power gain       | $P_L = 20\text{ W}$ | 12  | 15.5 | -   | dB   |
| $\eta_D$ | drain efficiency | $P_L = 20\text{ W}$ | 40  | 45   | -   | %    |
| $t_r$    | rise time        | $P_L = 20\text{ W}$ | -   | 20   | 50  | ns   |
| $t_f$    | fall time        | $P_L = 20\text{ W}$ | -   | 10   | 50  | ns   |

7.1 Impedance information

Table 8. Typical impedance

| f   | Z <sub>S</sub> | Z <sub>L</sub> (optimized for η <sub>D</sub> ) | Z <sub>L</sub> (optimized for G <sub>p</sub> ) | G <sub>p(opt)</sub> | η <sub>D</sub> <a href="#">[1]</a> |
|-----|----------------|------------------------------------------------|------------------------------------------------|---------------------|------------------------------------|
| GHz | Ω              | Ω                                              | Ω                                              | dB                  | %                                  |
| 3.1 | 31.24 – j31.07 | 6.99 + j12.9                                   | 13.01 + j14.75                                 | 18.08               | 48.34                              |
| 3.2 | 50.56 – j12.48 | 5.82 + j8.77                                   | 11.47 + j11.17                                 | 17.97               | 45.60                              |
| 3.3 | 43.66 + j17.27 | 2.32 + j6.17                                   | 10.05 + j10.55                                 | 17.75               | 47.01                              |
| 3.4 | 24.13 + j28.47 | 5.52 + j6.10                                   | 9.93 + j8.48                                   | 17.91               | 47.03                              |
| 3.5 | 10.56 + j22.21 | 5.79 + j3.19                                   | 9.37 + j5.73                                   | 17.68               | 46.54                              |

[1] Measured with Z<sub>L</sub> optimized for G<sub>p</sub>.

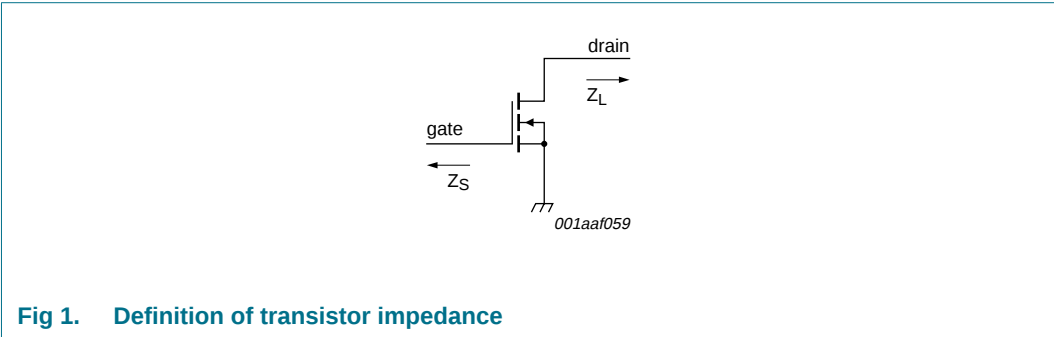
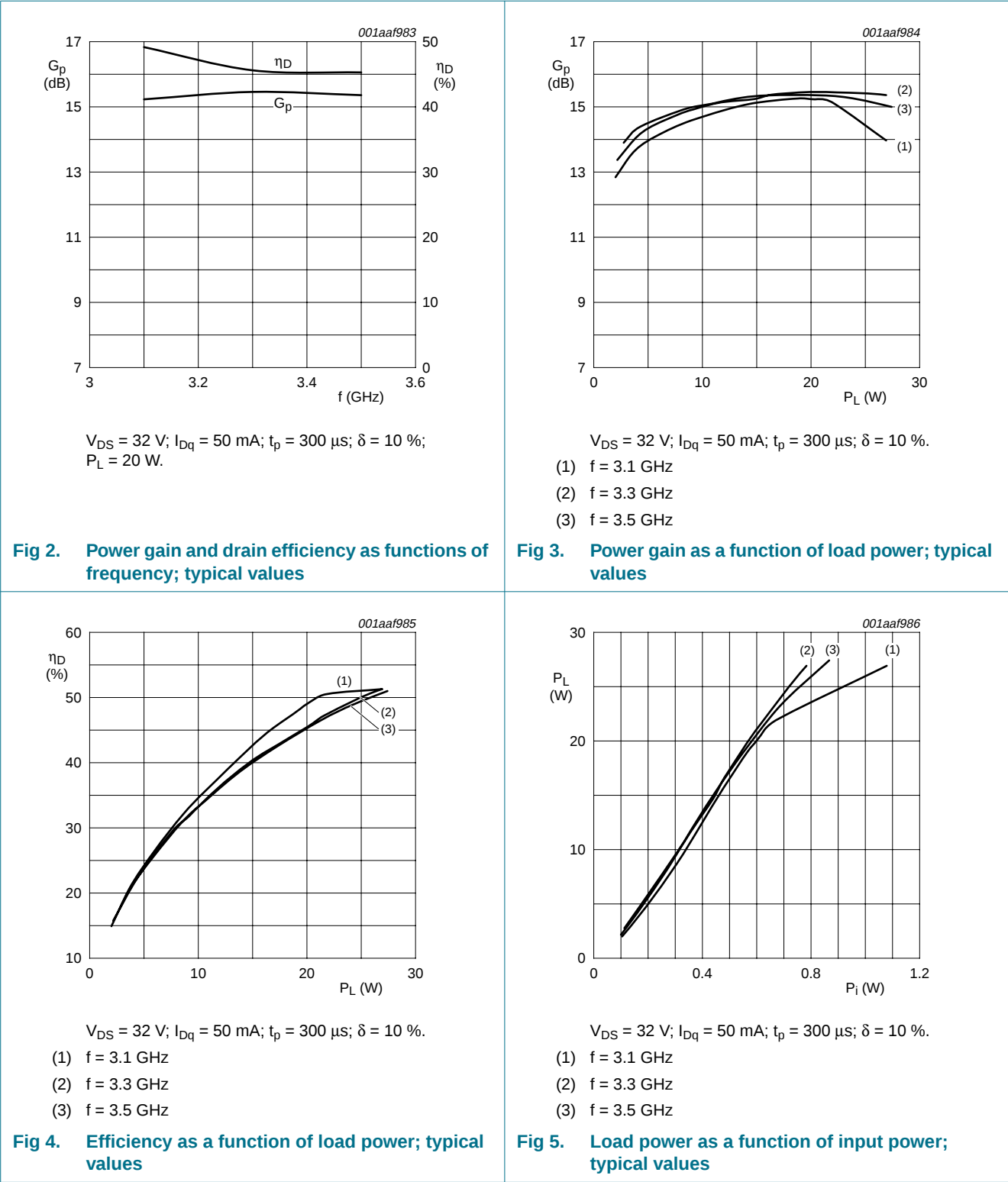


Fig 1. Definition of transistor impedance

7.2 Ruggedness in class-AB operation

The BLS6G3135-20 and BLS6G3135S-20 are capable of withstanding a load mismatch corresponding to VSWR = 5 : 1 through all phases under the following conditions:  
V<sub>DS</sub> = 32 V; I<sub>Dq</sub> = 50 mA; P<sub>L</sub> = 20 W; t<sub>p</sub> = 300 μs; δ = 10 %.

7.3 Graphs



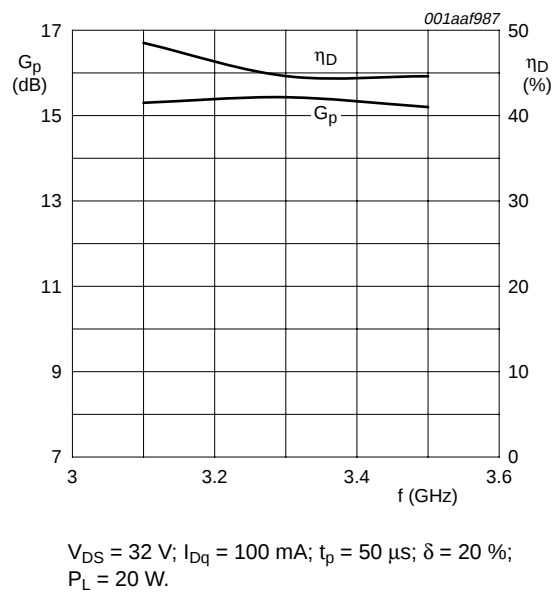


Fig 6. Power gain and drain efficiency as functions of frequency; typical values

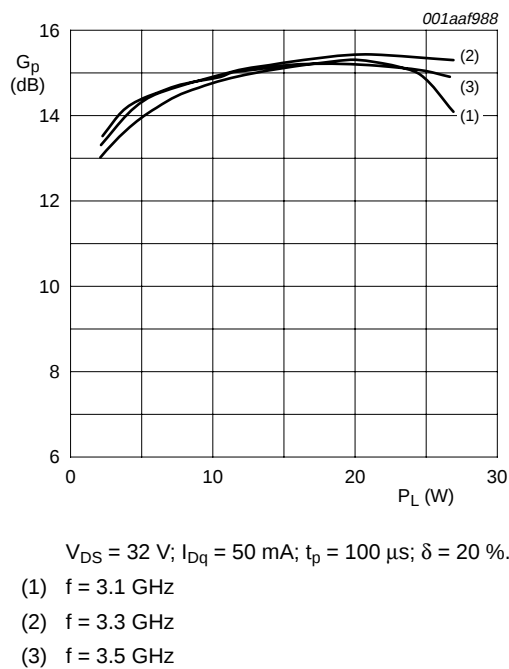


Fig 7. Power gain as a function of load power; typical values

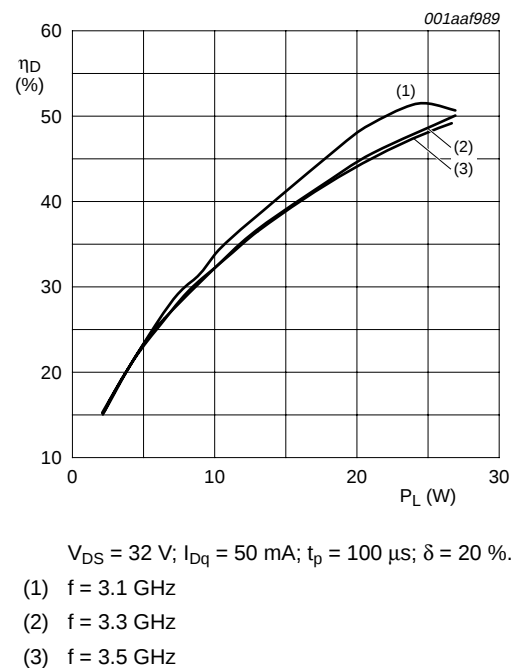


Fig 8. Efficiency as a function of load power; typical values

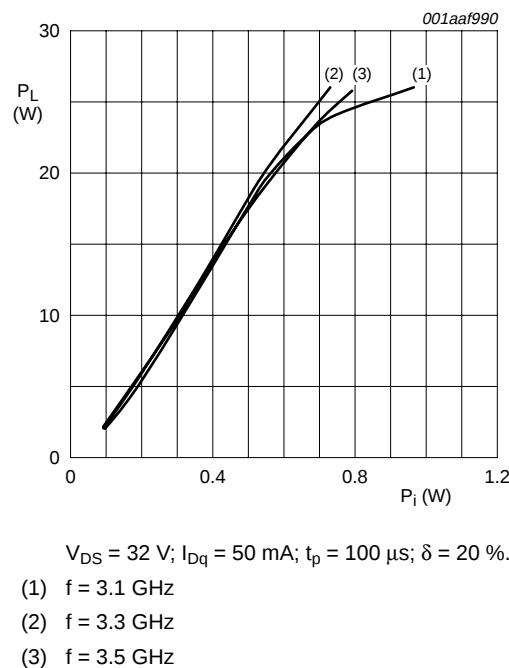
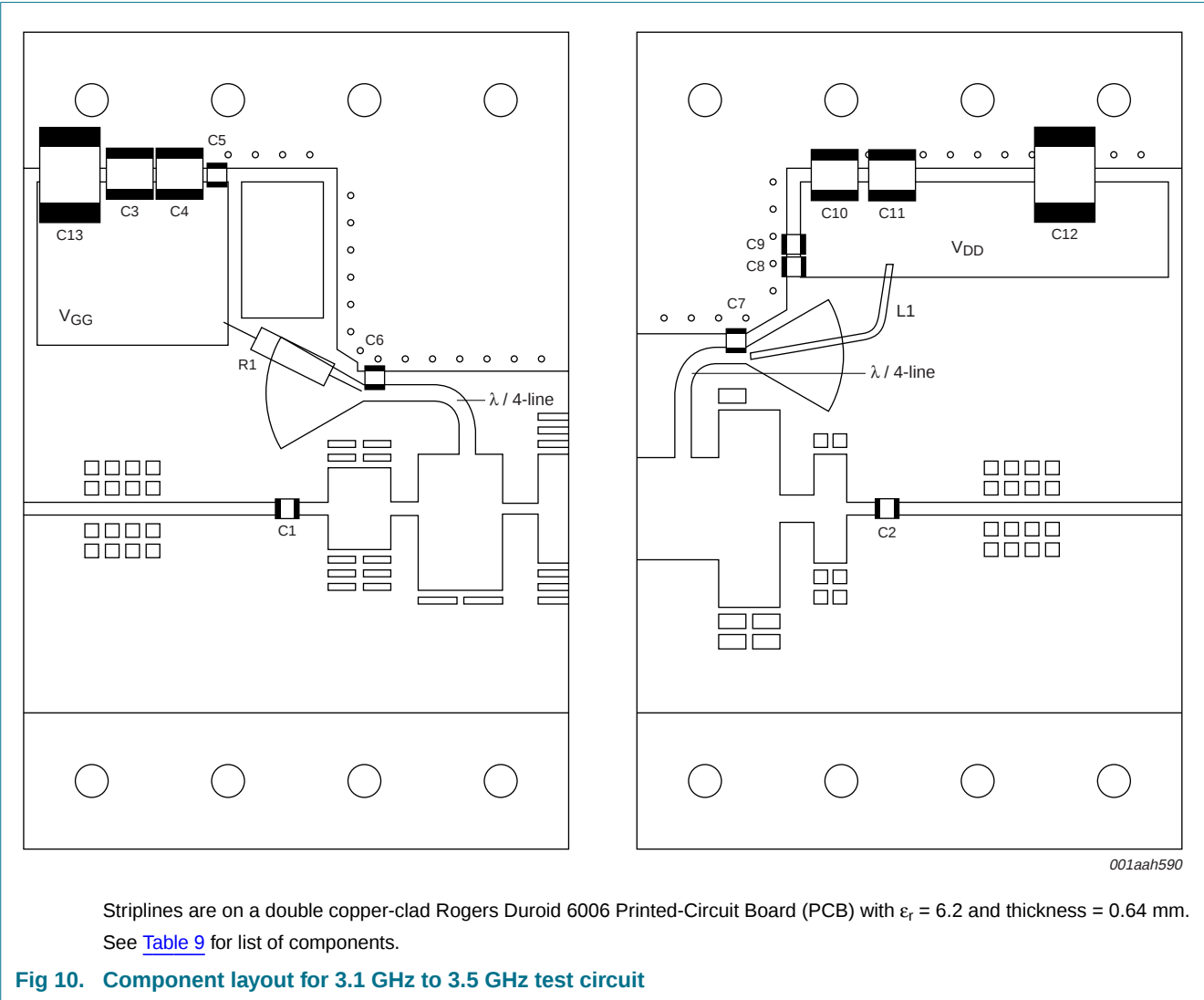


Fig 9. Load power as a function of input power; typical values

8. Test information



**Table 9. List of components**  
See [Figure 10](#).

| Component                  | Description                       | Value            | Remarks |
|----------------------------|-----------------------------------|------------------|---------|
| C1, C2, C5, C6, C7, C8, C9 | multilayer ceramic chip capacitor | 33 pF            | [1]     |
| C3, C4, C10, C11           | multilayer ceramic chip capacitor | 470 pF           | [2]     |
| C12                        | electrolytic capacitor            | 47 $\mu$ F; 63 V |         |
| C13                        | electrolytic capacitor            | 10 $\mu$ F; 35 V |         |
| L1                         | copper wire                       | -                |         |
| R1                         | resistor                          | 49.9 $\Omega$    |         |

[1] American Technical Ceramics type 100A or capacitor of same quality.  
[2] American Technical Ceramics type 100B or capacitor of same quality.

9. Package outline

Flanged ceramic package; 2 mounting holes; 2 leads

SOT608A

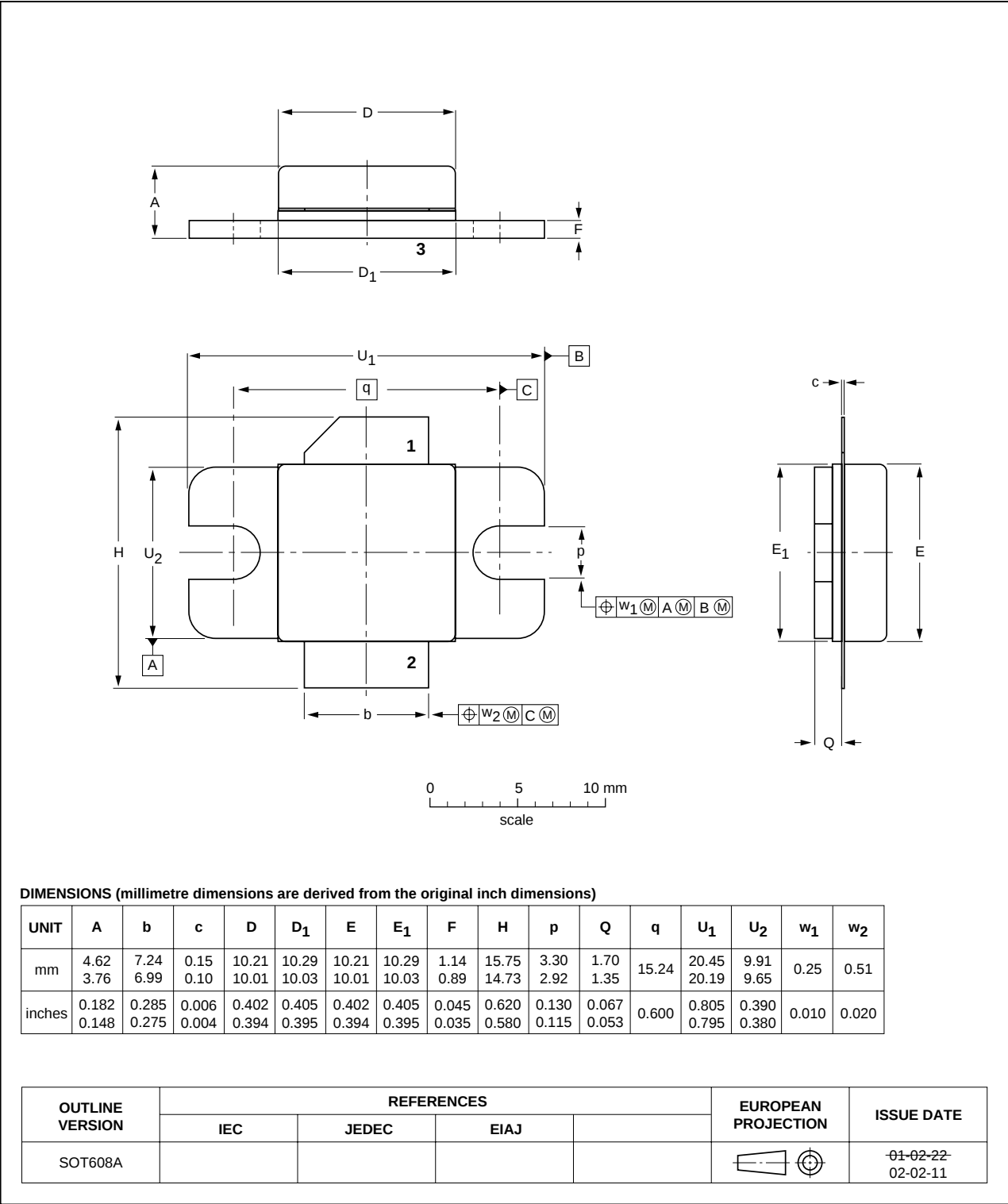
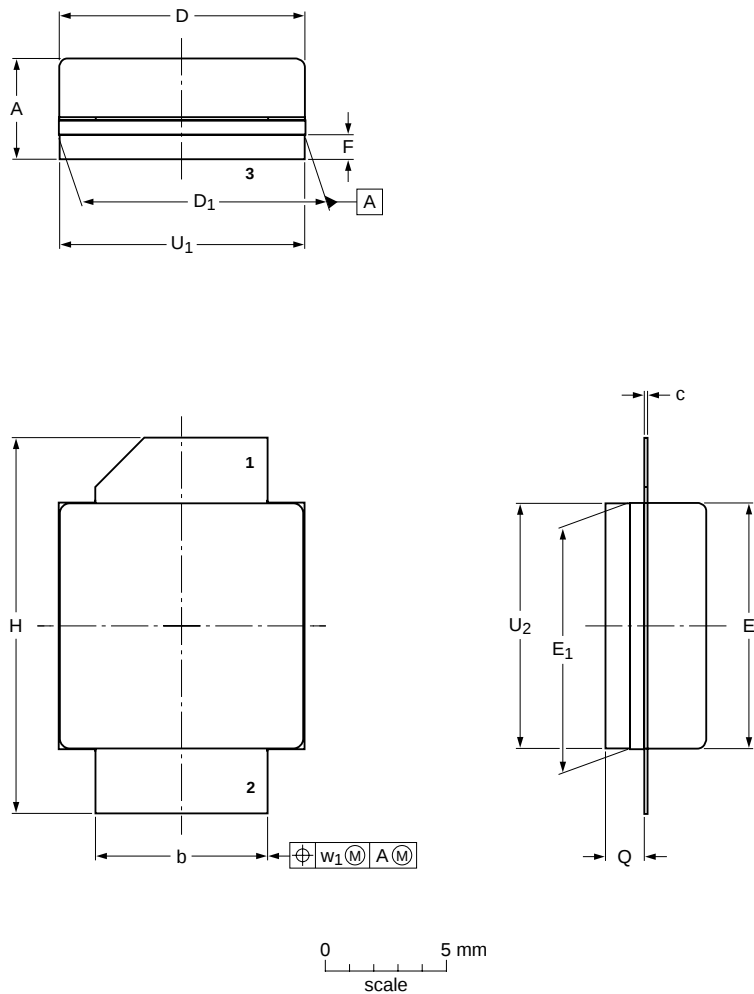


Fig 11. Package outline SOT608A

Ceramic earless flanged package; 2 leads

SOT608B



DIMENSIONS (mm dimensions are derived from the original inch dimensions)

| UNIT | A              | b              | c              | D              | D <sub>1</sub> | E              | E <sub>1</sub> | F              | H              | Q              | U <sub>1</sub> | U <sub>2</sub> | w <sub>1</sub> |
|------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| mm   | 4.62<br>3.76   | 7.24<br>6.99   | 0.15<br>0.10   | 10.21<br>10.01 | 10.29<br>10.03 | 10.21<br>10.01 | 10.29<br>10.03 | 1.14<br>0.89   | 15.75<br>14.73 | 1.70<br>1.35   | 10.24<br>9.98  | 10.24<br>9.98  | 0.51           |
| inch | 0.182<br>0.148 | 0.285<br>0.275 | 0.006<br>0.004 | 0.402<br>0.394 | 0.405<br>0.395 | 0.402<br>0.394 | 0.405<br>0.395 | 0.045<br>0.035 | 0.620<br>0.580 | 0.067<br>0.053 | 0.403<br>0.393 | 0.403<br>0.393 | 0.020          |

| OUTLINE<br>VERSION | REFERENCES |       |       |  | EUROPEAN<br>PROJECTION | ISSUE DATE           |
|--------------------|------------|-------|-------|--|------------------------|----------------------|
|                    | IEC        | JEDEC | JEITA |  |                        |                      |
| SOT608B            |            |       |       |  |                        | 06-11-27<br>06-12-06 |

Fig 12. Package outline SOT608B

## 10. Abbreviations

**Table 10. Abbreviations**

| Acronym | Description                                  |
|---------|----------------------------------------------|
| LDMOS   | Laterally Diffused Metal Oxide Semiconductor |
| RF      | Radio Frequency                              |
| S-Band  | Short wave Band                              |
| VSWR    | Voltage Standing-Wave Ratio                  |

## 11. Revision history

**Table 11. Revision history**

| Document ID                                                                                                                         | Release date | Data sheet status    | Change notice | Supersedes                |
|-------------------------------------------------------------------------------------------------------------------------------------|--------------|----------------------|---------------|---------------------------|
| BLS6G3135-20_6G3135S-20_3                                                                                                           | 20090303     | Product data sheet   | -             | BLS6G3135-20_6G3135S-20_2 |
| Modifications: <ul style="list-style-type: none"><li>• <a href="#">Section 7.1 on page 4</a>: Impedance information added</li></ul> |              |                      |               |                           |
| BLS6G3135-20_6G3135S-20_2                                                                                                           | 20081217     | Product data sheet   | -             | BLS6G3135-20_6G3135S-20_1 |
| BLS6G3135-20_6G3135S-20_1                                                                                                           | 20070307     | Objective data sheet | -             | -                         |

## 12. Legal information

### 12.1 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".

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