

# BLA9H0912L-1200P; BLA9H0912LS-1200P

LDMOS avionics power transistor

Rev. 1 — 1 November 2018

AMPLEON

Product data sheet

## 1. Product profile

### 1.1 General description

1200 W LDMOS power transistor for avionics applications in the frequency range of 960 MHz to 1215 MHz.

**Table 1. Typical performance**

Typical RF performance at  $T_{case} = 25\text{ }^{\circ}\text{C}$ ;  $t_p = 50\text{ }\mu\text{s}$ ;  $\delta = 2\text{ }\%$ ;  $I_{DQ} = 75\text{ mA}$ ; in a class-AB demo circuit.

| Test signal                   | f<br>(MHz)  | V <sub>DS</sub><br>(V) | P <sub>L</sub><br>(W) | G <sub>p</sub><br>(dB) | $\eta_D$<br>(%) |
|-------------------------------|-------------|------------------------|-----------------------|------------------------|-----------------|
| pulsed RF                     | 1030        | 50                     | 1200                  | 19                     | 60              |
| pulsed RF at 1 dB compression | 960 to 1215 | 50                     | >1050                 | 19                     | 57              |

### 1.2 Features and benefits

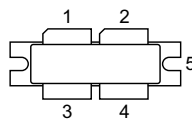
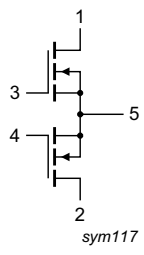
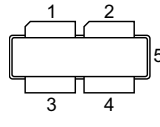
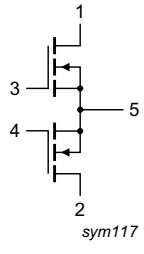
- High efficiency
- Excellent ruggedness
- Designed for avionics band operation
- Excellent thermal stability
- Easy power control
- Integrated dual sided ESD protection enables excellent off-state isolation
- High flexibility with respect to pulse formats
- Internally matched for ease of use
- For RoHS compliance see the product details on the Ampleon website

### 1.3 Applications

- Avionics applications in the frequency range of 960 MHz to 1215 MHz

## 2. Pinning information

Table 2. Pinning

| Pin                                | Description                | Simplified outline                                                                  | Graphic symbol                                                                       |
|------------------------------------|----------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| <b>BLA9H0912L-1200P (SOT539A)</b>  |                            |                                                                                     |                                                                                      |
| 1                                  | drain1                     |   |   |
| 2                                  | drain2                     |                                                                                     |                                                                                      |
| 3                                  | gate1                      |                                                                                     |                                                                                      |
| 4                                  | gate2                      |                                                                                     |                                                                                      |
| 5                                  | source <a href="#">[1]</a> |                                                                                     |                                                                                      |
| <b>BLA9H0912LS-1200P (SOT539B)</b> |                            |                                                                                     |                                                                                      |
| 1                                  | drain1                     |  |  |
| 2                                  | drain2                     |                                                                                     |                                                                                      |
| 3                                  | gate1                      |                                                                                     |                                                                                      |
| 4                                  | gate2                      |                                                                                     |                                                                                      |
| 5                                  | source <a href="#">[1]</a> |                                                                                     |                                                                                      |

[1] Connected to flange.

## 3. Ordering information

Table 3. Ordering information

| Type number       | Package |                                                             |         |
|-------------------|---------|-------------------------------------------------------------|---------|
|                   | Name    | Description                                                 | Version |
| BLA9H0912L-1200P  | -       | flanged balanced ceramic package; 2 mounting holes; 4 leads | SOT539A |
| BLA9H0912LS-1200P | -       | earless flanged balanced ceramic package; 4 leads           | SOT539B |

## 4. Limiting values

Table 4. Limiting values

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

| Symbol    | Parameter                           | Min | Max  | Unit |
|-----------|-------------------------------------|-----|------|------|
| $V_{DS}$  | drain-source voltage                | -   | 106  | V    |
| $V_{GS}$  | gate-source voltage                 | -6  | +11  | V    |
| $T_{stg}$ | storage temperature                 | -65 | +150 | °C   |
| $T_j$     | junction temperature <sup>[1]</sup> | -   | 225  | °C   |

[1] Continuous use at maximum temperature will affect the reliability, for details refer to the online MTF calculator.

## 5. Thermal characteristics

Table 5. Thermal characteristics

| Symbol         | Parameter                                                  | Conditions                                                  | Typ   | Unit |
|----------------|------------------------------------------------------------|-------------------------------------------------------------|-------|------|
| $Z_{th(j-mb)}$ | transient thermal impedance from junction to mounting base | $T_{case} = 85\text{ }^{\circ}\text{C}; P_L = 600\text{ W}$ |       |      |
|                |                                                            | $t_p = 32\text{ }\mu\text{s}; \delta = 2\%$                 | 0.027 | K/W  |
|                |                                                            | $t_p = 10\text{ }\mu\text{s}; \delta = 10\%$                | 0.036 | K/W  |
|                |                                                            | $t_p = 64\text{ }\mu\text{s}; \delta = 1\%$                 | 0.032 | K/W  |
|                |                                                            | $t_p = 2.4\text{ ms}; \delta = 6.4\%$                       | 0.126 | K/W  |

## 6. Characteristics

Table 6. DC characteristics

$T_j = 25\text{ }^{\circ}\text{C}$ , per section unless otherwise specified.

| Symbol        | Parameter                        | Conditions                                                  | Min | Typ   | Max | Unit          |
|---------------|----------------------------------|-------------------------------------------------------------|-----|-------|-----|---------------|
| $V_{(BR)DSS}$ | drain-source breakdown voltage   | $V_{GS} = 0\text{ V}; I_D = 4\text{ mA}$                    | 106 | -     | -   | V             |
| $V_{GS(th)}$  | gate-source threshold voltage    | $V_{DS} = 10\text{ V}; I_D = 400\text{ mA}$                 | 1.5 | 2.0   | 2.5 | V             |
| $I_{DSS}$     | drain leakage current            | $V_{GS} = 0\text{ V}; V_{DS} = 50\text{ V}$                 | -   | -     | 2.8 | $\mu\text{A}$ |
| $I_{DSX}$     | drain cut-off current            | $V_{GS} = V_{GS(th)} + 3.75\text{ V}; V_{DS} = 10\text{ V}$ | -   | 60    | -   | A             |
| $I_{GSS}$     | gate leakage current             | $V_{GS} = 11\text{ V}; V_{DS} = 0\text{ V}$                 | -   | -     | 280 | nA            |
| $g_{fs}$      | forward transconductance         | $V_{DS} = 10\text{ V}; I_D = 400\text{ mA}$                 | -   | 3.7   | -   | S             |
| $R_{DS(on)}$  | drain-source on-state resistance | $V_{GS} = V_{GS(th)} + 3.75\text{ V}; I_D = 14\text{ A}$    | -   | 0.060 | -   | $\Omega$      |

Table 7. RF characteristics

Test signal: pulsed RF;  $f = 1030\text{ MHz}$ ;  $t_p = 50\text{ }\mu\text{s}$ ;  $\delta = 2\%$ ; RF performance at  $V_{DS} = 50\text{ V}$ ;  $I_{Dq} = 75\text{ mA}$ ;  $T_{case} = 25\text{ }^{\circ}\text{C}$ ; unless otherwise specified, in a class-AB production circuit.

| Symbol             | Parameter                             | Conditions            | Min  | Typ  | Max | Unit |
|--------------------|---------------------------------------|-----------------------|------|------|-----|------|
| $G_p$              | power gain                            | $P_L = 1200\text{ W}$ | 17.8 | 19   | -   | dB   |
| $\eta_D$           | drain efficiency                      | $P_L = 1200\text{ W}$ | 57   | 60   | -   | %    |
| $RL_{in}$          | input return loss                     | $P_L = 1200\text{ W}$ | -    | -15  | -   | dB   |
| $P_{droop(pulse)}$ | pulse droop power                     | $P_L = 1200\text{ W}$ | -    | 0.2  | 0.5 | dB   |
| $t_r$              | rise time                             | $P_L = 1200\text{ W}$ | -    | 6    | 50  | ns   |
| $t_f$              | fall time                             | $P_L = 1200\text{ W}$ | -    | 6    | 50  | ns   |
| $P_{L(2dB)}$       | output power at 2 dB gain compression |                       | -    | 1400 | -   | W    |

## 7. Test information

### 7.1 Ruggedness in class-AB operation

The BLA9H0912L-1200P and BLA9H0912LS-1200P are capable of withstanding a load mismatch corresponding to  $VSWR = 20 : 1$  through all phases under the following conditions:  $V_{DS} = 50\text{ V}$ ;  $I_{Dq} = 75\text{ mA}$ ;  $P_L = 1200\text{ W}$ ;  $t_p = 50\text{ }\mu\text{s}$ ;  $\delta = 2\%$ .

7.2 Impedance information

Table 8. Typical impedance (per section)

| f     | Z <sub>S</sub> [1] | Z <sub>L</sub> [1] |
|-------|--------------------|--------------------|
| (MHz) | (Ω)                | (Ω)                |
| 950   | 0.717 – j1.793     | 0.965 – j1.305     |
| 1000  | 0.953 – j1.886     | 1.049 – j1.561     |
| 1050  | 1.091 – j1.910     | 1.032 – j1.780     |
| 1100  | 1.353 – j0.443     | 1.291 – j1.952     |
| 1150  | 1.962 – j1.061     | 1.474 – j2.081     |
| 1200  | 0.837 – j0.936     | 1.514 – j2.413     |

[1] Z<sub>S</sub> and Z<sub>L</sub> defined in [Figure 1](#).

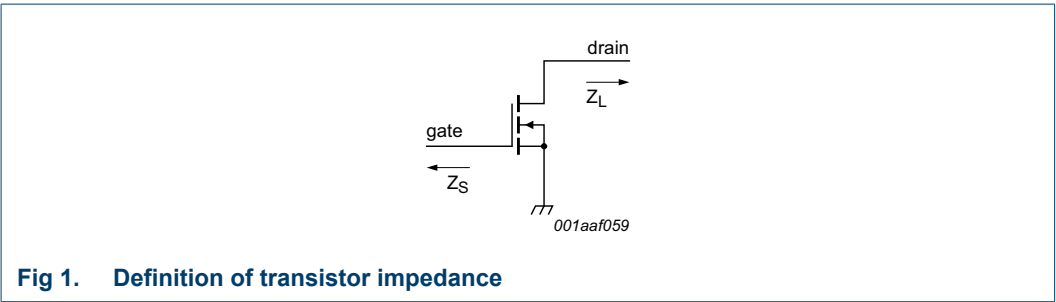
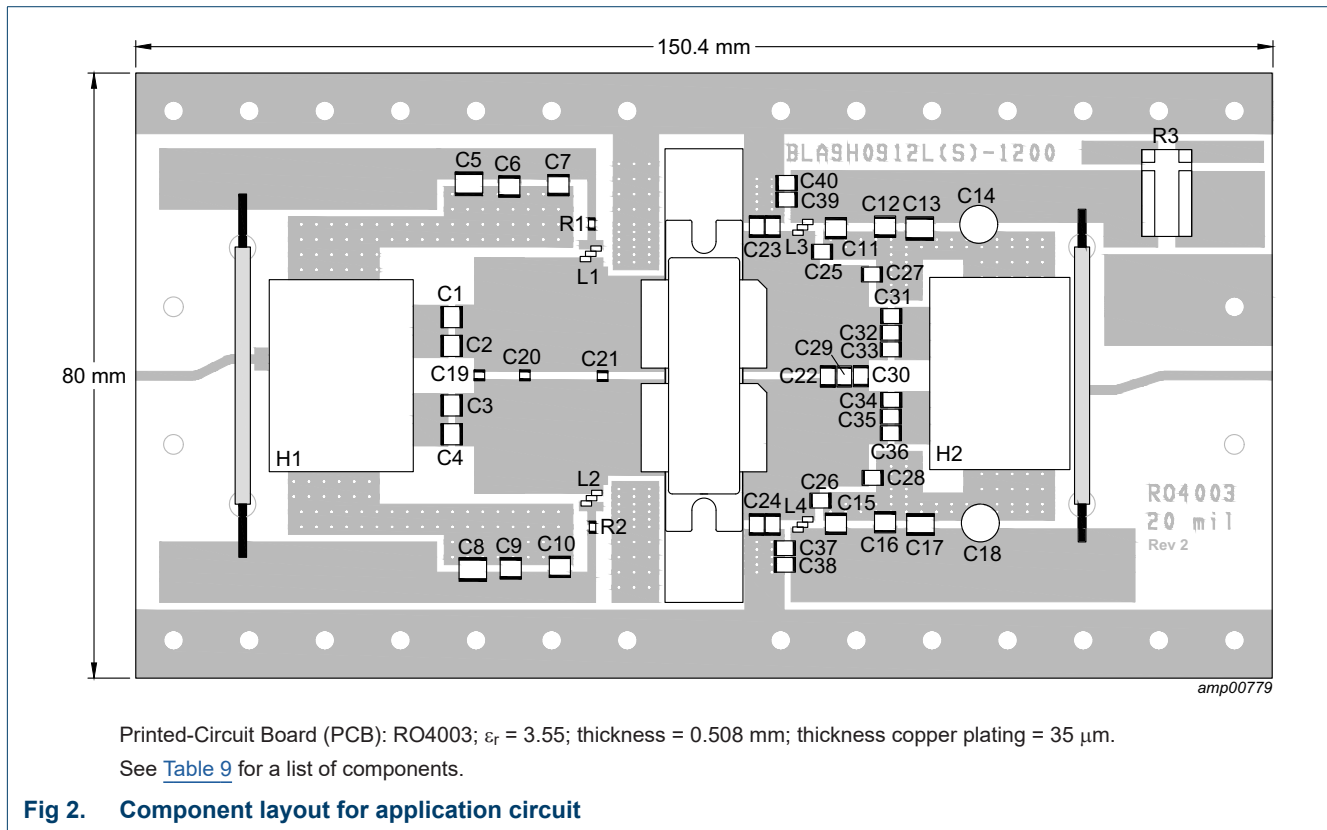


Fig 1. Definition of transistor impedance

### 7.3 Test circuit



**Table 9. List of components**

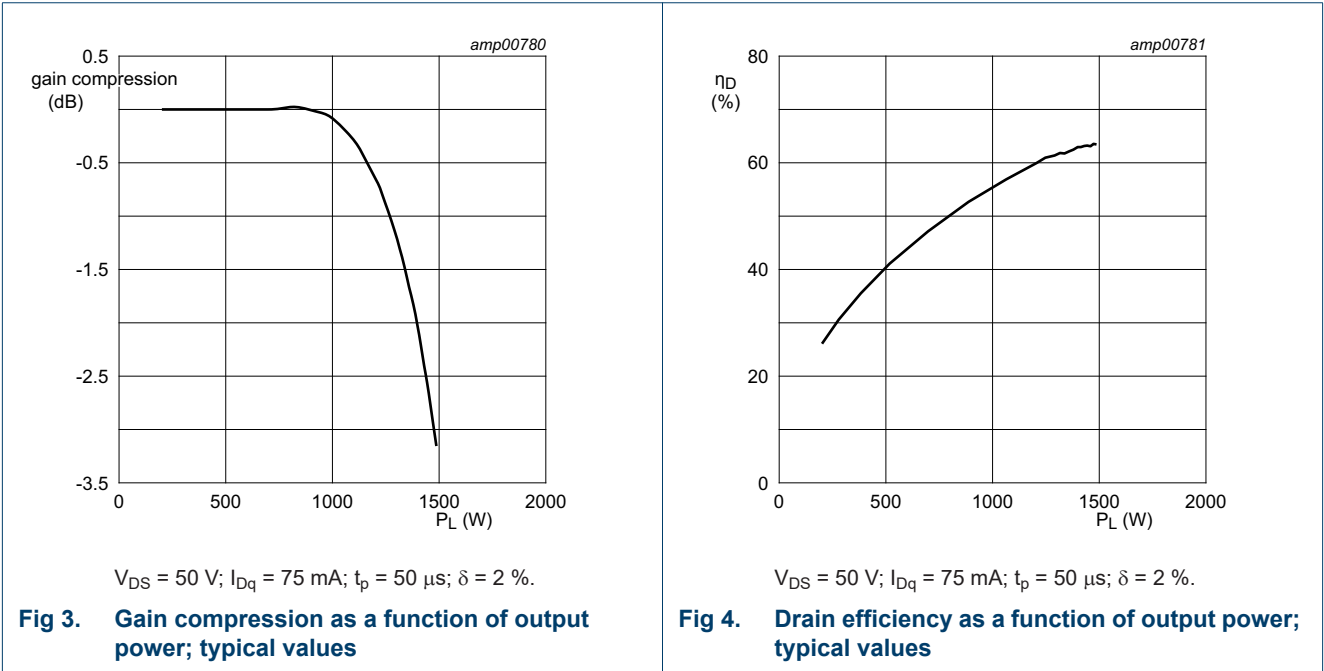
See [Figure 2](#) for component layout.

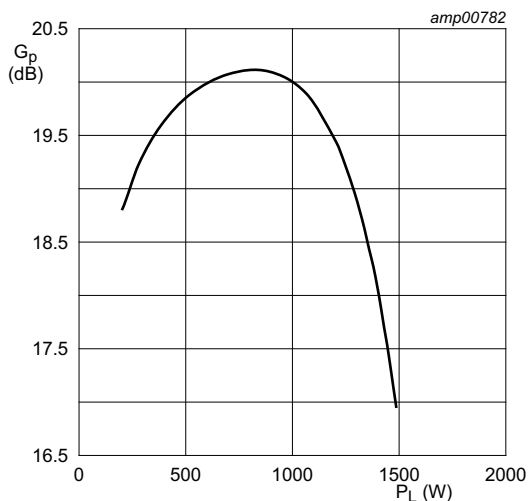
| Component                    | Description                       | Value                    | Remarks                    |
|------------------------------|-----------------------------------|--------------------------|----------------------------|
| C1, C2, C3, C4               | multilayer ceramic chip capacitor | 39 pF                    | ATC 100B                   |
| C5, C8, C13, C17             | multilayer ceramic chip capacitor | 10 $\mu\text{F}$         | Murata: GRM55DR61H106KA88L |
| C6, C9, C12, C16             | multilayer ceramic chip capacitor | 1 nF                     | ATC 100B                   |
| C7, C10, C11, C15            | multilayer ceramic chip capacitor | 51 pF                    | ATC 100B                   |
| C14, C18                     | electrolytic capacitor            | 100 $\mu\text{F}$ , 63 V |                            |
| C19, C20                     | multilayer ceramic chip capacitor | 0.5 pF                   | ATC 100A                   |
| C21                          | multilayer ceramic chip capacitor | 5.6 pF                   | ATC 100A                   |
| C22                          | multilayer ceramic chip capacitor | 3.0 pF                   | ATC 100B                   |
| C23a, C23b, C24a, C24b       | multilayer ceramic chip capacitor | 5.1 pF                   | ATC 800B                   |
| C25, C26, C27, C28           | multilayer ceramic chip capacitor | 2.4 pF                   | ATC 100B                   |
| C29                          | multilayer ceramic chip capacitor | 0.8 pF                   | ATC 100B                   |
| C30                          | multilayer ceramic chip capacitor | 1.6 pF                   | ATC 100B                   |
| C31, C32, C33, C34, C35, C36 | multilayer ceramic chip capacitor | 43 pF                    | ATC 100B                   |
| C37, C39                     | multilayer ceramic chip capacitor | 20 nF                    | ATC 200B                   |
| C38, C40                     | multilayer ceramic chip capacitor | 1 nF                     | ATC 200B                   |
| H1, H2                       | balun transformer                 |                          | Anaren: 3A412S             |

**Table 9.** List of components ...continued  
See [Figure 2](#) for component layout.

| Component | Description | Value                            | Remarks                  |
|-----------|-------------|----------------------------------|--------------------------|
| L1, L2    | inductor    | 27 nH                            | Coilcraft: 1111SQ-27NJEB |
| L3, L4    | inductor    | 1/2 turns, D = 1.5 mm,<br>8.9 nH | 8 mm copper wire         |
| R1, R2    | resistor    | 5 Ω                              | SMD 0603                 |
| R3        | resistor    | 5 mΩ                             | FC4L110R005FER           |

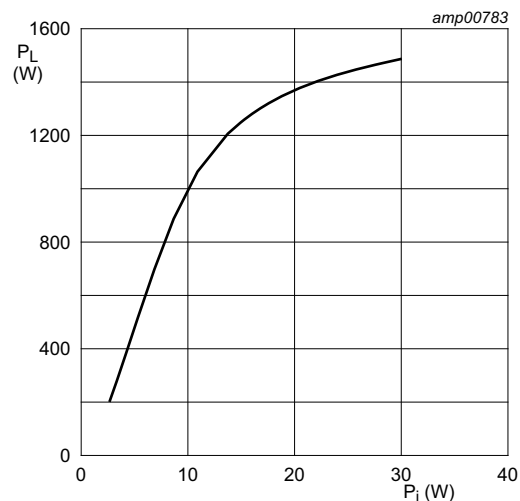
### 7.4 Graphical data





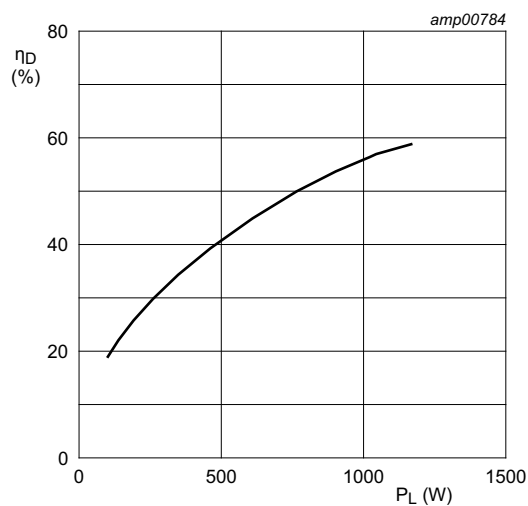
$V_{DS} = 50$  V;  $I_{Dq} = 75$  mA;  $t_p = 50$   $\mu$ s;  $\delta = 2$  %.

**Fig 5. Power gain as a function of output power; typical values**



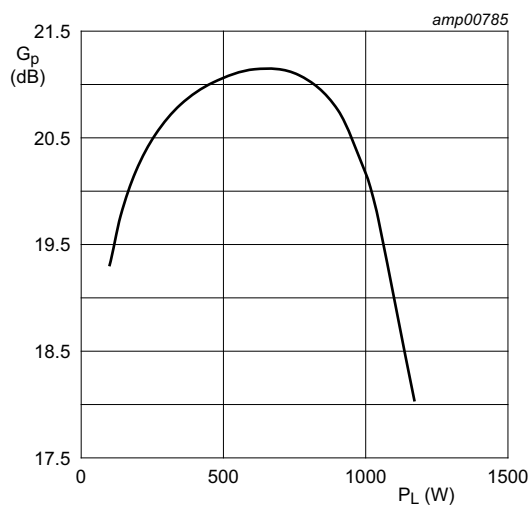
$V_{DS} = 50$  V;  $I_{Dq} = 75$  mA;  $t_p = 50$   $\mu$ s;  $\delta = 2$  %.

**Fig 6. Output power as a function of input power; typical values**



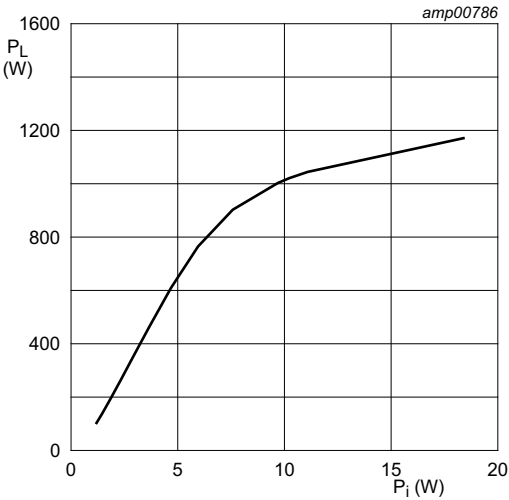
$V_{DS} = 50$  V;  $I_{Dq} = 200$  mA;  $t_p = 2.4$  ms;  $\delta = 6.4$  %.

**Fig 7. Drain efficiency as a function of output power; typical values**



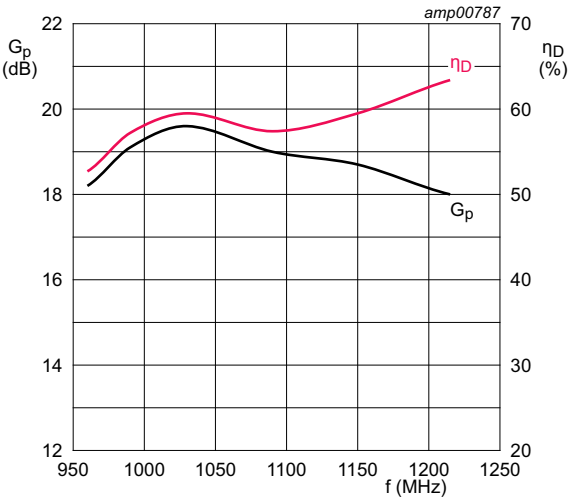
$V_{DS} = 50$  V;  $I_{Dq} = 200$  mA;  $t_p = 2.4$  ms;  $\delta = 6.4$  %.

**Fig 8. Power gain as a function of output power; typical values**



$V_{DS} = 50\text{ V}$ ;  $I_{Dq} = 200\text{ mA}$ ;  $t_p = 2.4\text{ ms}$ ;  $\delta = 6.4\text{ \%}$ .

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



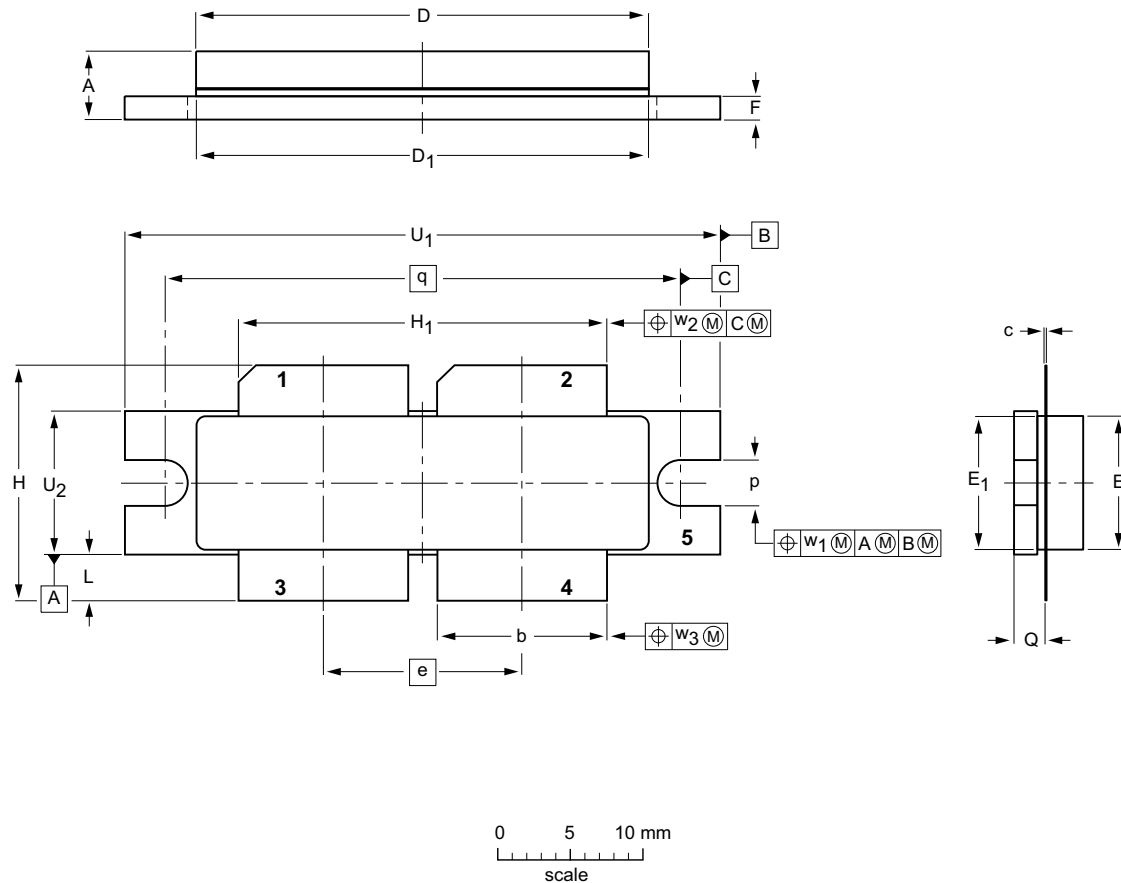
$V_{DS} = 51.6\text{ V}$ ;  $I_{Dq} = 100\text{ mA}$ ;  $P_L = P_{L(1\text{dB})} (>1050\text{ W})$ ;  
 $t_p = 50\text{ }\mu\text{s}$ ;  $\delta = 5\text{ \%}$ .  
Performance measured in a dedicated broadband fixture.

Fig 10. Power gain and drain efficiency as function of frequency; typical values

## 8. Package outline

Flanged balanced ceramic package; 2 mounting holes; 4 leads

SOT539A



**DIMENSIONS** (millimetre dimensions are derived from the original inch dimensions)

| UNIT   | A              | b              | c              | D              | D <sub>1</sub> | e     | E              | E <sub>1</sub> | F              | H              | H <sub>1</sub> | L              | p              | Q              | q     | U <sub>1</sub> | U <sub>2</sub> | w <sub>1</sub> | w <sub>2</sub> | w <sub>3</sub> |
|--------|----------------|----------------|----------------|----------------|----------------|-------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|-------|----------------|----------------|----------------|----------------|----------------|
| mm     | 4.7<br>4.2     | 11.81<br>11.56 | 0.18<br>0.10   | 31.55<br>30.94 | 31.52<br>30.96 | 13.72 | 9.50<br>9.30   | 9.53<br>9.27   | 1.75<br>1.50   | 17.12<br>16.10 | 25.53<br>25.27 | 3.48<br>2.97   | 3.30<br>3.05   | 2.26<br>2.01   | 35.56 | 41.28<br>41.02 | 10.29<br>10.03 | 0.25           | 0.51           | 0.25           |
| inches | 0.185<br>0.165 | 0.465<br>0.455 | 0.007<br>0.004 | 1.242<br>1.218 | 1.241<br>1.219 | 0.540 | 0.374<br>0.366 | 0.375<br>0.365 | 0.069<br>0.059 | 0.674<br>0.634 | 1.005<br>0.995 | 0.137<br>0.117 | 0.130<br>0.120 | 0.089<br>0.079 | 1.400 | 1.625<br>1.615 | 0.405<br>0.395 | 0.010          | 0.020          | 0.010          |

Note

1. millimeter dimensions are derived from the original inch dimensions.
2. recommended screw pitch dimension of 1.52 inch (38.6 mm) based on M3 screw.

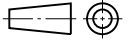
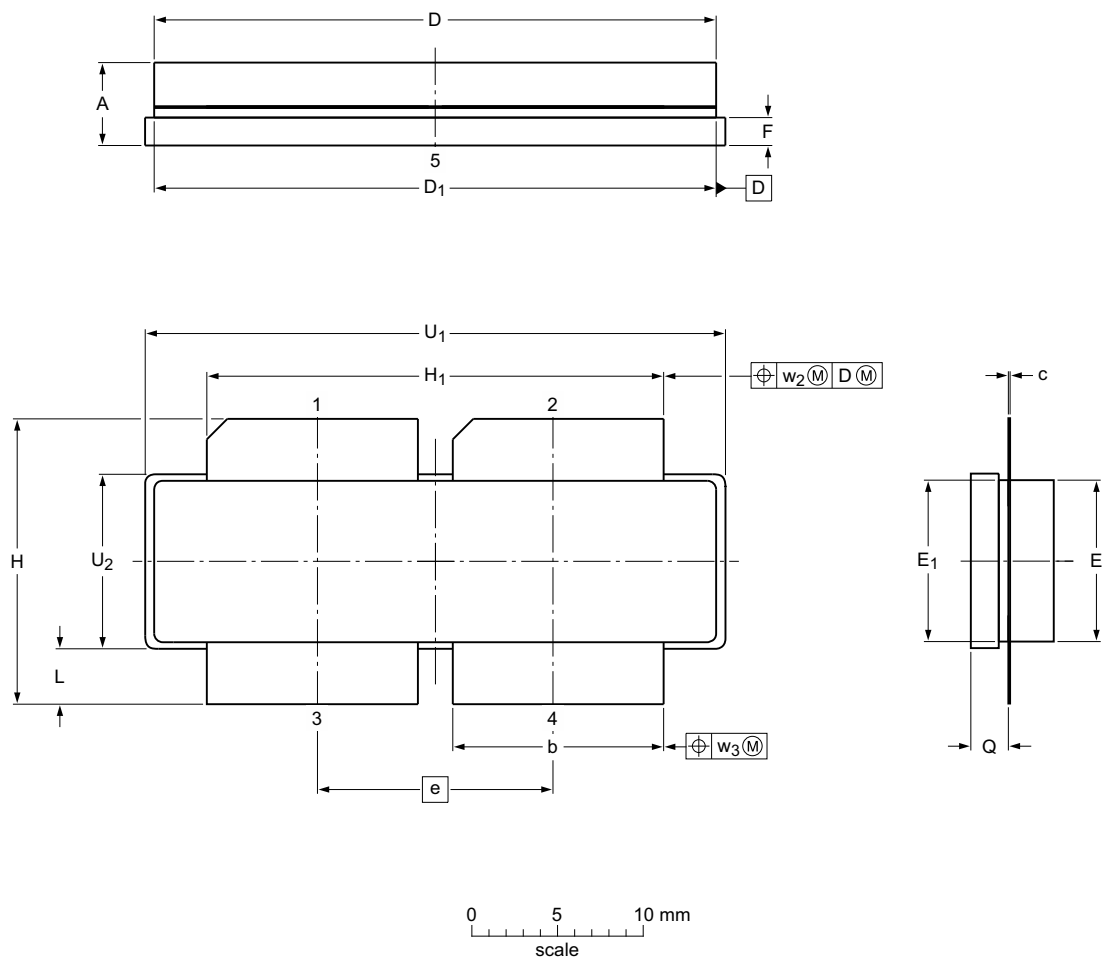
| OUTLINE<br>VERSION | REFERENCES |       |      |  | EUROPEAN<br>PROJECTION                                                                | ISSUE DATE                      |
|--------------------|------------|-------|------|--|---------------------------------------------------------------------------------------|---------------------------------|
|                    | IEC        | JEDEC | EIAJ |  |                                                                                       |                                 |
| SOT539A            |            |       |      |  |  | <del>10-02-02</del><br>12-05-02 |

Fig 11. Package outline SOT539A

Earless flanged balanced ceramic package; 4 leads

SOT539B



| Dimensions          |     |       |       |       |                |       |                |       |       |       |                |       |       |                |                |                |                |
|---------------------|-----|-------|-------|-------|----------------|-------|----------------|-------|-------|-------|----------------|-------|-------|----------------|----------------|----------------|----------------|
| Unit <sup>(1)</sup> | A   | b     | c     | D     | D <sub>1</sub> | E     | E <sub>1</sub> | e     | F     | H     | H <sub>1</sub> | L     | Q     | U <sub>1</sub> | U <sub>2</sub> | w <sub>2</sub> | w <sub>3</sub> |
| mm                  | max | 4.7   | 11.81 | 0.18  | 31.55          | 31.52 | 9.5            | 9.53  | 1.75  | 17.12 | 25.53          | 3.48  | 2.26  | 32.39          | 10.29          | 0.25           | 0.25           |
|                     | min | 4.2   | 11.56 | 0.10  | 30.94          | 30.96 | 9.3            | 9.27  | 1.50  | 16.10 | 25.27          | 2.97  | 2.01  | 32.13          | 10.03          |                |                |
| inches              | max | 0.185 | 0.465 | 0.007 | 1.242          | 1.241 | 0.374          | 0.375 | 0.069 | 0.674 | 1.005          | 0.137 | 0.089 | 1.275          | 0.405          | 0.01           | 0.01           |
|                     | min | 0.165 | 0.455 | 0.004 | 1.218          | 1.219 | 0.366          | 0.365 | 0.059 | 0.634 | 0.995          | 0.117 | 0.079 | 1.265          | 0.395          |                |                |

Note 1. millimeter dimensions are derived from the original inch dimensions. sot539b\_po

| Outline version | References |       |       |  | European projection | Issue date           |
|-----------------|------------|-------|-------|--|---------------------|----------------------|
|                 | IEC        | JEDEC | JEITA |  |                     |                      |
| SOT539B         |            |       |       |  |                     | 12-05-02<br>13-05-24 |

Fig 12. Package outline SOT539B

## 9. Handling information

### CAUTION



This device is sensitive to ElectroStatic Discharge (ESD). Observe precautions for handling electrostatic sensitive devices.

Such precautions are described in the *ANSI/ESD S20.20*, *IEC/ST 61340-5*, *JESD625-A* or equivalent standards.

**Table 10. ESD sensitivity**

| ESD model                                                                | Class                   |
|--------------------------------------------------------------------------|-------------------------|
| Charged Device Model (CDM); According to ANSI/ESDA/JEDEC standard JS-002 | C2A <a href="#">[1]</a> |
| Human Body Model (HBM); According to ANSI/ESDA/JEDEC standard JS-001     | 2 <a href="#">[2]</a>   |

[1] CDM classification C2A is granted to any part that passes after exposure to an ESD pulse of 500 V.

[2] HBM classification 2 is granted to any part that passes after exposure to an ESD pulse of 2000 V.

## 10. Abbreviations

**Table 11. Abbreviations**

| Acronym | Description                                  |
|---------|----------------------------------------------|
| ESD     | ElectroStatic Discharge                      |
| LDMOS   | Laterally Diffused Metal-Oxide Semiconductor |
| MTF     | Median Time to Failure                       |
| RoHS    | Restriction of Hazardous Substances          |
| SMD     | Surface Mounted Device                       |
| VSWR    | Voltage Standing Wave Ratio                  |

## 11. Revision history

**Table 12. Revision history**

| Document ID                   | Release date | Data sheet status  | Change notice | Supersedes |
|-------------------------------|--------------|--------------------|---------------|------------|
| BLA9H0912L-1200P_LS-1200P v.1 | 20181101     | Product 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".

[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.ampleon.com>.

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## 13. Contact information

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Date of release: 1 November 2018

Document identifier: BLA9H0912L-1200P\_LS-1200P