# BLF574

## HF / VHF power LDMOS transistor

Rev. 4 — 1 December 2016

AMPLEON

Product data sheet

# 1. Product profile

## 1.1 General description

A 500 W to 600 W LDMOS power transistor for broadcast applications and industrial applications in the HF to 500 MHz band.

**Table 1. Application information**

| Mode of operation | f | $V_{DS}$ | $P_L$ | $G_p$ | $\eta_D$ |
|---|---|---|---|---|---|
| | (MHz) | (V) | (W) | (dB) | (%) |
| CW | 225 | 50 | 500 | 26.5 | 70 |
| | 108 | 50 | 600 | 27.5 | 73 |

## 1.2 Features and benefits

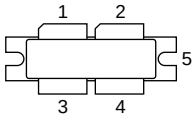
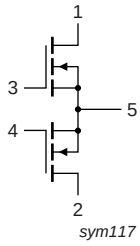
- Typical CW performance at frequency of 225 MHz, a supply voltage of 50 V and an $I_{Dq}$ of 1000 mA:
  - Average output power = 500 W
  - Power gain = 26.5 dB
  - Efficiency = 70 %
- Easy power control
- Integrated ESD protection
- Excellent ruggedness
- High efficiency
- Excellent thermal stability
- Designed for broadband operation (10 MHz to 500 MHz)
- Compliant to Directive 2002/95/EC, regarding Restriction of Hazardous Substances (RoHS)

## 1.3 Applications

- Industrial, scientific and medical applications
- Broadcast transmitter applications

## 2. Pinning information

**Table 2. Pinning**

| Pin | Description | Simplified outline | Graphic symbol |
|---|---|---|---|
| 1 | drain1 |  |  |
| 2 | drain2 | | |
| 3 | gate1 | | |
| 4 | gate2 | | |
| 5 | source [1] | | |





[1] Connected to flange.

## 3. Ordering information

**Table 3. Ordering information**

| Type number | Package | | |
|---|---|---|---|
| | Name | Description | Version |
| BLF574 | - | flanged balanced LDMOST ceramic package; 2 mounting holes; 4 leads | SOT539A |

## 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 | | - | 110 | V |
| $V_{GS}$ | gate-source voltage | | −0.5 | +11 | V |
| $I_D$ | drain current | | - | 56 | 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 | Unit |
|---|---|---|---|---|
| $R_{th(j-c)}$ | thermal resistance from junction to case | $T_{case}$ = 80 °C; $P_L$ = 400 W | 0.23 | K/W |

[1] $R_{th(j-c)}$ is measured under RF conditions.

# 6. Characteristics

**Table 6. DC characteristics**

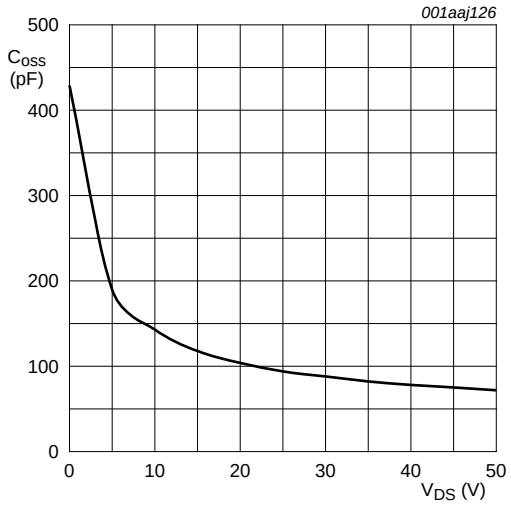
*$T_j$ = 25 °C; per section unless otherwise specified.*

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | drain-source breakdown voltage | $V_{GS}$ = 0 V; $I_D$ = 2.5 mA | 110 | - | - | V |
| $V_{GS(th)}$ | gate-source threshold voltage | $V_{DS}$ = 10 V; $I_D$ = 250 mA | 1.25 | 1.7 | 2.25 | V |
| $V_{GSq}$ | gate-source quiescent voltage | $V_{DS}$ = 50 V; $I_D$ = 500 mA | 1.35 | 1.85 | 2.35 | V |
| $I_{DSS}$ | drain leakage current | $V_{GS}$ = 0 V; $V_{DS}$ = 50 V | - | - | 2.8 | µA |
| $I_{DSX}$ | drain cut-off current | $V_{GS}$ = $V_{GS(th)}$ + 3.75 V; $V_{DS}$ = 10 V | 29 | 37.5 | - | A |
| $I_{GSS}$ | gate leakage current | $V_{GS}$ = 11 V; $V_{DS}$ = 0 V | - | - | 280 | nA |
| $g_{fs}$ | forward transconductance | $V_{DS}$ = 10 V; $I_D$ = 12.5 A | - | 17 | - | S |
| $R_{DS(on)}$ | drain-source on-state resistance | $V_{GS}$ = $V_{GS(th)}$ + 3.75 V; $I_D$ = 8.33 A | - | 0.14 | - | Ω |
| $C_{rs}$ | feedback capacitance | $V_{GS}$ = 0 V; $V_{DS}$ = 50 V; f = 1 MHz | - | 1.5 | - | pF |
| $C_{iss}$ | input capacitance | $V_{GS}$ = 0 V; $V_{DS}$ = 50 V; f = 1 MHz | - | 204 | - | pF |
| $C_{oss}$ | output capacitance | $V_{GS}$ = 0 V; $V_{DS}$ = 50 V; f = 1 MHz | - | 72 | - | pF |

**Table 7. RF characteristics**

*Mode of operation: CW; f = 225 MHz; RF performance at $V_{DS}$ = 50 V; $I_{Dq}$ = 1000 mA for total device; $T_{case}$ = 25 °C; unless otherwise specified; in a class-AB production test circuit.*

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $G_p$ | power gain | $P_L$ = 400 W | 25 | 26.5 | 28 | dB |
| $RL_{in}$ | input return loss | $P_L$ = 400 W | 13 | 20 | - | dB |
| $\eta_D$ | drain efficiency | $P_L$ = 400 W | 66 | 70 | - | % |




$V_{GS}$ = 0 V; f = 1 MHz.

**Fig 1. Output capacitance as a function of drain-source voltage; typical values per section**

## 6.1 Ruggedness in class-AB operation

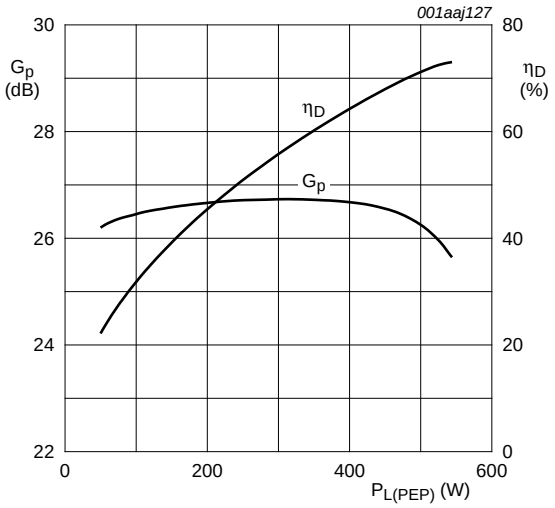
The BLF574 is capable of withstanding a load mismatch corresponding to VSWR = 13 : 1 through all phases under the following conditions: $V_{DS}$ = 50 V; $I_{Dq}$ = 1000 mA; $P_L$ = 400 W; f = 225 MHz.

# 7. Application information

## 7.1 RF performance

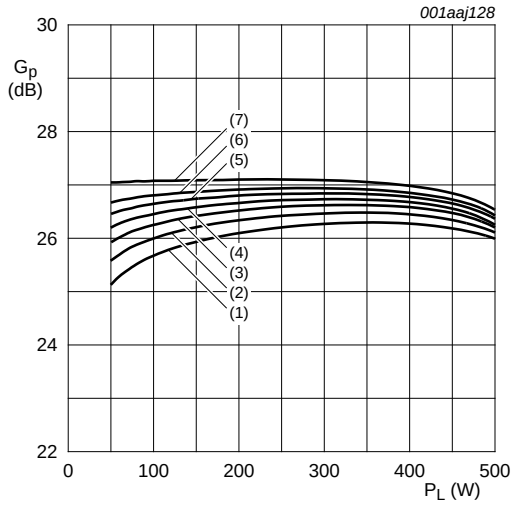
RF performance in a 500 W application circuit at 225 MHz.

### 7.1.1 1-Tone CW




$V_{DS}$ = 50 V; $I_{Dq}$ = 1000 mA; f = 225 MHz.

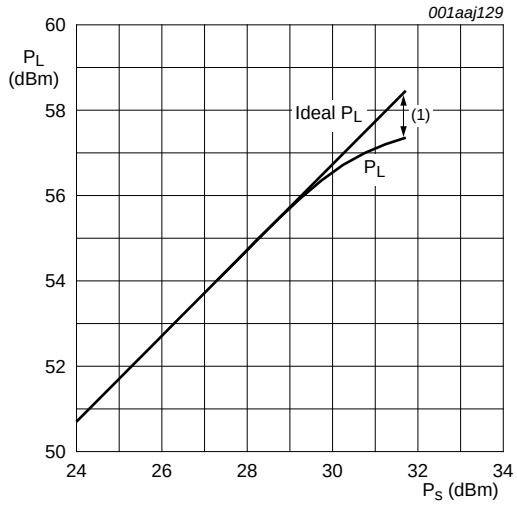
**Fig 2. Power gain and drain efficiency as functions of load power; typical values**




$V_{DS}$ = 50 V; f = 225 MHz.

(1) $I_{Dq}$ = 400 mA
(2) $I_{Dq}$ = 600 mA
(3) $I_{Dq}$ = 800 mA
(4) $I_{Dq}$ = 1000 mA
(5) $I_{Dq}$ = 1200 mA
(6) $I_{Dq}$ = 1400 mA
(7) $I_{Dq}$ = 1800 mA

**Fig 3. Power gain as function of load power; typical values**

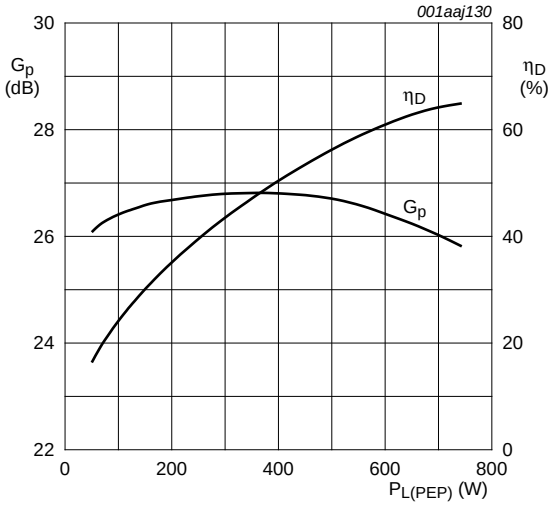



$V_{DS}$ = 50 V; $I_{Dq}$ = 1000 mA; f = 225 MHz.

(1) $P_{L(1dB)}$ = 57.32 dBm (540 W)

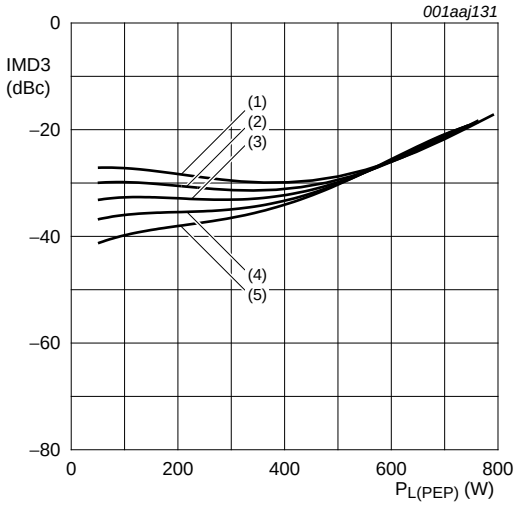
**Fig 4. Load power as function of source power; typical values**

### 7.1.2 2-Tone CW




$V_{DS}$ = 50 V; $I_{Dq}$ = 1000 mA; $f_1$ = 224.95 MHz; $f_2$ = 225.05 MHz.

**Fig 5. Power gain and drain efficiency as functions of peak envelope load power; typical values**




$V_{DS}$ = 50 V; $f_1$ = 224.95 MHz; $f_2$ = 225.05 MHz.

(1) $I_{Dq}$ = 600 mA

(2) $I_{Dq}$ = 800 mA

(3) $I_{Dq}$ = 1000 mA

(4) $I_{Dq}$ = 1200 mA

(5) $I_{Dq}$ = 1400 mA

**Fig 6. Third order intermodulation distortion as a function of peak envelope load power; typical values**

### 7.1.3 Application circuit

**Table 8. List of components**

*For application circuit, see Figure 7.*
*Printed-Circuit Board (PCB): Rogers 5880; $\varepsilon_r$ = 2.2 F/m; height = 0.79 mm; Cu (top/bottom metallization); thickness copper plating = 35 $\mu$m.*

| Component | Description | Value | Remarks |
|---|---|---|---|
| C1, C2, C23, C24 | multilayer ceramic chip capacitor | 100 pF [1] | |
| C3 | multilayer ceramic chip capacitor | 24 pF [1] | |
| C4, C5 | multilayer ceramic chip capacitor | 39 pF [1] | |
| C6, C9 | multilayer ceramic chip capacitor | 4.7 μF | TDK4532X7R1E475Mt020U |
| C7, C8, C10, C11 | multilayer ceramic chip capacitor | 1 nF [1] | |
| C12, C16 | electrolytic capacitor | 220 μF; 63 V | |
| C13, C15 | multilayer ceramic chip capacitor | 62 pF [1] | |
| C14 | multilayer ceramic chip capacitor | 15 pF [1] | |
| C17, C19 | multilayer ceramic chip capacitor | 47 pF [1] | |
| C18 | multilayer ceramic chip capacitor | 33 pF [1] | |
| C20, C22 | multilayer ceramic chip capacitor | 10 pF [1] | |
| C21 | multilayer ceramic chip capacitor | 18 pF [1] | |
| L1, L2, L3, L4 | 3 turns 1 mm copper wire | D = 3 mm; length = 3 mm | |
| L5, L6 | stripline | - | (L × W) 125 mm × 7 mm |
| L7, L8, L9, L10 | stripline | - | (L × W) 8 mm × 15 mm |
| L11, L12 | stripline | - | (L × W) 132 mm × 7 mm |
| R1, R2 | metal film resistor | 10 Ω; 0.6 W | |
| R3, R4 | metal film resistor | 3 Ω; 0.6 W | |
| T1, T2, T3, T4 | semi rigid coax | 50 Ω; 120 mm | EZ-141-AL-TP-M17 |

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

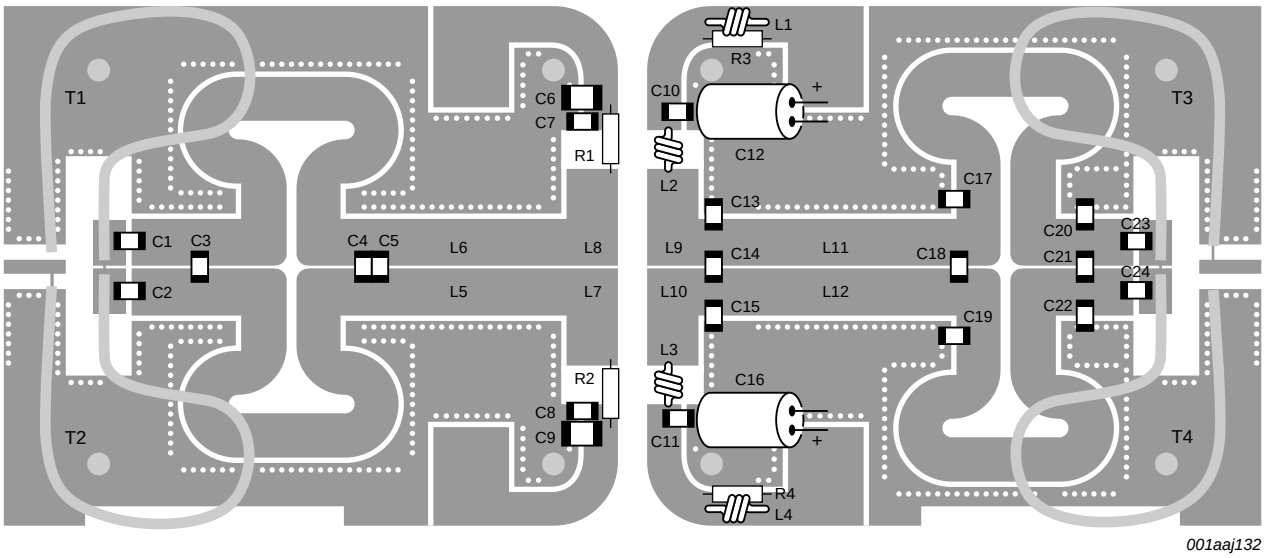
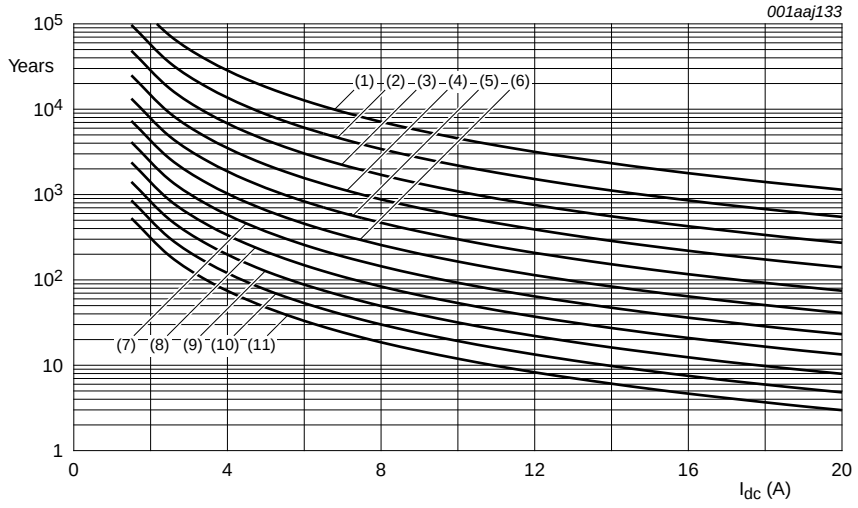



**Fig 7. Component layout for class-AB application circuit**

## 7.2 Reliability




TTF (0.1 % failure fraction).

(1) $T_j$ = 100 °C
(2) $T_j$ = 110 °C
(3) $T_j$ = 120 °C
(4) $T_j$ = 130 °C
(5) $T_j$ = 140 °C
(6) $T_j$ = 150 °C
(7) $T_j$ = 160 °C
(8) $T_j$ = 170 °C
(9) $T_j$ = 180 °C
(10) $T_j$ = 190 °C
(11) $T_j$ = 200 °C

**Fig 8. BLF574 electromigration ($I_D$, total device)**

# 8. Test information

## 8.1 Impedance information

**Table 9. Typical impedance**

*Simulated $Z_S$ and $Z_L$ test circuit impedances.*

| f | $Z_S$ | $Z_L$ |
|---|---|---|
| **MHz** | **Ω** | **Ω** |
| 225 | 3.2 + j2.5 | 7.5 + j4.0 |

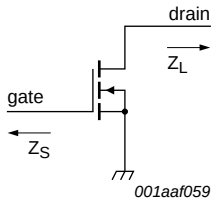
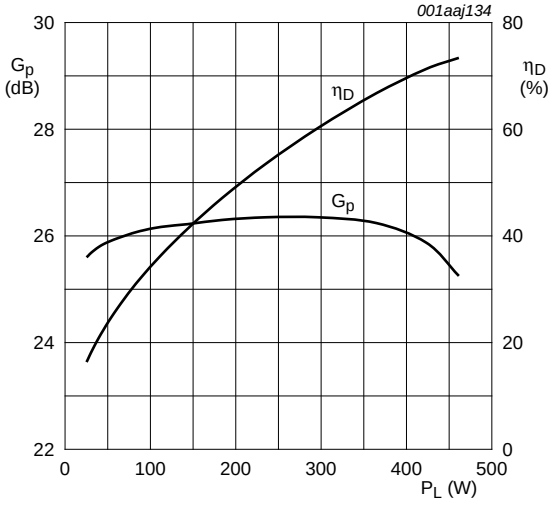



**Fig 9. Definition of transistor impedance**

## 8.2 RF performance

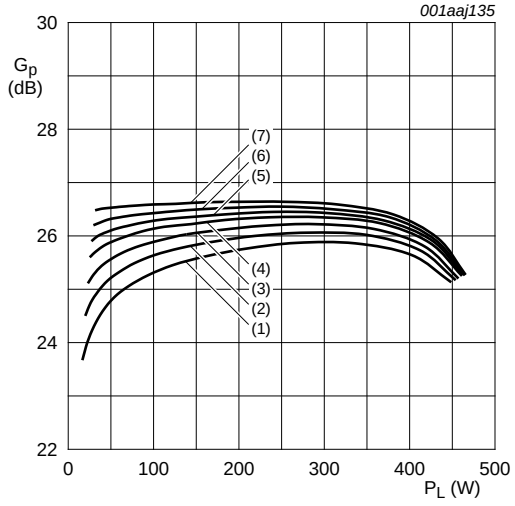
The following figures are measured in a class-AB production test circuit.

### 8.2.1 1-Tone CW




$V_{DS}$ = 50 V; $I_{Dq}$ = 1000 mA; f = 225 MHz.

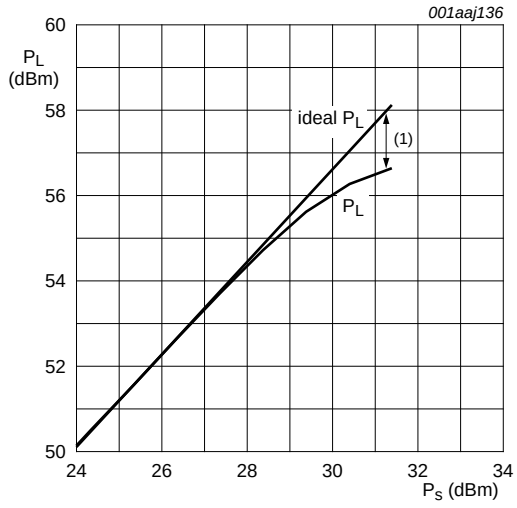
**Fig 10. Power gain and drain efficiency as functions of load power; typical values**




$V_{DS}$ = 50 V; f = 225 MHz.

(1) $I_{Dq}$ = 400 mA
(2) $I_{Dq}$ = 600 mA
(3) $I_{Dq}$ = 800 mA
(4) $I_{Dq}$ = 1000 mA
(5) $I_{Dq}$ = 1200 mA
(6) $I_{Dq}$ = 1400 mA
(7) $I_{Dq}$ = 1800 mA

**Fig 11. Power gain as function of load power; typical values**

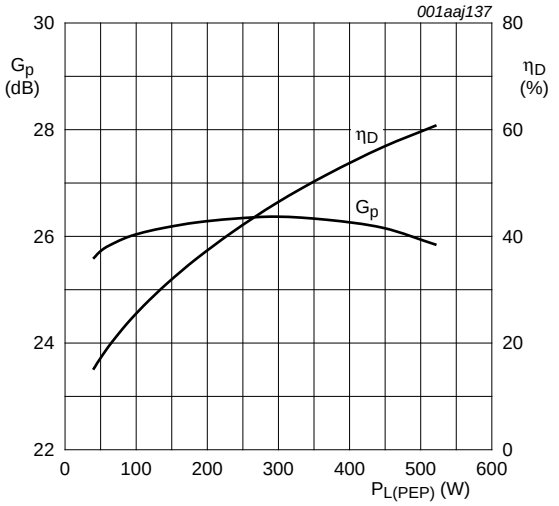



$V_{DS}$ = 50 V; $I_{Dq}$ = 1000 mA; f = 225 MHz.

(1) $P_{L(1dB)}$ = 56.43 dBm (440 W)

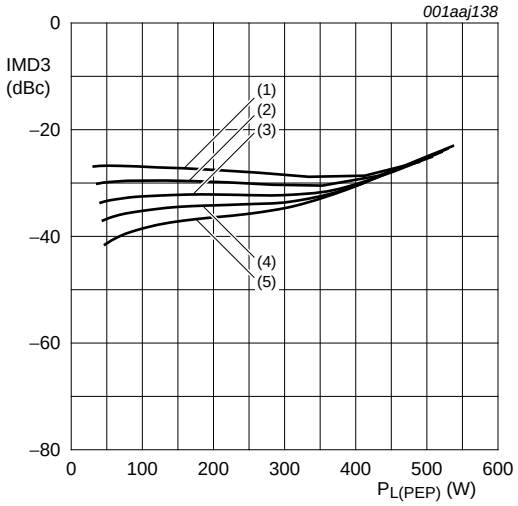
**Fig 12. Load power as function of source power; typical values**

### 8.2.2 2-Tone CW




$V_{DS}$ = 50 V; $I_{Dq}$ = 1000 mA; $f_1$ = 224.95 MHz; $f_2$ = 225.05 MHz.

**Fig 13. Power gain and drain efficiency as functions of peak envelope load power; typical values**




$V_{DS}$ = 50 V; $f_1$ = 224.95 MHz; $f_2$ = 225.05 MHz.

(1) $I_{Dq}$ = 600 mA

(2) $I_{Dq}$ = 800 mA

(3) $I_{Dq}$ = 1000 mA

(4) $I_{Dq}$ = 1200 mA

(5) $I_{Dq}$ = 1400 mA

**Fig 14. Third order intermodulation distortion as a function of peak envelope load power; typical values**

### 8.2.3 Test circuit

**Table 10. List of components**

*For production test circuit, see Figure 15 and Figure 16.*
*Printed-Circuit Board (PCB): Rogers 5880; $\varepsilon_r$ = 2.2 F/m; height = 0.79 mm; Cu (top/bottom metallization); thickness copper plating = 35 $\mu$m.*

| Component | Description | Value | Remarks |
|---|---|---|---|
| C1, C2, C20, C21 | multilayer ceramic chip capacitor | 100 pF [1] | |
| C3 | multilayer ceramic chip capacitor | 24 pF [1] | |
| C4, C5 | multilayer ceramic chip capacitor | 39 pF [1] | |
| C6, C7, C10, C11 | multilayer ceramic chip capacitor | 1 nF [1] | |
| C8, C9 | multilayer ceramic chip capacitor | 4.7 $\mu$F [1] | TDK4532X7R1E475Mt020U |
| C12, C13 | electrolytic capacitor | 220 $\mu$F; 63 V | |
| C14, C15 | multilayer ceramic chip capacitor | 47 pF [1] | |
| C16 | multilayer ceramic chip capacitor | 33 pF [1] | |
| C17 | multilayer ceramic chip capacitor | 18 pF [1] | |
| C18, C19 | multilayer ceramic chip capacitor | 10 pF [1] | |
| C22 | multilayer ceramic chip capacitor | 15 pF [1] | |
| C23, C24 | multilayer ceramic chip capacitor | 62 pF [1] | |
| L1, L2, L3, L4 | 3 turns 1 mm copper wire | D = 3 mm; length = 2 mm | |
| L5, L6 | stripline | - | (L $\times$ W) 125 mm $\times$ 7 mm |
| L7, L8, L9, L10 | stripline | - | (L $\times$ W) 8 mm $\times$ 15 mm |
| L11, L12 | stripline | - | (L $\times$ W) 132 mm $\times$ 7 mm |
| R1, R2 | metal film resistor | 10 $\Omega$; 0.6 W | |
| R3, R4 | metal film resistor | 3 $\Omega$; 0.6 W | |
| T1, T2, T3, T4 | semi rigid coax | 50 $\Omega$; 120 mm | EZ-141-AL-TP-M17 |

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

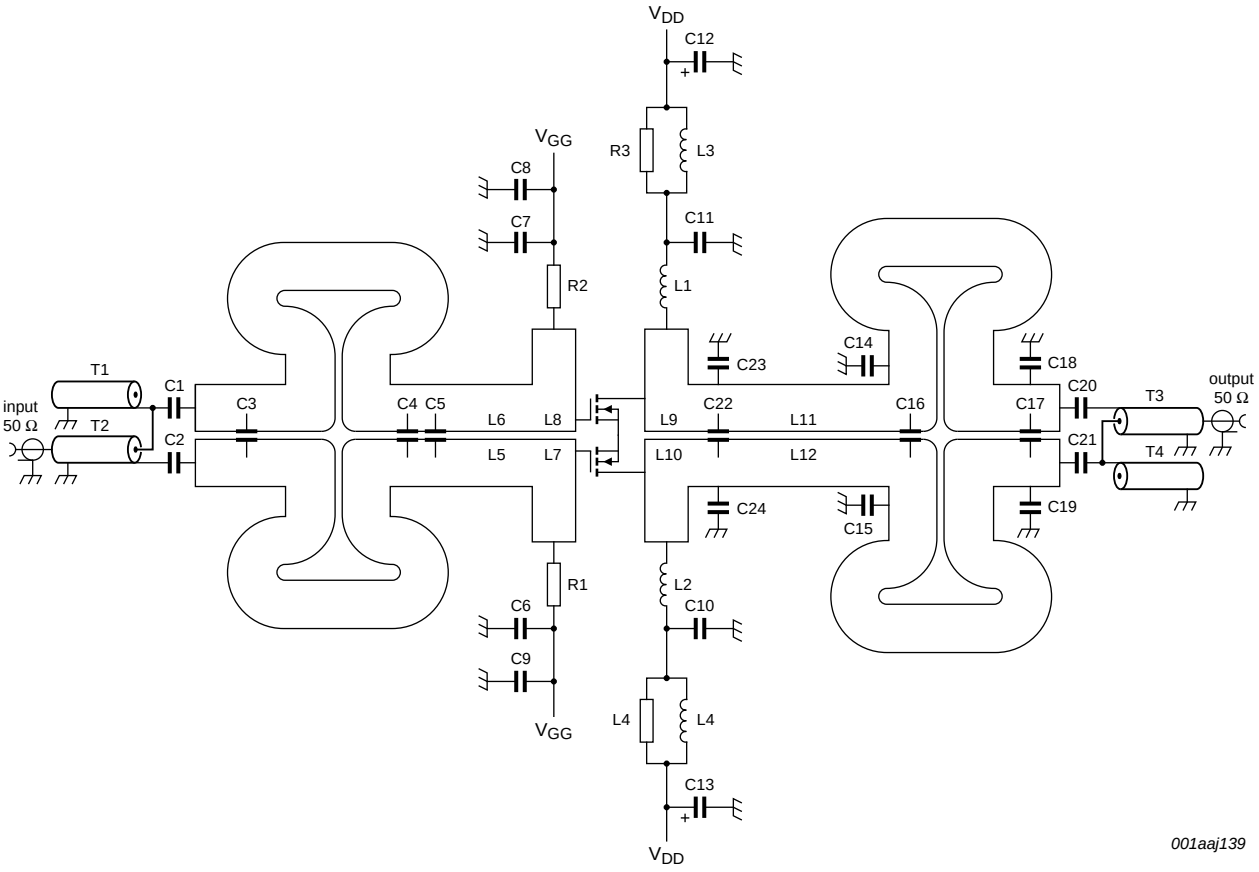



**Fig 15. Class-AB common-source production test circuit**

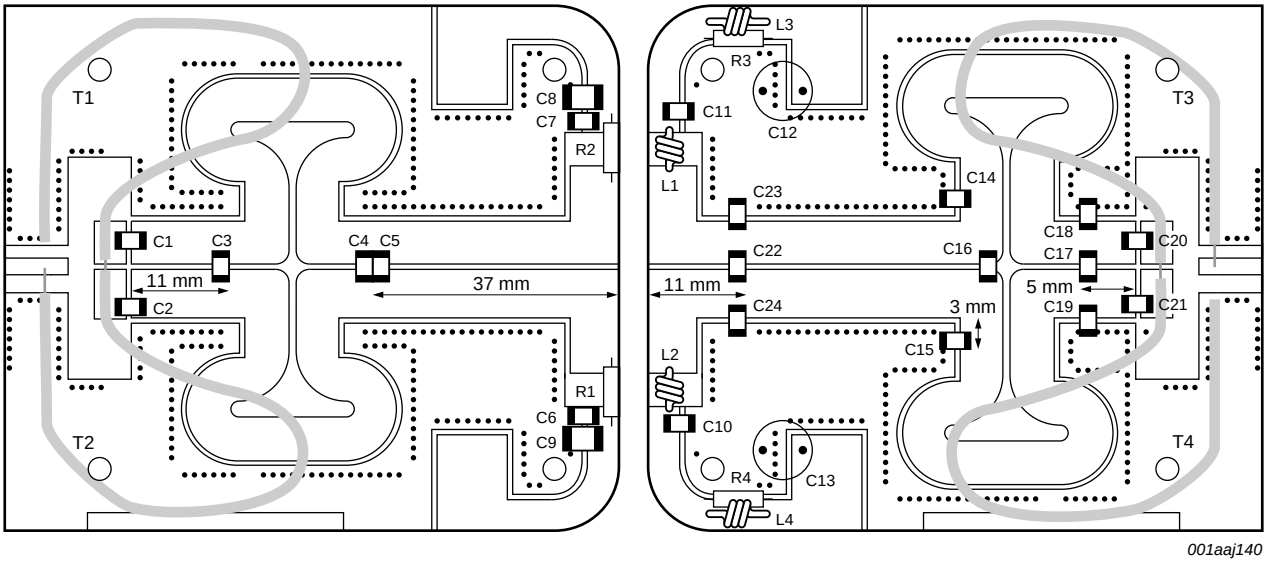
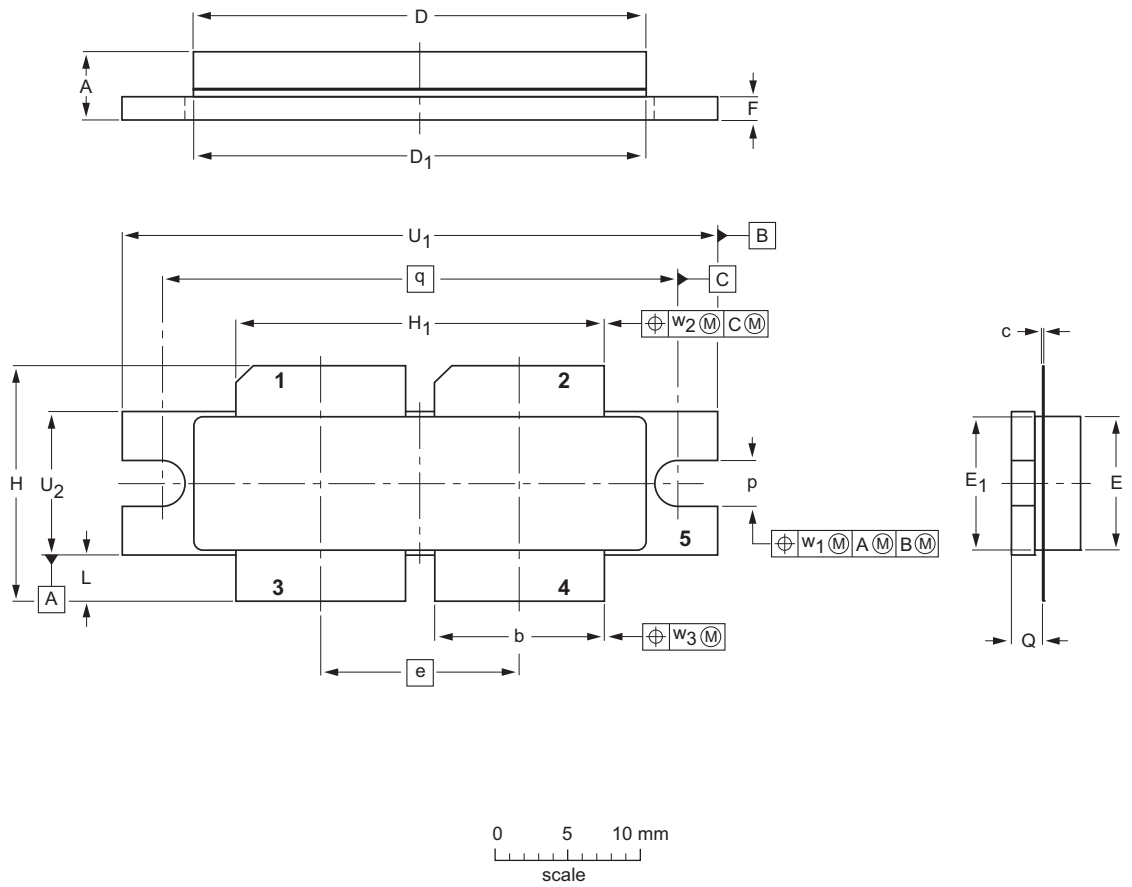



**Fig 16. Component layout for class-AB production test circuit**

# 9. 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 | $D_1$ | e | E | $E_1$ | F | H | $H_1$ | L | p | Q | q | $U_1$ | $U_2$ | $w_1$ | $w_2$ | $w_3$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | EIAJ | | | |
| SOT539A | | | | | | ~~10-02-02~~<br>12-05-02 |

**Fig 17. Package outline SOT539A**

## 10. 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 11. ESD sensitivity**

| ESD model | Class |
|---|---|
| Human Body Model (HBM); According to ANSI/ESDA/JEDEC standard JS-001 | 2 [1] |

[1] HBM classification 2 is granted to any part that passes after exposure to an ESD pulse of 2000 V, but fails after exposure to an ESD pulse of 4000 V.

## 11. Abbreviations

**Table 12. Abbreviations**

| Acronym | Description |
|---|---|
| CW | Continuous Wave |
| EDGE | Enhanced Data rates for GSM Evolution |
| GSM | Global System for Mobile communications |
| HF | High Frequency |
| LDMOS | Laterally Diffused Metal-Oxide Semiconductor |
| LDMOST | Laterally Diffused Metal-Oxide Semiconductor Transistor |
| RF | Radio Frequency |
| TTF | Time To Failure |
| VHF | Very High Frequency |
| VSWR | Voltage Standing-Wave Ratio |

## 12. Revision history

**Table 13. Revision history**

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| BLF574 v.4 | 20161201 | Product data sheet | - | BLF574_3 |
| Modifications: | • Section 10 on page 16: updated Handling information | | | |
| BLF574_3 | 20150901 | Product data sheet | - | BLF574_2 |
| BLF574_2 | 20090224 | Product data sheet | - | BLF574_1 |
| BLF574_1 | 20081208 | Preliminary data sheet | - | - |

# 13. Legal information

## 13.1 Data sheet status

| Document status[1][2] | Product status[3] | 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.

## 13.2 Definitions

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## 14. Contact information

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For sales office addresses, please visit: **http://www.ampleon.com/sales**

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