

# BLF369

Multi-use VHF power LDMOS transistor

Rev. 5 — 1 September 2015

AMMPLÉON

Product data sheet

## 1. Product profile

### 1.1 General description

A general purpose 500 W LDMOS RF power transistor for pulsed and continuous wave applications in the HF/VHF band up to 500 MHz.

**Table 1. Typical performance**

Typical RF performance at  $V_{DS} = 32$  V and  $T_h = 25$  °C in a common-source 225 MHz test circuit.<sup>[1]</sup>

Mode of operation	f (MHz)	P <sub>L</sub> (W)	P <sub>L(PEP)</sub> (W)	G <sub>p</sub> (dB)	η <sub>D</sub> (%)	IMD3 (dBc)
CW, class AB	225	500	-	18	60	-
2-tone, class AB	f <sub>1</sub> = 225; f <sub>2</sub> = 225.1	-	500	19	47	-28
pulsed, class AB <sup>[2]</sup>	225	500	-	19	55	-

[1] T<sub>h</sub> is the heatsink temperature.

[2] t<sub>p</sub> = 2 ms; δ = 10 %.

#### CAUTION



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

### 1.2 Features

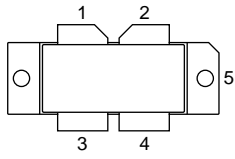
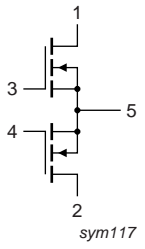
- Typical pulsed performance at 225 MHz, a drain-source voltage V<sub>DS</sub> of 32 V and a quiescent drain current I<sub>Dq</sub> = 2 × 1.0 A:
  - ◆ Load power P<sub>L</sub> = 500 W
  - ◆ Power gain G<sub>p</sub> = 19 dB
  - ◆ Drain efficiency η<sub>D</sub> = 55 %
- Advanced flange material for optimum thermal behavior and reliability
- Excellent ruggedness
- High power gain
- Designed for broadband operation (HF/VHF band)
- Source on underside eliminates DC isolators, reducing common-mode inductance
- Easy power control
- Integrated ESD protection
- Compliant to Directive 2002/95/EC, regarding Restriction of Hazardous Substances (RoHS), using exemption No. 7 of the annex

### 1.3 Applications

- Pulsed applications up to 500 MHz
- Communication transmitter applications in the HF/VHF/UHF band under specific conditions
- Industrial applications up to 500 MHz under special conditions

## 2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Graphic symbol
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
BLF369	-	flanged LDMOST ceramic package; 2 mounting holes; 4 leads	SOT800-2

## 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		-	65	V
$V_{GS}$	gate-source voltage		-0.5	+13	V
$T_{stg}$	storage temperature		-65	+150	°C
$T_j$	junction temperature		-	200	°C

## 5. Thermal characteristics

**Table 5. Thermal characteristics**

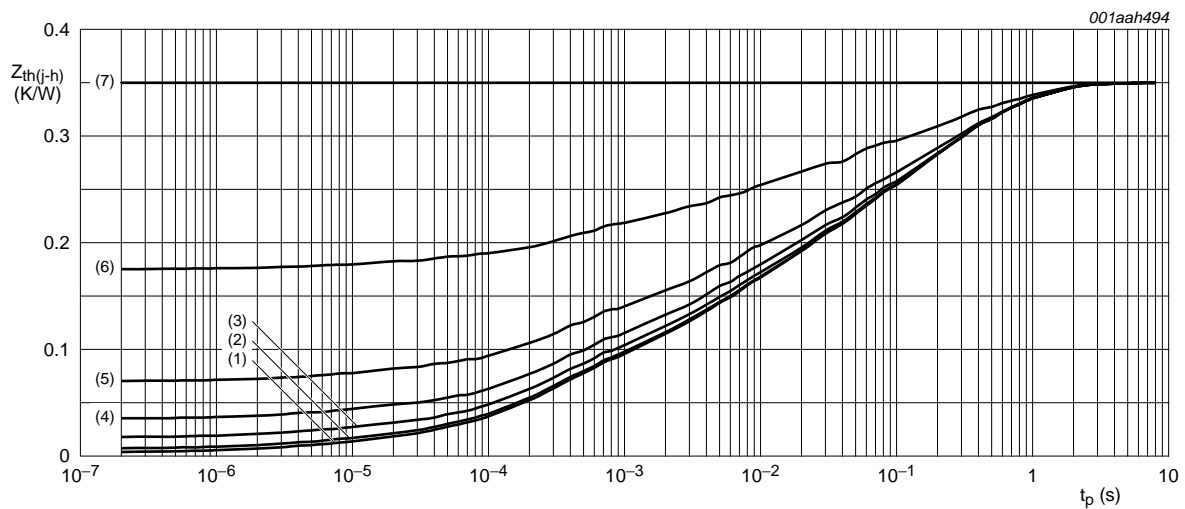
Symbol	Parameter	Conditions	Typ	Unit
$R_{th(j-case)}$	thermal resistance from junction to case	$T_j = 200\text{ }^\circ\text{C}$	[1][2]	0.26 K/W
$R_{th(j-h)}$	thermal resistance from junction to heatsink	$T_j = 200\text{ }^\circ\text{C}$	[1][2][3]	0.35 K/W
$Z_{th(j-h)}$	transient thermal impedance from junction to heatsink	$T_j = 200\text{ }^\circ\text{C}$		
		$t_p = 100\text{ }\mu\text{s}; \delta = 10\text{ }\%$	[4]	0.063 K/W
		$t_p = 1\text{ ms}; \delta = 10\text{ }\%$	[4]	0.117 K/W
		$t_p = 2\text{ ms}; \delta = 10\text{ }\%$	[4]	0.133 K/W
		$t_p = 3\text{ ms}; \delta = 10\text{ }\%$	[4]	0.142 K/W
		$t_p = 1\text{ ms}; \delta = 20\text{ }\%$	[4]	0.140 K/W

[1]  $T_j$  is the junction temperature.

[2]  $R_{th(j-case)}$  and  $R_{th(j-h)}$  are measured under RF conditions.

[3]  $R_{th(j-h)}$  is dependent on the applied thermal compound and clamping/mounting of the device.

[4] See [Figure 1](#).



- (1)  $\delta = 1\text{ }\%$
- (2)  $\delta = 2\text{ }\%$
- (3)  $\delta = 5\text{ }\%$
- (4)  $\delta = 10\text{ }\%$
- (5)  $\delta = 20\text{ }\%$
- (6)  $\delta = 50\text{ }\%$
- (7)  $\delta = 100\text{ }\%$  (DC)

**Fig 1. Transient thermal impedance from junction to heatsink as function of pulse duration**

## 6. Characteristics

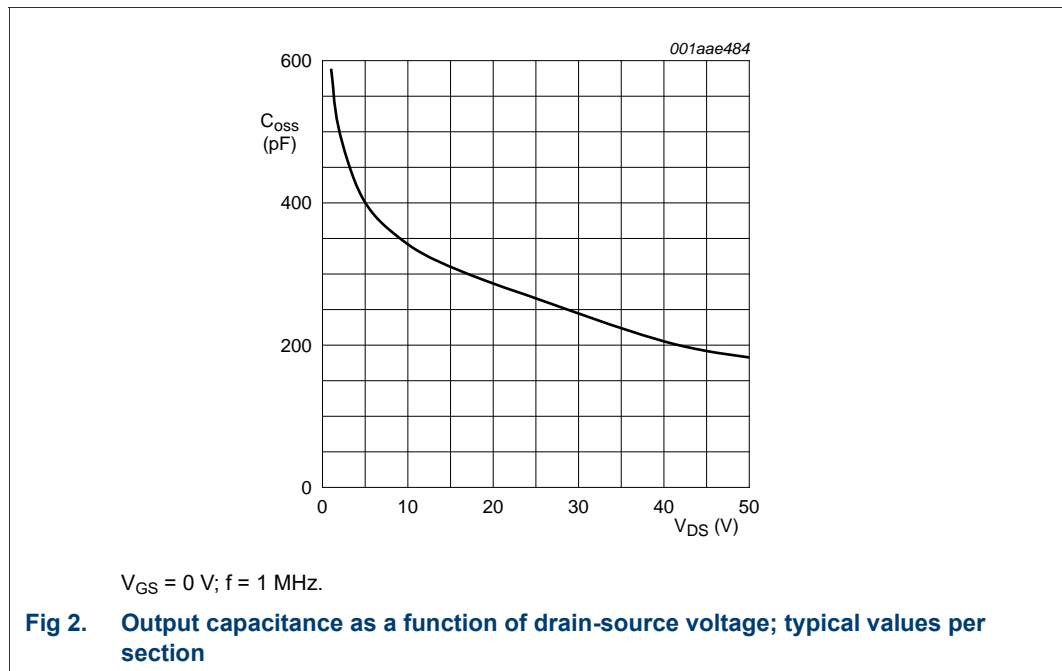
**Table 6. Characteristics**

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{(BR)DSS}$	drain-source breakdown voltage	$V_{GS} = 0\text{ V}; I_D = 6\text{ mA}$	[1]	65	-	V
$V_{GS(th)}$	gate-source threshold voltage	$V_{DS} = 20\text{ V}; I_D = 600\text{ mA}$	[1]	4	5.5	V
$I_{DSS}$	drain leakage current	$V_{GS} = 0\text{ V}; V_{DS} = 32\text{ V}$	-	-	4.2	$\mu\text{A}$
$I_{DSX}$	drain cut-off current	$V_{GS} = V_{GS(th)} + 9\text{ V}; V_{DS} = 10\text{ V}$	-	100	-	A
$I_{GSS}$	gate leakage current	$V_{GS} = 20\text{ V}; V_{DS} = 0\text{ V}$	-	-	60	nA
$g_{fs}$	forward transconductance	$V_{GS} = 20\text{ V}; I_D = 13\text{ A}$	[1]	15	-	S
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = V_{GS(th)} + 9\text{ V}; I_D = 13\text{ A}$	[1]	40	-	$\text{m}\Omega$
$C_{iss}$	input capacitance	$V_{GS} = 0\text{ V}; V_{DS} = 32\text{ V}; f = 1\text{ MHz}$	[2]	400	-	pF
$C_{oss}$	output capacitance	$V_{GS} = 0\text{ V}; V_{DS} = 32\text{ V}; f = 1\text{ MHz}$	[2]	230	-	pF
$C_{rss}$	reverse transfer capacitance	$V_{GS} = 0\text{ V}; V_{DS} = 32\text{ V}; f = 1\text{ MHz}$	-	15	-	pF

[1]  $I_D$  is the drain current.

[2]  $C_{iss}$  and  $C_{oss}$  include reverse transfer capacitance ( $C_{rss}$ ).



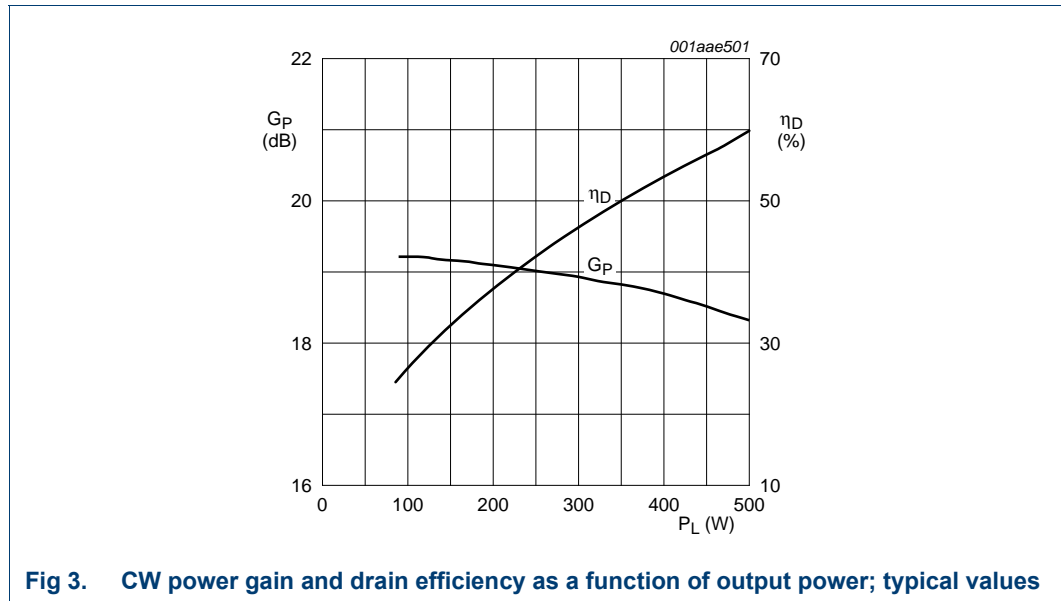
## 7. Application information

**Table 7. RF performance in a common-source 225 MHz test circuit**  
 $T_h = 25\text{ }^\circ\text{C}$  unless otherwise specified.

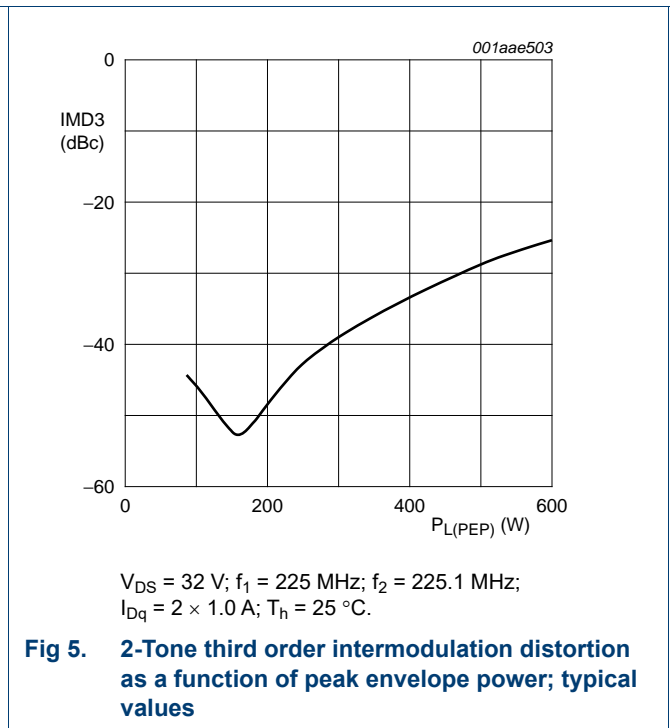
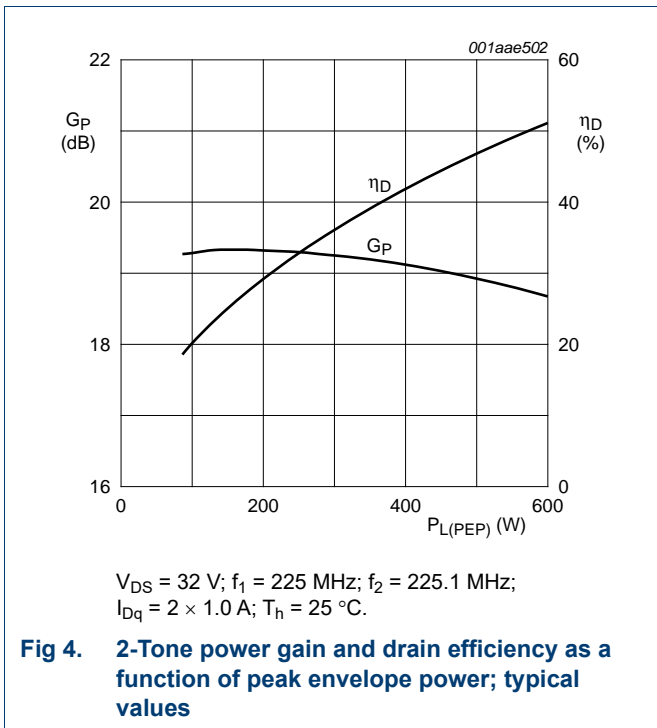
Mode of operation	f (MHz)	V <sub>DS</sub> (V)	I <sub>Dq</sub> (A)	P <sub>L</sub> (W)	P <sub>L(PEP)</sub> (W)	G <sub>p</sub> (dB)	η <sub>D</sub> (%)	IMD3 (dBc)	ΔG <sub>p</sub> (dB)
CW, class AB	225	32	2 × 1.0	500	-	> 17	> 55	-	-
2-tone, class AB	f <sub>1</sub> = 225; f <sub>2</sub> = 225.1	32	2 × 1.0	-	500	> 18	> 43	< -24	1
pulsed, class AB [1]	225	-	-	500	-	> 18	> 50	-	-

[1] t<sub>p</sub> = 2 ms; δ = 10 %.

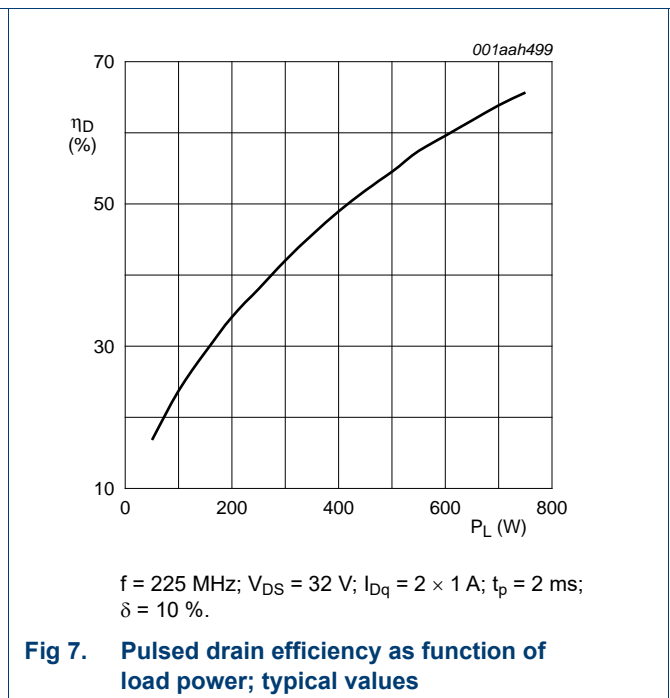
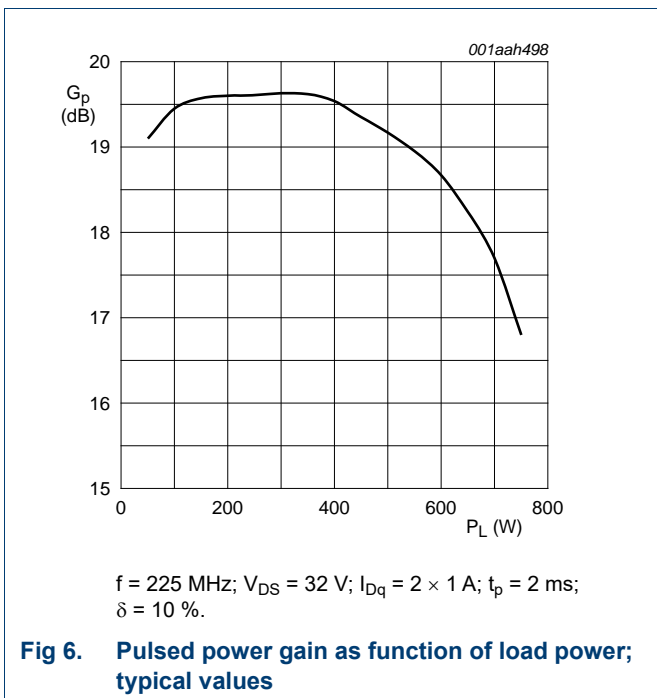
### 7.1 CW

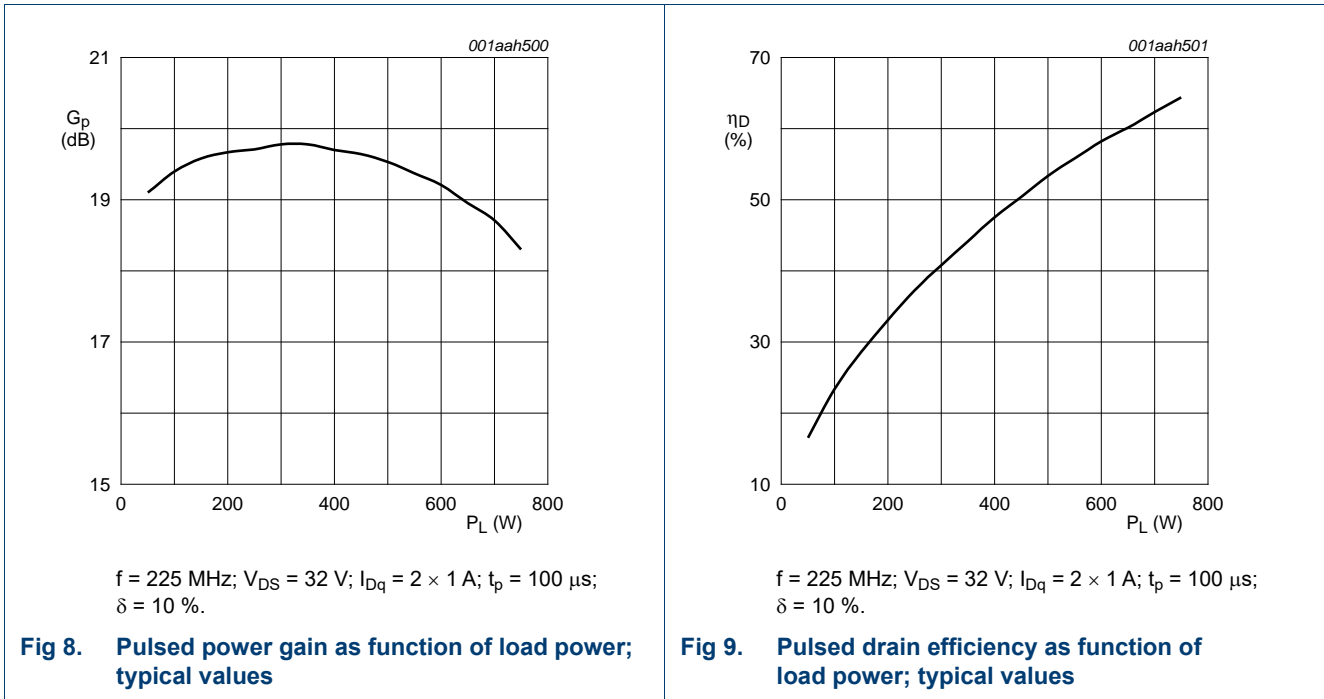


7.2 2-Tone



7.3 Pulsed

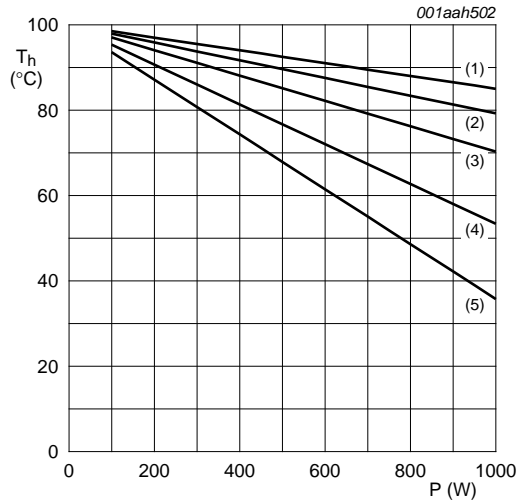




### 7.4 Maximum heatsink temperature

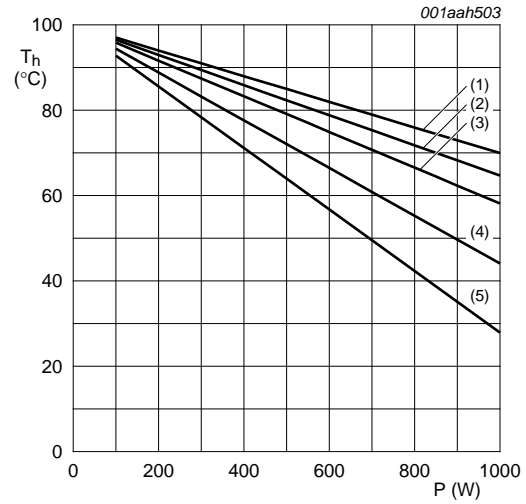
The heatsink temperature is defined 1 mm below the surface of the heatsink at the center of the flange.

The maximum allowable heatsink temperature is given in the following graphs at several pulsed conditions as well as for CW.



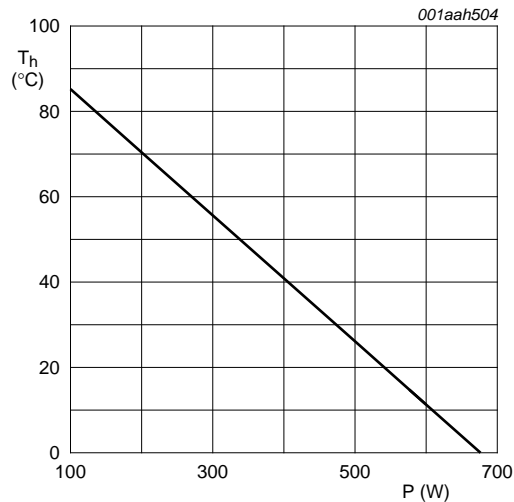
- $\delta = 10\%$ .
- (1)  $t_p \leq 2$  ms
  - (2)  $t_p = 10$  ms
  - (3)  $t_p = 20$  ms
  - (4)  $t_p = 50$  ms
  - (5)  $t_p = 100$  ms

**Fig 10. Heatsink temperature as function of power dissipation at a duty cycle of 10 %**



- $\delta = 20\%$ .
- (1)  $t_p \leq 2$  ms
  - (2)  $t_p = 10$  ms
  - (3)  $t_p = 20$  ms
  - (4)  $t_p = 50$  ms
  - (5)  $t_p = 100$  ms

**Fig 11. Heatsink temperature as function of power dissipation at a duty cycle of 20 %**



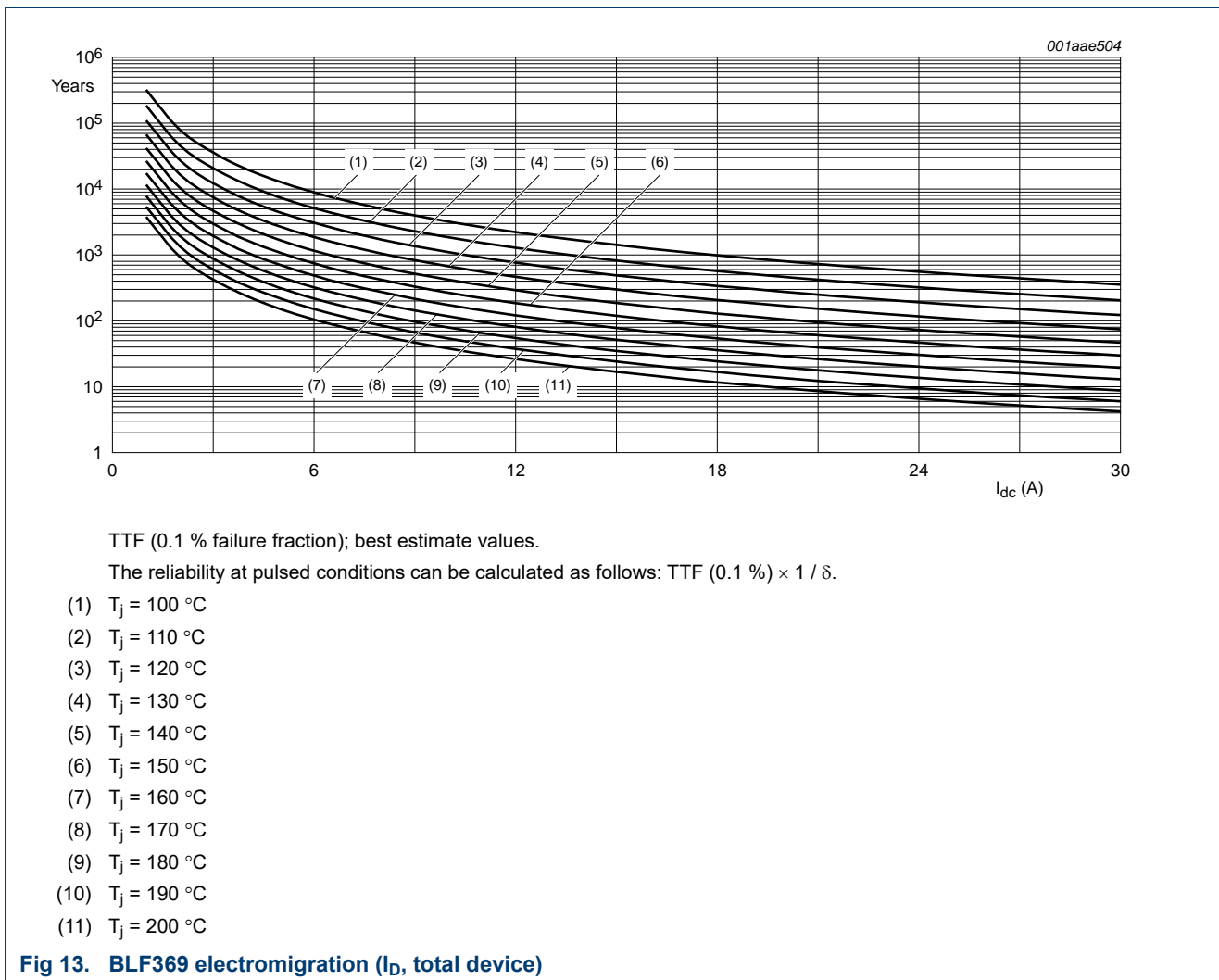
**Fig 12. CW heatsink temperature as function of power dissipation**

### 7.5 Ruggedness in class-AB operation

The BLF369 is capable of withstanding a load mismatch corresponding to VSWR = 10 : 1 through all phases under the following conditions: 2-tone signal;  $V_{DS} = 32$  V;  $f = 225$  MHz at rated load power ( $P_{L(PEP)} = 500$  W).



### 7.6 Reliability



## 8. Test information

**Table 8. List of components**

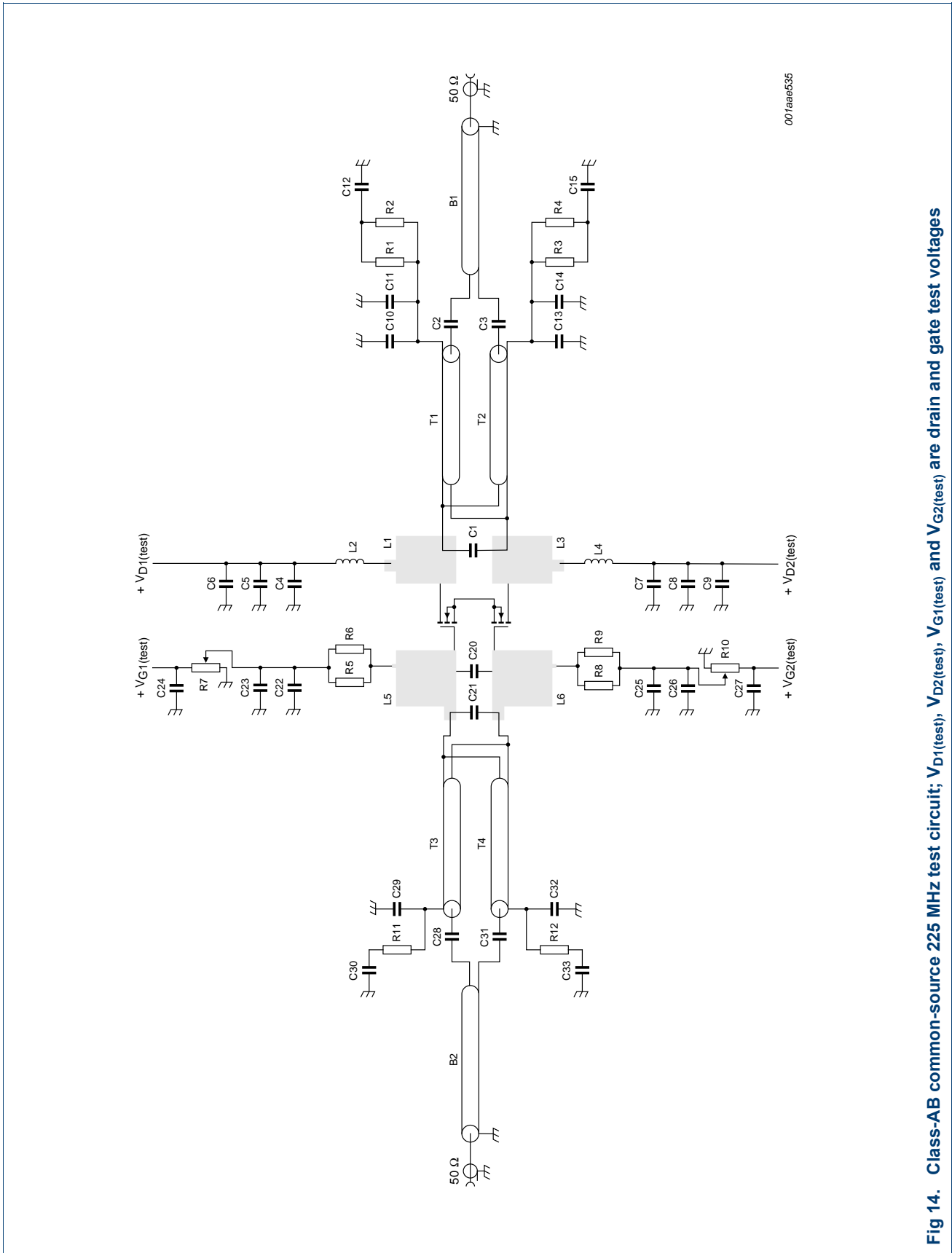
For test circuit, see [Figure 14](#), [Figure 15](#) and [Figure 16](#).

Component	Description	Value	Remarks
B1	semi rigid coax	25 Ω; 120 mm	EZ90-25-TP
B2	semi rigid coax	25 Ω; 56 mm	EZ90-25-TP
C1	multilayer ceramic chip capacitor	91 pF	[1]
C2, C3	multilayer ceramic chip capacitor	56 pF	[1]
C4, C7	multilayer ceramic chip capacitor	100 pF	[1]
C5, C8	ceramic capacitor	15 nF	
C6, C9	electrolytic capacitor	220 μF	
C10, C11, C13, C14	multilayer ceramic chip capacitor	220 pF	[1]
C12, C15	ceramic capacitor	15 nF	[1]

**Table 8. List of components ...continued**  
 For test circuit, see [Figure 14](#), [Figure 15](#) and [Figure 16](#).

Component	Description	Value	Remarks
C20	multilayer ceramic chip capacitor	100 pF	[1]
C21	multilayer ceramic chip capacitor	20 pF	[1]
C22, C25	multilayer ceramic chip capacitor	100 pF	[1]
C23, C26	ceramic capacitor	15 nF	
C24, C27	electrolytic capacitor	10 $\mu$ F	
C28, C31	multilayer ceramic chip capacitor	100 pF	[1]
C29, C32	multilayer ceramic chip capacitor	220 pF	
C30, C33	ceramic capacitor	15 nF	
L1, L3	stripline	-	[2] (W $\times$ L) 12 mm $\times$ 15 mm
L2, L4	air coil	-	4 windings; D = 8 mm; d = 1 mm
L5, L6	stripline	-	[2] (W $\times$ L) 14 mm $\times$ 15 mm
R1, R2, R3, R4	resistor	0.25 W; 4 $\Omega$	
R5, R6, R8, R9	resistor	0.25 W; 10 $\Omega$	
R7, R10	potentiometer	10 k $\Omega$	
R11, R12	resistor	0.25 W; 1 $\Omega$	
T1, T2	semi rigid coax	25 $\Omega$ ; 68 mm	EZ90-25-TP
T3, T4	semi rigid coax	25 $\Omega$ ; 60 mm	EZ90-25-TP

- [1] American technical ceramics type 100B or capacitor of same quality.
- [2] Printed-Circuit Board (PCB): Rogers 5880;  $\epsilon_r = 2.2$  F/m; height = 0.79 mm; Cu (top/bottom metallization); thickness copper plating = 35  $\mu$ m.



001aae535

Fig 14. Class-AB common-source 225 MHz test circuit;  $V_{D1(test)}$ ,  $V_{D2(test)}$ ,  $V_{G1(test)}$  and  $V_{G2(test)}$  are drain and gate test voltages

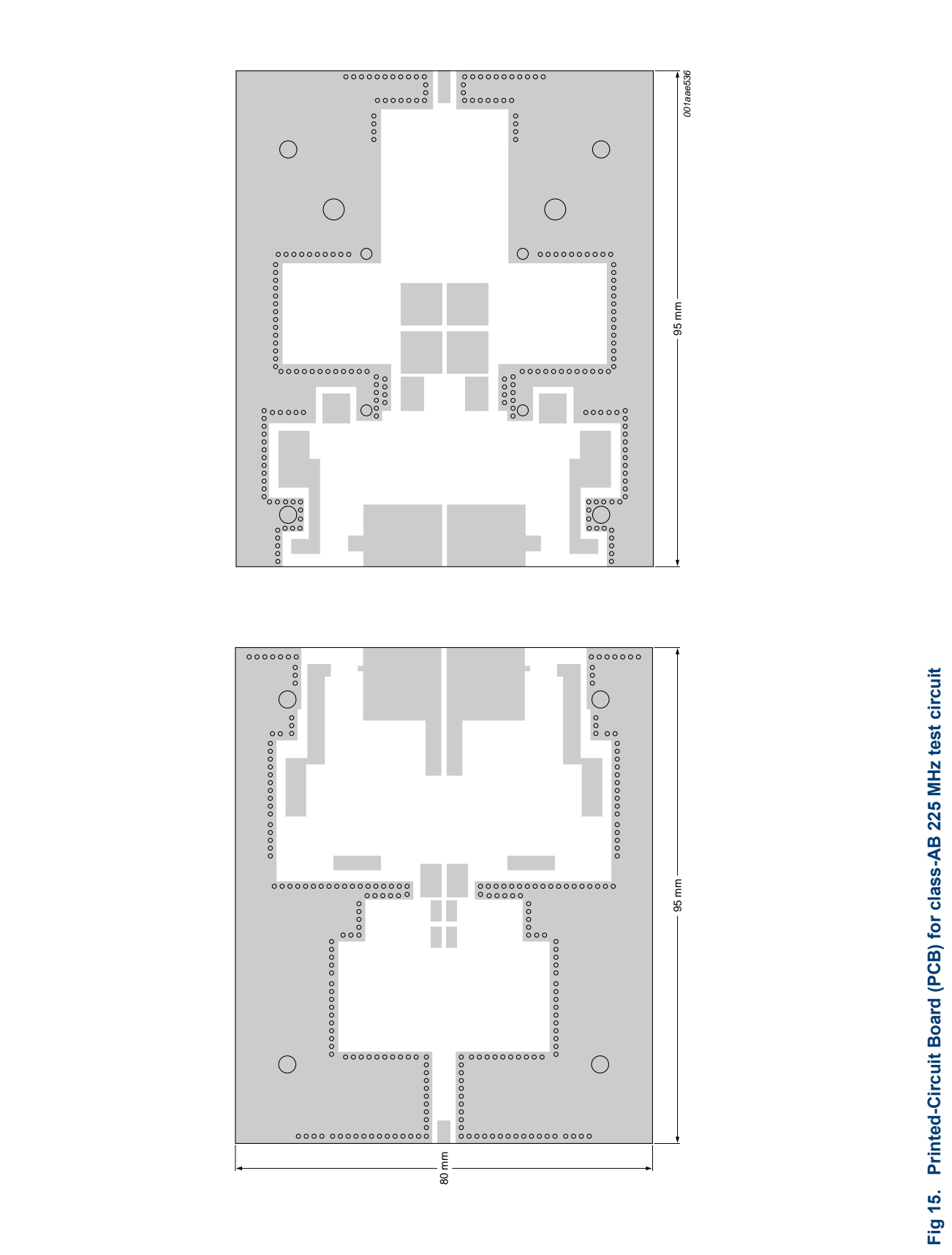
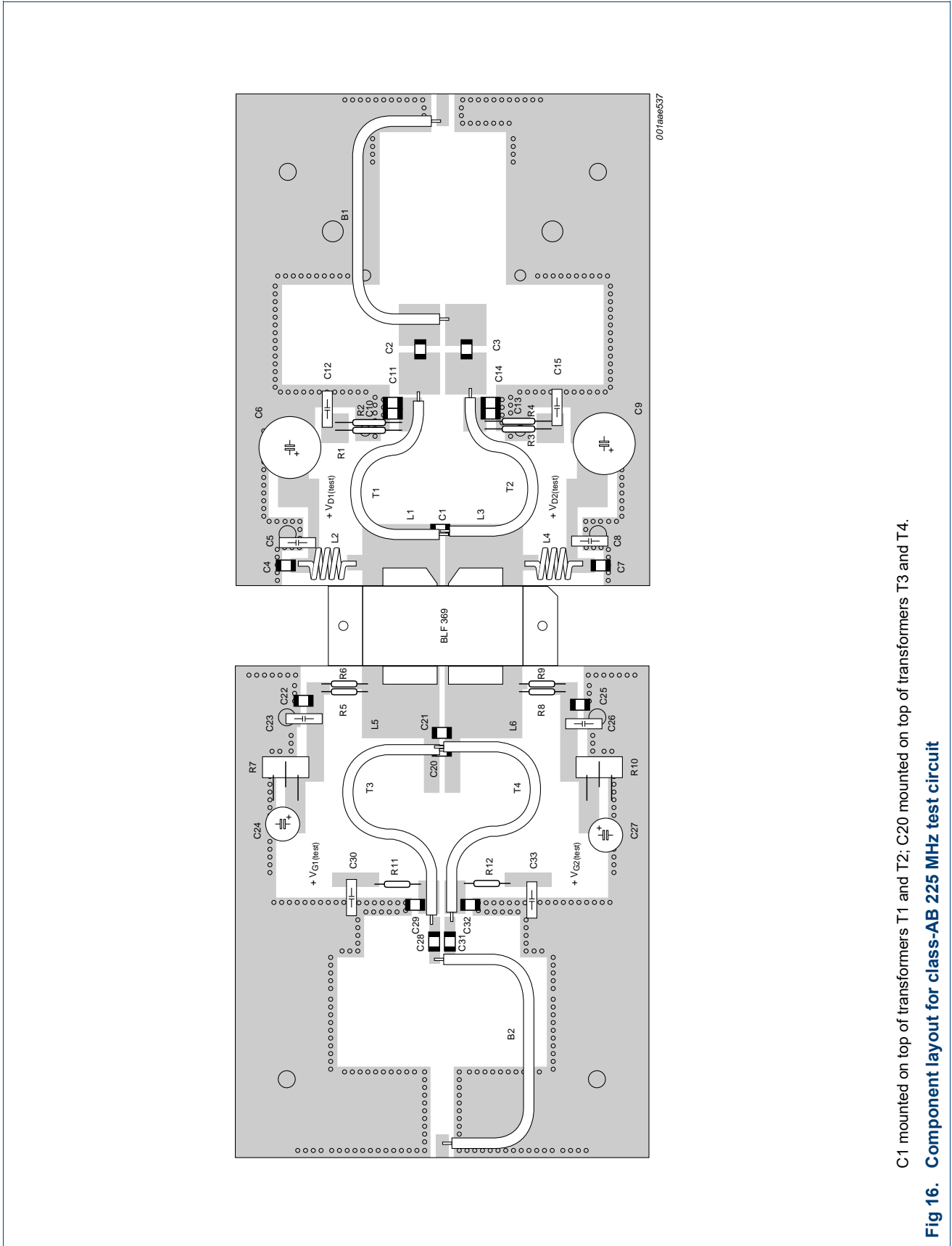


Fig 15. Printed-Circuit Board (PCB) for class-AB 225 MHz test circuit



C1 mounted on top of transformers T1 and T2; C20 mounted on top of transformers T3 and T4.  
**Fig 16. Component layout for class-AB 225 MHz test circuit**

9. Package outline

Flanged ceramic package; 2 mounting holes; 4 leads

SOT800-2

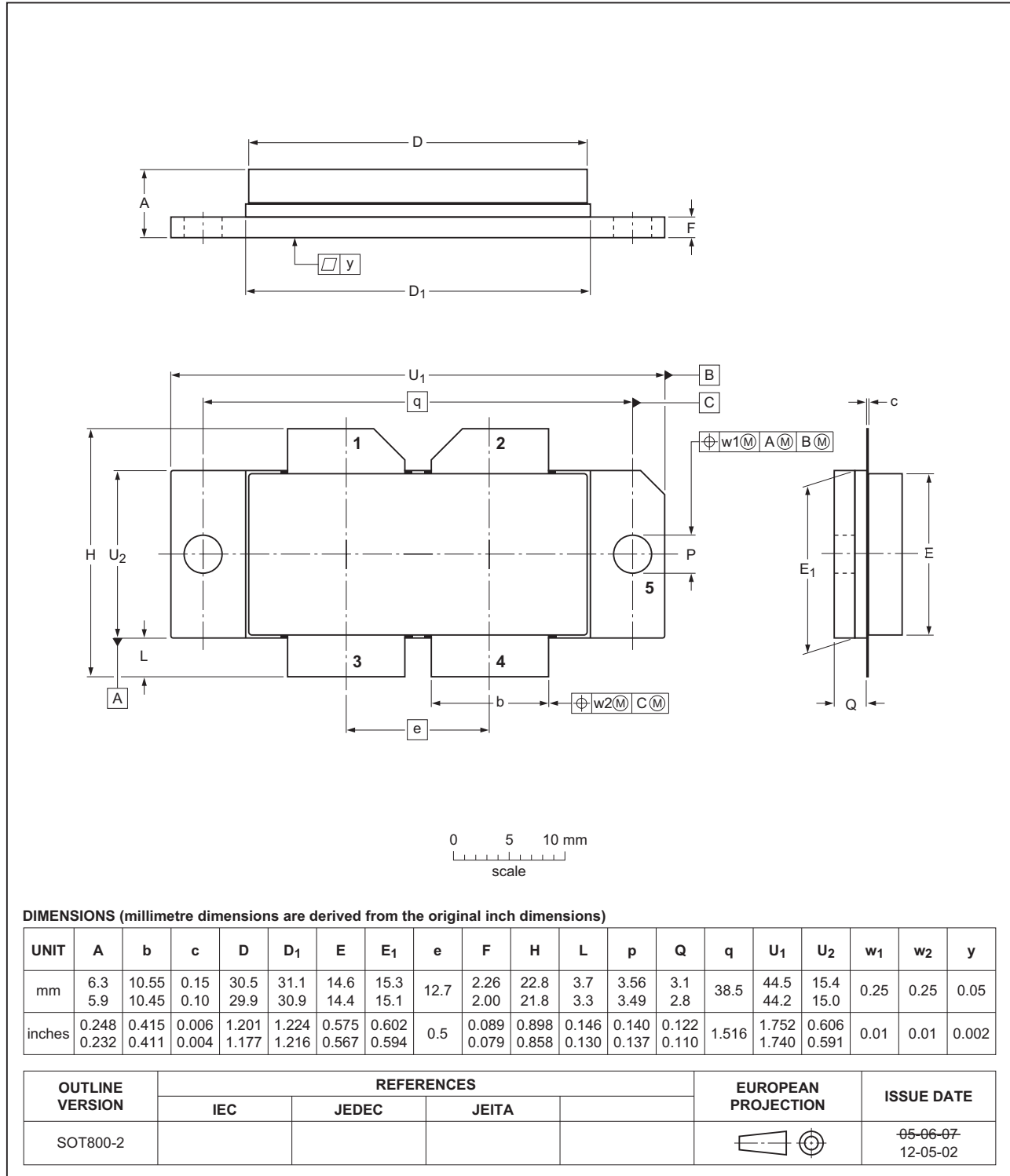


Fig 17. Package outline SOT800-2

## 10. Abbreviations

Table 9. Abbreviations

Acronym	Description
CW	Continuous Wave
DC	Direct Current
GSM	Global System for Mobile communications
HF	High Frequency
LDMOS	Laterally Diffused Metal-Oxide Semiconductor
LDMOST	Laterally Diffused Metal-Oxide Semiconductor Transistor
PEP	Peak Envelope Power
RF	Radio Frequency
TTF	Time To Failure
UHF	Ultra High Frequency
VHF	Very High Frequency
VSWR	Voltage Standing-Wave Ratio

## 11. Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BLF369#5	20150901	Product data sheet	-	BLF369_4
Modifications:	<ul style="list-style-type: none"> <li>The format of this document has been redesigned to comply with the new identity guidelines of Ampleon.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> </ul>			
BLF369_4	20090219	Product data sheet	-	BLF369_3
BLF369_3	20080129	Preliminary data sheet	-	BLF369_2
BLF369_2	20061208	Objective data sheet	-	BLF369_1
BLF369_1	20060413	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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