

# BLF369

## VHF power LDMOS transistor

Rev. 01 — 13 April 2006

Objective data sheet

## 1. Product profile

### 1.1 General description

A 500 W LDMOS RF Power transistor for broadcast transmitter applications and industrial applications in the HF/VHF band.

**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)	$P_L$ (W)	$P_{L(PEP)}$ (W)	$G_p$ (dB)	$\eta_D$ (%)	IMD3 (dBc)
CW, class AB	225	500	-	18	60	-
2-tone, class AB	$f_1 = 225; f_2 = 225.1$	-	500	19	47	-28

[1]  $T_h$  is the heatsink temperature.

### CAUTION



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

### 1.2 Features

- Typical CW performance at 225 MHz, a drain-source voltage  $V_{DS}$  of 32 V and a quiescent drain current  $I_{Dq} = 2 \times 1.0$  A:
  - ◆ Load power  $P_L = 500$  W
  - ◆ Gain  $G_p \geq 18$  dB
  - ◆ Drain efficiency  $\eta_D = 60$  %
- 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

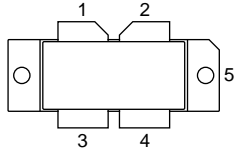
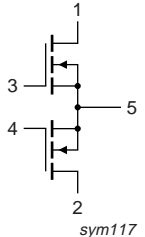
### 1.3 Applications

- Communication transmitter applications in the UHF band
- Industrial applications in the UHF band

# PHILIPS

## 2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Symbol
1	gate1		
2	gate2		
3	drain1		
4	drain2		
5	source		

[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		-	$\pm 13$	V
$T_{stg}$	storage temperature		-65	+150	$^{\circ}\text{C}$
$T_j$	junction temperature		-	200	$^{\circ}\text{C}$

## 5. Thermal characteristics

Table 5: Thermal characteristics

Symbol	Parameter	Conditions	Typ	Unit
$R_{th(j-c)}$	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

[1]  $T_j$  is the junction temperature.

[2]  $R_{th(j-c)}$  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.

## 6. Characteristics

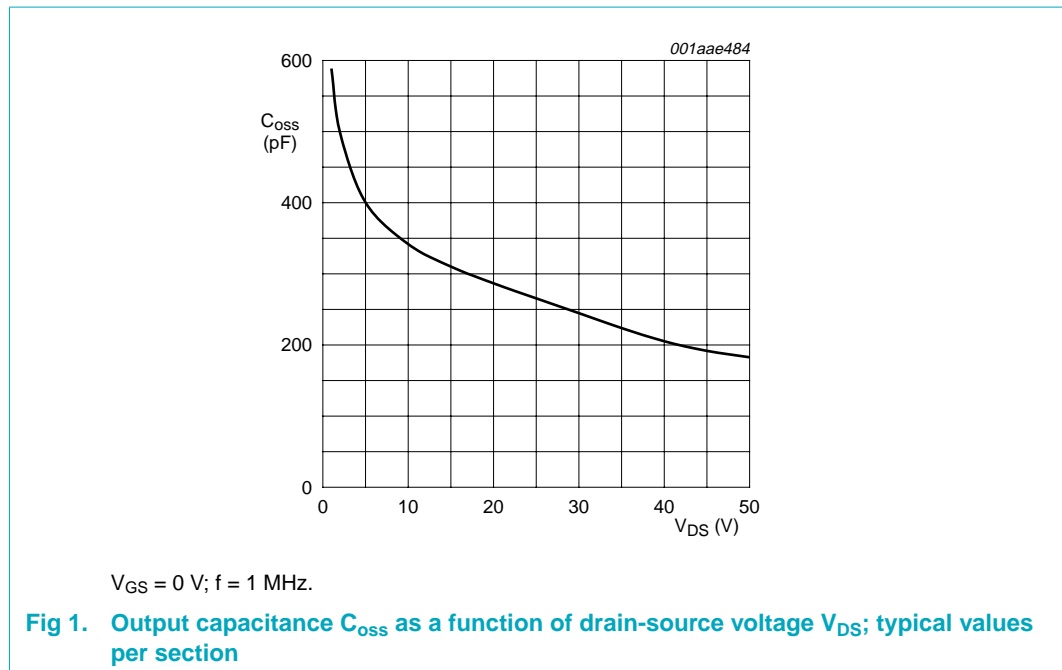
**Table 6: Characteristics**

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

Symbol	Parameter	Conditions <sup>[1]</sup>	Min	Typ	Max	Unit
$V_{(BR)DSS}$	drain-source breakdown voltage	$V_{GS} = 0\text{ V}; I_D = 6\text{ mA}$	65	-	-	V
$V_{GSth}$	gate-source threshold voltage	$V_{DS} = 20\text{ V}; I_D = 600\text{ mA}$	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	$V_{GS} = V_{GSth} + 9\text{ V}; V_{DS} = 10\text{ V}$	-	100	-	A
$I_{GSS}$	gate leakage current	$V_{GS} = 20\text{ V}; V_{DS} = 0\text{ V}$	-	-	60	nA
$g_{fs}$	forward transconductance	$V_{GS} = 20\text{ V}; I_D = 13\text{ A}$	-	15	-	S
$R_{DSon}$	drain-source on-state resistance	$V_{GS} = V_{GSth} + 9\text{ V}; I_D = 13\text{ A}$	-	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 ( $C_{rss}$ ).

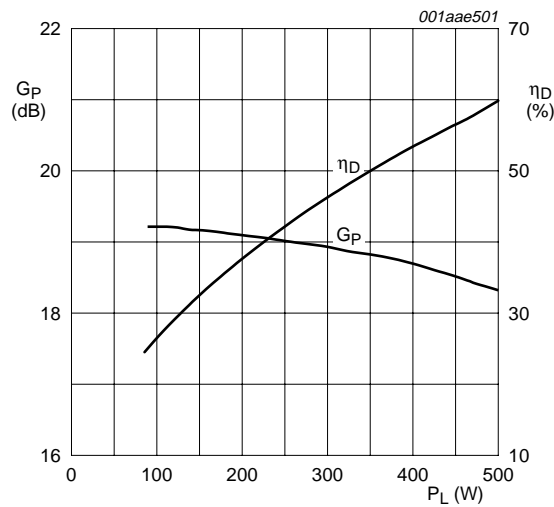


## 7. Application information

**Table 7: RF performance in a common-source 225 MHz test circuit**

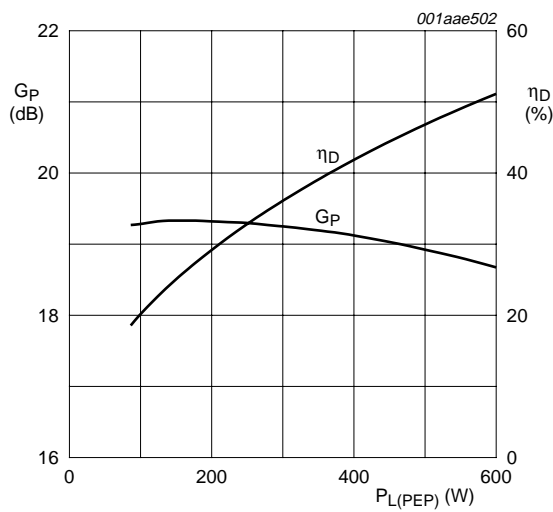
$T_h = 25\text{ }^\circ\text{C}$  unless otherwise specified.

Mode of operation	f (MHz)	$V_{DS}$ (V)	$I_{Dq}$ (A)	$P_{L(PEP)}$ (W)	$G_p$ (dB)	$\eta_D$ (%)	IMD3 (dBc)	$\Delta G_p$ (dB)
2-tone, class AB	$f_1 = 225; f_2 = 225.1$	32	$2 \times 1.0$	300	> 18	> 43	< -24	1



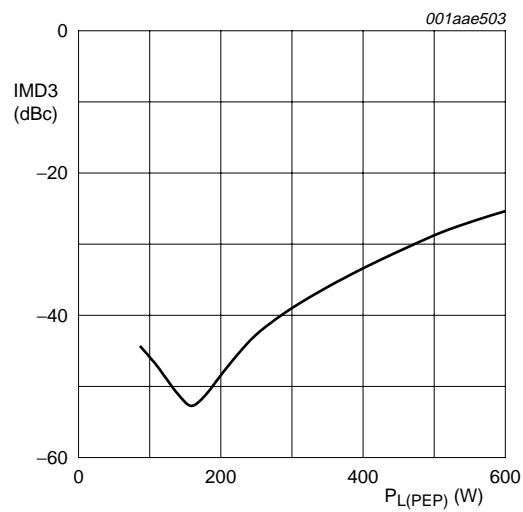
$V_{DS} = 32$  V;  $f = 225$  MHz;  $I_{Dq} = 2 \times 1.0$  A;  $T_h = 25$  °C.

Fig 2. CW power gain  $G_P$  and drain efficiency  $\eta_D$  as a function of output power  $P_L$ ; typical values



$V_{DS} = 32$  V;  $f_1 = 225$  MHz;  $f_2 = 225.1$  MHz;  $I_{Dq} = 2 \times 1.0$  A;  $T_h = 25$  °C.

Fig 3. 2-tone power gain  $G_P$  and drain efficiency  $\eta_D$  as a function of peak envelope power  $P_{L(PEP)}$ ; typical values



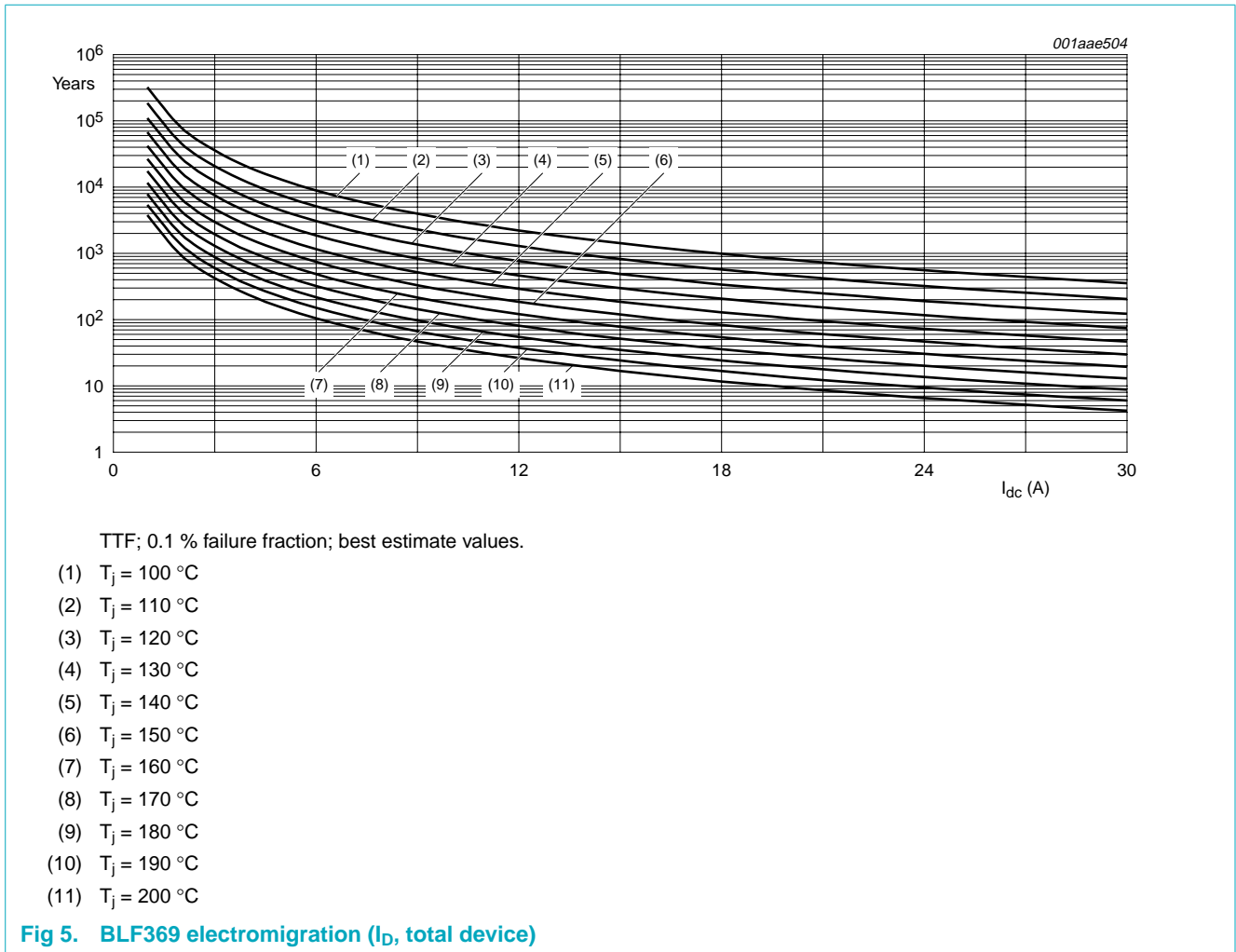
$V_{DS} = 32$  V;  $f_1 = 225$  MHz;  $f_2 = 225.1$  MHz;  $I_{Dq} = 2 \times 1.0$  A;  $T_h = 25$  °C.

Fig 4. 2-tone third order intermodulation distortion  $IMD_3$  as a function of peak envelope power  $P_{L(PEP)}$ ; typical values

### 7.1 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:  $V_{DS} = 32$  V;  $f = 225$  MHz at rated load power ( $P_{L(PEP)} = 500$  W).

7.2 Reliability



8. Test information

Table 8: List of components

For test circuit, see Figure 6, 7 and 8.

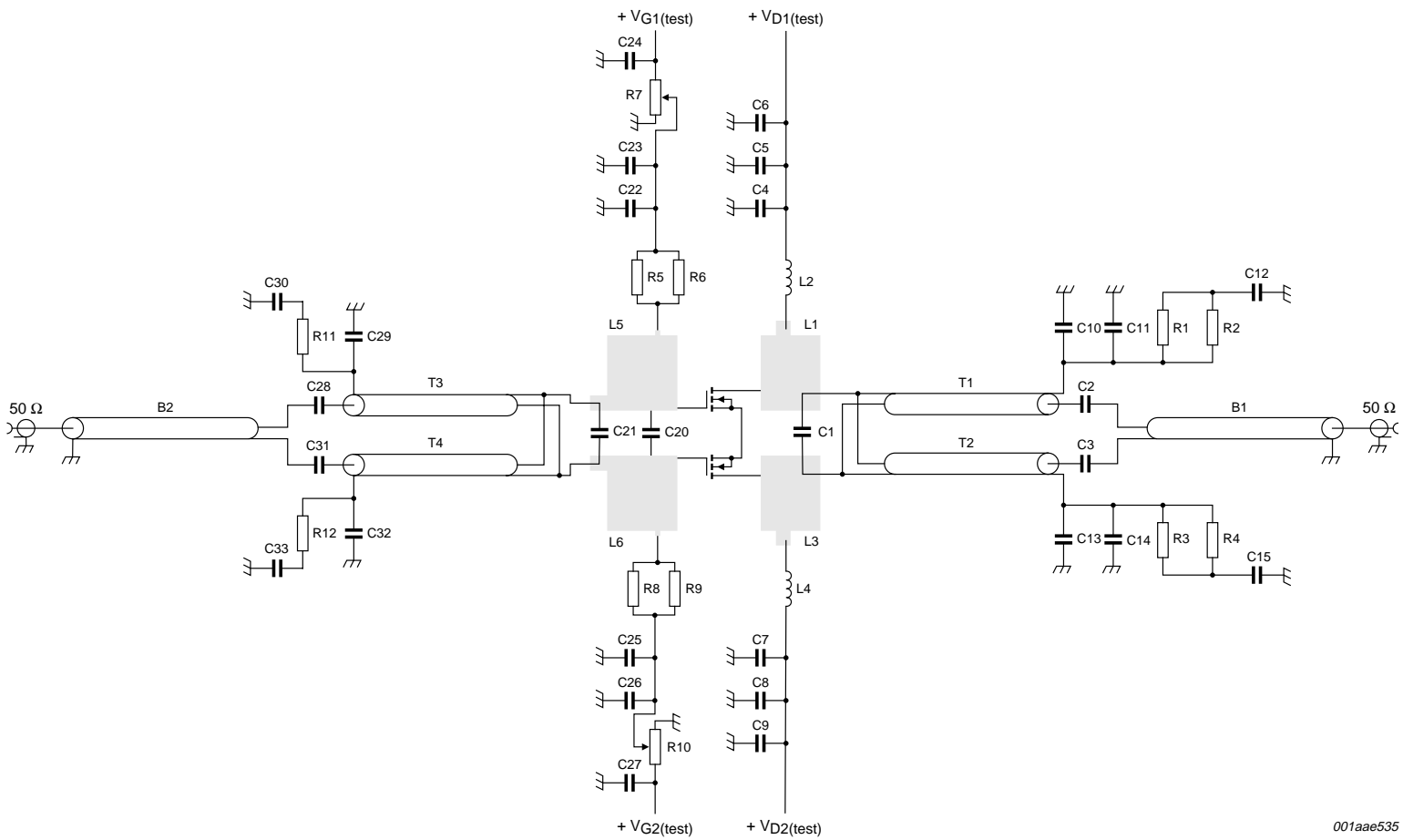
Component	Description	Value	Remarks
B1	semi rigid coax	25 Ω; 120 mm	EZ90-25-TP
B2	semi rigid coax	25 Ω; 56 mm	EZ90-25-TP
C1	multilayer ceramic chip capacitor	91 pF	[1]
C2, C3	multilayer ceramic chip capacitor	56 pF	[1]
C4, C7	multilayer ceramic chip capacitor	100 pF	[1]
C5, C8	ceramic capacitor	15 nF	
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 ...continuedFor test circuit, see [Figure 6](#), [7](#) and [8](#).

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] PCB: Rogers 5880;  $\epsilon_r = 2.2$  F/m; height = 0.79 mm; Cu (top/bottom metallization); thickness copper plating = 35  $\mu$ m.



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Fig 6. 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

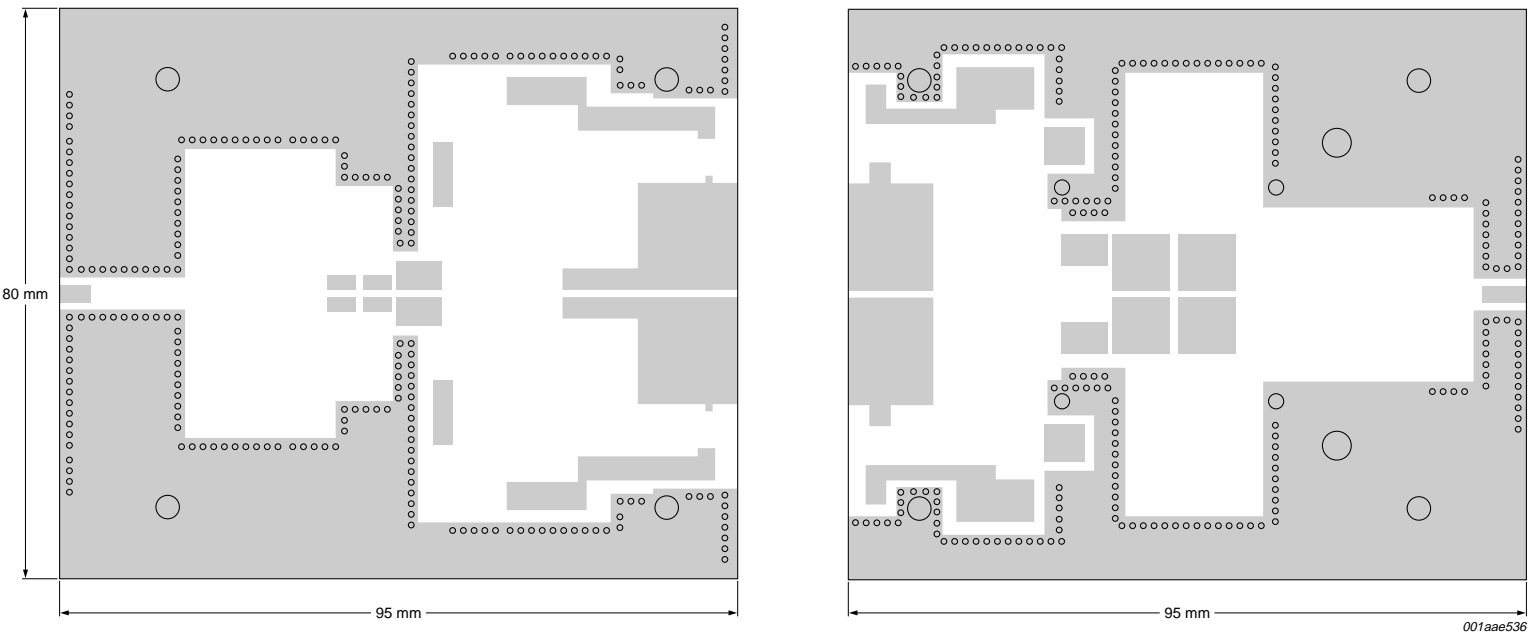
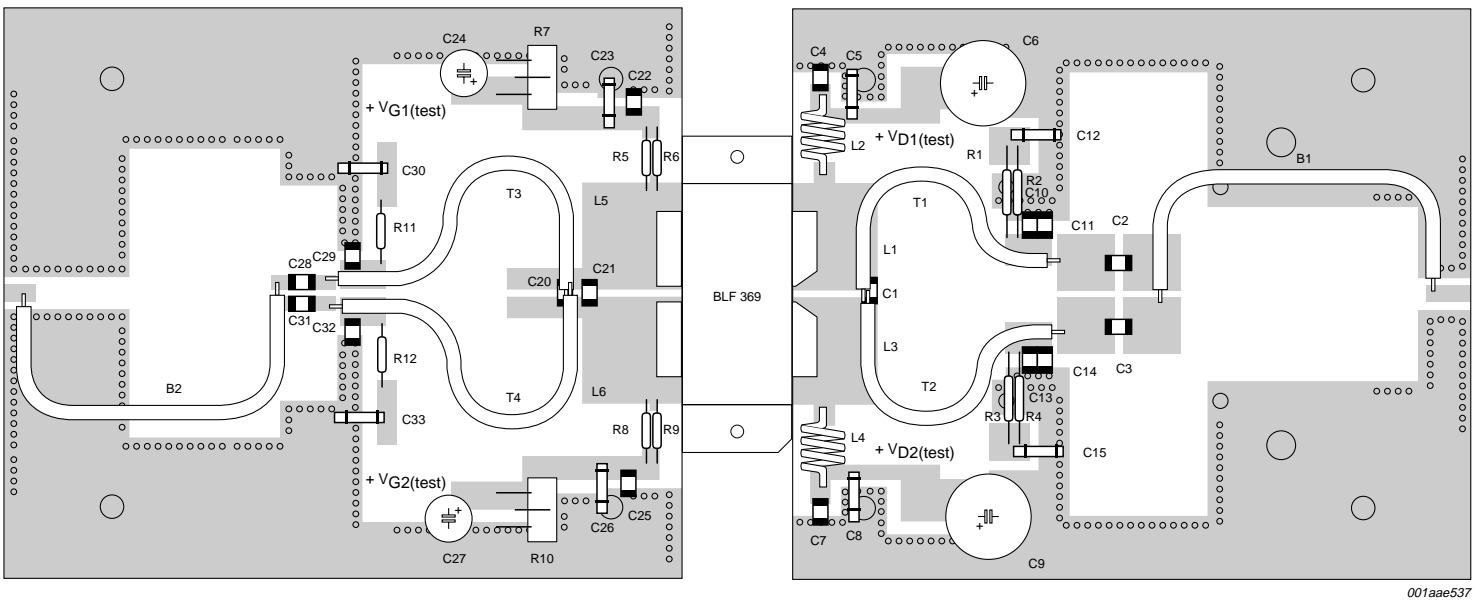


Fig 7. Printed-circuit board for class-AB 225 MHz test circuit





C1 mounted on top of transformers T1 and T2; C20 mounted on top of transformers T3 and T4

**Fig 8. Component layout for class-AB 225 MHz test circuit**

**9. Package outline**

Flanged LDMOST ceramic package; 2 mounting holes; 4 leads

SOT800-2

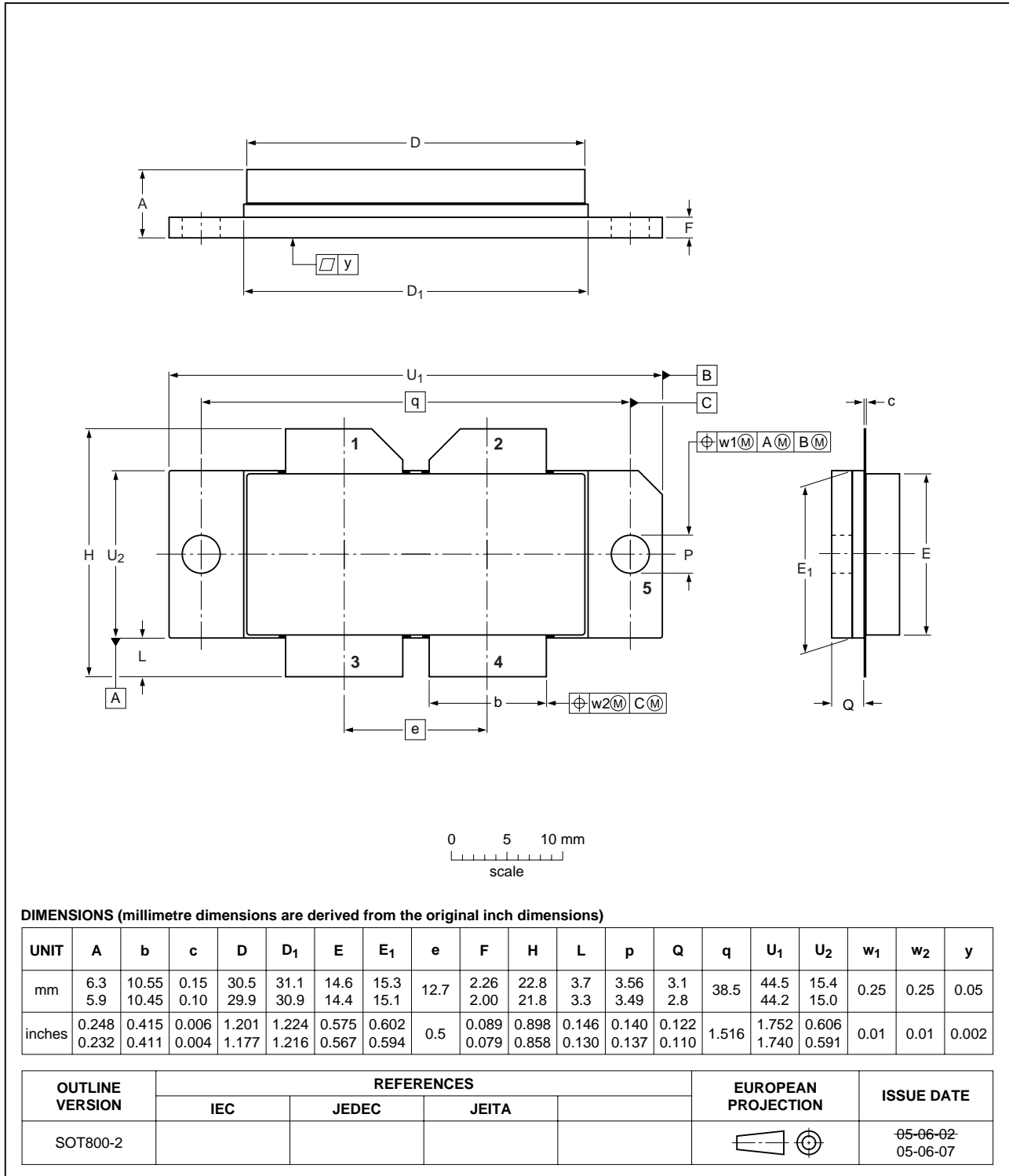


Fig 9. Package outline SOT800-2

## 10. Abbreviations

**Table 9: Abbreviations**

<b>Acronym</b>	<b>Description</b>
CW	Continuous Wave
GSM	Global System for Mobile communications
LDMOS	Laterally Diffused Metal Oxide Semiconductor
PCB	Printed-Circuit Board
PEP	Peak Envelope Power
RF	Radio Frequency
TTF	Time To Failure
VSWR	Voltage Standing Wave Ratio

## 11. Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BLF369_1	20060413	Objective data sheet	-	-

## 12. Legal information

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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.
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Product [short] data sheet	Production	This document contains the product specification.

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