

# BLF6G38-50; BLF6G38LS-50

WiMAX power LDMOS transistor

Rev. 01 — 12 February 2008

Preliminary data sheet

## 1. Product profile

### 1.1 General description

50 W LDMOS power transistor for base station applications at frequencies from 3400 MHz to 3800 MHz.

**Table 1. Typical performance**

Typical RF performance at  $T_{case} = 25\text{ }^{\circ}\text{C}$  in a class-AB production test circuit.

Mode of operation	f (MHz)	V <sub>DS</sub> (V)	P <sub>L(AV)</sub> (W)	P <sub>L(M)</sub> <sup>[1]</sup> (W)	G <sub>p</sub> (dB)	η <sub>D</sub> (%)	ACPR <sub>885k</sub> (dBc)	ACPR <sub>1980k</sub> (dBc)
1-carrier N-CDMA <sup>[2]</sup>	3400 to 3600	28	9	70	14	23	-49 <sup>[3]</sup>	-64 <sup>[3]</sup>

[1] P<sub>L(M)</sub> stands for peak output power.

[2] Single carrier N-CDMA with pilot, paging, sync and 6 traffic channels (Walsh codes 8 - 13). PAR = 9.7 dB at 0.01 % probability on the CCDF. Channel bandwidth is 1.23 MHz.

[3] Measured within 30 kHz bandwidth.

#### CAUTION



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

### 1.2 Features

- Typical 1-carrier N-CDMA performance (Single carrier N-CDMA with pilot, paging, sync and 6 traffic channels [Walsh codes 8 - 13]. PAR = 9.7 dB at 0.01 % probability on the CCDF. Channel bandwidth is 1.23 MHz) at a frequency of 3400 MHz, 3500 MHz and 3600 MHz, a supply voltage of 28 V, an I<sub>DQ</sub> of 450 mA, a power gain of 14 dB, a drain efficiency of 23 % and a peak output power of 70 W:
- Qualified up to a maximum V<sub>DS</sub> operation of 32 V
- Suitable for operation in the 3.4 GHz to 3.8 GHz frequency range
- Integrated ESD protection
- Excellent ruggedness
- High efficiency
- Excellent thermal stability
- Designed for broadband operation
- Internally matched for ease of use
- Low gold plating thickness on leads

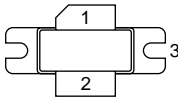
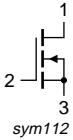
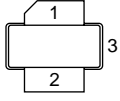
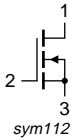
- Compliant to Directive 2002/95/EC, regarding Restriction of Hazardous Substances (RoHS)

## 1.3 Applications

- RF power amplifiers for base stations and multicarrier applications in the 3400 MHz to 3800 MHz frequency range

## 2. Pinning information

Table 2: Pinning

Pin	Description	Simplified outline	Symbol
<b>BLF6G38-50 (SOT502A)</b>			
1	drain		 sym112
2	gate		
3	source		
<b>BLF6G38LS-50 (SOT502B)</b>			
1	drain		 sym112
2	gate		
3	source		

[1] Connected to flange.

## 3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BLF6G38-50	-	flanged LDMOST ceramic package; 2 mounting holes; 2 leads	SOT502A
BLF6G38LS-50	-	earless flanged LDMOST ceramic package; 2 leads	SOT502B

## 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
$I_D$	drain current		-	16.5	A
$T_{stg}$	storage temperature		-65	+150	°C
$T_j$	junction temperature		-	225	°C

## 5. Thermal characteristics

**Table 5. Thermal characteristics**

Symbol	Parameter	Conditions	Type	Typ	Max	Unit
$R_{th(j-case)}$	thermal resistance from junction to case	$T_{case} = 80\text{ °C};$ $P_L = 50\text{ W}$	BLF6G38-50	0.9	-	K/W
			BLF6G38LS-50	0.7	-	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	$V_{GS} = 0\text{ V}; I_D = 0.4\text{ mA}$	65	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$V_{DS} = 10\text{ V}; I_D = 80\text{ mA}$	1.4	2	2.4	V
$I_{DSS}$	drain leakage current	$V_{GS} = 0\text{ V}; V_{DS} = 28\text{ V}$	-	-	2.8	$\mu\text{A}$
$I_{DSX}$	drain cut-off current	$V_{GS} = V_{GS(th)} + 3.75\text{ V};$ $V_{DS} = 10\text{ V}$	11.9	16.4	-	A
$I_{GSS}$	gate leakage current	$V_{GS} = +11\text{ V}; V_{DS} = 0\text{ V}$	-	-	280	nA
$g_{fs}$	forward transconductance	$V_{DS} = 10\text{ V}; I_D = 2.8\text{ A}$	-	5.6	-	S
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = V_{GS(th)} + 3.75\text{ V};$ $I_D = 2.8\text{ A}$	-	0.18	0.29	$\Omega$
$C_{rs}$	feedback capacitance	$V_{GS} = 0\text{ V}; V_{DS} = 28\text{ V};$ $f = 1\text{ MHz}$	-	1.17	-	pF

## 7. Application information

**Table 7. Application information**

Mode of operation: 1-carrier N-CDMA; Single carrier N-CDMA with pilot, paging, sync and 6 traffic channels (Walsh codes 8 - 13). PAR = 9.7 dB at 0.01 % probability on the CCDF; Channel bandwidth is 1.23 MHz;  $f_1 = 3400\text{ MHz}; f_2 = 3500\text{ MHz}; f_3 = 3600\text{ MHz}$ ; RF performance at  $V_{DS} = 28\text{ V}; I_{Dq} = 450\text{ mA}; T_{case} = 25\text{ °C}$ ; unless otherwise specified, in a class-AB production circuit.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
$P_{L(M)}$	peak output power	$P_{L(AV)} = 9\text{ W}$	65	70	-	W	
$G_p$	power gain	$P_{L(AV)} = 9\text{ W}$	12.5	14	-	dB	
$RL_{in}$	input return loss	$P_{L(AV)} = 9\text{ W}$	-	-10	-	dB	
$\eta_D$	drain efficiency	$P_{L(AV)} = 9\text{ W}$	20	23	-	%	
$ACPR_{885k}$	adjacent channel power ratio (885 kHz)	$P_{L(AV)} = 9\text{ W}$	[1]	-46	-49	-	dBc
$ACPR_{1980k}$	adjacent channel power ratio (1980 kHz)	$P_{L(AV)} = 9\text{ W}$	[1]	-62	-64	-	dBc

[1] Measured within 30 kHz bandwidth.

### 7.1 Ruggedness in class-AB operation

The BLF6G38-50 and BLF6G38LS-50 are capable of withstanding a load mismatch corresponding to VSWR = 10 : 1 through all phases under the following conditions:  $V_{DS} = 28\text{ V}; I_{Dq} = 450\text{ mA}; P_L = P_{L(1dB)}; f = 3600\text{ MHz}$ .

**7.2 NXP WiMAX signal**

**7.2.1 WiMAX signal description**

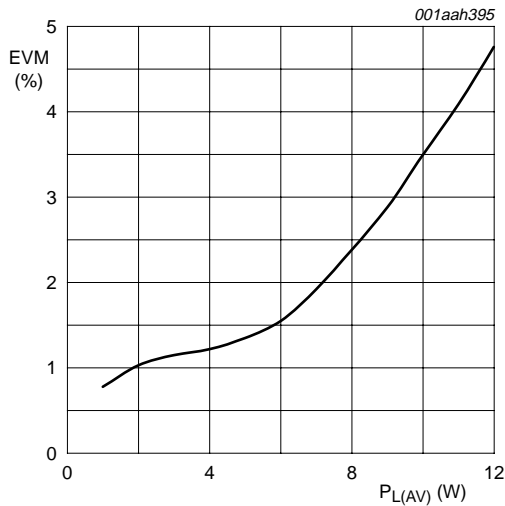
Frame duration = 5 ms; bandwidth = 10 MHz; sequency = 1 frame;  
 frequency band = WCS; sampling rate = 11.2 MHz;  $n = 8 / 7$ ;  $G = T_g / T_b = 1 / 8$ ;  
 FFT = 1024; zone type = PUSC;  $\delta = 97.7 \%$ ; number of symbols = 46;  
 number of subchannels = 30; PAR = 9.5 dB.

Preamble: 1 symbol  $\times$  30 subchannels;  $P_L = P_{L(nom)} + 3.86$  dB.

**Table 8. Frame structure**

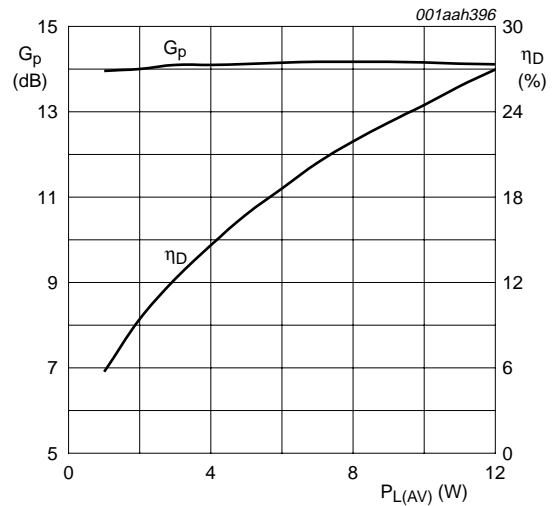
Frame contents	Modulation technique	Data length
Zone 0 FCH 2 symbols $\times$ 4 subchannels	QPSK1/2	3 bit
Zone 0 data 2 symbols $\times$ 26 subchannels	64QAM3/4	692 bit
Zone 0 data 44 symbols $\times$ 30 subchannels	64QAM3/4	10000 bit

**7.2.2 Graphs**



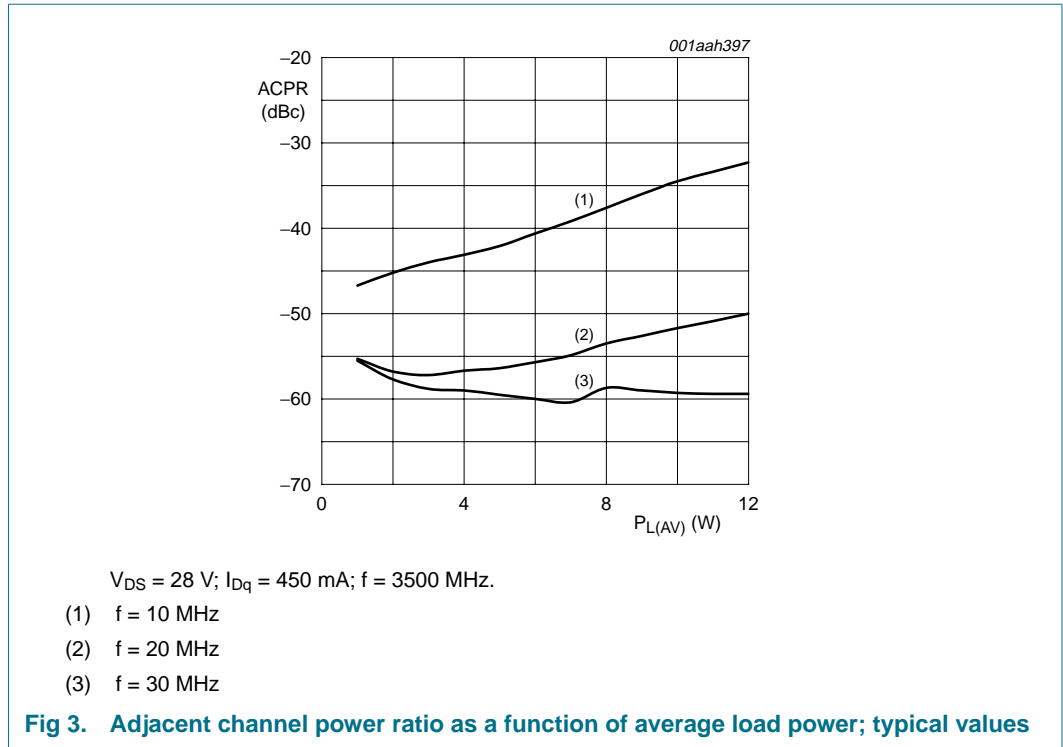
$V_{DS} = 28$  V;  $I_{Dq} = 450$  mA;  $f = 3500$  MHz.

**Fig 1. EVM as a function of average load power; typical values**



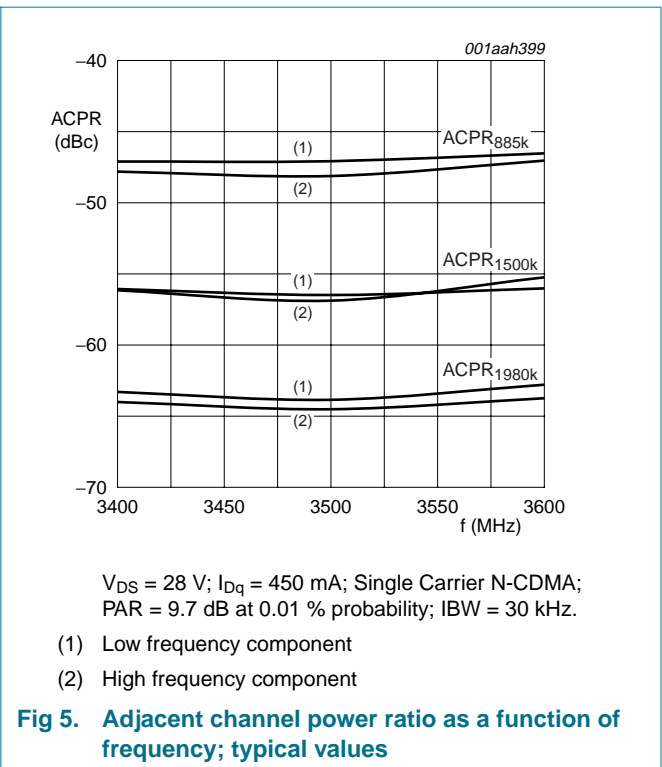
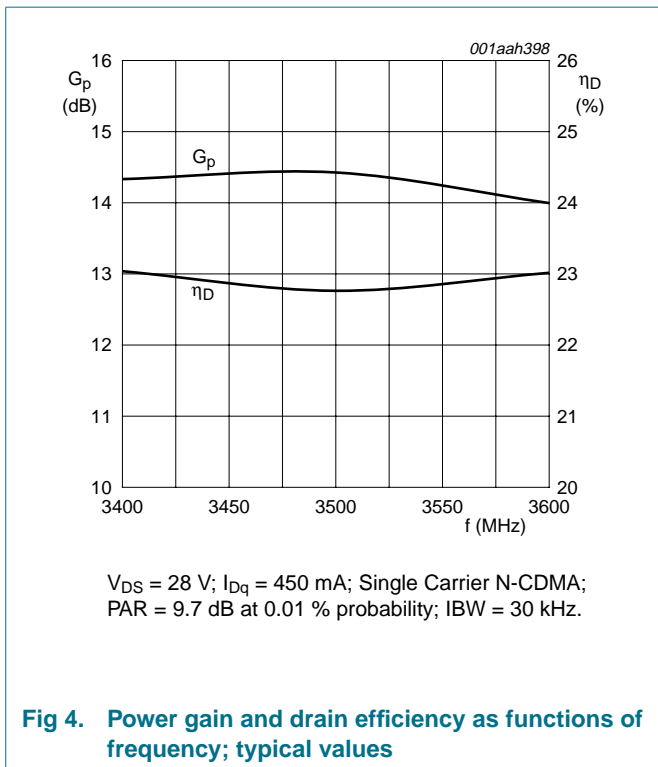
$V_{DS} = 28$  V;  $I_{Dq} = 450$  mA;  $f = 3500$  MHz.

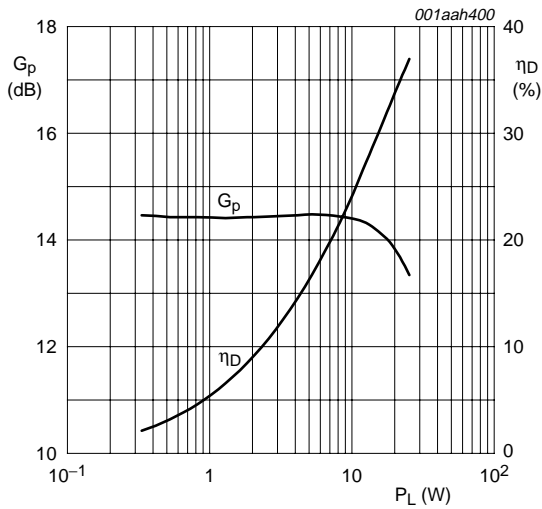
**Fig 2. Power gain and drain efficiency as functions of average load power; typical values**



### 7.3 Single carrier N-CDMA broadband performance at 9 W average

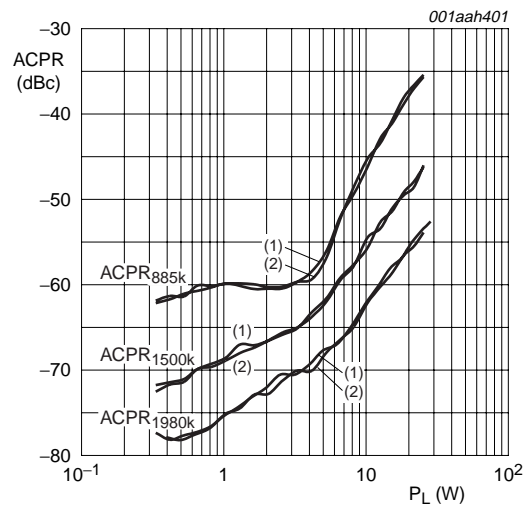
#### 7.3.1 Graphs





$V_{DS} = 28$  V;  $I_{Dq} = 450$  mA;  $f = 3500$  MHz;  
Single Carrier N-CDMA; PAR = 9.7 dB at 0.01 % probability; Channel Bandwidth = 1.23 MHz; IBW = 30 kHz.

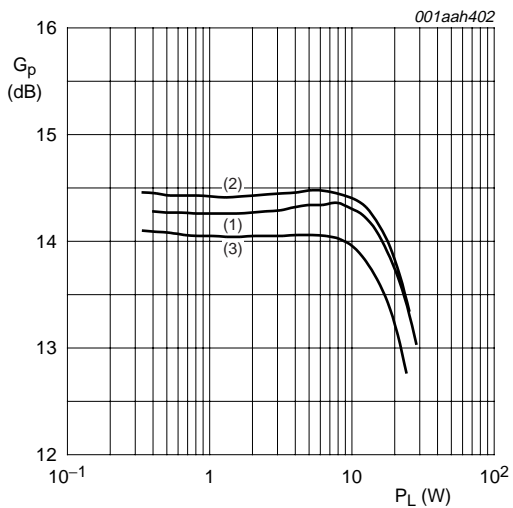
**Fig 6. Power gain and drain efficiency as functions of load power; typical values**



$V_{DS} = 28$  V;  $I_{Dq} = 450$  mA;  $f = 3500$  MHz;  
Single Carrier N-CDMA; PAR = 9.7 dB at 0.01 % probability; Channel Bandwidth = 1.23 MHz; IBW = 30 kHz.

- (1) Low frequency component
- (2) High frequency component

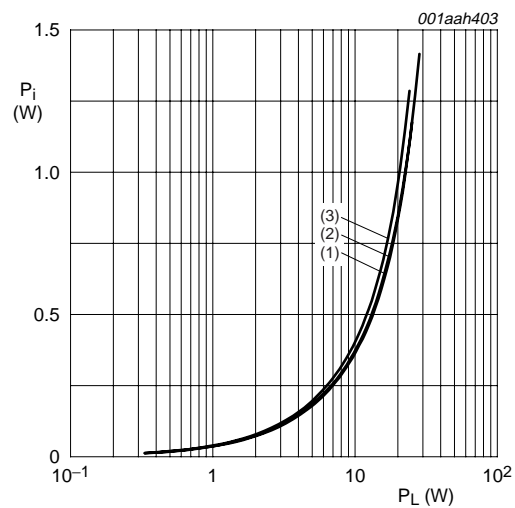
**Fig 7. Adjacent channel power ratio as a function of load power; typical values**



$V_{DS} = 28$  V;  $I_{Dq} = 450$  mA; Single Carrier N-CDMA;  
PAR = 9.7 dB at 0.01 % probability; Channel Bandwidth = 1.23 MHz; IBW = 30 kHz.

- (1)  $f = 3400$  MHz
- (2)  $f = 3500$  MHz
- (3)  $f = 3600$  MHz

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

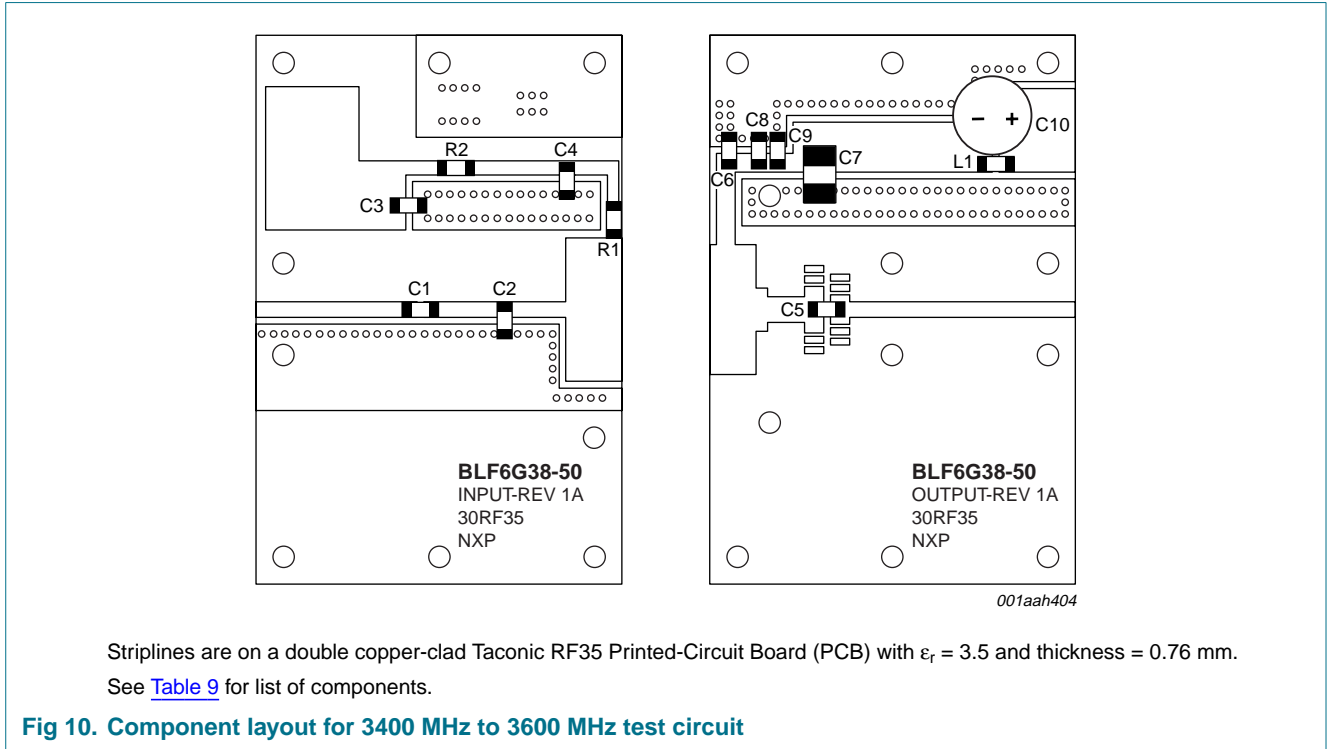


$V_{DS} = 28$  V;  $I_{Dq} = 450$  mA; Single Carrier N-CDMA;  
PAR = 9.7 dB at 0.01 % probability; Channel Bandwidth = 1.23 MHz; IBW = 30 kHz.

- (1)  $f = 3400$  MHz
- (2)  $f = 3500$  MHz
- (3)  $f = 3600$  MHz

**Fig 9. Input power as a function of load power; typical values**

**8. Test information**



**Table 9. List of components**

For test circuit, see [Figure 10](#).

Component	Description	Value	Remarks
C1, C4, C5, C6	multilayer ceramic chip capacitor	10 pF	[1]
C2	multilayer ceramic chip capacitor	0.7 pF	[1]
C3, C8, C9	multilayer ceramic chip capacitor	100 nF	[2]
C7	multilayer ceramic chip capacitor	10 $\mu$ F; 50 V	[3]
C10	electrolytic capacitor	470 $\mu$ F; 63 V	
R1, R2	SMD resistor	9.1 $\Omega$	
L1	ferrite SMD bead	-	Ferroxcube BDS 3/3/4.6-4S2 or equivalent

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

[2] Vishay VJ1206Y104KXB or capacitor of same quality.

[3] TDK C5750X7R1H106M or capacitor of same quality.

**9. Package outline**

Flanged LDMOST ceramic package; 2 mounting holes; 2 leads

SOT502A

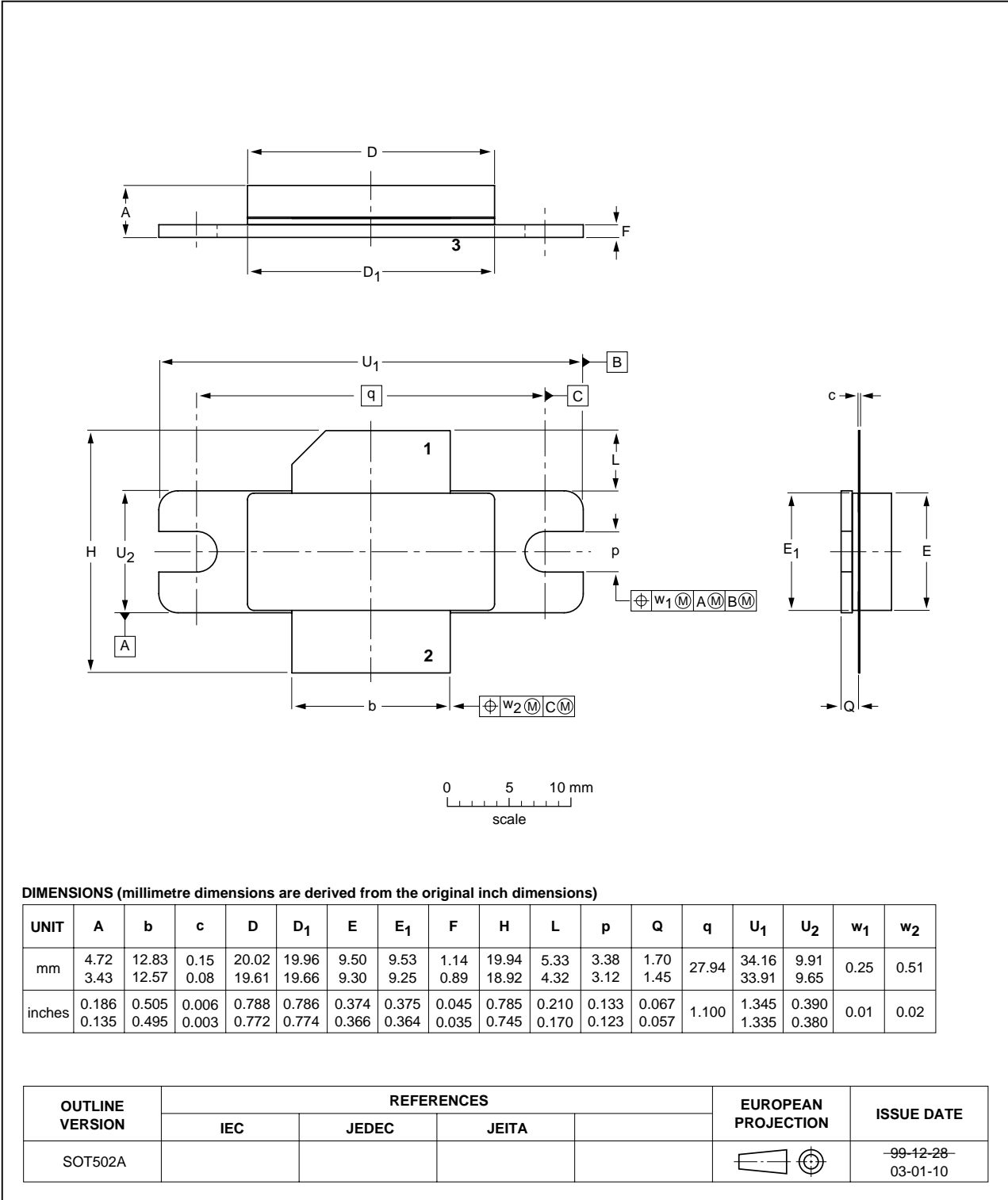


Fig 11. Package outline SOT502A



Earless flanged LDMOST ceramic package; 2 leads

SOT502B

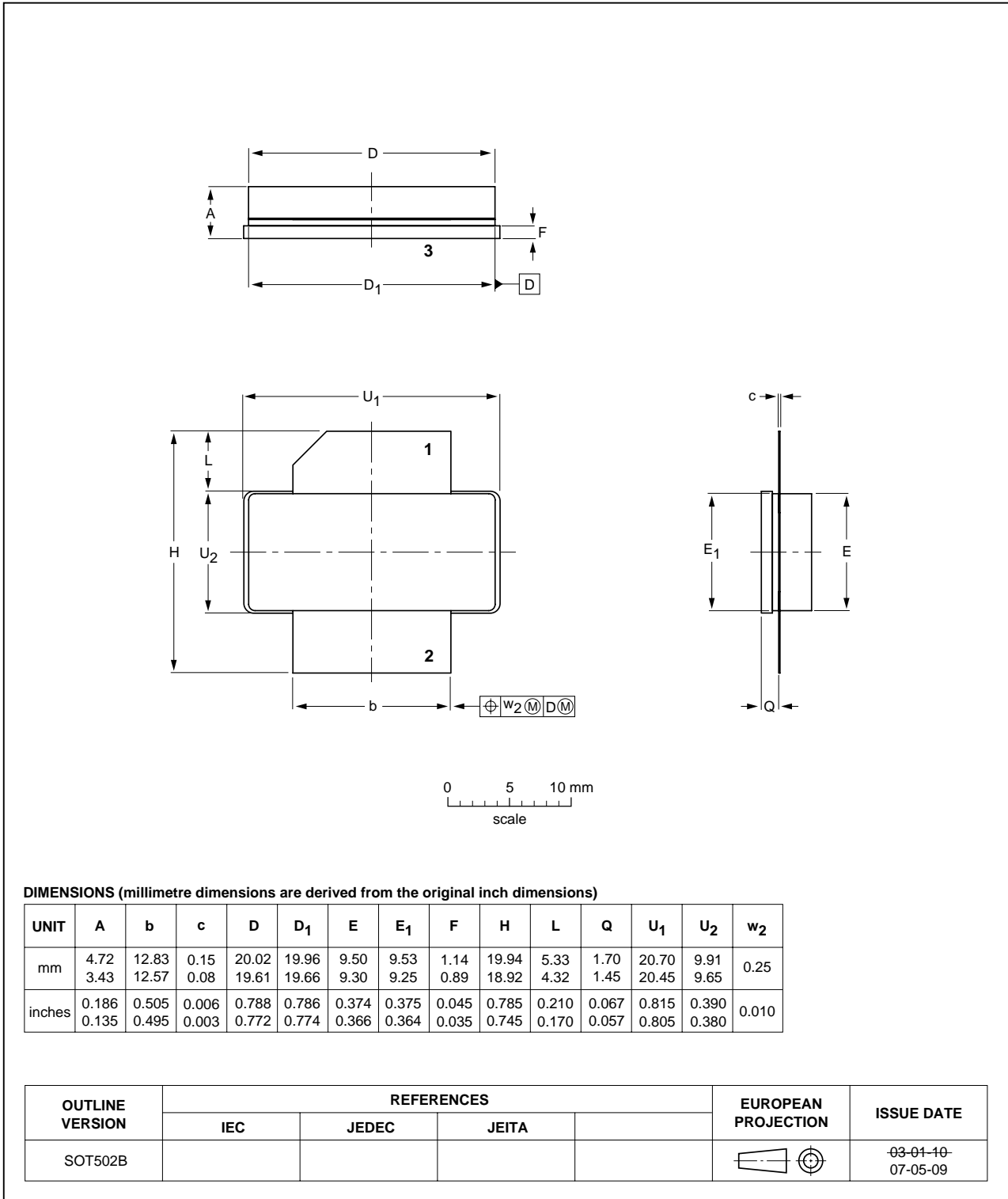


Fig 12. Package outline SOT502B

## 10. Abbreviations

**Table 10. Abbreviations**

Acronym	Description
CCDF	Complementary Cumulative Distribution Function
CW	Continuous Wave
EVM	Error Vector Magnitude
FCH	Frame Control Header
FFT	Fast Fourier Transform
IBW	Instantaneous BandWidth
LDMOS	Laterally Diffused Metal-Oxide Semiconductor
LDMOST	Laterally Diffused Metal-Oxide Semiconductor Transistor
N-CDMA	Narrowband Code Division Multiple Access
PAR	Peak-to-Average power Ratio
PUSC	Partial Usage of SubChannels
RF	Radio Frequency
SMD	Surface Mounted Device
VSWR	Voltage Standing-Wave Ratio
WCS	Wireless Communications Service
WiMAX	Worldwide Interoperability for Microwave Access

## 11. Revision history

**Table 11. Revision history**

Document ID	Release date	Data sheet status	Change notice	Supersedes
BLF6G38-50_BLF6G38LS-50_1	20080212	Preliminary 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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