

# BLF6G38-50; BLF6G38LS-50

WiMAX power LDMOS transistor

Rev. 02 — 1 June 2010

Product 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)	$\eta_D$ (%)	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 and benefits

- Typical 1-carrier N-CDMA performance (Single carrier N-CDMA with pilot, paging, synchronization 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)

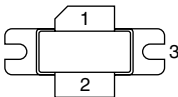
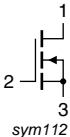
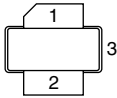
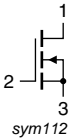


**1.3 Applications**

- 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	Graphic 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 ceramic package; 2 mounting holes; 2 leads	SOT502A
BLF6G38LS-50	-	earless flanged 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		-	200	°C

## 5. Thermal characteristics

**Table 5. Thermal characteristics**

Symbol	Parameter	Conditions	Type	Typ	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	-
			BLF6G38LS-50	0.7	-

## 6. Characteristics

**Table 6. Characteristics**

$T_j = 25\text{ °C}$  per section; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{(BR)DSS}$	drain-source breakdown voltage	$V_{GS} = 0\text{ V}; I_D = 0.4\text{ mA}$	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	$V_{GS} = V_{GS(th)} + 3.75\text{ V};$ $V_{DS} = 10\text{ V}$	11.8	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**

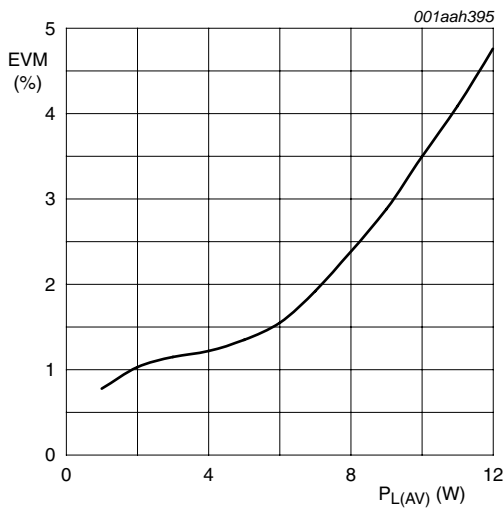
Frame duration = 5 ms; bandwidth = 10 MHz; sequency = 1 frame;  
 frequency band = WCS; sampling rate = 11.2 MHz;  $n = 8 / 7$ ;  $G = T_g / T_b = 1 / 8$ ;  
 FFT = 1024; zone type = PUSC;  $\delta = 97.7 \%$ ; number of symbols = 46;  
 number of subchannels = 30; PAR = 9.5 dB.

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

**Table 8. Frame structure**

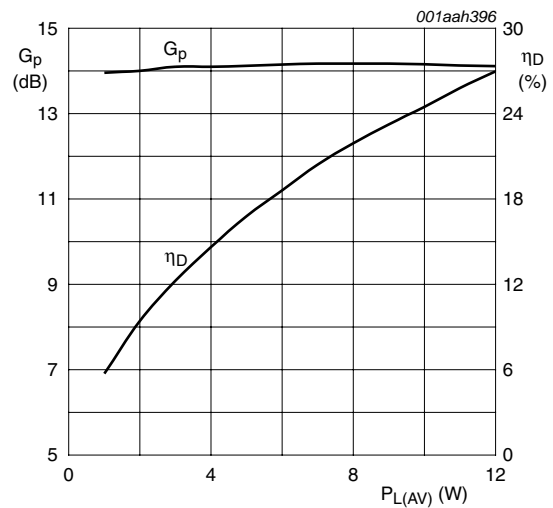
Frame contents	Modulation technique	Data length
Zone 0 FCH 2 symbols $\times$ 4 subchannels	QPSK1/2	3 bit
Zone 0 data 2 symbols $\times$ 26 subchannels	64QAM3/4	692 bit
Zone 0 data 44 symbols $\times$ 30 subchannels	64QAM3/4	10000 bit

**7.2.2 Graphs**



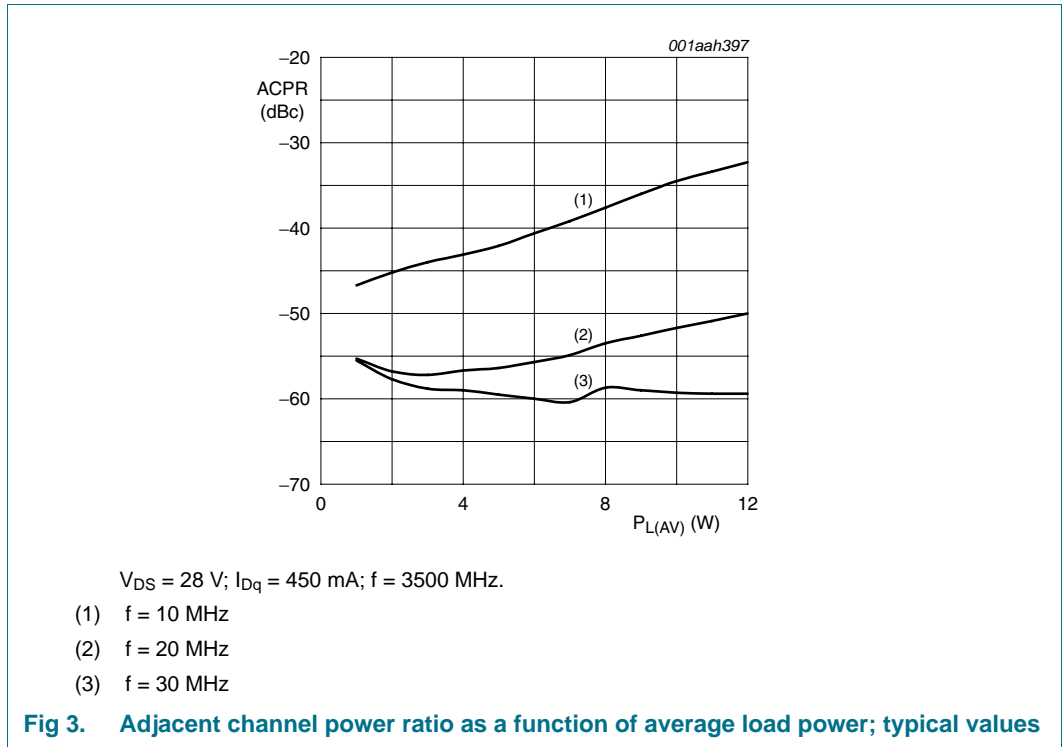
$V_{DS} = 28 \text{ V}$ ;  $I_{Dq} = 450 \text{ mA}$ ;  $f = 3500 \text{ MHz}$ .

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



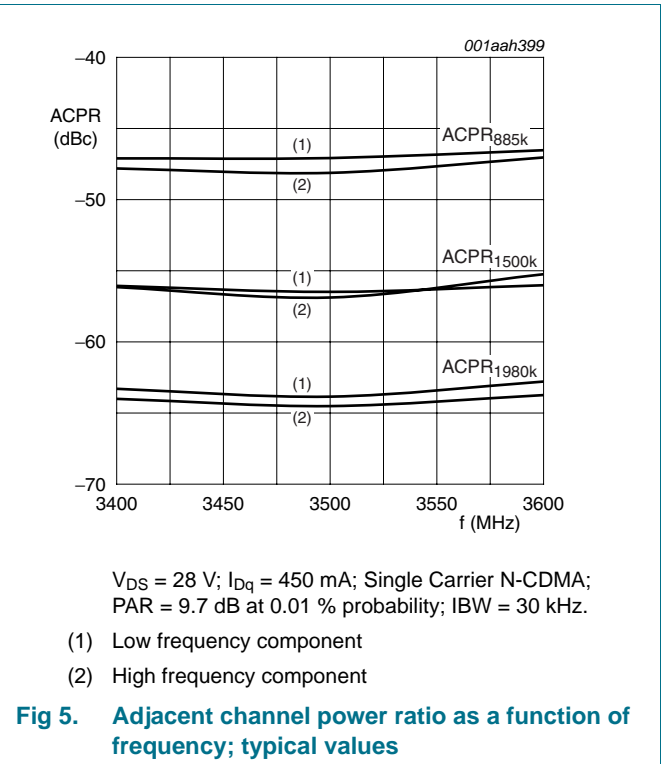
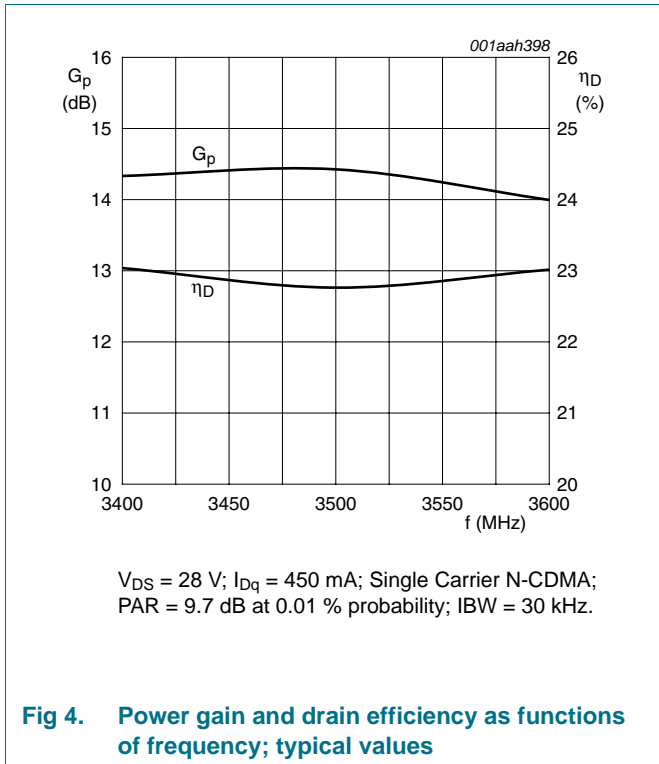
$V_{DS} = 28 \text{ V}$ ;  $I_{Dq} = 450 \text{ mA}$ ;  $f = 3500 \text{ MHz}$ .

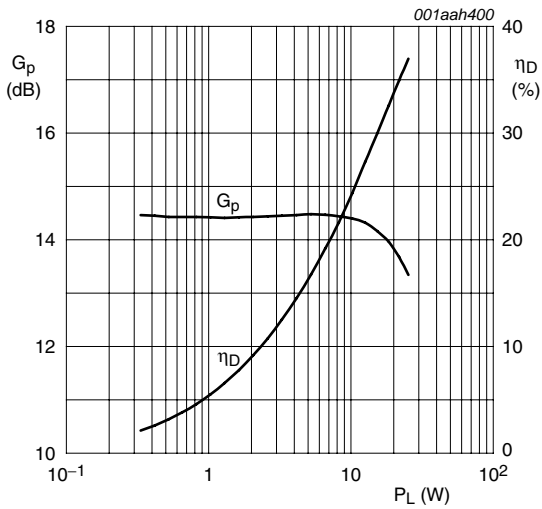
**Fig 2. Power gain and drain efficiency as functions of average load power; typical values**



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

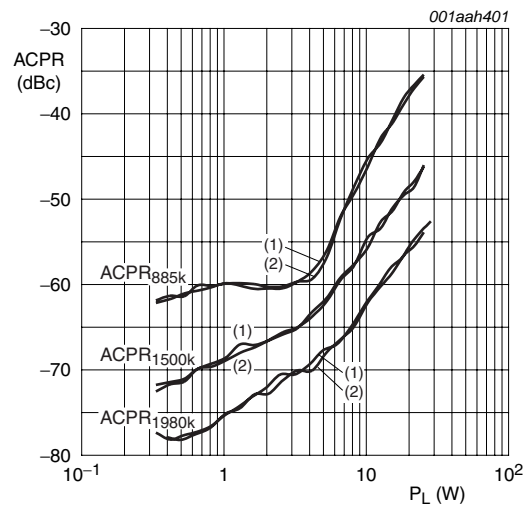
**7.3.1 Graphs**





$V_{DS} = 28$  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.

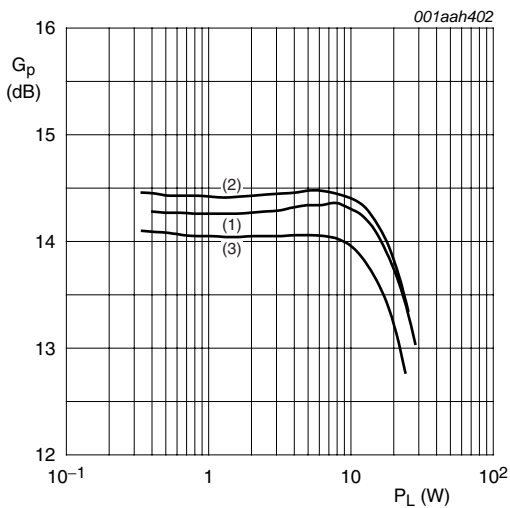
Fig 6. Power gain and drain efficiency as functions of load power; typical values



$V_{DS} = 28$  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

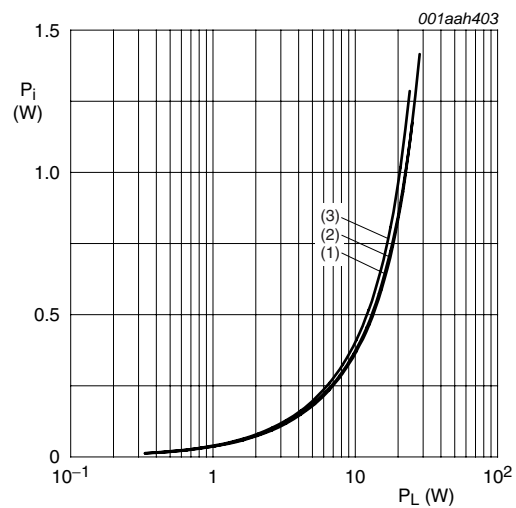
Fig 7. Adjacent channel power ratio as a function of load power; typical values



$V_{DS} = 28$  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

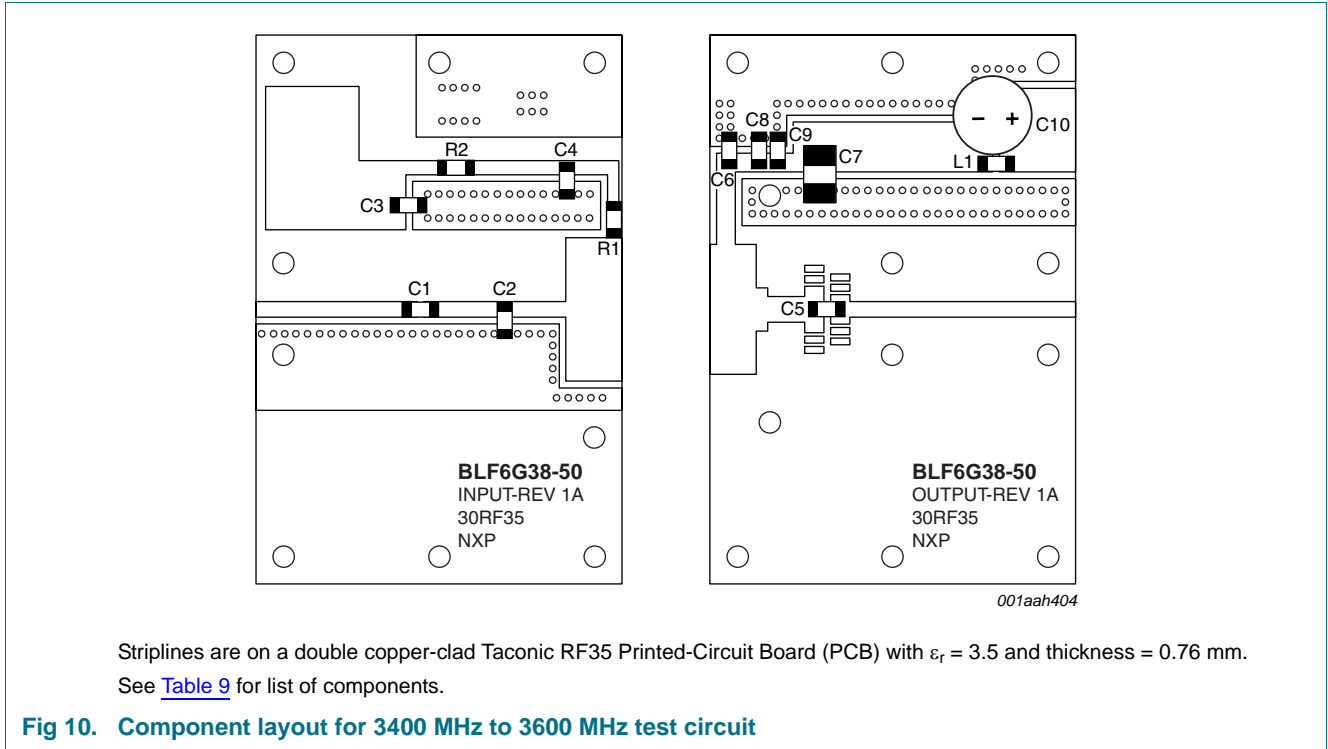


$V_{DS} = 28$  V;  $I_{Dq} = 450$  mA; Single Carrier N-CDMA; PAR = 9.7 dB at 0.01 % probability; Channel Bandwidth = 1.23 MHz; IBW = 30 kHz.

- (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**



**Fig 10. Component layout for 3400 MHz to 3600 MHz test circuit**

**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 μF; 50 V	[3]
C10	electrolytic capacitor	470 μF; 63 V	
R1, R2	SMD resistor	9.1 Ω	
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.

**Table 10. Measured test circuit impedances**

f (GHz)	Z <sub>i</sub> (Ω)	Z <sub>o</sub> (Ω)
3.4	5.48 – j9.38	12.42 – j4.58
3.5	5.39 – j9.43	10.41 – j5.31
3.6	5.55 – j9.15	14.31 – j7.04
3.8	9.60 – j12.48	17.70 – j11.57

**9. Package outline**

Flanged LDMOST ceramic package; 2 mounting holes; 2 leads

SOT502A

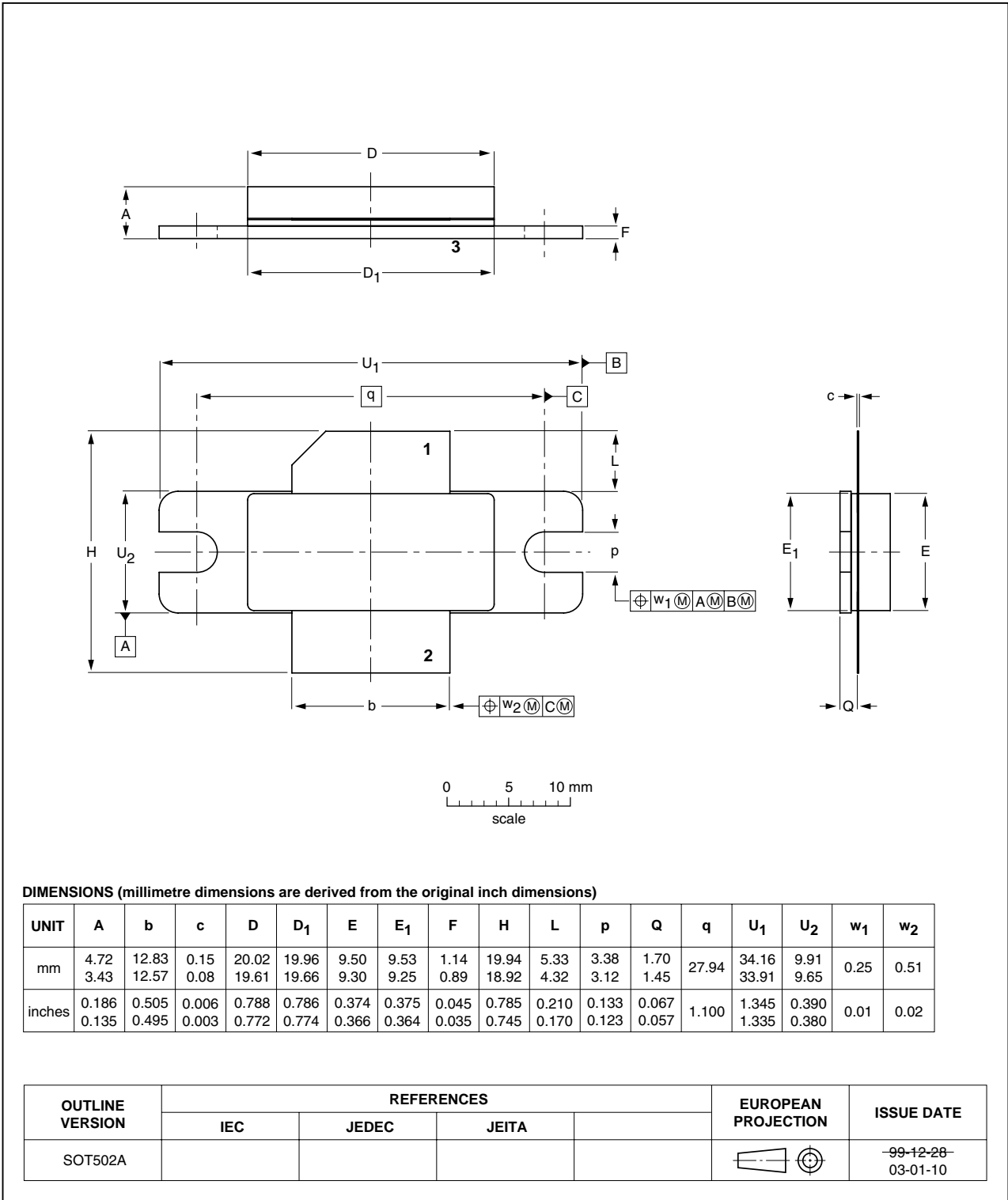


Fig 11. Package outline SOT502A

Earless flanged LDMOST ceramic package; 2 leads

SOT502B

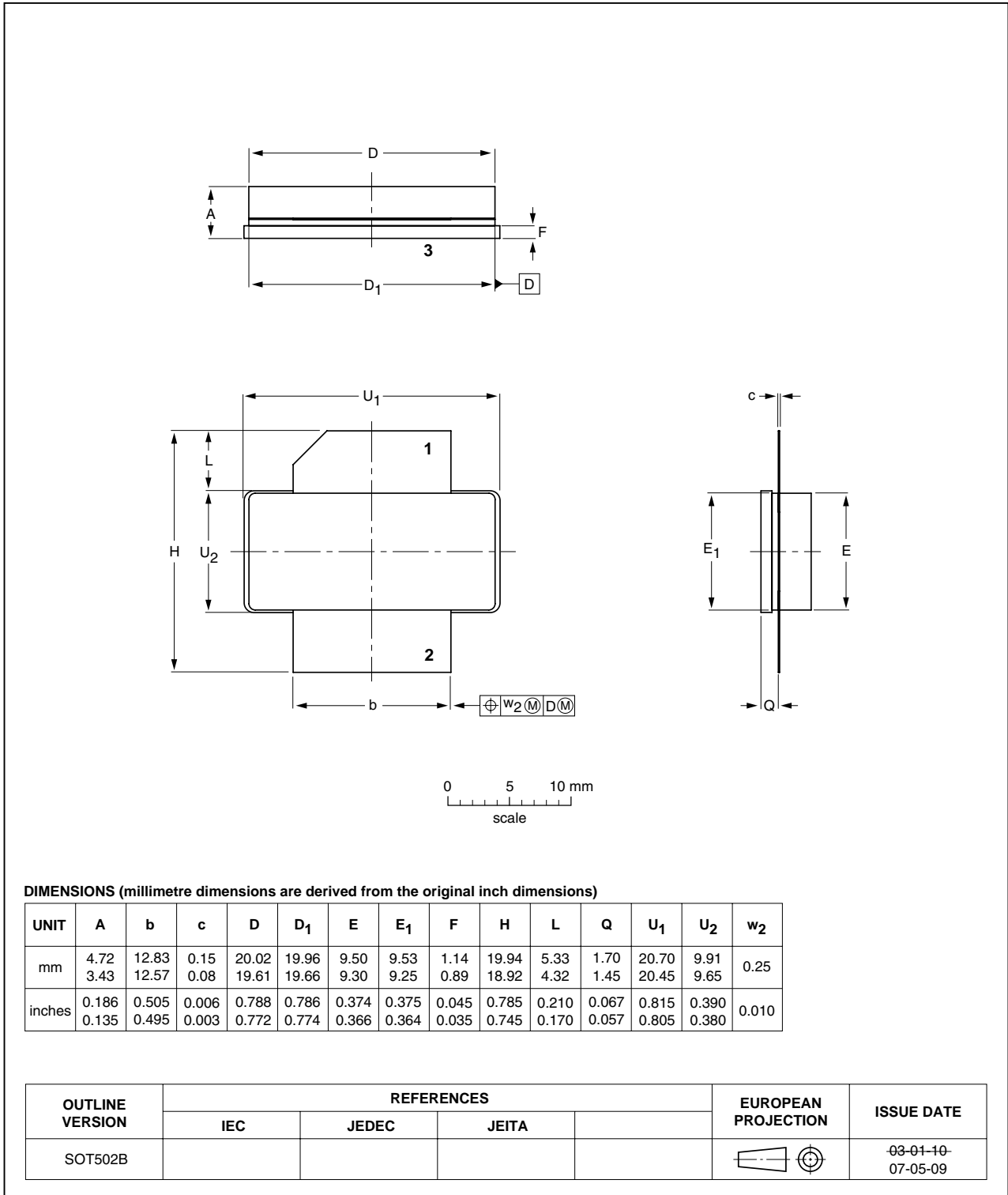


Fig 12. Package outline SOT502B

## 10. Abbreviations

Table 11. 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 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BLF6G38-50_BLF6G38LS-50 v.2	20100601	Product data sheet	-	BLF6G38-50_BLF6G38LS-50_1
Modifications:			<ul style="list-style-type: none"> <li>Data sheet status changed from preliminary to product.</li> <li><a href="#">Section 12 "Legal information"</a> updated.</li> </ul>	
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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