BLF6G38-25; BLF6G38S-25

WiMAX power LDMOS transistor

Rev. 02 — 23 December 2008 | Product data sheet

1. Product profile

1.1 General description

25 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 °C in a class-AB production test circuit.

Mode of operation	f (MHz)	V_{DS} (V)	$P_{L(AV)}$ (W)	G_p (dB)	η_D (%)	$ACPR_{885k}$ (dBc)	$ACPR_{1980k}$ (dBc)
1-carrier N-CDMA[1]	3400 to 3600	28	4.5	15	24	–45[2]	–61[2]

[1] Single carrier IS-95 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 1.2288 MHz.

[2] Measured within 30 kHz bandwidth.

1.2 Features

- Typical 1-carrier N-CDMA performance (single carrier IS-95 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 1.2288 MHz) at a frequency of 3400 MHz, 3500 MHz and 3600 MHz, a supply voltage of 28 V and an I_{Dq} of 225 mA:
  - Average output power = 4.5 W
  - Power gain = 15 dB
  - Drain efficiency = 24 %
  - $ACPR_{885k}$ = –45 dBc in 30 kHz bandwidth
- Easy power control
- Integrated ESD protection
- Excellent ruggedness
- High efficiency
- Excellent thermal stability
- Designed for broadband operation (3400 MHz to 3800 MHz)
- Internally matched for ease of use
- Compliant to Directive 2002/95/EC, regarding Restriction of Hazardous Substances (RoHS)

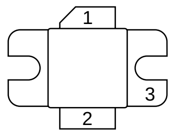
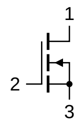
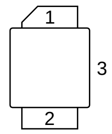
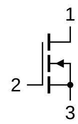
1.3 Applications

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

founded by Philips

2. Pinning information

Table 2. Pinning

Pin	Description		Simplified outline	Graphic symbol
BLF6G38-25 (SOT608A)				
1	drain			 sym112
2	gate			
3	source	[1]		
BLF6G38S-25 (SOT608B)				
1	drain			 sym112
2	gate			
3	source	[1]		

[1] Connected to flange.

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BLF6G38-25	-	flanged ceramic package; 2 mounting holes; 2 leads	SOT608A
BLF6G38S-25	-	ceramic earless flanged package; 2 leads	SOT608B

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		-	8.2	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	Max	Unit
$R_{th(j\text{-}case)}$	thermal resistance from junction to case	T_{case} = 80 °C; P_L = 25 W	BLF6G38-25	1.8	-	K/W
			BLF6G38S-25	1.8	-	K/W

6. Characteristics

Table 6. Characteristics

T_j = 25 °C unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{(BR)DSS}$	drain-source breakdown voltage	V_{GS} = 0 V; I_D = 0.4 mA	65	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	V_{DS} = 10 V; I_D = 40 mA	1.4	2	2.4	V
I_{DSS}	drain leakage current	V_{GS} = 0 V; V_{DS} = 28 V	-	-	1.5	μA
I_{DSX}	drain cut-off current	V_{GS} = $V_{GS(th)}$ + 3.75 V; V_{DS} = 10 V	6	8.2	-	A
I_{GSS}	gate leakage current	V_{GS} = +11 V; V_{DS} = 0 V	-	-	150	nA
g_{fs}	forward transconductance	V_{DS} = 10 V; I_D = 1.4 A	-	2.8	-	S
$R_{DS(on)}$	drain-source on-state resistance	V_{GS} = $V_{GS(th)}$ + 3.75 V; I_D = 1.4 A	-	0.37	0.58	Ω
C_{rs}	feedback capacitance	V_{GS} = 0 V; V_{DS} = 28 V; f = 1 MHz	-	0.59	-	pF

7. Application information

Table 7. Application information

Mode of operation: 1-carrier N-CDMA; single carrier IS-95 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 1.2288 MHz; f_1 = 3400 MHz; f_2 = 3500 MHz; f_3 = 3600 MHz; RF performance at V_{DS} = 28 V; I_{Dq} = 225 mA; T_{case} = 25 °C; unless otherwise specified, in a class-AB production circuit.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
G_p	power gain	$P_{L(AV)}$ = 4.5 W	12.5	15	-	dB
RL_{in}	input return loss	$P_{L(AV)}$ = 4.5 W	-	–10	-	dB
η_D	drain efficiency	$P_{L(AV)}$ = 4.5 W	22	24	-	%
$ACPR_{885k}$	adjacent channel power ratio (885 kHz)	$P_{L(AV)}$ = 4.5 W [1]	-	–45	–40	dBc
$ACPR_{1980k}$	adjacent channel power ratio (1980 kHz)	$P_{L(AV)}$ = 4.5 W [1]	-	–61	–56	dBc

[1] Measured within 30 kHz bandwidth.

7.1 Ruggedness in class-AB operation

The BLF6G38-25 and BLF6G38S-25 are capable of withstanding a load mismatch corresponding to VSWR = 10 : 1 through all phases under the following conditions: V_{DS} = 28 V; I_{Dq} = 225 mA; P_L = $P_{L(1dB)}$; f = 3600 MHz.

7.2 NXP WiMAX signal

7.2.1 WiMAX signal description

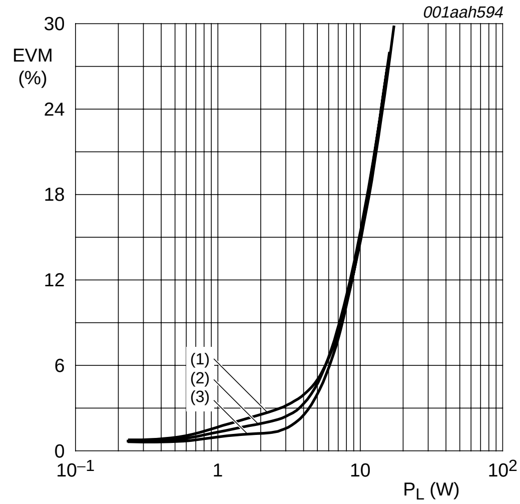
frame duration = 5 ms; bandwidth = 10 MHz; sequency = 1 frame;
frequency band = WCS; sampling rate = 11.2 MHz; n = 8 / 7; $G = T_g / T_b = 1 / 8$;
FFT = 1024; zone type = PUSC; δ = 97.7 %; number of symbols = 46;
number of subchannels = 30; PAR = 9.5 dB.

Preamble: 1 symbol × 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 × 4 subchannels	QPSK1/2	3
Zone 0	data	2 symbols × 26 subchannels	64QAM3/4	692
Zone 0	data	44 symbols × 30 subchannels	64QAM3/4	10000

7.2.2 Graphs



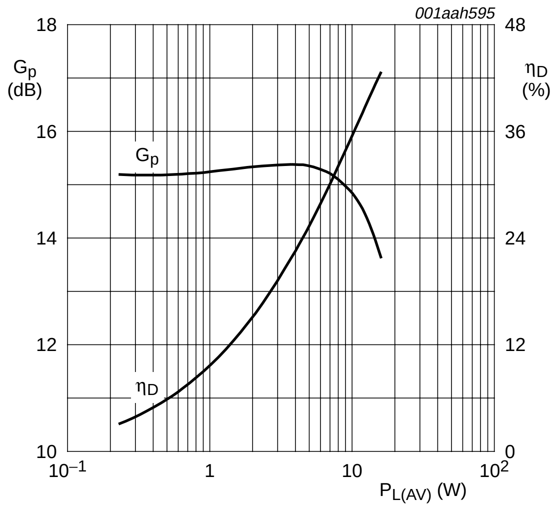
V_{DS} = 28 V; I_{Dq} = 225 mA; OFDMA signal;
frame duration = 5 ms; bandwidth = 10 MHz;
frequency band = WCS; n = 28 / 25; G = 1 / 8;
FFT = 1024; zone type = PUSC;
number of symbols = 46; number of subchannels = 30.

(1) f = 3400 MHz

(2) f = 3500 MHz

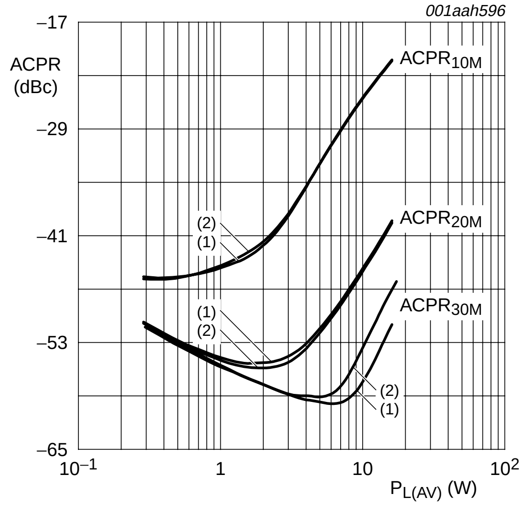
(3) f = 3600 MHz

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



V_{DS} = 28 V; I_{Dq} = 225 mA; f = 3500 MHz;
OFDMA signal; frame duration = 5 ms;
bandwidth = 10 MHz; frequency band = WCS;
n = 28 / 25; G = 1 / 8; FFT = 1024; zone type = PUSC;
number of symbols = 46; number of subchannels = 30.

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



V_{DS} = 28 V; I_{Dq} = 225 mA; f = 3500 MHz; OFDMA signal; frame duration = 5 ms; bandwidth = 10 MHz; frequency band = WCS; n = 28 / 25; G = 1 / 8; FFT = 1024; zone type = PUSC; number of symbols = 46; number of subchannels = 30.

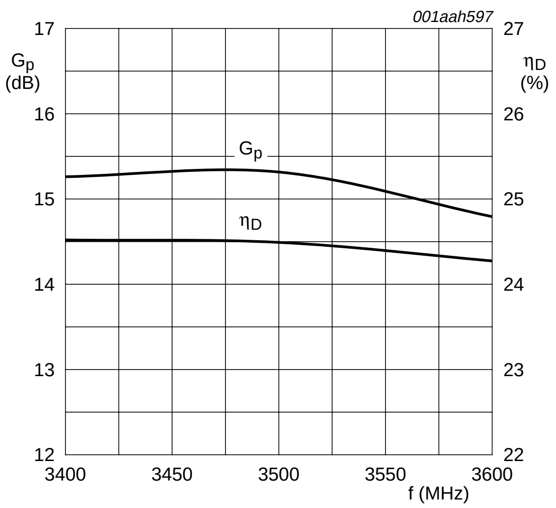
(1) Low frequency component

(2) High frequency component

Fig 3. Adjacent channel power ratio as function of average load power; typical values

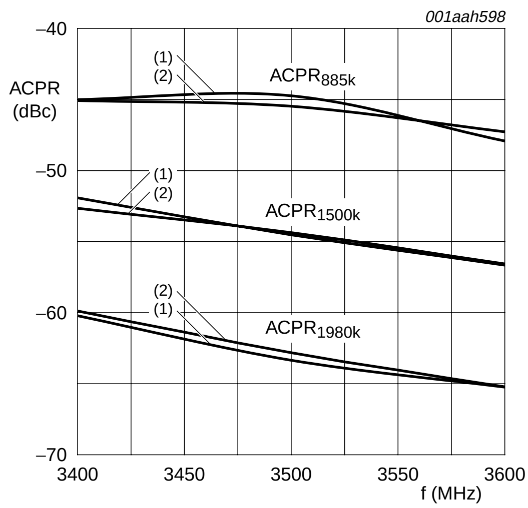
7.3 Single carrier N-CDMA broadband performance at 9 W average

7.3.1 Graphs



$P_{L(AV)}$ = 4.5 W.

Fig 4. Power gain and drain efficiency as functions of frequency; typical values

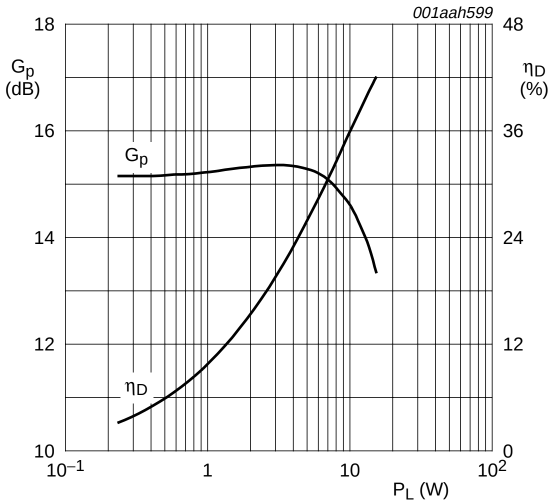


V_{DS} = 28 V; I_{Dq} = 350 mA; $P_{L(AV)}$ = 4.5 W; single carrier N-CDMA; PAR = 9.7 dB at 0.01 % probability; IBW = 30 kHz.

(1) Low frequency component

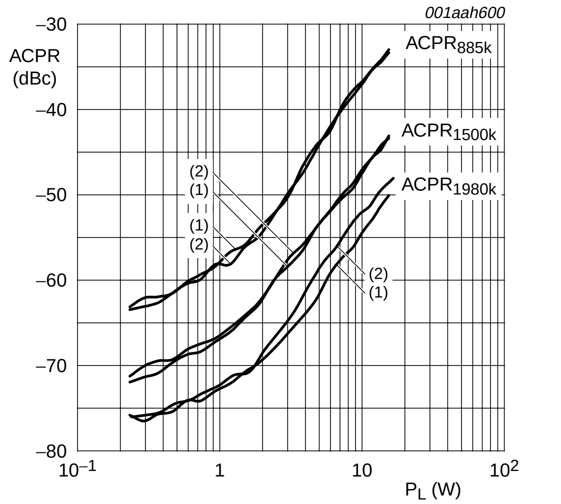
(2) High frequency component

Fig 5. Adjacent channel power ratio as function of frequency; typical values



V_{DS} = 28 V; I_{Dq} = 225 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

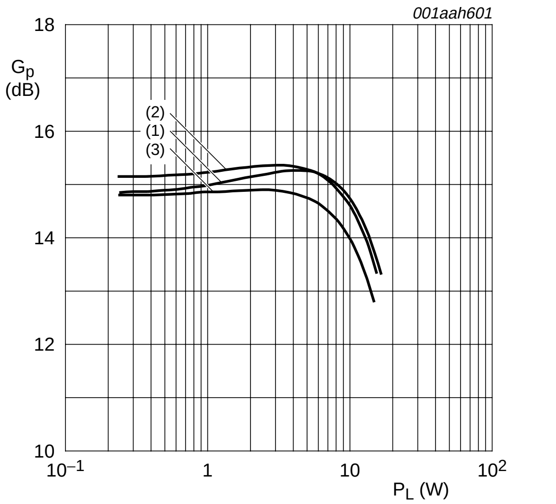


V_{DS} = 28 V; I_{Dq} = 225 mA; f = 3500 MHz; single carrier N-CDMA; PAR = 9.7 dB at 0.01 % probability; channel bandwidth = 1.23 MHz; IBW = 30 kHz.

(1) Low frequency component

(2) High frequency component

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



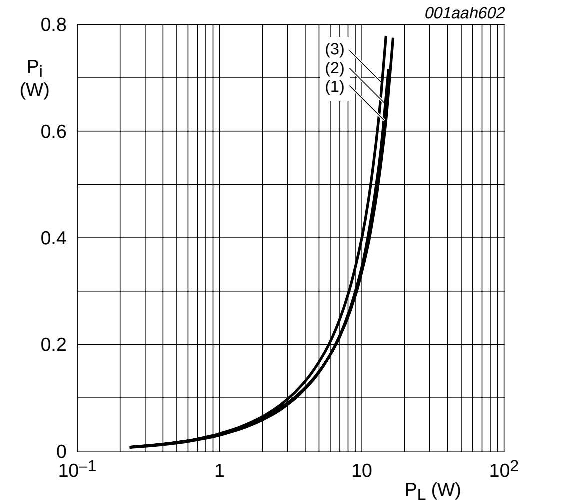
V_{DS} = 28 V; I_{Dq} = 225 mA; single carrier N-CDMA; PAR = 9.7 dB at 0.01 % probability; channel bandwidth = 1.23 MHz; IBW = 30 kHz.

(1) f = 3400 MHz

(2) f = 3500 MHz

(3) f = 3600 MHz

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



V_{DS} = 28 V; I_{Dq} = 225 mA; single carrier N-CDMA; PAR = 9.7 dB at 0.01 % probability; channel bandwidth = 1.23 MHz; IBW = 30 kHz.

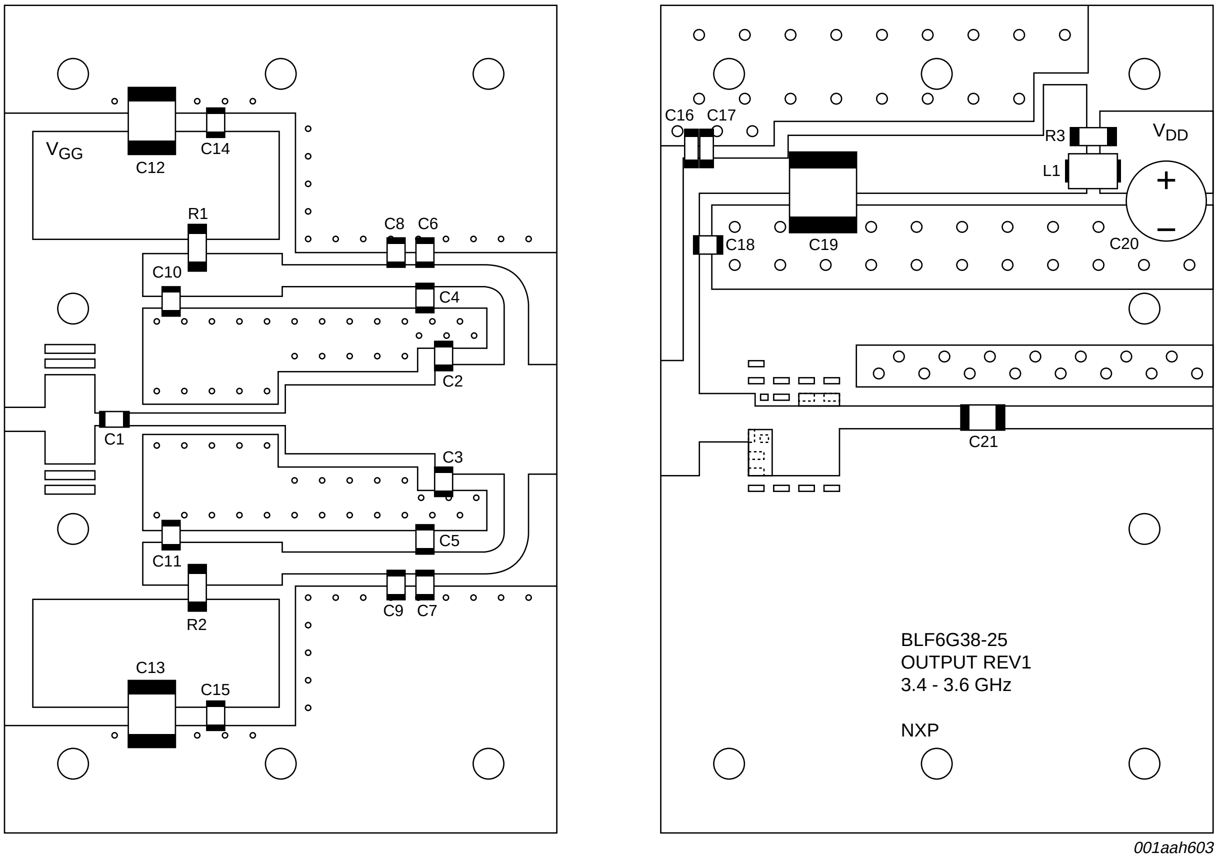
(1) f = 3400 MHz

(2) f = 3500 MHz

(3) f = 3600 MHz

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

8. Test information



Striplines are on a double copper-clad Taconic RF35 Printed-Circuit Board (PCB) with ε_r = 3.5 and thickness = 0.76 mm.

See Table 9 for list of components.

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

Table 9. List of components (see Figure 10)

Component	Description	Value	Remarks
C1	multilayer ceramic chip capacitor	22 pF	ATC 100A or equivalent
C2, C3	multilayer ceramic chip capacitor	3 pF	ATC 100A or equivalent
C4, C5, C6, C7, C8, C9, C18	multilayer ceramic chip capacitor	10 pF	ATC 100A or equivalent
C10, C11	multilayer ceramic chip capacitor	24 pF	ATC 100A or equivalent
C12, C13	multilayer ceramic chip capacitor	4.7 μF; 50 V	TDK C4532X7R1H475M or equivalent
C14, C15	multilayer ceramic chip capacitor	1 nF	ATC 700A or equivalent
C16, C17	multilayer ceramic chip capacitor	100 nF	Vishay VJ1206Y104KXB or equivalent
C19	multilayer ceramic chip capacitor	10 μF; 50 V	TDK C5750X7R1H106M or equivalent
C20	electrolytic capacitor	470 μF; 63 V	
C21	multilayer ceramic chip capacitor	10 pF	ATC 100B or equivalent

Table 9. List of components (see Figure 10) *…continued*

Component	Description	Value	Remarks
L1	ferrite SMD bead	-	Ferroxcube BDS3/3/4.6-4S2 or equivalent
R1, R2	SMD resistor	20 Ω	SMD 1206
R3	SMD resistor	9.1 Ω	SMD 1206

Table 10. Measured test circuit impedances

f MHz	Z_S Ω	Z_L Ω
3400	14.65 + j29.87	13.46 + j3.58
3450	14.16 + j28.69	13.56 + j4.12
3500	14.56 + j30.52	13.76 + j4.74
3550	17.49 + j30.11	13.97 + j5.41
3600	15.50 + j29.36	14.16 + j5.95

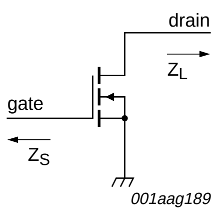
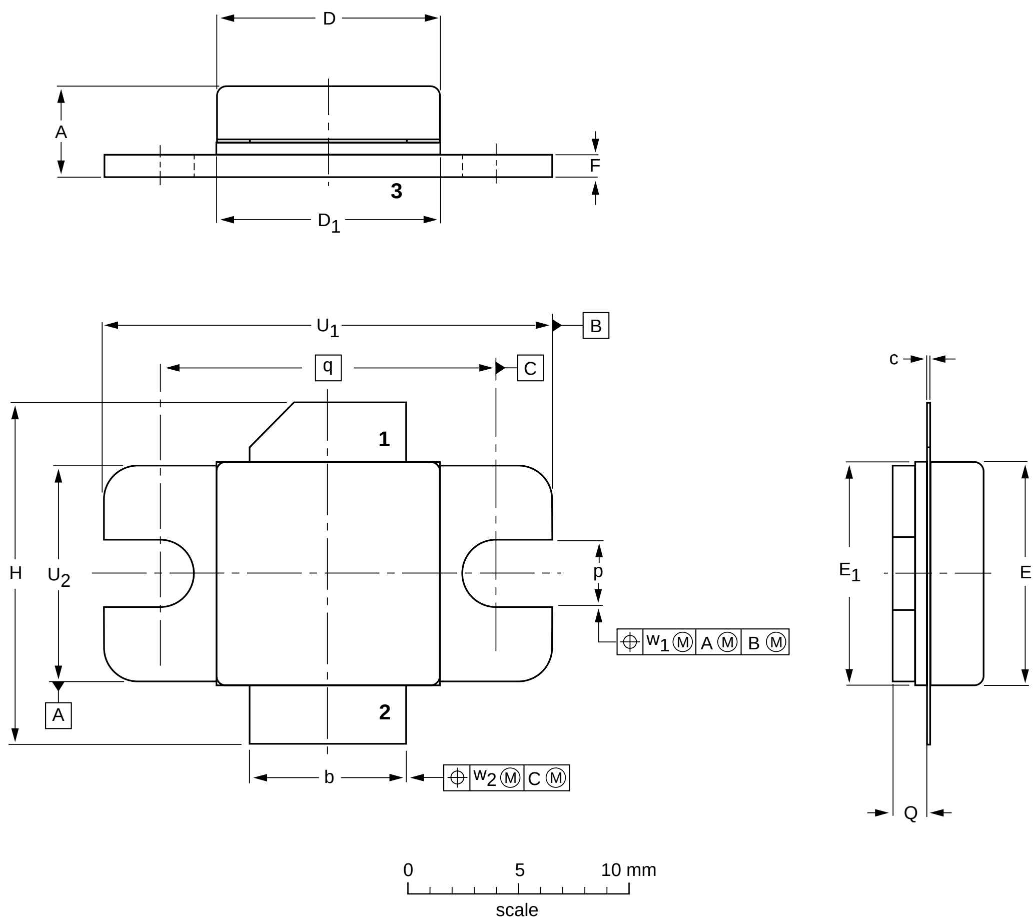


Fig 11. Definition of transistor impedance

9. Package outline

Flanged ceramic package; 2 mounting holes; 2 leads **SOT608A**



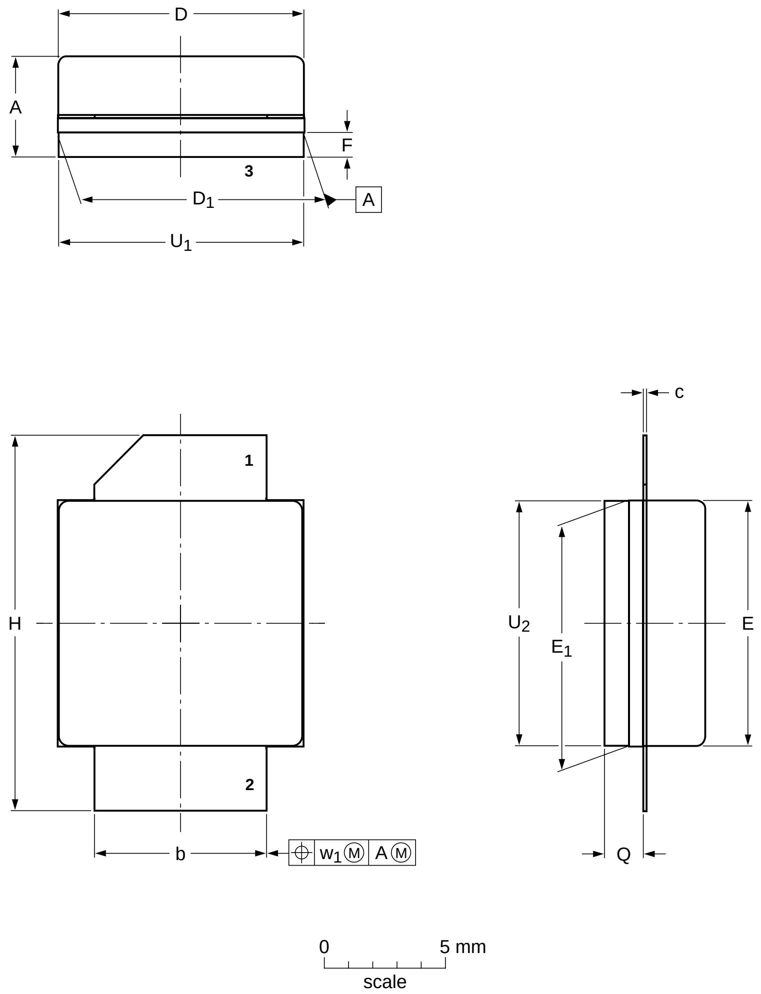
DIMENSIONS (millimetre dimensions are derived from the original inch dimensions)

UNIT	A	b	c	D	D_1	E	E_1	F	H	p	Q	q	U_1	U_2	w_1	w_2
mm	4.62 3.76	7.24 6.99	0.15 0.10	10.21 10.01	10.29 10.03	10.21 10.01	10.29 10.03	1.14 0.89	15.75 14.73	3.30 2.92	1.70 1.35	15.24	20.45 20.19	9.91 9.65	0.25	0.51
inches	0.182 0.148	0.285 0.275	0.006 0.004	0.402 0.394	0.405 0.395	0.402 0.394	0.405 0.395	0.045 0.035	0.620 0.580	0.130 0.115	0.067 0.053	0.600	0.805 0.795	0.390 0.380	0.010	0.020

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT608A						~~01-02-22~~ 02-02-11

Fig 12. Package outline SOT608A

Ceramic earless flanged package; 2 leads **SOT608B**



DIMENSIONS (mm dimensions are derived from the original inch dimensions)

UNIT	A	b	c	D	D_1	E	E_1	F	H	Q	U_1	U_2	w_1
mm	4.62 3.76	7.24 6.99	0.15 0.10	10.21 10.01	10.29 10.03	10.21 10.01	10.29 10.03	1.14 0.89	15.75 14.73	1.70 1.35	10.24 9.98	10.24 9.98	0.51
inch	0.182 0.148	0.285 0.275	0.006 0.004	0.402 0.394	0.405 0.395	0.402 0.394	0.405 0.395	0.045 0.035	0.620 0.580	0.067 0.053	0.403 0.393	0.403 0.393	0.020

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT608B						~~06-11-27~~ 06-12-06

Fig 13. Package outline SOT608B

10. Abbreviations

Table 11. Abbreviations

Acronym	Description
CCDF	Complementary Cumulative Distribution Function
CW	Continuous Wave
ESD	ElectroStatic Discharge
EVM	Error Vector Magnitude
FCH	Frame Control Header
FFT	Fast Fourier Transform
IBW	Instantaneous BandWidth
IS-95	Interim Standard 95
LDMOS	Laterally Diffused Metal-Oxide Semiconductor
N-CDMA	Narrowband Code Division Multiple Access
OFDMA	Orthogonal Frequency Division Multiple Access
PAR	Peak-to-Average power Ratio
PUSC	Partial Usage of SubChannels
RF	Radio Frequency
QAM	Quadrature Amplitude Modulation
QPSK	Quadrature Phase Shift Keying
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
BLF6G38-25_BLF6G38S-25_2	20081223	Product data sheet	-	BLF6G38-25_BLF6G38S-25_1
Modifications:	• Changed the maximum drain current and the maximum junction temperature in Table 4 on page 2 • Moved impedance information to Section 8			
BLF6G38-25_BLF6G38S-25_1	20080218	Preliminary data sheet	-	-

12. Legal information

12.1 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.nxp.com.

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14. Contents

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