BLF984P; BLF984PS

Power LDMOS transistor

AMPLEON

Rev. 3 — 14 August 2024 **Product data sheet**

1. Product profile

1.1 General description

A 450 W LDMOS RF power transistor for broadcast Doherty, class-AB transmitter and industrial applications. The excellent ruggedness of this device makes it ideal for digital and analog transmitter applications in the frequency range from 30 MHz to 860 MHz.

Table 1. Typical information

RF performance at T_{case} = 25 °C; I_{Dq} = 2 × 325 mA; in a class-AB test circuit, unless otherwise specified, typical values.

Test signal	f	V_{DS}	P_L	G_p	η_D	IMD_{shldr}	PAR
	(MHz)	(V)	(W)	(dB)	(%)	(dBc)	(dB)
DVB-T (8k OFDM)	700	50	80 (AV)	22.5	34	−30 [1]	8 [2]
pulsed CW [3]	700	50	450 (peak)	22	67.5	-	-
CW [4]	30 to 520	28	80	19.2	50.5	-	-

[1] Measured [dBc] with delta marker at 4.3 MHz from center frequency.

[2] PAR (of output signal) at 0.01 % probability on CCDF; PAR of input signal = 9.5 dB at 0.01 % probability on CCDF.

[3] t_p = 100 μs; δ = 10 %.

[4] Center band performance numbers across the indicated frequency range measured with total I_{Dq} of 300 mA.

1.2 Features and benefits

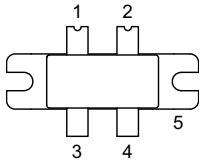
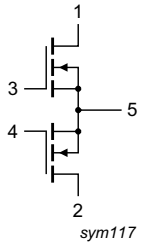
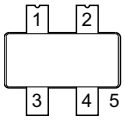
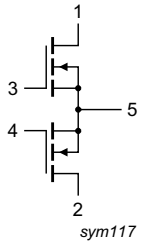
- Designed for broadband and Doherty operation
- High efficiency
- Integrated double sided ESD protection
- Excellent ruggedness
- High power gain
- Excellent reliability
- Easy power control
- Excellent stability
- For RoHS compliance see the product details on the Ampleon website

1.3 Applications

- Broadcast transmitter applications in the UHF band
- Digital and analog broadcasting
- Industrial, scientific and medical applications
- Applicable at frequencies from 30 MHz to 860 MHz

2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Graphic symbol
BLF984P (SOT1121A)			
1	drain1		
2	drain2		
3	gate1		
4	gate2		
5	source [1]		
BLF984PS (SOT1121B)			
1	drain1		
2	drain2		
3	gate1		
4	gate2		
5	source [1]		

[1] Connected to flange.

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BLF984P	-	flanged LDMOST ceramic package; 2 mounting holes; 4 leads	SOT1121A
BLF984PS	-	earless flanged ceramic package; 4 leads	SOT1121B

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		-	108	V
V_{GS}	gate-source voltage		–6	+11	V
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature	[1]	-	225	°C

[1] Continuous use at maximum temperature will affect the reliability, for details refer to the online MTF calculator.

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5. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Typ	Unit
$R_{th(j-c)}$	thermal resistance from junction to case	T_{case} = 85 °C; $P_{L(AV)}$ = 80 W [1]	0.23	K/W

[1] $R_{th(j-c)}$ is measured under RF conditions.

6. Characteristics

Table 6. DC characteristics

T_j = 25 °C; per section unless otherwise specified.

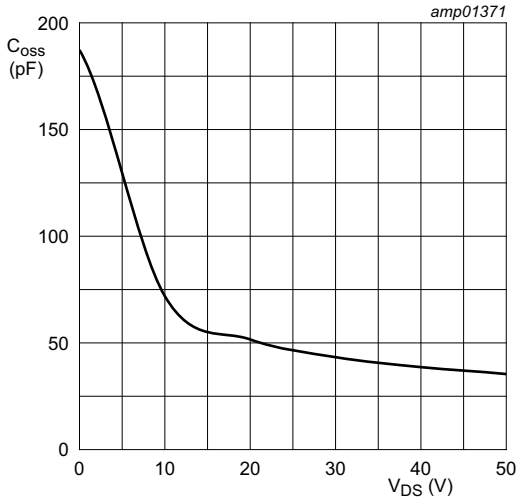
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{(BR)DSS}$	drain-source breakdown voltage	V_{GS} = 0 V; I_D = 1.2 mA	108	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	V_{DS} = 10 V; I_D = 120 mA	1.5	2.0	2.5	V
I_{DSS}	drain leakage current	V_{GS} = 0 V; V_{DS} = 50 V	-	-	1.4	µA
I_{DSX}	drain cut-off current	V_{GS} = $V_{GS(th)}$ + 3.75 V; V_{DS} = 10 V	-	22	-	A
I_{GSS}	gate leakage current	V_{GS} = 10 V; V_{DS} = 0 V	-	-	140	nA
$R_{DS(on)}$	drain-source on-state resistance	V_{GS} = $V_{GS(th)}$ + 3.75 V; I_D = 4.2 A	-	180	-	mΩ

Table 7. AC characteristics

T_j = 25 °C; per section unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
C_{rs}	feedback capacitance	V_{GS} = 0 V; V_{DS} = 50 V; f = 1 MHz	-	0.42	-	pF
C_{iss}	input capacitance	V_{GS} = 0 V; V_{DS} = 50 V; f = 1 MHz	-	176	-	pF
C_{oss}	output capacitance	V_{GS} = 0 V; V_{DS} = 50 V; f = 1 MHz	-	35	-	pF

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V_{GS} = 0 V; f = 1 MHz.

Fig 1. Output capacitance as a function of drain-source voltage; typical values per section

Table 8. RF characteristics

RF characteristics in Ampleon production test circuit, T_{case} = 25 °C; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
DVB-T (8k OFDM), class-AB operation						
V_{DS}	drain-source voltage		-	50	-	V
I_{Dq}	quiescent drain current	per section	-	325	-	mA
$P_{L(AV)}$	average output power	f = 700 MHz	78.4	80	81.6	W
G_p	power gain	f = 700 MHz	21.8	22.5	-	dB
η_D	drain efficiency	f = 700 MHz	31	34	-	%
ACPR	adjacent channel power ratio	f = 700 MHz	-	−30	−27	dBc
PAR	peak-to-average ratio	f = 700 MHz	7.2	8	8.4	dB

7. Test information

7.1 Ruggedness in class-AB operation

The BLF984P and BLF984PS are capable of withstanding a load mismatch corresponding to VSWR ≥ 40 : 1 through all phases under the following conditions: V_{DS} = 60 V; f = 700 MHz; $P_{L(AV)}$ = 80 W; DVB-T; PAR = 8 dB.

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7.2 Impedance information

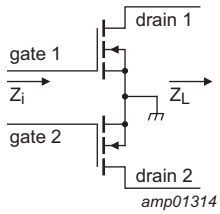


Fig 2. Definition of transistor impedance

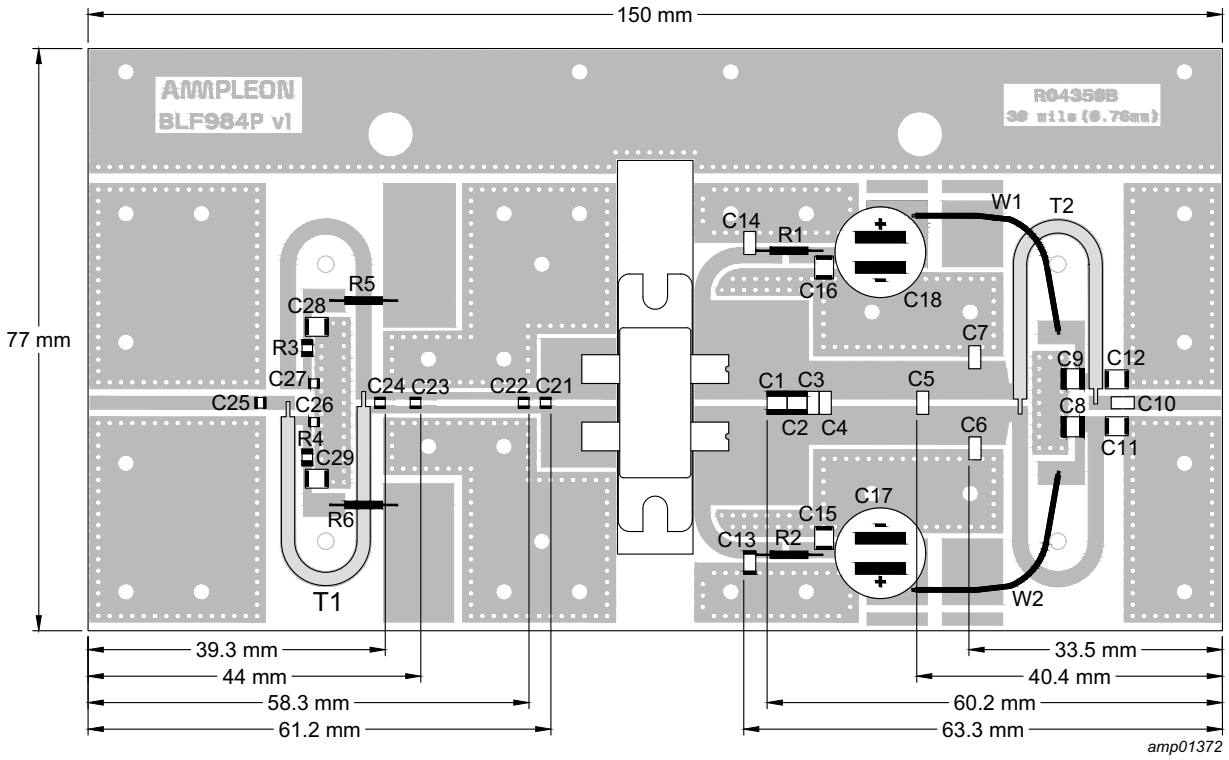
Table 9. Typical push-pull impedance

Simulated Z_i and Z_L device impedance; impedance info at V_{DS} = 50 V and $P_{L(AV)}$ = 80 W (DVB-T).

f	Z_i	Z_L
(MHz)	(Ω)	(Ω)
300	1.039 – j5.449	7.509 + j0.721
325	0.996 – j4.490	7.461 + j0.770
350	0.972 – j3.609	7.409 + j0.817
375	0.962 – j2.786	7.355 + j0.861
400	0.967 – j2.003	7.298 + j0.902
425	0.985 – j1.248	7.239 + j0.941
450	1.016 – j0.508	7.176 + j0.977
475	1.062 + j0.229	7.112 + j1.009
500	1.124 + j0.973	7.046 + j1.039
525	1.206 + j1.739	6.977 + j1.066
550	1.311 + j2.538	6.907 + j1.090
575	1.448 + j3.387	6.835 + j1.110
600	1.625 + j4.307	6.762 + j1.128
625	1.858 + j5.323	6.688 + j1.142
650	2.170 + j6.470	6.612 + j1.153
675	2.598 + j7.796	6.535 + j1.161
700	3.206 + j9.372	6.458 + j1.166
725	4.106 + j11.298	6.380 + j1.167
750	5.516 + j13.726	6.301 + j1.166
775	7.890 + j16.867	6.222 + j1.161
800	12.268 + j20.922	6.142 + j1.154
825	21.207 + j25.389	6.063 + j1.144
850	39.606 + j24.564	5.983 + j1.130
875	57.589 – j1.016	5.904 + j1.114
900	39.887 – j28.218	5.824 + j1.095
925	20.026 – j28.829	5.745 + j1.074
950	10.693 – j23.560	5.666 + j1.049
975	6.354 – j18.981	5.588 + j1.022
1000	4.114 – j15.546	5.510 + j0.993

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7.3 Test circuit



Printed-Circuit Board (PCB): Rogers RO4350B; ε_r = 3.48 F/m; height = 0.762 mm; Cu (top/bottom metallization); thickness copper plating = 35 μm.

See Table 10 for a list of components.

Fig 3. Component layout

Table 10. List of components

For test circuit see Figure 3.

Component	Description	Value	Remarks
C1, C2	multilayer ceramic chip capacitor	5.1 pF	ATC800B5R1BT500XT
C3, C4	multilayer ceramic chip capacitor	6.8 pF	ATC800B6R8BT500XT
C5	multilayer ceramic chip capacitor	8.2 pF	ATC800B8R2BT500XT
C6, C7	multilayer ceramic chip capacitor	10 pF	ATC800B100FT500XT
C8, C9, C10, C13, C14	multilayer ceramic chip capacitor	100 pF	ATC800B101JT500XT
C11, C12, C28, C29	multilayer ceramic chip capacitor	4.7 μF, 100 V	Murata: GMR31CC72A475KE11L, SMD 1210
C15, C16	multilayer ceramic chip capacitor	10 μF, 100 V	SMD 1210
C17, C18	electrolytic capacitor	470 μF, 63 V	axial
C21	multilayer ceramic chip capacitor	11 pF	ATC800A110GT250XT
C22	multilayer ceramic chip capacitor	4.7 pF	ATC800A4R7BT250XT
C23	multilayer ceramic chip capacitor	22 pF	ATC800A220JT250XT
C24	multilayer ceramic chip capacitor	18 pF	ATC800A180JT250XT
C25, C26, C27	multilayer ceramic chip capacitor	100 pF	ATC800A101JT250XT
R1, R2	wire resistor	10 Ω, 0.6 W	

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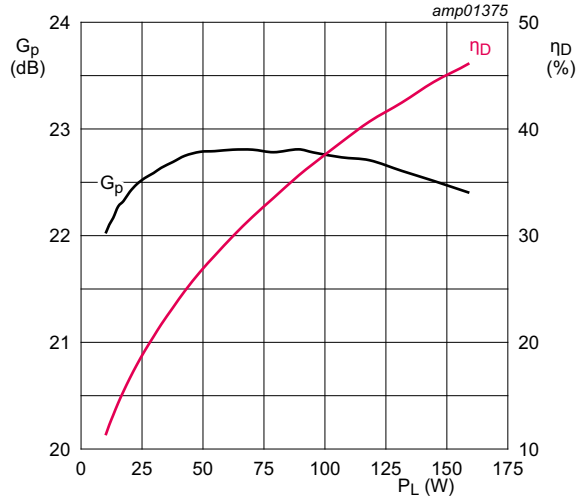
Table 10. List of components *…continued*
For test circuit see Figure 3.

Component	Description	Value	Remarks
R3, R4	resistor	5.6 Ω	SMD 0805
R5, R6	wire resistor	100 Ω, 0.6 W	
T1	semi rigid coax	25 Ω, 50 mm	EZ90-25
T2	semi rigid coax	25 Ω, 50 mm	EZ90-25
W1, W2	wire		0.75 mm^2 conductor cross section

7.4 Graphical data

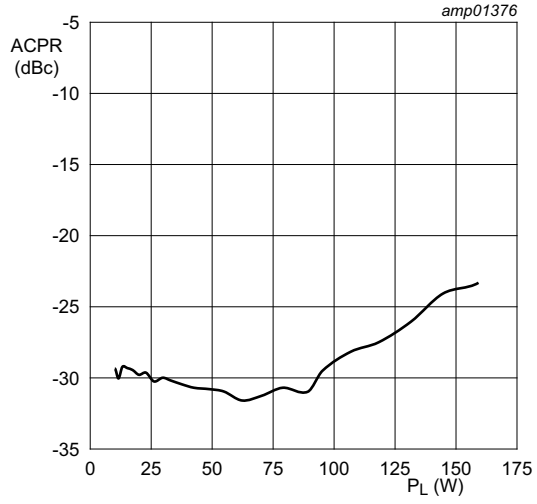
7.4.1 DVB-T

Measured in a narrowband RF production test circuit



f = 700 MHz; V_{DS} = 50 V; I_{Dq} = 2 × 325 mA.

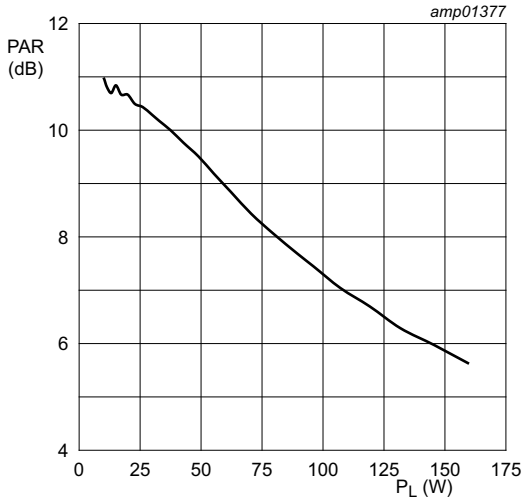
Fig 4. Power gain and drain efficiency as function of output power; typical values



f = 700 MHz; V_{DS} = 50 V; I_{Dq} = 2 × 325 mA.

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

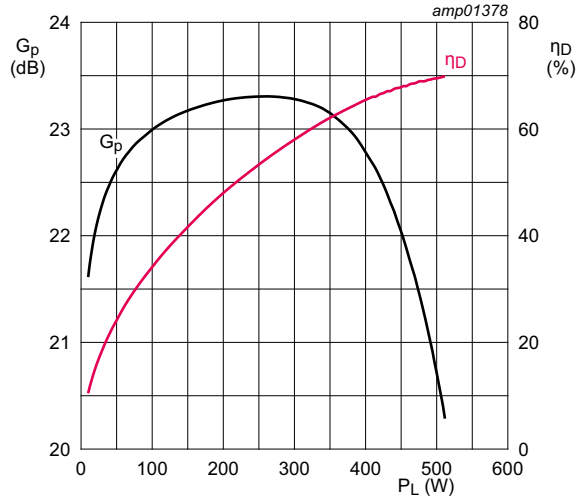
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f = 700 MHz; V_{DS} = 50 V; I_{Dq} = 2 × 325 mA.

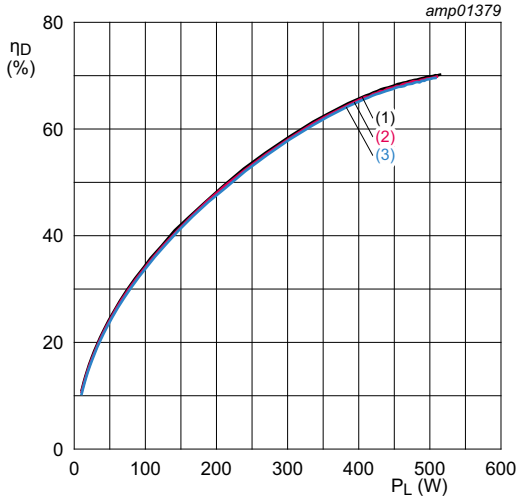
Fig 6. Peak-to-average power ratio as a function of output power; typical values

7.4.2 Pulsed CW



V_{DS} = 50 V; f = 700 MHz; I_{Dq} = 2 × 325 mA; t_p = 100 μs; δ = 10 %.

Fig 7. Power gain and drain efficiency as function of output power; typical values



V_{DS} = 50 V; f = 700 MHz; t_p = 100 μs; δ = 10 %.

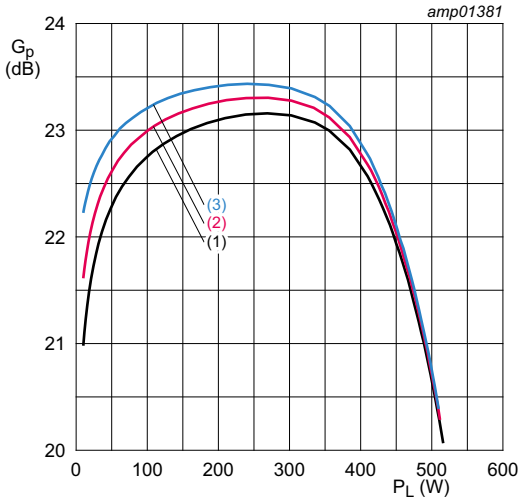
(1) I_{Dq} = 225 mA

(2) I_{Dq} = 325 mA

(3) I_{Dq} = 425 mA

Fig 8. Drain efficiency as a function of output power; typical values

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V_{DS} = 50 V; f = 700 MHz; t_p = 100 μs; δ = 10 %.

(1) I_{Dq} = 225 mA

(2) I_{Dq} = 325 mA

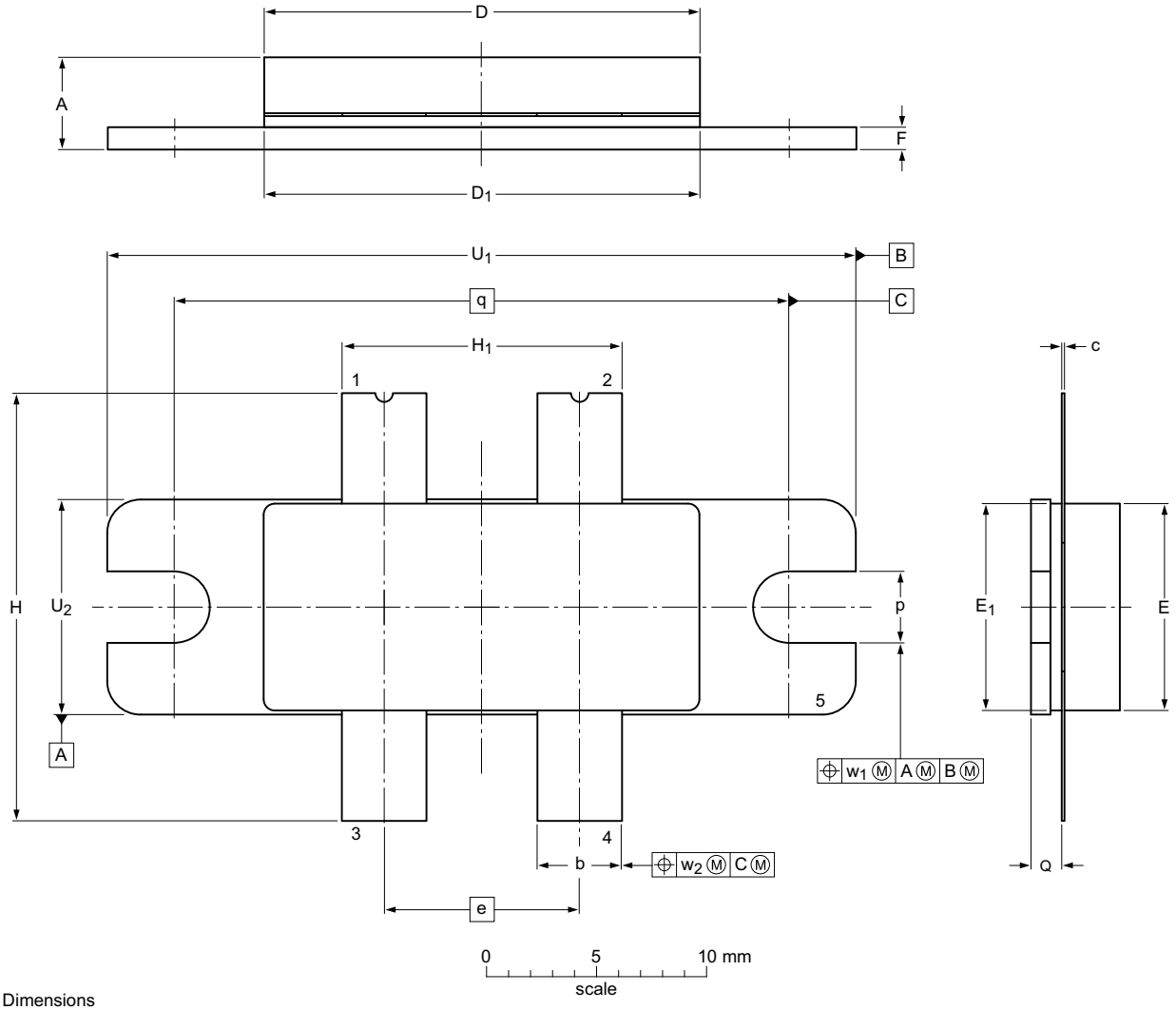
(3) I_{Dq} = 425 mA

Fig 9. Power gain as a function of output power; typical values

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8. Package outline

Flanged LDMOST ceramic package; 2 mounting holes; 4 leads **SOT1121A**



Dimensions

Unit[1]		A	b	c	D	D1	e	E	E1	F	H	H1	p	Q[2]	q	U1	U2	w1	w2
mm	max	4.75	3.94	0.18	20.02	19.96		9.53	9.53	1.14	19.94	12.83	3.38	1.70		34.16	9.91		
	nom						8.89								27.94			0.25	0.51
	min	3.45	3.68	0.10	19.61	19.66		9.27	9.27	0.89	18.92	12.57	3.12	1.45		33.91	9.65		
inches	max	0.187	0.155	0.007	0.788	0.786		0.375	0.375	0.045	0.785	0.505	0.133	0.067		1.345	0.39		
	nom						0.35								1.1			0.01	0.02
	min	0.136	0.145	0.004	0.772	0.774		0.365	0.365	0.035	0.745	0.495	0.123	0.057		1.335	0.38		

Note
1. millimeter dimensions are derived from the original inch dimensions.
2. dimension is measured 0.030 inch (0.76 mm) from the body.

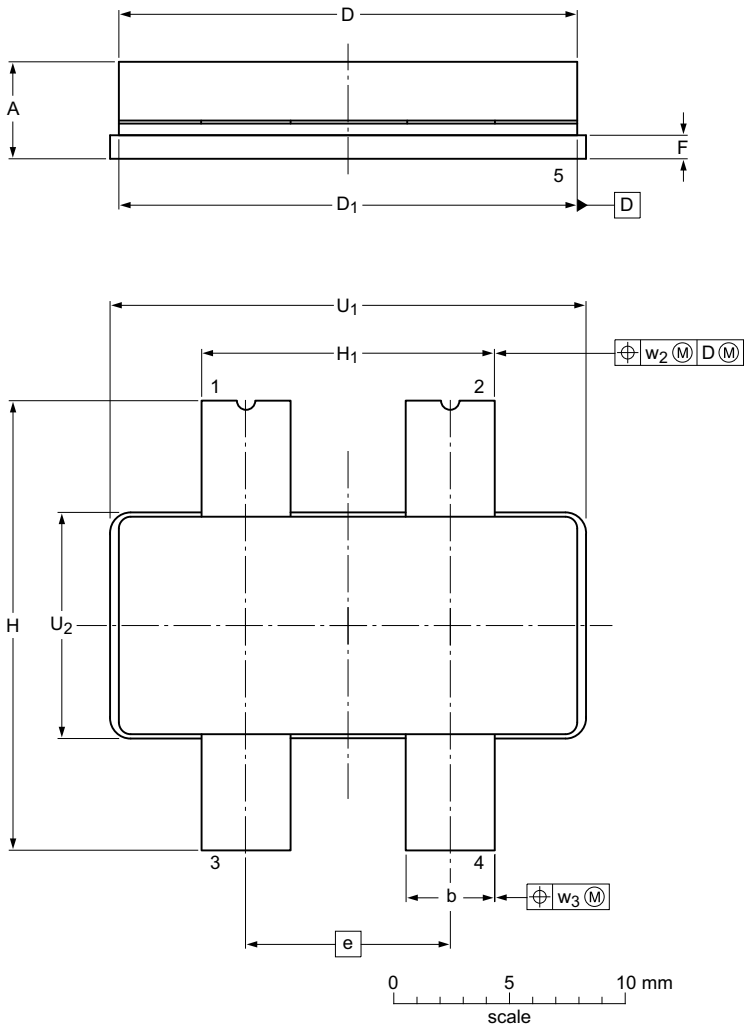
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Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT1121A						~~09-10-12~~ 10-02-02

Fig 10. Package outline SOT1121A

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Earless flanged ceramic package; 4 leads **SOT1121B**



Dimensions

Unit[1]		A	b	c	D	D_1	e	E	E_1	F	H	H_1	Q	U_1	U_2	w_2	w_3	y
mm	max	4.75	3.94	0.18	20.02	19.96		9.53	9.53	1.14	19.94	12.83	1.70	20.70	9.91	0.51	0.25	0.10
	nom						8.89											
	min	3.45	3.68	0.08	19.61	19.66		9.27	9.27	0.89	18.92	12.57	1.45	20.45	9.65			
inches	max	0.187	0.155	0.007	0.788	0.786		0.375	0.375	0.045	0.785	0.505	0.067	0.815	0.39	0.02	0.01	0.004
	nom						0.35											
	min	0.136	0.145	0.003	0.772	0.774		0.365	0.365	0.035	0.745	0.495	0.057	0.805	0.38			

Note
1. millimeter dimensions are derived from the original inch dimensions.
2. dimension is measured 0.030 inch (0.76 mm) from the body.

sot1121b_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT1121B						~~12-06-07~~ 15-07-21

Fig 11. Package outline SOT1121B

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9. Handling information

CAUTION



This device is sensitive to ElectroStatic Discharge (ESD). Observe precautions for handling electrostatic sensitive devices.

Such precautions are described in the *ANSI/ESD S20.20*, *IEC/ST 61340-5*, *JESD625-A* or equivalent standards.

Table 11. ESD sensitivity

ESD model	Class
Charged Device Model (CDM); According to ANSI/ESDA/JEDEC standard JS-002	C2A
Human Body Model (HBM); According to ANSI/ESDA/JEDEC standard JS-001	2

10. Abbreviations

Table 12. Abbreviations

Acronym	Description
CCDF	Complementary Cumulative Distribution Function
DVB-T	Digital Video Broadcast - Terrestrial
ESD	ElectroStatic Discharge
LDMOS	Laterally Diffused Metal-Oxide Semiconductor
LDMOST	Laterally Diffused Metal-Oxide Semiconductor Transistor
MTF	Median Time to Failure
OFDM	Orthogonal Frequency Division Multiplexing
PAR	Peak-to-Average Ratio
RoHS	Restriction of Hazardous Substances
SMD	Surface Mounted Device
UHF	Ultra High Frequency
VSWR	Voltage Standing Wave Ratio

11. Revision history

Table 13. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BLF984P_BLF984PS v.3	20240814	Product data sheet	-	BLF984P_BLF984PS v.2
Modifications:	• Section 1.1 on page 1: changed in first paragraph 400 MHz to 30 MHz • Table 1 on page 1: updated • Section 1.3 on page 1: changed 400 MHz to 30 MHz • Section 7.2 on page 5: section added			
BLF984P_BLF984PS v.2	20200729	Product data sheet	-	BLF984P_BLF984PS v.1
BLF984P_BLF984PS v.1	20200430	Product data sheet	-	-

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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.ampleon.com.

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